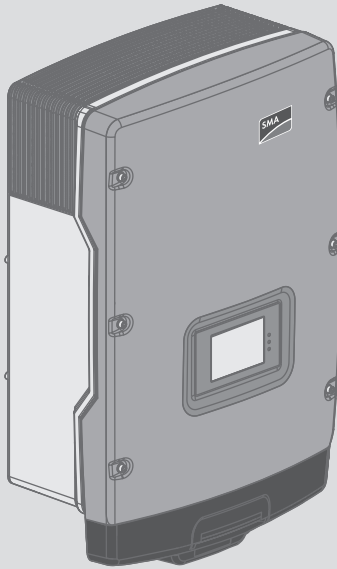


Service Manual for Installers

## **SUNNY TRIPOWER**

**5000TL/6000TL/7000TL/8000TL/9000TL/  
10000TL/12000TL**



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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 from firmware version 2.56.03.R:




- STP 5000TL-20 (Sunny Tripower 5000TL)
- STP 6000TL-20 (Sunny Tripower 6000TL)
- STP 7000TL-20 (Sunny Tripower 7000TL)
- STP 8000TL-20 (Sunny Tripower 8000TL)
- STP 9000TL-20 (Sunny Tripower 9000TL)
- STP 10000TL-20 (Sunny Tripower 10000TL)
- STP 12000TL-20 (Sunny Tripower 12000TL)





## 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
 <b>DANGER</b>	Indicates a hazardous situation which, if not avoided, will result in death or serious injury
 <b>WARNING</b>	Indicates a hazardous situation which, if not avoided, can result in death or serious injury
 <b>CAUTION</b>	Indicates a hazardous situation which, if not avoided, can result in minor or moderate injury
<b>NOTICE</b>	Indicates a situation which, if not avoided, can result in property damage

Symbol	Explanation
	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 non-insulated 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.

#### DANGER

##### **Danger to life due to electric shock**

Touching an ungrounded PV module or array frame can cause a lethal 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.

- During operation, do not touch any parts other than the enclosure lid of the inverter.

**NOTICE****Damage to the seal of the enclosure lid in sub-zero conditions**

If you open the enclosure lid in sub-zero conditions, the sealing of the enclosure lid can be damaged. This can lead to moisture entering the inverter.

- Do not open the inverter at ambient temperatures lower than  $-5^{\circ}\text{C}$ .
- If a layer of ice has formed on the seal of the enclosure lid in sub-zero conditions, remove it prior to opening 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 and clear water only.

## 2.2 Disconnecting the Inverter from Voltage Sources

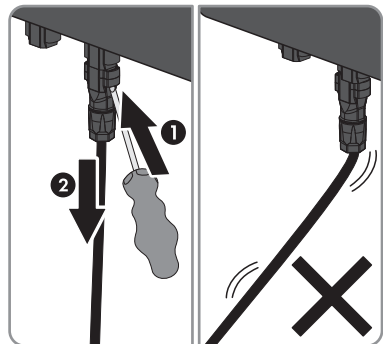
Prior to performing any work on the inverter, always disconnect it from all voltage sources as described in this section. Always adhere to the prescribed sequence.

**NOTICE****Destruction of the measuring device due to overvoltage**

- Only use measuring devices with a DC input voltage range of 1000 V or higher.

**Procedure:**

1. Disconnect the circuit breaker from all three line conductors and secure against reconnection.
2. Remove the ESS.
3. Loosen two screws of the protective cover using an Allen key (AF 5) and remove the protective cover.
4. Use a current clamp to ensure that no current is present in the DC cables.
5. 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.



6. **⚠ DANGER**

**Danger to life due to high voltages**

The capacitors in the inverter take five minutes to discharge.

- Wait five minutes before opening the enclosure lid.

7. Ensure that no voltage is present at the DC inputs of the inverter.

8. Unscrew all the screws of the enclosure lid using an Allen key (AF 5) and remove the enclosure lid.

9. 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.

10. 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.

11. Ensure that no voltage is present between any terminal of the multifunction relay and **PE** of the AC connecting terminal plate.

12. **NOTICE**

**Damage to the inverter due to electrostatic discharge**

The internal components of the inverter can be irreparably damaged by 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 and clear water 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 <a href="http://www.SMA-Solar.com">www.SMA-Solar.com</a> ).
	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 <a href="http://www.SMA-Solar.com">www.SMA-Solar.com</a> ).
Blue LED	glowing	For inverters including BLUETOOTH as standard equipment: BLUETOOTH communication is activated.

### 4.2 Event Messages

Display message	Cause
Update file OK	The update file found is valid.
Grid parameter locked	The parameters are locked and you cannot change them.
Update communication	The inverter is updating the communication component.
Update main CPU	The inverter is updating the inverter component.
Update Bluetooth	The inverter updates the BLUETOOTH component.
Upd. language table	The inverter is updating the language table.
Update completed	The inverter has successfully completed the update.
Grid parameters unchanged	The selected rotary switch position is not assigned or the grid parameters cannot be changed.
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.
Self-test	The self-test is in progress.

## 4.3 Error Messages

Event number	Display message, cause and corrective measures
101 to 103	<p data-bbox="292 236 393 258"><b>Grid fault</b></p> <p data-bbox="292 272 981 325">The grid voltage or grid impedance at the connection point of the inverter is too high. The inverter has disconnected from the utility grid.</p> <p data-bbox="292 336 508 359"><b>Corrective measures:</b></p> <ul data-bbox="311 370 990 422" style="list-style-type: none"> <li data-bbox="311 370 990 422">• Check whether the grid voltage at the connection point of the inverter is permanently in the permissible range.</li> </ul> <p data-bbox="337 437 990 549">If the grid voltage is outside the permissible range due to local grid conditions, contact the grid operator. Ask the grid operator whether the voltage can be adjusted at the feed-in point or request approval to change the monitored operating limits.</p> <p data-bbox="337 560 975 612">If the grid voltage is permanently within the permissible range and this message is still displayed, contact the SMA Service Line.</p>
202 to 203	<p data-bbox="292 628 393 651"><b>Grid fault</b></p> <p data-bbox="292 665 990 745">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.</p> <p data-bbox="292 756 508 778"><b>Corrective measures:</b></p> <ul data-bbox="311 790 990 963" style="list-style-type: none"> <li data-bbox="311 790 781 812">• Make sure that the circuit breaker is switched on.</li> <li data-bbox="311 831 754 853">• Make sure that the AC cable is not damaged.</li> <li data-bbox="311 873 810 895">• Make sure that the AC cable is correctly connected.</li> <li data-bbox="311 914 990 963">• Check whether the grid voltage at the connection point of the inverter is permanently in the permissible range.</li> </ul> <p data-bbox="337 978 990 1090">If the grid voltage is outside the permissible range due to local grid conditions, contact the grid operator. Ask the grid operator whether the voltage can be adjusted at the feed-in point or request approval to change the monitored operating limits.</p> <p data-bbox="337 1101 975 1153">If the grid voltage is permanently within the permissible range and this message is still displayed, contact Service.</p>

Event number	Display message, cause and corrective measures
301	<p><b>Grid fault</b></p> <p>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.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Check whether the grid voltage at the connection point of the inverter is permanently in the permissible range.</li> </ul> <p>If the grid voltage is outside the permissible range due to local grid conditions, contact the grid operator. Ask the grid operator whether the voltage can be adjusted at the feed-in point or request approval to change the monitored operating limits.</p> <p>If the grid voltage is permanently within the permissible range and this message is still displayed, contact Service.</p>
401 to 404	<p><b>Grid fault</b></p> <p>The inverter is no longer in grid-parallel operation. The inverter has stopped feeding into the utility grid.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Check the grid connection for significant short-term frequency fluctuations.</li> </ul>
501	<p><b>Grid fault</b></p> <p>The power frequency is not within the permissible range. The inverter has disconnected from the utility grid.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• If possible, check the power frequency and observe how often fluctuations occur.</li> </ul> <p>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.</p> <p>If the grid operator gives his approval, discuss any changes to the operating parameters with the Service.</p>
601	<p><b>Grid fault</b></p> <p>The inverter has detected an excessively high proportion of direct current in the grid current.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Check the grid connection for direct current.</li> <li>• If this message is displayed frequently, contact the grid operator and check whether the monitoring threshold on the inverter can be raised.</li> </ul>

Event number	Display message, cause and corrective measures
701	<p><b>Frq. not permitted &gt; Check parameter</b></p> <p>The power frequency is not within the permissible range. The inverter has disconnected from the utility grid.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• If possible, check the power frequency and observe how often fluctuations occur.</li> </ul> <p>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.</p> <p>If the grid operator gives his approval, discuss any changes to the operating parameters with the Service.</p>
1302	<p><b>Waiting for grid voltage &gt; Installation failure grid connection &gt; Check grid and fuses</b></p> <p>The inverter has detected an error in the AC cabling or the potential difference between N and the grounding conductor in the installation is higher than 50 V.</p> <p>The inverter cannot connect to the utility grid.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Ensure that the AC connection is correct (see operating manual of the inverter).</li> <li>• Ensure that there is no potential difference between N and the grounding conductor in the building installation.</li> <li>• Ensure that the country data set has been configured correctly. Check the positions of the rotary switches <b>A</b> and <b>B</b> or select and check the parameter for the country data set.</li> </ul>
1501	<p><b>Reconnection fault Utility grid</b></p> <p>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.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Ensure that the country data set has been configured correctly. Check the positions of the rotary switches <b>A</b> and <b>B</b> or select and check the parameter for the country data set.</li> </ul>
3302 to 3303	<p><b>Unstable operation</b></p> <p>There is not enough power at the DC input of the inverter for stable operation. The inverter cannot connect to the utility grid.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Ensure that the PV array is designed correctly.</li> </ul>

Event number	Display message, cause and corrective measures
3401 to 3402	<p><b>DC overvoltage &gt; Disconnect generator</b></p> <p>Overvoltage at the DC input. This can destroy the inverter.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Immediately disconnect the inverter from all voltage sources (see Section 2.2, page 7).</li> <li>• 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.</li> <li>• If the DC voltage is above the maximum input voltage of the inverter, ensure that the PV array has been correctly rated or contact the installer of the PV array.</li> <li>• If this message is repeated frequently, contact the Service.</li> </ul>
3501	<p><b>Insulation resist. &gt; Check generator</b></p> <p>The inverter has detected a ground fault in the PV array.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Check the PV system for ground faults (see Section 5, page 18).</li> </ul>
3601	<p><b>High discharge curr. &gt; Check generator</b></p> <p>The leakage current from the inverter and the PV array is too high. There is a ground fault, a residual current or a malfunction.</p> <p>The inverter interrupts feed-in operation immediately after exceeding a threshold and then automatically reconnects to the utility grid.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Check the PV system for ground faults (see Section 5, page 18).</li> </ul>
3701	<p><b>Resid.curr.too.high &gt; Check generator</b></p> <p>The inverter has detected a residual current due to temporary grounding of the PV array.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Check the PV system for ground faults (see Section 5, page 18).</li> </ul>
3801 to 3802	<p><b>DC overcurrent &gt; Check generator</b></p> <p>Overcurrent at the DC input. The inverter briefly interrupts feed-in operation.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• If this message is displayed frequently, ensure that the PV array has been correctly rated and wired.</li> </ul>

Event number	Display message, cause and corrective measures
3901 to 3902	<p><b>Waiting for DC start conditions &gt; Start cond. not met</b>            The feed-in conditions for the utility grid are not yet fulfilled.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Wait for higher irradiation.</li> <li>• If this message is displayed frequently in the morning, increase the voltage limit for starting grid feed-in. Change the parameter <b>Critical voltage to start feed-in</b>.</li> <li>• If this message is displayed frequently with medium irradiation, ensure that the PV array is correctly rated.</li> </ul>
6001 to 6438	<p><b>Self diagnosis &gt; Interference device</b>            The cause must be determined by the Service.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Contact the Service.</li> </ul>
6501 to 6509	<p><b>Self-diagnosis &gt; Overtemperature</b>            The inverter has switched off due to excessive temperature.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Clean the fans (see Section 8, page 25).</li> <li>• Ensure that the inverter has sufficient ventilation.</li> </ul>
6511	<p><b>Overtemperature</b>            The inverter has switched off due to excessive temperature.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Clean the fans (see Section 8, page 25).</li> <li>• Ensure that the inverter has sufficient ventilation.</li> </ul>
6603 to 6604	<p><b>Self-diagnosis &gt; Overload</b>            The cause must be determined by the Service.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Contact the Service.</li> </ul>
6801 to 6802	<p><b>Self-diagnosis &gt; Input A defective</b>            The cause must be determined by the Service.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Contact the Service.</li> </ul>
6901 to 6902	<p><b>Self-diagnosis &gt; Input B defective</b>            The cause must be determined by the Service.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Contact the Service.</li> </ul>

Event number	Display message, cause and corrective measures
7001 to 7002	<p><b>Sensor fault fan permanently on</b></p> <p>The cause must be determined by the Service.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Contact the Service.</li> </ul>
7401	<p><b>Varistor defective</b></p> <p>At least one of the thermally monitored varistors is defective.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Check the function of the varistors (see Section 6, page 22).</li> </ul>
7701 to 7703	<p><b>Self diagnosis &gt; Interference device</b></p> <p>The cause must be determined by the Service.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Contact the Service.</li> </ul>
8001	<p><b>Derating occurred</b></p> <p>The inverter has reduced its power output for more than ten minutes due to excessive temperature.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• If this message is displayed frequently, clean the fans (see Section 8, page 25).</li> <li>• Ensure that the inverter has sufficient ventilation.</li> </ul>
8101 to 8104	<p><b>Comm. disturbed</b></p> <p>The cause must be determined by the Service.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Contact the Service.</li> </ul>
8801 to 8803	<p><b>No display</b></p> <p>This error message can have three causes, but the inverter continues to feed into the utility grid.</p> <p>The ambient temperature is lower than -25°C. The display switched off for reasons of protection.</p> <p>The inverter cannot identify the display type.</p> <p>No display is connected to the inverter or the connection is defective.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• If the display switched off due to the ambient temperature being too low, wait until the ambient temperature is above -25°C.</li> <li>• If the ambient temperature is above -25°C, contact the Service.</li> </ul>



Event number	Display message, cause and corrective measures
9002	<p data-bbox="288 177 468 209"><b>Inst. code invalid</b></p> <p data-bbox="288 209 990 272">The Grid Guard code entered is incorrect. The operating parameters are still protected and cannot be changed.</p> <p data-bbox="288 272 508 304"><b>Corrective measures:</b></p> <ul data-bbox="306 304 654 336" style="list-style-type: none"><li data-bbox="306 304 654 336">• Enter the correct Grid Guard code.</li></ul>
9003	<p data-bbox="288 347 530 379"><b>Grid parameter locked</b></p> <p data-bbox="288 379 922 411">The parameters are now locked. You cannot change the parameters.</p> <p data-bbox="288 411 508 443"><b>Corrective measures:</b></p> <ul data-bbox="306 443 788 475" style="list-style-type: none"><li data-bbox="306 443 788 475">• Unlock the parameters with the Grid Guard code.</li></ul>

## 5 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.

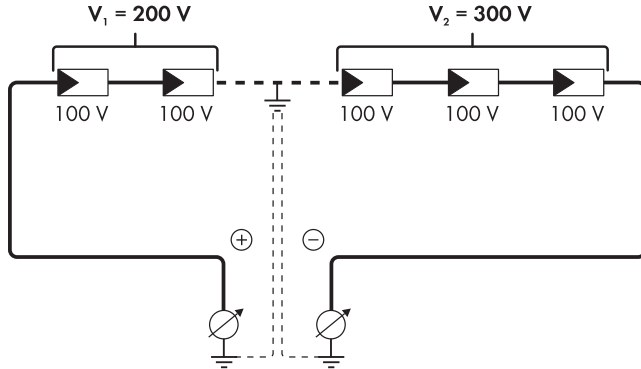
If the following results are present at the same time, there is a ground fault in the PV system:

- 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.

**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.

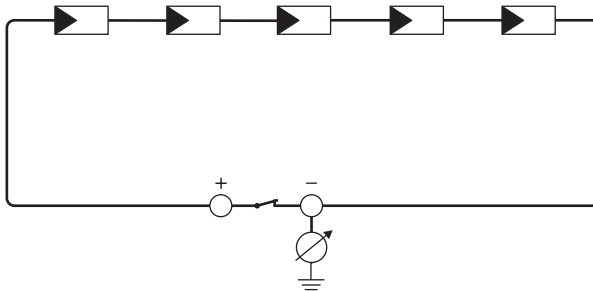


Figure 1: Schematic diagram of the measurement

### Calculating the insulation resistance

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

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

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 MΩ and for polycrystalline and monocrystalline PV modules approximately 50 MΩ 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](http://www.SMA-Solar.com)).

#### Required devices:

- Suitable device for safe disconnection and short-circuiting
- Measuring device for insulation resistance

### 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.
13. If the inverter still displays an insulation error, contact the Service (see Section 13 "Contact", page 34). The PV modules might not be suitable for the inverter in the present quantity.

## 6 Checking the Function of the Varistors

If the inverter is equipped with varistors and the error message **7401** occurs, the function of the varistors needs to be checked.

### Overview of the varistors

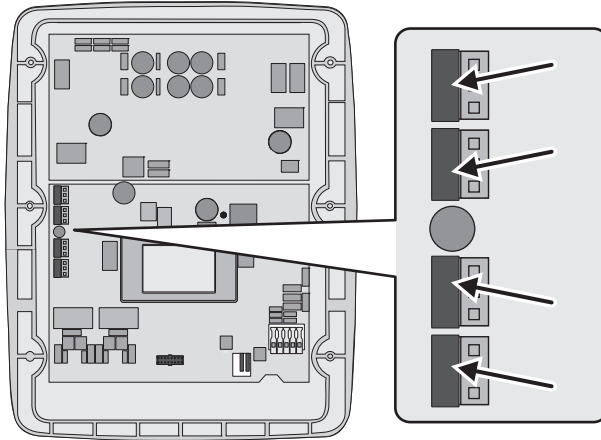


Figure 2: Position of the varistors inside the inverter

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

#### **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 1000 V or higher.

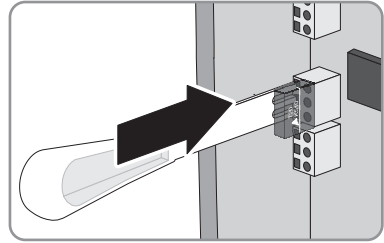
### Procedure:

1. **⚠ DANGER**

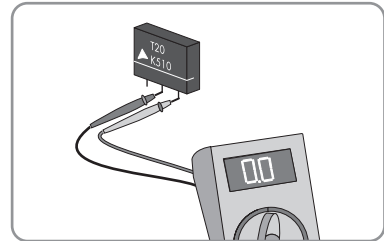
#### **Danger to life due to high voltages**

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

2. Position the insertion tool into the clamping contacts of the connecting terminal plate.



3. Remove the varistor from the connecting terminal plate.
4. Use a measuring device to measure whether there is a conductive connection between the middle and the right-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 12 "Spare Parts", page 33).
- 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 7, page 24).

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

## 7 Replacing the Varistors

Proceed as follows to replace each varistor.

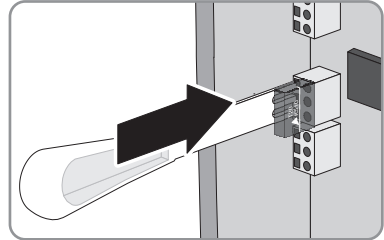
### Procedure:

1. **⚠ DANGER**

#### Danger to life due to high voltages

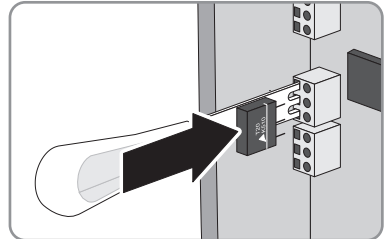
- Disconnect the inverter from all voltage sources and open the enclosure lid (see Section 2.2, page 7).

2. Position the insertion tool into the clamping contacts of the connecting terminal plate.



3. Remove the varistor from the connecting terminal plate.

4. Insert the new varistor into the connecting terminal plate. The label of the varistor must face to the right in the inside of the inverter.



5. Remove the insertion tool from the clamping contacts of the connecting terminal plate.
6. Recommission the inverter (see Section 10, page 28).



## 8 Cleaning the Fans

### Procedure:

- Clean the ventilation grids.
- Clean the fans.

### Cleaning the Ventilation Grids

Proceed as follows to clean each ventilation grid.

### Procedure:

1. Remove the ventilation grid laterally.
2. 

<b><i>NOTICE</i></b>
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#### Damage to the inverter due to foreign bodies

- Do not remove the ventilation grid permanently, otherwise foreign bodies could penetrate the enclosure.
3. Clean the ventilation grid with a soft brush, a paint brush, or compressed air.
  4. Close the recessed grips with the ventilation grids. Ensure that 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.

### Cleaning the Fans

Proceed as follows to clean each fan.

1. 

<b>⚠ DANGER</b>
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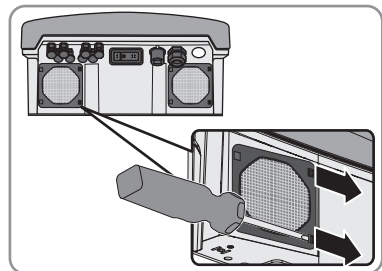
#### Danger to life due to high voltages

- Disconnect the inverter from all voltage sources (see Section 2.2, page 7).
2. Wait for the fans to stop rotating.
  3. Check whether the fan guard is dusty or badly clogged.

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

If the fan guard is heavily soiled, remove it 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.

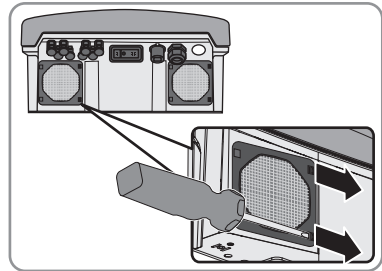


- Carefully remove the fan guard.
- Clean the fan guard with a soft brush, a paint brush, a cloth or compressed air.

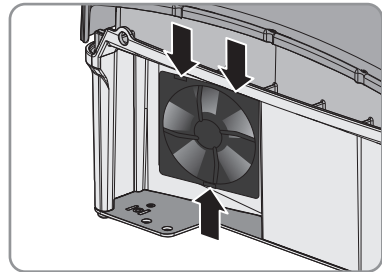
## 4. Check whether the fan is soiled.

If the fan is soiled, remove the fan:

- 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.
- Press the locking tabs of the fan to the center of the fan.



- Carefully remove the fan from the inverter.
- Release 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 in the pin connector until it snaps into place.
7. Insert the fan into the inverter until it snaps into place.
8. Press the fan guard into the bracket until it audibly snaps into place.
9. Recommission the inverter (see Section 10, page 28).
10. Check the fans to ensure that they are working properly (see Section 9, page 27).

## 9 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 13, page 34).

4. Select the parameter **Fan test** or **FanTst** and set to **Off**.
5. Save settings.

## 10 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.

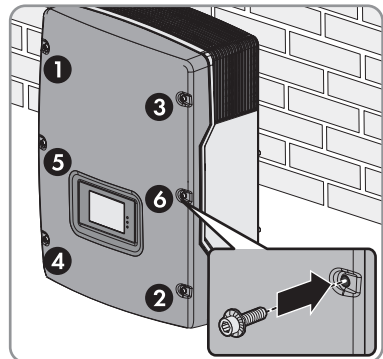
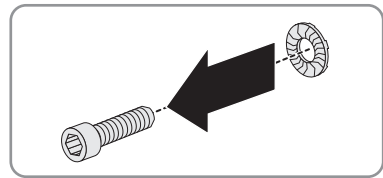
### Requirements:

- The circuit breaker must be correctly rated.
- The inverter must be correctly mounted.

### Procedure:

1. Attach the enclosure lid as follows:

- Fit one conical spring washer to each screw. The grooved side of the conical spring washer must face the screw head.
- Position the enclosure lid with the six screws on the enclosure and tighten all six screws in the sequence 1 to 6 using an Allen key (AF 5) (torque:  $6 \text{ Nm} \pm 0.5 \text{ Nm}$ ).
- The teeth of the conical spring washer press into the enclosure lid. This ensures that the enclosure lid is grounded.



2. Connect the DC connectors to the inverter.
3. Seal all unused DC inputs using the DC connectors with sealing plugs.
4. Secure the protective cover using two screws and an Allen key (AF 5).
5. Securely plug in the ESS.

6. Switch on the circuit breaker of all three line conductors.
  7. If the multifunction relay is used, switch on any supply voltage to the load.
- The start-up phase begins. The start-up phase may take several minutes.
  - The green LED is glowing and the display alternates between the firmware version, the serial number or designation of the inverter, the NetID, the IP address, the subnet mask, the configured country data set and the display language.
  - The 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?
    - Eliminate the error (see Section 4 "Troubleshooting", page 10).

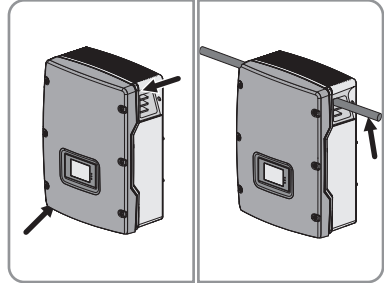
# 11 Decommissioning the Inverter

## ⚠ CAUTION

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

The inverter weighs 38 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 upright with the help of several people. Use both hands to grasp the recessed grips at the top and bottom, or use a steel rod (diameter: 30 mm at maximum). This will prevent the inverter from tipping forward.

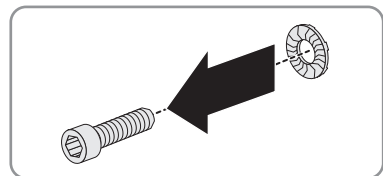


### Procedure:

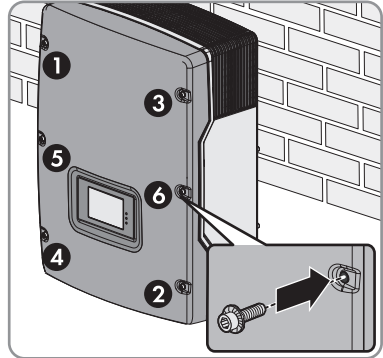
#### 1. ⚠ DANGER

#### Danger to life due to high voltages

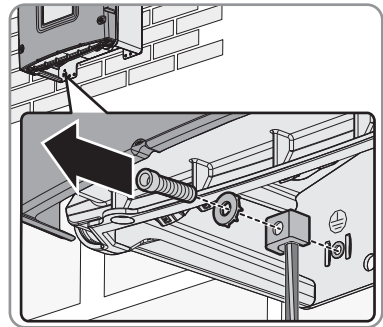
- Disconnect the inverter from all voltage sources (see Section 2.2, page 7).
2. Remove the AC cable from the inverter. Press the locking levers all the way upward and pull the conductors out of the connecting terminal plate for the AC cable.
  3. Press down the locking levers of the connecting terminal plate for the AC cable.
  4. If an Ethernet cable is connected for Speedwire communication, remove the cable from the inverter.
  5. If the multifunction relay, the SMA Power Control Module or the 485 Data Module Type B are used, remove the connection cable from the inverter.
  6. Attach the enclosure lid as follows:
    - Fit one conical spring washer to each screw. The grooved side of the conical spring washer must face the screw head.



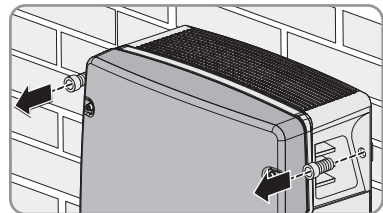
- Position the enclosure lid with the six screws on the enclosure and tighten all six screws in the sequence 1 to 6 using an Allen key (AF 5) (torque:  $6 \text{ Nm} \pm 0.5 \text{ Nm}$ ).
- ☑ The teeth of the conical spring washer press into the enclosure lid. This ensures that the enclosure lid is grounded.



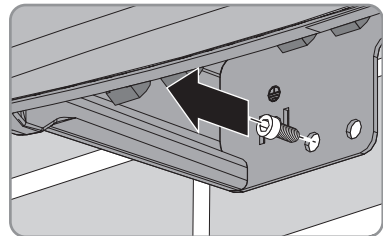
7. If an additional grounding or equipotential bonding is connected, loosen the cylindrical screw M6x16 and remove the screw, conical spring washer, clamping bracket and grounding conductor.



8. Remove the ventilation grids laterally.
9. Loosen the screws on both sides between the inverter and the wall mounting bracket using an Allen key (AF 5).



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



11. Remove the inverter by lifting it vertically up and off the wall mounting bracket.

12. 

<b><i>NOTICE</i></b>
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**Damage to the ESS pin connector from dirt and foreign bodies**

By setting down the inverter on uneven ground, dirt or foreign bodies can penetrate the interior of the pin connector and cause damage to the contacts. This will impair the function of the ESS.

- Always set the inverter down on a level support surface or lay it on its back.
13. If the inverter is to be stored or shipped in a package, pack the inverter, the protective cover and 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.



## 12 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.

<b>Designation</b>	<b>Brief description</b>	<b>SMA order number</b>
Electronic Solar Switch	ESS as spare part	ESS-HANDLE*
Replacement varistors	Set with four thermally-monitored varistors incl. insertion tool	STP-TV10
Insertion tool for replacing varistors	Insertion tool for varistors	SB-TVWZ
Ventilation grid	Ventilation grid set (right and left) as spare part	45-7202
SUNCLIX DC connector	Field plug for conductor cross-sections of 2.5 mm <sup>2</sup> to 6 mm <sup>2</sup>	SUNCLIX-FC6-SET

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

## 13 Contact

If you have technical problems with our products, please 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
- Inverter firmware version
- Special country-specific settings of the inverter (if applicable)
- Type and number of PV modules connected
- Mounting location and altitude of the inverter
- Inverter message
- Optional equipment, e.g. communication products
- If necessary, system name in the Sunny Portal
- If necessary, access data in the Sunny Portal
- Operating mode of the multifunction relay

Danmark	SMA Solar Technology AG	Belgien	SMA Benelux BVBA/SPRL
Deutschland	Niestetal	Belgique	Mechelen
Österreich	Sunny Boy, Sunny Mini Central,	België	+32 15 286 730
Schweiz	Sunny Tripower: +49 561 9522-1499	Luxemburg	SMA Online Service Center: www.SMA-Service.com
	Monitoring Systems (Kommunikationsprodukte): +49 561 9522-2499	Luxembourg	
	Fuel Save Controller (PV-Diesel-Hybridsysteme): +49 561 9522-3199	Nederland	
	Sunny Island, Sunny Boy Storage, Sunny Backup, Hydro Boy: +49 561 9522-399	Česko	SMA Service Partner
	Sunny Central, Sunny Central Storage: +49 561 9522-299	Magyarország	TERMS a.s.
	SMA Online Service Center: www.SMA-Service.com	Slovensko	+420 387 6 85 111 SMA Online Service Center: www.SMA-Service.com
		Türkiye	SMA Service Partner DEKOM Ltd. Şti. +90 24 22430605 SMA Online Service Center: www.SMA-Service.com

France	SMA France S.A.S. Lyon +33 472 22 97 00 SMA Online Service Center : www.SMA-Service.com	Ελλάδα Κύπρος	SMA Service Partner AKTOR FM. Αθήνα +30 210 8184550 SMA Online Service Center: www.SMA-Service.com
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United Arab Emirates	SMA Middle East LLC Abu Dhabi +971 2234 6177 SMA Online Service Center: www.SMA-Service.com	India	SMA Solar India Pvt. Ltd. Mumbai +91 22 61713888
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South Africa	SMA Solar Technology South Africa Pty Ltd. Cape Town 08600SUNNY (08600 78669) International: +27 (0)21 826 0600 SMA Online Service Center: www.SMA-Service.com	Argentina Brasil Chile Perú	SMA South America SPA Santiago de Chile +562 2820 2101
Australia	SMA Australia Pty Ltd. Sydney Toll free for Australia: 1800 SMA AUS (1800 762 287) International: +61 2 9491 4200	Other countries	International SMA Service Line Niestetal 00800 SMA SERVICE (+800 762 7378423)



