

PV Inverters

SUNNY TRIPOWER 15000TL Economic Excellence

SUNNY TRIPOWER 20000TL Economic Excellence

Installation Manual

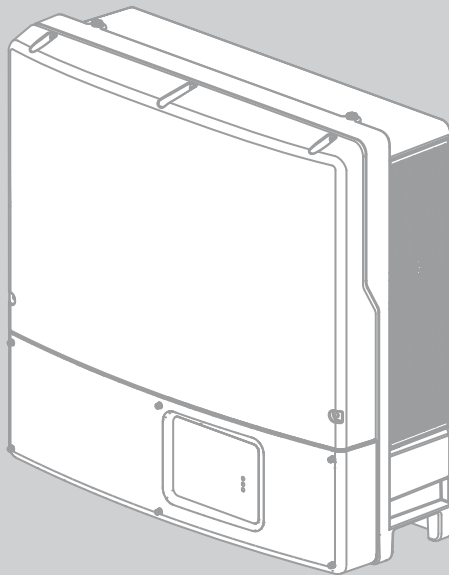


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1 Information on this Manual

1.1 Validity

This manual describes the procedure for mounting, installation, commissioning, maintenance and troubleshooting of the following SMA inverters from firmware version 2.54:

- Sunny Tripower 15000TL Economic Excellence (STP 15000TLEE-10)
- Sunny Tripower 20000TL Economic Excellence (STP 20000TLEE-10)

Keep this manual in a convenient place for future reference.

1.2 Target Group

This manual is for the use of electrically skilled persons. The tasks described in this manual must be performed by electrically skilled persons only.

1.3 Additional Information

You will find further information on special topics such as designing a miniature circuit-breaker or the description of the parameters and measured values at www.SMA.de/en.

Refer to the user manual provided for detailed information on how to operate the inverter.

The following types of safety precautions and general information appear in this document:



DANGER!

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



WARNING!

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



CAUTION!

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



NOTICE!

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



Information

Information provides tips that are valuable for effective installation and operation of the product.

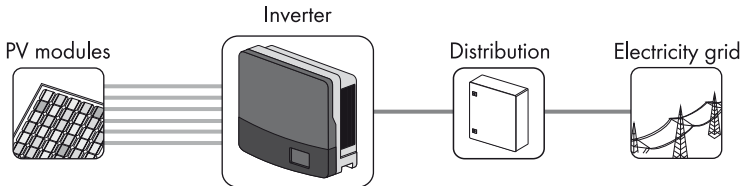
- ☒ This symbol indicates the result of an action.

2 Safety

2.1 Appropriate Usage

The Sunny Tripower is a PV inverter which converts the direct current of the PV array to grid-compliant alternating current and performs three-phase feed-in into the electricity grid.

Principle of a PV Plant with Sunny Tripower



The Sunny Tripower is suitable for indoor and outdoor use.

The Sunny Tripower must only be operated with PV arrays of protection class II, in accordance with IEC 61730, application class A. Do not connect any energy sources other than PV modules to the Sunny Tripower.



Capacitive leakage currents


PV modules with large capacities relative to earth, such as thin-film PV modules with cells on a metallic substrate, may only be used if their coupling capacity does not exceed 500 nF.

During feed-in operation, a leakage current flows from the cells to earth. The size of this leakage current depends on the mounting type of the PV modules (e.g. foil on metal roof) and on the weather (rain, snow). This normal leakage current must not exceed 50 mA, as otherwise the inverter would automatically disconnect from the electricity grid as a protective measure. For further information on this subject, see the Technical Information "Capacitive Leakage Currents" at www.SMA.de/en.

When designing the PV plant, ensure that the permitted operating range of all components is complied with at all times. The free design program "Sunny Design", version 2.0 or higher (see www.SMA.de/en/SunnyDesign), will assist you in this. The manufacturer of the PV modules must have approved the PV modules for use with the Sunny Tripower. You must also ensure that all measures recommended by the module manufacturer for the long-term maintenance of the module properties are taken (see also Technical Information "Module Technology" at www.SMA.de/en).

Do not use the Sunny Tripower for purposes other than those described here. Alternative uses, modifications to the Sunny Tripower or the installation of components not expressly recommended or sold by SMA Solar Technology AG void the warranty claims and operation permission.


2.2 Safety Precautions



DANGER!
Danger to life due to electric shock

When exposed to sunlight, the PV array generates a dangerous direct voltage which is present in the DC conductors or the live components in the inverter.


- Do not touch the DC conductors.
- Do not touch live components in the inverter.
- Prior to performing any work on the inverter, always disconnect it from any voltage sources as described in this document (see Section 8 "Disconnecting the Inverter from Voltage Sources" (page 55)).



CAUTION!
Risk of burns due to hot enclosure parts

During operation, the upper enclosure lid and the enclosure body may get hot.

- Only touch the lower enclosure lid during operation.









Earthing of the PV array

Comply with the local regulations for earthing the modules and the PV array. SMA Solar Technology AG recommends connecting the array frame and other electrically conductive surfaces so that there is continuous conduction, and earthing them in order to ensure maximum protection for property and persons.










2.3 Explanation of Symbols








2.3.1 Symbols on the Inverter

Symbol	Explanation
	Operation indicator Shows the operating state of the inverter
	A disturbance has occurred. Read Section 11 "Troubleshooting" (page 72) to remedy the disturbance.
	SMA Bluetooth® Wireless Technology Shows the status of Bluetooth communication
	Danger to life due to high voltages in the inverter There is residual voltage in the inverter. The inverter takes 20 minutes to discharge. <ul style="list-style-type: none"> • Wait 20 minutes before you open the upper enclosure lid or the DC lid.

Symbol	Explanation
	NOTICE, danger! <ul style="list-style-type: none"> Observe the connection requirements for a second protective conductor in Section 6.3.1 "Conditions for AC Connection" (page 29).
	QR Code® Links to additional information on the inverter can be found at www.SMA-Solar.com .

2.3.2 Symbols on the Type Label

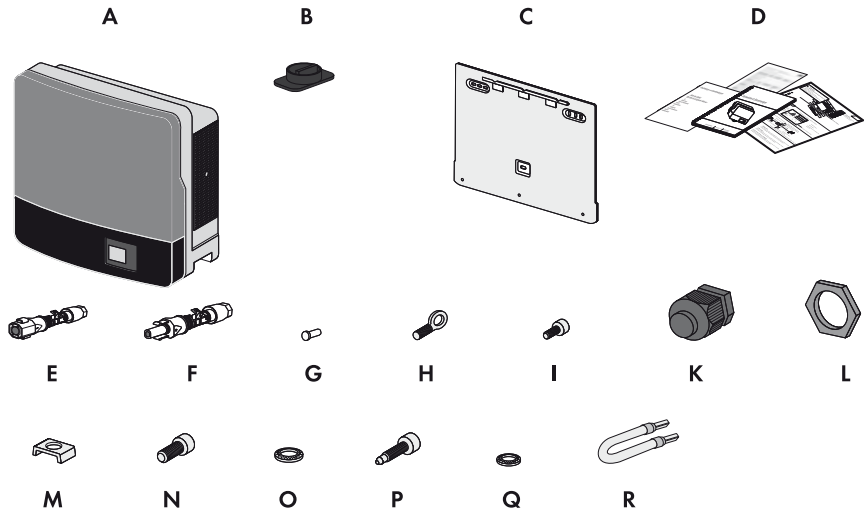
Symbol	Explanation
	Beware of hazardous voltage. The inverter operates at high voltages. All work on the inverter must be carried out by skilled persons only.
	Warning of hot surface. The inverter can get hot during operation. Avoid contact during operation.
	Observe all documentation supplied with the inverter.
	The inverter must not be disposed of together with the household waste. For more information on disposal, see Section 12.5 "Disposing of the Inverter" (page 79).
	CE marking The inverter complies with the requirements of the applicable EC directives.
	The inverter does not have a transformer.
	Direct current (DC)
	Three-phase alternating current (AC) with neutral conductor
	Degree of protection IP65 The product is protected against dust intrusion and water jets from any angle.

Symbol	Explanation
	Outdoor The inverter is suitable for outdoor installation.
	RAL quality mark for solar products The inverter complies with the requirements of the German Institute for Quality Assurance and Labelling.
	Device class label The inverter is equipped with a wireless component that complies with the harmonised standards.
	Certified safety The inverter complies with the requirements of the European Equipment and Product Safety Act.
	Australian mark of conformity
	Korean mark of conformity
	Chinese mark of conformity

3 Unpacking

3.1 Scope of Delivery

Check the delivery for completeness and for any visible external damage. Contact your specialist dealer if the delivery is incomplete or you find any damage.



Object	Number	Description
A	1	Sunny Tripower
B	1	Handle of the DC switch-disconnector*
C	1	Rear panel
D	1	Installation manual including user manual, document set with declarations and certificates, supplementary sheet with the default settings
E	6	Negative DC connector
F	6	Positive DC connector
G	12	Sealing plugs
H	1	Eye bolt M8 for securing the inverter to the rear panel
I	2	Cheese-head screw M5x10 for attaching the enclosure to the rear panel
K	1	Cable gland for AC connection
L	1	Counter nut for cable gland at AC connection
M	1	Clamping bracket M6 for additional earthing
N	1	Cheese-head screw M6 for earth terminal
O	1	Conical spring washer M6 for earth terminal
P	2	Cheese-head screws M5x20 for upper enclosure lid (spares)

Object	Number	Description
Q	2	Conical spring washers M5 for upper enclosure lid (spares)
R	1	Jumper cable for deactivating the reverse-current protection

*Optional

3.2 Identifying the Inverter

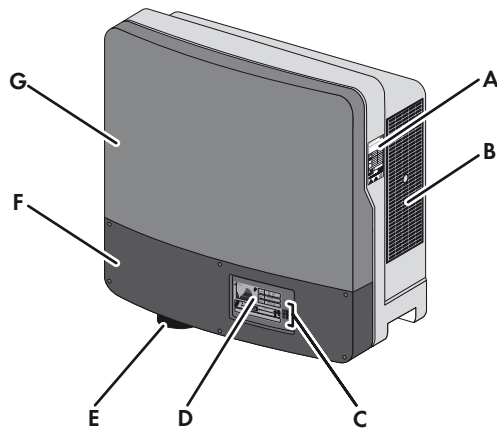
You can identify the inverter by the type label. The type label is located on the right-hand side of the housing.

The inverter type (type/model), serial number (serial no.) and other device-specific characteristics are specified on the type label.

4 Product Description

4.1 Sunny Tripower

The Sunny Tripower is a PV inverter which converts the direct current of the PV array to grid-compliant alternating current and performs three-phase feed-in into the electricity grid.

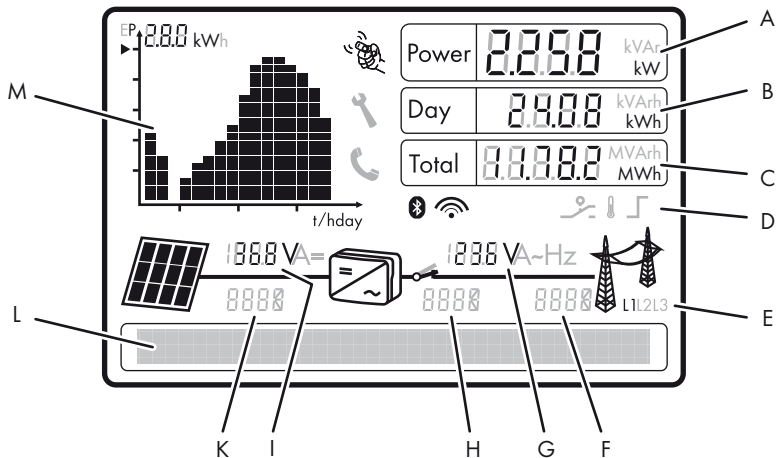


Item	Description
A	Type label
B	Ventilation grids
C	LEDs
D	Display
E	DC switch-disconnector*
F	Lower enclosure lid
G	Upper enclosure lid

*Optional

4.2 Display










The display shows the current operating data of the inverter (e.g. status, power, input voltage) as well as errors and disturbances.






Item	Description	Explanation
A	Power	Displays the current power
B	Day	Displays the amount of energy fed in so far today
C	Total	Total amount of energy fed in until now
D	Active functions	The symbols indicate which communication or power regulation functions are enabled.
E	Line conductor assignment	The phase conductor assignment indicates the phase conductor for which output current or output voltage is currently being displayed.
F	Electricity grid event number	Event number of a disturbance in the electricity grid
G	Output voltage/output current	The display alternately shows the output voltage and the output current of the respective phase conductor. The display automatically switches between the three connected phase conductors.
H	Inverter event number	Event number of a device disturbance
I	Input voltage/input current	The display alternately shows the input voltage and the input current of the inverter.
K	PV array event number	Event number of a disturbance in the PV array

Item	Description	Explanation
L	Text line	The text line shows event messages.
M	Power and yield curve	The diagram shows the power curve over the last 16 feed-in hours or the energy yields over the last 16 days. Tap the display once to switch between views.

Symbols on the Display

Symbol	Description	Explanation
	Tap symbol	You can operate the display by tapping it: <ul style="list-style-type: none"> Single tap: the backlight switches on or the display scrolls to the next display message. Tapping twice: the display successively shows the firmware version, the serial number or designation of the inverter, the <i>Bluetooth</i> NetID, the configured country data set and display language.
	Telephone receiver	Device disturbance present. Contact the SMA Service Line.
	Spanner	Disturbance which can be resolved on-site.
	<i>Bluetooth</i>	<i>Bluetooth</i> communication is enabled.
	<i>Bluetooth</i> connection	<i>Bluetooth</i> connection to other devices is active.
	Multi-function relay	The multi-function relay is active.
	Temperature symbol	Inverter power limitation is active due to excessive temperature.
	Power limitation	External active power limitation via the Power Reducer Box is active.
	PV array	-

Symbol	Description	Explanation
	Inverter	-
	Grid relay	When the grid relay is closed, the inverter feeds into the electricity grid. When the grid relay is open, the inverter is disconnected from the electricity grid.
	Electricity grid	-

4.3 DC Switch-Disconnecter

The DC switch-disconnector is optional. If you have ordered the inverter with DC switch-disconnector, it will be pre-installed in the inverter on delivery.

By means of the DC switch-disconnector, you can manually close or interrupt the electric circuit between the PV array and the inverter. The DC switch-disconnector enables the safe disconnection of the inverter from the PV array. Disconnection takes place at all poles.

4.4 Communication

The inverter is equipped with a *Bluetooth* interface as standard. A multi-function relay and an additional communication interface (e.g. RS485) can be retrofitted. The inverter can communicate with special SMA communication products (e.g. data logger, software) or other inverters via the communication interfaces (for information on supported communication products, see www.SMA.de/en). The inverter parameters can only be set via SMA communication products.

If you 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 the same factory-installed plant passwords. You must change the plant passwords using a communication product in order to protect the PV plant from unauthorised access.

If you do not communicate via *Bluetooth*, deactivate the *Bluetooth* communication (see Section 6.6.1 "Bluetooth" (page 48)). This will protect your PV plant from unauthorised access.



Varying parameter display

Depending on the type of communication, RS485 or *Bluetooth*, the parameters and messages are displayed differently on the communication products.

Example: display of parameter for fan test

- If you are using RS485: parameter "CoolSys.FanTst"
- If you are using *Bluetooth*: parameter "Fan test"

4.5 Multi-Function Relay

The inverter may be equipped with a multi-function relay. The multi-function relay is an interface for error messages or for controlling loads. Disturbances can be transmitted to a fault indicator. For this purpose, the multi-function relay switches the fault indicator on and off. The multi-function relay can control a load via a contactor. For this purpose, the inverter determines when the load is switched on and off, depending on the operating parameters and measured values. You can configure the multi-function relay for various operating modes (see manual of the multi-function relay available at www.SMA.de/en).



Error message required by standards

In some countries, an error message is required by standards, e.g. IEC 62109-2.

In order to meet the requirements of IEC 62109-2, either the multi-function relay must be used as a fault indicator and configured accordingly or a connection to Sunny Portal must be available and the fault alarm must be activated in Sunny Portal (for information on fault alarm via e-mail, see the Sunny Portal user manual at www.SMA-Solar.com).

4.6 Feed-In Management

The Sunny Tripower is reactive-power capable and can feed reactive power into the grid via the setting of a default value for the displacement power factor ($\cos \phi$). Additionally, this inverter is also equipped with advanced feed-in management functions, e.g. power limitation and dynamic grid support. You can enable and configure these functions depending on the requirements set by the network operator.

You can find detailed information on setting the parameters of these functions in the Technical Description "Measured Values and Parameters" at www.SMA.de/en in the "Technical Description" category for the respective inverter.

4.7 Operating Parameters

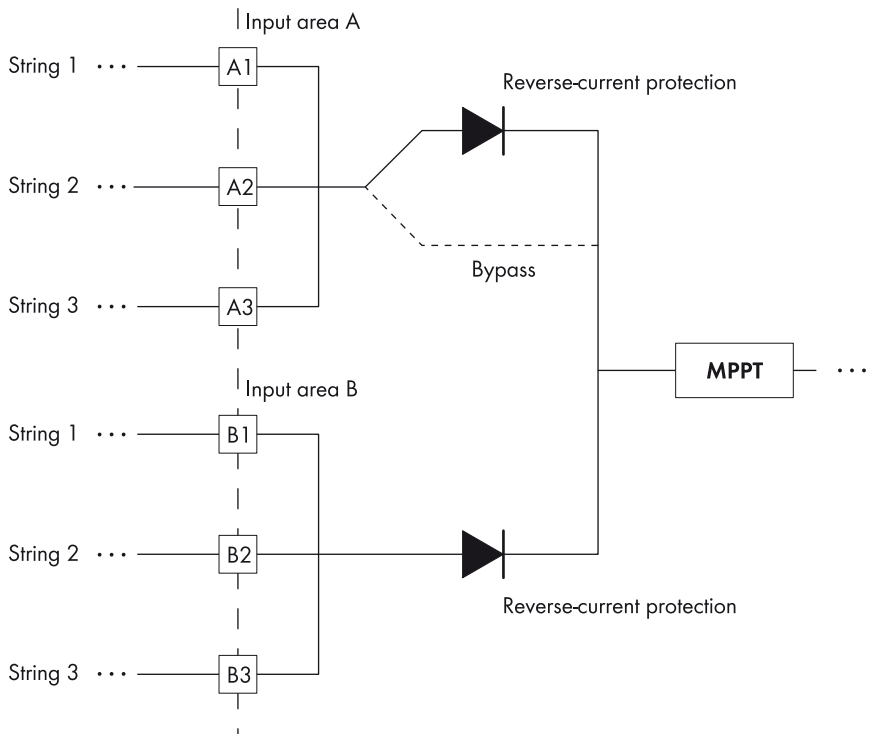
Various operating parameters control the functional performance of the inverter. Apart from the country data set, the operating parameters of the inverter can only be adjusted using an SMA communication product (information on the parameters can be found in the Technical Description "Parameters and Measured Values" at www.SMA-Solar.com). You can adjust the country data set before commissioning or within the first ten feed-in hours via two rotary switches in the inverter (see Section 6.5.3 "Setting the Country Data Set and Language Using Rotary Switches" (page 47)).

4.8 Reverse-Current Protection

Each inverter input area is equipped with a diode as reverse-current protection. This prevents any reverse currents occurring between the input areas.

If only input area A is in use and the reverse-current resistance of the PV modules is complied with, the reverse-current protection at input area A can be bypassed (see Section 6.7 "Activating and Deactivating Reverse-Current Protection at Input Area A" (page 50)). Bypassing the reverse-current protection slightly increases inverter efficiency.

The reverse-current protection at input area B cannot be deactivated.



5 Installation

5.1 Safety

**DANGER!****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.

**CAUTION!****Risk of injury due to the heavy weight of the inverter (approximately 53 kg)**

- Take the weight of the inverter into account during transport.
- Select a suitable mounting location and mounting surface.
- When mounting the rear panel, use fastening material suitable for the mounting surface.
- Two people are needed to mount the inverter.

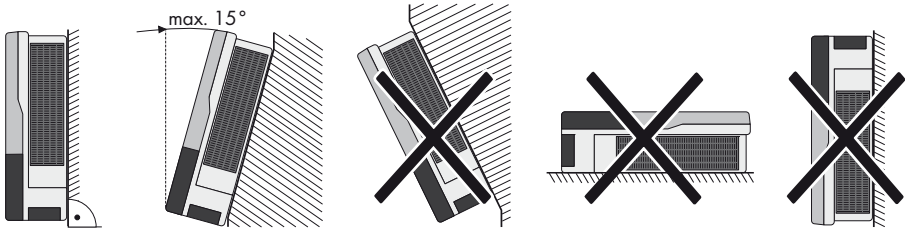
**CAUTION!****Risk of burns due to hot enclosure parts**

- Mount the inverter in such a way that it cannot be touched inadvertently.

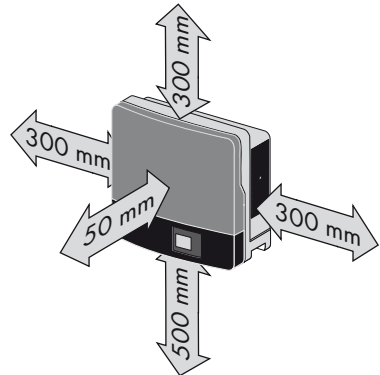
5.2 Selecting the Mounting Location

Take the following requirements into consideration when selecting the mounting location:

- The mounting method and location must be suitable for the weight and dimensions of the inverter (see Section 13 "Technical Data" (page 80)).
- Mount on a solid surface.
- The mounting location must at all times be clear and safely accessible without the use of additional aids such as scaffolding or lifting platforms. Non-fulfilment of these criteria may restrict execution of servicing.

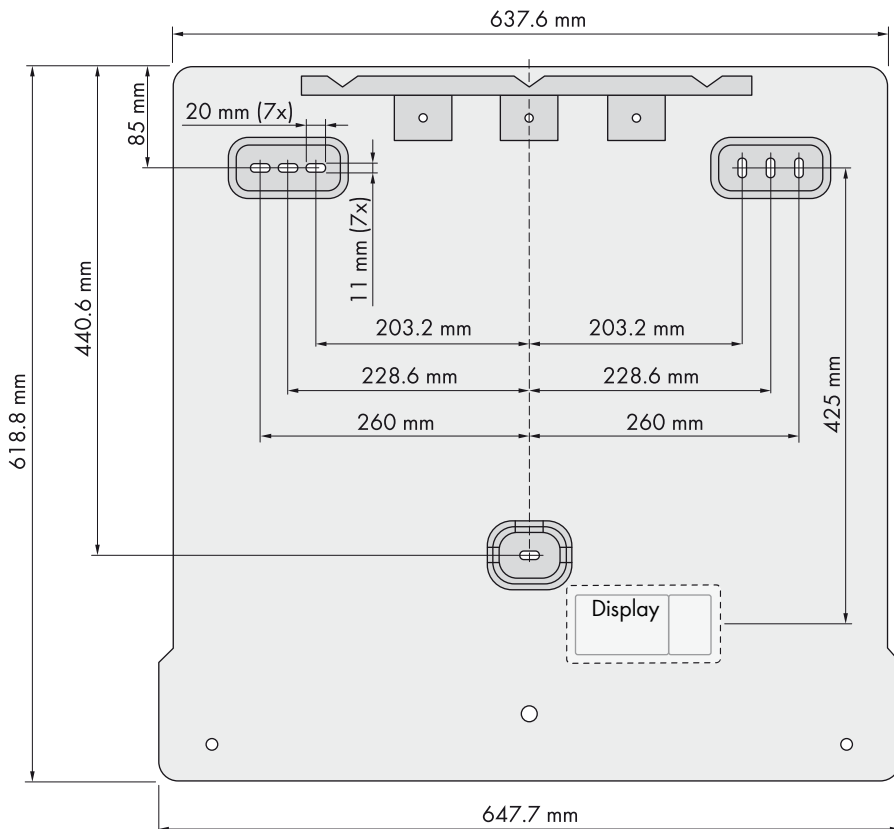


- Mount vertically or tilted backwards by max. 15°.
- The connection area must face downwards.
- Never mount the device with a forward tilt.
- Never mount the device with a sideways tilt.
- Do not mount horizontally.
- Mount the inverter at eye level. Given the weight of the device, this will facilitate disassembly if service work is necessary.
- The ambient temperature should be below 40°C to ensure optimum operation.
- Do not expose the inverter to direct solar irradiation as this can cause excessive heating and thus power reduction.
- In living areas, do not mount the unit on plasterboard walls or similar in order to avoid audible vibrations. When in use, the inverter emits noises which may be perceived as a nuisance in a living area.
- Observe the recommended clearances to walls, other inverters or other objects, as shown in the diagram. This ensures adequate heat dissipation and sufficient room to operate the optional DC switch-disconnector.
- 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 will prevent a reduction in inverter power as a result of excessively high temperatures (details on temperature derating can be found in the Technical Information "Temperature Derating" at www.SMA.de/en).



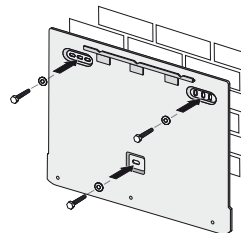
5.3 Mounting the Inverter

1. Use the rear panel as a drilling template and mark the positions of the drill holes.

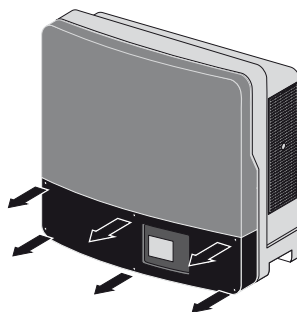
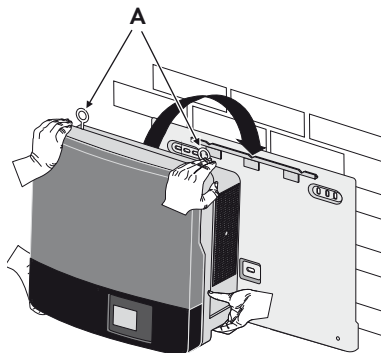


2. Mount the rear panel.

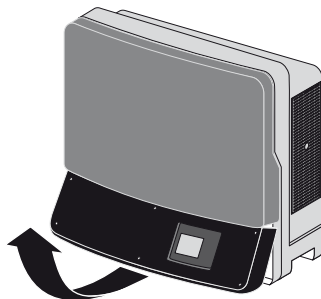
To do this, use one upper hole on the right and one on the left plus the hole in the middle.



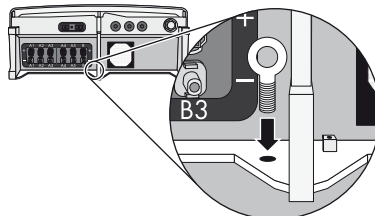
3. Hook the inverter into the rear panel, ensuring that the inverter enclosure is flush with the rear panel.
 - For two people to transport the inverter, hold the inverter by the recessed grips at the bottom and the top edge of the enclosure lid.
 - For transport by crane, you can attach two ring bolts to the top of the inverter (see A: M10, diameter = 10 mm). To do this, remove the filler-plugs and screw in the ring bolts as far as they will go.
4. Remove the ring bolts after transport and re-insert the filler plugs.
5. Release all six captive screws of the lower enclosure lid.



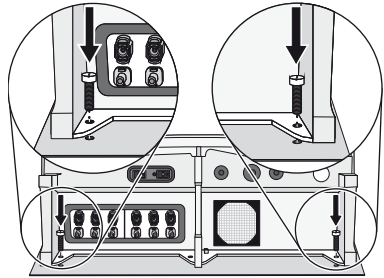
6. To remove the lower enclosure lid, lift it from the bottom.



7. To secure the enclosure from being lifted off, screw the supplied eye bolt into the drill hole provided. Fasten the eye bolt hand-tight.



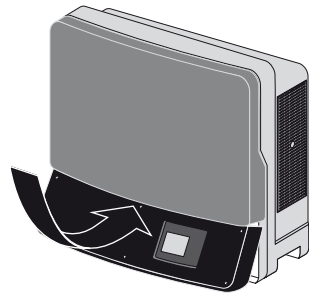
8. In order to secure the enclosure to the rear panel, fasten the underside of the enclosure with the two M5x10 cheese-head screws supplied (torque: 6.0 Nm).



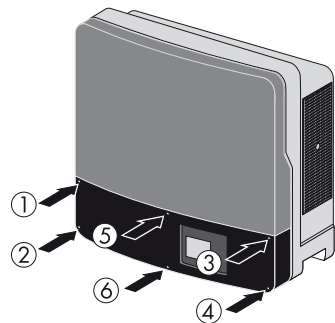
9. Check that the inverter is securely in place.
☒ The inverter is now securely mounted to the wall.

If the inverter is not to be connected immediately, re-attach the lower enclosure lid:

- Dock the lower enclosure lid at an angle and attach. The captive screws must protrude.



- Pre-screw all six screws and then tighten them in the sequence shown on the right (torque: 2.0 Nm).

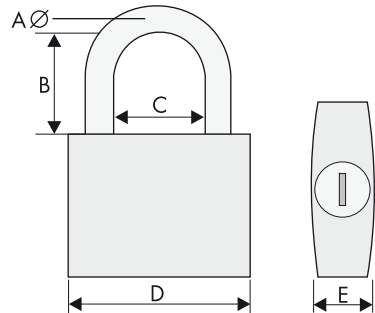


Optional Anti-Theft Protection

To protect the inverter from theft, you can fasten it to the rear panel with a padlock.

The padlock must meet the following requirements:

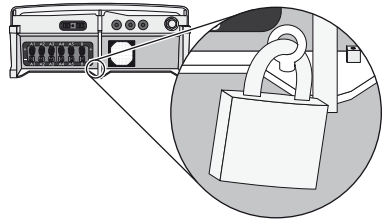
- Size:
 - A: 6 mm to 8 mm diameter
 - B: 23 mm to 29 mm
 - C: 23 mm to 28 mm
 - D: 39 mm to 50 mm
 - E: 13 mm to 18 mm
- Stainless
- Hardened shackle
- Secured lock cylinder



Storage of the key

Keep the key in a safe place in case it is needed for service purposes.

1. Put the shackle of the padlock through the eye of the previously mounted eye bolt and close the padlock.



- ☒ The inverter is now protected against theft.

6 Electrical Connection

6.1 Safety



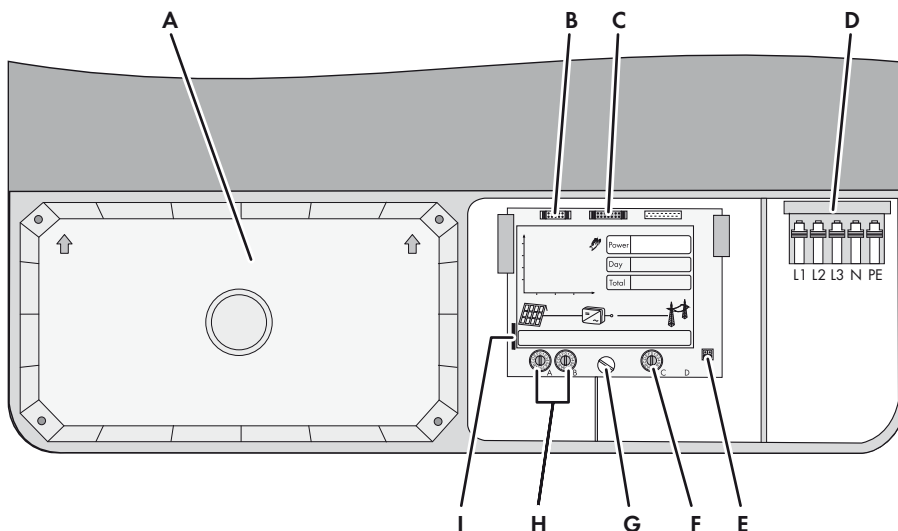
NOTICE!

Electrostatic discharge can damage the inverter.

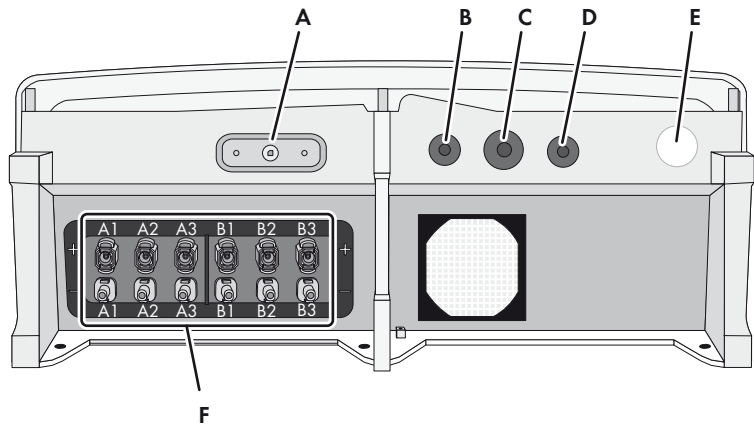
Internal components of the inverter can be irreparably damaged by electrostatic discharge.

- Earth yourself before touching any components.

6.2 Overview of the Connection Area



Object	Description
A	DC lid
B	Plug for connecting the optional multi-function relay
C	Plug for connecting the optional RS485 communication module
D	Terminal for grid connection
E	Switch for changing the display language to English (for service purposes)
F	Rotary switch for setting the <i>Bluetooth</i> NetID
G	Screw for releasing and raising the display
H	Rotary switch for setting the country data set and the display language
I	Slot for SD card (for service purposes only)



Object	Description
A	Socket for the handle of the DC switch-disconnector*
B	Enclosure opening M20 for the optional multi-function relay
C	Enclosure opening M32 for the optional communication via RS485
D	Additional enclosure opening M20
E	Enclosure opening M32 for the AC connection
F	DC connectors for connecting the strings

*Optional

6.3 Connection to the Electricity Grid (AC)

6.3.1 Conditions for AC Connection

You must comply with the connection requirements of your network operator.

Residual-Current Device

The inverter is equipped with an integrated all-pole-sensitive residual current monitoring unit. The inverter can automatically differentiate between residual currents and normal capacitive leakage currents.

If the network operator stipulates a residual-current device, you must use a device that triggers in the event of a residual current of 100 mA or more.

Further information on the use of a residual-current protective device can be found in the Technical Information "Selecting a Residual Current Protective Device" at www.SMA.de/en.

Cable Requirements

- External diameter: 14 mm to 25 mm
- Conductor cross-section: max. 16 mm²; with bootlace ferrule: max. 10 mm².
- Stripping length: 12 mm
- The cable must be dimensioned in accordance with any local and national directives on cable dimensions which specify requirements for the minimum conductor cross-section. Examples of factors influencing cable dimensioning are: nominal AC current, type of cable, routing method, cable bundling, ambient temperature and maximum desired line losses (for calculation of line losses, see design software Sunny Design from software version 2.0 at www.SMA.de/en).

Connection of a Second Protective Conductor

In some installation countries, a second protective conductor is required to prevent a touch current in the event of a malfunction in the original protective conductor.

For installation countries falling within the scope of validity of the IEC standard 62109, the following requirements are applicable:

- Installation of protective conductor at the AC terminal with a conductor cross-section of at least 10 mm² Cu.

or

- Installation of a second protective conductor on the earth terminal with the same cross-section as the original protective conductor on the AC terminal (see Section 6.3.3 "Connecting the Second Protective Conductor" (page 33)).

In each case, observe the applicable regulations for the site.

Overvoltage Category

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

Switch-Disconnecter

You must install a **separate, three-phase** miniature circuit-breaker for each inverter so that the inverter can be safely disconnected under load. The maximum permissible fuse protection can be found in Section 13 "Technical Data" (page 80).



DANGER!

Danger to life due to fire

When more than one inverter is connected in parallel to the same miniature circuit-breaker, the protective function of the miniature circuit-breaker is no longer guaranteed. This could result in a cable fire or destruction of the inverter.

- Never connect several inverters to the same miniature circuit-breaker.
- Observe the maximum permissible fuse protection of the inverter when selecting the miniature circuit-breaker.



DANGER!

Danger to life due to fire

When a generator (inverter) and a load are connected to the same miniature circuit-breaker, the protective function of the miniature circuit-breaker is no longer guaranteed. The currents from the inverter and the electricity grid can accumulate to form overcurrents which are not detected by the miniature circuit-breaker.

- Never connect loads between the inverter and the miniature circuit-breaker without fuse protection.
- Always fuse each load separately.



NOTICE!

Damage to the inverter by using screw-type fuses as a load disconnection unit

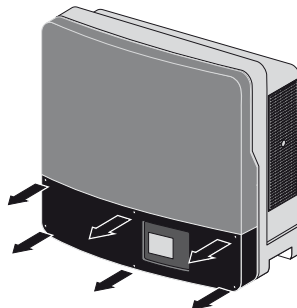
A screw-type fuse, e.g. DIAZED fuse or NEOZED fuse, is not a switch-disconnector and thus **may not be used** as a load disconnection unit. A screw-type fuse only acts as cable protection.

If the inverter is disconnected under load using a screw-type fuse, the inverter may be damaged.

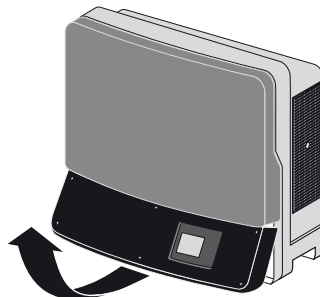
- Use only a switch-disconnector or a miniature circuit-breaker as a load disconnection unit.

6.3.2 AC Connection Procedure

1. Check the mains voltage and compare it with the permissible voltage range (see Section 13 "Technical Data" (page 80)).
2. Disconnect the miniature circuit-breaker from all three phase conductors and secure against reconnection.
3. Release all six captive screws of the lower enclosure lid.



4. To remove the lower enclosure lid, lift it from the bottom.

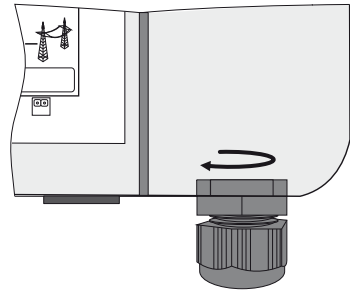


5. Check that the country setting of the inverter is correct using the supplementary sheet with the default settings provided.

If the inverter is not set to the desired country data set, adjust the country data set using the rotary switches as described in Section 6.5 "Setting the Country Data Set and Display Language" (page 40).

6. Remove the adhesive tape from the AC enclosure opening.

7. Insert the AC cable gland from the outside into the enclosure opening and tighten it from the inside using the counter nut.



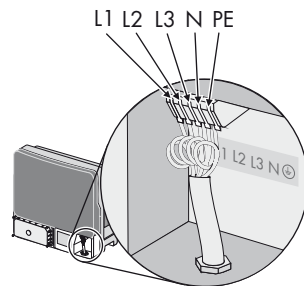
8. Pull the cable through.
9. Raise all five terminals of the AC terminal as far as they will go.

**NOTICE!****Risk of fire if two conductors are connected**

If two conductors are connected to one terminal, this may result in a poor electrical contact which could pose a risk of overheating or fire.

- Never connect more than one conductor per terminal.

10. Connect L1, L2, L3, N and the protective conductor (PE) to the AC terminal in accordance with the labelling.
 - To do this, the PE insulated wire must be 5 mm longer than the L and N insulated conductors.
 - L and N must not be swapped.
 - The direction of rotation of L1, L2 and L3 is not relevant.

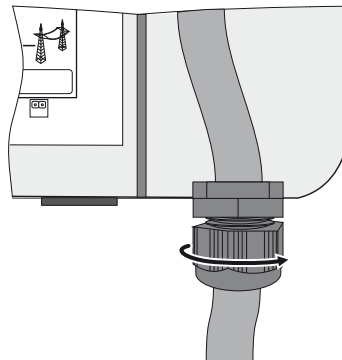
**CAUTION!****Danger of crushing when terminals snap shut**

The terminals close by snapping down fast and hard.

- Press the terminals down with your thumb only, do not grip the sides of the terminal between fingers and thumb.
- Keep fingers away from the terminals.

11. Close all terminals of the AC terminal until they snap into place.

12. Tighten the swivel nut firmly to the cable gland.

**DANGER!**

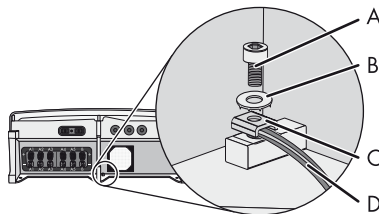
Danger to life due to high voltages in the inverter

- Do not switch on the miniature circuit-breaker until the PV array has been connected and the inverter is securely closed.

6.3.3 Connecting the Second Protective Conductor

If required by the installation, the earth terminal can be used to connect a second protective conductor or as equipotential bonding.

1. Take the clamping bracket, cheese-head screw M6 and conical spring washer M6 out of the accessory kit.
2. Insert the stripped earthing cable (D) under the clamping bracket (C) (maximum conductor cross-section 16 mm²).
3. Fasten terminal (C):



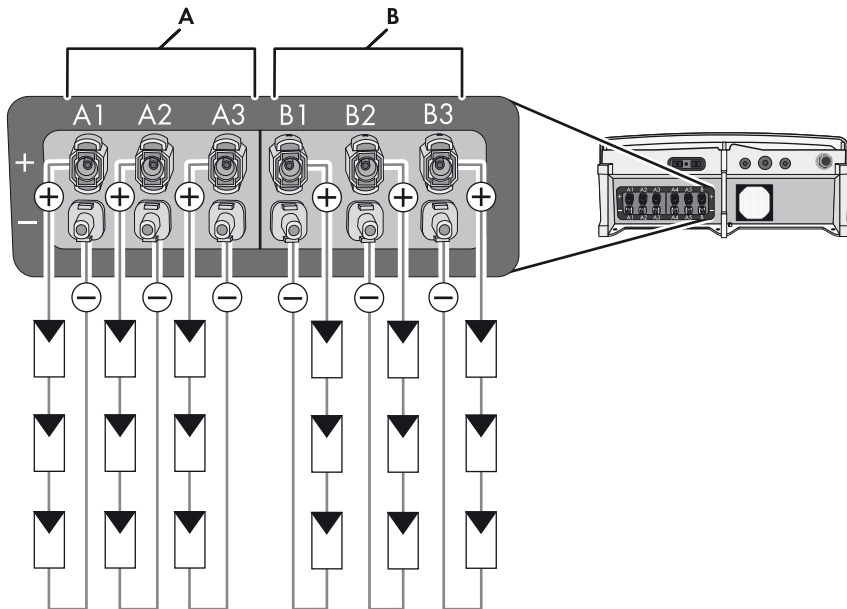
- Place the conical spring washer over the screw.
The grooved side of the conical spring washer must face the screw head.
- Tighten the screw (torque: 6.0 Nm).

- ☒ The teeth of the conical spring washer press into the clamping bracket. The earthing cable now has conductive connection to the enclosure.

6.4 Connection of the PV Array (DC)

6.4.1 Conditions for DC Connection

The inverter has two input areas, "A" and "B", each with its own reverse current protection. In total, up to six strings can be connected.



- Requirements for the PV modules of the connected strings:
 - Same type
 - Same number of in-series-connected PV modules
 - Identical alignment
 - Identical tilt
- The connection cables of the PV modules must be fitted with connectors. The DC plug connectors for the DC connectors are included in the scope of delivery.



Use of Y adaptors

Y adaptors must not be visible or freely accessible within close proximity of the inverter.

- The DC circuit must not be interrupted by Y adaptors.
- Observe the procedure for disconnecting the inverter as described in Section 8 "Disconnecting the Inverter from Voltage Sources" (page 55).

- If the inverter is not equipped with a DC switch-disconnector but this is mandatory in the country of installation, install an external DC switch-disconnector.
- At the DC input of the inverter, the following limits must not be exceeded:

Maximum input voltage	Maximum input current
1,000 V (DC)	36 A (DC)



No mixed connections at input areas

For instance, if the positive pole of a string is connected at input area A and the negative pole of the same string is connected at input area B, this is called a mixed connection.

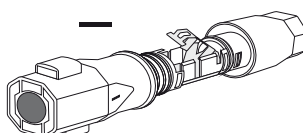
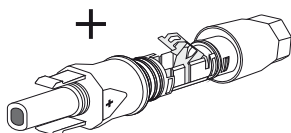
Only connect strings at one input area and never mix the input areas A and B!

Otherwise, the inverter will not comply with the requirements of the EMC directive (directive on the electromagnetic compatibility of devices), and will forfeit its operating licence.

6.4.2 Assembling the DC Connectors

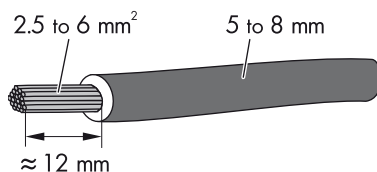
For connection to the inverter, all connection cables of the PV modules must be equipped with the DC connectors provided.

To assemble the DC connectors, proceed as follows. Be sure to observe the correct polarity. The DC connectors have the symbols "+" and "-".



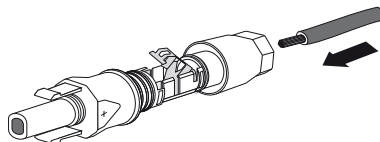
Cable Requirements

- Use a PV1-F cable.

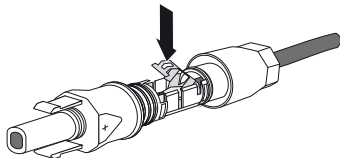


Procedure

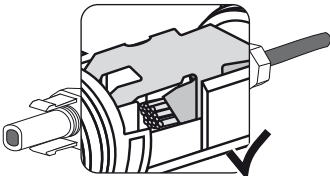
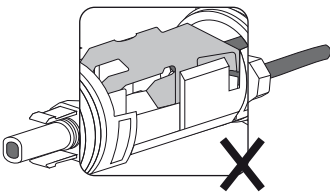
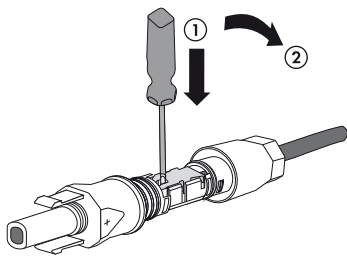
1. Lead the stripped cable all the way into the plug.



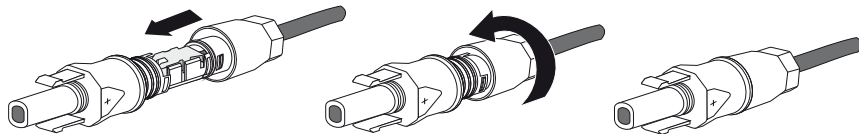
2. Push the clamping bracket down.
☒ The clamping bracket clicks audibly into place.



3. Ensure that the cable is correctly positioned:

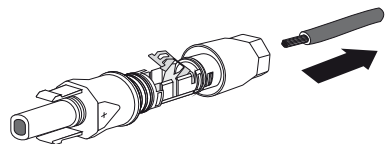
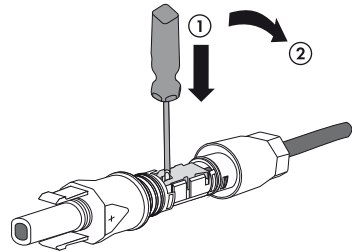
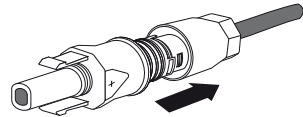
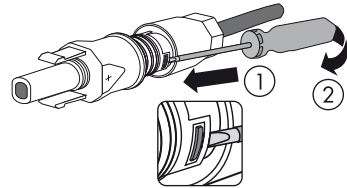
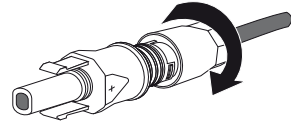
Result	Measure
<input checked="" type="checkbox"/> If the stranded wires are visible in the chamber of the clamping bracket, the cable is correctly positioned. 	<ul style="list-style-type: none"> Proceed to step 4.
<input checked="" type="checkbox"/> If the stranded wires are not visible in the chamber, the cable is not correctly positioned. 	<ul style="list-style-type: none"> Loosening the clamping bracket: insert a screwdriver (blade width: 3.5 mm) into the clamping bracket and lever it out.  Remove the cable and go back to step 1.

4. Push the swivel nut up to the thread and tighten (torque: 2.0 Nm).



6.4.3 Disassembling the DC Connector

1. Unscrew the swivel nut.
2. Unlocking the DC connector: insert a screwdriver (blade width: 3.5 mm) into the snap slot on the side and lever it out.
3. Carefully pull the DC connector apart.
4. Loosening the clamping bracket: insert a screwdriver (blade width: 3.5 mm) into the clamping bracket and lever it out.
5. Remove the cable.



6.4.4 Connecting the PV Array (DC)



DANGER!

Danger to life due to high voltages in the inverter

- Before connecting the PV array, ensure that the AC miniature circuit-breaker is disconnected from all three phase conductors and that it cannot be reconnected.



NOTICE!

Destruction of the inverter due to overvoltage

If the voltage of the PV modules exceeds the maximum input voltage of the inverter, it could be destroyed by the overvoltage. This will void all warranty claims.

- Do not connect any strings to the inverter which have an open-circuit voltage greater than the maximum input voltage of the inverter.
- Check the plant design.



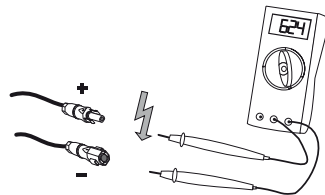
NOTICE!

Excessive voltages can destroy the multimeter.

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

1. Check the connection cables of the PV modules for correct polarity and make sure that the maximum input voltage of the inverter is not exceeded.

At an ambient temperature of over 10°C, the open-circuit voltage of the PV modules should not exceed 90% of the maximum input voltage of the inverter. If this is not the case, review the plant design and the PV module circuitry. Otherwise, the maximum inverter input voltage may be exceeded at low ambient temperatures.

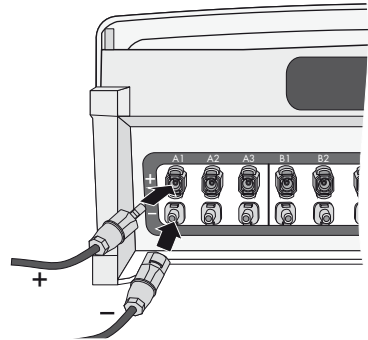


2. Check the strings for earth faults as described in Section 11.1 "Checking the PV Array for Earth Faults" (page 72).

3. Check the assembled DC connectors for correct polarity and connect them to the inverter.

☑ The DC connectors click audibly into place.

To release the DC connectors, see Section 12.1 "Dismounting the Inverter" (page 77).



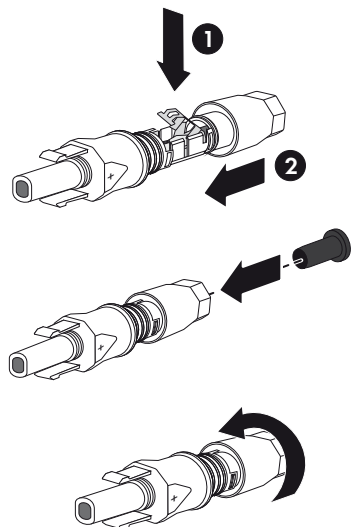
4. In order to seal the inverter, all unused DC inputs must be closed using DC connectors and sealing plugs:



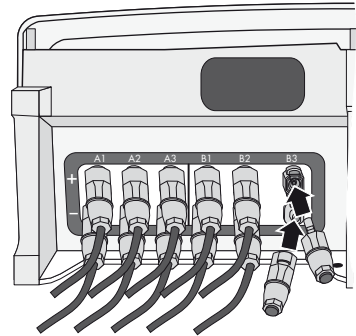
Sealing plugs

Do **not** insert the sealing plugs directly into the DC inputs on the inverter.

- For unused DC connectors, push down the clamping bracket and push the swivel nut up to the thread.
- Insert the sealing plug into the DC connector.
- Fasten the DC connector (torque: 2.0 Nm).



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



5. Ensure that all DC connectors are securely in place.
- ☑ You can now commission the inverter as described in Section 7 "Commissioning" (page 52). The following connections and settings are optional.

6.5 Setting the Country Data Set and Display Language

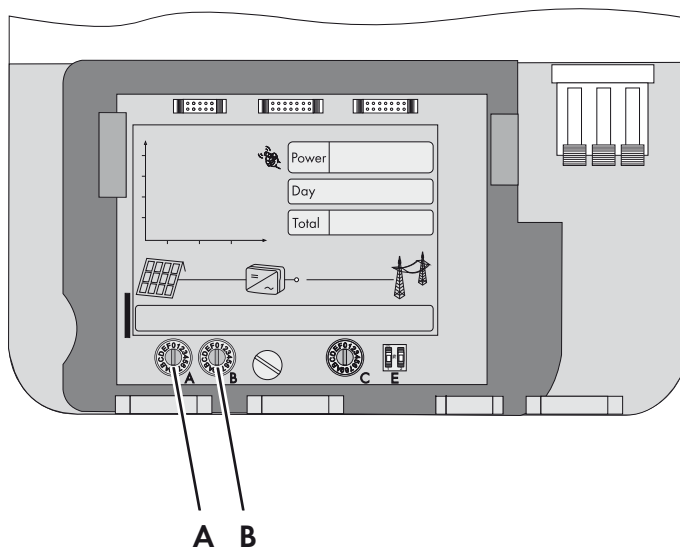
The inverter can be configured for various countries. This can be done prior to commissioning via two rotary switches on the display or after commissioning by configuring the "CntrySet" or "Set country standard" parameter using a communication product (e.g. Sunny WebBox or Sunny Explorer). For devices ordered without any specified country of installation, the default country setting is "VDE-AR-N4105-HP" and the display language is set to German.

Both rotary switches are set to 0 upon delivery. If you have ordered the inverter with specific country settings, they will have already been preset at the factory via a communication product. In this case, you will not be able to recognise the currently valid setting by the switch position.

If changes are made via the rotary switches or via a communication product, the default grid parameters are overwritten. They cannot be restored, and must be re-entered via a communication product.

The display language can be changed at any time using the rotary switches, independent of the grid parameters. This means that the default grid parameters remain unchanged, but the display messages are shown in the set language.

Changes will be applied immediately after switching the miniature circuit-breaker on. If an unprogrammed switch setting is selected, the inverter displays an error message. The last valid setting is retained.



SMA Grid Guard-Protected Country Data Sets

In some countries, the local connection conditions demand a mechanism which prevents the feed-in parameters from being changed. Therefore, certain country data sets are protected against unauthorised changes. They can only be unlocked with a personal access code - the SMA Grid Guard code.

SMA Grid Guard-protected country data sets are automatically locked for ten feed-in hours after commissioning, or after the last change. If the country data set is changed after these 10 feed-in hours, the inverter will not apply the changes but display the error message "Grid parameter locked". If, however, a later change to the country data set only relates to a change of the display language via the rotary switches in the inverter, this change is immediately applied.

It is also possible to configure country data sets (parameter "CntrySet" or "Set country standard"), and to lock or unlock these manually via a communication product. To block a data set, enter the digit sequence "54321" instead of the password into the SMA Grid Guard code field. The data set can only be unlocked by entering a personal, ten-digit SMA Grid Guard code which is valid for a maximum of ten feed-in hours. The application form for the personal access code is available at www.SMA.de/en, in the "Certificate" category of the respective inverter.

The language can be configured without a password, regardless of the country data set.



Changing parameters in SMA Grid Guard-protected country data sets

If the parameters within protected country data sets are changed, these are no longer protected and instead of the standard "ADJ" or "Special setting" is displayed. In this case, a change to parameters is not locked automatically after 10 feed-in hours, but has to be locked manually. To manually lock the parameters, set the SMA Grid Guard Code to "54321".



Further information on parameter settings

For detailed information on making adjustments and changing parameters, see the corresponding user manual for your communication product.

The last change (executed via rotary switch or communication product) is always verified and activated if applicable. Consequently, the switch position may not necessarily show the actual country configuration.

6.5.1 Checking the Country Data Set

Make sure that the inverter is set to the country of installation.

Before commissioning:

- Check that the country data set of the inverter is correct by using the supplementary sheet provided and comparing this to the default settings of the inverter.

After commissioning:

- Check that the country data set is correct using the display message during (re-)commissioning (see Section 7 "Commissioning" (page 52)).
- Check that the country data set is correct by tapping the display twice and viewing the display messages of the start-up phase again.

or

- Check that the country data set is correct using the "SMA grid guard" measurement channel via an SMA communication product.



Display language

Once you have configured the country data set, you can always set the display language later using rotary switch B. However, you have to then set rotary switch A to "0" in order to keep the country data set.

The settings of each country data set are specified in the operating parameters. The parameters can be read using a communication product. The description of the operating parameters is available at www.SMA.de/en in the category "Technical Description" of the respective inverter.

(A)	(B)	Country data set	Display language	SMA Grid Guard protection	Country
0	0	Default setting	Default setting	Dependent on parameter set	Dependent on parameter set
0	1	Retained	English	Dependent on parameter set	Dependent on parameter set
0	2	Retained	German	Dependent on parameter set	Dependent on parameter set
0	3	Retained	French	Dependent on parameter set	Dependent on parameter set

(A)	(B)	Country data set	Display language	SMA Grid Guard protection	Country
0	4	Retained	Spanish	Dependent on parameter set	Dependent on parameter set
0	5	Retained	Italian	Dependent on parameter set	Dependent on parameter set
0	6	Retained	Greek	Dependent on parameter set	Dependent on parameter set
0	7	Retained	Czech	Dependent on parameter set	Dependent on parameter set
0	8	Retained	Korean	Dependent on parameter set	Dependent on parameter set
0	9	Retained	Portuguese	Dependent on parameter set	Dependent on parameter set
0	A	Retained	Dutch	Dependent on parameter set	Dependent on parameter set
0	B	Retained	Slovenian	Dependent on parameter set	Dependent on parameter set
0	C	Retained	Bulgarian	Dependent on parameter set	Dependent on parameter set
0	D	Retained	Polish	Dependent on parameter set	Dependent on parameter set
1	0	VDE0126-1-1	German	Yes	Germany, Switzerland
1	6	VDE-AR-N4105-HP ^{a)}	German	Yes	Germany
1	8	VDE0126-1-1	French	Yes	Switzerland, France
1	9	VDE 0126-1-1/UTE	French	Yes	France
2	0	VDE0126-1-1	Italian	Yes	Switzerland
2	8	AS4777.3	English	No	Australia
3	2	CEI0-21Ext ^{b)} *	Italian	Yes	Italy
4	0	RD1699	Spanish	Yes	Spain
4	1	RD1663/661-A	Spanish	Yes	Spain
4	8	PPC	Greek	No	Greece
4	9	PPC	English	No	Greece
5	1	KEMCO 502_2009	English	No	South Korea
5	2	KEMCO 502_2009	Korean	No	South Korea
5	A	G59/2	English	No	England

(A)	(B)	Country data set	Display language	SMA Grid Guard protection	Country
6	0	EN50438	German	Yes	Various EU countries
6	1	EN50438	English	Yes	
6	2	EN50438	French	Yes	
6	3	EN50438	Italian	Yes	
6	4	EN50438	Spanish	Yes	
6	5	EN50438	Greek	Yes	
6	6	EN50438	Czech	Yes	
6	7	EN50438	Portuguese	Yes	
6	8	EN50438	Bulgarian	Yes	
6	9	EN50438	Polish	Yes	
6	E	NEN-EN50438	Dutch	Yes	Netherlands
7	4	PPDS	Czech	Yes	Czech Republic
7	5	PPDS	English	Yes	Czech Republic
7	6	PPDS	German	Yes	Czech Republic
7	8	C10/11/2012	French	Yes	Belgium
7	9	C10/11/2012	English	Yes	Belgium
7	A	C10/11/2012	German	Yes	Belgium
7	B	C10/11/2012	Dutch	Yes	Belgium
A	0	MVtg-Directive	German	Yes	Germany
A	1	MVtg-Directive	English	Yes	Flexible
A	2	MVtg-Directive	French	Yes	France
A	3	MVtg-Directive	Spanish	Yes	Spain
A	4	MVtg-Directive	Czech	Yes	Czech Republic
A	C	SI 4777*	English	Yes	Israel
B	0	MVtg-Directive int	German	Yes	Germany
B	1	MVtg-Directive int	English	Yes	Flexible
B	2	MVtg-Directive int	French	Yes	France
B	3	MVtg-Directive int	Spanish	Yes	Spain
B	4	MVtg-Directive int	Czech	Yes	Czech Republic
B	8	IEC61727/MEA	English	No	Thailand
B	C	IEC61727/PEA	English	No	Thailand
C	0	Customer	English	No	Flexible
C	1	Customer	German	No	Flexible
C	2	Customer	French	No	Flexible
C	3	Customer	Spanish	No	Flexible

(A)	(B)	Country data set	Display language	SMA Grid Guard protection	Country
C	4	Customer	Italian	No	Flexible
C	5	Customer	Greek	No	Flexible
C	6	Customer	Czech	No	Flexible
D	0	Off-Grid60*	English	No	Flexible
D	1	Off-Grid60*	German	No	Flexible
D	2	Off-Grid60*	French	No	Flexible
D	3	Off-Grid60*	Spanish	No	Flexible
D	4	Off-Grid60*	Italian	No	Flexible
D	5	Off-Grid60*	Greek	No	Flexible
D	6	Off-Grid60*	Czech	No	Flexible
E	0	Off-Grid50*	English	No	Flexible
E	1	Off-Grid50*	German	No	Flexible
E	2	Off-Grid50*	French	No	Flexible
E	3	Off-Grid50*	Spanish	No	Flexible
E	4	Off-Grid50*	Italian	No	Flexible
E	5	Off-Grid50*	Greek	No	Flexible
E	6	Off-Grid50*	Czech	No	Flexible
F	0	SD-Card	SD-Card	No	Flexible
a) Setting in accordance with VDE-AR-N-4105 for PV plants > 13.8 kVA (Germany) b) Setting in accordance with CEI 0-21 for PV plants with external grid and plant protection > 6 kVA (Italy) * Planned					

If the inverter is not set to the installation country, there are several ways of configuring the required country data set:

- Setting via two rotary switches, as described in Section 6.5.3 "Setting the Country Data Set and Language Using Rotary Switches" (page 47).
- Alternatively you can conduct the settings via the "CntrySet" or "Set country standard" parameters via a communication product, once you have commissioned the inverter.
- If you require adjusted parameter settings for your installation site, you can change these with the help of a communication product.

6.5.2 Extension of the Deactivation Limits

The deactivation criteria (voltage, frequency) are specified by the country parameters.

The inverters have the additional country data set "MVtgDirective Internal/Medium-Voltage Directive (Germany)". This parameter expands the deactivation limits of the inverter for voltage and frequency to a maximum/minimum. This country setting may only be selected if the plant or the inverter is operated with external three-phase decoupling protection, which will automatically disconnect the inverter from the electricity grid if non-permissible voltage and frequency values occur. Device protection is still guaranteed.



DANGER!

Electric shock due to missing external decoupling protection.

If you set the country data set "MVtgDirective Internal/Medium-Voltage Directive (Germany)", you may only operate the inverter with external three-phase decoupling protection. Without external three-phase decoupling protection, the inverter will not disconnect from the electricity grid when the standard requirement is exceeded.

- Install external three-phase decoupling protection.

6.5.3 Setting the Country Data Set and Language Using Rotary Switches

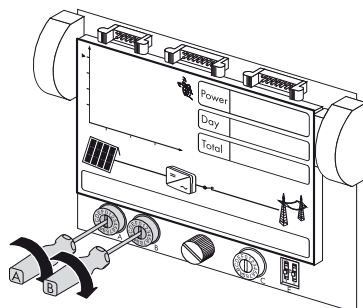
1. Disconnect the inverter (see Section 8 "Disconnecting the Inverter from Voltage Sources" (page 55)).

! DANGER!
Danger to life due to high voltages in the event of electricity grid failure

If you set the inverter to "Off-Grid50/Island mode 50 Hz" or "Off-Grid60/Island mode 60 Hz", you may not operate the inverter on the electricity grid, but only on the stand-alone grid, because the inverter does not then satisfy any country-specific standards or directives. In the event of electricity grid failure, this will prevent the danger of backfeed.

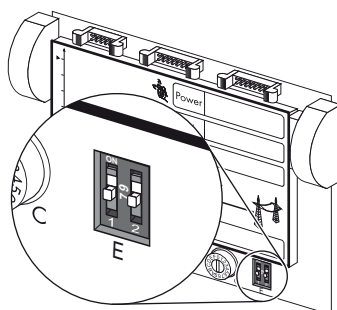
- If the inverter is set to "Off-Grid50/Island mode 50 Hz" or "Off-Grid60/Island mode 60 Hz", never operate the inverter directly on the electricity grid.

2. Set the rotary switches A and B with a screwdriver (blade width: 2.5 mm) to the desired position (see table in Section 6.5.1 "Checking the Country Data Set" (page 42)).



i Temporarily setting the display language to English

- To set the display language to English, push the left switch 1 up until it locks into place. Use an object with a small tip, e.g. a ballpoint pen, to do this.
- To reset the display language back to the original language, push the left switch 1 down until it locks into place. Use an object with a small tip, e.g. a ballpoint pen, to do this.



3. Commission the inverter (see Section 7 "Commissioning" (page 52)).

6.6 Communication

6.6.1 Bluetooth

Communication with a communication product via *Bluetooth* is activated by default. Networking with other inverters via *Bluetooth* is deactivated by default.

The following setting options are possible via a rotary switch:

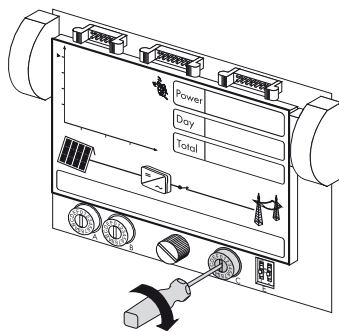
Switch position (NetID)	Setting
0	<i>Bluetooth</i> communication is deactivated.
1	Communication via <i>Bluetooth</i> with communication product possible, no networking with other inverters (default setting)
2 to F	Networking via <i>Bluetooth</i> with other inverters is activated.

If you do not communicate using *Bluetooth*, deactivate the *Bluetooth* communication on your inverter. This will protect your PV plant from unauthorised access.

In order to restrict communication via *Bluetooth* between the inverters of your PV plant and those of neighbouring systems, you can assign an individual NetID to the inverters of your PV plant (switch position 2 to F). However, this is only necessary if neighbouring plants are located within a radius of 500 m.

For all inverters in your PV plant to be detected by your communication product, they must all have the same NetID.

1. Determine a free NetID using Sunny Explorer (see Sunny Explorer user manual).
2. Disconnect the inverter (see Section 8 "Disconnecting the Inverter from Voltage Sources" (page 55)).
3. Set the arrow on the right-hand rotary switch C to the required position using a screwdriver (blade width: 2.5 mm).



4. Commission the inverter (see Section 7 "Commissioning" (page 52)).



Activation of settings

The *Bluetooth* settings will only be applied once the inverter has been commissioned.

6.6.2 Multi-Function Interface

The inverter is equipped with a slot for multi-function interfaces. This slot is designed to connect a simple multi-function relay or an SMA Power Control Module. The interface can either be retrofitted, installed at the factory according to a specific order, or included in the regular scope of delivery.

Multi-Function Relay

You can configure the multi-function relay for various operating modes. The multi-function relay is used, for example, to switch fault indicators on or off (for information on installation and configuration, see installation manual of the multi-function relay).

SMA Power Control Module

The SMA Power Control Module enables the inverter to implement grid management services and is equipped with an additional multi-function relay (for information on installation and configuration, see installation manual of the SMA Power Control Module).

6.6.3 Communication Interface

The inverter can be fitted with an extra communication interface (e.g. RS485). This communication interface will enable the inverter to communicate with special SMA communication products or other inverters (for information on supported products, see www.SMA.de/en). The interface can either be retrofitted, installed at the factory according to a specific order, or included in the regular scope of delivery.

You can only set the operating parameters of the inverter via SMA communication products. You can only set the country data set of the inverter via the two rotary switches in the inverter prior to commissioning or within the first ten operating hours.



Display of parameters

Depending on the type of communication, RS485 or *Bluetooth*, the parameters and messages are displayed differently on the communication products.

Example of how the country data set parameter is displayed:

- For communication with RS485: "CntrySet" parameter
- For communication with *Bluetooth*: parameter "Set country standard"

6.7 Activating and Deactivating Reverse-Current Protection at Input Area A

Reverse-current protection is activated upon delivery. If you are using both input areas, reverse-current protection must be activated at both input areas.

If you are using only input area A, you can deactivate the reverse current protection at input area A, which will slightly increase the inverter efficiency.

The reverse-current protection at input area B cannot be deactivated.

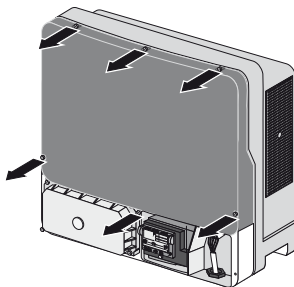
The procedure for deactivating and reactivating the reverse-current protection at input area A is described below.

Requirements for deactivating reverse-current protection:

- Input area B must not be used.
- The reverse-current resistance of the PV modules must be complied with.

Procedure

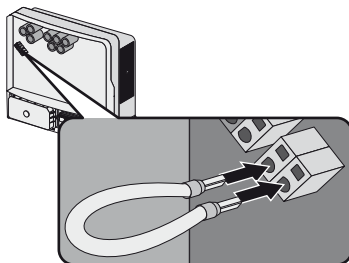
1. If the inverter is in operation, disconnect it (see Section 8 "Disconnecting the Inverter from Voltage Sources" (page 55)).
2. Release the screws of the upper enclosure lid. For this purpose, use an Allen key (AF 4).
3. Pull the upper enclosure lid forwards to remove it.



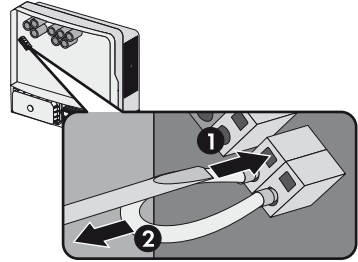
Jumper cable

Use only the supplied jumper cable to deactivate the reverse-current protection.

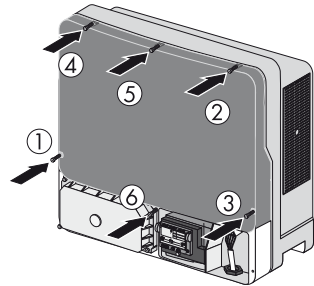
4. Deactivate or activate the reverse-current protection at input area A as follows:
 - To deactivate the reverse-current protection, insert both ends of the jumper cable into the yellow terminals as far as they will go. Do not kink the cable.



- To activate the reverse-current protection, remove both ends of the jumper cable from the yellow terminals one after the other. To do so, insert a screwdriver (blade width: 3.5 mm) into the rectangular opening on the terminal and remove the cable end.



5. Pre-screw all screws and the corresponding conical spring washers on the upper enclosure lid and then tighten them in the sequence shown on the right (torque: 6.0 Nm). The toothing of the conical spring washers must point towards the enclosure lid. The scope of delivery of the inverter includes a spare screw and conical spring washer.

**DANGER!**

Danger to life due to enclosure lid carrying voltage

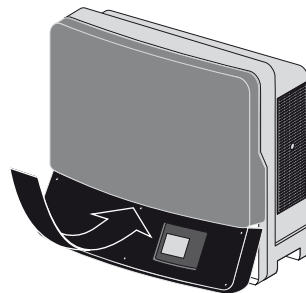
The earthing of the upper enclosure lid is ensured by the toothed conical spring washers.

- For all six screws, attach the conical spring washers with the toothing facing towards the enclosure lid.

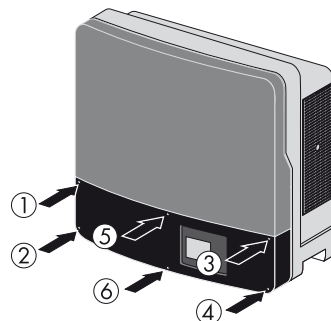
7 Commissioning

7.1 Commissioning the Inverter

1. The following conditions must be fulfilled before commissioning:
 - Correct mounting (see Section 5)
 - Correct country setting (see Section 6.5)
 - AC cable correctly connected (see Section 6.3)
 - DC cable correctly connected (PV strings) (see Section 6.4)
 - Unused DC inputs are closed using the corresponding DC connectors and sealing plugs (see Section 6.4.4)
 - All enclosure openings are closed
 - The miniature circuit-breaker is correctly sized
2. Dock the lower enclosure lid at an angle and attach. The captive screws must protrude.



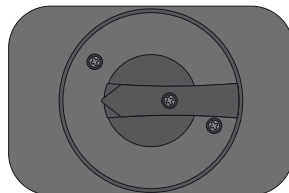
3. Pre-screw all six screws and then tighten them in the sequence shown on the right (torque: 2.0 Nm). For this purpose, use an Allen key (AF 3).



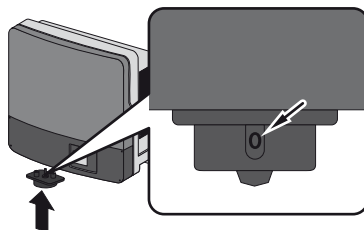
4. If an external DC switch-disconnector is installed, switch it off.

5. If the inverter is equipped with an integrated DC switch-disconnector, plug the handle in and switch it on.

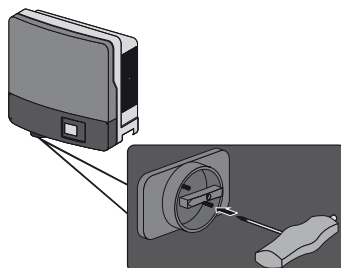
- Set the handle of the DC switch-disconnector to position "0" so that the captive screws are visible in the handle.
- Align the handle of the DC switch-disconnector so that the sharp end of the handle points to the left.



- Insert the handle of the DC switch-disconnector in the socket at the bottom of the inverter. To do this, the switch position "0" must be visible from the front.



- Secure the handle of the DC switch-disconnector with the two captive screws (torque: 2 Nm). For this purpose, use an Allen key (AF 3).



- Switch the DC switch-disconnector on.

6. Switch the miniature circuit-breaker on.

☒ Green LED is glowing: commissioning successful.

or

☒ Green LED flashes if irradiation is insufficient: grid connection conditions have not yet been reached. Wait for sufficient irradiation.

or

☒ Red LED is glowing: a disturbance has occurred. Eliminate the fault (see Section 1.1 "Troubleshooting" (page 72)).

7. If a multi-function relay is connected, switch on the supply voltage to the relay.

8. For communication via *Bluetooth*, make the following settings:





- Change the plant time (see the manual of the communication product).
- Change the passwords (see the manual of the communication product).

7.2 Display Messages during the Start-Up Phase



Illustrated display messages

The display messages illustrated in this section serve as examples and, depending on the country setting, may differ from the actual display messages on your inverter.

- The firmware version of the internal processors appears first in the text line.

- After an interval of five seconds, or after tapping on the enclosure lid, the serial number or designation of the inverter and the NetID for communication via *Bluetooth* will appear. The designation of the inverter can be changed via a communication product.

- After another five seconds, or by tapping the lid again, the selected country data set will appear (e.g. "VDE-AR-N4105-HP").

- After a further five seconds or another tap, the configured language is displayed (example: "Sprache Deutsch" (Language English)).

- During normal operation, the text line of the display will subsequently be blank. For event messages displayed in the text line and their meaning, refer to Section 10 "Messages" (page 63).



Showing display messages again

If you want to view the display messages of the start phase again during normal operation, double-tap the display.

8 Disconnecting the Inverter from Voltage Sources



DANGER!

Danger to life due to high voltages in the inverter
Death from electric shock

The inverter operates at high voltages and must be disconnected prior to carrying out any work. In addition, if the DC connectors are pulled out without first switching off the DC switch-disconnector, a dangerous electric arc can occur.

- Disconnect the inverter as described in this section.



CAUTION!

Risk of burns due to hot DC lid

During operation, the DC lid on the left-hand side of the connection area can get hot.

- Take care not to touch the DC lid when working in the connection area.



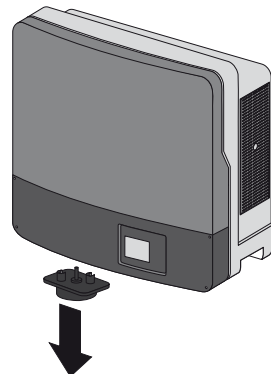
NOTICE!

Electrostatic discharge can damage the inverter.

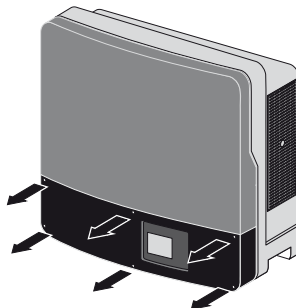
Internal components of the inverter can be irreparably damaged by electrostatic discharge.

- Earth yourself before touching any components.

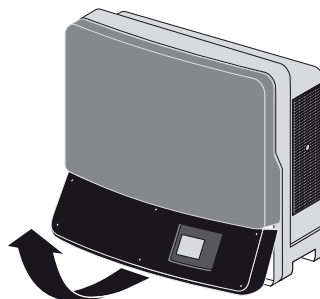
1. Disconnect the miniature circuit-breaker from all three phase conductors and secure against reconnection.
2. If a multi-function relay is connected, disconnect its supply voltage and ensure that it cannot be reconnected.
3. If an integrated or external DC switch-disconnector is installed, switch it off.
4. Wait until the LEDs, display and fault indicator have gone out.
5. If a DC switch-disconnector is installed, unscrew and pull out the handle. For this purpose, use an Allen key (AF 3).



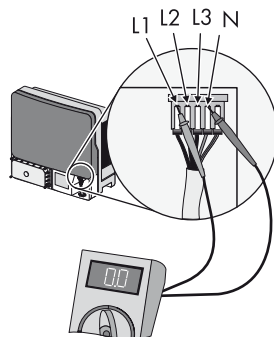
6. Loosen all six captive screws of the enclosure lid.



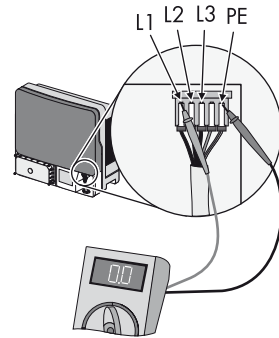
7. To remove the lower enclosure lid, lift it up from the bottom.



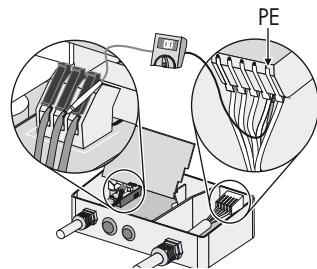
8. Ensure that L1, L2 and L3 are disconnected from voltage sources to N. For this purpose, use a test probe with a maximum diameter of 2 mm.



9. Ensure that L1, L2 and L3 are disconnected from voltage sources to PE.



10. If a multi-function relay is installed in the inverter, ensure that it is disconnected from all voltage sources as follows:
- Release the screw in the display and flip the display up until it clicks into place.
 - Ensure that all terminals of the multi-function relay are disconnected from voltage sources to PE.

**DANGER!**

Danger to life due to high voltages in the inverter
Death from electric shock

There is residual voltage in the inverter.

- Wait 20 minutes before opening the upper enclosure lid.
- Do not open the DC lid.

- ☒ The inverter is now dead and work can be carried out on it.

9 Maintenance and Cleaning

9.1 Cleaning the Inverter

If the inverter is soiled, clean the enclosure lid, the display and the LEDs with clear water and a cloth only.

9.2 Checking the Heat Dissipation

If the inverter regularly goes into derating due to excessive heat (temperature symbol on the display illuminates), this may be due to one of the following reasons:

- The ventilation grids on the sides are clogged with dirt.
Clean the ventilation grids as described below.
- One of the fans is clogged.

The inverter has two integrated fans for cooling. One of these is located at the bottom of the inverter next to the connection area and the other on the left-hand side of the enclosure under the ventilation grid.

If the fan enclosure is just covered in loose dust, you can clean it with a vacuum cleaner.

If you do not achieve satisfactory results with a vacuum cleaner, you can dismantle the fan for cleaning, as described in the following sections.

9.2.1 Cleaning the Ventilation Grids

The inverter takes cooling air in from the bottom left and blows it out again through the ventilation grids at the top. Clean the ventilation grids if they are soiled.

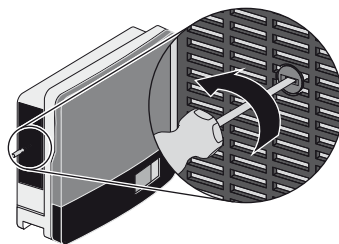


NOTICE!

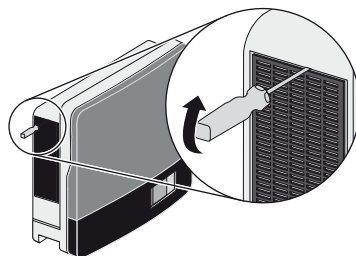
Risk of damage to the inverter through intrusion of insects

- The ventilation grids must not be removed permanently, otherwise the device will not be protected against the intrusion of insects.

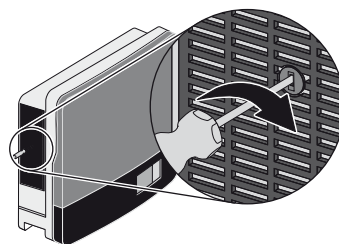
1. Turn the rotary fastener of the ventilation grid in the direction of the arrow until the notch is in a vertical position.



2. Remove the ventilation grid.



3. Clean the ventilation grid with a soft brush, a paint brush or compressed air.
4. Re-attach the ventilation grid to the inverter.
5. Turn the notch of the rotary fastener back 90° to a horizontal position.

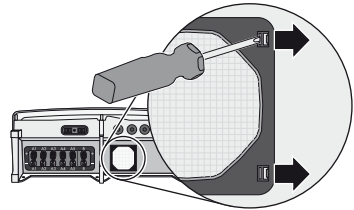


9.2.2 Cleaning the Fan at the Bottom of the Inverter

1. Disconnect the inverter as described in Section 8 "Disconnecting the Inverter from Voltage Sources" (page 55).
2. Wait for the fan to stop rotating.

Cleaning the Fan Guards

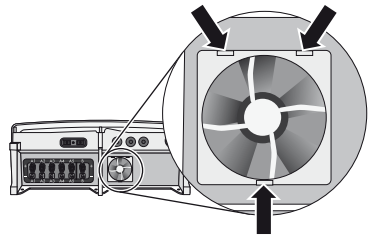
3. To dismantle the fan guard:
 - Press both detents on the right-hand edge of the fan guard to the right using a screwdriver and release from the retainer.
 - Carefully remove the fan guard.



4. Clean the fan guard with a soft brush, a paint brush, a cloth or compressed air.

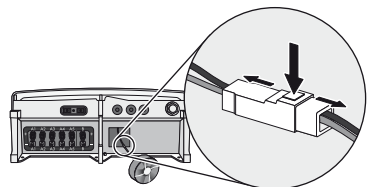
Cleaning the Fan

5. Press the detents in towards the centre.
6. Remove the fan by pulling it slowly and carefully downwards.



7. Unlock and remove the plug.

The fan cables are long enough to let you lift the fan out sufficiently to disconnect the plugs inside the inverter.



8. Remove the fan and clean it with a soft brush, a paint brush or a cloth and water.



NOTICE!

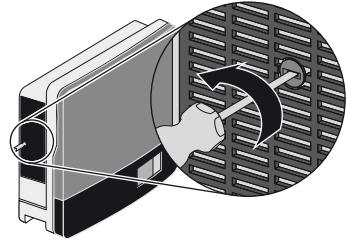
Damage to the fan through use of compressed air

- Do not use compressed air to clean it. This could damage the fan.

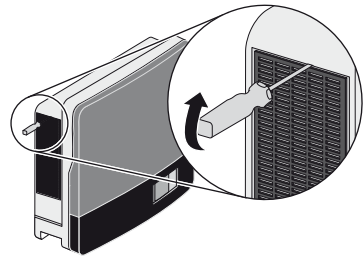
9. After cleaning, reassemble everything in reverse order.
10. Check the function of the fan as described in Section 9.2.4 "Testing the Fans" (page 62).

9.2.3 Cleaning the Fan on the Left-Hand Side of the Inverter Enclosure

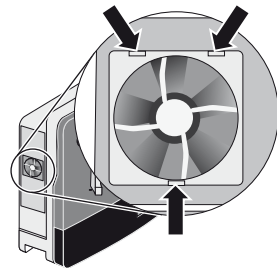
1. Disconnect the inverter as described in Section 8 "Disconnecting the Inverter from Voltage Sources" (page 55).
2. Turn the rotary fastener of the ventilation grid in the direction of the arrow until the notch is in a vertical position.



3. Remove the ventilation grid.



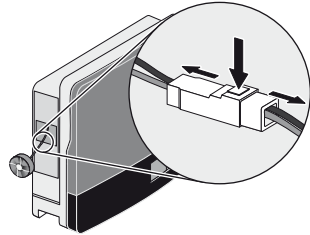
4. Wait for the fan to stop rotating.
5. Press the detents in towards the centre.



6. Remove the fan by pulling it slowly and carefully out sideways.

7. Unlock and remove the plug.

The fan cables are long enough to let you lift the fan out sufficiently to disconnect the plugs inside the inverter.



8. Remove the fan and clean it with a soft brush, a paint brush or a cloth and water.



NOTICE!

Damage to the fan through use of compressed air

- Do not use compressed air to clean it. This could damage the fan.

9. After cleaning, reassemble everything in reverse order.
10. Check the function of the fans as described in Section 9.2.4 "Testing the Fans" (page 62).

9.2.4 Testing the Fans



Testing the fans

To test the fans you will need a special data capture device (e.g. Sunny WebBox) or a PC with appropriate software (e.g. Sunny Explorer) in order to change the parameters of the inverter.

You will also need the installer password to access the installer mode.

1. Enter the installer password.
2. In the installer mode, set the parameters "CoolSys.FanTst" or "Fan test" to "On".
3. Check the air flow in both fans.

The inverter takes cooling air in from the bottom left and blows it out again through the ventilation grids at the top. Listen for any unusual noise, which could indicate incorrect installation or a fault in the fans.

4. After the test, set the parameter "CoolSys.FanTst" or "Fan test" back to the "Off" position.
- ☒ The fan test is now complete.

10 Messages

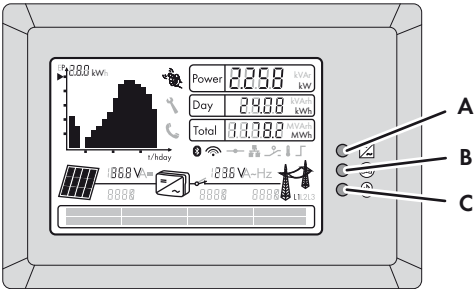


No display messages if no DC voltage is present

Measurements and the display of messages can only be carried out when there is sufficient DC voltage (green LED flashing or glowing).

10.1 LED Signals

Position of the LEDs



Item	Description	Status	Explanation
A	Green LED	Glowing	Operation
		Flashing	Grid connection conditions are not yet met.
B	Red LED	Glowing	Errors
C	Blue LED	Glowing	Bluetooth communication is activated.
		Flashing	The inverter has been identified via Sunny Explorer by setting the "Find device" parameter.

10.2 Event Messages

During an update, relevant display messages are shown in the text line of the display.

Message	Description
< Inst. code valid >	The SMA Grid Guard code entered is valid. The configured country data set is now unlocked and can be changed. If the configured country data set is protected, the unlocking is valid for a maximum of ten feed-in hours.
<No new update on the SD card >	There is no update file relevant for this inverter on the SD card or the available update has already been carried out.
< Grid parameter unchanged >	The selected switch setting is not programmed or there is no country data set available on the SD card.
< Parameters set successfully >	All parameters of the SD card, e.g. country data set, have been successfully applied.
< SD card is read >	The inverter is currently reading the SD card.
< Set parameter >	The inverter is configuring the parameters from the SD card settings.
< Update completed >	The inverter has successfully completed the update.
< Update Bluetooth >	The inverter updates the <i>Bluetooth</i> component.
< Update display >	The inverter is updating the display.
< Update main CPU >	The inverter is updating the inverter component.
< Update communication >	The inverter is updating the communication component.
< Update RS485I module >	The inverter is updating the RS485 communication interface.
< Update language table >	The inverter is updating the language table.
< Update file OK >	The update file found is valid.

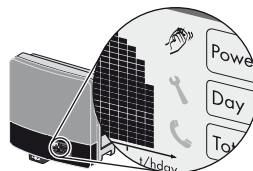
10.3 Error Messages

The text line on the display shows the relevant display messages whenever an error occurs. The event numbers for the displayed error messages appear above the text line. By tapping on the enclosure lid, you can scroll through multi-line messages.

If the error exists over a long period of time, the red LED glows and the multi-function relay is activated.

In addition, depending on the severity of the disturbance, the "spanner" or "telephone receiver" symbol on the display will light up.

- Spanner: disturbance which can be remedied on-site (see table below)
- Telephone receiver: device disturbance
Contact the SMA Service Line.



Event no.	Display message and cause	Corrective measures
101 to 103	<p>< System incident ></p> <p>The mains voltage has exceeded the permissible range. This error can have the following causes:</p> <ul style="list-style-type: none"> • The mains voltage at the termination point of the inverter is too high. • The grid impedance at the termination point of the inverter is too high. <p>The inverter disconnects itself from the electricity grid for safety reasons.</p>	<ul style="list-style-type: none"> • Check the mains voltage and grid connection on the inverter. <p>If the mains voltage is outside the permissible range due to local grid conditions, ask your network operator if the voltage can be adjusted at the feed-in point or if it would be acceptable to change the monitored operating limits.</p> <p>If the mains voltage is within the tolerance range, but this error is still displayed, contact the SMA Service Line.</p>
202 to 203	<p>< System incident ></p> <p>The mains voltage has fallen below the permissible range. This error can have the following causes:</p> <ul style="list-style-type: none"> • Electricity grid disconnected • AC cable damaged • The mains voltage at the termination point of the inverter is too low. <p>The inverter disconnects itself from the electricity grid for safety reasons.</p>	<ul style="list-style-type: none"> • Check the triggering of the miniature circuit-breaker. • Check the mains voltage and grid connection on the inverter. <p>If the mains voltage is outside the permissible range due to local grid conditions, ask your network operator if the voltage can be adjusted at the feed-in point or if it would be acceptable to change the monitored operating limits.</p> <p>If the mains voltage is within the tolerance range, but this error is still displayed, contact the SMA Service Line.</p>

Event no.	Display message and cause	Corrective measures
301	<p>< System incident ></p> <p>The ten-minute average of the mains voltage is no longer within the permissible range.</p> <p>This can be caused by one of the following:</p> <ul style="list-style-type: none"> • The mains voltage at the termination point of the inverter is too high. • The grid impedance at the termination point of the inverter is too high. <p>The inverter disconnects to assure compliance with the power quality of the electricity grid.</p>	<ul style="list-style-type: none"> • Check the mains voltage at the termination point of the inverter: <p>If, due to local grid conditions, the mains voltage exceeds the configured threshold, ask the network operator whether the voltage can be adjusted at the feed-in point, or whether it would be acceptable to modify the threshold for power quality monitoring.</p> <p>If the mains voltage is permanently within the tolerance range and this error is still displayed, contact the SMA Service Line.</p>
401 to 404	<p>< System incident ></p> <p>The inverter is no longer in grid-parallel operation and has stopped feed-in for safety reasons.</p>	<ul style="list-style-type: none"> • Check the grid connection for strong, short-term frequency variations.
501	<p>< System incident ></p> <p>The mains frequency is not within the permissible range. The inverter disconnects itself from the electricity grid for safety reasons.</p>	<ul style="list-style-type: none"> • If possible, check the mains frequency and observe how often major fluctuations occur. <p>If there are frequent fluctuations and this error occurs as a result, ask your network operator if it would be acceptable to change the operating parameters.</p> <p>Discuss the proposed parameters with the SMA Service Line.</p>
601	<p>< System incident ></p> <p>The internal monitoring function of the inverter has detected an excessively high proportion of direct current in the line current.</p>	<ul style="list-style-type: none"> • Check the grid connection for direct current. • If this event occurs often, check with the network operator whether it is possible to raise the monitoring threshold.

Event no.	Display message and cause	Corrective measures
701	<p>< Frequency not permitted > < Check parameter ></p> <p>The mains frequency is outside the permissible range. The inverter disconnects itself from the electricity grid for safety reasons.</p>	<ul style="list-style-type: none"> As far as possible, check the mains frequency and observe how often major fluctuations occur. <p>If there are frequent fluctuations and this error occurs as a result, ask your network operator if it would be acceptable to change the operating parameters.</p> <p>Discuss the proposed parameters with the SMA Service Line.</p>
1302	<p>< Waiting for grid voltage > or < Installation failure grid connection > < Check grid and fuses ></p> <p>The inverter has detected an error in the AC cabling and cannot connect to the electricity grid. The reason for this could be an incorrect country setting.</p>	<ul style="list-style-type: none"> Check AC installation. Adjust the connection as described in Section 6.3 "Connection to the Electricity Grid (AC)" (page 29). Check that the country setting is correct: <ul style="list-style-type: none"> Via the rotary switch: see Section 6.5.1 "Checking the Country Data Set" (page 42). Via communication: set the parameter "CntrySet" or "Set country standard"
1501	<p>< Reconnection fault grid ></p> <p>The measured voltage or frequency is too high or too low for connection to the electricity grid.</p> <p>It may be that a changed country data set or changed parameters do not correspond to the local requirements for connecting to the electricity grid.</p>	<ul style="list-style-type: none"> Check that the country setting is correct: <ul style="list-style-type: none"> Via the rotary switch: see Section 6.5.1 "Checking the Country Data Set" (page 42). Via communication: set the parameter "CntrySet" or "Set country standard" Check whether the voltage and frequency of the electricity grid are within the limits of the configured country data set. If individual parameters within a country data set have been changed, re-select the original country data set for the country of installation.
3301 to 3303	<p>< Unstable operation ></p> <p>There is not enough power at the DC input of the inverter for stable operation. This may be caused by snow on the PV modules.</p>	<ul style="list-style-type: none"> Wait until irradiation is higher. If this event recurs at medium irradiation levels, check the PV plant design and the correct circuitry of the PV array.

Event no.	Display message and cause	Corrective measures
3401	<p>< DC overvoltage > < Disconnect generator ></p> <p>The DC input voltage connected to the inverter is too high.</p>	<ul style="list-style-type: none"> • Immediately disconnect the inverter from the PV array, as described in Section 8 "Disconnecting the Inverter from Voltage Sources" (page 55). Otherwise, the inverter could be destroyed. • Check that the DC voltage of the strings is in compliance with the maximum input voltage of the inverter before reconnecting the inverter to the PV array.
3501	<p>< Insulation resistor > < Check PV array ></p> <p>The inverter has detected an earth fault in the PV array.</p>	<ul style="list-style-type: none"> • Check the strings for earth faults as described in Section 11.1 "Checking the PV Array for Earth Faults" (page 72). • The installer of the PV array must remedy any earth faults before the affected string is reconnected.
3601	<p>< High leakage current > < Check PV array ></p> <p>The leakage current from the inverter and the PV array is too high.</p> <p>This can be caused by a sudden earth fault, a residual current or a malfunction.</p> <p>The inverter interrupts feed-in operation immediately after exceeding a threshold and then automatically reconnects to the electricity grid.</p>	<ul style="list-style-type: none"> • Check the strings for earth faults as described in Section 11.1 "Checking the PV Array for Earth Faults" (page 72). • The installer of the PV array must remedy any earth faults before the affected string is reconnected.
3701	<p>< Residual current too high > < Check PV array ></p> <p>The inverter has detected a residual current due to transient PV array earthing.</p>	<ul style="list-style-type: none"> • Check the strings for earth faults as described in Section 11.1 "Checking the PV Array for Earth Faults" (page 72). • The installer of the PV array must remedy any earth faults before the affected string is reconnected.
3801	<p>< DC overcurrent > < Check PV array ></p> <p>On the DC side of the inverter, an overcurrent has been detected and the inverter has briefly interrupted feed-in.</p>	<p>If this event occurs frequently:</p> <ul style="list-style-type: none"> • Check the design and the circuitry of the PV array.

Event no.	Display message and cause	Corrective measures
3901 to 3902	<p>< Waiting for DC start conditions > < Start conditions not met ></p> <p>The input power or input voltage of the PV modules is insufficient for feeding into the electricity grid.</p>	<ul style="list-style-type: none"> • Wait until irradiation is higher. • If the event occurs frequently in the morning, it may be necessary to increase the voltage threshold for the start of feed-in (parameter setting via communication). • If this event recurs at medium irradiation levels, check the PV plant design and the correct circuitry of the PV array.
6001 to 6438	<p>< Self diagnosis > or < Device disturbance ></p>	<ul style="list-style-type: none"> • Contact the SMA Service Line (see Section 15 "Contact" (page 86)).
6501 to 6511	<p>< Self diagnosis > or < Overtemperature ></p> <p>The inverter switches off due to excessive temperature.</p>	<ul style="list-style-type: none"> • Ensure sufficient ventilation. • Check heat dissipation, as described in Section 9.2 "Checking the Heat Dissipation" (page 58).
6603 to 6604	<p>< Self diagnosis > or < Overload ></p>	<ul style="list-style-type: none"> • Contact the SMA Service Line (see Section 15 "Contact" (page 86)).
6701 to 6702	<p>< Communication disturbed ></p> <p>A fault has occurred in the internal communication of the inverter. However, the inverter continues feeding into the grid.</p>	<p>If this event occurs frequently:</p> <ul style="list-style-type: none"> • Contact the SMA Service Line (see Section 15 "Contact" (page 86)).
6801 to 6802	<p>< Self diagnosis > or < Input A defective ></p>	<ul style="list-style-type: none"> • Contact the SMA Service Line (see Section 15 "Contact" (page 86)).
7001 to 7002	<p>< Sensor fault fan permanently on ></p>	<ul style="list-style-type: none"> • Contact the SMA Service Line (see Section 15 "Contact" (page 86)).
7008	<p>< Disturbance sensor display temperature ></p>	<ul style="list-style-type: none"> • Contact the SMA Service Line (see Section 15 "Contact" (page 86)).
7101	<p>< SD card defective ></p>	<p>Re-format the SD card.</p> <ul style="list-style-type: none"> • Re-save the files to the SD card.
7102	<p>< Parameter file not found or defective ></p>	<ul style="list-style-type: none"> • Copy the parameter file into the SD card drive : \PARASET directory.
7105	<p>< Parameter setting failed ></p>	<ul style="list-style-type: none"> • Check whether the parameters of the SD card are valid. • Ensure change rights via SMA Grid Guard code.
7106	<p>< Update file defect. ></p>	<ul style="list-style-type: none"> • Re-format the SD card. • Re-save the files to the SD card.

Event no.	Display message and cause	Corrective measures
7110	< No update file found >	<ul style="list-style-type: none"> Copy the update file into the SD card drive : \UPDATE directory.
7201 to 7202	< Data storage not possible > An internal device fault that does not prevent the inverter from feeding power to the grid.	<ul style="list-style-type: none"> If this fault occurs often, contact the SMA Service Line (see Section 15 "Contact" (page 86)).
7303	< Update main CPU failed > Internal device fault.	<ul style="list-style-type: none"> Contact the SMA Service Line (see Section 15 "Contact" (page 86)).
7305	< Update RS485I module failed > An internal device fault that does not prevent the inverter from feeding power to the grid.	<ul style="list-style-type: none"> Re-try update. If this fault occurs again, contact the SMA Service Line (see Section 15 "Contact" (page 86)).
7307	< Bluetooth update failed > An internal device fault that does not prevent the inverter from feeding power to the grid.	<ul style="list-style-type: none"> Re-try update. If this fault occurs again, contact the SMA Service Line (see Section 15 "Contact" (page 86)).
7311	< Update language table failed > An internal device fault that does not prevent the inverter from feeding power to the grid.	<ul style="list-style-type: none"> Re-try update. If this fault occurs again, contact the SMA Service Line (see Section 15 "Contact" (page 86)).
7401	< Varistor defective > At least one of the thermally monitored varistors is defective.	<ul style="list-style-type: none"> Check the varistors as described in Section 11.2 "Checking the Function of the Varistors" (page 74).
7702 to 7703	< Self diagnosis > or < Device disturbance >	<ul style="list-style-type: none"> Contact the SMA Service Line (see Section 15 "Contact" (page 86)).
8001	< Derating occurred > The power supplied by the inverter has been reduced to below nominal power for more than ten minutes due to excessive temperature.	If this event occurs frequently: <ul style="list-style-type: none"> Ensure sufficient ventilation. Check heat dissipation, as described in Section 9.2 "Checking the Heat Dissipation" (page 58).

Event no.	Display message and cause	Corrective measures
8801 to 8803	<p>The display is blank. The inverter continues feeding into the electricity grid. This error can have the following causes:</p> <ul style="list-style-type: none"> • The ambient temperature is so low that the display disconnects to protect itself. • The inverter cannot identify the display type. • No display is connected or the connection is defective. 	<ul style="list-style-type: none"> • Wait until the temperature has risen above -25 °C. • Contact the SMA Service Line (see Section 15 "Contact" (page 86)).
9002	<p>< Inst. code invalid ></p> <p>The SMA Grid Guard code entered (personal installer password) is not valid.</p>	<ul style="list-style-type: none"> • Enter a valid SMA Grid Guard code.
9003	<p>< Grid parameter locked ></p> <p>The current country data set is locked.</p>	<ul style="list-style-type: none"> • Enter a valid SMA Grid Guard code for changing the country data set.
9005	<p>< Changing grid param. not possible ></p> <p>< Ensure DC supply ></p> <ul style="list-style-type: none"> • DC voltage at the DC input is not sufficient to run the main CPU. • The selected rotary switch setting for the language settings is not programmed. • The parameters to be changed are protected. 	<ul style="list-style-type: none"> • Make sure that there is sufficient DC voltage available (green LED glowing or flashing). • Check the setting of the rotary switches (see Section 5.4.2). • Enter the SMA Grid Guard code.
9007	<p>< Abort self-test ></p> <p>There is either an error in the AC installation or the set voltage and frequency limits do not comply with the requirements of the Italian electricity grids.</p>	<ul style="list-style-type: none"> • Check AC installation. • Adjust the connection as described in Section 6.3 "Connection to the Electricity Grid (AC)" (page 29). • Check for correct country settings as described in Section 6.5 "Setting the Country Data Set and Display Language" (page 40). <p>The self-test is only required for installations in Italy.</p>

11 Troubleshooting

11.1 Checking the PV Array for Earth Faults

If the inverter displays event numbers "3501", "3601" or "3701", there is a high probability of an earth fault in the PV array.

Check the strings for earth faults as described below:

1. Disconnect the inverter as described in Section 8 "Disconnecting the Inverter from Voltage Sources" (page 55).



DANGER!

Danger to life due to live PV array

- Only touch the cables of the PV array on their insulation.
- Do not connect strings with earth faults to the inverter.

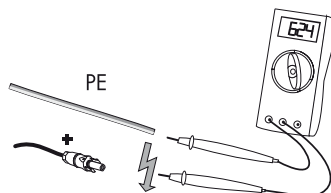


NOTICE!

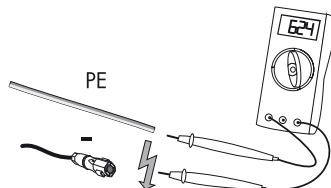
Excessive voltages can destroy the multimeter.

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

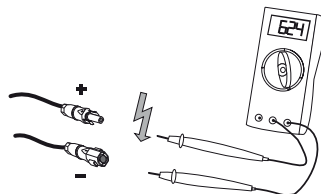
2. Measure the voltages between the positive pole of each string and the earth potential (PE).



3. Measure the voltages between the negative pole of each string and the earth potential (PE).



4. Measure the voltages between the positive and negative poles of each string.



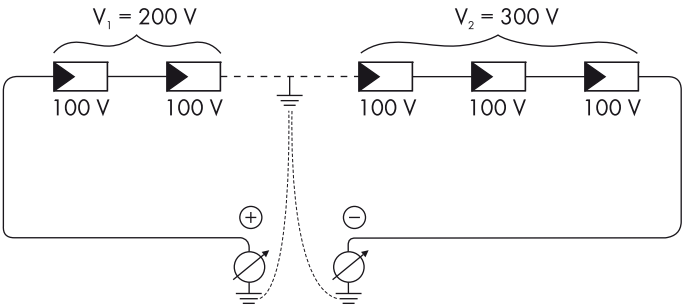
- ☑ An earth fault is present if the measured voltages are stable and the sum of the voltages of the positive pole against earth potential and the negative pole against earth potential of a string is approximately equal to the voltage between the positive and negative poles.

Result	Measure
☑ You have detected an earth fault .	<ul style="list-style-type: none">• The installer of the PV array must remedy the earth fault in the affected string. You can determine the location of the earth fault as described below.• Do not reconnect the faulty string.• Recommission the inverter as described in Section 7 "Commissioning" (page 52).
☑ You have not detected an earth fault .	<p>It is likely that one of the thermally monitored varistors is defective.</p> <ul style="list-style-type: none">• Check the varistors as described in Section 11.2 "Checking the Function of the Varistors" (page 74).

Location of the Earth Fault

The approximate position of the earth fault can be determined from the ratio of the measured voltages between plus to earth potential and minus to earth potential.

Example:



In this case, the earth fault is between the second and third PV modules.

- ☑ The earth fault check is now complete.

11.2 Checking the Function of the Varistors

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

Varistors are wear parts. Their functional efficiency diminishes with age or following repeated responses as a result of overvoltages. It is therefore possible that one of the thermally monitored varistors has lost its protective function.



NOTICE!

Destruction of the inverter due to overvoltage

If varistors are missing or defective, the inverter is no longer protected against overvoltages.

- Replacement varistors should be obtained without delay.
- In PV plants with a high risk of overvoltages, **never** operate the inverter without varistors.

Check the varistors as described below:

1. Disconnect the inverter (see Section 8 "Disconnecting the Inverter from Voltage Sources" (page 55)).



DANGER!

Danger to life due to high voltages in the inverter Death from electric shock

There is residual voltage in the inverter. The inverter takes 20 minutes to discharge.

- Wait 20 minutes before you open the upper enclosure lid or the DC lid.

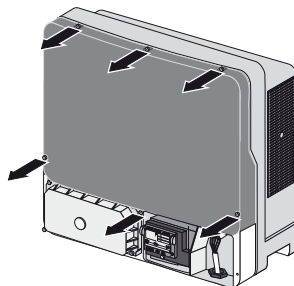


CAUTION!

Risk of burns due to hot components inside the inverter

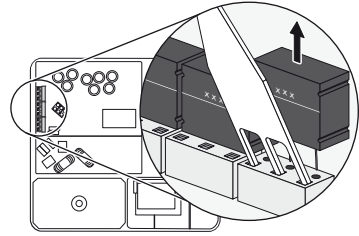
- Wait until the components inside the inverter have cooled down.

2. Release the screws of the upper enclosure lid. For this purpose, use an Allen key (AF 4).
3. Pull the enclosure lid forwards to remove it.

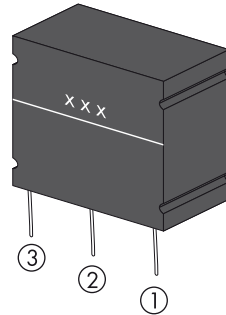


4. Remove all varistors.

Together with the replacement varistors, you should have received an insertion tool for operating the terminals. If not, please contact SMA Solar Technology AG.



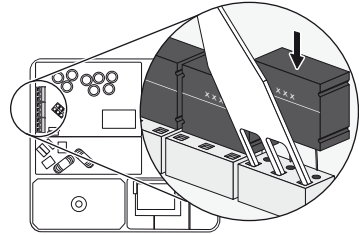
5. Use a multimeter to check each varistor to see if there is a conductive connection between terminals 2 and 3.



Result	Measure
<input checked="" type="checkbox"/> There is a conductive connection.	The varistor is functional. Presumably there is a different error in the inverter. <ul style="list-style-type: none"> • Proceed to step 8. • Contact the SMA Service Line (see Section 1.5 "Contact" (page 86)).
<input checked="" type="checkbox"/> There is no conductive connection.	The respective varistor is defective and needs to be replaced. Varistor failure is due to influences which affect all varistors similarly (temperature, age, induced overvoltages). SMA Solar Technology AG recommends replacing all varistors. The varistors are specially manufactured for use in the inverter and are not commercially available. You must order replacement varistors directly from SMA Solar Technology AG (see Section 1.4 "Accessories" (page 85)). Only use original varistors that are sold by SMA Solar Technology AG. <ul style="list-style-type: none"> • To replace the varistors, proceed to step 6.

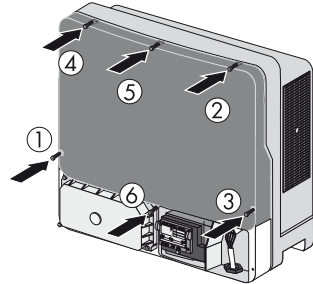
6. Insert an insertion tool into the openings of the terminal contacts.
7. Insert new varistors into the slots (as shown in the diagram on the right).

Make sure that the labelling is pointing to the front, i.e. towards the insertion tool.



8. Pre-screw all screws and the corresponding conical spring washers on the upper enclosure lid and then tighten them in the sequence shown on the right (torque: 6.0 Nm). The toothing of the conical spring washers must point towards the enclosure lid.

The scope of delivery of the inverter includes a spare screw and conical spring washer.



DANGER!

Danger to life due to enclosure lid carrying voltage

The earthing of the upper enclosure lid is ensured by the toothed conical spring washers.

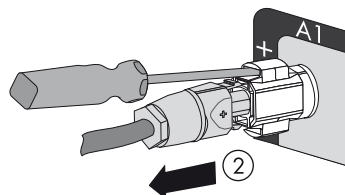
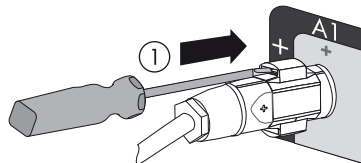
- For all six screws, attach the conical spring washers with the toothing facing towards the enclosure lid.

9. Recommission the inverter as described in Section 7 "Commissioning" (page 52).
- ☒ The varistors have now been replaced and the inverter is back in operation.

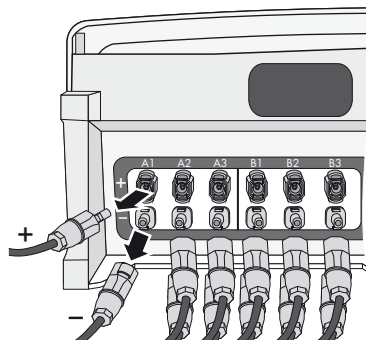
12 Decommissioning

12.1 Dismounting the Inverter

1. Disconnect the inverter as described in Section 8 "Disconnecting the Inverter from Voltage Sources" (page 55).
2. Release and disconnect all DC connectors.
To do this, insert a flat-blade 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.



- ☑ All DC connectors are now disconnected from the inverter. The inverter is entirely disconnected from the PV array.



3. Remove any connected communication cables from the inverter.



CAUTION!

Risk of burns due to hot enclosure parts

- Wait 30 minutes for the enclosure to cool down before disassembling.

4. Screw off all projecting cable glands.
5. If necessary, open the padlock.
6. Remove the inverter from the rear panel and take the rear panel off the mounting surface.

12.2 Replacing the Enclosure Lid

In the event of a fault, your inverter may need to be replaced. If this is the case, you will receive a replacement device fitted with transport lids.



DANGER!

Danger to life due to electric shock

During operation, there are high voltages present in the inverter.

- Do not operate the inverter without the upper and lower enclosure lid in place.



Remove jumper cable

If you have deactivated the reverse current protection at input area A by means of the jumper cable, you must remove the jumper cable before sending the inverter back to SMA Solar Technology AG.

Prior to returning your inverter to SMA Solar Technology AG, you must replace the upper and lower enclosure lids of your inverter with the corresponding transport lids:



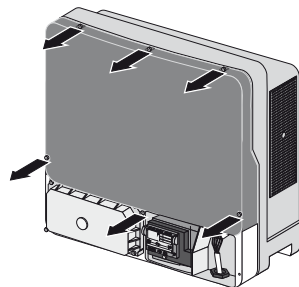
DANGER!

Danger to life due to high voltages in the inverter Death from electric shock

After disconnecting the inverter, there is residual voltage in the inverter. The inverter takes 20 minutes to discharge.

- Wait 20 minutes before you open the upper enclosure lid or the DC lid.

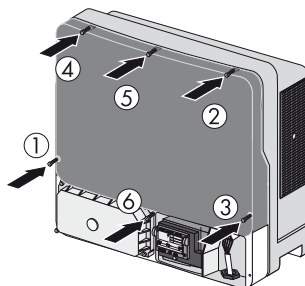
1. Disassemble the inverter as described in Section 12.1 "Dismounting the Inverter" (page 77).
2. Release the screws of the upper enclosure lid.
For this purpose, use an Allen key (AF 4).
3. Pull the upper enclosure lid forwards to remove it.
4. Remove the two transport lids from the replacement device in the same manner.
5. If in place, remove the jumper cable for deactivating the reverse current protection and install it in the replacement device (see 6.7 "Activating and Deactivating Reverse-Current Protection at Input Area A" (page 50)).



6. Pre-screw the upper enclosure lid of your inverter to the replacement device with the 6 enclosure lid screws and corresponding conical spring washers and then tighten them in the sequence shown on the right (torque: 6.0 Nm). For this purpose, use an Allen key (AF 4).

The tothing of the conical spring washers must point towards the enclosure lid.

The scope of delivery of the inverter includes a spare screw and conical spring washer.



DANGER!

Danger to life due to enclosure lid carrying voltage

The earthing of the upper enclosure lid is ensured by the toothed conical spring washers.

- For all six screws, attach the conical spring washers with the tothing facing towards the enclosure lid.

7. Screw the lower enclosure lid of your inverter onto the replacement device.
8. Now attach the two transport lids of the replacement device to your inverter in the same manner.
☒ Your inverter is now ready to be sent back to SMA Solar Technology AG.
9. Mount and connect the replacement device (see Section 5.3 "Mounting the Inverter" (page 23) and Section 6 "Electrical Connection" (page 27)).

12.3 Packing the Inverter

- If the original packaging is available, the inverter should be packed in its original packaging and secured with tension straps.
- If the original packaging is not available, use a cardboard box suitable for the weight and size of the inverter.

12.4 Storing the Inverter

Store the inverter in a dry place where ambient temperatures are always within the range -25°C to $+60^{\circ}\text{C}$.

12.5 Disposing of the Inverter

Dispose of the inverter at the end of its service life in accordance with the current locally applicable disposal regulations for electronic waste. Alternatively, send it back to SMA Solar Technology AG with shipping paid by sender, and labelled "ZUR ENTSORGUNG" ("FOR DISPOSAL") (contact see page 86).

13 Technical Data

13.1 DC/AC

13.1.1 Sunny Tripower 15000TL Economic Excellence

DC Input

Maximum DC power at $\cos \varphi = 1$	15,260 W
Maximum input voltage*	1,000 V
MPP voltage range at 230 V AC	580 V to 800 V
Rated input voltage	580 V
Minimum input voltage at 230 V AC	570 V
Initial input voltage	620 V
Maximum input current	36 A
Maximum input current per string	36 A
Number of independent MPP inputs	1
Strings per MPP input	6

* The maximum open-circuit voltage which can occur at a cell temperature of -10°C must not exceed the maximum input voltage.

AC Output

Rated power at 230 V, 50 Hz	15,000 W
Maximum apparent AC power $\cos \varphi = 1$	15,000 VA
Rated grid voltage	3/N/PE, 230 V/400 V
AC voltage range*	160 V to 280 V
Nominal AC current at 230 V	21.7 A
Maximum output current	24.0 A
Maximum output current in case of faults	50 A
Total harmonic factor of the output current at total harmonic factor of the AC voltage $< 2\%$, AC power > 0.5 rated power	$\leq 2.6\%$
Maximum residual output current	96 mA
Rated mains frequency	50 Hz
AC mains frequency*	50 Hz/60 Hz
Operating range at AC mains frequency 50 Hz	44 Hz to 55 Hz
Operating range at AC mains frequency 60 Hz	54 Hz to 65 Hz
Displacement power factor, adjustable	0.8 _{overexcited} to 1 to 0.8 _{underexcited}
Feed-in phases	3
Connection line conductors	3
Overvoltage category as per IEC 60664-1	III

* Depending on country setting

Efficiency

Maximum efficiency, η_{\max}	98.5%
European weighted efficiency, η_{EU}	98.3%

13.1.2 Sunny Tripower 20000TL Economic Excellence

DC Input

Maximum DC power at $\cos \varphi = 1$	20,450 W
Maximum input voltage*	1,000 V
MPP voltage range at 230 V AC	580 V to 800 V
Rated input voltage	580 V
Minimum input voltage at 230 V AC	570 V
Initial input voltage	620 V
Maximum input current	36 A
Maximum input current per string	36 A
Number of independent MPP inputs	1
Strings per MPP input	6

* The maximum open-circuit voltage which can occur at a cell temperature of -10°C must not exceed the maximum input voltage.

AC Output

Rated power at 230 V, 50 Hz	20,000 W
Maximum apparent AC power $\cos \varphi = 1$	20,000 VA
Rated grid voltage	3/N/PE, 230 V/400 V
AC voltage range*	160 V to 280 V
Nominal AC current at 230 V	29 A
Maximum output current	29 A
Maximum output current in case of faults	50 A
Total harmonic factor of the output current with total harmonic factor of the AC voltage < 2%, AC power > 0.5 rated power	$\leq 2.6\%$
Maximum residual output current	96 mA
Rated mains frequency	50 Hz
AC mains frequency*	50 Hz/60 Hz
Operating range at AC mains frequency 50 Hz	44 Hz to 55 Hz
Operating range at AC mains frequency 60 Hz	54 Hz to 65 Hz
Displacement power factor, adjustable	0.8 _{overexcited} to 1 to 0.8 _{underexcited}
Feed-in phases	3
Connection line conductors	3
Overvoltage category as per IEC 60664-1	III

* Depending on country setting

Efficiency

Maximum efficiency, η_{\max}	98.5%
European weighted efficiency, η_{EU}	98.2%

13.2 General Data

Width x height x depth, with handle of DC switch-disconnector*	665 mm x 680 mm x 265 mm
Weight	45 kg
Length x width x height of packaging	780 mm x 380 mm x 790 mm
Transport weight	53 kg
Climatic class as per IEC 60721-3-4	4K4H
Environment category	Outdoors
Degree of pollution outside the enclosure	3
Degree of pollution inside the enclosure	2
Operating temperature range	-25°C to +60°C
Maximum permissible value for relative humidity, non-condensing	100%
Maximum operating altitude above MSL	3,000 m
Noise emission (typical)	≤ 51 dB(A)
Power loss in night mode	< 1 W
Topology	Transformerless
Cooling concept	OptiCool: temperature-controlled fan
Fan connection	Designed for safe disconnection in accordance with DIN EN 62109-1
Degree of protection as per IEC 60529	IP65
Protection class according to IEC 62103	I
Strain relief category of the cable glands according to EN 50262	A
Grid Configuration	TN-C system, TN-S system, TN-C-S system, TT grounding system
Approvals, as per 03/2013**	VDE-AR-N4105, VDE 0126-1-1, AS4777, C10/11, PPDS, UTE C15-712-1, PPC, EN50438, RD661/2007, IEC 61727, G59/2, CEI 0-21, NRS 97-1-2, BDEW 2008, RD1699:2011, NEN EN 50438, DIN EN 62109-1, IEC 62109-2, SI4777

*Optional

** **EN 50438**: Does not apply to all country standard deviations of EN 50438

IEC 62109-2: In order to meet the requirements of this standard, the inverter must either be equipped with a multi-function relay used as a fault indication relay or there must be a connection to Sunny Portal with the fault alarm in Sunny Portal activated.

RD 1699 and RD 661/2007: Contact the SMA Service Line for restrictions in specific regions.

NRS 97-1-2: This standard stipulates that a special label be attached to the AC distribution board to draw attention to the AC-side disconnection of the inverter in the event of grid failure (for more details, see NRS 97-1-2, Sec. 4.2.7.1 and 4.2.7.2)

13.3 Protective Devices

DC reverse-polarity protection	Short-circuit diode
Protection against module reverse currents	Diode
Input-side load disconnect unit*	DC switch-disconnector
Utilisation category of the DC switch-disconnector*	DC-21B
DC overvoltage protection	Thermally monitored varistors
AC short-circuit current capability	Current control
Grid monitoring	SMA Grid Guard 4
Maximum permissible fuse protection	50.0 A
Earth fault monitoring	Insulation monitoring $R_{iso} > 200 \text{ k } \Omega$
All-pole sensitive residual-current monitoring unit	Installed

*Optional

13.4 Climatic Conditions

As per IEC 60721-3-4, Installation Type C, Class 4K4H

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

As per IEC 60721-3-4, Transport Type E, Class 2K3

Temperature range	-25°C to +70°C
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13.5 Features

DC connection	SUNCLIX DC connector
AC connection	Spring-clamp terminal
Display	LC graphic display
Bluetooth	As standard
RS485, galvanically isolated	Optional
Multi-function relay	Optional

13.6 Torques

Upper enclosure lid screws	6.0 Nm
Lower enclosure lid screws	2.0 Nm
Screws in the handle of the DC switch-disconnector*	2.0 Nm
Additional earth terminal	6.0 Nm
Cheese-head screws (M5x10) for securing the enclosure to the rear panel	6.0 Nm
SUNCLIX swivel nut	2.0 Nm
RS485 communication connection	1.5 Nm
Multi-function relay fastening screw	1.5 Nm

*Optional

13.7 Data Storage Capacity

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

14 Accessories

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

Designation	Brief description	SMA order number
Replacement varistors	Set of thermally monitored varistors (3 pieces)	STP-TV9
RS485 retrofit kit	RS485 interface	DM-485CB-10
Speedwire/Webconnect Data Module	Data module for communication via Speedwire/Webconnect for data exchange with Sunny Portal	SWDM-10
Multi-function relay	Multi-function relay for retrofitting in PV inverters	MFR01-10
Ventilation grids	1 ventilation grid as spare part	45-10899080
SUNCLIX DC connector	Field plug for conductor cross-sections of 2.5 mm ² to 6 mm ²	SUNCLIX-FC6-SET

15 Contact

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

- Inverter device type
- Inverter serial number
- Type and number of connected PV modules
- Four-digit event number or display message of the inverter
- Mounting location
- Optional equipment, e.g. communication products
- Use of a multi-function relay

Australia	SMA Australia Pty Ltd. Sydney	Toll free for Australia:	1800 SMA AUS (1800 762 287)
		International:	+61 2 9491 4200
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Česko	SMA Central & Eastern Europe s.r.o. Praha	+420 235 010 417	
Danmark	Se Deutschland (Tyskland)		
Deutschland	SMA Solar Technology AG Niestetal	Medium Power Solutions	
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		SMS mit „Rückruf“:	+49 176 888 222 44
		Hybrid Energy Solutions	
		Sunny Island:	+49 561 9522-399
		Power Plant Solutions	
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Nederland	zie Belgien (België)	
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