Wind Power Inverter

WINDY BOY 5000A / 6000A

Installation Manual

WB5A_6A-IA-IEN114540 | IME-WB50A_60A | Version 4.0

EN

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1 Information on this Manual

1.1 Validity

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

- Windy Boy 5000A (WB 5000A, WB 5000A-11, WB 5000A-IT)
- Windy Boy 6000A (WB 6000A, WB 6000A-11, WB 6000A-IT)

Keep this manual in a convenient place for future reference.

1.2 Target Group

This manual is intended for electrically qualified persons. The tasks described in this manual may be performed by electrically qualified persons only.

1.3 Additional Information

You will find further information on special topics such as designing a miniature circuit-breaker or the description of the operating parameters in the download area at www.SMA.de/en.

Refer to the user manual provided for detailed information on operating the inverter.

1.4 Symbols Used

The following types of safety precautions and general information are used in this manual:

DANGER!

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

WARNING!

WARNING indicates a hazardous situation which, if not avoided, can 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 indicates a situation that can result in property damage if not avoided.

Information

Information provides tips that are valuable for the optimal installation and operation of the product.

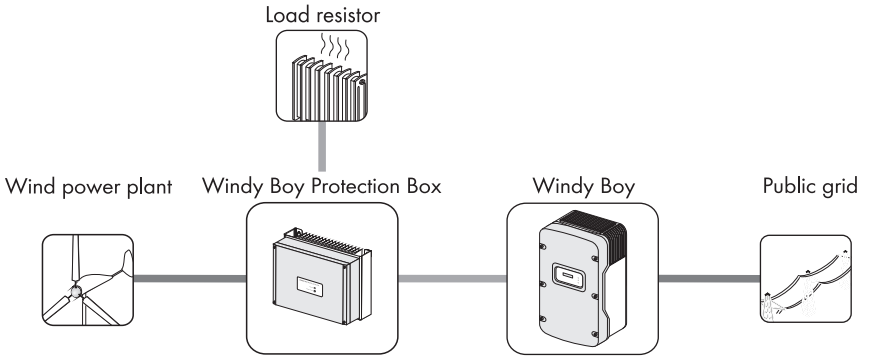
☑ This symbol indicates the result of an action.

2 Safety

2.1 Intended Use

The Windy Boy is a wind power inverter, which converts rectified current of a small wind turbine system into AC current and feeds this energy into the power distribution grid, domestic grid or the Sunny Island system.

Principle of a small wind turbine system with Windy Boy



Furthermore, the Windy Boy can be used as an inverter for power conversion units based on permanent magnet generators (hydro power systems, combined heat and power plant, diesel generator, etc.). The manufacturer of the small wind turbine system or generator must have approved his plant for operation with this Windy Boy.

When designing the PV plant, ensure that the permitted operating range of all components is maintained at all times. In addition, ensure that through the use of appropriate protective measures the maximum permissible input voltage of the inverter is not exceeded. SMA Solar Technology AG offers you the corresponding components, such as the Windy Boy Protection Box (overvoltage protection for wind power inverters including the rectifier).

2.2 Safety Precautions

DANGER!

Danger to life due to high voltages in the inverter

- All work on the inverter may be carried out by electrically qualified persons only.

CAUTION!

Risk of burns due to hot enclosure parts

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

2.3 Explanation of Symbols

This section gives an explanation of all the symbols found on the inverter and on the type label.

2.3.1 Symbols on the Inverter

Symbol	Explanation
	Operation display. Indicates the operating state of the inverter.
	Ground fault or varistor defective. Read Section 9.3 "Red LED Permanently On" (page 71).
	Error or disturbance Read Section 9 "Troubleshooting" (page 65).
	You can operate the display by tapping. • Single tap: the backlight switches on or the display scrolls one message further. • 2 consecutive taps*: the inverter displays the startup phase message once again (see Section 6.2 "Display Messages in the Startup Phase" (page 49)).
	QR-Code® ** for SMA bonus program You will find information on the SMA bonus program at www.SMA-Bonus.com.

* This function is valid from firmware version 2.18

** QR-Code is a registered wordmark of DENSO WAVE INCORPORATED.

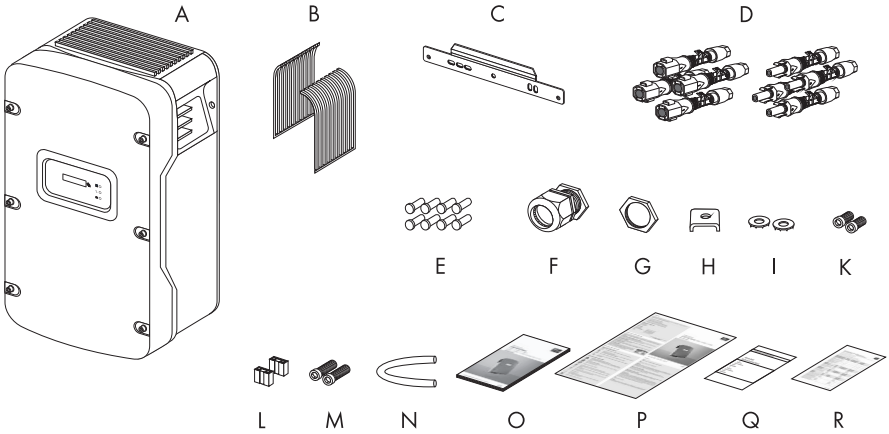
2.3.2 Symbols on the Type Label

Symbol	Explanation
	Beware of hazardous voltage. The inverter operates at high voltages. All work on the inverter may be carried out by electrically qualified persons only.
	Beware of hot surface. The inverter can become hot during operation. Avoid contact during operation.
	Observe all documentation that accompanies the inverter.
	The inverter must not be disposed of together with the household waste. For more information on disposal, see Section 10.4 "Disposing of the Inverter" (page 75).
	CE marking. The inverter complies with the requirements of the applicable EC guidelines.
	RAL quality mark for solar products. The inverter complies with the requirements of the German Institute for Quality Assurance and Labeling.
	The inverter has a transformer.
	Direct current (DC)
	Alternating current (AC)
	The inverter is protected against dust intrusion and water jets from any angle.

3 Unpacking

3.1 Scope of Delivery

Check the delivery for completeness and any visible external damage. Contact your specialty retailer if anything is damaged or missing.



Object	Quantity	Description
A	1	Inverter
B	2	Ventilation grid (1 x left, 1 x right)
C	1	Wall mounting bracket
D	8	DC connector (4 x positive, 4 x negative)
E	8	Sealing plug for DC connectors
F	1	Cable gland for AC connection
G	1	Counter nut for cable gland at AC connection
H	1	Clamping bracket for additional grounding
I	2	Conical spring washer (1 x replacement for enclosure lid, 1 x for ground terminal)
K	2	M6x16 cheese-head screw (1 x replacement for enclosure lid, 1 x for ground terminal)
L	2	Jumper (1 x for fan test, 1 x for the SMA Power Balancer wiring)
M	2	M6x8 cheese-head screw for securing the inverter in the wall mounting bracket
N	1	Silicone tube
O	1	Installation manual
P	1	User manual
Q	1	Document set with explanations and certificates
R	1	Supplementary sheet with inverter default settings

3.2 Identifying the Inverter

You can identify the inverter using the type label. The type label is on the right-hand side of the enclosure.

The serial number (Serial no.) and the type (Type / Model) of the product, as well as device-specific characteristics are specified on the type label.

4 Mounting

4.1 Safety

DANGER!

Danger to life due to fire or explosion

Despite careful construction, electrical devices can cause fires.

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

CAUTION!

Risk of burns due to hot enclosure parts

- Mount the inverter in such a way that the enclosure cannot be touched inadvertently.

CAUTION!

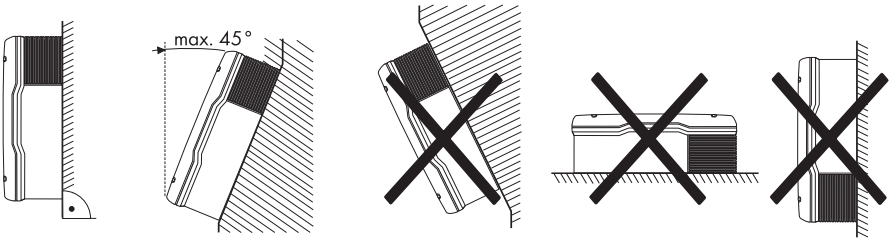
Risk of injury due to the heavy weight of the inverter

- Note that the inverter weighs approx. 62 kg.

4.2 Selecting the Mounting Location

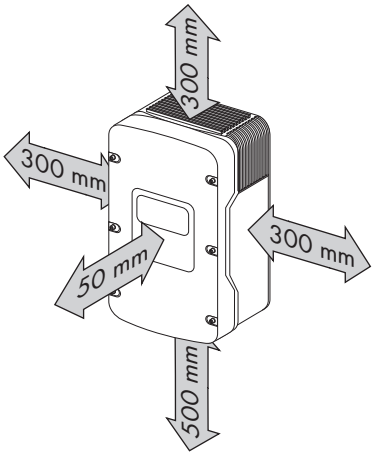
Consider the following requirements when selecting the mounting location:

- The mounting method and location must be suitable for the inverter's weight and dimensions (see Section 11 "Technical Data" (page 76)).
- Mount on a solid surface.
- The mounting location must at all times be clear and safely accessible without the use of additional aids such as scaffolding or lifting platforms. Non-fulfillment of these criteria may restrict servicing.



- Mount vertically or tilted backwards by max. 45 °.
- Never mount the device with a forward tilt.
- Never mount the device with a sideways tilt.
- Do not mount horizontally.
- The connection area must point downward.
- Install at eye level in order to allow operating states to be read at all times.
- To ensure optimal operation, the ambient temperature should be below 40°C.
- Do not expose the inverter to direct solar irradiation as this can cause excessive heating and thus power reduction.
- In living areas, to avoid audible vibrations do not mount the device on plasterboard walls or similar. When in operation, the inverter may emit noises which are perceived as annoying in living areas.

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



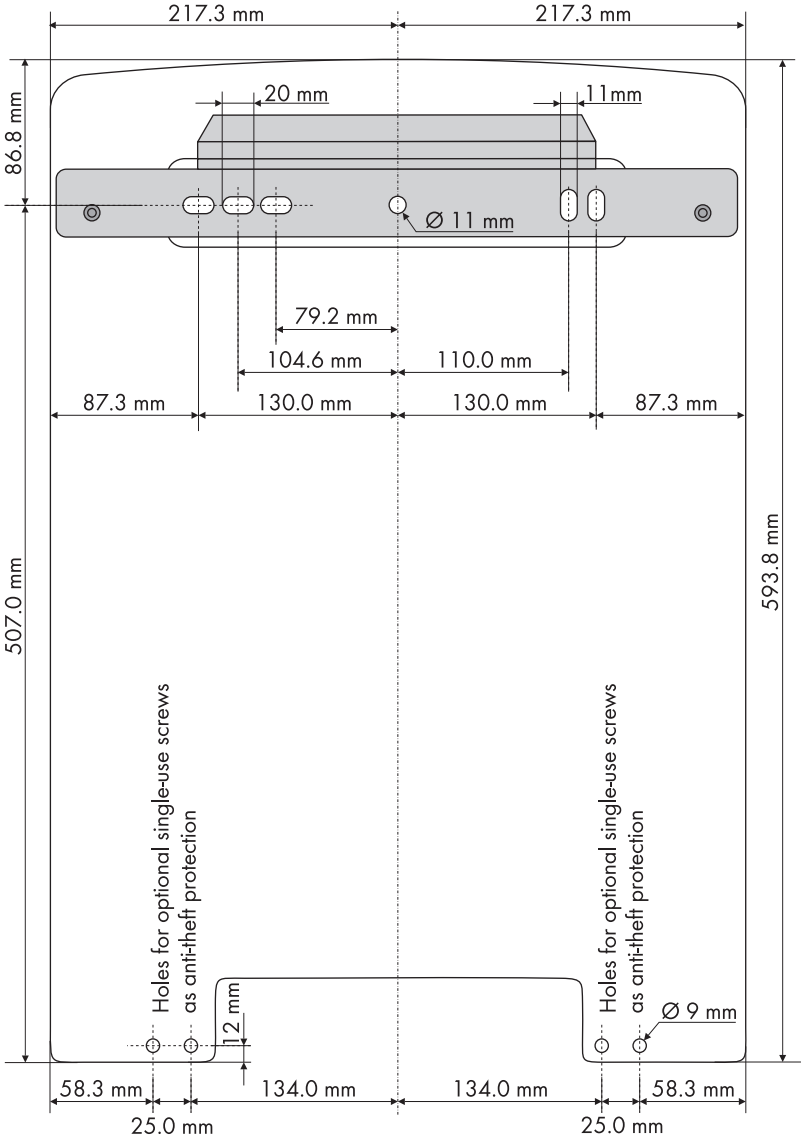
Multiple inverters installed in areas with high ambient temperatures

There must be sufficient clearance between the individual inverters to ensure that the cooling air of the adjacent inverter is not drawn in.

If necessary, increase the spacing and make sure there is enough fresh-air supply to ensure sufficient cooling of the inverters.

4.3 Mounting the Inverter with the Wall Mounting Bracket

1. Mark the position of the drill holes using the wall mounting bracket and drill the holes. Use at least 2 of the 6 holes, 1 hole each on the left- and right-hand sides respectively.

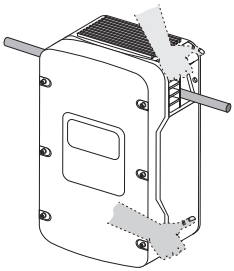


CAUTION!

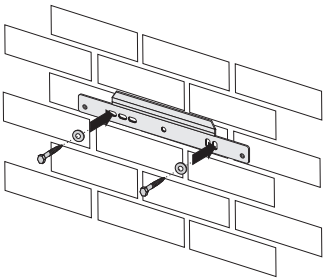
Risk of injury due to the heavy weight of the inverter

The inverter weighs approx. 62 kg.

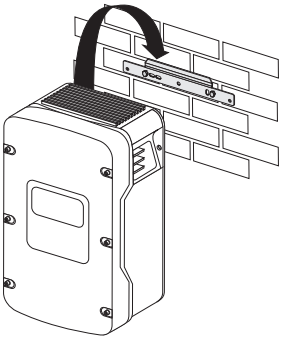
- Mount the wall mounting bracket with the appropriate mounting material (depending on the surface).
- Use the side handles (top and bottom) or a steel rod (maximum diameter 30 mm) for transport and mounting. The rod must be pushed through the enclosure openings.



2. Secure the wall mounting bracket to the wall using appropriate screws and washers.

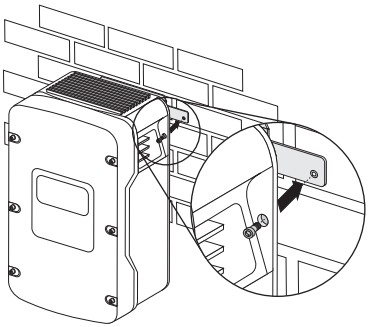


3. Attach the inverter to the wall mounting bracket using the special opening at the rear of the enclosure.



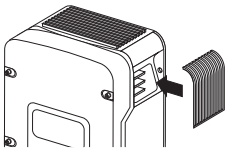
4. Screw the inverter onto the wall mounting bracket on both sides using the screws (M6x8) provided.

   Only fasten the screws hand-tight.



5. Check to ensure that the inverter is securely in place.
6. Close the recessed grips with the ventilation grids provided. To help you identify the sides, the ventilation grids are marked on the inside with "links/left" and "rechts/right".

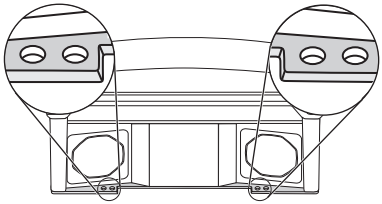
   The ventilation grids prevent intrusion of dust and insects, and can be reordered from SMA Solar Technology AG as required (see Section 12 "Accessories" (page 83)).



Optional anti-theft protection

To protect the inverter against theft, the back panel can be secured to the wall at the bottom using 2 safety screws.

The other 2 holes are spares.



5 Electrical Connection

NOTICE!

Damage to the inverter due to electrostatic discharge

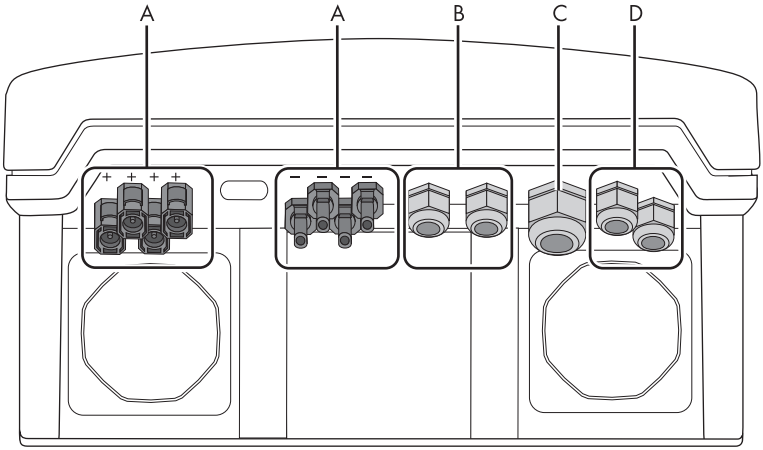
The internal components of the inverter can be irreparably damaged by electrostatic discharge.

- Ground yourself before touching a component part.

5.1 Overview of the Connection Area

5.1.1 Exterior View

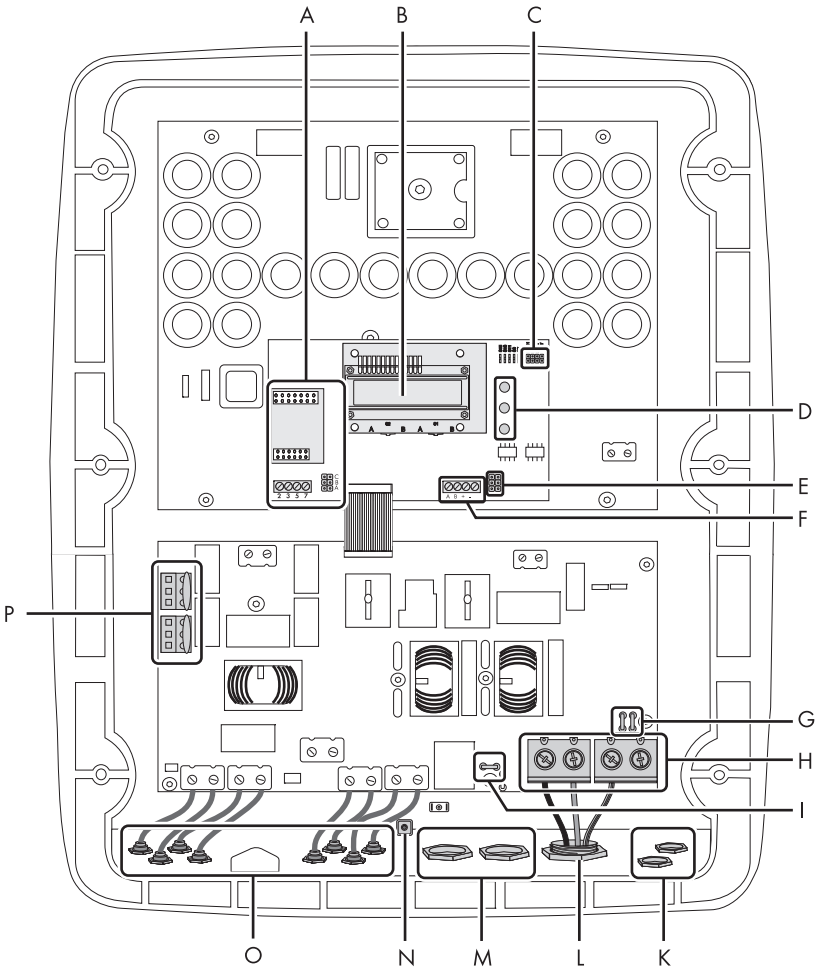
The following figure shows the assignment of the individual connection areas at the bottom of the inverter.



Object	Description
A	DC connector for connecting the small wind turbine system
B	Cable gland for optional communication via RS485 (PG16)
C	Cable gland for grid connection (AC) (12 mm ... 25 mm)
D	Cable gland for SMA Power Balancer

5.1.2 Interior View

The following figure shows the various components and connection areas of the open inverter.



Object	Description
A	Connection area and slots for communication
B	Display
C	Jumper slot for the fan test
D	LEDs for displaying the operating states
E	Jumper slot for SMA Power Balancer
F	Terminals for SMA Power Balancer
G	Flat connector for grounding the cable shield when connecting the SMA Power Balancer
H	Terminals for grid cable (AC)
I	Plug for grounding the cable shield for communication
K	Cable gland for the SMA Power Balancer
L	Cable gland for grid cable (AC)
M	Cable gland for communication
N	Screw fixture of shield clamp for data cable
O	DC connector
P	Varistors

5.2 Connection to the Power Distribution Grid (AC)

5.2.1 Conditions for AC Connection

Connection requirements of the grid operator

Always observe the connection requirements of your grid operator.

Cable Design

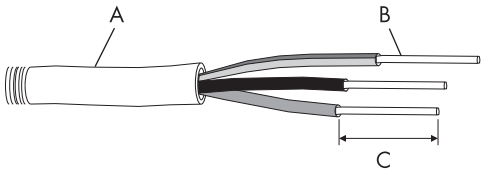
The maximum cable lengths relative to the cable cross-section are shown in the following table.

Cable cross-section	Maximum cable length	
	WB 5000A/WB 5000A-11	WB 6000A/WB 6000A-11
6 mm²	18 m	15 m
10 mm²	31 m	25 m
16 mm²	49 m	41 m

Reducing line losses by half

If three inverters with symmetrical feed-in are combined to form a three-phase system, the neutral conductor is not subjected to any load, and the line losses are halved. This reduction of line losses by 50% increases the maximum cable length by 100%.

Cable Requirements



Object	Description	Value
A	External diameter	12 mm ... 25 mm
B	Cable cross-section	6 mm² ... 16 mm²
C	Stripping length	approx. 16 mm

Load Disconnection Unit

You must install a **separate** miniature circuit-breaker for each inverter in order to ensure that the inverter can be securely disconnected under load. The maximum permissible fuse protection can be found in Section 11 "Technical Data" (page 76).

Detailed information and examples on the design of miniature circuit-breakers are available in the Technical Information "Miniature circuit-breaker" to be found in the download area of SMA Solar Technology AG at www.SMA.de/en.

DANGER!

Danger to life due to fire

In the event of parallel connection of more than one inverter to the same miniature circuit-breaker, the protective function of the miniature circuit-breaker is no longer guaranteed. It can result in a cable fire or destruction of the inverter.

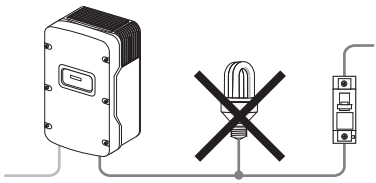
- Never connect several inverters to the same miniature circuit-breaker.
- Observe the maximum permissible fuse protection of the inverter when selecting the miniature circuit-breaker.

DANGER!

Danger to life through electric shock

When a generator (inverter) and a load are connected to the same miniature circuit-breaker, the protective function of the miniature circuit-breaker is no longer guaranteed. The currents from the inverter and the grid can accumulate to form overcurrents that are not detected by the miniature circuit-breaker.

- Never connect the load between the inverter and the miniature circuit-breaker without protection.
- Always protect the load separately.



NOTICE!

Damage to the inverter due to the use of screw-type fuses as load disconnection units

A screw-type fuse, e.g., DIAZED fuse or NEOZED fuse, is not a switch-disconnector and must **never** be used as such. A screw-type fuse only acts as cable protection.

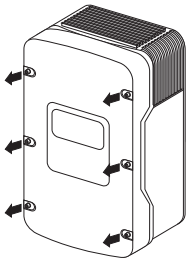
Disconnection under load using a screw-type fuse can damage the inverter.

- Use only a switch-disconnector or a miniature circuit-breaker as a load disconnection unit.

5.2.2 Connecting the Inverter to the Power Distribution Grid (AC)

1. Check that the line voltage is within the permissible voltage range.

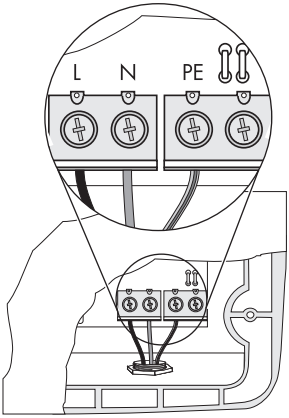
   The exact operating range of the inverter is specified in the operating parameters. The relevant document can be found in the download area at www.SMA.de/en, in the "Technical Description" category of the respective inverter.
2. Disconnect the miniature circuit-breaker and secure against re-connection.
3. Loosen all screws of the enclosure lid and remove the lid. To do this, use a hexagon socket wrench (6 mm).



4. Remove the adhesive tape from the AC enclosure opening.
5. Place the AC cable gland in position on the outside of the enclosure opening and fasten with the counter nut on the inside.
6. Pull the cable through.
7. Connect L, N and the protective conductor (PE) to the terminal blocks using a screwdriver in accordance with the labels.

   The PE conductor must be 5 mm longer than the L and N conductors.

   L and N must not be swapped.

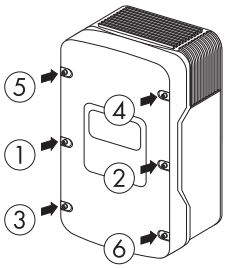


8. Fasten the cable gland tightly on the enclosure opening.

9. Secure the enclosure lid with all screws and the corresponding conical spring washers. To do this, use a hexagon socket wrench (6 mm).

   Tighten the screws with 6 Nm torque in the order shown in the figure on the right. The toothing of the conical spring washers must point toward the enclosure lid.

   The scope of delivery of the inverter includes a spare screw and a spare conical spring washer.



DANGER!

Danger to life due to live enclosure lid

The grounding of the enclosure lid is ensured by the conical spring washers.

- Attach the conical spring washers for all 6 screws with the toothing facing toward the enclosure lid.

DANGER!

Danger to life due to high voltages in the inverter

- Do not switch on the miniature circuit-breaker until the small wind turbine system has been connected and the inverter is securely closed.

☑ The inverter is connected to the power distribution grid (AC).

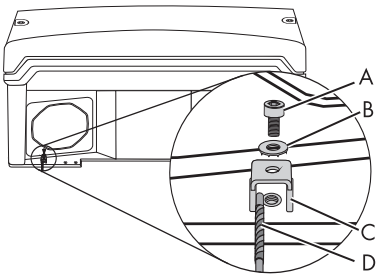
5.2.3 Additional Grounding of the Enclosure

If the installation so requires, you can use the ground terminal to connect a second protective conductor or as equipotential bonding.

Procedure

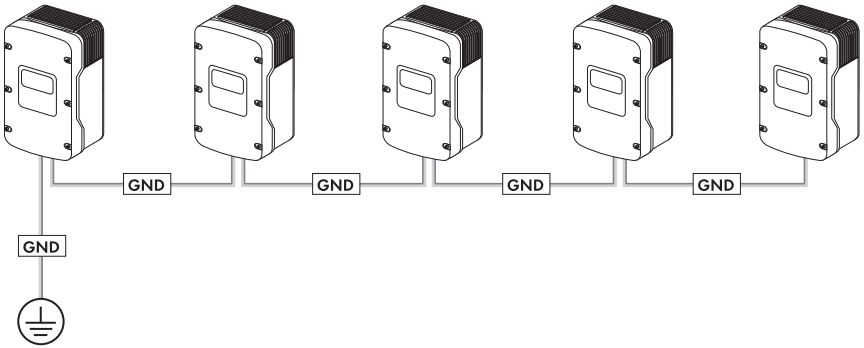
1. Insert stripped grounding cable (D) underneath the clamping bracket (C) (cross-section max. 16 mm² or with bootlace ferrule max. 10 mm²).
2. Secure the clamping bracket with the screw (A) and washer (B).

   The toothing of the washer must face toward the clamping bracket.



☑ The inverter enclosure is additionally grounded.

You can ground multiple inverters as shown in the diagram below:



5.3 Setting the Display Language

You can set the display language using the switches underneath the display assembly inside the inverter.

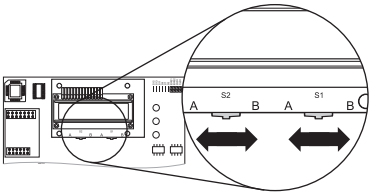
For inverters configured to the Italian country standard DK 5940, different switch positions apply. You can find the standard to which the inverter was set upon delivery on the type label and the enclosed supplement with the default settings. For more information, see the Technical Description "Operating Parameters" at www.SMA.de/en.

Procedure

1. Open the inverter as described in Section 7.2 "Opening the Inverter" (page 57).
2. Set the switches to the required language as shown below.

   For all country settings apart from DK 5940, the following switch positions apply:

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



   For inverters configured to the country standard DK 5940, the following switch positions apply:

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

3. Close the inverter as described in Section 7.3 "Closing the Inverter" (page 59).

☑ The display language is set.

5.4 Connecting the Small Wind Turbine System (DC)

5.4.1 Conditions for the DC Connection

- The connection cables of the small wind turbine system must be fitted with connectors. The DC connectors needed for DC connection are included in the delivery.
- The following limits at the DC input of the inverter must not be exceeded:

Maximum input voltage	Maximum input current
600 V	26 A

DANGER!

Danger to life through electric shock or fire

The maximum possible input current is limited by the connectors used. If the connectors are overloaded, an electric arc may occur and there is a risk of fire.

- Ensure that the input current does not exceed the maximum through-fault current of the connectors used.

NOTICE!

Destruction of the inverter due to overvoltage

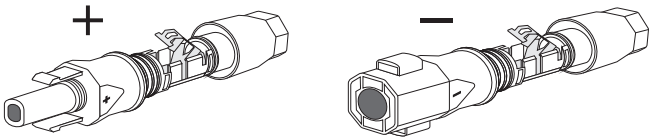
If the voltage of the small wind turbine system exceeds the maximum input voltage of the inverter, the inverter can be destroyed by overvoltage. This will void all warranty claims.

- Install overvoltage protection, e.g. Windy Boy Protection Box, between the small wind turbine system and the inverter.

5.4.2 Assembling the DC Connectors

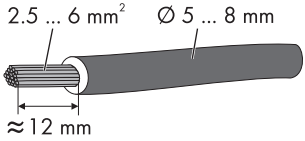
For connection to the inverter, all connection cables of the small wind turbine system must be fitted with the supplied DC connectors.

To assemble the DC connectors, proceed as follows. Ensure the connectors have the correct polarity. The DC connectors are marked with the symbols "+" and " – ".



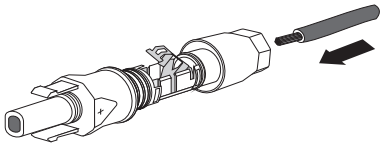
Cable requirements:

- Use a PV1-F cable.

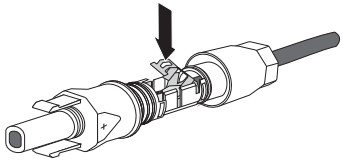


Procedure

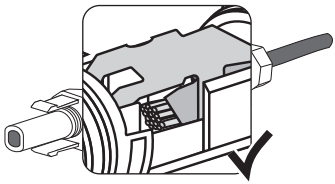
1. Lead the stripped cable all the way into the plug.

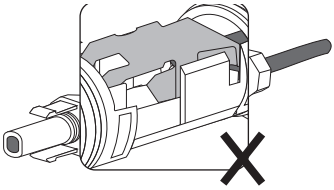
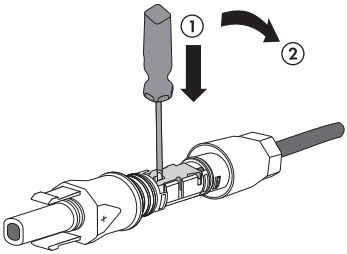


2. Press the clamping bracket down until it audibly snaps into place.

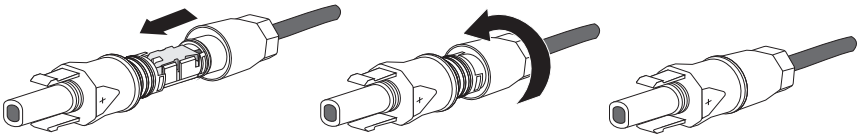


3. Ensure that the cable is correctly inserted:

Result	Measure
☑ If the stranded wires are visible in the chamber of the clamping bracket, the cable is correctly inserted. 	• Proceed to step 4.

Result	Measure
☑ If the stranded wires are **not** visible, the cable is not correctly inserted. 	• Loosen the clamping bracket. To do so, insert a screwdriver into the clamping bracket to lever it open (blade width: 3.5 mm).  • Remove the cable and go back to step 1.

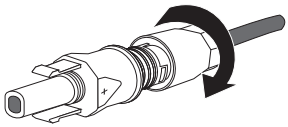
4. Slide the screw joint up to the thread and fasten with a torque of 2 Nm.



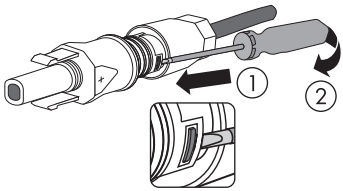
☑ The DC connectors are assembled and can now be connected to the inverter as described in Section 5.4.4 "Connecting the Small Wind Turbine System (DC)" (page 34).

5.4.3 Opening the DC Connector

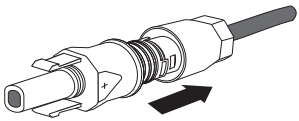
1. Unscrew the screw connection.



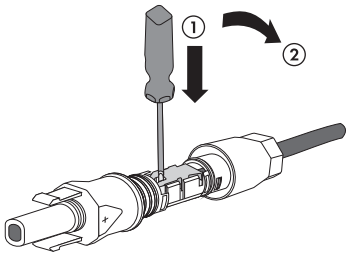
2. Release the DC connector. To do so, insert a screwdriver into the lateral shaft latching and lever it open (blade width: 3.5 mm).



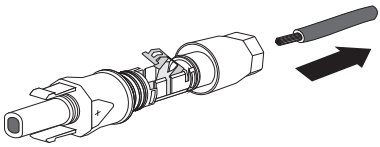
3. Carefully pull the DC connector apart.



4. Loosen the clamping bracket. To do so, insert a screwdriver into the clamping bracket to lever it open (blade width: 3.5 mm).



5. Remove the cable.



☑ The cable is now detached from the DC connector.

5.4.4 Connecting the Small Wind Turbine System (DC)

DANGER!

Danger to life due to high voltages in the inverter

- Before connecting the small wind turbine system, ensure that it is not running.

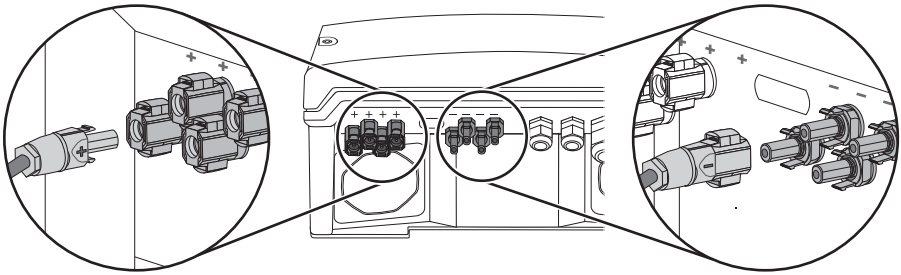
NOTICE!

Destruction of the inverter due to overvoltage

- If the output voltage of the small wind turbine system exceeds the maximum input voltage of the inverter, do not connect any DC cables to the inverter and check the design of the plant.

1. Connect the assembled DC connectors to the inverter.

   ☑ The DC connectors click audibly into position.
   To release the DC connectors, see Section 7.2 "Opening the Inverter" (page 57).

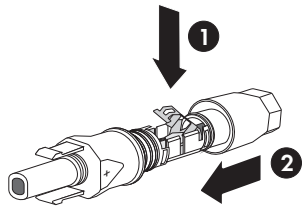


2. To seal the inverter, any unused DC inputs must be closed with DC connectors and sealing plugs.

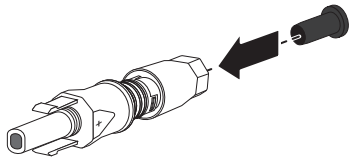
Sealing plugs

- Do **NOT** insert the sealing plugs **DIRECTLY** into the DC inputs on the inverter.

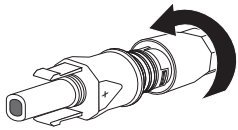
– For unused DC connectors, push down the clamping bracket and slide the screw joint up to the thread.



– Insert sealing plug into the DC connector.

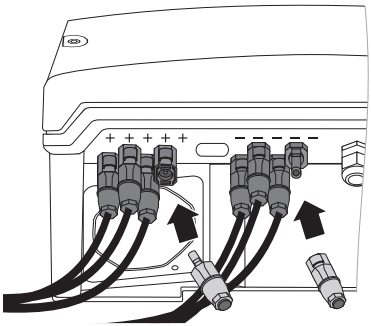


– Fasten the DC connector (torque: 2 Nm).



– Insert the DC connectors with sealing plugs into the corresponding DC inputs on the inverter.

☑ The DC connectors click audibly into position.



3. Ensure that all DC connectors are securely in place.

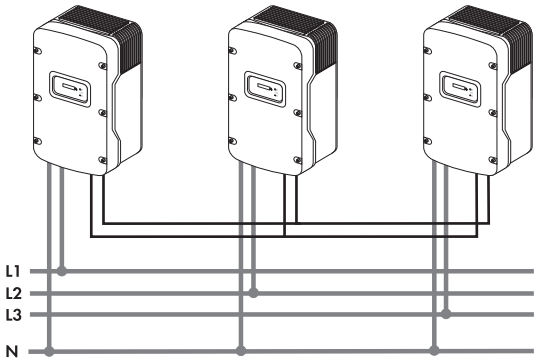
☑ The small wind turbine system is connected.

You can now commission the inverter as described in Section 6 "Commissioning" (page 48).
The following connections are optional.

5.5 Connection of the SMA Power Balancer

The inverter is standardly equipped with the SMA Power Balancer. This enables a circuitry of 3 inverters to a three-phase feed-in system.

Each of the three inverters in a group must be connected to a different line conductor of the low-voltage grid (L1, L2, L3)!



If this electronic circuit is activated, you can specify how the other two inverters should react if there is a device fault in the third inverter or a line voltage fault occurs in its phase.

The connections for the SMA Power Balancer are galvanically isolated from the rest of the inverter electronic circuit.

5.5.1 Configuration

With configured country standard VDE-AR-N4105-MP or VDE-AR-N4105-HP, in the WB 5000A-11 and WB 6000A-11, the default setting of the SMA Power Balancer is activated and set to the operation mode "PowerGuard". With all other country standards, the default setting of the SMA Power Balancer in WB 5000A-11 und WB 6000A-11 is deactivated.

In WB 5000A/WB 5000A-IT/WB 6000A/WB 6000A-IT, the default setting of the SMA Power Balancer is always deactivated, regardless of the configured country standard.

The SMA Power Balancer can be activated and configured via a communication product. To change the "PowerBalancer" parameter, you need a personal access code, the so-called SMA Grid Guard code. The application form for the personal access code is available in the download area at www.SMA.de/en, in the "Certificate" category of the respective inverter.

The configuration options are described below.

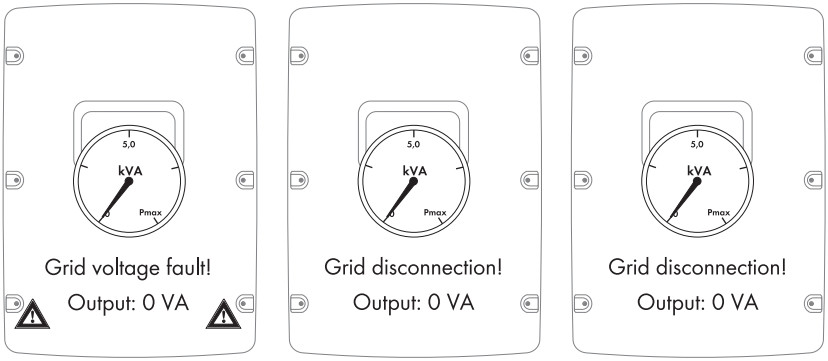
Configuration Options

There are 4 different configuration options for the "PowerBalancer" parameter.

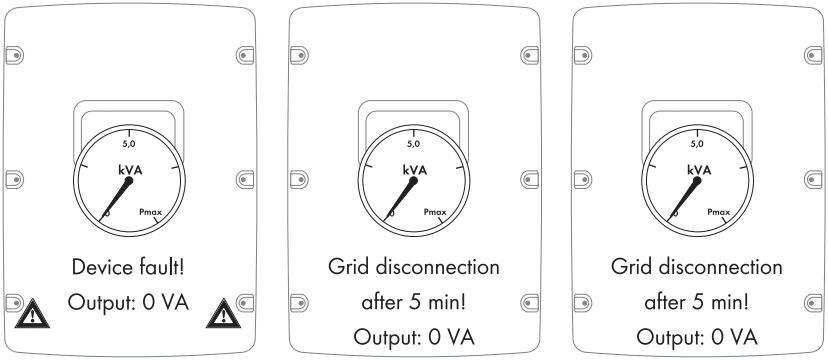
Local connection requirements

Select the respective setting and always observe the local connection requirements and provisions of your grid operator.

- **FaultGuard**
  - If one of the 3 inverters indicates a **line voltage fault** and stops feeding in, the other two inverters also disconnect from the power distribution grid immediately.



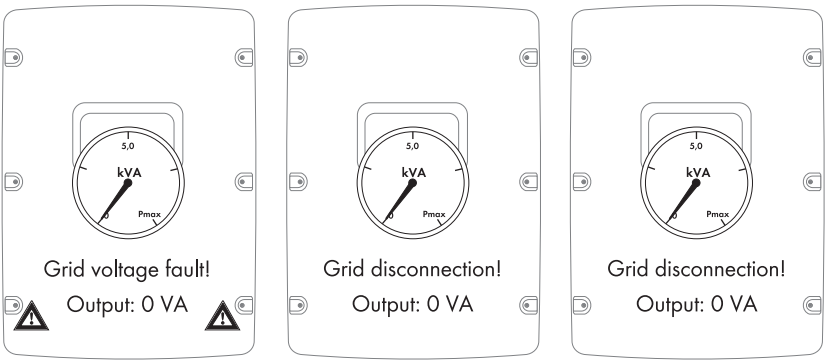
  - If one of the 3 inverters indicates a **device fault** and stops feeding in, the other two inverters also disconnect from the power distribution grid 5 minutes later.



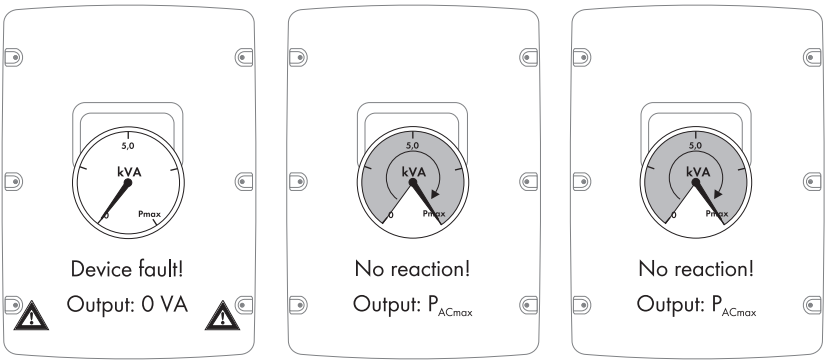
- **PhaseGuard**

  This operating mode enables the implementation of three-phase line voltage monitoring.

  – If one of the 3 inverters indicates a **line voltage fault** and stops feeding in, the other two inverters also disconnect from the power distribution grid automatically.



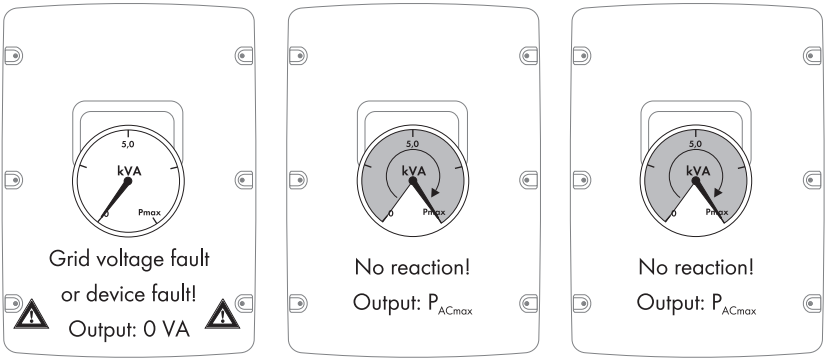
  – If one of the three inverters indicates a **device fault** and stops feeding in, the other two inverters are not affected and continue to feed in at full power.



- **Off**

  The SMA Power Balancer is deactivated.

  – If one of the inverters displays a **device fault** or a **line voltage fault** , only the affected inverter disconnects from the power distribution grid and the other two inverters continue to feed in at full power.



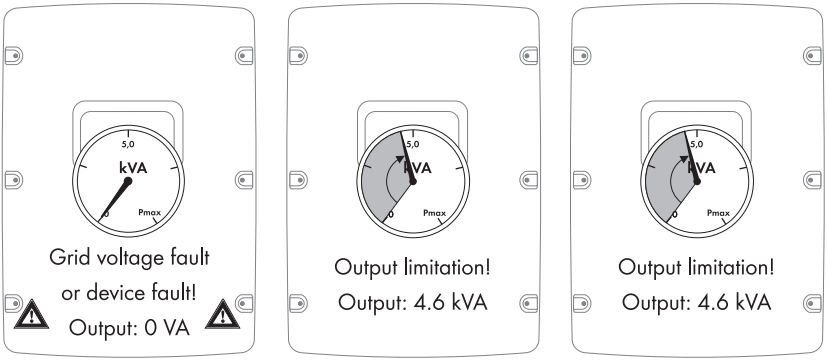
- **PowerGuard**

  This setting can be carried out if the entire small wind turbine system consists of 3 inverters only and the asymmetric load is to be limited to 4.6 kVA in case of failure.

Differing asymmetric load limit for Italy

In inverters configured to country standard DK 5940, the asymmetric load is limited to 6 kVA.

  – If one of the 3 inverters indicates a **line voltage fault** or a **device fault** and stops feeding in, the other two inverters automatically limit their power to 4.6 kVA.



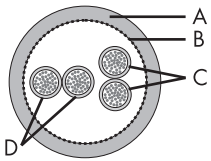
5.5.2 Cabling

Cable Requirements

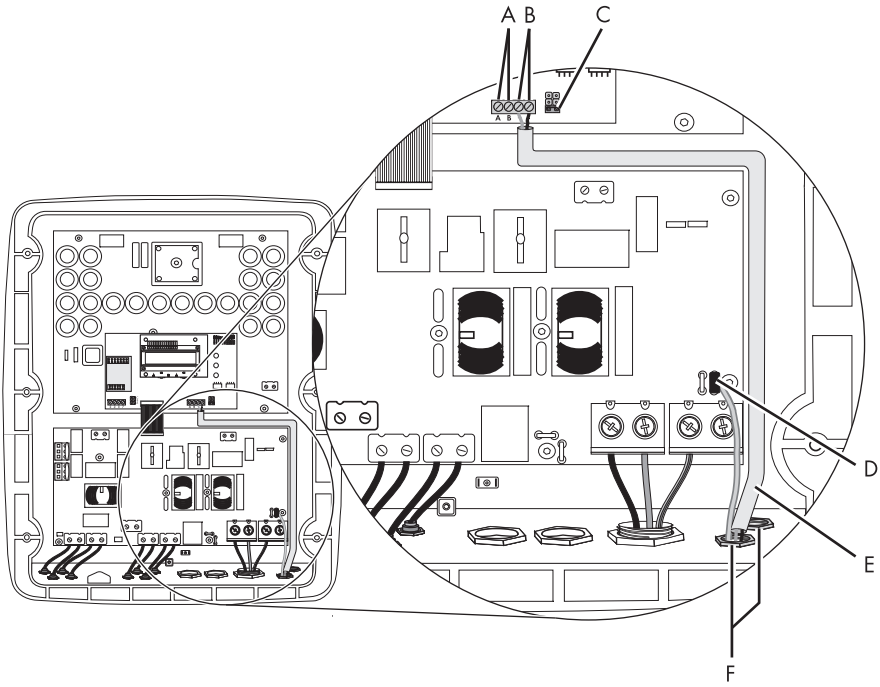
To connect the SMA Power Balancer, use a "LiYCY" cable with the following structure:

- Indoors: LiYCY 2 x 2 x 0.25
- Outdoors: Li-2YCYv 2 x 2 x 0.25

Object	Description
A	Flexible insulation
B	Shielding
C	Twisted pair 2 (2 x 0.25 mm²)
D	Twisted pair 1 (2 x 0.25 mm²)



Overview of the Connection Area



Position	Description
A	Screw terminals for the wire bridge
B	Screw terminals for connecting the cables
C	Jumper slot
D	Flat connector for grounding the cable shield
E	Silicone tube / cable route
F	Cable gland

Procedure

1. Open the inverter as described in Section 7.2 "Opening the Inverter" (page 57).
2. Insert the cable into each inverter.

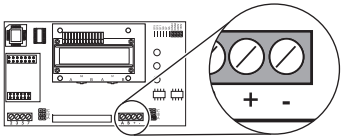
   Use one of the two enclosure openings (F) on the bottom right hand side.

DANGER!

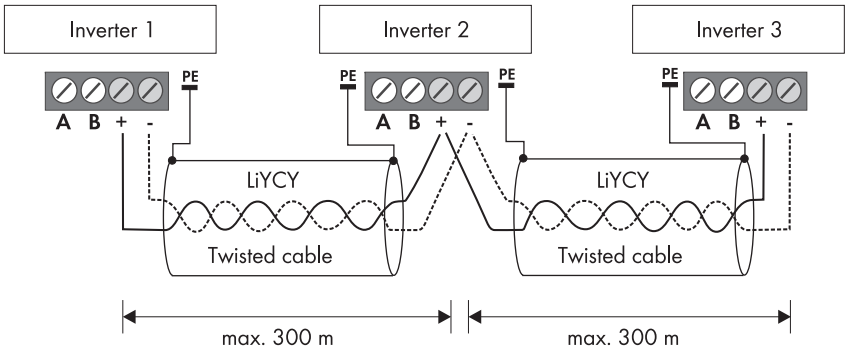
Danger to life due to high voltages on the SMA Power Balancer cable when faults occur

- Sheath the positive and negative cable conductors in each inverter using the silicone tube provided.
- Cut the silicone tube to the required length.
- The silicone tube must completely protect the cable inside the inverter.

3. Lead the cable along the cable route (E) as far as the terminal block (B).
4. Ground the cable shield in each inverter at the PE terminal (D).
5. Sheath the positive and negative cable conductors in each inverter with end sleeves.
6. Connect the positive and negative pole to the corresponding screw terminals.



7. To connect the 3 inverters, connect the positive and negative cables from the 2 other inverters to the terminal block of the middle inverter.



The length of the cables between 2 inverters must not exceed 300 m.

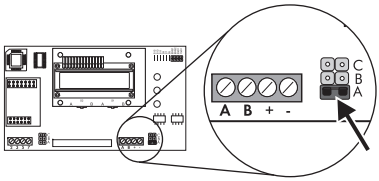
8. **Only** in the **middle** inverter (the one with 2 insulated conductors per terminal), insert one of the jumpers provided into the lowest of the three slots as depicted on the right.

   Do **not** plug the jumpers into the bottom slot of the two other inverters.

   or

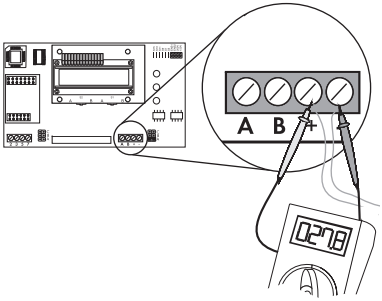
   Bridge the "A" and "B" screw terminals on the **middle** inverter with a wire bridge.

   Do **not** bridge the "A" and "B" screw terminals in the two other inverters!



9. Measure the resistance between the positive and negative poles of the terminal block in the **middle** inverter.

   ☑ If the resistance is approximately 27.8 k Ω (±370 Ω), the SMA Power Balancer has been connected correctly. Otherwise, check the cabling.



10. Close all inverters as described in Section 7.3 "Closing the Inverter" (page 59).

5.5.3 Function Test

To test whether the SMA Power Balancer is operating correctly, proceed as follows:

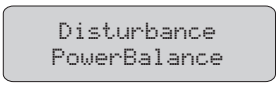
1. Select the "PhaseGuard" setting of the "PowerBalancer" parameter for all three inverters.
2. Check whether all inverters in the group are feeding into the power distribution grid normally.

   ☑ Green LED glows continuously, or you see the display message on the right: Proceed to step 3.

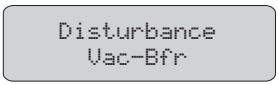
   or

   ☑ If all the inverters in this group are displaying the message on the right: check installation of the SMA Power Balancer and contact the SMA Service Line if necessary.

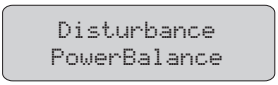
   

3. Switch off the miniature circuit-breaker in 1 of the 3 inverters.

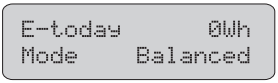
- The inverter with the deactivated miniature circuit-breaker will then indicate a line voltage fault by the display message pictured on the right ("Bfr" and "Srr" are irrelevant).

- The other 2 inverters will then also disconnect from the power distribution grid, showing the display message pictured on the right.

- Both inverters subsequently switch to "Balanced" mode.

  ☑ If the inverters react as described above, the function test has been completed successfully. Otherwise, check the configuration.

4. If applicable, reset the "PowerBalancer" parameter to the desired setting in all inverters.
5. Switch on the miniature circuit-breaker again.

☑ The function test is complete.

5.6 Communication

The inverter is equipped with a slot for communication interfaces which enable it to communicate with data loggers (e.g., Sunny WebBox) or a PC with appropriate software (e.g., Sunny Explorer).

Refer to the communication interface manual for a detailed wiring diagram and installation instructions.

The Power Reducer Box by SMA Solar Technology AG enables the active power of the inverter to be limited or the displacement power factor to be set via external specification.

For detailed information on the Power Reducer Box, see the relevant technical description at www.SMA.de/en.

5.7 Setting the Grid and Country Parameters

Changing grid-relevant and country parameters

To change grid-relevant parameters, you need a personal access code – the so-called SMA Grid Guard code. The application form for the personal access code is available in the download area at www.SMA.de/en, in the "Certificate" category of the respective inverter.

Confirm the changes to these parameters with your grid operator.

A detailed description of the operating parameters for the inverter is available in the download area at www.SMA.de/en in the category "Technical Description" of the respective inverter.

5.7.1 Setting the Country of Installation

Using the "Default" parameter, you can set the country of installation and/or the grid connection standard valid for that country via a communication product (e.g., Sunny WebBox) or a PC with corresponding software (e.g., Sunny Data Control or Sunny Explorer). However, this is only required if the inverter was originally ordered for another country. You can find the standard to which the inverter was set upon delivery on the type label and the enclosed supplement with the default settings.

5.7.2 Setting Off-Grid Operation

To operate the inverter in an off-grid system with Sunny Island, you must set the inverter via the "Default" parameter to off-grid operation ("OFF-Grid") operation.

You have several possibilities to set the inverter to off-grid operation:

- Setting via Sunny WebBox

  or

- Setting via Sunny Data Control or Sunny Explorer

DANGER!

Danger to life due to high voltages in the event of outage of the power distribution grid

If you set the inverter to off-grid operation, it does not fulfill any country-specific standards or guidelines. If there is a power distribution grid outage, there will consequently be a danger of back-feed.

- **Never** operate the inverter directly on the power distribution grid when set to off-grid operation.

5.8 Polynomial Curve

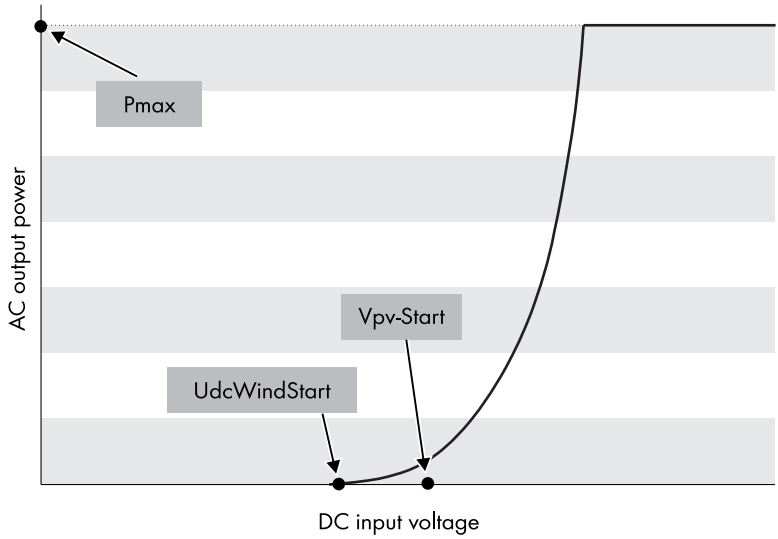
The polynomial curve is a programmable power curve depending on the DC input voltage. By adapting the default polynomial curve to the small wind turbine system being used, you can optimize the energy output of the small wind turbine system.

To adapt the polynomial curve of the inverter to the small wind turbine system being used, you should change the following parameters on the PC with the "Windy Boy Setup Tool" (www.SMA.de/en):

- Vpv-Start
- UdcWindStart
- Wind_a0 ... Wind_a3
- Pmax
- P-Wind-Ramp
- KP-Wind-Reg
- KI-Wind-Reg
- T-Stop

A description of the operating parameters is available in the download area at www.SMA.de/en in the category "Technical Description" of the respective inverter.

The inverter regulates its output power according to the generator voltage. The following diagram shows the function of a typical polynomial curve in a WB 5000A/WB 5000A-11/WB 6000A/ WB 6000A-11. Here, the AC power fed in is depicted as a function of the DC input voltage of the inverter.

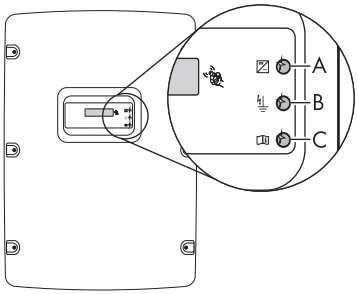


6 Commissioning

6.1 Commissioning the Inverter

1. Check the following requirements before commissioning:
   - The inverter is correctly mounted and connected.
   - The miniature circuit-breaker is correctly dimensioned.
   - The small wind turbine system is correctly grounded in accordance with the instructions of the manufacturer.
   - The rectifier and overvoltage protection (e.g. Windy Boy Protection Box) are installed between the small wind turbine system and the inverter
   - Unused DC inputs are closed using the corresponding DC connectors and sealing plugs.
2. Switch on the miniature circuit-breaker.
3. Commission the small wind turbine system in accordance with the instructions of the manufacturer.
   ☑ All 3 LEDs lit or flashing: the startup phase commences.
   ☑ Green LED lit: commissioning was successful.
   or
   ☑ Green LED flashing: grid connection conditions have not yet been reached.
   or
   ☑ Red LED lit or flashing: a disturbance has occurred. Proceed to step 4.

Object	Description
A	Green LED: operation
B	Red LED: ground fault or varistor defective
C	Yellow LED: disturbance



Self-test in accordance with DK 5940, Ed. 2.2 for initial commissioning (applies to Italy only)

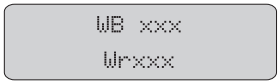
The Italian standard DK 5940 requires that an inverter may only be operated on the power distribution grid if the disconnection times for overvoltage, undervoltage, minimum frequency and maximum frequency have been tested.

Start the self-test as described in Section 6.3 "Self-test in Accordance with DK 5940, Ed. 2.2 (Applies to Italy Only)" (page 50). The test takes approx. 8 minutes.

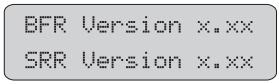
4. Read Section 9 "Troubleshooting" (page 65) and if necessary, eliminate the error or fault.

6.2 Display Messages in the Startup Phase

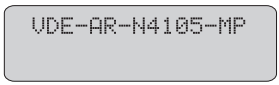
- After commissioning, the inverter displays the device type in the startup phase.



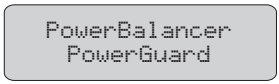
- After 5 seconds or a further tap on the enclosure lid, the inverter displays the firmware version of the internal processors.



- After another 5 seconds or a further tap, the inverter displays the configured country standard (example: "VDE-AR-N4105-MP").



- After another 5 seconds or a further tap, the inverter displays the configured operating mode of the SMA Power Balancer (example: "PowerGuard").



Show display messages again (applicable from firmware version 2.18)

To have the startup phase messages displayed again during operation, tap on the enclosure twice in rapid succession.

6.3 Self-test in Accordance with DK 5940, Ed. 2.2 (Applies to Italy Only)

6.3.1 Starting the Self-Test by Tapping

You can start the test of the disconnection times by tapping on the enclosure lid. The requirement for this is that the country configuration of the inverter has been set to Italy ("IT/DK5940 ") or "trimmed". Proceed as follows for checking the disconnection times:

1. Connect the small wind turbine system to the inverter. The inverter can only initialize once the small wind turbine system is producing enough power. It is therefore not possible to test the disconnection time if there is no wind.
2. Connect the inverter on the AC side. To do this, you must execute the AC connection (AC plug or direct connection) and/or switch on the miniature circuit-breaker on the grid supply line (fuse and circuit-breaker).
3. The inverter is now in the startup phase, i.e. all 3 LEDs are simultaneously lit.

   Start the self-test **immediately** after all 3 LEDS have gone out by tapping on the display of the inverter.
4. The display will ask whether you would like to start the test sequence. Confirm by tapping on the display again within 30 seconds.

Once you have started the test sequence, the inverter will consecutively check the disconnection times for overvoltage, undervoltage, maximum frequency and minimum frequency. During the test, the inverter will display the values described in Section 6.3.2 "Completion of the Self-test" (page 51).

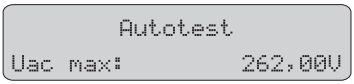
6.3.2 Completion of the Self-test

Note the values which are displayed during the self-test. These values must be entered in a test report. The results of each test test are displayed 3 times, one after the other. The respective message is displayed for 10 seconds.

In the self-test, the upper and lower disconnection thresholds for each protective function are adjusted on a linear basis with a variation of 0.05 Hz/s and 0.05 Vn/s for frequency and voltage monitoring. As soon as the actual measured value goes outside the permitted range (adjusted disconnection threshold), the inverter disconnects from the power distribution grid. Thus, the inverter determines the reaction time and performs the self-test.

Overvoltage Test

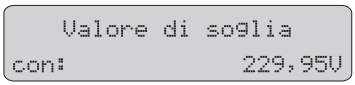
The inverter begins with the overvoltage test. During the test sequence, the voltage limit applied is shown in the display of the inverter.



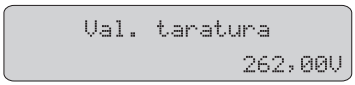
The voltage is reduced step by step until the disconnection threshold is reached and the inverter disconnects from the power distribution grid.

Once the inverter has disconnected from the power distribution grid, the display successively shows the following values:

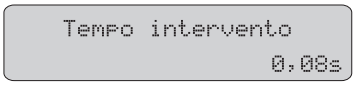
- Disconnection value,



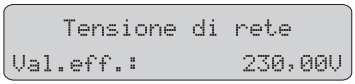
- Calibration value,



- Reaction time,



- Current line voltage.



Undervoltage Test

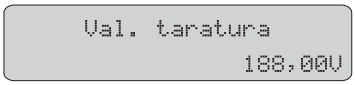
After the overvoltage test, the inverter proceeds to carry out the undervoltage test. During the test sequence, the current calibration value of the voltage limit applied is shown in the display of the inverter.

The voltage is increased step by step until the disconnection threshold is reached and the inverter disconnects from the power distribution grid.

Once the inverter has disconnected from the power distribution grid, the display successively shows the following values:

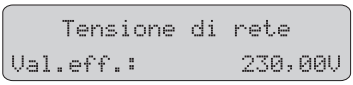
- Disconnection value,

- Calibration value,



- Reaction time,

- Current line voltage.



Maximum Frequency

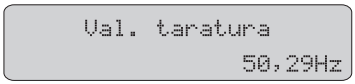
In a third step, the inverter tests the maximum frequency. During the test sequence, the frequency limit applied is shown in the display of the inverter.

The frequency is reduced step by step until the disconnection threshold is reached and the inverter disconnects from the power distribution grid.

Once the inverter has disconnected from the power distribution grid, the display successively shows the following values:

- Disconnection value,

- Calibration value,



- Reaction time,

- Current power frequency

Minimum Frequency

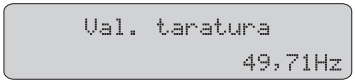
In the last step, the inverter tests the minimum frequency. During the test sequence, the frequency limit applied is shown in the display of the inverter.

The frequency is increased step by step until the disconnection threshold is reached and the inverter disconnects from the power distribution grid.

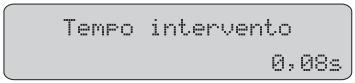
Once the inverter has disconnected from the power distribution grid, the display successively shows the following values:

- Disconnection value,

- Calibration value,



- Reaction time,



- Current power frequency

When the inverter has carried out all four tests, it switches to the "Turbine" operating mode. The original calibration values are then reset and the inverter automatically connects to the power distribution grid. If you wish to repeat the test, you must switch off the inverter, i.e. disconnect it on the AC and DC sides, and then recommission. You can then restart the self-test as described in Section 6.3.1 "Starting the Self-Test by Tapping" (page 50). The inverter recommences the test sequence as described in Section 6.3.2 "Completion of the Self-test" (page 51).

6.4 Operating States of the Inverter

Startup Procedure

If the inverter has enough voltage and power, the three LEDs on the inverter light up simultaneously, indicating that the startup process is ongoing.

As soon as the DC input voltage reaches the value configured for the parameter "Vpv-Start", the inverter trips several self-tests, measuring procedures and synchronization with the power distribution grid. This operating state is indicated on the inverter by the flashing green LED.

Once the DC input voltage has reached the "Vpv-Start" value for the time configured in "T-Start" and all the tests have been completed successfully, the inverter connects to the power distribution grid and the green LED comes on permanently. The inverter then switches to characteristic curve operation, and regulates the input current according to the generator voltage.

Characteristic Curve Operation

After the startup procedure, the inverter switches to characteristic curve operation and regulates the input current according to the generator voltage.

The inverter then begins to exert a load on the small wind turbine system, draws power from the small wind turbine system according to the input voltage present, and then feeds it into the power distribution grid. The maximum power output corresponds to the maximum AC power of the inverter. However, it can be reduced using the "Pmax" parameter.

Shutdown Procedure

If wind strength is so low that the DC input voltage falls below an internally calculated value, the inverter stops feeding power to the power distribution grid for the period defined in "T-Stop". As soon as DC input voltage increases again, the inverter switches back to characteristic curve operation.

If the DC input voltage remains below an internally calculated value for the time set in "T-Stop", the inverter will switch off.

If the DC input voltage is no longer sufficient to supply the on-board electronics with power, the inverter switches off immediately.

7 Opening and Closing

7.1 Safety

DANGER!

Electric shock due to high voltages in the inverter

Before opening the inverter, observe the following:

- Ensure that no voltage is present on the AC side.
- Ensure that no voltage or current is present on the DC side.

NOTICE!

Damage to the inverter due to electrostatic discharge

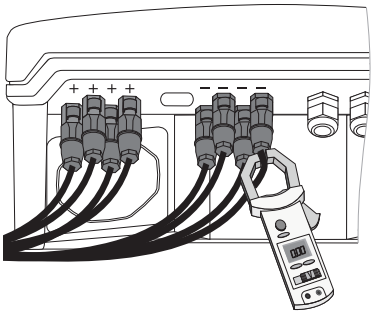
The internal component parts of the inverter can be irreparably damaged by electrostatic discharge.

- Ground yourself before touching a component part.

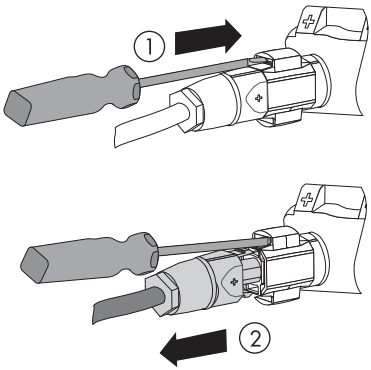
7.2 Opening the Inverter

1. Stop the small wind turbine system and make sure that it cannot restart.
2. Disconnect the miniature circuit-breaker and secure against re-connection.
3. Use a current probe to make sure all DC cables are current free.

   ☑ If current is present, check the installation.



4. Release and pull off all DC connectors with a screwdriver (blade width: 3.5 mm):
   - Insert a screwdriver into one of the side slots (1).
   - Remove the DC connector by pulling straight down (2). Do **not pull the cable**.



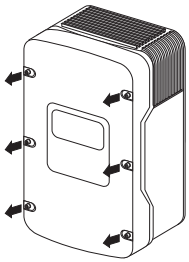
DANGER!

Danger to life due to high voltages in the inverter

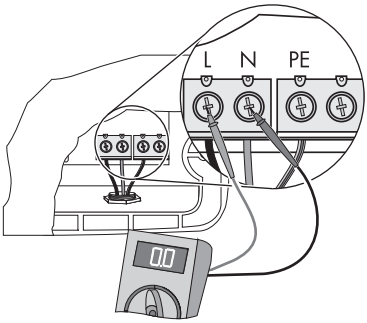
The capacitors in the inverter take 5 minutes to discharge.

- Wait 5 minutes before opening the inverter.

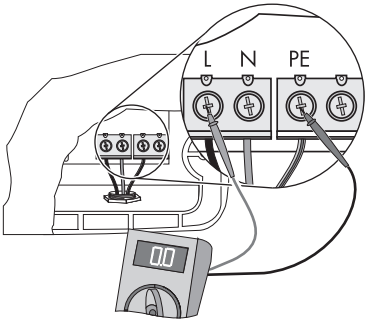
5. Loosen all screws of the enclosure lid. To do this, use a hexagon socket wrench (6 mm).



6. Remove enclosure lid by pulling towards you.
7. Verify the absence of voltage L to N at the AC terminal with a suitable instrument.
   ☑ If voltage is present, check the installation.



8. Verify the absence of voltage L to PE at the AC terminal with a suitable instrument.
   ☑ If voltage is present, check the installation.



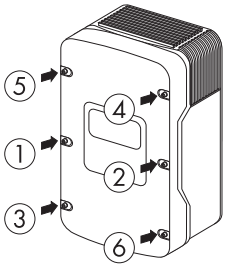
☑ The inverter is open and no voltage is present.

7.3 Closing the Inverter

1. Secure the enclosure lid with the 6 screws and the corresponding conical spring washers. To do this, use a hexagon socket wrench (6 mm).

   Tighten the screws with 6 Nm torque in the order shown in the figure on the right. The toothing of the conical spring washers must point toward the enclosure lid.

   The scope of delivery of the inverter includes a spare screw and a spare conical spring washer.



DANGER!

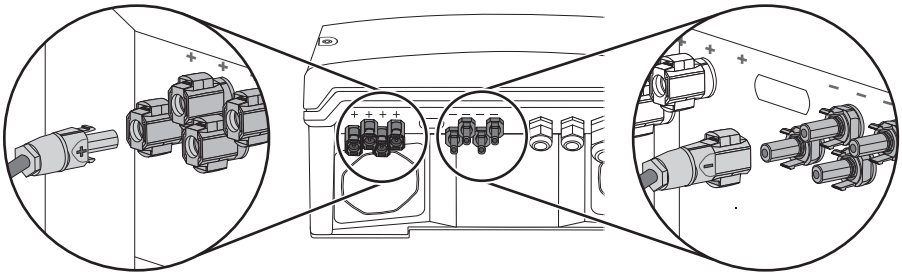
Danger to life due to live enclosure lid

The grounding of the enclosure lid is ensured by the conical spring washers.

- Attach the conical spring washers for all 6 screws with the toothing facing toward the enclosure lid.

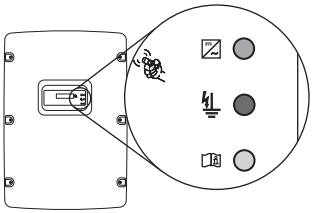
2. Check the DC connectors for correct polarity and connect them to the inverter. To release the DC connectors, see Section 7.2 "Opening the Inverter" (page 57).

   ☑ The DC connectors click audibly into position.
   To release the DC connectors, see Section 7.2 "Opening the Inverter" (page 57).



3. Close all unused DC inputs as described in Section 5.4.4 "Connecting the Small Wind Turbine System (DC)" (page 34) to seal the inverter.
4. Ensure that all DC connectors are securely in place.
5. Switch on the miniature circuit-breaker.
6. Commission the small wind turbine system in accordance with the instructions of the manufacturer.

7. Check whether the display and the LEDs indicate a normal operating state
(see Section 6 "Commissioning" (page 48)).



☑ The inverter is closed and in operation.

8 Maintenance and Cleaning

8.1 Cleaning the Inverter

If the inverter is soiled and visibility of inverter operating data and operating modes is restricted, wipe the enclosure lid, display and LEDs clean with a damp cloth. Do not use any caustic substances (e.g., solvents, abrasives) for cleaning.

8.2 Checking the Heat Dissipation

8.2.1 Cleaning the Fans

If the fan guards are just clogged with loose dust, clean them with a vacuum cleaner. If you do not achieve satisfactory results with a vacuum cleaner, dismantle the fans for cleaning.

Procedure

DANGER!

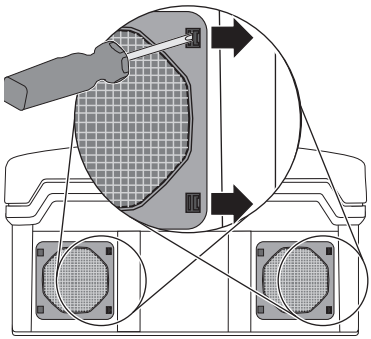
Danger to life due to high voltages in the inverter

- Stop the small wind turbine system and make sure that it cannot restart.
- Disconnect the inverter on the AC and DC sides.

1. Disconnect the inverter from both the DC and AC sides as described in Section 7.2 "Opening the Inverter" (page 57).
2. Wait for the fans to stop rotating.

Cleaning the Fan Guards

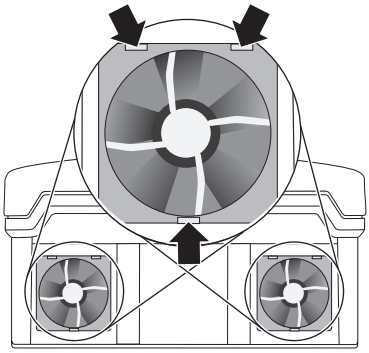
3. Remove the fan guards:
   - Press both latches on the right edge of the fan guard to the right using a screwdriver and dislodge from the retainer.
   - Carefully remove the fan guard.



4. Clean the fan guards with a soft brush, a paint brush, a cloth or compressed air.

Cleaning the fans

5. Press the front latches of the fan backwards and the rear latch forwards.



6. Remove the fan by pulling it slowly and carefully downwards.
7. Release and remove the plug.

   The fan cables are long enough for you to lift the fans far enough out to disconnect the plug inside the inverter.
8. Remove the fan.
9. Clean the fan with a soft brush, a paint brush, or a damp cloth.

NOTICE!

Damage to the fan by use of compressed air

- Do not use compressed air to clean the fan. This can damage the fan.

10. After cleaning, reassemble everything in reverse order.
11. Check the function of the fan as described in the following section.

8.2.2 Checking the Fan

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

- In the installer mode, set the "Fan-Test" parameter to "1" via a communication product.

  or

- Plug the provided jumper into the system control board.

Setting Parameters

1. Request an installer password from the SMA Service Line (contact see page 84).
2. In the installer mode, set the "Fan-Test" parameter to "1".
3. Check the air flow of the fans.

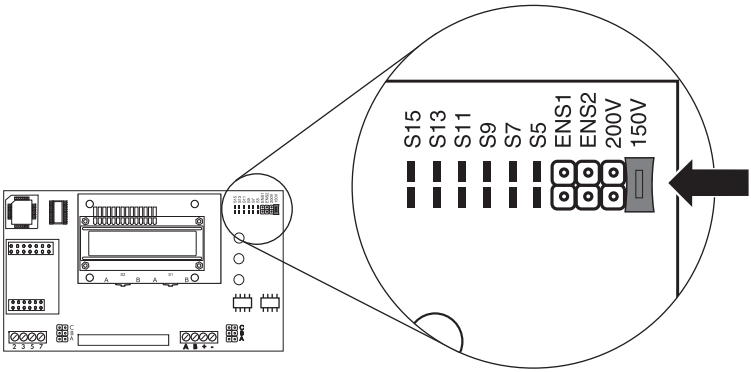
   The inverter draws air in from underneath and then blows it back out on either side at the top. Listen for any unusual noise which could indicate incorrect installation or a fault in the fans.
4. After the test, set the parameter "Fan-Test" back to "0".

☑ The test of the fans is complete.

Plugging the Jumper

The inverter recognizes the jumper only after a system restart
(i.e. all LEDs must have gone out prior to restart).

1. Open the inverter as described in Section 7.2 "Opening the Inverter" (page 57).
2. Plug the provided jumper in the slot on the system control board as shown below.



3. Close the inverter as described in Section 7.3 "Closing the Inverter" (page 59).

4. Check the air flow of the fans.

   The inverter draws air in from underneath and then blows it back out on either side at the top. Listen for any unusual noise which could indicate incorrect installation or a fault in the fans.

5. After checking the fans, remove the jumper. Open and close the inverter as described in Section 7 "Opening and Closing" (page 56).

☑ The test of the fans is now complete.

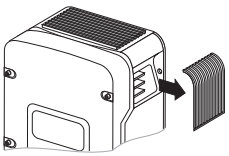
8.3 Cleaning the Ventilation Grids

The inverter draws cooling air in from underneath and then blows it back out through the ventilation grids at the top. Clean the ventilation grids if they are soiled.

Procedure

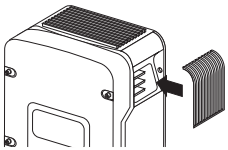
1. Remove the ventilation grids.

   To do this, insert your finger into the top of the space between ventilation grid and enclosure and remove the ventilation grid laterally.



2. Clean the ventilation grids with a soft brush, a paint brush, or compressed air.
3. Re-attach the ventilation grids to the inverter.

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



NOTICE!

Risk of damage to the inverter by intrusion of insects

- The ventilation grids must not be removed permanently, as otherwise the device will not be protected against intrusion of insects.

9 Troubleshooting

If the inverter displays blink codes which differ from those described below, contact the SMA Service Line.

In the user manual provided, you will also find a description of the display messages during operation, status messages and measurement channels.

Do not try to carry out repairs other than those described here. Instead, use the SMA Solar Technology AG 24-hour replacement service (the inverter will be ready for dispatch and at the forwarding agency within 24 hours) and repair service.

9.1 Blink Codes

Green	Red	Yellow	Status
flashing	flashing	flashing	OK (startup phase)
permanently on	off	off	OK (feed-in operation)
	permanently on	off	ground fault or varistor defective
		permanently on	OK (initialization)
flashing quickly (3 x per second)	off	off	OK (stop)
	permanently on	off	ground fault or varistor defective
flashing slowly (1 x per second)	off	off	OK (waiting, grid monitoring)
goes off briefly (approx. 1 x per second)	permanently on	off	ground fault or varistor defective
	off	off	OK (derating)
off	off	off	OK (night-time deactivation)
		on / flashing	Fault
	permanently on	off	ground fault or varistor defective
		on / flashing	ground fault or varistor defective and disturbance

9.2 Error Messages

When a disturbance occurs, the inverter generates a display message depending on the operating mode and the detected disturbance.

Message	Description and Corrective Measures
!PV-Overvoltage! **!DISCONNECT DC!**	Overvoltage at DC input! Overvoltage can destroy the inverter.
	Corrective measures Disconnect the inverter **immediately**. 1. Stop the small wind turbine system. 2. Disconnect the miniature circuit-breaker. 3. Remove all DC connectors. 4. Check the DC voltage: – If the DC voltage is above the maximum input voltage, check the plant design. – If the DC voltage is under the maximum input voltage, reconnect the small wind turbine system to the inverter as described in Section 5.4.4 "Connecting the Small Wind Turbine System (DC)" (page 34). If the display message is repeated, disconnect the inverter again and contact the SMA Service Line.
ACVtgRPro	The 10-minute average line voltage is no longer within the permissible range. This can be caused by either of the following: • The line voltage at the connection point is too high. • The grid impedance at the connection point is too high. The inverter disconnects from the power distribution grid to assure compliance with the power quality.
	Corrective measures Check the line voltage at the connection point of the inverter: • If the line voltage is 253 V or higher as a result of local grid conditions, contact the grid operator to request that the voltage be adjusted at the feed-in point. **or** • Ask the grid operator to agree to an adjustment of the limit value for the parameter "ACVtgRPro" for monitoring voltage quality. • If the line voltage is permanently within the tolerance range and the error message is still displayed, contact the SMA Service Line.

Message	Description and Corrective Measures
Bfr-Srr	Internal measurement comparison disturbance or hardware defect.
	Corrective measures • Contact the SMA Service Line if this disturbance occurs frequently.
Derating	The "Derating" operating state is a normal operating state which may occur occasionally and can have several causes. Once the inverter enters the "Derating" mode, it will display the "Derating" warning until the next total shutdown of the inverter.
	Corrective measures • Check the heat dissipation as described in Section 8.2 "Checking the Heat Dissipation" (page 61).
EEPROM	Temporary disturbance while data is being written or read from EEPROM. The data is not relevant for safe operation. • This disturbance has no impact on the performance of the inverter.
EEPROM dBh	EEPROM data is defective. The inverter has switched off because the loss of data has disabled important functions of the inverter.
	Corrective measures • Contact the SMA Service Line.
EeRestore	One of the duplicate records in the EEPROM is defective and has been reconstructed without loss of data. • This error message is only for information purposes and has no effect on the performance of the inverter.
Fac-Bfr **Fac-Srr** **FacFast**	The grid frequency is no longer within the permissible range ("Bfr" or "Srr" is an internal display message which has no relevance for the user). The inverter disconnects from the power distribution grid for safety reasons.
	Corrective measures • Eliminate the disturbance. • If the grid frequency is within the tolerance range and the disturbances "Fac-Bfr", "Fac-Srr" or "FacFast" are still displayed, contact the SMA Service Line.
Imax	Overcurrent on the AC side. This message is displayed when the current on the AC grid is greater than specified.
	Corrective measures • Check the plant design and grid conditions.

Message	Description and Corrective Measures
K1-Close	Error during relay test.
K1-Open	**Corrective measures** • Contact the SMA Service Line if this disturbance occurs frequently or recurrently.
MSD-Fac	Internal measurement comparison disturbance or hardware defect.
MSD-Vac	**Corrective measures**
MSD-Timeout	• Contact the SMA Service Line if this disturbance occurs frequently.
Offset	The "Offset" operating state is a normal operating state that occurs prior to grid monitoring. If "Offset" is displayed as an error, there is a disturbance in the data logging.
	Corrective measures • Contact the SMA Service Line if this disturbance occurs frequently.
PowerBalance	The inverter is part of a three-phase system with two further inverters and equipped with the SMA Power Balancer for preventing asymmetric loads. The operating parameter "PowerBalancer" is set to "PhaseGuard" or "FaultGuard".
	Corrective measures • For detailed descriptions of the operation modes "PhaseGuard" and "FaultGuard", refer to Section 5.5.1 "Configuration" (page 36).
Riso	The electrical insulation between the small wind turbine system and ground is faulty. The resistance between the DC plus and/or DC minus connection and ground is outside the defined limit range.
	Corrective measures • Check the insulation of the small wind turbine system. • Check the small wind turbine system for ground faults as described in Section 9.3.1 "Checking the Small Wind Turbine System for a Ground Fault" (page 71).
ROM	The inverter firmware is faulty.
	Corrective measures • Contact the SMA Service Line if this disturbance occurs frequently.
Shutdown	Temporary inverter disturbance.
	Corrective measures • Contact the SMA Service Line.
Trafo-Temp-F	Temperatures in the transformer have exceeded the acceptable limit. The inverter stops feeding the grid until the temperature reverts to within the acceptable range. • If this fault occurs frequently, check the heat dissipation.

Message	Description and Corrective Measures
Trafo-Temp-W	If the transformer temperature has risen above the acceptable level, the inverter stops feeding the grid until the temperature has reverted to an acceptable level and the plant can begin feeding the grid again. The "Trafo-Temp-W" warning is displayed until the device is completely disconnected.
	Corrective measures • Check the heat dissipation of the inverter.
Vac-Bfr **Vac-Srr**	The line voltage is no longer within the permissible range ("Bfr" or "Srr" is an internal display message which has no relevance for the user). This disturbance can be caused by any of the following conditions: • Grid disconnected (miniature circuit-breaker, fuse) • AC cable is interrupted or • AC cable is of high-resistance type. The inverter disconnects from the power distribution grid for safety reasons.
	Corrective measures • Check the line voltage and power supply line on the inverter. • If the line voltage is outside the acceptable range because of local grid conditions, ask the grid operator if the voltages can be adjusted at the feed-in point or if they will agree to changes in the values of the monitored operating limits (operating parameters: Vac-Min and Vac-Max). • If the grid frequency is within the tolerance range and the disturbances "Vac-Bfr", or "Vac-Srr" are still displayed, contact the SMA Service Line.

Message	Description and Corrective Measures
VpvMax	Overvoltage at DC input! Overvoltage can destroy the inverter.
	Corrective measures Disconnect the inverter **immediately**. 1. Stop the small wind turbine system. 2. Disconnect the miniature circuit-breaker. 3. Remove all DC connectors. 4. Check the DC voltage: – If the DC voltage is above the maximum input voltage, check the plant design. – If the DC voltage is under the maximum input voltage, reconnect the small wind turbine system to the inverter as described in Section 5.4.4 "Connecting the Small Wind Turbine System (DC)" (page 34). If the display message is repeated, disconnect the inverter again and contact the SMA Service Line.
Watchdog **Watchdog Srr**	Internal program run disturbance.
	Corrective measures • Contact the SMA Service Line if this disturbance occurs frequently.

9.3 Red LED Permanently On

If the red LED of the status display is continuously on during operation, there is either a ground fault in the system or at least one of the varistors for the overvoltage protection is defective.

In deliberately grounded small wind turbine systems, the red LED has been on ever since the inverter was commissioned. However, this has no impact on the function of the inverter. Before you check the small wind turbine system for a ground fault, check whether deliberate grounding has been carried out.

In deliberately grounded small wind turbine systems, check every so often that the varistors in the inverter are working properly, since a varistor fault can no longer be displayed.

9.3.1 Checking the Small Wind Turbine System for a Ground Fault

DANGER!
Risk of lethal electric shock

- Do not touch the small wind turbine system
- Only touch the insulation of the cables on the small wind turbine system.
- Do not touch PE.

1. Disconnect the inverter on both the DC and AC sides as described in Section 7.2 "Opening the Inverter" (page 57).
2. Measure resistances between the phases and the ground potential:
   - Measure resistance between L1 of the small wind turbine system and the ground potential, and record value.
   - Measure resistance between L2 of the small wind turbine system and the ground potential, and record value.
   - Measure resistance between L3 of the small wind turbine system and the ground potential, and record value.

   If the measured resistances are smaller than 10 Ω , there is a ground fault present in the small wind turbine system. Eliminate the ground fault.

   If the measured resistances tend towards infinity, there is no ground fault present in the small wind turbine system and presumably the varistors are faulty.
   - Check the function of the varistors as described in Section 9.3.2 "Checking the Function of the Varistors" (page 72).

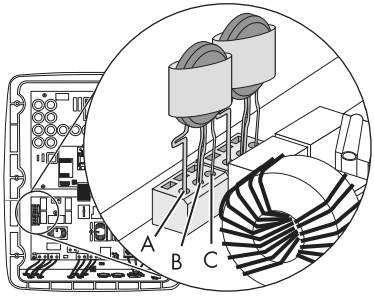
9.3.2 Checking the Function of the Varistors

Varistors are wear parts. Their functional efficiency diminishes with age or repeated strain as a result of overvoltage. It is therefore possible that one of the thermally monitored varistors has lost its protective function.

Position of varistors

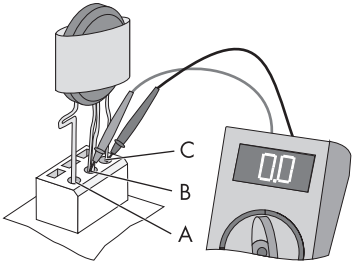
The position of the varistors can be determined with the help of the diagram below. Observe the following assignment of the terminals:

- Terminal A: outer terminal with loop (varistor connection **with crimp**)
- Terminal B: middle terminal
- Terminal C: outer terminal with loop (varistor connection **without crimp**)



You can check the function of the varistors as follows:

1. Open the inverter as described in Section 7.2 "Opening the Inverter" (page 57).
2. Use a multimeter to check that all the installed varistors have a conductive connection between connectors B and C.



Result	Measure
There is **a conductive** connection.	There must be a different error in the inverter. • Close the inverter as described in Section 7.3 "Closing the Inverter" (page 59). • Contact the SMA Service Line.

Result	Measure
There is **no conductive** connection.	The respective varistor is defective and must be replaced. Varistor failure is generally due to influences that affect all varistors in a similar manner (temperature, age, induced overvoltage). SMA Solar Technology AG recommends that you replace both varistors. The varistors are specially manufactured for use in the inverter and are not commercially available. You must order replacement varistors directly from SMA Solar Technology AG (see Section 12 "Accessories" (page 83)). • To replace the varistors, proceed to step 3.

NOTICE!

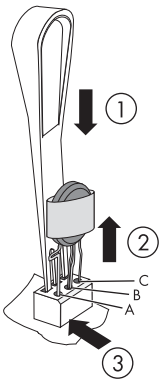
Destruction of the inverter as a result of defective varistors.

- Provide for replacement varistors immediately and replace the defective varistors.
- For systems with a high risk of overvoltage, do **not** operate inverters using faulty varistors or no varistors at all.

3. Insert insertion tool into the openings of the terminal contacts (1).

   ☑ This releases the terminals.

   If you have not received an insertion tool for operating the terminals together with the replacement varistors, please contact SMA Solar Technology AG. As an alternative, the terminal contacts can be operated using a 3.5 mm screwdriver.



4. Remove the varistor (2).
5. Insert the new varistor (3).

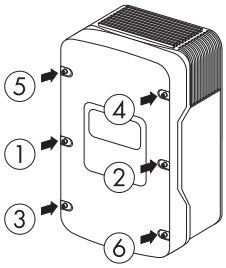
   When reinstalling, the pole with the small loop (crimp) must be mounted in terminal A (3).
6. Close the inverter as described in Section 7.3 "Closing the Inverter" (page 59).

☑ Testing and replacement of the varistors is complete.

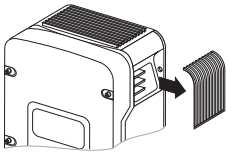
10 Decommissioning

10.1 Disassembling the Inverter

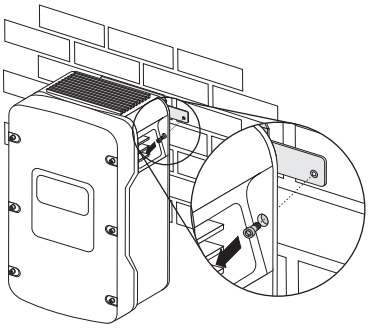
1. Open the enclosure lid as described in Section 7.2 "Opening the Inverter" (page 57).
2. Remove all cables from the inverter.
3. Close the inverter with the 6 screws and the corresponding conical spring washers.



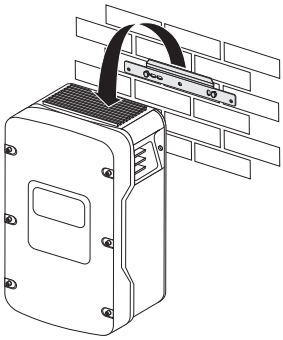
4. Remove the ventilation grids on both sides.



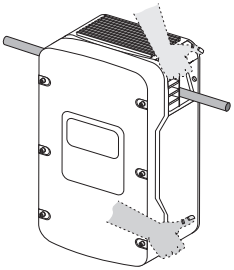
5. Remove the 2 screws on the left and right side of the inverter that attach it to the wall mounting bracket.
6. Disconnect the anti-theft protection, if applicable.



7. Remove the inverter from the wall mounting bracket by lifting it vertically upwards.



8. To transport the inverter, use the side handles (top and bottom) or a steel rod (maximum diameter 30 mm). The rod must be pushed through the enclosure openings.



☑ The inverter is disassembled.

10.2 Packing the Inverter

If possible, always pack the inverter in its original packaging. If the original package is no longer available, use an equivalent box. The box must be completely closeable and suitable for the weight and the size of the inverter.

10.3 Storing the Inverter

Store the inverter in a dry place where ambient temperatures are always between –25°C and +60°C.

10.4 Disposing of the Inverter

Dispose of the inverter at the end of its service life in accordance with the disposal regulations for electronic waste which apply at the installation location at that time. Alternatively, send it back to SMA Solar Technology AG with shipping paid by sender, and labeled "ZUR ENTSORGUNG" ("for disposal") (see Section 13 "Contact" (page 84)).

11 Technical Data

11.1 DC/AC

11.1.1 Windy Boy 5000A

DC Input

Turbine control	Polynomial Curve
Maximum DC power at cos φ = 1	5 750 W
Recommended generator power at 2 500 full-load hours per year	4 600 W
Recommended generator power at 5 000 full-load hours per year	4 200 W
Maximum input voltage	600 V
DC voltage range	246 V ... 600 V
Rated input voltage	270 V
Minimum input voltage	211 V
Start input voltage	250 V
Maximum input current	26 A

AC Output

Rated power at 230 V, 50 Hz	5 000 W
Maximum apparent AC power	5 500 VA
Rated grid voltage	230 V
AC nominal voltage	220 V / 230 V / 240 V
AC voltage range	165 V ... 265 V
Nominal AC current at 220 V	22.7 A
Nominal AC current at 230 V	21.7 A
Nominal AC current at 240 V	20.8 A
Maximum output current	26 A
Total harmonic factor of output current at AC voltage < 2% and AC power > 50% of rated power	≤ 3%
Rated power frequency	50 Hz
AC power frequency	50 Hz / 60 Hz
Operating range at AC power frequency 50 Hz	44 Hz ... 55 Hz
Operating range at AC power frequency 60 Hz	54 Hz ... 65 Hz
Displacement power factor, adjustable*	$0.8_{overexcited}$ ... $0.8_{underexcited}$
Power factor at nominal AC power**	1
Feed-in phases	1
Connection phases	1
Overvoltage category as per IEC 60644-1	III

* for WB 5000A-11

** for WB 5000A/WB 5000A-IT

Efficiency

Maximum efficiency, η_{max}	96.1%
European weighted efficiency, η_{EU}	95.3%

11.1.2 Windy Boy 6000A

DC Input

Turbine control	Polynomial Curve
Maximum DC power at cos φ = 1	6 300 W
Recommended generator power at 2 500 full-load hours per year	5 500 W
Recommended generator power at 5 000 full-load hours per year	5 100 W
Maximum input voltage	600 V
DC voltage range	246 V ... 600 V
Rated input voltage	270 V
Minimum input voltage	242 V
Start input voltage	250 V
Maximum input current	26 A

AC Output

Rated power at 230 V, 50 Hz	6 000 W
Maximum apparent AC power	6 000 VA
Rated grid voltage	230 V
AC nominal voltage	220 V / 230 V / 240 V
AC voltage range	220 V ... 240 V
Nominal AC current at 230 V	26 A
Nominal AC current at 240 V	25 A
Maximum output current	26 A
Total harmonic factor of output current at AC voltage < 2% and AC power > 50% of rated power	≤ 3%
Rated power frequency	50 Hz
AC power frequency	50 Hz / 60 Hz
Operating range at AC power frequency 50 Hz	44 Hz ... 55 Hz
Operating range at AC power frequency 60 Hz	54 Hz ... 65 Hz
Displacement power factor, adjustable*	$0.8_{overexcited}$ ... $0.8_{underexcited}$
Power factor at nominal AC power**	1
Feed-in phases	1
Connection phases	1
Overvoltage category as per IEC 60644-1	III

* for WB 6000A-11

** for WB 6000A/WB 6000A-IT

Efficiency

Maximum efficiency, η_{max}	96.1%
European weighted efficiency, η_{EU}	95.3%

11.2 General Data

Width x height x depth	468 mm x 613 mm x 242 mm
Weight	62 kg
Length x width x height of packaging	396 mm x 803 mm x 596 mm
Transport weight	68 kg
Climatic category according to IEC 60721-2-1	4K4H
Operating temperature range	– 25°C ... +60°C
Max. permissible value for relative humidity, non-condensing	100%
Maximum operating altitude above mean sea level	2 000 m
Noise emission (typical)	≤ 31 dB(A)
Power loss in night operation	0.25 W
Topology	LF transformer
Cooling concept	OptiCool
Fan connection	designed for safe disconnection in accordance with DIN EN 50178:1998-04
Degree of protection for electronics according to IEC 60529	IP65
Protection class (according to IEC 62103)	I

11.3 Protective devices

DC reverse polarity protection	Short-circuit diode
DC overvoltage protection	Thermally monitored varistors
AC short-circuit current capability	Current control
Grid monitoring	SMA Grid Guard 2.1
Maximum permissible fuse protection	40 A
Ground fault monitoring	Insulation monitoring: $R_{iso} > 0.7$ M Ω
Galvanic isolation	available

11.4 National Standards

National standard, status of 11/2011	WB 5000A-11	WB 6000A-11	WB 5000A	WB 6000A	WB 5000A-IT	WB 6000A-IT
VDE0126-1-1	✓	✓	✓	✓	–	–
VDE-AR-N-4105	✓	✓	–	–	–	–
AS 4777	○	○	✓	✓	–	–
VDE0126-1-1/ UTE C15-712-1	✓	✓	✓	✓	–	–
UTE C15-712-1/ EDF SEI req.	✓	✓	✓	✓	–	–
DK5940	–	–	–	–	✓	✓
EN 50438*	✓	✓	✓	✓	–	–
RD 1663/2000	✓	✓	✓	✓	–	–
RD 661/2007	✓	✓	✓	✓	–	–
G83/1-1	✓	✓	✓	✓	–	–

○ In planning stage

* EN 50438: not applicable to all national standard deviations.

11.5 Climatic Conditions

According to IEC 60721-3-4, Installation Type C, Class 4K4H

Extended temperature range	– 25°C ... +60°C
Extended humidity range	0% ... 100%
Extended air pressure range	79.5 kPa ... 106 kPa

According to IEC 60721-3-2, Transport Type E, Class 2K3

Temperature range	– 25°C ... +70°C

11.6 Features

DC connection	SUNCLIX DC connector
AC connection	Screw terminal
Display	LC text display
Bluetooth® Wireless Technology	optional
RS485, galvanically isolated	optional

11.7 Torque

Enclosure lid screws	6.0 Nm
Additional ground terminal	6.0 Nm
Cheese-head screw for attaching the enclosure to the wall mounting bracket	6.0 Nm
SUNCLIX swivel nut	2.0 Nm
Screw terminal AC connection	2.5 Nm
RS485 communication connection	1.5 Nm

11.8 Distribution Systems

IT system	appropriate
TN-C system	appropriate
TN-S system	appropriate
TN-C-S system	appropriate
TT system	appropriate
Split-Phase	appropriate

12 Accessories

You will find the corresponding accessories and spare parts for your inverter in the following overview. If required, you can order these from SMA Solar Technology AG or your specialty retailer.

Designation	Brief Description	SMA order number
Windy Boy Protection Box	Rectifiers and overvoltage protection for small wind turbine systems with Windy Boy	WBP-Box 600
Ventilation grids	Ventilation grid set "right and left" as spare part	45-7202
Replacement varistors	Set of thermally controlled varistors (2 pcs.) including insertion tool	SB-TV 4
Insertion tool for replacement of varistors	Insertion tool for varistors	SB-TVWZ
RS485 retrofit kit	RS485 communication interface	485PB-SMC-NR
Bluetooth® Wireless Technology retrofit kit	Bluetooth communication interface	BTPBINV-NR
SUNCLIX DC connector	Field plug for cable cross-section between 2.5 mm² ... 6 mm²	SUNCLIX-FC6-SET

13 Contact

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

- Inverter type
- inverter serial number
- Type of connected small wind turbine system
- Optional equipment, e.g. communication products
- Blink code or display message of the inverter

SMA Solar Technology AG

Sonnenallee 1

34266 Niestetal, Germany

www.SMA.de

SMA Service Line

Inverters:	+49 561 9522 1499
Communication:	+49 561 9522 2499
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E-Mail:	ServiceLine@SMA.de

Exclusion of liability

The general terms and conditions of delivery of SMA Solar Technology AG shall apply.

The content of these documents is continually checked and amended, where necessary. However, discrepancies cannot be excluded. No guarantee is made for the completeness of these documents. The latest version is available online at www.SMA.de or from the usual sales channels.

Guarantee or liability claims for damages of any kind are excluded if they are caused by one or more of the following:

- Damages during transportation
- Improper or inappropriate use of the product
- Operating the product in an unintended environment
- Operating the product whilst ignoring relevant, statutory safety regulations in the deployment location
- Ignoring safety warnings and instructions contained in all documents relevant to the product
- Operating the product under incorrect safety or protection conditions
- Altering the product or supplied software without authority
- The product malfunctions due to operating attached or neighboring devices beyond statutory limit values
- In case of unforeseen calamity or force majeure

The use of supplied software produced by SMA Solar Technology AG is subject to the following conditions:

- SMA Solar Technology AG rejects any liability for direct or indirect damages arising from the use of software developed by SMA Solar Technology AG. This also applies to the provision or non-provision of support activities.
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SMA Factory Warranty

The current guarantee conditions come enclosed with your device. These are also available online at www.SMA.de and can be downloaded or are available on paper from the usual sales channels if required.

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