



PV Inverter

# SUNNY BOY 2000HF-US / 2500HF-US / 3000HF-US

Installation Guide





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## IMPORTANT SAFETY INSTRUCTIONS

### SAVE THESE INSTRUCTIONS

This manual contains important instructions for models Sunny Boy 2000HF-US, 2500HF-US, 3000HF-US inverter, that must be followed during installation and maintenance of the inverter.

The Sunny Boy 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 Sunny Boy. To reduce the risk of personal injury and to ensure the safe installation and operation of the Sunny Boy, you must carefully read and follow all instructions, cautions and warnings in this installation 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.

#### **DANGER**

DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury.

#### **WARNING**

WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.

#### **CAUTION**

CAUTION indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

#### **NOTICE**

NOTICE is used to address practices not related to personal injury.

## Other symbols in this document

In addition to the safety and hazard symbols described on the previous pages, the following symbol is also used in this installation guide:



### Information

This symbol accompanies notes that call attention to supplementary information that you must know and use to ensure optimal operation of the system.

## Markings on this product

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



Warning regarding dangerous voltage

The product works with high voltages. All work on the product must only be performed as described in the documentation of the product.



Beware of hot surface

The product can become hot during operation. Do not touch the product during operation.



Observe the operating instructions

Read the documentation of the product before working on it. Follow all safety precautions and instructions as described in the documentation.



This inverter is evaluated to UL 1741, which includes assessment to all of the requirements of IEEE 1547 and IEEE 1547.1, which are an outgrowth and further development of the IEEE recommended practices and guidelines contained in IEEE Std. 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 utility grid. The inverter is additionally evaluated to CAN/CSA C22.2 No. 107.1-1.

## General Warnings

### DANGER

#### 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 inverter, 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 inverter.

The Sunny Boy contains no user-serviceable parts except for the fan on the bottom of the enclosure. For all repair and maintenance always return the unit to an authorized SMA Service Center.

Before installing or using the Sunny Boy, read all of the instructions, cautions, and warnings on the Sunny Boy in this installation guide.

Before connecting the Sunny Boy to the power distribution grid, contact the local power distribution grid company. This connection must be made only by qualified personnel.

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# 1 Notes on this manual

This manual describes the assembly, installation, commissioning and maintenance of the following SMA inverters:

- Sunny Boy 2000HF-US (SB 2000HFUS-30)
- Sunny Boy 2500HF-US (SB 2500HFUS-30)
- Sunny Boy 3000HF-US (SB 3000HFUS-30)

This manual does not cover any details concerning equipment connected to the Sunny Boy (e. g. solar modules). Information concerning the connected equipment is available from the manufacturer of the equipment.

## 1.1 Validity

This manual is valid for the Sunny Boy 2000HF-US, Sunny Boy 2500HF-US and Sunny Boy 3000HF-US.

## 1.2 Target group

This manual is for qualified personnel. Qualified personnel have received training and have demonstrated skills and knowledge in the construction and operation of the device. Qualified personnel is trained to deal with the dangers and hazards involved in installing electric devices.

### WARNING

Dangerous voltages are present at various points in a PV system. For safety reasons, it is recommended that only qualified personnel install and operate this equipment.

## 1.3 Additional information

You can find further information on special subjects in the download area of [www.SMA-America.com](http://www.SMA-America.com). Refer to the user manual for detailed information on operating the Sunny Boy.

## 1.4 Nomenclature

In this document SMA America Production, LLC and SMA Solar Technology Canada Inc. are referred to in the following as SMA.

## 2 Safety

### 2.1 Appropriate usage

The Sunny Boy is a PV inverter which converts the direct current of a PV array into alternating current and feeds this into the power distribution grid. The Sunny Boy is suitable for installation indoors and outdoors.

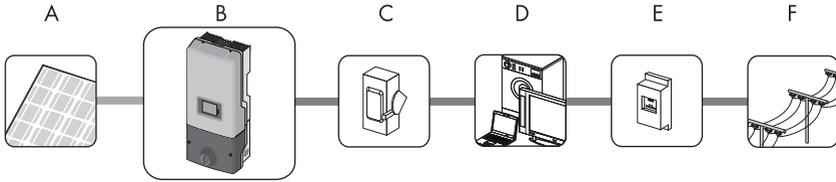
You can use the generated alternating current electricity as follows:

- House grid: The energy is fed into the house grid and is used there by connected consumers (for example household devices or lights). The surplus energy is fed into the power distribution grid. When the Sunny Boy is not generating energy, for example at night, the connected consumers are supplied by the power distribution grid.
- The Sunny Boy does not have its own energy meter. When the energy is supplied into the power distribution grid, the energy meter runs in reverse.
- Power distribution grid: The energy is fed directly into the power distribution grid. The Sunny Boy does not have its own energy meter. Dependent on the utility supplier, the energy produced is compensated.

#### AC and DC load circuit breaker

Secure the AC and DC cables on the Sunny Boy with load circuit breakers. With the AC and DC load circuit breakers you can safely disconnect the Sunny Boy from the grid and the PV arrays. A DC load circuit breaker is included in the Sunny Boy delivery. You must provide an AC load circuit breaker.

## Principle of a PV plant with this Sunny Boy



Position	Name
A	PV array
B	Sunny Boy with integrated SMA DC-Disconnect
C	Line circuit breaker
D	Load
E	Energy meter
F	Power distribution grid

You must operate the Sunny Boy only with PV arrays (modules and cabling) of protection class II. Do not connect any sources of energy other than PV modules to the Sunny Boy.

When designing the PV system, ensure that the values comply with the permitted operating range of all components at all times. The free design program "Sunny Design" ([www.SMA-America.com](http://www.SMA-America.com)) will assist you. The manufacturer of the PV modules must have approved the modules for use with this Sunny Boy device. You must also ensure that all measures recommended by the module manufacturer for long-term maintenance of the module properties are taken. You will find further information in the download area of [www.SMA-America.com](http://www.SMA-America.com).

Do not use the Sunny Boy for purposes other than those described here. Alternative uses, modifications to the Sunny Boy or the installation of components not expressly recommended or sold by the manufacturer void the warranty claims and operation permission.

### Anti-Islanding protection

Islanding is a condition that can occur if the power distribution grid is disconnected while the Sunny Boy is operating and the remaining load is resonant at 60 Hz and matches the output of the Sunny Boy perfectly. This condition is highly unlikely and had never been witnessed outside of a controlled laboratory. Nevertheless, the Sunny Boy incorporates an advanced active islanding protection algorithm to ensure that the system will not export power into a balanced 60 Hz resonant load while the utility is disconnected. The Sunny Boy periodically injects both leading and lagging reactive current into the power distribution grid. This method has been proven by Underwriters Laboratories to effectively destabilize and disconnect from a balanced island condition.

## PV ground fault detection and interruption

The Sunny Boy is equipped with a ground fault detection device. If a ground fault current greater than 1 Amp is detected, the Sunny Boy will shut down and display the fault condition on the user interface display. Once the ground fault is located and corrected, the ground fault error will need to be manually cleared and the inverter will then resume normal operation.

## PV series fusing

Series fusing may be required depending on the type of PV module used in the system. See *National Electrical Code*® 690.9

## Interconnection code compliance

The Sunny Boy has been tested and listed by Underwriters Laboratories to meet the requirements of UL1741 Static Inverters and Charge Controllers for use in Photovoltaic Power Systems, as well as IEEE-929-2000 Recommended Practice for Utility Interface of Photovoltaic Systems and IEEE 1547 Standard for Interconnecting Distributed Resources with Electric Power Systems.

UL1741 is the standard applied by Underwriters Laboratories to the Sunny Boy to certify that it meets the requirements of the NEC 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 utility grid.

The Sunny Boy is also certified to C22.2 No 107.1-01 (General Use Power Supplies).



Contact the local utility and/or the authority having jurisdiction prior to connecting the Sunny Boy to the power distribution grid.

## Operating temperature

The Sunny Boy has been designed to maintain full power output at ambient temperatures as high as +113 °F (+45 °C). Fan cooling allows this level of output power to be achieved even in enclosed spaces. The Sunny Boy will continue to operate well beyond +113 °F (+45 °C) and derates as needed to maintain a safe internal component temperature.

## 2.2 Safety instructions

### DANGER

#### **During operation high voltages are present in the Sunny Boy.**

Death or serious injury due to electric shock.

- All work on the Sunny Boy must only be carried out by qualified personnel.

During operation high voltages are present in the PV plant.

Death or serious injury due to electric shock in the event of missing or damaged array grounding.

- Comply with the local requirements for grounding the modules and the PV array.
- Thoroughly connect and ground the generator frame and other electrically conducting surfaces.

### WARNING

#### **The Sunny Boy can become hot during operation.**

Risk of burns.

- Do not touch the enclosure body during operation.
- Only touch the lid during operation.

### CAUTION

#### **Possible damage to health as a result of the effects of radiation.**

- Do not stay closer than 8 in. (20 cm) to the Sunny Boy for any length of time.

## 2.3 FCC Compliance Information

### **SMA PV inverter, model Sunny Boy 2000HF-US, Sunny Boy 2500HF-US, Sunny Boy 3000HF-US**

This device complies with Part 15 A and B 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 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, LLC could void the user's authority to operate this equipment. Contact SMA for more information.

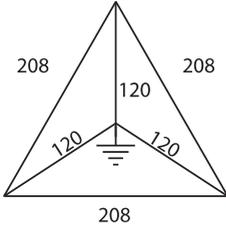
### **RF-exposure Statement**

The SMA Sunny Boy 2000HF-US, Sunny Boy 2500HF-US, Sunny Boy 3000HF-US contains a modular transmitter. Thus it must have a separation of at least 8 in. (20 cm) between the antenna and the body of the user or nearby persons, excluding hands, wrists, feet, and ankles.

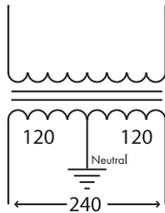
## 2.4 Common utility voltage configurations

The figure below illustrates common utility voltage configurations. Remember, when connecting the Sunny Boy to the power distribution grid, the phase relationship is not important, but the voltage must be compatible.

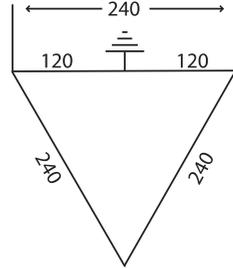
**208 Delta: 120 WYE**



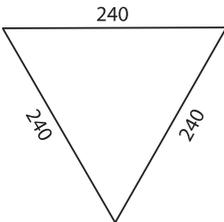
**240: 120 Split Phase**



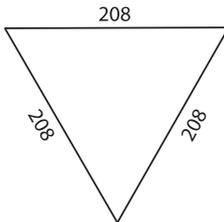
**240 Delta: 120 Stinger**



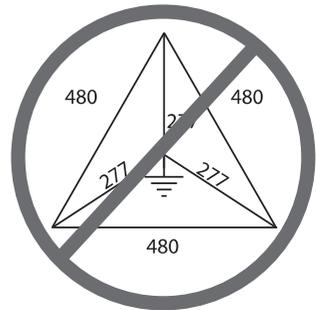
**240 Delta**



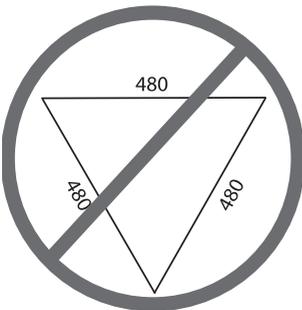
**208 Delta**



**480 Delta: 277 WYE  
DO NOT USE!**



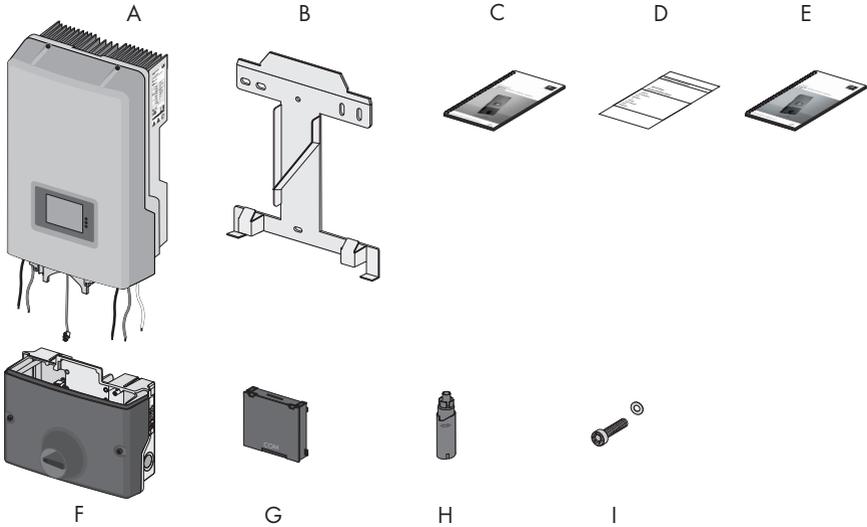
**480 Delta  
DO NOT USE!**



### 3 Unpacking and inspection

#### 3.1 Scope of delivery

Check the delivery for completeness and for visible external damage, such as cracks in the enclosure or in the display. Contact your dealer if anything is damaged or missing.



Object	Quantity	Description
A	1	Sunny Boy
B	1	Wall mounting bracket
C	1	Installation manual
D	1	Document set
E	1	User manual
F	1	SMA DC-Disconnect
G	1	Communication module (SMA Quick Module)
H	1	SMA Plug-in Grounding
I	3	Screws and washers (M5)

#### 3.2 Identifying the Sunny Boy

You can identify the Sunny Boy using the type label. The type label is on the right side of the enclosure. The serial number (Serial No.) and the type (Type / Model) of the Sunny Boy are specified on the type label.

## 4 Mounting the Device

### 4.1 Safety

#### **⚠ DANGER**

##### **Danger to life due to fire or explosions.**

There is always a certain risk with electric devices that a fire can occur, even though greatest attention was paid to avoid this during the development.

- Do not install the inverter on flammable construction materials.
- Do not install the inverter in areas where highly flammable materials are stored.
- Do not install the inverter in potentially explosive areas.

#### **⚠ WARNING**

##### **The Sunny Boy can become hot during operation.**

Risk of burns.

- Mount the Sunny Boy in such a way that it cannot be touched inadvertently during operation.

#### **⚠ CAUTION**

##### **Danger of crushing due to the Sunny Boy falling.**

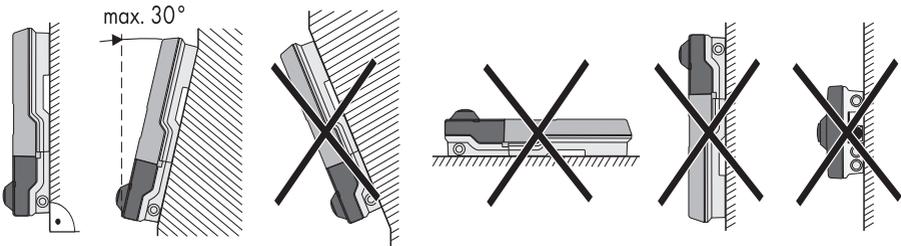
Crushing of body parts

- Consider the weight of the Sunny Boy with SMA DC-Disconnect of approximately 50 lb. (23 kg) during mounting.
- Always lift the Sunny Boy with both hands.

## 4.2 Selecting the wall mounting location

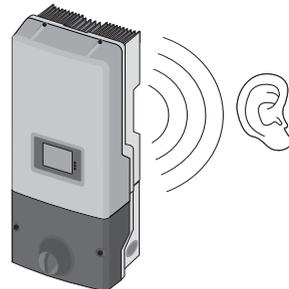
### Observe the following conditions during installation:

- The installation method and mounting location must be suitable for the weight and dimensions of the Sunny Boy (see Section 13 "Technical Data", page 102).
- Mount on a solid surface.
- The mounting location must be accessible at all times. Otherwise proper maintenance of the Sunny Boy is not possible.



- Vertical installation or tilted backwards by max. 30°.
- The connection area must point downwards.
- Never install the device with a forward tilt.
- Do not install horizontally.
- Install at eye level to allow operating status to be read at all times.
- The ambient temperature must be below +113 °F (+45 °C) to ensure optimal operation.
- Do not expose the Sunny Boy to direct sunlight, in order to avoid power reduction due to excessive heating.
- In a living area, do not mount the unit on plasterboard walls (or similar) in order to avoid audible vibrations.

The Sunny Boy can make noises when in use which can be regarded as a nuisance when installed in a living area.

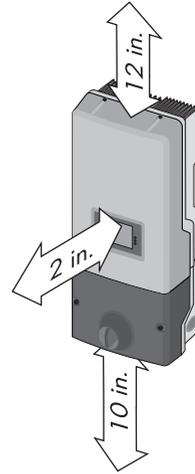


- Observe the minimum clearances to walls, other devices or objects as shown in the diagram in order to guarantee sufficient heat dissipation.

Overview minimum clearances for indoor installation:

Top	12 in. (300 mm)
Front	2 in. (50 mm)
Bottom	10 in. (250 mm)

For outdoor installation make sure that the Sunny Boy has a clearance of 3 ft. (90 cm) from ground.



### **i** Multiple Sunny Boy units installed in areas with high ambient temperatures

The individual Sunny Boy units must be far enough apart to ensure that the individual Sunny Boy units do not take in the cooling air of the neighboring unit.

If necessary, increase the clearances and make sure there is enough ventilation to ensure sufficient cooling of the Sunny Boy units.

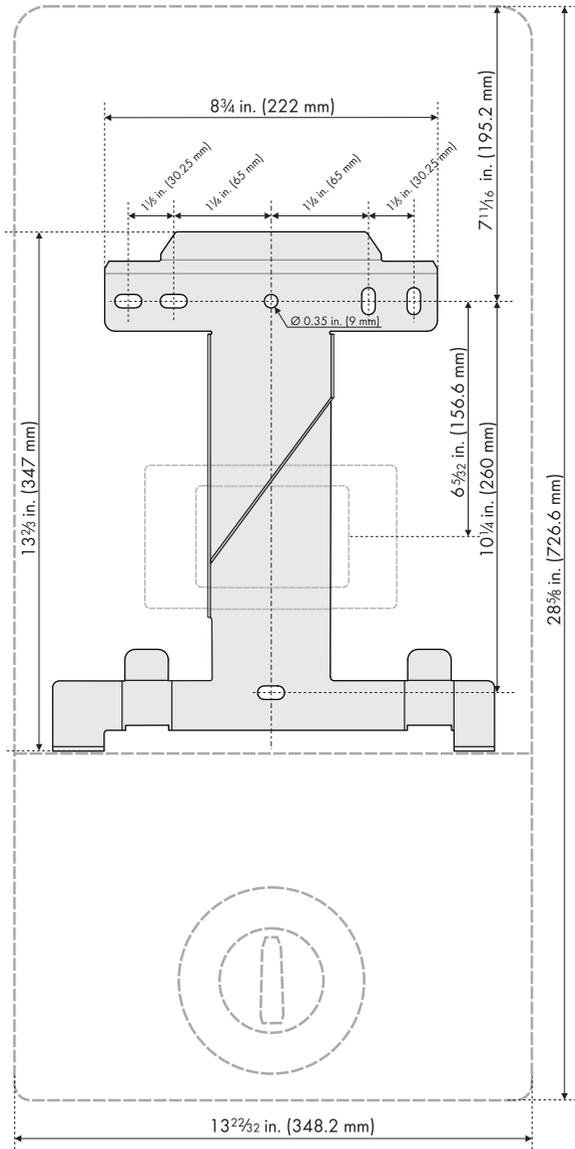
Do not install several Sunny Boy inverters on top of each other. The Sunny Boy takes cooling air in from underneath and blows it out above through the cooling fins. The heated air disperses upwards. In case several Sunny Boy inverters are installed on top of each other, the lower Sunny Boy blows the heated air into the Sunny Boy installed above.

This reduces the cooling efficiency and thus the yield of the upper Sunny Boy.

## 4.3 Mounting the wall mounting bracket

The Sunny Boy is shipped with a wall mounting bracket that is suitable for use with most walls. The horizontal part of the bracket has 5 holes. Make sure that the wall you choose to mount the Sunny Boy on is sturdy enough to support its weight (50 lb./23 kg) over a long period of time and that the wall is plumb. Be sure to use the appropriate type of mounting hardware for the wall material and ensure that the hardware is no smaller than  $\frac{1}{4}$  in. (6 mm) in diameter.

### Dimensions of the Wall Mounting Bracket



### 4.3.1 Possibilities for mounting the wall mounting bracket

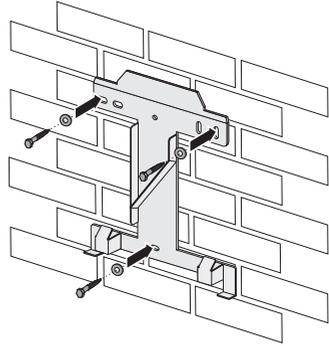
#### Mounting on stone wall

For mounting on a stone wall you must affix the wall mounting bracket with a minimum of 3 screws.

The position of the screws on the wall mounting bracket is as follows:

- 1 screw on the upper left side of the wall mounting bracket.
- 1 screw on the upper right side of the wall mounting bracket.
- 1 screw below on the wall mounting bracket.

Mount the wall mounting bracket as described in section (see Section 4.3.2 "Mounting the wall mounting bracket", page 23).

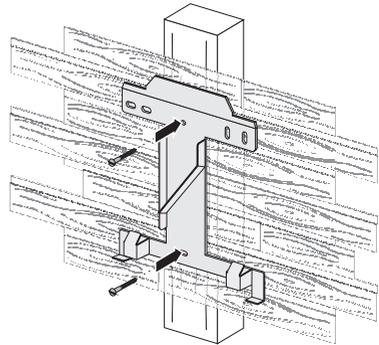


#### Mounting on a wooden wall with a stud

For mounting on a wooden wall with a stud you must affix the wall mounting bracket with 2 screws. The position of the screws on the wall mounting bracket is as follows:

- 1 screw at the upper middle of the wall mounting bracket.
- 1 screw below on the wall mounting bracket.

Mount the wall mounting bracket as described in section (see Section 4.3.2 "Mounting the wall mounting bracket", page 23).



### 4.3.2 Mounting the wall mounting bracket

1. Position the wall mounting bracket against the wall where you intend to mount the Sunny Boy. (Try to mount the Sunny Boy so that the display is approximately at eye-level.) Place a level on the top edge of the bracket, and adjust the position of the bracket until it is level. The enclosure bottom of the inverter will be located approximately  $9 \frac{3}{4}$  in. (240 mm) underneath the lower end of the wall mounting bracket.

**⚠ DANGER****Drilling into live cables.**

Death or serious injury due to electric shock.

- Before drilling the holes, check whether electricity cables run through the walls at the desired mounting location. If cables run through the walls at the desired mounting location, then select a different mounting location.

**⚠ CAUTION****Danger of crushing due to the Sunny Boy falling.**

Crushing of body parts.

- If mounting onto a wall, ensure that the wall can carry the weight of the Sunny Boy.
  - If mounting onto a wooden wall with studs, ensure that the wall mounting bracket is firmly connected with all studs and the stud can carry the weight of the Sunny Boy.
2. Using the wall mounting bracket as a template, mark the wall through the holes in the horizontal or vertical portion of the bracket (see Section 4.3.1 "Possibilities for mounting the wall mounting bracket", page 23). Set the bracket aside temporarily.
  3. Ensure that the material behind the markings for the drill holes is capable of bearing load.
  4. Drill holes at the marks you made on the wall.
  5. Insert wall anchors into the drill holes.  
DO NOT use molly or toggle bolts to mount the Sunny Boy to sheet rock or panelling.

**i Tip for installing**

The diameter of the holes you drill must match the hardware you are using to mount the Sunny Boy.

For example, if you are mounting the Sunny Boy to a concrete wall, the hole diameter must be approximately the same as the outside diameter of the concrete anchors you intend to use. If you are mounting the Sunny Boy on a wall that has wooden studs inside it, the hole diameter must be the correct size for the lag screws you intend to use to mount the bracket. It is recommended that the lag screws be made of stainless steel, and the diameter of the screws closely match the diameter of the holes in the wall mounting bracket. Make sure that the screws are long enough to penetrate the wall to a depth of 1 1/2 in. (38 mm).

6. Insert the screws through the holes in the wall mounting bracket and into the holes you drilled in the wall.
  7. Tighten the screws clockwise until the bracket is held firmly against the wall. Do not overtighten the screws.
- The wall mounting bracket is mounted.

## 4.4 Mounting the SMA DC-Disconnect

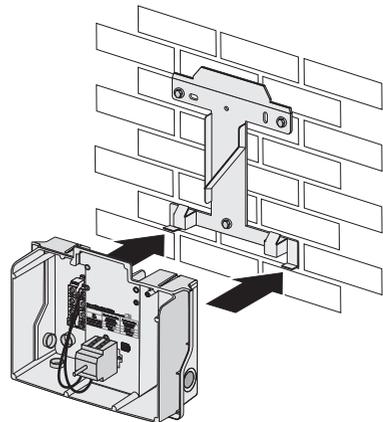
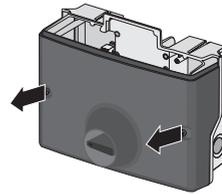
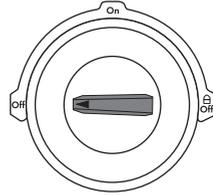
### ⚠ CAUTION

**Danger of crushing due to the SMA DC-Disconnect falling.**

Crushing of body parts.

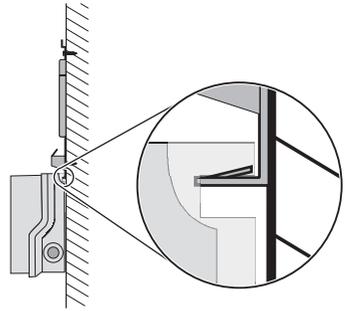
- Consider the weight of the SMA DC-Disconnect of approximately 11 lb. (5 kg) during mounting.

1. Turn the DC disconnect switch of the SMA DC-Disconnect to position "Off".
2. Loosen the screws on the enclosure of the SMA DC-Disconnect. Do not take the screws out of the lid.
3. Remove the lid with the screws to the front.
4. Set the lid aside in such a way that it will not become damaged.
5. Hold the SMA DC-Disconnect with both hands slightly slanted. Push both slots of the SMA DC-Disconnect to the lower hooks of the mounting bracket until it clicks.



6. Push SMA DC-Disconnect straight onto the wall.

7. Ensure the SMA DC-Disconnect is correctly in place.



- The SMA DC-Disconnect is mounted onto the wall mounting bracket.

## 4.5 Mounting the Sunny Boy onto the Wall mounting bracket

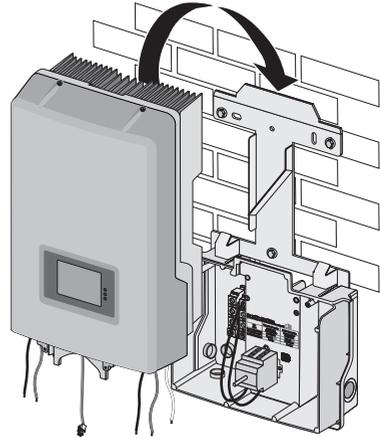
### ⚠ CAUTION

The Sunny Boy weighs approximately 40 lb. (18 kg).

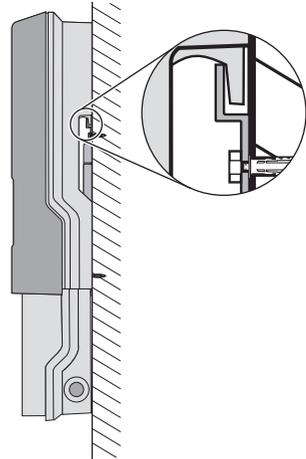
Risk of injury during lifting of the Sunny Boy.

- Always lift the Sunny Boy with both hands.

1. Lift up the Sunny Boy with both hands and hang from above in the SMA DC-Disconnect and in the wall mounting bracket. While hanging the Sunny Boy, ensure that all cables of the inverter do not become trapped.



2. Ensure the Sunny Boy is correctly in place on the wall mounting bracket and the SMA DC-Disconnect.



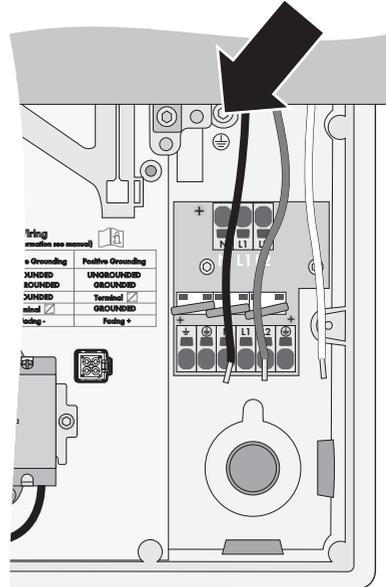
- The Sunny Boy is mounted onto the wall mounting bracket.

## 4.6 Grounding the SMA DC-Disconnect

**i** The Sunny Boy is grounded via the connection of the grounding cable to the DC side and the AC side (see Section 6 "Wiring the Sunny Boy", page 39).

To ensure proper grounding of the SMA Disconnect, it must be connected with the Sunny Boy via an electric conductive connection. This electric conductive connection has to be provided by a screw and a locking washer included in the scope of delivery.

1. Lead the screw with locking washer facing teeth down into the opening of the Sunny Boy and screw into the thread of the SMA DC-Disconnect (turn the screw clockwise).



- The SMA DC-Disconnect is connected to the Sunny Boy via an electric conductive connection.

## 5 Configuring the Sunny Boy

The Sunny Boy is fitted with the communication interface Quick Module.

You can configure the Quick Module before and after its installation to the Sunny Boy.

### 5.1 The Quick Module

The inverter is equipped with *Bluetooth*<sup>®</sup> Wireless Technology. This allows you to wirelessly request measurement, event and meter information and to change parameters.

Inside the Quick Module are a slot for a SD card and 3 rotary switches with following functions:

- Rotary switches (A) and (B) for setting the country of installation, the grid type and the display language (see Section 5.1.1 "Country setting via rotary switch", page 31).
- Rotary switch (C) for the allocation of the NetID for communication via *Bluetooth*<sup>®</sup> Wireless Technology (see (see Section 5.2.2 "Configuration for Bluetooth communication", page 33)).



#### **Protection against unauthorized access**

The inverter is delivered with preset plant passwords. These passwords are the same for every inverter.

In order to protect the PV plant against unauthorized access, change the preset plant passwords for the user groups "Installer" and "User" or deactivate Bluetooth completely by turning the NetID of the inverter to "0" (see section "Configuration for Bluetooth communication" on page 33).

You can only change the plant passwords using a computer equipped with Bluetooth and the Sunny Explorer software. The Sunny Explorer user manual describes how to change the plant passwords. You can download Sunny Explorer free of charge at [www.SMA-America.com](http://www.SMA-America.com).

Write down the new passwords and inform the user about it.

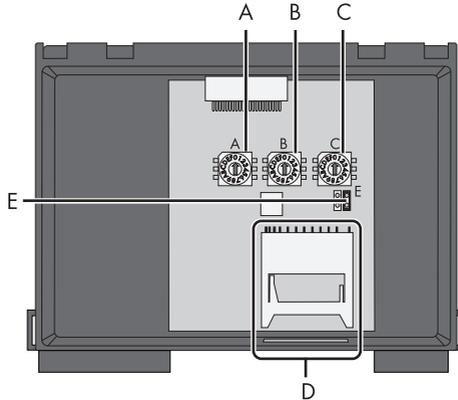
#### **Quick Module 485QM and multi-function relay**

You can purchase the Quick Module 485QM with RS485 interface and a multi-function relay from SMA or your dealer (see Section 14 "Accessories", page 107). You will find detailed descriptions of the functions in the respective manual.

## Identifying the Quick Module

You can identify the Quick Module by its type label. The type label is affixed at the lid of the Quick Module and shows name, serial number, version and type of the Quick Module.

## Inner View of the Quick Module

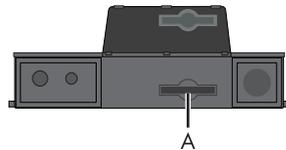


Object	Description
A	Rotary switch for configuration of country and grid type (switch A)
B	Rotary switch for configuration of language and grid type (switch B)
C	Rotary switch for configuration of Bluetooth communication
D	Slot for SD card
E	Jumper socket for the configuration of the language to English

## Slot for SD card

The Quick Module contains a slot for an SD card. The slot is on the outside of the Quick Module (A).

- To insert an SD card, flip the lower flap upwards.



In case of a firmware update an SD card is necessary. Contact the SMA Service Line for details.

### **i** Properties of the SD Card

- A maximum of 2 GB of storage space.
- Use the SD card exclusively for this Sunny Boy. Do not save any other files on the SD card.

### 5.1.1 Country setting via rotary switch

The switch position 0 / 0 indicates the factory setting. If you have ordered the Sunny Boy with a certain country or grid setting, the setting is done in the factory via a communication device. The setting will be overwritten by changes to the rotary switch or via a communication device and can not be recovered. For orders without a specified installation country or grid type the standard setting is "US auto" with display language "German".

Changes to configuration will immediately be accepted after switching on the line circuit breaker. If an un-programmed switch setting is selected, the Sunny Boy issues an error message.

- Check whether the Sunny Boy is set to the installation country and grid type using the listed switch settings in the following table.
- For display language in English set the switch (B) to position "1".



#### Display Language

Once you have configured the country data set, you can set the display language later without changing the country data set using rotary switch (B).

#### Rotary switch positions

The operating parameters show the corresponding parameter set. You can read these off via a communication device or download them from [www.SMA-America.com](http://www.SMA-America.com).

(A)	(B)	Parameter Set	Display Language	Country/grid
0	0	Delivery state	Delivery state	dependent on parameter set
0	1	as preset	English	dependent on parameter set
0	3	as preset	French	dependent on parameter set
0	4	as preset	Spanish	dependent on parameter set
8	0	US 208V without neutral	English	USA
8	1	US 208V without neutral	Spanish	USA
8	2	US 208V without neutral	French	USA
8	8	US 240V without neutral	English	USA
8	9	US 240V without neutral	Spanish	USA
8	A	US 240V without neutral	French	USA
9	8	US auto	English	USA
9	9	US auto	Spanish	USA
9	A	US auto	French	USA

If the Sunny Boy is not set to the correct installation country, configure it via the two rotary switches as described in section (see Section 5.2.2 "Configuration for Bluetooth communication", page 33).

Alternatively you can set the settings via the parameters "CntrySet" or "Sett.country stand." using a communication device, once you have commissioned the Sunny Boy.

If you require adjusted parameter settings for your installation location, you can change these with the help of a communication device.

## 5.2 Configuring the Quick Module

**i** You can configure the Quick Module before connecting it to the Sunny Boy.

The Sunny Boy can be configured in two ways for several countries and grids.

- By using the two rotary switches (A) and (B) of the Quick Module.
- By changing the parameters "CntrySet" or "Sett.country stand." using an external communication device with *Bluetooth* interface.

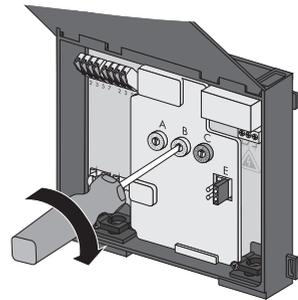
If you don't want to use *Bluetooth* communication, deactivate *Bluetooth* completely by turning the NetID of the inverter to "0" (see section "Configuration for Bluetooth communication" on page 33).

### 5.2.1 Configuration before installation

If you have not yet installed the Quick Module into the Sunny Boy, proceed as follows for the configuration:

1. Open the Quick Module by flipping up the lower flap of the Quick Module and opening the lid of the Quick Module until it locks in place.
2. Set the arrows on both left rotary switches (A and B) to the desired positions using a  $\frac{1}{8}$  in. (2.5 mm) screw driver.

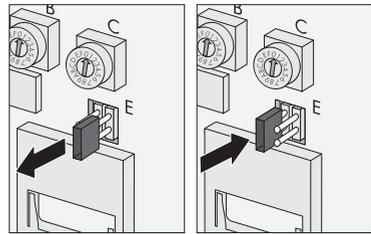
See table in section (see Section 5.1.1 "Country setting via rotary switch", page 31).



3. **i Jumper for English language**

The possibility to swap the language to English exists additionally via a jumper (e.g. during maintenance work).

- Plug the jumper onto both left pins as shown on the right.



The language and installation country are set.

### 5.2.2 Configuration for *Bluetooth* communication

Communication via *Bluetooth* with a communication device is activated as standard. Networking via *Bluetooth* with other inverters is deactivated as a delivery condition.

The following configuration settings are possible via a rotary switch (switch C):

Switch position (NetID)	Setting
0	Off
1	Communication via <i>Bluetooth</i> with communication device possible, no networking with other inverters (factory setting)
2 to F	Networking with other inverters

In order to restrict communication via *Bluetooth* between the inverters of your system and those of neighboring systems, you can assign an individual NetID to the inverters of your system (switch position 2 to F). This, however, is only necessary if neighboring systems are to be found within a radius of 1 640 ft. (500 m).

To ensure that all inverters in your system are detected by your communication device, all inverters must have the same NetID. To assign a NetID, proceed as follows:

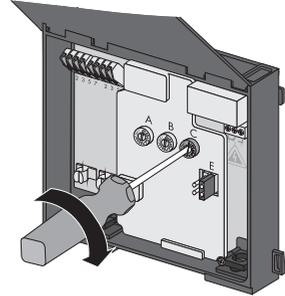
**⚠ DANGER**

**High voltages in the inverter. Death or serious injury due to electric shock.**

If you have already connected the Quick Module to the Sunny Boy, carry out the following steps.

- Switch off the line circuit breaker and secure it against being reactivated.
- If a multi-function relay is present, disconnect the multi-function relay power supply.

1. Set the arrow on the right rotary switch (C) using a screw driver of width  $\frac{1}{8}$  in. (2.5 mm).

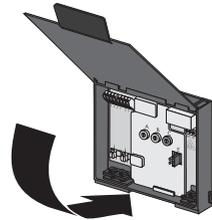


### Acceptance of the settings

The *Bluetooth* settings will first be accepted upon commissioning.

## 5.2.3 Closing the Quick Module

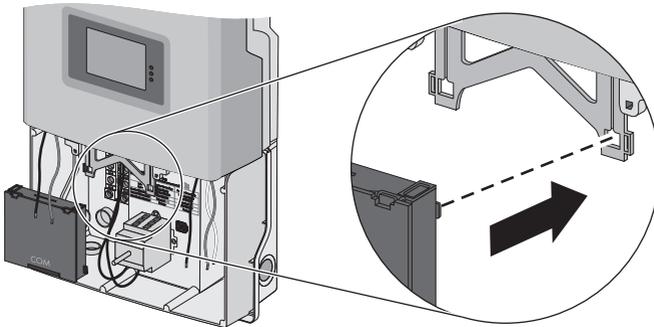
1. Close the lid of the Quick Module and flip the flap down.



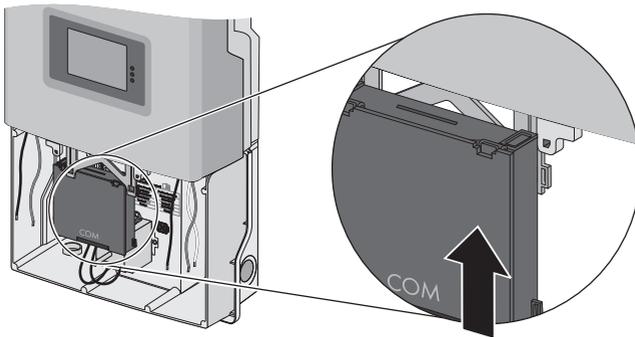
- The Quick Module is closed. You can now mount the Quick Module to the Sunny Boy, as described in section (see Section 5.3 "Mounting the Quick Module", page 35).

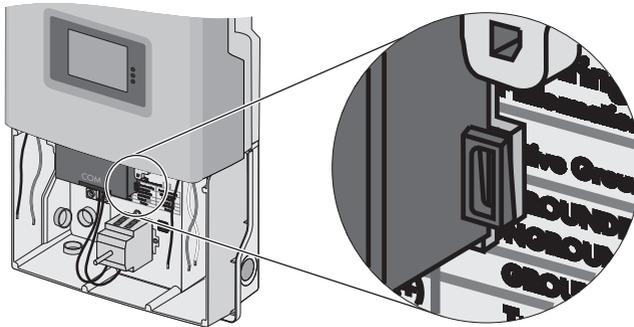
### 5.3 Mounting the Quick Module

1. If the Sunny Boy is already operating: Disconnect the Sunny Boy from voltage sources (see Section 8.1 "Disconnect the Sunny Boy from Voltage Sources", page 64) and open the SMA DC Disconnect (see Section 8.2 "Open SMA DC Disconnect", page 65).
2. Plug the Quick Module into the designated holes on the bracket until it snaps into place.



3. Push the Quick Module carefully upwards to the stopper.





- The lug of the Quick module is flush with the lug of the bracket.
- 4. Check that the Quick Module is securely in place.
- 5. Close the SMA DC Disconnect (see Section 8.3 "Closing the SMA DC-Disconnect", page 66).
- 6. Commission the Sunny Boy (see Section 7 "Commissioning", page 62).
- The Quick Module is mounted.

## 5.4 Configuration after installation

If you would like to make configurations to the Sunny Boy although you already have installed the Quick Module to the Sunny Boy , then proceed as follows.

### 5.4.1 Opening the installed Quick Module

#### **⚠ DANGER**

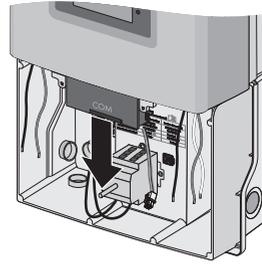
#### **High voltages inside the inverter**

Death or serious injury due to electric shock.

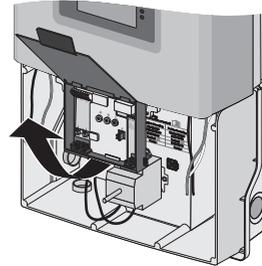
- Switch off the line circuit breaker and secure it against being reactivated.
  - If a multi-function relay is present, disconnect the multi-function relay power supply.
1. Disconnect the Sunny Boy from all voltage sources (see Section 8.1 "Disconnect the Sunny Boy from Voltage Sources", page 64).
  2. Open the SMA DC Disconnect (see Section 8.2 "Open SMA DC Disconnect", page 65).

3. Pull the Quick Module carefully downwards to the stopper.

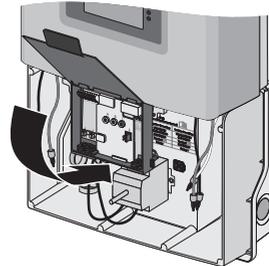
The Quick Module is completely visible.



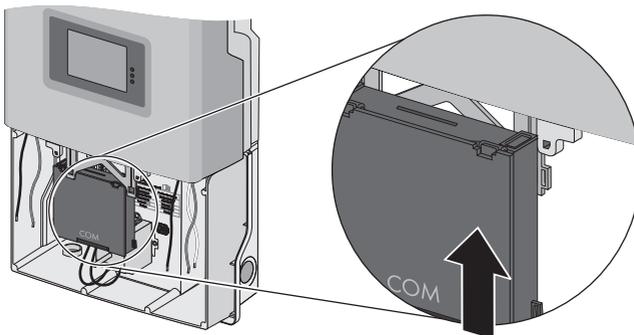
4. Flip up the lower flap of the Quick Module and open the lid.
5. Set the installation country and display language (see Section 5.2.2 "Configuration for Bluetooth communication", page 33).
6. Set the Net ID for Bluetooth communication (see Section 5.2.2 "Configuration for Bluetooth communication", page 33).

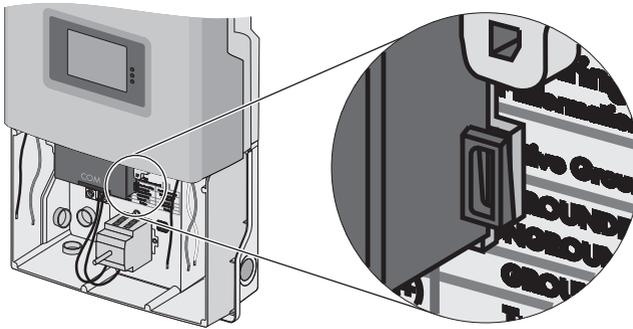


7. Close the lid of the Quick Module.



8. Push the Quick Module carefully upwards to the stopper.

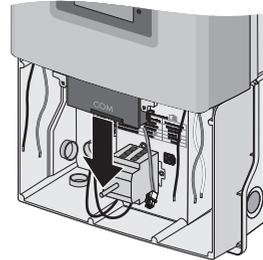




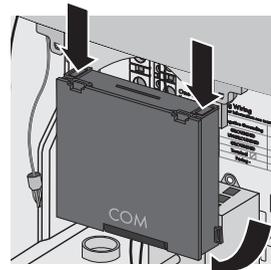
- The lug of the Quick module is flush with the lug of the bracket.
- 9. Close the SMA DC-Disconnect (see Section 6.8 "Closing the SMA DC Disconnect", page 61).
- 10. Commission the Sunny Boy (see Section 7 "Commissioning", page 62).
- The country configuration is complete.

### 5.5 Disassembling the Quick Module

1. Disconnect the Sunny Boy from voltage sources (see Section 8.1 "Disconnect the Sunny Boy from Voltage Sources", page 64).
2. Open the SMA DC Disconnect (see Section 8.2 "Open SMA DC Disconnect", page 65).
3. Pull the Quick Module carefully downwards to the stopper.
  - The Quick Module is completely visible.



4. Lay two thumbs on the upper edge of the Quick Module and carefully push the Quick Module downwards using your thumbs. When the Quick Module is at the end of the bracket, pull the lower edge of the Quick Module slightly forward.
  - The Quick Module is loosened from its bracket.
5. Carefully take the Quick Module out of the bracket to the front.
  - The Quick Module is disassembled.



## 6 Wiring the Sunny Boy

This section provides step-by-step instructions and other information required for wiring the Sunny Boy to the PV array and the power distribution grid. To complete the installation in a safe and efficient manner, complete the steps in the order that they appear.

### 6.1 Safety

#### **⚠ DANGER**

##### **Inappropriate performing of the activities described in this manual.**

Death or serious injuries.

- All work on the Sunny Boy must only be carried out by qualified personnel.
- Work on the Sunny Boy must only be carried out as described in this manual.
- Observe all safety instructions listed on the Sunny Boy, in this manual and those of the PV plant.

#### **NOTICE**

##### **Ingress of water when mounting and installing the Sunny Boy.**

Damage of the Sunny Boy may result.

- Do not open the Sunny Boy when it is raining.



#### **Electrical installations**

All electrical installations must be done in accordance with all local electrical codes and the *National Electrical Code*®, ANSI/NFPA 70. For installation in Canada the installations must be done in accordance with applicable Canadian standards.

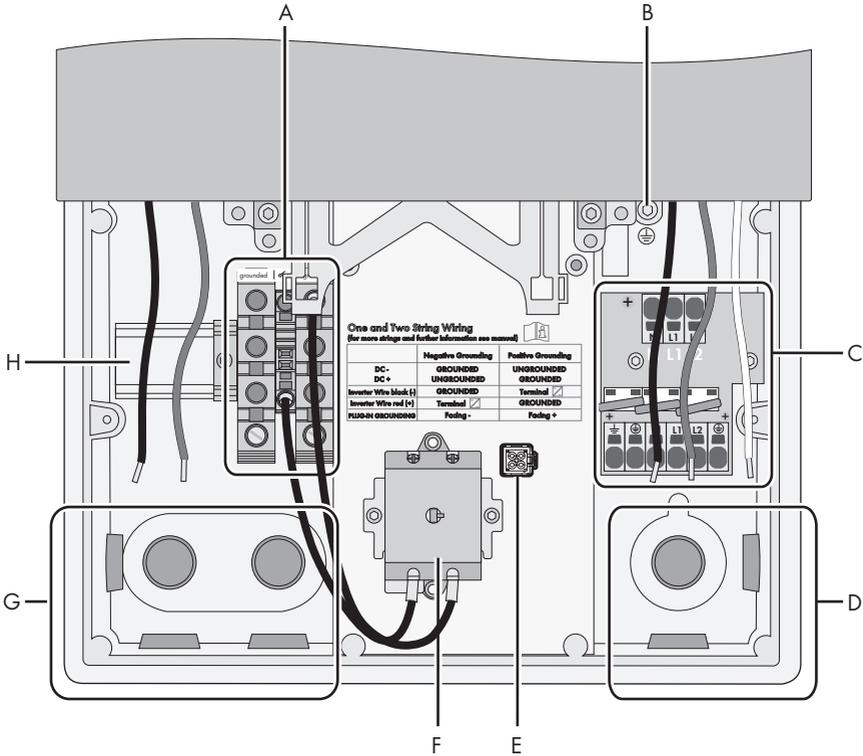
#### **For inverters provided with a fixed AC output**

The AC input and AC output circuits are isolated from the enclosure and system grounding, if required by section 250 of the National Electric Code, ANSI/NFPA 70, is the responsibility of the installer.

The Photovoltaic System Grounding must be installed per the requirements of sections 690.41 through 690.47 of the *National Electrical Code*®, ANSI/NFPA 70, and is the responsibility of the installer.

For optimum connection of the cables to the terminals use a  $\frac{9}{64}$  in. x  $4\frac{3}{4}$  in. (3.5 mm x 120 mm) screwdriver.

**Overview Connection Area**



Object	Description
A	DC side terminals
B	Connection point grounding Sunny Boy / SMA DC-Disconnect
C	AC side terminals
D	Opening for AC cable
E	Connector for fan power supply
F	DC-Disconnect Switch
G	Openings for DC cable
H	Top-hat rail for optional string fuses

### AC Grounding

The Sunny Boy must be connected to the AC ground from the utility via the Ground Terminals . See illustration above (C).

### PV Grounding

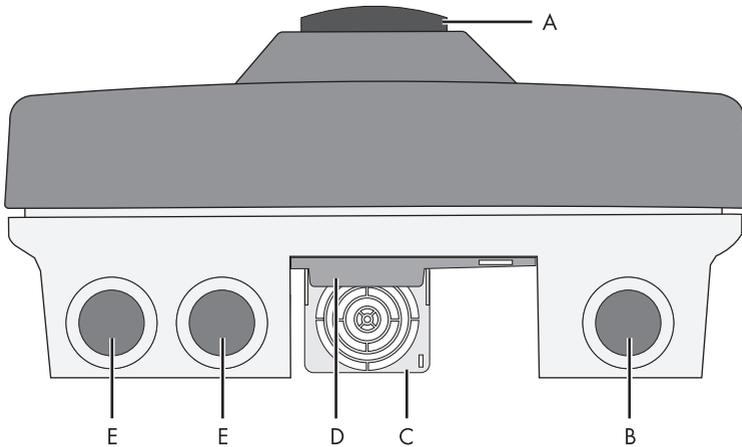
The PV array ground must be connected to the array grounding and DC Grounding Electrode Conductor – see illustration on page 46. The size for the conductor is usually based on the size of the largest conductor in the DC system.

### DC Grounding Electrode Conductor

A DC grounding electrode conductor may be required by the Authority Having Jurisdiction (AHJ). Use the array grounding and DC Grounding Electrode Conductor – see illustration on page 46.

## 6.2 Lower view of the SMA DC-Disconnect

The following graphic shows the bottom of the SMA DC-Disconnect.



Object	Description
A	Knob of SMA DC Disconnect
B	Opening with protective cap (AC side) for 3/4 in. (19 mm) cable conduit.
C	Fan with fan bracket
D	Handle of the fan bracket
E	Opening with protective cap (DC side) for 3/4 in. (19 mm) cable conduit.

### 6.3 Connection of the PV array (DC)

You can connect two PV strings directly to the terminal of the Sunny Boy. If you need to connect 3 PV strings, fuses as required by the *National Electrical Code*® may be installed on the hat rail. For additional information refer to section (see Section 6.5 "Connection of PV strings with optional fuses", page 49).

#### **⚠ WARNING**

You must connect the wires that carry the DC voltage from the PV array to the Sunny Boy in the order described in the following procedure. Deviating from this procedure could expose you to lethal voltages that can cause serious injury and/or death.

#### **⚠ WARNING**

PV arrays are energized when exposed to light. Use safe working practices when working on PV arrays.

#### **⚠ WARNING**

Always turn OFF all AC breakers and switches in the PV system and wait a minimum of 5 minutes, until the Sunny Boy is completely discharged and all LEDs are off, before connecting any wires to the Sunny Boy or disconnecting any wires from the Sunny Boy. Failure to do so could expose you to lethal voltages that can cause serious injury and/or death.

#### **⚠ WARNING**

Electric shock as a result of incorrect array grounding before installation of the SMA Plug-in Grounding. Death or serious injuries.

The PV plant is only grounded when the inverter and the SMA Plug-in Grounding are completely installed.

Leave the inverter disconnected on both the DC and AC sides until installation of the inverter and the SMA Plug-in Grounding is completed.

#### **⚠ WARNING**

Verify that the DC current of your installation does not exceed the maximum values specified in the type rating label.

**⚠ CAUTION**

Verify the polarity and the open-circuit voltage from the PV strings before you connect the DC wires to the Sunny Boy. Applying an open-circuit DC-input voltage that exceeds the maximum DC-input-voltage range will cause irreversible damage to the Sunny Boy and void the warranty! Always configure the DC-input-voltage range correctly before connecting the DC-input wires from the PV array to the Sunny Boy. Use Sunny Design at [www.SMA-America.com](http://www.SMA-America.com) to determine the correct string configuration.



Series fusing may be required depending on the type of PV module and the number of strings used in the system. See *National Electrical Code*® 690.9.

Check both the polarity and the open-circuit voltage from the PV strings!

### 6.3.1 Installing cable conduits and leading cable into the Sunny Boy

**⚠ CAUTION**

**Ground faults, unreliable and resistive connections due to faulty wire nuts.**

- Avoid using wire nuts to join any wires together or to make any connections anywhere in the PV system.

**NOTICE**

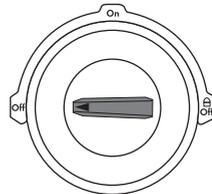
**Ingress of water when mounting and installing the Sunny Boy.**

Damage to the Sunny Boy will result.

- Do not enlarge openings for the cable conduits. The openings are intended for the installation of inflexible cable conduits of a size of up to  $\frac{3}{4}$  in. (19 mm).
- For conduit hubs, use only UL Listed raintight, or wet location hubs of type 3R for entry into the enclosure.

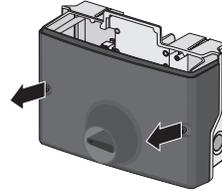
#### Installing cable conduit and cable on the DC side

1. Turn the DC disconnect switch of the SMA DC-Disconnect to position "Off".
2. Loosen the screws on the enclosure of the SMA DC-Disconnect. Do not take the screws out of the lid.

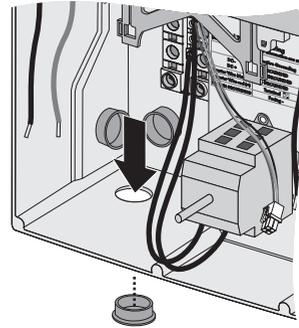


3. Remove the lid to the front.
4. Lay the lid to one side in such a way that it will not become damaged.

The SMA DC-Disconnect is open.



5. Push out the protective caps of the openings through which the DC cables are to be lead from the inside of the enclosure of the SMA DC-Disconnect.
6. Install cable conduits ( $\frac{3}{4}$  in. (19 mm)) on the free openings of the SMA DC-Disconnect. Screw the cable conduits with counter nuts to the inner side of the SMA DC-Disconnect.
7. Pull the cables of the PV strings and the cable of the ground rod through the cable conduits.



Cable conduits on the DC side are installed and the cables of the PV strings are lead into the Sunny Boy.

### Installing cable conduit and inserting cable on the AC side

1. Push out the protective caps of the openings through which the AC cables are to be lead from the inside of the enclosure of the SMA DC-Disconnect.
  2. Install cable conduits ( $\frac{3}{4}$  in. (19 mm)) on the free openings of the SMA DC-Disconnect. Screw the cable conduits with counter nuts to the inner side of the SMA DC-Disconnect.
  3. Lead the AC cable through the cable conduit from the inside of the safety enclosure into the inside of the SMA DC-Disconnect.
- Cable conduits are installed and the cable for the AC connection are lead into the Sunny Boy.

## 6.4 Connection of PV strings without optional string fuses

### DC connection of the Sunny Boy with a negatively grounded PV array

If your PV plant requires negative grounding, connect the cables of the PV strings and the DC cable of the Sunny Boy to the terminal block in the following way:

#### Using DC-Terminal blocks

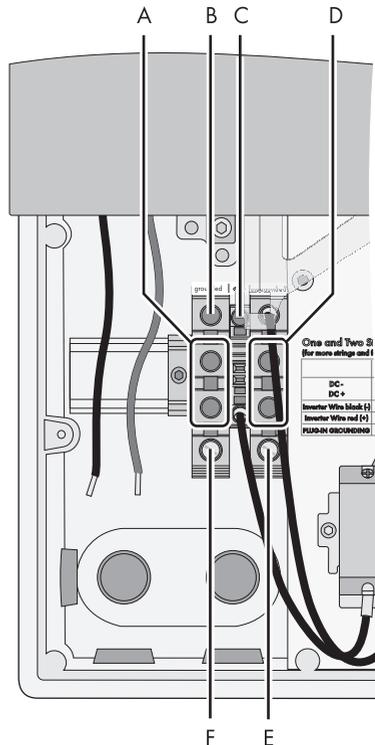
Connect the wires to the DC-terminal block as described in section (see Section 12.7.1 "Connect wires to DC terminal block", page 100).

### Connecting the Sunny Boy on the DC side

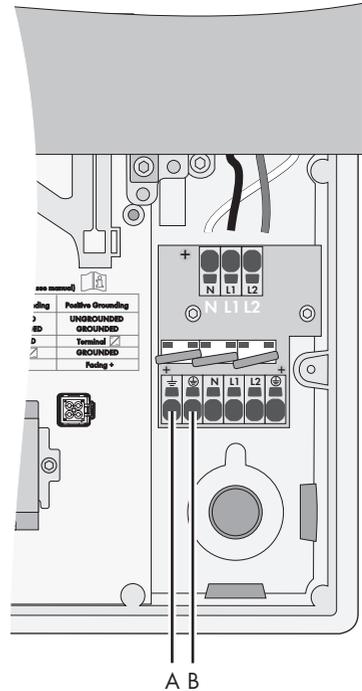
1. Connect the negative inverter wire (black wire) of the Sunny Boy to the terminal (B).
2. Connect the positive inverter wire (red wire) of the Sunny Boy to the terminal (C).

### Connecting the PV strings

3. Connect the negative DC wires of the PV strings with a cross-sectional area of AWG 10 up to but not including AWG 8 (10 mm<sup>2</sup>) to the terminal (A).
4. If a negative DC wire of the PV strings has a cross-sectional area of AWG 8 (10 mm<sup>2</sup>) to maximum AWG 2 (35 mm<sup>2</sup>):
  - Completely loosen the screw of the screw clamp (F) (turn the screw counterclockwise).
  - Feed in the DC wire from below into the screw clamp.
  - Tighten the screw of the screw clamp (turn the screw clockwise).
5. Connect the positive DC wires of the PV strings with a cross-sectional area of AWG 10 up to but not including AWG 8 (10 mm<sup>2</sup>) to the terminal (D).
6. If a positive DC wire of the PV strings has a cross-sectional area of AWG 8 (10 mm<sup>2</sup>) to maximum AWG 2 (35 mm<sup>2</sup>):
  - Completely loosen the screw of the screw clamp (E) (turn the screw counterclockwise).
  - Feed in the DC wire from below into the screw clamp.
  - Tighten the screw of the screw terminal clockwise.



7. Plug the equipment grounding conductor of the PV plant into terminal (B).
  8. If there is a grounding electrode conductor: plug the grounding electrode conductor into terminal (A).
- 
9. Verify that all connections are correctly wired and properly torqued. Pull the cables in order to make sure that they are sufficiently fixed.



- The Sunny Boy is connected on the DC side ready to ground the PV plant negatively.

**i** The grounded conductor may be color coded in accordance with the **National Electrical Code® article 200**.

- Use electricians tape for coding the grounded conductor.

## DC connection with a positively grounded PV plant

If your PV plant requires positive grounding, connect the cables of the PV strings and the DC cable of the Sunny Boy to the terminal block in the following way:

### **i** Using DC-Terminal blocks

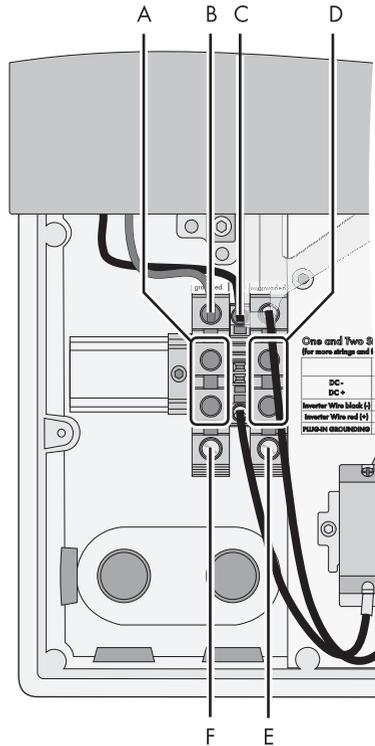
Connect the wires to the DC-terminal block as described in section (see Section 12.7.1 "Connect wires to DC terminal block", page 100).

### Connecting the Sunny Boy on the DC side

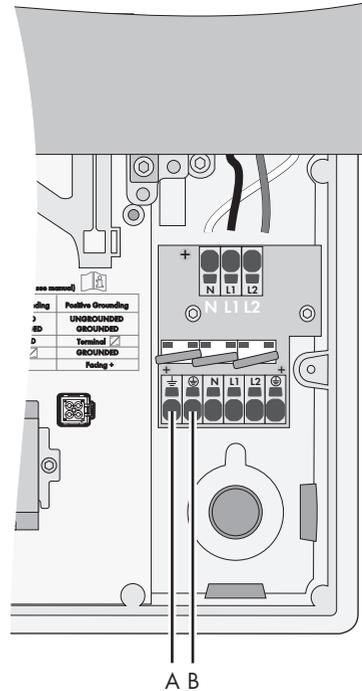
1. Connect the positive inverter wire (red wire) of the Sunny Boy to the terminal (B).
2. Connect the negative inverter wire (black wire) of the Sunny Boy to the terminal (C).

### Connecting the PV strings

3. Connect the positive DC wires of the PV strings with a cross-sectional area of up to AWG 8 (10 mm<sup>2</sup>) to the terminal (A).
4. If a positive DC wire of a PV string has a cross-sectional area of AWG 8 (10 mm<sup>2</sup>) to maximum AWG 2 (35 mm<sup>2</sup>):
  - Completely loosen the screw of the screw clamp (F) (turn the screw counterclockwise).
  - Feed in the DC wire from below into the screw clamp.
  - Tighten the screw of the screw clamp (turn the screw clockwise).
5. Connect the negative DC wires of the PV strings with a cross-sectional area of up to AWG 8 (10 mm<sup>2</sup>) to the terminal (D).
6. If a negative DC wire of a PV string has a cross-sectional area of AWG 8 (10 mm<sup>2</sup>) to maximum AWG 2 (35 mm<sup>2</sup>):
  - Completely loosen the screw of the screw clamp (E) (turn the screw counterclockwise).
  - Feed in the DC wire from below into the screw clamp.
  - Tighten the screw of the screw clamp (turn the screw clockwise).



7. Plug the equipment grounding conductor of the PV plant into terminal (B).
8. If there is a grounding electrode conductor: plug the grounding electrode conductor into terminal (A).



- ☑ Verify that all connections are correctly wired and properly clamped or torqued. Pull the cables in order to make sure that they are sufficiently fixed. The Sunny Boy is connected on the DC side ready to ground the PV plant positively.

**i** The grounded conductor may be color coded in accordance with the **National Electrical Code®** article 200.

- Use electricians tape for coding the grounded conductor.

## 6.5 Connection of PV strings with optional fuses

By using optional fuses for the connection of the PV strings, you can connect up to three PV strings to the Sunny Boy. For this you must install fuse holders to the top-hat rail next to the terminal block.

### Requirements for installing optional fuses

- Only use the fuse holders and fuses specified in section 14 "Accessories" on page 107.
- Use 3 wires with a length of 10 in. (254 mm) and a size of AWG 8 (10 mm<sup>2</sup>).  
These wires are not included in the delivery.

### DC connection with a negatively grounded PV plant

#### Connecting the Sunny Boy on the DC side

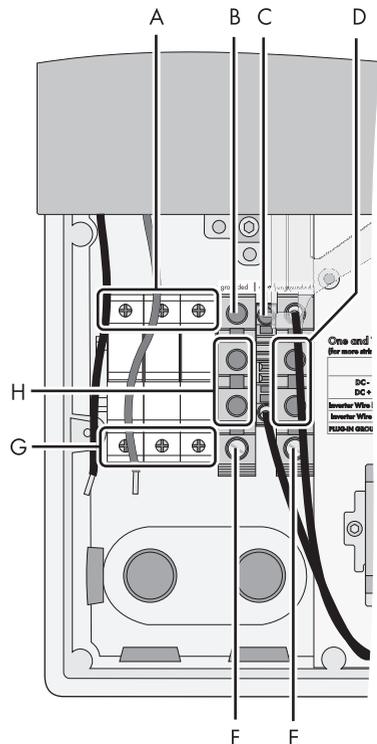
#### Using DC-Terminal blocks

Connect the wires to the DC-terminal block as described in section (see Section 12.7.1 "Connect wires to DC terminal block", page 100).

1. Connect the negative inverter wire (black wire) of the Sunny Boy to the terminal (B).
2. Connect the positive inverter wire (red wire) of the Sunny Boy to the terminal (C).

#### Connecting the PV strings

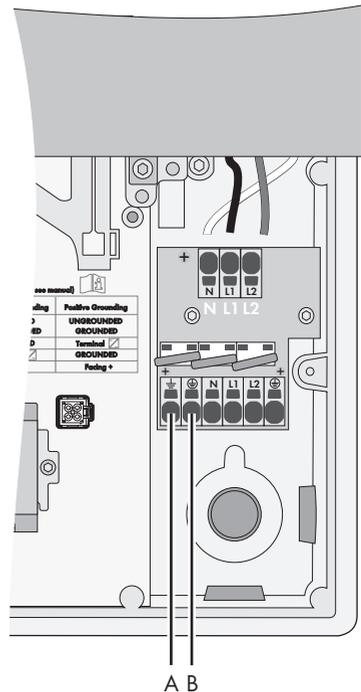
3. Remove the screwless end block from the top-hat-rail (left of the DC-terminal block).
4. Mount three fuse holders to the top-hat rail.
5. Install fuses in the fuse holders.  
The fuses must be functional and of the correct size. Refer to section (see Section 14 "Accessories", page 107) for a specification of suitable fuses.
6. Put the sticker delivered with the fuse holder plainly visible near by the fuse holder.
7. Loosen the screws of the lower terminals of the fuses (G) in a counterclockwise direction.
8. For each positive DC wire of the PV strings:
  - Feed in the wire from below into the terminal of a fuse (G).
  - Tighten the terminal screw in a clockwise direction.
9. Strip the ends of the additional wires on one side in accordance with the specifications of the fuse holder manufacturer.



10. Strip the ends of the additional wires on the other side to a length of  $\frac{1}{2}$  in. (12 mm).
11. Loosen the screws of the upper terminal of the fuses (A) in a counterclockwise direction.
12. For each additional wire:
  - Feed in the wire from above into the terminal of a fuse holder(A).
  - Tighten the terminal screw clockwise.
13. Connect two of the additional wires to the terminals (D).
14. Connect the third additional wire to screw clamp (E):
  - Completely open the screw terminal counterclockwise.
  - Feed in the wire from below into the screw terminal.
  - Tighten the screw clamp clockwise.
15. Connect two of the negative DC wires of the PV strings to the terminals (H).
16. Connect the third negative DC wire of the PV strings to screw terminal (F).
  - Completely open the screw clamp counterclockwise.
  - Feed in the wire from below into the screw terminal.
  - Tighten the screw clamp clockwise.
17. Plug the equipment grounding conductor of the PV plant into terminal (B).
18. If there is a grounding electrode conductor: plug the grounding electrode conductor into terminal (A).



- Verify that all connections are correctly wired and properly clamped or torqued. Pull the cables in order to make sure that they are sufficiently fixed. The Sunny Boy is connected on the DC side ready to ground the PV plant negatively.



## DC connection with a positively grounded PV plant

### Connecting the Sunny Boy on the DC side

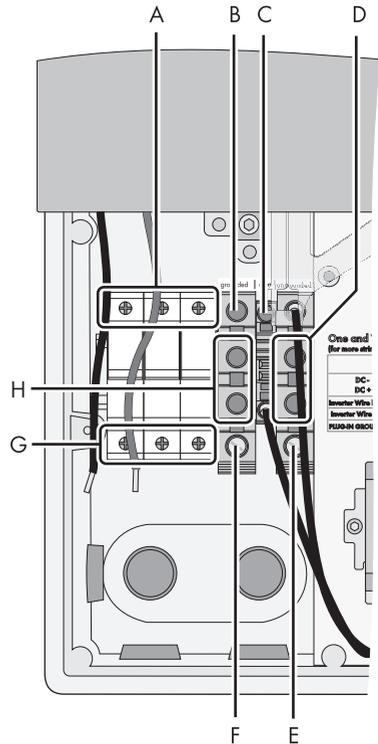
#### Using DC terminal blocks

Connect the wires to the DC terminal block as described in section (see Section 12.7.1 "Connect wires to DC terminal block", page 100).

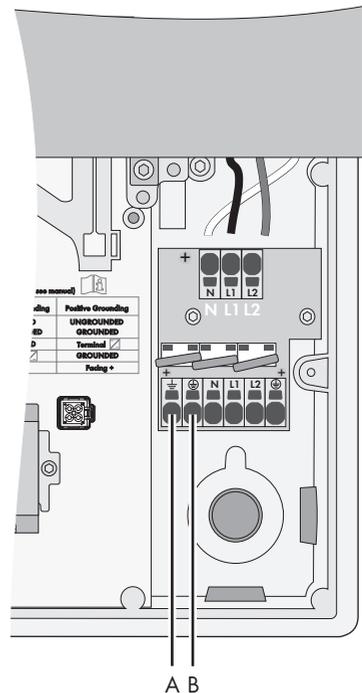
1. Connect the positive inverter wire (red wire) of the Sunny Boy to the terminal (B).
2. Connect the negative inverter wire (black wire) of the Sunny Boy to the terminal (C).

#### Connecting the PV strings

3. Remove the screwless end block from the top-hat-rail (left of the DC terminal block).
4. Mount three fuse holders to the top-hat rail. Refer to section (see Section 14 "Accessories", page 107) for a specification of suitable fuse holders.
5. Ensure that fuses are installed in the fuse holders. The fuses must be fully operative and of the correct size. Refer to section (see Section 14 "Accessories", page 107) for a specification of suitable fuses. If there are no functional fuses installed, then install fully operative fuses.
6. Put the sticker delivered with the fuse holder plainly visible near the fuse holder.
7. Loosen the screws of the lower terminals of the fuses (G) in a counterclockwise direction.
8. For each negative DC wire of the PV strings:
  - Feed in the wire from below into the terminal of a fuse (G).
  - Tighten the terminal screw in a clockwise direction.
9. Strip the ends of the additional wires on one side in accordance with the specifications of the fuse holder manufacturer.
10. Strip the ends of the additional wires on the other side to a length of  $\frac{1}{3}$  in. (8 mm).
11. Loosen the screws of the upper terminal of the fuses (A) in a counterclockwise direction.



12. For each additional wire:
  - Feed in the wire from above into the terminal of a fuse holder (A).
  - Tighten the terminal screw in a clockwise direction.
13. Connect two of the additional wires to the terminals (D).
14. Connect the third additional wire to screw clamp (E):
  - Completely open the screw clamp (turn the screw counterclockwise).
  - Feed in the wire from below into the screw clamp.
  - Close the screw clamp (turn the screw clockwise).
15. Connect two of the positive DC wires of the PV strings to the terminals (H).
16. Connect the third positive DC wire of the PV strings to screw clamp (F).
  - Completely open the screw clamp (turn the screw counterclockwise).
  - Feed in the wire from below into the screw clamp.
  - Close the screw clamp (turn the screw clockwise).
17. Plug the equipment grounding conductor of the PV plant into terminal (B).
18. If there is a grounding electrode conductor: plug the grounding electrode conductor into terminal (A).



- Verify that all connections are correctly wired and properly torqued. Pull the cables in order to make sure that they are sufficiently fixed. The Sunny Boy is connected on the DC side ready to ground the PV plant positively.

## 6.6 Installation of the SMA Plug-in Grounding

SMA Plug-in Grounding enables for array grounding and contains a fuse for Ground Fault Indication (GFDI). If a ground fault occurs, the fuse in the SMA Plug-in Grounding disconnects the fault current generated.

The type of grounding (positive/negative) is coded into the grounding stick.

The SMA Plug-in Grounding must be installed according to the desired array grounding before commissioning the Sunny Boy.

### **⚠ DANGER**

#### **Danger of electric shock caused by damaged SMA Plug-in Grounding.**

If the SMA Plug-in Grounding is damaged water can enter into it. Contact with high voltage possible.

- Check Plug-in Grounding before installation.
- Do not install a damaged Plug-in Grounding.
- If the Plug-in Grounding fell down and no damage is visible but you doubt its proper functionality, replace it with a new one.



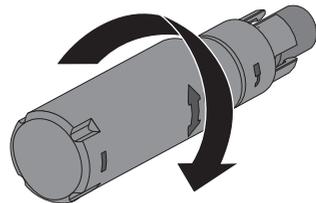
#### **Changing operating parameter for grounding of the Sunny Boy**

The operating parameter of the Sunny Boy is preset to negative grounding.

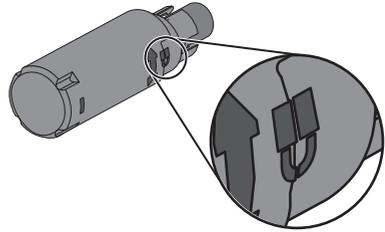
When the grounding of the Sunny Boy must be changed to positive grounding you must change the operating parameter "Cntry.Mdul.GndModReq" of the Sunny Boy via a communication product.

### **Installing the SMA Plug-in Grounding**

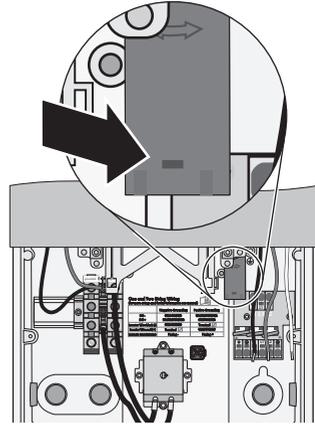
1. Disconnect the Sunny Boy from voltage sources (see Section 8.1 "Disconnect the Sunny Boy from Voltage Sources", page 64).
2. Open the SMA DC Disconnect (see Section 8.2 "Open SMA DC Disconnect", page 65).
3. Check whether the SMA Plug-in Grounding is screwed together: hold the connection part of the SMA Plug-in Grounding firmly and screw on the cap of the SMA Plug-in Grounding by hand.



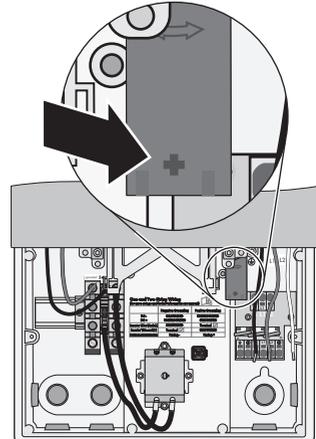
- ☑ Both parts of the lock symbol on the connection part and on the cap of the SMA Plug-in Grounding form the complete symbol of a lock.



4. If the PV array shall be negatively grounded: connect the SMA Plug-in Grounding to the terminal socket so that the "–" symbol shows to the front on the cap. Push the SMA Plug-in Grounding upwards until it clicks into place.



If the PV plant shall be positively grounded: connect the SMA Plug-in Grounding to the terminal socket so that the "+" symbol shows to the front on the cap. Push the SMA Plug-in Grounding upwards until it clicks into place.



- ☑ The SMA Plug-in Grounding is installed.
  - Make sure that the PV-generator is connected as described in section (see Section 6.3 "Connection of the PV array (DC)", page 42).
  - Make sure that the PV strings are connected as described in section (see Section 6.4 "Connection of PV strings without optional string fuses", page 45) or, if you use optional fuses, as described in section (see Section 6.5 "Connection of PV strings with optional fuses", page 49).
  - Close the SMA DC Disconnect (see Section 8.3 "Closing the SMA DC-Disconnect", page 66).
  - Commission the Sunny Boy (see Section 7 "Commissioning", page 62).

## 6.6.1 Configurable Grounding Parameters

### Parameter names according to the type of communication

Depending on the communication type (*Bluetooth* or *RS485*), the inverter uses a different communication protocol and the parameters are displayed differently.

- Communication via *Bluetooth* and Sunny Explorer: DATA II+
- Communication via *RS485*: DATA I

Two parameters are important for the grounding of the PV plant. You can configure these parameters in the inverter via a communication device or a PC with the appropriate software.

- Parameter "Module grounding prescribed?" (DATA II+) or "Md.GndMdt" (DATA I)
- Parameter "Prescribed grounding type" (DATA II+) or "Md.GndModReq" (DATA I)

## 6.6.2 Parameter "Module grounding prescribed?" or "GndMdt"

The grounding module in the inverter is configured via the parameter "Module grounding prescribed?" or "Md.GndMdt". Make sure you comply with the requirements of the module manufacturer as well as the regulations applicable at the installation location of the PV plant.

There are two configuration possibilities:

Value (DATA II+ / DATA I)	Explanation	Default Value (DATA II+ / DATA I)
No	not available	Yes
Yes	Grounding is <b>prescribed</b> by normative regulation or the module manufacturer. The inverter can only be operated with an SMA Plug-in Grounding set.  In case of a grounding error, the inverter will not continue to feed into the grid and interrupts operation. The inverter displays a warning with the event number "35" in case of an insulation error.	

## 6.6.3 Error Messages

### Always correct errors

Immediately correct errors, even if the inverter continues to feed into the grid.

The inverter behaves differently, depending on the configuration of the parameter "Module grounding prescribed?" or "MdGndMdt".

The following error messages may occur:

<b>Parameter "Module grounding prescribed?" / "MdGndMdt"</b>	
<b>Configuration: Yes</b>	<b>Cause / Correction</b>
<ul style="list-style-type: none"> <li>• Event number 35</li> <li>• Display message &lt; Ground fuse fault - check ground fuse &gt;</li> <li>• Red LED glows continuously.</li> <li>• Green LED blinks or disappears.</li> <li>• The inverter does not feed into the grid.</li> </ul>	<p>An overcurrent has occurred.</p> <ul style="list-style-type: none"> <li>• Correct the error as described in section (see Section 11.2 "Correct Grounding Fuse Fault", page 89).</li> </ul>
<ul style="list-style-type: none"> <li>• Event number 35</li> <li>• Display message &lt; Insulation resist. - check generator &gt;</li> <li>• Red LED glows continuously.</li> <li>• Green LED blinks or disappears.</li> <li>• The inverter does not feed into the grid.</li> </ul>	<p>An insulation fault has occurred.</p> <ul style="list-style-type: none"> <li>• If an SMA Plug-in Grounding is installed, correct the fault as described in section (see Section 11.2 "Correct Grounding Fuse Fault", page 89).</li> <li>• If the SMA Plug-in Grounding is missing, connect the SMA Plug-in Grounding as described in section (see Section 6.6 "Installation of the SMA Plug-in Grounding", page 53).</li> </ul>
<ul style="list-style-type: none"> <li>• Event number 42</li> <li>• Display message &lt; Wrong earthing type; check earthing set &gt;</li> <li>• Red LED glows continuously.</li> <li>• Green LED blinks or disappears.</li> <li>• The inverter does not feed into the grid.</li> </ul>	<p>The SMA Plug-in Grounding has been connected incorrectly (reverse polarity) or is missing.</p> <ul style="list-style-type: none"> <li>• Correct the error as described in section (see Section 11.3 "Correct the Grounding Type", page 90).</li> </ul>

<b>Parameter "Module grounding prescribed?" / "MdGndMdt"</b>	
<b>Configuration: No</b>	<b>Cause Correction</b>
<ul style="list-style-type: none"> <li>• Event number 42</li> <li>• Display message &lt; Wrong earthing type; check earthing set &gt;</li> <li>• Red LED glows continuously.</li> <li>• Green LED glows continuously.</li> <li>• The inverter feeds into the grid.</li> </ul>	<p>The SMA Plug-in Grounding has been connected incorrectly (reverse polarity) or is missing.</p> <ul style="list-style-type: none"> <li>• Correct the error as described in section (see Section 11.3 "Correct the Grounding Type", page 90).</li> </ul>

## 6.6.4 Parameter "Prescribed grounding type" or "Md.GndModReq"

Via the parameter "Prescribed grounding type" or "Md.GndModReq" you will be able to specify the required grounding type. Default configuration for the parameter is "Negative".

There are two ways to specify this parameter:

- **Automatically:** When in learning mode, the inverter automatically saves the grounding type of the plugged in SMA Plug-in Grounding after 10 hours of operation.
- **Manually:** You can change the grounding type you want to use via the communication tool (*Bluetooth/RS485*), after you have started up the inverter. It is also possible to manually configure the parameter without the SMA Plug-in Grounding.

There are four configuration options:

Value (DATA II+ / DATA I)	Explanation	Default Value (DATA II+ / DATA I)
Positive / GndModPs	The inverter only allows positive grounding.	Negative / GndModNg
Negative / GndModNg	The inverter only allows negative grounding.	
None prescribed / GndModNoneReq	No specific grounding mode is required.	
Learning / GndModLrn	The inverter detects the grounding and, after 10 hours of operation with the plugged in SMA Plug-in Grounding, saves the grounding type.  The inverter can be operated with or without grounding.	

## 6.7 Wiring the AC Output

This subsection provides complete, step-by-step procedures for wiring the AC output from the Sunny Boy to the power distribution grid.

### 6.7.1 AC connection safety requirements

#### **⚠ WARNING**

All electrical installations must be done in accordance with all local electrical codes and with the *National Electrical Code*<sup>®</sup>, ANSI/NFPA 70. Use 6 AWG (maximum), 194 °F (90 °C), copper wire for all AC wiring connections to the Sunny Boy. Voltage drop and other considerations may dictate that larger size wires be used. Use only solid wire or stranded wire.

#### **⚠ WARNING**

The *National Electrical Code*<sup>®</sup> states that the inverter must be connected to a dedicated circuit, and that no other outlets or devices can be connected to the same circuit. See *National Electrical Code*<sup>®</sup> section 690-64(b)(1). The *National Electrical Code*<sup>®</sup> also imposes limitations on the size of the inverter and the manner in which it is connected to the power distribution grid. See *National Electrical Code*<sup>®</sup> section 690-64(b)(2).

#### **⚠ WARNING**

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

#### **⚠ WARNING**

To reduce the risk of fire, connect only to a circuit provided with the required branch circuit overcurrent device sized in accordance with the *National Electrical Code*<sup>®</sup>, ANSI/NFPA 70. The maximum size overcurrent device shall not be more than 20 amperes.



#### **The AC outputs and the neutral conductors are not bonded to ground.**

The Sunny Boy must be connected to the AC grounding conductor of the power distribution grid via the ground terminal  (see Section 6.7 "Wiring the AC Output", page 58).

## 6.7.2 Connecting the Sunny Boy on the AC side

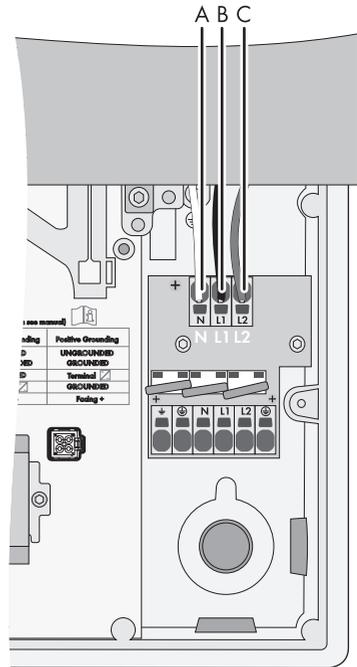
Use the following procedure to connect the AC wires to the Sunny Boy with the SMA DC-Disconnect:

### **⚠ WARNING**

You must connect the wires that carry the AC voltage from the Sunny Boy to the power distribution grid in the order described in this procedure. Deviating from this procedure could expose you to lethal voltages that can cause serious injury and/or death.

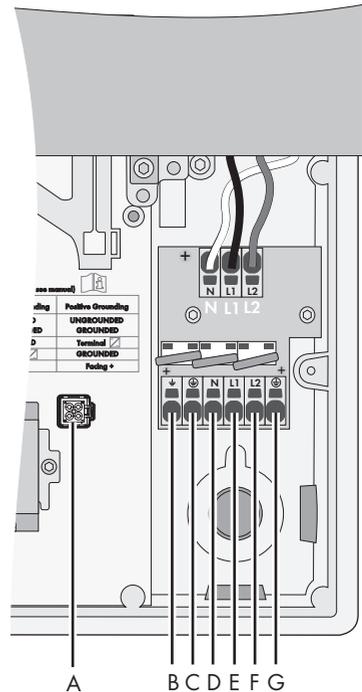
### Connecting the AC output of the Sunny Boy to the terminal block

1. Connect the N wire (white wire) of the Sunny Boy to the terminal (A).
2. Connect the L1 wire (black wire) of the Sunny Boy to the terminal (B).
3. Connect the L2 wire (red wire) of the Sunny Boy to the terminal (C).



## Connecting the AC cable of the power distribution grid and connecting the power supply of the fan

4. Connect the L1 wire of the power distribution grid to the terminal (E).
5. Connect the L2 wire of the power distribution grid to the terminal (F).
6. Connect the AC equipment ground wire from the power distribution grid to terminals (G).
7. If there is a neutral electric conductor from the power distribution grid: Connect the neutral conductor from the power distribution grid to terminal (D).



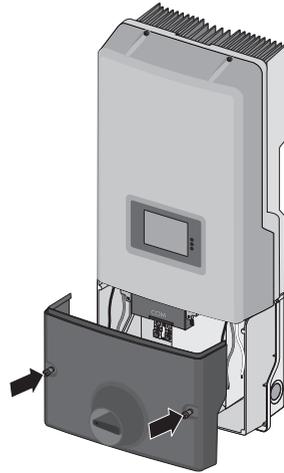
## Connecting the power supply of the fan

8. Plug in the plug of the fan into socket (A). A click sound can be heard by proper connection. Pull the fan plug slightly to ensure mechanical connection.
- The Sunny Boy is connected and grounded on the AC side. Fan power supply is connected.

## 6.8 Closing the SMA DC Disconnect

When you have finished connecting the DC input wires, the AC output wires and the fan power supply recheck all the connections to ensure that everything is in the right place and that all connections and knockout fittings are secure and properly torqued. Check all of the knockout fittings of the SMA DC-Disconnect to ensure that they are in place.

1. Check wire routing to ensure that no wires can interfere with proper sealing of the cover and that no pressure will be exerted on the connections when the cover is replaced.
2. Carefully position the cover on the front of the SMA DC-Disconnect.
  - Make sure that the switch handle snaps into place.
  - Make sure that the upper edge of the DC-Disconnect is covered by the lower edge of the Sunny Boy.
  - Make sure that the two screws in the cover are aligned correctly with the two threaded holes in the enclosure.
3. While holding the cover in place, insert the two screws into the threaded holes in the case and turn them clockwise until they are hand-tight. Be careful not to cross-thread any of the screws. Do not use power tools to fasten the screws.
4. Verify that the cover is in the correct position.
5. Tighten the cover screws to a torque of 53 in-lb. (6 Nm).



# 7 Commissioning

## ⚠ WARNING

Follow the steps in the commissioning procedure in the order they are presented. Deviating from these procedures could expose you to lethal voltages that can cause serious injury and/or death.

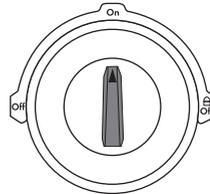
## ⚠ CAUTION

Follow the steps in the commissioning procedure in the order they are presented. Deviating from these procedures could cause irreversible damage to the Sunny Boy and void the warranty.

All Sunny Boy inverters have a sophisticated system for detecting and responding to PV array ground faults as required by *National Electrical Code*® section 690.5. The PV array normally operates in a grounded configuration. Depending on the type of system, the array’s negative or positive conductor is connected to the grounding system inside the inverter through the SMA Plug-in Grounding as a part of the UL1741 listed ground fault detection system. The GFDI protection is active whenever there is sufficient DC voltage to turn on the LCD in the Sunny Boy.

To commission the Sunny Boy, follow these simple instructions:

1. Make sure any covering placed over the PV array is removed.
2. If a multi-function relay is present, connect the multi-function relay power supply.
3. Connect the grid voltage to the Sunny Boy by switching on the main AC circuit breaker in the main utility panel.
4. Switch the SMA DC-Disconnect to position "On".



### Display messages during initialization

- First, the firmware version of the internal processors appears in the text lines.
- After 5 seconds or after tapping the enclosure lid the serial number or the identifier of the inverter appears. This identifier can be changed with a communications device.
- After another 5 seconds, or when you tap again, the configured standard and the grid type are displayed.



- After another 5 seconds, or when you tap again, the configured language is displayed.
- In normal operation the scrolling lines are subsequently empty. You can refer to the possible event messages in the scrolling lines and their meaning in section (see Section 10 "Messages", page 81).



**i** If there is a ground fault in the array before DC is switched on, the messages "Insulation Failure" and "Check Generator" will be displayed in turns and the GFDI fuse may clear.

If there is a ground fault in the array while DC is switched on, the messages "Ground Fuse Fault" and "Check Ground Fuse" will be displayed in turns.

- If these error messages are encountered, switch off the DC and AC disconnects to the Sunny Boy and troubleshoot the array.  
Refer to section "Checking the PV array for Ground Fault" on page 88.

If the Sunny Boy is not operating as expected after the commissioning procedure has been completed, refer to Section (see Section 10 "Messages", page 81) and to section (see Section 11 "Troubleshooting", page 88).

If there is adequate sun irradiation and the resulting PV input voltage is greater than 220 V DC, the Sunny Boy will automatically begin feeding power to the power distribution grid.

Anytime the AC power is disconnected from the inverter, either manually or as a result of an AC disturbance, the inverter will wait 5 minutes after the AC power has been restored to reconnect. When servicing the inverter, always disconnect the AC first, then switch off the DC-Disconnect.

## 8 Opening and closing

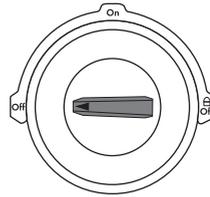
### 8.1 Disconnect the Sunny Boy from Voltage Sources

#### **⚠ DANGER**

**Electric shock due to improper opening of the SMA DC-Disconnect.**

Death resulting from burning and electric shock.

- Observe the sequence described here when opening the Sunny Boy.
  - If problems occur when performing the work described here, contact SMA.
1. Set the line circuit breaker on the AC side to position "Off" and secure against reconnection.
  2. If a multi-function relay is present, disconnect the multi-function relay power supply.
  3. Turn the DC disconnect switch to position "Off" and wait 5 minutes, until the capacitors of the Sunny Boy are discharged all LEDs are off.



## 8.2 Open SMA DC Disconnect

### **⚠ DANGER**

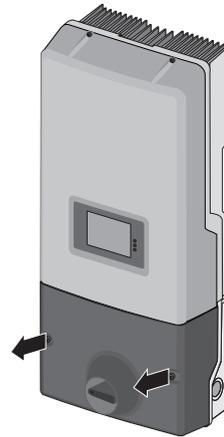
#### **High voltages inside the SMA DC-Disconnect.**

Death or serious injuries.

After opening the SMA DC-Disconnect there are still high voltages inside the SMA DC-Disconnect at the DC contacts of the DC terminal block and at the contacts of the DC switch.

- Do not touch contacts at the DC terminal block and on the DC switch.

1. Turn and loosen the screws on the enclosure of the SMA DC-Disconnect in a counterclockwise direction.
2. Remove the lid to the front.
3. Lay the lid to one side in such a way that it will not become damaged.

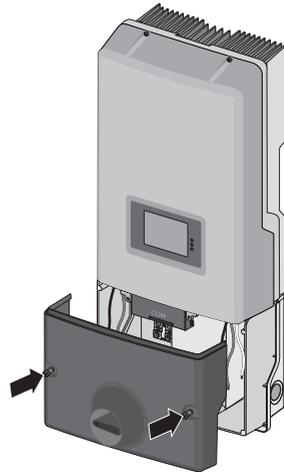


- The SMA DC-Disconnect is open.

### 8.3 Closing the SMA DC-Disconnect

Recheck all your connections to ensure that everything is in the right place and that all connections and knockout fittings are secure and properly torqued. Check all of the knockout fittings of the SMA DC-Disconnect to ensure that they are in place.

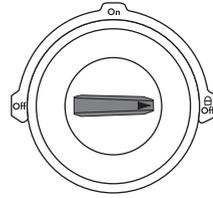
1. Check wire routing to ensure that no wires can interfere with proper sealing of the cover and that no pressure will be exerted on the connections when the cover is replaced.
2. Carefully position the cover on the front of the SMA DC-Disconnect.
  - Make sure that the switch handle snaps into place.
  - Make sure that the upper edge of the SMA DC-Disconnect is covered by the lower edge of the Sunny Boy.
  - Make sure that the two screws in the cover are aligned correctly with the two threaded holes in the enclosure.
3. While holding the cover in place, insert the two screws into the threaded holes in the enclosure and turn them until they are hand-tight. Be careful not to cross-thread any of the screws. Do not use power tools to fasten the screws.
4. Verify that the cover is in the correct position.
5. Tighten the cover screws to a torque of 53 in-lb. (6 Nm).



- The SMA DC-Disconnect is closed.

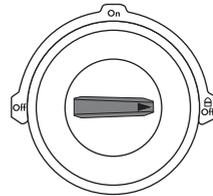
## 8.4 Lock-Off function

During work on the PV modules in your PV plant you must switch the Sunny Boy off and secure against reconnection. The Lock-Off function of the SMA DC-Disconnect secures the Sunny Boy against accidental reconnection during work on the PV plant.



### 8.4.1 Secure Sunny Boy against reconnection

1. Turn the DC disconnect switch to the "Lock off" position (symbol of a padlock).
  - The handle of the DC disconnect switch pops out of the DC disconnect switch.



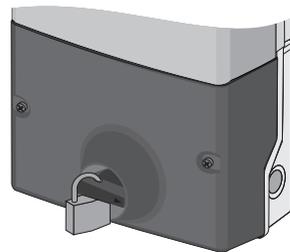
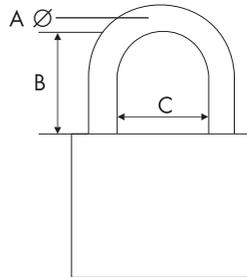
2. Hang and lock a suitable padlock in the handle of the DC disconnect switch.

Dimensions of the padlock:

A: maximum diameter of the shackle:  $\frac{1}{4}$  in. (6 mm)

B: maximum  $\frac{7}{10}$  in. (18 mm)

C: minimum  $\frac{5}{8}$  in. (16 mm)



- The Sunny Boy is mechanically secured against reconnection and against removing the cover.

## 8.4.2 Unlocking and switching on the Sunny Boy

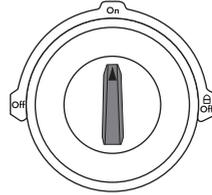
### **⚠ WARNING**

#### **High voltages in the PV plant.**

Death or serious injuries.

- Before reconnecting the Sunny Boy, ensure that all work on the PV system is completed.

1. Open and remove the padlock on the switch of the SMA DC-Disconnect switch.
2. Push the handle of the SMA DC-Disconnect into the SMA DC-Disconnect and turn to the "On" position.



- The Sunny Boy is unlocked and connected.

## 9 Maintenance and cleaning

Check the correct operation of the Sunny Boy at regular intervals.

Impurities such as dust or pollen can cause heat accumulation that can lead to yield losses. Also check the Sunny Boy and the cables for visible external damage. Undertake repairs if necessary.

### 9.1 Checking Heat Dissipation

If the Sunny Boy regularly reduces its output due to too high heat (temperature symbol on the display illuminates), this can be caused by the following:

#### **⚠ CAUTION**

**The cooling fins of the Sunny Boy become hot during operation.**

Burn injuries will result when touching the fins.

- Wait for the Sunny Boy to cool down, before checking the heat dissipation.
- The cooling fins on the rear side of the enclosure are clogged with dirt.
  - Clean the cooling fins with a soft brush.
- The fan is clogged with dirt.
  - Clean the fan.

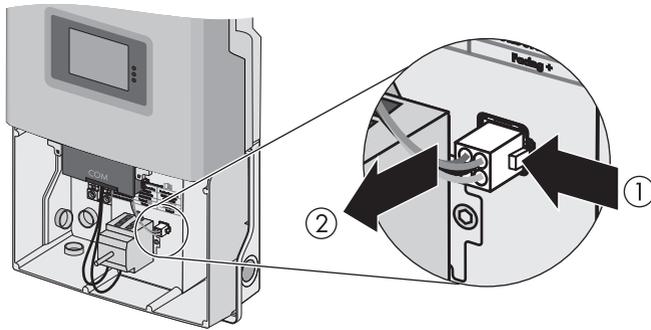
#### 9.1.1 Cleaning the fan

If the fan enclosure is soiled with loose dust, it can be cleaned using a vacuum cleaner. For locating the fan refer to section "Lower view of the SMA DC-Disconnect" on page 41.

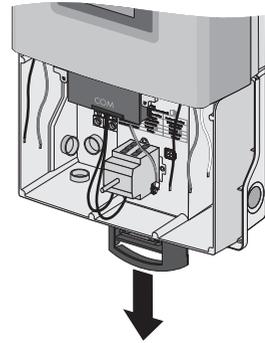
If you do not achieve satisfactory results with a vacuum cleaner, you can dismantle the fan for cleaning.

If the enclosure and fan are dirtier, proceed as follows:

1. Disconnect the Sunny Boy from voltage sources (see Section 8.1 "Disconnect the Sunny Boy from Voltage Sources", page 64).
2. Open the SMA DC Disconnect (see Section 8.2 "Open SMA DC Disconnect", page 65).
3. Unlock (1) and pull out (2) the fan socket.



4. Pull the handle of the fan bracket carefully downwards, until the fan bracket is pulled out of its guide rail.
  - ☑ The fan and fan bracket are removed.

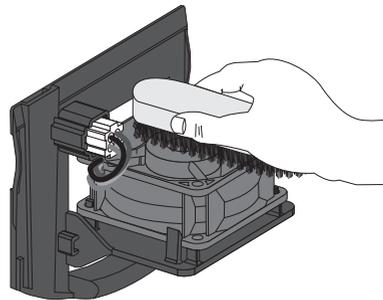


**NOTICE**

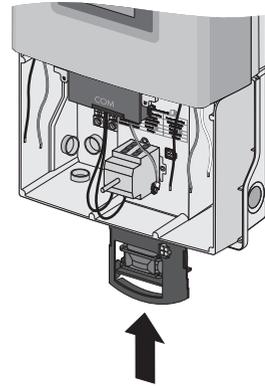
**Damage to the fan during cleaning with compressed air.**

- For cleaning the fan, only use a soft brush, a paint brush or a damp cloth.

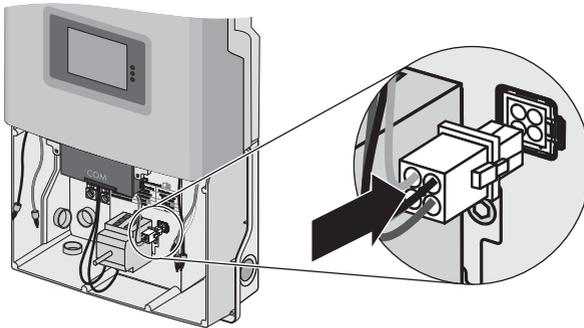
5. Clean the fan with a soft brush, a paint brush, or a damp cloth.



6. Insert the fan and the fan bracket into the guide rail and push upwards.



7. Plug the fan plug into the socket. A click sound can be heard by proper connection. Pull the fan plug slightly to ensure proper connection.



8. Close SMA DC-Disconnect (see Section 8.3 "Closing the SMA DC-Disconnect", page 66)
9. Commission the Sunny Boy (see Section 7 "Commissioning", page 62).
- The fan has been cleaned.

## 9.1.2 Checking the Fan

### Checking the Fan

In order to check the fan you need a special data acquisition device (e.g. Sunny WebBox) or a PC with the appropriate software (e.g. Sunny Explorer) in order to be able to change the parameters of the Sunny Boy.

You will also need the installer password to access the installer mode.

1. Request the installer password from the SMA Service Line (contact info see page 108).
  2. Set the "CoolSys.FanTst" parameter to "on" in the installer mode using a communications device (e.g. Sunny WebBox, Sunny Explorer).
  3. Check the air-flow of the fan. The Sunny Boy takes cooling air in from underneath and then blows it out through the cooling fans. Listen for any unusual noise, which could indicate incorrect installation or that the fans are faulty.
  4. After the test, set the parameter "CoolSys.FanTst" back to position "Off".
- The fan has been checked.

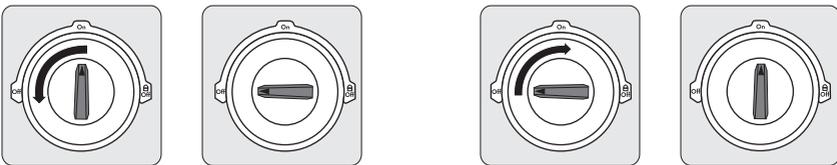
## 9.2 Checking the SMA DC Disconnect

When used appropriately the SMA DC Disconnect does not need maintenance.

It is recommended, though not compulsory to:

- Check the SMA DC Disconnect regularly.
- Operate the SMA DC Disconnect once a year 10 times.

Operating the switch will clean the contacts of the SMA DC Disconnect.



## 9.3 Exchanging fuses

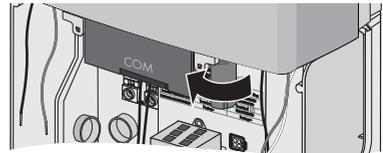
### 9.3.1 Exchanging SMA Plug-in Grounding fuse

SMA Plug-in Grounding enables for array grounding and contains a fuse for Ground Fault Indication (GFDI). If a ground fault occurs, the fuse in the SMA Plug-in Grounding disconnects the fault current generated. Once the ground fault is eliminated (see Section 11.1 "Checking the PV array for Ground Fault", page 88), you must replace the fuse of the SMA Plug-in Grounding.

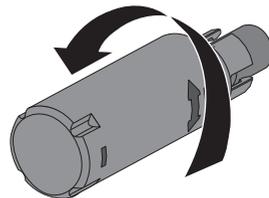
#### Dismantling and opening the SMA Plug-in Grounding

1. Disconnect the Sunny Boy from voltage sources (see Section 8.1 "Disconnect the Sunny Boy from Voltage Sources", page 64).
2. Open the SMA DC Disconnect (see Section 8.2 "Open SMA DC Disconnect", page 65).
3. Remove the SMA Plug-in Grounding. Turn it in counterclockwise direction and then pull it down.

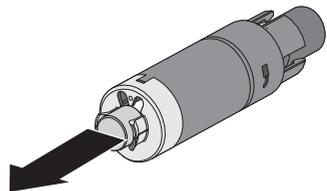
- The SMA Plug-in Grounding is loosened from its bracket.



4. Hold the connection part of the SMA Plug-in Grounding tightly, loosen and remove the cap of the SMA Plug-in Grounding.



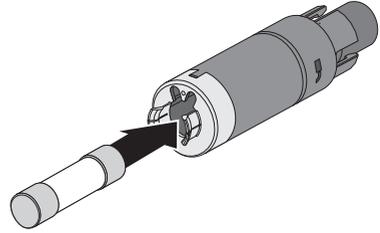
5. Using pliers pull out the fuse from the fuse holder of the SMA Plug-in Grounding.



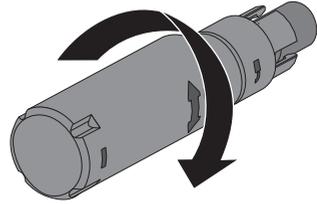
#### **⚠ WARNING**

For continued protection against risk of fire, replace only with the same type and ratings of fuse (600 VDC, 1 A).

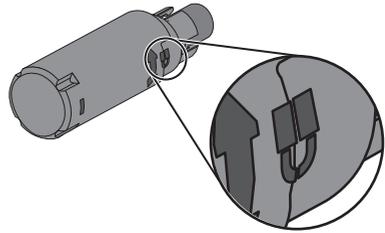
6. Insert new fuse into the fuse holder of the SMA Plug-in Grounding and push it firmly into the fuse holder.



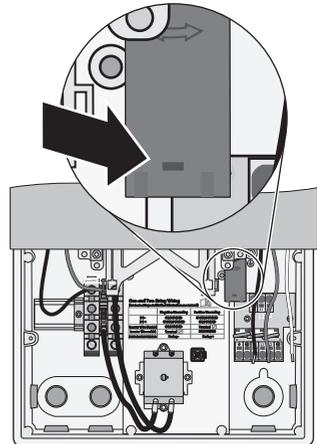
7. Hold the connection part of the SMA Plug-in Grounding tightly, replace the cap of the SMA Plug-in Grounding and tighten by hand.



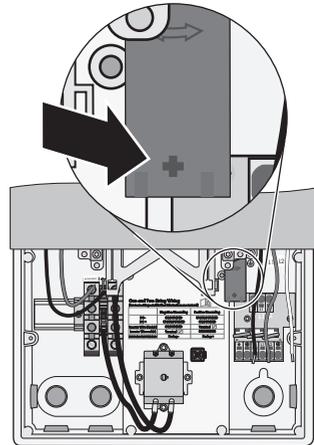
- ☑ Both parts of the lock symbol on the connection part and on the cap of the SMA Plug-in Grounding form the complete symbol of a lock.



8. If the PV plant shall be negatively grounded and is properly wired as described in section 6.3, section 6.4 and section 6.5: connect the SMA Plug-in Grounding to the terminal socket so that the “-” symbol shows to the front on the cap. Push the SMA Plug-in Grounding upwards until it clicks into place.



9. If the PV plant shall be positively grounded and is properly wired as described in section 6.3, section 6.4 and section 6.5: connect the SMA Plug-in Grounding to the terminal socket so that the "+" symbol shows to the front on the cap. Push the SMA Plug-in Grounding upwards until it clicks into place.
10. Close the SMA DC-Disconnect (see Section 8.3 "Closing the SMA DC-Disconnect", page 66).
11. Commission the Sunny Boy (see Section 7 "Commissioning", page 62).



- The SMA Plug-in Grounding fuse is changed.

## 9.3.2 Replacing optional string fuses

### PV String Fuse Sizing

#### **⚠ CAUTION**

The string fuse size must not be greater than the maximum fuse size rating of the PV module as provided on the PV module manufacturers data sheet. If no maximum fuse size is indicated, please contact the PV module manufacturer!



Refer to section (see Section 14 "Accessories", page 107) for a specification of suitable fuses.

### DC Disconnect Requirements

*National Electrical Code*® 690.15-18 allows the use of fuse holders as a suitable means of disconnecting PV arrays for servicing. Additional DC disconnects external to the inverter may be required by the local authority having jurisdiction.

#### **⚠ WARNING**

Never remove a fuse while it is under load. Electrical arcing and damage to the fuse holder will occur if a fuse is removed under load.

## Replacing string fuses

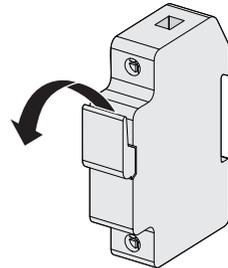
### **⚠ WARNING**

**The PV string fuses become hot during operation.**

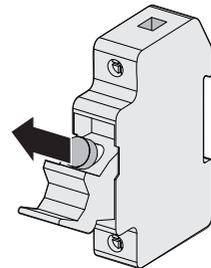
Burn injuries will result when touching the fuses.

- Wait for the fuses to cool down, after switching off the line circuit breaker and turning the DC-Disconnect switch to position "Off".

1. Disconnect the Sunny Boy from voltage sources (see Section 8.1 "Disconnect the Sunny Boy from Voltage Sources", page 64).
2. Open the SMA DC Disconnect (see Section 8.2 "Open SMA DC Disconnect", page 65).
3. Open fuse holder.



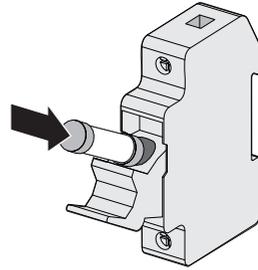
4. Take the fuse out of the fuse holder.



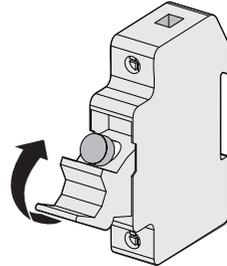
### **⚠ WARNING**

For continued protection against risk of fire, replace only with the same type and ratings of fuse.

- 5. Insert new fuse into the fuse holder.



- 6. Close fuse holder.



- 7. Repeat the replacement of fuse for each string.
- 8. Close the SMA DC-Disconnect (see Section 8.3 "Closing the SMA DC-Disconnect", page 66).
- 9. Commission the Sunny Boy (see Section 7 "Commissioning", page 62).
- The string fuses have been replaced.

## 9.4 Inspecting and changing the varistors

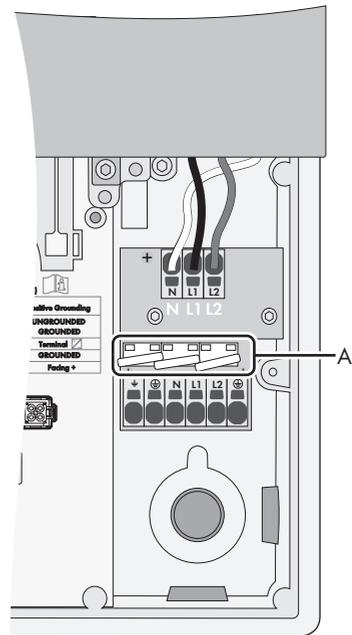
Varistors are used to protect circuits against excessive transient voltages by incorporating them into the circuit in such a way that, when triggered, they will shunt the current created by the high voltage away from the sensitive components. Varistors are designed according to the expected product use. Their functionality may diminish with following repeated responses as a result of overvoltages. It is therefore possible that one of the varistors has lost its protective function.

Inspect and change the varistors in the following manner:

1. Disconnect the Sunny Boy from voltage sources (see Section 8.1 "Disconnect the Sunny Boy from Voltage Sources", page 64).
2. Open the SMA DC Disconnect (see Section 8.2 "Open SMA DC Disconnect", page 65).
3. The position of the varistors are shown in the figure (A).

Inspect the varistors for discoloration or other signs of visual damage. Furthermore test the varistors with an ohmmeter: when the resistance of the varistor is nearly or equal 0, the varistor is damaged.

If varistors are discolored or damaged, you must replace them. Always replace the entire set of varistors.



### NOTICE

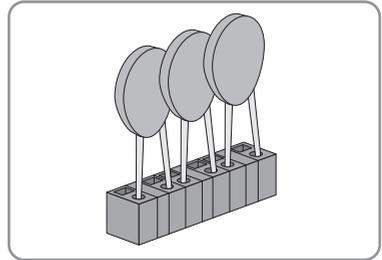
#### **Destruction of the inverter due to overvoltage.**

If varistors are missing or damaged, the inverter is not protected against overvoltages.

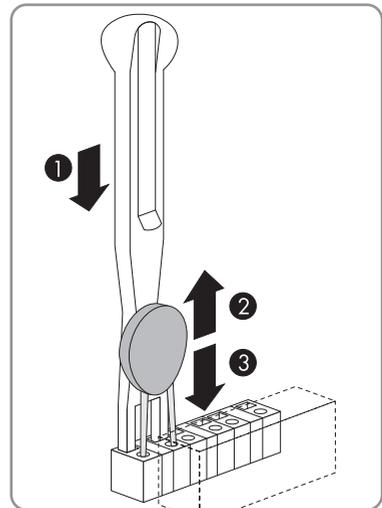
- Procure replacement varistors as soon as possible and replace the defective varistors immediately.
- Do not operate inverters with faulty varistors or without varistors.

**i** Use AC varistor replacement kit from SMA only.

- See section "Accessories" (Seite 107) for the order number.
- Arrange the varistors as shown in the figure.



4. Insert the insertion tool into the openings of the terminal contacts (1).
5. Remove the varistor (2).
6. Insert a new varistor (3).
7. Close the DC Disconnect as described in section (see Section 8.3 "Closing the SMA DC-Disconnect", page 66).
8. Commission the Sunny Boy (see Section 7 "Commissioning", page 62).



# 10 Messages

## 10.1 Green LED is lit or flashes

### Green LED is lit

- If the green LED is lit, the Sunny Boy is in feed-in operation.

### Green LED is flashing

- If the green LED flashes over a long period, this can mean that there is not sufficient DC voltage available.

### **No display in the event of insufficient DC voltage**

Measurements and the issuing of messages are only possible when there is sufficient DC voltage.

## 10.2 Update Messages

Appropriate display messages will be shown in the scrolling lines of the display in the event of an update.

Display	Description
< Inst.code valid >	The Inst.-Code entered is valid. The configured country data set is now unblocked and can be changed. If the configured country data set is protected, the unlocking is valid for a maximum of 10 feed-in hours.
< No new update on the SD card >	There is no update file relevant for this Sunny Boy on the SD card or the available update has already been carried out.
< Grid parameters not changed >	The selected switch setting is not programmed or there is no country data set available on the SD card.
< Parameters were successfully set >	A new country data set has been configured.
< Reading SD card >	The Sunny Boy is currently reading the SD card.
< Setting parameters >	The Sunny Boy is setting the configured parameters.
< Update complete >	The Sunny Boy has successfully completed the update.
< Bluetooth update >	Successful update of the <i>Bluetooth</i> components.
< Display update >	Successful update of display.
< Main computer update >	Successful update of inverter component.
< Communication update >	Successful update of communication component.

Display	Description
< Language table update >	Successful update of language table.
< Update file OK >	The file found is valid.

## 10.3 Error Messages

Appropriate display messages will be shown in the scrolling lines of the display if an event occurs. By tapping on the enclosure lid the multi-line messages can be switched further.

If an error exists over a long period of time, the red LED begins to light and the multi-function relay is switched (if available).

Event No.	Display message and cause	Corrective measures
1	<p>&lt; Grid fault &gt;</p> <p>The grid voltage has over-stepped the permissible range. This error can have the following causes:</p> <ul style="list-style-type: none"> <li>The grid voltage at the connection point of the Sunny Boy is too high.</li> <li>The grid impedance at the connection point of the Sunny Boy is too high.</li> </ul> <p>For safety reasons, the Sunny Boy disconnects itself from the grid.</p>	<ul style="list-style-type: none"> <li>Check the grid voltage and the grid connection to the Sunny Boy.</li> </ul> <p>If the grid voltage lies outside the acceptable range because of local grid conditions, ask the grid operator if the voltage can be adjusted at the feed-in point or if he agrees to changes in the values of the monitored operational limits.</p> <p>If the grid voltage lies within the tolerance range, yet this error is still being displayed, contact the SMA Service Line.</p>
2	<p>&lt; Grid fault &gt;</p> <p>The grid voltage has fallen below the permissible range. This error can have the following causes:</p> <ul style="list-style-type: none"> <li>Grid disconnected</li> <li>AC cable damaged</li> <li>The grid voltage at the connection point of the Sunny Boy is too low.</li> </ul> <p>For safety reasons, the Sunny Boy disconnects itself from the grid.</p>	<ul style="list-style-type: none"> <li>Check for tripping of the line circuit breaker.</li> <li>Check the grid voltage and the grid connection to the Sunny Boy.</li> </ul> <p>If the grid voltage lies outside the acceptable range because of local grid conditions, ask the grid operator if the voltage can be adjusted at the feed-in point or if he agrees to changes in the values of the monitored operational limits.</p> <p>If the grid voltage lies within the tolerance range, yet this error is still being displayed, contact the SMA Service Line.</p>

Event No.	Display message and cause	Corrective measures
3	<p>&lt; Grid fault &gt;</p> <p>The average grid voltage over 10 minutes is no longer within the permissible range.</p> <p>This can have the following causes:</p> <ul style="list-style-type: none"> <li>• The grid voltage at the connection point of the Sunny Boy is too high.</li> <li>• The grid impedance at the connection point of the Sunny Boy is too high.</li> </ul> <p>The Sunny Boy disconnects from the grid to assure compliance with the voltage quality.</p>	<ul style="list-style-type: none"> <li>• Check the grid voltage at the connection point of the Sunny Boy.</li> </ul> <p>If due to local grid conditions the grid voltage exceeds the configured limiting value, ask the utility operator whether the voltage can be adjusted at the feed-in point, or whether he will agree to a modification of the limiting value for voltage quality monitoring.</p> <p>If the grid voltage is continually within the acceptable range, and this error is still displayed, contact the SMA Service Line.</p>
4	<p>&lt; Grid fault &gt;</p> <p>The Sunny Boy stop feeding in due to grid fault.</p>	<ul style="list-style-type: none"> <li>• Check the grid connection for strong, short-term frequency variations.</li> </ul>
5	<p>&lt; Grid fault &gt;</p> <p>The grid frequency is not within the permissible range. For safety reasons, the Sunny Boy disconnects itself from the grid.</p>	<ul style="list-style-type: none"> <li>• If possible, check the grid frequency and observe how often major deviations occur.</li> </ul> <p>If repeated frequency variations occur and as a result this error occurs, ask the grid operator if he agrees to a modification to the operating parameter.</p> <p>Discuss the proposed parameters with the SMA Service Line.</p>
6	<p>&lt; Grid fault &gt;</p> <p>The internal inverter monitoring has detected an impermissibly high proportion of direct current in the grid current.</p>	<ul style="list-style-type: none"> <li>• Check the grid connection for direct current.</li> <li>• If this is a recurrent phenomenon, check with the grid operator whether it is possible to raise the limiting value of monitoring.</li> </ul>

Event No.	Display message and cause	Corrective measures
7	<p>&lt; Frequency not permitted &gt;</p> <p>The grid frequency has left the allowable range. For safety reasons, the Sunny Boy disconnects itself from the grid.</p>	<ul style="list-style-type: none"> <li>• If possible, check the grid frequency and observe how often major deviations occur.</li> </ul> <p>If repeated frequency variations occur and as a result this error occurs, ask the grid operator if he agrees to a modification to the operating parameter.</p> <p>Discuss the proposed parameters with the SMA Service Line.</p>
8	<p>&lt; Wait for grid voltage &gt;</p> <p>&lt; Grid Failure &gt;</p> <p style="padding-left: 40px;">&lt; Check fuse &gt;</p>	<ul style="list-style-type: none"> <li>• Check fuse.</li> <li>• Check AC installation.</li> <li>• Check whether there is a general black-out.</li> </ul>
33	<p>&lt; Unstable operation &gt;</p> <p>The supply at the DC input of the Sunny Boy is not sufficient for a stable operation.</p>	<ul style="list-style-type: none"> <li>• Wait for higher sun irradiation.</li> <li>• If this event recurs at medium sun irradiation, check the PV plant design and correct connection of the PV array.</li> </ul>
34	<p>&lt; DC overvoltage &gt;</p> <p style="padding-left: 40px;">&lt; Disconnect the generator &gt;</p> <p>The DC input voltage is too high at the Sunny Boy.</p>	<ul style="list-style-type: none"> <li>• Immediately disconnect the Sunny Boy from the PV array, as described in section (see Section 8.1 "Disconnect the Sunny Boy from Voltage Sources", page 64). Otherwise the Sunny Boy can be destroyed.</li> <li>• Check the DC voltage of the strings for adherence to the maximum input voltage of the Sunny Boy, before you re-connect the Sunny Boy to the PV array.</li> </ul>

Event No.	Display message and cause	Corrective measures
35	<p>&lt; Isolation resistance &gt;</p> <p>The Sunny Boy has detected a ground fault in the PV array.</p>	<ul style="list-style-type: none"> <li>• Check the strings for ground faults, as described in section (see Section 11.1 "Checking the PV array for Ground Fault", page 88).</li> <li>• The installer of the PV array must remedy the ground faults before you re-connect the affected string.</li> <li>• Check the SMA Plug-in Grounding. The fuse may be cleared.</li> </ul>
38	<p>&lt; DC Overcurrent &gt;</p> <p>&lt; Check Generator &gt;</p> <p>An overcurrent condition occurs on the DC side of the Sunny Boy and the Sunny Boy switches off.</p>	<p>If this event occurs often:</p> <ul style="list-style-type: none"> <li>• Check the layout and the wiring of the PV array.</li> </ul>
39	<p>&lt; Wait for DC start conditions &gt;</p> <p>&lt; Start conditions not achieved &gt;</p> <p>The input power or the voltage of the PV modules is not sufficient for feeding into the grid.</p>	<ul style="list-style-type: none"> <li>• Wait for higher sun irradiation.</li> <li>• If this event recurs at medium sun irradiation, check the PV plant design and correct connection of the PV array.</li> </ul>
42	<p>Wrong earthing type.</p> <p>The SMA Plug-in Grounding is not installed with the correct polarity.</p>	<ul style="list-style-type: none"> <li>• Check the polarity of the SMA Plug-in Grounding and refer to the inverter setting of the grounding polarity parameter (positive or negative).</li> </ul>
60 - 64	<p>&lt; Self diagnosis &gt;</p> <p>&lt; Device Fault &gt;</p>	<ul style="list-style-type: none"> <li>• Contact the SMA Service Line (see Section 15 "Contact", page 108).</li> </ul>
65	<p>&lt; Self diagnosis &gt;</p> <p>&lt; Overtemperature &gt;</p> <p>Sunny Boy switches off due to too high temperature</p>	<ul style="list-style-type: none"> <li>• Ensure sufficient ventilation.</li> <li>• Check heat dissipation, as described in section (see Section 9.1 "Checking Heat Dissipation", page 69).</li> </ul>
66	<p>&lt; Self diagnosis &gt;</p> <p>&lt; Overload &gt;</p>	<ul style="list-style-type: none"> <li>• Contact the SMA Service Line (see Section 15 "Contact", page 108).</li> </ul>
67	<p>&lt; Communication disturbed &gt;</p> <p>A fault has occurred in the internal communication of the inverter. However, the Sunny Boy continues to feed in.</p>	<p>If this event occurs often:</p> <ul style="list-style-type: none"> <li>• Contact the SMA Service Line (see Section 15 "Contact", page 108).</li> </ul>

Event No.	Display message and cause	Corrective measures
68	< Self diagnosis > < Input A defective >	<ul style="list-style-type: none"> <li>Contact the SMA Service Line (see Section 15 "Contact", page 108).</li> </ul>
70	< Sensor fault fan on permanently >	<ul style="list-style-type: none"> <li>Contact the SMA Service Line (see Section 15 "Contact", page 108).</li> </ul>
71	< SD Card defective >	Re-format the SD card. Format the SD card with file system "FAT32". <ul style="list-style-type: none"> <li>Re-save the files to the SD card.</li> </ul>
	< Parameter file not found or defective >	<ul style="list-style-type: none"> <li>Copy the parameter file into the Carddrive:\PARASET directory.</li> </ul>
	< Parameter configuration unsuccessful >	<ul style="list-style-type: none"> <li>Check the parameters for valid values.</li> <li>Ensure change rights via Inst. Code.</li> </ul>
	< Update file defective >	<ul style="list-style-type: none"> <li>Re-format the SD card.</li> <li>Re-save the files to the SD card.</li> </ul>
	< No update file found >	<ul style="list-style-type: none"> <li>Copy the update file into the SD-Carddrive:\UPDATE directory.</li> </ul>
72	< Data cannot be saved > Internal device fault: however, the Sunny Boy continues to feed in.	<ul style="list-style-type: none"> <li>If this fault occurs often, contact the SMA Service Line (see Section 15 "Contact", page 108).</li> </ul>
73	< Main computer update not successful > Internal device fault.	<ul style="list-style-type: none"> <li>Contact the SMA Service Line (see Section 15 "Contact", page 108).</li> </ul>
	< Bluetooth update not successful > Internal device fault: however, the Sunny Boy continues to feed in.	<ul style="list-style-type: none"> <li>Re-try update.</li> <li>If this fault occurs again, contact the SMA Service Line (see Section 15 "Contact", page 108).</li> </ul>
	< Display update not successful > Internal device fault: however, the Sunny Boy continues to feed in.	
	< Language table update not successful > Internal device fault: however, the Sunny Boy continues to feed in.	
77	< Self diagnosis > < Device Fault >	<ul style="list-style-type: none"> <li>Contact the SMA Service Line (see Section 15 "Contact", page 108).</li> </ul>

Event No.	Display message and cause	Corrective measures
80	<p>&lt; Derating pending &gt;</p> <p>The delivered power of the Sunny Boy was reduced below nominal power due to a too-high temperature for more than 10 minutes.</p>	<p>If this event occurs often:</p> <ul style="list-style-type: none"> <li>• Ensure sufficient ventilation.</li> <li>• Check heat dissipation, as described in section (see Section 9.1 "Checking Heat Dissipation", page 69).</li> </ul>
90	<p>&lt; Inst.-Code invalid &gt;</p> <p>The Inst.-Code entered (personal installer password) is invalid.</p>	<ul style="list-style-type: none"> <li>• Enter the valid Inst.Code.</li> </ul>
	<p>&lt; Grid parameters locked &gt;</p> <p>The actual country data set is locked.</p>	<ul style="list-style-type: none"> <li>• Enter the valid Inst.Code for changing the country data set.</li> </ul>
	<p>&lt; Abort self test &gt;</p>	<ul style="list-style-type: none"> <li>• Contact the SMA Service Line (see Section 15 "Contact", page 108).</li> </ul>
	<p>&lt; Changes to the grid parameters not possible &gt;</p> <ul style="list-style-type: none"> <li>• The selected rotary switch setting for the country configuration is not programmed.</li> <li>• The parameters to be changed are protected.</li> </ul> <p>&lt; Ensure DC supply &gt;</p> <ul style="list-style-type: none"> <li>- The DC supply for the writing procedure is not sufficient.</li> </ul>	<ul style="list-style-type: none"> <li>• Check setting of the rotary switch (see Section 5.2.2 "Configuration for Bluetooth communication", page 33).</li> <li>• Enter the Inst.Code.</li> <li>• Ensure that sufficient DC voltage is available.</li> </ul>

# 11 Troubleshooting

## 11.1 Checking the PV array for Ground Fault

If the Sunny Boy displays the event number "35" (see Section 10.3 "Error Messages", page 82), then there is probably a ground fault in the PV array.

Check the strings for ground faults, as described in the following:

1. Disconnect the Sunny Boy from voltage sources (see Section 8.1 "Disconnect the Sunny Boy from Voltage Sources", page 64).
2. Open the SMA DC Disconnect (see Section 8.2 "Open SMA DC Disconnect", page 65).

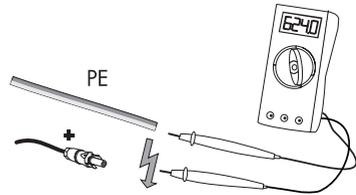
### NOTICE

**Excessive voltages can destroy measuring devices.**

- Only use measuring devices with a DC input voltage range up to at least 600 V.

3. Measure the voltages between the plus and minus pole for each string against the ground potential.

- If a voltage is found, then there is a ground fault in the corresponding string.



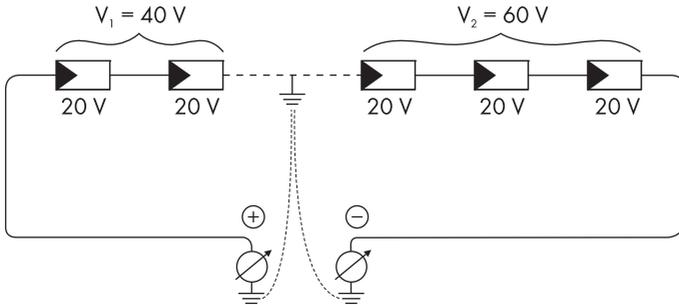
### **⚠ DANGER**

**Danger to life due to voltage in the PV array. Death or serious injuries.**

- Do not touch the frame of the PV array.
- Do not connect strings with ground faults to the Sunny Boy.
- Wait until no voltage can be measured.

You can determine the approximate position of the ground fault from the ratio of the measured voltages between plus against ground potential and minus against ground potential.

Example:



The ground fault is between the second and third module in this case.

### **⚠ WARNING**

**High voltages in the PV plant. Death or serious injury due to electric shock.**

- Only qualified personnel must carry out the installation of PV modules.

4. The installer must remedy the ground fault in the respective string.
5. Close the SMA DC-Disconnect (see Section 8.3 "Closing the SMA DC-Disconnect", page 66).
6. Commission the Sunny Boy (see Section 7 "Commissioning", page 62).
- The PV array has been checked for ground faults.

## 11.2 Correct Grounding Fuse Fault

Proceed as follows to correct the error < Ground fuse fault - check ground fuse >:

7. Disconnect the Sunny Boy from voltage sources (see Section 8.1 "Disconnect the Sunny Boy from Voltage Sources", page 64).
8. Open the SMA DC Disconnect (see Section 8.2 "Open SMA DC Disconnect", page 65).
9. Make a note of the type of generator grounding (" - " or " + ").
10. Remove the SMA Plug-in Grounding. Turn it in counterclockwise direction and then pull it down.
11. Check the PV array for a ground fault (see Section 11.1 "Checking the PV array for Ground Fault", page 88).
12. Close the SMA DC-Disconnect (see Section 8.3 "Closing the SMA DC-Disconnect", page 66).
13. Start operating the inverter **without** the SMA Plug-in Grounding, as described in section (see Section 7 "Commissioning", page 62).

- The inverter will now check, whether there is still a ground fault.
  - If the ground fault has been removed, the display shows < Insulation resist > as soon as the initial voltage has been reached.
  - If the ground fault still exists, the error message < Ground fuse fault > will remain on the display. In that case, repeat steps 3 and 4.
- 14. Disconnect the Sunny Boy from voltage sources (see Section 8.1 "Disconnect the Sunny Boy from Voltage Sources", page 64).
- 15. Open the SMA DC Disconnect (see Section 8.2 "Open SMA DC Disconnect", page 65).
- 16. Check the SMA Plug-in Grounding fuse and, if necessary, replace it as described in section (see Section 9.3.1 "Exchanging SMA Plug-in Grounding fuse", page 73).
- 17. Connect the fully operative SMA Plug-in Grounding to the inverter as described in section (see Section 6.6 "Installation of the SMA Plug-in Grounding", page 53).
- 18. Close the SMA DC-Disconnect (see Section 8.3 "Closing the SMA DC-Disconnect", page 66).
- 19. Start up the inverter again as described in section (see Section 7 "Commissioning", page 62) . In this process, the inverter checks whether the configured grounding type corresponds to the grounding type of the installed SMA Plug-in Grounding.
- After having been re-started, the inverter will start feeding into the grid again.

### 11.3 Correct the Grounding Type

Proceed as follows to remove the error < Wrong earthing type - check earthing set >:

1. Disconnect the Sunny Boy from voltage sources (see Section 8.1 "Disconnect the Sunny Boy from Voltage Sources", page 64).
  2. Open the SMA DC Disconnect (see Section 8.2 "Open SMA DC Disconnect", page 65).
  3. Connect a fully operative SMA Plug-in Grounding **with correct polarity** to the inverter as described in section (see Section 6.6 "Installation of the SMA Plug-in Grounding", page 53).
  4. Close the SMA DC-Disconnect (see Section 8.3 "Closing the SMA DC-Disconnect", page 66).
  5. Start up the inverter again as described in section (see Section 7 "Commissioning", page 62). In this process, the inverter will check whether the grounding type corresponds to the configured or learned grounding type.
- The error has been corrected and the inverter is feeding into the grid again.

### 11.4 Exchanging Grounding Fuse

Proceed as described in chapter (see Section 9.3.1 "Exchanging SMA Plug-in Grounding fuse", page 73).

### 11.5 AC fault

If the line circuit breaker installed at the Sunny Boy tripped out, check the varistors as described in section (see Section 9.4 "Inspecting and changing the varistors", page 79).

## 12 Decommissioning

### 12.1 Disassembling the Sunny Boy

#### Removing the connection of the Sunny Boy on the DC side

1. Disconnect the Sunny Boy from voltage sources (see Section 8.1 "Disconnect the Sunny Boy from Voltage Sources", page 64).
2. Open the SMA DC Disconnect (see Section 8.2 "Open SMA DC Disconnect", page 65).

#### **⚠ WARNING**

##### **High voltages inside the SMA DC-Disconnect.**

Death or serious injuries.

After opening the SMA DC-Disconnect there are still high voltages inside the SMA DC-Disconnect at the DC contacts of the DC terminal block and at the contacts of the DC switch.

- Do not touch contacts at the DC terminal block and on the DC switch.

#### **⚠ CAUTION**

##### **Danger of burn injuries due to hot enclosure parts.**

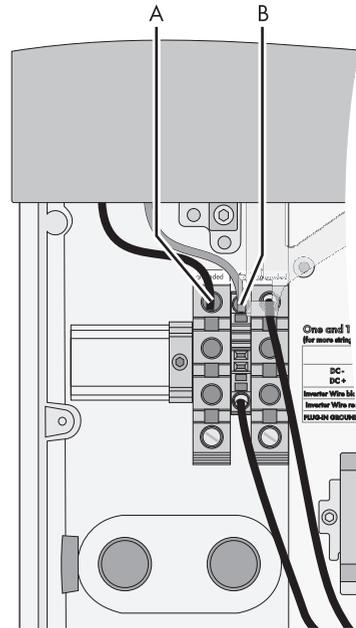
- Wait before disassembling until the enclosure has cooled down.



#### **Using DC Terminal blocks**

Disconnect the wires to the DC terminal block as described in section (see Section 12.7.2 "Disconnect wires from DC terminal block", page 101).

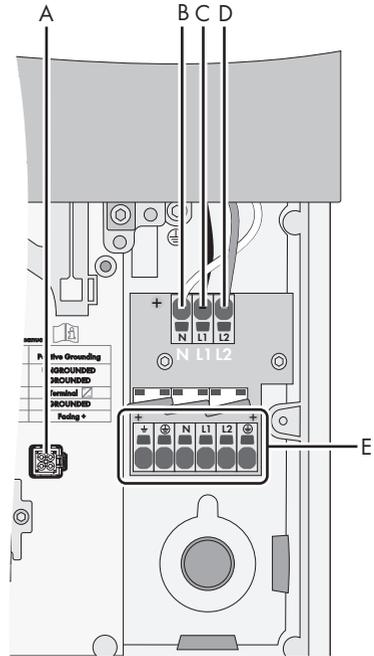
3. Remove the grounded DC wire of the Sunny Boy from the terminal (A).
4. Remove the ungrounded DC wire of the Sunny Boy from the terminal (B).



- The connection of the Sunny Boy on the DC side is removed.

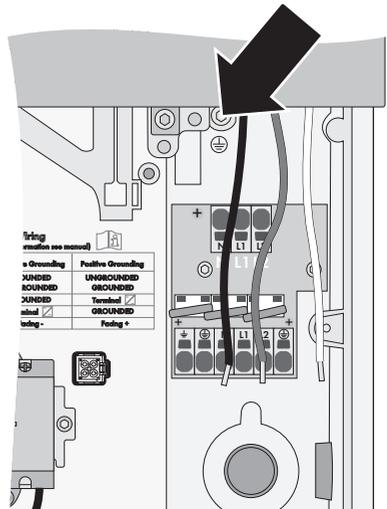
### Removing the connection of the Sunny Boy on the AC side

5. Remove the N wire of the Sunny Boy from the terminal (B).
6. Remove the L1 wire of the Sunny Boy from the terminal (C).
7. Remove the L2 wire of the Sunny Boy from the terminal (D).
8. Remove the grounding cables of the Sunny Boy and from the PV plant both AC- and DC-side from the terminal block (E).
9. Remove the plug of the fan from the socket (A).

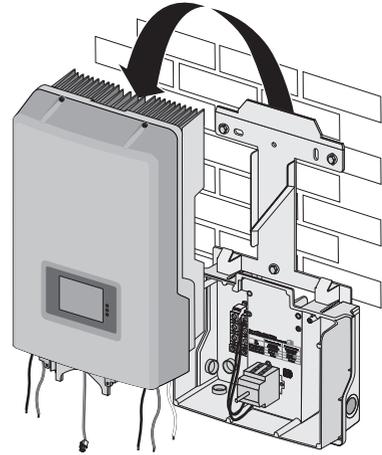


### Loosening the connection of the Sunny Boy with the SMA DC-Disconnect

10. Loosen the screw which is used for grounding of the SMA DC-Disconnect counterclockwise. Lay the screw to one side in such a way that it will not get lost.
  - The connection between Sunny Boy and SMA DC-Disconnect is removed.



11. Remove the Sunny Boy from the wall mounting bracket using both hands.



- The Sunny Boy is disassembled.

## 12.2 Disassembling SMA DC-Disconnect

### **⚠ WARNING**

#### **High voltages in the Sunny Boy.**

Death or serious injuries.

- Cover the solar modules.
- Switch off the AC load disconnection switch.
- Before dismantling the SMA DC-Disconnect ensure that the SMA DC-Disconnect is disconnected on both the AC and DC sides.

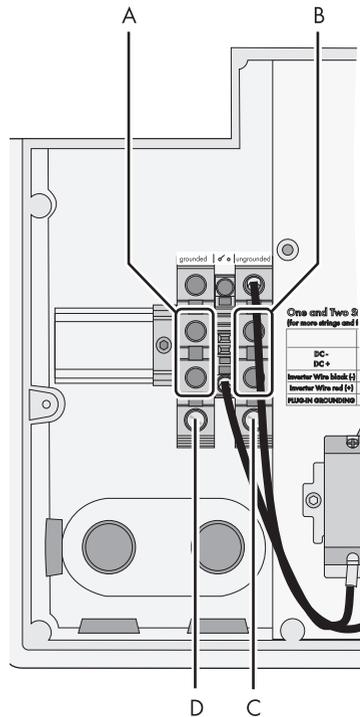
- i** Before you can dismantle the SMA DC-Disconnect, you must disassemble the Sunny Boy (see Section 12.1 "Disassembling the Sunny Boy", page 91).

## Removing cables of the PV plant from the DC side of the DC-Disconnect (without optional string fuses)

### Using DC-Terminal blocks

Disconnect the wires to the DC terminal block as described in section (see Section 12.7.2 "Disconnect wires from DC terminal block", page 101).

1. Remove cables of the PV strings from the terminals (A) and (B).
2. If the cables of the PV strings are connected to the screw clamps (C) and (D):
  - Loosen the screws of the screw clamps (C) and (D) counterclockwise.
  - Pull the cables from the screw clamps (C) and (D).
3. Pull the cables of the PV string, the grounding cable of the PV plant and the grounding cable of the ground rod through the opening of the SMA DC-Disconnect enclosure.



- The cables of the PV plant are removed from the DC side of the SMA DC-Disconnect.

## Removing cables of the PV strings from the DC side of the DC-Disconnect (with optional string fuses)

### **⚠ WARNING**

Danger of short circuit.

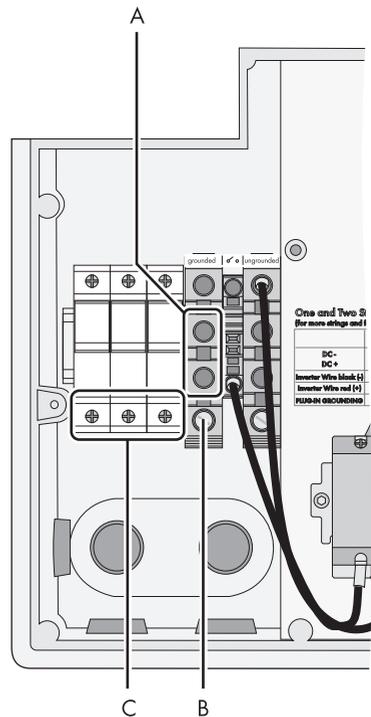
Voltage may be present at the DC cables of the PV plant.

- Do not short circuit the cables.
- Insulate the DC+ and DC- cable in such way, that they do not have contact.
- Pull out the cables out of the enclosure only after they have been separately insulated.

### **i** Using DC-Terminal blocks

Disconnect the wires to the AC-terminal block as described in section (see Section 12.7.3 "Disconnect wires from AC-terminal block", page 101).

1. Remove cables of the PV string from the terminals (A).
2. Remove the cables of the PV string connected to the screw clamps (B):
  - Loosen the screws of the screw clamps (B) counterclockwise.
  - Pull the cables from the screw clamps (B).
3. Remove the cables of the PV string connected to the screw clamps (C):
  - Loosen the screws of the screw clamps (C) counterclockwise.
  - Pull the cables from the screw clamps (C).
4. Pull the cables of the PV string, the grounding cable of the PV plant and the grounding cable of the ground rod through the opening of the SMA DC-Disconnect enclosure.

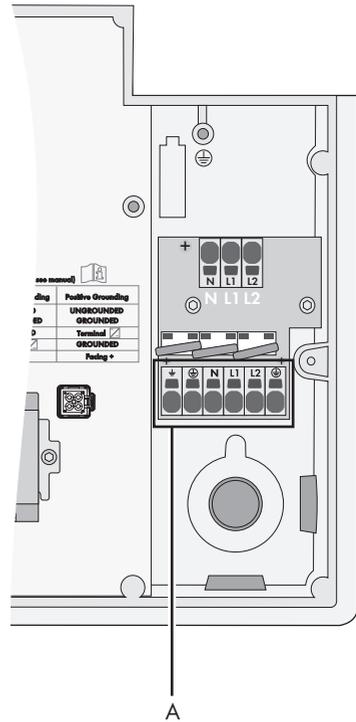


- The cables of the PV plant are removed from the DC side of the SMA DC-Disconnect.

## Removing cables of the power distribution grid from the AC side of the SMA DC-Disconnect

1. Remove cables of the power distribution grid from terminal block (A).

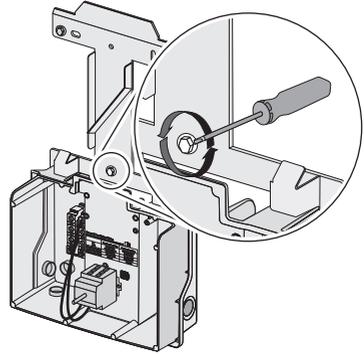
Pull the cables of the power distribution grid from the SMA DC-Disconnect enclosure.



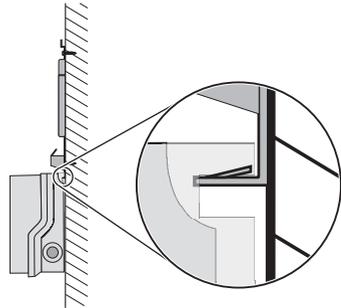
- The cables of the power distribution grid are removed from the AC side of the SMA DC-Disconnect.

## Disassembling the SMA DC-Disconnect enclosure

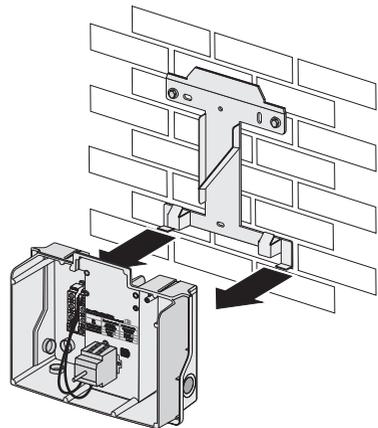
1. Loosen the screw at the bottom of the wallmounting bracket.



2. With both hands hold the SMA DC Disconnect slightly slanted and lift out of the wall mounting bracket.



3. Remove the SMA DC-Disconnect to the front.



- The SMA DC-Disconnect enclosure is disassembled.

## 12.3 Disassemble the Sunny Boy for Transport

In the event of a fault it can be that your Sunny Boy must be replaced. In this case you receive a replacement device with a transport lid.

1. Disassembling the Sunny Boy as described in section (see Section 12.1 "Disassembling the Sunny Boy", page 91).
2. Remove the SMA Plug-in Grounding. Turn it in counterclockwise direction and then pull it down.  
 The SMA Plug-in Grounding is loosened from its bracket.
3. Disassemble the Quick Module as described in section (see Section 5.5 "Disassembling the Quick Module", page 38).  
 The Sunny Boy is disassembled for transport. Pack the Sunny Boy for transport as described in section (see Section 12.4 "Packaging the Sunny Boy", page 99).

## 12.4 Packaging the Sunny Boy

If possible, always package the Sunny Boy in the original packaging. If it is no longer available, you can also use an equivalent box. The box must be completely closeable, have a handle system and made to support both the weight and size of the Sunny Boy.

## 12.5 Storing the Sunny Boy

Store the Sunny Boy in a dry place where ambient temperatures are always between -13 °F (-25 °C) and +140 °F (+60 °C).

## 12.6 Disposing of the Sunny Boy

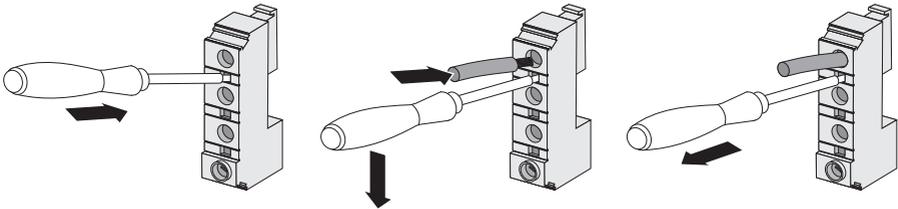
Dispose of the Sunny Boy at the end of its service life in accordance with the disposal regulations for electronic waste which apply at the installation location at that time. Alternatively, send it back to SMA with shipping paid by sender, and labeled "FOR DISPOSAL" (see Section 15 "Contact", page 108).

## 12.7 Supplementary Information

### 12.7.1 Connect wires to DC terminal block

Proceed as follows, in order to fix the wires into the terminals of the terminal block:

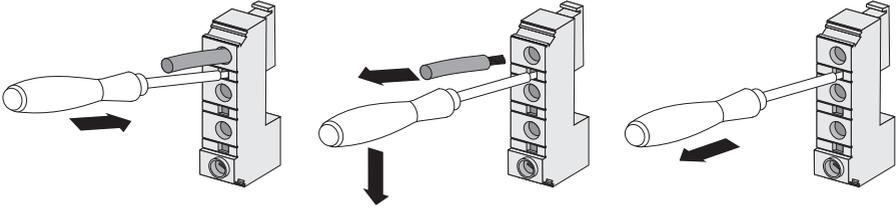
1. Strip the end of the wire to a length of  $\frac{1}{2}$  in. (12 mm).



2. Push an insulated screwdriver into the rectangular opening under the spring terminal, which should open.
3. Push the screwdriver down, and hold this position.
  - The spring terminal is open.
4. Lead the wire into the spring terminal.
5. Bring the screwdriver to its exit position and pull out of the rectangular opening.
6. Check for firm positioning of the wire in the spring terminal.
  - The wire is connected to the spring terminal.

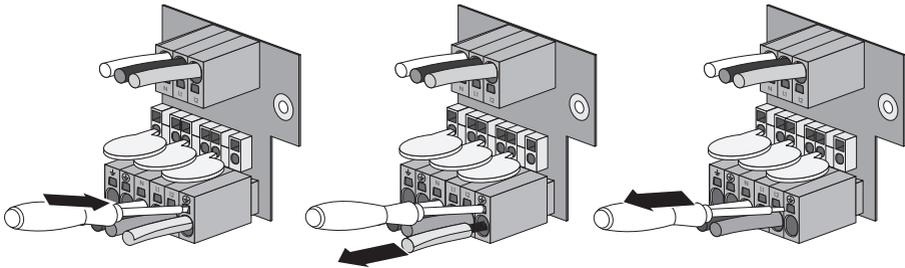
## 12.7.2 Disconnect wires from DC terminal block

Proceed as follows, in order to disconnect the wires from the terminals of the terminal block:



1. Push an insulated screw driver into the rectangular opening under the spring terminal, which should open.
2. Push the screwdriver down, and hold this position.
  - The spring terminal is open.
3. Remove the wire from the spring terminal.
4. Bring the screwdriver to its exit position and pull out of the rectangular opening.
  - The wire is removed from the spring terminal.

## 12.7.3 Disconnect wires from AC-terminal block



1. Strip the end of the wire to a length of  $\frac{5}{9}$  in. (14 mm).
2. Push an insulated screw driver into the rectangular opening under the spring terminal, which should open.
3. Push the screwdriver down, and hold this position.
  - The spring terminal is open.
4. Remove the wire from the spring terminal.
5. Bring the screwdriver to its exit position and pull out of the rectangular opening.
  - The wire is removed from the spring terminal.



## 13 Technical Data

PV array connection data		SB 2000HFUS-30	SB 2500HFUS-30	SB 3000HFUS-30
Max. input voltage, MPP	$U_{DC \text{ Max}}$	600 V*		
Input voltage range	$U_{PV}$	175 V to 480 V	220 V to 480 V	220 V to 480 V
PV start voltage, adjustable	$U_{PV \text{ Start}}$	220 V	220 V	220 V
Max. input current	$I_{PV \text{ Max}}$	15.0 A	15.0 A	15.0 A
Max. input power	$P_{DC}$	2 200 W	2 750 W	3 300 W
Number of MPP trackers		1		
Max. number of strings (parallel), extendable		2, 3		
Voltage ripple	$U_{pp}$	< 10 % of the input voltage		

\*The maximum open circuit voltage, which can occur at a cell temperature of 14°F (-10°C), must not exceed the maximum input voltage.

Power distribution grid connection (AC) data		SB 2000HFUS-30	SB 2500HFUS-30	SB 3000HFUS-30
AC nominal power	$P_{AC \text{ nom}}$	2 000 W	2 500 W	3 000 W
Max. AC power	$P_{AC \text{ max}}$	2 000 W	2 500 W	3 000 W
Rated output power, 220 V <sub>DC</sub> at 280 V <sub>AC</sub>	$P_{AC \text{ red}}$	2 300 W		
Rated output power, 480 V <sub>DC</sub> at 208 V <sub>AC</sub>	$P_{AC \text{ red}}$	2 400 W		
Nominal AC current at 240 V	$I_{AC \text{ nom}}$	8.3 A	10.4 A	12.5 A
Nominal AC current at 208 V	$I_{AC \text{ max}}$	9.6 A	12.0 A	14.4 A
Max. Branch Circuit overcurrent protection	$A_{AC \text{ max}}$	25 A		
Harmonic distortion of output current (at $K_{Ugrid} < 2\%$ , $P_{AC} < 0.5 P_{ACnom}$ )	$K_{IAC}$	< 4 %		
Nominal AC voltage	$U_{AC \text{ nom}}$	183 V to 229 V		
Operating range	$U_{AC}$	211 V to 264 V		
AC grid frequency	$f_{AC \text{ nom}}$	60 Hz/59.3 Hz to 60.6 Hz		
Operating range	$f_{AC}$			

Power distribution grid connection (AC) data		SB 2000HFUS-30	SB 2500HFUS-30	SB 3000HFUS-30
Power factor (at nominal AC power)	cos $\varphi$	1		
Overvoltage category		III		
Test surge voltage		4 kV		
Internal consumption at night		< 1 W		

General data	SB 2000HFUS-30	SB 2500HFUS-30	SB 3000HFUS-30
Dimensions, including DC-Disconnect (W x H x D)	13 <sup>3</sup> / <sub>4</sub> in x 28 <sup>5</sup> / <sub>8</sub> in x 7 <sup>1</sup> / <sub>4</sub> in (348 mm x 727 mm x 183 mm)		
Weight, including DC-Disconnect	approximately 50 <sup>3</sup> / <sub>4</sub> lb. (23 kg)		
Degree of protection	Electronics: NEMA 4X Connection area: NEMA 3R		
Operating temperature range	-13°F to +140°F (-25°C to +60°C)		
Max. operating altitude	6 560 ft. (3 000 m) above mean sea level		
Topology	HF-transformer		
Cooling concept	OptiCool	OptiCool	OptiCool
Noise emission (typical)	38 dBA	38 dBA	38 dBA
Conditions for full power output (class 4K4H)	Ambient temperature range: -13°F to +113°F (-25°C to +45°C) Ambient air humidity range: 0 to 100 % Ambient air pressure range: 79.5 kPa to 106 kPa		

Protective function DC side	SB 2000HFUS-30	SB 2500HFUS-30	SB 3000HFUS-30
Disconnection device	SMA DC-Disconnect		
Ground fault handling	GFDI		

<b>Protective function DC side</b>	<b>SB 2000HFUS-30</b>	<b>SB 2500HFUS-30</b>	<b>SB 3000HFUS-30</b>
DC reverse polarity protection	Via short-circuit diode		
Short-circuit protection	Current control		
All-pole disconnection unit on power distribution grid side	Automatic disconnection device		

<b>Communication interfaces</b>	<b>SB 2000HFUS-30</b>	<b>SB 2500HFUS-30</b>	<b>SB 3000HFUS-30</b>
Bluetooth	standard		
Quick Module 485QM (galvanically isolated)	optional		

<b>Efficiency</b>		<b>SB 2000HFUS-30</b>	<b>SB 2500HFUS-30</b>	<b>SB 3000HFUS-30</b>
CEC efficiency	$\eta_{\max}$	90 %	96.5 %	96.5 %

<b>Certificates</b>
UL 1741, UL 1998, IEEE 1547, CSA.22.107

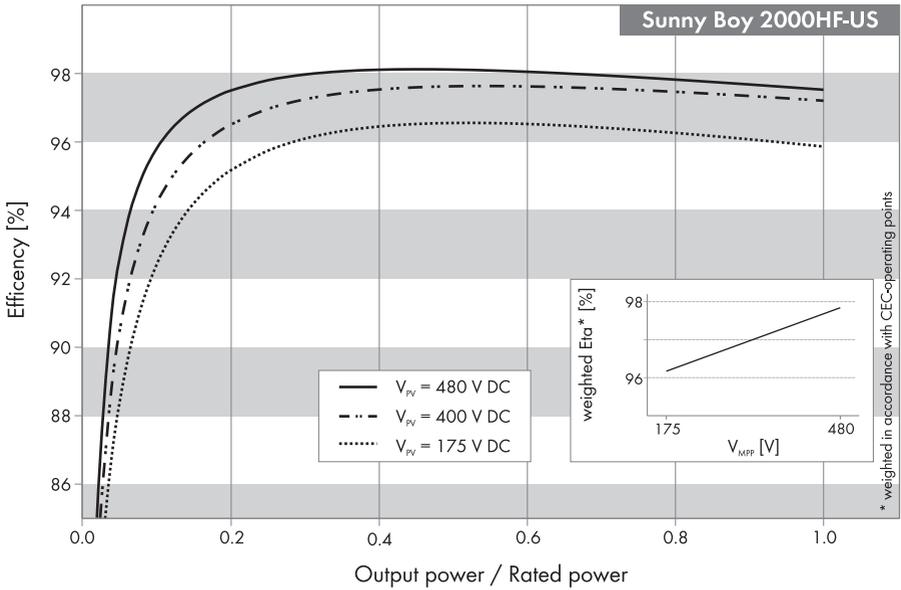
<b>Electromagnetic Compliance</b>
FCC, Part 15, Class A&B

## 13.1 Torque Values and Wire Sizes

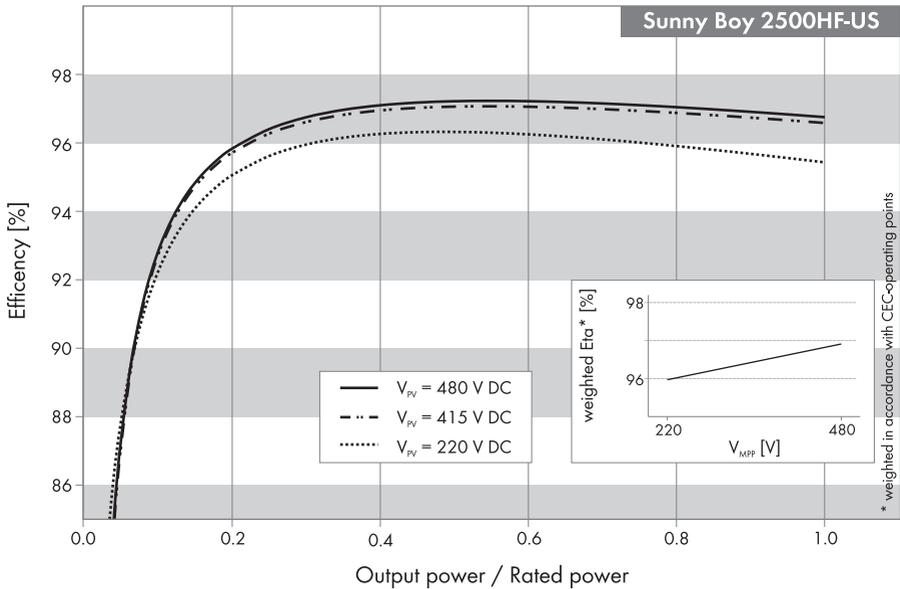
<b>Terminal</b>	<b>in-lb.</b>	<b>Nm</b>	<b>Wire Size</b>
Cage Clamp AC Terminal Blocks in DC Disconnect	–	–	AWG 12 ... 8
Screw Clamp DC Terminal Blocks in DC Disconnect	40	4.5	AWG 8 ... 2
Cage Clamp DC Terminal Blocks DC Disconnect	–	–	AWG 10 ... 8
Screws for fastening the Sunny Boy and the DC Disconnect	44	5	–
DC-Disconnect Lid Screws	26.5	3	–
Enclosure Lid Screws	53	6	–
Optional String Fuse Holder	19.5	2.2	AWG 10 ... 8

### 13.2 Efficiency curves

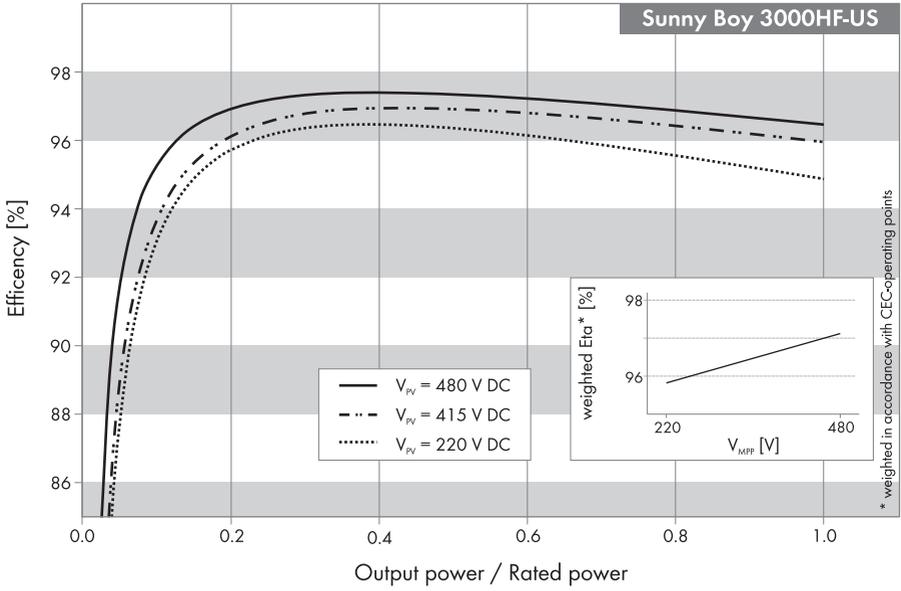
#### Sunny Boy 2000HF-US



#### Sunny Boy 2500HF-US



### Sunny Boy 3000HF-US



## 14 Accessories

You will find the corresponding accessories and replacement parts for your product in the following overview. If needed, you can order these from SMA or your dealer.

Name	SMA order number
Optional Quick Module 485QM with RS485 interface	485QMUS-10-NR
Optional Flush-Mount Kit for surface-flush installation	MOUNT KIT-10-NR
SMA Plug-in Grounding (stick) as replacement for positive or negative connection to ground	PLUGIN-GRDUS-10-NR
Spare fuse for grounding, set of 10 fuses 1A, 600V	KLKD-1
Optional string fuse kit, set of 3 holders with optional fuses (4, 5, 6, 8, 10, 12, 15, 20 A)	SB-SFK-US-10-NR
Optional string fuses, set of 10 Fuses listed to UL2579 under category JFGA, 600V DC, several sizes	PV-FUSE
Varistor	SB-VAC-US01

## 15 Contact

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

- Inverter type
- Serial number of the Sunny Boy
- Type and number of modules connected
- Event number or display message of the Sunny Boy
- Type of communication, if applicable
- Type of fault signaling contact connected, if applicable

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