



**KACO blueplanet
hybrid 10.0 TL3**

Operating Instructions

■ English translation of German original

Important safety instructions

Legal provisions

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KACO warranty

You can download the current warranty conditions on the Internet at <http://www.kaco-newenergy.com>.

Definitions on product designations

In these operating instructions, the product "blueplanet hybrid 10.0 TL3" is referred to as the device for ease of reading.

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Contents

1	General information.....	5
1.1	About this document.....	5
1.2	Layout of Instructions.....	5
1.2.1	Symbols used	5
1.2.2	Safety warnings symbols guide.....	6
1.2.3	Additional information symbols	6
1.2.4	Symbols for instructions	6
1.3	Target group.....	6
2	Safety.....	7
2.1	Proper use.....	7
2.2	Protection features	8
3	Description of the device	9
3.1	Mode of operation	9
3.2	Integrated energy management	9
3.2.1	Operation mode: Self-consumption optimisation with load compensation (Self-Consumption) .	9
3.2.2	Operation mode: Battery Charging.....	9
3.2.3	Operation mode: External presetting (External)	9
3.3	Integration diagram	10
3.4	Compatible accessories.....	11
3.4.1	KACO blueplanet hy-switch	11
3.4.2	Released battery storage units	11
4	Technical data	12
4.1	General data.....	12
4.2	Detailed technical data	12
4.3	Environmental data.....	13
5	Transportation and Delivery	14
5.1	Scope of delivery	14
5.2	Transporting the device	14
5.3	Installation tool	15
6	Assembly and preparation	16
6.1	Required material.....	16
6.2	Choosing the installation location.....	17
6.3	Unpacking the device	18
6.4	Securing the wall bracket	18
6.5	Installing and securing the device	20
7	Installation.....	22
7.1	General information.....	22
7.2	Information regarding electrical connections.....	24
7.3	Connecting the device to the power grid.....	24
7.3.1	Permissible connectors	25
7.3.2	AC cable fitting assembly	26
7.3.3	Connecting the connector	27
7.3.4	Technical data	27

7.4	Connect PV generator to device	28
7.4.1	Designing the PV generator	28
7.4.2	Configuring the DC connector	30
7.4.3	Checking the PV generator for a ground fault.....	31
7.4.4	Connecting the PV generator	31
7.5	Connecting the battery storage unit to the device.....	32
7.5.1	Checking the battery storage unit	32
7.5.2	Configuring the DC connector	33
7.5.3	Connecting the battery storage unit	33
7.6	Connecting KACO blueplanet hy-switch to the device	34
8	Commissioning	35
8.1	Hardware commissioning	35
8.2	Configuration with the KACO blueplanet hy-switch software	36
8.3	Display.....	37
8.3.1	Start display.....	37
8.3.2	Operating display.....	38
8.3.3	Selection menu	40
8.3.4	Deactivation in grid-parallel operation	43
8.3.5	Warning/fault	44
8.3.6	Warning display.....	45
8.4	Update	45
9	Maintenance and troubleshooting	46
9.1	Visual inspection	46
9.2	Cleaning	47
9.2.1	Cleaning the housing	47
9.3	Warning messages / fault messages / information	48
9.3.1	List of warning messages.....	48
9.3.2	List of fault messages	51
9.3.3	List of displayed information.....	52
9.4	Other faults.....	53
10	Decommissioning and dismantling	54
10.1	Switching off the device.....	54
10.2	Uninstalling the device	55
10.2.1	Disconnecting the DC connector	56
10.2.2	Disconnecting the communications cable.....	56
10.2.3	Disconnecting the AC connector	56
10.3	Disassembling the device.....	57
10.4	Packaging the device.....	57
10.5	Storing the device	57
11	Disposal.....	58
12	Service and warranty.....	58

1 General information

1.1 About this document

Other applicable documents

During installation, observe all assembly and installation instructions for components and other parts of the system. These instructions also apply to the equipment, related components and other parts of the system.

Some of the documents required for the registration and approval of your system are included with the operating instructions.

Links to more detailed information can be found at www.kaco-newenergy.com.

Document title	Document type
Technical data sheet	Technical information on the product
hy-sys software documentation	Application note – Operating the software tool for monitoring and configuration
Grid protection and safety parameters Default parameters	Application note
Software package hy sys	ZIP files for current software
EU Declaration of Conformity Country-specific certificates Certification for specific subassembly	Certificates

Storing the documents

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

- The current version of the operating Instructions can be downloaded at www.kaco-newenergy.com.

English translation of German original

These operating instructions have been produced in several languages. The German-language version of the operating instructions is the original version. All other language versions are translations of the original operating instructions.








WARNING

Improper handling of the device can be hazardous!

- › You must have read and understood the operating instructions in order to install and use the device safely!

1.2 Layout of Instructions

1.2.1 Symbols used

	General hazard		Fire and risk of explosion
	Electrical voltage		Risk of burns
	Earthing - ground conductor		Waiting time after discharge



Authorized electrician

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

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

Information that is important for a specific topic or objective, but that is not safety-relevant.

1.2.4 Symbols for instructions

- ☺ Prerequisite for use
- 1 Carry out the next step
 - 1. Additional action sequence
 - ⇒ Interim result of the action
- » End result

1.3 Target group

All activities described in the document may only be carried out by specially trained personnel with the following qualifications:

- Knowledge about how an inverter functions and operates
- Training in the handling of hazards and risks during the installation and operation of electrical devices and systems.
- Education concerning the installation and start-up of electrical devices and systems.
- Knowledge of applicable standards and directives.
- Knowledge and adherence to this document with all safety notices.

2 Safety

Before using the product for the first time, please read through the safety instructions carefully.

DANGER

Lethal voltages are still present in the connections and cables of the device even after the device has been switched off and disconnected!

Severe injuries or death may occur if the cables and/or terminals/busbars in the device are touched.



- › The device must be mounted in a fixed position before being connected electrically.
- › Comply with all safety regulations and current technical connection specifications of the responsible power supply company.
- › The device is only permitted to be opened or serviced by a qualified electrician.
- › Switch off the grid voltage by turning off the external circuit breakers.
- › Check that all AC and DC cables are completely free of current using a clip-on ammeter.
- › Do not touch the cables and/or terminals/busbars when switching the device on and off.
- › Keep the device closed when in operation.

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

- Keep unauthorised persons away from the device and/or system.
- In particular, making sure that the locally applicable version of the standard ¹"Requirements for special installations or locations – solar photovoltaic (PV) power supply systems" is observed.
- Ensure operational safety by providing proper grounding, conductor dimensioning and appropriate protection against short circuiting.
- Observe all safety instructions on the product 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 on the live device:
 - Do not touch the electrical connections
 - Remove all jewellery from wrists and fingers
 - Ensure that the testing equipment is in safe operating condition.
- Modifications to the surroundings of the device must comply with the applicable national and local standards.

2.1 Proper use

The device is a transformerless PV inverter which converts the direct current of the PV generator into grid-compatible three-phase alternating current and then feeds the three-phase alternating current into the public power grid. In addition, the device consists of a bidirectional, transformerless inverter for charging and discharging released battery storage.

The device is built using state-of-the-art technology and in accordance with the recognized safety rules. Nevertheless, improper use may cause lethal hazards for the operator or third parties, or may result in damage to the product and other property.

1	Country	Standard
	EU	Harmonised document - HD 60364-7-712 (European implementation of the IEC standard)

Examples of standards specific to business premises

The device is intended for use in air-conditioned indoor rooms and may only be used in countries for which it has been approved or for which it has been released by KACO new energy and the grid operator.

Operate the device only with a permanent connection to the public power grid. The country and grid type selection must be commensurate with the respective location and grid type.

The requirements of the grid operator must be met for grid connection to take place. The permission of the relevant authorities may also be required in order to secure authorisation to connection to the grid.

The enclosed documentation is an integral part of the product. The documentation must be read, observed and stored in a place which is freely accessible at all times.

The name plate must be permanently attached to the product.

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

This includes:

- Use of a distribution system that is not described (grid type)
- Use of sources other than PV-strings.
- Mobile use
- Use in rooms where there is a risk of explosion
- Use in direct sunlight, rain or a storm or other harsh environmental conditions
- Use in an outdoor area that does not meet the environmental conditions set down in Technical Data > Environmental Data.
- Operation outside the specification intended by the manufacturer
- Overvoltage of more than 1000 V on the DC connection
- Modifying the device
- Usage of unreleased battery storage

2.2 Protection features

The following monitoring and protection functions are built-in:

- Overvoltage conductor / varistor to protect the power semiconductors from high-energy transients on the grid and generator sides.
- Device temperature monitoring system
- EMC filter to protect the inverter from high-frequency grid interference
- ISO/AFI detection of an isolation fault on the generator.

3 Description of the device

3.1 Mode of operation

The device ensures the supply of the consumers in the household from three different sources: photovoltaics, energy storage unit and the public power grid. If there is sufficient solar radiation on the photovoltaic system and thus a certain minimum voltage is applied to the device, the start process begins. The feed-in process begins once the PV generator has passed the insulation test and the grid parameters are within the requirements imposed by the grid operator for a specific monitoring time. The inverter remains in operation as long as it is supplied from the photovoltaic system or battery storage unit. If the supply voltage is too low, it shuts down until the voltage of the photovoltaic system reaches the minimum value again.

The power of the photovoltaic system is used to supply consumers and charge the energy storage unit. This means that the energy generated can be used to supply loads with a time delay. If sufficient power cannot be provided by the photovoltaic system and the energy storage unit, the missing energy is taken from the public grid.

It is possible to use both integrated energy management and suitable external energy management. The selection is made in the blueplanet hy-sys software belonging to the device.

3.2 Integrated energy management

The device has integrated energy management. It is designed for mains parallel operation with load compensation. To use load compensation, the KACO blueplanet hy-switch is required as measuring point. The settings for integrated energy management are made in the blueplanet hy-sys software.

3.2.1 Operation mode: Self-consumption optimisation with load compensation (Self-Consumption)

If the photovoltaic system supplies energy, priority is given to connected loads. If the photovoltaic system has a surplus of energy, the energy storage unit is charged with it. When the energy storage unit is fully charged and there is still a surplus of energy, this energy is fed into the public grid. If the charging capacity of the energy storage unit has a limiting effect, it can be fed into the public power grid in parallel with the storage unit charging. The feed-in power into the public power grid can be limited to a freely selectable maximum power during installation. If the power of the photovoltaic system is not sufficient to supply the load, the energy storage unit is discharged to fully supply the load. If the discharge capacity of the energy storage unit is not sufficient, energy is taken from the public power grid.

3.2.2 Operation mode: Battery Charging

Priority battery charging is used to maximise the charge level of the energy storage unit. If the photovoltaic system supplies energy, priority is given to connected loads, provided this is possible by the hardware for load compensation. The excess energy is used to charge the energy storage unit with the maximum possible power. If there is an energy surplus, this energy is fed into the public grid. The maximum photovoltaic feed-in power into the public grid can be set by the installer.

3.2.3 Operation mode: External presetting (External)

Functionally, this operation mode corresponds to Operation mode: Self-consumption optimisation with load compensation (Self-Consumption) 3.2.1. In addition, the hybrid inverter is controlled by an external energy management system whose default values take precedence over the integrated energy management system. In this case, compliance with the relevant standards must be ensured by the system operating company.

3.3 Integration diagram

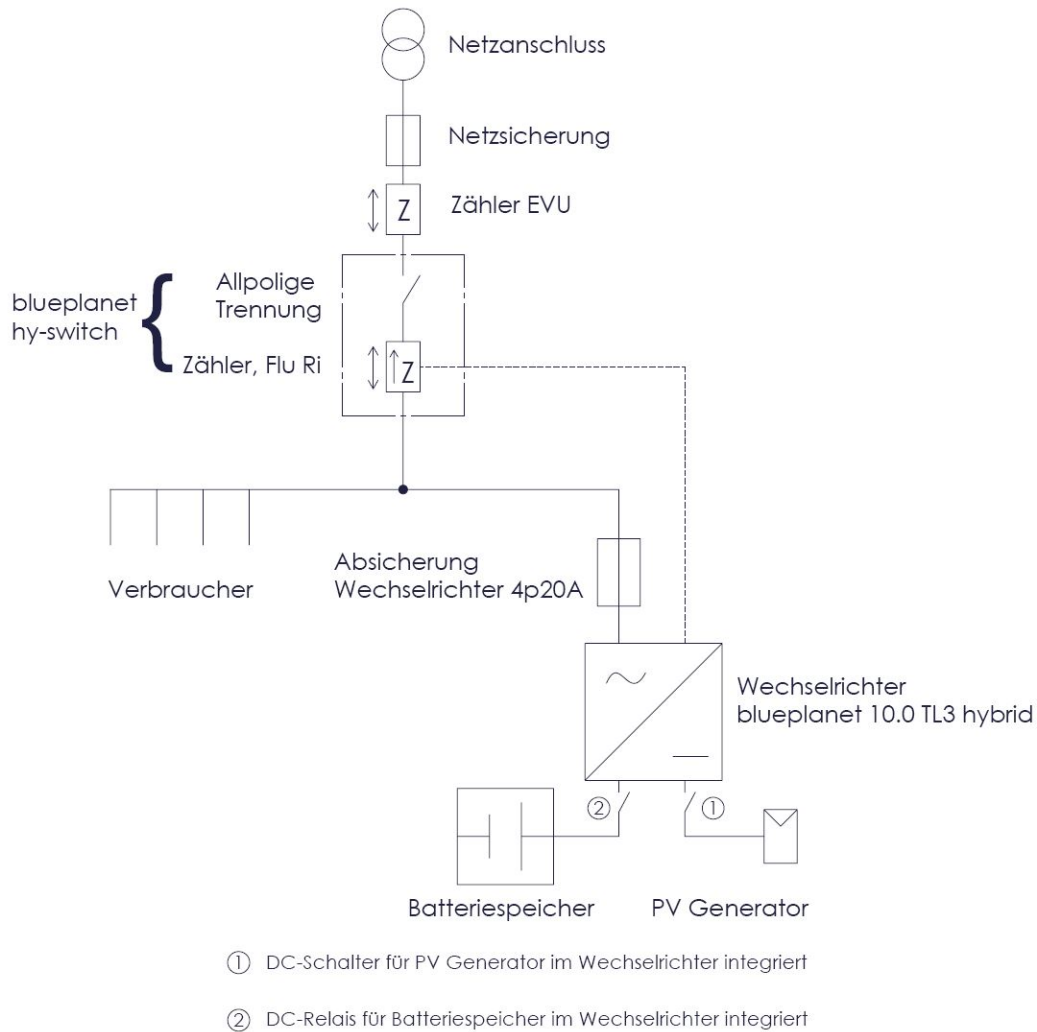


Fig. 1: Diagram of the system

Legend	Definition / information on the connection
PV generator	The PV generator converts the radiant energy of sunlight into electrical energy (direct current).
Inverter	The PV generator is connected to the device's DC connection.
Inverter fuse protection (line protection)	The circuit breaker is an overcurrent protection device.
Power supply company counter	The feed-in counter and reference counter are to be specified and installed by the power supply company. Some power supply companies also allow the installation of your own calibrated counters.
All-pole disconnection	Use the DC isolator switch to disconnect the device from the PV generator.
Battery	Excess power is stored in the battery storage unit until it is used again.

3.4 Compatible accessories

3.4.1 KACO blueplanet hy-switch

KACO blueplanet hy-switch is used to record the power at the grid connection point or the installation string to be compensated by the device. This measured value is transmitted to the device via data communication between the device and KACO blueplanet hy-switch. This enables the integrated energy management system to adjust for the load to be compensated and to perform this adjustment very quickly. KACO blueplanet hy-switch is required for grid-parallel installations with a battery storage unit.

Features of KACO blueplanet hy-switch:

- Energy consumption recording for optimisation of self-consumption
- In case of power failure, all poles are disconnected from the public power grid
Integrated current sensors up to 50A
- 3 x 3.5mm jack connector for expandability with external current sensors up to 100A
- RJ45 connector for communication between KACO blueplanet hy-switch and the device



Fig. 2: KACO blueplanet hy-switch

For further information, please refer to the KACO blueplanet hy-switch manual. The design of the communication port is described in chapter 7.6.

3.4.2 Released battery storage units

The following battery storage units are included in the current version 7.x of the device software.

Tab. 1: Released battery storage units

Vendor	Type	Capacity (approx.)
BYD	Battery-Box H	5.1 bis 10.2 kWh
BYD	Battery-Box Premium HVS	5.1 bis 10.2 kWh
BYD	Battery-Box Premium HVM	8.3 bis 22.1 kWh
Energy Depot	DOMUS 2.5	5.0 bis 20.0 kWh
Energy Depot	DOMUS 3.6	7.2 bis 28.8 kWh

The current release list can be found in the download area of the KACO new energy homepage.

General information on connecting the battery storage unit to the device can be found in chapter 7.5.

Please consult the manual of the battery manufacturer.

4 Technical data

4.1 General data



Fig. 3: KACO blueplanet hybrid 10.0 TL3 inverter

Features of blueplanet hybrid 10.0 TL3

- 3-phase 10 kW hybrid inverter
- 2 integrated MPP trackers
- Fast load regulation (<100 ms)
- High efficiency:
 - PV → grid = >98%
 - PV → battery = >97%
 - Battery → grid = >97%
- Pure sinusoidal output voltage
- Operation modes: Grid operation, Compensation mode
- Aluminium housing
- Convection cooling
- All connections are plug-and-play

4.2 Detailed technical data

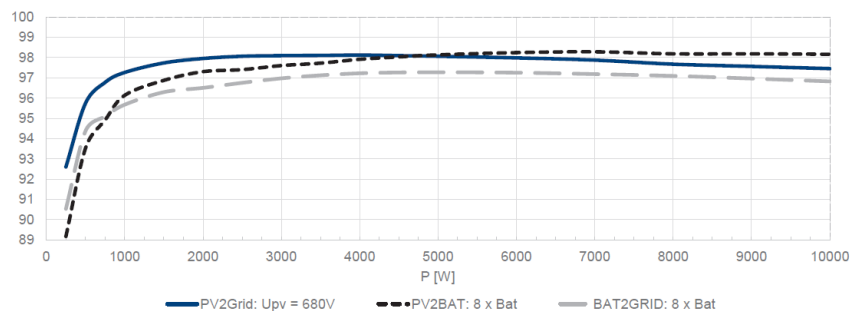
PV Eingang (DC)	
Max. Leistung je Eingang	6'000 W
Anzahl Eingänge / MPP Tracker	2
Nom./ max. DC Spannung	720 V DC / 900 V DC
Einschaltspannung	240 V DC
MPP Spannungsbereich	200 V DC - 740 V DC
Max. Eingangsstrom je MPP Tracker	12 A
Max. Kurzschlussstrom I _{sc}	15 A je Eingang
Überlastverhalten	Arbeitspunktverschiebung
Batteriebetrieb Eingang (DC)	
Nom. DC Spannung	410 V DC
Max. Lade- und Entladestrom	25 A
Batteriespannung Min. - Max.	96 V DC - 450 V DC
Galvanische Trennung	Nein
Absicherung	Sicherung, Trennrelais
Netzeinspeisung (AC)	
Nom. Leistung AC	9 990 W
Max. Leistung AC	11 000 VA
Anzahl der Phasen	3
Typ. Leistung pro Phase am Netz	3'333 W
Max. AC Strom pro Phase	16,1 A RMS
Einspeisung	Sym. / Asym.

Wirkungsgrad	
PV (DC) zu Netz (AC) [max.]	>98%
PV (DC) zu Netz (AC) [EU]	>97,5%
PV (DC) zu Batterie (DC) [max.]	>97%
Batterie (DC) zu Netz (AC) [max.]	>97%
Nachtverbrauch (aus)	<0,1 W
Leerlauf-Verbrauch	27 W

Batteriebetrieb AC-Anbindung	
Nominale Ladeleistung	9 990 W
Nominale Entladeleistung	9 990 W
Spannungsform im Inselbetrieb	Echter Sinus
Anzahl der Phasen	3

Nom. AC Spannung	210 - 264 V AC
AC Spannungsbereich	184 - 264 V AC
Netzfrequenzbereich	47,5 Hz - 51,5 Hz
Leistungsfaktor	0,9c - 0,9i
Topologie	Trafoles
Lastausregelung	100 ms

Allgemeine Daten			
Abmessungen (BxHxT)	610 x 552 x 200 mm	Geräuschemission	<35 dB(A)
Gewicht	33 kg	Übertemperaturverhalten	Abregelung
Display	LCD	Schutzart (IEC 60529)	IP20
DC Trennschalter	Integriert	Gehäuse	Aluminium
FI Schutzschalter	Integriert	Taktfrequenz	20 kHz
NA-Schutz	Integriert (VDE AR-N 4105)	Netzparallelbetrieb	Netzgeführt
Batterie Management System	Integriert	Energiequelle für Ladebetrieb	PV, Netz
Betriebstemperaturbereich	+5 bis +40°C	Verschmutzungsgrad	PD2
Aufstellhöhe*	0 – 1000 m		
Luftfeuchtigkeit		20 – 90% RH (nicht kondensierend)	
Schutz (Inselbetrieb)		PE, RCD Typ B integriert**	
Schutzklasse (IEC 62109-1)		I	
DC Überspannungskategorie (IEC 60664-1)		II	
AC Überspannungskategorie (IEC 60664-1)		III	
WEEE-Reg.-Nr.		DE571 10363	
Zertifikate		VDE 0126, VDE AR-N 4105	
Garantie		5 Jahre	
Anschlüsse			
DC Anschluss für Batterie mit automatischer Trennstelle		PhoenixContact Sunclix	
DC Anschluss für PV		PhoenixContact Sunclix	
AC Anschluss für Netz- und Inselbetrieb		5-Pol PhoenixContact - Art. 1409205	
AC Anschluss max. Kabelquerschnitt		4 mm ²	
Kommunikationsanschlüsse		2 x RJ45 (RS485), 1 x RJ45 (Ethernet) nach extern	
Unterstützte Geräte			
Energiespeicher		ab blueplanet hy-bat 3.6, ab DOMUS 3.6, BYD Battery-Box H6.4-10.2	
Messung		blueplanet hy-switch	
Energiewandlungspfade			
PV (DC) zu Netz (AC)	PV (DC) zu Batterie (DC)	Netz (AC) zu Batterie (DC)	Batterie (DC) zu Netz (AC)
Ja	Ja	Ja (wenn zulässig)	Ja



* Leistungsreduzierung 2 % je 100 m Höhe über 1000 m
 ** Bei zwei oder mehr miteinander gekoppelten Wechselrichtern muss eine separate Fehlerstrom-Schutzeinrichtung (RCD Typ B) installiert werden.

Additional technical data according to IEC 62109-2

Input levels	Max. input source feedback current	0
Output levels	Initial short-circuit alternating current (I _k " first single period effective value)	16.4 A
	Inrush current	1.7 A

4.3 Environmental data

Table 1: Environmental data

Installation height	<2,000 m
Ambient temperature	+5°C + 40°C
Protection rating (KACO installation location)	IP20
Humidity range (non-condensing) [%]	20 - 90

5 Transportation and Delivery

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

5.1 Scope of delivery

The following parts and components are supplied with the device:



Inverter



3 pairs of DC connectors
(SUNCLIX connectors)



1 x AC connector (Phoenix
Contact PRC 5-FC-FS6 12-1)



2 x countersunk screw M4x20mm
(already pre-assembled)



Wall bracket
(already pre-assembled)



Manual

Check the equipment included

1. Carefully inspect the device for transport damage; check the scope of supply.
2. Immediately notify the shipping company in case of the following:
 - Damage to the packaging that indicates that the device may have been damaged.
 - Obvious damage to the device.
3. Send a damage report to the shipping company immediately.
4. The damage report must be received by the shipping company in writing within six days following receipt of the device. We will be glad to help you if necessary.

5.2 Transporting the device



CAUTION

Risk of injury caused by excessive physical strain

Lifting the device, for transport, relocation and assembly, can result in injuries (e.g. back injuries).

- › The device must be transported and installed by at least 2 persons.

CAUTION

Hazard due to impact; risk of breakage to the device!

- › Pack the device securely for transport.
- › Transport the device using the intended carrying handles of the packaging box.
- › Do not expose the device to any shocks.

Packaging: Folding cardboard box
 Packaging size: 720 x 685 x 320 mm
 Total weight, including packaging: 40Kg

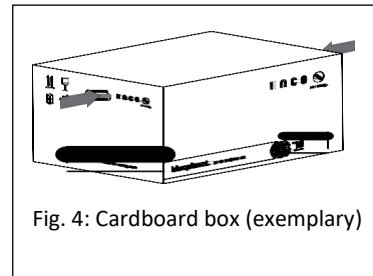


Fig. 4: Cardboard box (exemplary)

5.3 Installation tool

The codes given in the table below are used in all usage instructions for assembly/installation/maintenance and disassembly for the tools and tightening torques being used.

Tab. 2: Key and description of tool codes

Code (s)	Contour of the connector
XW	External hexagon
XA	Internal hexagon
XT	Torx
XS	Slot

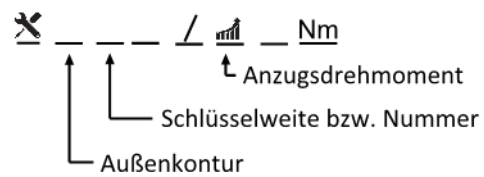


Fig. 5: Form pattern

6 Assembly and preparation



⚠ CAUTION

Risk of injury caused by excessive physical strain

Lifting the device, for transport, relocation and assembly, can result in injuries (e.g. back injuries).

- › The device must be transported and installed by at least 2 persons.

6.1 Required material

Solar cable

For the connection of the PV generator to the device. It can also be used to connect the battery; refer to the battery manufacturer's manual.

- Only designated solar cables are permitted, either type PV1-F or UL-certified solar cables (ZKLA), AWG 10-14.

Table 2: Technical requirements for solar cables

Technical data according to standard	EN 50521	UL 6703
Ambient temperature	-40°C...+85°C	-40°C...+70°C
Max. nominal voltage	1100 VDC	600 VDC
Max. nominal current	2.5 mm ² - 27 A; 4.0 mm ² - 40 A; 6.0 mm ² - 40 A	AWG 14 - 15 A; AWG 12 - 20 A; AWG 10 - 30 A
Cable diameter	5 ... 8 mm	5 ... 8 mm

NOTE



Observe the manufacturer's instructions of the manufacturer of the connector.

To use the provided SUNCLIX connectors, use only solar cables with a nominal cross section between 2.5 mm² and 6 mm².

- › Please observe the information on nominal voltage and nominal current.
- › Protect the connectors from moisture and dirt.

Connecting cable for the battery storage unit

If specific connection cables have been supplied by the battery manufacturer, these cables must be used. To be on the safe side, make sure that SUNCLIX connectors are installed on the side of the device.

Communication cable

Patch cable for communication with KACO blueplanet hy-switch, the battery and the Internet. An RJ45 connector must be fitted on the device side. The cable must comply with CAT 5E S/FTP. The length depends on the installation location, but should not exceed 20m. Cross-over assignments cannot be used.

Wall bracket fixing materials

- 4x fixings
- 4x fixing screw min. Ø6mm, minimum length 40mm
- 4x plain washer matching the screw, outer Ø max. 20mm

6.2 Choosing the installation location



DANGER

Risk of fatal injury due to fire or explosions!

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

- › Do not mount the inverter in potentially explosive atmospheres or in the vicinity of highly flammable materials.

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 device housing can be seriously damaged due to gases in combination with air humidity resulting from weather conditions (e.g. ammonia, sulphur).

- › If the device is exposed to gases, the installation must be carried out at observable locations.
- › Perform regular visual inspections.
- › Immediately remove any moisture from the housing.
- › Ensure adequate ventilation at the installation location.
- › Immediately remove dirt, especially on vents.
- › Failure to observe these warnings may lead to device damage which is not covered by the manufacturer warranty.



NOTE

Access by maintenance personnel for service

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

Requirements for the installation space

- As dry as possible, climate-controlled, the waste heat must be able to be dissipated away from the device.
- Unobstructed air circulation.
- Observe ambient temperatures according to the data sheet.
- Observe minimum distances to the sides of the housing; see Fig. 7.
- Accessible from the front and sides without requiring additional resources.
- At a height at which the display can be read at any time.
- Do not install outdoors; the device is designed for indoor use only (IP20).

Requirements on the installation surface

- Must have adequate load-bearing capacity
- Must be accessible for installation and maintenance
- Must be made of heat-resistant material (up to 90 °C)
- Must be flame resistant

6.3 Unpacking the device

CAUTION

Property damage as a result of condensation

Faulty storage can form condensate in the device and impair the device functioning (e.g. storage outside the ambient conditions or temporary relocation from a cold to a hot environment).

- › Prior to installation, check the inner area for condensation and if necessary, allow it to dry sufficiently before installation.

Unpacking the device

1. Loosen packaging tape from cardboard box.
2. Open the carton at the top. Be careful not to damage the device when using sharp objects.
3. Remove installation material and documentation.
4. Reach through the housing and slide the device out of the carton.
5. Remove the protective packaging from the housing.
6. Remove the wall bracket from the back of the device by loosening and removing the locking screws according to Fig. 6 [~~X~~TX20/m 1.5Nm].

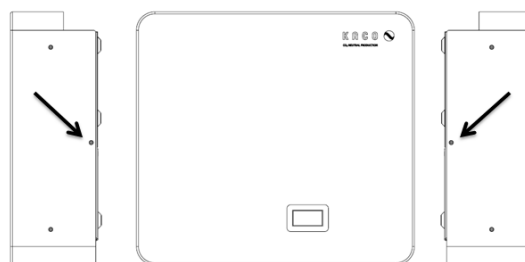


Fig. 6: Position of the locking screws

6.4 Securing the wall bracket

CAUTION



Hazard when using unsuitable fixing materials!

If unsuitable fixing materials are used, the device could fall and persons in front of the device may be seriously injured.

- › Use only fixing materials that are suitable for the mounting base.
- › Only install the devices upright and side by side.

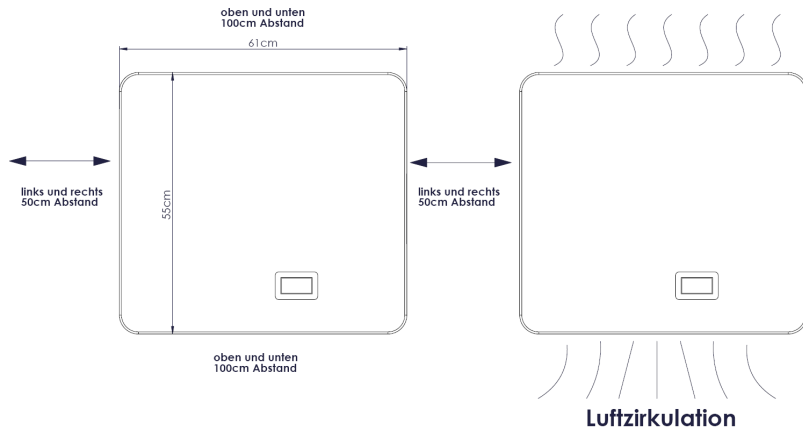


Fig. 7: Minimum distances around the device

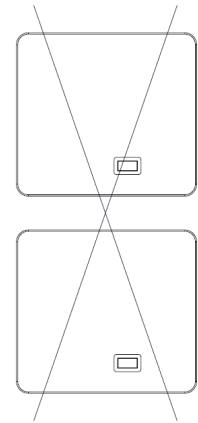


Fig. 8: Prohibited mounting position

NOTE



Side distance

The minimum side distance corresponds both to the distance to structural elements and to the total distance between two devices.

NOTE



Do not mount two devices one above the other!

The devices may only be mounted side by side. When mounted one above the other, the warm air escaping from the lower device can impair the function of the upper device.

The appropriate screw connection (fixings and screws) is selected and provided by the installer, taking the wall thickness and material into consideration. The wall bracket must be firmly screwed to the wall with the four suitable screws.

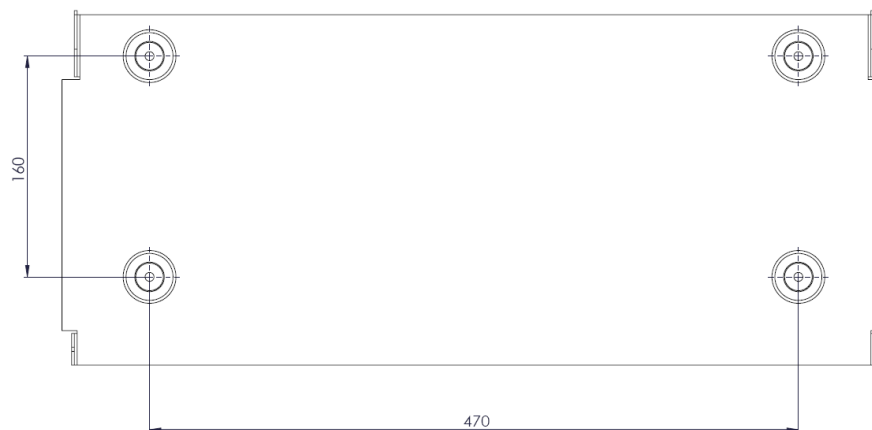


Fig. 9: Drill hole dimensions

Procedure for mounting the wall bracket

- ⌚ The wall bracket must be removed from the back of the device. (cable ties)
- 1. Remove the wall bracket from the device.
- 2. Determine the mounting position of the device. Check the observance of the minimum distances (Fig. 7).
- 3. Hold the wall bracket horizontally in position as a template.
- 4. Mark the position of the drill holes using the recess in the wall bracket, or mark them according to the dimensions in Fig. 9.
- 5. Determine the size of the drill holes according to the fixing material and drill holes.
- 6. Fix the wall bracket to the wall with suitable fixing material (see 6.1).
- 7. Check the wall bracket for a firm seat.

6.5 Installing and securing the device

CAUTION



Risk of injury from improper lifting and transport

If the device is lifted improperly, it can tilt and result in a fall.

- › Always lift the device vertically.
- › Use a climbing aid for the chosen installation height.
- › Wear protective gloves and safety shoes when lifting and lowering the device.

NOTE



Power reduction due to heat accumulation!

If the recommended minimum clearances are not observed, the device may reduce the power due to insufficient ventilation and the resulting heat build-up.

- › Observe minimum clearances and provide for sufficient heat dissipation.
- › All objects on the device housing must be removed during operation.
- › Ensure that no foreign bodies prevent heat dissipation following device installation.

Lifting and installing the device

- ⌚ The mount has been installed.
- 1. The device is tilted slightly to the rear. Both hooks of the wall bracket must engage into the bolts of the outer cooling fins. When inserting, make sure that the hooks are not bent. When the bolts are hooked into the wall bracket, the device is carefully tilted down until it is parallel to the wall.

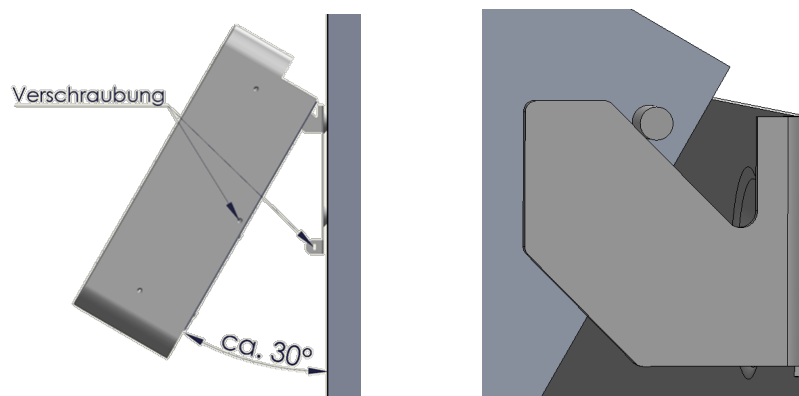


Fig. 10: Installation

⚠ CAUTION

Avoid damage due to hard striking!

Hard hitting or an uneven surface can damage the device, especially the heat sink.

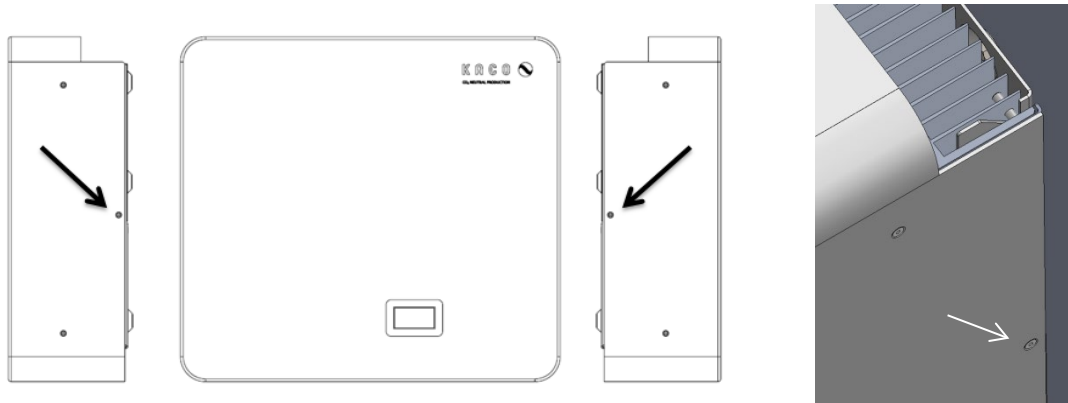



Fig. 11: Position of the safety screws (on left and right side)

2. After attaching the device to the wall bracket, screw in the countersunk screw [X_T_TX20/ 1.5 Nm] on both sides to fix it. Make sure that the bottom of the housing cannot be moved forward.

» The device is successfully installed.

⚠ CAUTION



Safety catch

The safety screws are used to prevent the device from being accidentally unhooked.

- › This screw connection may only be removed for disassembly!

7 Installation

7.1 General information

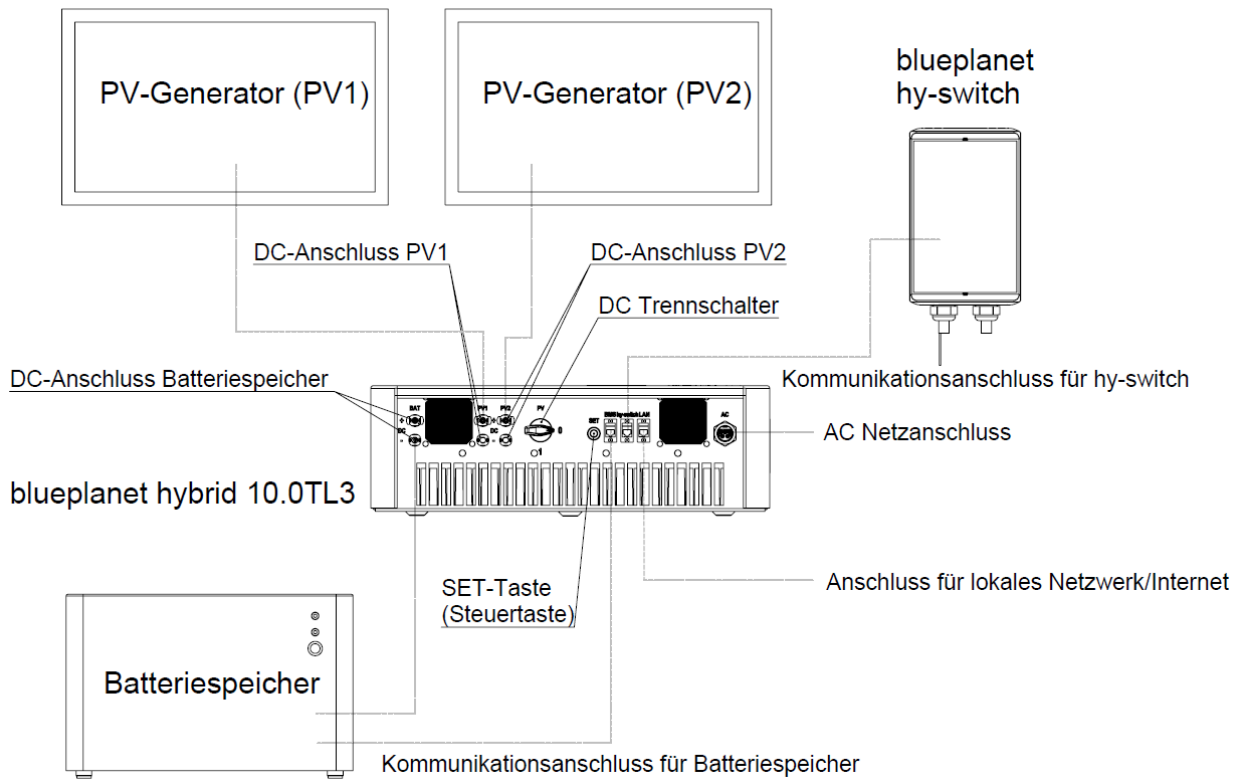


Fig. 12: Overview of connections

DANGER

Lethal voltages are still present in the connections and cables even after the device has been switched off and disconnected!

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



- › **Do not open the device!** All connections are externally accessible.
- › The device must be mounted in a fixed position before being connected electrically.
- › Comply with all safety regulations and current technical connection specifications of the responsible power supply company.
- › The device is only permitted to be installed by an authorised electrician.
- › Switch off the grid voltage by turning off the external circuit breakers.
- › Terminate DC circuits.
- › Simply switching off the inverter does not protect against electric shock.
- › Check that all AC and DC cables are completely free of current using a clip-on ammeter.

 **WARNING**



Arc event

An arc event can cause serious injury if plug connections, especially the DC connectors, are disconnected under load.

Never disconnect a connector from a live cable during operation!

 **WARNING**



To prevent the risk of fire

Never cover the device completely or partially when it is in operation.




NOTE



Opening of the device

No opening is required for installation, maintenance or deinstallation.
Opening the housing cover will invalidate your warranty.

Required tools:

- Screwdriver  [S_3.5]
- Open-end spanner  [W_30]
- Open-end spanner  [W_15]

7.2 Information regarding electrical connections

 **Authorised elec-**

WARNING

Risk of fire or electric shock



To avoid the risk of fire or electric shock, make sure that the cabling is in good condition and not under-sized.

- › Never install defective or inferior cables.
- › Cable connections may only be connected or disconnected to a switched-off device. Please note the following: 10.1.

NOTE



Select conductor cross-section, safety type and safety value in accordance with the following basic conditions:

Country-specific installation standards; power rating of the device; cable length; type of cable installation; local temperature

7.3 Connecting the device to the power grid

 **Authorised elec-**

WARNING



Possible risk of fatal electric shock

This device may cause a current with a DC component. If additional residual current devices (RCD) and residual current monitors (RCM) are used to protect against direct or indirect contact, only RCD or RCM type B are permitted on the supply side of this product.

NOTE



AC-side disconnection unit

An AC-side disconnection unit must be provided during the final installation stage.

- › This disconnecter mechanism must be installed so that it can be accessed at any time without obstruction.
- › The grid connection leads (AC) must be protected with a four-pole circuit breaker type B 20A.

NOTE



When the line resistance is high, i.e. long cables on the grid side, the voltage at the grid terminals of the device will increase in feed-in mode. If the voltage exceeds the country-specific grid overvoltage limit value, the device switches off.

- › Ensure that the cable cross-sections are sufficiently large or that the cable lengths are sufficiently short.
- › Ensure proper strain relief of the connecting cables.

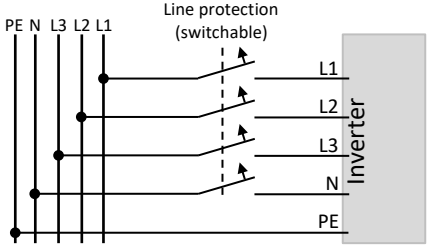
NOTE



Make sure that the device is compatible with the installation environment:

- Is the type of grid suitable for the installation?
- Is the grounding implemented correctly?
- Are grid voltage and grid frequency within specification?

Tab. 2 Connecting the device to the power grid

Model	blueplanet hybrid 10.0 TL3	
Nominal grid voltage	230/240 VAC	
Line cross-section (mm ²)	≥2.5	
AWG	14	
Recommended cable:	H05RR-F 5G2,5	

7.3.1 Permissible connectors



Only the Phoenix Contact AC connector PRC 5-FC-FS6 12-1 may be used.

CAUTION



Bending radii of the cables

Observe the permissible bending radii during installation, as the protection rating is endangered by excessive bending forces (Fig. 19: Connecting the connector Fig. 20 Minimum bending radius). Intercept mechanical loads upstream of the connector (e.g. with cable ties).

CAUTION

Only use the original PRC 5-FC-FS6 connector from Phoenix Contact to connect to the PRC 5-FT25-MC device connector.

NOTE



Use a 5-pin cable with the diameter stated/suitable in the table and with wires with a cross-section of 2.5 ...6 mm². The cable diameter must lie between 12 and 16 mm.

- › Ensure that the cable cross-sections are sufficiently large or that the cable lengths are sufficiently short.
- › Ensure proper strain relief of the connecting cables.

7.3.2 AC cable fitting assembly



Description of the individual parts of the AC connector (Fig. 13: AC connector)

1. Cable fitting
2. Seal
3. Housing
4. Contact carrier

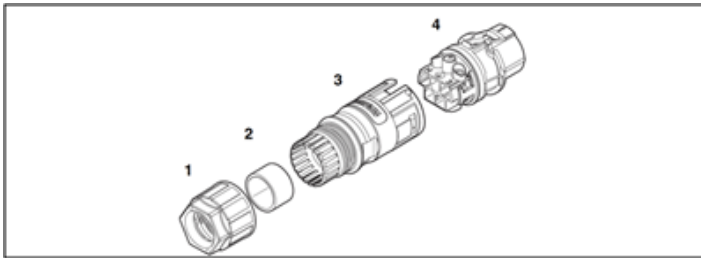


Fig. 13: AC connector

Preparation for mounting the connector according to Fig. 14

1. Slide the cable fitting over the cable.
2. **Only for 1410656:** Choose a seal that fits your cable diameter.
3. Slide the housing with the seal over the cable.
4. Strip the cable by 50 mm.
5. Then shorten wires N and L1, L2, L3 by 8 mm.
6. Strip the wires by 12 mm.
7. With flexible wires, we recommend the use of wire sleeves conforming to DIN 46228 that are pressed together using crimping pliers CRIMPFOX 6 (1212034).

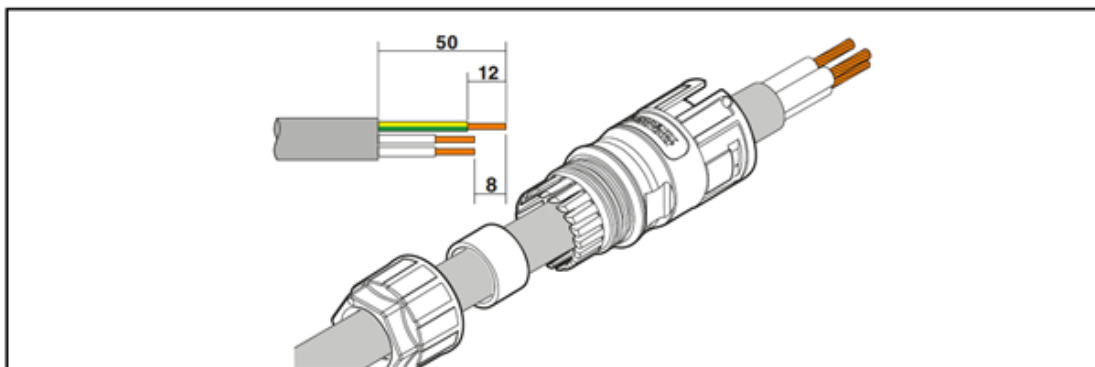


Fig. 14: Cable stripping dimensions

Connecting wires

- Connect the wires to the contact carrier (Fig. 15).
- The assignment depends on the marking on the contact carrier.
- Connect the screws on the contact carrier with 1 Nm (: Placing the wires Fig. 16).
- Push the contact carrier into the housing until it audibly engages (Fig. 17).
- Tighten the cable fitting with an open-ended spanner [$\times W_{30}/m$ 6.5 Nm] (: Interconnection Fig. 18).

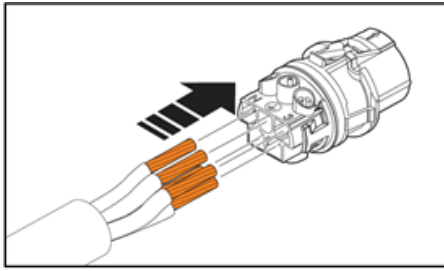


Fig. 15: Placing the wires

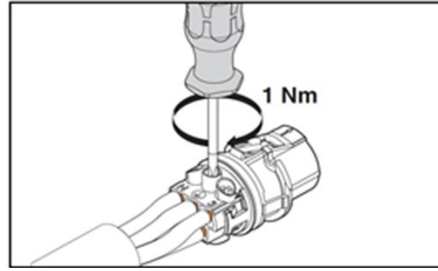


Fig. 16: Tightening the wires

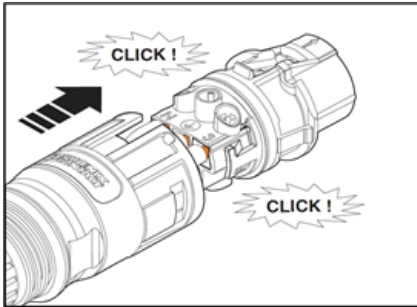


Fig. 17: Interconnection

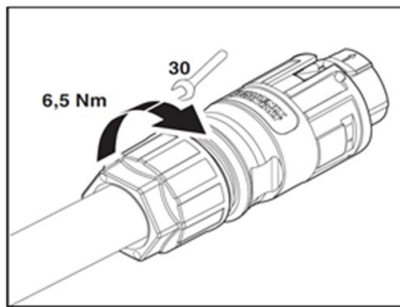


Fig. 18: Tightening the cable fitting

7.3.3 Connecting the connector

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Latch the assembled connector with the device connector (Fig. 19: Connecting the connector Fig. 20 Minimum bending radius). Observe the required minimum bending radii when laying the cable (Fig. 19: Connecting the connector Fig. 20 Minimum bending radius).

 **CAUTION**

Plug in or disconnect connectors

Never connect or disconnect the connectors under load. The connectors are not suitable for disconnecting the power.

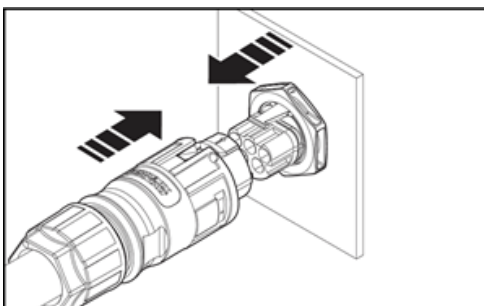


Fig. 19: Connecting the connector

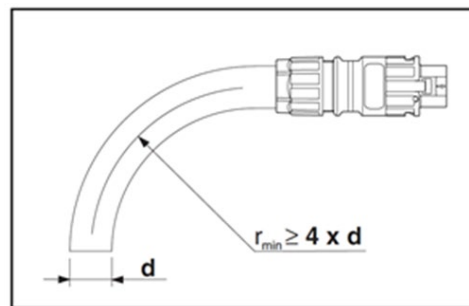


Fig. 20 Minimum bending radius

7.3.4 Technical data

Protection rating	IP65/IP68 (2m, 24h)
Nominal current	35 A (observe the derating and the cable cross-section)
Nominal voltage	690 V

Operating temperature	-40°C ... 100°C
Material	PPE

The following figure shows the dependence of the nominal current [A] on the ambient temperature [°C] depending on the cable cross-section:

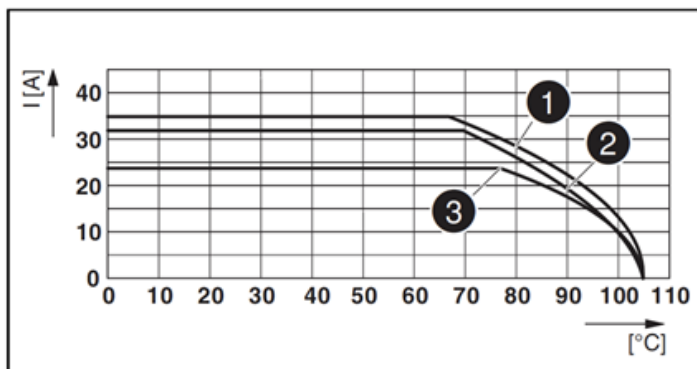


Fig. 21: Maximum currents and derating according to cable cross-sections used.

7.4 Connect PV generator to device

7.4.1 Designing the PV generator



The maximum generator power (under STC conditions) per input (MPP tracker) must not exceed 6 kW.

CAUTION

Damage to components due to faulty configuration

In the expected temperature range of the PV generator, the values for the no-load-voltage and the short circuit current must never exceed the values for U_{dcmax} and I_{scmax} in accordance with the technical data.

- › Observe limit values in accordance with the technical data.

CAUTION

Grounding the PV system

To ensure proper installation of the PV generator, the PV module frames and mounting frames in particular must be grounded.

- › The PV modules themselves (positive or negative pole) must not be earthed!

NOTE

Type and configuration of the PV modules

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

It is a transformerless inverter. It can be operated with mono- or polycrystalline PV modules. If you wish to operate thin-film modules together with the hybrid inverter, please contact the module manufacturer beforehand to ensure the compatibility of the entire system.

Recommended standard connection

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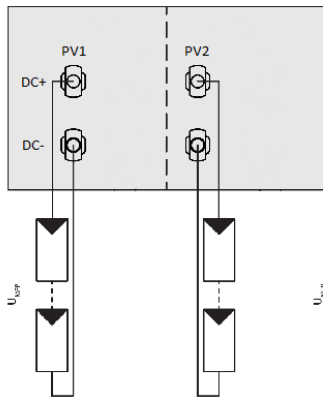


Fig. 22: Recommended standard wiring and assignment of both MPP trackers.

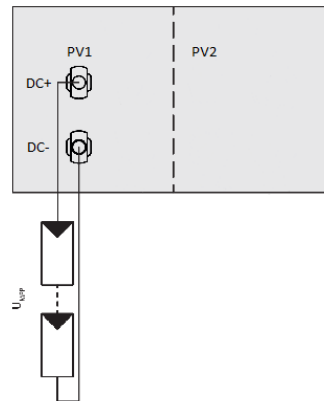


Fig. 23: Assignment of only one MPP tracker.

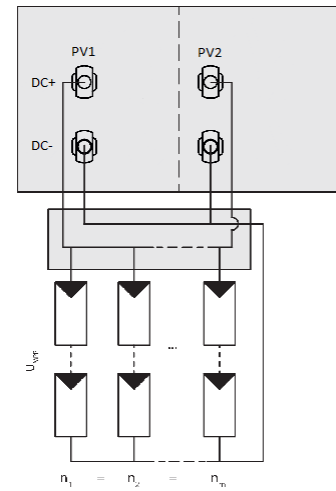


Fig. 24: Parallel input circuit for one or more module strings.

Possible wiring variants

1 PV generator each on one MPP tracker

The MPP voltages of the two DC strings can be different. They are supplied by separate, independently operating MPP trackers (MPP trackers A and B).

The number of modules per MPP tracker is arbitrary as long as the power, current and voltage limits are observed.

The maximum power per input according to the technical data must be observed (see 4.2).

I_{max} : Amperage per tracker < max. input current per MPP tracker (see 4.2).

1 PV generator for one tracker. The second tracker is deactivated

The MPP voltage must be within the specifications. A voltage is induced at the unassigned PV input, which is displayed on the inverter during the start process. This behaviour can be avoided by short circuiting the unassigned PV input.

The number of modules per MPP tracker is arbitrary as long as the power, current and voltage limits are observed.

The maximum power per input according to the technical data must be observed (see 4.2).

I_{max} : Amperage per tracker < max. input current per MPP tracker (see 4.2).

1 PV generator parallel on both MPP trackers

The DC inputs can also be connected in parallel. The maximum permissible nominal current (DC) is doubled. In this way, it is possible to connect several strings in parallel. They must have the same voltage. ($U_{n1}=U_{n2}=U_{nm}$).

The number of modules per string must be identical: $n_1=n_2=n_m$
The power, current and voltage limits must be observed.

The double maximum power per input according to the technical data must be observed (see 4.2).

I_{max} : Amperage < the double max. input current per MPP tracker (see 4.2).

EN

7.4.2 Configuring the DC connector

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The number of DC connectors to be configured depends on the number of strings used. At least two DC connectors must be configured. Please proceed as follows for each DC connector:

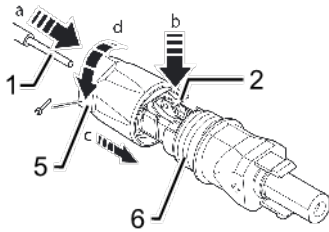


Fig. 25: Insert wires

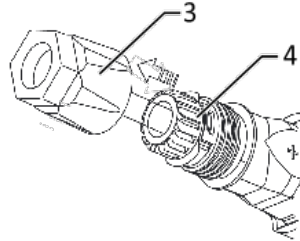


Fig. 26: Slide insert into sleeve

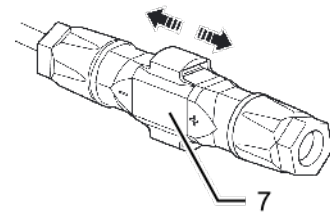


Fig. 27: Check fastening

Legend

1	Wire for DC connection	5	Cable fitting
2	Spring	6	Contact plug
3	Insert	7	Coupling
4	Sleeve		

⚠️ DANGER

Lethal voltages are present in the DC cables!

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



- › The installation may only be carried out by a recognised electrician.
- › DC voltages of up to 900 V are possible.
- › Check that there is no current in any of the DC cables using a clip-on ammeter.
- › Photovoltaic modules supply a DC voltage as soon as they are exposed to light!

- ⊖ Stripped and voltage-free solar cables
Whilst stripping wires, ensure that you do not cut any individual wires.
- 1. Insert isolated wires with twisted ends carefully up to the end stop.

Wire ends must be visible in the spring.

2. Close the spring so that the spring latches.
3. Slide insert into sleeve.
4. Secure and tighten the cable fitting [$\times W_{15}/m$ 1.8 Nm].
5. Join insert with contact plug.
6. Check latch by lightly pulling on the coupling.

» DC connector configured.

NOTE



The permissible bending radius of at least 4x the cable diameter should be observed during installation. Excessive bending forces endanger the protection rating.

- › All mechanical loads must be absorbed in front of the plug connection.
- › Rigid adaptations are not permitted on DC plug connectors.

7.4.3 Checking the PV generator for a ground fault

 **Authorised elec-**

 **DANGER**



Risk of fatal injury due to electric shock!

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

- › Only touch the PV generator cables on the insulation. Do not touch the exposed ends of the cables.
- › Avoid short circuits.
- › Do not connect any strings with a ground fault to the device.

7.4.4 Connecting the PV generator

 **Authorised elec-**

 **DANGER**



Risk of fatal injury due to electric shock!

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

- › Only touch the PV generator cables on the insulation. Do not touch the exposed ends of the cables.
- › Avoid short circuits.
- › Do not connect any strings with a ground fault to the device.

 **CAUTION**

Damage to the PV generator in case of faulty configuration of the DC connector.

A faulty configuration of the DC connector (polarity +/-) causes equipment damage in the DC connection if it is connected permanently.

- › Please check polarity (+/-) of the DC connector before connecting the DC generator.
- › Before using the solar modules, check the vendor’s calculated voltage values against those actually measured. The DC voltage of the PV system must not exceed the maximum no-load voltage at any time.

 **CAUTION**

An incorrect connection of the PV generator can damage the device.

Do not confuse the inputs for the PV generator with the battery input. Incorrect connection can damage the PV input or even the battery input.

- › The battery input can be damaged by the high PV voltage.
- › The PV input can be damaged by the high battery current.

Connecting the PV generator

- ↻ DC plug connector configured and PV generator checked to ensure there is no ground fault.
 - ↻ Device is switched off
 - 1. Connect the DC plug connectors to the DC positive and DC negative connectors in pairs. The connections are marked with PV1 and PV2.
- » The PV generator is connected to the device.

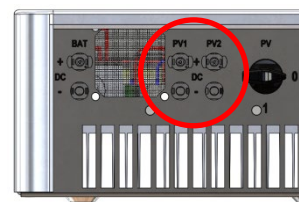


Fig. 28: Connections PV1 and PV2

7.5 Connecting the battery storage unit to the device

7.5.1 Checking the battery storage unit

 **Authorised elec-**

DANGER

Risk of fatal injury due to electric shock, fire or explosions!

Serious injury or death due to the use of unsuitable, not intrinsically safe or defective battery storage units!



- › Check the certification and release of the battery storage unit.
- › Check the battery storage unit for obvious damage.
- › Observe the manual of the battery manufacturer.

CAUTION

Damage to the battery storage unit or the device due to the use of incorrect batteries

Only released battery storage units may be connected. Please refer to our release list under 3.4.2 and the manual of the battery manufacturer.

NOTE



Check the grounding of the battery storage unit!

Check that the battery storage unit is properly grounded according to the manufacturer's instructions. It must be connected to the same ground potential as the device itself.

7.5.2 Configuring the DC connector

 **Authorised elec-**

DANGER

Risk of fatal injury due to electric shock!

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

A high DC voltage can be applied to the battery storage unit at the open ends of the DC lines.



- › Only touch the battery storage unit cables on the insulation. Do not touch the exposed ends of the cables.
- › Avoid short circuits. This can lead to destruction of the battery.

CAUTION

Damage to the battery storage unit in case of faulty configuration of the DC connector.

A faulty configuration of the DC connector (polarity +/-) causes equipment damage in the DC connection if it is connected permanently.

- › Please check polarity (+/-) of the DC connector before connecting the battery storage unit.

The connectors of the battery storage unit are configured according to the instructions for the PV generator; see 7.4.2.

7.5.3 Connecting the battery storage unit



 **Authorised elec-**

CAUTION

An incorrect connection of the battery can damage the device.

Do not confuse the battery input with the inputs of the PV generator. Incorrect connection can damage the PV input or even the battery input.

- › The battery input can be damaged by the high PV voltage.
- › The PV input can be damaged by the high battery current.

-  The connectors of the battery storage unit are configured.
-  Device is switched off

Connecting the battery storage unit

DC plug connector

1. Connect the DC connectors to the DC positive and DC negative connectors in pairs. The connection is marked as BAT.
- » The device is connected to the battery storage unit on the DC side.

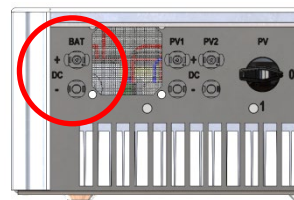


Fig. 29: BAT connection (DC)

Communication cable

1. The communication cable of the battery is connected to the device. The communication cable must have an RJ45 connector. It must be connected to the BMS connection of the three communication ports on the bottom of the device.
- » The device is communicatively connected to the battery storage unit.

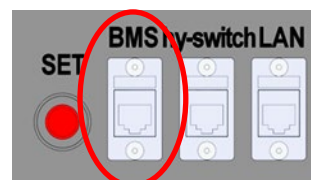


Fig. 30: BMS communication connection

7.6 Connecting KACO blueplanet hy-switch to the device



KACO blueplanet hy-switch is required for the adjustment and disconnection of the grid connection or the installation string to be compensated. This component is not required for installations without access to the public power grid.

⚠ DANGER

Improper installation of KACO blueplanet hy-switch allows components and cables to come into contact with life-threatening voltages



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

- › Observe the KACO blueplanet hy-switch manual.
- › The device must be mounted in a fixed position before being connected electrically.
- › The device is only permitted to be installed by an authorised electrician.
- › Switch off the grid voltage by turning off the external circuit breakers.
- › Check that all AC and DC cables are completely free of current using a clip-on ammeter.

↻ KACO blueplanet hy-switch must be installed according to the enclosed manual.

Connecting KACO blueplanet hy-switch

1. Connect the communication cable of KACO blueplanet hy-switch to the device. The communication cable must have an RJ45 connector on both sides. It must be connected to the hy-switch connection of the three communication ports on the bottom of the device.
- » The device is connected to Kaco blueplanet hy-switch.

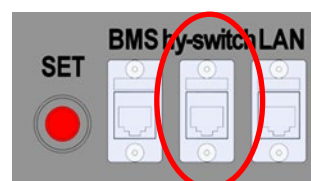


Fig. 31: Connecting the KACO blueplanet hy-switch communication

NOTE



Observe the requirements for the communication cable

The communication cable must comply with the requirements described in 6.1, Especially in the case of longer cable lengths, high-quality communication cables and connectors must be used to ensure that the signal quality is adequate.

- › KACO blueplanet hy-switch is also powered by the device via the communication cable.

8 Commissioning

8.1 Hardware commissioning



WARNING

Risk of electric shock



Before connecting or checking the DC cable (PV), make sure that the DC switch is in the OFF position.

- › Before connecting or checking the AC cable, make sure that the corresponding circuit breaker is switched off!

1. Check the following points before commissioning:

1. The device must be safely and firmly mounted.
2. Make sure the no-load voltage of the PV system meets the requirements.
3. Make sure the no-load voltage of the public grid corresponds to the nominal value.
4. Make sure the AC cable is correctly connected to the grid.
5. Check the cabling of the PV modules.

» If the points are in order, the device can be started.

2. Starting the device

1. Switch on the public grid at the external, AC-side disconnecter mechanism.
2. Make sure the battery storage unit is ready for operation and switch it on.
3. Switch on the PV system with the DC isolator switch:
Turn the DC isolator switch to the "I" position.

» Now that the device is ready for operation, it will start operating as soon as sufficient voltage is applied to the PV input.

240 VDC is required for the start. After DC switch is turned on, the display does not come on until 60 seconds has elapsed! If the device does not respond after 60 s when voltage is applied, the DC disconnecter must be turned to the "0" position and the polarity of the PV connections must be checked.

If warnings/errors are displayed on the LCD display, a problem or error is present. Please consult chapter 9.3 of this manual for troubleshooting or contact your installer.

8.2 Configuration with the KACO blueplanet hy-switch software



EN

NOTE



Configuration of the device

The device is configured using the blueplanet hy-sys software. This software is available in the download area of www.kaco-newenergy.de.

- ↻ Download the latest version of the blueplanet hy-sys software.
 1. **Observe the separate functional description of the blueplanet hy-switch software.**
 2. Update the firmware of the device and its components. Please observe the software update sequence: 1. COM, 2. CONTROLLER, after that, other components.
 3. Update the country settings of the device using country-specific setup files.
 4. Set and check the software settings when commissioning the device.
 5. Save all changes made in the *User Settings* tab.

8.3 Display

The display shows the device status. Current measurements and fault messages are displayed on this display. The various basic settings can be made on this display.

8.3.1 Start display

After activation, the name of the device series is briefly displayed.

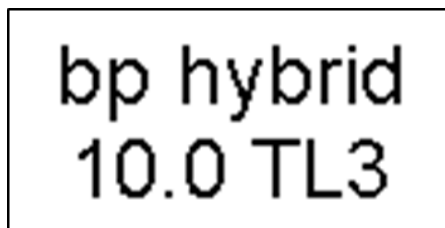


Fig. 32: Display of the device series

The figure shows the standby display in which you can see that the basic requirements for starting the system have been met. The PV system must have sufficient voltage for the start and the grid must be connected.

The display is divided into two areas.

The current status, extended measurements, error messages and selection menu are displayed in the left field.

The right field displays basic measurements, the battery status and battery error messages.

The figure shows

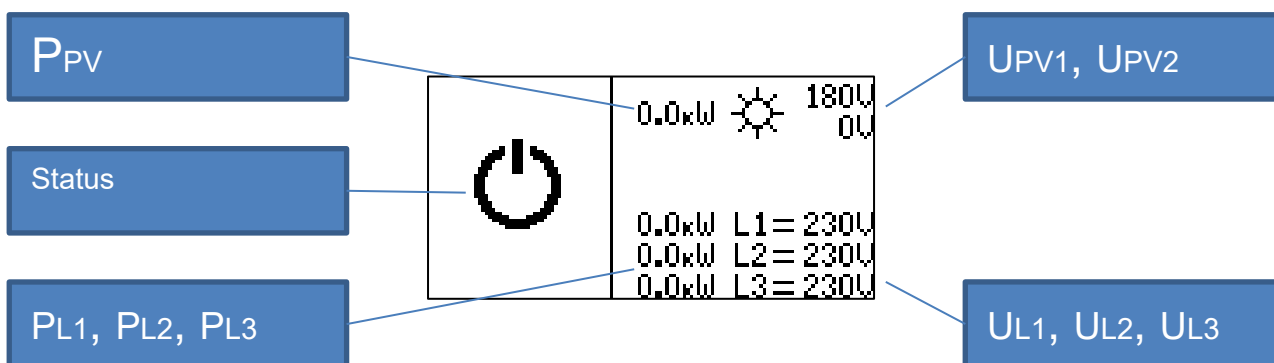


Fig. 33: Standby

- UPV_1, UPV_2 – Input voltage at PV connections
- PPV - Total power PV inputs, the sum of power outputs PPV_1 and PPV_2
- UL_1, UL_2, UL_3 - Grid voltage at device connection terminals
- PL_1, PL_2, PL_3 - Device output power per phase

An active Ethernet connection is indicated by the "e" symbol.

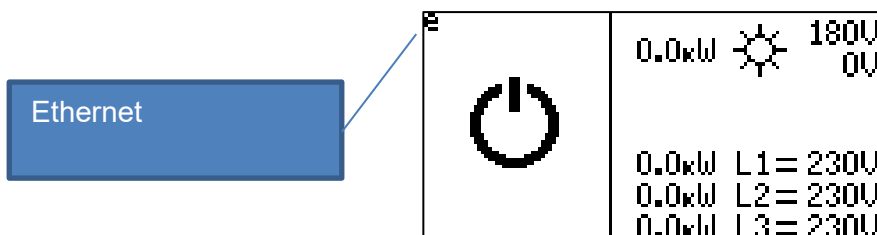


Fig. 34: Ethernet symbol "e"

As soon as the voltage of the solar generator exceeds the switch-on limit, the device goes into test mode. In the process, the system and the grid are checked.

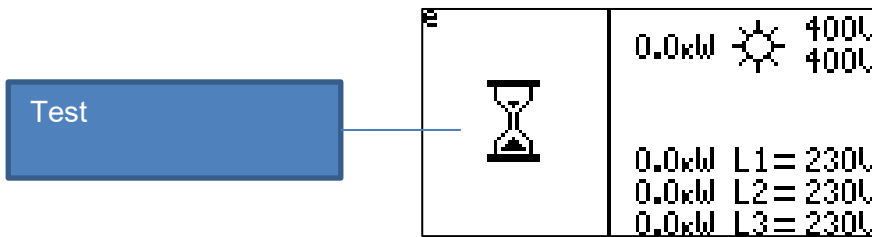


Fig. 35: Test mode display

8.3.2 Operating display

If the test is completed successfully, the device switches to grid operation. Grid operation is illustrated by the "house" symbol. The direction of energy transfer "PL direction" per phase can be recognised by the following symbols:

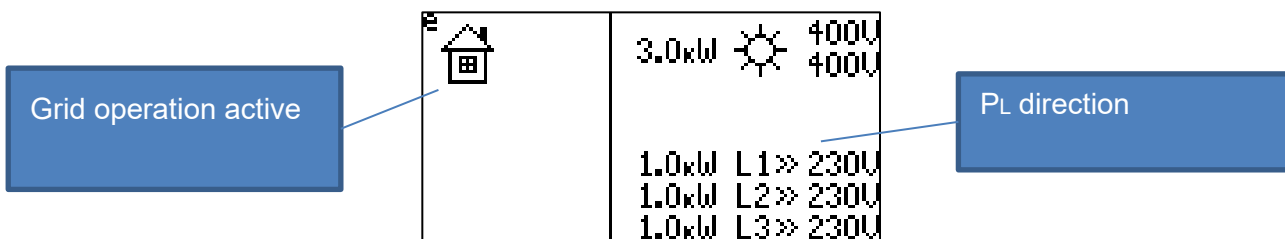


Fig. 36: Grid operation

- ">>" – Supply to grid
- "=" – No energy transfer
- "<<" – Energy is taken from the grid
- The power delivered to the grid is equal to the current power on the solar generator:
- $P_{L1} + P_{L2} + P_{L3} = P_{PV}$.

After blueplanet hy-switch has been connected and activated, the display shows the total household consumption P_{House} , the grid power P_{Grid} and the direction of energy transfer.

The device feeds into the grid.

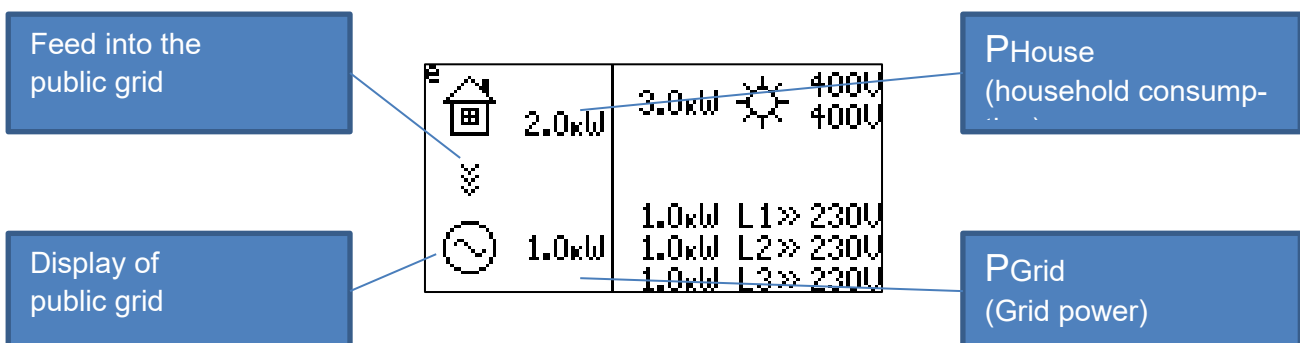


Fig. 37: Grid operation with hy-switch

- ">>>" – Energy surplus, energy is fed into the public grid
- "<<<" – Energy shortage, energy is taken from the public grid
- "=" – No energy exchange takes place, self-consumption is fully compensated.

- The values P_{House} and P_{Grid} depend on the current household consumption and the power currently provided by the device: $P_{House} + P_{Grid} = P_{L1} + P_{L2} + P_{L3} = P_{PV}$.

EN

The figure shows a compensated household consumption.

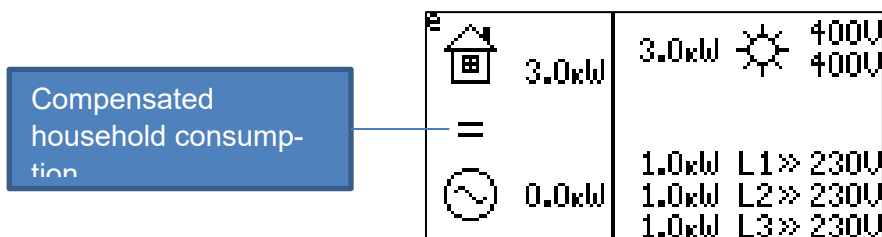


Fig. 38: Compensated household consumption

Household consumption is supplemented by public grid consumption.

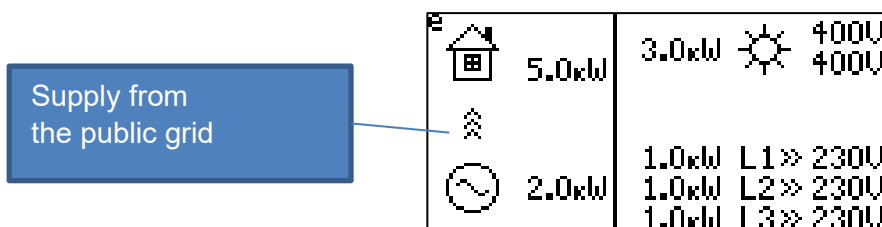


Fig. 39: Supply from the public grid

When operating on battery power, a battery symbol with information appears on the display: SOC = state of charge, battery voltage and operation mode (charge, wait, discharge).

The battery is discharged to cover the increased household consumption.

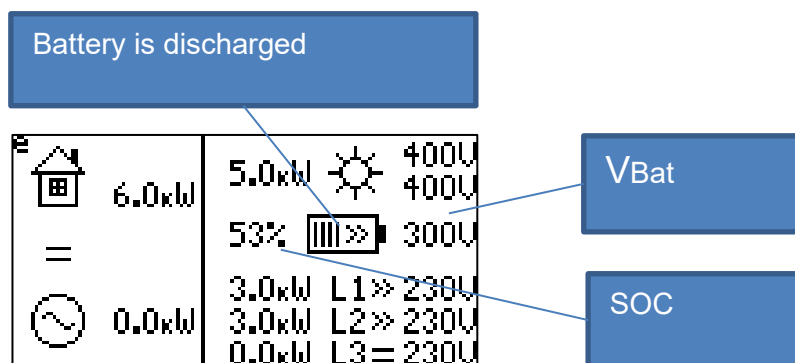


Fig. 40: Household consumption with battery discharge

- ">>" - The battery is discharged
- "<<" - The battery is charged
- The values P_{House} and P_{Grid} depend on the current household consumption and the power currently provided by the device: $P_{House} + P_{Grid} = P_{L1} + P_{L2} + P_{L3} = P_{PV} + P_{Bat}$. The P_{Bat} battery power is not directly shown on the display.

The battery has a SOC of 100% and is in standby mode. The excess current is supplied to the grid.

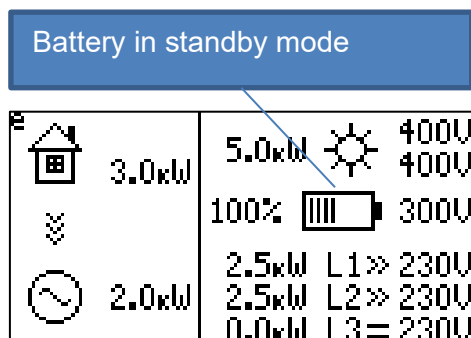


Fig. 41: Battery in standby mode

8.3.3 Selection menu

Use the selection menu to display device information. The hy-switch and battery mode can be activated in this way

The selection menu is displayed by briefly pressing the red "Set" button. The active element is marked with a frame (position marker). In the selection menu, you can jump to the next selection by briefly pressing the "Set" button. To select and activate a menu, press and hold the "Set" button for about 2 seconds. The selection menu is exited with the back symbol (Exit).

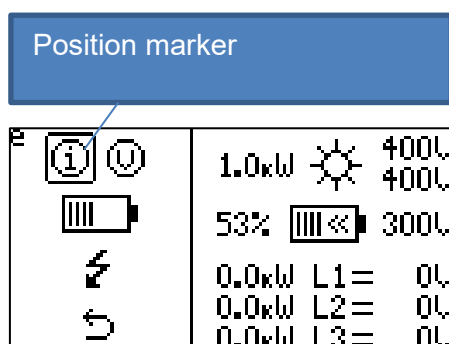


Fig. 42: Selection

Selection for device information

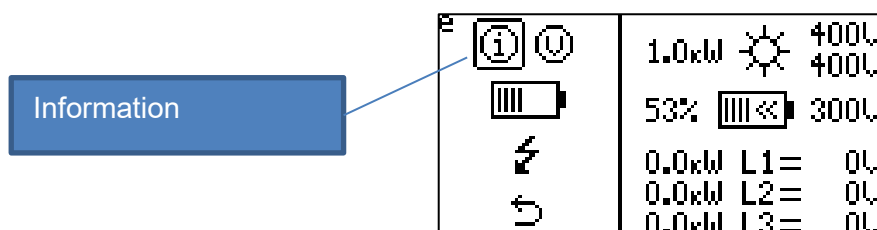


Fig. 43: Information

The information field shows: Versions of the individual software units (control, communication, blueplanet hy-switch), current date and time, the current temperature in the device, the currently assigned IP address, the serial number of the device and its MAC address The information field closes when the "Set" button is pressed briefly.

The display shows the device-internal information.

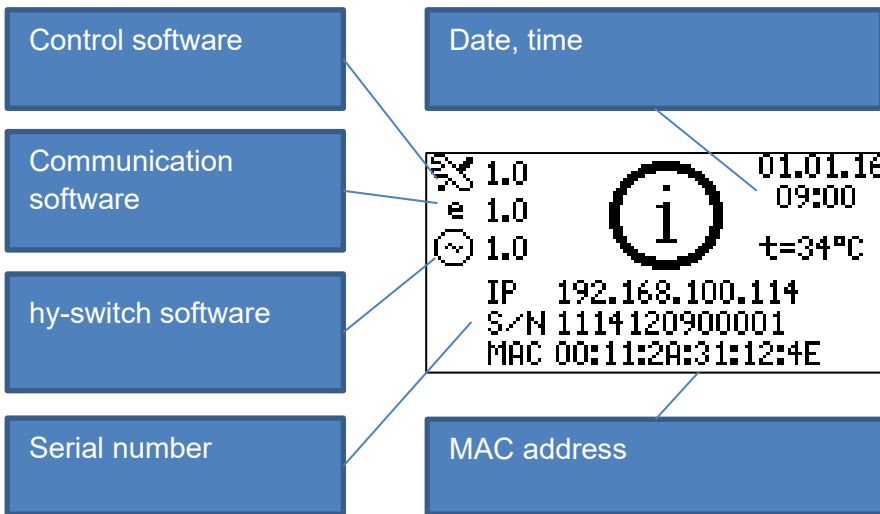


Fig. 44: Information field

Exit returns you to the higher-level menu.

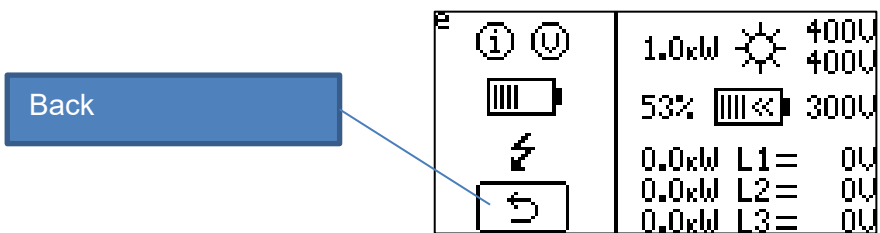


Fig. 45: Exit

8.3.3.1 hy-switch

The hy-switch determines the power consumption of the house. Before use, hy-switch must be configured.

Selection of hy-switch.

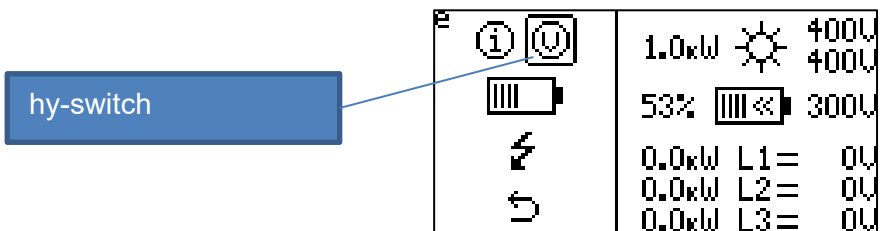


Fig. 46: hy-switch symbol

To configure hy-switch, the current sensors to be used must be activated, which also activates hy-switch.

Selection of current sensors for hy-switch.

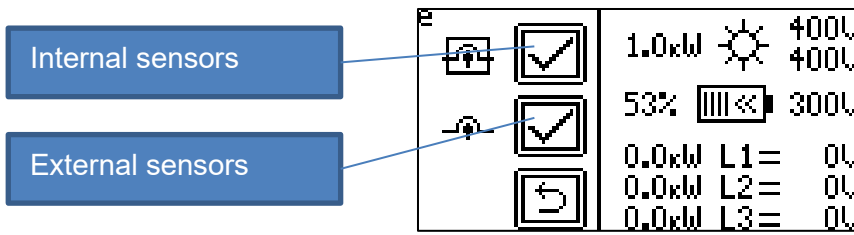


Fig. 47: Selecting the current sensors

8.3.3.2 Battery

Use the selection to activate the battery.

Selection for connecting the battery.

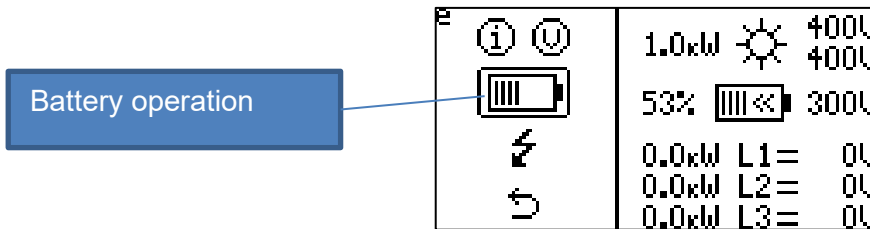


Fig. 48: Battery symbol

The battery can be switched on or off. When the battery is connected, a one-time search process is performed in which the battery type is automatically detected. The search procedure can take a few minutes.

Connecting the battery.

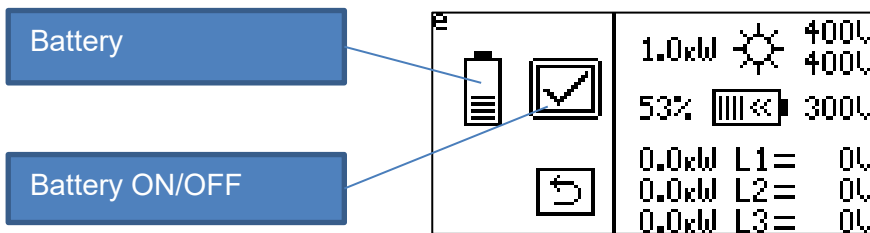


Fig. 49: Battery selection

8.3.3.3 Password

All changes must be confirmed and enabled with the password.

Password assignment can be used to protect against access by unauthorised persons.

The password is activated in hy-sys. The activation is described in the hy-sys manual.

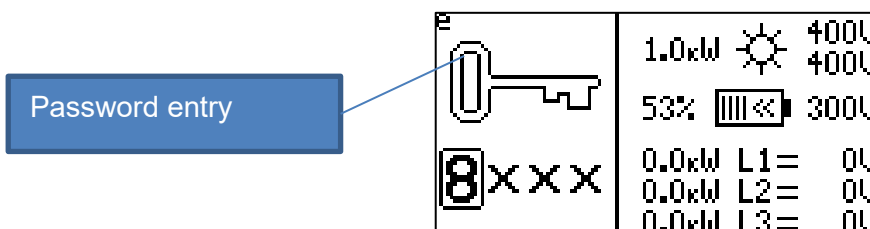


Fig. 50: Password

8.3.4 Deactivation in grid-parallel operation

The system is shut down by pressing and holding the "Set" button (longer than 5 seconds).

The batteries are disconnected from the system.

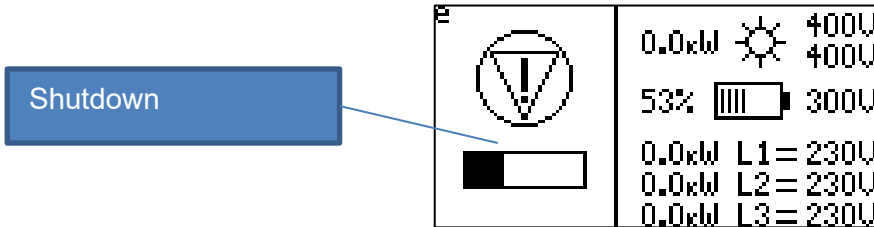


Fig. 51: Progress bar during shutdown

After the device has been shut down, the PV switch must be set to the "0" position, in order to shut down the device completely.

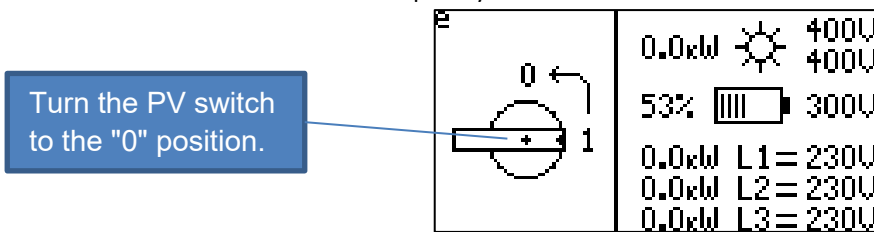


Fig. 52: Turning off the PV switch

8.3.5 Warning/fault

If the device is in a warning or error state, a warning (A) or fault (E) message is displayed. Up to three messages can be displayed simultaneously.

Display of warning messages / fault messages on the display

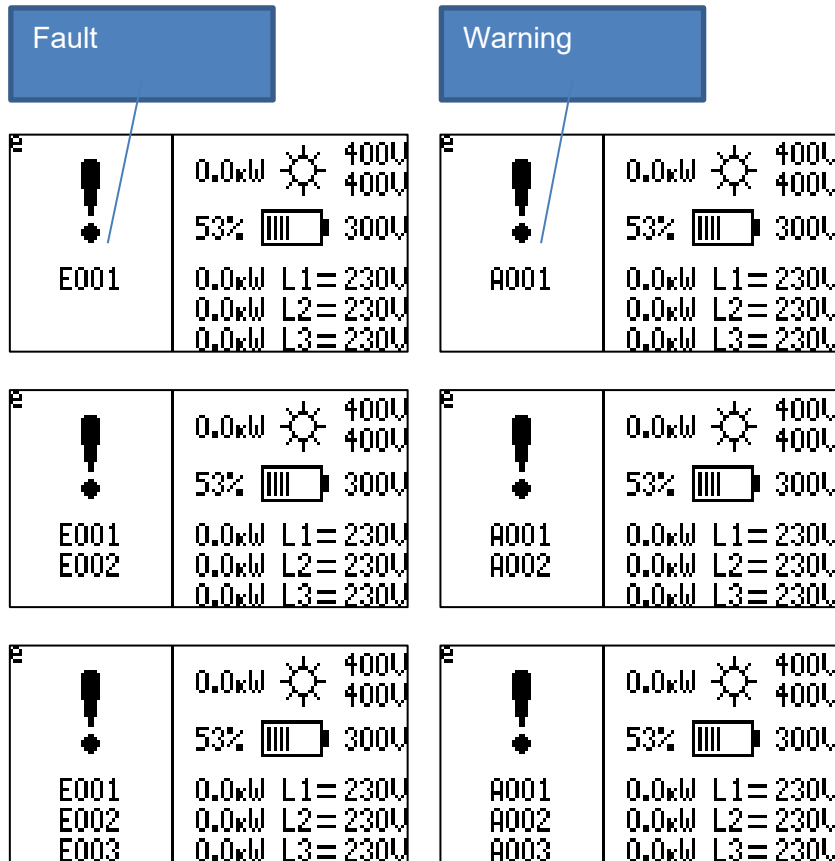


Fig. 53: Faults and warnings on the display

The warning messages / fault messages are listed in chapter 9.3.

If the battery is in a warning or fault condition, a cross is displayed on the battery.

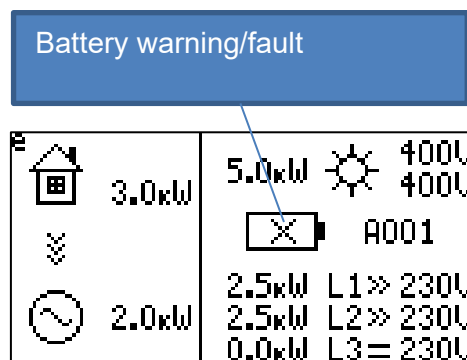


Fig. 54: Battery warning/fault

8.3.6 Warning display

The measurements that lie outside the operating limits are displayed flashing.

An example: If the voltage on the solar generator has not yet reached the switch-on limit, the PV voltage is displayed flashing.

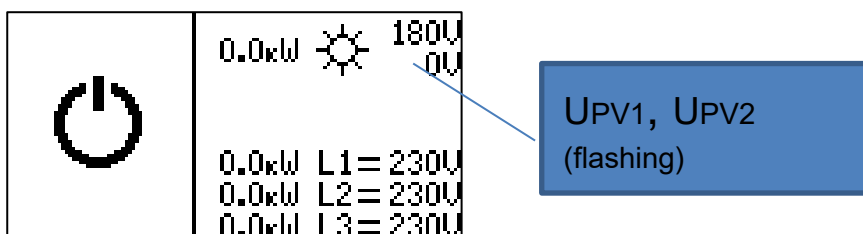


Fig. 55: Flashing display

8.4 Update

During the update, sufficient sunlight must be ensured. The device is restarted after the update, requiring sufficient PV power for this purpose.

CAUTION

No PV power

If no PV power is available, deactivating the battery can cause the device to shut down completely.

- › Reactivation is only possible when the PV modules once again provide enough power to turn on the system.

When updating the COM

COM update

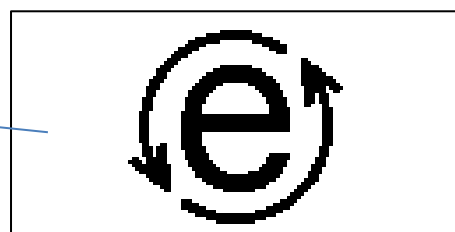


Fig. 56: Symbol when updating the COM

When updating the control

Control update

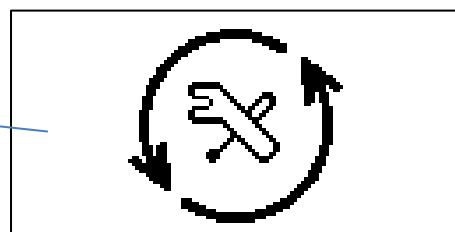


Fig. 57: Symbol when updating the control

When updating hy-switch

hy-switch update

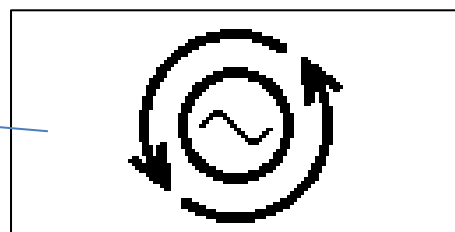


Fig. 58: Symbol when updating hy-switch

9 Maintenance and troubleshooting

9.1 Visual inspection

DANGER

Risk of fatal injury due to contact voltages!

Removing the plug connections before disconnecting the device from the PV generator may lead to injuries and damage the device.



- › During installation: Electrically disconnect the DC positive and DC negative from the protective earth (PE).
- › Disconnect the device from the PV generator using the integrated DC isolator switch.
- › Remove the plug connector.

DANGER

Dangerous voltage due to two operating voltages

Severe injuries or death may occur if the cables and/or terminals/busbars in the device are touched. The discharge time of the capacitors is up to 5 minutes.



NOTE

Opening the device is not permitted, as this will invalidate the warranty



Do not attempt to eliminate faults that are not described here (in chapter "Warning messages / fault messages"). Contact our Customer Service department. Only perform the maintenance work that is described here.

The device should be checked for proper operation by a qualified electrician at regular intervals and if you experience problems, you should always contact the system manufacturer's Service department.

1. Inspect the device and the cables for visible external damage.
2. Check all connections for a firm seat and cleanliness.
3. Pay attention to the operating displays and messages on the display.
4. Inspect the device from the outside to see if it is infested with vermin.

In the event of damage, notify your installation engineer. Repairs may only be carried out by authorised electricians.

9.2 Cleaning

9.2.1 Cleaning the housing

DANGER



Danger of death due to penetrating fluid

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

- › Only use completely dry objects to clean the device.
- › The device should only be cleaned from the outside.
- › Do not use a high-pressure cleaner.

CAUTION



Risk of burns from hot surface.

Heat sinks become very hot when in operation.

- › Never touch the heat sinks after commissioning the device.
- › Allow the heat sinks at least 10 minutes to cool down before cleaning.

CAUTION

Damage to the housing parts when using cleaning agents!

- › If the device is contaminated, only clean the housing, cooling fins, housing cover, display and the LEDs with water and a cloth.

NOTE



Refer to our service and guarantee conditions on our homepage.

- › The cleaning intervals must be adapted to match the ambient conditions of the installation location.
- › In sandy environments, we recommend a ¼-yearly cleaning of the heat sink.

1. Clean the device whenever it gets dirty, preferably during the cooler times of the day.
2. Use a vacuum cleaner or a soft brush to remove loose dust from the top side of the device and the heat sink on a regular basis.
3. Clean the space between the cooling ribs with a suitable brush.

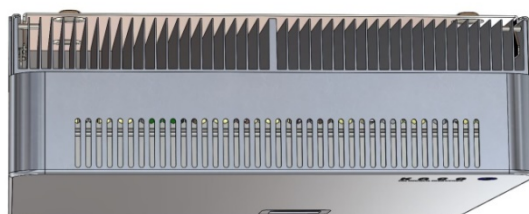


Fig. 59: Radiator fins and top air outlet

4. If necessary, remove coarse dust from the ventilation inlets on the bottom of the device.

9.3 Warning messages / fault messages / information

9.3.1 List of warning messages

Warnings indicate a temporary device shutdown. The device restarts automatically once the cause of the warning has been eliminated.

Code	Meaning	Explanation / recommendation
A001	Grid voltage: Undervoltage	The device monitors the voltage level in the grid. If the voltage falls below the configured limit values, the device stops and only starts up again once the voltage value is back within the limits.
A002	Grid voltage: Overvoltage	The device monitors the voltage level in the grid. If the voltage exceeds the configured limit values, the device stops and only starts up again once the voltage value is back within the limits.
A003	Grid voltage: Overvoltage 10%	The voltage of the individual phases is higher than 10% above the nominal value. If this is the case for more than ten minutes, the device stops supplying and only switches on once when the voltage drops below this limit.
A004	Grid voltage: Linked undervoltage	The device is equipped with three-phase grid monitoring, which is used for island formation detection. If the three-phase grid conditions do not correspond to the limit values entered, the device switches off.
A005	Grid voltage: Linked overvoltage	The device is equipped with three-phase grid monitoring, which is used for island formation detection. If the three-phase grid conditions do not correspond to the limit values entered, the device switches off.
A006	Grid voltage: Undervoltage	The device monitors the voltage level in the grid. If the voltage falls below the configured limit values, the device stops and only starts up again once the voltage value is back within the limits.
A010	Insulation resistance	The device monitors the insulation resistance of the PV modules and battery to earth. If the insulation resistance is too low, it may indicate that the insulation is damaged.
A021	Leakage current: Personal protection 30mA	The device monitors the leakage current to earth. If a rapid change in the leakage current is detected, the device switches off and repeats the insulation measurement. If the insulation resistance is OK, the device switches on again.
A022	Leakage current: Fire protection 300mA	The device monitors the leakage current to earth. If a high leakage current is detected, the device switches off and repeats the insulation

		measurement. If the insulation resistance is OK, the device switches on again.
A031	Undertemperature	The device is not suitable for operation below 5°C.
A032	Overtemperature	The cooling is not sufficient. The ambient temperature must not exceed 40°C. Check the device position and installation site.
A040	Island formation	The device has detected that the power connection to the public grid has been shut off. Check the grid connection.
A050	Frequency shift	The grid frequency is unstable. This can occur due to a grid overload or oversupply of energy in the grid. Find out about local grid conditions.
A060	DC current injection	The device monitors the DC component of the output current. If an increased DC component is detected in the supplied current, the device stops the supply. This problem can be caused, for example, by quick-moving cloud cover.
A071	Connection conditions not met (grid voltage)	Connection to the grid is only permitted if the grid is stable, otherwise an additional grid supply can increase grid instability. For this reason, the device checks the stability of the grid before each connection.
A072	Connection conditions not met (grid frequency)	Connection to the grid is only permitted if the grid is stable, otherwise an additional grid supply can increase grid instability. For this reason, the device checks the stability of the grid before each connection.
A081	Grid voltage: FRT overvoltage	Check grid voltage. Check the setting values in the Setup menu. Check the AC cabling of the inverter.
A082	Grid voltage: FRT undervoltage	Check grid voltage. Check the setting values in the Setup menu. Check the AC cabling of the inverter.
A100	blueplanet hy-switch: Wiring fault	Phase, neutral or earth connections are mixed up on blueplanet hy-switch, the input and output positions do not match on the blueplanet hy-switch, or the phase position on the hy-switch and blueplanet hybrid 10.0TL3 do not match.
A110 A111	blueplanet hy-switch: PE connection	Problems with the earth potential of hy-switch.

A112	PE connection on device unavailable	The PE connection is not connected to the device or it has been incorrectly connected. Check the installation.
A120	Setting parameters	The device could not be configured from EEPROM. Contact Service. Note: During commissioning, the grid operator settings must be made once in the hy-sys software.
A121 A122	Setting parameters	EEPROM can not be written because not enough supply voltage is available. Make sure that the PV voltage amounts to at least 240V.
A123 A124	Setting parameters	The EEPROM cannot be read. Contact Service.
A125	Unsaved changes	Settings have been made on the device, but have not yet been saved. If necessary, the settings can be saved under <i>User Settings</i> .
A130	Check supply settings	Check the $P_{av,e}$ and $P_{feed_in_limit}$ settings. The fault will occur if $P_{feed_in_limit}$ is $> P_{av,e}$.
A131	Power limitation	The device limits the output power as the device is too warm.
A132	Power limitation	The device limits the output power according to the specified characteristic curve $P(U)$.
A133	Power limitation	The device limits the output power according to the specified characteristic curve $P(f)$.
A200	Battery: Undervoltage	The connected battery has a voltage $< 96V$
A240	Battery communication	The device cannot communicate with the battery. Check the communication connection to the battery, including the pertinent software settings.
A250	Battery wiring fault	The measured battery voltage does not correspond with the battery voltage determined in the BCU (Battery Control Unit).
A260	Battery not found	The device cannot communicate with the battery. Check the communication connection to the battery, including the pertinent software settings.

9.3.2 List of fault messages

Faults indicate states of the device where a defect may exist or which may cause a defect. If faults occur repeatedly or regularly, KACO Service must be informed and the device decommissioned.

Code	Meaning	Explanation / recommendation
E001	Overvoltage Solar generator Input 1/2	Turn off the DC switch immediately, and check the voltage at the PV connection. Your device is approved for a maximum solar generator no-load voltage of 900V. Higher input voltages can damage the device.
E002	Overvoltage Solar generator Input 2/2	Turn off the DC switch immediately, and check the voltage at the PV connection. Your device is approved for a maximum solar generator no-load voltage of 900V. Higher input voltages can damage the device.
E011 E012	Grid overvoltage	Voltage at the grid connection is too high or has a high noise level. Check the grid voltages. A grid filter may be necessary. A more frequent occurrence of the fault can reduce the service life of the device.
E021 E022 E023	Device fault	DC link voltage. Inform the service technician in case of repeated faults.
E030	Battery overvoltage:	Switch off the battery and check the voltage at the battery connections. A high input voltage can damage the device (if the fault is present for a longer period of time). May also occur when the battery is switched off due to another fault.
E041 E042	Initialisation error Leakage current	The leakage current (residual current) is too high. Check the operating conditions, and contact the service technician if necessary.
E051 E052	Grid overcurrent	Severe grid disturbances or failures may result in overcurrent in the device under certain circumstances. The device shuts down to protect itself. Check the stability of the grid. Inform the service technician in case of repeated faults.
E060	General fault	Inform the service technician in case of repeated faults.
E070	AC relay: Self-test Initialisation error	Check the operating conditions. Inform the service technician in case of repeated faults.
E080	Battery DC relay Self-test Initialisation error	Check the operating conditions. Inform the service technician in case of repeated faults.
E090	Temperature sensor Initialisation error	Check the ambient temperature and the temperature display on the device. Make sure that the device is being operated within the permissible temperature range.
E101 E102 E103 E104 E110	Device fault	Internal power supply Inform the service technician in case of repeated faults.

E120	Self-test Initialisation error	Check the operating conditions, and contact the service technician if necessary.
E130	General fault	Inform the service technician in case of repeated faults.
E140	General fault	Inform the service technician in case of repeated faults.
E150	Self-test Initialisation error	Check the operating conditions, and contact the service technician if necessary.
E160	General fault	Inform the service technician in case of repeated faults.
E170	Monitoring stop	May occur during a software update. If this error occurs frequently during operation, please inform the service technician.
E180 E181 E182	Self-test Initialisation error	Inform the service technician in case of repeated faults.
E190 E191	Battery service	General battery fault. Please check the battery fault log for the exact cause of the fault.
E200	General fault	Inform the service technician in case of repeated faults.
E211	EEPROM Initialisation error	The configuration data of the device cannot be read from EEPROM. Inform the service technician in case of repeated faults.
E220	Self-test Initialisation error	Inform the service technician in case of repeated faults.
E230	General fault	Inform the service technician in case of repeated faults.
E9xxx	General fault	Inform the service technician in case of repeated faults.

9.3.3 List of displayed information

Information indicates limitations in device functions.

Code	Meaning	Explanation / recommendation
I001	Heat sink temperature	The temperature of the heat sink is too high. The power is reduced. Check the installation.
I002	Temperature of hy-switch	The internal temperature of hy-switch is too high. Check the installation.
I003	Battery temperature	The battery temperature is too high. The battery power is reduced.
I010	Power reduction	The energy supplier has reduced the power of the device. Wait until the power setting changes.
I031 I032	Deactivation by button	Device has been switched off by button.
I040	Battery charge balancing	The connected batteries have very different states of charge. Charge balancing of the battery is recommended.
I121	Supply settings	The setting of $P_{av,e}$ is lower than $P_{feed_in_limit}$. Check the settings in the device.

I141	Communication of hy-switch	hy-switch is switched to active, but cannot be addressed. Check the system components of hy-switch
I142	Battery communication	The battery is switched to active, but cannot be addressed. Check the battery
I903	Commissioning	Device has not yet been commissioned or sufficiently configured. Perform the commissioning procedure.
I904	FRT undervoltage	FRT undervoltage detected Wait until the result is no longer present. If it persists, check the installation.
I905	FRT overvoltage	FRT overvoltage detected Wait until the result is no longer present. If it persists, check the installation.
I906	Power reduction Overfrequency	Power reference due to overfrequency. Wait until the result is no longer present.
I907	Power reduction Underfrequency	Power reference due to underfrequency. Wait until the result is no longer present.
I908	Unsaved settings	New settings have been made on the device, but have not yet been saved. If necessary, the settings can be saved under <i>User Settings</i> .
I909	AC overvoltage	AC overvoltage detected. Wait until the result is no longer present. If it persists, check the installation.
I911	hy-switch connection	Unstable connection to hy-switch. Check the installation.

9.4 Other faults

Fault pattern:

Display without function and device cannot be switched on

Possible solutions:

- The device runs without battery power and is shut down at night. It starts automatically the next day.
- The device runs without battery power and the power supply from the PV modules is interrupted. Check the position of the DC disconnecter and the fuse protection of the supply line. Contact your installer.
- The device has a power supply fault. Check the power supply and functioning of the battery. Contact your installer.

10 Decommissioning and dismantling

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DANGER



Lethal voltages are still present in the connections and cables of the device even after the device has been switched off and disconnected!

Severe injuries or death may occur if the cables and/or terminals/busbars in the device are touched.

Only appropriately qualified electricians authorised by the mains supply network operator are permitted to open and maintain the device.

- › Comply with all safety regulations and current technical connection specifications of the responsible power supply company.

DANGER



Risk of fatal injury due to electric shock!

The DC isolator switch only disconnects the PV generator from the device. The storage battery is not disconnected. Voltage is still present at the DC connector BAT.

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

- › Only touch the PV generator cables on the insulation. Do not touch the exposed ends of the cables.

10.1 Switching off the device



WARNING

Risk of burns caused by hot housing components

Housing components can become hot during operation.

- › During operation, only touch the housing cover on the device.

1. Press and hold the "Set" button (on the bottom of the device). A status bar appears on the display. The "Set" button must be pressed until this bar is completely filled and the request to operate the DC isolator switch appears on the display.
2. The device discharges. The display goes out after about 60 seconds.
3. Set the DC isolator switch to "0" to prevent unintentional starting.



NOTE

If the display is dark, the device does not necessarily have to be switched off permanently.

- › To prevent the device from starting, the DC switch must be set to "0".

10.2 Uninstalling the device

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 **DANGER**

Dangerous voltage due to several operating voltages

Severe injuries or death may occur if the cables and/or terminals/busbars in the device are touched. The discharge time of the capacitors is up to 5 minutes.



- › The device is supplied on the DC side from the PV system and the battery storage unit
- › The device can be connected to the public power grid on the AC side.

 **DANGER**



Do not open the device! All connections are externally accessible.

Lethal voltages are still present in the connections and cables/terminals of the device even after the device has been switched off and disconnected!

- › Severe injuries and/or death may occur if the cables and terminals are touched.

- ↻ The device and storage battery are disconnected from the power supply and secured against being switched on again.
- ↻ Device is switched off, and the DC switch is in position "0".
- 1. Disconnect the DC connections of the battery; see 10.2.1.
- 2. Disconnect the DC connections of the PV generators; see 10.2.1.
- 3. Disconnect the three communication cables BAT, hy-switch and LAN; see 10.2.2.
- 4. Disconnect the AC connector; see 10.2.3.

10.2.1 Disconnecting the DC connector

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 **DANGER**



Destruction of the DC plug connectors

DC plug connectors can be destroyed by an arc event if disconnected while still live. It is absolutely essential that the following shutdown sequence be carried out in the correct order:

- › Check that there is no current in any of the DC cables using a clip-on ammeter.
- › Disconnect all DC connections one by one.

- ⌚ Ensure that the device is completely free of AC/DC voltage.
- ⌚ Check that there is no current using a clip-on ammeter.

Plug connectors may be unplugged under voltage, but never under load.

1. Use a screwdriver [~~X~~S_3.0] to push out the latch on the coupling.
2. Leave the screwdriver in place.
3. Disconnect the DC connector from the DC socket.

1 Screwdriver

2 Latch

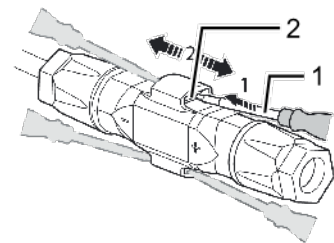


Fig. 60: Unplugging the plug con-

10.2.2 Disconnecting the communications cable

1. Carefully press down the retaining lug on the RJ45 connector.
2. Remove the RJ45 connector from the socket.

10.2.3 Disconnecting the AC connector

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 **CAUTION**

Plug in or disconnect connectors

Never connect or disconnect the connectors under load.

- › The connectors are not suitable for disconnecting the power.

1. Disengage the two connectors by pressing down the retaining lug with a screwdriver.
2. Remove the DC connector.

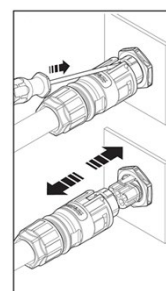


Fig. 61: Disconnecting the DC connector.

10.3 Disassembling the device

CAUTION

Risk of injury from improper lifting and transport



If the device is lifted improperly, it can tilt and result in a fall.

- › Always lift the device vertically.
- › Use a climbing aid for the chosen installation height.
- › Wear protective gloves and safety shoes when lifting and lowering the device.

↻ The device has been switched off and uninstalled.

1. Remove both countersunk screws [XA_2.5] on the left and right side of the cover to secure it against being lifted off.
2. Move the bottom part of the device away from the wall at an angle of about 30°.
3. Disengage it from the wall bracket at the top.

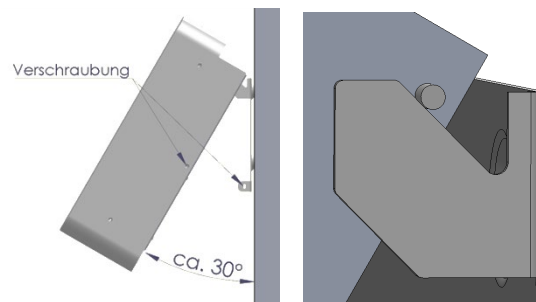


Fig. 62: Tilt the device 30° and disengage it from the wall bracket.

10.4 Packaging the device

↻ Device has been uninstalled.

1. If possible, always pack the device in the original packaging. If this is no longer available, an alternative is to use equivalent packaging.
2. You must be able to close the box completely and it must be able to accommodate the weight and size of the device.

10.5 Storing the device

CAUTION

Property damage as a result of condensation

Faulty storage can form condensate in the device and impair the device functioning (e.g. storage outside the ambient conditions or temporary relocation from a cold to a hot environment).

- › Store it according to the environmental data (see chapter 4.3)

↻ Device packaged.

1. Store the device in a dry place according to the environmental data (see 4.3).

11 Disposal

CAUTION

Risk to the environment if disposal is not carried out in the correct manner



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

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

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

The device complies with the relevant provisions of the RoHS Directive for the European Union. Like all other electrical and electronic products (EEE), it must not be disposed of as household waste.

The KACO new energy brand is registered in Germany under WEEE reg. no: DE 57110363.

12 Service and warranty

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:

- Device name / serial number
- Date of installation / Start-up report
- 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
- Consignment identification / Delivery address / Contact person (with telephone number)
- Information about the accessibility of the installation site.

You can find the following items and other information at our website kaco-newenergy.de:

- our current warranty conditions,
- a complaint form,
- a form for registering your device. Please register your device without delay. In this manner, you can assist us in providing you with the quickest service possible.



NOTE

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

