

PV Inverter

SUNNY TRIPOWER

5000TL / 6000TL / 7000TL / 8000TL / 9000TL

Installation Manual

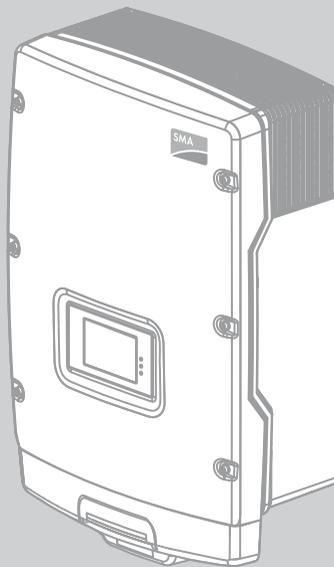


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1 Information on this Document

Validity

This document is valid for the following devices types from firmware version 2.50:

- STP 5000TL-20
- STP 6000TL-20
- STP 7000TL-20
- STP 8000TL-20
- STP 9000TL-20

Target Group

This document is intended for skilled persons. Only qualified personnel are allowed to perform the tasks described in this manual (See Section 2.2 "Qualifications of Skilled Persons", Page 11).

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
Measured Values and Parameters	Technical Description
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
	Information that is important for a specific topic or goal, but is not safety-relevant
<input type="checkbox"/>	Indicates a requirement for achieving a specific goal
<input checked="" type="checkbox"/>	Desired result
x	A problem that might occur

Typographies

Typography	Usage	Example
Bold	<ul style="list-style-type: none"> • Display messages • Elements on a user interface • Parameters • Connections • Elements to be selected • Elements to be entered 	<ul style="list-style-type: none"> • Select the Fan test parameter and set to 1.
>	<ul style="list-style-type: none"> • Connects several elements that are to be selected 	<ul style="list-style-type: none"> • Select the parameter group Plant Communication > Speedwire.

Nomenclature

Complete designation	Designation in this document
Electronic Solar Switch	ESS
PV plant	Plant
SMA <i>Bluetooth</i> [®] Wireless Technology	<i>Bluetooth</i>
Sunny Tripower	Inverter, product
SMA Webconnect function	Webconnect function

Abbreviations

Abbreviation	Designation	Explanation
AC	Alternating Current	-
DC	Direct Current	-
EC	European Community	-
EMC	Electromagnetic Compatibility	-
LED	Light-Emitting Diode	-
MPP	Maximum Power Point	-
MSL	Mean Sea Level	-
NetID	Network Identification	Identification number for SMA <i>Bluetooth</i> network
PE	Protective Earth	Protective conductor
PIC	Product Identification Code	Identification key for registration in Sunny Portal
PV	Photovoltaics	-
RID	Registration Identifier	Registration key for registration in Sunny Portal
VDE	Verband der Elektrotechnik Elektronik Informationstechnik e. V.	Association for Electrical, Electronic and Information Technologies

2 Safety

2.1 Intended Use

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.

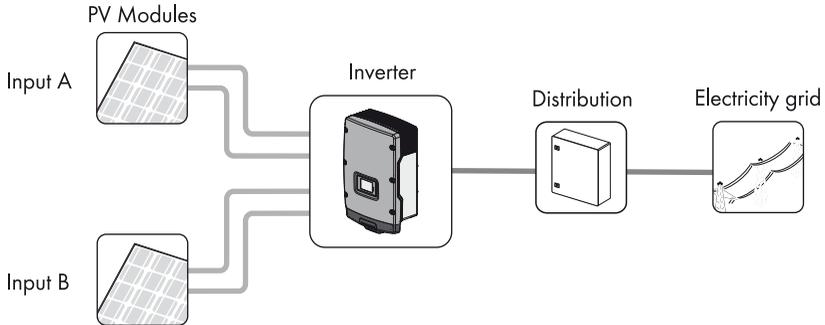


Figure 1: Design of a PV plant with Sunny Tripower

The Sunny Tripower is suitable for indoor and outdoor use.

The Sunny Tripower may only be operated with PV arrays (PV modules and cabling) of protection class II. The PV modules must be suitable for use with the Sunny Tripower and must have been released by the module manufacturer.

PV modules with a high capacity to earth may only be used if their coupling capacity does not exceed 1.25 μF .

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

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

Only use the Sunny Tripower in accordance with the information provided in the enclosed documentation. Any other use may result in personal injury or property damage.

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.

- 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.

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 operating 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 compliance with this document and all safety precautions

2.3 Safety Precautions

Electric Shock

High voltages are present in the live components of the inverter. Touching these components can cause fatal electric shock.

- Always disconnect the inverter from voltage sources before performing any work on it as described in this document (see Section 9).

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.

Burn Hazards

Some parts of the enclosure can become hot during operation.

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

Electrostatic Discharge

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.

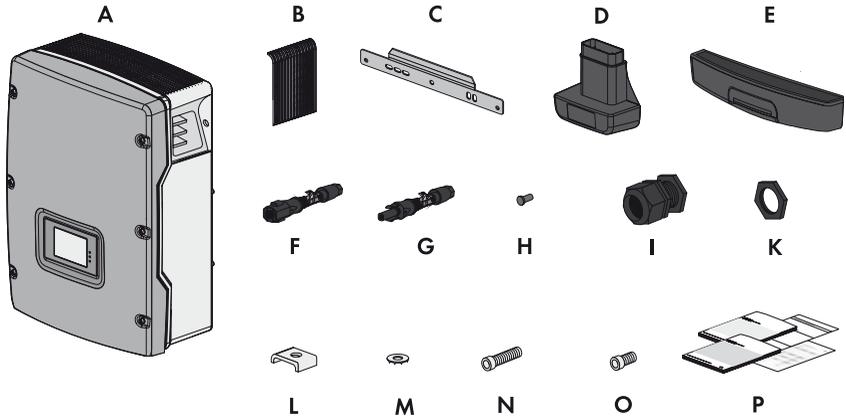


Figure 2: Components included in scope of delivery

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 explanations and certificates, supplementary sheet with default settings, supplementary sheet with information on SMA Webconnect

* 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.

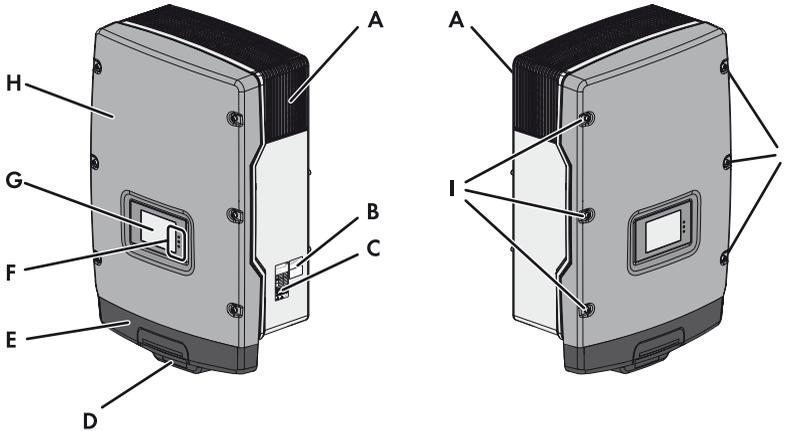


Figure 3: Design of the Sunny Tripower

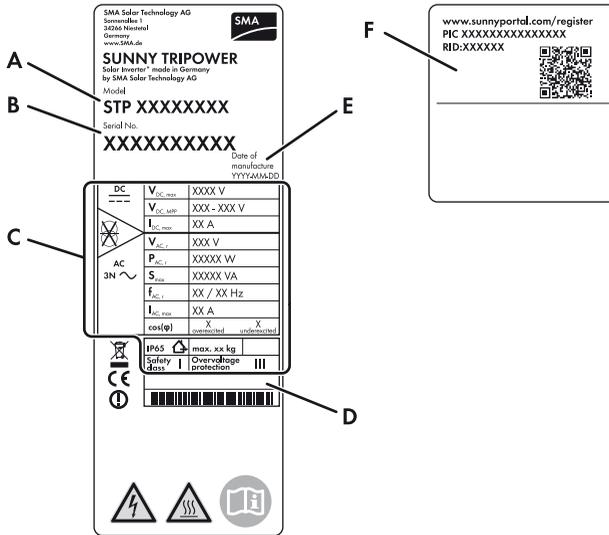
Position	Designation
A	Ventilation grid
B	Additional sticker on the type label
C	Type label
D	Electronic Solar Switch
E	Protective cover
F	LEDs
G	Display
H	Enclosure lid
I	Screws and conical spring washers of the enclosure lid

Symbols on the Inverter

Symbol	Designation	Explanation
	Inverter	This symbol defines the function of the green LED. The green LED indicates the operating state of the inverter.
	Observe the documentation.	This symbol defines the function of the red LED. The red LED indicates an error. Read this document for instructions on how to remedy the error.
	Bluetooth	This symbol defines the function of the blue LED. It indicates that communication via <i>Bluetooth</i> is activated.
	Danger	If a second protective conductor is required, also earth the enclosure (See Section 6.3.3).
	QR Code [®]	The QR Code [®] links to the SMA Bonus Programme (for information on the SMA Bonus Programme, see www.SMA-Bonus.com).

4.2 Type Label

The type label uniquely identifies the inverter. The type label is located on the right-hand side of the enclosure. To the right of the type label, there is an additional sticker with information for registration in Sunny Portal.



Position	Explanation
A	Inverter device type
B	Inverter serial number
C	Device-specific characteristics
D	Field for additional information, e.g. details of country-specific standards
E	Inverter manufacture date (day-month-year)
F	Internet address, identification key (PIC) and registration ID (RID) for registration in Sunny Portal

You require 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	Designation	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 become 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.
<u>DC</u> ---	DC	Direct current
	Without transformer	The product does not have a transformer.
AC 3N ~	AC	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.
	Device class ID	The product is equipped with a wireless component and complies with device class 2.
IP65	Degree of protection	The product is protected against dust intrusion and water jets from any angle.
	Outdoor	The product is suitable for outdoor installation.

Symbol	Designation	Explanation
	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.

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.

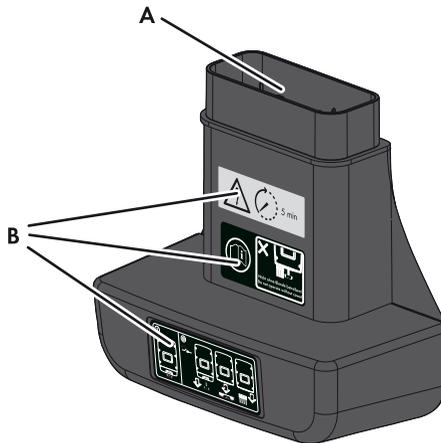


Figure 4: Design of the ESS

Position	Designation	Explanation
A	Plug	The plug and the <i>Bluetooth</i> antenna are inside the enclosure.
B	Label	-

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	Designation	Explanation
	Functionality with ESS plugged in and removed	<ul style="list-style-type: none"> • ① If the ESS is plugged in, the DC electric circuit is closed. • ② To interrupt the DC electric circuit, you must perform the following steps in order: <ul style="list-style-type: none"> • ↓ Remove the ESS. • ↘ Remove the protective cover. • ↘ Unlock and remove all DC connectors.
	Danger to life due to high voltages in the inverter; observe waiting time.	High voltages that can cause fatal electric shocks are present in the live components of the inverter. Disconnect the inverter from any voltage sources before performing any work on it (See Section 9 "Disconnecting the Inverter", Page 61).
	Using 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.

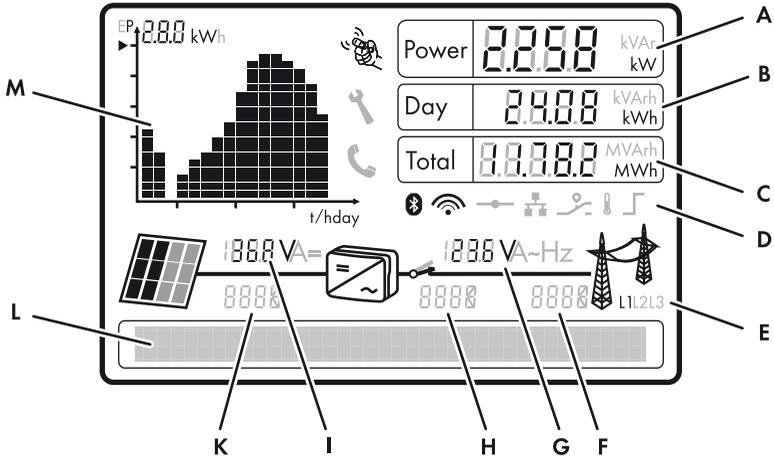


Figure 5: Display design (example)

Position	Designation	Explanation
A	Power	Current power
B	Day	Daily energy
C	Total	Total amount of energy fed in until now
D	Active functions	The different symbols indicate which functions for communication, grid management or temperature derating are enabled or active.
E	Line conductor	Line conductor the displayed values are assigned to
F	Event number relating to the electricity grid	Event number of errors relating to the electricity grid
G	Output voltage/ output current	Alternates between output voltage and output current of a line conductor
H	Event number relating to the inverter	Event number of errors relating to the inverter
I	Input voltage/ input current	Alternates between input voltage and input current of an input

Position	Designation	Explanation
K	Event number relating to the PV array	Event number of errors relating to the PV array
L	Text line	Displays the event message or error message
M	Power and yield curve	Changes in power over the last 16 feed-in hours or the energy yields over the last 16 days <ul style="list-style-type: none"> In order to switch between the displays, tap once on the enclosure lid.

Icons on the Display

Icon	Designation	Explanation
	Tapping	You can operate the display by tapping on the enclosure lid: <ul style="list-style-type: none"> 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, IP address, subnet mask, the configured country data set and display language.
	Telephone receiver	Indicates that the error cannot be rectified on-site <ul style="list-style-type: none"> Contact the SMA Service Line.
	Spanner	Indicates that an error can be rectified on-site
	<i>Bluetooth</i>	Indicates that an active <i>Bluetooth</i> connection is established
	<i>Bluetooth</i> connection quality	Indicates the quality of the <i>Bluetooth</i> connection to other <i>Bluetooth</i> devices
	Speedwire	Indicates that communication via Speedwire is active and there is a network connection

Icon	Designation	Explanation
	Webconnect function	Indicates that there is a connection to Sunny Portal
	Multi-function relay	Indicates that the multi-function relay is active
	Thermometer	Indicates that the power of the inverter is limited due to excessive temperature
	Power limitation	Indicates that the external active power limitation via the plant control is active
	PV array	-
	Inverter	-
	Grid relay	A closed grid relay indicates that the inverter is feeding into the electricity grid. An open grid relay shows that the inverter is disconnected from the electricity grid.
	Electricity grid	-

4.5 Bluetooth

As standard, the inverter is equipped with a *Bluetooth* interface which allows it to communicate 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 Sunny Explorer (for information on changing the plant password, refer to the Sunny Explorer help).

If you do not want to communicate via *Bluetooth*, deactivate *Bluetooth* communication (See Section 7.3 "Setting the NetID", Page 53).

4.6 Speedwire with Webconnect Function

Speedwire is a type of communication based on Ethernet. You can connect the inverter to your network via Speedwire. The Webconnect function 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 connect to Sunny Portal, the inverter must be connected to a router with an Internet connection and be integrated in 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 need the access data, identification key (PIC) and registration ID (RID) on the additional label beside the type label or on the supplementary sheet with information on SMA Webconnect. After registration, you can monitor your plant in Sunny Portal.

4.7 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 8.8). 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).

4.8 Multi-Function Relay

You can use the multi-function relay for various purposes:

Application (operating mode) of multi-function relay	Description
Fault indication	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	The multi-function relay switches the loads on or off depending on the power range of the PV plant.
Control via communication	The multi-function relay switches the loads on and off via a communication product.
Battery bank	The multi-function relay controls the charging of the batteries depending on the power range of the PV plant.
Fan control	The multi-function relay controls an external fan depending on the temperature of the inverter.
Switching status grid relay	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.

There is a different connection procedure depending on how you intend to use the multi-function relay (See Section 6.5.1 "Connection Options for the Multi-Function Relay", Page 44).

The operating mode of the multi-function relay is set by default to **Fault indication**. 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 may have to make further adjustments for the operating mode (See Section 8.6 "Setting the Operating Mode of the Multi-Function Relay", Page 59).

4.9 Slot for SMA Power Control Module

The inverter has a slot for the SMA Power Control Module. The SMA Power Control Module can be retrofitted or installed ex works if ordered accordingly.

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.

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).

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 line 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 caused by 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, leakage currents caused by operation 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 the 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 array 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 8.7).

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 on entry of 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 66).

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 Selecting the Mounting Location

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.

- The mounting location must be inaccessible to children.
- A solid surface 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 considered disturbing.
- It may not be mounted on a pillar.
- The mounting location must be suitable for the weight and dimensions of the inverter (See Section 13 "Technical Data", Page 87).
- The mounting location must be freely and safely accessible at all times without the necessity for any auxiliary equipment, such as scaffolding or lifting platforms. Non-fulfillment of these criteria may restrict servicing.
- The installation site should not be exposed to direct solar irradiation. Direct solar irradiation can heat up the inverter excessively. As a result, the inverter reduces its power output.
- Climatic conditions must be met (See Section 13 "Technical Data", Page 87).
- The ambient temperature must be below 40°C to ensure the optimal operation of the inverter.

Dimensions for wall mounting:

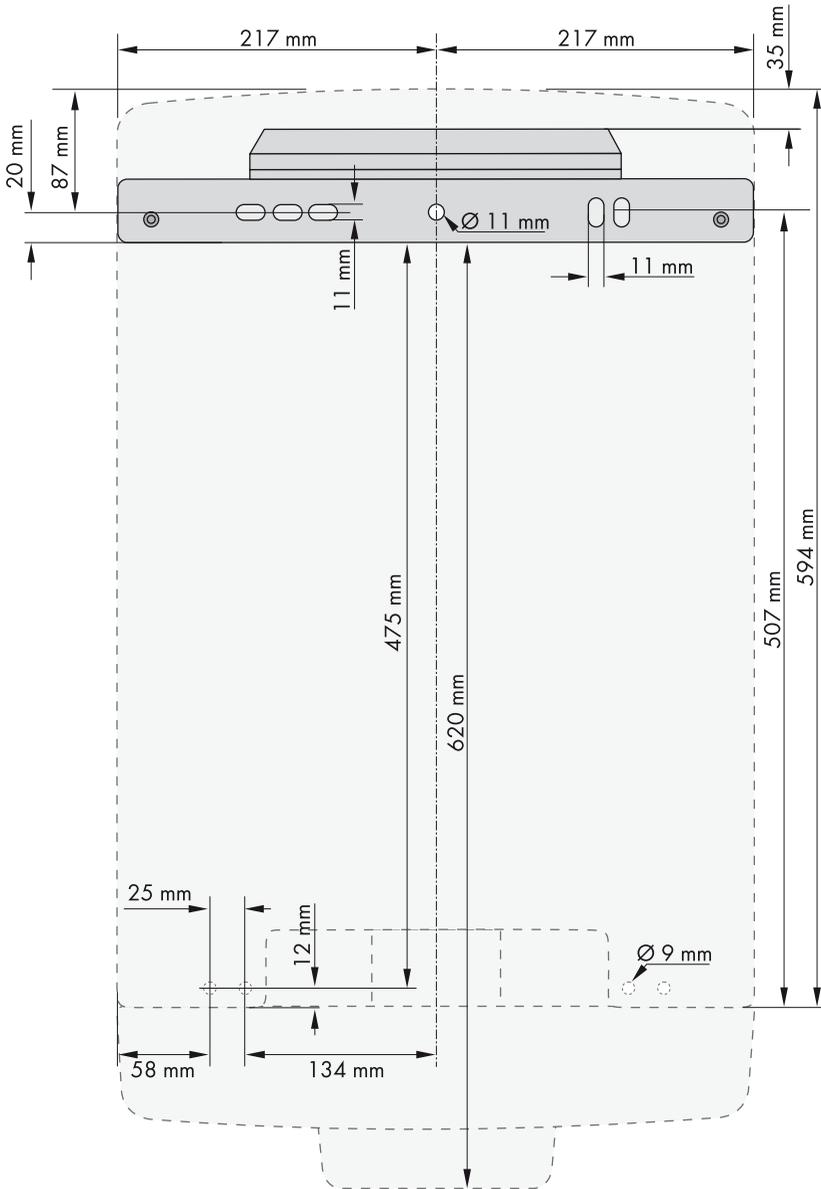


Figure 6: Dimensions of the wall mounting bracket and dimensions of the holes for the optional anti-theft device in the inverter enclosure

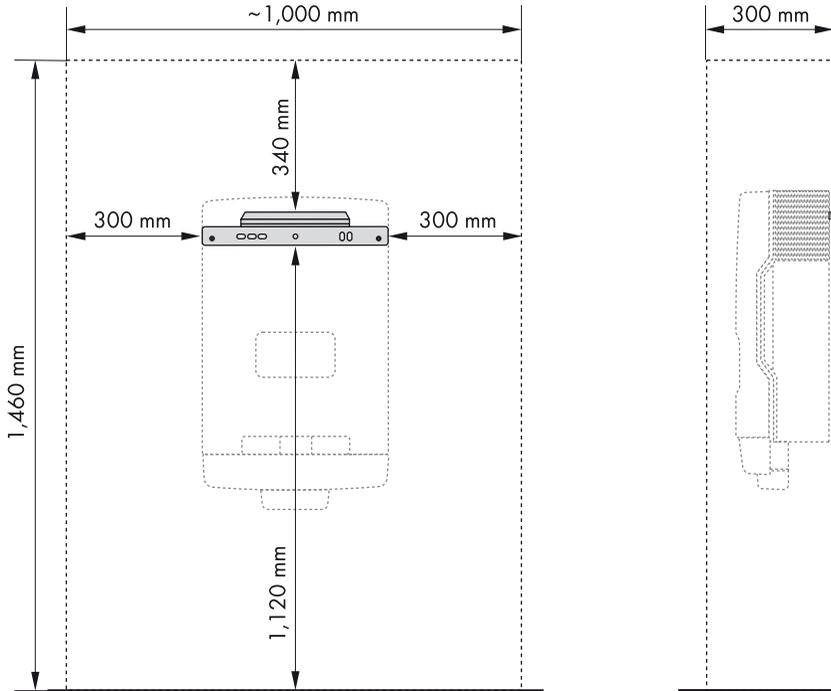
Observe recommended clearances:

Figure 7: Recommended clearances

- Observe the recommended clearances to the walls as well as to other inverters or objects. This ensures adequate heat dissipation and sufficient space to remove the ESS.
- If multiple inverters are mounted in areas with high ambient temperatures, increase the clearances between the inverters and ensure an adequate fresh-air supply.
 - 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 permitted mounting position:

Figure 8: Permitted and prohibited mounting positions

Mount the inverter in a permitted mounting position. The display should be mounted at eye level.

- Mounting the inverter in a permissible position will ensure that no moisture can enter.
- By mounting the device at eye level, display messages and LED signals can be read without difficulty.

5.2 Mounting the Inverter

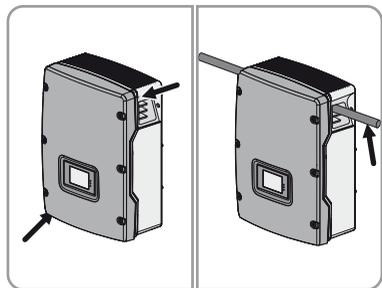
Additionally required mounting material (not included in the scope of delivery):

- 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
- At least two wall plugs that are suitable for the foundation and for the screws
- 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 and from falling inverter**

The inverter is heavy (See Section 1.3 "Technical Data", Page 87). Lifting the inverter incorrectly, or if it falls during transportation or while attaching it to the wall mounting bracket result in a risk of injury.

- Lift and transport the inverter into the mounting position horizontally. Use the side recessed grips or a steel rod (diameter: maximum 30 mm).

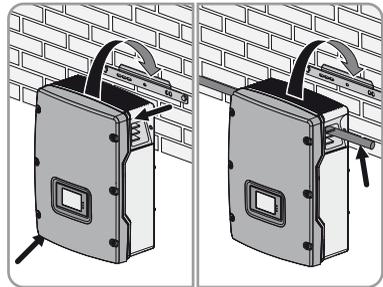


NOTICE**Damage to the ESS socket from dirt and foreign bodies**

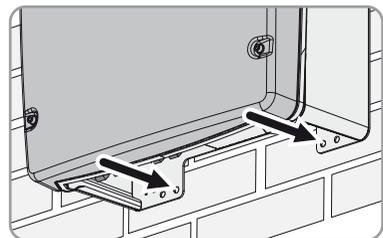
Lowering the inverter onto an uneven building ground can allow dirt or foreign bodies, e.g. stones, to enter the socket and damage the contacts. That prevents the ESS functioning.

- Always lower the inverter on an even building ground.

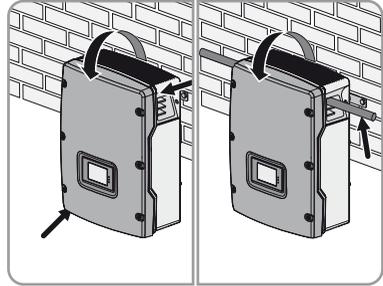
1. Ensure that there are no lines laid in the wall which could be damaged when drilling.
2. Align the wall mounting bracket horizontally on the wall and mark the position of the drill holes using the wall mounting bracket. Use at least one hole on the left-hand side and one on the right-hand side of the wall mounting bracket.
3. Drill the holes and insert the wall plugs.
4. Secure the wall mounting bracket horizontally to the wall using screws and washers.
5. 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 side or right-hand side. If you want to secure the inverter with two safety screws, mark both drill holes.

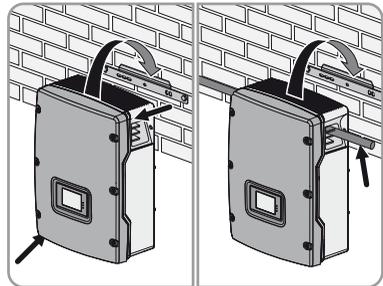


- Remove the inverter by lifting it up vertically and out of the wall mounting bracket.

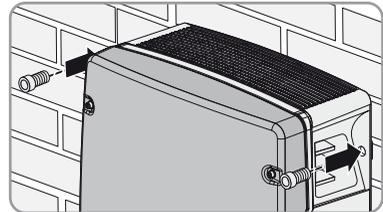


- Drill the hole or the two holes to attach the safety screw and insert the wall plug(s).

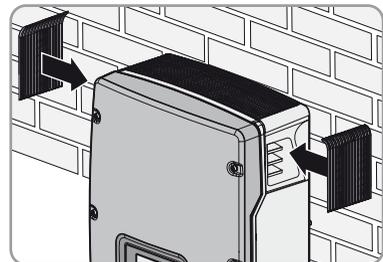
- Hook the inverter into the wall mounting bracket.



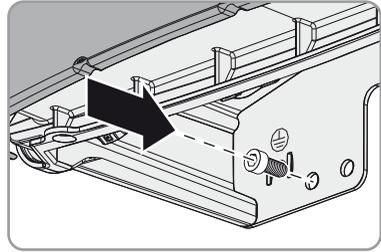
- Attach the inverter to the wall mounting bracket on both sides using the M6x8 screws provided and an Allen key (AF 5). Only tighten the screws hand-tight. That prevents the inverter being lifted out.



- Close the recessed grips with the ventilation grids. Ensure the assignment is correct. Each ventilation grid is assigned to an enclosure side on the inside: **"links/left"** for the left-hand side and **"rechts/right"** for the right-hand side.



9. 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.



10. Ensure that the inverter is securely attached.

6 Electrical Connection

6.1 Safety during Electrical Connection

Electric Shock

High voltages are present in the live components of the inverter. Touching these components can cause fatal electric shock.

- Always disconnect the inverter from voltage sources before performing any work on it as described in this document (See Section 9).

Electrostatic Discharge

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

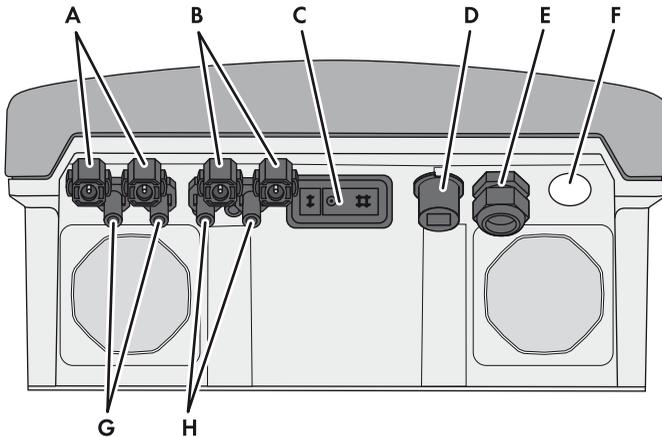


Figure 9: Connection areas and enclosure openings at the bottom of the inverter

Position	Designation
A	Positive DC connectors for connecting the positive DC cables for input A
B	Positive DC connectors for connecting the positive DC cables for input B
C	Socket for connecting the ESS
D	Socket with filler-plug for the network connection

Position	Designation
E	M25 cable gland with filler-plug for connection to the multi-function relay or SMA Power Control Module
F	Enclosure opening for the AC cable
G	Negative DC connectors for connecting the negative DC cables for input A
H	Negative DC connectors for connecting the negative DC cables for input B

6.2.2 Interior View

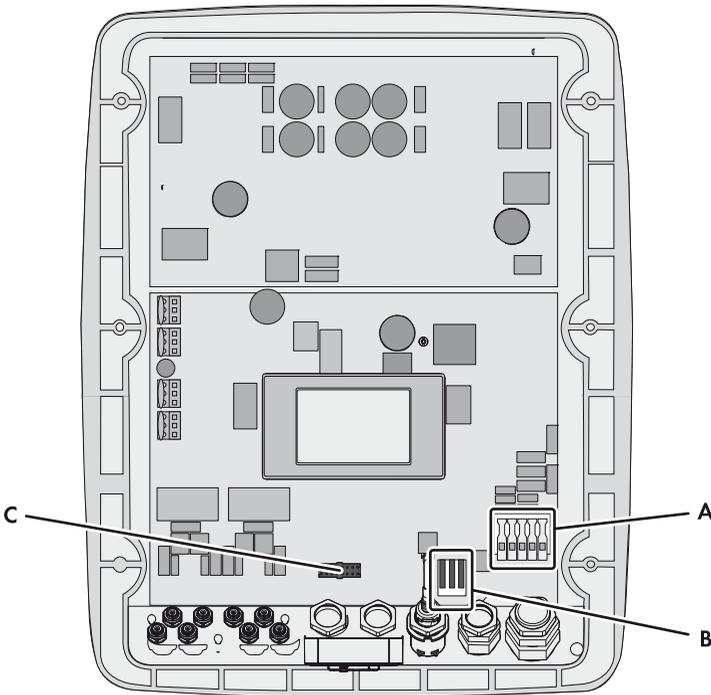


Figure 10: Connection areas in the interior of the inverter

Position	Designation
A	Connecting terminal plate for the AC cable
B	Terminal for connection to the multi-function relay
C	Slot for the SMA Power Control Module

6.3 AC Connection

6.3.1 Conditions for the AC Connection

Cable requirements:

- External diameter of the cable must correspond to the clamping range of the cable gland: 12 mm ... 21 mm
- Recommended conductor cross-section for stiff or flexible cables, with or without bootlace ferrule: 1.5 mm² ... 6 mm²
- Conductor cross-section: 10 mm² at maximum
- Stripping length of the insulated wires: 18 mm
- The cable must be dimensioned in accordance with the local and national directives for the dimensioning of cables. The requirements for the minimum conductor cross-section derive from these directives. Factors influencing cable dimensioning include the following, among others: nominal AC current, type of cable, routing method, cable bundling, ambient temperature and maximum line losses required (for details on how to calculate line losses, see the design software "Sunny Design" from software version 2.0 at 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 fuses or NEOZED fuses) are not switch-disconnectors.

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

- In plants with multiple inverters, protect every inverter with a separate three-phase miniature circuit-breaker. Observe the maximum permissible fuse protection (See Section 13 "Technical Data", Page 87). That prevents residual voltage being present at the corresponding cable after disconnection.
- Loads installed between the inverter and the miniature circuit-breaker must be protected separately.

Residual-current monitoring unit:

- If an external residual-current device is required, install a residual-current device which trips at a residual current of 100 mA or higher (for details on selecting a residual-current device, see the Technical Information "Criteria for Selecting a Residual-Current Device" at www.SMA-Solar.com).
- If a residual-current device with a tripping threshold of 30 mA is required and used, the **RCD adjustment** parameter must be set to 30 mA after initial start-up (See Section 8.5).

Protective conductor monitoring:

The inverter is equipped with protective conductor monitoring which detects when the protective conductor is not connected and disconnects the inverter from the electricity grid when this is the case.



Connection of a second protective conductor

In some countries a second protective conductor is required as a matter of principle. In each case, observe the local applicable regulations.

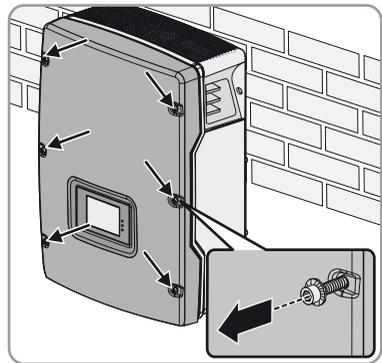
- If a second protective conductor is required, connect a second protective conductor with the same conductor cross-section as the original protective conductor (See Section 6.3.3 "Additional Earthing of the Enclosure", Page 38). This prevents touch current if the original protective conductor fails.

6.3.2 Connecting the Inverter to the Electricity Grid

Requirements:

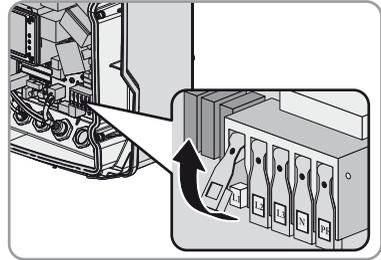
- The connection requirements of the network operator must be met.
- The mains voltage must be in the permissible range. The exact operating range of the inverter is specified in the operating parameters (see the Technical Description "Measured Values and Parameters" at www.SMA-Solar.com).

1. Disconnect the miniature circuit-breaker from all three line conductors and secure against reconnection.
2. Loosen the 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 insulation.
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.

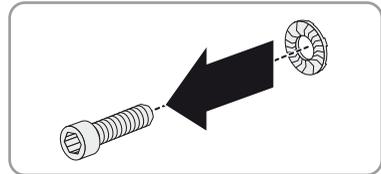


10. Connect the AC cable to the connecting terminal plate for the AC cable:
- Connect the protective conductor to the **PE** terminal and push the safety lever down.
 - Connect the neutral conductor to the **N** terminal and push the safety lever down.
 - Connect the line conductor L3 to the **L3** terminal and push the safety lever down.
 - Connect the line conductor L2 to the **L2** terminal and push the safety lever down.
 - Connect the line conductor L1 to the **L1** terminal and push the safety lever down.

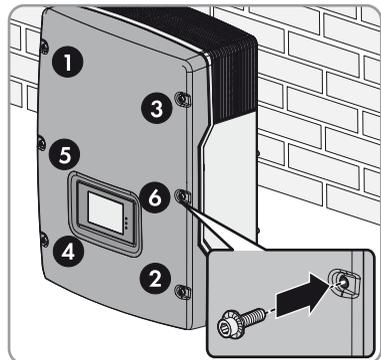
11. Tighten the swivel nut of the cable gland.

12. 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) 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.

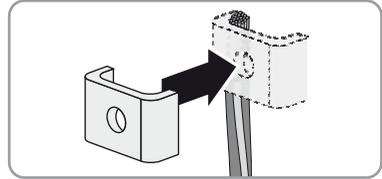
6.3.3 Additional Earthing of the Enclosure

If a second protective conductor or equipotential bonding is required locally, you can also earth the enclosure. This prevents touch current if the original protective conductor fails.

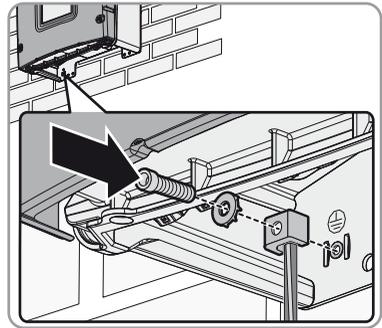
Cable requirement:

- Earthing cable cross-section: 16 mm² at maximum

1. Strip the earthing cable insulation.
2. Lead the clamping bracket over the earthing cable. Arrange the protective conductor on the left.



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 Conditions for 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 87).
- The thresholds for the input voltage and the input current of the inverter must be observed (See Section 13 "Technical Data", Page 87).
- At an ambient temperature over 10 °C, the open-circuit voltage of the PV modules must not exceed 90% of the maximum input voltage of the inverter. That prevents the voltage exceeding the maximum input voltage of the inverter at lower ambient temperatures.

- The positive connection cables of the PV modules must be equipped with the positive DC connectors.
- The negative connection cables of the PV modules must be equipped with the negative DC connectors.

i 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 may not be visible or freely accessible.
- Only disconnect the inverter as described in this manual (See Section 9).

6.4.2 Assembling the DC Connectors

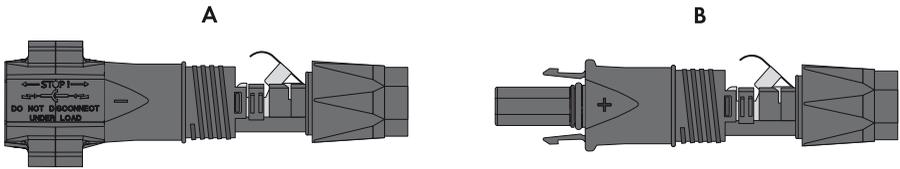


Figure 11: DC connectors

Position	Designation
A	Negative DC connector
B	Positive DC connector

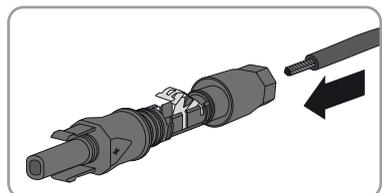
Cable requirements:

The cable must be of type PV1-F, UL-ZKLA or USE2 and comply with the following properties:

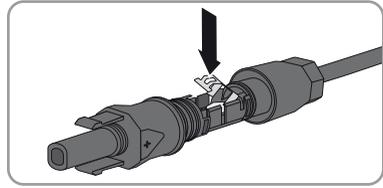
- External diameter: 5 mm ... 8 mm
- Conductor cross-section: 2.5 mm² ... 6 mm²
- Number of conductors: at least seven
- Nominal voltage: at least 1,000 V

Proceed as follows to assemble each DC connector.

1. Strip 12 mm of the cable insulation.
2. Route the stripped cable all the way into the DC connector. Ensure that the stripped cable and the DC connector have the same polarity.

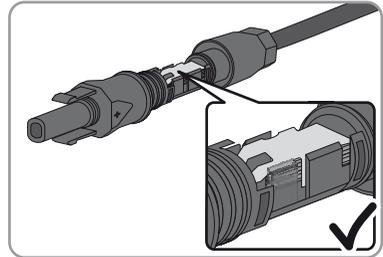


3. Push the clamping bracket down.



☑ The clamping bracket clicks audibly into place.

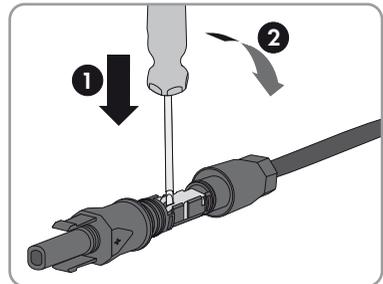
☑ The stranded wire can be seen inside the clamping bracket chamber.



✘ Is the stranded wire not visible in the chamber?

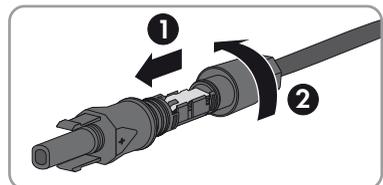
The cable is not correctly in place.

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



- Remove the cable and go back to step 2.

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



6.4.3 Connecting the PV Array

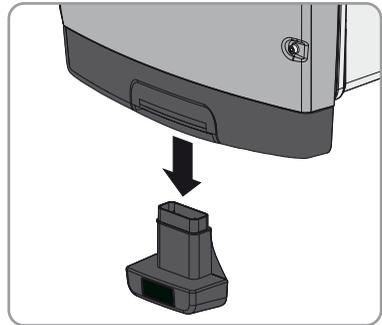
NOTICE

Destruction of the inverter due to overvoltage

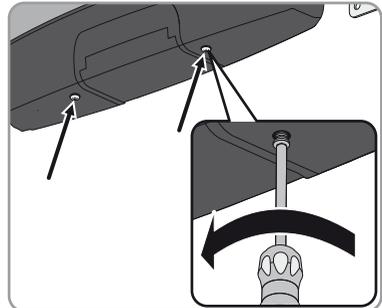
If the open-circuit voltage of the PV modules exceeds the maximum input voltage of the inverter, the inverter can be destroyed by the overvoltage.

- 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 line conductors and secure against reconnection.
2. If the ESS is plugged in, remove the ESS.

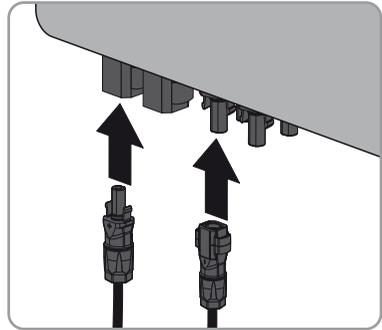


3. If the protective cover is mounted, loosen the two screws of the protective cover using an Allen key (AF 5) and remove the protective cover.



4. Check the PV strings for earth faults (See Section 11.5).

5. Connect the assembled DC connectors to the inverter.



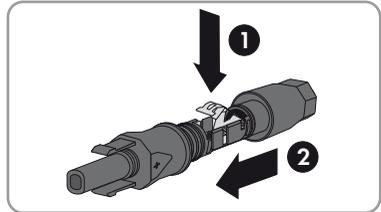
- The DC connectors click audibly into place.

6. **NOTICE**

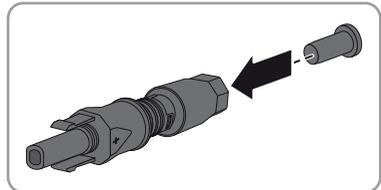
Damage to the inverter due to moisture penetration

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

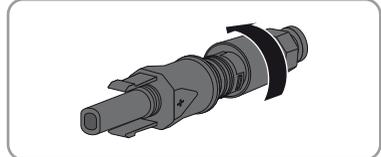
- **DO NOT** insert the sealing plugs **DIRECTLY** into the DC inputs on the inverter.
- For unused DC connectors, push down the clamping bracket and push the swivel nut to the thread.



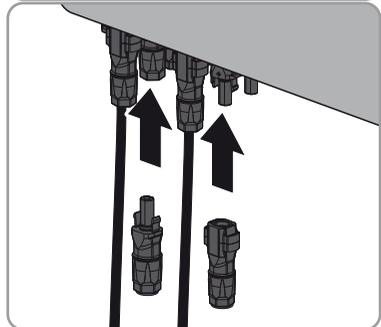
- Insert the sealing plug into the DC connector.



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



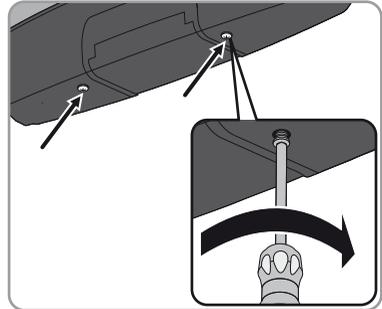
- Insert the DC connectors with sealing plugs into the corresponding DC inputs on the inverter.
 - ☑ The DC connectors click audibly into place.



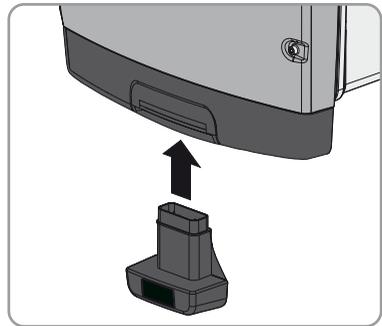
7. Ensure that all DC connectors are securely in place.

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 signaling contact
- Controlling loads or charging batteries via the multi-function relay
- Reporting the switching status of grid relay

Using the Multi-Function Relay as Fault Signaling Contact

You can make use of the multi-function relay as a fault signaling 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.

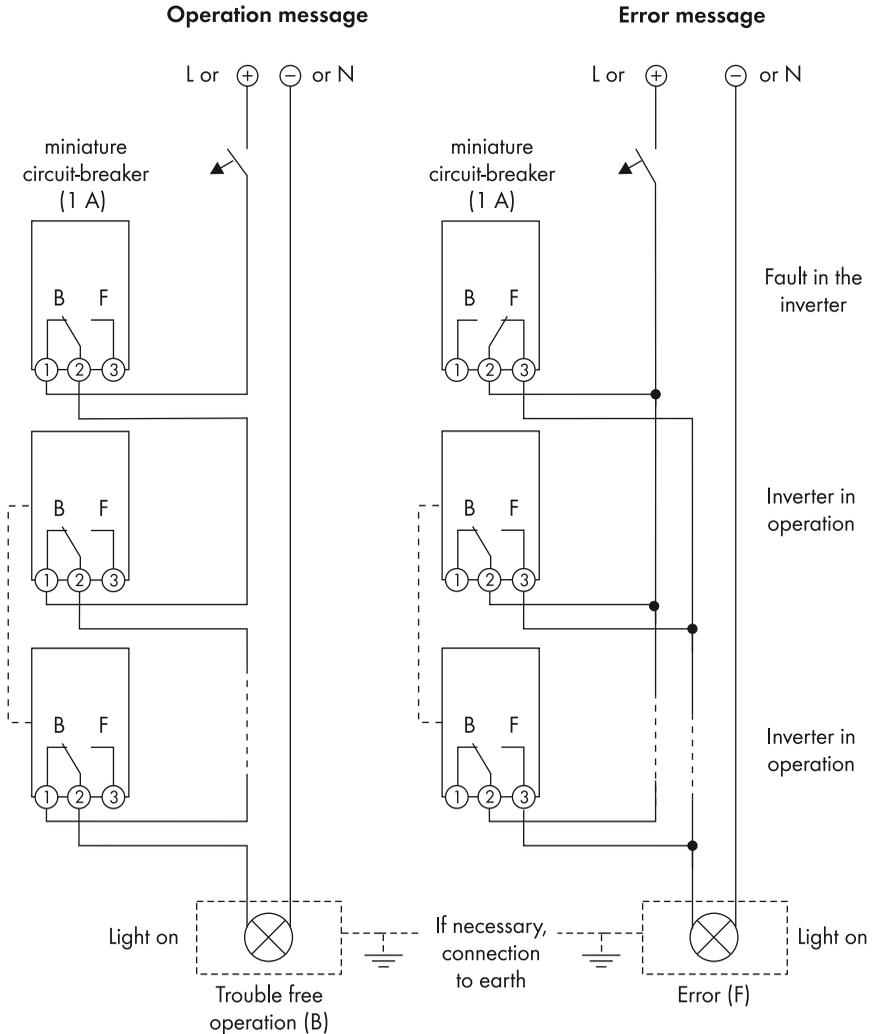


Figure 12: Circuit diagram with multiple inverters for connection to an operation indicator and circuit diagram for connection to a fault indicator (example)

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.

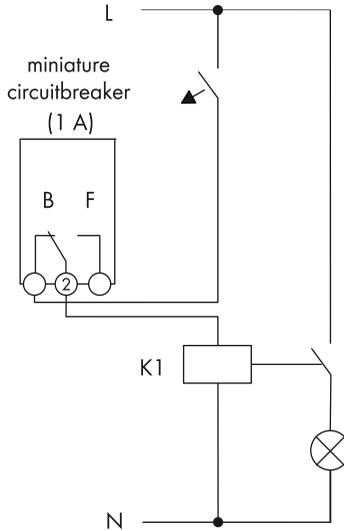


Figure 13: Circuit diagram for connection to control a load or for power-dependent charging of batteries

Reporting the Switching Status of Grid Relay

The multi-function relay can trip 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.

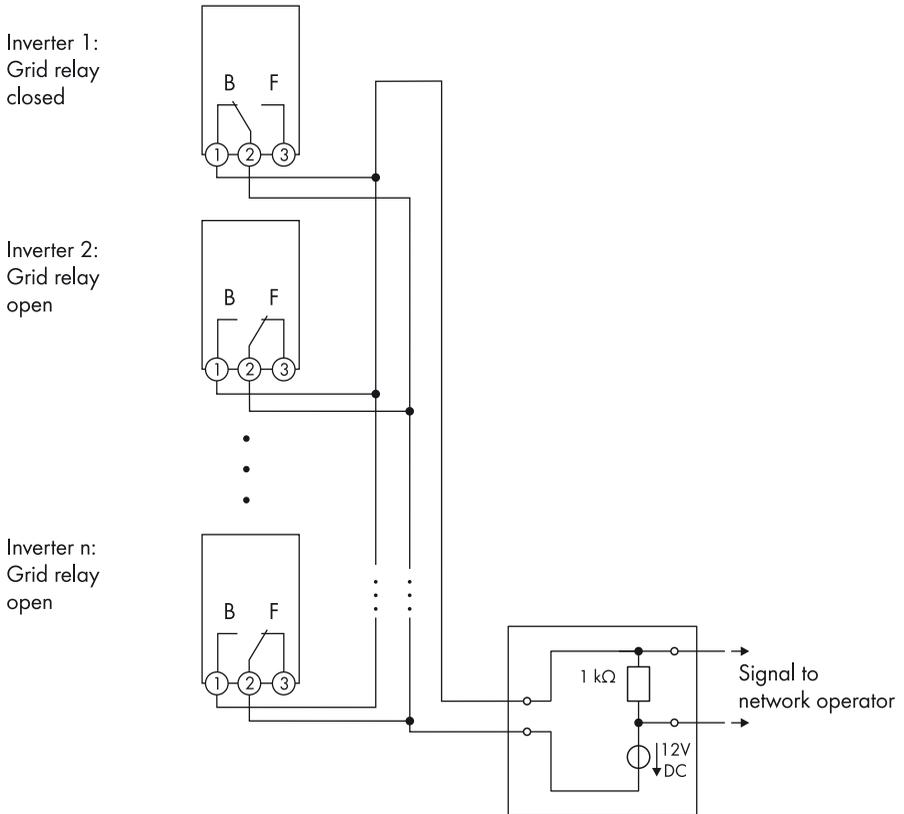


Figure 14: Circuit diagram for reporting the switching status of the grid relay (example)

6.5.2 Connection to the Multi-Function Relay

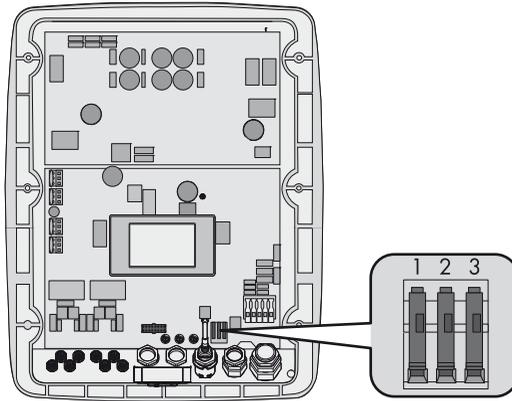


Figure 15: Connecting terminal plate for connecting to the multi-function relay

Requirements:

- The technical requirements of the multi-function relay must be met (See Section 13 "Technical Data", Page 87).

Cable requirements:

- The cable is double-insulated.
- External diameter: 5 mm ... 12 mm
- Conductor cross-section: 0.08 mm² ... 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

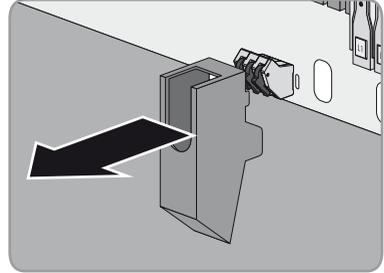
- Observe the maximum switching voltage and maximum switching current (See Section 13.8 "Multi-Function Relay", Page 99).
- When connecting the multi-function relay to the electricity grid, fuse the multi-function relay with a separate miniature circuit-breaker.



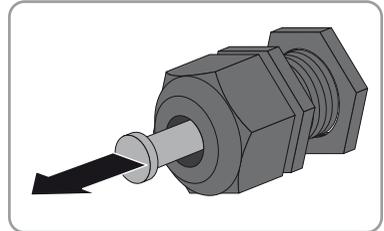
Operating the Multi-Function Relay and SMA Power Control Module in Parallel

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

1. When connecting to the electricity grid, fuse the multi-function relay with a separate miniature circuit-breaker.
2. Ensure that the inverter is disconnected from voltage sources (See Section 9).
3. Remove the protective cover of the multi-function relay.



4. Remove the filler-plug from the M25 cable gland for connection to the multi-function relay.



5. Route the cable into the inverter through the cable gland. If necessary, slightly loosen the swivel nut of the M25 cable gland for connection to the multi-function relay.
6. Strip 15 mm of the cable insulation at maximum.
7. Strip 8 mm of the insulated wires at maximum.
8. Depending on the intended use (operating mode), connect the cable to the connecting terminal plate for connection to the multi-function relay in accordance with the circuit diagram.

9. **⚠ WARNING**

Danger to life due to live cables

If one insulated wire, e.g. L1, L2 or L3 comes loose from the AC terminal, and touches the connection cable of the multi-function relay for example, the connection cable is live.

- Attach the protective cover of the multi-function relay. That isolates the AC connection area from other connections.

10. Tighten the swivel nut of the cable gland.
11. Commission the inverter (See Section 7).

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
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.	(See Section 7.2)
3. If the inverter is to communicate with multiple <i>Bluetooth</i> devices or if <i>Bluetooth</i> is not to be used as the type of communication, adjust the NetID.	(See Section 7.3)
4. Commission the inverter for the first time.	(See Section 7.4)

7.2 Adjusting the Country Data Set

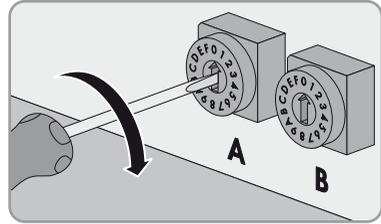
A display language is assigned to every country data set. Set the country data set with the corresponding display language appropriate for your country or purpose. If the display language does not match the required language, you can change it after commissioning (See Section 8.1).

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 valid 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.

1. Ensure that the inverter is open and no voltage is present (See Section 9).
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	1	RD1663/661-A	Spanish
4	8	PPC	Greek
4	9	PPC	English
5	8	G83/1-1	English
6	0	EN50438	German
6	1	EN50438	English
6	2	EN50438	French
6	3	EN50438	Italian
6	4	EN50438	Spanish
6	5	EN50438	Greek
6	6	EN50438	Czech
6	7	EN50438	Portuguese
6	8	EN50438	Bulgarian

Rotary switch A	Rotary switch B	Country data set	Display language
6	9	EN50438	Polish
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	French
7	9	C10/11	English
7	A	C10/11	German
7	B	C10/11	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
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

Rotary switch A	Rotary switch B	Country data set	Display language
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)

**** Special setting for France: *Bluetooth* transmission power reduced in accordance with French requirements

***** 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.

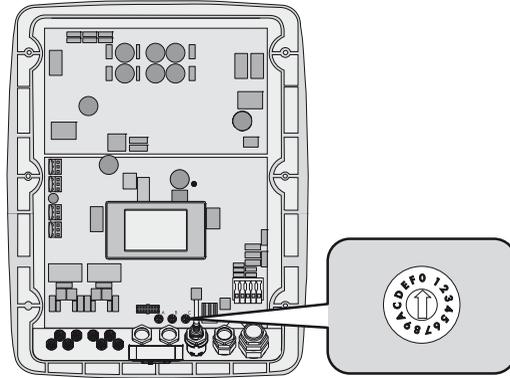
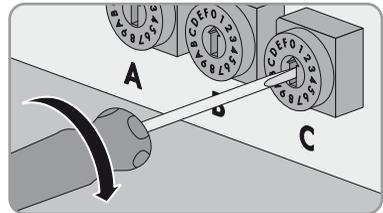


Figure 16: Positions of rotary switch C

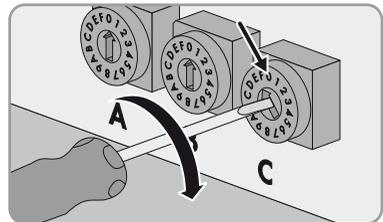
Position	Explanation
0	Bluetooth communication is deactivated.
1	Communication via Bluetooth with another Bluetooth device
2 ... F	NetID for communication via Bluetooth with multiple Bluetooth devices

1. Ensure that the inverter is open and no voltage is present.

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 ESS must be securely plugged in.
- The protective cover must be correctly mounted.
- The inverter must be closed.

1. Switch on the miniature circuit-breakers of all three line conductors.
2. If the 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, IP address, subnet mask, the configured country data set and 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.

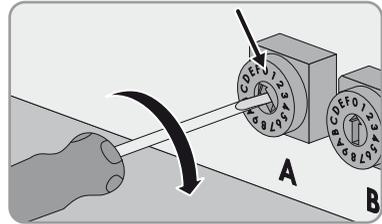
 - If the DC input voltage is sufficiently high and the grid connection conditions are met, the inverter starts operation.
 - The red LED is glowing and an error message and event number appear in the display?
 - Rectify the error (See Section 1.1 "Troubleshooting", Page 66).
3. Configure the inverter (See Section 8).

8 Configuration

8.1 Changing the Display Language

If the language for the country data set is not the language you want set, you can change the display language using the following procedure.

1. Disconnect the inverter from voltage sources and open the enclosure lid (See Section 9).
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).
 - The inverter adopts the settings after commissioning. This can take up to five minutes.

8.2 Connecting the Inverter to the Network

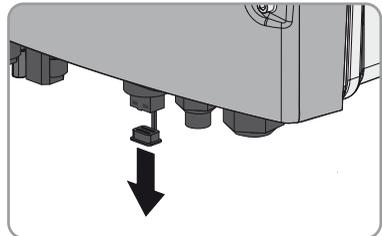
Required material (not included in the scope of delivery):

- One mating plug for RJ45 socket in accordance with IEC 61076-3-106, model 4 with push-pull lock

Recommendations:

- "STX V4 RJ45" plug set; manufacturer: Telegärtner
 - "IE-PS-V04P-RJ45-FH" plug set; manufacturer: Weidmüller
- One network cable with the following properties:
 - Cable type: 100BaseTx, Cat5 with S-UTP, F-UTP shielding or higher
 - Cross-section: at least 2x2x0.22 mm² or at least 2x2 AWG 24
 - Maximum cable length: 50 m
 - UV-resistant for outdoor use
 - Type of plug: RJ45

1. Disconnect the inverter from voltage sources (See Section 9).
2. Connect one end of the network cable to the mating plug (see documentation of mating plug).
3. Remove the filler-plug from the socket for connecting the inverter to the network.



4. 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.
5. Connect the other end of the network cable to the network or to one of the other nodes. You can only connect the inverter to the other nodes via a star network topology.

8.3 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 Sunny Explorer.

Requirements:

- Depending on the type of communication, a computer with a *Bluetooth* or Ethernet interface must be available.
 - Sunny Explorer with software version 1.05 or higher must be installed on the computer.
 - The plant must be registered in Sunny Explorer.
- Change the standard plant password (see Sunny Explorer help). This protects your plant from unauthorised access.
 - Change the plant time (see Sunny Explorer help).

8.4 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 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 supplementary label beside the type label or supplementary sheet with information on SMA Webconnect).
- Register the inverter in Sunny Portal (see the user manual of Webconnect plants in Sunny Portal).

8.5 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 **RCD adjustment** parameter to 30 mA (for further information, see the Technical Information "Capacitive Leakage Currents" at www.SMA-Solar.com).

Requirement:

- A communication product that is appropriate for the type of communication used must be available.
1. Log in as an **Installer** in the communication product.
 2. Set the **RCD adjustment** parameter to **30 mA**.
 3. Save setting.

8.6 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.

1. Select the parameter **Operating mode of multifunction relay** and set the required operating mode (See Section 4.8).
2. Once you have set the **Self-consumption** operating mode, you can make other settings:
 - Select the parameter **Minimum On power for MFR self-consumption** and set the required 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** and set the required 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** and set the required value. By doing this, you are setting the minimum time for which the load remains activated.
3. If you have set the Control via communication operating mode, select the parameter **Status of MFR with control via communication** and set the required 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 Battery bank operating mode, then make other settings:
 - Select the parameter **Minimum On power for MFR battery bank** and set the required 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** and set the required value. By doing this, you are setting the minimum time which must elapse after charging the battery before the battery can be charged again.

8.7 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.

Requirement:

- A communication product that is appropriate for the type of communication used must be available.
1. Log in to the communication product as an **Installer**.
 2. Select the parameter **OptiTrac Global Peak switched on** and set to **On**.
 3. Select the parameter **Cycle time of the OptiTrac Global Peak algorithm** and set the required time interval. Useful hint: 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.

8.8 Changing Operating Parameters

The operating parameters of the inverter are set to certain values by default (for information on the default settings of the inverter, see the Technical Description "Parameter Settings" at www.SMA-Solar.com). 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 the Technical Description "Measured Values and Parameters" at www.SMA-Solar.com).

Always proceed as follows to change an operating parameter (e.g. the active power limitation).

Requirements:

- A communication product that is appropriate for the type of communication used must be available.
 - The changes to the grid-relevant 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).
1. Access the user interface of the communication product and log in as an installer.
 2. If necessary, enter the SMA Grid Guard code.
 3. Select and set the required parameter.
 4. Save setting.

9 Disconnecting the Inverter

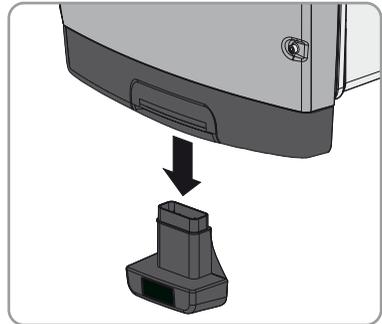
Always disconnect the inverter from voltage sources before performing any work on it as described in this section. Always proceed according to the required sequence to do so.

NOTICE

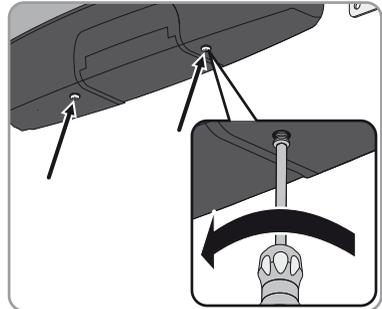
Destruction of the measuring device due to overvoltage

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

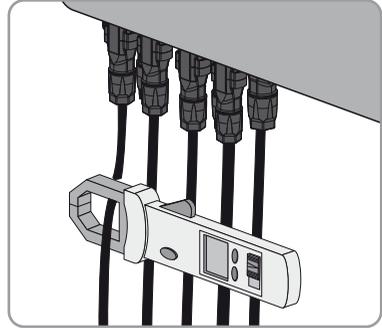
1. Disconnect the miniature circuit-breaker from all three line conductors and secure against reconnection.
2. Remove the ESS.



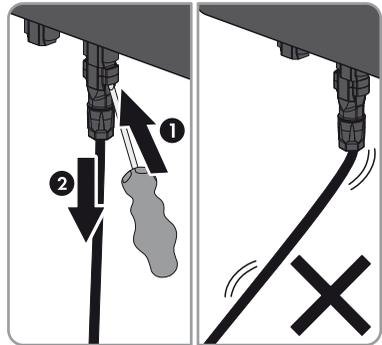
3. Loosen two screws of the protective cover using an Allen key (AF 5) and remove the protective cover.



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** whilst doing this.



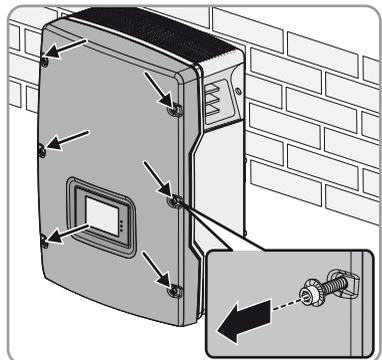
6. **⚠ DANGER**

Danger to life due to high voltages

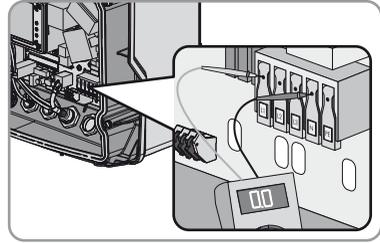
The capacitors in the inverter take five minutes to discharge.

- Wait five minutes before opening the enclosure lid.

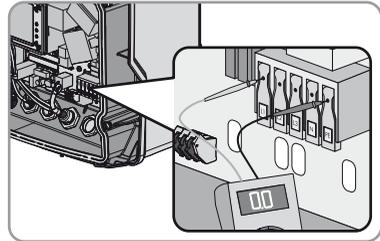
7. Ensure that no voltage is present at the DC inputs of the inverter.
8. Loosen all screws of the enclosure lid using a Allen key (AF 5) and remove the enclosure lid.



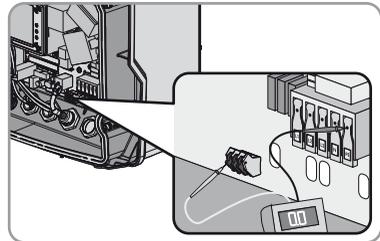
9. Ensure that no voltage is present between **L1** and **N**, **L2** and **N** and **L3** and **N** on the AC connecting terminal plate one after another using a suitable measuring device. Insert a test probe in each round opening of the terminal.



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

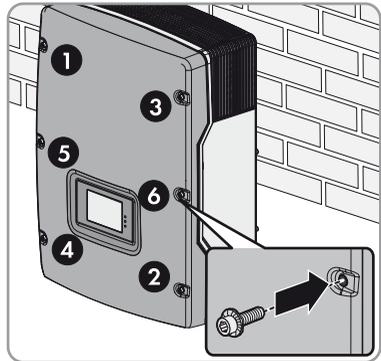
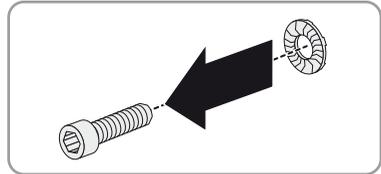
If you have disconnected the inverter from voltage sources (e.g. for configuration purposes) and want to recommission it, proceed as follows.

Requirements:

- The miniature circuit-breaker must be correctly rated.
- The inverter must be correctly mounted.

1. Close the inverter and earth the enclosure lid:

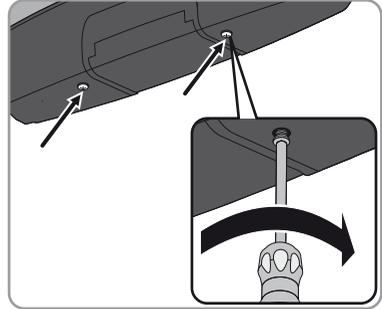
- Attach one conical spring washer to each screw. The grooved side of the conical spring washer must point to the screw head.
- Secure the enclosure lid in the sequence 1 to 6 (torque: 6 Nm) using an Allen key (AF 5).



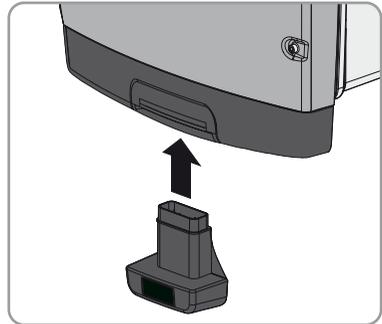
- The teeth of the conical spring washers are pushed into the enclosure lid. This ensures that the enclosure lid is earthed.

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 line 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, IP address, subnet mask, the configured country data set and 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.

 - If the DC input voltage is sufficiently high and the grid connection conditions are met, the inverter starts operation.
 - ✘ The red LED is glowing and an error message and event number appear in the display?
 - Rectify the error (See Section 1.1 "Troubleshooting", Page 66).

11 Troubleshooting

11.1 LED Signals

The LEDs indicate the operating state of the inverter.

LED	Status	Explanation
Green LED	Glowing	Operation If an event occurs, the event message is shown in the display (See Section 11.2).
	Flashing	The requirements for the connection to the electricity grid have not been met.
Red LED	Glowing	Error The display shows the error message and event number (See Section 11.3).
Blue LED	Glowing	<i>Bluetooth</i> Communication is activated.

11.2 Event Messages

Display message	Cause
Update file OK	The update file found is valid.
SD card is read	The inverter is currently reading the SD card.
No new update SDcard	There are no update files relevant for this inverter on the SD card or the available update has already been carried out.
Grid param. locked	The 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 <i>Bluetooth</i>	The inverter is updating the <i>Bluetooth</i> 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 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 ... 103	Grid fault	<p>The mains voltage or grid impedance at the termination point of the inverter is too high. The inverter has disconnected from the electricity grid.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Check that the mains voltage at the termination point of the inverter is permanently in the permissible range. <p>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.</p> <p>If the mains voltage is permanently in the permissible range and this message is still displayed, contact the SMA Service Line.</p>

Event number	Display message	Cause and corrective measures
202 ... 203	Grid fault	<p>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.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • 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. <p>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.</p> <p>If the mains voltage is permanently in the permissible range and this message is still displayed, contact the SMA Service Line.</p>

Event number	Display message	Cause and corrective measures
301	Grid fault	<p>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.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Check that the mains voltage at the termination point of the inverter is permanently in the permissible range. <p>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.</p> <p>If the mains voltage is permanently in the permissible range and this message is still displayed, contact the SMA Service Line.</p>
401	Grid fault	<p>The inverter is no longer in grid-parallel operation. The inverter has stopped feeding into the electricity grid.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Check the grid connection for significant, short-term frequency fluctuations.
404	Grid fault	<p>The inverter is no longer in grid-parallel operation. The inverter has stopped feeding into the electricity grid.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Check the grid connection for significant, short-term frequency fluctuations.

Event number	Display message	Cause and corrective measures
501	Grid fault	<p>The mains frequency is not within the permissible range. The inverter has disconnected from the electricity grid.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • As far as possible, check the mains frequency and observe how often major fluctuations occur. <p>If fluctuations occur frequently and this message is displayed often, contact the network operator and ask whether they approve a change of the inverter operating parameters.</p> <p>If the network operator approves, discuss any changes to the operating parameters with the SMA Service Line.</p>
601	Grid fault	<p>The inverter has detected an excessively high proportion of direct current in the mains current.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Check the grid connection for direct current. • If this message is displayed frequently, contact the network operator and check whether it is possible to raise the threshold for monitoring on the inverter.

Event number	Display message	Cause and corrective measures
701	Frq. not permitted Check parameter	<p>The mains frequency is not within the permissible range. The inverter has disconnected from the electricity grid.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> As far as possible, check the mains frequency and observe how often major fluctuations occur. <p>If fluctuations occur frequently and this message is displayed often, contact the network operator and ask whether they approve a change of the inverter operating parameters.</p> <p>If the network operator approves, discuss any changes to the operating parameters with the SMA Service Line.</p>
1302	Waiting for grid voltage Installation failure grid connection Check grid and fuses	<p>The inverter has detected an error in the AC cabling or the potential difference between the neutral conductor and the protective conductor in the building installation is above 50 V.</p> <p>The inverter cannot connect to the electricity grid.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> Ensure that the AC connection at the inverter is correct (See Section 6.3.2). Ensure that there is no potential difference between the neutral conductor and the protective conductor in the building installation. Ensure that the country data set has been configured correctly. Check the setting of the rotary switches A and B or select the parameter Set country standard and check the value.

Event number	Display message	Cause and corrective measures
1501	Reconnection fault grid	<p>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.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Ensure that the country data set has been configured correctly. Check the setting of the rotary switches A and B or select the parameter Set country standard and check the value.
3302 ... 3303	Unstable operation	<p>There is not enough power at the DC input of the inverter for stable operation. The inverter cannot connect to the electricity grid.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Ensure that the PV array is designed correctly.
3401 ... 3402	DC overvoltage Disconnect generator	<p>Overvoltage at DC input. The inverter may be destroyed.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • IMMEDIATELY DISCONNECT THE INVERTER from voltage sources (See Section 9). • 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.

Event number	Display message	Cause and corrective measures
3501	Insulation resist. Check generator	The inverter has detected an earth fault in the PV array. Corrective measures: <ul style="list-style-type: none"> • Check the PV plant for earth faults (See Section 11.5).
3601	High discharge curr. Check generator	The leakage current from the inverter and the PV array is too high. This can be caused by an earth fault, a residual current or a malfunction. The inverter interrupts feed-in operation immediately after exceeding a threshold and then automatically reconnects to the electricity grid. Corrective measures: <ul style="list-style-type: none"> • Check the PV plant for earth faults (See Section 11.5).
3701	Resid.curr.too.high Check generator	The inverter has detected a residual current due to temporary PV array earthing. Corrective measures: <ul style="list-style-type: none"> • Check the PV plant for earth faults (See Section 11.5).
3801 ... 3802	DC overcurrent Check generator	Overcurrent at the DC input. The inverter briefly interrupts feed-in. Corrective measures: <ul style="list-style-type: none"> • If this message is displayed frequently, ensure that the PV array has been correctly rated and wired.
3901 ... 3902	Waiting for DC start conditions Start cond. not met	The requirements for the feed-in to the electricity grid have not been met. Corrective measures: <ul style="list-style-type: none"> • 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.

Event number	Display message	Cause and corrective measures
6001 ... 6009	Self diagnosis Interference device	The cause must be determined by the SMA Service Line. Corrective measures: <ul style="list-style-type: none"> • Contact the SMA Service Line.
6101 ... 6112	Self diagnosis Interference device	The cause must be determined by the SMA Service Line. Corrective measures: <ul style="list-style-type: none"> • Contact the SMA Service Line.
6201 ... 6203	Self diagnosis Interference device	The cause must be determined by the SMA Service Line. Corrective measures: <ul style="list-style-type: none"> • Contact the SMA Service Line.
6301	Self diagnosis Interference device	The cause must be determined by the SMA Service Line. Corrective measures: <ul style="list-style-type: none"> • Contact the SMA Service Line.
6304 ... 6306	Self diagnosis Interference device	The cause must be determined by the SMA Service Line. Corrective measures: <ul style="list-style-type: none"> • Contact the SMA Service Line.
6401 ... 6416	Self diagnosis Interference device	The cause must be determined by the SMA Service Line. Corrective measures: <ul style="list-style-type: none"> • Contact the SMA Service Line.
6422	Self diagnosis Interference device	The cause must be determined by the SMA Service Line. Corrective measures: <ul style="list-style-type: none"> • Contact the SMA Service Line.
6433	Self diagnosis Interference device	The cause must be determined by the SMA Service Line. Corrective measures: <ul style="list-style-type: none"> • Contact the SMA Service Line.
6437 ... 6438	Self diagnosis Interference device	The cause must be determined by the SMA Service Line. Corrective measures: <ul style="list-style-type: none"> • Contact the SMA Service Line.

Event number	Display message	Cause and corrective measures
6501 ... 6502	Self diagnosis Overtemperature	The inverter has switched off due to excessive temperature. Corrective measures: <ul style="list-style-type: none"> • Clean the fans Cleaning the Fans. • Ensure that the inverter has sufficient ventilation.
6509	Self diagnosis Overtemperature	The inverter has switched off due to excessive temperature. Corrective measures: <ul style="list-style-type: none"> • Clean the fans Cleaning the Fans. • Ensure that the inverter has sufficient ventilation.
6511	Overtemperature	The inverter has switched off due to excessive temperature. Corrective measures: <ul style="list-style-type: none"> • Clean the fans Cleaning the Fans. • Ensure that the inverter has sufficient ventilation.
6603 ... 6604	Self diagnosis Overload	The cause must be determined by the SMA Service Line. Corrective measures: <ul style="list-style-type: none"> • Contact the SMA Service Line.
6801 ... 6802	Self diagnosis Input A defective	The cause must be determined by the SMA Service Line. Corrective measures: <ul style="list-style-type: none"> • Contact the SMA Service Line.
6901 ... 6902	Self diagnosis Input B defective	The cause must be determined by the SMA Service Line. Corrective measures: <ul style="list-style-type: none"> • Contact the SMA Service Line.
7001 ... 7002	Sensor fault fan permanently on	The cause must be determined by the SMA Service Line. Corrective measures: <ul style="list-style-type: none"> • Contact the SMA Service Line.

Event number	Display message	Cause and corrective measures
7401	Varistor defective	At least one of the thermally monitored varistors is defective. Corrective measures: <ul style="list-style-type: none"> • Check the function of the varistors (See Section 11.6).
7701 ... 7703	Self diagnosis Interference device	The cause must be determined by the SMA Service Line. Corrective measures: <ul style="list-style-type: none"> • Contact the SMA Service Line.
8001	Derating occurred	The inverter has reduced its power output for more than ten minutes due to excessive temperature. Corrective measures: <ul style="list-style-type: none"> • If this message is displayed frequently, clean the fans Cleaning the Fans. • Ensure that the inverter has sufficient ventilation.
8101 ... 8104	Comm. disturbed	The cause must be determined by the SMA Service Line. Corrective measures: <ul style="list-style-type: none"> • Contact the SMA Service Line.
8801 ... 8803	No display	This error message can have three causes, yet the inverter still 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: <ul style="list-style-type: none"> • 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.

Event number	Display message	Cause and corrective measures
9002	Inst. code invalid	The SMA Grid Guard code entered is not correct. The parameters are still protected and cannot be changed. Corrective measures: <ul style="list-style-type: none"> Enter the correct SMA Grid Guard code.
9003	Grid param. locked	The parameters are now locked. You cannot change the parameters. Corrective measures: <ul style="list-style-type: none"> Unlock the parameters with the SMA Grid Guard code.

11.4 Cleaning the Inverter

NOTICE

Damage to the display by 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 parts of the sub-structure and 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.

1. Disconnect the inverter from voltage sources (See Section 9).
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 poles.

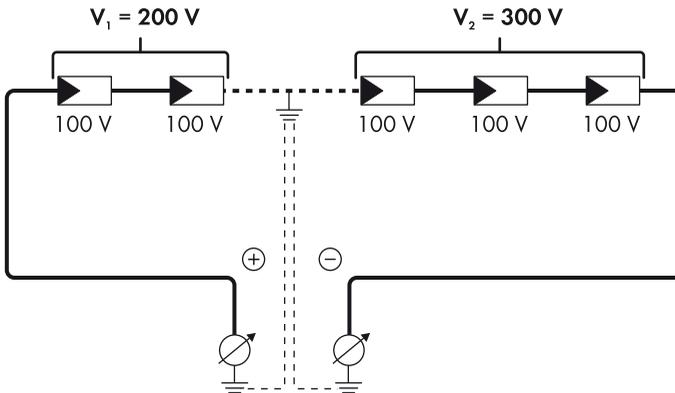
If the following results are present at the same time, there is an earth fault in the PV plant.

- All measured voltages are stable.
- The sum of the two voltages against the earth potential is approximately the same as 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.



3. Recommission the inverter (See Section 10).

11.6 Checking the Function of the Varistors

If the inverter displays event number **7401**, one of the varistors is probably defective. Check the function of each varistor as described below.

NOTICE

Destruction of the inverter due to overvoltage

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

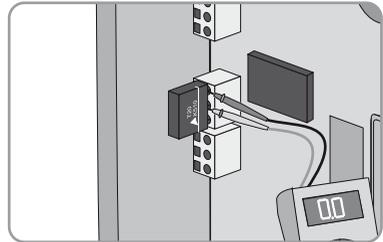
- Do not operate the inverter without varistors in plants with a high risk of overvoltages.
- Do not recommission the inverter until the defective varistors have been replaced.

NOTICE

Destruction of the measuring device due to overvoltage

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

1. Disconnect the inverter from voltage sources (See Section 9).
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.

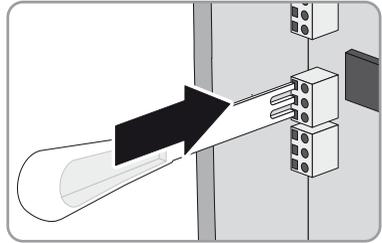
- Order new varistors and insertion tools (See Section 14 "Accessories", Page 101).
- If new varistors are available, replace all varistors (See Section 11.7).

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

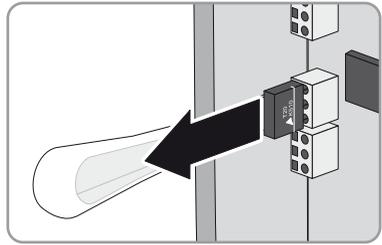
11.7 Replacing the Varistors

Proceed as follows to replace each varistor.

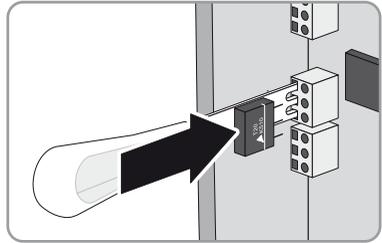
1. Disconnect the inverter from voltage sources (See Section 9).
2. Insert the insertion tool into the clamp contacts of the connecting terminal plate.



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).

11.8 Cleaning the Fans

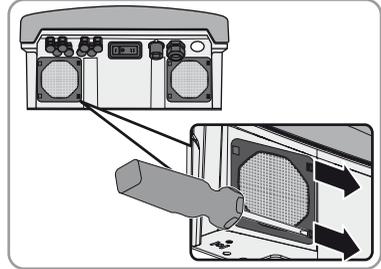
Proceed as follows to clean each fan.

1. Disconnect the inverter from voltage sources (See Section 9).
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:

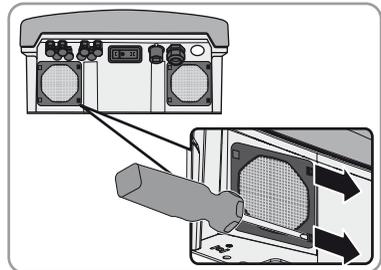
- Use a screwdriver to push the two detents at the right edge of the fan guard to the right and remove them from the retainer.



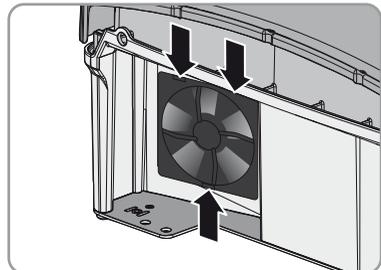
- Carefully remove the fan guard.
 - Clean the fan guard with a soft brush, a paint brush, a cloth or compressed air.
4. Check whether the fan is soiled.

If the fan is soiled, remove the fan:

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

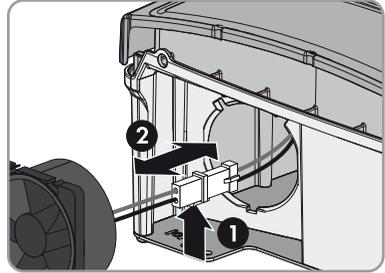


- Carefully remove the fan guard.
- Push the detents of the fan towards the middle of the fan.



- Remove the fan slowly from the inverter.

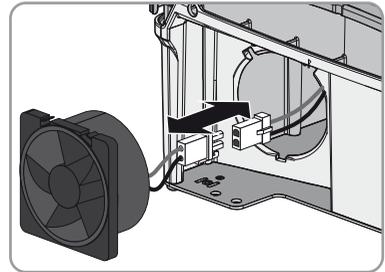
- Unlock and remove the fan plug.



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).
10. Check the fan to ensure that it is functioning (See Section 11.9).

11.9 Checking the Fans

You can check the function of the fans by setting a parameter.

Requirement:

- A communication product that is appropriate for the type of communication used must be available.
1. Access the user interface of the communication product and log in as an installer.
 2. Select the **Fan test** parameter and set it to **On**.
 3. Save setting.

4. Check whether air is coming out of the ventilation grids and whether the fans are making any unusual noises.

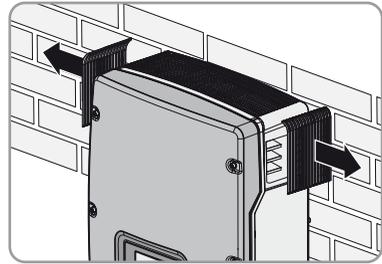
If there is no air coming out of the ventilation grids or the fans are making unusual noises, then presumably the fans were not installed properly. Check the installation of the fans.

If despite proper installation, no air is coming out through the ventilation grids or the fans are making unusual noises, contact the SMA Service Line.

5. Select the parameter **Fan test** and set to **Off**.
6. Save setting.

11.10 Cleaning the Ventilation Grids

1. Remove the ventilation grids towards the side.



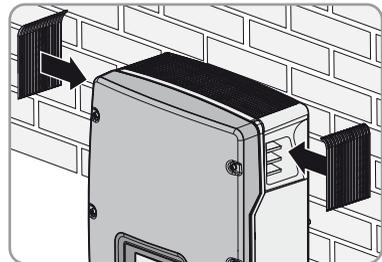
2. **NOTICE**

Damage to the inverter due to foreign bodies

- Do not remove the ventilation grids permanently, otherwise foreign bodies could enter into the enclosure.

3. Clean the ventilation grids with a soft brush, a paint brush, or compressed air.

4. Close the recessed grips with the ventilation grids. Ensure the assignment is correct. Each ventilation grid is assigned to an enclosure side on the inside: **links/left** for the left-hand side and **rechts/right** for the right-hand side.



12 Decommissioning

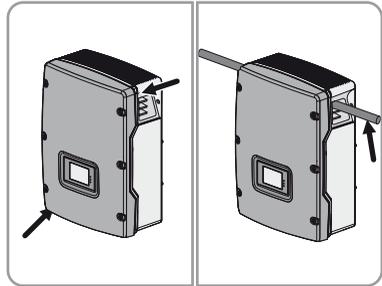
12.1 Dismantling the Inverter

⚠ CAUTION

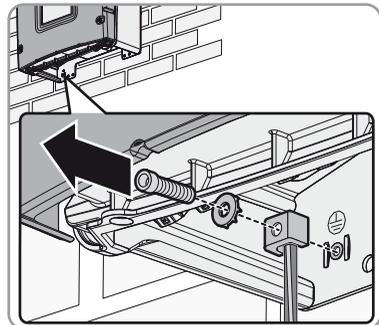
Risk of injury when lifting and from falling inverter

The inverter is heavy (See Section 13 "Technical Data", Page 87). Lifting the inverter incorrectly, or if it falls during transportation or while attaching it to the wall mounting bracket result in a risk of injury.

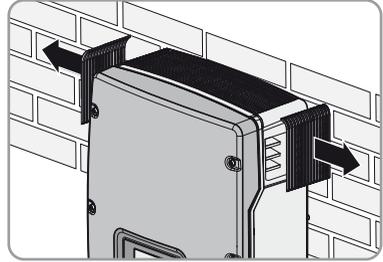
- Lift and transport the inverter into the mounting position horizontally. Use the side recessed grips or a steel rod (diameter: maximum 30 mm).



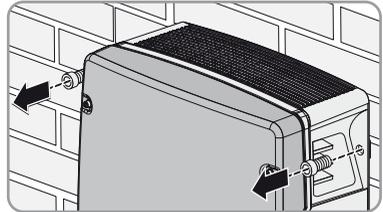
1. Disconnect the inverter from voltage sources (See Section 9).
2. Remove the AC cable from the inverter.
3. If an Ethernet cable is connected for Speedwire communication, remove the cable from the inverter.
4. If the multi-function relay or the SMA Power Control Module are used, remove the connection cable from the inverter.
5. 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.



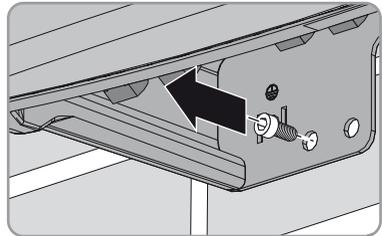
6. Remove the ventilation grids towards the side.



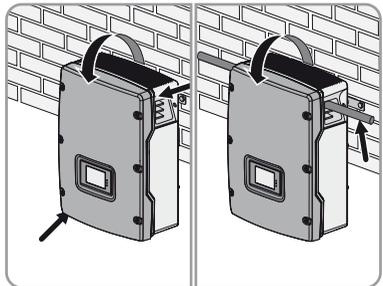
7. Loosen the screws on both sides between the inverter and the wall mounting bracket using an Allen key (AF 5).



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



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



NOTICE

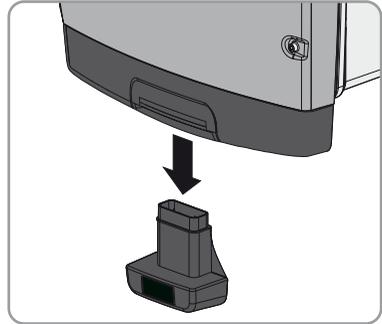
Damage to the ESS socket from dirt and foreign bodies

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 functioning.

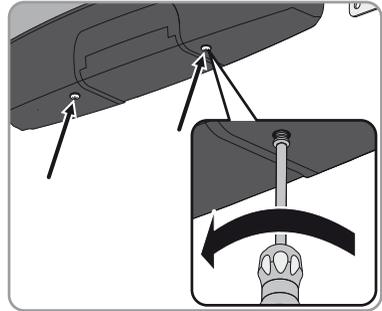
- Always lower the inverter on an even building ground.

12.2 Packing the Inverter

1. If the ESS is plugged in, remove the ESS.



2. 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.



3. Remove the cable glands from the inverter.
4. Package the inverter, cable glands, protective cover and ESS. Use the original packaging or packaging that is suitable for the weight and dimensions of the inverter.

12.3 Disposing of the Inverter

- Dispose of the inverter in accordance with the locally applicable disposal regulations for electronic waste.

or

Return the inverter at your own cost to SMA Solar Technology AG (See Section 15 "Contact", Page 102). Label the package "ZUR ENTSORGUNG" ("FOR DISPOSAL").

13 Technical Data

13.1 DC/AC

13.1.1 Sunny Tripower 5000TL

DC Input

Maximum DC power at $\cos \varphi = 1$	5,100 W
Maximum input voltage *	1,000 V
MPP voltage range	245 V ... 800 V
Rated input voltage	580 V
Minimum input voltage	150 V
Initial input voltage	188 V
Maximum input current, input A	11 A
Maximum input current, input B	10 A
Maximum input current per string, input A **	11 A
Maximum input current per string, input B **	10 A
Number of independent MPP inputs	2
Strings per MPP input	2

* The maximum open-circuit voltage that can occur with -10°C cell temperature must not exceed the maximum input voltage.

** Maximum permitted current which may flow via one DC connector.

AC Output

Rated power at 230 V, 50 Hz	5,000 W
Maximum apparent AC power	5,000 VA
Rated grid voltage	230 V
Nominal AC voltage at 220 V	380 V
Nominal AC voltage at 230 V	400 V
Nominal AC voltage at 240 V	415 V
AC voltage range *	160 V ... 280 V
Nominal AC current at 220 V	7.3 A
Nominal AC current at 230 V	7.3 A
Nominal AC current at 240 V	6.9 A
Maximum output current	7.3 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%
Rated power frequency	50 Hz
AC mains frequency *	50 Hz / 60 Hz
Operating range at AC mains frequency 50 Hz	45.5 Hz ... 54.5 Hz
Operating range at AC mains frequency 60 Hz	55.5 Hz ... 64.5 Hz
Displacement power factor $\cos \varphi$, adjustable	0.8 underexcited ... 0.8 overexcited
Feed-in phases	3
Connection phases	3
Overvoltage category in accordance with IEC 60664-1	III

* Depending on the configured country data set

Efficiency

Maximum efficiency, η_{\max}	98%
European efficiency, η_{EU}	97.1%

13.1.2 Sunny Tripower 6000TL

DC Input

Maximum DC power at $\cos \varphi = 1$	6,125 W
Maximum input voltage *	1,000 V
MPP voltage range	295 V ... 800 V
Rated input voltage	580 V
Minimum input voltage	150 V
Initial input voltage	188 V
Maximum input current, input A	11 A
Maximum input current, input B	10 A
Maximum input current per string, input A **	11 A
Maximum input current per string, input B **	10 A
Number of independent MPP inputs	2
Strings per MPP input	2

* The maximum open-circuit voltage that can occur with -10°C cell temperature must not exceed the maximum input voltage.

** Maximum permitted current which may flow via one DC connector.

AC Output

Rated power at 230 V, 50 Hz	6,000 W
Maximum apparent AC power	6,000 VA
Rated grid voltage	230 V
Nominal AC voltage at 220 V	380 V
Nominal AC voltage at 230 V	400 V
Nominal AC voltage at 240 V	415 V
AC voltage range *	160 V ... 280 V
Nominal AC current at 220 V	8.7 A
Nominal AC current at 230 V	8.7 A
Nominal AC current at 240 V	8.33 A
Maximum output current	8.7 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%
Rated power frequency	50 Hz
AC mains frequency *	50 Hz / 60 Hz
Operating range at AC mains frequency 50 Hz	45.5 Hz ... 54.5 Hz
Operating range at AC mains frequency 60 Hz	55.5 Hz ... 64.5 Hz
Displacement power factor $\cos \varphi$, adjustable	0.8 underexcited ... 0.8 overexcited
Feed-in phases	3
Connection phases	3
Overvoltage category in accordance with IEC 60664-1	III

* Depending on the configured country data set

Efficiency

Maximum efficiency, η_{\max}	98%
European efficiency, η_{EU}	97.4%

13.1.3 Sunny Tripower 7000TL

DC Input

Maximum DC power at $\cos \varphi = 1$	7,175 W
Maximum input voltage *	1,000 V
MPP voltage range	290 V ... 800 V
Rated input voltage	580 V
Minimum input voltage	150 V
Initial input voltage	188 V
Maximum input current, input A	15 A
Maximum input current, input B	10 A
Maximum input current per string, input A **	15 A
Maximum input current per string, input B **	10 A
Number of independent MPP inputs	2
Strings per MPP input	2

* The maximum open-circuit voltage that can occur with -10°C cell temperature must not exceed the maximum input voltage.

** Maximum permitted current which may flow via one DC connector.

AC Output

Rated power at 230 V, 50 Hz	7,000 W
Maximum apparent AC power	7,000 VA
Rated grid voltage	230 V
Nominal AC voltage at 220 V	380 V
Nominal AC voltage at 230 V	400 V
Nominal AC voltage at 240 V	415 V
AC voltage range *	160 V ... 280 V
Nominal AC current at 220 V	10.2 A
Nominal AC current at 230 V	10.2 A
Nominal AC current at 240 V	10.14 A
Maximum output current	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%
Rated power frequency	50 Hz
AC mains frequency *	50 Hz / 60 Hz
Operating range at AC mains frequency 50 Hz	45.5 Hz ... 54.5 Hz
Operating range at AC mains frequency 60 Hz	55.5 Hz ... 64.5 Hz
Displacement power factor $\cos \varphi$, adjustable	0.8 underexcited ... 0.8 overexcited
Feed-in phases	3
Connection phases	3
Overvoltage category in accordance with IEC 60664-1	III

* Depending on the configured country data set

Efficiency

Maximum efficiency, η_{\max}	98%
European efficiency, η_{EU}	97.5%

13.1.4 Sunny Tripower 8000TL

DC Input

Maximum DC power at $\cos \varphi = 1$	8,200 W
Maximum input voltage *	1,000 V
MPP voltage range	330 V ... 800 V
Rated input voltage	580 V
Minimum input voltage	150 V
Start input voltage	188 V
Maximum input current, input A	15 A
Maximum input current, input B	10 A
Maximum input current per string, input A **	15 A
Maximum input current per string, input B **	10 A
Number of independent MPP inputs	2
Strings per MPP input	2

* The maximum open-circuit voltage that can occur with -10°C cell temperature must not exceed the maximum input voltage.

** Maximum permitted current which may flow via one DC connector.

AC Output

Rated power at 230 V, 50 Hz	8,000 W
Maximum apparent AC power	8,000 VA
Rated grid voltage	230 V
Nominal AC voltage at 220 V	380 V
Nominal AC voltage at 230 V	400 V
Nominal AC voltage at 240 V	415 V
AC voltage range *	160 V ... 280 V
Nominal AC current at 220 V	11.6 A
Nominal AC current at 230 V	11.6 A
Nominal AC current at 240 V	11.11 A
Maximum output current	11.6 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%
Rated power frequency	50 Hz
AC mains frequency *	50 Hz / 60 Hz
Operating range at AC mains frequency 50 Hz	45.5 Hz ... 54.5 Hz
Operating range at AC mains frequency 60 Hz	55.5 Hz ... 64.5 Hz
Displacement power factor $\cos \varphi$, adjustable	0.8 underexcited ... 0.8 overexcited
Feed-in phases	3
Connection phases	3
Overvoltage category in accordance with IEC 60664-1	III

* Depending on the configured country data set

Efficiency

Maximum efficiency, η_{\max}	98%
European efficiency, η_{EU}	97.6%

13.1.5 Sunny Tripower 9000TL

DC Input

Maximum DC power at $\cos \varphi = 1$	9,225 W
Maximum input voltage *	1,000 V
MPP voltage range	370 V ... 800 V
Rated input voltage	580 V
Minimum input voltage	150 V
Initial input voltage	188 V
Maximum input current, input A	15 A
Maximum input current, input B	10 A
Maximum input current per string, input A **	15 A
Maximum input current per string, input B **	10 A
Number of independent MPP inputs	2
Strings per MPP input	2

* The maximum open-circuit voltage that can occur with -10°C cell temperature must not exceed the maximum input voltage.

** Maximum permitted current which may flow via one DC connector.

AC Output

Rated power at 230 V, 50 Hz	9,000 W
Maximum apparent AC power	9,000 VA
Rated grid voltage	230 V
Nominal AC voltage at 220 V	380 V
Nominal AC voltage at 230 V	400 V
Nominal AC voltage at 240 V	415 V
AC voltage range *	160 V ... 280 V
Nominal AC current at 220 V	13.1 A
Nominal AC current at 230 V	13.1 A
Nominal AC current at 240 V	12.5 A
Maximum output current	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%
Rated power frequency	50 Hz
AC mains frequency *	50 Hz / 60 Hz
Operating range at AC mains frequency 50 Hz	45.5 Hz ... 54.5 Hz
Operating range at AC mains frequency 60 Hz	55.5 Hz ... 64.5 Hz
Displacement power factor $\cos \varphi$, adjustable	0.8 underexcited ... 0.8 overexcited
Feed-in phases	3
Connection phases	3
Overvoltage category in accordance with IEC 60664-1	III

* Depending on the configured country data set

Efficiency

Maximum efficiency, η_{\max}	98%
European efficiency, η_{EU}	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 according to IEC 60721-3-4	4K4H
Operating temperature range	- 25 °C ... +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
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
Approvals, as per 11/2012*	CE, VDE-AR-N 4105, VDE0126-1-1 / UTE C15-712-1, AS4777, C10/11, PPDS, PPC, CEI 0-21 (> 6 kWp), RD 661/2007, RD 1699, SI4777, EN 50438, G83/1-1, IEC 61727/MEA, IEC 61727/PEA, NRS 97-2-7
Planned approvals, as of 11/2012	SI 4777-2

* **EN 50483:** does not apply for all national appendices of EN 50438

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)

C10/11: only possible if the three-phase line-to-line voltage is 400 V

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: $R_{iso} > 385 \Omega$
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 ... 60°C
Extended humidity range	0% ... 100%
Extended air pressure range	79.5 kPa ... 106 kPa

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

Temperature range	- 25°C ... +70°C
-------------------	------------------

13.5 Features

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

13.6 Torques

Enclosure lid screws	6.0 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 Earthing Systems

IT system	Not suitable
TN-C system	Suitable
TN-S system	Suitable
TN-C-S system	Suitable
TT system, if $U_{NPE} < 30 \text{ V}$	Suitable
Split-phase	Not suitable

13.8 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

13.9 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

13.10 Data Storage Capacity

Daily energy yield performance	63 days
Daily yields	30 years
Event messages for users	250 events
Event messages for installers	250 events

13.11 Webconnect Function

Maximum data volume per inverter	550 MB
Additional data volume for use of the Sunny Portal live interface per hour	600 kB

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	Short designation	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 mm ² ... 6 mm ²	SUNCLIX-FC6-SET
SMA Power Control Module	Multi-function interface for implementing grid management	PWCBRD-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

SMA Solar Technology AG

Sonnenallee 1
34266 Niestetal
www.SMA.de

SMA Service Line

Inverters:	+49 561 9522 1499
Communication:	+49 561 9522 2499
SMS with "RÜCKRUF" to:	+49 176 888 222 44
Fax:	+49 561 9522 4699
E-mail:	ServiceLine@SMA.de

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SMA Solar Technology AG

Sonnenallee 1

34266 Niestetal

Germany

Tel. +49 561 9522-0

Fax +49 561 9522-100

www.SMA.de

E-mail: info@SMA.de

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SMA Solar Technology

www.SMA-Solar.com

