



PV Inverter

SUNNY BOY 1300TL/1600TL/2100TL

Installation Guide



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1 Information on this Manual

1.1 Validity

This manual describes the assembly, installation, commissioning, maintenance and failure search procedures for the following SMA inverters:

- Sunny Boy 1300TL (SB 1300TL-10)
- Sunny Boy 1600TL (SB 1600TL-10)
- Sunny Boy 2100TL (SB 2100TL)

Keep this manual in a convenient place for future reference.

1.2 Target Group

This manual is for 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 operating parameters in the download area at www.SMA.de/en.

Refer to the User Manual provided for detailed information on operating the inverter.

1.4 Symbols Used

The following types of safety instructions and general information are used in this manual:

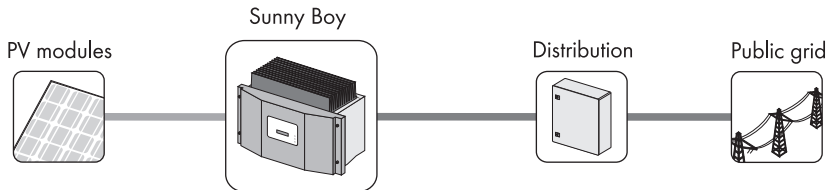
	DANGER! "DANGER" indicates a hazardous situation which, if not avoided, will result in death or serious injury.
	WARNING! "WARNING" indicates a hazardous situation which, if not avoided, could result in death or serious injury.
	CAUTION! "CAUTION" indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.
	NOTICE! "NOTICE" indicates a situation that can result in property damage if not avoided.
	Information Information provides tips that are valuable for the optimal installation and operation of your product. <input checked="" type="checkbox"/> This symbol indicates the result of an action.

2 Safety

2.1 Appropriate Usage

The Sunny Boy is a PV inverter which converts the DC current of the PV array to AC current and feeds it into the power distribution grid.

Principle of a PV plant with this Sunny Boy



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



Capacitive discharge currents

PV modules with large capacities relative to ground, such as thin-film modules with cells on a metallic substrate, may only be used if their coupling capacity does not exceed 1400 nF.

During feed-in operation, a discharge current flows from the cells to ground. The amount of current depends on the manner in which the modules are installed (e.g., foil on metal roof) and on the weather (rain, snow). This "normal" discharge current may not exceed 50 mA due to the fact that the inverter would otherwise automatically disconnect from the grid as a protective measure.

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" (www.SMA.de/en/SunnyDesign) will assist you. The manufacturer of the PV modules must have approved the modules for use with this Sunny Boy device. 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 Description "Module Technology" in the download area of www.SMA.de/en).

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

2.2 Safety Instructions

**DANGER!**

Danger to life due to high voltages in the inverter.

- All work on the inverter may only be carried out by an electrically skilled person.
- The appliance is not to be used by children or persons with reduced physical, sensory or mental capabilities, or lack of experience and knowledge, unless they have been given supervision or instruction.
- Children should be supervised to ensure that they do not play with the appliance.

**WARNING!**

Risk of electric shock when pulling out the DC connectors under load.

If you disconnect the DC connectors from the inverter under load, an electric arc may occur, leading to electric shock and burns.

- If the inverter is not equipped with an Electronic Solar Switch and the regulations in the country of installation require an external DC switch-disconnector, install an external DC switch-disconnector.
- Switch off the AC miniature circuit-breaker and disconnect the inverter on the DC side before pulling out the DC connectors.

**CAUTION!**

Danger of burn injuries due to hot enclosure parts.

- Do not touch enclosure during operation.
- Only touch the lid during operation.

**NOTICE!**

Dust and water in the inverter can damage the device.

If the inverter is equipped with an Electronic Solar Switch, it will only provide IP21 degree of protection once the Electronic Solar Switch has been pulled out. The inverter is therefore no longer protected against water and dust. In order to also maintain the IP65 degree of protection during temporary decommissioning, proceed as follows:

- Unlock and disconnect all DC connectors.
- Open all DC connectors and remove the cables.
- Close all DC inputs with the corresponding DC connectors and the supplied sealing plugs.
- Securely attach the Electronic Solar Switch again.



Grounding the PV array

Comply with the local regulations for grounding 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 to ground them in order to ensure maximum protection for plants and persons.

2.3 Explanation of Symbols

This section gives an explanation of all the symbols found on the inverter and on the type label.

2.3.1 Symbols on the Inverter












Symbol	Explanation
	Operation display. Indicates the operating state of the inverter.
	Ground fault or varistor defective. Read section 9.3 "Red LED is Glowing Continuously" (page 52).
	Error or fault. Read section 9 "Failure Search" (page 46).
	You can operate the display by tapping on the enclosure lid: <ul style="list-style-type: none"> • Tapping once: the backlight switches on or the display scrolls to the next display message. • Tapping twice in quick succession*: the inverter shows the display messages from the startup phase again (see Section 6.2 "Display Messages during the Startup Phase" (page 38)).
	Electronic Solar Switch (ESS) DC switch-disconnector**.
	<ul style="list-style-type: none"> • ❶ When the Electronic Solar Switch is plugged in, the DC circuit is closed. • ❷ To interrupt the DC circuit and disconnect the inverter securely under load, you have to first pull out the Electronic Solar Switch ❶ and then remove all DC connectors ❷, as described in section 7.2 "Opening the Inverter" (page 39).
	QR-Code*** for SMA bonus program You will find information on the SMA bonus programme at www.SMA-Bonus.com .

* This function is valid from firmware version 4.00

** optional

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

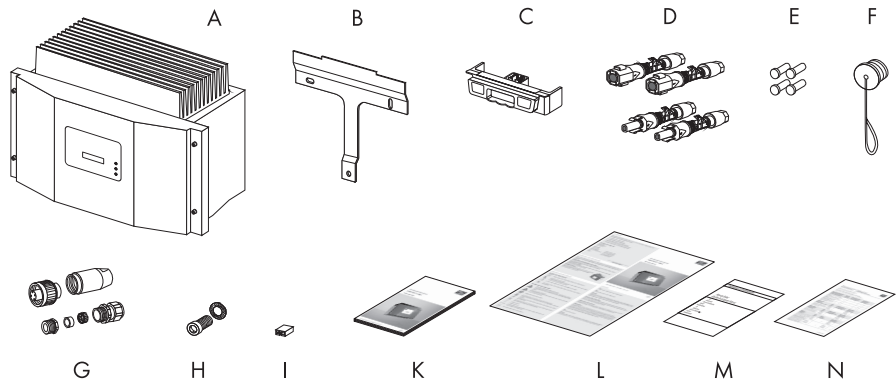
2.3.2 Symbols on the Type Label

Symbol	Explanation
	Beware of dangerous electrical voltage. The inverter operates at high voltages. All work on the inverter may only be carried out by an electrically skilled person.
	Beware of hot surface. The inverter can become hot during operation. Avoid contact during operation.
	Observe all documentation that accompanies the inverter.
	The inverter must not be disposed of together with household waste. For more information on disposal, see section 10.4 "Disposing of the Inverter" (page 58).
	CE mark. The inverter complies with the requirements of the applicable EC guidelines.
	The inverter is transformerless.
	Direct current (DC).
	Alternating current (AC).
	Degree of protection IP65. The inverter is protected against penetration by dust particles and water jets from any angle.
	RAL quality mark for solar products. The inverter complies with the requirements of the German Institute for Quality Assurance and Labeling.
	Australian mark of conformity.

3 Unpacking

3.1 Scope of Delivery

Check the delivery for completeness and for any visible external damage. Contact your dealer if anything is damaged or missing.



Object	Number	Description
A	1	Sunny Boy
B	1	Wall mounting bracket
C	1	Electronic Solar Switch (ESS)*
D	2/4	DC connectors Sunny Boy 1300TL/1600TL: 2 units (1 x positive, 1 x negative) Sunny Boy 2100TL: 4 units (2 x positive, 2 x negative)
E	2/4	Sealing plugs for DC connectors Sunny Boy 1300TL/1600TL: 2 units Sunny Boy 2100TL: 4 units
F	1	Protective cap for AC socket on inverter
G	1	AC connection socket: socket unit, threaded sleeve, pressure screw PG13.5, sealing ring PG13.5, fastening case PG13.5, cable gland PG16
H	1	M6x12 cylinder head screw and conical spring washer
I	1	Jumper
K	1	Installation manual
L	1	User manual
M	1	Set of documents with explanations and certificates
N	1	Supplementary sheet with inverter factory settings

* optional

3.2 Identifying the Inverter

You can identify the inverter by the type label. The type label is on the right 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 Assembly

4.1 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 areas with a risk of explosion.



CAUTION!

Danger of burn injuries due to hot enclosure parts.

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



CAUTION!

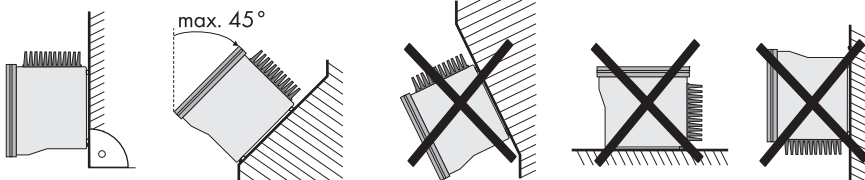
Risk of injury due to the heavy weight of the inverter.

- Take the inverter's weight of approx. 16 kg into account for mounting.

4.2 Selecting the Mounting Location

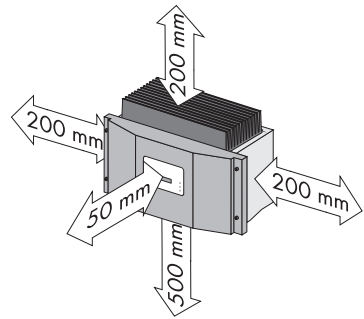
Consider the following points when selecting where to install:

- The mounting method and location must be suitable for the inverter's weight and dimensions (see section 11 "Technical Data" (page 59)).
- 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 servicing.



- Mount vertically or tilted backwards at a maximum angle of 45°.
- The connection area must point downwards.

- Never mount the device with a forward tilt.
- Never install the device with a sideways tilt.
- Do not mount horizontally.
- Install at eye level in order to allow operating states to be read at all times.
- To ensure optimal operation, the ambient temperature should be below 40°C.
- Do not expose the inverter to direct sunlight, as this can cause excessive heating and power reduction.
- In a living area, do not mount the unit on plasterboard walls (or similar) in order to avoid audible vibrations. When in use, the inverter emits noises which may be perceived as a nuisance in a living area.
- Observe the minimum clearances to walls, other inverters or objects as shown in the diagram in order to ensure sufficient heat dissipation and sufficient space for removing the Electronic Solar Switch.



Multiple inverters installed in areas with high ambient temperatures

If necessary, increase the clearance spaces and make sure there is enough ventilation to ensure sufficient cooling of the inverters.

4.3 Mounting the Inverter with the Wall Mounting Bracket

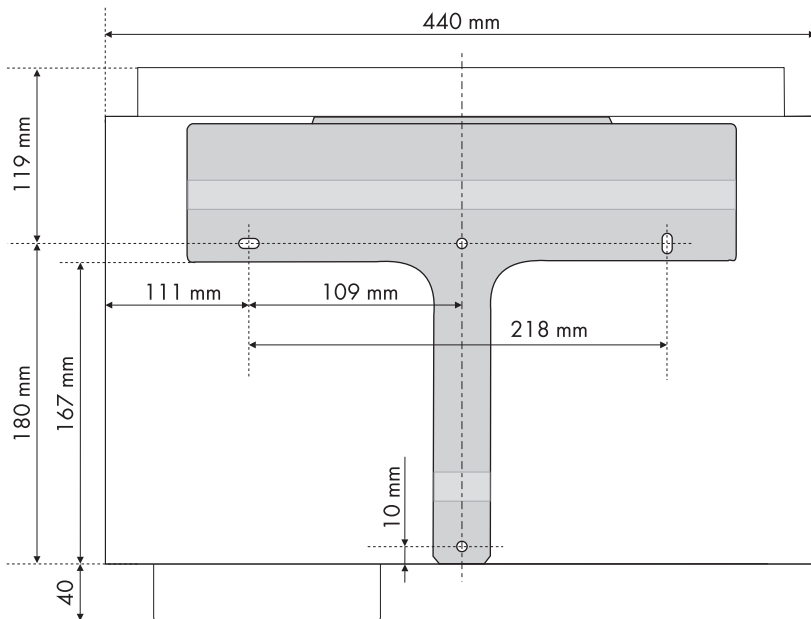


CAUTION!

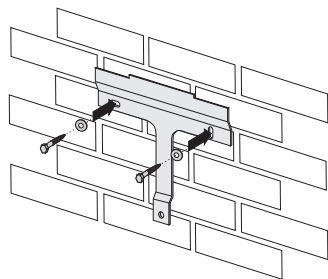
Risk of injury due to the heavy weight of the inverter.

- Take the inverter's weight of approx. 16 kg into account for mounting.
- Use mounting material suitable for the surface when attaching the wall mounting bracket.

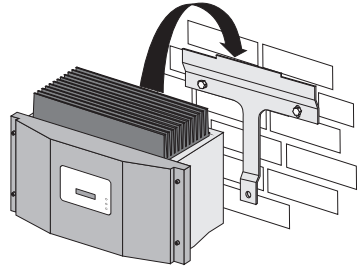
1. Use the wall mounting bracket as a drilling template and mark the positions of the drill holes.



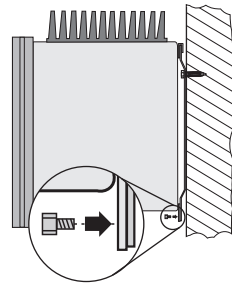
2. Attach the wall mounting bracket to the wall using appropriate screws and washers.



3. Mount the inverter with its upper fastening plates on the wall mounting bracket in such a way that it cannot slide out of the bracket sideways.




4. If a second protective conductor is required in the country of installation, ground the inverter and fix it securely, as described in section 5.2.3 "Connecting Additional Grounding" (page 27).
5. If a second protective conductor is not required, fix the inverter securely using the enclosed M6x12 screw.



6. Check to ensure that the inverter is securely in place.
- ☒ The inverter is now mounted to the wall.

5 Electrical Connection



NOTICE!

Electrostatic discharges can damage the inverter.

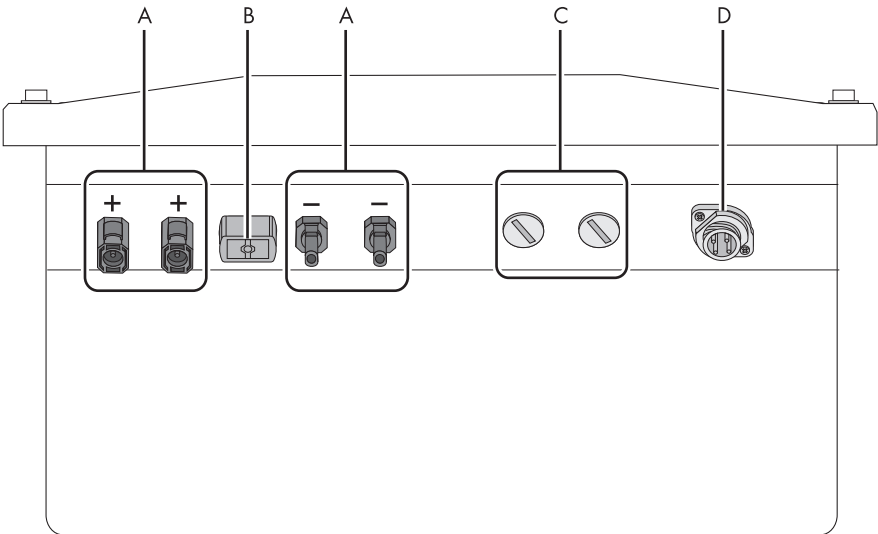
Internal components of the inverter can be irreparably damaged by static discharge.

- Ground yourself before touching a component.

5.1 Overview of the Connection Area

5.1.1 Exterior View

The following figure shows the assignment of the individual connection areas on the bottom of the inverter:

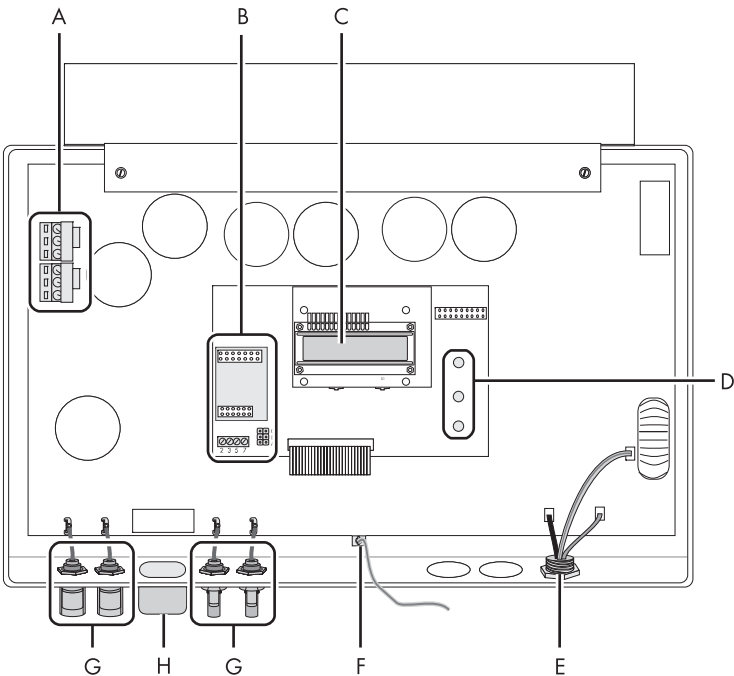


Object	Description
A	DC connectors for connecting the strings Sunny Boy 1300TL/1600TL: connection for 1 string Sunny Boy 2100TL: connection for 2 strings
B	Socket for connecting the Electronic Solar Switch (ESS) DC switch-disconnector*
C	Enclosure opening with filler-plugs for communication
D	Socket for AC connection

* optional

5.1.2 Interior View

The following figure shows the various components and connection areas of the open inverter:



Object	Description
A	Varistors
B	Connection area and sockets for optional communication via RS485 or Bluetooth
C	Display
D	Operating status LEDs
E	Socket for AC connection
F	Flat male tab for grounding the cable shield during RS485 communication
G	DC connectors for connecting the strings Sunny Boy 1300TL/1600TL: connection for 1 string Sunny Boy 2100TL: connection for 2 strings
H	Electronic Solar Switch (ESS) socket*

* optional

5.2 Connection to the Power Distribution Grid (AC)

5.2.1 Conditions for the AC Connection



Connection requirements of the network operator

Comply with the connection requirements of your network operator!

Residual current device

The inverter is equipped with an integrated all-pole sensitive residual-current monitoring unit. The inverter can automatically distinguish between real residual currents and "normal" capacitive discharge currents.

If an external RCD or residual current device is strictly required, you must use a switch that triggers at a residual current of 100 mA or higher.

You will find detailed information for using an RCD in the Technical Description "Criteria for Selecting an RCD" in the download area at www.SMA.de/en.

Cable Sizing

Select a cable diameter that does not lead to cable losses of more than 1 % at rated output power.

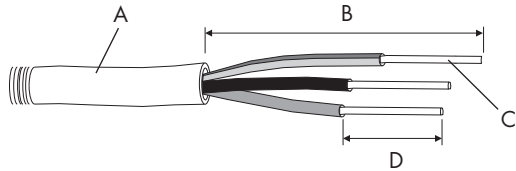
The maximum cable lengths in relation to the cable diameter are shown in the following table:

Cable diameter	Maximum cable length
1.5 mm ²	11 m
2.5 mm ²	18 m

The cable diameter required in individual cases depends on the following factors, among others:

- Ambient temperature
- Type of cable installation
- Cable losses
- Applicable installation guidelines of the respective country (installation location)

Cable Requirements



Position	Description	Value
A	External diameter	9 mm ... 17 mm
B	Stripping length	30 mm
C	Cable diameter	max. 2.5 mm ²
D	Strip insulation	4 mm ... 5 mm

Load Disconnection Unit

You must install a **separate** miniature circuit-breaker for each inverter in order to ensure that the inverter can be securely disconnected under load. The maximum permissible rating can be found in section 11 "Technical Data" (page 59).

Detailed information and examples for the rating of a miniature circuit-breaker can be found in the Technical Description "Line Circuit Breaker" in the SMA Solar Technology AG download area at www.SMA.de/en.

DANGER!

Danger to life due to fire.

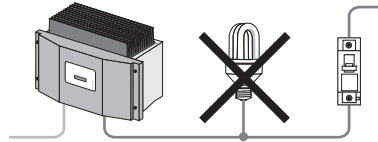
When more than one inverter is connected to the same miniature circuit-breaker, the protective function of the miniature circuit-breaker is no longer guaranteed. This can result in a cable fire or destruction of the inverter.

- Never connect several inverters to a single 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 producer (inverter) and a consumer 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 grid can accumulate to form overcurrents that are not detected by the miniature circuit-breaker.

- Never connect consumers between the inverter and the miniature circuit-breaker without protection.
- Always protect consumers separately.

**NOTICE!**

Using screw type fuse elements as load disconnection units can damage the inverter.

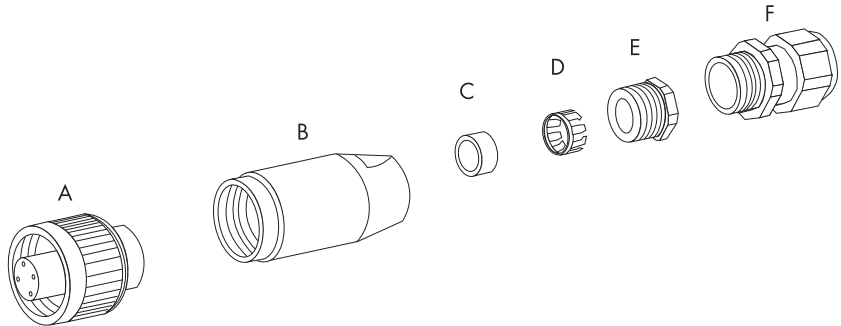
A screw type fuse element, e.g., D system (Diazed) or D0 system (Neozed), is not a switch-disconnector, and therefore may **not** be used as a load disconnection unit. A screw type fuse element serves for cable protection only.

When disconnecting under load using a screw type fuse element, the inverter can be damaged.

- Only use a switch-disconnector or a miniature circuit-breaker as a load disconnection unit.

5.2.2 Connecting the Inverter to the Power Distribution Grid (AC)

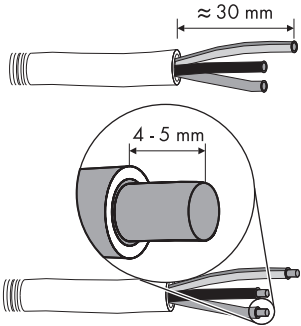
Overview of the AC Connection Socket



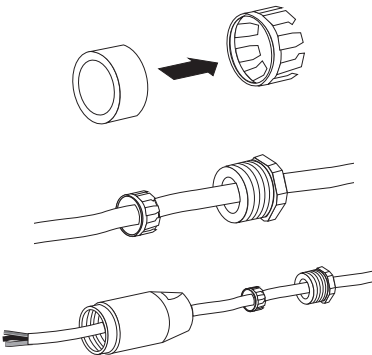
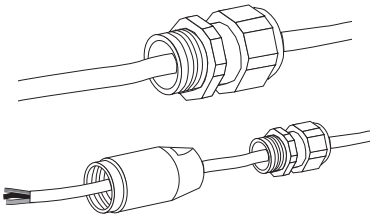
Object	Description
A	Socket element
B	Threaded sleeve
C	PG13.5 sealing ring
D	PG13.5 fastening case
E	PG 13.5 pressure screw (for a cable diameter between 9 mm and 13.5 mm)
F	PG16 cable gland (for a cable diameter between 13.5 and 17 mm)

Procedure

1. Choose an appropriate gland for the AC cable.
2. Check the grid voltage and compare with " $V_{AC\ nom}$ " on the type label.
The exact operating range of the inverter is specified in the operation parameters. The corresponding document can be found in the download area at www.SMA.de/en, in the "Technical Description" category of the respective inverter.
3. Switch off the miniature circuit-breaker, ensure that the device cannot be unintentionally or accidentally reconnected, and make sure no voltage is present.
4. Strip approx. 30 mm from the AC cable.
5. Shorten L and N by 5 mm.
6. Strip the wires of the cable by 4 to 5 mm.



7. Attach the pressure screw or cable gland and the threaded sleeve.

Size used	Procedure
PG13.5	<div><ul style="list-style-type: none">• Push the sealing ring into the fastening case.• Slide the PG13.5 pressure screw and the fastening case including the sealing ring over the AC cable.• Slide the threaded sleeve over the AC cable.</div> <div></div>
PG16	<div><ul style="list-style-type: none">• Slide the PG16 cable gland over the AC cable.• Slide the threaded sleeve over the AC cable.</div> <div></div>

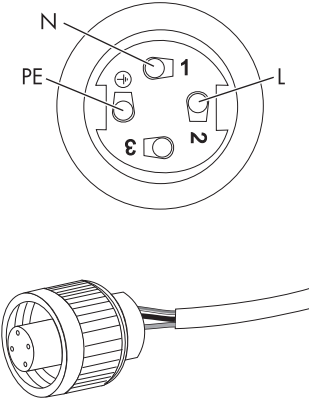
8. Insert the protective conductor PE (green-yellow) into the screw terminal with the grounding sign on the socket and tighten the screw.

9. Insert the neutral conductor N (blue) into screw terminal 1 on the socket and tighten the screw.

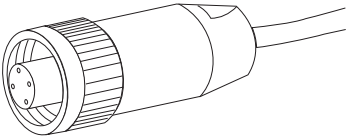
10. Insert phase L (brown or black) into screw terminal 2 on the socket and tighten the screw.

11. Leave screw terminal 3 on the socket free.

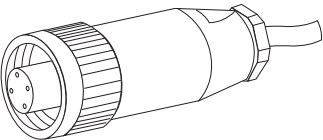
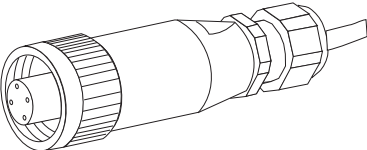
12. Make sure the wires are securely connected.



13. Screw the threaded sleeve onto the socket element.

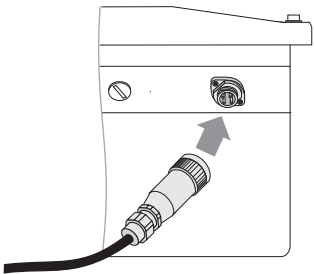


14. Tighten the pressure screw or cable gland tightly onto the threaded sleeve.

Size used	Procedure
PG13.5	 <p>The fastening case along with the sealing ring is pressed into the threaded sleeve and can no longer be seen.</p>
PG16	<ul style="list-style-type: none">Retighten the lock nut of the cable gland. 

☒ The AC connection socket has been screwed together.

15. If the AC connection socket is not immediately connected to the inverter, close up the AC socket on the inverter with the protective cap provided.
16. Insert the AC connection socket into the AC socket on the inverter. Remove the protective cap beforehand, if required.
17. Screw the threaded ring of the AC connection socket tightly onto the AC socket on the inverter. The threaded ring serves to seal and relieve strain on the AC connection socket.



☒ The AC cable is now connected to the inverter.



DANGER!

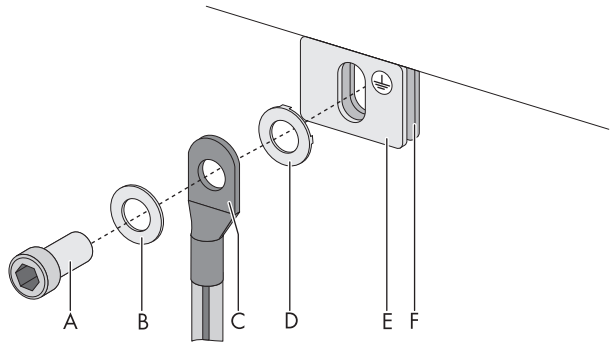
Danger to life due to high voltages in the inverter.

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

5.2.3 Connecting Additional Grounding

If a second protective conductor, additional grounding or equipotential bonding is required, you can additionally ground the inverter on the enclosure.

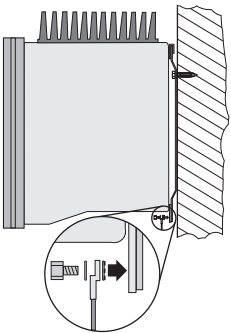
Overview of the Additional Grounding



Object	Description
A	M6x12 cylinder head screw (included in the scope of delivery)
B	Washer
C	Terminal lug (M6) with protective conductor
D	Conical spring washer (included in the scope of delivery)
E	Metal shackle on the underside of the enclosure
F	Wall mounting bracket of the inverter

Procedure

1. Attach the washer, terminal lug with protective conductor and the conical spring washer to the cylinder head screw. The teeth of the conical spring washer must be facing the metal shackle.
2. Insert the cylinder head screw into the metal shackle on the underside of the enclosure and screw into the wall mounting bracket. Tighten the cylinder head screw using a torque of 6 Nm.
3. Check that the contact between the protective conductor and the enclosure is in accordance with the regulations valid for the country of installation.



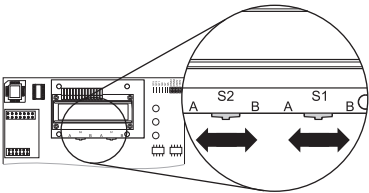
5.3 Setting the Display Language

You can set the language of the display using the switches underneath the display assembly inside the inverter.

Procedure

- 1. Open the inverter as described in section 7.2 "Opening the Inverter" (page 39).
- 2. Set the switches to the required language, as shown below.

Language	Switch S2	Switch S1
German	B	B
English	B	A
French	A	B
Spanish	A	A



- 3. Close the inverter as described in section 7.3 "Closing the Inverter" (page 42).
- ☒ The display language is set.

5.4 Connecting the PV Array (DC)

5.4.1 Conditions for the DC Connection




Use of Adaptors

Adaptors (branch plug connectors) must not be visible or freely accessible in the immediate surroundings of the inverter.

- The DC circuit may **not** be interrupted by adaptors.
- Observe the procedure for disconnecting the inverter as described in section 7.2 "Opening the Inverter" (page 39).
- Requirements for the PV modules of the connected strings:
 - Same type
 - Same number
 - Identical alignment
 - Identical tilt
- The connection cables of the PV modules must be equipped with connectors. You will find the necessary DC connectors for DC connection included in the delivery.
- If the inverter is not equipped with an Electronic Solar Switch and the regulations in the country of installation require an external DC switch-disconnector, 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
600 V (DC)	11.0 A (DC)



DANGER!

Risk of lethal electric shock or fire.

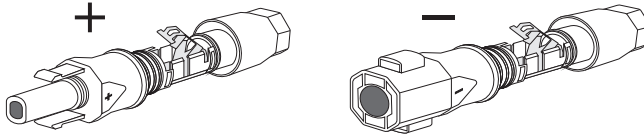
The maximum possible input current per string is limited by the connectors used. If the connector is overloaded, an electric arc may occur and there is a risk of fire.

- Ensure that the input current for each string does not exceed the maximum flow current of the connectors used.

5.4.2 Assembling the DC Connector

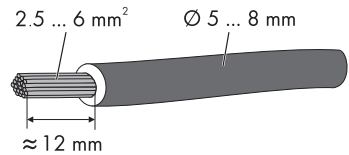
In order to be connected to the inverter, all connection cables of the PV modules must be equipped with the DC connectors provided.

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



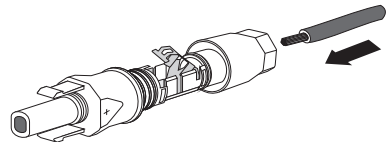
Cable requirements:

- Use a PV1-F cable.

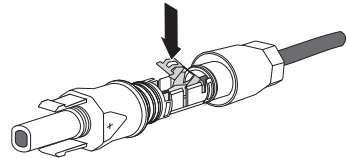


Procedure

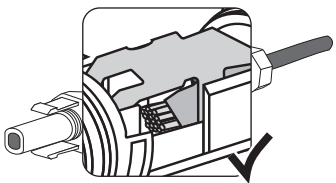
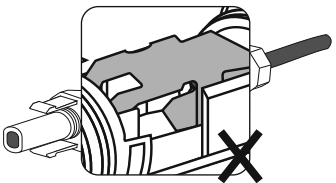
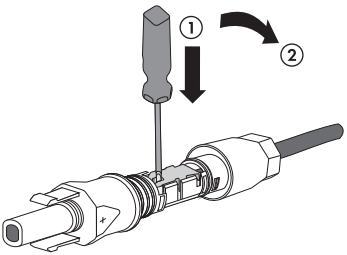
1. Insert stripped cable into the plug as far as it will go.



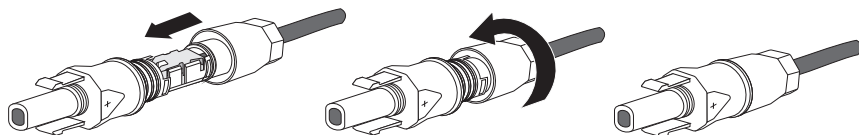
2. Press the clamping clip down until it audibly snaps into place.



3. Ensure the cable is correctly in place.

Result	Measure
<p>✓ If the conductors are visible in the hollow cavity of the clamping clip, the cable is in the correct position.</p> 	<ul style="list-style-type: none"> Proceed to step 4.
<p>✓ If the conductors are not visible in the hollow cavity, the cable is not in the correct position.</p> 	<ul style="list-style-type: none"> Loosen the clamping clip. For this purpose, use a screwdriver with a width of 3.5 mm.  Remove cable and start again from step 1.

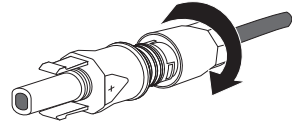
4. Push the bolted connection toward the thread and fasten to a torque of 2 Nm.



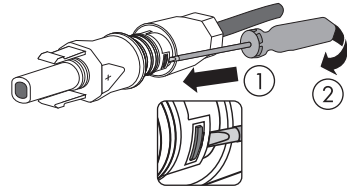
✓ The DC connectors are now assembled and can be connected to the inverters, as described in section 5.4.4 "Connecting the PV Array (DC)" (page 33).

5.4.3 Opening the DC Connector

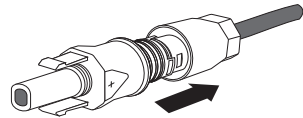
1. Unscrew the bolted connection.



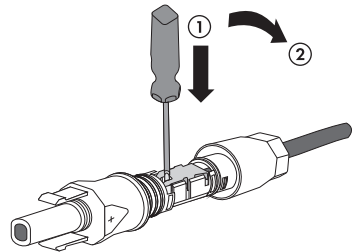
2. To open the connector, insert a screwdriver into the side catch and pry it open. For this purpose, use a screwdriver with a width of 3.5 mm.



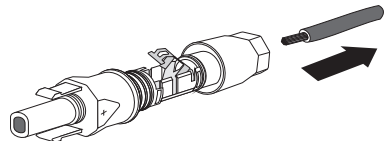
3. Carefully pull the DC connector apart.



4. Loosen the clamping clip. For this purpose, use a screwdriver with a width of 3.5 mm.



5. Remove the cable.



- ☒ The cable is now removed from the DC connector.

5.4.4 Connecting the PV Array (DC)


DANGER!

Danger to life due to high voltages in the inverter.

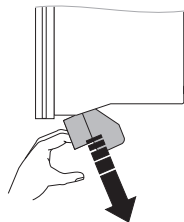
- Before connecting the PV array, ensure that the miniature circuit-breaker is switched off.


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.

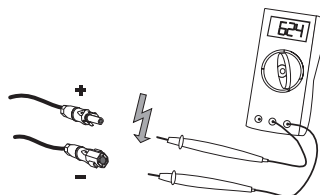
1. Disconnect the miniature circuit-breaker and secure against re-connection.
2. If an Electronic Solar Switch is installed, pull it downwards, slightly towards the wall.



3. 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 ambient temperatures above 10 °C, the open-circuit voltage of the PV modules must not be more than 90 % of the maximum inverter input voltage.

Otherwise, check the plant design and the PV module connection. If this is not done, the maximum inverter input voltage can be exceeded at lower ambient temperatures.



**NOTICE!**

Exceeding the maximum input voltage can destroy the inverter.

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 with an open-circuit voltage greater than the maximum input voltage of the inverter.
- Check the plant design.

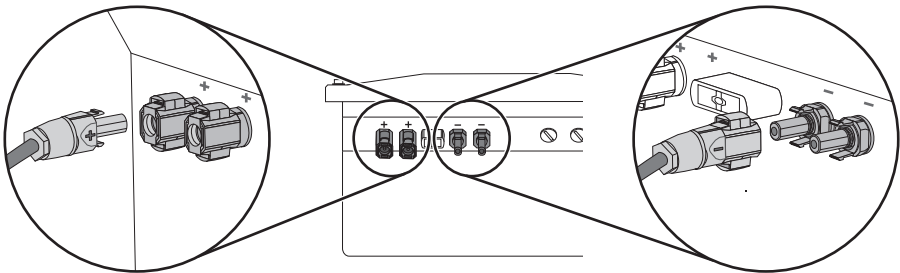
4. Check the strings for ground faults, as described in section 9.3.1 "Checking the PV Array for a Ground Fault" (page 52).

**DANGER!**

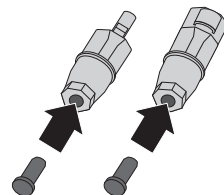
Risk of lethal electric shock.

- Do not connect strings with ground faults.
- First, rectify the ground fault in the respective string.

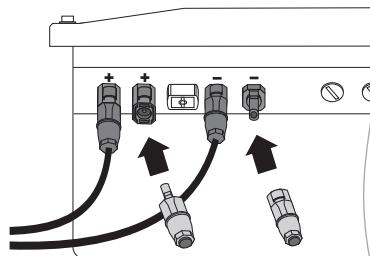
5. Check the DC connectors for correct polarity and connect them.
To unlock the DC connectors see section 7.2 "Opening the Inverter" (page 39).



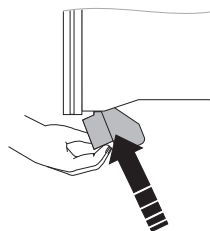
6. In order to seal the inverter, all the DC inputs that are not required have to be closed as follows:
 - Insert the provided sealing plugs into the DC connectors that are not needed.
 Do **not** insert the sealing plugs into the DC inputs on the inverter.



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



7. If an Electronic Solar Switch is installed, check it for wear, as described in section 8.1 "Checking the Electronic Solar Switch for Wear" (page 44), and reattach it firmly.

**NOTICE!**

Manipulating the connector in the handle can damage the Electronic Solar Switch.

The connector within the handle must remain movable in order to ensure proper contact. Tightening the screw voids all warranty claims and creates a fire hazard.

- Do **not** tighten the connector screw in the Electronic Solar Switch handle.

**NOTICE!**

The Electronic Solar Switch can be damaged if it is attached incorrectly.

If it is not correctly attached, the Electronic Solar Switch can be damaged by high voltages.

- Plug the handle firmly onto the socket of the Electronic Solar Switch.
- Check that the handle is securely in place.

- ☒ The PV array is now connected.

5.5 Communication

The inverter is equipped with a socket for communication interfaces in order to communicate with special data logging devices (e.g., Sunny WebBox) or a PC with corresponding software (e.g., Sunny Data Control or Sunny Explorer).

Refer to the communication interface manual for a detailed wiring diagram and a mounting description.

5.6 Setting the Grid and Country Parameters



Changing grid-relevant and country parameters

To change grid-relevant parameters, you need a personal access code - the so-called SMA Grid Guard Code. The application form for the personal access code is available in the download area at www.SMA.de/en, in the "Certificate" category of the respective inverter.

Ensure that you discuss the changes to these parameters with your network operator.

A detailed description of the operating parameters for the inverter is available in the download area at www.SMA.de/en, in the "Technical Description" category of the respective inverter.

5.6.1 Setting the Installation Country

Using the "Default" parameter you can set the installation country and/or the grid connection standard valid for the country via a communication device (e.g., Sunny WebBox) or a PC with corresponding software (e.g., Sunny Data Control or Sunny Explorer). This, however, is only required if the inverter was originally ordered for another country. You can see the default standard to which the inverter was set on the type label and on the included supplementary document with the factory settings.

6 Commissioning

6.1 Commissioning the Inverter

1. Check the following requirements before commissioning:
 - The inverter is firmly in place
 - Correct connection of the AC cable (grid)
 - All DC cables connected (strings)
 - Unnecessary DC inputs are closed with the corresponding DC connectors and sealing plugs
 - The enclosure lid is securely screwed in place
 - External DC switch-disconnector additionally connected or, if available, the Electronic Solar Switch (ESS) is firmly in place
 - The miniature circuit-breaker is laid out correctly
2. Switch on the miniature circuit-breaker.

☒ Green LED glows: commissioning has been successful.

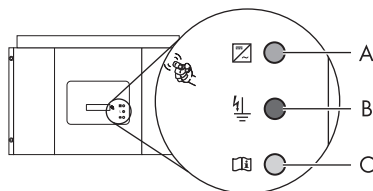
or

☒ Green LED flashes in case of insufficient irradiation: grid connection conditions have not yet been reached. Wait for sufficient irradiation.

or

☒ The red or yellow LED is glowing or flashing: an error has occurred. Proceed to step 3.

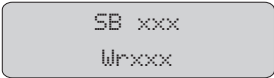
A	Green LED	Operation
B	Red LED	Ground fault or varistor defective
C	Yellow LED	Fault



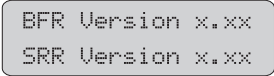
3. Read section 9 "Failure Search" (page 46) and if necessary eliminate the error or fault.

6.2 Display Messages during the Startup Phase

- After commissioning, the inverter displays the device type in the startup phase.
- After 5 seconds or when you tap on the enclosure lid again, the firmware version of the internal processors is displayed by the inverter.
- After a further 5 seconds or when you tap again, the configured country standard is displayed by the inverter (example: "VDE-AR-N4105").



SB xxx
Wrxxx



BFR Version x.xx
SRR Version x.xx



VDE-AR-N4105



Show the display messages again (valid from firmware version 4.00)

If you want to view the display messages of the startup phase again while in normal operation, double tap on the enclosure lid.

7 Opening and Closing

7.1 Safety



DANGER!

Risk of lethal electric shock.

Before opening the inverter observe the following:

- Ensure that no voltage is present on the AC side
- Ensure that neither voltage nor current is present on the DC side.



NOTICE!

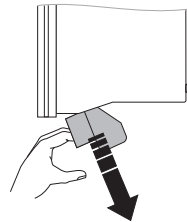
Electrostatic discharges can damage the inverter.

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

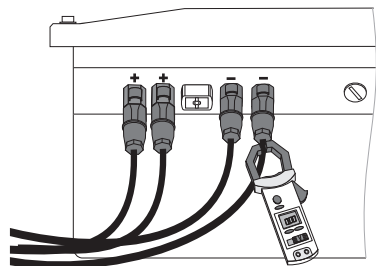
- Ground yourself before touching a component.

7.2 Opening the Inverter

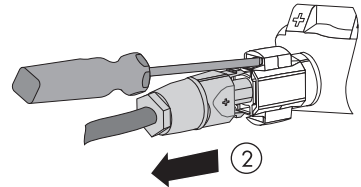
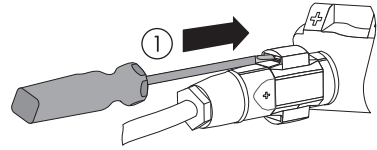
1. Disconnect the miniature circuit-breaker and prevent it from being reactivated.
2. If an external DC switch-disconnector is available, disconnect it.
3. If an Electronic Solar Switch is installed, pull it downwards, slightly towards the wall.



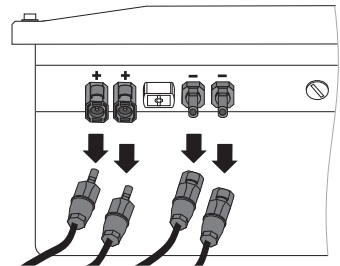
4. Using a current probe, ensure that no current is present at all DC cables.
☒ If current is present, check the installation.



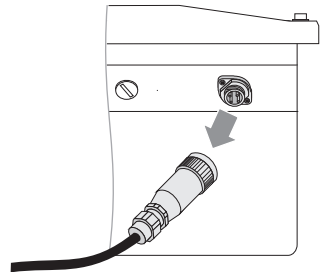
5. Unlock all DC connectors. For this purpose, use a screwdriver with a width of 3.5 mm.
- Insert the screwdriver into one of the side slits (1).
 - Disconnect DC connectors (2).



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



6. Pull out the AC plug.



7. Check whether all LEDs and the display have gone out.

**DANGER!**

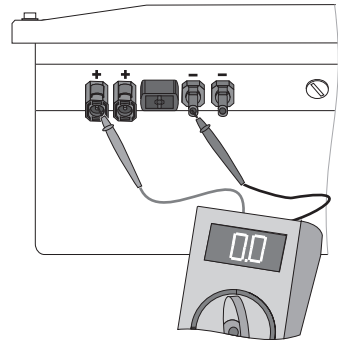
Danger to life due to high voltages in the inverter.

The capacitors in the inverter require 15 minutes to discharge.

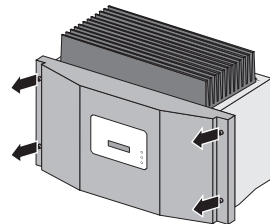
- Wait 15 minutes before opening the inverter.

8. Ensure that no voltage is present at the DC plugs on the inverter.

☒ If voltage is present, check the installation.



9. Remove all screws from the enclosure lid and pull the lid forward smoothly.

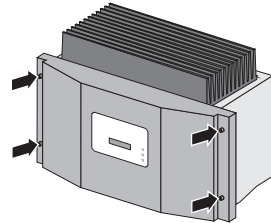


10. Remove protective conductor (PE) connection from the lid by loosening the PE connection lock on the lid.

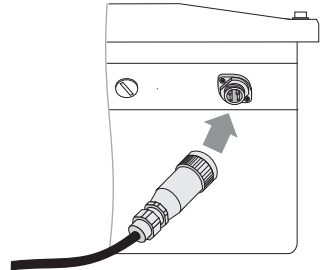
☒ The inverter is now open and free of voltage.

7.3 Closing the Inverter

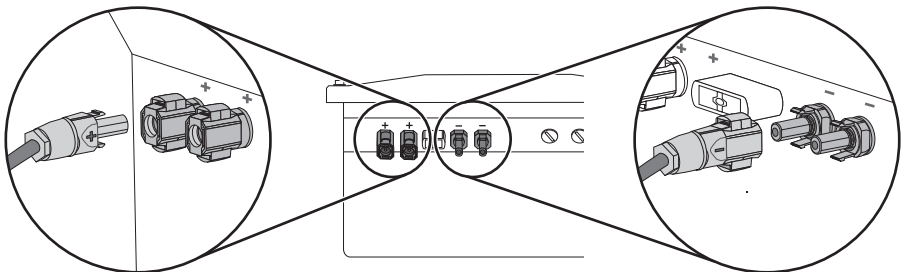
1. Establish the protective conductor (PE) connection to the lid.
2. Secure the enclosure lid of the inverter by evenly tightening the 4 lid screws.



3. Attach the AC plug.

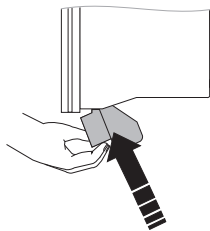


4. Check the DC connectors for correct polarity and connect them.
To unlock the DC connectors see section 7.2 "Opening the Inverter" (page 39).



5. Close all the DC inputs that are not needed as described in section 5.4.4 "Connecting the PV Array (DC)" (page 33) in order to seal the inverter.

6. If an external DC switch-disconnector is available, connect it.
7. If an Electronic Solar Switch is installed, check it for wear, as described in section 8.1 "Checking the Electronic Solar Switch for Wear" (page 44), and reattach it firmly.

**NOTICE!**

Manipulating the connector in the handle can damage the Electronic Solar Switch.

The connector within the handle must remain movable in order to ensure proper contact. Tightening the screw voids all warranty claims and creates a fire hazard.

- Do **not** tighten the connector screw in the Electronic Solar Switch handle.

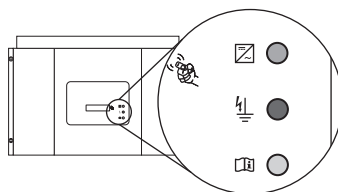
**NOTICE!**

The Electronic Solar Switch can be damaged if it is attached incorrectly.

If it is not correctly attached, the Electronic Solar Switch can be damaged by high voltages.

- Plug the handle firmly onto the socket of the Electronic Solar Switch.
- Check that the handle is securely in place.

8. Switch on the miniature circuit-breaker.
9. Check whether the display and the LEDs indicate a normal operating state (see section 6 "Commissioning" (page 37)).



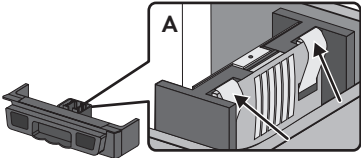
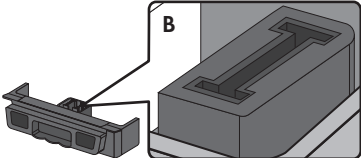
- ☒ The inverter is now closed and in operation.

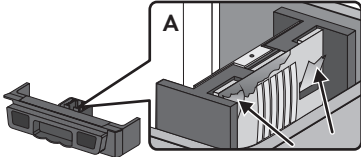
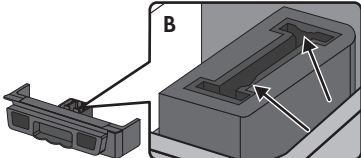
8 Maintenance and Cleaning

Check the correct operation of the inverter at regular intervals. Dirt such as dust or pollen can cause heat concentration that can lead to yield losses. Also check the inverters and the cables for visible external damage. Undertake repairs if necessary.

8.1 Checking the Electronic Solar Switch for Wear

Check the Electronic Solar Switch for wear before plugging it in. Depending on the shape of the Electronic Solar Switch, you can estimate the wear on either the metal tongues (shape A) or on the plastic (shape B).

Result	Measure
<div><div><input checked="" type="checkbox"/> The metal tongues in the Electronic Solar Switch are undamaged and not discolored (A).</div><div></div><div>or</div><div><input checked="" type="checkbox"/> The plastic in the Electronic Solar Switch is undamaged (B).</div><div></div></div>	<div><div>1. Securely attach the Electronic Solar Switch handle.</div><div>2. Commission the inverter as described in section 6 "Commissioning" (page 37).</div></div>

Result	Measure
<p>☑ The metal tongues in the Electronic Solar Switch have a brown discoloration or are burned through (A).</p> 	<p>The Electronic Solar Switch can no longer reliably disconnect the DC supply.</p> <ol style="list-style-type: none"> 1. Replace the Electronic Solar Switch handle before attaching it again (for the order number see section 12 "Accessories" (page 71)). 2. Re-commission the inverter as described in section 6 "Commissioning" (page 37).
<p>or</p> <p>☑ The plastic in the Electronic Solar Switch shows thermal deformation (B).</p> 	

9 Failure Search

If the inverter displays other blink codes or error messages than the ones described below, contact the SMA Serviceline.

You will also find a description of display messages during operation, status messages and measuring channels in the user manual provided.

Do not perform any repairs that are not described here and instead take advantage of the 24-hour replacement service (inverter ready for shipping and handed over to a freight-forwarding company within 24 hours) and the SMA Solar Technology AG repair service.

9.1 Blink Codes

Green	Red	Yellow	Status
flashing	flashing	flashing	OK (startup phase)
Is glowing continuously	Is not glowing	Is not glowing	OK (feed-in operation)
	Is glowing continuously	Is not glowing	Ground fault or varistor defective
		Is glowing continuously	OK (initialization)
Flashes quickly (3 x per second)	Is not glowing	Is not glowing	OK (stop)
	Is glowing continuously	Is not glowing	Ground fault or varistor defective
Flashes slowly (1 x per second)	Is not glowing	Is not glowing	OK (waiting, grid monitoring)
	Is glowing continuously	Is not glowing	Ground fault or varistor defective
Goes out briefly (approx. 1 x per second)	Is not glowing	Is not glowing	OK (derating)
	Is glowing continuously	Is not glowing	Ground fault or varistor defective
Is not glowing	Is not glowing	Is not glowing	OK (overnight shutdown or Electronic Solar Switch is not plugged or external DC switch-disconnector is not connected.)
		Glowing/flashing	Fault
	Is glowing continuously	Is not glowing	Ground fault or varistor defective
		Glowing/flashing	Ground fault or varistor defective and disturbance

9.2 Error Messages

When an error occurs, the inverter generates a message which depends on the operating mode and the type of the detected error.

Message	Description and Corrective Measure
!PV Overvoltage! !DISCONNECT DC!	Overvoltage at DC input. Overvoltage can destroy the inverter.
	Corrective measures Disconnect the inverter from the grid immediately. <ol style="list-style-type: none"> 1. Turn off the miniature circuit-breaker. 2. If an external DC switch-disconnector is available, disconnect it. 3. If an Electronic Solar Switch is installed, remove it. 4. Disconnect all the DC connectors. 5. Check the DC voltage: <ul style="list-style-type: none"> - If the DC voltage is above the maximum input voltage, check the plant design or contact the PV array installer. - If the DC voltage is below the maximum input voltage, reconnect the inverter to the PV array as described in section 5.4 "Connecting the PV Array (DC)" (page 29). If the message reappears, disconnect the inverter again and contact the SMA Serviceline (see section 13 "Contact" (page 72)).
Bfr-Srr	Internal measurement comparison fault or hardware defect.
	Corrective measures <ul style="list-style-type: none"> • If this fault continues to occur, contact the SMA Serviceline.
Fault current dl-Srr	The inverter has detected a drastic change in the differential current. The integrated differential current monitoring system plays an important part in ensuring personal safety. A drastic change in the differential current can be caused by a sudden ground fault, residual current or an actual fault in the device. The inverter disconnects from the grid.
	Corrective measures <ul style="list-style-type: none"> • If the "dl-Bfr" or "dl-Srr" message appears for no apparent reason, check the plant for correct insulation and a possible ground fault, as described in section 9.3.1 "Checking the PV Array for a Ground Fault" (page 52).

Message	Description and Corrective Measure
dZac-Bfr dZac-Srr	<p>Sudden changes in grid impedance exceed the permissible range ("Bfr" or "Srr" is an internal message of no relevance for the user). For safety reasons, the inverter disconnects itself from the grid.</p> <p>Corrective measures</p> <p>Check the grid impedance and observe how often major deviations occur.</p> <p>If repeated frequency variations occur and this is causing "dZac-Bfr" or "dZac-Srr" errors, ask the network operator if they would agree to modify the operating parameter (dZac-Max).</p> <p>Discuss any changes to this operating parameter with the SMA Serviceline.</p>
EEPROM	<p>Transition disturbance while data is being written or read from EEPROM. The data is not relevant for safe operation.</p> <p>The disturbance has no effect on the performance of the inverter.</p>
EEPROM dBh	<p>EEPROM data is defective, the device has switched off because the loss of data has disabled important functions of the inverter.</p> <p>Corrective measures</p> <ul style="list-style-type: none"> • Contact the SMA Serviceline.
EeRestore	<p>One of the duplicate data sets in the EEPROM is defective and has been reconstructed without loss of data.</p> <ul style="list-style-type: none"> • The error message only serves to inform you and has no effect on the performance of the inverter.
Fac Fac-Bfr Fac-Srr	<p>The grid frequency is no longer within the permissible range ("Bfr" or "Srr" is an internal message of no relevance for the user). For safety reasons, the inverter disconnects itself from the grid.</p> <p>Corrective measures</p> <ul style="list-style-type: none"> • Check the grid connection and contact the network operator if necessary. • If the grid frequency is within the tolerable range but the "Fac-Bfr", "Fac-Srr" or "FacFast" errors are still being displayed, contact the SMA Serviceline.
lac-DC_Offs-Srr lac-DC_Offs-Bfr	<p>There is a grid fault ("Bfr" or "Srr" is an internal message of no relevance for the user).</p> <p>Corrective measures</p> <ul style="list-style-type: none"> • Check the grid conditions. • Contact the SMA Serviceline if this fault occurs frequently or repeatedly.

Message	Description and Corrective Measure
I_{max} / overcurrent	Overcurrent on the AC side. This message is displayed if the current on the AC grid is larger than specified.
	Corrective measures <ul style="list-style-type: none"> Check the plant design and grid conditions.
K1-Close K1-Open K2-Open	Error during relay test.
	Corrective measures <ul style="list-style-type: none"> Contact the SMA Serviceline if this fault occurs frequently or repeatedly.
MSD-dI MSD-Fac MSD-Vac MSD-Timeout MSD-Zac	Internal measurement comparison fault or hardware defect.
	Corrective measures <ul style="list-style-type: none"> If this fault continues to occur, contact the SMA Serviceline.
Offset	The "Offset" operating state is a normal operating state that occurs prior to grid monitoring. If "Offset" is displayed as an error, then there is a data logging disturbance.
	Corrective measures <ul style="list-style-type: none"> If this fault continues to occur, contact the SMA Serviceline.
Riso	The electrical insulation of the PV plant to ground is faulty. The resistance between the DC plus and/or DC minus connection and ground is outside the defined limit range.
	Corrective measures <ul style="list-style-type: none"> Check the plant insulation. Check the plant for ground faults as described in section 9.3.1 "Checking the PV Array for a Ground Fault" (page 52).
ROM	The inverter firmware is faulty.
	Corrective measures <ul style="list-style-type: none"> If this fault continues to occur, contact the SMA Serviceline.
Shutdown	Temporary inverter disturbance.
	Corrective measures <ul style="list-style-type: none"> Contact the SMA Serviceline.

Message	Description and Corrective Measure
Vac-Bfr Vac-Srr	<p>The grid voltage is no longer within the permissible range ("Bfr" or "Srr" is an internal message of no relevance for the user). This fault can be caused by any of the following conditions:</p> <ul style="list-style-type: none"> • Grid disconnected (miniature circuit-breaker, fuse) • AC cable is broken or • AC cable is highly resistive <p>For safety reasons, the inverter disconnects itself from the grid.</p> <p>Corrective measures</p> <ul style="list-style-type: none"> • Check the grid voltage and connection on the inverter. • If the grid voltage lies outside the acceptable range because of local grid conditions, ask the network operator if the voltages can be adjusted at the feed-in point or if they agree to changes in the values of the monitored operational limits (operating parameters: Vac-Min and Vac-Max). • If the grid voltage is within the tolerable range but the "Vac-Bfr" or "Vac-Srr" errors are still being displayed, contact the SMA Serviceline.
Vpv-Max	<p>Overvoltage at DC input. The inverter could be damaged.</p> <p>Corrective measures</p> <p>Immediately disconnect the inverter from the grid.</p> <ol style="list-style-type: none"> 1. Turn off the miniature circuit-breaker. 2. If an external DC switch-disconnector is available, disconnect it. 3. If an Electronic Solar Switch is installed, remove it. 4. Disconnect all the DC connectors. 5. Check the DC voltage: <ul style="list-style-type: none"> - If the DC voltage is above the maximum input voltage, check the plant design or contact the PV array installer. - If the DC voltage is below the maximum input voltage, reconnect the inverter to the PV array as described in section 5.4 "Connecting the PV Array (DC)" (page 29). <p>If the message reappears, disconnect the inverter again and contact the SMA Serviceline (see section 13 "Contact" (page 72)).</p>
Vinternal	<p>The internal hardware monitor has detected an overvoltage condition in the intermediate circuit of the inverter.</p> <p>Corrective measures</p> <ul style="list-style-type: none"> • If this fault continues to occur, contact the SMA Serviceline.

Message	Description and Corrective Measure
Watchdog	Internal program run fault.
	Corrective measures <ul style="list-style-type: none"> • If this fault continues to occur, contact the SMA Serviceline.
Zac-Bfr Zac-Srr	The grid impedance is no longer within the permissible range ("Bfr" or "Srr" is an internal message of no relevance for the user). For safety reasons, the inverter disconnects itself from the grid. The impedance is calculated from both the grid impedance and the impedance of the power supply line cable (AC cable) of the inverter.
	Corrective measures <ul style="list-style-type: none"> • Check the grid impedance and grid connection on the inverter. • Use an AC cable with an adequate diameter (= low impedance) as described in section 5.2.2 "Connecting the Inverter to the Power Distribution Grid (AC)" (page 24). If required, re-tighten the screws on the AC terminals. • If this fault recurs, contact the SMA Serviceline.

9.3 Red LED is Glowing Continuously

If the red status display LED lights up continuously during operation, there is a ground fault in the PV array, at least one varistor for overvoltage protection is defective or there is an insulation fault.

Procedure

1. Check for ground faults in the PV array as described in section 9.3.1 "Checking the PV Array for a Ground Fault" (page 52).
2. If the red LED continues to glow, check the varistors as described in section 9.3.2 "Checking the Function of the Varistors" (page 54).

9.3.1 Checking the PV Array for a Ground Fault

1. Disconnect the inverter from both the DC and AC connections as described in section 7.2 "Opening the Inverter" (page 39).

DANGER!

Risk of lethal electric shock.

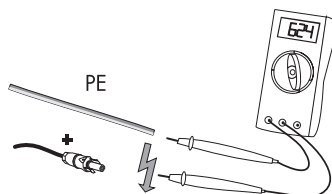
- Only touch the cables of the PV array on their insulation.
- Do not connect strings with ground faults to the inverter.

NOTICE!

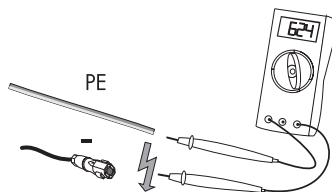
Excessive voltages can destroy the measuring device.

- Use only measuring devices with a DC input voltage range up to at least 1 000 V.

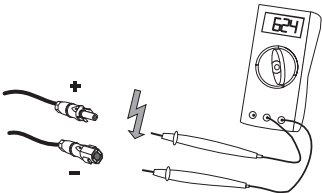
2. Measure the voltages between the plus pole of each string and the ground potential (PE).



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



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

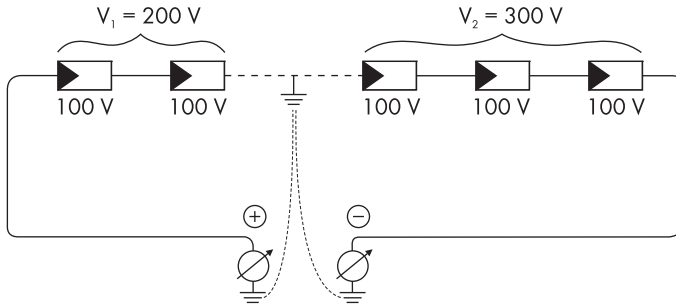


- ☑ A ground fault exists if the measured voltages are stable and the sum of the voltages from the plus pole to the ground potential and from the minus pole to the ground potential of a string are almost the same as the voltage between the plus and minus poles.

Result	Measure
☑ You have found a ground fault .	<ul style="list-style-type: none">• The installer of the PV array must remedy the ground fault in the affected string. You can determine the location of the ground fault as described below.• Do not reconnect the faulty string.• Commission the inverter as described in section 6.1 "Commissioning the Inverter" (page 37).
☑ You have found no ground fault .	<p>It is likely that one of the thermally monitored varistors is defective.</p> <ul style="list-style-type: none">• Check the varistors as described in section 9.3.2 "Checking the Function of the Varistors" (page 54).

The approximate position of the ground fault can be determined from the ratio of the measured voltages between the plus pole against ground potential (PE) and the minus pole against ground potential (PE).

Example:



The ground fault is between the second and third module in this case.

- ☒ The ground fault check is finished.

9.3.2 Checking the Function of the Varistors

Varistors are wear parts. Their functional efficiency diminishes with age or repeated strain as a result of overvoltage. It is therefore possible that one of the thermally monitored varistors has lost its protective function, and thus the red LED is lit.

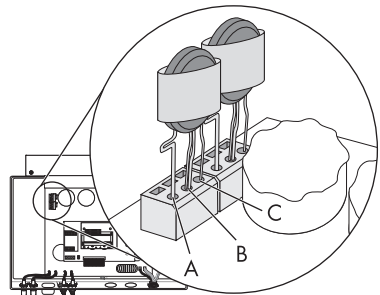


Position of varistors

You can determine the position of the varistors using the illustration below.

Observe the following allocation of the terminals:

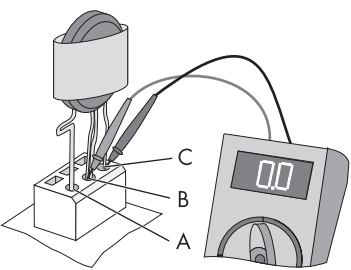
- Terminal A: outer terminal (varistor connection **with loop** [crimp])
- Terminal B: middle terminal
- Terminal C: outer terminal (varistor connection **without loop** [crimp]).



Check the function of the varistors as described below:

1. Open the inverter as described in section 7.2 "Opening the Inverter" (page 39).

2. Using a multimeter and with both varistors installed, determine whether there is a conductive connection between terminals B and C.



Result	Measure
<input checked="" type="checkbox"/> There is a conductive connection.	<p>There is probably a different fault in the inverter.</p> <ul style="list-style-type: none">• Contact the SMA Serviceline (see section 12 "Accessories" (page 71)).
<input checked="" type="checkbox"/> There is no conductive connection.	<p>The respective varistor is defective and must be replaced. Varistor failure is generally due to influences which affect all varistors similarly (temperature, age, induced overvoltage). SMA Solar Technology AG recommends that you replace both varistors.</p> <p>The varistors are specially manufactured for use in the inverter and are not commercially available. They must be ordered directly from SMA Solar Technology AG (see section 12 "Accessories" (page 71)).</p> <ul style="list-style-type: none">• To replace the varistors, proceed to step 3.



NOTICE!

Destruction of the inverter due to overvoltage.

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

- Replacement varistors should be obtained as soon as possible.
- Do **not** operate the inverter without varistors in plants with a high risk of overvoltages.

3. Insert an insertion tool into the openings of the terminal contacts (1).

☑ The terminals will loosen.

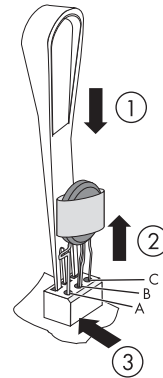
If you do not receive an insertion tool for operating the terminals with your replacement varistors, contact SMA Solar Technology AG. As an alternative, the individual terminal contacts can be operated using a 3.5 mm wide screwdriver.

4. Remove varistor (2).
5. Insert new varistor (3).

The pole with the small loop (crimp) must be mounted into terminal A when reinstalling it (3).

6. Close the inverter as described in section 7.3 "Closing the Inverter" (page 42).

☑ The check and replacement of the varistors is completed.



10 Decommissioning

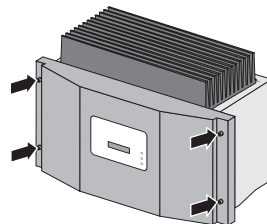
10.1 Disassembling the Inverter

**CAUTION!**

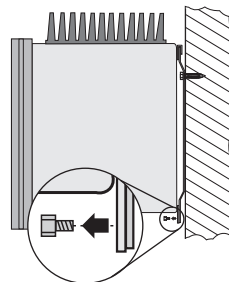
Risk of injury due to the heavy weight of the inverter.

- Note that the inverter weighs approx. 16 kg.

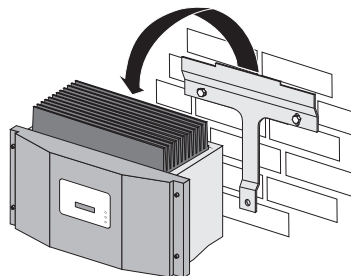
1. Open the inverter as described in section 7.2 "Opening the Inverter" (page 39).
2. Remove all cables from the inverter.
3. Close the inverter with the 4 screws.



4. Loosen the lower screw between the inverter and the wall mounting bracket.



5. Lift the inverter off the wall mounting bracket.



- ☒ The inverter is disassembled.

10.2 Packing the Inverter

If possible, always pack the inverter in its original packaging. If it is no longer available, you can also use an equivalent box. The box must be capable of being closed completely and made to support both the weight and the size of the inverter.

10.3 Storing the Inverter

Store the inverter in a dry place where ambient temperatures are always between -25 °C and $+60\text{ °C}$.

10.4 Disposing of the Inverter

Dispose of the inverter at the end of its service life in accordance with the disposal regulations for electronic waste which apply at the installation location at that time. Alternatively, send it back to SMA Solar Technology AG with shipping paid by sender, and labeled "ZUR ENTSORGUNG" ("for disposal") (see section 13 "Contact" (page 72)).

11 Technical Data

11.1 Sunny Boy 1300TL

DC Input

Maximum DC power at $\cos \varphi = 1$	1 400 W
Maximum input voltage*	600 V
MPP voltage range	125 V ... 480 V
Rated input voltage	400 V
Minimum input voltage	125 V
Start input voltage	150 V
Maximum input current	11 A
Maximum input current per string	11 A
Number of independent MPP inputs	1
Strings per MPP input	1

* The maximum open-circuit voltage, which can occur at a cell temperature of $-10\text{ }^{\circ}\text{C}$, must not exceed the maximum input voltage.

AC Output

Rated power at 230 V, 50 Hz	1 300 W
Maximum AC apparent power	1 300 VA
Rated grid voltage	230 V
AC nominal voltage	220 V/230 V/240 V
AC voltage range	180 V ... 260 V
Nominal AC current at 220 V	5.9 A
AC nominal current at 230 V	5.7 A
AC nominal current at 240 V	5.4 A
Maximum output current	7.2 A
Harmonic distortion of output current at AC THD voltage < 2 %, AC power > 0.5 rated power	$\leq 3\%$
Rated grid frequency	50 Hz
AC grid frequency	50 Hz
Operating range at AC grid frequency 50 Hz	45.5 Hz ... 52.5 Hz
Power factor at rated power	1
Feed-in phases	1
Connection phases	1
Overvoltage category according to IEC 60664-1	III

Maximum cable length at cable diameter of 1.5 mm ²	11 m
Maximum cable length at cable diameter of 2.5 mm ²	18 m

Protective Devices

DC reverse-polarity protection	Short circuit diode
Input-side disconnection device*	Electronic Solar Switch
DC overvoltage protection	Thermally monitored varistors
AC short-circuit current capability	Current control
Grid monitoring	SMA Grid Guard 2.1
Maximum permissible fuse protection	16 A
Ground fault monitoring	Insulation monitoring: $R_{iso} > 1 \text{ M}\Omega$
All-pole sensitive residual current monitoring unit	Available

* optional

General Data

Width x height x depth	440 mm x 299 mm x 214 mm
Width x height x depth with Electronic Solar Switch	440 mm x 339 mm x 214 mm
Weight	16 kg
Length x width x height of packaging	532 mm x 392 mm x 318 mm
Weight with packaging	21.2 kg
Climatic category according to IEC 60721-2-1	4K4H
Operating temperature range	- 25 °C ... +60 °C
Maximum permissible value for relative humidity, non-condensing	100 %
Maximum operating altitude above mean sea level	2 000 m
Noise emission, typical	≤ 33 dB(A)
Power loss in night operation	0.1 W
Topology	Transformerless
Cooling concept	Convection
Degree of protection according to IEC 60529	IP65
Protection class according to IEC 62103	I

Country standards, as of 03/2012*	VDE 0126-1-1 UTE C15-712 AS 4777 C10/11 PPDS EN 50438 G83/-1-1 RD1663/661-A
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* EN 50438: Does not apply to all country standard deviations of EN 50438

G83/-1-1: Valid from firmware version 4.20

Climatic conditions in accordance with IEC 60721-3-4, installation type C, class 4K4H

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

Climatic conditions in accordance with IEC 60721-3-4, transport type E, class 2K3

Temperature range	– 25 °C ... +70 °C
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Features

DC connection	SUNCLIX DC connector
AC connection	AC connector
Display	LC text display
Bluetooth® Wireless Technology	Optional
RS485, galvanically isolated	Optional

Electronic Solar Switch (optional)

Electric service life in the event of a short circuit, with a nominal current of 35 A	A minimum of 50 switching operations
Maximum switching current	35 A
Maximum switching voltage	800 V
Maximum PV power	11 kW
Degree of protection when plugged	IP65
Degree of protection when unplugged	IP21

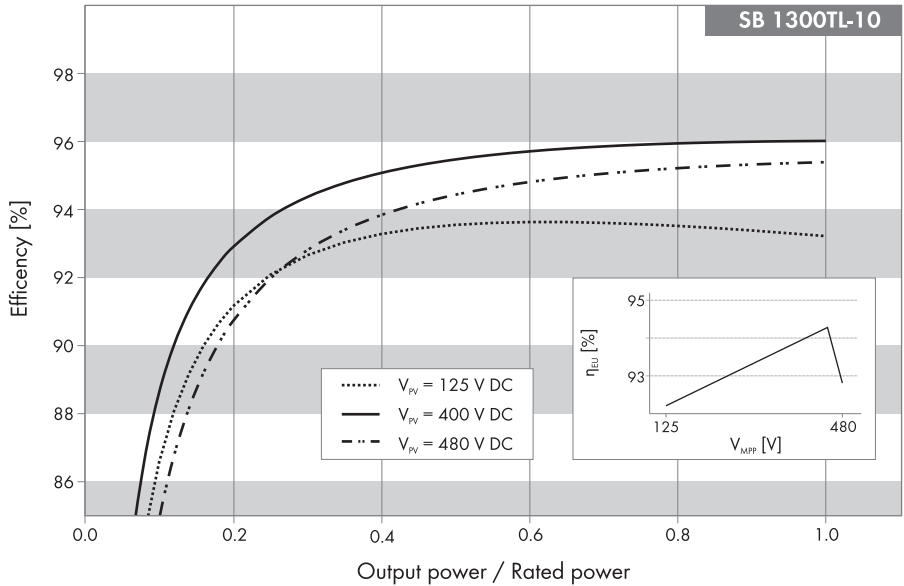
Torque

Enclosure lid screws	6.0 Nm
Additional grounding screw	6.0 Nm
Cylinder head screw for attaching the enclosure to the wall mounting bracket	6.0 Nm
SUNCLIX lock nut	2.0 Nm
RS485 communication connection	1.5 Nm

Grid Forms

TN-C grid	Suitable
TN-S grid	Suitable
TN-C-S grid	Suitable
TT grid, if $U_{N-PE} < 30\text{ V}$	Suitable

Efficiency



Maximum efficiency, η_{\max}	96.0 %
European efficiency, η_{EU}	94.3 %

11.2 Sunny Boy 1600TL

DC Input

Maximum DC power at $\cos \varphi = 1$	1 700 W
Maximum input voltage*	600 V
MPP voltage range	155 V ... 480 V
Rated input voltage	400 V
Minimum input voltage	125 V
Start input voltage	150 V
Maximum input current	11 A
Maximum input current per string	11 A
Number of independent MPP inputs	1
Strings per MPP input	1

* The maximum open-circuit voltage, which can occur at a cell temperature of $-10\text{ }^{\circ}\text{C}$, must not exceed the maximum input voltage.

AC Output

Rated power at 230 V, 50 Hz	1 600 W
Maximum AC apparent power	1 600 VA
Rated grid voltage	230 V
AC nominal voltage	220 V/230 V/240 V
AC voltage range	180 V ... 260 V
Nominal AC current at 220 V	7.3 A
AC nominal current at 230 V	7.0 A
AC nominal current at 240 V	6.7 A
Maximum output current	8.9 A
Harmonic distortion of output current at AC THD voltage < 2 %, AC power > 0.5 rated power	$\leq 3\%$
Rated grid frequency	50 Hz
AC grid frequency	50 Hz
Operating range at AC grid frequency 50 Hz	45.5 Hz ... 52.5 Hz
Power factor at rated power	1
Feed-in phases	1
Connection phases	1
Overvoltage category according to IEC 60664-1	III

Maximum cable length at cable diameter of 1.5 mm ²	11 m
Maximum cable length at cable diameter of 2.5 mm ²	18 m

Protective Devices

DC reverse-polarity protection	Short circuit diode
Input-side disconnection device*	Electronic Solar Switch
DC overvoltage protection	Thermally monitored varistors
AC short-circuit current capability	Current control
Grid monitoring	SMA Grid Guard 2.1
Maximum permissible fuse protection	16 A
Ground fault monitoring	Insulation monitoring: $R_{iso} > 1 \text{ M}\Omega$
All-pole sensitive residual current monitoring unit	Available

* optional

General Data

Width x height x depth	440 mm x 299 mm x 214 mm
Width x height x depth with Electronic Solar Switch	440 mm x 339 mm x 214 mm
Weight	16 kg
Length x width x height of packaging	532 mm x 392 mm x 318 mm
Weight with packaging	21.2 kg
Climatic category according to IEC 60721-2-1	4K4H
Operating temperature range	- 25 °C ... +60 °C
Maximum permissible value for relative humidity, non-condensing	100 %
Maximum operating altitude above mean sea level	2 000 m
Noise emission, typical	≤ 33 dB(A)
Power loss in night operation	0.1 W
Topology	Transformerless
Cooling concept	Convection
Degree of protection according to IEC 60529	IP65
Protection class according to IEC 62103	I

Country standards, as of 03/2012*	VDE 0126-1-1 UTE C15-712 AS 4777 C10/11 PPDS EN 50438 G83/-1-1 RD1663/661-A
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* EN 50438: Does not apply to all country standard deviations of EN 50438

G83/-1-1: Valid from firmware version 4.20

Climatic conditions in accordance with IEC 60721-3-4, installation type C, class 4K4H

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

Climatic conditions in accordance with IEC 60721-3-4, transport type E, class 2K3

Temperature range	– 25 °C ... +70 °C
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Features

DC connection	SUNCLIX DC connector
AC connection	AC connector
Display	LC text display
Bluetooth® Wireless Technology	Optional
RS485, galvanically isolated	Optional

Electronic Solar Switch (optional)

Electric service life in the event of a short circuit, with a nominal current of 35 A	A minimum of 50 switching operations
Maximum switching current	35 A
Maximum switching voltage	800 V
Maximum PV power	11 kW
Degree of protection when plugged	IP65
Degree of protection when unplugged	IP21

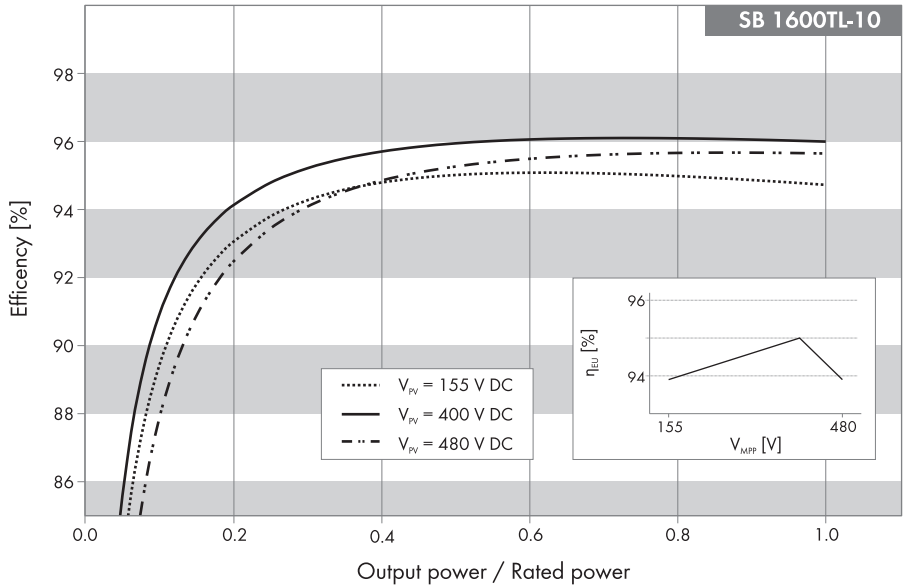
Torque

Enclosure lid screws	6.0 Nm
Additional grounding screw	6.0 Nm
Cylinder head screw for attaching the enclosure to the wall mounting bracket	6.0 Nm
SUNCLIX lock nut	2.0 Nm
RS485 communication connection	1.5 Nm

Grid Forms

TN-C grid	Suitable
TN-S grid	Suitable
TN-C-S grid	Suitable
TT grid, if $U_{N-PE} < 30\text{ V}$	Suitable

Efficiency



Maximum efficiency, η_{max}	96.0 %
European efficiency, η_{EU}	95.0 %

11.3 Sunny Boy 2100TL

DC Input

Maximum DC power at $\cos \varphi = 1$	2 200 W
Maximum input voltage*	600 V
MPP voltage range	200 V ... 480 V
Rated input voltage	400 V
Minimum input voltage	125 V
Start input voltage	150 V
Maximum input current	11 A
Maximum input current per string	11 A
Number of independent MPP inputs	1
Strings per MPP input	2

* The maximum open-circuit voltage, which can occur at a cell temperature of $-10\text{ }^{\circ}\text{C}$, must not exceed the maximum input voltage.

AC Output

Rated power at 230 V, 50 Hz	1 950 W
Maximum AC apparent power	2 100 VA
Rated grid voltage	230 V
AC nominal voltage	220 V/230 V/240 V
AC voltage range	180 V ... 260 V
Nominal AC current at 220 V	8.7 A
AC nominal current at 230 V	8.5 A
AC nominal current at 240 V	8.1 A
Maximum output current	11 A
Harmonic distortion of output current at AC THD voltage < 2 %, AC power > 0.5 rated power	$\leq 3\%$
Rated grid frequency	50 Hz
AC grid frequency	50 Hz
Operating range at AC grid frequency 50 Hz	45.5 Hz ... 52.5 Hz
Power factor at rated power	1
Feed-in phases	1
Connection phases	1
Overvoltage category according to IEC 60664-1	III

Maximum cable length at cable diameter of 1.5 mm ²	11 m
Maximum cable length at cable diameter of 2.5 mm ²	18 m

Protective Devices

DC reverse-polarity protection	Short circuit diode
Input-side disconnection device*	Electronic Solar Switch
DC overvoltage protection	Thermally monitored varistors
AC short-circuit current capability	Current control
Grid monitoring	SMA Grid Guard 2.1
Maximum permissible fuse protection	16 A
Ground fault monitoring	Insulation monitoring: $R_{iso} > 1 \text{ M}\Omega$
All-pole sensitive residual current monitoring unit	Available

* optional

General Data

Width x height x depth	440 mm x 299 mm x 214 mm
Width x height x depth with Electronic Solar Switch	440 mm x 339 mm x 214 mm
Weight	16 kg
Length x width x height of packaging	532 mm x 392 mm x 318 mm
Weight with packaging	21.2 kg
Climatic category according to IEC 60721-2-1	4K4H
Operating temperature range	- 25 °C ... +60 °C
Maximum permissible value for relative humidity, non-condensing	100 %
Maximum operating altitude above mean sea level	2 000 m
Noise emission, typical	≤ 33 dB(A)
Power loss in night operation	0.1 W
Topology	Transformerless
Cooling concept	Convection
Electronics degree of protection according to IEC 60529	IP65
Protection class according to IEC 62103	I

Country standards, as of 03/2012*	VDE 0126-1-1 UTE C15-712 AS 4777 C10/11 PPDS EN 50438 G83/-1-1 RD1663/661-A
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* EN 50438: Does not apply to all country standard deviations of EN 50438

G83/-1-1: Valid from firmware version 4.20

Climatic conditions in accordance with IEC 60721-3-4, installation type C, class 4K4H

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

Climatic conditions in accordance with IEC 60721-3-4, transport type E, class 2K3

Temperature range	– 25 °C ... +70 °C
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Features

DC connection	SUNCLIX DC connector
AC connection	AC connector
Display	LC text display
Bluetooth® Wireless Technology	Optional
RS485, galvanically isolated	Optional

Electronic Solar Switch (optional)

Electric service life in the event of a short circuit, with a nominal current of 35 A	A minimum of 50 switching operations
Maximum switching current	35 A
Maximum switching voltage	800 V
Maximum PV power	11 kW
Degree of protection when plugged	IP65
Degree of protection when unplugged	IP21

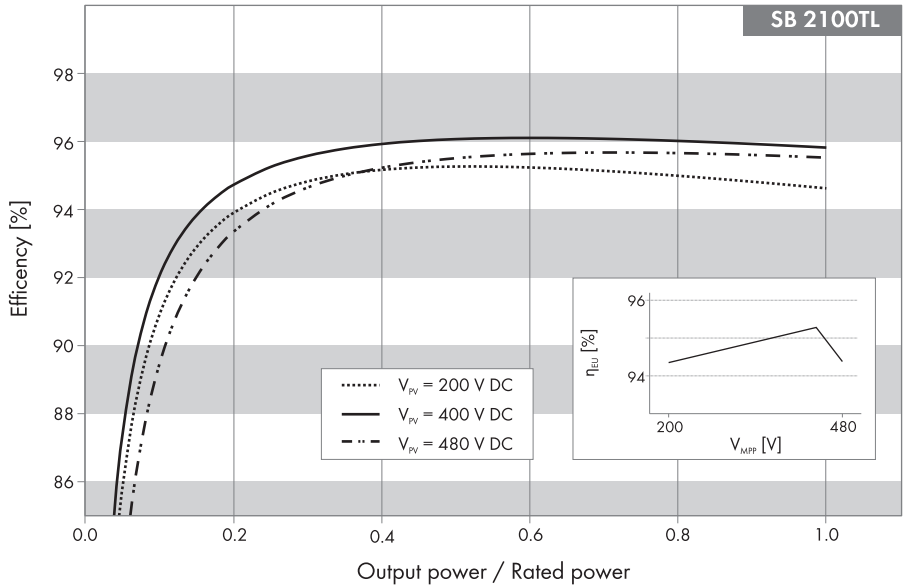
Torque

Enclosure lid screws	6.0 Nm
Additional grounding screw	6.0 Nm
Cylinder head screw for attaching the enclosure to the wall mounting bracket	6.0 Nm
SUNCLIX lock nut	2.0 Nm
RS485 communication connection	1.5 Nm

Grid Forms

TN-C grid	Suitable
TN-S grid	Suitable
TN-C-S grid	Suitable
TT grid, if $U_{N-PE} < 30\text{ V}$	Suitable

Efficiency



Maximum efficiency, η_{max}	96.0 %
European efficiency, η_{EU}	95.2 %

12 Accessories

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

Description	Brief description	SMA order number
Electronic Solar Switch	ESS handle replacement part	ESS-HANDLE:01 Also enter the inverter's serial number.
Replacement varistors	Set of thermally monitored varistors (2 pcs.) incl. insertion tool SB TVWZ	SB-TV4
RS485 upgrade kit	RS485 interface	485PB-NR
<i>Bluetooth</i> upgrade kit	<i>Bluetooth</i> interface	BTPBINV-NR
SUNCLIX DC connector	Field plug for cable diameters between 2.5 mm ² and 6 mm ²	SUNCLIX-FC6-SET

13 Contact

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

- Inverter type
- Serial number of inverter
- Type and number of the PV modules connected
- Optional equipment, e.g. communication devices
- Blink code or display message of the inverter

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