System Manual

SMA Home Storage Solution with SMA Backup Secure - Generate solar power, store and use it effectively

The solution for the flexible and effective use of solar energy with added peace of mind in the event of power outage with Sunny Boy Smart Energy-US, SMA Energy Meter-US, SMA Backup Secure, and battery

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1 Information on this Document

1.1 Validity

This document is valid for:

- SMA Home Storage Solution with Sunny Boy Smart Energy-US, SMA Energy Meter-US, SMA Backup Secure, and battery

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
- Knowledge of how battery-backup and secure power supply operation works in PV systems and is set up
- Knowledge of how energy meters 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 summarizes the specific information for the system and describes the procedure for installation and commissioning.

Circuitry overviews provide the basic principle of how a system must be set up and connected.

The latest version of this document and additional information about the SMA products 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 inverter.

This document supplements the documents that are enclosed with each product and does not replace any locally applicable codes or standards. Read and observe all documents supplied with 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

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	• Select **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 Storage Solution	System
Sunny Boy Smart Energy	Inverter, hybrid inverter
SMA Energy Meter-US	Energy meter

1.8 Additional Information

Additional information is available at www.SMA-Solar.com.

Title and information content	Type of information
"PUBLIC CYBER SECURITY - Guidelines for a Secure PV System Communication"	Technical Information
"SMA GRID GUARD 10.0 - Grid Management Services via Inverter and System Controller"	Technical Information
"Efficiency and Derating" Efficiency and derating behavior of the SMA inverters	Technical Information
"Compatibility between common grid configurations and SMA inverters and SMA charging stations"	Technical Information
"Parameters and Measured Values" Device-specific overview of all parameters and measured values and their setting options Information about the SMA Modbus registers	Technical Information
"Approved Batteries and Information on Battery Communication Connection" Overview of approved batteries	Technical Information
"SMA Modbus ®-interface - ennexOS" Information on the SMA Modbus interface	Technical Information
"SunSpec Modbus ®-interface - ennexOS" Information about the SunSpec Modbus interface and supported information models	Technical Information

2 Safety

2.1 Intended Use

The SMA Energy Solution Home is a PV and storage system and optimizes self-consumption of PV energy and lowers the energy obtained from the utility grid by the following measures:

- Use of self-generated PV energy
- Intermediate storage of PV energy in the battery
- Energy management of the battery with the inverter as System Manager and the SMA Energy Meter-US
- Visualization of consumption and generation data from the system in the SMA Energy app, in Sunny Portal, and in the SMA 360° app
- Use of self-generated PV energy for selected loads in the event of power outage

Grid feed-in and grid-supplied power are recorded with the SMA Energy Meter. The SMA Energy Meter does not replace the energy meter of the electric utility company.

The SMA Energy Solution Home may be equipped with the manual secure power supply function SMA Backup Secure when using the SMA Backup Start. When needed, for example in case of a power outage, the inverter can continue to supply electric current from the battery and the PV system to selected loads by means of a socket connected to the inverter.

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

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.

The SMA products in the system are approved for the USA market.

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.

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 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 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.

Sunny Boy Smart Energy:

The Sunny Boy Smart Energy is a single-phase, transformerless hybrid inverter with 3 PV inputs 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 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 may only be operated with PV modules and cables that are approved in accordance with the electrical standards applicable on-site and the *National Electrical Code*® ANSI/NFPA 70.

No galvanic isolation

The product is not equipped with a transformer and therefore has no galvanic isolation.

- Do not operate grounded PV modules or batteries together with the product. If grounded PV modules or batteries are connected to the product, then an event will occur. The event will be displayed, along with the associated message, in the event list on the user interface of the product.
- Only ground the mounting frames of the PV modules.
- Only ground the enclosure of the battery.
- The neutral conductor of the AC output is not bonded to ground within the product.
- The neutral conductor of the AC output for secure power supply operation can be grounded depending on the configuration.

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 (for information on how to determine the coupling capacity, see the Technical Information "Leading Leakage Currents" at www.SMA-Solar.com).

To protect the PV system against excessive reverse currents under fault conditions, a DC-side overcurrent protective device must be connected in accordance with the *National Electrical Code*® to prevent any short-circuit currents that exceed the ampacity of the DC electric circuit or the maximum series fuse rating of the PV modules.

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 this document.

The battery must comply with UL 1973 and must be intrinsically safe.

The inverter/battery combination must be certified in accordance with UL 9540.

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.

The type label must remain permanently attached to the product.

SMA Backup Start:

SMA Backup Start is required in order to use secure power supply and battery-backup operation (e.g., SMA Backup Secure) in the SMA Home Energy Solution with the SMA inverters listed below. SMA Backup Start is a module that is integrated in the inverter. SMA Backup Start is equipped with a battery that can be charged to start the system as soon as energy is present in the PV system or the system battery. Thus, SMA Backup Start makes it possible to start emergency power operation or battery-backup operation, even with a completely de-energized inverter. This is particularly necessary if PV module switches are installed in the system that support the the SunSpec communication signal for Rapid Shutdown systems and disconnect the inverter from the PV modules. SMA Backup Start can be used in systems with or without a battery.

The SMA Backup Start must only be installed in the following SMA inverters:

- SBSE3.8-US-50 (Sunny Boy Smart Energy 3.8-US)
- SBSE4.8-US-50 (Sunny Boy Smart Energy 4.8-US)
- SBSE5.8-US-50 (Sunny Boy Smart Energy 5.8-US)
- SBSE7.7-US-50 (Sunny Boy Smart Energy 7.7-US)

Even with SMA Backup Start, the system is not suitable for supplying life-sustaining medical devices. A power outage must not lead to personal injury.

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.

⚠ 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 system from voltage sources and make sure it cannot be reconnected before working on the device.
- Observe all safety information of the battery manufacturer.
- Do not touch non-insulated parts or cables.
- Do not pull the DC conductors under load out of the terminal blocks.
- 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 system 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.
- Once disconnected from voltage sources, wait five minutes before touching any parts of the PV system or the system.

⚠ 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 inverter or the battery outdoors to the inside of a building.
- The Ethernet interface of the inverter 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 inverter under fault conditions. In this state, switching operations can cause a fire and, in very rare cases, a deflagration inside the inverter. Death or lethal injuries due to the spread of a fire can result.

- In case of failure, do not perform any direct actions on the inverter.
- In case of failure, ensure that unauthorized persons have no access to the product.
- In case of failure, 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 case of failure, disconnect the battery from the inverter via an external disconnection device. Do not operate the DC load-break switch on the inverter.
- 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 inverter. 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 inverter and battery (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 system.

⚠ 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.

⚠ CAUTION

Risk of fire

- To reduce the risk of fire, the inverter must only be connected to an electric circuit provided with a branch overcurrent protective device with maximum 50 A in accordance with the *National Electrical Code*® ANSI/NFPA 70 or the *Canadian Electrical Code*® CSA C22.1.

NOTICE

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

Sand, dust and moisture penetration can damage the products of the system and impair its functionality.

- Only open the inverter if the humidity is within the thresholds and the environment is free of sand and dust.
- Do not open the inverter during a dust storm or precipitation.
- Close the inverter in case of interruption of work or after finishing work.
- Only operate the inverter in a closed state.
- Close all enclosure openings of the inverter tightly.
- Only use listed rain-tight conduit fittings or conduit fittings for wet locations to attach the conduits to the inverter.

NOTICE

Damage to the enclosure seal in subfreezing conditions

If you open the inverter when temperatures are below freezing, the enclosure seals can be damaged. This can lead to moisture entering the inverter.

- Only open the inverter 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 inverter (e.g. by melting the ice with warm air).
- If the inverter 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.

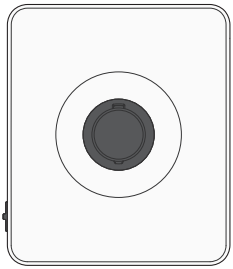
Electrical installations (for North America)

All installations must conform with the laws, regulations, codes and standards applicable in the jurisdiction of installation (e.g. *National Electrical Code*® ANSI/NFPA 70.

- Before connecting the product to the utility grid, contact your local grid operator. The electrical connection of the product must be carried out by qualified persons only.
- Ensure that the cables or conductors used for electrical connection are not damaged.

3 System Components

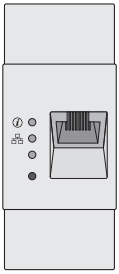
3.1 Sunny Boy Smart Energy



As the System Manager, the Sunny Boy Smart Energy is the central device for energy management in homes with a PV system for self-consumption. The Sunny Boy Smart Energy can perform the following tasks:

- Managing the energy flows in the system
- Managing the energy storage in the system
- Incorporating PV and battery power into the system

3.2 SMA Energy Meter



The energy meter SMA Energy Meter (EMETER-US-50) measures the flow of energy out of and into the utility grid. The measured values it produces are used by the Sunny Boy Smart Energy for the purpose of energy management.

The Sunny Boy Smart Energy can perform the following tasks together with the energy meter:

- Collection of energy- and power measured values in the interconnected household
- Energy monitoring: display energy flows via the SMA Energy App and Sunny Portal powered by ennexOS
- Dynamic limiting of the active power feed-in
- Measurement of currents up to 200 A with the supplied electrical current transducers

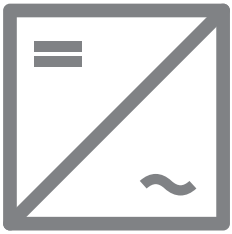
3.3 Battery

The battery performs the following tasks in the system:

- Storage of surplus energy from the PV system
- Optimization of self-consumption or energy self-sufficiency in parallel grid operation through the energy in intermediate storage
- Supplying of electrical loads with energy from intermediate storage in the event of grid failure, when SMA Backup Start is installed

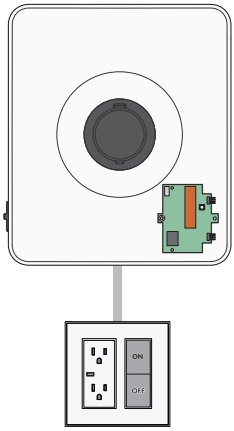
An updated list of batteries approved by SMA Solar Technology AG can be found in this document (see Section 3.9, page 23).

3.4 Additional PV inverters



The system contains additional PV inverters that convert the direct current from the PV modules into grid-compliant alternating current. The hybrid inverter can convert the power generated by the PV inverters into direct current and feed it to the battery. In secure power supply and battery-backup operation, power generated by additional PV inverters cannot be used.

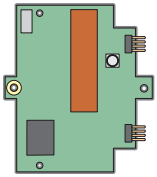
3.5 SMA Backup Secure



The system can be equipped with the manual secure power supply function SMA Backup Secure when SMA Backup Start is installed. In the event of a power outage, the inverter can continue to supply selected loads with power from the battery and the PV modules connected to the Sunny Boy Smart Energy. The loads are connected to the inverter via a socket. SMA Backup Secure is started manually, if needed, via a switch connected to the inverter. SMA Backup Secure can be activated when AC voltage is no longer being applied to the inverter. Switch and socket are not sold by SMA Solar Technology AG.

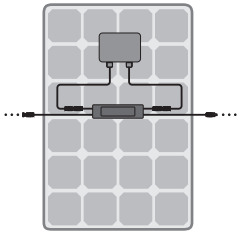
SMA Backup Secure must be combined with a rapid shutdown initiator. This can be an external rapid shutdown initiator or the DC load-break switch of the inverter, configured as a rapid shutdown initiator.

3.6 SMA Backup Start



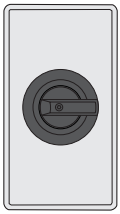
SMA Backup Start (BU-STRT-US-50) is required in order to use secure power supply and battery-backup operation (e.g., SMA Backup Secure) in the SMA Energy System Home.
SMA Backup Start is equipped with a battery that can be charged to start the system when energy is present in the PV system or the system battery.

3.7 PV Modules with Rapid Shutdown Devices



The PV modules convert sunlight into electrical energy. If required for your system, you must equip the PV modules with rapid shutdown devices. An updated list of rapid shutdown devices approved by SMA Solar Technology AG can be found in this document Approved SunSpec-certified Rapid Shutdown Devices.

3.8 Rapid Shutdown Initiator



The DC load-break switch of the inverter can be configured as a rapid shutdown initiator (SIM16-PEL64R-2). If a rapid shutdown initiator is required in your system and the DC load-break switch of the inverter is not easily accessible, an external rapid shutdown initiator must be installed in the system. Up to 3 inverters can be connected to this rapid shutdown initiator using an adapter matched to the Sunny Boy Smart Energy.

3.9 Approved Batteries

You can find the batteries approved by SMA Solar Technology AG in the SMA Energy Solution Home with the Sunny Boy Smart Energy in the following table.

Firmware version of the battery

The firmware versions of the batteries can be viewed via the user interface of the respective battery after successful commissioning. For BYD batteries, the firmware of the batteries is updated via the user interface of the battery (see manufacturer's manual).

Inverter firmware version

The firmware version of the inverter can be accessed via the user interface of the inverter.

Type (manufacturer)	System designation according to UL9540	Firmware version of the battery	Inverter firmware version
Battery-Box Premium HVL (12.0-32.0) (BYD Company Limited)	• SMA-SBSE-3.8-ESS-HVL • SMA-SBSE-4.8-ESS-HVL • SMA-SBSE-5.8-ESS-HVL • SMA-SBSE-7.7-ESS-HVL	BMU: ≥ 3.23 BMS: ≥ 3.28	≥ 3.06.15.R

3.10 Approved PID Boxes

The PID boxes (Potential Induced Degradation boxes) used with the Sunny Boy Smart Energy must be equipped with a disconnect.

4 SMA Home Energy Solution - System Overview

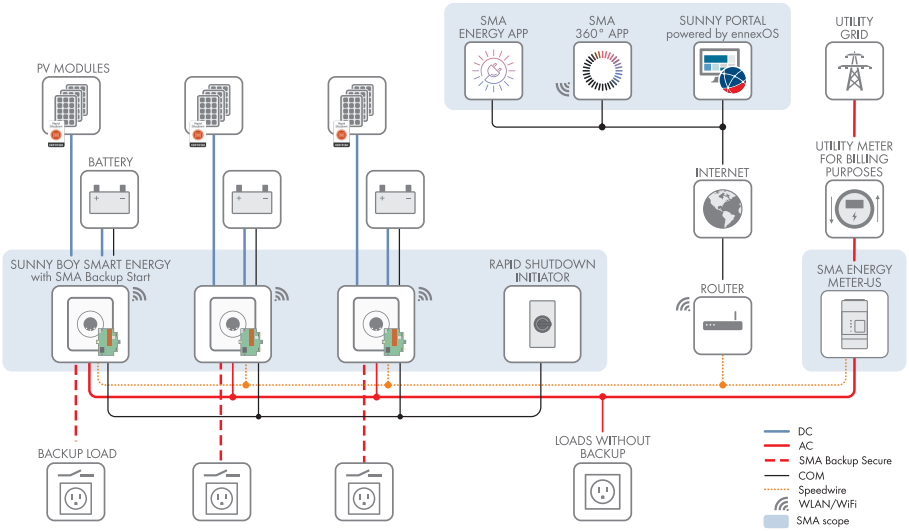


Figure 1: System with 3 Sunny Boy Smart Energy units

5 Circuitry Overview

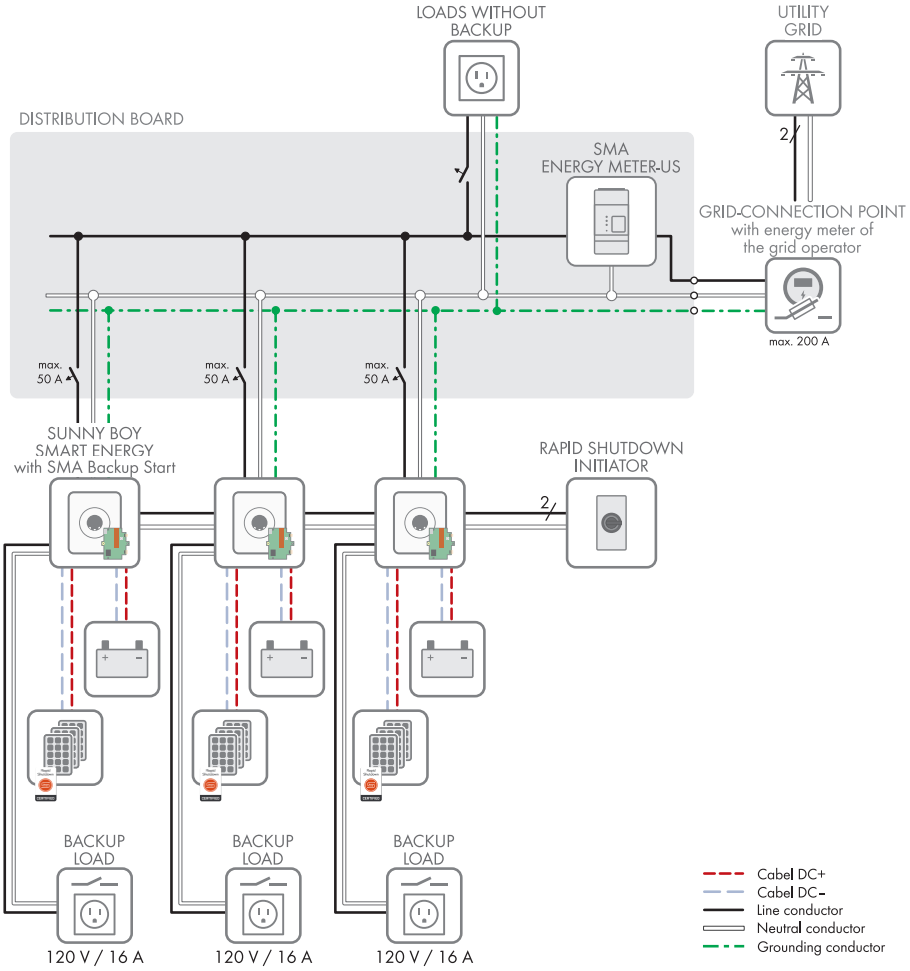


Figure 2: Circuitry of the system with 3 Sunny Boy Smart Energy units

6 Communication Overview

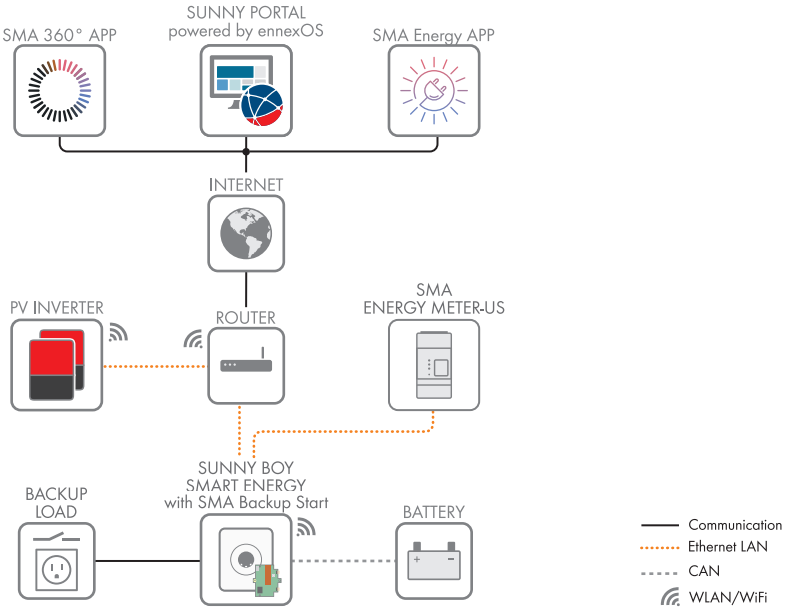


Figure 3: Communication Overview of System

7 Interfaces and Functions

7.1 Sunny Boy Smart Energy as System Manager

The Sunny Boy Smart Energy can be used as a System Manager for energy management. As a System Manager, the Sunny Boy Smart Energy can provide control at the point of interconnection, in conjunction with an energy meter, and can thereby control subordinate devices (e.g., additional Sunny Boy Smart Energy units). The System Manager also takes over system monitoring and communication to the Sunny Portal powered by ennexOS.

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

There is a QR code on the inverter as standard. By scanning the QR Code attached to the product via the SMA 360° app or SMA Energy app, access to the product is established via Wi-Fi and the connection to the user interface is made automatically.

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

Also see:

- Direct connection via Wi-Fi ⇒ page 82

7.3 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 86

7.4 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.

7.5 Arc-Fault Circuit Interrupter (AFCI)

The inverter is equipped with an integrated photovoltaic (PV) arc-fault circuit interrupter as required for PV systems by *National Electrical Code*® ANSI/NFPA 70 (NEC). The inverters' arc-fault circuit interrupter (AFCI) functionality is certified to Standard UL 1699B Edition 1 (August 2018), Photovoltaic (PV) DC Arc-Fault Circuit Protection, which defines requirements for PV arc-fault protection devices intended for use in solar photovoltaic electrical energy systems as described in NEC 690.11.

The arc-fault circuit interrupter (AFCI) is activated by default and set so that the inverter interrupts the feed-in operation after 5 arc fault detections within 24 hours, and a manual restart must be performed. If the installation conditions permit this, you can change the default setting.

The arc-fault circuit interrupter (AFCI) can detect electric arcs in the PV modules and the module wiring of connected strings. The arc-fault circuit interrupter ensures that the inverter ceases operations and interrupts any electric arcs as soon as they are detected. This involves halting the flow of current.

The arc-fault circuit interrupter (AFCI) has proved extremely reliable, meaning that the inverter dependably detects and interrupts electric arcs that actually occur in the PV electric circuit and is generally not susceptible to false tripping. AFCI incidents output by the inverter should be regarded as reliable indicators of actual errors in the PV electric circuit displayed and should be investigated immediately and thoroughly by qualified persons to localize and rectify errors in the PV electric circuit.

Also see:

- Arc-Fault Circuit Interrupter (AFCI) ⇒ page 87
- Manual restart after electric arc ⇒ page 127

7.6 Rapid Shutdown Equipment

The inverter is listed as PV Rapid Shutdown Equipment (PVRSE) according to UL 1741.

All DC inputs and AC outputs of this product comply with photovoltaic rapid shutdown requirements for controlled conductors outside the array.

A complete PV Rapid Shutdown System (PVRSS) consists of the PV or hybrid inverter, the PV module switches, and a rapid shutdown initiator. The Rapid Shutdown initiation device serves to initiate a rapid shutdown. The PV Rapid Shutdown System must limit the DC conductors to < 30 V within 30 seconds.

NOTICE - The inverter's Rapid Shutdown function can be initiated if the inverter is disconnected from the AC grid voltage, for example, by opening the main PV system AC disconnect. The AC disconnect that serves as the Rapid Shutdown initiation device must be readily accessible and clearly marked in accordance with *National Electrical Code*®. The Rapid Shutdown status of the PV system will be indicated by the On/Off (Closed/Open) position of this AC disconnect. The Off (Open) position indicates that a rapid shutdown has been initiated.

If PV array disconnect switches compliant with the SunSpec communication signal for Rapid Shutdown systems are installed, the inverter can transmit a SunSpec-compliant "permission to operate" signal to them via its DC input conductors. When a rapid shutdown is initiated, the inverter will stop transmitting the SunSpec signal. When the SunSpec signal is not being received, the PV

array disconnect switches are responsible for reducing line voltages within the PV array in accordance with *National Electrical Code®*. In the event of a rapid shutdown via the SunSpec communication signal, it is important that all PV modules connected to the inverter are always equipped with SunSpec-compliant PV array disconnect switches, otherwise the inverter cannot start feed-in operation. For reliable discharge of the DC connection conductors, it is necessary for the sum of the standby voltages of all PV array disconnect switches of a string to be > 3.6 V and < 30 V. In addition, the recommended total length of all DC lines of a string should not exceed 80 m (260 ft). The total length defines the length of the entire string wiring including the connection cable of the PV module switch in the string (measured from the positive DC terminal to the negative DC terminal of the inverter).

The rapid shutdown system can also be equipped with PV module switches, which initiate the rapid shutdown in response to an AC power outage or by other means. In these cases, it must be ensured that the PV system Rapid Shutdown initiation device initiates a rapid shutdown of the PV array devices at the same time that the inverter is disconnected from grid voltage.

The PV array disconnect switches must disconnect the PV array from the inverter within a maximum of 15 seconds after Rapid Shutdown initiation.

The inverter is capable of grid support operation where in case of a power failure or by activating the AC disconnect, the inverter remains connected to the utility grid for a defined ride-through time and waits for voltage recovery. If the grid voltage does not recover within the defined ride-through time, the inverter disconnects from the grid and a rapid shutdown is initiated.

The Rapid Shutdown function is enabled by default. The Rapid Shutdown function should only be enabled when PV array disconnect switches have been installed within the PV array or between the PV array and the inverter. The Rapid Shutdown function can be enabled during or after inverter commissioning via the user interface or the SMA 360° app by selecting the operating mode suitable for the PV array disconnect switches. If the Rapid Shutdown function is enabled and no PV array disconnect switches are installed, the inverter cannot discharge the connected DC input conductors during a rapid shutdown. As a result, the inverter can be damaged.

WARNING - THIS PV RAPID SHUTDOWN EQUIPMENT DOES NOT PERFORM ALL OF THE FUNCTIONS OF A COMPLETE PV RAPID SHUTDOWN SYSTEM. THIS PV RAPID SHUTDOWN EQUIPMENT MUST BE INSTALLED WITH OTHER EQUIPMENT TO FORM A COMPLETE PV RAPID SHUTDOWN SYSTEM THAT MEETS THE REQUIREMENTS OF NEC (NFPA 70) FOR CONTROLLED CONDUCTORS OUTSIDE THE ARRAY. OTHER EQUIPMENT INSTALLED IN OR ON THIS PV SYSTEM MAY ADVERSLY AFFECT THE OPERATION OF THE PV RAPID SHUTDOWN SYSTEM. IT IS THE RESPONSIBILITY OF THE INSTALLER TO ENSURE THAT THE COMPLETED PV SYSTEM MEETS THE RAPID SHUT DOWN FUNCTIONAL REQUIREMENTS. THIS EQUIPMENT MUST BE INSTALLED ACCORDING TO THE MANUFACTURER'S INSTALLATION MANUAL.

7.7 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

7.8 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 grid connection point is reduced when the energy can be consumed or stored at the place where it is generated. The power draw at the grid connection point is reduced since a large proportion of the self-generated energy is being used.

The system consisting of inverter, energy meter, and battery supports the increased self-consumption through intermediate storage of energy produced from generators.

7.9 Energy Monitoring

The inverter supports the display of balances relating to PV generation in Sunny Portal powered by ennexOS or in the SMA Energy app. If the inverter is used together with the SMA Energy Meter-US, further and more detailed balances are shown.

7.10 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 grid connection point. This is mostly useful when a higher supply of energy would lead to a higher electricity cost. With the "Peak Load Shaving" function, certain grid-exchange power outputs to which the battery inverter is adjusted depending on its power and battery capacity available can be set. Power peaks and additional costs can thus be avoided.

You can configure setpoints 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.

7.11 Display of I-V characteristic curve

On the user interface of the inverter, a characteristic curve from current and voltage values of the PV modules can be generated per MPP tracker. Using this I-V characteristic curve, problems in the PV array can be detected at an early stage.

7.12 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.

7.13 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.

7.14 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.

7.15 Device Key (DEV KEY)

If you have forgotten the administrator password for the inverter, 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 inverter in digital communication. The Device Key is provided on a sheet with a password label supplied with the inverter. Keep the device key safe in case you forget the administrator password.

8 Scope of Delivery

8.1 Scope of Delivery of the Inverter

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

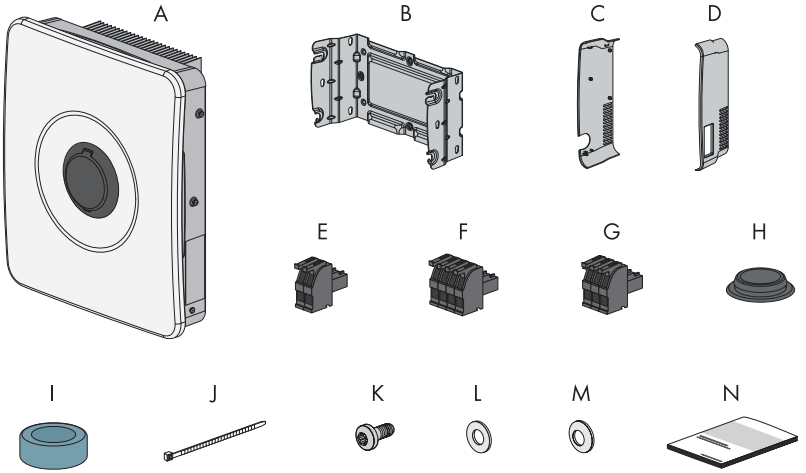


Figure 4: Components included in scope of delivery

Position	Quantity	Designation
A	1	Inverter
B	1	Mounting bracket
C	1	Left side cover
D	1	Right side cover
E	3	2-pole plug for connecting the switch for secure power supply operation, fast stop, and monitored DC-SPD
F	1	4-pole plug for connecting the energy meter per RS485
G	1	3-pole plug for connecting the multifunctional relay
H	1	Sealing plug for the first enclosure opening from the left
I	1	Ferrite for the AC connection
J	1	Cable tie for securing the ferrite
K	1	M5x12 screw for the additional grounding
L	1	M5 washer for the additional grounding

Position	Quantity	Designation
M	1	Conical spring washer M5 for the additional grounding
N	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

8.2 SMA Backup Start scope of delivery

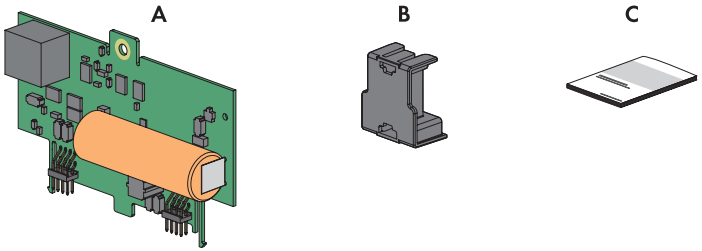


Figure 5: Components included in scope of delivery

Position	Quantity	Designation
A	1	SMA Backup Start modules
B	1	Spacer
C	1	Documentation package consists of: • Safety information booklet • Quick reference guide poster with illustrated instructions for initial installation and commissioning

8.3 Scope of Delivery of the SMA Energy Meter-US

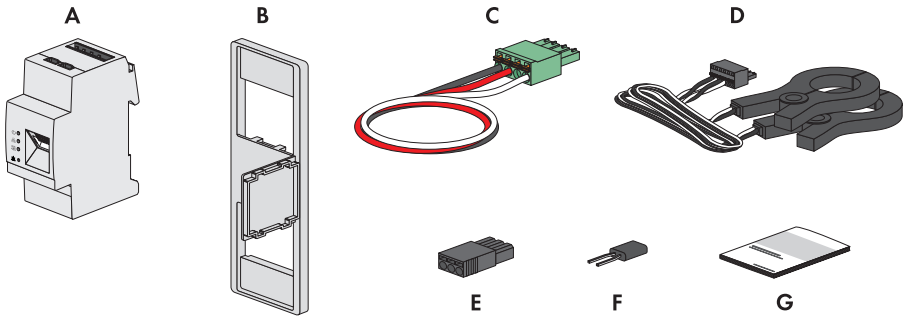


Figure 6: Components included in scope of delivery

Position	Quantity	Designation
A	1	SMA Energy Meter
B	1	Mounting bracket
C	1	Power cable with preconfigured connector
D	1	2 electrical current transducers with preconfigured connector
E	2	RS485 connector
F	1	120 Ω load resistance for the connection via RS485
G	1	Documentation

8.4 Scope of Delivery of the Rapid Shutdown Initiator

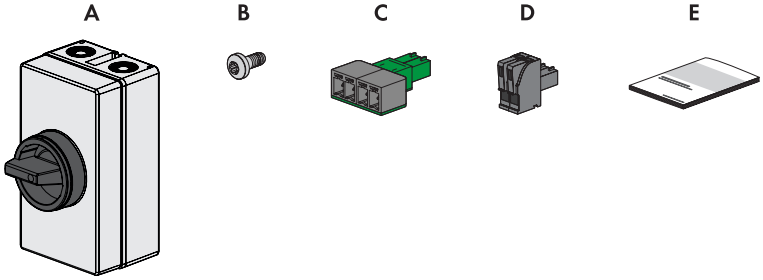


Figure 7: Components included in scope of delivery

Position	Quantity	Designation
A	1	Rapid Shutdown Initiator
B	2	Screw to fasten the switch unit in the switch enclosure

Position	Quantity	Designation
C	3	Adapter for connection to several Sunny Boy Smart Energy units
D	3	Two-pole connector
E	1	Documentation

9 Product Overview of the inverter

9.1 Product Description

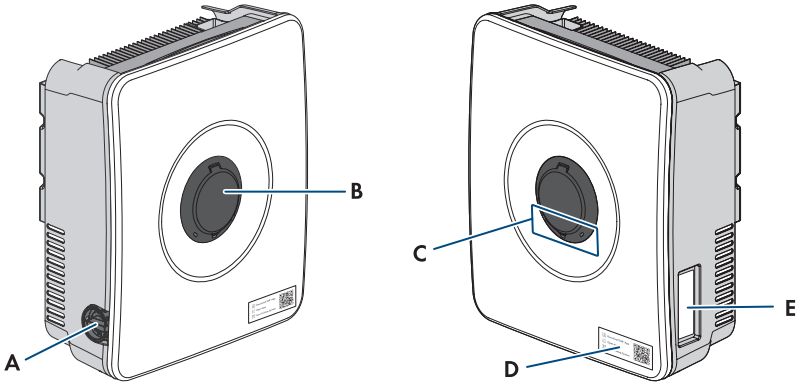


Figure 8: Design of the product

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

9.2 Symbols on the Inverter

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.

Symbol	Explanation
	Beware of electrical voltage The product operates at high voltages.
	Beware of hot surface The product can get hot during operation.
	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. Prior to performing any work on the inverter, disconnect it from all voltage sources as described in this document.
	Observe the documentations Observe all documentations supplied with the product.
	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.
	Equipment Grounding Terminal This symbol indicates the position for the connection of an equipment grounding conductor.
	Grounding This symbol indicates the position for the connection of an additional equipment grounding conductor.
	The product has no galvanic isolation.
	UL 62109-1 is the standard applied by Underwriters Laboratories to the product to certify that the product meets the requirements of the *National Electrical Code*® and the IEEE 1547 standard.

9.3 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 battery-backup or secure power supply operation.
The green LED is glowing	Operation The inverter is in operation.
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 18.1, 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 18.1, 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.

LED signal	Explanation
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.

10 Procedure for Initial Installation and Commissioning of the System

The procedure for initial installation, electrical connection, and commissioning of the system is described in the following. It provides an overview of the steps, which must be performed in the prescribed sequence.

Procedure		See
1.	Ensure that the requirements for the installation of the system components are fulfilled.	Section 11.1, page 41
2.	Install rapid shutdown devices at the PV modules.	Manual for the rapid shutdown devices
3.	Mount the inverter.	Mounting the Inverter
4.	Mount the energy meter.	Manual for the energy meter
5.	Mount the battery.	Manual for the battery
6.	Ensure that the requirements for the electrical connection are fulfilled.	Section 12.1, page 47
7.	Remove the cover of the inverter.	Section 15, page 91
8.	Mount SMA Backup Start.	Section 11.3, page 45
9.	Connect the utility grid together with the switch and socket for secure power supply operation to the inverter.	
10.	Connect the network cables to the inverter.	
11.	Connect the energy meter via Ethernet.	
12.	Connect the data cables of the battery.	
13.	Connect the PV modules to the inverter.	
14.	Connect the battery power cables.	
15.	Connect the additional grounding to the inverter.	Connecting Additional Grounding
16.	Connect the rapid shutdown initiator.	Section 12.10, page 70
17.	Close the inverter with the cover of the enclosure.	
18.	Commission the system.	Section 13, page 74
19.	Test SMA Backup Secure.	Section 13.5, page 78

11 Mounting

11.1 Requirements for Mounting

11.1.1 Requirements for the mounting location of the inverter

⚠ 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 system in areas containing highly flammable materials or gases.
- Do not mount the system 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 (1 in). 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 mounting location 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 (-13°F to +113°F) to ensure optimal operation.

Also see:

- Mounting the Inverter ⇒ page 43

11.1.2 Permissible and impermissible mounting positions of the inverters

- ☐ 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.

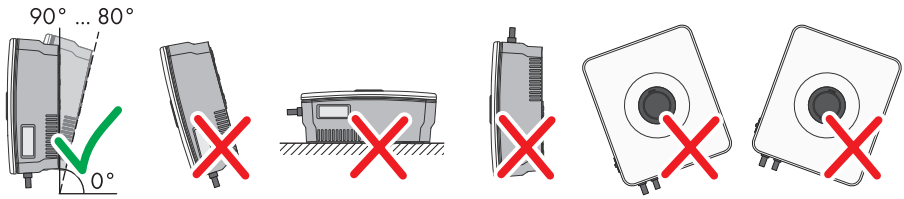
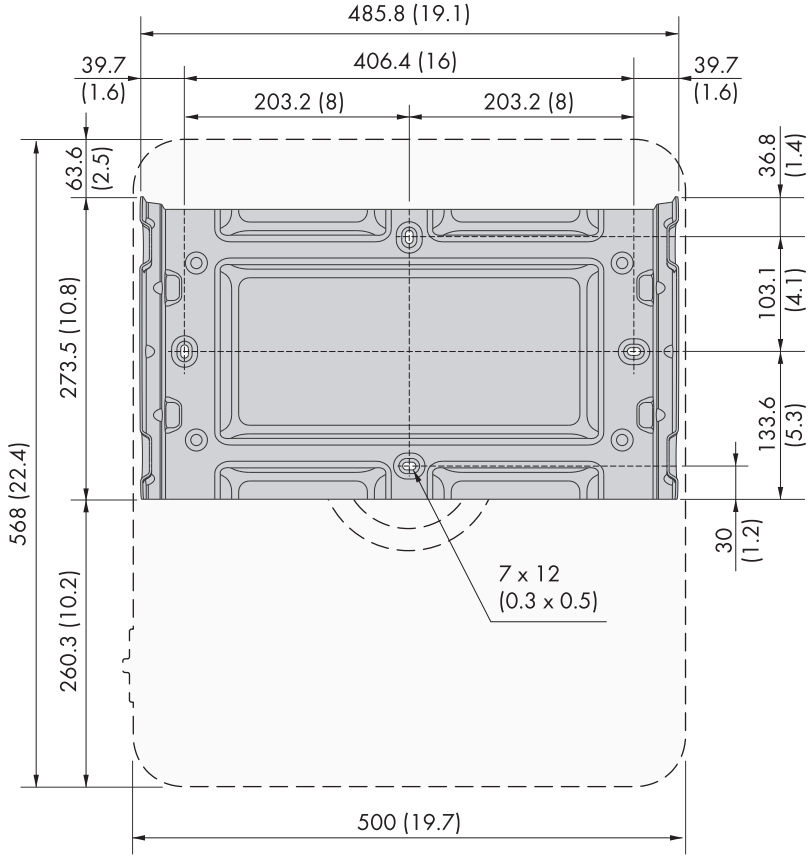


Figure 9: Permitted and prohibited mounting positions

Also see:

- Mounting the Inverter ⇒ page 43

11.1.3 Inverter Mounting Dimensions



Position of the anchoring points (dimensions in mm (in))

Also see:

- Mounting the Inverter ⇒ page 43

11.1.4 Recommended inverter mounting clearances

To guarantee optimal operation and adequate heat dissipation for the inverter, the following requirements for clearances should be observed. This will prevent the inverter power output from being reduced due to excessive temperatures. However, smaller distances are permissible without causing any risk to safety or service life of the product.

Prescribed clearances in accordance with the *National Electrical Code®*

Under certain conditions, *the National Electrical Code®* specifies greater clearances.

- Make sure that the prescribed clearances are met, according to the *National Electrical Code®*.

☐ 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.

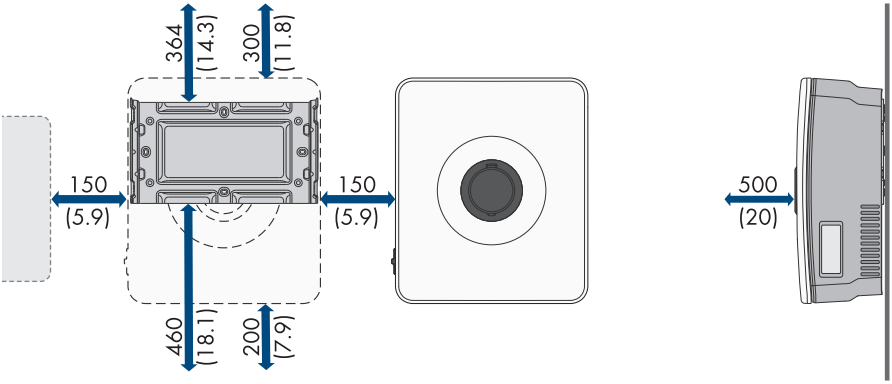


Figure 10: Recommended clearances (dimensions in mm (in))

Also see:

- Mounting the Inverter ⇒ page 43

11.2 Mounting the Inverter

⚠ QUALIFIED PERSON

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

☐ 2 pcs M6 screws, suitable for the support surface and weight of the inverter.

☐ 2 washers suitable for the screws

☐ Where necessary, 2 screw anchors suitable for the support surface and the screws

⚠ CAUTION

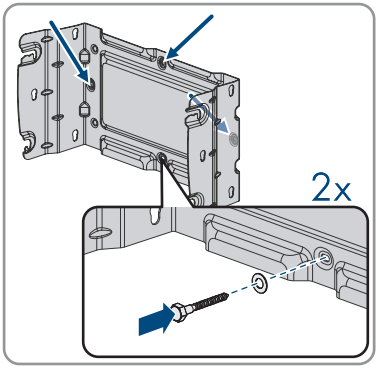
Risk of injury due to weight of product

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

- Wear suitable personal protective equipment for all work on the product.

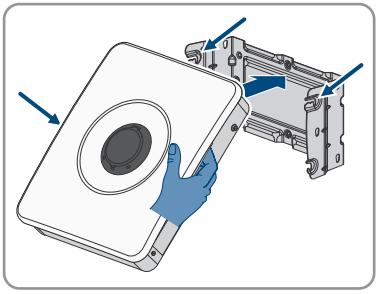
Procedure:

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.
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.

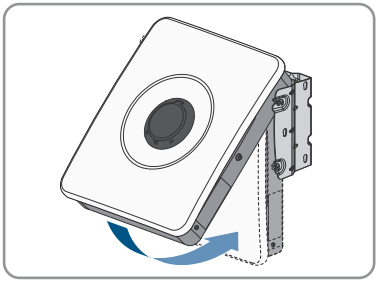


☑ The mounting bracket is installed correctly.

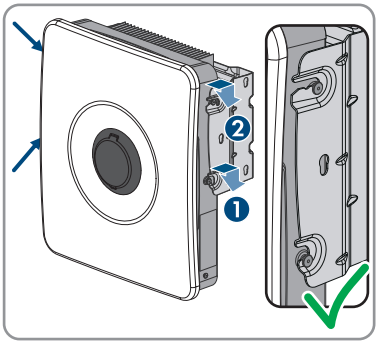
5. Lift the inverter with the help of the indentations on the enclosure and suspend it at a 45° angle in the top guide rails of the mounting bracket with the top 2 rivets.



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



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



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

Also see:

- Recommended inverter mounting clearances ⇒ page 43
- Inverter Mounting Dimensions ⇒ page 42
- Permissible and impermissible mounting positions of the inverters ⇒ page 41
- Requirements for the mounting location of the inverter ⇒ page 41

11.3 Install SMA Backup Start

⚠ QUALIFIED PERSON

⚠ CAUTION

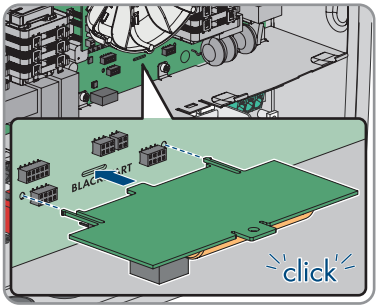
Risk of injury due to sharp EMC clips

The EMC clips installed on the enclosure of the inverter may have sharp edges and can cause cut injuries.

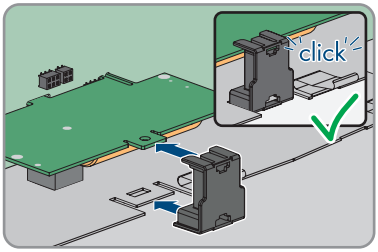
- Do not touch the EMC clips.
- Use caution when installing and removing modules in the inverter.
- Wear suitable personal protective equipment.

Procedure:

1. Disconnect the inverter from all voltage sources (see Section 16, page 93).
2. Install the SMA Backup Start Module in the area labeled **BLACKSTART**. Make sure that the locking tabs on the module are inserted in the recesses in the assembly in the inverter, and that both plug connections are properly connected.



3. Install the spacer on the SMA Backup Start modules and install the sheet metal in the inverter.



☑ SMA Backup Start is ready for operation.

4. Recommission the inverter (see Section 13.2, page 74).

Also see:

- Testing SMA Backup Secure ⇒ page 78

12 Electrical Connection

12.1 Requirements for the electrical connection

12.1.1 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.

12.1.2 Overvoltage category

The inverter can be used in grids of overvoltage category IV or lower in accordance with UL 62109-1. That means that the product can be permanently connected to the grid-connection point of a building.

12.1.3 Permitted grid configurations

The connection procedure will vary, depending on the grid configuration; the country data set may have to be set. The following table provides an overview of the compatible grid configurations, which conductors have to be connected to the inverter to comply with the grid configuration and which country data set can be set. As standard, the inverter is meant for connection to a utility grid with a 208 V wye connection or a 240 V split-phase system. The grid configuration is set separately from the country data set.

If special grid connection requirements apply to your country or intended use, you have the option of configuring the inverter with a configuration file provided by SMA Solar Technology AG, depending on availability. The configuration file can be found in the download area at www.SMA-Solar.com. For 208 V grids, note the settings for the grid support functions (see Section 13.4, page 78).

Compatible grid configuration	Conductors to be connected	Configurable country data sets
240 V split-phase system	L1, L2 and N	• [US] CA-R21 IEEE1547:2018 Cat.B III • [US] HECO SRD2.0 IEEE1547:2018 Cat.B-III • [US] UL1741/SB Cat B-III Storage • [US] UL1741/SB Cat.B-II • [US] UL1741/SB Cat B-II Storage • [US] UL1741/SB Cat.B-III
208 V wye connection	L1, L2 and N	
208 V delta connection	L1 and L2	
240 V delta connection	L1 and L2	

12.1.4 Requirements on the AC conductors

The following requirements apply only to the N and L1 and L2 conductors. For PE, note that the requirements are different.

- ☐ Conductor type: copper wire
- ☐ Permissible temperature: at least 90°C (194°F)
- ☐ The conductors must be solid or stranded wire.
- ☐ Conductor cross-section: 6 mm² to 10 mm² (10 AWG to 8 AWG)
- ☐ Insulation stripping length: 18 mm (0.71 in)
- ☐ The conductors with regards to their ampacity, rated temperatures, operating conditions and power loss must be made in accordance with the local standards and the *National Electrical Code®* ANSI/NFPA 70.

Also see:

- Requirements for the AC Grounding Conductor ⇒ page 48
- Connect the utility grid together with the socket and the switch for secure power supply operation. ⇒ page 56

12.1.5 Requirements for the AC Grounding Conductor

For the grounding conductor (PE) of the connection to the utility grid, the following requirements apply that are different from the requirements for the other conductors.

- ☐ Conductor type: copper wire
- ☐ Permissible temperature: at least 90°C (194°F)
- ☐ The PE conductor must be solid or stranded wire.
- ☐ Conductor cross-section: 10 mm² (6 AWG)
- ☐ Insulation stripping length: 18 mm (0.71 in)
- ☐ The conductors with regards to their ampacity, rated temperatures, operating conditions and power loss must be made in accordance with the local standards and the *National Electrical Code®* ANSI/NFPA 70.

Also see:

- Requirements on the AC conductors ⇒ page 48

12.1.6 Requirements for cables for secure power supply outlets

- ☐ Conductor type: copper wire
- ☐ Permissible temperature: at least 90°C (194°F)
- ☐ The conductors must be solid or stranded wire.
- ☐ Conductor cross-section when using solid or stranded wire without bootlace ferrules: 1.5 mm² to 4 mm² (14 AWG to 12 AWG)
- ☐ Conductor cross-section when using bootlace ferrules: 1.5 mm² to 2.5 mm² (14 AWG)
- ☐ Insulation stripping length: 10 mm to 12 mm (0.39 in to 0.47 in)
- ☐ Maximum length of conductors: 10 m (33 ft)

Also see:

- Connect the utility grid together with the socket and the switch for secure power supply operation. ⇒ page 56

12.1.7 Requirements for the cables for the secure power supply operation switch

- ☐ Conductor type: copper wire
- ☐ Permissible temperature: at least 90°C (194°F)
- ☐ The conductors must be solid or stranded wire.
- ☐ Conductor cross-section: 0.8 mm² to 1.5 mm² (18 AWG to 16 AWG)
- ☐ Insulation stripping length: 6 mm (0.24 in)
- ☐ Nominal voltage: at least 600 V
- ☐ Maximum length of conductors: 10 m (33 ft)

Also see:

- Connect the utility grid together with the socket and the switch for secure power supply operation. ⇒ page 56

12.1.8 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 mm² (2 x 2 x 24 AWG)
- ☐ Maximum cable length between 2 nodes when using patch cables: 50 m (164 ft)
- ☐ Maximum cable length between 2 nodes when using installation cables: 100 m (328 ft)
- ☐ UV-resistant for outdoor use.

Also see:

- Connecting the Network Cable for Local Network and Energy Meter ⇒ page 60

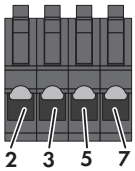
12.1.9 Information on Connection of the Energy Meter

Along with the energy meter, 2 electrical current transducers must be installed between the grid connection point and the feed-in point of all loads and feed-ins in the system. Observe all specifications and safety information in the energy meter manual when installing the energy meter. The energy meter is not a replacement for a revenue grade meter (RGM). The energy meter data may not be used for billing purposes. For more details, refer to the manual for the energy meter.

Also see:

- Connecting the energy meter via RS485 ⇒ page 62
- Connecting the Network Cable for Local Network and Energy Meter ⇒ page 60

12.1.10 Pin assignment of the RS485 terminal block

Terminal block	Clamping position	Assignment
	2	Data+ (D+)
	3	Not assigned
	5	Ground (GND)
	7	Data- (D-)

Also see:

- Connecting the energy meter via RS485 ⇒ page 62

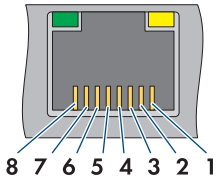
12.1.11 Requirements for network cable (RS485)

- ☐ Cross-section: at least 2 x 2 x 0.22 mm² (2 x 2 x 24 AWG)
- ☐ Shielding: yes
- ☐ Twisted pair conductors
- ☐ UV-resistant if installed outdoors.
- ☐ Sheath stripping length: 50 mm (2 in)
- ☐ Insulation stripping length: 6 mm (0.24 in)
- ☐ Maximum cable length: 10 m (33 ft)

Also see:

- Connecting the energy meter via RS485 ⇒ page 62

12.1.12 Pin assignment of RJ45 plug connector for battery communication

RJ45 plug	Pin	Signal
	1	-
	2	EN_GND
	3	-
	4	CAN_H
	5	CAN_L
	6	-
	7	BAT_EN
	8	-

12.1.13 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
- ☐ Number of insulated conductor pairs and insulated conductor cross-section: at least 2 x 2 x 0.34 mm² (2 x 2 x 22 AWG)
- ☐ Maximum cable length between 2 nodes when using patch and installation cables: 10 m (33 ft)
- ☐ UV-resistant if installed outdoors.

12.1.14 Cabling plan with Battery-Box Premium HVL

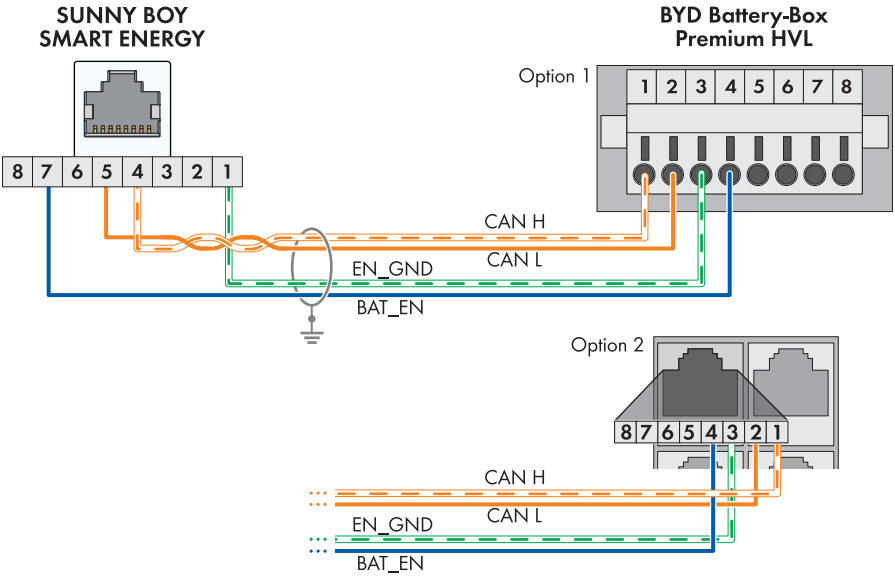


Figure 11: Cabling plan SBSE3.8-US-50 / SBSE4.8-US-50 / SBSE5.8-US-50 / SBSE7.7-US-50 with Battery-Box Premium HVL

Pin at the RJ45 connector on the inverter	Signal	Terminal point at battery
1	-	-
2	EN_GND	3
3	-	-
4	CAN_H	1
5	CAN_L	2
6	-	-
7	BAT_EN	4
8	-	-

Also see:

- Connecting the Data Cable of the Battery ⇒ page 64

12.1.15 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 should be connected to each string. Otherwise the yields may be reduced.
- ☐ 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 not be exceeded, and must not be greater than the rated through-current of the DC plug connectors.
- ☐ The thresholds for the input voltage and the input current of the inverter must be adhered to.
- ☐ Strings in which rapid shutdown modules are used must consist of at least 6 PV modules.

Also see:

- Connecting the PV Array ⇒ page 66

12.1.16 Requirements for the PV cables

The following requirements apply only to the PV+ and PV- conductors. For PE, note that the requirements are different.

- ☐ The cables must be made of copper.
- ☐ Conductor cross-section: 2.5 mm² to 10 mm² (12 AWG to 8 AWG)
- ☐ Cable diameter: 5 mm to 8 mm (0.2 in to 0.3 in)
- ☐ Nominal voltage: at least 600 V
- ☐ Insulation stripping length: 12 mm (0.47 in)

Also see:

- Connecting the PV Array ⇒ page 66
- Requirements for the PV Grounding Conductors ⇒ page 53

12.1.17 Requirements for the PV Grounding Conductors

For the equipment grounding conductor (PE) of the PV modules, the following requirements apply that are different from the requirements for the other conductors.

- ☐ Conductor type: copper wire
- ☐ Permissible temperature: at least 90°C (194°F)
- ☐ The PE conductor must be solid or stranded wire.
- ☐ Conductor cross-section: 6 mm² to 16 mm² (6 AWG to 10 AWG)
- ☐ Insulation stripping length: 18 mm (0.71 in)
- ☐ The conductors with regards to their ampacity, rated temperatures, operating conditions and power loss must be made in accordance with the local standards and the *National Electrical Code®* ANSI/NFPA 70.

Also see:

- Connecting the PV Array ⇒ page 66
- Requirements for the PV cables ⇒ page 53

12.1.18 Requirements for the Battery Power Cables

- ☐ The cables must be made of copper.
- ☐ Conductor cross-section: 6 mm² to 10 mm² (10 AWG to 8 AWG)
- ☐ Insulation stripping length: 12 mm (0.47 in)
- ☐ Cables can be used with or without bootlace ferrules
- ☐ Nominal voltage: at least 600 V

Also see:

- Connecting the power cable of the battery ⇒ page 68

12.1.19 Requirements for the grounding cable for additional 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. Make sure 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: 10 mm² (6 AWG)
- ☐ The cables with regards to their ampacity, rated temperatures, operating conditions and power loss must be made in accordance with the local standards and the *National Electrical Code®* ANSI/NFPA 70.

Also see:

- Connecting Additional Grounding ⇒ page 69

12.1.20 Connection of Several Inverters to a Rapid Shutdown Initiator

The connection of up to 3 inverters to the rapid shutdown initiator can take the form of either a series or wye connection.

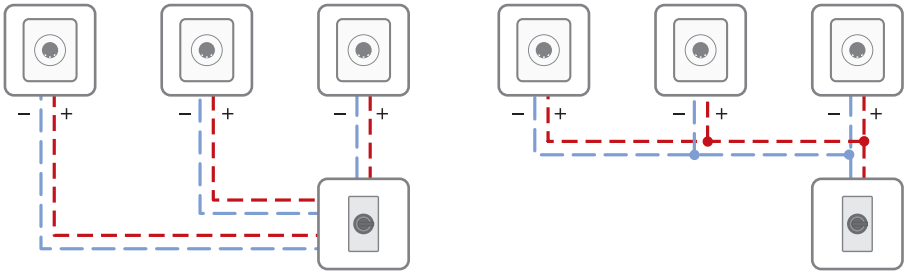


Figure 12: Connection of up to 3 inverters to the rapid shutdown initiator

Also see:

- Connecting a Rapid Shutdown Initiator to the Digital Input ⇒ page 70

12.1.21 Requirements for the Cable for the Rapid Shutdown Initiator

- ☐ Conductor type: copper wire
- ☐ Permissible temperature: at least 90°C (194°F)
- ☐ The conductors must be solid or stranded wire.
- ☐ Conductor cross-section: 0.8 mm² to 1.5 mm² (18 AWG to 16 AWG)
- ☐ Insulation stripping length: 6 mm (0.24 in)
- ☐ Nominal voltage: at least 600 V
- ☐ UV-resistant for outdoor use

Also see:

- Connecting a Rapid Shutdown Initiator to the Digital Input ⇒ page 70

12.2 Overview of the Connection Area

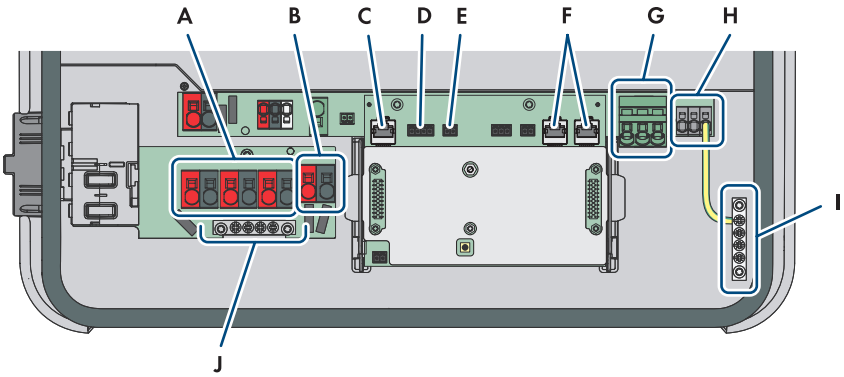


Figure 13: Connection Area of the Inverter

Position	Designation
A	Connection terminals **PVA**, **PVB** and **PVC** for connecting the PV modules
B	Connection terminals **BAT+** and **BAT -** for battery power cables
C	Network connector **BATTERY** for connecting the battery communication
D	Slot **E-METER** for connecting an energy meter per RS485
E	Connection terminals **SPS** for connecting the secure power supply outlet
F	Network ports **LAN-1** and **LAN-2**, e.g., for connecting energy meter, router, battery communication system, communication system for other PV inverters, or other Ethernet-capable devices
G	Connection terminals **AC** for AC cables

Position	Designation
H	Slot **SPS** for the secure power supply operation switch
I	Busbar for grounding the AC connection
J	Busbar for grounding the DC connection

12.3 Connect the utility grid together with the socket and the switch for secure power supply operation.

⚠ QUALIFIED PERSON

⚠ 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).

Requirements:

☐ The cables for connection to the utility grid, the socket and the secure power supply operation switch must be preassembled.

☐ SMA Backup Start must be mounted.

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

☐ 1 standard outlet

☐ 1 standard commercial switch

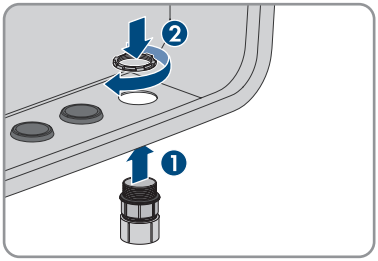
☐ 1 conduit (trade size: 19.05 mm (0.75 in) or smaller with suitable reducer bush)

☐ Sealing compound for sealing the join between the conduit and inverter if a weep hole has been added to the conduit

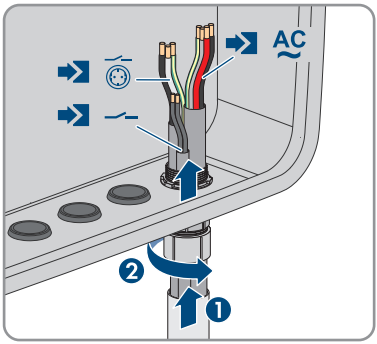
☐ 1 rain-tight conduit fitting or conduit fitting for wet locations complying with UL 514B (trade size: 19.05 mm (0.75 in) or smaller with suitable reducing bush)

Procedure:

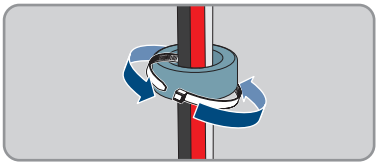
1. Disconnect the inverter from all voltage sources .
2. Remove the filler plug from the first enclosure opening from the right.
3. Insert the conduit fitting in the first enclosure opening from the right and tighten with the counter nut from the inside.



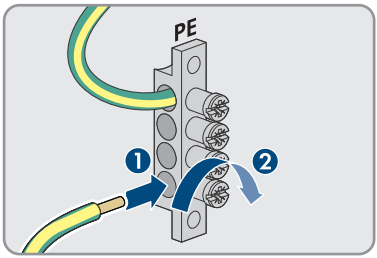
4. Run the AC conductors together with the conductors for connecting the socket and the switch through the conduit into the inverter and attach the conduit to the conduit fitting.
5. Run N, L1 and L2 for the AC connection through the ferrite.



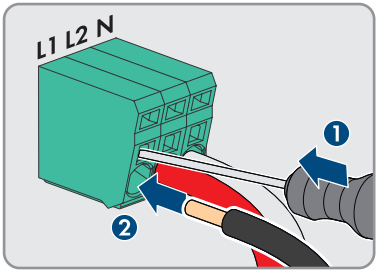
6. Secure the ferrite with a cable tie.



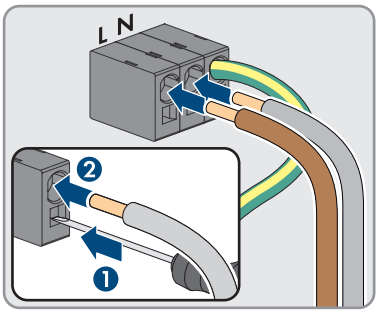
7. Connect the grounding conductor for the AC connection to the busbar ⏚ according to the label, as short as possible without the conductor being under tension. To do so, insert the conductor into the busbar against the stop and tighten the screw (PZ2, minimum torque 2.5 Nm).



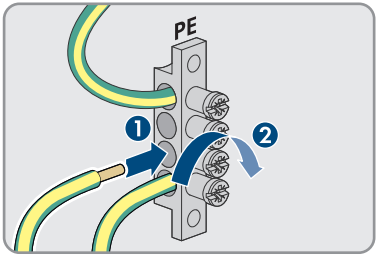
8. Attach N, L1 and L2 of the AC connection to the **AC** terminals according to the labels. To do so, stick a flathead screwdriver (4 mm (0.16 in)) into the top opening of the terminal and insert the cable into the lower opening against the stop. Then remove the screwdriver.



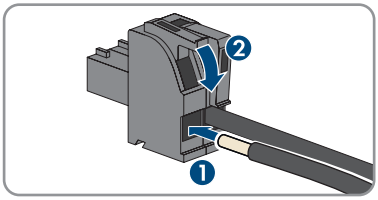
9. Connect the conductors N and L for the socket to the **SPS** terminals according to the labels.



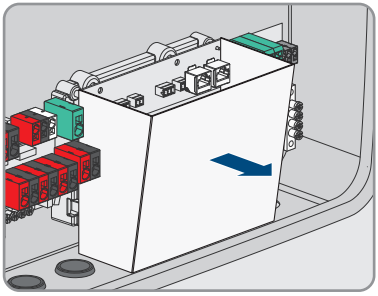
10. Connect the grounding conductor for the socket to the busbar ⏚ according to the label, as short as possible without the conductor being under tension. To do so, insert the conductor into the busbar against the stop and tighten the screw (PZ2, minimum torque 2.5 Nm).



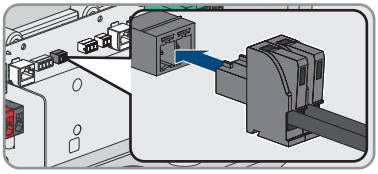
11. Attach the conductors for the secure power supply operation switch to the two-pole connector.



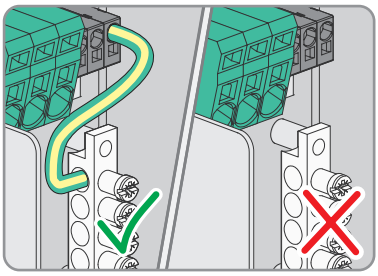
12. Remove the cover from the communication connection area.



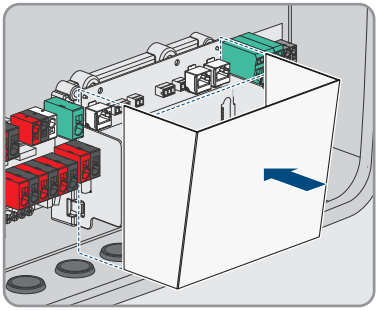
13. Plug the connector into the **SPS** slot. The connector must snap audibly into place.



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



15. Tug lightly to ensure that all conductors are secured in the terminals.
16. If no other connections are made in the communication connection area, replace the cover.



17. If a weep hole has been added to the conduit, seal the conduit with sealing compound.

Also see:

- Requirements for the AC Grounding Conductor ⇒ page 48
- Requirements on the AC conductors ⇒ page 48
- Requirements for cables for secure power supply outlets ⇒ page 48
- Requirements for the cables for the secure power supply operation switch ⇒ page 49
- Permitted grid configurations ⇒ page 47

12.4 Connecting the Network Cable for Local Network and Energy Meter

⚠ QUALIFIED PERSON

The following action describes how you can connect the inverter to the local network and additionally to an energy meter. If there are several inverters in the system, the energy meter should be connected to the inverter that is to be configured as the 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 inverter or the battery outdoors to the inside of a building.
- The Ethernet interface of the inverter is classified as "TNV-1" and offers protection against overvoltages of up to 1.5 kV.

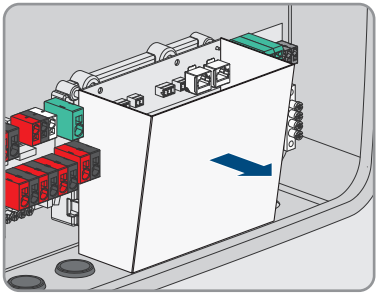
Additionally required material (not included in the scope of delivery):

- ☐ Where required: Field-assembly RJ45 connector.
- ☐ 1 conduit (trade size: 19.05 mm (0.75 in) or smaller with suitable reducer bush)
- ☐ Sealing compound for sealing the join between the conduit and inverter if a weep hole has been added to the conduit
- ☐ 1 rain-tight conduit fitting or conduit fitting for wet locations complying with UL 514B (trade size: 19.05 mm (0.75 in) or smaller with suitable reducing bush)

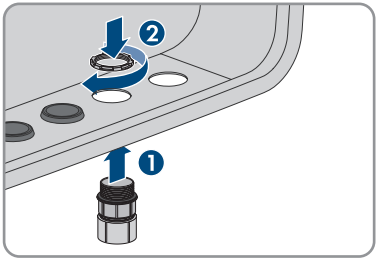
Procedure:

1. Disconnect the inverter from all voltage sources .
2. When using a self-assembly network cable, assemble the RJ45 connectors and connect them to the network cable (see connector documentation).

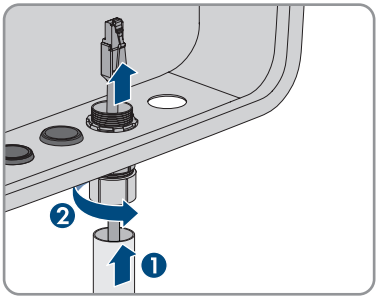
3. Remove the cover from the communication connection area.



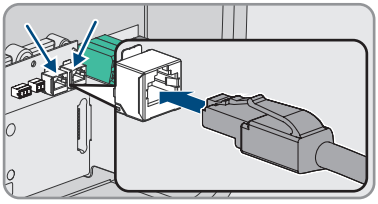
4. Remove the filler plug from the second enclosure opening from the right.
5. Insert the conduit fitting into the opening and tighten from the inside using the counter nut.



6. Run the network cable through the conduit into the inverter.
7. Attach the conduit to the conduit fitting.

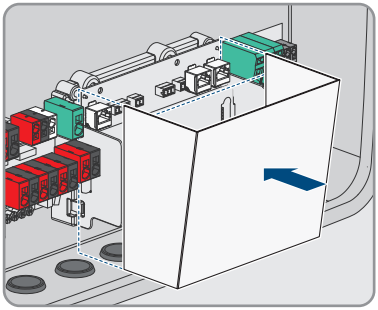


8. Plug the network cable into the **LAN-1** or **LAN-2** network port. Make sure that the network cable cannot touch the AC cables.



9. Tug lightly to make sure that the network cable is secure.

10. If no other connections are made in the communication connection area, replace the cover.



11. If the inverter is installed outdoors, install overvoltage protection for all components in the network.
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. If you want to connect the inverter to an energy meter, connect the other end of the second network cable to the energy meter.
14. If you want to connect the inverter directly to another inverter, connect the other end of the second network cable to the other inverter.
15. If a weep hole has been added to the conduit, seal the conduit with sealing compound.

Also see:

- Information on Connection of the Energy Meter ⇒ page 49
- Network cable requirements ⇒ page 49

12.5 Connecting the energy meter via RS485

⚠ QUALIFIED PERSON

SMA Solar Technology AG recommends connecting the energy meter via network cable . If the energy meter is connected via RS485, the system cannot be commissioned with the 360° app exclusively – the inverter user interface must also be used.

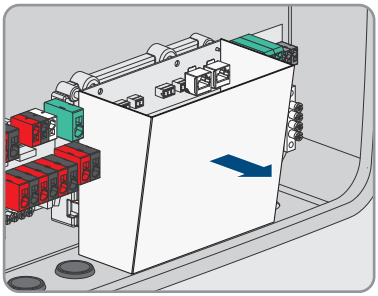
Additionally required material (not included in the scope of delivery):

- ☐ 1 conduit (trade size: 19.05 mm (0.75 in) or smaller with suitable reducer bush)
- ☐ Sealing compound for sealing the join between the conduit and inverter if a weep hole has been added to the conduit
- ☐ 1 rain-tight conduit fitting or conduit fitting for wet locations complying with UL 514B (trade size: 19.05 mm (0.75 in) or smaller with suitable reducing bush)

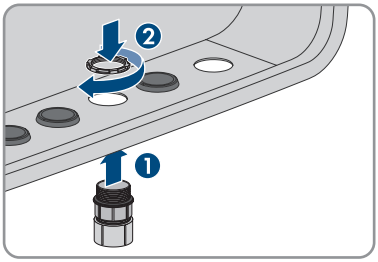
Procedure:

1. Disconnect the inverter from all voltage sources .
2. Strip the RS485 communication cable.
3. Trim the cable shield to a length of 15 mm (0.59 in) and fold it over the cable sheath.
4. Strip the insulation off the wires.

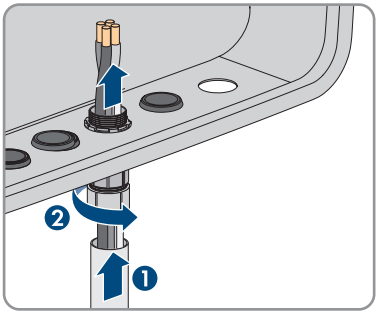
5. If necessary, trim unused insulated conductors flush with the cable sheath or fold it over the cable sheath.
6. Remove the cover from the communication connection area.



7. Remove the filler plug from the third enclosure opening from the left.
8. Insert the conduit fitting into the opening and tighten from the inside using the counter nut.

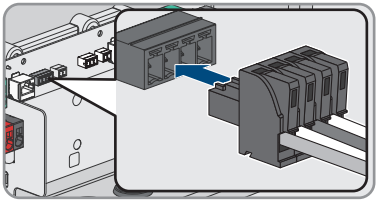


9. Guide the communication cable through the conduit into the inverter.
10. Attach the conduit to the conduit fitting.

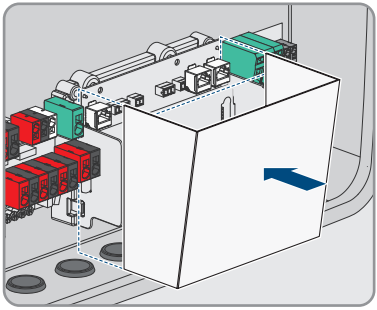


11. Unlock the terminal points of the 4-pole terminal block.
12. Connect the conductors of the RS485 communication cable to the 4-pole terminal block. To this end, insert the conductors into the terminal points and unlock the terminal points by pressing the lever down. Observe the terminal block assignment.
13. Ensure that the conductors are plugged into the terminal points tightly by pulling slightly on the conductors.

14. Insert the 4-pole terminal strip into the jack **E-METER** connector.



15. If no other connections are made in the communication connection area, replace the cover.



16. Connect the RS485 cable to the energy meter (see energy meter manual).
17. If a weep hole has been added to the conduit, seal the conduit with sealing compound.

Also see:

- Information on Connection of the Energy Meter ⇒ page 49
- Information on Connection of the Energy Meter ⇒ page 49
- Requirements for network cable (RS485) ⇒ page 50
- Pin assignment of the RS485 terminal block ⇒ page 50

12.6 Connecting the Data 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.

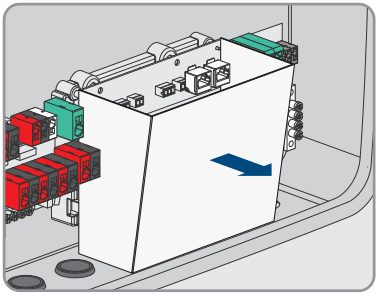
Additionally required material (not included in the scope of delivery):

- Where required: Field-assembly RJ45 connector.
- Sealing compound for sealing the join between the conduit and inverter if a weep hole has been added to the conduit
- 1 rain-tight conduit fitting or conduit fitting for wet locations complying with UL 514B (trade size: 19.05 mm (0.75 in) or smaller with suitable reducing bush)

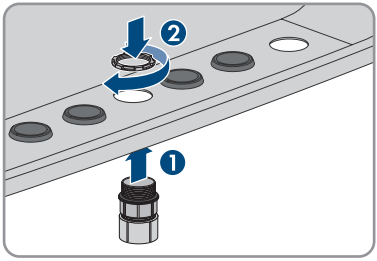
Procedure:

1. Disconnect the inverter from all voltage sources .
2. When using a self-assembly network cable, assemble the RJ45 connectors and connect them to the network cable (see connector documentation).

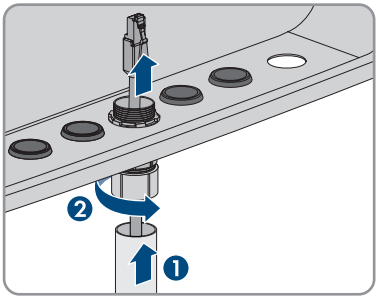
3. Remove the cover from the communication connection area.



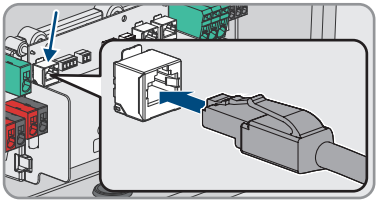
4. Remove the filler plug from the middle enclosure opening.
5. Insert the conduit fitting into the opening and tighten from the inside using the counter nut.



6. Run the network cable through the conduit into the inverter.
7. Attach the conduit to the conduit fitting.

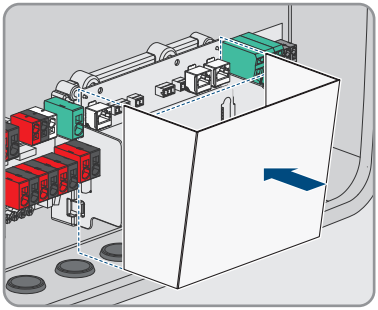


8. Plug the network cable into the **BATTERY** network connector.



9. Tug lightly to make sure that the network cable is secure.

10. If no other connections are made in the communication connection area, replace the cover.



11. Connect the network cable to the battery (see battery manual).
12. If a weep hole has been added to the conduit, seal the conduit with sealing compound.

Also see:

- Cabling plan with Battery-Box Premium HVL ⇒ page 52
- Network cable requirements ⇒ page 49
- Pin assignment of RJ45 plug connector for battery communication ⇒ page 51

12.7 Connecting the PV Array

⚠ QUALIFIED PERSON

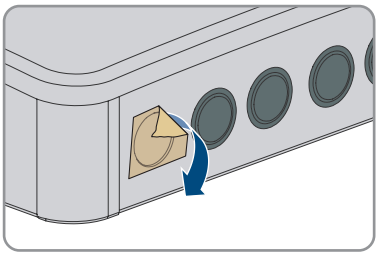
Additionally required material (not included in the scope of delivery):

- 1 conduit (trade size: 27 mm (1 in) or smaller with suitable reducer bush)
- Sealing compound for sealing the join between the conduit and inverter if a weep hole has been added to the conduit
- 1 rain-tight conduit fitting or conduit fitting for wet locations complying with UL 514B (trade size: 27 mm (1 in) or smaller with suitable reducing bush)
- If 3 strings are connected, additionally 1 conduit (trade size: 19.05 mm (0.75 in) or smaller with suitable reducing bush)
- If 3 strings are connected, 1 rain-tight conduit fitting or conduit fitting for wet locations complying with UL 514B (trade size: 19.05 mm (0.75 in) or smaller with suitable reducing bush)

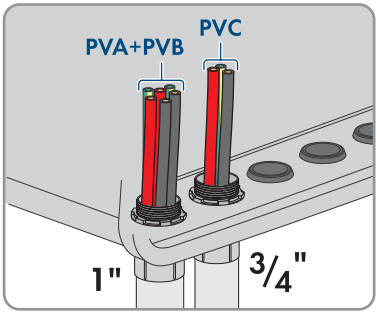
Procedure:

1. Disconnect the inverter from all voltage sources .

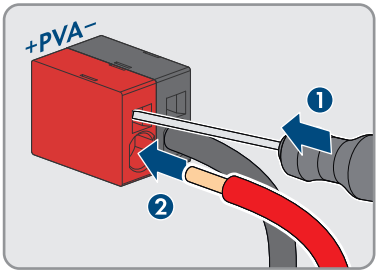
2. Remove the adhesive tape from the first enclosure opening from the left.



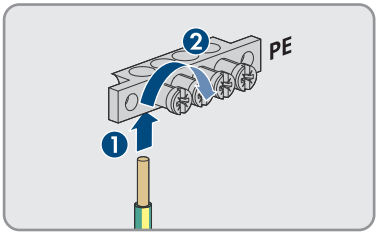
3. If 3 strings are connected, remove the filler plug from the second enclosure opening from the left.
4. Insert the conduit fitting into the opening and tighten from the inside using the counter nut.
5. Run the DC cables of the PV modules through the conduit into the inverter. Run the cables for **PVA** and **PVB** together through a conduit and the first enclosure opening into the inverter. If 3 strings are connected, run the cable for **PVC** through a further conduit and the second enclosure opening into the inverter.



6. Attach the conduit to the conduit fitting.
7. Strip the DC cable insulation.
8. Connect the DC cables to the terminals according to the labels.



9. Connect the cable for grounding the PV modules to the busbar for grounding the DC connection (PZ2, minimum tightening torque 2.5 Nm).



10. Tug lightly to ensure that the cables are secured in the terminals.
11. If a weep hole has been added to the conduit, seal the conduit with sealing compound.

Also see:

- Requirements for the PV Grounding Conductors ⇒ page 53
- Requirements for the PV cables ⇒ page 53
- Requirements for the PV modules per input ⇒ page 52

12.8 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.

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

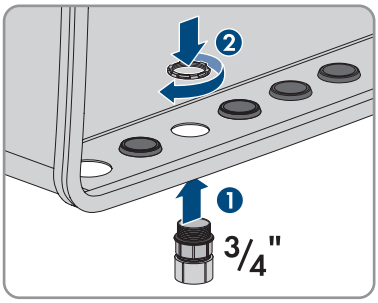
- 1 conduit (trade size: 19.05 mm (0.75 in) or smaller with suitable reducer bush)
- Sealing compound for sealing the join between the conduit and inverter if a weep hole has been added to the conduit
- 1 rain-tight conduit fitting or conduit fitting for wet locations complying with UL 514B (trade size: 19.05 mm (0.75 in) or smaller with suitable reducing bush)

Requirement:

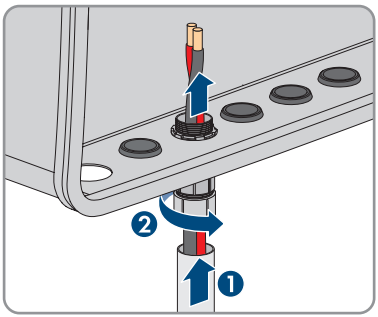
☐ The battery power cables must be pre-assembled.

Procedure:

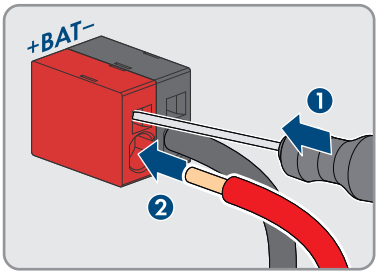
1. Disconnect the inverter from all voltage sources .
2. Ensure that the battery is switched off.
3. Remove the filler plug from the third enclosure opening from the left.
4. Insert the conduit fitting in the third enclosure opening from the left and tighten with the counter nut from the inside.



5. Run the battery power cables through the conduit into the inverter.



6. Attach the conduit to the conduit fitting.
7. Connect the battery power cables to the terminals for the battery connection according to the labels. 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.



8. Tug lightly to ensure that the cables are secured in the terminals.
9. If a weep hole has been added to the conduit, seal the conduit with sealing compound.

Also see:

- Requirements for the Battery Power Cables ⇒ page 54

12.9 Connecting Additional Grounding

⚠ QUALIFIED PERSON

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

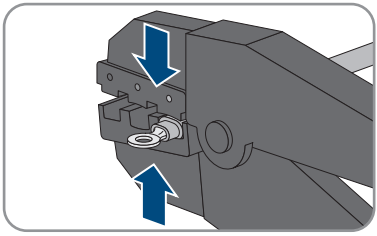
Additionally required material:

- 1 ring terminal lug

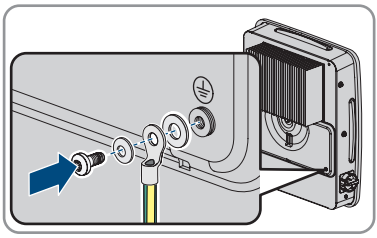
Procedure:

1. Strip the grounding cable insulation.

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



3. Insert the screw with conical spring washer through the hole in the ring terminal lug and washer and tighten the ring terminal lug with the screw to the connection point for additional grounding with a Torx screwdriver (TX25) (tightening torque: 2.5 Nm (22.2 in-lb)).



Also see:

- Requirements for the grounding cable for additional grounding ⇒ page 54

12.10 Connecting a Rapid Shutdown Initiator to the Digital Input

⚠ QUALIFIED PERSON

The DC disconnect switch of the inverter acts as the rapid shutdown initiator. If an external rapid shutdown initiator is to be additionally connected, proceed as described below. Following connection, both the DC load-break switch of the inverter and the external rapid shutdown initiator can be used.

Requirements:

☐ The cable for connecting the external rapid shutdown initiator must be pre-assembled.

☐ The external rapid shutdown initiator must be mounted (see manual for the rapid shutdown initiator).

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

☐ 1 conduit (trade size: 19.05 mm (0.75 in) or smaller with suitable reducer bush)

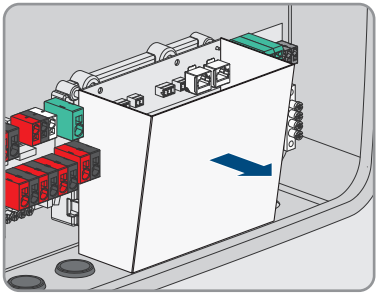
☐ Sealing compound for sealing the join between the conduit and inverter if a weep hole has been added to the conduit

☐ 1 rain-tight conduit fitting or conduit fitting for wet locations complying with UL 514B (trade size: 19.05 mm (0.75 in) or smaller with suitable reducing bush)

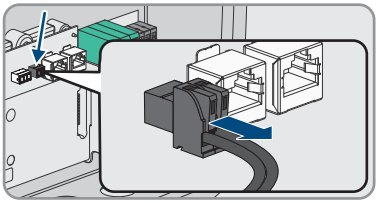
Procedure:

1. Disconnect the inverter from all voltage sources .

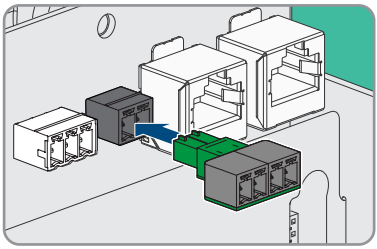
2. Remove the cover from the communication connection area.



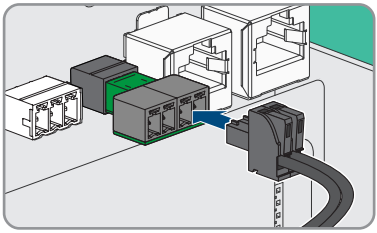
3. Unplug the two-pole connector to which the DC load-break switch is connected from the **GSI** slot.



4. Plug an adapter into the **GSI** slot.

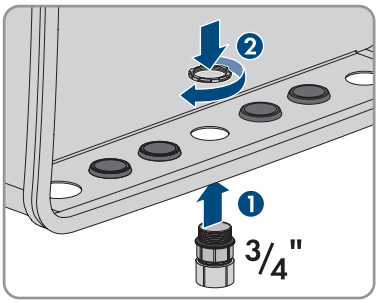


5. Plug the two-pole connector to which the DC load-break switch is connected into a slot on the adapter.

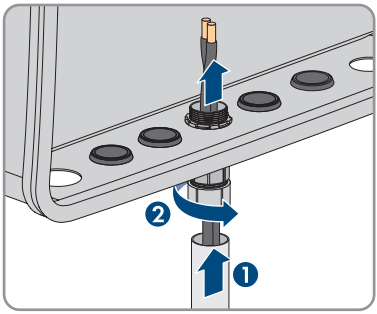


6. Remove the filler plug from the middle enclosure opening.

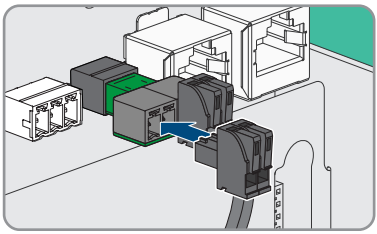
7. Insert a conduit fitting in the center enclosure opening and tighten with the counter nut from the inside.



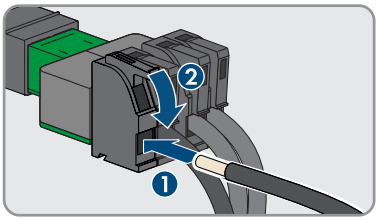
8. Run the cable for connecting the external rapid shutdown initiator through the conduit into the inverter and attach the conduit to the conduit fitting.



9. Plug a two-pole connector from the scope of delivery into the second slot on the adapter.

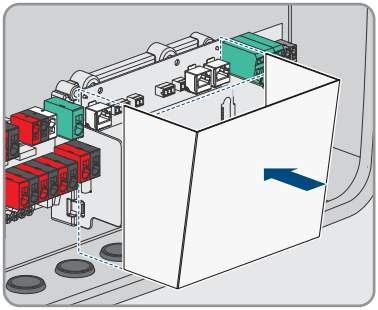


10. Attach the conductors for the rapid shutdown initiator to the two-pole terminal block.

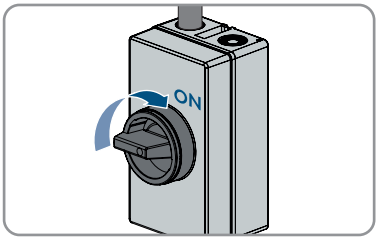


11. Tug lightly to ensure that the conductors are secured in the terminals.

12. If no other connections are made in the communication connection area, replace the cover.



13. Commission the inverter.
14. Switch on the rapid shutdown initiator.



15. If a weep hole has been added to the conduit, seal the conduit with sealing compound.

Also see:

- Connection of Several Inverters to a Rapid Shutdown Initiator ⇒ page 54
- Requirements for the Cable for the Rapid Shutdown Initiator ⇒ page 55
- Rapid Shutdown Equipment ⇒ page 28
- Rapid shutdown function ⇒ page 87

13 Commissioning

13.1 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 13.2, page 74
2.	Configure the inverter that is to become the System Manager using the commissioning wizard of the SMA 360° app. Select **Inverter as System Manager** in the device configuration.	Section 13.3, page 77
3.	If the system is in a 208 V utility grid, make settings for the correct operation of the grid support functions on the System Manager user interface.	Section 13.4, page 78
4.	Make further settings if necessary (e.g., configure multifunction relay, configure arc-fault circuit interrupter).	Operation

13.2 Commissioning the Inverter

⚠ QUALIFIED PERSON

Requirements:

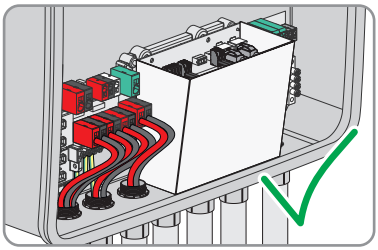
☐ The AC circuit breaker must be correctly rated and mounted.

☐ The inverter must be correctly mounted.

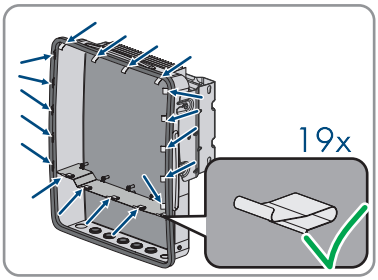
☐ All cables must be correctly connected.

Procedure:

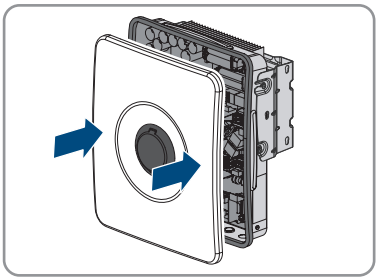
1. Make sure that the communication cables do not touch the AC or DC cables and that the cover for the connection area is attached.



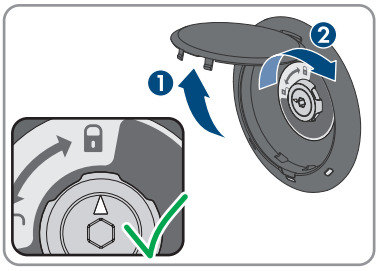
2. Make sure that all EMC terminals are present and correctly attached to the enclosure.



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.

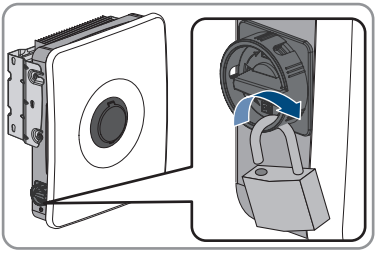


5. Open the cover of the enclosure lock and tighten the screw in the middle with an Allen key (1/4") until an audible click can be heard. Note the direction of rotation printed on the cover.

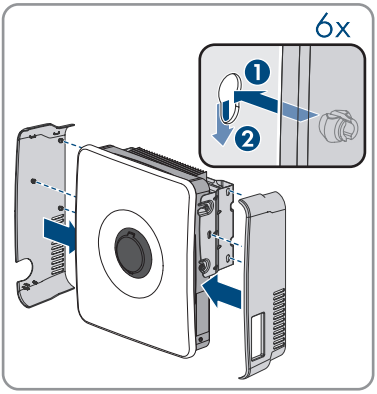


6. Close the cover of the enclosure lock again.
   ☑ The enclosure cover is attached.

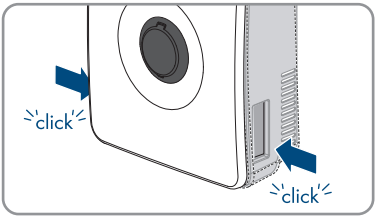
7. If the DC load-break switch was secured with a lock, open and remove the lock.



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 AC circuit breaker.
12. Switch on the battery.
13. Switch on the DC load-break switch of the inverter.
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.

13.3 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.

Requirement:

☐ The inverter must have already been commissioned (see Section 13.2, page 74).

Procedure:

1. Download the SMA 360° App from the App Store or Play Store.
2. Open the SMA 360° app.
3. Start the commissioning wizard in the app.
4. When requested by the app, scan the QR code on the cover of the inverter.
5. Connect to the inverter's Wi-Fi.
6. Start configuration and follow the instructions of the commissioning assistant.

13.4 Settings for Grid Support Functions in 208 V Grids

For the grid support functions to work correctly, the following parameters must be set to the specified values on the System Manager user interface.

Parameter	Name	Setting value for SBSE-3.8-US-50	Setting value for SBSE-4.8-US-50	Setting value for SBSE-5.8-US-50	Setting value for SBSE-7.7-US-50
Inverter.WMax	Set active power limit	3328 W	4160 W	4992 W	6656 W
Inverter.WMaxIn	Nominal active power WMaxIn	- 3328 W	- 4160 W	- 4992 W	- 6656 W
Inverter.VAMaxOut	Nominal apparent power VAMaxOut	3328 W	4160 W	4992 W	6656 W
Inverter.VAMaxIn	Nominal apparent power VAMaxIn	3328 W	4160 W	4992 W	6656 W
Inverter.VArMaxQ1	Nominal reactive power VArMaxQ1	1997 W	2496 W	2995 W	3994 W
Inverter.VArMaxQ2	Nominal reactive power VArMaxQ2	1997 W	2496 W	2995 W	3994 W
Inverter.VArMaxQ3	Nominal reactive power VArMaxQ3	- 1997 W	- 2496 W	- 2995 W	- 3994 W
Inverter.VArMaxQ4	Nominal reactive power VArMaxQ4	- 1997 W	- 2496 W	- 2995 W	- 3994 W

Also see:

- Changing parameters ⇒ page 86

13.5 Testing SMA Backup Secure

Requirements:

☐ SMA Backup Start must be mounted.

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

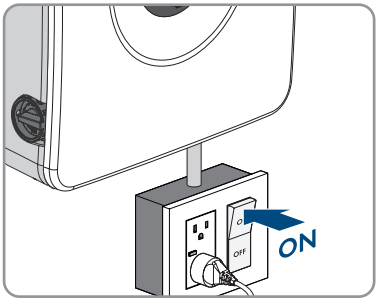
☐ The inverter must be commissioned.

☐ Secure power supply operation must have been configured during commissioning.

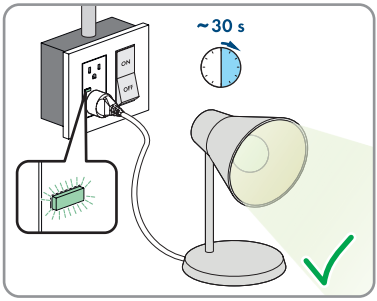
- ☐ If PV module switches are installed in the system that support the SunSpec communication signal for rapid shutdown systems, the rapid shutdown initiator must be configured as a digital input.
- ☐ A load must be connected to the socket for the secure power supply operation.

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.

14 Using the System Manager

14.1 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.

14.2 Establishing a connection to the user interface

14.2.1 Connection in the local network

14.2.1.1 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 a 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 (router) or manually by you.

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

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

14.2.1.2 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 80

14.2.1.3 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 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 80

14.2.2 Direct connection via Wi-Fi

14.2.2.1 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 14.2.2.3, page 83)
- Direct Wi-Fi connection with WPS (see Section 14.2.2.4, page 83)
- Direct Wi-Fi connection with Wi-Fi network search (see Section 14.2.2.5, page 84)

Also see:

- Establishing a direct Wi-Fi connection with the 360° app ⇒ page 83

14.2.2.2 Access information for direct Wi-Fi connection

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.

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**

14.2.2.3 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. Activate the Wi-Fi access point of the inverter. To do this, tap on the enclosure lid of the inverter twice.
   ☑ The blue LED flashes quickly for approx. two minutes. The WPS function is active during this time.
2. Enable the WPS function on your smart device.
3. Open the SMA 360° App and login with the Sunny Portal account details.
4. Select **QR-Code Scan** in the menu.
5. Scan the QR Code on you product via the SMA 360° App.
   ☑ The smart device automatically connects to the product. The web browser of your smart device opens and the login page of the user interface is displayed.
6. If the web browser of the smart end device does not open automatically and 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 82

14.2.2.4 Establishing a direct Wi-Fi connection with WPS

Requirements:

☐ A smart device 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 quickly for approx. two minutes. The WPS function is active during this time.
2. Enable the WPS function on your smart device.
3. Open the web browser of your smart device and enter http://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.

Also see:

- Access information for direct Wi-Fi connection ⇒ page 82

14.2.2.5 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 **192.168.12.3** or, if your smart device supports mDNS services, **SMA[serial number].local** or **http://SMA[serial number]** in the address bar of the web browser.

Also see:

- Access information for direct Wi-Fi connection ⇒ page 82

14.3 WPS function

14.3.1 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

14.3.2 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.

14.3.3 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 signaled by rapid flashing of the blue LED.

14.4 Design of the User Interface

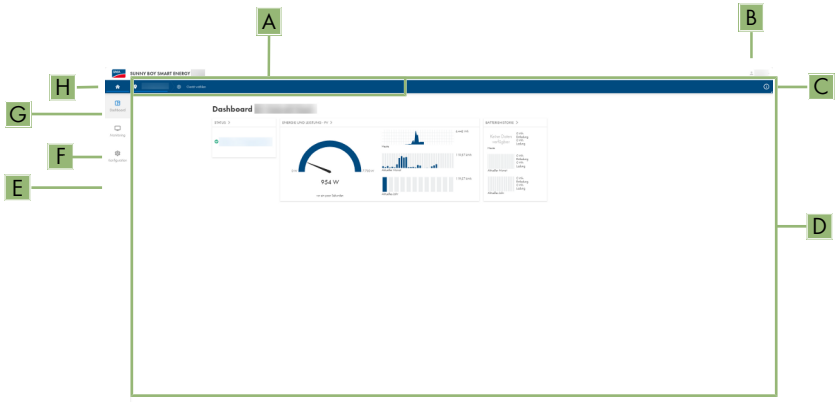


Figure 14: Design of the User Interface

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.

Position	Designation	Description
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

14.5 Access rights to the user interface

1 administrator is created during registration. As administrator, 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 rights for users:

- Administrator
- User
- Installer

14.6 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 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 **Administrator** or **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**].

14.7 Arc-Fault Circuit Interrupter (AFCI)

⚠ 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:

- Arc-Fault Circuit Interrupter (AFCI) ⇒ page 28
- Changing parameters ⇒ page 86
- Manual restart after electric arc ⇒ page 127

14.8 Rapid shutdown function

You can use the following parameters to set up the operating mode of the rapid shutdown function.

Channel	Name	Settings
Operation.RSSOpMode	**Rapid shutdown mode**	**On** **Off** **Sunspec Shutdown**

You can use the following parameters to set which switch will act as the rapid shutdown initiator.

Channel	Name	Settings
Operation.RSSInitiator	**Rapid Shutdown Initiator**	**DC load break switch** **Digital input**

Also see:

- Changing parameters ⇒ page 86

14.9 Backup file

14.9.1 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
- Network
- 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
- Historic energy and performance values

14.9.2 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 lbd file with all parameter settings is downloaded.

Also see:

- Function and content of the backup file ⇒ page 88

14.10 Carry out a manual firmware update

Requirements:

☐ An update file with the desired inverter firmware 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** or **Administrator**.

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.
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.

14.11 Device Administration

14.12 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. 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**].

14.13 Deleting the Admin Account

⚠ QUALIFIED PERSON

In case the password gets lost, the admin account can be reset and newly created. All system data will be retained.

Requirements:

☐ The Device Key from the label on the back of the supplied manual must be present.

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

Procedure:

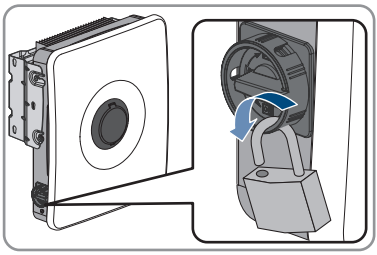
1. Select the [**Delete admin account?**] button.
2. Enter the Device Key from the label on the back of the supplied manual.
3. Select [**Delete**].

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

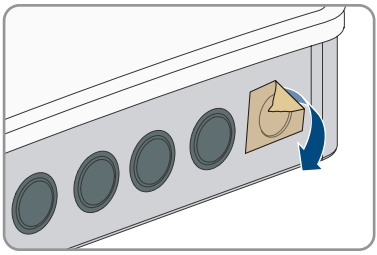
15 Remove enclosure lid

⚠ QUALIFIED PERSON

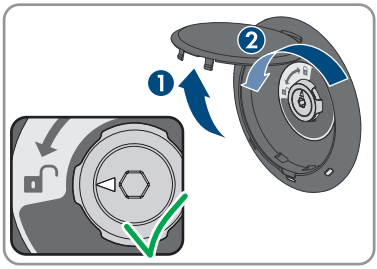
1. Ensure that the AC miniature circuit breaker is switched off and that it cannot be reconnected.
2. Ensure that the DC load-break switch of the inverter is in the **O** position.
3. If your country requires the DC load-break switch to be protected against reconnection, remove the side covers. To do so, slide the side covers upward slightly, so that they can be removed 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.



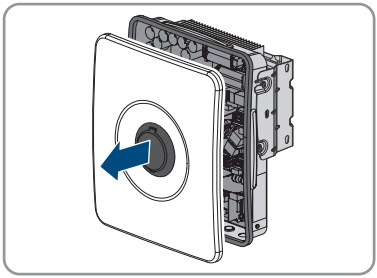
5. Switch off the battery or the load-break switch of the battery (see documentation of the battery manufacturer).
6. If the inverter is wet, ensure that the areas around all openings are dry and that no water can get into the inside of the inverter when it is opened.
7. Ensure that the battery is switched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



11. Open the cover of the enclosure lock and loosen the screw in the middle with an Allen key (1/4") until an audible click can be heard. Note the direction of rotation printed on the cover.



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



13. Disconnect the inverter from all voltage sources .

16 Disconnecting the Inverter from Voltage Sources

⚠ 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.

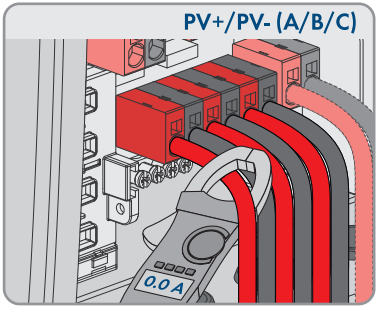
- Only use measuring devices with a measurement ranges designed for the maximum AC and DC voltage of the inverter.
- Only use measuring devices with measurement ranges designed for the maximum DC voltage of the battery.

Prerequisite:

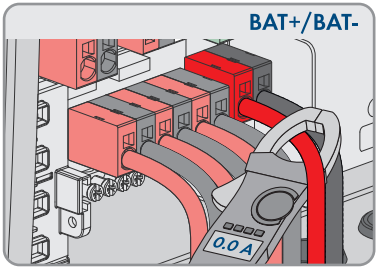
☐ The enclosure cover must be removed (see Section 15, page 91).

Procedure:

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

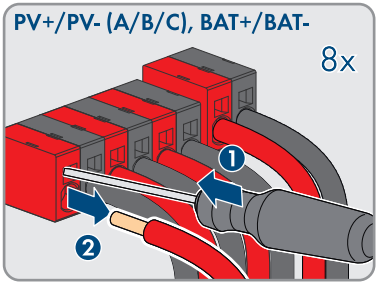


2. Use a current clamp to ensure that no current is present in the DC conductors for the battery.

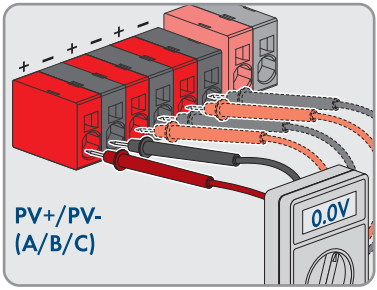


3. Note the positions of the DC conductors.

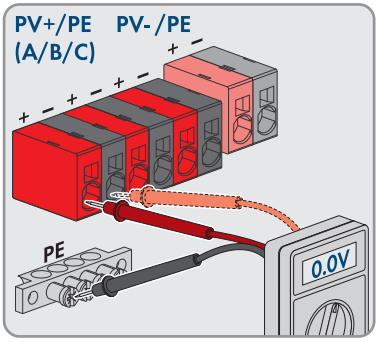
4. Remove the DC conductors from the connection terminals. Make sure that the stripped DC conductors do not tough each other.



5. Use a suitable measuring device to make sure that there is no voltage between each of the connection terminals **PVA**, **PVB** and **PVC** and **PV+** and **PV-**.

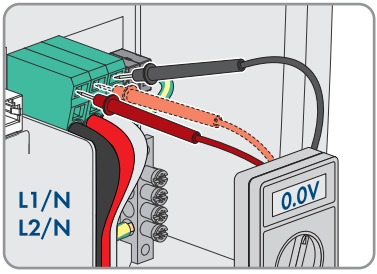


6. Make sure that there is no voltage between each of the connection terminals **PVA**, **PVB** and **PVC** and **PV+** and **PE** on the busbar for grounding the PV modules.

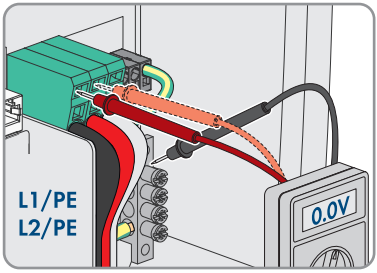


7. Use a suitable measuring device to make sure that there is no voltage between the connection terminals **BAT+** and **BAT-**.
8. Use a suitable measuring device to make sure that there is no voltage between the connection terminal **BAT+** and **PE** on the busbar for grounding the PV modules.

9. Make sure there is no voltage at the **AC** terminals between **L1** and **N** as well as between **L2** and **N**.



10. Make sure there is no voltage between **L1** and **L2** on the **AC** terminals and **PE** on the busbar for grounding the AC connection.



17 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 system components due to cleaning agents

The use of cleaning agents may cause damage to the system components and parts of the components.

- Clean the inverter and all its components only with a cloth moistened with clear water.
- Clean all battery components with a dry cloth only.

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.

18 Troubleshooting

18.1 Event messages

18.1.1 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.

18.1.2 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.

18.1.3 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.

18.1.4 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.

18.1.5 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 standard 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.

18.1.6 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 standard 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.

18.1.7 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 standard 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.

18.1.8 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.

18.1.9 Event 302

⚠ QUALIFIED PERSON

Event message:

- Temperature 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.

18.1.10 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.

18.1.11 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.

18.1.12 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.

18.1.13 Event 507

⚠ QUALIFIED PERSON

Event message:

- Temperature 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.

18.1.14 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.

18.1.15 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.

18.1.16 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.

18.1.17 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.

18.1.18 Event 1101

⚠ QUALIFIED PERSON

Event message:

- Installation fault
- Check connection

Explanation:

A second line conductor is connected to N.

Corrective measures:

- Connect the neutral conductor to N.

18.1.19 Event 1302

⚠ QUALIFIED PERSON

Event message:

- Waiting for grid voltage
- Grid connection installation error
- Check grid connections and fuses

Explanation:

L or N not connected.

Corrective measures:

- 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.

18.1.20 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 standard has been configured correctly. To do this, select the parameter **Set country standard** and check the value.

18.1.21 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.

18.1.22 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.

18.1.23 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.

18.1.24 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.

18.1.25 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 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 exceeds the maximum input voltage of the inverter, ensure that the PV module has been correctly rated or contact the installer of the PV module.
- If this message is repeated frequently, contact the Service.

18.1.26 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 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 exceeds the maximum input voltage of the inverter, ensure that the PV module has been correctly rated or contact the installer of the PV module.
- If this message is repeated frequently, contact the Service.

18.1.27 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 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 exceeds the maximum input voltage of the inverter, ensure that the PV module has been correctly rated or contact the installer of the PV module.
- If this message is repeated frequently, contact the Service.

18.1.28 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.

18.1.29 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 is within the safe range. The inverter will be restarted once during an insulation test.

18.1.30 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.

18.1.31 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.

18.1.32 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.

18.1.33 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.

18.1.34 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.

18.1.35 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.

18.1.36 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.

18.1.37 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.

18.1.38 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.

18.1.39 Event 4301

⚠ QUALIFIED PERSON

Event message:

- Serial electric arc in string |s0| detected by AFCI module

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 all voltage sources.
- 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).

18.1.40 Event 6001-6499

⚠ QUALIFIED PERSON

Event message:

- Self-diagnosis
- Device fault

Explanation:
The cause must be determined by the Service.

Corrective measures:
- Contact Service.

18.1.41 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.

18.1.42 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.

18.1.43 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.

18.1.44 Event 6511

⚠ QUALIFIED PERSON

Event message:

- 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.

18.1.45 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.

18.1.46 Event 6602

⚠ QUALIFIED PERSON

Event message:

- Overvoltage grid (AF)

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.

18.1.47 Event 6606

⚠ QUALIFIED PERSON

- Self-diagnosis
- Device fault

Explanation:

The cause must be determined by the Service.

Corrective measures:

- Contact the Service.

18.1.48 Event 6633

⚠ QUALIFIED PERSON

Event message:

- Self-diagnosis
- Device fault

Explanation:

The cause must be determined by the Service.

Corrective measures:

- Contact the Service.

18.1.49 Event 6801

⚠ QUALIFIED PERSON

Event message:

- Self-diagnosis > Input A defective

Explanation:

Polarity error on the inverter.

Corrective measures:

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

18.1.50 Event 6901

⚠ QUALIFIED PERSON

Event message:

- Self-diagnosis > Input B defective

Explanation:

Polarity error on the inverter.

Corrective measures:

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

18.1.51 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.

18.1.52 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.

18.1.53 Event 7014

⚠ QUALIFIED PERSON

Event message:

- Fault boost converter temperature sensor

Explanation:

Fan is always on.

Corrective measures:

- Contact Service.

18.1.54 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.

18.1.55 Event 7622

⚠ QUALIFIED PERSON

Event message:

- No communication with I/O module

Explanation:

This event is displayed during a device-internal communication error with the SMA I/O Modul. The inverter disconnects from the utility grid for safety reasons.

18.1.56 Event 7702

⚠ QUALIFIED PERSON

Event message:

- Self-diagnosis
- Interference device

Explanation:

The cause must be determined by the Service.

Corrective measures:

- Contact Service.

18.1.57 Event 7703

⚠ QUALIFIED PERSON

Event message:

- Self-diagnosis
- Interference device

Explanation:

The cause must be determined by the Service.

Corrective measures:

- Contact Service.

18.1.58 Event 7801

⚠ QUALIFIED PERSON

Event message:

- Fault overvoltage protector

Explanation:

One or more surge arresters have tripped or one or more surge arresters are not inserted correctly.

Corrective measures:

- Ensure that the surge arrester is inserted correctly.
- If surge arresters have tripped, replace the tripped surge arresters with new surge arresters.

18.1.59 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.

18.1.60 Event 8104

⚠ QUALIFIED PERSON

Event message:

- Communication impaired

Explanation:

The cause must be determined by the Service.

Corrective measures:

- Contact Service.

18.1.61 Event 8205

⚠ QUALIFIED PERSON

Event message:

- Arc fault detection self-test successful.

Explanation:

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

18.1.62 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.

18.1.63 Event 8709

⚠ QUALIFIED PERSON

Event message:

- Timeout in communication for reactive power setpoint

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.

18.1.64 Event 8710

⚠ QUALIFIED PERSON

Event number:

- Timeout in communication for cos phi setpoint

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.

18.1.65 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.

18.1.66 Event 9033

⚠ QUALIFIED PERSON

Event message:

- Rapid shutdown has been triggered

Explanation:

The inverter detected the triggering of a Rapid Shutdown. The AC side of the inverter was disconnected.

18.1.67 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.

Corrective measures:

- Check the configuration 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.

18.1.68 Event 9035

⚠ QUALIFIED PERSON

Event message:

- Rapid shutdown performed successfully

Explanation:

The voltage at the DC inputs and at the AC output of the inverter was successfully discharged.

18.1.69 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.

18.1.70 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.

18.1.71 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.

18.1.72 Event 9107

⚠ QUALIFIED PERSON

Event message:

- Self-diagnosis
- Interference device

Explanation:

The cause must be determined by the Service.

Corrective measures:

- Contact Service.

18.1.73 Event 9202

⚠ QUALIFIED PERSON

Event message:

- SPS AC overvoltage

Explanation:
The cause must be determined by the Service.

Corrective measures:
- Contact the Service.

18.1.74 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.

18.1.75 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.

18.1.76 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.

18.1.77 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.

18.1.78 Event 9395

Event message:

- Battery separated externally

Explanation:

The DC power connection to the battery was disconnected.

18.1.79 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:

- Ensure that the parameter settings for battery-backup operation are configured to SPS.

18.1.80 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.

18.2 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 125

18.3 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 system 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.
- Once disconnected from voltage sources, wait five minutes before touching any parts of the PV system or the system.

⚠ 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.

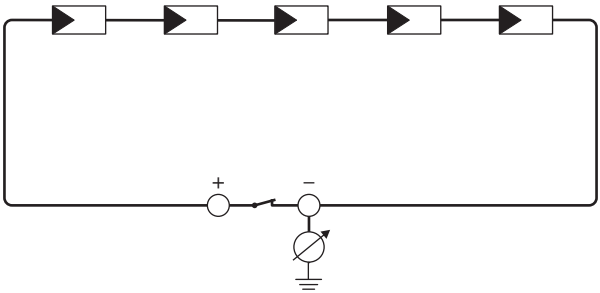


Figure 15: Schematic diagram of the measurement

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 .
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 125

18.4 Manual restart after electric arc

⚠ QUALIFIED PERSON

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

Also see:

- Arc-Fault Circuit Interrupter (AFCI) ⇒ page 28
- Arc-Fault Circuit Interrupter (AFCI) ⇒ page 87

19 Decommissioning

19.1 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.

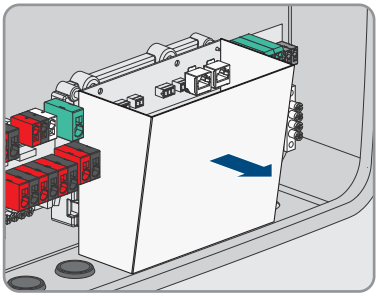
- Wear suitable personal protective equipment for all work on the product.

Procedure:

1. Disconnect the inverter from all voltage sources .
2. **⚠ CAUTION**

   Risk of burns due to hot enclosure parts

   - Wait 30 minutes for the enclosure to cool down.
3. Remove SMA Backup Start.
4. Undo the screw for the additional grounding (TX25) and remove the grounding cable.
5. Remove the cover of the communication connection area.



6. Unplug the two-pole connector for the external rapid shutdown initiator from the adapter.
7. Detach the conduit and guide the cable out of the inverter.
8. Unplug the two-pole connector to which the DC load-break switch is connected from the adapter.
9. Unplug the adapter from the **GSI** slot.
10. Plug the two-pole connector to which the DC load-break switch is connected into the **GSI** slot.
11. Remove the battery power cable from the terminals.
12. Detach the conduit and guide the cable out of the inverter.

13. Remove the cable for grounding the PV modules. To do this, twist off the cable from the busbar for grounding the DC connection (PZ 2).
14. Remove the DC cables for the PV modules from the terminals.
15. Detach the conduits and guide the cables out of the inverter.
16. Unplug the network cable from the **BATTERY** network port.
17. Detach the conduit and guide the cable out of the inverter.
18. Remove the network cable from the **LAN-1** and **LAN-2** network ports.
19. Detach the conduit and guide the cable out of the inverter.
20. Unplug the connector from the **SPS** slot.
21. Unplug the AC conductor from the busbar. To do this, first undo the screw (PZ2).
22. Remove the N and L conductors from the **SPS** terminals.
23. Remove N, L1, and L2 from the **AC** terminals.
24. Remove the ferrite. To do this, cut the cable tie.
25. Detach the conduit and guide the cable out of the inverter.
26. Detach the cable for the additional grounding (TX25).

Also see:

- Removing SMA Backup Start ⇒ page 129

19.2 Removing SMA Backup Start

⚠ QUALIFIED PERSON

⚠ CAUTION

Risk of injury due to sharp EMC clips

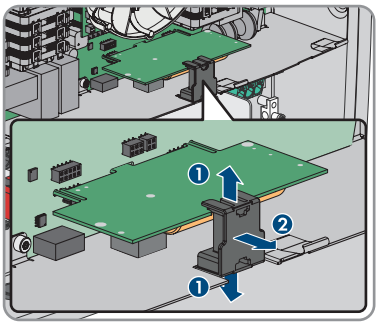
The EMC clips installed on the enclosure of the inverter may have sharp edges and can cause cut injuries.

- Do not touch the EMC clips.
- Use caution when installing and removing modules in the inverter.
- Wear suitable personal protective equipment.

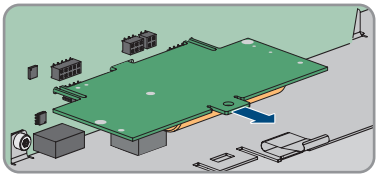
Procedure:

1. Disconnect the inverter from all voltage sources (see Section 16, page 93).

2. Remove the spacer. To do this, raise both locking tabs and lift the spacer upwards.



3. Carefully detach the SMA Backup Start module from the assembly in the inverter and remove it.



19.3 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.

- Wear suitable personal protective equipment for all work on the product.

Requirement:

- The terminals must be disconnected from the inverter (see Section 19.1, page 128).

Procedure:

1. Remove the side covers. To do so, slide the side covers upward slightly, so that they can be removed from the hooks on the mounting bracket and the inverter.
2. Lift the inverter with the help of the indentations on the enclosure and 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.

19.4 Disposal

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

20 Replacing the Product

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 had been registered by a communication product (e.g. System Manager), replace it with the new product in the communication product (see manual for communication product).
5. 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.

21 Technical Data for Inverter

21.1 General Data

Width x height x depth	500 mm x 586 mm x 236 mm (19.7 in x 23.1 in x 9.3 in)
Weight	17.5 kg (38.6 lb)
Length x width x height of the packaging	760 mm x 580 mm x 350 mm (29.9 in x 22.8 in x 13.8 in)
Transport weight (including pallet)	23 kg (50.7 lbs)
Operating temperature range	-25°C to +60°C (-13°F to +140°F)
Max. permissible value for relative humidity (condensing)	100 %
Maximum operating altitude above mean sea level (MSL)	3000 m (9843 ft)
Typical noise emission	35 dB(A)
Power loss in night mode	< 6 W
Topology	Transformerless (Non-isolated)
Cooling method	natural convection
Enclosure degree of protection according to UL 50	Type 3R
Degree of protection for electronics in accordance with IEC 60529	IP65
Protection class	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 (33 ft)
Quantity maximum detectable Wi-Fi networks	32
Grid configurations	240 V : 120 V split-phase system, 208 V delta connection : 120 V wye connection, 208 V delta connection, 240 V delta connection
National standards and approvals, as per 04/2023	UL 62109-1, UL 1741, UL 62109-1 CRD, UL 1699B

21.2 DC input of PV

	SBSE3.8-US-50	SBSE4.8-US-50	SBSE5.8-US-50	SBSE7.7-US-50
Maximum power of PV array	7680 Wp STC	9600 Wp STC	1160 Wp STC	15360 Wp STC
Maximum input voltage	600 V	600 V	600 V	600 V
MPP voltage range	60 V to 480 V	60 V to 480 V	60 V to 480 V	60 V to 480 V
Minimum input voltage	60 V	60 V	60 V	60 V
Initial input voltage	66 V	66 V	66 V	66 V
Maximum usable input current per input	15 A	15 A	15 A	15 A
Maximum short-circuit current per input[1)]	30 A	30 A	30 A	30 A
Maximum short-circuit current for all inputs in total[1)]	60 A	60 A	60 A	60 A
Maximum reverse current into the PV modules	0 A	0 A	0 A	0 A
Number of independent MPP inputs	3	3	3	3
Strings per MPP input	1	1	1	1
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
Overvoltage category in accordance with UL 62109-1	II	II	II	II

[1)] In accordance with UL 62109-1: $I_{SC\ PV}$

21.3 Battery DC input

	SBSE3.8-US-50	SBSE4.8-US-50	SBSE5.8-US-50	SBSE7.7-US-50
Voltage range	90 V to 500 V	90 V to 500 V	90 V to 500 V	90 V to 500 V
Maximum charging current	30 A	30 A	30 A	30 A
Maximum discharge current	30 A	30 A	30 A	30 A
Maximum short-circuit current	55 A	55 A	55 A	55 A
Maximum charging power	10000 W	10000 W	10000 W	10000 W
Maximum discharge power	4042 W	5053 W	6063 W	8084 W
Battery type[2)]	Li-ion	Li-ion	Li-ion	Li-Ion
Number of independent inputs	1	1	1	1
Overvoltage category UL 62109-1	II	II	II	II

21.4 AC Output

	SBSE3.8-US-50	SBSE4.8-US-50	SBSE5.8-US-50	SBSE7.7-US-50
Rated power at 240 V, 60 Hz	3840 W	4800 W	5760 W	7680 W
Rated power at 208 V, 60 Hz	3328 W	4160 W	4992 W	6656 W
Maximum apparent power	3840 VA	4800 VA	5760 VA	7680 VA
Nominal grid voltage	240 V / 208 V	240 V / 208 V	240 V / 208 V	240 V / 208 V
Voltage range[3)]	211 V to 264 V / 183 V to 229 V	211 V to 264 V / 183 V to 229 V	211 V to 264 V / 183 V to 229 V	211 V to 264 V / 183 V to 229 V
Rated current at 240 V	16 A	20 A	25 A	32 A

[2)] 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).

[3)] Depending on the configured country data set

	SBSE3.8-US-50	SBSE4.8-US-50	SBSE5.8-US-50	SBSE7.7-US-50
Maximum output current	16 A	20 A	25 A	32 A
Maximum output current under fault conditions	488 A	488 A	488 A	488 A
Total harmonic distortion of the output current with total harmonic distortion of the AC voltage <2%, and AC power >50% of the rated power	< 3 %	< 3 %	< 3 %	< 3 %
Inrush current	< 10% of the nominal AC current for a maximum of 10 ms	< 10% of the nominal AC current for a maximum of 10 ms	< 10% of the nominal AC current for a maximum of 10 ms	< 10% of the nominal AC current for a maximum of 10 ms
Rated grid frequency	60 Hz	60 Hz	60 Hz	60 Hz
Grid frequency[3)]	60 Hz	60 Hz	60 Hz	60 Hz
Operating range at grid frequency 60 Hz	55 Hz to 66 Hz	55 Hz to 66 Hz	55 Hz to 66 Hz	55 Hz to 66 Hz
Power factor at rated power	1	1	1	1
Displacement power factor, adjustable	0.8 overexcited to 0.8 underexcited	0.8 overexcited to 0.8 underexcited	0.8 overexcited to 0.8 underexcited	0.8 overexcited to 0.8 underexcited
Feed-in phases	1	1	1	1
Connection phases	2-(N)-PE	2-(N)-PE	2-(N)-PE	2-(N)-PE
Overvoltage category in accordance with UL 62109-1	III	III	III	III

21.5 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[4]	100000 switching cycles
Bounce time	5 ms
Reset time	5 ms
Maximum cable length	100 m (328 ft)

21.6 Communication

SMA devices	Max. 5 inverters with SMA Speedwire and 1 energy meter, 100 Mbit/s
I/O systems and meters	Ethernet, 10/100 Mbit/s, Modbus TCP

21.7 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

21.8 Efficiency

	SBSE3.8-US-50	SBSE4.8-US-50	SBSE5.8-US-50	SBSE7.7-US-50
Maximum efficiency, η_{max}	98.15 %	98.15 %	98.15 %	98.15 %
CEC weighted efficiency at 240 V, $\eta_{CEC, 240\ V}$	96.5 %	97.0 %	97.5 %	97.5 %
CEC weighted efficiency at 208 V, $\eta_{CEC, 208\ V}$	97.0 %	97.0 %	97.0 %	97.0 %

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

21.9 Protective Devices

DC reverse polarity protection	Short-circuit diode
Input-side disconnection point	DC load-break switch
AC short-circuit current capability	Current control
Grid monitoring	SMA Grid Guard 10.0
Maximal output overcurrent protection	50 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
Arc fault detection AFCI, type 1, listed according to UL1699B Ed. 1	Available
Rapid Shutdown Equipment	Present, listed according to UL 1741
Active anti-islanding method	Frequency shift

21.10 Climatic Conditions

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

Extended temperature range	-25°C to +60°C (-13°F to +140°F)
Extended humidity range	0% to 100%
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 (-40°F to +158°F)

21.11 Equipment

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

22 SMA Backup Start Technical Data

Maximum storage duration	2 years

23 Compliance Information

FCC Compliance

This device complies with Part 15 of the FCC Rules.

Operation is subject to the following two conditions:

1. this device may not cause harmful interference, and
2. this device must accept any interference received, including interference that may cause undesired operation.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Changes or modifications made to this equipment not expressly approved by SMA Solar Technology AG may void the FCC authorization to operate this equipment.

24 Contact

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

- Type of device
- Serial number
- Firmware version
- Device configuration (System Manager or subordinate device)
- Special country-specific settings (if available)
- Event message
- Mounting location 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)
- 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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