Operating manual

SUNNY BOY SMART ENERGY 3.6 / 4.0 / 5.0 / 6.0 / 8.0 / 9.9

ENGLISH

SBSExx-50-BE-en-10 | Version 1.0

Table of Contents

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You can download the current warranty conditions from the Internet at www.SMA-Solar.com.

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The licenses for the installed software modules (open source) can be found in the user interface of the product.

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1 Information on this Document

1.1 Validity

This document is valid for:

- SBSE3.6-50 (Sunny Boy Smart Energy 3.6)
- SBSE4.0-50 (Sunny Boy Smart Energy 4.0)
- SBSE5.0-50 (Sunny Boy Smart Energy 5.0)
- SBSE6.0-50 (Sunny Boy Smart Energy 6.0)
- SBSE8.0-50 (Sunny Boy Smart Energy 8.0) / **Grid approval only available for Italy**
- SBSE9.9-50 (Sunny Boy Smart Energy 9.9) / **Grid approval only available for Italy**

1.2 Target Group

This document is intended for qualified persons and end users. Only qualified persons are allowed to perform the activities marked in this document with a warning symbol and the caption "Qualified person". Tasks that do not require any particular qualification are not marked and can also be performed by end users. Qualified persons must have the following skills:

- Knowledge of how to safely disconnect SMA inverters
- Knowledge of how an inverter works and is operated
- Knowledge of how batteries work and are operated
- Training to deal with risks associated with installing, repairing, and using electrical devices, inverters, and batteries
- Training in the installation and commissioning of electrical devices and installations
- Knowledge of all applicable laws, regulations, standards, and directives
- Knowledge of and compliance with this document and all safety information
- Knowledge of and compliance with the documents of the battery manufacturer with all safety information

1.3 Content and Structure of this Document

This document describes the mounting, installation, commissioning, configuration, operation, troubleshooting and decommissioning of the product.

The latest version of this document and additional information about the product can be found in PDF format and as an eManual at www.SMA-Solar.com. You can also call up the eManual via the user interface of the product.

Illustrations in this document are reduced to the essential information and may deviate from the real product.

1.4 Levels of Warning Messages

The following levels of warning messages may occur when handling the product.

⚠ DANGER
Indicates a hazardous situation which, if not avoided, will result in death or serious injury.

⚠ WARNING
Indicates a hazardous situation which, if not avoided, could result in death or serious injury.

⚠ CAUTION
Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

NOTICE
Indicates a situation which, if not avoided, can result in property damage.

1.5 Symbols in the Document

Symbol	Explanation
	Information that is important for a specific topic or goal, but is not safety-relevant
☐	Indicates a requirement for meeting a specific goal
☑	Required result
	Example
⚠ QUALIFIED PERSON	Sections describing activities to be performed by qualified persons only

1.6 Typographies in the document

Typography	Use	Example
bold	• Messages • Terminals • Elements on a user interface • Elements to be selected • Elements to be entered	• Connect the insulated conductors to the terminals **X703:1** to **X703:6**. • Enter **10** in the field **Minutes**.
>	• Connects several elements to be selected	• Go to **Settings > Date**.
[**Button**] [**Key**]	• Button or key to be selected or pressed	• Select [**Enter**].
#	• Placeholder for variable components (e.g., parameter names)	• Parameter **WCtlHz.Hz#**

1.7 Designations in the Document

Complete designation	Designation in this document
SMA Home Energy Solution	System
Sunny Boy Smart Energy	Inverter, hybrid inverter
SMA Energy Meter	Energy meter
Sunny Home Manager 2.0	Energy meter, communication product
SMA Backup 3P Kit	SMA Backup Solution
SMA Backup 1P	SMA Backup Solution

1.8 Additional Information

The following table provides some important additional information. Additional documents and language versions are available in the Downloads section of the Sunny Boy Smart Energy product page at **www.SMA-Solar.com**.

Title and information content	Type of information	QR code
"Approved Batteries and Information on Battery Communication Connection" Overview of approved batteries	Technical Information	
"TechTip: Unboxing SMA Sunny Boy Smart Energy 3.6 / 4.0 / 5.0 / 6.0" Overview of the contents of the delivery	Video	
"TechTip: Mounting & Installing Sunny Boy Smart Energy 3.6 / 4.0 / 5.0 / 6.0" Installation and electrical connection of the inverter	Video	
"TechTip: Connecting a Sunny Home Manager 2.0 to Sunny Boy Smart Energy 3.6 / 4.0 / 5.0 / 6.0" Connection of a Sunny Home Manager 2.0 to the inverter	Video	
"TechTip: Connecting an SMA Home Storage to a Sunny Boy Smart Energy 3.6 / 4.0 / 5 .0 / 6.0" Connection of SMA Home Storage to the inverter	Video	
"TechTip: Secure Power Supply Operation with a Sunny Boy Smart Energy 3.6 / 4.0 / 5.0 / 6.0" Connection of the socket and switch for emergency power operation	Video	
"TechTip: Configuring Sunny Boy Smart Energy with SMA Home Storage in the commissioning wizard" Commissioning the inverter with the commissioning wizard of the user interface	Video	
Answers to frequently asked questions	FAQ on product page	

2 Safety

2.1 Intended Use

The Sunny Boy Smart Energy is a single-phase, transformerless hybrid inverter with 3 PV inputs (SBSE3.6-50 / SBSE4.0-50 / SBSE5.0-50 / SBSE6.0-50) or with 4 PV inputs (SBSE8.0-50 / SBSE9.9-50) and a battery connection. The inverter feeds the direct current from the PV modules into the connected battery or converts it to grid-compliant alternating current and then feeds it into the utility grid. The Sunny Boy Smart Energy also converts the direct current supplied by the battery into grid-compliant alternating current. In a system with additional PV inverters, the Sunny Boy Smart Energy can convert the alternating current generated by the PV inverters into direct current and feed it into the battery.

The Sunny Boy Smart Energy has a manual emergency power supply function (Secure Power Supply). When needed, in the event of a power outage, the Sunny Boy Smart Energy can continue to supply selected loads with electricity from the battery and the PV system by means of a socket connected to the inverter.

The product is intended for use in residential and industrial environments.

The product must only be used as stationary equipment.

The product is suitable for indoor and outdoor use.

The product must only be operated with PV modules of protection class II in accordance with IEC 61730, application class A. The PV modules must be compatible with this product.

The product is not equipped with an integrated transformer and therefore has no galvanic isolation. The product must not be operated with PV modules or batteries whose outputs are grounded. This can cause the product to be destroyed. The product may be operated with PV modules whose frame is grounded. The product may be operated with batteries whose enclosure is grounded.

PV modules with a high capacity to ground must only be used if the coupling capacity of all PV modules does not exceed 1.54 µF (SBSE3.6-50 / SBSE4.0-50 / SBSE5.0-50 / SBSE6.0-50) or 2.30 µF (SBSE8.0-50 / SBSE9.9-50) (for information on determining the coupling capacitance, see technical information "Leading Leakage Currents" at www.SMA-Solar.com).

The product may only be operated in connection with a lithium-ion battery approved by SMA Solar Technology AG. An updated list of batteries approved by SMA Solar Technology AG can be found in the system manual at www.SMA-Solar.com.

The battery must comply with the locally applicable standards and directives and must be intrinsically safe (see technical information "Safety Concept for Battery-Storage System" for detailed explanations regarding the safety concept of battery inverters by SMA Solar Technology AG).

The communication interface of the battery used must be compatible with the product. The entire battery voltage range must be completely within the permissible input voltage range of the product. The maximum permissible DC input voltage of the product must not be exceeded.

All components must remain within their permitted operating ranges and their installation requirements at all times.

The product is not suitable for supplying life-sustaining medical devices. A power outage must not lead to personal injury.

The product must only be used in countries for which it is approved or released by SMA Solar Technology AG and the grid operator.

The installation of the product in Brazil must meet the current technical standards for "Electrical installations of photovoltaic arrangements" (NBR 16690) and the "Managing fire risk related to photovoltaic (PV) systems on buildings" (IEC 63226).

The product may only be operated with one of the energy meters approved by SMA Solar Technology AG. The following energy meters are allowed to be used when operating this product:

- EMETER-20 (SMA Energy Meter)
- EM-1CT63A-21 (Energy Meter CT with 1 CT terminal)

- EM-3CT63A-21 (Energy Meter CT with 3 CT terminals)
- HM-20 (Sunny Home Manager 2.0)

The products by SMA Solar Technology AG are not suitable for use in

- Medical devices, in particular products for supplying life-support systems and machines,
- Aircraft, the operation of aircraft, the supply of critical airport infrastructure and airport systems,
- Rail vehicles, the operation and supply of rail vehicles and their critical infrastructure.

The above list is not exhaustive. Contact us if you are unsure whether products by SMA Solar Technology AG are suitable for your application.

Use SMA products only in accordance with the information provided in the enclosed documentation and with the locally applicable laws, regulations, standards and directives. Any other application may cause personal injury or property damage.

The documentation must be strictly followed. Deviations from the described actions and the use of materials, tools, and aids other than those specified by SMA Solar Technology AG are expressly forbidden.

Alterations to the SMA products, e.g., changes or modifications, are only permitted with the express written permission of SMA Solar Technology AG. Unauthorized alterations as well as failure to observe the documentation will void guarantee and warranty claims and in most cases terminate the operating license. SMA Solar Technology AG shall not be held liable for any damage caused by such changes.

Any use of the product other than that described in the Intended Use section does not qualify as appropriate.

The documentation supplied is an integral part of SMA products. Keep the documentation in a convenient, dry place for future reference and observe all instructions contained therein.

This document does not replace any regional, state, provincial, federal or national laws, regulations or standards that apply to the installation, electrical safety and use of the product. SMA Solar Technology AG assumes no responsibility for the compliance or non-compliance with such laws or codes in connection with the installation of the product.

The type label must remain permanently attached to the product.

2.2 IMPORTANT SAFETY INSTRUCTIONS

Keep the manual for future reference.

This section contains safety information that must be observed at all times when working.

The product has been designed and tested in accordance with international safety requirements. As with all electrical or electronical devices, some residual risks remain despite careful construction. To prevent personal injury and property damage and to ensure long-term operation of the product, read this section carefully and observe all safety information at all times.

⚠ DANGER

Danger to life due to electric shock when live components or DC cables are touched

The DC cables connected to a battery or a PV module may be live. Touching live DC cables results in death or serious injury due to electric shock.

- Disconnect the product and battery from voltage sources and make sure it cannot be reconnected before working on the device.
- Wait five minutes before working on the inverter.
- Observe all safety information of the battery manufacturer.
- Do not touch non-insulated parts or cables.
- Do not remove the terminal block with the connected DC conductors from the slot under load.
- Wear suitable personal protective equipment for all work on the product.

⚠ DANGER

Danger to life due to electric shock from touching an ungrounded PV module or array frame

Touching ungrounded PV modules or array frames results in death or lethal injuries due to electric shock.

- Connect and ground the frame of the PV modules, the array frame and the electrically conductive surfaces so that there is continuous conduction. Observe the applicable local regulations.

⚠ DANGER

Danger to life due to electric shock when touching live system components in case of a ground fault

If a ground fault occurs, parts of the system may still be live. Touching live parts and cables results in death or lethal injuries due to electric shock.

- Disconnect the product and battery from voltage sources and make sure it cannot be reconnected before working on the device.
- Only touch the cables of the PV modules on their insulation.
- Do not touch any parts of the substructure or frame of the PV array.
- Do not connect PV strings with ground faults to the inverter.
- Ensure that no voltage is present and wait 5 minutes before touching any parts of the PV system or the product.

⚠ DANGER

Danger to life due to electric shock in case of overvoltages and if surge protection is missing

Overvoltages (e.g., in the event of a flash of lightning) can be further conducted into the building and to other connected devices in the same network via the network cables or other data cables if there is no surge protection. Touching live parts and cables results in death or lethal injuries due to electric shock.

- Ensure that all devices in the same network and the battery are integrated into the existing surge protection.
- When laying the network cables or other data cables outdoors, it must be ensured that a suitable surge protection device is provided at the transition point of the cable from the product or the battery outdoors to the inside of a building.
- The Ethernet interface of the product is classified as "TNV-1" and offers protection against overvoltages of up to 1.5 kV.

⚠ WARNING

Danger to life due to fire and deflagration

In rare cases, an explosive gas mixture can be generated inside the product under fault conditions. In this state, switching operations can cause a fire and, in very rare cases, a deflagration inside the product. Death or lethal injuries due to the spread of a fire can result.

- In the event of a fault, do not perform any direct actions on the product.
- In the event of a fault, ensure that unauthorized persons have no access to the product.
- In the event of a fault, disconnect the PV module from the inverter via an external disconnection device. If there is no disconnecting device present, wait until no more DC power is applied to the inverter.
- In the event of a fault, disconnect the battery from the product via an external disconnection service. Do not operate the DC load-break switch on the product.
- In the event of a fault, disconnect the AC circuit breaker, or keep it disconnected in case it has already tripped, and secure it against reconnection.

⚠ WARNING

Risk of injury due to toxic substances, gases and dusts

In rare cases, damages to electronic components can result in the formation of toxic substances, gases or dusts inside the product. Touching toxic substances and inhaling toxic gases and dusts can cause skin irritation, burns or poisoning, trouble breathing and nausea.

- Only perform work on the product (e.g., troubleshooting, repair work) when wearing personal protective equipment for handling of hazardous substances (e.g., safety gloves, eye and face protection, respiratory protection).
- Ensure that unauthorized persons have no access to the product.

⚠ WARNING

Danger to life due to fire or explosion when batteries are fully discharged

A fire may occur due to incorrect charging of fully discharged batteries. This can result in death or serious injury.

- Before commissioning the system, verify that the battery is not fully discharged.
- Do not commission the system if the battery is fully discharged.
- If the battery is fully discharged, contact the battery manufacturer for further proceedings.
- Only charge fully discharged batteries as instructed by the battery manufacturer.

⚠ WARNING

Danger to life due to burns caused by electric arcs through short-circuit currents

Short-circuit currents in the battery can cause heat build-up and electric arcs. Heat build-up and electric arcs may result in lethal injuries due to burns.

- Disconnect the battery from all voltages sources prior to performing any work on the battery.
- Observe all safety information of the battery manufacturer.

⚠ WARNING

Danger to life due to electric shock from destruction of the measuring device due to overvoltage

Overvoltage can damage a measuring device and result in voltage being present in the enclosure of the measuring device. Touching the live enclosure of the measuring device results in death or lethal injuries due to electric shock.

- Only use measuring devices with a measurement ranges designed for the maximum AC and DC voltage of the inverter.
- Only use measuring devices with measurement ranges designed for the maximum DC voltage of the battery.

⚠ CAUTION

Risk of burns due to hot inverter enclosure parts

Some parts of the inverter enclosure can get hot during operation. Touching hot enclosure parts can result in burn injuries.

- During operation, do not touch any parts other than the enclosure lid of the inverter.
- Wait until the inverter has cooled down before touching the enclosure.

NOTICE

Damage to the product due to sand, dust and moisture ingress

Sand, dust and moisture penetration can damage the product and impair its functionality.

- Only open the product if the humidity is within the thresholds and the environment is free of sand and dust.
- Do not open the product during a dust storm or precipitation.
- Close the product in case of interruption of work or after finishing work.
- Only operate the product with the doors closed.
- Only operate the product when it is closed.
- Close tightly all enclosure openings.

NOTICE

Damage to the enclosure seal in subfreezing conditions

If you open the product when temperatures are below freezing, the enclosure seals can be damaged. Moisture can penetrate the product and damage it.

- Only open the product if the ambient temperature is not below -5 °C (23 °F).
- If a layer of ice has formed on the enclosure seal when temperatures are below freezing, remove it prior to opening the product (e.g. by melting the ice with warm air).
- If the product must be opened in freezing conditions, make sure that the DC load-break switch is free of ice.

NOTICE

Damage to the inverter due to electrostatic discharge

Touching electronic components can cause damage to or destroy the inverter through electrostatic discharge.

- Ground yourself before touching any component.

DHCP Server is recommended

The DCHP server automatically assigns the appropriate network settings to your nodes in the local network. A manual network configuration is therefore not necessary. In a local network, the Internet router is usually the DHCP server. If the IP addresses in the local network are to be assigned dynamically, DHCP must be activated in the Internet router (see the Internet router manual). In order to receive the same IP address by the internet router after a restart, set the MAC address binding.

In networks where no DHCP server is active, proper IP addresses must be assigned from the free address pool of the network segment to all network participants to be integrated during commissioning.

Communication disturbances in the local network

The IP address range 192.168.12.0 to 192.168.12.255 is occupied for communication amongst SMA products and for direct access to SMA products.

Communication problems might occur if this IP address range is used in the local network.

- Do not use the IP address range 192.168.12.0 to 192.168.12.255 in the local network.

3 Scope of Delivery

3.1 Scope of delivery for SBSE3.6-50 / SBSE4.0-50 / SBSE5.0-50 / SBSE6.0-50

Check the scope of delivery for completeness and any externally visible damage. Contact your distributor if the scope of delivery is incomplete or damaged.

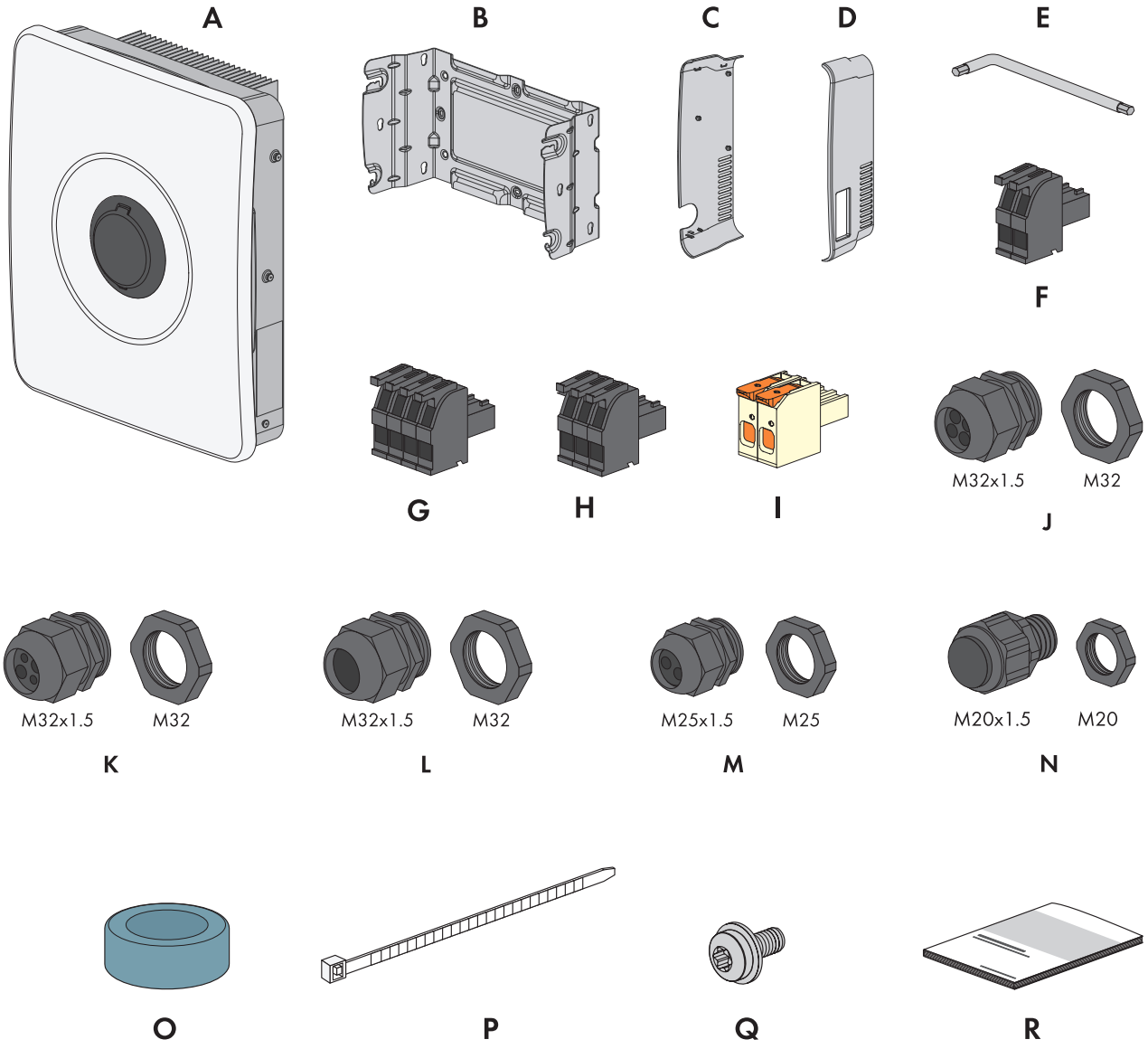


Figure 1: Components included in scope of delivery

Position	Quantity	Designation
A	1	Inverter
B	1	Mounting bracket
C	1	Left side cover
D	1	Right side cover
E	1	Allen key 1/4

Position	Quantity	Designation
F	1	2-pole connector for the signal cable of the backup operation
G	1	4-pole connector for connecting the energy meter per RS485
H	1	3-pole connector for connecting the multifunctional relay
I	3	Terminal blocks for connection of PV modules
J	3	M32x1.5 cable gland with four-hole cable support sleeve with 2 differently sized enclosure openings for the communication connections
K	2	M32x1.5 cable gland with four-hole cable support sleeve with 4 equally sized enclosure openings for the DC connection
L	1	M32x1.5 cable gland with seal insert for connection to the utility grid
M	1	Cable gland M25x1.5 with two-hole cable support sleeve for connection of battery power cables
N	1	Cable gland M20x1.5 with sealing plug for connection of backup power cable
O	1	Ferrite
P	1	Cable tie
Q	1	Screw and washer assembly M5x12 for additional protective grounding
R	1	Documentation package consists of: • Safety information booklet • Quick reference guide poster with illustrated instructions for initial installation and commissioning • Sheet with a password label contains the following information: – PIC (Product Identification Code) identification key for registering the system in Sunny Portal – RID (Registration Identifier) registration ID for registering the system in Sunny Portal – Wi-Fi password WPA2-PSK (WiFi Protected Access 2 - Preshared Key) for direct connection to the product via Wi-Fi – Device Key (DEV KEY) for resetting the administrator password

3.2 Scope of delivery for SBSE8.0-50 / SBSE9.9-50

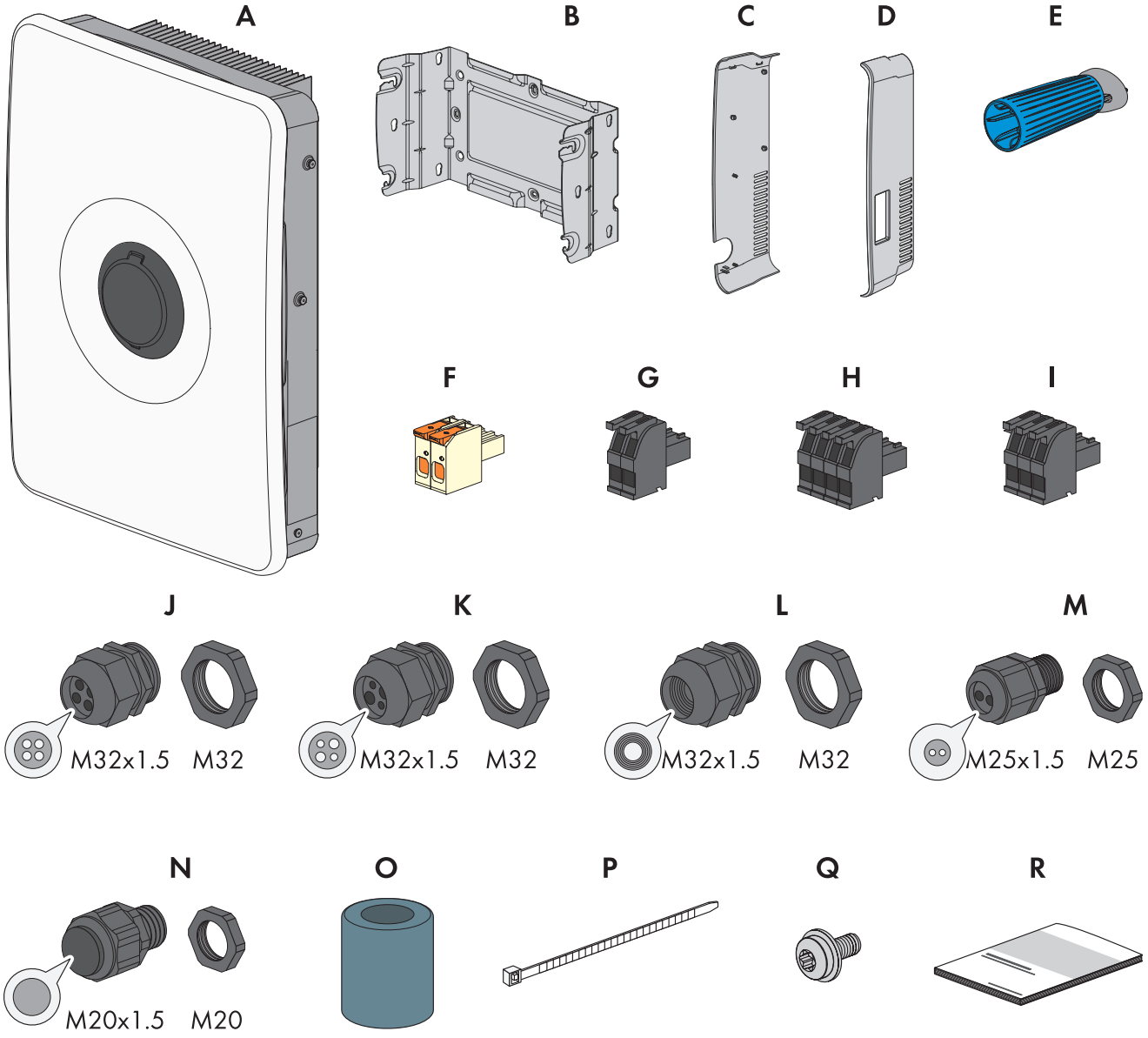


Figure 2: Components included in scope of delivery

Position	Quantity	Designation
A	1	Inverter
B	1	Mounting bracket
C	1	Left side cover
D	1	Right side cover
E	1	Spacer
F	4	Terminal blocks for connection of PV modules
G	1	2-pole connector for the signal cable of the backup operation
H	1	4-pole connector for connecting the energy meter per RS485

Position	Quantity	Designation
I	1	3-pole connector for connecting the multifunctional relay
J	3	M32x1.5 cable gland with four-hole cable support sleeve with 2 differently sized enclosure openings for the communication connections
K	2	M32x1.5 cable gland with four-hole cable support sleeve with 4 equally sized enclosure openings for the DC connection
L	1	M32x1.5 cable gland with seal insert for connection to the utility grid
M	1	Cable gland M25x1.5 with two-hole cable support sleeve for connection of battery power cables
N	1	Cable gland M20x1.5 with sealing plug for connection of backup power cable
O	2	Ferrite
P	1	Cable tie
Q	1	Screw and washer assembly M5x12 for additional protective grounding
R	1	Documentation package consists of: • Safety information booklet • Quick reference guide poster with illustrated instructions for initial installation and commissioning • Sheet with a password label contains the following information: – PIC (Product Identification Code) identification key for registering the system in Sunny Portal – RID (Registration Identifier) registration ID for registering the system in Sunny Portal – Wi-Fi password WPA2-PSK (WiFi Protected Access 2 - Preshared Key) for direct connection to the product via Wi-Fi – Device Key (DEV KEY) for resetting the administrator password

4 Product overview

4.1 Device function of Sunny Boy Smart Energy

In systems with multiple inverters, you have the option of using and configuring the Sunny Boy Smart Energy either as a System Manager or as a subordinate device.

When using the Sunny Boy Smart Energy, you can use up to 6 devices (e.g. 1 Sunny Boy Smart Energy as System Manager, 2 Sunny Boy Smart Energy as subordinate devices, 2 PV inverters and 1 energy meter) in one system. Note that there may be a maximum of 3 inverters with connected batteries in the system.

Only 1 Sunny Boy Smart Energy can be used in systems with Sunny Home Manager. The Sunny Boy Smart Energy must be configured as subordinate inverter.

You can configure the device function using the commissioning wizard in the SMA 360° app or on the System Manager user interface.

Inverter as System Manager

If you configure the inverter as System Manager, the inverter as a superordinate device in conjunction with an energy meter takes over the control at the point of interconnection. The inverter can control other subordinate devices, takes over the monitoring of the system and the communication to the Sunny Portal powered by ennexOS.

Subordinate device

If you configure the inverter as a subordinate device, there is no independent closed-loop control or open-loop control at the point of interconnection. The subordinate inverter receives specifications from a superordinate device (e.g. inverter as System Manager or Sunny Home Manager) and implements them. It should be noted that the Sunny Home Manager cannot be used for reactive power control of the subordinate inverters.

4.2 Product Description

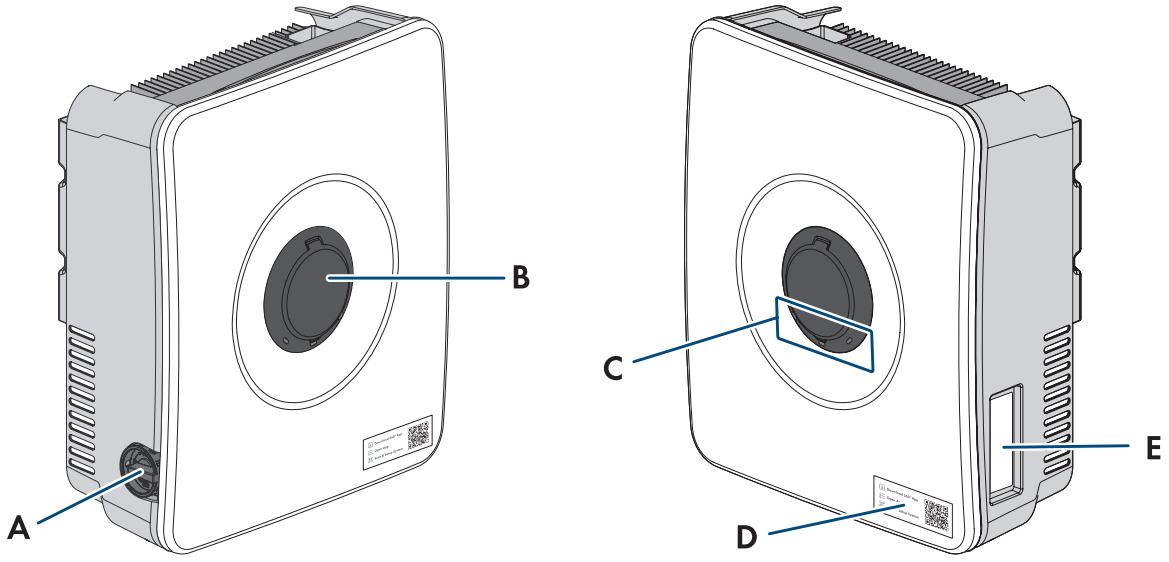


Figure 3: Design of the product

Position	Designation
A	DC load-break switch
B	SMA Easy Lock enclosure lock

Position	Designation
C	LEDs The LEDs indicate the operating state of the product.
D	A label with a QR code to be scanned using the SMA apps
E	Type label The type label clearly identifies the product. The type label must remain permanently attached to the product. You will find the following information on the type label: • Device type (Model) • Serial number (Serial No. or S/N) • Date of manufacture • Device-specific characteristics

4.3 Symbols on the Product

Symbol	Explanation
	Beware of a danger zone This symbol indicates that the product must be additionally grounded if additional grounding or equipotential bonding is required at the installation site.
	Beware of electrical voltage The product operates at high voltages.
	Beware of hot surface The product can get hot during operation.
	Observe the documentation Observe all documentations supplied with the product.
	Danger to life due to high voltages in the inverter; observe a waiting time of 5 minutes. High voltages that can cause lethal electric shocks are present in the live components of the inverter. Before carrying out any work on the inverter, always de-energize the inverter as described in this document and secure it against reconnection.
	Operation LED Indicates whether the product is in operation.
	Error Together with the red LED, this symbol indicates an error. Observe the documentation.
	Data transmission Together with the blue LED, this symbol indicates the status of the network connection.
	Grounding conductor This symbol indicates the position for connecting a grounding conductor.

Symbol	Explanation
	Grounding This symbol indicates the position for the connection of an additional grounding conductor.
	The product has no galvanic isolation.
	WEEE designation Do not dispose of the product together with the household waste but in accordance with the disposal regulations for electronic waste applicable at the installation site.
	CE marking The product complies with the requirements of the applicable EU directives.
	RoHS labeling The product complies with the requirements of the applicable EU directives.

4.4 Interfaces and Functions

4.4.1 User Interface

The product is equipped as standard with an integrated webserver, which provides a user interface for configuring and monitoring the product.

Once the connection has been established to the smart device, use a device (e.g. smartphone, tablet or laptop) to connect to the product's user interface using a web browser.

Also see:

- Access rights to the user interface ⇒ page 76

4.4.2 Device Key (DEV KEY)

If you have forgotten the administrator password for the product, you can reset the administrator account with the device key and assign a new password. The device key can be used to prove the identity of the product in digital communication. The Device Key is provided on a sheet with a password label supplied with the product. Keep the device key safe in case you forget the administrator password.

4.4.3 Diagnostic function

The inverter has a diagnostic function for measuring the current/voltage characteristic curve (I-V characteristic curve) of the PV modules connected to DC inputs. The characteristic curve shows deviations and changes from the ideal curve. By this, problems in the PV modules can be detected at an early stage.

Also see:

- Generating the I-V Characteristic Curve ⇒ page 90

4.4.4 Increased self-consumption

With increased self-consumption, the highest possible proportion of the energy of a generator (e.g., a PV system) is consumed and stored at the place where it is generated. With increased self-consumption, power output at the point of interconnection is reduced when the energy can be consumed or stored at the place where it is generated. The power draw at the point of interconnection is reduced since a large proportion of the self-generated energy is being used.

The SMA Home Storage Solution supports the increased self-consumption through intermediate storage of energy from generators. In addition to the inverter, an energy meter and a battery are required for operation.

4.4.5 Energy Monitoring

The inverter supports the display of balances for PV generation and battery charging and discharging in the Sunny Portal powered by ennexOS or in the SMA Energy App. When the inverter is used together with the SMA Energy Meter or the Sunny Home Manager, further and more detailed balances are displayed.

4.4.6 Peak load shaving

With the "Peak Load Shaving" function, you can optimize the behavior of the inverter with respect to the power exchange at the point of interconnection. This is mostly useful when a higher supply of energy would lead to a higher electricity cost. With peak load shaving, the inverter controls - depending on its output and, in systems with a battery, on the available battery capacity - to previously defined grid exchange capacities. Power peaks and additional costs can thus be avoided.

You can configure maximum values for the power drawn at the point of interconnection. When the loads require additional energy, the battery is discharged and the maximum value is kept constant at the grid-connection point. This is based on the prerequisite that the battery is sufficiently charged.

In addition to the inverter, an energy meter and a battery are required for operation.

The peak load shaving function in the inverter is not available if the inverter is operated in a system with the Sunny Home Manager. In these systems, the Sunny Home Manager takes over the function.

4.4.7 SMA ArcFix

SMA ArcFix is an Arc Fault Circuit Interrupter (AFCI). With this function, the inverter effectively detects arcs on the DC side and interrupts them.

A detected electric arc causes the inverter to interrupt feed-in operation. To restart feed-in operation, the operational disruption which has occurred, must be reset through a manual restart. Alternatively, the arc-fault circuit interrupter can be activated without inhibiting operation. Depending on the country data set, arc fault detection is activated or deactivated by default. If the installation conditions permit this, you can change the default setting.

SMA ArcFix complies with the requirements of the IEC 63027 and corresponds to the following installation classes:

- F-I-AFPE-1-6-1
- F-I-AFPE-2-3-1

Also see:

- Manual restart after electric arc ⇒ page 123

4.4.8 Modbus

The inverter is equipped with a Modbus interface. The Modbus interface is deactivated by default and must be configured as needed.

The Modbus interface of the supported SMA products is designed for industrial use – via SCADA systems, for example – and has the following tasks:

- Remote query of measured values
- Remote setting of operating parameters
- Setpoint specifications for system control
- Controlling the battery

4.4.9 Grid Management Services

The product is equipped with service functions for grid management.

Depending on the requirements of the grid operator, you can activate and configure the functions (e.g. active power limitation) via operating parameters.

4.4.10 Secure Power Supply Operation

In case of a grid failure, the secure power supply operation supplies the loads with energy from the battery and the PV system. You can connect a standard socket (230 V) and a standard switch to the inverter. You can connect a load with a maximum of 16 A and 230 V to the secure power supply socket. The load is supplied with energy from the battery and PV system during grid failure. The switch is used to enable and disable secure power supply operation.

The secure power supply operation is not automatically enabled in the event of a grid failure, neither is it automatically disabled once the utility grid is available again. If the utility grid fails, the load must be connected to the socket for secure power supply operation. The supply to the load must be activated manually by switching on the switch to secure power supply operation. The inverter automatically regulates the energy supply of the socket after activating the secure power supply operation. When the utility grid is available again and the loads can be supplied from it, the loads must be connected to the previous supply and the secure power supply operation must be deactivated manually by switching off the switch.

During active secure power supply operation, the inverter is disconnected from the building's main electrical system and does not therefore feed into the utility grid. The loads can only be supplied in secure power supply operation as long as energy can still be provided by the PV modules and/or the battery. If there is insufficient energy available, the secure power supply operation remains active, even if the utility grid is available again. Switching over to supplying the loads from the utility grid is not carried out automatically.

Do not connect any loads that require an uninterrupted energy supply

The secure power supply operation and the battery-backup operation may not be used for loads that require a uninterrupted energy supply. The energy that is available during the secure power supply operation or battery-backup operation depends on the battery capacity available and the state of charge of the battery (SOC).

- Do not connect loads if they are dependent on an uninterrupted energy supply for reliable operation.

4.4.11 Parallel Operation of DC Inputs

You have the option of operating DC inputs A and B and, if available, DC inputs C and D of the inverter in parallel. As a result, and as opposed to normal operation, several parallel-connected strings can be connected to the inverter. To do this, the [**Parallel connection of PV inputs**] parameter must be activated on the inverter user interface.

4.4.12 SMA Dynamic Power Control

SMA Dynamic Power Control is a pre-installed software that allows a System Manager to control the active and reactive power of up to 5 inverters (including the System Manager).

4.4.13 SMA ShadeFix

The inverter is equipped with the shade management system SMA ShadeFix. SMA ShadeFix uses an intelligent MPP tracking system to determine the operating point with the highest output during shading conditions. With SMA ShadeFix, inverters use the best possible energy supply from the PV modules at all times to increase yields in shaded systems.

The time interval of SMA ShadeFix is usually 6 minutes. This means that the inverter determines the optimum operating point every 6 minutes. Depending on the PV system or shading situation, it may be useful to adjust the time interval.

Also see:

- Setting of SMA ShadeFix ⇒ page 77

4.4.14 SMA Smart Connected

SMA Smart Connected is the free monitoring of the inverter via the SMA Sunny Portal. Thanks to SMA Smart Connected, the operator and qualified person will be informed automatically and proactively about inverter events that occur.

SMA Smart Connected is activated during registration in Sunny Portal. In order to use SMA Smart Connected, it is necessary that the inverter is permanently connected to Sunny Portal and the data of the operator and qualified person is stored in Sunny Portal and up-to-date.

4.4.15 SMA Speedwire

The inverter is equipped with SMA Speedwire as standard. SMA Speedwire is a type of communication based on the Ethernet standard. SMA Speedwire is designed for a data transfer rate of 100 Mbps and enables optimum communication between Speedwire devices within systems.

The inverter supports the encrypted system communication with SMA Speedwire Encrypted Communication. In order to be able to use the Speedwire encryption in the system, all Speedwire devices, except for the energy meter (e.g. SMA Energy Meter) must support the function SMA Speedwire Encrypted Communication.

Also see:

- Enabling Speedwire Encryption ⇒ page 90

4.4.16 Protective Battery Charging

If the battery is not charged for a long time, there is a risk of deep discharge. To prevent damage to the battery due to deep discharge, the inverter charges the battery from the utility grid for approx. 10 to 15 minutes when the SOC (State of Charge) is very low.

4.4.17 Wi-Fi

The inverter is equipped with a WLAN interface as standard. The inverter is delivered with the WLAN interface activated as standard. If you do not want to use WLAN, you can deactivate the WLAN interface.

In addition, the inverter has a WPS function. The WPS function is for automatically connecting the inverter to a network (e.g., via router) and establishing a direct connection between the inverter and a smart end device.

4.4.18 Wi-Fi connection to SMA 360° app and SMA Energy app

There is a QR code on the inverter as standard. Scanning the QR Code on the product using the SMA 360° app enables Wi-Fi access and automatically connects to the user interface.

Commissioning of the system can be started and carried out by scanning the QR code with the SMA 360° app. Subsequently, the SMA Energy App can be used for energy monitoring of the system.

Also see:

- Direct connection via Wi-Fi ⇒ page 73

4.5 LED Signals

The LEDs indicate the operating state of the inverter.

LED signal	Explanation
Green LED and red LED flash simultaneously (2 s on and 2 s off)	No country data set set Operation of the inverter is stopped because no country data set is set. The inverter automatically starts operation as soon as the configuration has been carried out (e.g., using the commissioning wizard or via a System Manager).
The green LED is flashing (2 s on and 2 s off)	Waiting for feed-in conditions The conditions for feed-in operation are not yet met. As soon as the conditions are met, the inverter will start feed-in operation.
The green LED is flashing (1.5 s on and 0.5 s off)	The inverter is in backup operation.
The green LED is glowing	Operation The inverter is in operation.

LED signal	Explanation
The green LED is off	No DC voltage is present.
The red LED is glowing	Error Inverter operation has been stopped. In addition, a specific event message and the associated event number are displayed on the user interface of the inverter or System Manager (see Section 11.1, page 97).
Red LED is flashing (0.25 s on, 0.25 s off, 0.25 s on, 1.25 s off)	Warning Communication with the System Manager failed. The inverter continues to operate with restricted function (e.g., with set fallback level). In addition, a specific event message and the associated event number are displayed on the user interface of the inverter or System Manager (see Section 11.1, page 97).
The blue LED is flashing slowly (2 s on and 2 s off)	Communication connection is being established. The inverter is establishing a connection with a local network or is establishing a direct connection to a smart device (e.g., smartphone, tablet, or laptop).
The blue LED is flashing fast (0.25 s on and 0.25 s off)	A System Manager is requesting identification of the inverter.
The blue LED is glowing	There is an active connection with a local network or there is a direct connection with a smart device (e.g., smartphone, tablet or laptop).
Blue LED is off	There is no active connection.
All 3 LEDs are on	Inverter update or booting procedure.

5 Mounting

5.1 Requirements for Mounting

5.1.1 Requirements for the Mounting Location

⚠ WARNING

Danger to life due to fire or explosion

Despite careful construction, electrical devices can cause fires. This can result in death or serious injury.

- Do not mount the product in areas containing highly flammable materials or gases.
- Do not mount the product in potentially explosive atmospheres.

- ☐ The mounting location must be suitable for the weight and dimensions of the product.
- ☐ A solid support surface must be available (e.g., concrete or masonry, free-standing constructions). When mounted on drywall or similar materials, the inverter emits audible vibrations during operation which could be perceived as annoying.
- ☐ Drywall must have a minimum thickness of 25 mm. This means that double-layer drywall must be used or the drywall must be additionally reinforced (e.g., with plywood, OSB, or chipboard).
- ☐ The installation site can be exposed to direct solar irradiation. There is, however, the possibility that the product reduces its power output to avoid overheating due to high temperatures.
- ☐ The installation site should be freely and safely accessible at all times without the need for any auxiliary equipment (such as scaffolding or lifting platforms). Non-fulfillment of these criteria may restrict servicing.
- ☐ The DC load-break switch of the product must always be freely accessible.
- ☐ All ambient conditions must be met.
- ☐ The ambient temperature should be -25 °C to +45 °C to ensure optimal operation.

Also see:

- Mounting the Inverter ⇒ page 30

5.1.2 Permitted and prohibited mounting positions

- ☐ The product may only be mounted in a permitted position. This will ensure that no moisture can penetrate the product.
- ☐ The product should be mounted such that the LED signals can be read off without difficulty.

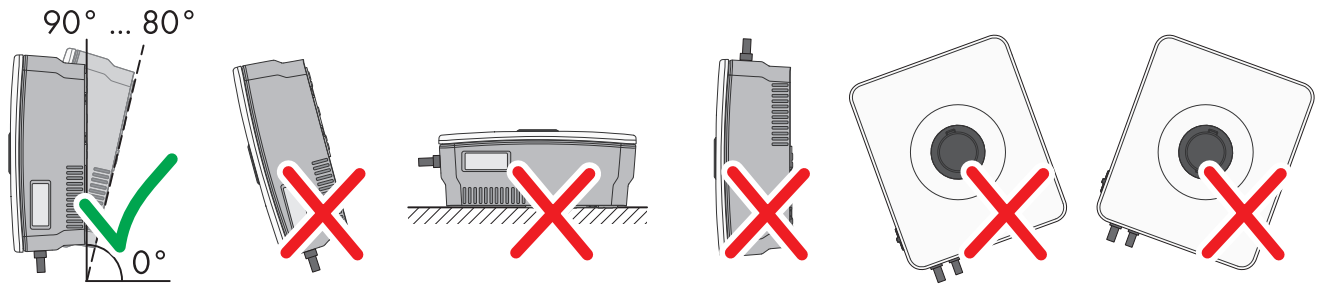


Figure 4: Permitted and prohibited mounting positions

Also see:

- Mounting the Inverter ⇒ page 30

5.1.3 Dimensions for mounting SBSE3.6-50 / SBSE4.0-50 / SBSE5.0-50 / SBSE6.0-50

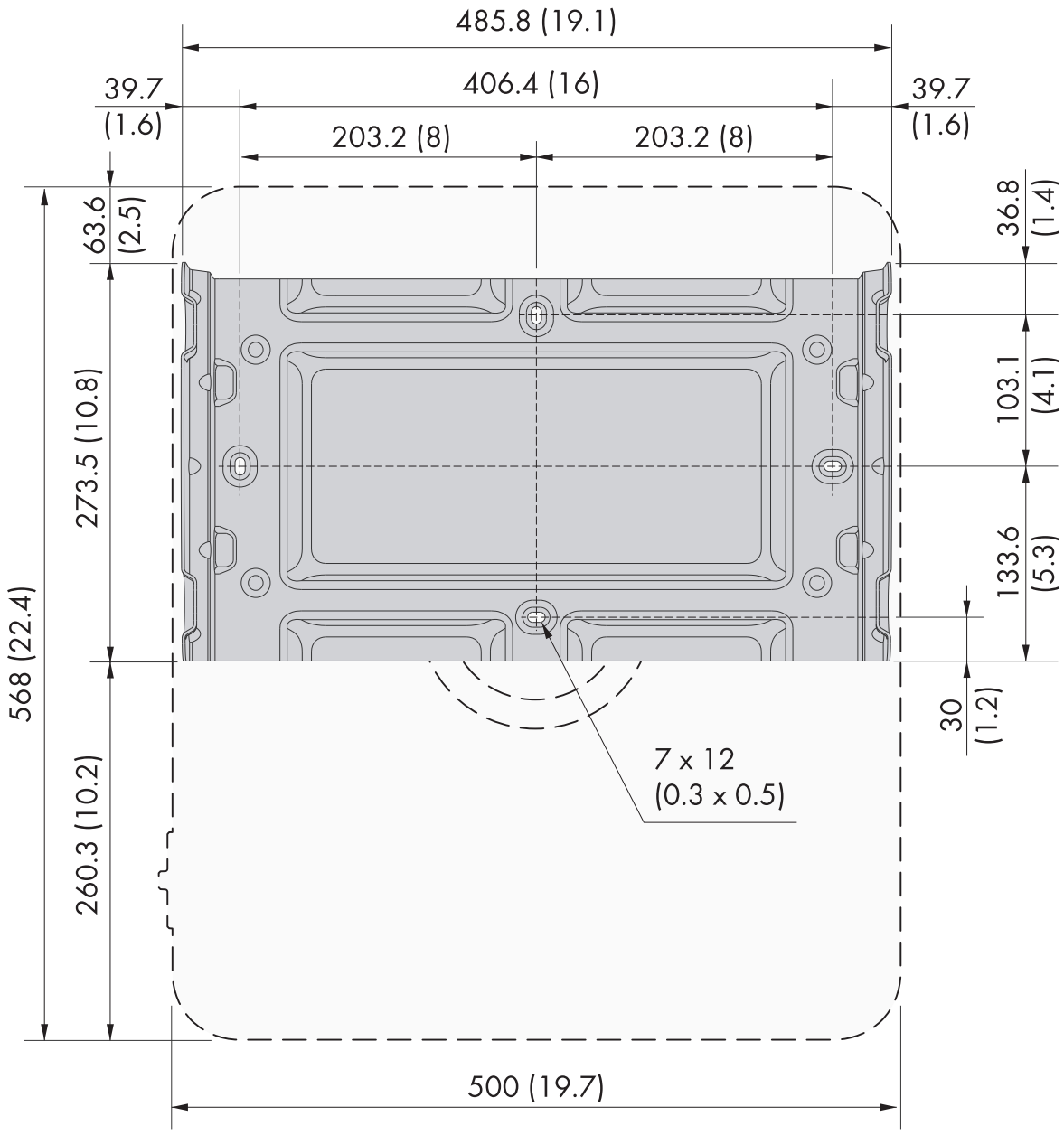


Figure 5: Position of the anchoring points (dimensions in mm (in))

Also see:

- Mounting the Inverter ⇒ page 30

5.1.4 Mounting Dimensions for SBSE8.0-50 / SBSE9.9-50

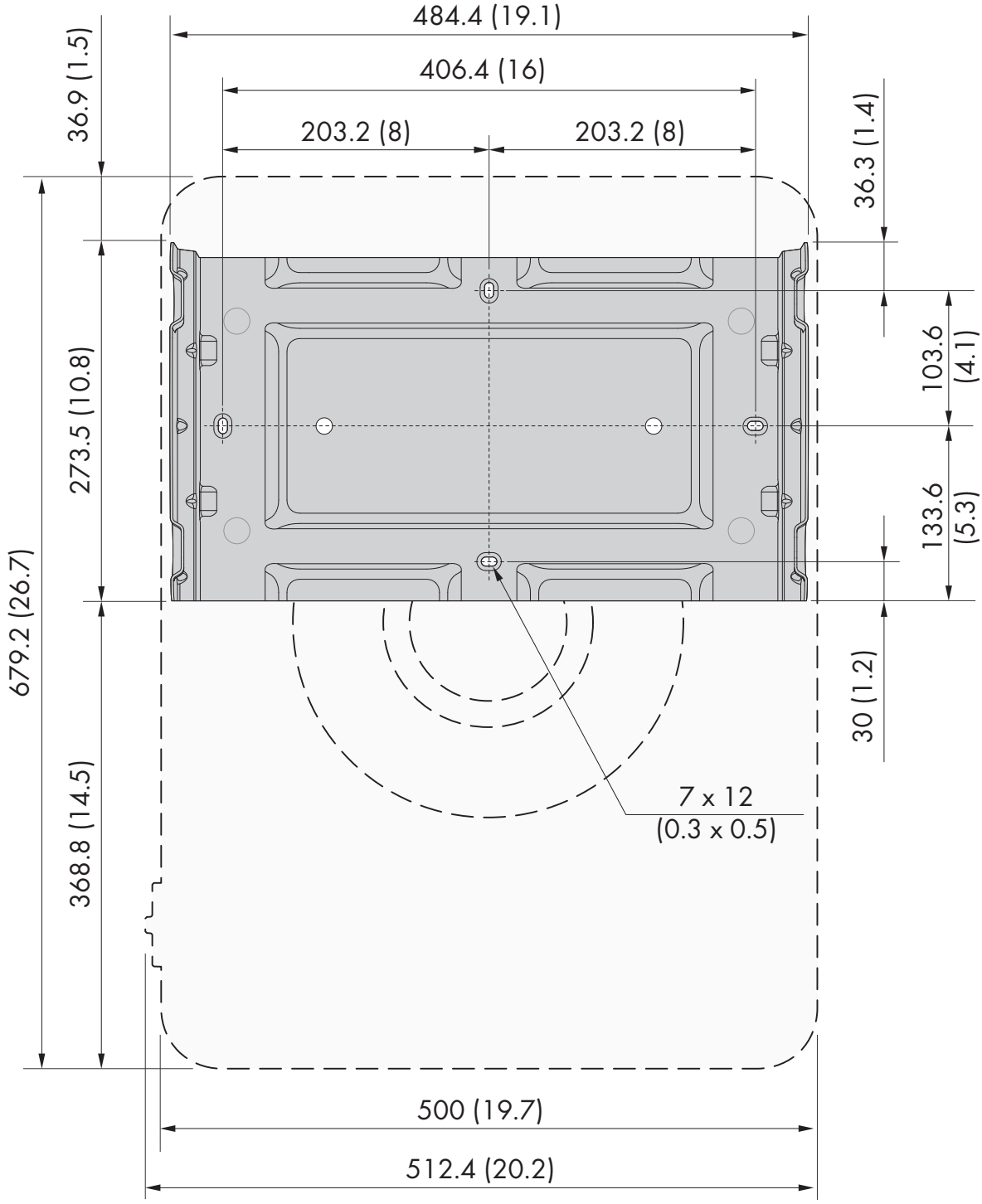


Figure 6: Position of the anchoring points (dimensions in mm (in))

5.1.5 Recommended clearances for mounting

If you maintain the recommended clearances, adequate heat dissipation will be ensured. Thus, you will prevent power reduction due to excessive temperature.

- ☐ Recommended distances to walls, other devices and objects should be maintained.
- ☐ If multiple products are mounted in areas with high ambient temperatures, increase the clearances between the products and ensure sufficient fresh-air supply.

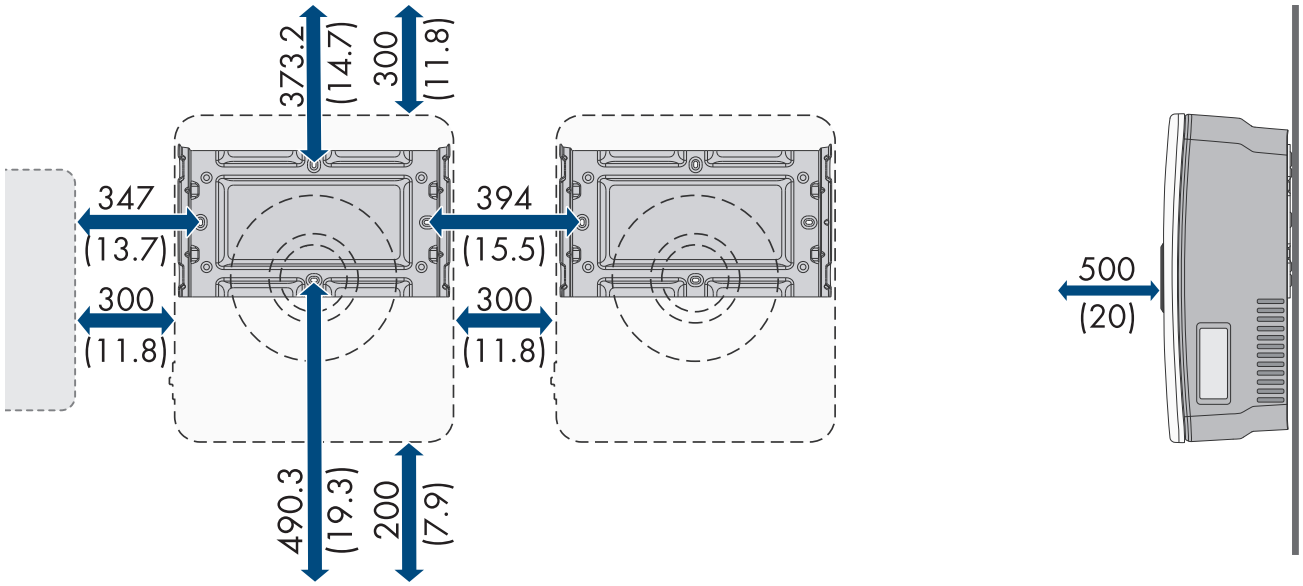


Figure 7: Recommended clearances (dimensions in mm (in))

Also see:

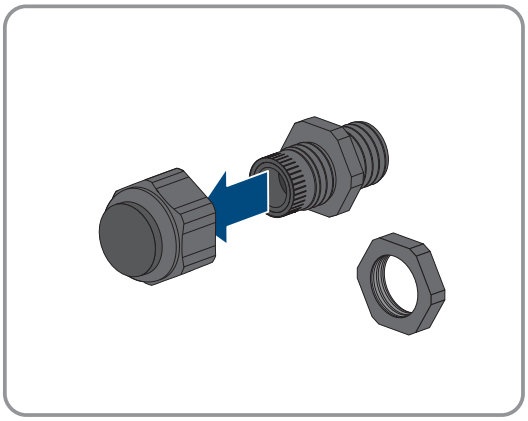
- Mounting the Inverter ⇒ page 30

5.2 Install cable gland for backup connection

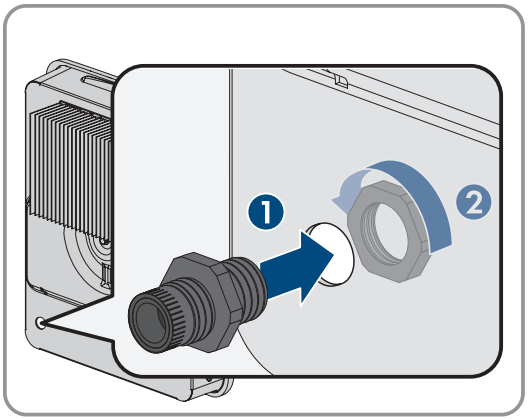
Even if you do not wish to use the connection, you must mount the cable gland to the inverter to prevent moisture from entering the inverter.

Procedure:

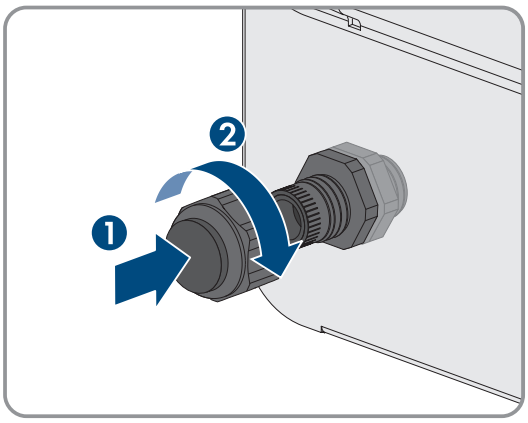
1. Remove the union nut with sealing plug from the M20x1.5 cable gland.



2. Insert the cable gland into the hole on the rear of the inverter and tighten it from the inside using the counter nut.



3. Tighten the union nut on the cable gland incl. sealing plug hand-tight.



5.3 Mounting the Inverter

⚠ QUALIFIED PERSON

Additionally required material (not included in the scope of delivery):

- ☐ 2 or 4 screws (depending on support surface) suitable for both the support surface and the inverter's weight
- ☐ 2 or 4 washers suitable for the screws
- ☐ 2 or 4 screw anchors (depending on support surface) suitable for the support surface and the screws

⚠ CAUTION

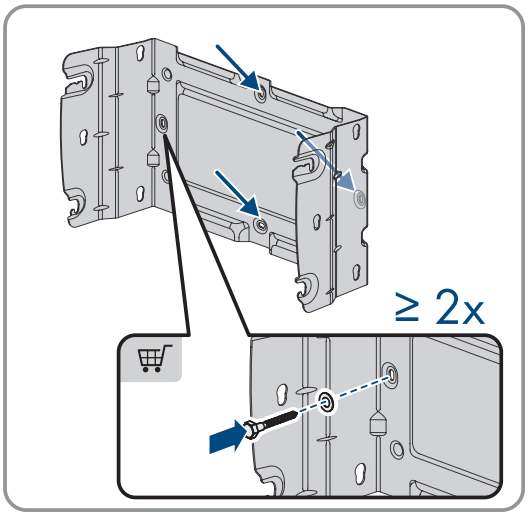
Risk of injury due to weight of product

Injuries may result if the product is lifted incorrectly or dropped while being transported or mounted.

- Transport and lift the product carefully. Take the weight of the product into account.
- Wear suitable personal protective equipment for all work on the product.

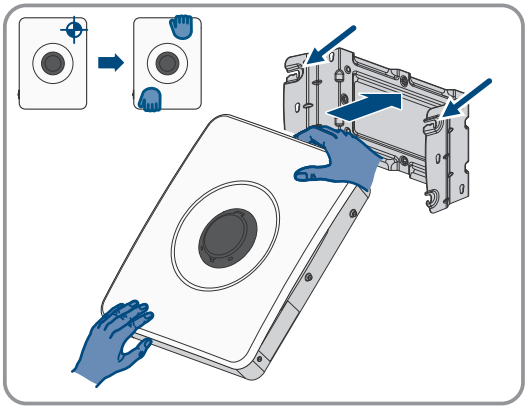
Procedure:

1. Align the mounting bracket horizontally and mark the position of the drill holes. Use either the 2 holes in the center of the wall mounting bracket, or 1 hole each on the left and right. All 4 holes have to be utilized when mounting to drywall.
2. Set the mounting bracket aside and drill the marked holes.
3. Insert screw anchors into the drill holes if the support surface requires them.
4. Tighten the mounting bracket horizontally with screws and washers. Ensure the mounting bracket is correctly aligned.

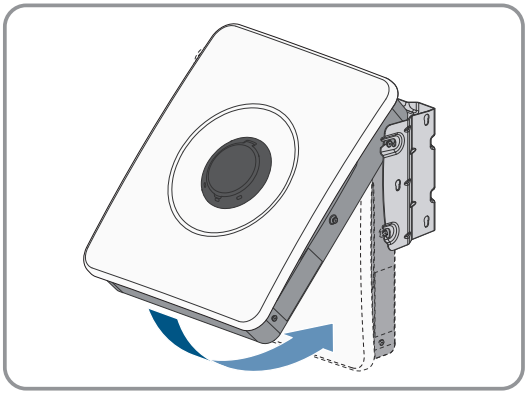


☑ The mounting bracket is installed correctly.

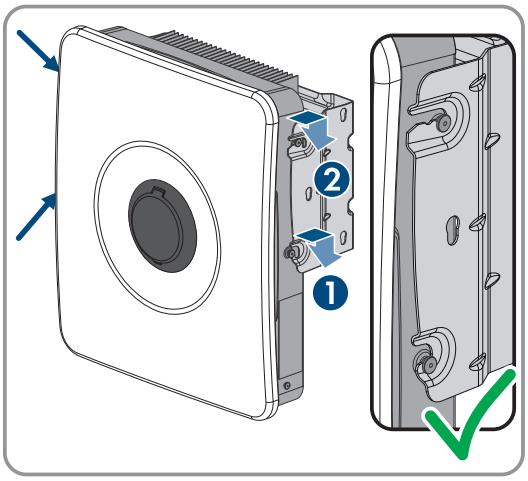
5. Do not place the inverter vertically under any circumstances.
6. Pick up the inverter at the top and bottom of the enclosure and place it at a 45° angle over the upper 2 rivets in the upper guide rails of the mounting bracket.



7. Carefully rotate the bottom of the inverter toward the support surface and place it at a 90° angle to the base.



8. Engage the top and bottom rivets in the corresponding recesses.



9. Make sure that the inverter is securely attached by carefully moving the enclosure back and forth.

Also see:

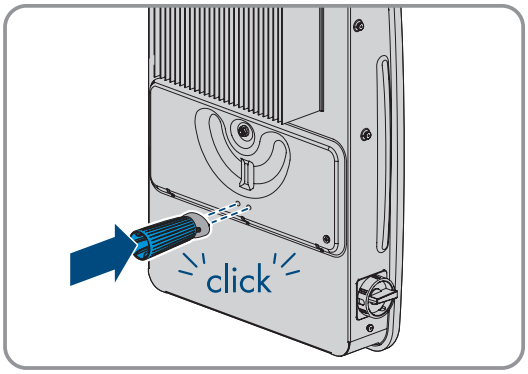
- Recommended clearances for mounting ⇒ page 28
- Permitted and prohibited mounting positions ⇒ page 26
- Requirements for the Mounting Location ⇒ page 26

5.4 Spacer Installation

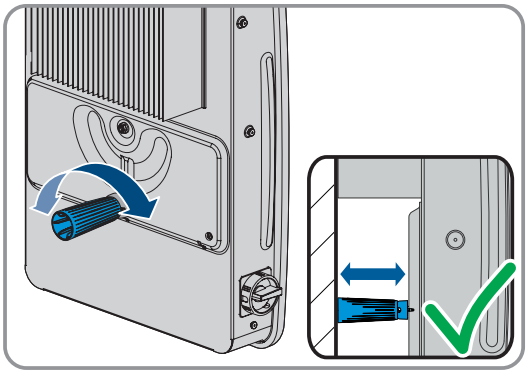
For the **SBSE8.0-50 / SBSE9.9-50** products, an additional spacer must be installed.

Procedure:

1. Attach the spacer from the scope of delivery to the enclosure. The spacer audibly snaps into place.



2. Adjust the spacer by turning it to the left or right so that the inverter is attached vertically to the support surface.



3. Make sure that the inverter is securely attached by carefully moving the enclosure back and forth.

6 Electrical Connection

6.1 Requirements for the electrical connection

6.1.1 Equipotential Bonding

If components are used in the PV system that require equipotential bonding (e.g., mounting racks, module frames), these must be connected to a central equipotential panel provided for this purpose.

Observe the installation guidelines and regulations applicable in your country. The enclosure of the inverter is not suitable as equipotential bonding. Incorrect implementation of equipotential bonding can lead to an inverter defect that is not covered under warranty.

6.1.2 Residual-current monitoring unit (RCMU)

The inverter is equipped with an all-pole sensitive residual-current monitoring unit in accordance with IEC/EN 62109-2 and VDE 0126-1-1. The all-pole sensitive residual-current monitoring unit monitors AC and DC residual currents. It disconnects the inverter redundantly from the utility grid in the event of residual current jumps of > 30 mA. If the residual current monitoring unit malfunctions, the inverter is immediately disconnected from the utility grid at all poles. If the protection by automatic disconnection of supply according to DIN VDE 0100-410 is fulfilled by an appropriate overcurrent protective device, the inverter does not require an external residual-current device for safe operation. If local regulations require a residual-current device, the following must be observed in addition to the information in the local regulations:

- The inverter is compatible with type A and B residual-current devices. The rated residual current of the residual-current device must be 30 mA or higher (for information on selecting a residual-current device, see Technical Information "Criteria for Selecting a Residual-Current Device" under www.SMA-Solar.com). Each inverter in the system must be connected to the utility grid via a separate residual-current device.
- When using residual-current device with a lower rated residual current, there is a risk of false tripping of the residual-current device, depending on the system design.

6.1.3 Overvoltage category

The product can be used in grids of overvoltage category III or lower in accordance with IEC 60664-1. That means that the product can be permanently connected to the grid-connection point of a building.

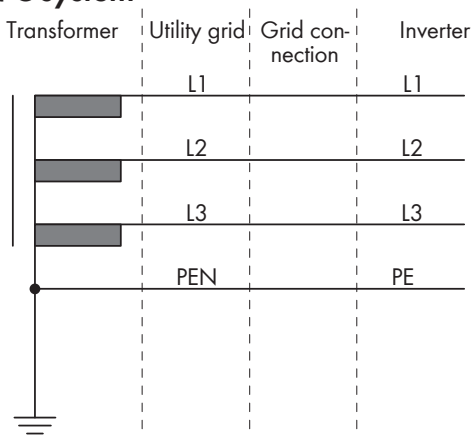
6.1.4 Permitted grid configurations

The inverter approved for operation in the following utility grids:

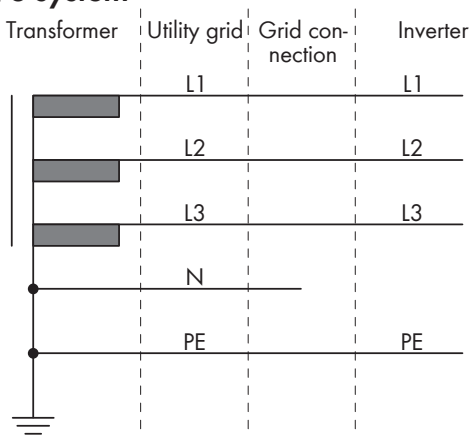
- TN-C
- TN-S
- TN-C-S
- TT[1)]
- Delta IT

[1)] It must be ensured that the local grounding has a sufficiently low-impedance connection to the grounding of the transformer, otherwise operational leakage currents can lead to potential differences. For error-free operation, the ground potential at the neutral point of the transformer must be the same as that of the grounding conductor connection on the inverter. Improper implementation of the transformer/grid connection with regard to low-impedance grounding of the neutral point can lead to a device defect that is not covered by the warranty.

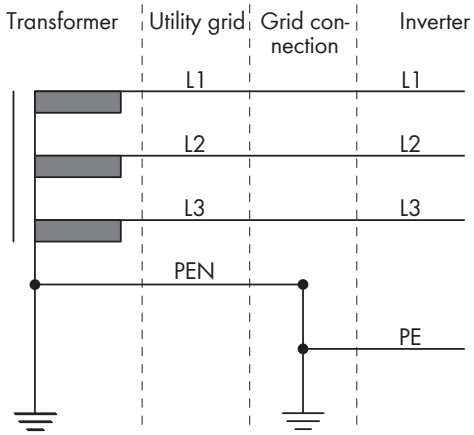
TN-C system



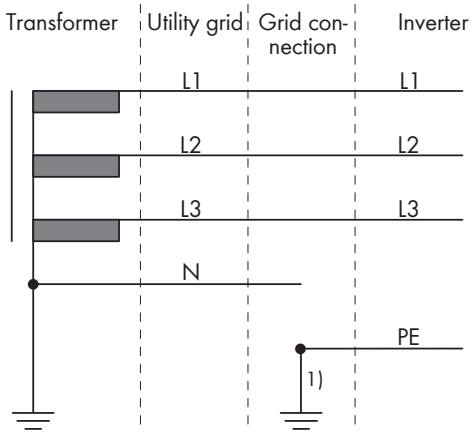
TN-S system



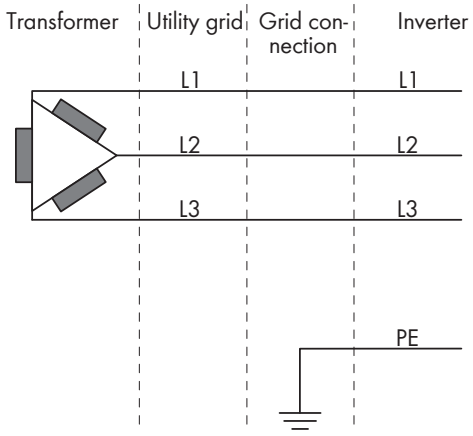
TN-C-S grid configuration



TT system



Delta-IT system



6.1.5 Requirements for the PV modules per input

- ☐ All PV modules should be of the same type.
- ☐ All PV modules should be aligned and tilted identically. Otherwise the yields may be reduced.
- ☐ If 2 strings are connected to one input, the same number of PV modules wired in series must be connected to each string.
- ☐ On the coldest day based on statistical records, the open-circuit voltage of the PV array must never exceed the maximum input voltage of the inverter.

☐ The maximum input current per string must be observed and must not exceed the through-fault current of the DC connectors in the installation.

☐ The thresholds for the input voltage and the input current of the inverter must be adhered to.

6.1.6 DC Connection Options

The inverter features either 3 PV inputs (SBSE3.6-50 / SBSE4.0-50 / SBSE5.0-50 / SBSE6.0-50) or 4 PV inputs (SBSE8.0-50 / SBSE9.9-50), depending on the power class. In normal operation, one string can be connected to each PV input.

You have the option of operating the DC inputs A and B for all power classes in parallel, and therefore of connecting more strings to the inverter. With SBSE8.0-50 / SBSE9.9-50, DC inputs C and D can be connected in parallel instead of DC inputs A and B.

Use of Y adapters for parallel connection of strings

The Y adapters must not be used to interrupt the DC circuit.

- Do not use the Y adapters in the immediate vicinity of the inverter. The adapters must not be visible or freely accessible.
- In order to interrupt the DC circuit, always disconnect the inverter as described in this document .

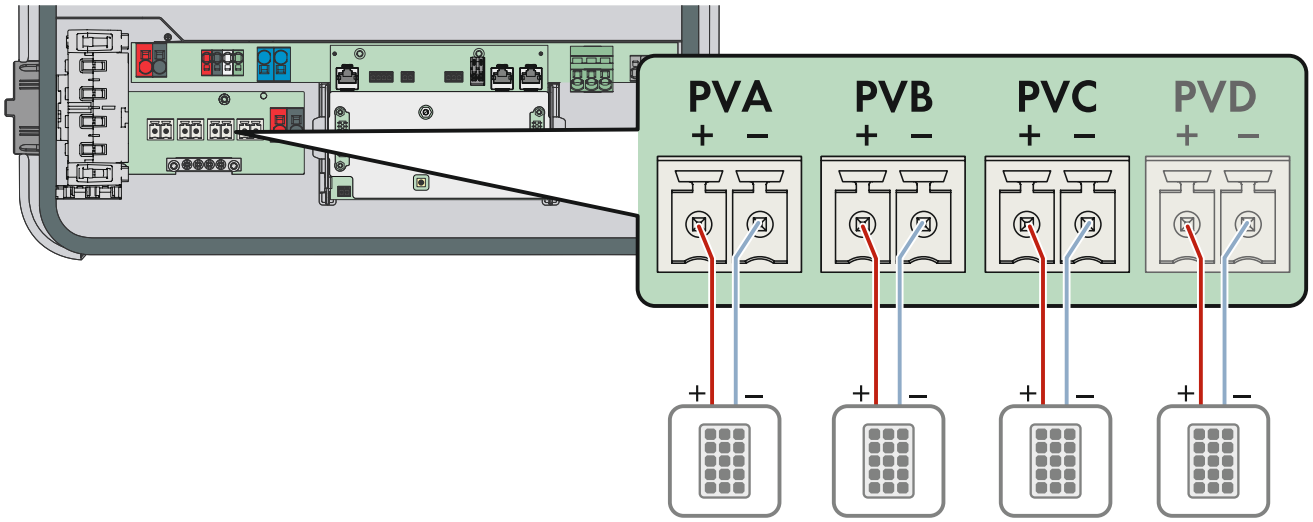


Figure 8: Connection overview for normal operation

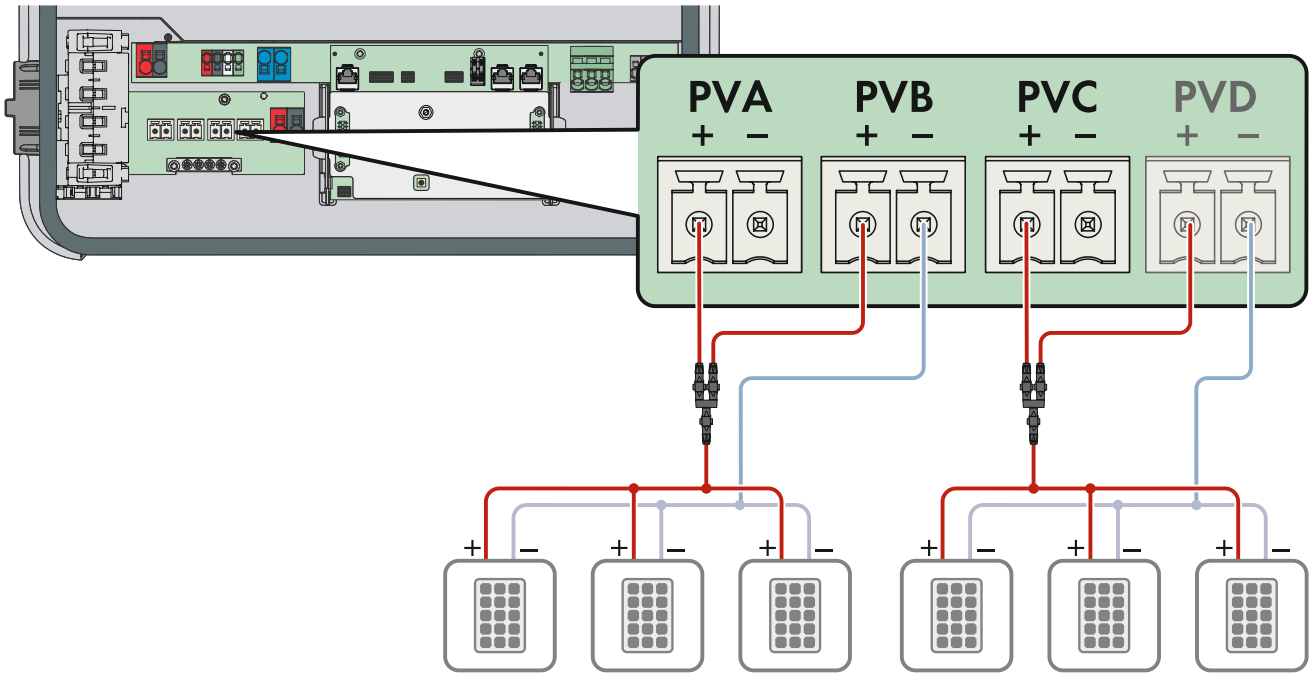


Figure 9: Connection overview for parallel connection of inputs A/B and C/D

6.1.7 Cable Requirements

6.1.7.1 AC cable requirements

- ☐ Conductor type: copper wire
- ☐ The conductors must be made of solid wire, stranded wire or fine stranded wire. When using fine stranded wire, bootlace ferrules must be used.
- ☐ Maximum cable length within the inverter: 180 mm
- ☐ Conductor cross-section for **SBSE3.6-50 / SBSE4.0-50 / SBSE5.0-50 / SBSE6.0-50:** 1.5 mm² to 10 mm²
- ☐ Conductor cross-section for **SBSE8.0-50 / SBSE9.9-50:** 6 mm² to 10 mm²
- ☐ The cross-section of the grounding conductor must not be smaller than the cross-section of the other conductors.
- ☐ External diameter: 10 mm to 25 mm
- ☐ Insulation stripping length: 18 mm
- ☐ The cable and conductor cross-sections must always be dimensioned according to the local and national directives and within the range specified by the manufacturer (SMA Solar Technology AG)." If the manufacturer (SMA Solar Technology AG) requires a higher conductor cross-section than the standard, the range of the manufacturer must be observed. Examples of factors influencing cable dimensioning are: nominal AC current, type of cable, routing method, cable bundling, ambient temperature and maximum desired line losses (for calculation of line losses, see the design software "Sunny Design" from software version 2.0 at www.SMA-Solar.com).

6.1.7.2 Requirements for the PV cables

The following requirements apply only to the PV+ and PV- cables. For grounding conductor, note that the requirements are different.

- ☐ Conductor type: copper wire
- ☐ Maximum cable length within the inverter: 180 mm (7.1 in)
- ☐ Conductor cross-section: 2 mm² to 6 mm²
- ☐ External diameter: 5 mm to 8 mm
- ☐ Nominal voltage: at least 600 V

- ☐ Insulation stripping length: 12 mm
- ☐ The cables must be designed according to the local and national guidelines for the dimensioning of lines.

6.1.7.3 Requirements for the power cable for backup operation

- ☐ Conductor type: copper wire
- ☐ The conductors must be solid or stranded wire.
- ☐ Maximum cable length within the inverter: 180 mm
- ☐ Conductor cross-section when using solid or stranded wire without bootlace ferrules: 1.5 mm^2 to 6 mm^2
- ☐ Conductor cross-section when using bootlace ferrules: 1.5 mm^2 to 4 mm^2
- ☐ External diameter: 10 mm to 14 mm
- ☐ Insulation stripping length: 10 mm to 12 mm
- ☐ Maximum length of conductors: 10 m

Also see:

- Connect the power cable for backup operation ⇒ page 45

6.1.7.4 Requirements for signal cables for backup operation, MFR, and fast stop

The cable length and quality affect the quality of the signal. Observe the following cable requirements:

- ☐ Conductor type: copper wire
- ☐ The conductors must be solid or stranded wire.
- ☐ Maximum cable length within the inverter: 260 mm
- ☐ Conductor cross-section: 0.2 mm^2 to 1.5 mm^2
- ☐ External outer diameter: max. 9 mm
- ☐ Insulation stripping length: 6 mm
- ☐ Nominal voltage: at least 600 V
- ☐ Maximum length of conductors: 30 m
- ☐ The cable type and cable-laying method must be appropriate for the application and location.

Also see:

- Connect signal cables for backup operation ⇒ page 43

6.1.7.5 Network cable requirements

The cable length and quality affect the quality of the signal. Observe the following cable requirements:

- ☐ Cable type: 100BaseTx
- ☐ Cable category: minimum CAT5e
- ☐ Plug type: RJ45 of Cat5e or higher
- ☐ Shielding: SF/UTP, S/UTP, SF/FTP or S/FTP
- ☐ Number of insulated conductor pairs and insulated conductor cross-section: at least 2 x 2 x 0.22 mm^2
- ☐ Maximum cable length within the inverter: 260 mm
- ☐ Maximum cable length between two nodes when using patch cables: 50 m
- ☐ Maximum cable length between two nodes when using installation cables: 100 m
- ☐ UV-resistant if installed outdoors.

6.1.7.6 Battery Communication Cable Requirements

The cable length and quality affect the quality of the signal. Observe the following cable requirements:

- ☐ Cable type: 100BaseTx
- ☐ Cable category: minimum CAT5e
- ☐ Plug type: RJ45 of Cat5e or higher
- ☐ Shielding: SF/UTP, S/UTP, SF/FTP or S/FTP
- ☐ Maximum cable length within the inverter: 260 mm
- ☐ Number of insulated conductor pairs and insulated conductor cross-section: at least 2 x 2 x 0.34 mm²
- ☐ Maximum cable length between inverter and battery when using patch and installation cables: 10 m
- ☐ UV-resistant for outdoor installation.

6.1.7.7 Requirements for the Battery Power Cables

- ☐ Conductor type: copper wire
- ☐ Maximum cable length within the inverter: 180 mm
- ☐ Conductor cross-section: 6 mm² to 8 mm²
- ☐ Insulation stripping length: 12 mm
- ☐ Cables can be used with or without bootlace ferrules
- ☐ Maximum permissible cable length between the inverter and the battery: 10 m
- ☐ The cables must be rated for a minimum voltage of 600 V.

6.1.7.8 Requirements for the grounding cable for additional protective grounding

- ☐ The conductor must be solid or stranded or finely stranded wire. If finely stranded wire is used, the conductor must be double-crimped with a ring terminal lug. Ensure that no insulated conductor is visible when pulling or bending. This will ensure sufficient strain relief by means of the ring terminal lug.
- ☐ Cable cross section: at least 6 mm²
- ☐ The cable must be dimensioned in accordance with the local and national directives for the dimensioning of cables. The requirements for the minimum conductor cross-section derive from these directives. Examples of factors influencing cable dimensioning are: nominal AC current, the connected AC backup loads, type of cable, routing method, cable bundling, ambient temperature and maximum desired line losses (for calculation of line losses, see the design software "Sunny Design" from software version 2.0 at www.SMA-Solar.com).

Also see:

- Connecting additional protective grounding ⇒ page 61

6.2 Overview of the Connection Area

6.2.1 View from Below

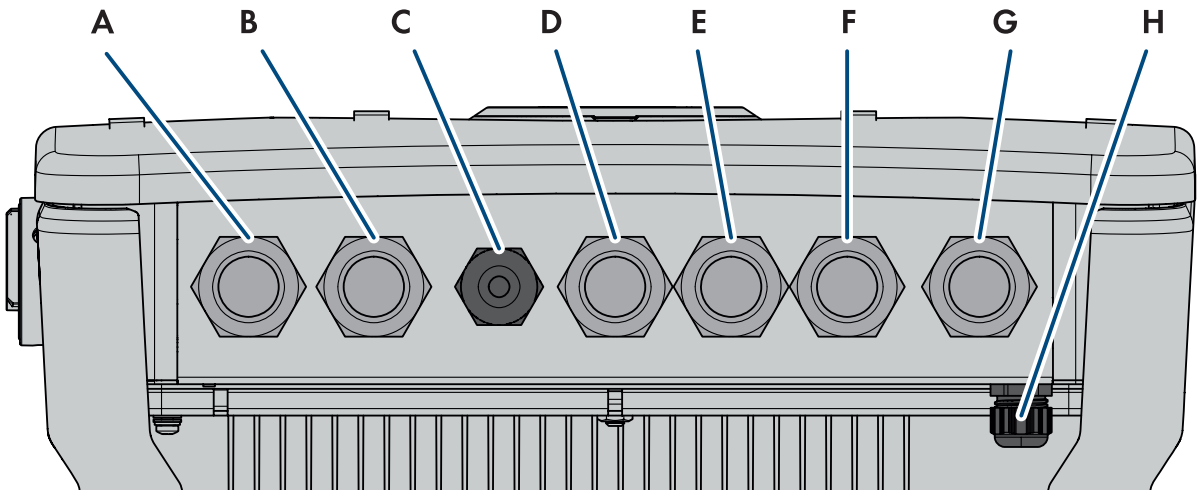


Figure 10: Bottom view of inverter

Position	Designation
A	Enclosure opening for connecting the PV modules to input A and B
B	Enclosure opening for connecting the PV modules to input C and, depending on the power class, to input D
C	Enclosure opening for battery connection
D	Enclosure opening for connecting the battery communication cable
E	Enclosure opening for connection to the multifunction relay and for signal cables for backup operation
F	Enclosure opening for connecting the network cable and the fast-stop switch
G	Enclosure opening for connecting the utility grid
H	Enclosure opening for connecting to the power cable for backup operation

6.2.2 Interior View

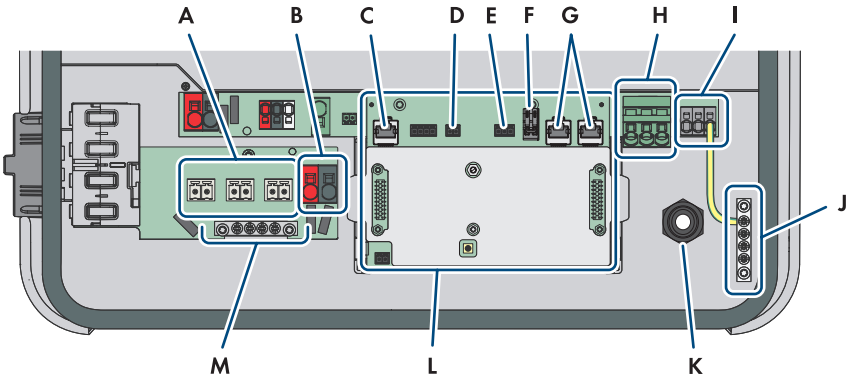


Figure 11: Connection Area of the Inverter

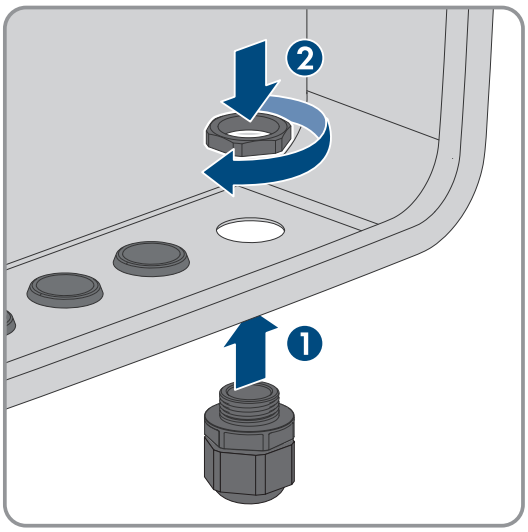
Position	Designation
A	**+PVA-**, **+PVB-**, **+PVC-** and, depending on the power class,**+PVD-** terminal blocks for connecting the PV modules
B	Connection terminals **BAT+** and **BAT -** for connecting the battery power cables
C	Network connector **BATTERY** for connecting the battery communication cable
D	Slot **SPS** for connecting the signal cable for backup operation
E	**MFR** slot for connection to the multifunction relay
F	Terminal block **GSI** with inserted bridge for the connection of a fast-stop switch
G	Network ports **LAN-1** and **LAN-2** for connecting energy meter, router, battery communication system, communication system for other PV inverters, or other Ethernet-capable devices
H	Terminal block **AC** for the connection of L and N of the utility grid
I	Terminal block **SPS** for connecting L and N of the signal cable for backup operation
J	Busbar for grounding of AC connections
K	Cable gland M20x1.5 for connection of power cable for backup operation
L	Communication assembly
M	Grounding busbar for connection of additional grounding (if necessary)
N	Wi-Fi antenna socket

6.3 Connecting the Utility Grid

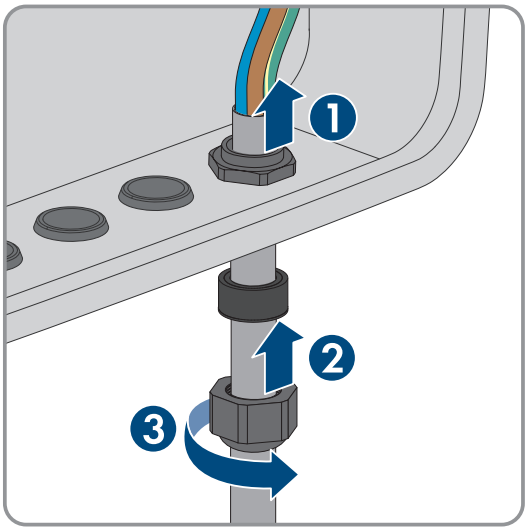
⚠ QUALIFIED PERSON

1. Disconnect the inverter from all voltage sources (see Section 9.2, page 93).
2. Remove the filler plug from the enclosure opening for connection to the utility grid.

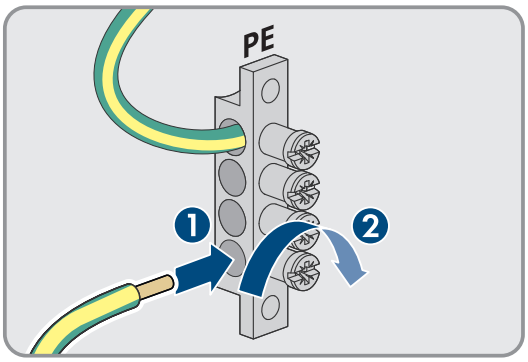
3. Insert the M32x1.5 cable gland with seal insert into the enclosure opening for connecting to the utility grid and tighten it from the inside with the counter nut.



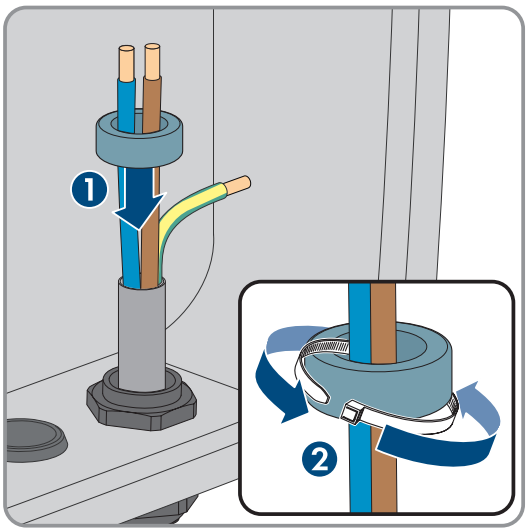
4. For cable diameters over 18 mm, remove the seal insert from the cable gland
5. Feed the cable through the cable gland and the seal insert into the interior of the inverter. If necessary, slightly loosen the swivel nut of the cable gland.



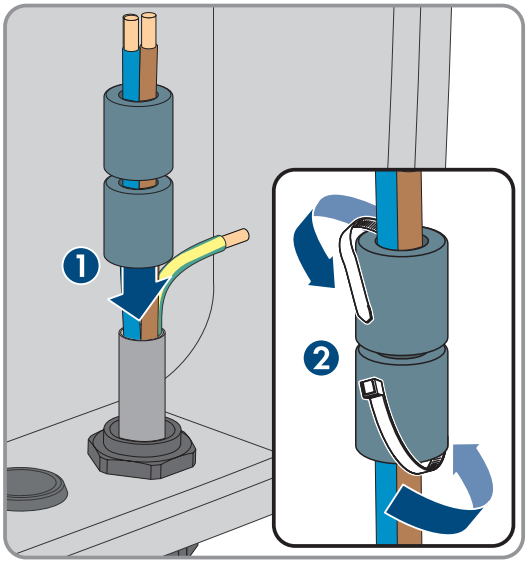
6. Dismantle the cable by 100 mm.
7. Strip the insulation of L, N and the grounding conductor by 18 mm.
8. Connect the PE to the busbar ⏚ according to the label, as short as possible without the conductor being under tension. To do so, insert the conductor into the busbar against the stop and tighten the screw (PZ2, minimum torque 2.5 Nm).



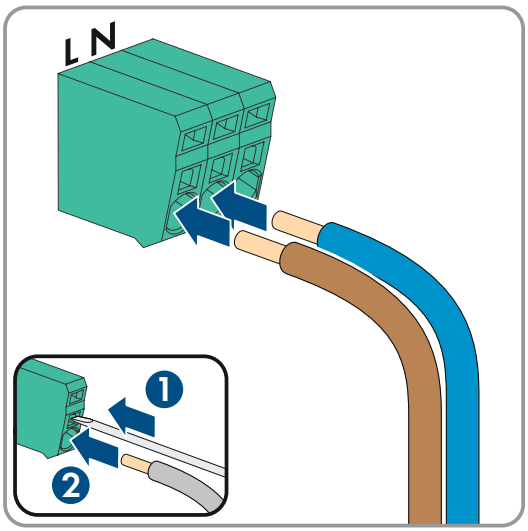
9. **For SBSE3.6-50 / SBSE4.0-50 / SBSE5.0-50 / SBSE6.0-50:** Pass the N and L through the ferrite and secure the ferrite with cable ties.



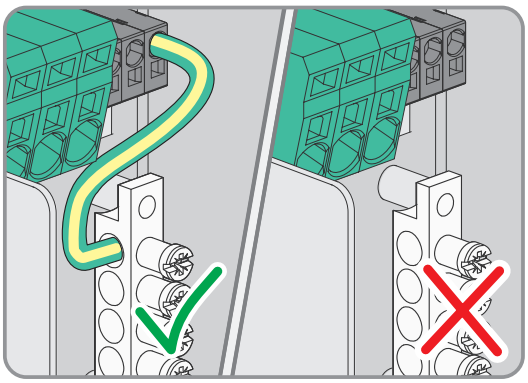
10. **For SBSE8.0-50 / SBSE9.9-50:** Pass N and L through the two ferrites and secure the ferrites with cable ties.



11. Connect N and L to the terminal block **AC** according to labeling. If necessary, open the terminal points with a flat-blade screwdriver (4 mm).



12. Make sure that the cable bridge for grounding the **N** conductor is installed.



13. Tug lightly to ensure that all conductors are secured in the terminals.
14. Tighten the union nut on the cable gland hand-tight.

6.4 Connect signal cables for backup operation

⚠ QUALIFIED PERSON

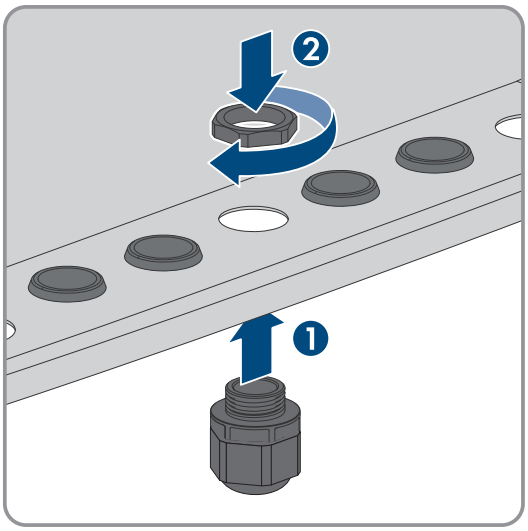
If there are multiple inverters in the system but backup loads are only connected to one of them, the backup loads should be connected to the inverter that is configured as the System Manager.

Additionally required material (not included in the scope of delivery):

☐ For secure power supply operation: 1 standard commercial switch

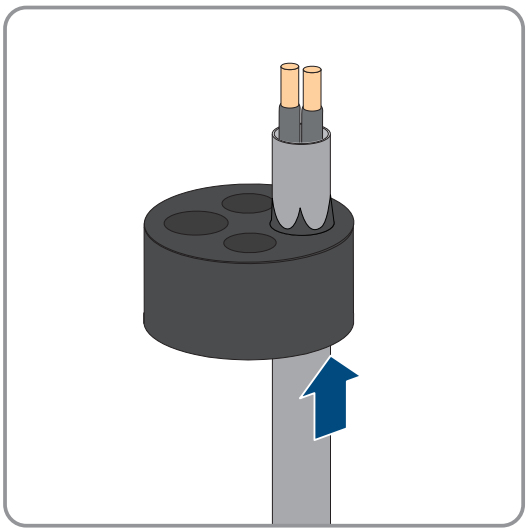
Procedure:

1. Connect the connection cable to the switch (see the manual of switch).
2. Disconnect the inverter from all voltage sources (see Section 9.2, page 93).
3. Remove the filler plug from the enclosure opening for connection to the multifunction relay and the signal cable for backup operation.
4. Insert the M32x1.5 cable gland with a four-hole cable support sleeve into the enclosure opening for connection to the multifunction relay and the signal cable for backup operation. Then, tighten it from the inside using the counter nut.

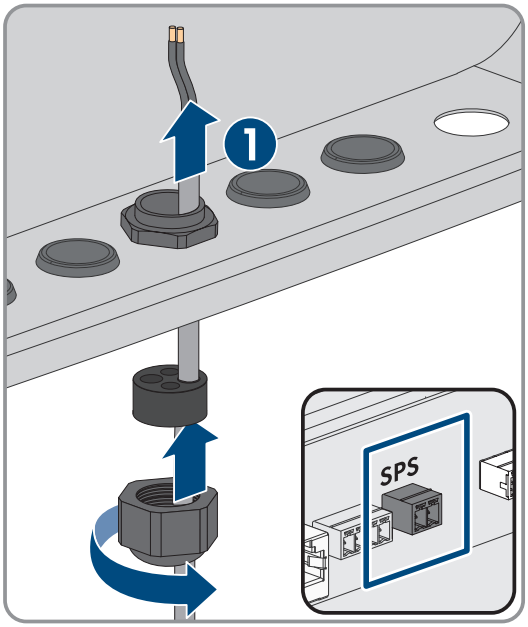


5. Unscrew the union nut from the cable gland and lead the cable through.
6. Remove the four-hole cable support sleeve from the cable gland.

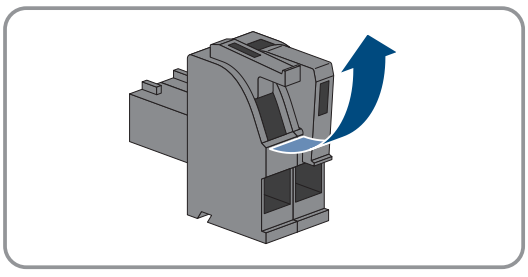
7. Insert the cable into a fitting enclosure opening of the four-hole cable support sleeve. In doing so, pierce the closed side of the enclosure opening.



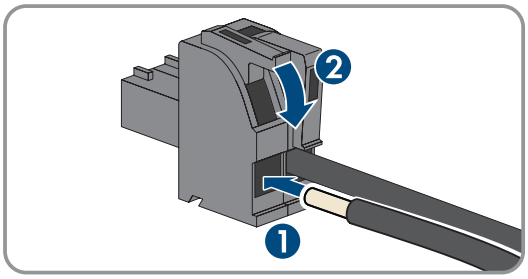
8. Press the four-hole cable support sleeve with the cable into the cable gland and route the cable to the **SPS** slot on the communication assembly.



9. Dismantle the cable by 20 mm.
10. Strip off the conductor insulation by 6 mm.
11. Release the conductor entries on the supplied two-pole connector.



12. Connect the conductors to the supplied 2-pole connector. To do so, plug the conductors into the conductor entries and close the conductor entries. Observe the connector assignment.



13. Plug the 2-pole connector into the socket **SPS** on the communication assembly. Observe the pin assignment.

14. Ensure that the connector is securely in place.
15. Ensure that all conductors are correctly connected.
16. Ensure that the conductors sit securely in the terminal points.
17. Tighten the swivel nut on the cable gland hand-tight.

Also see:

- Requirements for signal cables for backup operation, MFR, and fast stop ⇒ page 37

6.5 Connect the power cable for backup operation

⚠ QUALIFIED PERSON

If there are multiple inverters in the system but backup loads are only connected to one of them, the backup loads should be connected to the inverter that is configured as the System Manager.

Requirements:

☐ The power cables for backup operation must be pre-assembled.

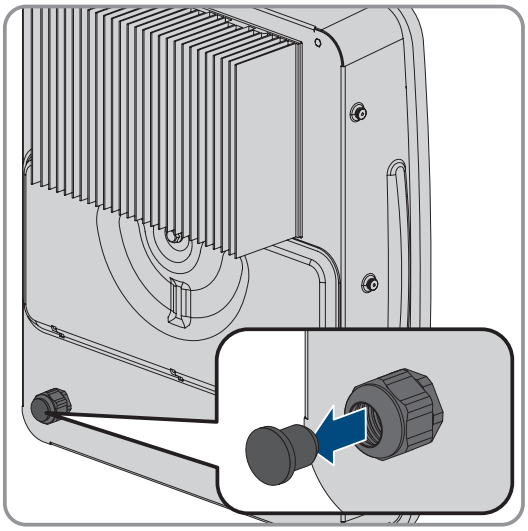
Additionally required material (not included in the scope of delivery):

☐ For secure power supply operation: 1 standard commercial socket

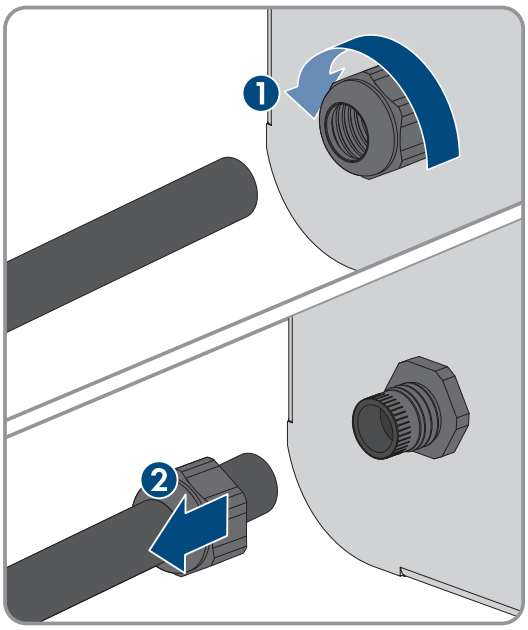
☐ For battery-backup operation: SMA Backup 3P Kit or SMA Backup 1P

Procedure:

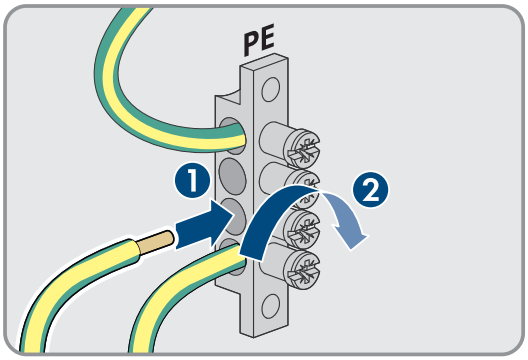
1. Disconnect the inverter from all voltage sources (see Section 9.2, page 93).
2. Remove the filler plug from the cable gland.



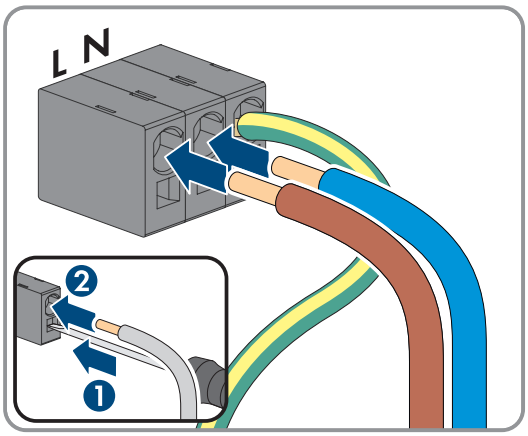
3. Unscrew the union nut at the back of the inverter from the cable gland and lead the cable through.



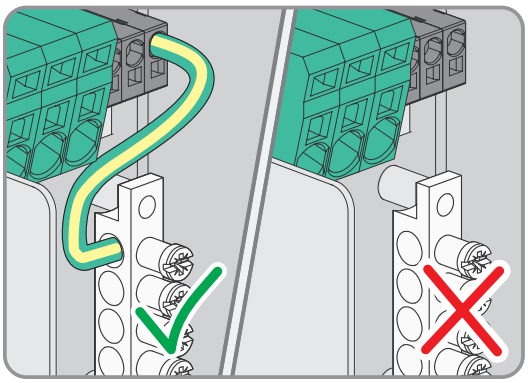
4. Feed the cable through the cable gland into the interior of the inverter.
5. Dismantle the cable by 100 mm.
6. Strip off the conductor insulation by 10 mm to 12 mm each.
7. Connect the grounding conductor to the busbar ⏚, as short as possible without the conductor being under voltage. To do so, insert the conductor into the busbar against the stop and tighten the screw (PZ2, minimum torque 2.5 Nm).



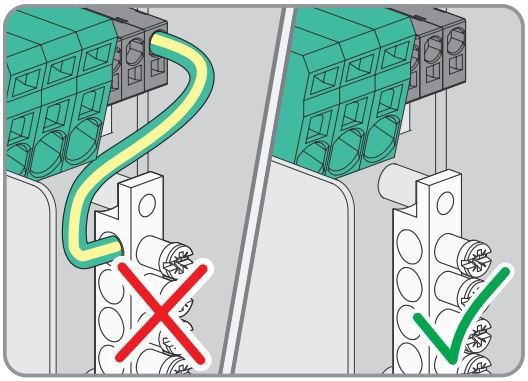
8. Connect N and L to the terminal block **SPS** according to labeling. To do this, unlock the terminal with a flat-blade screwdriver (3.5 mm).



9. **For secure power supply operation**: Ensure that the cable bridge is fitted between **N** and the busbar ⏚.



10. **For battery-backup operation**: If present, remove the grounding conductor connection between N and the busbar ⏚ grounding conductor connection. To do this, unlock the terminal with a flat-blade screwdriver (3.5 mm).



11. Tug lightly to ensure that all conductors are secured in the terminals.
12. Tighten the union nut on the cable gland hand-tight.

Also see:

- Requirements for the power cable for backup operation ⇒ page 37

6.6 Connecting the Network Cables

⚠ QUALIFIED PERSON

The following action describes how you can connect the inverter to the local network and the SMA Energy Meter or Sunny Home Manager. If there are multiple inverters in the system, the SMA Energy Meter must be connected to the inverter that will be configured as System Manager.

⚠ DANGER

Danger to life due to electric shock in case of overvoltages and if surge protection is missing

Overvoltages (e.g., in the event of a flash of lightning) can be further conducted into the building and to other connected devices in the same network via the network cables or other data cables if there is no surge protection. Touching live parts and cables results in death or lethal injuries due to electric shock.

- Ensure that all devices in the same network and the battery are integrated into the existing surge protection.
- When laying the network cables or other data cables outdoors, it must be ensured that a suitable surge protection device is provided at the transition point of the cable from the product or the battery outdoors to the inside of a building.
- The Ethernet interface of the product is classified as "TNV-1" and offers protection against overvoltages of up to 1.5 kV.

i Network cable and fast-stop switch use the same cable gland

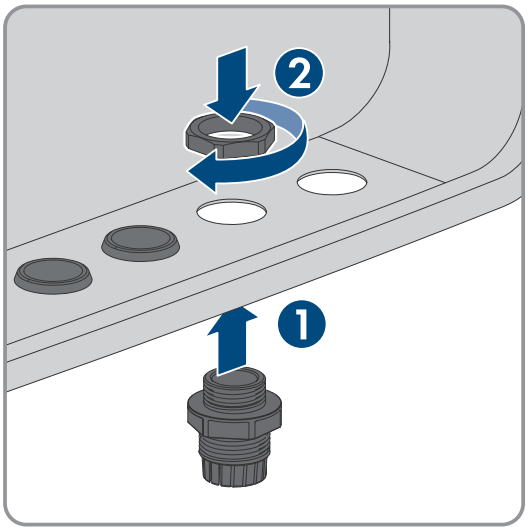
If a fast-stop switch is to be connected, plug the network cables into the cable support sleeve along with the fast-stop switch connection cable and insert them into the inverter.

Additionally required material (not included in the scope of delivery):

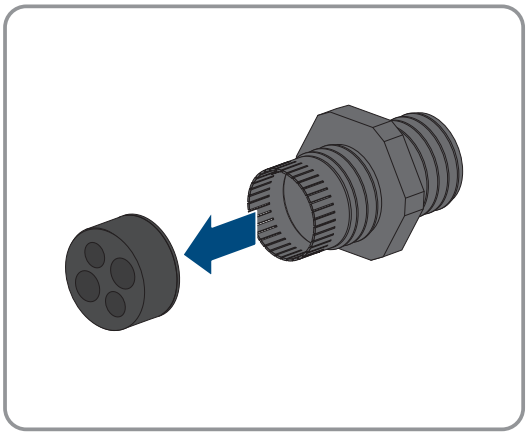
- ☐ Network cablesNetwork cable requirements
- ☐ Where required: Field-assembly RJ45 connector.

Procedure:

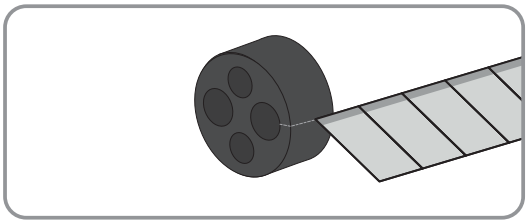
1. Disconnect the inverter from all voltage sources (see Section 9.2, page 93).
2. Remove the filler plug from the enclosure opening for connecting the network cables.
3. Insert the M32x1.5 cable gland with four-hole cable support sleeve for communication connections into the enclosure opening for connecting the network cables as well as the fast-stop switch and tighten it from the inside with the counter nut.



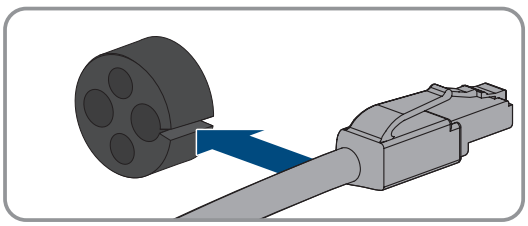
4. Unscrew the union nut from the cable gland and run it over each network cable.
5. Remove the four-hole cable support sleeve from the cable gland.



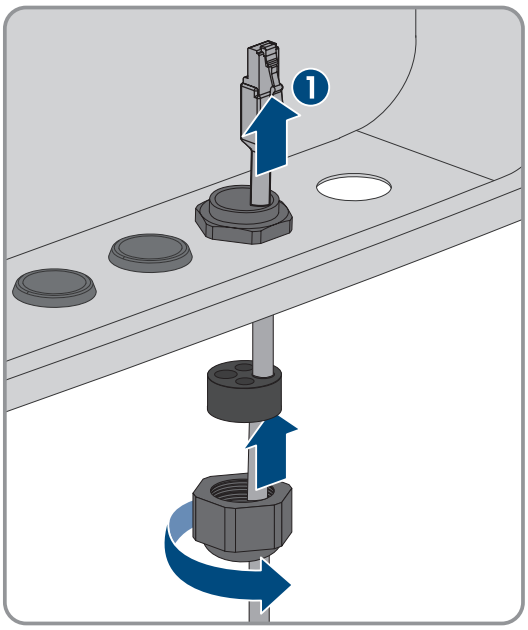
6. Use a cutter knife to cut a enclosure opening suitable for each network cable into the four-hole cable support sleeve.



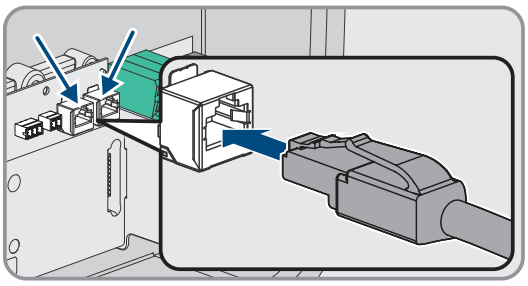
7. Insert each network cable into one of the enclosure opening.



8. Press the 4-hole cable support sleeve into the cable gland and guide each network cable to the network port.



9. When using a self-assembly network cable, assemble the RJ45 connectors and connect them to the network cable (see connector documentation).
10. Insert each network cable into one of the network connectors **LAN-1** and **LAN-2**. Ensure that the network cable cannot touch the AC cables.



11. Tug lightly to ensure that the network cable is secure.
12. If you would like to integrate the inverter into a local network, connect the other end of a network cable to the local network (e.g., via a router).
13. To connect the inverter to an SMA Energy Meter or an SMA Home Manager, connect the other end of the network cable to the SMA Energy Meter or to the Sunny Home Manager. Note that an SMA energy meter must always be connected to the inverter, which is configured as a System Manager.
14. Tighten the union nut on the cable gland hand-tight.

Also see:

- Network cable requirements ⇒ page 37

6.7 Connecting the Data Cable of the Battery

⚠ QUALIFIED PERSON

For details on approved batteries and a circuitry overview of the battery communication connection, refer to the technical information available "Approved Batteries and Information on Battery Communication Connection" at www.SMA-Solar.com

If there are several inverters and only one battery in the system, the battery should be connected to the inverter that is to be configured as the System Manager.

Battery communication and switch for secure power supply operation use the same cable gland

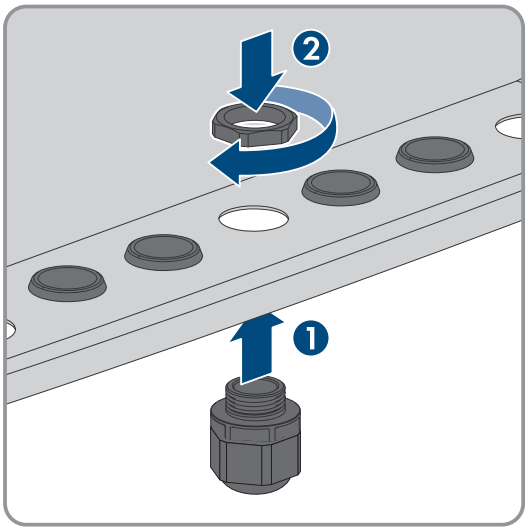
If a switch for secure power supply operation is to be connected, insert the battery communication cable into the cable support sleeve along with the switch connection cable for secure power supply operation and insert it into the inverter.

Additionally required material (not included in the scope of delivery):

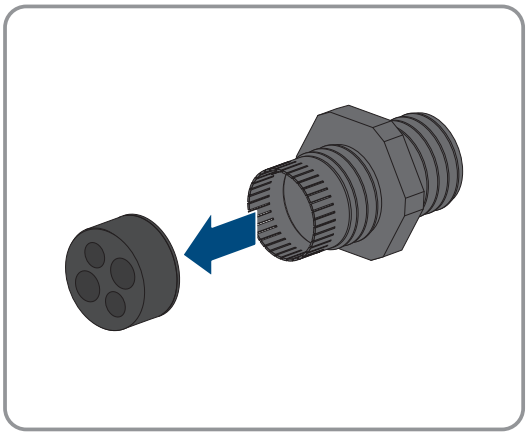
- Where required: Field-assembly RJ45 connector.

Procedure:

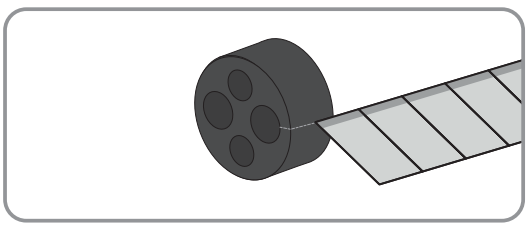
1. Disconnect the inverter from all voltage sources (see Section 9.2, page 93).
2. When using a self-assembly network cable, assemble the RJ45 connectors and connect them to the network cable (see connector documentation).
3. Remove the filler plug from the enclosure opening for connecting the battery communication cable.
4. Insert the M32x1.5 cable gland with four-hole cable support sleeve for communication connections into the enclosure opening for connecting the battery communication cable and tighten it from the inside with the counter nut.



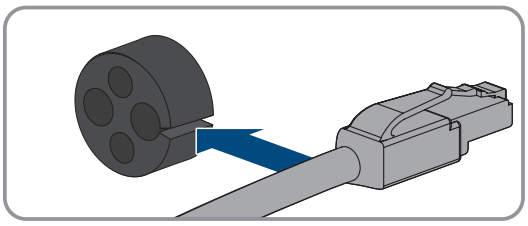
5. Unscrew the union nut from the cable gland and lead the battery communication cable through.
6. Remove the four-hole cable support sleeve from the cable gland.



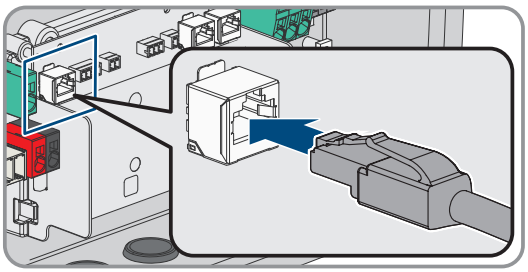
7. Insert the data cable of the battery through the cable gland.
8. Use a cutter knife to cut an enclosure opening suitable for the battery communication cable into the four-hole cable support sleeve.



9. Insert the battery communication cable into the enclosure opening.



10. Press the cable support sleeve into the 4-hole cable gland and guide the battery communication cable to the network port **BATTERY**.
11. Plug the battery communication cable into the **BATTERY** network port.



12. Ensure that the battery data cable is securely in place by pulling slightly on it.
13. Tighten the union nut on the cable gland hand-tight.

Also see:

- Network cable requirements ⇒ page 37

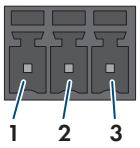
6.8 Connection to the Multifunction Relay

6.8.1 Digital output (MFR)

The multifunction relay (MFR) is a digital output that can be specifically configured to the system.

In a system with multiple inverters, you must carry out the connection to the multifunction relay of the System Manager.

6.8.2 Pin assignment MFR

Digital input	Pin	Assignment
	1	NO
	2	CO
	3	NC

6.8.3 Connect signal source to MFR

⚠ QUALIFIED PERSON

If there are several inverters in the system, the multifunction relay should be connected to the inverter that is configured as the System Manager.

Requirements:

☐ The technical requirements of the multifunction relay must be met Technical Data for Inverter.

⚠ DANGER

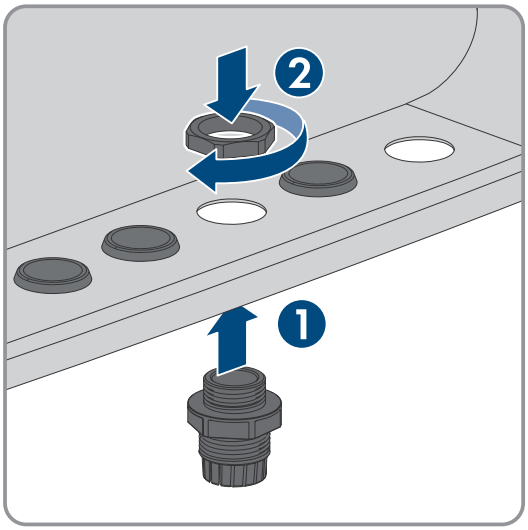
Danger to life due to electric shock

When connecting signals with voltages above 30 V to the switch connection, there is a risk of life-threatening electric shock.

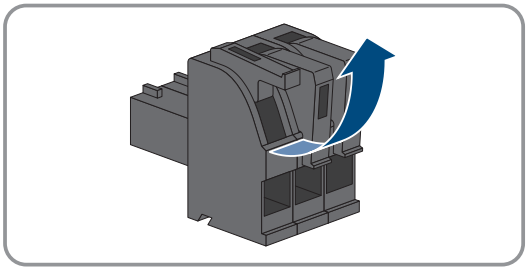
- Only connect signals with protective extra-low voltage (< 30 V).

Procedure:

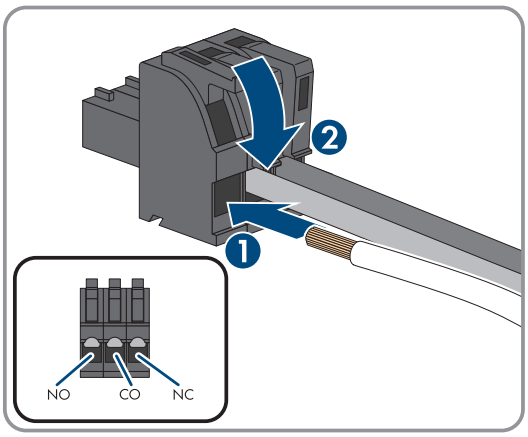
1. Disconnect the inverter from all voltage sources (see Section 9.2, page 93).
2. Remove the filler plug from the enclosure opening for connection to the multifunction relay and the switch for secure power supply operation.
3. Insert the M32x1.5 cable gland with four-hole cable support sleeve for communication connections into the enclosure opening for connection to the multifunction relay and the switch for secure power supply operation and tighten it from the inside with the counter nut.



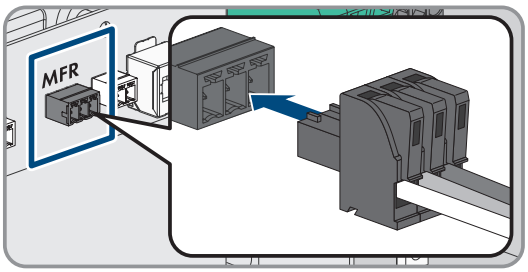
4. Unscrew the union nut from the cable gland and lead the cable through.
5. Remove the four-hole cable support sleeve from the cable gland.
6. Insert the cable into a fitting enclosure opening of the four-hole cable support sleeve. In doing so, pierce the closed side of the enclosure opening.
7. Press the four-hole cable support sleeve with the cable into the cable gland and route the cable to the **MFR** slot on the communication assembly.
8. Dismantle the cable by 20 mm.
9. Strip off the conductor insulation by 6 mm.
10. Release the conductor entries on the supplied 3-pole connector.



11. Connect the conductors to the supplied 3-pole connector. To do so, plug the conductors into the conductor entries and close the conductor entries. Observe the connector assignment.



12. Plug the 3-pole connector into the socket **MFR** on the communication assembly. Observe the pin assignment.



13. Ensure that the connector is securely in place.
14. Ensure that all conductors are correctly connected.
15. Ensure that the conductors sit securely in the terminal points.
16. Tighten the swivel nut on the cable gland hand-tight.

Also see:

- Digital output (MFR) ⇒ page 51
- Pin assignment MFR ⇒ page 51

6.9 Connection to digital input GSI

6.9.1 Digital Input GSI

You can connect a fast-stop switch at digital input **GSI**. In a system with multiple inverters, the switch for the fast stop must be connected to digital input **GSI** of the System Manager.

Also see:

- Connecting Signal Source to Digital Input GSI ⇒ page 54

6.9.2 Circuitry overview GSI

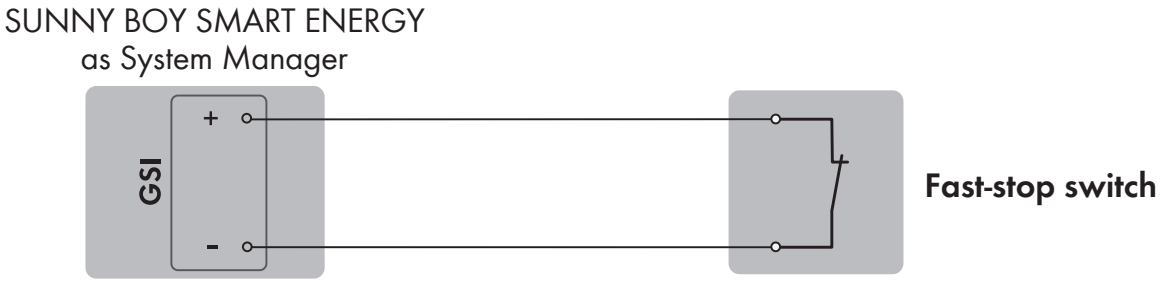


Figure 12: Connection of a switch for the fast stop to digital input GSI of the Sunny Boy Smart Energy that is to be configured as System Manager

Also see:

- Connecting Signal Source to Digital Input GSI ⇒ page 54

6.9.3 Connecting Signal Source to Digital Input GSI

⚠ QUALIFIED PERSON

Network cable and fast-stop switch use the same cable gland

If a fast-stop switch is to be connected, plug the network cables into the cable support sleeve along with the fast-stop switch connection cable and insert them into the inverter.

Additional required material (not included in the scope of delivery):

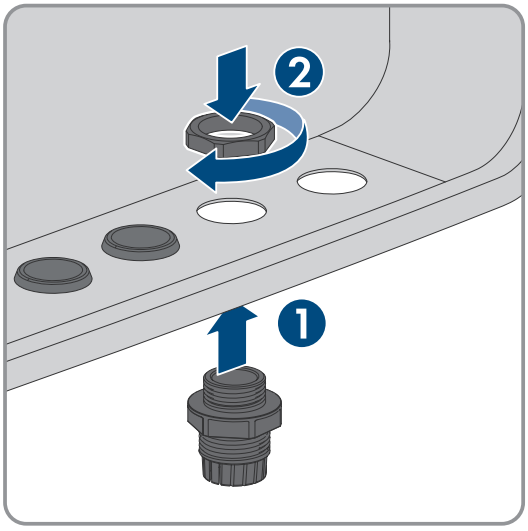
☐ 1 fast-stop switch (break contact)

Requirements:

☐ The signal source must be technically suitable for connection to the digital inputs (see Section 15, page 129).

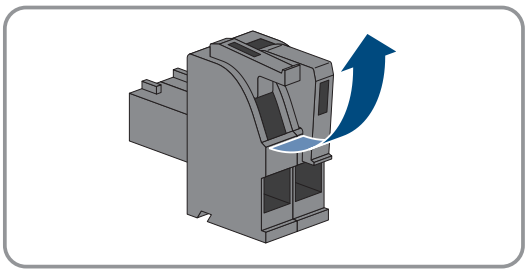
Procedure:

1. Disconnect the inverter from all voltage sources (see Section 9.2, page 93).
2. Remove the filler plug from the enclosure opening for connecting the network cables.
3. Insert the M32x1.5 cable gland with four-hole cable support sleeve for communication connections into the enclosure opening for connecting the network cables as well as the fast-stop switch and tighten it from the inside with the counter nut.

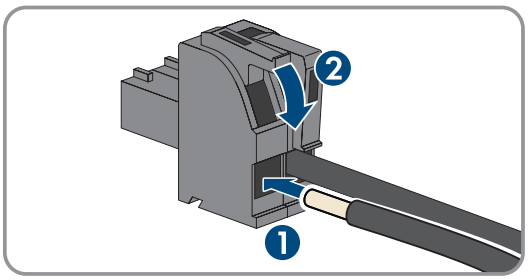


4. Unscrew the union nut from the cable gland and lead the cable through.
5. Remove the four-hole cable support sleeve from the cable gland.
6. Insert the cable into a fitting enclosure opening of the four-hole cable support sleeve. In doing so, pierce the closed side of the enclosure opening.
7. Press the four-hole cable support sleeve with the cable into the cable gland and route the cable to the **GSI** slot on the communication assembly.
8. Dismantle the cable by 20 mm.
9. Strip off the conductor insulation by 6 mm.
10. Remove the plugged two-pole connector with bridge from the **GSI** socket.
11. Remove the bridge from the 2-pole connector.

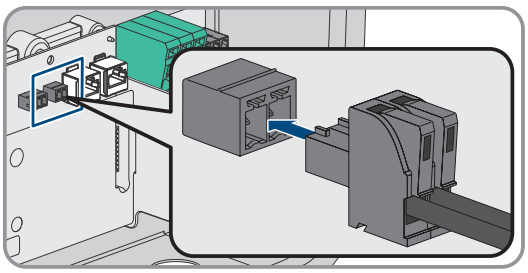
12. Release the conductor entries on the 2-pole connector.



13. Connect the conductors to the 2-pole connector. To do so, plug the conductors into the conductor entries and close the conductor entries. Observe the connector assignment.



14. Plug the two-pole connector with connection cables into the socket **GSI** on the communication assembly. Observe the pin assignment.



15. Ensure that the connector is securely in place.
16. Ensure that all conductors are correctly connected.
17. Ensure that the conductors sit securely in the terminal points.
18. Tighten the swivel nut on the cable gland hand-tight.

Also see:

- Requirements for signal cables for backup operation, MFR, and fast stop ⇒ page 37
- Circuitry overview GSI ⇒ page 53
- Digital Input GSI ⇒ page 53

6.10 Mounting the WLAN Antenna

⚠ QUALIFIED PERSON

If the Wi-Fi range is insufficient, the signal can be enhanced with a Wi-Fi antenna.

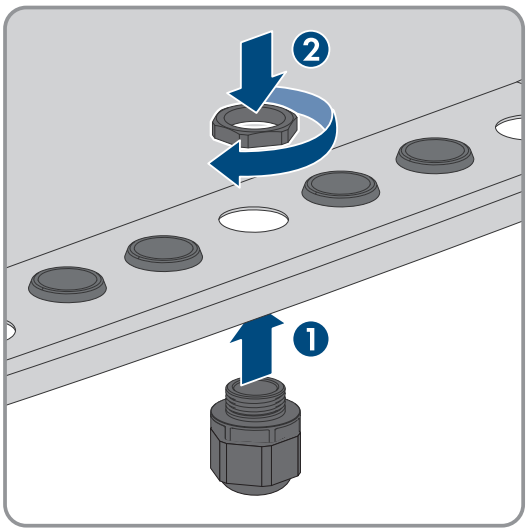
Additionally required material:

- 1 passive Wi-Fi antenna with cable and SMB socket

Procedure:

1. Disconnect the inverter from all voltage sources (see Section 9.2, page 93).
2. Remove the filler plug from the middle enclosure opening.

3. Insert the M32x1.5 cable gland with four-hole cable support sleeve for communication connections into the enclosure opening at the center and tighten it from the inside with the counter nut.



4. Unscrew the union nut from the cable gland and lead the cable through.
5. Remove the four-hole cable support sleeve from the cable gland.
6. Insert the cable into a fitting enclosure opening of the four-hole cable support sleeve. In doing so, pierce the closed side of the enclosure opening.
7. Press the four-hole cable support sleeve with the cable into the cable gland.
8. Plug the Wi-Fi antenna cable into the socket and screw tight (tightening torque: 1 Nm).
9. Ensure that the cable is secure by gently pulling on it.
10. Tighten the swivel nut on the cable gland hand-tight.
11. Install the antenna as far away as possible from the inverter in order to achieve a wide Wi-Fi range. Do not attach the antenna to the enclosure of the inverter.
12. **Information:** The appropriate Wi-Fi antenna is automatically selected depending on the connection quality. The currently active antenna is displayed via the instantaneous value **WiFi antenna type**.

6.11 Connecting the PV Array

⚠ QUALIFIED PERSON

NOTICE

Damage to the product due to ground fault on DC side during operation

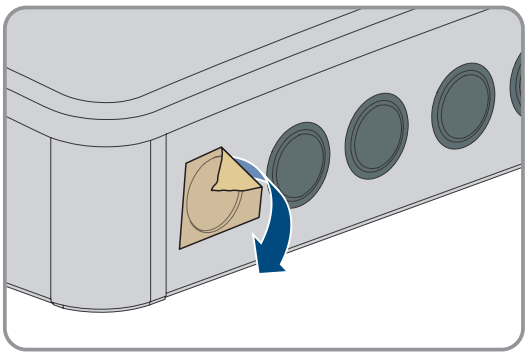
Due to the transformerless topology of the product, the occurrence of ground faults on DC side during operation can lead to irreparable damage. Damages to the product due to a faulty or damaged DC installation are not covered by warranty. The product is equipped with a protective device that checks whether a ground fault is present during the starting sequence. The product is not protected during operation.

- Ensure that the DC installation is carried out correctly and no ground fault occurs during operation.

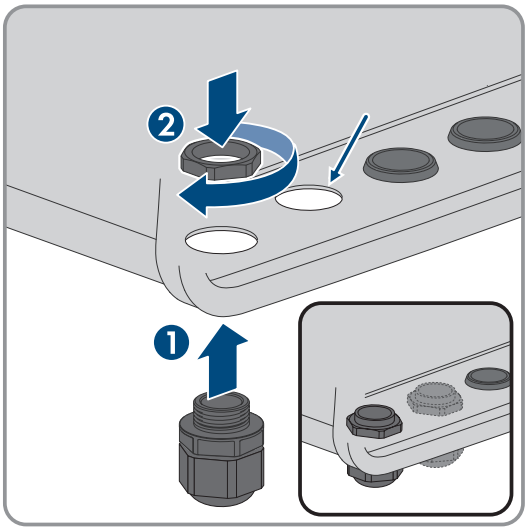
Procedure:

1. Disconnect the inverter from all voltage sources (see Section 9.2, page 93).

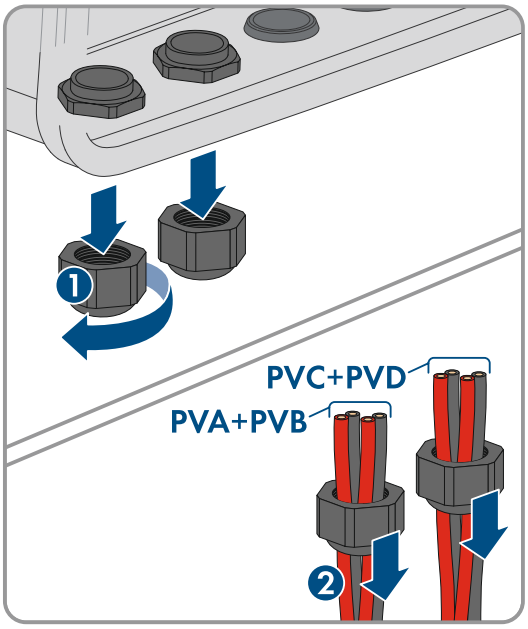
2. Remove the adhesive tape from the enclosure opening for connecting the PV modules to inputs A and B.



3. If more than 2 strings are connected, remove the filler plug from the second enclosure opening from the left.
4. Depending on the number of strings available, insert 1 or 2 M32x1.5 cable glands with four-hole cable support sleeve into an enclosure opening for connecting the PV modules and tighten them from the inside with the counter nut.

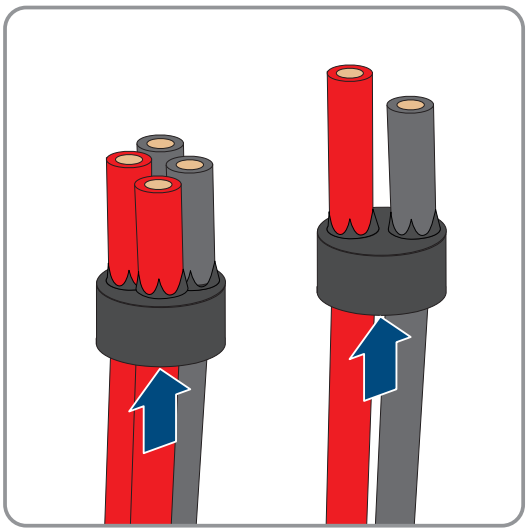


5. Unscrew the union nut from each cable gland and run it over the DC cables. Depending on the power class, run the cables for **PVA** and **PVB** together through a union nut and cable gland, and the cable for **PVC** and, if applicable, **PVD** through another union nut and cable gland.

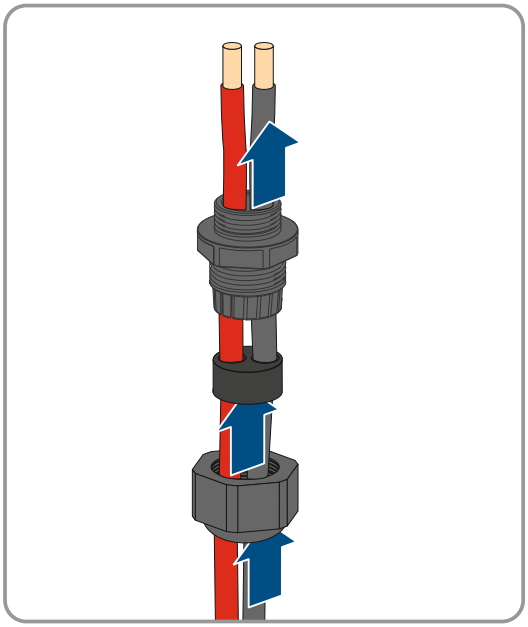


6. Remove the four-hole cable support sleeve from the cable gland.

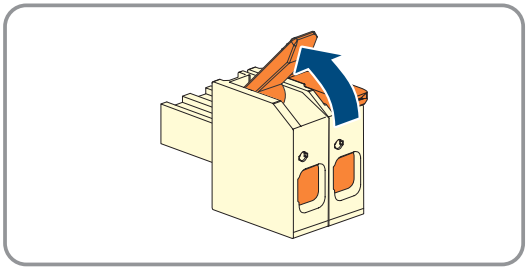
7. Plug the DC cables into one enclosure opening in each of the four-hole cable support sleeves. In doing so, pierce the closed side of the enclosure opening.



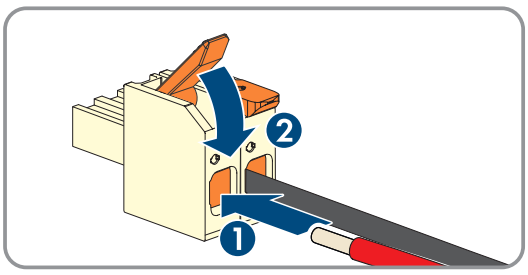
8. Strip the insulation of the DC cables by approx. 12 mm.



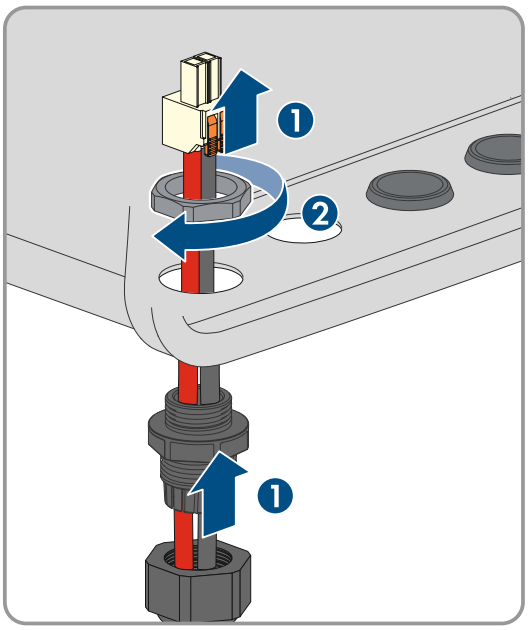
9. Push up the levers on the terminal blocks for connecting the PV modules.



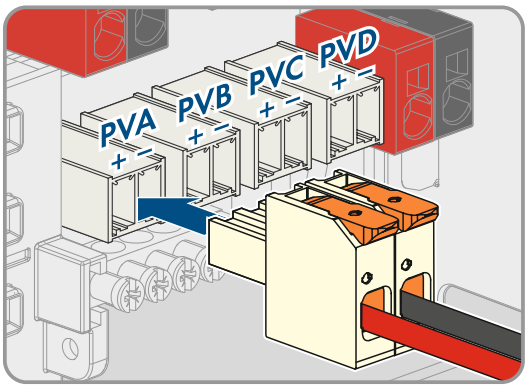
10. Connect the DC cables to the terminal blocks for connecting the PV modules. To do this, insert the conductor and push down the lever.



11. Feed the DC cable through the enclosure opening and then through the nut of the PG cable gland.



12. Plug the terminal blocks onto the **PVA**, **PVB**, **PVC** and, if applicable, **PVD** slots.



13. Firmly hand-tighten the swivel nuts of the cable glands.

Also see:

- Requirements for the PV modules per input ⇒ page 34
- Requirements for the PV cables ⇒ page 36

6.12 Connecting the power cable of the battery

⚠ QUALIFIED PERSON

If there are several inverters and only one battery in the system, the battery should be connected to the inverter that is to be configured as the System Manager.

Bridge at GSI terminal must be inserted when operating with BYD battery

Upon delivery of the Sunny Boy Smart Energy, there is a jumper wire on the **GSI** terminal block. This jumper wire must be removed when a switch for the fast stop is connected. As soon as the jumper wire has been removed, operation with a battery from BYD is no longer possible.

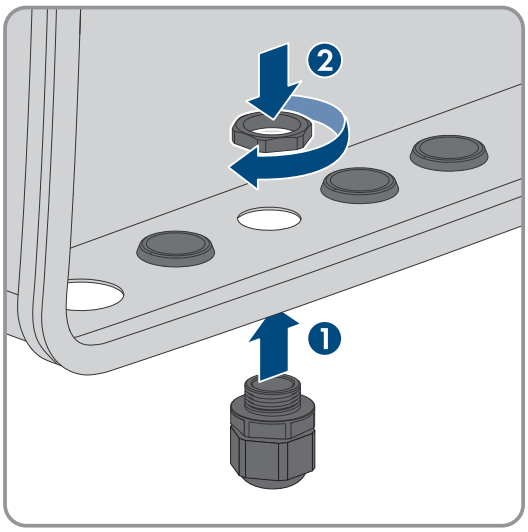
Requirements:

☐ The battery power cables must be pre-assembled.

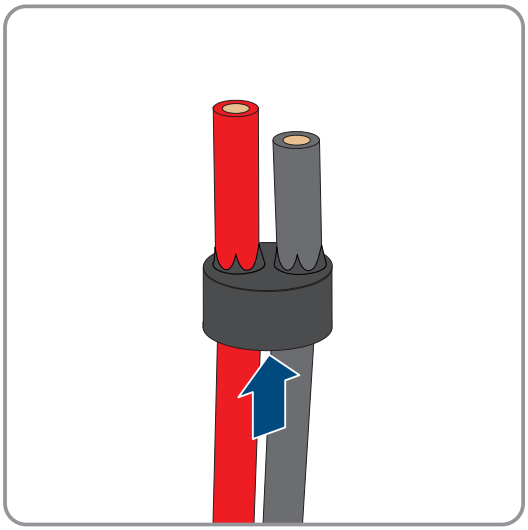
Procedure:

1. Disconnect the inverter from all voltage sources (see Section 9.2, page 93).

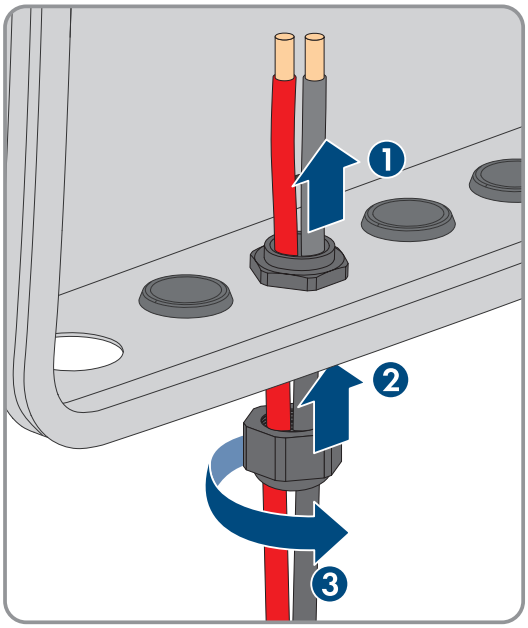
2. Insert the M25x1.5 cable gland with two-hole cable support sleeve into the enclosure opening for connecting the battery power cables and tighten it from the inside with the counter nut.



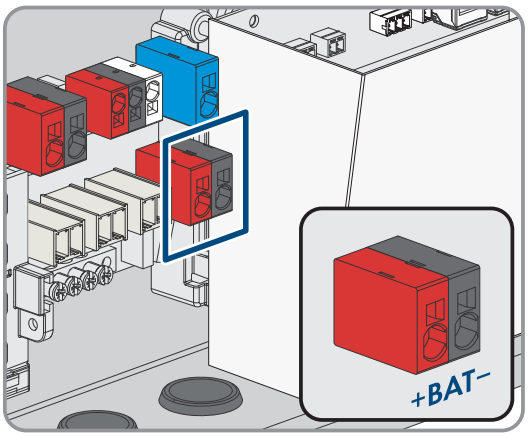
3. Unscrew the union nut from the cable gland and lead the cable through.
4. Remove the two-hole cable support sleeve from the cable gland.
5. Insert the battery power cables into the enclosure openings. In doing so, pierce the closed side of the enclosure opening.



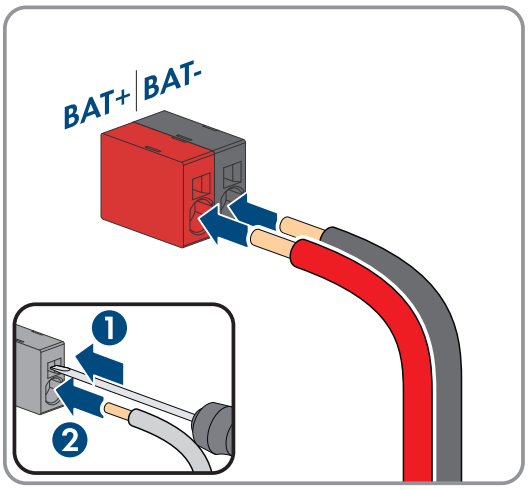
6. Press the two-hole cable support sleeve including the battery power cables into the cable gland.



7. Route the battery power cables to the terminal block **BAT+** and **BAT-**.



8. Connect the battery power cables to the terminal block **BAT+** and **BAT-** according to the label. To do so, insert a flathead screwdriver into the top opening of the terminal and insert the cable into the bottom opening. Then remove the screwdriver.



9. Tug lightly to ensure that the cables are secured in the terminals.
10. Tighten the union nut on the cable gland hand-tight.

Also see:

- Requirements for the Battery Power Cables ⇒ page 38

6.13 Connecting additional protective grounding

⚠ QUALIFIED PERSON

If additional protective grounding or equipotential bonding is required locally, you can connect additional protective grounding to the product. This prevents touch current if the grounding conductor at the terminal for the AC cable fails. The required M5x16 screw and washer assembly, the washer, and the conical spring washer are included in the scope of delivery of the inverter.

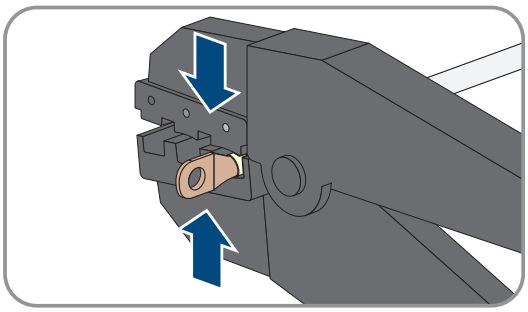
Additionally required material:

- 1 ring terminal lug

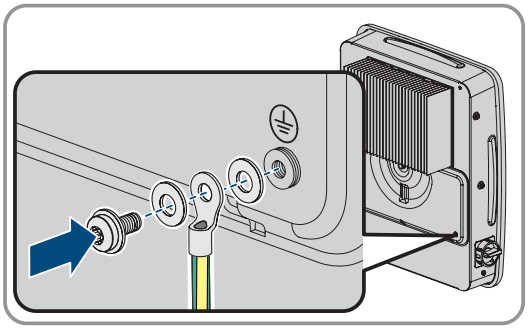
Procedure:

1. Disconnect the inverter from all voltage sources (see Section 9.2, page 93).
2. Strip the grounding cable insulation.

3. Insert the stripped part of the grounding cable into the ring terminal lug and crimp using a crimping tool.



4. Insert the screw and washer assembly through the hole in the ring terminal lug and tighten the screw with a Torx screwdriver (TX25) (tightening torque: 2.5 Nm) at the connection point for additional grounding.



Also see:

- Requirements for the grounding cable for additional protective grounding ⇒ page 38

7 Commissioning

7.1 Commissioning Procedure of System with the SMA 360° App

The entire system can be configured with the SMA 360° app following the connection of the individual components. SMA Solar Technology AG recommends using the SMA 360° app to configure the system.

Procedure		See
1.	Connect and switch on all devices in the system (e.g. inverter, energy meter, battery).	Manuals for the devices Section 7.3, page 66
2.	Carry out the configuration using the commissioning wizard of the SMA 360° app.	Section 7.4, page 69
3.	Make further settings if necessary (e.g., configure multifunction relay, configure arc-fault circuit interrupter).	Section 8, page 71

7.2 Commissioning via User Interface

7.2.1 Procedure for commissioning as System Manager

This section describes the procedure of commissioning an inverter that is used in systems as System Manager. For commissioning, proceed as described in this section and perform the steps in the given order.

Only 1 device in the system can be used as System Manager at a time. All other devices must be configured as a subordinate device and recorded in the System Manager.

If a Sunny Home Manager is available, all inverters must be configured as subordinate inverters (see Section 7.2.2, page 64).

i A country data set must be set for feed-in operation

To ensure the inverter starts feed-in operation during initial commissioning, a country data set must be set (e.g., via the product commissioning wizard or on the user interface of the product, or via a System Manger).

If no country data set is set, then feed-in operation will be stopped. This state is signaled by the green and red LEDs flashing simultaneously.

The inverter will automatically start feed-in operation only after the inverter configuration is completed.

i The country data set must be set correctly.

If you select a country data set which is not valid for your country and purpose, it can cause a disturbance in the PV system and lead to problems with the grid operator. When selecting the country data set, you must always observe the locally applicable standards and directives as well as the properties of the PV system (e.g. PV system size, grid-connection point).

- If you are not sure which standards and directives are valid for your country or purpose, contact the grid operator.

i The grid type must be set correctly

If you select the wrong grid type, it can cause a disturbance in the PV system and lead to problems with the grid operator.

Procedure		See
1.	Switch on all SMA Speedwire devices that are to be subordinate to the System Manager (e.g., inverters, SMA Energy Meter).	Manual of the devices

Procedure		See
2.	Commission the inverter that is to be configured as the System Manager.	Commissioning the Inverter
3.	Establish a connection to the user interface of the inverter that is to be configured as System Manager. There are various connection options to choose from for this: • Direct connection via Wi-Fi • Connection via Wi-Fi in the local network • Connection via Ethernet in the local network	Section 8.2.2, page 73 Section 8.2.1, page 71
4.	If required, change the network configuration on the welcome page. The automatic network configuration recommended by SMA Solar Technology AG via DHCP server is activated by default. Only change the network configurations if the default configuration is not suitable for your network.	Commissioning Assistant
5.	Carry out the configuration using the Commissioning Assistant. Select **Inverter as System Manager** in the device function.	Commissioning Assistant
6.	Configure energy management and activate increased self-consumption.	Section 8.14, page 79
7.	Make further settings if necessary (e.g., configure multifunction relay,configure digital input of fast stop, configure arc-fault circuit interrupter).	Section 8, page 71
8.	To monitor the system in the Sunny Portal and view the data visually, create a user account in the Sunny Portal and create a system in the Sunny Portal or add devices to an existing system.	https://ennexOS.SunnyPortal.com

7.2.2 Procedure for commissioning in systems with Sunny Home Manager

This section describes the procedure of commissioning an inverter that is used in systems with Sunny Home Manager. For commissioning, proceed as described in this section and perform the steps in the given order.

If a Sunny Home Manager is available, all inverters must be configured as subordinate inverters.

A country data set must be set for feed-in operation

To ensure the inverter starts feed-in operation during initial commissioning, a country data set must be set (e.g., via the product commissioning wizard or on the user interface of the product, or via a System Manger).

If no country data set is set, then feed-in operation will be stopped. This state is signaled by the green and red LEDs flashing simultaneously.

The inverter will automatically start feed-in operation only after the inverter configuration is completed.

The country data set must be set correctly.

If you select a country data set which is not valid for your country and purpose, it can cause a disturbance in the PV system and lead to problems with the grid operator. When selecting the country data set, you must always observe the locally applicable standards and directives as well as the properties of the PV system (e.g. PV system size, grid-connection point).

- If you are not sure which standards and directives are valid for your country or purpose, contact the grid operator.

The grid type must be set correctly

If you select the wrong grid type, it can cause a disturbance in the PV system and lead to problems with the grid operator.

Procedure		See
1.	Switch on each inverter in the system.	Commissioning the Inverter
2.	Establish a connection to the user interface of the inverter. There are various connection options to choose from for this: • Direct connection via Wi-Fi • Connection via Wi-Fi in the local network • Connection via Ethernet in the local network	Section 8.2.2, page 73 Section 8.2.1, page 71
3.	If required, change the network configuration on the welcome page. The automatic network configuration recommended by SMA Solar Technology AG via DHCP server is activated by default. Only change the network configurations if the default configuration is not suitable for your network.	Commissioning Assistant
4.	Carry out the configuration using the Commissioning Assistant. Select **Subordinate inverter** in the device function and set the country data set.	Commissioning Assistant
5.	Put the Sunny Home Manager into operation and register all inverters in the Sunny Home Manager.	Manual of the Sunny Home Manager

7.2.3 Procedure for commissioning as a subordinate device

This section describes the procedure of commissioning an inverter that is used in systems with or without System Manager. For commissioning, proceed as described in this section and perform the steps in the given order.

In systems with System Manager, only 1 device can be used as System Manager at a time. All other devices must be configured as a subordinate device and recorded in the System Manager.

If a Sunny Home Manager is available, all inverters must be configured as subordinate inverters (see Section 7.2.2, page 64).

A country data set must be set for feed-in operation

To ensure the inverter starts feed-in operation during initial commissioning, a country data set must be set (e.g., via the product commissioning wizard or on the user interface of the product, or via a System Manger).

If no country data set is set, then feed-in operation will be stopped. This state is signaled by the green and red LEDs flashing simultaneously.

The inverter will automatically start feed-in operation only after the inverter configuration is completed.

The country data set must be set correctly.

If you select a country data set which is not valid for your country and purpose, it can cause a disturbance in the PV system and lead to problems with the grid operator. When selecting the country data set, you must always observe the locally applicable standards and directives as well as the properties of the PV system (e.g. PV system size, grid-connection point).

- If you are not sure which standards and directives are valid for your country or purpose, contact the grid operator.

The grid type must be set correctly

If you select the wrong grid type, it can cause a disturbance in the PV system and lead to problems with the grid operator.

Procedure		See
1.	Switch on the inverter.	Commissioning the Inverter
2.	Establish a connection to the user interface of the inverter. There are various connection options to choose from for this: • Direct connection via Wi-Fi • Connection via Wi-Fi in the local network • Connection via Ethernet in the local network	Section 8.2.2, page 73 Section 8.2.1, page 71
3.	If required, change the network configuration on the welcome page. The automatic network configuration recommended by SMA Solar Technology AG via DHCP server is activated by default. Only change the network configurations if the default configuration is not suitable for your network.	Commissioning Assistant
4.	Carry out the configuration using the Commissioning Assistant. Select **Subordinate inverter** in the device function.	Commissioning Assistant
5.	Commissioning the inverter to be configured as a System Manager, performing the plant-wide configuration using the commissioning wizard. Register all devices in the system and carry out the system-wide configuration.	Procedure for commissioning as System Manager

7.3 Switching the Inverter On

⚠ QUALIFIED PERSON

Requirements:

☐ The AC circuit breaker must be correctly rated and mounted.

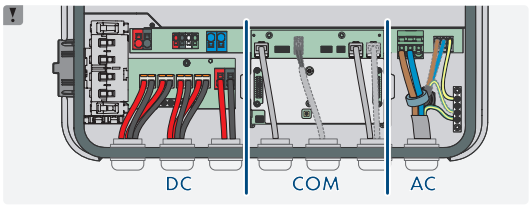
☐ The inverter must be correctly mounted.

☐ All cables must be correctly connected.

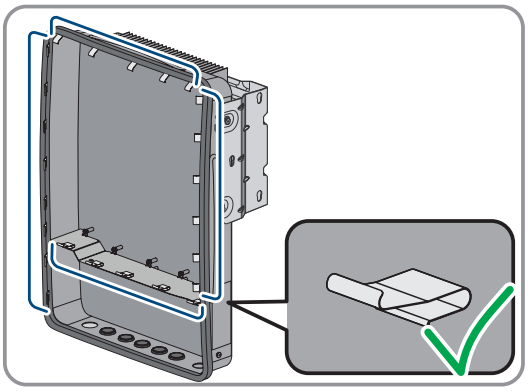
☐ Unused enclosure openings must be sealed tightly with filler plugs.

Procedure:

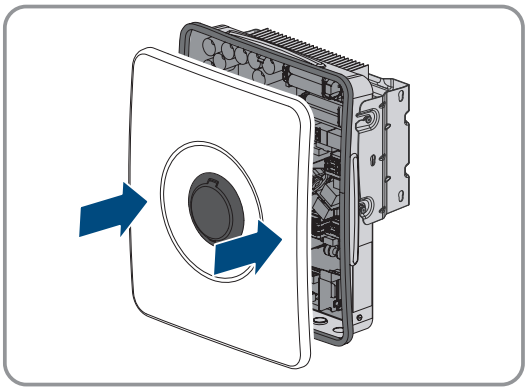
1. Make sure that the communication cables do not touch the AC or DC cables.



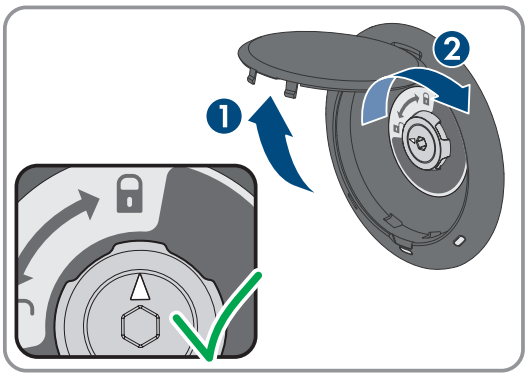
2. Make sure that all EMC terminals are present and correctly attached to the enclosure. SBSE-3.6-50 / SBSE-4.0-50 / SBSE-5.0-50 / SBSE-5.8-US-50 / SBSE-6.0-50 have 9 shield connection terminals, SBSE8.0-50 / SBSE9.9-50 have 24 shield connection terminals.



3. Make sure that cables do not protrude out of the enclosure, so that they could press against the cover when it is installed.
4. Align the cover with the enclosure and press in place with both hands.



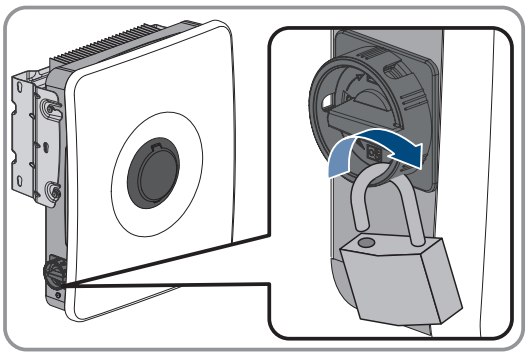
5. Open the cover of the enclosure lock and use an Allen key to tighten the central screw until you hear an audible click. Note the direction of rotation printed on the cover.



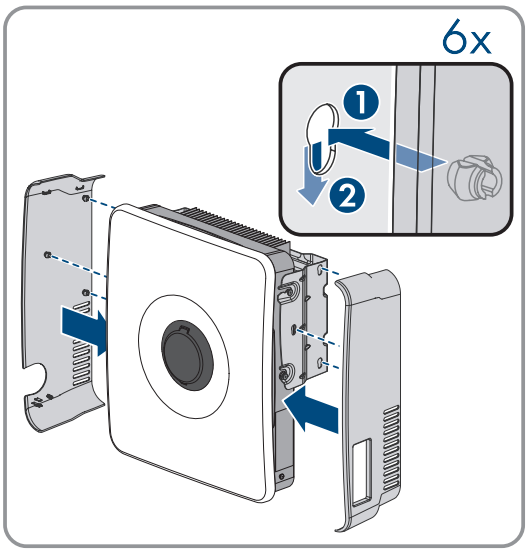
6. Close the cover of the enclosure lock again.

☑ The enclosure cover is attached.

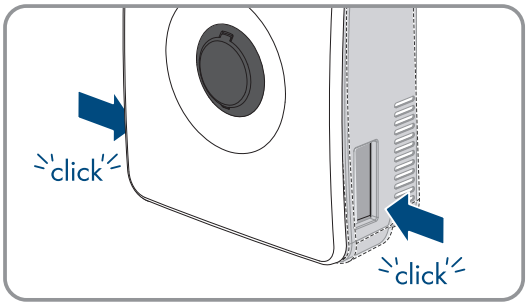
7. If the DC load-break switch was secured with a lock, open and remove the lock.



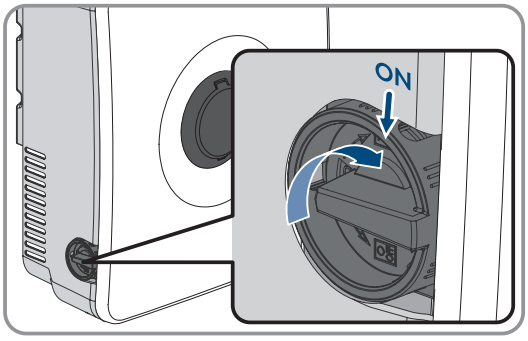
8. Hang the side covers on the hooks on the left and right of the mounting bracket and slide them downwards.



9. Press the side covers downwards until an audible click can be heard.



10. Make sure that the side covers are mounted correctly. Otherwise, the inverter is not protected against being prized out.
11. Switch on the battery (see battery manual).
12. Switch on the DC load-break switch of the inverter.



13. Switch on the AC circuit breaker.
14. Wait until the green LED lights up or pulses or the green and red LEDs flash simultaneously. This can take up to 5 minutes.

15. If the green and red LEDs flash simultaneously during initial commissioning, operation is stopped because no country data set has been set yet. For the inverter to begin operation, the configuration must be completed and a country data set must be set.
16. If the green LED is still flashing, the conditions for activating feed-in operation are not yet met. As soon as the conditions for feed-in operation are met, the inverter starts with feed-in operation and, depending on the available power, the green LED will light up continuously or it will pulse.
17. If the red LED lights up, an event has occurred. Find out which event has occurred and, if necessary, initiate countermeasures.
18. Ensure that the inverter feeds in correctly.

7.4 Configuring the System with the SMA 360° App

⚠ QUALIFIED PERSON

i A country data set must be set for feed-in operation

To ensure the inverter starts feed-in operation during initial commissioning, a country data set must be set (e.g., via the product commissioning wizard in the SMA 360 app or on the user interface of the product, or via a System Manger).

If no country data set is set, then feed-in operation will be stopped. This state is signaled by the green and red LEDs flashing simultaneously.

The inverter will automatically start feed-in operation only after the inverter configuration is completed.

i The country data set must be set correctly.

If you select a country data set which is not valid for your country and purpose, it can cause a disturbance in the PV system and lead to problems with the grid operator. When selecting the country data set, you must always observe the locally applicable standards and directives as well as the properties of the PV system (e.g. PV system size, grid-connection point).

- If you are not sure which standards and directives are valid for your country or purpose, contact the grid operator.

i The grid type must be set correctly

If you select the wrong grid type, it can cause a disturbance in the PV system and lead to problems with the grid operator.

Requirements:

☐ The inverter must be switched on.

☐ The latest firmware must be installed on all system components.

☐ An user account for Sunny Portal must already exist.

Procedure:

1. Download the SMA 360° App from the App Store or Play Store.
2. Open the SMA 360° App and login with the SMA ID.
3. For systems with multiple inverters using Wi-Fi, navigate to **Setup** > **Network setup** to connect subordinate inverters to the inverter's Wi-Fi network. Follow the instructions in the SMA 360° app and scan the QR code on the cover of the inverter when the app prompts you to do so. This needs to be performed for each subordinate inverter within the system.
4. To start the commissioning wizard, go to **Setup** > **Commissioning**.
5. Follow the SMA 360° app instructions and scan the QR code on the inverter's cover when prompted to configure it as the System Manager.
6. Select the **Inverter as System Manager** in the device settings, then continue with the app instructions.

Also see:

- Switching the Inverter On ⇒ page 66

7.5 Checking the Secure Power Supply Operation

Requirements:

☐ The socket and switch for the secure power supply operation must be connected.

☐ The inverter must be commissioned.

☐ **Emergency power mode** must be configured under **Configuration of the backup type**.

☐ A load must be connected to the socket for the secure power supply operation.

Procedure:

1. Switch off the AC miniature circuit breaker.
2. Turn on the switch for secure power supply operation.
3. Check whether the load connected to the socket for secure power supply operation is turning on. This can take up to 30 seconds.
4. If the load does not turn on, make sure that the socket and the switch for the secure power supply operation are correctly connected and that SMA Backup Start is properly installed. If the load still fails to turn on, contact Service.
5. Switch off the switch for secure power supply operation.
6. Switch on AC miniature circuit breaker.
7. **Information:** If secure power supply operation is to be permanent, the switch can remain switched on. It is not necessary to switch the switch on and off.

Also see:

- Setting backup operation ⇒ page 77

8 Operation

8.1 Operation notes

NOTICE

High costs due to inappropriate Internet tariff

Depending on use, the data volume of the product transferred via the Internet may vary in size. The data volume depends, for example, on the number of devices in the system, the frequency of device updates, the frequency of data transfer to Sunny Portal or the use of FTP push. High costs for the Internet connection can be the result.

- SMA Solar Technology AG recommends using an Internet flat rate.
- If you do not use a flat rate, you can set the amount of data transmission in the Sunny Portal powered by EnnexOS.

The following sections describe how to control the system via the System Manager user interface. Settings made in the System Manager are transferred to other devices, e.g., lower-level inverters.

8.2 Establishing a Connection to the User Interface

8.2.1 Connection in the local network

8.2.1.1 Access addresses for the product in the local network

DHCP Server is recommended

The DCHP server automatically assigns the appropriate network settings to your nodes in the local network. A manual network configuration is therefore not necessary. In a local network, the Internet router is usually the DHCP server. If the IP addresses in the local network are to be assigned dynamically, DHCP must be activated in the Internet router (see the Internet router manual). In order to receive the same IP address by the internet router after a restart, set the MAC address binding.

In networks where no DHCP server is active, proper IP addresses must be assigned from the free address pool of the network segment to all network participants to be integrated during commissioning.

Communication disturbances in the local network

The IP address range 192.168.12.0 to 192.168.12.255 is occupied for communication amongst SMA products and for direct access to SMA products.

Communication problems might occur if this IP address range is used in the local network.

- Do not use the IP address range 192.168.12.0 to 192.168.12.255 in the local network.

If the product is connected to a local network (e.g. via an Internet router or Wi-Fi), the product will receive a new IP address. Depending on the type of configuration, the new IP address will be assigned automatically by the DHCP server (Internet router) or manually by you.

Upon completion of the configuration, the product can only be reached via the listed access addresses in the local network:

- Generally applicable access address: IP address manually assigned or assigned by the DHCP server (Internet router) (identification via network scanner software or network configuration of the Internet router).
- Access address: **https://SMA[serial number]** (e.g. https://SMA0123456789)

8.2.1.2 Establishing a Connection via Ethernet in the local network

Requirements:

☐ The product must be connected to the local network via a network cable (e.g. via a router).

- ☐ The product must be integrated into the local network. Tip: You can change the network configuration on the welcome page of the product.
- ☐ A smart device (e.g. laptop) must be available.
- ☐ The smart device must be in the same local network as the product.
- ☐ The respective latest version of one of the following web browsers must be installed on the smart device: Chrome, Edge, Firefox or Safari.

Procedure:

1. Open the web browser of your smart device.
2. Enter the access address of the product in the address bar of the web browser.
3. **Web browser displays warning**
   After the access address of the product has been entered, a message might appear indicating that the connection to the user interface of the product is not secure.
   - Continue loading the user interface (scroll to bottom and click proceed/advance).

- ☑ When you connect to the user interface for the first time, the welcome page opens. The Commissioning Assistant for configuring the product can be started via the welcome page.
- ☑ The login page of the user interface opens if the product has already been configured.

Also see:

- Access addresses for the product in the local network ⇒ page 71

8.2.1.3 Establishing a Connection via WLAN in the Local Network

Requirements:

- ☐ The product must be commissioned.
- ☐ The product must be integrated into the local network. Tip: You can change the network configuration on the welcome page of the product.
- ☐ A smart terminal device (e.g., laptop) must be available.
- ☐ The smart terminal device must be in the same local network as the product.
- ☐ The respective latest version of one of the following web browsers must be installed on the smart terminal device: Chrome, Edge, Firefox or Safari.

Procedure:

1. Open the web browser of your smart terminal device.
2. Enter the access address of the product in the address bar of the web browser.
3. **Web browser displays warning**
   After the access address of the product has been entered, a message might appear indicating that the connection to the user interface of the product is not secure.
   - Continue loading the user interface (scroll to bottom and click proceed/advance).

- ☑ When you connect to the user interface for the first time, the welcome page opens. The Commissioning Assistant for configuring the product can be started via the welcome page.
- ☑ The login page of the user interface opens if the product has already been configured.

Also see:

- Access addresses for the product in the local network ⇒ page 71

8.2.2 Direct connection via Wi-Fi

8.2.2.1 Connection options for Wi-Fi direct connection

You have several options to connect the product to a smart device. The procedure can be different depending on the devices. If the procedures described do not apply to your end device, establish the direct connection via Wi-Fi as described in the manual of your end device.

The following connection options ar available:

- Direct Wi-Fi connection with 360° app (see Section 8.2.2.3, page 73)
- Direct Wi-Fi connection with WPS (see Section 8.2.2.4, page 73)
- Direct Wi-Fi connection with Wi-Fi network search (see Section 8.2.2.5, page 74)

Also see:

- Establishing a direct Wi-Fi connection with the 360° app ⇒ page 73

8.2.2.2 Access information for direct Wi-Fi connection

Access information for the direct WiFi connection can be found below:

- SSID: **SMA[serial number]** (e.g., SMA0123456789)
- Device-specific Wi-Fi password: WPA2-PSK (see type label of the product)
- Default access address: **https://smalogin.net** or **https://192.168.12.3**

8.2.2.3 Establishing a direct Wi-Fi connection with the 360° app

Requirements:

☐ A smart end device with camera must be available.

☐ The SMA 360° App must be installed on the smart device.

☐ An user account for Sunny Portal must already exist.

Procedure:

1. Open the SMA 360° App and login with the Sunny Portal account details.
2. Go to **Operation** > **User interface** to connect to the inverter's Wi-Fi.
3. Scan the QR Code on you product via the SMA 360° App.
   ☑ The smart device automatically connects to the product. The login page of the user interface is displayed in the 360° App.
4. If the login page of the user interface is not displayed, open the web browser and enter **https://smalogin.net** in the address bar.

Also see:

- Access information for direct Wi-Fi connection ⇒ page 73

8.2.2.4 Establishing a direct Wi-Fi connection with WPS

Requirements:

☐ A smart device (e.g., laptop) with WPS function must be available.

Procedure:

1. Enable the WPS function on the inverter. To do this, tap on the enclosure lid of the inverter twice.
   ☑ The blue LED flashes slowly for approx. 2 minutes. The WPS function is active during this time.
2. Ensure that the WPS function is enabled on your smart device.

3. Open the web browser of your smart end device and enter **https://smalogin.net** in the address bar.
   ☑ When you connect to the user interface for the first time, the welcome page opens. The Commissioning Assistant for configuring the product can be started via the welcome page.
   ☑ The login page of the user interface opens if the product has already been configured.
4. If the login page of the user interface does not open, enter the IP address **https://192.168.12.3** or, if your smart terminal supports mDNS services, **SMA[serial number].local** or **https://SMA[serial number]** in the address bar of the web browser.

Also see:

- Access information for direct Wi-Fi connection ⇒ page 73

8.2.2.5 Establishing direct Wi-Fi connection with Wi-Fi network search

1. Search for Wi-Fi networks with your smart device.
2. Select the SSID of the product **SMA[serial number]** in the list with the detected Wi-Fi networks.
3. Enter the device-specific Wi-Fi password (see WPA2-PSK on the type label).
4. Open the web browser of your smart end device and enter **https://smalogin.net** in the address bar.
   ☑ When you connect to the user interface for the first time, the welcome page opens. The Commissioning Assistant for configuring the product can be started via the welcome page.
   ☑ The login page of the user interface opens if the product has already been configured.
5. If the login page of the user interface does not open, enter the IP address **https://192.168.12.3** or, if your smart terminal supports mDNS services, **SMA[serial number].local** or **https://SMA[serial number]** in the address bar of the web browser.

Also see:

- Access information for direct Wi-Fi connection ⇒ page 73

8.3 WPS function

8.3.1 Connection options with WPS

You have several options to use the WPS function. Depending on the possible application of the WPS function, the procedure for activation will vary.

The following options are available:

- WPS for automatic connection to a network (e.g. via a router)
- WPS for direct connection between the product and a smart device

8.3.2 Activating WPS for automatic connection

Requirements:

☐ WLAN must be activated in the product.

☐ WPS must be activated on the router.

☐ The user interface is open and you are logged in.

Procedure:

1. Select the menu **Configuration**.
2. Select **Network configuration** menu item.
3. Click on the button **Use WPS** in the **Wi-Fi** section.
4. Click on [**Save**].

☑ The WPS function is activated and the automatic connection to the network can be established.

8.3.3 Activating WPS for direct connection to a smart device

- Tap on the enclosure lid of the product twice in direct succession.

☑ The WPS function is activated for about 2 minutes. Activation is indicated by a slow flashing blue LED.

8.4 Design of the User Interface

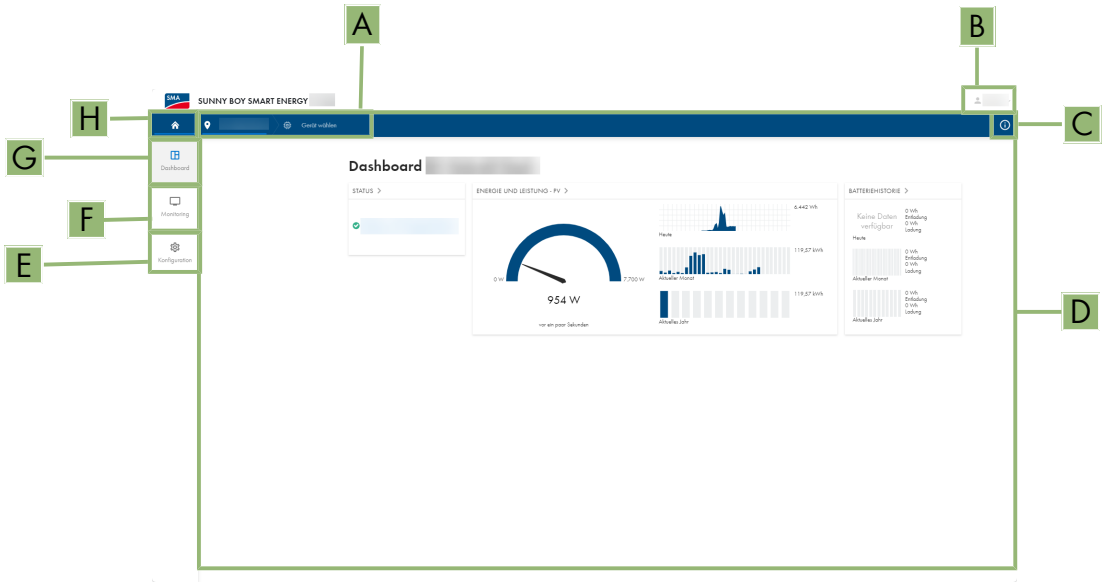


Figure 13: Design of the User Interface

Position	Designation	Description
A	Focus navigation	Enables the navigation between the following levels: • System • Device
B	User settings	Provides the following functions: • Configuring personal data • Logout
C	System information	Displays the following information: • System • Device information • Licenses • eManual
D	Content Area	Displays the dashboard or content of the selected menu.
E	Configuration	Offers different views for configuration, depending on the selected level and user role.
F	Monitoring	Offers different views for monitoring, depending on the scope of the connected devices.
G	Dashboard	Displays information and instantaneous values of the device or system currently selected.
H	Home	Opens the user interface home page

8.5 Access rights to the user interface

During registration, 1 user with administrator rights is created. With administrator rights, you can add further system users who can configure user rights or delete users.

This gives users access to the system and to the devices recorded in the system.

You can assign the following roles for users:

- User
- Installer

In addition, administrator rights can be assigned for each role.

8.6 Changing parameters

The parameters of the product are set to certain values by default. You can change the parameters to optimize the performance of the product.

This section describes the basic procedure for changing parameters. Always change parameters as described in this section.

Requirements:

☐ The product's user interface must be open and you must be logged in.

☐ Changes to grid-relevant parameters must be approved by the responsible grid operator, and can only be made as an **installer**.

Procedure:

1. Choose the product in the focus navigation.
2. Select the menu **Configuration**.
3. Select the **Parameters** menu item.
4. Call up the parameter via the search function or navigate to the parameter.
5. Change the parameter value.
6. Click on [**Save**].

8.7 SMA ArcFix

⚠ QUALIFIED PERSON

You can set the arc-fault circuit interrupter using the following parameters.

Channel	Name	Settings
AfciIsOn	**AFCI switched on**	**Yes** **No**

You can use the following parameters to set the manual restart after an arc fault detection.

Channel	Name	Settings
Operation.ManRstr.IsOn	**Manual restart activated**	**Yes** **No**
Operation.ManRstr.ManRstrAFCI	**Manual restart after arc detection**	**On** **Off** **Yes, after 5 electric arc detections within 24 hrs**

Also see:

- Changing parameters ⇒ page 76
- Manual restart after electric arc ⇒ page 123

8.8 Setting backup operation

You can use the following parameters on the user interface of the inverter to set the operating mode of the secure power supply function and battery-backup function.

Channel	Name	Settings
Operation.BckTyp	**Configuration of the backup type**	**Off** **Emergency power mode**

8.9 Setting of SMA ShadeFix

⚠ QUALIFIED PERSON

You can set the time interval in which the inverter has to determine the optimum operating point and to optimize the MPP of the PV system. The ideal time interval is usually six minutes. This value should only be increased if the shading situation changes extremely slowly.

Channel	Name	Settings
DcCfg.MPP-Shdw.CycTms	**Cycle time of SMA ShadeFix**	Time interval in seconds (180 s to 3600 s)

8.10 Control of external devices via Modbus

To control external devices, such as a battery, via Modbus using an additional system controller, activate the following parameter. The parameter is deactivated by default. If you activate the parameter, it is possible that SMA Energy Management will no longer function as expected because the settings via Modbus overwrite the settings from the SMA system.

Further information on control via Modbus can be found in the technical information "SMA GRID GUARD 10.0 - Grid Management Services via Inverter and System Controller" at www.SMA-Solar.com.

Channel	Name	Settings
Mb.ScdInEna	**Modbus P-settings at input 2**	**On** **Off**

8.11 Rated Residual Current of the Residual-Current Device

When using residual-current devices with a rated residual current of < 30 mA, set the rated residual current to the respective value in the inverter. In this way the inverter reduces the operational leakage currents and prevents a false triggering of the residual-current device (further information see technical information "Leading Leakage Currents" at www.SMA-Solar.com).

Channel	Name	Settings
GridGuard.Cntry.LeakAMax	**Disconnection limit for leakage current**	Amperage (0.001 A to 0.300 A)

8.12 Digital output (MFR)

8.12.1 Use of the digital output (MFR)

The digital output (MFR) can be switched depending on measured values or states.

You have several options to use the digital output.

Possible use	Category	Explanation
Notification in the event of an error	System state	System is in warning or error state.
Alarm in case of warning or error	System state	System is in error state.
Direct selling enabled	System state	The active power limitation of the direct seller is currently used for the point of interconnection.
Battery state of charge[2)]	Monitoring	Balanced state of charge of all batteries in the system
System active power[2)]	Monitoring	Sum of the active power of all PV inverters in the system.
System reactive power[2)]	Monitoring	Balance of the reactive power of all selected PV inverters in the system.
Reactive power setpoint[2)]	Setpoints	Reactive power value to be set.
Setpoint of active power limitation[2)]	Setpoints	The active power value currently to be set.
Standardized measured voltage value for Q(V)[2)]	Grid connection point	Standardized measured voltage value from the point of interconnection. For this, you require a valid Q(V) configuration in the grid management services.
System active power (grid-supplied power)[2)]	Grid connection point	Currently drawn active power.
System active power (grid feed-in)[2)]	Grid connection point	Currently fed-in active power.
System reactive power at the grid connection point[2)]	Grid connection point	Current reactive power.

8.12.2 Configure the digital output (MFR)

⚠ QUALIFIED PERSON

Requirements:

☐ A signal source must be connected to the digital output (**MFR**).

☐ The inverter to which the signal source is connected, must be configured as System Manager.

☐ The user interface must be open and you must be logged in as **Installer**.

Procedure:

1. Select the product in the focus navigation.
2. Select the menu **Configuration**.
3. Select the menu item **I/O configurations**.

[2)] Conditions for activating the outlet signal must be specified

4. Select + **New I/O configuration** to add a new configuration.
5. Select the type of the I/O channel **Digital output**.
6. Select the use for the digital output.
7. If necessary, activate inversion of the signal. Observe the pin assignment of the terminal block.
8. Click on [**Save**].

8.13 Configuring the Digital Input for Fast Stop

⚠ QUALIFIED PERSON

Requirements:

☐ A switch for a fast stop must be connected to the digital input **GSI**.

☐ The inverter to which the switch is connected, must be configured as System Manager.

☐ The digital input must **not** be inverted.

☐ The user interface must be open and you must be logged in as **Installer** or **Administrator**.

Procedure:

1. Select the product in the focus navigation.
2. Select the menu **Configuration**.
3. Select the menu item **I/O configurations**.
4. Select + to add a new configuration.
5. Select the type of the I/O channel **Digital input**.
6. Select the use for the digital input **Signal fast stop**.
7. Configure the connected switch as a break contact to ensure the safety of the system in the event of a cable break.
8. Select the System Manager to which the switch for the fast stop is connected.
9. Select the digital input.
10. Assign the name of the I/O channel (e.g. fast stop).
11. Click on [**Save**].

8.14 Energy management

8.14.1 Activating the energy management

⚠ QUALIFIED PERSON

Requirements:

☐ A suitable energy meter is installed and configured at the point of interconnection within the system.

☐ A battery is available in the system and has been put into operation.

☐ The user interface is open and you are logged in.

Procedure:

1. Select the menu item **Energy management** in the menu **Configuration**.
2. Select **Advanced settings**.
3. Select **Control by SMA energy management**.
4. Finish by clicking [**Save**].

Also see:

- Available operating modes ⇒ page 82

8.14.2 Deactivating the energy management

⚠ QUALIFIED PERSON

A single energy management profile cannot be deactivated, only changed. To deactivate the entire energy management, proceed as described in this section.

Requirements:

☐ The user interface must be open and you must be logged in.

Procedure:

1. Select the menu item **Energy management** in the menu **Configuration**.
2. Select **Advanced settings**.
3. Select **No control by SMA energy management**.
4. Finish by clicking [**Save**].

☑ Energy management is deactivated. If there is a battery in the system, the respective battery or hybrid inverter must take over control itself. Otherwise, the battery will behave according to its fallback behavior (see Section 8.14.3, page 80).

Also see:

- Available operating modes ⇒ page 82

8.14.3 Set battery fallback behavior when energy management is disabled

If SMA energy management is not to be used, SMA recommends making the following settings. If energy management is deactivated and no further settings are made, the battery will behave according to its fallback behavior. The default setting is **Values maintained**, so that the battery continues to be charged or discharged depending on its last status.

Requirement:

☐ Energy management is activated (see Section 8.14.1, page 79).

☐ The user interface is open and you are logged in.

Procedure:

1. In the focus navigation, select the inverter to which the battery is connected.
2. Select **Configuration** > **Parameters** in the menu.
3. Set the parameter **External active power setting, fallback behavior** to **Apply fallback values**.
4. Set parameter **Fallback of the limitation of the battery discharge.** to 0 W.
5. Set parameter **Fallback of the limitation of the battery charge.** to 0 W.
6. Configure the energy management so that the battery should not charge or discharge.
7. Ensure that the battery is not charging or discharging.
8. Deactivate the energy management (see Section 8.14.2, page 80).

8.14.4 Predefined operating modes

The page of the user interface shows predefined operating modes that are stored in the product. These profiles form the basis for configuring the energy management using individual operating modes.

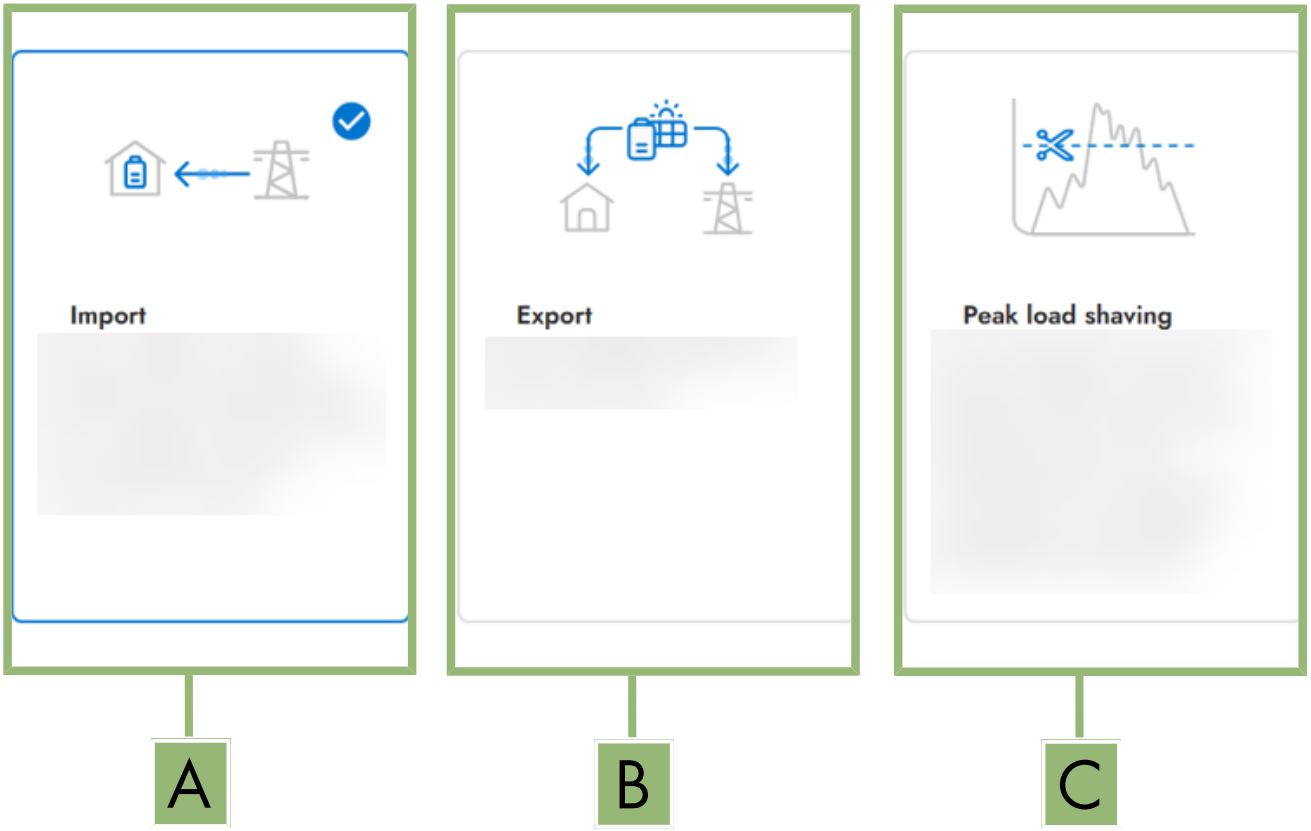


Figure 14: Overview of predefined energy management profiles

Position	Energy management profile	Explanation
A	Import	The battery is charged with excess energy from the PV system. If there is no excess energy available, the battery is charged from the utility grid.
B	Export	The available energy from the PV system is fed into the utility grid.
C	Peak Shaving	During peak loads, energy from the PV system or battery is used to reduce the amount of energy drawn from the utility grid. A combination of increased self-consumption and peak load shaving can be set (multiuse).
-	Maximum Increased Self-Consumption	This operating mode is always active if no other mode has been selected. Self-consumption is maximized through intelligent charging and discharging of the battery, and feed-in to the utility grid is minimized. The operating mode cannot be used as a basis for configuring individual operating modes.

Also see:

- Add new operating mode ⇒ page 82

8.14.5 Available operating modes

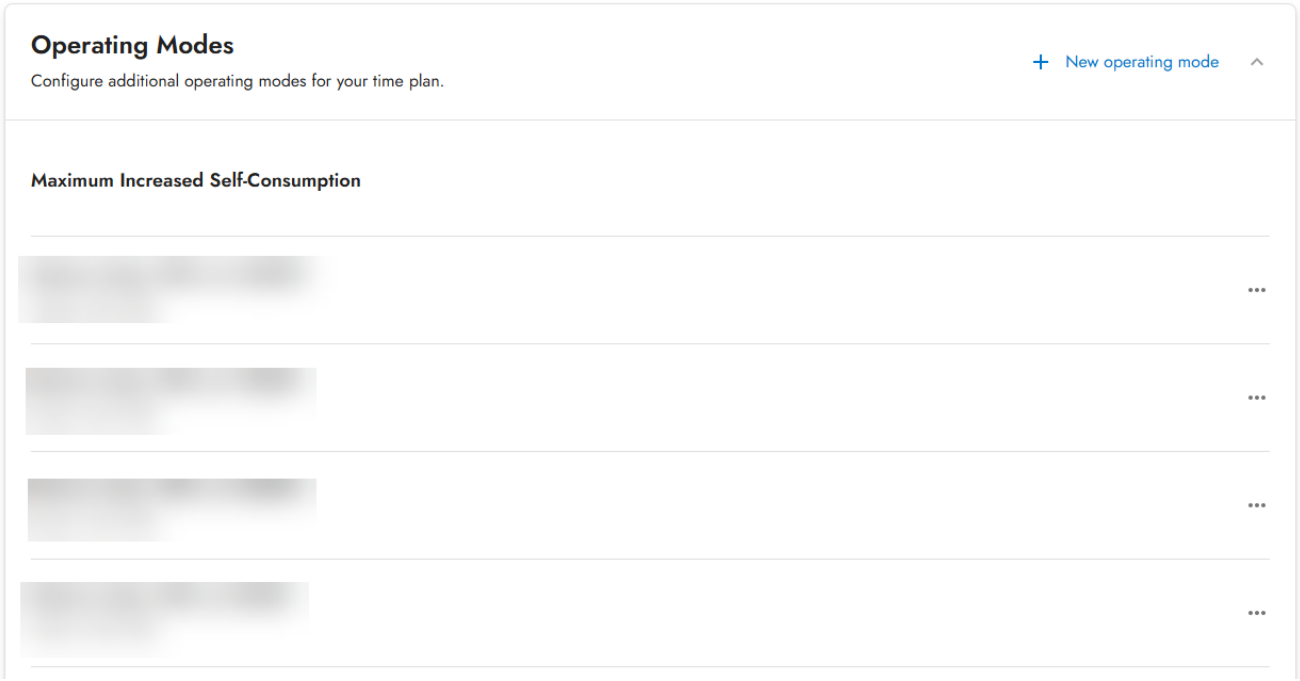


Figure 15: Overview of the used energy management profiles (example)

In the **Configuration** > **Energy management** menu, under **Operating modes**, you will find an overview of all available operating modes.

When energy management is started for the first time after commissioning, only the predefined profile **Maximum increased self-consumption** is displayed.

Also see:

- Predefined operating modes ⇒ page 81
- Add new operating mode ⇒ page 82
- Activating the energy management ⇒ page 79
- Deactivating the energy management ⇒ page 80

8.14.6 Add new operating mode

⚠ QUALIFIED PERSON

Requirement:

☐ Energy management is activated (see Section 8.14.1, page 79).

☐ The user interface is open and you are logged in.

Procedure:

1. Select the menu item **Energy management** in the menu **Configuration**.
2. In the **Operating modes** section, select the **New operating mode** button.
   ☑ The overview of the predefined operating modes opens.
3. Select the preferred operating mode to serve as the basis for configuration.
4. Configure individual settings.

Also see:

- Predefined operating modes ⇒ page 81

- Available operating modes ⇒ page 82
- Setting options for peak load shaving ⇒ page 83

8.14.7 Setting options for peak load shaving

Setting option	Explanation
Threshold for peak load shaving	Limiting value for the grid supply from which the battery is to be used to reduce peak loads. Only whole numbers are accepted as an entry.
Battery charge for peak load shaving	The parameter **Battery charge** controls the charging behavior of the inverter during peak load shaving: If the state of charge of the battery should always be as high as possible, for example, activate or leave the option **Recharge start voltage corresponds to threshold for peak load shaving** activated for the parameter **Battery state of charge**. If recharging of the battery from the utility grid is to be avoided, for example, deactivate the option **Recharge start voltage corresponds to threshold for peak load shaving** and set the **Recharge start voltage** to 0 kW for the parameter **Battery state of charge**.
Averaging interval in the tariff	Interval for billing the performance prices: If the tariff of your electric utility company does not specify an interval for billing the performance prices or if the interval for billing the performance prices is not known, select the **Unknown** option.
Adjustment	If no value is specified for the **Billing interval in the tariff**, the option **Immediate adjustment** is always active. In this case, peak load shaving is controlled according to the instantaneous value of the grid supply at the point of interconnection. If a value for the **Averaging interval in the tariff** is specified, the option **Billing interval** can be selected. In this case, peak load shaving is controlled according to the averaging value of the grid supply at the point of interconnection. If a peak load that is too high cannot be curtailed, the resulting overload can be compensated for at another time in the averaging interval. It can happen that the inverter curtails the grid-supplied power even further than specified by the threshold for peak load shaving.
Automatic threshold adjustment	Only if a value for the **Averaging interval in the tariff** is specified, can the function **Automatic threshold adjustment** be used. If the option **Adaptively increase threshold** is activated and the threshold for peak load shaving could not be observed despite adjustment via the averaging interval, the threshold is automatically increased. Exceeding the original threshold specifies the measure for the adaptive increase. Optionally, the threshold for peak load shaving can be reset to the originally entered value at the end of the billing period.

Also see:

- Add new operating mode ⇒ page 82

8.14.8 Create a new schedule

Schedules control the use of operating modes. If no schedule is created, the operating mode **Maximum increased self-consumption** is always active.

Requirement:

☐ Energy management is activated (see Section 8.14.1, page 79).

☐ The user interface is open and you are logged in.

Procedure:

1. Select the menu item **Energy management** in the menu **Configuration**.
2. In the **Schedules** section, select the **New schedule** button.
3. Set the name of the schedule, standard operating mode, and time period.
4. Click on [**Next**].
5. Use the [**New time window**] button to define which operating mode should be used in which time windows. If no time slots are defined, the default operating mode is active for the entire duration of the schedule.

8.14.9 Export schedules

To use a schedule in another facility, it can be exported.

Requirement:

☐ At least 1 schedule has been created.

☐ The user interface is open and you are logged in.

Procedure:

1. Select the menu item **Energy management** in the menu **Configuration**.
2. In the **Schedules** section, select ⋯.
3. Select **Download schedules**.
4. Select the button [**Download**].

☑ A .zip file containing all created schedules has been created. The file cannot be unzipped and is only intended for import into another system.

Also see:

- Import schedules ⇒ page 84

8.14.10 Import schedules

Schedules that have already been created can be imported into another system.

Requirement:

☐ A .zip file containing schedules for another system is available.

☐ The user interface is open and you are logged in.

Procedure:

1. Select the menu item **Energy management** in the menu **Configuration**.
2. In the **Schedules** section, select ⋯.
3. Select **Upload schedules**.
4. Add file and select [**Upload**].

☑ The schedules from the file and the corresponding operating modes are now available in the system. Existing schedules have been overwritten.

Also see:

- Export schedules ⇒ page 84

8.14.11 Backup Configuration

The **Energy management** allows for detailed backup settings, including operating mode and battery reserve. Alternatively, these settings can be configured using the SMA 360° commissioning wizard.

Procedure:

1. Select **Configuration** > **Energy management**.
2. Select the **Configure** in the **Backup** area.
3. Make the desired settings.

8.15 Backup file

8.15.1 Function and content of the backup file

The backup file is used to transfer configuration information, e.g., when commissioning a replacement device or when restoring previously saved parameter settings.

The backup file includes the following system and device configuration data for your product:

- Grid Management Services
- Ethernet
- Energy meter
- Sunny Portal setting
- Self-defined Modbus profiles
- System password
- User interface login data
- List of connected devices

The following information is not included in the backup file:

- Notifications
- Wi-Fi data
- Historic energy and performance values

8.15.2 Creating a Backup File

Requirements:

☐ The user interface must be open and you must be logged in.

Procedure:

1. Select the product in the focus navigation.
2. Select the menu **Configuration**.
3. Select the **Update and backup** menu item.
4. Select the [**Create backup file**] button.
5. Enter a password to encrypt the backup file and confirm with [**Create and download backup file**]. Please note that the password will be needed later for importing the backup file.
   ☑ An Ibd file with all parameter settings will be downloaded.

Also see:

- Function and content of the backup file ⇒ page 85

8.15.3 Upload backup file

⚠ QUALIFIED PERSON

Requirement:

☐ The backup file and the corresponding password must be available.

Procedure:

1. Open the user interface.
2. Log into the user interface.
   ☑ After you connect to the user interface of the inverter (e.g., a replacement device) for the first time, the commissioning wizard opens.
3. If the commissioning wizard does not open, reset the inverter to the default settings.
4. On the first page of the commissioning wizard in the row **Device function**, select the option [**Start restoration**].
5. Select the desired backup file and enter the backup file password.
6. Confirm with [**Upload backup file**].
   ☑ The Ibd file with all parameter settings will be uploaded to the product. The product restarts automatically. This process can take several minutes.

Also see:

- Resetting the product to default setting ⇒ page 89
- Function and content of the backup file ⇒ page 85

8.16 Firmware Update

8.16.1 Automatically Updating the Firmware

By activating the automatic firmware update, the product searches and installs new firmware versions automatically provided an Internet connection exists. In the process, an available firmware update may take up to 48 hours.

i Functional limitations during the update

While an update is being performed, the functions of the product may be limited. The product is performing a restart and may be without function at times. This process takes several minutes and cannot be canceled.

The automatic firmware update can be activated via the user interface during commissioning.

Requirements:

☐ The user interface must be open and you must be logged in as **Installer**.

Procedure:

1. Select the product in the focus navigation.
2. Select the menu **Configuration**.
3. Select the menu item **Parameters**.
4. Select the value **Yes** for the parameter **Automatic updates activated**.
5. Click on [**Save**].

8.16.2 Carry out a manual firmware update

⚠ QUALIFIED PERSON

Functional limitations during the update

While an update is being performed, the functions of the product may be limited. The product is performing a restart and may be without function at times. This process takes several minutes and cannot be canceled.

Requirements:

☐ An update file with the desired firmware of the product must be available. You can download the update file, for example, from the product page under www.SMA-Solar.com.

☐ The user interface must be open and you must be logged in as **Installer**.

Procedure:

1. Select the product in the focus navigation.
2. Select the menu **Configuration**.
3. Select the **Update and backup** menu item.
4. In the **Manual update** area, click [**Select file**] and select the update file for the product.
   ☑ The user interface confirms that the update file is compatible.
5. If the user interface does not confirm the compatibility of the update file, replace the update file.
6. Select [**Start update**].
7. Follow the instructions in the dialog.
   ☑ The product is performing a restart after the firmware update.
8. Select the **Monitoring** menu.
9. Select the menu item **Event monitor**.
10. Check the events to see whether the firmware update has been completed successfully.

8.16.3 Performing the Firmware Update via SMA 360° App

⚠ QUALIFIED PERSON

A firmware update can be carried out for the Sunny Boy Smart Energy via the SMA 360° app. This is possible before configuration or during operation.

Functional limitations during the update

While an update is being performed, the functions of the product may be limited. The product is performing a restart and may be without function at times. This process takes several minutes and cannot be canceled.

Requirements:

☐ The inverter must be switched on (see Section 7.3, page 66).

☐ The SMA 360° app must be installed and open on your end device.

Procedure:

1. Select **Setup** > **Manual update**.
2. To download the firmware to the end device, scroll down the displayed page and select **Download firmware for SBSE**.
   Tip: If you then want to update other Sunny Boy Smart Energy devices, you can skip this step as the file is already on your end device.
   ☑ The firmware file is stored on your end device.
3. Select **[Activate scanner]** and scan the QR code on the cover of the inverter.

4. Log in with the access data for the inverter or create an administrator account.
   ☑ The current firmware version of the inverter is displayed.
5. Click on **[Select file]** and select firmware file on your end device.
   ☑ The new firmware version is shown.
6. Select **[Execute update]** to start update.

8.17 Device Administration

8.17.1 Register Devices

You can register new devices and add them to the system on system level. This is required, for example, if your system has been expanded.

Requirements:

☐ The user interface must be open and you must be logged in.

Procedure:

1. Select the system in the focus navigation.
2. Select the menu **Configuration**.
3. Select the **Device management** menu item.
4. Select the ⊕ button.
5. Follow the steps of the device registration wizard.

8.17.2 Delete devices

You can delete registered devices on system level.

Requirements:

☐ The user interface must be open and you must be logged in.

Procedure:

1. Select the system in the focus navigation.
2. Select the menu **Configuration**.
3. Select the **Device management** menu item.
4. In the row of the device to be deleted, click the ••• button.
5. Select **Delete device**.
6. Select [**Delete**] in the displayed message.

8.18 Restart the inverter via the user interface

Requirements:

☐ The user interface must be open and you must be logged in as **Installer**.

Procedure:

1. Choose the product in the focus navigation.
2. Select the menu **Configuration**.
3. Select the **Parameters** menu item.
4. Call up the parameter **Initiate device restart** (**Sys.DevRstr**) via the search function or navigate to the parameter.

5. Change the parameter value to **Execute**.
6. Click on [**Save**].
   ☑ The inverter is performing a restart.

8.19 Resetting the product to default setting

Loss of data due to replacement or due to resetting to default settings

If the product is reset to the default settings or replaced, all data saved in the product and the admin account will be deleted. Some of the data saved in Sunny Portal can be transmitted to the product after calling up the Sunny Portal system again.

Requirements:

☐ The user interface must be open and you must be logged in.

Procedure:

1. Select the product in the focus navigation.
2. Select the menu **Configuration**.
3. Select the menu item **Device properties**.
4. Select the button [**If you want to reset the device to the default settings, click here**].
5. Select [**Reset**].

Also see:

- Upload backup file ⇒ page 86

8.20 Delete user accounts

⚠ QUALIFIED PERSON

If the password is lost, all user accounts can be reset and recreated. All system data will be retained.

Individual user accounts can be deleted via **Configuration** > **User management** if a user with administrator rights is still able to log in.

Requirements:

☐ The Device Key on the password sheet enclosed in the documentation package must be included in the scope of delivery.

☐ The login page of the user interface must be open.

Procedure:

1. Click [**Delete user accounts?**] button.
2. Enter Device Key.
3. Select [**Delete**].

☑ The product is performing a restart. Then a new user account can be created.

8.21 Configuring Service Access

The PUK 2.0 function allows you to grant an SMA-authorized service user access to the product's user interface in the event of a product malfunction or when performing warranty services. With PUK 2.0, you can configure yourself whether and for how long service access to your system is possible. If no service access is configured, your system cannot be accessed.

In order for the service user to access your system, a VPN connection may also need to be set up.

Requirements:

☐ The product's user interface must be open and you must be logged in.

Procedure:

1. In the user settings, select **PUK 2.0 configuration**.
2. Select [**Configure**].
3. Select the desired duration for service access.
4. Click on [**Save**].

8.22 Generating the I-V Characteristic Curve

⚠ QUALIFIED PERSON

Requirements:

☐ The user interface must be open and you must be logged in as **Installer**.

Procedure:

1. Select the product in the focus navigation.
2. Select the **Monitoring** menu.
3. Select the menu item **Diagnosis**.
4. Select the **I-V characteristic curve**.
5. Select [**New measurement**].
6. Use the measurement results to check whether there are any deviations or changes.
7. If necessary, carry out measures to correct the problems on the PV modules.
8. Export the results if necessary.

8.23 Enabling Speedwire Encryption

⚠ QUALIFIED PERSON

Requirements:

☐ All devices in the local network must be in operation and connected to the product via an Internet router.

☐ All devices must support the Speedwire encryption.

☐ The user interface must be open and you must be logged in.

Procedure:

1. Select the system in the focus navigation.
2. Select the menu **Configuration**.
3. Select the **Device management** menu item.
4. Select the ⊕ button.
5. Select **SMA Speedwire devices** and confirm with [**Next**].
   ☑ All SMA Speedwire devices in the systems are searched for and displayed.
6. Enable SMA Speedwire encryption and select [**Continue**].
7. Assign a new system password and select [**Save**].

8.24 Country standard

The product is not set to any country data set at the factory. While commissioning the product using the commissioning wizard, a country data set appropriate for the installation site and intended purpose must be selected for the product to start operating.

You can change the country standard via the user interface. First select the country data set and then the grid type suitable for your application.

The country data set must be set correctly.

If you select a country data set which is not valid for your country and purpose, it can cause a disturbance in the PV system and lead to problems with the grid operator. When selecting the country data set, you must always observe the locally applicable standards and directives as well as the properties of the PV system (e.g. PV system size, grid-connection point).

- If you are not sure which standards and directives are valid for your country or purpose, contact the grid operator.

The grid type must be set correctly

If you select the wrong grid type, it can cause a disturbance in the PV system and lead to problems with the grid operator.

Channel	Name	Settings
CntrySet	**Set country standard**	Selection of different country data sets
Inverter.GriTyp	**Grid type**	Selection of different grid types
Cntry	**Country standard**	Display of the currently set country data set
CntryBas	**Underlying country standard**	Display of the country data set on which the current settings are based
GridMs.GriTyp	**Grid type**	Display of the currently set grid type

8.25 Overview of Grid Types

Depending on the selected country data set, some of the listed grid types can be selected.

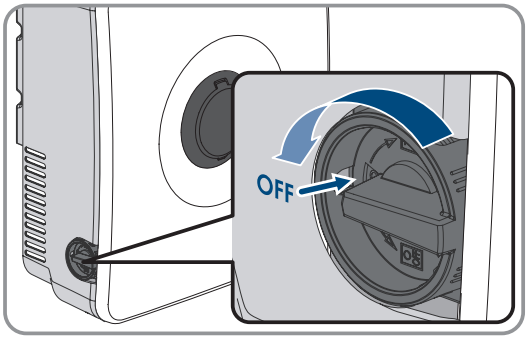
Designation	Explanation
GriTyp1P2W_400V_LL	1 line conductor und neutral conductor (1P2W), nominal voltage: 400 V line conductor - line conductor
GriTyp1P2W_230V_LN	1 line conductor and neutral conductor (1P2W), nominal voltage: 230V line conductor - neutral conductor
GriTyp1P2W_380V_LL	1 line conductor und neutral conductor (1P2W), nominal voltage: 380 V line conductor - line conductor
GriTyp2P2W_230V_LL	2 line conductors (2P2W), nominal voltage: 230 V line conductor - line conductor
GriTyp1P2W_420V_LL	1 line conductor und neutral conductor (1P2W), nominal voltage: 420 V line conductor - line conductor
GriTyp1P2W_440V_LL	1 line conductor und neutral conductor (1P2W), nominal voltage: 440 V line conductor - line conductor

9 Disconnecting the Inverter from Voltage Sources

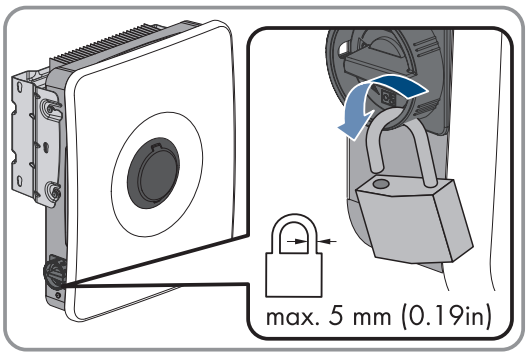
9.1 Remove enclosure lid

⚠ QUALIFIED PERSON

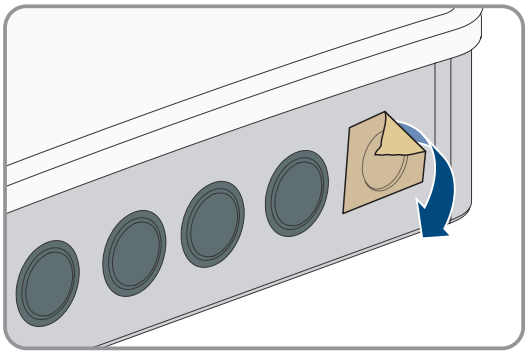
1. Ensure that the AC miniature circuit breaker is switched off and that it cannot be reconnected.
2. Ensure that the DC load-break switch of the inverter is in the **O** position.



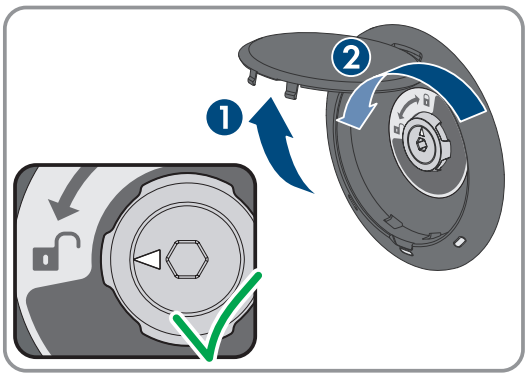
3. If your country requires the DC load-break switch to be protected against reconnection, remove the side covers. To do so, release the side covers at the bottom of the inverter and slide them upward slightly to disengage from the hooks on the mounting bracket and the inverter.
4. If your country requires the DC load-break switch to be protected against reconnection, secure the DC load-break switch against reconnection with a padlock.



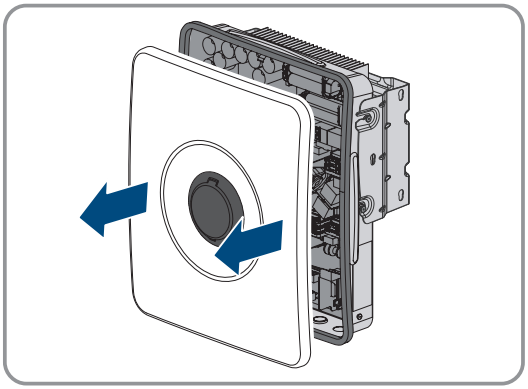
5. Switch off the battery or the load-break switch of the battery (see documentation of the battery manufacturer).
6. If the inverter is wet, ensure that the areas around all openings are dry and that no water can get into the inside of the inverter when it is opened.
7. Wait until the LEDs have gone out.
8. Wait 5 minutes until the capacitors inside the inverter have discharged.
9. If the enclosure cover is being opened for the first time: remove the adhesive tape from the first enclosure opening on the right.



10. Open the cover of the enclosure lock and loosen the screw in the middle with an Allen key until an audible click can be heard. Note the direction of rotation printed on the cover.
Information: Negative pressure may develop inside the enclosure. This may result in the enclosure lock not being completely unlocked. Therefore, pull on one of the corners of the cover so that air can enter the interior of the enclosure.



11. Remove the enclosure cover and place it to one side.



12. Check that the inverter is de-energized.

9.2 Check that the inverter is de-energized

⚠ QUALIFIED PERSON

Prior to performing any work on the inverter, always disconnect it from all voltage sources as described in this section. Always adhere to the prescribed sequence.

⚠ WARNING

Danger to life due to electric shock from destruction of the measuring device due to overvoltage

Overvoltage can damage a measuring device and result in voltage being present in the enclosure of the measuring device. Touching the live enclosure of the measuring device results in death or lethal injuries due to electric shock.

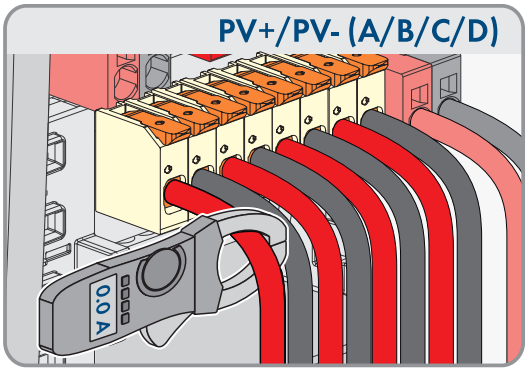
- Only use measuring devices with a measurement ranges designed for the maximum AC and DC voltage of the inverter.
- Only use measuring devices with measurement ranges designed for the maximum DC voltage of the battery.

Requirement:

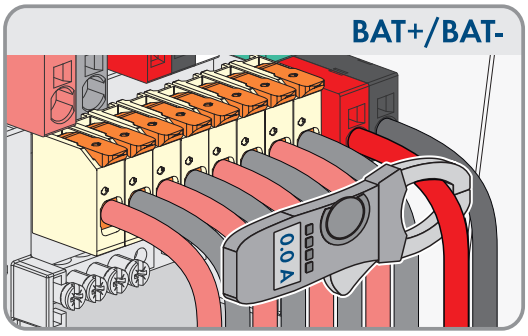
☐ The enclosure cover must be removed (see Section 9.1, page 92).

Procedure:

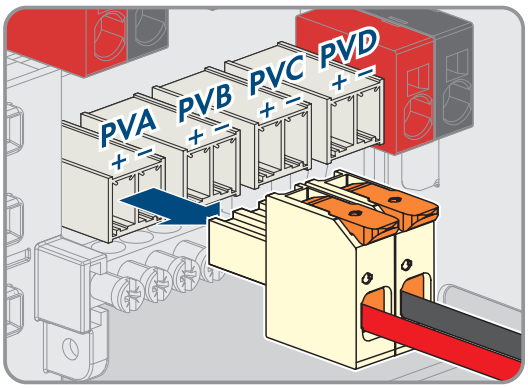
1. Use a current clamp to check that no current is present in the DC conductors for the PV modules.



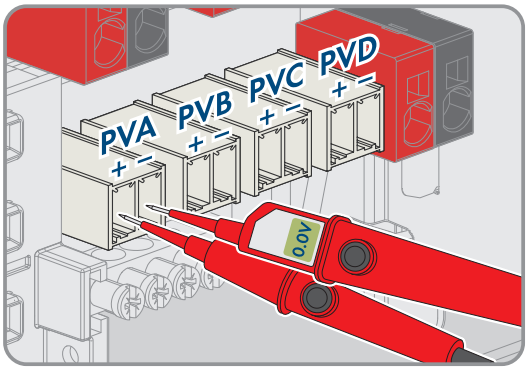
2. Use a current clamp to ensure that no current is present in the DC conductors for the battery.



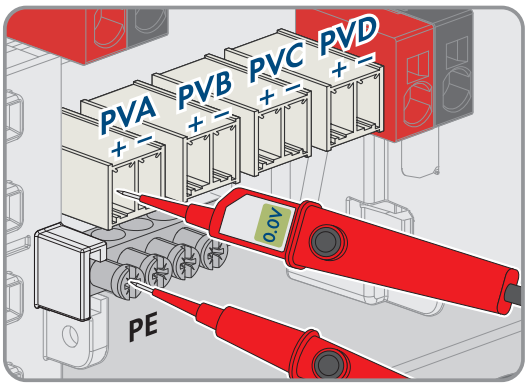
3. Write down the positions of the terminal blocks for connecting the PV modules.
4. Remove the terminal blocks for connecting the PV modules from the slots.



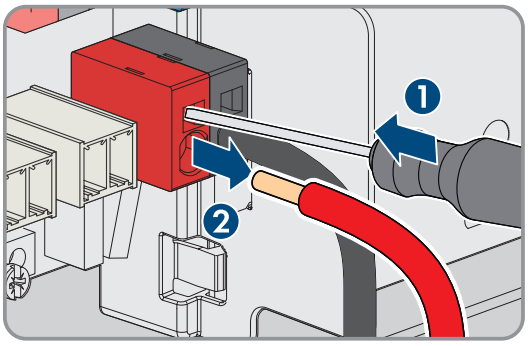
5. Use a suitable voltage detector to check that there is no voltage at the **PVA**, **PVB**, **PVC**, and, if applicable, **PVD** slots between **PV+** and **PV-**.



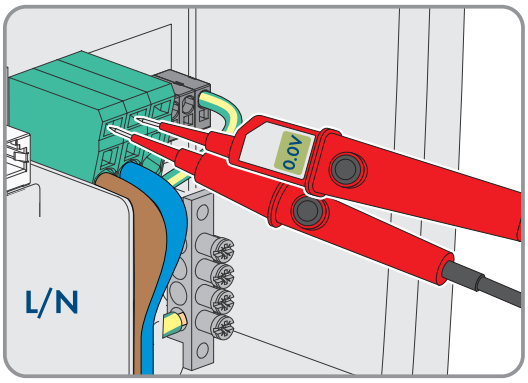
6. At each of the slots **PVA**, **PVB**, **PVC** and, if applicable, **PVD**, verify the absence of voltage between **PV+** and **PE** on the busbar for grounding the PV modules.



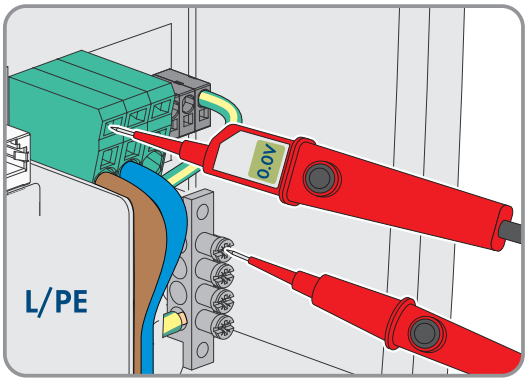
7. At each of the slots **PVA**, **PVB**, **PVC** and, if applicable, **PVD**, verify the absence of voltage between **PV-** and **PE** on the busbar for grounding the PV modules.
8. Remove the DC conductors for the battery from the terminals.



9. Use a suitable voltage detector to ensure that there is no voltage between the connection terminals **BAT+** and **BAT-**.
10. Use a suitable voltage detector to ensure that there is no voltage between the connection terminal **BAT+** and **PE** on the busbar for grounding the PV modules.
11. Use a suitable voltage detector to ensure that there is no voltage between the connection terminal **BAT-** and **PE** on the busbar for grounding the PV modules.
12. Ensure that there is no voltage at the **AC** connection terminals between **L1** and **N**.



13. Ensure that there is no voltage between **L** on the **AC** connection terminals and **PE** on the busbar for grounding the AC connection.



10 Cleaning

System components exposed to soiling must be cleaned regularly to ensure that all products are free of dust, leaves, and other dirt.

NOTICE

Damage to the product due to cleaning agents

The use of cleaning agents may cause damage to the product and its components.

- Clean the product and all its components only with a cloth moistened with clear water.

NOTICE

Yield reduction due to dirty cooling fins

The power output of the inverter is reduced if the cooling fins are very dirty.

- Clean the cooling fins of the inverter.

11 Troubleshooting

11.1 Event messages

11.1.1 Event 101

⚠ QUALIFIED PERSON

Event message:

- **Grid incident**

Explanation:

The grid voltage or grid impedance at the connection point of the inverter is too high. The inverter has disconnected from the utility grid.

Corrective measures:

- Check whether the grid voltage at the connection point of the inverter is permanently in the permissible range.

  If the grid voltage is outside the permissible range due to local grid conditions, contact the grid operator. The grid operator must agree with an adjustment of the voltage at the feed-in point or with a change of the monitored operating limits.

  If the grid voltage is permanently within the permissible range and this message is still displayed, contact the Service.

11.1.2 Event 102

⚠ QUALIFIED PERSON

Event message:

- **Grid incident**

Explanation:

The grid voltage or grid impedance at the connection point of the inverter is too high. The inverter has disconnected from the utility grid.

Corrective measures:

- Check whether the grid voltage at the connection point of the inverter is permanently in the permissible range.

  If the grid voltage is outside the permissible range due to local grid conditions, contact the grid operator. The grid operator must agree with an adjustment of the voltage at the feed-in point or with a change of the monitored operating limits.

  If the grid voltage is permanently within the permissible range and this message is still displayed, contact the Service.

11.1.3 Event 103

⚠ QUALIFIED PERSON

Event message:

- **Grid incident**

Explanation:

The grid voltage or grid impedance at the connection point of the inverter is too high. The inverter has disconnected from the utility grid.

Corrective measures:

- Check whether the grid voltage at the connection point of the inverter is permanently in the permissible range.

  If the grid voltage is outside the permissible range due to local grid conditions, contact the grid operator. The grid operator must agree with an adjustment of the voltage at the feed-in point or with a change of the monitored operating limits.

  If the grid voltage is permanently within the permissible range and this message is still displayed, contact the Service.

11.1.4 Event 105

⚠ QUALIFIED PERSON

Event message:

- **Grid incident**

Explanation:

The grid voltage or grid impedance at the connection point of the inverter is too high. The inverter has disconnected from the utility grid.

Corrective measures:

- Check whether the grid voltage at the connection point of the inverter is permanently in the permissible range.

  If the grid voltage is outside the permissible range due to local grid conditions, contact the grid operator. The grid operator must agree with an adjustment of the voltage at the feed-in point or with a change of the monitored operating limits.

  If the grid voltage is permanently within the permissible range and this message is still displayed, contact the Service.

11.1.5 Event 202

⚠ QUALIFIED PERSON

Event message:

- **Grid incident**

Explanation:

The utility grid has been disconnected, the AC cable is damaged or the grid voltage at the connection point of the inverter is too low. The inverter has disconnected from the utility grid.

Corrective measures:

- Ensure that the miniature circuit breaker is switched on.
- Ensure that the AC cable is not damaged and that it is connected correctly.
- Ensure that the country data set has been configured correctly.
- Check whether the grid voltage at the connection point of the inverter is permanently in the permissible range.

  If the grid voltage is outside the permissible range due to local grid conditions, contact the grid operator. The grid operator must agree with an adjustment of the voltage at the feed-in point or with a change of the monitored operating limits.

  If the grid voltage is permanently within the permissible range and this message is still displayed, contact the Service.

11.1.6 Event 203

⚠ QUALIFIED PERSON

Event message:

- **Grid incident**

Explanation:

The utility grid has been disconnected, the AC cable is damaged or the grid voltage at the connection point of the inverter is too low. The inverter has disconnected from the utility grid.

Corrective measures:

- Ensure that the miniature circuit breaker is switched on.
- Ensure that the AC cable is not damaged and that it is connected correctly.
- Ensure that the country data set has been configured correctly.
- Check whether the grid voltage at the connection point of the inverter is permanently in the permissible range.

  If the grid voltage is outside the permissible range due to local grid conditions, contact the grid operator. The grid operator must agree with an adjustment of the voltage at the feed-in point or with a change of the monitored operating limits.

  If the grid voltage is permanently within the permissible range and this message is still displayed, contact the Service.

11.1.7 Event 206

⚠ QUALIFIED PERSON

Event message:

- **Grid incident**

Explanation:

The utility grid has been disconnected, the AC cable is damaged or the grid voltage at the connection point of the inverter is too low. The inverter has disconnected from the utility grid.

Corrective measures:

- Ensure that the miniature circuit breaker is switched on.
- Ensure that the AC cable is not damaged and that it is connected correctly.
- Ensure that the country data set has been configured correctly.
- Check whether the grid voltage at the connection point of the inverter is permanently in the permissible range.

  If the grid voltage is outside the permissible range due to local grid conditions, contact the grid operator. The grid operator must agree with an adjustment of the voltage at the feed-in point or with a change of the monitored operating limits.

  If the grid voltage is permanently within the permissible range and this message is still displayed, contact the Service.

11.1.8 Event 301

⚠ QUALIFIED PERSON

Event message:

- **Grid incident**

Explanation:

The ten-minute average value of the grid voltage is no longer within the permissible range. The grid voltage or grid impedance at the connection point is too high. The inverter disconnects from the utility grid to maintain power quality.

Corrective measures:

- During the feed-in operation, check whether the grid voltage at the connection point of the inverter is permanently in the permissible range.

  If the grid voltage is outside the permissible range due to local grid conditions, contact the grid operator. The grid operator must agree with an adjustment of the voltage at the feed-in point or with a change of the monitored operating limits.

  If the grid voltage is permanently within the permissible range and this message is still displayed, contact the Service.

11.1.9 Event 302

⚠ QUALIFIED PERSON

Event message:

- **Active power limited AC voltage**

Explanation:

The inverter has reduced its power due to a too-high grid voltage to ensure grid stability.

Corrective measures:

- If possible, check the grid voltage and observe how often fluctuations occur. If fluctuations occur frequently and this message is displayed often, contact the grid operator and request approval to change the operating parameters of the inverter. If the grid operator gives approval, discuss any changes to the operating parameters with the Service.

11.1.10 Event 401

⚠ QUALIFIED PERSON

Event message:

- **Grid incident**

Explanation:

The inverter has disconnected from the utility grid. A stand-alone grid or a very large change in the grid frequency was detected.

Corrective measures:

- Make sure there is no power outage or work being done on the utility grid and contact a grid operator if necessary.
- Check the grid connection for significant short-term frequency fluctuations.

11.1.11 Event 404

⚠ QUALIFIED PERSON

Event message:

- **Grid incident**

Explanation:

The inverter has disconnected from the utility grid. A stand-alone grid or a very large change in the grid frequency was detected.

Corrective measures:

- Make sure there is no power outage or work being done on the utility grid and contact a grid operator if necessary.
- Check the grid connection for significant short-term frequency fluctuations.

11.1.12 Event 501

⚠ QUALIFIED PERSON

Event message:

- **Grid incident**

Explanation:

The grid frequency is not within the permissible range. The inverter has disconnected from the utility grid.

Corrective measures:

- If possible, check the grid frequency and observe how often fluctuations occur.

  If fluctuations occur frequently and this message is displayed often, contact the grid operator and request approval to change the operating parameters of the inverter.

  If the grid operator gives approval, discuss any changes to the operating parameters with the Service.

11.1.13 Event 507

⚠ QUALIFIED PERSON

Event message:

- **Active power limit AC frequency**

Explanation:

The inverter has reduced its power due to a too-high grid frequency to ensure grid stability.

Corrective measures:

- If possible, check the grid frequency and observe how often fluctuations occur. If fluctuations occur frequently and this message is displayed often, contact the grid operator and request approval to change the operating parameters of the inverter. If the grid operator gives approval, discuss any changes to the operating parameters with the Service.

11.1.14 Event 601

⚠ QUALIFIED PERSON

Event message:

- **Grid incident**

Explanation:

The inverter has detected an excessively high proportion of direct current in the grid current.

Corrective measures:

- Check the grid connection for direct current.

- If this message is displayed frequently, contact the grid operator and check whether the monitoring threshold on the inverter can be raised.

11.1.15 Event 701

⚠ QUALIFIED PERSON

Event message:

- **Frequency not permitted**
- **Check parameter**

Explanation:

The grid frequency is not within the permissible range. The inverter has disconnected from the utility grid.

Corrective measures:

- Check the AC wiring from the inverter to the feed-in meter.
- If possible, check the grid frequency and observe how often fluctuations occur.

  If fluctuations occur frequently and this message is displayed often, contact the grid operator and request approval to change the operating parameters of the inverter.

  If the grid operator gives approval, discuss any changes to the operating parameters with the Service.

11.1.16 Event 901

⚠ QUALIFIED PERSON

Event message:

- **PE connection missing**
- **Check connection**

Explanation:

The grounding conductor is not correctly connected.

Corrective measures:

- Ensure that the grounding conductor is correctly connected.

11.1.17 Event 1001

⚠ QUALIFIED PERSON

Event message:

- **L / N swapped**

Explanation:

Incorrect installation of the L / N connection.

Corrective measures:

- Check the AC wiring from the inverter to the feed-in meter.
- Check the AC voltages on the inverter connection.
- If this message is still displayed, contact the Service.

11.1.18 Event 1101

⚠ QUALIFIED PERSON

Event message:

- **Installation error**
- **Check connection**

Explanation:

A second line conductor is connected to N.

Corrective measures:

- Connect the neutral conductor to N.

11.1.19 Event 1302

⚠ QUALIFIED PERSON

Event message:

- **Waiting for grid voltage**
- **Grid connection installation failure**
- **Check grid and fuses**

Explanation:

Either L or N is not connected, or the utility grid has failed.

Corrective measures:

- Ensure that there is no utility grid failure.
- Ensure that the line conductors are connected.
- Ensure that the miniature circuit breaker is switched on.
- Ensure that the AC cable is not damaged and that it is connected correctly.

11.1.20 Event 1501

⚠ QUALIFIED PERSON

Event message:

- **Reconnection fault grid**

Explanation:

The changed country standard or the value of a parameter you have set does not correspond to the local requirements. The inverter cannot connect to the utility grid.

Corrective measures:

- Ensure that the country data set has been configured correctly. To do this, select the parameter **Set country standard** and check the value.

11.1.21 Event 3302

⚠ QUALIFIED PERSON

Event message:

- Unstable operation

Explanation:

There is not enough power at the DC input of the inverter for stable operation. The inverter cannot connect to the utility grid.

Corrective measures:

- Ensure that the PV module is dimensioned correctly.
- Ensure that the PV module is not covered by snow or otherwise shaded.
- Ensure that the PV module is free of defects.
- Ensure that the battery is fault-free.

11.1.22 Event 3303

⚠ QUALIFIED PERSON

Event message:

- Unstable operation

Explanation:

There is not enough power at the DC input of the inverter for stable operation. The inverter cannot connect to the utility grid.

Corrective measures:

- Ensure that the PV module is dimensioned correctly.
- Ensure that the PV module is not covered by snow or otherwise shaded.
- Ensure that the PV module is free of defects.
- Ensure that the battery is fault-free.

11.1.23 Event 3401

⚠ QUALIFIED PERSON

Event message:

- DC overvoltage
- Disconnecting generator

Explanation:

Overvoltage at the DC input. This can destroy the inverter.

Corrective measures:

- **Immediately** disconnect the inverter from all voltage sources.
- Check whether the DC voltage is below the maximum input voltage of the inverter. If the DC voltage is below the maximum input voltage of the inverter, reconnect the DC cables to the inverter.
- If the DC voltage is above the maximum DC voltage of the inverter, ensure that the correct battery has been selected.
- If the DC voltage exceeds the maximum input voltage of the inverter, ensure that the PV array has been correctly rated or contact the installer of the PV array.
- If this message is repeated frequently, contact the Service.

11.1.24 Event 3402

⚠ QUALIFIED PERSON

Event message:

- DC overvoltage
- Disconnecting generator

Explanation:

Overvoltage at the DC input. This can destroy the inverter.

Corrective measures:

- **Immediately** disconnect the inverter from all voltage sources.
- Check whether the DC voltage is below the maximum input voltage of the inverter. If the DC voltage is below the maximum input voltage of the inverter, reconnect the DC cables to the inverter.
- If the DC voltage is above the maximum DC voltage of the inverter, ensure that the correct battery has been selected.
- If the DC voltage exceeds the maximum input voltage of the inverter, ensure that the PV array has been correctly rated or contact the installer of the PV array.
- If this message is repeated frequently, contact the Service.

11.1.25 Event 3407

⚠ QUALIFIED PERSON

Event message:

- **DC overvoltage**
- **Disconnect generator**

Explanation:

Overvoltage at the DC input. This can destroy the inverter.

This message is signalized additionally by rapid flashing of the LEDs.

Corrective measures:

- **Immediately** disconnect the inverter from voltage sources and secure it against being switched on again.
- Check whether the DC voltage is below the maximum input voltage of the inverter. If the DC voltage is below the maximum input voltage of the inverter, reconnect the DC cables to the inverter.
- If the DC voltage exceeds the maximum input voltage of the inverter, ensure that the PV array has been correctly rated or contact the installer of the PV array.
- If this message is repeated frequently, contact the Service.

11.1.26 Event 3410

⚠ QUALIFIED PERSON

Event message:

- **DC overvoltage**
- **Disconnect generator**

Explanation:

Overvoltage at the DC input. This can destroy the inverter.

This message is signalized additionally by rapid flashing of the LEDs.

Corrective measures:

- **Immediately** disconnect the inverter from voltage sources and secure it against being switched on again.
- Check whether the DC voltage is below the maximum input voltage of the inverter. If the DC voltage is below the maximum input voltage of the inverter, reconnect the DC cables to the inverter.
- If the DC voltage exceeds the maximum input voltage of the inverter, ensure that the PV array has been correctly rated or contact the installer of the PV array.
- If this message is repeated frequently, contact the Service.

11.1.27 Event 3411

⚠ QUALIFIED PERSON

Event message:

- **DC overvoltage**
- **Disconnect generator**

Explanation:

Overvoltage at the DC input. This can destroy the inverter.

This message is signalized additionally by rapid flashing of the LEDs.

Corrective measures:

- **Immediately** disconnect the inverter from voltage sources and secure it against being switched on again.
- Check whether the DC voltage is below the maximum input voltage of the inverter. If the DC voltage is below the maximum input voltage of the inverter, reconnect the DC cables to the inverter.
- If the DC voltage exceeds the maximum input voltage of the inverter, ensure that the PV array has been correctly rated or contact the installer of the PV array.
- If this message is repeated frequently, contact the Service.

11.1.28 Event 3501

⚠ QUALIFIED PERSON

Event message:

- Ground fault
- Check generator

Explanation:

The inverter has detected a ground fault on the DC side.

Corrective measures:

- Check the PV system for ground faults.
- Check the battery and DC cabling for ground faults.
- Perform a visual check to ensure that the DC cabling is free of faults.

11.1.29 Event 3523

Event message:

- Start of cyclic insulation test

Explanation:

During the cyclic insulation test, it is tested whether the electric strength of the battery and PV system is within the safe range. The inverter will be restarted once during an insulation test.

11.1.30 Event 3601

⚠ QUALIFIED PERSON

Event message:

- High leakage current
- Check generator

Explanation:

The leakage current of the inverter and the PV modules or the battery is too high. There is a ground fault, a residual current or a malfunction.

The inverter interrupts feed-in operation immediately after exceeding a threshold. When the fault is eliminated, the inverter automatically reconnects to the utility grid.

Corrective measures:

- Check the PV system for ground faults.
- Check the battery and DC cabling for ground faults.

11.1.31 Event 3701

⚠ QUALIFIED PERSON

Event message:

- Residual current too high
- Check generator

Explanation:

The inverter detected a residual current due to brief grounding of the PV modules, the battery, or the DC wiring.

Corrective measures:

- Check the PV system for ground faults.
- Check the battery and DC cabling for ground faults.

11.1.32 Event 3901

⚠ QUALIFIED PERSON

Event message:

- Waiting for DC start conditions
- Start conditions not met

Explanation:

The feed-in conditions for the utility grid are not yet fulfilled.

Corrective measures:

- Check whether a new firmware version is available for the inverter and the battery. If a newer version is available, perform the firmware update.
- Ensure that the PV module is not covered by snow or otherwise shaded.

- Wait for higher irradiation.
- If this message is displayed frequently in the morning, increase the voltage limit for starting grid feed-in. Change the parameter **Critical voltage to start feed-in**.
- If this message is displayed frequently with medium irradiation, ensure that the PV module is correctly rated.

11.1.33 Event 3902

⚠ QUALIFIED PERSON

Event message:

- Waiting for DC start conditions
- Start conditions not met

Explanation:

The feed-in conditions for the utility grid are not yet fulfilled.

Corrective measures:

- Check whether a new firmware version is available for the inverter and the battery. If a newer version is available, perform the firmware update.
- Ensure that the PV module is not covered by snow or otherwise shaded.
- Wait for higher irradiation.
- If this message is displayed frequently in the morning, increase the voltage limit for starting grid feed-in. Change the parameter **Critical voltage to start feed-in**.
- If this message is displayed frequently with medium irradiation, ensure that the PV module is correctly rated.

11.1.34 Event 4013

⚠ QUALIFIED PERSON

Event message:

- Reverse currents or input X polarity reversed
- Check generator

Explanation:

The displayed input is in reverse polarity or reverse current has been detected in the input.

Corrective measures:

- Check the correct polarity of the connected PV modules.
- Ensure correct design and circuitry of the PV array.
- If solar irradiation is sufficient, check whether the same voltage is present at the DC inputs.
- Ensure that no PV module is defective.

11.1.35 Event 4014

⚠ QUALIFIED PERSON

Event message:

- Reverse currents or input X polarity reversed
- Check generator

Explanation:

The displayed input is in reverse polarity or reverse current has been detected in the input.

Corrective measures:

- Check the correct polarity of the connected PV modules.
- Ensure correct design and circuitry of the PV array.
- If solar irradiation is sufficient, check whether the same voltage is present at the DC inputs.
- Ensure that no PV module is defective.

11.1.36 Event 4015

⚠ QUALIFIED PERSON

Event message:

- Reverse currents or input X polarity reversed
- Check generator

Explanation:

The displayed input is in reverse polarity or reverse current has been detected in the input.

Corrective measures:

- Check the correct polarity of the connected PV modules.
- Ensure correct design and circuitry of the PV array.
- If solar irradiation is sufficient, check whether the same voltage is present at the DC inputs.
- Ensure that no PV module is defective.

11.1.37 Event 4016

⚠ QUALIFIED PERSON

Event message:

- Reverse currents or input X polarity reversed
- Check generator

Explanation:

The displayed input is in reverse polarity or reverse current has been detected in the input.

Corrective measures:

- Check the correct polarity of the connected PV modules.
- Ensure correct design and circuitry of the PV array.
- If solar irradiation is sufficient, check whether the same voltage is present at the DC inputs.
- Ensure that no PV module is defective.

11.1.38 Event 4017

⚠ QUALIFIED PERSON

Event message:

- Reverse currents or input X polarity reversed
- Check generator

Explanation:

The displayed input is in reverse polarity or reverse current has been detected in the input.

Corrective measures:

- Check the correct polarity of the connected PV modules.
- Ensure correct design and circuitry of the PV array.
- If solar irradiation is sufficient, check whether the same voltage is present at the DC inputs.
- Ensure that no PV module is defective.

11.1.39 Event 4301

⚠ QUALIFIED PERSON

Event message:

- **Serial el.arc in String |s0| detected by AFCI mod.**

Explanation:

The inverter has detected an electric arc in the displayed string. If "String N/A" is displayed, the string could not be uniquely assigned.

The inverter stops feeding into the utility grid.

Corrective measures:

- Disconnect the inverter from voltage sources and secure it against being switched on again.
- Check the PV modules and the cabling in the affected string or, if the string was not displayed, in all strings for damage.
- Ensure that the DC connection in the inverter is correct.
- Repair or replace defective PV modules, DC cables or the DC connection in the inverter.
- Start manual restart (if necessary).

11.1.40 Event 6001-6499

⚠ QUALIFIED PERSON

Event message:

- **Self-diagnosis**
- **Interference device**

Explanation:

The cause must be determined by the Service.

Corrective measures:

- Contact Service.

11.1.41 Event 6501

⚠ QUALIFIED PERSON

Event message:

- **Self-diagnosis**
- **Overtemperature**

Explanation:

The inverter has switched off due to excessive temperature.

Corrective measures:

- Clean the cooling fins on the rear of the enclosure and the air ducts on the top using a soft brush.
- Ensure that the inverter has sufficient ventilation.
- Ensure the maximum ambient temperature is not exceeded.

11.1.42 Event 6502

⚠ QUALIFIED PERSON

Event message:

- **Self-diagnosis**
- **Overtemperature**

Explanation:

The inverter has switched off due to excessive temperature.

Corrective measures:

- Clean the cooling fins on the rear of the enclosure and the air ducts on the top using a soft brush.
- Ensure that the inverter has sufficient ventilation.
- Ensure that the maximum permissible ambient temperature is complied with.

11.1.43 Event 6509

⚠ QUALIFIED PERSON

Event message:

- **Self-diagnosis**
- **Overtemperature**

Explanation:

The inverter has switched off due to excessive temperature.

Corrective measures:

- Clean the cooling fins on the rear of the enclosure and the air ducts on the top using a soft brush.
- Ensure that the inverter has sufficient ventilation.
- Ensure the maximum ambient temperature is not exceeded.

11.1.44 Event 6511

⚠ QUALIFIED PERSON

Event message:

- **Self-diagnosis**
- **Overtemperature**

Explanation:

An overtemperature has been detected in the choke area.

Corrective measures:

- Clean the cooling fins on the rear of the enclosure and the air ducts on the top using a soft brush.
- Ensure that the inverter has sufficient ventilation.

11.1.45 Event 6512

Event message:

- **Minimum operating temperature not reached**

Explanation:

The inverter will only recommence grid feed-in once the temperature has reached at least −25 °C.

11.1.46 Event 6602

⚠ QUALIFIED PERSON

Event message:

- **Overvoltage grid (SW)**

Explanation:

The effective value of the grid voltage is above the permitted voltage threshold values for a specified period of time (AF limit).

Corrective measures:

- Check the grid voltage and connection on the inverter.

  If the grid voltage lies outside the permissible range due to local grid conditions, ask your grid operator if the voltage can be adjusted at the feed-in point or if it would be acceptable to change the monitored operating limits.

11.1.47 Event 6606

⚠ QUALIFIED PERSON

Event message:

- Self-diagnosis
- Device fault

Explanation:

The cause must be determined by the Service.

Corrective measures:

- Contact Service.

11.1.48 Event 6633

⚠ QUALIFIED PERSON

Event message:

- Self-diagnosis
- Device fault

Explanation:

The cause must be determined by the Service.

Corrective measures:

- Contact the Service.

11.1.49 Event 6801

⚠ QUALIFIED PERSON

Event message:

- **Self-diagnosis**
- **Input A defective**

Explanation:

The inverter has detected an error at DC input A.

Corrective measures:

- Check whether a string is connected to input A.
- Contact Service.

11.1.50 Event 6901

⚠ QUALIFIED PERSON

Event message:

- **Self-diagnosis**
- **Input B defective**

Explanation:

The inverter has detected an error at DC input B.

Corrective measures:

- Check whether a string is connected to input B.
- Contact Service.

11.1.51 Event 7001

⚠ QUALIFIED PERSON

Event message:

- **Fault sensor interior temperature**

Explanation:

A temperature sensor in the inverter is defective and the inverter interrupts the feed-in operation. The cause must be determined by the Service.

Corrective measures:

- Contact Service.

11.1.52 Event 7002

⚠ QUALIFIED PERSON

Event message:

- **Fault sensor interior temperature**

Explanation:

A temperature sensor in the inverter is defective and the inverter interrupts the feed-in operation. The cause must be determined by the Service.

Corrective measures:

- Contact Service.

11.1.53 Event 7014

⚠ QUALIFIED PERSON

Event message:

- **Fault boost converter temperature sensor**

Explanation:

Fan is always on.

Corrective measures:

- Contact Service.

11.1.54 Event 7015

⚠ QUALIFIED PERSON

Event message:

- **Fault sensor interior temperature**

Explanation:

A temperature sensor in the inverter is defective and the inverter interrupts the feed-in operation. The cause must be determined by the Service.

Corrective measures:

- Contact Service.

11.1.55 Event 7702

⚠ QUALIFIED PERSON

Event message:

- **Self-diagnosis**
- **Interference device**

Explanation:

The cause must be determined by the Service.

Corrective measures:

- Contact Service.

11.1.56 Event 7703

⚠ QUALIFIED PERSON

Event message:

- **Self-diagnosis**

- **Interference device**

Explanation:

The cause must be determined by the Service.

Corrective measures:

- Contact Service.

11.1.57 Event 8003

⚠ QUALIFIED PERSON

Event message:

- **Temperature derating**

Explanation:

The inverter has reduced its power output for more than 10 minutes due to excessive temperature.

Corrective measures:

- Clean the cooling fins on the rear of the enclosure and the air ducts on the top using a soft brush.
- Ensure that the inverter has sufficient ventilation.
- Ensure the maximum ambient temperature is not exceeded.
- Ensure that the inverter is not exposed to direct solar irradiation.

11.1.58 Event 8104

⚠ QUALIFIED PERSON

Event message:

- Communication impaired

Explanation:

The cause must be determined by the Service.

Corrective measures:

- Contact Service.

11.1.59 Event 8205

⚠ QUALIFIED PERSON

Event message:

- **AFCI self-test successful**

Explanation:

The self-test of SMA ArcFix has been completed successfully.

11.1.60 Event 8503

⚠ QUALIFIED PERSON

Event message:

- **Self-diagnosis**
- **Input C defective**

Explanation:

Polarity error on the inverter.

Corrective measures:

- Check whether a string is connected to input C. If a string that once was connected is not used anymore, the string-failure detection must be reset.
- Contact Service.

11.1.61 Event 8708

⚠ QUALIFIED PERSON

Event message:

- **Timeout in communication for active power limitation**

Explanation:

Communication to the system control absent. Depending on the fallback setting, either the last received values will be retained or the active power will be limited to the set percentage value of the inverter nominal power.

Corrective measures:

- Ensure that the connection to the System Manager is intact and that no cables are damaged or that no plugs have been pulled.

11.1.62 Event 8709

⚠ QUALIFIED PERSON

Event message:

- **Timeout in communication for reactive power spec.**

Explanation:

Communication to the system control absent. Depending on the fallback setting, either the last received values will be retained or the active power will be limited to the set percentage value of the inverter nominal power.

Corrective measures:

- Ensure that the connection to the System Manager is intact and that no cables are damaged or that no plugs have been pulled.

11.1.63 Event 8710

⚠ QUALIFIED PERSON

Event number:

- **Timeout in communication for cos-Phi spec.**

Explanation:

Communication to the system control absent.

Corrective measures:

- Ensure that the connection to the System Manager is intact and that no cables are damaged or that no plugs have been pulled.

11.1.64 Event 9007

⚠ QUALIFIED PERSON

Event message:

- **Abort self-test**

Explanation:

The self-test was terminated.

Corrective measures:

- Ensure that the AC connection is correct.
- Ensure that the country data set has been entered correctly.
- Restart the self-test.

11.1.65 Event 9034

⚠ QUALIFIED PERSON

Event message:

- **Error in the rapid shutdown system**

Explanation:

This message can have the following causes:

- The rapid shutdown function was not correctly configured.
- The PV module could not be correctly disconnected. Voltage can be applied to the DC inputs of the inverter.
- The standby voltage of all PV module switches of a string is > 30 V.
- With DC lines laid in parallel, another inverter in the system has caused the Sunspec signal to be overwritten.

Corrective measures:

- Check the settings of the rapid shutdown function and ensure that the operating mode selected is selected according to the DC disconnection unit used.
- Check the functionality of the PV module switches.
- Check the standby voltage of the PV module switches used and ensure that the standby voltage of all PV module switches of a string < 30 V.

11.1.66 Event 9037

⚠ QUALIFIED PERSON

Event message:

- Generator not connected

Explanation:

The PV module switches did not connect the PV module.

Corrective measures:

- Check the functionality of the SunSpec-compliant PV module switches.

11.1.67 Event 9038

⚠ QUALIFIED PERSON

Event message:

- **Redundant rapid shutdown discharge function not assured**

Explanation:

The cause must be determined by the Service.

Corrective measures:

- Contact Service.

11.1.68 Event 9101

⚠ QUALIFIED PERSON

Event message:

- AC voltage calibration failed.

Explanation:

An error has occurred during calibration. The cause must be determined by the Service.

Corrective measures:

- Contact Service.

11.1.69 Event 9107

⚠ QUALIFIED PERSON

Event message:

- **Self-diagnosis**
- **Interference device**

Explanation:

The cause must be determined by the Service.

Corrective measures:

- Contact Service.

11.1.70 Event 9202

⚠ QUALIFIED PERSON

Event message:

- **SPS AC overvoltage**

Explanation:

The cause must be determined by the Service.

Corrective measures:

- Contact the Service.

11.1.71 Event 9203

⚠ QUALIFIED PERSON

Event message:

- **Short circuit in the SPS power outlet**

Explanation:

A short circuit occurred at the socket for manual secure power supply operation.

Corrective measures:

- Ensure that the socket is correctly wired.
- Ensure that the load connected to the socket is working correctly.
- Unplug the load from the socket and switch on secure power supply operation.

11.1.72 Event 9214

Event message:

- **Black start battery voltage too low**

Explanation:

If the event is active for more than 5 consecutive days, the battery of the SMA Backup Start Module in the inverter will be completely discharged. SMA Backup Start must be replaced.

Corrective measures:

- Remove the defective SMA Backup Start module from the inverter and install a new module.

11.1.73 Event 9308

⚠ QUALIFIED PERSON

Event message:

- Battery system communication error

Explanation:

Event 9308 indicates a communication error in the battery system.

Corrective measures:

- Ensure that the battery system is switched on correctly.
- Check that the battery communication cable is connected correctly and that the CAN bus is wired correctly. Make sure that:
  - correct connection of the Enable and GND lines
  - Cable category is at least Cat 5e, twisted pair
  - maximum cable length: 10 m
  - Sufficient stripping of 12 mm. If multi-core stranded wires are used, use bootlace ferrules (12 mm).
- Check the grounding of the inverter and the battery system.
- Perform communication test via the user interface.
- Check the condition of the battery using the battery manufacturer's documentation and contact them if necessary.

11.1.74 Event 9342

⚠ QUALIFIED PERSON

Event message:

- **DC connection, polarity reversed**
- **Check connection**

Explanation:

The DC conductors are not assigned to the correct inputs in the inverter.

Corrective measures:

- Ensure that all DC conductors for PV and battery are connected to the correct terminals.

11.1.75 Event 9345

⚠ QUALIFIED PERSON

Event message:

- **Battery charge too low for start procedure**

Explanation:

The state of charge of the battery is too low for the start process. The inverter can no longer charge the battery by itself. The battery must be charged immediately by a qualified person.

Corrective measures:

- If a battery from SMA Solar Technology AG is used, contact Service and instruct them to manually charge the battery.
- If a battery from another manufacturer is used, contact the manufacturer.

11.1.76 Event 9350

⚠ QUALIFIED PERSON

Event message:

- Timeout for battery status change

Explanation:

A requested status change of the battery did not occur within the specified time.

Corrective measures:

- Ensure that the battery is switched on.
- Ensure that the battery is fault-free.
- Ensure that the battery communication cable is correctly assembled and connected.

11.1.77 Event 9394

Event message:

- Deep discharge protection activated

Explanation:

The battery management system has activated the deep discharge protection. For grid-connected systems, this message is an event message, not a warning message.

11.1.78 Event 9395

Event message:

- Battery separated externally

Explanation:

The DC power connection to the battery was disconnected.

11.1.79 Event 29252

Event message:

- **SPS mode not available**

Explanation:

SPS mode is not started because the connection to the utility grid is still active.

Corrective measures:

- Verify that the utility grid is down or that the AC power supply to the inverter has been disconnected using the AC circuit breaker.
- Ensure that the parameter settings for backup operation are properly configured.

11.1.80 Event 29254

Event message:

- **Input power for SPS too low**

Explanation:

The battery and PV power are not sufficient to supply the SPS load.

Corrective measures:

- Ensure that sufficient PV power is available.
- Ensure that the battery is charged correctly.
- Reduce the SPS load.

11.2 Calculating the insulation resistance

The expected total resistance of the PV system or of an individual string can be calculated using the following formula:

The exact insulation resistance of a PV module can be obtained from the module manufacturer or the datasheet.

$$\frac{1}{R_{total}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \ldots$$

The exact insulation resistance of a PV module can be obtained from the module manufacturer or the datasheet.

For the resistance of a PV module an average value can be assumed: for thin-film PV modules approximately 40 MOhm and for polycrystalline and monocrystalline PV modules approximately 50 MOhm per PV module.

Also see:

- Checking the PV System for Ground Faults ⇒ page 122

11.3 Checking the PV System for Ground Faults

⚠ QUALIFIED PERSON

If the red LED is glowing and the event number 3501, 3601 or 3701 is being displayed in the **Results** menu on the inverter user interface, there may be a ground fault present. The electrical insulation from the PV system to ground is defective or insufficient.

⚠ DANGER

Danger to life due to electric shock when touching live system components in case of a ground fault

If a ground fault occurs, parts of the system may still be live. Touching live parts and cables results in death or lethal injuries due to electric shock.

- Disconnect the product and battery from voltage sources and make sure it cannot be reconnected before working on the device.
- Only touch the cables of the PV modules on their insulation.
- Do not touch any parts of the substructure or frame of the PV array.
- Do not connect PV strings with ground faults to the inverter.
- Ensure that no voltage is present and wait 5 minutes before touching any parts of the PV system or the product.

⚠ WARNING

Danger to life due to electric shock from destruction of the measuring device due to overvoltage

Overvoltage can damage a measuring device and result in voltage being present in the enclosure of the measuring device. Touching the live enclosure of the measuring device results in death or lethal injuries due to electric shock.

- Only use measuring devices with a measurement ranges designed for the maximum AC and DC voltage of the inverter.
- Only use measuring devices with measurement ranges designed for the maximum DC voltage of the battery.

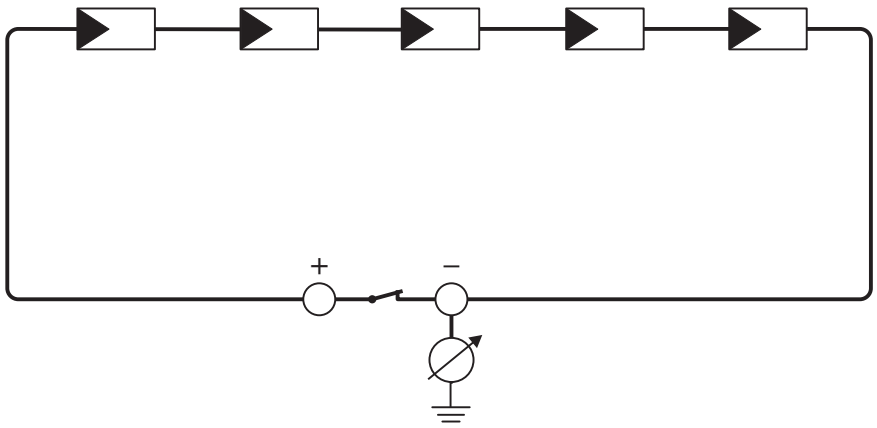


Figure 16: Schematic diagram of the measurement

Required equipment:

☐ Suitable device for safe disconnection and short-circuiting

☐ Measuring device for insulation resistance

Device required for safe disconnection and short-circuiting of the PV modules

The insulation resistance can only be measured with a suitable device for safe disconnection and short-circuiting of the PV modules. If no suitable device is available, the insulation measurement must not be carried out.

Procedure:

1. Calculate the expected insulation resistance per string.
2. Disconnect the inverter from all voltage sources (see Section 9, page 92).
3. Install the short circuit device.
4. Connect the measuring device for insulation resistance.
5. Short-circuit the first string.
6. Set the test voltage. The test voltage should be as close as possible to the maximum system voltage of the PV modules but must not exceed it (see datasheet of the PV modules).
7. Measure the insulation resistance.
8. Eliminate the short circuit.
9. Measure the remaining strings in the same manner.
   ☑ If the insulation resistance of a string deviates considerably from the theoretically calculated value, there is a ground fault present in that string.
10. Reconnect to the inverter only those strings from which the ground fault has been eliminated.
11. Reconnect all other strings to the inverter.
12. Recommission the inverter.
13. If the inverter still displays an insulation error, contact the Service. The PV modules might not be suitable for the inverter in the present quantity.

Also see:

- Calculating the insulation resistance ⇒ page 121

11.4 Manual restart after electric arc

⚠ QUALIFIED PERSON

If manual restart is configured and an electric arc is detected, the feed-in operation will automatically stop. You can use the following parameter to resume feed-in operation after an electric arc has been detected.

Channel	Name	Settings
Operation.OpMod	**General operating mode**	**Start**

11.5 Create Diagnostics Data

Download the diagnostic data of the device in case of failure. Diagnostic data makes it easier for SMA Service to analyze errors.

Requirements:

☐ The user interface must be open and you must be logged in.

Procedure:

1. Select the product in the focus navigation.
2. In the **Monitoring** menu, select **Diagnostics**.
3. Select **Diagnostic data**.

4. Select the required values and click [**Download**].
5. Provide diagnostic data to the SMA Service.

12 Decommissioning

12.1 Disconnecting the Terminals from the Inverter

⚠ QUALIFIED PERSON

To decommission the inverter completely upon completion of its service life, proceed as described in this Section.

⚠ CAUTION

Risk of injury due to weight of product

Injuries may result if the product is lifted incorrectly or dropped while being transported or mounted.

- Transport and lift the product carefully. Take the weight of the product into account.
- Wear suitable personal protective equipment for all work on the product.

Procedure:

1. Disconnect the inverter from all voltage sources (see Section 9, page 92).
2. **⚠ CAUTION**

   Risk of burns due to hot enclosure parts

   - Wait 30 minutes for the enclosure to cool down.
3. Undo the screw for the additional grounding (TX25) and remove the grounding cable.
4. Unplug the two-pole connector to which the DC load-break switch is connected from the adapter.
5. Unplug the adapter from the **GSI** slot.
6. Plug the two-pole connector to which the DC load-break switch is connected into the **GSI** slot.
7. Remove the battery power cable from the terminals.
8. Remove the DC cables for the PV modules from the terminals. Then loosen the nut on the respective PG cable gland. Pull the mating connectors through the nut one after the other and then through the enclosure opening.
9. Unplug the network cable from the **BATTERY** network port.
10. Remove the network cable from the **LAN-1** and **LAN-2** network ports.
11. Unplug the connector from the **SPS** slot.
12. Unplug the AC conductor from the busbar. To do this, first undo the screw (PZ2).
13. Remove the N and L conductors from the **SPS** terminals.
14. Remove N, L1, and L2 from the **AC** terminals.
15. Remove the ferrite. To do this, cut the cable tie.
16. Detach the cable for the additional grounding (TX25).

12.2 Disassembling the Inverter

⚠ CAUTION

Risk of injury due to weight of product

Injuries may result if the product is lifted incorrectly or dropped while being transported or mounted.

- Transport and lift the product carefully. Take the weight of the product into account.
- Wear suitable personal protective equipment for all work on the product.

Requirements:

- The terminals must be disconnected from the inverter Disconnecting the Terminals from the Inverter.

Procedure:

1. Remove the side covers. To do so, release the side covers at the bottom of the inverter and slide them upward slightly to disengage from the hooks on the mounting bracket and the inverter.
2. Lift the inverter by the top and bottom of the enclosure, then unhook it from the mounting bracket.
3. Remove the mounting bracket from the wall.
4. If the inverter is to be stored or shipped in packaging, pack the inverter and mounting bracket. Use the original packaging or packaging that is suitable for the weight and dimensions of the inverter.

13 Replacing the Product

⚠ QUALIFIED PERSON

Under fault conditions, an SMA product in the system may need to be replaced. If this is the case, you will receive a replacement device from SMA Solar Technology AG. If you received a replacement device, replace the defective product with the replacement device as described below.

1. Decommission the defective product.
2. Mount the replacement device and make the electrical connections.
3. Commission the replacement device.
4. If the defective product was registered by a System Manager (e.g., an inverter configured as a System Manager) or by a communication product, replace it with the new product in the System Manager or communication product (see the Communication Product or System Manager manual).
5. If the System Manager has been replaced, confirm the replaced device in Sunny Portal (see Sunny Portal manual)
6. Pack the defective product in the packaging of the replacement device and arrange with SMA Solar Technology AG for it to be picked up. If a wall mounting bracket is enclosed with the replacement device, pack it with the defective product.

14 Disposal

The product must be disposed of in accordance with the locally applicable disposal regulations for waste electrical and electronic equipment.

15 Technical Data

15.1 General Data

	SBSE3.6-50 / SBSE4.0-50 / SBSE5.0-50 / SBSE6.0-50	SBSE-8.0-50 / SBSE-9.9-50
Width x height x depth	500 mm x 586 mm x 236 mm	500 mm x 679 mm x 233 mm
Weight	17.5 kg	22 kg
Length x width x height of the packaging	760 mm x 580 mm x 350 mm	760 mm x 580 mm x 350 mm
Transport weight	23 kg	25.9 kg
Climatic category in accordance with IEC 60721-3-4	4K26	
Environmental category	outdoors	
Pollution degree of all enclosure parts	2	
Operating temperature range	-25°C to +60°C	
Max. permissible value for relative humidity (condensing)	100 %	
Maximum operating altitude above mean sea level (MSL)	3000 m	
Typical noise emission	35 dB(A)	
Power loss in night mode	< 6 W	
Topology	Transformerless (Non-isolated)	
Cooling method	natural convection	
Degree of protection for electronics in accordance with IEC 60529	IP65	
Protection class in accordance with IEC 62109-1	I	
Radio technology	WLAN 802.11 b/g/n	
Radio spectrum	2.4 GHz	
Maximum transmission power	100 mW	
Wi-Fi range in free-field conditions	10 m	
Quantity maximum detectable Wi-Fi networks	32	
Grid configurations	TN-C, TN-S, TN-C-S, TT (when V_{N_PE} < 20 V), Delta-IT	

15.2 DC input of PV

	SBSE3.6-50	SBSE4.0-50	SBSE5.0-50	SBSE6.0-50	SBSE-8.0-50	SBSE-9.9-50
Maximum power of PV array	7200 Wp	8000 Wp	10000 Wp	12000 Wp	16000 Wp	19800 Wp
Maximum input voltage	600 V					
MPP voltage range	60 V to 480 V					
Minimum input voltage	60 V					
Initial input voltage	66 V					
Maximum usable input current per input	15 A					
Maximum short-circuit current per input[3)]	30 A					
Maximum short-circuit current for all inputs in total[3)]	60 A					
Maximum reverse current into the PV modules	0 A					
Number of independent MPP inputs	3	3	3	3	4	4
Inputs per MPP	1					
Connection of MPP inputs in parallel possible	A and B	A and B	A and B	A and B	A and B / C and D	A and B / C and D

[3)] In accordance with IEC 62109-2: $I_{SC\ PV}$

	SBSE3.6-50	SBSE4.0-50	SBSE5.0-50	SBSE6.0-50	SBSE-8.0-50	SBSE-9.9-50
Coupling capacity of all PV modules in case of PV modules with high capacity to ground	1.54 µF	1.54 µF	1.54 µF	1.54 µF	2.30 µF	2.30 µF
Overvoltage category as per IEC 62109-1	II					

15.3 Battery DC input

	SBSE3.6-50	SBSE4.0-50	SBSE5.0-50	SBSE6.0-50	SBSE-8.0-50	SBSE-9.9-50
Voltage range	90 V to 500 V					
Maximum charging current	30 A					
Maximum discharging current	30 A					
Maximum short-circuit current	55 A					
Maximum charging power	10000 W	10000 W	10000 W	10000 W	12000 W	12000 W
Maximum discharge power	3789 W	4211 W	5263 W	6316 W	8421 W	10421 W
Battery type[4)]	Li-ion					
Number of independent inputs	1					
Overvoltage category (according to IEC 60664-1)	II					

[4)] Warning! Danger of fire due to use of non-approved batteries. Only use batteries approved by SMA Solar Technology AG (technical information with list of approved batteries at www.SMA-Solar.com).

15.4 AC output

	SBSE3.6-50	SBSE4.0-50	SBSE5.0-50	SBSE6.0-50	SBSE-8.0-50	SBSE-9.9-50
Rated power at 230 V, 50 Hz	3600 W	4000 W	5000 W	6000 W	8000 W	9900 W
Maximum apparent power	3600 VA	4000 VA	5000 VA	6000 VA	8000 VA	9900 VA
Nominal grid voltage	230 V / 240 V					
Voltage range[5)]	184 V to 253 V / 192 V to 264 V					
Rated current at 230 V	15.7 A	17.4 A	21.7 A	26.1 A	34.8 A	43.0 A
Maximum output current	16 A	20 A	25 A	30 A	40 A	48 A
Maximum output current under fault conditions	488 A					
The total harmonic distortion of the output current and AC voltage must each be <2%. This condition applies when the AC power is > 50% of the rated power.	< 3 %					
Inrush current	< 10% of the nominal AC current for a maximum of 10 ms					
Rated grid frequency	50 Hz					
Grid frequency[5)]	50 Hz / 60 Hz					
Operating range at grid frequency 50 Hz	44 Hz to 56 Hz					

[5)] Depending on the configured country data set

	SBSE3.6-50	SBSE4.0-50	SBSE5.0-50	SBSE6.0-50	SBSE-8.0-50	SBSE-9.9-50
Operating range at grid frequency 60 Hz	54 Hz to 66 Hz					
Power factor at rated power	1					
Displacement power factor, adjustable	1 / 0.0 overexcited to 0.0 underexcited					
Feed-in phases	1	1	1	1	1	1
Connection phases	1-(N)-PE					
Overvoltage category as per IEC 62109-1	III					

15.5 Digital inputs

Digital inputs

Quantity	1
Maximum cable length	100 m

15.6 Digital output (multifunction relay)

Quantity	1
Execution	Potential-free relay contacts
Maximum switching voltage	30 V DC
Maximum switching current	1 A
Minimum switching current	10 mA
Minimum electrical endurance when the maximum switching voltage and maximum switching current are complied with[6)]	100000 switching cycles
Bounce time	5 ms
Reset time	5 ms
Maximum cable length	< 30 m

[6)] Corresponds to 20 years at 12 switching operations per day

15.7 Communication

SMA devices	Max. 5 subordinate devices with SMA Speedwire (inverter and energy meter), 100 Mbit/s
I/O systems and meters	Ethernet, 10/100 Mbit/s, Modbus TCP

15.8 Data Storage Capacity

1-minute values	7 days
5-minute values	7 days
15-minute values	30 days
60-minute values	3 years
Event messages	1024 events

15.9 Efficiency

Maximum efficiency, η_{max}	98.15 %

15.10 Protective Devices

	SBSE3.6-50 / SBSE4.0-50 / SBSE5.0-50 / SBSE6.0-50	SBSE8.0-50 / SBSE9.9-50
DC reverse polarity protection	Short-circuit diode	
Input-side disconnection point	DC load-break switch[7)]	
AC short-circuit current capability	Current control	
Grid monitoring	SMA Grid Guard 10.0	
Maximal output overcurrent protection	50 A	60 A
Ground fault monitoring	Insulation monitoring: R_{iso} > 120 kΩ	
All-pole sensitive residual-current monitoring unit	Available	
Residual-current device (RCD)	Compatible with Type A and Type B	
SMA ArcFix arc-fault circuit interrupter	Available	
Active anti-islanding method	Frequency shift	

15.11 Climatic Conditions

Installation in accordance with IEC 60721-3-4, Class 4K26

Extended temperature range	-25°C to +60°C
Extended humidity range	0% to 100%

[7)] Usage category according to IEC 60947: DC-PV2

Threshold for relative humidity, non-condensing	100 %
Extended air pressure range	79.5 kPa to 106 kPa

Transport in accordance with IEC 60721-3-4, Class 2K12

Temperature range	-40°C to +70°C

15.12 Equipment

PV connection	Lever clamp
Battery connection	Push-in terminal
AC connection	Push-in terminal
Multifunction relay	As standard

16 EU Declaration of Conformity

within the scope of the EU directives

- Electromagnetic compatibility 2014/30/EU (29.3.2014 L 96/79-106) (EMC)
- Low Voltage Directive 2014/35/EU (29.3.2014 L 96/357-374) (LVD)
- Radio Equipment Directive 2014/53/EU (22.5.2014 L 153/62) (RED)
- Restriction of the use of certain hazardous substances 2011/65/EU (L 174/88, June 8, 2011) and 2015/863/EU (L 137/10, March 31, 2015) (RoHS)

SMA Solar Technology AG confirms herewith that the products described in this document are in compliance with the fundamental requirements and other relevant provisions of the aforementioned directives. More information on the availability of the entire Declaration of Conformity can be found at https://www.sma.de/en/ce-ukca.

Radio technology	WLAN 802.11 b/g/n
Radio spectrum	2.4 GHz
Maximum transmission power	100 mW

17 Contact

If you experience any technical problems with our products, please contact the Service. The following data is required in order to provide you with the necessary assistance:

- Device type
- Serial number
- Firmware version
- Device configuration (System Manager or subordinate device)
- Special country-specific settings (if available)
- Event message
- Installation site and mounting height
- Type and number of PV modules
- Optional equipment (e.g. accessories used)
- Use the name of the system in Sunny Portal (if available)
- Access data for Sunny Portal (if available)
- Information on the ripple control receiver (if available)
- Operating mode of the multifunction relay (if used)
- Detailed description of the problem

You can find your country's contact information at:

https://go.sma.de/service

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