



## SUNNY BOY 1.5 / 2.0 / 2.5

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You can download the current warranty conditions from the Internet at [www.SMA-Solar.com](http://www.SMA-Solar.com).

### Software licenses

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

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# 1 Information on this Document

## 1.1 Validity

- SB1.5-1VL-40 (Sunny Boy 1.5) from firmware version  $\geq 3.11.00.R$
- SB2.0-1VL-40 (Sunny Boy 2.0) from firmware version  $\geq 3.11.00.R$
- SB2.5-1VL-40 (Sunny Boy 2.5) from firmware version  $\geq 3.11.00.R$

## 1.2 Target Group

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

- Knowledge of how an inverter works and is operated
- Training in how to deal with the dangers and risks associated with installing, repairing and using electrical devices 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

## 1.3 Content and Structure of this Document

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

You will find the latest version of this document and further information on the product in PDF format and as eManual at [www.SMA-Solar.com](http://www.SMA-Solar.com). You can also call up the eManual via the user interface of the product.

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

## 1.4 Levels of warning messages

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

### DANGER

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

### WARNING

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





### CAUTION

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

## NOTICE

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

## 1.5 Symbols in the Document

Icon	Explanation
	Information that is important for a specific topic or goal, but is not safety-relevant
<input type="checkbox"/>	Indicates a requirement for meeting a specific goal
<input checked="" type="checkbox"/>	Desired result
	A problem that might occur.
	Example
	Sections describing activities to be performed by qualified persons only

## 1.6 Typographical Elements in the Document

Typographical element	Use	Example
<b>bold</b>	<ul style="list-style-type: none"> <li>Messages</li> <li>Terminals</li> <li>Elements on a user interface</li> <li>Elements to be selected</li> <li>Elements to be entered</li> </ul>	<ul style="list-style-type: none"> <li>Connect the insulated conductors to the terminals <b>X703:1</b> to <b>X703:6</b>.</li> <li>Enter <b>10</b> in the field <b>Minutes</b>.</li> </ul>
>	<ul style="list-style-type: none"> <li>Connects several elements to be selected</li> </ul>	<ul style="list-style-type: none"> <li>Go to <b>Settings &gt; Date</b>.</li> </ul>
[Button] [Key]	<ul style="list-style-type: none"> <li>Button or key to be clicked on or pressed down</li> </ul>	<ul style="list-style-type: none"> <li>Select <b>[Enter]</b>.</li> </ul>
#	<ul style="list-style-type: none"> <li>Placeholder for variable components (e.g., parameter names)</li> </ul>	<ul style="list-style-type: none"> <li>Parameter <b>WCtHz.Hz#</b></li> </ul>

## 1.7 Designations in the Document

Complete designation	Designation in this document
Sunny Boy	Inverter, product

## 1.8 Additional Information

For more information, please go to [www.SMA-Solar.com](http://www.SMA-Solar.com).

Title and information content	Type of information
"PUBLIC CYBER SECURITY - Guidelines for a Secure PV System Communication"	Technical Information
"SMA GRID GUARD 10.0 - Grid Management Services via Inverter and System Controller"	Technical Information
"Efficiency and Derating" Efficiency and derating behavior of the SMA inverters	Technical Information
"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 list of the Modbus register	Technical Information
"SMA SPEEDWIRE FIELDBUS"	Technical information



## 2 Safety

### 2.1 Intended Use

The Sunny Boy is a transformerless PV inverter which converts the direct current of the PV array to grid-compliant alternating current and feeds it into the utility grid.

The product is suitable for indoor and outdoor use.

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

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

PV modules with a high capacity to ground must only be used if their coupling capacity does not exceed 900 nF (for information on how to determine the coupling capacity, see the Technical Information "Leading Leakage Currents" at [www.SMA-Solar.com](http://www.SMA-Solar.com)).

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

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

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

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

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

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 any regional, state, provincial, federal or national laws, regulations or standards that apply to the installation, electrical safety and use of the product. SMA Solar Technology AG assumes no responsibility for the compliance or non-compliance with such laws or codes in connection with the installation of the product.

The type label must remain permanently attached to the product.

### 2.2 IMPORTANT SAFETY INSTRUCTIONS

Keep the manual for future reference.

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

The product has been designed and tested in accordance with international safety requirements. As with all electrical or electronical devices, 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 cables are touched**

When exposed to light, the PV modules generate high DC voltage which is present in the DC cables. Touching live DC cables results in death or lethal injuries due to electric shock.

- Do not touch non-insulated parts or cables.
- Disconnect the product from voltage sources and ensure it cannot be reconnected before working on the device.
- Do not disconnect the DC connectors under load.
- Wear suitable personal protective equipment for all work on the product.

### DANGER

#### **Danger to life due to electric shock when live components are touched on opening the product**

High voltages are present in the live parts and cables inside the product during operation. Touching live parts and cables results in death or lethal injuries due to electric shock.

- Do not open the product.

### DANGER

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

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

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

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

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

- Disconnect the product from voltage sources and ensure it cannot be reconnected before working on the device.
- Only touch the cables of the PV modules on their insulation.
- Do not touch any parts of the substructure or frame of the PV array.
- Do not connect PV strings with ground faults to the inverter.

**⚠ 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 are integrated in the existing overvoltage protection.
- When laying the network cable outdoors, ensure that there is suitable surge protection at the network cable transition from the product outdoors to the network inside the building.
- The Ethernet interface of the product is classified as "TNV-1" and offers protection against overvoltages of up to 1.5 kV.

**⚠ WARNING****Danger to life due to fire and explosion**

In rare cases, an explosive gas mixture can be generated inside the product under fault conditions. In this state, switching operations can cause a fire inside the product or explosion. Death or lethal injuries due to hot or flying debris can result.

- In the event of a fault, do not perform any direct actions on the product.
- Ensure that unauthorized persons have no access to the product.
- Do not operate the DC load-break switch on the inverter in case of an error.
- Disconnect the PV array from the inverter via an external disconnection device. If there is no disconnecting device present, wait until no more DC power is applied to the inverter.
- Disconnect the AC circuit breaker, or keep it disconnected in case it has already tripped, and secure it against reconnection.
- Only perform work on the product (e.g., troubleshooting, repair work) when wearing personal protective equipment for handling of hazardous substances (e.g., safety gloves, eye and face protection, respiratory protection).

**⚠ WARNING****Risk of injury due to toxic substances, gases and dusts.**

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

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

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

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

- Only use measuring devices with a DC input voltage range of 1000 V or higher.

**⚠ CAUTION****Risk of burns due to hot enclosure parts**

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

- During operation, do not touch any parts other than the enclosure lid of the inverter.

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

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

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

**NOTICE****High costs due to inappropriate Internet tariff**

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

- SMA Solar Technology AG recommends using an Internet flat rate.

**NOTICE****Damage to the product due to cleaning agents**

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

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

**i Change to the names and units of grid parameters to comply with the grid-connection requirements in accordance with Regulation (EU) 2016/631 (valid from April 27, 2019)**

To comply with the EU grid-connection requirements (valid from April 27, 2019) the names and units of grid parameters were changed. This change is valid from firmware version  $\geq 3.00.00.R$  if a country data set for fulfilling the EU grid-connection requirements (valid from 2019-04-27) is set. Names and units of grid parameters for inverters with firmware version  $\leq 2.99.99.R$  are not affected by this change and remain valid. This also applies from firmware version  $\geq 3.00.00.R$  if a country data set that is valid for countries outside the EU is set.

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

From firmware version 3.11.00.R, the activation conditions for feed-in operation were changed.

To ensure the inverter begins feed-in operation during initial commissioning, a country data set must be set (for instance via the installation assistant on the user interface of the product, or via a communication product).

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

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

**i The country data set must be set correctly.**

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

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

### 3 Scope of Delivery

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

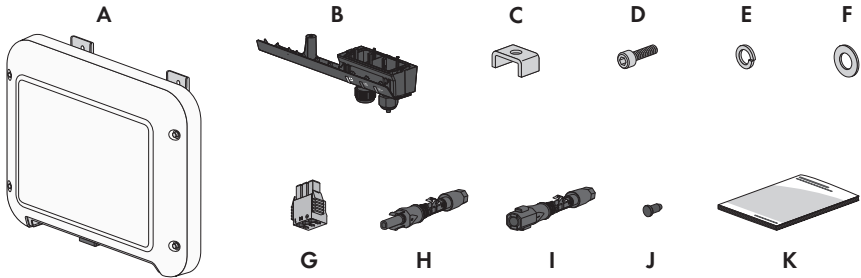


Figure 1: Components included in the scope of delivery

Position	Quantity	Designation
A	1	Inverter
B	1	Connection cap
C	1	Clamping bracket
D	1	Cylindrical screw M5 x 16
E	1	Spring lock washer
F	1	Washer M5
G	1	Terminal block for the AC connection
H	1	Positive DC connector
I	1	Negative DC connector
J	2	Sealing plug
K	1	Quick reference guide with password label on the rear side The label contains the following information: <ul style="list-style-type: none"> <li>• PIC (Product Identification Code) identification key for registering the system in Sunny Portal</li> <li>• RID (Registration Identifier) registration ID for registering the system in Sunny Portal</li> <li>• WLAN password WPA2-PSK (WiFi Protected Access 2 - Preshared Key) for direct connection to the inverter via WLAN</li> </ul>

## 4 Product Overview

### 4.1 Product Description

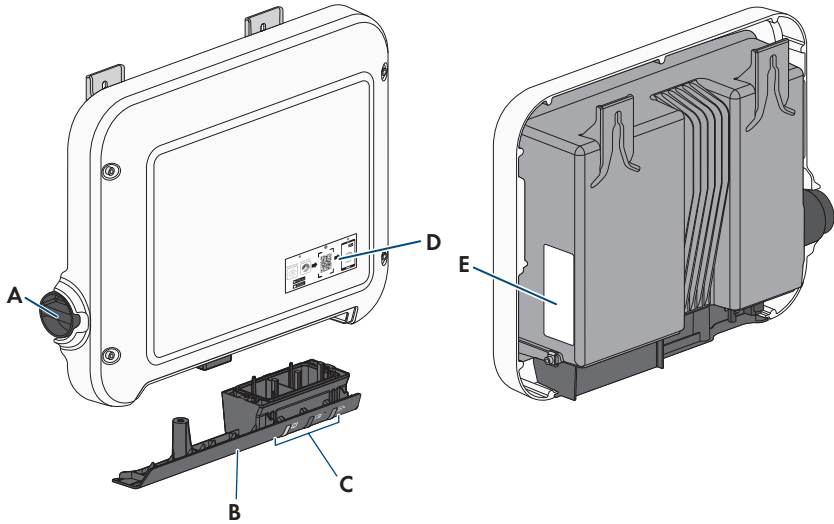







Figure 2: Design of the product













Position	Designation
A	DC load-break switch
B	Connection cap Connection area with cable glands for connection to the utility grid and the local network
C	LEDs The LEDs indicate the operating state of the product.





Position	Designation
D	Label with QR Code for scanning via the SMA 360° App and easy connection to the inverter's user interface via WLAN
E	<p>Type label</p> <p>The type label clearly identifies the product. The type label must remain permanently attached to the product. You will find the following information on the type label:</p> <ul style="list-style-type: none"> <li>• Device type (Model)</li> <li>• Serial number (Serial No. or S/N)</li> <li>• Date of manufacture</li> <li>• Identification key (PIC) for registration in Sunny Portal</li> <li>• Registration ID (RID) for registration in Sunny Portal</li> <li>• Wi-Fi password (WPA2-PSK) for the direct connection to the user interface of the product via Wi-Fi</li> <li>• Device-specific characteristics</li> </ul>

## 4.2 Symbols on the Product

Icon	Explanation
	<p>Beware of a danger zone</p> <p>This symbol indicates that the product must be additionally grounded if additional grounding or equipotential bonding is required at the installation site.</p>
	<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>Danger to life due to high voltages in the inverter; observe a waiting time of 5 minutes.</p> <p>High voltages that can cause lethal electric shocks are present in the live components of the inverter.</p> <p>Prior to performing any work on the inverter, disconnect it from all voltage sources as described in this document.</p>
	<p>Observe the documentations</p> <p>Observe all documentations supplied with the product.</p>



Icon	Explanation
	Inverter Together with the green LED, this symbol indicates the operating state of the inverter.
	Observe the documentations Together with the red LED, this symbol indicates an error.
	Data transmission Together with the blue LED, this symbol indicates the status of the network connection.
	Grounding conductor This symbol indicates the position for connecting a grounding conductor.
	Alternating current
	Direct current
	The product has no galvanic isolation.
	WEEE designation Do not dispose of the product together with the household waste but in accordance with the disposal regulations for electronic waste applicable at the installation site.
	The product is suitable for outdoor installation.
<b>IP65</b>	Degree of protection IP65 The product is protected against the penetration of dust and water that is directed as a jet against the enclosure from all directions.
	CE marking The product complies with the requirements of the applicable EU directives.
	UKCA marking The product complies with the regulations of the applicable laws of England, Wales and Scotland.
	RoHS labeling The product complies with the requirements of the applicable EU directives.

Icon	Explanation
	RCM (Regulatory Compliance Mark) The product complies with the requirements of the applicable Australian standards.
 TA-2016/1360 APPROVED	ICASA The product complies with the requirements of the South African standards for telecommunication.
 ANATEL Agência Nacional de Telecomunicações 03931-16-03337	ANATEL The product complies with the requirements of the Brazilian standards for telecommunication.  Este equipamento opera em caráter secundário, isto é, não tem direito a proteção contra interferência prejudicial, mesmo de estações do mesmo tipo, e não pode causar interferência a sistemas operando em caráter primário.
	The product complies with the Moroccan safety and EMC requirements for electronic products.

## 4.3 Interfaces and Functions

The product is equipped with the following interfaces and functions:

### User interface for configuration and monitoring

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

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

### Smart Inverter Screen

The Smart Inverter Screen enables you to view the status display and to display the current power and consumption on the user interface login page. This gives you an overview of the most important product 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 product 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.

The products supports the encrypted system communication with SMA Speedwire Encrypted Communication. In order to be able to use the Speedwire encryption in the system, all Speedwire devices, except for the SMA Energy Meter, must support the function SMA Speedwire Encrypted Communication.

## SMA Webconnect

The product is equipped with a Webconnect function as standard. The Webconnect function enables direct data transmission between the product and Internet portals Sunny Portal and Sunny Places without any additional communication device and for a maximum of 4 products per visualized system. In PV systems with more than 4 products, there is the option of establishing data transmission between the products and Sunny Portal via the data logger (e.g., SMA Data Manager) or distributing the inverters over several systems. If there is an existing Wi-Fi or Ethernet connection, you can directly access your visualized system via the web browser on your smart device (e.g. smartphone, tablet or laptop).

Webconnect enables - for PV systems operated in Italy - the connection or disconnection of the inverter to or from the utility grid and the specifying of the frequency limits to be used via IEC61850-GOOSE messages.

## WLAN connection to SMA 360° app

The product has a QR code. By scanning the QR Code attached to the product via the SMA 360° app, access to the product is established via WLAN and the connection to the user interface is made automatically.

## 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 inverter has a WPS (WiFi Protected Setup) function. The WPS function connects the inverter automatically with a smart device (e.g. smartphone, tablet or laptop). You can activate the WPS function by tapping on the enclosure lid twice in quick succession. The open interface will then be signaled via the rapid flashing of the blue LED on the inverter.

### Limited function in the event of frost

The integrated WLAN interface of the product is only designed for temperatures down to -20°C.

- Deactivate the WLAN interface at low temperatures (see Section 8.6, page 58).

## Grid management services

The product is equipped with service functions for grid management.

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

## SMA ShadeFix

The inverter is equipped with the shade management system SMA ShadeFix. SMA ShadeFix uses an intelligent MPP tracking system to determine the operating point with the highest output during shading conditions. With SMA ShadeFix, inverters use the best possible energy supply from the PV modules at all times to increase yields in shaded systems. SMA ShadeFix is enabled by default. The time interval of SMA ShadeFix is usually six minutes. This means that the inverter determines the optimum operating point every six minutes. Depending on the PV system or shading situation, it may be useful to adjust the time interval.

## All-pole sensitive residual-current monitoring unit

The all-pole sensitive residual-current monitoring unit detects alternating and direct differential currents. In single-phase and three-phase inverters, the integrated differential current sensor detects the current difference between the neutral conductor and the line conductor(s). If the current difference increases suddenly, the inverter disconnects from the utility grid.

## Connection of the SMA Energy Meter

If an SMA Energy Meter is installed in the PV system, the inverter can receive data on the household energy consumption directly from this.

## SMA Smart Connected

SMA Smart Connected is the free monitoring of the product via the SMA Sunny Portal. Thanks to SMA Smart Connected, the operator and qualified person will be informed automatically and proactively about product 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 product is permanently connected to Sunny Portal and the data of the operator and qualified person is stored in Sunny Portal and up-to-date.

## 4.4 LED Signals

LED signal	Explanation
Green LED and red LED flash simultaneously (2 s on and 2 s off)	No country data set set Operation of the product is stopped because no country data set is set. Once the configuration has been completed (for instance using the installation assistant or via a communication product), the product will start operation automatically.
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 flashes quickly	Update of central processing unit The central processing unit of the inverter is being updated.
The green LED is glowing	Feed-in operation The inverter feeds in with a power of at least 90%.
The green LED is pulsing	Feed-in operation The inverter is equipped with a dynamic power display via the green LED. Depending on the power, the green LED pulses fast or slow. If necessary, you can switch off the dynamic power display via the green LED.
The green LED is off	The inverter is not feeding into the utility grid.

LED signal	Explanation
The red LED is glowing	<p>Event occurred</p> <p>If an event occurs, a distinct event message and the corresponding event number will be displayed in addition on the product user interface or in the communication product (e.g. SMA Data Manager).</p>
The blue LED flashes slowly for approx. 1 minute	<p>Communication connection is being established</p> <p>The product is establishing a connection to a local network or is establishing a direct connection to a smart device via Ethernet (e.g. smartphone, tablet or laptop).</p>
The blue LED flashes quickly for approx. two minutes (0.25 s on and 0.25 s off).	<p>WPS active</p> <p>The WPS function is active.</p>
The blue LED is glowing	<p>Communication active</p> <p>There is an active connection with a local network or there is a direct connection via Ethernet with a smart end device (e.g. smartphone, tablet or laptop).</p>

### 4.5 System Overview

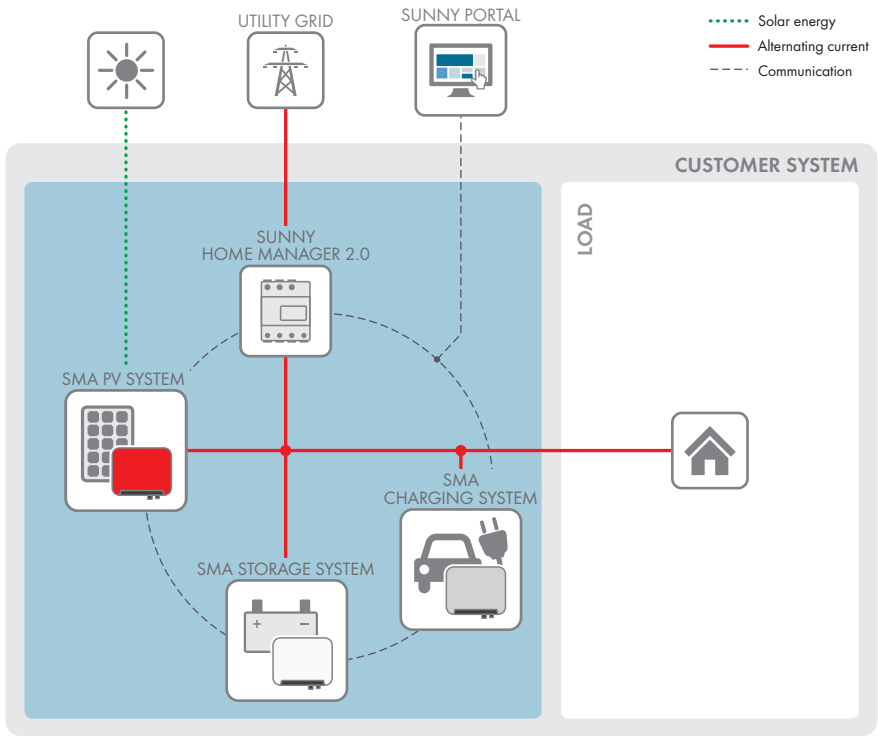


Figure 3: Design of the system

### 4.5.1 Circuitry Overview

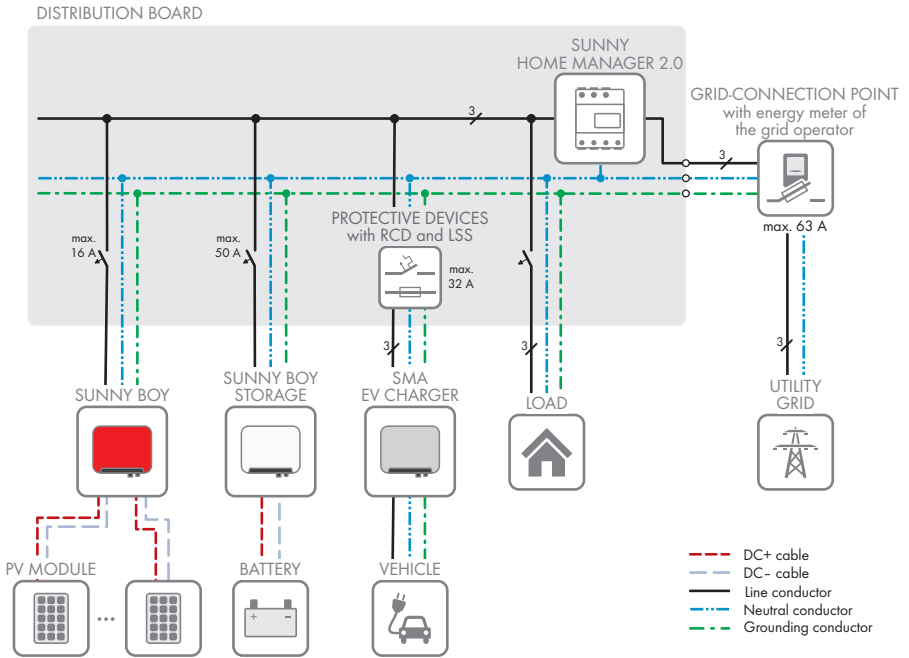


Figure 4: Circuitry overview (example)

### 4.5.2 Communication Overview

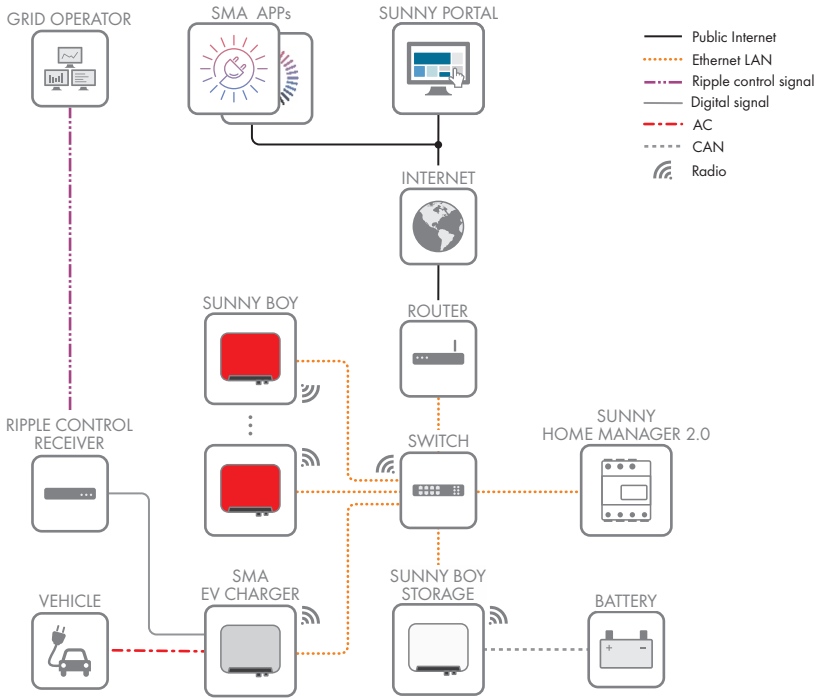


Figure 5: Design of system communication



## 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. This can result in death or serious injury.

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

#### Requirements:

- Do not mount the inverter on a pillar.
- A solid, flat support surface, e.g. concrete or masonry, must be available for mounting. The difference between the outer anchoring points must not exceed 5 mm.
- The mounting location must be inaccessible to children.
- The mounting location must be suitable for the weight and dimensions of the product (see Section 13, page 95).
- The mounting location must not be exposed to direct solar irradiation. If the product is exposed to direct solar irradiation, the exterior plastic parts might age prematurely and overheating might occur. When becoming too hot, the product reduces its power output to avoid overheating.
- The mounting location should be freely and safely accessible at all times without the need for any auxiliary equipment (such as scaffolding or lifting platforms). Non-fulfillment of these criteria may restrict servicing.
- The DC load-break switch of the product must always be freely accessible.
- All ambient conditions must be met (see Section 13, page 95).
- To ensure optimum operation, the ambient temperature should be between  $-25^{\circ}\text{C}$  and  $+40^{\circ}\text{C}$ .

#### 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.

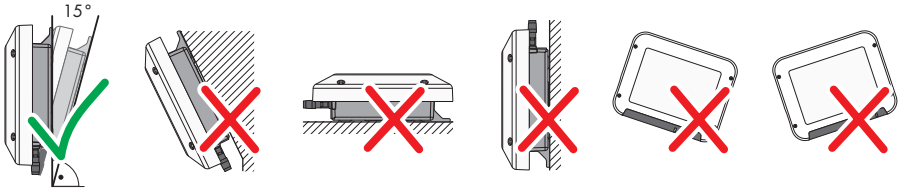


Figure 6: Permitted and prohibited mounting positions

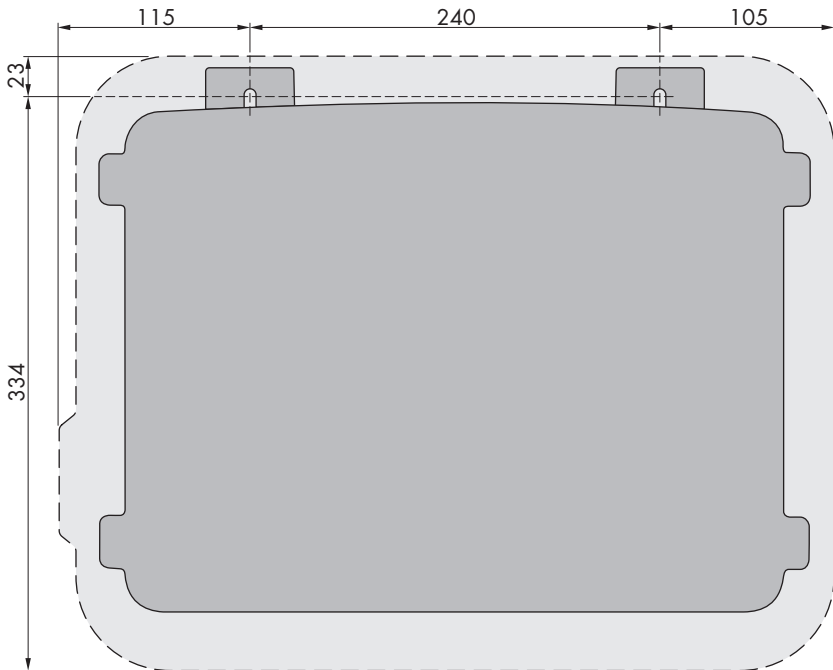
**Dimensions for mounting:**

Figure 7: Position of the anchoring points(Dimensions in mm)

**Recommended clearances:**

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

- Maintain the recommended clearances to walls as well as to other inverters or objects.
- If multiple products are mounted in areas with high ambient temperatures, increase the clearances between the products and ensure sufficient fresh-air supply.

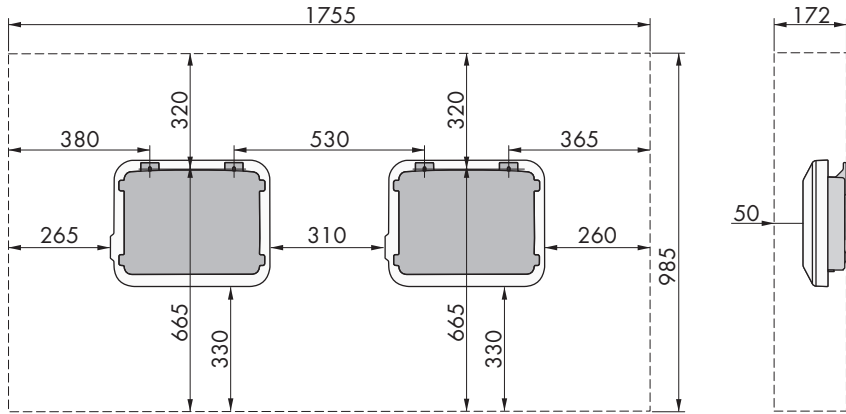


Figure 8: Recommended clearances (Dimensions in mm)

## 5.2 Mounting the product

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

- 2 stainless steel hexagon head wood screws (AF 10, diameter 6 mm), screw length must be suitable for the support surface and the weight of the product (fastening bracket thickness: 4 mm)
- Where necessary, 2 screw anchors suitable for the support surface and the screws

### ⚠ CAUTION

#### Risk of injury due to weight of product

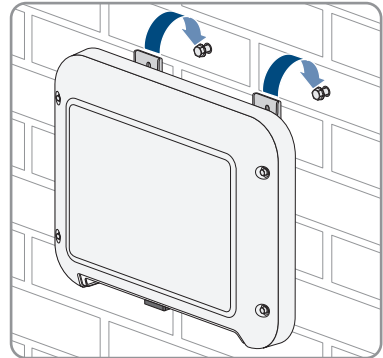
Injuries may result if the product is lifted incorrectly or dropped while being transported or mounted.

- 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.

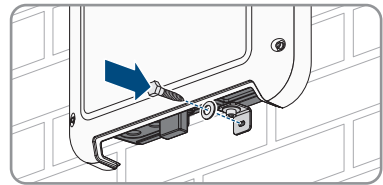
#### Procedure:

1. Mark the position of the drill holes. Align the markings horizontally.
2. Drill the holes.
3. Insert screw anchors into the drill holes if the support surface requires them.
4. Insert the screws until there is at least 6 mm clearance between the screw head and the support surface.

5. Hang the product onto the screws using the metal brackets.



6. Tighten the screws hand-tight using a ratchet or box wrench. When doing this you can compensate for any misalignment of the drill holes by aligning the metal brackets accordingly.



7. Ensure that the product is securely in place.

8.

## NOTICE

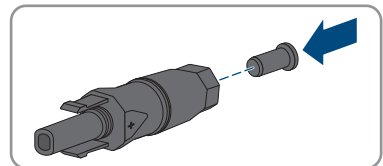
### Damage to the product due to sand, dust and moisture ingress if the DC inputs are not closed

The product is only properly sealed when all unused DC inputs are closed with DC connectors and sealing plugs. Sand, dust and moisture penetration can damage the product and impair its functionality.

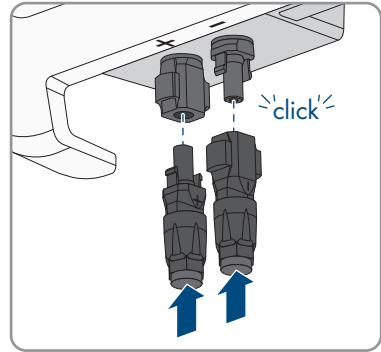
- Seal all unused DC inputs using the DC connectors and sealing plugs as described in the following. When doing so, do not plug the sealing plugs directly into the DC inputs on the inverter.

9. For unused DC connectors, push down the clamping bracket and push the swivel nut up to the thread.

10. Insert the sealing plug into the DC connector.



11. Insert the DC connectors with sealing plugs into the corresponding DC inputs on the inverter.



- The DC connectors snap into place.

12. Ensure that the DC connectors with sealing plugs are securely in place.

## 6 Electrical Connection

### 6.1 Overview of the Connection Area

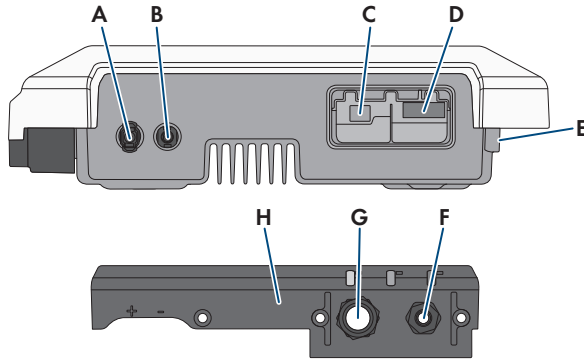


Figure 9: Connection areas and enclosure openings at the bottom of the inverter

Position	Designation
A	Positive DC connector
B	Negative DC connector
C	RJ45 pin connector for the network cable
D	Pin connector for the AC connector
E	Connection of the grounding terminal for additional grounding
F	Cable gland for the AC cable
G	Cable gland with filler plug for the network cable
H	Connection cap

## 6.2 AC Connection

### 6.2.1 Requirements for the AC Connection

AC cable requirements as follows:

- Conductor type: copper wire
- External diameter: 5 mm to 13 mm
- Conductor cross-section: 1.5 mm<sup>2</sup> to 4 mm<sup>2</sup>
- Insulation stripping length: 15 mm
- Sheath stripping length: 70 mm

- The cable must be dimensioned in accordance with the local and national directives for the dimensioning of cables. The requirements for the minimum wire size derive from these directives. Examples of factors influencing cable dimensioning are: nominal AC current, type of cable, routing method, cable bundling, ambient temperature and maximum desired line losses (for calculation of line losses, see the design software "Sunny Design" from software version 2.0 at [www.SMA-Solar.com](http://www.SMA-Solar.com)).

#### Load-break switch and cable protection:

### NOTICE

#### **Damage to the inverter due to the use of screw-type fuses as load-break switches**

Screw-type fuses (e.g. DIAZED fuse or NEOZED fuse) are not load-break switches.

- Do not use screw-type fuses as load-break switches.
- Use a load-break switch or circuit breaker as a load disconnection unit (for information and design examples, see the Technical Information "Circuit Breaker" at [www.SMA-Solar.com](http://www.SMA-Solar.com)).

- In PV systems with multiple inverters, protect each inverter with a separate circuit breaker. Make sure to observe the maximum permissible fuse protection (see Section 13 "Technical Data", page 95). This will prevent residual voltage from being present at the corresponding cable after disconnection.
- Loads installed between the inverter and the circuit breaker must be fused separately.

#### Residual-current monitoring unit:

The inverter does not require an external residual-current device when operating. If local regulations require the use of a residual-current device, the following must be observed:

- The inverter is compatible with type A and B residual-current devices that have a rated residual current of 30 mA or higher (information about the selection of a residual-current device see technical information "Criteria for Selecting a Residual-Current Device" at [www.SMA-Solar.com](http://www.SMA-Solar.com)). Each inverter in the system must be connected to the utility grid via a separate residual-current device.

#### Overvoltage category:

The product can be used in grids of overvoltage category III or lower in accordance with IEC 60664-1. That means that the product can be permanently connected to the grid-connection point of a building. In case of installations with long outdoor cabling routes, additional measures to reduce overvoltage category IV to overvoltage category III are required (see the Technical Information "Overvoltage Protection" at [www.SMA-Solar.com](http://www.SMA-Solar.com)).

**Grounding conductor monitoring:**

The inverter is equipped with a grounding conductor monitoring device. This grounding conductor monitoring device detects when there is no grounding conductor connected and disconnects the inverter from the utility grid if this is the case. Depending on the installation site and grid configuration, it may be advisable to disable the grounding conductor monitoring. This can be necessary, for example, in a Delta IT system or other grid configurations if there is no neutral conductor present and you intend to install the inverter between two line conductors. If you are uncertain about this, contact your grid operator or SMA Solar Technology AG.

- Grounding conductor monitoring must be disabled after initial start-up depending on the grid configuration (see Section 8.14, page 64).

**i** **Safety in accordance with IEC 62109 when the grounding conductor monitoring is deactivated**

In order to guarantee safety in accordance with IEC 62109 when the grounding conductor monitoring is deactivated, you have to connect additional grounding:

- In order to guarantee safety in accordance with IEC 62109 when the grounding conductor monitoring is deactivated, you have to connect additional grounding (see Section 6.2.3, page 34): The additional grounding conductor must have the same cross-section as the connected grounding conductor at the connecting terminal plate for the AC cable. This prevents touch current if the grounding conductor at the connecting terminal plate for the AC cable fails.

**i** **Connection of additional grounding**

In some countries, additional grounding is generally required. In each case, observe the locally applicable regulations.

- If additional grounding is required, connect an additional grounding that has at least the same cross-section as the connected grounding conductor to the connecting terminal plate for the AC cable (see Section 6.2.3, page 34). This prevents touch current if the grounding conductor at the connecting terminal plate for the AC cable fails.

## 6.2.2 Connecting the Inverter to the Utility Grid

### **⚠ QUALIFIED PERSON**

**Requirements:**

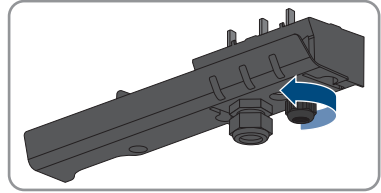
- Only the terminal block supplied may be used for the AC connection.
- The connection requirements of the grid operator must be met.
- The grid voltage must be within the permissible range. The exact operating range of the inverter is specified in the operating parameters.

**Procedure:**

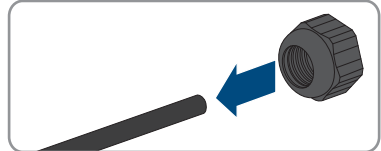
1. Disconnect the AC circuit breaker and secure it against reconnection.



2. Unscrew the swivel nut from the cable gland for the AC connection at the connector cap.

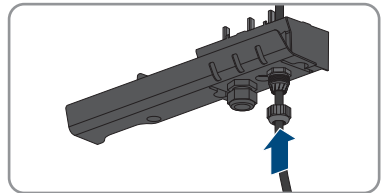


3. Thread the swivel nut over the AC cable.

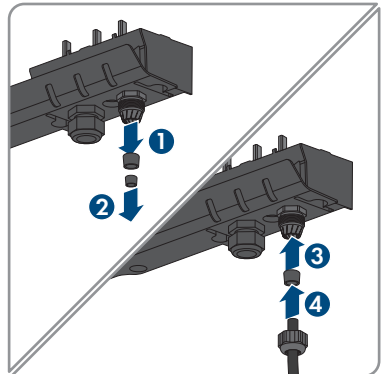


4. Thread the AC cable through the cable gland of the AC connection:

- If the external diameter of the cable is 5 mm to 7 mm, thread the AC cable through the cable gland directly.

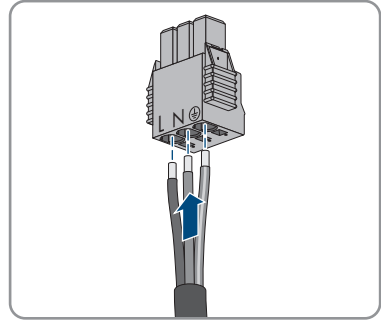


- If the external diameter of the AC cable is 8 mm to 13 mm, first remove the inner sealing ring from the cable gland and then thread the AC cable through the cable gland. When doing so, ensure that the outer sealing ring is positioned correctly in the cable gland.

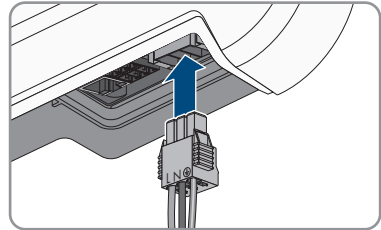


5. Dismantle 70 mm of the AC cable.
6. Shorten L and N by 5 mm each. Thus, the grounding conductor will be released from the terminal block last when tensile load is applied.
7. Strip 15 mm of the insulation of L, N and the grounding conductor.

8. Connect L, N and the grounding conductor to the terminal block for the AC connection in accordance with the labeling. When doing so, ensure that the conductors are plugged completely into the terminals up to the insulation. Tip: To release the conductors from the terminals, the terminals must be opened. To do this, stick a flat-blade screwdriver (blade width: 3 mm) as far as it can go into the rectangular opening behind the terminal.



9. Ensure that all terminals are allocated to the correct conductors.  
 10. Make sure that all conductors are securely in place.  
 11. Plug the terminal block with the connected conductors for the AC connection into the slot in the inverter until the terminal block clicks into place.



12. Ensure that the terminal block is securely in place by slightly pulling it.

### 6.2.3 Connecting Additional Grounding

#### **⚠ QUALIFIED PERSON**

If additional grounding or equipotential bonding is required locally, you can connect additional grounding to the product. This prevents touch current if the grounding conductor at the terminal for the AC cable fails.

The required clamping bracket, the cylindrical screw M5x16, the washer and the spring lock washer are part of the scope of delivery of the inverter.

#### **Cable requirements:**

#### **i Use of fine-stranded conductors**

You can use an inflexible or a flexible, fine-stranded conductor.

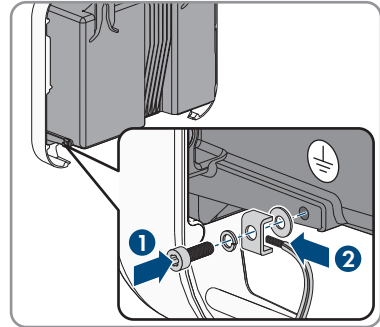
- When using a fine-stranded conductor, it has to be double crimped by a ring terminal lug. Make sure that no insulated conductor is visible when pulling or bending. This will ensure sufficient strain relief by means of the ring terminal lug.

- Grounding cable cross-section: max. 10 mm<sup>2</sup>

#### **Procedure:**

1. Strip off 12 mm of the grounding cable insulation.
2. Insert the screw through the spring lock washer, the clamping bracket and the washer.

3. Lightly screw the screw into the thread of the connection point for the additional grounding.
4. Guide the grounding cable between the washer and clamping bracket and tighten the screw (TX25) (torque: 6 Nm).



## 6.3 Connecting the Network Cables

### ⚠ QUALIFIED PERSON

### ⚠ 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 are integrated in the existing overvoltage protection.
- When laying the network cable outdoors, ensure that there is suitable surge protection at the network cable transition from the product outdoors to the network inside the building.
- The Ethernet interface of the product 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 network cable
- Where required: Field-assembly RJ45 connector for the network cable. SMA Solar Technology AG recommends the connector "MFP8 T568 A Cat.6A" from "Telegärtner".

#### Network cable requirements:

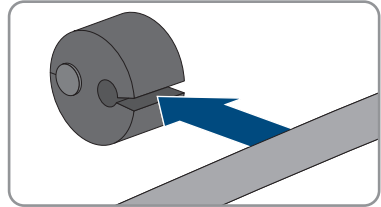
The cable length and quality affect the quality of the signal. Observe the following cable requirements:

- Cable type: 100BaseTx
- Cable category: minimum CAT5e
- Plug type: RJ45 of Cat5, Cat5e or higher
- Shielding: SF/UTP, S/UTP, SF/FTP or S/FTP

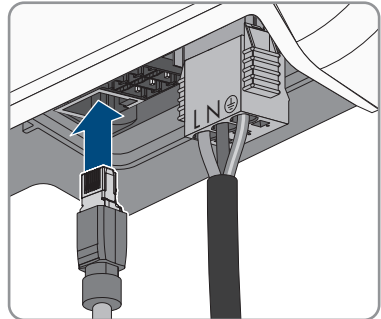
- Number of insulated conductor pairs and insulated conductor cross-section: at least 2 x 2 x 0.22 mm<sup>2</sup>
- Maximum cable length between 2 nodes when using patch cables: 50 m
- Maximum cable length between 2 nodes when using installation cables: 100 m
- UV-resistant for outdoor use.

**Procedure:**

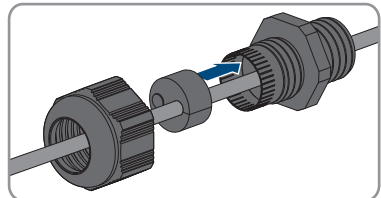
1. When using a self-assembly network cable, assemble the RJ45 connector and connect to the network cable (see connector documentation).
2. Remove the swivel nut from the cable gland for the network connection on the connection cap.
3. Thread the swivel nut over the network cable.
4. Press the cable support sleeve out of the cable gland.
5. Remove one filler plug from the cable support sleeve.
6. Route the network cable through an opening in the cable support sleeve.



7. Thread the network cable through the cable gland.
8. Insert the RJ45 plug of the network cable into the network pin connector on the inverter until it snaps into place.

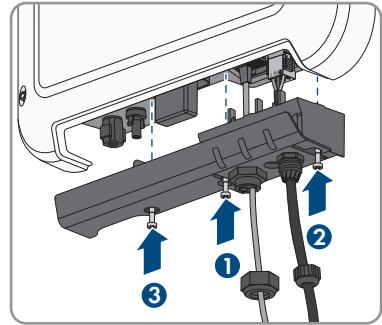


9. Ensure that the RJ45 plug is securely in place by pulling slightly on the network cable.
10. Press the cable support sleeve back into the cable gland.



11. Screw the swivel nut hand-tight onto the cable gland.

12. Tighten the connection cap with the three screws (TX20, torque: 3.5 Nm).



13. Screw the swivel nuts hand-tight onto the cable gland of the AC connection and the cable gland of the network cable.
14. If the inverter is installed outdoors, install overvoltage protection.
15. If you would like to establish a direct connection, connect the other end of the network cable directly to the computer.
16. If you would like to integrate the inverter into a local network, connect the other end of the network cable to the local network (e.g. via a router).

**Also see:**

- > Section 9 "Disconnecting the Inverter from Voltage Sources", page 69

## 6.4 DC Connection

### 6.4.1 Requirements for the DC Connection

**Requirements for the PV modules:**

- All PV modules should be of the same type.
- All PV modules should be aligned and tilted identically.
- On the coldest day based on statistical records, the open-circuit voltage of the PV array must never exceed the maximum input voltage of the inverter.
- The same number of series-connected PV modules must be connected to each string.
- The maximum input current per string must be maintained and must not exceed the through-fault current of the DC connectors (see Section 13 "Technical Data", page 95).
- The thresholds for the input voltage and the input current of the inverter must be adhered to (see Section 13 "Technical Data", page 95).
- The positive connection cables of the PV modules must be equipped with positive DC connectors (see Section 6.4.2, page 38).
- The negative connection cables of the PV modules must be equipped with the negative DC connectors (see Section 6.4.2, page 38).

### **i** Use of Y adapters for parallel connection of strings

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

- Do not use the Y adapters in the immediate vicinity of the inverter. The adapters must not be visible or freely accessible.
- In order to interrupt the DC circuit, always disconnect the inverter as described in this document (see Section 9, page 69).

## 6.4.2 Assembling the DC Connectors

### **⚠ QUALIFIED PERSON**

### **⚠ DANGER**

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

When exposed to light, the PV modules generate high DC voltage which is present in the DC cables. Touching live DC cables results in death or lethal injuries due to electric shock.

- Do not touch non-insulated parts or cables.
- Disconnect the product from voltage sources and ensure it cannot be reconnected before working on the device.
- Do not disconnect the DC connectors under load.
- Wear suitable personal protective equipment for all work on the product.

For connection to the inverter, all PV module connection cables must be fitted with the DC connectors provided. Assemble the DC connectors as described in the following. The procedure is identical for both connectors (+ and -). The graphics for the procedure are shown for only the positive connector as an example. Pay attention to the correct polarity when assembling the DC connectors. The DC connectors are marked with the symbols "+" and "-".

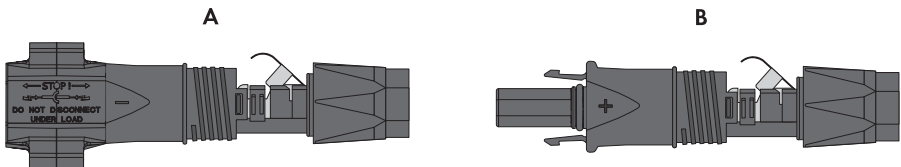


Figure 10: Negative (A) and positive (B) DC connectors

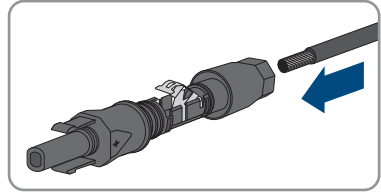
#### **Cable requirements:**

- External diameter: 5.5 mm to 8 mm
- Conductor cross-section: 2.5 mm<sup>2</sup> to 6 mm<sup>2</sup>
- Qty single wires: minimum 7
- Nominal voltage: minimum 1000 V
- Using bootlace ferrules is not allowed.

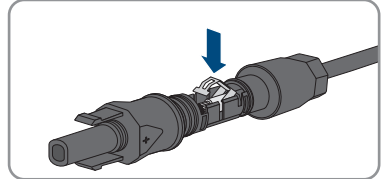
#### **Procedure:**

1. Strip 12 mm of the cable insulation.

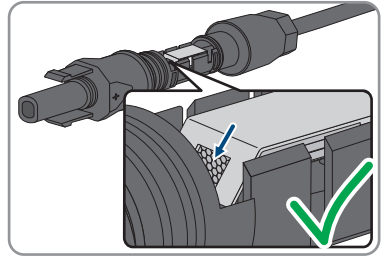
2. Insert the stripped cable into the DC connector up to the stop. When doing so, ensure that the stripped cable and the DC connector are of the same polarity.



3. Press the clamping bracket down until it audibly snaps into place.

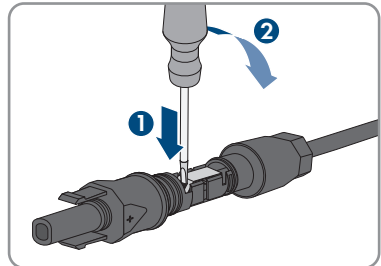


- ☑ The stranded wire can be seen inside the clamping bracket chamber.

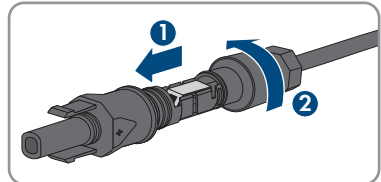


4. If the stranded wire is not visible in the chamber, the cable is not correctly inserted and the connector must be reassembled. To do this, the cable must be removed from the connector.

- Release the clamping bracket. To do so, insert a screwdriver (blade width: 3.5 mm) into the clamping bracket and pry the clamping bracket open.



- Remove the cable and go back to step 2.



5. Push the swivel nut up to the thread and tighten (torque: 2 Nm).

### 6.4.3 Connecting the PV Array

#### ⚠ QUALIFIED PERSON

#### NOTICE

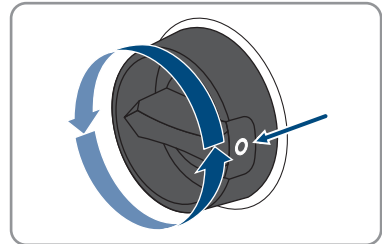
#### Damage to the DC connectors due to the use of contact cleaner of other cleaning agents

Some contact cleaners or other cleaning agents may contain substances that decompose the plastic of the DC connectors.

- Do not use contact cleaners or other cleaning agents for cleaning the DC connectors.

#### Procedure:

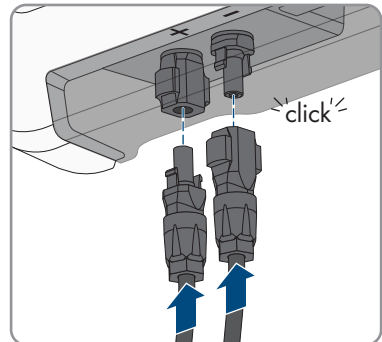
1. Ensure that the circuit breaker is switched off and that it cannot be reconnected.
2. If an external DC load-break switch is installed, disconnect the external DC load-break switch from all voltage sources.
3. Set the DC load-break switch of the inverter to position **O**.



4. Measure the PV array voltage. Ensure that the maximum input voltage of the inverter is adhered to and that there is no ground fault in the PV array.
5. Check whether the DC connectors have the correct polarity.

If the DC connector is equipped with a DC cable of the wrong polarity, the DC connector must be reassembled. The DC cable must always have the same polarity as the DC connector.

6. Connect the assembled DC connectors to the inverter.



- ☑ The DC connectors snap into place.

7. Ensure that all DC connectors are securely in place.



## 6.4.4 Disassembling the DC Connectors

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To disassemble the DC connectors for connection to the pv modules (e.g. due to faulty assembly), proceed as follows.

### ⚠ DANGER

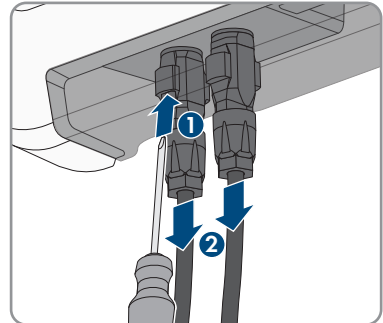
#### **Danger to life due to electric shock when touching exposed DC conductors or DC plug contacts if the DC connectors are damaged or loose**

The DC connectors can break or become damaged, become free of the DC cables, or no longer be connected correctly if the DC connectors are released and disconnected incorrectly. This can result in the DC conductors or DC plug contacts being exposed. Touching live DC conductors or DC plug connectors will result in death or serious injury due to electric shock.

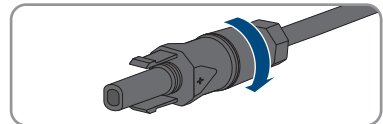
- Wear insulated gloves and use insulated tools when working on the DC connectors.
- Ensure that the DC connectors are in perfect condition and that none of the DC conductors or DC plug contacts are exposed.
- Carefully release and remove the DC connectors as described in the following.

#### **Procedure:**

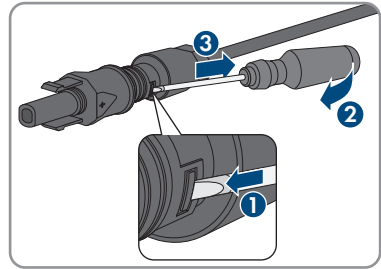
1. Release and remove the DC connectors. To do so, insert a flat-blade screwdriver or an angled screwdriver (blade width: 3.5 mm) into one of the side slots and pull the DC connectors out. When doing so, do not lever the DC connectors out, but insert the tool into one of the side slots only to release the locking mechanism, and do not pull on the cable.



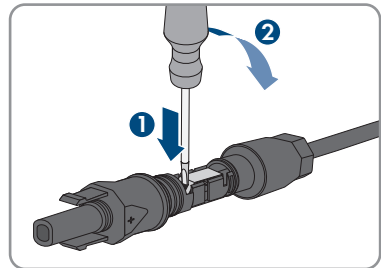
2. Remove the DC connector swivel nut.



3. Unlock the DC connector. To do this, insert a flat-blade screwdriver (blade width: 3.5 mm) into the side catch mechanism and pry the catch mechanism open.



4. Carefully pull the DC connector apart.
5. Release the clamping bracket. To do so, insert a flat-blade screwdriver (blade width: 3.5 mm) into the clamping bracket and pry the clamping bracket open.



6. Remove the cable.

## 7 Commissioning

### 7.1 Commissioning Procedure

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

#### Commissioning an inverter that is captured in a communication device

When the inverter is captured in a communication device, the communication device (e.g. SMA Data Manager) is the unit for configuring the total system. The configuration is transferred to all inverters in the system. The system password assigned via the communication device is also the password for the user interface of the inverter.

- Commission the inverter (see Section 7.2, page 44).
- The initial configuration of the inverter is made via the communication device. The configuration is transferred to the inverter and the settings of the inverter are overwritten.
- Deactivate the Webconnect function of the inverter via the Sunny Portal. This prevents unnecessary connection attempts of the inverter with Sunny Portal.

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

From firmware version 3.11.00.R, the activation conditions for feed-in operation were changed.

To ensure the inverter begins feed-in operation during initial commissioning, a country data set must be set (for instance via the installation assistant on the user interface of the product, or via a communication product).

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

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

Procedure	See
1. Commission the inverter.	Section 7.2, page 44
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"> <li>• Direct connection via WLAN</li> <li>• Direct connection via Ethernet</li> <li>• Connection via WLAN in the local network</li> <li>• Connection via Ethernet in the local network</li> </ul>	Section 8.1, page 48
3. Log into the user interface.	Section 8.2, page 52

Procedure	See
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. You can request the SMA Grid Guard code via the Online Service Center.	Section 7.3, page 45
5. Configure the product and set country data set. Then the product will begin operation.	Section 8.10, page 61
6. For PV systems in Italy or Dubai: Start the self-test.	Section 7.4, page 47
7. Make further inverter settings as needed.	Section 8, page 48

## 7.2 Commissioning the Inverter

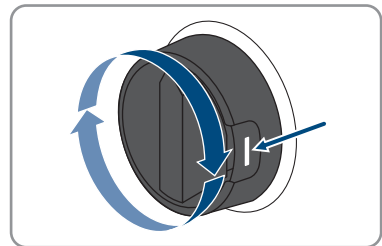
### ⚠ QUALIFIED PERSON

#### Requirements:

- The AC circuit breaker must be correctly rated and mounted.
- The product must be correctly mounted.
- All cables must be correctly connected.

#### Procedure:

1. Switch on the AC circuit breaker.
2. Turn the DC load-break switch of the inverter to position I.



- All 3 LEDs light up. The start-up phase begins.
  - All 3 LEDs go out again after approximately 90 seconds.
3. If the green and red LEDs flash simultaneously during initial commissioning, operation is stopped because no country data set has been set yet. For the inverter to begin operation, the configuration must be completed and a country data set must be set.
  4. 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.
  5. If the red LED lights up, an event has occurred. Find out which event has occurred and, if necessary, initiate countermeasures.

**Also see:**

> Section 11 "Troubleshooting", page 72

## 7.3 Selecting a configuration option

### **⚠ QUALIFIED PERSON**

After you have assigned the password for the user groups **Installer** and **User** and logged in as **Installer**, the **Configuring the Inverter** page opens.

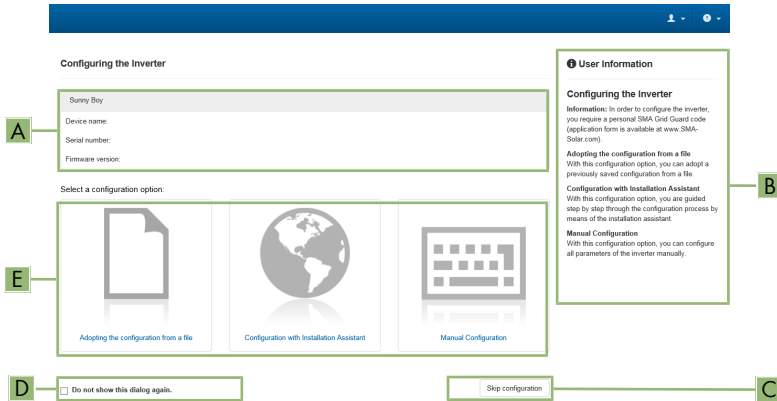


Figure 11: Layout of the **Configuring the Inverter** page

Position	Designation	Description
A	Device information	Provides the following information: <ul style="list-style-type: none"> <li>• Device name</li> <li>• Inverter serial number</li> <li>• Inverter firmware version</li> </ul>
B	User information	Provides brief information on the listed configuration options
C	Skip configuration	Offers the option of skipping the inverter configuration and go directly to the user interface (not recommended)
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

### Configuration options:

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

### **i** Accepting the settings

Saving the made settings is indicated by an hourglass symbol on the user interface. If the DC voltage is sufficient, the data is transferred directly to the inverter and accepted. If the DC voltage is too low (e. g. in the evening), the settings are saved, but they cannot be directly transferred to or accepted by the inverter. As long as the inverter has not yet received and accepted the settings, the hourglass symbol will continue to be displayed on the user interface. The settings will be accepted when there is sufficient DC voltage applied and the inverter restarts. As soon as the hourglass symbol appears on the user interface, the settings have been saved. The settings will not be lost. You can log off of the user interface and leave the system.

### 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)

#### 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 correct settings you made, select [**Back**], navigate to the desired step, correct settings and select [**Save and continue**].
5. Once all settings are correct, select [**Next**] in the summary.
6. To save the settings to a file, select [**Export a summary**] and save the file on your smart device.
7. To export all parameters and their settings, select [**Export all parameters**]. This exports all parameters and their settings into an HTML file.
  - 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.

## 7.4 Starting the Self-Test (for Italy and Dubai)

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The self-test is only required for inverters that are to be commissioned in Italy or Dubai. The Italian standard CEI 0-21 and the DEWA (Dubai Electricity and Water Authority) stipulate that all inverters that feed into the utility grid are equipped with a self-test function. During the self-test, the inverter will consecutively check the reaction times for overvoltage, undervoltage, maximum frequency and minimum frequency.

The self-test changes the upper and lower disconnection values for each protective function on a linear basis for frequency monitoring and voltage monitoring. As soon as the measured value exceeds the permitted disconnection threshold, the inverter disconnects from the utility grid. In this way, the inverter determines the reaction time and checks itself.

After the self-test has been completed, the inverter automatically switches back to feed-in operation, resets the original disconnection conditions and connects to the utility grid. The test takes approximately three minutes.

### Requirements:

- The country data set of the inverter must be set to **CEI 0-21 internal** or **DEWA 2016 internal**.

### Procedure:

1. Select the menu **Device Configuration**.
2. Select [**Settings**].
3. Select [**Starting the Self-Test**] in the subsequent context menu.
4. Follow the instructions appearing in the dialog and save the report of the self-test where necessary.

## 8 Operation

### 8.1 Establishing a connection to the user interface

#### 8.1.1 Establishing a Direct Connection via Ethernet

##### Requirements:

- The product must be commissioned.
- A smart device (e.g. laptop) with an Ethernet interface must be available.
- The product must be connected directly to the smart device.
- The respective latest version of one of the following web browsers must be installed on the smart device: Chrome, Edge, Firefox or Safari.
- The installer's SMA Grid Guard code must be available to change network-relevant settings after the first 10 hours of feed-in operation, or after completing the installation assistant. You can request the SMA Grid Guard code via the Online Service Center.

##### IP address of the inverter

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

##### Procedure:

1. Open the web browser of your smart device and enter the IP address **169.254.12.3** in the address bar.
2. Press the enter key.

##### 3. Web browser signals a security vulnerability

After the IP address has been entered, a message might appear indicating that the connection to the user interface of the product is not secure. SMA Solar Technology AG guarantees the security of the user interface.

- Continue loading the user interface.

- The login page of the user interface opens.

#### 8.1.2 Establishing a direct connection via WLAN

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

The following connection options are available:

- Connection to SMA 360° App
- Connection with WPS
- Connection with Wi-Fi network search

##### Requirements:

- The product must be commissioned.
- A smart device (e.g. smartphone, tablet or laptop) must be available.



- The respective latest version of one of the following web browsers must be installed on the smart device: Chrome, Edge, Firefox or Safari.
- JavaScript must be enabled in the web browser of the smart device.
- The installer's SMA Grid Guard code must be available to change network-relevant settings after the first 10 hours of feed-in operation, or after completing the installation assistant. You can request the SMA Grid Guard code via the Online Service Center.

### **i** SSID, IP address and WLAN password

- SSID in WLAN: **SMA[serial number]** (e.g. SMA0123456789)
- Device-specific WLAN password: see WPA2-PSK on the type label of the product or the rear side of the manual included in delivery
- Standard access address for a direct connection via WLAN outside of a local network: **http://smalogin.net** or **192.168.12.3**

### **i** Importing and exporting files with smart 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 smart devices having an iOS operating system.

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

## Connection to SMA 360° App

### Requirements:

- A smart device with camera (e.g. smartphone or tablet) must be available.
- The SMA 360° App must be installed on the smart device.
- An user account for Sunny Portal must already exist.

### Procedure:

1. Open the SMA 360° App and login with the Sunny Portal account details.
2. Select **QR-Code Scan** in the menu.
3. Scan the QR Code on you product via the SMA 360° App.
  - The smart device automatically connects to the product. The web browser of your smart device opens and the login page of the user interface is displayed.
4. If the web browser of the smart end device does not open automatically and the login page of the user interface is not displayed, open the web browser and enter **http://smalogin.net** in the address bar.

## Connection with WPS

### Requirement:

- The smart device must have a WPS function.

**Procedure:**

1. Enable the WPS function on the inverter. To do this, tap on the enclosure lid of the inverter twice.
  - The blue LED flashes quickly for approx. two minutes. The WPS function is active during this time.
2. Enable the WPS function on your smart device.
3. Open the web browser of your smart end device and enter **http://smalogin.net** in the address bar.

**Connection with Wi-Fi network search**

1. Search for Wi-Fi networks with your smart device.
2. Select the SSID of the product **SMA[serial number]** in the list with the detected Wi-Fi networks.
3. Enter the device-specific Wi-Fi password (see WPA2-PSK on the type label of the product or the rear side of the manual included in delivery).
4. Open the web browser of your smart end device and enter **http://smalogin.net** in the address bar.
  - The login page of the user interface is displayed.
5. If the login page of the user interface does not open, enter the IP address **192.168.12.3** or, if your smart device supports mDNS services, **SMA[serial number].local** or **http://SMA[serial number]** in the address bar of the web browser.

**8.1.3 Establishing a Connection via Ethernet 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: **http://SMA[serial number]** (e.g., http://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.
- A smart device (e.g. smartphone, tablet or laptop) must be available.

- The smart device must be in the same local network as the product.
- The respective latest version of one of the following web browsers must be installed on the smart device: Chrome, Edge, Firefox or Safari.
- The installer's SMA Grid Guard code must be available to change network-relevant settings after the first 10 hours of feed-in operation, or after completing the installation assistant. You can request the SMA Grid Guard code via the Online Service Center.

#### Procedure:

1. Open the web browser of your smart device. Enter the IP address of the product in the address bar of the web browser. Then press Enter key.
  2.  **Web browser signals a security vulnerability**  
After the IP address has been entered, a message might appear indicating that the connection to the user interface of the product is not secure. SMA Solar Technology AG guarantees the security of the user interface.
    - Continue loading the user interface.
- The login page of the user interface opens.

### 8.1.4 Establishing a Connection via WLAN 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: **http://SMA[serial number]** (e.g., http://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.
- A smart device (e.g. smartphone, tablet or laptop) must be available.
- The smart device must be in the same local network as the product.
- The respective latest version of one of the following web browsers must be installed on the smart device: Chrome, Edge, Firefox or Safari.
- The installer's SMA Grid Guard code must be available to change network-relevant settings after the first 10 hours of feed-in operation, or after completing the installation assistant. You can request the SMA Grid Guard code via the Online Service Center.

### **i** Importing and exporting files with smart 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 smart devices having an iOS operating system.

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

#### **Procedure:**

- Enter the IP address of the product in the address bar of the web browser.
  - The login page of the user interface opens.

## 8.2 Logging In and Out of 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.

### **Log in as Installer or User for the First Time**

#### **i** Password assignment for user and installer

The passwords for the user groups **Installer** and **User** must be assigned when accessing the user interface for the first time. If the inverter was registered in a communication device (e.g., SMA Data Manager) and the system password was assigned, the system password is also the installer password. In this case, only the user password must be assigned.

- If you as a specialist assign the user password, only pass the password on to persons to access the inverter data via the user interface.
- If you as a user assign the installer password, only pass the password on to persons to receive access to the system.

#### **i** Installer password for inverters registered in a communication device or in Sunny Portal

To be able to register the inverter in a communication device (e.g., SMA Data Manager) or in a Sunny Portal system, the password for the user group **Installer** must match the system password. If you assign a password for the user group **Installer** via the user interface of the inverter, the same password must also be used as the system password.

- Assign a uniform installer password to all SMA devices in the system.

#### **Procedure:**

1. In the drop-down list **Language**, select the desired language.
2. In the **Password** field, enter a password for the **User** user group.
3. In the **Repeat password** field, enter the password again.
4. Click on **Save**.
5. In the **New password** field, enter a password for the **Installer** user group. Assign a uniform password to all SMA devices to be registered in a system. The installer password is also the system password.

6. In the **Repeat password** field, enter the password again.
7. Click on **Save and log in**.

The **Configuring the Inverter** page opens.

### **Log in as the User or Installer**

1. In the drop-down list **Language**, select the desired language.
2. In the **User group** drop-down list, select the entry **Installer** or **User**.
3. Enter the password in the field **Password**.
4. Select **Login**.

The start page of the user interface opens.

### **Log Out as the User or Installer**

1. On the right-hand side of the menu bar, select the menu **User Settings**.
2. In the subsequent context menu, select [**Logout**].

The login page of the user interface opens. The logout was successful.

### 8.3 Start Page Design of the User Interface

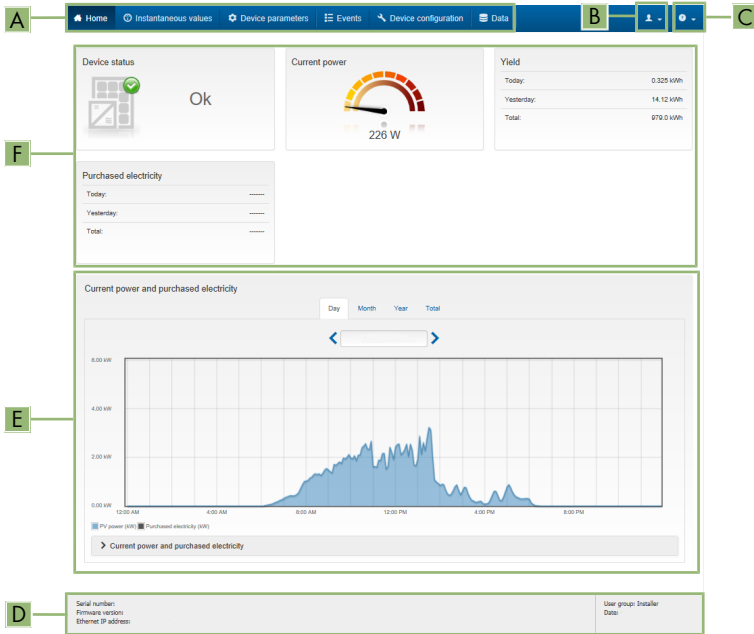


Figure 12: Design of the user interface's home page (example)

Position	Designation	Description
A	Menu	<p>Provides the following functions:</p> <ul style="list-style-type: none"> <li>• <b>Home</b> Opens the user interface homepage</li> <li>• <b>Instantaneous values</b> Current measured values of the inverter</li> <li>• <b>Device Parameters</b> The various operating parameters of the inverter can be viewed and configured here depending on the user group.</li> <li>• <b>Events</b> All events that have occurred in the selected time period are displayed here. The event types are <b>Information</b>, <b>Warning</b> and <b>Error</b>. Currently existing events of the types <b>Error</b> and <b>Warning</b> will be additionally displayed in the <b>Device status</b> viewlet. However, only the higher-priority event is displayed. If, for example, there is a Warning and an Error present at the same time, only the Error will be displayed.</li> <li>• <b>Device configuration</b> Various settings for the inverter can be made here. The selection available is dependent on which user group you are logged in as and the operating system of the device with which the user interface has been called up.</li> <li>• <b>Data</b> You will find all data that is saved in the internal memory of the inverter or on an external storage medium on this page.</li> </ul>
B	User settings	<p>Provides the following functions, depending on the user group logged in:</p> <ul style="list-style-type: none"> <li>• Starting the installation assistant</li> <li>• SMA Grid Guard login</li> <li>• Logout</li> </ul>
C	Help	<p>Provides the following functions:</p> <ul style="list-style-type: none"> <li>• Displaying information on Open Source licenses used</li> <li>• Link to the website of SMA Solar Technology AG</li> </ul>

Position	Designation	Description
D	Status bar	<p>Displays the following information:</p> <ul style="list-style-type: none"> <li>• Inverter serial number</li> <li>• Inverter firmware version</li> <li>• IP address of the inverter within the local network and/or IP address of the inverter during WLAN connection</li> <li>• With WLAN connection: Signal strength of WLAN connection</li> <li>• User group logged in</li> <li>• Date and device time of the inverter</li> </ul>
E	Current power and current consumption	<p>Temporal progression of the PV power and the power consumption of the household over the selected time period. Please note, the power consumption will only be displayed if an energy meter is installed in the PV system.</p>
F	Status display	<p>The various areas display information on the current status of the PV system.</p> <ul style="list-style-type: none"> <li>• <b>Device status</b> Displays whether the inverter is currently in a fault-free operating state or whether there is an Error or Warning present.</li> <li>• <b>Current power</b> Displays the power currently being generated by the inverter.</li> <li>• <b>Yield</b> Displays the energy yield of the inverter.</li> <li>• <b>Grid supply</b> Displays the energy supply from the utility grid.</li> <li>• <b>Power at the grid-connection point</b> Indicates which power is currently fed in or obtained at the grid-connection point.</li> </ul>

## 8.4 Starting the Installation Assistant

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The installation assistant leads you step-by-step through the steps necessary for the initial configuration of the inverter.



### Layout of the installation assistant

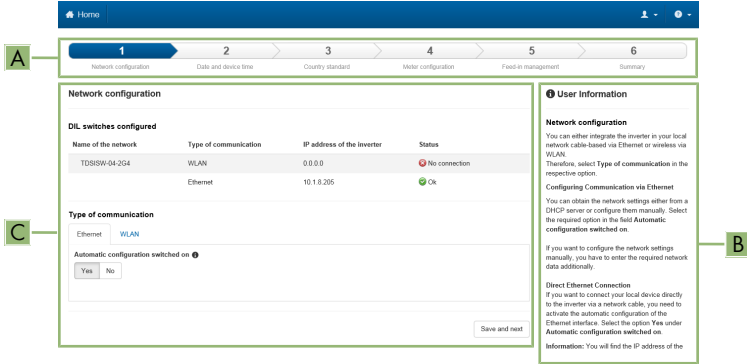


Figure 13: Layout of the installation assistant (example)

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.

**Requirement:**

- The SMA Grid Guard code must be available to change network-relevant parameters after the first 10 hours of feed-in operation, or after completing the installation assistant. You can request the SMA Grid Guard code via the Online Service Center.

**Procedure:**

1. Open the user interface (see Section 8.1, page 48).
  2. Log in as **Installer**.
  3. Select the menu **User Settings** (see Section 8.3, page 54) on the start page of the user interface.
  4. In the context menu, select **[Starting the installation assistant]**.
- The installation assistant will open.

## 8.5 Activate WPS Function

The WPS function can be used for different purposes:

- Automatic connection to a network (e.g. via router)
- Direct connection between the product and a smart device

Depending on the intended application of the WPS function, the procedure for activation will vary.

## Activating WPS function for automatic connection to a network

### Requirements:

- WLAN must be activated in the product.
- WPS must be activated on the router.

### Procedure:

1. Open the user interface (see Section 8.1, page 48).
  2. Log in as **Installer**.
  3. Start the installation assistant (see Section 8.4, page 56).
  4. Select **Network configuration**.
  5. Select **WPS for WLAN network** button in the **WLAN** tab.
  6. Select **Activate WPS**.
  7. Select **Save and next** and exit the installation assistant.
- The WPS function is activated and the automatic connection to the network can be established.

## Activating the WPS function for direct connection to the smart device.

- Enable WPS function on the product. To do this, tap on the enclosure lid of the product twice.
  - The blue LED flashes quickly for approx. 2 minutes. The WPS function is active during this time.

## 8.6 Switching WLAN On and Off

The inverter is equipped with an activated WLAN interface as standard. If you do not want to use WLAN, you can switch the WLAN function off and switch it on again whenever needed. In doing so, you can switch the WLAN direct connection and the WLAN connection in the local network on independently of each other.

### Switching on the WLAN function only possible via Ethernet connection

If you switch off both the WLAN function for the direct connection and for the connection in the local network, access to the inverter user interface and therefore reactivation of the WLAN interface is only possible via an Ethernet connection.

The basic procedure for changing operating parameters is explained in another section (see Section 8.9 "Changing Operating Parameters", page 60).

### Switching WLAN Off

If you would like to switch the WLAN function off completely, you must switch off both the direct connection and the connection in the local network.

### Procedure:

- To switch off the direct connection in the parameter group **PV system communication > WLAN**, select the parameter **Soft-access-point is turned on** and set this to **No**.
- To switch off the connection in the local network in the parameter group **PV system communication > WLAN**, select the parameter **WLAN is turned on** and set this to **No**.

## Switching WLAN On

If you have switched the WLAN function for direct connection or for connection in the local network off, you can switch the WLAN function back on in accordance with the following procedure.

### Requirement:

- If the WLAN function was previously switched off completely, the inverter must be connected to a computer or router via Ethernet.

### Procedure:

- To switch on the WLAN direct connection, in the parameter group **PV system communication > WLAN**, select the parameter **Soft-access-point is turned on** and set this to **Yes**.
- To switch on the WLAN connection in the local network, in the parameter group **System communication > WLAN**, select the parameter **WLAN is turned on** and set this to **Yes**.

## 8.7 Switching the Dynamic Power Display Off

As standard, the product signals its power dynamically via the pulsing of the green LED. When doing so, the LED flashes on and off uniformly or is permanently lit at full power. The various gradations are related here to the set active power limit of the product. If this display is not desired, switch this function off in accordance with the following procedure. Once this has been done, the green LED is lit permanently to signalize feed-in operation.

The basic procedure for changing operating parameters is explained in another section (see Section 8.9 "Changing Operating Parameters", page 60).

### Procedure:

- In the parameter group **Device > Operation**, select the parameter **Dynamic power display via green LED** and set this to **Off**.

## 8.8 Changing the Password

The password for the inverter can be changed for both user groups. Furthermore, the user group **Installer** can change the password for the user group **User** as well as its own password.

### **i** PV systems registered in a communication product

With PV systems that are registered in a communication product (e.g. Sunny Portal, Sunny Home Manager), you can also assign a new password for the user group **Installer** via the communication product. The password for the user group **Installer** is also the system password. If you assign a password for the user group **Installer** via the user interface of the inverter that does not correspond to the system password in the communication product, the inverter can no longer be reached by the communication product.

- Ensure that the password for the user group **Installer** is the same as the system password in the communication product.

### Procedure:

1. Activate the user interface (see Section 8.1, page 48).
2. Log into the user interface (see Section 8.2, page 52).

3. Call up the menu **Device Parameters**.
4. Select [**Edit parameters**].
5. In the parameter group **User Rights > Access Control** change the password of the desired user group.
6. Select [**Save all**] to save the changes.

## 8.9 Changing Operating Parameters

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

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

Some function-sensitive parameters can only be viewed by qualified persons and can only be changed by qualified persons by entering the personal SMA Grid Guard code. You can request the SMA Grid Guard code via the Online Service Center.

### No configuration via Sunny Explorer

Sunny Explorer does not support the configuration of inverters with their own user interface. The inverter can be detected via Sunny Explorer, however it is expressly not recommended to use Sunny Explorer to configure this inverter. SMA Solar Technology AG does not accept liability for missing or incorrect data and possibly resulting yield losses.

- Use the user interface for the configuration of the inverter.

#### Requirements:

- Changes to grid-relevant parameters must be approved by the responsible grid operator.

#### Procedure:

1. Open the user interface (see Section 8.1, page 48).
  2. Log into the user interface (see Section 8.2, page 52).
  3. Call up the menu **Device parameters**.
  4. Click on [**Edit parameters**].
  5. Log in using the SMA Grid Guard code to change those parameters designated by a lock (only for installers):
    - Select the menu **User settings** (see Section 8.3, page 54).
    - In the subsequent context menu, select [**SMA Grid Guard login**].
    - Enter the SMA Grid Guard code and select [**Login**].
  6. Expand the parameter group that contains the parameter which is to be configured.
  7. Change the required parameters.
  8. Select [**Save all**] to save the changes.
- The parameters are set.

### **i** Accepting the settings

Saving the made settings is indicated by an hourglass symbol on the user interface. If the DC voltage is sufficient, the data is transferred directly to the inverter and accepted. If the DC voltage is too low (e. g. in the evening), the settings are saved, but they cannot be directly transferred to or accepted by the inverter. As long as the inverter has not yet received and accepted the settings, the hourglass symbol will continue to be displayed on the user interface. The settings will be accepted when there is sufficient DC voltage applied and the inverter restarts. As soon as the hourglass symbol appears on the user interface, the settings have been saved. The settings will not be lost. You can log off of the user interface and leave the system.

## 8.10 Configuring the Country Data Set

### **⚠** QUALIFIED PERSON

For the product to begin operation, a country data set must be set (for instance via the installation assistant on the user interface of the product, or via a communication product). As long as no country data set is set, operation of the product will remain stopped. This state is signaled by the green and red LEDs flashing simultaneously. Once configuration of the product is completed, the product will start operating automatically.

By default, the inverter is set to a universally valid country data set. You must adjust the country data set for the installation site.

### **i** The country data set must be set correctly.

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

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

### **i** Change to the names and units of grid parameters to comply with the grid-connection requirements in accordance with Regulation (EU) 2016/631 (valid from April 27, 2019)

To comply with the EU grid-connection requirements (valid from April 27, 2019) the names and units of grid parameters were changed. This change is valid from firmware version  $\geq 3.00.00.R$  if a country data set for fulfilling the EU grid-connection requirements (valid from 2019-04-27) is set. Names and units of grid parameters for inverters with firmware version  $\leq 2.99.99.R$  are not affected by this change and remain valid. This also applies from firmware version  $\geq 3.00.00.R$  if a country data set that is valid for countries outside the EU is set.

The basic procedure for changing operating parameters is explained in another section (see Section 8.9 "Changing Operating Parameters", page 60).

#### Procedure:

- In the parameter group **Grid monitoring > Grid monitoring** select the parameter **Set country standard** and set the required country data set.

## 8.11 Configuring the Active Power Mode

### ⚠ QUALIFIED PERSON

#### Starting the installation assistant

1. Open the user interface (see Section 8.1, page 48).
2. Log in as **Installer**.
3. Start the installation assistant (see Section 8.4, page 56).
4. Select [**Save and continue**] after each step up until the step **Grid management service**.
5. Make the settings as described in the following.

#### Setting the connected line conductors

- In the tab **Active power mode**, select the line conductor to which the inverter is connected from the drop-down list **Connected line conductors**.

#### Make the settings for systems with external setpoint

1. Set the **Grid connection point regulation** to [**Off**].
2. In the tab **Active power mode** set the switch **Active power setpoint** to [**On**].
3. In the drop-down list **Operating mode active power setpoint**, select the entry **External setpoint**.
4. In the drop-down list **Fallback behavior**, select the entry **Apply fallback values**.
5. In the field **Fallback value of the maximum active power** enter the value to which the inverter is to limit its nominal power in case of a communication failure to the higher control unit at the end of the timeout time.
6. In the field **Timeout**, enter the time that the inverter is to wait before it limits its nominal power to the set fallback value.
7. If, in the event of a 0% or 0 W specification, the inverter is not permitted to feed small amounts of active power into the utility grid, select the entry **Yes** in the drop-down list **Grid disconnection for 0% active power setpoint**. This ensures that in the event of a 0% or 0 W specification, the inverter disconnects from the utility grid and does not feed in active power.

#### Make the settings for systems with manual setpoint

1. In the tab **Active power mode** set the switch **Grid connection point regulation** to [**On**].
2. Enter the total power of the PV array in the field **Nominal system power**.
3. In the drop-down list **Operating mode active power setting**, select whether active power limitation is to be performed via a fixed specification in percent or in watts.
4. In the field **Set active power limit**, enter the value to which the active power at the point of interconnection is to be limited. The value must be set to **0** for zero active power.
5. Set the **Active power setpoint** to [**On**].
6. Select the entry **Manual setpoint in %** or **Manual setpoint in W** for manual specification and enter the respective setpoint value.
7. If the inverter itself is to control active power at the point of interconnection, perform the following steps:

- In the drop-down list **Operating mode active power setting**, select the entry **External setting**.
- In the drop-down list **Fallback behavior**, select the entry **Apply fallback values**.
- In the drop-down list **Grid disconnection for active power setpoint of 0%** select the entry **No**.

## 8.12 Configuring the Modbus Function

### QUALIFIED PERSON

The Modbus interface is deactivated by default and the communication ports 502 set.

In order to access SMA inverters with SMA Modbus® or SunSpec® Modbus®, the Modbus interface must be activated. After activating the interface, the communication ports of both IP protocols can be changed. For information on commissioning and configuration of the Modbus interface, see the technical information "SMA and SunSpec Modbus® Interface" at [www.SMA-Solar.com](http://www.SMA-Solar.com).

For information on which Modbus registers are supported, see the technical information "Modbus® parameters and measured values" at [www.SMA-Solar.com](http://www.SMA-Solar.com).

#### Measures for data security during activated Modbus interface

If you activate the Modbus interface, there is a risk that unauthorized users may access and manipulate the data or devices in your PV system.

To ensure data security, take appropriate protective measures such as:

- Set up a firewall.
- Close unnecessary network ports.
- Only enable remote access via VPN tunnel.
- Do not set up port forwarding at the communication port in use.
- In order to deactivate the Modbus interface, reset the inverter to the default settings or deactivate the activated parameter again.

#### Procedure:

- Activate the Modbus interface and adjust the communication ports if necessary (see the technical information "SMA and SunSpec Modbus® Interface" at [www.SMA-Solar.com](http://www.SMA-Solar.com)).

## 8.13 Activating the Receipt of Control Signals (Only for Italy)

### QUALIFIED PERSON

In order for PV systems in Italy to receive control commands from the grid operator, set the following parameters.

The basic procedure for changing operating parameters is explained in another section (see Section 8.9 "Changing Operating Parameters", page 60).

Parameter	Value/range	Resolution	Default
Application ID	0 to 16384	1	16384
GOOSE-Mac address	01:0C:CD:01:00:00 to 01:0C:CD:01:02:00	1	01:0C:CD:01:00:00

**Procedure:**

1. Select the parameter group **External communication > IEC 61850 configuration**.
  2. In the field **Application ID**, enter the application ID of the grid operator gateway. You will receive this value from your grid operator. You can enter a value between 0 and 16384. The value 16384 indicates "deactivated".
  3. In the field **GOOSE-Mac address**, enter the MAC address of the grid operator gateway from which the inverter is to receive the control commands. You will receive this value from your grid operator.
- The receipt of control signals from the grid operator is activated.

## 8.14 Deactivating Grounding Conductor Monitoring

### QUALIFIED PERSON

If the inverter is to be installed in an IT network or another grid configuration in which deactivation of the grounding conductor monitoring is required, deactivate the grounding conductor monitoring as follows.

The basic procedure for changing operating parameters is explained in another section (see Section 8.9 "Changing Operating Parameters", page 60).

**Procedure:**

- In the parameter group **Grid monitoring > Grid monitoring > Country standard** set the parameter **PE connection monitoring** to **Off**.

## 8.15 Configuring the Energy Meter

You can add an energy meter to your PV system or replace an existing energy meter.

The basic procedure for changing operating parameters is explained in another section (see Section 8.9 "Changing Operating Parameters", page 60).

### Removing a detected energy meter from the PV system

If only one energy meter is detected by the inverter, this will be added to the PV system automatically. Removal via the menu **Device configuration** is not possible in this case. To remove the energy meter from the PV system, proceed as follows:

- In the parameter group **System communication > Measured values > Meter on Speedwire**, set the parameter **Serial number** to any number (e.g. 1). In this way, instead of the energy meter detected, the PV system will add a fictitious energy meter to which the inverter cannot establish communication.

**Procedure:**

1. Activate the user interface (see Section 8.1, page 48).



2. Log in as **Installer**.
3. Start the installation assistant (see Section 8.4, page 56).
4. In the context menu, select [**Starting the installation assistant**].
5. Select [**Save and next**] until you get to the step **Meter configuration**.
6. Add or replace the desired energy meter.

## 8.16 Setting SMA ShadeFix

### QUALIFIED PERSON

You can set the time interval in which the inverter has to determine the optimum operating point. If you do not want to use SMA ShadeFix, you can disable the feature.

The basic procedure for changing operating parameters is explained in another section (see Section 8.9 "Changing Operating Parameters", page 60).

#### Procedure:

- In the parameter group **DC-side > DC settings > SMA ShadeFix**, set the parameter **Time interval of SMA ShadeFix** and set the required time interval. The ideal time interval is usually six minutes. This value should only be increased if the shading situation changes extremely slowly.
  - The inverter optimizes the MPP of the PV system at the predetermined time interval.
- In order to disable the SMA ShadeFix feature, in the parameter group **DC-side > DC settings > SMA ShadeFix**, set the parameter **SMA ShadeFix switched on** to **Off**.

## 8.17 Saving the Configuration in a File

You can save the current configuration of the inverter in a file. You can use this file as a data backup for this inverter and then import this file into this inverter again or another inverter from the same type or device family to configure the inverter. When saving, only the device parameters will be saved, not any passwords.

#### Procedure:

1. Activate the user interface (see Section 8.1, page 48).
2. Log into the user interface (see Section 8.2, page 52).
3. Select the menu **Device Configuration**.
4. Select [**Settings**].
5. In the context menu, select [**Saving the configuration in a file**].
6. Follow the instructions in the dialog.

## 8.18 Adopting a Configuration from a File

### QUALIFIED PERSON

To configure the inverter, you can adopt the configuration from a file. To be able to do this, you must first save the configuration of another inverter from the same type or device family in a file (see Section 8.17 "Saving the Configuration in a File", page 65). When saving, only the device parameters will be adopted, not any passwords.

#### Requirements:

- Changes to grid-relevant parameters must be approved by the responsible grid operator.
- The SMA Grid Guard code must be available. You can request the SMA Grid Guard code via the Online Service Center.

#### Procedure:

1. Open the user interface (see Section 8.1, page 48).
2. Log into the user interface as an **Installer** (see Section 8.2, page 52).
3. Select the menu **Device Configuration**.
4. Select [**Settings**].
5. In the context menu, select [**Adopting the configuration from a file**].
6. Follow the instructions in the dialog.

## 8.19 Firmware Update

You can activate an automatic firmware update in the inverter or in the communication product.

If no automatic update is set in the communication product (e.g. SMA Data Manager or Sunny Home Manager) or in Sunny Portal, you have the option of carrying out a manual firmware update.

You have the following options to update the firmware:

- Automatic Firmware Update (Recommended)
- Update the firmware with the existing update file via the user interface of the inverter.
- Search and install the firmware via the user interface of the inverter.

### 8.19.1 Activating Automatic Firmware Update

#### QUALIFIED PERSON

You can activate the automatic firmware update in the inverter or in the communication product.

If the automatic firmware update is activated in the inverter, the inverter searches for updates and carries out the update.

If the automatic firmware update is activated in the communication product, the communication product searches for updates for the inverter and carries out the update of the inverter. In this case, the automatic firmware update is deactivated by default in the inverter. This prevents multiple downloads of updates.

In this section we describe how to activate the automatic firmware update in the inverter. The procedure for activating the automatic firmware update for detected devices in the communication product can be found in the manual for the communication product.

The basic procedure for changing operating parameters is explained in another section (see Section 8.9 "Changing Operating Parameters", page 60).

**Procedure:**

- In the parameter group **Device > Update**, select the **Automatic Update** parameter and set to **Yes**.

### 8.19.2 Updating Firmware with Update File via the User Interface

#### QUALIFIED PERSON

**Requirements:**

- An update file with the desired inverter firmware must be available. The update file is, for example, available for download on the product page of the inverter at [www.SMA-Solar.com](http://www.SMA-Solar.com).

**Procedure:**

1. Open the user interface (see Section 8.1, page 48).
2. Log into the user interface as an **Installer** (see Section 8.2, page 52).
3. Click on [**Edit parameters**].
4. Select the menu **Device Configuration**.
5. In the inverter row, click on the gear icon and select **Update firmware**.
6. Select [**Browse**] and select the update file for the inverter.
7. Select **Update firmware**.
8. Follow the instructions in the dialog.

### 8.19.3 Searching for and Installing New Firmware via the User Interface

#### QUALIFIED PERSON

**Requirement:**

- The inverter must be connected to the Internet.

**Procedure:**

1. Open the user interface (see Section 8.1, page 48).
2. Log into the user interface as an **Installer** (see Section 8.2, page 52).
3. Click on [**Edit parameters**].
4. Go to **Device > Update**.

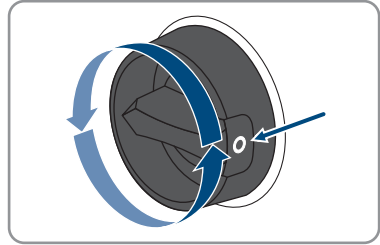
5. Select the parameter **Check for update and install it** and set it to **Execute**.
  6. Click on [**Save all**].
- The firmware is updated in the background.

## 9 Disconnecting the Inverter from Voltage Sources

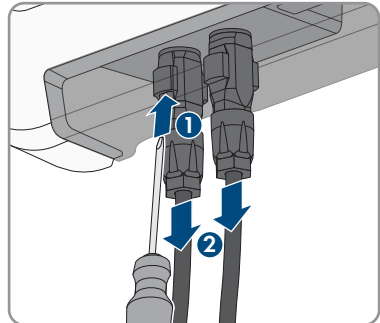
### ⚠ QUALIFIED PERSON

#### Procedure:

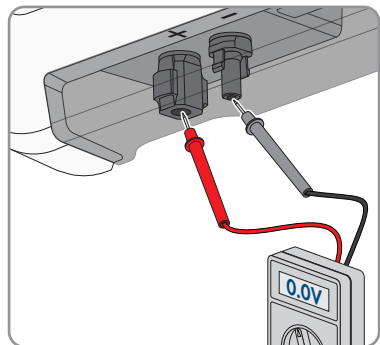
1. Disconnect the circuit breaker and secure it against reconnection.
2. If an external DC load-break switch is installed, disconnect the external DC load-break switch from all voltage sources.
3. Set the DC load-break switch of the inverter to **O**.



4. Wait until the LEDs have gone out.
5. Use a current clamp to ensure that no current is present in the DC cables.
6. Release and remove all DC connectors. To do this, insert a flat-blade screwdriver or an angled screwdriver (blade width 3.5 mm) into one of the slide slots and pull the DC connectors out in a downward direction. Do not pull on the cable.

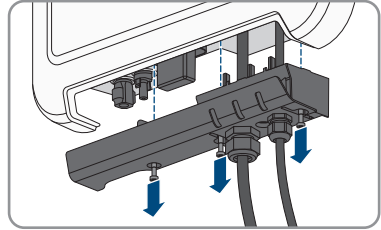


7. Ensure that no voltage is present at the DC inputs on the inverter using a suitable measuring device.

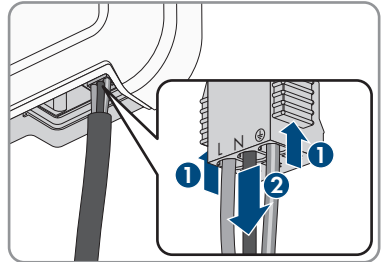


8. Loosen the swivel nuts.

9. Loosen the screws of the connection cap and remove the connection cap.



10. Use a suitable measuring device to check that no voltage is present at the AC connector between L and N and between L and the grounding conductor. To do so, insert the test probe (maximum diameter: 2 mm) into each round opening of the terminal block.
11. Release and disconnect the AC connector using the sliders located on the side.



## 10 Clean the product

### NOTICE

#### Damage to the product due to cleaning agents

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

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

#### Procedure:

- Ensure that the product is free of dust, foliage and other dirt.

# 11 Troubleshooting

## 11.1 Forgotten Password

### **i** Password assignment for inverters that are registered in a communication product

The password for the user group **Installer** is also the system password for the system in the communication product. Changing the password of the user group **Installer** can lead to the inverter no longer being able to be reached by the communication product.

- In the communication product, assign the changed password of the user group **Installer** as the new system password (see the manual of the communication product).

If you have forgotten the password for the inverter, you can unlock the inverter with a Personal Unlocking Key (PUK). For each inverter, there is 1 PUK for each user group (**User** and **Installer**).  
Tipp: With PV systems that are registered in a communication product, you can also assign a new password for the user group **Installer** via the communication product. The password for the user group **Installer** is the same as the system password in the communication product.

#### **Procedure:**

1. Request PUK (application form available at [www.SMA-Solar.com](http://www.SMA-Solar.com)).
2. Open the user interface (see Section 8.1, page 48).
3. Enter the PUK instead of the password into the field **Password**.
4. Select **Login**.
5. Call up the menu **Device parameters**.
6. Click on [**Edit parameters**].
7. In the parameter group **User Rights > Access Control** change the password of the desired user group.
8. Select [**Save all**] to save the changes.



## 11.2 Event Messages

Event number	Message, cause and corrective measures
101 102 103 105	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Grid incident</b></p> <p>The grid voltage or grid impedance at the connection point of the inverter is too high. The inverter has disconnected from the utility grid.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Check whether the grid voltage at the connection point of the inverter is permanently in the permissible range.</li> </ul> <p>If the grid voltage is outside the permissible range due to local grid conditions, contact the grid operator. The grid operator must agree with an adjustment of the voltage at the feed-in point or with a change of the monitored operating limits.</p> <p>If the grid voltage is permanently within the permissible range and this message is still displayed, contact the Service.</p>
202 203 205 206	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Grid incident</b></p> <p>The utility grid has been disconnected, the AC cable is damaged or the grid voltage at the connection point of the inverter is too low. The inverter has disconnected from the utility grid.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Ensure that the miniature circuit breaker is switched on.</li> <li>• Ensure that the AC cable is not damaged and that it is connected correctly.</li> <li>• Ensure that the country data set has been configured correctly.</li> <li>• Check whether the grid voltage at the connection point of the inverter is permanently in the permissible range.</li> </ul> <p>If the grid voltage is outside the permissible range due to local grid conditions, contact the grid operator. The grid operator must agree with an adjustment of the voltage at the feed-in point or with a change of the monitored operating limits.</p> <p>If the grid voltage is permanently within the permissible range and this message is still displayed, contact the Service.</p>

Event number	Message, cause and corrective measures
302	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Active power limit AC voltage</b></p> <p>The inverter has reduced its power due to a too-high grid voltage to ensure grid stability.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• If possible, check the grid voltage and observe how often fluctuations occur. If fluctuations occur frequently and this message is displayed often, contact the grid operator and request approval to change the operating parameters of the inverter. If the grid operator gives his approval, discuss any changes to the operating parameters with the Service.</li> </ul>
401 404	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Grid incident</b></p> <p>The inverter has disconnected from the utility grid. A stand-alone grid or a very large change in the grid frequency was detected.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Check the grid connection for significant short-term frequency fluctuations.</li> </ul>
501	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Grid incident</b></p> <p>The power frequency is not within the permissible range. The inverter has disconnected from the utility grid.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• If possible, check the power frequency and observe how often fluctuations occur. If fluctuations occur frequently and this message is displayed often, contact the grid operator and request approval to change the operating parameters of the inverter. If the grid operator gives his approval, discuss any changes to the operating parameters with the Service.</li> </ul>

Event number	Message, cause and corrective measures
507	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Active power limit AC frequency</b></p> <p>The inverter has reduced its power due to a too-high power frequency to ensure grid stability.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• If possible, check the power frequency and observe how often fluctuations occur. If fluctuations occur frequently and this message is displayed often, contact the grid operator and request approval to change the operating parameters of the inverter. If the grid operator gives his approval, discuss any changes to the operating parameters with the Service.</li> </ul>
601	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Grid incident</b></p> <p>The inverter has detected an excessively high proportion of direct current in the grid current.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Check the grid connection for direct current.</li> <li>• If this message is displayed frequently, contact the grid operator and check whether the monitoring threshold on the inverter can be raised.</li> </ul>
701	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Frequency not permitted &gt; Check parameter</b></p> <p>The power frequency is not within the permissible range. The inverter has disconnected from the utility grid.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• If possible, check the power frequency and observe how often fluctuations occur. If fluctuations occur frequently and this message is displayed often, contact the grid operator and request approval to change the operating parameters of the inverter. If the grid operator gives his approval, discuss any changes to the operating parameters with the Service.</li> </ul>

Event number	Message, cause and corrective measures
801	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Waiting for grid voltage &gt; Grid failure &gt; Check AC circuit breaker</b></p> <p>The AC cable is not correctly connected or the country data set is not correctly configured.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Ensure that the miniature circuit breaker is switched on.</li> <li>• Ensure that the AC cable is not damaged and that it is connected correctly.</li> <li>• Ensure that the country data set has been configured correctly.</li> <li>• Check whether the grid voltage at the connection point of the inverter is permanently in the permissible range.</li> </ul> <p>If the grid voltage is outside the permissible range due to local grid conditions, contact the grid operator. The grid operator must agree with an adjustment of the voltage at the feed-in point or with a change of the monitored operating limits.</p> <p>If the grid voltage is permanently within the permissible range and this message is still displayed, contact the Service.</p>
901	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Grounding connection missing &gt; Check connection</b></p> <p>The grounding conductor is not correctly connected.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Ensure that the grounding conductor is correctly connected.</li> </ul>
1001	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>L / N swapped &gt; Check connection</b></p> <p>The connection of L and N is swapped.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Ensure that L and N are correctly connected.</li> </ul>
1101	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Installation fault &gt; Check connection</b></p> <p>A second line conductor is connected to N.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Connect the neutral conductor to N.</li> </ul>

Event number	Message, cause and corrective measures
1302	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Waiting for grid voltage &gt; Installation failure grid connection &gt; Check grid and fuses</b></p> <p>L or N not connected.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Ensure that L and N are connected.</li> <li>• Ensure that the miniature circuit breaker is switched on.</li> <li>• Ensure that the AC cable is not damaged and that it is connected correctly.</li> </ul>
1501	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Reconnection fault grid</b></p> <p>The changed country data set or the value of a parameter you have set does not correspond to the local requirements. The inverter cannot connect to the utility grid.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Ensure that the country data set has been configured correctly. To do this, select the parameter <b>Set country standard</b> and check the value.</li> </ul>
3302-3303	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Unstable operation</b></p> <p>There is not enough power at the DC input of the inverter for stable operation. The inverter cannot connect to the utility grid.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Ensure that the PV array is designed correctly.</li> <li>• Ensure that the PV array is not covered by snow or otherwise shaded.</li> <li>• Ensure that the PV array is free of errors.</li> </ul>

Event number	Message, cause and corrective measures
3401	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>DC overvoltage &gt; Disconnect PV array</b></p> <p>Overvoltage at the DC input. This can destroy the inverter. This message is signaled additionally by rapid flashing of the LEDs.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• <b>Immediately</b> disconnect the inverter from all voltage sources.</li> <li>• Check whether the DC voltage is below the maximum input voltage of the inverter. If the DC voltage is below the maximum input voltage of the inverter, reconnect the DC connectors to the inverter.</li> <li>• If the DC voltage exceeds the maximum input voltage of the inverter, ensure that the PV array has been correctly rated or contact the installer of the PV array.</li> <li>• If this message is repeated frequently, contact the Service.</li> </ul>
3501	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Insulation failure &gt; Check generator</b></p> <p>The inverter has detected a ground fault in the PV array.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Check the PV system for ground faults.</li> </ul>
3601	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>High leakage current &gt; Check PV array</b></p> <p>The leakage current of the inverter and the PV array is too high. There is a ground fault, a residual current or a malfunction.</p> <p>The inverter interrupts feed-in operation immediately after exceeding a threshold. When the fault is eliminated, the inverter automatically reconnects to the utility grid.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Check the PV system for ground faults.</li> </ul>
3701	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Residual current too high &gt; Check PV array</b></p> <p>The inverter has detected a residual current due to temporary grounding of the PV array.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Check the PV system for ground faults.</li> </ul>

Event number	Message, cause and corrective measures
3801	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>DC overcurrent &gt; Check PV array</b></p> <p>Overcurrent at the DC input. The inverter briefly interrupts feed-in operation.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• If this message is displayed frequently, ensure that the PV array has been correctly rated and wired.</li> </ul>
3901 3902	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Waiting for DC start conditions &gt; Start conditions not met</b></p> <p>The feed-in conditions for the utility grid are not yet fulfilled.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Ensure that the PV array is not covered by snow or otherwise shaded.</li> <li>• Wait for higher irradiation.</li> <li>• If this message is displayed frequently in the morning, increase the voltage limit for starting grid feed-in. Change the parameter <b>Critical voltage to start feed-in</b>.</li> <li>• If this message is displayed frequently with medium irradiation, ensure that the PV array is correctly rated.</li> </ul>
6001-6438	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Self-diagnosis &gt; Device disturbance</b></p> <p>The cause must be determined by the SMA Service Line.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Contact Service.</li> </ul>
6501 6502 6509	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Self-diagnosis &gt; Overtemperature</b></p> <p>The inverter has switched off due to excessive temperature.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Clean the cooling fins on the rear of the enclosure and the air ducts on the top using a soft brush.</li> <li>• Ensure that the inverter has sufficient ventilation.</li> <li>• Ensure that the ambient temperature +40 °C has not been exceeded.</li> <li>• Ensure that the inverter is not exposed to direct solar irradiation.</li> </ul>
6512	<p><b>Minimum operating temperature not reached</b></p> <p>The inverter will only recommence feeding into the utility grid once the temperature has reached at least -25 °C.</p>

Event number	Message, cause and corrective measures
6603 6604	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Self-diagnosis &gt; Overload</b></p> <p>The cause must be determined by the Service.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Contact Service.</li> </ul>
7001 7002	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Sensor fault</b></p> <p>A temperature sensor in the inverter is defective and the inverter interrupts the feed-in operation. The cause must be determined by the Service.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Contact Service.</li> </ul>
7201 7202	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Data stor. not poss.</b></p> <p>Internal error. The inverter continues to feed into the utility grid.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Contact Service.</li> </ul>
7303	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Host computer update failed</b></p> <p>The cause must be determined by the Service.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Contact Service.</li> </ul>
7320	<p><b>The device with serial number [x] was successfully updated to firmware version [x].</b></p> <p>The firmware update was completed successfully.</p>
7329	<p><b>Condition test successful</b></p> <p>The testing of the update conditions was successful. The firmware update package is suitable for this inverter.</p>



Event number	Message, cause and corrective measures
7330	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Condition test failed</b></p> <p>The testing of the update conditions was not successful. The firmware update package is not suitable for this inverter.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Retry update.</li> <li>• Ensure that the selected update file is suitable for this inverter.</li> <li>• If this message is displayed again, contact the Service.</li> </ul>
7331	<p><b>Update transport started</b></p> <p>Update file is being copied.</p>
7332	<p><b>Update transport successful</b></p> <p>Update file was copied successfully to the inverter's internal memory.</p>
7333	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Update transport failed</b></p> <p>Update file could not be copied to the inverter's internal memory. In the event of connection with the inverter via Wi-Fi network, a poor connection quality can be the cause.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Retry update.</li> <li>• For Wi-Fi connection: Improve the Wi-Fi connection quality (e.g. via Wi-Fi repeater) or establish connection with the inverter via Ethernet.</li> <li>• If this message is displayed again, contact the Service.</li> </ul>
7341	<p><b>Update Bootloader</b></p> <p>The inverter is performing a bootloader update.</p>
7342	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Update Bootloader failed</b></p> <p>The bootloader update failed.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Retry update.</li> <li>• If this message is displayed again, contact the Service.</li> </ul>

Event number	Message, cause and corrective measures
7347	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Incompatible file</b></p> <p>The configuration file is not suitable for this inverter.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Ensure that the selected configuration file is suitable for this inverter.</li> <li>• Retry import.</li> </ul>
7348	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Incorrect file format</b></p> <p>The configuration file is not of the required format or is damaged.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Ensure that the selected configuration file is of the required format and is not damaged.</li> <li>• Retry import.</li> </ul>
7349	<p><b>Incorrect login rights for configuration file</b></p> <p>The user group logged in does not have the user rights necessary to be able to import a configuration.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Log in as <b>Installer</b>.</li> <li>• Import configuration file again.</li> </ul>
7350	<p><b>Transfer of a configuration file has started</b></p> <p>The configuration file is being transferred.</p>
7351	<p><b>Update Wi-Fi</b></p> <p>The inverter is updating the Wi-Fi module.</p>
7352	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Update of Wi-Fi not successful</b></p> <p>The update of the Wi-Fi module failed.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Retry update.</li> <li>• If this message is displayed again, contact the Service.</li> </ul>
7353	<p><b>Update time zone database</b></p> <p>The inverter is updating the time zone database.</p>

Event number	Message, cause and corrective measures
7354	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Update of time zone database not successful</b> The update of the time zone database failed.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Retry update.</li> <li>• If this message is displayed again, contact the Service.</li> </ul>
7355	<p><b>Update WebUI</b> The inverter is updating the inverter user interface.</p>
7356	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Update of the WebUI not successful</b> The update of the inverter user interface failed.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Retry update.</li> <li>• If this message is displayed again, contact the Service.</li> </ul>
7619	<p><b>Communication fault with meter unit &gt; Check communication to meter</b> The inverter is not receiving any data from the energy meter.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Ensure that the energy meter is correctly integrated into the same network as the inverter (see energy meter manual).</li> <li>• For Wi-Fi connection: Improve the Wi-Fi connection quality (e.g., via Wi-Fi repeater) or connect the inverter with the DHCP server (router) via Ethernet.</li> </ul>
7701 7702 7703	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Self-diagnosis &gt; Device disturbance</b> The cause must be determined by the Service.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Contact Service.</li> </ul>

Event number	Message, cause and corrective measures
8003	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Active power limit temperature</b></p> <p>The inverter has reduced its power output for more than 10 minutes due to excessive temperature.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Clean the cooling fins on the rear of the enclosure and the air ducts on the top using a soft brush.</li> <li>• Ensure that the inverter has sufficient ventilation.</li> <li>• Ensure that the ambient temperature +40 °C has not been exceeded.</li> <li>• Ensure that the inverter is not exposed to direct solar irradiation.</li> </ul>
8708	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Timeout in communication for active power limitation</b></p> <p>Communication to the system control absent. Depending on the fall-back setting, either the last received values will be retained or the active power will be limited to the set percentage value of the inverter nominal power.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Ensure that the connection to the system manager (e.g. Sunny Home Manager) is intact and that no cables are damaged or that no plugs have been pulled.</li> </ul>
8709	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Timeout in communication for reactive power setpoint</b></p> <p>Communication to the system control absent. Depending on the fall-back setting, either the last received values will be retained or the reactive power will be set to the set value.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Ensure that the connection to the system manager (e.g. Sunny Home Manager) is intact and that no cables are damaged or that no plugs have been pulled.</li> </ul>
8710	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Timeout in communication for cos phi setpoint</b></p> <p>Communication to the system control absent. Depending on the fall-back setting, either the last received values will be retained or the displacement power factor will be set to the set value.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Ensure that the connection to the system manager (e.g. Sunny Home Manager) is intact and that no cables are damaged or that no plugs have been pulled.</li> </ul>

Event number	Message, cause and corrective measures
9002	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>SMA Grid Guard code invalid</b></p> <p>The SMA Grid Guard code entered is incorrect. The operating parameters are still protected and cannot be changed.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Enter the correct SMA Grid Guard code.</li> </ul>
9003	<p><b>Grid parameters locked</b></p> <p>Changes to the grid parameters are now blocked. In order to be able to make changes to the grid parameters, from now on you must log in using the SMA Grid Guard code.</p>
9005	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Changing of grid parameters not possible &gt; Ensure DC supply</b></p> <p>This error can have the following causes:</p> <ul style="list-style-type: none"> <li>• The parameters to be changed are protected.</li> <li>• The DC voltage at the DC input is not sufficient to run the main CPU.</li> </ul> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Enter the SMA Grid Guard code.</li> <li>• Ensure that at least the DC start voltage is available (green LED is flashing, pulsing or glowing).</li> </ul>
9007	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Abort self-test</b></p> <p>The self-test (Italy only) was terminated.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Ensure that the AC connection is correct.</li> <li>• Restart the self-test.</li> </ul>
10110	<p><b>Time synchronization failed [x]</b></p> <p>No time information could be called up from the set NTP server.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Ensure that the NTP server was configured correctly.</li> <li>• Ensure that the inverter is integrated into a local network with Internet connection.</li> </ul>

Event number	Message, cause and corrective measures
10248	<p><b>[Interface]: network busy</b></p> <p>The network is busy. Data exchange between the devices is not at an optimum and is greatly delayed.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Increase the query intervals.</li> <li>• If necessary, reduce the number of devices in the network.</li> </ul>
10249	<p><b>[Interface]: network overloaded</b></p> <p>The network is overloaded. There is no data exchange between the devices.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Reduce the number of devices in the network.</li> <li>• If necessary, increase the data query intervals.</li> </ul>
10250	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>[Interface]: package error rate [ok / high]</b></p> <p>The package error rate has changed. If the package error rate is high, the network is overloaded or the connection to the network switch or DHCP server (router) is impaired.</p> <p><b>Corrective measures if the package error rate is high:</b></p> <ul style="list-style-type: none"> <li>• Ensure that with an Ethernet connection, the network cable and the network connector are not damaged and that the network connectors are correctly plugged.</li> <li>• If necessary, increase the data query intervals.</li> <li>• If necessary, reduce the number of devices in the network.</li> </ul>
10251	<p><b>[Interface]: communication status goes to [OK / Warning / Error / Not connected]</b></p> <p>The communication status to the network switch or DHCP server (router) has changed. An additional error message may be displayed.</p>
10252	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>[Interface]: communication disrupted</b></p> <p>There is no valid signal on the network line.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Ensure that with an Ethernet connection, the network cable and the network connector are not damaged and that the network connectors are correctly plugged.</li> <li>• Ensure that the DHCP server (router) and any network switches are signaling correct operation.</li> </ul>

Event number	Message, cause and corrective measures
10253	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>[Interface]: connection speed goes to [100 Mbit / 10 Mbit]</b></p> <p>The data transfer rate has changed. The cause for the status [10 Mbit] can be a defective plug, a defective cable or the pulling or plugging of the network connector.</p> <p><b>Corrective measures if the status is [10 Mbit]:</b></p> <ul style="list-style-type: none"> <li>• Ensure that with an Ethernet connection, the network cable and the network connector are not damaged and that the network connectors are correctly plugged.</li> <li>• Ensure that the DHCP server (router) and any network switches are signaling correct operation.</li> </ul>
10254	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>[Interface]: duplex mode goes to [Full / Half]</b></p> <p>The duplex mode (data transfer mode) has changed. The cause for the status [Half] can be a defective plug, a defective cable or the pulling or plugging of the network connector.</p> <p><b>Corrective measures if the status is [Half]:</b></p> <ul style="list-style-type: none"> <li>• Ensure that with an Ethernet connection, the network cable and the network connector are not damaged and that the network connectors are correctly plugged.</li> <li>• Ensure that the DHCP server (router) and any network switches are signaling correct operation.</li> </ul>
10255	<p><b>[Interface]: Network load OK</b></p> <p>The network load has returned to a normal range after being busy.</p>
10282	<p><b>[User group]-Login via [protocol] locked</b></p> <p>After several incorrect login attempts, login has been blocked for a limited time. In this case, the User login will be blocked for 15 minutes, the Grid Guard login for 12 hours.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Wait until the given time has expired and then retry login.</li> </ul>
10283	<p><b>⚠ QUALIFIED PERSON</b></p> <p><b>Wi-Fi module faulty</b></p> <p>The Wi-Fi module integrated in the inverter is defective.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Contact Service.</li> </ul>

Event number	Message, cause and corrective measures
10284	<p><b>No Wi-Fi connection possible</b></p> <p>The inverter does not currently have a Wi-Fi connection to the selected network.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Ensure that the SSID, the Wi-Fi password and the encryption method have been entered correctly. The encryption method is specified by your Wi-Fi router or Wi-Fi access point and can be changed there.</li> <li>• Ensure that the Wi-Fi router or Wi-Fi access point is in range and is signaling correct operation.</li> <li>• If this message is displayed often, improve the Wi-Fi connection by using a Wi-Fi repeater.</li> </ul>
10285	<p><b>Wi-Fi connection established</b></p> <p>Connection to the selected Wi-Fi network has been established.</p>
10286	<p><b>Wi-Fi connection lost</b></p> <p>The inverter has lost Wi-Fi connection to the selected network.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Ensure that the Wi-Fi router or Wi-Fi access point is still active.</li> <li>• Ensure that the Wi-Fi router or Wi-Fi access point is in range and is signaling correct operation.</li> <li>• If this message is displayed often, improve the Wi-Fi connection by using a Wi-Fi repeater.</li> </ul>
27301	<p><b>Update communication</b></p> <p>The inverter is updating the communication component.</p>
27302	<p><b>Update main CPU</b></p> <p>The inverter is updating the inverter component.</p>
27312	<p><b>Update completed</b></p> <p>The inverter has successfully completed the update.</p>
29004	<p><b>Grid parameter unchanged</b></p> <p>Changing the grid parameters is not possible.</p>
20901	<p><b>Inst. code valid</b></p> <p>The entered Grid Guard code is valid. Protected parameters have now been unlocked and you can adjust the parameters. The parameters will be automatically locked again after 10 feed-in hours.</p>
20906	<p><b>Self-test</b></p> <p>The self-test is in progress.</p>



Event number	Message, cause and corrective measures
29001	<p><b>Inst. code valid</b></p> <p>The entered Grid Guard code is valid. Protected parameters have now been unlocked and you can adjust the parameters. The parameters will be automatically locked again after 10 feed-in hours.</p>
29006	<p><b>Self-test</b></p>

#### Also see:

- > Section 15 "Contact", page 101
- > Section 7.4 "Starting the Self-Test (for Italy and Dubai)", page 47
- > Section 6.2.2 "Connecting the Inverter to the Utility Grid", page 32
- > Section 9 "Disconnecting the Inverter from Voltage Sources", page 69
- > Section 11.3 "Checking the PV System for Ground Faults", page 89

## 11.3 Checking the PV System for Ground Faults

### QUALIFIED PERSON

If the inverter displays the event numbers **3501**, **3601** or **3701**, there could be a ground fault. The electrical insulation from the PV system to ground is defective or insufficient.

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

### DANGER

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

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

- Disconnect the product from voltage sources and ensure it cannot be reconnected before working on the device.
- Only touch the cables of the PV modules on their insulation.
- Do not touch any parts of the substructure or frame of the PV array.
- Do not connect PV strings with ground faults to the inverter.

## WARNING

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

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

- Only use measuring devices with a DC input voltage range of 1000 V or higher.

#### **Procedure:**

In order to check the PV system for ground faults, perform the following actions in the prescribed order. The exact procedure is described in the following sections.

- Check the PV system for ground faults by measuring the voltage.
- If the voltage measurement was not successful, check the PV system via insulation resistance measurement for ground faults.

#### **Test by Measuring the Voltage**

Proceed as follows to check each string in the PV system for ground faults.

#### **Procedure:**

1.

## DANGER

### **Danger to life due to high voltages**

- Disconnect the inverter from all voltage sources (see Section 9, page 69).

2. Measure the voltages:

- Measure the voltage between the positive terminal and the ground potential (PE).
- Measure the voltage between the negative terminal and the ground potential (PE).
- Measure the voltage between the positive and negative terminals.

If the following results are present at the same time, there is a ground fault in the PV system:

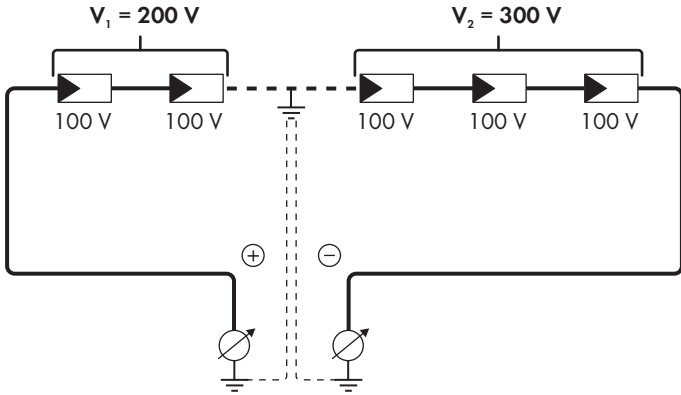
- All measured voltages are stable.
- The sum of the two voltages to ground potential is approximately equal to the voltage between the positive and negative terminals.

3. If a ground fault is present, determine the location of the ground fault via the ratio of the two measured voltages and eliminate the ground fault.
4. If a definite ground fault cannot be measured and the message is still displayed, measure the insulation resistance.
5. Reconnect the strings without ground faults to the inverter and recommission the inverter (see inverter installation inverter).



### Location of the ground fault

The example shows a ground fault between the second and third PV module.



### Test by Measuring the Insulation Resistance

If the voltage measurement does not provide sufficient evidence of a ground fault, the insulation resistance measurement can provide more exact results.

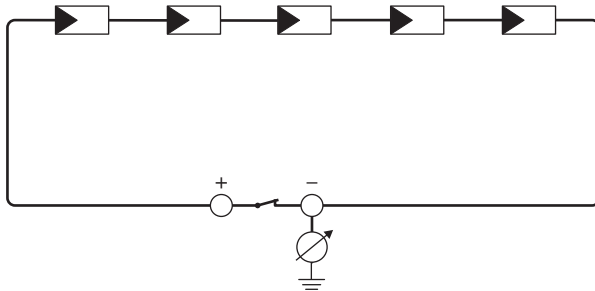


Figure 14: Schematic diagram of the measurement

### **i** Calculating the insulation resistance

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

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

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

For the resistance of a PV module an average value can be assumed: for thin-film PV modules approximately 40 MΩ and for polycrystalline and monocrystalline PV modules approximately 50 MΩ per PV module (for further information on calculating the insulation resistance see the Technical Information "Insulation Resistance (Riso) of Non-Galvanically Isolated PV Systems" at [www.SMA-Solar.com](http://www.SMA-Solar.com)).

#### **Required devices:**

- Suitable device for safe disconnection and short-circuiting
- Measuring device for insulation resistance

### **i** Device required for safe disconnection and short-circuiting of the PV array

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

#### **Procedure:**

1. Calculate the expected insulation resistance per string.

- 2.

**⚠ DANGER**

#### **Danger to life due to high voltages**

- Disconnect the inverter from all voltage sources (see Section 9, page 69).

3. Install the short circuit device.
4. Connect the measuring device for insulation resistance.
5. Short-circuit the first string.
6. Set the test voltage. The test voltage should be as close as possible to the maximum system voltage of the PV modules but must not exceed it (see datasheet of the PV modules).
7. Measure the insulation resistance.
8. Eliminate the short circuit.
9. Measure the remaining strings in the same manner.
  - If the insulation resistance of a string deviates considerably from the theoretically calculated value, there is a ground fault present in that string.
10. Reconnect to the inverter only those strings from which the ground fault has been eliminated.
11. Reconnect all other strings to the inverter.

12. Recommission the inverter.
13. If the inverter still displays an insulation error, contact the Service (see Section 15, page 101).  
The PV modules might not be suitable for the inverter in the present quantity.

## 11.4 Problems with streaming services

If you use the streaming service in your local network (in which the inverter is also included), there may be interference to the transfer of data. In this case, the IGMP settings of the inverter can be changed via operating parameters.

- Contact the Service and change IGMP settings in consultation with the Service department.

## 12 Decommissioning the Inverter

### QUALIFIED PERSON

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

### CAUTION

#### Risk of injury due to weight of product

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

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

#### Procedure:

1.

### DANGER

#### Danger to life due to high voltages

- Disconnect the inverter from all voltage sources (see Section 9, page 69).

2.

### CAUTION

#### Risk of burns due to hot enclosure parts

- Wait 30 minutes for the enclosure to cool down.

3. If an additional grounding or an equipotential bonding is connected, remove the cylindrical screw using a Torx screwdriver (TX25) and remove the grounding cable.
4. Remove the inverter from the wall.
5. If the inverter is to be stored or shipped, pack the inverter. Use the original packaging or packaging that is suitable for the weight and dimensions of the inverter.
6. Dispose of the inverter in accordance with the locally applicable disposal regulations for electronic waste.

## 13 Technical Data

### DC input

	<b>SB1.5-1VL-40</b>	<b>SB2.0-1VL-40</b>	<b>SB2.5-1VL-40</b>
Maximum PV array power	3000 W <sub>p</sub>	4000 W <sub>p</sub>	5000 W <sub>p</sub>
Maximum input voltage	600 V	600 V	600 V
MPP voltage range	160 V to 500 V	210 V to 500 V	260 V to 500 V
Rated input voltage	360 V	360 V	360 V
Minimum input voltage	50 V	50 V	50 V
Initial input voltage	80 V	80 V	80 V
Maximum input current	10 A	10 A	10 A
Maximum short-circuit current*	18 A	18 A	18 A
Maximum reverse current into the PV array	0 A	0 A	0 A
Number of independent MPP inputs	1	1	1
Surge category in accordance with IEC 60664-1	II	II	II

\* In accordance with IEC 62109-2:  $I_{SC\ PV}$

### AC Output

	<b>SB1.5-1VL-40</b>	<b>SB2.0-1VL-40</b>	<b>SB2.5-1VL-40</b>
Rated power at 230 V, 50 Hz	1500 W	2000 W	2500 W
Maximum apparent power at $\cos \varphi = 1$	1500 VA	2000 VA	2500 VA
Rated apparent power at $\cos \varphi = 1$	1500 VA	2000 VA	2500 VA
Rated grid voltage	220 V / 230 V / 240 V	220 V / 230 V / 240 V	220 V / 230 V / 240 V
Rated grid voltage	230 V	230 V	230 V
Voltage range*	180 V to 280 V	180 V to 280 V	180 V to 280 V
Rated current at 220 V	7 A	9 A	11 A
Rated current at 230 V	6.5 A	9 A	11 A

	<b>SB1.5-1VL-40</b>	<b>SB2.0-1VL-40</b>	<b>SB2.5-1VL-40</b>
Rated current at 240 V	6.25 A	8.6 A	10.5 A
Maximum output current	7 A	9 A	11 A
Total harmonic distortion of the output current with total harmonic distortion of the AC voltage <2%, and AC power >50% of the rated power	≤3 %	≤3 %	≤3 %
Maximum output current under fault conditions	12 A	16 A	19 A
Inrush current	< 20% of the nominal AC current for a maximum of 10 ms	< 20% of the nominal AC current for a maximum of 10 ms	< 20% of the nominal AC current for a maximum of 10 ms
Rated grid frequency	50 Hz	50 Hz	50 Hz
Grid frequency*	50 Hz / 60 Hz	50 Hz / 60 Hz	50 Hz / 60 Hz
Operating range at grid frequency 50 Hz	45 Hz to 55 Hz	45 Hz to 55 Hz	45 Hz to 55 Hz
Operating range at grid frequency 60 Hz	55 Hz to 65 Hz	55 Hz to 65 Hz	55 Hz to 65 Hz
Power factor at rated power	1	1	1
Displacement power factor cos φ, adjustable	0.8 underexcited to 1 to 0.8 overexcited	0.8 underexcited to 1 to 0.8 overexcited	0.8 underexcited to 1 to 0.8 overexcited
Feed-in phases	1	1	1
Connection phases	1	1	1
Surge category in accordance with IEC 60664-1	III	III	III

\* Depending on the configured country data set



## Efficiency

	SB1.5-1VL-40	SB2.0-1VL-40	SB2.5-1VL-40
Maximum efficiency, $\eta_{\max}$	97.2 %	97.2 %	97.2 %
European weighted efficiency, $\eta_{\text{EU}}$	96.1 %	96.4 %	96.7 %

## Protective devices

DC reverse polarity protection	Short-circuit diode
Input-side disconnection point	DC load-break switch
AC short-circuit current capability	Current control
Grid monitoring	SMA Grid Guard 10.0
Maximal output overcurrent protection	16 A
Ground fault monitoring	Insulation monitoring: $R_{\text{iso}} > 1 \text{ M}\Omega$
All-pole sensitive residual-current monitoring unit	Available
Active anti-islanding method	Frequency shift

## General data

Width x height x depth	460 mm x 357 mm x 122 mm
Weight	9.2 kg
Length x width x height of the packaging	597 mm x 399 mm x 238 mm
Weight including packaging	11.5 kg
Climatic category in accordance with IEC 60721-3-4	4K4H
Environmental category	Outdoors
Pollution degree outside the inverter	3
Pollution degree inside the inverter	2
Operating temperature range	-40 °C to +60 °C
Max. permissible value for relative humidity (condensing)	100 %
Maximum operating altitude above mean sea level (MSL)	3000 m
Noise emission, typical	< 25 dB
Power loss in night mode	5 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
Power control / Demand response (DRED)	Communication via Modbus interface
Export limiting according to AS/NZS 4777.2	EMETER-20, HM-20
Demand response mode in accordance with AS/NZS 4777.2	DRMO
Topology	Transformerless (Non-isolated)
Cooling method	Convection
Degree of protection in accordance with IEC 60529	IP65
Protection class in accordance with IEC 62477	I
Radio technology	WLAN 802.11 b/g/n
Radio spectrum	2.4 GHz
Maximum transmission power	100 mW
Quantity maximum detectable Wi-Fi networks	32
Grid configurations	TN-C, TN-S, TN-CS, TT (if $V_{N,PE} < 30$ V), IT, Delta IT, split phase

## Climatic conditions

### Installation in accordance with IEC 60721-3-4, Class 4K4H

Extended temperature range	-40 °C to +60 °C
Extended humidity range	0 % to 100 %
Extended air pressure range	79.5 kPa to 106 kPa

### Transport in accordance with IEC 60721-3-4, Class 2K3

Extended temperature range	-25 °C to +70 °C
----------------------------	------------------

## Equipment

DC terminal	SUNCLIX DC connector
AC connection	Spring-cage terminal
Speedwire interface	As standard
Webconnect interface	As standard
Wi-Fi	As standard

## DC Load-Break Switch

Electrical endurance in the event of short circuit,  
at nominal current of 10 A

At least 50 switching operations

Maximum switching current	35 A
Maximum switching voltage	800 V
Maximum PV power	11 kW

## Torques

Screws wall mounting	Hand-tight
Screws of terminal cover	3.5 Nm
SUNCLIX swivel nut	2.0 Nm
AC swivel nut	Hand-tight
Network swivel nut	Hand-tight
Additional grounding terminal	6.0 Nm

## Data Storage Capacity

Energy yields in the course of the day	63 days
Daily yields	30 years
Event messages for users	1024 events
Event messages for installers	1024 events

## 14 Spare Parts

You will find the spare parts for your product in the following overview. If required, these can be ordered from SMA Solar Technology AG or your distributor.

<b>Designation</b>	<b>Brief description</b>	<b>SMA order number</b>
Enclosure lid	Enclosure lid red	90-157500.02
Connection cap	Connection cap for covering the connection area	90-133100.06
accessory kit	Accessory kit with DC connectors, grounding terminal for additional grounding and AC connector	85-101600.01
Switching lever of the DC load-break switch	Switching lever of the DC load-break switch as spare part	90-206200.01

## 15 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:

- Device type
- Serial number
- Firmware version
- Event message
- Mounting location and mounting height
- Type and number of PV modules
- 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)

You can find your country's contact information at:



<https://go.sma.de/service>

## 16 EU Declaration of Conformity

within the scope of the EU directives

- Radio Equipment Directive 2014/53/EU (22.5.2014 L 153/62) (RED)
- Restriction of the use of certain hazardous substances 2011/65/EU (L 174/88, June 8, 2011) and 2015/863/EU (L 137/10, March 31, 2015) (RoHS)



SMA Solar Technology AG confirms herewith that the products described in this document are in compliance with the fundamental requirements and other relevant provisions of the above-mentioned directives. The entire EU Declaration of Conformity can be found at [www.SMA-Solar.com](http://www.SMA-Solar.com).

## 17 UK Declaration of Conformity

according to the regulations of England, Wales and Scotland

- Electromagnetic Compatibility Regulations 2016 (SI 2016/1091)
- Electrical Equipment (Safety) Regulations 2016 (SI 2016/1101)
- Radio Equipment Regulations 2017 (SI 2017/1206)
- The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012



SMA Solar Technology AG confirms herewith that the products described in this document are in compliance with the fundamental requirements and other relevant provisions of the above-mentioned regulations. The entire UK Declaration of Conformity can be found at [www.SMA-Solar.com](http://www.SMA-Solar.com).



[www.SMA-Solar.com](http://www.SMA-Solar.com)

