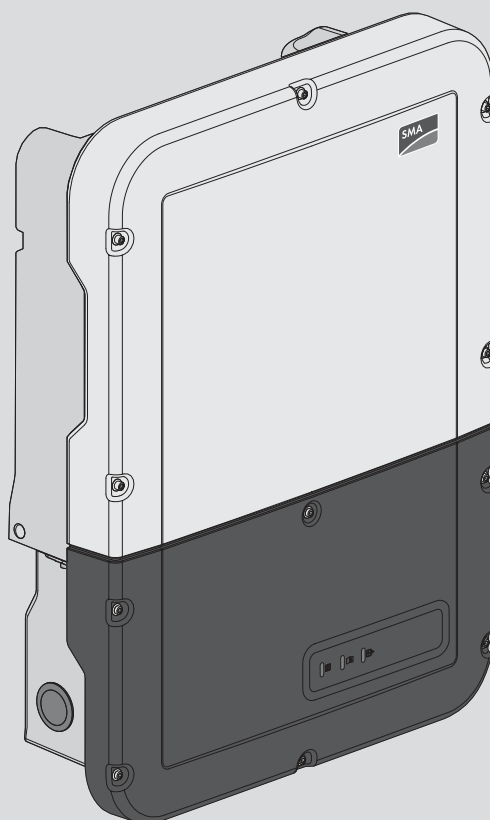


SUNNY BOY STORAGE 3.8-US / 5.0-US / 6.0-US



eManual



ENGLISH

Installation Manual

ESPAÑOL

Instrucciones de instalación

FRANÇAIS

Instructions d'installation



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1 Information on this Document

1.1 Validity

This document is valid for:

- SBS3.8-US-10 (Sunny Boy Storage 3.8-US) from firmware version 1.50.10.R.
- SBS5.0-US-10 (Sunny Boy Storage 5.0-US) from firmware version 1.50.10.R.
- SBS6.0-US-10 (Sunny Boy Storage 6.0-US) from firmware version 1.50.10.R.

1.2 Target Group

The tasks described in this document must only be performed by qualified persons. Qualified persons must have the following skills:

- Knowledge of how batteries work and are operated
- Training in how to deal with the dangers and risks associated with installing, repairing and using electrical devices, batteries and installations
- Training in the installation and commissioning of electrical devices and installations
- Knowledge of all applicable laws, standards and directives
- Knowledge of and compliance with this document and all safety information
- Knowledge of and compliance with the documents of the battery manufacturer with all safety information

1.3 Content and Structure of this Document

This document describes the installation, commissioning and decommissioning of the product.

The latest version of this document and the manual for operating the user interface as well as information on configuration and troubleshooting of the product are to be found in PDF format at www.SMA-Solar.com.

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
	Desired result
	A problem that might occur
	Example

1.6 Typographies in the document

Typography	Use	Example
bold	<ul style="list-style-type: none"> Messages Terminals Elements on a user interface Elements to be selected Elements to be entered 	<ul style="list-style-type: none"> Connect the insulated conductors to the terminals X703:1 to X703:6. Enter 10 in the field Minutes.
>	<ul style="list-style-type: none"> Connects several elements to be selected 	<ul style="list-style-type: none"> Select Settings > Date.
[Button] [Key]	<ul style="list-style-type: none"> Button or key to be selected or pressed 	<ul style="list-style-type: none"> Select [Enter].

1.7 Designation in the document

Complete designation	Designation in this document
SMA Solar Technology AG	SMA
Sunny Boy Storage	Inverter, product

1.8 Additional Information

For more information, please go to www.SMA-Solar.com.

Title and information content	Type of information
Operation, configuration and troubleshooting	User Manual

Title and information content	Type of information
"Approved batteries and battery communication connection" Overview of approved batteries	Technical Information
"Application for SMA Grid Guard Code"	Form
"Efficiency and Derating" Efficiency and derating behavior of the SMA inverters	Technical Information
"Grid Support Utility Interactive Inverters" Information about how to activate and to set the grid supporting features according to UL 1741 SA	Technical Information
"Parameters and Measured Values" Overview of all inverter operating parameters and their configuration options	Technical Information
"SMA and SunSpec Modbus® Interface" Information on the Modbus interface	Technical Information
"Modbus® parameters and measured values" Device-specific register HTML file	Technical Information

2 Safety

2.1 Intended Use

The Sunny Boy Storage is an AC-coupled battery inverter for parallel grid and stand-alone mode operation. The Sunny Boy Storage converts the direct current supplied by a battery into grid-compliant alternating current. The Sunny Boy Storage, together with a battery and a compatible energy meter, make up a system for increased self-consumption (Flexible Storage System) or, together with a automatic transfer switch compatible with Sunny Boy Storage, a battery-backup system (Flexible Storage System with battery-backup function).

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 one of the energy meters approved by SMA Solar Technology AG. An updated list of energy meters approved by SMA Solar Technology AG is available at www.SMA-Solar.com.

The product must only be operated in connection with an intrinsically safe lithium-ion battery approved by SMA Solar Technology AG. An updated list of batteries approved by SMA Solar Technology AG is available at www.SMA-Solar.com.

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

The communication interface of the used battery 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 product is not suitable for supplying life-sustaining medical devices. A power outage must not lead to personal injury.

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

The product is approved for the US and Canadian market.

Use this product 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 product, 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 of the product other than that described in the Intended Use section does not qualify as the intended use.

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

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

The type label must remain permanently attached to the product.

2.2 IMPORTANT SAFETY INSTRUCTIONS

SAVE THESE INSTRUCTIONS

This section contains safety information that must be observed at all times when working on or with the product.

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

DANGER

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

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

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

DANGER

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

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

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

⚠ 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.

⚠ CAUTION**Risk of burns from hot surfaces**

The surface of the inverter can get very hot. Touching the surface can result in burns.

- Mount the inverter in such a way that it cannot be touched inadvertently.
- Do not touch hot surfaces.
- Wait 30 minutes for the surface to cool sufficiently.
- Observe the safety messages on 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 when attaching it to or removing it from the wall mounting bracket.

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

NOTICE**Damage to the enclosure seal in subfreezing conditions**

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

- Only open the product if the ambient temperature is not below 0°C (32°F).
- If a layer of ice has formed on the enclosure seal when temperatures are below freezing, remove it prior to opening the product (e.g. by melting the ice with warm air). Observe the applicable safety regulations.
- Do not disassemble the Power Unit and Connection Unit unless the ambient temperature is at least 0°C (32°F) and conditions are frost-free.

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

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

- Only open the product if the humidity is within the thresholds and the environment is free of sand and dust.
- Do not open the product during a dust storm or precipitation.
- Close tightly all enclosure openings.
- Only use listed rain-tight or liquid-tight conduit fittings to attach the conduits to the product.

NOTICE**Damage due to cleaning agents**

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

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

NOTICE**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.

NOTICE**Destruction of the measuring device due to overvoltage**

- Only use measuring devices with a DC input voltage range of 600 V or higher.

i 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 or *Canadian Electrical Code*® CSA-C22.1.).

- 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 Scope of Delivery

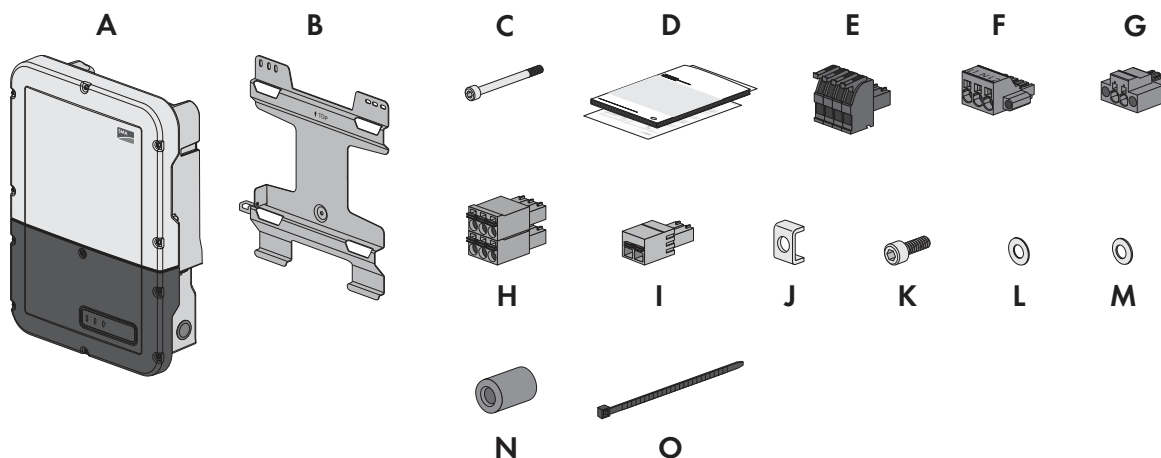


Figure 1 : Components included in the scope of delivery

Position	Quantity	Designation
A	1	Inverter
B	1	Wall mounting bracket
C	1	Cylindrical screw M5 x 60
D	1	Installation manual, production test report, supplementary sheet with the default settings
E	1	4-pole terminal block for connecting a RS485 energy meter
F	1	Terminal block for the AC connection
G	1	Terminal block for connecting the outlet for secure power supply operation
H	4	6-pole terminal block for connecting the battery communication cables and the communication cable of the automatic transfer switch
I	1	2-pole terminal block for the switch connection for secure power supply operation or for black start feature.
J	5	Clamping bracket
K	5	Cylindrical screw M5 x 16
L	5	Washer M5
M	5	Spring washer M5
N	1	Ferrite
O	1	Cable tie

4 Product Overview

4.1 Product Description

The Sunny Boy Storage uses the connected battery for the intermediate storage of excess PV energy in the SMA Flexible Storage System. For this purpose, the Sunny Boy Storage receives the feed-in data and purchased electricity data from the energy meter. This data is used by the Sunny Boy Storage to control the charging and discharging of the battery.

The use of an automatic transfer switch is required in the battery-backup system. In the event of grid failure, the automatic transfer switch disconnects the PV system, loads and the Sunny Boy Storage from the utility grid and creates a battery-backup grid. The battery-backup grid supplies loads that should continue to be supplied with electricity in the event of grid failure. In the event of grid failure, the Sunny Boy Storage supplies the loads with energy after a short switching time. The PV system supplies additional energy that can be used to supply the loads and charge the battery.

i Secure power supply operation in Flexible Storage Systems with backup power supply not possible

If the inverter is used in a battery-backup system and connected with an automatic transfer switch, the secure power supply operation is not available.

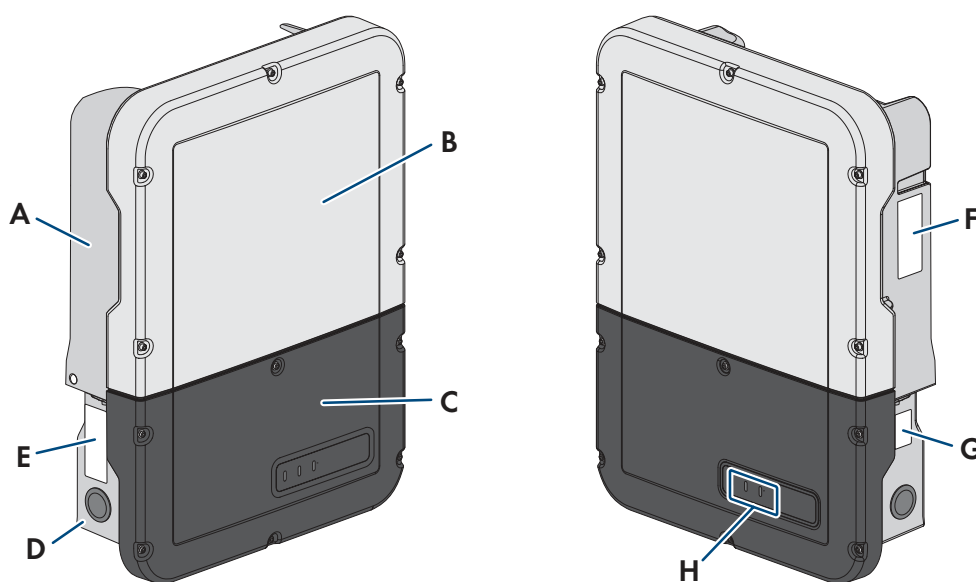











Figure 2 : Design of the inverter

Position	Designation
A	Power Unit
B	Enclosure lid of the Power Unit
C	Enclosure lid for the Connection Unit
D	Connection Unit
E	Warning label with compliance information

Position	Designation
F	<p>Type label</p> <p>The type label uniquely identifies the inverter. The type label must remain permanently attached to the product. You will find the following information on the type label:</p> <ul style="list-style-type: none"> • Inverter device type (Model) • Serial number of the Power Unit (Serial No. Power Unit or S/N Power Unit) • Date of manufacture • Device-specific characteristics
G	<p>Additional type label</p> <p>The additional type label must remain permanently attached to the product. You will find the following information on the additional type label:</p> <ul style="list-style-type: none"> • Device type (Model) • Inverter serial number (Serial number device or S/N device) • Identification key (PIC) for registration in Sunny Portal • Registration ID (RID) for registration in Sunny Portal • WLAN password (WPA2-PSK) for the direct connection to the user interface of the inverter via WLAN
H	<p>LEDs</p> <p>The LEDs indicate the operating state of the inverter.</p>

4.2 Symbols on the Product

Symbol	Explanation
	<p>Beware of electrical voltage</p> <p>The product operates at high voltages.</p>
	<p>Beware of hot surface</p> <p>The product can get hot during operation.</p>
	<p>Observe the documentation</p> <p>Observe all documentation supplied with the product.</p>
	<p>Observe the documentation</p> <p>Together with the red LED, this symbol indicates an error.</p>

Symbol	Explanation
	Inverter Together with the green LED, this symbol indicates the operating state of the inverter.
	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.
	The product is has no galvanic isolation.
	UL 1741 and CSA C22.2 No. 107.1 are the standards applied by Underwriters Laboratories to the product to certify that it meets the requirements of the <i>National Electrical Code</i> ®, the <i>Canadian Electrical Code</i> ® and IEEE 1547.

4.3 Interfaces and Functions

The inverter can be equipped or retrofitted with the following interfaces and functions:

User interface for monitoring and configuration

The product is equipped as standard with an integrated webserver, which provides a user interface for configuring and monitoring the product. The product user interface can be called up via the web browser if there is an existing connection to an end device (e.g. computer, tablet PC or smartphone).

Smart Inverter Screen

The Smart Inverter Screen enables you to view the status display and to display the nominal energy throughput and state of charge of the battery on the user interface login page. You therefore have an overview of the most important inverter and battery data without having to log into the user interface.

The Smart Inverter Screen is deactivated by default. The Smart Inverter Screen can be activated via the user interface once the inverter has been commissioned.

SMA Speedwire

The product 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.

Class 1 wiring methods are to be used for field wiring connection to the terminals of the communication interface.

SMA Webconnect

The inverter is equipped with a Webconnect function as standard. The Webconnect function enables direct data transmission between the inverters and Internet portals Sunny Portal and Sunny Places without any additional communication device and for a maximum of 1 inverters per visualized system. In PV systems with more than 1 inverters, there is the option of establishing data transmission between the inverters and Sunny Portal via the data logger (e.g., SMA Data Manager) or distributing the inverters over several systems. If there is an existing WLAN or Ethernet connection, you can directly access your visualized system via the web browser on your end device.

WLAN

The product 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 product has a WPS function. The WPS function is for automatically connecting the product to a network (e.g. via router) and establish a direct connection between the product and an end device.

Modbus

The product is equipped with two Modbus interfaces.

One interface can be controlled via Ethernet and the other interface via RS485. The Modbus interface via Ethernet is designed for industrial use – via SCADA systems, for example – and deactivated as standard. The Modbus interface via Ethernet must be configured via the user interface of the inverter (if necessary). The Modbus interface via RS485 is used for data exchanges with an energy meter. The Modbus interface via RS485 must be configured via the user interface of the inverter and set on the energy meter accordingly.

The Modbus interface via Ethernet has the following tasks:

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

Grid Management Services

The inverter is a grid support multi-mode inverter.

The inverter was tested in accordance with the UL 1741 SA (2016-09-07) to be compliant with the source requirements documents of the states available at the time. For connecting the inverter to the utility grid, no additional grid monitoring equipment is necessary. A description of the tested functions and instructions on the activation and setting of functions can be found in the technical information "Grid Support Utility Interactive Inverters" at www.SMA-Solar.com.

Secure power supply operation

In case of a grid failure, the secure power supply operation supplies the loads with energy from the battery. You can connect a standard outlet and a standard switch to the inverter. You can connect a load with a maximum of 16 A and 120 V to the outlet. The load is supplied with energy from the battery during grid failure. The switch is used to activate and deactivate secure power supply operation.

The secure power supply operation is not automatically activated in the event of a grid failure, neither is it automatically deactivated once the utility grid is available again. If the utility grid fails, the load supply must be activated manually by activating the switch. The inverter automatically regulates the energy supply of the outlet after activating the switch. When the utility grid is available again and the load can be supplied by this again, the secure power supply operation must be deactivated manually by switching the switch off.

During active secure power supply operation, the inverter is disconnected from the electricity and does not therefore feed into the utility grid. During secure power supply operation, the load can only be supplied with energy as long as there is stored energy available in the battery. If there is insufficient energy available from the battery, the secure power supply operation remains active, even if the utility grid is available again. Switching over to supplying the load from the utility grid does not take place automatically. Once the battery is sufficiently charged again and the load can be supplied, the secure power supply operation must be restarted.

i Secure power supply operation in Flexible Storage Systems with backup power supply not possible

If the inverter is used in a battery-backup system and connected with an automatic transfer switch, the secure power supply operation is not available.

i Do not connect any loads that require a stable energy supply

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

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

Battery-backup function

The inverter is equipped with a battery-backup function. The battery-backup function is deactivated by default and must be activated via the user interface. The battery-backup function can only be activated if the inverter is operated in a battery-backup system with an automatic transfer switch. If the system is retrofitted with an automatic transfer switch, the battery configuration must be reset and carried out once again. Then the battery-backup system must be configured. The configuration is carried out via the installation assistant on the user interface of the battery inverter.

The battery-backup function ensures that the inverter forms a battery-backup grid that uses energy from the battery and the PV system to supply the household grid in the event of a utility grid failure. When the battery-backup operation is activated, the automatic transfer switch disconnects the PV system and the household grid from the utility grid in the event of a grid failure, and connects these to the battery-backup grid. After a short switch-over time, the battery-backup grid and loads

connected can be supplied by the battery and supplemented with energy from the PV system. The charging of the battery is ensured by the existing PV system during battery-backup operation. The charging process of the battery (initiated by the PV system) can be deactivated via a certain parameter during battery-backup operation. As soon as the utility grid is available again, the battery-backup operation is deactivated automatically and the loads are supplied with energy from the utility grid. If the automatic battery-backup operation is not set, the battery-backup operation must be manually activated in the event of a grid failure, and must also be deactivated again once the utility grid is available (information in terms of switching operations of the automatic transfer switch and procedures during grid failure and grid reconnection see planning guidelines "SMA FLEXIBLE STORAGE SYSTEM with Battery-Backup Function").

When the utility grid is down and the battery discharged, there is, in the beginning, not enough power available to create a stable battery-backup grid. In this case, the battery must be charged by the PV system. The battery inverter is able to create a stable battery-backup grid only when enough power is available in the battery. To use battery charging power from the PV system, the battery inverter has to create a stand-alone grid. For this purpose, the battery inverter requires energy from the battery reserve. If enough PV power is available, the PV inverters start automatically and the battery is charged with energy from the PV system. The battery is charged with energy until the battery inverter is able to provide a battery-backup grid. The state of charge can be configured via certain parameter. If not enough PV energy is available to start the PV inverters, the stand-alone grid breaks down. Two hours later, the battery inverter tries to start the PV inverter again to charge the battery with energy from the PV system. If the battery inverter still fails to create a stand-alone grid after several attempts due to insufficient PV energy, the battery inverter and battery switch to sleep mode. In this case, a manual black start is required to switch the battery inverter and battery from sleep mode back to operation.

An updated list of automatic transfer switches approved by SMA Solar Technology AG is available at www.SMA-Solar.com. You are not allowed to install automatic transfer switches for operation with this inverter by yourself on the basis of a circuit diagram.

i Secure power supply operation in Flexible Storage Systems with backup power supply not possible

If the inverter is used in a battery-backup system and connected with an automatic transfer switch, the secure power supply operation is not available.

i Do not connect any loads that require a stable energy supply

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

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

Black start function

The inverter has a black start function and an auxiliary battery that provides energy for the black start. In battery-backup systems, you have the possibility to install a standard switch for black starting the inverter and battery. The black-start switch is used to start the battery-backup operation manually in the event of grid failure if the battery and inverter are in sleep mode and, therefore, are

unable to provide energy. When the black-start switch is switched on manually, the energy from the auxiliary battery is made available in order to automatically switch the battery and therefore also the inverter from sleep mode to operation in order that the inverter can make energy available from the battery. You can stop the battery-backup operation by switching it off manually. To enable the black-start function, at least one battery must be connected to input A.

Multi-battery device

The product is equipped with the multi-battery function as standard from firmware version 1.50.10.R. The multi-battery function enables to charge and discharge several batteries of the same or different type. If the system is extended by one or several batteries or one battery is replaced, the battery configuration must be reset and carried out again. The configuration is carried out via the installation assistant on the user interface of the battery inverter. An overview of batteries approved by SMA Solar Technology AG and their possible combinations is available at www.SMA-Solar.com.

SMA Smart Connected

SMA Smart Connected is the free monitoring of the inverter via the SMA Sunny Portal. Thanks to SMA Smart Connected, the PV system 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 PV system operator and qualified person is stored in Sunny Portal and up-to-date.

Time-of-Use

With the "Time-of-Use" function, you can adjust the charging behavior of the battery to your electricity tariff. Energy bills are thus reduced and electricity at lower cost can be used. You can determine in which time range the battery with a specified charging power is operated. At specific times, this is mostly useful when the battery's state of charge has to take on a certain value or the tariff situation makes the charging more attractive, regardless of the power at the grid-connection point. This means that the charging of the battery is independent from the power of the PV system and energy consumption of the loads connected in the house. The charging parameters set in the power profile are only limited by the state of charge (SOC). At times when the "Time-of-Use" function is not activated, the battery is charged correspondent to the increased self-consumption for the entire system. The "Time-of-Use" function is deactivated by default and must be activated by creating power profiles.

Peak load shaving

With the "Peak Load Shaving" function, you can optimize the behavior of the battery 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 tariff. 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 can thus be avoided.

You can configure times and setpoints for the power drawn at the grid-connection point. 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. At times when the "Peak Load Shaving" function is not activated, the battery is charged or discharged correspondent to the increased self-consumption for the entire system. The "Peak Load Shaving" function is deactivated by default and must be activated by creating power profiles.

Frequency Shift Power Control

If PV inverters are connected on the AC side during battery-backup operation, the battery inverter must be able to limit their output power. This limitation becomes necessary when, for example, the battery inverter's battery is fully charged and the power available from the PV system exceeds the power requirement of the connected loads.

To prevent excess energy from overcharging the battery, the battery inverter automatically detects the problem and changes the frequency at the AC output. This frequency adjustment is analyzed by the PV inverter. As soon as the power frequency of the battery-backup grid increases beyond the value specified in **f Start Delta**, the PV inverter limits its output power accordingly.

The frequency shift power control is activated by default. No additional settings must be carried out. It must be ensured that the connected PV inverters limit their power at the AC output via the battery inverter due to changes in frequency. The frequency-dependent active power limitation $P(f)$ must be set in the PV inverter.

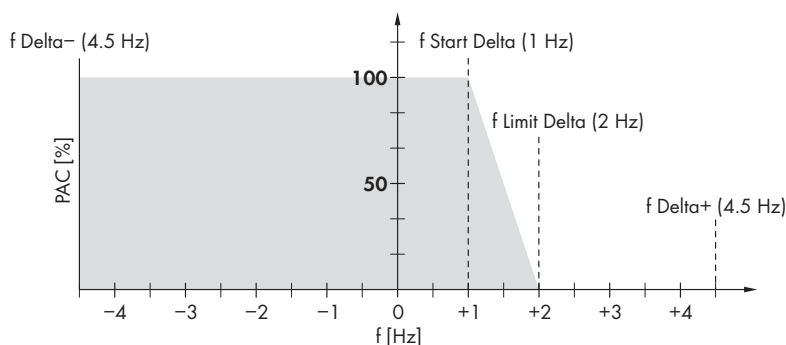


Figure 3 : Impact of the frequency shift power control on the power output of a PV inverter

Designation	Explanation
f	Base frequency of the stand-alone grid (50 Hz)
f Delta- to f Delta+	Maximum range in relation to the base frequency in which the PV inverter is active.
f Start Delta	Frequency increase in relation to the base frequency, at which point the power regulation via frequency begins.
f Limit Delta	Frequency increase in relation to the base frequency, at which point the power regulation via frequency ends. The power of the PV inverter at this point is 0 W.

4.4 LED Signals

LED signal	Explanation
The green LED is flashing (two seconds on and two seconds 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)	Secure power supply operation or battery-backup function The secure power supply operation or battery-backup function is activated and the inverter supplies the loads with energy from the battery.
The green LED flashes quickly	Update of central processing unit The central processing unit of the inverter is being updated.
The green LED is glowing	Parallel grid operation
The green LED is off	The inverter is not feeding into the utility grid.
The red LED is glowing	Event occurred If an event occurs, a distinct event message and the corresponding event number will be displayed in addition on the inverter user interface or in the communication product.
The blue LED flashes slowly for approx. one minute	Communication connection is being established The inverter is establishing a connection to a local network or is establishing a direct connection to an end device via Ethernet (e.g. computer, tablet PC or smartphone).
The blue LED flashes quickly for approx. two minutes.	WPS active The WPS function is active.
The blue LED is glowing	Communication active There is an active connection with a local network or there is a direct connection with an end device via Ethernet (e.g. computer, tablet PC or smartphone).

4.5 System Structure

Flexible Storage System

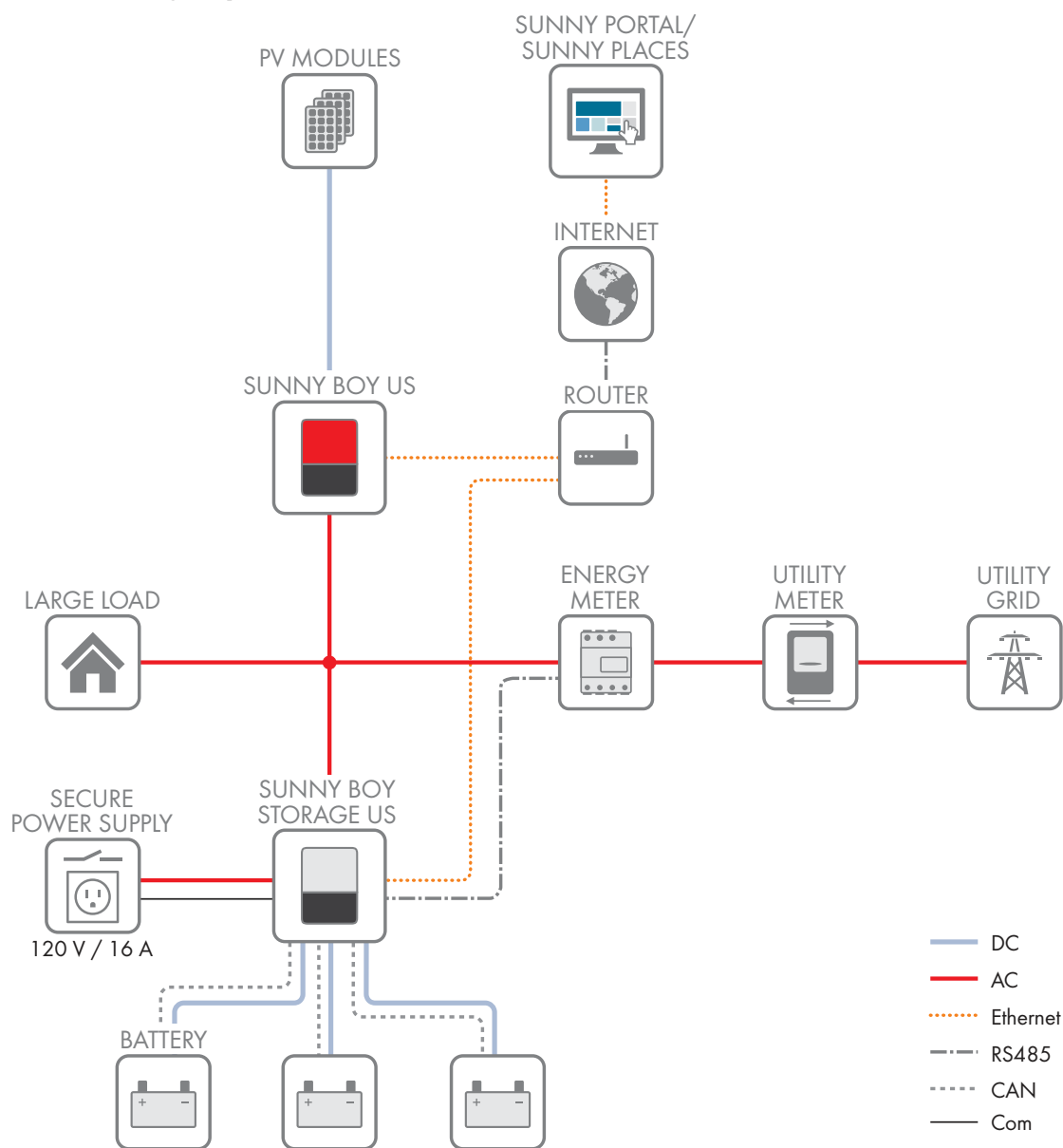


Figure 4 : System design of a flexible storage system with switch and outlet for secure power supply operation (example)

SMA Flexible Storage System with Battery-Backup Function

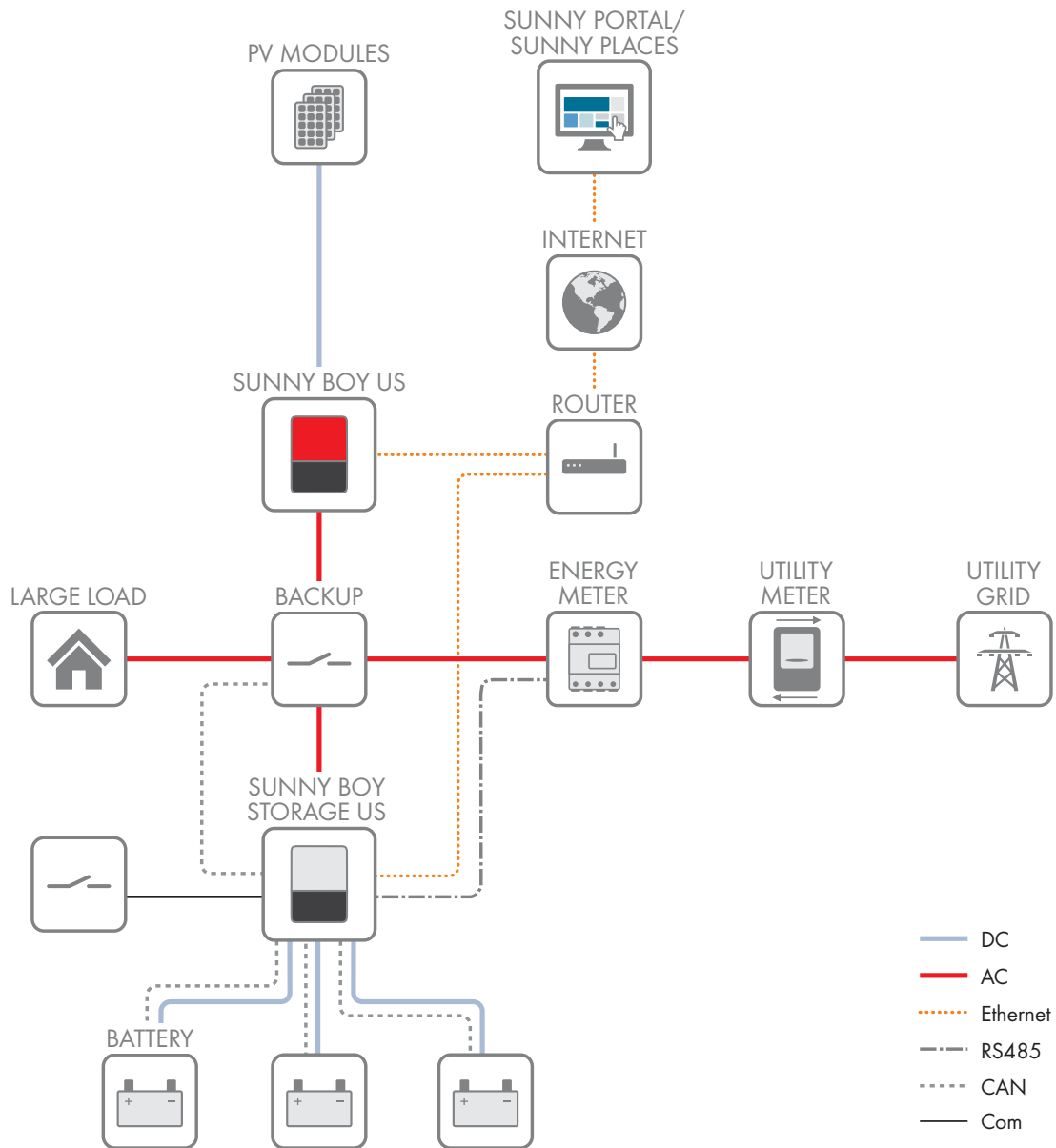


Figure 5 : System design of a flexible storage system with battery-backup function (example)

5 Mounting

5.1 Requirements for Mounting

Requirements for the Mounting Location:

⚠ WARNING

Danger to life due to fire or explosion

Despite careful construction, electrical devices can cause fires.

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

- ☐ 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.
- ☐ 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.

Permitted and prohibited mounting positions:

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

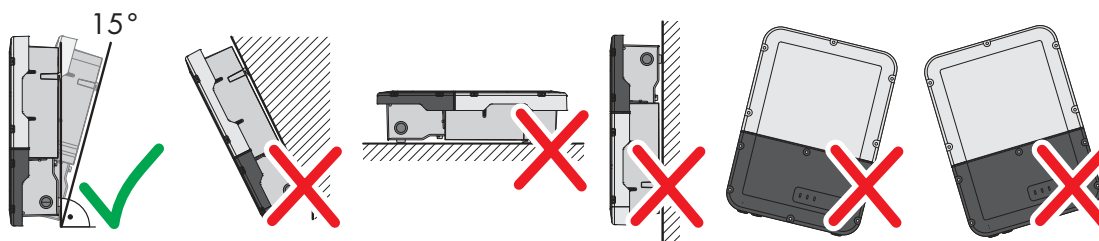


Figure 6 : Permitted and prohibited mounting positions

- ☐ Do not mount multiple inverters directly above one another.

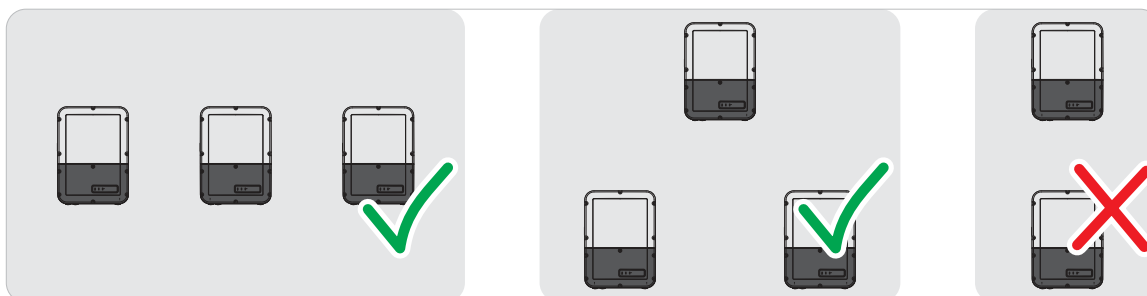


Figure 7 : Permissible and impermissible mounting positions of multiple inverters

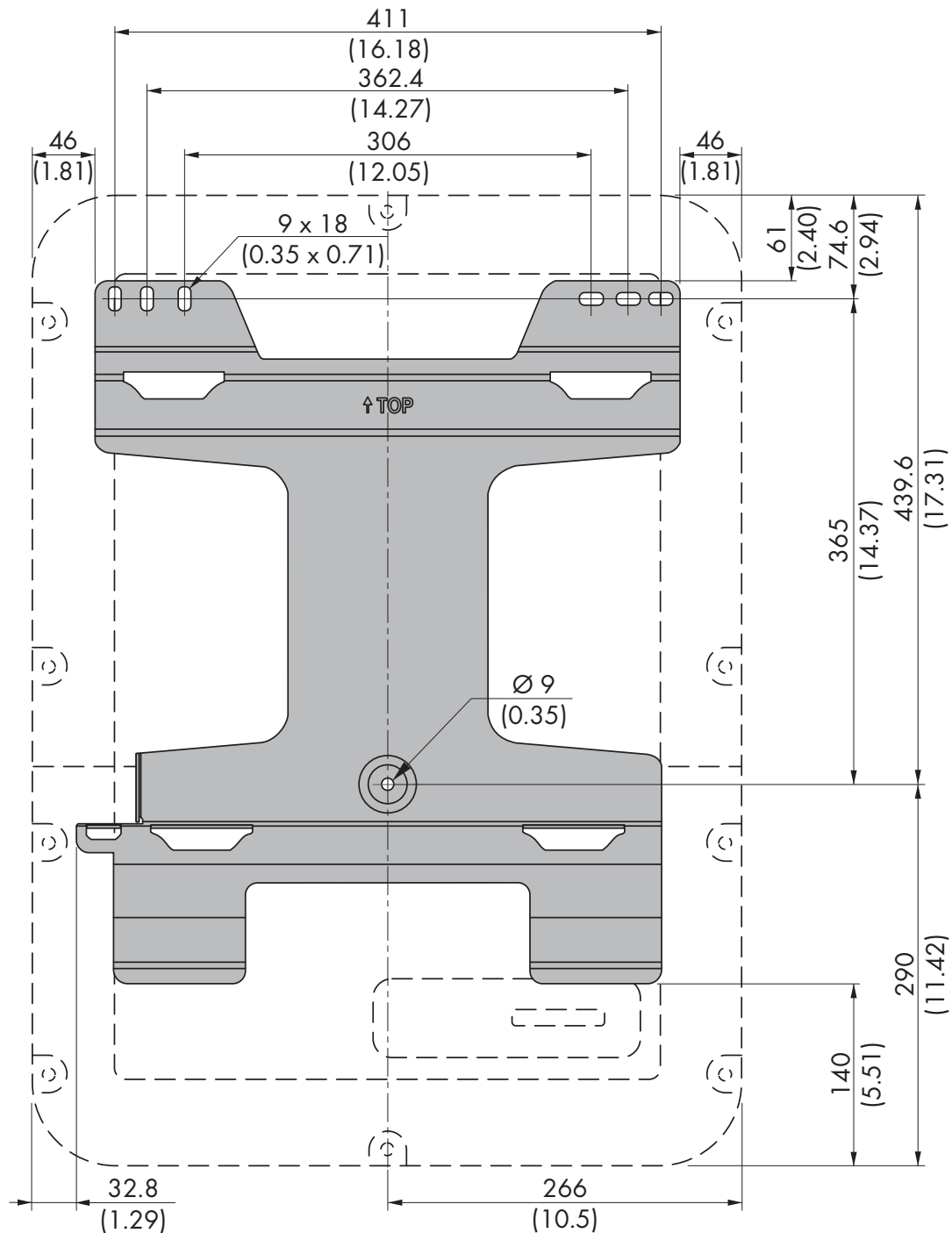
Dimensions for mounting:

Figure 8 : Position of the anchoring points(Dimensions in mm (in))

Recommended 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 clearances are permitted without causing any risk.

i Prescribed clearances in accordance with the *National Electrical Code*® or *Canadian Electrical Code*® CSA C22.1

Under certain conditions, the *National Electrical Code*® or the *Canadian Electrical Code*® CSA C22.1 specify greater clearances.

- Ensure that the prescribed clearances in accordance with the *National Electrical Code*® or *Canadian Electrical Code*® CSA C22.1 are adhered to.
- ☐ Maintain the recommended clearances to walls as well as to other inverters or objects.
- ☐ If multiple inverters are mounted in areas with high ambient temperatures, increase the clearances between the inverters and ensure sufficient fresh-air supply.

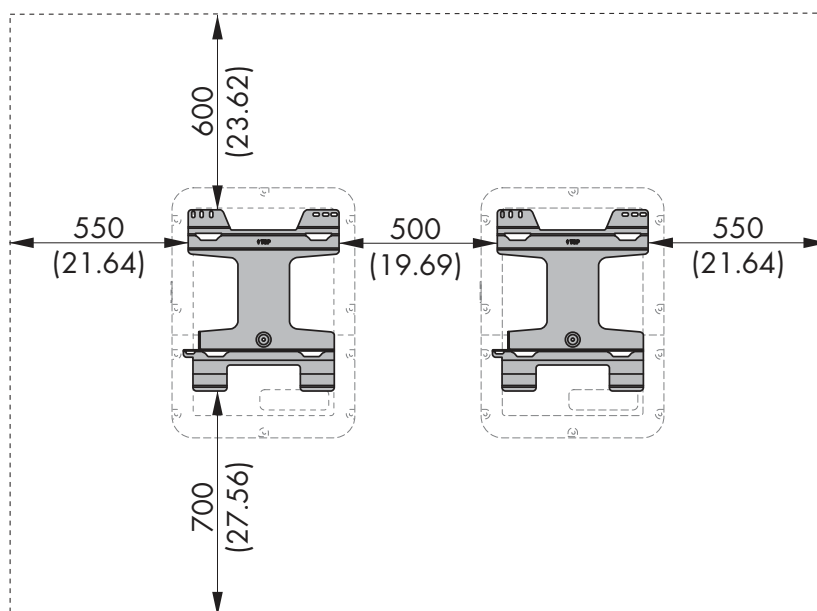


Figure 9 : Recommended clearances(Dimensions in mm (in))

5.2 Mounting the Inverter

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

- ☐ Three screws suitable for the support surface (diameter: 8 mm (5/16 in))
- ☐ Three washers suitable for the screws
- ☐ Where necessary, 3 screw anchors suitable for the support surface and the screws
- ☐ To secure the inverter against theft: one padlock suitable for outdoor use
- ☐ Padlock dimensions:
 - Diameter of the shackle: 8 mm to 10 mm (0.31 in to 0.39 in)
 - Width of the shackle (inner dimension): 30 mm to 40 mm (1.18 in to 1.57 in)
 - Height of the shackle (inner dimension): 30 mm to 40 mm (1.18 in to 1.57 in)

⚠ CAUTION**Risk of injury due to weight of product**

Injuries may result if the product is lifted incorrectly or dropped while being transported or when attaching it to or removing it from the wall mounting bracket.

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

i The Connection Unit and Power Unit can be disconnected from one another to make mounting easier

If the local conditions make it difficult to mount the entire inverter, you can disconnect the Connection Unit and Power Unit from each other if the ambient temperature is at least 0°C (32°F) and there is no frost. This way, you can transport each enclosure part and also attach to the wall mounting bracket individually. Then, during assembly, both enclosure parts must be joined again. A detailed description for how to disconnect the Connection Unit and Power Unit from each other and to individually mount them to the wall mounting bracket can be found on the Internet under www.SMA-Solar.com.

Procedure:

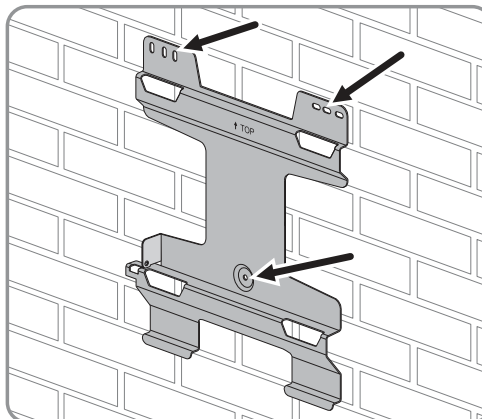
1.

⚠ CAUTION**Risk of injury due to damaged cables**

There may be power cables or other supply lines (e.g. gas or water) routed in the wall.

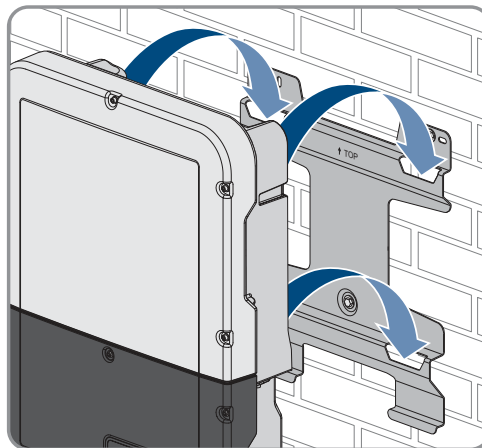
- Ensure that no lines are laid in the wall which could be damaged when drilling holes.

2. Align the wall mounting bracket horizontally on the wall and use it to mark the position of the drill holes. Here, use at least one hole each, to the right and left, and the hole at the bottom center.



3. Set the wall mounting bracket aside and drill the marked holes.
 4. Insert screw anchors into the drill holes if the support surface requires them.
 5. Secure the wall mounting bracket horizontally using screws and washers.

6. Hook the inverter into the wall mounting bracket. Here, the lugs on the rear side of the Power Unit must be hooked into the upper recesses and the lugs in the Connection Unit into the lower recesses in the wall mounting bracket.

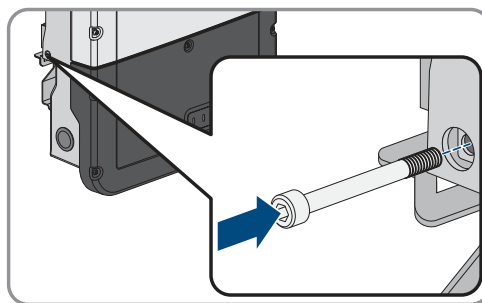


7. Check whether the inverter is securely in place.

If the Connection Unit can be moved forward, the lugs on the rear side of the Connection Unit are not hooked into the lower recesses in the wall mounting bracket. Remove the inverter from the wall mounting bracket and hook it in again.

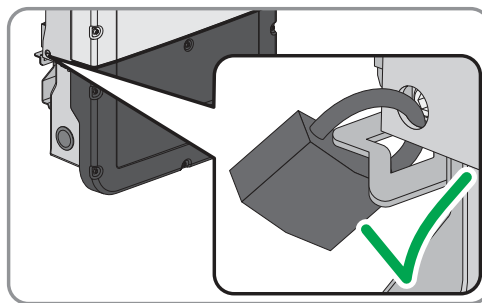
Once the Connection Unit cannot be moved forward, the inverter is securely in place.

8. Secure the inverter to the wall mounting bracket. To do this, insert the screw M5x60 through the hole on the left side of the Power Unit using a Torx screwdriver (TX 25) and tighten it (TX25, torque: $1.7 \text{ Nm} \pm 0.3 \text{ Nm}$ ($15.06 \text{ in-lb} \pm 2.65 \text{ in-lb}$)).



9. If the inverter is to be protected against theft, attach a padlock:

- To do this, guide the shackle of the padlock through the provided hole on the left side of the Power Unit and close the shackle.



- Keep the key of the padlock in a safe place.

6 Electrical Connection

6.1 Overview of the Connection Area

6.1.1 View from Below

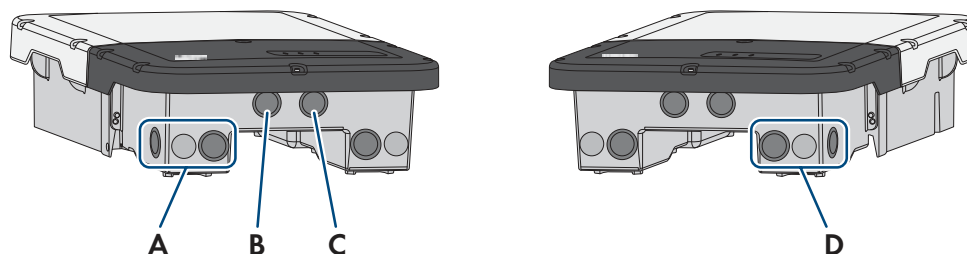


Figure 10 : Enclosure openings at the bottom of the inverter

Position	Designation
A	Enclosure opening for DC connection (for 21 mm (0.75 in) trade size conduits)
B	Enclosure opening for the battery communication cable (for 21 mm (0.75 in) trade size conduits)
C	Enclosure opening for the network cables and, if needed, for other data cables (for 21 mm (0.75 in) trade size conduits)
D	Enclosure opening for AC connection, connection cables of the outlet and switch for the secure power supply operation or for the connection cable of the switch for black start (for 21 mm (0.75 in) trade size conduits)

6.1.2 Interior View

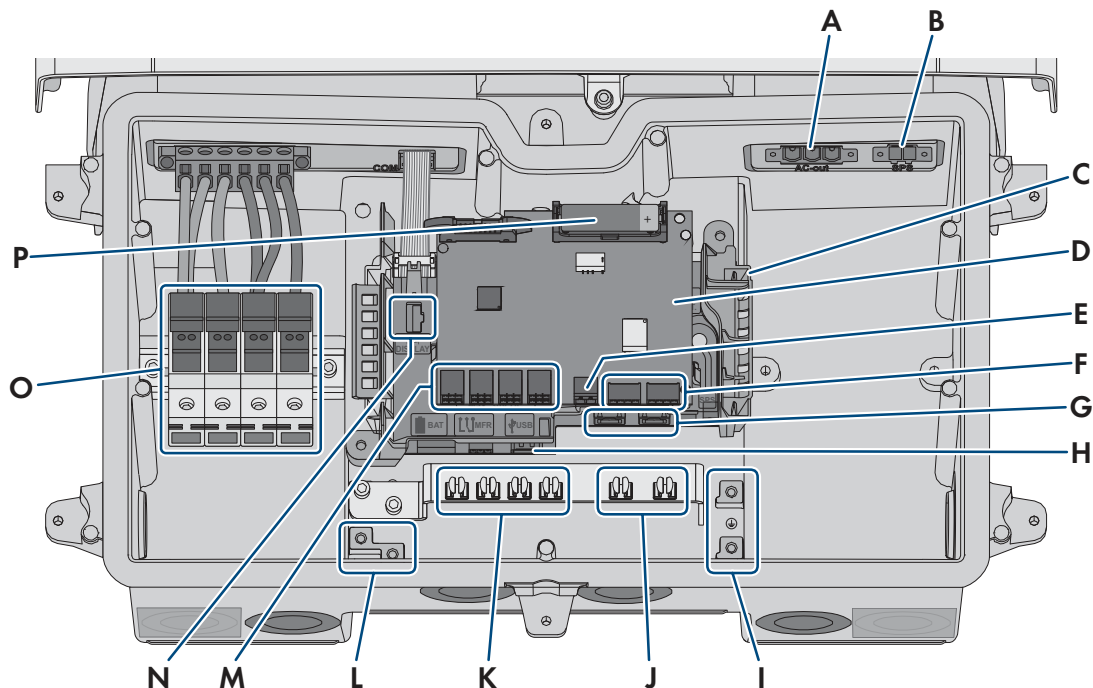


Figure 11 : Connection areas in the interior of the inverter

Position	Designation
A	Slot AC-out for den direct connection of the utility grid or of the AC electric circuit via the automatic transfer switch
B	SPS slot for connecting the secure power supply outlet
C	Communication assembly
D	Interface module of the battery
E	Jack for the switch connection for secure power supply operation or black-start function
F	Jacks for the connection of an energy meter
G	Network ports A and B for connecting a router or network switch
H	USB port for connecting a USB flash drive (for service purposes)
I	Equipment grounding terminal for the equipment grounding conductor of the utility grid, the outlet for secure power supply operation and, if necessary, an additional grounding or for the equipotential bonding
J	Shield clamps for the connection of the cable shields of the RS485 communication cables
K	Shield clamps for the connection of the cable shields of the battery communication cables

Position	Designation
L	Equipment grounding terminal for equipment grounding conductors of the battery/batteries
M	Jacks BAT1 to BAT4 for the connection of the battery communication cable and the communication cable of the automatic transfer switch
N	Jack DISPLAY for the LED assembly connection in the enclosure lid of the Connection Unit
O	Fuses for DC connection
P	Auxiliary battery (3.6 V, 2600 mAh, size: AA / 14500) After switching the black-start switch, energy is made available from the auxiliary battery in order to switch the battery and therefore also the inverter on when they are in sleep mode. The auxiliary battery is designed to function for the entire service life of the product and must not be replaced when used in the usual manner.

6.2 AC Connection

6.2.1 Requirements for the AC Connection

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

- ☐ Conduits (trade size: 21 mm (0.75 in) or smaller with suitable reducer bush)
- ☐ UL-listed raintight or liquidtight conduit fittings (trade size: 21 mm (0.75 in) or smaller with suitable reducer bush)

Requirements on the AC conductors:

- ☐ The maximum permitted temperature of the terminal block for AC connection of 105°C (221 °F) must be observed.
- ☐ The conductors with regards to its ampacity, rated temperatures, operating conditions and its power loss must be made in accordance with the local standards and the *National Electrical Code*® ANSI/NFPA 70 or the *Canadian Electrical Code*® CSA C22.1.
- ☐ Conductor type: copper wire
- ☐ Maximum permissible temperature: 75°C (+167°F) or 90°C (194°F)
- ☐ The conductors must be made of solid wire, stranded wire or fine stranded wire. When using fine stranded wire, bootlace ferrules must be used.
- ☐ Conductor cross-section: 4 mm² to 16 mm² (12 AWG to 6 AWG)

Load-break switch and cable protection:

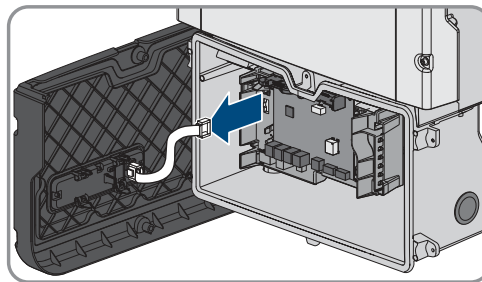
- ☐ In PV systems with multiple inverters, protect each inverter with its own overcurrent protective device. Observe the maximum permissible fuse protection (see Section 10 "Technical Data", page 69). This will prevent residual voltage from being present at the corresponding conductor after disconnection.
- ☐ The load-break switch or circuit breaker must be listed (see *National Electrical Code*® ANSI/NFPA 70) or *Canadian Electrical Code*® CSA C22.1).
- ☐ Loads installed between the inverter and the overcurrent protective device must be fused separately.
- ☐ The overcurrent protective device for the AC output circuit is to be provided by others.

6.2.2 Connecting the Inverter to the Utility Grid**Requirements:**

- ☐ All electrical installations must be carried out in accordance with the local standards and the *National Electrical Code*® ANSI/NFPA 70 or the *Canadian Electrical Code*® CSA C22.1.
- ☐ The AC and DC electric circuits are isolated from the enclosure. If required by the *National Electrical Code*® ANSI/NFPA 70 or *Canadian Electrical Code*® CSA C22.1, the installer is responsible for grounding the system.
- ☐ The connection requirements of the grid operator must be met.
- ☐ The grid voltage must be within the permissible range. The exact operating range of the inverter is specified in the operating parameters.

Procedure:

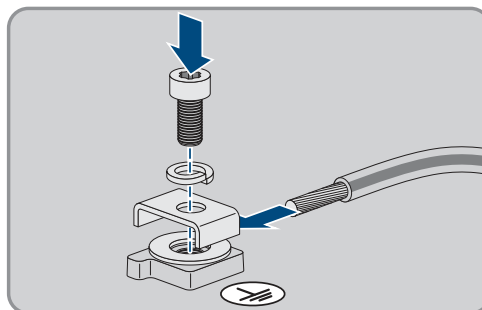
1. Disconnect the AC circuit breaker and secure it against reconnection.
2. If the enclosure lid of the Connection Unit is mounted, remove it as follows:
 - Unscrew all six screws (TX 25) and carefully remove the enclosure lid towards the front. While doing so, note that the assembly on the enclosure lid of the Connection Unit and the communication assembly in the Connection Unit are connected via a ribbon cable. During the first installation, the ribbon cable is to be connected only to the LED assembly on the enclosure lid of the Connection Unit.
 - Disconnect the ribbon cable from the socket on the communication assembly. During the first installation, the ribbon cable is to be connected only to the assembly on the enclosure lid of the Connection Unit.



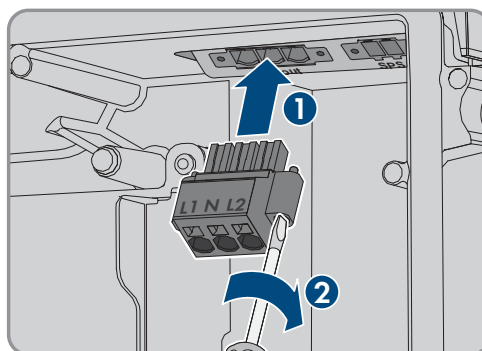
3. Remove the adhesive tape from the enclosure opening for the AC connection.
4. Insert the conduit fitting into the opening and tighten from the inside using the counter nut.
5. Attach the conduit to the conduit fitting.

6. Guide the conductors from the conduit into the inverter. In the process, install the conductors in the inverter such that they do not come into contact with communication cables, the cable of the LED assembly or other live conductors. Lay the conductors as a loop if they are too long.
7. Connect the equipment grounding conductor of the utility grid to the equipment grounding terminal:

- Strip the insulation of the equipment grounding conductor by 18 mm (0.71 in).



- Insert the screw through the spring washer, the clamping bracket and the washer.
 - Guide the equipment grounding conductor between the washer and clamping bracket and tighten the screw (TX 25) (torque: 6 Nm \pm 0.3 Nm (53.10 in-lb \pm 2.65 in-lb)).
8. Plug the terminal block for the AC connection in the **AC-out** slot in the inverter, and tighten it with a flat-blade screwdriver (blade width: 4 mm ($\frac{5}{32}$ in)) (torque: 0.3 Nm (2.65 in-lb)).



9. Ensure that the terminal block is securely in place and the screws are tightened.
10. Thread the conductors L1, L2 and N through the ferrite.
11. Strip off the conductor insulation of L1, L2 and N by 18 mm (0.71 in) each.
12. In the case of fine stranded wire, provide the conductors with a bootlace ferrule.

13. **i Connection of conductors of finely stranded wire**

To connect conductors made of finely stranded wire, each terminal point must be opened.

- First insert the connector into the terminal point all the way to the lock (round opening). Then insert a flat-blade screwdriver (blade: 4 mm ($\frac{5}{32}$ in)) as far as it can go into the actuation shaft (rectangular opening). Hereby the lock opens and the conductor can be placed into the terminal point as far as possible. After the connection has been made, the flat-blade screwdriver must be pulled out of the actuation shaft.

14.

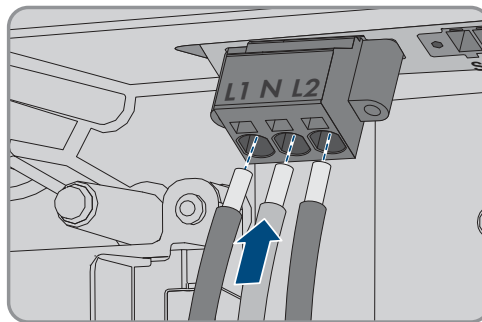
⚠ WARNING

Fire hazard due to faulty conductor connection

If the conductors are inserted into the actuation shafts (right-angled openings), a fire may occur during inverter commissioning.

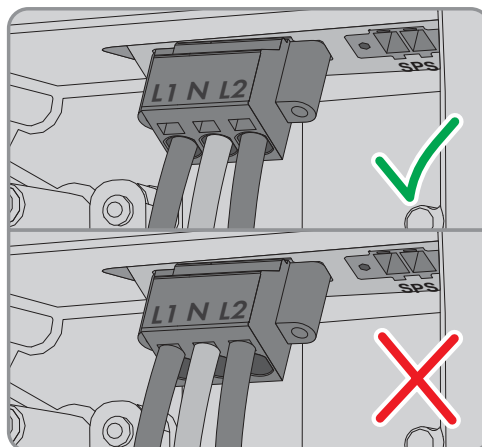
15. Connect the conductors to the terminal block for the AC connection:

- Connect the neutral conductor to the terminal block in accordance with the labeling. Insert the conductor into the corresponding terminal point (round opening) up to the stop.



- Connect L1 and L2 to the terminal block in accordance with the labeling. Insert each conductor into the corresponding terminal point (round opening) up to the stop.

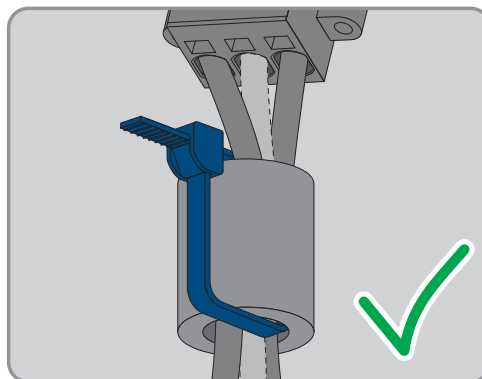
16. Ensure the conductors are plugged into the terminal points (round openings) as far as it will go and not into the actuation shafts (rectangular openings).



17. Ensure that the terminal points are allocated to the correct conductors.

18. Ensure that the conductors are plugged completely into the terminal points up to their insulation.

19. Position the ferrite as close as possible to the bottom of the AC connection terminal block and secure using the cable tie.



6.3 Connecting the Network Cables

DANGER

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

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

- Ensure that all devices in the same network and the battery are integrated into the existing surge protection.
- When laying the network cables or other data cables outdoors, it must be ensured that a suitable surge protection device is provided at the transition point of the cable from the product or the battery outdoors to the inside of a building.
- The Ethernet interface of the 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):

- One to two network cables
- Where required: Field-assembly RJ45 connector.
- If cables are routed in a conduit: conduit (trade size: 21 mm (0.75 in) or smaller with suitable reducer bush)
- If cables are routed in a conduit: UL-listed raintight or liquidtight conduit fitting (trade size: 21 mm (0.75 in) or smaller with suitable reducer bush)
- If cables are used for outdoors: one waterproof cable gland

Network cable requirements:

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

- ☐ Cable type: 100BaseTx
- ☐ Cable category: Cat5, Cat5e or higher
- ☐ Plug type: RJ45 of Cat5, 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 two nodes when using patch cables: 50 m (164 ft)
- ☐ Maximum cable length between two nodes when using installation cables: 100 m (328 ft)
- ☐ UV-resistant for outdoor use

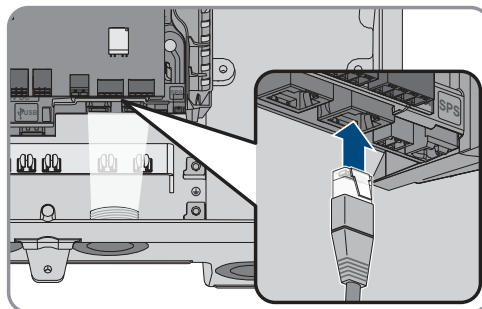
Procedure:

1.

⚠ DANGER**Danger to life due to electric shock**

- Disconnect the inverter from all voltage sources (see Section 8, page 66).

2. Remove the sealing plugs from the network connection opening on the inverter.
3. Insert the conduit fitting into the opening and tighten from the inside using the counter nut.
4. Attach the conduit to the conduit fitting.
5. Lead one end of each network cable from the conduit into the inverter.
6. Put the network plug of each cable into one of the network sockets of the communication assembly.



7. Ensure that the network connector is securely in place by pulling slightly on each cable.
8. Connect the other end of the network cable to the energy meter.

6.4 Connecting the Data Cable of the Battery and Communication Cable of the Automatic Transfer Switch

Connect the communication cable of each battery and, in battery-backup systems, the communication cable of the automatic transfer switch as described in the following.

i Communication between Inverter and Battery

- Communication between the inverter and the battery takes place via the battery communication cable via CAN bus.

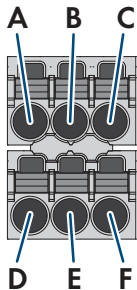
Additionally required material (not included in the scope of delivery):

- ☐ One battery communication cable for the communication between inverter and battery
- ☐ In battery-backup systems with automatic transfer switch: one communication cable between inverter and automatic transfer switch
- ☐ If cables are routed in a conduit: conduit (trade size: 21 mm (0.75 in) or smaller with suitable reducer bush)
- ☐ If cables are routed in a conduit: UL-listed raintight or liquidtight conduit fitting (trade size: 21 mm (0.75 in) or smaller with suitable reducer bush)
- ☐ If cables are used for outdoors: one waterproof cable gland

Requirements for data cable of battery:

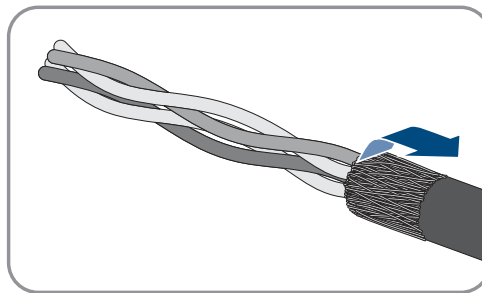
- ☐ Twisted pair conductors
- ☐ Cable category: minimum CAT5e
- ☐ Shielding: yes
- ☐ Conductor cross-section: 0.25 mm² to 0.34 mm² (24 AWG to 16 AWG)
- ☐ Recommended number of conductor pairs: 4
- ☐ External diameter: 6 mm to 8.5 mm (0.24 in to 0.33 in)
- ☐ Maximum cable length between battery and inverter and, in battery-backup systems, between automatic transfer switch and inverter: 10 m (33 ft)
- ☐ If the cables are routed together with the DC conductors in a conduit, each cable has to be insulated for 600 A.
- ☐ UV-resistant for outdoor use.
- ☐ Comply with the requirements of the battery manufacturer.

Assignment of the terminal block:

Terminal block	Position	Assignment
	A	Not assigned
	B	Enable
	C	GND
	D	CAN L
	E	CAN H
	F	Not assigned

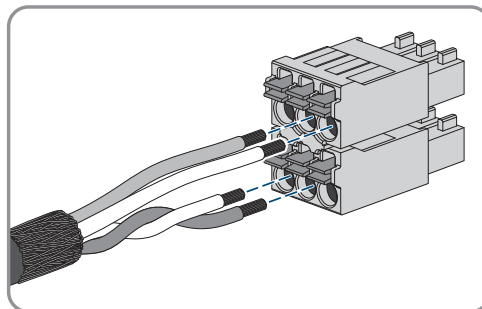
Procedure:

1. Remove the sealing plugs from the network connection opening on the inverter.
2. Insert the conduit fitting into the opening and tighten from the inside using the counter nut.
3. Attach the conduit to the conduit fitting.
4. Lead the communication cable into the inverter.
5. Strip the communication cable 50 mm (2 in).
6. Trim the cable shield to a length of 15 mm (0.59 in) and fold it over the cable sheath.

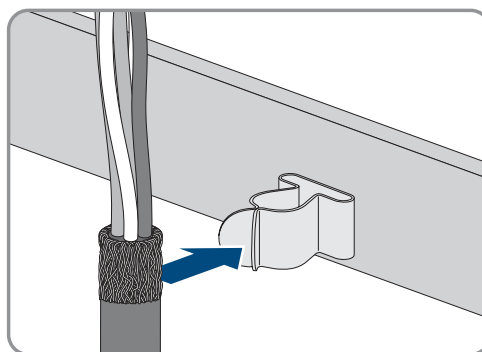
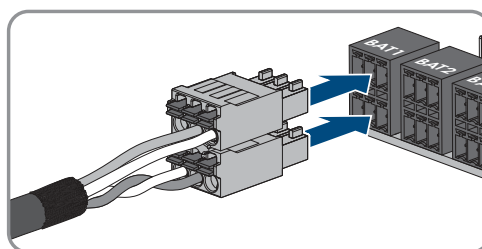


7. Strip the insulation on the insulated conductors each by 6 mm (0.24 in). The **CAN L** and **CAN H** must be a twisted pair.

8. If necessary, trim unused insulated conductors flush with the cable sheath or fold it over the cable sheath.
9. Connect the conductors of the communication cables to a 6-pole terminal block. Pay attention to the assignment of the terminal block and communication connection on the battery and/or automatic transfer switch and make sure that **CAN L** and **CAN H** consist of a pair of conductors.



10. Make sure that the conductors are plugged into the terminal points tightly by pulling slightly on the conductors.
11. Insert the terminal block for the communication connection into the jack **BATx** on the battery interface module. If only one battery is available, insert the plug into the jack **BAT1**. If multiple batteries and/or an automatic transfer switch are available, insert the communication connection of the first battery into the jack **BAT1** and connect all other communication cables in succession to the respective jacks.
12. Press the communication cable with cable shield into the shield clamp on the busbar below the communication assembly.



6.5 Connecting the energy meter

This section describes how to connect the energy meter to the inverter.

The energy meter measures the flow of energy out of and into the utility grid. The measured values of the energy meter are transmitted to the inverter and influence the charging behavior of the battery. Along with the energy meter, two electrical current strength transducers must be installed between the grid-connection point and the feed-in point of the battery inverter and the PV system.

The energy meter and the electrical current strength transducers can also be mounted in the automatic transfer switch in battery-backup systems. Observe all manufacturer specifications and safety information 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.

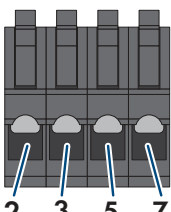
Additionally required material (not included in the scope of delivery):

- ☐ 1 approved energy meter (WattNode® Modbus WNC-3Y-208-MB or WNC-3D-240-MB from Continental Control Systems, LLC)
- ☐ One data cable
- ☐ Two electrical current strength transducers from Continental Control Systems, LLC (mechanical and electrical characteristics of the selected electrical current strength transducers must be in accordance with the installation on site)

Cable requirements:

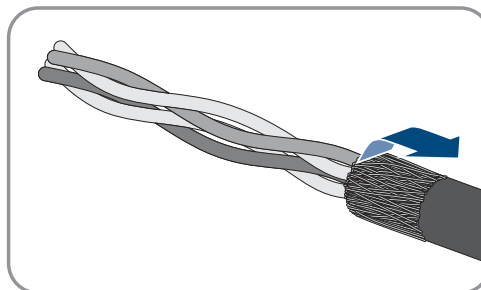
- ☐ Cross-section: at least $2 \times 2 \times 0.22 \text{ mm}^2$ (2 x 2 x 24 AWG)
- ☐ Shielding: yes
- ☐ Twisted pair conductors
- ☐ UV-resistant for outdoor use.
- ☐ Maximum cable length: 10 m (33 ft)

Assignment of the terminal block:

Plug	Position	Assignment
	2	Data+ (D+)
	3	Not assigned
	5	Ground (GND)
	7	Data (D-)

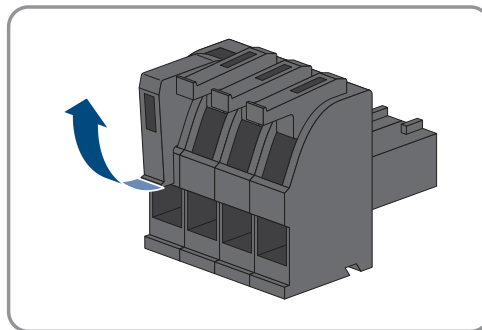
Procedure:

1. Strip the RS485 communication cable 50 mm (2 in).
2. Trim the cable shield to a length of 15 mm (0.59 in) and fold it over the cable sheath.

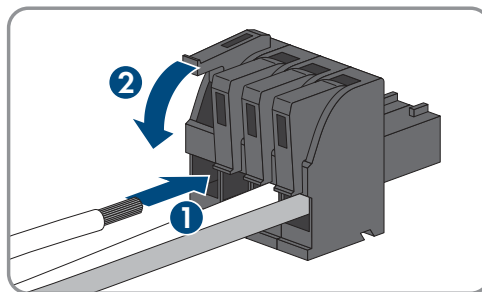


3. Strip the insulation on the insulated conductors each by 6 mm (0.24 in).
4. If necessary, trim unused insulated conductors flush with the cable sheath or fold it over the cable sheath.

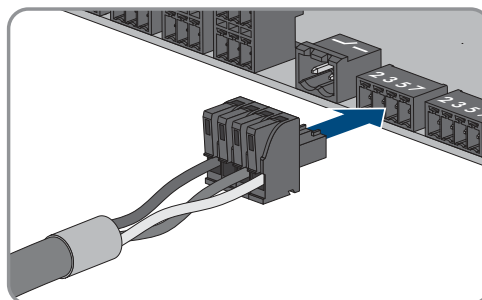
5. Unlock the terminal points of the 4-pole terminal block.



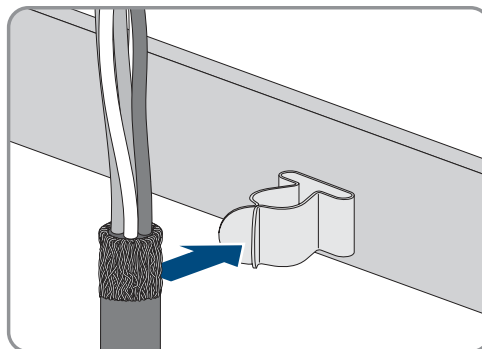
6. Connect the conductors of the RS485 communication cables to a 4-pole terminal block. To this end, insert the conductors into the terminal points and unlock the terminal points by pressing the lever down. Observe the terminal block assignment.



7. Ensure that the conductors are plugged into the terminal points tightly by pulling slightly on the conductors.
8. Insert the 4-pole terminal block for the communication connection into the jack BATx on the battery interface module.

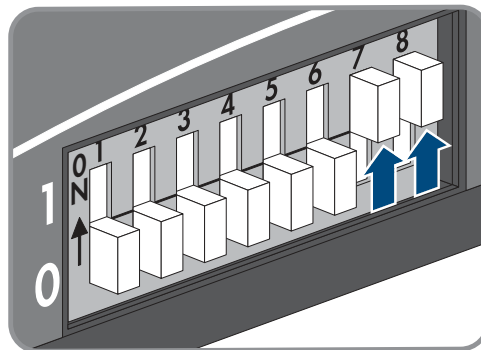


9. Press the RS485 communication cable with cable shield into the shield clamp on the busbar below the communication assembly.



10. Connect the RS485 cable to the energy meter (see energy meter manual).

11. Configure the energy meter for operation with the inverter. When doing so, set the DIP switches **7** and **8** to **ON (1)** and the DIP switches **1** through **6** to **0**. This ensures that the energy meter data can be transmitted to the inverter.



6.6 Connecting the Switch and Outlet for Secure Power Supply Operation

i Neutral and grounding conductor of output for secure power supply permanently connected

The inverter's output for secure power supply includes a permanent connection between neutral and grounding conductor, which cannot be disconnected.

Requirements:

- ☐ The technical requirements must be met for connecting the switch and outlet for secure power supply operation (see Section 10 "Technical Data", page 69).
- ☐ All electrical installations must be carried out in accordance with the local standards and the *National Electrical Code*® ANSI/NFPA 70 or the *Canadian Electrical Code*® CSA C22.1.

Residual-current device:

- ☐ SMA Solar Technology AG recommends to install a residual-current device (type A) between the inverter's output for secure power supply and the outlet for secure power supply operation, which trips at a residual current of 30 mA. Observe all locally applicable standards and directives when doing so.

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

- ☐ One standard outlet
- ☐ One standard switch (e.g. light switch)
- ☐ Conduits (trade size: 21 mm (0.75 in) or smaller with suitable reducer bush)
- ☐ UL-listed raintight or liquidtight conduit fittings (trade size: 21 mm (0.75 in) or smaller with suitable reducer bush)

Procedure:

- Connect the outlet for secure power supply operation.
- Connect the switch for secure power supply operation.

Connect the outlet for secure power supply operation

Requirements on the conductors:

- ☐ The conductors with regards to its ampacity, rated temperatures, operating conditions and its power loss must be made in accordance with the local standards and the *National Electrical Code*® ANSI/NFPA 70 or the *Canadian Electrical Code*® CSA C22.1.
- ☐ Conductor type: copper wire
- ☐ The conductors must be made of solid wire, stranded wire or fine stranded wire. When using fine stranded wire, bootlace ferrules must be used.
- ☐ Conductor cross-section: 2.5 mm² to 4 mm² (14 AWG to 12 AWG)
- ☐ Maximum length of conductors: 10 m (33 ft)

Procedure:

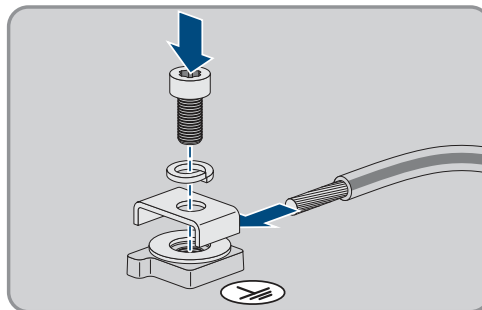
1.

⚠ DANGER

Danger to life due to high voltages

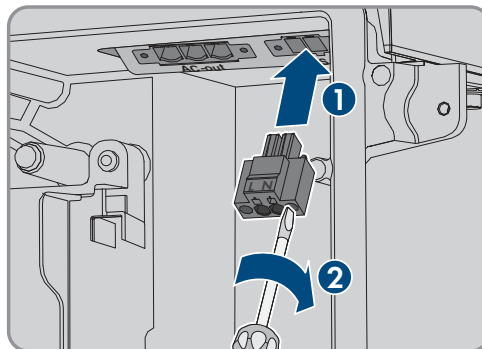
- Ensure that the inverter is disconnected from all voltage sources (see Section 8, page 66).

2. Remove the sealing plug from the enclosure opening for connecting the outlet for secure power supply operation.
3. Insert the conduit fitting into the opening and tighten from the inside using the counter nut.
4. Attach the conduit to the conduit fitting.
5. Guide the conductors into the inverter.
6. Connect the equipment grounding conductor of the outlet for secure power supply operation to an equipment grounding terminal:
 - Strip the insulation of the equipment grounding conductor by 18 mm (0.71 in).
 - Insert the screw through the spring washer, the clamping bracket and the washer.



- Guide the equipment grounding conductor between the washer and clamping bracket and tighten the screw (TX 25) (torque: 6 Nm ± 0.3 Nm (53.10 in-lb ± 2.65 in-lb)).

7. Plug the terminal block for connecting the outlet for secure power supply operation into the **SPS** slot in the inverter and tighten it with a flat-blade screwdriver (blade width: 4 mm ($5/32$ in)).



8. Ensure that the terminal block is securely in place.
 9. Strip off the conductor insulation by max. 15 mm (0.59 in).
 10. In the case of finely stranded wire, provide the conductors L and N with a bootlace ferrule.

11. **i** **Connection of conductors of finely stranded wire**

To connect conductors made of finely stranded wire, each terminal point must be opened.

- First insert the connector into the terminal point all the way to the lock (round opening). Then insert a flat-blade screwdriver (blade: 3.2 mm ($1/8$ in)) as far as it can go into the actuation shaft (rectangular opening). Hereby the lock opens and the conductor can be placed into the terminal point as far as possible. After the connection has been made, the flat-blade screwdriver must be pulled out of the actuation shaft.

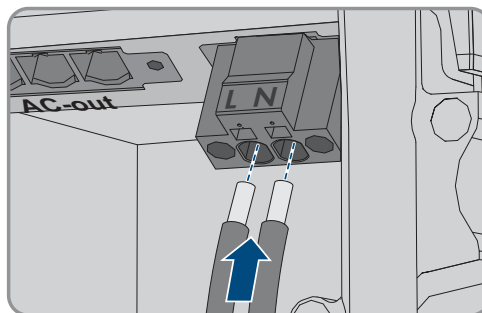
12.

! WARNING

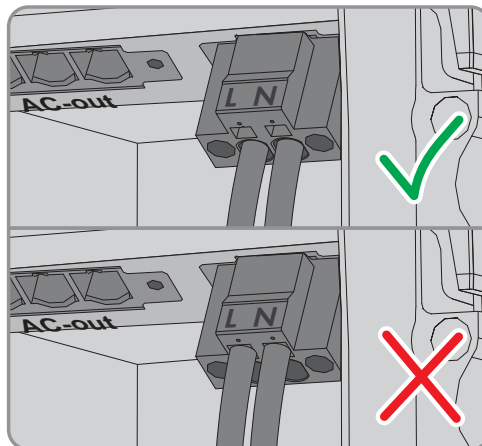
Fire hazard due to faulty conductor connection

If the conductors are inserted into the actuation shafts (right-angled openings), a fire may occur during inverter commissioning.

13. Connect the conductors L and N to the terminal block in accordance with the labeling. Insert each conductor into the corresponding terminal point (round opening) up to the stop.



14. Ensure the conductors are plugged into the terminal points (round openings) as far as it will go and not into the actuation shafts (rectangular openings).



15. Ensure that the terminal points are allocated to the correct conductors.
16. Ensure that the conductors are plugged completely into the terminal points up to their insulation.
17. Install outlet in desired position (e.g. next to the inverter or as switch/outlet combination optionally at short distance from the inverter (to max. 10 m (393.7 in))).
18. Connect the other end of the cable using it directly as energy supply to the outlet.

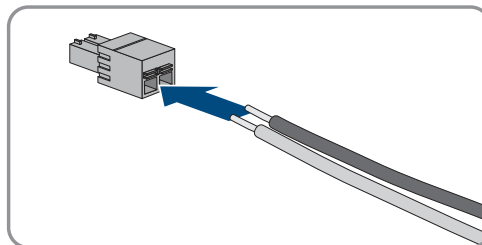
Connect the switch for secure power supply operation


Requirements on the conductors:

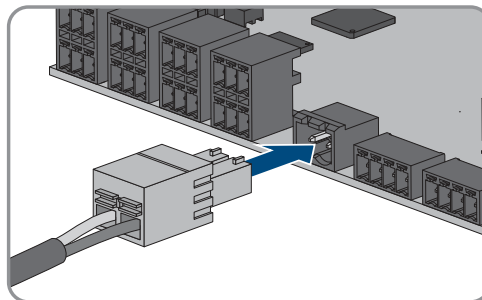
- ☐ Conductor cross-section: 0.2 mm² to 2.5 mm² (24 AWG to 14 AWG)
- ☐ The conductor type and wiring method must be appropriate for the application and location.
- ☐ Maximum length of conductors: 10 m (393.7 in)

Procedure:

1. Remove the sealing plug from the opening for connecting the switch for secure power supply operation.
2. Insert the conduit fitting into the opening and tighten from the inside using the counter nut.
3. Attach the conduit to the conduit fitting.
4. Guide the conductors into the inverter.
5. Strip off the conductor insulation by min. 6 mm (0.24 in) to max. 10 mm (0.39 in).
6. Connect the conductors to the 2-pole terminal blocks. Ensure that the conductors are plugged completely into the terminal points up to their insulation.



7. Stick the terminal block into the slot  on the battery interface module in the inverter.



8. Ensure that the terminal block is securely in place.
9. Ensure that all conductors are correctly connected.
10. Ensure that the conductors sit securely in the terminal points. Tip: To release the conductors from the terminal block, open the terminal points using a suitable tool.
11. Install switch in desired position (e.g. next to the inverter or as switch/outlet combination optionally at short distance from the inverter (to max. 10 m (393.7 in))).
12. Connect the other end of the cable directly to the switch.

6.7 Connecting Switch for black start (in battery-backup systems)

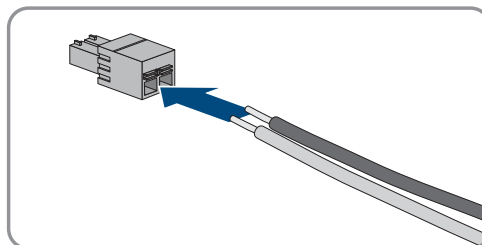
The switch for black start is connected to the same jack as the switch for secure power supply operation. Observe that the secure power supply operation is not available in battery-backup systems.


Requirements on the conductors:

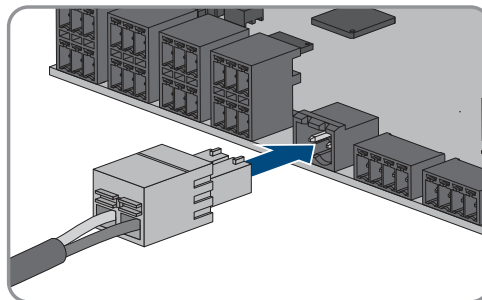
- ☐ Conductor cross-section: 0.2 mm² to 2.5 mm² (24 AWG to 14 AWG)
- ☐ The conductor type and wiring method must be appropriate for the application and location.
- ☐ Maximum length of conductors: 10 m (393.7 in)

Procedure:

1. Remove the sealing plug from the opening for connecting the switch for secure power supply operation.
2. Insert the conduit fitting into the opening and tighten from the inside using the counter nut.
3. Attach the conduit to the conduit fitting.
4. Guide the conductors into the inverter.
5. Strip off the conductor insulation by min. 6 mm (0.24 in) to max. 10 mm (0.39 in).
6. Connect the conductors to the 2-pole terminal blocks. Ensure that the conductors are plugged completely into the terminal points up to their insulation.



7. Stick the terminal block into the slot  on the battery interface module in the inverter.



8. Ensure that the terminal block is securely in place.
 9. Ensure that all conductors are correctly connected.
 10. Ensure that the conductors sit securely in the terminal points. Tip: To release the conductors from the terminal block, open the terminal points using a suitable tool.
 11. Install switch in desired position (e.g. next to the inverter or as switch/outlet combination optionally at short distance from the inverter (to max. 10 m (393.7 in))).
 12. Connect the other end of the cable directly to the switch.

6.8 DC Connection

6.8.1 Possible Connection

The inverter includes the multi-battery function. This enables to charge and discharge several batteries of the same or different type.

Each DC terminal is designed for a maximum charging/discharging current of 10 A. You can choose between the following connection possibilities:

- Connection of two batteries: The first has a charging/discharging current limit of 20 A and the second 10 A.
- Connection of one single battery with a charging/discharging current limit of 10 A.
- Connection of one single battery with a charging/discharging current limit of 20 A.
- Connection of one single battery with a charging/discharging current limit of 30 A.
- Connection of three batteries with a charging/discharging current limit of 10 A each.

In the following sections, you find detailed information as well as a wiring- and connection overview for each connection possibility.

6.8.1.1 Connection of Two Batteries

You may connect two batteries to the inverter:

- Connection of two batteries with varying charging/discharging current limits.
- Connection of two batteries with a charging/discharging current limit of 10 A each.

Connection of two batteries with varying charging/discharging current limits.

The DC terminals A and B of the inverter are connected in parallel as standard. The parallelly connected DC terminal A/B limits the charging/discharging current to 20 A and the DC terminal C to 10 A.

Procedure:

The battery limited to a charging/discharging current of 20 A must be connected to the terminal blocks of the fuse holder A/B.

The battery limited to a charging/discharging current of 10 A must be connected to the terminal blocks of the fuse holder C.

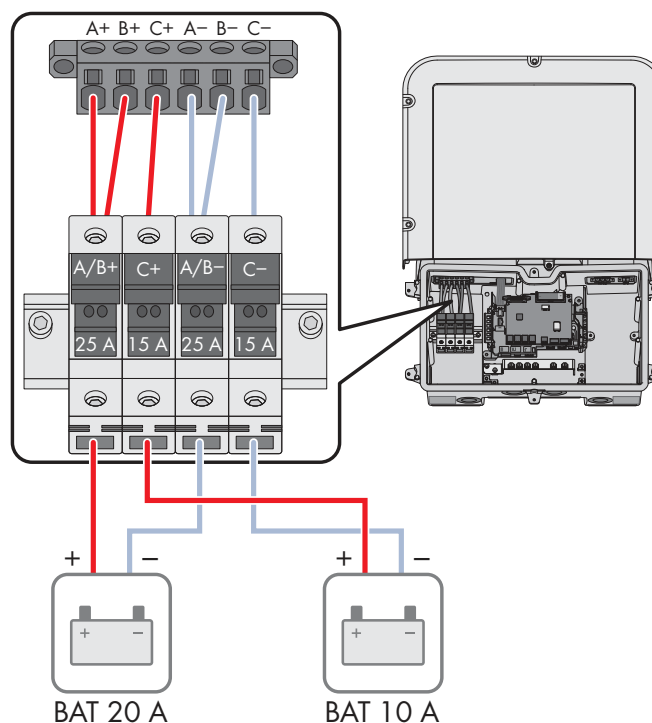


Figure 12 : Overview for connection of two batteries with varying charging/discharging current limits

Connection of two batteries with a charging/discharging current limit of 10 A each

The DC terminals A and B of the inverter are connected in parallel as standard. The parallelly connected DC terminal A/B limits the charging/discharging current to 20 A and the DC terminal C to 10 A.

If you want to connect two batteries with a charging/discharging current limit of 10 A each, proceed as follows: First, remove the parallel connection of the DC terminal A/B. Then replace the 25 A fuses of the fuse holder A/B with 15 A fuses. When the parallel connection has been removed and the fuses replaced, the DC terminal A/B is able to limit the charging/discharging current to 10 A.

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

- ☐ One cylindrical fuse link (15 A, 10x38 mm, ≥ 600 V DC)
- ☐ DC conductor for connection to fuse holders The requirements in terms of the DC conductors used for connection to the fuse holders must be met (see Section 6.8.2 "Requirements for the DC Connection", page 53).

Procedure:

The wiring between the fuse holders A/B and DC terminal block must be changed: The conductors between the fuse holders A/B and terminal block B must be removed.

The 25 A fuses in the fuse holders A/B must be replaced with 15 A fuses.

One battery must be connected to the terminal blocks A/B and the other to the terminal blocks of the fuse holders C.

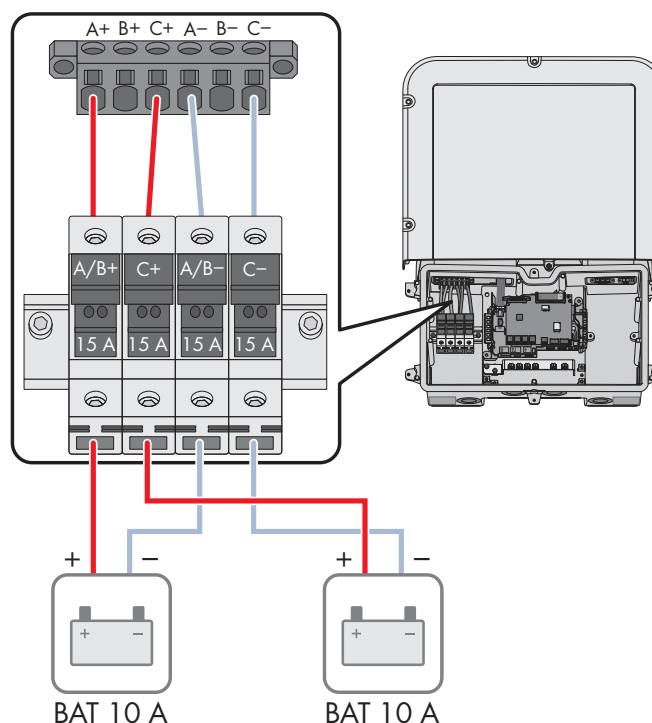


Figure 13 : Overview for connection of two batteries with a charging/discharging current limit of 10 A each

6.8.1.2 Connection of a battery with a charging/discharging current limit of 10 A

Usually, the DC terminal C is used for the connection of a battery with a charging/discharging current limit of 10 A. If the battery is connected to the fuse holders C, the black-start function will not be available.

If you want to use the black-start function, the parallel connection of the DC terminals A and B must be removed and the battery connected to the fuse holders A/B.

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

- ☐ DC conductor for connection to fuse holders The requirements in terms of the DC conductors used for connection to the fuse holders must be met (see Section 6.8.2 "Requirements for the DC Connection", page 53).

Procedure:

The wiring between the fuse holders A/B and DC terminal block must be changed: The conductors between the fuse holders A/B and terminal block B must be removed.

The cylindrical fuse links of the fuse holders A/B and C must be replaced. The removal of the cylindrical fuse links must be documented (e.g. on the label underneath the fuse holders).

The battery must be connected to the terminal blocks of the fuse holder A/B.

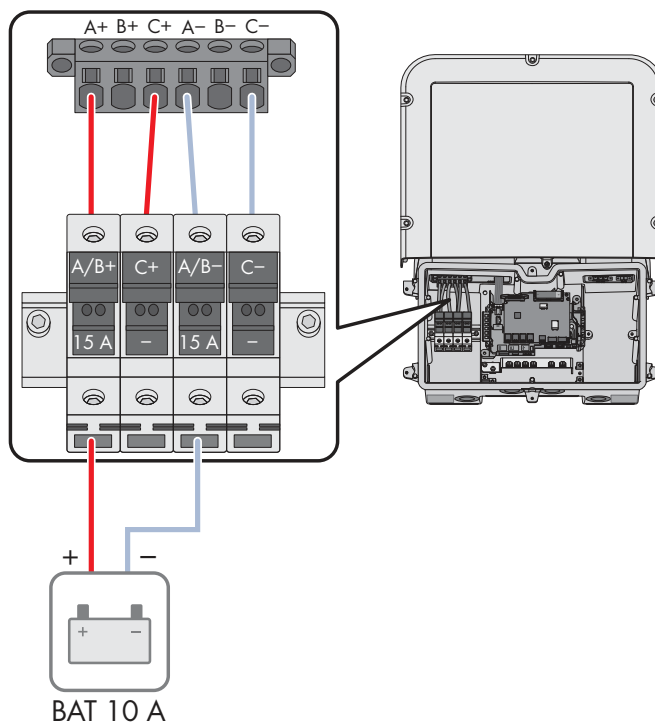


Figure 14 : Overview for connection of one battery with a charging/discharging current limit of 10 A (with black-start function)

6.8.1.3 Connection of one battery with a charging/discharging current limit of 20 A

The DC terminals A and B of the inverter are connected in parallel as standard. The parallelly connected DC terminal A/B limits the charging/discharging current to 20 A.

The battery with a charging/discharging current limit of 20 A must be connected to the terminal blocks of the fuse holder A/B.

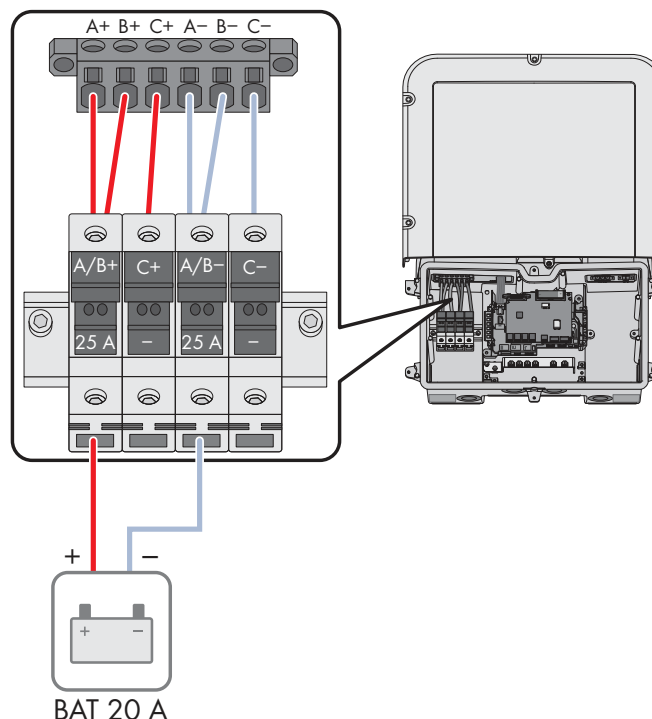


Figure 15 : Overview for connection of one battery with a charging/discharging current limit of 20 A

6.8.1.4 Connection of a battery with a charging/discharging current limit of 30 A

Each DC terminal is designed for a maximum charging/discharging current of 10 A. For the connection of a battery with a charging/discharging current limit of 30 A, all DC terminals must be switched in parallel.

The installed standard fuse holders and fuses cannot be used for the connection of a battery with a charging/discharging current limit of 30 A. The DC terminals must be modified.

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

- ☐ Two fuse holders for cylindrical fuses (14x51 mm)
- ☐ Two cylindrical fuse links (40 A, 14x51 mm, ≥ 600 V DC)
- ☐ DC conductors for connection between fuse holders and DC terminal block The requirements in terms of DC conductors for connection between fuse holders and DC terminal block must be met (see Section 6.8.2 "Requirements for the DC Connection", page 53).
- ☐ DC conductor for connection to fuse holders The requirements in terms of the DC conductors used for connection to the fuse holders must be met (see documentation of fuse holders).

Procedure:

The wiring between the fuse holders A/B and DC terminal block and all fuse holders must be removed.

Two new fuse holders with a 40 A cylindrical fuse link must be installed and connected with DC terminal blocks. All terminals must be switched parallelly.

The battery must be connected to the terminal blocks of the new fuse holder.

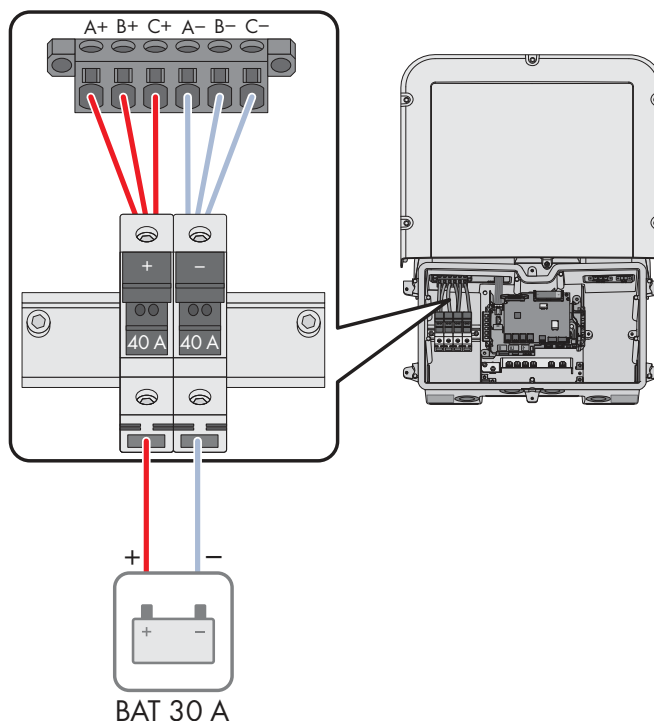


Figure 16 : Overview for connection of one battery with a charging/discharging current limit of 30 A

6.8.1.5 Connection of Three Batteries

To connect three batteries with a charging/discharging current limit of 10 A each, the parallel connection of the DC terminals A and B must be removed. The installed standard fuse holders and fuses can be used for the connection of a maximum of two batteries. To connect three batteries, two external fuse holders are required that must be connected with the DC terminal block in the inverter.

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

- ☐ Two fuse holders for cylindrical fuses (10x38 mm)
- ☐ Four cylindrical fuse link (15 A, 10x38 mm, ≥ 600 V DC)
- ☐ DC conductors for connection between fuse holders and DC terminal block The requirements in terms of DC conductors for connection between fuse holders and DC terminal block must be met (see Section 6.8.2 "Requirements for the DC Connection", page 53).
- ☐ DC conductor for connection to fuse holders The requirements in terms of the DC conductors used for connection to the fuse holders must be met (see Section 6.8.2 "Requirements for the DC Connection", page 53).

Procedure:

The two new fuse holders incl. fuses must be installed outside the inverter.

The wiring between the fuse holders A/B and DC terminal block must be changed: The wiring between the fuse holders A/B and DC terminal block A must be removed.

The outputs of the new fuse holders must be connected with DC terminal block A in the inverter. The 25 A cylindrical fuse links of the fuse holders A/B must be replaced with 15 A cylindrical fuse links.

Two batteries must be connected to the fuse holders A/B and C inside the inverter. One battery must be connected to the new fuse holders outside the inverter.

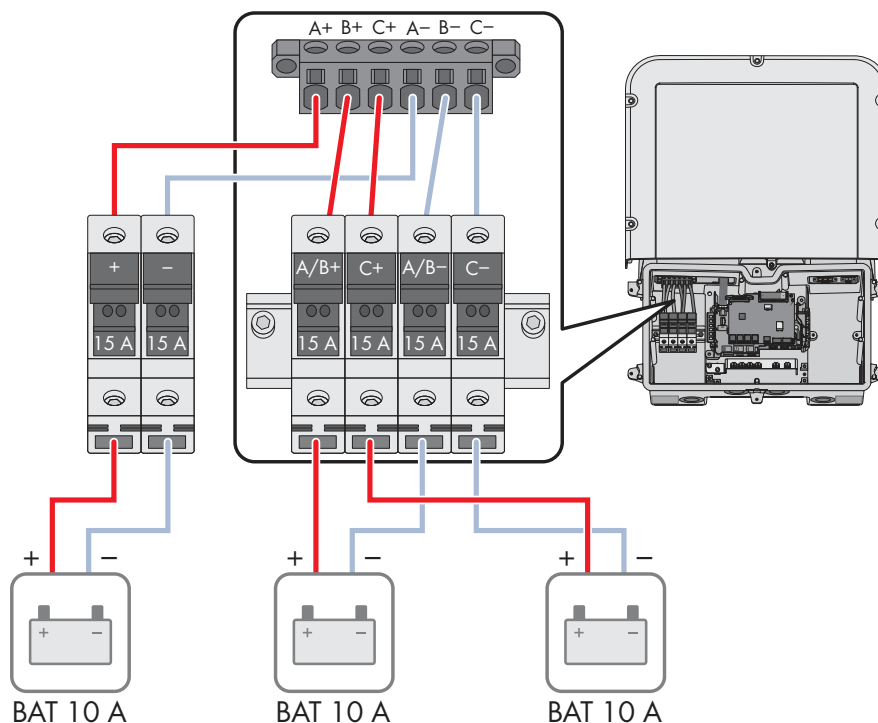


Figure 17 : Overview for connection of three batteries with a charging/discharging current limit of 10 A each

6.8.2 Requirements for the DC Connection

Fusing the DC terminals:

The DC terminals A and B are connected in parallel as standard. The DC terminal A/B is secured by a 25 A fuse (10x38 mm, 1000 V DC). The DC terminal C is secured by a 15 A fuse (10x38 mm, 1000 V DC). The fuses protect the inverter and battery against short-circuit currents. The fuses must only be replaced by fuses of the same type. If all three terminals are switched in parallel, a 40 A fuse must be used. For this purpose, the DC connection area must be modified.

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

- ☐ Conduits (trade size: 21 mm (0.75 in) or smaller with suitable reducer bush)
- ☐ UL-listed raintight or liquidtight conduit fittings (trade size: 21 mm (0.75 in) or smaller with suitable reducer bush)

Requirements on the DC conductors:

- ☐ The conductors with regards to its ampacity, rated temperatures, operating conditions and its power loss must be made in accordance with the local standards and the *National Electrical Code*® ANSI/NFPA 70 or the *Canadian Electrical Code*® CSA C22.1.
- ☐ The DC terminal block temperature rating is +90°C (+194°F).
- ☐ The maximum permitted temperature for the fuses of the DC connection of 105°C (221°F) must be observed.
- ☐ Conductor type: copper wire
- ☐ Maximum permissible temperature: 75°C (+167°F) or 90°C (194°F)
- ☐ The conductors must be made of solid wire, stranded wire or fine stranded wire. When using fine stranded wire, bootlace ferrules must be used.
- ☐ Conductor cross-section: 2.5 mm² to 10 mm² (14 AWG to 8 AWG)
- ☐ Maximum length of conductors: 10 m (33 ft)

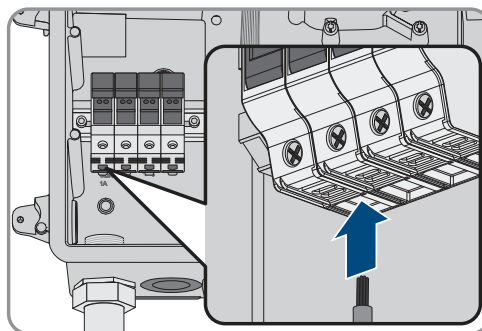
6.8.3 Connecting the power cable of the battery**⚠ DANGER****Danger to life from electric shock due to live DC cables at the battery.**

The DC cables connected to a battery may be live. Touching the DC conductors or the live components leads to lethal electric shocks.

- Ensure that the inverter is disconnected from all voltage sources.
- Do not touch non-insulated cable ends.

Procedure:

1. Remove the adhesive tape from the enclosure opening for the DC connection and, if other enclosure openings are to be used, take the sealing plugs out of these enclosure openings.
2. Insert the conduit fitting into the opening and tighten from the inside using the counter nut.
3. Attach the conduit to the conduit fitting.
4. Guide the conductors from the conduit into the inverter. In the process, install the conductors in the inverter such that they do not come into contact with communication cables, the cable of the LED assembly or other live conductors. Lay the conductors as a loop if they are too long.
5. Strip off the conductor insulation.
6. Connect the conductors to the fuse holders in accordance with the labeling. To do so, insert each conductor into the terminal point of the fuse holder and tighten the screw (PZ 2, torque: 2 Nm to 2.5 Nm (18 in-lb to 22 in-lb)).



7. Ensure that the terminal points are allocated to the correct conductors.
8. Ensure that the conductors are plugged completely into the terminal points up to their insulation.

7 Commissioning

7.1 Commissioning Procedure

This section describes the commissioning procedure and gives an overview of the steps you must perform in the prescribed order.

Procedure	See
1. Commission the inverter.	see section 7.2, page 56
2. Establish a connection to the user interface of the inverter. There are various connection options to choose from for this: <ul style="list-style-type: none"> • Direct connection via WLAN • Direct connection via Ethernet • Connection via WLAN in the local network • Connection via Ethernet in the local network 	see section 7.3, page 58
3. Log into the user interface.	see section 7.4, page 62
4. Select the inverter configuration option. Please note that the SMA Grid Guard code for changing the grid-relevant parameters must be available after completion of the first ten feed-in hours or installation assistant (see "Application for the SMA Grid Guard code" available at www.SMA-Solar.com).	see section 7.5, page 63
5. Ensure that the country data set has been configured correctly.	Inverter user manual
6. Make further inverter settings as needed.	Inverter user manual

7.2 Commissioning the Inverter

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.

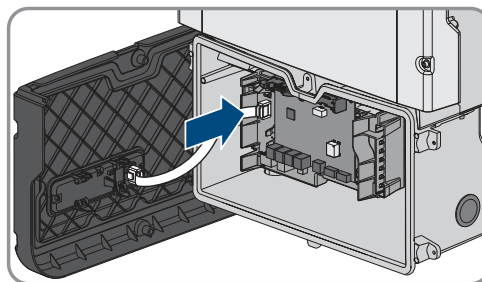
- Before commissioning the system, verify that the battery is not fully discharged.
- Do not commission the system if the battery is fully discharged.
- If the battery is fully discharged, contact the battery manufacturer for further proceedings.
- Only charge fully discharged batteries as instructed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

Requirements:

- ☐ The AC circuit breaker must be correctly rated and mounted.
- ☐ The inverter must be correctly mounted.
- ☐ All conductors must be correctly connected.
- ☐ Unused enclosure openings must be sealed tightly with sealing plugs.

Procedure:

1. Lead the enclosure lid to the Connection Unit and plug the ribbon cable into the socket on the communication assembly.



2. Ensure that the ribbon cable is securely plugged into the sockets at both ends.
3. Position the enclosure lid of the Connection Unit on the enclosure and tighten all 6 screws crosswise (TX 25, torque: $3 \text{ Nm} \pm 0.3 \text{ Nm}$ ($26.55 \text{ in-lb} \pm 2.65 \text{ in-lb}$)).
4. Switch on the AC circuit breaker.
5. Switch on the battery or the load-break switch of the battery (see documentation of the battery manufacturer).
 - ☒ All three LEDs light up. The start-up phase begins.
 - ☒ All three LEDs go out again after approximately 90 seconds.
 - ☒ Depending on the available power, the green LED pulses or is continuously illuminated. The inverter is feeding in.
6. If the LEDs do not start to glow, the ribbon cable between the assembly in the enclosure lid and the communication assembly in the inverter is most likely not properly plugged in. Ensure that the ribbon cable is securely plugged into the sockets at both ends.
7. 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.
8. If the red LED lights up, an error has occurred. Rectify the error (for information regarding troubleshooting see the user manual under www.SMA-Solar.com).

7.3 Establishing a connection to the user interface

7.3.1 Establishing a Direct Connection via Ethernet


Requirements:

- ☐ The product must be commissioned.
- ☐ An end device (e.g. computer) with an Ethernet interface must be available.
- ☐ The product must be connected directly to the end device.
- ☐ The respective latest version of one of the following web browsers must be installed: Chrome, Edge, Firefox, Internet Explorer or Safari.
- ☐ The SMA Grid Guard code of the Installer must be available for the changing of grid-relevant settings after completion of the first ten feed-in hours or installation assistant (see "Application for SMA Grid Guard Code" at www.SMA-Solar.com).

IP address of the inverter

- Standard inverter IP address for direct connection via Ethernet: 169.254.12.3

Procedure:

1. Open the web browser of your device, enter the IP address **169.254.12.3** in the address line and press the enter key.
 2.  **Web browser signals a security vulnerability**
After the IP address has been confirmed by pressing the enter key, a message might appear indicating that the connection to the user interface of the inverter is not secure. SMA Solar Technology AG guarantees that calling up the user interface is secure.
 - Continue loading the user interface.
- ☒ The login page of the user interface opens.

7.3.2 Establishing a direct connection via WLAN

Requirements:

- ☐ The product must be commissioned.
- ☐ An end device (e.g. computer, tablet PC or smartphone) must be available.
- ☐ The respective latest version of one of the following web browsers must be installed: Chrome, Edge, Firefox, Internet Explorer or Safari.
- ☐ JavaScript must be enabled in the web browser of the end device.
- ☐ The SMA Grid Guard code of the Installer must be available for the changing of grid-relevant settings after completion of the first ten feed-in hours or installation assistant (see "Application for SMA Grid Guard Code" at www.SMA-Solar.com).

i SSID, IP address and necessary passwords

- SSID in WLAN: SMA[serial number] (e.g. SMA0123456789)
- Standard WLAN password (usable until completion of the configuration by means of the installation assistant or prior to the end of the first ten feed-in hours): SMA12345
- Device-specific WLAN password (usable for initial configuration to completion of the first ten feed-in hours): see WPA2-PSK on the type label of the inverter or on the back of the manual included in the delivery
- Standard IP address for a direct connection via WLAN outside of a local network: 192.168.12.3

i Importing and exporting files with end devices having an iOS operating system is not possible.

For technical reasons, importing and exporting files (e.g. importing an inverter configuration, saving the current inverter configuration or exporting events and parameters) is not possible with mobile end devices having an iOS operating system.

- Use an end device that does not have an iOS operating system for importing and exporting files.

The procedure can be different depending on the end devices. If the procedure described does not apply to your end device, establish the direct connection via WLAN as described in the manual of your end device.

Procedure:

1. If your end device has a WPS function:
 - Activate the WPS function on the inverter. To do this, tap twice on the enclosure lid of the Connection Unit.
 - ☒ The blue LED flashes quickly for approx. two minutes. The WPS function is active during this time.
 - Activate the WPS on your end device.
 - ☒ The connection with your end device will be established automatically. It can take up to 20 seconds for this connection to be established.
2. If your end device has not a WPS function:
 - Search for WLAN networks with your end device.
 - Select the SSID of the inverter **SMA[serial number]** in the list with the found WLAN networks.
 - Enter the inverter WLAN password. Within the first ten feed-in hours and prior to completing the configuration by means of the installation assistant, you must use the standard WLAN password **SMA12345**. After the first ten feed-in hours or after completing the configuration by means of the installation assistant, you must use the device-specific WLAN password (WPA2-PSK) of the inverter. You find the WLAN password (WPA2-PSK) on the type label.
3. Enter the IP address **192.168.12.3** or, if your device supports mDNS services, **SMA[serial number].local** or **https://SMA[serial number]** in the address bar of the web browser and press the enter key.

4. **Web browser signals a security vulnerability**

After the IP address has been confirmed by pressing the enter key, a message might appear indicating that the connection to the user interface of the inverter is not secure. SMA Solar Technology AG guarantees that calling up the user interface is secure.

- Continue loading the user interface.

☒ The login page of the user interface opens.

7.3.3 Establishing a Connection via Ethernet in the local network

New IP address for connecting with a local network

If the product is connected to a local network (e.g. via a router), 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 following 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 for Apple and Linux systems: SMA[serial number].local (e.g. SMA0123456789.local)
- Access address for Windows and Android systems: https://SMA[serial number] (e.g. https://SMA0123456789)

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: There are various methods of integrating the product into the local network with the aid of the installation assistant.
- ☐ An end device (e.g. computer, tablet PC or smartphone) must be available.
- ☐ The end 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: Chrome, Edge, Firefox, Internet Explorer or Safari.
- ☐ The SMA Grid Guard code of the Installer must be available for the changing of grid-relevant settings after completion of the first ten feed-in hours or installation assistant (see "Application for SMA Grid Guard Code" at www.SMA-Solar.com).

Procedure:

1. Open the web browser of your end device, enter the IP address of the inverter in the address line of the web browser and press the enter key.

2. **i Web browser signals a security vulnerability**

After the IP address has been confirmed by pressing the enter key, a message might appear indicating that the connection to the user interface of the inverter is not secure. SMA Solar Technology AG guarantees that calling up the user interface is secure.

- Continue loading the user interface.

☒ The login page of the user interface opens.

7.3.4 Establishing a Connection via WLAN in the Local Network

i New IP address for connecting with a local network

If the product is connected to a local network (e.g. via a router), 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 following 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 for Apple and Linux systems: SMA[serial number].local (e.g. SMA0123456789.local)
- Access address for Windows and Android systems: https://SMA[serial number] (e.g. https://SMA0123456789)

Requirements:

- ☐ The product must be commissioned.
- ☐ The product must be integrated into the local network. Tip: There are various methods of integrating the product into the local network with the aid of the installation assistant.
- ☐ An end device (e.g. computer, tablet PC or smartphone) must be available.
- ☐ The end 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: Chrome, Edge, Firefox, Internet Explorer or Safari.
- ☐ The SMA Grid Guard code of the Installer must be available for the changing of grid-relevant settings after completion of the first ten feed-in hours or installation assistant (see "Application for SMA Grid Guard Code" at www.SMA-Solar.com).

i Importing and exporting files with end devices having an iOS operating system is not possible.

For technical reasons, importing and exporting files (e.g. importing an inverter configuration, saving the current inverter configuration or exporting events and parameters) is not possible with mobile end devices having an iOS operating system.

- Use an end device that does not have an iOS operating system for importing and exporting files.

Procedure:

1. Enter the IP address of the inverter in the address bar of the web browser.

2. **Web browser signals a security vulnerability**

After the IP address has been confirmed by pressing the enter key, a message might appear indicating that the connection to the user interface of the inverter is not secure. SMA Solar Technology AG guarantees that calling up the user interface is secure.

- Continue loading the user interface.

☒ The login page of the user interface opens.

7.4 Logging Into the User Interface

After a connection to the user interface of the inverter has been established, the login page opens. Log onto the user interface as described below.

Procedure:

1. In the drop-down list **Language**, select the desired language.
2. In the **User group** drop-down list, select the entry **Installer**.
3. In the **New password** field, enter a new password for the **Installer** user group.
4. In the **Repeat password** field, enter the new password again.
5. Select **Login**.

☒ The **Configuring the Inverter** page opens.

7.5 Selecting a configuration option

After you have logged onto the user interface as **Installer**, the **Configuring the Inverter** page opens.

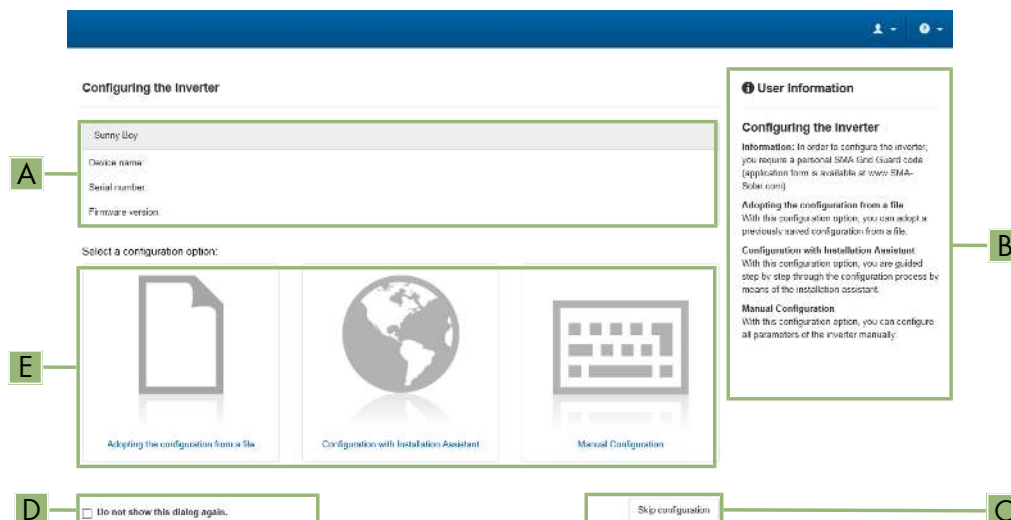


Figure 18 : Layout of the **Configuring the Inverter** page

Position	Designation	Description
A	Device information	Provides the following information: <ul style="list-style-type: none"> • Device name • Inverter serial number • Inverter firmware version
B	User information	Provides brief information on the listed configuration options
C	Skip configuration	Offers the option of skipping the inverter configuration and going directly to the user interface (not recommended; the inverter cannot be operated without configuration)
D	Checkbox	Allows you to choose not to have the displayed page displayed again when the user interface is called up again
E	Configuration options	Provides a selection of the various configuration options

Procedure:

On the **Configuring the Inverter** page, different configuration options are available to choose from. Select one of the options and proceed for the selected option as described below. SMA Solar Technology AG recommends carrying out the configuration with the installation assistant. This way, you ensure that all relevant parameters are set for optimal inverter operation.

- Adoption of configuration from a file

- Configuration with the installation assistant (recommended)
- Manual configuration

Adopting the Configuration from a File

You can adopt the inverter configuration from a file. To do this, there must be an inverter configuration saved to a file.

Procedure:

1. Select the configuration option **Adopting configuration from a file**.
2. Select **[Browse...]** and select the desired file.
3. Select **[Import file]**.

Configuring the Installation Assistant (Recommended)

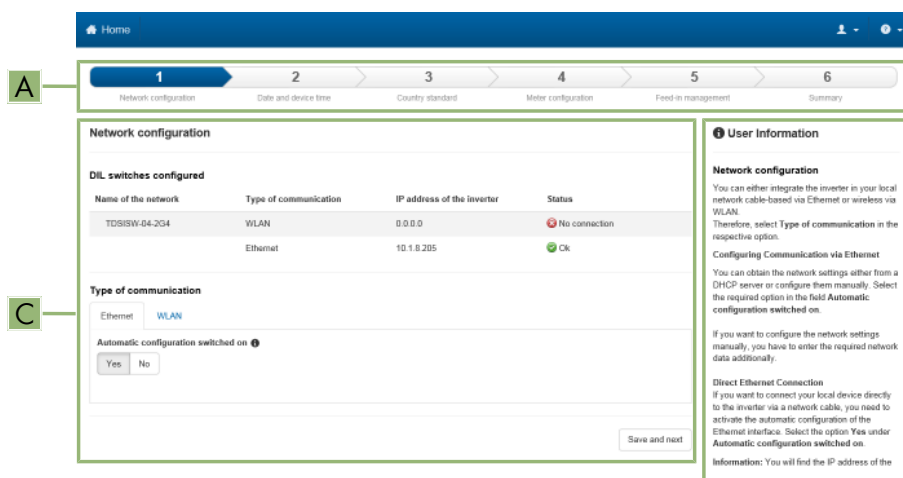


Figure 19 : Layout of the installation assistant (example)

Position	Designation	Description
A	Configuration steps	Overview of the installation assistant steps. The number of steps depends on the type of device and the additionally installed modules. The current step is highlighted in blue.
B	User information	Information about the current configuration step and the setting options of the configuration step.
C	Configuration field	You can make settings in this field.

Procedure:

1. Select the configuration option **Configuration with Installation Assistant**.
 - ☑ The installation assistant will open.
2. Follow the installation assistant steps and make the settings appropriate for your system.
3. For every setting made in a step, select **[Save and next]**.
 - ☑ In the last step, all made settings are listed in a summary.

4. To save the settings to a file, select [**Export a summary**] and save the file on your computer, tablet PC or smartphone.
 5. To export all parameters and their settings, select [**Export all parameters**]. This exports all parameters and their settings into an HTML file.
 6. To correct settings you made, select [**Back**], navigate to the desired step, correct settings and select [**Save and continue**].
 7. Once all settings are correct, select [**Next**] in the summary.
- ☒ The start page of the user interface opens.

Manual configuration

You can configure the inverter manually by setting the desired parameters.

Procedure:

1. Select the configuration option **Manual Configuration**.
 - ☒ The **Device Parameters** menu on the user interface will open and all available parameter groups of the inverter will be displayed.
 2. Select [**Edit parameters**].
 3. Select the desired parameter group.
 - ☒ All available parameters of the parameter group will be displayed.
 4. Set the desired parameters.
 5. Select [**Save all**].
- ☒ The inverter parameters are set.

8 Disconnecting the Inverter from Voltage Sources

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.

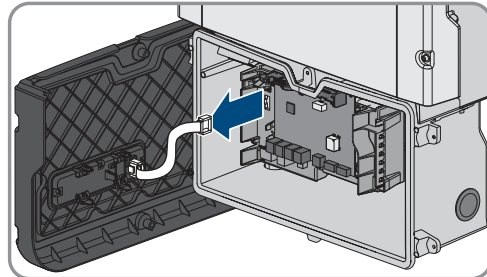
NOTICE

Destruction of the measuring device due to overvoltage

- Only use measuring devices with a DC input voltage range of 600 V or higher.

Procedure:

1. Disconnect the AC circuit breaker and secure it against reconnection.
2. Switch off the battery or the load-break switch of the battery (see documentation of the battery manufacturer).
3. Wait five minutes. This will ensure that the capacitors are discharged.
4. Unscrew all six screws of the enclosure lid of the Connection Unit and remove the enclosure lid carefully towards the front (TX25). When doing so, note that the LED assembly in the enclosure lid and the communication assembly in the inverter are connected via a ribbon cable.
5. Pull the ribbon cable connecting the LED assembly in the enclosure lid to the communication assembly out of the jack located on the communication assembly.



6. Ensure that no voltage is present at the fuses of the DC inputs between **A+** and **A-** and between **B+** and **B-** as well as between **C+** and **C-**. To do so, insert the test probe into the screw points of the respective fuse.
7. Ensure there is no voltage on the **AC-out** terminal block between **L1** and **N** and **L2** and **N** using a suitable measuring device. To do this, stick the test probe in each rectangular opening of the terminal.
8. Ensure there is no voltage on the **AC-out** terminal block between **L1** and the equipment grounding conductor and **L2** and the equipment grounding conductor using a suitable measuring device. To do this, stick the test probe in each rectangular opening of the terminal.

9 Decommissioning the Inverter

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 when attaching it to or removing it from the wall mounting bracket.

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

Procedure:

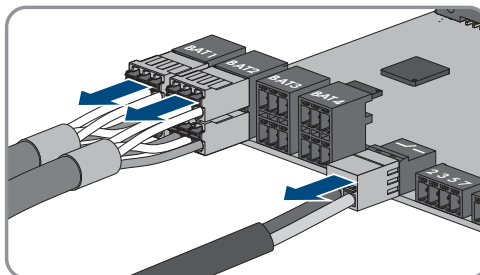
1.

⚠ DANGER

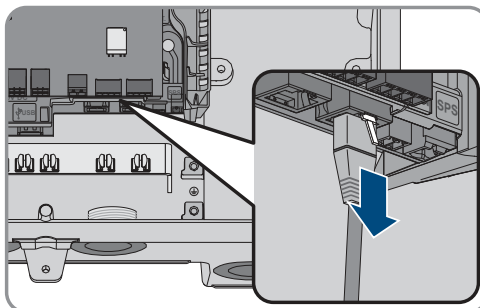
Danger to life due to high voltages

- Disconnect the inverter from all voltage sources (see Section 8, page 66).

2. Remove the DC conductor from the fuses for the DC connection.
3. Remove the AC conductors from the **AC-out** terminal block. To release the conductors from the terminals, open the terminals with a flat-blade screwdriver (blade width: 4 mm ($\frac{5}{32}$ in)).
4. Screw out the screws from the **AC-out** terminal block using a flat-blade screwdriver (blade width: 4 mm ($\frac{5}{32}$ in)) and pull the terminal block out of the slot.
5. Remove all connection cables from the jacks located on the battery interface module.

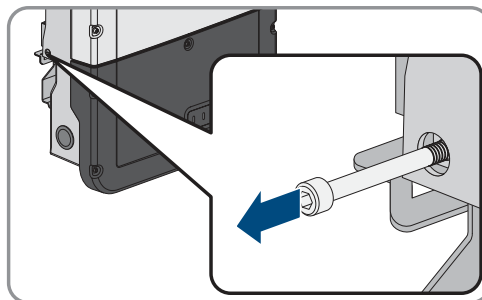


6. Remove all equipment grounding conductors from the equipment grounding terminals. To do this, loosen each screw (TX 25), remove the equipment grounding conductor from the inverter and retighten each screw (TX 25).
7. Remove the network cables from the jacks of the communication assembly.

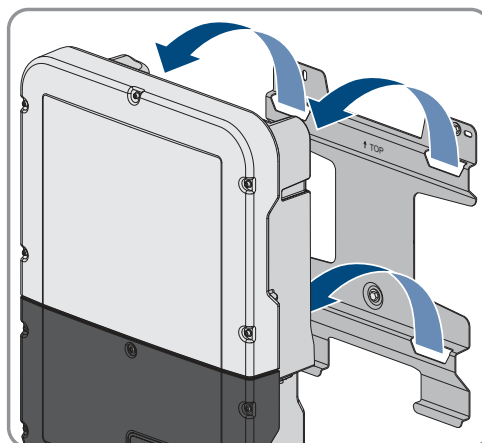


8. Remove all conduits with conductors from the inverter. To do this, screw the conduit fittings out of the enclosure openings from the inside.

9. Seal all enclosure openings with sealing plugs.
10. Lead the enclosure lid to the Connection Unit and plug the ribbon cable into the socket on the communication assembly.
11. Ensure that the ribbon cable is securely plugged into the sockets at both ends.
12. Position the enclosure lid of the Connection Unit on the enclosure and tighten all 6 screws crosswise (TX 25, torque: $3 \text{ Nm} \pm 0.3 \text{ Nm}$ ($26.55 \text{ in-lb} \pm 2.65 \text{ in-lb}$)).
13. If the inverter is secured against theft with a padlock, open the padlock and remove it from the inverter.
14. Unscrew the screw M5x60 which fastens the inverter to the wall mounting bracket (TX25).



15. Remove the inverter by lifting it vertically up and off the wall mounting bracket.



16. Unscrew the screws for fastening the wall mounting bracket and remove the wall mounting bracket.
17. If the inverter is to be stored or shipped, pack the inverter and the wall mounting bracket. Use the original packaging or packaging that is suitable for the weight and dimensions of the inverter and secure the packaging with tension belts, if necessary.
18. Dispose of the inverter in accordance with the locally applicable disposal regulations for electronic waste.

10 Technical Data

10.1 DC/AC

10.1.1 Sunny Boy Storage 3.8-US / 5.0-US

AC connection

	SBS3.8-US-10	SBS5.0-US-10
Rated power	3800 W	5000 W
Maximum apparent AC power	3800 VA	5000 VA
Rated grid voltage	240 V	240 V
AC voltage range	211 V to 264 V	211 V to 264 V
Nominal AC current	15.8 A	21 A
Maximum output current during stand-alone mode	20 A	28 A
Total harmonic factor of output current	< 4 %	< 4 %
Maximum residual output current	198 A _{peak}	198 A _{peak}
Duration of the maximum residual output current	33 ms	33 ms
Line synchronization characteristics/inrush current	Method 2/18.5 A	Method 2/18.5 A
Rated power frequency	60 Hz	60 Hz
Limits of accuracy of voltage measurement	2% of the AC voltage	2% of the AC voltage
Limits of accuracy of frequency measurement	±0.1 Hz	±0.1 Hz
Limits of accuracy of time measurement at nominal trip time	± 0.1 %	± 0.1 %
Limits of accuracy of current measurement	1% of the AC current	1% of the AC current
Limits of accuracy of power (active/reactive) measurement	5% of the nominal AC power	5% of the nominal AC power
Limits of accuracy of power factor measurement	0.01	0.01

	SBS3.8-US-10	SBS5.0-US-10
Limits of accuracy of time measurement	0.001 s	0.001 s
Operating range at AC power frequency 60 Hz	59.3 Hz to 60.5 Hz	59.3 Hz to 60.5 Hz
Output power at +60°C (+140°F)	> 3300 W	> 4000 W
Power factor at rated power	1	1
Range of the displacement power factor (adjustable)	0.8 _{overexcited} to 0.8 _{underexcited}	0.8 _{overexcited} to 0.8 _{underexcited}
Feed-in phases	1	1
Phase connection	2	2
Overvoltage category in accordance with UL 1741	IV	IV

DC connection for battery

Maximum DC voltage	600 V
Voltage range*	100 V to 550 V
DC rated voltage	360 V
Maximum DC current	3 x 10 A
Maximum short-circuit current	40 A
Battery type**	Li-ion
Overvoltage category in accordance with IEC 60664-1	III

* The charging and discharging voltage of the connected batteries must be in the range of 220 V and 500 V in order to make optimum use of the power of the inverter

** Only use batteries approved by SMA Solar Technology AG (see list of approved batteries at www.SMA-Solar.com)

Efficiency

	SBS3.8-US-10	SBS5.0-US-10
Maximum efficiency, η_{\max}	97.5 %	97.5 %
CEC efficiency, η_{CEC}	96.5 %	96.5 %

10.1.2 Sunny Boy Storage 6.0-US

AC connection

	SBS6.0-US-10
Rated power	6000 W
Maximum apparent AC power	6000 VA
Rated grid voltage	240 V
AC voltage range	211 V to 264 V
Nominal AC current	25 A
Maximum output current during stand-alone mode	32 A
Total harmonic factor of output current	<4 %
Maximum residual output current	198 A _{peak}
Duration of the maximum residual output current	33 ms
Line synchronization characteristics/inrush current	Method 2/18.5 A
Rated power frequency	60 Hz
Limits of accuracy of voltage measurement	2% of the AC voltage
Limits of accuracy of frequency measurement	±0.1 Hz
Limits of accuracy of time measurement at nominal trip time	± 0.1 %
Limits of accuracy of current measurement	1% of the AC current
Limits of accuracy of power (active/reactive) measurement	5% of the nominal AC power
Limits of accuracy of power factor measurement	0.01
Limits of accuracy of time measurement	0.001 s
Operating range at AC power frequency 60 Hz	59.3 Hz to 60.5 Hz
Output power at +60°C (+140°F)	> 4000 W
Power factor at rated power	1
Range of the displacement power factor (adjustable)	0.8 _{overexcited} to 0.8 _{underexcited}
Feed-in phases	1
Phase connection	2
Overvoltage category in accordance with UL 1741	IV

DC connection for battery

Maximum DC voltage	600 V
Voltage range*	100 V to 550 V
DC rated voltage	360 V
Maximum DC current	3 x 10 A
Maximum short-circuit current	40 A
Battery type**	Li-ion
Overvoltage category in accordance with IEC 60664-1	III

* The charging and discharging voltage of the connected batteries must be in the range of 220 V and 500 V in order to make optimum use of the power of the inverter

** Only use batteries approved by SMA Solar Technology AG (see list of approved batteries at www.SMA-Solar.com)

Efficiency

	SBS6.0-US-10
Maximum efficiency, η_{\max}	97.5 %
CEC efficiency, η_{CEC}	96.5 %

10.2 AC Output, Secure Power Supply Operation

Maximum AC power	2000 W
Nominal AC voltage	120 V
AC voltage range	109 V to 132 V
Maximum output current	16 A
Minimum load	1 W

10.3 Triggering Thresholds and Tripping Time

Rated power frequency	Triggering threshold	Triggering frequency	Tripping time
60 Hz	> 60.5 Hz	60.45 Hz to 60.55 Hz	max. 0.1602 s
	< 57 Hz to 59.8 Hz (Standard: 59.3 Hz)	56.95 Hz to 59.85 Hz (Standard: 59.25 Hz to 59.35 Hz)	Adjustable: 0.16 s to 300 s (Standard: max. 0.1602 s)
	< 57.0 Hz	56.95 Hz to 57.05 Hz	max. 0.1602 s

Rated grid voltage	Triggering threshold - Triggering voltages	Triggering voltage - Neutral conductor	Triggering voltage - L1 and L2	Tripping time
240 V	50 %	57.6 V to 62.4 V	115.2 V to 124.8 V	max. 0.1602 s
	88 %	103.2 V to 108.0 V	206.4 V to 216.0 V	max. 2.002 s
	110 %	129.6 V to 134.4 V	259.2 V to 268.8 V	max. 1.001 s
	120 %	141.6 V to 146.4 V	283.2 V to 292.8 V	max. 0.1602 s

Measuring precisions:

- Triggering threshold: $\pm 2\%$ of the rated grid voltage
- Tripping time: $\pm 1\%$ of the nominal tripping time
- Triggering frequency: $\pm 0.2\%$ of rated power frequency

10.4 General Data

Width x height x depth	535 mm x 730 mm x 198 mm (21.1 in x 28.7 in x 7.8 in)
Weight	26 kg (57.32 lbs)
Length x width x height of the packaging	800 mm x 600 mm x 300 mm (31.5 in x 23.6 in x 11.8 in)
Transport weight	30 kg (66.14 lbs)
Operating temperature range	-25 °C to +60 °C (-13 °F to +140 °F)
Storage temperature	-40 °C to +60 °C (-40 °F to +140 °F)
Maximum permissible value for relative humidity, non-condensing	95 %
Maximum operating altitude above mean sea level (MSL)	3000 m (9843 ft)
Typical noise emission	39 dB(A)
Self-consumption in standby mode without the load necessary to supply the battery	< 5 W
Self-consumption without the load necessary to supply the battery	< 10 W
Maximum data volume per inverter with Speedwire/Webconnect	550 MB/month

Additional data volume when using the Sunny Portal live interface	600 kB/hour
WLAN range in free-field conditions	100 m
Quantity maximum detectable WLAN networks	32
Topology	Transformerless
Cooling method	Convection
Enclosure type in accordance with UL 50E	3R
Protection class	1
Grid configurations	240 V : 120 V split-phase system
Approvals and national standards, as per 10/2017	UL 1741, IEEE 1547

10.5 Protective Devices

DC reverse polarity protection	Short-circuit diode
AC short-circuit current capability	Current control
Grid monitoring	SMA Grid Guard 4.0
Maximum permissible AC fuse protection	50 A
Ground fault monitoring SBS3.8-US-10	Insulation monitoring: $R_{iso} > 600 \text{ k}\Omega$
Ground fault monitoring SBS5.0-US-10	Insulation monitoring: $R_{iso} > 600 \text{ k}\Omega$
Ground fault monitoring SBS6.0-US-10	Insulation monitoring: $R_{iso} > 500 \text{ k}\Omega$
All-pole sensitive residual-current monitoring unit	Available

10.6 Torques

Screw M5x60 for securing the inverter to the wall mounting bracket	1.7 Nm \pm 0.3 Nm (15.05 in-lb \pm 2.65 in-lb)
Screws for attaching the enclosure lid of the Connection Unit	3 Nm \pm 0.3 Nm (26.55 in-lb \pm 2.65 in-lb)
Screws for grounding at equipment grounding terminals	6 Nm \pm 0.3 Nm (53.10 in-lb \pm 2.65 in-lb)
Screws for SPS terminal block for connecting the outlet for secure power supply operation	0.3 Nm (2.65 in-lb)
Screws and fuses for DC connection	2 Nm to 2.5 Nm (18 in-lb to 22 in-lb)

10.7 Data Storage Capacity

State of charge of the battery throughout the day	63 days
Daily state of charge of the battery	30 years
Event messages for users	1024 events
Event messages for installers	1024 events

11 Compliance Information

FCC Compliance

This device complies with Part 15 of the FCC Rules and with Industry Canada licence-exempt RSS standard(s).

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.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence.

L'exploitation est autorisée aux deux conditions suivantes :

1. l'appareil ne doit pas produire de brouillage, et
2. l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

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.

12 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:

- Battery inverter:
 - Device type
 - Serial number
 - Firmware version
 - Event message
 - Mounting location and mounting height
 - Optional equipment, e.g. communication products
 - Use the name of the system in Sunny Portal (if available)
 - Access data for Sunny Portal (if available)
 - Special country-specific settings (if available)
- Batteries:
 - Type
 - Firmware version
 - Type of automatic transfer switch (if available)

United States	SMA Solar Technology America LLC Rocklin, CA	Toll free for USA and US Territories +1 877-MY-SMATech (+1 877-697-6283) International: +1 916 625-0870
Canada	SMA Solar Technology Canada Inc. Mississauga	Toll free for Canada / Sans frais pour le Canada : +1 877-MY-SMATech (+1 877-697-6283)
México	SMA Solar Technology de México Mexico City	Internacional: +1 916 625-0870

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