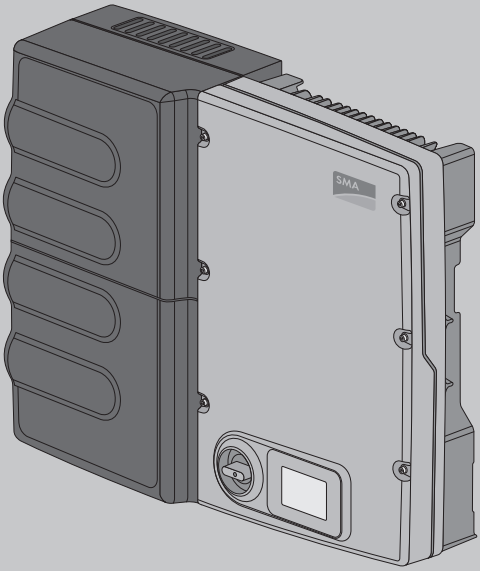
Service Manual

SUNNY BOY 3600 / 5000 SMART ENERGY
BATTERY PACK SMART ENERGY



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AMERICAN ENGLISH

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SMA Solar Technology AG

Sonnenallee 1

34266 Niestetal

Germany

Tel. +49 561 9522-0

Fax +49 561 9522-100

www.SMA.de

E-mail: info@SMA.de

Table of Contents

1 Information on this Document

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.

Validity

This document is valid for the following device types from firmware version 2.02.17.R:

- SB 3600SE-10 (Sunny Boy 3600 Smart Energy)
- SB 5000SE-10 (Sunny Boy 5000 Smart Energy)

Target Group

This document is intended for qualified persons. Only persons with the appropriate skills are allowed to perform the tasks described in this document (see Section 2.1 "Skills of Qualified Persons", page 6).

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

Document title	Document type
SUNNY BOY 3600 / 5000 SMART ENERGY BATTERY PACK SMART ENERGY	Operating Manual
BATTERY PACK SMART ENERGY	Technical Information
Inverter Replacement in PV Systems with Communication Products and Replacement of the SMA Energy Meter	Installation Manual
Parameter List	Technical Information
Order Form for the SMA Grid Guard Code	Certificate
Webconnect Systems in Sunny Portal	User Manual
Sunny Home Manager in Sunny Portal	User Manual

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

Symbol	Explanation
⚠ QUALIFIED PERSON	Sections describing activities to be performed by qualified persons only
i	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

Nomenclature

Complete designation	Designation in this document
Battery Pack Smart Energy	Battery Pack
Sunny Boy 3600 / 5000 Smart Energy	Inverter, product

2 Safety

2.1 Skills of Qualified Persons

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, batteries and systems
- Training in the installation and commissioning of electrical devices and systems
- Knowledge of the applicable standards and directives
- Knowledge of and compliance with this document and all safety precautions
- Knowledge of and compliance with the documents of the battery manufacturer and all safety precautions
- Knowledge of and compliance with the regulations of the European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR) for packaging, transport and labeling of dangerous goods
- Training in accordance with Section 1.3 ADR for packaging and transport of the Battery Pack Smart Energy

2.2 Safety Precautions

This section contains safety precautions 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 follow all safety precautions 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 by qualified persons with the appropriate skills only.
- 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 2.3, page 8).

⚠ DANGER

Danger to life due to high voltages on the Battery Pack

Lethal voltage is present at the pin connector for the power cable. Reaching into the pin connector for the power cable can result in lethal electric shock.

- Do not open the Battery Pack.
- Do not wipe over the Battery Pack with a damp cloth.
- Leave the protective caps on the pin connectors for the power cable and the data cable until the inverter cables are connected to the Battery Pack.
- Only operate the Battery Pack with its protective cover. The protective cover is separately packed.
- Prior to performing any work on the inverter or the Battery Pack, disconnect the inverter from all voltage sources as described in this document (see Section 2.3, page 8).

⚠ DANGER

Danger to life due to electric shock

Touching an ungrounded PV module or an 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.

⚠ WARNING

Risk of chemical burns from electrolyte or toxic gases

During normal operation, no electrolyte can leak from the Battery Pack and no toxic gases can form. Despite careful construction, if the Battery Pack is damaged or a fault occurs, it is possible that electrolyte may be leaked or toxic gases formed.

- Store the Battery Pack in a cool and dry place.
- Do not drop the Battery Pack or damage it with sharp objects.
- Only set the Battery Pack down on its back, i.e., on the side with the mounting lugs.
- Do not open the Battery Pack.
- Only operate the Battery Pack at ambient temperatures between 0°C and +40°C.
- Do not install or operate the Battery Pack in potentially explosive atmospheres or areas of high humidity.
- If moisture has penetrated the Battery Pack (e.g. due to a damaged enclosure), do not install or operate the Battery Pack.
- In case of contact with electrolyte, rinse the affected areas immediately with water and consult a doctor without delay.

⚠ WARNING

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 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.

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 cooling fins, the enclosure lid, the type label, the display and the LEDs using only water and a cloth.

2.3 Disconnecting the Inverter from Voltage Sources

1. Disconnect the circuit breaker and secure it against reconnection.
2. If the multi-function relay is used, switch off the load supply voltage, if necessary.
3. Turn the DC load-break switch towards **OFF** until it snaps into place at position **O**.
4. Wait until all LEDs and the display have gone out.
5. **⚠ DANGER**

   Danger to life due to high voltages

   The capacitors in the inverter take five minutes to discharge.

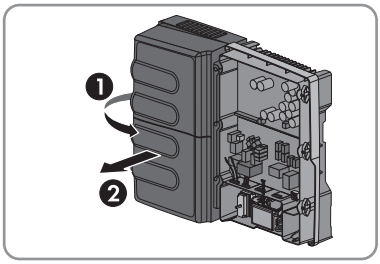
   - Wait five minutes before opening the enclosure lid.
6. **⚠ CAUTION**

   Risk of injury from dropping the enclosure lid

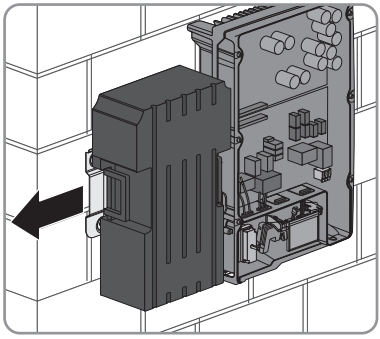
   After removing the last screw, the enclosure lid could fall off.

   - Remove all screws of the enclosure lid using an Allen key (AF 5). When removing the last screw, support the enclosure lid with one hand. Then remove the enclosure lid by pulling it forwards and make sure that the conical spring washers are retained.

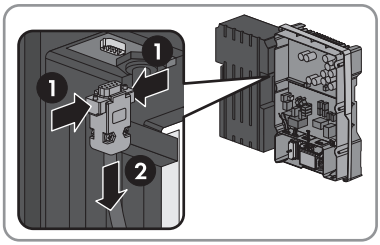
7. Grip behind the left-hand side of the protective cover and lever it loose. Then lift the protective cover forwards and off.



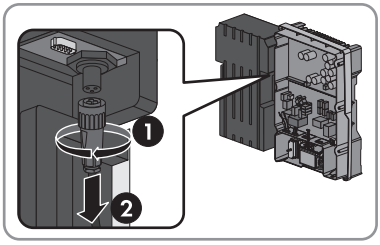
8. Hold the Battery Pack by the side handles, and slide it to the left of the wall mounting plate up to the stop. This deactivates the lift-off protection of the Battery Pack and gives you more room to pull out the cables.



9. Remove the data cable from the Battery Pack. Press the lateral brackets in and pull the plug out of the pin connector.

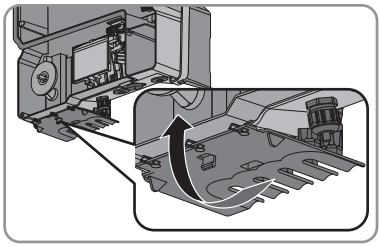


10. Remove the power cable from the Battery Pack. Turn the mating plug to the left until it releases and pull it out of the pin connector.

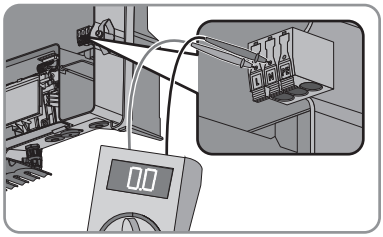


11. If the protective caps of the pin connectors for the data cable and the power cable are available, use them to cover the corresponding pin connectors of the Battery Pack.
12. Insert the data cable and power cable into the bracket on the left-hand side of the inverter.

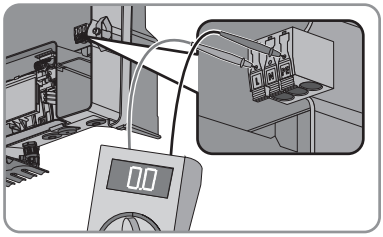
13. Flip the DC contact protection up and press firmly until it snaps into place.



14. Use a current clamp to ensure that no current is present in the DC cables.
15. Unlock and remove all DC connectors. 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.
16. Ensure that no voltage is present at the DC inputs on the inverter.
17. Ensure that no voltage is present on the AC connecting terminal plate between **L** and **N** using a suitable measuring device. Insert a test probe in each round opening of the terminal.



18. Ensure that no voltage is present on the AC connecting terminal plate between **L** and **PE** using a suitable measuring device. Insert a test probe in each round opening of the terminal.



19. 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.
20. ***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 cooling fins, the enclosure lid, the type label, the display and the LEDs using only water and a cloth.

- If the cooling fins on the rear of the enclosure are dirty, clean them using a soft brush.
- If the air ducts on the top of the inverter are dirty, clean them using a soft brush.
- If the protective cover of the Battery Pack is dirty, clean it with a dry cloth.
- If the Battery Pack is dirty, clean it with a dry cloth.

4 Troubleshooting

4.1 LED Signals

The LEDs indicate the operating state of the inverter.

LED	Status	Explanation
Green LED	glowing	Operation
	flashing	The requirements for the connection to the utility grid have not been met.
Red LED	glowing	Error The red LED indicates an error (see Section 4.3 "Error Messages", page 13).
Blue LED	-	No function

4.2 Event Messages

Display message	Cause
Set parameter	The parameter change is adopted.
Parameters set successfully	The parameter changes were successfully adopted.
Update file OK	The update file found is valid.
Memory card is read	USB stick (memory card) is searched for the update file and the update file is checked.
No new update on the memory card	On the USB stick (memory card), there is an update file that has already been used.
Update communication	The inverter is updating the communication component.
Update main CPU	The inverter is updating the inverter component.
Update completed	The inverter has successfully completed the update.
Condition test successful	Conditions from the update file have been tested successfully.
Update transport started	Update file is being copied.
Update transport successful	Update file was copied successfully to the inverter's internal memory.
Update BMS	Battery management software (BMS) is updated.
Grid parameter unchanged	The parameters have been locked and cannot be changed.

4.3 Error Messages

Error 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 the SMA Service Line.
202 to 205	**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 the SMA Service Line.

Error number	Display message, cause and corrective measures
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 comply with the 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 the SMA Service Line.
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.
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 the SMA Service Line.
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.

Error number	Display message, cause and corrective measures
701	**Frequency 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 the SMA Service Line.
801	**Waiting for grid voltage > Grid failure > Check fuse** 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 inverter manual at www.SMA-Solar.com). • 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. • Check the fuse.
901	**PE conn. missing > Check connection** The grounding conductor is not correctly connected. **Corrective measures:** • Ensure that the grounding conductor is correctly connected (see inverter manual at www.SMA-Solar.com).
1001	**L / N swapped > Check connection** The connection of L and N is swapped. **Corrective measures:** • Ensure that L and N are correctly connected (see inverter manual at www.SMA-Solar.com).
1101	**Installation fault > Check connection** A second line conductor is connected to N. **Corrective measures:** • Correct the AC connection (see inverter manual at www.SMA-Solar.com).

Error 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 comply with the 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 the SMA Service Line.
3401 to 3402	**DC overvoltage > Disconnect generator** Overvoltage at 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 2.3, page 8). • 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 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. • If this message is displayed frequently, contact the SMA Service Line.

Error number	Display message, cause and corrective measures
3405	**IRE defective > Disconnect the PV array** **Corrective measures:** • Immediately disconnect the inverter from all voltage sources (see Section 2.3, page 8). • 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 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. • If this message is displayed frequently, contact the SMA Service Line.
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 5, page 26).
3601	**High discharge current > Check generator** The leakage current from 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 re-connects to the utility grid. **Corrective measures:** • Check the PV system for ground faults (see Section 5, page 26).
3701	**Residual current 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 5, page 26).
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.

Error number	Display message, cause and corrective measures
3901 to 3902	**Waiting for DC start conditions > Start conditions 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.
6001 to 6462	**Self diagnosis > Interference of device** The cause must be determined by the SMA Service Line. **Corrective measures:** • Contact the SMA Service Line.
6501 to 6513	**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 inverter has detected an internal overload and interrupts the feed-in operation. **Corrective measures:** • Contact the SMA Service Line.
6607 to 6608	**Self-diagnosis > Battery overcurrent** Internal error. The inverter continues to feed into the utility grid. **Corrective measures:** • If this message is displayed frequently, contact the SMA Service Line.
6609	**Self-diagnosis > Battery undervoltage** Internal error. The inverter continues to feed into the utility grid. **Corrective measures:** • If this message is displayed frequently, contact the SMA Service Line.

Error number	Display message, cause and corrective measures
6610	**Self-diagnosis > Battery overvoltage** **Corrective measures:** • Turn the DC load-break switch towards **OFF** until it snaps into place at position **O**. • Contact the SMA Service Line and clarify the next steps.
6701 to 6702	**Comm. disturbed** An error has occurred in the internal communication of the inverter. The inverter continues feeding power into the grid. **Corrective measures:** • If this message is displayed frequently, contact the SMA Service Line.
6801 to 6802	**Self diagnosis > Input A defective** Input A of the inverter is defective. **Corrective measures:** • Contact the SMA Service Line.
6901 to 6902	**Self diagnosis > Input B defective** Input B of the inverter is defective. **Corrective measures:** • Contact the SMA Service Line.
7001 to 7002	**Sensor fault** A temperature sensor in the inverter is defective and the inverter interrupts the feed-in operation. **Corrective measures:** • Contact the SMA Service Line.
7008	**Disturbance sensor display temperature** The ambient temperature sensor is defective. The display is not switched off at temperatures below -25°C and, as a result, it may have been destroyed. The inverter continues feeding power into the grid. **Corrective measures:** • Contact the SMA Service Line.
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 to the correct folder again.

Error number	Display message, cause and corrective measures
7105	**Param. setting failed** Parameters could not be set using the memory card. The inverter continues to feed in. **Corrective measures:** • Ensure that the parameters are set correctly. • Ensure that you have an SMA Grid Guard code.
7106	**Update file defect.** Update file on the memory card is defective. **Corrective measures:** • Reformat the memory card. • Re-save the files to the memory card.
7110	**No update file** No update file has been found. **Corrective measures:** • Copy the update file to the memory card folder. Select the folder **\UPDATE**.
7112	**Update file copied** The update file was successfully copied to the memory of the inverter processor.
7201 to 7202	**Data stor. not poss.** Internal error. The inverter continues to feed into the utility grid. **Corrective measures:** • Contact the SMA Service Line.
7303	**Update main CPU failed** The cause must be determined by the SMA Service Line. **Corrective measures:** • Contact the SMA Service Line.
7324	**Wait for update conditions** The inverter has successfully completed the update.
7330	**Condition test failed** The conditions of the update file used for the inverter settings (e.g. country data set, device type) are not fulfilled. **Corrective measures:** • Contact the SMA Service Line.

Error number	Display message, cause and corrective measures
7333	**Update transport failed** The update was not carried out successfully. **Corrective measures:** • Restart the update.
7337	**Update BMS failed** The cause must be determined by the SMA Service Line. **Corrective measures:** • Contact the SMA Service Line.
7340	**Update communication failed** The cause must be determined by the SMA Service Line. **Corrective measures:** • Contact the SMA Service Line.
7401	**Varistor defective** At least one of the thermally monitored varistors is defective. **Corrective measures:** • Check the function of the varistors (see Section 6, page 29).
7701 to 7703	**Self diagnosis > Interference of device** The cause must be determined by the SMA Service Line. **Corrective measures:** • Contact the SMA Service Line.
8001	**Derating occurred** The inverter has reduced its power output for more than ten minutes 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.
8902	**Self-diagnosis > Battery controller relay defective** The cause must be determined by the SMA Service Line. **Corrective measures:** • Contact the SMA Service Line.
8903	**Battery controller defective > Disconnect PV array, open DC switch** The cause must be determined by the SMA Service Line. **Corrective measures:** • Contact the SMA Service Line.

Error number	Display message, cause and corrective measures
8904	**Self diagnosis > Interference of device** The cause must be determined by the SMA Service Line. **Corrective measures:** • Contact the SMA Service Line.
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 parameter locked** The parameters are now locked. You cannot change the parameters. **Corrective measures:** • Unlock the parameters with the SMA Grid Guard code.
9005	**Changing grid params not possible > Ensure DC supply** PV power is too low for setting the country data set. As soon as sufficient irradiation is available, the inverter assumes the setting automatically.
9007	**Abort self-test** The self-test (Italy only) was terminated. **Corrective measures:** • Restart the self-test (see inverter manual at www.SMA-Solar.com).
9301	**New battery detected** The inverter has detected a new Battery Pack.
9302	**Self diagnosis > Interference of device** The cause must be determined by the SMA Service Line. **Corrective measures:** • Contact the SMA Service Line.
9303	**The service life of the battery is expiring** The state of health of the Battery Pack is 70%. **Corrective measures:** • Replace the Battery Pack with a new one. Contact the SMA Service Line.

Error number	Display message, cause and corrective measures
9304	**Fault in battery connection > Check battery connection** The connection between the Battery Pack and the inverter is disrupted. **Corrective measures:** • Ensure that the power cable and the data cable are properly connected to the Battery Pack (see inverter manual at www.SMA-Solar.com). • Ensure that the plug contacts of the power cable and the data cable are not damaged.
9305	**Unauthorized battery system** The Battery Pack is not suitable for operation with the inverter. **Corrective measures:** • If the battery has been approved by SMA for operation with the inverter, contact the SMA Service Line.
9306	**Deviation in battery voltage** The cause must be determined by the SMA Service Line. **Corrective measures:** • Contact the SMA Service Line.
9307	**Battery system defective** The cause must be determined by the SMA Service Line. **Corrective measures:** • Contact the SMA Service Line.
9308	**Communication fault in battery system > Check battery connection** The connection between the Battery Pack and the inverter is disrupted. **Corrective measures:** • Ensure that the power cable and the data cable are properly connected to the Battery Pack (see inverter manual at www.SMA-Solar.com). • Ensure that the plug contacts of the power cable and the data cable are not damaged.
9309	**Battery system defective** The Battery Pack is defective. **Corrective measures:** • Contact the SMA Service Line.

Error number	Display message, cause and corrective measures
9310	**Signal fault in battery system > Check battery connection** The connection between the Battery Pack and the inverter is disrupted. **Corrective measures:** • Ensure that the power cable and the data cable are properly connected to the Battery Pack (see inverter manual at www.SMA-Solar.com). • Ensure that the plug contacts of the power cable and the data cable are not damaged.
9311	**Battery cell overvoltage fault** The voltage of at least one cell is outside the threshold. **Corrective measures:** • Immediately disconnect the inverter from all voltage sources (see Section 2.3, page 8). • Contact the SMA Service Line.
9312	**Battery cell undervoltage fault** The cause must be determined by the SMA Service Line. **Corrective measures:** • Contact the SMA Service Line.
9313	**Low temperature fault in battery > Check installation site** The ambient temperature is below the lowest permitted temperature. The inverter and the Battery Pack must only be operated at ambient temperatures from 0°C to 40°C. **Corrective measures:** • Ensure that the permitted ambient temperatures are complied with at the installation site. • If this message is displayed even though the permitted ambient temperature is complied with, contact the SMA Service Line.
9314	**Overtemperature fault in battery > Check installation site** The ambient temperature is above the highest permitted temperature. The inverter and the Battery Pack must only be operated at ambient temperatures from 0°C to 40°C. **Corrective measures:** • Ensure that the permitted ambient temperatures are complied with at the installation site. • If this message is displayed even though the permitted ambient temperature is complied with, contact the SMA Service Line.

Error number	Display message, cause and corrective measures
9315	**Battery imbalancing fault** The cause must be determined by the SMA Service Line. **Corrective measures:** • Contact the SMA Service Line.
9334	**Battery charging test** The function of the Battery Pack is tested. The Battery Pack is charged.
9335	**Discharge battery test** The function of the Battery Pack is tested. The Battery Pack is discharged.
9336	**Start conditions for battery test not fulfilled** The function of the Battery Pack cannot be tested because the requirements are not fulfilled. **Corrective measures:** • Ensure that the requirements for testing the Battery Pack are fulfilledTesting the Function of the Battery Pack.
9337	**Charge battery test successful** The Battery Pack was charged successfully. The function of the Battery Pack is ensured.
9338	**Battery discharging test successful** The Battery Pack was discharged successfully. The function of the Battery Pack is ensured.
9339	**Battery charging test failed** The Battery Pack could not be charged. **Corrective measures:** • Ensure that the function of the Battery Pack was tested correctly Testing the Function of the Battery Pack.
9340	**Battery discharging test failed** The Battery Pack could not be discharged. **Corrective measures:** • Ensure that the function of the Battery Pack was tested correctly Testing the Function of the Battery Pack.

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 sub-structure 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

- 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**

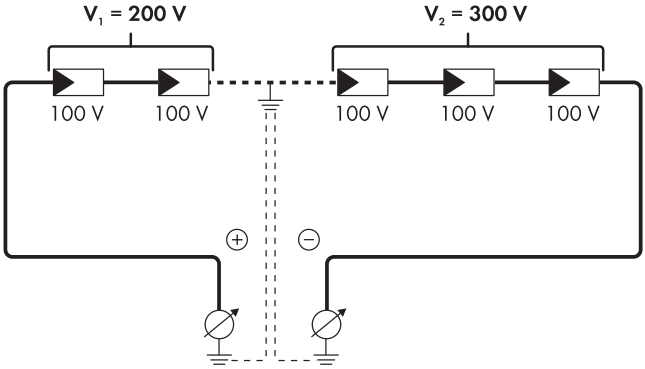
   Danger to life due to high voltages

   - Disconnect the inverter from all voltage sources (see Section 2.3, page 8).

2. Measure the voltages:
   - Measure the voltages between the positive terminal and the ground potential (PE).
   - Measure the voltages between the negative terminal and the ground potential (PE).
   - Measure the voltages 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 fault to the inverter and recommission the inverter (see Section 9, page 33).

Test by Measuring the Insulation Resistance

If the voltage measurement does not accurately indicate a ground fault, the insulation resistance measurement can provide more detailed results.

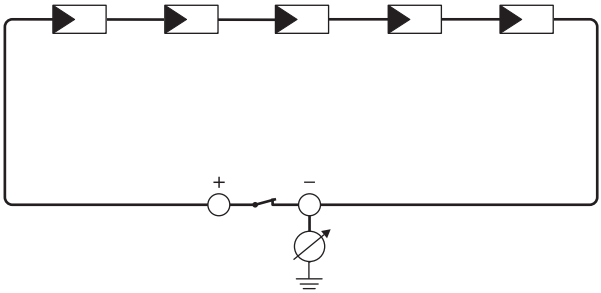


Figure 1: Schematic diagram of the measurement

Calculating the insulation resistance

The total resistance of the PV system to be expected 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

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 insulation resistance per string to be expected.
2. **⚠ DANGER**

   Danger to life due to high voltages

   - Disconnect the inverter from all voltage sources (see Section 2.3, page 8).
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 the respective string.
10. Reconnect only those strings to the inverter from which the ground fault was eliminated.
11. Reconnect all other strings to the inverter.
12. Recommission the inverter (see Section 9, page 33).
13. If the inverter still displays an insulation error, contact the SMA Service Line. The PV modules might not be suitable for the inverter in the present quantity.

6 Checking the Function of the Varistors

If the inverter displays event number **7401**, one of the varistors is probably defective.

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:

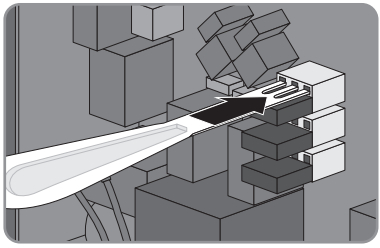
Procedure:

1. **⚠ DANGER**

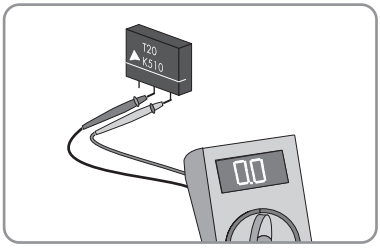
   Danger to life due to high voltages

   - Disconnect the inverter from all voltage sources and open the enclosure lid (see Section 2.3, page 8).

2. Insert the insertion tool in 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 11 "Spare Parts", page 38).

- 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 31).

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

7 Replacing the Varistors

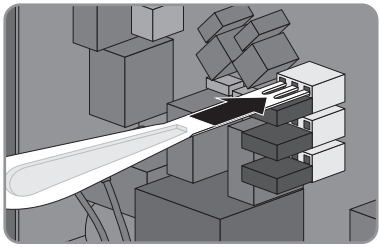
Proceed as follows to replace each varistor.

1. **⚠ DANGER**

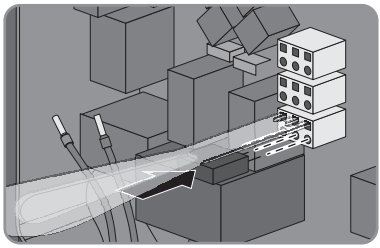
   Danger to life due to high voltages

   - Disconnect the inverter from all voltage sources and open the enclosure lid (see Section 2.3, page 8).

2. Insert the insertion tool in the clamping contacts of the connecting terminal plate.



3. Remove the varistor from the connecting terminal plate.
4. Insert the new varistor in the connecting terminal plate. The labeling on the varistor must face downwards.



5. Remove the insertion tool from the clamping contacts of the connecting terminal plate.
6. Recommission the inverter (see Section 9, page 33).

8 Testing the Function of the Battery Pack

You can test the function of the Battery Pack by manually charging and discharging. The sequence for charging and discharging depends on the current state of charge of the Battery Pack.

Procedure:

- If the current state of charge of the Battery Pack is lower than 10%, first charge the Battery Pack until the state of charge has increased to more than 10% and then discharge the Battery Pack.
- If the current state of charge of the Battery Pack is higher than 95%, first discharge the Battery Pack until the state of charge has dropped to below 90% and then charge the Battery Pack.

Requirements:

☐ The inverter must be in feed-in operation.

☐ The current PV power must be at least 200 W.

☐ The current feed-in AC power must not exceed 90% of the maximum AC power of the inverter.

Charging the Battery Pack

- Select parameter **Battery installation mode** and set to **Charge battery**.
  - ☑ The message **Charge battery test** appears in the display.

☑ The message **Battery charging test successful** appears in the display. The Battery Pack was charged successfully.

✖ Does the message **Charge battery test failed** appear in the display?

The Battery Pack was not charged successfully. The requirements are probably not fulfilled.

- Ensure that the requirements are fulfilled.
- Ensure that the Battery Pack and the inverter are connected correctly.
- Ensure that the Battery Pack is not defective.
- Ensure that the inverter does not display any other error messages.

Discharging the Battery Pack

- Select parameter **Battery installation mode** and set to **Discharge battery**.
  - ☑ The message **Battery discharging test** appears in the display.

☑ The message **Battery discharging test successful** appears in the display. The Battery Pack was discharged successfully.

✖ The message **Battery discharging test failed** appears in the display.

The Battery Pack was not discharged successfully. The requirements are probably not fulfilled.

- Ensure that the requirements are fulfilled.
- Ensure that the Battery Pack and the inverter are connected correctly.
- Ensure that the Battery Pack is not defective.
- Ensure that the inverter does not display any other error messages.

9 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.

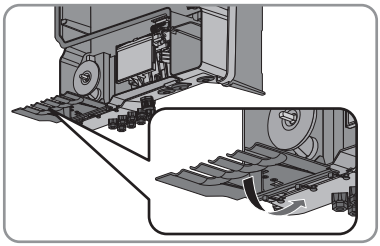
Requirements:

☐ The circuit breaker must be correctly rated.

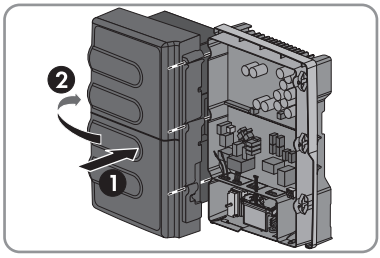
☐ The inverter and the battery must be correctly mounted.

Procedure:

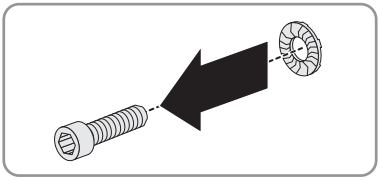
1. Connect the DC connectors to the inverter.
   ☑ The DC connectors snap into place.
2. Seal all unused DC inputs using the DC connectors with sealing plugs.
3. Ensure that all DC connectors are securely in place.
4. Flip the DC contact protection down until it snaps into place.



5. Connect the inverter and the Battery Pack (see inverter manual at www.SMA-Solar.com).
6. Slide the protective cover across the Battery Pack and push the brackets on the right of the protective cover into the guides on the left of the inverter enclosure. Then, press the left side of the protective cover down onto the Battery Pack until it snaps into place.



7. Ensure that the DC load-break switch is turned to position **OFF**. This makes it possible to fit the enclosure lid to the enclosure.
8. Attach the enclosure lid:
   - Attach one conical spring washer to each screw. The grooved side of the conical spring washer must point to the screw head.



   - Position the enclosure lid on the enclosure using the six screws and tighten all screws diagonally to each other using an Allen key (AF 5) (torque: 6 Nm ± 0.5 Nm).

9. Switch on the circuit breaker.
10. Turn the DC load-break switch towards **ON** until it snaps into place at position **I**.

☑ The start-up phase begins.

☑ The green LED is glowing and the display alternates between the firmware version, the serial number or designation of the inverter, the IP address, the subnet mask, the serial number of the Battery Pack, 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 12).

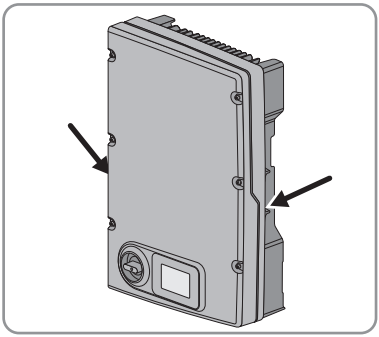
10 Decommissioning the Inverter

⚠ CAUTION

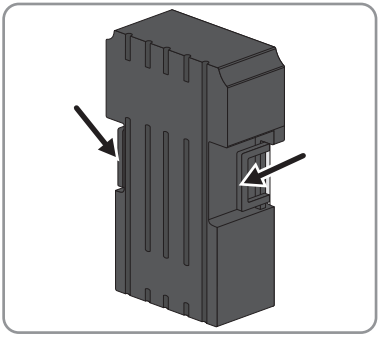
Risk of injury through lifting or dropping the inverter or Battery Pack

The inverter and the Battery Pack are heavy (for weight, see operating manual at www.SMA-Solar.com). There is risk of injury if the inverter or Battery Pack are lifted incorrectly or dropped during transport or when attaching or removing it from the wall.

- Hold the inverter by the right-hand and left-hand recessed grips, and lift and transport it to the mounting position horizontally.



- Lift and transport the Battery Pack by the lateral handles.

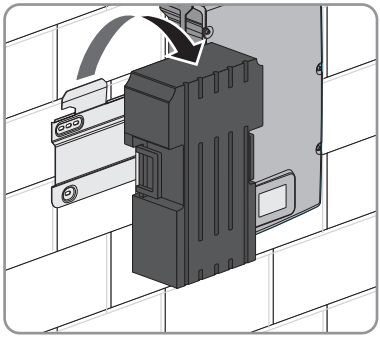


1. **⚠ DANGER**

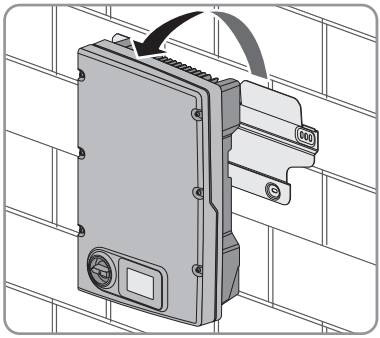
   Danger to life due to high voltages

   - Disconnect the inverter from all voltage sources (see Section 2.3, page 8).
2. Remove the AC cable from the inverter. Also push the locking levers right up to the top and pull out the cables.
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 other cables are connected to the inverter, remove the connection cables from the inverter.

6. 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.
7. Position the enclosure lid on the enclosure using the six screws and tighten all screws diagonally to each other using an Allen key (AF 5) (torque: 6 Nm ± 0.5 Nm).
8. Remove the battery by lifting it vertically up and off the wall mounting bracket.



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



10. If the inverter is to be stored or shipped, pack the inverter and the protective cover of the battery. Use the original packaging or packaging that is suitable for the weight and dimensions of the inverter and the protective cover.
11. Dispose of the inverter in accordance with the locally applicable disposal regulations for electronic waste.
12. **⚠ DANGER**

    Danger to life due to incorrect packaging and transport of the Battery Pack

    The Battery Pack is considered to be dangerous goods. If the Battery Pack is to be transported, special regulations must be complied with for packaging and transport.

    - When packaging and transporting the Battery Pack, observe the regulations of the European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR).
    - Packaging and transport of the Battery Pack may only be carried out by persons who have been trained in accordance with Section 1.3 ADR and whose training has been documented.

13. If the Battery Pack is not damaged and it is to be disposed of, dispose of it in accordance with the SMA Solar Technology AG regulations.
14. If the Battery Pack is damaged and it is to be disposed of, contact the SMA Service Line and clarify the procedure for its disposal.

11 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
Replacement varistors	Set with three thermally-monitored varistors incl. insertion tool	STP-TV10
Insertion tool for replacing varistors	Insertion tool for varistors	SB-TVWZ
SUNCLIX DC connector	Field plug for conductor cross-sections of 2.5 mm² to 6 mm²	SUNCLIX-FC6-SET

12 Contact

If you have technical problems concerning our products, 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
- Type of the Battery Pack
- Serial number of the Battery Pack
- Manufacturing code of the Battery Pack
- Firmware version of the Battery Pack
- Hardware version of the Battery Pack
- Manufacturing week of the Battery Pack
- Special country-specific settings of the inverter (if applicable)
- Type and number of PV modules connected
- Mounting location and mounting altitude of the inverter
- Three-digit or four-digit event number and display message of the inverter
- Optional equipment, e.g. communication products
- Use 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	Medium Power Solutions Wechselrichter: +49 561 9522-1499 Kommunikation: +49 561 9522-2499 SMA Online Service Center: www.SMA.de/Service
		Hybrid Energy Solutions Sunny Island: +49 561 9522-399 PV-Diesel Hybridsysteme: +49 561 9522-3199
		Power Plant Solutions Sunny Central: +49 561 9522-299
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	Medium Power Solutions Onduleurs : +33 472 09 04 40 Communication : +33 472 09 04 41
		Hybrid Energy Solutions Sunny Island : +33 472 09 04 42
		Power Plant Solutions Sunny Central : +33 472 09 04 43
India	SMA Solar India Pvt. Ltd. Mumbai	+91 22 61713888
Italia	SMA Italia S.r.l. Milano	+39 02 8934-7299
Κύπρος/Kıbrıs	Βλέπε Ελλάδα/ Bkz. Ελλάδα (Yunanistan)	
Luxemburg/ Luxembourg	Siehe Belgien Voir Belgique	
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	Isento de taxas 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
United Kingdom	SMA Solar UK Ltd. Milton Keynes	+44 1908 304899
Ελλάδα	SMA Hellas AE Αθήνα	801 222 9 222 International: +30 212 222 9 222
България	Вижте Ελλάδα (Гърция)	
ไทย	SMA Solar (Thailand) Co., Ltd. กรุงเทพฯ	+66 2 670 6999
대한민국	SMA Technology Korea Co., Ltd. 서울	+82 2 508-8599
中国	SMA Beijing Commercial Company Ltd. 北京	+86 10 5670 1350
+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)

SMA Solar Technology

www.SMA-Solar.com