



Windy Boy WB 2500 / 3000 Inverter for Wind Energy Power Plants



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1 Explanation of the Symbols Used

To ensure optimum use of this document, note the following explanation of the symbols used.

This symbol indicates an example.



This symbol indicates a notice where failure to follow the advice will make the procedure or operation more difficult.



This symbol indicates a fact which, if not observed, could result in damage to components or represent a danger to persons. Read these passages especially carefully.



2 Foreword

The Windy Boy WB 2500 / 3000 contains the SMA grid guard 2. This is a type of independent disconnection device. It ensures that the Windy Boy WB 2500 / 3000 complies with the VDEW (Verband der Elektrizitätswirtschaft – German Electricity Industry Association) regulations for the operation of power-generating systems in parallel to the low-voltage grid of the electricity supply company and with DIN VDE 0126-1-1, which forms a part of these regulations.



For detailed information on troubleshooting and on how to use the Windy Boy and the various communications options, see the operating manual.

If you require further information, call the Sunny Boy Hotline:

+49 561 95 22 - 499

2.1 Target Group

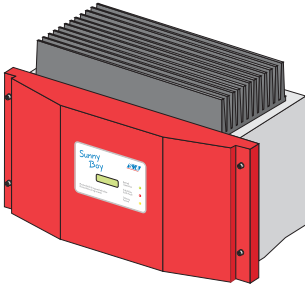
Warning!

The Windy Boy may only be installed by trained specialists. The installation engineer must be approved by the local energy supplier. Carefully read through this installation manual. All prescribed safety regulations, the technical connection requirements of the local energy supplier and all other applicable regulations must be adhered to.



This installation manual is intended solely for qualified electricians. Its purpose is to help install and commission SMA Windy Boy WB 2500 / 3000 inverters quickly and correctly.

3 Safety Instructions



Warning! Overvoltage!

Overvoltages lead to the destruction of the Windy Boy WB 2500 / 3000.



Warning! High voltage!

Work on the Windy Boy with the lid removed must be carried out by a qualified electrician! High voltages are present in the device. Work is to be carried out on the Windy Boy only once the AC and DC voltages have been disconnected from the Windy Boy, and once it has been ensured that the capacitors have been discharged.

The Windy Boy must be disconnected from the grid and precautions must be taken to prevent the grid being reconnected. In addition, the connections to the DC input must be disconnected.

After disconnecting the AC and DC voltage you must wait approximately 30 minutes for the capacitors in the Windy Boy to discharge. Only then is it safe to open the unit by removing the lid, and to check if voltage is present in the device.



Warning! Electrostatic discharge!

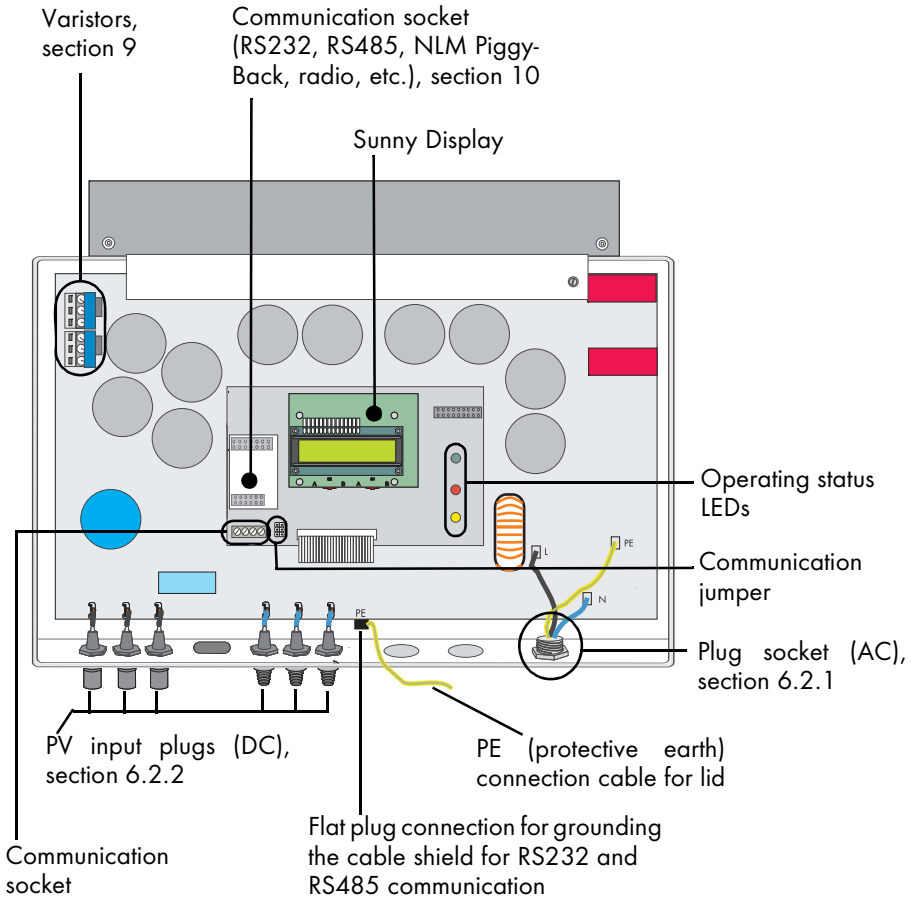
When working on the Windy Boy WB 2500 / 3000 and handling the components, remember to observe all ESD safety regulations. Electronic components are susceptible to electrostatic discharge. Discharge any electrostatic discharge by touching the grounded housing before handling any electronic component.



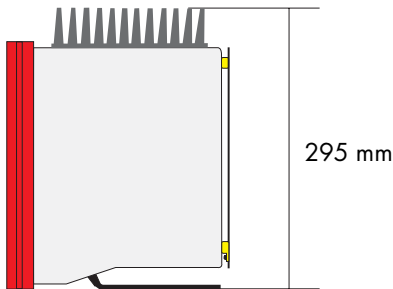
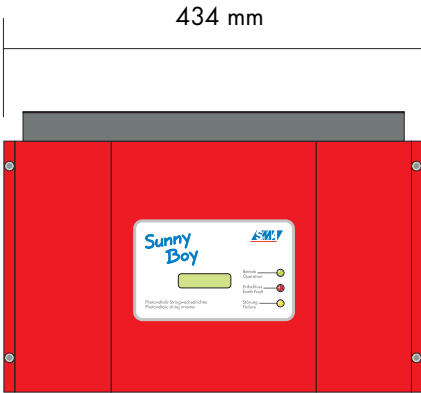
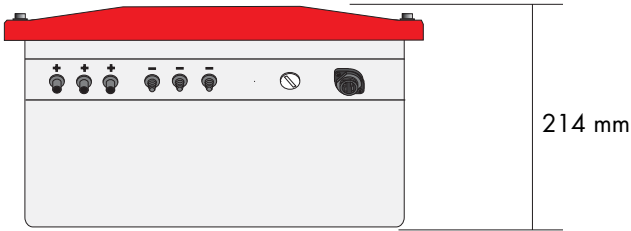
4 Overview

4.1 Unit Description

The following diagram gives a schematic overview of the various components and connection points inside the Windy Boy WB 2500 / 3000 with the lid removed:



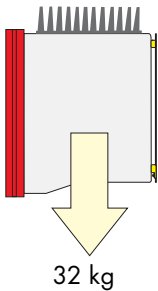
4.2 External Dimensions



5 Installation Requirements

Check that all of the requirements listed below are met before installing and commissioning the Windy Boy.

5.1 Installation Site Requirements



The Windy Boy WB 2500 / 3000 weighs approx. 32 kg. Take this weight into account when choosing the installation site and method of installation.



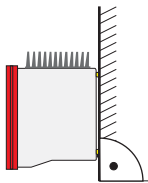
The ambient temperature must not be outside the $-25\text{ }^{\circ}\text{C}$ to $+60\text{ }^{\circ}\text{C}$ range.



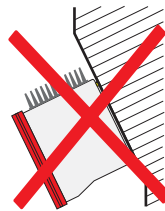
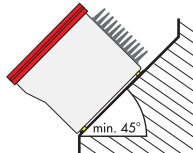
The Windy Boy WB 2500 / 3000 should be installed in a location where it is not exposed to direct sunlight. An increased ambient temperature can reduce the yield of the wind turbine.

The Windy Boy is designed to be mounted on a vertical wall. If absolutely necessary, however, the Windy Boy can be installed tilted back at a maximum angle of 45° . Vertical installation at eye-level is preferable for an optimum energy yield and maximum operational comfort. If installing the unit outdoors, make sure that it is not slanting slightly forwards. The rear panel is designed so that the Windy Boy WB 2500 / 3000 tilts slightly backward on a perfectly vertical wall.

We advise against installing the unit in a horizontal position outdoors.



Install the inverter vertically or tilting backward.



Never install the inverter horizontally or so that it tilts forward.



When choosing the installation site, be sure to observe the following:



Warning! Risk of burns!

The temperature of individual parts of the housing and components within the Windy Boy can reach more than 60 °C. Touching could result in burns!

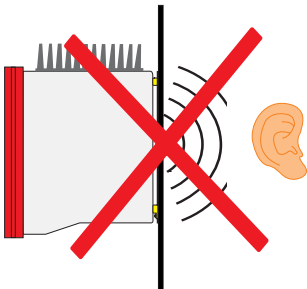
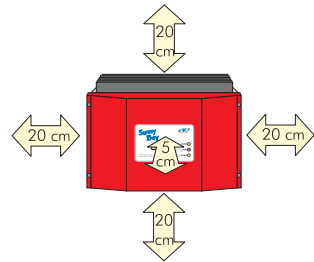


Warning!

Do not install the Windy Boy on flammable construction materials, in areas where highly inflammable materials are stored or in potentially explosive environments!

When choosing the installation site, ensure there is enough space for heat to dissipate! Under normal conditions, the following guidelines should be applied for the space to be kept clear around the Windy Boy WB 2500 / 3000:

	Minimum clearance
Sides	20 cm
Top	20 cm
Underneath	20 cm
Front	5 cm



In domestic installations, the unit should not be mounted on plasterboard walls or alike as otherwise audible vibrations are likely to result.

We recommend securing the unit to a solid surface. The Windy Boy makes noises when in use which can, be seen as a nuisance in living areas.

5.2 DC Input Requirements

The DC connection of the generator is carried out using screw terminals within the housing. Make sure that the polarity is correct. As housing feed-through and strain relief use the PG16 screw fittings supplied.

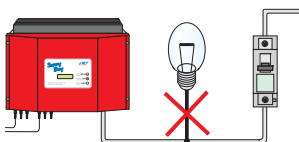
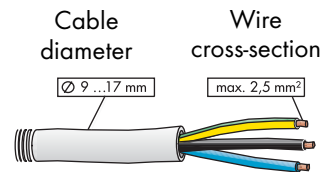
The DC side must be equipped with an extra DC circuit breaker compliant to DIN VDE 0100-712 to allow the generator to be disconnected from the Windy Boy.

Limit values for DC input	
Max. voltage	600 V (DC)
Max. input current	12 A (DC)

5.3 AC low voltage grid

The Windy Boy must have a three-conductor connection to the grid (live (L), neutral (N), protective earth (PE)).

The grid connection terminals on the AC connection socket included in the accessories kit can take wires with a cross-section of up to 2.5 mm². The accessories kit also contains a PG13.5 AC connection socket for connecting cables with a cable diameter between 9 mm and 13.5 mm, while the PG16 connection socket is used for cables with cable diameters from 13.5 mm up to a maximum of 17 mm. For detailed instructions, see sections "Connecting the AC Output with PG13.5" (Page 24) and "Connecting the AC Plug with PG16" (Page 26).



Warning!

We recommend using a 16 A line circuit breaker to protect the power circuit. No loads should be connected to this power circuit.



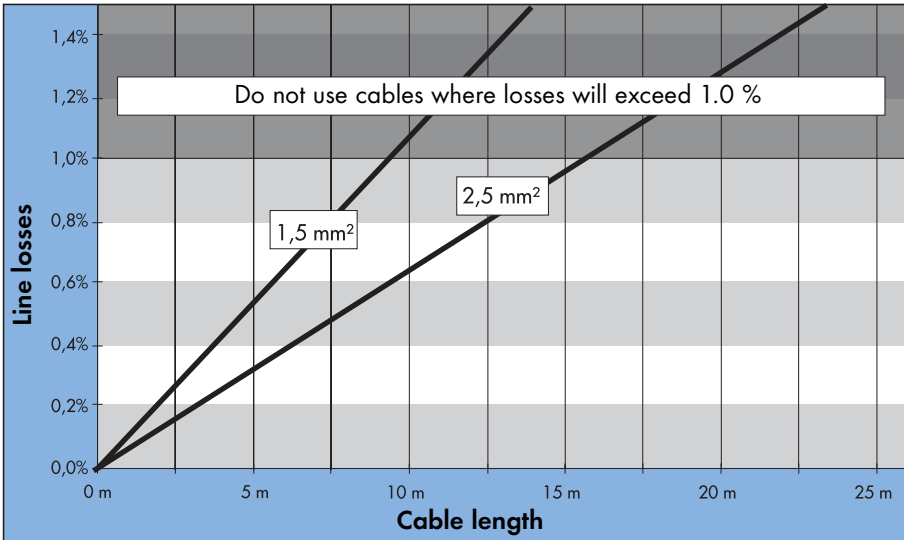
Rating for a Line Circuit Breaker in a Photovoltaic Power Generating System Operated in Parallel to the Low-voltage Grid

Various factors should be taken into account when selecting line circuit breakers. These include, for example:

- the type of cable used (conductor material and insulation)
- ambient temperatures affect the cables (higher temperatures result in a reduced maximum current load)
- method of routing the cable (reduces the maximum current load)
- bundling cables together (reduces the maximum current load)
- loop impedance [Z] (in the event of a body contact this limits the current that can flow and therefore determines the response behavior of the circuit breaker)
- sufficient distance between the circuit breakers so as to avoid undue heating (heat can trigger the circuit breaker early)
- selectivity
- Protection class of the connected load

AC cable system impedance should not exceed 1 ohm. This is necessary, amongst other things, for the correct operation of the impedance monitoring. In addition, we recommend dimensioning the conductor cross-section so that line losses do not exceed 1 % at the nominal power. Line losses depending on the cable length and cross-section are shown in the graph below. Multi-wire cables with copper forward and return conductors are used.

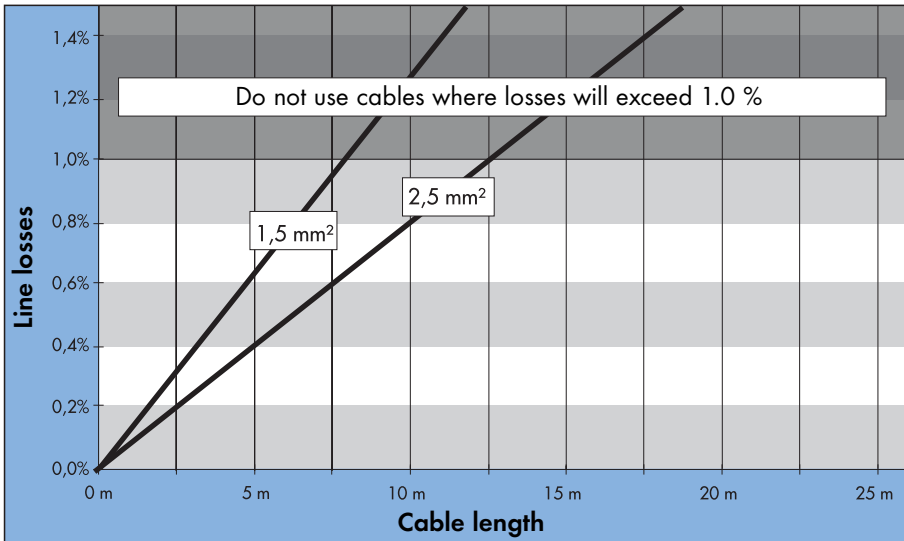
Cable Losses WB 2500



The maximum cable lengths for the different cable cross-sections are as follows:

Cable cross-section	1.5 mm ²	2.5 mm ²
Max. length	9.3 m	15.5 m

Cable Losses WB 3000



The maximum cable lengths for the different cable cross-sections are as follows:

Cable cross-section	1.5 mm ²	2.5 mm ²
Max. length	7.7 m	12.9 m

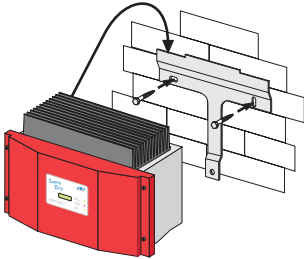
The Windy Boy WB 2500 / 3000 is designed for operation on 220 - 240 V. Additionally, it is equipped with an automatic grid frequency identifier and can thus be connected to a 50 or 60 Hz system without further parameterization. When connecting an inverter to the public grid, adhere to the local connection requirements of your grid operator.

	Limit values for AC output
Voltage range (in the area of application of DIN VDE 0126-1-1 ^a)	198 V ... 253 / 260 V ^a)
Voltage range (extended operating range)	180 V .. 265 V
Frequency range (in the area of application of DIN VDE 0126-1-1 ^a)	47.5 Hz ... 50.2 Hz
Frequency range (extended operating range)	50 Hz: 45.5 Hz ... 54.5 Hz 60 Hz: 55.5 Hz ... 64.5 Hz

- a The Windy Boy WB 2500 / 3000 can temporarily feed power into the grid with a maximum output voltage of 260 V. However, DIN VDE 0126-1-1 stipulates that the 10-minute average must not exceed a voltage of 253 V. That means, if the grid voltage is constantly 254 V (e.g.), the inverter disconnects itself from the grid. In this case, contact the local grid operator for assistance. DIN VDE 0126-1-1 only applies in Germany. See section „Country-specific Parameter Settings“ in the Operating Instructions of the Windy Boy for all other preset country values of your inverter.

6 Installation

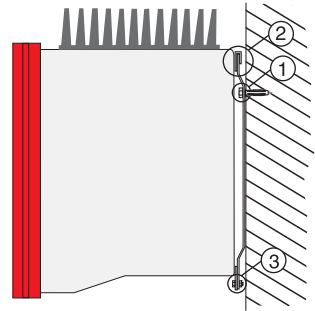
6.1 Mounting the Unit



To make the job easier, we recommend you use the supplied wall bracket to mount the Windy Boy WB 2500 / 3000. For vertical installation and installation on solid concrete or block walls, for example, you can fit the bracket using 8 mm x 50 mm hexagon bolts to DIN 571 standard, stainless steel type, and with wall anchors type SX10.

When selecting the mounting materials, be sure to take into account the weight of the Windy Boy WB 2500 / 3000 (29 kg).

1. Fit the wall bracket (1). To mark the positions to drill the holes, you can use the wall bracket as a drilling template.
2. Now hook the Windy Boy WB 2500 / 3000 onto the wall bracket (2) at its upper mounting plate so that it cannot be moved sideways.
3. Fix the Windy Boy WB 2500 / 3000 onto its bracket by screwing the supplied M6x10 bolt into the central threaded hole at the bottom of the bracket (3).
4. Make sure the Windy Boy WB 2500 / 3000 is positioned securely on the bracket.



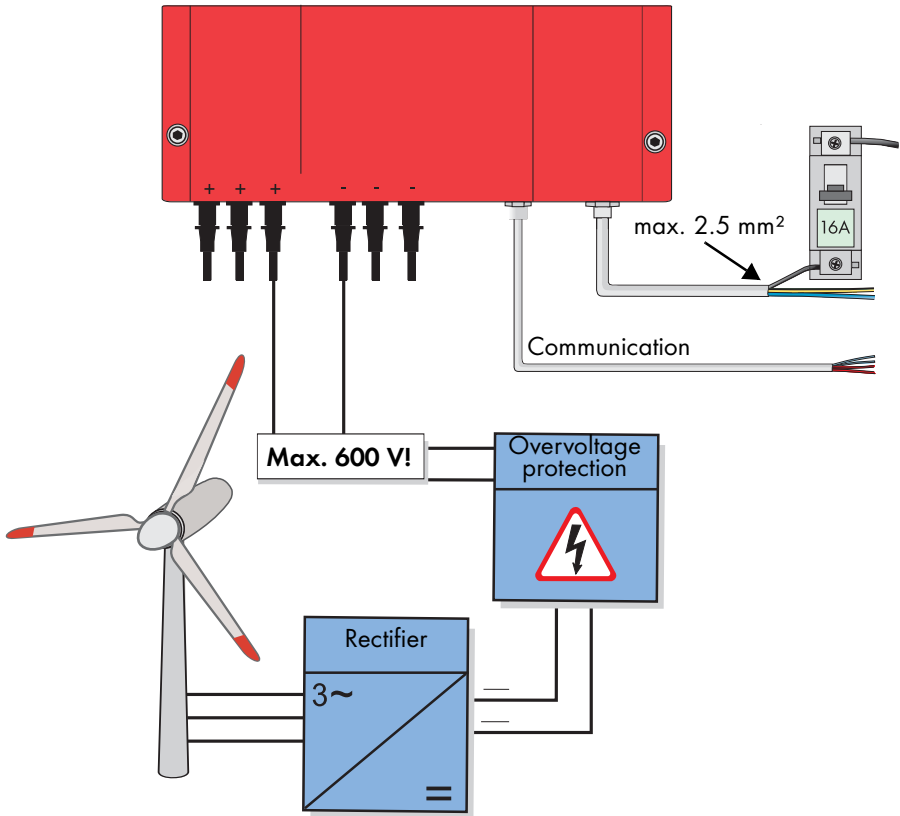
6.2 Electrical Installation



Warning!

Make sure to check the polarity of the DC connections before connecting them!

The complete wiring for a Windy Boy WB 2500 / 3000 is shown schematically in the following diagram:



Make sure that the DC input voltage never exceeds 60 V! Higher input voltages will damage the Windy Boy and will lead to the loss of any and all warranty rights.

6.2.1 Connecting the AC Output

Warning! Voltage!

Before you connect the grid connection cable to the AC connection socket, make sure that no voltage is present in the cable.



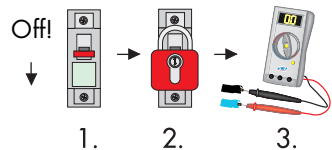
A round plug connector system is used, which allows various cable diameters to be used in the cable outlet. For this reason, the accessories kit includes a PG13.5 pressure screw and a PG16 pressure screw. Check which screw fitting is the right one for your AC cable.

To connect up the AC output, follow these steps:

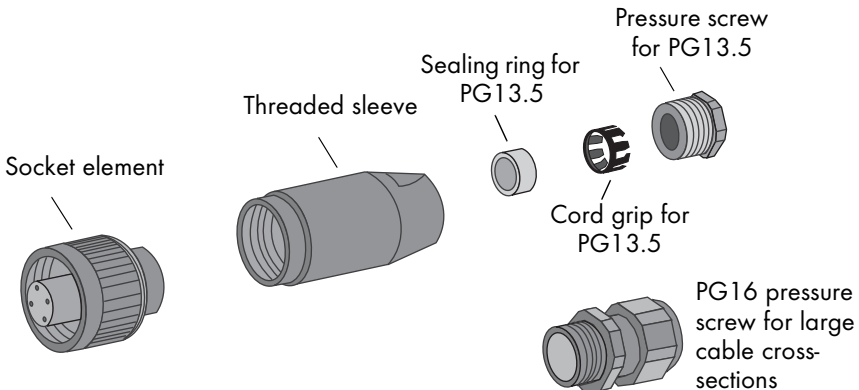
1. Check the grid voltage.

For Germany, the following applies: If the grid voltage is constantly higher than 253 V, the Windy Boy WB 2500 / 3000 will not be fully operational. In this case, contact the local grid operator for assistance. The inverter can temporarily feed power into the grid with a maximum output voltage of 260 V. However, the 10-minute average must not exceed 253 V.

2. Isolate the grid connection (switch the line circuit breaker to its "off" position), make sure it cannot be switched back on, and test to make sure no voltage is present.



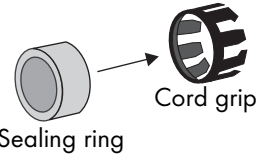
3. Now take the AC connection socket parts from the accessories kit and connect up the cable, with shielding and insulation stripped, as described on the following pages.



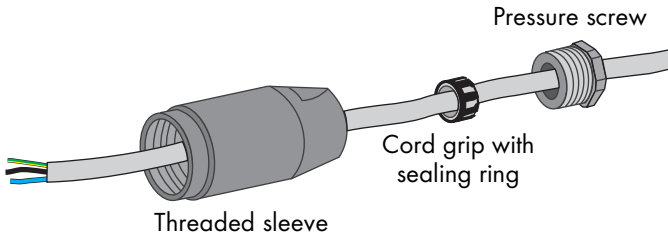
Connecting the AC Output with PG13.5

To connect a cable with a maximum cross-section of 13.5 mm², proceed as follows.

1. Press the sealing ring into the cord grip.

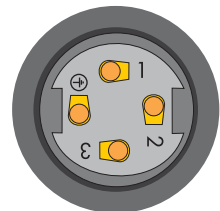


2. Now slide the pressure screw over the cable first of all, followed by the cord grip with the sealing ring in it. Now slide the threaded sleeve over the cable.



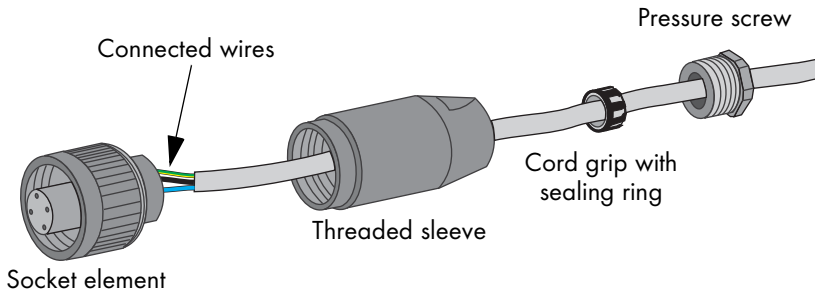
3. Now connect the individual conductors to the socket element in sequence.

- Protective earth PE (green/yellow) to the screw terminal with the earth sign. Make sure that the PE earth wire is longer than the N and L connected wires.
- Neutral conductor N (blue) to screw terminal 1.
- Live L (brown or black) to screw terminal 2.
- Terminal 3 remains unused.

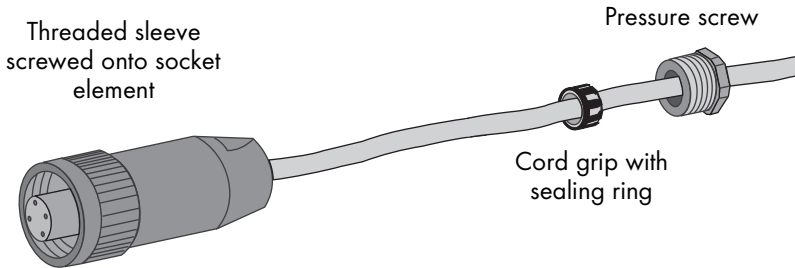


Terminals in the socket element

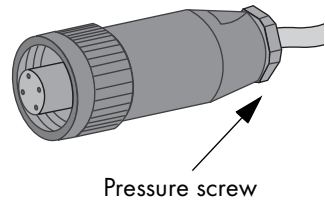
4. Make sure the wires are securely connected.



5. Now screw the threaded sleeve onto the socket element and tighten it.



6. Screw the pressure screw into the threaded sleeve and tighten it. The cord grip with the sealing ring is pressed into the threaded sleeve and can no longer be seen.



The AC connecting socket is now fully assembled.

If you are not going to immediately connect the Windy Boy, close off the socket element using the cap supplied in the accessories kit.

If the Windy Boy is already installed, you can now connect the fully assembled AC connection socket to the flange plug on the Windy Boy. To do this, remove the protective cap from the flange plug on the Windy Boy. Firmly tighten the threaded ring on the AC connecting socket to the flange plug to seal the connection and secure it.

Warning!

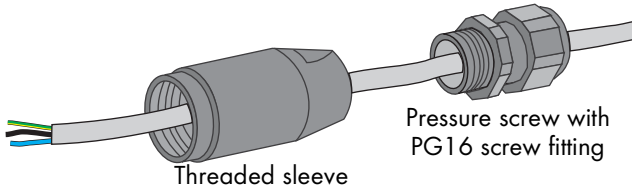
Do not switch the line circuit breaker on yet! The Windy Boy WB 2500 / 3000 may only be connected to the AC grid once the DC input is connected and the device is securely closed.



Connecting the AC Plug with PG16

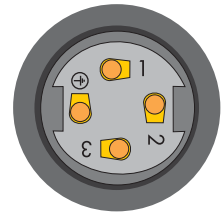
To connect a cable with a cross-section between 13.5 mm² and 16 mm², proceed as follows.

1. First of all, slide the pressure screw with the PG16 screw fitting onto the cable. Now slide the threaded sleeve over the cable.



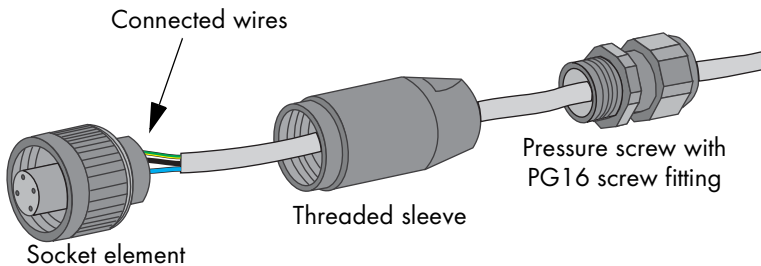
2. Now connect the individual conductors to the socket element in sequence.

- Protective earth PE (green/yellow) to the screw terminal with the earth sign. Make sure that the PE earth wire is longer than the N and L connected wires.
- Neutral conductor N (blue) to screw terminal 1.
- Live L (brown or black) to screw terminal 2.
- Terminal 3 remains unused.

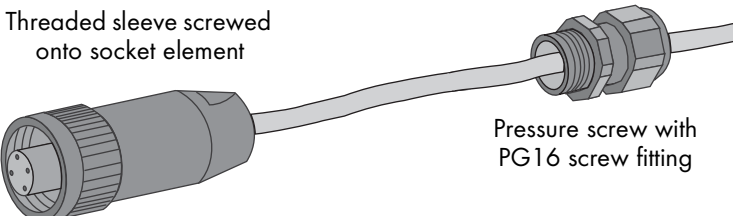


Terminals in the socket element

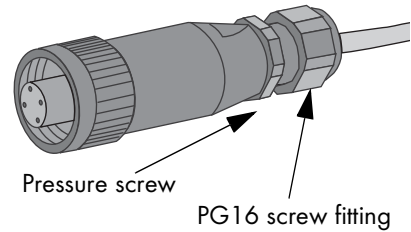
3. Make sure the wires are securely connected.



4. Now screw the threaded sleeve onto the socket element and tighten it.



5. Now screw the pressure screw into the threaded sleeve and tighten it.
6. Firmly tighten the screw fitting against the seal and strain relief.



The AC connecting socket is now fully assembled.

If you are not going to immediately connect the Windy Boy, close off the socket element using the cap supplied in the accessories kit.

If the Windy Boy is already installed, you can now connect the fully assembled AC connection socket to the flange plug on the Windy Boy. To do this, remove the protective cap from the flange plug on the Windy Boy. Firmly tighten the threaded ring on the AC connecting socket to the flange plug to seal the connection and secure it.

Warning!

Do not switch the line circuit breaker on yet! The Windy Boy WB 2500 / 3000 may only be connected to the AC grid once the DC input is connected and the device is securely closed.



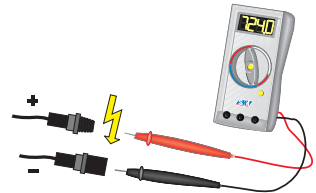
6.2.2 DC Connection



The inverter has to be disconnected from the grid, before connecting the DC input!

To connect up the input, follow these steps:

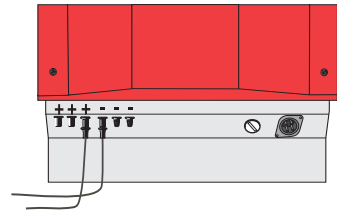
1. Check that the generator connection has the right polarity and does not exceed the maximum DC input voltage of 60 V (DC), see also section 5.2 "DC Input Requirements" (Page 15).



Warning!

Dangerously high voltages may be present. Danger of death! Make sure that you only use measuring devices with a DC input voltage range up to at least 600 V.

2. Connect the DC connector of the generator to the Windy Boy. Make sure that the polarity is correct!



3. Close the unused DC plug connectors with the protective caps included in the delivery.

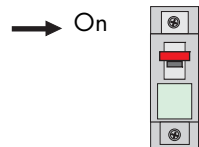
6.3 Commissioning

You can commission the Windy Boy WB 2500 / 3000 when

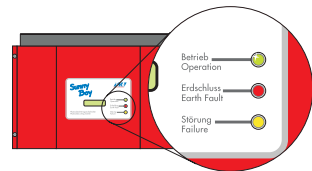
- the housing lid is securely screwed shut,
- the AC (grid) cable is connected correctly,
- the DC cables are fully connected and the unused DC plug connectors on the bottom of the housing are closed using the protective caps,
- the DC input voltage is sufficient for supplying the onboard electronics,
- you are sure, that the input voltage cannot exceed 600 V.

How to Commission the Inverter

1. First of all, switch the line circuit breaker and the DC circuit breaker to the "on" position.



2. Look at the LED display and consult the table on the following page to check whether the Windy Boy WB 2500 / 3000 is in a fault-free and expedient operating mode. If this is the case, commissioning was successfully completed.



Warning!

If the bottom yellow LED flashes four times at intervals of one second, the grid voltage and the DC connection must be disconnected from the Windy Boy WB 2500 / 3000 immediately! There is a risk of damage to the inverter resulting from excessive DC input voltage!



Check the input voltage again to make sure they are within the limits stated in section 5.2 "DC Input Requirements" (Page 15). If the input voltage is too high, contact the planner / installation engineer of the wind turbine for assistance.

If despite checking the input voltage the LED signal occurs again when the generator is connected to the Windy Boy WB 2500 / 3000, disconnect the generator from the Windy Boy again and contact **SMA** Technologie AG (see section 10 "Contact" (Page 39)).

Green	Red	Yellow	Status
illuminates continuously	is not illuminated	is not illuminated	OK (working mode)
	illuminates continuously	is not illuminated	fault
flashes quickly (3 x per second)	illuminates continuously	illuminates continuously	OK (initialization)
	is not illuminated	is not illuminated	OK (stop)
flashes slowly (1 x per second)	illuminates continuously	is not illuminated	fault
	is not illuminated	is not illuminated	OK (waiting, grid monitoring)
briefly goes out (approx. 1 x per second)	illuminates continuously	is not illuminated	fault
	is not illuminated	is not illuminated	OK (derating)
is not illuminated	is not illuminated	illuminating/ flashing	fault
		is not illuminated	fault
	illuminates continuously	illuminating/ flashing	fault
		is not illuminated	fault

For a detailed description of the fault messages and their causes, see the operating manual.

7 Opening and Closing the Windy Boy

Warning!

If you need to open the device for whatever reason, pay attention to section 3 "Safety Instructions" (Page 9).



7.1 Opening the Windy Boy

Warning!

Follow the sequence below under all circumstances!



1. Switch the line circuit breaker to the "off" position.
2. Disconnect the DC input from the Windy Boy.
3. **Wait 30 minutes!**
4. Remove the four screws from the housing lid and pull the lid forward smoothly. At the same time remove the PE connection from the lid. Loosen the locking on the PE connectors on the lid when you remove them.

7.2 Closing the Windy Boy

Warning!

Follow the sequence below under all circumstances!



1. Reconnect the earth wire (PE) to the housing lid. Now secure the housing lid to the Windy Boy WB 2500 / 3000 by tightening the four screws evenly.
2. Switch on the DC circuit breaker.
3. Switch the line circuit breaker to the "on" position.
4. Now check whether the LED display on the Windy Boy WB 2500 / 3000 indicates that the device is functioning correctly.

8 The Communications Interface

Warning!

Installation or replacement of the communications interface is only to be carried out by a trained electrician.



The communications interface is used to communicate with SMA communication devices (e. g. Sunny Boy Control, Sunny WebBox) or a PC with appropriate software (e. g. Sunny Data Control). Depending on the selected communications interface, up to 2500 inverters can be interconnected. Detailed information on this topic can be found in the communication device manual, the software, or on the Internet at www.SMA.de.

The detailed wiring diagram for each communication interface can be found in the communication device manual. This wiring diagram includes:

- details on the required cable type
- which of the inverter's connections are used
- whether jumpers need to be mounted, and if so, which jumpers
- whether the PE needs to be connected to the cable shield

The next pages will describe the following:

- the housing feed-throughs for the communications interface
- the permitted cable route inside the Windy Boy
- the location of the PE connector
- the location of the screw terminals for connecting the communication wires
- the location of the jumper slots
- the location of the interface port

8.1 Connection of the Interface



Warning!

When opening the Windy Boy, follow all the safety instructions as described in section 3.

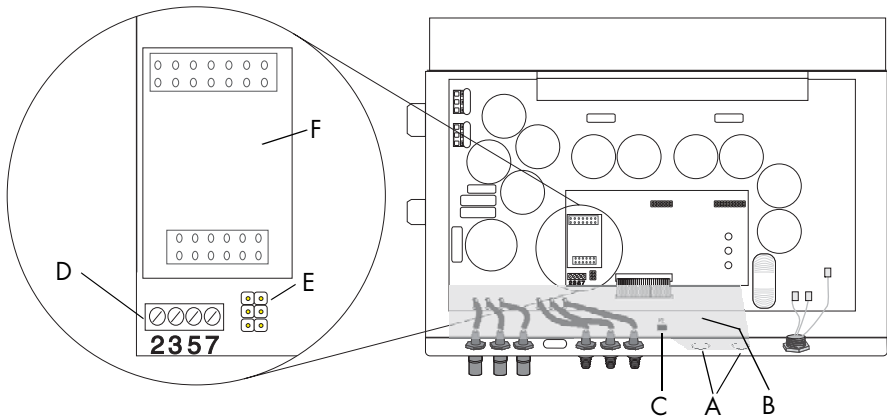


Electrostatic discharges are an acute danger to the Windy Boy and its communications interface. Ground yourself by touching PE before removing the communications interface from the packaging, and before touching any components within the Windy Boy.



Read the communication device manual before beginning installation work. Further wiring details can be found there.

1. Open the inverter as described in section 7.1.
2. Guide the PG screw fitting over the communication cable.
3. Thread the cable through the cable feed-through (A) on the Windy Boy.
4. Screw the PG screw fitting onto the Windy Boy.
5. Sheathe the cable inside the Windy Boy using the silicone tube provided. The silicone tube is imperative for safety reasons. The interface may not be commissioned without this silicon tube (with the exception of the Sunny Beam Piggy-Back).
6. Lay the cable in area (B) as shown in the figure to the right.
7. Ground the cable shield at the PE connector (C) if the terminal connection diagram of the communication device indicates this as necessary.
8. Connect the communication wires to screw terminal strip (D) as described in the terminal connection diagram of the communication device. Note down the connector color coding for the respective pin numbers. Connecting the receiver incorrectly can cause the devices to be damaged.
 - Pin 2 color: _____
 - Pin 3 color: _____
 - Pin 5 color: _____
 - Pin 7 color: _____
9. Connect the jumpers (E) if the terminal connection diagram of the communication device indicates this as necessary. The table shown to the right provides an overview of the jumper functions.
10. Plug the communications interface to the left of the board (F).
11. Close the Windy Boy as described in section 7.2.



- A Housing feed-throughs in the base of the Windy Boy
- B Cable route (gray surface)
- C PE connector
- D Screw terminals for connection of the communication wires
- E Jumper slot
- F Interface port

8.1.1 Jumper Functions

	Jumper A	Jumper B	Jumper C
RS232	-	-	-
RS485	termination	bias 1	bias 2
NLM	-	-	-
Sunny Beam	-	-	-

A detailed description of the jumper functions can be found in the communication device manual.

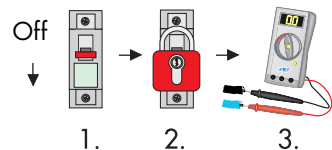


9 Replacing the Varistors

The Windy Boy WB 2500 / 3000 is a complex high-technology device. As a result, the possibilities for fixing faults on site are limited to just a few items. Do not attempt to carry out repairs other than those described here. Use the **SMA Technologie AG** 24-hour exchange service and repair service instead.

If the red LED on the status display illuminates continuously during operation, the installation engineer should first of all make sure that there is no ground fault in the wind turbine. If there is no ground fault in the system, it is likely that one of the thermally monitored varistors has lost its protective function. Check the varistors as described in the following.

1. Disconnect the Windy Boy WB 2500 / 3000 from the low voltage grid (switch the line circuit breaker to its "off" position). Make sure the grid cannot be inadvertently reconnected and that no voltage is present.
2. Switch off the DC circuit breaker.



Warning!

Dangerously high voltages may be present. Danger of death!



3. Open the Windy Boy as described in section 7.1 "Opening the Windy Boy" (Page 31).
4. Use a continuity tester to check all the varistors and see if there is a conducting connection between connectors 2 and 3. The positions of the varistors in the Windy Boy WB 2500 / 3000 can be seen in the diagram in section 4.1 "Unit Description" (Page 11).

If there is a conducting connection:

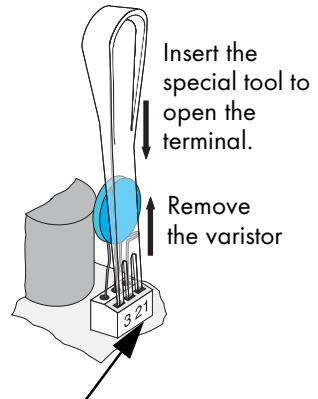
It is likely that there is a different fault in the Windy Boy which has activated the blink code. Close the Windy Boy again as described in chapter 7.2 "Closing the Windy Boy" (Page 31) and contact the SMA hotline to discuss further steps.

If there is no conducting connection:

The varistors are specially manufactured for use in the Windy Boy WB 2500 / 3000 and are not commercially available. They must be ordered directly from SMA Technologie AG (SMA order code: SB-TV4).

To replace the part, proceed to step 5.

- Replace the varistor concerned with a new one as shown in the drawing to the right. Ensure the varistor is installed the right way round! If you do not receive a special tool for operating the terminal clamps together with your replacement varistors, contact SMA. As an alternative, the terminal contacts can be operated using a suitable screwdriver. Since the failure of one varistor is generally due to factors that affect all varistors in a similar way (temperature, age, inductive overvoltages), it is highly recommended that you replace both varistors, not just the one that is obviously defective.



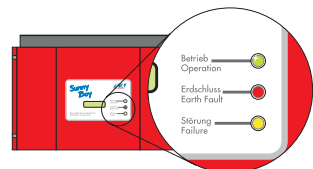
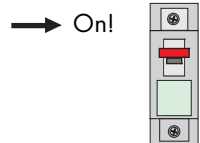
The pole with the small loop (crimp) must be fitted to terminal 1 when replacing the varistor.



Warning!

If no spare varistors are available on site, the Windy Boy WB 2500 / 3000 can once again feed into the grid. The input is no longer protected against overvoltages! Replacement varistors should be obtained as soon as possible. In systems with a high risk of overvoltages, the Windy Boy WB 2500 / 3000 should not be operated with defective varistors!

- Reconnect the PE connection to the lid and close the Windy Boy WB 2500 / 3000 as described in section 7.2 "Closing the Windy Boy" (Page 31).
- Switch on the DC circuit breaker.
- Switch the line circuit breaker to the "on" position.
- Now check whether the LED display on the Windy Boy WB 2500 / 3000 indicates that the device is functioning correctly.



If no ground fault and no defective varistor were found, there is probably a fault in the Windy Boy. In this case, contact the SMA hotline to discuss what to do next.

10 Contact

If you have any questions or technical problems concerning the Windy Boy WB 2500 / 3000, contact our hotline. Have the following information available when you contact SMA:

- Inverter type
- Type of wind turbine and rectifier
- Type of overvoltage protection
- Communication method
- Serial number of the Windy Boy
- Blink code or display of the Windy Boy



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