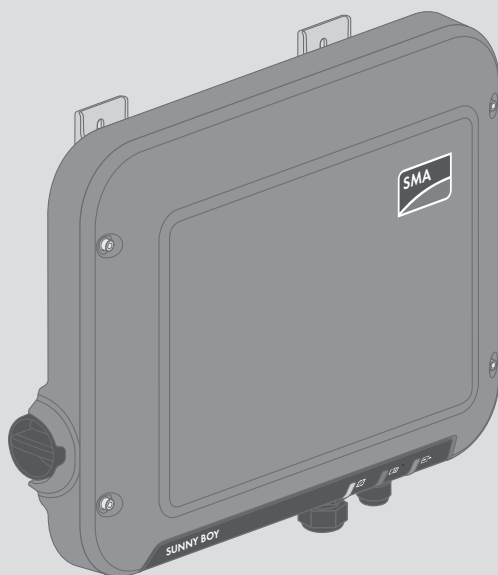


Operating Manual
SUNNY BOY 1.5 / 2.5



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1 Information on this Document

1.1 Validity

This document is valid for the following device types from firmware version 2.04.03.R:

- SB1.5-1VL-40 (Sunny Boy 1.5)
- SB2.5-1VL-40 (Sunny Boy 2.5)

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 and using electrical devices and installations
- Training in the installation and commissioning of electrical devices and installations
- Knowledge of the applicable standards and directives
- Knowledge of and compliance with this document and all safety information



1.3 Structure

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 at www.SMA-Solar.com.

1.4 Symbols

Symbol	Explanation
 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, can result in death or serious injury
 CAUTION	Indicates a hazardous situation which, if not avoided, can result in minor or moderate injury
NOTICE	Indicates a situation which, if not avoided, can result in property damage
 QUALIFIED PERSON	Sections describing activities to be performed by qualified persons only

Symbol	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

1.5 Additional Information

Links to additional information can be found at www.SMA-Solar.com:

Document title	Document type
"Efficiency and Derating" Efficiency and Derating Behavior of the Sunny Boy, Sunny Tripower and Sunny Mini Central Inverters	Technical Information
"Criteria for Selecting a Residual-Current Device" Criteria for Selecting a Residual-Current Device	Technical Information
"Circuit Breaker" Dimensioning and Selection of a Suitable AC Circuit Breaker for Inverters under PV-Specific Influences	Technical Information
"Application for SMA Grid Guard Code"	Certificate
"Webconnect Systems in Sunny Portal" Registration in Sunny Portal	User Manual
"SunSpec® Modbus® Interface" Information on the commissioning and configuration of the SunSpec Modbus interface	Technical Information
"SMA Modbus® Interface" List with the product specific SMA Modbus registers	Technical Information
"SunSpec® Modbus® Interface" List with the product specific SunSpec Modbus registers	Technical Information
"Parameters and Measured Values" Overview of All Inverter Operating Parameters and Their Configuration Options	Technical Information

1.6 Nomenclature

Complete designation	Designation in this document
Sunny Boy	Inverter, product

1.7 Typographies

Typography	Use	Example
bold	<ul style="list-style-type: none"> • Display texts • Elements on a user interface • Terminals • Elements to be selected • Elements to be entered 	<ul style="list-style-type: none"> • The value can be found in the field Energy. • Select Settings. • Enter 10 in the field Minutes.
>	<ul style="list-style-type: none"> • Connects several elements to be selected 	<ul style="list-style-type: none"> • Select Settings > Date.
[Button] [Key]	<ul style="list-style-type: none"> • Button or key to be selected or pressed 	<ul style="list-style-type: none"> • Select [Next].

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

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 calculate the coupling capacity, see the Technical Information "Leading Leakage Currents" at www.SMA-Solar.com).

All components must remain within their permitted operating ranges 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.

The product is also approved for the Australian market and may be used in Australia. If DRM support is specified, the inverter may only be used in conjunction with a Demand Response Enabling Device (DRED). This ensures that the inverter implements the commands from the grid operator for active power limitation at all times. The inverter and the Demand Response Enabling Device (DRED) must be connected in the same network and the inverter Modbus interface must be activated and the TCP server set.

Use this product only in accordance with the information provided in the enclosed documentation and with the locally applicable standards and directives. Any other application may cause personal injury or property damage.

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

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

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

The type label must remain permanently attached to the product.

2.2 Safety Information

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

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 high voltages of the PV array**

When exposed to sunlight, the PV array generates dangerous DC voltage, which is present in the DC conductors and the live components of the inverter. Touching the DC conductors or the live components can lead to lethal electric shocks. If you disconnect the DC connectors from the inverter under load, an electric arc may occur leading to electric shock and burns.

- Do not touch non-insulated cable ends.
- Do not touch the DC conductors.
- Do not touch any live components of the inverter.
- Have the inverter mounted, installed and commissioned only by qualified persons with the appropriate skills.
- If an error occurs, have it rectified by qualified persons only.
- Prior to performing any work on the inverter, disconnect it from all voltage sources as described in this document.

⚠ DANGER**Danger to life due to high voltages in the inverter**

Touching live components within the inverter can lead to lethal electric shocks. Some components also require at least five minutes to discharge after the inverter has been disconnected from voltage sources.

- Do not open the inverter.

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

Touching an ungrounded PV module or array frame can cause a lethal electric shock.

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

NOTICE**Damage to the inverter due to the use of cleaning agents**

- If the inverter is dirty, clean the enclosure, the enclosure lid, the type label and the LEDs using only clean water and a cloth.

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.

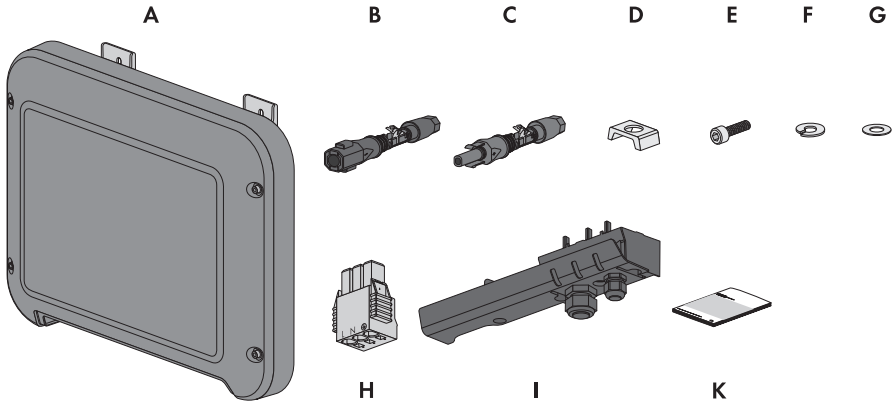


Figure 1: Components included in the scope of delivery

Position	Quantity	Designation
A	1	Inverter
B	1	Negative DC connector
C	1	Positive DC connector
D	1	Clamping bracket
E	1	Cylindrical screw M5 x 16
F	1	Spring lock washer
G	1	Washer
H	1	AC connector

Position	Quantity	Designation
I	1	Connection cap
K	1	<p>Quick reference guide with password label on the rear side</p> <p>The label contains the following information:</p> <ul style="list-style-type: none">• PIC (Product Identification Code) identification key for registering the system in Sunny Portal• RID (Registration Identifier) registration ID for registering the system in Sunny Portal• WLAN password WPA2-PSK (WiFi Protected Access 2 - Preshared Key) for direct connection to the inverter via WLAN

4 Product Description

4.1 Sunny Boy

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.

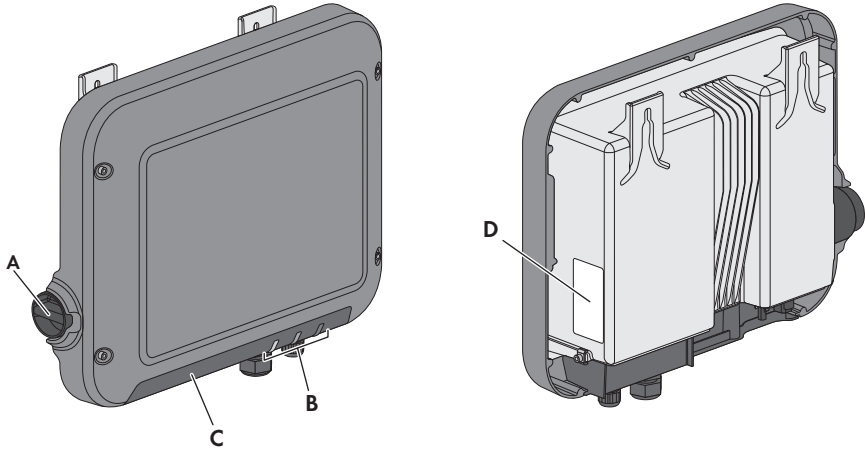


















Figure 2: Design of the Sunny Boy




Position	Designation
A	<p>DC load-break switch</p> <p>The inverter is equipped with a DC load-break switch. If the DC load-break switch is set to the position I, it establishes a conductive connection between the PV array and the inverter. Setting the DC load-break switch to the 0 position interrupts the DC electric circuit and completely disconnects the PV array from the inverter. Disconnection takes place at all poles.</p>
B	<p>LEDs</p> <p>The LEDs indicate the operating state of the inverter.</p>

Position	Designation
C	<p>Connection cap</p> <p>Connection area with cable glands for connection to the utility grid and the local network</p>
D	<p>Type label</p> <p>The type label uniquely identifies the inverter. You will require the information on the type label to use the product safely and when seeking customer support from the SMA Service Line. 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"> • Device type (Model) • Serial number (Serial No.) • Date of manufacture • Identification key (PIC) for registration in Sunny Portal • Registration ID (RID) for registration in Sunny Portal • WLAN password (WPA2-PSK) for direct access to the inverter via WLAN • Device-specific characteristics

Symbols on the Inverter and on the Type Label

Symbol	Explanation
	<p>Inverter</p> <p>Together with the green LED, this symbol indicates the operating state of the inverter.</p>
	<p>Observe the documentation</p> <p>Together with the red LED, this symbol indicates an error.</p>
	<p>Data transmission</p> <p>Together with the blue LED, this symbol indicates the status of the network connection.</p>
	<p>Grounding conductor</p> <p>This symbol indicates the position for connecting a grounding conductor.</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>

Symbol	Explanation
	Risk of burns due to hot surfaces The product can get hot during operation. Avoid contact during operation. Prior to performing any work on the product, allow the product to cool down sufficiently.
	Danger to life due to electric shock The product operates at high voltages. Prior to performing any work on the product, disconnect the product from voltage sources. All work on the product must be carried out by qualified persons only.
	Observe the documentation Observe all documentation supplied with the product.
	Danger This symbol indicates that the inverter must be additionally grounded if additional grounding or equipotential bonding is required at the installation site.
	Direct current
	The product is has no galvanic isolation.
	Alternating current
	WEEE designation Do not dispose of the product together with the household waste but in accordance with the disposal regulations for electronic waste applicable at the installation site.
	CE marking The product complies with the requirements of the applicable EU directives.
	Degree of protection IP65 The product is protected against dust intrusion and water jets from any angle.
	The product is suitable for outdoor installation.

Symbol	Explanation
	RCM (Regulatory Compliance Mark) The product complies with the requirements of the applicable Australian standards.
	ICASA The product complies with the requirements of the South African standards for telecommunication.
	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.

4.2 Interfaces and Functions

The inverter is equipped with the following interfaces and functions:

User interface for the monitoring and configuration of the inverter

The inverter is standard-equipped with an integrated web server, which provides a user interface for configuring and monitoring the inverter. The inverter user interface can be called up via the web browser if there is an existing WLAN or Ethernet connection to a computer, tablet PC or smartphone.

SMA Speedwire

The inverter is equipped with SMA Speedwire as standard. SMA Speedwire is a type of communication based on the Ethernet standard. This enables inverter-optimized 10 or 100 Mbit data transmission between Speedwire devices in PV systems and the user interface of the inverter.

SMA Webconnect

The inverter is equipped with a Webconnect function as standard. The Webconnect function enables direct data transmission between the inverters of a small-scale system and the Internet portal Sunny Portal without any additional communication device and for a maximum of 4 inverters per Sunny Portal system. If there is an existing WLAN or Ethernet connection, you can directly access your Sunny Portal system via the web browser on the computer, tablet PC or smartphone.

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

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

In addition, the inverter has a WPS (WiFi Protected Setup) function. The WPS function connects the inverter automatically with an end device (e.g. smartphone, tablet PC or computer). 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 is only designed for temperatures down to -20°C .

- Deactivate the WLAN interface at low temperatures (see Section 9.14 "Switching WLAN On and Off", page 57).

Grid Management Services

The inverter 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 OptiTrac Global Peak

SMA OptiTrac Global Peak is an advancement of SMA OptiTrac and allows the operating point of the inverter to follow the optimal operating point of the PV array (MPP) precisely at all times. In addition, with the aid of SMA OptiTrac Global Peak, the inverter detects several maximum power points in the available operating range, such as may occur particularly with partially shaded strings. SMA OptiTrac Global Peak is enabled by default.

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.

4.3 LED Signals

LED	Status	Explanation
Green LED	flashing: 2 s on 2 s off	Waiting for feed-in conditions The conditions for feed-in operation are not yet met. As soon as the conditions are met, the inverter will start feed-in operation.
	flashing quickly	Update of central processing unit The central processing unit of the inverter is being updated.
	glowing	Feed-in operation The inverter feeds in with a power of at least 90%.
	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.
	Off	The inverter is not feeding into the utility grid.
Red LED	glowing	Event occurred If an event occurs, a distinct event message and the corresponding event number will be displayed in addition on the inverter user interface or in the communication product.
Blue LED	flashes slowly for approx. one minute	Communication connection is being established The inverter is establishing a connection to a local network or is establishing a direct connection to an end device via Ethernet (e.g. computer, tablet PC or smartphone).
	flashes quickly for approx. two minutes	WPS active The WPS function is active.
	glowing	Communication active There is an active connection with a local network or there is a direct connection with an end device via Ethernet (e.g. computer, tablet PC or smartphone).

5 Mounting

5.1 Requirements for Mounting

Requirements for the mounting location:

⚠ WARNING

Danger to life due to fire or explosion

Despite careful construction, electrical devices can cause fires.

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

- Do not mount the inverter on a pillar.
- The mounting location must be suitable for the weight and dimensions of the inverter (see Section 15 "Technical Data", page 85).
- The mounting location must not be exposed to direct solar irradiation. Direct solar irradiation can result in the premature aging of the exterior plastic parts of the inverter and direct solar irradiation can cause the inverter to overheat. When becoming too hot, the inverter 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.
- To ensure optimum operation, the ambient temperature should be between -25°C and $+40^{\circ}\text{C}$.
- Climatic conditions must be met (see Section 15 "Technical Data", page 85).

Permitted and prohibited mounting positions:

- The inverter must only be mounted in one of the permitted positions. This will ensure that no moisture can penetrate the inverter.
- The inverter should be mounted in such a way that LED signals can be read without difficulty.

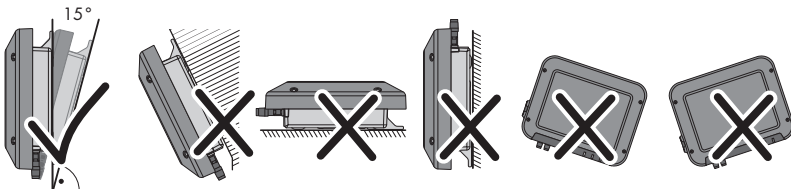


Figure 3: Permitted and prohibited mounting positions:

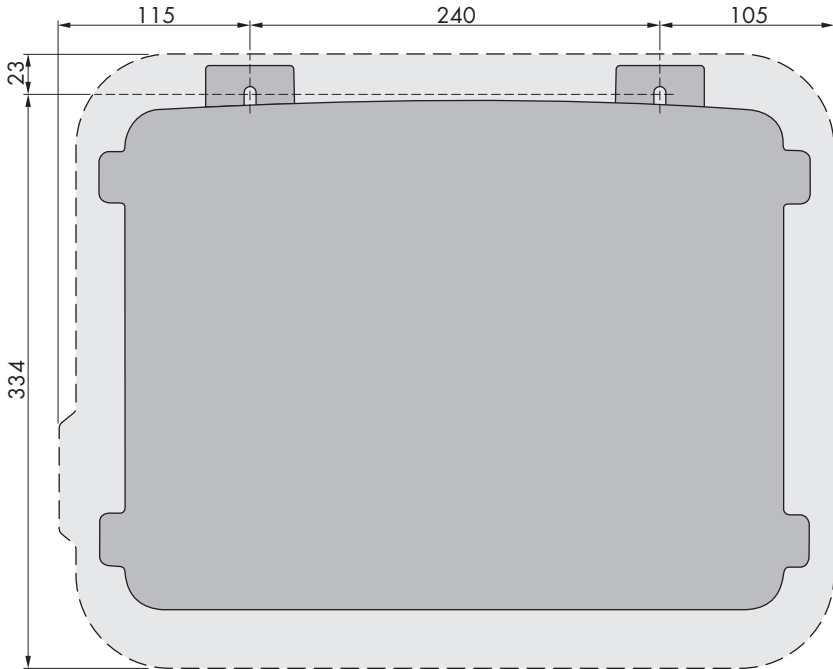
Dimensions for mounting:

Figure 4: Position of the anchoring points (dimensions in mm (in))

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 inverters are mounted in areas with high ambient temperatures, increase the clearances between the inverters and ensure sufficient fresh-air supply.

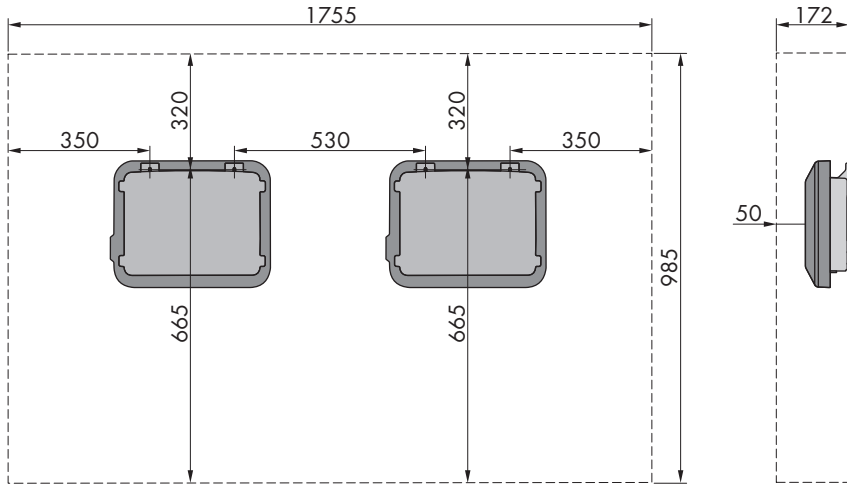


Figure 5: Recommended clearances (dimensions in mm (in))

5.2 Mounting the Inverter

⚠ QUALIFIED PERSON

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

- Two 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 inverter (fastening bracket thickness: 4 mm)
- If necessary, two screw anchors suitable for the support surface and the screws

⚠ CAUTION

Risk of injury when lifting the inverter, or if it is dropped

The inverter weighs 9 kg. There is risk of injury if the inverter is lifted incorrectly or dropped while being transported or when attaching it to or removing it from the wall mounting bracket.

- Transport and lift the inverter carefully.

Procedure:

1. **⚠ CAUTION**

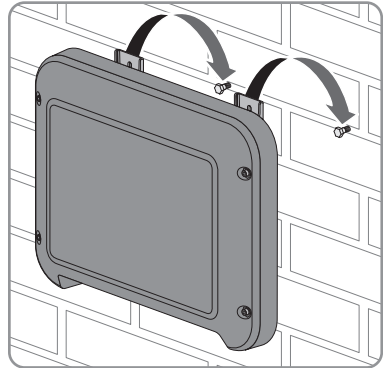
Risk of injury due to damaged cables

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

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

2. Mark the position of the drill holes. Align the markings horizontally.
3. Drill the holes.

4. Insert screw anchors into the drill holes if the support surface requires them.
5. When screwing the screws in, make sure that there is at least 6 mm left between the screw head and the support surface.
6. Hang the inverter onto the screws using the metal brackets.



7. 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.
8. Ensure that the inverter is securely in place.

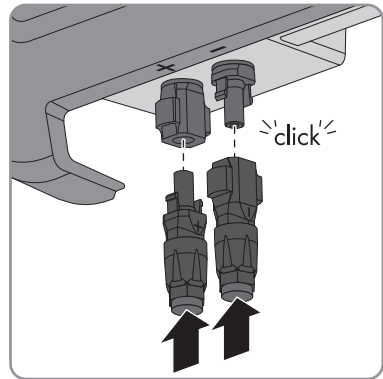
9.

NOTICE**Damage to the inverter due to moisture ingress**

If the electrical connection is not made immediately after the installation, the inverter is not sealed and moisture can penetrate the inverter. The inverter is only sealed if the DC connectors are connected to the inverter with the DC conductors or with sealing plugs.

If the electrical connection is to be carried out at a later time, close the DC inputs on the inverter with DC connectors and sealing plugs as described below.

- Do not insert the sealing plugs directly into the DC inputs on the inverter.
- For unused DC connectors, push down the clamping bracket and push the swivel nut up to the thread.
- Insert the sealing plug into the DC connector.
- Insert the DC connectors with sealing plugs into the corresponding DC inputs on the inverter.



- The DC connectors snap into place.
- Ensure that the DC connectors with sealing plugs are securely in place.

6 Electrical Connection

6.1 Safety during Electrical Connection

⚠ DANGER

Danger to life due to high voltages of the PV array

When exposed to sunlight, the PV array generates dangerous DC voltage, which is present in the DC conductors and the live components of the inverter. Touching the DC conductors or the live components can lead to lethal electric shocks. If you disconnect the DC connectors from the inverter under load, an electric arc may occur leading to electric shock and burns.

- Do not touch non-insulated cable ends.
- Do not touch the DC conductors.
- Do not touch any live components of the inverter.
- Have the inverter mounted, installed and commissioned only by qualified persons with the appropriate skills.
- If an error occurs, have it rectified by qualified persons only.
- Prior to performing any work on the inverter, disconnect it from all voltage sources as described in this document.

NOTICE

Damage to the seal of the enclosure lid in sub-zero conditions

If you open the enclosure lid in sub-zero conditions, the sealing of the enclosure lid can be damaged. This can lead to moisture entering the inverter.

- Do not open the inverter at ambient temperatures lower than -5°C .
- If a layer of ice has formed on the seal of the enclosure lid in sub-zero conditions, remove it prior to opening the inverter (e.g. by melting the ice with warm air). Observe the applicable safety regulations.

6.2 Overview of the Connection Area

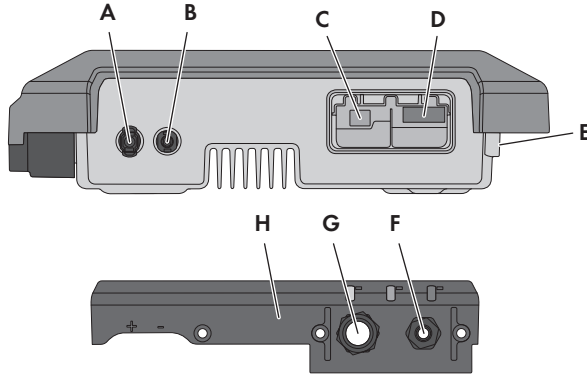


Figure 6: Connection areas and enclosure openings at the bottom of the inverter

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

6.3 AC Connection

6.3.1 Requirements for the AC Connection

Cable requirements:

- External diameter: 5 mm to 13 mm
- Conductor cross-section: 1.5 mm² to 4 mm²
- 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).

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).
- 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 15 "Technical Data", page 85). This will prevent residual voltage 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:

- If an external residual-current device is required, install a residual-current device which trips at a residual current of 100 mA or higher (for details on selecting a residual-current device, see the Technical Information "Criteria for Selecting a Residual-Current Device" at www.SMA-Solar.com).

Overvoltage category:

The inverter can be used in grids of overvoltage category III or lower in accordance with IEC 60664-1. That means that the inverter 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).

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 deactivate the grounding conductor monitoring. This is necessary, for example, in an IT system 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 deactivated after initial start-up depending on the grid configuration (see Section 9.11, page 56).

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 6.3.3, page 29): 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 6.3.3, page 29). This prevents touch current if the grounding conductor at the connecting terminal plate for the AC cable fails.

6.3.2 Connecting the Inverter to the Utility Grid

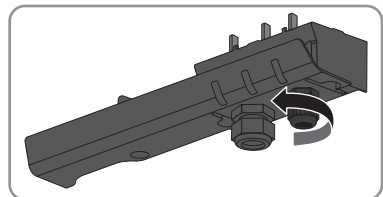
⚠ QUALIFIED PERSON

Requirements:

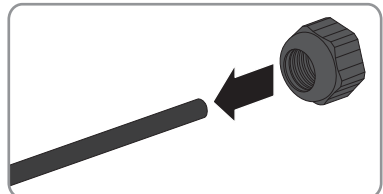
- Only the connecting terminal plate supplied may be used for the AC connection.
- The connection requirements of the grid operator must be met.
- The grid voltage must be in the permissible range. The exact operating range of the inverter is specified in the operating parameters.

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.

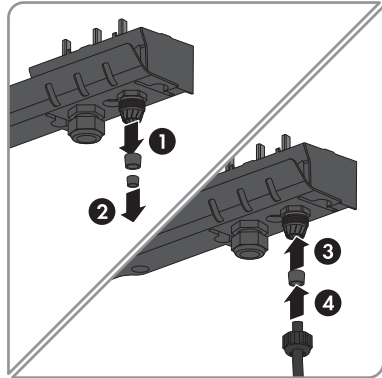
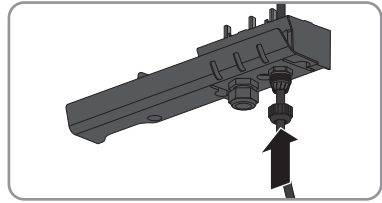


3. Thread the swivel nut over the AC cable.



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.



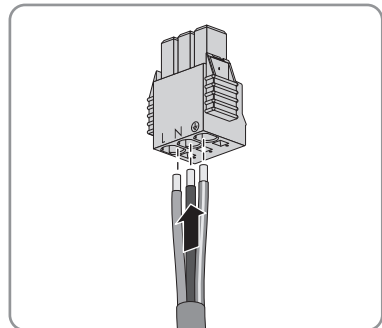
5. Dismantle 70 mm of the AC cable.

6. Shorten L and N by 5 mm each. Thus, the grounding conductor will be released from the connecting terminal plate 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 connecting terminal plate 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.

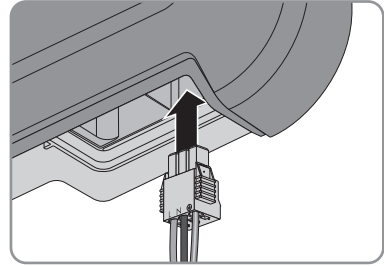
Useful hint: To release the conductors from the terminals, the terminals must be opened. To do this, stick a flat-blade screwdriver (blade width: 3 mm) as far as it can go into the rectangular opening behind the terminal.



9. Ensure that all terminals are allocated to the correct conductors.

10. Make sure that all conductors are securely in place.

11. Plug the connecting terminal plate with the connected conductors for the AC connection into the slot in the inverter until the connecting terminal plate clicks into place.



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

6.3.3 Connecting Additional Grounding

⚠ QUALIFIED PERSON

If additional grounding or equipotential bonding is required locally, you can connect additional grounding to the inverter. 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

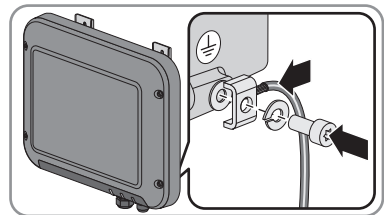
You can use an inflexible or a flexible, fine-stranded conductor.

- 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 mm²

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. Lead the grounding cable between the washer and clamping bracket and tighten the screw (torque: 6 Nm) using a Torx screwdriver (TX 25).



6.4 DC Connection

6.4.1 Requirements for the DC Connection

Requirements for the PV modules of a string:

- All PV modules must be of the same type.
- All PV modules must be aligned identically.
- All PV modules must have the same tilt angle.
- The thresholds for the input voltage and the input current of the inverter must be adhered to (see Section 1.5 "Technical Data", page 85).
- 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.

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 10 "Disconnecting the Inverter from Voltage Sources", page 59).

6.4.2 Assembling the DC Connectors

⚠ QUALIFIED PERSON

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. Be sure to observe the correct polarity. The DC connectors are marked with the symbols "+" and "-".

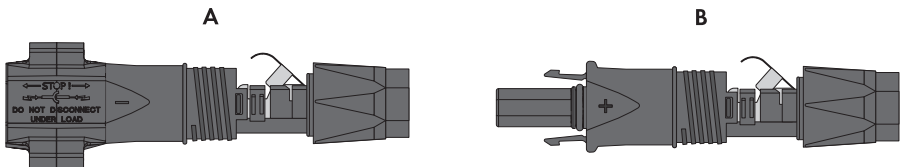


Figure 7: Negative (A) and positive (B) DC connectors

Cable requirements:

- Cable type: PV1-F, UL-ZKLA, USE2
- External diameter: 5 mm to 8 mm
- Conductor cross-section: 2.5 mm² to 6 mm²
- Qty single wires: minimum 7
- Nominal voltage: minimum 1000 V
- Using bootlace ferrules is not allowed.

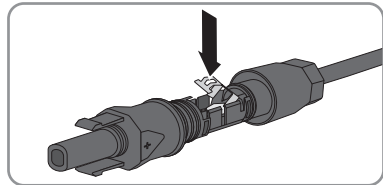
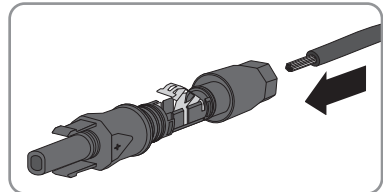
⚠ DANGER**Danger to life due to high voltages on the DC conductors**

When exposed to sunlight, the PV array generates dangerous DC voltage which is present in the DC conductors. Touching the DC conductors can lead to lethal electric shocks.

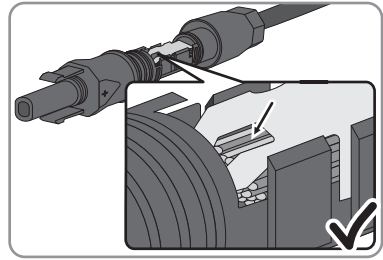
- Ensure that the inverter is disconnected from all voltage sources.
- Do not touch non-insulated cable ends.
- Do not touch the DC conductors.

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.



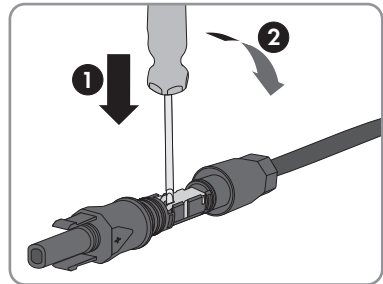
- ☑ The stranded wire can be seen inside the clamping bracket chamber.



- ✘ The stranded wire cannot be seen in the chamber?

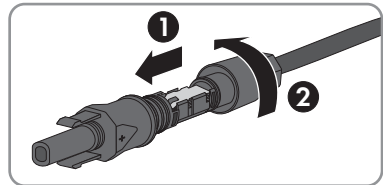
The cable is not correctly in place.

- 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.

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



6.4.3 Connecting the PV Array

⚠ QUALIFIED PERSON

NOTICE

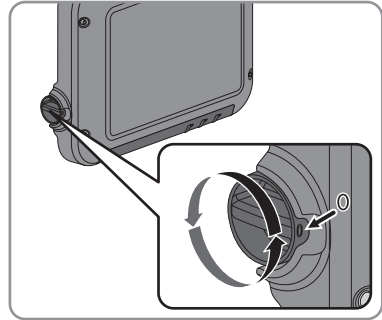
Damage to the DC connectors due the use of contact cleaner of other cleaning agents

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.

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.

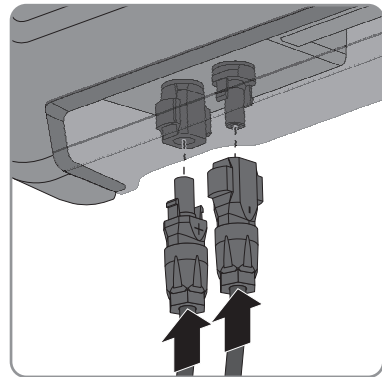
- Set the DC load-break switch of the inverter to position **0**.



- 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.
- 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.

- Connect the assembled DC connectors to the inverter.



- The DC connectors snap into place.

- Ensure that all DC connectors are securely in place.

6.4.4 Disassembling the DC Connectors

⚠ QUALIFIED PERSON

⚠ DANGER

Danger to life due to high voltages on DC conductors

When exposed to sunlight, the PV array generates dangerous DC voltage which is present in the DC conductors. Touching the DC conductors can lead to lethal electric shocks.

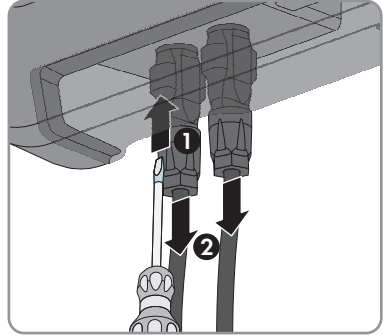
- Cover the PV modules.
- Do not touch the DC conductors.

To disassemble the DC connectors, proceed as follows.

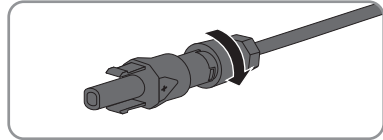
Procedure:

1. Set the DC load-break switch of the inverter to position **O**.

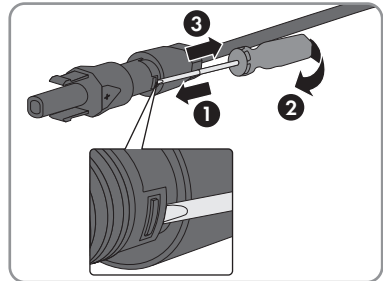
2. Release and remove all DC connectors. To do this, insert a flat-blade screwdriver or an angled screwdriver (blade width 3.5 mm) into one of the slide slots and pull the DC connectors out in a downward direction. Do not pull on the cable.



3. Remove the DC connector swivel nut.

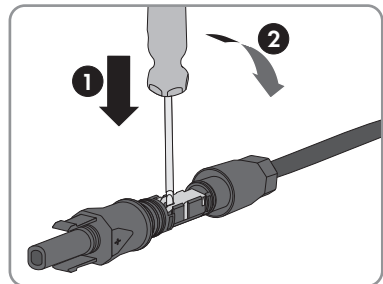


4. Unlock the DC connector. To do this, insert a flat-blade screwdriver (blade width: 3.5 mm) into the side catch mechanism and pry the catch mechanism open.



5. Carefully pull the DC connector apart.

6. 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.



7. Remove the cable.

6.5 Connecting the Network Cables

⚠ QUALIFIED PERSON

⚠ DANGER

Danger to life due to electric shock

Overvoltages (e. g. in the case of a flash of lightning) can be further conducted into the building and to other connected devices in the same network via the network cable if there is no overvoltage protection.

- Ensure that all devices in the same network are integrated in the existing overvoltage protection.
- When laying the network cable outdoors, attention must be given to suitable overvoltage protection at the network cable transition from the inverter outdoors to the network inside the building.
- The Ethernet interface of the inverter is classified as "TNV-1" and offers protection against overvoltages up to 1.5 kV.

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

- 1 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".

Cable requirements:

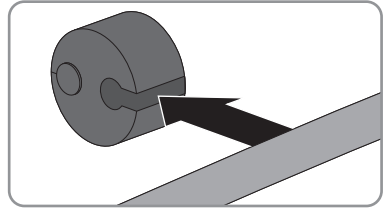
The cable length and quality affect the quality of the signal. Observe the following cable requirements.

- Cable type: 100BaseTx
- Cable category: Cat5, Cat5e, Cat6, Cat6a or Cat7
- Plug type: RJ45 of Cat5, Cat5e, Cat6 or Cat6a
- Shielding: SF/UTP, S/UTP, SF/FTP or S/FTP
- Number of insulated conductor pairs and insulated conductor cross-section: at least $2 \times 2 \times 0.22 \text{ mm}^2$
- Maximum cable length between two nodes when using patch cables: 50 m
- Maximum cable length between two nodes with installation cable: 100 m
- UV-resistant for outdoor use

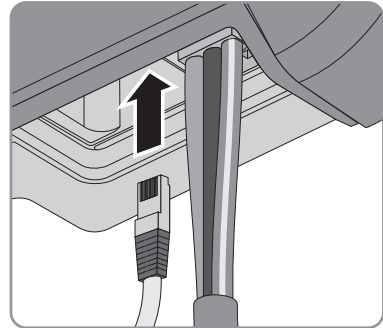
Procedure:

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.

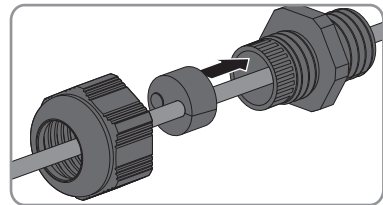
4. Press the cable support sleeve out of the cable gland.
5. Remove one filler plug from the cable support sleeve.
6. Route the network cable through an opening in the cable support sleeve.



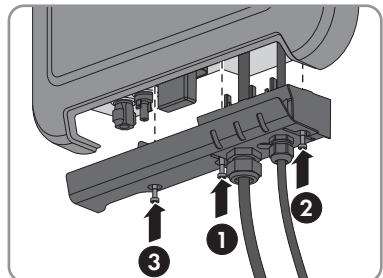
7. Thread the network cable through the cable gland.
8. Insert the RJ45 plug of the network cable into the network pin connector on the inverter until it snaps into place.



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 to the inverter using the three screws and a Torx screwdriver (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 connect the inverter in a local network, connect the other end of the network cable to the local network (e. g. via a router).

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.

Procedure	See
1. Commission the inverter.	Section 7.2, page 38
2. Establish a connection to the user interface of the inverter. There are three connection options available to choose from: <ul style="list-style-type: none"> • Direct connection via WLAN • Direct connection via Ethernet • Connection via Ethernet in the local network 	Section 8.1, page 43
3. Log into the user interface.	Section 8.2, page 46
4. Configure the inverter. Please note, that the personal SMA Grid Guard code for changing the grid-relevant parameters must be available after completion of the first ten operating hours (see "Application for the SMA Grid Guard code" available at www.SMA-Solar.com).	Section 7.3, page 40
5. Ensure that the country data set has been configured correctly.	Section 9.3, page 52
6. For PV systems in Italy: Start the self-test.	Section 7.4, page 42
7. Make further inverter settings as needed.	Section 9, page 51

7.2 Commissioning the Inverter

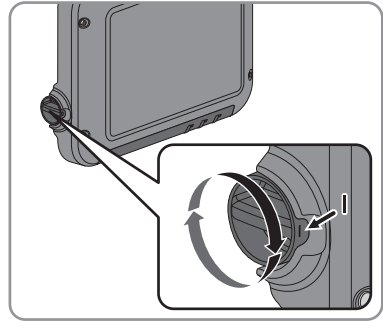
QUALIFIED PERSON

Requirements:

- The inverter must be correctly mounted.
- The circuit breaker must be correctly rated.
- All cables must be correctly connected.
- A computer with a WLAN- or Ethernet interface or a tablet PC or smartphone with a WLAN interface must be available.

Procedure:

1. Turn the DC load-break switch of the inverter to position I.



2. Switch on the circuit breaker.
 - ☑ The green LED flashes for approx. 30 seconds and then glows permanently or pulses. Feed-in operation begins.
 - ✘ The green LED is still flashing after one minute?
 - The DC input voltage is still too low.
 - Once the DC input voltage is sufficiently high, feed-in operation begins.
 - ✘ The red LED is glowing?
 - An error has occurred.
 - Rectify the error (see service manual at www.SMA-Solar.com).
3. Configure the inverter via the user interface (see Section 8.1.1 "Establishing a direct connection via WLAN", page 43). When doing so you can either configure the inverter manually, use the installation assistant or adopt an existing configuration from a file. SMA Solar Technology AG recommends configuration with the help of the installation assistant.

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 country data set is valid for your country or purpose, contact your grid operator for information on which country data set is to be configured.

7.3 Configuring the Inverter

QUALIFIED PERSON

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

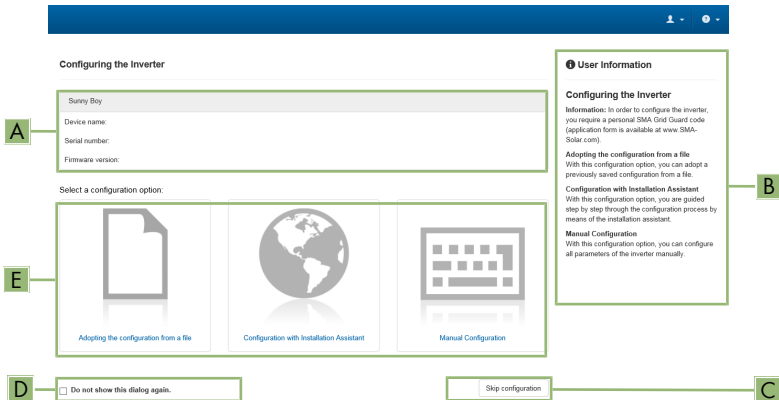


Figure 8: Layout of the **Configuring the Inverter** page

Procedure:

On the **Configuring the Inverter** page, three configuration options are available to choose from. Select one of the three 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.

- Adopt the configuration from a file
- Configuration with the Installation Assistant (recommended)
- Manual configuration

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**].

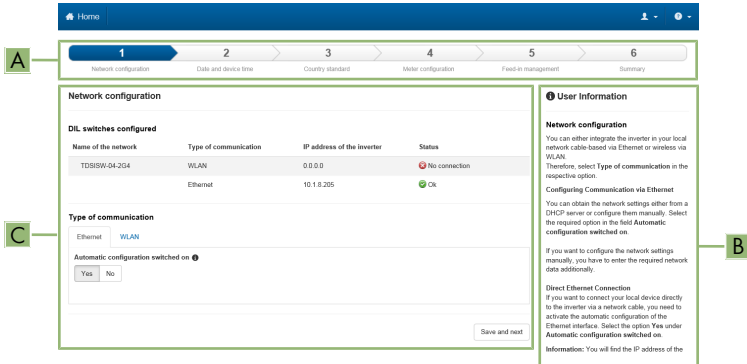
Configuration with the Installation Assistant (Recommended)

Figure 9: Layout of the installation assistant

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

Procedure:

1. Select the configuration option **Configuration with Installation Assistant**.
 - The Installation Assistant will open.
2. Follow the Installation Assistant steps and make the settings appropriate for your system.
3. For every setting made in a step, select [**Save and next**].
 - In the last step, all made settings are listed in a summary.
4. To save the settings to a file, select [**Export a summary**] and save the file on your computer, tablet PC or smartphone.

5. To correct settings you made, select **[Back]**, navigate to the desired step, correct settings and select **[Save and continue]**.
6. Once all settings are correct, select **[Next]** in the summary.
 - The start page of the user interface opens.

Manual Configuration

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

Procedure:

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

7.4 Starting the Self-Test (For Italy Only)

QUALIFIED PERSON

The self-test is only required for inverters to be commissioned in Italy. The Italian standard requires that all inverters feeding into the utility grid are equipped with a self-test function in accordance with CEI 0-21. 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**.

Procedure:

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

8 Using the Inverter User Interface

8.1 Establishing a connection to the user interface

8.1.1 Establishing a direct connection via WLAN

Requirements:

- The inverter must be commissioned.
- A computer, tablet PC or smartphone with WLAN interface must be available.
- In the case of a computer connection, one of the following web browsers must be installed: Firefox (as of version 25), Internet Explorer (as of version 10), Safari (as of version 7), Opera (as of version 17) or Google Chrome (as of version 30).
- In the case of a tablet PC or smartphone connection, one of the following web browsers must be installed: Firefox (as of version 25), Safari (as of version iOS 7) or Google Chrome (as of version 29).
- The personal SMA Grid Guard code of the Installer must be available for the changing of grid-relevant settings after completion of the first ten operating hours (see "Application for SMA Grid Guard Code" at www.SMA-Solar.com).

Inverter SSID and IP address and necessary passwords

- Inverter SSID in WLAN: SMA[serial number] (e.g. SMA2130019815)
- Standard WLAN password (usable for initial configuration to completion of the first ten operating hours): SMA 12345
- Device-specific WLAN password (usable for initial configuration to completion of the first ten operating hours): see WPA2-PSK on the type label of the inverter or on the back of the manual included in the delivery
- Standard IP inverter address for a direct connection via WLAN outside of a local network: 192.168.12.3


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

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

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

The procedure can be different depending on the terminal devices used (e.g. computer, tablet PC or smartphone). If the procedure described does not apply to your device, establish the direct connection via WLAN as described in the manual of your device.

Procedure:

1. If your computer, tablet PC or smartphone has a WPS function:
 - Activate 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.
 - Activate the WPS on your device.
 - The connection with your device will be established automatically. It can take up to 20 seconds for this connection to be established.
2. If your computer, tablet PC or smartphone does not have a WPS function:
 - Search for WLAN networks with your device.
 - Select the SSID of the inverter **SMA[serial number]** in the list with the found WLAN networks.
 - Enter the inverter WLAN password. Within the first 10 operating hours, you must use the standard WLAN password **SMA12345**. After the first 10 operating hours, you must use the device-specific WLAN password (WPA2-PSK) of the inverter. The WLAN password (WPA2-PSK) is printed on the type label.
3. Enter the IP address **192.168.12.3** or, if your device supports mDNS services, **SMA[serial number].local** in the address line of the web browser and press the enter key.
4.  **Web browser signals a security vulnerability**

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

 - Continue loading the user interface.
 - The login page of the user interface opens.

8.1.2 Establishing a Direct Connection via Ethernet


Requirements:

- The inverter must be commissioned.
- A computer with an Ethernet interface must be available.
- The inverter must be connected directly to a computer.
- One of the following web browsers must be installed: Firefox (as of version 25), Internet Explorer (as of version 10), Safari (as of version 7), Opera (as of version 17) or Google Chrome (as of version 30).
- The personal SMA Grid Guard code of the Installer must be available for the changing of grid-relevant settings after completion of the first ten operating hours (see certificate "Application for SMA Grid Guard Code" at www.SMA-Solar.com).

 IP address of the inverter

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

Procedure:

1. Open the web browser of your device, enter the IP address **169.254.12.3** in the address line and press the enter key.
 2.  **Web browser signals a security vulnerability**

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

 - Continue loading the user interface.
- The login page of the user interface opens.

8.1.3 Establishing a Connection via Ethernet in the local network

New IP address for connecting with a local network

If the inverter is connected to a local network via a network cable (e.g. via a router), the inverter 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 inverter is only reachable via this new IP address or the alternative addresses.

Access addresses of the inverter:


- Generally applicable access address, e.g. for android products: IP address manually assigned or assigned by the DHCP server (router) (identification via network scanner software or router manual).
- Alternative access address for Apple products: SMA[serial number].local (e.g. SMA2130019815.local)
- Alternative access address for certain Windows products: SMA[serial number] (e.g. SMA2130019815)

Requirements:

- The inverter must be connected to the local network via a network cable (e.g. via a router).
- The inverter must be integrated in the local network.
- A computer, tablet PC or smartphone must be available and the computer, tablet PC or smartphone must be connected with the network to which the inverter is also connected.
- In the case of a computer connection, one of the following web browsers must be installed: Firefox (as of version 25), Internet Explorer (as of version 10), Safari (as of version 7), Opera (as of version 17) or Google Chrome (as of version 30).
- In the case of a tablet PC or smartphone connection, one of the following web browsers must be installed: Firefox (as of version 25), Safari (as of version iOS 7) or Google Chrome (as of version 29).

- The personal SMA Grid Guard code of the Installer must be available for the changing of grid-relevant settings after completion of the first ten feed-in hours (see certificate "Application for SMA Grid Guard Code" at www.SMA-Solar.com).

Procedure:

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

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

Procedure:

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. In the **New password** field, enter a new password for the selected user group.
 4. In the **Repeat password** field, enter the new password again.
 5. Select **Login**.
- The **Configuring the Inverter** page or the user interface start 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 10: Start page design of the user interface (example)

Position	Designation	Description
A	Menu	<p>Provides the following functions:</p> <ul style="list-style-type: none"> • Home Opens the user interface homepage • Instantaneous values Current measured values of the inverter • Device Parameters The various operating parameters of the inverter can be viewed and configured here depending on the user group. • Events All events that have occurred in the selected time period are displayed here. The event types are Information, Warning and Error. Currently existing events of the types Error and Warning will be additionally displayed in the Device status 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. • Device configuration The following settings for the inverter can be performed here. The selection is, however, dependent on the user group logged in and the set country data set. <ul style="list-style-type: none"> - Changing the device name - Updating firmware (not available with devices having an iOS operating system) - Saving a configuration to file (not available with devices having an iOS operating system) - Loading a configuration from a file (not available with devices having an iOS operating system) - Importing a proxy certificate (not available with devices having an iOS operating system) - Start the self-test
B	User settings	<p>Provides the following functions, depending on the user group logged in:</p> <ul style="list-style-type: none"> • Start the installation assistant • SMA Grid Guard login • Logout

Position	Designation	Description
C	Help	<p>Provides the following functions:</p> <ul style="list-style-type: none"> • Displaying information on Open Source licenses used • Link to the website of SMA Solar Technology AG
D	Status bar	<p>Displays the following information:</p> <ul style="list-style-type: none"> • Inverter serial number • Inverter firmware version • IP addresses of the inverter within the local network and/ or IP address of the inverter during WLAN connection • With WLAN connection: Signal strength of WLAN connection • User group logged in • Date and device time of the inverter
E	PV power and power consumption progression	<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"> • Device status Displays whether the inverter is currently in a fault-free operating state or whether there is an Error or Warning present. • Current power Displays the power currently being generated by the inverter. • Current consumption Displays the current consumption of the household if an energy meter is installed in the PV system. • Yield Displays the energy yield of the inverter. • Consumption Displays the energy consumption of the household if an energy meter is installed in the PV system. • Feed-in management Displays whether the inverter is currently limiting its active power.

8.4 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.

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 43).
2. Log into the user interface (see Section 8.2, page 46).
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.

9 Configuration of the Inverter

9.1 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.

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:

- The changes to the grid-relevant parameters must be approved by the grid operator.
- When changing grid-relevant parameters, the SMA Grid Guard code must be available (see "Application for SMA Grid Guard Code" at www.SMA-Solar.com).

Procedure:

1. Activate the user interface (see Section 8.1, page 43).
 2. Log into the user interface (see Section 8.2, page 46).
 3. Call up the menu **Device Parameters**.
 4. Select [**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 47).
 - 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 desired parameters.
 8. Select [**Save all**] to save the changes.
- The inverter parameters are set.

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.

9.2 Starting the Installation Assistant

QUALIFIED PERSON

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

Requirements:

- When configuring after completion of the first ten operating hours, the SMA Grid Guard code must be available (see "Application for SMA Grid Guard Code" at www.SMA-Solar.com).

Procedure:

1. Access the webserver (see Section 8.1, page 43).
 2. Log in as **Installer**.
 3. On the right-hand side of the menu bar, select the menu **User Settings** (see Section 8.3 "Start Page Design of the User Interface", page 47).
 4. In the subsequent context menu, select [**Start the installation assistant**].
- The Installation Assistant will open.

9.3 Configuring the Country Data Set

QUALIFIED PERSON

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

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 country data set is valid for your country or purpose, contact your grid operator for information on which country data set is to be configured.

The basic procedure for changing operating parameters is explained in another section (see Section 9.1 "Changing Operating Parameters", page 51).

Procedure:

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

9.4 Configuring Feed-In Management

QUALIFIED PERSON

If required by the grid operator, the inverter can provide grid management services. You can configure these via the inverter feed-in management. Coordinate the configuration of the feed-in management with your grid operator beforehand.

The basic procedure for changing operating parameters is explained in another section (see Section 9.1 "Changing Operating Parameters", page 51).

Procedure:

1. Activate the user interface (see Section 8.1, page 43).
2. Log into the user interface as an **Installer**.
3. On the right-hand side of the menu bar, select the menu **User Settings** (see Section 8.3 "Start Page Design of the User Interface", page 47).
4. In the subsequent context menu, select [**Start the installation assistant**].
5. Select [**Save and next**] until you arrive in the menu **Feed-in management**.
6. Configure the feed-in management as desired.

9.5 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 Modbus® Interface" or in the Technical Information "SunSpec® Modbus® Interface" at www.SMA-Solar.com.

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.

- 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 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 Modbus® Interface" or "SunSpec® Modbus® Interface" at www.SMA-Solar.com).

9.6 Setting SMA OptiTrac Global Peak

QUALIFIED PERSON

For partially shaded PV modules, you should set the interval at which the inverter is to optimize the MPP of the PV system. If you do not want to use SMA OptiTrac Global Peak feature, you can deactivate the feature.

The basic procedure for changing operating parameters is explained in another section (see Section 9.1 "Changing Operating Parameters", page 51).

Procedure:

- In the parameter group **DC-side > DC settings > OptiTrac Global Peak**, set the parameter **Cycle time of the OptiTrac Global Peak algorithm** 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 deactivate the SMA OptiTrac Global Peak feature, in the parameter group **DC-side > DC settings > OptiTrac Global Peak**, set the parameter **OptiTrac Global Peak switched on** to **Off**.

9.7 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 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 43).
2. Log into the user interface (see Section 8.2, page 46).
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.

9.8 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 in a file (see Section 9.7 "Saving the Configuration in a File", page 54). When saving, only the device parameters will be adopted, not any passwords.

Requirements:

- The SMA Grid Guard code must be available (see "Application for SMA Grid Guard Code" at www.SMA-Solar.com).
- Changes to grid-relevant parameters must be approved by the responsible grid operator.

Procedure:

1. Activate the user interface (see Section 8.1, page 43).
2. Log into the user interface as an **Installer**.
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.

9.9 Activate WPS Function

- Activate 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.

9.10 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 9.1 "Changing Operating Parameters", page 51).

Parameters	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.

9.11 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 9.1 "Changing Operating Parameters", page 51).

Procedure:

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

9.12 Configuring the Energy Meter

QUALIFIED PERSON

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 9.1 "Changing Operating Parameters", page 51).

i 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 **PV 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 43).
2. Log in as **Installer**.
3. Start the installation assistant (see Section 9.2, page 52).
4. In the context menu, select **[Start the installation assistant]**.
5. Select **[Save and next]** until you get to the step **Meter configuration**.
6. Add or replace the desired energy meter.

9.13 Switching the Dynamic Power Display Off

As standard, the inverter 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 inverter. 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 9.1 "Changing Operating Parameters", page 51).

Procedure:

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

9.14 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.

i 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 9.1 "Changing Operating Parameters", page 51).

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**.

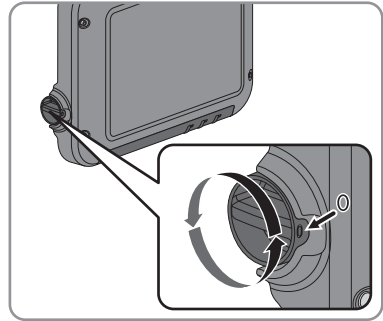
10 Disconnecting the Inverter from Voltage Sources

⚠ QUALIFIED PERSON

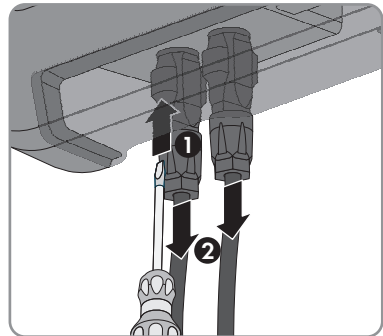
Prior to performing any work on the inverter, always disconnect it from all voltage sources as described in this section. Always adhere to the prescribed sequence.

Procedure:

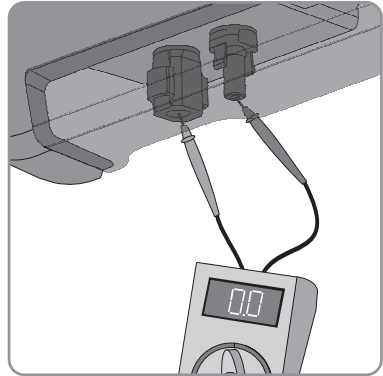
1. Disconnect the circuit breaker and secure it against reconnection.
2. If an external DC load-break switch is installed, disconnect the external DC load-break switch from all voltage sources.
3. Set the DC load-break switch of the inverter to **O**.



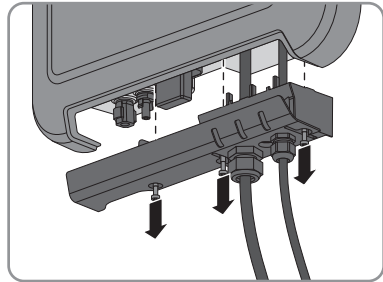
4. Wait until the LEDs have gone out.
5. Use a current clamp to ensure that no current is present in the DC cables.
6. Release and remove all DC connectors. To do this, insert a flat-blade screwdriver or an angled screwdriver (blade width 3.5 mm) into one of the slide slots and pull the DC connectors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



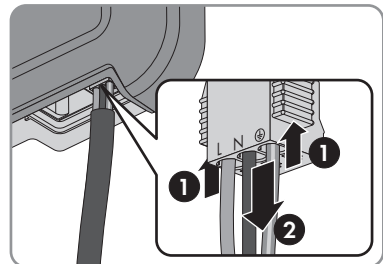
7. Ensure that no voltage is present at the DC inputs on the inverter using a suitable measuring device.



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 connecting terminal plate.
11. Release and disconnect the AC connector using the sliders located on the side.



11 Cleaning the Inverter

NOTICE

Damage to the inverter due to the use of cleaning agents

- If the inverter is dirty, clean the enclosure, the enclosure lid, the type label and the LEDs using only clean water and a cloth.
- Ensure that the inverter is free of dust, foliage and other dirt.

12 Troubleshooting

12.1 Forgotten Password

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 one PUK for each user group (**User** and **Installer**). Useful hint: With PV systems in Sunny Portal, you can also assign a new password via Sunny Portal for the user group **Installer**. The password for the user group **Installer** is the same as the system password in Sunny Portal.

Procedure:

1. Request PUK (application form available at www.SMA-Solar.com).
2. Activate the user interface (see Section 8.1, page 43).
3. Enter the PUK instead of the password into the field **Password**.
4. Select **Login**.
5. Call up the menu **Device Parameters**.
6. Select [**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.

PV Systems in Sunny Portal

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

- Assign the changed password of the user group **Installer** as the new system password in Sunny Portal (see the Sunny Portal user manual at www.SMA-Solar.com).

12.2 Event Messages

Event number	Message, cause and corrective measures
101 to 103	<p data-bbox="292 236 393 263">Grid fault</p> <p data-bbox="292 272 981 328">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 data-bbox="292 338 508 365">Corrective measures:</p> <ul data-bbox="311 375 988 427" style="list-style-type: none"> <li data-bbox="311 375 988 427">• Check whether the grid voltage at the connection point of the inverter is permanently in the permissible range. <p data-bbox="337 437 992 552">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 data-bbox="337 561 999 646">If the grid voltage is permanently within the permissible range and this message is still displayed, contact the Service (see Section 17 "Contact", page 91).</p>
202 to 205	<p data-bbox="292 655 393 683">Grid fault</p> <p data-bbox="292 692 992 777">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 data-bbox="292 786 508 813">Corrective measures:</p> <ul data-bbox="311 823 988 1023" style="list-style-type: none"> <li data-bbox="311 823 782 850">• Make sure that the circuit breaker is switched on. <li data-bbox="311 860 930 912">• Ensure that the AC cable is not damaged and that it is connected correctly. <li data-bbox="311 922 906 949">• Ensure that the country data set has been configured correctly. <li data-bbox="311 959 988 1023">• Check whether the grid voltage at the connection point of the inverter is permanently in the permissible range. <p data-bbox="337 1032 992 1149">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 data-bbox="337 1158 999 1240">If the grid voltage is permanently within the permissible range and this message is still displayed, contact the Service (see Section 17 "Contact", page 91).</p>

Event number	Message, cause and corrective measures
301	<p>Grid fault</p> <p>The ten-minute average value of the grid voltage is no longer within the permissible range. The grid voltage or grid impedance at the connection point is too high. The inverter disconnects from the utility grid to maintain power quality.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • During the feed-in operation, check whether the grid voltage at the connection point of the inverter is permanently in the permissible range. <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 (see Section 17 "Contact", page 91).</p>
302	<p>Active power limited AC voltage</p> <p>The inverter has reduced its power due to a too-high grid voltage to ensure grid stability.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • 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 Service (see Section 17 "Contact", page 91).
401 to 404	<p>Grid fault</p> <p>The inverter has disconnected from the utility grid. A stand-alone grid or a very large change in the power frequency was detected.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Check the grid connection for significant short-term frequency fluctuations.

Event number	Message, cause and corrective measures
501	<p>Grid fault</p> <p>The power frequency is not within the permissible range. The inverter has disconnected from the utility grid.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • If possible, check the power frequency and observe how often fluctuations occur. <p>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.</p> <p>If the grid operator gives his approval, discuss any changes to the operating parameters with Service (see Section 17 "Contact", page 91).</p>
507	<p>Active power limited AC frequency</p> <p>The inverter has reduced its power due to a too-high power frequency to ensure grid stability.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • 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 Service (see Section 17 "Contact", page 91).
601	<p>Grid fault</p> <p>The inverter has detected an excessively high proportion of direct current in the grid current.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Check the grid connection for direct current. • If this message is displayed frequently, contact the grid operator and check whether the monitoring threshold on the inverter can be raised.

Event number	Message, cause and corrective measures
701	<p>Frq. not permitted > Check parameter</p> <p>The power frequency is not within the permissible range. The inverter has disconnected from the utility grid.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • If possible, check the power frequency and observe how often fluctuations occur. <p>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.</p> <p>If the grid operator gives his approval, discuss any changes to the operating parameters with Service (see Section 17 "Contact", page 91).</p>
801	<p>Waiting for grid voltage > Grid failure > Check AC circuit breaker</p> <p>The AC cable is not correctly connected or the country data set is not correctly configured.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Make sure that the circuit breaker is switched on. • Ensure that the AC cable is not damaged and that it is connected correctly. • Ensure that the country data set has been configured correctly. • Check whether the grid voltage at the connection point of the inverter is permanently in the permissible range. <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 (see Section 17 "Contact", page 91).</p>
901	<p>PE conn. missing > Check connection</p> <p>The grounding conductor is not correctly connected.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Ensure that the grounding conductor is correctly connected (see Section 6.3.2, page 27).

Event number	Message, cause and corrective measures
1001	<p>L/N swapped > Check connection</p> <p>The connection of L and N is swapped.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Ensure that L and N are correctly connected (see Section 6.3.2, page 27).
1101	<p>Installation fault > Check connection</p> <p>A second line conductor is connected to N.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Connect the neutral conductor to N (see Section 6.3.2, page 27).
1302	<p>Waiting for grid voltage > Installation failure grid connection > Check grid and fuses</p> <p>L or N not connected.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Ensure that L and N are connected. • Make sure that the circuit breaker is switched on. • Ensure that the AC cable is not damaged and that it is connected correctly.
1501	<p>Reconnection fault grid</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>Corrective measures:</p> <ul style="list-style-type: none"> • Ensure that the country data set has been configured correctly. To do this, select the parameter Set country standard and check the value.
3301 to 3303	<p>Unstable operation</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>Corrective measures:</p> <ul style="list-style-type: none"> • Ensure that the PV array is designed correctly. • Ensure that the PV array is not covered by snow or otherwise shaded. • Ensure that the PV array is free of errors.

Event number	Message, cause and corrective measures
3401	<p>DC overvoltage > Disconnect generator</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>Corrective measures:</p> <ul style="list-style-type: none"> • Immediately disconnect the inverter from all voltage sources (see Section 10, page 59). • 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. • If the DC voltage exceeds the maximum input voltage of the inverter, ensure that the PV array has been correctly rated or contact the installer of the PV array. • If this message is repeated frequently, contact the Service (see Section 17 "Contact", page 91).
3501	<p>Insulation failure > Check generator</p> <p>The inverter has detected a ground fault in the PV array.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Check the PV system for ground faults (see Section 12.3, page 77).
3601	<p>High discharge curr. > Check generator</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>Corrective measures:</p> <ul style="list-style-type: none"> • Check the PV system for ground faults (see Section 12.3, page 77).
3701	<p>Resid.curr.too.high > Check generator</p> <p>The inverter has detected a residual current due to temporary grounding of the PV array.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Check the PV system for ground faults (see Section 12.3, page 77).
3801	<p>DC overcurrent > Check generator</p> <p>Overcurrent at the DC input. The inverter briefly interrupts feed-in operation.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • If this message is displayed frequently, ensure that the PV array has been correctly rated and wired.

Event number	Message, cause and corrective measures
3901 to 3902	<p>Waiting for DC start conditions > Start cond. not met The feed-in conditions for the utility grid are not yet fulfilled.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Ensure that the PV array is not covered by snow or otherwise shaded. • Wait for higher irradiation. • If this message is displayed frequently in the morning, increase the voltage limit for starting grid feed-in. Change the parameter Critical voltage to start feed-in. • If this message is displayed frequently with medium irradiation, ensure that the PV array is correctly rated.
6001 to 6438	<p>Self diagnosis > Interference device The cause must be determined by the SMA Service Line.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Contact the Service (see Section 17 "Contact", page 91).
6501 to 6509	<p>Self-diagnosis > Overtemperature The inverter has switched off due to excessive temperature.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Clean the cooling fins on the rear of the enclosure and the air ducts on the top using a soft brush. • Ensure that the inverter has sufficient ventilation. • Ensure that the ambient temperature 40°C has not been exceeded. • Ensure that the inverter is not exposed to direct solar irradiation.
6512	<p>Minimum operating temperature not reached The inverter will only recommence feeding into the utility grid once the temperature has reached at least -25°C.</p>
6603 to 6604	<p>Self-diagnosis > Overload The cause must be determined by the Service.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Contact the Service (see Section 17 "Contact", page 91).
6701 to 6702	<p>Communication disturbed Error in the communication processor, the inverter continues feeding in, however. The cause must be determined by the Service.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • If this message is displayed frequently, contact the Service (see Section 17 "Contact", page 91).

Event number	Message, cause and corrective measures
7001 to 7002	<p>Sensor fault</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>Corrective measures:</p> <ul style="list-style-type: none"> • Contact the Service (see Section 17 "Contact", page 91).
7201 to 7202	<p>Data stor. not poss.</p> <p>Internal error. The inverter continues to feed into the utility grid.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Contact the Service (see Section 17 "Contact", page 91).
7303	<p>Update main CPU failed</p> <p>The cause must be determined by the Service.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Contact the Service (see Section 17 "Contact", page 91).
7320	<p>The device with serial number [x] was successfully updated to firmware version [x].</p> <p>The firmware update was completed successfully.</p>
7329	<p>Condition test successful</p> <p>The testing of the update conditions was successful. The firmware update package is suitable for this inverter.</p>
7330	<p>Condition test failed</p> <p>The testing of the update conditions was not successful. The firmware update package is not suitable for this inverter.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Retry update. • Ensure that the selected update file is suitable for this inverter. • If this message is displayed again, contact the Service (see Section 17 "Contact", page 91).
7331	<p>Update transport started</p> <p>Update file is being copied.</p>
7332	<p>Update transport successful</p> <p>Update file was copied successfully to the inverter's internal memory.</p>

Event number	Message, cause and corrective measures
7333	<p>Update transport failed</p> <p>Update file could not be copied to the inverter's internal memory. In the event of connection with the inverter via WLAN, a poor connection quality can be the cause.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Retry update. • For WLAN connection: Improve the WLAN connection quality (e.g. via WLAN repeater) or establish connection with the inverter via Ethernet. • If this message is displayed again, contact the Service (see Section 17 "Contact", page 91).
7341	<p>Update Bootloader</p> <p>The inverter is performing a bootloader update.</p>
7342	<p>Update Bootloader failed</p> <p>The bootloader update failed.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Retry update. • If this message is displayed again, contact the Service (see Section 17 "Contact", page 91).
7347	<p>Incompatible file</p> <p>The configuration file is not suitable for this inverter.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Ensure that the selected configuration file is suitable for this inverter. • Retry import.
7348	<p>Incorrect file format</p> <p>The configuration file is not of the required format or is damaged.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Ensure that the selected configuration file is of the required format and is not damaged. • Retry import.
7349	<p>Incorrect login rights for configuration file</p> <p>The user group logged in does not have the user rights necessary to be able to import a configuration.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Log in as Installer. • Import configuration file again.

Event number	Message, cause and corrective measures
7350	<p>Transfer of a configuration file has started The configuration file is being transferred.</p>
7351	<p>Update WLAN The inverter is updating the WLAN module.</p>
7352	<p>Update of WLAN not successful The update of the WLAN module failed.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Retry update. • If this message is displayed again, contact the Service (see Section 17 "Contact", page 91).
7353	<p>Update time zone database The inverter is updating the time zone database.</p>
7354	<p>Update of time zone database not successful The update of the time zone database failed.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Retry update. • If this message is displayed again, contact the Service (see Section 17 "Contact", page 91).
7355	<p>Update WebUI The inverter is updating the inverter user interface.</p>
7356	<p>Update of the WebUI not successful The update of the inverter user interface failed.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Retry update. • If this message is displayed again, contact the Service (see Section 17 "Contact", page 91).
7619	<p>Communication fault with meter unit > Check communication to meter The inverter is not receiving any data from the energy meter.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Ensure that the energy meter is correctly integrated into the same network as the inverter (see energy meter manual). • For WLAN connection: Improve the WLAN connection quality (e.g. via WLAN repeater) or connect the inverter with the DHCP server (router) via Ethernet.

Event number	Message, cause and corrective measures
7701 to 7703	<p>Self diagnosis > Interference device</p> <p>The cause must be determined by the Service.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Contact the Service (see Section 17 "Contact", page 91).
8003	<p>Active power limited derating</p> <p>The inverter has reduced its power output for more than ten minutes due to excessive temperature.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Clean the cooling fins on the rear of the enclosure and the air ducts on the top using a soft brush. • Ensure that the inverter has sufficient ventilation. • Ensure that the ambient temperature 40°C has not been exceeded. • Ensure that the inverter is not exposed to direct solar irradiation.
8708	<p>Timeout in communication for active power limitation</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>Corrective measures:</p> <ul style="list-style-type: none"> • 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.
8709	<p>Timeout in communication for reactive power spec.</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>Corrective measures:</p> <ul style="list-style-type: none"> • 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.
8710	<p>Timeout in communication for cos-Phi spec.</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>Corrective measures:</p> <ul style="list-style-type: none"> • 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.

Event number	Message, cause and corrective measures
9002	<p>SMA Grid Guard code invalid</p> <p>The SMA Grid Guard code entered is incorrect. The operating parameters are still protected and cannot be changed.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Enter the correct SMA Grid Guard code.
9003	<p>Grid parameter locked</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>Changing of grid parameters not possible > Ensure DC supply</p> <p>This error can have the following causes:</p> <ul style="list-style-type: none"> • The parameters to be changed are protected. • The DC voltage at the DC input is not sufficient to run the main CPU. <p>Corrective measures:</p> <ul style="list-style-type: none"> • Enter the SMA Grid Guard code. • Ensure that at least the DC start voltage is available (green LED is flashing, pulsing or glowing).
9007	<p>Abort self-test</p> <p>The self-test (Italy only) was terminated.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Ensure that the AC connection is correct. • Restart the self-test (see Section 7.4, page 42).
10110	<p>Time synchronization failed [x]</p> <p>No time information could be called up from the set NTP server.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Ensure that the NTP server was configured correctly. • Ensure that the inverter is integrated into a local network with Internet connection.
10248	<p>[Interface]: network busy</p> <p>The network is busy. Data exchange between the devices is not at an optimum and is greatly delayed.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Increase the query intervals. • If necessary, reduce the number of devices in the network.

Event number	Message, cause and corrective measures
10249	<p>[Interface]: network overloaded</p> <p>The network is overloaded. There is no data exchange between the devices.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Reduce the number of devices in the network. • If necessary, increase the data query intervals.
10250	<p>[Interface]: package error rate [ok / high]</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 disturbed.</p> <p>Corrective measures if the package error rate is high:</p> <ul style="list-style-type: none"> • Ensure that with an Ethernet connection, the network cable and the network connector are not damaged and that the network connectors are correctly plugged. • If necessary, increase the data query intervals. • If necessary, reduce the number of devices in the network.
10251	<p>[Interface]: communication status goes to [OK / Warning / Error / Not connected]</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>[Interface]: communication disrupted</p> <p>There is no valid signal on the network line.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Ensure that with an Ethernet connection, the network cable and the network connector are not damaged and that the network connectors are correctly plugged. • Ensure that the DHCP server (router) and any network switches are signaling correct operation.
10253	<p>[Interface]: connection speed goes to [100 Mbit / 10 Mbit]</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>Corrective measures if the status is [10 Mbit]:</p> <ul style="list-style-type: none"> • Ensure that with an Ethernet connection, the network cable and the network connector are not damaged and that the network connectors are correctly plugged. • Ensure that the DHCP server (router) and any network switches are signaling correct operation.

Event number	Message, cause and corrective measures
10254	<p>[Interface]: duplex mode goes to [Full / Half]</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>Corrective measures if the status is [Half]:</p> <ul style="list-style-type: none"> • Ensure that with an Ethernet connection, the network cable and the network connector are not damaged and that the network connectors are correctly plugged. • Ensure that the DHCP server (router) and any network switches are signaling correct operation.
10255	<p>[Interface]: Network load OK</p> <p>The network load has returned to a normal range after being busy.</p>
10282	<p>[User group]-Login via [protocol] locked</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>Corrective measures:</p> <ul style="list-style-type: none"> • Wait until the given time has expired and then retry login.
10283	<p>WLAN module faulty</p> <p>The WLAN module integrated in the inverter is defective.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Contact the Service (see Section 17 "Contact", page 91).
10284	<p>No WLAN connection possible</p> <p>The inverter does not currently have a WLAN connection to the selected network.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Ensure that the SSID, the WLAN password and the encryption method have been entered correctly. The encryption method is specified by your WLAN router or WLAN Access Point and can be changed there. • Ensure that the WLAN router or WLAN Access Point is in range and is signaling correct operation. • If this message is displayed often, improve the WLAN connection by using a WLAN repeater.
10285	<p>WLAN connection established</p> <p>Connection to the selected WLAN network has been established.</p>

Event number	Message, cause and corrective measures
10286	<p>WLAN connection lost</p> <p>The inverter has lost WLAN connection to the selected network.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Ensure that the WLAN router or WLAN Access Point is still active. • Ensure that the WLAN router or WLAN Access Point is in range and is signalizing correct operation. • If this message is displayed often, improve the WLAN connection by using a WLAN repeater.
27301	<p>Update communication</p> <p>The inverter is updating the communication component.</p>
27302	<p>Update main CPU</p> <p>The inverter is updating the inverter component.</p>
27312	<p>Update completed</p> <p>The inverter has successfully completed the update.</p>
29004	<p>Grid parameters unchanged</p> <p>Changing the grid parameters is not possible.</p>
20901	<p>Inst. code valid</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 ten feed-in hours.</p>
20906	<p>Self-test</p> <p>The self-test is in progress.</p>

12.3 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.

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

In the event of a ground fault, high voltages can be present.

- Touch the cables of the PV array on the insulation only.
- 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.

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

- 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 10, page 59).

2. Measure the voltages:

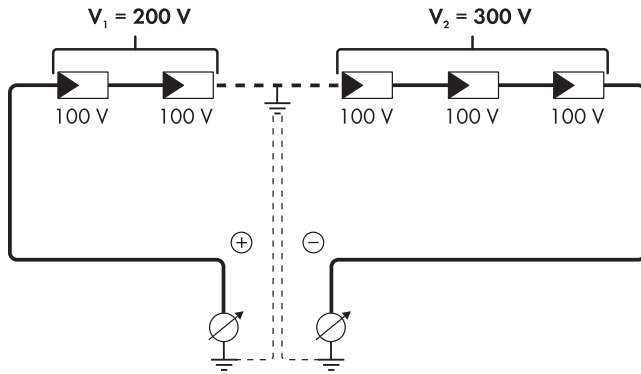
- Measure the voltage between the positive terminal and the ground potential (PE).
- Measure the voltage between the negative terminal and the ground potential (PE).
- Measure the voltage between the positive and negative terminals.

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.
- 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.

Example: Location of the ground fault

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



3. If a definite ground fault cannot be measured and the message is still displayed, measure the insulation resistance.
4. Reconnect the strings without ground faults to the inverter and recommission the inverter.

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.

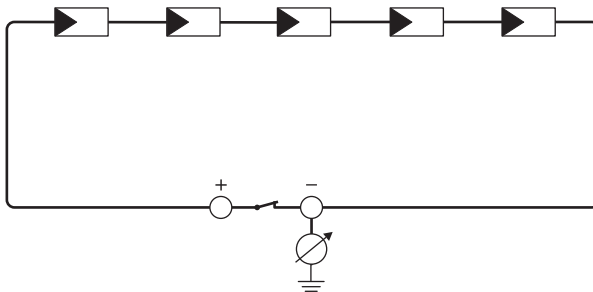


Figure 11: Schematic diagram of the measurement

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).

Required devices:

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

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 10, page 59).

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 17 "Contact", page 91). The PV modules might not be suitable for the inverter in the present quantity.

12.4 Updating the Firmware

QUALIFIED PERSON

If there is not an automatic update enabled for the inverter in the communication product (e.g. Sunny Home Manager) or in Sunny Portal, you can update the inverter firmware as described in the following.

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.

Procedure:

1. Activate the user interface (see Section 8.1, page 43).
2. Log into the user interface (see Section 8.2, page 46).
3. Select the menu **Device Configuration**.
4. Select [**Settings**].
5. In the subsequent context menu, select [**Updating the firmware**].
6. Follow the instructions in the dialog.

12.5 Opening the Inverter

QUALIFIED PERSON

If you have to open the inverter enclosure lid for repairs or replacement, proceed as described in the following.

NOTICE

Damage to the seal of the enclosure lid in sub-zero conditions

If you open the enclosure lid in sub-zero conditions, the sealing of the enclosure lid can be damaged. This can lead to moisture entering the inverter.

- Do not open the inverter at ambient temperatures lower than -5°C .
- If a layer of ice has formed on the seal of the enclosure lid in sub-zero conditions, remove it prior to opening the inverter (e.g. by melting the ice with warm air). Observe the applicable safety regulations.

Procedure:

1.  **DANGER**

Danger to life due to high voltages

- Disconnect the inverter from all voltage sources (see Section 10, page 59).
 - Wait five minutes until the capacitors have discharged.
2. To prevent water or dust entering the interior of the inverter, clean and dry the lid prior to removal.
 3. Unscrew all four enclosure lid screws using a Torx screwdriver (TX25) and store safely.
 4. Carefully remove the enclosure lid.

5. **NOTICE**

Damage to the inverter due to electrostatic discharge

The internal components of the inverter can be irreparably damaged by electrostatic discharge.

- Ground yourself before touching any component.
6. Perform the repair or replacement.
 7. Replace the enclosure lid with the four screws onto the enclosure and hold in place.
 8. Tighten all four screws using a Torx screwdriver (TX25) crosswise (torque: 6 Nm).
 9. Recommission the inverter (see Section 13, page 83).

13 Recommissioning the Inverter

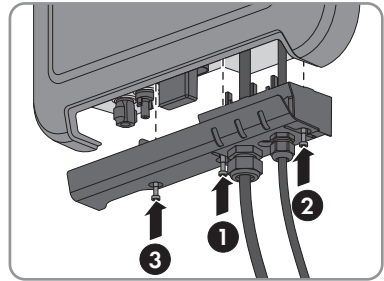
⚠ QUALIFIED PERSON

Requirements:

- The inverter must be correctly mounted.
- The circuit breaker must be correctly rated.
- All cables must be correctly connected.

Procedure:

1. Attach the connection cap to the inverter using the three screws and a Torx screwdriver (TX20) (torque: 3.5 Nm).



2. Tighten the swivel nuts of the AC cable gland and network connection hand-tight.
3. Set the DC load-break switch of the inverter to position **1**.
4. Switch on the circuit breaker.
 - The green LED flashes slowly on and off or glows permanently. Feed-in operation begins.
 - Green LED is flashing?
 - The DC input voltage is still too low.
 - Once the DC input voltage is sufficiently high, feed-in operation begins.
 - The red LED is glowing?
 - There is probably an error.
 - Call up the inverter user interface (see Section 8.1.1 "Establishing a direct connection via WLAN", page 43).
 - Call up the menu **Events** and identify the error via the event ID.
 - Rectify the error (see Section 12.2 "Event Messages", page 63).
5. If required, configure the inverter via the user interface.

14 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 when lifting the inverter, or if it is dropped

The inverter weighs 9 kg. There is risk of injury if the inverter is lifted incorrectly or dropped while being transported or when attaching it to or removing it from the wall mounting bracket.

- Transport and lift the inverter carefully.

1. ⚠ DANGER

Danger to life due to high voltages

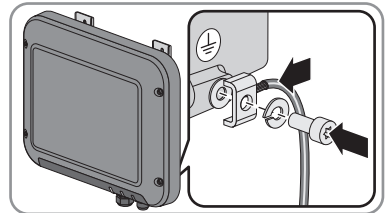
- Disconnect the inverter from all voltage sources (see Section 10, page 59).

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.

15 Technical Data

DC Input

	SB1.5-1VL-40	SB2.5-1VL-40
Maximum DC power at $\cos \varphi = 1$	1600 W	2650 W
Maximum input voltage	600 V	600 V
MPP voltage range	160 V to 500 V	260 V to 500 V
Rated input voltage	360 V	360 V
Minimum usable input voltage	50 V	50 V
Start input voltage	80 V	80 V
Maximum input current	10 A	10 A
Maximum short-circuit current*	18 A	18 A
Maximum reverse current from the inverter in the system for max. 1 ms	0 A	0 A
Number of independent MPP inputs	1	1
Oversoltage category in accordance with IEC 60664-1	II	II

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

AC Output

	SB1.5-1VL-40	SB2.5-1VL-40
Rated power at 230 V, 50 Hz	1500 W	2500 W
Maximum apparent AC power at $\cos \varphi = 1$	1500 VA	2500 VA
Rated grid voltage	230 V	230 V
Nominal AC voltage	220 V / 230 V / 240 V	220 V / 230 V / 240 V
AC voltage range*	180 V to 280 V	180 V to 280 V
Nominal AC current at 220 V	7 A	11 A
Nominal AC current at 230 V	6.5 A	11 A
Nominal AC current at 240 V	6.25 A	10.5 A
Maximum output current	7 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%

	SB1.5-1VL-40	SB2.5-1VL-40
Maximum output current under fault conditions	12 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
Rated power frequency	50 Hz	50 Hz
AC power frequency*	50 Hz / 60 Hz	50 Hz / 60 Hz
Operating range at AC power frequency 50 Hz	45 Hz to 55 Hz	45 Hz to 55 Hz
Operating range at AC power frequency 60 Hz	55 Hz to 65 Hz	55 Hz to 65 Hz
Power factor at rated power	1	1
Displacement power factor $\cos \varphi$, adjustable	0.8 underexcited to 1 to 0.8 overexcited	0.8 underexcited to 1 to 0.8 overexcited
Feed-in phases	1	1
Phase connection	1	1
Overvoltage category in accordance with IEC 60664-1	III	III

* Depending on the configured country data set

Efficiency

	SB1.5-1VL-40	SB2.5-1VL-40
Maximum efficiency, η_{\max}	97.2%	97.2%
European weighted efficiency, η_{EU}	96.1%	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 6
Maximum permissible fuse protection	16 A
Ground fault monitoring	Insulation monitoring: $R_{\text{iso}} > 1 \text{ M}\Omega$
All-pole sensitive residual-current monitoring unit	Available

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
Maximum permissible value for relative humidity, non-condensing	100%
Maximum operating altitude above mean sea level (MSL)	3000 m
Noise emission, typical	< 25 dB
Power loss in night mode	2 W
Maximum data volume per inverter with Speedwire/Webconnect	550 MB/month
Additional data volume when using the Sunny Portal live interface	600 kB/hour
WLAN range in free-field conditions	100 m
Quantity maximum detectable WLAN networks	32
Topology	Transformerless
Cooling method	Convection
Degree of protection in accordance with IEC 60529	IP65
Protection class in accordance with IEC 62103	I

Grid configurations	TN-C, TN-S, TN-CS, TT (if $V_{N,PE} < 30$ V), IT, Delta IT, split phase
National standards and approvals, as per 01/2017*	AS 4777, C10/11/2012, CEI 0-21, EN 50438:2013, DIN EN 62109-1, G83/2, IEC 62109-2, NBR 16149, NEN-EN50438, NRS097-2-1, RD1699/413, VDE 0126-1-1, VDE-AR-N 4105, VFR2014

* **IEC 62109-2:** In order to meet the requirements of this standard, there must be a link to Sunny Portal with the fault alert via e-mail activated.

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
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Equipment

DC connection	SUNCLIX DC connector
AC connection	Spring-cage terminal
Speedwire interface	As standard
Webconnect interface	As standard
WLAN	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 connection cap	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

16 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.

Designation	Brief description	SMA order number
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

17 Contact

If you have technical problems with our products, please contact the SMA Service Line. We require the following information in order to provide you with the necessary assistance:

- Inverter device type
- Inverter serial number
- Inverter firmware version
- Special country-specific settings of the inverter (if applicable)
- Type and number of PV modules connected
- Mounting location and altitude of the inverter
- Inverter message
- Optional equipment, e.g. communication products
- If necessary, system name in the Sunny Portal
- If necessary, access data in the Sunny Portal

Danmark	SMA Solar Technology AG	Belgien	SMA Benelux BVBA/SPRL
Deutschland	Niestetal	Belgique	Mechelen
Österreich	Sunny Boy, Sunny Mini Central,	België	+32 15 286 730
Schweiz	Sunny Tripower: +49 561 9522-1499	Luxemburg	SMA Online Service Center: www.SMA-Service.com
	Monitoring Systems (Kommunikationsprodukte): +49 561 9522-2499	Luxembourg	
	Fuel Save Controller (PV-Diesel-Hybridsysteme): +49 561 9522-3199	Nederland	
	Sunny Island, Sunny Boy Storage, Sunny Backup, Hydro Boy: +49 561 9522-399	Česko	SMA Service Partner TERMS a.s.
	Sunny Central, Sunny Central Storage: +49 561 9522-299	Magyarország	+420 387 6 85 111
	SMA Online Service Center: www.SMA-Service.com	Slovensko	SMA Online Service Center: www.SMA-Service.com
France	SMA France S.A.S. Lyon +33 472 22 97 00	Türkiye	SMA Service Partner DEKOM Ltd. Şti. +90 24 22430605
	SMA Online Service Center : www.SMA-Service.com	Ελλάδα	SMA Service Partner AKTOR FM. Αθήνα +30 210 8184550
		Κύπρος	SMA Online Service Center: www.SMA-Service.com

España Portugal	SMA Ibérica Tecnología Solar, S.L.U. Barcelona +34 935 63 50 99 SMA Online Service Center: www.SMA-Service.com	United Kingdom	SMA Solar UK Ltd. Milton Keynes +44 1908 304899 SMA Online Service Center: www.SMA-Service.com
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United Arab Emirates	SMA Middle East LLC Abu Dhabi +971 2234 6177 SMA Online Service Center: www.SMA-Service.com	India	SMA Solar India Pvt. Ltd. Mumbai +91 22 61713888
ไทย	SMA Solar (Thailand) Co., Ltd. บริษัท สแม โซลาร์ (ไทยแลนด์) จำกัด +66 2 670 6999	대한민국	SMA Technology Korea Co., Ltd. 서울 +82-2-520-2666
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Australia	SMA Australia Pty Ltd. Sydney Toll free for Australia: 1800 SMA AUS (1800 762 287) International: +61 2 9491 4200	Other countries	International SMA Service Line Niestetal 00800 SMA SERVICE (+800 762 7378423)

18 EU Declaration of Conformity

within the scope of the EU directives

- Electromagnetic compatibility 2014/30/EU (L 96/79-106, March 29, 2014) (EMC)
- Low Voltage Directive 2014/35/EU (L 96/357-374, March 29, 2014) (LVD)
- Radio and telecommunications terminal equipment (R&TTE) 1999/05/EC



SMA Solar Technology AG confirms herewith that the inverters 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.

