PV Inverter

SUNNY BOY 3000TL / 3600TL / 4000TL / 5000TL

Installation Manual



SB30-50TL-21-IA-en-20 | IMEN-SBXTL-21 | Version 2.0

EN

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1 Information on this Manual

1.1 Validity

This manual applies to the following device types:

- Sunny Boy 3000TL (SB 3000TL-21)
- Sunny Boy 3600TL (SB 3600TL-21)
- Sunny Boy 4000TL (SB 4000TL-21)
- Sunny Boy 5000TL (SB 5000TL-21)

1.2 Target Group

This manual is intended for skilled persons. Only qualified personnel with the appropriate skills are allowed to perform the tasks set forth in this manual (see Section 2.2 "Qualification of Skilled Persons", page 11).

1.3 Additional Information

For further information, see www.SMA-Solar.com:

Document title	Document type
Miniature Circuit-breaker	Technical information
Measured Values and Parameters	Technical description
SMA *Bluetooth* – SMA *Bluetooth*® Wireless Technology in Practice	Technical information
SMA *Bluetooth*® Wireless Technology	Technical description
Multi-function relay and OptiTrac Global Peak	Technical description
Module Technology	Technical information
Capacitive Leakage Currents	Technical information

1.4 Symbols Used

The following types of safety precautions 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 safety precaution 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

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

☑ This symbol indicates the result of an action.

Nomenclature

The following nomenclature is used in this manual:

Complete designation	Designation in this manual
Sunny Boy 3000TL / 3600TL / 4000TL / 5000TL	Inverter
Electronic Solar Switch	ESS
SMA *Bluetooth*® Wireless Technology	*Bluetooth*

Abbreviations

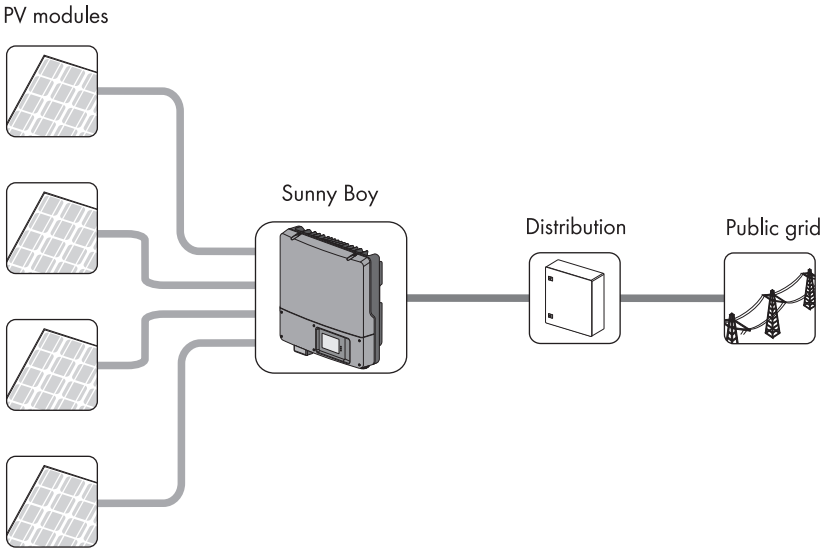
Abbreviation	Designation	Explanation
AC	Alternating Current	–
DC	Direct Current	–
EC	European Community	–
LED	Light-Emitting Diode	–
MPP	Maximum Power Point	–
NetID	Network Identification	Identification number for SMA *Bluetooth* network
MSL	Mean Sea Level	–
PE	Protective Earth	Protective conductor
PV	Photovoltaics	–
AF	Width Across Flats	The distance between two parallel flat surfaces ("flats") of a screw head.
VDE	Verband der Elektrotechnik Elektronik Informationstechnik e.V.	Association for Electrical, Electronic and Information Technologies

2 Safety

2.1 Intended Use

The Sunny Boy is a PV inverter, which converts the direct current of the PV array to grid-compliant alternating current and feeds it into the electricity grid.

Principle of a PV plant with this Sunny Boy



The Sunny Boy is suitable for indoor and outdoor use.

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

PV modules with large capacities to earth may only be used if their coupling capacity does not exceed 1,400 nF.

Alternative uses, modifications to the Sunny Boy or the installation of component parts not expressly recommended or sold by SMA Solar Technology AG are not permitted.

Persons with limited physical or mental abilities may only work on the Sunny Boy after due instruction and under constant supervision. Children are forbidden to play with the Sunny Boy. Ensure that the Sunny Boy is kept out of reach of children.

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

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

The enclosed documentation is an integral part of this product.

- Read and follow the documentation to to ensure the correct and optimum use of the Sunny Boy.
- Keep the documentation in a convenient place for future reference.

2.2 Qualification of Skilled Persons

The tasks described in this manual may be performed by skilled persons only. Skilled persons must have the following qualifications:

- Knowledge of how an inverter works and is operated
- Training in how to deal with the dangers and risks associated with installing and using electrical devices and plants
- Training in the installation and commissioning of electrical devices and plants
- Knowledge of all applicable standards and directives
- Knowledge of and adherence to this manual and all the specified safety precautions

2.3 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 9.2 "Disconnecting the Inverter from Voltage Sources", page 63).

⚠ DANGER

Risk of burns due to electric arc

To prevent arcing when disconnecting DC connectors, the ESS and DC connectors must be removed from the inverter before performing any work on the PV array.

- Before starting work on the PV array, always disconnect the inverter on the AC and DC sides (see Section 9.2 "Disconnecting the Inverter from Voltage Sources", page 63).
- Attach the enclosed warning label "Risk of burns from electric arc" so that it is clearly visible on the external AC disconnection device.

⚠ CAUTION

Risk of burns due to hot enclosure parts

Some parts of the enclosure may become hot during operation.

- Do not touch any parts other than the lower enclosure lid of the inverter during operation.

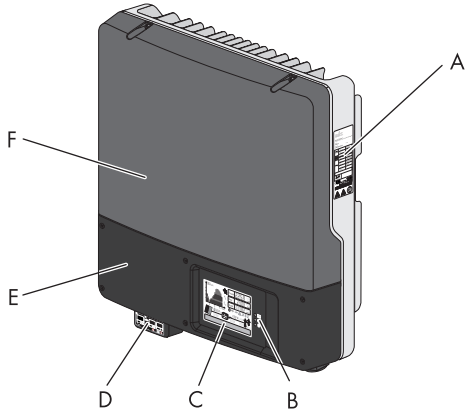
i Earthing of the PV array

Comply with local regulations for the earthing of 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.

3 Product Description

3.1 Sunny Boy

The Sunny Boy is a PV inverter, which converts the direct current of the PV array to grid-compliant alternating current and feeds it into the electricity grid.



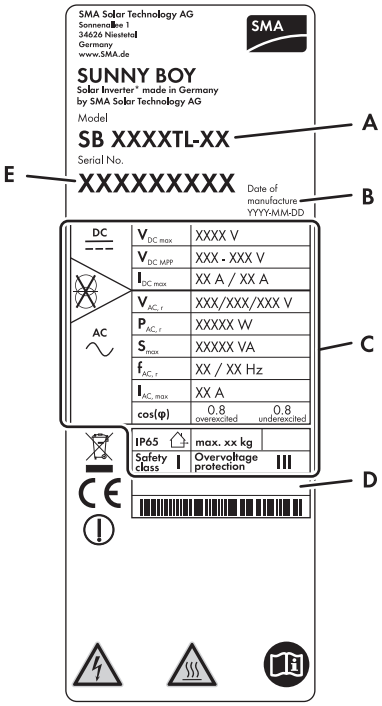
Item	Description
A	Type label
B	LEDs
C	Display
D	Electronic Solar Switch
E	Lower enclosure lid
F	Upper enclosure lid

3.2 Symbols on the Inverter

Symbol	Description	Explanation
	Inverter	This symbol defines the function of the green LED. It indicates the operating state of the inverter.
	Observe the documentation.	This symbol defines the function of the red LED. It indicates a fault or disturbance. Please read the manual to find information on how to remedy the fault or disturbance.
	*Bluetooth*	This symbol defines the function of the blue LED. It indicates that communication via *Bluetooth* is activated.
	QR Code® for SMA Bonus Program	For information on the SMA Bonus Program, see www.SMA-Bonus.com.
	Danger	Observe the connection requirements for a second protective conductor (see Section 6.3.1 "Conditions for the AC Connection", page 33).
	Danger to life due to high voltages in the inverter	The capacitors in the inverter may be charged with very high voltages. • Disconnect the inverter from voltage sources (see Section 9.2) and wait 5 minutes before opening the upper lid, in order to allow time for the capacitors to discharge.

3.3 Type label

The type label uniquely identifies the inverter. The type label is located on the right-hand side of the enclosure.



Item	Explanation
A	Inverter device type
B	Inverter manufacture date (year-month-day)
C	Device-specific characteristics
D	Field for additional information, e.g. details of country-specific standards
E	Inverter serial number

The information on the type label is intended to help you use the inverter safely and receive targeted customer support from the SMA Service Line. The type label must remain permanently attached to the inverter.

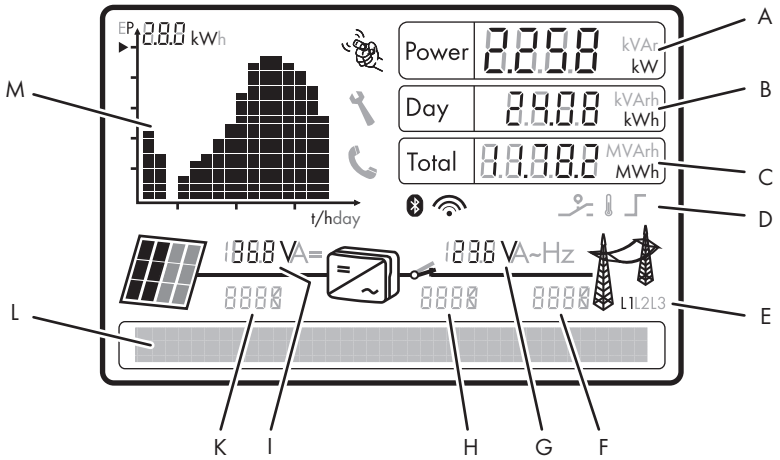
Symbols on the Type Label

Symbol	Description	Explanation
	Danger to life due to high voltages	The product operates at high voltages. All work on the product must be carried out by skilled persons only.
	Risk of burns from hot surfaces	The product can become hot during operation. Avoid contact during operation. Allow the product to cool down sufficiently before carrying out any work. Wear personal protective equipment such as safety gloves.
	Observe the documentation	Observe all documentation that is supplied with the product.
	Without transformer	The product does not have a transformer.
	DC	Direct current
	AC	Alternating current
IP65	Degree of protection	The product is protected against dust intrusion and water jets from any angle.
	Outdoor	The product is suitable for outdoor installation.
	WEEE designation	Do not dispose of the product together with the household waste, but only in accordance with the locally applicable regulations for the disposal of electronic waste.
CE	CE marking	The product complies with the requirements of the applicable EC directives.
	Device class ID	The product is equipped with a wireless component and complies with Device Class 2.
	RAL quality mark for solar products	The product complies with the requirements of the German Institute for Quality Assurance and Certification.

Symbol	Description	Explanation
	Certified safety	The product is VDE-tested and complies with the requirements of the German Equipment and Product Safety Act.
N23114	C-Tick	The product complies with the requirements of the applicable Australian EMC standards.

3.4 Display

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



Item	Description	Explanation
A	Power	Displays the current power
B	Day	Displays the amount of energy fed in so far today
C	Total	Total amount of energy fed in until now
D	Active functions	The symbols indicate which communication or power regulation functions are enabled.
E	Phase assignment	Shows assignment of the inverter to a phase. It is also used to indicate external power limitation.
F	Electricity grid event number	Event number of a disturbance in the electricity grid

Item	Description	Explanation
G	Output voltage/output current	The display alternately shows the output voltage and the output current of the inverter.
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 at one input 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.
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.

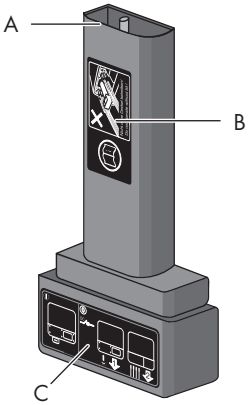
Symbols on the Display

Symbol	Designation	Explanation
	Tapping	You can operate the display by tapping it: • Single tap: the backlight switches on or the display scrolls to the next display message. • Double tap: the display shows, in succession, the firmware version, the inverter serial number or designation, the *Bluetooth* NetID, the configured country standard and the display language.
	Telephone receiver	Device disturbance present. Contact the SMA Service Line.
	Spanner	Disturbance which 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.

Symbol	Designation	Explanation
	Temperature symbol	The power of the inverter is limited due to excessive temperature.
	Power limitation	The external active power limitation via plant control is active
	PV array	This symbol represents a PV array with strings connected to two inputs on the inverter. The left half of the symbol stands for input A and the right half for input B. Whichever half is darker indicates the input to which the current values refer. The display switches between the inputs every 10 seconds.
	Inverter	–
	Grid relay	If the grid relay is closed, the inverter feeds power into the grid. If the grid relay is open, the inverter is disconnected from the grid.
	Electricity grid	–

3.5 Electronic Solar Switch

The ESS is a DC switch-disconnector. The ESS prevents the formation of electric arcs when the DC connector is pulled.



Item	Description	Explanation
A	Plug	–
B	Safety precautions sticker	• Never operate the inverter without the lower enclosure lid in place. • Observe all documentation that accompanies the inverter.
C	ESS sticker	• I If the ESS is plugged in, the DC electric circuit remains closed. • O To interrupt the DC electric circuit, you first need to perform steps 1 and 2. • 1 Remove the ESS. • 2 Remove all DC connectors.

When plugged in, the ESS forms a conductive link between the PV array and the inverter. Removing the ESS interrupts the electric circuit and allows you to disconnect the DC connectors from the inverter safely.

3.6 *Bluetooth*

The inverter is equipped with a serial *Bluetooth* interface and can communicate with specific SMA communication products and other inverters (for information on supported products, see www.SMA-Solar.com).

If you wish to communicate via *Bluetooth*, you can protect the inverter with one plant password for the user and one plant password for the installer. All inverters are delivered with a standard plant password for the user (0000) and a standard plant password for the installer (1111).

To protect the plant from unauthorized access, you must change the plant passwords via Sunny Explorer (for information on changing the plant password, refer to the Sunny Explorer help).

If you do not intend to communicate via *Bluetooth*, deactivate *Bluetooth* communication (see Section 6.6.2 "Setting the Bluetooth NetID", page 56).

3.7 Slot for Communication Interface

The inverter can optionally be fitted with an extra communication interface (e.g., RS485 or Speedwire). This communication interface will enable the inverter to communicate with specific SMA communication products (for information on supported products, see www.SMA-Solar.com).

The communication interface can either be retrofitted or installed ex works if specified in the corresponding order.

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

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

Example: How the country data set parameter is displayed

- For communication via RS 485: parameter **CntrySet**
- For communication via *Bluetooth* or Speedwire: parameter **Set country standard**

3.8 Slot for 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, an SMA Power Control Module or a fan retrofit kit. The multi-function interface can be retrofitted or installed if specified in the corresponding order.

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).

Fan Retrofit Kit

The fan retrofit kit is used for additional inverter cooling at high ambient temperatures and also has a multi-function relay (for information on installation and configuration, see the fan retrofit kit installation manual). The fan retrofit kit and the SMA Power Control Module cannot be operated in parallel.

3.9 SMA OptiTrac Global Peak

SMA OptiTrac Global Peak is a more advanced form of the MPP tracking tool SMA OptiTrac.

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

SMA OptiTrac ensures that the operating point of the inverter always coincides exactly with the MPP. In addition, with the aid of SMA OptiTrac Global Peak, the inverter can detect the presence of several maximum power points in the available operating range, such as may occur particularly with partially shaded PV strings. By these means, almost the entire available power of partially shaded PV strings can be fed into the electricity grid.

SMA OptiTrac Global Peak is deactivated by default. In the case of partially shaded PV modules, it should be activated and configured via a communication product (see Section 8.2 "Activating and Setting SMA OptiTrac Global Peak", page 61).

3.10 Grid Management

The inverter is equipped with grid management functions.

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

3.11 Varistors

Varistors are voltage-dependent resistors to protect the inverter against overvoltage. The inverter is equipped with 3 thermally monitored varistors.

The function of the varistors can diminish with age or repeated strain as a result of overvoltage. This can cause varistors to wear. The inverter detects if one of the varistors is defective and indicates a disturbance.

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

3.12 SMA Grid Guard

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

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

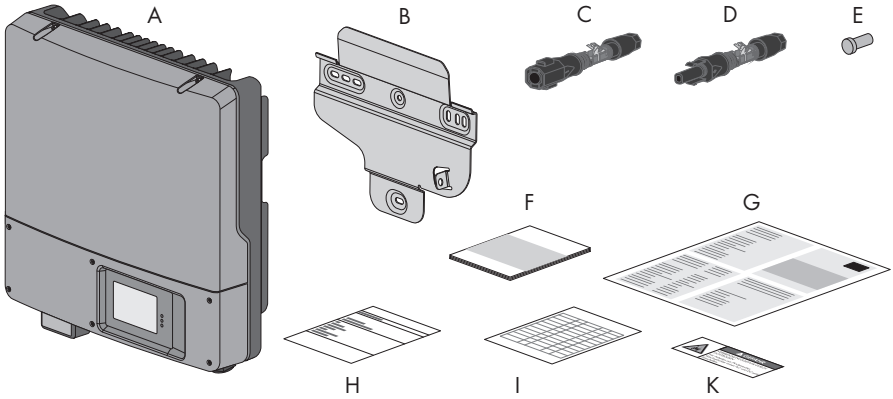
In some countries, the connection conditions stipulate installation of a device which protects grid-relevant operating parameters from unauthorised changes. SMA Grid Guard performs this function.

Some country data sets are automatically protected after the first ten feed-in hours. After the initial ten feed-in hours, the protected country data sets can only be changed via a communication product and subject to entry of a personal access code, the SMA Grid Guard code (for information on how to change parameters, see communication product manual). You can obtain the SMA Grid Guard code from SMA Solar Technology AG (to apply for the SMA Grid Guard code, see certificate "Application for a Personal Access Code" at www.SMA-Solar.com).

4 Unpacking

4.1 Scope of delivery

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



Object	Quantity	Description
A	1	Sunny Boy
B	1	Wall mounting bracket
C	4	Positive DC connector
D	4	Negative DC connector
E	8	Sealing plugs for the DC connectors
F	1	Installation manual
G	1	User manual
H	1	Set of documents with explanations and certificates
I	1	Supplementary sheet with inverter default settings
K	1	Warning label "Risk of burns from electric arc" for the disconnection device on the AC side.

5 Mounting

5.1 Safety

⚠ DANGER

Danger to life due to fire or explosions

- 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 burns due to hot enclosure parts

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

⚠ CAUTION

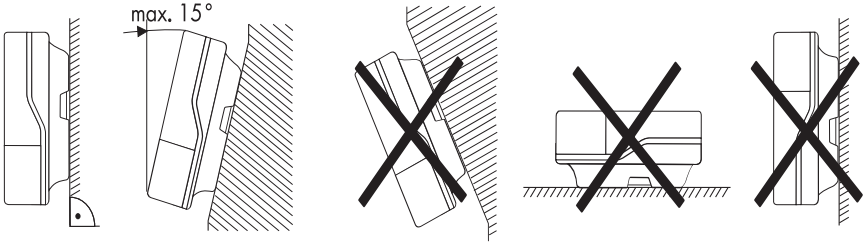
Risk of injury due to the heavy weight of the inverter

- When mounting, bear in mind that the inverter weighs approx. 26 kg.

5.2 Selecting the Mounting Location

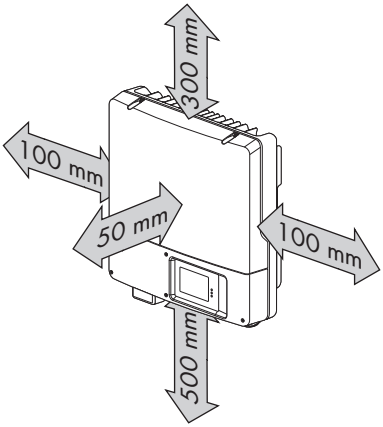
Take the following requirements into consideration when selecting the mounting location:

- The mounting method and location must be suitable for the weight and size of the inverter (see Section 14 "Technical Data", page 92).
- Mount on a solid surface.
- The mounting location must be clear and safely accessible at all times without the use of additional aids such as scaffolding or lifting platforms. Non-fulfillment of these criteria may restrict execution of servicing.



- Mount vertically or tilted backwards by max. 15°.
- The connection area must face downwards.
- Never mount the device with a forward tilt.
- Never mount the device with a sideways tilt.
- Do not mount horizontally.
- Mount at eye level in order that operating states can be read at all times.
- The ambient temperature should be below 40°C to ensure optimum operation.
- Do not expose the inverter to direct solar irradiation as this can cause excessive heating and thus power reduction.
- In living areas, do not mount the unit on plasterboard walls or similar in order to avoid audible vibrations. When in use, the inverter emits noises which may be perceived as a nuisance in a living area.

- Observe the recommended clearances to walls, other inverters or objects as depicted in the diagram to ensure adequate heat dissipation and to give you sufficient room to pull the ESS out.



Multiple inverters installed in areas with high ambient temperatures

There must be sufficient clearance between the individual inverters to ensure that the cooling air of the adjacent inverter is not drawn in.

If necessary, increase the clearances and make sure there is enough fresh-air supply to ensure sufficient cooling of the inverters. A fan for connection to the inverter is available as an accessory (see Section 15 "Accessories", page 112).

5.3 Mounting the Inverter

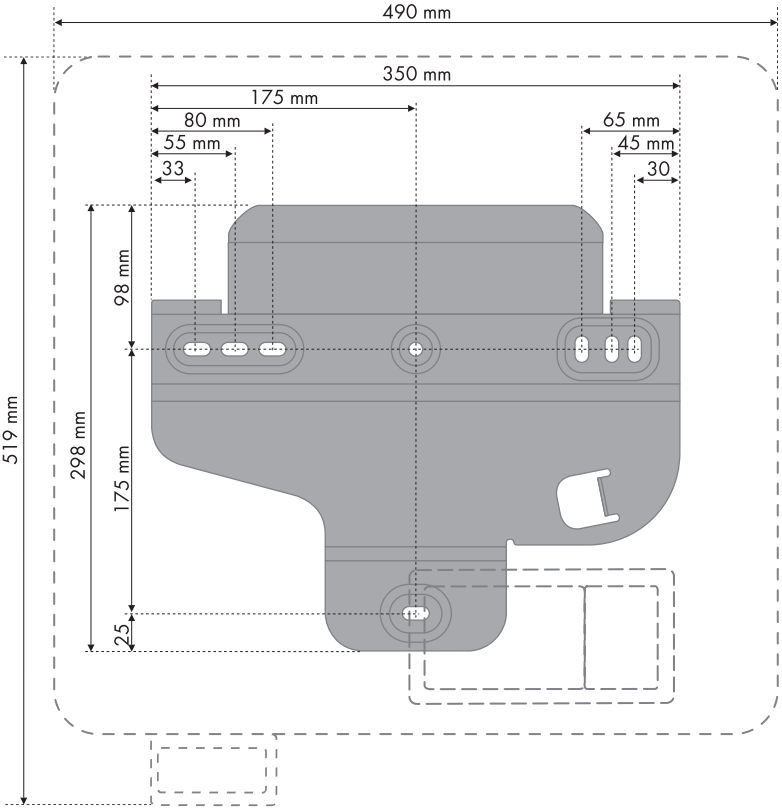
Additionally required mounting material (not included in the scope of delivery):

- 3 screws (diameter: at least 6 mm)
- 3 wall plugs
- 3 washers (external diameter: at least 18 mm)

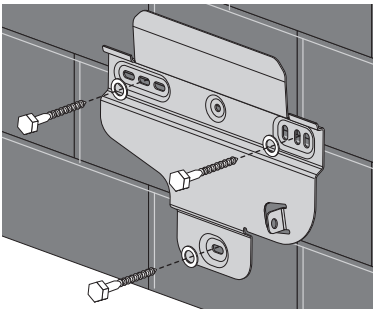
1. Use the wall mounting bracket as a drilling template and mark the positions of the drill holes.

Number of drill holes to use

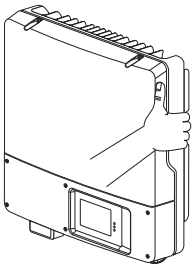
- When mounting onto the wall, use at least two of the horizontal holes and the lower centre hole.
- Use the two holes in the centre when mounting the device on a pillar.



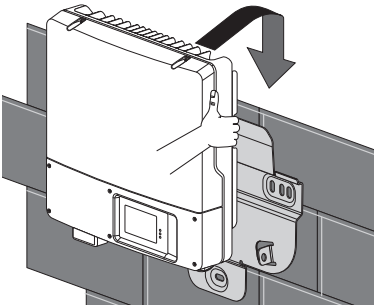
2. Drill the holes.
3. Attach the wall mounting bracket using appropriate screws (diameter min. 6 mm) and washers (outer diameter min. 18 mm).



4. Transport the inverter using the recessed grips on the sides.



5. Hook the inverter into the mounting bracket from above.

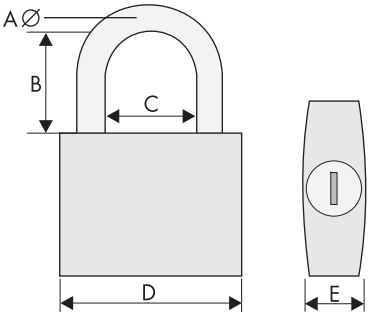


6. Check both sides of the inverter to make sure it is correctly in place.

Optional Anti-Theft Protection

To protect the inverter from theft, you can lock it to the wall mounting bracket using a padlock.

The padlock must meet the following requirements:

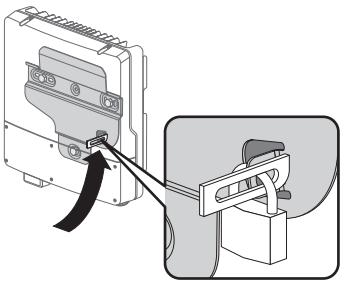


- Size:
  - A: 6 mm ... 8 mm diameter
  - B: 23 mm ... 29 mm
  - C: 23 mm ... 28 mm
  - D: 39 mm ... 50 mm
  - E: 13 mm ... 18 mm
- stainless
- hardened shackle
- protected lock cylinder

Outdoor installation

Always use a lock suitable for outdoor applications. Check regularly that the padlock is working properly.

- Thread the padlock shackle from the centre of the device outwards through the metal clip on the wall mounting bracket and the slot on the inverter, and close the padlock.



Storage of the key

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

6 Electrical Connection

6.1 Safety

NOTICE

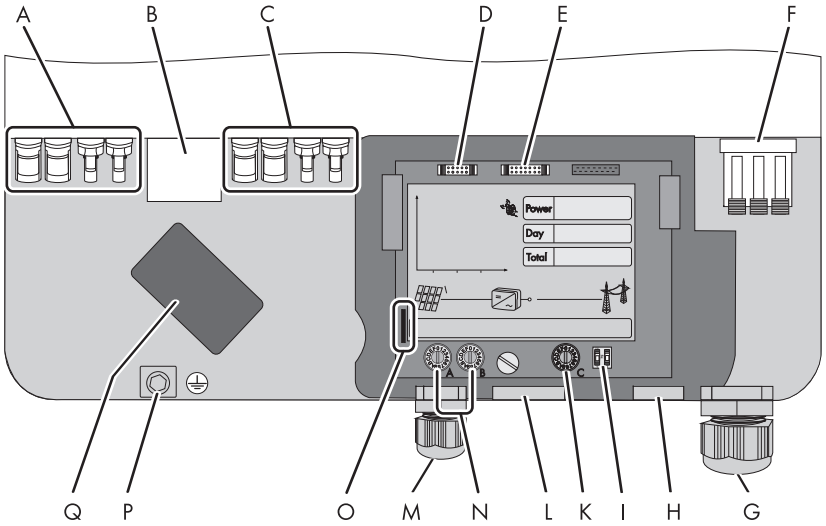
Electrostatic discharge can damage the inverter

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

The following figure shows the inverter connection area with the lower enclosure lid open.



Item	Description
A	DC plug connectors for connecting the strings (input area A)
B	Socket for connecting the ESS
C	DC connectors for connecting the strings (input area B)
D	Slot for connecting the multifunction interface (optional)
E	Slot for connecting the communication interface (optional)
F	Terminal for the AC cable
G	Cable gland (12 mm ... 21 mm) for routing the AC cable
H	Enclosure opening for connecting the multifunction relay or the fan retrofit kit or the communication interface
I	Switch for temporarily changing the display language to English (for service purposes)
K	Rotary switch for the configuration of *Bluetooth* communication
L	Enclosure opening for connecting the communication interface
M	Cable gland (5 mm ... 13 mm) for connecting the multifunction interface or communication interface (optional)
N	Rotary switches for setting the country standard and display language
O	Slot for SD Card
P	Earth terminal for additional earthing of the inverter
Q	Enclosure opening for installation of a fan (available as accessory)

6.3 Connection to the Electricity Mains (AC)

6.3.1 Conditions for the AC Connection

- Comply with the connection requirements of your network operator.

Residual current monitoring unit

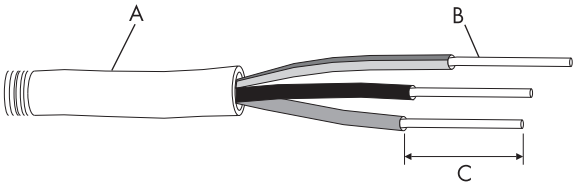
The inverter is equipped with an integrated all-pole-sensitive residual current monitoring unit. Consequently, the inverter can differentiate automatically between residual currents and "normal" capacitive leakage currents.

If regulations in the country of installation stipulate an external residual current device, you must use a device with a tripping threshold of 100 mA or more.

Cable dimensioning

The cable must be dimensioned in accordance with any local and national directives on cable dimensions which specify requirements for the minimum conductor cross-section. Cable dimensioning factors are e.g.: nominal AC current, type of cable, type of routing, cable bundling, ambient temperature and maximum specified line losses (for calculation of line losses, see design software "Sunny Design" with software version 2.0 or higher at www.SMA-Solar.com).

Cable requirements



Object	Description	Value
A	External diameter	12 mm ... 21 mm
B	Conductor cross-section	maximum 10 mm²
C	Stripping length	approx. 12 mm

Connection of a second protective conductor

The inverter is equipped with a protective conductor monitoring function, which detects errors in the installation and switches the inverter off if no protective conductor is installed. At some grid-connection points, it may be advisable to deactivate this monitoring function.

If this is the case, and to ensure safety standards equivalent to IEC 62109, the protective earth terminal must be executed in one of the following ways:

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

or

- Installation of a second protective conductor at the earth terminal with the same cross-section as the original protective conductor at the AC terminal (see Section 6.3.3 "Additional Earthing of the Enclosure", page 39).

In some installation countries, however, a second protective conductor is a general requirement to prevent contact currents in the event of malfunction of the original protective conductor.

You must always observe the applicable regulations in the country of installation.

Load disconnection unit

Attach the warning labels on the load disconnect unit on the AC side

To prevent arcing, always disconnect the inverter from the AC **and** DC side before starting work on the PV array.

Attach the warning label "Risk of burns from electric arc" so that it is clearly visible on the external AC disconnection device.

You must install a **separate** miniature circuit-breaker for each inverter in order to ensure that the inverter can be securely disconnected under load. For information on the maximum permissible fuse protection, please refer to the Technical Data (see Section 14).

You will find detailed information and examples for dimensioning of miniature circuit-breakers in the technical information "Miniature Circuit Breaker" at www.SMA-Solar.com.

⚠ DANGER

Danger to life due to fire

When more than 1 inverter is connected in parallel to the same miniature circuit-breaker, the protective function of the miniature circuit-breaker is no longer guaranteed. This could result in a cable fire or destruction of the inverter.

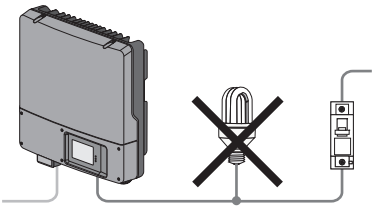
- Never connect several inverters to the same miniature circuit-breaker.
- Observe the maximum permissible fuse protection of the inverter when selecting the miniature circuit-breaker.

⚠ DANGER

Danger to life due to fire

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

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



NOTICE

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

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

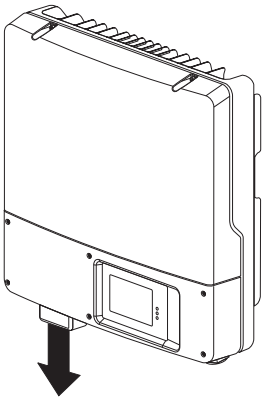
If the inverter is disconnected under load using a screw-type fuse, the inverter may be damaged.

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

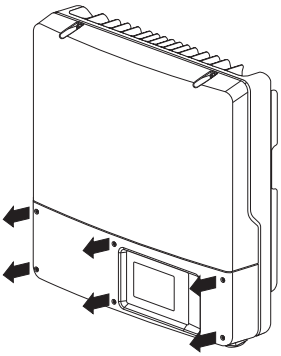
6.3.2 Connecting the Inverter to the Electricity Mains (AC)

1. Make sure that the mains voltage is within the permissible voltage range.

   The exact operating range of the inverter is specified in the operating parameters. You will find this document in the download area at www.SMA-Solar.com in the "Technical Description" category of the given inverter.
2. Disconnect the miniature circuit-breaker and secure against reconnection.
3. Remove the ESS.



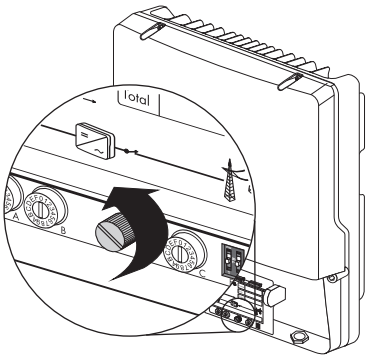
4. Loosen all six captive screws and remove the lower enclosure lid. Use an Allen key (AF 3) to do this.



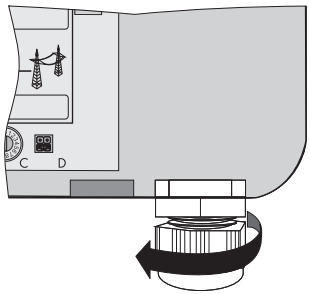
5. Check that the country setting of the inverter is correct using the supplementary sheet with the default settings provided.

   If the inverter is not configured to the required country standard, set the country standard (see Section 6.5.2 "Setting the Country Standard and Language using the Rotary Switches", page 54).

6. For ease of connection, loosen the display screw until the display can be flipped up.

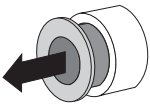


7. Flip the display up until it clicks into place.
8. Undo the swivel nut of the AC cable gland and remove the filler-plug from the cable gland.



Seal in the AC cable gland

There is a two-part seal in the cable gland. Remove the internal ring insert if necessary, e.g. to introduce a thicker cable.



The following guideline values apply:

- Cable diameter with seal and insert: 12 mm ... 16 mm
- Cable diameter with seal only and without insert: 15 mm ... 21 mm

9. Pull the cable through.
10. Raise all 3 terminals of the AC terminal as far as they will go.

NOTICE

Risk of fire when connecting two conductors to a single terminal

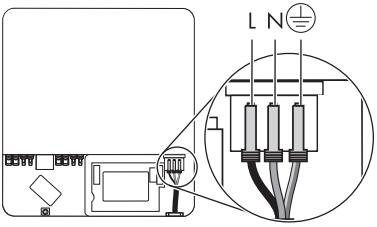
If two conductors are connected to one terminal, this may result in a poor electrical contact which could pose a risk of overheating or fire.

- Never connect more than one conductor per terminal.

11. Connect L, N and the protective conductor (PE) to the AC terminal in accordance with the label.

    The protective conductor must be 5 mm longer than the insulated L and N conductors.

    L and N must not be swapped.



⚠ 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 the sides of the terminal between fingers and thumb.
- Keep fingers away from the terminals.

12. Close all terminals of the AC terminal until they snap into place.
13. Fold down the display and fasten the screw hand-tight.
14. Hand-tighten the swivel nut firmly to the cable gland.

⚠ DANGER

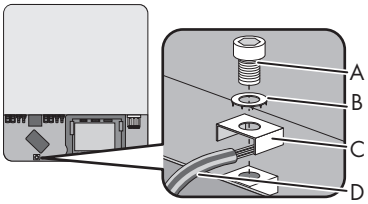
Danger to life due to high voltages in the inverter

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

15. Attach the enclosed warning label "Risk of burns from electric arc" so that it is clearly visible on the load disconnect unit on the AC side.

6.3.3 Additional Earthing of the Enclosure

If required in the country of installation, you can use the earth terminal on the enclosure to connect a second protective conductor or as equipotential bonding.



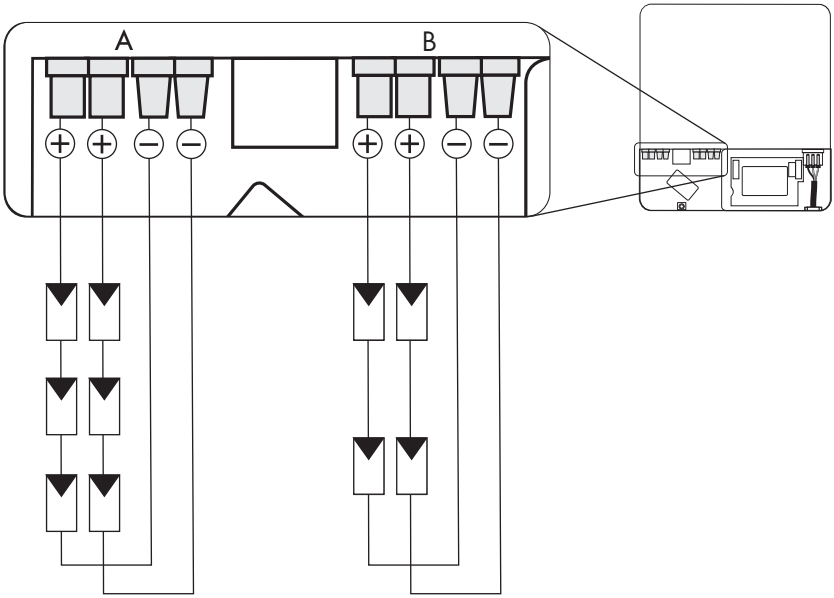
1. Release screw (A) and conical spring washer (B) half-way. Use an Allen key (AF 4) to do this.
2. Insert the stripped earthing cable (D) under the clamping bracket (C) (maximum conductor cross-section 10 mm²).
3. Screw the clamping bracket down as follows:
   - Place the conical spring washer over the screw. The grooved side of the conical spring washer must face towards the screw head.
   - Tighten the screw (torque: 6 Nm). Use an Allen key (AF 4) to do this.

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

6.4 Connecting the PV Array (DC)

6.4.1 Conditions for DC Connection

The inverter has two input areas "A" and "B", each with its own MPP tracker. Two strings can be connected to each of the two input areas.



Use of Y adaptors

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

- The DC circuit must not be interrupted by Y adaptors.
- Observe the procedure for disconnecting the inverter (see Section 9.2 "Disconnecting the Inverter from Voltage Sources", page 63).

- For each input area (A or B), the following requirements apply for the PV modules of the connected strings:
  - same type
  - same number of in-series-connected PV modules
  - identical alignment
  - identical tilt

No mixed connections at input areas

For instance, if the plus pole of a string is connected at input area A and the minus pole of the string at input area B, this comprises a mixed connection.

Connect the strings at one input area and do not mix up the input areas A and B.

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

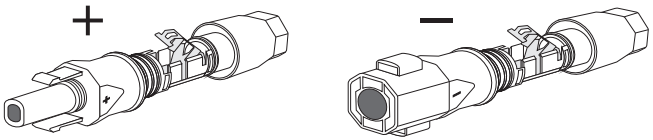
- The connection cables of the PV modules must be equipped with connectors. The DC plug connectors for the DC connection are included in the delivery.
- At the DC input of the inverter, the following limits must not be exceeded:

Maximum input voltage	Maximum input current	
	Input area A	Input area B
750 V	15.0 A	15.0 A

6.4.2 Assembling the DC Connectors

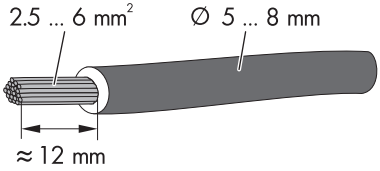
All PV display module connection cables must be equipped with the DC connectors supplied before connecting them to the inverter.

Assemble the DC connectors as described below. Be sure to observe the correct polarity. The DC connectors are marked with the symbols "+" and " – ".



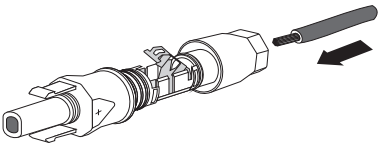
Cable Requirements

- Use a PV1-F cable.

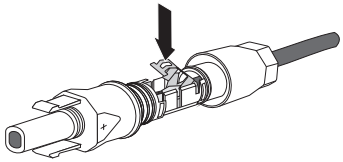


Procedure

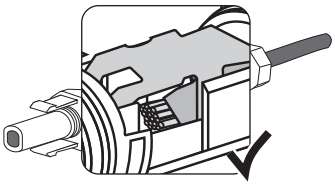
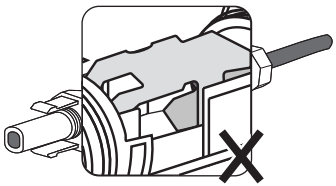
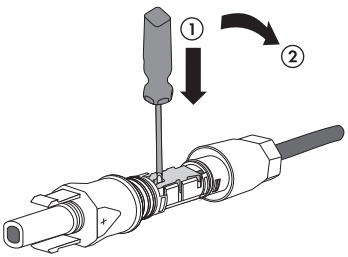
1. Lead the stripped cable all the way into the DC connector.



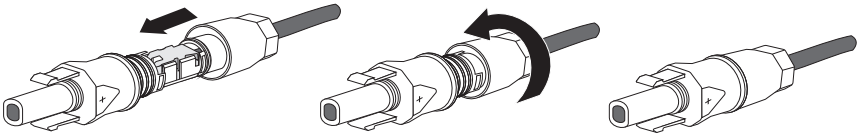
2. Press the clamping bracket down until it audibly snaps into place.



3. Ensure that the cable is correctly positioned:

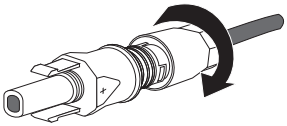
Result	Measure
☑ If the stranded wires are visible in the chamber of the clamping bracket, the cable is correctly positioned. 	• Proceed to Step 4.
☑ If the stranded wires are **not** visible in the chamber, the cable is not correctly positioned. 	• Release the clamping bracket. To do so, insert a 3.5 mm screwdriver into the clamping bracket and lever it open.  • Remove the cable and go back to step 1.

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

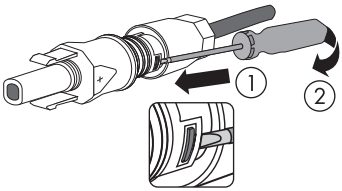


6.4.3 Disassembling the DC Plug Connector

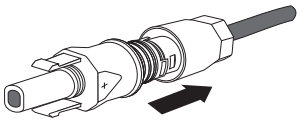
1. Unscrew the swivel nut.



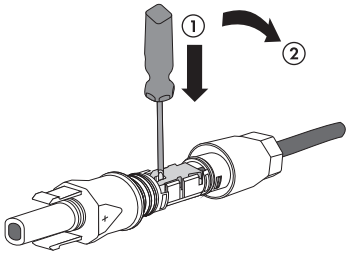
2. To release the DC connector: Insert a 3.5 mm screwdriver into the snap slot on the side and lever it open.



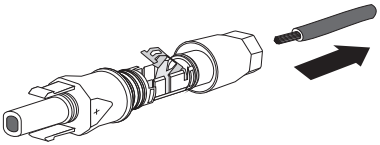
3. Carefully pull the DC connector apart.



4. Release the clamping bracket. To do so, insert a 3.5 mm screwdriver into the clamping bracket and lever it open.



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, make sure that the miniature circuit-breaker is disconnected and cannot be reconnected.

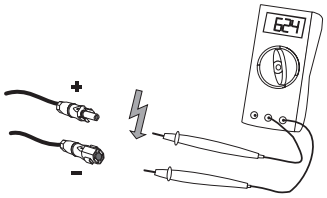
NOTICE

Excessive voltages can destroy the multimeter

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

1. Check the connection cable 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 above 10°C, the open-circuit voltage of the PV modules must not be more than 90% of the maximum inverter input voltage. If this is not the case, review the plant design and the PV module circuitry. At lower ambient temperatures, the maximum input voltage of the inverter could otherwise be exceeded.



NOTICE

Destruction of the inverter due to overvoltage

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

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

2. Check strings for earth faults (see Section 12.5 "Checking the PV Array for Earth Faults", page 83).

⚠ DANGER

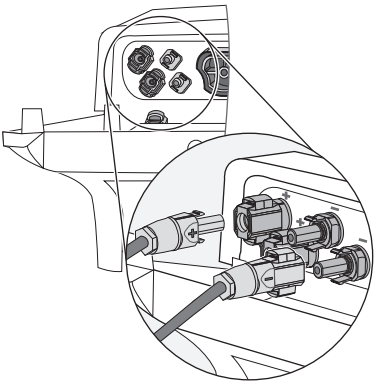
Danger to life due to electric shock.

- Do not connect any strings in which earth faults are present.
- Before connecting the DC cable, rectify the earth fault in the respective string.

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

   ☑ The DC connectors click audibly into place.

   For information on how to release the DC connector (see Section 9.2 "Disconnecting the Inverter from Voltage Sources", page 63).

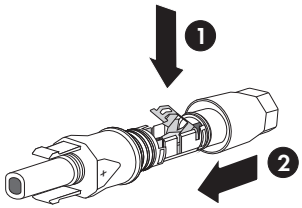


4. If you do not need all DC inputs on the inverter, seal the enclosure using DC connectors and sealing plugs:

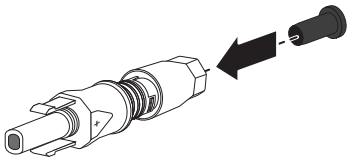
Sealing plug

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

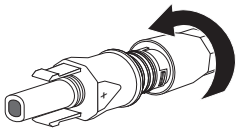
– With unused DC connectors, push down the clamping bracket and push the screw connection up to the thread.



– Insert the sealing plug into the DC connector.

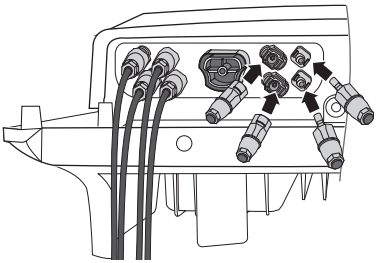


– Tighten the screw connection (torque: 2 Nm).



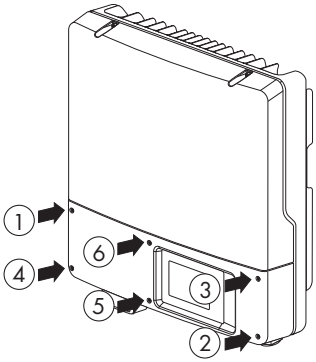
– Insert the DC connectors with sealing plugs into the corresponding DC inputs on the inverter.

☑ The DC connectors click audibly into place.

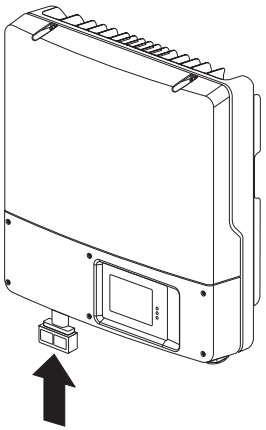


5. Ensure that all DC connectors are securely in place.
6. Close the lower enclosure lid again using the six screws.

   Tighten the screws (2 Nm torque) in the order shown on the right.



7. Check the ESS for wear (see Section 10.3 "Checking the Electronic Solar Switch for Wear", page 69).
8. Plug the ESS in securely. The ESS must be aligned parallel to and flush with the enclosure.



NOTICE

Damage to the ESS

- Plug the handle firmly onto the jack of the ESS.
- The handle must be flush with the enclosure.
- Make sure that the ESS is securely attached to the inverter.

Currents in DC cabling

After connecting the ESS, DC currents may occur in the DC cabling, even when there is no AC-side supply. This is not an error but normal behaviour of the inverter when in operation.

☑ The PV array is connected. You can now commission the inverter (see Section 7 "Commissioning", page 57). Other connections are optional (see Section 6.6 "Communication", page 55).

6.5 Setting the Country Standard and Display Language

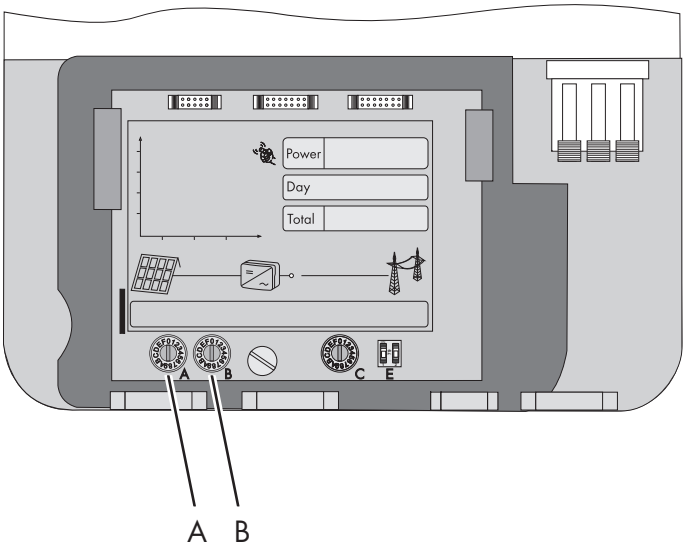
The inverter can be configured for various countries. This can be done prior to commissioning via 2 rotary switches on the display or after commissioning by configuring the "CntrySet" or "Set country standard" parameter using a communication product (e.g. Sunny WebBox or Sunny Explorer). For devices ordered without any specified country of installation, the default country data set is "VDE-AR-N4105-HP" and the display language is set to German.

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

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

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

Changes will be 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 feed-in parameters from being changed. Therefore, certain country data sets are protected against unauthorised changes. They can only be unlocked with a personal access code - the SMA Grid Guard code.

SMA Grid Guard-protected country data sets are automatically 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 lock a data set, enter the digit sequence "54321" instead of the password in 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-Solar.com 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 setting.

6.5.1 Checking the Country Standard

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

Before commissioning:

- Check that the country standard of the inverter is correct by comparing the default settings of the inverter listed on the supplementary sheet provided.

After commissioning:

- Check that the country standard is correct by comparing the display message during (re-)commissioning (see Section 7 "Commissioning", page 57).
- Check whether the country standard is correct by tapping the display twice and viewing the display messages of the start-up phase again.

  or

- Check that the country standard is correct using the "SMA grid guard" measuring channel via a communication product.

Display language

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

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

A	B	Country data set	Display language	Grid Guard protection	Country
0	0	default setting	default setting	dependent on parameter set	dependent on parameter set
0	1	retained	English	dependent on parameter set	dependent on parameter set
0	2	retained	German	dependent on parameter set	dependent on parameter set
0	3	retained	French	dependent on parameter set	dependent on parameter set
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

A	B	Country data set	Display language	Grid Guard protection	Country
0	7	retained	Czech	dependent on parameter set	dependent on parameter set
0	8	retained	Korean	dependent on parameter set	dependent on parameter set
0	9	retained	Portuguese	dependent on parameter set	dependent on parameter set
0	A	retained	Dutch	dependent on parameter set	dependent on parameter set
0	B	retained	Slovenian	dependent on parameter set	dependent on parameter set
0	C	retained	Bulgarian	dependent on parameter set	dependent on parameter set
0	D	retained	Polish	dependent on parameter set	dependent on parameter set
1	0	VDE0126-1-1	German	yes	Germany, Switzerland,
1	2	VDE-AR-N4105[a)]	German	yes	Germany
1	4	VDE-AR-N4105-MP[b)]	German	yes	Germany
1	6	VDE-AR-N4105-HP[c)]	German	yes	Germany
1	8	VDE0126-1-1	French	yes	Switzerland, France
1	9	VDE0126-1-1/UTE[d)]	French	yes	France
2	0	VDE0126-1-1	Italian	yes	Switzerland
3	1	CEI0-21Int[e)]	Italian	yes	Italy
3	2	CEI0-21Ext[f)]	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	8	G83/1-1	English	no	England
5	A	G59/2	English	no	England
6	0	EN50438	German	yes	various EU countries

A	B	Country data set	Display language	Grid Guard protection	Country
6	1	EN50438	English	yes	various EU countries
6	2	EN50438	French	yes	various EU countries
6	3	EN50438	Italian	yes	various EU countries
6	4	EN50438	Spanish	yes	various EU countries
6	5	EN50438	Greek	yes	various EU countries
6	6	EN50438	Czech	yes	various EU countries
6	7	EN50438	Portuguese	yes	various EU countries
6	8	EN50438	Bulgarian	yes	various EU countries
6	9	EN50438	Polish	yes	various EU countries
7	0	EN50438-CZ	Czech	yes	Czech Republic
7	1	EN50438-CZ	English	yes	Czech Republic
7	2	EN50438-CZ	German	yes	Czech Republic
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
C	0	Customer	English	no	flexible
C	1	Customer	German	no	flexible
C	2	Customer	French	no	flexible
C	3	Customer	Spanish	no	flexible
C	4	Customer	Italian	no	flexible
C	5	Customer	Greek	no	flexible

A	B	Country data set	Display language	Grid Guard protection	Country
C	6	Customer	Czech	no	flexible
D	0	Off-Grid 60 Hz	English	no	flexible
D	1	Off-Grid 60 Hz	German	no	flexible
D	2	Off-Grid 60 Hz	French	no	flexible
D	3	Off-Grid 60 Hz	Spanish	no	flexible
D	4	Off-Grid 60 Hz	Italian	no	flexible
D	5	Off-Grid 60 Hz	Greek	no	flexible
D	6	Off-Grid 60 Hz	Czech	no	flexible
E	0	Off-Grid 50 Hz	English	no	flexible
E	1	Off-Grid 50 Hz	German	no	flexible
E	2	Off-Grid 50 Hz	French	no	flexible
E	3	Off-Grid 50 Hz	Spanish	no	flexible
E	4	Off-Grid 50 Hz	Italian	no	flexible
E	5	Off-Grid 50 Hz	Greek	no	flexible
E	6	Off-Grid 50 Hz	Czech	no	flexible

a)	Setting in accordance with VDE-AR-N-4105 for PV plants ≤ 3.68 kVA (Germany)
b)	Setting in accordance with VDE-AR-N-4105 for PV plants > 3.68 kVA and < 13.8 kVA (Germany)
c)	Setting in accordance with VDE-AR-N-4105 for PV plants > 13.8 kVA (Germany)
d)	Special setting for France: *Bluetooth* transmission power reduced in accordance with French requirements
e)	Setting in accordance with CEI 0-21 for PV plants ≤ 6 kVA (Italy)
f)	Setting in accordance with CEI 0-21 for PV plants with external grid and plant protection > 6 kVA (Italy)

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

- Setting via the two rotary switches (see Section 6.5.2 "Setting the Country Standard and Language using the Rotary Switches", page 54).
- Alternatively you can conduct the settings via the "CntrySet" or "Set country standard" parameters via a communication product, once you have commissioned the inverter.
- If you require adjusted parameter settings for your installation site, you can change these with the help of a communication product.

6.5.2 Setting the Country Standard and Language using the Rotary Switches

1. Disconnect the inverter from voltage sources and open it (see Section 9.2 "Disconnecting the Inverter from Voltage Sources", page 63).

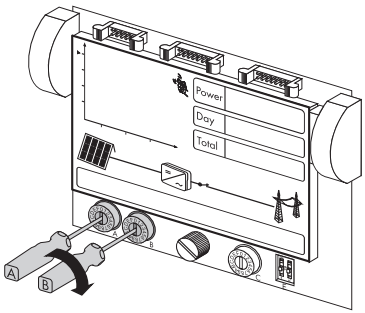
⚠ DANGER

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

If you set the inverter to stand-alone grid operation "Off-Grid 50 Hz"/"Off-Grid 60 Hz", you are not allowed to operate the inverter on the electricity grid, but only on the stand-alone grid, because the inverter does not satisfy any country-specific standards and guidelines in this setting. In the event of electricity grid failure, this will prevent the danger of backfeed.

- If the inverter is set to "Off-Grid 50 Hz" or "Off-Grid 60 Hz", never operate the inverter directly on the electricity grid.

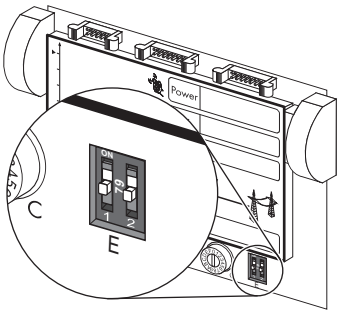
2. Set the arrows on the rotary switches (A and B) to the required position with a screwdriver (see Section 6.5.1 "Checking the Country Standard", page 50). Use a screwdriver with blade width 2.5 mm.



Temporarily setting the display language to English

In addition, it is possible to use a switch to set the display language to English temporarily, e.g. for service purposes. The inverter's parameter settings are not changed in the process.

- 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 to the original language, push the left switch 1 back down until it locks into place.



3. Close the inverter (see Section 9.3 "Closing the Inverter", page 66).

6.6 Communication

6.6.1 Interface for Wireline Communication

If you have ordered an inverter with an interface for wireline communication, the inverter will be delivered with the interface ready installed.

A further option is to retrofit an interface for wireline communication at a later date (see Section 15 "Accessories", page 112). You will find a detailed illustration of the wiring principle and instructions for conversion in the communication interface retrofit kit.

6.6.2 Setting the *Bluetooth* NetID

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

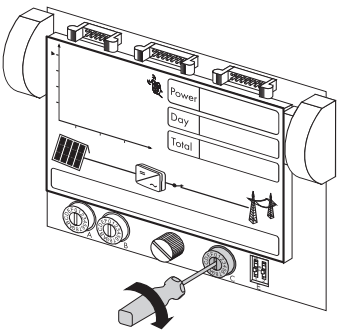
The following configuration settings are possible via a rotary switch (switch C):

Switch position (NetID)	Setting
0	*Bluetooth* communication is deactivated.
1	Communication with a communication product via *Bluetooth* is activated and networking with other inverters is deactivated. (default setting)
2 ... F	Networking via *Bluetooth* with other inverters is activated.

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 situated within a radius of 500 m.

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

1. Disconnect the inverter from voltage sources and open it (see Section 9.2 "Disconnecting the Inverter from Voltage Sources", page 63).
2. Set the arrow on the rotary switch (C) to the required position with a screwdriver. Use a 2.5 mm screwdriver for this purpose.
3. Close the inverter (see Section 9.3 "Closing the Inverter", page 66).



Activation of settings

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

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 6.5.1)
   - AC cable is correctly connected (electricity grid)
   - Protective conductor is correctly connected (see Section 6.3.3)
   - DC cables (PV strings) are correctly connected
   - Unused DC inputs are closed using the corresponding DC connectors and sealing plugs
   - All enclosure openings are closed
   - The enclosure lid is securely screwed into place
   - The ESS is securely plugged in
   - The AC distribution is correctly installed
   - The miniature circuit-breaker is correctly sized
2. Switch the miniature circuit-breaker on.
   ☑ Green LED is lit: commissioning successful.

   or

   ☑ Green LED will flash 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. Localise and eliminate the fault (see Section 12 "Troubleshooting", page 71).

Self-test in accordance with CEI 0-21 during initial start-up (applies to Italy only)

The Italian standard prescribes that an inverter can only operate on the electricity grid after the disconnection times for overvoltage, undervoltage, minimum frequency and maximum frequency have been checked.

If the country data set is configured to **CEI0-21 Int** / **CEI 0-21 intern,** start the self-test (see Section 7.3 "Self-test (Applies to Italy Only)", page 59).

If the country data set is configured to **CEI0-21 Ext** / **CEI 0-21 extern**, no self-test is required. Go to step 3.

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

7.2 Display Messages during the Start-up Phase

Illustrated display messages

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

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



- After 5 seconds, or after tapping on the display, the serial number or the description of the inverter and the NET ID for communication via *Bluetooth* will appear. The designation of the inverter can be changed via a communication product.



- After a further 5 seconds, or after a further tap, the configured country standard is displayed (example: "VDE-AR-N4105-MP").



- 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 be blank. For possible event messages that may be displayed in the text line and their meaning, refer to (see Section 12 "Troubleshooting", page 71) of this document .

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.

7.3 Self-test (Applies to Italy Only)

The self-test is only valid for inverters configured to the country data set **CEI0-21 Int/CEI 0-21 Intern** and commissioned in Italy.

The Italian standard requires that all inverters feeding into the electricity grid perform a self-test in accordance with CEI 0-21. During the self-test, the inverter will consecutively check the reaction times for overvoltage, undervoltage, maximum frequency and minimum frequency.

The self-test changes the upper and lower trip-limit values for each protective function on a linear basis for frequency monitoring and voltage monitoring. As soon as the measured value exceeds the permitted trip-limit value, the inverter disconnects from the electricity grid. In this way, the inverter determines the reaction time up to disconnection and the self-test is performed.

After completion of the self-test, the inverter automatically switches back to feed-in operation, resets to the original shutdown conditions and connects to the electricity grid.

7.3.1 Starting the Self-Test

Requirements:

- Configured country data set: **CEI0-21 Int / CEI 0-21 Intern** or amended country data set **trimmed / Special setting** based on one of the country data sets mentioned above.
- A report for entering the test results in accordance with CEI 0-21 must be available.
- The inverter must be in operation and in the start-up phase.

1. As soon as the configured country data set appears in the display, tap once on the display within ten seconds.

   ☑ A message informing you that the self-test has started is shown in the display: **Avvio Autotest**.

   ✖ The message Avvio Autotest is not shown in the display?

   You exceeded the 10-second time limit so the self-test cannot start.

   - Restart the self-test (see Section 7.3.3).

2. Tap on the display within 20 seconds and enter the test results into the test report as they appear.

   ☑ The self-test starts.

   ☑ The inverter displays the results of the individual tests for overvoltage, undervoltage, maximum frequency and minimum frequency. The results are displayed three times in succession for ten seconds each. Tip: to speed up the display rate, tap the display once. This will take you straight on to the next result.

Example: Display messages for overvoltage test

- Name of the test: **Autotest (59.S1) 240.00V**
- Disconnection value: **Valore di soglia con 230.00V**
- Normative value: **Va. taratura 253.00V**
- Disconnection time: **Tempo die intervento 0.2 s**
- Current mains voltage: **Tensione di rete Val.eff.: 229.80V**

7.3.2 Abortion of the Self-Test

If, during the self-test, an unexpected disconnection requirement occurs, the self-test is aborted. The same applies if the DC voltage is so low that feed-in cannot be continued.

- A message informing you that the self-test has been aborted is shown in the display for ten seconds: **Autotest interroto**.
- Restart the self-test (see Section 7.3.3).

7.3.3 Restarting the Self-Test

In order to restart the self-test, proceed as follows:

1. Disconnect the miniature circuit-breaker and secure against reconnection.
2. If a multi-function relay is connected, disconnect its supply voltage.
3. Remove the ESS from the inverter for five minutes and then plug it in again firmly.
4. Restart the inverter (see Section 7 "Commissioning", page 57).

☑ The inverter is now back in the start phase and you can restart the self-test from step 3 (see Section 7.3 "Self-test (Applies to Italy Only)", page 59).

8 Configuration

8.1 Changing the Plant Time and Plant Password

Requirements:

- A computer with *Bluetooth* interface must be available.
- Sunny Explorer with software version 1.04 or higher must be installed on the computer.
- The plant must be logged in Sunny Explorer.

1. Change the standard plant password (see Sunny Explorer help). This will protect your plant from unauthorized access.
2. Change the plant time (see Sunny Explorer help).

8.2 Activating and Setting SMA OptiTrac Global Peak

With partially shaded PV modules, you should activate SMA OptiTrac Global Peak and set the time interval for the inverter to optimise the MPP of the PV plant.

Requirements:

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

1. Access the user interface of the communication product and log in as an installer.
2. Select the parameter **Power limit of the OptiTrac Global Peak** and set to **On**.
3. Select the parameter **Cycle time of the OptiTrac Global Peak algorithm** and set the desired time interval. Hint: The ideal time interval is normally six minutes. This value should only be increased if the shading situation changes extremely slowly.

   ☑ The inverter optimises the MPP of the PV plant at the specified time interval.

9 Opening and Closing

9.1 Safety

⚠ DANGER

Danger to life due to high voltages in the inverter

Before opening the inverter, observe the following:

- Disconnect the miniature circuit-breaker and secure against reconnection.

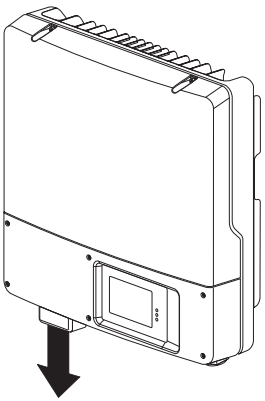
If a multi-function relay is connected, disconnect its supply voltage and ensure that it cannot be reconnected.

⚠ DANGER

Danger to life due to electric shock.

If the DC connectors are pulled out without first disconnecting the ESS, a dangerous electric arc can occur.

- First remove the ESS.
- Then, open the lower enclosure lid and remove the DC connectors.



NOTICE

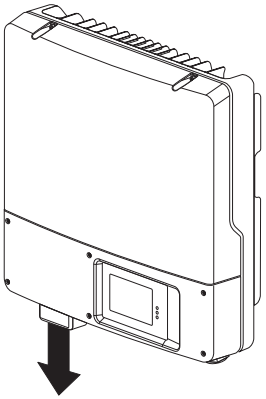
Electrostatic discharge can damage the inverter

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

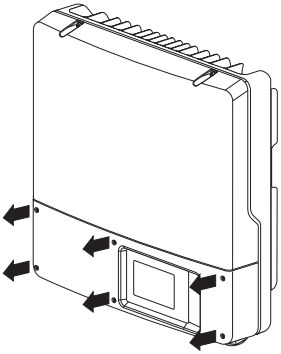
- Earth yourself before touching any components.

9.2 Disconnecting the Inverter from Voltage Sources

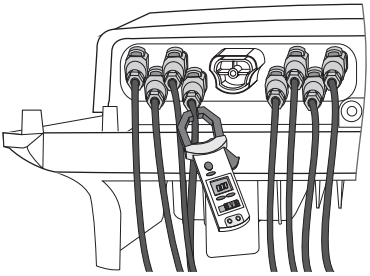
1. Disconnect the miniature circuit-breaker and secure against reconnection.
2. If a multi-function relay is connected, disconnect its supply voltage and ensure that it cannot be reconnected.
3. Remove the ESS.



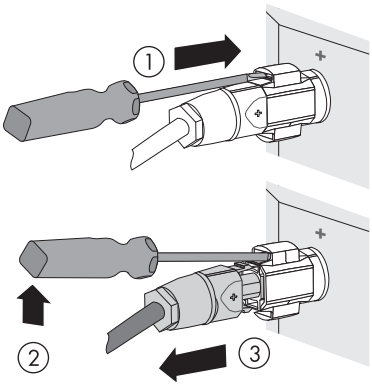
4. Loosen all six captive screws and remove the lower enclosure lid. Use an Allen key (AF 3) to do this.



5. Use a current clamp to make sure no current is present in the DC cables.
   ☑ If current is present, check the installation.

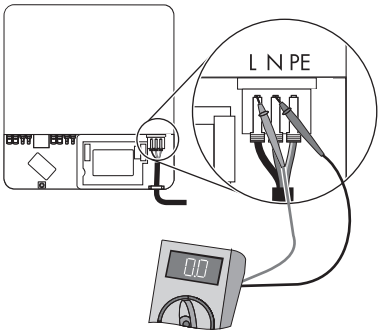


6. Release and disconnect all DC connectors. To do this, insert a flat-blade screwdriver (blade width: 3.5 mm) into one of the side slots and pull the DC connectors straight out. Do **NOT PULL ON THE CABLE**.



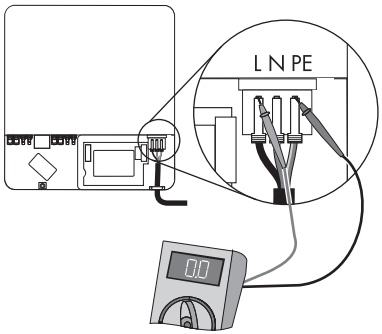
7. Wait until the LEDs, display and fault indicator have gone out.
8. Verify the absence of voltage between L to N at the AC terminal using a suitable measuring device. The maximum diameter of the test probe is 2 mm.

   ☑ If voltage is present, check the installation.

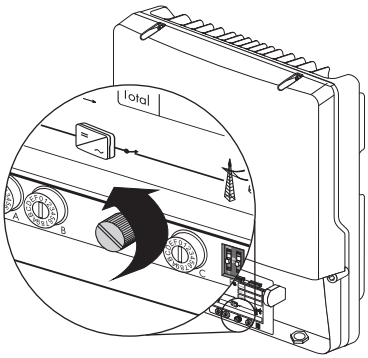


9. Verify that no voltage is present between L and PE at the AC terminal using a suitable measuring device.

   ☑ If voltage is present, check the installation.

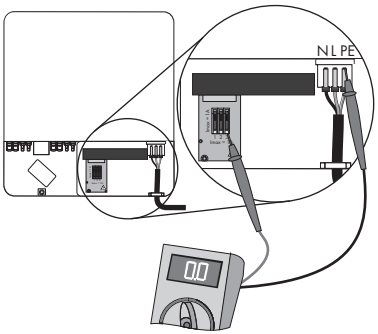


10. Loosen the screw on the display and flip the display up until it clicks into place.



11. Verify the absence of voltage in the multi-function relay against PE at all terminals. The maximum diameter of the test probe is 2 mm.

    ☑ If voltage is present, check the installation.



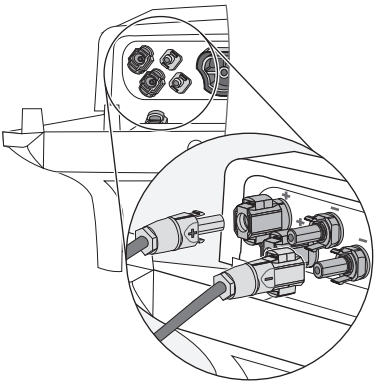
☑ The inverter is open and no voltage is present.

9.3 Closing the Inverter

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

   ☑ The DC connectors click audibly into place.

   To release the DC connectors (see Section 9.2 "Disconnecting the Inverter from Voltage Sources", page 63).



2. Close all unused DC inputs (see Section 6.4.4 "Connecting the PV Array (DC)", page 44). This will ensure that the inverter is tightly sealed.
3. Ensure that all DC connectors are securely in place.

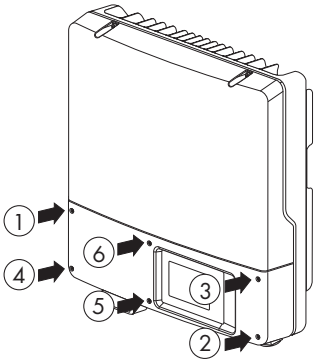
⚠ DANGER

Danger to life due to electric shock.

If the inverter is operated without the lower enclosure lid, the DC connectors could be disconnected while under load. This could cause arcing.

- Insert the ESS only when the lower enclosure lid is closed.
- Only operate the inverter with the lower enclosure lid closed. This will ensure that the DC connectors cannot be readily removed.

4. Attach the lower enclosure lid to the enclosure and fasten it using the six screws. Use an Allen key (AF 3) to tighten the screws in the order shown on the right (torque 2 Nm).



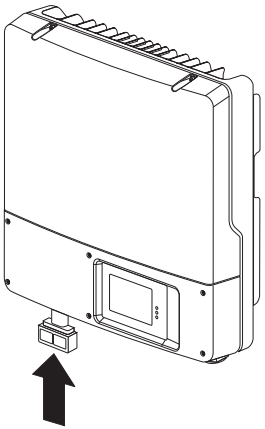
5. Check the ESS for wear (see Section 10.3 "Checking the Electronic Solar Switch for Wear", page 69).

NOTICE

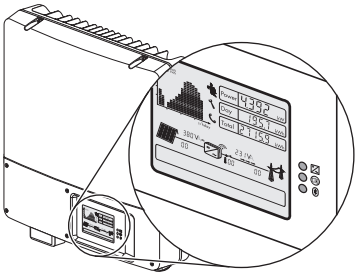
The ESS can be damaged if it is not connected correctly.

- Plug the ESS in securely.

  The handle of the Electronic Solar Switch must be flush with the enclosure.
- Check that the ESS is securely in place.



6. If a multi-function relay is connected, switch on the supply voltage to the relay.
7. Switch the miniature circuit-breaker on.
8. Check whether the display and LEDs are indicating a normal operating state (see Section 7 "Commissioning", page 57).



☑ The inverter is now closed and in operation.

10 Maintenance and Cleaning

10.1 Cleaning the Inverter

NOTICE

Damage to the display by use of cleaning agents

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

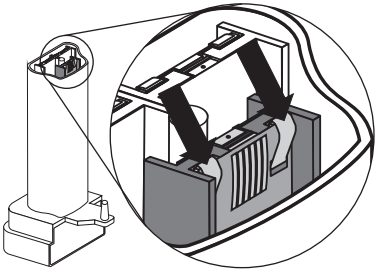
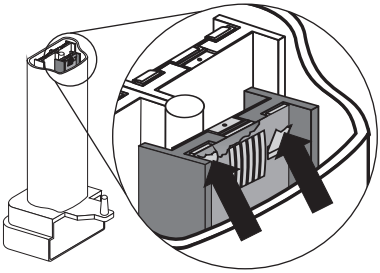
10.2 Checking Heat Dissipation

If the inverter regularly reduces its power output due to excessive heat (temperature symbol on the display lights up), this may be for one of the following reasons:

- The cooling fins on the rear side of the enclosure are clogged.
  - Clean the cooling fins using a soft brush.
- The air ducts at the top are clogged.
  - Clean the air ducts using a soft brush.

10.3 Checking the Electronic Solar Switch for Wear

Check the ESS for wear before plugging it in.

Result	Measure
☑ The metal tongues inside the plug are not damaged or discoloured. 	1. Insert the handle of the ESS securely into the socket at the bottom of the enclosure. 2. Restart the inverter (see Section 7 "Commissioning", page 57).
☑ The metal tongues inside the plug have a brown discolouration or are burned out. 	The ESS can no longer safely disconnect the DC side. 1. Replace the ESS handle before attaching it again. Order the new ESS handle through the SMA Service Line (see Section 16 "Contact", page 113). 2. After replacing the ESS, restart the inverter (see Section 7 "Commissioning", page 57).

11 Slot for SD Card

The SD card is used to import files if you need to perform a firmware update after consulting the SMA Service Line.

SMA Solar Technology AG will send you a file with the firmware update by e-mail or on an SD card, or will make the file available in the download area at www.SMA-Solar.com.

For a description of the firmware update, see the download area at www.SMA-Solar.com.

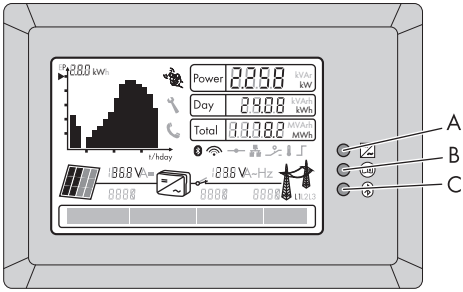
Properties of the SD card

Use an SD card that is FAT16 or FAT32 formatted and has a maximum storage capacity of 2 GB.

Use the SD card exclusively for this inverter. Do not save any multimedia files or other unsuitable files on the SD card.

12 Troubleshooting

12.1 LED Signals



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

12.2 Event Messages

No display in the event of insufficient DC voltage

It is only possible to take measurements and display messages when there is sufficient DC voltage.

During an update, the relevant display message is shown in the text line of the display.

Message	Description
Avvio Autotest	Only applicable for installation in Italy: tapping on the display starts the self-test in accordance with CEI 0-21 (see Section 7.3 "Self-test (Applies to Italy Only)", page 59).
Inst. code valid	The SMA Grid Guard code entered is valid. The configured country data set is now unlocked and can be changed. If it is a Grid Guard-protected country data set, the unlocking is valid for a maximum of 10 feed-in hours.
No new update SDcard	There is no update file relevant for this inverter on the SD card or the available update has already been carried out.
Grid param.unchanged	The selected switch setting is not programmed or there is no country data set available on the SD card.
Parameters set successfully	A new country data set has been configured.
SD card is read	The inverter is currently reading the SD card.
Set parameter	The inverter is setting the configured parameters.
Update completed	The inverter has successfully completed the update.
Update Bluetooth	The inverter is updating the *Bluetooth* component.
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 communication interface.
Upd. language table	The inverter is updating the language table.
Update file OK	The update file found is valid.

12.3 Error messages

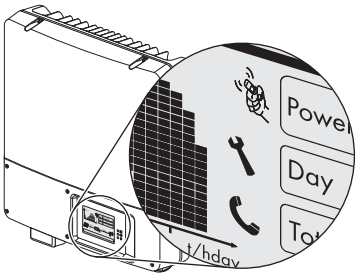
No display in the event of insufficient DC voltage

It is only possible to take measurements and display messages when there is sufficient DC voltage.

The text line on the display shows the relevant display messages whenever an error occurs. The event numbers for the displayed error messages appear above the text line. If the error persists for a prolonged period, the red LED lights up and the fault indicator is activated (if connected).

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

- Spanner: signifies a disturbance that can be remedied on site.
- Telephone receiver: signifies a device disturbance. Contact the SMA Service Line.



Event no.	Message	Cause and corrective measures
101 ... 103	**System disturbance**	The mains voltage has exceeded the permissible range. This error can have the following causes: • The mains voltage at the termination point of the inverter is too high. • The grid impedance at the termination point of the inverter is too high. The inverter disconnects itself from the electricity grid for safety reasons. **Corrective measures:** • Check the mains voltage and grid connection on the inverter. If the mains voltage is outside the permissible range due to local grid conditions, ask your network operator if the voltage can be adjusted at the feed-in point or if it would be acceptable to change the monitored operating limits. If the mains voltage is within the tolerance range, yet this error is still displayed, contact the SMA Service Line.

Event no.	Message	Cause and corrective measures
202 ... 205	**System disturbance**	The mains voltage has fallen below the permissible range. This error can have the following causes: • Electricity grid disconnected • AC cable damaged • The mains voltage at the termination point of the inverter is too low. The inverter disconnects itself from the electricity grid for safety reasons. **Corrective measures:** • Check whether the miniature circuit-breaker has tripped. • Check the mains voltage and grid connection on the inverter. If the mains voltage is outside the permissible range due to local grid conditions, ask your network operator if the voltage can be adjusted at the feed-in point or if it would be acceptable to change the monitored operating limits. If the mains voltage is within the tolerance range, yet this error is still displayed, contact the SMA Service Line.
301	**System disturbance**	The 10-minute-average mains voltage is no longer within the permissible range. This can be caused by one of the following: • The mains voltage at the termination point of the inverter is too high. • The grid impedance at the termination point of the inverter is too high. The inverter disconnects to assure compliance with the power quality of the electricity grid. **Corrective measures:** • Check the mains voltage at the termination point of the inverter: If, due to local grid conditions, the mains voltage exceeds the configured threshold, ask the network operator whether the voltage can be adjusted at the feed-in point, or whether it would be acceptable to modify the threshold for power quality monitoring. If the mains voltage is permanently within the tolerance range and this error is still displayed, contact the SMA Service Line.

Event no.	Message	Cause and corrective measures
401 ... 404	**System disturbance**	The inverter is no longer in grid-parallel operation and has stopped feed-in for safety reasons. **Corrective measures:** • Check the grid connection for strong, short-term frequency variations. 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.
501	**System disturbance**	The mains frequency is not within the permissible range. The inverter disconnects itself from the electricity grid for safety reasons. **Corrective measures:** • If possible, check the mains 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.
601	**System disturbance**	The internal monitoring function of the inverter has detected an excessively high proportion of direct current in the grid current. The inverter disconnects from the electricity grid. **Corrective measures:** • Check the grid connection for direct current. • If this event occurs often, check with the network operator whether it is possible to raise the threshold for monitoring.
701	**Frq. not permitted**	The mains frequency is outside the permissible range. The inverter disconnects from the electricity grid for safety reasons. **Corrective measures:** • If possible, check the mains 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.	Message	Cause and corrective measures
801	**Waiting for grid voltage** **Grid failure** **Check fuse**	There is no mains voltage at the AC output of the inverter. **Corrective measures:** • Check the fuse and replace it if necessary. • Check AC installation. • Check whether there is a general power failure.
901	**PE conn. missing** **Check connection**	The PE connection is missing. Half of the mains voltage may be present on an unearthed enclosure. The inverter will not connect to the electricity grid. **Corrective measures:** • Check AC installation. • (see Section 6.3.2 "Connecting the Inverter to the Electricity Mains (AC)", page 36)
1001	**L / N swapped** **Check connection**	L and N have been connected the wrong way round. The inverter will not connect to the electricity grid. **Corrective measures:** • Eliminate connection error (see Section 6.3.2 "Connecting the Inverter to the Electricity Mains (AC)", page 36).
1101	**Installation fault** **Check connection**	A second phase is connected to N. **Corrective measures:** • Correct the connection (see Section 6.3.2 "Connecting the Inverter to the Electricity Mains (AC)", page 36).
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 or insufficient sunlight. The inverter interrupts feed-in operation. **Corrective measures:** • Wait until irradiation is higher. • If this event recurs at medium irradiation levels, check the PV plant design and the correct circuitry of the PV array.

Event no.	Message	Cause and corrective measures
3401 ... 3402	**DC overvoltage** **Disconnect generator**	The DC input voltage connected to the inverter is too high. The inverter interrupts feed-in operation. **Corrective measures:** • **Disconnect the inverter from the PV array immediately (see Section 9.2 "Disconnecting the Inverter from Voltage Sources", page 63). Otherwise, the inverter could be destroyed.** • Check that the DC voltage of the strings is in compliance with the input voltage range of the inverter the maximum input voltage of the inverter before reconnecting the inverter to the PV array. • If the voltage is within the permissible input voltage range, the inverter may be defective. Contact the SMA Service Line.
3501	**Insulation resist.** **Check generator**	The inverter has detected an earth fault in the PV array and does not connect to the electricity grid for safety reasons. Damaged insulation can cause electric shock. **Corrective measures:** • Check strings for earth faults (see Section 12.5 "Checking the PV Array for Earth Faults", page 83). • The installer of the PV array must remedy any earth faults before the affected string is reconnected.
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 the specified threshold and then automatically reconnects to the electricity grid once the fault has been remedied. **Corrective measures:** • Check strings for earth faults (see Section 12.5 "Checking the PV Array for Earth Faults", page 83). • The installer of the PV array must remedy any earth faults before the affected string is reconnected.

Event no.	Message	Cause and corrective measures
3701	**Resid.curr.too.high** **Check generator**	The inverter has detected residual current and interrupts feed-in operation. **Corrective measures:** • Check strings for earth faults (see Section 12.5 "Checking the PV Array for Earth Faults", page 83). • The installer of the PV array must remedy any earth faults before the affected string is reconnected.
3801 ... 3802	**DC overcurrent** **Check generator**	The inverter switches off due to an overcurrent on the DC side. **Corrective measures:** 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 voltage of the PV modules is not yet sufficient for feeding into the electricity grid. **Corrective measures:** • Wait until irradiation is higher. • If this event recurs at medium irradiation levels, check the PV plant design and the correct circuitry of the PV array.
6001 ... 6438	**Self diagnosis** **Interference device**	Internal device fault. The inverter interrupts feed-in operation. **Corrective measures:** • Contact the SMA Service Line (see Section 16 "Contact", page 113)
6501 ... 6502	**Self diagnosis** **Overtemperature**	The inverter interrupts feed-in operation due to interior overheating. **Corrective measures:** • Ensure sufficient ventilation. • Check heat dissipation (see Section 10.2 "Checking Heat Dissipation", page 68).
6603 ... 6604	**Self diagnosis** **Overload**	The inverter has detected an internal overload and interrupts feed-in operation. **Corrective measures:** • Contact the SMA Service Line (see Section 16 "Contact", page 113)

Event no.	Message	Cause and corrective measures
6701 ... 6702	**Comm. disturbed**	A fault has occurred in the internal communication of the inverter. The inverter continues feeding into the electricity grid. **Corrective measures:** If this event occurs frequently: • Contact the SMA Service Line (see Section 16 "Contact", page 113)
6801 ... 6802	**Self diagnosis** **Input A defective**	Inverter input A is defective. **Corrective measures:** • Contact the SMA Service Line (see Section 16 "Contact", page 113)
6901 ... 6902	**Self diagnosis** **Input B defective**	Inverter input B is defective. **Corrective measures:** • Contact the SMA Service Line (see Section 16 "Contact", page 113)
7001 ... 7002	**Sensor fault**	A temperature sensor in the inverter is faulty. The inverter interrupts feed-in operation. **Corrective measures:** • Contact the SMA Service Line (see Section 16 "Contact", page 113)
7008	**Disturbance sensor display temperature**	The ambient-temperature sensor is faulty. The display does not switch off at temperatures below –25°C and may be irreparably damaged as a result. The inverter continues feeding into the electricity grid. **Corrective measures:** • Contact the SMA Service Line (see Section 16 "Contact", page 113)
7101	**SD card defective**	The SD card is not formatted correctly or is defective. Update failed. The inverter continues feeding into the electricity grid. **Corrective measures:** • Re-format the SD card. • Re-save the files to the SD card.
7102	**Parameter file not found or defective**	The parameter file was not found or is defective. Update failed. The inverter continues feeding into the electricity grid. **Corrective measures:** • Copy the parameter file into the SD card drive :\PARASET directory.

Event no.	Message	Cause and corrective measures
7105	**Param. setting failed**	It is not possible to set parameters via the SD card. The inverter continues feeding into the electricity grid. **Corrective measures:** • Check the parameters for valid values. • Ensure change rights via SMA Grid Guard code.
7106	**Update file defect.**	The update file is defective. Update failed. The inverter continues feeding into the electricity grid. **Corrective measures:** • Re-format the SD card. • Re-save the files to the SD card.
7110	**No update file found**	No new update file found on the SD card. Update failed. The inverter continues feeding into the electricity grid. **Corrective measures:** • Copy the update file into the SD card drive :\UPDATE directory.
7201 ... 7202	**Data stor. not poss.**	Internal device fault, the inverter continues feeding into the electricity grid. **Corrective measures:** • If this error occurs frequently, contact the SMA Service Line (see Section 16 "Contact", page 113).
7303	**Update main CPU failed**	Internal device fault. The inverter continues feeding into the electricity grid. In very rare cases, the firmware is damaged and the inverter interrupts feed-in. **Corrective measures:** • Contact the SMA Service Line (see Section 16 "Contact", page 113)
7305	**Update RS485I module failed**	Internal device fault, the inverter continues feeding into the electricity grid. **Corrective measures:** • Re-try update. • If this error occurs again, contact the SMA Service Line (see Section 16 "Contact", page 113).
7307	**Update Bluetooth failed**	
7311	**Update language table failed**	

Event no.	Message	Cause and corrective measures
7401	**Varistor defective**	At least 1 of the thermally monitored varistors is defective. The inverter is no longer protected against overvoltage. The inverter continues feeding into the electricity grid. **Corrective measures:** • Check varistors (see Section 12.6 "Checking the Function of the Varistors", page 85).
7508	**External fan fault** **Replace fan**	The fan is clogged or defective. The inverter may reduce its power output due to overheating. The inverter continues feeding into the electricity grid. **Corrective measures:** • Clean the fan • Replace the fan
7701 ... 7703	**Self diagnosis** **Interference device**	Internal device fault. The inverter disconnects from the electricity grid. **Corrective measures:** • Contact the SMA Service Line (see Section 16 "Contact", page 113)
8001	**Derating occurred**	The power supplied by the inverter has been reduced to below nominal power for more than 10 minutes due to overheating. **Corrective measures:** If this event occurs frequently: • Ensure sufficient ventilation. • Check heat dissipation (see Section 10.2 "Checking Heat Dissipation", page 68).
8101 ... 8104	**Comm. disturbed**	A fault has occurred in the internal communication of the inverter. The inverter continues feeding into the electricity grid. **Corrective measures:** • Contact the SMA Service Line (see Section 16 "Contact", page 113)

Event no.	Message	Cause and corrective measures
8801 8803	**No display**	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. **Corrective measures:** • Wait until the temperature has risen above –25°C. • Contact the SMA Service Line (see Section 16 "Contact", page 113)
9002	**Inst. code invalid**	The SMA Grid Guard code entered (personal installer password) is not valid. **Corrective measures:** • Enter a valid SMA Grid Guard code.
9003	**Grid param. locked**	The current country data set is locked. **Corrective measures:** • Enter a valid SMA Grid Guard code for changing the country data set.
9005	**Changing grid param. not possible** **Ensure DC supply**	This error can have the following causes: • The selected rotary switch setting for the language settings is not programmed. • The parameters to be changed are protected. • DC voltage at the DC input is not sufficient to run the main CPU. **Corrective measures:** • Check setting of the rotary switches (see Section 6.5.1 "Checking the Country Standard", page 50). • Enter the SMA Grid Guard code. • Ensure that sufficient DC voltage is available (green LED lit or flashing).

12.4 DC Current after AC-side Disconnection

In spite of the AC side having been disconnected, a current is still detectable in the DC cables with a current clamp. This is not an error but normal behaviour of the inverter when in operation.

- Always disconnect the inverter on the AC **and** DC sides (see Section 9.2 "Disconnecting the Inverter from Voltage Sources", page 63).

12.5 Checking the PV Array for Earth Faults

If the red LED is lit and the inverter displays event number "3501", "3601" or "3701", then there is probably an earth fault in the PV array.

Check the strings for earth faults as described below:

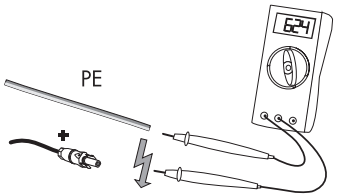
1. Disconnect the inverter from voltage sources and open it (see Section 9.2 "Disconnecting the Inverter from Voltage Sources", page 63).

NOTICE

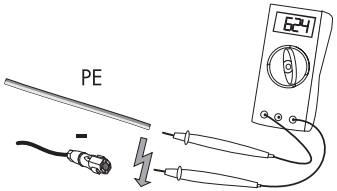
Excessive voltages can destroy the multimeter

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

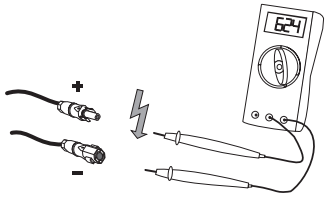
2. Measure the voltages between the positive pole of each string and the earth potential (PE).



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



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



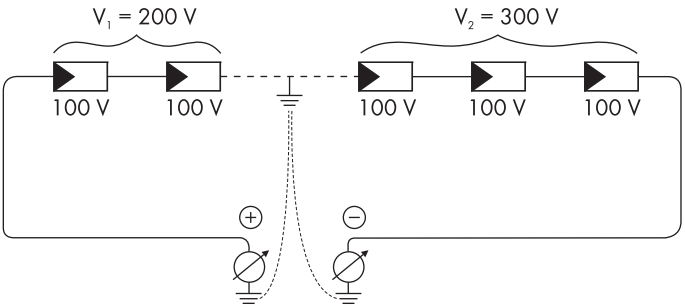
☑ An earth fault is present if the measured voltages are stable and the sum of the voltages of the positive pole against earth potential and the negative pole against earth potential of a string is approximately equal to the voltage between the positive and negative poles.

Result	Measure
☑ You have detected an **earth fault**.	• The installer (electrically skilled person) of the PV array must remedy the earth fault in the affected string before you reconnect the string to the inverter. You can determine the location of the earth fault using the illustration below. • Do not reconnect the faulty string. • Restart the inverter (see Section 7.1 "Commissioning the Inverter", page 57).
☑ You **have not** detected an earth fault.	One of the thermally monitored varistors is probably defective. • Check the function of the varistors (see Section 12.6 "Checking the Function of the Varistors", page 85).

Location of the earth fault

The approximate position of the earth fault can be determined from the ratio of the measured voltages between the positive pole against earth potential (PE) and the negative pole against earth potential (PE).

Example:



In this case, the earth fault is between the 2nd and 3rd PV modules.

☑ The earth fault check is now complete.

12.6 Checking the Function of the Varistors

If the inverter displays the event number "7401", then 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.

- In PV plants with a high risk of overvoltages, never operate the inverter without varistors
- Replacement varistors should be fitted as soon as possible.

Check the varistors as described below:

1. Disconnect the inverter from voltage sources and open it (see Section 9.2 "Disconnecting the Inverter from Voltage Sources", page 63).

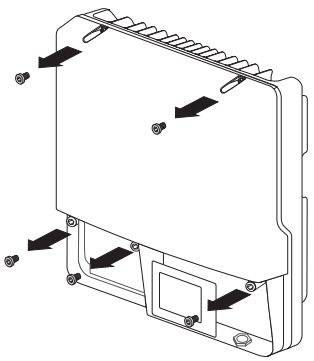
⚠ DANGER

Danger to life due to high voltages in the inverter

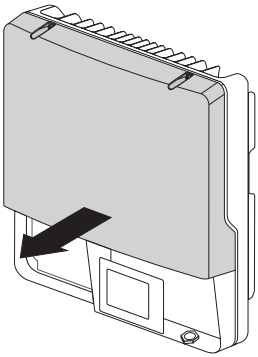
The capacitors in the inverter may be charged with very high voltages.

- Wait 5 minutes before opening the upper enclosure lid, in order to allow time for the capacitors to discharge.

2. Undo the screws of the upper enclosure lid. Use an Allen key (AF 4) to do this.



3. Pull the upper enclosure lid forwards to remove it.



NOTICE

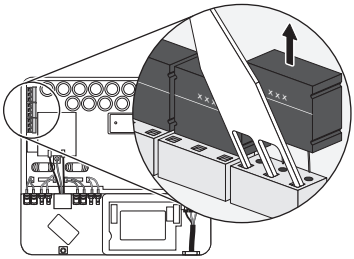
Electrostatic discharge can damage the inverter

Components on the inside of the inverter may be irreparably damaged due to electrostatic discharge.

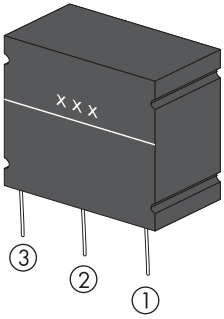
- Earth yourself before touching any components.

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.



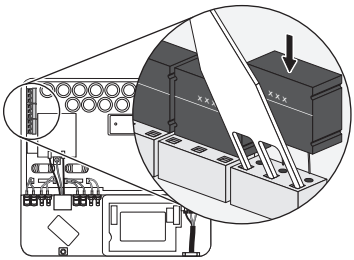
5. Use a multimeter to check each varistor for a conductive connection between terminals 2 and 3.



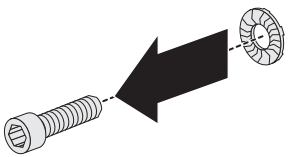
Result	Measure
☑ There is a **conductive** connection.	The varistor is functional. There must be a different error in the inverter. • Contact the SMA Service Line (see Section 16 "Contact", page 113)
☑ There is **no conductive** connection.	The respective varistor is defective and must be replaced. Varistor failure is generally due to influences that affect all varistors in a similar manner (temperature, age, induced overvoltage). SMA Solar Technology AG recommends replacing all varistors. The varistors are specially manufactured for use in the inverter and are not commercially available. You will need to order replacement varistors directly from SMA Solar Technology AG (see Section 15 "Accessories", page 112). Only use original varistors that are sold by SMA Solar Technology AG. • For replacing the varistors, proceed to step 6.

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

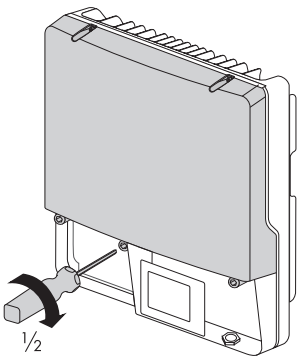
   Make sure that the labelling points to the left, i.e. towards the insertion tool.



8. Close and earth the inverter:
   - Place one conical spring washer over each screw. The grooved side of the conical spring washer must face the screw head.

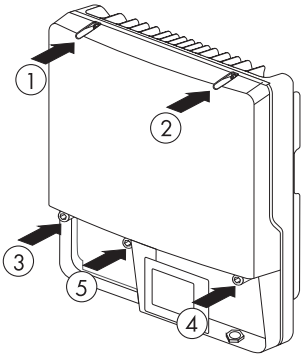


   - Attach the upper enclosure lid to the enclosure and tighten the centre lower screw halfway. Use an Allen key (AF 4) to do this.



   - Secure the upper enclosure lid in the sequence 1 to 5 (torque: 6 Nm). Use an Allen key (AF 4) to do this.

   ☑ The teeth of the conical spring washer press into the upper enclosure lid. The lid is thus earthed.



9. Close the lower enclosure lid and restart the inverter (see Section 9.3 "Closing the Inverter", page 66).

13 Decommissioning

13.1 Dismantling the Inverter

1. Disconnect the inverter from voltage sources and open it (see Section 9.2 "Disconnecting the Inverter from Voltage Sources", page 63).
2. 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.

3. If necessary, remove the padlock.
4. Remove the inverter by lifting it upwards off the wall mounting bracket.

13.2 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 an upper and lower transport lid.

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:

1. Dismantle the inverter (see Section 13.1 "Dismantling the Inverter", page 89).

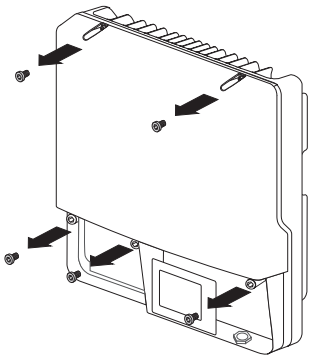
⚠ DANGER

Danger to life due to high voltages in the inverter

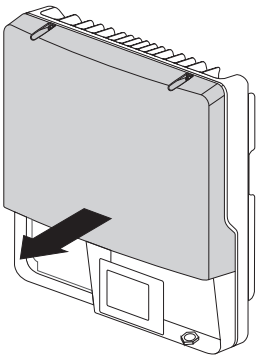
The capacitors in the inverter may be charged with very high voltages.

- Wait 5 minutes before opening the enclosure cover, in order to allow time for the capacitors to discharge.

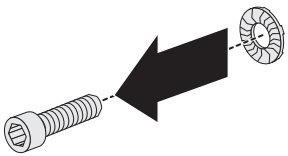
2. Undo the screws of the upper enclosure lid. Use an Allen key (AF 4) to do this.



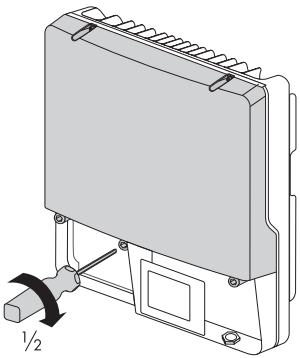
3. Pull the upper enclosure lid forwards to remove it.



4. Remove the two transport lids from the replacement device in the same manner.
5. Close and earth the replacement device:
   - Place one conical spring washer over each screw. The grooved side of the conical spring washer must face the screw head.

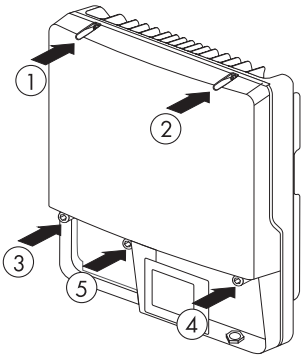


   - Attach the upper enclosure lid to the enclosure and tighten the centre lower screw halfway. Use an Allen key (AF 4) to do this.



– Fasten the upper enclosure lid in the sequence 1 to 5 (torque: 6 Nm). Use an Allen key (AF 4) to do this.

☑ The teeth of the conical spring washer press into the upper enclosure lid. The lid is thus earthed.



6. Mount the replacement device (see Section 5 "Mounting", page 25).
7. Connect the replacement device (see Section 6 "Electrical Connection", page 31).
8. Commission the replacement device (see Section 7 "Commissioning", page 57).
9. Now mount the two transport lids of the replacement device onto the defective inverter.
   ☑ You can now send the defective inverter back to SMA Solar Technology AG.

13.3 Packing the Inverter

- Package the inverter in the original packaging if available.
- If the original packaging is not available, use a cardboard box suitable for the weight and size of the inverter.

13.4 Storing the Inverter

Store the inverter in a dry place where ambient temperatures are always between –25°C and +60°C.

13.5 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 labelled "ZUR ENTSORGUNG" ("for disposal") (for contact, see page 113).

14 Technical Data

14.1 Sunny Boy 3000TL

DC Input

Maximum DC power at cos φ = 1	3,200 W
Maximum input voltage*	750 V
MPP voltage range	175 V ... 500 V
Rated input voltage	400 V
Minimum input voltage	125 V
Initial input voltage	150 V
Maximum input current	2 x 15 A
Maximum input current per string	15 A
Number of independent MPP inputs	2
Strings per MPP input	2

* 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	3,000 W
Maximum apparent AC power	3,000 VA
Rated grid voltage	230 V
AC nominal voltage	220 V / 230 V / 240 V
AC voltage range*	180 V ... 280 V
Nominal AC current at 220 V	13.6 A
Nominal AC current at 230 V	13.0 A
Nominal AC current at 240 V	12.5 A
Maximum output current	16 A
Total harmonic factor of output current at AC total harmonic factor < 2%, AC power > 0.5 nominal AC power	≤ 4%
Rated mains frequency	50 Hz
AC mains frequency*	50 Hz/60 Hz
Operating range at AC mains frequency 50 Hz	45 Hz ... 55 Hz
Operating range at AC mains frequency 60 Hz	55 Hz ... 65 Hz
Displacement power factor, adjustable	$0.8_{overexcited}$ ... $0.8_{underexcited}$
Feed-in phases	1
Connection phases	1
Overvoltage category as per IEC 60664-1	III

* Depending on country setting

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 3
Maximum permissible fuse protection	25 A
Earth fault monitoring	insulation monitoring: R_{Iso} > 625 k Ω
All-pole sensitive residual-current monitoring unit	available

General Data

Width x height x depth with Electronic Solar Switch	490 mm x 519 mm x 185 mm
Weight	26 kg
Length x width x height of packaging	597 mm x 617 mm x 266 mm
Transport weight	31 kg
Climatic category as per 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 MSL	2,000 m
Noise emission (typical)	≤ 25 dB(A)
Power loss in night operation	< 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 per 10/2012*	VDE 0126-1-1 C10/C11 PPDS UTE C15-712-1 PPC EN 50438 RD 1699 RD 661/2007 IEC 61727 (PEA) G83/1-1 G59/2 VDE-AR-N 4105 CEI 0-21 AS 4777 NRS 97-1-2

* C10/11 (05/2009): Only possible when the phase voltage is 230 V.

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

RD 1669 and RD 661/2007: contact the SMA Service Line for restrictions in specific regions.

NRS 97-1-2: 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 the case of grid failure (for more details, see NRS 97-1-2, Sec. 4.2.7.1 and 4.2.7.2)

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

Features

DC connection	SUNCLIX DC connector
AC connection	spring clamp terminal
Display	LC graphic display
Bluetooth	as standard
RS485, galvanically isolated	optional
Webconnect Data Module	optional
Multi-function relay	optional
Fan retrofit kit	optional
Power Control Module	optional

Electronic Solar Switch

Electrical endurance in the event of short circuit, at nominal current 35 A	at least 50 switching processes
Maximum switching current	35 A
Maximum switching voltage	800 V
Maximum PV power	12 kW
Degree of protection when plugged in	IP65
Degree of protection when unplugged	IP21

Torques

Upper enclosure lid screws	6.0 Nm
Lower enclosure lid screws	2.0 Nm
Additional earth terminal	6.0 Nm
SUNCLIX swivel nut	2.0 Nm
RS485 interface fastening screw	1.5 Nm
Multi-function relay fastening screw	1.5 Nm

Earthing Systems

TN-C	suitable
TN-S	suitable
TN-C-S	suitable
TT, if $U_{N_PE} < 15$ V	suitable

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

Efficiency

Maximum efficiency, η_{max}	97.0%
European weighted efficiency, η_{EU}	96.0%

14.2 Sunny Boy 3600TL

DC Input

Maximum DC power at cos φ = 1	3,880 W
Maximum input voltage*	750 V
MPP voltage range	175 V ... 500 V
Rated input voltage	400 V
Minimum input voltage	125 V
Initial input voltage	150 V
Maximum input current	2 x 15 A
Maximum input current per string	15 A
Number of independent MPP inputs	2
Strings per MPP input	2

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

AC Output

Rated power at 230 V, 50 Hz	3,680 W
Maximum apparent AC power	3,680 VA
Rated grid voltage	230 V
AC nominal voltage	220 V / 230 V / 240 V
AC voltage range*	180 V ... 280 V
Nominal AC current at 220 V	16 A
Nominal AC current at 230 V	16 A
Nominal AC current at 240 V	15.3 A
Maximum output current	16 A
Total harmonic factor of output current at AC total harmonic factor < 2%, AC power > 0.5 nominal AC power	≤ 4%
Rated mains frequency	50 Hz
AC mains frequency*	50 Hz/60 Hz
Operating range at AC mains frequency 50 Hz	45 Hz ... 55 Hz
Operating range at AC mains frequency 60 Hz	55 Hz ... 65 Hz
Displacement power factor, adjustable	$0.8_{overexcited}$ ... $0.8_{underexcited}$
Feed-in phases	1
Connection phases	1
Overvoltage category as per IEC 60664-1	III

* Depending on country setting

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 3
Maximum permissible fuse protection	32 A
Earth fault monitoring	Insulation monitoring: R_{Iso} > 500 kΩ
All-pole sensitive residual-current monitoring unit	available

General Data

Width x height x depth with Electronic Solar Switch	490 mm x 519 mm x 185 mm
Weight	26 kg
Length x width x height of packaging	597 mm x 617 mm x 266 mm
Transport weight	31 kg
Climatic category as per 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 MSL	2,000 m
Noise emission (typical)	≤ 29 dB(A)
Power loss in night operation	< 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 per 10/2012*	VDE 0126-1-1 C10/C11 PPDS UTE C15-712-1 PPC EN 50438 RD 1699 RD 661/2007 IEC 61727 (PEA) G83/1-1 G59/2 VDE-AR-N 4105 CEI 0-21 AS 4777 NRS 97-1-2

* C10/11 (05/2009): Only possible when the phase voltage is 230 V.

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

RD 1669 and RD 661/2007: contact the SMA Service Line for restrictions in specific regions.

NRS 97-1-2: 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 the case of grid failure (for more details, see NRS 97-1-2, Sec. 4.2.7.1 and 4.2.7.2)

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

Features

DC connection	SUNCLIX DC connector
AC connection	spring clamp terminal
Display	LC graphic display
Bluetooth	as standard
RS485, galvanically isolated	optional
Webconnect Data Module	optional
Multi-function relay	optional
Fan retrofit kit	optional
Power Control Module	optional

Electronic Solar Switch

Electrical endurance in the event of short circuit, at nominal current 35 A	at least 50 switching processes
Maximum switching current	35 A
Maximum switching voltage	800 V
Maximum PV power	12 kW
Degree of protection when plugged in	IP65
Degree of protection when unplugged	IP21

Torques

Upper enclosure lid screws	6.0 Nm
Lower enclosure lid screws	2.0 Nm
Additional earth terminal	6.0 Nm
SUNCLIX swivel nut	2.0 Nm
RS485 interface fastening screw	1.5 Nm
Multi-function relay fastening screw	1.5 Nm

Earthing Systems

TN-C	suitable
TN-S	suitable
TN-C-S	suitable
TT, if $U_{N_PE} < 15$ V	suitable

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

Efficiency

Maximum efficiency, η_{max}	97.0%
European weighted efficiency, η_{EU}	96.3%

14.3 Sunny Boy 4000TL

DC Input

Maximum DC power at cos φ = 1	4,200 W
Maximum input voltage*	750 V
MPP voltage range	175 V ... 500 V
Rated input voltage	400 V
Minimum input voltage	125 V
Initial input voltage	150 V
Maximum input current	2 x 15 A
Maximum input current per string	15 A
Number of independent MPP inputs	2
Strings per MPP input	2

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

AC Output

Rated power at 230 V, 50 Hz	4,000 W
Maximum apparent AC power	4,000 VA
Rated grid voltage	230 V
AC nominal voltage	220 V / 230 V / 240 V
AC voltage range*	180 V ... 280 V
Nominal AC current at 220 V	18.2 A
Nominal AC current at 230 V	17.4 A
Nominal AC current at 240 V	16.7 A
Maximum output current	22 A
Total harmonic factor of output current at AC total harmonic factor < 2%, AC power > 0.5 nominal AC power	≤ 4%
Rated mains frequency	50 Hz
AC mains frequency*	50 Hz/60 Hz
Operating range at AC mains frequency 50 Hz	45 Hz ... 55 Hz
Operating range at AC mains frequency 60 Hz	55 Hz ... 65 Hz
Displacement power factor, adjustable	$0.8_{overexcited}$ ... $0.8_{underexcited}$
Feed-in phases	1
Connection phases	1
Overvoltage category as per IEC 60664-1	III

* Depending on country setting

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 3
Maximum permissible fuse protection	32 A
Earth fault monitoring	Insulation monitoring: R_{Iso} > 500 kΩ
All-pole sensitive residual-current monitoring unit	available

General Data

Width x height x depth with Electronic Solar Switch	490 mm x 519 mm x 185 mm
Weight	26 kg
Length x width x height of packaging	597 mm x 617 mm x 266 mm
Transport weight	31 kg
Climatic category as per 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 MSL	2,000 m
Noise emission (typical)	≤ 29 dB(A)
Power loss in night operation	< 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 per 10/2012*	VDE 0126-1-1 C10/C11 PPDS UTE C15-712-1 PPC EN 50438 RD 1699 RD 661/2007 IEC 61727 (PEA) G83/1-1 G59/2 VDE-AR-N 4105 CEI 0-21 AS 4777 NRS 97-1-2

* C10/11 (05/2009): Only possible when the phase voltage is 230 V.

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

RD 1669 and RD 661/2007: contact the SMA Service Line for restrictions in specific regions.

NRS 97-1-2: 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 97-1-2, Sec. 4.2.7.1 and 4.2.7.2)

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

Features

DC connection	SUNCLIX DC connector
AC connection	spring clamp terminal
Display	LC graphic display
Bluetooth	as standard
RS485, galvanically isolated	optional
Webconnect Data Module	optional
Multi-function relay	optional
Fan retrofit kit	optional
Power Control Module	optional

Electronic Solar Switch

Electrical endurance in the event of short circuit, at nominal current 35 A	at least 50 switching processes
Maximum switching current	35 A
Maximum switching voltage	800 V
Maximum PV power	12 kW
Degree of protection when plugged in	IP65
Degree of protection when unplugged	IP21

Torques

Upper enclosure lid screws	6.0 Nm
Lower enclosure lid screws	2.0 Nm
Additional earth terminal	6.0 Nm
SUNCLIX swivel nut	2.0 Nm
RS485 interface fastening screw	1.5 Nm
Multi-function relay fastening screw	1.5 Nm

Earthing Systems

TN-C	suitable
TN-S	suitable
TN-C-S	suitable
TT, if $U_{N_PE} < 15$ V	suitable

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

Efficiency

Maximum efficiency, η_{max}	97.0%
European weighted efficiency, η_{EU}	96.4%

14.4 Sunny Boy 5000TL

DC Input

Maximum DC power at cos φ = 1	5,200 W
Maximum input voltage*	750 V
MPP voltage range	175 V ... 500 V
Rated input voltage	400 V
Minimum input voltage	125 V
Initial input voltage	150 V
Maximum input current	2 x 15 A
Maximum input current per string	15 A
Number of independent MPP inputs	2
Strings per MPP input	2

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

AC Output

Rated power at 230 V, 50 Hz	4,600 W
Maximum apparent AC power*	5,000 VA
Rated grid voltage	230 V
AC nominal voltage	220 V / 230 V / 240 V
AC voltage range**	180 V ... 280 V
Nominal AC current at 220 V	20.9 A
Nominal AC current at 230 V	20.0 A
Nominal AC current at 240 V	19.2 A
Maximum output current	22 A
Total harmonic factor of output current at AC total harmonic factor < 2%, AC power > 0.5 nominal AC power	≤ 4%
Rated mains frequency	50 Hz
AC power frequency**	50 Hz/60 Hz
Operating range at AC mains frequency 50 Hz	45 Hz ... 55 Hz
Operating range at AC mains frequency 60 Hz	55 Hz ... 65 Hz
Displacement power factor, adjustable	$0.8_{overexcited}$ ... $0.8_{underexcited}$
Feed-in phases	1
Connection phases	1
Overvoltage category as per IEC 60664-1	III

* at country configuration VDE-AR-N-4105: 4,600 VA
** depending on country configuration

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 3
Maximum permissible fuse protection	32 A
Earth fault monitoring	Insulation monitoring: R_{Iso} > 400 k Ω
All-pole sensitive residual-current monitoring unit	available

General Data

Width x height x depth with Electronic Solar Switch	490 mm x 519 mm x 185 mm
Weight	26 kg
Length x width x height of packaging	597 mm x 617 mm x 266 mm
Transport weight	31 kg
Climatic category as per 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 MSL	2,000 m
Noise emission (typical)	≤ 29 dB(A)
Power loss in night operation	< 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 per 10/2012*	VDE 0126-1-1 C10/C11 PPDS UTE C15-712-1 PPC EN 50438 RD 1699 RD 661/2007 IEC 61727 (PEA) G83/1-1 G59/2 VDE-AR-N 4105 CEI 0-21 AS 4777 NRS 97-1-2

* C10/11 (05/2009): Only possible when the phase voltage is 230 V.

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

RD 1669 and RD 661/2007: contact the SMA Service Line for restrictions in specific regions.

NRS 97-1-2: 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 the case of grid failure (for more details, see NRS 97-1-2, Sec. 4.2.7.1 and 4.2.7.2)

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

Features

DC connection	SUNCLIX DC connector
AC connection	spring clamp terminal
Display	LC graphic display
Bluetooth	as standard
RS485, galvanically isolated	optional
Webconnect Data Module	optional
Multi-function relay	optional
Fan retrofit kit	optional
Power Control Module	optional

Electronic Solar Switch

Electrical endurance in the event of short circuit, at nominal current 35 A	at least 50 switching processes
Maximum switching current	35 A
Maximum switching voltage	800 V
Maximum PV power	12 kW
Degree of protection when plugged in	IP65
Degree of protection when unplugged	IP21

Torques

Upper enclosure lid screws	6.0 Nm
Lower enclosure lid screws	2.0 Nm
Additional earth terminal	6.0 Nm
SUNCLIX swivel nut	2.0 Nm
RS485 interface fastening screw	1.5 Nm
Multi-function relay fastening screw	1.5 Nm

Earthing Systems

TN-C	suitable
TN-S	suitable
TN-C-S	suitable
TT, if $U_{N_PE} < 15$ V	suitable

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

Efficiency

Maximum efficiency, η_{max}	97.0%
European weighted efficiency, η_{EU}	96.5%

15 Accessories

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

Description	Brief description	SMA order number
Replacement varistors	Set of thermally monitored varistors	MSWR-TV9
Electronic Solar Switch	ESS handle (spare)	Please order the new ESS handle via the SMA Service Line (see Section 16 "Contact", page 113).
RS485 retrofit kit	RS485 interface	DM-485CB-10
Webconnect Data Module	Interface for communication via Speedwire incl. Webconnect for data exchange with Sunny Portal	SWDM-10
SUNCLIX DC connector	Field plug for conductor cross-sections of 2.5 mm^2 ... 6 mm^2	SUNCLIX-FC6-SET
Additional fan kit	Fan for installation in the inverter	FANKIT01-10
Power Control Module	Interface for direct connection to a radio ripple control receiver, incl. multi-function relay	PWCMOD-10

16 Contact

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

- Inverter type
- Inverter serial number
- Type and number of the PV modules connected
- Event number and display message on the inverter
- Optional equipment (e.g. communication products)
- If applicable: type of external wiring of the multi-function relay

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SMA Service Line

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