KACO new energy.

Powador
16.0 TR3
18.0 TR3

Operating Instructions

■ **English translation of German original**

KACO new energy.

Operating Instructions

for Installers and Operators

Powador
16.0 TR3
18.0 TR3

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.

Some of the documents which are required for registering and approving your photovoltaic (PV) system are included with the operating instructions.

1.1.2 Retention of documents

These instructions and other documents must be stored near the system and be available whenever they are needed.

1.2 Design features

1.2.1 Symbols used in this document

General hazard symbol

Risk of fire or explosion

High voltage

Risk of burns

Authorised electrician

The tasks indicated with this symbol may only be carried out by an authorised electrician.

1.2.2 Description of safety instructions

DANGER

Imminent danger

Failure to observe this warning will lead directly to serious bodily injury or death.

WARNING

Potential danger

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

Hazard with risk of property damage

Failure to observe this warning will lead to property damage.

1.2.3 Description of additional information

NOTICE

Useful information and notes

DE

Country-specific function

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

1.2.4 Description of action instructions

a) One-step actions or actions that can be carried out in any sequence:

Action instructions

↻ Prerequisite(s) for your action(s) (optional)

☞ Carry out action.

☞ (Additional actions, if applicable)

» Result of your action(s) (optional)

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

Action instructions

↻ Prerequisite(s) for your actions (optional)

1. Carry out action.
2. Carry out action.
3. (Additional actions, if applicable)

» Result of your actions (optional)

1.2.5 Abbreviations

PV	Photovoltaics
EEG	German Renewable Energies Act
MPP	Maximum power point (point of the current-voltage diagram of 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	Green-yellow
GY	Grey

2 Safety

DANGER

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

Severe injuries or death if the leads and terminals in the inverter are touched.

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

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

› Do not touch the leads and 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 unauthorized persons away from the inverter and PV system.
- Be sure to observe IEC 60364-7-712:2002 (“Requirements for special installations or locations – solar photovoltaic (PV) power supply systems”) in particular.
- 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 while it is switched on.
- 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 disconnector 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 leads this into the grid feed-in. The inverter is built according to the state of the art and recognised 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 is not considered the proper use. 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 specification 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

The inverter is labelled with the CE mark. The inverter complies with the following standards and directives:

2006/95/EC "Directive relating to electrical equipment designed for use within certain voltage limits"	**Safety of the unit**	IEC 62109-1:2010
2004/108/EC **Directive relating to electromagnetic compatibility**	**Interference immunity**	EN 61000-6-1:2007 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 61000-3-3:2008** EN 61000-3-11:2000*** ** applicable for models ≤ 16 A *** applicable for models ≥ 16 A
Directive for connection and parallel operation of in-system generation on the low-voltage grid	4th edition 2001)	
Grid monitoring	DIN V VDE V 0126-1-1:2006-02	

NOTICE

The declaration of conformity can be found in the appendix.

3 Description

3.1 How it works

The inverter converts the DC voltage generated by the PV modules into AC voltage and leads this into the grid feed-in. The feed-in process begins when there is sufficient irradiance and a specific minimum voltage is present in the inverter. If, as nightfall approaches, the voltage drops below the minimum voltage value, feed-in mode ends and the inverter switches off.

3.2 Unit description

3.2.1 Powador inverter as part of a PV system

3.2.1.1 System layout

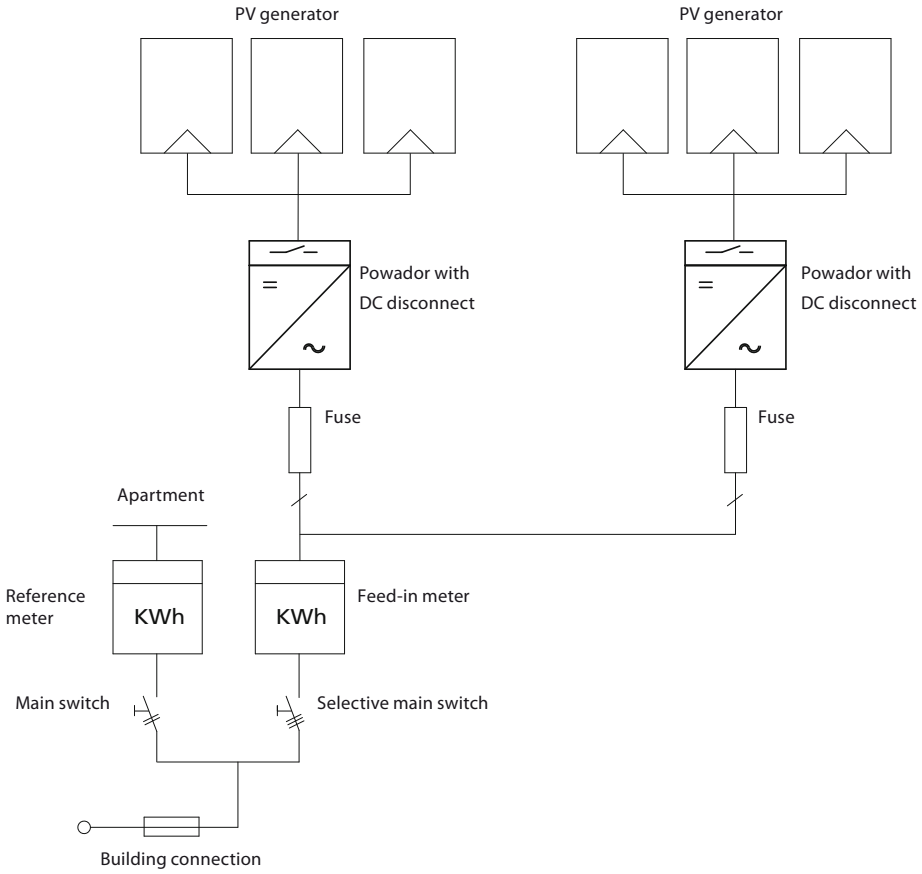


Fig. 1: Overview circuit diagram for a system with two inverters

3.2.1.2 A 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

Variants of parallel connection of several generator strings:

- To a DC terminal point between the DC generator and inverter
- Directly to the inverter (terminals for 9 (3x3) 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.

Line fuses

NEOZED fuses or automatic circuit breakers are suitable.

Feed-in meter

The feed-in meter is 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.

3.2.2 Design of the inverter

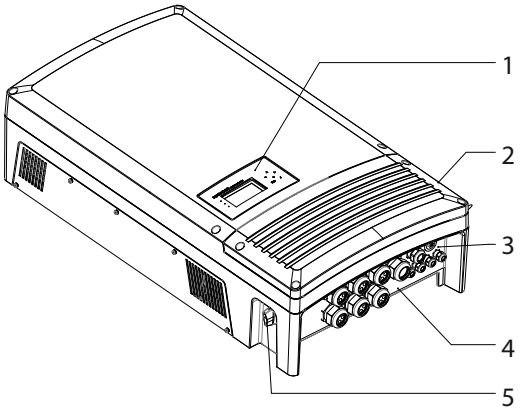


Fig. 2: Design of the inverter

Key			
1	Operator panel	4	Connection board
2	Cover for the connection area	5	DC disconnect
3	USB interface		

3.2.3 Electrical functions

3.2.3.1 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 the connection, see section 7.3.2 on page 25.

DE

Country-specific function

3.2.3.2 Fault signal relay/Relay 33

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

- Fault signal relay (see above)
- Relay 33

Relay 33

The new version of the German Renewable Energies Act (EEG) includes compensation for personal consumption of self-generated PV energy for plants up to 500 kWp. 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 "Relay 33" mode, the potential-free contact takes care of this function.

The contact closes if sufficient PV energy is made 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).

Activation of the function (optional)

The "Relay 33" function is not active in the unit's delivery state. You can obtain the password for the function from your specialist dealer. The authorised electrician then activates the function in the configuration menu (see section 8.3.2 on page 32).

R33 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.

You obtain both as an R33 switch from your specialist dealer.

DE

Country-specific function

3.2.3.3 Power limitation (power control)

Since 01/01/2009, the German Renewable Energies Act (EEG) requires power limitation for systems >100 kW. This limit value can be exceeded in 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.

In KACO new energy GmbH inverters, this power reduction is achieved using a ripple control receiver. The power supply company can reduce the power of the system remotely, if necessary, 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 dealer.

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

IT

Country-specific function

3.2.3.4 Self-test in accordance with ENEL grid connection guide, Ed. 2.1

NOTICE

The tests should, if necessary, be conducted by the gird operator. You activate the self test in the parameter menu during feed-in operation (see section 8.3 on page 31). The self-test presumes that the inverter is already feeding into the grid, so that the shutdown condition can be simulated.
Do not press the control keys of the inverter during the self-test.

Method in which the shutdown test proceeds:

The stored undervoltage cut-off limit is increased by means of a software ramp function. The ramp function has a gradient of 5 V/s. The software increases the undervoltage cut-off limit for as long as the inverter is feeding into the grid according to the specified ramp function. As soon as the inverter switches off, the software automatically calculates the cut-off limit. The calculated cut-off limit, as well as the cut-off time and the type of test, are transmitted via the RS485 interface to a terminal program. The subsequent overvoltage shutdown test is started automatically. This test runs according to the same design as the undervoltage shutdown test.

Frequency is also measured with the procedure described here. In this case, a software ramp function with a gradient of 0.05 Hz/s is used. The result of the entire test is sent to the terminal program at the end of the test, as well as being in the display of the inverter. If a test fails, the entire test is cancelled and a corresponding message is issued. The test can subsequently be repeated.

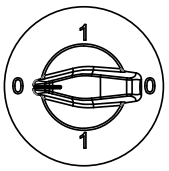
KACO recommends the Tera Term terminal program. This software, offered as freeware, is able to output the results of the shutdown test in a text file. A PDF file that also contains a date and time stamp can then be created from this text file.

The self test runs automatically and can last several minutes. After the self test finishes successfully, the unit restores the previously set switch-off values. The inverter automatically starts the feed-in process.

3.2.4 Mechanical components

3.2.4.1 DC disconnect

The DC disconnect is located on the left side of 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 disconnect from 1 (ON) to 0 (OFF).

Connecting the inverter to the PV generator

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

3.2.5 Interfaces

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

- RS485 interface
- Ethernet interface
- USB interface
- S0 interface

You configure the interfaces and the web server in the configuration menu (see section 8.3.2 on page 32)

3.2.5.1 RS485 interface

Use this monitoring variant if you cannot check the function 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 units:

Powador-proLOG S to XL (optional)

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

Powador-link RS485 (optional)

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

3.2.5.2 Ethernet interface

Monitoring can occur directly on the unit using the integrated Ethernet interface. A local web server is installed in the unit for this purpose.

For monitoring a system comprising several inverters, we recommend you use an external data logging and monitoring system.

3.2.5.3 USB interface

The USB connection of the inverter is a type A socket. It is located on the connection board on the underside of the inverter under a cover. The USB connection is specified to draw 100 mA of power. Use the USB interface for reading out stored operating data and loading software updates using a FAT32-formatted USB stick.

3.2.5.4 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).

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	16.0 TR3	18.0 TR3
Max. PV generator power [W]	16,000	18,000
DC MPP range from [V] to [V]	200 to 510	
Minimum DC voltage [V]	200	
Number of strings	9	
Number of MPP controls	3	
Polarity safeguard	Short-circuit diode	
DC overvoltage category	OVCII	
Output Levels		
Rated power [VA]	13,500	15,000
Max. power [VA]	13,500	15,000
Grid voltage [V]	230/400	
Rated current [A]	3 x 19.5	3 x 21.7
Max. current [A]	3 x 19.5	3 x 21.7
Rated frequency [Hz]	50/60	
cos phi	0.80 inductive to 0.80 capacitive	
Number of feed-in phases	3	
Distortion factor [%]	<3	
AC overvoltage category	OVCIII	
General electrical data		
Max. efficiency [%]	96.2	
European efficiency [%]	95.6	
Internal consumption: standby [W]	< 10	
Internal consumption: night [W]	1.9	
Feed-in starts at [W]	180	
Circuit design	Self-commutated, galvanically isolated, RF transformer	
Transformer unit	Yes	
Grid monitoring	Country-specific	
CE conformity	Yes	
Clock frequency [kHz]	17	

Table 1: Electrical data

4.2 Mechanical data

	16.0 TR3/18.0 TR3
Display	LCD graphical display, 3 LEDs
Controls	4-way key, 2 keys
Interfaces	Ethernet, USB, RS485, S0
Fault signal relay	Potential-free NO contact, max. 30 V DC/1 A or 250 V AC/1 A
AC connections: PCB terminal	PCB terminals inside the unit (max. cross section: 6 mm^2 flexible, 10 mm^2 rigid)
AC connections: Cable connection	Cable connection via M40 cable fitting
DC connections: PCB terminal	PCB terminals inside the unit (max. cross section: 10 mm^2 flexible, 16 mm^2 rigid)
DC connections: Cable connection	Cable connection via M16 cable fitting
Ethernet connection: Cable connection	Cable connection via M25 cable fitting
Ambient temperature range [°C]	-25 to 60
Humidity range (non-condensing) [%]	0 to 95
Maximum installation elevation (m above sea level)	2,000
Temperature monitoring	Yes
Cooling (free convection (K)/fan (L))	L
Protection rating according to EN 60529	IP 54
Degree of contamination	PD2
Noise emission [dB(A)]	< 45/noiseless without fan operation
DC disconnect	Built-in
Housing	Cast aluminium
H x W x D [mm]	945 x 510 x 269
Total weight [kg]	Approx. 80

Table 2: Mechanical data

4.3 Country-specific parameter settings

	Grid voltage range [V]	Grid voltage according to EN 50160 [V]	Standard frequency range [Hz]	Switch-on time after restart* [s]	Restart time after feed-in power that is too low* [s]	Restart time after fault* [s]
DE	190 to 264	253	47.5 to 50.2	> 60	> 180	> 30
ES	196 to 254	-	49.0 to 51.0	> 180	> 180	> 180
IT	190 to 264	-	49.7 to 50.3	> 180	> 180	> 30
FR	190 to 264	253	49.5 to 50.5	> 60	> 180	> 30
CY	208 to 252	-	49.5 to 50.5	> 180	> 180	> 180
GR	190 to 264	-	49.5 to 50.5	> 180	> 180	> 180
KR	194 to 242	-	59.7 to 60.3	> 360	> 360	> 360
CZ	196 to 252	253	47.0 to 51.0	> 60	> 180	> 30
PT	196 to 264	253	47.0 to 51.0	> 60	> 180	> 30
BG	196 to 264	-	47.0 to 51.0	> 60	> 180	> 30

* approx. values

Table 3: Country-specific parameter settings

5 Transportation and Delivery

5.1 Delivery

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

Scope of delivery

- 1 Powador inverter
- 1 wall bracket
- 1 installation kit
- 1 grounding bridge
- 1 documentation set

Checking your delivery

1. Inspect your inverter thoroughly.
2. Immediately notify the shipping company in case of the following:
   - Damage to the packaging that indicates that the inverter may have been damaged
   - Obvious damage to the inverter
3. Send a damage report to the shipping company immediately.

The damage report must be delivered to the shipping company in writing within six days following receipt of the inverter. We will be glad to help you, if necessary.

5.2 Transportation

WARNING

Impact hazard, risk of breakage to the inverter

› Pack the inverter securely for transport.
› Transport the inverter carefully using the the carrying handles of the pallet.
› Do not subject the inverter to shocks.

Two persons are required for safe transportation of the inverter. Use the holding openings in the carton to carry it.

Fig. 3: Transportation of the inverter

Authorised electrician

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 solar irradiance and moisture (rain) in outdoor areas
- For easy operation, ensure during installation that the display is slightly below eye level.

Wall

- 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 clearance during installation: see Fig. 5 on page 18 and Fig. 6 on page 18.

CAUTION

Use suitable mounting fixtures.

› Use the supplied anchoring bolts only.

› Mount the inverter in non-cracked cement only.

› Mount the inverter upright on a vertical wall only.

NOTICE

Power reduction due to heat accumulation.

If the recommended minimum clearances are not observed, the inverter can have power regulation and a protective shutdown due to insufficient ventilation and the associated heat.

› Maintain minimum clearances.

› Provide for sufficient heat dissipation.

⚠ Authorised electrician

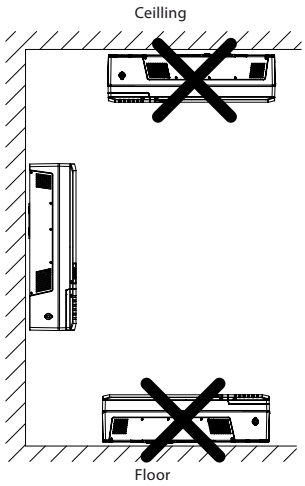


Fig. 4: Instructions for wall mounting

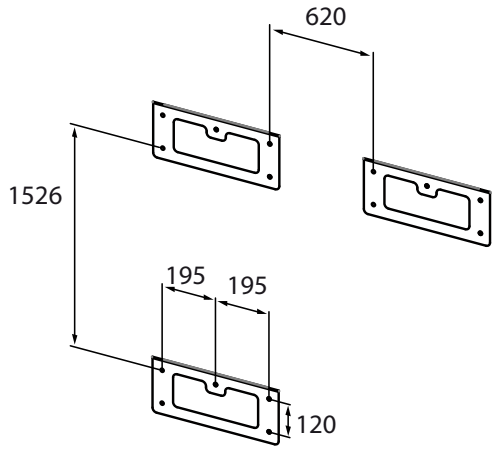


Fig. 5: Drill stencil for wall mounting with minimum clearances (in mm)

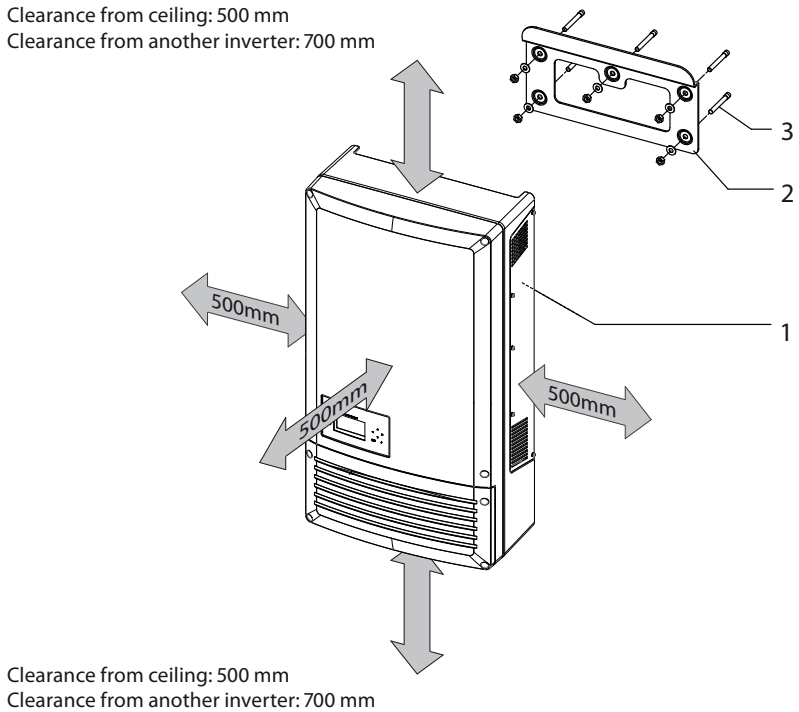


Fig. 6: Minimum clearances/mounting plate

Key

1	Suspension brackets (back of housing)	3	Anchoring bolts
2	Mounting plate		

⚠ Authorised electrician

Mounting the Inverter

1. Mark the positions of the drill holes using the cut-outs in the mounting plate.
2. Attach the mounting plate to the wall with the anchoring bolts and nuts. Make sure that the mounting plate is oriented correctly.
3. Hang the inverter on the mounting plate using the suspension brackets on the back of the housing.

» 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 leads of the inverter even after the inverter has been switched off and disconnected.

Severe injuries or death if the leads 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 all safety regulations and the currently applicable technical connection specifications of the responsible power supply company.
› Disconnect the AC and DC sides.
› Secure them against being inadvertently switched back on.
› Assure 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 on the wall.

1. Unscrew the four Torx screws on the front side of the connection cover (blue).
2. Remove the connection cover.
3. Remove the grounding cable lug from the grounding point of the housing.
4. Pull down the connection cover.

» Carry out the electrical connection.

7.2 Carrying out 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. Maintain the following conductor cross-sections:

	AC connection	DC connection
Max. conductor cross-section without wire sleeves	16 mm²	16 mm²
Max. conductor cross-section with wire sleeves	10 mm²	10 mm²
Length of insulation to be stripped off	10 mm	10 mm

Authorised electrician

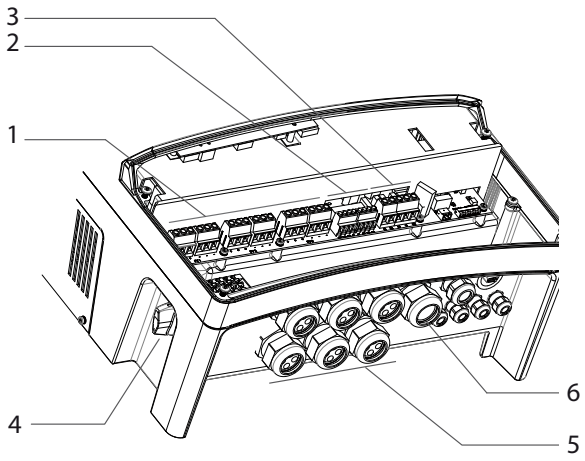


Fig. 7: Connection area: Electrical connection

Key			
1	DC connection terminals	4	DC disconnect
2	Grounding terminals for PV generator	5	Cable fitting (M40) for DC connection
3	AC connection terminals	6	Cable fitting (M40) for AC connection

7.2.1 Connecting the inverter to the power grid

The grid connection leads are connected on the right in the connection area (see figure 7).

DANGER

Risk of fatal injury due to electric shock

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

› Disconnect the inverter from all power sources before you insert the grid power lead into the unit.

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

For lead lengths up to 20 m, use the conductor cross-sections listed in table 4. Longer lead lengths require larger conductor cross-sections.

Model	Conductor cross-section	Fuse protection: NEOZED safety fuses gL or comparable automatic circuit breakers
Powador 16.0 TR3	6.0 mm²	35 A for 6.0 mm² conductor cross-section
Powador 18.0 TR3	6.0 mm²	35 A for 6.0 mm² conductor cross-section

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

NOTICE

When the lead impedance is high (i.e. long grid-side leads), 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 line overvoltage limit value, the inverter switches off.

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

⚠ Authorised electrician

Making the grid connection

↻ Use leads with five wires (L1, L2, L3, N, PE).

1. Unscrew the cable fitting.
2. Remove the outer cladding of the AC leads.
3. Insert the AC leads through the cable fitting into the connection area.
4. Strip the insulation from the AC leads.
5. Connect the leads according to the labelling of the PCB terminals (figure 8 on page 21).
6. Check that all connected leads are tightly seated.
7. Tighten the cable fitting.

» The inverter is now connected to the power grid.

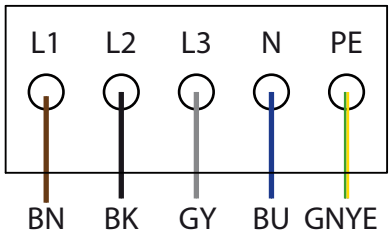


Fig. 8: AC connection terminals

NOTICE

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

If a residual current circuit breaker is necessary due to the installation specification, a type “A” AFI (AC/DC-sensitive residual current circuit breaker) must be used.

7.2.2 Connecting the PV generator

Connect the PV generator in the connection area left. Use the cable fittings provided (see figure 7 on page 20).

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 PC generator can result in a hazard to health and damage to the inverter.

› Disconnect the inverter from the PV generator by actuating the integrated DC disconnector.

› Remove the plug connector.

⚠ Authorised electrician

7.2.2.1 Before the connection

Ensure that there is no ground fault

1. Determine the DC voltage between the
   - protective earth (PE) and the positive lead of the PV generator
   - protective earth (PE) and the negative lead of the PV generator

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 lead of the PV generator
   - protective earth (PE) and the negative lead of the PV generator

Low resistance (< 2 MΩ) indicates a high-ohm ground fault of the DC generator.

4. Rectify any faults before connecting the DC generator.

7.2.2.2 Connecting the PV generator

⚠ DANGER

Risk of fatal injury due to electric shock

Severe injuries or death will result if the live connections are touched. When there is irradiance, DC voltage is present on the exposed ends of the DC leads.

› Do not touch the exposed ends of the leads.

› Avoid short circuits.

1. Unscrew the cable fittings.
2. Remove the outer cladding of the DC leads.
3. Insert the DC leads through the cable fittings into the connection area.
4. Strip the insulation from the DC leads.
5. Connect the ends of the leads to the connections “PV+” and “PV-”.
6. Check that all connected leads are tightly seated.
7. Tighten the cable fittings.
8. Meet the requirements of protection rating IP54 by closing the unused cable fittings with blind caps.

» The inverter is connected to the PV generator.

7.2.3 Grounding the PV generator (optional)

Various manufacturers stipulate that the PV generator must be grounded. You can find out which pole you need to ground from the manufacturer of the photovoltaic modules. The full bridge needed for the grounding of the positive or negative poles of the PV generator is included with the unit. The required fuse is already installed in the unit.

⚠ DANGER

Risk of fatal injury due to electric shock

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

› Disconnect the inverter from all power sources.

› Wait at least five minutes before working on the inverter.

› Then start with the grounding of the system.

Authorised electrician

FR

GFDI (ground fault detector-interrupter)/ground fault monitoring

The inverter supports ground fault monitoring of the non-grounded pole. You can activate or deactivate this option in the parameter menu (see section 8.3 on page 31).

Mounting the full bridge

↻ Determine whether the positive or negative pole is to be grounded.

1. Unscrew the fittings of the grounding terminals.
2. Plug the full bridge onto the positive or negative grounding terminal. Example: Installation on the plus grounding terminal (see figure 9 on page 23).
3. Tighten the grounding terminal fittings.

» The PV generator is grounded.

4. Activate the ground fault monitor in the Settings menu (see section 8.3 on page 31).

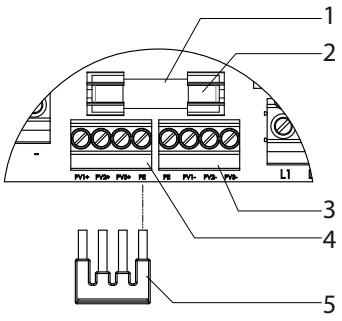


Fig. 9: Installation of full bridge for grounding the PV generator

Key			
1	Fuse holder	4	Positive grounding terminal
2	Ground fuse	5	Full bridge for grounding the PV generator
3	Negative grounding terminal		

NOTICE

If the function of ground fault monitoring is activated in the inverter, the installed fuse trips after a ground fault in the PV system. The inverter interrupts the feed-in until the fuse has been replaced.

Use PV fuses of type URZ 10 x 38 mm 1,000 V 1 A only.

7.3 Connecting the interfaces

All interfaces, with the exception of the Ethernet interface, are located on the connection circuit board. The Ethernet interface is located on the underside of the control circuit board. Both connection locations are located behind the cover for the connection area. Use the cable fittings provided (see figure 10 on page 24).

DANGER

Risk of fatal injury due to electric shock

Severe injury or death from improper use of the interface connections and non-observance of protection class III.

› The SELV circuits (SELV: safety extra low voltage) can only be connected to other SELV circuits with protection class III.

NOTICE

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

⚠ Authorised electrician

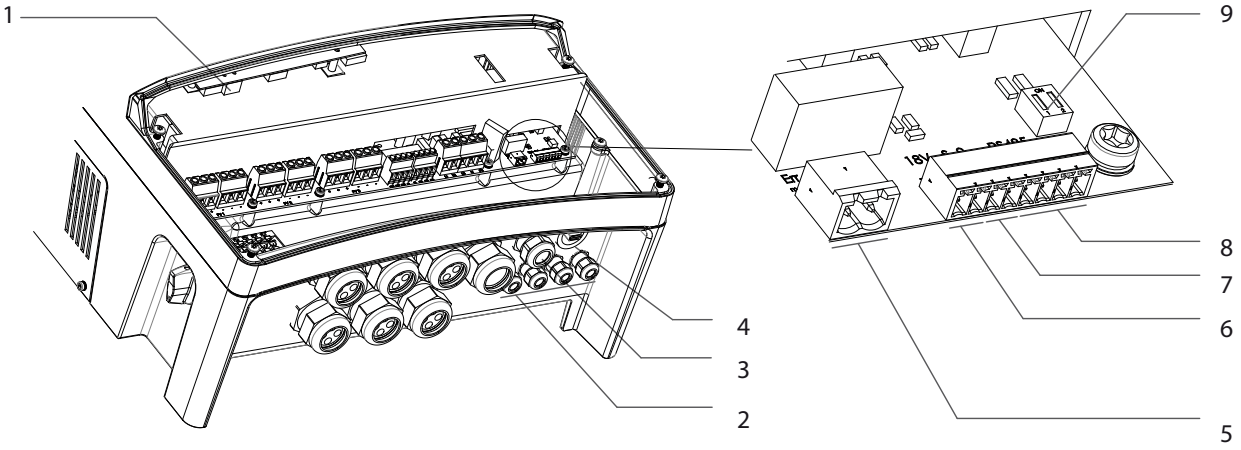


Fig. 10: Connection area: connecting the interfaces

Key			
1	Ethernet interface	5	Connection for the fault signal relay
2	Cable fittings (M16) for interface connections	6	18 V output
3	Cable fitting (M25) for Ethernet cable	7	S0 output
4	USB interface with cover	8	RS485 interface
		9	DIP switch for terminating resistor R_a

7.3.1 Connecting the Ethernet interface

NOTICE

The connection plug of an RJ45 cable is larger than the opening of an M25 cable fitting when it is installed. For this reason, remove the sealing insert before installation and thread the Ethernet cable outside of the cable fitting through the sealing insert.

NOTICE

Use a suitable category 5 network cable. The maximum length of a network segment is 100 m. Ensure that the cable is correctly assigned. The Ethernet connection of the inverter supports auto-sensing. You can use both crossed and 1:1 Ethernet connection cables.

Connecting an Ethernet cable to the inverter

1. Unscrew the cable fitting (see figure 10 on page 24) and remove the lock.
2. Remove the sealing insert from the cable fitting.
3. Thread the Ethernet cable through the lock of the cable fitting and the sealing insert.
4. Thread the Ethernet cable through the cable fitting inside the housing.
5. Connect the Ethernet cable to the Ethernet interface (see figure 10 on page 24).
6. Insert the sealing insert into the cable fitting.
7. Attach and tighten the lock of the cable fitting.

⚠ Authorised electrician

Connecting the inverter with the network

↻ Connect the Ethernet cable to the inverter.

↻ Configure the Ethernet interface.

☞ Connect the Ethernet cable to the network or a computer.

☞ Configure the Ethernet settings and web server in the Settings menu (see section 8.3 on page 31).

7.3.2 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 (see figure 10 on page 24).
2. Thread the connection cable through the cable fitting.
3. Connect the connection cable to the socket.
4. Tighten the cable fitting.

7.3.3 Connecting the 18 V output

An 18 V output is located on the communication board. It is used for supplying power to external sensors or similar devices.

Connecting the 18 V output

1. Unscrew the cable fitting (see figure 10 on page 24).
2. Thread the connection cable through the cable fitting.
3. Connect the connection cable to the connection terminals.
4. Tighten the cable fitting.

7.3.4 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 in the configuration menu.

Connecting the S0 output

1. Unscrew the cable fitting (see figure 10 on page 24).
2. Thread the connection cable through the cable fitting.
3. Connect the connection cable to the connection terminals.
4. Tighten the cable fitting.

⚠ Authorised electrician

7.3.5 Connecting the RS485 bus

NOTICE

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

7.3.5.1 Wiring diagram

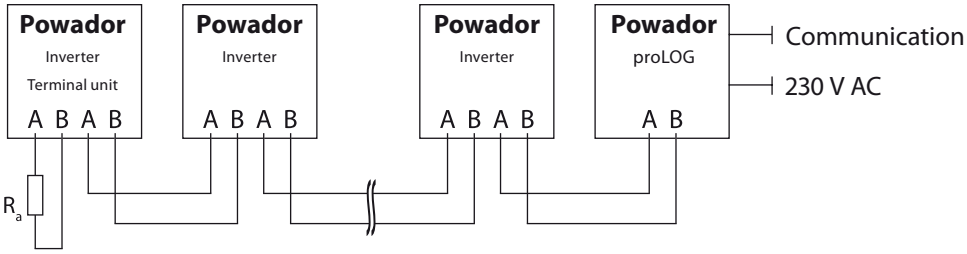


Fig. 11: RS485 interface wiring diagram

NOTICE

Various manufacturers interpret the standard on which the RS485 protocol is based in differing ways. Note that the wire designations (- and +) for wires A and B can vary between manufacturers.

NOTICE

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

- ☞ Maximum length of the RS485 wiring: 1,200 m under optimal conditions.
- ☞ Maximum number of connected bus devices: 31 inverters + 1 data monitoring unit.
- ☞ Use shielded twisted data lines.
  Recommendation (using wire sleeves)
  - LI2YCYv (TP) black for laying cable outside and in the ground 2 x 2 x 0.5
  - LI2YCY (TP) grey for dry and moist indoor spaces 2 x 2 x 0.5

1. Unscrew the cable fitting (see figure 10 on page 24).
2. Thread the connection cable through the cable fitting.
3. Connect the connection cable to the connection terminals provided (see figure 10 on page 24).
4. Connect the following to all inverters and Powador-proLOG as follows:
   - Wire A (-) with wire A (-) and
   - Wire B (+) with wire B (+) (see figure 11 on page 26)
5. Tighten the cable fitting.
6. Activate the terminating resistor on the terminal unit.

NOTICE

When using the RS485 bus system, assign a unique address to every bus device (inverter, sensor) and terminate the terminal units (see the “Settings” menu) .

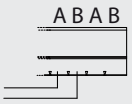
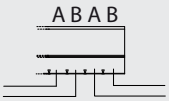
⚠ Authorised electrician

7.3.5.2 Activating the terminating resistor (switches 1 and 2 on the connection circuit board)

Activate the terminating resistor in the inverter that represents the terminal unit within your wiring diagram.

NOTICE

Always activate the terminating resistor in the terminal unit using the left DIP switch (1).

	Sample connection	DIP switch	Switch 1	Switch 2
The inverter is the terminal unit: ☞ Activate R_a			ON	OFF
The inverter is not the terminal unit: ☞ Deactivate R_a			OFF	OFF

7.4 Sealing the connection area

1. Place the grounding cable lug on the grounding point of the housing.
2. Place the connection cover on the connection area of the inverter.
3. Screw in the four Torx screws on the front side of the connection cover (blue).

7.5 Starting up the inverter

DANGER

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

Severe injuries or death if the leads and terminals in the inverter are touched.

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

7.5.1 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 > 200 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 (see section 8.2 on page 31).

8 Configuration and Operation

8.1 Controls

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

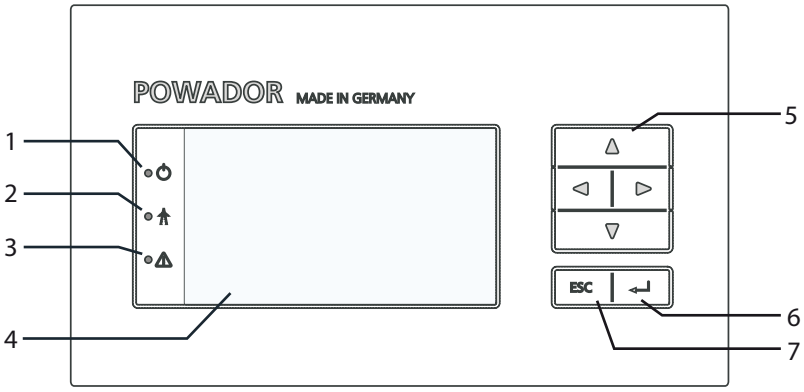


Fig 12: Control panel

Key			
1	"Operating" LED	5	4-way button
2	"Feed-in" LED	6	"OK" button
3	"Fault" LED	7	"ESC" button
4	LCD		

8.1.1 LED indicators

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

●	LED illuminated	✺	LED flashing	○	LED not illuminated

The LED indicators show the following operating states:

Operating state	LEDs	Display	Description
Start	● ⏻		The green "Operating" LED is on when AC voltage is present, independent of the DC voltage.
Feed-in start	● ⏻ ● 🗼	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 line relay switch on.

* The waiting period ensures that the generator voltage continuously remains above the power delivery limit of 200 V. For the country-specific waiting times, see section 4.3 on page 15.

Operating state	LEDs	Display	Description
Feed-in operation		Power fed into the grid or measured values	The green “Operating” LED is illuminated. The green “Feed-in” LED is illuminated. The “Feed-in” icon appears on the desktop. The inverter feeds into the grid.
Non-feed-in operation		Status message	The display shows the corresponding message.
Voltage		Fault message	The display shows the corresponding message. The red “Fault” LED is illuminated.

8.1.2 Graphical display

The graphical display shows measured values and data and allows the configuration of the inverter using a graphical menu. In normal operation, the backlighting is switched off. As soon as you press one of the control buttons, the backlight is activated. If no button is pressed for an adjustable period of time, it switches off again. You can also activate or deactivate the backlighting permanently. In sleep mode, the inverter deactivates the display regardless of the selected setting.

NOTICE

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 start screen (the desktop). If you are in the menu and do not touch the control buttons for two minutes, the inverter returns to the desktop. For information about initial start-up, see section 8.2 on page 31.

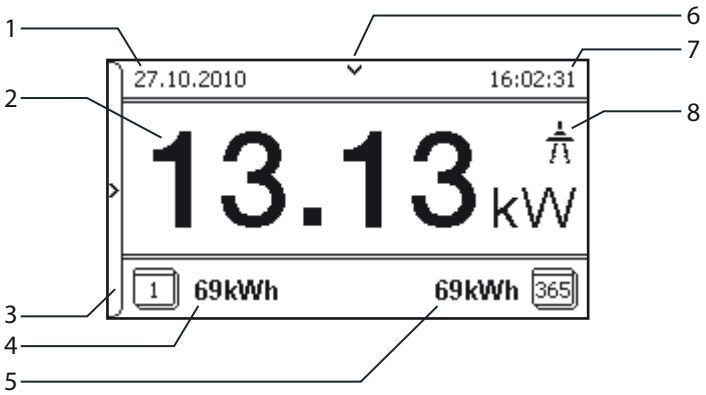


Fig 13: Desktop

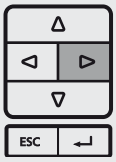
Key			
1	Current date	6	Status bar
2	Current power	7	Current time
3	Menu indicator	8	Feed-in indicator
4	Daily yield		
5	Annual yield		

8.1.3 Control buttons

You operate the inverter using the 4-way button and the OK and ESC control buttons.

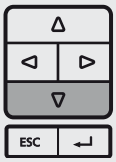
8.1.3.1 Desktop

Opening the menu



↻ The inverter is operating.
↻ The LCD is showing the desktop.
☞ Press the right arrow button.
» The menu opens up over the desktop from left to right.

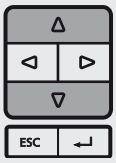
Displaying the daily output



↻ The inverter is operating.
↻ The LCD is showing the desktop.
☞ Press the down arrow button.
» The LCD displays the daily yield in a diagram.
☞ To return to the desktop, press any button.

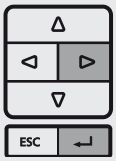
8.1.3.2 Inverter menu

Selecting a menu item



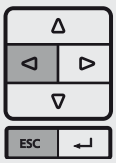
↻ You have left the desktop. The inverter displays the menu.
☞ Use the up and down arrow buttons.

Opening a menu item or a setting



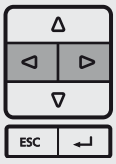
☞ Use the right arrow button and the OK button.

Jump to the next higher menu level/discard changes



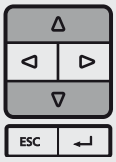
☞ Press the left arrow button or the ESC button.

Selecting an option



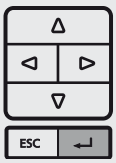
☞ Use the right and left arrow buttons.

Changing an option/the value of an input field



☞ Use the up and down arrow buttons.

Saving changed settings



☞ Press the OK button.

8.2 Initial start-up

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

NOTICE

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. The other settings can still be changed in the configuration menu.

NOTICE

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

Initial configuration

- ☞ In order to select a setting, press the up and down buttons.
- ☞ To select the next menu item, press the OK button.
- ☞ To return to the most recently selected menu item, press the ESC button.
- ☞ Carry out the required settings.

Press the OK button in the last menu item.

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

8.3 Menu structure

8.3.1 Display on the LCD

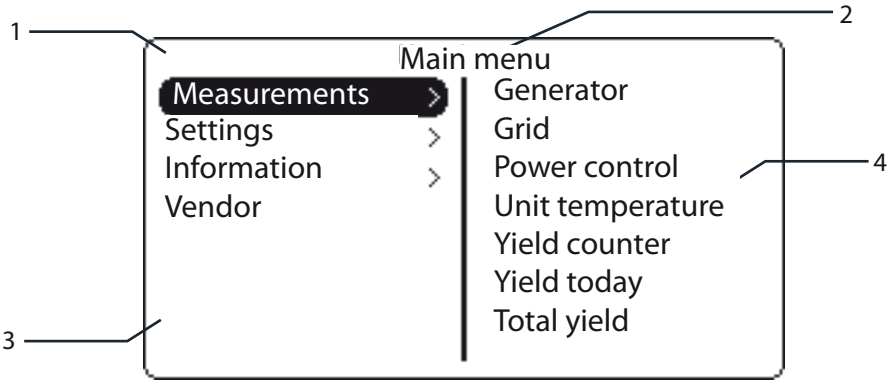


Fig 14: Main menu

Key			
1	Display of the menu level (0, 1, 2)	3	Active menu (example: main menu)
2	Designation of the active menu	4	Menu items of the next lower menu level

8.3.2 Menu structure

Icons used:

0 1 2 3	Menu level (0, 1, 2, 3)	↳	Submenu available
	Display menu	DE	Country-specific setting
	Option menu	DE MSp.	Country and grid type-specific setting
	Password-protected menu		

Country-spec. setting	Menu level	Display/ Setting		Action in this menu/meaning
All countries	Desktop	**Desktop**	↳	☞ Press the right arrow button.
	0 1 2 3	**"Measurements" menu**	↳	☞ Open the menu: Press the right arrow button or the OK button.
	0 1 2 3	**Generator**		Displays the DC-side voltage, amperage and power
	0 1 2 3	**Grid**		Displays the AC-side voltage, amperage and power
DE	0 1 2 3	**Power control**		Displays the current value of the external power limitation by the grid operator.
DE	0 1 2 3	**Relay remain. time**		Displays the current remaining time of relay 33. After this period elapses, the inverter deactivates relay 33. This menu item is only available if you have selected the "On" option for the menu item "Activ. Relay 33" in the "Settings" menu.
DE MSp.	0 1 2 3	**cos-phi**		Indicates the status of the idle power control
All countries	0 1 2 3	**Unit temperature**		Displays the temperature in the inverter housing.
	0 1 2 3	**Yield counter**		Displays the yield in kWh. ☞ Reset the counter using the "Reset" button.
	0 1 2 3	**Yield today**		Displays the yield of the current day up to now.
	0 1 2 3	**Total yield**		Displays the total yield up to now.
	0 1 2 3	**CO2 savings**		Displays the calculated CO_2 savings (in kg).
	0 1 2 3	**Oper. hrs cntr**		Displays the duration of operation in hours. ☞ Reset the counter using the "Reset" button.
	0 1 2 3	**Oper. time today**		Displays the duration of operation on the current day
	0 1 2 3	**Total oper. time**		Displays the total operating time.
	0 1 2 3	**Log data display**	↳	☞ Open the menu: Press the right arrow button or the OK button.

Country-spec. setting	Menu level	Display/ Setting	Action in this menu/meaning
All countries	0 1 2 3	**Day display**	Displays the recorded operating data graphically. 1. Select the measured value to be displayed. Supported measured values: • Grid power P(grid) • DC power per string P(PV) 1-2 • DC voltage per string U(PV) 1-2 • Unit temperature 2. Select a date. 3. Press the OK button. » The display shows the selected data. ☞ Press any button to return to the previous menu.
	0 1 2 3	**Month display**	Displays the recorded operating data graphically. 1. Select a date. 2. Press the OK button. » The display shows the selected data. ☞ Press any button to return to the previous menu.
	0 1 2 3	**Year display**	Displays the recorded operating data graphically. 1. Select a date. 2. Press the OK button. » The display shows the selected data. ☞ Press any button to return to the previous menu.
	0 1 2 3	**Save to USB**	In this menu, you can export the saved operating data to a connected USB storage device. ↻ You have connected a USB storage device to the inverter. 1. Select the data to be exported (year, month or day) with the 4-way button. 2. Press the OK button. » The inverter writes the data to the USB storage device.
All countries	0 1 2 3	**“Settings” menu**	☞ Open the menu: Press the right arrow button or the OK button.
	0 1 2 3	**Language**	☞ Select the desired language for the user interface.
	0 1 2 3	**Def. 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 the “Save” button and confirm with the OK button.

Country-spec. setting	Menu level	Display/ Setting		Action in this menu/meaning
All countries	0 1 2 3	**Interface**		☞ If the inverter is a terminal unit: Activate termination (“Bus termination” menu item) ☞ Assign a unique RS485 bus address to the inverter (“proLOG address” menu item). The address must not be the same as that of another inverter or a proLOG unit.
	0 1 2 3	**S0 pulse rate**		☞ Set the pulse rate of the S0 connection.
DE	0 1 2 3	**Activ. Relay 33**		Releases the use of the fault signal relay for internal consumption control relay 33. 1. Enter the password. 2. Confirm the entry with the OK button. 3. Activate or deactivate the home feed-in function. **NOTICE:** Activating this option enables the menu item **Relay 33 set**.
	0 1 2 3	**Relay 33 set.**		☞ 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 relay 33 after activation). **NOTICE:** This menu item is only available if you have selected the “On” option for the menu item “Activ. Relay 33” in the “Settings” menu.
All countries	0 1 2 3	**Quick start**		☞ Reduce the waiting times during the self test by pressing the “Activate” button.
	0 1 2 3	**Logging interval**		☞ Set the time between two log data recordings.
	0 1 2 3	**Log data backup**		The inverter supports the backing up of all recorded yield data to a connected USB storage device. ☞ Activate or deactivate log data backup.
	0 1 2 3	**Display**		☞ Configure the contrast setting for the display. ☞ Set the length of time without user input after which the backlighting of the LCD switches off. ☞ Alternatively: activate or deactivate backlighting permanently by selecting “On” or “Off”.
	0 1 2 3	**Date & time**		☞ Set the time and date. **NOTICE:** For self-diagnostic purposes, the inverter carries out a daily restart at midnight. To avoid having a restart occur during feed-in operation and to always obtain reliable log data, ensure that the time is correctly set.
	0 1 2 3	**Ethernet**		☞ Assign a unique IP address. ☞ Assign a subnet mask. ☞ Assign a gateway.

Country-spec. setting	Menu level	Display/ Setting		Action in this menu/meaning
All countries	0 1 2 3	**Web server**		☞ Activate or deactivate the integrated web server.
All countries	0 1 2 3	**"Parameters" menu**	⌙	☞ Press the right arrow button or the OK button. **NOTICE:** The inverter does not display the "Parameters" menu in the standard configuration. To display the menu: 1. Open the menu. 2. Simultaneously hold down the up and down buttons for several seconds.
	0 1 2 3	**Country**		1. Input the four-character password via the 4-way button. The password is unit-specific. 2. Confirm the entry with the OK button. 3. Set the desired country setting. NOTICE: This option influences the country-specific operating settings of the inverter. Please consult KACO service for further information.
	0 1 2 3	**Grid type/ guideline**		☞ Select the type of grid applicable to the use of the inverter.
AU ES GB GR IL IT PT	0 1 2 3	**Switch-off volt.**		The inverter is equipped with redundant 3-phase monitoring. If the line voltage drops below the value set for "Minimum line voltage", the inverter switches off. The minimum cut-off threshold can be set in 1 V increments. ☞ Configure the switch-off values for undervoltage and overvoltage.
BE BG CZ FR DE NSp.	0 1 2 3	**Grid shutd. EN50160**		The grid voltage is recorded and averaged over ten minutes. If the set value is exceeded, the inverter is disconnected from the grid. ☞ Specify the voltage threshold.
BE BG CZ FR DE NSp.	0 1 2 3	**Voltage drop**		The voltage drop between the inverter and the feed-in 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).
All countries	0 1 2 3	**Switch-off freq.**		The inverter monitors the line frequency continuously. If the line frequency exceeds or drops below the configured values, the inverter switches off. ☞ Set limit values for underfrequency and overfrequency in 0.1 Hz steps.
	0 1 2 3	**DC starting volt.**		The inverter begins feed-in as soon as this PV voltage is present. ☞ Set the starting voltage.

Country-spec. setting	Menu level	Display/ Setting		Action in this menu/meaning
All countries	0 1 2 3	**Grnd flt monitor**		One pole of the PV generator is grounded in the device using a fuse. The ground fault monitor is triggered in the event of a ground fault in the generator. This prevents possible damage to the modules. **NOTICE:** Activate ground fault monitoring only if you have grounded one pole of the PV generator (see section 7.2.3 on page 22). ☞ Activate or deactivate ground fault monitoring.
	0 1 2 3	**Const. volt. ctrl**		Lets you deactivate the MPP seek mode in order to operate the inverter with a constant DC voltage. ☞ Activate or deactivate MPP seek mode. ☞ Set value for constant voltage control (200 - 510 V).
DE MSp.	0 1 2 3	**Overvoltage shutd.**		☞ Specify the switch-off threshold for overvoltage shutdown.
	0 1 2 3	**Undervoltage shutd.**		☞ Specify the switch-off threshold for fast undervoltage shutdown. ☞ Specify the switch-off threshold for slow undervoltage shutdown.
	0 1 2 3	**Activate FRT**		The inverter supports dynamic grid stabilization (Fault Ride-Through) in accordance with the BDEW Medium Voltage Directive. ☞ Specify constant k. ☞ Specify the dead band. ☞ Activate or deactivate FRT.
	0 1 2 3	**Idle power**	⌙	☞ Open the menu: Press the right arrow button or the OK button.
	0 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 (inductive/capacitive).
	0 1 2 3	**Q specification**		☞ Set the idle power Q (in %) to a fixed value. ☞ Select the type of phase shift (inductive/capacitive).
	0 1 2 3	**cos-phi(P/Pn)**	⌙	☞ Open the menu: Press the right arrow button or the OK button.
	0 1 2 3	**Number of support points**		This option defines how many support points can be defined in the subsequent menu. ☞ Specify the number of support points for the idle power characteristic curve.
	0 1 2 3	**1. Support point**		☞ Specify the power factor for the first, second, ... support point
	0 1 2 3	**2. Support point...**		☞ If a power factor not equal to 0 is selected: Select the type of phase shift (inductive/capacitive).

Country-spec. setting	Menu level	Display/ Setting		Action in this menu/meaning
DE MSp.	0 1 **2** 3	**Q(U) characteristic curve**		☞ Specify the target voltage. ☞ Specify slope. ☞ Specify change time.
IT	0 **1** 2 3	**Activ. self test**		Enables manual execution of the self test. ☞ To manually start the self test, select the “Activate" button.
All countries	**0** 1 2 3	**“Information” menu**	⌙	☞ Open the menu: Press the right arrow button or the OK button.
	0 **1** 2 3	**Inv. type**		Displays the type designation of the inverter.
	0 **1** 2 3	**SW version**		Displays the installed software version.
	0 **1** 2 3	**Serial no.**		Displays the serial number of the inverter.
	0 **1** 2 3	**Display country**		Displays the selected country setting. Optional: Displays the grid type if a grid type has been selected.
All countries	**0** 1 2 3	**“Vendor” menu**	⌙	» The display shows information about the unit manufacturer.

8.4 Monitor inverter

The inverter has an integrated web server. This makes it possible to monitor and record the operating state and yield of your PV system.

You can display the recorded data via:

- The integrated LCD
- The integrated web server using an Internet-capable device connected to the Ethernet interface of the inverter

You can read the recorded data using a storage medium connected to the USB interface of the inverter, e.g. a USB stick.

8.4.1 USB interface

Use an external USB storage device to read operating data saved in the inverter.

8.4.1.1 Reading log data

NOTICE

The USB interface is approved solely for use with USB flash memories (“USB sticks”). The maximum available current is 100 mA. If a device with a higher power requirement is used, the power supply for the USB interface automatically shuts down to protect the inverter from damage.

Reading log data

1. Connect a suitable USB storage device to the USB interface on the underside of the inverter.
2. Open the “Log data display” menu.
3. Select the “Save to USB” item.
4. Select the desired log data using the 4-way button.
5. Press the OK button.

» The inverter saves the selected log data to the USB storage device.

8.4.2 Web server

The inverter has an integrated web server. After configuring the network and activating the web server in the configuration menu, you can open the web server from an Internet browser. The language version of the web site delivered by the browser is adapted to the pre-set language preferences in your Internet browser. If your Internet browser requests a language that is unknown to the inverter, the web server uses the menu language set in the inverter.

8.4.2.1 Setting up the web server

Configuring the Ethernet interface

↻ You have connected the inverter to your network.

1. Open the Settings/Ethernet menu.
2. Assign a unique IP address.
3. Assign a subnet mask.
4. Assign a gateway.
5. Save your settings.

8.4.2.2 Using the web server

To avoid problems with incompatibility, use the most recent version of your Internet browser.

NOTICE

You can also access the web server of the inverter via the Internet. To do this, additional settings of your network configuration, particularly your Internet router, are required.

Note that communication with the inverter is carried out over an unsecured connection, particularly in the case of a connection over the Internet.

Calling up the web server

↻ Configure the Ethernet interface.

↻ Connect the Ethernet interface.

1. Open an Internet browser.
2. In the address field of the Internet browser, enter the IP address of the inverter and open the site.

» The Internet browser displays the start screen of the web server.

After it has opened, the web server displays information about the inverter as well as the current yield data. The web server supports the display of the following measurement data and yield data:

- Feed-in power
- Status
- Grid power
- Grid voltage
- Generator power
- Generator voltage
- Unit temperature

In order to display and export yield data, proceed as follows:

Select the display period

1. Call up the web server.
2. Select the display period by choosing one of the buttons: day view, month view, year view or overall view.

Filtering display data (day view only)

1. Open the web server.
2. Select the day view.
3. To show or hide measured values, select or deselect the corresponding checkboxes in the “Select display” area.

Exporting data

1. Filter the display data if necessary.
2. Select the display period if applicable (day, month, year or overall view).
3. Click the “Export data” button.
4. Save the file.

NOTICE

Regardless of the display data selected in the “Select display” area, an export file always contains all measurement data and yield data available for the selected period.

8.5 Performing a software update

You can update the software of the inverter to a new version via the integrated USB interface. Us a FAT32-formatted USB stick to do this. Do not use any storage media, such as an external hard disk, with an external power supply.

NOTICE

Ensure that the power supply of the AC and DC sides is active. It is only possible to update all components of the inverter to the most current software version in this operating state.

CAUTION

Damage to the inverter

The update can fail if the power supply is interrupted during the update process. Parts of the software or of the inverter itself can then be damaged.

» Do not interrupt the DC and AC power supply during the update process.

Preparing for the software update

1. Download the software update file from the KACO web site and store it on your hard disk.
2. Extract the update file (.ZIP) completely onto the USB stick.

» Perform software update.

Performing the software update.

↻ Prepare for the software update.

↻ Ensure supply of DC and AC power.

1. Connect USB stick to the inverter.

» The message “Configuration found. Do you want to load?” appears on the display.

2. If you would like to perform the update, select the “Yes” button.

» The inverter begins the update.

The update can take several minutes. The “Operating” LED flashes during the update process. The inverter may restart several times. The update is finished when the desktop is shown on the display screen.

The inverter then returns to feed-in mode. You can check to see if the update was successful in the menu:

Displaying the software version

☞ Open the Information/SW version menu.

» The inverter will display the versions and checksums of the software that is currently loaded.

9 Maintenance/Troubleshooting

9.1 Visual inspection

Inspect the inverter and the leads for visible damage and pay attention to the operating status display of the inverter. In case of damage, notify your installer. Only authorised electricians may make repairs.

NOTICE

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 if moisture enters the inverter.

› Only use objects that are free of moisture to clean the inverter.

› The inverter should only be cleaned on the outside.

Cleaning the inverter

☞ Do not use compressed air.

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

☞ Remove dust from the ventilation inlets if necessary.

Authorised electrician

9.3 Shutting down for maintenance and troubleshooting

DANGER

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

Severe injuries or death if the leads and terminals in the inverter are touched.

When there is irradiance, DC voltage is present on the exposed ends of the DC leads. Arcing may occur if the DC leads are disconnected while under a load.

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 switched on again.

› Do not touch the exposed ends of the leads.

› Avoid short circuits.

› 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 under load.

› It is absolutely necessary that the shutdown sequence be carried out in the correct order.

Shutting down the inverter

1. Switch off the grid voltage by deactivating the external circuit breakers.
2. Disconnect the PV generator using the DC disconnect.

DANGER! The DC leads remain live.

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

⚠ Authorised electrician

9.4 Replacing or cleaning the fans

The inverter is equipped with three axial fans. They are located next to each other in the lower area of the housing. Replace the fan:

- In case of heavy soiling
- If it is defective

Removing the fans

1. Ensure complete disconnection on the AC and DC sides.
2. Wait until the fans are no longer turning.

☞ If you want to replace the left fan: Open the housing cover on the left side.

☞ If you want to replace the right or centre fan: Open the housing cover on the right side.

3. Unscrew the Torx crews of the side housing cover (figure 15 on page 42).
4. Remove the side housing cover.
5. Unplug the fan plug.
6. Push the fan horizontally away from the fan plug.
7. Release the fan from the fan holding fixture (figure 17 on page 43).
8. Remove the fan from the housing.

» Install the replacement fan.

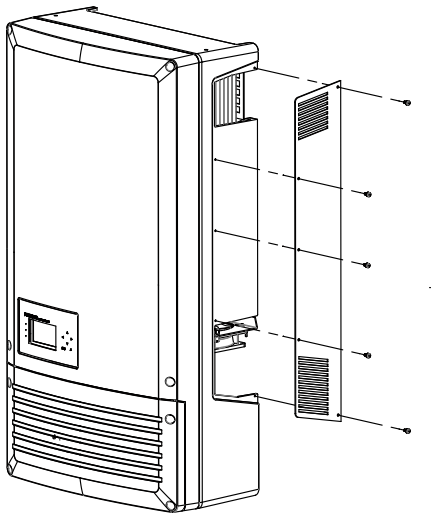


Fig. 15: Removing the side housing cover

Installing the fan

↻ You have removed the defective fan.

☞ Replace the fan only with a fan recommended by KACO. Ask KACO Service if necessary.

☞ Attach the rubber collar to the replacement fan (figure 16 on page 43).

☞ Ensure that the rubber collar is correctly seated.

1. Insert the replacement fan into the fan holding fixture (figure 17 on page 43).
2. Move the fan to the side until it locks into the fan holding fixture.
3. Plug in the fan plug.
4. Place the side housing cover on the unit.
5. Fasten the side housing cover to the unit with the Torx screws.
6. Check that the fittings are secure and that the terminals are well seated.

» The replacement fan is ready for operation.

7. Switch on inverter as described in section 7.4 on page 27.

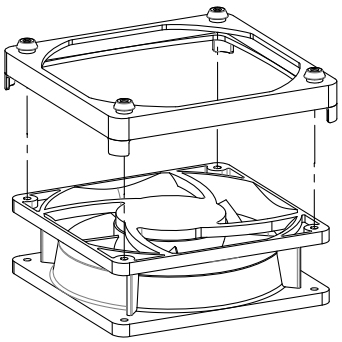


Fig. 16: Rubber collar

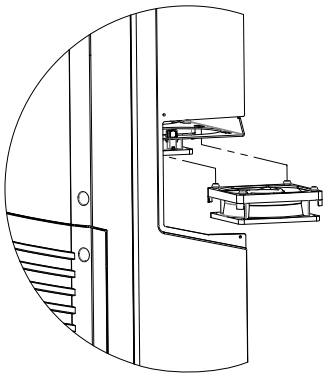


Fig. 17: Replacing the fan

⚠ Authorised electrician

9.5 Replacing the ground fuse

Replacing the ground fuse

1. Open the connection area (see section 7.1 on page 19).
2. Ensure complete disconnection on the AC and DC sides.
3. Remove defective fuse from fuse holder.
4. Insert the replacement fuse into the fuse holder.
5. Close the connection area (see section 7.4 on page 27).

» The fuse has been replaced.

6. Switch on the inverter (see section 7.5 on page 27).

9.6 Faults

9.6.1 Procedure

DANGER

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

Severe injuries or death if the leads 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.

9.6.2 Troubleshooting

Fault	Cause of fault	Explanation/remedy	By
The display is blank and the LEDs do not light up.	Line 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 irradiance.	Faulty grid separation relay in the inverter.	If the grid separation relay is defective, the inverter will recognize 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.	E
		☞ Notify KACO Service.	
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 grid-feed and disconnected from the grid for safety reasons.	
		☞ Change the line parameters within the permitted operating limits (see the “Start-Up” section).	E

Table 5: Troubleshooting

B = Action of the operator

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

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

Fault	Cause of fault	Explanation/remedy	By
The line fuse trips.	The line fuse capacity is too low.	In cases of high irradiance, 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 constantly occurs.	**E**
	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**
The inverter displays an impossible daily peak value.	Faults in the grid.	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 reset the value immediately, switch the inverter off by disconnecting it from the grid and switching off the DC, then switch it back on.	**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 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 irradiance is too low). • The inverter checks the line parameters before the feed-in process begins. The length of the switch-on time 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**

Table 5: Troubleshooting

B = Action of the operator

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

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

Fault	Cause of fault	Explanation/remedy	By
Noise emission from the inverter.	Particular ambient conditions.	When there are certain ambient conditions, the units may emit audible noises. • Line 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 irradiance, a light hum may be audible due to the increased power. • Under particular 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.	
In spite of high irradiance, the inverter does not feed in the maximum power into the grid.	The device is too hot and the power is reduced.	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 unhindered convection cooling from the exterior. Do not cover the cooling fins.	
		☞ Provide for sufficient cooling of the unit. ☞ Do not cover the cooling fins.	**B, E**

Table 5: Troubleshooting

B = Action of the operator

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

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

9.7 Messages on the display/"Fault" LED

Many fault signals indicate a fault in the grid. They are not operational faults of the inverter. The minimum triggering levels are determined by standards (e.g. VDE0126-1-1). The inverter must switch off if the permitted values are undershot or exceeded.

9.7.1 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 deenergizes again. • The inverter feeds back into the grid again after a country-specific time period.

On the display you can find details regarding the fault or operating status or the data that was recorded through the RS485 interface.

9.7.2 Status and fault signals

The following table lists the possible status and fault signals that the inverter shows on the LCD and the LEDs.

Status		Display		⚠	Explanation	Action	By
OS	1	Waiting for feed-in	○	○	Self test: Grid parameters and generator voltage are being checked.	-	-
OS	2	Generator voltage too low	○	○	Insufficient generator voltage and power, status before the transition to night shutdown	-	-
OS	7	Self-test	○	○	Checks the shutdown of the power electronics as well as the line relay before feed-in mode The self-test consists of three successive individual tests with the status 7, 75 and 8.	-	-
OS	75	Self-test	○	○			
OS	8	Self-test	○	○			
FS	10	Temperature in unit too high	○	●	In case of overheating, the inverter switches off. Possible causes: • Ambient temperature too high • Fans covered • Inverter defect	☞ Cool off the vicinity of the inverter. ☞ Uncover the fans. ☞ Notify your authorised electrician.	**B** **B** **E**

Table 6: Operating states and fault messages on the display

BS = operating status, FS = fault status;

B = Action of the operator

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

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

Status		Display		⚠	Explanation	Action	By
OS	11	Measured values	●	○	Power limitation: If the generator power is too high, the inverter limits itself to the maximum power (e.g. in the midday hours if the generator has been too largely dimensioned).	-	-
OS	29	Check ground fault fuse	○	●	A ground fault was detected on the DC side.	☞ Check the PV generator	**E**
FS	30	Voltage trans. fault	○	●	The current and voltage measurements in the inverter are not plausible.	-	-
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	Internal communication error	○	●	A communication error has occurred in the internal data transmission.	☞ Notify your authorised electrician. ☞ Check the data cable.	**E**
FS	35	Protect. shutdown SW	○	●	Protection shutdown of the software (AC overvoltage, AC overcurrent, DC link overvoltage, DC overvoltage, DC overtemperature).	Not a fault Grid-related shutdown, the grid connects again automatically.	-
FS	36	Protect. shutdown HW	○	●	Protection shutdown of the hardware (AC overvoltage, AC overcurrent, DC link overvoltage).	Not a fault Grid-related shutdown, the grid connects again automatically.	-
FS	38	Generator overvoltage error	○	●	The voltage of the DC generator is too high. The PV generator is incorrectly dimensioned.	☞ Notify your authorised electrician.	**E**
FS	41	Line failure: undervolt. 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: overvolt. 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: undervolt. 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 6: Operating states and fault messages on the display

BS = operating status, FS = fault status;

B = Action of the operator

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

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

Status		Display			Explanation	Action	By
FS	44	Line failure: overvolt. 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: undervolt. 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: overvolt. 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 volt	○	●	The measured line-to-line voltage is outside of the tolerance limits.		
FS	48	Line failure: underfrequency	○	●	Grid frequency is too low. This fault can be grid-related.	☞ Notify your authorised electrician.	**E**
FS	49	Line failure: overfrequency	○	●	Grid frequency too high. This fault can 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.	☞ Notify your authorised electrician.	**E**
FS	57	Waiting for reactivation	○	●	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 overtemp.	○	●	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	Generator voltage too high	○	●	The inverter does not begin feeding into the grid until the PV voltage falls below a specified value.	-	**-**
OS	61	External limit (%)	✳	○	The external limit *Power control* 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 is activated with the activation of the BDEW Medium Voltage Directive (“Mittelspannungsrichtlinie”). Power reduction starts at a frequency of 50.2 Hz.	-	**-**

Table 6: Operating states and fault messages on the display

BS = operating status, FS = fault status;

B = Action of the operator

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

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

Status		Display			Explanation	Action	By
OS	64	Measured values	●	○	Output current limiting: The AC current is limited once the specified maximum value has been reached.	-	**-**
FS	67	Fault power section 1	●	○	There is a fault in the power section.	☞ Notify your authorised electrician.	**E**
FS	70	Fan 1 error	●	○	Fan 1 is indicating a malfunction.	☞ Replace defective fan (see section 9.4 on page 42).	**B**
FS	71	Fan 2 error	●	○	Fan 2 is indicating a malfunction.		**B**
FS	72	Fan 3 error	●	○	Fan 3 is indicating a malfunction.		**B**
FS	73	Standalone grid err.	○	●	Standalone mode was detected.	-	**-**
OS	74	External idle power requirement	✳	○	The grid operator limits the feed-in power of the inverter.	-	**-**

Table 6: Operating states and fault messages on the display

BS = operating status, FS = fault status;

B = Action of the operator

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

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

10 Service

We place special emphasis on the quality and longevity of our inverters, starting even in 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 such faults in an expeditious manner and without a great deal of bureaucracy.
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 will find our warranty conditions on our website.

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

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

Please use our website to register your unit within 24 months:

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

On this page as well, you can click on the appropriate flag to easily reach the website for your own nation.

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.

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

We have prepared a form for complaints. It is located at
http://www.kaco-newenergy.de/en/site/service/kundendienst

Hotlines

	Technical problem resolution	**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 number (*)	+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)

⚠ Authorised electrician

11 Shutdown/Disassembly

11.1 Shutting down the inverter

⚠ DANGER

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

Severe injuries or death if the leads and terminals in the inverter are touched.

› After shutdown, wait at least 5 minutes before working on the inverter.

› When working on photovoltaic modules, in addition to disconnecting from the grid, always disconnect the DC main switch on the generator junction box (or the DC plug connectors). Disconnecting the grid voltage is not enough.

⚠ DANGER

Destruction of the DC plug

DC plugs can be destroyed by arcing when being disconnected under load.

› It is absolutely necessary that the shutdown sequence be carried out in the correct order.

Shutdown sequence

1. Switch off the grid voltage by deactivating the external circuit breakers.
2. Disconnect the PV generator using the DC disconnect.

DANGER! The DC leads remain live.

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

11.2 Deinstalling the inverter

↻ Shut down the inverter.

1. Open the connection area.
2. Remove the interface cable.
3. Release the DC and AC leads from the spring-type terminals.
4. Open the cable fittings.
5. Pull out the leads.

» The deinstallation of the inverter is complete. Continue with dismantling.

11.3 Dismantling the inverter

↻ Shut down the inverter.

↻ Deinstall the inverter.

1. Take the inverter down from the mounting plate.
2. Securely pack up the inverter if it is to be used later,
   or
   have the inverter professionally disposed of (see chapter 12 on page 53).

12 Disposal

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

12.1 Unit

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.

12.2 Packaging

Ensure that the transport packaging is disposed of properly.

13 Documents

13.1 EU Declaration of Conformity

Manufacturer's name and address	**KACO new energy GmbH** Carl-Zeiss-Straße 1 74172 Neckarsulm, Germany
Product description	**Photovoltaic feed-in inverter**
Type description	**Powador 16.0 TR3/18.0 TR3**

This is to confirm that the units stated above are compliant with the protection requirements set forth in the Directive of the European Parliament and of the Council of 15 December 2004 on the harmonization of the laws of the Member States relating to electromagnetic compatibility (2004/108/EC) and the Low Voltage Directive (2006/95/EC)

The units are compliant with the following standards:

2006/95/EC	**Safety of the unit**
„Directive relating to electrical equipment designed for use within certain voltage limits"	IEC 62109-1:2010
2004/108/EC	**Interference immunity**
„Directive relating to electromagnetic compatibility"	EN 61000-6-1:2007
	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 61000-3-3:2008**
	EN 61000-3-11:2000***
	** applicable for models ≤ 16 A
	*** applicable for models ≥ 16 A

The types mentioned above are therefore labelled with the CE marking.

Any 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, 23 November 2010

KACO new energy GmbH

Matthias Haag

CTO

13.2 VDEW Declaration of Conformity

Name and address of the manufacturer:	**KACO new energy GmbH** Carl-Zeiss-Str. 1 74172 Neckarsulm, Germany
Product description	**Photovoltaic feed-in inverter**
Type description	**Powador 16.0 TR3/18.0 TR3**

This is to confirm that the units stated above are compliant with the guidelines for connection and parallel operation of in-system generation on the low-voltage grid (4th edition, 2001).

The inverters are equipped with a three-phase voltage drop protector and overvoltage protector. The inverters are not designed for standalone operation. Safety-related parameters for the automatic disconnecting devices are routinely tested on each unit.

The inverter's grid monitoring conforms with the standard DIN V VDE V 0126-1-1:2006-02.

Declaration regarding rated power and maximum output power of photovoltaic inverters:

Inverter type	AC rated power (ACRATED) in VA	AC peak power* (ACPEAK) in VA	Ratio ACPEAK/ACRATED
Powador 16.0 TR3	13,500	13,500	1
Powador 18.0 TR3	15,000	15,000	1

* The average over 10 minutes is given for the AC peak power.

Any 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, 23 November 2010

KACO new energy GmbH

Matthias Haag

CTO

Notes

Notes

Notes

31001198-01-110707

KACO new energy.

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