Windy Boy 5000
Windy Boy 6000
Inverter for Wind Energy Power Plants

Revision History

Document number	Changes	Author
WB50_60-11:FE4105	First issue	Welzel

Explanation of Symbols used in this Document

This symbol indicates information that is essential for a trouble-free and safe operation of the product. Please read these sections carefully in order to avoid any damages of the equipment and for optimal personal protection.

This symbol indicates information that is required for the optimal operation of the product. Read these sections carefully in order to ensure an optimal operation of the product and all its features.

This symbol indicates an example.

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1 Introduction

The installation of the Windy Boy 5000 / 6000 may only be done by qualified technicians. The installer must be approved by the utility company. Please read the installation guide carefully before you begin with the installation. The installation of utility interactive power sources must be compliant with all applicable regulations of the utility company and with all applicable regulations and standards.

The Windy Boy inverters make it possible to operate small wind turbines as grid-connected systems. Grid-connected means that the energy generated by the wind turbine can be fed directly into an existing house power grid, a stand-alone power system, or the mains supply.

To this end, the Windy Boy converts the direct current (DC) from permanent-magnet wind turbines, which vary with speed, into grid-compatible alternating current (AC). The Windy Boy requires the constant presence of mains supply voltage!

The Windy Boy 5000 / 6000 complies with all the VDEW (Verband der Elektrizitätswirtschaft – German Electricity Industry Association) regulations for the connection and parallel operation of electrical power units to the low-voltage grid of the electricity supply company. This also encompasses the regulations of the German Professional Association for Precision Engineering and Electro technology relating to "Automatic switching of electrical power units" (SMA grid guard) and/or DIN VDE 0126. In addition to this, the Windy Boy 5000 / 6000 conforms to the electromagnetic tolerance regulations and the low-voltage regulations of the relevant combined European norms, as confirmed in the CE conformity declaration (10.3 "Declaration of conformity (CE)" (page 63)).

The documentation provided here covers all such topics that are of interest when operating Windy Boy 5000 / 6000 inverters. In addition to explanations of the operational methods of the device and detailed technical data, advice as to data capture and analysis is also provided.

Information relating to the installation and commission of the Windy Boy 5000 / 6000 should be taken from the installation instructions delivered with the device. The Windy Boy 5000 / 6000 inverter has a special operational mode for wind turbines which allows performance adjustment to the characteristic curve of the generator. In this way you will obtain maximum yields from your wind turbine.

A wide input voltage range, high efficiency and a freely configurable output characteristic curve with the highest level of reliability are only some of the properties that are useful for your grid-connected system, or in a stand-alone system when combined with the Sunny Island.

The Windy Boy 5000 / 6000 is compatible with all SMA communications products (RS232, RS485, Powerline, Wireless, Display), providing numerous possibilities for diagnosis, data visualization and remote maintenance of your small wind turbine system.

For stand-alone systems, that use the Sunny Island: Please configure your Windy Boy 5000 / 6000 according to the specifications in the Sunny Island manual.

Configuration of the V/I properties of the Windy Boy 5000 / 6000 with respect to your wind turbine: the parameters U_{PV}Start, U_{DC}WindStart and U_{DC}WindMax must be configured to guarantee optimum operation of your Windy Boy 5000 / 6000 with your wind turbine. The configuration process is described in chapter 6 "Turbine operation" (page 33).

Apart from the parameter settings, the Windy Boy 5000 / 6000 is identical to the Sunny Mini Central photovoltaic inverter and can therefore also be used as a PV inverter. Please download the Sunny Mini Central manual from www.SMA.de, and if you are planning to use the Windy Boy 5000 / 6000 in a photovoltaic system please contact us on the SMA hotline.

2 Safety information

Opening of the device, and any

- **electrical installation,**
- **repair or**
- **modification**

of the Windy Boy 5000 / 6000 may only be performed by qualified electrical personnel. Even when no external voltage is present, the device can still contain high voltages and the danger of electrical shock.

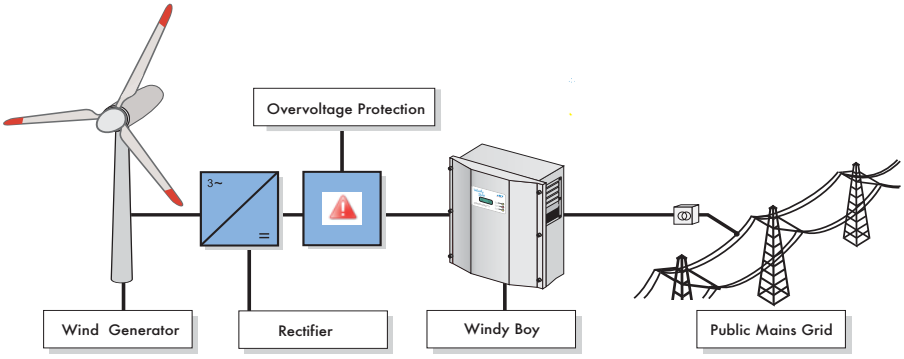
The temperature of individual parts of the case of the Windy Boy 5000 / 6000 - in particular the temperature of the heatsink - can reach 60 °C in normal operation. Touching could result in burns!

The Windy Boy 5000 / 6000 contains an independent mains disconnection device, the "SMA grid guard". It ensures that the Windy Boy 5000 / 6000 complies with the VDEW (Verband der Elektrizitätswirtschaft – German Electricity Industry Association) regulations for the connection and parallel operation of electrical power units to the low-voltage grid of the electricity supply company and with DIN VDE 0126 (4.99), which forms a part of these regulations.

3 Unit description

3.1 Appropriate usage of the Windy Boy 5000 / 6000

The Windy Boy 5000 / 6000 is designed for the conversion of DC voltage from a wind turbine (permanent magnet generator) into AC voltage for feeding into the public mains supply. The technical data are described in more detail in chapter 9 "Technical data" (page 49).



Many wind turbine manufacturers offer an extra over-voltage protection module. These components prevent the destruction of the downstream Windy Boy in the case of overvoltage.

Overvoltage can occur under the following conditions:

- High turbine rotation speeds under strong wind conditions
- An increase in turbine rotation speed caused by load-shedding when the Windy Boy is disconnected from the mains supply e.g. in the case of mains interference or power outage.

The overvoltage protection system has the following tasks:

- When a pre-defined voltage is reached, the Windy Boy is disconnected from the generator and a short-circuit slows the generator and/or brings it to a standstill.
- Some devices reduce the turbine rotation speed, and thus the generator output voltage, by switching in a resistor assembly (Dumpload). The electrical energy generated by the turbine is then converted to heat.

In grid-connected systems, we recommend the use of one of the electronic protection mechanisms described here. Please note that overvoltage on the Windy Boy can lead to destruction of the device. In addition to this, you lose the right to all warranty claims - even if the maximum input voltage of the Windy Boy is only exceeded for a short time.

The electronic protection systems described here are preferable to mechanical solutions (pitch control, "turning out of the wind") in every case.

Any other use of the Windy Boy 5000 / 6000 leads to loss of the right to all warranty claims.

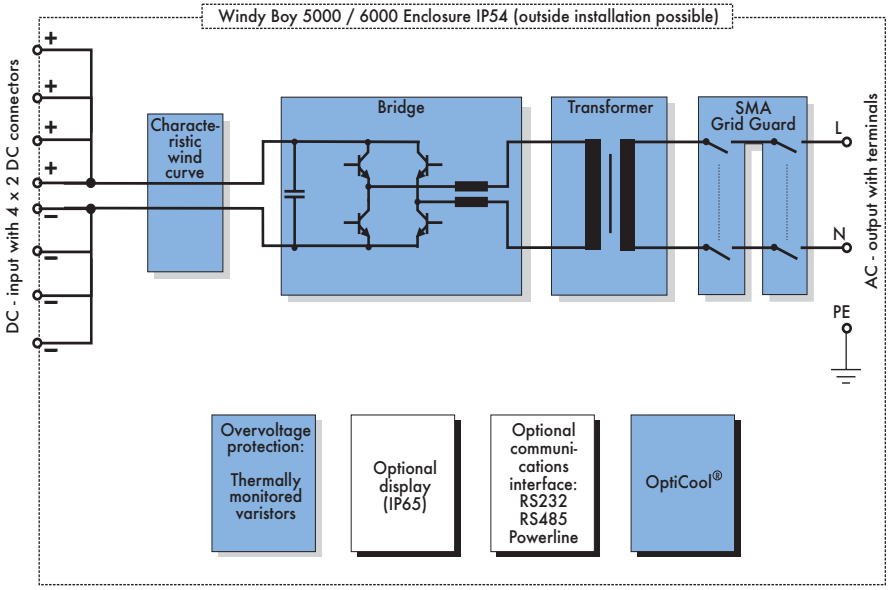
In case of overvoltage, immediately disconnect the DC input of the Windy Boy 5000 / 6000! The presence of excessive input voltage can lead to irreparable damage!

When the Windy Boy 5000 / 6000 receives an excessive DC input voltage, it automatically disconnects from the mains supply and no longer feeds power into the grid. When the Windy Boy 5000 / 6000 is in operation, you must always first disconnect the AC voltage (mains supply) and only then should you disconnect the DC voltage from the Windy Boy 5000 / 6000!

3.2 Device construction

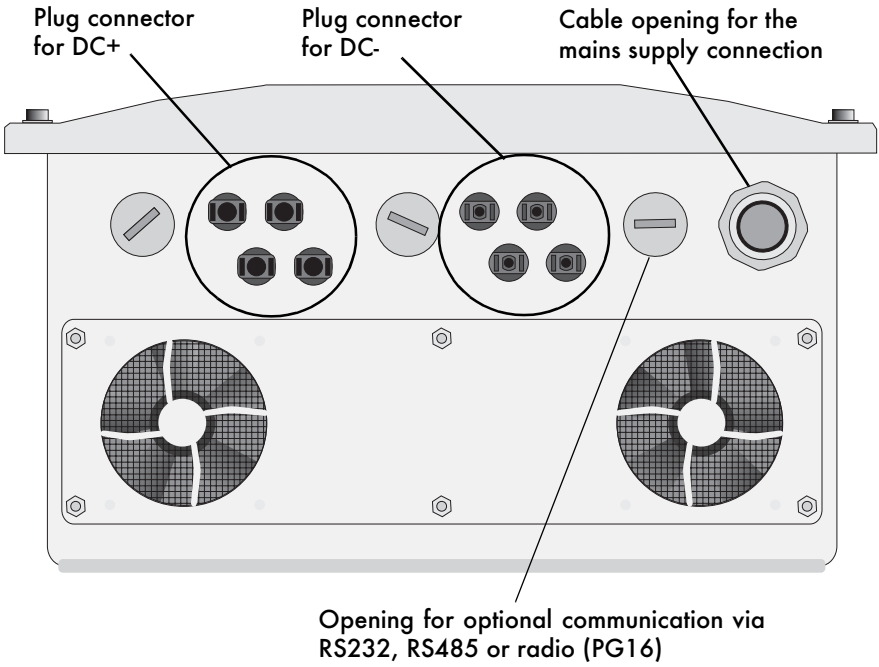
An attractive, functional design is one of the major design objectives of the entire Windy Boy 5000 / 6000 product range. In its basic configuration, the Windy Boy 5000 / 6000 has the proven status display consisting of three LEDs. An extra display can be provided already installed or can be retrofitted.

As long as it is installed and commissioned according to the technical specifications, the Windy Boy 5000 / 6000 can be operated without any further modification or configuration. The device parameters can however be modified, if required.



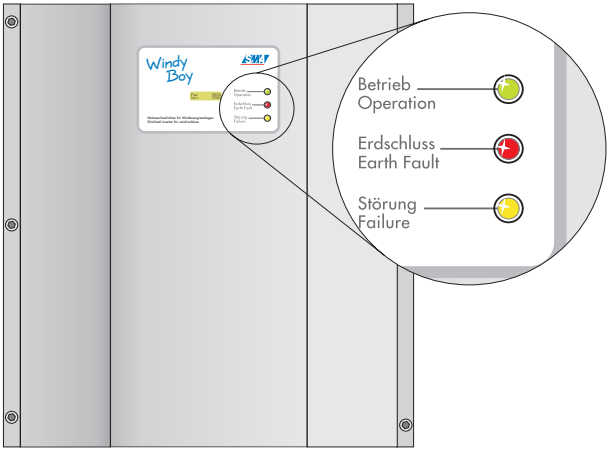
An extra communications interface is required for ideal adaptation of the Windy Boy 5000 / 6000 to suit the particular wind turbine being used, and this can also be used for reporting operation data. For further details, please refer to chapter 8 "Expansions" (page 41).

All DC connections and connections for the mains supply, as well as any optional communications connections are to be found on the underside of the Windy Boy 5000 / 6000. Each of the + and - DC connections are internally connected in parallel within the Windy Boy 5000 / 6000.



3.3 Operating modes

The operational status is displayed using three light-emitting diodes (LEDs) in the cover of the Windy Boy 5000 / 6000. To allow the device to signal its operational status via the integrated LEDs, the Windy Boy 5000 / 6000 must be connected to the DC side of the system. There must be enough wind energy present, so that the Windy Boy 5000 / 6000 has adequate DC voltage.



Especially in the first year of operation, the operator of the system should check this display under different wind speeds.

A complete description of the possible displays can be found in chapter 3.3.4 "Description of the operational status" (page 19). These can be split into three categories:

3.3.1 Normal operation

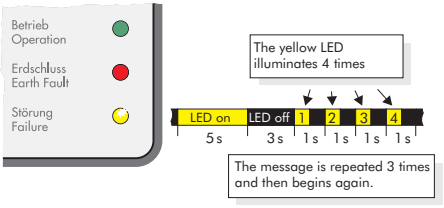
As long as the green control LED is on, or blinking, the Windy Boy 5000 / 6000 is operating normally. The simultaneous illumination of all three LEDs is also an indication of normal operation ("Initialization"). All other displays are a sign of abnormal operation.

3.3.2 Critical, faulty operation

A comprehensive safety concept limits the number of critical conditions that can occur to a single situation:

Input voltage exceeds the permitted value

This is indicated by the following blink-code on the yellow LED:



The yellow fault LED illuminates for 5 seconds when the fault occurs, and then begins displaying the blink code of: 3 seconds off and then 4 times briefly on. This code is displayed three times in succession. If the fault is still present, the fault display starts again from the beginning.

The presence of excessive input voltage can lead to irreparable damage! Immediately disconnect the DC input of the Windy Boy 5000 / 6000.

When the Windy Boy 5000 / 6000 receives an excessive DC input voltage, it automatically disconnects from the mains supply and no longer feeds power into the grid. When the Windy Boy 5000 / 6000 is in operation, you must always first disconnect the AC voltage (mains supply) and only then should you disconnect the DC voltage from the Windy Boy 5000 / 6000!

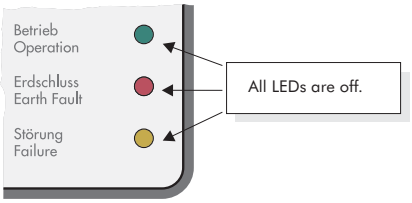
3.3.3 Non-critical, faulty operation

All other fault codes indicate some form of faulty operation, which are not usually dangerous to people or equipment, but which should nevertheless be investigated and corrected.

Despite all precautions, it is possible that other faults may occur that cannot be displayed (e.g. failure of the status display). In order to recognize such faults, the operator of the system should use the explanations in chapter 3.3.4 "Description of the operational status" (page 19) to check the plausibility of the displayed status. Further detailed diagnoses are possible using the communications options detailed in chapter 8 "Expansions" (page 41).

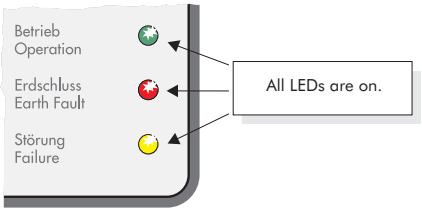
3.3.4 Description of the operational status

No (or low) input voltage



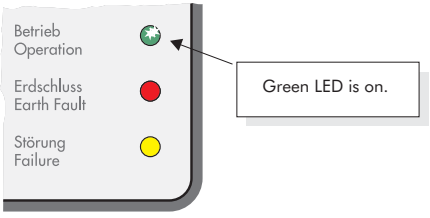
The Windy Boy 5000 / 6000 is in Standby mode. This situation occurs when the input performance at the Windy Boy 5000 / 6000 is too low for feeding the mains supply (DC input voltage < approx. 80 V) and for satisfying the on-board power requirements.

Initialization



The on-board computer of the Windy Boy 5000 / 6000 is presently in the initialization process. The DC input voltage of the Windy Boy 5000 / 6000 lies between approx. 80 V and approx. 120 V. The power is adequate for the on-board power requirements but insufficient for mains supply feed-in or for data transmission.

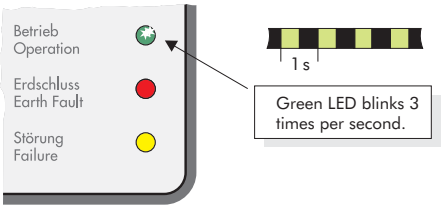
Working mode



The Windy Boy 5000 / 6000 has successfully passed the measurement electronics and SMA grid guard self-tests and has begun feed-in operation.

The Windy Boy 5000 / 6000 is working normally and is feeding electricity into the mains supply. It is converting the DC voltage from the wind turbine according to the V/I characteristic curve defined by U_{PV}Start, U_{DC}WindStart and U_{DC}WindMax (chapter 5 “Turbine operation" on page 33).

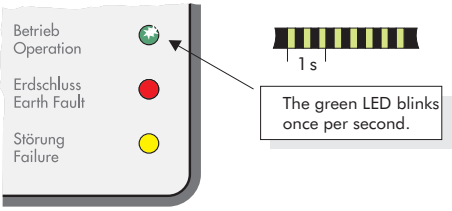
Stop



The Windy Boy 5000 / 6000 is in Stop mode. Among other functions, the measurement electronics are calibrated and then finally, the device switches to "Waiting" mode.

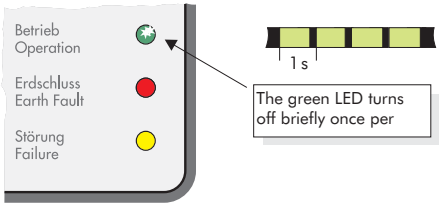
The "Stop" mode can also be manually set by the system operator via the Sunny Boy Control or the Sunny Data PC program. In this case, the Windy Boy 5000 / 6000 remains in "Stop" mode until a new operating mode ("MPP mode", "Turbine mode") has been set.

Maintenance, grid monitoring



The Windy Boy 5000 / 6000 checks if the initial conditions necessary for feeding the mains supply are satisfied (e.g. start voltage) and then begins monitoring the mains supply.

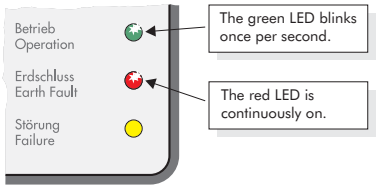
Derating



The temperature monitoring of the Windy Boy 5000 / 6000 has reduced the output performance to prevent the device from overheating. If this occurs often, then this is an indication of inadequate heat dissipation.

To avoid unnecessary reductions in yield, in this case it should be checked if the Windy Boy 5000 / 6000 can be mounted in a better position with better ventilation.

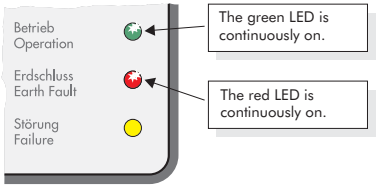
Insulation fault



The Windy Boy 5000 / 6000 indicates a ground fault by illuminating the red LED.

Consult trained electrical personnel to correct the fault using the "Installation manual".

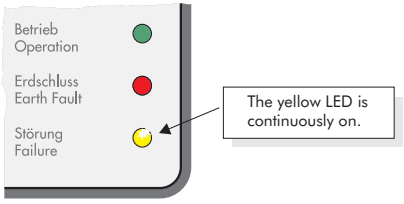
Defective varistor



At least one of the two thermally monitored varistors on the DC input side of the device has become highly resistive and thus no longer functions correctly.

Consult trained electrical personnel to correct the fault using the "Installation manual".

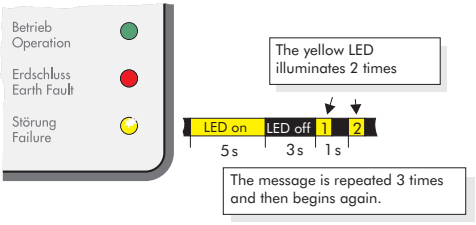
Constant operational limiting



This message is displayed if a fault develops in the grid monitoring and/or the independent disconnection device (SMA grid guard). The Windy Boy 5000 / 6000 has detected a fault in the SMA grid guard during an internal test and has disabled the mains supply feed-in.

This usually indicates a fault that cannot be corrected on site. Please consult the manufacturer (chapter 12 "Contact" (page 67)) and discuss further action to solve the problem with them.

Mains supply fault



The yellow fault LED illuminates for 5 seconds when the fault occurs, and then begins displaying the blink code of: 3 seconds off and then 2 times briefly on. This code is displayed three times in succession. If the fault is still present, the fault display starts again from the beginning.

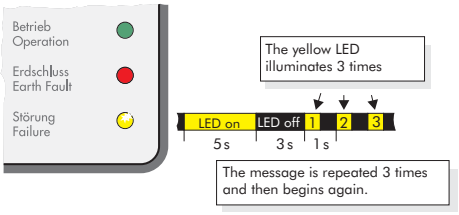
The Windy Boy 5000 / 6000 indicates a mains supply fault with this message, which can have the following causes:

- Low mains supply voltage (VAC < "Vac-Min")
- High mains supply voltage (VAC > "Vac-Max")
- Low mains supply frequency (fAC < "Fac-Min")
- High mains supply frequency (fAC > "Fac-Max")
- A change in mains supply frequency ("dFac")

Check if a general mains supply dropout has occurred (check the operation of other mains supply devices), and check if the fuse of the feed-in connection of the Windy Boy 5000 / 6000 is intact.

If one of these faults can be found, then the mains supply connection of the Windy Boy 5000 / 6000 must be checked by qualified electrical personnel.

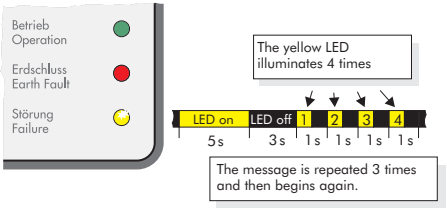
Mains supply impedance is too high



The yellow fault LED illuminates for 5 seconds when the fault occurs, and then begins displaying the blink code of: 3 seconds off and then 3 times briefly on. This code is displayed three times in succession. If the fault is still present, the fault display starts again from the beginning.

The Windy Boy 5000 / 6000 has detected a fault relating to an unacceptable impedance in the mains supply. If the Windy Boy 5000 / 6000 frequently displays this fault during mains monitoring, the cause can be a mains impedance that is too high. An electrician can usually assist with this problem by increasing the cross section of the mains connection cable. Other measures can be taken to correct this problem, but they require the agreement and cooperation of the electricity supplier.

Input voltage too high

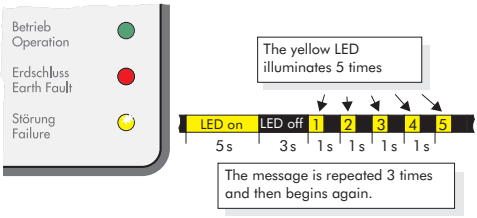


The yellow fault LED illuminates for 5 seconds when the fault occurs, and then begins displaying the blink code of: 3 seconds off and then 4 times briefly on. This code is displayed three times in succession. If the fault is still present, the fault display starts again from the beginning.

Immediately disconnect the DC input of the Windy Boy 5000 / 6000. The presence of excessive input voltage can lead to irreparable damage! Make sure that the input voltage never exceeds 600 V.

When the Windy Boy 5000 / 6000 receives an excessive DC input voltage, it automatically disconnects from the mains supply and no longer feeds power into the grid. When the Windy Boy 5000 / 6000 is in operation, you must always first disconnect the AC voltage (mains supply) and only then should you disconnect the DC voltage from the Windy Boy 5000 / 6000!

Device faults

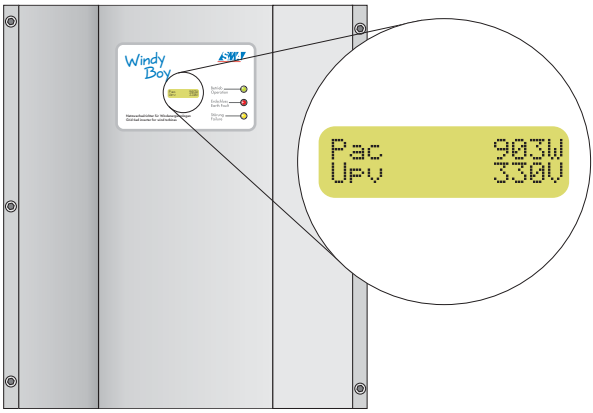


The yellow fault LED illuminates for 5 seconds when the fault occurs, and then begins displaying the blink code of: 3 seconds off and then 5 times briefly on. This code is displayed three times in succession. If the fault is still present, the fault display starts again from the beginning.

If the device fault leads to a major reduction in normal operation, the Windy Boy and the entire system installation should be checked by an electrician.

3.4 Messages in the optional display

The Windy Boy 5000 / 6000 can be factory fitted with an LCD display in the lid of the case.



The display can also be retrofitted (SMA order code, "SB-Display", language specification to be provided when ordering).

Switching on the display illumination

The background illumination is switched on by tapping on the lid of the case. Tapping again switches the display to the next message.

After 2 minutes, the illumination switches off automatically.

Display messages in the startup phase

The following messages are displayed during the startup phase of the Windy Boy 6000 and are identical to those in the Windy Boy 5000. Since the Windy Boy 5000 / 6000 is identically to the Sunny Mini Central, apart from the mode of operation, the display shows "Sunny Mini Central".

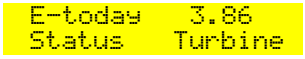
SMC6000
WR6K-003
Initialization phase

After 6 seconds, the firmware version of the operation control unit (BFR) and the current control unit (SRR) are displayed.

BFR Version 2.52
SRR Version 2.49
Initialization phase

Display message during operation

The display shows the most important operational information of the Windy Boy 5000 / 6000 in a continuous cycle. The following three diagrams serve to clarify the messages. Every message is displayed for 5 seconds. Then the cycle begins again.



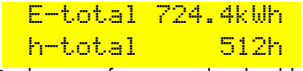
Energy sum since the last activation, and the current operational status

The energy generated today and the current operational status are first displayed.

The amount of energy shown under "E-today" does not necessarily reflect the amount of energy produced over the last 24 hours. This is rather the energy produced by the Windy Boy 5000 / 6000 since the last deactivation/ activation.

Current feed-in power and AC voltage

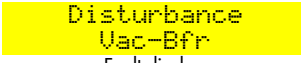
Subsequently, the current feed-in power and the output voltage are displayed.



Total amount of energy produced and the total number of operating hours

This is then followed by the total energy produced so far and the operational hours of the device.

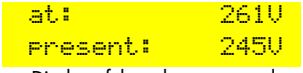
Fault displays



Fault display

If an operational fault develops, the display immediately switches to "Disturbance" and the background illumination is switched on.

The cause of the fault is displayed for 5 seconds in the second line of the display.



Display of the values measured during the fault

If a measured value is responsible for the fault condition, then the value measured at the time of the fault is displayed. If another measurement is possible, the current value is displayed in the second line.

After another 5 seconds, normal operational information is again displayed.

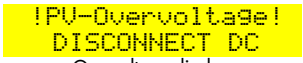
If the fault is still present, the fault display starts again from the beginning. An overview of the status and fault messages can be found in chapter 10.2 "Fault messages" (page 60) of this document.

"Error ROM" indicates, that the Windy Boy 5000 / 6000 has recognized a fault in the Firmware EEPROM. Contact SMA to correct the fault.

Fault displays of the Firmware EEPROM

Special display in the case of excessive DC input voltage

If an excessive DC input voltage is present on the Windy Boy 5000 / 6000, then this is indicated by rapid blinking of the background illumination and a corresponding message.



Overvoltage displays

Immediately disconnect the DC input of the Windy Boy 5000 / 6000. The presence of excessive input voltage can lead to irreparable damage! Make sure that the input voltage never exceeds 600 V.

When the Windy Boy 5000 / 6000 receives an excessive DC input voltage, it automatically disconnects from the mains supply and no longer feeds power into the grid. When the Windy Boy 5000 / 6000 is in operation, you must always first disconnect the AC voltage (mains supply) and only then should you disconnect the DC voltage from the Windy Boy 5000 / 6000.

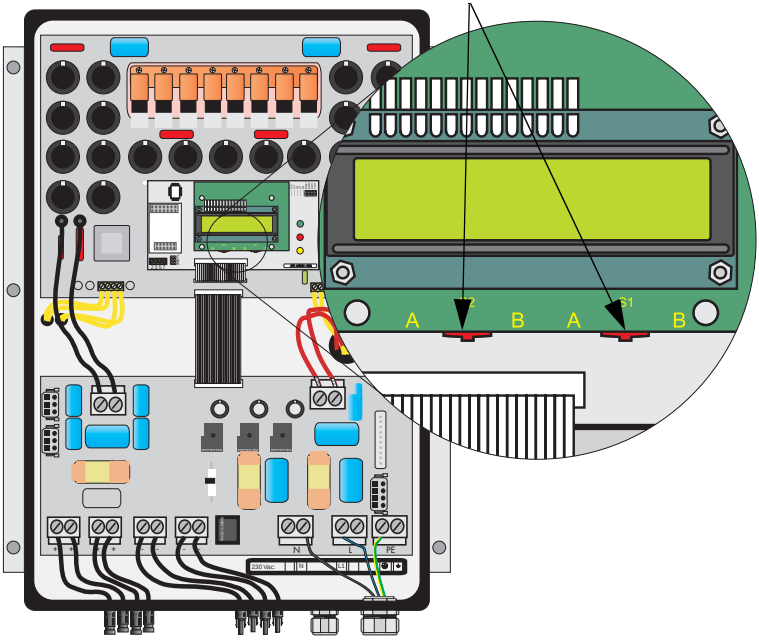
Before placing the device back into operation, the input voltage must be checked before reconnecting the DC voltage to the Windy Boy 5000 / 6000! Since the Windy Boy 5000 / 6000 is identical to the Sunny Mini Central, apart from the mode of operation, the display of the Windy Boy 5000 / 6000 shows "PV" (Photovoltaic) as its input source.

4 Setting the display language

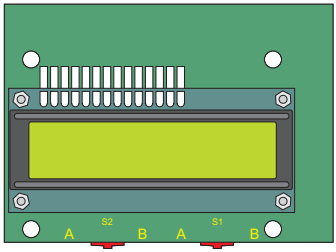
The display language is set using the switches on the underside of the SB-LCD components.

Since the cover must be removed, please ask a qualified electrician to disconnect the DC and AC connections from the Windy Boy 5000 / 6000, according to the installation instructions.

Position of the switches for setting the display language



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



5 Maintenance and care

Because the Windy Boy 5000 / 6000 can be used outdoors in places that are difficult to access, it has been constructed for low maintenance.

In the interests of maximum yield, the operator should check, weekly if possible, under various conditions of wind, if the displays of the Windy Boy 5000 / 6000 indicate plausible normal operation (cf. chapter 3.3.4 "Description of the operational status" (page19)). Naturally, this information can be obtained by using one of the communications options.

The cleaning intervals are dependent from the ambient conditions. Make sure that enough air can flow through the fan guards. With that you can contribute to an optimum yield of your system.

If the LEDs are so dirty that they can no longer be seen, then they can be cleaned with a damp cloth. Solvents, abrasives or corrosive liquids must not be used!

A detailed description of how to clean the fans can be found in the installation manual of the Windy Boy 5000 / 6000.

6 Turbine operation

6.1 Overview

The Windy Boy 5000 / 6000 is a single phase inverter that converts DC current into AC current and feeds the energy generated by a wind turbine into an existing mains supply.

The Windy Boy 5000 / 6000 is externally identical to the Sunny Mini Central inverter for photovoltaic systems.

The Windy Boy 5000 / 6000 inverter has a special operational mode for wind generators however, which allows performance adjustment to the characteristic curves of many different manufacturers' generators ("Turbine" operating mode). In this way maximum yields can be obtained from your wind turbine.

The mechanical power of the wind turbine is presented to the Windy Boy in the form of a direct, rotation speed variable DC voltage (RPM) and current intensity (torque).

Most small wind turbines have a so-called permanent magnet generator and a downstream rectifier for converting the variable frequency AC generator voltage into DC current.

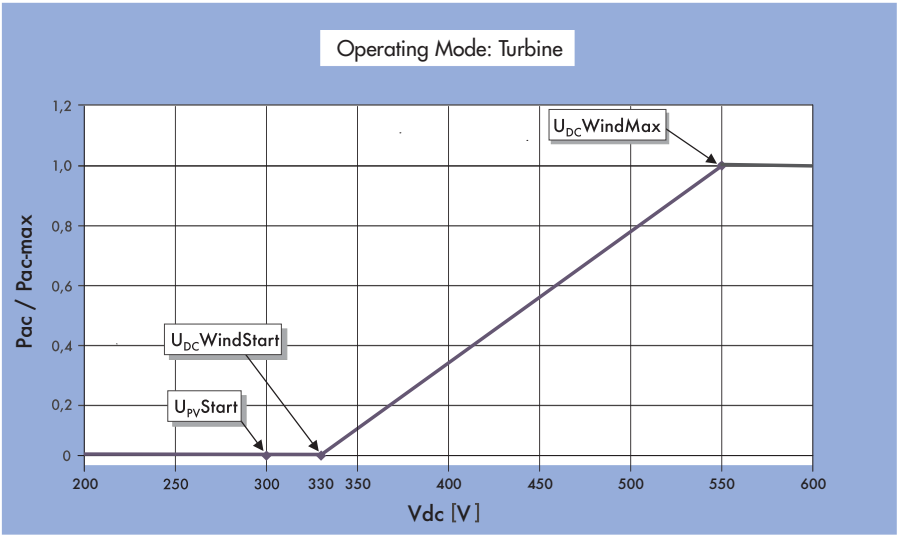
6.2 Characteristic curve function

The "Turbine" operating mode of the Windy Boy 5000 / 6000 uses a programmable power/voltage curve to regulate the input current depending on the generator voltage (V/I characteristic curve).

Every wind generator is designed to have an optimum working point for voltage and current, at different rotational speeds or wind speeds. This behavior is not linear.

The Windy Boy 5000 / 6000 uses an approximation based on a simple ramp function. The function can be programmed by the user so that it comes close to the behavior of the wind generator being used and thus provides power adaptation.

The diagram shows the ramp function of a typical Windy Boy 5000 / 6000 power/voltage curve. The feed-in AC power depending on the DC input voltage of the Windy Boy is shown here. The adjustable parameters U_{PV}Start, U_{DC}WindStart and U_{DC}WindMax are used to adapt the power/voltage curve of the Windy Boy 5000 / 6000 to the wind generator being used.



The correct configuration of the parameters shown in the diagram is absolutely necessary to guarantee optimum operation with wind generators from different manufacturers.

The basic parameters of a Windy Boy 5000 / 6000 (factory settings) are shown in the following table.

Name	WB 5000	WB 6000	Unit	Description
UpvStart	300 (250 ... 600)	300 (250 ... 600)	V_{DC}	Defines the voltage at the moment when the Windy Boy 5000 / 6000 is ready to perform a mains supply synchronization.
UdcWindStart	330 (1 ... 800)	330 (1 ... 800)	V_{DC}	Defines the voltage at the moment when the Windy Boy 5000 / 6000 is ready to begin feeding power into the mains supply.
UdcWindMax	550 (1 ... 800)	550 (1 ... 800)	V_{DC}	Defines the voltage at the moment when the Windy Boy 5000 / 6000 begins feeding maximum power into the mains supply.
P-Wind-Ramp	500 (10 ... 2000)	500 (10 ... 2000)	W/sec	Controls a delayed startup of the characteristic curve, only after the Windy Boy 5000 / 6000 has been switched on. This avoids the generator being suddenly presented with a heavy load.
T-Start	10 (5 ... 1600)	10 (5 ... 1600)	sec	Start Timer Mains synchronization.
T-Stop	2 (1 ... 3600)	2 (1 ... 3600)	sec	Stop Timer Aborting the supply of power and switching off.

The correct configuration of the parameters above is absolutely necessary to guarantee optimum operation with generators from different manufacturers. Preconditions for changing the operating parameters are described in chapter 6.4 "General setting example" (page 37).

To perform the configuration process, the DC input voltage must be greater than <UpvStart> and the Windy Boy 5000 / 6000 must be connected to the mains supply.

6.3 Characteristic curve operation in "Turbine" operating mode

Please note: The linear characteristic curve of the Windy Boy 5000 / 6000 only approximates the actual characteristics of a real wind generator. Consult the manufacturer of your wind generator for the typical characteristics of your generator before changing the characteristic curve parameters.

As soon as the DC input voltage defined in the parameter <UpvStart> is reached, the Windy Boy begins a number of self tests, measurement processes and synchronizes with the mains supply. If the self tests are successfully completed, and the DC input voltage remains above the value defined in <UpvStart> for the time defined in <T-Start>, the Windy Boy connects to the mains supply.

As soon as the DC input voltage reaches the value defined in <UdcWindStart>, the Windy Boy begins feeding power into the mains supply. As you can see from the characteristic curve, the power fed into the mains supply rises with the DC input voltage.

As soon as the DC input voltage reaches the value defined in the parameter <UdcWindMax>, the Windy Boy 5000 / 6000 feeds the mains supply with the maximum possible power. If the input voltage continues to rise, the Windy Boy 5000 / 6000 continues to feed the mains supply at maximum power.

The characteristic curve ends at the maximum permissible input voltage of the Windy Boy 5000 / 6000, which must never be exceeded.

If the wind strength is so low that the DC input voltage falls below <UpvStart>, then the Windy Boy ceases feeding power into the mains supply for the period defined in <T-Stop>.

If the DC input voltage increases again, then the Windy Boy will again operate according to the characteristic curve.

If the DC input voltage falls below the internally calculated minimum operating value of <Vmin>, then there is insufficient energy for the on-board electronics and the Windy Boy will switch off.

If the DC input voltage lies between <Vmin> and <UpvStart> for the time defined by <T-Stop>, then the Windy Boy will also switch off.

After the switch-off process, the whole process begins anew.

Only change the operating parameters when you know exactly what you are doing!

6.4 General setting example

Please note that the following example only represents a starting point for operating with a wind generator.

- <UpvStart> is set to the lowest possible value:
  This achieves an early switch-on of the Windy Boy 5000 / 6000.
- <UdcWindStart> is set to the same value of <UpvStart>:
  This achieves an early mains supply feed-in. If the wind turbine does not properly start, or the Windy Boy frequently switches on and off, it is recommended that you increase <UdcWindStart> in (e.g.) 10 V steps.
- <UdcWindMax> is initially set to approx. 10 % below the maximum MPP voltage of the Windy Boy 5000 / 6000:
  In this case the slope of the ramp function is relatively flat. The maximum output power is only reached with a relatively high DC input voltage, which avoids "braking" of the wind generator through excessive power consumption. This setting is especially suitable in locations with little or weak wind. Once the properties of the wind generator are known, then the reduction of the <UdcWindMax> parameter may be necessary, in order to extract the maximum power from the wind generator even at low DC input voltages (low wind speeds). The ramp function will then be steeper.

Contact the manufacturer of your wind generator for the typical properties of your generator (voltage/power characteristic).

- <T-Stop> is set to the maximum value:
  Here, the Windy Boy remains connected to the mains supply, even at low DC input voltage levels, and "waits" for the next gust of wind. This delays an early switch-off of the Windy Boy.
- <T-Start> is set to the minimum value:
  This achieves a reduction of the switch-on time (please observe the regulations of the energy supplier responsible).

Only change the operating parameters when you know exactly what you are doing!

7 Maintenance and care

Because the Windy Boy 5000 / 6000 can be used outdoors in places that are difficult to access, the Windy Boy has been constructed for low maintenance. To guarantee safe operation, it is usually adequate to check the device visually for damage approximately every two months. It should also be checked if the red LED is illuminated and, if necessary, remove the fault by referring to chapter 3.3.4 "Description of the operational status" (page 19).

In the interests of maximum yield, the operator should check, weekly if possible, under various conditions of solar irradiation, if the displays of the Windy Boy 5000 / 6000 indicate plausible normal operation (cf. chapter 3.3.4 "Description of the operational status" (page 19)). Naturally, this information can be obtained by using one of the communications options.

Cleaning of the Windy Boy is only necessary when the heat dissipation is limited by dirty cooling fins or a dirty space between the Windy Boy and the wall. The dirt should be carefully removed with an appropriate soft brush or paintbrush.

If the LEDs are so dirty that they can no longer be seen, then they can be cleaned with a damp cloth. Solvents, abrasives or corrosive liquids must not be used!

8 Expansions

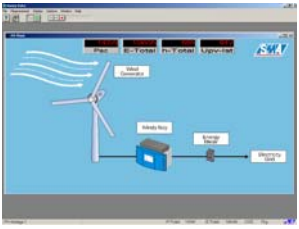
As with all inverters in the Sunny Boy family, the Windy Boy 5000 / 6000 can also be expanded with a range of communications interfaces. This provides the operator with the possibility of requesting detailed operational data and error messages, for subsequent analysis on a PC using (e.g.) the free software available from SMA.

The data can currently be transferred in five different ways:

- using Powerline
- using a separate RS485 cable
- using a separate RS232 cable
- using a wireless link (Sunny Beam)
- using a separate USB-Service-Interface (USBPBS)

The wind turbine can be monitored by the Windy Boy 5000 / 6000 in a number of different ways. SMA offers a range of products for this purpose, allowing you to install a tailor-made monitoring system for your system. If you require detailed information about the Windy Boy products, please request the Sunny Family catalog or visit www.SMA.de. In the following sections the currently available communications options are schematically described.

8.1 Sunny Data



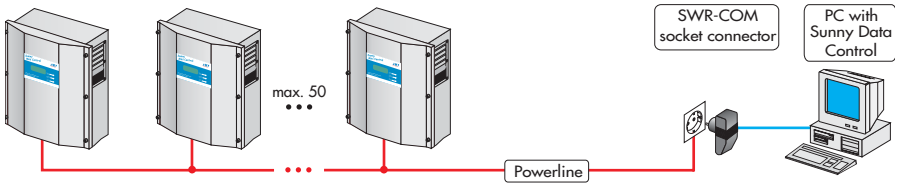
Sunny Data is a PC program for direct monitoring of your system. The connection of the Windy Boys to a PC is described in the following sections.

8.2 Sunny Data via Powerline

"Wireless" communication via the mains power line

(up to 50 Windy Boys)

Prerequisites: The Windy Boys must be equipped with a Powerline Piggy-Back and the PC must be equipped with an SWR-COM plug modem. The connection of the PC using SWR-COM is described in the SWR-COM documentation.



8.3 Sunny Data over RS232

Communication via a cable

(a single Windy Boy 5000 / 6000)

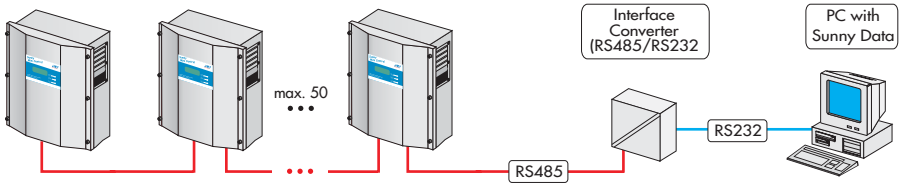
Prerequisites: The Windy Boy must be equipped with an RS232 Piggy-Back, the connection to the PC usually occurs directly over the COM1 or COM2 port of the PC. The installation of the RS232 cable is described in the installation instructions of the Windy Boy 5000 / 6000.

8.4 Sunny Data over RS485

Communication via a cable

(up to 50 Windy Boys)

Prerequisites: All Windy Boys must be equipped with an RS485 Piggy-Back, the connection with the PC usually occurs via an RS485/RS232 interface converter connected to the COM1 or COM2 port or via an RS485/USB interface converter connected to the USB port. The installation of the RS232 cable is described in the installation instructions of the Windy Boy 5000 / 6000.



8.5 Sunny Beam

Simple wireless system monitoring for up to 4 Windy Boys.

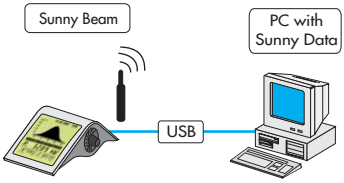
Prerequisites: The Windy Boys must be equipped with a wireless Piggy-Back and a Sunny Beam must be present at an appropriate distance. The installation of the wireless Piggy-Back is described in the Sunny Beam user manual.

8.6 Sunny Data Control over Sunny Beam

Communication with a PC over Sunny Beam

(up to 4 Windy Boys)

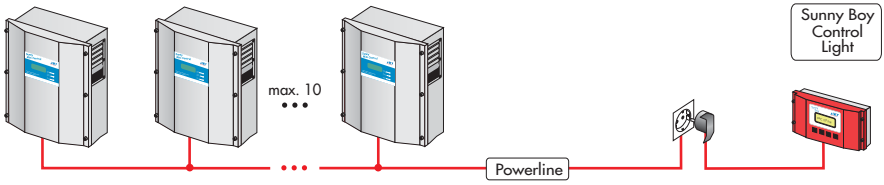
Prerequisites: All 4 Windy Boys must be equipped with a wireless Piggy-Back and accessible to Sunny Beam for system monitoring. The Sunny Beam is connected to the PC via an USB cable. The installation of the wireless Piggy-Backs and the connection to the PC is described in the Sunny Beam user manual.



8.7 Sunny Boy Control Light

The simple data logger for systems with up to 10 Windy Boys. The connection between the Sunny Boy Control Light and the Windy Boys occurs via Powerline.

Prerequisites: The Windy Boys must be equipped with a Powerline Piggy-Back. The installation is described in detail in the Sunny Boy Control Light documentation.

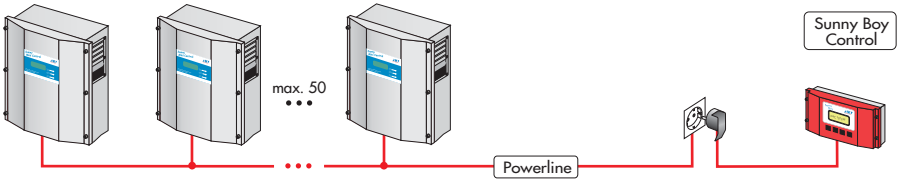


8.8 Sunny Boy Control

The simple data logger for systems with up to 50 Windy Boys. The connection between the Sunny Boy Control and the Windy Boys can be achieved as follows:

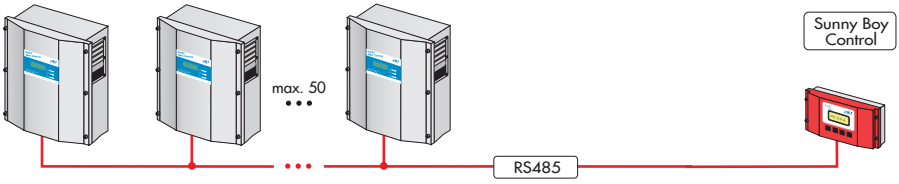
Powerline - "Wireless" communication via the mains power line

Prerequisites: All the Windy Boys must be equipped with a Powerline Piggy-Back.



RS485 Communication via a cable

Prerequisites: All Windy Boys must be equipped with an RS485 Piggy-Back, the Sunny Boy Control must be equipped with an RS485 Piggy-Back on the "COM1 - Sunny Boy" interface.



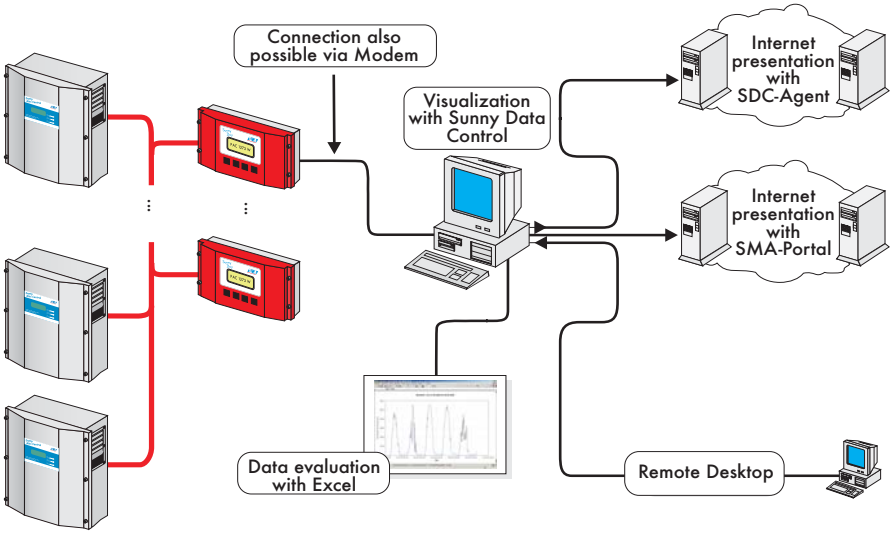
8.9 Sunny Boy Control Plus

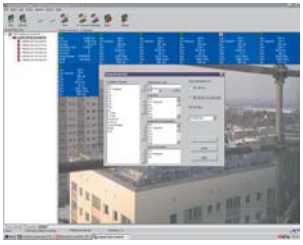
The data logger for systems with up to 50 Windy Boys, an additional interface for connection to PCs or large displays and additional connection possibilities for digital and analog inputs and outputs. Prerequisites: See Sunny Boy Control.

8.10 Sunny Data Control

This is a PC program for system monitoring and visualization on a PC for systems with a Sunny Boy Control.

Prerequisites: A system with a Sunny Boy Control, Sunny Boy Control Plus or Sunny Boy Control Light with a connection to a PC.

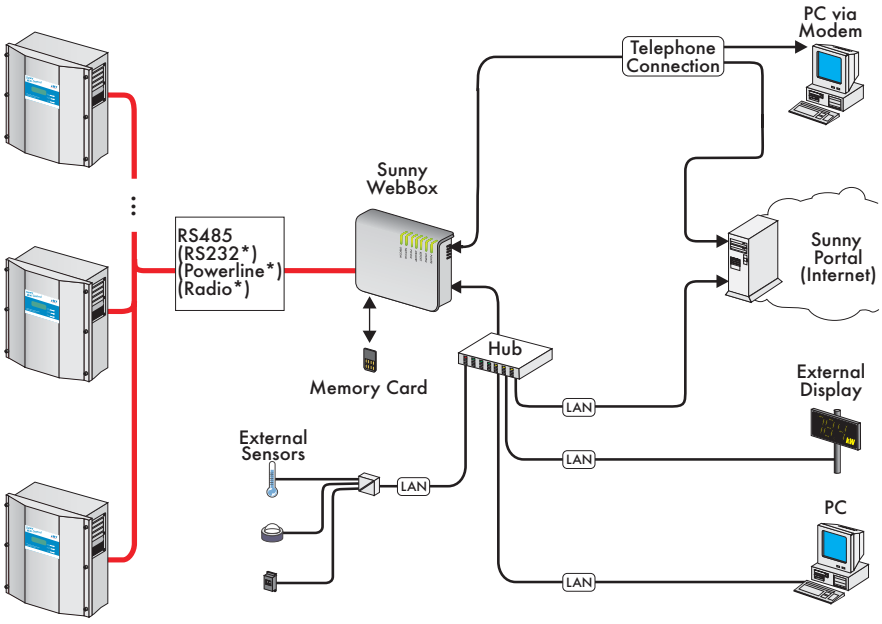




The connection between the PC and the Sunny Boy Control can occur via modem if required. Large systems with more than 50 Windy Boys can be monitored by coupling several Sunny Boy Controls together.

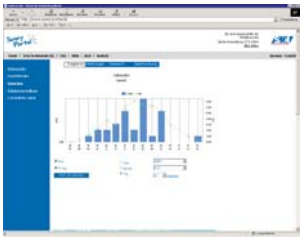
8.11 Sunny WebBox

The Sunny WebBox is a versatile inexpensive platform for system visualization directly on a PC or via the Internet using the Sunny Portal. The Sunny WebBox will be available from the 2nd quarter of 2005.



* Communication with Sunny WebBox via RS232, Powerline or using a wireless link will be possible at the end of 2005 or later.

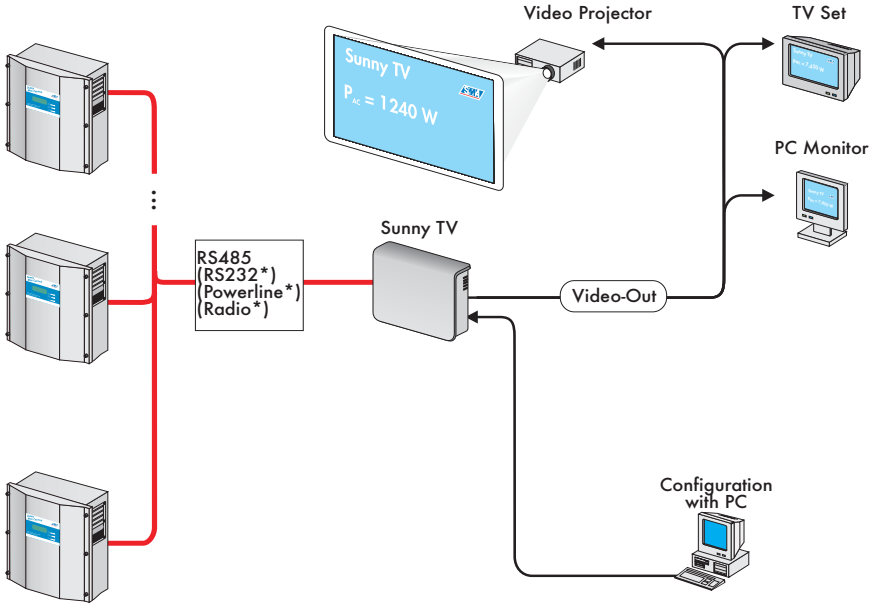
8.12 Sunny Portal



The Sunny Portal is a high performance interface from SMA for the monitoring and presentation of your system in the Internet. Details can be obtained from the Sunny Family catalog or directly under www.SUNNY-PORTAL.de.

8.13 Sunny TV

Sunny TV is an accessory for Windy Boy inverters, which displays the system data and the current performance on a monitor or video projector. It is suitable for the presentation of large systems in lobbies and entrance halls as well as in private areas.



* Communication with Sunny TV via RS232, Powerline or using a wireless link will be possible at the end of 2005 or later.

9 Technical data

9.1 Windy Boy 5000

9.1.1 DC connection data

Max. input open circuit voltage	$V_{DC\ 0}$	600 V
Input voltage, MPP range	V_{DC}	246 V ... 600 V DC
Nominal DC operating voltage	$V_{DC\ nom}$	270 V
Max. input current	$I_{DC\ max}$	26 A
Max. input power	$P_{DC\ max}$	5750 W
Recommended generator power at 5,000 full-load hours / year	$P_{turb\ max}$	4000 W
Recommended generator power at 2,500 full-load hours / year	$P_{turb\ max}$	4500 W
All-pole isolator on the DC input side		DC plug connector
Overvoltage protection		Thermally monitored varistors
DC voltage ripple	U_{SS}	< 10% of the input voltage
Personal protection		Insulation monitoring (Riso > 1 MΩ)
Own consumption in standby mode		< 7 W (standby)
Reverse polarity protection		Short circuit diode

9.1.2 Grid connection data

Nominal output power	P_{ACnom}	5000 W
Peak output power	P_{ACmax}	5500 W
Nominal output current	I_{ACnom}	21,7 A
Harmonic distortion of output current	THD_{IAC}	< 4 % (P_{AC} > 0.5 P_{ACnom})
Operating range, grid voltage	V_{AC}	198 ... 260 V AC (180 ... 265 V AC programmable)
Operating range, grid frequency	f_{AC}	49.8 ... 50.2 Hz / 59.8 ... 60.2 Hz (45.5 ... 54.5 Hz programmable)
All-pole isolator grid side		Independent disconnection device (SMA grid guard)
Phase shift angle (based on the current's fundamental frequency)	cos j	1
Overvoltage category		III
Test voltage (50 Hz)		2 kV (1 s routine testing / 60 s type testing)
Test surge voltage		4 kV (1.2 / 50 µs) type testing (serial interface: 6 kV)
Own consumption in standby mode		0.25 W

9.1.3 General data

For a detailed description of the device, see chapter 3 "Unit description" (page 13) of this manual.

General data

Protection category per DIN EN 60529	IP54
External temperature range	-25° C to +60° C
Dimensions (w x h x d)	430 mm x 600 mm x 450 mm
Weight	63 kg (approx.)

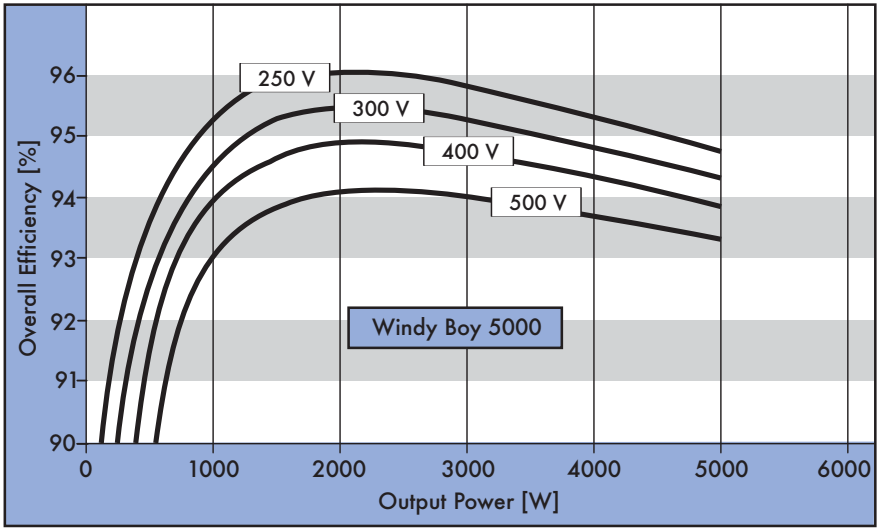
External interfaces

Data transfer (mains cable)	Optional
Data transfer (data cable)	optional, RS232 / RS485, electrically separated
Data transfer (wireless)	Optional

Efficiency

Max. efficiency	η_{max}	> 95,6 %

The efficiency of the Windy Boy 5000 / 6000 is heavily dependent on the DC input voltage.



9.2 Windy Boy 6000

9.2.1 DC connection data

Max. input open circuit voltage	$U_{DC\ 0}$	600 V
Input voltage, MPP range	U_{DC}	246 V ... 600 V DC
Nominal DC operating voltage	$U_{DC\ nom}$	270 V
Max. input current	$I_{DC\ max}$	26.0 A
Max. input power	DC_{max}	6300 W
Recommended generator power at 5,000 full-load hours / year	$P_{turb\ max}$	4400 W
Recommended generator power at 2500 full-load hours / year	$P_{turb\ max}$	4950 W
All-pole isolator on the DC input side		DC plug connector
Overvoltage protection		Thermally monitored varistors
Voltage ripple	U_{PP}	< 10% of the input voltage
Personal protection		Insulation monitoring (Riso > 1 MΩ)
Own consumption in standby mode		< 7 W
Reverse polarity protection		Short circuit diode

9.2.2 Grid connection data

Nominal output power	P_{ACnom}	5500 W
Peak output power	P_{ACmax}	6000 W
Nominal output current	I_{ACnom}	24.0 A
Harmonic distortion of output current (at K_{Unom} < 2 %, P_{AC} > 0.5 P_{ACnom})	THD_{IAC}	< 4 %
Operating range, grid voltage	V_{AC}	198 ... 260 V AC (180 ... 265 V AC programmable)
Operating range, grid frequency	f_{AC}	49.8 ... 50.2 Hz / 59.8 ... 60.2 Hz (45.5 ... 54.5 programmable)
All-pole isolator grid side		Independent disconnection device (SMA grid guard)
Phase shift angle (based on the current's fundamental frequency)	cos j	1
Overvoltage category		III
Test voltage (50 Hz)		2 kV (1 s routine testing / 60 s type testing)
Test surge voltage		4 kV (1.2 / 50 µs) type testing (serial interface: 6 kV)
Own consumption in standby mode		0.25 W

9.2.3 General data

For a detailed description of the device, see chapter 3 "Unit description" (page 13) of this manual.

General data

Protection category per DIN EN 60529	IP54
Dimensions (w x h x d)	430 mm x 600 mm x 450 mm
Weight	63 kg (approx.)

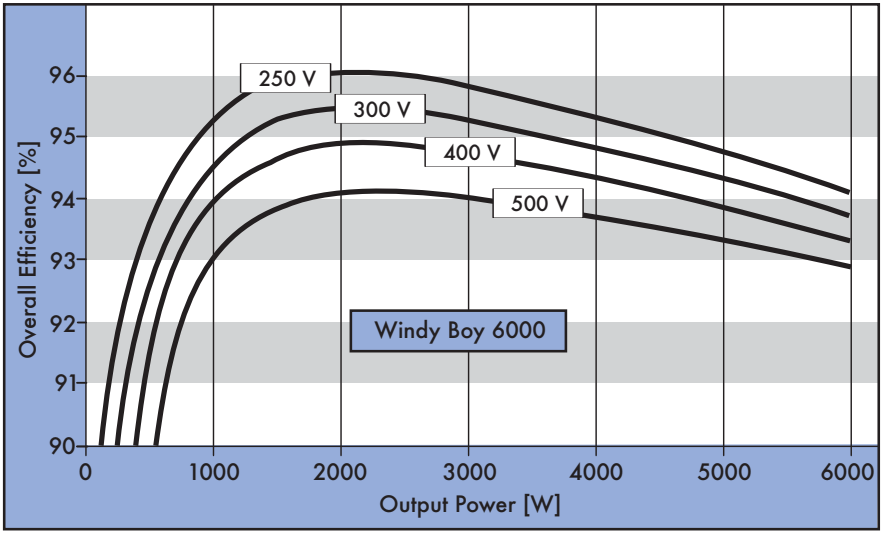
External interfaces

Data transfer (mains cable)	Optional
Data transfer (separate data cable)	optional, RS232 / RS485, electrically separated
Data transfer (wireless)	Optional

Efficiency

Max. efficiency	η_{max}	> 96,0 %

The efficiency of the Windy Boy 5000 / 6000 is heavily dependent on the DC input voltage. The lower the input voltage, the higher the efficiency.



10 General information

10.1 Measurement channels and messages

If your Windy Boy 5000 / 6000 is equipped with a communications component, then numerous measurement channels and messages can be consulted. These can be useful for both performance improvement and for fault prevention.

The following abbreviations apply:

BFR: Operation control unit

SRR: Current control unit

E-Total	Total amount of feed-in energy
Fac	Grid frequency
Fehler / Error	Fault type display under "Disturbance" status
h-Total	Total hours of mains supply feed-in operation
Iac-Ist	Mains supply current
Ipv	DC current
Netz-Ein / Power on	Total number of mains supply switch-ons
Pac	Mains supply performance provided
Riso	Insulation resistance of the system to the mains supply connection
Seriennummer / Serial number	Serial number of the Windy Boy
Status / State	Display of the current operational status
Uac / Vac	Grid voltage
Upv-Ist / Vpv	DC input voltage
Upv-Soll / Vpv-Setpoint	Nominal DC voltage
Zac	Mains supply impedance

The measurement channels provide information in German (e.g."Fehler"), or in English (e. g. "Error"), depending on which software you are using (Sunny Data or Sunny Data Control).

10.1.1 Status messages

The Windy Boy 5000 / 6000 produces a range of status messages, depending on the mode in which it is currently operating. The status messages can vary, depending on the type of communications system you are using.

Derating	Overtemperature in inverter ("WR"). The Windy Boy 5000 / 6000 reduces its performance to avoid overheating the device. To avoid unnecessary yield losses, the configuration and string size should be checked. Check if the Windy Boy 5000 / 6000 can be located in a better position with better ventilation, thus providing better heat dissipation.
Mpp	The Windy Boy 5000 / 6000 is operating in MPP mode. The Windy Boy 5000 / 6000 takes the highest possible performance from the PV generator. MPP is the standard display when operating with normal sunshine (PV operation only).
Island Mode	The Windy Boy 5000 / 6000 is in Island Mode. This mode is specially conceived for operation in a stand alone power system with a Sunny Island as network controller. More information about this topic can be obtained from the Sunny Island operating manual under the category "Droop Mode".
grid mon.	Testing the mains supply status (mains impedance), relay tests etc. This message appears only during the startup phase, before the Windy Boy 5000 / 6000 is connected to the mains supply. This message mainly appears when there is little or no wind.
Offset	Offset compensation of the measurement electronics
disturb.	Fault (see table "Fault messages") This fault occurs for reasons of safety and prevents the Windy Boy 5000 / 6000 from connecting to the mains supply. This mode can also be manually set.
Stop	Interruption of operation after a fault. This status can also be manually set.
Turbine Mode	Default setting for Windy Boy 5000 / 6000 inverters. The input voltage is converted according to the V/I function U_{PV}Start, U_{DC}Start and U_{DC}WindMax. See chapter 6 "Turbine operation" (page 33).
V-Const	Constant voltage operation (the input voltage is predefined. The Windy Boy 5000 / 6000 operates in neither MPP mode nor Turbine mode). In some cases, this can be set as the operational mode.
waiting	The switch-on conditions are not (yet) satisfied.

10.1.2 Windy Boy 5000 / 6000 Operating parameters

Unauthorized changes to the operating parameters may result in:

- **Injury or accidents as a result of changing the internal safety routines in the Windy Boy 5000 / 6000,**
- **Voiding of the Windy Boy 5000 / 6000 operating approval certificate**
- **Voiding of the Windy Boy 5000 / 6000 warranty**

Never change the parameters of your Windy Boy 5000 / 6000 without explicit authorization and instructions.

Name	Unit	Value range (WB 5000 / WB 6000)	Factory settings (WB 5000 /WB 6000)	Description
Betriebsart / Operating Mode		MPP UKonst Stop Turbine Mode Insel Mode	Turbine	Operating mode of the Windy Boy 5000 / 6000: MPP: Maximum Power Point UKonst: Constant voltage mode (Desired voltage is defined in "Usoll-Konst") Stopp: Disconnection from mains supply, no operation Turbine: Operating mode for wind turbines, the input voltage is converted according to the V/I function defined by U_{PV}Start, U_{DC}WindStart and U_{DC}WindMax.
Default			GER/ENS	Used for setting the country specific information.
dFac-MAX	Hz/s	0.005 ... 4,0	0,25	Maximum "Mains frequency change" before the mains monitoring system disconnects the device from the mains supply.
dZac-MAX	mOhm	0 ... 20000	350	Maximum "Mains impedance change" before the mains monitoring system disconnects the device from the mains supply.
E_Total	kWh	0 ... 200000		Total energy yield (E_Total) and total hours of operation (h_Total) for the Windy Boy. This change may be necessary when you exchange your Windy Boy 5000 / 6000 and want to use the data from the old device.
h_Total	h	0 ... 200000		
Fac-delta-	Hz	0 ... 4,5	0,19	Maximum frequency, above (Fac-Delta+) and below (Fac-Delta-) the mains frequency of 50 Hz, before the mains monitoring system disconnects the device from the mains supply.
Fac-delta+	Hz	0 ... 4,5	0,19	

Name	Unit	Value range (WB 5000 / WB 6000)	Factory settings (WB 5000 /WB 6000)	Description
I-NiTest	mA	0 ... 25000	16000	Activation (16000) and deactivation (0) of the automatic leakage current measurement. This parameter only functions when the Windy Boy is deactivated (disconnected on the AC side) or in "Stop" mode.
Inst.-Code				Parameters for mains supply monitoring can only be changed after entering the "SMA grid guard" password.
KI-Wind-Reg		0 ... 0,25	0,005	Control speed (only possible in Turbine mode!)
KP-Wind-Reg		0 ... 0,25	0,117	Control speed (only possible in Turbine mode!)
P-Wind-Ramp	W/s	10 ... 2000	500	Slow startup during mains supply connection (only possible in Turbine mode!)
Speicher–funktion / Memory function		Default, Parameter, Reset Betriebsdaten, Reset Fehler	none	Default parameter: Returns all parameter values to the factory setting. Reset Betriebsdaten: Returns all user level parameter values to the factory setting. Reset Fehler: Resets a permanent fault.
Speichern/ store		Permanent, volatile	Permanent	Permanent: Modified parameters are stored in the EEPROM and can be used even when the Windy Boy has been restarted. Volatile: Prevents the parameters from being stored in the EEPROM, the parameters are stored until the next restart.
T-Start	sec	5 ... 300	10	Start timer for mains supply synchronization. (only possible in Turbine mode!)
T-Stop	sec	1 ... 3600	2	Stop timer for stopping operation and switching off. (only possible in Turbine mode!)
Uac-Min / Vac-Min	V	180 ... 300	198	Lower (Uac-Min) and upper (Uac-Max) limits of the acceptable AC voltage (self contained power system recognition).
Uac-Max / Vac-Max	V	180 ... 300	260	
U_{DC}WindMax	V	1 ... 800	550	U_{DC}WindMax represents the highest point of the function (please read more about this topic in chapter 6 "Turbine operation" (page 33)). (only possible in Turbine mode!)

Name	Unit	Value range (WB 5000 / WB 6000)	Factory settings (WB 5000 /WB 6000)	Description
U_{DC}WindStart	V	1 ... 800	330	U_{DC}WindStart represents the lowest point of the function (please read more about this topic in chapter 6 "Turbine operation" (page 33)). (only possible in Turbine mode!)
Usoll-Konst / Vconst-Setpiont	V	250 ...600	600	Desired DC voltage for constant operational voltage. These parameters are only important when the "Betriebsart" parameter is set to U-Konst.
U_{PV}Start	V	250 ... 600	300	U_{PV}Start is the parameter defining the voltage at which the Windy Boy is capable of connecting to the system. 180 V is the recommended voltage for the Windy Boy 5000 and the Windy Boy 6000. Reducing this voltage parameter can lead to numerous unnecessary connection attempts. Increasing this voltage parameter can lead to energy losses since the Windy Boy does not immediately connect to the system.

The following parameters are displayed in the parameter list but cannot be modified:

Name	Unit	Value range (WB5000/ 6000)	Factory settings (WB5000/ 6000)	Description
Plimit	W	5000 / 6000	5000 / 6000	Upper limit for AC output power
SMA-SN				Serial number of the Windy Boy 5000 / 6000
Software-BFR / Firmware-BFR				Firmware version of the operation control unit (BFR)
Software-SRR / Firmware-SRR				Firmware version of the current control unit (SRR)

10.2 Fault messages

If a fault develops, the Windy Boy 5000 / 6000 generates a message, which is dependent on the operational mode and the type of fault.

Fault code	Description
Bfr-Srr NUW-FAC NUW-UAC NUW-ZAC	Internal measurement comparison fault: the Windy Boy 5000 / 6000 found a too large difference between values provided by the BFR and SRR. Contact SMA.
dZac-Bfr dZac-Srr	The changes in mains impedance exceed the permissible range ("Bfr" or "Srr" is an internal message that has no meaning for the user). The Windy Boy 5000 / 6000 disconnects from the mains supply or stand-alone grid, to avoid potential damage. If possible, check the mains impedance and check how often major deviations occur. If repeated variations occur and this is causing "dZac-Bfr" or "dZac-Srr" faults, ask the electricity provider if they agree to a modification of the operating parameters. Discuss the proposed parameters with the SMA hotline.
EEPROM	A data transfer fault occurred during reading or writing of data from the EEPROM. The data is not relevant for safe operation - this fault has no effect on performance.
EEPROM dBh	Data EEPROM is defective. The device has switched itself off because the loss of important functions has disabled the Windy Boy 5000 / 6000. Contact SMA.
EeRestore	One of the duplicate data sets in the EEPROM is defective and has been reconstructed without loss of data.
Fac-Bfr Fac-Srr	The mains frequency has exceeded the permissible range ("Bfr" or "Srr" is an internal message that has no meaning for the user). The Windy Boy 5000 / 6000 disconnects from the mains supply or stand-alone grid, to avoid potential damage. Check the mains frequency and mains connections on the Windy Boy 5000 / 6000. If the mains frequency lies outside the permissible range because of local conditions, ask the electricity provider if they agree to a modification of the operating parameters. If the mains frequency lies within an acceptable range and "Fac-Bfr" or "Fac-Srr" faults are still being displayed, please contact the SMA hotline.

Fault code	Description
Imax	Overcurrent on the AC side. This fault code is displayed if the current in the AC network is larger that specified. Check your system configuration and the mains supply conditions.
K1-Schliess / K1-Close K1-Trenn / K1-Open	Fault during relay test. Please contact SMA if this fault occurs often or repeatedly.
NUW-Mes	Measurement difference between BFR and SRR: Fac, Uac or Zac.
Offset	Fault in the acquisition of measurement data. Contact SMA if this fault occurs frequently.
Rechner / NuW-Timeout	Functional fault in one of the two microcontrollers. Please contact SMA if this fault occurs often or repeatedly.
Riso	A grounding fault exists or one of the thermally monitored varistors on the DC input is defective as a result of overvoltage. Consult trained electrical personnel to correct the fault. You can find Instructions on how to change the varistors in the "Installation manual".
ROM	The Windy Boy 5000 / 6000 firmware is faulty. Contact SMA if this fault occurs frequently.
Uac-Bfr / Vac-Bfr Uac-Srr / Vac-Srr	The mains voltage has exceeded the permissible range ("Bfr" or "Srr" is an internal message that has no meaning for the user). The Uac fault can have the following causes: • Mains supply disconnected (circuit breaker or fuse) • Broken AC cable or • AC cable has a high internal resistance For reasons of safety, the Windy Boy 5000 / 6000 disconnects itself from the mains supply. Check the mains voltage and mains connections on the Windy Boy 5000 / 6000. If the mains voltage lies outside the acceptable range because of local conditions, ask the electricity provider if the voltage can be adjusted at the feed-in point or if they agree to changes in the values of the monitored operational limits. If the mains voltage lies within an acceptable range and "Uac-Bfr" or "Uac-Srr" faults are still being displayed, please contact the SMA hotline.

Fault code	Description
UpvMax / Vpv-Max	Over voltage on DC input Immediately disconnect the DC input of the Windy Boy 5000 / 6000. The Windy Boy 5000 / 6000 may otherwise be damaged seriously! Check the configuration of your system and measure the DC voltage before reconnecting the Windy Boy 5000 / 6000 to the DC voltage.
Watchdog	Fault in the program code flow monitoring.
Zac-Bfr/ Zac-Srr	The mains impedance has exceeded the permissible range ("Bfr" or "Srr" is an internal message that has no meaning for the user). The Windy Boy 5000 / 6000 disconnects from the mains supply or stand-alone grid, to avoid potential damage. The impedance is calculated from the mains supply impedance and the impedance of the mains connection cable (AC cable) of the Windy Boy 5000 / 6000. Check the mains impedance and mains connections on the Windy Boy 5000 / 6000. Use a mains connection cable with an adequate cross section (= low impedance), and observe the advice to this effect in the installation guide in chapter 4.3. If the mains impedance is still too high, then ask the electricity provider if the characteristics of the mains supply at the feed-in point can be altered.

10.3 Declaration of conformity (CE)

CE Declaration of Conformity

for utility interactive inverters

Product: **Windy Boy**
Type: **WB 3300, WB 3800, WB 5000, WB 6000**

We declare that the above specified devices are compliant with the regulations of the European Community, in terms of the design and the version fabricated by SMA. This especially applies for the EMC Regulation defined in 89/336/EWG and the low voltage regulation defined in 73/23/EWG.

The devices are compliant with the following standards:

EMC:	
Emission:	DIN EN 61000-6-3: 2002-08
	DIN EN 61000-6-4: 2002-08
	DIN EN 55022: 2003-09, Class B
Utility Interference:	DIN EN 61000-3-11: 2001-04
	DIN EN 61000-3-12: 2004-06 (Draft)
Immunity:	DIN EN 61000-6-1: 2002-08
	DIN EN 61000-6-2: 2002-08
Safety:	DIN EN 50178: 1998-04
Semiconductor-Converter:	DIN EN 60146-1-1: 1994-03

The above mentioned devices are therefore marked with a CE sign.

Niestetal, 20th of June 2005
SMA Technologie AG
i.V. Frank Greizer
i.V. Frank Greizer
(Head of Development Department Solar Technology)

WB-G16A-CE-12:BE2905

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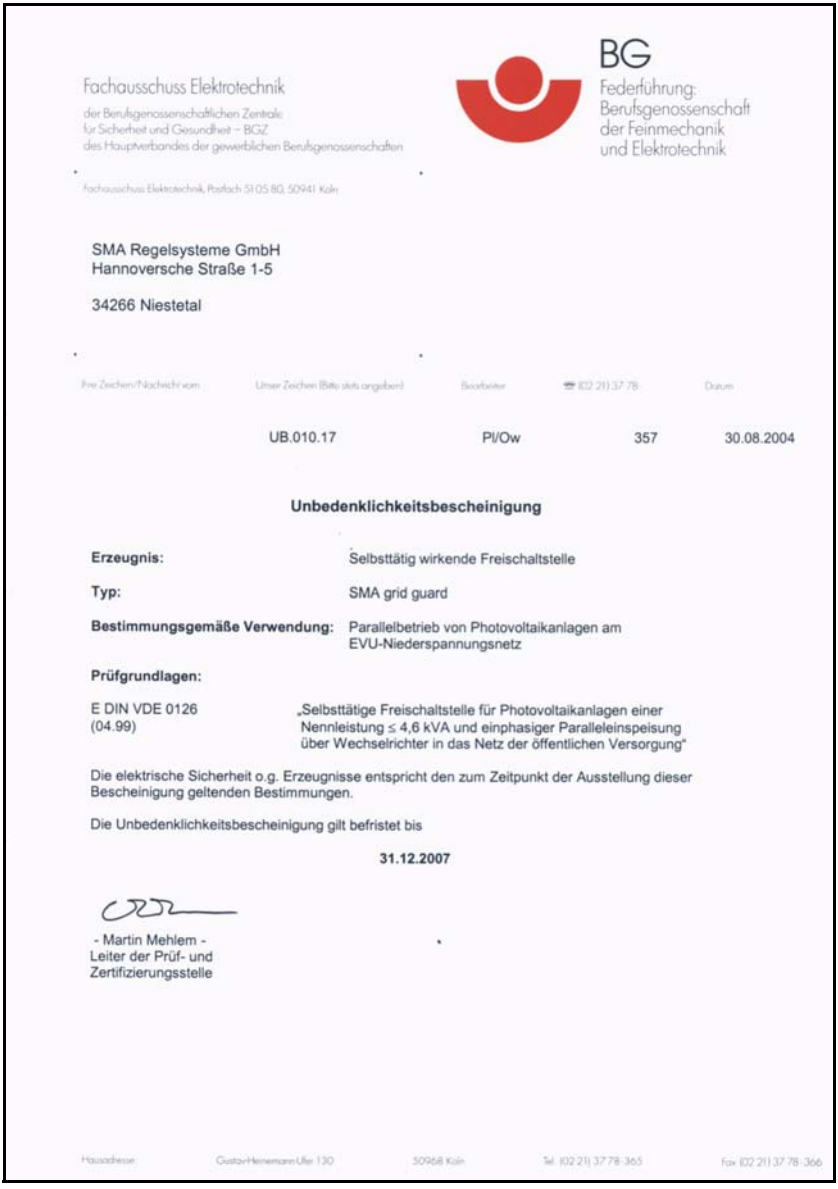
CE SMA

10.4 Import certificate

The Windy Boy 5000 / 6000 string inverter is equipped with the "SMA grid guard" independent disconnection device and it is covered by the industrial trade association "SMA grid guard" import certificate.



Fachausschuss Elektrotechnik
der Berufsgenossenschaftlichen Zentrale
für Sicherheit und Gesundheit – BGZ
des Hauptverbandes der gewerblichen Berufsgenossenschaften

BG
Federführung:
Berufsgenossenschaft
der Feinmechanik
und Elektrotechnik

Fachausschuss Elektrotechnik, Postfach 51 05 80, 50941 Köln

SMA Regelsysteme GmbH
Hannoversche Straße 1-5

34266 Niestetal

Ihre Zeichen/Nachricht vom	Unser Zeichen (Bitte stets angeben)	Bearbeiter	☎ (02 21) 37 78	Datum
	UB.010.17	PI/Ow	357	30.08.2004

Unbedenklichkeitsbescheinigung

Erzeugnis:	Selbsttätig wirkende Freischaltstelle
Typ:	SMA grid guard
Bestimmungsgemäße Verwendung:	Parallelbetrieb von Photovoltaikanlagen am EVU-Niederspannungsnetz

Prüfgrundlagen:

E DIN VDE 0126 (04.99)	„Selbsttätige Freischaltstelle für Photovoltaikanlagen einer Nennleistung ≤ 4,6 kVA und einphasiger Paralleleinspeisung über Wechselrichter in das Netz der öffentlichen Versorgung"

Die elektrische Sicherheit o.g. Erzeugnisse entspricht den zum Zeitpunkt der Ausstellung dieser Bescheinigung geltenden Bestimmungen.

Die Unbedenklichkeitsbescheinigung gilt befristet bis

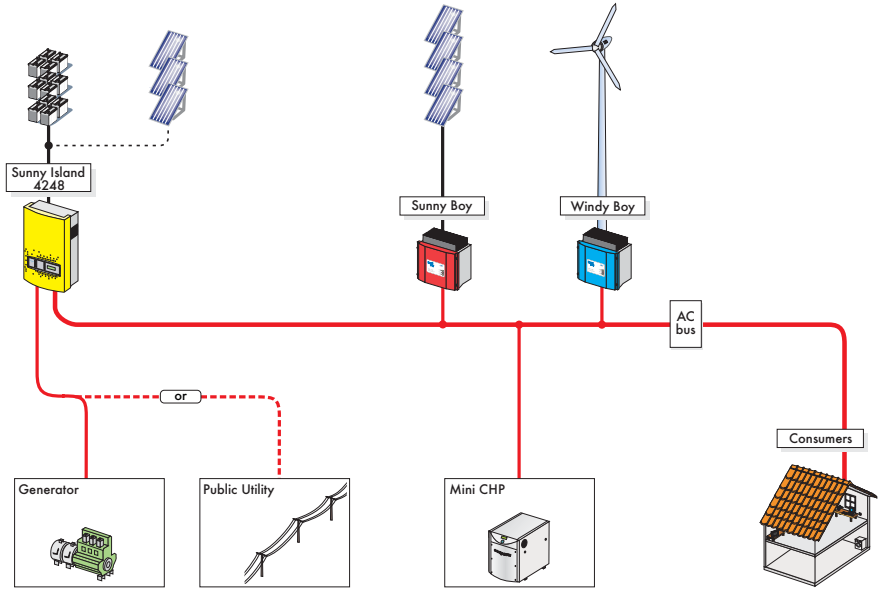
31.12.2007

- Martin Mehlem -
Leiter der Prüf- und
Zertifizierungsstelle

Hausadresse: Gustav-Heinemann-Ufer 130 50968 Köln Tel. (02 21) 37 78-365 Fax (02 21) 37 78-366

11 Stand-alone systems

The Windy Boy 5000 / 6000 is suitable for use in stand-alone systems based on the Sunny Island. The Windy Boy 5000 / 6000 requires extra settings for this to ensure optimum operation and also to achieve deactivation of the standard mains supply monitoring settings. Please obtain all further relevant information from the Sunny Island manuals.



12 Contact

If you have any questions or technical problems concerning the Windy Boy 5000 / 6000, please contact our service hotline. Please have the following information available when you contact SMA:

- Inverter type
- Type of wind turbine and AC/DC converter
- Type of overvoltage protection
- Communication
- Serial number of the Windy Boy 5000 / 6000

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Innovation in Systems Technology
for the Success of Photovoltaics