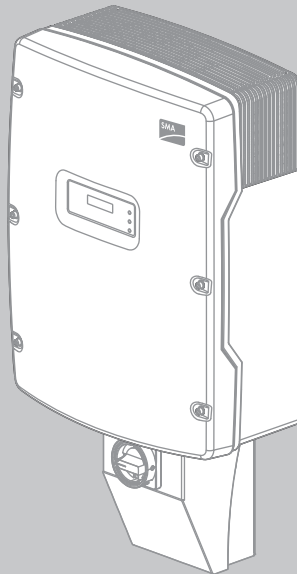




PV Inverter

**SUNNY BOY 6000TL-US / 7000TL-US / 8000TL-US /  
9000TL-US / 10000TL-US / 11000TL-US**

User Manual





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SMA America, LLC  
3801 N. Havana Street  
Denver, CO 80239 U.S.A.

SMA Solar Technology Canada Inc.  
2425 Matheson Blvd. E  
8th Floor  
Mississauga, ON L4W 5K5  
Canada

# IMPORTANT SAFETY INSTRUCTIONS

## SAVE THESE INSTRUCTIONS

This manual contains important instructions for the following products:




- Sunny Boy 6000TL-US/7000TL-US/8000TL-US/9000TL-US/10000TL-US/11000TL-US

This manual must be followed during installation and maintenance.

The product is designed and tested according to international safety requirements, but as with all electrical and electronic equipment, certain precautions must be observed when installing and/or operating the product. To reduce the risk of personal injury and to ensure the safe installation and operation of the product, you must carefully read and follow all instructions, cautions and warnings in this manual.



## Warnings in this document

A warning describes a hazard to equipment or personnel. It calls attention to a procedure or practice, which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the SMA equipment and/or other equipment connected to the SMA equipment or personal injury.

| Symbol                                                                                           | Description                                                                                              |
|--------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|
|  <b>DANGER</b>  | DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury.    |
|  <b>WARNING</b> | WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.  |
|  <b>CAUTION</b> | CAUTION indicates a hazardous situation which, if not avoided, could result in minor or moderate injury. |
| <b>NOTICE</b>                                                                                    | NOTICE is used to address practices not related to personal injury.                                      |

## Markings on this product

The following symbols are used as product markings with the following meanings.

| Symbol                                                                            | Description                                                                                                                                                                  |
|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <b>Beware of dangerous voltage</b><br>The product works with high voltages. All work on the product must only be performed as described in the documentation of the product. |
|  | <b>Beware of hot surface</b><br>The product can become hot during operation. Do not touch the product during operation.                                                      |

## General Warnings

### **⚠ WARNING**

#### General Warnings

All electrical installations must be done in accordance with the local and *National Electrical Code*® ANSI/NFPA 70 or the *Canadian Electrical Code*® CSA C22.1. This document does not and is not intended to replace any local, state, provincial, federal or national laws, regulation or codes applicable to the installation and use of the product, including without limitation applicable electrical safety codes. All installations must conform with the laws, regulations, codes and standards applicable in the jurisdiction of installation. SMA assumes no responsibility for the compliance or noncompliance with such laws or codes in connection with the installation of the product.

The product contains no user-serviceable parts except for the fans on the bottom of the enclosure and the filters behind the fans as well as the handle covers on the sides of the unit. For all repair and maintenance, always return the unit to an authorized SMA Service Center.

Before installing or using the product, read all of the instructions, cautions, and warnings in this manual.

Before connecting the product to the electrical utility grid, contact the local utility company. This connection must be made only by qualified personnel.

Wiring of the product must be made by qualified personnel only.

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# 1 Information on this Document

## Validity

This document is valid for the following device types:

- SB 6000TLUS-12
- SB 7000TLUS-12
- SB 8000TLUS-10
- SB 8000TLUS-12
- SB 9000TLUS-10
- SB 9000TLUS-12
- SB 10000TLUS-10
- SB 10000TLUS-12
- SB 11000TLUS-12

## Target Group

This document is intended for end users.

## Additional Information

Additional information is available at [www.SMA-America.com](http://www.SMA-America.com).

## Typography

| Typography  | Usage                                                                                                                            | Example:                                                                                                     |
|-------------|----------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|
| "light"     | <ul style="list-style-type: none"> <li>• Display messages</li> <li>• Parameters</li> <li>• Terminals</li> <li>• Slots</li> </ul> | <ul style="list-style-type: none"> <li>• The inverter switches to "Balanced" mode.</li> </ul>                |
| <b>bold</b> | <ul style="list-style-type: none"> <li>• Elements to be selected</li> <li>• Elements to be entered</li> </ul>                    | <ul style="list-style-type: none"> <li>• Select the <b>FanTest</b> parameter and set to <b>1</b>.</li> </ul> |

## Nomenclature

The following nomenclature is used in this document:

| Complete designation                                                           | Designation in this document |
|--------------------------------------------------------------------------------|------------------------------|
| SMA America, LLC                                                               | SMA                          |
| SMA Solar Technology Canada Inc.                                               | SMA                          |
| Sunny Boy<br>6000TL-US/7000TL-US/8000TL-US/<br>9000TL-US/10000TL-US/11000TL-US | Inverter/Sunny Boy           |

## Abbreviations

| Abbreviations | Designations                  |
|---------------|-------------------------------|
| AC            | Alternating Current           |
| AFCI          | Arc-Fault Circuit Interrupter |
| DC            | Direct Current                |
| LED           | Light-Emitting Diode          |
| MPP           | Maximum Power Point           |
| MPPT          | Maximum Power Point Tracker   |
| PV            | Photovoltaics                 |

## 2 Safety

### 2.1 Intended Use

The Sunny Boy is a PV inverter which converts the direct current of the PV array to alternating current and feeds it into the power distribution grid.

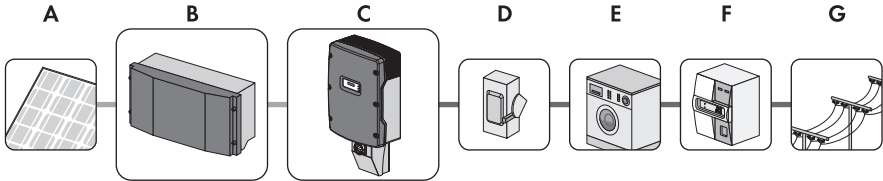


Figure 1: Principle of a PV plant with Sunny Boy

| Position | Description                  |
|----------|------------------------------|
| A        | PV array                     |
| B        | Sunny Boy Combiner Box       |
| C        | Sunny Boy with DC Disconnect |
| D        | AC miniature circuit-breaker |
| E        | Loads                        |
| F        | Energy meter                 |
| G        | Power distribution grid      |

The Sunny Boy takes current from a DC source and converts it to alternating current for the power distribution grid. This current is first supplied to the local loads (E). The surplus energy is fed into the power distribution grid (G). The amount of current required from the power distribution grid is reduced by the current supplied directly to the local loads. An energy surplus may even result in the energy meter (F) of your plant running backwards. This power may also be recorded as power credits by the electric utility company depending on the interconnection agreement.

The Sunny Boy is suitable for indoor and outdoor use.

The PV modules used must be suitable for use with the Sunny Boy and must be approved by the module manufacturer. Do not connect any energy sources other than PV modules to the Sunny Boy.

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

The enclosed documentation is an integral part of this product.

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

## 2.2 Safety Precautions

### **⚠ DANGER**

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

The components in the inverter are live. Touching live components can result in serious injury or death.

- Do not open the inverter.
- Electrical installation, repairs and conversions may only be carried out by electrically qualified persons.
- Do not touch damaged inverters.

### **⚠ CAUTION**

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

Parts of the enclosure can become very hot during operation. Touching hot enclosure parts can result in burns.

- Only touch the enclosure lid and display during operation.

### **NOTICE**

#### **Excessive input voltage can damage the inverter.**

Incorrect sizing of the PV plant may result in voltages being present which could destroy the inverter. The inverter display will read the error message „!PV-Overvoltage!, !DISCONNECT DC!“ or "V<sub>pV</sub>Max".

- Turn the rotary switch of the DC Disconnect to the **Off** position immediately.
- Contact installer.

## 3 Product Description

### 3.1 Sunny Boy

The Sunny Boy is a PV inverter which converts the direct current of the PV array to alternating current and feeds it into the power distribution grid.

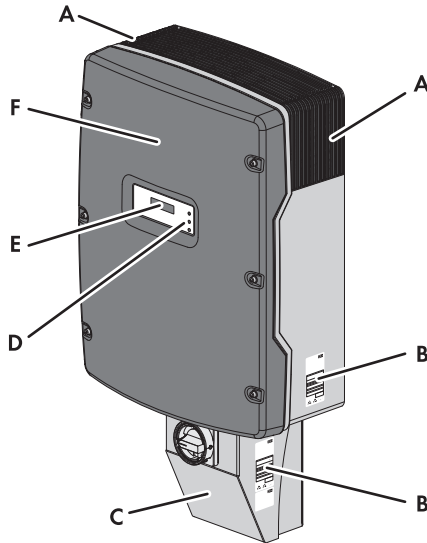






Figure 2: Sunny Boy design

| Position | Description                        |
|----------|------------------------------------|
| A        | Ventilation grids (left and right) |
| B        | Type label                         |
| C        | DC Disconnect                      |
| D        | LEDs                               |
| E        | Display                            |
| F        | Enclosure lid                      |

## Symbols on the inverter

| Symbol                                                                            | Description | Explanation                                                            |
|-----------------------------------------------------------------------------------|-------------|------------------------------------------------------------------------|
|  | Tap symbol  | Indicates display operation (see Section 4).                           |
|  | Green LED   | Indicates the operating state of the inverter (see Section 5.1).       |
|  | Red LED     | Indicates the status of the ground fault monitoring (see Section 5.1). |
|  | Yellow LED  | Indicates a fault or a disturbance (see Section 5.3.2).                |

## 3.2 Type Labels

### 3.2.1 Type Label of the Sunny Boy

The type label provides a unique identification of the inverter. The type label is on the right-hand side of the enclosure.

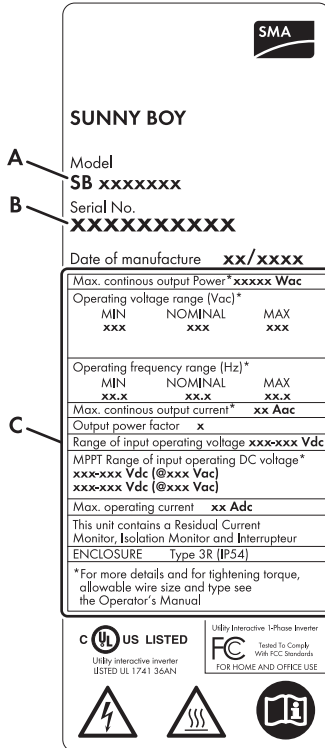


Figure 3: Layout of the Sunny Boy type label

| Position | Description                     | Explanation            |
|----------|---------------------------------|------------------------|
| A        | Model                           | Device type            |
| B        | Serial No.                      | Inverter serial number |
| C        | Device-specific characteristics | -                      |

You require the information on the type label to use the inverter safely and for customer support at the SMA Service Line. The type label must be permanently affixed to the inverter.

### 3.2.2 Type Labels of the DC Disconnect

The type labels provide a unique identification of the DC Disconnect. The type labels are on the right-hand side of the enclosure.

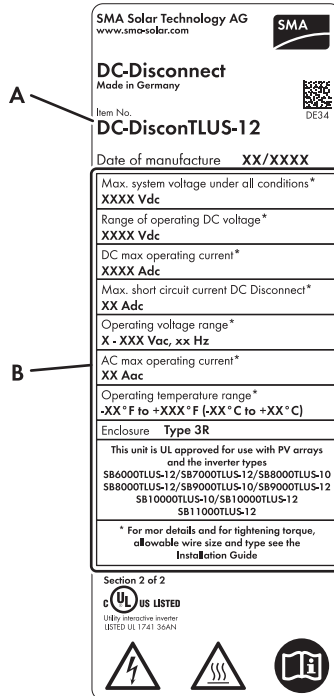


Figure 4: Layout of the DC Disconnect type label

| Position | Description                     | Explanation |
|----------|---------------------------------|-------------|
| A        | Item No.I                       | Device type |
| B        | Device-specific characteristics | -           |



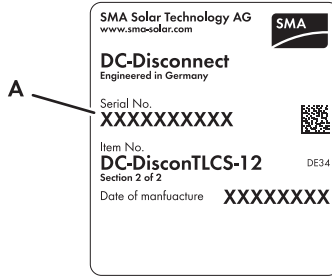


Figure 5: Layout of the DC Disconnect type label

| Position | Description | Explanation                 |
|----------|-------------|-----------------------------|
| A        | Serial No.  | DC Disconnect serial number |

You require the information on the type labels to use the DC Disconnect safely and for customer support at the SMA Service Line. The type labels must be permanently affixed to the DC Disconnect.

### Symbols on the type labels

| Symbol | Explanation                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|--------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|        | <b>Observe the operating instructions</b><br>Read the documentation of the product before working on it. Follow all safety precautions and instructions as described in the documentation.                                                                                                                                                                                                                                                                    |
|        | UL1741 is the standard applied by Underwriters Laboratories to the product to certify that it meets the requirements of the <i>National Electrical Code</i> <sup>®</sup> , the <i>Canadian Electrical Code</i> <sup>®</sup> CSA C22.1, and IEEE-929-2000. IEEE 929-2000 provides recommendations regarding the proper equipment and functionality necessary to ensure compatible operation when power generation is connected to the power distribution grid. |

### 3.3 DC Disconnect

The DC Disconnect safely disconnects the PV array from the inverter.

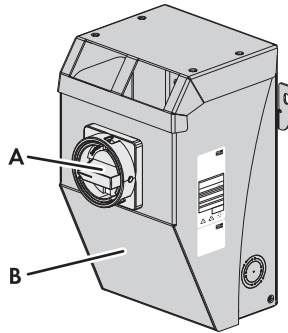


Figure 6: DC Disconnect design

| Position | Description   |
|----------|---------------|
| A        | Rotary switch |
| B        | Cover         |

The DC Disconnect forms a conductive path between the PV array and the inverter. Actuating the DC Disconnect interrupts the flow of current and the DC cabling can be safely disconnected from the inverter.

### 3.4 Communication

The inverter can be fitted with a Piggy-Back to enable cable-based communication with special data capture devices or a PC with the relevant software (for information about supported communication products for communication via Piggy-Back, see [www.SMA-America.com](http://www.SMA-America.com)).

### 3.5 Arc-Fault Circuit Interrupter (AFCI)

In accordance with the *National Electrical Code*<sup>®</sup>, Article 690.11, the Sunny Boy is equipped with a system for electric arc detection and interruption.

An electric arc with a power of 300 W or greater must be interrupted by the AFCI in the time specified by UL 1699B. A tripped AFCI may only be reset manually.

Only the following types of Sunny Boy are equipped with an automatic arc-fault circuit interrupter:

- SB 6000TLUS-12
- SB 7000TLUS-12
- SB 8000TLUS-12
- SB 9000TLUS-12
- SB 10000TLUS-12
- SB 11000TLUS-12

The 2011 edition of the *National Electrical Code*<sup>®</sup>, Article 690.11 stipulates that newly installed PV plants attached to a building must be fitted with a means of detecting and disconnecting serial electric arcs on the PV side.

If the automatic arc-fault circuit interrupter function is not required, it can be deactivated in the "Installer" mode via the communication device.

## 4 Operating the Display

The display shows the current operating data of the inverter (e.g. status, power, input voltage) and errors or disturbances.

The displayed operating data is updated every five seconds. The backlight shuts off automatically after two minutes.

You can operate the display by tapping on the enclosure lid:

- To activate the backlight, tap once.
- To scroll to the next text line of a displayed message, tap once.
- To display the serial number and designation of the inverter, the firmware version, and the status of the Power Balancer (if active) in succession during operation, tap twice in succession.

## 5 Troubleshooting

### 5.1 LED Signals

The LEDs display the operating state of the inverter and indicate the messages in the display via various blink codes.

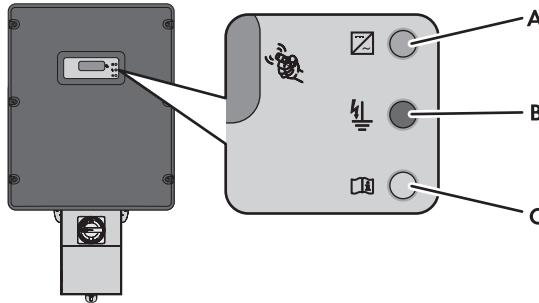


Figure 7: Position of the LEDs

| Position | Description             | Status                                                                  | Explanation                                                                                                                      |
|----------|-------------------------|-------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| A        | Green LED               | Glowing                                                                 | Operation<br>Indicates normal operation of the inverter.                                                                         |
|          |                         | Flashes three times per second                                          | Start<br>The inverter is calibrating internal systems. Calibration takes 10 s, after which the inverter begins normal operation. |
|          |                         |                                                                         | Stop<br>The inverter has been set manually to Stop mode.                                                                         |
|          | Flashes once per second | Waiting<br>The inverter is checking the conditions for grid connection. |                                                                                                                                  |

| Position | Description | Status                           | Explanation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|----------|-------------|----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|          |             | Goes out briefly once per second | <p>Derating</p> <p>At temperatures above +113 °F (+45 °C), the inverter continues to operate but reduces the power so as to protect the internal components from overheating.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Ensure that the inverter has sufficient ventilation.</li> <li>• Ensure that air can emerge from the fan guards at the bottom of the inverter. If air is not emerging from the fan guards, clean the fan guards (see Section 6.4).</li> </ul> |
| B        | Red LED     | Glowing                          | <p>Ground fault</p> <p>A ground fault is present in the PV array. The inverter does not feed into the power distribution grid.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Contact installer.</li> </ul>                                                                                                                                                                                                                                                               |

| Position | Description | Status                                           | Explanation                                                                                                                                                                                                                                                                                                                       |
|----------|-------------|--------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| C        | Yellow LED  | Glowing                                          | Control system fault<br>The inverter is no longer feeding into the power distribution grid.<br><b>Corrective measures:</b> <ul style="list-style-type: none"> <li>Contact installer.</li> </ul>                                                                                                                                   |
|          |             | Blinking                                         | AFCI self-test<br>The inverter is performing an AFCI self-test.                                                                                                                                                                                                                                                                   |
|          |             | Glowes for 5 s, goes out for 3 s, blinks twice   | Grid failure<br>The power distribution grid has failed or the AC miniature circuit-breaker has tripped.<br><b>Corrective measures:</b> <ul style="list-style-type: none"> <li>Ensure that there is no power distribution grid failure.</li> <li>If there is no power distribution grid failure, contact the installer.</li> </ul> |
|          |             | Glowes for 5 s, goes out for 3 s, blinks 4 times | DC overvoltage<br>The inverter has detected a DC input voltage that is too high for safe operation.<br><b>Corrective measures:</b> <ul style="list-style-type: none"> <li>Contact installer.</li> </ul>                                                                                                                           |
|          |             | Glowes for 5 s, goes out for 3 s, blinks 5 times | Disturbance<br>The inverter has detected an internal fault that interrupts normal operation.<br><b>Corrective measures:</b> <ul style="list-style-type: none"> <li>Contact installer.</li> </ul>                                                                                                                                  |

| Position  | Description             | Status                                               | Explanation                                                                                                                                                                                                                                                           |
|-----------|-------------------------|------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|           |                         | Glow for 5 s,<br>goes out for 3 s,<br>blinks 6 times | High leakage current<br>The leakage current from the inverter and the PV array is too high.<br><b>Corrective measures:</b> <ul style="list-style-type: none"> <li>Contact installer.</li> </ul>                                                                       |
|           |                         | Glow for 5 s,<br>goes out for 3 s,<br>blinks 7 times | Change of differential current<br>The inverter has detected a change of differential current. The inverter is no longer feeding into the power distribution grid.<br><b>Corrective measures:</b> <ul style="list-style-type: none"> <li>Contact installer.</li> </ul> |
| B + C     | Red LED +<br>yellow LED | Glowing                                              | Ground fault<br>The inverter has detected a ground fault. The inverter will not restart automatically after detecting a ground fault.<br><b>Corrective measures:</b> <ul style="list-style-type: none"> <li>Contact installer.</li> </ul>                             |
| A + B + C | All LEDs                | Glowing                                              | Initialization<br>The DC input current available from the PV array is not sufficient for normal operation. Data transmission is not possible during initialization.                                                                                                   |
| A + B + C | All LEDs                | Not glowing                                          | Standby<br>The inverter is in standby mode. The input voltage is too low for operation.                                                                                                                                                                               |



## 5.2 Measurement Channels

The measured values of the inverter are shown on the display in the measurement channels. In addition, you can read out a variety of measurement channels and messages from the inverter using special communication devices (e.g. Sunny WebBox) or a PC with the relevant software (e.g. Sunny Explorer).

| Measurement channel | Explanation                                                                            |
|---------------------|----------------------------------------------------------------------------------------|
| Balancer            | Operating mode set via "Power Balancer" parameter                                      |
| CO2 saved           | Amount of CO <sub>2</sub> saved during the operating time                              |
| E-total             | Total energy yield                                                                     |
| Error               | Description of fault                                                                   |
| Event-Cnt           | Number of events                                                                       |
| Fac                 | Power frequency                                                                        |
| Grid Type           | Type of power distribution grid to which the inverter is connected                     |
| h-on                | Total operating hours                                                                  |
| h-Total             | Total number of operating hours in feed-in operation                                   |
| I-dif               | Residual current                                                                       |
| Iac                 | Line current                                                                           |
| Inv.TmpVal          | Temperature measured at IGBT module                                                    |
| Ipv                 | DC input current                                                                       |
| Max Vpv             | Maximum DC input voltage                                                               |
| Mode                | Current operating mode                                                                 |
| Pac                 | Power fed into the power distribution grid                                             |
| Pcb.Tmp.Val         | Temperature measured at printed circuit board                                          |
| Power On            | Total system start-up counter                                                          |
| Riso                | Insulation resistance of the PV plant before connecting to the power distribution grid |
| Serial Number       | Inverter serial number                                                                 |
| Vac                 | Line voltage L1 - L2                                                                   |
| Vac L1              | Line voltage L1 - N                                                                    |
| Vac L2              | Line voltage L2 - N                                                                    |
| Vpv                 | DC Input voltage                                                                       |
| Vpv Setpoint        | MPP tracking DC target voltage                                                         |

## 5.3 Display Messages

### 5.3.1 Status Messages

| Message         | Explanation                                                                                                                                                                                                                                                                                            |
|-----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Balanced        | The inverter has disconnected from the power distribution grid or is limiting its power to a defined value over a 10-minute average. The inverter is part of a three-phase system with two further inverters and is equipped with the SMA Power Balancer to prevent the formation of unbalanced loads. |
| Derating        | Reduction of the power due to abnormal heat sink temperatures                                                                                                                                                                                                                                          |
| Disturbance     | The inverter has detected a disturbance. The inverter is no longer feeding into the power distribution grid.                                                                                                                                                                                           |
| Error           | The inverter has detected a fault. The error has to be remedied before the inverter can continue feeding into the power distribution grid.                                                                                                                                                             |
| Grid monitoring | When the system starts, the inverter synchronizes with the power distribution grid.                                                                                                                                                                                                                    |
| MPP             | The inverter is in MPP mode.<br>The inverter adjusts the DC input voltage and the DC input current of the PV array to achieve the highest possible AC output power.                                                                                                                                    |
| MPP-Search      | When the system starts, the inverter checks the MPP tracking range.                                                                                                                                                                                                                                    |
| Offset          | When the system starts, the inverter calibrates the electronics.                                                                                                                                                                                                                                       |
| Riso            | The inverter measures the PV plant insulation resistance.                                                                                                                                                                                                                                              |
| Stop            | The inverter has been manually set to system stop.                                                                                                                                                                                                                                                     |
| Turbine         | The inverter is in turbine mode.<br>This operating mode was specifically designed for use with wind turbine systems.                                                                                                                                                                                   |
| V-Const         | The input voltage of the PV array is set at a given target value and the inverter is not operating in MPP mode. This operating mode is suitable for using the inverter with fuel cells or small hydroelectric power plants.                                                                            |
| Wait            | The DC input voltage is not high enough for the start.                                                                                                                                                                                                                                                 |
| Warning         | System warning requires further investigation.                                                                                                                                                                                                                                                         |

### 5.3.2 Error Messages

In the event of an error, the relevant messages are shown on the display and the backlight is activated. Each error message is displayed for 5 seconds. After 5 seconds, the display scrolls through the regular operation messages. The error message will be displayed in the display sequence until the fault is rectified.

| Message                             | Cause and corrective measures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|-------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| IPV-Overvoltage!<br>!DISCONNECT DC! | <p>Overvoltage at DC input, Risk of inverter destruction. When this message is signaled, it is accompanied by rapid flashing of the backlight.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Turn the rotary switch of the DC Disconnect to the <b>Off</b> position immediately.</li> <li>• Contact installer.</li> </ul>                                                                                                                                                                      |
| CAN                                 | <p>An internal communication fault has occurred.</p> <p>The inverter disconnects from the power distribution grid. As soon as the error has been remedied, the inverter tries to feed into the power distribution grid again. If the inverter cannot feed into the power distribution grid after several attempts, the inverter trips the permanent operation inhibition.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Contact installer.</li> </ul>                                          |
| Check L-N-PE                        | <p>L and N are swapped on the AC connection or PE is not connected.</p> <p>The inverter disconnects from the power distribution grid. As soon as the error has been remedied, the inverter tries to feed into the power distribution grid again. If the inverter cannot feed into the power distribution grid after several attempts, the inverter trips the permanent operation inhibition.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Contact installer.</li> </ul>                       |
| DC link                             | <p>The internal hardware monitoring system has detected a fault in the power electronics.</p> <p>The inverter disconnects from the power distribution grid. As soon as the error has been remedied, the inverter tries to feed into the power distribution grid again. If the inverter cannot feed into the power distribution grid after several attempts, the inverter trips the permanent operation inhibition.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Contact installer.</li> </ul> |

| Message                | Cause and corrective measures                                                                                                                                                                                                                                                                                                                                             |
|------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Derating               | <p>The inverter reduces the output power due to high internal temperatures.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Ensure that the inverter has sufficient ventilation.</li> <li>• Ensure that air can emerge from the fan guards. If no air is emerging from the fan guards, clean the fan guards (see Section 6.4).</li> </ul> |
| dl-OCU<br>dl-Srr       | <p>The inverter has detected a change in the differential current.</p> <p>A change of the differential current can be caused by a ground fault, residual current or a malfunction. The inverter disconnects from the power distribution grid.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Contact installer.</li> </ul>               |
| dl-Meas-Srr<br>dl-Meas | <p>The inverter has detected a deviation in the differential current measurement. If this message is repeated frequently, the inverter disconnects from the power distribution grid.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Contact installer.</li> </ul>                                                                        |
| EEPROM                 | <p>Temporary disturbance during reading or writing of data from the EEPROM.</p> <p>This data are not essential for safe operation. This message is for information purposes and has no effect on the performance of the inverter.</p>                                                                                                                                     |
| EEPROM p               | <p>EEPROM data are defective.</p> <p>The inverter has switched off because the loss of data has disabled important inverter functions.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Contact installer.</li> </ul>                                                                                                                      |
| EeRestore              | <p>One of the duplicate records in the EEPROM is defective and has been reconstructed without loss of data. This message is for information purposes and has no effect on the performance of the inverter.</p>                                                                                                                                                            |

| Message            | Cause and corrective measures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Error AFCI         | <p>The inverter has detected an electric arc in the PV system.</p> <p>The inverter disconnects from the power distribution grid. As soon as the error is remedied, the inverter performs an AFCI test. If the AFCI test is unsuccessful, the inverter keeps restarting the AFCI test until it has been carried out successfully.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Restart the inverter (see section 5.3.3 "Resetting "Error AFCI", page 34).</li> <li>• If the message occurs frequently, contact the installer.</li> </ul> |
| Fac-Bfr<br>Fac-Srr | <p>The AC power frequency has exceeded the permissible range. The inverter disconnects from the power distribution grid to prevent islanding.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Contact installer.</li> </ul>                                                                                                                                                                                                                                                                                                                |
| HW Signal          | <p>The inverter has detected an internal measuring disturbance or the hardware is defective.</p> <p>The inverter disconnects from the power distribution grid. As soon as the error has been remedied, the inverter tries to feed into the power distribution grid again. If the inverter cannot feed into the power distribution grid after several attempts, the inverter trips the permanent operation inhibition.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Contact installer.</li> </ul>                                        |
| Iac-DC_Offs-Srr    | <p>The inverter has detected a system incident.</p> <p>The inverter disconnects from the power distribution grid. As soon as the error has been remedied, the inverter tries to feed into the power distribution grid again. If the inverter cannot feed into the power distribution grid after several attempts, the inverter trips the permanent operation inhibition.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Contact installer.</li> </ul>                                                                                     |

| Message                         | Cause and corrective measures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| IGBTs                           | <p>The inverter has detected a disturbance in the power electronics.</p> <p>The inverter disconnects from the power distribution grid. As soon as the error has been remedied, the inverter tries to feed into the power distribution grid again. If the inverter cannot feed into the power distribution grid after several attempts, the inverter trips the permanent operation inhibition.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Contact installer.</li> </ul>               |
| MSD-FAC<br>MSD-Idif             | <p>The inverter has detected an internal measurement comparison disturbance or the hardware is defective.</p>                                                                                                                                                                                                                                                                                                                                                                                                             |
| MSD-VAC                         | <p>The inverter disconnects from the power distribution grid. As soon as the error has been remedied, the inverter tries to feed into the power distribution grid again. If the inverter cannot feed into the power distribution grid after several attempts, the inverter trips the permanent operation inhibition.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Contact installer.</li> </ul>                                                                                        |
| Offset                          | <p>The grid monitoring self-test has failed.</p> <p>The inverter disconnects from the power distribution grid. As soon as the error has been remedied, the inverter tries to feed into the power distribution grid again. If the inverter cannot feed into the power distribution grid after several attempts, the inverter trips the permanent operation inhibition.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• If the message occurs frequently, contact the installer.</li> </ul> |
| PowerBalancer                   | <p>Three Sunny Boys are combined into one three-phase feed-in unit to prevent unbalanced loads. The parameter "PowerBalancer" is set to "PhaseGuard" or "FaultGuard".</p>                                                                                                                                                                                                                                                                                                                                                 |
| REL_INV_CLOSE<br>REL_GRID_CLOSE | <p>A grid relay does not close. The inverter checks the relays connecting it to the power distribution grid before feeding power into the grid.</p> <p>If the grid relays do not function properly, the inverter cannot connect to the power distribution grid.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Contact installer.</li> </ul>                                                                                                                                             |

| Message                       | Cause and corrective measures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|-------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| REL_INV_OPEN<br>REL_GRID_OPEN | <p>A grid relay does not open. The inverter checks the relays connecting it to the power distribution grid before feeding power into the grid.</p> <p>If the grid relays do not function properly, the inverter cannot connect to the power distribution grid.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Contact installer.</li> </ul>                                                                                                                                                                      |
| Riso                          | <p>The electrical insulation between the PV plant and ground is defective.</p> <p>The resistance between the positive and negative DC connection to ground is outside the permissible range. The inverter disconnects from the power distribution grid.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Contact installer.</li> </ul>                                                                                                                                                                             |
| Riso-Sense                    | <p>Insulation measurement failed.</p> <p>The inverter disconnects from the power distribution grid. As soon as the error has been remedied, the inverter tries to feed into the power distribution grid again. If the inverter cannot feed into the power distribution grid after several attempts, the inverter trips the permanent operation inhibition.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Contact installer.</li> </ul>                                                                          |
| ROM                           | <p>The internal test of the inverter control system firmware failed.</p> <p>The inverter disconnects from the power distribution grid. As soon as the error has been remedied, the inverter tries to feed into the power distribution grid again. If the inverter cannot feed into the power distribution grid after several attempts, the inverter trips the permanent operation inhibition.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• If the message occurs frequently, contact the installer.</li> </ul> |
| SD-DI-Conv                    | <p>The inverter has detected an insulation fault on the DC side.</p> <p>The inverter disconnects from the power distribution grid. As soon as the error has been remedied, the inverter tries to feed into the power distribution grid again. If the inverter cannot feed into the power distribution grid after several attempts, the inverter trips the permanent operation inhibition.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Contact installer.</li> </ul>                                           |

| Message            | Cause and corrective measures                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| SD-lmax            | <p>The inverter has detected an overcurrent on the AC side.</p> <p>The inverter disconnects from the power distribution grid. As soon as the error has been remedied, the inverter tries to feed into the power distribution grid again. If the inverter cannot feed into the power distribution grid after several attempts, the inverter trips the permanent operation inhibition.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Contact installer.</li> </ul>       |
| SD-INV-Bridge      | <p>The inverter has detected a fault in the power electronics.</p> <p>The inverter disconnects from the power distribution grid. As soon as the error has been remedied, the inverter tries to feed into the power distribution grid again. If the inverter cannot feed into the power distribution grid after several attempts, the inverter trips the permanent operation inhibition.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Contact installer.</li> </ul>    |
| Shut-Down          | <p>Overcurrent present at the DC input of the inverter.</p> <p>The inverter switches off.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Contact installer.</li> </ul>                                                                                                                                                                                                                                                                                                  |
| STM-Timeout        | <p>The inverter has detected an internal program run disturbance.</p> <p>The inverter disconnects from the power distribution grid. As soon as the error has been remedied, the inverter tries to feed into the power distribution grid again. If the inverter cannot feed into the power distribution grid after several attempts, the inverter trips the permanent operation inhibition.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Contact installer.</li> </ul> |
| Vac-Bfr<br>Vac-Srr | <p>The AC line voltage has exceeded the permissible range.</p> <p>The cause may be disconnection of the power distribution grid or an AC cable. The inverter disconnects itself from the power distribution grid to prevent islanding.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Contact installer.</li> </ul>                                                                                                                                                     |

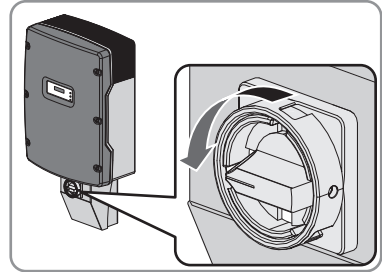


| Message                                           | Cause and corrective measures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|---------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| VacL1-Bfr<br>VacL2-Bfr,<br>VacL1-Srr<br>VacL2-Srr | <p>The DC input voltage is too high or too low on the indicated branch.</p> <p>The inverter disconnects from the power distribution grid. As soon as the error has been remedied, the inverter tries to feed into the power distribution grid again. If the inverter cannot feed into the power distribution grid after several attempts, the inverter trips the permanent operation inhibition.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Contact installer.</li> </ul>                                                                                         |
| VdclinkMax                                        | <p>The internal hardware monitoring system has detected an overvoltage in the intermediate circuit of the inverter.</p> <p>The inverter disconnects from the power distribution grid. As soon as the error has been remedied, the inverter tries to feed into the power distribution grid again. If the inverter cannot feed into the power distribution grid after several attempts, the inverter trips the permanent operation inhibition.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Contact installer.</li> </ul>                                             |
| VpvMax                                            | <p>The DC input voltage is above the set maximum limiting value.</p> <p>The inverter disconnects from the power distribution grid. As soon as the error has been remedied, the inverter tries to feed into the power distribution grid again. If the inverter cannot feed into the power distribution grid after several attempts, the inverter trips the permanent operation inhibition.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Turn the rotary switch of the DC Disconnect to the <b>Off</b> position immediately.</li> <li>• Contact installer.</li> </ul> |
| Watchdog<br>Watchdog Srr                          | <p>The inverter has detected an internal program run disturbance.</p> <p>The inverter disconnects from the power distribution grid. As soon as the error has been remedied, the inverter tries to feed into the power distribution grid again. If the inverter cannot feed into the power distribution grid after several attempts, the inverter triggers the permanent operation inhibition.</p> <p><b>Corrective measures:</b></p> <ul style="list-style-type: none"> <li>• Contact installer.</li> </ul>                                                                                            |

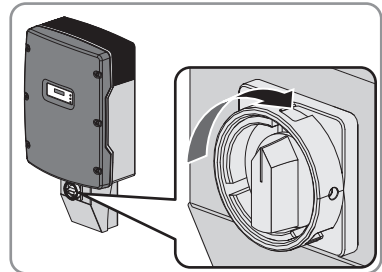
### 5.3.3 Resetting "Error AFCI"

If the yellow LED is permanently glowing and the message "Error AFCI" is displayed, an electric arc has been detected in the PV system. The AFCI has been tripped and operation of the inverter is permanently inhibited.

1. Turn the rotary switch of the DC Disconnect to the **Off** position.



2. Wait until the display and all LEDs switch off.
3. Turn the rotary switch of the DC Disconnect to the **On** position.



- The message "Error AFCI. Knock to reset." is displayed.
  - The message "Error AFCI. Knock to reset." is not displayed.
- Possible error cause: The disturbance was not remedied.
- Contact installer.
4. If the message "Error AFCI. Knock to reset." is displayed, tap the enclosure lid within 10 s.
    - The inverter starts up.
    - The inverter does not start up.

Possible cause of error: You did not tap the enclosure lid within 10 s of the message appearing.

    - Repeat steps 1 to 3.

## 6 Cleaning and Care

### 6.1 Checking the Inverter

- Ask the installer to check for correct inverter operation at regular intervals.
- Check whether there is any externally visible damage to the inverter.

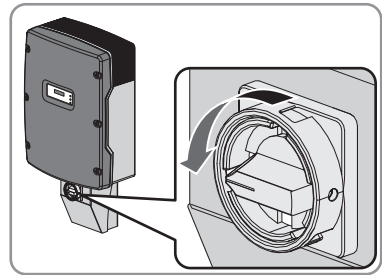
If there is any externally visible damage to the inverter, contact the installer.

### 6.2 Checking the DC Disconnect

- Check for externally visible damage and discoloration of the DC Disconnect and the cables at regular intervals.

If there is any visible damage to the DC Disconnect, or visible discoloration or damage to the cables, contact the installer.

- Once a year, turn the rotary switch of the DC Disconnect from the **On** position to the **Off** position 10 times in succession. This cleans the contacts of the rotary switch and prolongs the electrical endurance of the DC Disconnect.



### 6.3 Cleaning the Inverter

- If the inverter is dirty, clean the enclosure lid, the display, and the LEDs using only clean water and a cloth. Do not use any cleaning agents (e.g. solvents or abrasives).

### 6.4 Cleaning the Fan Guards

If the inverter displays the message "Derating", the fan guards may be dusty or dirty.

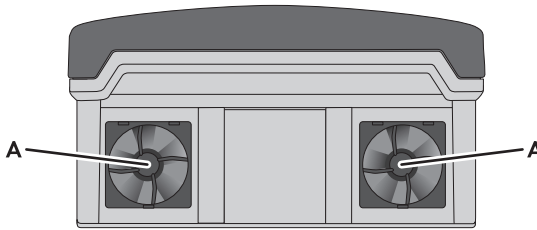


Figure 8: Position of fan guards and fan

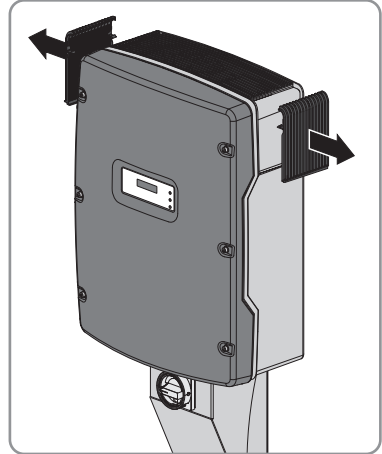
| Position | Description         |
|----------|---------------------|
| A        | Fan guards with fan |

- Check whether the fan guards are dusty or dirt-clogged.  
 If the fan guards are dusty, clean them with a vacuum cleaner.  
 If the fan guards are clogged with dirt, contact the installer.

## 6.5 Cleaning the Ventilation Grids

The ventilation grids must be clean for optimum heat dissipation of the device. Clean the ventilation grids regularly according to the following procedure.

1. Remove the ventilation grids sideways.

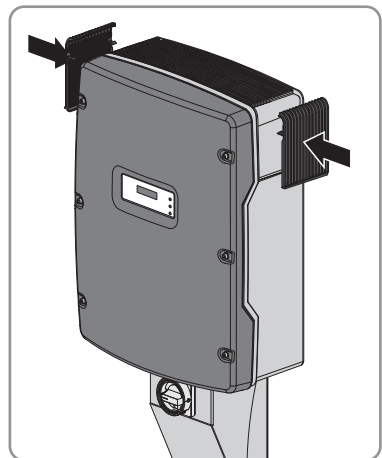


### 2. **NOTICE**

#### **Damage to the inverter caused by foreign bodies.**

- Do not remove the ventilation grids permanently. This prevents foreign bodies from entering the enclosure.

3. Clean the ventilation grids with a soft brush, a paintbrush or compressed air.
4. Close the recessed grips with the ventilation grids. Ensure that the assignment is correct. The correct enclosure side is marked on the interior of each ventilation grid: left side "links/left" and right side "rechts/right".



## 7 Compliance Information

### FCC Compliance

This device complies with Part 15 of the FCC Rules. Operation is subject to the following conditions:

1. This device may not cause harmful interference, and
2. This device must accept any interference received, including interference that may cause undesired operation.

NOTE: This equipment has been tested and found to comply with the limits for a Class A & B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and the receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

The user is cautioned that changes or modifications not expressly approved by SMA America, Inc. could void the user's authority to operate this equipment.

### IC Compliance

This device complies with Industry of Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions:

- This device may not cause interference, and
- This device must accept any interference, including interferences that may cause undesired operation of the device.

## 8 Contact

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

- Inverter device type
- Inverter serial number
- Type and number of the PV modules connected
- LED signal and display message of the inverter
- Optional equipment, e.g. communication products

### **SMA Solar Technology America, LLC**

6020 West Oaks Blvd, Ste 300

Rocklin, CA 95765

Tel. +1 916 625 0870

Tel. +1 877-MY SMA TECH

Tel. +1 877 697 6283 (Toll free, available for USA, Canada and Puerto Rico)

Fax +1 916 625 0871

Service@SMA-America.com

www.SMA-America.com

### **SMA Solar Technology Canada Inc.**

2425 Matheson Blvd E , 8th Floor

Mississauga, ON L4W 5K5 , Canada

Tel. +1 877 506 1756 (Toll free, available for Canada)

Service@SMA-Canada.ca

www.SMA-Canada.ca

**SMA Solar Technology**

**www.SMA-Solar.com**

**SMA America, LLC**

[www.SMA-America.com](http://www.SMA-America.com)

