KACO
new energy.

**Powador
2002 | 3002
4202 | 5002
6002**

Operating Manual

- ■ **English translation of German original**

KACO
new energy.

Operating Manual

for Installation Engineers and Operators

Powador
2002 | 3002
4202 | 5002
6002

Contents

1   General Notes

1.1   About this documentation

⚠ WARNING
Improper handling of the inverter can be hazardous
› You must read and understand the operating instructions before you can install and use the inverter safely.

1.1.1   Other applicable documents

During installation, observe all assembly and installation instructions for components and other parts of the system. These instructions are delivered together with the respective components and other parts of the system.

1.1.2   Storing the documents

These instructions and other documents must be stored near the system and be available at all times.

1.2   Layout of Instructions

1.2.1   Symbols used

⚠ General hazard   🔥 Risk of fire or explosion

⚡ High voltage!   ♨ Risk of burns

⚠ Authorised electrician   Only authorised electricians may carry out tasks indicated with this symbol.

1.2.2   Safety warnings symbols guide

⚠ DANGER
High risk
Failure to observe this warning will lead directly to serious bodily injury or death.

⚠ WARNING
Potential risk
Failure to observe this warning may lead to serious bodily injury or death.

⚠ CAUTION
Low-risk hazard
Failure to observe this warning will lead to minor or moderate bodily injury.

CAUTION
Risk of damage to property
Failure to observe this warning will lead to property damage.

	ACTIVITY
	Risk of damage to property
	Failure to observe this warning will lead to property damage.

1.2.3 Additional information symbols

	NOTE
	Useful information and notes

	Country-specific function
DE	Functions restricted to one or more countries are labelled with country codes in accordance with ISO 3166-1.

1.2.4 Instructions symbols guide

a) Single step instructions or instructions that can be carried out in any sequence:

Instructions

↻   Prerequisite(s) for the step(s) (optional)

☞   Carry out step.

☞   (Additional steps, if applicable)

»   Result of the step(s) (optional)

b) Multi-step instructions that must be carried out in a fixed sequence:

Instructions

↻   Prerequisite(s) for the steps (optional)

1.   Carry out step.

2.   Carry out step.

3.   (Additional steps, if applicable)

»   Result of the steps (optional)

1.2.5 Abbreviations

PV   Photovoltaic

EEG   German Renewable Energies Act

MPP   Maximum power point (point on the current-voltage diagram for a PV generator at which the maximum amount of power can be drawn)

Colour codes (in accordance with IEC 60757)

BK	Black	BN	Brown
BU	Blue	GNYE	Yellow-green
GY	Grey		

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2   Safety

⚠	**DANGER**

Lethal voltages are still present in the terminals and cables of the inverter even after the inverter has been switched off and disconnected.

Severe injuries or death may occur if the cables and terminals in the inverter are touched.

Only authorised electricians who are approved by the supply grid operator may open, install or maintain the inverter.

› Keep the inverter closed when the unit is in operation.

› Do not touch the cables or terminals when switching the unit on and off.

› Do not make any modifications to the inverter.

The electrician is responsible for observing all existing standards and regulations.

• Keep unauthorised persons away from the inverter and PV system.

• In particular, be sure to observe IEC-60364-7-712:2002 "Requirements for special types of business premises, rooms and installations - Solar-Photovoltaic-(PV) Power Supply Systems.

• Ensure operational safety by providing proper grounding, conductor dimensioning and appropriate protection against short circuiting.

• Observe the safety instructions on the inverter and in these operating instructions.

• Switch off all voltage sources and secure them against being inadvertently switched back on before performing visual inspections and maintenance.

• When taking measurements while the inverter is live:

 – Do not touch the electrical connections.

 – Remove all jewellery from your wrists and fingers.

 – Ensure that the testing equipment is in safe operating condition.

• Stand on an insulated surface when working on the inverter.

• Modifications to the surroundings of the inverter must comply with the applicable national and local standards.

• When working on the PV generator, it is also necessary to switch off the DC voltage with the DC disconnect in addition to disconnecting the PV generator from the grid.

2.1   Proper use

The inverter converts the DC voltage generated by the PV modules into AC voltage and feeds it into the grid. The inverter is built according to the latest technological standards and safety regulations. Nevertheless, improper use may cause lethal hazards for the operator or third parties, or may result in damage to the unit and other property.

Operate the inverter only with a permanent connection to the public power grid.

Any other or additional use of the device shall be regarded as improper. This includes:

• Mobile use,

• Use in rooms where there is a risk of explosion,

• Use in rooms where the humidity is higher than 95%,

• Operation outside of the specifications intended by the manufacturer,

• Standalone operation.

2.2   Protection features

For your safety, the following monitoring and protective functions are integrated into Powador inverters:

• Overvoltage conductors/varistors to protect the power semiconductors from high-energy transients on the grid and generator side,

• Temperature monitoring of the heat sink,

• EMC filters to protect the inverter from high-frequency grid interference,

• Grid-side grounded varistors to protect the inverter against burst and surge pulses,

• Islanding detection according to VDE 0126-1-1.

2.3   Standards and directives

NOTE

The EU declaration of conformity can be found in the appendix.

For information on grid coupling, grid protection and safety parameters along with more detailed instructions see our web site at http://kaco-newenergy.de/en/site/index.xml.

3 Description

3.1 Mode of Operation

The inverter converts the DC voltage generated by the PV modules into AC voltage and feeds it into the grid. The feed-in process begins when there is sufficient sunlight and a specific minimum voltage is present in the inverter. If, as it gets dark, the voltage drops below the minimum voltage value, the feed-in operation ends and the inverter switches off.

3.2 Description of the unit

3.2.1 Powador inverter as part of a PV system

3.2.1.1 System layout
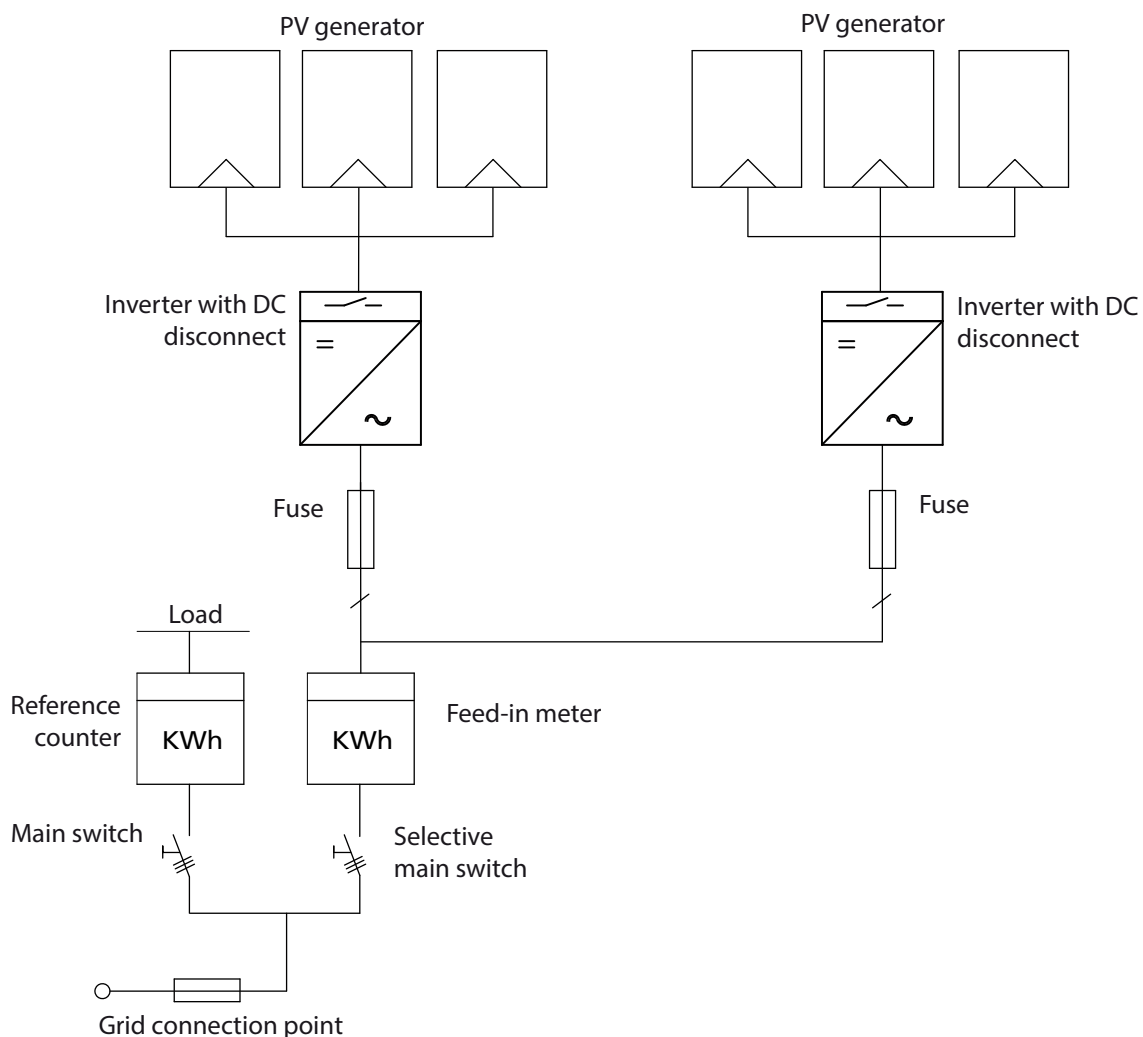
Figure 1:   Overview circuit diagram for a system with two inverters

3.2.2   System with multiple inverters

3.2.2.1   Asymmetric feed-in
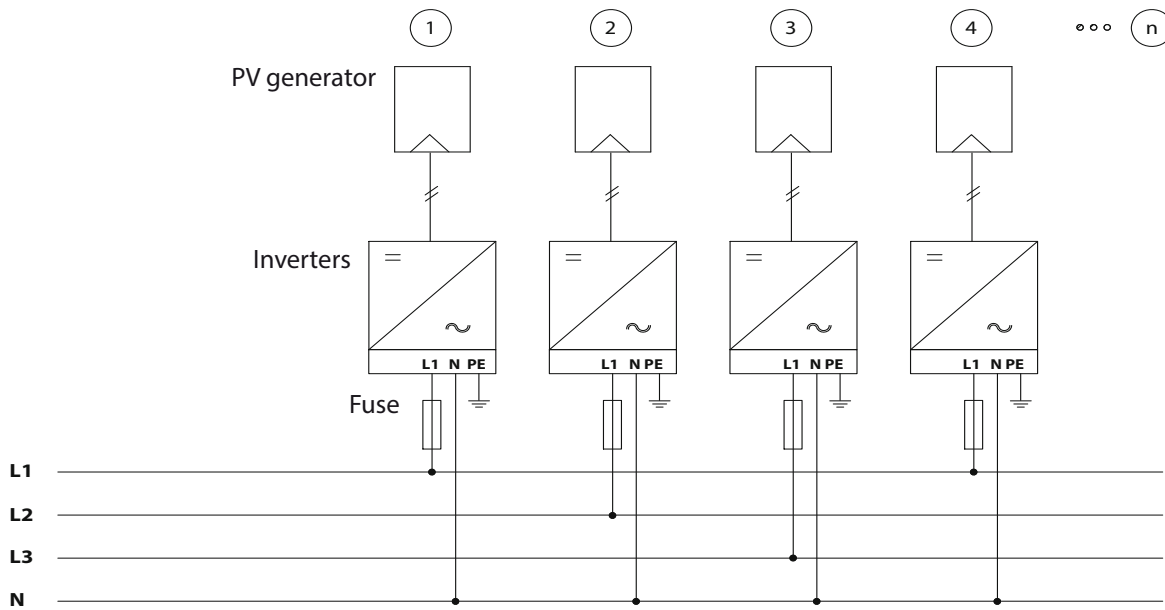
Figure 2:   Grid-side connection for systems with multiple inverters with single-phase grid monitoring

3.2.3   Electrical connection

> **NOTE**
>
> Note the grid-type-specific connection conditions (see section 7.2.1 on page 22)

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3.2.4   Summary of the components

PV generator

The PV generator, i.e. the PV modules, converts the radiant energy of sunlight into electrical energy.

DC terminal point

Options for parallel connections of several generator strings:

*   To a DC terminal point between the DC generator and inverter,
*   Directly to the inverter (terminals for 3 strings are provided on the inverter),
*   Directly to the PV generator with a positive and negative lead to the inverter.

DC disconnect

Use the DC disconnect to disconnect the inverter from all power sources on the PV generator side.

Grid fuses

gL fuses are suitable.

Feed-in meter

The feed-in meter is to be specified and installed by the power supply company. Some power supply companies also allow the installation of your own calibrated meters.

Selective main switch

If you have questions about the selective main switch, contact your power supply company.

3.2.5   Inverter diagram
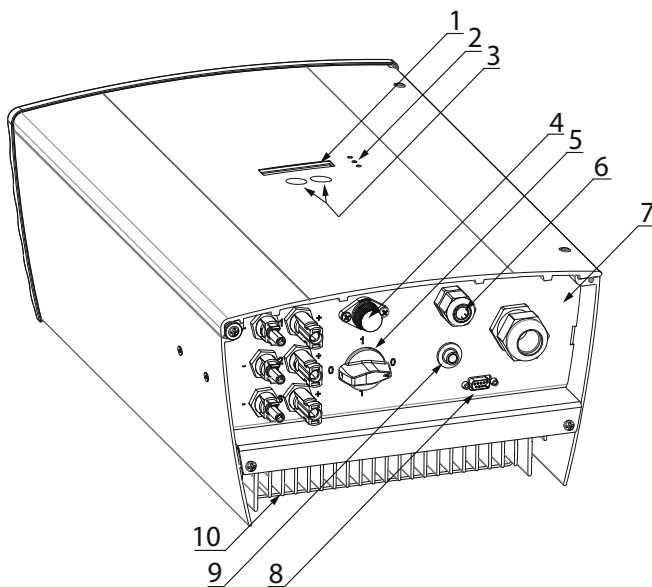
Figure 3:   Inverter diagram

Key

1	Display	6	Cable fitting for interface cable
2	LED indicators	7	Connection board
3	Control buttons	8	RS232 port
4	Fuse for generator grounding (optional)	9	Night start button
5	DC disconnect	10	Mounting plate

3.2.6   Electrical functions

3.2.6.1   Fault signal relay

A potential-free relay contact is integrated in the inverter. The contact closes as soon as there is a fault during operation.

For connection see section 7.4.1 on page 29.

DE   **Country-specific function**

3.2.6.2   Fault signal relay/Powador-priwatt

A potential-free relay contact is integrated in the inverter. Use this contact for one of the following functions:

- Fault signal relay
- Powador-priwatt

Powador-priwatt

The energy that is provided by the PV system can be put to use directly by the appliances that are connected in your home. In "Powador-priwatt" mode, the potential-free contact takes care of this function.

The contact closes if sufficient PV energy is available over a period of 30 minutes. When the contact closes, a visual or acoustic signal is emitted, e.g. from a signal lamp or siren (optional).

Activating the function (optional)

The "Powador-priwatt" function is not active in the unit's factory default state. You can obtain the password for the function from your specialist retailer. The electrician then activates the function in the configuration menu (see section 8.3 on page 36).

Powador-priwatt switch (optional)

The potential-free contact switches larger appliances (e.g. air conditioning units) on and off. This requires an external power supply (max. 30 V DC) and an external load relay.

Both can be obtained as part of the Powador-priwatt switch from your specialist retailer.

DE   **Country-specific function**

3.2.6.3   Power limitation (power control)

Since 1 January 2009, the German Renewable Energies Act (EEG) requires power limitation for systems with an output of more than 100 kW. This limit value can be exceeded when using a unit group of several inverters. Therefore, each inverter must have an option for limiting power, even if this is not needed in a system that is smaller than 100 kW.

The power reduction is achieved using a ripple control receiver in KACO new energy GmbH inverters. If necessary, the power supply company can reduce the power of the system remotely using an additional device from the Powador proLOG family. The Powador-proLOG activates this function, which is already integrated in the inverter. After a specified period of time without any signal from the power supply company, the inverter returns to normal operation. For information about Powador-proLOG, contact your specialist retailer.

Levels of AC power reduction	Inverter action
100%	Normal feed-in mode
60 %	Limitation of power to 60%
30 %	Limitation of power to 30 %
0 %	Disconnection from the grid

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| DE NSp. | **Country-specific function** |

3.2.6.4 Control procedure cos phi (P/Pn)

The control procedure cos phi (P/Pn) offers the option of defining up to 10 nodes (minimum of 2) for shift factor cos phi. A node is defined by the relevant pair of values (Specification of an active power in % based on a nominal power of the device and an associated cos phi value.)

In the delivery state cos phi is activated with a predefined characteristic.

This characteristic, which consists of three individual nodes, depends on the rated AC power of the inverter.
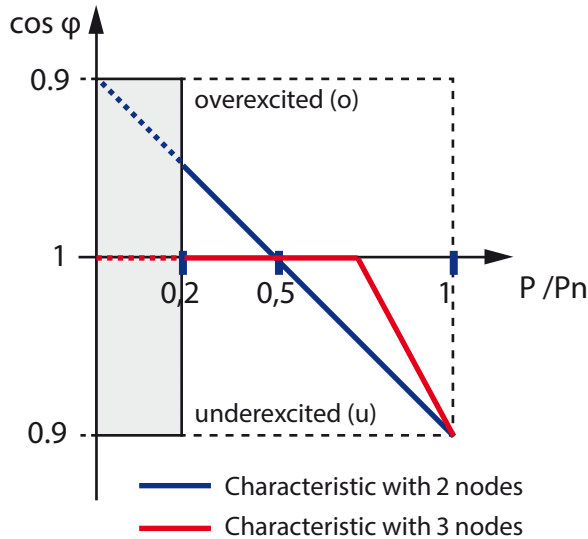
Figure 4:   Control procedure as per cos phi (P/pn)

P_{AC},nom < 13.8 kVA

1. node   0 % $P/_{PN}$ - - cos phi 1.000

2. node   50 % $P/_{PN}$ - - cos phi 1.000

3. Node 100 % $P/_{PN}$ - - cos phi 0.950 under-excited (u)

To meet the requirements for reactive power feed even at system level, the inverters must be adjustable in the range from cos phi 0.8 over-excited (o) and 0.8 under-excited (u).

3.2.7   Mechanical components

3.2.7.1   DC disconnect

There is one DC disconnect in the inverter housing. The DC disconnect is used to disconnect the inverter from the PV generator in order to carry out service.
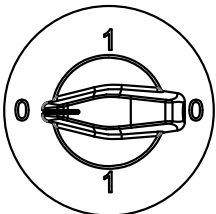
Disconnecting the inverter from the PV generator

☞ Switch the DC disconnects from 1 (ON) to 0 (OFF).

Connecting the inverter to the PV generator

☞ Switch the DC disconnects from 0 (OFF) to 1 (ON).

Figure 5:   DC disconnect

3.2.7.2 Night start button

The unit switches off in the evening as nightfall approaches. At this point, nothing is shown on the display. In order to retrieve the values from the current day (daily yield, daily hours of operation and max. feed-in power) after the display switches off, the unit can also be activated during the night by pressing the night start-up button on the underside of the inverter.
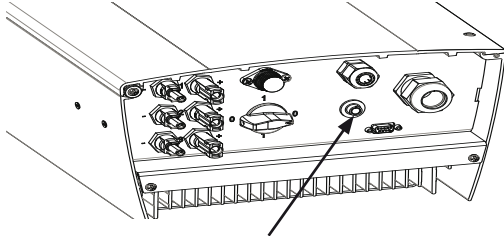
Figure 6:   Night-start interface on the inverter

3.2.8 Interfaces

The inverter has the following interfaces for communication and remote monitoring:

• RS232 port
• RS485 interface
• S0 interface

You configure the interfaces in the Settings mode (see section 8.3 on page 36).

3.2.8.1 RS232 port

Use this monitoring option if you wish to manage system operating data directly on a computer. The data can be processed with standard spreadsheet programs.

The inverter and computer are connected with a serial 1:1 interface cable.

The cable length should not exceed 20 metres.

The data from the inverter is sent unidirectionally as pure ASCII text via the serial interface. The data is not checked for errors.

The RS232 interface has the following parameters:

Baud rate	Data bits	Parity	Stop bits	Protocol
9600 baud	8	None	1	None

The table below shows an example of a few lines of data transmitted over the RS232 interface.

```
Column 1      2       3   4       5      6     7      8      9     10
00.00.0000 00:05:30   3   363.8   0.37   134   226.1  0.53   103   23
00.00.0000 00:05:40   3   366.0   0.39   142   226.1  0.53   112   23
00.00.0000 00:05:50   3   359.5   0.41   147   226.1  0.53   116   23
00.00.0000 00:06:00   3   369.8   0.42   155   226.1  0.58   118   23
00.00.0000 00:06:10   3   377.0   0.43   162   226.1  0.63   131   23
00.00.0000 00:06:20   3   373.6   0.45   168   226.1  0.63   133   23
00.00.0000 00:06:30   3   364.0   0.48   174   226.1  0.68   146   23
00.00.0000 00:06:40   3   364.3   0.49   178   226.1  0.68   146   23
```

Table 1:   Excerpt from the RS232 interface transmission log

Key				
Column	Meaning		Column	Meaning
1	Placeholder		6	Generator power in W
2	Daily running time		7	Line voltage in V
3	Operating status (see section 8.1 on page 13)		8	Line current, feed-in current in A
4	Generator voltage in V		9	Power fed into the grid in W
5	Generator current in A		10	Temperature of the unit in °C

3.2.8.2   Software for direct monitoring

Together with the Powador inverter, KACO-viso takes over the role of a data logger. It saves the data from the inverter and displays it in various diagram types as a daily or monthly representation.

The PC, however, must also run continuously. Because of the amount of energy used, this type of monitoring only makes sense over limited periods, such as during a fault analysis. For permanent system monitoring, we recommend the optional accessories. (Powador proLog)

3.2.8.3   RS485 interface

Use this monitoring option if you cannot check the functioning of the system on-site on a regular basis, e.g. if your place of residence is located a great distance from the system. To connect the RS485 interface, contact your authorised electrician.

For monitoring your PV system using the RS485 interface, KACO new energy GmbH offers the following data loggers:

Powador-proLOG S to XL (optional)

Powador-proLOG allows you to monitor up to 31 inverters simultaneously. Depending on the product model, Powador-proLOG sends yield and operating data by SMS or e-mail.

Powador-piccoLOG (optional)

Powador-piccoLOG allows you to monitor up to 3 inverters up to 20 kWp simultaneously. With this self-learning data logger, yield and operating data as well as error messages are transferred to monitoring devices via Ethernet. System errors are also issued optically and acoustically. A ripple control receiver can be connected via the integrated digital input.

Powador-link RS485 (optional)

Use the Powador-link RS485 to bridge long distances between several inverters or between an inverter and the Powador-proLOG or Powador-piccoLOG by means of wireless radio transmission.

3.2.8.4   S0 interface

The S0 interface transmits pulses between a pulsing counter and a tariff metering unit. It is a galvanically isolated transistor output. It is designed according to DIN EN 62053-31:1999-04 (pulse output devices for electromechanical and electronic meters).

NOTE
The S0 interface pulse rate can be chosen in three unit intervals (500, 1,000 and 2,000 pulses/kWh).

4 Technical Data

4.1 Electrical Data

Input levels	2002	3002	4202	5002	6002
Max. recommended PV generator power [W]	2 000	3 000	4 200	5 000	6 000
DC MPP range from [V] to [V]	125 to 510	200 to 510			
Operating range from [V] to [V]	125 to 295	200 to 300			
Starting voltage [V]	125	200			
Open circuit voltage [V]*		600			
Max. rated current [A]	14.3	13.5	18.5	22.4	26.5
Number of strings		3			
Number of MPP controls		1			
Polarity safeguard		Short-circuit diode			

* To protect the electronic system, the grid-feed is made at < 550 V.

Output levels					
Rated power [VA]	1 650	2 500	3 500	4 200	4 600
Grid voltage [V]		184 to 264 V			
Rated current [A]	7.2	10.9	15.2	18.3	20.0
Rated frequency [Hz]		50			
cos phi		0.80 over-excited ... 0.80 under-excited			
Number of feed-in phases		1			
Distortion factor [%]		<3			

General electrical data					
Maximum efficiency	95.9 %	96.0 %	95.9 %	95.9 %	95.9 %
European efficiency	95.3 %	95.4 %	95.1 %	95.3 %	95.3 %
Internal consumption: Standby [W] / operation [W]		0.4 / < 5			
Feed-in starts at [W]	10	15	25	25	25
Circuit design		Galvanically isolating high-frequency DC/DC converter with down-stream self-commutated inverter			
Clock frequency		17 kHz			
Grid monitoring		Automatic disconnection device in accordance with DIN VDE 0126-1-1:2006-02			
CE conformity		yes			

Table 2: Electrical data

4.2 Mechanical data

	2002	3002	4202	5002	6002
Visual displays	LEDs: PV generator (green), supply (green), fault (red) LCD (2 x 16 characters)				
Controls	2 keys for operating display				
DC disconnect	Integrated DC disconnect with rotary switch				
DC connections	6 (2 x 3) MC-4 compatible solar plug connections				
Ambient temperature	-20 °C to +60 °C (Powador 2002 / 3002) -25 °C to +60 °C (Powador 4202 / 6002) (> +40 °C Power derating at high ambient temperatures)				
Temperature monitoring	> 75 °C > 85 °C		> 70 °C (temperature-dep. power matching) > 80 °C (disconnection from the grid)		
Max. humidity	95% (non-condensing)				
Maximum installation elevation [m above sea level]	2 000				
Cooling	Free convection (no fan)			Fans	
Protection class	IP54 according to EN 60529				
Noise emission	< 35 dB (noiseless)			< 45 dB (fan operation)	
Housing	Aluminium wall-mounted housing				
H x W x D [mm]	450 x 340 x 200	500 x 340 x 200	600 x 340 x 240	600 x 340 x 240	600 x 340 x 240
Total weight [kg]	14.5	20	26	28	28

Table 3:   Mechanical data

5   Transportation and Delivery

5.1   Delivery

Every inverter leaves our factory in proper electrical and mechanical condition. Special packaging ensures that the units are transported safely. The shipping company is responsible for any transport damage that occurs.

5.1.1   Scope of delivery

• Powador inverter
• Wall bracket
• Installation kit
• Documentation

5.2   Transportation

⚠	**WARNING**

Impact hazard, risk of breakage to the inverter

› Pack the inverter securely for transport.
› Carefully transport the inverter using the the carrying handles of the boxes.
› Do not subject the inverter to shocks.

For safe transportation of the inverter, use the holding openings in the carton.

Figure 7:   Transportation of the inverter

6 Mounting the Inverter

⚠	**DANGER**

Risk of fatal injury from fire or explosions

Fire caused by flammable or explosive materials in the vicinity of the inverter can lead to serious injuries.

› Do not mount the inverter in an area at risk of explosion or in the vicinity of highly flammable materials.

⚠	**CAUTION**

Risk of burns from hot housing components.

Coming into contact with the housing can cause burns.

› Mount the inverter so that it cannot be touched unintentionally.

Installation space

- As dry as possible, climate-controlled, with the waste heat dissipated away from the inverter,
- Unobstructed air circulation,
- When installing the unit in a control cabinet, provide forced ventilation so that the heat is sufficiently dissipated,
- Easily accessible from the front and sides,
- Protected from direct sunlight and moisture (rain) in outdoor areas,
- For easy operation, ensure during installation that the display is slightly below eye level.

Installation location

- Free-standing installation or wall mounting possible,
- Consisting of non-cracked cement,
- With sufficient load-bearing capacity,
- Accessible for installation and maintenance,
- Made from heat-resistant material (up to 90 °C),
- Flame resistant,
- Minimum clearances to be observed during assembly: see Figure 11 and Figure 12 on page 20.

CAUTION

Property damage due to gases that have an abrasive effect on surfaces when they come into contact with ambient humidity caused by weather conditions

The inverter housing may be severely damaged by gases (ammonia, sulphur, etc.) when they come into contact with ambient humidity caused by weather conditions.

 If the inverter is exposed to gases, it must be mounted so that it can be seen at all times.

› Perform regular visual inspections.

› Immediately remove any moisture from the housing.

› Take care to ensure sufficient ventilation of the inverter.

› Immediately remove dirt, especially on vents.

› Failure to observe these warnings may lead to inverter damage which is not covered by the KACO new energy GmbH manufacturer warranty.

6.1 Unpacking the inverter

> ⚠️ **CAUTION**
>
> **Risk of injury due to high weight of the inverter (approx. 14.5-2 kg) !**
> › Observe the weight of the inverter during transport.
> › Select suitable mounting location and mounting base.
> › Use mounting material corresponding to or included with the base for mounting the inverter.
> › Only mount the inverter with the help of a second person.
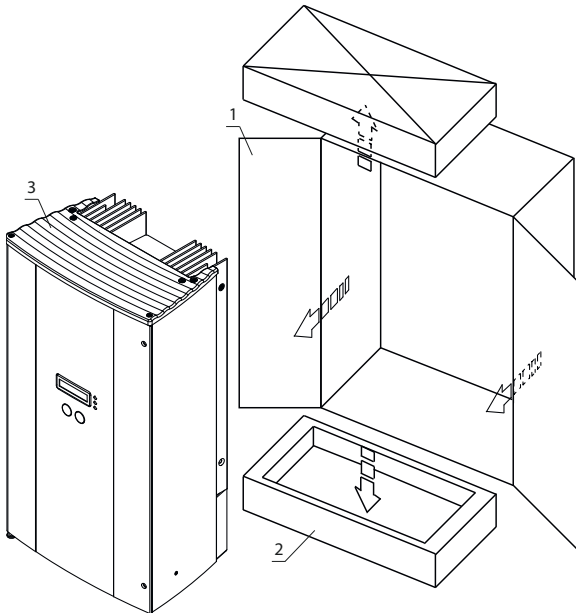
Figure 8: Unpacking the inverter

Figure 9: Setting up the inverter

Key

1	Carton	3	Inverters
2	Protective packaging		

Unpacking the inverter

1. Open carton at the front.
2. Remove installation material and documentation.
3. Slide inverter carefully out of the carton with the protective packaging.
4. Place the protective packaging back into the carton during mounting.
» Continue setting up the inverter.

6.2 Setting up the inverter

> ℹ️ **NOTE**
>
> **Power reduction due to heat accumulation.**
> If the recommended minimum clearances are not observed, the inverter may go into power regulation mode due to insufficient ventilation and the resulting heat build-up.
> › Maintain minimum clearances.
> › Ensure sufficient heat dissipation.

⚠ Authorised electrician
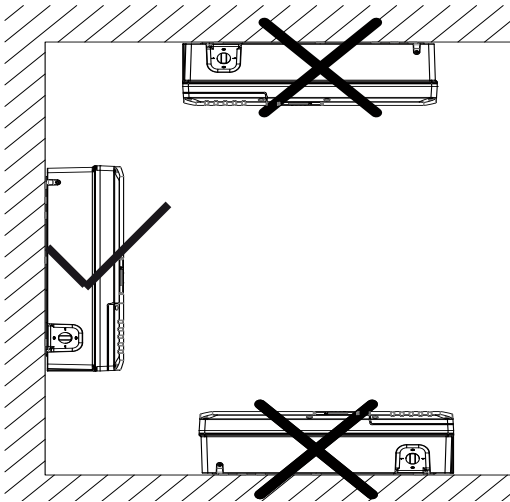
Figure 10: Instructions for wall mounting
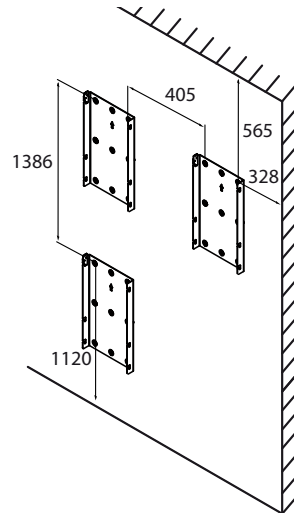
Figure 11: Drill stencil for wall mounting with mini-mum clearances (in mm)

Fasten wall holder to mounting location

5. Mark the positions of the drill holes using the cut-outs in the wall holder.
   NOTE: The minimum clearances between two inverters, or the inverter and the ceiling/floor have already been taken into account in the diagram (see Figure 11 on page 20).

6. Fix wall holder to the wall with the mounting fixtures.
   Make sure that the wall holder is oriented correctly.

Clearance from the ceiling: 500 mm
Clearance from any other inverter: 700 mm
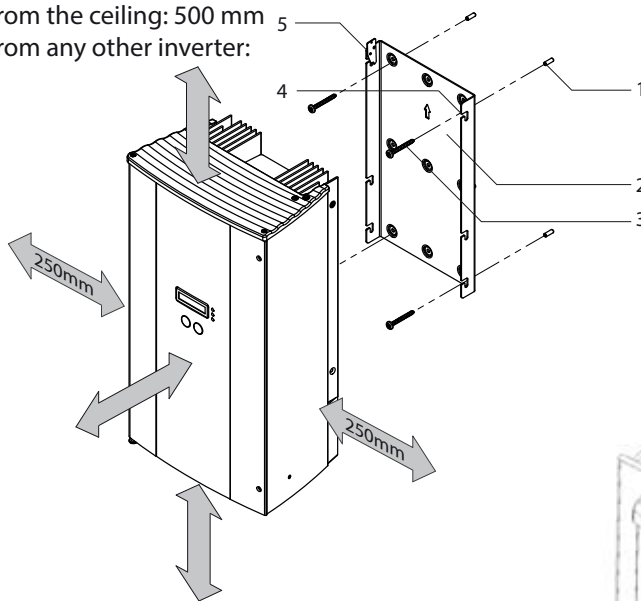
Clearance from the floor 500 mm
Clearance from any other inverter: 700 mm

Safety catch (open)

Safety catch (closed)

Figure 12: Minimum clearances/mounting plate

Key

1	Fixings for mounting	4	Suspension bracket
2	Mounting plate	5	Safety catch
3	Screws for mounting		

⚠ Authorised electrician

Securing the inverter

7. Secure the inverter with a second person and with both hands on the housing side and base plate, and move to the mounting location. (See Figure 10 on page 20)

8. Hang the inverter on the wall holder using the suspension brackets on the back of the housing.

9. Secure the inverter with safety catch. (See Figure 13 on page 22)

» The mounting of the inverter is complete. Continue with the installation.

7 Installing the inverter

| ⚠ | **DANGER** |

Lethal voltages are still present in the terminals and cables of the inverter even after the inverter has been switched off and disconnected.

Severe injuries or death may occur if the cables and terminals in the inverter are touched.

Only authorised electricians who are approved by the supply grid operator may open and install the inverter.

The inverter must be mounted in a fixed position before being connected electrically.

› Observe the safety regulations and current technical connection specifications of the responsible power supply company.

› Disconnect the AC and DC sides.

› Secure both sides against being inadvertently switched back on.

› Ensure that the AC and DC sides are completely voltage-free.

› Connect the inverter only after the aforementioned steps have been taken.

7.1 Opening the connection area

Opening the connection area

↺ You have mounted the inverter.

1. Unscrew the two Philips screws on the right-hand side of the housing.

2. Open the housing door.

» Make the electrical connection.

7.2 Making the electrical connection

Make the connection to the PV generator as well as the grid connection via the PCB terminals in the connection area of the inverter. Note the following conductor cross-sections:

	AC connection	**DC connection**
Max. conductor cross-section without wire sleeves	6 mm^2	
Max. conductor cross-section with wire sleeves	4 mm^2	MC4 solar plug connection
Length of insulation to be stripped off	12 mm	

A screwdriver (slotted, 3.5 mm) is to be used for the terminals in the inverter. Put the screwdriver into the cut-out provided. Press the screwdriver upwards slightly. Feed the cable into the spring terminal. Put the screwdriver back into the original position. Remove the screwdriver. The spring terminal is closed and the cable is held in place.

The power section has two internal circuit board fuses. These are labelled F701 or F801 and F861 on the circuit board.

⚠ Authorised electrician

	2002 / 3002	**4202 / 5002 / 6002**
Fuse	F801 type 179120 5x20 slow-blow 250 V / 0.4 A	
Vendor	SIBA	
Fuse	F861 type TR5 fuse, series 372 slow-blow 250 V / 125 V / 1 A	F701 type 179200 5x20 slow-blow 250 V / 0.4 A
Vendor	Littelfuse/Wickmann	SIBA
Overvoltage safety class	DC: III, AC: III	
Overvoltage safety category	DC: II, AC: III	
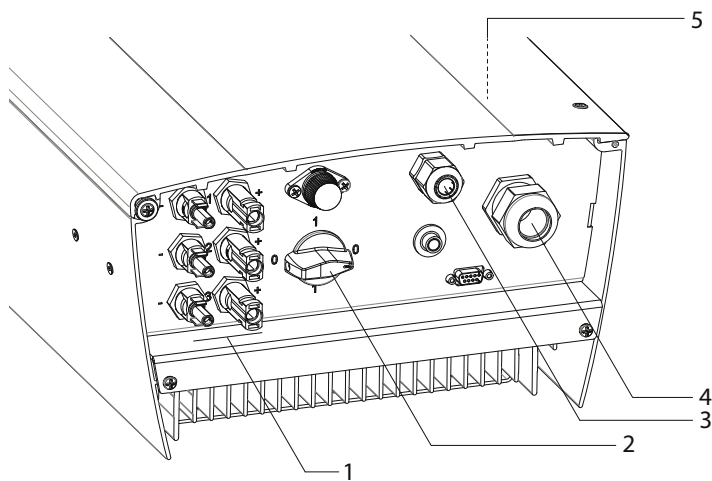
Figure 13:   Connection area: Powador 2002-6002

Key			
1	6 (2 x 3) MC4-compatible DC plug connectors for PV generator	4	Cable fitting (M40) for AC connection
2	DC disconnect	5	AC connection terminals
3	Cable fittings (M16) for housing ground connection		

7.2.1   Connecting the inverter to the power grid

The grid connection cables are connected on the right in the connection area (see Figure 13 and Figure 14 on page 24).

⚠ **DANGER**

Risk of fatal injury due to electric shock

Severe injury or death will result if the live connections are touched.

› Switch off all power sources to the inverter before you insert the grid power cable into the unit.

› Make sure that the device is isolated from the public power supply and the system power supply before starting work.

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Recommended conductor cross-sections and fuse protection of NYM cables for fixed wiring according to VDE 0100 part 430

For cable lengths up to 20 m, use the conductor cross-sections named in table 6. Longer cable lengths require larger conductor cross-sections.

Model	Conductor cross-section	Fuse protection: gL safety fuses
Powador 2002	1.5 mm²	16 A for 1.5 mm² conductor cross-section
Powador 3002	2.5 mm²	20 A for 2.5 mm² conductor cross-section
Powador 4202	4.0 mm²	25 A for 4.0 mm² conductor cross-section
Powador 5002	4.0 mm²	25 A for 4.0 mm² conductor cross-section
Powador 6002	6.0 mm²	35 A for 6.0 mm² conductor cross-section

Table 4:   Recommended conductor cross-sections and fuse protection of NYM cables

NOTE

When the line resistance is high (i.e. long grid-side cables), the voltage at the grid terminals of the inverter will increase during feed-in to the grid. The inverter monitors this voltage. If it exceeds the country-specific grid overvoltage limit value, the inverter switches off.

› Ensure that the conductor cross-sections are sufficiently large or that the cable lengths are sufficiently short.

NOTE

In order to avoid asymmetries in the grid, systems with multiple inverters should be designed so that the inverters feed into the grid in differing phases.

› The dynamic grid support (FRT) only functions with a three-phase grid connection.

› Observe the following grid-type-specific connection requirements and the schematic view in section 3.2.3 on page 9.

Country and grid-type	Grid monitoring	Required monitoring	max. asymmetry between phases L1,L2,L3
DE NSp.	Three-phase or single phase	phase unbalanced load	4.6 kVA
IT	Single-phase	phase unbalanced load	6 kVA
other countries	Three-phase or single phase	If you have any queries, please contact your grid operator.	

Table 5:   Grid-type-specific connection conditions

ACTIVITY

Cables on the AC screw terminal must be re-tightened at regular intervals using the necessary tightening torque (see chapter 7.2 on page 21).

⚠ Authorised electrician

Figure 14:   Insert AC leads into the connection area

Figure 15:   AC leads wound around the ferrite cores

Making the grid connection

↻   Use cables with three wires (L1, N, PE).

1.   Loosen cable fitting for AC connection.

2.   Remove the outer cladding of the AC cables.

3.   Insert the AC leads through the cable fitting into the connection area. (See Figure 14 on page 24)

4.   Strip the insulation from the AC cables.

5.   Guide the AC leads through the ferrite cores.

6.   Wrap the AC leads once around the ferrite cores. (See Figure 15 on page 24)

7.   Connect wires in accordance with the labels on the PCB terminals (Figure 16 on page 24).

8.   Check that all connected cables are securely fitted.

9.   Tighten the cable fitting.

»   The inverter is now connected to the power grid.
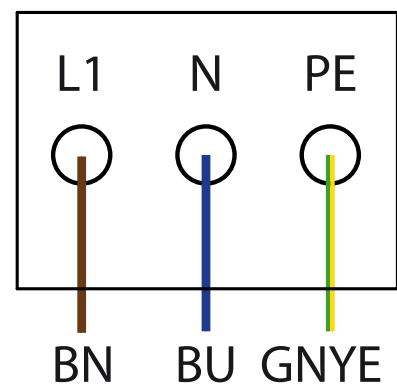
Figure 16:   AC connection terminals

ℹ **NOTE**

An AC-side disconnection unit must be provided in the final installation. This disconnection unit must be installed so that it can be accessed at any time without obstruction.

If a residual current circuit breaker is necessary due to the installation specification, a type A residual current circuit breaker must be used.

7.2.2   Connecting the PV generator

A suitable crimping tool must be used to connect the stripped DC leads to the MC-4 coupling plug and coupling socket.

Connect the MC-4 coupling plugs to the 3 DC positive and the 3 DC negative mating parts on the underside of the housing (see Figure 17 on page 25).

⚠ Authorised electrician

ℹ **NOTE**

Connected PV modules must be dimensioned for the DC system voltage in accordance with IEC 61730 Class A, but at least for the value of the AC grid voltage.

⚠ **DANGER**

Risk of fatal injury due to contact voltages.

› During installation: Electrically disconnect the DC positive and DC negative from the protective earth (PE).

Removing the plug connection without previously disconnecting the inverter from the PV generator may lead to injuries and damage the inverter.

› Disconnect the inverter from the PV generator using the integrated DC disconnect.

› Remove the plug connector.
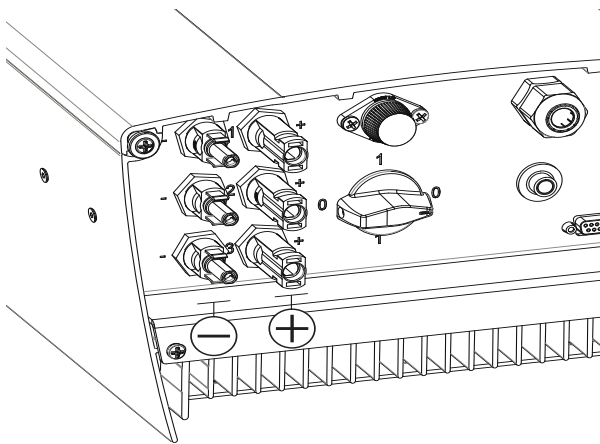
Figure 17:   Connections for DC positive and DC negative

7.2.2.1   Before connecting

Ensure that there is no ground fault

1.   Determine the DC voltage between the

– protective earth (PE) and the positive cable of the PV generator,

– protective earth (PE) and the negative cable of the PV generator are identified.

If stable voltages can be measured, there is a ground fault in the DC generator or its wiring. The ratio between the measured voltages gives an indication as to the location of this fault.

2.   Rectify any faults before taking further measurements.

3.   Determine the electrical resistance between the

– protective earth (PE) and the positive cable of the PV generator,

– protective earth (PE) and the negative cable of the PV generator are identified.

In addition, ensure that the PV generator has a total insulation resistance of more than 2.0 megohms, since the inverter will not feed in if the insulation resistance is too low.

4.   Rectify any faults before connecting the DC generator.

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7.2.2.2 Connecting the PV generator

> ⚠ **DANGER**
>
> **Risk of fatal injury due to electric shock**
>
> Severe injury or death will result if the live connections are touched. When there is sunlight present on the PV modules, there is DC voltage on the open ends of the DC cables.
>
> › Do not touch the exposed ends of the cables.
>
> › Avoid short circuits.

Connecting the PV generator

1. Remove protective caps from the DC connection plugs.
2. Connect PV generator to the DC plug connectors on the underside of the housing.
3. Meet the requirements of protection rating IP65 by closing the unused plug connectors with protective caps.
» The inverter is connected to the PV generator.

7.3 Generator grounding (optional)

Some module manufacturers stipulate that the solar modules must be grounded at the generator (especially when applied to thin-film modules). An optional grounding kit for use on galvanically isolated Powador inverters is available for this purpose.

> ℹ **NOTE**
>
> When grounding the generator poles, heed the information provided by the module manufacturer.

Installing the grounding kit

1. Remove the fuse holder cover with a screwdriver
2. Attach fuse holder using the available screws
3. Connect black cable in the DC terminal with the label "GFDI" (below)
4. Install green/yellow PE cable to the provided PCB attachment using the cable lug
5. **For Powador 4202-6002** Plug PE cable with wire sleeve into PE terminal
6. Clamp accompanying cable link into upper GFDI terminal to DC+ or DC-
7. Activate grounding monitoring in the parameter menu. (See Section 8.3 on page 36)

GN/YE

GN/YE   BK   BU   GN/YE
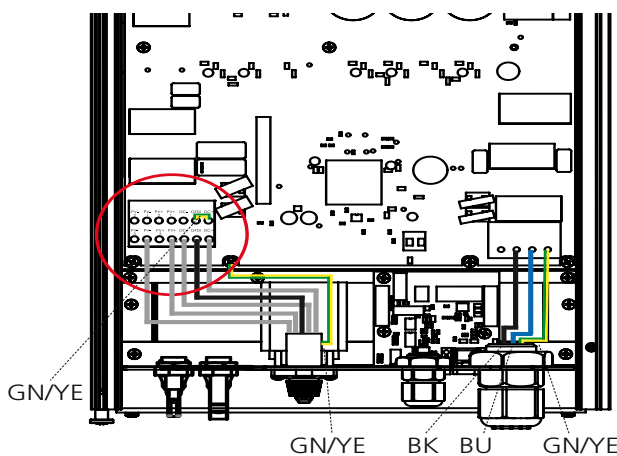
Figure 18: Powador 2002-3002 with generator grounding kit

GN/YE

GN/YE   BK   BK   BU   GN/YE
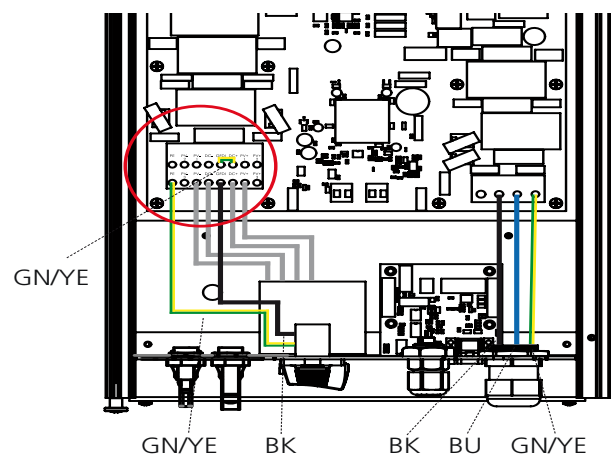
Figure 19: Powador 4202-5002-6002 with generator grounding kit (via PE terminal)

⚠ Authorised electrician
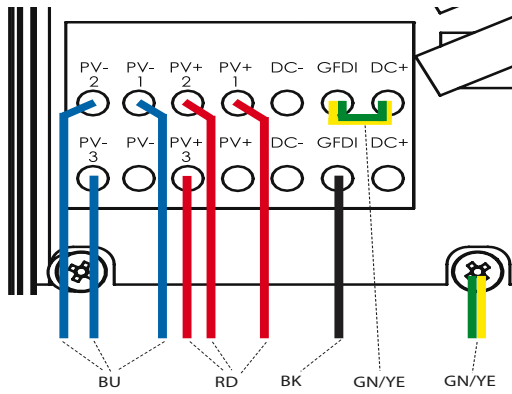
Figure 20: Positive grounding on the Powador 2002-3002
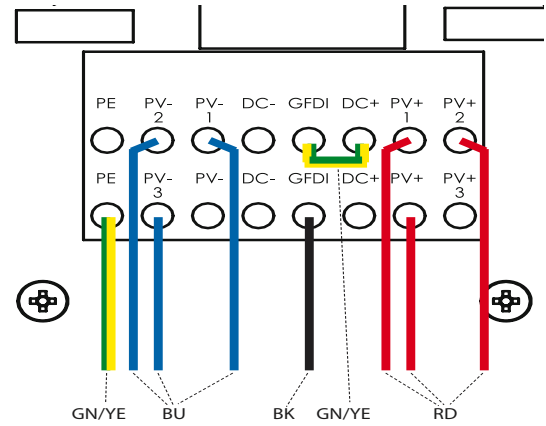
Figure 21: Positive grounding on the Powador 4202-6002 (via PE terminal)
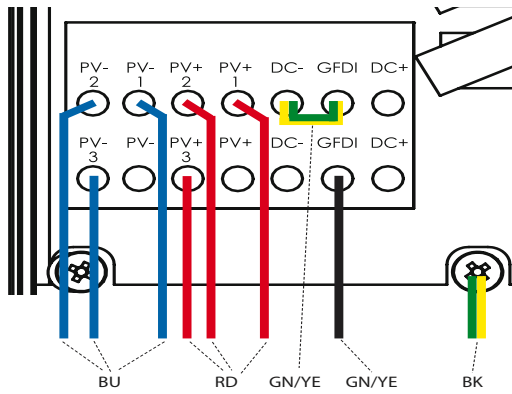
Figure 22: Negative grounding on the Powador 2002-3002
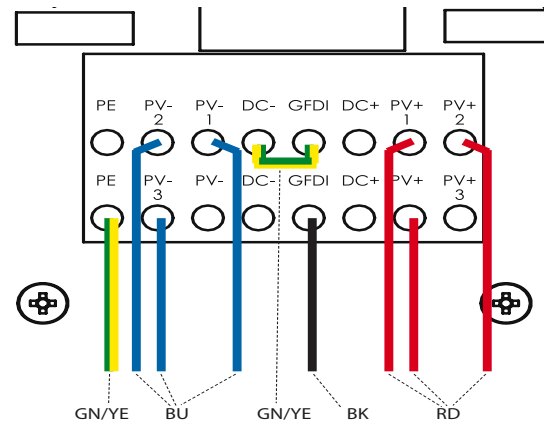
Figure 23: Negative grounding on the Powador 4202-6002 (via PE terminal)

> **NOTE**
> The fuse is triggered in the event of a ground fault in the PV system. The inverter interrupts the grid feed-in until the fuse has been replaced.
> Only use identical fuses (Littelfuse KLKD1, 600 V, 1 A, fast-acting).

7.4 Connecting the interfaces

All interfaces are connected on the communication circuit board. The circuit board is located directly underneath the terminal block of the cable feed.

> ⚠ **DANGER**
>
> **Risk of fatal injury due to electric shock**
>
> Severe injury or death may result from improper use of the interface connections and failure to observe protection class III.
>
> › The SELV circuits (SELV: safety extra low voltage) can only be connected to other SELV circuits with protection class III.

⚠ Authorised electrician

> **NOTE**
>
> When laying the interface connection cable, note that too little clearance to the DC or AC cables can cause interference during data transfer.

Switch
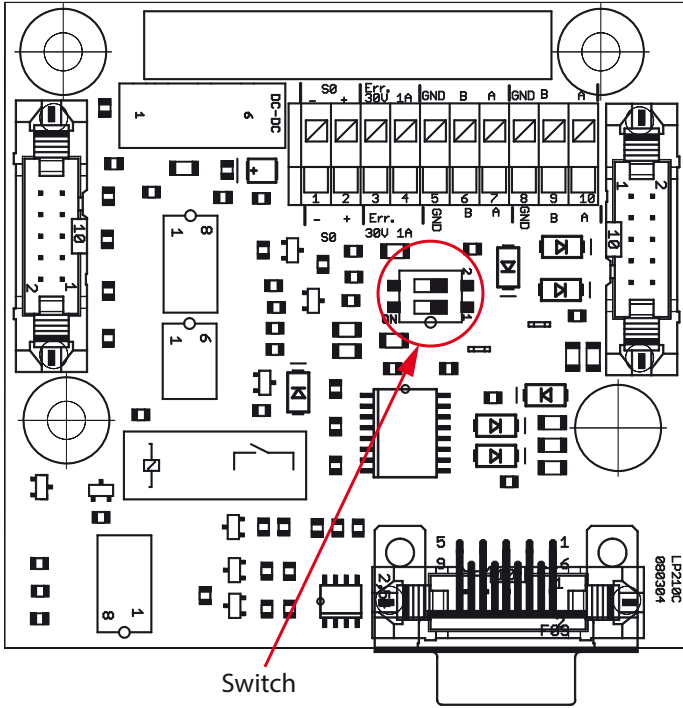
Figure 24:   Communication circuit board

Activating the terminating resistor

On the terminal unit of an inverter chain, a terminating resistor (Ra) of 330 Ω is connected.
(Figure 24). This resistor is required for correct signal transmission.

1.   Switch "1" must be set to "ON" on the terminal unit.
2.   Switch "2" must be set to "OFF".
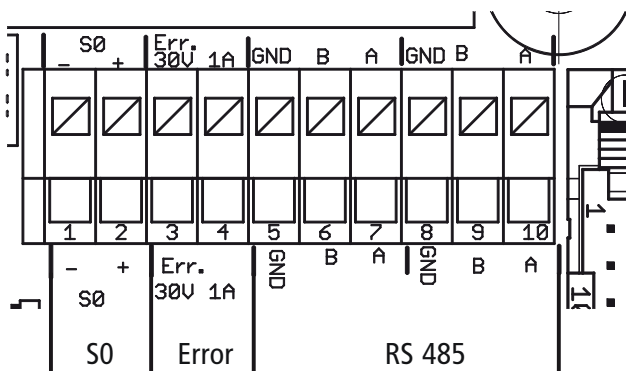
Figure 25:   Interface terminals

7.4.1 Connecting the fault signal relay

The contact is designed as an N/O contact and is labelled "ERR" on the circuit board.

Maximum contact load	
DC	30 V / 1 A
AC	250 V / 1 A

Connecting the fault signal relay

1. Unscrew the cable fitting.
2. Thread the connection cables through the cable fitting.
3. Connect the connection cables to the connection terminals.
4. Tighten the cable fitting.

7.4.2 Connecting the S0 output

An S0 pulse output is located on the communication board. Use this output to control accessories such as a large display, for example. The pulse rate of the output is adjustable.

Connecting the S0 output

1. Unscrew the cable fitting.
2. Thread the connection cables through the cable fitting.
3. Connect the connection cables to the connection terminals.
4. Tighten the cable fitting.

NOTE

Ensure that the wires are properly connected. Communication is not possible if the wires are reversed.

7.4.3 Connecting the RS485 bus

NOTE

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

7.4.3.1 Wiring diagram
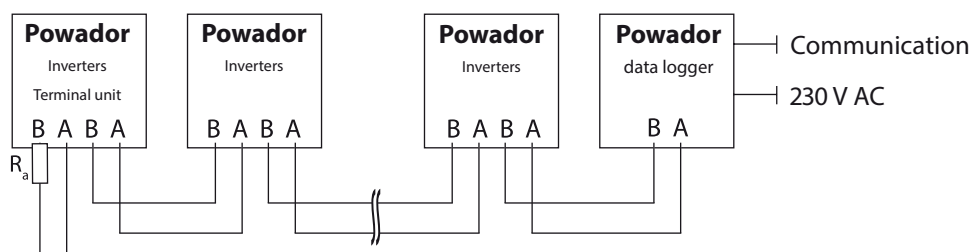
Figure 26: RS485 interface wiring diagram

⚠ Authorised electrician

Properties of the RS485 data line

Maximum length of the RS485 bus line	The maximum allowed length of the RS485 bus is 1200 m. This length can be reached only under optimum conditions. Lengths exceeding 500m generally require a repeater or a hub.
Maximum number of connected bus devices	31 inverters + 1 data monitoring unit
Data line	Twisted, shielded. Recommendations: LI2YCYv (twisted pair) black for laying cable outside and in the ground, 2 x 2 x 0.5 LI2YCY (twisted pair) grey for dry and moist indoor spaces, 2 x 2 x 0.5

ℹ **NOTE**

Different manufacturers do not always interpret the standard on which the RS485 protocol is based in the same way. Note that the wire designations (- and +) for wires A and B can vary between manufacturers.

ℹ **NOTE**

Calculating efficiency by measuring the current and voltage values leads to unusable results due to the tolerances of the measurement devices. The sole purpose of these measured values is to monitor the basic operation of the system.

Connecting the RS485 bus

☞ To prevent interference during data transmission:

• Observe the wire pairing when connecting DATA+ and DATA- (see Figure 27)

• Do not install RS485 bus lines in the vicinity of live DC/AC cables.

1. Unscrew the cable fitting.
2. Thread the connection cables through the cable fitting.
3. Connect the connection cables to the corresponding connection terminals (see Figure 25 on page 28).
4. The following must be connected to all inverters and to the data monitor unit in the same way:
   – Wire A (-) with wire A (-) and
   – Wire B (+) with wire B (+) (see Figure 26 on page 29)
5. Tighten the cable fitting.
6. Activate the terminating resistor on the terminal unit.
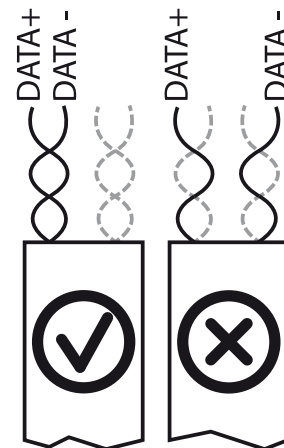
Figure 27: RS485 bus: Assignment of twisted-pair wires

ℹ **NOTE**

When using the RS485 bus system, assign a unique address to every bus device (inverter, sensor) and terminate the terminal units (see the "Settings" 8.3 on page 36 menu) .

7.5   Sealing the connection area

1.   The requirements of protection rating IP54 are met by closing the unused cable fittings with blind caps.
2.   Put on the lid for the connection area.
3.   Close and lock the housing door.
»   The inverter has been mounted and installed.
»   Start up the inverter.

7.6   Starting up the inverter

⚠ DANGER

Lethal voltages are still present in the terminals and cables of the inverter even after the inverter has been switched off and disconnected.

Severe injuries or death may occur if the cables and terminals in the inverter are touched.

Only authorised electricians who are approved by the supply grid operator may start up the inverter.

FR   **Attachment of safety label in accordance with UTE C 15-712-1**

The code of practice UTE C 15-712-1 requires that, upon connection to the French low-voltage distribution network, a safety sticker showing a warning to isolate both power sources when working on the device must be attached to each inverter.

☞   Attach the provided safety sticker visibly to the outside of the inverter housing.

ATTENTION
Présence de deux
sources de tension
- Réseau de distribution
-Panneux photovoltaïques

Isoler les deux sources
avant toute intervention
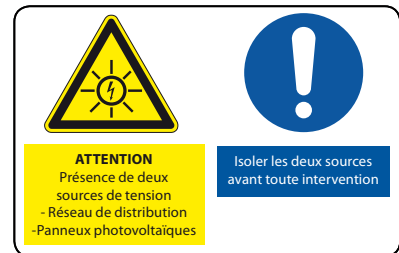
7.6.1   Switching on the inverter

↻   The inverter has been mounted and electrically installed.
↻   The cover for the connection area is grounded and closed.
↻   The PV generator is supplying a voltage > 350 V.
1.   Connect the grid voltage using the external circuit breakers.
2.   Connect the PV generator using the DC disconnect (0 → 1).
»   The inverter begins to operate.
»   During the initial start-up: Follow the instructions of the New Connection Wizard.

8 Configuration and Operation

8.1 Controls

The inverter has a backlit LCD as well as three status LEDs. The inverter is operated using two buttons.

Figure 28: LED indicators

Key

1	"Operating" LED
2	"Feed-in" LED
3	"Fault" LED

8.1.1 LED indicators

The three LEDs on the front of the inverter show the different operating statuses. The LEDs can take on the following states:

🟢	LED illuminated	🟢	LED flashing	⚪	LED not illuminated

The LED indicators show the following operating statuses:

Operating status	LEDs	Display	Description
Start	🟢 ok		The green "Operating" LED is illuminated if an AC voltage is present, independently of the DC voltage.
Grid-feed start	🟢 ok 🟢 ⌂⚡⼈	Power fed into the grid or measured values	The green "Operating" LED is illuminated. The green "Feed-in" LED is illuminated after the country-specific waiting period*. The inverter is ready to feed in, i.e. is on the grid. You can hear the grid relay switch on.
Grid-feed start	🟢 ok 🟢 ⌂⚡⼈	Power fed into the grid or measured values	The green "Operating" LED is illuminated. The green "Grid feed" LED is illuminated after the country-specific waiting period*. The inverter is internally power-reduced and ready to feed in, i.e. is on the grid. (in accordance with the VDE Rules of Application AR-N-4105) Alternatives 1. Internal/external power limiting or start-up limiting is active 2. The inverter is operating in standalone mode

* The waiting period ensures that the generator voltage continuously remains above the power delivery limit of 200 V. For country-specific waiting periods see out web site at http://kaco-newenergy.de/en/site/index.xml.

Non-grid feed mode	● ok ○ ⌂⚡⚠	Status message	The display shows the corresponding message.
Fault	● ⚠	Fault message	The display shows the corresponding message. The red "Fault" LED is illuminated. The inverter is not ready for grid feed, i.e. no longer on the grid.
Fault	☀ ⚠	Fault message	The display shows a SYM bus parameter error.

8.1.2 Display

The display shows measured values and data and allows the configuration of the inverter. In normal operation, the backlighting is switched off. As soon as you press one of the control buttons, the backlighting is activated. If no button is pressed for a minute, it switches off again.

In sleep mode, the inverter deactivates the display regardless of the selected setting.

ℹ️ **NOTE**

Depending on the tolerances of the measuring elements, the measured and displayed values are not always the actual values. However, the measuring elements ensure maximum solar yield. Due to these tolerances, the daily yields shown on the display may deviate from the values on the grid operator's feed-in meter by up to 15%.

After being switched on and after the initial start-up is complete, the inverter displays the unit name.

Figure 29: Display (shows the unit name or menu item)

8.1.3 Control buttons

Operate the inverter with the two control buttons
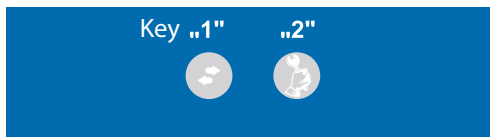
Figure 30: Control buttons

Key

1	Shift button	Opens menu
2	Set button	Make settings or selection

8.1.4 Inverter menu

Opening the menu
- ↻ The inverter is in grid-feed mode.
- ↻ The LCD is showing the grid parameters.
- ☞ Press the "1" key.
- » The power and configuration values are displayed in succession by pressing key "1" multiple times or by pressing and holding it.

Displaying the daily output
- ↻ The inverter is operating.
- ↻ The LCD is showing the grid parameters.
- ☞ Press key "1" repeatedly or press and hold until the display shows "Yield today".
- » The LCD is showing the daily yield.
- ☞ To return to the base display, press key "1" repeatedly or press and hold or wait for one minute without pressing a key.

Setting display language
- ↻ The LCD is showing menu level "2".
- ↻ The "Language" menu item is displayed.
- ☞ Press "2" to select the language.
- ☞ Press "1" to change the language.
- » After selection, menu level "1" is displayed in the selected language for the country.

Selecting a menu item
- ↻ The inverter is operating.
- ↻ The inverter displays a selection menu item.
- ☞ Press "2" to make a selection.
- ☞ Press "1" to confirm a selection.
- » The next menu item is displayed.

Making settings
- ↻ The inverter is operating.
- ↻ The LCD is showing a setting menu item.
- ☞ Press "1" to navigate to the setting position.
- ☞ Press key "2" repeatedly or press and hold until the setting value is correctly shown.
- » After running though all setting positions the value is saved and the next menu item is displayed.

Selecting menu level "2"
- ↻ The inverter is operating.
- ↻ The LCD is showing the unit name.
- ☞ Press keys "1" and "2" simultaneously.
- » The LCD is showing the software version.
- ☞ Press key "1" repeatedly or press and hold.
- » The display runs through menu level "2" and returns to the start point.
- ☞ To return to menu level "1", press keys "1" and "2" simultaneously or wait for one minute without pressing a key.

Selecting menu level "3" (service technician)

↻ The inverter is operating.

↻ The LCD is showing the unit name.

☞ Press key "2" for 15 seconds.

» The LCD is showing the country-specific parameters.

☞ Press key "1" repeatedly or press and hold.

» The display runs through menu level "3".

☞ To return to menu level "1", press key "1" and "2" simultaneously or wait for one minute without pressing a key.

Entering password or unlock code

☞ Key "1" selection of items (1-4).

↻ The LCD shows the selected digits by underlining them.

☞ Press key "2" to set the value. (0-9, A-F).

↻ The LCD shows the set digits or letters.

☞ Press "1" to check password.

↻ If the password is correct, the unlocked menu item is displayed.

Saving changed settings

☞ Press keys "1" and "2" simultaneously to save settings or wait one minute after setting.

» The LCD jumps back to menu level "1".

8.2 Starting up for the first time

When started for the first time, the inverter displays the configuration assistant. It takes you through the settings necessary for the initial start-up.

> **ⓘ NOTE**
>
> After configuration is completed, the configuration assistant does not appear again when the inverter is restarted. You can then change the country setting only in the password-protected parameter menu.

> **ⓘ NOTE**
>
> The sequence of the settings required for initial start-up is preset in the configuration assistant.

Initial configuration

↻ You are in the parameter menu

☞ Select the country of operation.

☞ Select the required grid type.

☞ Press key 1 and confirm with "Yes" that you want to permanently save the country set.

» You have completed the initial configuration. The inverter begins to operate.

8.3 Menu structure

Icons used:

⊞2⃞3	Menu level (1, 2, 3)	↳	Submenu available
👁	Display menu	(DE)	Country-specific setting
☰	Option menu	(DE)NSp.	Country and grid type-specific setting
🔒	Password-protected menu item		

Country-spec. Setting	Menu level	Display/ setting		Action in this menu/meaning
All countries	1⃞2⃞3⃞	**Display**	↳	☞ Press keys "1" or "2".
	1⃞2⃞3⃞	**"Display" menu**	↳	☞ Press key "1" to run through the following menu level "1".
	1⃞2⃞3⃞	**Unit name**	👁	Displays the unit name of the inverter.
	1⃞2⃞3⃞	**Generator voltage and current**	👁	Displays the current voltage and current of the PV array that is connected to the inverter.
	1⃞2⃞3⃞	**Grid voltage, current and power**	👁	Shows the current grid parameters that the unit is feeding into the grid. (Nominal power [W], nominal voltage [V], grid frequency [Hz] and amperage [A]).
DE NSp,	**1**⃞2⃞3⃞	**Mode**	👁	Menu item with default value is only displayed when grid operator is limiting power. Display of one of the following control procedures: - cos phi (P) : specific characteristic - cos phi (P) : standard characteristic - cos phi 0.800 u (constant) - Q stepping of active power in % steps - Q(U) stepping of active power based on characteristic
IT				- Q=f(U) Specific characteristic with 5 nodes - Q=f(U) Specific characteristic with 2 State DDC
DE NSp,	**1**⃞2⃞3⃞	**Ramping-up limitation**	👁	Menu item is displayed with active ramp limitation. (power ramp-up)
	1⃞2⃞3⃞	**External limitation**	👁	Menu option is displayed with external active power limitation. Shows the power control in % steps (0%, 30% 60%) . In accordance with the requirements of the German renewable energy act (EEG)
	1⃞2⃞3⃞	**Remaining time for Powador-priwatt**	👁	Menu item is displayed with active Powador priwatt function and potential-free contact switched. Shows the remaining runtime in hours and minutes.
IT	**1**⃞2⃞3⃞	**SPI status**	👁	Status display of the specific "System Protection Interface" (Remote tripping/External signal/local control)
All countries	**1**⃞2⃞3⃞	**Temperature inside unit**	👁	Displays the temperature of the heat sink in °C. If the unit overheats, the first response is automatic power reduction. In the second step the unit shuts down.
	1⃞2⃞3⃞	**Yield meter**	👁	Shows the total yield back to the last reset. Press "2" to clear the yield meter.

Country-spec. Setting	Menu level	Display/ setting		Action in this menu/meaning
All countries	**1**-2-3	**Yield today**	👁	Displays the yield of the current day up to now.
	1-2-3	**Total yield**	👁	Displays the total yield up to now. The total yield value can be set in menu level "2".
	1-2-3	**CO2 savings**	👁	Displays the calculated CO_2 savings (in kg).
	1-2-3	**Operating hours counter**	👁	Shows the total operating time back to the last reset. The yield-hour meter can be cleared in menu level "2" "Grid feed meter".
	1-2-3	**Operating hours- today meter**	👁	Displays the duration of operation on the current day.
	1-2-3	**Operating hours- total meter**	👁	Displays the total operating time.
	1-2-3	**Displaying grid error**	👁 ☰	If the function is enabled, the five most recent grid errors in last 1000 operating hours are displayed. ☞ The fault messages are displayed by pressing "1". ☞ Once the grid faults have been displayed, the menu level is run through and starts by displaying the unit name when key "1" is pressed again.
	1-**2**-3	**"Setting mode" menu**	⌐	☞ Press keys "1" and "2" to run through the following menu level "2".
	1-**2**-3	**Software version**	👁	Displays the installed software version.
	1-**2**-3	**Configuration version**	👁	Displays the installed configuration version.
	1-**2**-3	**Serial no.**	👁	Displays the serial number of the inverter.
	1-**2**-3	**Country and grid- type display**	👁	Displays the selected country setting. Optional: Displays the grid type if a grid type has been selected.
	1-**2**-3	**Language**	☰	☞ Select the desired menu language.
	1-**2**-3	**Clearing the grid- feed meter**	👁 ☰	Allows the grid-feed meter to be cleared. ("Yield" meter and "Operating hours" meter) ☞ If "yes" is selected the password is requested. ☞ Setting required password number "2" If the code number is valid, the grid-feed meter is cleared and a confirmation is displayed. (Grid-feed meter cleared!)
	1-**2**-3	**Defining total yield**	👁 ⌐	You can set the total yield to any value, for example, when you have received a replacement unit and want to continue the recording from the present value. ☞ Select "yes" to set the total yield.

Country-spec. Setting	Menu level	Display/ setting		Action in this menu/meaning
All countries	1 **2** 3	**Interface**	👁	A selection is possible only if both RS232 and RS485 interfaces are installed.
			⌐	☞ The interface is changed by pressing "2".
	1 **2** 3	**Inverter address**	👁	Every inverter must have a unique address. The interface is used to communicate with the Powador-proLog.
			⌐	☞ By pressing key "2", the RS485 address can be set consecutively from 1 to 32.
	1 **2** 3	**S0 interface**	👁	Selection of pulse rate for the S0 interface 500, 1000 and 2000 pulses/kWh
			☰	☞ Set pulse rate.
EN	1 **2** 3	**Activate priwatt**	👁 🔒	Releases the use of the fault signal relay for the Powador priwatt internal consumption control relay. 1. Enter the password. (See Section 8.1.4 on page 34) 2. Confirm what you have entered using key "1". 3. Activate or deactivate the home grid-feed function. NOTE: Activating this option enables the menu item "Set Powador-priwatt".
	1 **2** 3	**Set priwatt**	☰	☞ Define the switch-on power in kW that needs to be available on an uninterrupted basis for 30 minutes before the home feed-in is activated. ☞ Define the switch-on time (operating time of Powador-priwatt after activation). NOTE: This menu item is only available if you have selected the "On" option for the "Activate priwatt" menu item in the "Settings" menu.
All countries	1 **2** 3	**Power Boost**	👁 ☰	Offers the option of reducing the frequency of the IGBT bridge from 17 kHz to 9 kHz to improve efficiency. ☞ Power Boost mode is activated by pressing "2". NOTE: The change may cause operating noise.
	1 **2** 3	**Quick start**	👁 ☰	Menu item is displayed only when waiting for grid feed and during ramp-up limiting. Offers the option of ramping up the inverter faster for inspection or testing. If there is insufficient PV array power, the inverter stops feeding into the grid after a short period of time. ☞ If the function is disabled, the display runs through the menu level and when key "1" is pressed again it shows the software version.

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Country-spec. Setting	Menu level	Display/ setting	Action in this menu/meaning
All countries	1–2–**3**	**"Parameters" menu** ↳	Only service technicians are permitted to make changes in the parameter menu. ↻ You are in menu level "1". ↻ The unit name is displayed. ☞ Press "2" for at least 15 seconds to run through menu level 3.
	1–2–**3**	**Selecting country with grid type and directive** 🔒 ☰	The default setting is used if "no" is selected. 1. Enter the four-digit password using key "2". The password is unit-specific. 2. Confirm what you have entered using key "1". 3. Set the desired country setting. ☞ Select the type of grid applicable to the use of the inverter. NOTE: This option influences the country-specific operating settings of the inverter. Please consult KACO service for further information.
ES P.O. 12.3, ES RD 661, ES RD 1699, HU, IN, IT, UD		☰	☞ Specify the shutdown threshold for fast and slow overvoltage shutdown. ☞ Set period from occurrence of the fault to shutdown of the inverter.
DE, DE-VD-N,BE	1–2–**3**	**Overvoltage shutdown** ☰ 🔒	☞ Activate or deactivate password protection. ☞ Specify the shutdown threshold for overvoltage shutdown. The 10-minute average for the measured voltage as per EN50160 is used. ☞ Set period from occurrence of the fault to shutdown of the inverter.
BG, CZ, FR		☰	☞ Specify the shutdown threshold for overvoltage shutdown. The 10-minute average for the measured voltage as per EN50160 is used. ☞ Set period from occurrence of the fault to shutdown of the inverter.
BG, CZ, FR ,PF	1–2–**3**	**Max. line voltage EN 50160** ☰	The grid voltage is averaged over ten minutes. If the defined value is exceeded, the inverter is disconnected from the grid. ☞ Set voltage threshold.
BG, CZ, FR , PF, DE, DE-VDN, BE	1–2–**3**	**Voltage drop between meter and inverter** ☰	The voltage drop between the inverter and the grid-feed meter is added to the limit value that was set for grid shutdown according to EN 50160. The limit value can be set from 0 to 11 V in 1 V increments. ☞ Specify the switch-off value for the voltage drop (0 to 11 V).
DK, GR-(M/I), GB-G83, IL, PT, KR, SI	1–2–**3**	**Line undervoltage/overvoltage switch-off** ☰	The inverter is equipped with redundant 3-phase monitoring. If the grid frequency exceeds or drops below the configured values, the inverter switches off. The minimum switch-off threshold can be set in 1 V increments. ☞ Configure the switch-off values for undervoltage and overvoltage.

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Country-spec. Setting	Menu level	Display/ setting		Action in this menu/meaning
ES P.O. 12.3, ES RD 661, ES RD 1699, UD, IT-CEI021, GB-G59	1 2 **3**	**Minimum grid frequency**	▤	The inverter monitors the grid frequency continuously. If the grid frequency exceeds or drops below the configured values, the inverter switches off. ☞ Set limit values for fast and slow underfrequency shutdown in 0.1 Hz increments ☞ Enter the shutdown threshold for fast and slow overvoltage shutdown.
	1 2 **3**	**Maximum grid frequency**	▤	☞ Set limit values for fast and slow underfrequency shutdown in 0.1 Hz increments ☞ Enter the shutdown threshold for fast and slow overfrequency shutdown.
DE NSp,	1 2 **3**	**Minimum/ maximum grid frequency**	👁	Shows the minimum/maximum allowable grid frequency.
All countries	1 2 **3**	**Minimum/ maximum grid frequency**	▤	Shows the minimum/maximum allowable grid frequency. ☞ Set limit values for underfrequency and overfrequency switch-off in 0.1 Hz increments
All countries	1 2 **3**	**Starting voltage**	👁 ▤	The inverter begins feed-in as soon as this PV voltage is present. ☞ Set the starting voltage.
	1 2 **3**	**Grnd flt monitor**	▤	One pole of the PV generator is grounded in the unit using a fuse. Ground fault monitoring is triggered in the event of an ground fault in the generator. This prevents possible damage to the modules. **NOTE:** Activate ground fault monitoring only if you have grounded one pole of the PV generator. (See section 7.3 on page 40) ☞ Activate or deactivate the ground fault monitoring function.
All countries	1 2 **3**	**Internal power limiting**	👁 ▤	The power reduction function is password-protected. Power is reduced in 10 W steps and is limited to 50% of the nominal unit power. ☞ Enter the four-digit password using key "2". ☞ Set power limiting. ☞ Password protection can be re-activated.
BE, DE	1 2 **3**	**Reactive power setting**	👁 ▤	The following control methods can be set. At least one mode must be active. ☞ Q specification ☞ cos phi specification ☞ cos phi(P/Pn) ☞ Q(U) characteristic
IT			👁 ▤	☞ Characteristic Q=f(U) - activate 5 nodes from value pairs (Q1:U1 – Q5:U5). ☞ Characteristic Q=f(U) - activate two-state controller with 4 fixed value pairs (Q:U).

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Country-spec. Setting	Menu level	Display/ setting		Action in this menu/meaning
DE, BE, IT	1-2-**3**	**cos phi specification**	👁 ☰	☞ Configure power factor. ☞ If a power factor not equal to 1 is selected: Select the type of phase shift (under-excited (u) /over-excited (o)).
	1-2-**3**	**cos phi (P/Pn)**	👁 ☰	☞ Press "2" to retain the following mode > edit characteristic.
	1-2-**3**	**Nodes**	👁 ☰	Offers the option of resetting or editing the nodes. ☞ Press "1" to display all nodes in succession. ☞ Press "1" to activate default characteristic and a confirmation message is shown. ☞ By pressing "1" the individual nodes can be edited
	1-2-**3**	**Number of support points**	☰	This option defines the number of nodes that can be defined in the subsequent menu. • Grid type for medium voltage and low voltage: up to 10 nodes definable
	1-2-**3**	**1. Node** **2. Node**	☰	☞ Increment P/Pn in % with key "2" and confirm with key "1". ☞ Increment cos phi with key "2" and confirm with key "1". ☞ If a power factor not equal to 1 is selected: Select the type of phase shift (under-excited/over-excited). ☞ After running through all selected nodes, all values are saved by pressing "1" and this characteristic then is checked for consistency. In the event of an error, the characteristic that was previously active is restored and the error message "Characteristic invalid" appears. You then have the option of correcting the characteristic.
DE, BE	1-2-**3**	**Q(U) characteristic**	☰	☞ Specify the target voltage. ☞ Specify slope. ☞ Specify change time.

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Country-spec. Setting	Menu level	Display/ setting		Action in this menu/meaning
IT	1–2–**3**	**Q=f(U) 5 Supports**	◉	Select the preset control procedure.
		Q(U) Parameter	☞	The parameters of the selected procedure can be changed by selecting "Yes".
		Slope K	▤ ☞	Specify slope. (Default value: 01000/1000)
		Change time	☞	Set the response speed of the control. (ms)
		Lock-in power	▤	Power range set as ‰ of rated power, in which the network support process is active.
		Lock out power	▤ ☞	
		Q=f(U) 2-point controller	↳	Select the preset control procedure.
		Q(U) Parameter	☞	Control parameters can be changed by selecting "Yes".
		Slope K	▤ ☞	Specify slope. (Default value: 01000/1000)
		Change time	☞	Set the response speed of the control. (ms)
		Lock-in power	▤	Power range set as ‰ of rated power, in which the network support process is active.
		Lock out power	▤ ☞	
		Activate SPI mode	▤ ☞	Provides the option of activating or configuring the specific "System Protection Interface" for Italian. (Additional PCB required!)

9 Maintenance/Troubleshooting

9.1 Visual inspection

Inspect the inverter and the cables for visible damage and note the operating status display of the inverter. In case of damage, notify your installation engineer. Repairs may only be carried out by authorised electricians.

> **ℹ NOTE**
>
> Have your installer check for proper operation of the inverter at regular intervals.

9.2 External cleaning

> **⚠ DANGER**
>
> **Lethal voltages in the inverter**
>
> Serious injuries or death can result if moisture enters the inverter.
>
> › Only use completely dry objects to clean the inverter.
>
> › Only the exterior of the inverter should be cleaned.

Cleaning the inverter

☞ Do not use compressed air.

☞ Use a vacuum cleaner or a soft brush to remove dust from the bottom fan covers and from the top of the inverter on a regular basis.

☞ Remove dust from the ventilation inlets if necessary.

9.2.1 Cleaning the fan

> **ℹ NOTE**
>
> If the fan is only covered with loose dust, it can be cleaned with the help of a vacuum cleaner or a soft brush.
>
> If the fan is very dirty, or if it is defective, it can be removed.
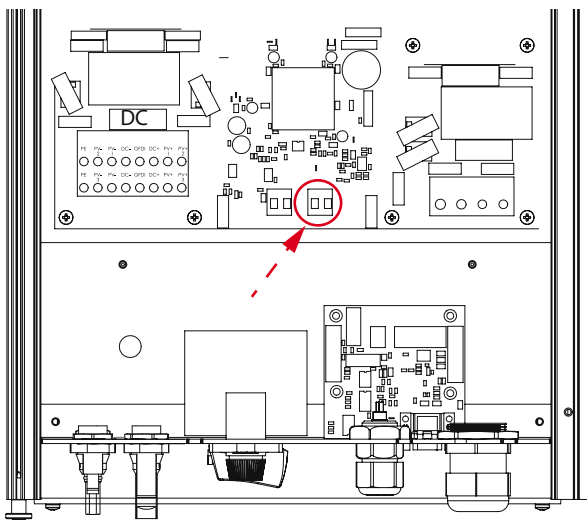
Figure 31:   Plug for fan
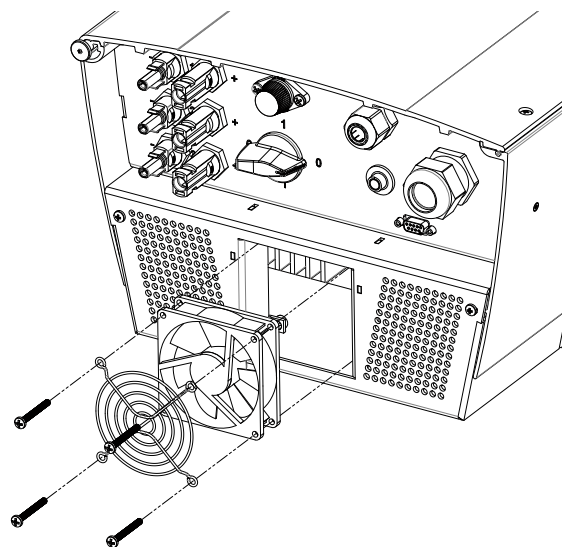
Figure 32:   Fan cover

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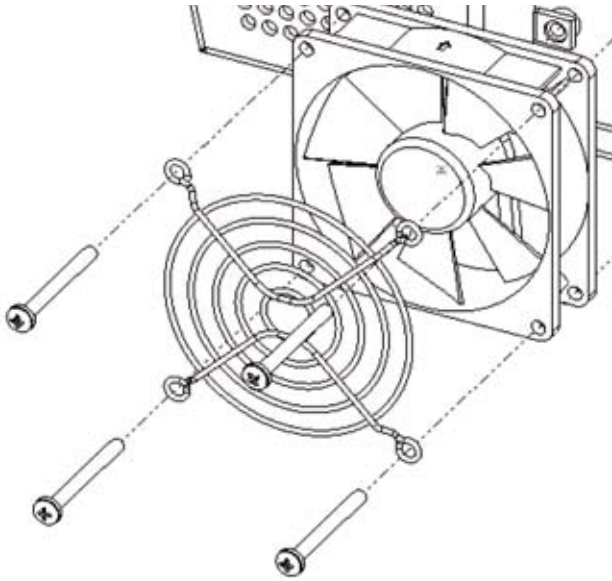
Figure 33:   Removing the fan cover

Removing the fans

☞ Disconnect the fan from all power sources and wait until the fan no longer turns.

☞ Disconnect the fan plug.

☞ Loosen four screws on housing floor.

» Fan can be removed along with cover (see Figure 33). Clean the fan with a soft brush or moist cloth.

☞ Install fan after cleaning.

9.3   Shutting down for maintenance and troubleshooting

⚠ **DANGER**

Lethal voltages are still present in the terminals and cables of the inverter even after the inverter has been switched off and disconnected.

Severe injuries or death may occur if the cables and terminals in the inverter are touched.

Only authorised electricians who are approved by the supply grid operator may open and maintain the inverter.

› Observe all safety regulations and the currently applicable technical connection specifications of the responsible power supply company.

› Disconnect the AC and DC sides.

› Secure the AC and DC sides from being inadvertently switched back on.

› Do not open the inverter until after these two steps are complete.

› After shutdown, wait at least 30 minutes before working on the inverter.

CAUTION

Destruction of the DC connection

The connection terminals can be destroyed by arcing if disconnected while still live.

› It is essential that the shutdown sequence is carried out in the correct order.

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Shutting down the inverter
1. Switch off the grid voltage by turning off the external circuit breakers.
2. Disconnect the PV generator using the DC disconnect.

DANGER! The DC cables are still live.
☞ Ensure that there is no voltage present on the grid connection terminals.

9.4 Faults

9.4.1 Procedure

> ⚠ **DANGER**
>
> **Lethal voltages are still present in the terminals and cables of the inverter even after the inverter has been switched off and disconnected.**
>
> Severe injuries or death may occur if the cables and terminals in the inverter are touched.
>
> ☞ When a fault occurs, notify an authorised electrician approved by the supply grid operator or KACO new energy GmbH Service.
>
> ☞ The operator can only carry out actions marked with a B.

☞ In case of power failure, wait for the system to automatically restart.
☞ Notify your electrician if there is an extended power failure.

9.4.2 Troubleshooting

B = Action of the operator

E = The indicated work may only be carried out by an authorised electrician.

K = The indicated work may only be carried out by a service employee of KACO new energy GmbH.

Fault	Cause of fault	Explanation/remedy	By
The display is blank and the LEDs are not lighting up.	Grid voltage not available	☞ Check whether the DC and AC voltages are within the permitted limits (see Technical Data).	E
		☞ Notify KACO Service.	E
The inverter stops feeding into the grid shortly after being switched on, even though there is sunlight present.	Faulty grid separation relay in the inverter.	If the grid separation relay is defective, the inverter will recognise this during the self-test.	
		☞ Ensure that there is sufficient PV generator power.	E
		☞ If the grid separation relay is defective, have it replaced by KACO Service. ☞ Notify KACO Service.	E
The inverter is active but does not feed into the grid. The display indicates a line failure.	Grid-feed is interrupted due to a grid fault.	Due to a grid fault (grid impedance too high, over/undervoltage, over/underfrequency), the inverter stopped the feed-in process and disconnected from the grid for safety reasons.	
		☞ Change the line parameters within the permitted operating limits (see the "Start-Up" section).	E

Table 6: Troubleshooting

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Fault	Cause of fault	Explanation/remedy	By
The grid fuse trips.	The grid fuse capacity is too low.	In cases of high solar radiation, the inverter exceeds its rated current for a short period, depending on the PV generator.	
		☞ Select the capacity of the inverter's pre-fuse to be somewhat higher than the maximum feed-in current (see the "Installation" section).	**E**
		☞ Contact the grid operator if the grid failure continues to occur.	**E**
The grid fuse trips.	Damage to the inverter's hardware.	If the line fuse trips immediately when the inverter goes into feed-in mode (after the start-up period is complete), the inverter's hardware is probably damaged.	
		☞ Contact KACO Service to test the hardware.	**E**
Daily yields do not correspond to the yields on the feed-in meter.	Tolerances of the measuring elements in the inverter.	The measuring elements of the inverter have been selected to ensure maximum yields. Due to these tolerances, the daily yields shown may deviate from the values on the feed-in meter by up to 15%.	
		☞ No action	-
The inverter is active but does not feed into the grid. Display: "Waiting for feed-in"	• Generator voltage too low • Grid voltage or PV generator voltage unstable.	• The PV generator voltage or power is not sufficient for feed-in (solar radiation is too low). • The inverter checks the grid parameters before the feed-in process begins. The length of time it takes to switch back on again differs by country according to applicable standards and regulations and can take several minutes. • The starting voltage may have been set incorrectly.	
		☞ Adjust starting voltage in the Parameter menu if required.	**K**
Noise emission from the inverter.	Particular ambient conditions.	When there are certain ambient conditions, the units may emit audible noises. • Grid interference or grid failure caused by particular loads (motors, machines, etc.) which are either connected to the same point on the grid or located in the vicinity of the inverter. • In cases of volatile weather conditions (frequent switching between sunny and cloudy conditions) or strong solar radiation, a light hum may be audible due to the increased power. • Under certain grid conditions, resonances may form between the unit's input filter and the grid, which may be audible even when the inverter is switched off. These noise emissions do not affect the operation of the inverter. They do not lead to loss of efficiency, failure, damage or to a shortening of the unit's service life. People with very sensitive hearing (particularly children) are able to hear the high-frequency hum caused by the inverter's operating frequency of approximately 17 kHz.	
		☞ No action	

Table 6:   Troubleshooting

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Fault	Cause of fault	Explanation/remedy	By
In spite of high radiation levels, the inverter does not feed the maximum power into the grid.	The device is too hot and the system limits the power.	Because the temperatures inside the unit are too high, the inverter reduces its power to prevent damage to the unit. Note the technical data. Ensure that the convection cooling is not impeded from the exterior. Do not cover the cooling fins.	
		☞ Provide for sufficient cooling of the unit. ☞ Do not cover the cooling fins.	**B, E**
Additional devices that are connected via the potential-free contact suddenly start up, even though the "priwatt" function is deactivated and the inverter indicates an error.	The potential-free contact connects to indicate an error.	If the "priwatt" function is not activated, the potential-free contact functions as a fault signal relay and therefore indicates errors. However, if additional devices that are provided for the "priwatt" function are connected to the inverter via the contact, they can still start up when the inverter experiences an error, because the contact is connected at that point in time. If you deactivate the "priwatt" function, we recommend that you disconnect devices from the inverter that were connected for this function.	

Table 6:   Troubleshooting

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9.5 Messages on the display and the "Fault" LED

Many fault signals indicate a fault in the grid. They are not operational faults of the inverter. The triggering levels are defined in standards, e.g. VDE0126-1-1. The inverter shuts down if the values exceed or fall below the approved levels.

9.5.1 Display of status and fault messages

Display	Fault LED (red)		
FS (fault status)	🔴 ⚠	**ON**	• Fault signal relay has switched. • Feed-in was ended due to a fault.
OS (operating status)	⚪ ⚠	**OFF**	• The fault signal relay releases again. • The inverter feeds back into the grid again after a country-specific time period.

Details regarding the fault or operating status can be found either on the display or in the data that was recorded through the RS485 interface.

9.5.2 Status and fault signals

The following table lists the possible status and fault signals that the inverter shows on the LCD and the LEDs. For the status, consult the data that is logged via the RS485 interface.

BS = operating status, FS = fault status;

B = Action of the operator

E = The indicated work may only be carried out by an authorised electrician.

K = The indicated work may only be carried out by a service employee of KACO new energy GmbH.

Status		Display	⚠ ⚡	ⓘ	Explanation	Action		By
OS	1	Start from ### V Measurem. ### V	⚪	⚪	Self-test: The grid parameters and generator voltage are being checked.	-		-
OS	2	Voltage too low!	⚪	⚪	Generator voltage and power are too low; situation before transition into night shutdown	-		-
OS	8	Self-test	⚪	⚪	Checks the shutdown of the power electronics as well as the grid relay before feed-in mode	-		-
FS	10	Temperature in unit too high	⚪	🔴	In case of overheating, the inverter switches off. Possible causes: • ambient temperature too high, fan covered, inverter defective.	☞ Clean the fans. ☞ Notify your authorised electrician.		**B** **B** **E**
FS	18	Resid. current shutdown	⚪	🔴	Residual current was detected. The feed-in was interrupted.	☞ Notify your authorised electrician.		**E**
FS	19	Generator insulation fault	⚪	🔴	There is an insulation fault on the PV generator. The feed-in was interrupted.	☞ Notify your authorised electrician if the fault occurs several times.		**E**

Table 7: Operating statuses and fault messages on the display

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Status		Display	⌂⚡🏠	⚠	Explanation	Action		By
FS	29	Ground fault Check fuse	○	🔴	A ground fault was detected at the PV generator.	☞	Notify your authorised electrician.	E
FS	30	Fault transformer fault	○	🔴	The current and voltage measurements in the inverter are not plausible.	-		-
FS	31	RCD module error			An fault has occurred in the AC/DC-sensitive residual current device.			
FS	32	Fault Self-test	○	🔴	The internal grid separation relay test has failed.	☞	Notify your authorised electrician if the fault occurs several times.	**E**
FS	33	Fault DC feed-in	○	🔴	The DC feed-in has exceeded the permitted value. This DC feed-in can be adopted from the grid onto the inverter so that no fault occurs.	☞	Notify your authorised electrician if the fault occurs several times.	**E**
FS	34	Communication error	○	🔴	A communication error has occurred in the internal data transmission.	☞	Notify your authorised electrician.	**E**
						☞	Check the data cable.	
FS	35	Protection shutdown SW	○	🔴	Protective shutdown of the software (AC overvoltage, AC overcurrent, DC link overvoltage, DC overvoltage).	Not a fault Grid-related shutdown, the grid connects again automatically.		-
FS	36	Protection shutdown HW	○	🔴	Protective shutdown of the hardware (AC overvoltage, AC overcurrent, DC link overvoltage).	Not a fault Grid-related shutdown, the grid connects again automatically.		-
FS	38	Error PV overvoltage	○	🔴	The voltage of the DC generator is too high. The PV generator is configured incorrectly.	☞	Notify your authorised electrician.	**E**
FS	41	Line failure: undervoltage L1	○	🔴	The voltage of a grid phase is too low; the grid cannot be fed into. The phase experiencing failure is displayed.	☞	Notify your authorised electrician.	**E**
FS	42	Line failure: overvoltage L1	○	🔴	The voltage of a grid phase is too high, the grid cannot be fed into. The phase experiencing failure is displayed.	☞	Notify your authorised electrician.	**E**
FS	43	Line failure: undervoltage L2	○	🔴	The voltage of a grid phase is too low; the grid cannot be fed into. The phase experiencing failure is displayed.	☞	Notify your authorised electrician.	**E**

Table 7:   Operating statuses and fault messages on the display

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Status		Display	⌂♨Å	!	Explanation	Action		By
FS	44	Line failure: overvoltage L2	○	🔴	The voltage of a grid phase is too high, the grid cannot be fed into. The phase experiencing failure is displayed.	☞	Notify your authorised electrician.	**E**
FS	45	Line failure: undervoltage L3	○	🔴	The voltage of a grid phase is too low; the grid cannot be fed into. The phase experiencing failure is displayed.	☞	Notify your authorised electrician.	**E**
FS	46	Line failure: overvoltage L3	○	🔴	The voltage of a grid phase is too high, the grid cannot be fed into. The phase experiencing failure is displayed.	☞	Notify your authorised electrician.	**E**
FS	47	Line failure: line-to-line voltage	○	🔴	The measured line-to-line voltage is outside of the tolerance limits.			
FS	48	Line failure: Under frequency	○	🔴	Grid frequency is too low. This fault may be grid-related.	☞	Notify your authorised electrician.	**E**
FS	49	Line failure: Over frequency	○	🔴	Grid frequency is too high. This fault may be grid-related.	☞	Notify your authorised electrician.	**E**
FS	50	Line failure: average voltage	○	🔴	The grid voltage measurement according to EN 50160 has exceeded the maximum permitted limit value. This fault may be grid-related.	☞	Notify your authorised electrician.	**E**
FS	57	Waiting for reconnect	○	🔴	Waiting time of the inverter after a fault.	Inverter does not switch on again until a country-specific time has elapsed.		
FS	58	Control board overtemperature	○	🔴	The temperature inside the unit was too high. The inverter switches off to prevent damage to the hardware.	☞	Provide for sufficient ventilation.	**E**
FS	59	Self test error	○	🔴	A fault occurred during a self-test.	☞	Notify your authorised electrician.	**E**
OS	60	Waiting for PV voltage <550V	🟢	○	The inverter does not begin feeding into the grid until the PV voltage falls below a specified value.	-		-
OS	61	External limit (%)	🟢	○	The external *Power Control* limit was activated by the grid operator. The inverter limits its power.	-		-
OS	63	Measured values	🟢	○	P(f)/frequency-dependent power reduction: Frequency-dependent power reduction will be activated when the BDEW (German Association of Energy and Water Industries) Medium Voltage Directive goes into effect. Power reduction starts at a frequency of 50.2 Hz.	-		-
OS	64	Measured values	🟢	○	Output current limiting: The AC current is limited once the specified maximum value has been reached.	-		-

Table 7:   Operating statuses and fault messages on the display

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Status		Display	⌂⚡☖ ①	Explanation	Action	By
FS	66	Instrument transformer fault	○ ●	Plausibility test of ADC test between ARM and DSP has failed	☞ In case of repeated occurrence: Notify your authorised electrician.	**E**
FS	70	Fan error	● ○	The fan is malfunctioning.	☞ Replace defective fan	E
FS	77	DC disconnect disconnect	○ ●	Inverter disconnected from generator by the switch, or DC relay does not close.		
FS		Config. error Invalid CRC	○ ●	The checksum of the loaded config. file does not match the checksum in the EEPROM. This means that the EEPROM data originate from a different config. file.	☞ Notify authorised electrician / KACO Service	**E/K**

Table 7:   *Operating statuses and fault messages on the display*

⚠ Authorised electrician

10 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 power converters support us in this philosophy.

However, in spite of all quality assurance measures, faults may occur in rare cases. In such cases, KACO new energy GmbH will provide you with the maximum possible support. KACO new energy GmbH will make every effort to remedy faults quickly and without requiring a lot of paperwork.

If you need help solving a technical problem with one of our KACO products, please contact our service hotline. Please have the following information ready so that we can help you quickly and efficiently:

- Inverter type / serial number
- Fault message shown on the display / Description of the fault / Did you notice anything unusual? / What has already been done to analyse the fault?
- Module type and string circuit
- Date of installation / Start-up report
- Consignment identification / Delivery address / Contact person (with telephone number)

You can find our warranty conditions on our website:

http://kaco-newenergy.de/en/site/service/garantie/index.xml

From there, you can easily navigate to our international websites by clicking on the appropriate flag. Websites.

Please use our website to register your unit immediately:

http://kaco-newenergy.de/en/site/service/registrieren/index.xml

You can also select the appropriate flag on this page to access the website for your own country.

In this manner, you can assist us in providing you with the quickest service possible. In return, you receive two additional years of warranty coverage for your unit.

Note: The maximum length of the warranty is based on the currently applicable national warranty conditions.

A form is provided for submitting complaints. It is located at
http://kaco-newenergy.de/en/site/service/kundendienst/index.xml

Hotlines

	Technical troubleshooting	**Technical consultation**
Inverters (*)	+49 (0) 7132/3818-660	+49 (0) 7132/3818-670
Data logging and accessories	+49 (0) 7132/3818-680	+49 (0) 7132/3818-690
Construction site emergency (*)	+49 (0) 7132/3818-630	
Customer help desk	Monday to Friday from 7:30 a.m. to 5:30 p.m. (CET)	

(*) Also on Saturdays from 8:00 a.m. to 2:00 p.m. (CET)

11 Shutdown/Disassembly

11.1 Shutting down the inverter

> ⚠️ **DANGER**
>
> **Lethal voltages are still present in the terminals and cables of the inverter even after the inverter has been switched off and disconnected.**
>
> Severe injuries or death may occur if the cables and terminals in the inverter are touched.
>
> › After shutdown, wait at least 30 minutes before working on the inverter.

> ⚠️ **DANGER**
>
> **Destruction of the DC plug**
>
> DC plugs can be destroyed by arcing if disconnected while still live.
>
> › It is essential that the shutdown sequence is carried out in the correct order.

Shutdown sequence

1. Switch off the grid voltage by turning off the external circuit breakers.
2. Disconnect the photovoltaic generator using the DC disconnects.

DANGER! The DC cables are still live.

☞ Ensure that there is no voltage present on the grid connection terminals.

11.2 Uninstalling the inverter

↻ Shut down the inverter.
1. Unscrew the two Philips screws on the right-hand side of the housing.
2. Detach DC connection plug.
3. Open the housing door.
4. Remove the interface cable.
5. Detach AC connection cables for the connection terminals.
6. Open the cable fittings.
7. Pull out the cables.
» The uninstallation of the inverter is complete. Continue with dismantling.

11.3 Dismantling the inverter

↻ Shut down the inverter.
↻ Uninstall the inverter.
1. Remove the inverter fastening.
2. Securely pack up the inverter if it is to be used later or have the inverter disposed of professionally.

12 Disposal

For the most part, both the inverter and the corresponding transport packaging are made from recyclable raw materials.

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

12.1 Packaging

Ensure that the transport packaging is disposed of properly.

13   Documents

13.1   EU Declaration of Conformity

Vendor's name and address	**KACO new energy GmbH** Carl-Zeiss-Straße 1 74172 Neckarsulm, Germany
Product description	**Photovoltaic feed-in inverter**
Type designation	**Powador 2002 / 3002 / 4202 / 5002 / 6002**

This is to confirm that the units listed above comply with the safety requirements set forth in the Directive of the Council of the European Union of 15th December 2004 on the harmonisation of the laws of the member states relating to electromagnetic compatibility (2004/108/EC) and the Low Voltage Directive (2006/95/EC).

The units conform to the following standards:

2006/95/EC

"Directive relating to electrical equipment designed for use within specific voltage limits"

2004/108/EC

"Directive relating to electromagnetic compatibility"

Safety of the unit:
EN 62103:2003-07
EN 50178:1997

Interference immunity:
EN 61000-6-2:2005

Emitted interference:
EN 61000-6-3:2007
EN 61000-6-4:2007

Secondary effects on the grid:
EN 61000-3-2:2006
EN 61000-3-12:2005
EN 61000-3-3:1995 + A1:2001 + A2:2005
EN 61000-3-11:2000

The types mentioned above are therefore labelled with the **CE mark**.

Unauthorised modifications to the supplied units and/or any use of the units that is contrary to their proper use shall render this Declaration of Conformity null and void.

Neckarsulm, 17/10/2011

KACO new energy GmbH

p.p. Matthias Haag
CTO

KACO
new energy.