KACO new energy.

Powador
10.0 TL3
12.0 TL3
14.0 TL3
18.0 TL3

Operating Instructions

■ **English translation of German original**

Operating Instructions

for Installers and Operators

Powador
10.0 TL3
12.0 TL3
14.0 TL3
18.0 TL3

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 the registration and approval of your photovoltaic (PV) system are included with the operating instructions.

1.1.2 Storing the documents

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

1.2 Layout of Instructions

1.2.1 Symbols used


General hazard


Risk of fire or explosion


High voltage!


Risk of burns

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

1.2.2 Safety warnings symbols guide

DANGER

High risk

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

WARNING

Potential risk

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

CAUTION

Low-risk hazard

Failure to observe this warning will lead to minor or moderate bodily injury.

CAUTION

Risk of damage to property

Failure to observe this warning will lead to property damage.

1.2.3 Additional information symbols

NOTE

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 Instructions symbols guide

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

Instructions

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

☞ Carry out the next step.

☞ (Additional steps, if applicable)

» Result of the step(s) (optional)

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

Instructions

↻ Prerequisite(s) for the steps (optional)

1. Carry out the next step.
2. Carry out the next step.
3. (Additional steps, if applicable)

» Result of the steps (optional)

1.2.5 Abbreviations

Colour codes (in accordance with IEC 60757)

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

2 Safety

DANGER

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

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

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

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

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

› Do not make any modifications to the inverter.

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

- Keep unauthorised persons away from the inverter and PV system.
- 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 disconnect in addition to disconnecting the PV generator from the grid.

2.1 Proper use

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

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

Any other or additional use of the device is deemed improper. This includes:

- Mobile use
- Use in rooms where there is a risk of explosion
- Use in rooms where the humidity is higher than 95%
- Operation outside of the specifications intended by the manufacturer
- Standalone operation

2.2 Protection features

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

- Overvoltage conductors/varistors to protect the power semiconductors from high-energy transients on the grid and generator side
- Temperature monitoring of the heat sink
- EMC filters to protect the inverter from high-frequency grid interference
- Grid-side grounded varistors to protect the inverter against burst and surge pulses
- Islanding detection according to VDE 0126-1-1

2.3 Additional information

NOTE

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

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

3 Description

3.1 Mode of Operation

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

3.2 Description of the unit

3.2.1 Powador inverter as part of a PV system

3.2.1.1 System layout

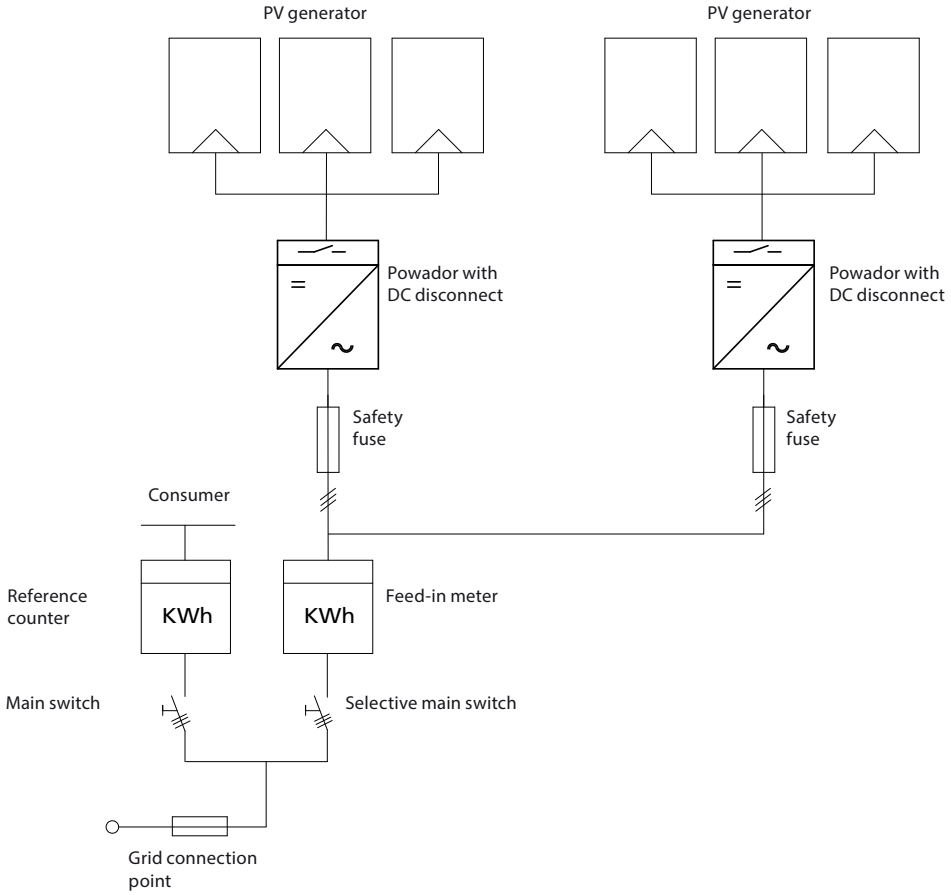


Figure 1: Circuit diagram of a system with two inverters

3.2.1.2 Summary of the components

PV generator

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

DC terminal point

Options for parallel connections of several generator strings:

- To a DC terminal point between the DC generator and inverter,
- Directly to the inverter (plug connectors for 4 (2 x 2) strings are provided on the inverter)
- Directly to the PV generator with a positive and negative lead to the inverter

DC disconnect

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

Grid fuses

gL safety fuses or automatic circuit breakers are suitable.

Feed-in meter

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

Selective main switch

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

3.2.2 Inverter diagram

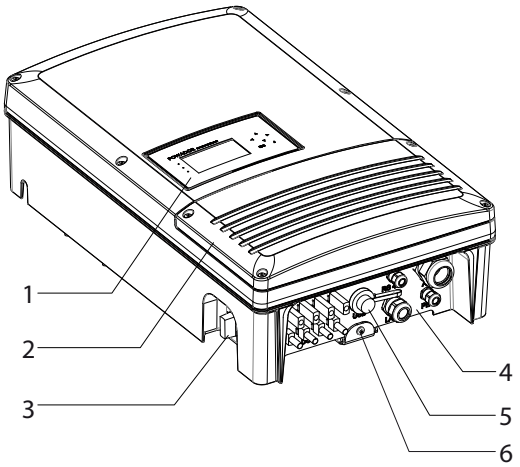


Figure 2: Inverter diagram

Key			
1	Control panel	4	Connection board
2	Cover for the connection area	5	USB interface
3	DC disconnect	6	Mounting plate

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.

DE

Country-specific function

3.2.3.2 Fault signal relay/Powador-priwatt

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

- Fault signal relay (see above)
- Powador-priwatt

Powador-priwatt

Paragraph 33 of the German Renewable Energies Act (EEG) includes compensation for personal consumption of self-generated PV energy for systems up to a maximum of 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 “Powador-priwatt” mode, the potential-free contact takes care of this function.

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

Activating the function (optional)

The “Powador-priwatt” function is not active in the unit’s factory default state. You can obtain the password for the function from your specialist retailer. The electrician then activates the function in the Settings menu.

Powador-priwatt switch (optional)

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

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

DE

Country-specific function

3.2.3.3 Power limitation (power control)

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

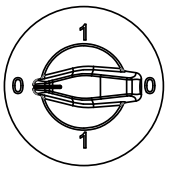
The power reduction is achieved using a ripple control receiver in KACO new energy GmbH inverters. If necessary, the power supply company can reduce the power of the system remotely using an additional device from the Powador proLOG family. The Powador-proLOG activates this function, which is already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

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

3.2.4 Mechanical components

DC disconnect

The DC disconnect is located on the bottom 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 disconnects from 1 (ON) to 0 (OFF).

Connecting the inverter to the PV generator

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

3.2.5 Interfaces

The inverter has 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 Settings menu.

3.2.5.1 RS485 interface

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

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

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).

3.2.5.5 Digital input

If a Powador protect is installed as external grid and system protection, the fail-safe disconnection of suitable Powador inverters from the public grid can be initiated by a digital signal instead of by tie circuit-breakers. This requires the inverters in the photovoltaic system to be connected to the Powador protect. For information on the installation and use see this manual, the Powador protect manual and the instructions for use of the Powador protect on the KACO web site.

4 Technical Data

4.1 Electrical Data

Input levels	10.0 TL3	12.0 TL3	14.0 TL3	18.0 TL3
Max. recommended PV generator power [W]	10 000	12 000	14 000	18 000
DC MPP range from [V] to [V]	350 to 800	350 to 800	350 to 800	420 to 800
Operating range from [V] to [V]	200 to 800*			
Starting voltage [V]	250			
Open circuit voltage [V]	1,000 (start up to 1,000)			
Max. rated current [A]	2 x 18,6			
Max. power per tracker [W]	9 200	10 200	12 800	15 300
Number of strings	2 x 2			
Number of MPP controls	2			
Polarity safeguard	Short-circuit diode			
DC overvoltage category	II			

* For voltages below the device-specific MPP voltage the possible input power is reduced. The rated current is limited to 18.6 A per input. For PV generators with MPP voltages of less than 250 V, the start voltage must be set in the parameter menu.

Output levels				
Rated power [VA]	9 000	10 000	12 500	15 000
Max. power [VA]	9 000	10 000	12 500	15 000
Grid voltage [V]	400/230 (3/N/PE)			
Rated current [A]	3 x 13,0	3 x 14,5	3 x 18,1	3 x 21,8
Max. current [A]	3 x 13,0	3 x 14,5	3 x 18,1	3 x 21,8
Rated frequency [Hz]	50 / 60			
cos phi	0.80 inductive to 0.80 capacitive			
Number of feed-in phases	3			
Distortion factor [%]	< 5			
AC overvoltage category	III			
General electrical data				
Max. efficiency [%]	98.0	98.0	98.0	98.0
European efficiency [%]	97.4	97.5	97.6	97.7
Make current [A] and ON duration [ms]	4.52 A / 4.4ms			
Internal consumption: night [W]	< 1.5			
Feed-in starts at [W]	20			
Circuit design	Transformerless			

Table 1: Electrical data

Transformer unit	No
Grid monitoring	Country-specific
CE conformity	yes

Table 1: Electrical data

4.2 Mechanical data

	10.0 TL3, 12.0 TL3, 14.0 TL3, 18.0 TL3
Display	Graphical LCD, 3 LEDs
Controls	4-way button, 2 buttons
Interfaces	Ethernet, USB, RS485, S0
Fault signal relay	Potential-free NO contact, 230 V/1 A
AC connections: PCB terminal	PCB terminals inside the unit (max. cross-section: 16 mm² flexible, 10 mm² rigid)
AC connections: Cable connection	Cable connection via M40 cable fitting
DC connections	8 (2 x 4) MC-4-compatible plug connections
Ethernet connection: Cable connection	Cable connection via M25 cable fitting
Optional DC connection	-
Ambient temperature range [°C]	-25 to +60, derating from +40
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	IP65
Degree of contamination	2
Noise emission [dB(A)]	< 45/noiseless without fan operation
DC disconnect	Built-in
Housing	Cast aluminium
H x W x D [mm]	Approx. 690 x 420 x 200
Total weight [kg]	< 40

Table 2: Mechanical data

5 Transportation and Delivery

5.1 Delivery

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

Scope of delivery

- 1 Powador inverter
- 1 wall bracket
- 1 installation kit
- 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 of receiving 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.
› Carefully transport the inverter using the carrying handles of the pallet.
› Do not subject the inverter to shocks.

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

Figure 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,
- close to the ground, from the front and sides with no additional resources available to
- Protected from direct sunshine outdoors,
- For easy operation, ensure during installation that the display is slightly below eye level.

Wall

- With sufficient load-bearing capacity,
- Accessible for installation and maintenance,
- Made from heat-resistant material (up to 90 °C),
- Flame resistant,
- Minimum clearances to be observed during assembly: see Figure 5 on page 17.

NOTE

Access by maintenance personnel for service

Any additional costs arising from unfavourable structural or mounting conditions shall be billed to the customer.

CAUTION

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

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

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

› Perform regular visual inspections.

› Immediately remove any moisture from the housing.

› Take care to ensure sufficient ventilation of the inverter.

› Immediately remove dirt, especially on vents.

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

⚠ Authorised electrician

NOTE

Power reduction due to heat accumulation.

If the recommended minimum clearances are not observed, the inverter may go into power regulation mode due to insufficient ventilation and the resulting heat build-up.

› Maintain minimum clearances.

› Ensure sufficient heat dissipation.

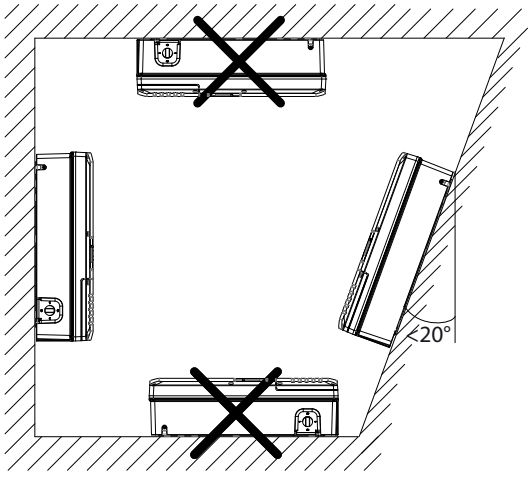


Figure 4: Instructions for wall mounting

CAUTION

Use suitable mounting parts.

› Use only the supplied mounting parts.

› Mount the inverter upright on a vertical wall only.

› For a free-standing mounting an incline of 20° is allowed.

⚠ Authorised electrician

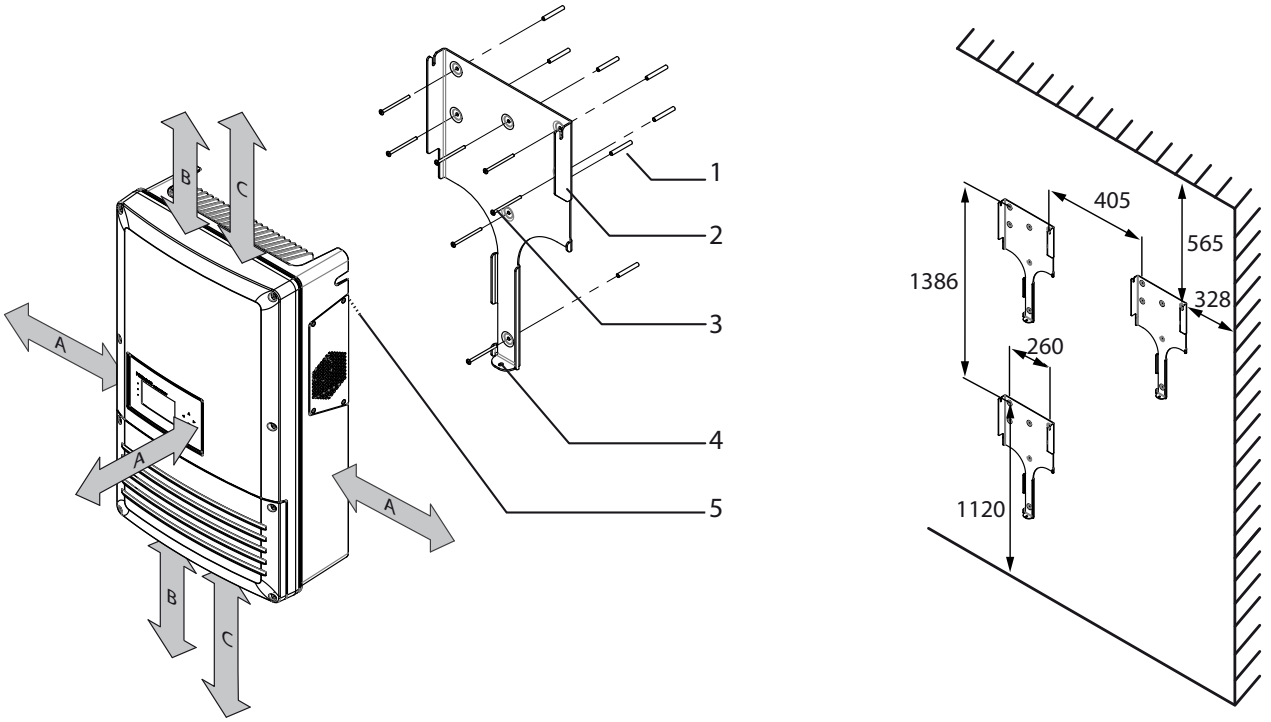


Figure 5: Minimum clearances/mounting plate

Key

1	Fixings for mounting	4	Detachment protector
2	Mounting plate	5	Suspension brackets (back of housing)
3	Screws for mounting		
A	• horizontal distance between the two inverters / inverter and the wall • Distance in front	B	Distance between the inverter and the ceiling / floor
C	vertical distance between the two inverters		

Mounting the Inverter

1. Mark the positions of the drill holes using the cut-outs in the mounting plate.
   NOTE: The minimum clearances between two inverters, or the inverter and the ceiling/floor have already been taken into account in the diagram.
2. Fix mounting plate to the wall with the supplied mounting fixtures.
   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.
4. Fix the inverter with the enclosed screws to the detachment protector at the connection area.

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

⚠ Authorised electrician

7 Installing the Inverter

⚠ DANGER

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

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

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

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

› Observe the safety regulations and current technical connection specifications of the responsible power supply company.
› Disconnect the AC and DC sides.
› Secure both sides against being inadvertently switched back on.
› Ensure that the AC and DC sides are completely voltage-free.
› Connect the inverter only after the aforementioned steps have been taken.

7.1 Opening the connection area

Opening the connection area

↻ You have mounted the inverter on the wall.

1. Unscrew the four Torx screws on the front side of the connection cover (blue).
2. Pull down the connection cover.

» Make the electrical connection.

NOTE

Only take the connection cover (blue) off. The opening of the case cover (grey) leads to loss of warranty.

7.2 Making the electrical connection

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

	AC connection	DC connection
Max. conductor cross-section without wire sleeves	16 mm²	dependent on the plug that is used
Max. conductor cross-section with wire sleeves	10 mm²	
Length of insulation to be stripped off	10 mm	

⚠ Authorised electrician

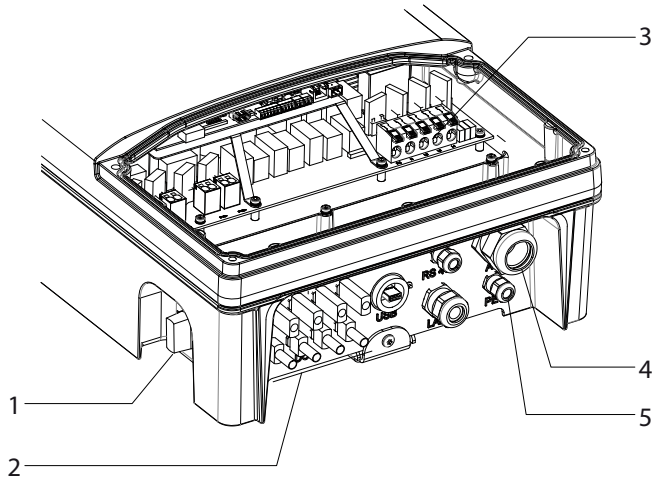


Figure 6: Connection area: electrical connection

Key			
1	DC disconnect	3	AC connection terminals
2	8 (2 x 4) MC4-compatible DC plug connectors for PV generator	4	Cable fitting (M40) for AC connection
		5	Cable fittings (M16) for housing ground connection

7.2.1 Connecting the inverter to the power grid

The power connection wires are connected on the right of the connection area (see Figure 6 on page 19).

⚠ DANGER

Risk of fatal injury due to electric shock

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

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

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

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

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

Model	Conductor cross-section	Fuse protection: gL safety fuses or comparable automatic circuit breakers
Powador 10.0 TL3	6.0 mm²	25 A for 4.0 mm² conductor cross-section
Powador 12.0 TL3	6.0 mm²	25 A for 4.0 mm² conductor cross-section
Powador 14.0 TL3	6.0 mm²	25 A for 4.0 mm² conductor cross-section
Powador 18.0 TL3	6.0 mm²	32 A for 6.0 mm² conductor cross-section

Table 3: Recommended conductor cross-sections and fuse protection of NYM cables

Authorised electrician

NOTE

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

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

Making the grid connection

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

1. Unscrew the cable fitting.
2. Remove the outer cladding of the AC cables.
3. Insert the AC leads through the cable fitting into the connection area.
4. Strip the insulation from the AC cables.
5. Open the locks for the PCB terminals.
6. Connect the wires in accordance with the labels on the PCB terminals (Figure 7 on page 20).
7. Close the locks for the PCB terminals.
8. Check that all connected cables are securely fitted.
9. Tighten the cable fitting.

» The inverter is now connected to the power grid.

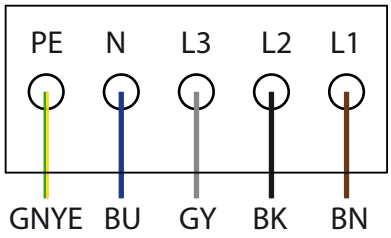


Figure 7: AC connection terminals

NOTE

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

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

7.2.2 Connecting the PV generator

Connect the PV generator to the 4 DC positive and the 4 DC negative connection plugs on the underside of the housing (see Figure 8 on page 21).

NOTE

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

DANGER

Risk of fatal injury due to contact voltages.

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

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

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

› Remove the plug connector.

⚠ Authorised electrician

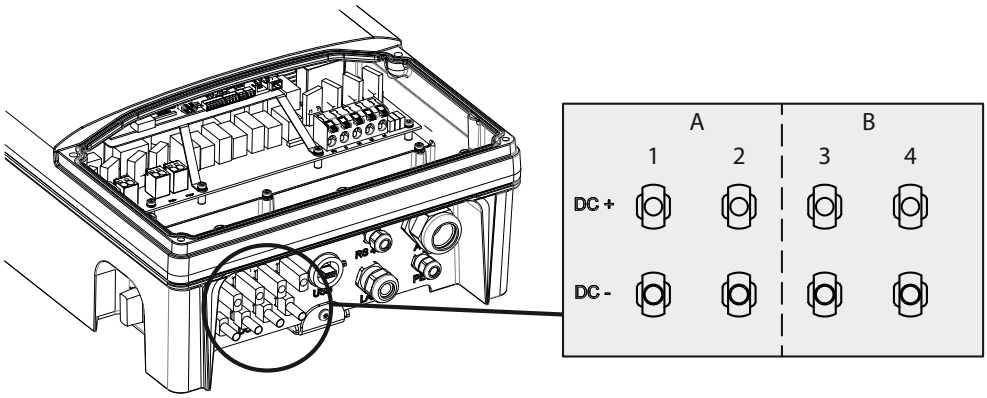


Figure 8: Connections for DC positive and DC negative

Key			
A	MPP tracker A	B	MPP tracker B
1.2	DC-Plus/DC-Minus-Connections to MPP tracker A	3.4	DC-Plus/DC-Minus-Connections to MPP tracker B

7.2.2.1 Before connecting

Ensure that there is no ground fault

1. Determine the DC voltage between the
   - protective earth (PE) and the positive cable of the PV generator,
   - protective earth (PE) and the negative cable of the PV generator
     are identified.

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

2. Rectify any faults before taking further measurements.
3. Determine the electrical resistance between the
   - protective earth (PE) and the positive cable of the PV generator,
   - protective earth (PE) and the negative cable of the PV generator
     are identified.

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 Maximum input power

The input power of the inverter is limited only by the maximum rated current of 18.6 A per input. This causes the maximum input power per path to increase with the input voltage.

NOTE

The overall power of the unit continues to be limited. If one input is connected to more than P(DCmax)/2, the maximum input power of the second input decreases accordingly. Take care that the maximum input power is not exceeded.

Authorised electrician

7.2.2.3 Recommended standard connection

DANGER

Risk of fatal injury due to electric shock (electric arc)!

Wrong assignment of MPP trackers will seriously damage the inverter

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

› Make sure that each MPP tracker can be disconnected from all poles.

› Observe recommended standard connection.

Equal MPP voltages must be applied to input 1 and 2, as well as inputs 3 and 4. The MPP voltages of the two DC paths can be different. They are tracked by separate, independently operating MPP trackers (MPP trackers A and B). (n_1=n_2, n_3=n_4).

Electrical data for standard connection	
Connecting the DC inputs	Number of modules per string: n_1=n_2, n_3=n_4
P_{max}	per string < 9 kW MPP trackers A+B together < 18 kW
I_{max}	< 18.6 A per tracker

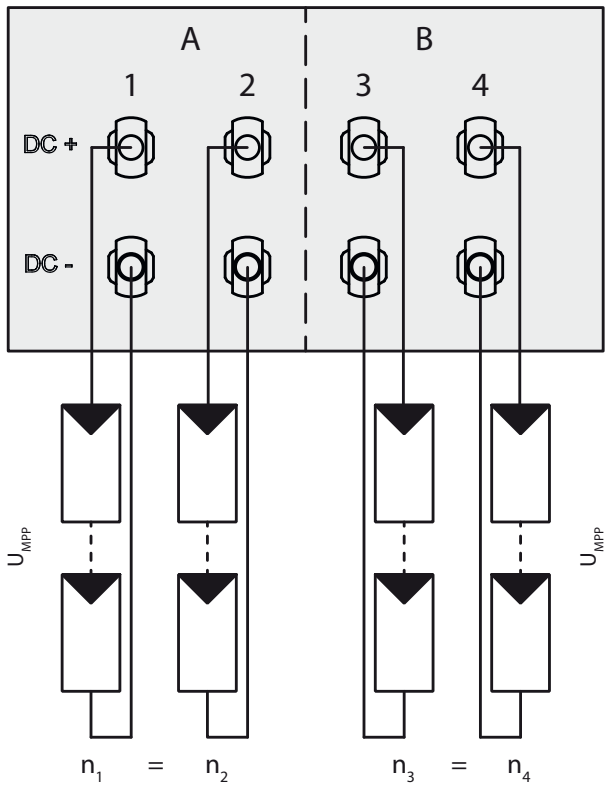


Figure 9: Recommended standard connection

⚠ Authorised electrician

7.2.2.4 Parallel input connection

The DC inputs can also be connected in parallel. Only strings with identical MPP voltage can be connected in parallel (n_1=n_2=n_m).

The maximum rated current rises to 37.2 A for parallel connection.

In case of a parallel input connection, MPP trackers A and B must be bridged. If input 1 is connected to input 2 and input 3 is connected to input 4, then there is no parallel operation and the maximum rated current continues to be 18.6 A.

Electrical data for parallel connection	
Connecting the DC inputs	Number of modules per string: n_1=n_2=n_m
P_{max}	< 18 kW
I_{max}	< 37.2 A

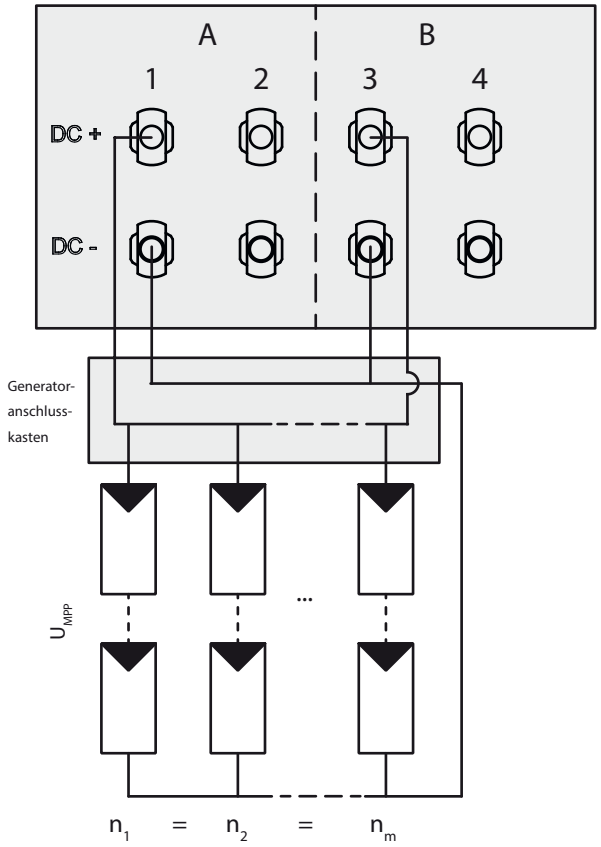


Figure 10: Parallel input connection in the generator junction box

Authorised electrician

7.2.2.5 Unconnected inputs

NOTE

If one of the MPP trackers (A or B) is not used, then it must be closed, otherwise faults can occur in the self-test of the unit and the feed-in operation is not guaranteed. This does not lead to damage to the unit.

The recommended standard connection or the parallel input connection should be selected as a matter of course before an MPP tracker is short-circuited and therefore remains unused.

Electrical data for unused MPP trackers	
Connecting the DC inputs	Number of modules per string: $n_1=n_2=n_m$
P_{max}	per string < 9 kW P_{max} on used MPP-Tracker < 15.3 kW
I_{max}	< 18.6 A

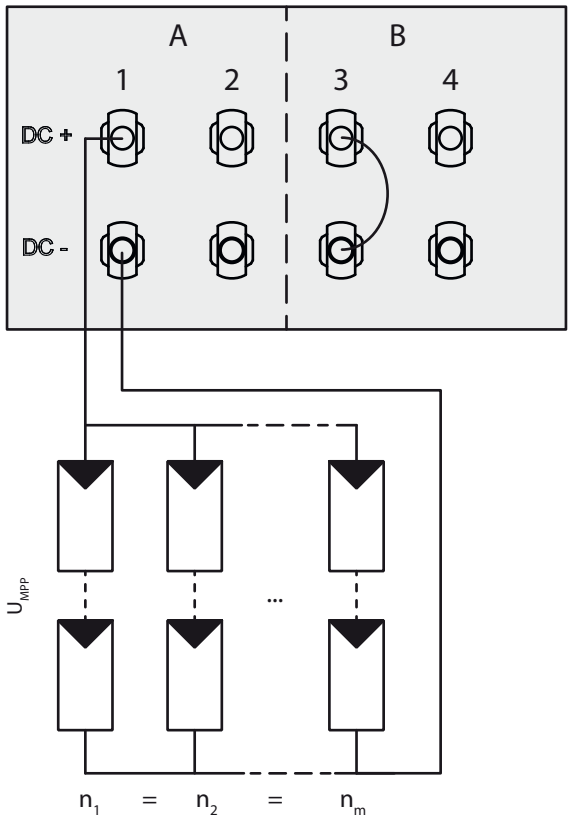


Figure 11: Parallel Input with Y-adapter, short-circuits the unused MPP Tracker B

Authorised electrician

7.2.2.6 Connecting the PV generator

DANGER

Risk of fatal injury due to electric shock

Severe injury or death will result if the live connections are touched. When there is sunlight present, there is DC voltage on the open ends of the DC cables.

› Do not touch the exposed ends of the cables.

› Avoid short circuits.

Connecting the PV generator

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

» The inverter is connected to the PV generator.

7.2.3 Grounding the housing

An optional grounding of the housing is possible at the grounding point provided for that purpose in the connection area of the inverter. Please observe any national installation regulations in this regard.

Ground the housing of the inverter, if necessary, at the grounding point provided for that purpose in the connection field of the inverter

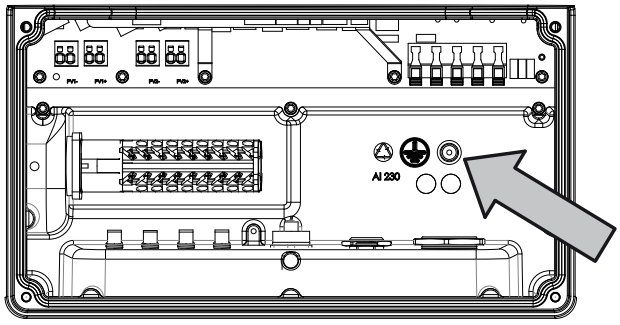


Figure 12: Grounding point in the connection area

Grounding the housing

1. Detach cable fitting for grounding the housing.
2. Remove the outer cladding from the grounding cable.
3. Insert the grounding cable through the cable fitting into the connection area.
4. Remove the insulation from the grounding cable.
5. Furnish the stripped cable with an M4 ring cable lug.
6. Screw the ring cable lug to the grounding point with an M4/TX30 screw.
7. Check that the cable is secure.

» Tighten the cable fitting.

Authorised electrician

7.3 Connecting the interfaces

All interfaces are located on the connection circuit board behind the cover for the connection area. Use the cable fittings and plug connections provided (see Figure 13 on page 26).

DANGER

Risk of fatal injury due to electric shock

Severe injury or death may result from improper use of the interface connections and failure to observe protection class III.

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

NOTE

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

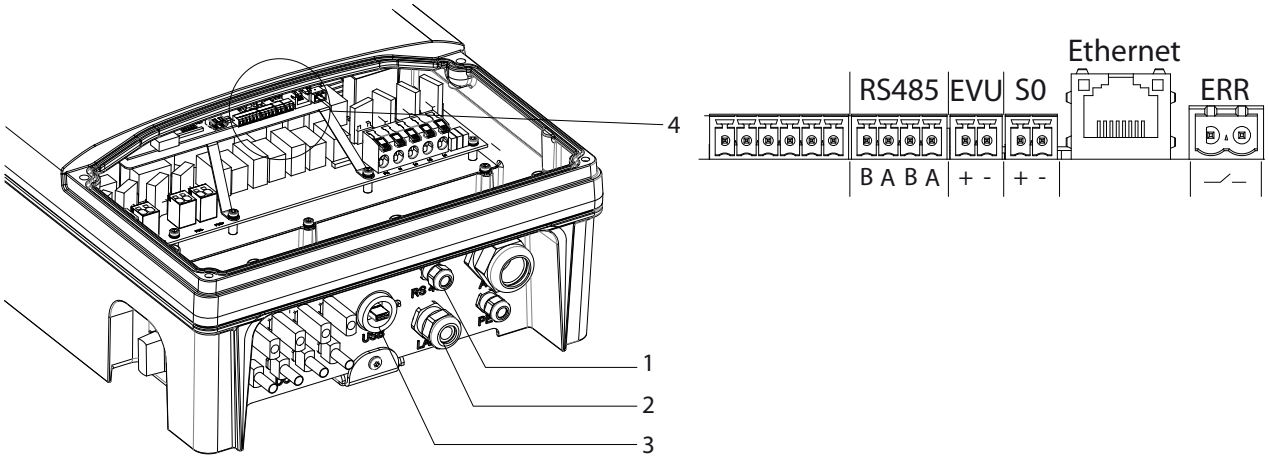


Figure 13: Connection area: Connection and assignment of the interfaces

Key			
1	Cable fitting for RS485 connection cable	4	Interface connections / pin assignment
2	Cable fitting (M25) for Ethernet connection cable		
3	USB interface with cover		

7.3.1 Connecting the RS485 bus

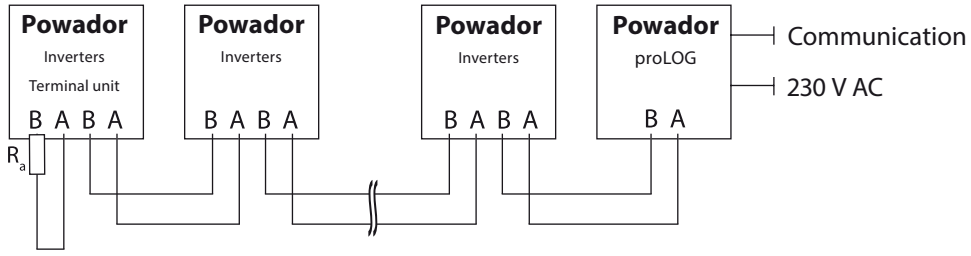


Figure 14: RS485 interface wiring diagram

⚠ Authorised electrician

NOTE

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

NOTE

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

Connecting the RS485 bus

- ☞ 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 a twisted, shielded data cable.
  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 13 on page 26).
2. Thread the connection cables through the cable fitting.
3. Connect the connection cables to the corresponding connection terminals (see Figure 13 on page 26).
4. Connect the following to all inverters and to the Powador-proLOG as follows:
   - Wire A (-) with wire A (-) and
   - Wire B (+) with wire B (+) (see Figure 14 on page 26)
5. Tighten the cable fitting.
6. Activate the terminating resistor on the terminal unit.

7.3.2 Connecting "Inverter off" digital input (optional)

NOTE

The Powador-protect digital output can only be used with suitable KACO inverters. When using devices from other manufacturers or in combination with KACO inverters, bus coupler circuit-breakers as a minimum must be used for shutting down devices from other manufacturers.

Connecting and activating "Inverter off" digital input

- ↻ Can only be used with suitable KACO inverters.

1. Unscrew the cable fitting.
2. Thread the connection cables through the cable fitting.
3. Connect wire A (+) to the terminal marked "EVU+" on the first inverter via the "DO1" terminal of the Powador-protect.
4. Connect wire B (-) to the terminal marked "EVU-" on the first inverter via the "GND" terminal of the Powador-protect.
5. Connect the other inverters to one another as follows:
   - wire A (+) to wire A (+) and wire B (-) to wire B (-).
6. Tighten the cable fitting.
7. After commissioning: Activate the support for the Powador protect in the parameter menu under the "Powador-protect" menu item.

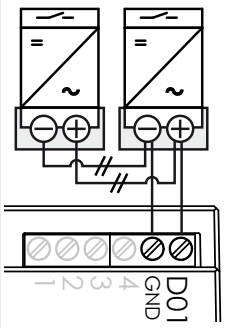


Figure 15: Powador-protect

⚠ Authorised electrician

7.3.3 Connecting the S0 output

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

Connecting the S0 output

1. Unscrew the cable fitting (see Figure 13 on page 26).
2. Thread the connection cables through the cable fitting.
3. Connect the connection cables to the connection terminals.
4. Tighten the cable fitting.

7.3.4 Connecting the Ethernet interface

NOTE

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.

NOTE

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. Loosen and remove the cover of the cable fitting (see Figure 13 on page 26).
2. Remove the sealing insert.
3. Thread the connection cable through the cover of the cable fitting and the sealing insert.
4. Insert the sealing insert into the cable fitting.
5. Connect the connection cable to the Ethernet interface (see Figure 13 on page 26).
6. Attach and tighten the cover of the cable fitting.

Connecting the inverter to the network

↻ Connect the Ethernet cable to the inverter.
↻ Configure the Ethernet interface in the configuration menu.
☞ Connect the Ethernet cable to the network or a computer.
☞ Configure the Ethernet settings and the web server in the Settings menu (see section 8.3 on page 33).

7.3.5 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

⚠ Authorised electrician

Connecting the fault signal relay

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

7.4 Sealing the connection area

1. The requirements of protection rating IP65 are met by closing the unused cable fittings with blind caps.
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 cables of the inverter even after the inverter has been switched off and disconnected.

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

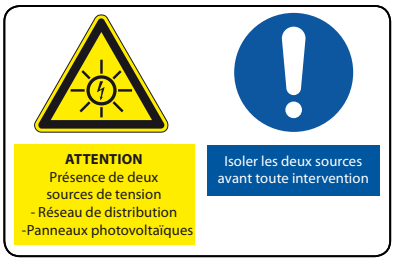
Only authorised electricians who are approved by the supply grid operator may start up the inverter.

FR

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

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

☞ Attach the provided safety sticker visibly to the outside of the enclosure.



7.5.1 Switching on the inverter

↻ The inverter has been mounted and electrically installed.

↻ The cover for the connection area is closed.

↻ The PV generator supplies a voltage above the configured start voltage.

1. Connect the grid voltage using the external circuit breakers.
2. Connect the PV generator using the DC disconnect (0 ⟶ 1).

» The inverter begins to operate.

» During the initial start-up: Follow the instructions of the New Connection Wizard.

8 Configuration and Operation

8.1 Controls

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

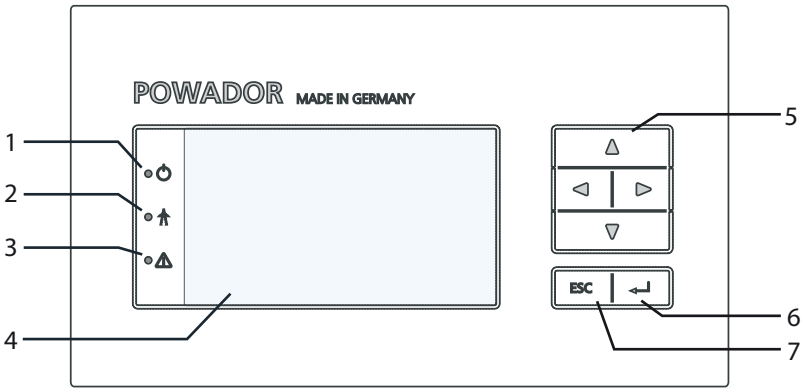


Figure 16: Control panel

Key			
1	"Operating" LED	5	4-way button
2	"Grid feed" LED	6	"OK" button
3	"Fault" LED	7	"ESC" key
4	LCD		

8.1.1 LED indicators

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

●	LED illuminated	✺	LED flashing	○	LED not illuminated

The LED indicators show the following operating statuses:

Operating status	LEDs	Display	Description
Start	● ⏻		The green "Operating" LED is illuminated if an AC voltage is present, independently of the DC voltage.
Grid-feed start	● ⏻ ● 🗼	Power fed into the grid or measured values	The green "Operating" LED is illuminated. The green "Grid-feed" LED is illuminated after the country-specific waiting period*. The inverter is ready to feed in, i.e. is on the grid. You can hear the grid relay switch on.

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

Operating status	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.
Fault		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 backlighting 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.

NOTE

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

After being switched on and after the initial start-up is complete, the inverter displays the 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 initial commissioning see Section 8.2 on page 33.

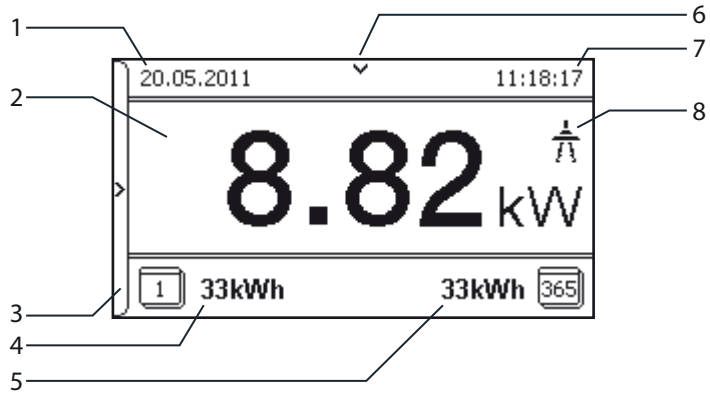


Figure 17: Desktop

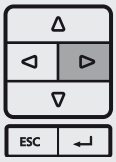
Key			
1	Current date	6	Status bar
2	Current power	7	Current time
3	Menu indicator	8	Feed-in indicator
4	Daily yield		
5	Annual yield		

8.1.3 Control buttons

The inverter is operated using the 4-way button and the OK and ESC buttons.

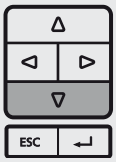
8.1.3.1 Desktop

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.

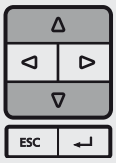
Displaying the daily output



↻ 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.

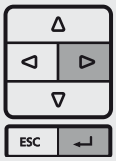
8.1.3.2 Inverter menu

Selecting a menu item



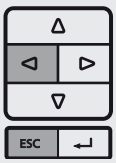
↻ You have left the desktop. The inverter displays the menu.
☞ Use the up and down arrow buttons.

Opening a menu item or a setting



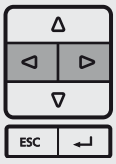
☞ Use the right arrow button and the OK button.

Jump to the next higher menu level/discard changes



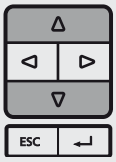
☞ Press the left arrow button or the ESC button.

Selecting an option



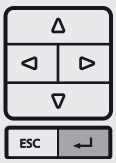
☞ Use the right and left arrow buttons.

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 Starting up for the first time

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

NOTE

After configuration is completed, the configuration assistant does not appear again when the inverter is restarted. You can then change the country setting only in the password-protected parameter menu. The other settings can still be changed in the Settings menu.

NOTE

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.
- ☞ Set 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

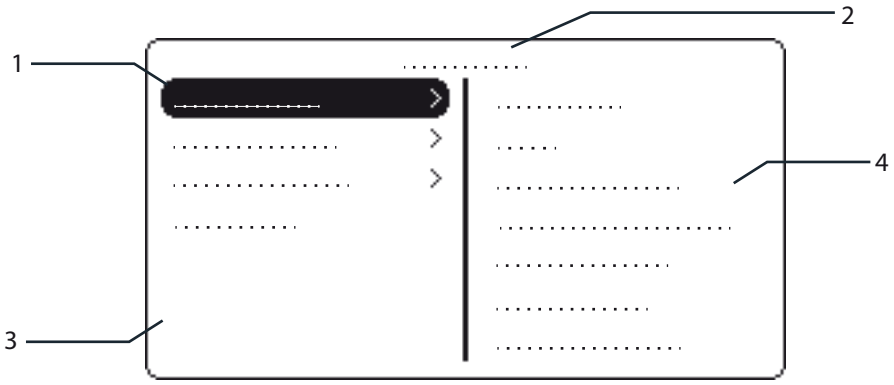


Figure 18: Main menu

Key			
1	Selected menu item	3	Menu items of the active menu level
2	Name of the active menu level	4	Menu items of the next lower menu level

8.3.2 Menu structure

NOTE

The menu items displayed on screen may vary depending on the country and network settings, and also the type of device.

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.
	0 1 2 3	**priwatt time remain.**		Displays the current remaining time for the Powador-priwatt. After this period elapses, the inverter deactivates the Powador-priwatt. This menu item is only available if you have selected the “On” option for the menu item “Activate priwatt” in the “Settings” menu.
	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” key.
	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” key.
	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.

Country-spec. setting	Menu level	Display/setting		Action in this menu/meaning
All countries	0 1 2 3	**Log data display**	⌙	☞ Open the menu: Press the right arrow button or the OK button. ☞ Measurement data can be transferred to a USB stick by selecting it and moving it.
	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). 2. Press the OK button. » The inverter writes the data to the USB storage device.
	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 (“RS485 address” menu item). The address must not be the same as that of any other 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	**Activate priwatt**	Releases the use of the fault signal relay for internal consumption control of the Powador-priwatt. 1. Enter the password. 2. Confirm the entry with the OK button. 3. Activate or deactivate the home feed-in function. **NOTE:** Activating this option enables the menu item **Set priwatt**.
	0 1 2 3	**Set priwatt**	☞ Define the switch-on power in kW that needs to be available on an uninterrupted basis for 30 minutes before the home feed-in is activated. ☞ Define the switch-on time (operating time of Powador-priwatt after activation). **NOTE:** This menu item is only available if you have selected the “On” option for the menu item “Activate priwatt” in the “Settings” menu.
All countries	0 1 2 3	**Quick start**	☞ Reduce the waiting times during the self test by pressing the “Activate” key.
	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: Permanently activate or deactivate the backlighting by selecting “On” or “Off”.
	0 1 2 3	**Date & time**	☞ Set the date and time. **NOTE:** 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	**Network**	☞ 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	**DHCP**		Activate or deactivate DHCP. ☞ On: Activate DHCP. Once the DHCP server becomes available, the IP address, subnet mask, gateway and DNS server are automatically applied and the afore-mentioned menu items are hidden. ☞ Off: DHCP deactivated, make settings manually.
	0 1 **2** 3	**IP address**		☞ Allocate a unique IPv4 address in the network.
	0 1 **2** 3	**Subnet mask**		☞ Allocate a network mask
	0 1 **2** 3	**Gateway**		☞ Enter IPv4 address of gateway.
	0 1 **2** 3	**DNS-Server (+++DNS server)**		☞ Enter IPv4 address of DNS server.
	0 1 **2** 3	**Web server**		☞ Activate or deactivate the integrated web server. ☞ Set the port at which the web server can be reached.
	0 1 **2** 3	**Powador-web**		☞ On: The inverter attempts to connect to the Powador-web web portal. ☞ Off: The connection to Powador web is deactivated.
	0 1 **2** 3	**Connection status**		Indicates the status of the network connection:
	0 1 2 3	**“Parameters” menu**	⌙	☞ Press the right arrow button or the OK button. **NOTE:** 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. Enter the four-digit password using the 4-way button. The password is unit-specific. 2. Confirm the entry with the OK button. 3. Set the desired country setting. **NOTE:** This option influences the country-specific operating settings of the inverter. Please consult KACO service for further information.
DE GR ES IT	0 **1** 2 3	**Grid type/guide-line**		☞ Select the grid type for the inverter’s installation location.

Country-spec. setting	Menu level	Display/setting		Action in this menu/meaning
DE MSp. ES 661 ES 1699 ES PO 12.3				☞ Specify the shutdown threshold for fast and slow overvoltage shutdown. ☞ Set period from occurrence of the fault to shutdown of the inverter.
DE NSp.	0 1 2 3	**Overvoltage shutd.**		☞ Activate or deactivate password protection. ☞ Specify the shutdown threshold for overvoltage shutdown. The 10-minute average for the measured voltage as per EN50160 is used. ☞ Set period from occurrence of the fault to shutdown of the inverter.
BG CZ FR				☞ Specify the shutdown threshold for overvoltage shutdown. The 10-minute average for the measured voltage as per EN50160 is used. ☞ Set period from occurrence of the fault to shutdown of the inverter.
BG CZ FR	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).
DE MSp. ES 661 ES 1699 ES PO 12.3	0 1 2 3	**Undervoltage shutd.**		☞ Specify the shutdown threshold for fast and slow overvoltage shutdown. ☞ Set period from occurrence of the fault to shutdown of the inverter.
DE ES PO 12.3	0 1 2 3	**Connect time**		Set period for grid observation (in seconds) when switching on and reconnection after a fault.
DE NSp.	0 1 2 3	**Max. feed-in power**		The output power of the inverter can be set permanently to a lower value than the maximum output power by the internal power limiting. This may be necessary in order to limit the maximum power rating of the system at the grid connection point, upon the grid operator's request. The value can be protected from the very first output limitation entry. After setting a limitation, the value can only be changed by entering a device-specific password. 1. Activate password protection if necessary. 2. Specify the activation status. 3. Specify the limit value for maximum feed-in power. 4. Confirm the entry with the OK button.

Country-spec. setting	Menu level	Display/setting	Action in this menu/meaning
DE MSp. ES PO 12.3	0 1 2 3	**Activate FRT**	The inverter supports dynamic grid stabilisation (Fault Ride-Through) in accordance with the BDEW Medium Voltage Directive. ☞ Specify constant k. ☞ Specify the dead band. ☞ Activate or deactivate FRT.
DE ES PO 12.3 IT	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 (under-excited/over-excited).
DE MSp. ES PO 12.3 IT	0 1 2 3	**Q specification**	☞ Set the idle power Q (in %) to a fixed value. ☞ Select the type of phase shift (under-excited/over-excited).
DE ES PO 12.3 IT	0 1 2 3	**cos-phi(P/Pn)**	☞ Open the menu: Press the right arrow button or the OK button.
IT	0 1 2 3	**Lock-in voltage**	☞ Power range set as % of rated voltage, where the network support process is active.
	0 1 2 3	**Lock-out voltage**	
DE ES PO 12.3 IT	0 1 2 3	**Number of support points**	This option defines how many support points can be defined in the subsequent menu. • Medium-voltage grid type: up to 10 support points can be defined • Low-voltage grid type: up to 4 support points can be defined ☞ Specify the number of support points for the idle power characteristic curve.
DE ES PO 12.3 IT	0 1 2 3	**1., 2. ...Support point**	☞ Specify the power factor for the 1st, 2nd (etc.) support point ☞ If a power factor not equal to 0 is selected: Select the type of phase shift (under-excited/over-excited).
DE MSp. ES PO 12.3	0 1 2 3	**Q(U) characteristic**	☞ Specify the target voltage. ☞ Specify slope. ☞ Specify change time.

Country-spec. setting	Menu level	Display/setting		Action in this menu/meaning
IT	0 1 **2** 3	**Q(U) 5 Supports**	⌙	☞ Open the menu: Press the right arrow button or the OK button.
	0 1 2 **3**	**Lock-in power**	≡	☞ Power range set as % of rated power, in which the network support process is active.
	0 1 2 **3**	**Lock out power**	≡	
	0 1 2 **3**	**Time constant**	≡	☞ Set the response speed of the control.
	0 1 2 **3**	**Number of support points**	≡	☞ Specify the number of support points for the idle power characteristic curve.
	0 1 2 **3**	**1., 2. ...Support point**	≡	☞ Specify the support points for voltage, power and nature of the phase shift
	0 1 **2** 3	**Q(U) 2-point**	⌙	☞ Open the menu: Press the right arrow button or the OK button.
	0 1 2 **3**	**Lock-in power**	≡	☞ Power range set as % of rated power, in which the network support process is active.
	0 1 2 **3**	**Lock out power**	≡	
	0 1 2 **3**	**Time constant**	≡	☞ Set the response speed of the control.
	0 1 2 **3**	**1.-4. Support point**	≡	☞ Specify the support points for voltage, power and nature of the phase shift
DE NSp.	0 **1** 2 3	**Line error**	≡	Display failures caused by grid. ☞ To show the last 5 grid fault messages, select the “Display” key.
	0 **1** 2 3	**Protection parameters**	≡	Display of essential protection parameters. ☞ To show the protection parameters, select the “Display” key.
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. If feed-in power is actively limited: display maximum power in kW.
	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.
	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 using:

- 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

NOTE

The USB interface is approved solely for use with USB flash storage devices (“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 Settings menu, you can open the web server from an Internet browser. The language 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.

NOTE

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 enables the following measurement data and yield data to be displayed:

- 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. Open the web server.
2. Select the display period by choosing either daily view, monthly view, yearly view or overview.

Filtering display data (daily view only)

1. Open the web server.
2. Select daily 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 (daily, monthly, yearly or overview).
3. Click the “Export data” key.
4. Save the file.

NOTE

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 using the integrated USB interface. Use a FAT32-formatted USB stick to do this. Do not use any storage media with an external power supply (for example: an external hard disk).

NOTE

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 the supply of DC and AC power.

1. Connect the USB stick to the inverter.

» The message “Configuration found. Would you like to load it?” 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 cables for visible damage and pay attention to the operating status display of the inverter. In case of damage, notify your installer. Repairs may only be carried out by authorised electricians.

NOTE

Have your installer check for proper operation of the inverter at regular intervals.

9.2 Cleaning the inverter externally

DANGER

Lethal voltages in the inverter

Serious injuries or death can result if moisture enters the inverter.

› Only use completely dry objects to clean the inverter.

› Only the exterior of the inverter should be cleaned.

Cleaning the inverter

☞ Do not use compressed air.

☞ Use a vacuum cleaner or a soft brush to remove dust from the fan cover and from the top side 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 cables of the inverter even after the inverter has been switched off and disconnected.

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

When there is solar radiation, DC voltage will be present at the open ends of the DC leads. Arcing may occur if the DC cables are disconnected while they are still live.

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

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

› Disconnect the AC and DC sides.

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

› Do not touch the exposed ends of the cables.

› 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 while still live.

› 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 turning off the external circuit breakers.
2. Disconnect the PV generator using the DC disconnect.

DANGER! The DC cables are still live.

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

9.4 Faults

9.4.1 Procedure

DANGER

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

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

☞ When a fault occurs, notify an authorised electrician approved by the supply grid operator or KACO new energy GmbH Service.

☞ The operator can only carry out actions marked with a B.

☞ In case of power failure, wait for the system to automatically restart.

☞ Notify your electrician if there is an extended power failure.

B = Action of the operator

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

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

9.4.2 Troubleshooting

Fault	Cause of fault	Explanation/remedy	By
The display is blank and the LEDs do not light up.	Grid voltage not available	☞ Check whether the DC and AC voltages are within the permitted limits (see Technical Data).	E
		☞ Notify KACO Service.	E

Table 4: Troubleshooting

Fault	Cause of fault	Explanation/remedy	By
The inverter stops feeding into the grid shortly after being switched on, even though there is sunlight present.	Faulty grid separation relay in the inverter.	If the grid separation relay is defective, the inverter will recognise this during the self-test.	
		☞ Ensure that there is sufficient PV generator power.	**E**
		☞ If the grid separation relay is defective, have it replaced by KACO Service. ☞ Notify KACO Service.	**K**
The inverter is active but does not feed into the grid. The display indicates a line failure.	Grid-feed is interrupted due to a grid fault.	Due to a grid fault (grid impedance too high, over/undervoltage, over/underfrequency), the inverter stopped the feed-in process and disconnected from the grid for safety reasons.	
		☞ Change the line parameters within the permitted operating limits (see the "Start-Up" section).	**E**
The grid fuse trips.	The grid fuse capacity is too low.	In cases of high solar radiation, the inverter exceeds its rated current for a short period, depending on the PV generator.	
		☞ Select the capacity of the inverter's pre-fuse to be somewhat higher than the maximum feed-in current (see the "Installation" section).	**E**
		☞ Contact the grid operator if the grid failure continues to occur.	**E**
	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 these tolerances, the daily yields shown may deviate from the values on the feed-in meter by up to 15%.	
		☞ No action	-
The inverter is active but does not feed into the grid. Display: "Waiting for feed-in"	• Generator voltage too low • Grid voltage or PV generator voltage unstable.	• The PV generator voltage or power is not sufficient for feed-in (solar radiation is too low). • The inverter checks the grid parameters before the feed-in process begins. The length of time it takes to switch back on again differs by country according to applicable standards and regulations and can take several minutes. • The starting voltage may have been set incorrectly.	
		☞ Adjust starting voltage in the Parameter menu if required.	**E**

Table 4: Troubleshooting

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. • Grid interference or grid failure caused by particular loads (motors, machines, etc.) which are either connected to the same point on the grid or located in the vicinity of the inverter. • In cases of volatile weather conditions (frequent switching between sunny and cloudy conditions) or strong solar radiation, a light hum may be audible due to the increased power. • Under certain grid conditions, resonances may form between the unit's input filter and the grid, which may be audible even when the inverter is switched off. These noise emissions do not affect the operation of the inverter. They do not lead to loss of efficiency, failure, damage or to a shortening of the unit's service life. People with very sensitive hearing (particularly children) are able to hear the high-frequency hum caused by the inverter's operating frequency of approximately 17 kHz.	
		☞ No action	
In spite of high radiation levels, the inverter does not feed the maximum power into the grid.	The device is too hot and the system limits the power.	Because the temperatures inside the unit are too high, the inverter reduces its power to prevent damage to the unit. Note the technical data. Ensure that the convection cooling is not impeded from the exterior. Do not cover the cooling fins.	
		☞ Provide for sufficient cooling of the unit. ☞ Do not cover the cooling fins.	**B, E**

Table 4: Troubleshooting

9.5 Messages on the display and the “Fault” LED

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

9.5.1 Display of status and fault messages

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

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

Status and fault signals

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

BS = operating status, FS = fault status;

B = Action of the operator

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

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

Status		Display		⚠	Explanation	Action	
OS	1	Waiting for feed-in	○	○	Self-test: The 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	8	Self-test	○	○	Checks the shutdown of the power electronics as well as the grid relay before feed-in mode	-	-
FS	10	Temperature in unit too high	○	●	In case of overheating, the inverter switches off. Possible causes: • Ambient temperature too high • Fans covered • Inverter defect	☞ Cool off the area around the inverter. ☞ Uncover the fans. ☞ Notify your authorised electrician.	**B** **B** **E**
OS	11	Measured values	●	○	Power limitation: If the generator power is too high, the inverter limits itself to the maximum power (e.g. around noon if the generator capacity is too large).		
FS	17	Shutting down Powador-protect	○	●	The activated grid and system protection has been tripped.	☞ Wait for reactivation. ☞ Notify your authorised electrician if the fault occurs several times.	**E**

Table 5: Operating statuses and fault messages on the display

Status		Display			Explanation	Action	
FS	18	Resid. current shutdown	○	●	Residual current was detected. The feed-in was interrupted.	☞ Notify your authorised electrician.	**E**
FS	19	Generator insulation fault	○	●	There is an insulation fault on the PV generator. The feed-in was interrupted.	☞ Notify your authorised electrician if the fault occurs several times.	**E**
FS	30	Instrument transformer 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	○	●	Protective 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	○	●	Protective shutdown of the hardware (AC overvoltage, AC overcurrent, DC link overvoltage).	Not a fault Grid-related shutdown, the grid connects again automatically.	
FS	38	Generator overvoltage error	○	●	The voltage of the DC generator is too high. The PV generator is configured incorrectly.	☞ Notify your authorised electrician.	**E**
FS	41 42	Line failure: Under voltage L1, Over voltage 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**
	43 44	Under voltage L2, Over voltage L2,					
	45 46	Under voltage L3, Over voltage L3,					
FS	47	Line failure: line-to-line volt	○	●	The measured line-to-line voltage is outside of the tolerance limits.		
FS	48	Line failure: Under frequency	○	●	Grid frequency is too low. This fault may be grid-related.	☞ Notify your authorised electrician.	**E**
FS	49	Line failure: Over frequency	○	●	Grid frequency is too high. This fault may be grid-related.	☞ Notify your authorised electrician.	**E**

Table 5: Operating statuses and fault messages on the display

Status		Display			Explanation	Action	
FS	50	Line failure: average voltage	○	●	The grid voltage measurement according to EN 50160 has exceeded the maximum permitted limit value. This fault may be grid-related.	☞ Notify your authorised electrician.	**E**
FS	57	Waiting for reactivation	○	●	Waiting time of the inverter after a fault.	Inverter does not switch on again until the country-specific time has elapsed.	
FS	58	Control board overtemperature	○	●	The temperature inside the unit was too high. The inverter switches off to prevent damage to the hardware.	☞ Provide for sufficient ventilation.	**E**
FS	59	Self test error	○	●	A fault occurred during a self-test.	☞ Notify your authorised electrician.	**E**
OS	60	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 will be activated when the BDEW (German Association of Energy and Water Industries) Medium Voltage Directive goes into effect. Power reduction starts at a frequency of 50.2 Hz.		
OS	64	Measured values	●	○	Output current limiting: The AC current is limited once the specified maximum value has been reached.		
FS	67	Fault at power section 1	●	○	There is a fault in the power section.	☞ Notify your authorised electrician.	**E**
FS	70	Fan error	●	○	Fan 1 is malfunctioning.	☞ Replace defective fan	**E**
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.	-	-
OS	79	Insulation measurement	○	○	PV generator's insulation is being measured	-	**-**
FS	80	Insulation meas. not possible	○	●	The insulation measurement cannot be performed because the generator voltage is too volatile.	-	**-**
FS	81, 82, 83	Protect. shutdown line volt. L1 L2, L3	○	●	Overvoltage has been detected on a conductor. An internal protective mechanism has disconnected the device to protect it against damage.	☞ In case of repeated occurrence: Notify your authorised electrician.	**E**
FS	84	Protect. shutdown undervolt. DC link	○	●	A voltage deviation has been found in the DC link. An internal protective mechanism has disconnected the device to protect it against damage.	☞ In case of repeated occurrence: Notify your authorised electrician.	**E**
FS	85	Protect. shutdown overvolt. DC link	○	●			**E**

Table 5: Operating statuses and fault messages on the display

Status		Display			Explanation	Action	
FS	86	Protect. shutdown DC link asymmetry	○	●	Overvoltage has been found in the DC link. An internal protective mechanism has disconnected the device to protect it against damage.	☞ In case of repeated occurrence: Notify your authorised electrician.	**E**
FS	87, 88, 89	Protection shutdown overcurrent L1, L2, L3	○	●	A current that has been found on a conductor is too high. An internal protective mechanism has disconnected the device to protect it against damage.	☞ In case of repeated occurrence: Notify your authorised electrician.	**E**
FS	93, 94	Buffer 1, buffer 2 self test error	○	●	The control board is defective.	☞ Notify authorised electrician / KACO Service	**E/K**
FS	95, 96	Relay 1, relay 2 self test error	○	●	The power section is defective.	☞ Notify KACO Service	**K**
FS	97	Protect. shutdown overcurrent HW	○	●	Too much power has been fed into the grid. Complete disconnection of the device.	☞ Notify authorised electrician / KACO Service	**E/K**
FS	98	Protect. shutdown HW gate driver	○	●	An internal protective mechanism has disconnected the device to protect it against damage. Complete disconnection of the device.	☞ Notify authorised electrician / KACO Service	**E/K**
FS	99	Protect. shutdown: HW buffer free	○	●	An internal protective mechanism has disconnected the device to protect it against damage. Complete disconnection of the device.	☞ Notify authorised electrician / KACO Service	**E/K**
FS	100	Protect. shutdown HW overtemp.	○	●	The device has been switched off because the temperatures in the housing were too high.	☞ Check to make sure that the fans are working. ☞ Replace fan if necessary.	**B** **E**
FS	101 to 106	Plausibility error temperature, efficiency, DC link, AFI module, relay, DC/DC converter	○	●	The unit has shut down because of implausible internal measured values.	☞ Notify KACO Service	**K**

Table 5: Operating statuses and fault messages on the display

10 Service

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)
- Information about the accessibility of the installation site.
  Any additional costs arising from unfavourable structural or mounting conditions shall be billed to the customer.

You can 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(s).

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

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

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

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

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

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

Hotlines

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

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

⚠ Authorised electrician

11 Shutdown/Disassembly

11.1 Shutting down the inverter

⚠ DANGER

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

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

When there is solar radiation, DC voltage will be present at the open ends of the DC leads. Arcing may occur if the DC cables are disconnected while they are still live.

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

› After shutdown, wait at least 30 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 at all poles (or the DC plug connectors). Disconnecting the grid voltage is not enough.

Shutdown sequence

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

DANGER! The DC cables are still live.

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

11.2 Deinstalling the inverter

↻ Shut down the inverter.

1. Open the connection area.
2. Remove the interface cable.
3. Detach DC connection plug.
4. Detach AC connection cables for the connection terminals.
5. Open the cable fittings.
6. Pull out the cables.

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

11.3 Dismantling the inverter

↻ Shut down the inverter.

↻ Deinstall the inverter.

1. Unscrew the detachment protector.
2. Take the inverter down from the mounting plate.
3. Securely pack up the inverter if it is to be used later
   or
   have the inverter disposed of professionally.

12 Disposal

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

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.

Packaging: Ensure that the transport packaging is disposed of properly.

13 Appendix

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 designation	**10.0 TL3 / 12.0 TL3 / 14.0 TL3 / 18.0 TL3**

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

The units conform to the following standards:

2006/95/EC "Directive relating to electrical equipment designed for use within certain voltage limits"	**Safety of the unit** IEC 62109-1:2010 IEC 62109-2:2011 **Interference immunity** EN 61000-6-1:2007 EN 61000-6-2:2005
2004/108/EC "Directive relating to electromagnetic compatibility"	**Emitted interference** EN 61000-6-3:2007 EN 61000-6-4:2007 **Secondary effects on the grid** EN 61000-3-2:2006 EN 61000-3-3:2008

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

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

Neckarsulm, 22/05/2012

KACO new energy GmbH

p.p. Matthias Haag

CTO

31001212-02-120927

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