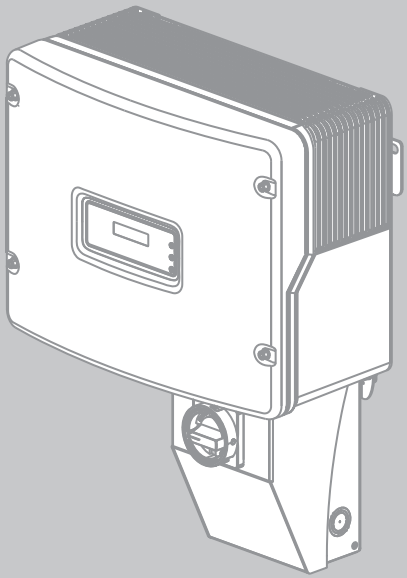
PV Inverter

SUNNY BOY 3000-US / 3800-US / 4000-US

Installation Manual



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IMPORTANT SAFETY INSTRUCTIONS

SAVE THESE INSTRUCTIONS

This manual contains important instructions for the following products:

- Sunny Boy 3000-US / 3800-US / 4000-US

This manual must be followed during installation and maintenance.

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

Warnings in this document

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

Symbol	Description
⚠ 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.

Markings on this product

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

Symbol	Description
	**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.

General Warnings

⚠ WARNING

General Warnings

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

The product contains no user-serviceable parts.
For all repair and maintenance, always return the unit to an authorized SMA Service Center.

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

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

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

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1 Information on this Document

Validity

This document is valid for the following device types:

- SB 3000US
- SB 3800-US-10
- SB 4000US
- SB 3000US-12
- SB 3800-US-12
- SB 4000-US-12

Target group

This document is for electrically qualified persons. Only skilled workers are allowed to perform the tasks set forth in this document (see Section 2.2 "Skills of Electrically Qualified Persons", page 14).

Additional information

Additional information is available at www.SMA-America.com.

Symbols

Symbols	Explanation
⚠ 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.
i	Indicates information that is important for a specific topic or objective, but is not safety-relevant.
☐	Indicates a requirement for meeting a specific goal.
☑	Desired result
✖	A problem that could occur

Typography

Typography	Usage	Example:
"light"	• Display messages • Parameters • Terminals • Slots	• The inverter switches to "Balanced" mode.
bold	• Elements to be selected • Elements to be entered	• Select the parameter **FanTest** and set to **1**.

Nomenclature

The following nomenclature is used in this document:

Complete designation	Designation in this document
SMA America, LLC	SMA
SMA Solar Technology Canada Inc.	SMA
Sunny Boy 3000-US/3800-US/4000-US	Inverter/Sunny Boy

Abbreviations

Abbreviations	Designation	Explanations
AC	Alternating Current	-
AFCI	Arc-Fault Circuit Interrupter	-
CCU	Current controlling unit	-
DC	Direct Current	-
EEPROM	Electrical Eraseable Programmable Read Only Memory	-
FCC	Federal Communications Commission	US agency for communication
GFDI	ground-fault Detection Interruption	-
LED	Light-Emitting Diode	-
MPP	Maximum Power Point	-
MPPT	Maximum Power Point Tracker	-
OCU	Operational Control Unit	-
PV	Photovoltaics	-

2 Safety

2.1 Intended Use

The Sunny Boy is a PV inverter that converts the direct current from the PV array into alternating current.

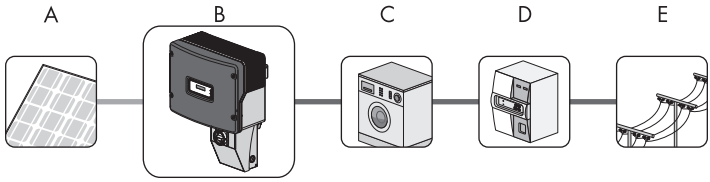


Figure 1: Principle of a PV plant with Sunny Boy

Position	Designation
A	PV array
B	Sunny Boy with DC Disconnect
C	Load
D	Energy meter
E	Power distribution grid

You can use the alternating current generated as follows:

Household grid: Energy flows into the household grid. The loads connected, for example household devices or lighting, consume the energy. The energy left over is fed into the power distribution grid. When the Sunny Boy is not generating any energy, e.g. at night, the loads that are connected are supplied by the power distribution grid. The Sunny Boy does not have its own energy meter. When energy is being fed into the power distribution grid, the energy meter runs in reverse.

Power distribution grid: Energy is fed directly into the power distribution grid. The Sunny Boy is connected to a separate energy meter. Depending on the electric utility company, you will be remunerated accordingly for the energy generated.

Stand-alone grid: The Sunny Boy is connected to a stand-alone grid. A stand-alone grid is a grid that is not connected to a power distribution 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.

The Sunny Boy is suitable for indoor and outdoor use.

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

The corresponding plant design may require the use of protective devices (see *National Electrical Code*® 690.9). For installations in Canada, the installation must be carried out in accordance with the applicable Canadian standards.

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

Use the Sunny Boy in accordance with the information provided in the enclosed documentation only. Any other use can result in personal injury or property damage.

The enclosed documentation is an integral part of this product.

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

2.2 Skills of Electrically Qualified Persons

The tasks described in this document are intended for skilled persons only. Electrically qualified persons must have the following skills:

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

2.3 Safety Precaution

⚠ DANGER

Danger to life due to high voltages in the inverter

High voltages capable of causing electric shocks are present in the conductive components of the inverter.

- All work on the inverter may be carried out by an electrically qualified person only.
- All work on the inverter should only be carried out as described in this document.
- The performance of work on the inverter is only permitted when the inverter is dead.
- Only commission the inverter when the enclosure lid is closed.

⚠ CAUTION

Risk of burns due to hot enclosure parts

Some parts of the enclosure can become hot during operation.

- During operation, touch the enclosure lid only.

NOTICE

Damage to the inverter due to electrostatic discharges

The inverter may be destroyed or damaged by electric discharges due to electronic components being touched.

- Ground yourself before touching any components.

3 Scope of Delivery

Check the delivery for completeness and any externally visible damage. Contact your specialty retailer if the delivery is incomplete or damaged.

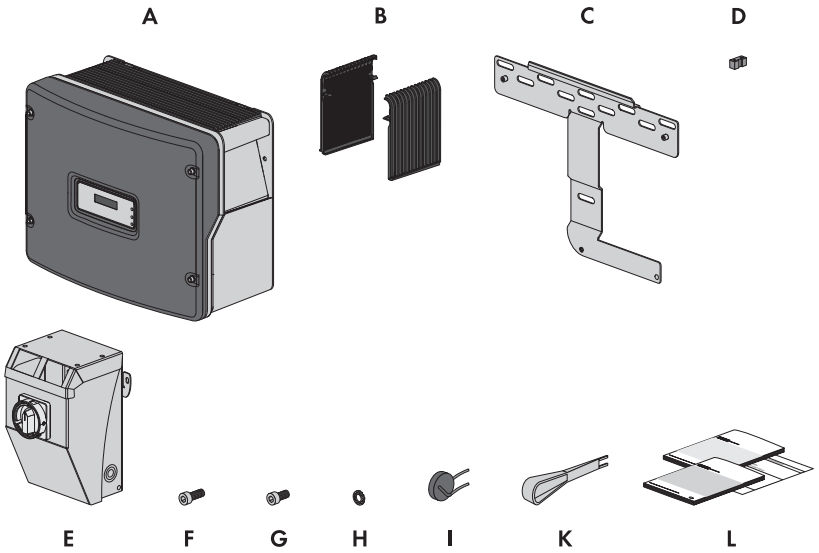


Figure 2: Components included in delivery

Position	Quantity	Designation	Explanation
A	1	Sunny Boy	–
B	2	Ventilation grid	For closing the recessed grips
C	1	Wall mounting bracket	–
D	2	Replacement jumper	For the fan test
E	1	DC Disconnect	–
F	1	M6x16 cheese-head screw	As spare part for closing the enclosure lid on the Sunny Boy
G	2	M6x10 cheese-head screw	For attaching the Sunny Boy to the wall mounting bracket
	2	M6x10 cheese-head screw	For attaching the DC Disconnect to the wall mounting bracket
	1	M6x10 cheese-head screw	For closing the cover on the DC Disconnect

Position	Quantity	Designation	Explanation
H	6	Conical spring washer	For M6x10 cheese-head screws and M6x16 cheese-head screw
I	3	DC varistor*	–
K	1	Insertion tool*	For DC varistors
L	1	Installation manual, user manual, document set with explanations and certificates	–

* Only applies for SB 3000US-12/SB 3800-US-12/SB 4000US-12

4 Product Description

4.1 Sunny Boy

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

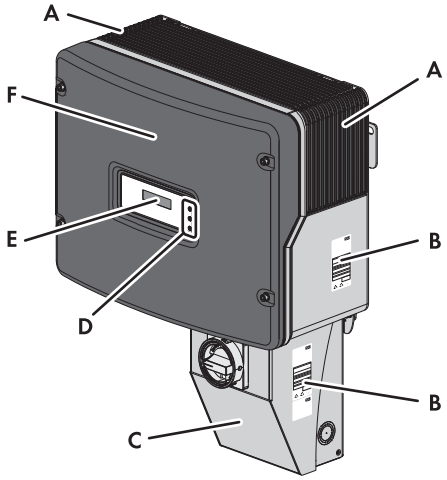


Figure 3: Sunny Boy design

Position	Designation
A	Ventilation grids (left and right)
B	Type labels
C	DC Disconnect
D	LEDs
E	Display
F	Enclosure lid

Symbols on the Inverter

Symbol	Designation	Explanation
	Tap symbol	You can operate the display by tapping on the enclosure lid: • To switch on the backlight, tap once. • To switch to the next displayed message, tap once. • To restart the inverter, tap once.* • To display the serial number and designation of the inverter, the firmware version, and the status of the Power Balancer (if activated) one after the other during operation, tap twice in succession.*
	Green LED	Indicates the operating state of the inverter (see Section 10.1).
	Red LED	Indicates the status of the grounding fuse (see Section 10.1).
	Yellow LED	Indicates a fault or a disturbance (see Section 10.4.2).

* Applies for SB 3000US-12/SB 3800-US-12/SB 4000US-12 only

4.2 Type Labels

4.2.1 Sunny Boy Type Label

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

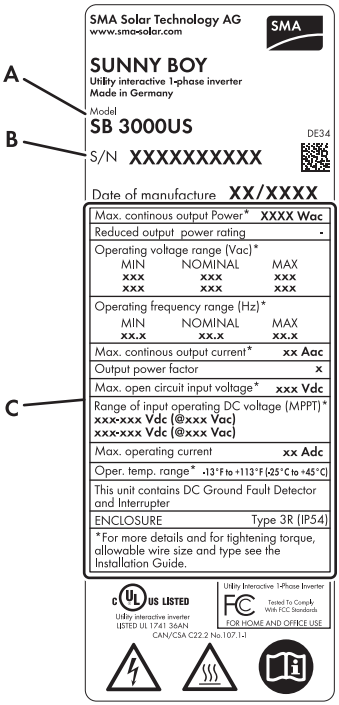


Figure 4: Layout of the Sunny Boy type label

Position	Designation	Explanation
A	Model	Device type
B	Serial no.	Inverter serial number
C	Device-specific characteristics	–

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

4.2.2 DC Disconnect Type Labels

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

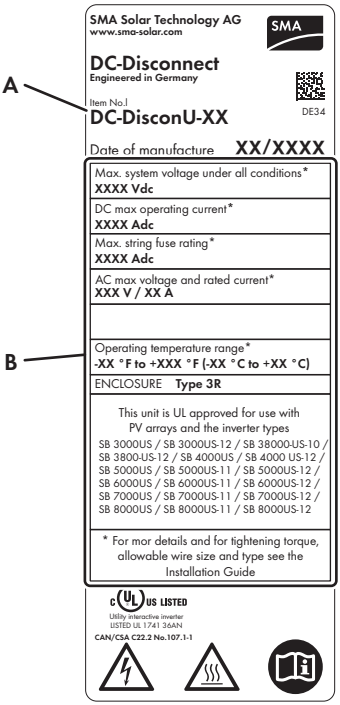


Figure 5: Layout of the DC Disconnect type label

Position	Designation	Explanation
A	Item No.I	Device type
B	Device-specific characteristics	–

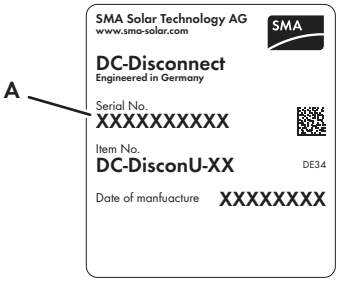


Figure 6: Layout of the DC Disconnect type label

Position	Designation	Explanation
A	Serial no.	DC Disconnect serial number

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

Symbols on the type labels

	**Observe the operating instructions** Read the relevant documentation before working on the product. Follow all safety precautions and instructions as described in the documentation.
	Evaluated to the requirements of the Underwriters Laboratories Standard for Safety for Inverters, Converters, Controllers and Interconnection System Equipment for Use With Distributed Energy Resources, UL 1741.

4.3 DC Disconnect

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

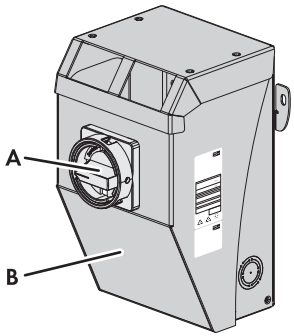


Figure 7: DC Disconnect design

Position	Designation
A	Rotary Switch
B	Cover

The DC Disconnect connects the PV array to the inverter. Turning the rotary switch interrupts the flow of current and the DC cabling can be safely disconnected from the inverter.

4.4 Communication

The inverter can be equipped with a communication module for wired communication with special data capture devices or a PC with corresponding software (for information on supported communication products connected to with the communication module, see www.SMA-America.com).

4.5 Ground-Fault Protective Device (GFDI)

According to the *National Electrical Code®*, Section 690.5, the Sunny Boy has a system for detecting ground-fault errors in the PV array.

The PV array is operated in a grounded configuration. The grounding of a PV plant is established as per the specifications of Section 690.41 to 690.47 of the *National Electrical Code®* ANSI/NFPA 70 and is the responsibility of the electrically qualified person. Installations in Canada must be carried out in accordance with the applicable Canadian standards.

Depending on the plant type, the cable for DC+ or DC− of the PV array is connected to the grounding system in the Sunny Boy. According to UL 1741, the GFDI is always active when the DC voltage present is sufficient for switching on the display in the Sunny Boy.

If the ground-fault current exceeds 1 A, the Sunny Boy switches off and displays a disturbance. After the ground-fault has been located and eliminated, the ground-fault disturbance must be cleared manually. Following this, the Sunny Boy resumes operation.

4.6 Arc-Fault Circuit Interrupter (AFCI)

According to the *National Electrical Code®*, Section 690.11, the Sunny Boy has a system for electric arc detection and interruption.

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

Only the following Sunny Boy device types are equipped with an automatic arc-fault circuit interrupter (AFCI):

- SB 3000-US-12
- SB 3800-US-12
- SB 4000-US-12

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

The automatic arc-fault circuit interrupter can be deactivated in the "Installer" mode via the communication device if this function is not desired.

4.7 Anti-Islanding Protection

The Sunny Boy has an active safety algorithm to protect against islanding.

A stand-alone grid occurs when the power distribution grid is switched off and the Sunny Boy attempts to continue to feed in to the power distribution grid. For this to happen, the remaining load must be resonant at 60 Hz and exactly match the power of the Sunny Boy. The effect of the safety algorithm is that, in the event of the power distribution grid being switched off, the PV plant does not supply any current to a symmetrical load that is resonant at 60 Hz.

4.8 String Fuses

The DC Disconnect is supplied with 4 string fuses (one fuse per string) designed for 15 A and 600 V. With string fuses, the DC Disconnect can protect the PV modules from potential reverse currents.

5 Mounting

5.1 Safety during Mounting

⚠ CAUTION

Risk of injury due to inverter falling over

Potential risk of bruising and broken bones due to the heavy weight of the inverter.

- When mounting the inverter, note that it has a weight of 88 lb. (40 kg).
- Use appropriate mounting material for the mounting location of the inverter:
  - For mounting on plasterboard, do not use hollow-wall anchors or toggle bolts.
  - Wooden supporting studs or posts must be present behind the mounting points on plasterboard.
- Use suitable lifting device when mounting.

The inverter can become hot during operation

Potential burn injuries when touching the enclosure.

- Install the inverter in such a way that it cannot be touched accidentally.

5.2 Selecting the Mounting Location

Requirements for the mounting location:

⚠ WARNING

Danger to life due to fire or explosions

With electrical devices, there is always a certain danger that a fire may break out.

- Do not mount the inverter in the vicinity of combustible materials.
- Do not mount the inverter in areas where highly flammable materials are stored.
- Do not mount the inverter in a potentially explosive atmosphere.

- ☐ The mounting must be on a stable surface, e.g. concrete and other walls.
- ☐ The mounting location must be suitable for the weight and dimensions of the inverter (see Section 12 "Technical Data", page 90).
- ☐ In living areas, make sure that the mounting surface is not made of plasterboard or similar. The inverter makes noises when in use, which can be perceived as a nuisance in a living area.
- ☐ Studs must be present behind the mounting points on plasterboard sheets or panels.
- ☐ The mounting location must be clear and have safe access at all times without the use of additional aids being necessary (such as scaffolding or lifting platforms). Non-fulfillment of these criteria may restrict servicing.
- ☐ The mounting location must not be exposed to direct solar irradiation. Direct solar irradiation can overheat the inverter. As a result, the inverter reduces its power output.
- ☐ The mounting location must not be exposed to direct sources of water spray such as sprinklers or gutters.
- ☐ The ambient temperature must be within a permissible range (see Section 12 "Technical Data", page 90). This ensures optimal operation of the inverter.
- ☐ The mounting location must be inaccessible to children.

Wall mounting bracket dimensions:

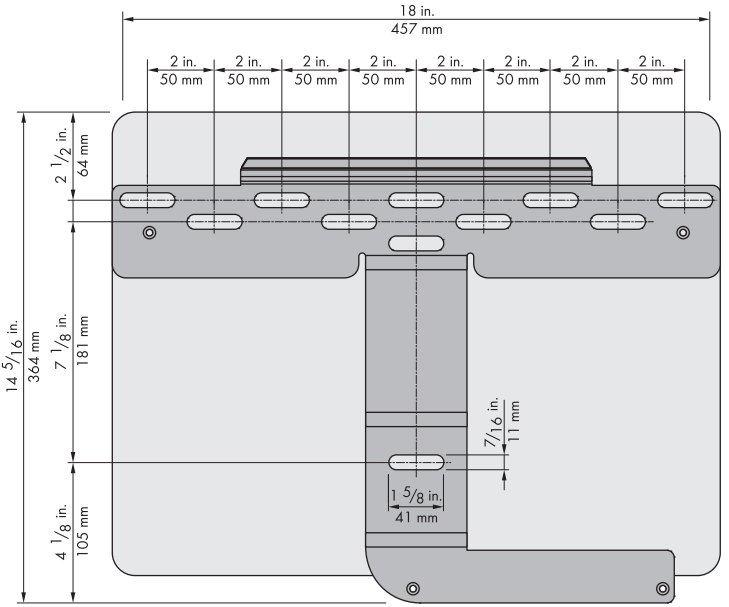


Figure 8: Dimensions of the wall mounting bracket

Observe recommended clearances:

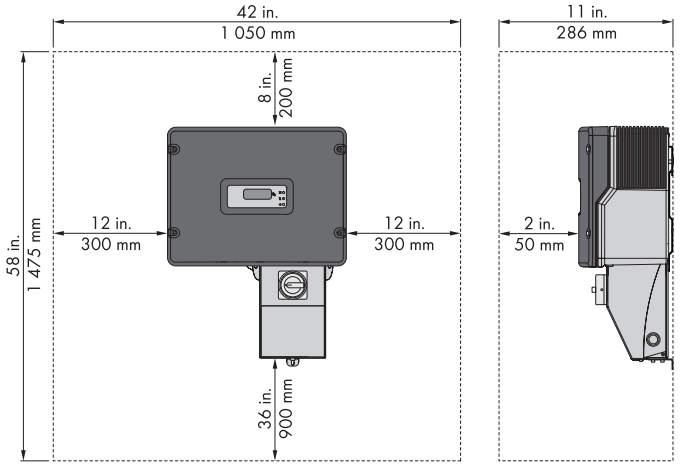


Figure 9: Recommended clearances for mounting the inverter

- If the inverter is mounted outdoors, the clearance below the inverter must amount to 3 ft. (900 mm). This prevents the ingress of waterspray into the inverter.
- Observe recommended clearances to the walls as well as to other inverters or objects. Thus, you will prevent the inverter's power output from being reduced due to excessive temperatures.
- If multiple inverters are mounted in areas with high ambient temperatures, increase the clearances between the inverters and ensure sufficient fresh-air supply. Thus, you will prevent the inverter's power output from being reduced due to excessive temperatures.
- Do not mount inverters on top of one another. This prevents the upper inverter from drawing in the heated air from the lower inverter.

Prescribed clearances

Under certain conditions, the *National Electrical Code®* specifies greater clearances. Ensure that you adhere to the prescribed clearances according to the *National Electrical Code®*, Paragraph 110.26.

Installations in Canada must be carried out in accordance with the applicable Canadian standards.

Observe permitted mounting position:

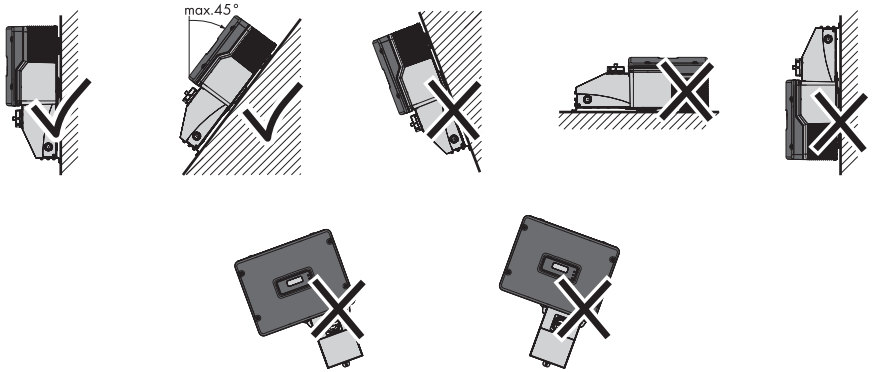


Figure 10: Permitted and prohibited mounting positions

- Mount the inverter in a permitted mounting position at eye level. This ensures that there can be no ingress of moisture into the inverter and you can read out display messages and LED signals without any problems.

5.3 Mounting the Wall Mounting Bracket on a Stone Wall

Additional required mounting material (not included in the scope of delivery):

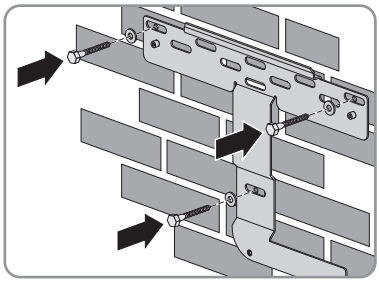
- ☐ 3 screws suitable for the foundation.
- ☐ 3 washers suitable for the screws.
- ☐ 3 screw anchors suitable for the foundation and for the screws.

1. Position the wall mounting bracket at the installation location. Tip: The bottom end of the wall mounting bracket reaches approximately to the bottom corner of the inverter.
2. Align the bracket with a spirit level.
3. **⚠ WARNING**

   Danger to life from electric shock due to damage to electric lines

   Electric lines may be located behind the installation points which can be damaged when mounting the inverter.

   - Ensure that no electric lines are located behind the installation points.
4. Use the wall mounting bracket as a template. For this purpose, mark the oblong holes at the extreme left and right as well as the lowest oblong hole in the middle of the wall mounting bracket.
5. Remove the bracket from the wall.
6. Bore drill holes at the markings.
7. Insert suitable screw anchors into the drill holes.
8. Insert screws with washers through the oblong holes of the wall mounting bracket into drill holes.



9. Tighten the screws. Ensure that no screws are loose.
10. Ensure that the wall mounting bracket is firmly positioned.

5.4 Mounting the Wall Mounting Bracket on a Wooden Wall with a Stud or a Post

Additional required mounting material (not included in the scope of delivery):

☐ 3 screws suitable for the foundation.

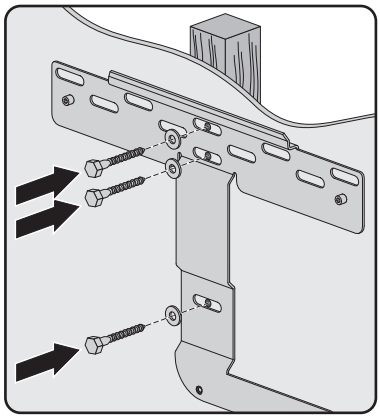
☐ 3 washers suitable for the screws.

1. Position the wall mounting bracket at the installation location. Tip: The bottom end of the wall mounting bracket reaches approximately to the bottom corner of the inverter.
2. Align the bracket with a spirit level.
3. **⚠ WARNING**

   Danger to life from electric shock due to damage to electric lines

   Electric lines may be located behind the installation points which can be damaged when mounting the inverter.

   - Ensure that no electric lines are located behind the installation points.
4. Use the wall mounting bracket as a template. For this purpose, mark both uppermost oblong holes and the lowest oblong hole in the center of the wall mounting bracket.
5. Remove the bracket from the wall.
6. Bore drill holes at the markings.
7. Insert screws with washers through the oblong holes of the wall mounting bracket into drill holes.



8. Tighten the screws. Ensure that no screws are loose.
9. Ensure that the wall mounting bracket is firmly positioned.

5.5 Mounting the Wall Mounting Bracket on a Wooden Wall with two Studs or on two Posts

Additional required mounting material (not included in the scope of delivery):

☐ 2 screws suitable for the foundation.

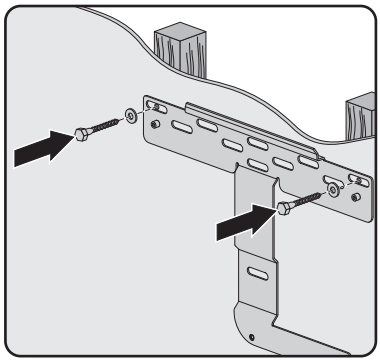
☐ 2 washers suitable for the screws.

1. Position the wall mounting bracket at the installation location. Tip: The bottom end of the wall mounting bracket reaches approximately to the bottom corner of the inverter.
2. Align the bracket with a spirit level.
3. **⚠ WARNING**

   Danger to life from electric shock due to damage to electric lines

   Electric lines may be located behind the installation points which can be damaged when mounting the inverter.

   - Ensure that no electric lines are located behind the installation points.
4. Use the wall mounting bracket as a template. For this purpose, use the oblong holes at the extreme left and right of the wall mounting bracket.
5. Remove the bracket from the wall.
6. Bore drill holes at the markings.
7. Insert screws with washers through the oblong holes of the wall mounting bracket into drill holes.



8. Tighten the screws. Ensure that no screws are loose.
9. Ensure that the wall mounting bracket is firmly positioned.

5.6 Mounting the DC Disconnect

5.6.1 Inserting the DC Varistors

To protect inverters with an arc-fault circuit interrupter from overvoltage, the provided DC varistors must be inserted into the intended terminals prior to mounting the DC Disconnect.

Only the following Sunny Boy device types are equipped with an automatic arc-fault circuit interrupter (AFCI):

- SB 3000-US-12
- SB 3800-US-12
- SB 4000-US-12

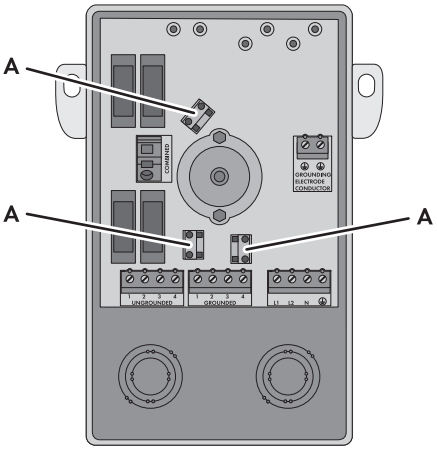
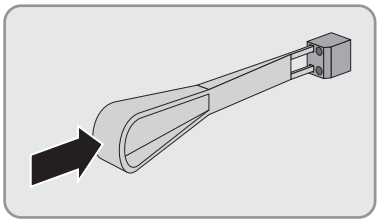


Figure 11: Position of terminals for the DC varistors

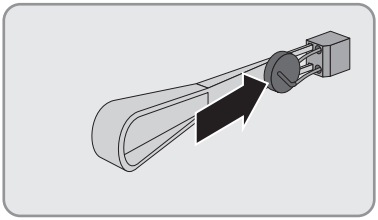
Position	Designation
A	Terminals for DC varistors

1. Open the DC Disconnect (see Section 9.3).

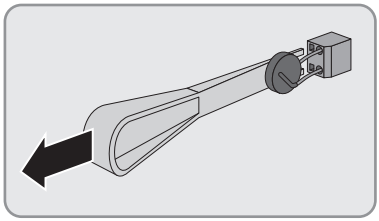
2. Equip the 3 terminals with DC varistors:
   - Insert the insertion tool into the rectangular opening of the terminal.



   - Insert the DC varistor into the terminal.



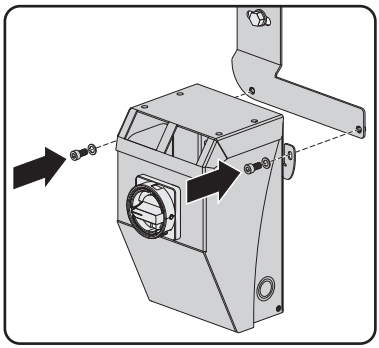
   - Pull the insertion tool out of the rectangular opening of the terminal.



3. Ensure that all DC varistors in the terminals are securely in place.
4. Close the DC Disconnect (see Section 9.4)

5.6.2 Mounting the DC Disconnect on the Wall

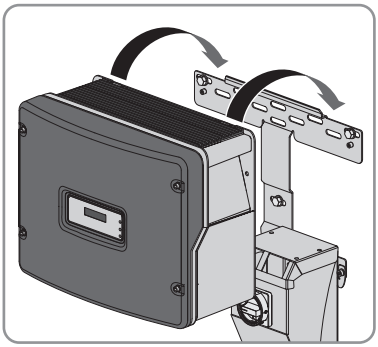
1. Position the DC Disconnect on the wall mounting bracket and insert screws with conical spring washers through the drill holes of the anchorage brackets on the DC Disconnect. For this purpose, the teeth of the conical spring washers must point in the direction of the wall.



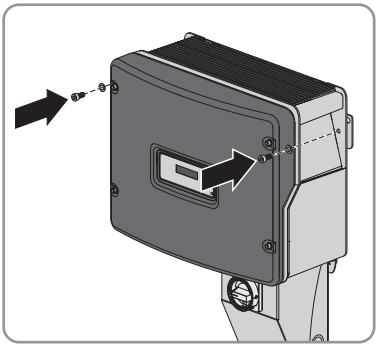
2. Tighten the screws (torque: 44 in-lb. (5 Nm)).

5.7 Mounting the Inverter

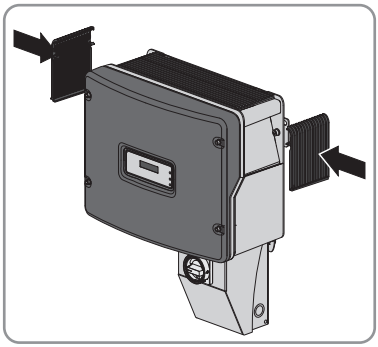
1. Transport the inverter using the side handles and hook the inverter into the wall mounting bracket from above. Ensure that the inverter is positioned in the center of the wall mounting bracket.



2. Screw the inverter onto the wall mounting bracket on both sides using the provided screws with conical spring washers (torque: 44 in-lb. (5 Nm)).



3. Close the recessed grips with the ventilation grids. Ensure that the side assignment is correct. Each ventilation grid is assigned to a side of the enclosure: Left side "links/left" and right side "rechts/right".



6 Electrical Connection

6.1 Safety During Electrical Connection

⚠ DANGER

Danger to life due to high voltages in PV modules that are exposed to light

Death or serious injury due to electric shock as a result of touching a DC cable.

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

NOTICE

Risk of damage to the inverter due to moisture penetration

Electronic components in the inverter can be destroyed or damaged as a result of moisture penetration.

- For conduit hubs, use UL listed raintight, wet location hubs for entry into the enclosure.

Risk of damage to or failure of the inverter due to the use of Wire Nuts®

The use of Wire Nuts® may cause ground-faults or prohibited and high-ohm connections, which can lead to inverter damage or failure.

- Do not use any Wire Nuts® for electrical connections in the PV system.

6.2 Overview of the Connection Area

6.2.1 Interior Connection Area

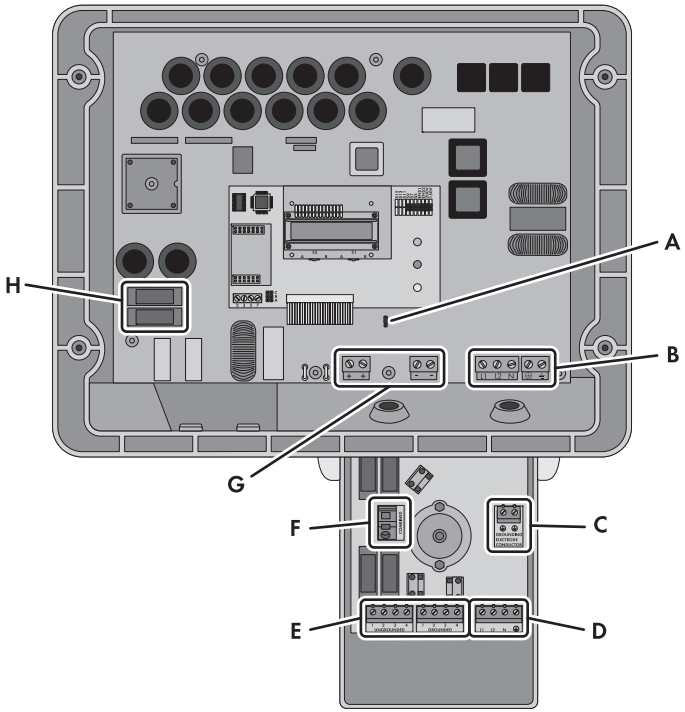


Figure 12: Components and connection areas in the interior of the inverter and the DC Disconnect

Position	Designation	Explanation
A	Pin header	For connecting the jumper when grounding the DC input
B	AC connecting terminal plate	For connecting the DC Disconnect
C	Connecting terminal plate for protective conductor	For connecting the PV protective conductor and the DC protective conductor
D	AC connecting terminal plate	For connecting the power distribution grid
E	DC connecting terminal plates	For connecting the PV array
F	"COMBINED" spring terminal	For connecting a Combiner Box
G	DC connecting terminal plate	For connecting the DC Disconnect
H	Fuse holder	For fuse extractor with grounding fuse for grounding the DC input

6.2.2 Connection Area of the Inverter

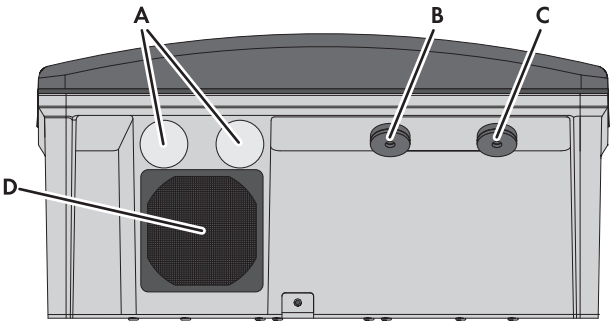


Figure 13: Terminals on the underside of the inverter

Position	Designation	Explanation
A	Enclosure opening with filler-plug	For inserting the communication cable
B	Enclosure opening with rubber grommet	For inserting the DC cable of the DC Disconnect
C	Enclosure opening with rubber grommet	For inserting the AC cable of the DC Disconnect
D	Fan guard	–

6.2.3 Connection Area of the DC Disconnect

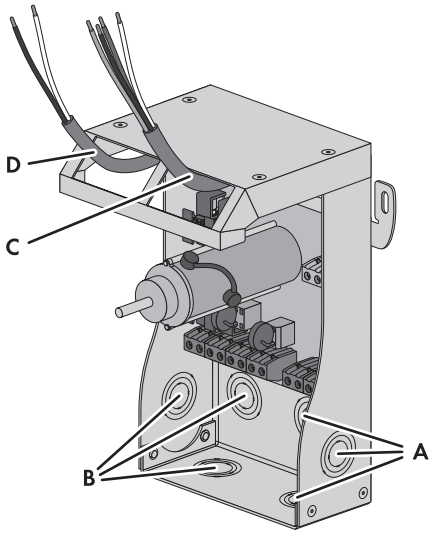


Figure 14: Connection Area of the DC Disconnect

Position	Designation	Explanation
A	Knockout	For inserting the AC cables of the power distribution grid
B	Knockout	For inserting the DC cable of the PV array
C	AC cable of the DC Disconnect	For the connection to the inverter
D	DC cable of the DC Disconnect	For the connection to the inverter

6.3 AC Connection

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

The circuits of the AC input and the AC output are isolated from the enclosure. The electrically qualified person is responsible for grounding the plant according to Section 250 of the *National Electrical Code* ANSI/NFPA 70.

The Sunny Boy must be connected to the AC grounding conductor of the power distribution grid via the ground terminal ⏚ of the AC connection terminal.

6.3.1 Inserting the AC Cables into the DC Disconnect

Additional required mounting material (not included in the scope of delivery):

- ☐ 1 rain-tight or water-tight sleeve ($^3/_4$ in. (19 mm)).
- ☐ 1 rigid conduit ($^3/_4$ in. (19 mm)).

Cable requirements:

- ☐ The AC cables must be designed for ambient temperatures exceeding +194°F (+90°C).
- ☐ The maximum cable length, which is dependent on the conductor cross-Section, must be adhered to.
- ☐ Conductor material: Copper wire
- ☐ Conductor cross-Section: AWG 10 to 6 AWG (6 mm^2 to 16 mm^2)
- ☐ The AC cables must be designed according to the installation requirements applicable on site.

Requirement:

- ☐ The AC cables must be protected using a switch-disconnector or miniature circuit-breaker (see *National Electrical Code®*, ANSI/NFPA 70). For this purpose, observe the maximum permissible fuse protection of 30 A.
- ☐ All electrical installations must be carried out according to all electrical standards applicable on site and the *National Electrical Code®* (NE, ANSI/NFPA 70).
- ☐ Installations in Canada must be carried out in accordance with the applicable Canadian standards.

1. Disconnect the AC miniature circuit-breaker and ensure that it cannot be reconnected.
2. Open the DC Disconnect (see Section 9.3).
3. Break out a suitable knockout on the underside of the DC Disconnect for inserting the AC cable.

4. **NOTICE**

   Damage to the DC Disconnect due to penetration of moisture

   Electronic components in the inverter can be destroyed or damaged as a result of moisture penetration.

   - Only break out 1 knockout for the connection of the AC cable.
   - Do not enlarge the enclosure opening.

5. Insert 1 rain-tight or water-tight sleeve ($^3/_4$ in. (19 mm)) in the enclosure opening of the DC Disconnect and tighten from the inside using a counter nut.
6. Install 1 rigid conduit ($^3/_4$ in. (19 mm)) in the enclosure opening.
7. Insert the AC cables of the power distribution grid into the interior of the DC Disconnect through a rigid conduit.

6.3.2 Connecting the AC Cables to the DC Disconnect

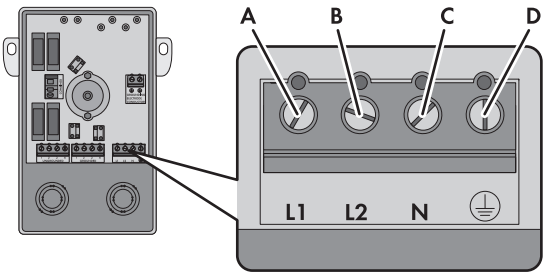


Figure 15: AC connecting terminal plate for connecting the power distribution grid

Position	Designation
A	Screw terminal "L1"
B	Screw terminal "L2"
C	Screw terminal "N"
D	Screw terminal ⏚

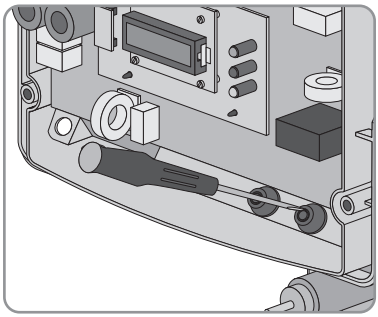
1. Connect conductor L1 to screw terminal "L1" (torque: 15 in-lb. (1.7 Nm)).
2. Connect conductor L2 to screw terminal "L2" (torque: 15 in-lb. (1.7 Nm)).
3. Connect conductor N to screw terminal "N" (torque: 15 in-lb. (1.7 Nm)).
4. Connect the AC protective conductor to screw terminal ⏚ (torque: 15 in-lb. (1.7 Nm)).
5. Ensure that all screw terminals are correctly cabled and that the cables are securely positioned in the screw terminals.

6.3.3 Connecting the AC Cable of the DC Disconnect to the Inverter

The power distribution grid is connected to the inverter via the DC Disconnect.

Inserting the AC cable of the DC Disconnect into the inverter

1. Open the inverter (see Section 9.1).
2. In order to insert the AC cable of the DC Disconnect, pierce a hole in the center of the rubber grommet in the enclosure opening. Use a screwdriver for this.



3. Insert the AC cable of the DC disconnect into the inverter through the rubber grommet.
4. Pull back the AC cable of the DC Disconnect slightly. This seals the rubber grommet.

Connecting the AC cable of the DC Disconnect to the inverter

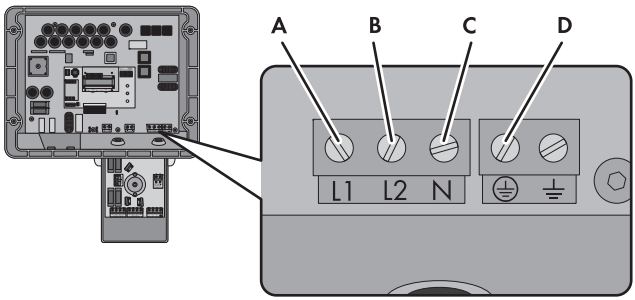


Figure 16: AC connecting terminal plate for connecting the AC cable of the DC Disconnect

Position	Designation
A	Screw terminal "L1"
B	Screw terminal "L2"
C	Screw terminal "N"
D	Screw terminal ⏚

1. Connect the black insulated conductor to screw terminal "L1" (torque: 15 in-lb. (1.7 Nm)).
2. Connect the red insulated conductor to screw terminal "L2" (torque: 15 in-lb. (1.7 Nm)).
3. Connect the white insulated conductor to screw terminal "N" (torque: 15 in-lb. (1.7 Nm)).
4. Connect the green-yellow insulated conductor to screw terminal ⏚ (torque: 15 in-lb. (1.7 Nm)).
5. Ensure that all screw terminals are correctly cabled and that the cables are securely positioned in the screw terminals.

6.4 DC Connection

6.4.1 Inserting the DC Cables into the DC Disconnect

Additional required mounting material (not included in the scope of delivery):

- ☐ 1 rain-tight or water-tight sleeve ($^3/_4$ in. (19 mm)).
- ☐ 1 rigid conduit ($^3/_4$ in. (19 mm)).

Cable requirements:

- ☐ The DC cables must be designed for ambient temperatures exceeding +194°F (+90°C).
- ☐ The maximum cable length, which is dependent on the conductor cross-Section, must be adhered to.
- ☐ Conductor material: Copper wire
- ☐ Conductor cross-Section: AWG 10 to 6 AWG (6 mm^2 to 16 mm^2)
- ☐ The DC cables must be designed according to the installation requirements applicable on site.

Requirements:

- ☐ The DC cables connected to the inverter must be protected via a switch-disconnector.
- ☐ The DC switch-disconnector for the inverter must be designed for at least 600 V and 30 A.
- ☐ If additional DC switch-disconnectors outside of the inverter are required by the Authority Having Jurisdiction (AHJ), these must be present.
- ☐ The grounding of the PV plant must be established as per the specifications of Paragraph 690.41 to 690.47 of the *National Electrical Code®* ANSI/NFPA 70 and is the responsibility of the installer.
- ☐ All electrical installations must be carried out in accordance with all electrical standards applicable on site and the *National Electrical Code®* (NE, ANSI/NFPA 70) (see *National Electrical Code®*, Paragraph 690-64(b) (1 and 2)).
- ☐ Installations in Canada must be carried out in accordance with the applicable Canadian standards.

1. Disconnect the AC miniature circuit-breaker and ensure that it cannot be reconnected.
2. Open the DC Disconnect (see Section 9.3).
3. Break out a suitable knockout on the underside of the DC Disconnect for inserting the DC cable of the PV array.
4. **NOTICE**

   Damage to the DC Disconnect due to penetration of moisture

   Electronic components in the inverter can be destroyed or damaged as a result of moisture penetration.

   - Only break out 1 knockout for the connection of the DC cable.
   - Do not enlarge the enclosure opening.
5. Insert 1 rain-tight or water-tight sleeve ($^3/_4$ in. (19 mm)) in the enclosure opening of the DC Disconnect and tighten from the inside using a counter nut.
6. Install 1 rigid conduit ($^3/_4$ in. (19 mm)) in the enclosure opening.
7. Insert the DC cables of the PV array into the interior of the DC Disconnect through a rigid conduit.

6.4.2 Grounding the DC Disconnect

The PV protective conductor on the frame of the PV array must be connected to the PV ground terminal. The cross-Section of the PV protective conductor corresponds to the cross-Section of the largest conductor in the DC system.

A DC grounding conductor may be required by the Authority Having Jurisdiction (AHJ).

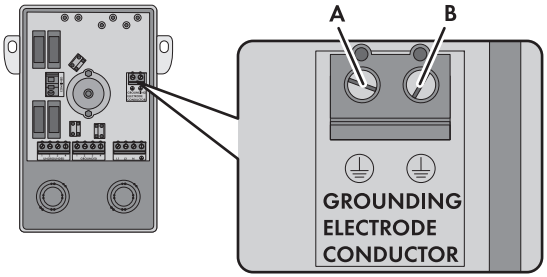


Figure 17: Connecting terminal plate for connecting the protective conductor

Position	Designation
A	PV ground terminal
B	DC ground terminal

1. Connect the PV ground terminal to the PV protective conductor (torque: 15 in-lb. (1.7 Nm)).
2. If a DC protective conductor is prescribed, connect the DC protective conductor to the DC ground terminal (torque: 15 in-lb. (1.7 Nm)).
3. Ensure that all ground terminals are correctly connected and that the cables are securely positioned in the screw terminals.

6.4.3 Grounding the DC Input

The grounding of the PV plant depends on the type of PV module used. At the factory, the inverter is designed for PV plants with negative grounding of the PV array.

⚠ DANGER

Danger to life due to high voltages in the PV plant

Death or serious injury due to electric shock.

- Only insert ground fuses into the inverter using a fuse extractor.

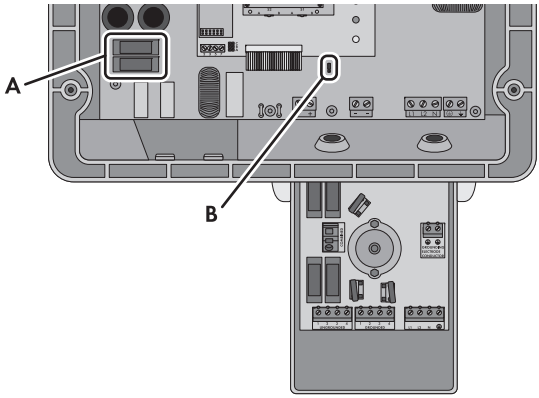
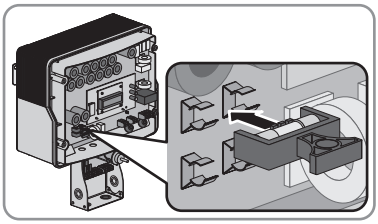


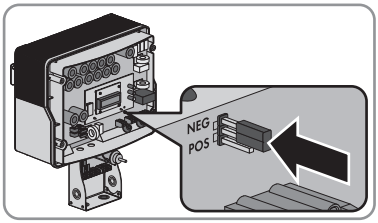
Figure 18: Position of fuse holder for fuse extractor with ground fuse and pin header for jumper

Position	Designation	
A	Fuse holder	For connecting the fuse extractor with ground fuse
B	Pin header	For connecting the jumper

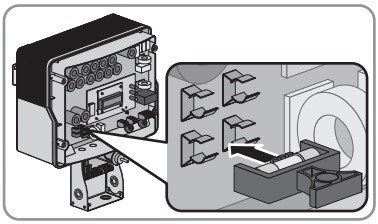
- To negatively ground the DC input, insert the fuse extractor with ground fuse into the fuse holder and insert the jumper into the pin header:
  - Insert the fuse extractor with ground fuse into the upper fuse holder.



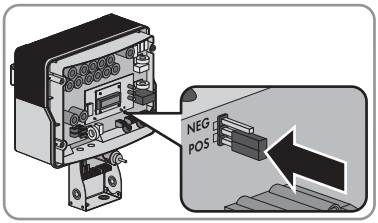
  - Insert the jumper into the upper pin, labeled "NEG", of the pin header.



- To positively ground the DC input, insert the fuse extractor with ground fuse into the fuse holder and insert the jumper into the pin header:
  - Insert the fuse extractor with ground fuse into the lower fuse holder.



  - Insert the jumper into the lower pin, labeled "POS", of the pin header.



6.4.4 Connecting the DC Cables to the DC Disconnect

Depending on the PV modules used in the PV plant, it is necessary to positively or negatively ground the PV array. The PV array must be connected to the DC Disconnect, taking into account the necessary type of grounding.

NOTICE

Potential damage to the inverter due to overvoltage

If the DC input voltage of the PV modules exceeds the maximum values of the inverter, the inverter can be damaged by overvoltage.

- The maximum permissible DC input voltage of the inverter must not be exceeded.
- Check the polarity and the open-circuit voltage of the PV strings before connecting the DC cables to the DC Disconnect.
- Configure the DC input voltage range accordingly before connecting the PV modules to the inverter. For this purpose, use the design program "Sunny Design" for string configuration (see PC Software>Sunny Design at www.SMA-America.com).

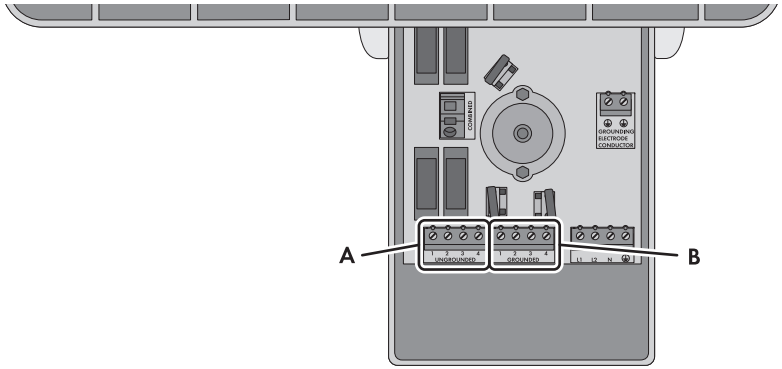


Figure 19: DC connecting terminal plates for connecting the PV array

Position	Designation
A	"UNGROUNDED" screw terminal
B	"GROUNDED" screw terminal

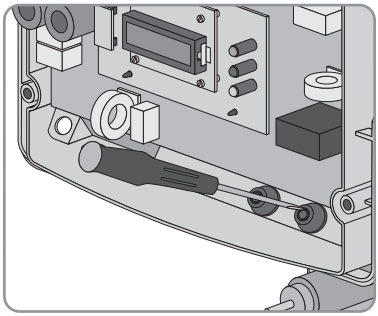
1. Ensure that the inverter is grounded as prescribed (see Section 6.4.3 "Grounding the DC Input", page 44).
2. Ensure that the DC Disconnect is grounded as prescribed (see Section 6.4.2 "Grounding the DC Disconnect", page 43).
3. To connect the PV array with negative polarity to the DC Disconnect, connect the DC cables:
   - Connect the DC+ cables to the "UNGROUNDED" screw terminal (torque: 15 in-lb. (1.7 Nm)).
   - Connect the DC − cables to the "GROUNDED" screw terminal (torque: 15 in-lb. (1.7 Nm)).
4. To connect the PV array with positive polarity to the DC Disconnect, connect the DC cables:
   - Connect the DC − cables to "UNGROUNDED" screw terminal (torque: 15 in-lb. (1.7 Nm)).
   - Connect the DC+ cables to "GROUNDED" screw terminal (torque: 15 in-lb. (1.7 Nm)).
5. Ensure that all screw terminals are correctly connected and that the cables are securely positioned in the screw terminals.

6.4.5 Connecting the DC Cable of the DC Disconnect to the Inverter

The PV array must be connected to the inverter via the DC Disconnect, taking into account the necessary type of grounding.

Inserting the DC cable of the DC Disconnect into the inverter

1. Open the inverter (see Section 9.1).
2. In order to connect the DC cable of the DC Disconnect, pierce a hole in the center of the rubber grommet in the enclosure opening.
   Use a screwdriver for this.



3. Insert the DC cable of the DC Disconnect into the inverter through the rubber grommet.
4. Pull back the DC cable of the DC Disconnect slightly. This seals the rubber grommet.

Connecting the DC cable of the DC disconnect to the inverter

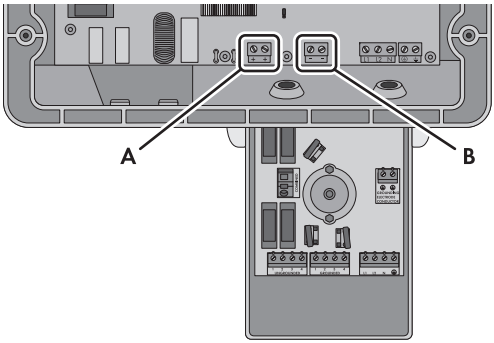


Figure 20: DC+ and DC − connecting terminal plates for connecting the DC cable of the DC Disconnect

Position	Designation
A	Screw terminal DC+
B	Screw terminal DC −

To connect the PV array with negative polarity to the inverter, connect the DC cables:

- Connect the black insulated conductor to screw terminal DC+ (torque: 15 in-lb. (1.7 Nm)).
- Connect the white insulated conductor to screw terminal DC − (torque: 15 in-lb. (1.7 Nm)).

To connect the PV array with positive polarity to the inverter, connect the DC cables:

- Connect the white insulated conductor to screw terminal DC+ (torque: 15 in-lb. (1.7 Nm)).
- Connect the black insulated conductor to screw terminal DC − (torque: 15 in-lb. (1.7 Nm)).

5. Ensure that all screw terminals are correctly connected and that the cables are securely positioned in the screw terminals.
6. Close the DC Disconnect (see Section 9.4).
7. Close the inverter (see Section 9.2).
8. Commission the inverter (see Section 8).

6.5 Connecting the Combiner Box to the DC Disconnect

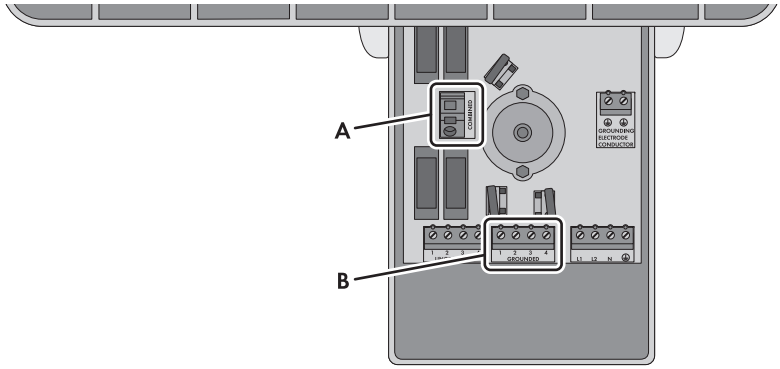


Figure 21: Terminals for the Combiner Box

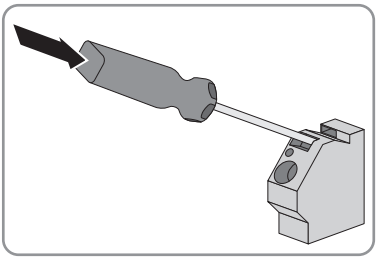
Position	Designation
A	"COMBINED" spring terminal
B	"GROUNDED" screw terminal

Connecting the DC cable to the "COMBINED" spring terminal

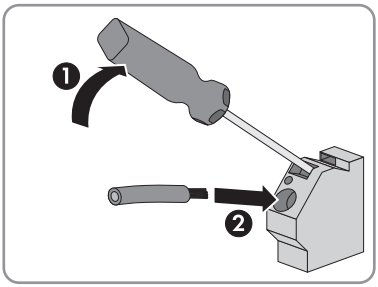
Requirement:

☐ A 3.5 mm x 120 mm insulated screwdriver must be available.

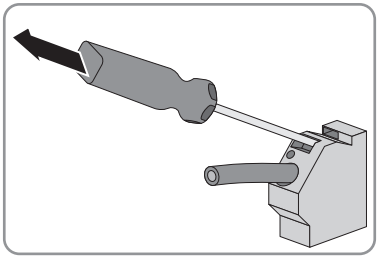
1. Insert a screwdriver into the rectangular opening of the spring terminal.



2. Press the insulated screwdriver upward and insert the stripped cable into the spring terminal.



3. Remove the insulated screwdriver from the spring terminal.



4. Carefully pull the cable to ensure that it is correctly connected.

Connecting the Combiner Box to the DC Disconnect

1. Open the DC Disconnect (see Section 9.3).
2. To connect the DC cables of the Combiner Box with negative polarity, connect the DC cables:
   - Connect the DC+ cable to the "COMBINED" spring terminal of the DC Disconnect.
   - Connect the DC − cable to the "GROUNDED" screw terminal of the DC Disconnect (torque: 15 in-lb. (1.7 Nm)).
3. To connect the DC cables of the Combiner Box with positive polarity, connect the DC cables:
   - Connect the DC − cable to the "COMBINED" spring terminal of the DC Disconnect.
   - Connect the DC+ cable to the "GROUNDED" screw terminal of the DC Disconnect (torque: 15 in-lb. (1.7 Nm)).
4. Ensure that all terminals are correctly connected and that the cables are securely positioned in the terminals.
5. Close the DC Disconnect (see Section 9.4).
6. Commission the inverter (see Section 8).

7 Configuration

7.1 Automatic Line Voltage Detection

The inverter automatically detects the line voltage that it must feed in. Depending on the voltage and the phase angle between L1-N and L2-N, the inverter determines whether it is connected to a 208 V or 240 V power distribution grid. If the inverter is configured for the wrong grounding system, the inverter displays an error message.

Limiting values for the voltage and frequency of the AC connection

AC connection	Range limit
AC operating voltage range at 208 V nominal value	183 V to 229 V
AC operating voltage range at 240 V nominal value	211 V to 264 V
AC operating frequency range	59.3 Hz to 60.5 Hz

7.2 Possible Grounding Systems

The image illustrates the permitted and prohibited grounding systems in which the inverter can be operated.

Tip: When connecting the inverter to the power distribution grid, the phase relationship is not important, but the voltage must be compatible.

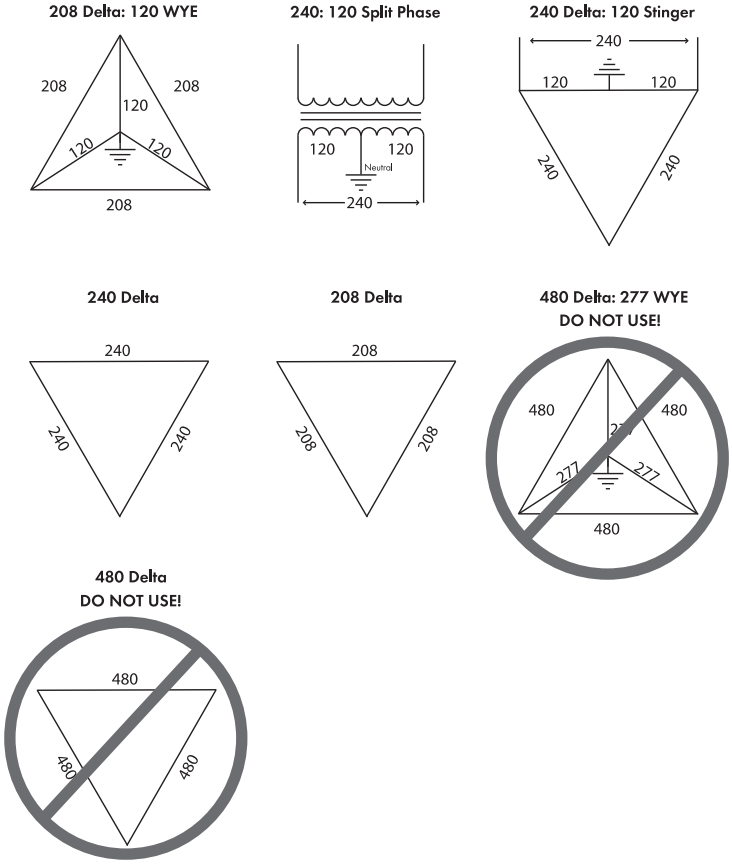


Figure 22: Permitted and prohibited grounding systems

7.3 Jumper Assignments for Grounding Systems

At the factory, the inverter is configured for connection to the power distribution grid via a neutral conductor. By setting the jumper, the inverter can be configured for various grounding systems. This means it is possible to connect the inverter to grounding systems without a neutral conductor (e.g. to a 240 Delta or 208 Delta).

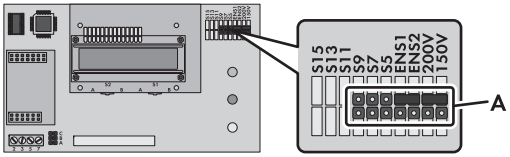
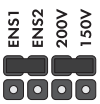
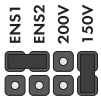


Figure 23: Pin header for setting the jumper

Position	Designation	Explanation
A	Pin header	For setting the jumper for various grounding systems

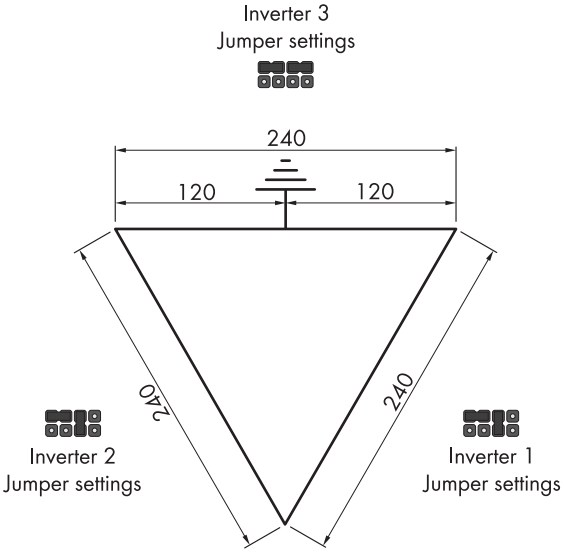
Possible jumper assignments

Jumper assignment	Explanation
	Jumper assignment for connection to a 240 V power distribution grid via a neutral conductor or a 208 V power distribution grid via a neutral conductor. This setting is configured at the factory.
	Jumper assignment for connection to a 208 V power distribution grid without a neutral conductor.
	Jumper assignment for connection to a 240 V power distribution grid without a neutral conductor.
	Jumper assignment for the fan test.

The inverter is compatible with grounding systems with a 208 V AC output or a 240 V AC output.

Example: Jumper assignment for 240 V Delta: 120 V Stinger

The example shows the jumper assignment for the connection of 3 inverters to a 240 Delta: 120 V Stinger power distribution grid. Observe the sequence in which the inverters are connected to the line conductors.



7.4 Changing the Display Language

You can change the display language of the inverter. The language is configured via two switches that are located on the bottom edge of the display.

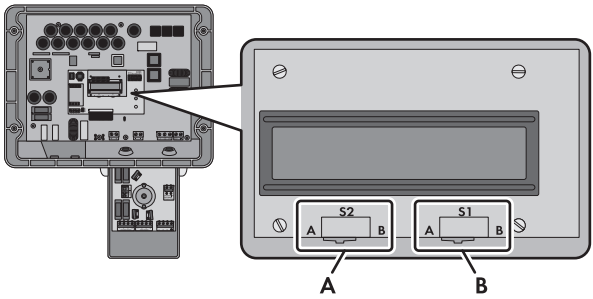


Figure 24: Switch for setting the language on the bottom edge of the display

Position	Designation
A	"S2" switch
B	"S1" switch

1. Open the inverter (see Section 9.1).
2. Set the desired language using the two rotary switches:

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

3. Commission the inverter (see Section 8).

8 Commissioning the Inverter

Always commission the inverter according to the following procedure.

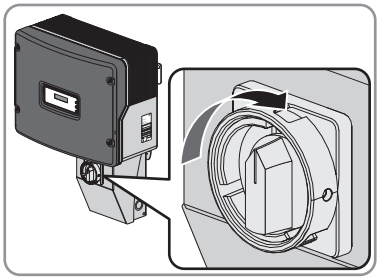
Requirements:

☐ The AC miniature circuit-breaker must be correctly rated.

☐ All cables must be correctly connected.

☐ The enclosure lid must be closed and correctly grounded.

1. Remove all covers from the PV array.
2. Switch on the AC miniature circuit-breaker.
3. Turn the rotary switch of the DC Disconnect to the **On** position.



☑ The start phase begins. The green LED blinks 3 times per second for 10 s.

☑ The green LED glows and the inverter feeds into the power distribution grid.

✖ Is the green LED not glowing?

- Observe LED signals and error messages in the display, and rectify errors (see Section 10 "Troubleshooting", page 63).

9 Opening and Closing

9.1 Opening the Inverter

⚠ DANGER

Danger to life due to high voltages in the inverter

High voltages capable of causing electric shocks are present in the conductive components of the inverter.

- Only open the inverter as described in this document.

Danger to life due to high voltages

The capacitors in the inverter require 5 minutes to discharge.

- Wait 5 minutes until the LEDs and the display switch off.

NOTICE

Risk of damage to the inverter due to moisture penetration

Electronic components in the inverter can be destroyed or damaged as a result of moisture penetration. This may result in functional faults or the destruction of the inverter.

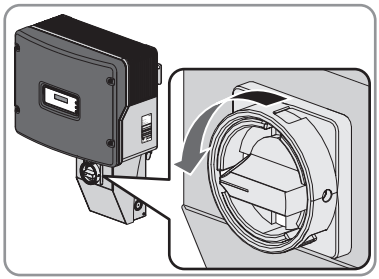
- Never open the inverter when it is raining or if there is a high level of humidity (> 95%).

Damage to the seal of the enclosure lid during frost

When opening the Sunny Boy in the event of frost, the seal of the enclosure lid can be damaged. There may be an ingress of moisture, which can damage the Sunny Boy.

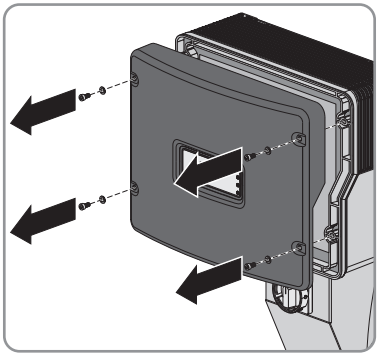
- Do not open the inverter when the outside temperature is below 23 °F (− 5 °C).

1. Disconnect the AC miniature circuit-breaker and secure against re-connection.
2. Turn the rotary switch of the DC Disconnect to the **Off** position and secure against re-connection.



3. If additional DC switch-disconnectors are available, switch off the DC switch-disconnectors and secure against re-connection.

4. Remove all 4 screws and conical spring washers from the enclosure lid and remove the enclosure lid in an upward direction.



5. The enclosure lid, screws, and conical spring washers are to be stored safely.

9.2 Closing the Inverter

Requirements:

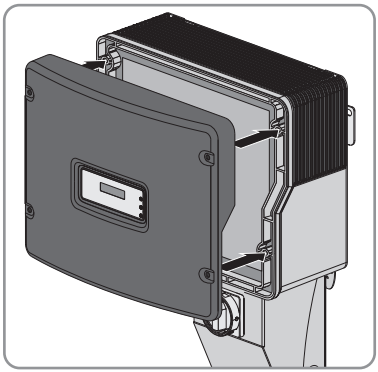
☐ All cables are routed correctly and are not jammed when closing the lid.

☐ The seal in the inside of the lid must be undamaged and in the correct position.

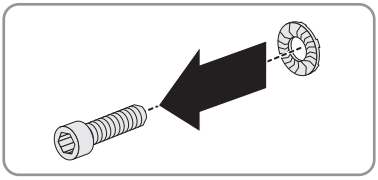
☐ The enclosure lid must not exert any pressure on the connections.

☐ The connections and screw connections at knockouts must be correctly tightened.

1. Mount the enclosure lid on the inverter. For this purpose, align the 4 drill holes in the enclosure lid with the 4 threaded bores in the enclosure.

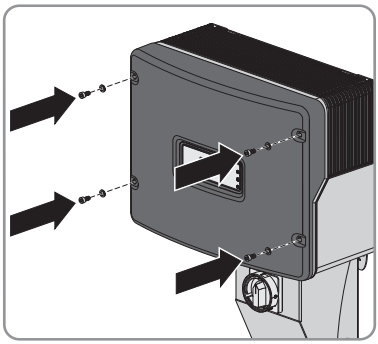


2. Attach the enclosure lid to the enclosure using all 4 screws and conical spring washers:
   - Attach 1 conical spring washer on each screw. Here, the grooved side of the conical spring washer must point to the screw head.



   - Tighten the 4 screws with conical spring washers through the drill holes in the enclosure lid into the threaded bores of the enclosure (torque: 53 in-lb. (6 Nm)).

   ☑ The teeth of the conical spring washer press into the enclosure lid. This grounds the enclosure lid.



3. Ensure that the enclosure lid is supported evenly on the enclosure.

9.3 Opening the DC Disconnect

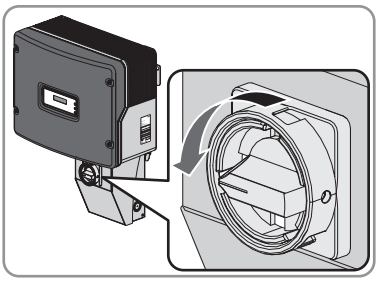
⚠ DANGER

Danger to life due to high voltages in DC connecting terminal plates with connected PV modules

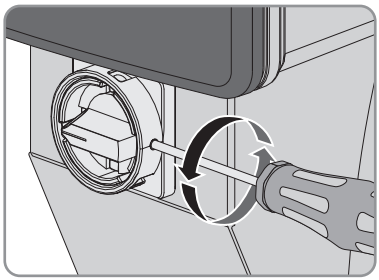
Death or serious injury as a result of touching the DC connecting terminal plates of the DC Disconnect. High voltages that can result in electric shocks are present in the live components of the DC connecting terminal plates.

- Do not touch the live components of the DC connecting terminal plates.

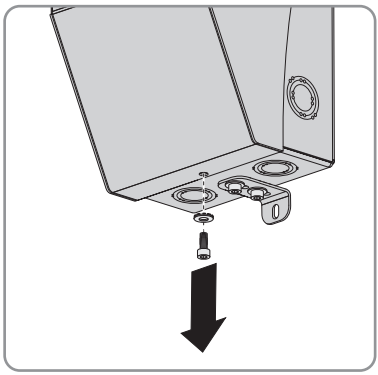
1. Disconnect the AC miniature circuit-breaker and secure against re-connection.
2. Turn the rotary switch of the DC Disconnect to the **Off** position and secure against re-connection.



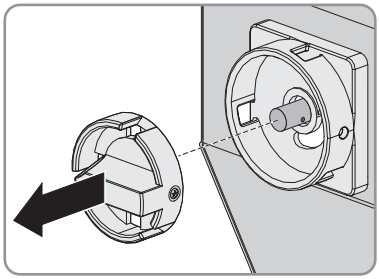
3. If additional DC switch-disconnectors are available, switch off the DC switch-disconnectors and secure against re-connection.
4. Loosen the screw on the rotary switch of the DC Disconnect. Use a cross-head screwdriver for this.



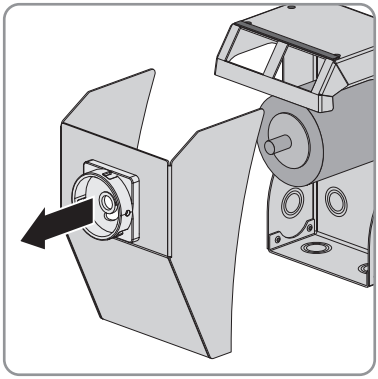
5. Remove the screw and conical spring washer of the cover on the underside of the DC Disconnect.



6. Remove the rotary switch of the DC Disconnect in an upward direction.



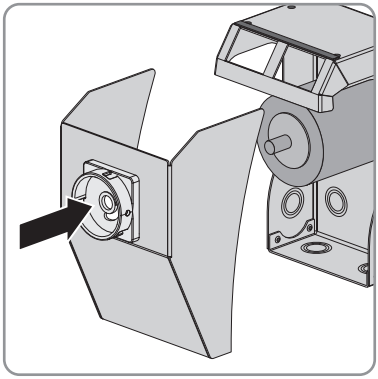
7. Remove the cover of the DC Disconnect.



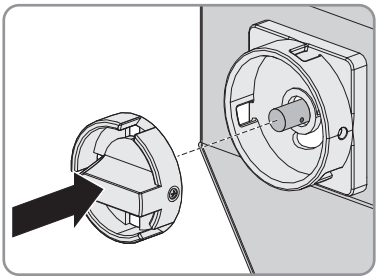
9.4 Closing the DC Disconnect

Always close the DC Disconnect as per the following procedure.

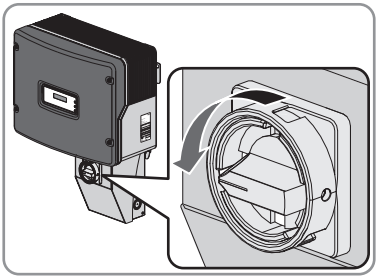
1. If a Combiner Box is not connected, ensure that the fuse extractors with string fuses are securely positioned in the fuse holders of the DC Disconnect (see Section 11.8 "Replacing String Fuses", page 88).
2. Mount the cover on the DC Disconnect.



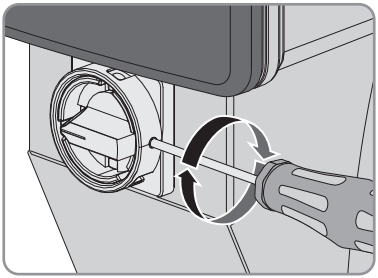
3. Connect the rotary switch.



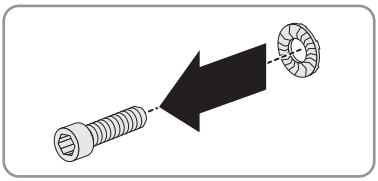
4. Turn the rotary switch of the DC Disconnect to the **Off** position.



5. Tighten the screw on the right-hand side of the rotary switch. Use a cross-head screwdriver for this.

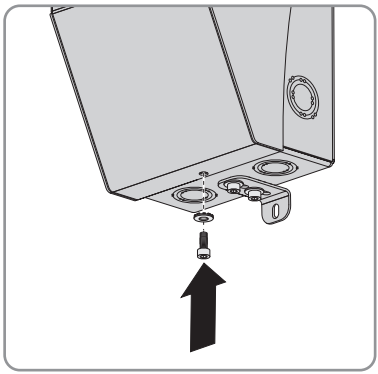


6. Attach the conical spring washer on the screw of the DC Disconnect. Here, the grooved side of the conical spring washer must point to the screw head.



7. Insert the screw and conical spring washer into the underside of the DC Disconnect and tighten the screw (torque: 44 in-lb. (5 Nm)). Ensure that the toothing of the conical spring washer points towards the cover.

   ☑ The teeth of the conical spring washer press into the cover of the DC Disconnect. This grounds the cover.



10 Troubleshooting

10.1 LED Signals

The LEDs represent the current operating state of the inverter clarify the messages in the display by means of the various blink codes.

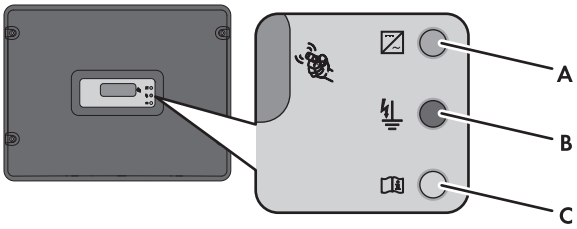


Figure 25: Position of the LEDs

Position	Designation	Status	Explanation
A	Green LED	Glowing	Operation Indicates standard operation of the inverter.
		Blinks 3 times per second	Start The inverter is calibrating internal systems. The calibration takes 10 s. Following successful calibration, the inverter resumes normal operation.
			Stop The inverter has been manually set to stop mode.
		Blinks once per second	Waiting The inverter is monitoring the grid limits and the DC voltage of the PV array. If both values meet the feed-in conditions, the inverter begins feeding into the power distribution grid.
		Goes out briefly once per second	Derating The inverter reduces the power in order to protect the internal components from overheating.

Position	Designation	Status	Explanation
B	Red LED	Glowing	Tripped ground fuse Ground fuse was tripped or is not available. **Corrective measures:** • Check the PV plant for ground-faults (see Section 11.6).
C	Yellow LED	Glowing	Control System Fault The operation of the inverter is permanently inhibited. The inverter no longer feeds into the power distribution grid.
		Blinking	AFCI self-test The inverter is carrying out the AFCI self-test.
		Glows for 5 s, goes out for 3 s, blinks twice	Grid failure This blink code can be caused by any of the following conditions: • Grid undervoltage • Grid overvoltage • Grid underfrequency • Grid overfrequency • Sudden change in the power frequency or the line voltage **Corrective measures:** • Monitor the status of the power distribution grid at the AC connecting terminal plate of the DC Disconnect and the AC miniature circuit-breaker between the inverter and the power distribution grid.

Position	Designation	Status	Explanation
		Glows for 5 s, goes out for 3 s, blinks 4 times	High DC input voltage The inverter has detected a DC input voltage that is too high for safe operation.
		Glows for 5 s, goes out for 3 s, blinks 5 times	Disturbance The inverter has detected an internal fault that interrupts normal operation:
B + C	Red LED + yellow LED	Glowing	ground-fault The inverter has detected a ground-fault. The inverter will not restart automatically after detecting a ground-fault. **Corrective measures:** • Check the PV plant for ground-faults (see Section 11.6).
A + B + C	All LEDs	Glowing	Initialization The inverter is initializing. The DC current available from the PV array is not sufficient for normal operation. Data transmission is not possible during initialization.
A + B + C	All LEDs	Not glowing	Standby The inverter is in standby mode. The DC input voltage is too low for operation.

10.2 Measurement Channels

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

Measurement channel	Explanation
CO2 saved	Amount of CO2 saved during operation time
E-total	Total energy yield
Error	Description of an error
Event-Cnt	Number of events
Fac	Power frequency
Grid type	Type of power distribution grid to which the inverter is connected
h-on	Total operating hours

Measurement channel	Explanation
h-Total	Total number of feed-in operation hours
I-dif	Residual current
Iac	Line current
Ipv	DC input current
Max Temperature	Measured maximum temperature at IGBT module
Max Vpv	Maximum DC input voltage
Mode	Current operating mode
Pac	Power fed into the power distribution grid
Power On	Total system start-up counter
Serial Number	Inverter serial number
Temperature	Temperature measured at IGBT module
Vac	Line voltage L1 - L2
Vac L1	Line voltage L1 - N
Vac L2	Line voltage L2 - N
Vfan	Fan voltage
Vpv	DC input voltage
Vpv-PE	DC voltage to ground (for troubleshooting PV ground-faults)
Vpv Setpoint	MPPT DC target voltage

10.3 Operating Parameters

Flexible operating parameters

Name	Description	Value/range	Explanation	Default value
AfciIsOn	Automatic arc-fault circuit interrupter (AFCI)	yes		yes
		no		
AntiIsland-Ampl*	Amplification of the anti-island process	0 deg to 10 deg		0 deg
AntiIsland-Freq*	Repetition rate of the anti-island process	0 mHz to 2,000 mHz		500 mHz

Name	Description	Value/range	Explanation	Default value
CO2-Fact	The inverter assesses the yield and displays the approximate amount of CO_2 that the inverter has saved. The amount of CO_2 is calculated by multiplying the generated kWh (E-total) by the factor defined in the parameter "CO2".	0 lb./kWh to 2 lb./kWh		1.7 lb./kWh
Default	Defines the country standard for adjusting country-specific information. Tip: After changing one of the parameters marked with "*", the parameter "Default" automatically changes to **adjusted**.	USA/UL1741/2005 OFF_Grid NON IEEE1547		USA/UL1741/2005
E_total	Total energy yield of the inverter. It may be necessary to change this if you replace your inverter and want to use data from the old device.	0 kWh to 200,000 kWh		0 kWh
Fac-delta–*	Maximum permissible frequency deviation below the power frequency of 60 Hz before the grid monitoring disconnects the device from the power distribution grid. The standard value is optimal for plants < 30 kW.	0.2 Hz to 3.0 Hz		0.69 Hz (for the country setting USA/UL1741/2005)

Name	Description	Value/range	Explanation	Default value
Fac-delta+*	Maximum permissible frequency deviation above the power frequency of 60 Hz before the grid monitoring disconnects the device from the power distribution grid. The standard value is optimal for plants < 30 kW.	0 Hz to 4.5 Hz		0.49 Hz (for the country setting USA/ UL1741/ 2005)
Fac-MinTripTime*	Switch-off time having fallen below power frequency. The standard value is optimal for plants <30 kW.	0.16 s to 300 s		0.16 s
Fan-Test	By setting this parameter to **1**, you can check the function of the fan.	1	The fan is set to the maximum speed.	0
		0	Operating mode: OptiCool	
h_total	Total operating hours of the inverter. It may be necessary to change this if you replace your inverter and want to use data from the old device.	0 h to 200,000 h		0 h

Name	Description	Value/range	Explanation	Default value
Memory Function		no function		no function
		Default param.	Sets all parameters to the standard value.	
		Reset Op.Data	Sets all parameters that are visible on the user level to the standard values.	
		Reset errors	Resets all permanent errors that lead to device disconnection.	
Operating Mode	Operating modes of an inverter	MPP-Operation	Sets the inverter to the operating mode "MPP"	MPP
		Turbine	Sets the inverter to the operating mode "Turbine"	
		V-const	Sets the inverter to the operating mode "V-Const"	
		Stop	Disconnection from the power distribution grid, no operation	
T-Max-Fan	Temperature at which the fan reaches the maximum fan speed.	32°F to 212°F (0°C to 100°C)		194°F (90°C)
T-Start	Gird monitoring time: Time during which the inverter monitors the power distribution grid before connecting. This value defaults to 5 minutes after a grid fault.	5 s to 1,600 s		10 s

Name	Description	Value/range	Explanation	Default value
T-Start-Fan	Fan turn-on temperature at minimum speed.	32°F to 212°F (0°C to 100°C)		122°F (50°C)
T-Stop	Time during which the inverter waits before disconnecting from the power distribution grid if "Pac" (fed-in power) falls below the minimum required "Vpv-Start" (DC voltage).	1 s to 1,800 s		2 s
T-Stop-Fan	Fan turn-off temperature	32°F to 212°F (0°C to 100°C)		122°F (50°C)
V-Const Setval	DC target voltage for the operating mode "V-Const". These parameters are important only if the parameter "Operating Mode" is set to "V-const".	SB 3000US: 185 V to 500 V SB 3800-US: 230 V to 600 V SB 4000US: 230 V to 600 V		SB 3000US: 500 V SB 3800-US: 600 V SB 4000US: 600 V
Vac-Min*	The value is used to calculate the lower limit of the permissible AC voltage. The standard value is optimal for plants < 30 kW. The standard value of 12% results in a trip value of 88%, as the list of trip limits shows (see Section 12.6).	0% to 50%		12%

Name	Description	Value/range	Explanation	Default value
Vac-Max*	Additional monitoring of the AC voltage The value is used to calculate the upper limit of the permissible AC voltage. The standard value is optimal for plants < 30 kW. The standard value of 10% results in a trip value of 110%, as the list of trip limits shows (see Section 12.6).	0% to 20%		10%
Vac-Min-Fast*	Additional monitoring of the AC voltage The value is used to calculate the lower limit of the permissible AC voltage. The standard value is optimal for plants <30 kW. The standard value of 50% results in a trip value of 50%, as the list of trip limits shows.	0% to 50%		50%
Vac-Max-Fast*	Additional monitoring of the AC voltage The value is used to calculate the upper limit of the permissible AC voltage. The standard value is optimal for plants <30 kW. The standard value of 20% results in a trip value of 120%, as the list of trip limits shows.	0% to 20%		20%
Vac-Min-Recnet	The value is used to calculate the lower limit that is required for reconnecting to the power distribution grid after a grid failure.	0% to 50%		11.7%

Name	Description	Value/range	Explanation	Default value
Vac-Max-Recnet	The value is used to calculate the upper limit that is required for reconnecting to the power distribution grid after a grid failure.	0% to 20%		5.83%
Vpv-Start	Minimum DC voltage from which the inverter feeds into the power distribution grid.	SB 3000US: 166 V to 480 V SB 3800-US: 208 V to 580 V SB 4000US: 208 V to 580 V		SB 3000US: 228 V SB 3800-US: 285 V SB 4000US: 285 V

* Changing the parameters can lead to changes regarding compliance with IEEE 1547 and must be approved by the on-site electric utility company and/or the Authority Having Jurisdiction (AHJ).

Fixed operating parameters

Name	Description	Default value
Plimit	Upper limit for AC output power	SB 3000US: 3,050 W SB 3800-US: 4,050 W SB 4000US: 4,050 W
SMA-SN	Inverter serial number	
Software-BFR	Firmware version of the operation control unit	
Software-SRR	Firmware version of the current controlling unit	

10.4 Display messages

10.4.1 Status Messages

Message	Explanation
Derating	Reduction of the power fed into the power distribution grid due to high heat sink temperatures
Disturbance	Displays an error status that concerns the power distribution grid. This error status resolves itself.
Error	Error status that must be rectified
Grid monitoring	When the system starts, the inverter performs a synchronization with the power distribution grid.
MPP	The inverter is in MPP mode. The inverter adjusts the input voltage and the input current from the PV array in order to achieve the highest possible DC output power.
MPP-Search	When the system starts, the inverter tests the MPP tracking range.
Offset	When the system starts, the inverter performs an offset calibration of the electronics.
Stop	The inverter has been manually set to system stop.
Turbine	The inverter is in turbine mode. This operating mode is specifically conceived for use with wind turbine systems.
V-Const	The input voltage of the PV array is set at a given target value and the inverter is not operating in MPP mode. This operating mode is suitable for using the inverter with fuel cells or small hydroelectric power plants.
Wait	DC voltage is not high enough to start.
Warning	Error status that requires an additional inspection

10.4.2 Error Messages

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

If the feed-in to the power distribution grid is interrupted either manually or due to a detected AC failure and then resumed, the inverter waits 5 minutes before resuming grid feed-in. For this purpose, the DC input voltage must be greater than the DC start voltage of the inverter (see Section 12 "Technical Data", page 90). If the feed-in conditions are not met 3 times in a row, the inverters waits 10 minutes and then attempts once more to feed into the power distribution grid.

Message	Cause and corrective measures
Bfr-Srr	Communication between micro-controllers is interrupted. **Corrective measures:** • Contact the SMA Service Line (see Section 15).
Derating	The inverter reduces its output power due to excess temperature. **Corrective measures:** • Clean the fan (see Section 11.2).
Error AFCI	The inverter has detected an electric arc in the PV system. **Corrective measures:** • Eliminate the disturbance (see Section 10.4.3 "Resetting "Error AFCI" Disturbance", page 77).
EarthCurMax-B, EarthCurMax-S	The ground-fault monitoring (GFDI) has detected an excessive residual current in the PV plant. **Corrective measures:** • Check the PV plant for ground-faults (see Section 11.6).
EEPROM	Temporary disturbance whilst reading or writing data from the EEPROM. This data is not essential for safe operation. This message only serves to inform you and has no effect on the performance of the inverter.
EEPROM p	Data from the EEPROM are defective. The inverter has switched off, because the loss of data has disabled important inverter functions. **Corrective measures:** • Contact the SMA Service Line (see Section 15).
EeRestore	One of the duplicate records in the EEPROM is defective and has been reconstructed without loss of data. This message only serves to inform you and has no effect on the performance of the inverter.

Message	Cause and corrective measures
Fac-Bfr, Fac-Srr	The AC power frequency exceeds the permissible range. To prevent islanding, the inverter disconnects from the power distribution grid. **Corrective measures:** • Ensure that the AC cable is correctly connected (see Section 6.3). • Ensure that the power frequency is within the permissible range. • If the power frequency is within the permissible range and this message continues to be displayed, contact SMA Service Line (see Section 15).
GFDI Fuse Open	The ground fuse has tripped. **Corrective measures:** • Check the PV plant for ground-faults (see Section 11.6). • Replace the ground fuse (see Section 11.7).
Grid-Timeout, Grid-Fault-S	The grounding system of the power distribution grid could not be detected. **Corrective measures:** • Contact the SMA Service Line (see Section 15).
Imax	Overcurrent detected on AC side. The current to the power distribution grid exceeds the specifications. This may be caused by a serious system incident. **Corrective measures:** • Ensure that the PV plant is correctly rated. • Ensure that the grid conditions are maintained.
K1-Close K1-Open, K2-Open	An internal test has failed. **Corrective measures:** • Contact the SMA Service Line (see Section 15).
MSD-FAC, MSD-Idif MSD-VAC	An internal measurement comparison fault has been detected. The measured values of both processes (OCU and current controlling unit) deviate too much from one another. **Corrective measures:** • Contact the SMA Service Line (see Section 15).
OFFSET	Grid monitoring self-test failed. **Corrective measures:** • If the message occurs frequently, contact the SMA Service Line (see Section 15).

Message	Cause and corrective measures
ROM	Internal test of the inverter control system firmware failed. **Corrective measures:** • If the message occurs frequently, contact the SMA Service Line (see Section 15).
Shut-Down	Overcurrent present at the DC input of the inverter. The inverter switches off. **Corrective measures:** • If the message occurs frequently, ensure that the design and circuitry of the PV array are correct.
Vac-Bfr, Vac-Srr	The AC line voltage exceeds the permissible range. This may be caused by disconnection of the power distribution grid or of an AC cable. To prevent islanding, the inverter disconnects from the power distribution grid. **Corrective measures:** • If the message "Vac-Bfr" or "Vac-Srr" is displayed, even though the line voltage is within the permissible range, contact the SMA Service Line (see Section 15).
VacL1-Ocu, VacL2-Ocu, VacL1-Srr, VacL2-Srr	The DC input voltage is too high or too low on the indicated branch. **Corrective measures:** • Contact the SMA Service Line (see Section 15).
VpvMax !PV Overvoltage!! Disconnect DC!	The DC input voltage is above the maximum configured limiting value. **Corrective measures:** • Turn the rotary switch of the DC Disconnect to the **Off** position immediately.
Watchdog	An internal program run fault has been detected. **Corrective measures:** • Contact the SMA Service Line (see Section 15).
XFMR_TEMP_F	A high transformer temperature has been detected. The inverter stops operation and the fan runs at maximum speed. **Corrective measures:** • Ensure sufficient ventilation.

Message	Cause and corrective measures
XFMR_TEMP_W	After high transformer temperatures are reduced, the inverter restarts feed-in operation. **Corrective measures:** • Ensure that the fan is functioning correctly (see Section 11.3 "Checking the Fan", page 81).

10.4.3 Resetting "Error AFCI" Disturbance

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

⚠ WARNING

Danger of fire due to electric arc in the PV plant

Risk of death or serious injury.

- Only test the AFCI for false tripping in the order described below.
- Do not deactivate the AFCI permanently.

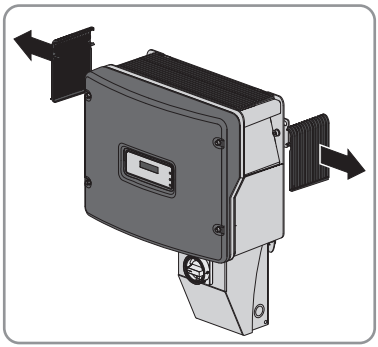
1. Turn the rotary switch of the DC Disconnect to the **Off** position.
2. Wait until the display and all LEDs switch off.
3. Perform troubleshooting in the PV system. Ensure that the correct open-circuit voltage values are present at all PV strings.
4. Turn the rotary switch of the DC Disconnect to the **On** position.
   ☑ The message "Error AFCI. Knock to reset." is displayed.
   ✖ Is the message "Error AFCI. Knock to reset." not displayed and is the yellow LED flashing?
   Possible cause of error: The solar irradiation is insufficient and the AFCI self-test cannot be performed successfully.
   - If the AFCI self-test continues to be unsuccessful, turn the rotary switch of the DC Disconnect to the **Off** position and switch off the AC miniature circuit-breaker.
   - If the AFCI self-test is consistently unsuccessful, contact the SMA Service Line (see Section 15 "Contact", page 99).
5. If the message "Error AFCI. Knock to reset." is displayed, tap the enclosure lid within 10 s.
   ☑ The green LED glows permanently and the inverter feeds into the power distribution grid.
   ✖ Is the green LED not glowing permanently and is the inverter not feeding into the power distribution grid?
   Possible cause of error: You did not tap the enclosure lid within 10 s of the message appearing.
   - Repeat steps 1 to 5.

11 Cleaning and Care

11.1 Cleaning the Ventilation Grids

For optimal heat dissipation of the device, the ventilation grids must be clean.

1. Remove the ventilation grids sideways.



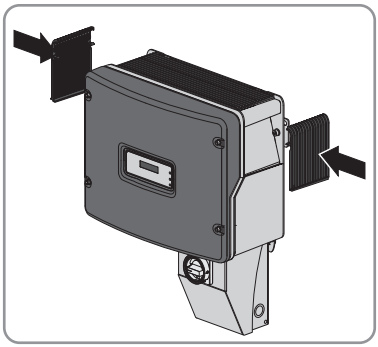
2. **NOTICE**

   Risk of damage to the inverter due to intrusion of foreign bodies

   If the ventilation grid has been removed, foreign bodies (e.g. insects or stones) can intrude into the inverter and cause damage.

   - Mount the ventilation grids after installation and every time you finish cleaning.
   - Never operation the inverter without ventilation grids.

3. Clean the ventilation grids with a soft brush or paintbrush.
4. Close the recessed grips with the ventilation grids. Ensure that the side assignment is correct. Each ventilation grid is assigned to a side of the enclosure: Left side "links/left" and right side "rechts/right".



11.2 Cleaning the Fans

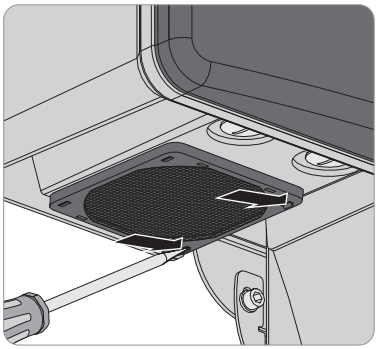
If the inverter displays the message "Derating", the fan may be dirty or defective. Always clean the fan as per the following procedure.

1. Open the inverter (see Section 9.1).
2. Wait 5 minutes until the fan stops rotating.
3. Check whether the fan guard is dusty or badly clogged.

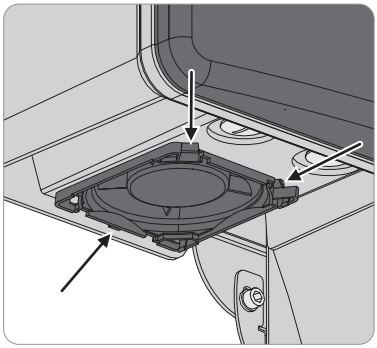
   If the fan guard is dusty, clean the fan guard with a vacuum cleaner.

   If the fan guard is badly clogged, remove and clean the fan guard:

   - Use a screwdriver to press both catches on the right edge of the fan guard to the right and remove from the retainer.

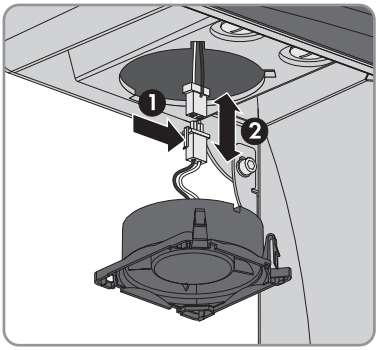


   - Carefully remove the fan guard.
   - Clean the fan guard with a brush, a paint brush, a cloth, or compressed air.
4. If the fan is soiled, remove the fan:
   - Press the fan catches to the center of the fan.



   - Slowly remove the fan from the inverter.

- Unlock and remove the fan plug.

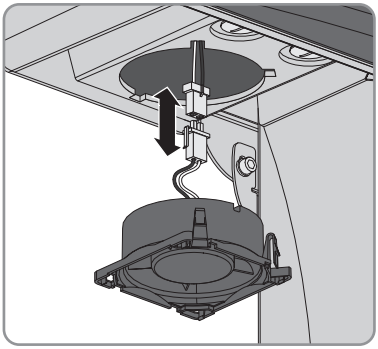


NOTICE

Damage to the fan due to compressed air

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

5. Insert the fan plug into the jack until it snaps into place.



6. Insert the fan into the inverter until the fan audibly snaps into place.
7. Press the fan guard into the retainer until it audibly snaps into place.
8. Commission the inverter (see Section 8).

11.3 Checking the Fan

You can check the fan by configuring a parameter via a communication product or by placing a jumper on the pin header of the printed circuit board of the inverter. At temperatures below 32°F (0°C), the fan will no longer be controlled and cannot be checked.

Fan test by configuring a parameter

☐ A communication product, data logger, or item of software, which is suitable for the type of communication used, must be available.

1. Request the installer password from the SMA Service Line (see Section 15 "Contact", page 99).
2. Launch the user interface of the data logger or the software.
3. Enter the installer password.
4. In installer mode, set the parameter "Fan Test" to **1**.
5. Check whether air is coming out of the fan guard and whether the fan makes any unusual noise.

   If the fan makes an unusual noise or no air is coming out, make sure that the fan is correctly installed.

   If the fan is installed correctly and the problem persists, contact the SMA Service Line.
6. Reset the parameter "Fan Test" to **0**.

Fan test by setting the jumpers

Requirement:

☐ Jumpers for fan test must be available.

1. Open the inverter (see Section 9.1).
2. Place the jumpers for the fan test on the printed circuit board. For this purpose, plug jumpers into the pins on the pin header labeled "200 V" and "150 V" in order to set the jumpers (see Section 7.3 "Jumper Assignments for Grounding Systems", page 53).
3. Close the inverter (see Section 9.2).
4. Commission the inverter (see Section 8).

   ☑ The fan starts up.
5. Check whether air is coming out of the fan guard and whether the fan makes any unusual noise.

   If the fan makes an unusual noise or no air is coming out, make sure that the fan is correctly installed.

   If the fan is installed correctly and the problem persists, contact the SMA Service Line.

6. After checking the fan, return the jumpers to the original position:
   - Open the inverter (see Section 9.1).
   - Place the jumpers on the pin header according to the desired jumper assignment (see Section 7.3 "Jumper Assignments for Grounding Systems", page 53).
   - Close the inverter (see Section 9.2).
   - Commission the inverter (see Section 8).

11.4 Checking the DC Disconnect

- Once a year, turn the rotary switch of the DC-Disconnect from the **On** position to the **Off** position 10 times in a row. This cleans the contacts of the rotary switch and extends the service life of the DC Disconnect.

11.5 Checking and Replacing the DC Varistors

In regions where storms or other DC overvoltages frequently occur, the DC varistors lose their functionality if the PV plant is not equipped with additional overvoltage protection. In such cases, SMA recommends replacing DC varistors with new ones after an operating period of 10 years in order to ensure that the functionality of the DC varistors remains at a constant level.

NOTICE

Destruction of the inverter due to DC overvoltage

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

- Do not operate the inverter without DC varistors in PV plants with a high risk of DC overvoltages.
- Replacement DC varistors should be obtained as fast as possible.
- Use the DC varistors by SMA Solar Technology AG only.
- Always replace the entire set of DC varistors.

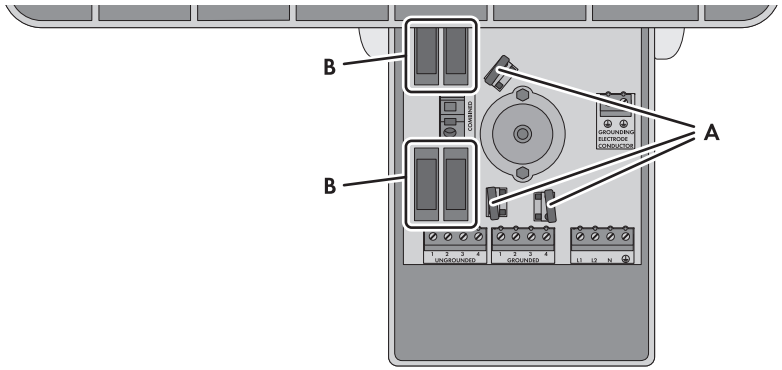


Figure 26: Position of the DC varistors and string fuses

Position	Designation	Explanation
A	DC varistors	–
B	Fuse holder	For connecting 4 fuse extractors with string fuses

Requirement:

☐ Set with 3 replacement varistors including insertion tool must be available (see Section 13 "Accessories", page 97).

1. Open the DC Disconnect (see Section 9.3).
2. Check whether the DC varistors are discolored or whether there is any other visible damage.
   If DC varistors are visibly discolored or damaged, replace the DC varistors.
3. **⚠ DANGER**

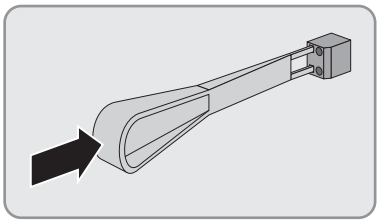
   Danger to life due to short circuits in the DC varistors

   Death or serious injury due to electric shock.

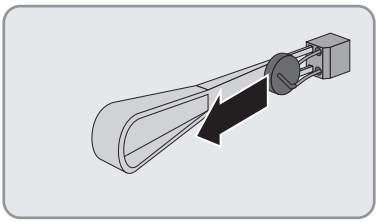
   - Check whether current is flowing in the DC cables.
4. Disconnect the DC varistors:
   - Disconnect the string connectors of all ungrounded DC cables from the PV array.
   - Remove the 4 fuse extractors with string fuses from the fuse holders of the DC Disconnect.
   - Remove the 4 string fuses from the fuse extractors.
   - Insert the 4 fuse extractors without string fuses into the fuse holder of the DC Disconnect.
5. Ensure that no voltage is present at the DC varistors.

If no voltage is present at the DC varistors, replace all DC varistors.

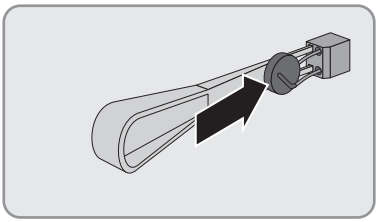
- Insert the insertion tool into the rectangular opening of the terminal.



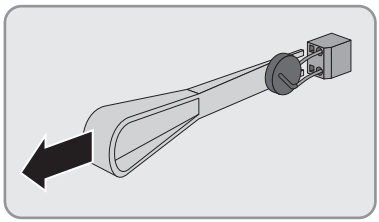
- Remove the DC varistor.



- Insert the new DC varistor into the terminal.



- Pull the insertion tool out of the rectangular opening of the terminal.



6. Ensure that all DC varistors in the terminals are securely in place.
7. Re-insert all string fuses into the DC Disconnect:
   - Remove the 4 fuse extractors without string fuses from the fuse holders of the DC Disconnect.
   - Equip the 4 fuse extractors with functional string fuses.
   - Insert the 4 fuse extractors with string fuses into the fuse holder of the DC Disconnect.
8. Re-connect the string connectors of all ungrounded DC cables to the PV array.
9. Close the DC Disconnect (see Section 9.4).
10. Commission the inverter (see Section 8).

11.6 Checking the PV Plant for a ground-fault

If the red and yellow LEDs glow, there may be a ground-fault in the PV plant.

Check each string of the PV plant for a ground-fault as per the following procedure:

⚠ DANGER

Danger to life due to electric shock

Death or serious injuries due to high voltages at the PV array.

- Only touch the insulation of the PV array cables.
- Do not connect strings with ground-faults to the inverter.

⚠ CAUTION

Risk of electric shock

Normally grounded conductors may be ungrounded and energized when a ground-fault is indicated by the inverter.

- Check the PV-system for a ground fault and replace the ground fuse as described in this document.

NOTICE

Destruction of the measuring device due to excessive voltages

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

1. Open the DC Disconnect (see Section 9.3).
2. Measure the voltages at all PV strings:
   - Measure the voltages between the positive terminal and the PV protective conductor.
   - Measure the voltages between the negative terminal and the PV protective conductor.

   If there is a voltage between the negative terminal of a string and the PV protective conductor or positive terminal of a string and the PV protective conductor, there is a ground-fault in the string.
   - The approximate position of the ground-fault can be determined from the ratio of the measured voltages between the positive terminal against the PV protective conductor and the negative terminal against the PV protective conductor.
   - Eliminate the ground-fault.

   If there is no ground-fault and the message continues to be displayed, contact the SMA Service Line.

Example: Location of the ground-fault

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

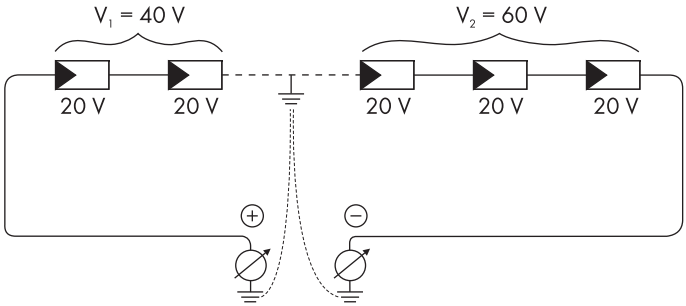


Figure 27: ground-fault in the PV array

3. Close the DC Disconnect (see Section 9.4).
4. Commission the inverter (see Section 8).

11.7 Replacing the Ground Fuse

If the red LED glows and the inverter displays the error message "GFDI Fuse Open", the ground fuse may have been tripped.

⚠ DANGER

Danger to life due to high voltages in the PV plant

Death or serious injury due to electric shock.

- Only insert ground fuses into the inverter using a fuse extractor.

⚠ WARNING

Danger of fire due to incorrectly rated fuse

Risk of injury due to fire.

- Only replace faulty ground fuses with ground fuses of the same type and size.

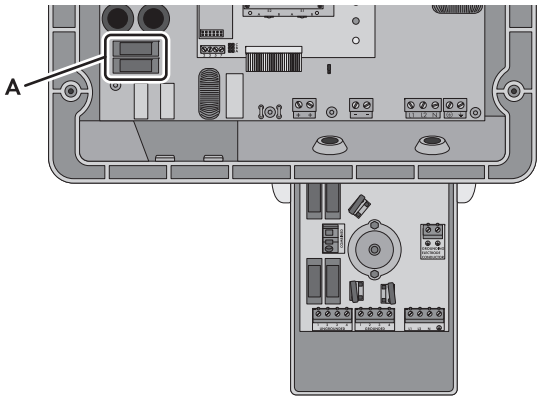


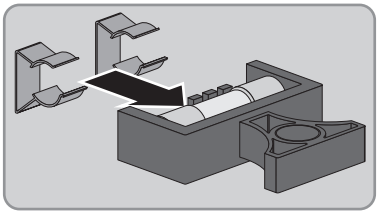
Figure 28: Position of the ground fuse

Position	Designation
A	Fuse extractor with ground fuse

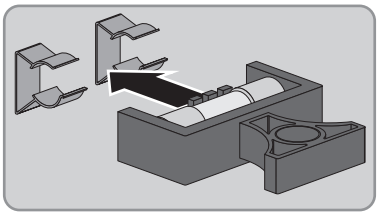
Additional required mounting material (not included in the scope of delivery):

☐ 1 functional and correctly designed ground fuse must be available

1. Open the inverter (see Section 9.1).
2. Remove the fuse extractor with ground fuse from the fuse holder.



3. Remove defective ground fuse from the fuse extractor and insert a new ground fuse into the fuse extractor. Ensure that the ground fuse is functional and is the correct size.
4. Insert the fuse extractor with the new ground fuse into the fuse holder. Note the type of grounding of the PV array (see Section 6.4.3 "Grounding the DC Input", page 44).



5. Close the inverter (see Section 9.2).
6. Commission the inverter (see Section 8).

11.8 Replacing String Fuses

⚠ DANGER

Danger to life due to high voltages in the PV plant

Death or serious injury due to electric shock.

- Only replace string fuses in the inverter with fuse extractors.

⚠ WARNING

Danger of fire due to incorrectly rated fuses

Risk of injury due to fire.

- Only replace faulty string fuses with string fuses of the same type and size.

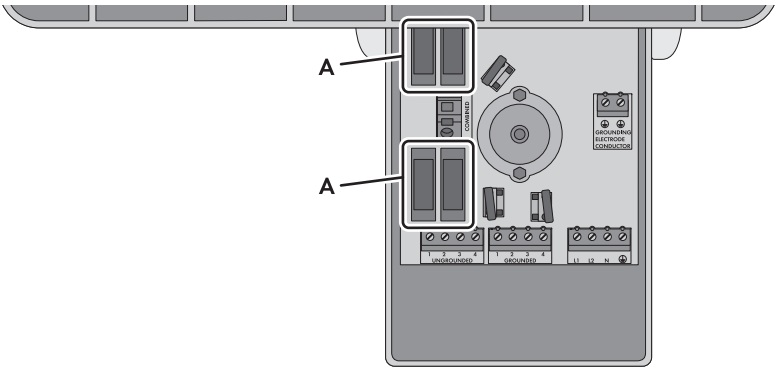


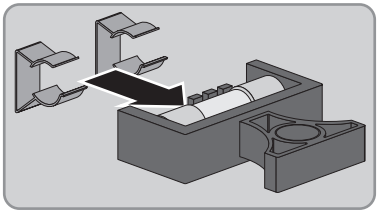
Figure 29: Position of the string fuses

Position	Designation	Explanation
A	Fuse holder	For connecting 4 fuse extractors with string fuses

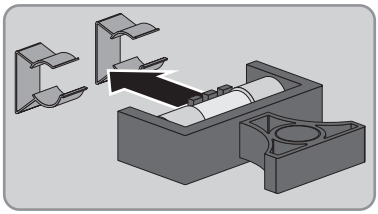
Additional required mounting material (not included in the scope of delivery):

☐ 4 functional and correctly rated string fuses must be available.

1. Open the DC Disconnect (see Section 9.3 "Opening the DC Disconnect", page 59).
2. Replace all string fuses:
   - Remove the fuse extractor with ground fuse from the fuse holder.



   - Remove the defective string fuse from the fuse extractor and insert the new string fuse into the fuse extractor.
   - Insert the fuse extractor with new string fuse into the fuse holder.



3. Close the DC Disconnect (see Section 9.4).
4. Commission the inverter (see Section 8).

12 Technical Data

12.1 DC/AC

12.1.1 Sunny Boy 3000-US

DC input

Maximum MPP voltage at 208 V nominal value	180 V to 400 V
Maximum MPP voltage at 240 V nominal value	200 V to 400 V
Input operating voltage range	200 V to 500 V
Maximum PV array input power	3,750 W
Maximum DC power	3,250 W
DC start voltage	230 V
Maximum DC input current	17 A
Maximum short-circuit current	24 A
DC voltage ripple	< 10%

AC output

AC operating voltage range at 208 V nominal value	183 V to 229 V
AC operating voltage range at 240 V nominal value	211 V to 264 V
AC operating frequency range	59.3 Hz to 60.5 Hz
AC frequency, nominal value	60 Hz
Maximum continuous AC output power	3,000 W
Total harmonic factor of the output current with total harmonic factor of the AC voltage < 2% and AC power > 50% rated power	< 4%
Maximum continuous AC output current at 208 V	15 A
Maximum continuous AC output current at 240 V	13 A
Maximum residual output current	30 A
Maximum output overcurrent protection	30 A
Maximum backfeed current from the power distribution grid to the PV array	30 A AC
Synchronization of inrush current	8 A
Tripping limit accuracy	− 2% to +2%
Tripping time accuracy	− 0.1% to +0.1%

Efficiency

Power factor at nominal power	1
Inverter peak efficiency	96.8%
CEC efficiency at 208 V nominal value	95.0%
CEC efficiency at 240 V nominal value	95.5%

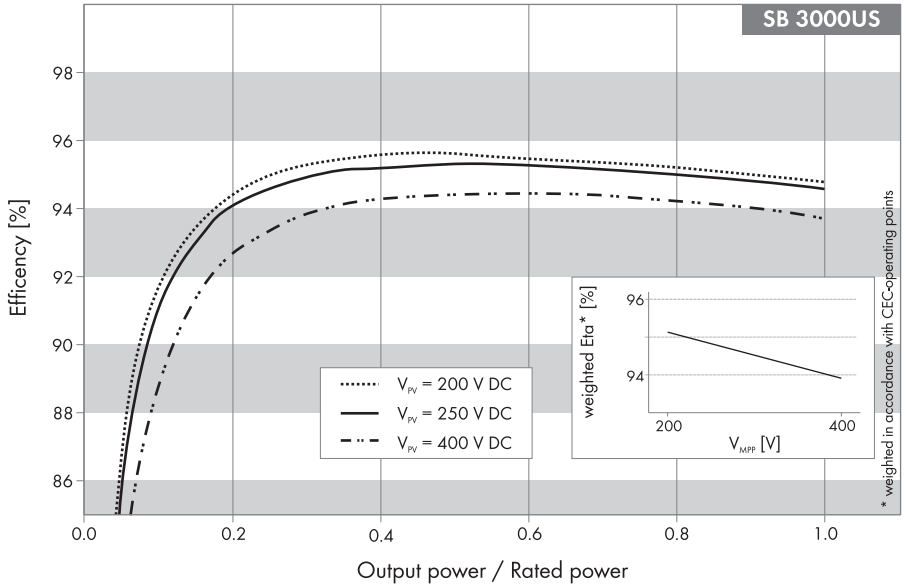


Figure 30: Efficiency curve SB 3000US/3000US-12

12.1.2 Sunny Boy 3800-US

DC input

Maximum MPP voltage at 240 V nominal value	250 V to 480 V
Input operating voltage range	250 V to 600 V
Maximum PV array input power	5,000 W
Maximum DC power	4,250 W
DC starting voltage	285 V
Maximum DC input current	18 A
Maximum short-circuit current	25 A
DC voltage ripple	< 10%

AC output

AC operating voltage range at 240 V nominal value	211 V to 264 V
AC operating frequency range	59.3 Hz to 60.5 Hz
AC frequency, nominal value	60 Hz
Maximum continuous AC output power	3,800 W
Total harmonic factor of the output current with total harmonic factor of the AC voltage < 2% and AC power > 50% rated power	< 4%
Maximum continuous AC output current at 240 V	16 A
Maximum residual output current	30 A
Maximum output overcurrent protection	30 A
Maximum backfeed current from the power distribution grid to the PV array	30 A AC
Synchronization of inrush current	8 A
Tripping limit accuracy	− 2% to +2%
Tripping time accuracy	− 0.1% to +0.1%

Efficiency

Power factor at nominal power	1
Inverter peak efficiency	96.8%
CEC efficiency at 240 V nominal value	96.0%

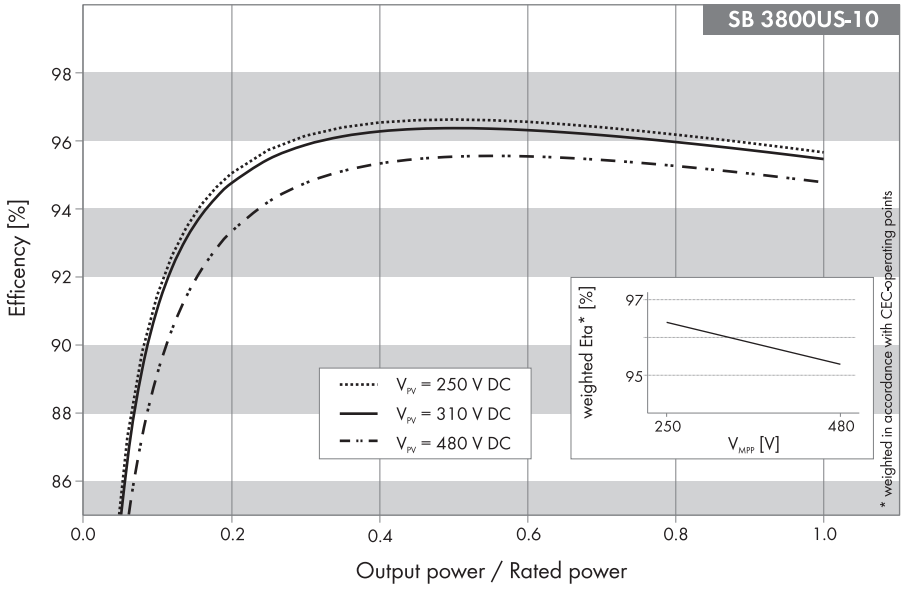


Figure 31: Efficiency curve SB 3800-US-10/3800-US-12

12.1.3 Sunny Boy 4000-US

DC input

Maximum MPP voltage at 208 V nominal value	220 V to 480 V
Maximum MPP voltage at 240 V nominal value	250 V to 480 V
Input operating voltage range	250 V to 600 V
Maximum PV array input power	5,000 W
Maximum DC power	4,300 W
DC starting voltage	285 V
Maximum DC-DC input current	18 A
Maximum short-circuit current	25 A
Maximum backfeed current from the power distribution grid to the PV array	30 A AC
DC voltage ripple	< 10%

AC output

AC operating voltage range at 208 V nominal value	183 V to 229 V
AC operating voltage range at 240 V nominal value	211 V to 264 V
AC operating frequency range	59.3 Hz to 60.5 Hz
AC frequency, nominal value	60 Hz
Maximum continuous AC output power	4,000 W
Total harmonic factor of the output current with total harmonic factor of the AC voltage < 2% and AC power > 50% rated power	< 4%
Maximum continuous AC output current at 208 V	17 A
Maximum continuous AC output current at 240 V	17 A
Maximum residual output current	30 A
Maximum output overcurrent protection	30 A
Synchronization of inrush current	8 A
Tripping limit accuracy	− 2% to +2%
Tripping time accuracy	− 0.1% to +0.1%

Efficiency

Power factor at nominal power	1
Inverter peak efficiency	96.8%
CEC efficiency at 208 V nominal value	95.5%
CEC efficiency at 240 V nominal value	96.0%

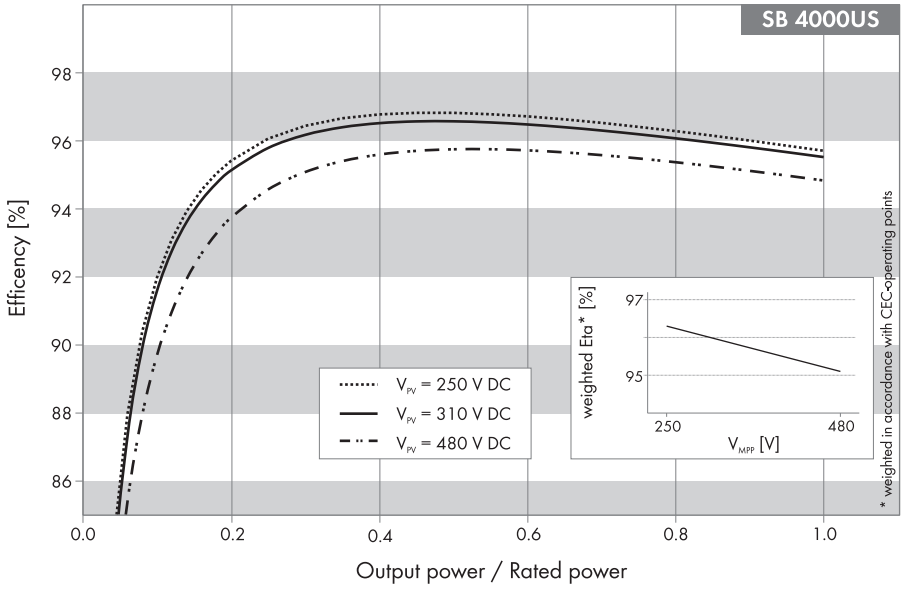


Figure 32: Efficiency curve SB 4000US/4000US-12

12.2 General Data

Width x height x depth	17 $^{51}/_{64}$ in. x 13 $^{53}/_{64}$ in. x 9 $^{19}/_{64}$ in. (462 mm x 351 mm x 236 mm)
Weight	88 lb. (40 kg)
Inverter technology	Low frequency transformer
Ambient temperature range	− 13°F to +113°F (− 25°C to +45°C)
Ambient temperature range*	− 40°F to +113°F (− 40°C to +45°C)
Electronics degree of protection	NEMA 3R
Cooling concept	OptiCool, forced active cooling
Noise emission	40 dB(A)
Power loss during night-time operation	0.1 W

* Applies for SB 3000US-12/SB 3800-US-12/SB 4000US-12 only

12.3 Protection Devices

DC reverse polarity protection	Short-circuit diode
AC short-circuit current capability	Software-controlled
AC overcurrent protection	Current-controlled
Grid monitoring (SMA Grid Guard® 2)	Yes

12.4 DC Disconnect

Maximum DC input current	30 A
Maximum DC short-circuit current	36 A
Maximum system voltage	600 V
Maximum nominal size for string fuses	20 A
Maximum AC operating current	34 A
Dimensions W x H x D	$7\,^{7}/_{8}$ in. x $12\,^{13}/_{64}$ in. x $7\,^{31}/_{64}$ in. (200 mm x 310 mm x 190 mm)
Weight	8 lb. (3.5 kg)
Electronics degree of protection	NEMA 3R

Specifications subject to change without notice.

12.5 Torques and Cable Sizes

Terminal	Torque	Cable size
AC & DC connecting terminal plate, inverter	15 in-lb. (1.7 Nm)	10 AWG to 6 AWG (6 mm^2 to 16 mm^2)
AC & DC connecting terminal plate, DC Disconnect	15 in-lb. (1.7 Nm)	10 AWG to 6 AWG (6 mm^2 to 16 mm^2)
"COMBINED" spring terminal, DC Disconnect	–	10 AWG to 6 AWG (6 mm^2 to 16 mm^2)
Ground terminals PV protective conductor/ DC protective conductor, DC Disconnect	15 in-lb. (1.7 Nm)	10 AWG to 6 AWG (6 mm^2 to 16 mm^2)
Screws for attaching the inverter and the DC Disconnect to the wall mounting bracket and closing the DC Disconnect cover	44 in-lb. (5 Nm)	–
Screws for the enclosure lid of the inverter	53 in-lb. (6 Nm)	–

12.6 Tripping Limits/Tripping Times

Nominal frequency	Tripping limit	Tripping frequencies	Tripping times
60 Hz	> 60.5 Hz	60.45 Hz to 60.55 Hz	max. 0.1602 s
	< 57.0 Hz to 59.8 Hz (standard 59.3 Hz)	56.95 Hz to 59.85 Hz (standard 59.25 Hz to 59.35 Hz)	Adjustable, 0.16 s to 300 s (standard max. 0.1602 s)
	< 57.0 Hz	56.95 Hz to 57.05 Hz	max. 0.1602 s

Nominal voltage	Tripping limit	Trip voltages, conductor-neutral conductor*	Trip voltages, conductor-conductor*	Tripping times
208 V	50%	57.6 V to 62.4 V	99.8 V to 108.2 V	max. 0.1602 s
	88%	103.2 V to 108.0 V	178.9 V to 187.2 V	max. 2.002 s
	110%	129.6 V to 134.4 V	224.6 V to 233.0 V	max. 1.001 s
	120%	141.6 V to 146.4 V	245.4 V to 253.8 V	max. 0.1602 s
240 V	50%	57.6 V to 62.4 V	115.2 V to 124.8 V	max. 0.1602 s
	88%	103.2 V to 108.0 V	206.4 V to 216.0 V	max. 2.002 s
	110%	129.6 V to 134.4 V	259.2 V to 268.8 V	max. 1.001 s
	120%	141.6 V to 146.4 V	283.2 V to 292.8 V	max. 0.1602 s

Manufacturer's accuracies

Tripping limit accuracy: ±2% of nominal line voltage

Tripping time accuracy: ±0.1% of nominal tripping time

Tripping frequency accuracy: ±0.1% of nominal frequency

13 Accessories

You will find the corresponding accessories and spare parts for your product in the following overview. If required, these can be ordered from SMA or your specialty retailer.

Name	Brief description	SMA order number
RS485 retrofit kit	RS485 interface	485 USPB-NR
Bluetooth retrofit kit	*Bluetooth* communication interface	BTPBINV-NR
Replacement varistors	Set with 3 DC varistors	SB-VDC-US01
Ventilation grid	Set with 2 "right and left" ventilation grids as spare parts	45-7202

14 Compliance Information

FCC Compliance

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

1. This device must 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 distance between the equipment and the receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

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

IC Compliance

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

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

15 Contact

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

- Inverter device type
- Inverter serial number
- Firmware version of the inverter
- Special country-specific settings of the inverter (if applicable)
- Type and number of the PV modules connected
- Mounting location and mounting altitude of the inverter
- Inverter LED signal and display message
- Optional equipment, e.g. communication products

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