



PV Inverter

SUNNY BOY 8000TL-US / 9000TL-US / 10000TL-US

Installation Guide



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IMPORTANT SAFETY INSTRUCTIONS

SAVE THESE INSTRUCTIONS

This manual contains important instructions for Sunny Boy 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 manual:



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 its documentation.



Electric arc hazards

The product has large electrical potential differences between its conductors. Arc flashes can occur through air when high-voltage current flows. Do not work on the product during operation.



Beware of hot surface

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

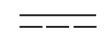


Observe the operating instructions

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



AC current



DC current



Transformerless



Earth Ground



UL1741 is the standard applied by Underwriters Laboratories to the Sunny Boy to certify that it meets the requirements of the *National Electrical Code*® 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.

General Warnings



General Warnings

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.

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

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

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

Wiring of the Sunny Boy must be made by qualified personnel only.

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1 Notes on this manual

1.1 Validity

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

- Sunny Boy 8000TL-US (SB 8000TL-US-10)
- Sunny Boy 9000TL-US (SB 9000TL-US-10)
- Sunny Boy 10000TL-US (SB 10000TL-US-10)

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

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 this device. Qualified personnel are trained to deal with the dangers and hazards involved in installing electric devices.

1.3 Storage of the manuals

Keep all Sunny Boy manuals in a convenient place for future reference.

1.4 Additional information

You will find further information on special topics in the download area at www.SMA-America.com.

1.5 Nomenclature

In this document SMA America Production, LLC is referred to in the following as SMA.

The syntax specified here for menus and parameters applies throughout the entire manual:

2 Safety

2.1 Appropriate Usage

The Sunny Boy is a PV inverter that converts DC current from PV generator into AC current. The Sunny Boy is suitable for mounting indoors and outdoors.

You can use the AC current generated as follows:

House grid:	Energy flows into the house grid. The consumers connected, for example, household devices or lighting, consume the energy. The energy left over is fed into the public grid. When the Sunny Boy is not generating any energy, e.g., at night, the consumers which are connected are supplied by the public grid. The Sunny Boy does not have its own energy meter. When energy is fed into the public grid, the energy meter spins backwards.
Public grid:	Energy is fed directly into the public grid. The Sunny Boy is connected to a separate energy meter. The energy produced is compensated at a rate depending on the electric power company.
Stand-alone grid:	The Sunny Boy is connected to a stand-alone grid. A stand-alone grid is a grid which is not connected to a public grid. The Sunny Boy needs a grid-forming generator, for example, a Sunny Island, in order to function. The energy generated is consumed directly on site, surplus energy can be stored in batteries.



Policies vary from one utility company to another. Consult with a representative of the local utility company before designing and installing a PV system.

Unbalanced load

The Sunny Boy inverters 8000TL-US, 9000TL-US and 10000TL-US generate a power exceeding 6 kVA. To prevent a situation of unbalanced loads between phases ensure that the inverters are installed in sets of 3, connected to L1-L2, L1-L3, and L2-L3.

AC and DC disconnectors

Separate the Sunny Boy securely from the grid and the PV generators using AC and DC disconnectors. You must provide an AC circuit breaker. The SMA DC Disconnect is included in the delivery of the Sunny Boy and must be used for operating the inverter.

Grounding the PV modules

The Sunny Boy 8000TL-US, 9000TL-US and 10000TL-US is a transformerless inverter. That is why it has no galvanic separation. Do not ground the DC circuits of the PV modules connected to the Sunny Boy. Only ground the mounting frame of the PV modules.

If you connect grounded modules to the Sunny Boy, the error message F-Riso is displayed.

During operation, the DC circuit is connected to the AC grid.

Fuses

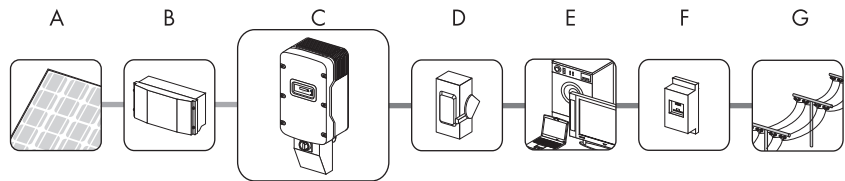
No string fuses are provided with the Sunny Boy or the SMA DC Disconnect.

In accordance to 2008 *National Electrical Code*® section 690.35 string fuses are required to protect the installation from reverse currents.

String fuses can be installed in the SMA Sunny Boy Combiner Box. Refer to the appropriate manual for detail information.

You can get more information about the Sunny Boy Combiner Box at www.SMA-America.com.

Principle of a PV plant with a Sunny Boy



Position	Description
A	PV modules
B	Sunny Boy Combiner Box
C	Sunny Boy with SMA DC Disconnect
D	AC load circuit breaker
E	Load
F	Energy meter
G	Utility grid

The Sunny Boy may only be operated with PV generators (modules and cabling) with protective insulation. Do not connect any sources of energy other than PV modules to the Sunny Boy.



Capacitive discharge currents

PV modules with large capacities relative to ground, such as thin-film modules with cells on a metallic substrate, are only to be implemented if their coupling capacity does not exceed 2 µF.

During grid feeding, a discharge current flows from the cells to ground. The amount of current depends on the manner in which the modules are installed (e.g. foil on metal roof) and on the weather (rain, snow). This "normal" discharge current may not exceed 50 mA due to the fact that the inverter would otherwise automatically disconnect from the grid as a protective measure.

PV plant design

When designing the PV plant, ensure that the values comply with the permitted operating range of all components at all times. The free design programs "Solar Design Tools" (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.



The Sunny Boy 8000TL-US, 9000TL-US and 10000TL-US is a transformerless inverter. That is why it has no galvanic separation.

- The PV modules must be rated for at least the maximum PV system voltage.

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.

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.
- Work on the Sunny Boy may only be carried out as described in this manual.
- Observe all safety instructions listed on the Sunny Boy, in this manual and of all components of the PV plant.



WARNING

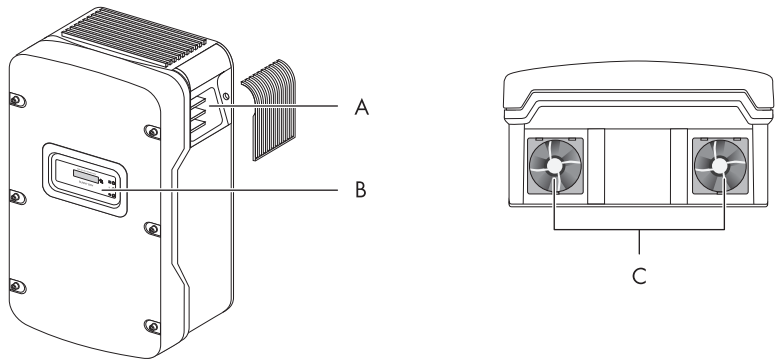
The Sunny Boy becomes hot during operation.

Risk of burn.

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

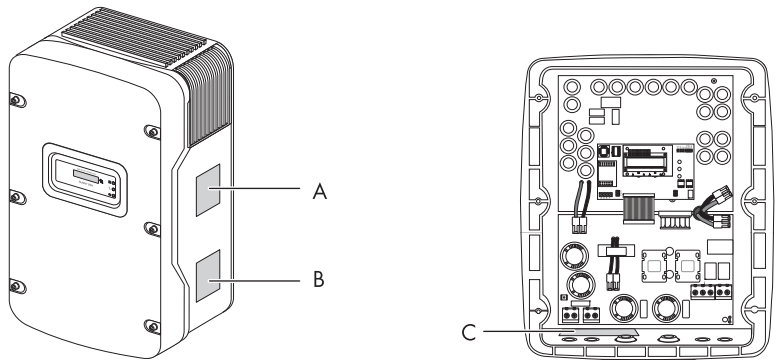
3 The Sunny Boy

3.1 Parts of the Sunny Boy



Position	Description
A	Ergonomic handles
B	Display
C	Fans

3.2 Position of the Labels



Position	Description
A	Type label
B	General warning label
C	Warning label DC connection

3.3 Identifying the Sunny Boy

You can identify the Sunny Boy by the type label. It is on the right side of the enclosure.

The type label shows:

- The serial number (Serial No.).
- The type of product (Type/Model).
- Device-specific characteristics.



SUNNY BOY

Model
SB xxxxxxxx

Serial No.
XXXXXXXXXXXX

Date of manufacture **xx/xxxx**

Max. continuous output Power* xxxxx Wac		
Operating voltage range (Vac)*		
MIN xxx	NOMINAL xxx	MAX xxx
Operating frequency range (Hz)*		
MIN xx.x	NOMINAL xx.x	MAX xx.x
Max. continuous output current* xx Aac		
Output power factor x		
Range of input operating voltage xxx-xxx Vdc		
MPPT Range of input operating DC voltage* xxx-xxx Vdc		
Max. operating current xx Adc		
This unit contains a Residual Current Monitor, Isolation Monitor and Interrupteur		
ENCLOSURE Type 3R (IP54)		
*For more details and for tightening torque, allowable wire size and type see the Operator's Manual		

Section 1 of 2

 **US LISTED**
Utility interactive inverter
LISTED UL 1741 36AN

Utility Interactive 1-Phase Inverter

 Tested To Comply With FCC Standards
FOR HOME AND OFFICE USE





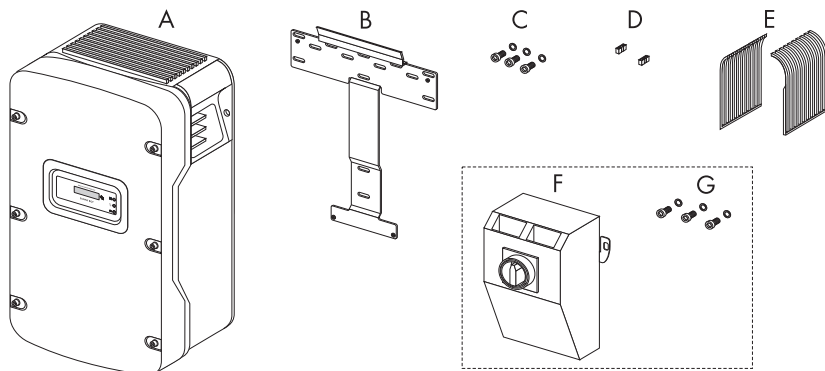


4 Unpacking and inspection

All Sunny Boy inverters are checked before shipping and packaged in sturdy boxes. However the sturdy boxes do not guarantee that damage will not occur during shipping and delivery.

It is important to carefully inspect the shipping box and contents prior to installation. If you detect any external damage after unpacking, report the damage immediately to your SMA dealer and to the shipping company that delivered the unit. If it becomes necessary to return the Sunny Boy, use the original packing material.

4.1 Scope of delivery



Position	Number	Description
A	1	Sunny Boy
B	1	Wall-mounting bracket
C	1	Spare screw and spare washer for closing the Sunny Boy lid
	2	Screws and washers for fastening the Sunny Boy to the wall-mounting bracket
D	2	Spare jumpers for fan test
E	2	Handle covers (left and right)
F	1	SMA DC Disconnect (type DC-DisconTL-US-10)
G	1	Screw and washer for closing the DC Disconnect lid
	2	Screws and washers for fastening the DC Disconnect to the wall-mounting bracket



If not ordered differently, the SMA Sunny Boy Combiner Box is included in the scope of delivery as a standard feature. Refer to the appropriate manual for detail information.

5 Mounting

5.1 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 avoiding this during the development.

Do not install the inverter:

- on flammable construction materials,
- in areas where highly flammable materials are stored,
- in potentially explosive areas.



WARNING

The Sunny Boy becomes hot during operation.

Burn injuries will occur when touching the enclosure.

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



CAUTION

Falling of the Sunny Boy may cause injuries.

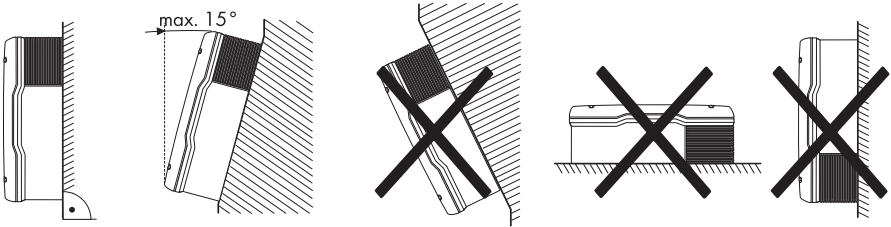
Crushing of body parts will result.

- Take the weight of the Sunny Boy of approximately 77 lbs. (35 kg) into account when mounting.

5.2 Selecting the mounting location

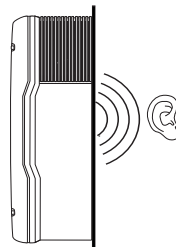
Observe the following conditions during installation:

- The installation method and mounting location must be suitable for the weight and dimensions of the Sunny Boy (see section 12 "Technical data" (page 60)).
- Take the dimensions of the DC Disconnect into account (Page 25).
- Mount on a solid surface.
- The mounting location must be accessible at all times.



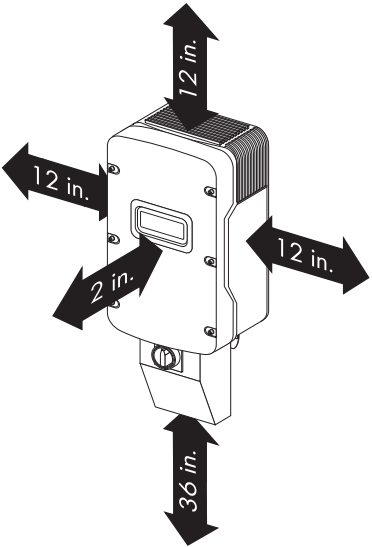
- Vertical installation or tilted backwards by max. 15°.
- The connection area must point downwards.
- Never install the device with a forward tilt.
- Do not install horizontally.
- Install at eye level to allow operating status to be read at all times.
- The ambient temperature must be below 113 °F (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 emit noises when in use which can be regarded as a nuisance.



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

Position	Clearance
Above	12 in. (30 cm)
Below	36 in. (90 cm)
Left	12 in. (30 cm)
Right	12 in. (30 cm)
Front	2 in. (5 cm)



Multiple Sunny Boy units installed in areas with high ambient temperatures

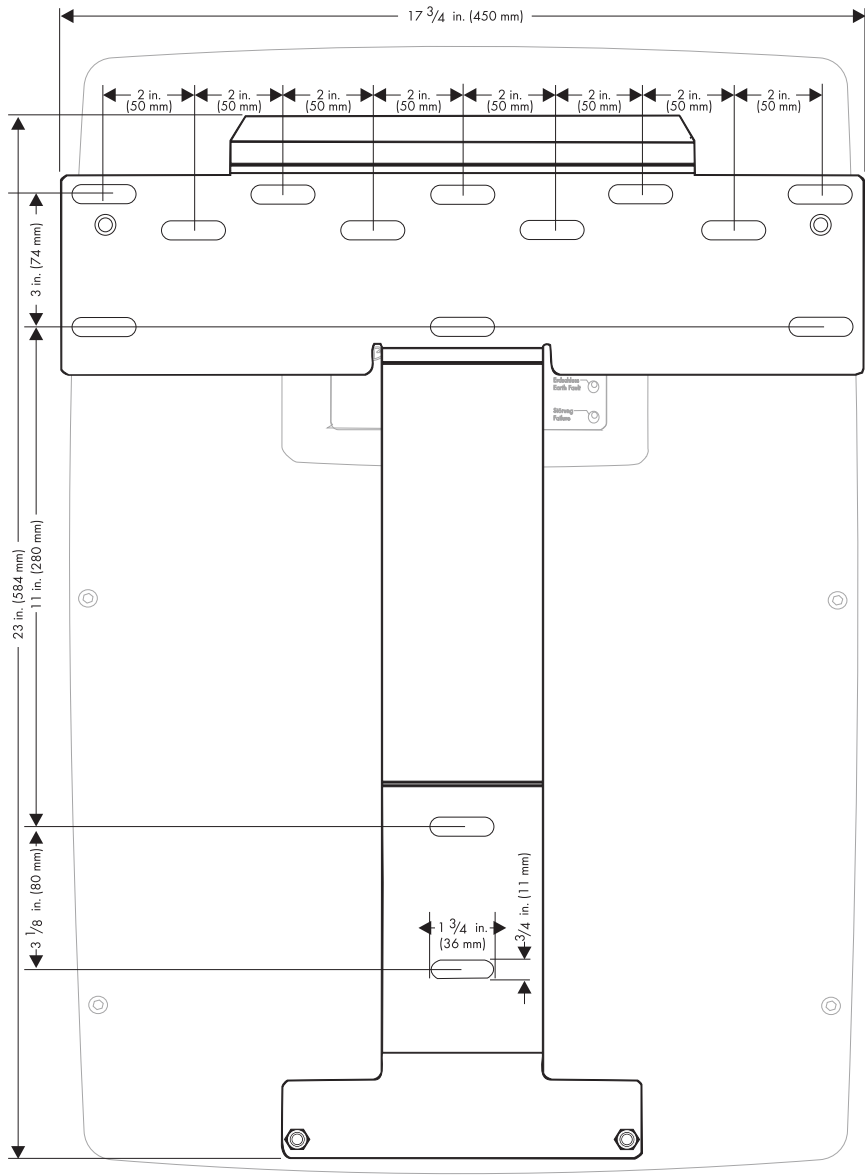
The individual Sunny Boy units must be far enough apart to ensure that the individual Sunny Boy units do not take in the cooling air of the neighboring unit.

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

5.3 Mounting the Sunny Boy with the wall mounting bracket

The Sunny Boy is shipped with a T-shaped wall-mounting bracket that is suitable for use with most walls. The horizontal part of the bracket has 12 holes. Make sure that the wall you choose to mount the Sunny Boy on is plumb and sturdy enough to support the weight over a long period of time. Be sure to use the appropriate type of mounting hardware for the wall material. Ensure that the hardware is no smaller than 1/4 in.

Dimensions of the wall mounting bracket



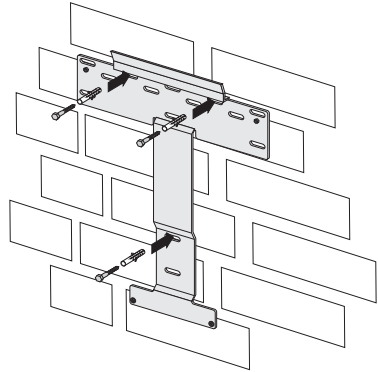
5.3.1 Possibilities for mounting the wall mounting bracket

Mounting on stone wall

Attach 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.
- 1 screw on the upper right side.
- 1 screw below.

Mount the wall mounting bracket as described in section 5.3.2 "Mounting the wall mounting bracket" (page 23).

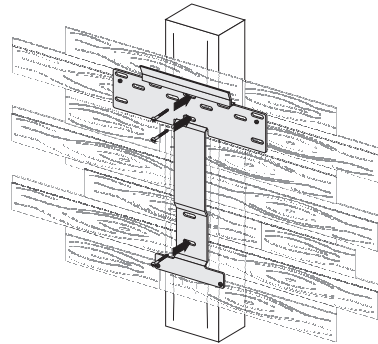


Mounting on a wooden wall with a stud or on a pillar

Attach the wall mounting bracket with 3 screws. The position of the screws on the wall mounting bracket is as follows:

- 2 screws on the upper middle.
- 1 screw below.

Mount the wall mounting bracket as described in section 5.3.2 "Mounting the wall mounting bracket" (page 23).



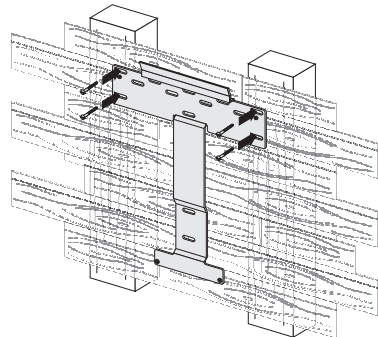
Mounting on a wooden wall with two studs

Attach the wall mounting bracket with 4 screws. The position of the screws on the wall mounting bracket is as follows:

- 2 screws on the upper left side.
- 2 screws on the upper right side.

Use the four external mounting screws on the left and right sides of the wall mounting bracket.

Mount the wall mounting bracket as described in section 5.3.2 "Mounting the wall mounting bracket" (page 23).



5.3.2 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 with the display at eye-level.
2. Place a level on the top edge of the bracket. Adjust the position until it is leveled. The bottom of the bracket will be the approximate location of the bottom of the inverter.



DANGER

Risk of electric shock by drilling into power cables.

Death or serious injuries will result.

- Before drilling, check installation location for power cables.



CAUTION

Falling of the Sunny Boy may cause injuries.

Crushing of body parts will result.

- Ensure that there are studs in the wall where you intend to drill holes.

3. Use the wall-mounting bracket as a template. Mark the wall through at least three holes in horizontal or vertical position of the bracket (see chapter 5.3.1 "Possibilities for mounting the wall mounting bracket" (page 22)).
4. Remove the bracket and drill holes at the marks.
5. Insert wall anchors into the drill holes.



CAUTION

Falling of the Sunny Boy may cause injuries.

Crushing of body parts will result.

- Do not use molly or toggle bolts to mount the Sunny Boy to sheet rock or panelling.

**Tip for installing**

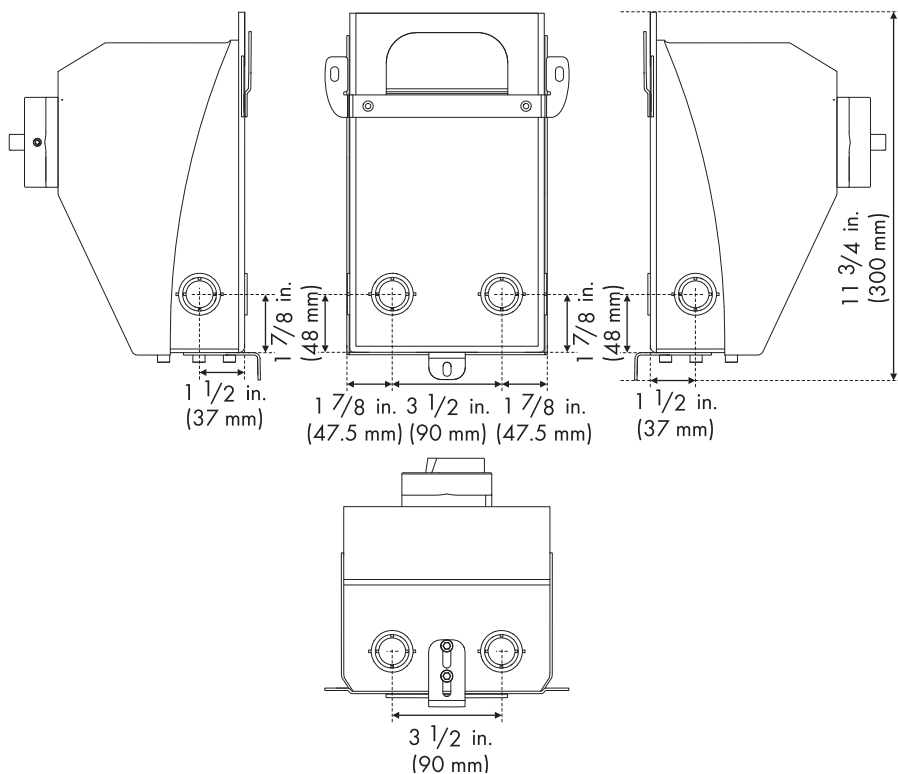
The diameter of the holes you drill must match the hardware you are using to mount the Sunny Boy.

For example, if you are mounting the Sunny Boy to a concrete wall, the hole diameter should 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 $1\frac{1}{2}$ in.

6. Insert the screws through the holes in the wall mounting bracket and into the drill holes.
 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.

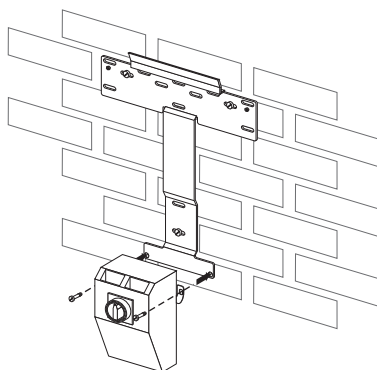
5.4 Mounting the SMA DC Disconnect

Dimensions of the SMA DC Disconnect



Attach the SMA DC Disconnect to the two lower holes of the wall-mounting bracket, using two screws and washers provided.

1. Place the screws and the washers in the holes in the fastening tabs on the DC Disconnect. The teeth on the washers must lie against the fastening tabs of the DC Disconnect.
 2. Place the SMA DC Disconnect against the wall mounting bracket.
 3. Tighten the screws with 44 in-lbs (5 Nm) torque.
- ☒ The SMA DC Disconnect is mounted.



5.5 Mounting the Sunny Boy onto the wall mounting bracket



CAUTION

Falling of the Sunny Boy may cause injuries. Crushing of body parts will result.

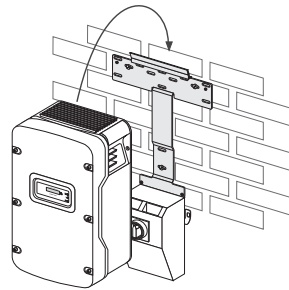
- Take the weight of the Sunny Boy into account when mounting.

1. Remove the handle covers on the right and left side of the Sunny Boy.
2. Transport the Sunny Boy between two persons, using the side handles above and below.

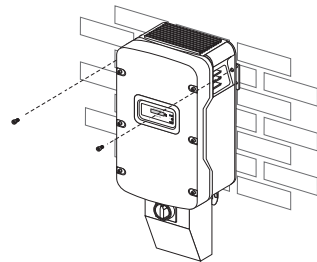
or

Put a steel bar with a maximum diameter of $1 \frac{1}{8}$ in (30 mm) through the enclosure opening above and transport it between two people.

3. Hook the Sunny Boy using the enclosure opening in the back plate into the wall bracket.
4. Inspect the Sunny Boy from both sides to ensure that it sits centered on the wall bracket.



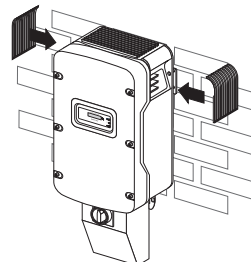
5. Screw the Sunny Boy onto the wall mounting bracket on both sides using the screws provided.
6. Tighten the screws clockwise with a torque of 44 in-lbs. (5 Nm).
7. Check that the unit is securely in place.



8. Put the handle covers over the handles.
The air grills are marked "rechts/right" and "links/left" on the interior for proper assignment.

The air grills prevent dirt and insects from entering the device and if necessary, can be reordered from SMA America 13 "Accessories" (page 70).

- ☒ The Sunny Boy is mounted.



6 Electrical Connection

6.1 Safety

NOTICE

Ingress of water when mounting and installing the Sunny Boy.

Damage to the Sunny Boy will result.

- Do not open the Sunny Boy when it is raining or when high humidity is present (> 95 %).

NOTICE

Touching the components can result in electrostatic discharges.

Damage to components will result.

- Ground yourself before touching a component.



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.

AC grounding

The Sunny Boy must be connected to the AC ground from the utility via the Ground Terminal (PE) (see 6.4 "Sunny Boy connection area overview" (page 30)).

PV grounding

The PV array (frame) ground must be connected to the grounding electrode terminal (see 6.4 "Sunny Boy connection area overview" (page 30)). The size for the conductor is usually based on the size of the largest conductor in the DC system.

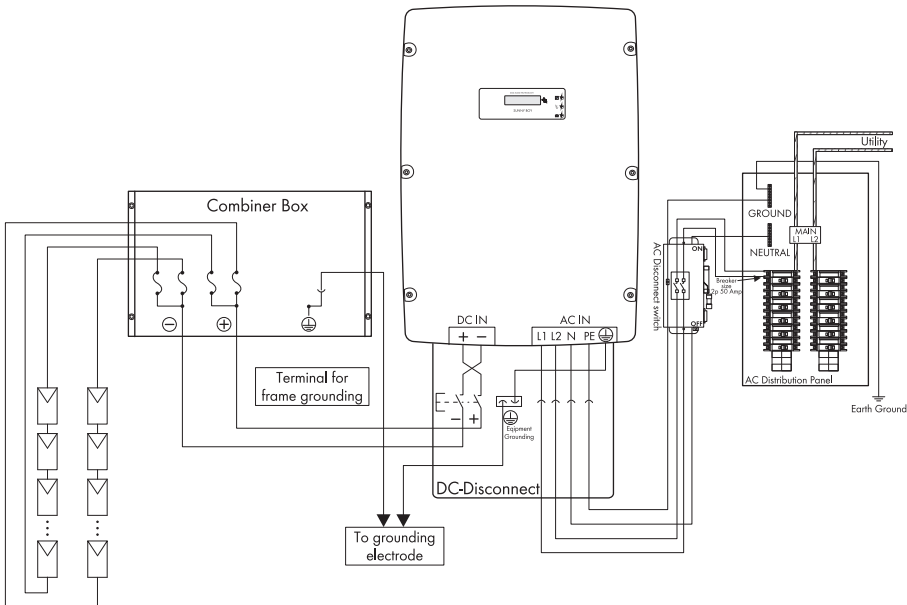
DC grounding electrode conductor

A DC grounding electrode conductor may be required by the Authority Having Jurisdiction (AHJ). Use the PV grounding and DC grounding electrode conductor terminal (see 6.4 "Sunny Boy connection area overview" (page 30)).

6.2 Wiring Diagram with SMA DC Disconnect and Combiner Box



For operating the Sunny Boy the provided SMA DC Disconnect must be used.



6.3 Insert the cable into the SMA DC Disconnect

NOTICE

Ingress of water when mounting and installing the Sunny Boy.

Damage to the Sunny Boy will result.

- For conduit hubs, use only UL Listed rainproof, or wet location hubs complying with UL 514B for entry into the enclosure.

Inserting the cable into the SMA DC Disconnect

1. Open the SMA DC Disconnect (see chapter 8.3 "Opening SMA DC Disconnect" (page 50)).
2. Break out the knockouts for the AC and DC cables. Use separate cable conduits for the AC and the DC cables.

NOTICE

Damage to the SMA DC Disconnect due to enlargement of the knockout holes.

- Do not enlarge the knockout holes. The knockout holes are intended for the installation of inflexible cable conduits of a size of up to 1 in. (25.4 mm).

3. Insert the cable conduit fittings into the knockout holes.
4. Pull the cable conduits into the fittings and tighten them.



DANGER

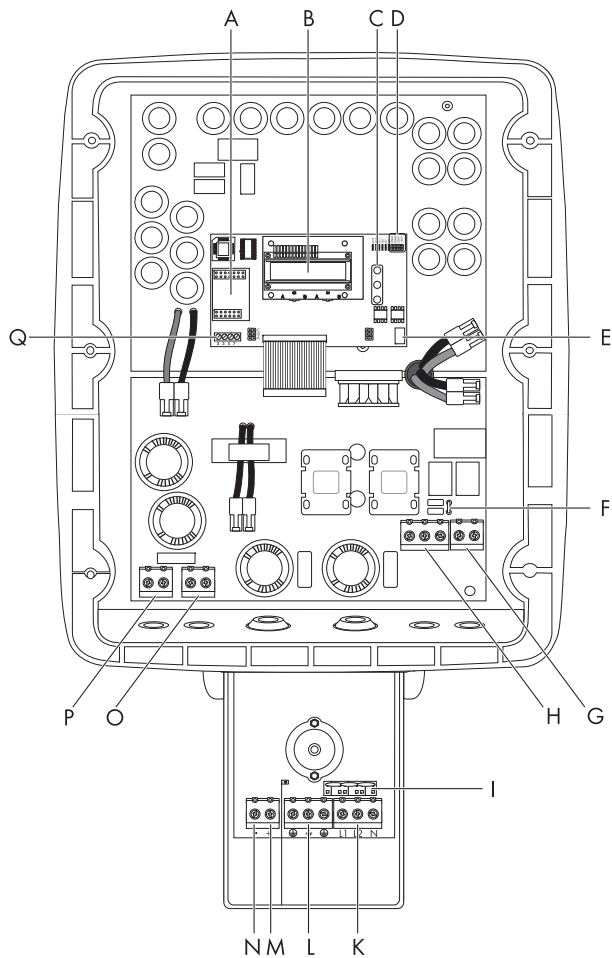
High voltages are present on the AC and DC cables.

Death or serious injuries due to touching the voltage-conducting cables.

5. Turn off the main switch in the switch cabinet.
 6. Cover the PV modules with opaque material.
 7. Pull the AC and DC cables through the cable conduits into the SMA DC Disconnect.
- ☒ The cables are inserted into the SMA DC Disconnect.

6.4 Sunny Boy connection area overview

In the following overview illustration there is a schematic representation of the connection area of an open Sunny Boy with SMA DC Disconnect.



Position	Description
A	Socket for optional communication Piggy-Back (RS485 or wireless)
B	Display
C	Status LEDs
D	Jumper position for verifying the operation of the fans
E	Power Balancer terminal
F	Flat connection for grounding the cable shield for communication
G	Sunny Boy: Ground terminal (PE)
H	Sunny Boy: Output AC line terminals (N, L1 and L2)
I	Varistor terminal with varistors
K	SMA DC Disconnect: Output AC line terminals (N, L1 and L2)
L	SMA DC Disconnect: Grounding electrode terminal for the connection of: • Grounding electrode conductor • DC equipment grounding • AC equipment grounding
M	SMA DC Disconnect: DC+ terminal
N	SMA DC Disconnect: DC – terminal
O	Sunny Boy: DC – terminal
P	Sunny Boy: DC+ terminal
Q	Terminal for optional communication (RS485)

6.5 AC connection

NOTICE

Danger of fire

Overvoltage may cause cable fire.

- Overcurrent protection for the AC output circuit must be provided in the electrical installation.
- The size of the overcurrent protection must be maximum 60 A.

6.5.1 AC cable requirements

Cable sizing

Use the free design programs "Solar Design Tools" at www.SMA-America.com to determine the correct string configuration.



Connection requirements of the utility operator

Always observe the connection requirements of your grid operator.

The maximum cable lengths relative to the conductor cross-section are shown in the following table.

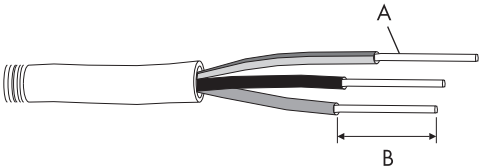
Conductor cross-section	Maximum cable length		
	SB 8000TL-US	SB 9000TL-US	SB 10000TL-US
2 AWG (35 mm²), 194 °F (90 °C) copper cable	184 ft (56 m)	164 ft (50 m)	148 ft (45 m)
4 AWG (25 mm²), 194 °F (90 °C) copper cable	115 ft (35 m)	103 ft (31 m)	92 ft (28 m)
6 AWG (16 mm²), 194 °F (90 °C) copper cable	72 ft (22 m)	65 ft (20 m)	58 ft (18 m)



Use only solid or stranded wire but not fine stranded wire.

- Ambient temperature
 - Routing method
- The higher the ambient temperature, the higher are the power losses. Use cables with a large cross-section at installations with high ambient temperatures.

The cables heat up during operation. If there are several cables in a cable conduit, the temperature of all cables increases. Use cables with a large cross-section if you lay several cables in one cable conduit.



Position	Name	Value
A	Coductor cross-section	6 ... 2 AWG (16 ... 35 mm²)
B	Strip insulation	3/4 in. (18 mm)

Load disconnection unit

You must install a separate line circuit breaker for each inverter in order to ensure that the inverter can be securely disconnected under load. See the technical data for the maximal permissible rating (Page 60).



DANGER

Risk of fire due to improper wiring.

Death or serious burn injuries will result.

When more than one inverter is connected to the same line circuit breaker, the protective function of the line circuit breaker is no longer guaranteed.

- Do not connect more than 1 inverter to each line circuit breaker.
- When selecting the circuit breaker comply with the maximum permissible fuse protection of the inverter.

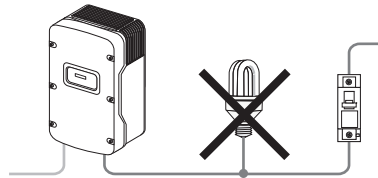


DANGER

Risk of fire due to overcurrent.

Death or serious burn injuries will result.

When a Sunny Boy and a consumer are connected to the same line circuit breaker, the protective function of the line circuit breaker is no longer guaranteed. The current from the Sunny Boy and the grid can add up to overcurrent which is not detected by the line circuit breaker.



- Do not connect loads between the Sunny Boy and the line circuit breaker without protection.
- Always install separate fuses for loads.

NOTICE

Damage to the Sunny Boy by using screw type fuse elements as a load disconnection unit.

A screw type fuse element is not a load disconnection device, and thus must not be used as a load disconnection unit. A screw type fuse element is only used as cable protection.

When disconnecting under load using a screw type fuse element, the Sunny Boy can be damaged.

- Only use a load disconnecting switch or a line circuit breaker as a load disconnecting unit.

6.5.2 Connect the AC cable in the DC Disconnect

1. Open all AC and DC circuit breakers or load-disconnecting switches.
2. Open the main fuse in the fuse box.
3. Remove the screws on the fuse box cover.
4. Remove the fuse box cover toward the front.
5. Ensure that there is no voltage between the fuse output and the ground bar. Use a multimeter. The voltage must be 0 V.
6. Break out a 1 in. (25.4 mm) knockout from the underside of the fuse box.
7. Lay a cable conduit from the fuse box to the DC Disconnect (see chapter 6.3 "Insert the cable into the SMA DC Disconnect" (page 29)).
8. Place the cover back onto the fuse box.
9. Tighten the screws.
10. Open the DC Disconnect as described in section 8.3 "Opening SMA DC Disconnect" (page 50).
11. Lead the AC cable through the cable conduit from the inside of the fuse box into the inside of the DC Disconnect.

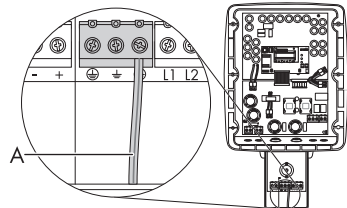


CAUTION

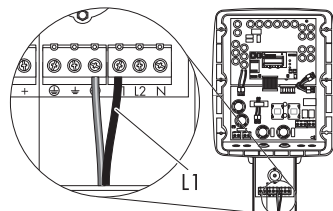
Ground faults, unreliable and resistive connections due to faulty wire nuts.

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

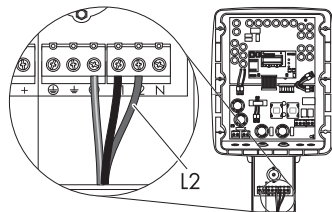
12. Open the screw terminals completely by turning the screws counterclockwise with a flat-head screwdriver.
13. Connect the AC equipment-ground wire (A) to the PE terminal labeled  in the SMA DC Disconnect.



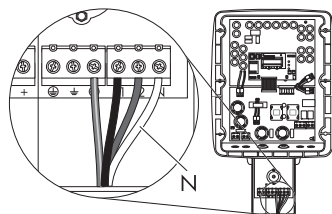
14. Connect the L1 (AC line 1) wire to the terminal labeled L1 in the SMA DC Disconnect.



15. Connect the L2 (AC line 2) wire to the terminal labeled L2 in the SMA DC Disconnect.



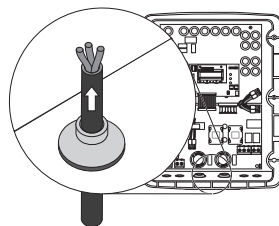
16. Connect the N (AC line N) wire to the terminal labeled N in the SMA DC Disconnect.



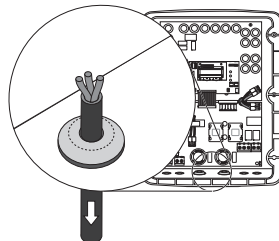
17. Connect the wires to the terminal blocks in the SMA DC Disconnect and tighten to a torque of 40 in-lbs. (4.5 Nm).
 18. Verify that all connections are correctly wired and properly torqued. Pull on the cable in order to make sure that it is sufficiently fixed in the terminal.
- ☒ The AC cables are now connected in the SMA DC Disconnect.

6.5.3 Connecting the AC cable in the Sunny Boy

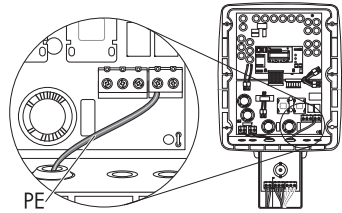
1. Open the Sunny Boy as described in section 8.1 "Opening the Sunny Boy" (page 48).
2. Push the cable through a grommet into the Sunny Boy in order to pierce the grommet. Do not use sharp tools to open the grommet.



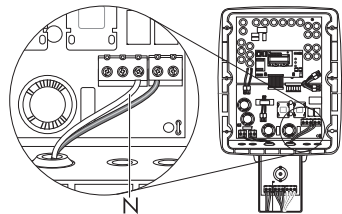
3. Pull the cable slightly back in order to seal the grommet.



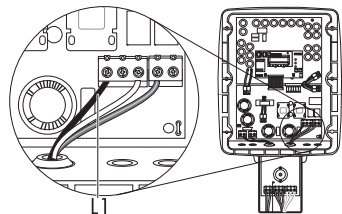
4. Connect the green/yellow cable to the terminal labeled: 



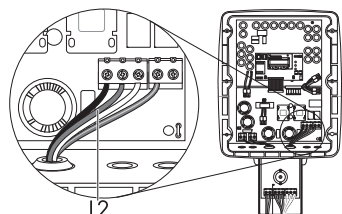
5. Connect the white wire of the SMA DC Disconnect to the terminal labeled N.



6. Connect the black wire of the SMA DC Disconnect to the terminal labeled L1 of the Sunny Boy.



7. Connect the red wire to the terminal labeled L2 in the Sunny Boy.

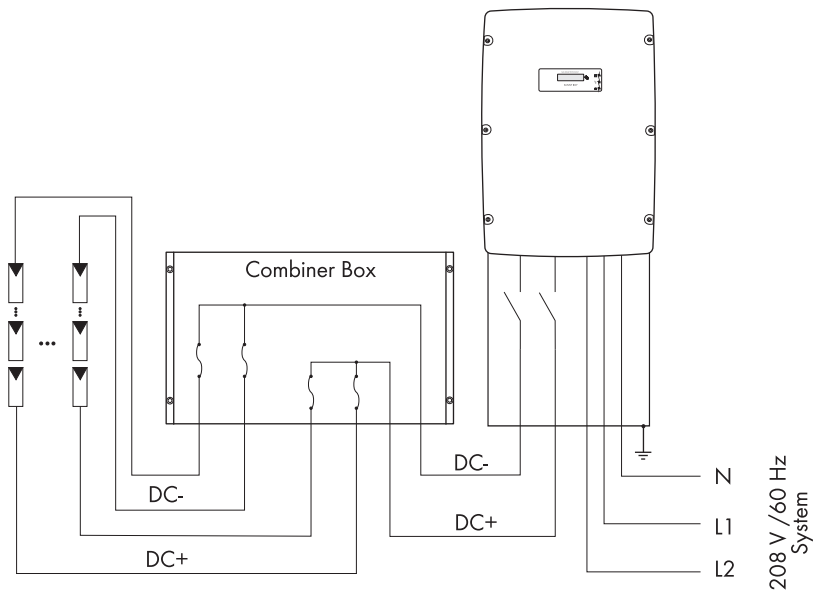


8. Connect the wires to the terminal blocks in the Sunny Boy and tighten to a torque of 40 in-lbs. (4.5 Nm).
9. Verify that all connections are correctly wired and properly torqued. Pull on the cable in order to make sure that it is sufficiently fixed in the terminal.
10. Close the SMA DC Disconnect as described in section 8.4 "Closing SMA DC Disconnect" (page 51).
11. Close the Sunny Boy as described in section 8.2 "Closing the Sunny Boy" (page 49).
- ☒ The AC cables are connected.

6.6 DC connection

This section provides procedures for wiring the DC input from the PV array to the Sunny Boy.

Simplified electrical wiring diagram of a PV system



WARNING

Danger of fire due to overheating.

- Fuse all DC+ and DC – wires of the strings connected to the DC Disconnect.
- Observe 2008 *National Electrical Code*® section 690.35.

6.6.1 DC connection requirements

Cable sizing

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

When selecting the type and cross-section of the cable in accordance with the routing method, observe the following requirements:

- For all DC wiring connections to the string combiner box use 10 ... 6 AWG (6 ... 16 mm²), 194 °F (90 °C) rated copper wire (*National Electrical Code*® 690.35).
- For DC wiring connection between the string combiner box and the inverter use min. 8 AWG (10 mm²), 194 °F (90 °C) rated copper wire (*National Electrical Code*® 310.16).
- Use only solid or stranded wire but not fine stranded wire.



Use the free design programs "Solar Design Tools" at www.SMA-America.com to determine the correct string configuration.

6.6.2 Connecting the DC cable



DANGER

High voltage is present inside the DC cables.

Death or serious injury will result when damaging a DC cable or touching a DC conductor.

- You have to connect the DC cables from the PV array to the Sunny Boy in the order described in this manual.

1. Lay a cable conduit from the Sunny Boy Combiner Box to the SMA DC Disconnect (see chapter 6.3 "Insert the cable into the SMA DC Disconnect" (page 29)).



DANGER

High voltage is present in PV modules exposed to light.

Death due to electric shock when touching a DC conductor.

- During installation, cover the PV modules with opaque material.

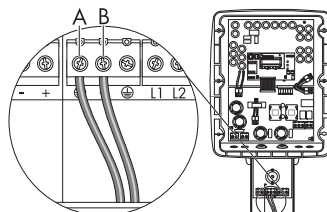
2. Follow all safety instructions of the PV module manufacturer.
3. Open the SMA DC Disconnect as described in section 8.3 "Opening SMA DC Disconnect" (page 50).
4. Lead the AC cable through the cable conduit into the inside of the SMA DC Disconnect.

**CAUTION**

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

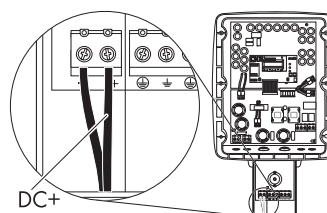
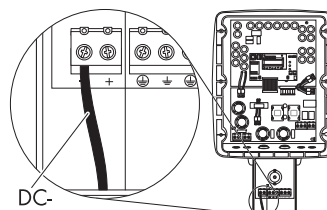
- Avoid using wire nuts to join any wires together or to make any connections anywhere in the PV system.

5. Open the screw terminals completely by turning the screws counterclockwise with a flat-head screwdriver.
6. Connect the grounding electrode conductor to the grounding electrode conductor terminal (B).
7. Optional: Connect the PV frame grounding to the grounding electrode conductor terminal (A).
8. Tighten the screw terminals clockwise with a torque of 40 in-lbs. (4.5 Nm).
9. Verify that all connections are correctly wired and properly torqued. Pull on the cable in order to make sure that it is sufficiently fixed in the terminal.



☑ The DC cables are now connected in the SMA DC Disconnect.

10. Check the connection cables of the PV modules for correct polarity and to make sure that the maximum input voltage of the Sunny Boy is not exceeded.
11. Open the screw terminals completely by turning the screws counterclockwise with a flat-head screwdriver.
12. Connect the negative DC wires (A) to the terminal labeled - in the SMA DC Disconnect.
13. Connect the positive DC wires (A) to the terminal labeled + in the SMA DC Disconnect.

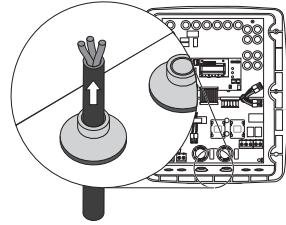


14. Torque all wires in the terminal blocks inside the SMA DC Disconnect to 40 in-lbs. (4.5 Nm).
15. Verify that all connections are correctly wired and properly torqued. Pull on the cable in order to make sure that it is sufficiently fixed in the terminal.

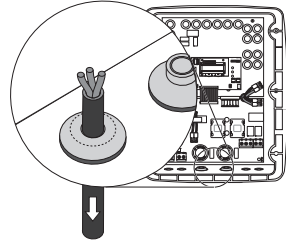
☑ The DC cables are now connected to the SMA DC Disconnect.

16. Open the Sunny Boy as described in section 8.1 "Opening the Sunny Boy" (page 48).

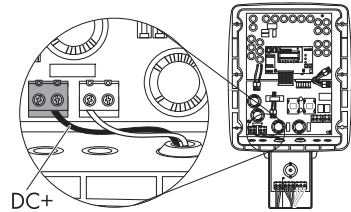
17. Push the DC wires from the SMA DC disconnect through a grommet into the Sunny Boy in order to pierce the grommet. Do not use sharp tools to open the grommet.



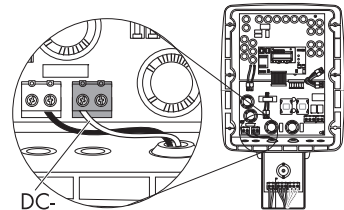
18. Pull the wires slightly back in order to seal the grommet.



19. Open the screw terminals completely by turning them counterclockwise with a flat-head screwdriver.
20. Connect the positive DC wire to the terminal labeled DC+ in the Sunny Boy.



21. Connect the negative DC wire to the terminal labeled DC - in the Sunny Boy.



22. Torque all wires in the terminal blocks inside the Sunny Boy to 40 in-lb.
23. Verify that all connections are correctly wired and properly torqued. Pull on the cable in order to make sure that it is sufficiently fixed in the terminal.
24. Close the SMA DC Disconnect as described in section 8.4 "Closing SMA DC Disconnect" (page 51).
25. Close the Sunny Boy as described in section 8.2 "Closing the Sunny Boy" (page 49).
- ☒ The DC cables are now connected in the Sunny Boy.

6.7 Communication

The Sunny Boy can be equipped with a communication interface (socket see section 6.4 "Sunny Boy connection area overview" (page 30)) to communicate with special data acquisition devices (e.g. Sunny WebBox) or a PC with appropriate software (e.g. Sunny Data).

For a complete listing of all applicable communication options refer to the SMA web page or the product catalogue.

See the communication interface documentation for a detailed wiring diagram and instructions for insertion.

7 Commissioning

All Sunny Boy inverters have a sophisticated system for detecting and responding to PV array ground faults as required by *National Electrical Code*® section 690.35 (C). The ground fault protection device is active whenever there is sufficient DC voltage to turn on the LCD in the Sunny Boy.

Check the following requirements before commissioning:

- AC cable correctly connected
- DC cable correctly connected
- securely fastened enclosure lid
- The line circuit breaker is laid out correctly, if used.

Commission the Sunny Boy

**DANGER**

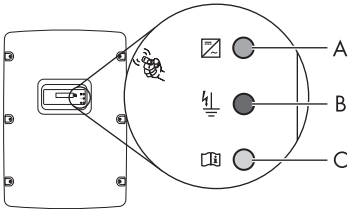
High voltage is present inside the PV power plant.

Death or serious injury will result when damaging a DC cable or touching a DC conductor.

- Commission the Sunny Boy in the order described in the following procedure.

1. Make sure any covering placed over the PV array is removed.
2. Connect the grid voltage to the Sunny Boy by switching on the main AC circuit breaker in the main utility panel.
3. Switch the SMA DC Disconnect to position labeled as "1". If there is sufficient sunlight available, the Sunny Boy will enter the "Wait" mode at this time and the green LED will begin to blink.

A	Green LED	Operation
B	Red LED	Ground fault
C	Yellow LED	Disturbance



- ☒ If no AC faults are detected, the "Wait" mode will end after 10 seconds and the green LED will stop blinking, remain on and the Sunny Boy will begin to operate normally. If an AC fault is registered, the Sunny Boy will wait 5 minutes prior to starting.
- ☒ If the Sunny Boy is not operating as expected after the commissioning procedure has been completed, refer to the user manual.
- ☒ The meaning of the red LED is described in detail in section 10 "Troubleshooting" (page 55).
- ☒ If there is adequate solar irradiation and the resulting PV input voltage is greater than 360 V DC, the Sunny Boy will automatically begin feeding power to the utility grid.

7.1 Display

Feeding operation

After fault-free grid connection of the Sunny Boy it takes approximately one minute until the following display messages are shown alternately. The display messages shown before only have the purpose of indicating the initialization of the Sunny Boy and the process of controlling whether the power supply requirements are fulfilled.

- The energy generated today and the current operating mode are displayed first.
- After 5 seconds or by tapping on the housing lid, the current feed-in output and the PV voltage appear.
- After a further 5 seconds, or when you tap again, the total energy produced and the time the Sunny Boy has been connected to the grid are displayed.
- Then the cycle begins again.

```
E-today 8.86kWh
Mode MPP
```

```
Pac      500W
Upv      380V
```

```
E-Total 724.4kWh
h-total  512h
```

Disturbance

- If a disturbance occurs, the message "Disturbance" will be shown in the status bar.
- The exact failure message follows.
For example, if the grid fault message shown here is displayed immediately after connection, it may be due to the fact that the AC wire is not correctly connected or the circuit breaker is not switched on yet.
- If a non-standard compliant measured value is responsible for the disturbance, then the value measured at the time of the fault is displayed. If another measurement is possible, the present value is displayed in the second line.

```
E-today      0Wh
Mode Disturbance
```

```
Disturbance
Fac-Bfr
```

```
at:      59.29Hz
Present: 59.30Hz
```

Refer to the delivered user manual of the Sunny Boy to read the exact explanations for the error and status messages!

PV overvoltage



```
!PV-Overvoltage!  
!DISCONNECT DC!
```

NOTICE

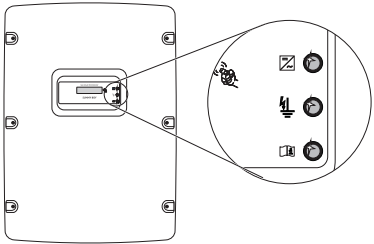
Excessive DC voltage can destroy the Sunny Boy.

- Open all AC and DC circuit breakers or load-disconnecting switches.

Check DC voltage:

- Greater than 600 V: Contact the planner/installer of the PV generator for assistance.
- Lower than 600 V: Reconnect the Sunny Boy to the PV generator as described in section 6.6 "DC connection" (page 37).
- If the message occurs again, disconnect the Sunny boy again and contact SMA (see section 14 "Contact" (page 71)).

7.2 LED Display



Overview

Green	Red	Yellow	Status
Glows continuously	Does not glow	Does not glow	OK (feeding operation)
	Glows continuously	Does not glow	Disturbance
		Glows continuously	OK (initialization)
Flashes quickly (3 x per second)	Does not glow	Does not glow	OK (stop)
	Glows continuously	Does not glow	Disturbance
Flashes slowly (1 x per second)	Does not glow	Does not glow	OK (waiting, grid monitoring)
Briefly goes out (ca. 1 x per second)	Glows continuously	Does not glow	Disturbance
	Does not glow	Does not glow	OK (derating)
Does not glow	Does not glow	Does not glow	OK (night shutdown)
		Glows / flashes	Disturbance
	Glows continuously	Does not glow	Disturbance
		Glows / flashes	Disturbance
Not relevant	Flashes	Not relevant	Warning (see section 10.1)

Feeding operation

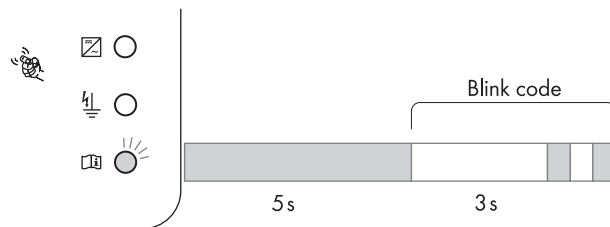
After a fault-free grid connection of the Sunny Boy, it takes approximately one minute until the green LED is continuously on. The blink codes shown before only have the purpose of indicating the initialization of the Sunny Boy and the process of checking whether the power supply requirements are fulfilled.



Disturbance or fault

If the Sunny Boy detects a disturbance or error, this is indicated through a blink code of the yellow and, where applicable, the red LEDs.

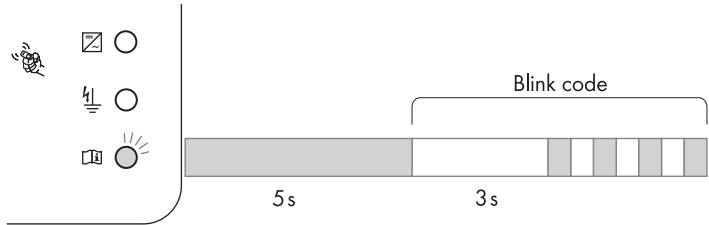
For example, if the yellow LED glows for 5 seconds immediately after connection, then goes out for 3 seconds and then flashes briefly twice, there is a grid fault. This could be because the AC cable has not been connected correctly or the line circuit breaker has not yet been switched on.



Explanation of the blink codes

For a detailed description of the blink codes, see the provided Sunny Boy user manual.

PV overvoltage
(Yellow LED flashes 4 times quickly in succession)



NOTICE

Excessive DC voltage can destroy the Sunny Boy.

- Open all AC and DC circuit breakers or load-disconnecting switches.

Check DC voltage:

- Greater than 600 V: Contact the planner/installer of the PV generator for assistance.
- Lower than 600 V: Reconnect the Sunny Boy to the PV generator as described in section 6.6 "DC connection" (page 37).

If the message occurs again, disconnect the Sunny boy again and contact SMA America (see section 14 "Contact" (page 71)).

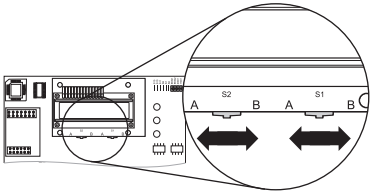
7.3 Setting the display language

You can set the language of the display using the switches on the underside of the display assemblies inside the Sunny Boy.

Proceed as follows:

1. Open the Sunny Boy as described in section 8.1 "Opening the Sunny Boy" (page 48).
2. Set the switches for the required language, as shown below.

Language	Switch S2	Switch S1
German	B	B
English	B	A
French	A	B
Spanish	A	A



3. Close the Sunny Boy as described in section 8.2 "Closing the Sunny Boy" (page 49).

- ☒ The display language is set.

8 Opening and closing

NOTICE

Electrostatic discharges.

Internal components of the Sunny Boy can be irreparably damaged by electrostatic discharge.

- Ground yourself before you touch a component.

8.1 Opening the Sunny Boy



DANGER

During operation, high voltages are present in the Sunny Boy.

Death or serious injury due to electric shock.

- Open the Sunny Boy in the order described in the following procedure.

1. Disconnect all AC and DC circuit breakers or load-disconnecting switches. Ensure they cannot reconnect accidentally.
2. Wait at least for 5 minutes for any residual voltages to dissipate.
3. Remove the six screws and lock washers from the enclosure lid. Pull the lid forward smoothly.
4. Place the lid, screws, and washers aside. They will be out of your way while you are connecting wires and cables to the Sunny Boy.

NOTICE

Ingress of water into the open Sunny Boy.

Damage to the Sunny Boy will result.

- Do not open the Sunny Boy when it is raining or when high humidity is present (> 95 %).
- Be careful not to misplace the screws or the washers. All six screws and lock washers are required to ensure that the lid is grounded properly and is fully sealed to the case.
- Handle the lid carefully. Even minor damage to the lid could result in an inadequate seal between the lid and the enclosure, thus allowing moisture to enter the case and damage the sensitive electronic components.

- ☒ The Sunny Boy is open.

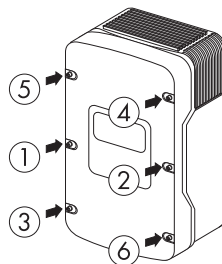
8.2 Closing the Sunny Boy

1. Check wire routing to ensure that no wires can interfere with proper sealing of the lid and that no pressure will be exerted on the connections when the lid is replaced.
2. Locate the six screws and lock washers you removed to take the lid off the Sunny Boy. Make sure you have all six screws and lock washers, as all of this hardware is necessary to ensure proper grounding and a weather-tight seal.
3. Check the seal on the inside of the lid to ensure it is undamaged and in correct position.
4. Carefully position the lid on the front of the Sunny Boy. Align the six holes in the lid correctly with the six threaded holes in the case.
5. Hold the lid in place. Insert the six screws with lock washers through the holes in the lid into the threaded holes of the enclosure. The tothing of the washers must face toward the lid.
6. Turn the screws finger-tight. Do not use power tools to tighten the screws.

	DANGER
Electric shock due to touching the ungrounded lid.	
Death or serious injury possible.	
• When tightening the lid, ensure the proper grounding of the lid. • The toothed washers ground the lid.	

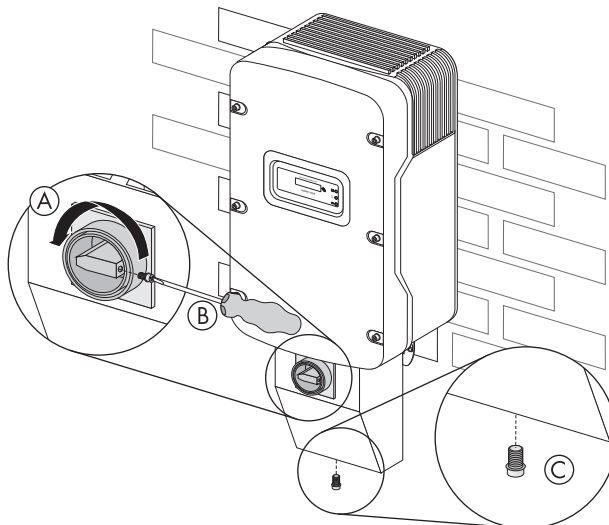
7. Tighten the screws clockwise with a torque of 53 in-lbs. (6 Nm) torque. Refer to the order shown to the right.

☒ The Sunny Boy is closed.

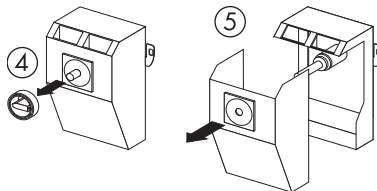


8.3 Opening SMA DC Disconnect

1. Turn the SMA DC Disconnect off by turning the switch to "0" (A).



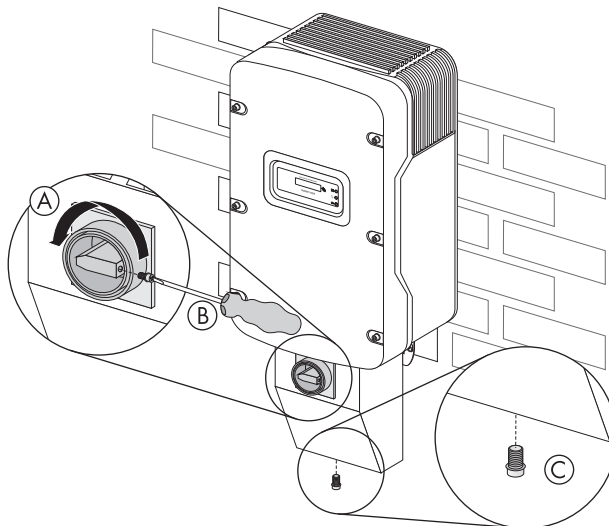
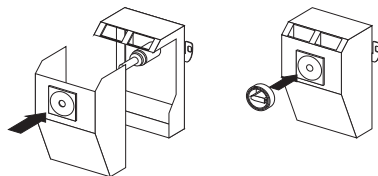
2. Loosen the screw in the right area of the SMA DC Disconnect (B) using a small phillips screwdriver (used screw: UNC no 5 x $\frac{3}{4}$ in. cross recess Phillips pan head machine screw). Do not remove the screw. Check if you can remove the knob of the SMA DC Disconnect. If not, unscrew the screw further until you can remove the knob. The screw is attached with a rubber washer in order to make the assembly easier.
3. Remove the screw and the washer from the bottom side of the SMA DC Disconnect (C), which fastens the lid.
4. Pull off the switch handle.
5. Remove the lid of the SMA DC Disconnect by pulling it down and moving it at the same time carefully forward at its lower edge.



- ☒ The SMA DC Disconnect is open.

8.4 Closing SMA DC Disconnect

1. Position the lid onto the SMA DC Disconnect. Insert the switch handle into the lid.



2. Turn the switch handle to position "0" (A).
3. Tighten the screw on the right side of the switch handle (B) using a small phillips screwdriver (used screw: UNC no 5 x $\frac{3}{4}$ in. cross recess Phillips pan head machine screw).
4. Install the screw and washer at the bottom side of the SMA DC Disconnect (C), to fasten the lid. The teeth of the washer must face toward the lid in order to ensure proper grounding. Tighten the screw to a torque of 44 in-lbs. (5 Nm).

9 Maintenance

9.1 Checking heat dissipation

9.1.1 Cleaning the fans

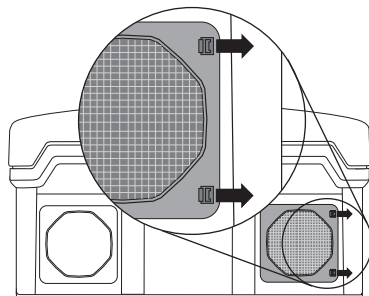
If the fan guards are only dirtied with loose dust, they can be cleaned with a vacuum cleaner. If you do not achieve satisfactory results with a vacuum cleaner, dismantle the fan for cleaning.

To do so, proceed as follows:

1. Disconnect the Sunny Boy from both the DC and AC connections, as described in section 8.1 "Opening the Sunny Boy" (page 48)
2. Wait for the fans to stop rotating.

Cleaning the fan guards

3. Push the two latches at the right edge of the black plastic cover to one side. Remove it carefully with the fan guards mounted behind it.
4. Clean the fan guard with a soft brush, a paint brush, a cloth, or compressed air.



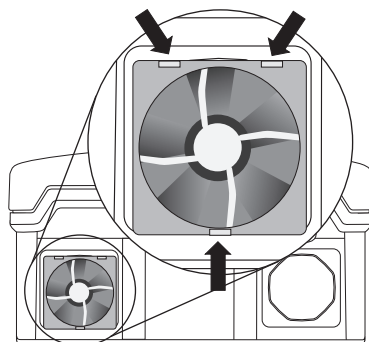
Cleaning the fan

5. Press the front latches backwards and the rear latches forwards.
6. Remove the fan by pulling it slowly and carefully downwards.
7. Unlock and remove the plugs.

The fan cables are long enough for lifting the fans far enough out to disconnect the internal plugs in the Sunny Boy.

8. Remove the fan and clean it with a soft brush, a paint brush, or a cloth and water.

Do not use compressed air as this can damage the fan.



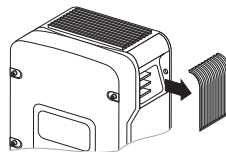
9. After cleaning, assemble everything in reverse order.
10. Check that the fans are functional as described in section 9.2.1 "Checking the fans" (page 54).

9.1.2 Cleaning the handle covers

The Sunny Boy sucks air in from underneath via the fans and blows it out again at the top on both sides via the handle covers. Clean the handle covers, if they are dirty. Proceed as follows:

1. Remove the handle covers.

Insert your finger above in the space between the handle cover and the housing and remove the handle covers to the side.



2. Clean the handle covers with a soft brush, a paint brush, or compressed air.
3. Fasten the handle covers back onto the Sunny Boy.

The handle covers must be attached according to the inside inscription ("links/left" and "rechts/right").

NOTICE

Insects entering the Sunny Boy can damage the inverter.

- The handle covers must not be removed permanently. Otherwise the device is not protected against the entrance of insects.

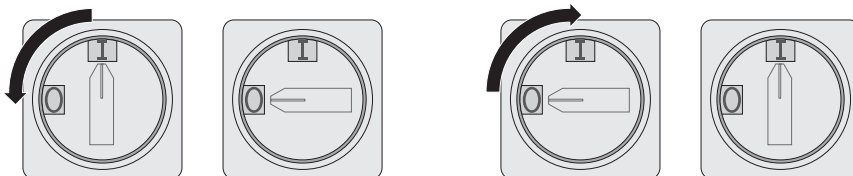
9.2 Checking the DC Disconnect

Under normal use the DC Disconnect does not need maintenance.

It is recommended, though not compulsory to:

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

Operating the switch will clean the contacts and will extend the life of the DC Disconnect.



9.2.1 Checking the fans

There are two ways to check that the fan is functional:

- Set the "Fan Test" parameter to "1" in the installer mode (using Sunny Data, Sunny Data Control, the Sunny Boy Control data logger, or Sunny WebBox),
or
- place the jumpers on the system control board (the jumpers required to check the fans is included in the Sunny Boy accessories kit).

Setting the parameter

1. Request the installer password on the SMA Serviceline (contact: see Page 71).
2. Set the "Fan Test" parameter to "1" in the installer mode.
3. Check the fans air-flow.

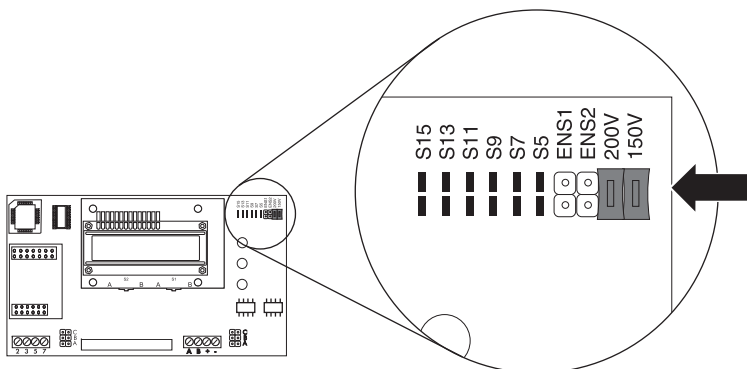
The Sunny Boy sucks air in from underneath and then blows it back out on the upper sides. Listen for any unusual noise, which could indicate incorrect installation or that the fans are faulty.

4. After checking the fans, set the "Fan Test" parameter back to "0".

Setting the jumper

The Sunny Boy recognizes the jumper only after the system has been restarted (i.e. all LEDs must have gone out before a restart).

1. Open the Sunny Boy as described in section 8.1 "Opening the Sunny Boy" (page 48)
2. Plug the provided jumpers in the slots on the system control board as shown below.



3. Close the Sunny Boy as described in section 8.2 "Closing the Sunny Boy" (page 49).
4. Check the air-flow of the fans.

The Sunny Boy sucks air in from underneath and then blows it back out on the upper sides. Listen for any unusual noise, which could indicate incorrect installation or that the fans are faulty.

5. After checking the fans, remove the jumpers. Open and close the Sunny Boy as described in section 8 "Opening and closing" (page 48).

10 Troubleshooting

Should the Sunny Boy display other blink codes or display messages than those described in section 7 "Commissioning" (page 42), please refer to the operating manual of the Sunny Boy to find the exact meaning of the display message or the blink code and, if necessary, the details on troubleshooting.

Do not attempt to carry out repairs other than those described here. Instead, use the SMA replacement and repair services. You can find more information on the replacement and repair services in the warranty conditions included with the Sunny Boy.

10.1 The red LED is on continuously

A ground fault exists in the PV generator

Proceed as follows:

1. Disconnect the Sunny Boy from both the DC and AC connections, as described in section 8.1 "Opening the Sunny Boy" (page 48).

NOTICE

Excessive voltages can destroy the measuring device.

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

2. Measure the voltages between the plus and minus pole of a string against the ground potential. If voltage is found, there is a ground fault in the corresponding string.



DANGER

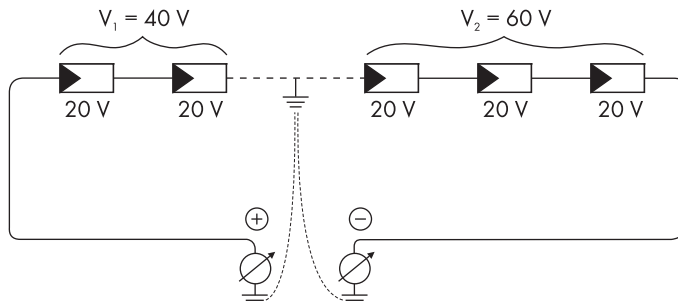
In case of a ground fault, the PV generator may carry high voltages.

Risk of lethal electric shock.

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

The approximate position of the ground fault can be determined 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.

3. Repeat step 2 for each string.
4. Fix the ground fault in the affected string.
5. Restart the Sunny Boy as described in section 8.2 "Closing the Sunny Boy" (page 49).

10.1.1 Inspecting and changing the varistors

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.

You can inspect the varistors in the following manner:

1. Open the DC Disconnect as described in section 8.3 "Opening SMA DC Disconnect" (page 50).
2. Inspect the varistors for discoloration or other signs of visual damage.
If varistors are discolored or damaged, you must replace them. Always replace the entire set of varistors. Refer to the section 6.4 (Page 30) for the position of the varistors.

NOTICE

Destruction of the inverter due to overvoltage can result.

If varistors are missing, the inverter is no longer protected against overvoltages.

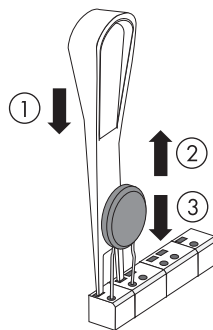
- Procure replacement varistors as soon as possible and replace the defective ones immediately.
- Do not operate inverters with faulty varistors or no varistors at all.



You must order an AC varistor replacement kit from SMA.

- See section "Accessories" (Page 70) for the order number.

3. Insert an insertion tool into the openings of the terminal contacts (1).
☒ The terminal clamps loosen.
If you do not receive an insertion tool for operating the terminal clamps with your replacement varistors: Open the individual terminal contacts using a 3.5 mm screwdriver.
4. Remove the varistor (2).
5. Insert a new varistor (3).



6. Close the DC Disconnect as described in section 8.4 "Closing SMA DC Disconnect" (page 51).
☒ The check and replacement of the varistors is completed.

11 Decommissioning

11.1 Disassembling the Sunny Boy and SMA DC Disconnect

1. Open the Sunny Boy as described in section 8.1 "Opening the Sunny Boy" (page 48).
2. Remove all connector cables from the Sunny Boy.
3. Close the Sunny Boy with the six screws and the corresponding washers.
4. Open the SMA DC Disconnect as described in section 8.3 "Opening SMA DC Disconnect" (page 50).
5. Open the terminals and remove all cables from the SMA DC Disconnect.



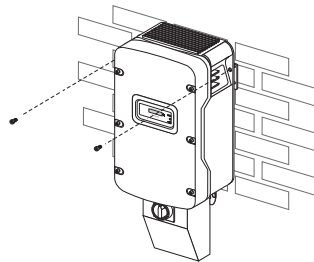
CAUTION

Falling of the Sunny Boy may cause injuries.

Crushing of body parts will result.

- Take the weight of the Sunny Boy into account when dismantling.

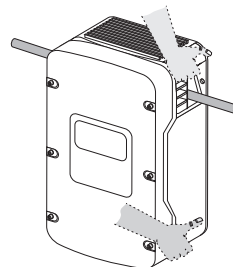
6. Remove both screws on the left and right side of the Sunny Boy that attach it to the wall mounting bracket.



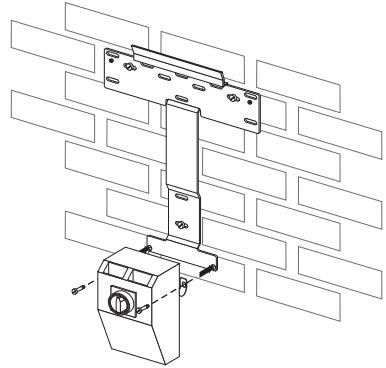
7. Remove the Sunny Boy upwards in a vertical position from the wall mounting bracket.
8. Transport the Sunny Boy between two persons, using the side handles above and below.

or

Put a steel bar with a maximum diameter of 1 1/8 in. (30 mm) through the enclosure opening above and transport it between two people.



9. Remove the screws left and right on the SMA DC Disconnect which attach it.



11.2 Packaging

If possible, always pack the Sunny Boy and the SMA DC Disconnect in the original packaging. If this is no longer available, use a similar box with a handle system which can withstand the weight of the Sunny Boy and the SMA DC Disconnect and can be closed fully.

11.3 Storage

Store the Sunny Boy and the SMA DC Disconnect in a dry place where ambient temperatures are always between $-13\text{ }^{\circ}\text{F}$... $+140\text{ }^{\circ}\text{F}$ ($-25\text{ }^{\circ}\text{C}$... $+60\text{ }^{\circ}\text{C}$).

11.4 Disposal

Dispose the Sunny Boy and SMA DC Disconnect at the end of its service life in accordance with the disposal regulations for electronic scrap which apply at the installation site at that time. Alternatively, send it back to SMA with shipping paid by sender, and labeled "FOR DISPOSAL" (contact: see Page 71).

12 Technical data



Specifications subject to change without notice.

Values at nominal conditions.

12.1 Sunny Boy 8000TL-US

PV generator connection data

Maximum DC power	8,300 W
Maximum array input power (DC@STC)	10,000 W
Maximum DC voltage	600 V
Peak power track voltage	300 V ... 480 V
Maximum DC input current	28 A
Number of MPP-Trackers	1 (OptiTrac)

Grid connection data

Nominal AC power	8,000 W
Maximum AC power	8,000 W
Reduced power output at 140 °F (60 °C)	8,000 W
Maximum AC current	40 A
Nominal AC voltage	208 V
Nominal AC voltage range	183 V ... 229 V
Nominal AC frequency	60 Hz
Nominal AC frequency range	59.3 HZ ... 60.5 Hz
Power factor	1 at Nominal Power
Current THD	< 4 %
AC connection/power balancing	Dual Phase/O
Ground fault monitoring (R-Iso)	yes

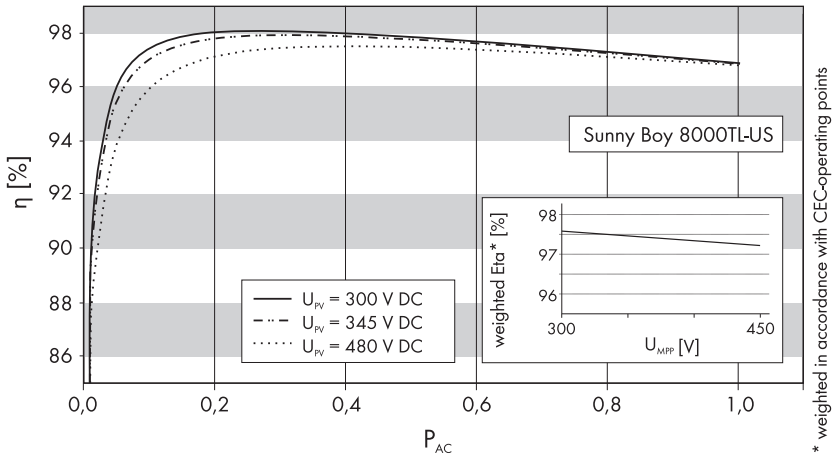
Protection Devices

DC reverse polarity protection	yes, short circuit diode
AC short circuit protection	yes, software controlled
AC overcurrent protection	yes, current controlled
Grid monitoring (SMA Grid Guard® 2)	yes

Equipment

DC connection	screw terminals
AC connection	screw terminals
LCD display	yes
Optional communication interfaces	RS485 or wireless (<i>Bluetooth</i>)

Efficiency



Peak inverter efficiency	98.3 %
Weighted efficiency (CEC)	98 %

General Data

Maximum dimensions, inverter and disconnect combined (width x height x depth)	18 ³ / ₈ in. x 33 in x 9 ⁷ / ₁₆ in. 467 mm x 838 mm x 241 mm
Weight of the inverter	77 lbs. (35 kg)
Weight of the SMA DC disconnect	8 lbs. (3.5 kg)
Ambient temperature range	- 13 °F ... +140 °F (- 25 °C ... +60 °C)
Ambient temperature range (full power output)	- 13 °F ... +113 °F (- 25 °C ... +45 °C)
Power consumption nighttime	≤ 0.25 W
Noise emission, typical	≤ 46 dB(A)
Topology	transformerless
Cooling concept	OptiCool
Mounting location	indoor/outdoor (NEMA 3R)

12.2 Sunny Boy 9000TL-US

PV generator connection data

Maximum DC power	9,300 W
Maximum array input power (DC@STC)	11,250 W
Maximum DC voltage	600 V
Peak power track voltage	300 V ... 480 V
Maximum DC input current	31 A
Number of MPP-Trackers	1 (OptiTrac)

Grid connection data

Nominal AC power	9,000 W
Maximum AC power	9,000 W
Reduced power output at 140 °F (60 °C)	8,000 W
Maximum AC current	44 A
Nominal AC voltage	208 V
Nominal AC voltage range	183 V ... 229 V
Nominal AC frequency	60 Hz
Nominal AC frequency range	59.3 HZ ... 60.5 Hz
Power factor	1 at Nominal Power
Current THD	< 4 %
AC connection/power balancing	Dual Phase/O
Ground fault monitoring (R-Iso)	yes

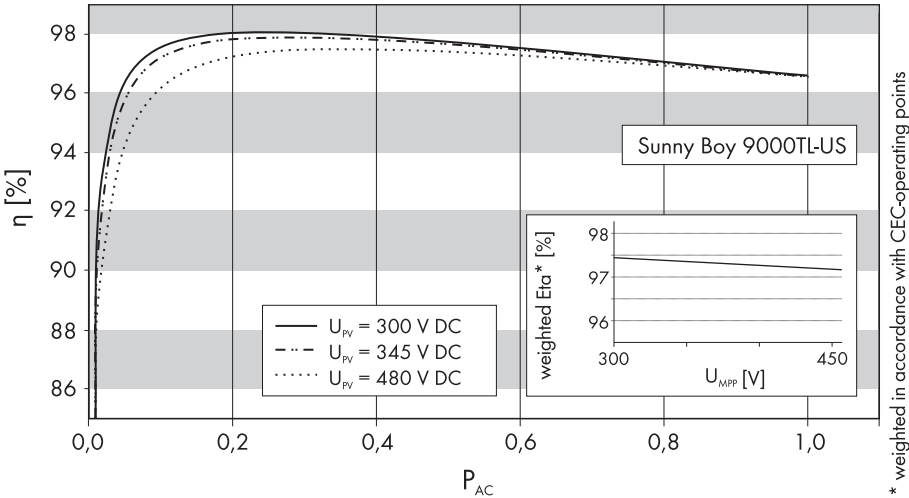
Protection Devices

DC reverse polarity protection	yes, short circuit diode
AC short circuit protection	yes, software controlled
AC overcurrent protection	yes, current controlled
Grid monitoring (SMA Grid Guard [®] 2)	yes

Equipment

DC connection	screw terminals
AC connection	screw terminals
LCD display	yes
Optional communication interfaces	RS485 or wireless (Bluetooth)

Efficiency



Peak inverter efficiency	98.3 %
Weighted efficiency (CEC)	98 %

General Data

Maximum dimensions, inverter and disconnect combined (width x height x depth)	18 ³ / ₈ in. x 33 in x 9 ⁷ / ₁₆ in. 467 mm x 838 mm x 241 mm
Weight of the inverter	77 lbs. (35 kg)
Weight of the SMA DC disconnect	8 lbs. (3.5 kg)
Ambient temperature range	- 13 °F ... +140 °F (- 25 °C ... +60°C)
Ambient temperature range (full power output)	- 13 °F ... +113 °F (- 25 °C ... +45 °C)
Power consumption nighttime	≤ 0.25 W
Noise emission, typical	≤ 46 dB(A)
Topology	transformerless
Cooling concept	OptiCool
Mounting location	indoor/outdoor (NEMA 3R)

12.3 Sunny Boy 10000TL-US

PV generator connection data

Maximum DC power	10,350 W
Maximum array input power (DC@STC)	12,500 W
Maximum DC voltage	600 V
Peak power track voltage	300 V ... 480 V
Maximum DC input current	35 A
Number of MPP-Trackers	1 (OptiTrac)

Grid connection data

Nominal AC power	10,000 W
Maximum AC power	10,000 W
Reduced power output at 140 °F (60 °C)	8,000 W
Maximum AC current	48 A
Nominal AC voltage	208 V
Nominal AC voltage range	183 V ... 229 V
Nominal AC frequency	60 Hz
Nominal AC frequency range	59.3 Hz ... 60.5 Hz
Power factor	1 at Nominal Power
Current THD	< 4 %
AC connection/power balancing	Dual Phase/O
Ground fault monitoring (R-Iso)	yes

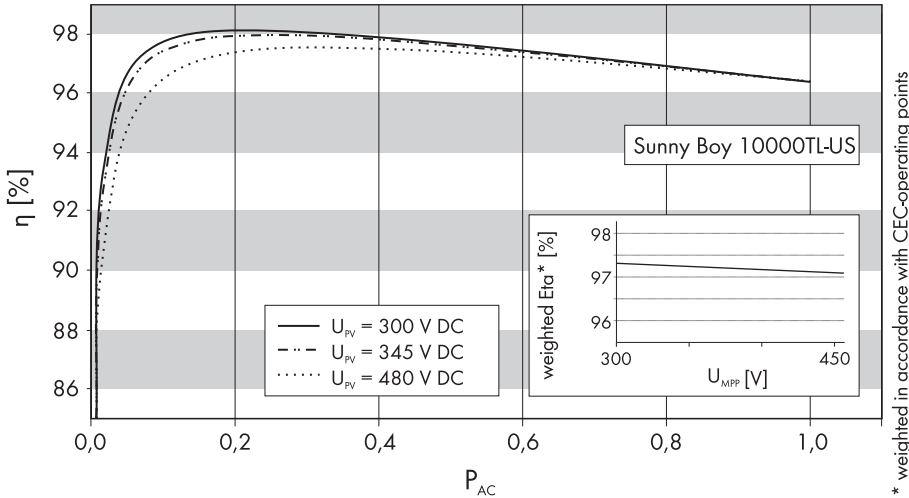
Protection Devices

DC reverse polarity protection	yes, short circuit diode
AC short circuit protection	yes, software controlled
AC overcurrent protection	yes, current controlled
Grid monitoring (SMA Grid Guard [®] 2)	yes

Equipment

DC connection	screw terminals
AC connection	screw terminals
LCD display	yes
Optional communication interfaces	RS485 or wireless (Bluetooth)

Efficiency



Peak inverter efficiency	98.3 %
Weighted efficiency (CEC)	97.5 %

General Data

Maximum dimensions, inverter and disconnect combined (width x height x depth)	18 ³ / ₈ in. x 33 in x 9 ⁷ / ₁₆ in. 467 mm x 838 mm x 241 mm
Weight of the inverter	77 lbs. (35 kg)
Weight of the SMA DC disconnect	8 lbs. (3.5 kg)
Ambient temperature range	- 13 °F ... +140 °F (- 25 °C ... +60 °C)
Ambient temperature range (full power output)	- 13 °F ... +113 °F (- 25 °C ... +45 °C)
Power consumption nighttime	≤ 0.25 W
Noise emission, typical	≤ 46 dB(A)
Topology	transformerless
Cooling concept	OptiCool
Mounting location	indoor/outdoor (NEMA 3R)

12.4 SMA DC Disconnect

PV generator connection data

Maximum DC voltage	600 V
Operating DC voltage range	0 V ... 600 V
Maximum DC operating current	35 A
Maximum DC short circuit current	45 A
Maximum String Fuse Rating	20 A

Grid connection data

Maximum AC current	48 A
--------------------	------

General Data

Dimensions (width x height x depth)	7.87 in. x 12.20 in. x 7.48 in. (200 mm x 310 mm x 190 mm)
Weight	8 lbs. (3.5 kg)
Ambient temperature range	– 13 °F ... +140 °F (– 25 °C ... +60 °C)
Cable requirements (<i>National Electrical Code</i> ® 310.16)	8 ... 2 AWG (10 ... 35 mm²), 194 °F (90 °C) rated copper wire
Enclosure	NEMA 3R rated, indoor/outdoor



Specifications subject to change without notice.

12.5 FCC compliance information

SMA Utility Interactive Inverter, Model Sunny Boy

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

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

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

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and the receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.
- The user is cautioned that changes or modifications not expressly approved by SMA America, Inc. could void the user's authority to operate this equipment.

12.6 Trip limits/trip times

Nominal frequency	Trip limit	Trip frequencies	Trip times
60 Hz	> 60.5 Hz	60.45 Hz ... 60.55 Hz	max. 0.1602 s
	< 57.0 Hz ... 59.8 Hz (default 59.3 Hz)	56.95 Hz ... 59.85 Hz (default 59.25 Hz ... 59.35 Hz)	adjustable 0.16 s ... 300 s (default max. 0.1602 s)
	< 57.0 Hz	56.95 Hz ... 57.05 Hz	max. 0.1602 s

Voltage	Trip limit trip voltages	Line-to-neutral *	Trip voltages line-to-line *	Trip times
208 V	50 %	57.6 ... 62.4 V	99.8 ... 108.2 V	max. 0.1602 s
	88 %	103.2 ... 108.0 V	178.9 ... 187.2 V	max. 2.002 s
	110 %	129.6 ... 134.4 V	224.6 ... 233.0 V	max. 1.001 s
	120 %	141.6 ... 146.4 V	245.4 ... 253.8 V	max. 0.1602 s

* The intervals result from the measuring accuracies listed below.

Manufacturer's accuracies:

Trip limit accuracy: ± 2 % of nominal grid voltage

Trip time accuracy: ± 0.1 % of nominal trip time

Trip frequency accuracy: ± 0.1 % of nominal frequency

12.7 Torque values and wire sizes

Terminal	in-lbs	Nm	Wire size
AC terminal blocks inverter	40	4.5	6 ... 2 AWG (16 ... 35 mm ²), 194 °F (90 °C) rated copper wire (NEC 310.16)
DC terminal blocks inverter	40	4.5	8 ... 2 AWG (10 ... 35 mm ²), 194 °F (90 °C) rated copper wire
AC terminal blocks DC Disconnect	40	4.5	6 ... 2 AWG (16 ... 35 mm ²), 194 °F (90 °C) rated copper wire (NEC 310.16)
DC terminal blocks DC Disconnect	40	4.5	8 ... 2 AWG (10 ... 35 mm ²), 194 °F (90 °C) rated copper wire (NEC 310.16)
Grounding electrode conductor terminal block DC Disconnect	40	4.5	8 ... 2 AWG (10 ... 35 mm ²), 194 °F (90 °C) rated copper wire (NEC 310.16)
Screws for fastening the Sunny Boy and the DC Disconnect to the wall mounting bracket and closing the DC Disconnect lid	44	5	—
Lid screws	53	6	—

13 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 SMA dealer.

Name	Description	SMA order number
Sunny Boy Combiner Box	String combiner for 6 strings maximum	SBCBTL6-10
Power Balancer set	Upgrade kit for the Power Balancer function	PBL-SBUS-10-NR
RS485 upgrade kit	RS485 interface	485USPB-SMC-NR
Bluetooth upgrade set	Bluetooth communication interface	BTPBINV-NR
Air grills	Air grill set "right and left" as replacement part	45-7202
AC varistors	AC varistor replacement kit	SB-VAC-US01

14 Contact

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

- Inverter type
- Type and number of modules connected
- Communication method
- Serial number of the Sunny Boy
- Failure or warning number of the Sunny Boy
- Display of the Sunny Boy

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