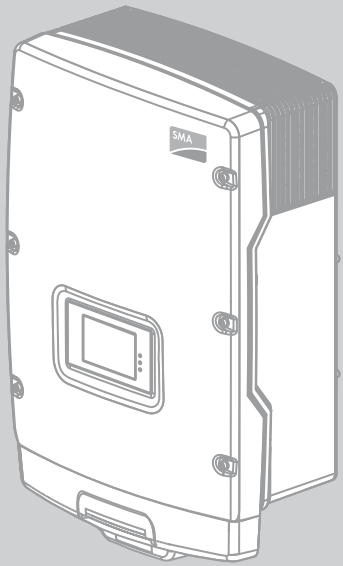
Installation Manual

SUNNY TRIPOWER
5000TL / 6000TL / 7000TL / 8000TL / 9000TL



STP5-9TL-IA-en-12 | Version 1.2

ENGLISH

SMA Factory Warranty

The current warranty regulations are included with your device. You can download the version on the Internet at www.SMA-Solar.com or obtain a printed version from the regular distribution channels.

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1 Information on this Document

Validity

This document is valid for the following device types from firmware version 2.51:

- STP 5000TL-20 (Sunny Tripower 5000TL)
- STP 6000TL-20 (Sunny Tripower 6000TL)
- STP 7000TL-20 (Sunny Tripower 7000TL)
- STP 8000TL-20 (Sunny Tripower 8000TL)
- STP 9000TL-20 (Sunny Tripower 9000TL)

Target Group

This document is intended for skilled persons. Only persons with the appropriate skills are allowed to perform the tasks described in this manual (see section 2.2 "Qualifications of Skilled Persons", page 9).

Additional Information

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

Document title	Document type
Insulation Resistance (R_{iso}) of Non-Galvanically Isolated PV Plants	Technical information
Criteria for Selecting a Residual-Current Device	Technical information
Miniature Circuit-Breaker	Technical information
Module Technology	Technical information
SMA *Bluetooth* – SMA *Bluetooth*® Wireless Technology in Practice	Technical information
SMA *Bluetooth*® Wireless Technology	Technical description
Temperature Derating	Technical information

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, could result in death or serious injury
⚠ CAUTION	Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury
NOTICE	Indicates a situation which, if not avoided, could result in property damage
i	Information that is important for a specific topic or goal, but is not safety-relevant
☐	Indicates an essential requirement for achieving a specific goal
☑	Desired result
✖	A problem that might occur

Nomenclature

Complete designation	Designation in this document
Torque	Torque
Electronic Solar Switch	ESS
PV plant	Plant
SMA *Bluetooth*® Wireless Technology	*Bluetooth*
Sunny Tripower	Inverter, product

2 Safety

2.1 Appropriate Usage

The Sunny Tripower is a transformerless PV inverter with two MPP trackers, which converts the direct current of the PV array to grid-compliant three-phase current and feeds it into the electricity 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 suitable for use with this product.

PV modules with a high capacity to earth must only be used if their coupling capacity does not exceed 1.25 µF (for information on how to calculate the coupling capacity, see Technical Information "Capacitive Leakage Currents" at www.SMA-Solar.com).

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

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

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

- Do not mount the product on flammable construction materials.
- Do not mount the product in areas where highly flammable materials are stored.
- Do not install the product in potentially explosive atmospheres.

For safety reasons, it is forbidden to modify the product or install components that are not explicitly recommended or distributed by SMA Solar Technology AG for this product.

The enclosed documentation is an integral part of this product.

- Read and observe the documentation.
- Keep the documentation in a convenient place for future reference.

2.2 Qualifications of Skilled Persons

The work described in this document must be performed by skilled persons only. Skilled persons must have the following qualifications:

- 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 plants
- Training in the installation and commissioning of electrical devices and plants
- Knowledge of the applicable standards and directives
- Knowledge of and adherence to this document and all safety precautions

2.3 Safety Precautions

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

To prevent personal injury or property damage and to ensure long-term operation of the product, read this section carefully and comply with the safety precautions at all times.

⚠ DANGER

Danger to life due to high voltages

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.

- Do not touch the DC conductors.
- Do not touch any live components of the inverter.
- Prior to performing any work on the inverter, disconnect it from all voltage sources, as described in this document (see section 9, page 59).

⚠ DANGER

Danger to life due to electric shock

Touching an unearthed PV module or an array frame can cause a fatal electric shock.

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

⚠ WARNING

Risk of burns due to hot enclosure parts

Some parts of the enclosure can get hot during operation.

- During operation, touch the inverter on the enclosure lid only.

NOTICE

Electrostatic discharge can damage the inverter.

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

- Earth yourself before touching any components.

3 Scope of Delivery

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

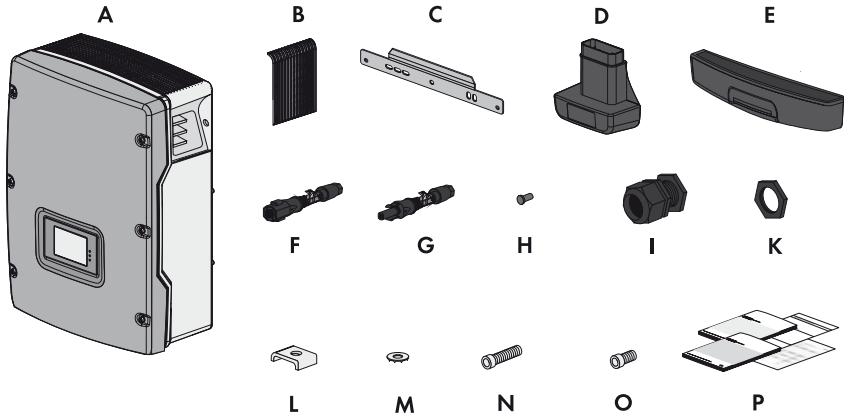


Figure 1: Components included in the scope of delivery

Position	Quantity	Designation
A	1	Inverter
B	2	Ventilation grid
C	1	Wall mounting bracket
D	1	Electronic Solar Switch
E	1	Protective cover
F	4	Negative DC connector
G	4	Positive DC connector
H	6	Sealing plug
I	1	M32x1.5 cable gland
K	1	Counter nut
L	1	Clamping bracket
M	2	Conical spring washer*

Position	Quantity	Designation
N	2	M6x16 cheese-head screw*
O	2	M6x8 cheese-head screw
P	1	Installation manual, user manual, document set with declarations and certificates, supplementary sheet with default settings, supplementary sheet with information on SMA Speedwire/Webconnect, installation manual of the DC connectors

* One spare part for the enclosure lid included

4 Product Description

4.1 Sunny Tripower

The Sunny Tripower is a transformerless PV inverter with two MPP trackers, which converts the direct current of the PV array to grid-compliant three-phase current and feeds it into the electricity grid.

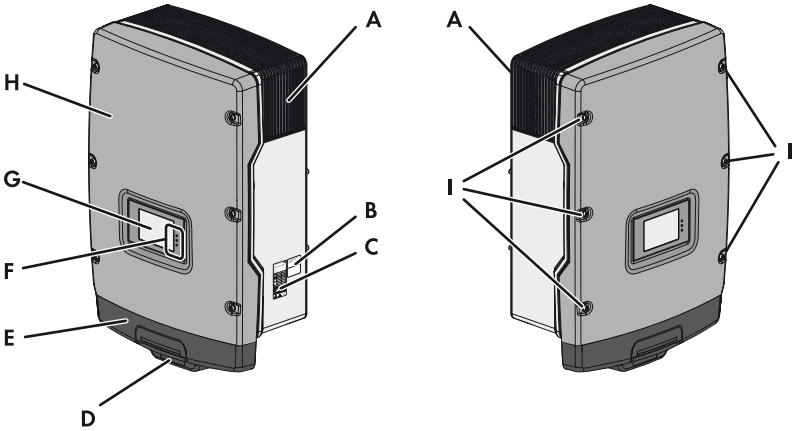


Figure 2: Design of the Sunny Tripower

Position	Designation
A	Ventilation grid
B	Additional label
C	Type label
D	Electronic Solar Switch
E	Protective cover
F	LEDs
G	Display
H	Enclosure lid
I	Screws and conical spring washers of the enclosure lid

Symbols on the Inverter

Symbol	Explanation
	Inverter This symbol is located next to the green LED which indicates feed-in operation of the inverter.
	Observe the documentation. This symbol is located next to the red LED which indicates a fault or disturbance (see section 11 "Troubleshooting", page 63).
	*Bluetooth* This symbol is located next to the blue LED which indicates an active *Bluetooth* communication.
	Danger This symbol indicates that the inverter must be additionally earthed if a second protective conductor or equipotential bonding is required locally (see section 6.3.3, page 37).
	QR Code® Links to additional information on the inverter can be found at www.SMA-Solar.com.

4.2 Type Label and Additional Label

The type label uniquely identifies the inverter. The type label is located on the right-hand side of the enclosure. You will find the following information on the type label:

- Device type (Model)
- Serial number (Serial No.)
- Date of manufacture
- Device-specific characteristics

You will need the information on the type label to use the product safely and for questions to the SMA Service Line. The type label must be permanently attached to the product.

Symbols on the Type Label

Symbol	Explanation
	Danger to life due to high voltages The product operates at high voltages. All work on the product must be carried out by skilled persons only.
	Risk of burns from hot surfaces The product can get hot during operation. Avoid contact during operation. Allow the product to cool down sufficiently before carrying out any work. Wear personal protective equipment such as safety gloves.
	Observe the documentation. Observe all documentation that is supplied with the product.
DC	Direct current
	The product does not have a transformer.
AC 3N	Three-phase current with neutral conductor
	WEEE designation Do not dispose of the product together with the household waste but in accordance with the locally applicable disposal regulations for electronic waste.
CE	CE marking The product complies with the requirements of the applicable EU directives.

Symbol	Explanation
	Device class ID The product is equipped with a wireless component and complies with device class 2.
IP65	Degree of protection IP65 The product is protected against dust intrusion and water jets from any angle.
	The product is suitable for outdoor installation.
	RAL quality mark for solar products The product complies with the requirements of the German Institute for Quality Assurance and Certification.
	Certified safety The product is VDE-tested and complies with the requirements of the German Equipment and Product Safety Act.
	C-Tick The product complies with the requirements of the applicable Australian EMC standards.

Additional Label for Registration in Sunny Portal

To the right of the type label, there is an additional label with information for registration in Sunny Portal:

- Internet address of the plant setup assistant
- Identification key (PIC)
- Registration ID (RID)

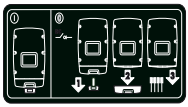
4.3 Electronic Solar Switch (ESS)

The ESS and the DC connectors form a DC load disconnect unit.

The *Bluetooth* antenna is integrated in the ESS.

When plugged in, the ESS forms a conductive path between the PV array and the inverter. Removing the ESS interrupts the DC electric circuit and removing all DC connectors disconnects the PV array completely from the inverter.

Labels on the ESS

Label	Explanation
	Operating principle of the ESS: • I If the ESS is plugged in, the DC electric circuit is closed. • 0 To interrupt the DC electric circuit, you must perform the following steps in order: – 1 Remove the ESS. – 2 Remove the protective cover. – 3 Unlock and remove all DC connectors.
	Danger to life due to high voltages in the inverter; observe the waiting time of five minutes. High voltages that can cause fatal electric shocks are present in the live components of the inverter. Disconnect the inverter from all voltage sources before performing any work on it (see section 9 "Disconnecting the Inverter", page 59).
	Operating the inverter without a protective cover is prohibited. Always operate the inverter with a protective cover.

4.4 Display

The display shows the current operating data of the inverter (e.g. current power, daily energy, total energy) as well as events or errors. Power and energy are displayed as bars in the diagram.

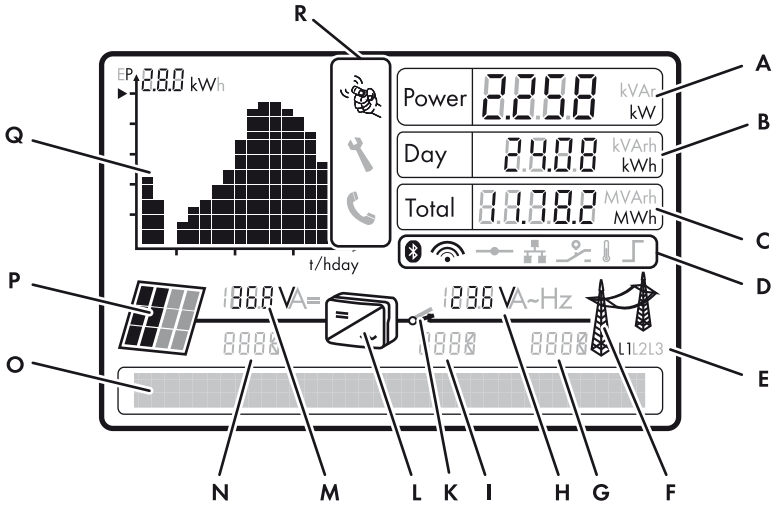


Figure 3: Display design (example)

Position	Symbol	Explanation
A	-	Current power
B	-	Energy on the current day
C	-	Total amount of energy fed in

Position	Symbol	Explanation
D		Active *Bluetooth* connection
		Quality of the *Bluetooth* connection
		Active connection to a Speedwire network
		Active connection to Sunny Portal
		Multi-function relay is active
		Power limitation due to excessive temperature
		Active power limitation via plant control
E	-	Phase conductor the displayed values are assigned to
F		Electricity grid
G	-	Event number of an error on the electricity grid side
H	-	Output voltage or output current of a phase conductor
I	-	Event number of an error present on the inverter
K		Grid relay If the grid relay is closed, the inverter is feeding into the electricity grid. If the grid relay is open, the inverter is disconnected from the electricity grid.
L		Inverter
M	-	Input voltage or input current of a phase conductor
N	-	Event number of an error on the PV array side
O	-	Text line to display event and error messages
P		PV array

Position	Symbol	Explanation
Q	-	Diagram with the power curve of the last 16 feed-in hours or energy yields of the last 16 days • In order to switch between the displays, tap once on the enclosure lid.
R		You can operate the display by tapping the enclosure lid: • Tapping once: to activate the backlight, to scroll to the next text line, to switch between the power graphs of the last 16 feed-in hours and the energy yields of the last 16 days • Tapping twice: the display alternates automatically between the firmware version, the serial number of the inverter, the NetID, the IP address, the subnet mask, the configured country data set and the display language.
		The displayed error must be rectified on-site by a skilled person.
		The displayed error cannot be rectified on-site. • Contact the SMA Service Line.

4.5 *Bluetooth*

As standard, the inverter is equipped with a *Bluetooth* interface which allows for communication with *Bluetooth* devices (for information on supported SMA products, see www.SMA-Solar.com).

If you would like to communicate via *Bluetooth*, you can protect the inverter with a plant password for the user and a plant password for the installer.

All inverters are delivered with a standard plant password for the user (0000) and a standard plant password for the installer (1111). To protect the plant from unauthorised access, you must change the plant passwords using an appropriate communication product (for information on changing the plant password, refer to the manual or the help of the communication product).

If you do not want to communicate via *Bluetooth*, deactivate *Bluetooth* communication (see section 7.3 "Setting the NetID", page 50).

4.6 Speedwire/Webconnect

As standard, the inverter is equipped with Speedwire/Webconnect. Speedwire is a type of communication based on Ethernet. You can connect the inverter to your network via Speedwire. Webconnect allows for data exchange between the inverter and Sunny Portal. Sunny Portal is an Internet portal which allows you to monitor plants and visualise and present plant data. In order to establish a connection to Sunny Portal, the inverter must be connected to a router with Internet connection and integrated into your network.

To allow data to be exchanged between the inverter and Sunny Portal, you must register the inverter in Sunny Portal (see the user manual of Webconnect plants in Sunny Portal at www.SMA-Solar.com). To do so, you will need the access data, identification key (PIC) and registration ID (RID) which you can find on the additional label or on the supplementary sheet with information on SMA Speedwire/ Webconnect. After registration, you can monitor your plant in Sunny Portal.

4.7 Slot for 485 Data Module Type B or SMA Power Control Module

The inverter can be retrofitted with the 485 Data Module Type B or SMA Power Control Module or installed ex works if ordered accordingly.

485 Data Module Type B

The 485 Data Module Type B is a communication interface which enables wired communication with RS485 (for information on installation and wiring, see installation manual of the 485 Data Module Type B and RS485 Cabling Plan at www.SMA-Solar.com).

With the 485 Data Module Type B, the inverter can communicate with special communication products (for information on supported products, see www.SMA-Solar.com). Depending on the type of communication, the operating parameters and messages are displayed differently on the communication products.

If you want to use the 485 Data Module Type B at the same time as the multi-function relay in the inverter, you must ensure that no more than 30 V DC or 25 V AC are connected to the multi-function relay.

Example: How the country data set parameter is displayed

For communication via RS485: parameter **CntrySet**

For communication via *Bluetooth* or Speedwire/Webconnect: parameter **Set country standard**

SMA Power Control Module

The SMA Power Control Module enables the inverter to perform grid management functions (you will find installation and configuration instructions in the installation manual of the SMA Power Control Module at www.SMA-Solar.com).

If you want to use the SMA Power Control Module at the same time as the multi-function relay in the inverter, you must ensure that no more than 30 V DC or 25 V AC are connected to the multi-function relay.

4.8 Operating Parameters

Various operating parameters control the functionality of the inverter. All operating parameters of the inverter, except the country data set, can only be adjusted using an SMA communication product (see section 8.9, page 58). You can adjust the country data set before commissioning or in the first ten feed-in hours via two rotary switches in the inverter (see section 7.2, page 46).

4.9 Multi-Function Relay

As standard, the inverter is equipped with a multi-function relay which you can use for various purposes. The multi-function relay is intended for several operating modes which you can select individually.

There is a different connection procedure depending on which operating mode you select (see section 6.5.1 "Connection Options for the Multi-Function Relay", page 40).

The operating mode of the multi-function relay is set by default to **Fault indication** or **FltInd**. If you choose a different operating mode, you must use a communication product to set the operating mode of the multi-function relay after commissioning, and you may have to make further adjustments for the operating mode (see section 8.7 "Setting the Operating Mode of the Multi-Function Relay", page 57).

Error message required by standard

In some countries, signalling of errors is required by standards, e.g. IEC 62109-2.

- In order to meet the requirements of IEC 62109-2, a display device signalling an error must be connected to the multi-function relay **or** the inverter must be registered in Sunny Portal where the fault alert must be activated (for information on fault alert via Sunny Portal, see Sunny Portal user manual at www.SMA-Solar.com).

Operating Modes of the Multi-Function Relay

Operating mode of multi-function relay (Mlt.OpMode)	Description
Fault indication (FltInd)	The multi-function relay controls a display device which, depending on the type of connection, either reports an error or the undisturbed operation of the inverter.
Self-consumption (SelfCsmp)	The multi-function relay switches the loads on or off depending on the power range of the PV plant.
Control via communication (ComCtl)	The multi-function relay switches the loads on and off via a communication product.
Battery bank (BatCha)	The multi-function relay controls the charging of the batteries depending on the power range of the PV plant.
Fan control (FanCtl)	The multi-function relay controls an external fan depending on the temperature of the inverter.
Switching status grid relay (GriSwCpy)	The local network operator may require that a signal is transmitted as soon as the inverter connects to the electricity grid. The multi-function relay simulates the switching status of the grid relay and trips a signal to the network operator.

4.10 All-Pole Sensitive Residual-Current Monitoring Unit

The inverter is equipped with an all-pole sensitive residual-current monitoring unit with an integrated differential current sensor.

The all-pole-sensitive residual-current monitoring unit detects alternating and direct differential currents. The integrated differential current sensor detects the current difference between the neutral conductor and the number of phase conductors for single-phase and three-phase inverters. If the current difference increases suddenly, the inverter disconnects from the electricity grid.

If an external residual-current device is required or planned, you must install a residual-current device which trips at a residual current of 100 mA or higher. That ensures that the inverter does not disconnect from the electricity grid due to leakage currents which are a normal phenomenon during operation. If the locally applicable installation regulations require the use of a residual-current device that trips at a lower residual current, e.g. 30 mA, normal leakage currents can cause false tripping.

4.11 Grid Management

The inverter is equipped with grid management functions.

Depending on the requirements of the network operator, you can activate and configure the functions (e.g. provision of reactive power, active power limitation) via operating parameters (for information on the functions and operating parameters, see Technical Description "Measured Values and Parameters" at www.SMA-Solar.com).

4.12 SMA OptiTrac Global Peak

SMA OptiTrac Global Peak is a development of the MPP tracking SMA OptiTrac.

MPP tracking is a feature that determines the highest usable power in the PV plant at any given time. The power generated by the PV plant depends on the level of solar irradiation and the temperature of the PV modules. As a result, the optimal operating point for the maximum power (MPP) changes constantly throughout the day.

SMA OptiTrac allows the operating point of the inverter to follow the MPP precisely at all times. SMA OptiTrac Global Peak also means that the inverter can detect the presence of multiple maximum power points in the available operating range, as can occur in partially shaded PV strings in particular. The available power of the partially shaded PV strings can therefore be almost completely fed into the electricity grid.

SMA OptiTrac Global Peak is deactivated by default and should be activated and set via a communication product for partially shaded PV modules (see section 8.8, page 58).

4.13 SMA Grid Guard

SMA Grid Guard acts as an automatic disconnection device between a grid-parallel generator (e.g. a PV plant or small wind turbine system) and the electricity grid.

SMA Grid Guard is also a grid monitoring concept which detects errors by permanently monitoring grid impedance, mains voltage and mains frequency. For example, SMA Grid Guard detects when a stand-alone grid is formed and disconnects the inverter from the electricity grid immediately.

In some countries, the connection conditions require a device which protects grid-relevant operating parameters against unpermitted changes. SMA Grid Guard performs this function.

Some country data sets are automatically protected after the first ten feed-in hours. The protected country data sets can only be changed via a communication product by entering a personal access code, the SMA Grid Guard code, after ten feed-in hours (for information on changing parameters, see the manual for the communication product). You will receive the SMA Grid Guard code from SMA Solar Technology AG (to apply for the SMA Grid Guard code, see the certificate "Application for SMA Grid Guard Code" at www.SMA-Solar.com).

4.14 Varistors

Varistors are voltage-dependent resistors that protect the inverter against overvoltage. The inverter is equipped with thermally monitored varistors.

Varistors can become worn and lose their protective function with age or repeated strain as a result of overvoltage. The inverter detects if one of the varistors is defective and indicates an error (see section 11 "Troubleshooting", page 63).

The varistors are specially manufactured for use in the inverter and are not commercially available. You must order new varistors directly from SMA Solar Technology AG.

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 inverter on flammable construction materials.
- Do not mount the inverter in areas where highly flammable materials are stored.
- Do not mount the inverter in a potentially explosive atmosphere.

- ☐ Do not mount the inverter on a pillar.
- ☐ The mounting location must be inaccessible to children.
- ☐ A solid foundation must be available for mounting, e.g. concrete or masonry. When mounted on plasterboard or similar materials, the inverter will develop audible vibrations during operation, which could be perceived as annoying.
- ☐ The mounting location must be suitable for the weight and dimensions of the inverter (see section 13 "Technical Data", page 81).
- ☐ Climatic conditions must be met (see section 13 "Technical Data", page 81).
- ☐ The ambient temperature should be below 40 °C to ensure the optimal operation of the inverter. If the output power is reduced, the inverter can also be operated at higher ambient temperatures without risk.
- ☐ The mounting location should be freely and safely accessible at all times without the necessity for any auxiliary equipment, such as scaffolding or lifting platforms. Non-fulfilment of these criteria may restrict servicing.
- ☐ The installation site should not be exposed to direct solar irradiation. Direct solar irradiation can cause the inverter to overheat. As a result, the inverter reduces its power output.

Dimensions for wall mounting:

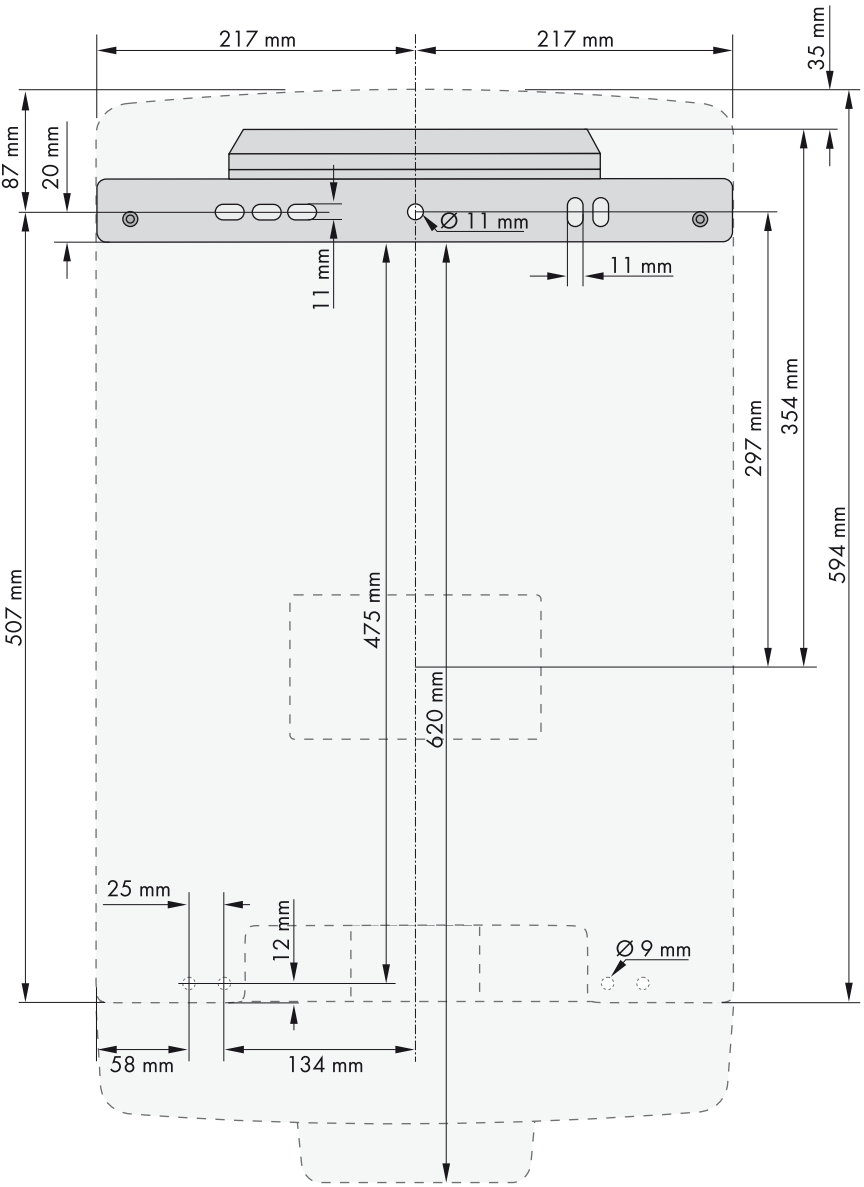


Figure 4: Dimensions of the wall mounting bracket and dimensions of the holes for the optional anti-theft device in the inverter enclosure

Recommended clearances:

Provided that the recommended clearances are observed, adequate heat dissipation will be ensured. This prevents a reduction in inverter power as a result of high temperatures (details on temperature derating can be found in the Technical Information "Temperature Derating" at www.SMA-Solar.com).

- ☐ Observe 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.

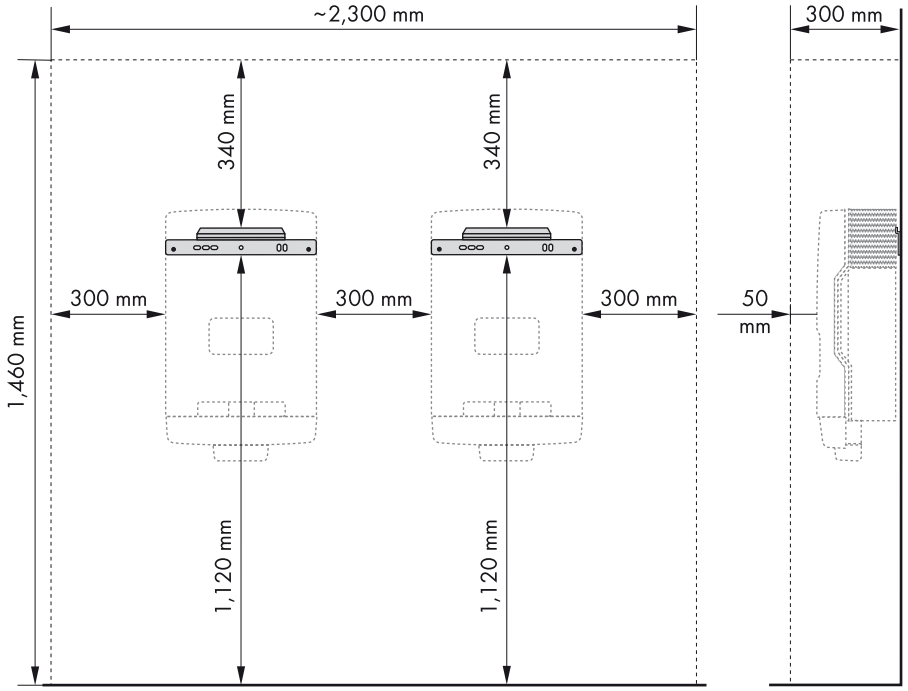


Figure 5: Recommended clearances

Permitted and Prohibited Mounting Positions

- ☐ The inverter must be mounted in one of the permitted positions. This will ensure that no moisture can penetrate the inverter.
- ☐ The inverter should be mounted at eye level. Thus, the display messages and LED signals can be read without difficulty.

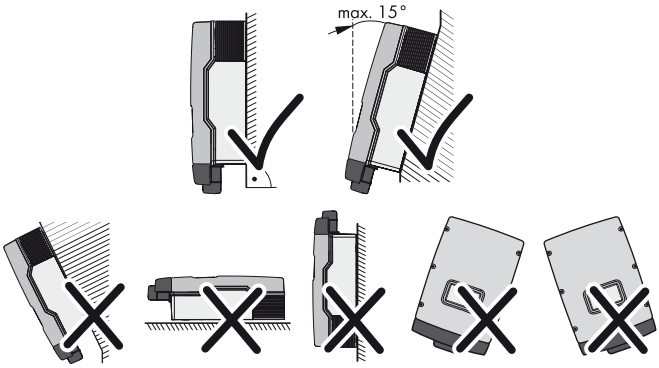


Figure 6: Permitted and prohibited mounting positions

5.2 Mounting the Inverter

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

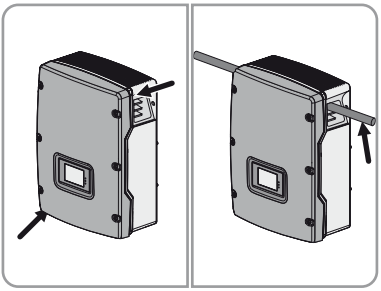
- ☐ At least two screws which are suitable for the weight of the inverter and the surface
- ☐ At least two washers that are suitable for the screws
- ☐ If necessary, two wall plugs suitable for the foundation
- ☐ If the inverter is to be secured against theft, at least one safety screw and one wall plug suitable for the safety screw

⚠ CAUTION

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

The inverter is heavy (see section 13 "Technical Data", page 81). If it is lifted incorrectly or dropped while being transported or attached to the wall mounting bracket, there is a risk of injury.

- Transport the inverter horizontally with several persons. With one hand each, grasp the recessed grips on the top and on the bottom or use a steel rod (diameter: 30 mm at maximum).



NOTICE

Damage to the ESS socket from dirt and foreign bodies

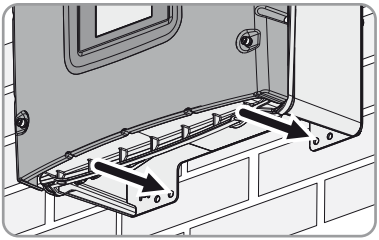
Lowering the inverter onto an uneven building ground can allow dirt or foreign bodies, e.g. stones, to enter the socket and damage the contacts. That prevents the ESS from functioning correctly.

- Always lower the inverter on an even building ground.

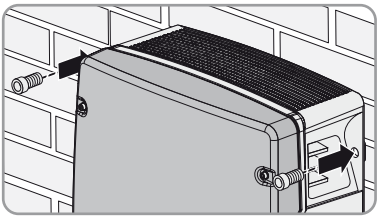
Procedure:

1. Ensure that no lines are laid in the wall which could be damaged when drilling holes.
2. Align the wall mounting bracket horizontally on the wall and use it to mark the position of the drill holes. Use at least one hole on the left-hand side and one on the right-hand side of the wall mounting bracket.
3. Set the wall mounting bracket aside and drill the marked holes.
4. Depending on the foundation, insert wall plugs into the drill holes, if necessary.
5. Secure the wall mounting bracket horizontally using screws and washers.

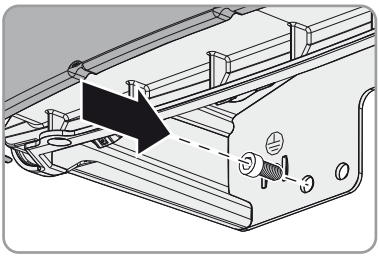
6. If the inverter is to be secured against theft, mark the drill hole for the attachment of the safety screw:
   - Hook the inverter into the wall mounting bracket.
   - Mark the drill hole on the left-hand or right-hand side. If you want to secure the inverter with two safety screws, mark one drill hole on the left and one on the right-hand side.



   - Remove the inverter by lifting it up vertically and out of the wall mounting bracket.
   - Drill the hole or holes to attach the safety screw and insert the wall plug(s).
7. Hook the inverter into the wall mounting bracket.
8. Secure the inverter to the wall mounting bracket on both sides using the M6x8 screws provided and an Allen key (AF 5). Only tighten the screws hand-tight.



9. Close the recessed grips with the ventilation grids. Ensure the assignment is correct. The correct assignment is marked on the inside of each ventilation grid: **links/left** for the left-hand side and **rechts/right** for the right-hand side.
10. If the holes for attaching the safety screw are pre-drilled, secure the inverter with at least one safety screw through the pre-drilled hole.



11. Ensure that the inverter is securely attached.

6 Electrical Connection

6.1 Safety during Electrical Connection

⚠ DANGER

Danger to life due to high voltages

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.

- Do not touch the DC conductors.
- Do not touch any live components of the inverter.
- Prior to performing any work on the inverter, disconnect it from all voltage sources, as described in this document (see section 9, page 59).

NOTICE

Electrostatic discharge can damage the inverter.

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

- Earth yourself before touching any components.

6.2 Overview of the Connection Area

6.2.1 View from Below

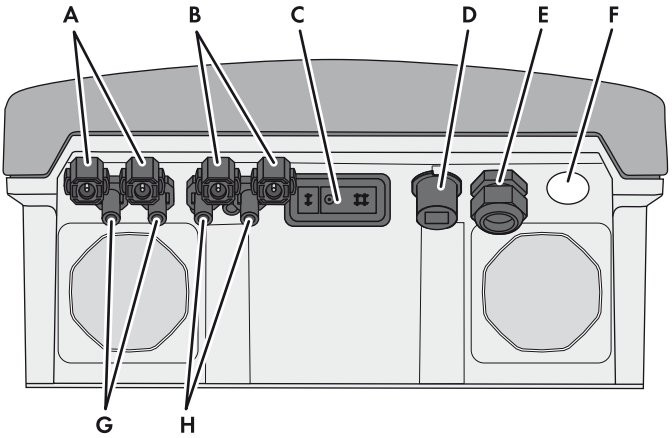


Figure 7: Connection areas and enclosure openings at the bottom of the inverter

Position	Designation
A	Positive DC connectors, input A for positive DC cables
B	Positive DC connectors, input B for positive DC cables
C	Socket for connecting the ESS
D	Socket with filler plug for the network connection
E	Cable gland M25 with filler plug for the data cables
F	Enclosure opening for the AC cable
G	Negative DC connectors, input A for negative DC cables
H	Negative DC connectors, input B for negative DC cables

6.2.2 Interior View

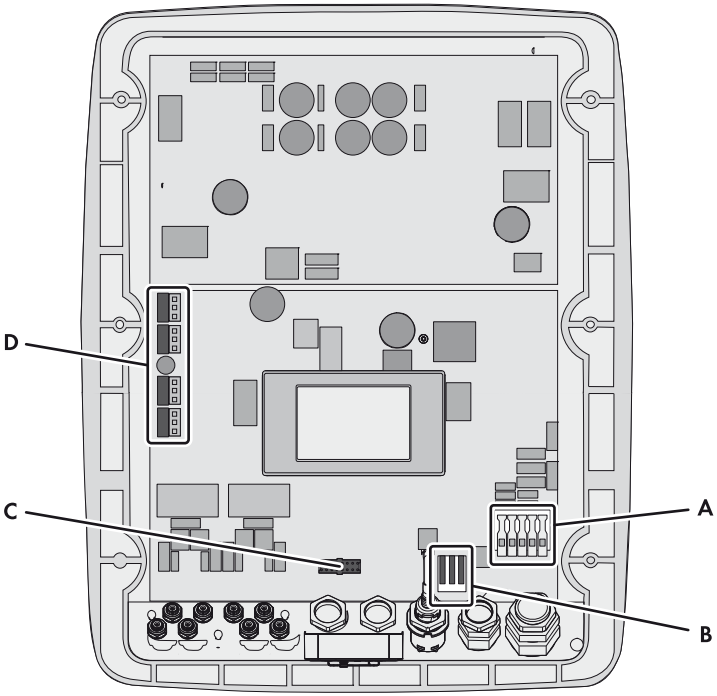


Figure 8: Connection areas in the interior of the inverter

Position	Designation
A	Connecting terminal plate for the AC cable
B	Multi-function relay with protective cover
C	Slot for 485 Data Module Type B or SMA Power Control Module
D	Varistors

6.3 AC Connection

6.3.1 Requirements for the AC Connection

Cable requirements:

- ☐ External diameter of the cable must correspond to the clamping range of the cable gland: 12 mm to 21 mm
- ☐ Recommended conductor cross-section for stiff or flexible cables, with or without bootlace ferrule: 1.5 mm² to 6 mm²
- ☐ Conductor cross-section: at maximum 10 mm²
- ☐ Stripping length of the insulated wires: 18 mm
- ☐ The cable must be dimensioned in accordance with any local and national guidelines on cable dimensions which specify requirements for the minimum conductor cross-section. 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 design software "Sunny Design" from software version 2.0 www.SMA-Solar.com).

Switch-disconnector and cable protection:

NOTICE

Damage to the inverter due to the use of screw-type fuses as switch-disconnectors

Screw-type fuses (e.g. DIAZED fuse or NEOZED fuse) are not switch-disconnectors.

- Do not use screw-type fuses as switch-disconnectors.
- Use a switch-disconnector or miniature circuit-breaker as a load disconnection unit (for information and design examples, see Technical Information "Miniature Circuit-Breaker" at www.SMA-Solar.com).

- ☐ In plants with multiple inverters, protect each inverter with a separate three-phase miniature circuit-breaker. Make sure to observe the maximum permissible fuse protection (see section 13 "Technical Data", page 81). That prevents residual voltage being present at the corresponding cable after disconnection.
- ☐ Loads installed between the inverter and the miniature 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 Technical Information "Criteria for Selecting a Residual-Current Device" at www.SMA-Solar.com).
- ☐ If a residual-current device with a tripping threshold of 30 mA is required and used, the parameter **RCD adjustment** must be set to **30 mA** after initial start-up (see section 8.6, page 56).

Overvoltage category

The inverter can be deployed in grids of installation category III or lower, as defined in IEC 60664-1. This means that the inverter can be permanently connected at the grid-connection point in a building. In installations involving long outdoor cable routes, additional measures must be taken so that the overvoltage category is reduced from IV to III (see Technical Information "Overvoltage Protection" at www.SMA-Solar.com).

Protective conductor monitoring:

The inverter is equipped with a protective conductor monitoring device. This protective conductor monitoring device detects when there is no protective conductor connected and disconnects the inverter from the electricity grid if this is the case.

Connection of an additional protective conductor

In some countries an additional earthing is required. In each case, observe the locally applicable regulations.

- If an additional earthing is required, earth the inverter (see section 6.3.3 "Additional Earthing of the Enclosure", page 37). The conductor cross-section must correspond to the cross section of the original protective conductor. This prevents touch current if the original protective conductor fails.

6.3.2 Connecting the Inverter to the Electricity Grid

Requirements:

☐ The connection requirements of the network operator must be met.

☐ The mains voltage must be in the permissible range. The exact operating range of the inverter is specified in the operating parameters (see Technical Description "Measured Values and Parameters" at www.SMA-Solar.com).

Procedure:

1. Disconnect the miniature circuit-breaker from all three phase conductors and secure against reconnection.
2. Loosen all screws and conical spring washers of the enclosure lid using an Allen key (AF 5) and remove the enclosure lid.
3. Remove the adhesive tape from the enclosure opening for the AC cable.
4. Attach the M32x1.5 cable gland to the enclosure opening for the AC cable using a counter nut.
5. Strip the AC cable jacket.
6. Shorten L1, L2, L3 and N by 5 mm each.
7. Strip 18 mm of the insulation from each of L1, L2, L3, N and the protective conductor.
8. Route the AC cable into the inverter through the cable gland. If necessary, slightly loosen the swivel nut of the cable gland.
9. Push the safety levers of the AC connecting terminal plate right up to the stop.

10. **⚠ CAUTION**

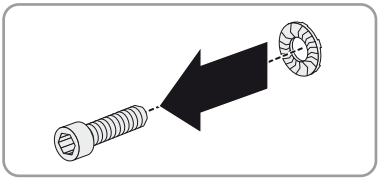
Risk of fire when connecting two conductors to a terminal

When connecting two conductors to a terminal, a fire might occur due to a bad electrical connection.

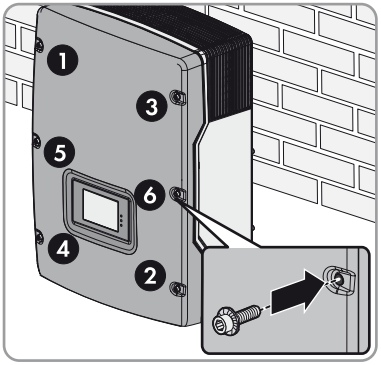
- Never connect more than one conductor per terminal.

11. Connect PE, N, L1, L2 and L3 according to the labelling to the connecting terminal plate for the AC cable and push the safety levers down. The direction of the rotating magnetic field of L1, L2 and L3 is not relevant.
12. Tighten the swivel nut of the cable gland.
13. Close the inverter and earth the enclosure lid:

- Attach one conical spring washer to each screw. The grooved side of the conical spring washer must point to the screw head.



- Secure the enclosure lid in the sequence 1 to 6 (torque: 6 Nm ± 0.5 Nm) using an Allen key (AF 5).



☑ The teeth of the conical spring washers are pushed into the enclosure lid. This ensures that the enclosure lid is earthed.

6.3.3 Additional Earthing of the Enclosure

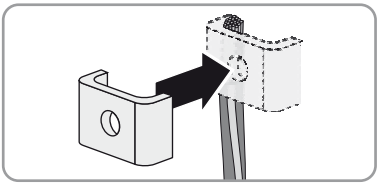
You can additionally earth the inverter enclosure if a second earthing or equipotential bonding is required locally. This prevents touch current if the original protective conductor fails.

Cable requirement:

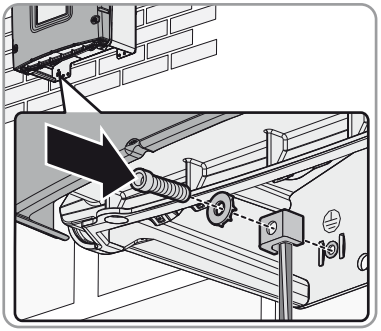
☐ Earthing cable cross-section: 16 mm² at maximum

Procedure:

1. Strip the earthing cable insulation.
2. Lead the clamping bracket over the earthing cable. Position the protective conductor on the left-hand side.



3. Screw the clamping bracket tight using the M6x16 cheese-head screw and a conical spring washer (torque: 6 Nm). The teeth of the conical spring washer must face the clamping bracket.



6.4 DC Connection

6.4.1 Requirements for the DC Connection

Requirements for the PV modules per input:

- ☐ All PV modules must be of the same type.
- ☐ The same number of series-connected PV modules must be connected to all strings.
- ☐ All PV modules must be aligned identically.
- ☐ All PV modules must have the same tilt angle.
- ☐ The maximum input current per string must be maintained and must not exceed the through-fault current of the DC connectors (see section 13 "Technical Data", page 81).
- ☐ The thresholds for the input voltage and the input current of the inverter must be observed (see section 13 "Technical Data", page 81).
- ☐ On the coldest day based on statistical records, the open-circuit voltage of the PV array must never exceed the maximum input voltage of the inverter.
- ☐ The positive connection cables of the PV modules must be fitted with the positive DC connectors (for information on assembling DC connectors, see the DC connector installation manual).
- ☐ The negative connection cables of the PV modules must be fitted with the negative DC connectors (for information on assembling DC connectors, see the DC connector installation manual).

Use of Y adaptors for parallel connection of strings

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

- Do not use the Y adaptors in the immediate vicinity of the inverter. The adaptors must not be visible or freely accessible.
- In order to interrupt the DC electric circuit, disconnect the inverter (see section 9, page 59).

6.4.2 Connecting the PV Array

NOTICE

Destruction of the inverter due to overvoltage

If the open-circuit voltage of the PV modules exceeds the maximum input voltage of the inverter, the inverter can be destroyed by overvoltage.

- If the open-circuit voltage of the PV modules exceeds the maximum input voltage of the inverter, do not connect any PV strings to the inverter and check the design of the PV plant.

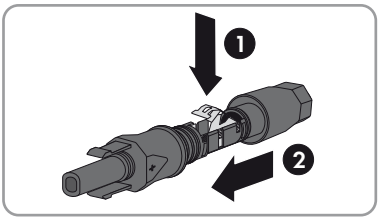
1. Disconnect the miniature circuit-breaker from all three phase conductors and secure against reconnection.
2. If the ESS is plugged in, remove the ESS.

3. If the protective cover is mounted, loosen the two screws of the protective cover using an Allen key (AF 5) and remove the protective cover.
4. Check the PV strings for earth faults (see section 11.5, page 71).
5. Connect the assembled DC connectors to the inverter.
   ☑ The DC connectors click audibly into place.
6. **NOTICE**

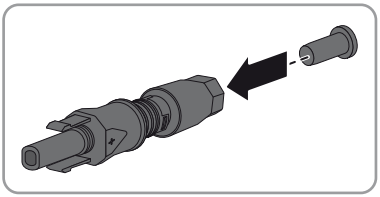
   Damage to the inverter due to moisture penetration

   The inverter is only properly sealed when all the unused DC inputs are closed with DC connectors and sealing plugs.

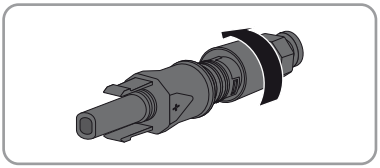
   - Do not insert the sealing plugs directly into the DC inputs on the inverter.
   - For unused DC connectors, push down the clamping bracket and push the swivel nut up to the thread.



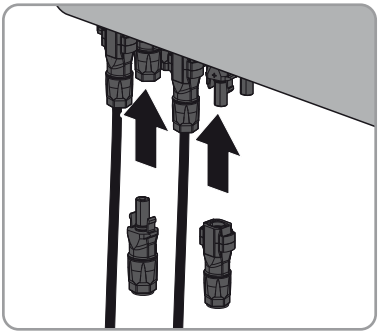
   - Insert the sealing plug into the DC connector.



   - Tighten the DC connector (torque: 2 Nm).



   - Insert the DC connectors with sealing plugs into the corresponding DC inputs on the inverter.
     ☑ The DC connectors click audibly into place.



7. Ensure that all DC connectors are securely in place.
8. If the multi-function relay is not used, attach the protective cover and plug in the ESS:
   - Secure the protective cover using two screws and an Allen key (AF 5).
   - Securely plug in the ESS.

6.5 Connecting the Multi-Function Relay

6.5.1 Connection Options for the Multi-Function Relay

You can choose between three connection options:

- Using the multi-function relay as fault or operation signalling contact
- Controlling loads or charging batteries via the multi-function relay
- Reporting the switching status of the grid relay

Using the Multi-Function Relay as Fault Signalling Contact

You can make use of the multi-function relay as a fault signalling contact and have an error of the inverter either displayed or reported. Alternatively, you can choose to have uninterrupted operation displayed or reported. It is possible to connect several inverters to one fault or operation indicator. To enable this function, the multi-function relays of all inverters must be connected.

Error message required by standard

In some countries, signalling of errors is required by standards, e.g. IEC 62109-2.

- In order to meet the requirements of IEC 62109-2, a display device signalling an error must be connected to the multi-function relay **or** the inverter must be registered in Sunny Portal where the fault alert must be activated (for information on fault alert via Sunny Portal, see Sunny Portal user manual at www.SMA-Solar.com).

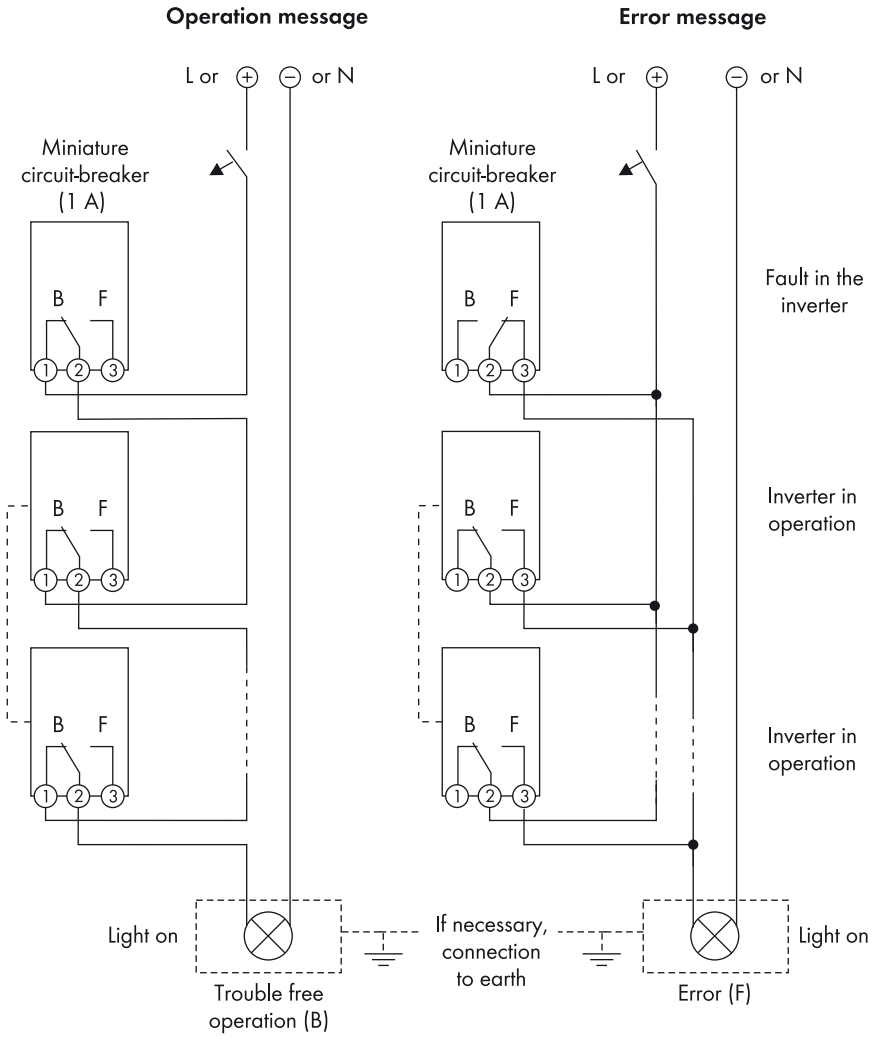


Figure 9: Circuit diagram with multiple inverters for connection to an operation indicator and circuit diagram for connection to a fault indicator (example)

Controlling Loads or Charging Batteries in a Power-Dependent Way via the Multi-Function Relay

The multi-function relay can control loads or charge batteries in a power-dependent way. To enable this function, you need to connect a contactor (K1) to the multi-function relay. The contactor (K1) switches the operating current for the load on or off. If you want batteries to be charged depending on the available power, the contactor activates or deactivates the charging of the batteries.

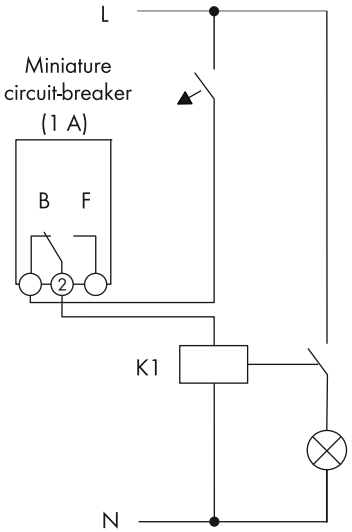


Figure 10: Circuit diagram for connection to control a load or for power-dependent charging of batteries

Reporting the Switching Status of the Grid Relay

The multi-function relay can trigger a signal to the network operator as soon as the inverter connects to the electricity grid. To enable this function, the multi-function relays of all inverters must be connected in parallel.

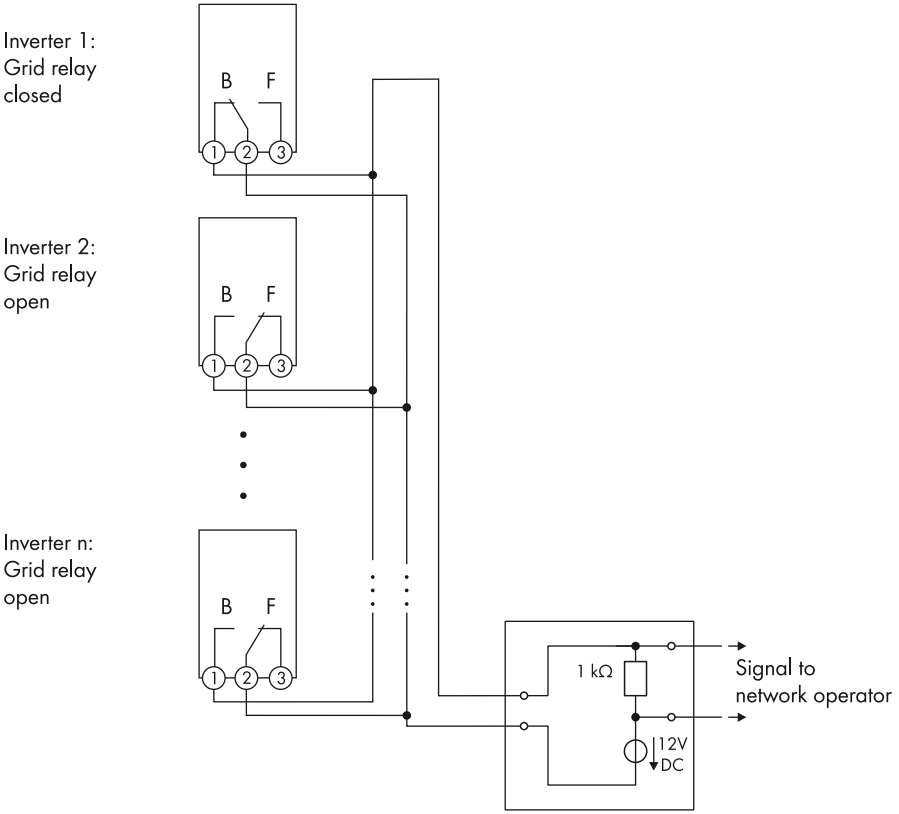


Figure 11: Circuit diagram for reporting the switching status of the grid relay (example)

6.5.2 Connecting to the Multi-Function Relay

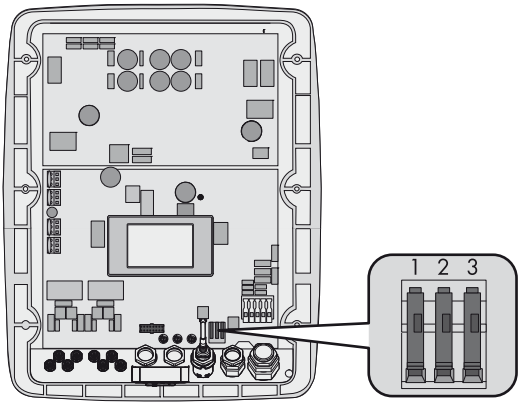


Figure 12: Connecting terminal plate for the connection to the multi-function relay

Requirement:

☐ The technical requirements of the multi-function relay must be met (see section 13 "Technical Data", page 81).

Cable requirements:

☐ The cable must be double-insulated.

☐ External diameter: 5 mm to 12 mm.

☐ Conductor cross-section: 0.08 mm² to 2.5 mm².

☐ The cable type and cable-laying method must be appropriate for the application and location.

NOTICE

Destruction of the multi-function relay as a result of excessive contact load

- Observe the maximum switching voltage and maximum switching current (see section 13.7 "Multi-Function Relay", page 87).
- When connecting the multi-function relay to the electricity grid, fuse the multi-function relay with a separate miniature circuit-breaker.

Operating the multi-function relay and 485 Data Module Type B or SMA Power Control Module in parallel

If you want to operate the multi-function relay and the 485 Data Module Type B or the SMA Power Control Module in parallel, no more than 30 V DC or 25 V AC must be connected to the multi-function relay.

Procedure:

1. When connecting to the electricity grid, fuse the multi-function relay with a separate miniature circuit-breaker.
2. **⚠ DANGER**

   Danger to life due to high voltages

   - Ensure that the inverter is disconnected from all voltage sources (see section 9, page 59).
3. Prepare the cable as follows:
   - Strip the cable jacket by a maximum of 15 mm.
   - Strip 8 mm of the insulated wires at maximum.
4. Prepare the cable gland M25 for the connection to the multi-function relay as follows:
   - Remove the swivel nut from the cable gland and remove the filler plug.
   - Remove the one-hole cable support sleeve from the cable gland and insert the cable into the one-hole cable support sleeve.
   - Press the one-hole cable support sleeve with the cable into the cable gland and lead the cable into the inverter.
   - Screw the swivel nut onto the cable gland.
5. Remove the protective cover of the multi-function relay.
6. Depending on the operating mode, connect the cable to the connecting terminal plate for the connection to the multi-function relay in accordance with the circuit diagram.
7. **⚠ WARNING**

   Danger to life due to live cables

   If, during inverter operation, an insulated wire (L1, L2 or L3) becomes detached from the AC terminal, there is the risk that the cables of the multi-function relay become live. Touching the cables can cause fatal electric shock.

   - Reattach the protective cover to the multi-function relay. This isolates the AC connection area in the inverter from other terminals.
8. Tighten the swivel nut of the cable gland.
9. Commission the inverter (see section 7, page 46).

7 Initial Start-Up

7.1 Procedure

Before you commission the inverter, you must check various settings and make changes if necessary. This section describes the procedure for initial start-up and gives an overview of the steps you must always perform in the prescribed order.

Procedure		see Section
1.	Check which country data set the inverter is set to.	Supplementary sheet with the default settings, type label or display
2.	If the country data set is not set correctly for your country or your purpose, adjust to the required country data set and corresponding display language.	7.2, page 46
3.	If the inverter is to communicate with multiple *Bluetooth* devices or if *Bluetooth* is not to be used as the type of communication, adjust the NetID.	7.3, page 50
4.	Commission the inverter for the first time.	7.4, page 52

7.2 Adjusting the Country Data Set

A display language is assigned to every country data set. Set the country data set with the corresponding display language appropriate for your country or purpose. If the display language does not match the required language, you can change it after commissioning (see section 8.2, page 54).

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 plant and lead to problems with the network operator. When selecting the country data set, you must always observe the locally applicable standards and directives as well as the properties of the plant (e.g. plant size, grid-connection point).

- If you are not sure which country data set is valid for your country or purpose, contact your network operator and ask which country data set should be configured.

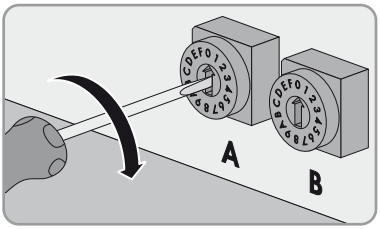
Procedure:

1. **⚠ DANGER**

   Danger to life due to high voltages

   - Ensure that the inverter is disconnected from all voltage sources (see section 9, page 59).

2. Set the rotary switches **A** and **B** to the required position using a flat-blade screwdriver (blade width: 2.5 mm).



☑ The inverter will adopt the setting after commissioning. This can take up to five minutes.

Rotary Switch Positions

Rotary switch A	Rotary switch B	Country data set	Display language
0	0	default setting	default setting
1	0	VDE0126-1-1	German
1	2	VDE-AR-N4105*	German
1	4	VDE-AR-N4105-MP**	German
1	6	VDE-AR-N4105-HP***	German
1	8	VDE0126-1-1	French
1	9	VDE0126-1-1/UTE	French
2	0	VDE0126-1-1	Italian
2	8	AS4777.3	English
3	2	CEI 0-21 external****	Italian
4	0	RD1699	Spanish
4	1	RD1663/661-A	Spanish
4	8	PPC	Greek
4	9	PPC	English
5	8	G83/1-1	English
5	A	G59/2	English
6	0	EN50438	German
6	1	EN50438	English
6	2	EN50438	French

Rotary switch A	Rotary switch B	Country data set	Display language
6	3	EN50438	Italian
6	4	EN50438	Spanish
6	5	EN50438	Greek
6	6	EN50438	Czech
6	7	EN50438	Portuguese
6	8	EN50438	Bulgarian
6	9	EN50438	Polish
6	E	NEN-EN50438	Dutch
7	0	EN50438-CZ	Czech
7	1	EN50438-CZ	English
7	2	EN50438-CZ	German
7	4	PPDS	Czech
7	5	PPDS	English
7	6	PPDS	German
7	8	C10/11/2012	French
7	9	C10/11/2012	English
7	A	C10/11/2012	German
7	B	C10/11/2012	Dutch
A	C	SI4777-2	English
B	8	IEC61727/MEA	English
B	C	IEC61727/PEA	English
C	0	Other standard	English
C	1	Other standard	German
C	2	Other standard	French
C	3	Other standard	Spanish
C	4	Other standard	Italian
C	5	Other standard	Greek
C	6	Other standard	Czech
D	0	Island mode 60 Hz	English
D	1	Island mode 60 Hz	German
D	2	Island mode 60 Hz	French
D	3	Island mode 60 Hz	Spanish

Rotary switch A	Rotary switch B	Country data set	Display language
D	4	Island mode 60 Hz	Italian
D	5	Island mode 60 Hz	Greek
D	6	Island mode 60 Hz	Czech
E	0	Island mode 60 Hz	English
E	1	Island mode 50 Hz	English
E	2	Island mode 50 Hz	German
E	3	Island mode 50 Hz	Spanish
E	4	Island mode 50 Hz	Italian
E	5	Island mode 50 Hz	Greek
E	6	Island mode 50 Hz	Czech

* Setting in accordance with VDE-AR-N 4105 for plants ≤ 3.86 kVA (Germany)

** Setting in accordance with VDE-AR-N 4105 for plants from 3.86 kVA to 13.8 kVA (Germany)

*** Setting in accordance with VDE-AR-N 4105 for plants ≤ 13.8 kVA (Germany)

**** Setting in accordance with CEI 0-21 for plants with external grid and plant protection > 6 kW (Italy)

7.3 Setting the NetID

By default, the NetID is set to **1** for all SMA inverters and SMA communication products with *Bluetooth*. If your plant consists of one inverter and no more than one other *Bluetooth* device (e.g. computer with *Bluetooth* or SMA communication product), you can leave the NetID set to **1**.

You must change the NetID in the following cases:

- If your plant consists of one inverter and two other *Bluetooth* devices (e.g. computer with *Bluetooth* interface and SMA communication product) or multiple inverters with *Bluetooth*, you must change the NetID of your plant. That enables communication with multiple *Bluetooth* devices.
- If there is another plant with *Bluetooth* within 500 m of your plant, you must change the NetID of your plant. This will help to separate both plants from each other.
- If you do not want to communicate using *Bluetooth*, deactivate communication via *Bluetooth* on your inverter. This protects your plant from unauthorised access.

All *Bluetooth* devices in one plant must have the same NetID. Before commissioning, you can set a new NetID in the inverter by using rotary switch C. The setting is adopted after commissioning. This can take up to five minutes.

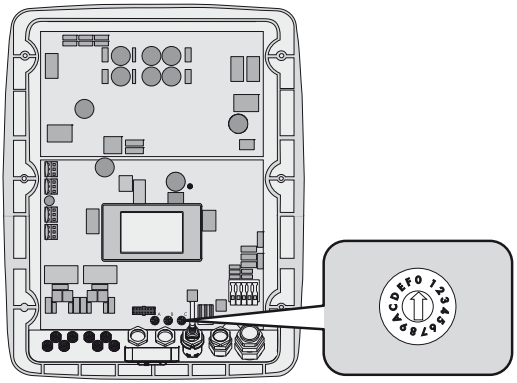


Figure 13: Rotary switch C positions

Position	Explanation
0	*Bluetooth* communication is deactivated.
1	Communication via *Bluetooth* with another *Bluetooth* device
2 to F	NetID for communication via *Bluetooth* with multiple *Bluetooth* devices

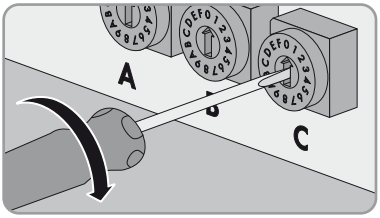
Procedure:

1. **⚠ DANGER**

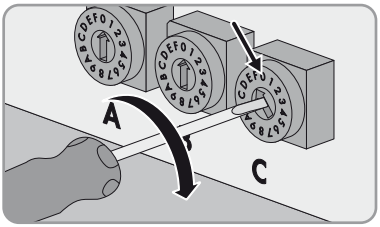
   Danger to life due to high voltages

   - Ensure that the inverter is disconnected from all voltage sources (see section 9, page 59).

2. To configure a new NetID, set rotary switch **C** to the determined NetID using a flat-blade screwdriver (blade width: 2.5 mm).



3. To deactivate the communication via *Bluetooth*, set rotary switch **C** to the position **0** using a flat-blade screwdriver (blade width: 2.5 mm). This protects your plant from unauthorised access.



☑ The inverter will adopt the setting after commissioning. This can take up to five minutes.

7.4 Commissioning the Inverter for the First Time

When commissioning the inverter for the first time, proceed as follows.

Requirements:

- ☐ The inverter must be correctly mounted.
- ☐ The miniature circuit-breaker must be correctly rated.
- ☐ All cables must be correctly connected.
- ☐ Unused DC inputs must be sealed using the corresponding DC connectors and sealing plugs.
- ☐ The country data set must be adjusted correctly for the country or the purpose.
- ☐ The inverter must be closed.
- ☐ The protective cover must be correctly mounted.
- ☐ The ESS must be securely plugged in.

Procedure:

1. Switch on the miniature circuit-breakers of all three phase conductors.
2. If a multi-function relay is used, switch on the load supply voltage.
   - ☑ The start-up phase begins.
   - ☑ The green LED is glowing and the display alternates automatically between the firmware version, the serial number or designation of the inverter, the NetID, the IP address, the subnet mask, the configured country data set and the display language.
   - ✖ Is the green LED flashing?

     Possible cause of the error: the DC input voltage is still too low or the inverter is monitoring the electricity grid.

     - Once the DC input voltage is sufficiently high and the grid connection conditions are met, the inverter will start operation.
   - ✖ The red LED is glowing and an error message and event number appear in the display?
     - Correct the error (see section 11 "Troubleshooting", page 63).
3. Configure the inverter (see section 8, page 53).

8 Configuration

8.1 Procedure

Once you have commissioned the inverter, you may have to adjust various settings via the rotary switches in the inverter or via a communication product. This section describes the procedure for configuration and gives an overview of the steps you must perform in the prescribed order.

Procedure		see Section
1.	If the display language is not set correctly, adjust the settings.	8.2, page 54
2.	If you want to integrate the inverter into a Speedwire network, connect the inverter to the network.	8.3, page 55
3.	Detect the inverter with a communication product.	Manual of the communication product at www.SMA-Solar.com
4.	Change the plant time and plant password.	8.4, page 55
5.	If a residual-current device with a tripping threshold of 30 mA is required and used, you must set the tripping threshold of the residual-current device.	8.6, page 56
6.	If you use the multi-function relay, ensure that the operating mode is set correctly and adjust further settings for the operating mode, if necessary.	8.7, page 57
7.	Activate and set SMA OptiTrac Global Peak for partially shaded PV modules.	8.8, page 58

8.2 Changing the Display Language

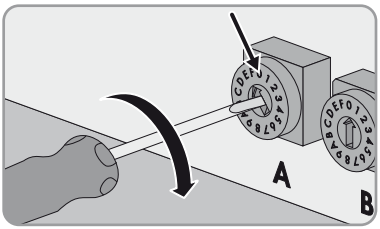
If the language for the country data set is not the language you want to use, you can change the display language as follows:

1. **⚠ DANGER**

   Danger to life due to high voltages

   - Disconnect the inverter from all voltage sources and open the enclosure lid (see section 9, page 59).

2. Set rotary switch **A** to **0** using a flat-blade screwdriver (blade width: 2.5 mm). This ensures that the data country set remains unchanged.



3. Set the rotary switch **B** to the required language using a flat-blade screwdriver (blade width: 2.5 mm).

Position	Display language
0	default setting
1	English
2	German
3	French
4	Spanish
5	Italian
6	Greek
7	Czech
8	Korean
9	Portuguese
A	Dutch
B	Slovenian
C	Bulgarian
D	Polish

4. Recommission the inverter (see section 10, page 61).

☑ The inverter adopts the settings after commissioning. This can take up to five minutes.

8.3 Connecting the Inverter to the Network

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

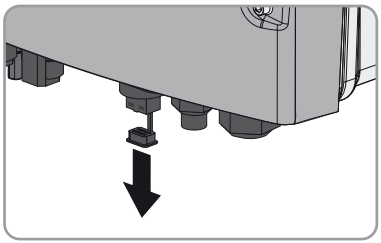
- ☐ One mating plug for RJ45 socket in accordance with IEC 61076-3-106, model 4 with push-pull lock SMA recommends the plug sets "STX V4 RJ45" from "Telegärtner" or "IE-PS-V04P-RJ45-FH" from "Weidmüller".
- ☐ 1 network cable

Cable requirements:

- ☐ Type of cable: 100BaseTx, CAT5 with S-FTP or S-STP shielding
  SMA recommends the cable type "SMA COMCAB-OUT-xxx" for outdoors, and the cable type "SMA COMCAB-IN-xxx" for indoors. The cables are available in the lengths
  xxx = 100 m, 200 m, 500 m, 1,000 m.
- ☐ Cross-section: at least 2 x 2 x 0.22 mm² or at least 2 x 2 AWG 24
- ☐ Maximum cable length: 50 m
- ☐ UV-resistant for outdoor use
- ☐ Type of plug: RJ45

Procedure:

1. Connect one end of the network cable to the mating plug (see documentation of mating plug).
2. Remove the filler plug from the socket for connecting the inverter to the network.



3. Connect the end of the network cable with the mating plug to the inverter. To do this, insert the mating plug firmly into the socket on the inverter.
4. Connect the other end of the network cable directly to the PC or router or connect it to another node. You can only connect the inverter to the other nodes via star topology.

8.4 Changing the Plant Time and Plant Password

To protect the inverter against unauthorised access and administer the plant correctly, change the standard plant password and the plant time with a communication product (for further information refer to the manual or help of the communication product).

- Change the standard plant password. This protects your plant from unauthorised access.
- Change the plant time.

8.5 Registering the Inverter in Sunny Portal

If you want to use the Webconnect function and monitor your plant in Sunny Portal, you must register your inverter in Sunny Portal.

Requirements:

☐ The inverter must be connected to a router with an Internet connection and must be integrated in your network. If the router does not support DHCP, or if DHCP is deactivated, you can use the SMA Connection Assist to integrate the inverter into the network (see www.SMA-Solar.com).

☐ The Internet address, registration ID (RID) and identification key (PIC) for registration in Sunny Portal must be available (see the additional label on the inverter or the supplementary sheet with information on SMA Speedwire Webconnect).

Procedure:

- Register the inverter in Sunny Portal (see the user manual of Webconnect plants in Sunny Portal).

8.6 Setting the Tripping Threshold of the Residual-Current Device

If a residual-current device with a tripping threshold of 30 mA is required and used, you must set the parameter **RCD adjustment** to **30 mA** (for further information, see Technical Information "Capacitive Leakage Currents" at www.SMA-Solar.com).

The basic procedure for changing operating parameters is explained in another section (see section 8.9, page 58).

- Select the parameter **RCD adjustment** and set it to **30 mA**.

8.7 Setting the Operating Mode of the Multi-Function Relay

By default, the multi-function relay is set to activate a fault indicator when an error occurs. If you use the multi-function relay for a different purpose, you must change the operating mode and make further adjustments to the operating mode.

The basic procedure for changing operating parameters is explained in another section (see section 8.9, page 58).

1. Select the parameter **Operating mode of multifunction relay** or **Mlt.OpMode** and set the desired operating mode (see section 4.9, page 22).
2. Once you have set the operating mode **Self-consumption** or **SelfCsmp**, you can configure other settings:
   - Select the parameter **Minimum On power for MFR self-consumption** or **Mlt.MinOnPwr** and set the desired value. By doing this, you are setting the power threshold from which a load is to be activated.
   - Select the parameter **Minimum power On time, MFR self-consumption** or **Mlt.MinOnPwrTmm** and set the desired value. By doing this, you are setting the minimum time for which the power must have exceeded the minimum switch-on power threshold in order to trip activation of the load.
   - Select the parameter **Minimum On time for MFR self-consumption** or **Mlt.MinOnTmm** and set the desired value. By doing this, you are setting the minimum time for which the load remains activated.
3. If you have set the operating mode **Control via communication** or **ComCtl**, select the parameter **Status of MFR with control via communication** or **Mlt.ComCtl.Sw** and set the desired value. By doing this, you are setting the status at which the multi-function relay is controlled via a communication product.
4. If you have set the operating mode **Battery bank** or **BatCha**, make further settings:
   - Select the parameter **Minimum On power for MFR battery bank** or **Mlt.BatCha.Pwr** and set the desired value. By doing this, you are setting the power threshold from which the battery is to be charged.
   - Select the parameter **Minimum time before reconnection of MFR battery bank** or **Mlt.BatCha.Tmm** and set the desired value. By doing this, you are setting the minimum time which must elapse after charging the battery before the battery can be charged again.

8.8 Activating and Setting SMA OptiTrac Global Peak

For partially shaded PV modules, you should activate SMA OptiTrac Global Peak and set the interval at which the inverter optimises the MPP of the PV plant.

The basic procedure for changing operating parameters is explained in another section (see section 8.9, page 58).

Procedure:

1. Select the parameter **OptiTrac Global Peak switched on** or **MPPShdw.IsOn** and set to **On**.
2. Select the parameter **Cycle time of the OptiTrac Global Peak algorithm** or **MPPShdw.CycTms** and set the desired time interval. The ideal time interval is usually six minutes. The value should only be increased if the shading situation changes extremely slowly.

☑ The inverter optimises the MPP of the PV plant in the predetermined time interval.

8.9 Changing Operating Parameters

This section describes the basic procedure for changing operating parameters. Change operating parameters always as described in this section.

The operating parameters of the inverter are set to certain values by default. You can change the operating parameters using a communication product to optimise the operation properties of the inverter (for a description of the operating parameters, see Technical Description "Measured Values and Parameters" at www.SMA-Solar.com).

Requirements:

☐ Depending on the type of communication, a computer with a *Bluetooth* or Ethernet interface must be available.

☐ A communication product that is appropriate for the type of communication used must be available.

☐ The inverter must be registered in the communication product.

☐ The changes to the grid-relevant operating parameters must be approved by the responsible network operator.

☐ To change grid-relevant parameters, the SMA Grid Guard code must be available (see Certificate "Application for SMA Grid Guard Code" at www.SMA-Solar.com).

Procedure:

1. Access the user interface of the communication product or software and log in as an installer.
2. If necessary, enter the SMA Grid Guard code.
3. Select and set the required parameter.
4. Save the setting.

9 Disconnecting the Inverter

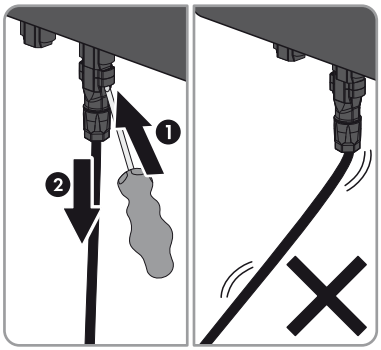
Always disconnect the inverter from all voltage sources before performing any work on it as described in this section. Proceed according to the required sequence to do so.

NOTICE

Destruction of the measuring device due to overvoltage

- Only use measuring devices with a DC input voltage range up to 1,000 V.

1. Disconnect the miniature circuit-breaker from all three phase conductors and secure against reconnection.
2. Remove the ESS.
3. Loosen two screws of the protective cover using an Allen key (AF 5) and remove the protective cover.
4. Use a current clamp to ensure that no current is present in the DC cables.
5. Unlock and remove all DC connectors. To do so, insert a slotted screwdriver or an angled screwdriver (blade width: 3.5 mm) into one of the side slots and pull the DC connectors straight out. Do not pull on the cable.



6. **⚠ DANGER**

   Danger to life due to high voltages

   The capacitors in the inverter take five minutes to discharge.

   - Wait five minutes before opening the enclosure lid.

7. Ensure that no voltage is present at the DC inputs of the inverter.
8. Loosen all screws of the enclosure lid using an Allen key (AF 5) and remove the enclosure lid.
9. Ensure that no voltage is present between **L1** and **N**, **L2** and **N,** and **L3** and **N** on the AC connecting terminal plate one after another using a suitable measuring device. To do so, insert a test probe in each round opening of the terminal.
10. Use an appropriate measuring device to ensure that there is no voltage at the AC connecting terminal plate between **L1** and **PE**, **L2** and **PE** and **L3** and **PE**. To do so, insert a test probe in each round opening of the terminal.

11. Ensure that there is no voltage between any terminal of the multi-function relay and **PE** of the AC connecting terminal plate.

12. ***NOTICE***

    Electrostatic discharge can damage the inverter.

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

    - Earth yourself before touching any components.

10 Recommissioning the Inverter

If you have disconnected the inverter from all voltage sources (e.g. for configuration purposes) and want to recommission it, proceed as follows.

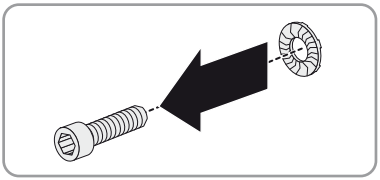
Requirements:

☐ The miniature circuit-breaker must be correctly rated.

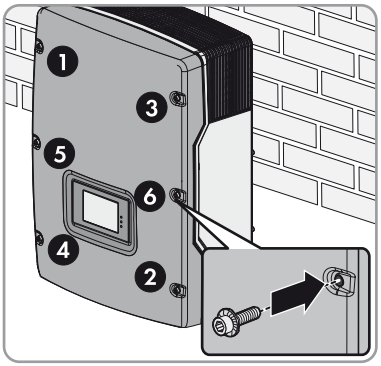
☐ The inverter must be correctly mounted.

Procedure:

1. Close the inverter and earth the enclosure lid:
   - Attach one conical spring washer to each screw. The grooved side of the conical spring washer must point to the screw head.



   - Secure the enclosure lid in the sequence 1 to 6 (torque: 6 Nm ± 0.5 Nm) using an Allen key (AF 5).



   ☑ The teeth of the conical spring washers are pushed into the enclosure lid. This ensures that the enclosure lid is earthed.
2. Connect the DC connectors to the inverter.
3. Seal all unused DC inputs using the DC connectors with sealing plugs.
4. Secure the protective cover using two screws and an Allen key (AF 5).
5. Securely plug in the ESS.
6. Switch on the miniature circuit-breakers of all three phase conductors.

7. If a multi-function relay is used, switch on the load supply voltage.

☑ The start-up phase begins.

☑ The green LED is glowing and the display alternates automatically between the firmware version, the serial number or designation of the inverter, the NetID, the IP address, the subnet mask, the configured country data set and the display language.

✖ Is the green LED flashing?

Possible cause of the error: the DC input voltage is still too low or the inverter is monitoring the electricity grid.

- Once the DC input voltage is sufficiently high and the grid connection conditions are met, the inverter will start operation.

✖ The red LED is glowing and an error message and event number appear in the display?

- Correct the error (see section 11 "Troubleshooting", page 63).

11 Troubleshooting

11.1 LED Signals

The LEDs indicate the operating state of the inverter.

LED	Status	Explanation
Green LED	Glowing	Feed-in operation If an event occurs during feed-in operation, the event message is shown in the display (see section 11.2, page 63).
	Flashing	Grid connection conditions are not met.
Red LED	Glowing	Errors The display shows an error message and an event number (see section 11.3, page 64).
Blue LED	Glowing	*Bluetooth* communication is active.

11.2 Event Messages

Display message	Cause
Update file OK	The update file found is valid.
Grid param. locked	The operating parameters have been blocked and cannot be changed.
Update communication	The inverter is updating the communication component.
Update main CPU	The inverter is updating the inverter component.
Update Bluetooth	The inverter is updating the *Bluetooth* component.
Upd. language table	The inverter is updating the language table.
Update completed	The inverter has successfully completed the update.
Grid param.unchanged	The selected rotary switch position is not assigned or the grid parameters cannot be changed.
Inst. code valid	The SMA Grid Guard code entered is valid. Protected operating parameters have now been unblocked and you can adjust the parameters. The parameters are automatically locked again after ten feed-in hours.
Self-test	The self-test is being carried out.

11.3 Error Messages

Event number	Display message	Cause and corrective measures
101 to 103	System incident	The mains voltage or grid impedance at the termination point of the inverter is too high. The inverter has disconnected from the electricity grid. **Corrective measures:** • Check that the mains voltage at the termination point of the inverter is permanently in the permissible range. If the mains voltage is outside the permissible range due to local grid conditions, contact the network operator. Ask the network operator whether the voltage can be adapted at the feed-in point or if it would be acceptable to change the monitored operating limits. If the mains voltage is permanently in the permissible range and this message is still displayed, contact the SMA Service Line.
202 to 203	System incident	The electricity grid has been disconnected, the AC cable is damaged or the mains voltage at the termination point of the inverter is too low. The inverter has disconnected from the electricity grid. **Corrective measures:** • Ensure that the miniature circuit-breaker is switched on. • Ensure that the AC cable is not damaged. • Ensure that the AC cable is correctly connected. • Check that the mains voltage at the termination point of the inverter is permanently in the permissible range. If the mains voltage is outside the permissible range due to local grid conditions, contact the network operator. Ask the network operator whether the voltage can be adapted at the feed-in point or if it would be acceptable to change the monitored operating limits. If the mains voltage is permanently in the permissible range and this message is still displayed, contact the SMA Service Line.

Event number	Display message	Cause and corrective measures
301	System incident	The ten-minute average mains voltage is no longer within the permissible range. The mains voltage or grid impedance at the termination point is too high. The inverter disconnects from the electricity grid to comply with the power quality. **Corrective measures:** • Check that the mains voltage at the termination point of the inverter is permanently in the permissible range. If the mains voltage is outside the permissible range due to local grid conditions, contact the network operator. Ask the network operator whether the voltage can be adapted at the feed-in point or if it would be acceptable to change the monitored operating limits. If the mains voltage is permanently in the permissible range and this message is still displayed, contact the SMA Service Line.
401 to 404	System incident	The inverter is no longer in grid-parallel operation. The inverter has stopped feeding into the electricity grid. **Corrective measures:** • Check the grid connection for significant, short-term frequency fluctuations.
501	System incident	The mains frequency is not within the permissible range. The inverter has disconnected from the electricity grid. **Corrective measures:** • As far as possible, check the mains frequency and observe how often major fluctuations occur. If fluctuations occur frequently and this message is displayed often, contact the network operator and ask whether they approve a change of the inverter's operating parameters. If the network operator approves, discuss any changes to the operating parameters with the SMA Service Line.

Event number	Display message	Cause and corrective measures
601	System incident	The inverter has detected an excessively high proportion of direct current in the mains current. **Corrective measures:** • Check the grid connection for direct current. • If this message is displayed frequently, contact the network operator and check whether it is possible to raise the threshold for monitoring on the inverter.
701	Frq. not permitted Check parameter	The mains frequency is not within the permissible range. The inverter has disconnected from the electricity grid. **Corrective measures:** • As far as possible, check the mains frequency and observe how often major fluctuations occur. If fluctuations occur frequently and this message is displayed often, contact the network operator and ask whether they approve a change of the inverter's operating parameters. If the network operator approves, discuss any changes to the operating parameters with the SMA Service Line.
1302	Waiting for grid voltage Installation failure grid connection Check grid and fuses	The inverter has detected an error in the AC cabling or the potential difference between N and the protective conductor in the building installation is above 50 V. The inverter cannot connect to the electricity grid. **Corrective measures:** • Ensure that the AC connection at the inverter is correct (see section 6.3.2, page 35). • Ensure that there is no potential difference between N and the protective conductor in the building installation. • Ensure that the country data set has been configured correctly. Check the positions of the rotary switches **A** and **B** or select and check the parameter for the country data set.

Event number	Display message	Cause and corrective measures
1501	Reconnection fault grid	The changed country data set or the value of an operating parameter you have set does not correspond to the local requirements. The inverter cannot connect to the electricity grid. **Corrective measures:** • Ensure that the country data set has been configured correctly. Check the positions of the rotary switches **A** and **B** or select and check the parameter for the country data set.
3302 to 3303	Unstable operation	There is not enough power at the DC input of the inverter for stable operation. The inverter cannot connect to the electricity grid. **Corrective measures:** • Ensure that the PV array is designed correctly.
3401 to 3402	DC overvoltage Disconnect generator	Overvoltage at DC input. The inverter may be destroyed. **Corrective measures:** • Immediately disconnect the inverter from all voltage sources (see section 9, page 59). • Check the DC voltage to ensure it is below the maximum input voltage of the inverter. If the DC voltage is below the maximum input voltage of the inverter, connect the DC connectors to the inverter again. • If the DC voltage is above the maximum input voltage of the inverter, ensure that the PV array has been correctly rated or contact the PV array installer. • If this message is repeated frequently, contact the SMA Service Line.
3501	Insulation resist. Check generator	The inverter has detected an earth fault in the PV array. **Corrective measures:** • Check the PV plant for earth faults (see section 11.5, page 71).

Event number	Display message	Cause and corrective measures
3601	High discharge curr. Check generator	The leakage current from the inverter and the PV array is too high. There is an earth fault, a residual current or a malfunction. The inverter interrupts feed-in operation immediately after exceeding a limiting value and then automatically re-connects to the electricity grid. **Corrective measures:** • Check the PV plant for earth faults (see section 11.5, page 71).
3701	Resid.curr.too.high Check generator	The inverter has detected a residual current due to temporary PV array earthing. **Corrective measures:** • Check the PV plant for earth faults (see section 11.5, page 71).
3801 to 3802	DC overcurrent Check generator	Overcurrent at the DC input. The inverter briefly interrupts feed-in. **Corrective measures:** • If this message is displayed frequently, ensure that the PV array has been correctly rated and wired.
3901 to 3902	Waiting for DC start conditions Start cond. not met	The conditions for the feed-in to the electricity grid have not been met. **Corrective measures:** • Wait for more irradiation. • If this message is displayed frequently in the morning, increase the limiting voltage to start the feed-in. To do so, 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	Self diagnosis Interference device	The cause must be determined by the SMA Service Line. **Corrective measures:** • Contact the SMA Service Line.

Event number	Display message	Cause and corrective measures
6501 to 6509	Self diagnosis Overtemperature	The inverter has switched off due to excessive temperatures. **Corrective measures:** • Clean the fans (see section 11.8, page 75). • Ensure that the inverter has sufficient ventilation.
6511	Overtemperature	The inverter has switched off due to excessive temperatures. **Corrective measures:** • Clean the fans (see section 11.8, page 75). • Ensure that the inverter has sufficient ventilation.
6603 to 6604	Self diagnosis Overload	The cause must be determined by the SMA Service Line. **Corrective measures:** • Contact the SMA Service Line.
6801 to 6802	Self diagnosis Input A defective	The cause must be determined by the SMA Service Line. **Corrective measures:** • Contact the SMA Service Line.
6901 to 6902	Self diagnosis Input B defective	The cause must be determined by the SMA Service Line. **Corrective measures:** • Contact the SMA Service Line.
7001 to 7002	Sensor fault fan permanently on	The cause must be determined by the SMA Service Line. **Corrective measures:** • Contact the SMA Service Line.
7401	Varistor defective	At least one of the thermally monitored varistors is defective. **Corrective measures:** • Check the function of the varistors (see section 11.6, page 73).
7701 to 7703	Self diagnosis Interference device	The cause must be determined by the SMA Service Line. **Corrective measures:** • Contact the SMA Service Line.

Event number	Display message	Cause and corrective measures
8001	Derating occurred	The inverter has reduced its power output for more than ten minutes due to excessive temperature. **Corrective measures:** • If this message is displayed frequently, clean the fans (see section 11.8, page 75). • Ensure that the inverter has sufficient ventilation.
8101 to 8104	Comm. disturbed	The cause must be determined by the SMA Service Line. **Corrective measures:** • Contact the SMA Service Line.
8801 to 8803	No display	This error message can have three causes, but the inverter continues to feed into the electricity grid. The ambient temperature is lower than -25°C. The display switched off for reasons of protection. The inverter cannot identify the display type. No display is connected to the inverter or the connection is defective. **Corrective measures:** • If the display switched off due to the ambient temperature being too low, wait until the ambient temperature is over -25°C. • If the ambient temperature is above -25°C, contact the SMA Service Line.
9002	Inst. code invalid	The SMA Grid Guard code entered is not correct. The operating parameters are still protected and cannot be changed. **Corrective measures:** • Enter the correct SMA Grid Guard code.
9003	Grid param. locked	The operating parameters are now locked. You cannot change the parameters. **Corrective measures:** • Unlock the parameters with the SMA Grid Guard code.

11.4 Cleaning the Inverter

NOTICE

Damage to the display due to the use of cleaning agents

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

11.5 Checking the PV Plant for Earth Faults

If the inverter displays the event numbers **3501**, **3601** or **3701**, there could be an earth fault. The electrical insulation between the PV plant and earth is defective or insufficient.

⚠ WARNING

Danger to life due to electric shock

In the event of an earth fault, high voltages can be present.

- Only touch the insulation of the PV array cables.
- Do not touch any parts of the sub-structure or frame of the PV array.
- Do not connect PV strings with earth faults to the inverter.

NOTICE

Destruction of the measuring device due to overvoltage

- Only use measuring devices with a DC input voltage range up to at least 1,000 V.

Proceed as follows to check each string in the PV plant for earth faults.

Procedure:

1. **⚠ DANGER**

   Danger to life due to high voltages

   - Disconnect the inverter from all voltage sources (see section 9, page 59).

2. Measure the voltages:
   - Measure the voltages between the positive pole and the earth potential (PE).
   - Measure the voltages between the negative pole and the earth potential (protective conductor).
   - Measure the voltages between the positive and negative pole.

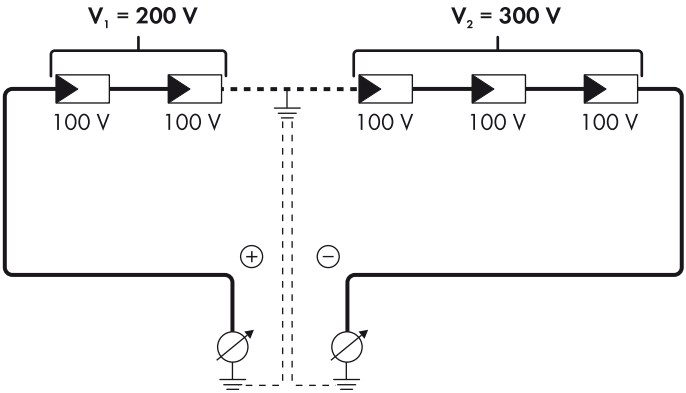
     If the following results are present at the same time, there is an earth fault in the PV plant.

   – All measured voltages are stable.
   – The sum of the two voltages against the earth potential is approximately equal to the voltage between the positive and negative poles.
   - Determine the location of the earth fault via the ratio of the two measured voltages.
   - Eliminate the earth fault.

     If there is no earth fault and the message is still displayed, contact the SMA Service Line.

Example: Location of the earth fault

The example shows an earth fault between the second and third PV module.



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3. Recommission the inverter (see section 10 "Recommissioning the Inverter", page 61).

11.6 Checking the Function of the Varistors

If the inverter displays event number **7401**, one of the varistors is probably defective.

NOTICE

Destruction of the inverter due to overvoltage

If varistors are missing, the inverter is no longer protected against overvoltage.

- Do not operate the inverter without varistors in plants with a high risk of overvoltages.
- Do not recommission the inverter until the defective varistors have been replaced.

NOTICE

Destruction of the measuring device due to overvoltage

- Only use measuring devices with a DC input voltage range up to 1,000 V.

Check the function of each varistor according to the following procedure.

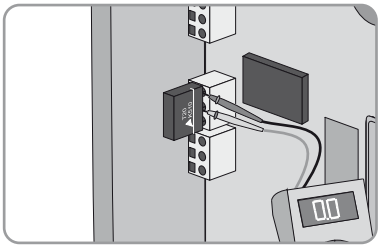
Procedure:

1. **⚠ DANGER**

   Danger to life due to high voltages

   - Disconnect the inverter from all voltage sources and open the enclosure lid (see section 9, page 59).

2. Use a measuring device to measure whether there is a conductive connection between the upper and the middle connection wire.



   If there is no conductive connection, the varistor is defective. SMA Solar Technology AG recommends replacing all varistors immediately.

   - Order new varistors and insertion tools (see section 14 "Accessories", page 88).
   - If new varistors are available, replace all varistors (see section 11.7, page 74).

   If there is no conductive connection, contact the SMA Service Line.

11.7 Replacing the Varistors

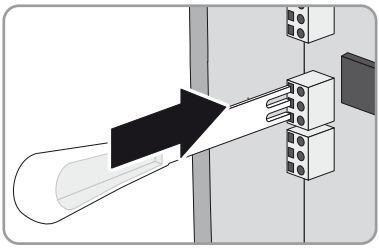
Proceed as follows to replace each varistor.

1. **⚠ DANGER**

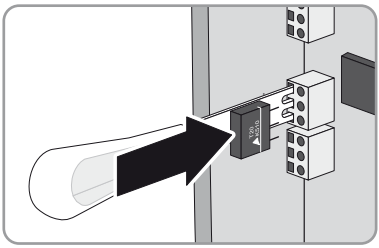
   Danger to life due to high voltages

   - Disconnect the inverter from all voltage sources and open the enclosure lid (see section 9, page 59).

2. Insert the insertion tool into the contacts of the connecting terminal plate.



3. Remove the varistor from the connecting terminal plate.
4. Insert the new varistor into the connecting terminal plate. The labels of the varistor must face to the right in the inside of the inverter.



5. Remove the insertion tool from the contacts of the connecting terminal plate.
6. Recommission the inverter (see section 10, page 61).

11.8 Clean the fan

Procedure:

- Cleaning the ventilation grids
- Cleaning the fans

Cleaning the Ventilation Grids

Proceed as follows to clean each ventilation grid.

1. Remove the ventilation grid laterally.
2. **NOTICE**

   Damage to the inverter due to foreign bodies

   - Do not remove the ventilation grid permanently, otherwise foreign bodies could penetrate the enclosure.
3. Clean the ventilation grid with a soft brush, a paint brush, or compressed air.
4. Close the recessed grips with the ventilation grids. Ensure the assignment is correct. The correct assignment is marked on the inside of each ventilation grid: **links/left** for the left-hand side and **rechts/right** for the right-hand side.

Cleaning the Fans

Proceed as follows to clean each fan.

1. **⚠ DANGER**

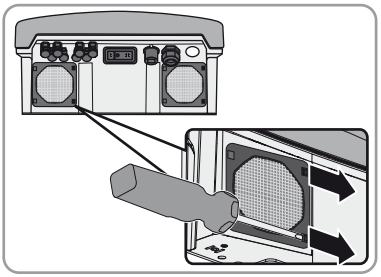
   Danger to life due to high voltages

   - Disconnect the inverter from all voltage sources (see section 9, page 59).
2. Wait for the fans to stop rotating.
3. Check whether the fan guard is dusty or heavily soiled.

   If the fan guard is dusty, clean the fan guard with a vacuum cleaner.

   If the fan guard is heavily soiled, remove the fan guard and clean it:

   - Use a screwdriver to push the two locking tabs at the right-hand edge of the fan guard to the right and remove them from the retainer.

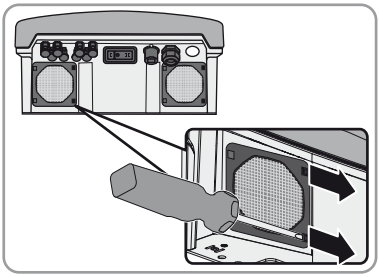


- Carefully remove the fan guard.
- Clean the fan guard with a soft brush, a paint brush, a cloth or compressed air.

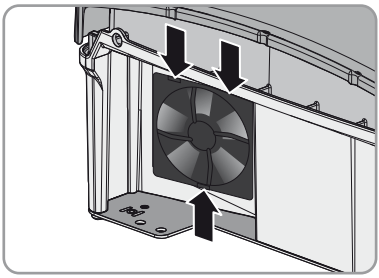
4. Check whether the fan is soiled.

   If the fan is soiled, remove the fan:

   - Use a screwdriver to push the two locking tabs at the right-hand edge of the fan guard to the right and remove them from the retainer.



   - Carefully remove the fan guard.
   - Push the locking tabs of the fan towards the middle of the fan.



   - Remove the fan slowly from the inverter.
   - Unlock and remove the fan plug.

5. **NOTICE**

   Damage to the fan due to compressed air

   - Clean the fan with a soft brush, a paint brush, or a damp cloth.

6. Insert the plug of the fan into the socket until it clicks into place.
7. Insert the fan into the inverter until the fan audibly clicks into place.
8. Push the fan guard into the retainer until it audibly clicks into place.
9. Recommission the inverter (see section 10, page 61).
10. Check the fan to ensure that it is functioning (see section 11.9, page 77).

11.9 Checking the Fans

You can check the function of the fans by setting an operating parameter.

Requirements:

☐ A communication product that is appropriate for the type of communication used must be available.

☐ The inverter must be in operation.

Procedure:

1. Access the user interface of the communication product and log in as an installer.
2. Select the parameter **Fan test** or **FanTst** and set to **On**.
3. Save the setting.
4. Check whether air is coming out of the ventilation grids and whether the fans are making any unusual noises.

   If there is no air coming out of the ventilation grids or the fans are making unusual noises, then presumably the fans were not installed properly. Check the installation of the fans.

   If the fans were installed correctly, contact the SMA Service Line.
5. Select the parameter **Fan test** or **FanTst** and set to **Off**.
6. Save the setting.

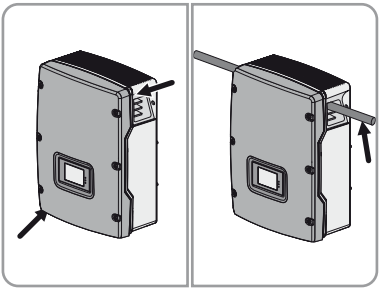
12 Decommissioning the Inverter

⚠ CAUTION

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

The inverter is heavy (see section 13 "Technical Data", page 81). If it is lifted incorrectly or dropped while being transported or attached to the wall mounting bracket, there is a risk of injury.

- Transport the inverter horizontally with several persons. With one hand each, grasp the recessed grips on the top and on the bottom or use a steel rod (diameter: 30 mm at maximum).



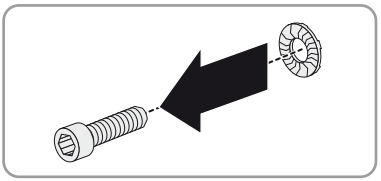
1. **⚠ DANGER**

   Danger to life due to high voltages

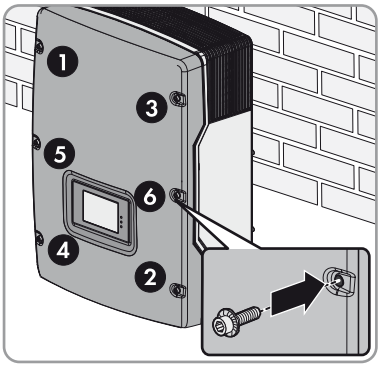
   - Disconnect the inverter from all voltage sources (see section 9, page 59).

2. Remove the AC cable from the inverter.
3. If an Ethernet cable is connected for Speedwire communication, remove the cable from the inverter.
4. If the multi-function relay, the SMA Power Control Module or the 485 Data Module Type B are used, remove the connection cable from the inverter.
5. Close the inverter:

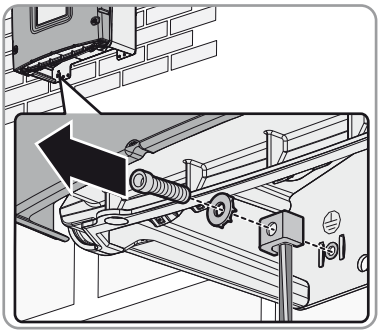
   - Attach one conical spring washer to each screw. The grooved side of the conical spring washer must point to the screw head.



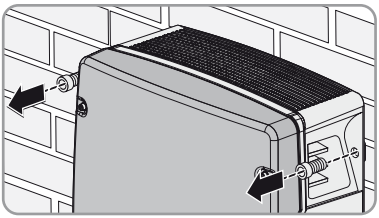
- Secure the enclosure lid in the sequence 1 to 6 (torque: 6 Nm ± 0.5 Nm) using an Allen key (AF 5).



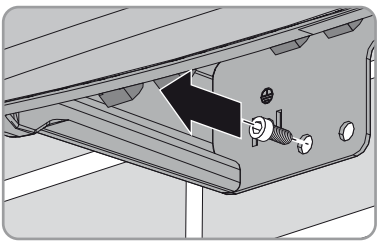
6. If a second protective conductor is connected, loosen the M6x16 cheese-head screw and remove the screw, conical spring washer, clamping bracket and protective conductor.



7. Remove the ventilation grids laterally.
8. Loosen the screws on both sides between the inverter and the wall mounting bracket using an Allen key (AF 5).



9. If the inverter is protected against theft, loosen the safety screws.



10. Remove the inverter by lifting it up vertically and out of the wall mounting bracket.

11. **NOTICE**

Damage to the ESS socket from dirt and foreign bodies

Lowering the inverter onto an uneven building ground can allow dirt or foreign bodies, e.g. stones, to enter the socket and damage the contacts. That prevents the ESS from functioning correctly.

- Always lower the inverter on an even building ground.

12. If the inverter is to be stored or shipped in a package, pack the inverter, the protective cover and the ESS. Use the original packaging or packaging that is suitable for the weight and dimensions of the inverter.
13. Dispose of the inverter in accordance with the locally applicable disposal regulations for electronic waste.

13 Technical Data

13.1 DC/AC

13.1.1 Sunny Tripower 5000TL / 6000TL / 7000TL

DC Input

	STP 5000TL-20	STP 6000TL-20	STP 7000TL-20
Maximum DC power at cos φ = 1	5,100 W	6,125 W	7,175 W
Maximum input voltage	1,000 V	1,000 V	1,000 V
MPP voltage range	245 V to 800 V	295 V to 800 V	290 V to 800 V
Rated input voltage	580 V	580 V	580 V
Minimum input voltage	150 V	150 V	150 V
Initial input voltage	188 V	188 V	188 V
Maximum input current, input A	11 A	11 A	15 A
Maximum input current, input B	10 A	10 A	10 A
Maximum input current per string, input A*	11 A	11 A	15 A
Maximum input current per string, input B*	10 A	10 A	10 A
Maximum short-circuit current, input A	22.5 A	22.5 A	22.5 A
Maximum short-circuit current, input A	15 A	15 A	15 A
Number of independent MPP inputs	2	2	2
Strings per MPP input	2	2	2

* Maximum permitted current allowed through one DC connector.

AC Output

	STP 5000TL-20	STP 6000TL-20	STP 7000TL-20
Rated power at 230 V, 50 Hz	5,000 W	6,000 W	7,000 W
Maximum apparent AC power at cos φ = 1	5,000 VA	6,000 VA	7,000 VA
Rated grid voltage	~ 3/N/PE, 230 V / 400 V	~ 3/N/PE, 230 V / 400 V	~ 3/N/PE, 230 V / 400 V
AC voltage range*	160 V to 280 V	160 V to 280 V	160 V to 280 V
Nominal AC current at 220 V	7.3 A	8.7 A	10.2 A
Nominal AC current at 230 V	7.3 A	8.7 A	10.2 A
Nominal AC current at 240 V	6.9 A	8.33 A	10.14 A
Maximum output current	7.3 A	8.7 A	10.2 A
Total harmonic factor of the output current with total harmonic factor of the AC voltage < 2%, and AC power > 50% of the rated power	≤ 3%	≤ 3%	≤ 3%
Maximum output current in the event of an error	12 A	15 A	17 A
Rated mains frequency	50 Hz	50 Hz	50 Hz
AC mains frequency*	50 Hz/60 Hz	50 Hz/60 Hz	50 Hz/60 Hz
Operating range at AC mains frequency 50 Hz	45.5 Hz to 54.5 Hz	45.5 Hz to 54.5 Hz	45.5 Hz to 54.5 Hz
Operating range at AC mains frequency 60 Hz	55.5 Hz to 64.5 Hz	55.5 Hz to 64.5 Hz	55.5 Hz to 64.5 Hz
Displacement power factor cos φ, adjustable	0.8 underexcited to **1** to 0.8 overexcited	0.8 underexcited to **1** to 0.8 overexcited	0.8 underexcited to **1** to 0.8 overexcited
Feed-in phases	3	3	3
Connection phases	3	3	3
Overvoltage category in accordance with IEC 60664-1	III	III	III

* Depending on the configured country data set

Efficiency

	STP 5000TL-20	STP 6000TL-20	STP 7000TL-20
Maximum efficiency, η_{max}	98%	98%	98%
European efficiency, η_{EU}	97.1%	97.4%	97.5%

13.1.2 Sunny Tripower 8000TL / 9000TL

DC Input

	STP 8000TL-20	STP 9000TL-20
Maximum DC power at cos φ = 1	8,200 W	9,225 W
Maximum input voltage	1,000 V	1,000 V
MPP voltage range	330 V to 800 V	370 V to 800 V
Rated input voltage	580 V	580 V
Minimum input voltage	150 V	150 V
Initial input voltage	188 V	188 V
Maximum input current, input A	15 A	15 A
Maximum input current, input B	10 A	10 A
Maximum input current per string, input A*	15 A	15 A
Maximum input current per string, input B*	10 A	10 A
Maximum short-circuit current, input A	22.5 A	22.5 A
Maximum short-circuit current, input B	15 A	15 A
Number of independent MPP inputs	2	2
Strings per MPP input	2	2

* Maximum permitted current allowed through one DC connector.

AC Output

	STP 8000TL-20	STP 9000TL-20
Rated power at 230 V, 50 Hz	8,000 W	9,000 W
Maximum apparent AC power at cos φ = 1	8,000 VA	9,000 VA
Rated grid voltage	~ 3/N/PE, 230 V / 400 V	~ 3/N/PE, 230 V / 400 V
AC voltage range*	160 V to 280 V	160 V to 280 V
Nominal AC current at 220 V	11.6 A	13.1 A

	STP 8000TL-20	STP 9000TL-20
Nominal AC current at 230 V	11.6 A	13.1 A
Nominal AC current at 240 V	11.11 A	12.5 A
Maximum output current	11.6 A	13.1 A
Total harmonic factor of the output current with total harmonic factor of the AC voltage < 2%, and AC power > 50% of the rated power	≤ 3%	≤ 3%
Inrush current		
Maximum output current in the event of an error	20 A	22 A
Rated mains frequency	50 Hz	50 Hz
AC mains frequency*	50 Hz/60 Hz	50 Hz/60 Hz
Operating range at AC mains frequency 50 Hz	45.5 Hz to 54.5 Hz	45.5 Hz to 54.5 Hz
Operating range at AC mains frequency 60 Hz	55.5 Hz to 64.5 Hz	55.5 Hz to 64.5 Hz
Displacement power factor cos φ, adjustable	0.8 underexcited to **1** to 0.8 overexcited	0.8 underexcited to **1** to 0.8 overexcited
Feed-in phases	3	3
Connection phases	3	3
Overvoltage category in accordance with IEC 60664-1	III	III

* Depending on the configured country data set

Efficiency

	STP 8000TL-20	STP 9000TL-20
Maximum efficiency, η_{max}	98%	98%
European efficiency, η_{EU}	97.6%	97.6%

13.2 General Data

Width x height x depth, with Electronic Solar Switch	470 mm x 730 mm x 240 mm
Weight	37 kg
Length x width x height of the packaging	798 mm x 598 mm x 398 mm
Transport weight	40 kg
Climatic category in accordance with IEC 60721-3-4	4K4H

Environmental category	Outdoors
Pollution degree outside the enclosure	3
Pollution degree inside the enclosure	2
Operating temperature range	− 25°C to +60°C
Maximum permissible value for relative humidity, non-condensing	100%
Maximum operating altitude above MSL	3,000 m
Typical noise emission	≤ 40 dB(A)
Power loss in night mode	1 W
Maximum data volume per inverter with Speedwire/Webconnect	550 MB/month
Additional data volume for use of the Sunny Portal live interface	600 kB/hour
Topology	Transformerless
Cooling concept	SMA OptiCool
Fan connection	Designed for safe disconnection in accordance with DIN EN 50178:1998-04
Degree of protection for electronics in accordance with IEC 60529	IP65
Protection class in accordance with IEC 62103	I
Grid configurations	TN-C, TN-S, TN-C-S, IT, TT (if V_{N_PE} < 30 V)
Approvals and national standards, as per 04/2013*	AS4777, CE, CEI 0-21 (> 6 kWp), C10/11:2012, DIN EN 62109-1, EN 50438, G59/2, G83/1-1, IEC 61727/MEA, IEC 61727/PEA, IEC 62109-2, NEN EN 50438, NRS 97-2-1, PPC, PPDS, RD 661/2007, RD 1699:2011, SI4777, SI 4777-2, VDE0126-1-1 / UTE C15-712-1, VDE-AR-N 4105

* **C10/11:2012:** only possible if the three-phase line-to-line voltage is 400 V
EN 50438: does not apply for all national appendices of EN 50438
IEC 62109-2: This standard requires that either the multi-function relay in the inverter is used as fault indicator or that the inverter is connected to Sunny Portal and that the fault alert is activated in Sunny Portal.
NRS 97-2-1: This standard requires a separate label attached to the AC distribution board, which indicates the AC-side disconnection of the inverter in case of a grid failure (for further details, see NRS 97-2-1, Sect. 4.2.7.1 and 4.2.7.2)

13.3 Protective Devices

DC reverse polarity protection	Short-circuit diode
Input-side disconnection device	Electronic Solar Switch, SUNCLIX DC connector
DC overvoltage protection	Thermally monitored varistors
AC short-circuit current capability	Current control
Grid monitoring	SMA Grid Guard 4
Maximum permissible fuse protection	32 A
Earth fault monitoring	Insulation monitoring: R_{iso} > 385 Ω
All-pole sensitive residual-current monitoring unit	Available

13.4 Climatic Conditions

In Accordance with IEC 60721-3-4, Installation Type C, Class 4K4H

Extended temperature range	− 25°C to 60°C
Extended humidity range	0% to 100%
Extended air pressure range	79.5 kPa to 106 kPa

In Accordance with IEC 60721-3-4, Transport Type E, Class 2K3

Temperature range	− 25°C to +70°C

13.5 Features

DC connection	SUNCLIX DC connector
AC connection	Spring clamp terminal
Display	LC graphic display
Bluetooth	Standard
Speedwire/Webconnect interface	Standard
Multi-function relay	Standard
SMA Power Control Module	Optional
RS485 interface	Optional

13.6 Torques

Enclosure lid screws	6.0 Nm ± 0.5 Nm
Protective cover screws	2.0 Nm
Additional earth terminal	6.0 Nm
Cheese-head screw for attaching the enclosure to the wall mounting bracket	6.0 Nm
SUNCLIX swivel nut	2.0 Nm

13.7 Multi-Function Relay

Maximum AC switching voltage	240 V
Maximum DC switching voltage	30 V
Maximum AC switching current	1.0 A
Maximum DC switching current	1.0 A
Minimum electrical endurance when the maximum switching voltage and maximum switching current are complied with*	100,000 switching cycles

* Corresponds to 20 years with 12 switching operations per day

13.8 Electronic Solar Switch

Electrical endurance in the event of a short circuit, with a nominal current of 30 A	At least 50 switching processes
Maximum switching current	30 A
Maximum switching voltage	1,000 V
Maximum power	9 kW
Degree of protection when plugged in	IP65
Degree of protection when removed	IP65
Fuses for Electronic Solar Switch	2 x 1,000 V / 4 A, fast (soldered, non-replaceable)

13.9 Data Storage Capacity

Energy yields in the course of the day	63 days
Daily yields	30 years
Event messages for users	250 events
Event messages for installers	250 events

14 Accessories

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

Designation	Brief description	SMA order number
Electronic Solar Switch	ESS as spare part	ESS-HANDLE*
Insertion tool for replacing varistors	Insertion tool for varistors	SB-TVWZ
Ventilation grid	Ventilation grid set (right and left) as spare part	45-7202
SUNCLIX DC connector	Field plug for conductor cross-sections of 2.5 mm² to 6 mm²	SUNCLIX-FC6-SET
SMA Power Control Module	Multi-function interface for implementing grid management	PWCBRD-10
RS485 interface	RS485 interface for establishing wired connection	485BRD-10

* When ordering a new ESS, always indicate the device type and serial number of the inverter.

15 Contact

If you have technical problems concerning our products, 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
- Firmware version of the inverter
- Special country-specific settings of the inverter (if applicable)
- Type and number of the PV modules connected
- Installation location and installation altitude of the inverter
- Three-digit or four-digit event number and display message
- Optional equipment, e.g. communication products
- Use of the multi-function relay

Australia	SMA Australia Pty Ltd. Sydney	Toll free for Australia: 1800 SMA AUS (1800 762 287) International: +61 2 9491 4200
Belgien/ Belgique/ België	SMA Benelux bvba/sprl Mecheln	+32 15 286 730
Česko	SMA Central & Eastern Europe s.r.o. Praha	+420 235 010 417
Danemark	See Germany	
Germany	SMA Solar Technology AG Niestetal	Medium Power Solutions Inverters: +49 561 9522-1499 Communication: +49 561 9522-2499 SMS with "Rückruf" to: +49 176 888 222 44
		Hybrid Energy Solutions Sunny Island: +49 561 9522-399
		Power Plant Solutions Sunny Central and system technology: +49 561 9522-299
España	SMA Ibérica Tecnología Solar, S.L.U. Barcelona	+34 900 14 22 22

France	SMA France S.A.S. Lyon	Medium Power Solutions Onduleurs : +33 472 09 04 40 Communication : +33 472 09 04 41
		Hybrid Energy Solutions Sunny Island : +49 561 9522-399
		Power Plant Solutions Sunny Central : +49 561 9522-299
India	SMA Solar India Pvt. Ltd. Mumbai	+91 22 61713844
Italy	SMA Italia S.r.l. Milano	+39 02 89347-299
Luxemburg/ Luxembourg	See Belgium Voir Belgien (Belgique)	
Magyarország	lásd Česko (Csehország)	
Nederland	zie Belgien (België)	
Austria	See Germany	
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