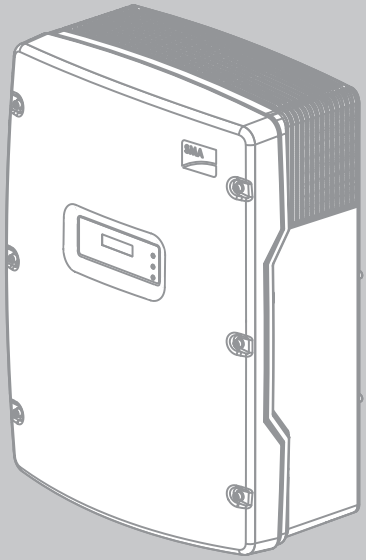
PV Inverter

SUNNY MINI CENTRAL 9000TL / 10000TL / 11000TL with Reactive Power Control

Installation Manual



SMC9-11TLRP-IA-en-51 | IMEN-SMCTLRP | Version 5.1

EN

Table of Contents

1 Information on this Document

Validity

This document is valid for the following device types:

- SMC 9000TLRP-10
- SMC 10000TLRP-10
- SMC 11000TLRP-10

Target Group

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

Additional Information

Links to additional information can be found at www.SMA-Solar.com:

Document title	Document type
Three-Phase Grid Connection	Technical information
Miniature Circuit-Breaker	Technical information
Module Technology	Technical information
Operating Parameters	Technical description
Insulation Resistance (R_{iso}) of Non-Galvanically Isolated PV Plants	Technical information
PV Inverters – Overview of Country Data Sets	Technical description

Symbols

Symbol	Explanation
⚠ DANGER	Indicates a hazardous situation which, if not avoided, will result in death or serious injury
⚠ WARNING	Indicates a hazardous situation which, if not avoided, could result in death or serious injury
⚠ CAUTION	Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury
NOTICE	Indicates a situation which, if not avoided, could result in property damage
i	Information that is important for a specific topic or goal, but is not safety-relevant
☐	Indicates a requirement for achieving a specific goal
☑	Desired result
✖	A problem that might occur

Typographies

Typography	Usage	Example
Bold	• Display messages • Parameter • Connections • Slots • Elements to be selected • Elements to be entered	• The inverter displays the status **Balanced**. • Select the parameter **FanTest** and set it to **1**.

Nomenclature

Complete designation	Designation in this document
Electronic Solar Switch	ESS
SMA *Bluetooth*® Wireless Technology	*Bluetooth*
Sunny Mini Central	Inverter, product

Abbreviations

Abbreviation	Designation	Explanation
AC	Alternating Current	–
DC	Direct Current	–
DSP	Digital Signal Processor	–
EC	European Community	–
EEPROM	Electrically Eraseable Programmable Read-Only Memory	–
LED	Light-Emitting Diode	–
MPP	Maximum Power Point	–
MSL	Mean Sea Level	–
OCU	Operation Control Unit	–
PC	Personal Computer	–
PE	Protective Earth	Protective conductor
PV	Photovoltaics	–
RP	Reactive Power	–

2 Safety

2.1 Intended Use

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

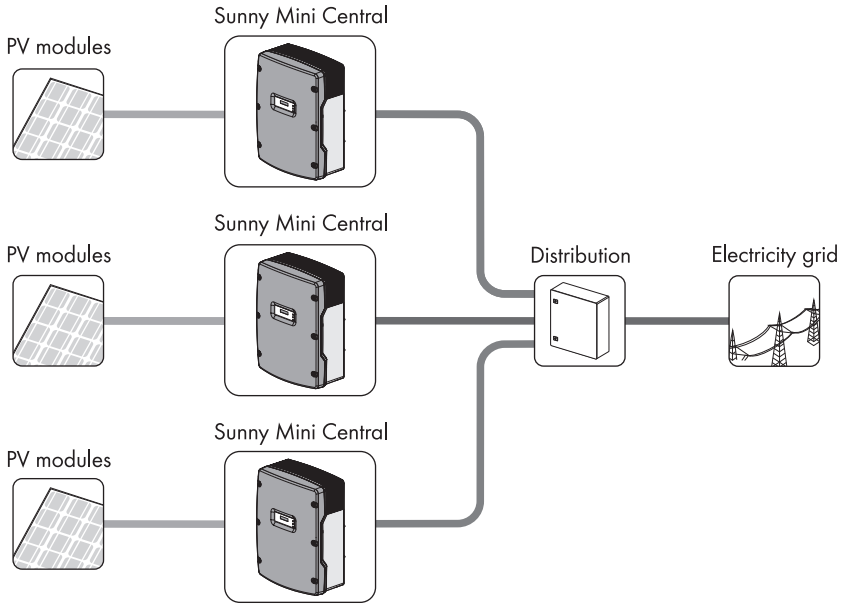


Figure 1: Design of a PV plant with three Sunny Mini Central inverters

The Sunny Mini Central is suitable for indoor and outdoor use.

The Sunny Mini Central should only be operated with PV arrays (PV modules and cabling) of protection class II. The PV modules used must be released by the module manufacturer for use with this Sunny Mini Central.

PV modules with a high capacity to earth should only be used if their coupling capacity does not exceed 1,400 nF.

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

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

For safety reasons, it is forbidden to modify the product or install components that are not explicitly recommended or distributed by SMA Solar Technology AG.

Only use the Sunny Mini Central in accordance with the information provided in the enclosed documentation. Any other application may cause injury to persons or lead to property damage.

- Do not mount the product on flammable construction materials.
- Do not mount the product in areas where highly flammable materials are stored.
- Do not install the product in potentially explosive atmospheres.

The enclosed documentation is an integral part of this product.

- Read and observe the documentation.
- Keep the documentation in a convenient place for future reference.

2.2 Qualifications of Skilled Persons

The work described in this document must be performed by skilled persons only. Skilled persons must have the following qualifications:

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

2.3 Safety Precautions

Electric Shock

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

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

Touching an unearthed PV module or an array frame can cause a fatal electric shock.

- Connect and earth the PV modules, array frame and electrically conductive surfaces so that there is continuous conduction. Observe the applicable local regulations.

Burn Hazards

Some parts of the enclosure can become hot during operation.

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

Environmental Influences

When closed and with the ESS plugged in, the inverter has the degree of protection IP65.

If the ESS is not plugged in or incorrectly plugged in during operation, moisture and dust can penetrate the inverter. If the ESS is not correctly plugged in, this can cause contacts in the ESS to wear or the ESS might fall out of the socket. This can result in yield loss and damage to the ESS.

- If the ESS is not plugged in, the inverter must be protected against moisture and dust.
- After performing any work on inverters, plug the ESS back in as follows:
  - Do not tighten the screw inside the ESS.
  - Firmly plug in the ESS until it is flush with the enclosure.
  - Ensure that the gap between the ESS and the enclosure is no more than 1 mm.

Electrostatic Discharge

Touching electronic components can cause damage to or destroy the inverter through electrostatic discharge.

- Earth yourself before touching any components.

3 Scope of Delivery

Check the scope of delivery for completeness and any externally visible damage. Contact your specialist dealer if the delivery is incomplete or damaged.

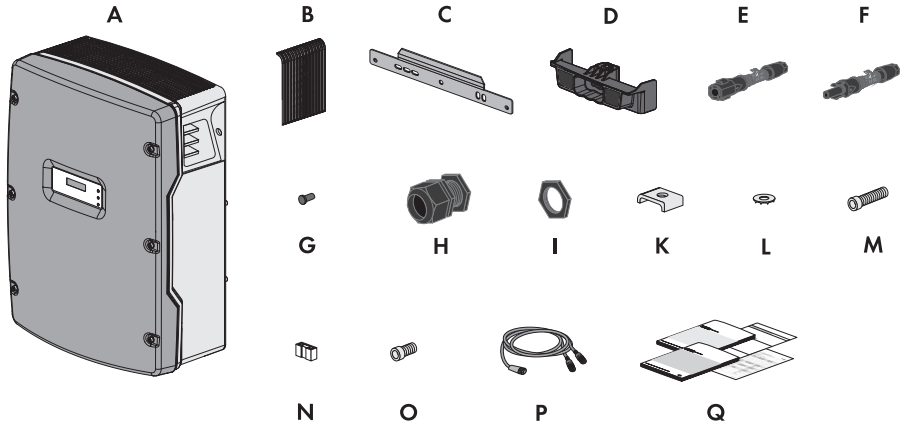


Figure 2: Components of the delivery

Position	Quantity	Designation
A	1	Sunny Mini Central
B	2	Ventilation grid
C	1	Wall mounting bracket
D	1	Electronic Solar Switch
E	5	Positive DC connector
F	5	Negative DC connector
G	10	Sealing plug
H	1	Cable gland
I	1	Counter nut
K	1	Clamping bracket
L	2	Conical spring washer*
M	2	M6x16 cheese-head screw*
N	1	Jumper
O	2	M6x8 cheese-head screw
P	1	Y cable**

Position	Quantity	Designation
Q	1	Installation manual, user manual, document set with explanations and certificates, supplementary sheet with the default settings

* 1 spare part for the enclosure lid included

** Optional

4 Product Description

4.1 Sunny Mini Central

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

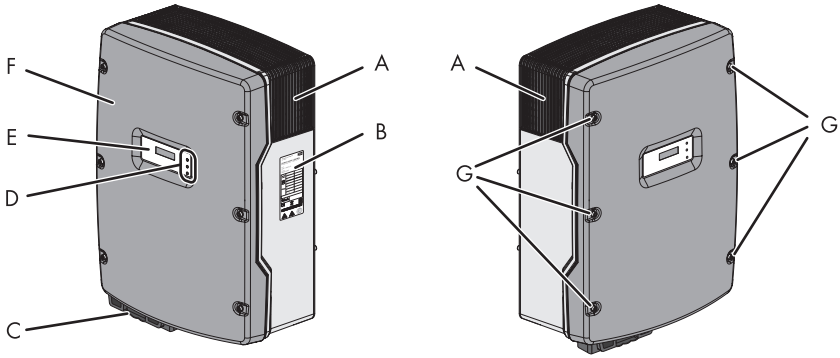


Figure 3: Design of the Sunny Mini Central

Item	Designation
A	Ventilation grid
B	Type label
C	Electronic Solar Switch (ESS)
D	LEDs
E	Display
F	Enclosure lid
G	Screws of the enclosure lid

Symbols on the Inverter

Icon	Designation	Explanation
	Tapping	You can operate the display by tapping it: • Single tap: Switch on display illumination or switch to the next display message. • Tapping twice: The inverter shows the display messages from the start-up phase. After two minutes, the backlight switches off automatically.
	Inverter	This symbol defines the function of the green LED. The green LED indicates the operating state of the inverter.
	Earth fault	This symbol defines the function of the red LED. The red LED indicates an earth fault, a defective varistor or a defective string fuse.
	Observe the documentation.	This symbol defines the function of the yellow LED which indicates a fault or disturbance. Read the manual to remedy the fault or disturbance.
	Protective conductor	This symbol indicates the position for the protective conductor connection.
	Danger to life due to high voltages in the inverter; observe waiting time.	High voltages that can cause fatal electric shocks are present in the live components of the inverter. The capacitors take ten minutes to discharge. Prior to performing any work on the inverter, disconnect it from all voltage sources, as described in this document (see section 9).
	QR Code®	The QR Code® links to the SMA Bonus Programme (for information see www.SMA-Bonus.com).

4.2 Type Label

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

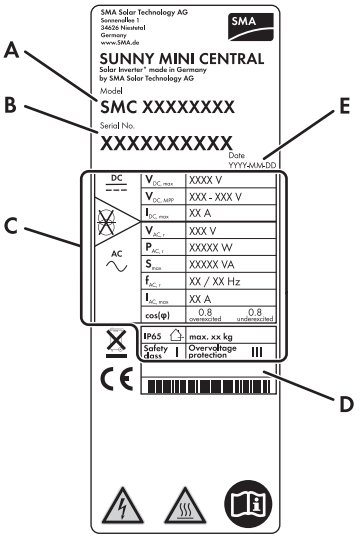


Figure 4: Layout of the type label

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

You require the information on the type label to use the product safely and for questions to the SMA Service Line. The type label must be permanently attached to the product.

Symbols on the Type Label

Icon	Designation	Explanation
	Danger to life due to high voltages	The inverter operates at high voltages. All work on the inverter must be carried out by skilled persons only.
	Risk of burns from hot surfaces	The inverter can get hot during operation. Avoid contact during operation. Allow the inverter 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 inverter.
DC	DC	Direct current
	Without transformer	The inverter does not have a transformer.
AC 	AC	Alternating current
	Proper disposal	Do not dispose of the inverter together with the household waste.
CE	CE marking	The inverter complies with the requirements of the applicable EU directives.
IP65	Degree of protection	The inverter is protected against dust intrusion and water jets from any angle.
	Outdoor	The inverter is suitable for outdoor installation.
	RAL quality mark for solar products	The inverter complies with the requirements of the German Institute for Quality Assurance and Labelling.
	Australian mark of conformity	The inverter complies with the requirements of the applicable Australian guidelines.

Icon	Designation	Explanation
	Korean mark of conformity	The inverter complies with the requirements of the applicable Korean guidelines.
	Chinese mark of conformity	The inverter complies with the requirements of the applicable Chinese guidelines.

4.3 Display and LEDs

The display and the LEDs of the inverter are located on the enclosure lid and indicate the operating state of the inverter.

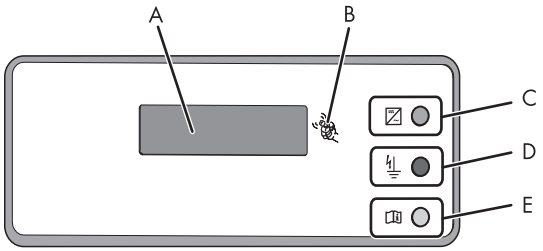


Figure 5: Design of the display

Position	Designation	Explanation
A	Display	2-line LC text display for displaying operating data
B	Tap symbol	You can operate the display by tapping it: • Tapping once: Switch on display illumination or switch to the next display message. • Tapping twice in quick succession: The inverter shows the display messages from the start-up phase. After two minutes, the backlight switches off automatically.
C	Green LED	Indicates the operating state of the inverter.
D	Red LED	Indicates an earth fault, a defective varistor or a defective string fuse.
E	Yellow LED	Indicates an error or fault. Read the manual to rectify the error or fault.

The display shows the current operating data of the inverter (e.g. mode, performance, input voltage) and errors or faults (see section 10.2 "Display Messages", page 58).

The LEDs indicate the operating state of the inverter, and clarify the messages in the display using different blink codes (see section 10.1 "LED Signals", page 56).

4.4 Electronic Solar Switch (ESS)

The ESS and the DC connectors form a DC load disconnect unit.

There are two types of ESS with different plug designs. The function of the ESS is identical in both cases.

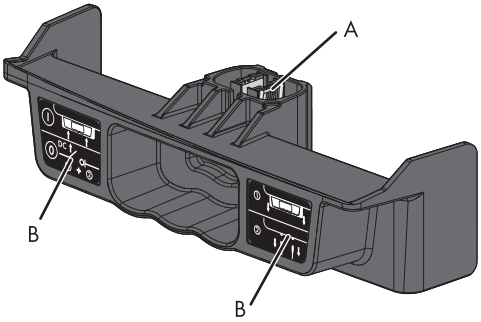


Figure 6: Example of ESS design with visible metal mounting tab

Item	Designation	Explanation
A	Plug	Depending on the type of ESS, the metal mounting tabs in the plug are visible or in a plastic enclosure.
B	Label	• ❶ If the ESS is plugged in, the DC electric circuit is closed. • ❷ To interrupt the DC electric circuit, you must first perform steps 1 and 2 consecutively. • ❶ Remove the ESS. • ❷ Remove all DC connectors.

When plugged in, the ESS forms a conductive path between the PV array and the inverter. Removing the ESS interrupts the DC electric circuit and removing all DC connectors disconnects the PV array completely from the inverter.

4.5 SMA Power Balancer

The SMA Power Balancer is a function of the Sunny Mini Central, which allows three-phase grid connection.

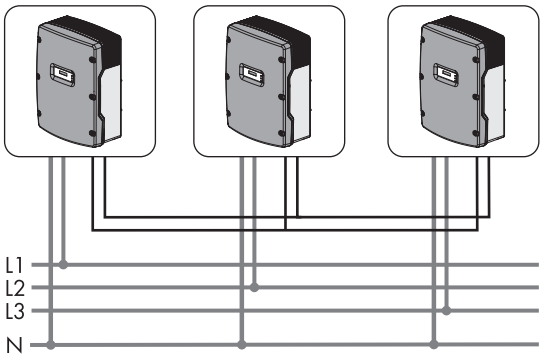


Figure 7: Design of a three-phase feed-in unit with three Sunny Mini Central inverters with SMA Power Balancer

Using the SMA Power Balancer, you can connect three Sunny Mini Central inverters to a three-phase feed-in unit, preventing unbalanced loads. Unbalanced load refers to power fed-in asymmetrically, which depends on the country data set selected and may be between 4.6 kVA and 6 kVA.

Taking the local network operator's connection conditions into account, you can use the SMA Power Balancer to implement three-phase line-voltage monitoring. This disconnects all three Sunny Mini Central inverters completely from the electricity grid or limits their power in the event of a grid error.

The connections for the SMA Power Balancer are galvanically isolated from the rest of the Sunny Mini Central electronic circuit.

This Sunny Mini Central has a socket for connecting the SMA Power Balancer to the bottom of the inverter. To connect three Sunny Mini Central inverters of the same type, you need a special Y cable. You can only connect Sunny Mini Central inverters which have the same type of connection for the SMA Power Balancer to one another. Sunny Mini Central inverters with a different type of connection for the SMA Power Balancer can be retrofitted and connected with the Y cable.

Operating Modes of the SMA Power Balancer

Wenn setting the country data set VDE-AR-N4105-HP, the SMA Power Balancer is activated by default and set to the operating mode **PowerGuard**. If the SMA Power Balancer is not connected to the other inverters, there is no communicative coupling between the inverters and the different line conductors and the feed-in power of the inverter is limited to 4.6 kVA.

By default, the SMA Power Balancer is deactivated for all other country data sets and can only be activated with an SMA communication product. To activate the SMA Power Balancer, you can choose from three operating modes.

Operating mode	Explanation
Off	The SMA Power Balancer is deactivated (default setting). If one of the three inverters indicates a line voltage error or a device fault, only the inverter affected disconnects from the electricity grid. The other two inverters continue to feed in at full power.
FaultGuard	This operating mode allows you to implement three-phase line-voltage monitoring, which also reacts to device faults. • If one of the three inverters indicates a line-voltage error and stops feeding in, the other two inverters also disconnect from the electricity grid immediately. • If one of the three inverters indicates a device fault and stops feeding in, the other two inverters also disconnect from the electricity grid after five minutes.
PhaseGuard	This operating mode allows you to implement three-phase line-voltage monitoring. • If one of the three inverters indicates a line-voltage error and stops feeding in, the other two inverters also disconnect from the electricity grid immediately. • If one of the three inverters indicates a device fault and stops feeding in, the other two inverters continue to feed in at full power.
PowerGuard	You can select this operating mode if the entire PV plant consists only of three Sunny Mini Central inverters and, in the event of an error, unbalanced load is to be limited to between 4.6 kVA and 6 kVA depending on the country data set selected. • If one of the three inverters indicates a line voltage error or device fault and stops feeding in, the other two inverters automatically limit their power to between 4.6 kVA and 6 kVA depending on the country data set selected.

4.6 Communication

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

You can only set the operating parameters of the inverter via SMA communication products.

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

Example: How the country data set parameter is displayed

For communication via RS485: parameter **CntrySet**

For communication with *Bluetooth*: parameter **Set country standard**

This manual specifies the parameter names and messages of the two types of communication.

In the inverter display, the parameters and messages are depicted independently of the connected communication interface and may also differ.

4.7 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 "Operating Parameters" at www.SMA-Solar.com).

4.8 Fuse Holders for String Fuses

The inverter is equipped with five fuse holders for string fuses. String fuses allow the inverter to protect the PV modules against possible reverse currents.

Whether you have to install string fuses in the inverter depends on the reverse-current resistance of the PV modules used and the number of strings directly connected to the inverter (for information on the string fuses, see the Technical Information "Use of String Fuses" at www.SMA-Solar.com).

Use only the string fuses available from SMA Solar Technology AG (see section 13 "Accessories", page 91).

Note that the string fuses are a precautionary measure only to minimise the risk of fire in the event of an error, for example. Using string fuses does not guarantee that the PV array is protected against consequential damage.

4.9 Varistors

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

Varistors can become worn and lose their protective function with age or repeated strain as a result of overvoltage. The inverter detects if one of the varistors is defective and indicates an error (see section 10 "Troubleshooting", page 56).

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.

4.10 SMA Grid Guard

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

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

In some countries, the connection conditions require a device which protects grid-relevant operating parameters against unpermitted changes. SMA Grid Guard performs this function.

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

4.11 All-Pole Sensitive Residual-Current Monitoring Unit

The inverter is equipped with an all-pole sensitive residual-current monitoring unit with an integrated differential current sensor.

The all-pole-sensitive residual-current monitoring unit detects alternating and direct differential currents. The integrated differential current sensor detects the current difference between the neutral conductor and the number of line conductors for single-phase and three-phase inverters. If the current difference increases suddenly, the inverter disconnects from the electricity grid.

If an external residual-current device is required or planned, you must install a residual-current device which trips at a residual current of 100 mA or higher. That ensures that the inverter does not disconnect from the electricity grid due to leakage currents caused by operation. If the locally applicable installation regulations require the use of a residual-current device that trips at a lower residual current, e.g. 30 mA, leakage currents caused by operation can cause false tripping.

5 Mounting

5.1 Selecting the Mounting Location

Requirements for the mounting location:

⚠ WARNING

Danger to life due to fire or explosion

Despite careful construction, electrical devices can cause fires.

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

- ☐ The mounting location must be inaccessible to children.
- ☐ A solid surface must be available for mounting, e.g. concrete or masonry. When mounted on plasterboard or similar materials, the inverter will develop audible vibrations during operation, which could be considered disturbing.
- ☐ It may not be mounted on a pillar.
- ☐ The mounting location must be suitable for the weight and dimensions of the inverter (see section 12 "Technical Data", page 82).
- ☐ The mounting location must be freely and safely accessible at all times without the necessity for any auxiliary equipment, such as scaffolding or lifting platforms. Non-fulfillment of these criteria may restrict servicing.
- ☐ The installation site should not be exposed to direct solar irradiation. Direct solar irradiation can heat up the inverter excessively. As a result, the inverter reduces its power output.
- ☐ Climatic conditions must be met (see section 12 "Technical Data", page 82).
- ☐ The ambient temperature must be below 40°C to ensure the optimal operation of the inverter.

Dimensions for wall mounting:

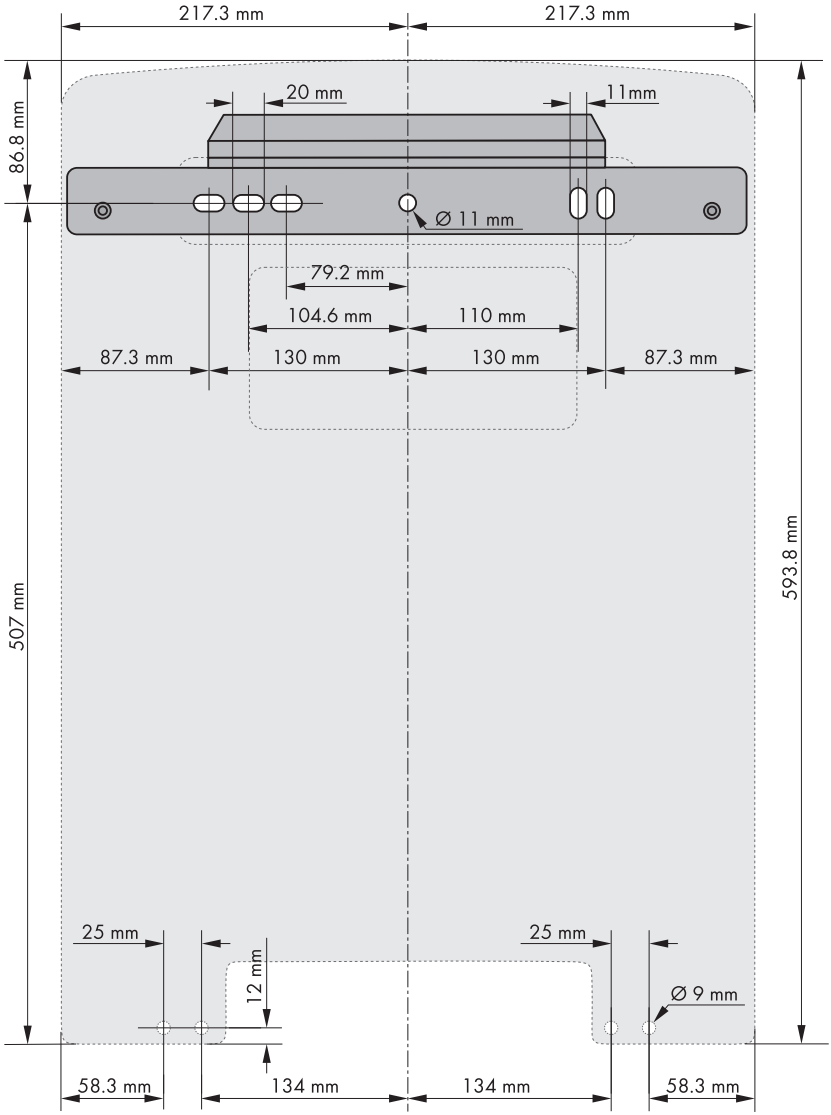


Figure 8: Dimensions of the wall mounting bracket and dimensions of the holes for the optional anti-theft device in the inverter enclosure

Observe recommended clearances:

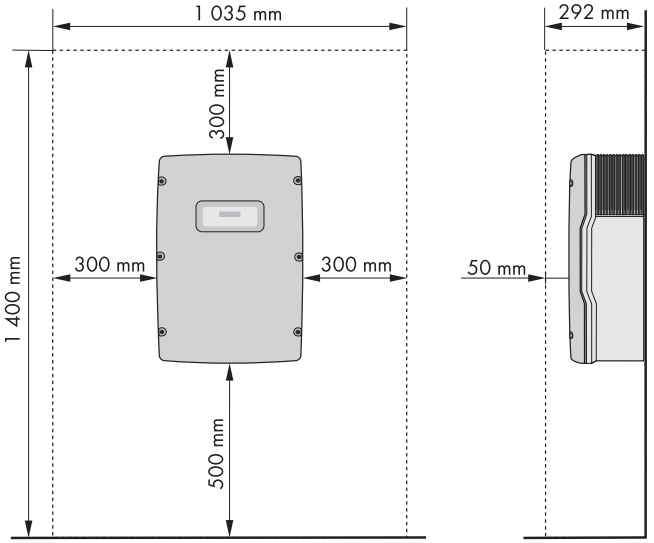


Figure 9: Recommended clearances

- Observe the recommended clearances to the walls as well as to other inverters or objects. This ensures adequate heat dissipation and sufficient space to remove the ESS.
- If multiple inverters are mounted in areas with high ambient temperatures, increase the clearances between the inverters and ensure an adequate fresh-air supply.
  ☑ This prevents a reduction in inverter power as a result of high temperatures (details on temperature derating can be found in the Technical Information "Temperature Derating" at www.SMA-Solar.com).

Observe the permitted mounting position:

Figure 10: Permitted and prohibited mounting positions

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

5.2 Mounting the Inverter

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

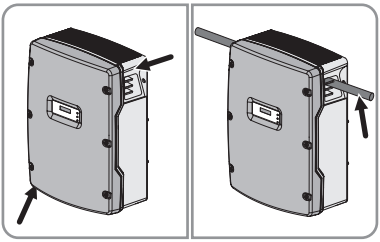
- ☐ At least two screws which are suitable for the weight of the inverter and the surface
- ☐ At least two washers that are suitable for the screws
- ☐ At least two wall plugs that are suitable for the mounting surface and for the screws
- ☐ If the inverter is to be secured against theft, at least one safety screw and one wall plug suitable for the safety screw

⚠ CAUTION

Risk of injury when lifting and from falling inverter

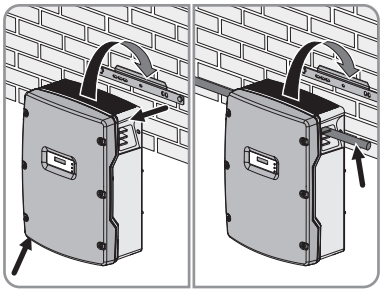
The inverter is heavy (see section 12 "Technical Data", page 82). Lifting the inverter incorrectly, or if it falls during transportation or while attaching it to the wall mounting bracket result in a risk of injury.

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

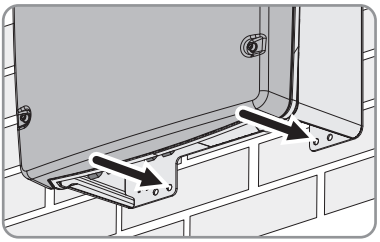


1. Ensure that there are no cables in the wall which could be damaged when drilling.
2. Align the wall mounting bracket horizontally on the wall and use it to mark the position of the drill holes. Use at least one hole on the left-hand side and one on the right-hand side of the wall mounting bracket.
3. Drill the holes and insert the wall plugs.
4. Secure the wall mounting bracket horizontally on the wall using screws and washers.

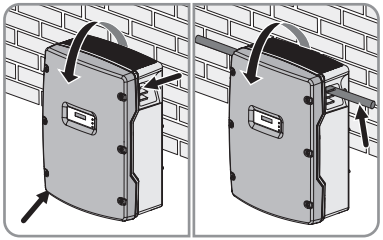
5. If the inverter is to be secured against theft, mark the drill hole for the attachment of the safety screw:
   - Hook the inverter into the wall mounting bracket.



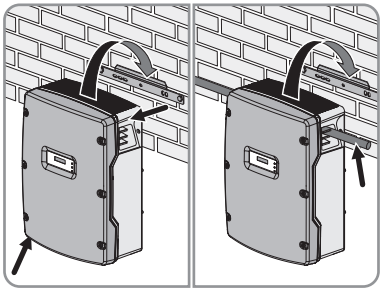
   - Mark the drill hole on the left-hand side or right-hand side. If you want to secure the inverter with two safety screws, mark both drill holes.



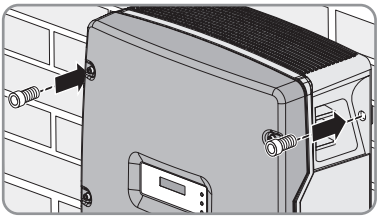
   - Remove the inverter by lifting it up vertically and out of the wall mounting bracket.



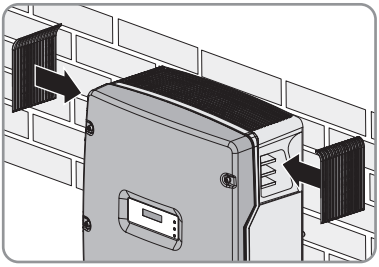
   - Drill the hole or holes to attach the safety screw and insert the wall plug(s).
6. Hook the inverter into the wall mounting bracket.



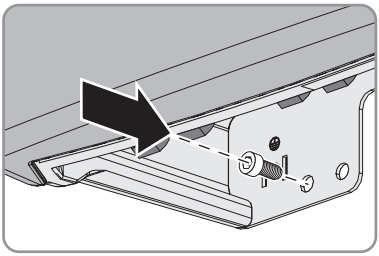
7. Attach the inverter to the wall mounting bracket on both sides using the M6x8 screws provided and an Allen key (AF 5). Only tighten the screws hand-tight. That prevents the inverter being lifted out.



8. Close the recessed grips with the ventilation grids. Ensure the assignment is correct. The correct assignment is marked on the inside of each ventilation grid: **links/left** for the left-hand side and **rechts/right** for the right-hand side.



9. If the holes for attaching the safety screw are pre-drilled, secure the inverter with at least one safety screw through the pre-drilled hole.



10. Ensure that the inverter is securely attached.

6 Electrical Connection

6.1 Safety during Electrical Connection

Electric Shock

When exposed to sunlight, the PV array generates dangerous DC voltage which is present in the DC conductors and the live components of the inverter. Touching the DC conductors or the live components can lead to lethal electric shocks.

- Do not touch the DC conductors.
- Do not touch any live components of the inverter.
- Before performing any work on the inverter, always disconnect it from all voltage sources, as described in this document (see section 9).

Electrostatic Discharge

Touching electronic components can cause damage to or destroy the inverter through electrostatic discharge.

- Earth yourself before touching any components.

6.2 Overview of the Connection Area

6.2.1 Bottom View

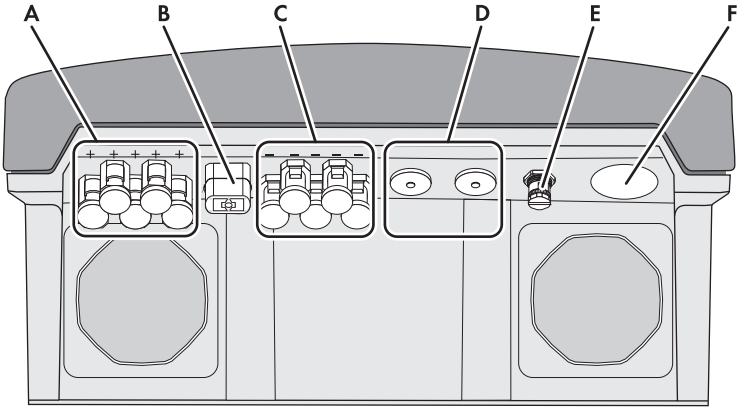


Figure 11: Connection areas and enclosure openings at the bottom of the inverter

Item	Designation	Explanation
A	Positive DC connector with filler plug	For connecting the positive DC cables
B	Socket	For connecting the ESS
C	Negative DC connector with filler plug	For connecting the negative DC cables
D	Enclosure opening	For routing the data cables through
E	Socket	For connecting the SMA Power Balancer
F	Enclosure opening	For routing the AC cable through

6.2.2 Interior View

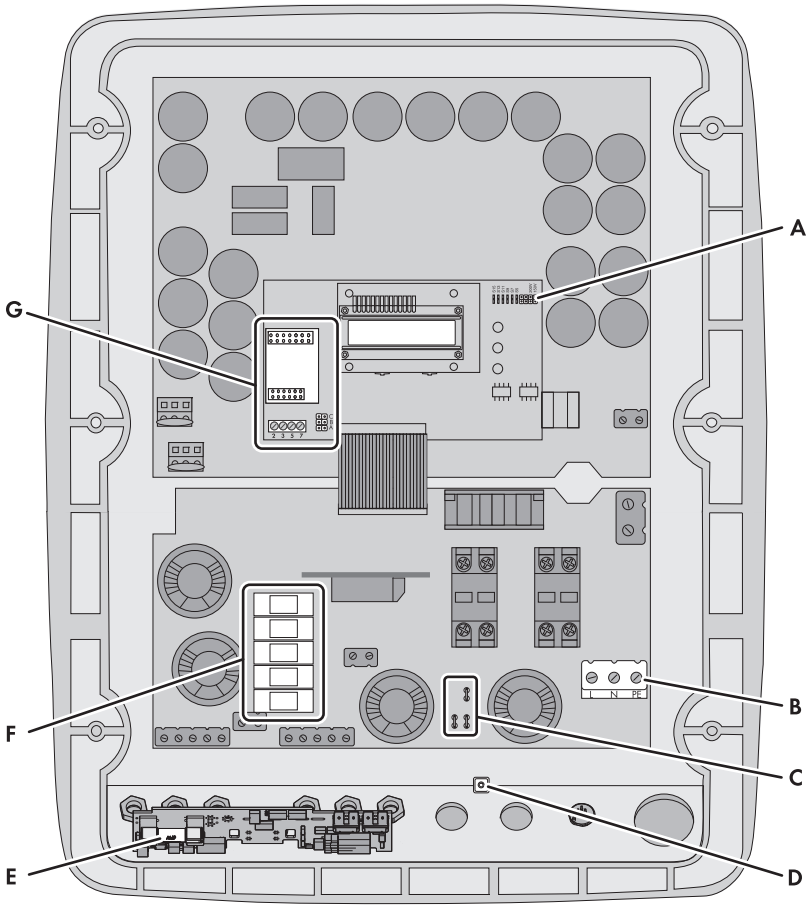


Figure 12: Components and connection areas in the interior of the inverter

Item	Designation	Explanation
A	Jumper slot	For checking the fans
B	Terminal	For the AC cable
C	Flat male tabs	For earthing the cable shield of the data cable
D	Screw fixture for the shield connection terminal	For earthing the cable shield of the data cable
E	Fuse	For the ESS

Item	Designation	Explanation
F	Fuse holders	For installing the string fuses
G	Connection area and slot	For communication interfaces

6.3 AC Connection

6.3.1 Conditions for AC Connection

Cable requirements:

- ☐ Conductor cross-section without bootlace ferrule: maximum 25 mm².
- ☐ Conductor cross-section with bootlace ferrule: maximum 10 mm².
- ☐ At a conductor cross-section of 25 mm², a flexible cable must be used.
- ☐ When designing the conductor cross-section, all factors must be taken into consideration (see the design program "Sunny Design" from software version 2.0 at www.SMA-Solar.com).
- ☐ The maximum cable length subject to conductor cross-section must be observed. Useful hint: If you group three inverters to a three-phase plant with symmetrical feed-in, the line losses are halved. That doubles the maximum cable length possible.
- ☐ External diameter of the cable corresponds to the clamping range of the cable gland: 18 mm ... 32 mm.
- ☐ The cable must be dimensioned in accordance with any local and national guidelines on cable dimensions which specify requirements for the minimum conductor cross-section. Examples of factors influencing cable dimensioning are: nominal AC current, type of cable, routing method, cable bundling, ambient temperature and maximum desired line losses (for calculation of line losses, see design software Sunny Design from software version 2.0 www.SMA-Solar.com).

Switch-disconnector and cable protection:

NOTICE

Damage to the inverter due to the use of screw-type fuses as switch-disconnectors

Screw-type fuses (e.g. DIAZED fuse or NEOZED fuse) are not switch-disconnectors.

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

- In plants with multiple inverters, protect every inverter with a separate miniature circuit-breaker. Observe the maximum permissible fuse protection (see section 12 "Technical Data", page 82). That prevents residual voltage being present at the corresponding cable after disconnection.
- Loads installed between the inverter and the miniature circuit-breaker must be protected separately.

Residual-current monitoring unit:

- If an external residual-current device is required, install a residual-current device which trips at a residual current of 100 mA or higher (for details on selecting a residual-current device, see the Technical Information "Criteria for Selecting a Residual-Current Device" at www.SMA-Solar.com).

Overvoltage category

The inverter can be used in grids of installation category III or lower in accordance with IEC 60664-1. That means that the inverter can be permanently connected to the junction box of a building. In case of installations with long outdoor cabling routes, additional measures to reduce overvoltage category IV to overvoltage category III are required.

Protective conductor monitoring:

The inverter is equipped with protective conductor monitoring which detects when no protective conductor is not connected and disconnects the inverter from the electricity grid.

Connection of an additional protective conductor

In some countries an additional earthing is required. In each case, observe the local applicable regulations.

- If an additional earthing is required, earth the inverter (see section 6.3.3 "Additional Earthing of the Enclosure", page 37). The conductor cross-section muss correspond to the cross section of the original protective conductor. This prevents touch current if the original protective conductor fails.

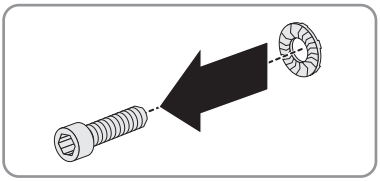
6.3.2 Connecting the Inverter to the Electricity Grid

Requirements:

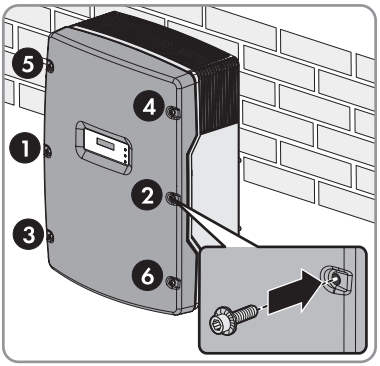
- ☐ The display language must be set to the required language (see section 7.4 "Changing the Display Language", page 50).
- ☐ The connection requirements of the network operator must be met.
- ☐ The mains voltage must be in the permissible range. The exact operating range of the inverter is specified in the operating parameters (see the Technical Description "Operating Parameters" at www.SMA-Solar.com).

1. Disconnect the miniature circuit-breaker and secure against reconnection.
2. Loosen all screws and conical spring washers of the enclosure lid and remove the lid.
3. Remove the adhesive tape from the enclosure opening for the AC cable.
4. Attach the cable gland to the enclosure opening for the AC cable using a counter nut.
5. Strip the AC cable insulation.
6. Shorten L and N by 5 mm each.
7. Strip 18 mm of the L, N and PE insulation each.
8. Route the AC cable into the inverter through the cable gland. If necessary, slightly loosen the swivel nut of the cable gland.

9. Connect the AC cable to the terminal block for the AC cable using a screwdriver:
   - Connect PE to terminal **PE**.
   - Connect N to terminal **N**.
   - Connect L to terminal **L**.
10. Close the inverter and earth the enclosure lid:
    - Attach one conical spring washer to each screw. The grooved side of the conical spring washer must point to the screw head.



    - Secure the enclosure lid with screws in the sequence 1 to 6 (torque: 6 Nm).



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

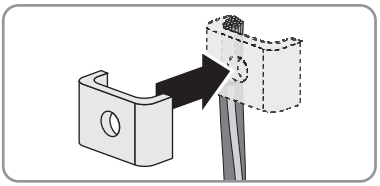
6.3.3 Additional Earthing of the Enclosure

You can additionally earth the inverter enclosure if a second earthing or equipotential bonding is required locally. This prevents touch current if the original protective conductor fails.

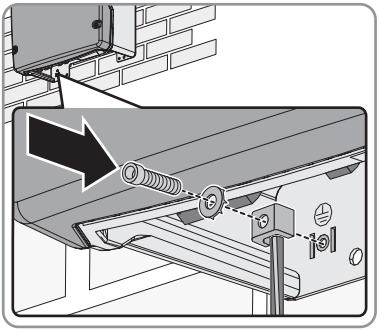
Cable requirement:

☐ Earthing cable cross-section: 16 mm² at maximum

1. Strip the earthing cable insulation.
2. Lead the clamping bracket over the earthing cable. Position the protective conductor on the left-hand side.



3. Screw the clamping bracket tight using the M6x16 cheese-head screw and a conical spring washer (torque: 6 Nm). The teeth of the conical spring washer must face the clamping bracket.



6.4 DC Connection

6.4.1 Conditions for DC Connection

Requirements for the PV modules:

- ☐ All PV modules must be of the same type.
- ☐ The same number of series-connected PV modules must be connected to all strings.
- ☐ All PV modules must be aligned identically.
- ☐ All PV modules must have the same tilt angle.
- ☐ The maximum input current per string must be maintained and must not exceed the through-fault current of the DC connectors (see section 12 "Technical Data", page 82).
- ☐ The thresholds for the input voltage and the input current of the inverter must be observed (see section 12 "Technical Data", page 82).
- ☐ At an ambient temperature over 10°C, the open-circuit voltage of the PV modules must not exceed 90% of the maximum input voltage of the inverter. That prevents the voltage exceeding the maximum input voltage of the inverter at lower ambient temperatures.
- ☐ The positive connection cables of the PV modules must be equipped with the positive DC connectors.
- ☐ The negative connection cables of the PV modules must be equipped with the negative DC connectors.

Use of Y adaptors for parallel connection of strings

The Y adaptors must not be used to interrupt the DC electric circuit.

- Do not use the Y adaptors in the immediate vicinity of the inverter. The adaptors must not be visible or freely accessible.
- In order to interrupt the DC electric circuit, disconnect the inverter (see section 9).

6.4.2 Assembling the DC Connectors

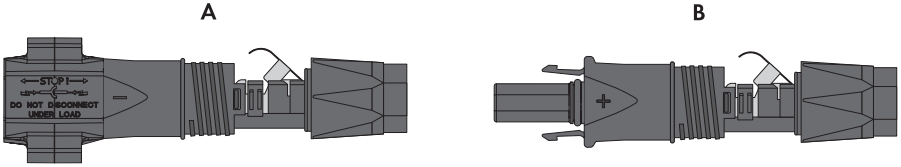


Figure 13: DC connectors

Item	Designation
A	Negative DC connector
B	Positive DC connector

Cable requirements:

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

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

Proceed as follows to assemble each DC connector.

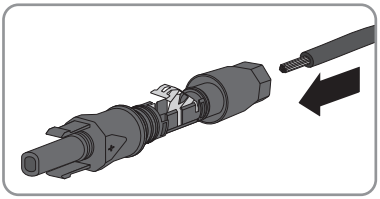
⚠ DANGER

Electric shock due to high voltages

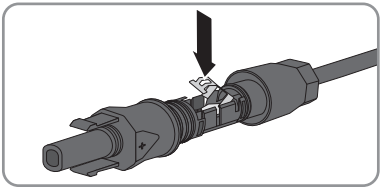
When exposed to sunlight, the PV array generates dangerous DC voltage which is present in the DC conductors and the live components of the inverter. Touching the DC conductors can result in lethal electric shocks.

- Do not touch the DC conductors.

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

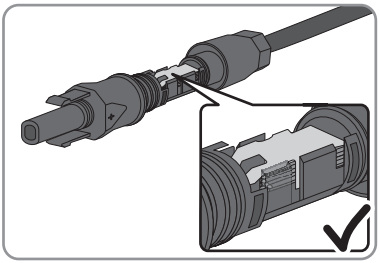


3. Push the clamping bracket down.



☑ The clamping bracket clicks audibly into place.

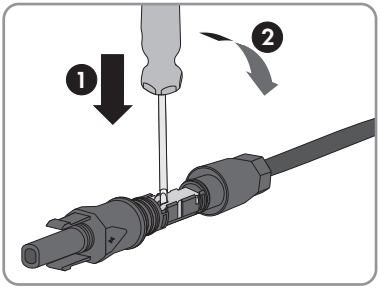
☑ The stranded wire can be seen inside the clamping bracket chamber.



✖ Is the stranded wire not visible in the chamber?

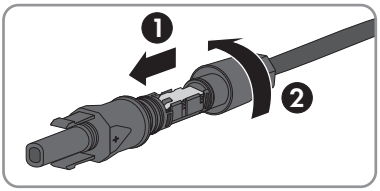
The cable is not correctly in place.

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



- Remove the cable and go back to step 2.

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



6.4.3 Connecting the PV Array

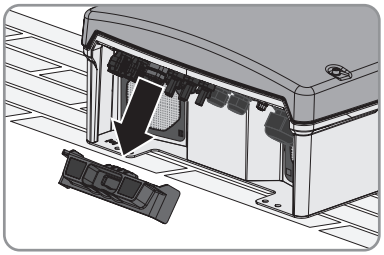
NOTICE

Destruction of the inverter due to overvoltage

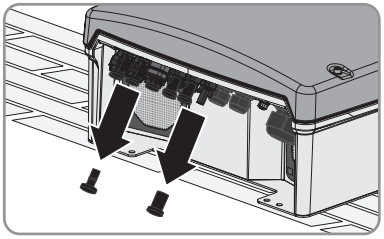
If the open-circuit voltage of the PV modules exceeds the maximum input voltage of the inverter, the inverter can be destroyed by the overvoltage.

- If the open-circuit voltage of the PV modules exceeds the maximum input voltage of the inverter, do not connect any PV strings to the inverter and check the design of the PV plant.

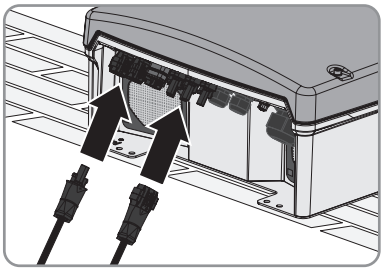
1. Disconnect the miniature circuit-breaker and secure against reconnection.
2. If the ESS is plugged in, remove the ESS.



3. Remove the filler plugs from all the DC inputs on the inverter.



4. Check strings for earth faults. Checking the PV Plant for Earth Faults.
5. Connect the assembled DC connectors to the inverter.



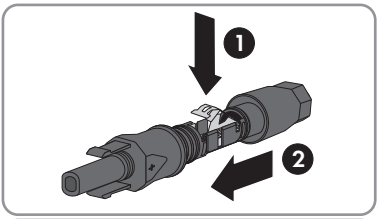
☑ The DC connectors click audibly into place.

6. **NOTICE**

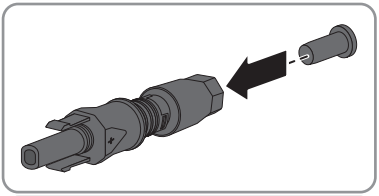
Damage to the inverter due to moisture penetration

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

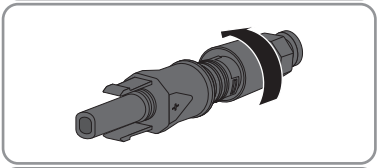
- **DO NOT** insert the sealing plugs **DIRECTLY** into the DC inputs on the inverter.
- For unused DC connectors, push down the clamping bracket and push the swivel nut up to the thread.



- Insert the sealing plug into the DC connector.

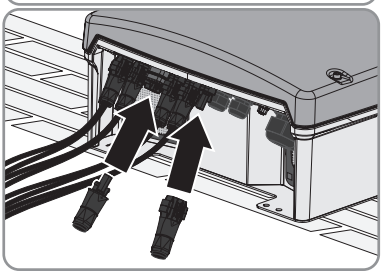


- Tighten the DC connector (torque: 2 Nm).



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

☑ The DC connectors click audibly into place.



7. Ensure that all DC connectors are securely in place.
8. Check the ESS for wear (see section 10.6).

9. **NOTICE**

Risk of fire due to tightening the screw within the ESS

A perfect contact between the ESS and the inverter is only guaranteed if the ESS plug remains flexible.

- Do not tighten the screw in the plug of the ESS.

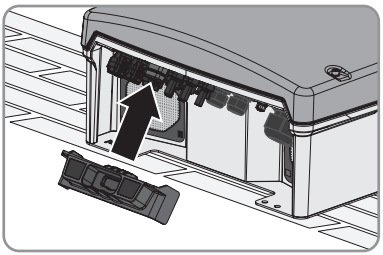
10. **NOTICE**

Damage to the inverter due to moisture and dust intrusion

If the ESS is not plugged in or incorrectly plugged in during operation, moisture and dust can penetrate the inverter. If the ESS is not correctly plugged in, this can cause contacts in the ESS to wear or the ESS might fall out of the socket. This can result in yield loss and damage to the ESS.

Always plug in the ESS as follows:

- Firmly plug in the ESS until it is flush with the enclosure.
- Ensure that the gap between the ESS and the enclosure is no more than 1 mm.



6.5 Connecting the SMA Power Balancer

You need a special Y cable to connect the SMA Power Balancer. The Y cable is not a standard accessory. You can order the Y cable from SMA Solar Technology AG (see section 13 "Accessories", page 91).

The Y cable is designed for distances of maximum 2 m between two inverters. If the distance between inverters is longer, you will have to extend the cable.

Requirements for the extension cord:

- ☐ Maximum cable length: 300 m
- ☐ Extension cord for indoor use: Li2YCY 1 x 2 x 0.25 mm², shielded, flexible, insulated, twisted pair.
- ☐ Extension cord for outdoor use: Li2YCYv 1 x 2 x 0.25 mm², shielded, flexible, insulated, twisted pair.

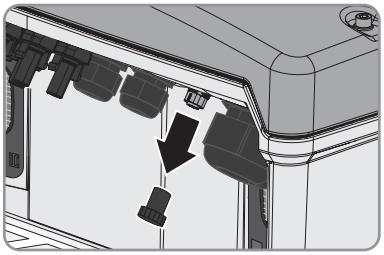
Requirements:

☐ Every inverter must be connected to a line conductor L1, L2 or L3 of the electricity grid (for information on the three-phase grid connection, see the Technical Information "Three-Phase Grid Connection" at www.SMA-Solar.com).

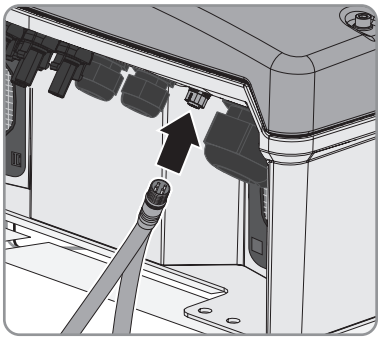
☐ All three inverters must be equipped with the SMA Power Balancer plug-in system.
Hint: If an inverter is not equipped with a SMA Power Balancer plug-in system, you can order a retrofit kit (see section 13 "Accessories", page 91).

☐ The Y cable for the SMA Power Balancer plug-in system must be available.

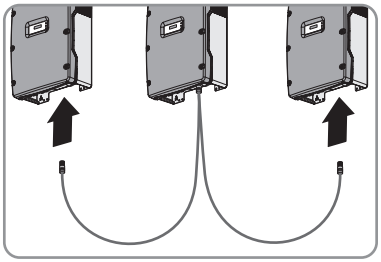
1. Disconnect the inverter from all voltage sources (see section 9).
2. To extend the Y cable:
   - Cut the Y cable in the middle.
   - Connect the conductors and cable shield 1:1 to the extension cord inside a junction box. Observe the maximum cable length of 300 m.
3. Remove the screw cap from the socket of each inverter.



4. Insert the plug of the Y cable with the two cable inputs into the socket of the middle inverter and tighten it.



5. Insert the other two plugs of the Y cable in the respective socket of the other inverters and tighten them.



6. Commission the inverter (see section 8 "Commissioning", page 51).
7. To use the SMA Power Balancer function, activate the SMA Power Balancer via a communication product (see section 7.1 "Checking the Function of the SMA Power Balancer and Setting the Operating Mode", page 47).

6.6 Installing the String Fuses

When installing string fuses in the inverter for the first time, always install all five string fuses. The same applies if you connect less than five strings to the inverter.

Install each string fuse as described in this section.

Requirement:

☐ A retrofit kit with five fuses and five fuse extractors must be available.

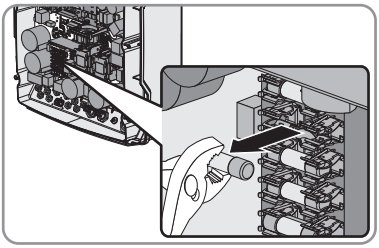
NOTICE

Damage to the inverter due to string fuse burn-off

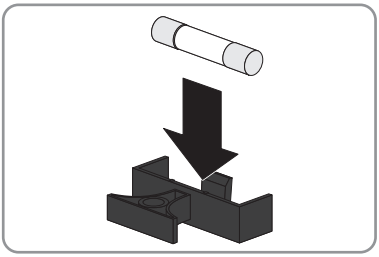
It cannot be guaranteed that commercially available string fuses will function correctly. In the event of an error, the string fuses can burn off.

- Use only the retrofit kits with string fuses available from SMA Solar Technology AG.

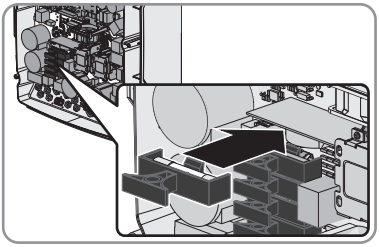
1. Disconnect the inverter from all voltage sources (see section 9).
2. Remove the jumper from the fuse holder using insulated pliers.



3. Insert the string fuse into the fuse extractor.



4. Insert the fuse extractor with the string fuse into the fuse holder.



5. Commission the inverter (see section 8 "Commissioning", page 51).

7 Configuration

7.1 Checking the Function of the SMA Power Balancer and Setting the Operating Mode

Requirements:

- ☐ The inverter must be equipped with a communication interface.
- ☐ A communication product, data logger or software appropriate for the type of communication used must be available.
- ☐ The responsible network operator must approve changes of grid-relevant parameters.
- ☐ SMA Grid Guard code for changing grid-relevant parameters must be available (to apply for an SMA Grid Guard code, see Certificate "Application for SMA Grid Guard Code" at www.SMA-Solar.com).

1. Open the user interface of the data logger or software.
2. Enter the SMA Grid Guard code.
3. For all three inverters, select the parameter **PowerBalancer** or **PowerBalancer operating mode** and set it to **PhaseGuard**.
4. Check whether all inverters display the message **Mode MPP** and whether the green LED of the inverters is glowing.

   If all inverters display the message **PowerBalance**, check the connection of the SMA Power Balancer.

   If the connection is correct and the problem persists, contact the SMA Service Line.
5. Switch off the miniature circuit-breaker of **1** inverter.

   ☑ The inverter with the deactivated miniature circuit-breaker displays the message **Vac-Bfr** and disconnects from the electricity grid.

   ☑ The other two inverters display the message **PowerBalance** and also disconnect from the electricity grid. They then display the message **Balanced**.

   ✖ The inverters do not disconnect from the electricity grid?

   The connection of the SMA Power Balancer is probably faulty or the parameter **Power Balancer** is not set to **PhaseGuard**.

   - Check the connection and setting of the SMA Power Balancer. If the connection is correct and the parameter **PowerBalancer** is set to **PhaseGuard**, contact the SMA Service Line.
6. For all three inverters, select the parameter **PowerBalancer** or **PowerBalancer operating mode** and set the required operating mode (description of the operating modes of the SMA Power Balancer (see section 4.5)).
7. Switch the miniature circuit-breaker.

7.2 Changing the Country Data Set

By default, the inverter is set to a specific country data set. You can see the country data set to which the inverter is set in the enclosed supplementary sheet with the default settings. If the country data set does not apply at the installation location, you will need to change it (for information on the operating parameters, see the Technical Descriptions "Operating Parameters" and "PV Inverters – Overview of Country Data Sets" at www.SMA-Solar.com).

⚠ DANGER

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

If you set the inverter to stand-alone grid operation **OFF-Grid**, you must not operate the inverter on the electricity grid, but only on a stand-alone grid. As a result, the inverter fulfills the country-specific grid connection standards and disconnects reliably from the electricity grid.

- If the inverter is set to **OFF-Grid**, never operate it directly on the electricity grid.

Requirements:

☐ The inverter must be equipped with a communication interface.

☐ A communication product, data logger or software appropriate for the type of communication used must be available.

☐ The responsible network operator must approve changes of grid-relevant parameters.

☐ The SMA Grid Guard code for changing the grid-relevant parameters must be available (to apply for an "SMA Grid Guard" code, see the certificate "Application for SMA Grid Guard Code" at www.SMA-Solar.com).

1. Open the user interface of the data logger or software.
2. Enter the SMA Grid Guard code in the communication product (e.g. software).
3. Select the parameter **Default** or **Set country standard** and adjust the required country data set.

7.3 Setting the Country Data Set for Operation with External Decoupling Protection

For operating the PV plant with external decoupling protection, the inverter has an additional country data set **MVtgDirective** or **Medium-Voltage Directive**. This country data set allows you to extend the operating range of the inverter for voltage and frequency (for information on the operating parameters and country data sets, see the technical descriptions "Operating Parameters and "PV Inverters – Overview of Country Data Sets" at www.SMA-Solar.com). This country data set should only be selected if the PV plant is disconnected via external decoupling.

⚠ DANGER

Electric shock due to lack of external decoupling protection

If you set the **MVtgDirective** or **Medium-Voltage Directive** country data set, you are only allowed to operate the inverter with an external three-phase decoupling protection. Without external three-phase decoupling protection, the inverter will not disconnect from the electricity grid when the standard requirement is exceeded.

- Install external three-phase decoupling protection.

Requirements:

☐ The inverter must be equipped with a communication interface.

☐ A communication product, data logger or software appropriate for the type of communication used must be available.

☐ The responsible network operator must approve changes of grid-relevant parameters.

☐ The SMA Grid Guard code for changing the grid-relevant parameters must be available (to apply for an "SMA Grid Guard" code, see the certificate "Application for SMA Grid Guard Code" at www.SMA-Solar.com).

1. Open the user interface of the data logger or software.
2. Enter the SMA Grid Guard code.
3. Select the parameter **Default** and set it to **MVtgDirective** or select the parameter **Set country standard** and set it to **Medium-Voltage Directive**.

7.4 Changing the Display Language

You can change the display language of the inverter. Various languages are available depending on the country data set selected.

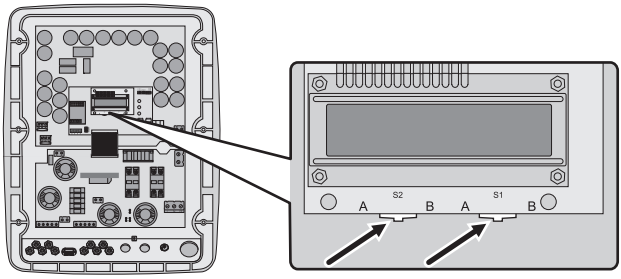


Figure 14: Two switches at the bottom of the display assembly

1. Disconnect the inverter from all voltage sources (see section 9).
2. Select the required language via the two switches:

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

3. Commission the inverter (see section 8 "Commissioning", page 51).

8 Commissioning

Initial Start-Up

When commissioning the inverter for the first time, proceed as follows.

Requirements:

☐ The miniature circuit-breaker must be correctly rated.

☐ The inverter must be correctly mounted and closed.

☐ All cables must be correctly connected.

☐ Unused DC inputs must be sealed using the corresponding DC connectors and sealing plugs.

☐ The ESS must be securely plugged in.

- Switch on the miniature circuit-breaker.

  ☑ The start-up phase begins. All three LEDs are glowing or flashing.

  ☑ The green LED is glowing and the start-up phase begins. The display shows the device type, firmware version, country data set and operating mode of the SMA Power Balancer consecutively. After the start-up phase has been completed, the current power, reactive power and displacement power factor cos φ are displayed.

  ✖ Have all LEDs gone out?

  The ESS is not plugged in or there is no DC input voltage.

  - Plug in the ESS securely or wait until DC input voltage is present.

  ✖ Is the green LED flashing?

  The DC input voltage is still too low.

  - Once the DC input voltage is sufficiently high, the inverter will start to operate.

  ✖ Is the yellow or red LED glowing or flashing?

  There is probably a fault or warning present.

  - Rectify the fault or warning (see section 10.1 "LED Signals", page 56).

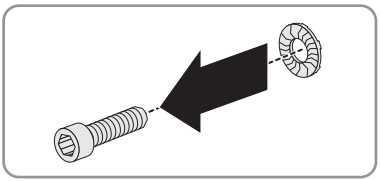
Recommissioning

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

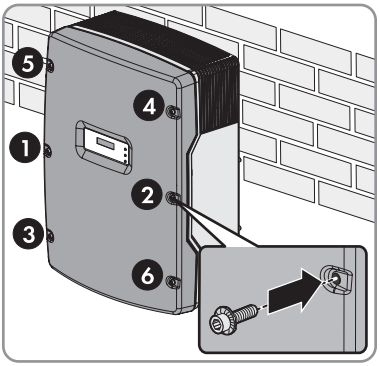
☐ The miniature circuit-breaker must be correctly rated.

☐ The inverter must be correctly mounted.

1. Close the inverter and earth the enclosure lid:
   - Attach one conical spring washer to each screw. The grooved side of the conical spring washer must point to the screw head.



   - Secure the enclosure lid with screws in the sequence 1 to 6 (torque: 6 Nm).



   ☑ The teeth of the conical spring washers are pushed into the enclosure lid. This ensures that the enclosure lid is earthed.
2. Connect the DC connectors to the inverter.
3. Seal all unused DC inputs using the DC connectors with sealing plugs.
4. Check the ESS for wear (see section 10.6).
5. Switch on the miniature circuit-breaker.
   ☑ The start-up phase begins. All three LEDs are glowing or flashing.
   ☑ The green LED is glowing and the start-up phase begins. The display shows the device type, firmware version, country data set and operating mode of the SMA Power Balancer consecutively. After the start-up phase has been completed, the current power, reactive power and displacement power factor cos φ are displayed.
   ✖ Have all LEDs gone out?

   The ESS is not plugged in or there is no DC input voltage.
   - Plug in the ESS securely or wait until DC input voltage is present.

   ✖ Is the green LED flashing?

   The DC input voltage is still too low.
   - Once the DC input voltage is sufficiently high, the inverter will start to operate.

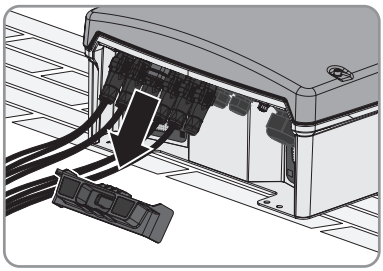
   ✖ Is the yellow or red LED glowing or flashing?

   There is probably a fault or warning present.
   - Rectify the fault or warning (see section 10.1 "LED Signals", page 56).

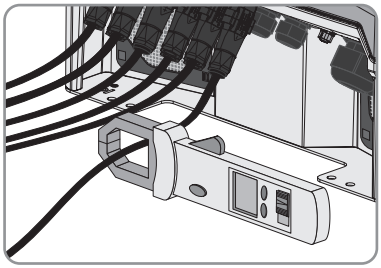
9 Disconnecting the Inverter

Before performing any work on the inverter, always disconnect it as described in this section.

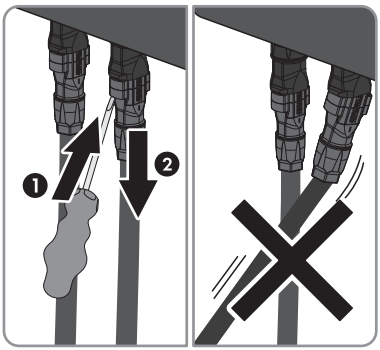
1. Disconnect the miniature circuit-breaker and secure against reconnection.
2. Remove the ESS.



3. Use a current clamp to ensure that no current is present in the DC cables.



4. Unlock and remove all DC connectors.
   To do so, insert a slotted screwdriver (blade width: 3.5 mm) into one of the side slots and pull the DC connectors straight down. **DO NOT PULL ON THE CABLE** whilst doing this.



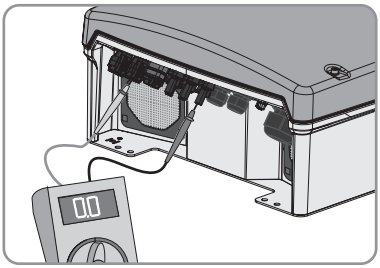
5. **⚠ DANGER**

   Danger to life due to high voltages

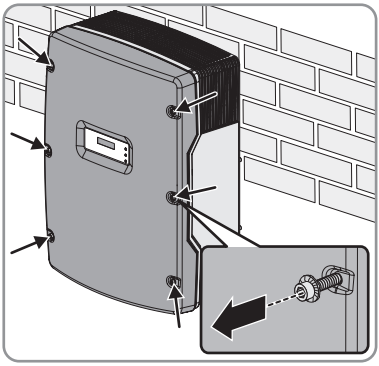
   The capacitors in the inverter take ten minutes to discharge.

   - Wait ten minutes before opening the enclosure lid.

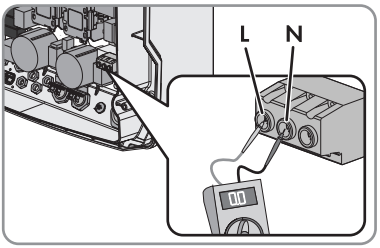
6. Ensure that no voltage is present at the DC inputs of the inverter using a suitable measuring device.



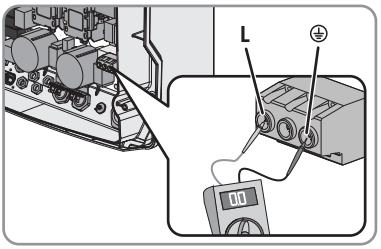
7. Unscrew all screws of the enclosure lid and remove the enclosure lid.



8. Ensure that no voltage is present between L and N at the AC terminal using a suitable measuring device.



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



10. **NOTICE**

Damage to the inverter due to electrostatic discharge

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

- Earth yourself before touching any components.

10 Troubleshooting

10.1 LED Signals

The LEDs indicate the operating state of the inverter.

Designation	Status	Explanation
Green LED	Glowing	Operation The specific status message is shown in the display (see section 10.2.2 "Status Messages", page 59).
	Flashing	Conditions for grid connection are not yet fulfilled.
Red LED	Glowing	Earth fault The specific error or fault message is shown in the display (see section 10.2.3 "Errors, Faults, Warnings", page 60).
	Flashing	Varistor or string fuse defective The specific error or fault message is shown in the display (see section 10.2.3 "Errors, Faults, Warnings", page 60).
Yellow LED	Glowing	Permanent operation inhibition The specific error or fault message is shown in the display (see section 10.2.3 "Errors, Faults, Warnings", page 60).
	Flashing	Error or fault The specific error or fault message is shown in the display (see section 10.2.3 "Errors, Faults, Warnings", page 60).

All LEDs are flashing

If the DC voltage is very low in the start-up phase, all three LEDs go out and the start-up phase begins again. If irradiation very low, all three LEDs flash. This flashing indicates a normal operating state. It does not indicate an error.

All LEDs have gone out

If all three LEDs have gone out, the inverter is switched off because the ESS is not plugged in or there is no irradiation.

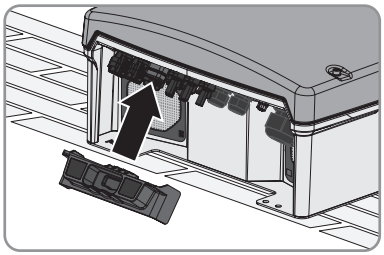
NOTICE

Damage to the inverter due to moisture and dust intrusion

If the ESS is not plugged in or incorrectly plugged in during operation, moisture and dust can penetrate the inverter. If the ESS is not correctly plugged in, this can cause contacts in the ESS to wear or the ESS might fall out of the socket. This can result in yield loss and damage to the ESS.

Always plug in the ESS as follows:

- Firmly plug in the ESS until it is flush with the enclosure.
- Ensure that the gap between the ESS and the enclosure is no more than 1 mm.



10.2 Display Messages

10.2.1 Measurement Channels

Measurement channels are measured values which are shown on the display. The measurement channels can also be read out using a communication product.

Measurement channel	Explanation
Balancer	Indicates the operating mode of the inverter which is set under the operating parameter **PowerBalancer**.
E-total	Total amount of energy fed in
Earthfault	Insulation resistance of the PV plant before connecting to the electricity grid.
Error	Designation of the current fault or the current error
Event-Cnt	Number of events that have occurred
Fac	Mains frequency
h-On	Total operating hours
h-total	Total number of operating hours in feed-in operation
Iac-Ist	Line current
Ipv	Direct current
Is	Apparent current
Line conductor	The line conductor to which the inverter is connected.
Netz-Ein	Total number of grid connections
Pac	AC power supplied
PF	Displacement power factor cos φ. In partial load, the value displayed may deviate from the set target value.
Qac	Reactive power
Sac	Apparent power
Serial number	Inverter serial number
Status	Indicates the current operating state
Upv-Soll	PV voltage setpoint
Vac	Mains voltage
Vpv	PV input voltage

10.2.2 Status Messages

Status messages are shown in the second line of the display and always start with the word "Mode".

Status messages indicate operating states which do not represent errors or faults. The inverter continues feeding into the electricity grid.

Message	Explanation
Balanced	The inverter has disconnected from the electricity grid or is limiting its power over a ten-minute average to 4.6 kVA. The inverter is part of a three-phase system with two further inverters and is equipped with the SMA Power Balancer to prevent the formation of unbalanced loads.
Derating	This message can have several causes: • Overtemperature in the inverter. The inverter reduces its power to prevent overheating. • External active power limitation via the Power Reducer Box and Sunny WebBox. The inverter reduces its power output automatically due to the network operator's specifications. The Power Reducer Box transfers the signal from the network operator to the inverter via the Sunny WebBox.
disturbance	The inverter has detected a fault. The specific message is also displayed (see section 10.2.3 "Errors, Faults, Warnings", page 60).
Earthfault	Measurement of the insulation resistance of the PV plant
Error	The inverter has detected an error. The specific error message is also displayed (see section 10.2.3 "Errors, Faults, Warnings", page 60).
grid mon.	Grid monitoring. This message appears before the inverter is connected to the electricity grid if irradiation is low and following an error.
MPP	The inverter is operating in MPP mode. MPP is the standard display message when operating under normal irradiation conditions.
MPP-Peak	The inverter is operating in MPP mode above its nominal power.
MPP-Search	The inverter is calculating the MPP.
offset	Offset alignment of the measurement electronics
Stop	Operation interrupted
V-Const	Constant voltage mode
Waiting	The conditions for grid connection are not (yet) fulfilled.

10.2.3 Errors, Faults, Warnings

Errors, faults and warnings are shown in the display and start in the first line with the word "Error", "Disturbance" or "Warning". In the second line of the display, the cause of the error, fault or warning is shown.

Message	Cause and corrective measures
!PV-Overvoltage! - !DISCONNECT DC!	Overvoltage at DC input. The inverter may be destroyed. This message is additionally highlighted by rapid flashing of the backlight. **Corrective measures:** • Disconnect the miniature circuit-breaker. • Remove the ESS. • Unlock and remove all DC connectors using a screwdriver (blade width: 3.5 mm). – Insert the screwdriver into one of the side slots. – Remove the DC connectors. • Check whether the DC voltage is below the inverter's maximum input voltage. If the DC voltage is below the maximum input voltage of the inverter, connect the DC connectors to the inverter again. If the DC voltage is above the maximum input voltage of the inverter, check the PV plant design or contact installer of the PV array. • If this message is repeated frequently, disconnect the inverter (see section 9) and contact the SMA Service Line.
ACVtgRPro	The ten-minute average mains voltage is no longer within the permissible range. The mains voltage or grid impedance at the termination point is too high. The inverter disconnects from the electricity grid to comply with the power quality. **Corrective measures:** • Check that the mains voltage at the termination point of the inverter is permanently in the permissible range. If the mains voltage is 253 V or higher, contact the network operator. Ask the network operator whether the voltage can be adapted at the feed-in point or whether the he will approve a change in the limiting value of the "ACVtgRPro" parameter. If the mains voltage is permanently in the permissible range and this message is still displayed, contact the SMA Service Line.

Message	Cause and corrective measures
CAN	Internal communication fault **Corrective measures:** • If this message is displayed frequently, contact the SMA Service Line.
Check L-N-PE	L and N are swapped on the AC connection or PE is not connected. **Corrective measures:** • Ensure that the AC cable is correctly connected (see section 6.3.2 "Connecting the Inverter to the Electricity Grid", page 35). • If the AC cable is connected correctly and this message is still displayed, contact the SMA Service Line.
Check Varistor	At least one of the varistors is defective. **Corrective measures:** • Check the function of the varistors (see section 10.8).
DC fuse	At least one of the string fuses has tripped or is defective. **Corrective measures:** • Check the function of the string fuses (see section 10.10).
Derating	The inverter reduces its power output due to overheating. **Corrective measures:** • Clean the fans .
	The inverter reduces its power output because the DC input current exceeds the maximum input current of the inverter. **Corrective measures:** • Ensure that the PV plant is designed correctly.
dI-Bfr dI-Srr	The inverter has detected a change in the differential current. A change in the differential current can be caused by an earth fault, residual current or a malfunction. The inverter disconnects from the electricity grid. **Corrective measures:** • If none of the above causes apply and this message is still displayed, ensure that the PV plant is insulated correctly and that there is no earth fault.
dI-Mess	Deviation in the differential current measurement If this message is displayed frequently, permanent shutdown will be triggered. **Corrective measures:** • Contact the SMA Service Line.

Message	Cause and corrective measures
EEPROM	Temporary fault during reading or writing of data from the EEPROM. This data is not essential for safe operation. This message is for your information only and has no effect on the performance of the inverter.
EEPROM	EEPROM data is defective. The inverter switches off because the loss of data has disabled important inverter functions. **Corrective measures:** • Contact the SMA Service Line.
EeRestore	One of the duplicate records in the EEPROM is defective and has been reconstructed without loss of data. This message is for your information only and has no effect on the performance of the inverter.
Fac-Bfr Fac-Fast Fac-Srr	The mains frequency is outside the permissible range. The inverter has disconnected from the electricity grid. **Corrective measures:** • Ensure that the AC cable is correctly connected (see section 6.3.2 "Connecting the Inverter to the Electricity Grid", page 35). • Ensure that the mains frequency is in the permissible range. If the mains frequency is in the permissible range and this message is still displayed, contact the SMA Service Line.
HW-Signal	Internal measurement fault or the hardware is defective. **Corrective measures:** • If this message is displayed frequently, contact the SMA Service Line.
Iac-DC_Offs-Srr	Excessive DC current is detected during feed-in operation. **Corrective measures:** • Ensure that the grid conditions are observed. • If this message is displayed frequently or recurrently, contact the SMA Service Line.
IGBTs	Fault in the power electronics **Corrective measures:** • Contact the SMA Service Line.
Imax	Overcurrent on the AC side. The current at the AC connection is higher than specified. **Corrective measures:** • Ensure that the PV plant is designed correctly. • Ensure that the grid conditions are observed.

Message	Cause and corrective measures
NUW-dI MSD-Fac MSD-Vac MSD-Timeout	Internal measurement comparison fault or the hardware is defective. **Corrective measures:** • If this message is displayed frequently, contact the SMA Service Line.
offset	Fault in recording measured values **Corrective measures:** • If this message is displayed frequently, contact the SMA Service Line.
PowerBalance	Three inverters are connected to a three-phase feed-in unit to prevent unbalanced loads. The parameter „PowerBalancer" is set to the operating modes „PhaseGuard" or „FaultGuard" (description of the operating modes of the SMA Power Balancer, see Section section 4.5).
REL_INV_CLOSE REL_GRID_CLOSE	One of the grid relays does not close. The inverter checks the relays which connect the inverter to the electricity grid before the inverter feeds in to the electricity grid. If the grid relays do not function properly, the inverter will not connect to the electricity grid. **Corrective measures:** • Contact the SMA Service Line.
REL_INV_OPEN REL_GRID_OPEN	One of the grid relays does not open. The inverter checks the relays which connect the inverter to the electricity grid before the inverter feeds in to the electricity grid. If the grid relays do not function properly, the inverter will not connect to the electricity grid. If this message is displayed frequently, permanent shutdown will be triggered. **Corrective measures:** • Rectify the fault using a communication product. • If the fault cannot be rectified using a communication product, contact the SMA Service Line.

Message	Cause and corrective measures
Earthfault	The electrical insulation between the PV plant and earth is defective. The resistance between the positive or negative DC connection and earth is outside the permissible range. **Corrective measures:** • Ensure that the PV plant is insulated correctly. • Ensure that there is no earth fault Checking the PV Plant for Earth Faults.
Riso-Sense	The insulation measurement has failed. **Corrective measures:** • If this message is displayed frequently, contact the SMA Service Line.
ROM	The inverter firmware is faulty. **Corrective measures:** • If this message is displayed frequently, contact the SMA Service Line.
SD-DI converter	The inverter has detected an insulation fault on the DC side. **Corrective measures:** • Ensure that the PV plant is insulated correctly. • Ensure that there is no earth fault Checking the PV Plant for Earth Faults.
SD-Imax	The inverter has detected an overcurrent on the AC side. The inverter disconnects from the electricity grid for safety reasons and afterwards tries to reconnect to the grid. **Corrective measures:** • If this message is displayed frequently, contact the SMA Service Line.
SD-WR-Bruecke	The inverter has detected a fault in the power electronics. The inverter disconnects from the electricity grid for safety reasons and afterwards tries to reconnect to the grid. **Corrective measures:** • If this message is displayed frequently, contact the SMA Service Line.
Shutdown	Temporary inverter fault **Corrective measures:** • Contact the SMA Service Line.

Message	Cause and corrective measures
STM Timeout	Internal program run fault **Corrective measures:** • If this message is displayed frequently, contact the SMA Service Line.
Vac-Bfr Vac-Srr	The mains voltage is no longer within the permissible range. The inverter has disconnected from the electricity grid for safety reasons. This can be caused by one of the following: • The miniature circuit-breaker is switched off. • The AC cable is interrupted. • The AC cable is highly resistive. **Corrective measures:** • Ensure that the AC cable is correctly connected.(see section 6.3.2 "Connecting the Inverter to the Electricity Grid", page 35) • Ensure that the mains voltage is in the permissible range. • Ask the network operator for permission to change the parameters **Uac-Min** and **Uac-Max**. If the AC cable is connected correctly, the mains voltage is within the permissible range and this message is still displayed, contact the SMA Service Line.
UpvMax Upv-Max	Overvoltage at DC input The inverter may be destroyed. **Corrective measures:** • Disconnect the miniature circuit-breaker. • Remove the ESS. • Unlock and remove all DC connectors. To do so, insert a slotted screwdriver (blade width: 3.5 mm) into one of the side slots and pull the DC connectors straight down. **DO NOT PULL ON THE CABLE** whilst doing this. • Ensure that the DC voltage is in the permissible range. • If the DC voltage is above the maximum input voltage of the inverter, check the PV plant design or contact installer of the PV array. • If the DC voltage is below the maximum input voltage of the inverter, connect the DC connectors to the inverter again. • If this message is repeated frequently, disconnect the inverter (see section 9) and contact the SMA Service Line.

Message	Cause and corrective measures
UZWK-Max UzwkMax	The internal hardware monitoring system has detected an overvoltage in the intermediate circuit of the inverter. **Corrective measures:** • If this message is displayed frequently, contact the SMA Service Line.
Watchdog Watchdog Srr	Internal program run fault **Corrective measures:** • If this message is displayed frequently, contact the SMA Service Line.

10.3 Cleaning the Fans

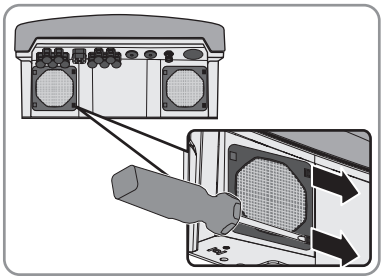
Proceed as follows to clean each fan.

1. Disconnect the inverter from all voltage sources (see section 9).
2. Wait for the fans to stop rotating.
3. Check whether the fan guard is dusty or heavily soiled.

   If the fan guard is dusty, clean the fan guard with a vacuum cleaner.

   If the fan guard is heavily soiled, remove the fan guard and clean it:

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

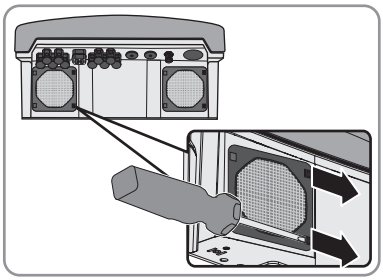


   • Carefully remove the fan guard.
   • Clean the fan guard with a soft brush, a paint brush, a cloth or compressed air.

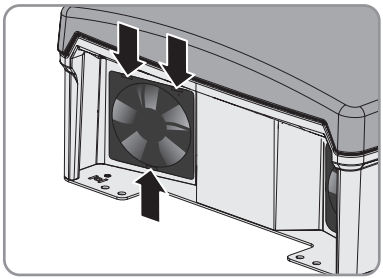
4. Check whether the fan is soiled.

   If the fan is soiled, remove the fan:

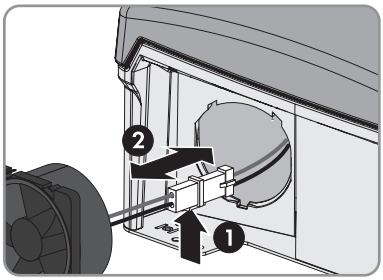
   - Use a screwdriver to push the two detents at the right-hand edge of the fan guard to the right-hand side and remove them from the retainer.



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



   - Remove the fan slowly from the inverter.
   - Unlock and remove the fan plug.

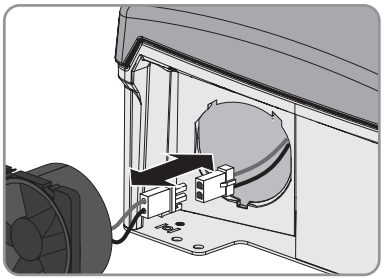


5. **NOTICE**

   Damage to the fan due to compressed air

   - Clean the fan with a soft brush, a paint brush, or a damp cloth.

6. Insert the plug of the fan into the socket until it clicks into place.



7. Insert the fan into the inverter until the fan audibly clicks into place.
8. Push the fan guard into the retainer until it audibly clicks into place.
9. Recommission the inverter (see section 8).
10. Check the fan to ensure that it is functioning (see section 10.4).

10.4 Checking the Fans

There are two ways to check the function of the fans:

- Using a communication product to set the parameters

  or

- Inserting a jumper in the inverter

Using a Communication Product to Set the Parameters

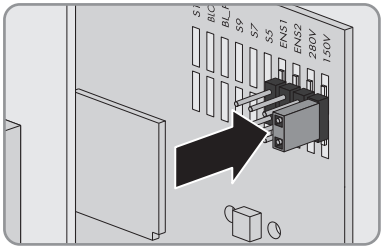
1. Open the user interface of the data logger or software.
2. Enter the installer password.
3. Select the parameter **Fan-Test** and set it to **1** or **Fan test** and set it to **On**.
4. Check whether air is coming out of the ventilation grids and whether the fans are making any unusual noises.

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

   If the fans were installed correctly, contact the SMA Service Line.
5. Select the parameter **Fan-Test** and set it to **0** or **Fan test** and set it to **Off**.

Plugging the Jumper

1. Disconnect the inverter from all voltage sources (see section 9).
2. Insert the jumper in the slot **150V** at the right-hand side next to the display.



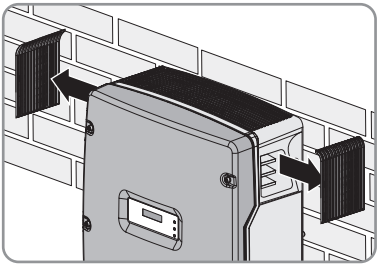
3. Commission the inverter (see section 8 "Commissioning", page 51).
4. Check whether air is coming out of the ventilation grids and whether the fans are making any unusual noises.

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

   If the fans were installed correctly, contact the SMA Service Line.
5. Disconnect the inverter from all voltage sources (see section 9).
6. Remove the jumper from the slot **150V** at the right-hand side next to the display.
7. Commission the inverter (see section 8 "Commissioning", page 51).

10.5 Cleaning the Ventilation Grids

1. Remove the ventilation grids towards the side.



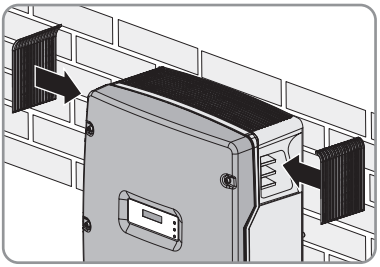
2. **NOTICE**

   Damage to the inverter due to foreign bodies

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

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

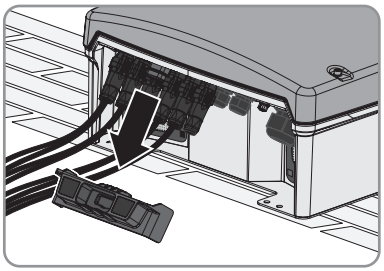
4. Close the recessed grips with the ventilation grids. Ensure the assignment is correct. Each ventilation grid is assigned to an enclosure side on the inside: "**links/left**" for the left-hand side and "**rechts/right**" for the right-hand side.



10.6 Checking the ESS for Wear

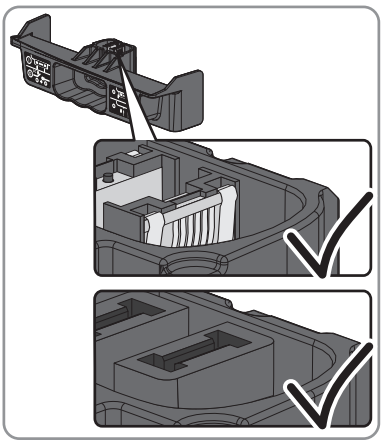
Depending on the design of the ESS, you can recognise wear either on the metal mounting tabs or on the plastic of the ESS.

1. Remove the ESS.



2. Check the metal mounting tabs or plastic inside the ESS.

   The metal mounting tabs and plastic must not be discoloured or damaged.



   The ESS is worn if the metal mounting tabs have brown discolouration or are burnt out or the plastic is damaged. That prevents the ESS disconnecting the PV array reliably. Order a new ESS and replace the damaged ESS (see section 13 "Accessories", page 91).

3. ***NOTICE***

   Risk of fire due to tightening the screw within the ESS

   A perfect contact between the ESS and the inverter is only guaranteed if the ESS plug remains flexible.

   - Do not tighten the screw in the plug of the ESS.

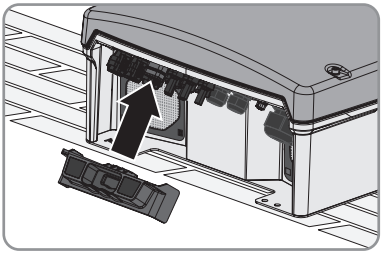
4. **NOTICE**

Damage to the inverter due to moisture and dust intrusion

If the ESS is not plugged in or incorrectly plugged in during operation, moisture and dust can penetrate the inverter. If the ESS is not correctly plugged in, this can cause contacts in the ESS to wear or the ESS might fall out of the socket. This can result in yield loss and damage to the ESS.

Always plug in the ESS as follows:

- Firmly plug in the ESS until it is flush with the enclosure.
- Ensure that the gap between the ESS and the enclosure is no more than 1 mm.



5. Commission the inverter (see section 8 "Commissioning", page 51).

10.7 Checking the PV Plant for Earth Faults

If the red LED is glowing and the inverter displays the message **Riso**, there is an earth fault in the PV array. The electrical insulation between the PV plant and earth is defective or insufficient.

⚠ WARNING

Danger to life due to electric shock

In the event of an earth fault, high voltages can be present.

- Only touch the insulation of the PV array cables.
- Do not touch any parts of the sub-structure or frame of the PV array.
- Do not connect PV strings with earth faults to the inverter.

NOTICE

Destruction of the measuring device due to overvoltage

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

Proceed as follows to check each string in the PV plant for earth faults.

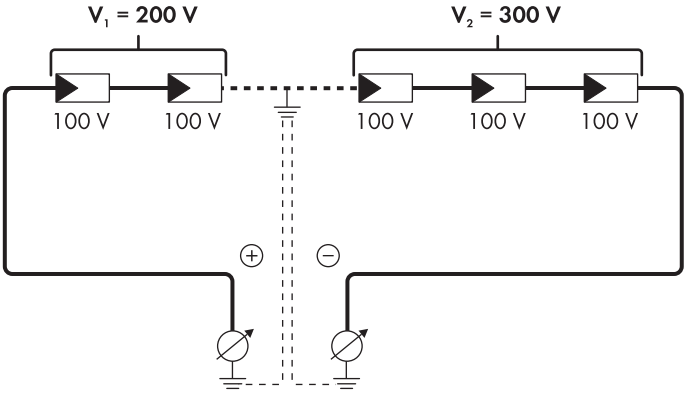
1. Disconnect the inverter from all voltage sources (see section 9).
2. Measure the voltages:
   - Measure the voltages between the positive pole and the earth potential (PE).
   - Measure the voltages between the negative pole and the earth potential (protective conductor).
   - Measure the voltages between the positive and negative pole.

     If the following results are present at the same time, there is an earth fault in the PV plant.
   - All measured voltages are stable.
   - The sum of the two voltages against the earth potential is approximately equal to the voltage between the positive and negative poles.
   - Determine the location of the earth fault via the ratio of the two measured voltages.
   - Eliminate the earth fault.

     If there is no earth fault and the message is still displayed, contact the SMA Service Line.

Example: Location of the earth fault

The example shows an earth fault between the second and third PV module.



3. Recommission the inverter (see section 8 "Commissioning", page 51).

10.8 Checking the Function of the Varistors

If the red LED is flashing and the inverter displays the message **Check Varistor**, one of the varistors may be defective. Check the function of each varistor as described in the following.

Position of the Varistors

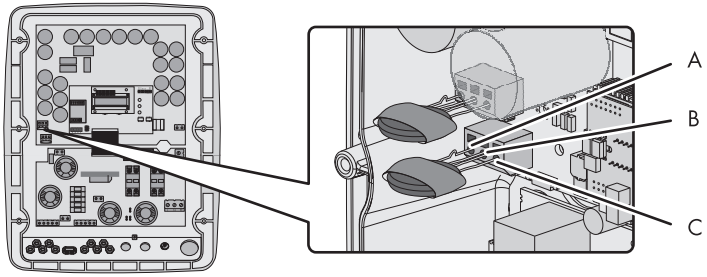


Figure 15: Varistors inside the inverter

Item	Designation
A	Left-hand connection wire with loop
B	Middle connection wire
C	Right-hand connection wire

NOTICE

Destruction of the inverter due to overvoltage

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

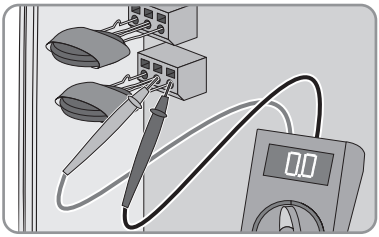
- Do not operate the inverter without varistors in plants with a high risk of overvoltages.
- Do not recommission the inverter until the defective varistors have been replaced.

NOTICE

Destruction of the measuring device due to overvoltage

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

1. Disconnect the inverter from all voltage sources (see section 9).
2. Use a multimeter to measure whether there is a conductive connection between the middle connection wire and the right-hand connection wire.



If there is no conductive connection, the varistor is defective. SMA Solar Technology AG recommends replacing all varistors immediately.

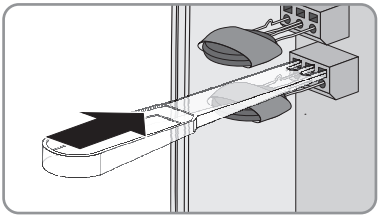
- Order new varistors and insertion tools (see section 13 "Accessories", page 91).
- If new varistors are available, replace all varistors (see section 10.9).

If a conductive connection is present, contact the SMA Service Line.

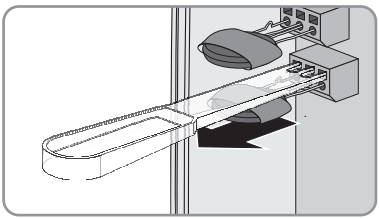
10.9 Replacing the Varistors

Proceed as follows to replace each varistor.

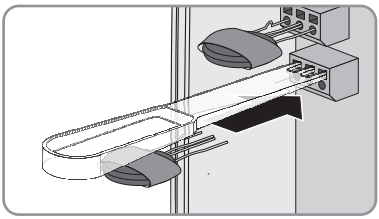
1. Disconnect the inverter from all voltage sources (see section 9).
2. Insert the insertion tool into the clamp contacts of the connecting terminal plate.



3. Remove the varistor from the connecting terminal plate.



4. Insert the new varistor into the terminals. For this purpose, insert the connection wire with loop into the left-hand terminal.



5. Remove the insertion tool from the contacts of the connecting terminal plate.
6. Commission the inverter (see section 8 "Commissioning", page 51).

10.10 Checking the Function of the String Fuses

If the red LED is flashing and the inverter displays the message **DC fuse**, at least one of the string fuses may have tripped or be defective. Each string fuse is assigned to one string.

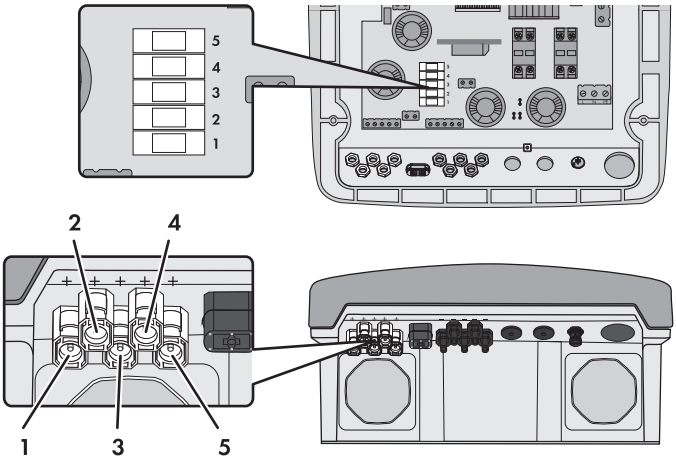
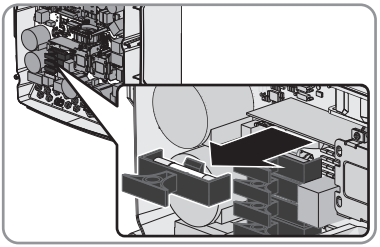


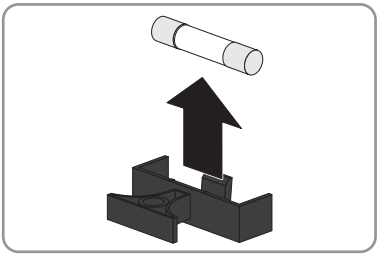
Figure 16: Assignment of the string fuses to the strings

Check the function of each string fuse as described below.

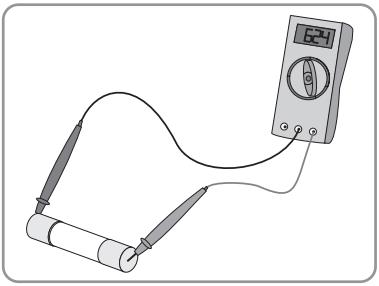
1. Disconnect the inverter from all voltage sources (see section 9).
2. Remove the string fuse with the fuse extractor from the fuse holder.



3. Remove the string fuse from the fuse extractor.



4. Use a continuity tester to measure whether the string fuse is conductive.



If the string fuse is not conductive, the string fuse is defective. Replace all string fuses immediately.

- Order a new string fuse (see section 13 "Accessories", page 91).
- Have all strings with defective string fuses checked by the installer of the PV array. Commission the inverter after the strings have been checked (see section 8 "Commissioning", page 51).
- If new string fuses are available, replace all string fuses (see section 10.11).

10.11 Replacing the String Fuses

Requirements:

☐ A retrofit kit with five string fuses and five fuse extractors must be available.

☐ All string fuses must be removed.

NOTICE

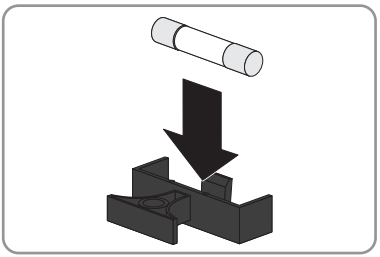
Damage to the inverter due to string fuse burn-off

It cannot be guaranteed that commercially available string fuses will function correctly. In the event of an error, the string fuses can burn off.

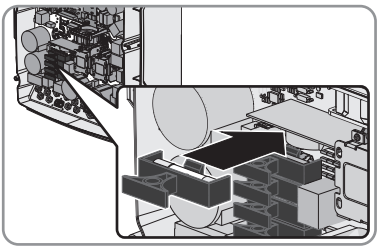
- Install only string fuses available from SMA Solar Technology AG in the inverter.

Proceed as follows to replace each string fuse:

1. Disconnect the inverter from all voltage sources (see section 9).
2. Insert a new string fuse in a new fuse extractor.



3. Insert the fuse extractor with the string fuse in the fuse holder.



4. Commission the inverter (see section 8 "Commissioning", page 51).

10.12 Cleaning the Inverter

NOTICE

Damage to the display by use of cleaning agents

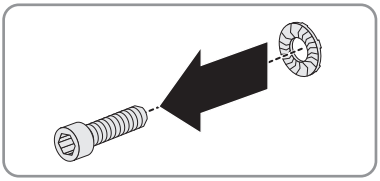
- If the inverter is dirty, clean the enclosure lid, the display and the LEDs using only clean water and a cloth.

11 Decommissioning

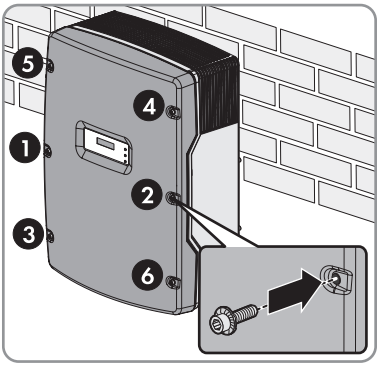
11.1 Dismounting the Inverter

1. Disconnect the inverter from all voltage sources (see section 9).
2. Remove the AC cable from the inverter.
3. If a data cable is connected, remove the data cable from the inverter.
4. If the SMA Power Balancer is connected, remove the cable of the SMA Power Balancer.
5. Close the inverter:

   • Attach one conical spring washer to each screw. The grooved side of the conical spring washer must point to the screw head.

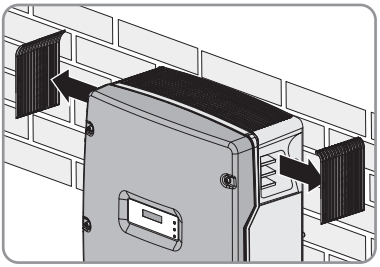


   • Secure the enclosure lid with screws in the sequence 1 to 6 (torque: 6 Nm).

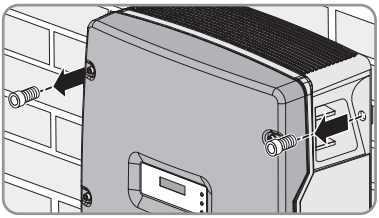


   ☑ The teeth of the conical spring washers are pushed into the enclosure lid. This ensures that the enclosure lid is earthed.

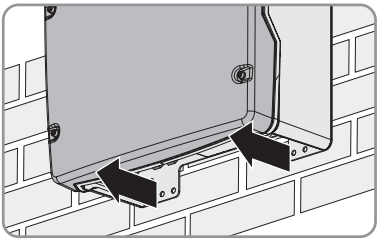
6. Remove the ventilation grids laterally.



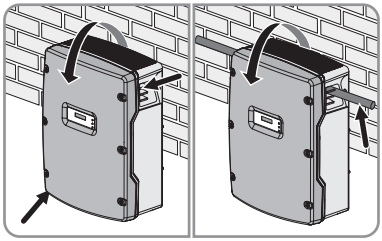
7. Loosen the screws between the inverter and the wall mounting bracket on both sides.



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



9. Remove the inverter by lifting it up vertically and out of the wall mounting bracket. Use the side recessed grips or a steel rod (diameter: maximum 30 mm). Transport the inverter horizontally.



11.2 Packing the Inverter

1. Remove the cable glands from the inverter.
2. Remove the ESS.
3. Pack the inverter, cable glands and ESS. Use the original packaging or packaging that is suitable for the weight and dimensions of the inverter (see section 12 "Technical Data", page 82).

11.3 Disposing of the Inverter

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

  or

  Return the inverter at your own cost to SMA Solar Technology AG (see section 14 "Contact", page 92). Label the package "ZUR ENTSORGUNG" ("FOR DISPOSAL").

12 Technical Data

12.1 DC/AC

12.1.1 Sunny Mini Central 9000TL with Reactive Power Control

DC Input

Maximum DC power at cos φ = 1	9,300 W
Maximum input voltage*	700 V
MPP voltage range	333 V ... 500 V
Rated input voltage	350 V
Minimum input voltage	333 V
Start input voltage	400 V
Maximum input current	28 A
Maximum input current per string**	28 A
Number of independent MPP inputs	1
Strings per MPP input	5

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

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

AC Output

Rated power at 230 V, 50 Hz	9,000 W
Maximum apparent AC power	9,000 VA
Rated grid voltage	230 V
Nominal AC voltage	220 V / 230 V / 240 V
AC voltage range	180 V ... 265 V
Nominal AC current at 220 V	40 A
Nominal AC current at 230 V	40 A
Nominal AC current at 240 V	37.5 A
Maximum output current	40 A
Total harmonic factor of the output current with total harmonic factor of the AC voltage < 2%, and AC power > 50% of the rated power	≤ 3%
Rated power frequency	50 Hz
AC power frequency	50 Hz / 60 Hz
Operating range at AC power frequency 50 Hz	44 Hz ... 55 Hz
Operating range at AC power frequency 60 Hz	54 Hz ... 65 Hz
Displacement power factor, adjustable	$0.8_{overexcited}$ ... $0.8_{underexcited}$
Feed-in phases	1
Connection phases	1
Overvoltage category according to IEC 60664-1	III

Efficiency

Maximum efficiency, n_{max}	97.7%
European weighted efficiency, n_{EU}	97.3%

12.1.2 Sunny Mini Central 10000TL with Reactive Power Control

DC Input

Maximum DC power at cos φ = 1	10,350 W
Maximum input voltage*	700 V
MPP voltage range	333 V ... 500 V
Rated input voltage	350 V
Minimum input voltage	333 V
Initial input voltage	400 V
Maximum input current	31 A
Maximum input current per string**	31 A
Number of independent MPP inputs	1
Strings per MPP input	5

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

** Maximum permitted current allowed through one DC connector

AC Output

Rated power at 230 V, 50 Hz	10,000 W
Maximum apparent AC power	10,000 VA
Rated grid voltage	230 V
AC nominal voltage	220 V / 230 V / 240 V
AC voltage range	180 V ... 265 V
Nominal AC current at 220 V	44 A
Nominal AC current at 230 V	44 A
Nominal AC current at 240 V	41.7 A
Maximum output current	44 A
Total harmonic factor of the output current with total harmonic factor of the AC voltage < 2%, and AC power > 50% of the rated power	≤ 3%
Rated mains frequency	50 Hz
AC mains frequency	50 Hz / 60 Hz
Operating range at AC mains frequency 50 Hz	44 Hz ... 55 Hz
Operating range at AC mains frequency 60 Hz	54 Hz ... 65 Hz
Displacement power factor, adjustable	$0.8_{overexcited}$ ... $0.8_{underexcited}$
Feed-in phases	1
Connection line conductor	1
Overvoltage category in accordance with IEC 60664-1	III

Efficiency

Maximum efficiency, n_{max}	97.7%
European weighted efficiency, n_{EU}	97.2%

12.1.3 Sunny Mini Central 11000TL with Reactive Power Control

DC Input

Maximum DC power at cos φ = 1	11,400 W
Maximum input voltage*	700 V
MPP voltage range	333 V ... 500 V
Rated input voltage	350 V
Minimum input voltage	333 V
Initial input voltage	400 V
Maximum input current	34 A
Maximum input current per string**	34 A
Number of independent MPP inputs	1
Strings per MPP input	5

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

** Maximum permitted current allowed through one DC connector

AC Output

Rated power at 230 V, 50 Hz	11,000 W
Maximum apparent AC power	11,000 VA
Rated grid voltage	230 V
AC nominal voltage	220 V / 230 V / 240 V
AC voltage range	180 V ... 265 V
Nominal AC current at 220 V	48 A
Nominal AC current at 230 V	48 A
Nominal AC current at 240 V	45.8 A
Maximum output current	48 A
Total harmonic factor of the output current with total harmonic factor of the AC voltage < 2%, and AC power > 50% of the rated power	≤ 3%
Rated mains frequency	50 Hz
AC mains frequency	50 Hz / 60 Hz
Operating range at AC mains frequency 50 Hz	44 Hz ... 55 Hz
Operating range at AC mains frequency 60 Hz	54 Hz ... 65 Hz
Displacement power factor, adjustable	$0.8_{overexcited}$ ... $0.8_{underexcited}$
Feed-in phases	1
Connection line conductor	1
Overvoltage category in accordance with IEC 60664-1	III

Efficiency

Maximum efficiency, n_{max}	97.7%
European weighted efficiency, n_{EU}	97.2%

12.2 General Data

Width × height × depth with Electronic Solar Switch	468 mm × 653 mm × 242 mm
Weight	35 kg
Length × width × height of packaging	390 mm × 800 mm × 580 mm
Transport weight	40 kg
Climatic category in accordance with IEC 60721-3-4	4K4H
Environmental category	Outdoors
Pollution degree outside the enclosure	3
Pollution degree inside the enclosure	2
Operating temperature range	– 25°C ... +60°C
Maximum permissible value for relative humidity, non-condensing	100%
Maximum operating altitude above MSL	3,000 m
Typical noise emission for SMC 9000TLRP-10	≤ 42 dB(A)
Typical noise emission for SMC 10000TLRP-10	≤ 45 dB(A)
Typical noise emission for SMC 11000TLRP-10	≤ 46 dB(A)
Power loss in night mode	0,15 W
Topology	Transformerless
Cooling concept	SMA OptiCool
Fan connection	Designed for safe disconnection in accordance with DIN EN 50178:1998-04
Degree of protection for electronics in accordance with IEC 60529	IP65
Protection class in accordance with IEC 62103	I

12.3 Protective Devices

DC reverse polarity protection	Short-circuit diode
DC disconnect device	Electronic Solar Switch
DC overvoltage protection	Thermally monitored varistors
AC short-circuit current capability	Current control
Grid monitoring	SMA Grid Guard 2.1
Maximum permissible fuse protection	80 A
Earth-fault monitoring	Insulation monitoring: Riso > 280 k Ω
All-pole sensitive residual-current monitoring unit	Available

12.4 Approvals

Country standard, as per 11/2012	SMC 9000TLRP-10	SMC 10000TLRP-10	SMC 11000TLRP-10
VDE 0126-1-1	✓	✓	✓
VDE-AR-N 4105	✓	✓	✓
UTE C15-712-1	✓	✓	✓
C10/C11	✓	✓	✓
PPDS	✓	✓	✓
RD 1663	✓	✓	✓
RD 661	✓	✓	✓
EN 50438*	✓	✓	✓
GBT19939-2005	✓	✓	✓
CGC GF001-2009	✓	✓	✓

* EN 50438: Does not apply to all national variations of the standard.

12.5 Climatic Conditions

According to IEC 60721-3-4, Installation Type C, Class 4K4H

Extended temperature range	– 25°C ... +60°C
Extended humidity range	0% ... 100%
Extended air pressure range	70.0 kPa ... 106 kPa

According to IEC 60721-3-4, Transport Type E, Class 2K3

Temperature range	– 25°C ... +70°C

12.6 Features

DC connection	SUNCLIX DC connector
AC connection	Screw terminal
Display	LC text display
Bluetooth	Optional
RS485, galvanically isolated	Optional

12.7 Electronic Solar Switch

Electrical endurance in the event of a short circuit, with a nominal current of 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 removed	IP21
Fuse for the ESS	F200, 600 V/4 A, fast acting (soldered, non-replaceable)

12.8 Torques

Enclosure lid screws	6.0 Nm
Additional earth terminal	6.0 Nm
Cheese-head screw for securing the enclosure to the wall mounting bracket	6.0 Nm
SUNCLIX swivel nut	2.0 Nm
Screw terminal AC connection	2.5 Nm
RS485 communication connection	1.5 Nm

12.9 Earthing Systems

TN-C system	Suitable
TN-S system	Suitable
TN-C-S system	Suitable
TT system, if U_{NPE} < 30 V	Suitable

13 Accessories

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

Designation	Brief description	SMA order number
Bluetooth retrofit kit	*Bluetooth* communication interface	BTPBINV-NR
Electronic Solar Switch	ESS as a spare part	ESS-HANDLE:04*
Insertion tool for replacement of varistors	Insertion tool for varistors	SB-TVWZ
Replacement varistors	Set with two thermally-monitored varistors incl. insertion tool	MSWR-TV 7
Ventilation grid	Ventilation grid set "right and left" as spare part	45-7202
RS485 retrofit kit	RS485 interface	485PB-SMC-NR
SMA Power Balancer Y cable	Connecting cable for SMA Power Balancer plug-in system, 2 × 2 m	PBL-YCABLE-10
String fuses, 8 A	Retrofit kit with 5 x 8 A fuses incl. fuse protection	FUSEKIT 8A-NR
String fuses, 10 A	Retrofit kit with 5 x 10 A fuses incl. fuse protection	FUSEKIT 10A-NR
String fuses, 12 A	Retrofit kit with 5 x 12 A fuses incl. fuse protection	FUSEKIT 12A-NR
String fuses, 16 A	Retrofit kit with 5 x 16 A fuses incl. fuse protection	FUSEKIT 16A-NR
String fuses, 20 A	Retrofit kit with 5 x 20 A fuses incl. fuse protection	FUSEKIT 20A-NR
SUNCLIX DC connector	Field plug for conductor cross-sections of 2.5 mm² ... 6 mm²	SUNCLIX-FC6-SET

* When ordering an Electronic Solar Switch, also indicate the serial number of the inverter.

14 Contact

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

- Inverter device type
- Inverter serial number
- Firmware version of the inverter
- Special country-specific settings of the inverter (if applicable)
- Type and number of the PV modules connected
- Installation location and installation altitude of the inverter
- LED signal and display message of the inverter
- Optional equipment, e.g. communication products

SMA Solar Technology AG

Sonnenallee 1

34266 Niestetal, Germany

www.SMA.de

SMA Service Line

Inverters: +49 561 9522 1499

Communication: +49 561 9522 2499

Fax: +49 561 9522 4699

E-Mail: ServiceLine@SMA.de

SMA Manufacturer's Warranty

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

Trademarks

All trademarks are recognised even if these are not marked separately. Missing designations do not mean that a product or brand is not a registered trademark.

The *Bluetooth*® word mark and logos are registered trademarks owned by Bluetooth SIG, Inc. and any use of such marks by SMA Solar Technology AG is under licence.

QR Code® is a registered trademark of DENSO WAVE INCORPORATED.

SMA Solar Technology AG
Sonnenallee 1
34266 Niestetal
Germany

Tel. +49 561 9522-0
Fax +49 561 9522-100
www.SMA.de
E-Mail: info@SMA.de

SMA Solar Technology

www.SMA-Solar.com