PV Inverter

SUNNY TRIPOWER 15000TL Economic Excellence
SUNNY TRIPOWER 15000TL High Efficiency
SUNNY TRIPOWER 20000TL Economic Excellence
SUNNY TRIPOWER 20000TL High Efficiency

Installation Manual

STP20TLHE-IA-IEN122222 | IMEN-STP20TLHE | Version 2.2

EN

Table of Contents

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:

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

Store this manual where it will be accessible at all times.

1.2 Target Group

This manual is for the use of electrically skilled persons. The tasks described in this manual may 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.

1.4 Symbols Used

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, could result in property damage.

Information

An Information block provides valuable hints for the efficient installation and operation of your product.

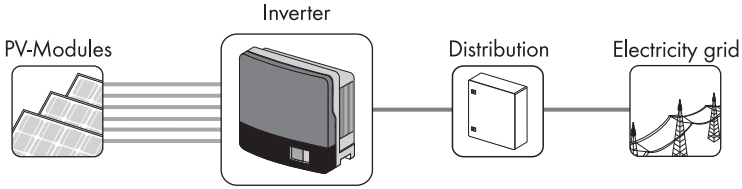
☑ This symbol indicates the result of an action.

2 Safety

2.1 Intended Use

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 this Sunny Tripower



The Sunny Tripower is suitable for indoor and outdoor use.

The Sunny Tripower may only be operated with PV arrays (PV modules and cabling) of protection class II. Do not connect any energy sources other than PV modules to the Sunny Tripower.

Capacitive Discharge 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 which depends on the manner in which the PV modules are installed (e.g. foil on metal roof) and on the weather (rain, snow). This "normal" leakage current may not exceed 50 mA due to the fact that the inverter would otherwise automatically disconnect from the electricity grid as a protective measure. For further information on this subject see the Technical Information "Capacitive Discharge Currents" at www.SMA.de/en.

When designing the PV plant, ensure that the values comply with the permitted operating range of all components at all times. The free design program "Sunny Design" from version 2.0 (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 this Sunny Tripower. You must also ensure that all measures recommended by the module manufacturer for 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 high voltages in the inverter

High voltages which may cause electric shocks are present in the conductive parts of the inverter.

- Prior to performing any work on the inverter, disconnect the inverter on the AC and DC sides (see Section 8 "Disconnecting the Inverter from Voltage Sources" (page 58)).

CAUTION!

Risk of burns due to hot enclosure parts

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

- Only touch the lower enclosure lid during operation.

PV array earthing

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 display Indicates the operating state of the inverter.
	A disturbance has occurred. Read section 11 "Troubleshooting" (page 75) 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. • Wait 20 minutes before you open the upper enclosure lid or the DC lid.
	**NOTICE, danger!** • Observe the connection requirements for the second protective conductor in Section 6.3.1 "Conditions for the AC Connection" (page 29).
	**QR Code®* for SMA bonus programme** You will find information on the SMA bonus programme at www.SMA-Bonus.com.

* QR-Code is a registered trademark of DENSO WAVE INCORPORATED.

2.3.2 Symbols on the Type Label

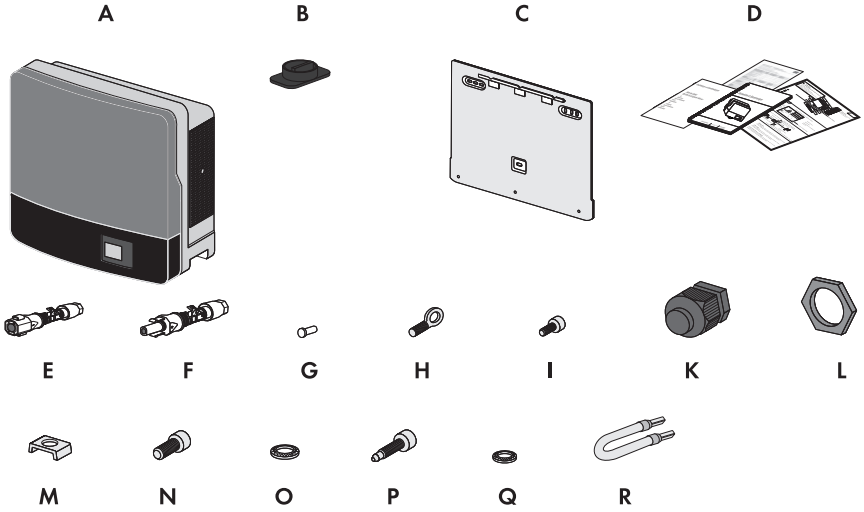
Symbol	Explanation
	Beware of dangerous voltage. The inverter operates at high voltages. All work on the inverter must be carried out by skilled persons only.
	Beware of hot surface. The inverter can become hot during operation. Avoid contact during operation.
	Observe all documentation accompanying the inverter.

Symbol	Explanation
	The inverter must not be disposed of together with household waste. For more information on disposal, see Section 12.5 "Disposing of the inverter" (page 84).
CE	CE marking The inverter complies with the requirements of the applicable EC directives.
	The inverter does not have a transformer.
DC	Direct current (DC)
AC 3N ~	Three-phase alternating current (AC) with neutral conductor
IP54	Protection rating IP54. The inverter is protected against dust deposits in the interior and against splashes of water from all angles.
	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	Quantity	Description
A	1	Sunny Tripower
B	1	Handle of the DC switch-disconnector*
C	1	Back panel
D	1	Installation manual including user manual, document set with explanations 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 back panel
I	2	Cheese-head screw M5x10 for attaching the enclosure to the back 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 (replacement)

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

*optional

3.2 Identifying the Inverter

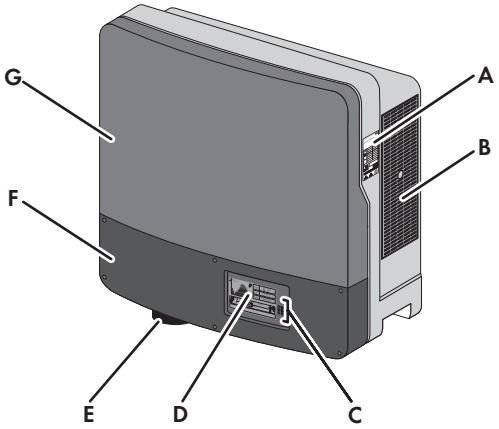
You can identify the inverter by the type label. The type label is located on the right-hand side of the enclosure.

The serial number (Serial No.) and the type (Type/Model) of the inverter, as well as 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.

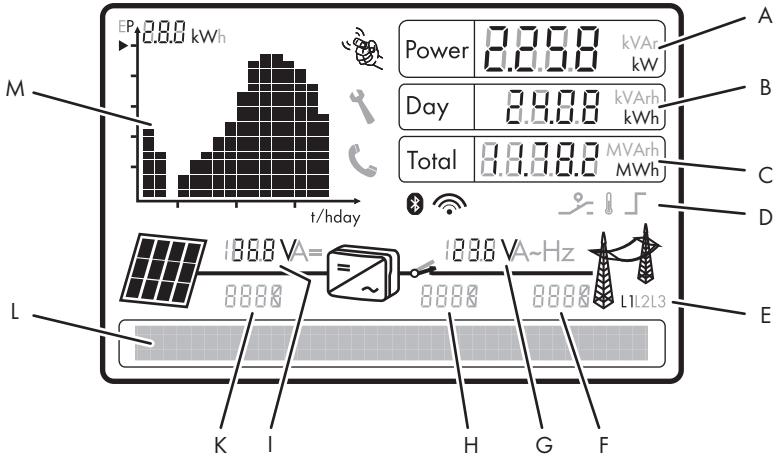


Position	Description
A	Type label
B	Ventilation grid
C	LEDs
D	Display
E	DC switch-disconnector*
F	Lower enclosure lid
G	Upper enclosure lid

*optional

4.2 Display

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



Position	Description	Explanation
A	Power	Displays the current power
B	Day	Displays the daily energy
C	Total	Displays the total amount of energy fed in until now
D	Active functions	The symbols indicate which communication or power regulation functions are enabled.
E	Phase assignment	The phase assignment states the line 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 line conductor. The display automatically switches between the 3 connected line 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
L	Text line	The text line shows event messages.

Position	Description	Explanation
M	Power and yield curve	The diagram shows the changes in power 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	Designation	Explanation
	Tap symbol	You can operate the display by tapping it: • Single tap: the backlight switches on or the display scrolls one message further. • Double tap: the display shows successively the firmware version, the serial number or designation of the inverter, the *Bluetooth* NetID, the configured country data set and display language.
	Telephone receiver	Device disturbance present. Contact the SMA Service Line.
	Spanner	Signifies a disturbance that can be resolved on-site.
	*Bluetooth*	*Bluetooth* communication is enabled.
	*Bluetooth* connection	*Bluetooth* connection to other devices is active.
	Multi-function relay	The multi-function relay is active.
	Temperature symbol	The power of the inverter is limited due to excessive temperature.
	Power limitation	The external active power limitation via the Power Reducer Box is active.
	PV array	–
	Inverter	–

Symbol	Designation	Explanation
	Grid relay	When the grid relay is closed, the inverter feeds into the grid. When the grid relay is open, the inverter is disconnected from the electricity grid.
	Electricity grid	–

4.3 DC switch-disconnector

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.

Using 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 safe disconnection of the inverter from the PV array. The 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). You can only set the inverter's parameters using 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 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 50)). This protects your PV plant from unauthorised access.

Various parameter displays

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

Example: parameter display for testing the fan

- 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 disturbance sensor. For this purpose, the multi-function relay switches the disturbance sensor 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 Technical Description "Multi-Function Relay and OptiTrac Global Peak" available at www.SMA.de/en).

4.6 Feed-In Management

The Sunny Tripower is capable of utilising reactive power and can feed reactive power into the grid via the setting of a default value for the displacement power factor (cos φ). 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.

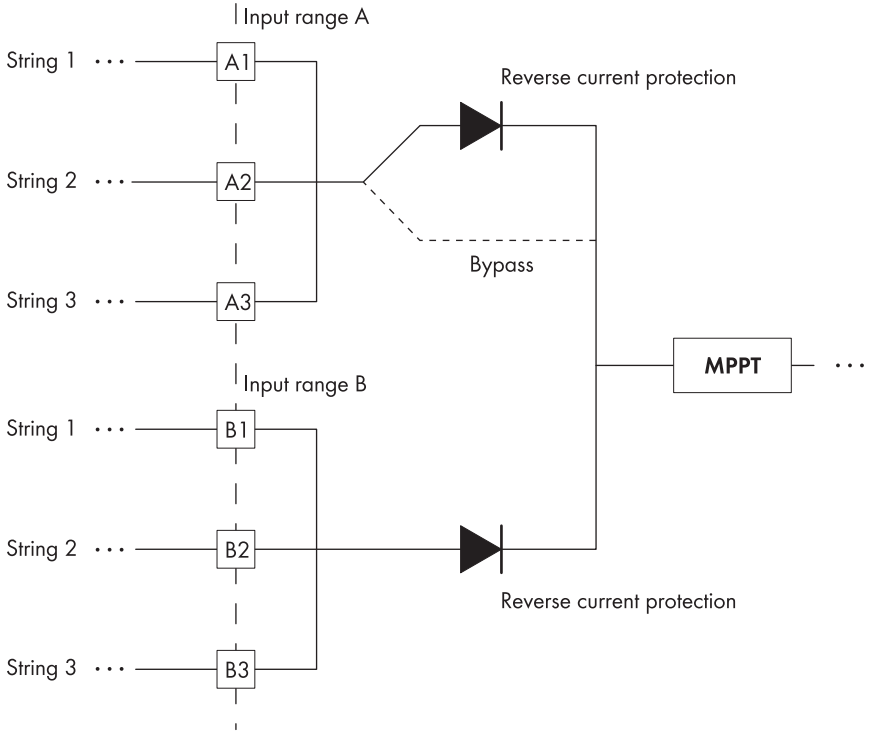
You can find detailed information on setting the parameters of these functions in the Technical Description "Measured Values and Parameters" at www.SMA.de/en in the "Technical Description" category for the respective inverter.

4.7 Reverse Current Protection

Every input area of the inverter is equipped with a diode as reverse current protection. A reverse current between the input areas is therefore not possible.

If only input area A is used 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 the Reverse Current Protection at Input Area A" (page 52)). Bypassing the reverse current protection slightly increases the inverter efficiency.

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



5 Mounting

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 (approx. 53 kg)

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

CAUTION!

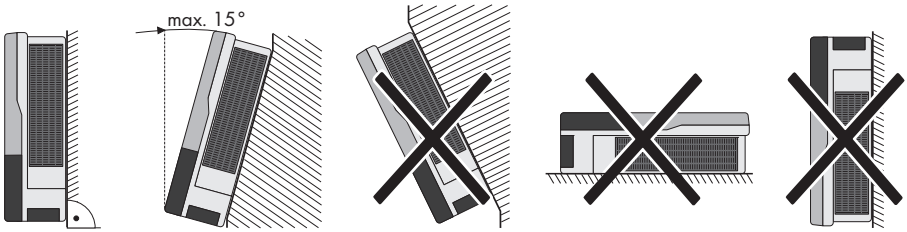
Risk of burns due to hot enclosure parts

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

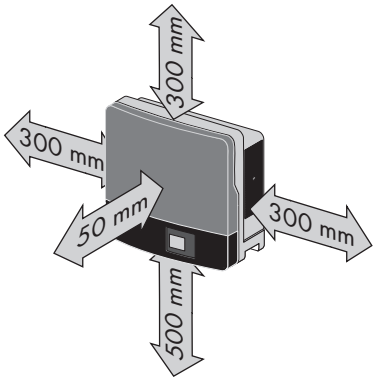
5.2 Selecting the Mounting Location

Consider the following requirements when selecting the mounting location:

- The mounting method and location must be suitable for the weight and size of the inverter (see Section 13 "Technical Data" (page 85)).
- 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-fulfillment of these criteria may restrict execution of service assignments.

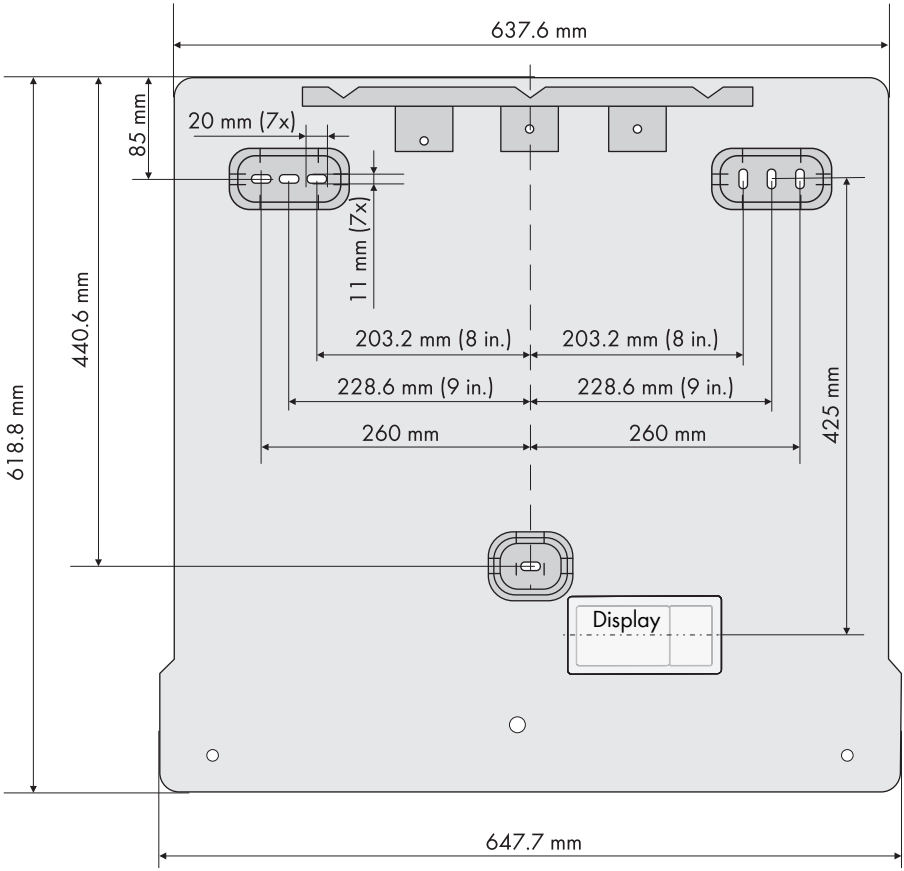


- Mount vertically or tilted backwards by max. 15°.
- The connection area must point downwards.
- Never mount the device with a forward tilt.
- Never mount the device with a sideways tilt.
- Do not mount horizontally.
- Mount the inverter at eye level. Given the weight of the device, this will facilitate disassembling 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 overheating and lead to power reduction.
- In living areas, do not mount the unit on plasterboard walls or similar in order to avoid audible vibrations. When in operation, the inverter emits noise which may be perceived as annoying in living areas.
- Observe the recommended clearances to the walls as well as to 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 prevents a reduction in inverter power as a result of high temperatures (details on temperature derating can be found in the Technical Information "Temperature Derating" at www.SMA.de/en).



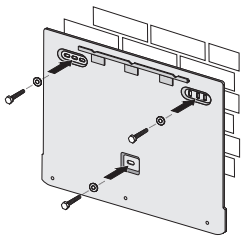
5.3 Mounting the Inverter

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

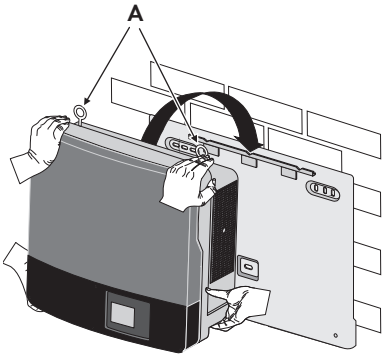


2. Mount the back panel.

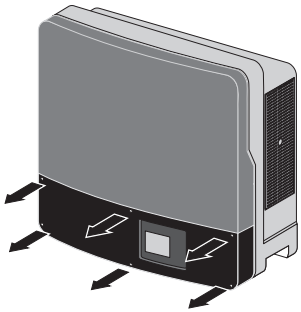
   For this, use 1 upper hole on the right and on the left and the hole in the middle.



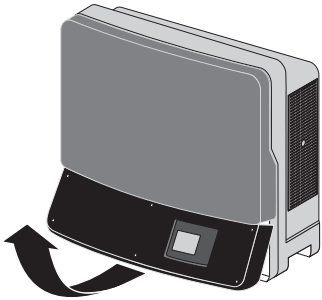
3. Hang the inverter in the back panel in such a way that the enclosure of the inverter lies flush with the back panel.
   - For two people to transport the inverter, use the recessed grips at the bottom and at the same time hold the upper edge of the enclosure lid.
   - For transport by crane, you can attach 2 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. If necessary, remove the ring bolts after transport and re-attach the filler-plugs.



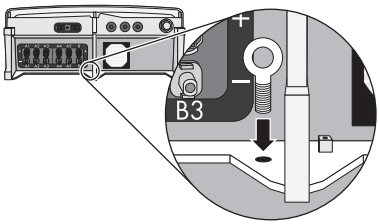
5. Loosen all 6 captive screws of the lower enclosure lid.



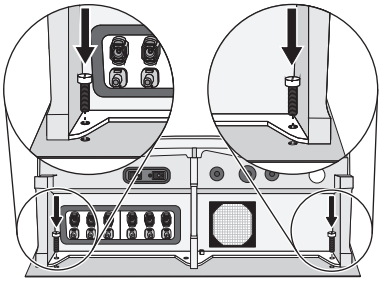
6. Lift and remove the lower enclosure lid from below.



7. Screw the supplied eye bolt into the drill hole provided in order to secure the enclosure against removal. Only tighten the eye bolt hand-tight.



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

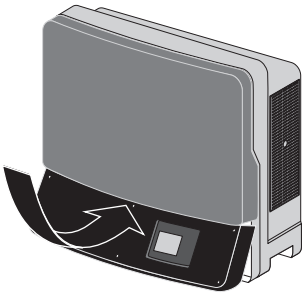


9. Check to ensure that the inverter is securely in place.

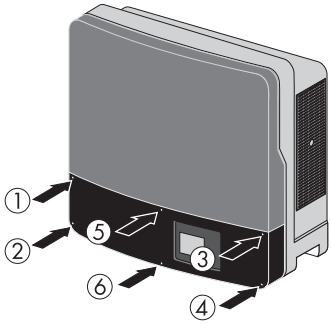
☑ The inverter is now securely mounted to the wall.

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.



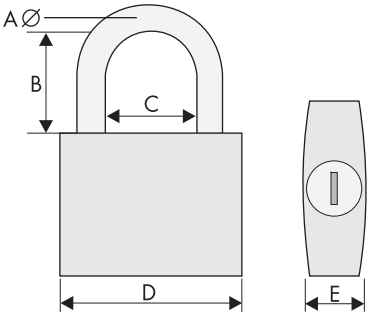
– Pre-screw all six screws and then tighten them in the sequence shown on the right (torque: 2.0 Nm).



Optional Anti-Theft Protection

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

The padlock must meet the following requirements:

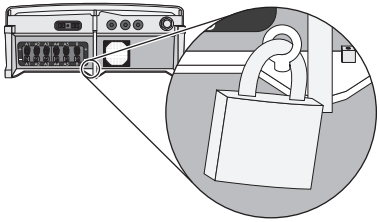


- Size:
  A: 6 mm ... 8 mm diameter
  B: 23 mm ... 29 mm
  C: 23 mm ... 28 mm
  D: 39 mm ... 50 mm
  E: 13 mm ... 18 mm
- Stainless
- Hardened shackle
- Secured lock cylinder

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

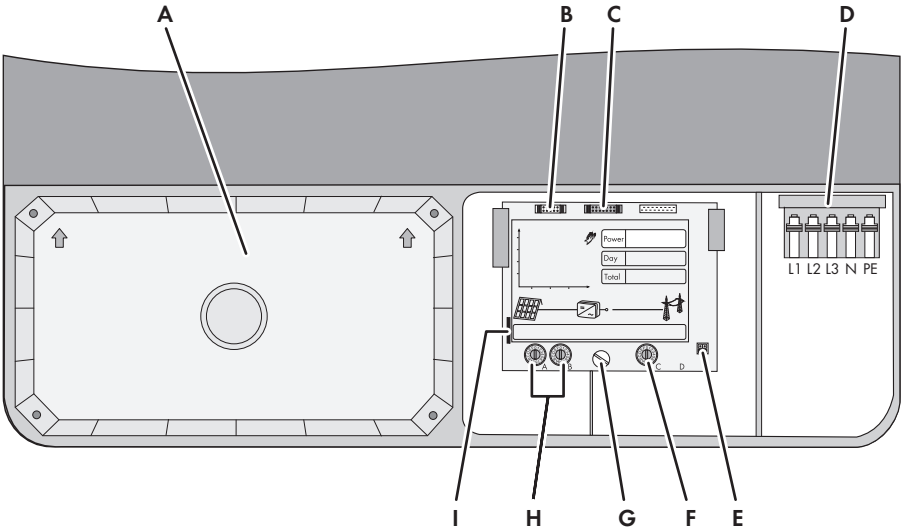
NOTICE!

Electrostatic discharge can damage the inverter

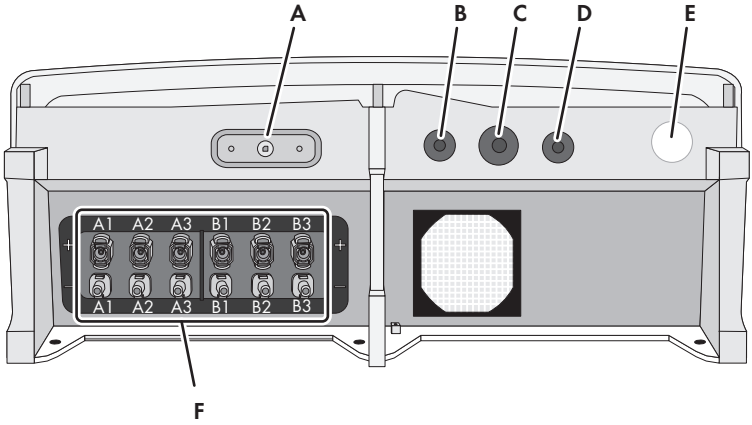
Internal components of the inverter can be irreparably damaged by electrostatic discharge.

- 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 *Bluetooth* 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	Jack 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 the AC Connection

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

Residual-current protective 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 leading leakage currents.

If the network operator stipulates a residual-current protective device, you must use a residual-current protective 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 "Criteria for selecting an RCD" at www.SMA.de/en.

Cable requirements

- External diameter: 14 mm ... 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 the local and national regulations for the dimensioning of cables. The requirements for the minimum conductor cross-section derive from these regulations. 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 the protective conductor on 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.

Load disconnection unit

You must install a **separate, 3-phase** miniature circuit-breaker for each inverter in order to ensure that the inverter can be securely disconnected under load. The maximum permissible fuse protection can be found in Section 13 "Technical Data" (page 85).

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. It can result in a cable fire or destruction of the inverter.

- Never connect multiple 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 current from the inverter and the electricity grid can accumulate to 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 protect loads separately.

NOTICE!

Damage to the inverter caused by use of screw-type fuses as load-disconnect units!

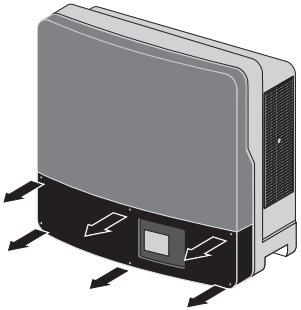
A screw-type fuse, e.g. DIAZED fuse or NEOZED fuse, is not a switch-disconnector and thus **may not be used** as a load disconnection unit. A screw-type fuse only acts as cable protection.

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

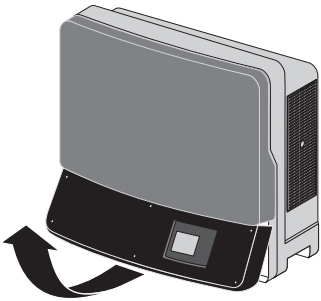
- Use only a switch-disconnector or a miniature circuit-breaker as a load disconnection unit.

6.3.2 AC Connection Procedure

1. Check the line voltage and compare it with the permissible voltage range (see Section 13 "Technical Data" (page 85)).
2. Disconnect the miniature circuit-breaker from all three line conductors and secure against reconnection.
3. Loosen all 6 captive screws of the lower enclosure lid.



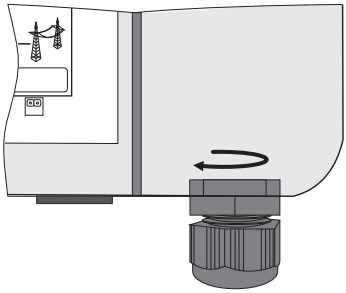
4. Lift and remove the lower enclosure lid from below.



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

   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 42).

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 with the counter nut.



8. Pull the cable through.
9. Raise all 5 terminals of the AC terminal as far as they will go.

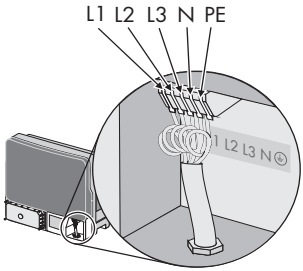
NOTICE!

Risk of fire when connecting 2 conductors

If 2 conductors are connected to one terminal, a poor electrical contact can result in overheating or a risk of 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 conductor 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.



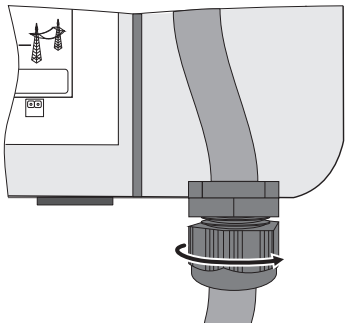
CAUTION!

Danger of crushing when terminals snap shut

The terminals close by snapping down fast and hard.

- Press the terminals down with your thumb, do not grip on either side of the terminal.
- Keep fingers away from the terminals.

11. Close all terminals of the AC terminal again 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

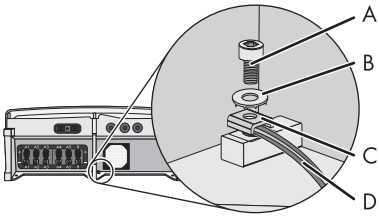
- Do not switch on the miniature circuit-breaker until the PV array has been connected and the inverter is securely closed.

6.3.3 Connecting the Second Protective Conductor

If the installation requires, 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):
   - Attach conical spring washer on the screw. Here, the grooved side of the conical spring washer must point to the screw head.
   - Tighten the screw (torque: 6.0 Nm).

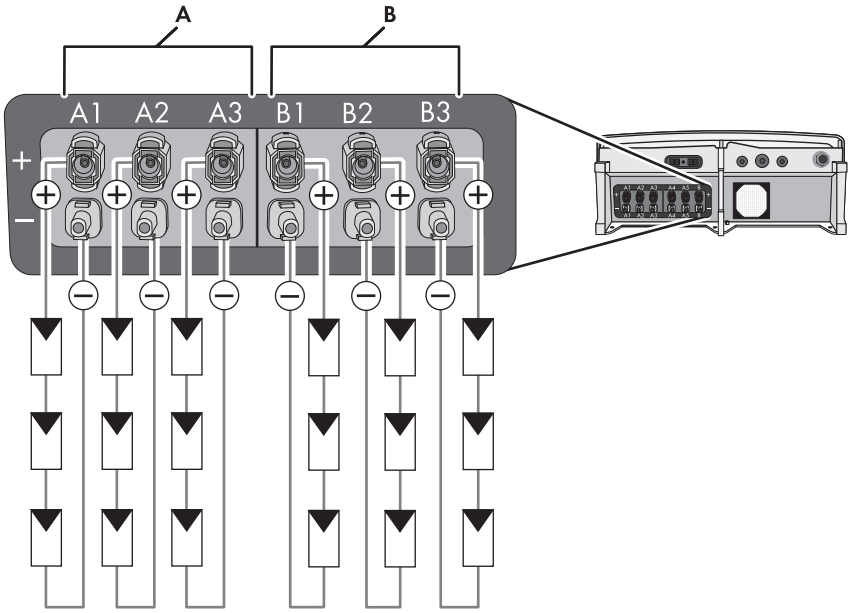
   ☑ The teeth of the conical spring washer are pushed into the clamping bracket. The conductive earthing cable is conductively connected to the enclosure.



6.4 Connecting the PV Array (DC)

6.4.1 Conditions for DC Connection

The inverter has 2 input areas, "A" and "B", each with its own reverse current protection. In total, up to 6 strings can be connected.



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

Use of Y adaptors

Y adaptors must not be visible or freely accessible in close proximity to the inverter.

- The DC electric 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 58).

- 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.
- The following limit values at the DC input of the inverter must not be exceeded:

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

No mixed connections between 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.

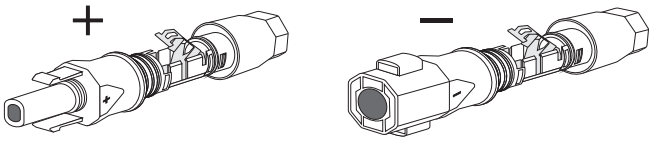
Only connect strings at 1 input area and never mix the input areas A and B!

Otherwise, the inverter no longer fulfills the requirements of the EMC Directive (Directive on the electromagnetic compatibility of a device) and forfeits its operation licence.

6.4.2 Assembling the DC Connectors

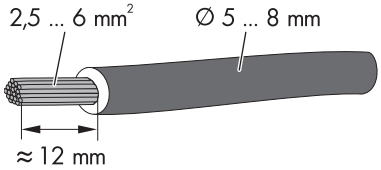
For connection to the inverter, all connection cables of the PV modules must be equipped with the DC connectors provided.

To assemble the DC connectors, proceed as follows. Ensure the connectors have the correct polarity. The DC connectors have the symbols "+" and "–".



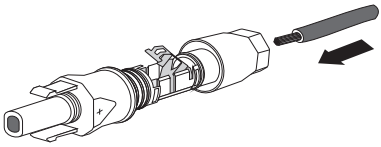
Cable requirements

- Use a PV1-F cable.

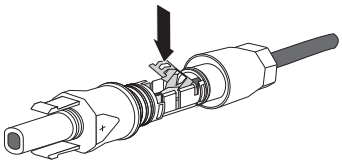


Procedure

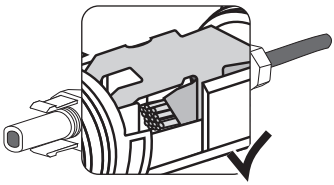
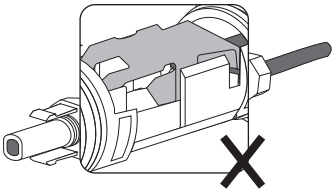
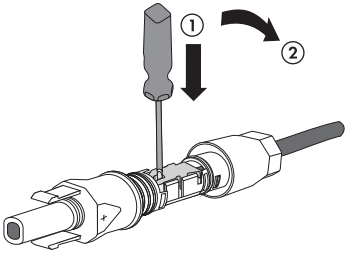
1. Lead the stripped cable all the way into the plug.



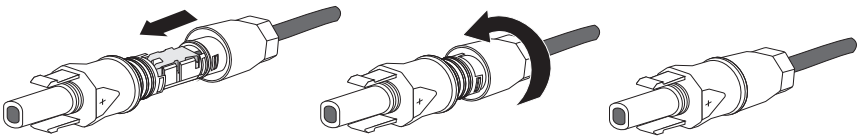
2. Press the clamping bracket down.
   ☑ The clamping bracket snaps audibly into place.



3. Ensure that the cable is correctly positioned:

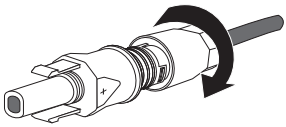
Result	Measure
☑ If the stranded wire is visible in the chamber of the clamping bracket, the cable is correctly positioned. 	• Proceed to Step 4.
☑ If the stranded wire is **not** visible in the chamber, the cable is not correctly positioned. 	• Loosening the clamping bracket: insert a screwdriver (blade 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).

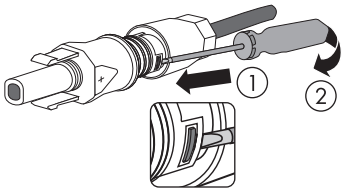


6.4.3 Opening the DC Connector

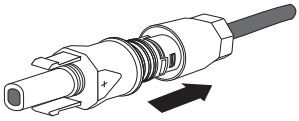
1. Unscrew the swivel nut.



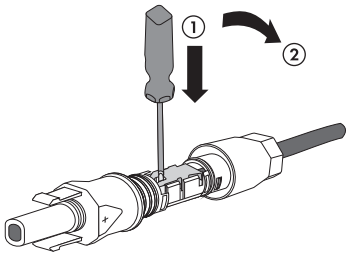
2. Unlocking the DC connector: insert a screwdriver (blade width: 3.5 mm) into the snap slot on the side and lever it out.



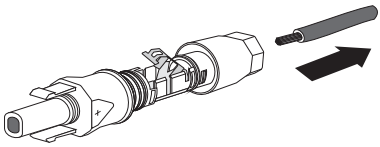
3. Carefully pull the DC connector apart.



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 3 line 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 can be destroyed by the overvoltage. This will void all warranty claims.

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

NOTICE!

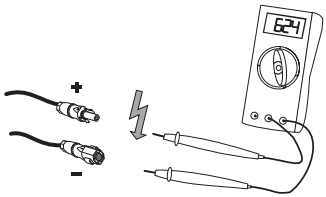
Excessive voltages can destroy the measuring device

- Only use measuring devices 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 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.

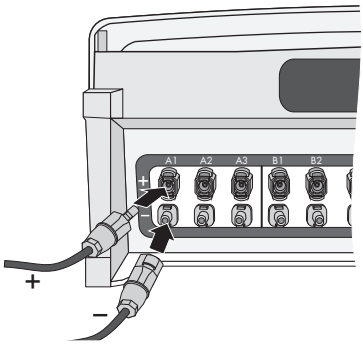
2. Check the strings for earth faults as described in Section 11.1 "Checking the PV Array for Earth Faults" (page 75).



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

   ☑ The DC connectors click audibly into position.

   To release the DC connectors, see Section 12.1 "Dismantling the Inverter" (page 81).

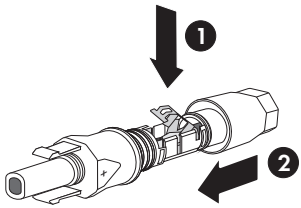


4. In order to seal the inverter, all unneeded DC inputs must be closed with DC connectors and sealing plugs:

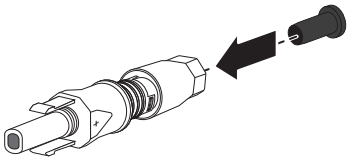
Sealing plugs

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

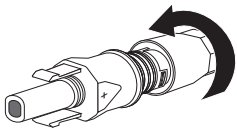
- For unused DC plug connectors, push down the clamping bracket and push the swivel nut up to the thread.



- Insert the sealing plug into the DC connector.

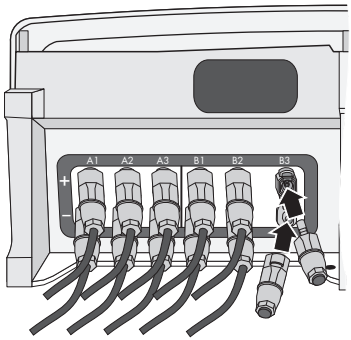


- Fasten the DC connector (torque: 2.0 Nm).



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

☑ The DC connectors click audibly into position.



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

☑ You can now commission the inverter as described in Section 7 "Commissioning" (page 55). The following connections and settings are optional.

6.5 Setting the Country Data Set and Display Language

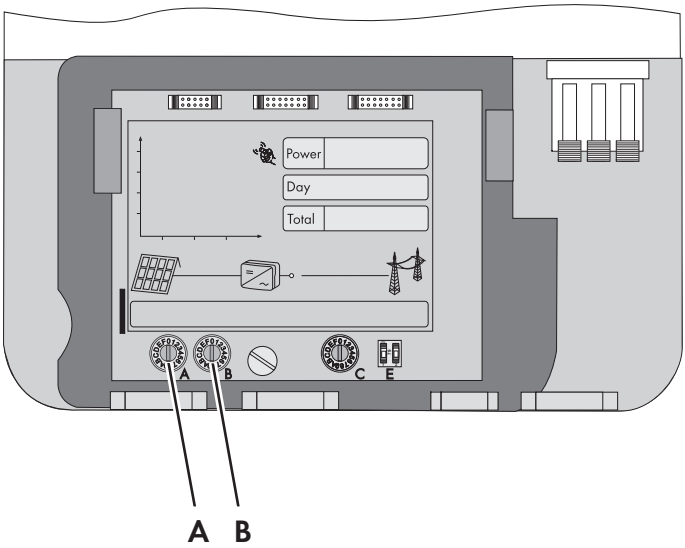
The inverter can be configured for various countries. This can be done prior to commissioning via 2 rotary switches on the display or after commissioning by configuring the "CntrySet" or "Set country standard" parameter using a communication product (e.g. Sunny WebBox or Sunny Explorer). For devices 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 current 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 accepted 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 parameters for the feed-in 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 blocked for 10 feed-in hours after commissioning, or after the last alteration. If the country data set is changed after these 10 feed-in hours, the inverter does not accept the changes and displays the error message "Grid param. 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, 10-digit SMA Grid Guard code which is valid for a maximum of 10 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 installation country.

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 55)).
- 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 out 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 settings	Default settings	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
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

(A)	(B)	Country data set	Display language	SMA Grid Guard protection	Country
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[b)]	French	Yes	France
2	0	VDE0126-1-1	Italian	Yes	Switzerland
2	8	AS4777.3	English	No	Australia
3	2	CEI0-21Ext[c)*]	Italian	Yes	Italy
4	0	RD1663-A	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	
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*	French	Yes	Belgium
7	9	C10/11*	English	Yes	Belgium
7	A	C10/11*	German	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

(A)	(B)	Country data set	Display language	SMA Grid Guard protection	Country
C	3	Customer	Spanish	No	Flexible
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) Special setting: *Bluetooth* transmission power reduced (in accordance with French standards)

c) Setting according to 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 2 rotary switches, as described in Section 6.5.3 "Setting the country data set and language using rotary switches" (page 49).
- Alternatively you can conduct the settings via the "CntrySet" or "Set country standard" parameters with 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 via country parameters.

The inverters have the additional country data set "MVtgDirective/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/Medium-Voltage Directive (Germany)", you may only operate the inverter with external 3-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 3-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 58)).

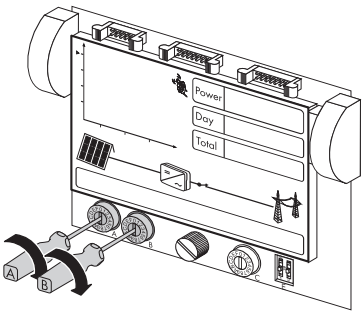
DANGER!

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. If there is an electricity grid failure, this prevents danger of backfeed.

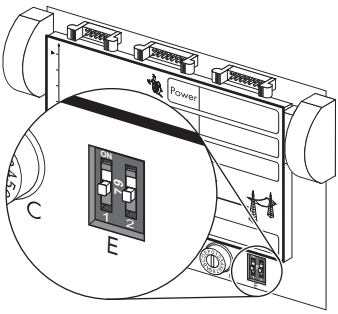
- If the inverter is set to "Off-Grid50/Island mode 50 Hz" or "Off-Grid60/Island mode 60 Hz", never operate the inverter directly on the electricity grid.

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 44)).



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 55)).

6.6 Communication

6.6.1 *Bluetooth*

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

The following setting options are possible via a rotary switch.

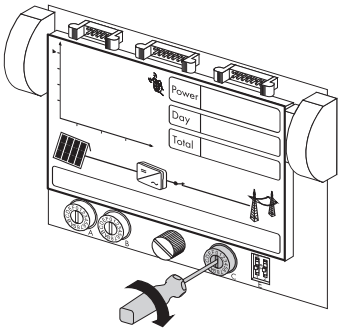
Switch position (NetID)	Setting
0	*Bluetooth* communication is deactivated.
1	Communication via *Bluetooth* with communication product possible, no networking with other inverters (default settings)
2 ... F	Networking via *Bluetooth* with other inverters is activated.

If you do not communicate using *Bluetooth*, deactivate the *Bluetooth* communication on your inverter. This protects 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 ... F). However, this is only necessary if neighbouring plants are located within a radius of 500 m.

So that all inverters in your PV plant are detected by your communication product, all inverters must 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 58)).
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 55)).

Acceptance of settings

The *Bluetooth* settings will only be accepted upon commissioning the inverter.

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 optionally be fitted with an extra communication interface (e.g., RS485). This communication interface enables 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 set the country data set of the inverter via the two rotary switches in the inverter only 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
- If you are using *Bluetooth*: parameter "Set country standard"

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

The reverse current protection is activated upon delivery. If you are using both input areas, the 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.

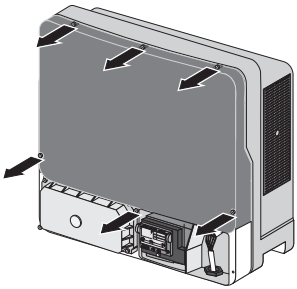
The procedure for deactivating and reactivating the reverse current protection at input area A is described below.

Requirements for deactivating the reverse current protection:

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

Procedure

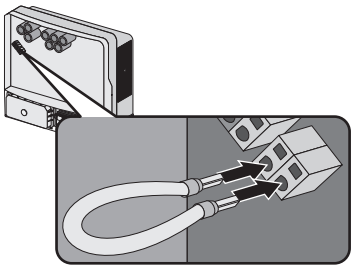
1. When the inverter is in operation, disconnect the inverter (see Section 8 "Disconnecting the Inverter from Voltage Sources" (page 58)).
2. Loosen the screws of the upper enclosure lid.
   For this purpose, use an Allen key (AF 4).
3. Pull the upper enclosure lid forwards to remove it.



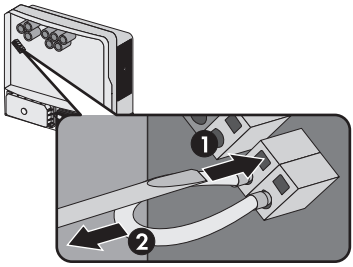
Jumper cable

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

4. Deactivating or activating the reverse current protection at input area A:
   – 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.

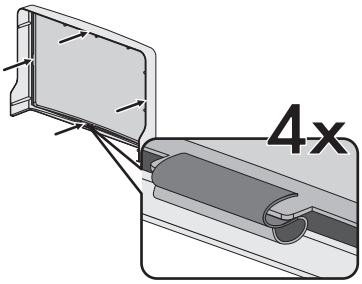


– To activate the reverse current protection, remove both ends of the jumper cable from the yellow terminals consecutively. To do so, insert a screwdriver (blade width: 3.5 mm) into the rectangular opening on the terminal and remove the cable end.



5. For STP 15000TLHE-10 / STP 20000TLHE-10:

   Make sure that all 4 EMC seals are present in the upper enclosure lid and that they are correctly positioned. The metal braiding of the EMC seals must point outwards.



EMC seals

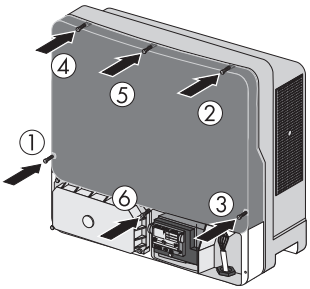
EMC seals are only installed in inverters of type STP 15000TLHE-10 / STP 20000TLHE-10.

Without EMC seals, the STP 15000TLHE-10 / STP 20000TLHE-10 no longer fulfil the requirements of the EMC Directive (Directive on the electromagnetic compatibility of a device) and forfeit their operating licence.

- Contact the SMA Service Line if one or more EMC seals is missing.

6. Pre-screw all screws and the corresponding conical spring washers for 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 live enclosure lid

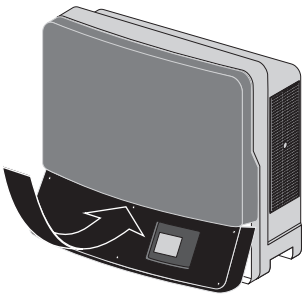
The earthing of the upper enclosure lid is ensured by the toothed conical spring washers.

- For all 6 screws attach the conical spring washers with the toothing facing towards the enclosure lid.

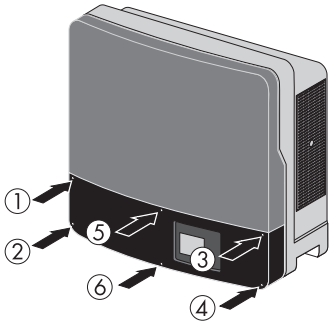
7 Commissioning

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 plug connectors and sealing plugs (see Section 6.4.4)
   - All enclosure openings are closed.
   - The miniature circuit-breaker is of the correct size.
2. Dock the lower enclosure lid at an angle and attach. The captive screws must protrude.

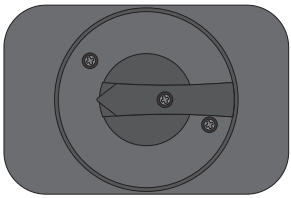


3. Pre-screw all six screws and then tighten them in the sequence shown on the right (torque: 2.0 Nm). For this purpose, use an Allen key (AF 3).

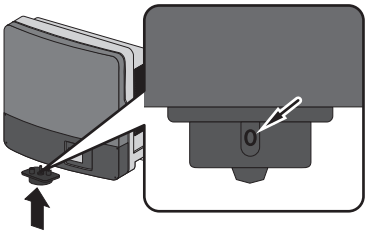


4. If an external DC switch-disconnector is installed, switch it off.

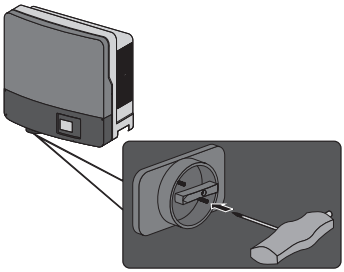
5. If the inverter is equipped with an integrated DC switch-disconnector, plug the handle in and switch it on.
   - Set the handle of the DC switch-disconnector to position "0" so that the captive screws are visible in the handle.
   - Align the handle of the DC switch-disconnector in such a way that the sharp side of the handle points to the left.



   - Insert the handle of the DC switch-disconnector in the socket on 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 2 captive screws (torque: 2 Nm). For this purpose, use an Allen key (AF 3).



   - Switch on the DC switch-disconnector.
6. Switch on the miniature circuit-breaker.
   ☑ Green LED is lit: commissioning was 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 lit: a disturbance has occurred. Eliminate the error (see Section 11 "Troubleshooting" (page 75)).
7. If a multi-function relay is connected, switch on the supply voltage.
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 Phase

Illustrated display messages

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

- Firstly, the firmware version of the internal processors appears in the text line.

- After an interval of 5 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 with a communication product.

- After another 5 seconds, or by tapping the lid again, the selected country data set will appear (e.g. "VDE-AR-N4105-HP").

- After a further 5 seconds, or after a further tap, the configured language is displayed (example: "Sprache Deutsch" (Language German).

- During normal operation, the text line of the display will subsequently be clear. See Section 10 "Messages" (page 66) for possible event messages which may be displayed in the text line and their meaning.

Showing display messages again

If you want to view the display messages of the start phase again whilst in 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 due to electric shock

The inverter operates at high voltages and must be disconnected prior to carrying out any work on the device. 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 become hot.

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

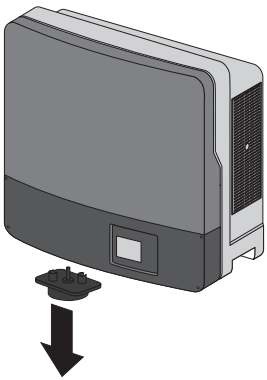
NOTICE!

Electrostatic discharge can damage the inverter

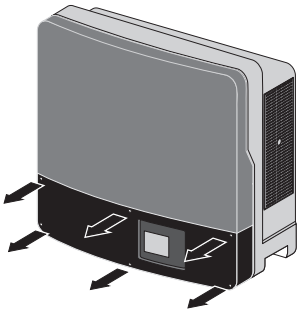
Internal components of the inverter can be irreparably damaged by electrostatic discharge.

- Earth yourself before touching any components.

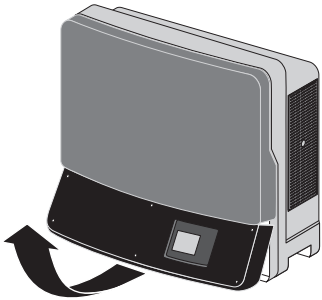
1. Disconnect the miniature circuit-breaker from all three line conductors and secure against reconnection.
2. If a multi-function relay is connected, disconnect its supply voltage and ensure that the device cannot be reconnected.
3. If an integrated or external DC switch-disconnector is connected, switch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



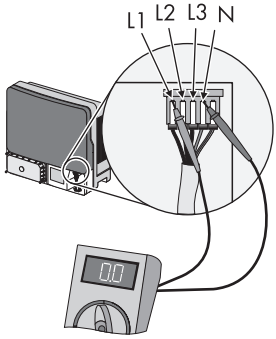
6. Loosen all six captive screws of the enclosure lid.



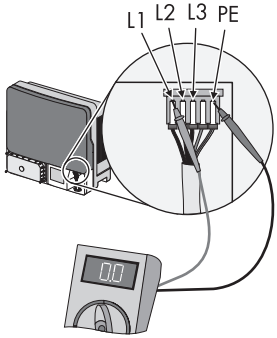
7. Lift and remove the enclosure lid from below.



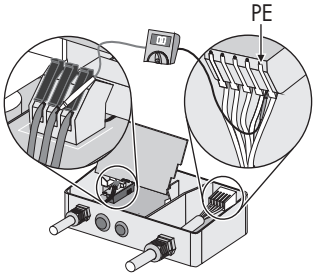
8. Ensure that L1, L2 and L3 are disconnected from voltage sources to N. For this purpose, use a test probe with a maximum diameter of 2 mm.



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 of 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 due to 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.

9 Maintenance and Cleaning

9.1 Cleaning the Inverter

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

9.2 Checking Heat Dissipation

If the inverter regularly reduces its power 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 in the following.
- One of the fans is clogged.

  The inverter has 2 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

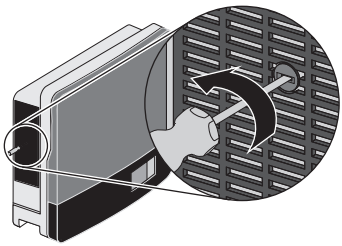
The inverter takes cooling air in from underneath on the left side and blows it out again through the ventilation grids at the top. Clean the ventilation grids if they are dirty.

NOTICE!

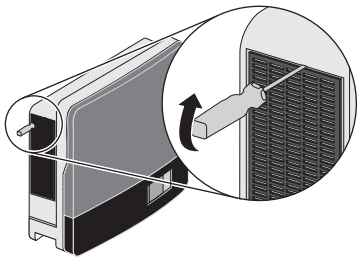
Risk of damage to the inverter through intrusion of insects

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

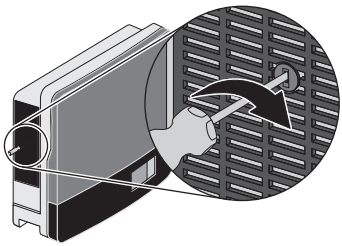
1. Turn the rotary fastener of the ventilation grid in the direction of the arrow until the notch is in a vertical position.



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 90° back to a horizontal position.

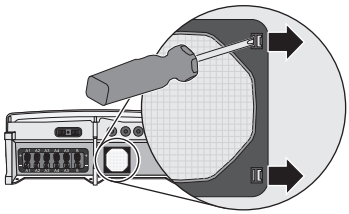


9.2.2 Cleaning the Fan on the Bottom of the Inverter

1. Disconnect the inverter as described in Section 8 "Disconnecting the Inverter from Voltage Sources" (page 58).
2. Wait for the fan to stop rotating.

Cleaning the fan guards

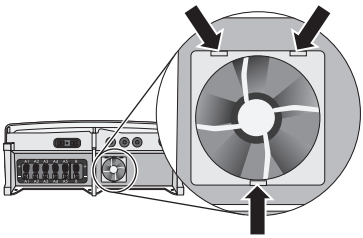
3. To dismantle the fan guard:
   - Press both latches on the right edge of the fan guard to the right using a screwdriver and release from the retainer.
   - Carefully remove the fan guard.



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

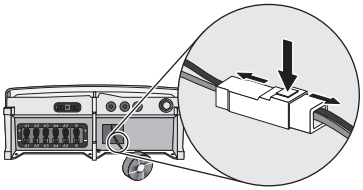
Cleaning the fans

5. Press the latches together towards the middle.
6. Remove the fan by pulling it slowly and carefully downwards.



7. Release and remove the plug.

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



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

NOTICE!

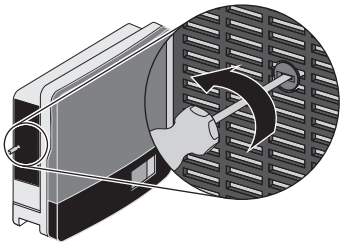
Damage to the fan through use of compressed air

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

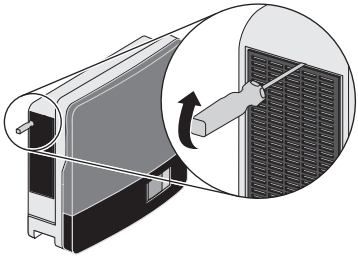
9. After cleaning, reassemble everything in reverse order.
10. Check the function of the fan as described in Section 9.2.4 "Checking the Fans" (page 65).

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

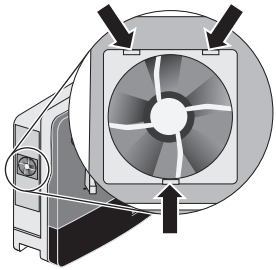
1. Disconnect the inverter as described in Section 8 "Disconnecting the Inverter from Voltage Sources" (page 58).
2. Turn the rotary fastener of the ventilation grid in the direction of the arrow until the notch is in a vertical position.



3. Remove the ventilation grid.



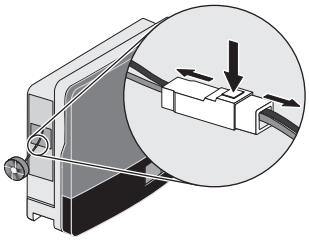
4. Wait for the fan to stop rotating.
5. Press the latches together towards the middle.



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

7. Release and remove the plug.

   The fan cables are long enough to let you lift the fan out sufficiently to disconnect the internal plugs in 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 the fan. 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 "Checking the Fans" (page 65).

9.2.4 Checking the Fans

Checking 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. Set the parameters "CoolSys.FanTst" or "Fan test" to "On" in the installer mode.
3. Check the air flow in both fans.

   The inverter takes cooling air in from underneath on the left side 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.

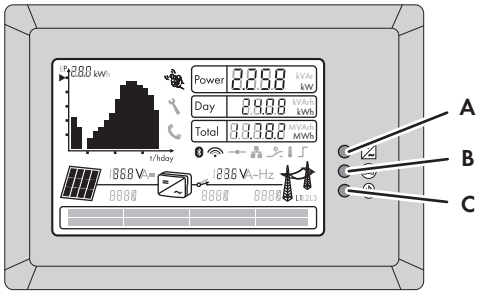
10 Messages

No display messages if no DC voltage present

Measurements and the display of messages are only possible when there is sufficient DC voltage (green LED flashes or glows).

10.1 LED Signals

Position of the LEDs



Position	Description	Status	Explanation
A	Green LED	glowing	Operation
		flashing	Grid connection conditions are not yet met.
B	Red LED	glowing	Error
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, the relevant display message is 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 10 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 adopted.
< Reading SD Card >	The inverter is currently reading the SD card.
< Set parameter >	The inverter sets the parameters of the SD card.
< Update completed >	The inverter has successfully completed the update.
< Update Bluetooth >	The inverter is updating the *Bluetooth* 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

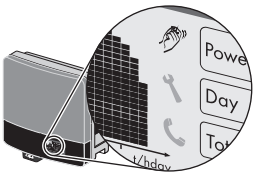
The text line on the display shows the relevant display messages whenever an error occurs. The event numbers for the displayed error messages will appear in the text line. By tapping on the enclosure lid, you can scroll through multi-line messages.

If the error exists over a long period of time, the red LED lights up 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: signifies a disturbance which can be remedied on-site (see table below).
- Telephone receiver: signifies device failure.

  Contact the SMA Service Line.



Event no.	Display message and cause	Corrective measures
101 ... 103	< Grid fault > The line voltage has exceeded the permissible range. This error can have the following causes: • The line voltage at the termination point of the inverter is too high. • The grid impedance at the termination point of the inverter is too high. The inverter disconnects from the electricity grid for safety reasons.	• Check the line voltage and grid connection on the inverter. If the line 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. If the line voltage is within the tolerance range, yet this error is still displayed, contact the SMA Service Line.
202 ... 203	< Grid fault > The line voltage has fallen below the permissible range. This error can have the following causes: • Electricity grid disconnected • AC cable damaged • The line voltage at the termination point of the inverter is too low. The inverter disconnects from the electricity grid for safety reasons.	• Check the triggering of the miniature circuit-breaker. • Check the line voltage and grid connection on the inverter. If the line 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. If the line voltage is within the tolerance range, yet this error is still displayed, contact the SMA Service Line.

Event no.	Display message and cause	Corrective measures
301	< Grid fault > The 10-minute average line voltage is no longer within the permissible range. This can be caused by one of the following: • The line voltage at the termination point of the inverter is too high. • The grid impedance at the termination point of the inverter is too high. The inverter disconnects from the grid to maintain power quality.	• Check the line voltage at the termination point of the inverter: If, due to local grid conditions, the line voltage exceeds the configured limiting value, ask the network operator whether the voltage can be adjusted at the feed-in point, or whether it would be acceptable to modify the limiting value for power quality monitoring. If the line voltage is continually within the tolerance range, and this error is still displayed, contact the SMA Service Line.
401 ... 404	< Grid fault > The inverter is no longer in grid-parallel operation and has stopped feed-in for safety reasons.	• Check the grid connection for strong, short-term frequency variations.
501	< Grid fault > The power frequency is not within the permissible range. The inverter disconnects from the electricity grid for safety reasons.	• If possible, check the power frequency and observe how often major deviations occur. 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. Discuss the proposed parameters with the SMA Service Line.
601	< Grid fault > The internal monitoring function of the inverter has detected an excessively high proportion of direct current in the line current.	• Check the grid connection for direct current. • If this event occurs often, check with the network operator whether it is possible to raise the limiting value for monitoring.
701	< Frequency not permitted > < Check parameter > The power frequency is outside the permissible range. The inverter disconnects from the electricity grid for safety reasons.	• As far as possible, check the power frequency and observe how often major fluctuations occur. 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. Discuss the proposed parameters with the SMA Service Line.

Event no.	Display message and cause	Corrective measures
1302	< Waiting for grid voltage > or < Installation failure grid connection > < Check grid and fuses > 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.	• 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: – Via the rotary switch: see Section 6.5.1 "Checking the Country Data Set" (page 44). – Via communication: setting the parameter "CntrySet" or "Set country standard"
1501	< Reconnection fault grid > The measured voltage or frequency is too high or too low for connection to the electricity grid. Possibly, a changed country data set or changed parameters do not correspond to the local requirements for connecting to the electricity grid.	• Check that the country setting is correct: – Via the rotary switch: see Section 6.5.1 "Checking the Country Data Set" (page 44). – Via communication: setting 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 installation country.
3301 ... 3303	< Unstable operation > 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.	• Wait for more irradiation. • If this event recurs at medium irradiation, check the PV plant design and correct the circuitry of the PV array.

Event no.	Display message and cause	Corrective measures
3401	< DC overvoltage > < Disconnect generator > The DC input voltage connected to the inverter is too high.	• **Immediately disconnect the inverter from the PV array, as described in Section 8 "Disconnecting the Inverter from Voltage Sources" (page 58). The inverter may otherwise be destroyed.** • Check the DC voltage of the strings for adherence to the maximum input voltage of the inverter before reconnecting the inverter to the PV array.
3501	< Insulation resist. > < Check generator > The inverter has detected an earth fault in the PV array.	• Check the strings for earth faults as described in Section 11.1 "Checking the PV Array for Earth Faults" (page 75). • The installer of the PV array must remedy the earth faults before you re-connect the affected string.
3601	< High discharge curr. > < Check generator > The leakage current from the inverter and the PV array is too high. This can be caused by a sudden earth fault, a residual current or a device malfunction. The inverter interrupts feed-in operation immediately after exceeding a limiting value and then automatically re-connects to the electricity grid.	• Check the strings for earth faults as described in Section 11.1 "Checking the PV Array for Earth Faults" (page 75). • The installer of the PV array must remedy the earth faults before you re-connect the affected string.
3701	< Resid.curr.too.high > < Check generator > The inverter has detected a residual current through brief earthing of the PV array.	• Check the strings for earth faults as described in Section 11.1 "Checking the PV Array for Earth Faults" (page 75). • The installer of the PV array must remedy the earth faults before you re-connect the affected string.

Event no.	Display message and cause	Corrective measures
3801	< DC overcurrent > < Check generator > On the DC side of the inverter, an overcurrent has been detected and the inverter has briefly interrupted feed-in.	If this event occurs frequently: • Check the design and the circuitry of the PV array.
3901 ... 3902	< Waiting for DC start conditions > < Start cond. not met > The input power or input voltage of the PV modules is insufficient for feeding into the electricity grid.	• Wait for more irradiation. • If necessary, increase the voltage limit for the start of feed-in if the event occurs frequently in the morning (parameter setting via communication). • If this event recurs at medium irradiation, check the PV plant design and correct the circuitry of the PV array.
6001 ... 6438	< Self diagnosis > or < Interference device >	• Contact the SMA Service Line (see Section 15 "Contact" (page 94)).
6501 ... 6511	< Self diagnosis > or < Overtemperature > The inverter switches off due to excessive temperature.	• Ensure sufficient ventilation. • Check heat dissipation, as described in Section 9.2 "Checking Heat Dissipation" (page 61).
6603 ... 6604	< Self diagnosis > or < Overload >	• Contact the SMA Service Line (see Section 15 "Contact" (page 94)).
6701 ... 6702	< Comm. disturbed > A fault has occurred in the internal communication of the inverter. However, the inverter continues feeding into the grid.	If this event occurs frequently: • Contact the SMA Service Line (see Section 15 "Contact" (page 94)).
6801 ... 6802	< Self diagnosis > or < Input A defective >	• Contact the SMA Service Line • (see Section 15 "Contact" (page 94)).
7001 ... 7002	< Sensor fault fan permanently on >	• Contact the SMA Service Line (see Section 15 "Contact" (page 94)).
7008	< Disturbance sensor display temperature >	• Contact the SMA Service Line (see Section 15 "Contact" (page 94)).
7101	< SD card defective >	Re-format the SD card. • Re-save the files to the SD card.
7102	< Parameter file not found or defective >	• Copy the parameter file into the SD card drive :\PARASET directory.

Event no.	Display message and cause	Corrective measures
7105	< Param. setting failed >	• Check the parameters of the SD card for valid values. • Ensure change rights via SMA Grid Guard code.
7106	< Update file defect. >	• Re-format the SD card. • Re-save the files to the SD card.
7110	< No update file found >	• Copy the update file into the SD card drive :\UPDATE directory.
7201 ... 7202	< Data stor. not poss. > An internal device fault that does not prevent the inverter from feeding power to the grid.	• If this fault occurs often, contact the SMA Service Line (see Section 15 "Contact" (page 94)).
7303	< Update main CPU failed > Internal device fault.	• Contact the SMA Service Line (see Section 15 "Contact" (page 94)).
7305	< Update RS485I module failed > An internal device fault that does not prevent the inverter from feeding power to the grid.	• Re-try update. • If this fault occurs again, contact the SMA Service Line (see Section 15 "Contact" (page 94)).
7307	< Update Bluetooth failed > An internal device fault that does not prevent the inverter from feeding power to the grid.	• Re-try update. • If this fault occurs again, contact the SMA Service Line (see Section 15 "Contact" (page 94)).
7311	< Update language table failed > An internal device fault that does not prevent the inverter from feeding power to the grid.	• Re-try update. • If this fault occurs again, contact the SMA Service Line (see Section 15 "Contact" (page 94)).
7401	< Varistor defective > At least one of the thermally monitored varistors is defective.	• Check the varistors as described in Section 11.2 "Checking the Function of the Varistors" (page 77).
7702 ... 7703	< Self diagnosis > or < Interference device >	• Contact the SMA Service Line (see Section 15 "Contact" (page 94)).
8001	< Derating occurred > The power supplied by the inverter has been reduced to below the nominal power for more than 10 minutes due to excessive temperature.	If this event occurs frequently: • Ensure sufficient ventilation. • Check heat dissipation, as described in Section 9.2 "Checking Heat Dissipation" (page 61).

Event no.	Display message and cause	Corrective measures
8801 ... 8803	The display is blank. The inverter continues feeding into the electricity grid. This error can have the following causes: • 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.	• Wait until the temperature has risen above –25°C. • Contact the SMA Service Line (see Section 15 "Contact" (page 94)).
9002	< Inst. code invalid > The SMA Grid Guard code entered (personal installer password) is not valid.	• Enter a valid SMA Grid Guard code.
9003	< Grid param. locked > The current country data set is locked.	• Enter a valid SMA Grid Guard code for changing the country data set.
9005	< Changing grid param. not possible > < Ensure DC supply > • 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.	• Make sure that there is sufficient DC voltage available (green LED is glowing or flashing). • Check the setting of the rotary switches (see Section 5.4.2). • Enter the SMA Grid Guard code.
9007	< Abort self-test > 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.	• 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 42). The self-test is only required for installations in Italy.

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 58).

DANGER!

Danger to life due to live PV array.

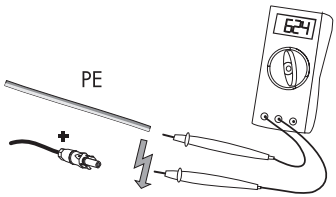
- Only touch the cables of the PV array by their insulation.
- Do not connect strings with earth faults to the inverter.

NOTICE!

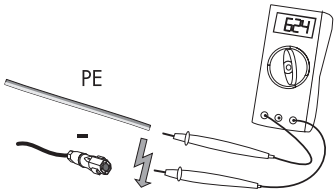
Excessive voltages can destroy the measuring device

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

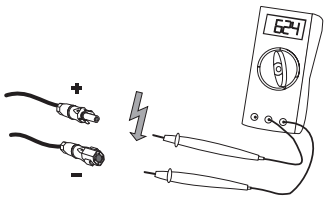
2. Measure the voltages between the plus pole of each string and the earth potential (PE).



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



4. Measure the voltages between the plus and minus poles of each string.



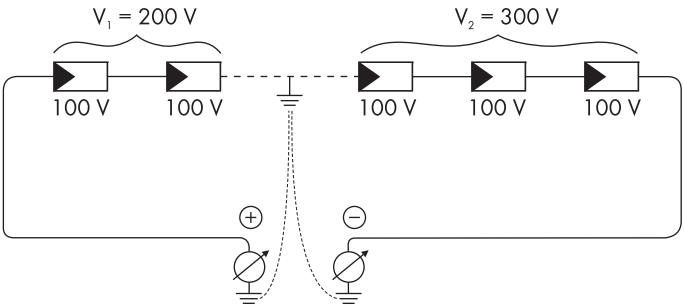
☑ An earth fault is present if the measured voltages are stable and the sum of the voltages of the plus pole against earth potential and the minus pole against earth potential of a string is approximately equal to the voltage between the plus and minus poles.

Result	Measure
☑ You have detected an **earth fault.**	• 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. • Restart the inverter as described in Section 7 "Commissioning" (page 55).
☑ You have **not detected any earth fault**.	It is likely that one of the thermally monitored varistors is defective. • Check the varistors as described in Section 11.2 "Checking the Function of the Varistors" (page 77).

Location of the earth fault

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

Example:



In this case, the earth fault is between the 2nd and 3rd 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 as soon as possible.
- 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 58)).

DANGER!

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

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

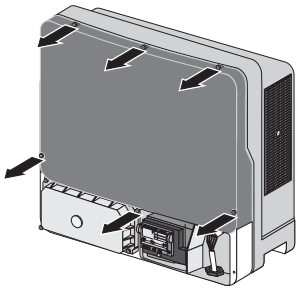
- Wait 20 minutes before you open the upper enclosure lid or the DC lid.

CAUTION!

Risk of burns due to hot components inside the inverter

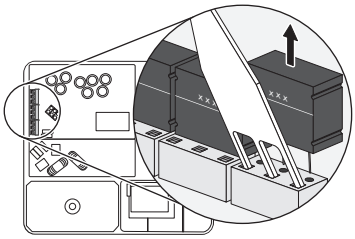
- Wait until the components inside the inverter have cooled down.

2. Loosen 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.

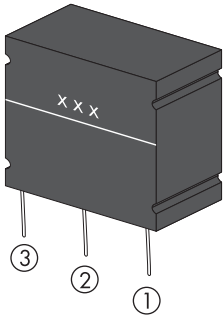


4. Remove all varistors.

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



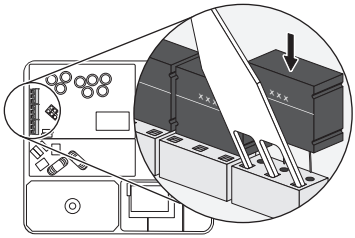
5. Use a multimeter to check all the varistors to see if there is a conductive connection between connectors 2 and 3.



Result	Measure
☑ There is a **conductive** connection.	The varistor is functional. Presumably there is a different error in the inverter. • Proceed to step 8. • Contact the SMA Service Line (see Section 15 "Contact" (page 94)).
☑ There is **no conductive** connection.	The respective varistor is defective and must 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 14 "Accessories" (page 93)). Only use original varistors that are sold by SMA Solar Technology AG. • To replace the varistors, proceed to step 6.

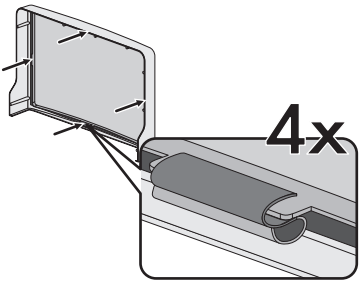
6. Insert an insertion tool into the openings of the terminal contacts.
7. Insert new varistors into the slots (as shown in the drawing at right).

   Here, the labelling must point to the front, i.e. towards the insertion tool.



8. For STP 15000TLHE-10 / STP 20000TLHE-10:

   Make sure that all 4 EMC seals are present in the upper enclosure lid and that they are correctly positioned. The metal braiding of the EMC seals must point outwards.



EMC seals

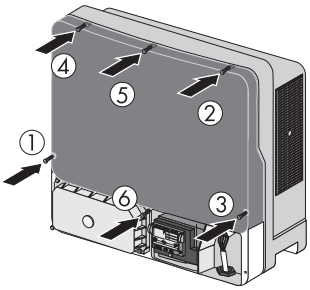
EMC seals are only installed in inverters of type STP 15000TLHE-10 / STP 20000TLHE-10.

Without EMC seals, the STP 15000TLHE-10 / STP 20000TLHE-10 no longer fulfil the requirements of the EMC Directive (Directive on the electromagnetic compatibility of a device) and forfeit their operating licence.

- Contact the SMA Service Line if one or more EMC seals is missing.

9. Pre-screw all screws and the corresponding conical spring washers for 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 live enclosure lid

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

- For all 6 screws attach the conical spring washers with the toothing facing towards the enclosure lid.

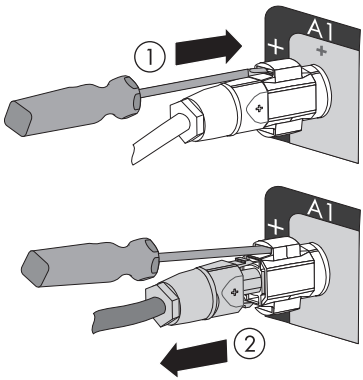
10. Restart the inverter as described in Section 7 "Commissioning" (page 55).

☑ The varistors have now been replaced and the inverter is back in operation.

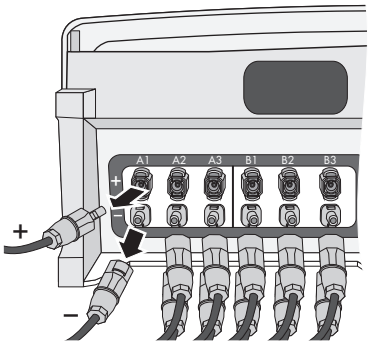
12 Decommissioning

12.1 Dismantling the Inverter

1. Disconnect the inverter as described in Section 8 "Disconnecting the Inverter from Voltage Sources" (page 58).
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. If connected, remove all 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 anti-theft lock.
6. Remove the inverter from the back panel and remove the back panel from 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 in the inverter.

- Do not operate the inverter without the upper and lower enclosure lid during operation.

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:

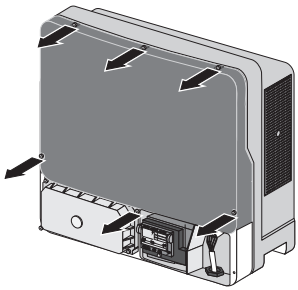
DANGER!

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

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

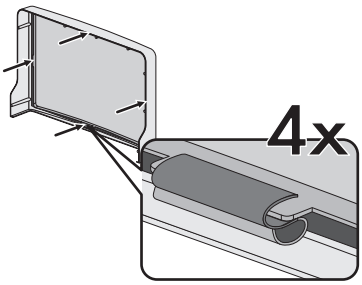
- Wait 20 minutes before you open the upper enclosure lid or the DC lid.

1. Disassemble the inverter as described in Section 12.1 "Dismantling the Inverter" (page 81).
2. Loosen 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 the Reverse Current Protection at Input Area A" (page 52)).



6. For STP 15000TLHE-10 / STP 20000TLHE-10:

   Make sure that all 4 EMC seals are present in the upper enclosure lid and that they are correctly positioned. The metal braiding of the EMC seals must point outwards.



EMC seals

EMC seals are only installed in inverters of type STP 15000TLHE-10 / STP 20000TLHE-10.

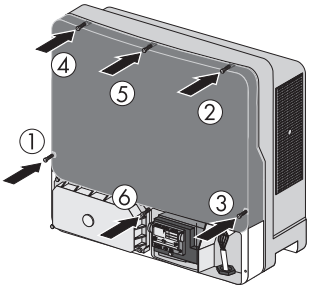
Without EMC seals, the STP 15000TLHE-10 / STP 20000TLHE-10 no longer fulfil the requirements of the EMC Directive (Directive on the electromagnetic compatibility of a device) and will forfeit their operating licence.

- Contact the SMA Service Line if one or more EMC seals is missing.

7. 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 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 live enclosure lid

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

- For all 6 screws attach the conical spring washers with the toothing facing towards the enclosure lid.

8. Screw the lower enclosure lid of your inverter onto the replacement device.
9. 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.
10. 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 be 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 between –25°C and +60°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 94).

13 Technical Data

13.1 DC/AC

13.1.1 SUNNY TRIPOWER 15000TL Economic Excellence

DC Input

Maximum DC power at cos φ = 1	15,260 W
Maximum input voltage*	1,000 V
MPP voltage range at 230 V AC	580 V ... 800 V
Rated input voltage	580 V
Minimum input voltage at 230 V AC	570 V
Start 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	15,000 VA
Rated grid voltage	3/N/PE, 230 V/400 V
AC voltage range*	160 V ... 280 V
Nominal AC current at 230 V	21.7 A
Maximum output current	24.0 A
Maximum short-circuit current	50 A
Total harmonic factor of the output current with total harmonic factor of the AC voltage < 2%, AC power > 0.5 rated power	≤ 2.6%
Maximum residual output current	96 mA
Rated power frequency	50 Hz
AC power frequency*	50 Hz/60 Hz
Operating range at AC power frequency 50 Hz	44 Hz ... 55 Hz
Operating range at AC power frequency 60 Hz	54 Hz ... 65 Hz
Displacement power factor, adjustable	$0.8_{\text{overexcited}}$ ... $0.8_{\text{underexcited}}$
Feed-in phases	3
Connection phases	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 15000TL High Efficiency

DC Input

Maximum DC power at cos φ = 1	15,200 W
Maximum input voltage*	1,000 V
MPP voltage range at 230 V AC	580 V ... 800 V
Rated input voltage	580 V
Minimum input voltage at 230 V AC	570 V
Start 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	15,000 VA
Rated grid voltage	3/N/PE, 230 V/400 V
AC voltage range*	160 V ... 280 V
Nominal AC current at 230 V	21.7 A
Maximum output current	24.0 A
Maximum short-circuit current	50 A
Total harmonic factor of the output current with total harmonic factor of the AC voltage < 2%, AC power > 0.5 rated power	≤ 2.6%
Maximum residual output current	96 mA
Rated power frequency	50 Hz
AC power frequency*	50 Hz/60 Hz
Operating range at AC power frequency 50 Hz	44 Hz ... 55 Hz
Operating range at AC power frequency 60 Hz	54 Hz ... 65 Hz

Displacement power factor, adjustable	0.8 $_{overexcited}$ ... 0.8 $_{underexcited}$
Feed-in phases	3
Connection phases	3
Overvoltage category as per IEC 60664-1	III

* Depending on country setting

Efficiency

Maximum efficiency, η_{max}	99.0%
European weighted efficiency, η_{EU}	98.7%

13.1.3 Sunny Tripower 20000TL Economic Excellence

DC Input

Maximum DC power at cos φ = 1	20,450 W
Maximum input voltage*	1,000 V
MPP voltage range at 230 V AC	580 V ... 800 V
Rated input voltage	580 V
Minimum input voltage at 230 V AC	570 V
Start 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	20,000 VA
Rated grid voltage	3/N/PE, 230 V/400 V
AC voltage range*	160 V ... 280 V
Nominal AC current at 230 V	29 A
Maximum output current	29 A
Maximum short-circuit current	50 A
Total harmonic factor of the output current with total harmonic factor of the AC voltage < 2%, AC power > 0.5 rated power	≤ 2.6%
Maximum residual output current	96 mA
Rated power frequency	50 Hz
AC power frequency*	50 Hz/60 Hz

Operating range at AC power frequency 50 Hz	44 Hz ... 55 Hz
Operating range at AC power frequency 60 Hz	54 Hz ... 65 Hz
Displacement power factor, adjustable	0.8 $_{overexcited}$ ... 0.8 $_{underexcited}$
Feed-in phases	3
Connection phases	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%

13.1.4 Sunny Tripower 20000TL High Efficiency

DC Input

Maximum DC power at cos φ = 1	20,300 W
Maximum input voltage*	1,000 V
MPP voltage range at 230 V AC	580 V ... 800 V
Rated input voltage	580 V
Minimum input voltage at 230 V AC	570 V
Start 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	20,000 VA
Rated grid voltage	3/N/PE, 230 V/400 V
AC voltage range*	160 V ... 280 V
Nominal AC current at 230 V	29 A
Maximum output current	29 A
Maximum short-circuit current	50 A
Total harmonic factor of the output current with total harmonic factor of the AC voltage < 2%, AC power > 0.5 rated power	≤ 2.6%
Maximum residual output current	96 mA

Rated power frequency	50 Hz
AC power frequency*	50 Hz/60 Hz
Operating range at AC power frequency 50 Hz	44 Hz ... 55 Hz
Operating range at AC power frequency 60 Hz	54 Hz ... 65 Hz
Displacement power factor, adjustable	0.8 $_{\text{overexcited}}$ ... 0.8 $_{\text{underexcited}}$
Feed-in phases	3
Connection phases	3
Overvoltage category as per IEC 60664-1	III

* Depending on country setting

Efficiency

Maximum efficiency, η_{max}	99.0%
European weighted efficiency, η_{EU}	98.7%

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 category (according to IEC 60721-3-4)	4K4H
Operating temperature range	– 25°C ... +60°C
Maximum permissible value for relative humidity, non-condensing	100%
Maximum operating altitude above Mean Sea Level	3,000 m
Noise emission (typical)	≤ 40 dB(A)
Power loss in night operation	< 1 W
Topology	Transformerless
Cooling concept	OptiCool: temperature-controlled fan
Fan connection	Designed for safe disconnection in accordance with DIN EN 62109-1
Protection rating according to IEC 60529	IP65
Protection class (according to IEC 62103)	I
Strain relief category of the cable glands according to EN 50262	A

* optional

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 k Ω
All-pole sensitive residual-current monitoring unit	available

* optional

13.4 Licences

Country standards, as of 06/12	STP 15000TLEE-10	STP 15000TLHE-10	STP 20000TLEE-10	STP 20000TLHE-10
VDE-AR-N4105	✓	✓	✓	✓
VDE 0126-1-1	✓	✓	✓	✓
AS4777	✓	✓	✓	✓
C10/11*	✓	✓	✓	✓
PPDS	✓	✓	✓	✓
UTE C15-712-1	✓	✓	✓	✓
PPC	✓	✓	✓	✓
EN50438**	✓	✓	✓	✓
RD1699/2000	✓	✓	✓	✓
RD661/2007	✓	✓	✓	✓
IEC 61727	✓	✓	✓	✓
G59/2	✓	✓	✓	✓
CEI 0-21	✓	–	✓	–
NRS 97-2-1***	✓	✓	✓	✓
BDEW 2008	✓	✓	✓	✓

* C 10/11: Only possible if the 3-phase nominal voltage of the phase conductor is 400 V

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

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

13.5 Climatic Conditions

According to IEC 60721-3-4, installation type C, class 4K4H

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

According to IEC 60721-3-4, transport type E, class 2K3

Temperature range	– 25°C ... +70°C

13.6 Features

DC connection	SUNCLIX DC connector
AC Connection	spring clamp terminal
Display	LC graphic display
Bluetooth	standard
RS485, galvanically isolated	optional
Multi-function relay	optional

13.7 Torque

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 back 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

13.8 Distribution systems

TN-C system	suitable
TN-S system	suitable
TN-C-S system	suitable
TT system	suitable

13.9 Data Storage Capacity

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

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.

Description	Brief description	SMA order number
Replacement varistors	Set of thermally monitored varistors (3 units)	STP-TV9
RS485 retrofit kit	RS485 interface	DM-485CB-10
Multi-function relay	Multi-function relay for retrofitting in PV inverters	MFR01-10
Ventilation grid	1 ventilation grid as spare part	45-10899080
SUNCLIX DC plug connector	Field plug for conductor cross-sections of 2.5 mm² ... 6 mm²	SUNCLIX-FC6-SET

15 Contact

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

- Inverter device type
- Inverter serial number
- Type and number of the PV modules connected
- 4-digit event number or display message of the inverter
- Installation location
- Optional equipment, e.g. communication products
- Confirmation of whether or not a multi-function relay is used

SMA Solar Technology AG

Sonnenallee 1

34266 Niestetal, Germany

www.SMA.de

SMA Service Line

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Communication: +49 561 9522 2499

Fax: +49 561 9522 4699

E-Mail: ServiceLine@SMA.de

SMA Factory Warranty

The current warranty conditions come enclosed with your device. These are also available online at www.SMA-Solar.com and can be downloaded and are available on paper from the usual sales channels if required.

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