


KACO new energy.

# Powador 25000xi
# Powador 30000xi
# Powador 33000xi
# M / L / XL / Park

## Operating instructions

- Operator
- Skilled and authorised electrician

**The installation instructions for authorised electricians begin after the operating instructions**

**Intended for use by the operator**

# Operating Instructions

**Powador 25000xi / 30000xi / 33000xi M/L/XL, Park**


General Notes ....4
1 About This Documentation ....4
1.1 Retention of documents....4
1.2 Symbols used in this document ....4
1.3 CE marking....4
1.4 Name plate ....4
2 Safety Instructions and Regulations ....5
3 Notes on Installation and Operation....5
3.1 Intended use ....5
3.2 Factory warranty and liability....5
3.3 Service ....6
4 Operation....6
4.1 Overview of controls and displays ....6
4.2 LED displays ....6
4.3 Keys "1" (Display) and "2" (Settings) ....7
4.4 Level 1 menu – Display menu....8
4.5 Level 2 menu – Configuration mode ....8
4.6 The RS485 interface ....9
4.7 Display ....9
5 Troubleshooting....12
6 Recycling and Disposal ....14

# General Notes

By purchasing an inverter from KACO new energy GmbH, you have opted for a reliable, high-performance technology and will profit from KACO new energy GmbH's many years of experience in the field of current inverter technology and power electronics.
The Powador 25000xi/30000xi/33000xi central inverters are transformerless, sturdy inverters with a high degree of efficiency and active cooling. With the aid of the illuminated display and intuitive menu navigation, you can display the most important information pertaining to the inverter's grid feed.
With protection class IP54, the units are ready for operation in all ambient conditions. The inverters can also be used without hesitation in agriculture and industry.

# 1 About This Documentation

The following notes guide you through all of the documentation. Additional documents are applicable in conjunction with these operating and installation instructions.
We assume no liability for any damage caused by failure to observe these instructions.

**Other applicable documents**

When installing the inverters, be sure to observe all assembly and installation instructions for components and other parts of the system. These instructions are delivered together with the respective components and additional parts of the system.

## 1.1 Retention of documents

Please pass these operating and installation instructions on to the plant operator. These documents must be stored next to the system and must be available at all times.

## 1.2 Symbols used in this document

Observe the safety information provided in these operating instructions when operating the inverters.

**DANGER**

**Failure to observe a warning indicated in this manner will directly lead to serious bodily injury or death.**

**WARNING**

**Failure to observe a warning indicated in this manner may directly lead to serious bodily injury or death.**

**CAUTION**

**Failure to observe a warning indicated in this manner may lead to minor or moderate bodily injury or to serious damage to property.**

**ATTENTION**

Failure to observe a warning indicated in this manner may lead to damage to property.

**NOTE**

Useful information and notes.

**ACTION**

This symbol indicates that a certain action is required.

**IMPORTANT**

Failure to observe this information may result in reduced convenience or impaired functionality.

## 1.3 CE marking

The CE marking is used to document that the Powador inverter shown on the name plate fulfills the fundamental requirements of the following relevant directives:
Directive concerning electromagnetic compatibility
(Council Directive 2004/108/EC)
Low voltage directive
(Council Directive 2006/95/EC).

## 1.4 Name plate

The name plate showing the exact designation of the unit is located in the connection box of the unit.

# 2 Safety Instructions and Regulations

**DANGER**

**Danger due to lethal voltages.**

**Lethal voltages are present within the unit and on the power supply lines. Therefore, only authorised electricians may install and open the unit.**

**Even when the unit is disconnected, high contact voltages may still be present within the unit.**

### Accident prevention regulations

The inverter must be installed by an authorised electrician who is responsible for observing existing standards and regulations.

The proper and safe operation of this unit requires proper transportation, storage, assembly and installation, as well as careful operation and maintenance.

The inverter may be operated only by persons who have read and understood the operating instructions.

### Modifications

It is generally not permitted to make changes to the inverter. Always consult an authorised electrician for modifications to the surroundings of the inverter, as they are qualified to undertake such work.

**CAUTION**

**Risk of damage due to improper modifications. Never modify or manipulate the inverter or other components of the system.**

### Transportation

The Powador is subjected to extensive testing and inspections in our test field. This is how we ensure the high quality of our products. Our inverters leave our factory in proper electrical and mechanical condition. Special packaging ensures that nothing will be damaged during transportation. However, transport damage may still occur. The shipping company is responsible in such cases.
Thoroughly inspect the inverter upon delivery. Immediately notify the responsible shipping company if you discover any damage to the packaging which indicates that the inverter may have been damaged or if you discover any visible damage to the inverter.

If necessary, your solar installer or KACO new energy GmbH will assist you. Damage reports must be received by the shipping company in writing within six days of receipt of the goods.
When transporting the inverter, the original or equivalent packaging is to be used, as this ensures safe transport.

# 3 Notes on Installation and Operation

## 3.1 Intended use

The Powador inverter converts the DC power generated by the photovoltaic (PV) modules into AC power and feeds this into the power grid.
The Powador inverter is built according to the state of the art and recognised safety rules. Nevertheless, improper use may cause lethal hazards for the operator or third parties or may result in damage to the units and other property.

The inverter may only be operated with a permanent connection to the public power grid. The inverter is not intended for mobile use.

Any other or additional use is not considered the intended use. The manufacturer/supplier is not liable for damage caused by such unintended use. Damage caused by such unintended use is at the sole risk of the operator.
Intended use also includes adherence to the operating and installation instructions. Your authorised electrician undertakes the registration with your power supply company and obtains approval for your photovoltaic installation from the supply grid operator on your behalf. Some of the documents that you require in order to register your photovoltaic installation and have it approved are included in the installation instructions.

## 3.2 Factory warranty and liability

KACO new energy GmbH grants a warranty of seven years on the Powador central inverter, starting from the date of installation, but at most 90 months after shipment by Kaco new energy GmbH.
During this time, KACO new energy GmbH guarantees the proper function of the units and free-of-charge repair at the factory in the event of a defect for which we are responsible.
Contact your specialty dealer or installer if your unit exhibits a defect or fault during the warranty period.
Warranty claims are excluded in the following cases:
- Use of the units in ways not intended
- Improper installation and installation that does not comply with standards
- Improper operation
- Operation of units with defective protective equipment
- Unauthorised modifications to the units or repair attempts
- Influence of foreign objects and force majeure (lightning, overvoltage, severe weather, fire)
- Insufficient ventilation of the unit
- Failure to observe the relevant safety regulations
- Transport damage.

All warranty claims can be handled at the premises of KACO new energy GmbH or on site. The unit must, where possible, be returned in its original or equivalent packaging. The costs for these services cannot be borne by KACO new energy GmbH.

Kaco new energy GmbH will only perform warranty services when the faulty unit is returned to Kaco new energy GmbH together with a copy of the invoice which was issued by the dealer to the user. The name plate on the unit must be fully legible. If these requirements are not fulfilled, Kaco new energy GmbH reserves the right to deny warranty services.

The warranty period for repairs or replacement deliveries is six months after delivery. However, it continues at least until the end of the original warranty period for the delivery item.

### 3.3 Service

We place special emphasis on the quality and longevity of our inverters, starting with the product development phase. More than 60 years of experience in the field of current inverters support us in this philosophy.

However, despite all quality assurance measures, faults may occur in exceptional cases. If this happens, KACO new energy GmbH will provide you with the maximum support possible. KACO new energy GmbH will make every effort to remedy such faults quickly and without a great deal of bureaucracy. In such cases, contact our service department directly by telephone at

**+49 (0)7132-3818-660.**

# 4 Operation

**CAUTION**

**Incorrect use is prohibited.**

The grid feed process begins in the morning if sufficient light is available and therefore a certain minimum voltage is present in the inverter.
The inverter enables grid feed after a country-specific start-up period (see Installation Instructions, Section 4, "Technical Data").
If, as nightfall approaches, the voltage drops below the minimum voltage, the grid feed mode ends and the inverter switches off.

## 4.1 Overview of controls and displays




Figure 4.1: **Displays**

**Legend**
**1 Display**
Displays measured values and configuration parameters
**2 Control keys**
Switch between measured values and configuration of parameters
**3 LED displays**
Display the operating status




Figure 4.2: **Connection options**

**Legend**
**1 Cable fitting for AC connection**
**2 Cable feedthrough for DC connection**
**3 Cable feedthrough for RS485 interface cable (Optional cable feedthrough for external fan power supply for the Park version)**

## 4.2 LED displays

During normal operation, the photovoltaic modules generate voltage as soon as there is enough sunlight. If this voltage is present in the inverter at a certain level for a certain time, the inverter begins to feed into the grid.
The inverter is equipped with three LEDs which give information about the various operating statuses as follows.

By pressing this key for approx. 1 second, you can choose which measured value is to be displayed. The menus are continuous, which means that when you arrive at the last entry in a menu, the first entry is displayed once again the next time key "1" is pressed (see Figure 4.5).




Figure 4.3: **LED displays**

**"OK" LED (1) (green):**

The LED begins to light up beginning with a photovoltaic module voltage of approx. 300 V and goes out again if the module voltage is lower than 250 V.
The "OK" LED indicates that the inverter and the inverter control are active. If this LED is not lit, the inverter cannot feed into the grid.
In normal mode, the LED begins to light up in the morning (if there is enough sunlight) and goes out as nightfall approaches.

**LED (2) (green):**

The LED lights up every time the inverter feeds into the grid. For this to happen, the photovoltaic module voltage must exceed 410 V (factory setting) and sufficient power must be provided by the PV generator. If the grid feed is interrupted because the power is too low, the inverter waits a country-specific time period before it begins feeding into the grid once again (see Installation Instructions, Section 4, "Technical Data"). LED (2) can therefore only light up when the "OK" LED is already lit.
In a normal state, the inverter begins feeding into the grid in the morning and stops feeding into the grid as it becomes increasingly darker. On cloudy days and in the winter months, the grid feed can – depending on the PV generator and the current grid feed power – be temporarily interrupted and subsequently re-started. This process can repeat itself several times, especially in the morning and evening. This is in no way an indication of defective operation, but instead constitutes normal operating behaviour.

**LED (3) (red):**

The LED indicates that the grid feed was stopped due to a fault.
The following faults activate the LED (3):
- Line overvoltage or undervoltage on one of the three phases
- Phase failure
- Grid feed power is too high
- Shutdown due to the temperature being too high
- Fault in the unit
- Residual current is too high (RCD type B)
- Overfrequency/underfrequency
- Error isolation
- Communication error
- Fault in the DC grid feed
- Measurement error
- Relay error
- Fault in the RCD type B module.

Wait approx. 10 minutes to see if the fault is only temporary in nature. Should this prove not to be the case, notify your authorised electrician. If the fault is cleared, the grid feed begins once again after a country-specific waiting period (see Installation Instructions, Section 4, "Technical Data").

**IMPORTANT**

In the event of a Phase L1 failure (power failure on the public grid), LED (3) does not light up. If this happens, all LEDs and the display go out. The inverter is shut down completely.
The inverter can only resume its normal operation when this phase is available once again.

Check whether the fault in question relates to a general power failure or whether the fuse between the meter and the inverter has failed. If the fuse has failed, notify your authorised technician. If there was a power failure, simply wait until the fault has been cleared. The system automatically re-starts.

## 4.3 Keys "1" (Display) and "2" (Settings)

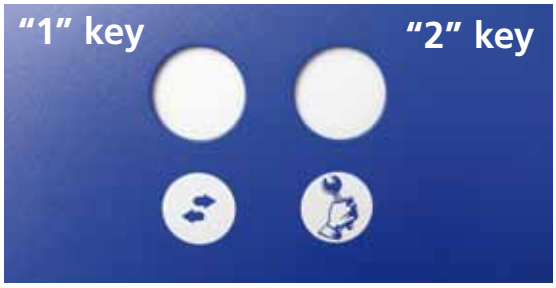



Figure 4.4: **Powador control keys**

Key "1" is used to switch between the various displays for measured values and data. You use key "2" to configure settings. Here, menu navigation is divided into two levels. In level 1 (display mode), measured values such as the solar generator voltage and yields can be read. Here, only key "1" is activated. In level 2 (configuration mode), key "1" is also used to navigate through the individual displays, and settings are configured with key "2".

**ACTION**

By pressing this key for approx. 1 second, you can choose which measured value is to be displayed. The menus are continuous, which means that when you arrive at the last entry in a menu, the first entry is displayed once again the next time key "1" is pressed (see Figure 4.5).

## 4.4 Level 1 menu – Display menu

The display menu is displayed once the Powador inverter has started up. Measured values and all of the meters are displayed here. Key "1" is used to navigate through the individual menu items.

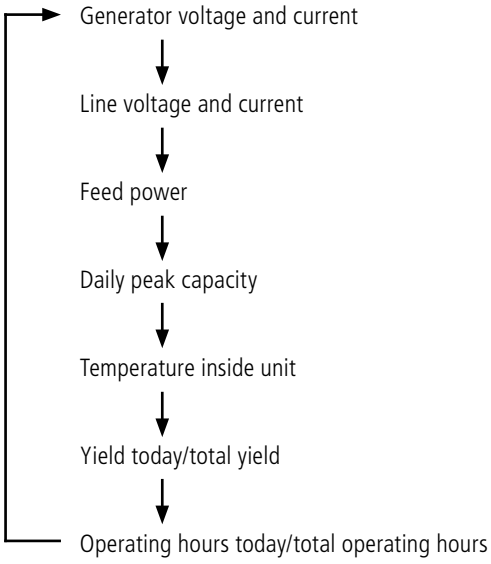



Figure 4.5: **Display mode menu**

If the "1" key is not pressed for a long period of time, the display automatically shows the power that is currently being fed into the grid.

The grid feed meter can only be cleared. You cannot set the meter to a specific value.

## 4.5 Level 2 menu – Configuration mode

**ACTION**

In order to access level 2 (configuration mode), press keys "1" and "2" simultaneously for approx. 1 second. Pressing the "1" key allows you to switch between the various configuration parameters. Press the "2" key to change the selected parameter. Depending on the parameter, pressing the "2" key will increase or decrease the value. The various configuration parameters are shown in Figure 4.6.

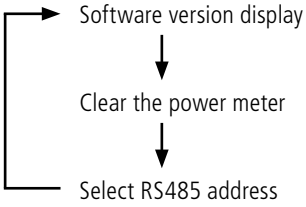



Figure 4.6: **Configuration mode menu**

### Clearing the grid feed meter

When you clear the grid feed meter, all yields and operation hours are reset to zero.
To clear the meters, select "Yes" with key "2", and confirm your selection by pressing the "1" key. The required code is (**2**) and is entered with key "2". By means of an additional confirmation with key "1", all meters are cleared. The display "Power meter cleared!" confirms that the grid feed counters have been cleared.

**NOTE**

The grid feed meter can only be cleared. You cannot set the meter to a specific value.

### Selecting the RS485 address

With the menu item "Choice of interface", you can use key "2" to switch between the RS232 and RS485 interfaces.
If the RS485 interface is activated, you can reach the address setting by pressing key "1". By pressing key "2", the address can be set in a consecutive manner from 1 to 32.
The address then jumps back to 1.

## 4.6 The RS485 interface

The Powador inverters are equipped with an RS485 interface (Figure 4.2 – (3)) in order to enable remote monitoring of your photovoltaic installation. Several inverters can be monitored over this interface at the same time. Using the Powador-proLOG series, you can receive yield and operating data as well as error messages by SMS (text message), fax or e-mail. This monitoring option is especially recommended for situations where you are unable to check the functionality of the installation on-site at regular intervals, e.g. if you live far away from the installation site. In addition, you can use the Powador link within your installation to bridge long distances between several inverters or between an inverter and the Powador-proLOG by means of a wireless radio transmission. Contact your installer if you wish to integrate remote monitoring into your system.

## 4.7 Display

Inverters in the Powador xi series are equipped with a back-lit LCD (Figure 4.1) which displays all measured values and data. In normal mode, the backlighting is switched off. As soon as you press one of the keys, the backlighting is activated. If no key is pressed for 10 seconds, it switches off once again.
In normal operation, when no key has been pressed for a long period of time, the power that is currently fed into the grid is shown in the display.

**IMPORTANT**

Due to measuring tolerances, the measured values may not always correspond to the actual values. The inverter's measuring elements have been selected to ensure maximum solar yields.

Due to these tolerances, the daily yields displayed on the inverter may deviate from the values on your supply grid operator's grid feed meter by up to 15 %.

You can use the control keys (Section 4.3) to show the following values and data in the display.

### Operating statuses

| No. | Display | Explanation |
|---|---|---|
| 1 | Waiting to start<br>Start > 410 V<br>DC1 xxx.x V xx.xx A<br>DC2 xxx.x V xx.xx A<br>DC3 xxx.x V xx.xx A | Display when starting (in the morning), after start-up, after a fault, or before shutting down at night. No power is fed into the grid in this operating state. The inverter waits until the voltage of the three generator inputs exceeds 410 V. When this voltage is exceeded, the inverter starts to feed power into the grid. An audible sound is made when the grid separation relay is engaged. |
| 2 | Solar generators<br>DC1 xxx.x V xx.xx A<br>DC2 xxx.x V xx.xx A<br>DC3 xxx.x V xx.xx A | Current voltage and current of the solar generators that are connected to the inverter. Expressed in volts and amperes. Voltage tolerance: ± 3 %, current tolerance: ± 5 % at rated power. The display may vary more for lower generator currents. |
| 3 | Line parameters<br>L1 xxx.x V xx.xx A<br>L2 xxx.x V xx.xx A<br>L3 xxx.x V xx.xx A | Current line voltages and currents of the three phases in which power is currently being fed into the grid. Expressed in volts and amperes. Voltage tolerance: ± 2 %, current tolerance: ± 3 %. |
| 4 | Total power xxxxx W<br>Phase L1 xxxxx W<br>Phase L2 xxxxx W<br>Phase L3 xxxxx W | Current total power that is being fed into the grid and the power of the individual grid phases. |
| 5 | Peak power/day<br>Phase L1 xxxxx W<br>Phase L2 xxxxx W<br>Phase L3 xxxxx W | The respective day's peak power (in watts) which was fed into the grid over a short period.<br>In accordance with the regulations of the power supply company, the peak power may exceed the rated power of the inverter by a maximum of 10 %. Nevertheless, the capacity of the generators can be higher. |
| 6 | Temperature<br>Phase L1 xx °C<br>Phase L2 xx °C<br>Phase L3 xx °C | Indicates the current heat sink temperature in °C. The inverter limits the power starting at a temperature of 75 °C. When the unit is hotter than 85 °C, it switches off. |
| 7 | Yield<br>Today xxxxx Wh<br>Total xxxxxxx kWh | Indicates yield data.<br>Note: The daily yield is indicated in watt-hours (not kWh) |
| 9 | Operating hours<br>Today xx:xx h<br>Total xxxxxx:xx h | Indicates hours of operation.<br>Expressed in hours and minutes. |

Table 4.1: **Operating statuses**

**Possible error messages**

| No. | Display | Explanation |
|---|---|---|
| 1 | Error Self test | The internal grid separation relay test has failed. The grid cannot be fed into. |
| | Error in the voltage transformer | The current and voltage measurements in the inverter are not plausible. The inverter was disconnected from the grid. |
| | Error isolation | The insulation resistance on the DC side is <1.2 MΩ. The grid cannot be fed into. |
| 2 | Line failure Undervoltage Lx | There is a problem with the line voltage; power cannot be fed into the grid. The phase in which the fault occurs (undervoltage) is displayed in each case. |
| | Line failure Overvoltage Lx | There is a problem with the line voltage; power cannot be fed into the grid. The phase in which the fault occurs (overvoltage) is displayed in each case. |
| | Line failure Phase conductor | There is a problem with the line-to-line voltage. A proper three-phase supply network is not connected. |
| | Line error Overvoltage | Overvoltage shutdown due to a voltage boost caused by increased line impedance of the grid connection. |
| | Line failure Underfrequency | The line frequency is too low. The grid cannot be fed into. |
| 3 | Line failure Overfrequency | The line frequency is too high. The grid cannot be fed into. |
| | Error DC-grid feeding | The DC feed into the grid has exceeded the permitted limit value. The inverter was disconnected from the grid. |
| | Error current Switch-off | There is impermissible residual current on the AC or DC side. The inverter was disconnected from the grid. |
| | Fault in the RCD type B module | An operational fault has occurred in the AC/DC-sensitive residual current circuit breaker. The inverter was disconnected from the grid. |
| 4 | Temperature inside unit too high | When the inverter overheats due to constant overload and a lack of air circulation, the inverter switches off. |
| | Failure PV-Overvoltage | The connected solar generator momentarily had so much power that the inverter was unable to readjust and shut down for safety reasons. |
| | Generator voltage is too low | Generator voltage and generator power is too low. The status before it changes over to night shutdown mode. |

Table 4.2: **Possible error messages**

# 5 Troubleshooting

In line with our ever-growing quality assurance system, we endeavour to eliminate all errors and faults. You have purchased a product which left our factory in proper condition. Endurance tests as well as extensive tests for the purpose of assessing the operating performance and the protective equipment have been successfully undertaken with each individual unit.

If your photovoltaic installation does not function properly, we suggest the following troubleshooting procedures:
The first step is to check that the solar generator and grid connections are properly connected to the Powador. In doing so, observe all the safety instructions specified in this manual. Monitor the inverter closely and, where applicable, make a note of display indications and LED displays.

The following faults may occur and should be remedied as described.

| Fault | Cause of fault | Troubleshooting / Explanation |
|---|---|---|
| Inverter displays an impossible daily peak value. | Faults in the line voltage. | The inverter continues to operate as normal without losses to the yield, even when an erroneous daily peak value is displayed. The value is reset overnight. (To immediately reset the value, the inverter must be switched off and switched on again by disconnecting it from the grid and switching off the DC.) |
| Daily energy yields do not correspond with the yields on the grid operator's grid feed meter. | Measuring elements' tolerances in the inverter. | A measurement error occurs due to the measuring elements' tolerances. The tolerances of the individual measured values can be found in the operating instructions. The daily energy yield may deviate from the yield on the grid feed meter by up to 15%, and even more in cases of low insolation. |
| The display is blank. | The unit is in night shutdown mode.<br>There is no line voltage.<br>The solar generator voltage is lower than 300 V. | The inverter switches off overnight. If the display does not light up during the daytime, check the grid feed meter to see if the grid is nevertheless being fed into. If the grid is being fed into, the display module is faulty. The inverter must be repaired by KACO new energy GmbH. |
| The inverter will not start. | The unit is in night shutdown mode.<br>There is no line voltage.<br>The solar generator voltage is lower than 410 V. | The inverter switches off overnight. If the display does not light up during the daytime, check the grid feed meter to see if the grid is nevertheless being fed into. If the grid is being fed into, the display module is faulty. The inverter must be repaired by KACO new energy GmbH. If the grid is not being fed into, you should check whether there is any line voltage and whether the solar generator voltage is greater than 410 V. If both are the case and the inverter still does not feed into the grid, the unit must be repaired by KACO new energy GmbH. |
| The inverter is active but does not feed in – the display shows:<br>"Start at 410 V meas. xxx V" | Not enough generator voltage available. The measured voltage of one of the three generator inputs is lower than 410 V. | After sunrise, at sunset and when there is not enough solar insolation due to bad weather conditions, the generator voltage or the generator power may be too low to be able to feed in. |
| The inverter is active but does not feed into the grid. The display shows: "Start at 410 V meas. xxx V" (measured voltage is greater than 410 V) | The inverter has interrupted the grid feed due to a fault. | After an interruption to the grid feed due to a fault (line failure, overtemperature, overload, etc.), the inverter waits a country-specific time period before switching over to grid feed mode (see Installation Manual, Section 4, "Technical Data"). With faulty grids, the inverters may even shut down during the day. Notify your solar installer if the inverter shuts down regularly over a period of several weeks (more than 10 times per day). |

| Fault | Cause of fault | Troubleshooting / Explanation |
|---|---|---|
| The inverter stops the grid feed mode shortly after being switched on, although there is sufficient sunlight. | Faulty grid separation relay in the inverter. | Although there is sufficient sunlight, the inverter feeds into the grid only for a few seconds before switching off again. During the short grid feed period, the inverter shows that the power being fed into the grid is between 0 and 30 W. If the inverter is definitely receiving sufficient generator power, the grid separation relay is presumably faulty, thus preventing the inverter from connecting. Should this be the case, the unit must be repaired by KACO new energy GmbH. |
| The line fuse trips. | – The line fuse capacity is too low.<br>– Damage to the inverter's hardware. | In cases of high insolation, the inverter can, depending on the solar generator, exceed its rated current for a short period. For this reason, the capacity of the inverter's pre-fuse should be somewhat higher than the maximum grid feed current.<br>The grid fuse immediately trips when the inverter switches to grid feed mode (after the start-up period is complete). In such a case, there is damage to the inverter's hardware. Should this be the case, the unit must be repaired by KACO new energy GmbH. |
| Noise emission from the inverter. | Particular ambient conditions | When there are unusual ambient conditions, the units may emit audible noises. The following reasons may be determining factors:<br>– Line interference or a line failure caused by particular loads (motors, machines, etc.) that are either connected to the same point on the grid or may be spatially situated nearby.<br>– In cases of dynamic weather conditions (frequent switching between sunny and cloudy conditions) or strong insolation, a light hum may be audible due to the increased power.<br>– With particular grid conditions, resonance may form between the unit's input filter and the grid which may even be audible (as a humming sound) when the inverter is switched off.<br>– People with very sensitive hearing (especially children) may be able to hear the high-frequency hum of approx. 18 kHz/9 kHz (Park version), which is caused by the inverter's operating frequency.<br>Such noise emissions do not affect the operation of the inverter. They also cannot lead to reduced efficiency, failure, deterioration or a shortening of the unit's service life. |

Table 5.1: **Reasons for faults**

If the measures described in this guide do not assist in clearing the fault, please notify your installer.

In order for our service department to respond in an appropriate and expeditious manner, some details are imperative:

**Details pertaining to the inverter**

– The unit's serial number
– Model
– A short description of the fault
– Is the error or fault reproducible? If yes, how?
– Does the error or fault occur sporadically?
– What type of insolation conditions existed?
– Time of day

**Details pertaining to the photovoltaic generator**

– Module type, manufacturer (if available, also send the data sheet)
– Number of modules in series
– Number of strings
– Generator power

# 6 Recycling and Disposal

Both the inverters and the corresponding transport packaging are primarily made from recyclable raw materials.

**Unit**

Do not dispose of faulty inverters or accessories together with household waste. Ensure that the old unit and, where applicable, any accessories are disposed of in a proper manner.

**Packaging**

Ensure that the transport packaging is disposed of in a proper manner.

Intended for use by authorised electricians

# Installation Instructions

**Powador 25000xi / 30000xi / 33000xi / M/L/XL, Park**


1 About This Documentation ....4
1.1 Retention of documents....4
1.2 Symbols used in this document ....4
1.3 CE marking....4
1.4 Name plate ....4
2 Safety Instructions and Regulations ....5
3 Notes on Installation and Operation....6
3.1 Intended use ....6
3.2 Factory warranty and liability....6
3.3 Service ....6
4 Technical Data....7
5 Device Description....11
5.1 Assembly instructions....11
5.2 Scope of delivery ....12
5.3 Dimensioning the PV generator....12
5.4 Protection concepts ....13
5.5 Powador dimensions....13
6 Installation and Start-Up....14
6.1 Selecting an appropriate place for installation....14
6.2 Installing the inverter....14
6.3 Electrical connection....15
6.4 Connecting the fault signal relay....18
6.5 The RS485 interface connection ....18
6.6 Starting up the inverter....19
6.7 Programming parameters ....19
7 Switching the Inverter Off....21
8 Maintenance ....21
8.1 Cleaning....21
8.2 Replacing the fans....22
9 Troubleshooting....22
10 Documents....25
10.1 EU Declaration of Conformity....25
10.2 Certificate ....26
10.3 Certificate of compliance ....27

# 1 About This Documentation

The following notes guide you through all of the documentation. Additional documents are applicable in conjunction with these operating and installation instructions.

We assume no liability for any damage caused by failure to observe these instructions.

**Other applicable documents**

When installing the inverters, be sure to observe all assembly and installation instructions for components and other parts of the system. These instructions are delivered together with the respective components and additional parts of the system.

## 1.1 Retention of documents

Please pass these operating and installation instructions on to the plant operator. The plant operator retains the documents. The instructions must be available whenever they are needed.

## 1.2 Symbols used in this document

When installing the inverter, observe the safety instructions provided in these installation instructions.

**DANGER**

**Failure to observe a warning indicated in this manner will directly lead to serious bodily injury or death.**

**WARNING**

**Failure to observe a warning indicated in this manner may directly lead to serious bodily injury or death.**

**CAUTION**

**Failure to observe a warning indicated in this manner may lead to minor or moderate bodily injury or to serious damage to property.**

**ATTENTION**

Failure to observe a warning indicated in this manner may lead to damage to property.

**NOTE**

Useful information and notes.

**ACTION**

This symbol indicates that a certain action is required.

**IMPORTANT**

Failure to observe this information may result in reduced convenience or impaired functionality.

## 1.3 CE marking

The CE marking is used to document that the Powador inverter shown on the name plate fulfills the fundamental requirements of the following relevant directives:

– Directive concerning electromagnetic compatibility (Council Directive 2004/108/EC)
– Low voltage directive (Council Directive 2006/95/EC).

## 1.4 Name plate

The name plate showing the exact designation of the unit is located in the inner connection area of the housing.



**Danger due to lethal voltages.**



**Risk of fatal injury from fire or explosions.**



**Risk of burns from hot housing components.**



**Disconnect the inverter from all power sources**

# 2 Safety Instructions and Regulations

**DANGER**

**Danger due to lethal voltages.**
**Lethal voltages are present within the unit and on the power supply lines. Therefore, only authorised electricians may install and open the unit.**

**Even when the unit is disconnected, high contact voltages may still be present within the unit.**

### Standards and regulations

IEC 60364-7-712:2002:
Requirements for special installations or locations – Solar photovoltaic (PV) power supply systems.

### Technical rules

The installation must be suited to the on-site conditions and comply with local regulations and technical rules.

### Accident prevention regulations

The inverter must be installed by an authorised, skilled electrician who is approved by the supply grid operator. The electrician is responsible for observing existing standards and regulations.

The proper and safe operation of this unit requires proper transportation, storage, assembly and installation, as well as careful operation and maintenance.

Only authorised electricians who have read and fully understood all of the safety instructions contained in these operating and installation instructions, as well as other instructions concerning assembly, operation and maintenance, may work on this unit.

When this unit is operating, certain parts of the unit unavoidably carry hazardous voltages, which can lead to death or serious bodily injury. The precautions listed below must be followed in order to minimise the risk of death or injury.

– The unit must be installed in compliance with safety regulations, as well as all other relevant national or local regulations. To ensure operational safety, you have to provide for proper earthing, conductor dimensioning and appropriate protection against short circuiting.

– Keep all covers on the unit closed during operation.

– Prior to performing any visual inspections or maintenance, ensure that the power supply has been switched off and is prevented from being inadvertently switched back on. Never touch the electrical connections when you have to take measurements while the power supply is switched on. Remove all jewellery from your wrists and fingers. Make sure that the testing equipment is in good and safe operating condition.

– Stand on an insulated surface when working on the unit while it is switched on, in order to ensure that there is no earthed connection.

– Follow the instructions contained in these operating and installation instructions exactly and observe all danger, warning and safety information.

– This list does not constitute a complete listing of all measures required for the safe operation of the unit. Contact your specialty dealer if any specific problems arise which are not sufficiently covered for the purposes of the buyer.

### Modifications

It is generally not permitted to make changes to the inverter. Changes to the surroundings of the inverter are only permitted if they comply with national standards.

**CAUTION**

**Risk of damage due to improper modifications.**
**Never modify or manipulate the inverter or other components of the system.**

### Transportation

The inverter is subjected to extensive testing and inspections in our test field. This is how we ensure the high quality of our products. Our inverters leave our factory in proper electrical and mechanical condition. Special packaging ensures safe and careful transportation. However, transport damage may still occur. The shipping company is responsible in such cases.

Thoroughly inspect the inverter upon delivery. Immediately notify the responsible shipping company if you discover any damage to the packaging which indicates that the inverter may have been damaged or if you discover any visible damage to the inverter.

If necessary, KACO new energy GmbH will assist you. Damage reports must be received by the shipping company in writing within six days of receipt of the goods.

When transporting the inverter, only the original packaging is to be used, as this provides for a safe transportation.

# 3 Notes on Installation and Operation

## 3.1 Intended use

The Powador inverter converts the DC power generated by the photovoltaic (PV) modules into AC power and feeds this into the power grid.
Powador inverters are built according to the state of the art and recognised safety rules. Nevertheless, improper use may cause lethal hazards for the operator or third parties or may result in damage to the units and other property.
The inverter may only be operated with a permanent connection to the public power grid. The inverter is not intended for mobile use.

Any other or additional use is not considered the intended use. The manufacturer/supplier is not liable for damage caused by such unintended use. Damage caused by such unintended use is at the sole risk of the operator.
Intended use also includes adherence to the operating and installation instructions. Some of the documents that you require in order to register your photovoltaic installation and have it approved are included in the installation instructions (see Section 10).

## 3.2 Factory warranty and liability

KACO new energy GmbH grants a warranty of seven years on Powador inverters, starting from the date of installation, but at most 90 months after shipment by KACO new energy GmbH.

During this time, KACO new energy GmbH guarantees the proper function of the units and free-of-charge repair at the factory in the event of a defect for which we are responsible.

Contact your specialty dealer if your unit exhibits a defect or fault during the warranty period.

Warranty claims are excluded in the following cases:
- Use of the units in ways not intended
- Improper installation and installation that does not comply with standards
- Improper operation
- Operation of units with defective protective equipment
- Unauthorised modifications to the units or repair attempts
- Influence of foreign objects and force majeure (lightning, overvoltage, severe weather, fire)
- Insufficient ventilation of the unit
- Failure to observe the relevant safety regulations
- Transport damage.

Warranty claims can be handled on site or at the premises of KACO new energy GmbH. If repair work is required at the factory, the unit must, where possible, be returned in its original or equivalent packaging. The costs for these services cannot be borne by KACO new energy GmbH.

KACO new energy GmbH will only perform warranty services when a complaint is filed or when the faulty unit is returned to KACO new energy GmbH together with a copy of the invoice which was issued by the dealer to the user. The name plate on the unit must be fully legible. If these requirements are not fulfilled, KACO new energy GmbH reserves the right to deny warranty services.

The warranty period for repairs or replacement deliveries is six months after delivery. However, it continues at least until the end of the original warranty period for the delivery item.

## 3.3 Service

We place special emphasis on the quality and longevity of our inverters, starting with the product development phase. More than 60 years of experience in the field of current inverters support us in this philosophy.

However, despite all quality assurance measures, faults may occur in exceptional cases. In such cases, KACO new energy GmbH will provide you with the maximum support possible. KACO new energy GmbH will make every effort to remedy such faults in an expeditious manner and without a great deal of bureaucracy. In such cases, contact our service department directly.

**Telephone +49 (0)7132-3818-660**

# 4 Technical Data

## Input – Electrical data

| Model | 25000xi | 30000xi | 33000xi |
|---|---|---|---|
| DC rated power | 30.0 kW | 37.5 kW | 39.0 kW |
| Max. PV generator power for each DC input | 10.0 kW | 12.5 kW | 13.0 kW |
| Max. number of strings | | 5 | |
| MPP range | | 350 ... 600 V | |
| No-load voltage | | Max. 800 V | |
| Monitoring Input voltage | | Stand-by from Ue > 300 V<br>Night shutdown from Ue < 250 V | |
| Max. DC input current for each string | 27.4 / 26.9* A | 32.8 / 29.2* A | 33.2 / 32.5* A |
| Polarity safeguard | | Short-circuit diode | |
| Overvoltage protection | | Varistors | |
| String fuses (versions L and XL) | | 12 A in "+" potential (10 x 38 mm) | |
| Overvoltage protection (version XL) | | Class II/"C" (medium protection) 3 varistors in Y (star) connection | |

## Output – Electrical data

| Model | 25000xi | 30000xi | 330000xi |
|---|---|---|---|
| AC rated power | 25.0 kW | 29.9 kW | 33.3 kW |
| Maximum power AC | 27.5 kW | 32.9 kW | 33.3 kW |
| Line voltage | See Section 4 – Technical Data – Country-specific parameters | | |
| Rated current | 36.2 A | 43.3 A | 48.3 A |
| Max. current | 39.9 A | 47.7 A | 48.3 A |
| Power factor | | ≈1 | |
| Frequency | See Section 4 – Technical Data – Country-specific parameters | | |
| Distortion factor<br>according to VDE0383 | | < 3 % at rated power<br>< 5 % over the entire range | |
| Fault signal relay | Potential-free NO contact (make contact), max. 30 V / 1 A | | |

***Park Version**

## Inverter – Electrical data

| Model | 25000xi | 30000xi | 33000xi |
|---|---|---|---|
| Maximum degree of efficiency | 96.5 % / 97.4 %* | | |
| European degree of efficiency | 96.0 % / 97.0 %* | | |
| Internal consumption | Night shutdown: 7 W<br>Operation: < 120 W | | |
| Minimum grid feed power | 120 W | | |
| Circuit design | Self-inverted, transformerless | | |
| Clock frequency | 18 kHz / 9 kHz* | | |
| Principle | 3 single-phase full bridges with IGBT technology | | |
| Grid monitoring | 3-phase monitoring | | |

## Inverter – Mechanical and technical data

| Model | 25000xi | 30000xi | 33000xi |
|---|---|---|---|
| Visual displays | LEDs: PV generator (green)<br>Grid feed (green)<br>Fault (red)<br>LCD (2 x 16 characters) | | |
| Controls | 2 keys for operating display | | |
| Connections | AC connection via screw terminals<br>Bushing 1 x M40<br>DC connection via screw/spring terminals<br>Bushing 8 x M32 (with 4 sealing inserts) | | |
| Ambient temperature | –20 to +60 °C (> 40 °C power derating at high ambient temperatures) | | |
| Temperature monitoring | >75 °C temperature-dependent impedance matching<br>>85 °C Disconnection from the grid | | |
| Interface | RS485 | | |
| Cooling | Forced-air cooling (variable speed fan, max. 600 m³/h) | | |
| Cooling for the Park version | Forced-air cooling (fan with external power supply, max. 600 m³/h) | | |
| Protection class | IP54 according to EN 60529 | | |
| Noise emission | 58 dB (A) due to fan operation<br>(measured at maximum fan speed) | | |
| Housing | Steel plating | | |
| Dimensions W x D x H | 835 x 340 x 1,460 mm | | |
| Weight | 190 kg | | |

***Park Version**

## Country-specific setting of parameters

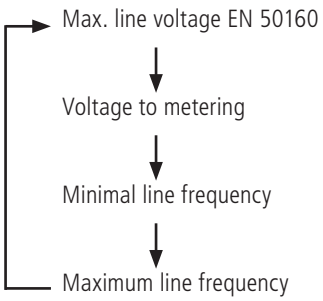
| Parameter → / ↓ Country | Line voltage range [V]) | Line voltage according to EN 50160 [V] | Standard frequency range [Hz] | Switch-on value after a re-start [s] | Reset time after insufficientgrid feed power [s] | Reset time after a fault [s] |
|---|---|---|---|---|---|---|
| **Germany** | 190 ... 264 | 253 | 47.5 ... 50.2 | > 60 | > 180 | > 30 |
| **Spain** | 196 ... 254 | – | 49.0 ... 51.0 | > 180 | > 180 | > 180 |
| **Italy** | 190 ... 264 | – | 49.7 ... 50.3 | > 180 | > 180 | > 30 |
| **France** | 190 ... 264 | 253 | 49.5 ... 50.5 | > 60 | > 180 | > 30 |
| **Cyprus (GR)** | 208 ... 252 | – | 49.5 ... 50.5 | > 180 | > 180 | > 180 |
| **Greece** | 190 ... 264 | – | 49.5 ... 50.5 | > 180 | > 180 | > 180 |
| **South Korea** | 194 ... 242 | – | 59.7 ... 60.3 | > 360 | > 360 | > 360 |
| **Czech Republic** | 196 ... 252 | 253 | 47.0 ... 51.0 | > 60 | > 180 | > 30 |
| **Portugal** | 196 ... 264 | 253 | 47.0 ... 51.0 | > 60 | > 180 | > 30 |
| **Bulgaria** | 196 ... 264 | – | 47.0 ... 51.0 | > 60 | > 180 | > 30 |
| **India** | 204 ... 264 | 253 | 47.5 ... 52.5 | > 60 | > 180 | > 30 |
| **Australia** | 200 ... 264 | – | 44.0 ... 55.0 | > 60 | > 60 | > 60 |
| **Israel** | 204 ... 264 | – | 44.0 ... 55.0 | > 60 | > 60 | > 60 |
| **China** | 190 ... 264 | – | 49.5 ... 50.5 | > 180 | > 180 | > 180 |
| **Malaysia** | 190 ... 264 | – | 49.5 ... 50.5 | > 180 | > 180 | > 180 |
| **Taiwan** | 194 ... 242 | – | 59.7 ... 60.3 | > 360 | > 360 | > 360 |

**The switch-on times after a re-start, a fault or after insufficient grid feed power are approximate values.**

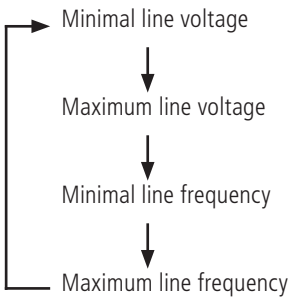
## Country-specific parameter menu

| Parameter menu → / Country ↓ | A | B |
|---|---|---|
| Germany | X | |
| Spain | | X |
| Italy | | X |
| France | X | |
| Cyprus (GR) | | X |
| Greece | | X |
| South Korea | | X |
| Czech Republic | X | |
| Portugal | | X |
| Bulgaria | | X |
| India | | X |
| Australia | | X |
| Israel | | X |
| China | | X |
| Malaysia | | X |
| Taiwan | | X |

### Parameter menu A




### Parameter menu B




**Parameters are explained in Section 6.7**

# 5 Device Description

## 5.1 Assembly instructions

Description of the design and dimensions for the Powador 25000xi / 30000xi / 33000xi (Dimensions expressed in mm / Scale 1:15, when printed on DIN A3)

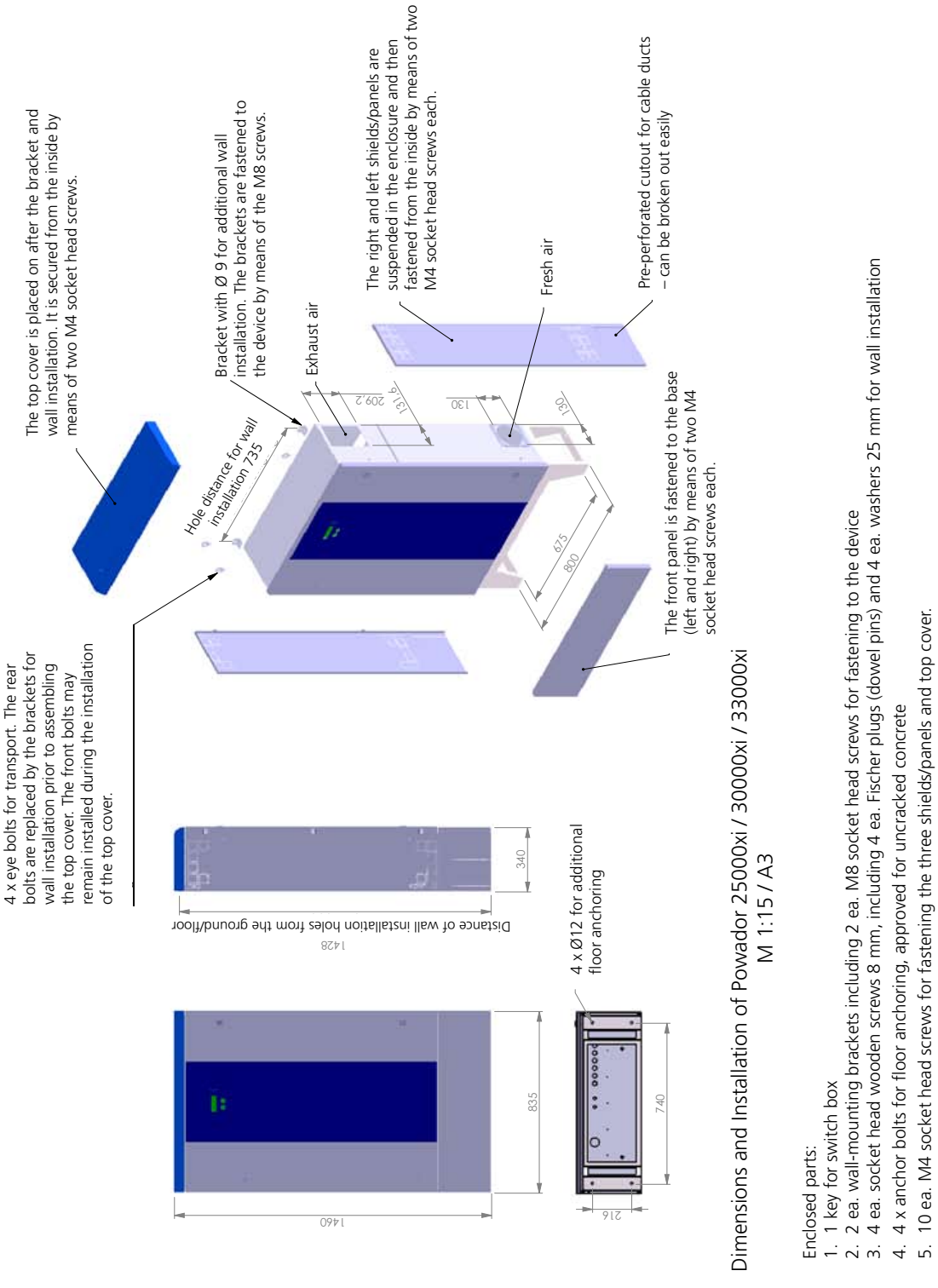



Figure 5.1: **Description of the design and dimensions**

First mount the unit on the wall. Then attach the side pieces (A) and the panel (B).




Figure 5.2: **Installing the Powador**

**CAUTION**

**Incorrect use is prohibited.**

## 5.2 Scope of delivery

– Powador
– Wall bracket
– Installation kit
– Documentation

## 5.3 Dimensioning the PV generator

The selection of the PV generator is of central importance when dimensioning a PV installation. When doing so, you must be sure that the solar generator is also compatible with the inverter.
Observe the data provided in the data sheet (see Section 4, Technical Data) when dimensioning the solar generator.

**NOTE**

KacoCalc PRO, a dimensioning program for the easy selection of PV modules, can be downloaded at no cost at the following address:
http://www.kaco-newenergy.de

### Dimensioning the PV generator

The inverters are equipped with three separate generator inputs, each with its own MPP tracker.

**IMPORTANT**

The power difference between the three PV generators must not exceed 4 kWp.
Failure to comply with this guideline can lead to power limitation, thereby reducing the yield.

The number of PV modules connected in series must be selected in such a way that the output voltage of the PV generator stays within the permitted input voltage range of the inverter – even during extreme outside temperatures. In Central Europe, module temperatures between -10 °C and +70 °C should be assumed. Depending on the way in which the modules are installed and the geographic location, +60 °C or +70 °C should be used when calculating the voltage. The temperature coefficients of the solar modules should be taken into account. The following criteria must be met for calculating the voltage of the PV generator:

– Uo (-10 °C) < max. input voltage (800 V).Even at very low outside temperatures (-10 °C), the no-load voltage of the connected string must lie within the permitted input voltage range. If the temperature falls from 25 °C to -10 °C, the no-load voltage in 12 V modules increases by approx. 2.8 V per module (5.6 V for a 24 V module). The no-load voltage of the entire string must be less than 800 V.

– UMpp (+60 °C) > min. input voltage (350 V)Even at very high module temperatures (+60 °C), the MPP voltage of the connected string should lie within the permitted input voltage range. If the temperature increases from 25 °C to 60 °C, the MPP voltage in 12 V modules decreases by approx. 3.6 V per module (7.2 V for a 24 V module). The MPP voltage of the entire string should be at least 350 V.

If the MPP voltage moves outside of the permitted input range, the installation still functions properly. In this situation, the maximum possible amount of power is not fed into the grid; instead, a small amount less is fed.

Provided that the input voltage is within the permitted input voltage range, the inverter will not be damaged if a connected PC generator provides current that is above the max. usable input current.

If the PV generator briefly provides more than the inverter's max. PV generator power, especially with changing cloud cover and relatively low module temperatures, the inverter may switch off due to safety reasons and automatically switch on again after a country-specific waiting period (see Section 4, Technical Data). The overload status is shown by a red LED and as plain text on the display. Under normal circumstances, the dynamic control of the inverter ensures that the inverter continues to operate without interruption.

The solar generator still represents the largest factor in the cost of a solar installation. For this reason, it is extremely important to obtain maximum energy yields from the solar generator. To achieve this, solar generators in Central Europe should be oriented to the south at an angle of inclination of 30°. They should never be shaded.
This orientation is quite often not possible due to structural reasons. In order to achieve the same energy yield as an optimally oriented solar generator (south, 30° angle of inclination), the solar generator power can be increased. For roofs with an east-west orientation, we recommend a two-string PV installation. To achieve an optimum yield from the installation, the first string must be installed on the east side of the roof; the second string on the west side.
For exposed locations in mountains or in southern regions, we recommend that the generator power be reduced appropriately. Please consult with us or your specialty dealer about this matter.

## 5.4 Protection concepts

The following monitoring and protective functions are integrated into Powador inverters:
- Redundant 3-phase grid monitoring for operator protection and to avoid islanding in accordance with VDE 0126-1-1
- Overvoltage conductors/varistors to protect the power semiconductors from high-energy transients on the grid side
- Temperature monitoring of the heat sink
- EMC filters to protect the inverter against high-frequency line interference
- Grid-side varistors to earth to protect the inverter against burst and surge pulses
- AC/DC-sensitive residual current circuit breaker (RCD type B switch), which monitors the leakage current from the Powador's grid connection to the PV generator and breaks the circuit when the residual current exceeds 30 mA. The RCD type B switch triggers when a cable has a fault in the insulation, a frame fault or an earth fault
- Overvoltage protection on the DC side (only in the XL version).The XL version of the inverter is equipped with an additional internal overvoltage protection for the DC side. The desired protection level is only achieved if a lightning protection zone concept exists for the DC side in accordance with the country-specific standards or regulations. The components pertaining to the lightning protection zone concept are not included in the scope of delivery.

## 5.5 Powador dimensions




Figure 5.1: **Powador dimensions**

| Model | Height | Width | Depth |
|---|---|---|---|
| 25000xi to 33000xi | 1,460 mm | 835 mm | 340 mm |

# 6 Installation and Start-Up

**WARNING**

**Risk of fatal injury from fire or explosions. The Powador's housing may become hot during operation.**
- **Do not mount the Powador on flammable materials.**
- **Do not install the Powador in areas which contain highly flammable materials.**
- **Do not install the Powador in explosion-prone areas.**

**CAUTION**

**Risk of burns from hot housing components. Install the Powador so that unintentional contact with it is not possible.**

## 6.1 Selecting an appropriate place for installation

**NOTE**

Powador inverters meet the requirements of protection class IP54 if all cable feedthroughs are used or suitably closed off and the cover and side pieces are installed.

The units should be installed in areas that are as dry as possible in order to extend their service life. In addition, be sure that the units are installed in climate-controlled areas in order to protect them from overheating. This extends their service life. When selecting the inverter's place of installation, attention should be paid to the following items:
- Ensure good access to the unit for installation or any service work that may later be required.
- Maintain the following minimum clearances around the unit:
  1,000 mm side clearance to other units,
  700 mm clearance to other stacked units,
  500 mm to cabinets, ceilings, etc.
- The unit has been designed for vertical upright installation
- Air must be allowed to circulate freely around the sides of the housing
- Make sure that heat can be sufficiently dissipated from the place of installation. You may have to furnish the room with forced-air circulation (450 m³/h)
- Make sure that the foundation (on which the inverter is installed) has adequate load-bearing capacity
- In areas prone to flooding, be sure to install the inverter in a sufficiently elevated place.

**IMPORTANT**

Due to the high system voltage, the current that flows on the DC side is lower than that flowing on the AC side. If the cable cross-sections are the same, losses on the AC side are therefore higher than those on the DC side. For this reason and due to thermal factors, it makes sense to position the inverter near the meter.

## 6.2 Installing the inverter

The inverters are supplied with an installation kit that comprises two angle brackets, two threaded screws, four washers, two carriage bolts, and two dowels. Check the composition and condition of the wall before installation. If necessary, use an installation kit other than the one shipped with the inverter.

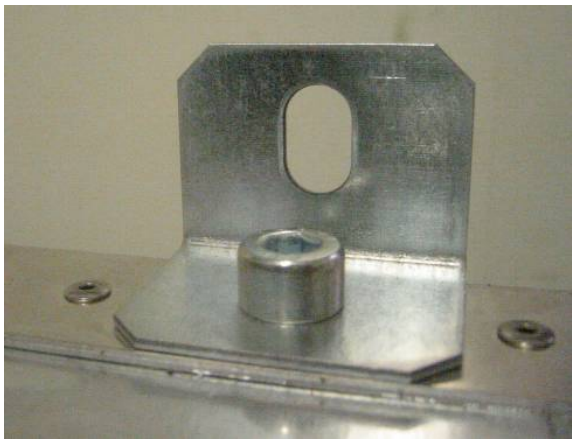


Figure 6.1: **Powador angle bracket**

**ACTION**
- Place the inverter directly on the wall
- Attach the angle brackets
- Drill the holes for the dowels in accordance with the locations of the angle brackets
- Place the dowels into the holes
- Bolt down the angle brackets to the wall.

**CAUTION**

**The angle brackets must be attached correctly to ensure that the unit is securely mounted.**

**NOTE**

Two units can be mounted back to back.

## 6.3 Electrical connection

### General information

After the inverter has been installed in its fixed location, the electrical connection to the unit can be established.

**DANGER**

**The Powador may be installed only by trained and authorised specialists.**

You must adhere to all mandatory safety regulations, the currently required technical connection specifications of the responsible electrical supply company, as well as other generally applicable local regulations.

To connect the inverter, the AC and DC side must be disconnected from all power sources and secured against being inadvertently switched back on. The connection of the PV generator and the grid connection are established via connection terminals in the connection box of the inverter (see Figure 6.2).

**ACTION**

The door of the housing must be opened to do this. The door is held shut by two control cabinet locks on the right side of the housing.

**NOTE**

Maximum connection cross-sections:

| | | |
|---|---|---|
| AC: | rigid 35 mm², flexible | 25 mm² |
| DC: | Version M | 16 mm² |
| | Versions L and XL | 10 mm² |

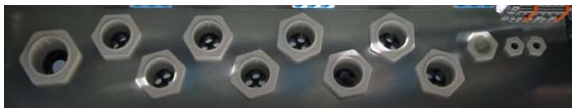


Figure 6.2: **Powador connection box**

### AC/DC-sensitive residual current circuit breaker RCD type B

The inverter is equipped with an AC/DC-sensitive residual current circuit breaker. If there is an impermissible residual current, the inverter is disconnected from the grid. An external residual current circuit breaker is, in compliance with the applicable directives in the respective country, not required if a corresponding low-resistance earthing of the unit is possible.

### Grid connection

The grid connection is made using 5 conductors (L1, L2, L3, N, PE). There is an M40 cable fitting on the underside of the housing for inserting the leads.

We recommend cable cross-sections of 16 mm² for cable lengths up to 20 m. Larger cross-sections should be used for longer leads.

For fuse protection, use 63 A safety fuses for each phase.

**CAUTION**

**This is a Class A device. Operating it in residential areas can cause radio disturbances. In this case, the operator may demand that appropriate measures be undertaken.**

**NOTE**

Be sure to use cables with a sufficiently large cross-section to avoid excessive line impedance between the building's distribution box and the respective Powador unit.
When the line impedance is high, i.e. with longer AC-side leads, the voltage at the grid terminals of the inverter will increase as power is being fed into the grid. The inverter measures this voltage. If the voltage at the grid terminals exceeds the line overvoltage limit, the inverter will switch off due to line overvoltage. This must be taken into consideration when wiring the AC and dimensioning the AC lead.

**DANGER**

**Risk of electric shock at live connections.
Check that the power lead is voltage-free before inserting it into the unit.**

**ACTION**

Guide the lead, which has been stripped of its jacket and insulation, through the cable fitting.
Connect the lead, which has been stripped of its jacket and insulation, as shown on the label of the mains filter, on the left side.
Use an appropriate cable lug to connect the protective earth to the marked threaded bolt.

**CAUTION**

**Check that the leads are properly connected. Exchanging L and N will destroy the inverter.**

**ACTION**

Once again, check that all connected leads are firmly connected.
Tighten the cable seal of the cable fitting.

External power supply for the fan (only on the Park version)

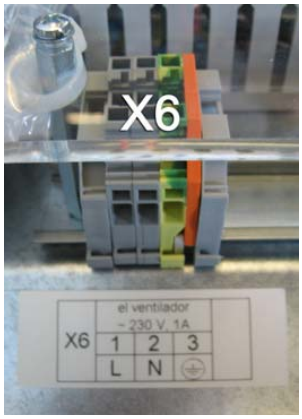



Figure 6.3: **External power supply**

The 230VAC1A power supply for the fan is connected to terminal X6.
The extra power supply must be protected by a maximum of 6 A on-site.

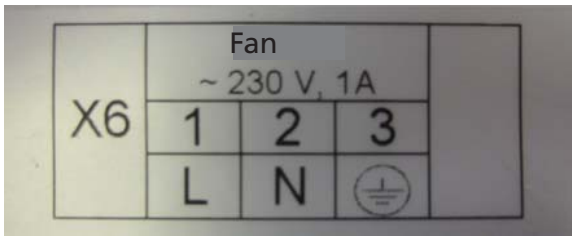



Figure 6.4: **Terminal label for the external power supply**

**PV generator connection**

The PV generator leads are connected in the connection box.

**DANGER**

**To ensure maximum protection against hazardous contact voltages while assembling photovoltaic installations, both the positive and the negative leads must be strictly isolated electrically from the earth potential (PE).**

**ATTENTION**

Risk of damage.
Ensure that the polarity is correct when connecting the unit.

## ACTION

**Before connecting the PV generator to the Powador, check that the PV generator is not earthed.**

– Measure the DC voltage between protective earth (PE) and the positive lead and the protective earth (PE) and the negative lead of the PV generator. **If stable voltages can be measured, there is an earth fault in the PV generator or its wiring. The ratio between the measured voltages gives a clue as to the location of this fault. This fault must be remedied before taking any further measurements.**

– Measure the electrical resistance using a tester (an insulation resistance meter) between the protective earth (PE) and the positive lead and the protective earth (PE) and the negative lead of the PV generator. **Low resistance (< 2 MΩ) indicates a high-impedance ground fault of the PV generator, which must be fixed prior to continuing with the installation.**

## CAUTION

**The voltage of the solar generator must be measured before connecting the DC leads to the inverter terminals. The DC voltage must not exceed 800 $V_{DC}$. Connecting to a higher voltage will destroy the unit.**

Depending on the version, there are two ways to connect the three PV generators.

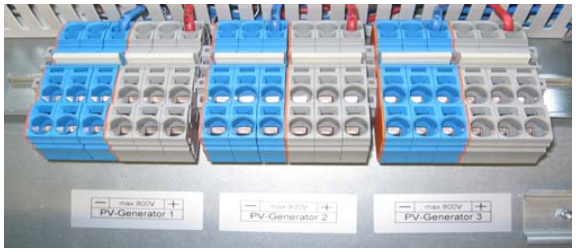



Figure 6.5: **DC connections for version M**

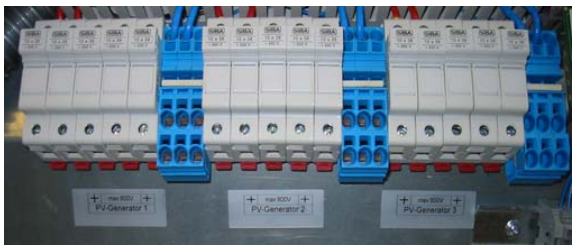



Figure 6.6: **DC connections for versions L and XL**

## CAUTION

**The three PV generators must absolutely be wired separately.**
**Any connection between the generators (e.g. due to a wiring error) can destroy the unit.**

## ACTION

Unscrew the cable fittings until you can insert the cables through the fitting. Guide the leads through the cable fittings and clamp the cable ends to the grey connection terminals (or string fuses) labeled "PV+" and blue connection terminals labeled "PV-". When doing this, ensure that the polarity is correct. Tighten the cap of the cable fitting.

## NOTE

To activate the unit, a DC disconnector for each DC input is located in the inside of the inverter door.

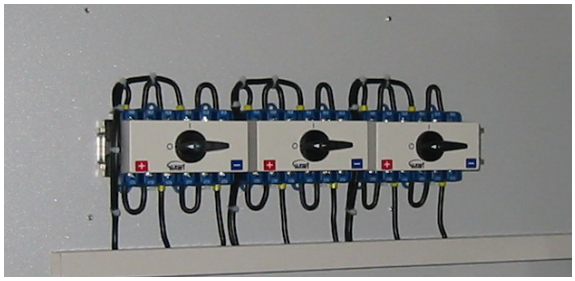


Figure 6.7: **DC switch**



Figure 6.8: **Overvoltage protection for the DC side (only in the XL-Version)**

**ATTENTION**

To achieve protection class IP54, unused cable fittings must be closed off by using the included blind caps.

## 6.4 Connecting the fault signal relay

The solar inverter is equipped with a potential-free relay contact in order to signal faults. This contact closes if a fault occurs. Maximum contact load: 30 V/1 A.

**IMPORTANT**

In the event of a Phase L1 failure (power failure on the public grid), the relay will not trigger. If this happens, all LEDs and the display go out. The inverter is shut down completely. A failure signal cannot be sent.

**NOTE**

In order to avoid contact problems, you have to strip enough insulation to ensure a secure connection. The connection must be made without the wire sleeves.

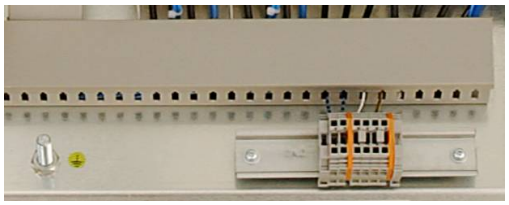


Figure 6.9: **X1 terminal strip**

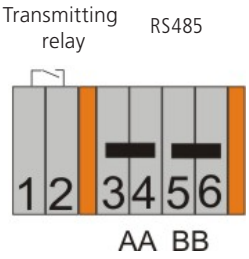



Figure 6.10: **Connection terminals for the RS485 interface**

## 6.5 The RS485 interface connection

The X1 terminal strip with six terminals (Figure 6.10) is located in the Powador connection box. To connect several Powadors, terminal A of one Powador is connected to terminal A of the other Powador. Terminal B is connected in the same manner. A twisted, shielded data cable, such as an ISDN cable, is required for this. The connection to the Powador -proLOG is established similarly to the interconnection of inverters.
A connection diagram is displayed in Figure 6.11. The length of the RS485 wiring should not exceed a total of 250 m.

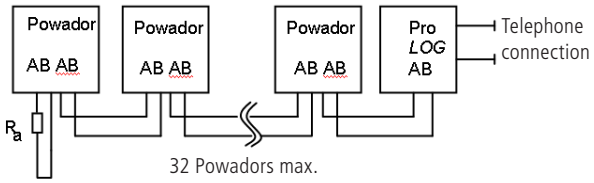



Figure 6.11: **Connection diagram for the RS485 interface**

In Figure 6.11, a terminating resistor (Ra) with 330 Ω is connected to the left inverter. For proper signal transmission, the last unit in a chain must have a terminating resistor. A terminating resistor is included with each Powador inverter.

With a bus system such as RS485, each device sharing this bus must possess a unique address, regardless of whether it is an inverter or a current sensing device (Powador-go). Inverters may have an address range from 1 to 32. You can define the address for each inverter via the configuration menu (see Operating Instructions).

**IMPORTANT**

Ensure that the A and B wires are properly connected. Communication is not possible if the wires are exchanged.

## 6.6 Starting up the inverter

After completing the mechanical and electrical installation, the inverter is put into operation as follows:

**ACTION**

– Switch on the line voltage (via the external circuit breakers).
– Switch on the solar generators using the three DC disconnectors (0 ⟶ 1).

The green "PV generator" LED will then light up (provided the generator voltage is greater than 300 V). The display now indicates the current generator voltages: "Start at 410 V". When all three measured voltages are greater than 410 V,the unit begins feeding into the grid. If the power being fed into the grid is too low, grid feed mode is interrupted for a country-specific amount of time (see Section 4, "Technical Data"). This interruption period is required in order to ensure that the generator voltage is continuously above the power delivery limit of 410 V.
The green "Feeding grid" LED indicates when the amount of power being into the grid is high enough. The display now shows the power being fed to the grid. The "Display" Key can now be used to display the various measured values (see Operating Instructions).

## 6.7 Programming parameters

Various operating parameters can be set in the programming mode of Powador xi units.

**DANGER**

**Disconnect the inverter from all power sources before opening the housing.**

**WARNING**

**Incorrect parameter settings will lead to a loss of function, render your Safety Certificate ["Unbedenklichkeitsbescheinigung"] invalid, and result in the loss of the safety functions.**

**Modifications may only be made in exceptional cases and only after having consulted with the manufacturer and the power supply company.**

**ACTION**

In order to access programming mode, you have to switch a jumper on the display circuit board (see Figure 6.12). Switch the jumper as shown in Figure 6.14 to access the display and programming modes.

**NOTE**

To save your changes, confirm the menu item "Save parameters" with "Yes".

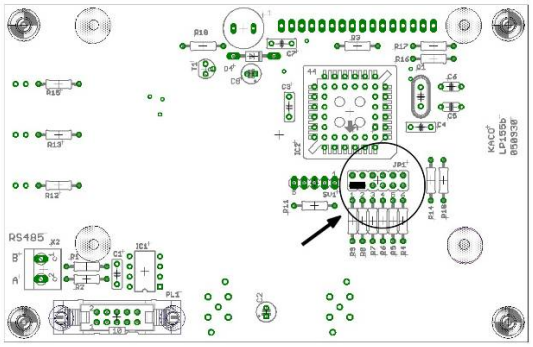


Figure 6.12: **Jumper position to switch between programming mode and grid feed mode**

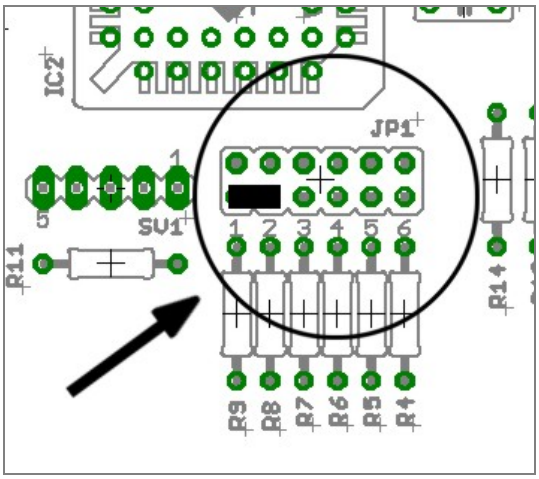



Figure 6.13: **Jumper position in normal grid feed mode (factory setting)**

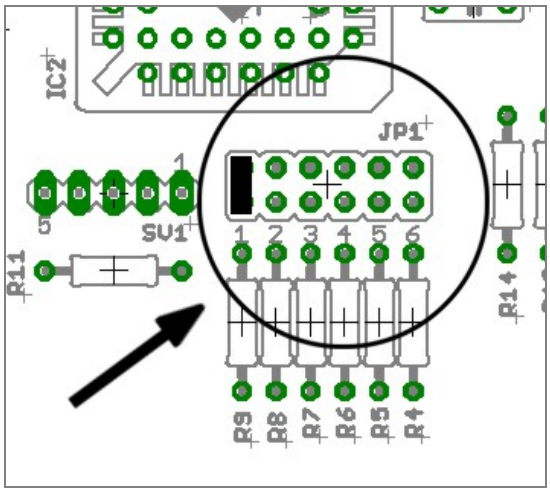



Figure 6.14: **Jumper position in programming mode**

**ACTION**

Close the unit back up. To access programming mode, press both keys at the same time. After approx. 2 seconds, the first configuration parameter will appear on the display. Use the "Display" key to scroll through the various menu items. The menu is continuous. When you reach the end, the display automatically jumps back to the first item.

**Parameter menus A and B are country-specific and can be found in**

- Section 4
- Technical Data
- Country-specific parameter menu

**ACTION**

Use the "Settings" key to change the parameter that is shown. When doing so, the value increases or decreases, depending on the parameter. The values here are also continuous, i.e. after you reach the maximum value, they jump back to the minimum value.

**Explanation of individual parameters:**

**Parameter menu A**

– Max. LineVoltage EN50160: The line voltage is averaged over 10 minutes. If the set value is exceeded, the inverter is disconnected from the grid. The voltage threshold can be set at 244 V or 253 V under "MAX. LINEVOLTAGE EN50160".

– Under "VOLTAGE TO METERING", the limit value can be set between 0 V and 11 V in 1 V increments. This voltage drop between the inverter and the grid-feed meter is added to the limit value of "Max. LineVoltage EN50160". With a line voltage of 253 V and a voltage drop of 5 V, the Powador switches off if the average line voltage over a ten-minute period is greater than 258 V.

– Minimum and maximum line frequency: the line frequency is also monitored. If the frequency drops below the value set in "MINIMAL LINE FREQUENCY" or exceeds the value set in "MAXIMUM LINE FREQUENCY", the inverter switches off. Both limit values can be set in 0.1 Hz increments. (Section 4, Technical Data, Country-specific setting of parameters).

**Parameter menu B:**

– Minimal line voltage: The inverter is equipped with redundant 3-phase monitoring. When the line voltage drops below the value set for "Minimal line voltage", the inverter switches off. The minimum cut-off threshold can be set in 2 V increments.

Maximum line voltage: When the line voltage exceeds the value set for "Maximum line voltage", the inverter switches off. The cut-off threshold can be set in 2 V increments.

– Minimum and maximum line frequency: the line frequency is also monitored. If the frequency drops below the value set in "Minimal Line Frequency" or exceeds the value set in "Maximum Line Frequency", the inverter switches off. Both limit values can be set in 0.1 Hz increments.

**ACTION**

Disconnect the inverter from all power sources and switch the jumper back to its initial state.

# 7 Switching the Inverter Off

The inverter must be switched off to adjust settings and for maintenance and repair work. This is done as follows:

**DANGER**

- **Risk of fatal injury by electric shock at live connections.**
- **Lethal voltages are still present in the inverter even after the electrical connections have been disconnected.**
- **Wait 30 minutes before reaching into the inverter.**
- **When working on the photovoltaic modules, you must always disconnect the DC disconnector at all poles in addition to disconnecting from the grid.**
- **Disconnecting the line voltage is not enough.**

**ACTION**

- Disconnect the line voltage (switch off the external circuit breakers).
- Disconnect the PV generators using the DC disconnector.
- Make sure that the line connection terminals of the inverter are voltage-free.

# 8 Maintenance

## 8.1 Cleaning

Depending on the ambient conditions, the cooling duct must be cleaned at regular intervals. The cover panels can be removed for this purpose.

**WARNING**

**Before you do this, disconnect the inverter from all power sources (see Section 7).**



Figure 8.1: **Air intake**

**ACTION**

- Switch off the inverter (see Section 7)
- Remove the side cover panels
- Vacuum the ventilation shaft to clean it out.
- Replace the side cover panels.

## 8.2 Replacing the fans

The inverter is equipped with high-quality ball-bearing fans. However, should you need to replace the fans, proceed as follows:

Before you replace the fans, you will first have to remove the side pieces (B) and the roof (C) (see Figure 8.2).

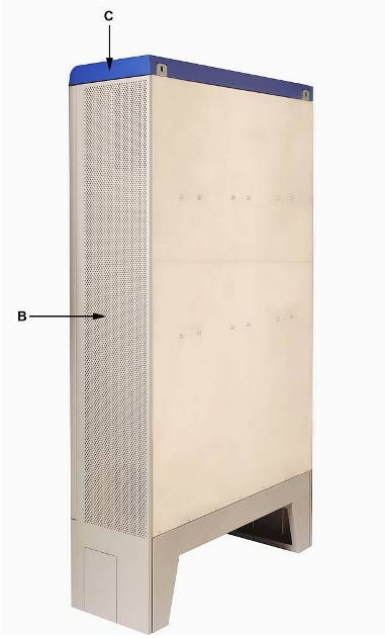



Figure 8.2: **Preparation for fan replacement**

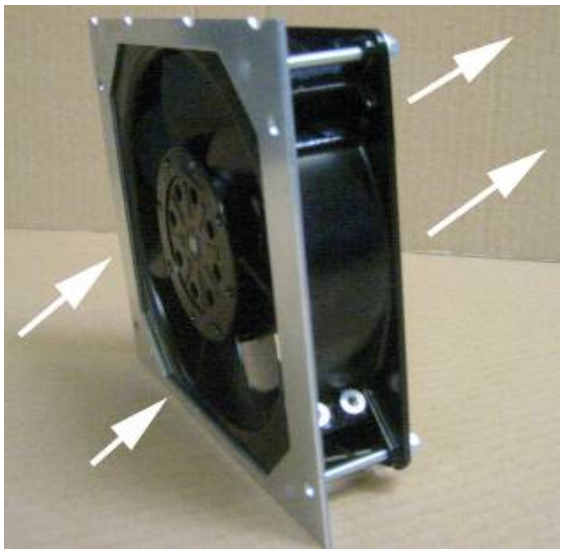


Figure 8.3: **Air flow direction**

**ACTION**

- Switch off the inverter (see Section 7)
- Remove the roof and side pieces
- Disconnect the connection leads at terminals X3 and X4 in the inside of the unit
- Unfasten the ventilator plate
- Pull back the connection leads through the rubber grommet.
- Replace the fan
- When you do so, pay attention to the air flow direction.
- Guide the connection leads through the rubber grommets and connect them to terminals X3 and X4.
- Replace the ventilator plate. CAUTION: When you install the lower air inlet grille, make sure that the connection leads for the fans are not pinched.

# 9 Troubleshooting

In line with our ever-growing quality assurance system, we endeavour to eliminate all errors and faults. You have purchased a product which left our factory in proper condition. Endurance tests as well as extensive tests for the purpose of assessing the operating performance and the protective equipment have been successfully undertaken with each individual unit.

If your photovoltaic installation does not function properly, we suggest the following troubleshooting procedures:
The first step is to check that the solar generator and grid connections are properly connected to the Powador. In doing so, observe all the safety instructions specified in this manual. Monitor the inverter closely and, where applicable, make a note of display indications and LED displays.

The following faults may occur and should be remedied as described:

| Fault | Cause of fault | Troubleshooting / Explanation |
|---|---|---|
| Inverter displays an impossible daily peak value. | Faults in the line voltage. | The inverter continues to operate as normal without losses to the yield, even when an erroneous daily peak value is displayed. The value is reset overnight. (To immediately reset the value, the inverter must be switched off and switched on again by disconnecting it from the grid and switching off the DC.) |
| Daily energy yields do not correspond with the yields on the energy supply company's grid feed meter. | Measuring elements' tolerances in the inverter. | A measurement error occurs due to the measuring elements' tolerances. The tolerances of the individual measured values can be found in the operating instructions. The daily energy yield may deviate from the yield on the grid feed meter by up to 15 %. If the deviation is higher, the unit must be repaired by KACO new energy GmbH. |
| The line fuse trips. | – The line fuse capacity is too low.<br>– Damage to the inverter's hardware. | In cases of high insolation, the inverter can, depending on the solar generator, exceed its rated current for a short period. For this reason, the capacity of the inverter's pre-fuse should be somewhat higher than the maximum grid feed current.<br>The grid fuse immediately trips when the inverter switches to grid feed mode (after the start-up period is complete). In such a case, there is damage to the inverter's hardware. Should this be the case, the unit must be repaired by KACO new energy GmbH. |
| The display is blank. | – The unit is in night shutdown mode.<br>– There is no line voltage.<br>– The solar generator voltage is lower than 300 V. | The inverter switches off overnight. If the display does not light up during the daytime, check the grid feed meter to see if the grid is nevertheless being fed into. If the grid is being fed into, the display module is faulty. The inverter must be repaired by KACO new energy GmbH. |
| The inverter will not start. | – The unit is in night shutdown mode.<br>– There is no line voltage.<br>– The solar generator voltage is lower than 410 V. | The inverter switches off overnight. If the display does not light up during the daytime, check the grid feed meter to see if the grid is nevertheless being fed into. If the grid is being fed into, the display module is faulty. The inverter must be repaired by KACO new energy GmbH. If the grid is not being fed into, you should check whether there is any line voltage and whether the solar generator voltage is greater than 410 V. If both are the case and the inverter still does not feed into the grid, the unit must be repaired by KACO new energy GmbH. |
| The inverter is active but does not feed into the grid. Display shows: "Start at 410 V meas. xxx V" | Not enough generator voltage available. The measured voltage is lower than 410 V. | After sunrise, at sunset and when there is not enough solar insolation due to bad weather conditions, the generator voltage or the generator power may be too low to be able to feed in. |
| The inverter is active but does not feed in – the display shows: "Start at 410 V meas. xxx V" (measured voltage is greater than 410 V)) | The inverter has interrupted the grid feed due to a fault. | After an interruption to the grid feed due to a fault (line failure, overtemperature, overload, etc.), the inverter waits approx. 15 seconds before switching over to grid feed mode. With faulty grids, the inverters may even shut down during the day. Notify your solar installer if the inverter shuts down regularly over a period of several weeks (more than 10 times per day). |

| Fault | Cause of fault | Troubleshooting / Explanation |
|---|---|---|
| The inverter stops the grid feed mode shortly after being switched on, although there is sufficient sunlight. | Faulty grid separation relay in the inverter. | Although there is sufficient sunlight, the inverter feeds into the grid only for a few seconds before switching off again. During the short grid feed period, the inverter shows that the power being fed into the grid is between 0 and 5 W. If the inverter is definitely receiving sufficient generator power, the grid separation relay is presumably faulty, thus preventing the inverter from connecting. |
| Noise emission from the inverter. | Unusual ambient conditions. | When there are unusual ambient conditions, the units may emit audible noises. The following reasons may be determining factors:<br><br>– Line interference or a line failure caused by particular loads (motors, machines, etc.) that are either connected to the same point on the grid or may be spatially situated nearby.<br>– In cases of dynamic weather conditions (frequent switching between sunny and cloudy conditions) or strong insolation, a light hum may be audible due to the increased power.<br>– With particular grid conditions, resonance may form between the unit's input filter and the grid which may even be audible when the inverter is switched off.<br>– People with very sensitive hearing (especially children) may be able to hear the high-frequency hum of approx. 18 kHz/9 kHz (Park version), which is caused by the inverter's operating frequency.<br><br>Such noise emissions do not affect the operation of the inverter. They also cannot lead to reduced efficiency, failure, deterioration or a shortening of the unit's service life. |

If the measures described in this guide do not assist in clearing the fault, please notify your installer.

In order to enable our factory customer support team to respond in an appropriate and expeditious manner, some details are imperative:

**Details pertaining to the inverter**
– The unit's serial number
– Model
– A short description of the fault
– Is the error or fault reproducible? If yes, how?
– Does the error or fault occur sporadically?
– What type of insolation conditions existed?
– Time of day

**Details pertaining to the photovoltaic generator:**
Module type, manufacturer (if available, also send the data sheet)
– Number of modules in series
– Number of strings
– Generator power

# 10 Documents

## 10.1 EU Declaration of Conformity

| | |
|---|---|
| **Name and address of the manufacturer:** | **KACO new energy GmbH**<br>Carl-Zeiss-Str. 1<br>74172 Neckarsulm, Germany |
| **Product description:** | **Photovoltaic grid feed inverter** |
| **Type description:** | **Powador 25000xi / 30000xi / 33000xi** |

This is to confirm that the devices stated above are compliant with the protection requirements set forth in the EU Council Directive as of 15 December 2004 for the Harmonization of Legal Stipulations of the Member States concerning Electromagnetic Compatibility (2004/108/EC) and the Low Voltage Directives (2006/95/EC).

The devices are compliant with the following standards:

| | |
|---|---|
| **2006/95/EC**<br>"Directive concerning electrical equipment designed for use within certain voltage limits" | **Safety of the device:**<br>EN 60950-1:2006<br>EN 50178:1997*<br>* regarding clearance and creepage distances |
| **2004/108/EC**<br>"Directive concerning electromagnetic compatibility" | **Interference immunity:**<br>EN 61000-6-1:2007<br>EN 61000-6-2:2005<br>**Emitted interference:**<br>EN 61000-6-4:2007<br>**Secondary effects on the grid:**<br>EN 61000-3-11:2000<br>EN 61000-3-12:2005 |

Therefore, the types stated above are labelled with the CE marking.

Any unauthorised modifications to the supplied devices and/or any use for other than for the intended purposes shall render this Declaration of Conformity null and void.

Neckarsulm, 01.02.2009
KACO new energy GmbH



ppa. Matthias Haag
Head of Grid-Coupled Systems Division

## 10.2 Certificate

**BV E&E Product Services GmbH**
Businesspark A96
86842 Türkheim
Germany

# Zertifikat
# Certificate

| | |
|---|---|
| **Antragsteller:**<br>Applicant: | **KACO new energy GmbH**<br>Gottfried-Leibniz-Str.1<br>**74172 Neckarsulm**<br>Deutschland |
| **Hersteller:**<br>Manufacturer: | As above |
| **Produkt Typ:**<br>Product type: | Solar Inverter |
| **Modell:**<br>Model: | POWADOR 20000xi, 25000xi, 30000xi and 33000xi |

| **Leistung:** Ratings: | **POWADOR 20000xi** | **POWADOR 25000xi** | **POWADOR 30000xi** | **POWADOR 33000xi** |
|---|---|---|---|---|
| **Input Voltage:** | Operating range 350 – 600 Vdc, max. 800Vdc | | | |
| **Input Current:** | 3 x 18,4 Adc | 3x 24,3 Adc3x | 3x 33,1 Adc | 3x 33,1 Adc |
| **Output Voltage:** | 400/230 Vac, 50 Hz | | | |
| **Output Current:** | 3x 29A | 3x 40,8 Aac | 3x 43,3 Aac | 3x 47,8 Aac |
| **Output Power:** | 20000 $W_{AC}$ | 25000 $W_{AC}$ | 29900 $W_{AC}$ | 33000 $W_{AC}$ |

**Zulassungszeichen**
Certification Mark

Ein repräsentatives Testmuster des o.g. Modells bestand die Prüfung nach
A representative Test sample of above stated model passed the tests according to

| | |
|---|---|
| **Norm:**<br>Standard: | IEC 60950-1:2005, EN 60950-1:2006, DIN EN 60950-1:2006, in addition spacing passed to requirements of DIN EN 50178:1998 and IEC 62103:2003 |

**und entsprechen den Anforderungen für Sicherheit und Gesundheit des Geräte- und Produktesicherheitsgesetzes (GPSG)**
*and comply with the requirements for safety and health of the GS-Law(GPSG)*

| | | | |
|---|---|---|---|
| **Bericht Nr.:**<br>Report No.: | 05KFS164-IEC60950 | | |
| **Zertifikat Nr.:**<br>Certificate No.: | 09-019 | | |
| **Datum:**<br>Issued: | 12.02.2009 | **Gültig bis:**<br>Valid until: | 11.02.2014 |

Der Hersteller hat die Voraussetzungen zu schaffen, die für eine vorschriftsmäßige Fertigung erforderlich sind sowie die damit verbundenen Kontrollmaßnahmen der Zertifizierungsstelle zu dulden (§7 Abs.3 GPSG). Der Zertifikatsinhaber ist berechtigt, **o.g. Produkt** mit dem GS-Zeichen in der abgebildeten Form zu versehen. Grundlage für die Ausstellung des Zertifikates sind die im GS-Vertrag geregelten Verfahren, welche auch den Entzug von GS-Zertifikaten regeln.

*The manufacturer has to ensure requirements of good technical practice and has accepted all necessary actions of surveillance by the certification body (§7 sec.3 GPSG). The holder of this Certificate is authorized to apply the GS-mark as shown **on above stated product**. Issuance of GS-Certificates is based on the regulations of the GS-Contract, which amongst others describe the rules of withdrawal of Certificates.*

Zertifizierungsstelle
Certification department

Achim Hänchen

## 10.3 Certificate of compliance

**Bureau Veritas Consumer Product Services GmbH**
Businesspark A96
86842 Türkheim
Germany
+ 49 (0) 8245 96810-0
cps-tuerkheim@de.bureauveritas.com

# Certificate of compliance

**Applicant:** **Kaco new energy GmbH**
Carl-Zeiss-Str. 1
74172 Neckarsulm
**Germany**

**Product:** **Automatic disconnection device between a generator and the public low-voltage grid**

**Model:** **Powador 20000xi Park, Powador 25000xi Park**
**Powador 30000xi Park, Powador 33000xi Park**

### Use in accordance with regulations:

Automatic disconnection device with three-phase mains surveillance in accordance with DIN V VDE V 0126-1-1:2006-02 for photovoltaic systems with a three-phase parallel coupling via an inverter in the public mains supply. The automatic disconnection device is an integral part of the aforementioned inverter. This serves as a replacement for the disconnection device with insulating function which the distribution network provider can access at any time.

### Applied rules and standards:

DIN V VDE V 0126-1-1 (VDE V 0126-1-1):2006-02 and „Generator at the public low-voltage grid, 4th edition 2001, guideline for connection and parallel operation of generators in the public low-voltage grid" with VDN additions (2005) from the German Electricity Association (VDEW) and Association of network operator (VDN).

The safety concept of an aforementioned representative product corresponds at the time of issue of this certificate to the valid safety specifications for the specified use in accordance with regulations.

**Report number:** **05KFS164-VDE0126**
**Certificate number:** **U10-267**
**Date of issue:** **2010-06-07** **Valid until:** **2013-06-07**

Achim Hänchen
Head of Certification

## Notes

## Notes

## Notes



31000598-04-100819

*The text and figures reflect the current technical state at the time of printing. Subject to technical changes. Errors and omissions excepted.*

KACO new energy.

Carl-Zeiss-Straße 1 · 74172 Neckarsulm · Germany · Phone +49 7132 3818-0 · Fax +49 7132 3818-703 · info@kaco-newenergy.de · www.kaco-newenergy.de