KACO new energy.

Application of Powador-protect

Application note

1 Introduction

The Powador-protect is a protection and control unit for generating plants and battery systems with the following functions:

- Monitoring the voltage 3*Ph-N
- Monitoring of voltage 3*Ph-Ph
- Frequency monitoring - three-phase
- Reading of potential-free contacts for power control of generation plants and battery systems
- 2 output relays for controlling interface switches
- Separate control of the output relays as a protection - back-up protection concept
- Triggering of internal interface switches of compatible KACO inverters
- Independently parameterizable network parameters for reconnection after tripping.

This document contains the system description of the Powador-protect and the overall system - consisting of the Powador-protect, the communication path and the compatible inverters.

This document explains basic principles resulting from grid connection conditions and the regulatory framework, as well as connection and configuration examples and the compatibility of the inverters offered by KACO new energy. As a supplement to the inverter operating instructions, the connection of the digital output of the Powador-protect, which is required for the control of the internal bus tie breakers, to various inverters is described.

2 Basic information

2.1 Voltage and frequency protection

The Powador-protect is a protection device that continuously monitors the mains parameters. If a limit value violation is detected, the Powador-protect activates the interface switches, causing the system to switch off. Central interface switches can be controlled with inverters from any manufacturer. If the Powador-protect is used in combination with inverters from KACO new energy, no central interface switches are required. These units are equipped with internal interface switches ex works. They are controlled via the "Inverter Off" digital output, which connects the Powador-protect to the inverters used in the generation plant to be monitored. They are controlled via the "Inverter Off" digital output, which connects the Powador-protect to the inverters used in the generation plant to be monitored. If a limit value violation is detected, the digital output is activated simultaneously with the central interface switches.

The Powador-protect, has fault detection in accordance with VDE-AR-N 4105:2018 6.1 and EN 50549-1:2019 4.13. A single fault does not lead to the loss of the safety function. Individual faults, such as the failure of a voltage measurement, the auxiliary voltage, a processor or an output signal, lead to the undelayed shutdown of all outputs.

In contrast to the solution with central interface switches, the entire shutdown chain NA-protection/interface switch is equipped with error detection when internal interface switches are activated, thus providing an additional level of safety. Like the Powador-protect, the interface switch function in the inverter is also designed in such a way that internal faults are detected and immediately lead to shutdown. This also applies to the connection of the Powador-protect to the inverter, the control signal is protected with a wire breakage and tampering detection.

2.2 Power control

The Powador-protect offers the possibility of serving as a gateway for the network operator's congestion management (feed-in management EEG §14). The specification of the feed-in power can be received, for example, by means of a (radio) ripple control receiver and its potential-free contacts. Up to 4 potential-free contacts can be read out. For each contact a power setting can be configured, e.g.: 100%, 60%, 30% 0%. The corresponding control commands are passed on to the connected inverters when the respective contact is activated and the specified power is realized by the inverters.

The control commands are transmitted via the RS485 interface. The Powador-protect is integrated as a terminal device and RS485 master.

3 Normative References

3.1 References for interface protection

3.1.1 Interface Protection according to EN50549-1

In chapter 4.9, EN 50549-1 requires interface protection with frequency and voltage protection function. This interface protection acts on the interface switch of the generating plant. According to EN 50549-1 - chapter 4.3.2, the interface switch can be integrated in the inverter in combination with the generator switch. The use of the internal interface switch of the inverters is foreseen in the standard.

3.1.2 Interface protection according CEI 0-21

CEI 0-21 requires a protection - back-up protection concept for generating plants connected to the low-voltage grid and with a capacity of more than 11.08 kW. If no switch opening is detected 500ms after the interface switch has been activated, the back-up switch must be tripped, and no automatic reconnection may take place. In the IT country setting, the Powador-protect can be configured so that the relay outputs are controlled independently of each other. Relay 1 can be used to actuate the interface switch. If no feedback signal is present at digital input 4 within 500ms after actuation of relay 1, back-up protection is triggered by relay 2. As back-up protection, for example, the circuit breaker with additional undervoltage triggering can be used, whereby the voltage supply of this undervoltage triggering is switched off via relay 2.

The switches internal to the inverters can be used as interface switch or as backup switch. the Powador-protect can be configured to operate the "inverter off" signal either simultaneously with relay 1 or simultaneously with relay 2.

Since the digital inputs are used for the feedback contact of the interface switch in this application, the power control function cannot be used.

3.1.3 Interface protection according G99 and G98

Technical recommendations G99 and G98 require in clause 10 an interface protection. The Powador-protect meets the requirements for voltage and frequency protection. The inverters used must have an anti-islanding function, which is provided by all KACO inverters.

The setting values for the frequency and voltage protection according to Table 10.1 of G99 must be set in the device in the default setting "User-Defined".

3.1.4 Interface protection according AS 4777.2015

In clause 7 of the AS 4777.2:2015, protection functions are required. These include requirements for the interface switch 7.2, active islanding detection 7.3, as well as interface protection, voltage and frequency protection 7.4 and 10min mean value voltage monitoring 7.5.2.

The interface switch used in the inverters of KACO new energy meets the requirements of chapter 7.2, as well as protective functions for islanding detection and frequency and voltage protection. This is confirmed in the respective AS4777.2:2015 certificates of the inverters.

The frequency and voltage protection of the Powador-protect also corresponds to AS 4777.2:2015. If the Powador-protect is used with inverters with islanding detection according to AS 4777.2:2015, the Powador-protect can be used as a frequency and voltage protection device. The internal interface switch of the inverter or AS 4777.2:2015 compliant external interface switches can be triggered.

3.1.5 Central grid and plant protection with use of the internal interface switches according to VDE-AR-N 4105:2018 for plants larger than 30kVA

In chapter 6.1, VDE-AR-N 4105:2018 requires the use of a central interface protection for generation plants with a plant ("inverter") capacity of more than 30kVA. In the usual configuration, the central interface protection controls a central interface switch.

In addition, VDE-AR-N 4105:2018 requires a functional check of the interface switches in chapter 6.4.1. This can be ensured

(a) by monitoring switching operations during operation when using an interface switch with automatic disconnection on loss of control voltage; or

(b) by monitoring at least one shutdown per day; or

(c) when using internal interface switches according to IEC/EN 62109.

A detected defect of the interface switch must lead to the shutdown of the generation plant. Therefore, according to VDE-AR-N 4105:2018, two switching elements are always required, the interface switch which, in the case of a central interface switch, can also be monitored by the interface protection and a reserve switch which can be triggered in the event of a detected defect. This could either be the inverter itself or a circuit breaker which is controlled by an undervoltage release.

Chapter 6.4.1 also explicitly describes the control of the internal interface switches by a central interface protection. A condition for this configuration is that the system is not intended to be used as a mains backup system or emergency power system for island operation. This is usually the case for generating plants. The simplest implementation of the requirements is therefore option c), for systems over 30kW via the control of the internal interface switches by the Powador-protect.

Option a) is also possible with the Powador-protect in the country setting IT but is not recommended due to the higher complexity. Option b) is not provided with the Powador-protect.

The setting values for the frequency and voltage protection according to Table 2 of VDE-AR-N 4105:2018 must be set in the device in the default setting "User-Defined".

3.1.6 Intermediate interface protection when using the internal interface switch according to VDE-AR-N 4110

Clauses 6.3.4.5 and 11.5.2 of VDE AR-N 4110:2018 require the presence of a test terminal strip for protection testing of the interface protection on the generating units. The protection test itself must then be carried out by the plant operator on his own responsibility every 4 years; test reports must be available to the grid operator on request.

Photovoltaic string inverters usually do not have such a test terminal strip. Chapter 10.3.3.6 therefore also describes the so-called intermediate protection as an alternative to the test terminal strip on the inverter. The intermediate protection monitors the voltage and frequency on the low-voltage side of the plant between the inverters and the low/medium-voltage transformer. The intermediate protection must be equipped with a test terminal block by the customer, so that a protection test is possible without disconnecting wires. In this case, the protection in the generation unit or its testing there can be omitted.

The Powador-protect can be used as an intermediate protection and, in the event of a fault, triggers the internal coupling switches of the connected KACO inverters. No additional external interface switch is required.

As the triggering of the internal coupling switch by the Powador-protect was tested during the unit certification in accordance with VDE-AR-N 4110 of the KACO PV and battery inverter and the total switch-off time has been verified technically by measurement, it is not necessary to measure the total switch-off time during the protection test during commissioning and for the periodic repeat test in accordance with VDE-AR-N 4110:2018 11.5.2.

3.2 References for power control

3.2.1 Grid security management according VDE-AR-N 4105:2018

The basis for the requirement of grid security management in Germany is the EEG 2017 §12. PV systems and storage plants must have a device for remote-controlled power reduction. Systems over 100kW must also provide the grid operator with the current feed-in power, which can be done, for example, via a remotely readable feed-in meter. For PV systems below 30KWp there is the option to replace remote controllability by a permanent limitation of the feed-in to 70% of the PV peak power.

The specification of the setpoint value of the power reduction is determined by the respective network operator. Many network operators use (radio) ripple control devices for this purpose which provide the generation plant control with four potential-free switching contacts.

VDE-AR-N 4105:2018 5.7.4.1 specifies a corridor for the power change gradients. The power change shall not be faster or slower than specified. This gradient can be set in the PV feed-in inverter blueplanet 92.0TL3 and the Powador-protect can be used as a gateway for the grid security management.

For all other devices, a system control concept is currently still required which implements the required power change gradient.

3.2.2 Demand response modes (DRMs) according AS NZS 4777.2-2015

In clause 6 AS NZS 4777.2-2015 requires a demand response of generating units in case of a command provided by a demand response enabling device (DRED). Where a plant controller is used to communicate with the inverter, the DRED can be connected to the plant controller and provide the power commands to the inverters using one of the available communication protocols of the inverter as described in the product documentation of the inverters (see also Note 3 of Chapter 6.2.2 in the standard AS NZS 4777.2-2015).

Alternatively, Powador-protect can be used as DRED communication interface.

DRM 1-4 are relevant for loads and storage inverters and do not apply for PV-Inverters. Powador protect does enable DRM 0, DRM 6-8 that are relevant for generating units and plants. DRM 5 is not implemented as it provides the same inverter response as DRM 0.

Table 1. Demand response modes and inverter reaction

Mode	Requirement	Reaction
DRM 0	Operate the disconnection device	The inverter opens the internal disconnection device
DRM 6	Do not inject more than 50% of rated power.	Inverter limits infeed to 50% If the available power is below 50% the PV-inverters operate at MPP
DRM 7	Do not inject more than 75% of rated power	Inverter limits infeed to 75% If the available power is below 75% the PV-inverters operate at MPP
DRM 8	Increase power generation.	PV-Inverter operate at MPP up to maximum power.

The Powador-protect provides a 5-pol screw clap for connecting potentially free contacts marked DI1-DI4 and GND. To interpret the connected potential free contacts the DRED must be connected as below.

Table 2. Terminal marking for DRM

Terminal Block marking according AS 4777.2 2015	Marking at Powador-protect	Mode if terminal is connected to GND
REF GEN/0	GND	-
COM LOAD/0	DI4	DRM 0
DRM 4/8	DI3	DRM 6
DRM 3/7	DI2	DRM 7
DRM 2/6	DI1	DRM 8

As described in the manual of Powador protect clause 8.2 the power levels for power control must be configured. In the default setting “user defined”, the default levels for DI3 and DI2 are 30% and 60%. To comply with AS 4777.2 2015 DRM levels DRM 6 and DRM 7 the parameters must be adjusted to 50% and 75% respectively.

4 Modes of operation

4.1 Interface protection

4.1.1 Protection function

For interface protection, Powador-protect offers the following features:

- Overvoltage/undervoltage monitoring (stage1 / stage2)
- Overfrequency/underfrequency monitoring (stage1 / stage2)
- Overvoltage monitoring as a 10 minute mean value
- Voltage evaluation 3*Ph-N
- Voltage evaluation 3*Ph-Ph
- Monitoring of three-phase frequency
- Monitoring of the connection conditions after a protective function has been triggered (voltage and frequency)
- Reading digital signals to the remote-controlled power reduction of PV systems
- 2 output relays to control interface switches
- Separate control of the output relays as a protection/backup protection concept
- Control of internal interface switches in compatible KACO inverters
- Independently parametrizable grid parameters for reconnection following activation.

The current parameter settings can be read off on the device display at any time. A description of the parameters can be found in the Powador-protect operating instructions.

Table 3. Measurement tolerance and drop-off ratio

Measurement tolerance of the frequency	<0.1 Hz
Measurement tolerance of the voltage	<1% U_N
reset ratio for overvoltage	<1.01
reset ratio for undervoltage	> 0.99

By monitoring the connection conditions, different grid parameters for voltage and frequency can be specified for reconnection compared to shutdown. This makes it possible to configure a reconnection hysteresis. After a protective function has been triggered, the outputs are only re-enabled when the grid parameters have been in the set value range for the set monitoring time.

4.1.2 Relay outputs for activation of interface switches

If inverters that were not manufactured by KACO are used or if a protection/backup protection concept is required, interface switches must be installed externally in the PV system in accordance with local requirements.

The configuration of the relay outputs for redundant interface switches or for a protection/backup protection concept is described in the Powador-protect manual.
Observe the grid failure bridging time of the interface switches. If necessary, the grid connection rule requires that the interface switch is not opened before the set response delay time.

4.1.3 Actuation of internal interface switches

If KACO new energy compatible inverters are used, Powador-protect can control the internal interface switches.

The entire trigger chain, the Powador-protect, the communication link and the interface switches are fail-safe.

The safety function in the shutdown chain is not lost due to an individual error.

The failure of a link in the entire shutdown chain leads to instantaneous shutdown of the shutdown chain. The single-fault tolerance conforms to the requirements of the VDE-AR-N 4105 A.6

The internal interface switch is actuated by a separate connection between the Powador-protect and the inverter. For this purpose, Powador-protect uses the "inverter OFF" signal (see chapter 8). The signal is a clocked 10V signal.

Figure 1. "Inverter Off" signal specification

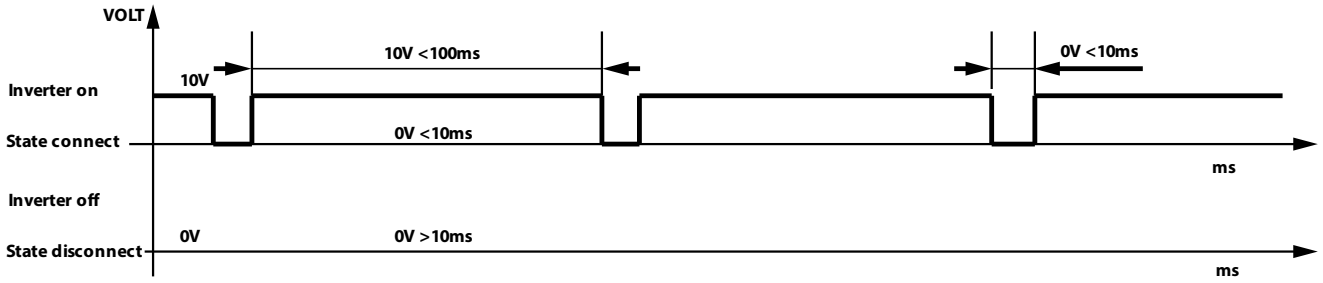


Table 4. Status definition of the "Inverter Off" signal

Status	Definition
STATE CONNECT	Level high (5V-20V) <100ms & Level low (0V-3V) <10ms
STATE DISCONNECT	Level low (0V-3V) > 10ms

The clocking of the "Inverter Off" signal ensures that the connection between Powador-protect and the inverter is available in its full bandwidth.

As soon as a 0V pulse is not transmitted in STATE CONNECT as a result of increased capacity, interruption or application of an interference voltage, the applicable inverters are shut down without time delay.

The trigger chain in the inverter is designed as fail-safe. The trigger chain interface processor is continuously monitored.

The trigger chain processor interface switch and the interface switch itself are tested every time, i.e. every day, before the inverter is connected. It is disconnected from the grid immediately after an error is detected. This guarantees that the shutdown chain operates correctly at all times.

4.1.4 Internal inverter interface protection upon connection of a Powador-protect

When the "Inverter Off" signal is connected and the external protection is activated in the inverter control, the inverters adjust the internal protection.

The internal protection is deactivated by setting the frequency and voltage limits to the maximum operating limits of the unit. The maximum operating limits of the respective device can be found in the technical data of the device and are displayed in the inverter control.

4.1.5 Timing

The following times are defined for protection systems with Powador-protect:

Figure 2. Time response of Powador-protect and shut down of internal interface switch of inverters.

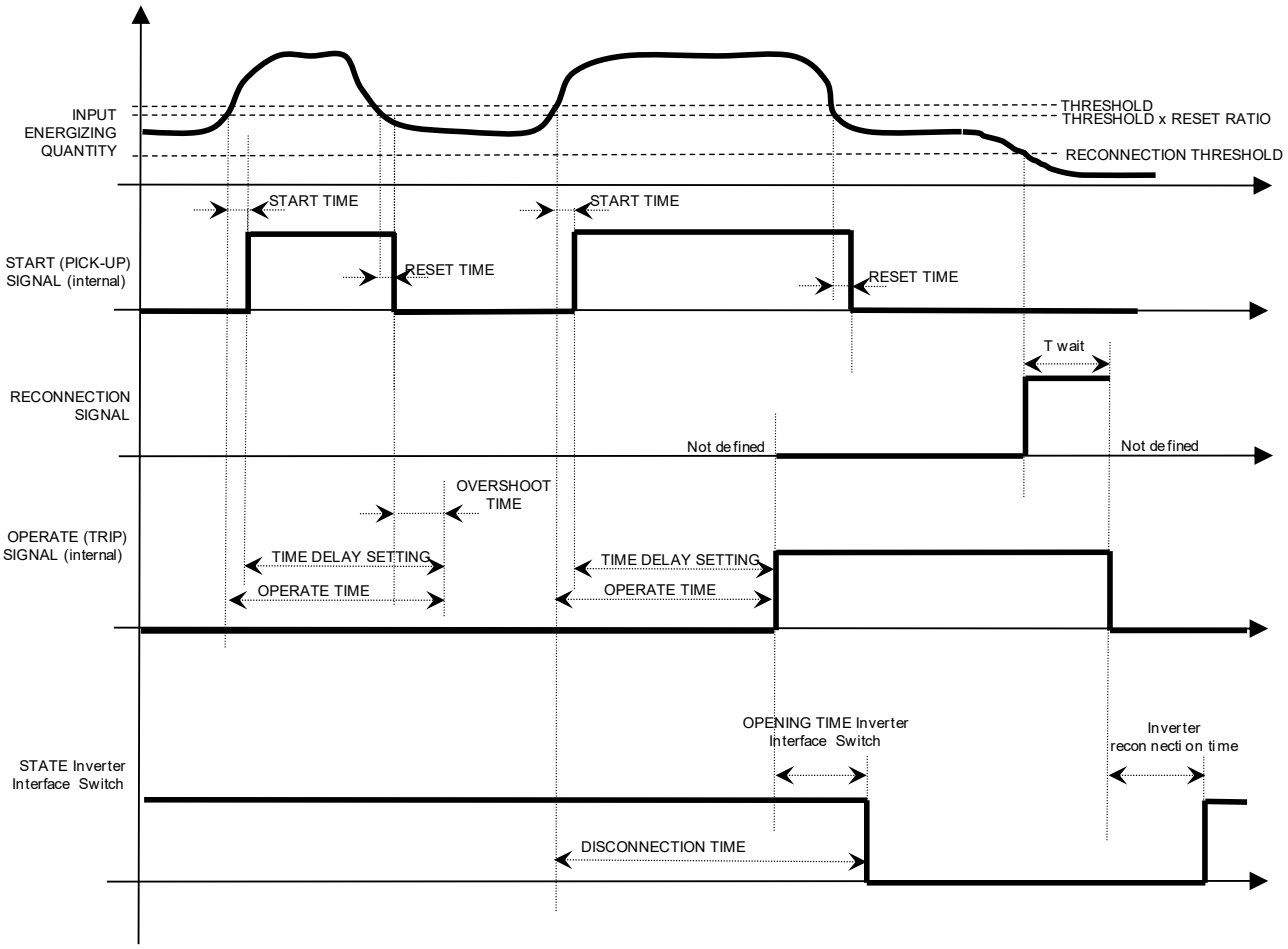


Table 5. Definition signals and times in Powador-protect

Designation	Description	Value
START TIME	Start time is the time between the moment when the set threshold value is exceeded and the moment the start signal is activated. This corresponds to the inherent delay of Powador-protect. (reference EN60255-127)	Voltage: 30-50ms Frequency: 60-80ms
OPERATE TIME / response time	Operate time is the time between the moment when the set threshold value is exceeded and the moment the output signal is activated. (reference EN60255-127) Relay output: The OPERATE TIME ends with the opening of the changeover contact of the Powador protect relay 1 and/or relay 2. Inverter off: The OPERATE TIME ends with the beginning of the STATE DISCONNECT, 10ms after the signal changes to Low (Low level to 10ms corresponds to the STATE CONNECT definition)	The delay time set on the display + START TIME

CIRCUIT BREAKER OPENING TIME	The inherent time of the switching device (switch-off time). Duration between activation of the switching device and completed switch-off. The switch-off times of the compatible inverters of the series are given in Table 6 on page 10. The switch-off time when using external interface switches must be taken from the respective data sheet.	According to Table 6 on Page 10 or interface switch data sheet
DISCONNECTION TIME	Total of OPERATE TIME and CIRCUITBREAKER OPENING TIME.	As set on the display.
RESET TIME	Time between falling below the threshold and resetting the START SIGNAL (refer to EN60255-127)	20ms
Twait	Time of grid monitoring up to reconnection after fault is triggered. All grid parameters must be within the configured connection parameters (RECONNECTION SIGNAL high). The RECONNECTION SIGNAL is not defined if the OPERATE SIGNAL is "low". The RECONNECTION SIGNAL is "low" if a grid parameter is outside the configured connection conditions. The RECONNECTION SIGNAL is "high" if all grid parameters are within the configured connection conditions.	
Inverter reconnection time	Time that the inverter requires to work through the internal monitoring routines and to perform synchronisation.	Variable (approx. 20s to 200s)

4.1.6 Switch off time of Inverters (Circuitbreaker opening time)

Table 6. Shutdown time of compatible inverters

Device series	Shutdown time*
blueplanet 3.0- 10.0TL3	10 ms
blueplanet 15.0 – 20.0TL3	20 ms
blueplanet 50.0 – 60.0TL3	20 ms
bowador 30.0TL3 – 72.0TL3	20 ms
blueplanet 87.0TL3 – 165TL3	10 ms
blueplanet gridsave 50.0TL3-S	20 ms
blueplanet gridsave 92.0 – 137TL3-S	10 ms

* The shutdown time relates to the galvanic opening of switching units. The power supply to all devices stops within 5ms.

4.1.7 Integration of further OFF commands (e.g.: triggering Q-U-protection or remote Quick-OFF)

With large PV systems, an option for fast remote shutdown by the grid operator or Q-U protection may be required in addition to the remote-controlled power reduction based on the situation in the upstream grid.

When using an integrated interface switch of a compatible inverter, an additional, externally actuated normally-closed contact can be installed between Powador-protect and the first inverter in the cable that transmits the "inverter off" digital signal.

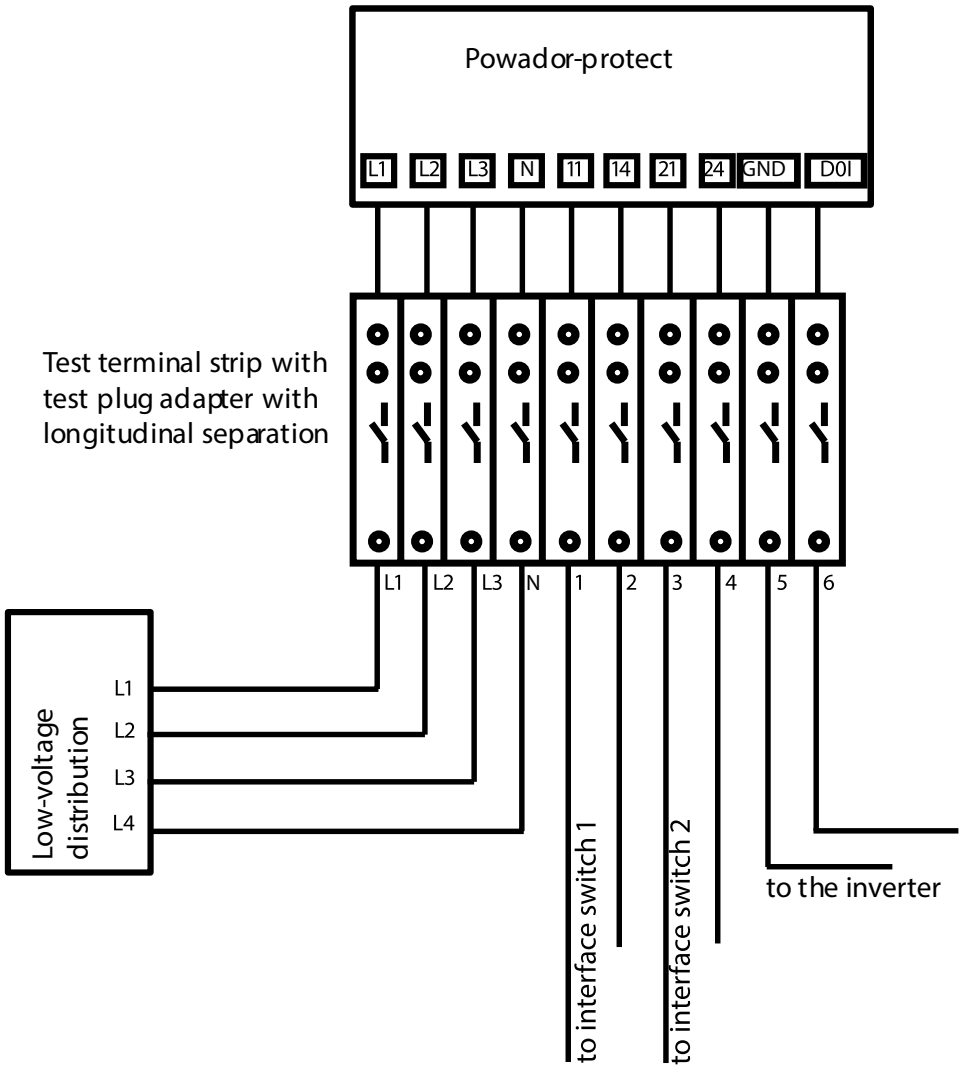
Opening the communication line causes a low level in the inverters, which is then recognised as STATE DISCONNECT after 10 ms.

The interface switches in the inverters can trip within the times specified in Table 4 and offer a time and thus a safety advantage compared to large circuit breakers or remote-controlled power reduction.

4.1.8 Protection test in Powador-protect

The Powador-protect can be connected on the building side with the monitored grid by a test terminal strip in accordance with Figure 3. This structure allows the Powador-protect to be tested with standard protection testing devices.

Figure 3. Typical set-up of a test terminal strip, connection to interface switches or inverters as applicable



For protective testing, a relay output or the "inverter off" signal can be evaluated.
When using the "inverter off" signal, debounce protection must be used due to the timing.
The debounce protection must be set to 10ms according to the STATE DISCONNECT state definition.

Due to the single-fault tolerance and unit certification in line with VDE-AR-N 4105, according to DE-AR-N 4105 it is not necessary to perform the recurring protection test. If a protection test is required nonetheless, it can be carried out as follows.

4.1.9 Protection test

Performing a protection test

Open the longitudinal separation of the test terminals for the interface switch control (relay and/or inverter OFF

=> interface switch opens).

Open the longitudinal separation of the test terminals for voltage measurement.

Connect the signal outputs of the protection testing device to the voltage measurement of the test terminal strip.

Connect the sensor inputs of the protection testing device to the control of the interface switch.

Configure the chatter protection of the sensor inputs of the protection testing device if "inverter OFF" signal is used.

Check setting values and response delay.

Note: **It is generally recommended that the protection test be performed in accordance with FGW TG3 Rev 25 Annex H.1.3, while taking the following points into account:**

a) Chapter H.1.3.2.2 does not apply because Powador-protect evaluates Ph-Ph and Ph-N voltages.

b) The frequency test should be carried out whenever possible with ramps or the smallest possible jumps. Frequency jumps are not possible in the energy network and large jump heights can lead to short-term measurement errors that can distort the test results for the response delay time.

Procedure for every protective function (U/f, <,<<,>,>>):

a) Check trigger values:

Gradual change of one phase voltage each or the frequency until it triggers.

- When checking U<< and U>>, there must be:
  - at least one jump from U< or U> to U_N within the trigger time to prevent the first level from being triggered.

or

- the 1st protection level must be temporarily deactivated via the display.

b) Check the response delay:

Jump to the trigger range e.g. setting value +5% or -5%.

c) Check the reset ration ratio:

Alternative 1

in accordance with **FGW TG3 Rev 25 Annex H.1.3** (recommended). Jump to the trigger range e.g. setting value +5% or -5%.

Before the setting time elapses, the jump to 0.99 or 1.01 in the setting value reset ratio <0.99 or >1.01 is verified if shutdown does not take place

Alternative 2

Temporary deactivation of the connection condition via the display. The outputs are enabled immediately after the triggered condition has reset.

Note: Since the reset ratio of the protective device is smaller than the measurement noise and noise reduction is deactivated due to the deactivation of the connection condition, chatter occurs at the output for voltages near the activation threshold.

Gradual change of one phase voltage each or the frequency until it triggers in a stable manner.

Gradual change of one phase voltage each or the frequency until reset occurs in a stable manner (no chatter).

Once the protection test is finished, remove the protection testing device and close the longitudinal separation of the interface switch control and voltage measurement.

Re-activate all deactivated functions (takes place automatically after 3 hours)

The interface switches close once the set grid monitoring time elapses.

Carrying out a check on the overall function chain

Due to the continuous or daily self-testing of the overall functional chain, there is no need for repeated overall functional chain testing. The function of the overall functional chain and the trigger time are ensured over the entire service life.

However, if an overall functional chain test is carried out, it is recommended to observe **FGW TG3 Rev 25 Annex H.1.3.2.10 and** VDE-AR-N 4110:2018 11.5.2:

Open the longitudinal separation of the test terminals for voltage measurement.

The Powador-protect detects a voltage error and triggers the connected interface switch.

Check that all controlled interface switches opened successfully:

(1) External interface switch: Audible switching or visual inspection of the switch position

(2) Integrated interface switch:

2a) With regard to system access for system monitoring and control, the status of each inverter can be checked in the monitoring system. All inverters must be in status 17 "Powador-protect shutdown".

2b) If there is no system access for system monitoring and control, the status of each inverter can be checked directly at the inverter. The red LED must light up and the message "Powador-protect shutdown" must show in the display if applicable.

After the protection test completes successfully, close the longitudinal separation for voltage measurement.

The interface switches close once the set grid monitoring time elapses.

Running the shutdown in case of loss of auxiliary power supply

It is possible to proceed in the same manner as when testing the overall functional chain.

The test terminal of the auxiliary power supply is disconnected instead of a voltage measurement.

4.2 Power control

The grid operator issues the command to reduce active power via a (radio) ripple control receiver providing up to 4 potential free relay contacts.

The Powador-protect has four digital inputs that are connected with the four potential free relay outputs of the (radio) ripple control receiver. This results in four limit control stages, which are factory-set in the Powador-protect to 0, 30, 60 and 100 percent.

The limit control stages and as well the behaviour in case of failure of the ripple control receiver can be configured via the Powador-protect setup menu. Since one contact is used for 100% fail-safe operation is applied. Powador-protect interprets the signals of the relay output of the (radio) ripple control receiver and sends a control command over an RS485 data bus. The configuration is described in the Powador-protect operating instructions.

5 Powador-protect as part of your PV system

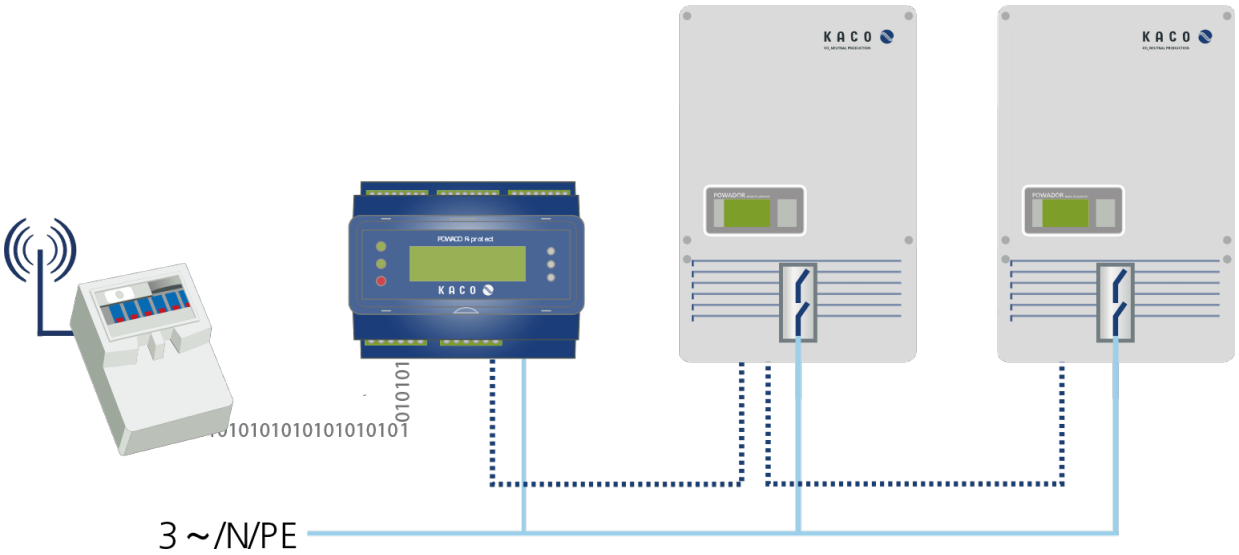
Powador-protect is installed in your photovoltaic system close to the grid feed-in point. If the grid connection point is in the medium voltage range, Powador-protect is always installed in the low voltage range.

If a (Powador-proLOG) data logger with or without a connected ripple-control receiver is installed in the monitored system, the Powador-protect can be configured accordingly. External interface switches are not required with compatible KACO inverters. The fail-safe shutdown in this case is implemented by the digitally transmitted shutdown signal.

key	
———	AC grid
– – – –	Shutdown signal (digital output)
01010101	Evaluation of ripple control receiver (DI1-DI4 on the Powador-protect)
.....	Signal for power control (RS485)
■ ■ ■ ■ ■ ■ ■ ■	Actuation of external interface switch

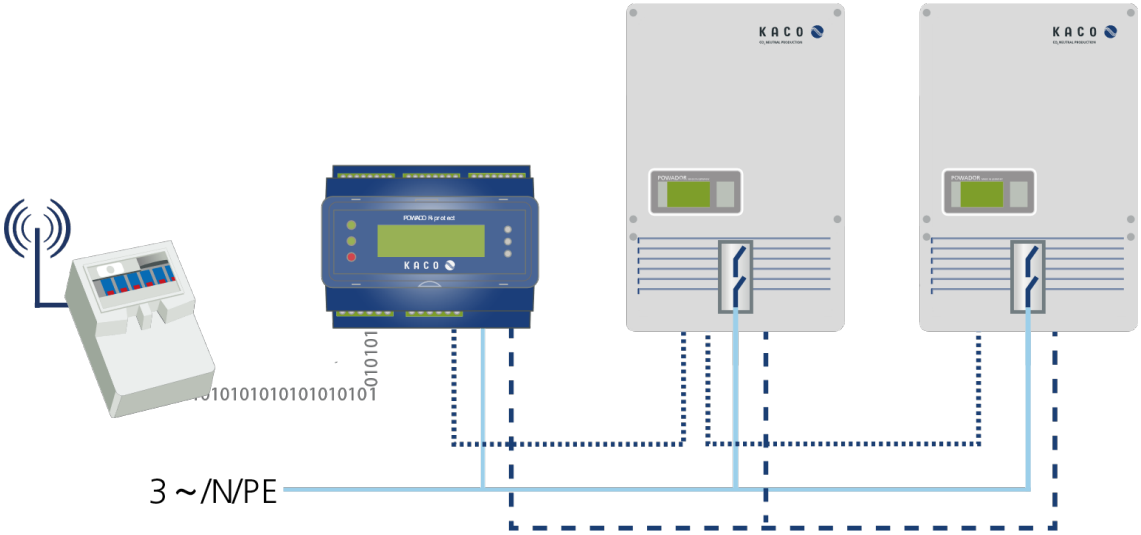
5.1 Powador protect as power control only (interface protection function deactivated)

Figure 4. Variant 1: Powador-protect used for power control with compatible KACO inverters. The interface protection of the inverter remains active.



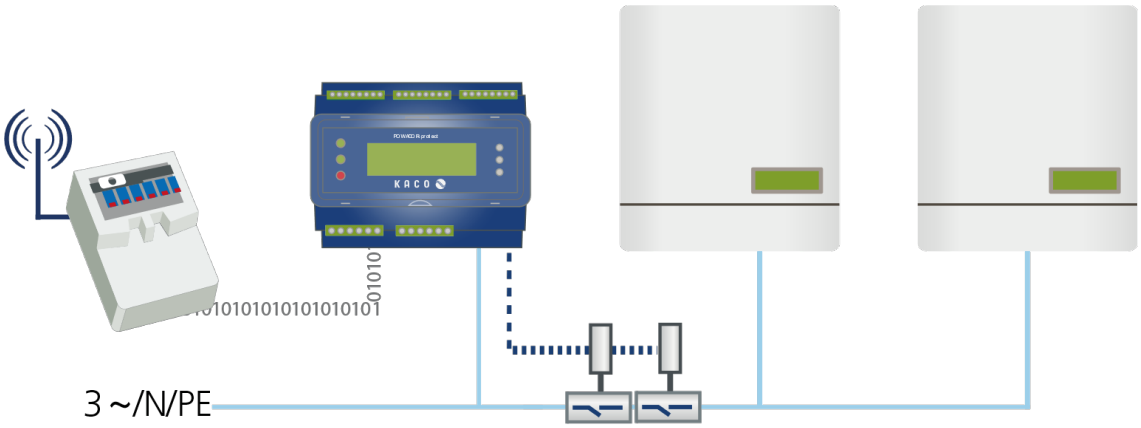
5.2 Compatible KACO inverter without external interface switches

Figure 5. Variant 2: Powador-protect used as interface protection and for power control with compatible KACO inverters. The interface switch of the inverter is actuated by the Powador-protect.



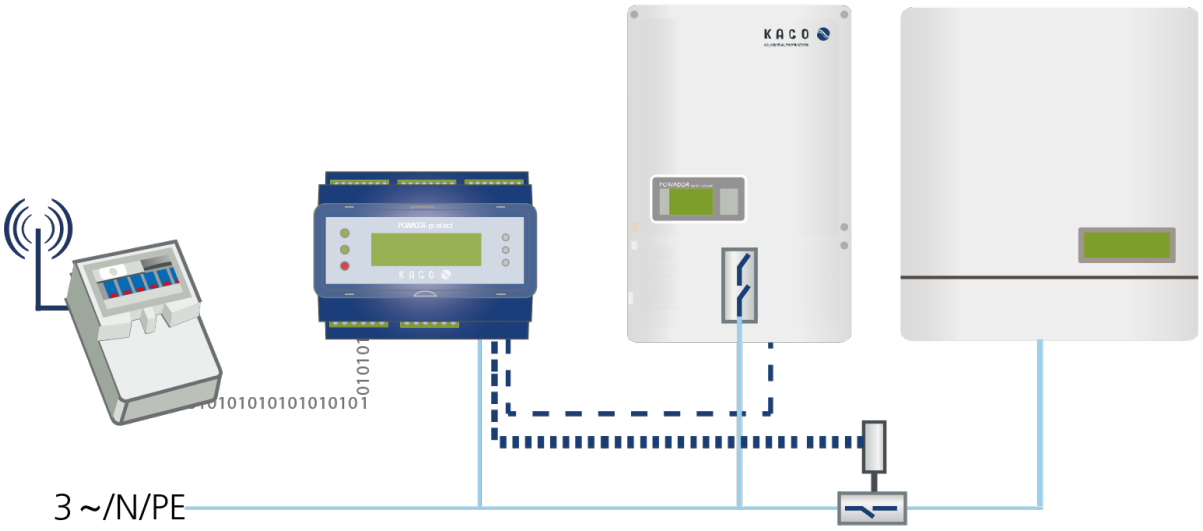
5.3 Devices from other manufacturers with external interface switches

Figure 6. Variant 3: Powador-protect as interface protection with third-party inverter with external interface switches



5.4 Mixed operation of KACO inverters and from other manufacturers

Figure 7. Variant 4: Powador-protect as interface protection with compatible KACO inverters and third-party inverters. An external interface switch is required for the non-KACO inverters.



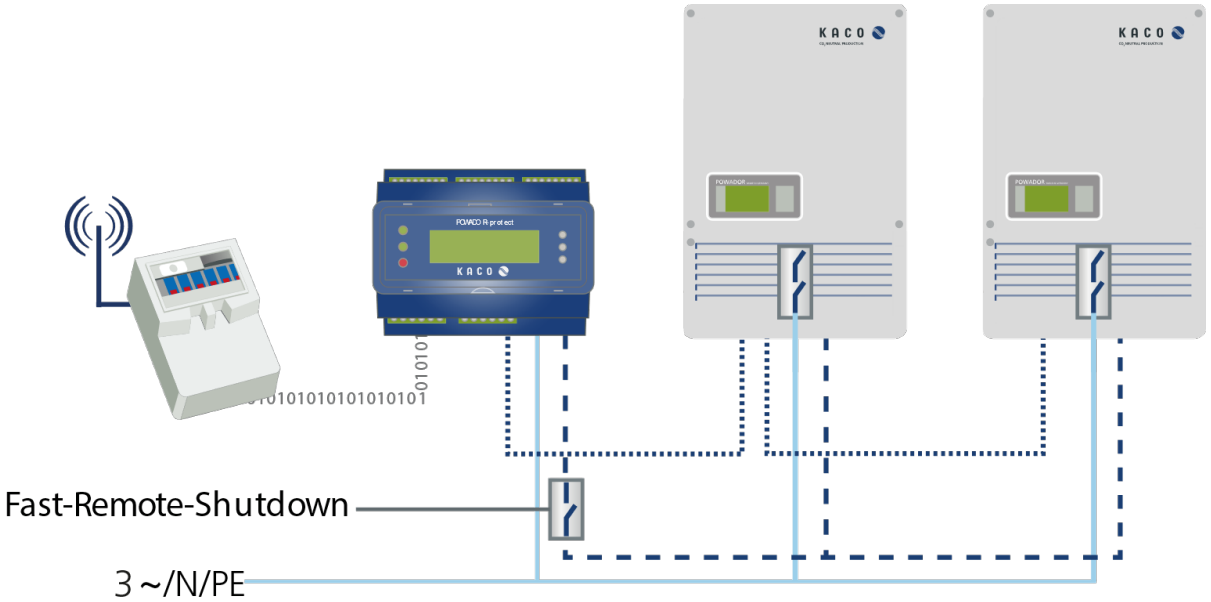
5.5 "Fast remote shutdown" with compatible KACO inverters

Where applicable, with large PV systems an option for fast remote shutdown by the grid operator is required in addition to the remote-controlled power reduction based on the situation in the upstream grid.

An additional, externally actuated normally closed contact can be installed between Powador-protect and the first inverter in the cable that transmits the "inverter off" digital signal.

The interface switches in the inverters can trip within 20 ms and offer a time and thus a safety advantage compared to large interface switches or remote-controlled power reduction.

Figure 8. "Fast remote shutdown" with compatible KACO inverters



6 Connection to compatible inverters

All transformer-less inverters with a rated voltage of 230V/400V and which were manufactured in 2013 or later are compatible.

	NOTE
	The digital output can only be used with compatible KACO inverters (see section "Suitability of KACO inverters"). When using devices from other manufacturers or in combination with KACO inverters, interface switches must be used.

6.1 Specifications

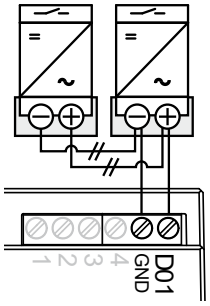
Cable: 2-conductor, e.g. ÖLFLEX® CLASSIC 100

Conductor cross-sections, conductor length and number of inverters connected to the Powador-protect:

l(m)/A(mm²)	0.5	0.75	1	1.5
250	49 inverter	50 inverter	50 inverter	50 inverter
500	24 inverter	36 inverter	49 inverter	50 inverter
750	16 inverter	24 inverter	32 inverter	49 inverter
1000	12 inverter	18 inverter	24 inverter	36 inverter

6.2 Connecting digital input

Figure 9. Connect the Powador-protect digital input to the inverter

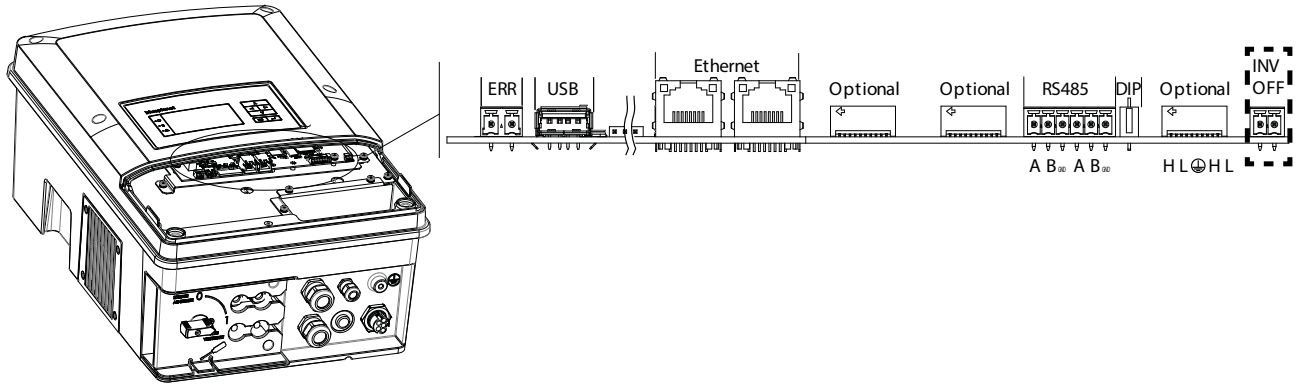


Open housing as directed by the inverter operating instructions.

6.2.1 blueplanet 5.0 - 10.0 TL3

Connection on the PCB in the connection area of the inverter.

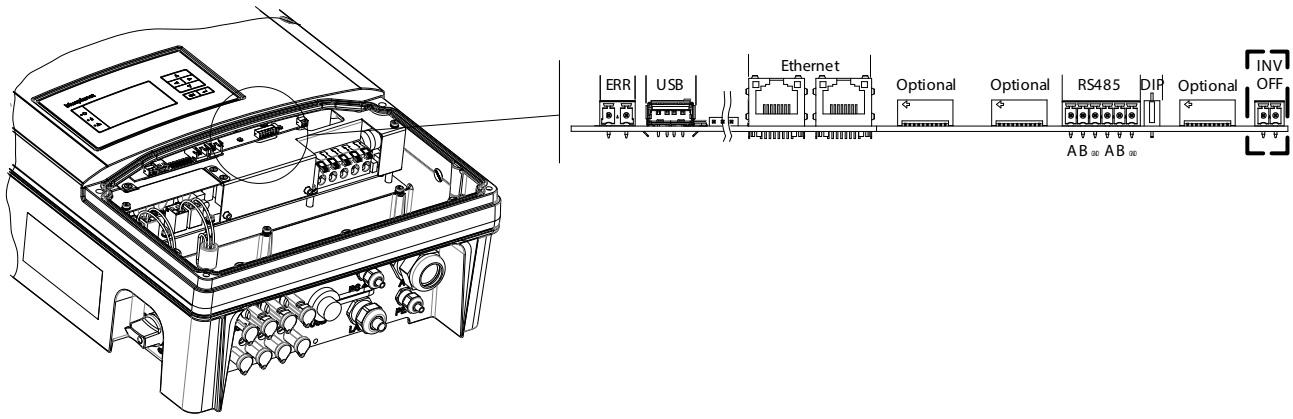
Figure 10. blueplanet 5.0 - 10.0 TL3 PCB



6.2.2 blueplanet 15.0 - 20.0 TL3

Connection on the PCB in the connection area of the inverter.

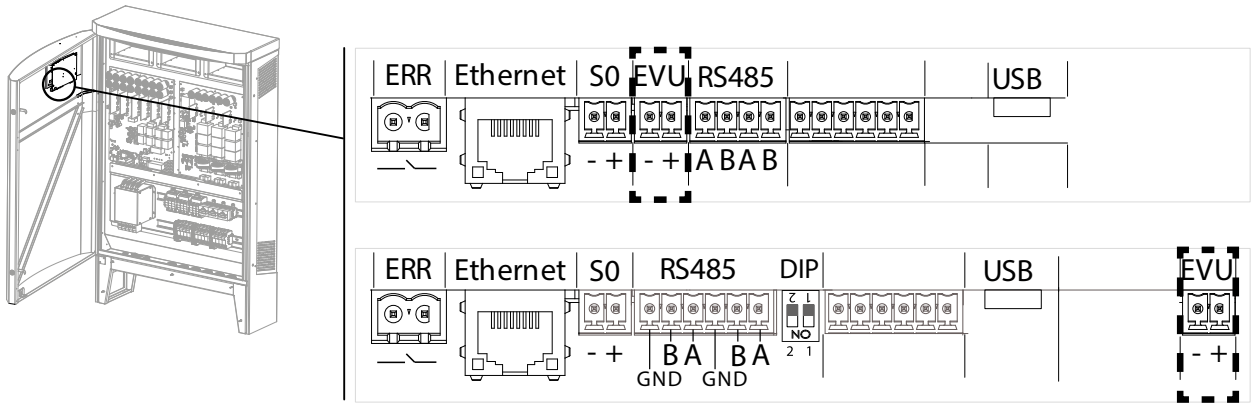
Figure 11. blueplanet 20.0 TL3 PCB



6.2.3 Powador 39.0 – 60.0 TL3

Connection on the PCB inside the door of the housing.

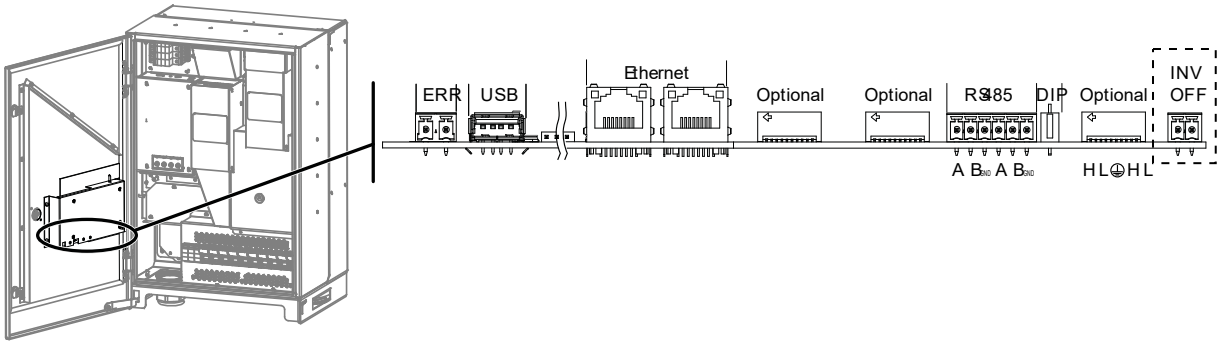
Figure 12. Powador 30.0 - 60.0 TL3 PCBs



6.2.4 blueplanet 50.0 + 60.0 TL3 Basic/M/XL

Connection on the PCB inside the door of the housing.

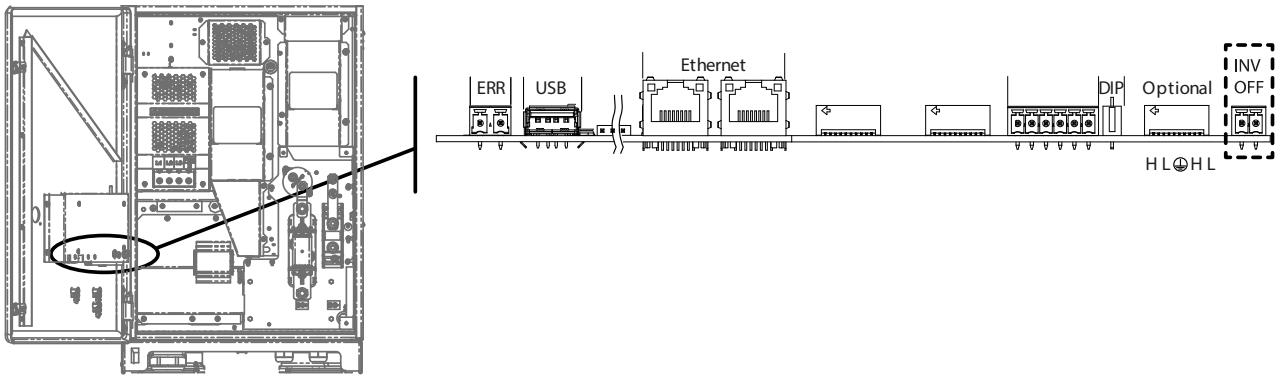
Figure 13. blueplanet 50.0 + 60.0 TL3 PCB



6.2.5 blueplanet gridsave 50.0 TL3-S

Connection on the PCB inside the door of the housing.

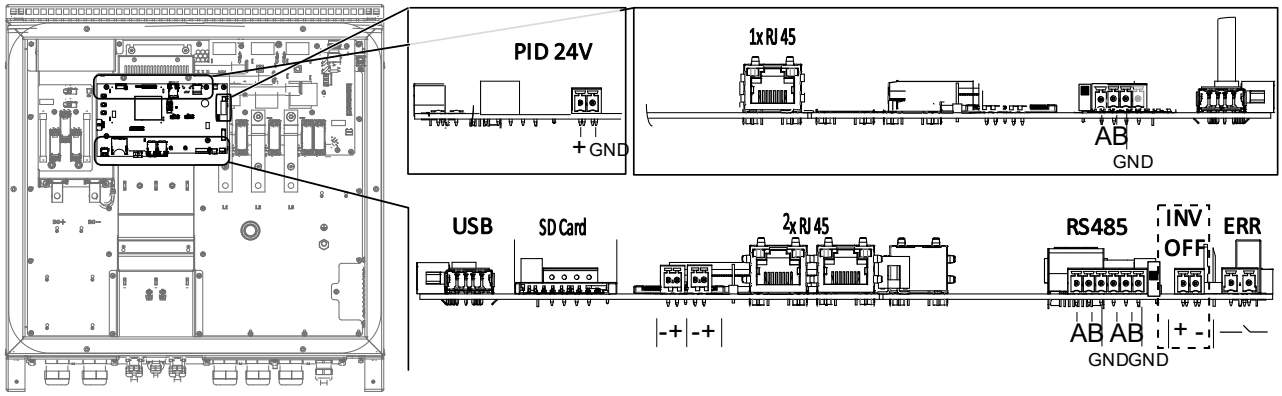
Abbildung 1. blueplanet gridsave 50.0 TL3-S PCB



6.2.6 blueplanet 87.0 – 92.0 TL3

Connection on the PCB inside the housing.

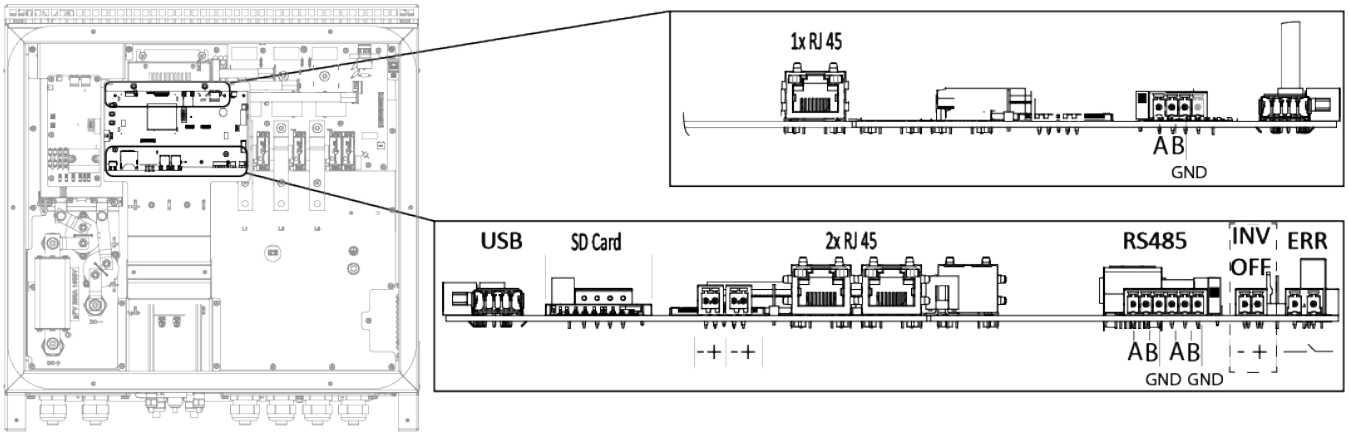
Figure 14. blueplanet 87.0 – 92.0TL3 PCB



6.2.7 blueplanet gridsave 92.0 TL3-S

Connection on the PCB inside the housing.

Figure 15. blueplanet gridsave 92.0TL3-S PCB



7 Activate Powador protect

The digital input of the inverter must be activated to enable the inverter to react to the shutdown signal of the Powador-protect. See the applicable operating instructions for information on the operation of your inverters. The inverters must also be updated to the latest software version beforehand.

The digital input for the relevant inverter is activated in the following steps:

blueplanet 5.0-10.0 TL3 / 15.0 - 20.0 TL3

Open parameter menu.

Go to the "Powador-protect" menu item.

Activate "Auto" mode.

Save the settings.

Powador 39.0-72.0 TL3

Open parameter menu.

Go to the "Powador-protect" menu item.

Activate "Auto" mode.

Save the settings.

blueplanet 50.0 + 60.0 TL3 + blueplanet gridsave 50.0 TL3-S

Open parameter menu.

Go to the "Powador-protect" menu item.

Activate "Auto" mode.

Save the settings.

blueplanet 87.0 – 92.0 TL3 + blueplanet gridsave 92.0 TL3

Open Configuration menu.

Go to the "Features / Functions" menu item.

Open item “External Grid Protection”.

Choose option “Powador-protect” and set operation mode.

Save the settings via “Apply Setting”-Button.

8 Additional information

NOTE

Additional information can be found in the brochure “The low-voltage directive. Part 2. Improved grid integration with low voltage directive and EEG 2012" and in the Powador-protect operating instructions.

These documents can be found in the download area of our website: kaco-newenergy.de.

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