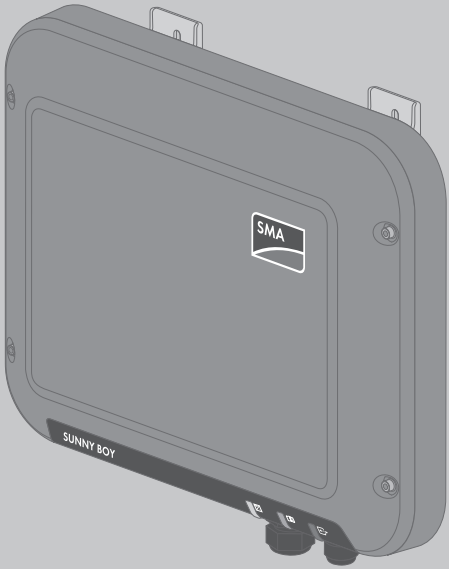
Service Manual for Installers

# SUNNY BOY 1.5 / 2.5




SB15-25-SG-en-10 | Version 1.0

**ENGLISH**

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# 1 Information on this Document

## 1.1 Validity

This document is valid for the following device types from firmware version 2.0.1.R:

- SB1.5-1VL-40 (Sunny Boy 1.5)
- SB2.5-1VL-40 (Sunny Boy 2.5)

## 1.2 Target Group

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

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

## 1.3 Symbols

| Symbol | Explanation |
|---|---|
| ⚠ DANGER | Indicates a hazardous situation which, if not avoided, will result in death or serious injury |
| ⚠ WARNING | Indicates a hazardous situation which, if not avoided, can result in death or serious injury |
| ⚠ CAUTION | Indicates a hazardous situation which, if not avoided, can result in minor or moderate injury |
| *NOTICE* | Indicates a situation which, if not avoided, can result in property damage |
| 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 |

## 1.4 Nomenclature

| Complete designation | Designation in this document |
|---|---|
| Sunny Boy | Inverter, product |

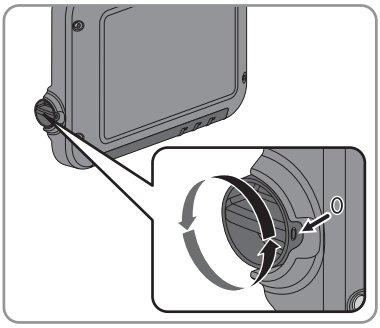
# 2 Safety

## 2.1 Disconnecting the Inverter from Voltage Sources

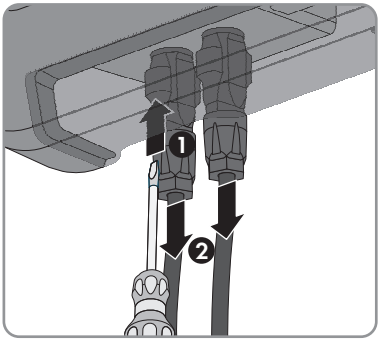
Prior to performing any work on the inverter, always disconnect it from all voltage sources as described in this section. Always adhere to the prescribed sequence.

**Procedure:**

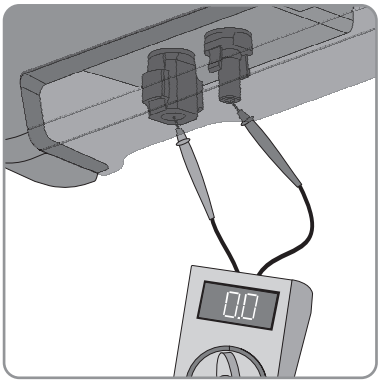
1. Disconnect the circuit breaker and secure it against reconnection.
2. If an external DC load-break switch is installed, disconnect the external DC load-break switch from all voltage sources.
3. Set the DC load-break switch of the inverter to **O**.



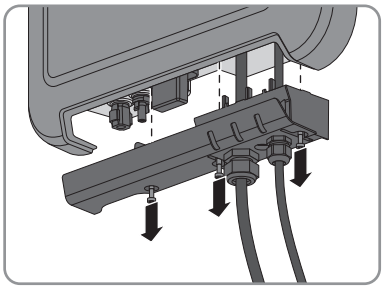

4. Wait until the LEDs have gone out.
5. Use a current clamp to ensure that no current is present in the DC cables.
6. Release and remove all DC connectors. To do this, insert a flat-blade screwdriver or an angled screwdriver (blade width 3.5 mm) into one of the slide slots and pull the DC connectors out in a downward direction. Do not pull on the cable.



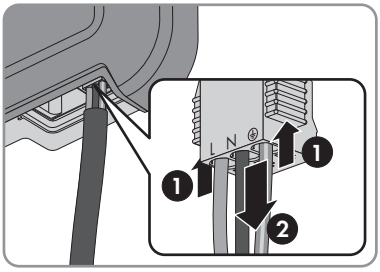
7. Ensure that no voltage is present at the DC inputs on the inverter using a suitable measuring device.



8. Loosen the swivel nuts.
9. Loosen the screws of the connection cap and remove the connection cap.



10. Use a suitable measuring device to check that no voltage is present at the AC connector between L and N and between L and the grounding conductor. To do so, insert the test probe (maximum diameter: 2 mm) into each round opening of the connecting terminal plate.
11. Release and disconnect the AC connector using the sliders located on the side.




## 2.2 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 (see Section 2.1 "Disconnecting the Inverter from Voltage Sources", page 5).

**⚠ 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.

***NOTICE***

**Damage to the inverter due to the use of cleaning agents**

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

# 3 Calling Up the Inverter User Interface via Direct Connection

You can call up the inverter user interface outside of a network via a direct connection between computer, tablet PC or smartphone and the inverter. There are two methods available for this:

- Direct connection via WLAN
- Direct connection via Ethernet

**Inverter SSID and IP address and necessary passwords**

- Inverter SSID in WLAN: SMA[serial number] (e.g. SMA2130019815)
- Standard WLAN password: SMA12345 (usable for initial configuration prior to completion of the first ten operating hours)
- Device-specific WLAN password: see WPA2-PSK on the inverter type label or the rear side of the Quick Installation Guide included in delivery
- Standard inverter IP address for direct connection via WLAN outside of a local network: 192.168.100.1
- Standard inverter IP address for direct connection via Ethernet outside of a local network: 169.254.100.1

## Direct connection via WLAN

**Requirements:**

☐ The inverter must be commissioned.

☐ A smartphone, tablet PC or computer with WLAN interface must be available.

☐ One of the following web browsers must be installed: Firefox (as of version 32), Internet Explorer (as of version 10), Safari (as of version 6) or Google Chrome (as of version 32).

☐ The personal SMA Grid Guard code of the Installer must be available for the changing of grid-relevant settings after completion of the first ten operating hours (see certificate "Application for SMA Grid Guard Code" at www.SMA-Solar.com).

**File export via Safari web browser not possible**

When using the Safari web browser, the exporting of files (e.g. saving the current inverter configuration or exporting events) is not possible for technical reasons.

- Use a different supported web browser.

**Procedure:**

1. If your smartphone, tablet PC or computer has a WPS function:
   - Tap twice on the lid of the inverter to activate the inverter WPS function.
     ☑ The inverter signalizes the open interface via the rapid flashing of the blue LED.
   - Activate the WPS on your device.
     ☑ The connection with your device will be established automatically. Please note that establishment of the connection to devices with Windows 7 or 8.1 can take up to 20 seconds.
2. If your smartphone, tablet PC or computer does not have a WPS function:

- Search for WLAN networks with your device.
- Select the inverter SSID **SMA[serial number]**.
- Enter the inverter WLAN password. Within the first ten operating hours and prior to closing the installation assistant for the first time, you can use the standard WLAN password **SMA12345**. After this, you must use the device-specific inverter WLAN password (WPA2-PSK), which is printed on the type label and the rear side of the Quick Installation Guide included in delivery.

3. Enter **192.168.100.1** in the address line of the web browser and press the enter key.
   ☑ The login page of the user interface opens.
4. Log in as **Installer** or **User**. A new password must be assigned upon logging in for the first time. To configure the inverter for the first time, login as an **Installer**.
5. Configure the inverter as desired.

## Direct connection via Ethernet

**Requirements:**

☐ The inverter must be commissioned.

☐ A computer with an Ethernet interface must be available.

☐ One of the following web browsers must be installed: Firefox (as of version 32), Internet Explorer (as of version 10), Safari (as of version 6) or Google Chrome (as of version 32).

☐ The inverter must be connected directly to a computer.

☐ The personal SMA Grid Guard code of the Installer must be available for the changing of grid-relevant settings after completion of the first ten operating hours (see certificate "Application for SMA Grid Guard Code" at www.SMA-Solar.com).

**i File export via Safari web browser not possible**

When using the Safari web browser, the exporting of files (e.g. saving the current inverter configuration or exporting events) is not possible for technical reasons.

- Use a different supported web browser.

**Procedure:**

1. Enter **169.254.100.1** in the address line of the web browser and press the enter key.
   ☑ The login page of the user interface opens.
2. Log in as **Installer** or **User**. A new password must be assigned upon logging in for the first time. The initial configuration of the inverter may only be performed by a qualified person. In this case, login as an **Installer**.
3. Configure the inverter as desired.

# 4 Event Messages

| Event number | Message, cause and corrective measures |
|---|---|
| 101 to 103 | **Grid fault**<br>The grid voltage or grid impedance at the connection point of the inverter is too high. The inverter has disconnected from the utility grid.<br>**Corrective measures:**<br>• Check whether the grid voltage at the connection point of the inverter is permanently in the permissible range.<br>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.<br>If the grid voltage is permanently within the permissible range and this message is still displayed, contact the Service (see Section 11 "Contact", page 33). |
| 202 to 205 | **Grid fault**<br>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.<br>**Corrective measures:**<br>• Make sure that the circuit breaker is switched on.<br>• Ensure that the AC cable is not damaged and that it is connected correctly.<br>• Ensure that the country data set has been configured correctly.<br>• Check whether the grid voltage at the connection point of the inverter is permanently in the permissible range.<br>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.<br>If the grid voltage is permanently within the permissible range and this message is still displayed, contact the Service (see Section 11 "Contact", page 33).<br>. |

| Event number | Message, cause and corrective measures |
|---|---|
| 301 | **Grid fault**<br>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.<br>**Corrective measures:**<br>• During the feed-in operation, check whether the grid voltage at the connection point of the inverter is permanently in the permissible range.<br>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.<br>If the grid voltage is permanently within the permissible range and this message is still displayed, contact the Service (see Section 11 "Contact", page 33). |
| 302 | **Temperature AC voltage**<br>The inverter has reduced its power due to a too-high grid voltage to ensure grid stability.<br>**Corrective measures:**<br>• If possible, check the grid voltage and observe how often fluctuations occur. If fluctuations occur frequently and this message is displayed often, contact the grid operator and request approval to change the operating parameters of the inverter. If the grid operator gives his approval, discuss any changes to the operating parameters with Service (see Section 11 "Contact", page 33). |
| 401 to 404 | **Grid fault**<br>The inverter has disconnected from the utility grid. A stand-alone grid or a very large change in the power frequency was detected.<br>**Corrective measures:**<br>• Check the grid connection for significant short-term frequency fluctuations. |

| Event number | Message, cause and corrective measures |
|---|---|
| 501 | **Grid fault**<br>The power frequency is not within the permissible range. The inverter has disconnected from the utility grid.<br>**Corrective measures:**<br>• If possible, check the power frequency and observe how often fluctuations occur.<br>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.<br>If the grid operator gives his approval, discuss any changes to the operating parameters with Service (see Section 11 "Contact", page 33). |
| 507 | **Temperature AC frequency**<br>The inverter has reduced its power due to a too-high power frequency to ensure grid stability.<br>**Corrective measures:**<br>• If possible, check the power frequency and observe how often fluctuations occur. If fluctuations occur frequently and this message is displayed often, contact the grid operator and request approval to change the operating parameters of the inverter. If the grid operator gives his approval, discuss any changes to the operating parameters with Service (see Section 11 "Contact", page 33). |
| 601 | **Grid fault**<br>The inverter has detected an excessively high proportion of direct current in the grid current.<br>**Corrective measures:**<br>• Check the grid connection for direct current.<br>• If this message is displayed frequently, contact the grid operator and check whether the monitoring threshold on the inverter can be raised. |
| 701 | **Frq. not permitted > Check parameter**<br>The power frequency is not within the permissible range. The inverter has disconnected from the utility grid.<br>**Corrective measures:**<br>• If possible, check the power frequency and observe how often fluctuations occur.<br>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.<br>If the grid operator gives his approval, discuss any changes to the operating parameters with Service (see Section 11 "Contact", page 33). |

| Event number | Message, cause and corrective measures |
|---|---|
| 801 | **Waiting for grid voltage > Grid failure > Check AC circuit breaker**<br>The AC cable is not correctly connected or the country data set is not correctly configured.<br>**Corrective measures:**<br>• Make sure that the circuit breaker is switched on.<br>• Ensure that the AC cable is not damaged and that it is connected correctly.<br>• Ensure that the country data set has been configured correctly.<br>• Check whether the grid voltage at the connection point of the inverter is permanently in the permissible range.<br>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.<br>If the grid voltage is permanently within the permissible range and this message is still displayed, contact the Service (see Section 11 "Contact", page 33).<br>. |
| 901 | **PE conn. missing > Check connection**<br>The grounding conductor is not correctly connected.<br>**Corrective measures:**<br>• Ensure that PE is correctly connected (see operating manual of the inverter). |
| 1001 | **L/N swapped > Check connection**<br>The connection of L and N is swapped.<br>**Corrective measures:**<br>• Ensure that L and N are correctly connected (see operating manual of the inverter). |
| 1101 | **Installation fault > Check connection**<br>A second line conductor is connected to N.<br>**Corrective measures:**<br>• Connect the neutral conductor to N. |

| Event number | Message, cause and corrective measures |
|---|---|
| 1302 | **Waiting for grid voltage > Installation failure grid connection > Check grid and fuses**<br>L or N not connected.<br>**Corrective measures:**<br>• Ensure that L and N are connected.<br>• Make sure that the circuit breaker is switched on.<br>• Ensure that the AC cable is not damaged and that it is connected correctly. |
| 1501 | **Reconnection fault grid**<br>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.<br>**Corrective measures:**<br>• Ensure that the country data set has been configured correctly. To do this, select the parameter **Set country standard** and check the value. |
| 3301 to 3303 | **Unstable operation**<br>There is not enough power at the DC input of the inverter for stable operation. The inverter cannot connect to the utility grid.<br>**Corrective measures:**<br>• Ensure that the PV array is designed correctly.<br>• Ensure that the PV array is not covered by snow or otherwise shaded.<br>• Ensure that the PV array is free of errors. |
| 3401 | **DC overvoltage > Disconnect generator**<br>Overvoltage at the DC input. This can destroy the inverter.<br>This message is signalized additionally by rapid flashing of the LEDs.<br>**Corrective measures:**<br>• **Immediately** disconnect the inverter from all voltage sources (see Section 2.1, page 5).<br>• 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.<br>• If the DC voltage exceeds the maximum input voltage of the inverter, ensure that the PV array has been correctly rated or contact the installer of the PV array.<br>• If this message is repeated frequently, contact the Service (see Section 11 "Contact", page 33). |

| Event number | Message, cause and corrective measures |
|---|---|
| 3501 | **Insulation failure > Check generator**<br>The inverter has detected a ground fault in the PV array.<br>**Corrective measures:**<br>• Check the PV system for ground faults (see Section 6, page 26). |
| 3601 | **High discharge curr. > Check generator**<br>The leakage current of the inverter and the PV array is too high. There is a ground fault, a residual current or a malfunction.<br>The inverter interrupts feed-in operation immediately after exceeding a threshold. When the fault is eliminated, the inverter automatically reconnects to the utility grid.<br>**Corrective measures:**<br>• Check the PV system for ground faults (see Section 6, page 26). |
| 3701 | **Resid.curr.too.high > Check generator**<br>The inverter has detected a residual current due to temporary grounding of the PV array.<br>**Corrective measures:**<br>• Check the PV system for ground faults (see Section 6, page 26). |
| 3801 | **DC overcurrent > Check generator**<br>Overcurrent at the DC input. The inverter briefly interrupts feed-in operation.<br>**Corrective measures:**<br>• If this message is displayed frequently, ensure that the PV array has been correctly rated and wired. |
| 3901 to 3902 | **Waiting for DC start conditions > Start cond. not met**<br>The feed-in conditions for the utility grid are not yet fulfilled.<br>**Corrective measures:**<br>• Ensure that the PV array is not covered by snow or otherwise shaded.<br>• Wait for higher irradiation.<br>• 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**.<br>• If this message is displayed frequently with medium irradiation, ensure that the PV array is correctly rated. |
| 6001 to 6438 | **Self diagnosis > Interference device**<br>The cause must be determined by the SMA Service Line.<br>**Corrective measures:**<br>• Contact the Service (see Section 11 "Contact", page 33). |

| Event number | Message, cause and corrective measures |
|---|---|
| 6501 to 6509 | **Self-diagnosis > Overtemperature**<br>The inverter has switched off due to excessive temperature.<br>**Corrective measures:**<br>• Clean the cooling fins on the rear of the enclosure and the air ducts on the top using a soft brush.<br>• Ensure that the inverter has sufficient ventilation.<br>• Ensure that the ambient temperature 40°C has not been exceeded.<br>• Ensure that the inverter is not exposed to direct solar irradiation. |
| 6512 | **Minimum operating temperature not reached**<br>The inverter will only recommence feeding into the utility grid once the temperature has reached at least -25°C. |
| 6603 to 6604 | **Self-diagnosis > Overload**<br>The cause must be determined by the Service.<br>**Corrective measures:**<br>• Contact the Service (see Section 11 "Contact", page 33). |
| 6701 to 6702 | **Communication disturbed**<br>Error in the communication processor, the inverter continues feeding in, however. The cause must be determined by the Service.<br>**Corrective measures:**<br>• If this message is displayed frequently, contact the Service (see Section 11 "Contact", page 33). |
| 7001 to 7002 | **Sensor fault**<br>A temperature sensor in the inverter is defective and the inverter interrupts the feed-in operation. The cause must be determined by the Service.<br>**Corrective measures:**<br>• Contact the Service (see Section 11 "Contact", page 33). |
| 7201 to 7202 | **Data stor. not poss.**<br>Internal error. The inverter continues to feed into the utility grid.<br>**Corrective measures:**<br>• Contact the Service (see Section 11 "Contact", page 33). |
| 7303 | **Update main CPU failed**<br>The cause must be determined by the Service.<br>**Corrective measures:**<br>• Contact the Service (see Section 11 "Contact", page 33). |
| 7320 | **The device with serial number [x] was successfully updated to firmware version [x].**<br>The firmware update was completed successfully. |

| Event number | Message, cause and corrective measures |
|---|---|
| 7329 | **Condition test successful**<br>The testing of the update conditions was successful. The firmware update package is suitable for this inverter. |
| 7330 | **Condition test failed**<br>The testing of the update conditions was not successful. The firmware update package is not suitable for this inverter.<br>**Corrective measures:**<br>• Retry update.<br>• Ensure that the selected update file is suitable for this inverter.<br>• If this message is displayed again, contact the Service (see Section 11 "Contact", page 33). |
| 7331 | **Update transport started**<br>Update file is being copied. |
| 7332 | **Update transport successful**<br>Update file was copied successfully to the inverter's internal memory. |
| 7333 | **Update transport failed**<br>Update file could not be copied to the inverter's internal memory. In the event of connection with the inverter via WLAN, a poor connection quality can be the cause.<br>**Corrective measures:**<br>• Retry update.<br>• For WLAN connection: Improve the WLAN connection quality (e.g. via WLAN repeater) or establish connection with the inverter via Ethernet.<br>• If this message is displayed again, contact the Service (see Section 11 "Contact", page 33). |
| 7341 | **Update Bootloader**<br>The inverter is performing a bootloader update. |
| 7342 | **Update Bootloader failed**<br>The bootloader update failed.<br>**Corrective measures:**<br>• Retry update.<br>• If this message is displayed again, contact the Service (see Section 11 "Contact", page 33). |

| Event number | Message, cause and corrective measures |
|---|---|
| 7347 | **Incompatible file**<br>The configuration file is not suitable for this inverter.<br>**Corrective measures:**<br>• Ensure that the selected configuration file is suitable for this inverter.<br>• Retry import. |
| 7348 | **Incorrect file format**<br>The configuration file is not of the required format or is damaged.<br>**Corrective measures:**<br>• Ensure that the selected configuration file is of the required format and is not damaged.<br>• Retry import. |
| 7349 | **Incorrect login rights for configuration file**<br>The user group logged in does not have the user rights necessary to be able to import a configuration.<br>**Corrective measures:**<br>• Log in as **Installer**.<br>• Import configuration file again. |
| 7350 | **Transfer of a configuration file has started**<br>The configuration file is being transferred. |
| 7351 | **Update WLAN**<br>The inverter is updating the WLAN module. |
| 7352 | **Update of WLAN not successful**<br>The update of the WLAN module failed.<br>**Corrective measures:**<br>• Retry update.<br>• If this message is displayed again, contact the Service (see Section 11 "Contact", page 33). |
| 7353 | **Update time zone database**<br>The inverter is updating the time zone database. |
| 7354 | **Update of time zone database not successful**<br>The update of the time zone database failed.<br>**Corrective measures:**<br>• Retry update.<br>• If this message is displayed again, contact the Service (see Section 11 "Contact", page 33). |

| Event number | Message, cause and corrective measures |
|---|---|
| 7355 | **Update WebUI**<br>The inverter is updating the inverter user interface. |
| 7356 | **Update of the WebUI not successful**<br>The update of the inverter user interface failed.<br>**Corrective measures:**<br>• Retry update.<br>• If this message is displayed again, contact the Service (see Section 11 "Contact", page 33). |
| 7619 | **Communication fault with meter unit > Check communication to meter**<br>The inverter is not receiving any data from the energy meter.<br>**Corrective measures:**<br>• Ensure that the energy meter is correctly integrated into the same network as the inverter (see energy meter manual).<br>• For WLAN connection: Improve the WLAN connection quality (e.g. via WLAN repeater) or connect the inverter with the DHCP server (router) via Ethernet. |
| 7701 to 7703 | **Self diagnosis > Interference device**<br>The cause must be determined by the Service.<br>**Corrective measures:**<br>• Contact the Service (see Section 11 "Contact", page 33). |
| 8003 | **Temperature derating**<br>The inverter has reduced its power output for more than ten minutes due to excessive temperature.<br>**Corrective measures:**<br>• Clean the cooling fins on the rear of the enclosure and the air ducts on the top using a soft brush.<br>• Ensure that the inverter has sufficient ventilation.<br>• Ensure that the ambient temperature 40°C has not been exceeded.<br>• Ensure that the inverter is not exposed to direct solar irradiation. |

| Event number | Message, cause and corrective measures |
|---|---|
| 8708 | **Timeout in communication for active power limitation**<br>Communication to the system control absent. Depending on the fall-back setting, either the last received values will be retained or the active power will be limited to the set percentage value of the inverter nominal power.<br>**Corrective measures:**<br>• Ensure that the connection to the system manager (e.g. Sunny Home Manager) is intact and that no cables are damaged or that no plugs have been pulled. |
| 8709 | **Timeout in communication for reactive power spec.**<br>Communication to the system control absent. Depending on the fall-back setting, either the last received values will be retained or the reactive power will be set to the set value.<br>**Corrective measures:**<br>• Ensure that the connection to the system manager (e.g. Sunny Home Manager) is intact and that no cables are damaged or that no plugs have been pulled. |
| 8710 | **Timeout in communication for cos-Phi spec.**<br>Communication to the system control absent. Depending on the fall-back setting, either the last received values will be retained or the displacement power factor will be set to the set value.<br>**Corrective measures:**<br>• Ensure that the connection to the system manager (e.g. Sunny Home Manager) is intact and that no cables are damaged or that no plugs have been pulled. |
| 9002 | **SMA Grid Guard code invalid**<br>The SMA Grid Guard code entered is incorrect. The operating parameters are still protected and cannot be changed.<br>**Corrective measures:**<br>• Enter the correct SMA Grid Guard code. |
| 9003 | **Grid parameter locked**<br>Changes to the grid parameters are now blocked. In order to be able to make changes to the grid parameters, from now on you must log in using the SMA Grid Guard code. |

| Event number | Message, cause and corrective measures |
|---|---|
| 9005 | **Changing of grid parameters not possible > Ensure DC supply.**<br>This error can have the following causes:<br>• The parameters to be changed are protected.<br>• The DC voltage at the DC input is not sufficient to run the main CPU.<br>**Corrective measures:**<br>• Enter the SMA Grid Guard code.<br>• Ensure that at least the DC start voltage is available (green LED is flashing, pulsing or glowing). |
| 9007 | **Abort self-test**<br>The self-test (Italy only) was terminated.<br>**Corrective measures:**<br>• Ensure that the AC connection is correct.<br>• Restart the self-test (see the inverter operating manual at www.SMA-Solar.com). |
| 10110 | **Time synchronization failed [x]**<br>No time information could be called up from the set NTP server.<br>**Corrective measures:**<br>• Ensure that the NTP server was configured correctly.<br>• Ensure that the inverter is integrated into a local network with Internet connection. |
| 10248 | **[Interface]: network busy**<br>The network is busy. Data exchange between the devices is not at an optimum and is greatly delayed.<br>**Corrective measures:**<br>• Increase the query intervals.<br>• If necessary, reduce the number of devices in the network. |
| 10249 | **[Interface]: network overloaded**<br>The network is overloaded. There is no data exchange between the devices.<br>**Corrective measures:**<br>• Reduce the number of devices in the network.<br>• If necessary, increase the data query intervals. |

| Event number | Message, cause and corrective measures |
|---|---|
| 10250 | **[Interface]: package error rate [ok / high]**<br>The package error rate has changed. If the package error rate is high, the network is overloaded or the connection to the network switch or DHCP server (router) is disturbed.<br>**Corrective measures if the package error rate is high:**<br>• Ensure that with an Ethernet connection, the network cable and the network connector are not damaged and that the network connector is correctly plugged.<br>• If necessary, increase the data query intervals.<br>• If necessary, reduce the number of devices in the network. |
| 10251 | **[Interface]: communication status goes to [OK / Warning / Error / Not connected]**<br>The communication status to the network switch or DHCP server (router) has changed. An additional error message may be displayed. |
| 10252 | **[Interface]: communication disrupted**<br>There is no valid signal on the network line.<br>**Corrective measures:**<br>• Ensure that with an Ethernet connection, the network cable and the network connector are not damaged and that the network connector is correctly plugged.<br>• Ensure that the DHCP server (router) and any network switches are signalizing correct operation. |
| 10253 | **[Interface]: connection speed goes to [100 Mbit / 10 Mbit]**<br>The data transfer rate has changed. The cause for the status [10 Mbit] can be a defective plug, a defective cable or the pulling or plugging of the network connector.<br>**Corrective measures if the status is [10 Mbit]:**<br>• Ensure that with an Ethernet connection, the network cable and the network connector are not damaged and that the network connector is correctly plugged.<br>• Ensure that the DHCP server (router) and any network switches are signalizing correct operation. |

| Event number | Message, cause and corrective measures |
|---|---|
| 10254 | **[Interface]: duplex mode goes to [Full / Half]**<br>The duplex mode (data transfer mode) has changed. The cause for the status [Half] can be a defective plug, a defective cable or the pulling or plugging of the network connector.<br>**Corrective measures if the status is [Half]:**<br>• Ensure that with an Ethernet connection, the network cable and the network connector are not damaged and that the network connector is correctly plugged.<br>• Ensure that the DHCP server (router) and any network switches are signalizing correct operation. |
| 10255 | **[Interface]: Network load OK**<br>The network load has returned to a normal range after being busy. |
| 10282 | **[User group]-Login via [protocol] locked**<br>After several incorrect login attempts, login has been blocked for a limited time. In this case, the User login will be blocked for 15 minutes, the Grid Guard login for 12 hours.<br>**Corrective measures:**<br>• Wait until the given time has expired and then retry login. |
| 10283 | **WLAN module faulty**<br>The WLAN module integrated in the inverter is defective.<br>**Corrective measures:**<br>• Contact the Service (see Section 11 "Contact", page 33). |
| 10284 | **No WLAN connection possible**<br>The inverter does not currently have a WLAN connection to the selected network.<br>**Corrective measures:**<br>• Ensure that the SSID, the WLAN password and the encryption method have been entered correctly. The encryption method is specified by your WLAN router or WLAN Access Point and can be changed there.<br>• Ensure that the WLAN router or WLAN Access Point is in range and is signalizing correct operation.<br>• If this message is displayed often, improve the WLAN connection by using a WLAN repeater. |
| 10285 | **WLAN connection established**<br>Connection to the selected WLAN network has been established. |

| Event number | Message, cause and corrective measures |
|---|---|
| 10286 | **WLAN connection lost**<br>The inverter has lost WLAN connection to the selected network.<br>**Corrective measures:**<br>• Ensure that the WLAN router or WLAN Access Point is still active.<br>• Ensure that the WLAN router or WLAN Access Point is in range and is signalizing correct operation.<br>• If this message is displayed often, improve the WLAN connection by using a WLAN repeater. |
| 27301 | **Update communication**<br>The inverter is updating the communication component. |
| 27302 | **Update main CPU**<br>The inverter is updating the inverter component. |
| 27312 | **Update completed**<br>The inverter has successfully completed the update. |
| 29004 | **Grid parameter unchanged**<br>Changing the grid parameters is not possible. |
| 20901 | **Inst. code valid**<br>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. |
| 20906 | **Self-test**<br>The self-test is in progress. |

# 5 Cleaning the Inverter

*NOTICE*

**Damage to the inverter due to the use of cleaning agents**

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

- Ensure that the inverter is free of dust, foliage and other dirt.

# 6 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**

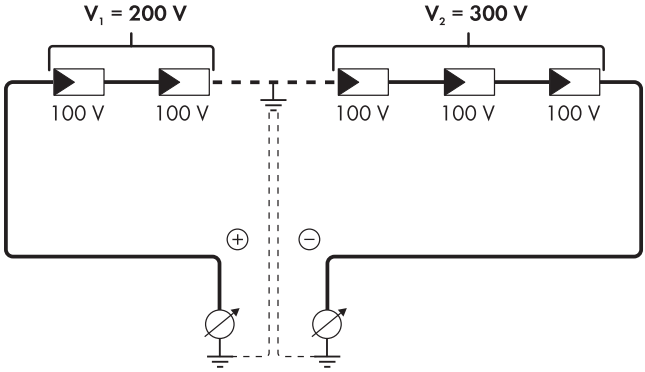
   **Danger to life due to high voltages**

   - Disconnect the inverter from all voltage sources (see Section 2.1, page 5).

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

### Example: Location of the ground fault

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




3. If a definite ground fault cannot be measured and the message is still displayed, measure the insulation resistance.
4. Reconnect the strings without ground faults to the inverter and recommission the inverter (see Section 8, page 30).

## 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.

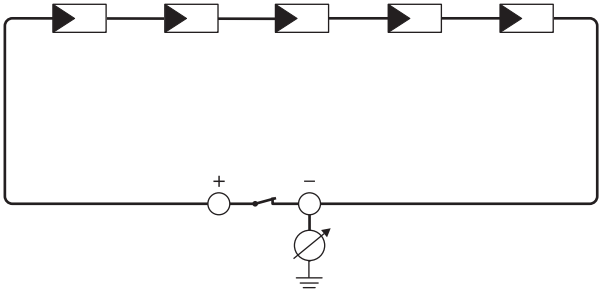



Figure 1: Schematic diagram of the measurement

**Calculating the insulation resistance**

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

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

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

   **Danger to life due to high voltages**

   - Disconnect the inverter from all voltage sources (see Section 2.1, page 5).
3. Install the short circuit device.
4. Connect the measuring device for insulation resistance.
5. Short-circuit the first string.
6. Set the test voltage. The test voltage should be as close as possible to the maximum system voltage of the PV modules but must not exceed it (see datasheet of the PV modules).
7. Measure the insulation resistance.
8. Eliminate the short circuit.
9. Measure the remaining strings in the same manner.
   - ☑ If the insulation resistance of a string deviates considerably from the theoretically calculated value, there is a ground fault present in that string.
10. Reconnect to the inverter only those strings from which the ground fault has been eliminated.
11. Reconnect all other strings to the inverter.
12. Recommission the inverter (see Section 8, page 30).
13. If the inverter still displays an insulation error, contact the Service (see Section 11 "Contact", page 33). The PV modules might not be suitable for the inverter in the present quantity.

# 7 Opening the Inverter

If you have to open the inverter enclosure lid for repairs or replacement, proceed as described in the following.

*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°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.

**Procedure:**

1. ⚠ DANGER

   **Danger to life due to high voltages**

   - Disconnect the inverter from all voltage sources (see Section 2.1, page 5).
   - Wait five minutes until the capacitors have discharged.
2. To prevent water or dust entering the interior of the inverter, clean and dry the lid prior to removal.
3. Unscrew all four enclosure lid screws using a Torx screwdriver (TX25) and store safely.
4. Carefully remove the enclosure lid.
5. *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.
6. Perform the repair or replacement.
7. Replace the enclosure lid with the four screws onto the enclosure and hold in place.
8. Tighten all four screws using a Torx screwdriver (TX25) crosswise (torque: 6 Nm).
9. Recommission the inverter (see Section 8, page 30).

# 8 Recommissioning the Inverter

**Requirements:**

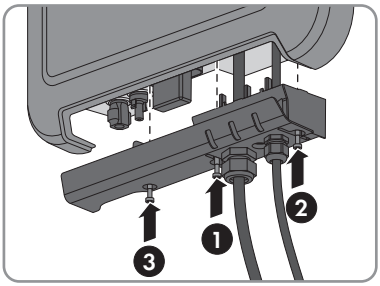
☐ The inverter must be correctly mounted.

☐ The circuit breaker must be correctly rated.

☐ All cables must be correctly connected.

**Procedure:**

1. Attach the connection cap to the inverter using the three screws and a Torx screwdriver (TX20) (torque: 3.5 Nm).




2. Tighten the swivel nuts of the AC cable gland and network connection hand-tight.
3. Set the DC load-break switch of the inverter to position **1**.
4. Switch on the circuit breaker.
   ☑ The green LED flashes slowly on and off or glows permanently. Feed-in operation begins.
   ✖ Green LED is flashing?
   The DC input voltage is still too low.
   - Once the DC input voltage is sufficiently high, feed-in operation begins.

   ✖ The red LED is glowing?
   There is probably an error.
   - Call up the inverter user interface (see Section 3 "Calling Up the Inverter User Interface via Direct Connection", page 8).
   - Call up the menu **Events** and identify the error via the event ID.
   - Rectify the error (see Section 4 "Event Messages", page 10).
5. If required, configure the inverter via the user interface.

# 9 Decommissioning the Inverter

To decommission the inverter completely upon completion of its service life, proceed as described in this Section.

**⚠ CAUTION**

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

The inverter weighs 9 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.

- Transport and lift the inverter carefully.

1. **⚠ DANGER**

   **Danger to life due to high voltages**

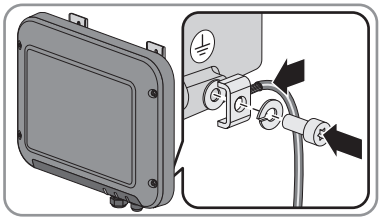
   - Disconnect the inverter from all voltage sources (see Section 2.1, page 5).

2. **⚠ CAUTION**

   **Risk of burns due to hot enclosure parts**

   - Wait 30 minutes for the enclosure to cool down.

3. If an additional grounding or an equipotential bonding is connected, remove the cylindrical screw using a Torx screwdriver (TX25) and remove the grounding cable.



4. Remove the inverter from the wall.
5. If the inverter is to be stored or shipped, pack the inverter. Use the original packaging or packaging that is suitable for the weight and dimensions of the inverter.
6. Dispose of the inverter in accordance with the locally applicable disposal regulations for electronic waste.

# 10 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 |
|---|---|---|
| Enclosure lid | Enclosure lid red | 90-157500.02 |
| Connection cap | Connection cap for covering the connection area | 90-133100.06 |
| accessory kit | Accessory kit with DC connectors, grounding terminal for additional grounding and AC connector | 85-101600.01 |
| Switching lever of the DC load-break switch | Switching lever of the DC load-break switch as spare part | 90-206200.01 |

# 11 Contact

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

| | | | |
|---|---|---|---|
| Australia | SMA Australia Pty Ltd.<br>Sydney<br>Toll free for Australia:<br>1800 SMA AUS<br>(1800 762 287)<br>International: +61 2 9491 4200 | Belgien<br>Belgique<br>België<br>Luxemburg<br>Luxembourg<br>Nederland | SMA Benelux BVBA/SPRL<br>Mechelen<br>+32 15 286 730 |
| Argentina<br>Brasil<br>Chile<br>Perú | SMA South America SPA<br>Santiago<br>+562 2820 2101 | Česko<br>Magyarország<br>Polska<br>România<br>Slovensko | SMA Central & Eastern Europe s.r.o.<br>Praha<br>+420 235 010 417 |
| Danmark<br>Deutschland<br>Österreich<br>Schweiz | SMA Solar Technology AG<br>Niestetal<br>SMA Online Service Center:<br>www.SMA.de/Service<br>Sunny Boy, Sunny Mini Central, Sunny Tripower:<br>+49 561 9522-1499<br>Monitoring Systems (Kommunikationsprodukte):<br>+49 561 9522-2499<br>Fuel Save Controller (PV-Diesel-Hybridsysteme):<br>+49 561 9522-3199<br>Sunny Island, Sunny Backup, Hydro Boy: +49 561 9522-399<br>Sunny Central:<br>+49 561 9522-299 | France | SMA France S.A.S.<br>Lyon<br>Sunny Boy, Sunny Mini Central, Sunny Tripower:<br>+33 472 09 04 40<br>Monitoring Systems:<br>+33 472 09 04 41<br>Sunny Island :<br>+33 472 09 04 42<br>Sunny Central :<br>+33 472 09 04 43 |
| España<br>Portugal | SMA Ibérica Tecnología Solar, S.L.U.<br>Barcelona<br>+34 935 63 50 99 | India | SMA Solar India Pvt. Ltd.<br>Mumbai<br>+91 22 61713888 |

| | | | |
|---|---|---|---|
| South Africa | SMA Solar Technology South Africa Pty Ltd.<br>Centurion (Pretoria)<br>08600 SUNNY (08600 78669)<br>International: +27 (12) 622 3000 | Ελλάδα<br>Κύπρος<br>Kıbrıs<br>България | SMA Hellas AE<br>Αθήνα<br>801 222 9 222<br>International: +30 212 222 9 222 |
| Italia | SMA Italia S.r.l.<br>Milano<br>+39 02 8934-7299 | United Kingdom | SMA Solar UK Ltd.<br>Milton Keynes<br>+44 1908 304899 |
| ไทย | SMA Solar (Thailand) Co., Ltd.<br>กรุงเทพฯ<br>+66 2 670 6999 | 대한민국 | SMA Technology Korea Co., Ltd.<br>서울<br>+82-2-520-2666 |
| الإمارات العربية المتحدة | SMA Middle East LLC<br>أبو ظبي<br>+971 2 234-6177 | Other countries | International SMA Service Line<br>Niestetal<br>Toll free worldwide: 00800 SMA SERVICE (+800 762 7378423) |

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