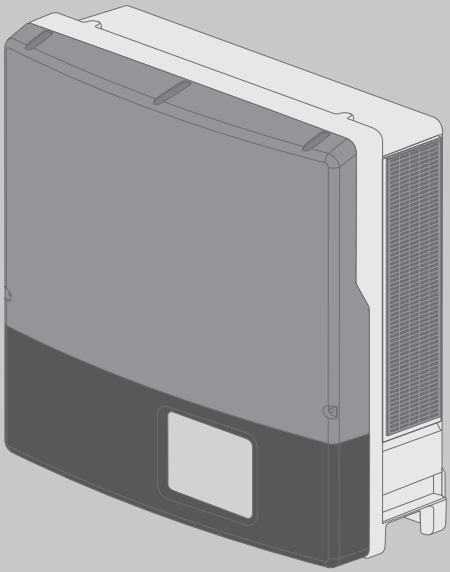
Service Manual

SUNNY TRIPOWER 15000TL / 17000TL



STP15-17TL-10-SG-en-10 | Version 1.0

AMERICAN ENGLISH

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1 Information on this Document

1.1 Validity

This document describes how to rectify certain errors and how to replace defective components. This document supplements the documents that are enclosed with each product and does not replace any locally applicable standards or directives. Read and observe all documents supplied with the product.

This document is valid for the following device types:

- STP 15000TL-10 (Sunny Tripower 15000TL)
- STP 17000TL-10 (Sunny Tripower 17000TL)

1.2 Target Group

The tasks described in this document must only be performed by qualified persons. Qualified persons must have the following skills:

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

1.3 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, can result in death or serious injury
⚠ CAUTION	Indicates a hazardous situation which, if not avoided, can result in minor or moderate injury
NOTICE	Indicates a situation which, if not avoided, can result in property damage
🛈	Information that is important for a specific topic or goal, but is not safety-relevant
☐	Indicates a requirement for meeting a specific goal
☑	Desired result
✖	A problem that might occur

1.4 Nomenclature

Complete designation	Designation in this document
Sunny Tripower	Inverter, product
Electronic Solar Switch	ESS
SMA BLUETOOTH Wireless Technology	BLUETOOTH

2 Safety

2.1 Safety Information

This section contains safety information that must be observed at all times when working on or with the product.

To prevent personal injury and property damage and to ensure long-term operation of the product, read this section carefully and observe all safety information at all times.

⚠ DANGER

Danger to life due to high voltages of the PV array

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

- Do not touch uninsulated cable ends.
- Do not touch the DC conductors.
- Do not touch any live components of the inverter.
- Have the inverter mounted, installed and commissioned only by qualified persons with the appropriate skills.
- If an error occurs, have it rectified by qualified persons only.
- Prior to performing any work on the inverter, disconnect it from all voltage sources as described in this document (see Section 2.2 "Disconnecting the Inverter from Voltage Sources", page 7).

⚠ DANGER

Danger to life due to electric shock

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

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

⚠ CAUTION

Risk of burns due to hot enclosure parts

Some parts of the enclosure can get hot during operation.

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

NOTICE

Damage to the seal of the enclosure lids in subfreezing conditions

If you open the upper and lower enclosure lids in subfreezing conditions, the seals on the enclosure lids can be damaged. This can lead to moisture entering the inverter.

- Do not open the inverter at ambient temperatures lower than -5 °C.
- If a layer of ice has formed on the seal of the lid in subfreezing conditions, remove it prior to opening the enclosure lids of the inverter (e.g. by melting the ice with warm air). Observe the applicable safety regulations.

NOTICE

Damage to the display or the type label due to the use of cleaning agents

- If the inverter is dirty, clean the enclosure, the enclosure lid, the type label, the display and the LEDs with a damp cloth only.

2.2 Disconnecting the Inverter from Voltage Sources

Prior to performing any work on the inverter, always disconnect it from all voltage sources as described in this section. Always adhere to the prescribed sequence.

NOTICE

Destruction of the measuring device due to overvoltage

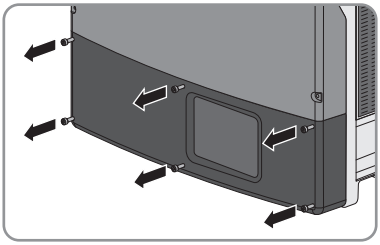
- Only use measuring devices with a DC input voltage range of 1,000 V or higher.

Procedure:

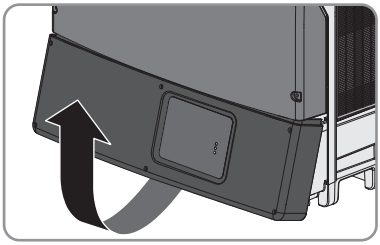
1. Disconnect the circuit breaker from all three line conductors and secure against reconnection.
2. If the multifunction relay is used, switch off any supply voltage to the load.
3. Test whether there is an acoustic signal.

   If an acoustic signals sounds and the display shows an error message that prohibits disconnecting the ESS, wait until dark. The ESS can only be disconnected once it is dark.

   If no acoustic signal sounds and the display does not show an error message, remove the ESS.
4. Wait until the LEDs and the display have gone out.
5. Remove all six screws from the lower enclosure lid using an Allen key (AF 3).



6. Flip the lower enclosure lid up and remove it.



7. **⚠ CAUTION**

   Risk of burns when touching the DC protective cover

   The DC protective cover can get hot during operation.

   - Do not touch the DC protective cover.

8. Use an appropriate measuring device to ensure that no voltage is present at the AC connecting terminal plate between **L1** and **N**, **L2** and **N**, and **L3** and **N**. Insert the test probe into each round opening of the terminal.
9. Use an appropriate measuring device to ensure that no voltage is present at the AC connecting terminal plate between **L1** and **PE**, **L2** and **PE**, and **L3** and **PE**. Insert the test probe into each round opening of the terminal.
10. If you are using the multifunction relay, ensure that no voltage is present between any of the terminals on the multifunction relay and **PE** on the AC connecting terminal plate.
11. Use a current clamp to ensure that no current is present in the DC cables.
12. Release and remove all DC connectors. To do this, insert a flat-blade screwdriver or an angled screwdriver (blade width: 3.5 mm) into one of the side slots and pull the DC connectors straight out. Do not pull on the cable.
13. **⚠ DANGER**

    Danger to life due to high voltages in the inverter

    The capacitors in the inverter take 20 minutes to discharge.

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

14. ***NOTICE***

    Damage to the inverter due to electrostatic discharge

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

    - Ground yourself before touching any component.

3 Cleaning the Inverter

NOTICE

Damage to the display or the type label due to the use of cleaning agents

- If the inverter is dirty, clean the enclosure, the enclosure lid, the type label, the display and the LEDs with a damp cloth only.

4 Troubleshooting

4.1 LED Signals

The LEDs indicate the operating state of the inverter.

LED	Status	Explanation
Green LED	glowing	Feed-in operation If an event occurs during feed-in operation, an event message will be shown on the display (for event messages see the service manual at www.SMA-Solar.com).
	flashing	The conditions for feed-in operation are not yet met. As soon as the conditions are met, the inverter will start feed-in operation.
Red LED	glowing	Error If an error occurs, the error message and the corresponding event number will be shown in the display. The error must be rectified by a qualified person (for troubleshooting, see the service manual at www.SMA-Solar.com).
Blue LED	glowing	BLUETOOTH communication is activated.

4.2 Event Messages

Display message	Cause
Self-test	The self-test is in progress.
Set parameter	The parameter changes are being adopted.
Parameters set successfully	The parameter changes were successfully adopted.
Update file OK	The update file found is valid.
SD card is read	The SD memory card is searched for update files and the update file is checked.
No new update SD card	The SD memory card contains an update file that has already been used.
Update communication	The inverter is performing an update of the communication component.
Update main CPU	The inverter is updating the inverter component.
Update RS485I module	The inverter is updating the corresponding component.
Update Speedwire	The inverter is updating the corresponding component.
Webconnect update	The inverter is updating the corresponding component.
Update Bluetooth	The inverter is updating the corresponding component.

Display message	Cause
Upd. language table	The inverter is updating the corresponding component.
Update display	The inverter is updating the corresponding component.
Update String prot.	The inverter is updating the corresponding component.
Update completed	The inverter has successfully completed the update.
Grid param. unchanged	The parameters are locked and you cannot change them.
Inst. code valid	The entered Grid Guard code is valid. Protected parameters have now been unlocked and you can adjust the parameters. The parameters will be automatically locked again after ten feed-in hours.

4.3 Error Messages

Event number	Display message, cause and corrective measures
101 to 103	**Grid fault** The grid voltage or grid impedance at the connection point of the inverter is too high. The inverter has disconnected from the utility grid. **Corrective measures:** • Check whether the grid voltage at the connection point of the inverter is permanently in the permissible range. If the grid voltage is outside the permissible range due to local grid conditions, contact the grid operator. The grid operator must agree with an adjustment of the voltage at the feed-in point or with a change of the monitored operating limits. If the grid voltage is permanently within the permissible range and this message is still displayed, contact Service.

Event number	Display message, cause and corrective measures
202 to 203	**Grid fault** The utility grid has been disconnected, the AC cable is damaged or the grid voltage at the connection point of the inverter is too low. The inverter has disconnected from the utility grid. **Corrective measures:** • Make sure that the circuit breaker is switched on. • Make sure that the AC cable is not damaged. • Make sure that the AC cable is correctly connected. • Check whether the grid voltage at the connection point of the inverter is permanently in the permissible range. If the grid voltage is outside the permissible range due to local grid conditions, contact the grid operator. The grid operator must agree with an adjustment of the voltage at the feed-in point or with a change of the monitored operating limits. If the grid voltage is permanently within the permissible range and this message is still displayed, contact Service (see Section 15, page 43).
301	**Grid fault** The ten-minute average value of the grid voltage is no longer within the permissible range. The grid voltage or grid impedance at the connection point is too high. The inverter disconnects from the utility grid to maintain power quality. **Corrective measures:** • Check whether the grid voltage at the connection point of the inverter is permanently in the permissible range. If the grid voltage is outside the permissible range due to local grid conditions, contact the grid operator. The grid operator must agree with an adjustment of the voltage at the feed-in point or with a change of the monitored operating limits. If the grid voltage is permanently within the permissible range and this message is still displayed, contact Service (see Section 15, page 43).
401 to 404	**Grid fault** The inverter is no longer in grid-parallel operation. The inverter has stopped feeding into the utility grid. **Corrective measures:** • Check the grid connection for significant short-term frequency fluctuations.

Event number	Display message, cause and corrective measures
501	**Grid fault** The power frequency is not within the permissible range. The inverter has disconnected from the utility grid. **Corrective measures:** • If possible, check the power frequency and observe how often fluctuations occur. If fluctuations occur frequently and this message is displayed often, contact the grid operator and request approval to change the operating parameters of the inverter. If the grid operator gives his approval, discuss any changes to the operating parameters with Service (see Section 15, page 43).
601	**Grid fault** The inverter has detected an excessively high proportion of direct current in the grid current. **Corrective measures:** • Check the grid connection for direct current. • If this message is displayed frequently, contact the grid operator and check whether the monitoring threshold on the inverter can be raised.
701	**Frq. not permitted > Check parameter** The power frequency is not within the permissible range. The inverter has disconnected from the utility grid. **Corrective measures:** • If possible, check the power frequency and observe how often fluctuations occur. If fluctuations occur frequently and this message is displayed often, contact the grid operator and request approval to change the operating parameters of the inverter. If the grid operator gives his approval, discuss any changes to the operating parameters with Service (see Section 15, page 43).
1302	**Waiting for grid voltage > Grid failure > Check AC circuit breaker** The AC cable is not correctly connected or the country data set is not correctly configured. **Corrective measures:** • Ensure that the AC cable is correctly connected (see the operating manual of the inverter). • Ensure that the country data set has been configured correctly. • Check the fuse.

Event number	Display message, cause and corrective measures
1501	**Reconnection fault grid** The changed country data set or the value of a parameter you have set does not correspond to the local requirements. The inverter cannot connect to the utility grid. **Corrective measures:** • Ensure that the country data set has been configured correctly. Check the setting of the rotary switches **A** and **B** or select the operating parameter **Set country standard** and check the value.
3301 to 3303	**Unstable operation** The ten-minute average value of the grid voltage is no longer within the permissible range. The grid voltage or grid impedance at the connection point is too high. The inverter disconnects from the utility grid to maintain power quality. **Corrective measures:** • Check whether the grid voltage at the connection point of the inverter is permanently in the permissible range. If the grid voltage is outside the permissible range due to local grid conditions, contact the grid operator. The grid operator must agree with an adjustment of the voltage at the feed-in point or with a change of the monitored operating limits. If the grid voltage is permanently within the permissible range and this message is still displayed, contact Service (see Section 15, page 43).
3401 to 3402	**DC overvoltage > Disconnect generator** Overvoltage at the DC input. This can destroy the inverter. This message is additionally highlighted by rapid flashing of the backlight. **Corrective measures:** • Immediately disconnect the inverter from all voltage sources (see Section 2.2, page 7). • Check whether the DC voltage is below the maximum input voltage of the inverter. If the DC voltage is below the maximum input voltage of the inverter, reconnect the DC connectors to the inverter. • If the DC voltage exceeds the maximum input voltage of the inverter, ensure that the PV array has been correctly rated or contact the installer of the PV array. • If this message is repeated frequently, contact Service (see Section 15, page 43).

Event number	Display message, cause and corrective measures
3501	**Insulation failure > Check generator** The inverter has detected a ground fault in the PV array. **Corrective measures:** • Check the PV system for ground faults (see Section 7, page 28).
3601	**High discharge curr. > Check generator** The leakage current of the inverter and the PV array is too high. There is a ground fault, a residual current or a malfunction. The inverter interrupts feed-in operation immediately after exceeding a limiting value. When the fault is eliminated, the inverter automatically reconnects to the utility grid. **Corrective measures:** • Check the PV system for ground faults (see Section 7, page 28).
3701	**Resid.curr.too.high > Check generator** The inverter has detected a residual current due to temporary grounding of the PV array. **Corrective measures:** • Check the PV system for ground faults (see Section 7, page 28).
3801 to 3802	**DC overcurrent > Check generator** Overcurrent at the DC input. The inverter briefly interrupts feed-in operation. **Corrective measures:** • If this message is displayed frequently, ensure that the PV array has been correctly rated and wired.
3901 to 3902	**Waiting for DC start cond. > Start cond. not met** The feed-in conditions for the utility grid are not yet fulfilled. **Corrective measures:** • Wait for higher irradiation. • If this message is displayed frequently in the morning, increase the voltage limit for starting grid feed-in. Change the parameter **Critical voltage to start feed-in**. • If this message is displayed frequently with medium irradiation, ensure that the PV array is correctly rated.

Event number	Display message, cause and corrective measures
4001	**String X defect. > Do not disconn. ESS** There is reverse current in the string displayed or the polarity of this string is reversed. Further strings could also be affected. The PV array is short-circuited. In exceptional circumstances, this error message may be triggered by soiling or shading of the modules (e.g. by leaves or snow). **Corrective measures:** • Disconnect the inverter from voltage sources when it is dark (see Section 2.2, page 7) • Check the design and the circuitry of the PV array. • If irradiation is sufficient, check whether the same voltage is present at the DC inputs **A1** to **A5**. If the same voltage is not present, one of the PV modules is possibly defective.
4002	**String X low power > Check generator** String-failure detection has detected a failed or weak string. **Corrective measures:** • Test the string that is shown in the message.
4003	**String X defect. > Do not disconn. ESS** String-failure detection has detected a failed or weak substring. **Corrective measures:** • Disconnect the inverter from all voltage sources (see Section 2.2, page 7) . • Check the design and the circuitry of the PV array. • If irradiation is sufficient, check whether the same voltage is present at the DC inputs **A1** to **A5**. If the same voltage is not present, one of the PV modules is possibly defective.
4005	**Part.str. X low p. > Check generator** String-failure detection has detected a failed or weak substring. **Corrective measures:** • Test the substring indicated in the message.
6001 to 6445	**Self diagnosis > Interference device** The cause must be determined by the Service. **Corrective measures:** • Contact Service (see Section 15, page 43).

Event number	Display message, cause and corrective measures
6313	**Interference device** The cause must be determined by the Service. **Corrective measures:** • Contact Service (see Section 15, page 43).
6429 to 6439	**Interference device** The cause must be determined by the Service. **Corrective measures:** • Contact Service (see Section 15, page 43).
6501 to 6502	**Self diagnosis > Overtemperature** The inverter has switched off due to excessive temperature. **Corrective measures:** • Clean the cooling fins on the rear of the enclosure and the air ducts on the top using a soft brush. • Ensure that the inverter has sufficient ventilation.
6603 to 6604	**Self-diagnosis > Overload** The cause must be determined by the Service. **Corrective measures:** • Contact Service (see Section 15, page 43).
6701 to 6702	**Comm. disturbed** The cause must be determined by the Service. **Corrective measures:** • Contact Service (see Section 15, page 43).
6801 to 6802	**Self-diagnosis > Input A defective** The cause must be determined by the Service. **Corrective measures:** • Contact Service (see Section 15, page 43).
6901 to 6902	**Self-diagnosis > Input B defective** The cause must be determined by the Service. **Corrective measures:** • Contact Service (see Section 15, page 43).
7001 to 7002	**Sensor fault fan permanently on** The cause must be determined by the Service. **Corrective measures:** • Contact Service (see Section 15, page 43).

Event number	Display message, cause and corrective measures
7101	**SD card defective** The SD memory card is not formatted. **Corrective measures:** • Re-format the SD memory card. • Re-save the files to the SD memory card.
7102	**Parameter file not found or defective** The parameter file was not found or is defective. The update failed. The inverter continues feeding power into the grid. **Corrective measures:** • Copy the parameter file into the card drive: \PARASET directory.
7105	**Param. setting failed** It was not possible to set the parameter via the SD memory card. The inverter continues feeding power into the grid. **Corrective measures:** • Check the parameters for valid values. • Ensure change rights via SMA Grid Guard code.
7106	**Update file defect.** Update file on the SD memory card is faulty. **Corrective measures:** • Re-format the SD memory card. • Re-save the files to the SD memory card.
7110	**No update file found** No update file has been found. **Corrective measures:** • Copy the update file in the SD memory card folder. Select the folder **\UPDATE**.
7201 to 7202	**Data stor. not poss.** Internal error. The inverter continues to feed into the utility grid. **Corrective measures:** • Contact Service.
7303	**Update main CPU failed** The cause must be determined by the Service. **Corrective measures:** • Contact Service (see Section 15, page 43).

Event number	Display message, cause and corrective measures
7305	**Update RS485I module failed** Internal error. The inverter continues to feed into the utility grid. **Corrective measures:** • Retry update. • If this message is displayed again, contact Service (see Section 15, page 43).
7307	**Update BT failed** Internal error. The inverter continues to feed into the utility grid. **Corrective measures:** • Retry update. • If this message is displayed again, contact Service (see Section 15, page 43).
7309	**Upd. display failed** Internal error. The inverter continues to feed into the utility grid. **Corrective measures:** • Retry update. • If this message is displayed again, contact Service (see Section 15, page 43).
7311	**Update language table failed** Internal error. The inverter continues to feed into the utility grid. **Corrective measures:** • Retry update. • If this message is displayed again, contact Service (see Section 15, page 43).
7314	**Update string protection failed** Internal error. The inverter continues to feed into the utility grid. **Corrective measures:** • Retry update. • If this message is displayed again, contact Service (see Section 15, page 43).
7316	**Update Speedwire module failed** Internal error. The inverter continues to feed into the utility grid. **Corrective measures:** • Retry update. • If this message is displayed again, contact Service (see Section 15, page 43).

Event number	Display message, cause and corrective measures
7324	**Wait for update conditions** • Ensure that there is DC supply to the inverter and that it feeds more than 1,000 W into the utility grid for over one minute.
7326	**Webconnect update failed** Internal error. The inverter continues to feed into the utility grid. **Corrective measures:** • Retry update.
7401	**Varistor defective** At least one of the thermally monitored varistors is defective. **Corrective measures:** • Check the function of the varistors (see Section 8, page 31).
7508	**Fan fault > Clean fan** One of the fans is blocked. **Corrective measures:** • Clean the fans (see Section 5, page 23).
7701 to 7703	**Self diagnosis > Interference device** The cause must be determined by the Service. **Corrective measures:** • Contact Service (see Section 15, page 43).
8001	**Derating occurred** The power supplied by the inverter was reduced to below the maximum possible instantaneous power (derating) for more than ten minutes due to excessive temperature. **Corrective measures:** • If this message is displayed frequently, clean the fans (see Section 5, page 23). • Ensure that the inverter has sufficient ventilation.
8104	**Interference device** The cause must be determined by the Service. **Corrective measures:** • Contact Service (see Section 15, page 43).
8201	**Interference device > Do not disconn. ESS** The cause must be determined by the Service. **Corrective measures:** • Disconnect the inverter from all voltage sources when it is dark (see Section 2.2, page 7). • Contact Service (see Section 15, page 43).

Event number	Display message, cause and corrective measures
8202	**Connect ESS, do not open cover** Device disturbance or reverse current in the PV array. Wait until dark before disconnecting the PV array from the inverter in order to prevent the risk of an electric arc occurring when the DC connectors are pulled out. **Corrective measures:** • Securely plug in the ESS all the way. • Disconnect the inverter from all voltage sources when it is dark (see Section 2.2, page 7).
8203	**Interference device > Do not disconn. ESS** The cause must be determined by the Service. **Corrective measures:** • Disconnect the inverter from all voltage sources when it is dark (see Section 2.2, page 7). • Contact Service (see Section 15, page 43).
8301	**Lightn.prot.inactive > Chk lightn.prot.A/PE** At least one surge arrester is defective. **Corrective measures:** • Check the function of the surge arresters (see Section 10, page 34).
8302	**Lightn.prot.inactive > Chk lightn.prot.B/PE** At least one surge arrester is defective. **Corrective measures:** • Check the function of the surge arresters (see Section 10, page 34).
8401	**Overheating > Disconn. device from generator and grid** Device disturbance due to overheating in the inverter. The inverter disconnects from the utility grid and from the PV array. **Corrective measures:** • Contact Service (see Section 15, page 43).
9002	**Grid Guard-Code invalid** The SMA Grid Guard code entered is incorrect. The operating parameters are still protected and cannot be changed. **Corrective measures:** • Enter the correct SMA Grid Guard code.
9003	**Grid param. locked** The parameters are now locked but can be changed at any time via the rotary switch. No corrective measures required.

Event number	Display message, cause and corrective measures
9005	**Changing grid param. not possible > Ensure DC supply** This error can have the following causes: • The selected rotary switch setting for the country configuration is not programmed. • The parameters to be changed are protected. • The DC voltage at the DC input is not sufficient to run the main CPU. **Corrective measures:** • Ensure that the country data set has been configured correctly. • Enter the SMA Grid Guard code. • Ensure that sufficient DC voltage is available (green LED is glowing or flashing).
9007	**Abort self-test** Error in the AC cabling. **Corrective measures:** • Ensure that the AC connection is correct (see operating manual of the inverter).

5 Cleaning the Fans

5.1 Cleaning the Fan at the Bottom

First clean the fan at the bottom of the inverter and then clean the fan on the left-hand side of the enclosure.

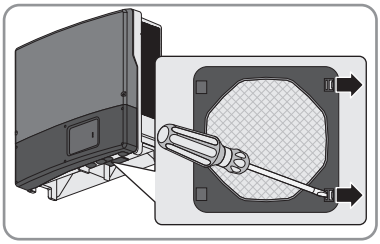
Procedure:

1. **⚠ DANGER**

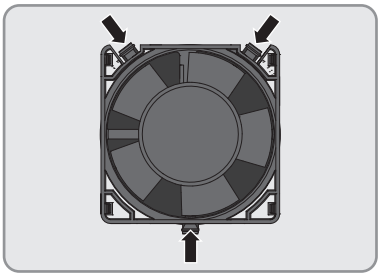
   Danger to life due to electric shock

   - Disconnect the inverter from all voltage sources (see Section 2.2 "Disconnecting the Inverter from Voltage Sources", page 7).

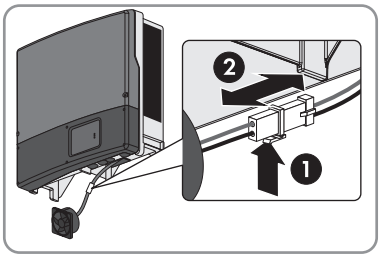
2. Wait for the fan to stop rotating.
3. Remove the fan guard and clean it:
   - Use a screwdriver to push the two locking tabs at the right-hand edge of the fan guard to the right-hand side and remove them from the retainer.



   - Carefully remove the fan guard.
   - Clean the fan guard with a soft brush, a paint brush, a cloth or compressed air.
4. Press the locking tabs on the fan toward the center of the fan.



5. Carefully remove the fan from the inverter.
6. Release and remove the fan plug.

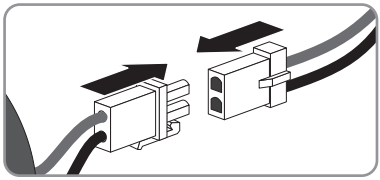


7. *NOTICE*

Damage to the fan due to compressed air

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

8. After cleaning, insert the fan plug back into the pin connector until it snaps into place.



9. Insert the fan into the inverter until it snaps into place.
10. Push the fan guard into the retainer until it snaps into place.
11. Clean the fan on the left-hand side of the enclosure (see Section 5.2 "Cleaning the Fan on the Left-Hand Side of the Enclosure", page 24).

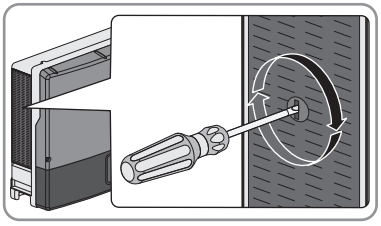
5.2 Cleaning the Fan on the Left-Hand Side of the Enclosure

1. **⚠ DANGER**

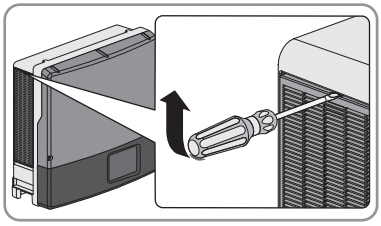
Danger to life due to electric shock

- Ensure that the inverter is disconnected from all voltage sources (see Section 2.2 "Disconnecting the Inverter from Voltage Sources", page 7).

2. Remove the ventilation grids on the left-hand and right-hand sides and clean them:
   - Turn the rotary fastener of the ventilation grid with a flat-blade screwdriver until the notch is in a vertical position.



   - Remove the ventilation grid. Use a screwdriver to gently lever open the ventilation grid.



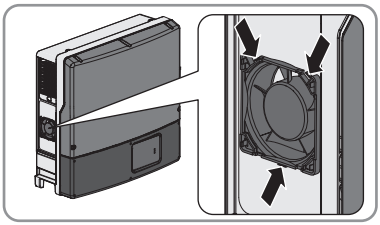
   - Clean the ventilation grid with a soft brush, a paint brush, or compressed air.

3. *NOTICE*

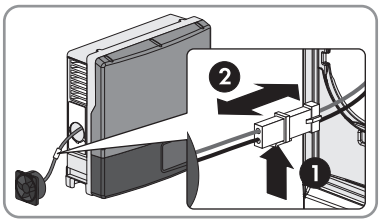
Damage to the inverter due to foreign bodies

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

4. Wait for the fan to stop rotating.
5. Press the locking tabs on the fan toward the center of the fan.



6. Carefully remove the fan from the inverter.
7. Release and remove the fan plug.

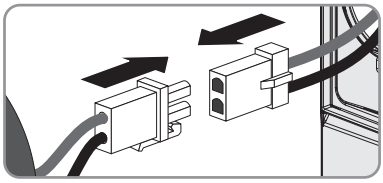


8. *NOTICE*

Damage to the fan due to compressed air

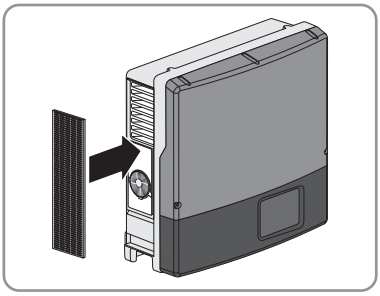
- Clean the fan only with a soft brush, a paint brush, or a damp cloth.

9. After cleaning, insert the fan plug into the pin connector until it snaps into place.

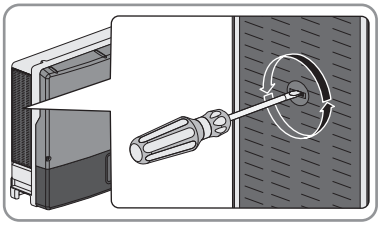


10. Insert the fan into the inverter until it snaps into place.
11. Attach the ventilation grids on the right-hand and left-hand side of the inverter:

- Reinsert the ventilation grid until it snaps into place.



- Turn the rotary lock of the ventilation grid with a flat-blade screwdriver until the slot is in a horizontal position and the arrows point to the right.



- Ensure that the ventilation grid is securely in place.

12. Recommission the inverter (see Section 12, page 38).
13. Check the fans to ensure that they are working properly (see Section 6, page 27).

6 Checking the Function of the Fans

You can check the function of the fans by setting a parameter.

The basic procedure for changing operating parameters is described in the manual of the inverter or the communication product (see the operating manual of the inverter or communication product).

Procedure:

1. Select the parameter **Fan test** or **FanTst** and set to **On.**
2. Save settings.
3. Check whether air is being drawn in through the bottom and is coming out of the upper ventilation grids and whether the fans are making any unusual noises.

   If no air is being drawn in through the bottom, no air is coming out of the ventilation grids, or the fans are making unusual noises, then the fans were presumably installed improperly. Check whether the fans have been installed correctly.

   If the fans were installed correctly, contact Service (see Section 15, page 43).
4. Select the parameter **Fan test** or **FanTst** and set to **Off**.
5. Save settings.

7 Checking the PV System for Ground Faults

If the inverter displays the event numbers **3501**, **3601** or **3701**, there could be a ground fault. The electrical insulation from the PV system to ground is defective or insufficient.

⚠ WARNING

Danger to life due to electric shock

In the event of a ground fault, high voltages can be present.

- Touch the cables of the PV array on the insulation only.
- Do not touch any parts of the substructure or frame of the PV array.
- Do not connect PV strings with ground faults to the inverter.

NOTICE

Destruction of the measuring device due to overvoltage

- Only use measuring devices with a DC input voltage range of 1,000 V or higher.

Procedure:

In order to check the PV system for ground faults, perform the following actions in the prescribed order. The exact procedure is described in the following sections.

- Check the PV system for ground faults by measuring the voltage.
- If the voltage measurement was not successful, check the PV system via insulation resistance measurement for ground faults.

Test by Measuring the Voltage

Proceed as follows to check each string in the PV system for ground faults.

Procedure:

1. **⚠ DANGER**

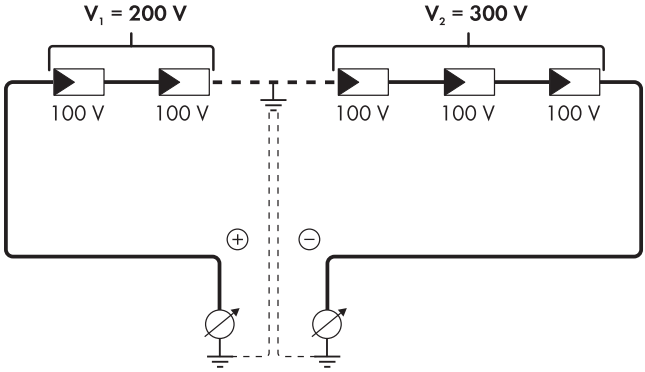
   Danger to life due to high voltages

   - Disconnect the inverter from all voltage sources (see Section 2.2, page 7).

2. Measure the voltages:
   - Measure the voltage between the positive terminal and the ground potential (PE).
   - Measure the voltage between the negative terminal and the ground potential (PE).
   - Measure the voltage between the positive and negative terminals.
     If the following results are present at the same time, there is a ground fault in the PV system:
     - ☑ All measured voltages are stable.
     - ☑ The sum of the two voltages to ground potential is approximately equal to the voltage between the positive and negative terminals.
   - If a ground fault is present, determine the location of the ground fault via the ratio of the two measured voltages and eliminate the ground fault.

Example: Location of the ground fault

The example shows a ground fault between the second and third PV module.



3. If a definite ground fault cannot be measured and the message is still displayed, measure the insulation resistance.
4. Reconnect the strings without ground faults to the inverter and recommission the inverter (see Section 12, page 38).

Test by Measuring the Insulation Resistance

If the voltage measurement does not provide sufficient evidence of a ground fault, the insulation resistance measurement can provide more exact results.

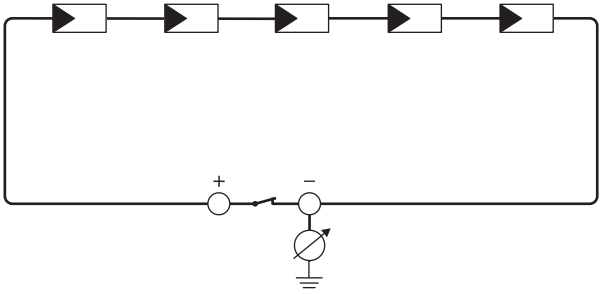


Figure 1: Schematic diagram of the measurement

i Calculating the insulation resistance

The expected total resistance of the PV system or of an individual string can be calculated using the following formula:

$$\frac{1}{R_{total}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \ldots$$

The exact insulation resistance of a PV module can be obtained from the module manufacturer or the datasheet.

For the resistance of a PV module an average value can be assumed: for thin-film PV modules approximately 40 MOhm and for polycrystalline and monocrystalline PV modules approximately 50 MOhm per PV module (for further information on calculating the insulation resistance see the Technical Information "Insulation Resistance (Riso) of Non-Galvanically Isolated PV Systems" at www.SMA-Solar.com).

Required devices:

☐ Suitable device for safe disconnection and short-circuiting

☐ Measuring device for insulation resistance

i Device required for safe disconnection and short-circuiting of the PV array

The insulation resistance can only be measured with a suitable device for safe disconnection and short-circuiting of the PV array. If no suitable device is available, the insulation measurement must not be carried out.

Procedure:

1. Calculate the expected insulation resistance per string.
2. **⚠ DANGER**

   Danger to life due to high voltages

   - Disconnect the inverter from all voltage sources (see Section 2.2, page 7).
3. Install the short circuit device.
4. Connect the measuring device for insulation resistance.
5. Short-circuit the first string.
6. Set the test voltage. The test voltage should be as close as possible to the maximum system voltage of the PV modules but must not exceed it (see datasheet of the PV modules).
7. Measure the insulation resistance.
8. Eliminate the short circuit.
9. Measure the remaining strings in the same manner.

   ☑ If the insulation resistance of a string deviates considerably from the theoretically calculated value, there is a ground fault present in that string.
10. Reconnect to the inverter only those strings from which the ground fault has been eliminated.
11. Reconnect all other strings to the inverter.
12. Recommission the inverter (see Section 12, page 38).
13. If the inverter still displays an insulation error, contact Service (see Section 15, page 43). The PV modules might not be suitable for the inverter in the present quantity.

8 Checking the Function of the Varistors

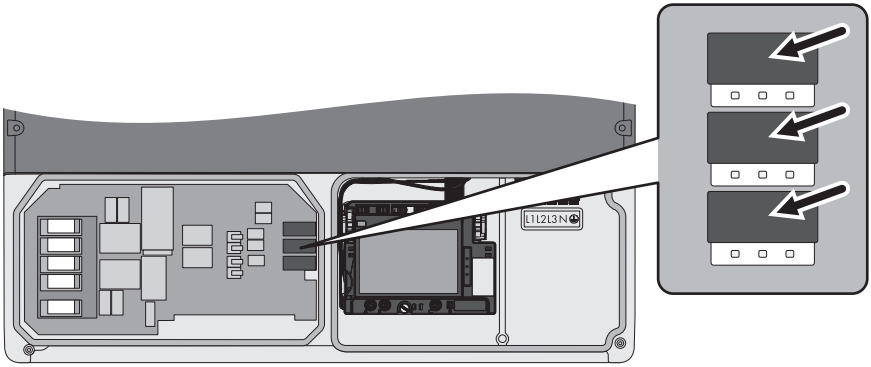


Figure 2: Varistors inside the inverter

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 PV systems 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 of 1,000 V or higher.

Check the function of each varistor as described in the following:

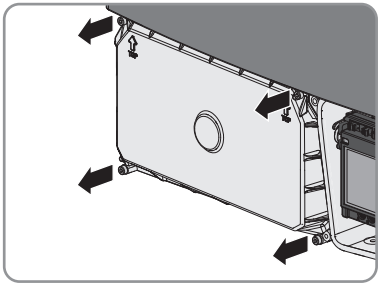
Procedure:

1. **⚠ DANGER**

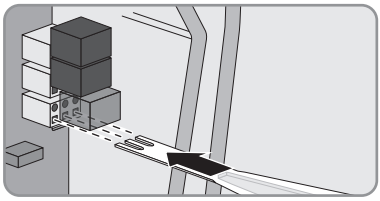
   Danger to life due to high voltages

   - Disconnect the inverter from all voltage sources and open the lower enclosure lid (see Section 2.2, page 7).

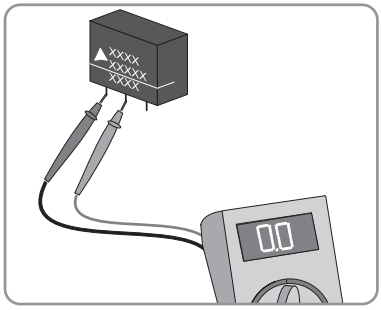
2. Release all four screws of the DC protective cover using an Allen key (AF 3) and remove the DC protective cover.



3. Insert the insertion tool into the clamping contacts of the connecting terminal plate.



4. Remove the varistor from the connecting terminal plate.
5. Use a measuring device to measure whether there is a conductive connection between the middle and the left-hand varistor lead. Hold the varistor with the labeling pointing forward.



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 14 "Spare Parts", page 42).
- Reinsert old varistors and leave them in place until new varistors and insertion tools are available.
- If new varistors are available, replace all varistors (see Section 9, page 33).

If a conductive connection is present, contact Service (see Section 15, page 43).

9 Replacing the Varistors

Proceed as follows to replace each varistor.

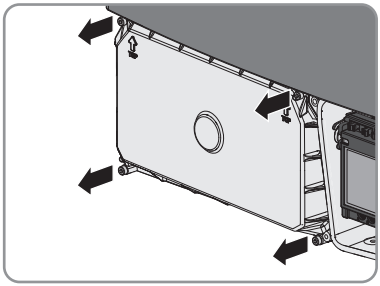
Procedure:

1. **⚠ DANGER**

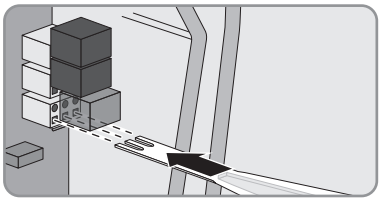
   Danger to life due to high voltages

   - Disconnect the inverter from all voltage sources and open the lower enclosure lid (see Section 2.2, page 7).

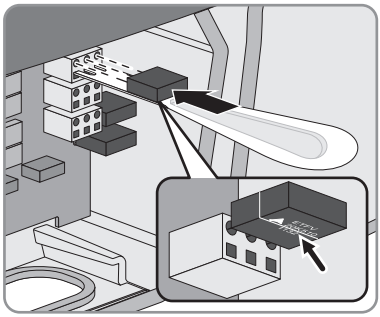
2. Release all four screws of the DC protective cover using an Allen key (AF 3) and remove the DC protective cover.



3. Insert the insertion tool into the clamping contacts of the connecting terminal plate.



4. Remove the varistor from the connecting terminal plate.
5. Insert the new varistor into the connecting terminal plate. The labeling on the varistor must face down towards the insertion tool.



6. Remove the insertion tool from the clamping contacts of the connecting terminal plate.
7. Recommission the inverter (see Section 12, page 38).

10 Checking the Function of the Surge Arresters

If the inverter displays the event numbers **8301** or **8302**, at least one surge arrester is defective. Check the function of each surge arrester as described in the following:

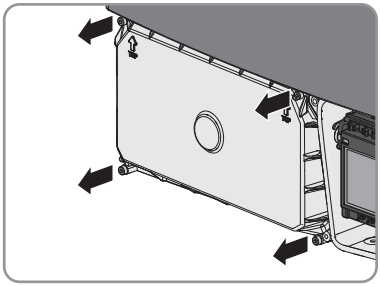
Procedure:

1. **⚠ DANGER**

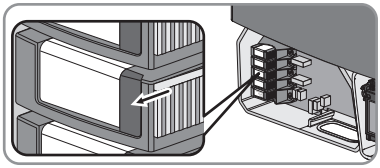
   Danger to life due to electric shock

   - Disconnect the inverter from all voltage sources (see Section 2.2, page 7).
   - Wait 20 minutes before removing the DC protective cover.

2. Release the screws on the DC protective cover using an Allen key (AF 3), lift the DC protective cover upwards from below and remove it.



3. Check whether a surge arrester is defective.

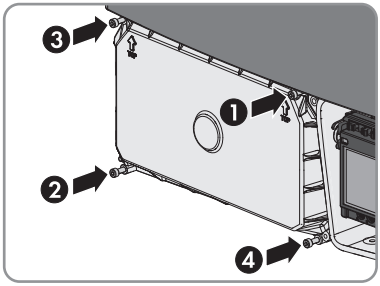


   If a green stripe is visible next to the type designation in the inspection window of the surge arrester, then the surge arrester is in good condition.

   If a red stripe is visible next to the type designation in the inspection window of the surge arrester, then the surge arrester is defective. SMA Solar Technology AG recommends replacing all surge arresters since the cause of the failure usually affects all surge arresters to the same extent.

   - Order new surge arresters (see Section 14 "Spare Parts", page 42).
   - If new surge arresters are available, replace all surge arresters (see Section 11, page 36).

4. Tighten all four screws on the DC protective cover with an Allen key (AF 3) in the sequence 1 to 4 (torque: 3 Nm ± 0.3 Nm).



5. Recommission the inverter (see Section 12, page 38).

11 Replacing the Surge Arrester

If the inverter displays the event numbers **8301** or **8302**, at least one surge arrester is defective. SMA Solar Technology AGrecommends replacing all surge arresters.

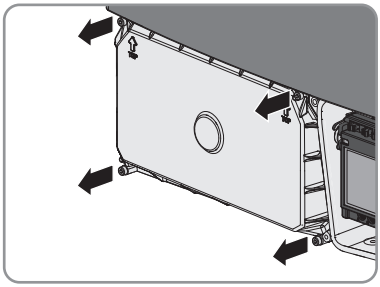
Procedure:

1. **⚠ DANGER**

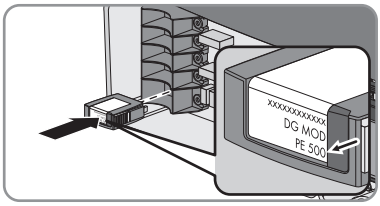
   Danger to life due to high voltages

   - Disconnect the inverter from all voltage sources and open the lower enclosure lid (see Section 2.2, page 7).
   - Wait 20 minutes before removing the DC protective cover.

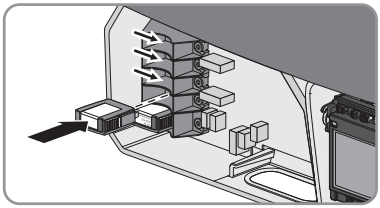
2. Release all four screws of the DC protective cover using an Allen key (AF 3) and remove the DC protective cover.



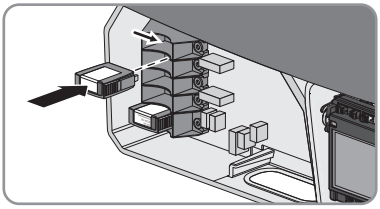
3. Pull all surge arresters out of the slots. To do so, squeeze the grooved areas on the left and right sides of the surge arrester.
4. Insert new surge arresters:
   - The surge arrester marked "PE 500" must be inserted in the bottom slot. The inspection window on the surge arrester must face to the right.



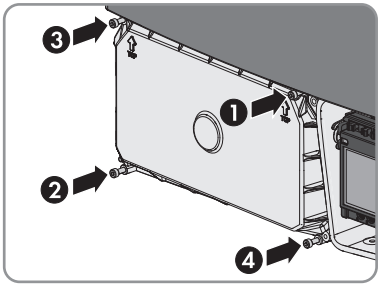
   - If input A and input B were secured with surge arresters, insert a new surge arrester into each slot. The inspection window on each surge arrester must face to the right.



- If only input A was secured with a surge arrester, insert both new surge arresters into the two upper slots. The inspection window on each surge arrester must face to the right.



5. Ensure that each surge arrester is securely inserted into its slot.
6. Tighten all four screws on the DC protective cover with an Allen key (AF 3) in the sequence 1 to 4 (torque: 3 Nm ± 0.3 Nm).



7. Recommission the inverter (see Section 12, page 38).

12 Recommissioning the Inverter

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

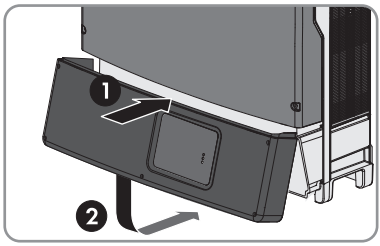
Requirements:

☐ The inverter must be correctly mounted.

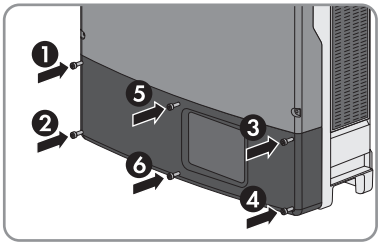
☐ The circuit breaker must be correctly rated.

Procedure:

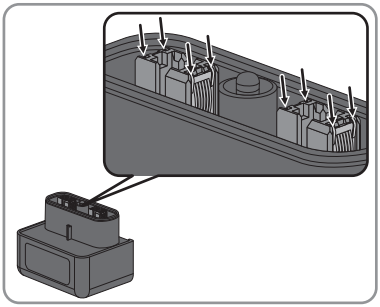
1. Connect the DC connectors to the inverter.
   ☑ The DC connectors snap into place.
2. Seal all unused DC inputs using the DC connectors with sealing plugs.
3. Ensure that all DC connectors are securely in place.
4. Insert the lower enclosure lid from above and fold it down. The screws must protrude from the lower enclosure lid.



5. Tighten all six screws with an Allen key (AF 3) in the order 1 to 6 (torque: 2.0 Nm ± 0.3 Nm). By tightening the screws in the prescribed order, you avoid warping the enclosure lid, which would keep it from sealing correctly.
   Useful hint: If the screws fall out of the lower enclosure lid, insert the long screw into the lower middle hole and the five short screws into the other holes.



6. If the ESS is used, check it for signs of wear:
   - Check the metal mounting tabs inside the ESS for discoloration or damage.
     If the metal mounting tabs show brown discoloration or are damaged, order a new ESS from SMA Solar Technology AG and have the ESS replaced.
     If the metal mounting tabs show no brown discoloration or damage, the ESS is not worn and can still be used.



7. Securely plug in the ESS. The ESS must be aligned parallel to and flush with the enclosure.

8. Switch on the circuit breaker of all three line conductors.
9. If the multifunction relay is used, switch on any supply voltage to the load.

☑ All three LEDs start to glow and the start-up phase begins. The start-up phase may take several minutes.

☑ The green LED is glowing and the display alternates between the device type, the firmware version, the serial number or designation of the inverter, the NetID, the configured country data set and the display language.

✖ Green LED is flashing?

Possible cause of error: the DC input voltage is still too low or the inverter is monitoring the utility grid.

- Once the DC input voltage is sufficiently high and the grid connection conditions are met, the inverter will start operation.

✖ The red LED is glowing and an error message and event number appear in the display?

An error has occurred.

- Rectify the error (see Section 4 "Troubleshooting", page 10).

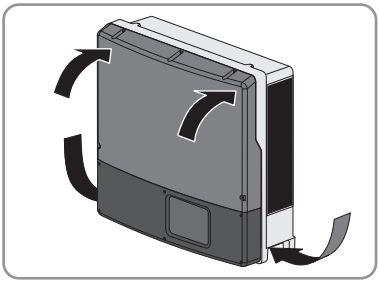
13 Decommissioning the Inverter

⚠ CAUTION

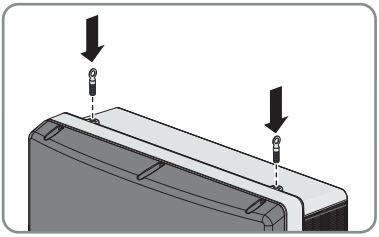
Risk of injury when lifting the inverter, or if it is dropped

The inverter weighs 59 kg. There is risk of injury if the inverter is lifted incorrectly or dropped while being transported or when attaching it to or removing it from the wall mounting bracket.

- Carry and lift the inverter in an upright position with several people without tilting it. With one hand grasp the recessed grip, and with the other hand support the top part of the enclosure. This will prevent the inverter tipping forward.



- If the inverter is to be transported and lifted with a crane, remove the filler plugs on the top of the inverter and screw the eye bolts into the threads.



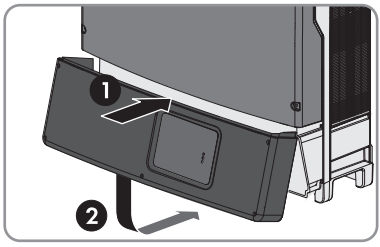
Procedure:

1. **⚠ DANGER**

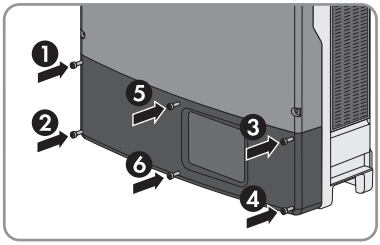
   Danger to life due to high voltages

   - Disconnect the inverter from all voltage sources (see Section 2.2, page 7).
2. Remove the AC cable from the inverter. Press the locking levers all the way upward and pull the conductors out of the connecting terminal plate for the AC cable.
3. Press down the locking levers of the connecting terminal plate for the AC cable.
4. If the multi-function relay or the SMA Power Control Module are used, remove the connection cable from the inverter.
5. If other cables (e.g. data cables or network cables) are connected, remove them from the inverter.
6. If the inverter is protected against theft, open the padlock and remove it.

7. Insert the lower enclosure lid from above and fold it down. The screws must protrude from the lower enclosure lid.



8. Tighten all six screws with an Allen key (AF 3) in the order 1 to 6 (torque: 2.0 Nm ± 0.3 Nm). By tightening the screws in the prescribed order, you avoid warping the enclosure lid, which would keep it from sealing correctly.
   Useful hint: If the screws fall out of the lower enclosure lid, insert the long screw into the lower middle hole and the five short screws into the other holes.



9. Securely plug in the ESS. The ESS must be aligned parallel to and flush with the enclosure.
10. **⚠ CAUTION**

    Risk of burns due to hot enclosure parts

    - Wait 30 minutes for the enclosure to cool down.
11. Using an Allen key (AF 4), unscrew the two M5x10 cylindrical screws by which the inverter is fastened to the rear panel.
12. Raise the inverter to remove it from the rear panel.
13. If the inverter is to be stored or shipped in packaging, pack the inverter and, if applicable, the ESS. Use the original packaging or packaging that is suitable for the weight and dimensions of the inverter.
14. Dispose of the inverter in accordance with the locally applicable disposal regulations for electronic waste.

14 Spare Parts

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

Designation	Brief description	SMA order number
Electronic Solar Switch	ESS as spare part	ESS-HANDLE*
Replacement varistors	Set with four thermally-monitored varistors incl. insertion tool	STP-TV9
Insertion tool for replacing varistors	Insertion tool for varistors	SB-TVWZ
Surge arrester type II	Type II surge arrester for input A and input B	DC_SPD_KIT_2-10
SUNCLIX DC connector	Field plug for conductor cross-sections of 2.5 mm² to 6 mm²	SUNCLIX-FC6-SET
Ventilation grid	Ventilation grid set (right and left) as spare part	45-1089980

* When ordering a new ESS, always indicate the device type and serial number of the inverter.

15 Contact

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

- Inverter device type
- Inverter serial number
- Inverter firmware version
- Special country-specific settings of the inverter (if applicable)
- Type and quantity of PV modules connected
- Mounting location and altitude of the inverter
- Inverter message
- Optional equipment, e.g. communication products
- Operating mode of the multifunction relay (if present)

Australia	SMA Australia Pty Ltd. Sydney	Toll free for Australia: 1800 SMA AUS (1800 762 287) International: +61 2 9491 4200
Belgien/Belgique/België	SMA Benelux BVBA/SPRL Mecheln	+32 15 286 730
Brasil	Vide España (Espanha)	
Česko	SMA Central & Eastern Europe s.r.o. Praha	+420 235 010 417
Chile	Ver España	
Danmark	Se Deutschland (Tyskland)	
Deutschland	SMA Solar Technology AG Niestetal	Sunny Boy, Sunny Mini Central, Sunny Tripower: +49 561 9522-1499 Monitoring Systems (Kommunikationsprodukte): +49 561 9522-2499 Fuel Save Controller (PV-Diesel-Hybridsysteme): +49 561 9522-3199 Sunny Island, Sunny Backup, Hydro Boy: +49 561 9522-399 Sunny Central: +49 561 9522-299 Online Service: www.SMA.de/Service
España	SMA Ibérica Tecnología Solar, S.L.U. Barcelona	Llamada gratuita en España: 900 14 22 22 Internacional: +34 902 14 24 24

France	SMA France S.A.S. Lyon	Sunny Boy, Sunny Mini Central, Sunny Tripower: +33 472 09 04 40 Monitoring Systems: +33 472 09 04 41 Sunny Island : +33 472 09 04 42 Sunny Central : +33 472 09 04 43
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Magyarország	lásd Česko (Csehország)	
Nederland	zie Belgien (België)	
Österreich	Siehe Deutschland	
Perú	Ver España	
Polska	Patrz Česko (Czechy)	
Portugal	SMA Solar Technology Portugal, Unipessoal Lda Lisboa	Gratuito em Portugal: 800 20 89 87 Internacional: +351 212377860
România	Vezi Česko (Cehia)	
Schweiz	Siehe Deutschland	
Slovensko	pozri Česko (Česká republika)	
South Africa	SMA Solar Technology South Africa Pty Ltd. Centurion (Pretoria)	08600 SUNNY (08600 78669) International: +27 (12) 643 1785
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Ελλάδα	SMA Hellas AE Αθήνα	801 222 9 222 International: +30 212 222 9 222
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대한민국	SMA Technology Korea Co., Ltd. 서울	+82-2-520-2666

		+971 2 234-6177	SMA Middle East LLC أبو ظبي الإمارات العربية المتحدة
Other countries	International SMA Service Line Niestetal	Toll free worldwide: 00800 SMA SERVICE (+800 762 7378423)	

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