



Manual

Battery Storage Outdoor BSO 50-88/109



Note

This manual contains important safety instructions that must be observed when installing and maintaining the appliance.

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Storage of the Manual

The manual is part of the scope of delivery of the product and must be available at all times. The manual must always be included with the device, even if it is transferred to another user or to another area.

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Foreword

Structure of this Manual

Please read the manual carefully before installation, operation or maintenance. This manual contains important safety information and installation instructions that must be followed when installing and maintaining the appliance.

Scope of Application

This manual describes the installation, electrical connections, commissioning, maintenance and troubleshooting of the Battery Storage Outdoor (BSO 50-88/109).

Keep this manual in a place where it is accessible at all times.

Target Group

This manual is intended for qualified electrical technicians who are responsible for the installation and commissioning of the Battery Storage Outdoor with all the necessary components, as well as for the operator of the Battery Storage Outdoor.

Symbols Used

This manual contains information on safe operation and uses symbols to ensure the safety of persons and property. Please read the instructions and explanations of the symbols in the manual completely before installing and commissioning the Battery Storage Outdoor. If you have any questions, please contact Pramac Storage Systems GmbH immediately for advice and instructions.

DANGER

Danger indicates a warning which, if ignored, will lead directly to death or serious injury.

WARNING

Warning indicates an instruction which, if ignored, can lead directly to death or serious injury.

CAUTION

Caution indicates a hazardous situation which, if not avoided, may result in minor or moderate injury.

NOTE

Note draws attention to potential risks which, if not avoided, can lead to device faults or damage to property.



REMARK

Remarks provide tips that are valuable for the optimal operation of the product.

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1 Basic Safety Information

1.1 General Safety Instructions for Handling the Battery Storage Outdoor

DANGER

Read the safety instructions in this manual carefully, otherwise serious injury or death may result.



REMARK

If you have any questions or problems, read the following information and contact Pramac Storage Systems GmbH.

DANGER

Batteries supply electricity and can explode or become a fire hazard if short-circuited or incorrectly installed.

DANGER

Dangerous voltages are present at the battery terminals and cables. Contact with the cables and poles can result in serious injury or death.

WARNING

Please do not open or technically modify the battery module.

WARNING

Wear suitable personal protective equipment (PPE) such as rubber gloves, steel-toed safety shoes and safety goggles when working on the battery.

WARNING

Temperature range of the Battery Storage Outdoor BSO 50-88/109:

Permissible ambient temperature: -20 °C ... +50 °C

Only operate the BSO within the ambient conditions described in the technical data in order to ensure proper operation in the long term.

CAUTION

Improper settings or maintenance can permanently damage the battery.

CAUTION












Incorrect inverter parameters lead to premature ageing of the battery.









NOTE

Please clarify the technical connection requirements with the responsible energy supply company and obtain approval before installation and commissioning.

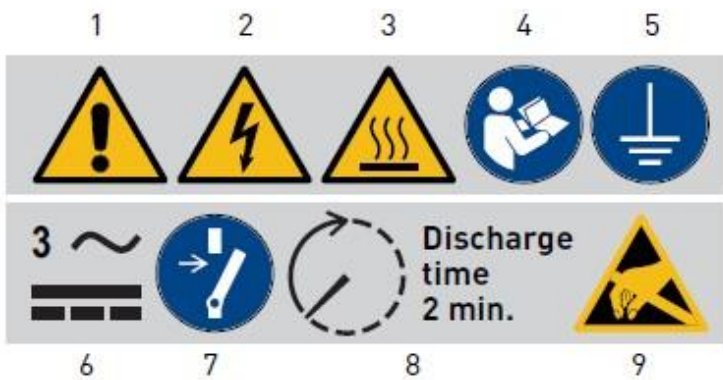
1.2 Symbols

The following symbols and information can be found on the type plate of the BSO:

	<p>See also the external checklists, data sheets and operating instructions for the individual main components.</p>
	<p>Danger! Warning!</p>
	<p>Caution, risk of electric shock!</p>
	<p>There is residual voltage in the inverter! Before opening the appliance, the operator should wait 2 minutes to ensure that the capacitor is completely discharged.</p>
	<p>Do not set up near flammable material!</p>
	<p>Caution, hot surface!</p>
	<p>Beware of hand injuries!</p>
	<p>The positive and negative poles must not be interchanged.</p>
	<p>Do not place near naked flames.</p>
	<p>Do not place in areas accessible to children and pets.</p>
	<p>Earthing point</p>

	<p>LTE connection</p>
	<p>This indicates the permissible temperature range.</p>
	<p>Recycling label</p>
	<p>Symbol for the Waste Electrical and Electronic Equipment (WEEE) Directive (2012/19/EU)</p>
	<p>Mark for EU conformity (Conformité Européenne)</p>
	<p>Sign for UK conformity</p>
	<p>Safety certificate from TÜV Rheinland</p>
	<p>Safety certificate from TÜV Rheinland for the US and Canadian markets</p>
<p>+ / -</p>	<p>Positive pole / negative pole of the input voltage (DC)</p>




The following symbols and information can be found on the type plate of the battery inverter:



No.	Description
1	General warning
2	Warning: electrical voltage
3	Warning: hot surface
4	Follow instructions before use
5	Earth before use
6	Warning: electrical voltage on the AC/DC side. All strings on the DC side are live.
7	Unlock before maintenance or repair
8	Discharge time: two minutes
9	Warning: device is susceptible to electrostatic discharge

1.3 Tools Required

The following tools are required to set up, assemble and install the BSO:

	Side cutter		Cordless screwdriver with bit set
	Crimping pliers		Adjustable spanner
	Cable ties		1,500 VDC insulating socket spanner set
	Screwdriver set		Multimeter CAT III 1,000 V
<p>Additional utensils and auxiliary tools are required to transport the BSO:</p> <ul style="list-style-type: none"> • Crane with suitable lifting gear <p>Alternative:</p> <ul style="list-style-type: none"> • 3 tonne forklift incl. driver • Forklift forks with a maximum height of 5 cm 			

CAUTION

Observe the 5 safety rules and only use properly insulated tools to avoid accidental electric shocks or short circuits.

1.4 Protective Equipment

WARNING

It is recommended to wear the following safety equipment when working with the BSO:

	<p>Voltage insulating gloves</p>		<p>Safety goggles</p>		<p>Steel toed safety shoes</p>
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WARNING

When installing and replacing battery modules, battery inverters or air conditioning units during service and maintenance work, a second assisting person with suitable equipment must always be called in.

1.5 Installation Conditions

The Battery Storage Outdoor BSO 50-88/109 is a lithium battery storage system with an integrated battery inverter. The components are manufactured in accordance with the current state of the art and applicable product-specific standards.

The Battery Storage Outdoor is only approved for operation with the integrated Pramac 50K-PC or 88K-PC battery inverter. Any other use must be agreed with the manufacturer and, if necessary, the local energy supplier.

CAUTION

- The Battery Storage Outdoor may only be installed and operated outdoors.
- The operating temperature range and the maximum permissible humidity can be found in the technical data.
- The BSO must not be installed in corrosive atmospheres (in accordance with ISO 12944 corrosivity category C3 – urban and industrial atmospheres with moderate sulphur dioxide pollution and not near the sea).
- When installing the BSO, it must be ensured that the system is mounted on a sufficiently dry, load-bearing, horizontal and level surface (inclination ≤ 0.5 %).
- Once the Battery Storage Outdoor has been installed at its designated location, it must not be moved. The maximum altitude of the installation site is 2,000 metres above sea level. Higher altitudes require the written approval of the manufacturer.
- Installation in the immediate vicinity of fire loads is prohibited.
- Furthermore, when installing in flood-prone areas or in topographical depressions, ensure that the Battery Storage Outdoor is always installed in an elevated position and protected from contact with water.
- It must be ruled out that an external mechanical overload can occur, e.g. collision with vehicles or falling trees.
- The operator is obliged to include the Battery Storage Outdoor in his risk analysis in accordance with DIN EN 62305-2 in order to take any necessary structural measures (e.g. impact protection / bollards etc.).
- It must also be ensured that the Battery Storage Outdoor is only opened by trained and instructed specialist personnel. The key must only be accessible to authorised persons. Any modifications to hardware and software are prohibited.

NOTE



- Intended use of the BSO 50-88/109 also includes compliance with the information in this manual.

⚠ WARNING

The use of BSO 50/109 or BSO 88/109 is prohibited for the following purposes:

- Mobile use on land, in the air or on water
- For the use of medical devices
- As a UPS system
- Continuous operation with open doors

The battery modules must not be used in potentially explosive atmospheres or installed and operated in areas with high humidity.

⚠ CAUTION

The following points must also be taken into account:

- Do not open, pierce or drop the battery cells or modules.
- Do not expose the battery cells or modules to high temperatures.
- Do not throw the battery cells or modules into a fire.
- In the event of a fire, use a CO₂ fire extinguisher if the fire originates from the battery. In the event of a fire in the vicinity of the battery, an ABC fire extinguisher must be used.
- In the event of an accident, keep your distance; do not open the doors of the BSO.
- Do not use defective or damaged battery modules.

NOTE



The following regulations have been taken into account and must also be observed by the operator:

- DGUV Regulation 3 – Electrical installations and equipment
- DIN VDE 0105-100 – Safe operation of electrical installations
- State building regulations
- VDE-AR-E 2510-50 – Stationary battery energy storage systems with lithium batteries – Safety requirements
- VDE-AR-E 2510-2 – Stationary electrical energy storage systems intended for connection to the low voltage grid

Recommended Minimum Distances

Minimum distance	Front/back to next BSO	1,80 m
	Front/back to the wall	1,80 m
	Side (door side) to next BSO/to the wall	1,80 m
	Side (doorless side) to next BSO (doorless side)/to the wall	0,80 m


1.6 Checklist BEFORE Commissioning

NOTE



- B2B Pre-Commissioning Checklist for BSO 50-88/109
- The checklist must be completed, signed and sent to info.pss@pramac.com before commissioning.

Extract from B2B Pre-Commissioning Checklist for BSO 50-88/109:

ID	Requirement	Description	Comment	Tested
01	The foundation has been laid in accordance with the current foundation plan.			<input type="checkbox"/>
02	The connection to the ring earthing of the foundation is available.			<input type="checkbox"/>
03	AC main supply 3P/PE/N for TNS network or 3P/PEN for TNC network is available at the connection point.	<ul style="list-style-type: none"> • Max cross-section at AC terminals: M8×70 mm² • Max cross-section on PEN rail: M8×70 mm² 		<input type="checkbox"/>
04	AC supply line fuse protection with max. 100 A for the 50K-PC and max. 160 A for the 88K-PC variant are available at the grid connection point.			<input type="checkbox"/>
05	Free network access line (customer LAN) is available at the connection point.	The Pramac Smart Energy Controller (PSEC) requires permanent internet access		<input type="checkbox"/>
05a	Alternative: Router incl. data sim card available.	Router can be ordered as an optional accessory		<input type="checkbox"/>
06	An interface for integrating the meter data is available at the connection point.	Integration of the energy meter either via RS485 (2-wire) to the Link B connection of the PSEC or via Ethernet via switch.		<input type="checkbox"/>
07	The installation site is accessible for lorries and forklifts.	Paved access roads, no kerbs, etc.		<input type="checkbox"/>
08	A 3 tonne forklift including driver is on call for unloading and installation.	 REMARK For stacker fork thickness see transport section of the foundation drawing		<input type="checkbox"/>
08a	A crane with suitable lifting equipment is available	For setting up the BSO with crane, see foundation and crane drawing		<input type="checkbox"/>
09	Suitable current transformers for energy meters are available at the connection point.	No current transformers are included in the scope of delivery		<input type="checkbox"/>
10	Suitable fixing material (suitable for the foundation and installation site) is available.	See foundation drawing: 8× mounting holes 16 mm		<input type="checkbox"/>
11	Make sure that the weather is mild during assembly and commissioning!			<input type="checkbox"/>
12	Check delivery for completeness.			<input type="checkbox"/>
13	Check compatibility with existing generation systems.			<input type="checkbox"/>
14	Provision of access authorisation for assembly personnel	If necessary		<input type="checkbox"/>

1.6.1 Requirements for the Foundation

Foundation according to the following foundation plan:

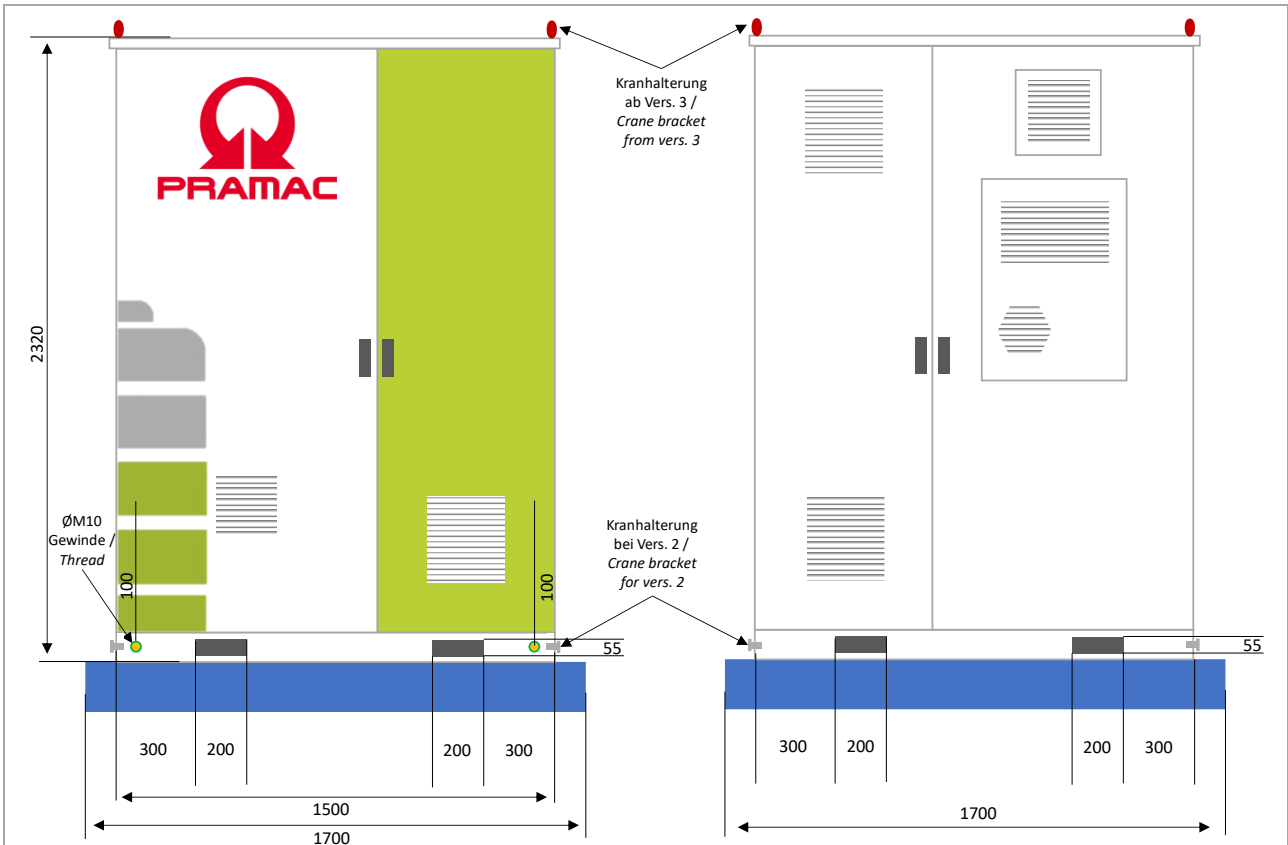


Figure 1-2: Front and rear view of foundation

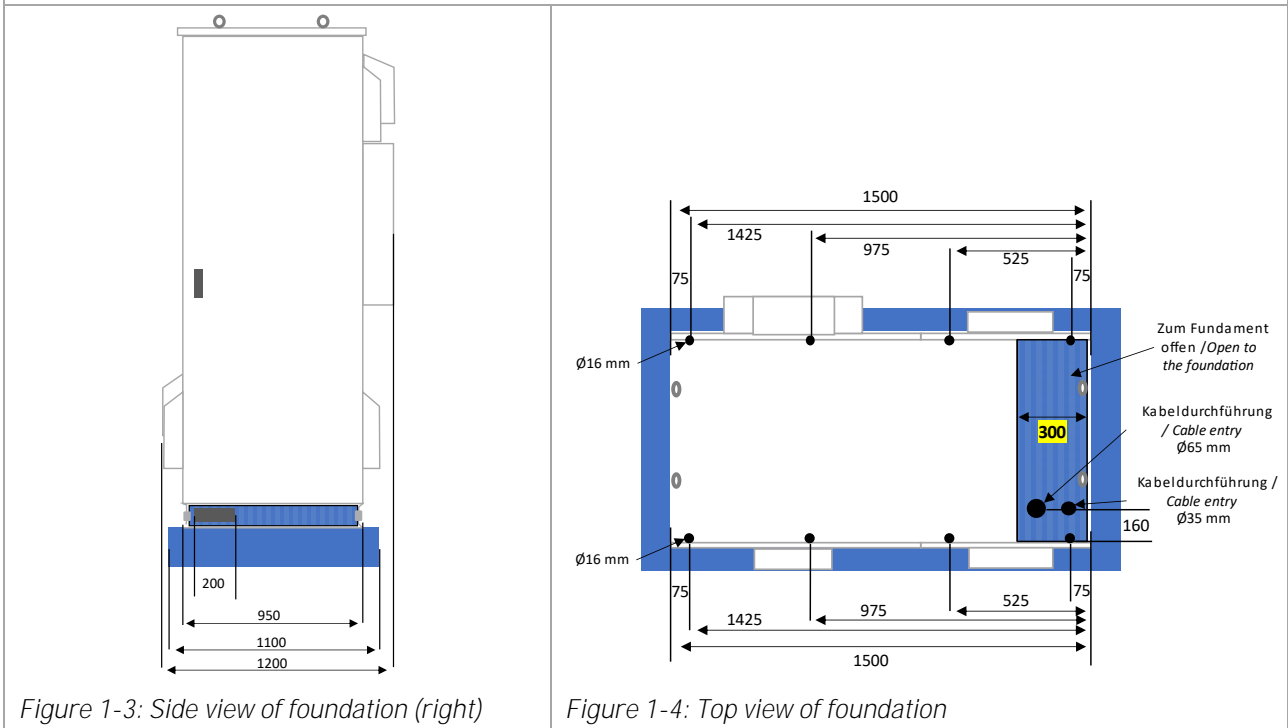


Figure 1-3: Side view of foundation (right)

Figure 1-4: Top view of foundation

▶ REMARKS

- The illustrated drawing views are for reference only.
- The foundation of the outdoor enclosure must be made of reinforced concrete at least 200 mm thick. The top of the foundation is levelled. The embedded parts of the foundation, such as cable entries etc. must be positioned precisely. The difference between the highest and lowest embedded part of the foundation must not exceed 3 mm.
- The specific, accurate detailed drawings must be prepared by specialists. The load-bearing construction depth must be determined according to the local circumstances and must fulfil the requirements of the national regulations for seismic vibrations up to a magnitude of 8.
- The total weight of the product (including cabinet) is approximately 2,100 kg.
- The inlet and outlet openings on the lower part of the outdoor enclosure must be sealed with suitable material in accordance with protection class IP54 after connecting the supply cables.
- The supply cables for the outdoor enclosure can be laid in empty conduits in the upper part of the foundation to avoid a poor cable connection.

1.6.2 Transport Requirements

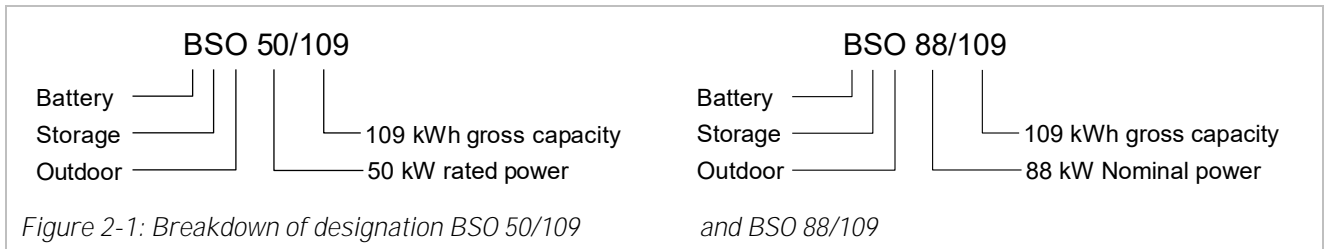
If you notice any packaging problems that could lead to damage to the components, or if you notice any visible damage, please inform the responsible transport company immediately. If necessary, you can ask the distributor or Pramac Storage Systems GmbH for help. Proper and safe transport of the device, especially by land, must be carried out in a suitable manner and by suitable means in order to protect the components (especially the electronic components) from heavy impact/shocks, moisture, vibrations, etc.

▶ REMARK

- The battery modules already installed must not be exposed to high ambient temperatures.
- The permissible storage temperature range is between -20 °C and +60 °C.

2 Overview of Battery Storage Outdoor

This chapter presents the individual components of the Battery Storage Outdoor.



2.1 Component Overview

The compact All-in-One Battery Storage Outdoor BSO 50/109 or BSO 88/109 with an output of 50 kW or 88 kW and a capacity of 109 kWh is already fully equipped on delivery.

The BSO is divided into 2 areas:

- Left-hand battery area, in which up to 23 battery modules, a battery management system (BMS) and various safety devices (e.g. fire protection device, CO and H₂ sensor) are installed
- Rear air conditioning unit

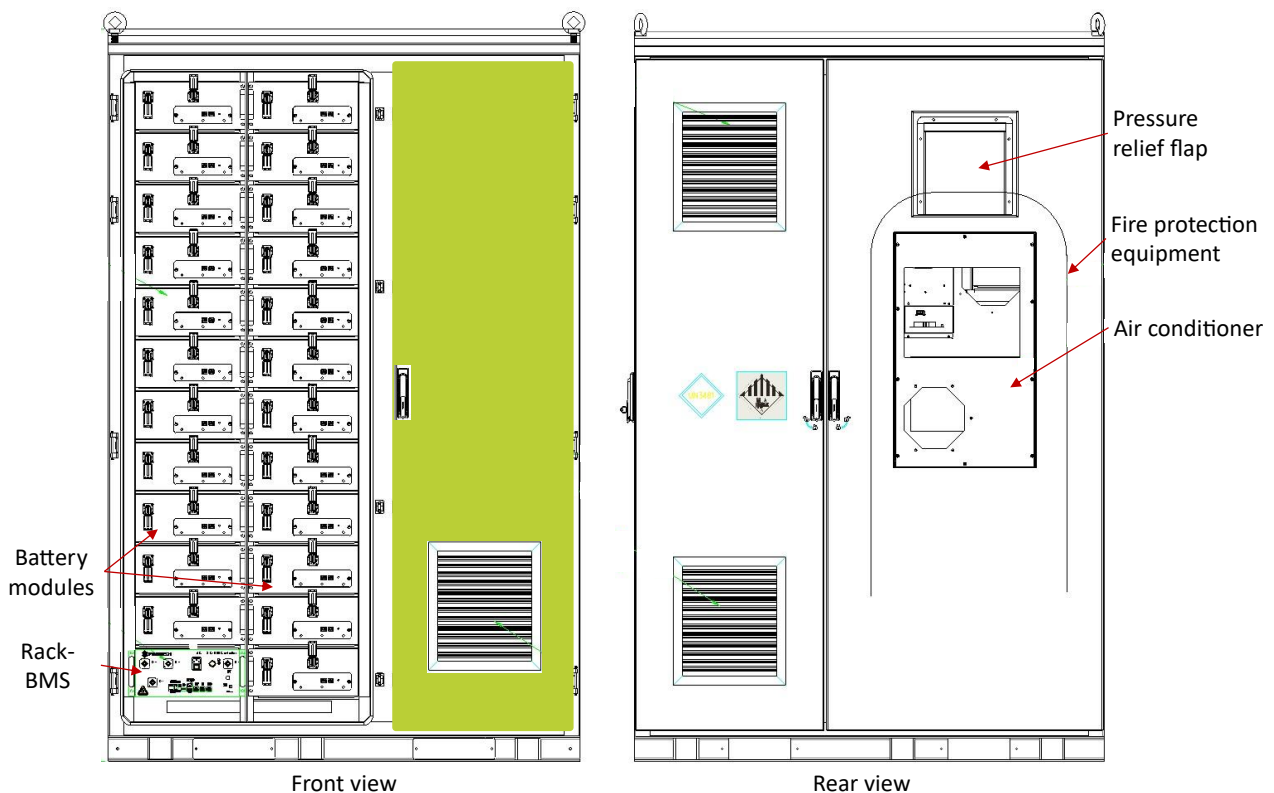


Figure 2-2: System overview: Battery area

The power unit, the PBI 50K-PC or PBI 88K-PC battery inverter, is located in the separate right-hand section of the BSO. The AC connection terminals, the AC disconnect switch and the fuses and terminals for the individual internal loads are located in the lower section.

The connection of the BSO is described in detail in "Chapter 3.3.2 Connection of the AC Supply Line".

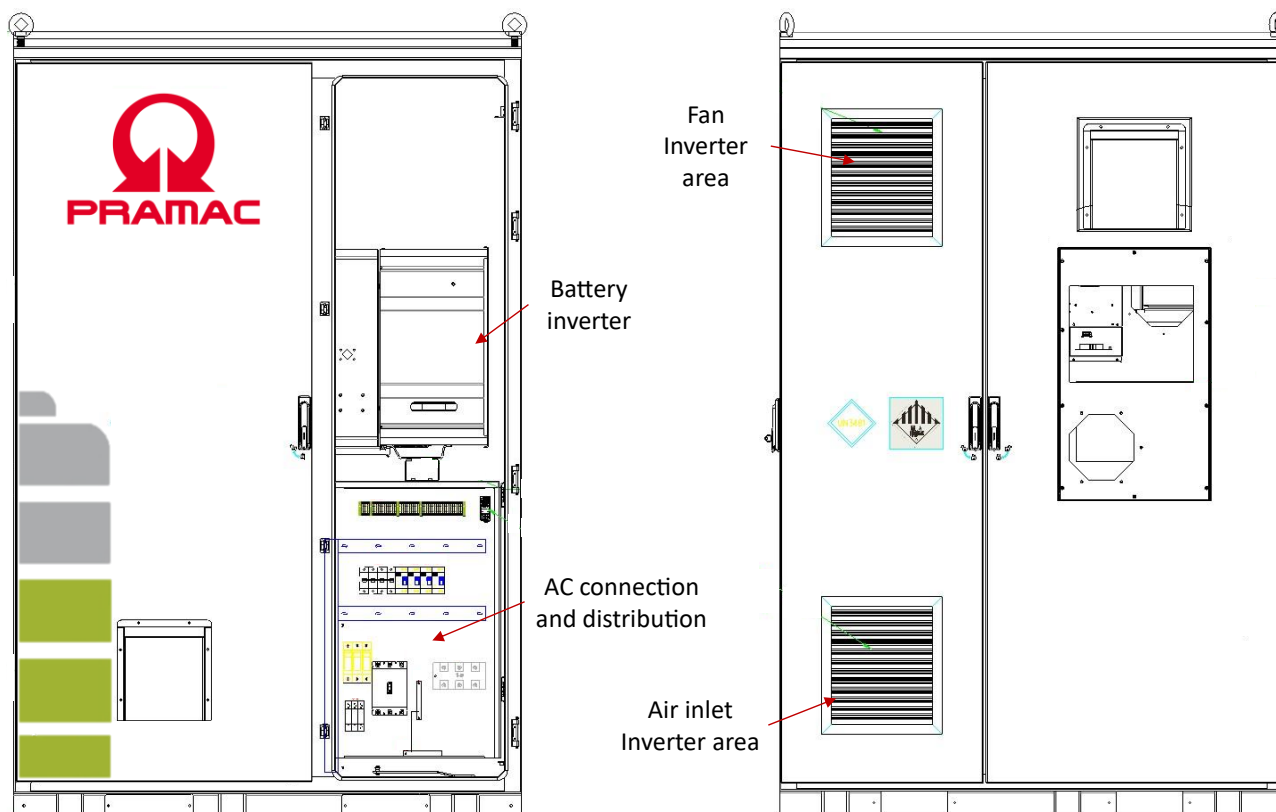


Figure 2-3: System overview: Inverter area

The control panel of the battery inverter is located behind the side door on the right. A 230 V service Schuko socket and the 24 VDC power supply unit are installed in the lower area. Next to it is a switch and the Pramac Smart Energy Controller (PSEC). Alternatively, an LTE router can be installed here for an independent internet connection. The configuration of the PSEC is described in detail in "Chapter 4.6 Commissioning the Pramac Smart Energy Controller (PSEC)".

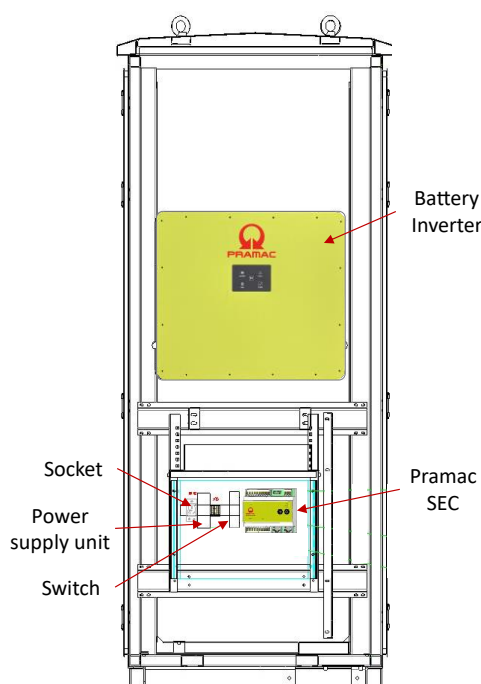


Figure 2-4: Overview of the inverter area

The BSO 50-88/109 are lockable and can be opened from 3 sides (see "Figure 2-3: System overview: Inverter area"). The universal keys included in the accessory pack are suitable for all doors.

If required, the locking cylinders of the individual doors can be replaced with your own keys and locking cylinders.

The keys for the first opening of the system are located on the base at the front (see "Figure 3-3: Foundation earthing and key").

⚠ CAUTION

After replacing the locking cylinders, make sure that the BSO is clean, tightly sealed, and can be locked. New keys must be stored by the operator and protected against unauthorised access.

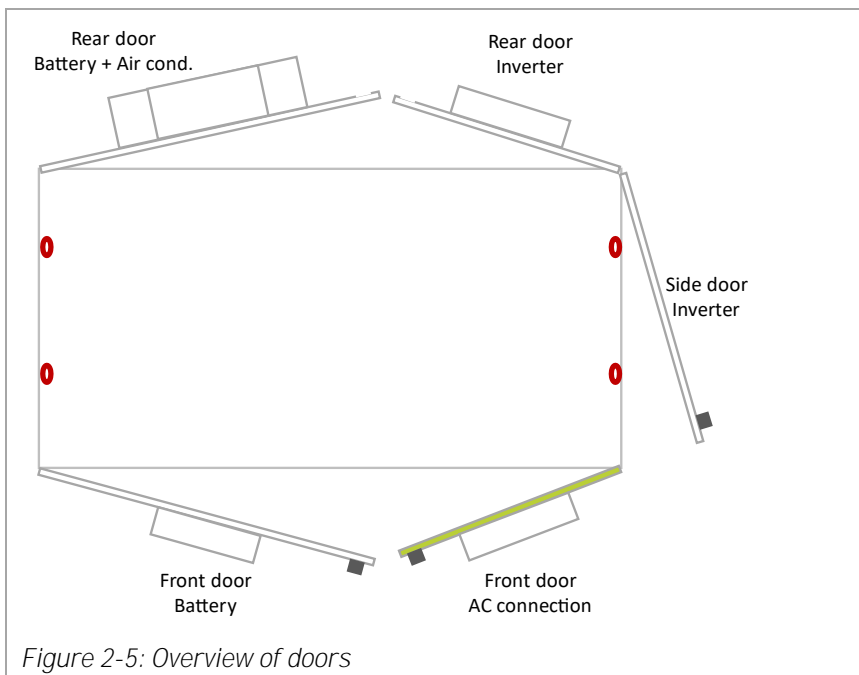


Figure 2-5: Overview of doors



Figure 2-6: Locking cylinder

The doors of the BSO have a mechanical stop for an opening angle exceeding 90° and can be locked at the foot end. To close the doors, a latch must be lifted over the guide rail.

An energy meter is also included in the accessory box. An optional industrial router can be ordered if the customer cannot provide an internet access point. Compatible current measuring transformers can be ordered as an option.

The accessory box contains the following components:

- 4× cover plate for base
- 8× M5 screws for base cover plate
- 4× key
- 46× rubber grommets for battery modules
- 1× remote control for CO and H₂ sensor
- Manual for battery inverter PBI 50K-PC / 88K-PC
- Operating instructions for PowerCube M1C
- Manual for BSO 50-88/109

2.1.1 Safety Devices

Various active and passive safety devices are installed in the Battery Storage Outdoor.

Active devices	
Permanent monitoring of the battery cells	The battery cells are permanently monitored via the battery management system (BMS) and the higher-level energy management system (EMS)
CO sensor	The CO sensor measures the air in the interior on the front of the battery area and signals acoustically and via RS485 if there is an increase in CO concentration.
H ₂ sensor	The H ₂ sensor measures the air in the interior on the front of the battery area and signals acoustically and via RS485 if there is an increase in H ₂ concentration.
Smoke sensor	The smoke sensor measures the air in the interior at the rear of the battery area and signals an increased smoke concentration acoustically and via RS485.
Exhaust fan	The exhaust fan in the front of the battery side is activated when the H ₂ or CO concentration rises and the respective sensor is triggered. The exhaust air fan is active until the CO or H ₂ concentration drops and is within the normal range.
Passive devices	
Pressure relief flap	The pressure relief flap on the back of the battery area is used to ensure correct venting in the event of abrupt pressure changes due to a fire.
Fire protection device with FK-5-1-12	The fire protection device in the form of the extinguishing agent hose on the rear of the battery area can actively inhibit the spread of a fire. The liquid fire retardant is released as a gas when the ambient temperature around the hose is > 90 °C. The fire protection device cannot be activated from outside and caused to burst.

WARNING

- The release of extinguishing agents for firefighting may result in a potential hazard to personnel from the natural form of the agent or from the combustion products generated when the agent is exposed to fire or hot surfaces.
- Any unnecessary risk to personnel from the extinguishing agent or decomposition products must be avoided.
- Do not touch the extinguishing agent hose with pointed or sharp objects, as this may cause the extinguishing agent to be released prematurely.

2.1.2 Data Sheet

Table 2-1: Battery Storage Outdoor data sheet

TECHNICAL DATA – Battery Storage Outdoor		BSO 50-88/109	
Gross capacity		109 kWh	
Net capacity (90 % DoD)		98 kWh	
Nominal voltage		736 VDC	
Max. charging/discharging current		148 A	
Cell type		Li-Ion (LFP) Pouch	
Cycles (90 % DoD 65 % SoH 0.5 C/0.5 C 25 °C)		7,300 cycles	
BATTERY INVERTER		BSO 50/109	BSO 88/109
Rated power		50 kW	88 kW
Nominal voltage		380 / 400 / 415 VAC	
Maximum AC current		128 A	
THDi		< 3 %	
AC power factor / range		1 / 0.3i ... 0.3c	
Max. Efficiency		98.6 %	
Topology		Inverterless	
SAFETY EQUIPMENT SYSTEM		BSO 50-88/109	
Safety devices	Active devices	Permanent monitoring of the battery cells	
		CO sensor	
		H ₂ sensor	
		Smoke sensor	
		Exhaust fan	
	Passive devices	Extinguishing device with FK-5-1-12	
		Pressure relief flap	

Table 2-2: General data – Battery Storage Outdoor

GENERAL DATA		BSO 50-88/109	
AC mains connection		3P, PE / TT, TN-C, TN-S	
Nominal frequency		50 Hz	
Permissible ambient temperature		-20 ... +50 °C *	
Humidity, RH		5 ... 95 %, non-condensing	
Cooling-/heating concept	Battery compartment	Cooling capacity 2 kW / heating capacity 1 kW	
	Inverter room	Forced air cooling	
Dimensions (WxDxH)		1,500x1,108x2,320 mm	
Weight: Total incl. batteries and inverter		2,100 kg	
Protection class		IP65 (battery compartment) / IP54 (inverter compartment)	
Max. permissible installation height		3,000 m	
Corrosion resistance of the housing		C3	
Noise emissions at distance of 1 m		68.0 dB(A)	
Housing colour		RAL 9016 / Pantone 382	
Interfaces		RJ45 (Ethernet)	
Certificates / Permits	Battery Storage Outdoor		CE / UN 38.3 / UN 3481 / IEC 62619 / IEC 63056 / UL 1973 / UL 9540A / VDE 2510-50 / EN 61000-6-2 / EN 61000-6-4
	Battery inverter	EU directives	2014/30/EU, 2014/35/EU, 2011/65/EU
		Product	IEC 62109-1 / IEC 62109-2 / IEC 62116 / IEC 61727 / IEC 62477-1 / IEC 61439-1 / IEC 61439-2 /
		Grid connection conditions	DIN VDE V 0126-1-1 / VDE AR-N 4105:2018 / VDE AR-N 4110:2018 / TOR Type A producer / UTE C15-712-1 VFR 2019 / G99 / EN 50549-1/-2
* The power of the PBI 88K-PC battery inverter is reduced from an ambient temperature of 33 °C.			

Warranty	5-year product warranty * 10-year performance guarantee
<p>* The following table is based on:</p> <ul style="list-style-type: none"> • 90 % DoD and an operating temperature range between +10 °C and +40 °C in a maximum of 10 years or • The achievement of the defined cycles, whichever occurs first. 	

SOH % of nominal energy	≤ 0.5 C-rate	≤ 1 C-rate
≤ 3,650 cycles	75 %	70 %
≤ 5,475 cycles	70 %	65 %
≤ 7,300 cycles	65 %	60 %

2.2 Overview: Connecting External Components

The following illustration describes the layout and the components to be provided by the customer:

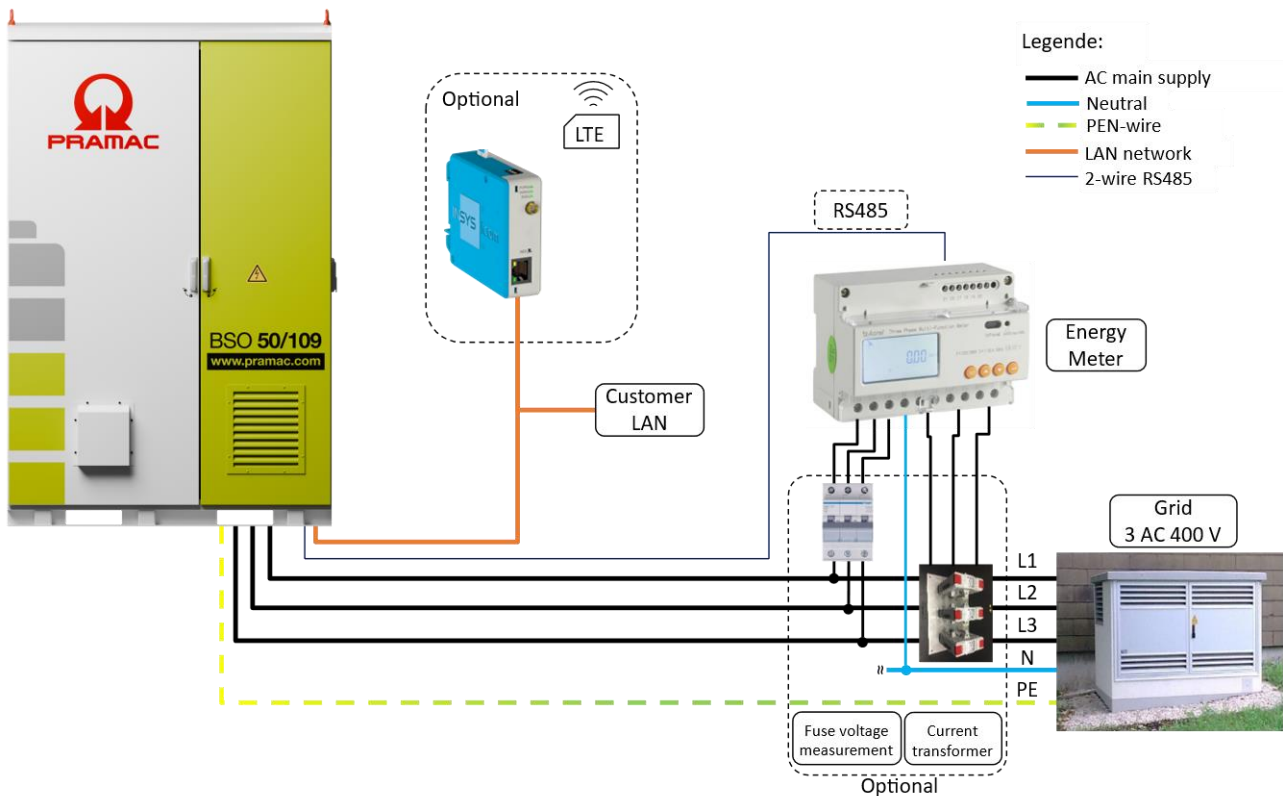


Figure 2-7: Overview of components



REMARK

To operate the Battery Storage Outdoor correctly, the customer must provide an AC connection (TN-C / TN-S).

A meter (energy meter) with voltage and current measurement must be installed at the grid connection point (NAP).

An energy meter is included in the scope of delivery (without fuse for voltage measurement and without transformer for current measurement). Furthermore, a suitable internet connection must be established. The EMS (PSEC) and the battery inverter require a permanent internet connection.

In addition to an accessible mounting surface, the following components and installations must be provided by the customer in advance (see Chapter "1.6 Checklist BEFORE Commissioning").

- The foundation has been laid in accordance with the foundation plan.
- AC supply line to the Battery Storage Outdoor incl. suitable fuse protection is available.
- Local IT network or LTE router for internet connection of the EMS (PSEC) to the portal <https://portal.pramac.energy>.
- Suitable instrument transformers for correct integration of the energy meter, including fuse protection for voltage measurement.

3 Installation of the BSO 50-88/109

This chapter describes the installation of the Battery Storage Outdoor.

NOTE



- The Powercube M1C battery rack is from the manufacturer Pylontech
- Battery inverters from Pramac Storage Systems GmbH

3.1 Before Installation

Before installation, check that all points from the B2B pre-commissioning checklist (see Chapter "1.6 Checklist BEFORE Commissioning") are fully met and completed.

⚠ WARNING

Ensure that there is no damp weather during installation and commissioning.

3.2 Assembling the Battery Storage System

Carry out assembly as follows:

1. Place the Battery Storage Outdoor on the prepared foundation using a 3 tonne forklift truck (or alternatively a crane) and then mark the 8 attachment holes. The attachment holes have a diameter of 16 mm.

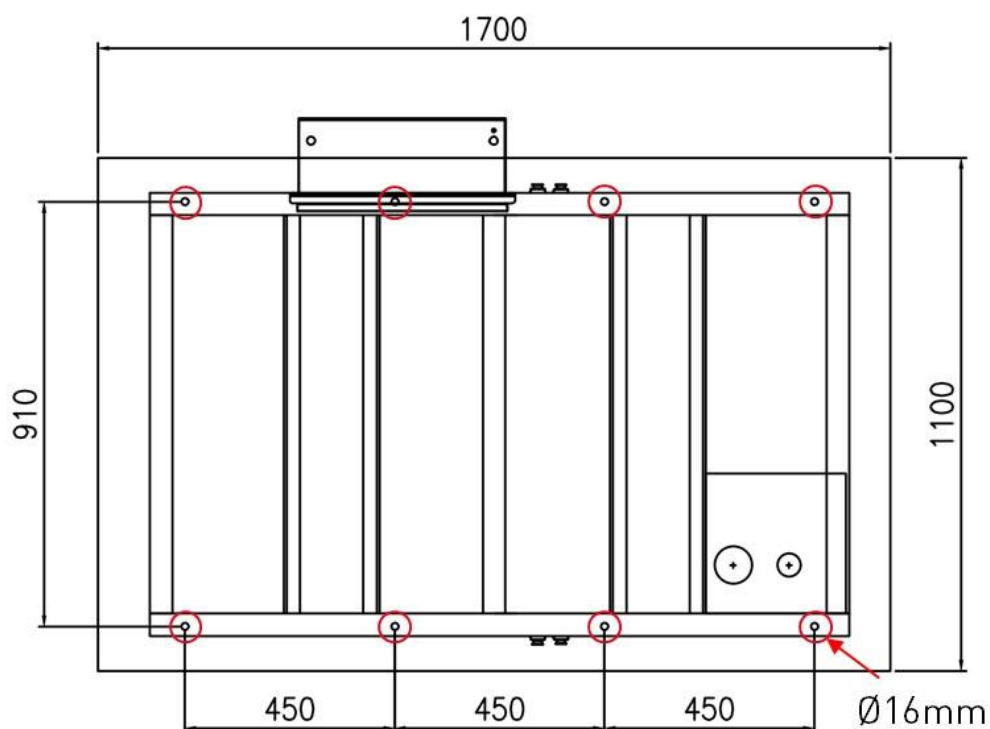


Figure 3-1: Mounting on foundation

2. The Battery Storage Outdoor can be securely fastened with ≥ 4 fastening bolts. The following figure illustrates a possible fastening bolt:

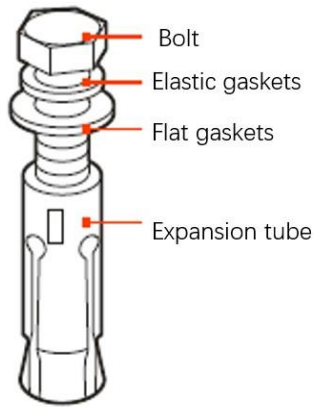


Figure 3-2: View of fastening bolts

3. Lift the BSO away from the foundation when drilling the holes. Insert the fastening bolts with a hammer. Now place the BSO back over the bolts on the foundation.
4. Insert the cable feed lines (AC supply line, network cable, communication cable to the meter).
5. Fasten the BSO with the nuts of the bolts.

NOTE

Install the BSO horizontally!

6. Cover the recesses of the fork openings in the base of the BSO with the enclosed transport covers and screws.

3.3 Electrical Connection of the BSO

⚠ WARNING

To connect to the AC power supply network, authorisation must be obtained in advance from the local energy supply company (EVU).

⚠ WARNING

Assembly, installation and initial commissioning may only be carried out by a trained electrician.

⚠ WARNING

The appliance must first be earthed and connected to the potential equalisation rail in the cabinet through the PE/PEN of the main supply line.

When connecting the BSO electrically, the following points should be checked and observed in accordance with the 5 safety rules:

- Ensure that the product cannot be switched on accidentally!
- Before switching on, use a multimeter to ensure that there are no short circuits or open circuits inside the product.
- Cover and insulate neighbouring, possibly live parts of the equipment.
- Ensure that escape routes are not blocked during maintenance and repairs.

3.3.1 Connecting the Foundation Earth Electrode

The ring earthing of the foundation earth electrode can be connected at the marked connection points of the BSO. The connections are equipped with an M10 thread. The cable cross-section may vary depending on the customer and must be determined by a qualified electrician.

NOTE

After connecting the earthing, carry out a recorded earthing measurement.

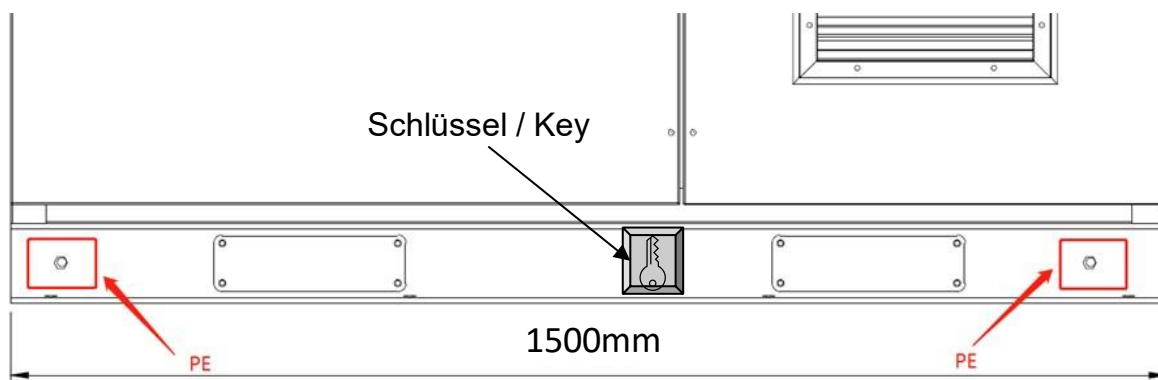


Figure 3-3: Foundation earthing and key

3.3.2 Connection of the AC Supply Line

⚠ WARNING

When connecting the AC supply cable from L1 to L2 to L3, ensure that the field of rotation is clockwise.

The AC feed line 3P/PEN to the BSO must be provided by the customer and must be fused with max. 100 A (BSO 50/109) or max. 160 A (BSO 88/109).

NOTE

The cable material must be copper (CU).

If the system is started with a 3P/N/PE (TN-S) mains supply line, the black cable jumper between N and PE must be removed from the respective connection rails.

The AC supply line is fed through the rubber grommet at the bottom of the BSO. To do this, slightly score the rubber grommet so that the supply line can be fed through. The connection is made to the AC terminal strip "TC". The maximum permissible cable cross-section of the AC terminal strip is $M8 \times 70 \text{ mm}^2$. The designation of the cores is described by U = L1 / V = L2 / W = L3. The maximum cable cross-section of the PE/PEN conductor on the PE rail is $M8 \times 70 \text{ mm}^2$.

A torque of 17 ... 20 Nm must be observed for the AC connections and the PE/PEN connection.

NOTE

Tighten the AC connections as well as the PE/PEN connection with a socket spanner (SW13).

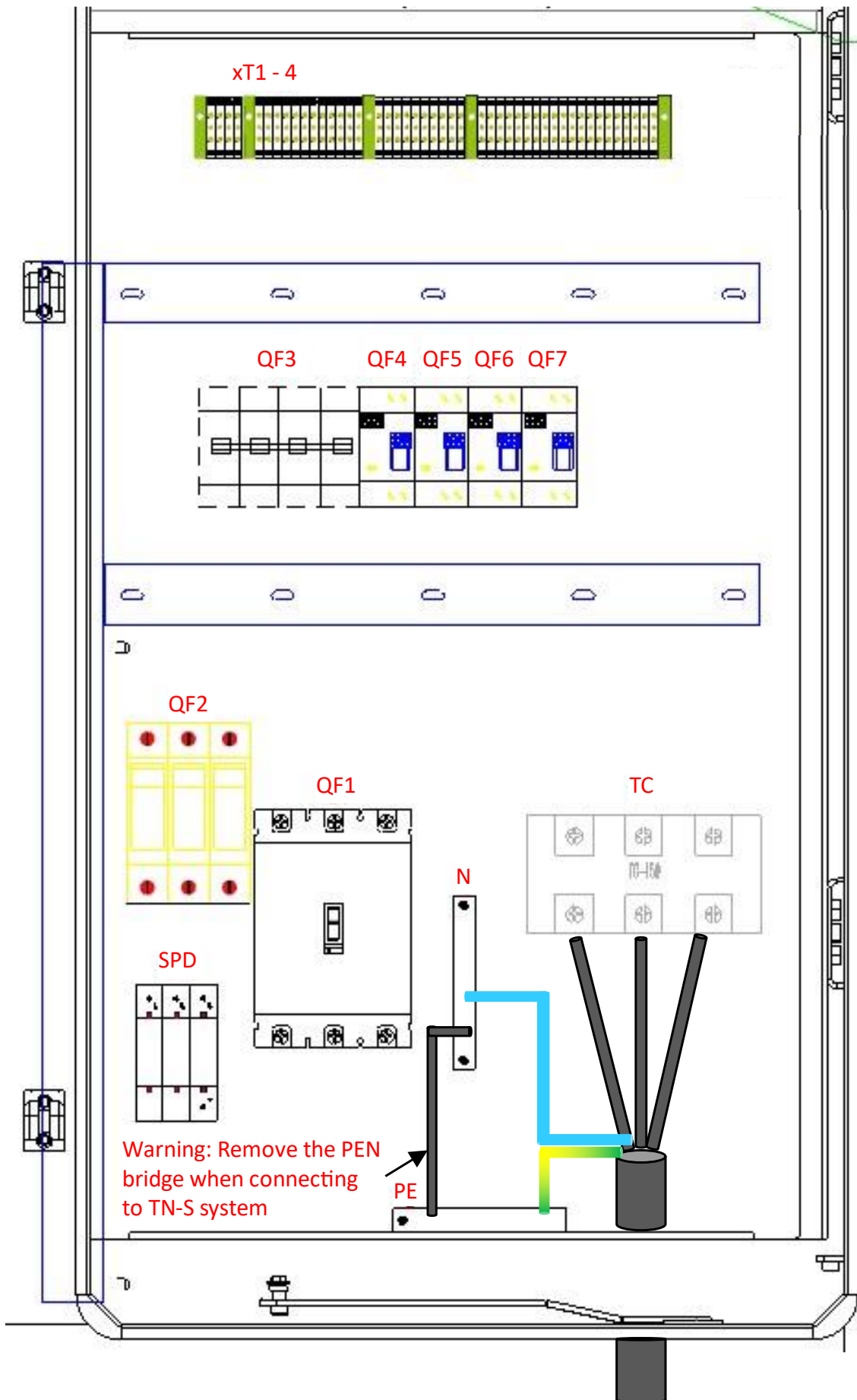


Figure 3-4: AC supply line connection

3.3.3 Connection of the Battery String

⚠ WARNING

When connecting the battery power cables (DC+ and DC-), ensure that there is no short circuit or polarity reversal to avoid injury.

⚠ WARNING

Ensure that the external communication cables are laid in an EMC-compliant manner.

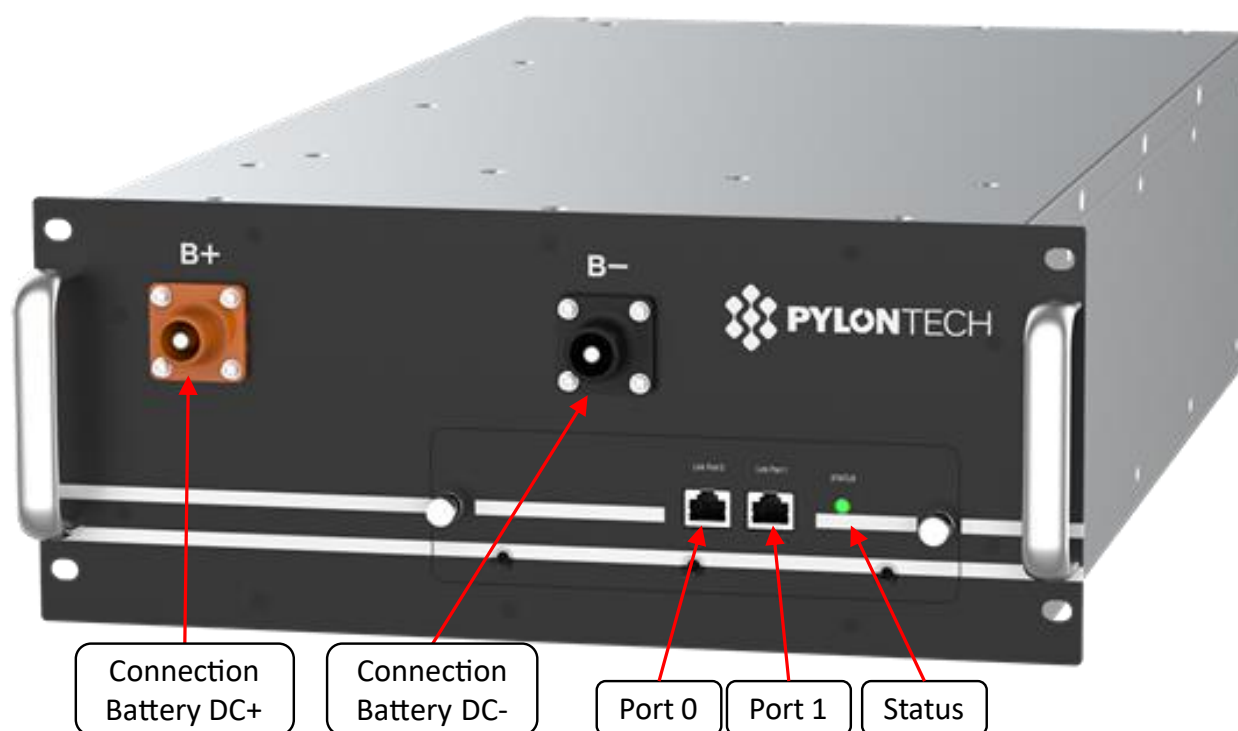


Figure 3-5: Front panel of battery module

NOTE

Ensure that the DC disconnect switch of the BMS is open (pos. OFF).

The battery rack in the Battery Storage Outdoor is largely pre-installed. The battery modules are professionally installed and secured and the network cables are all plugged in.

The power cables (DC+ and DC-) between the battery modules are still open on one side and must be plugged in according to "Figure 3-6: Overview of DC power cabling".

The DC power connection to the battery inverter is already fully connected.

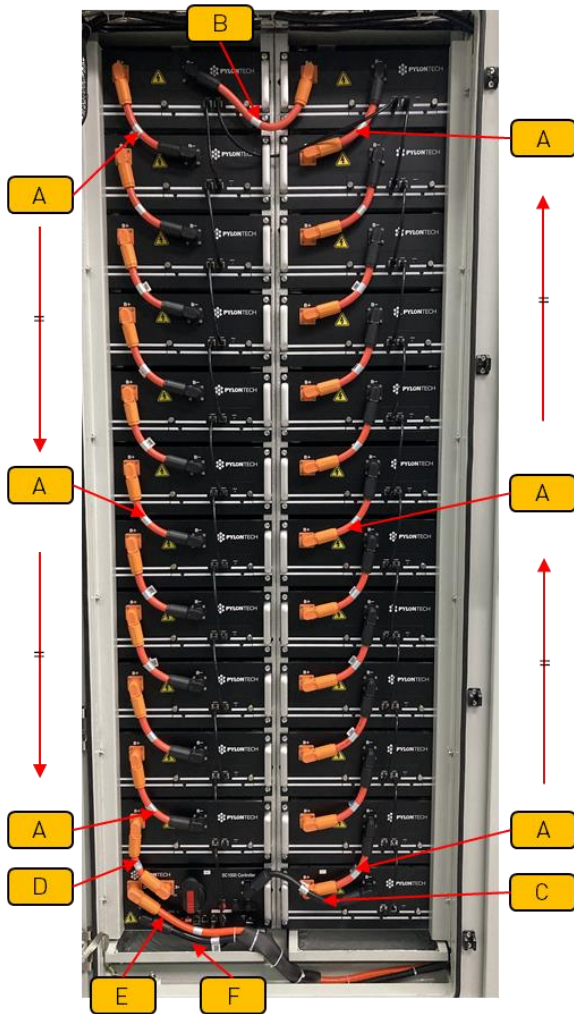
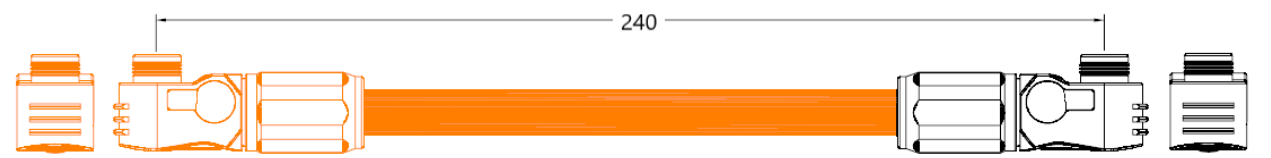


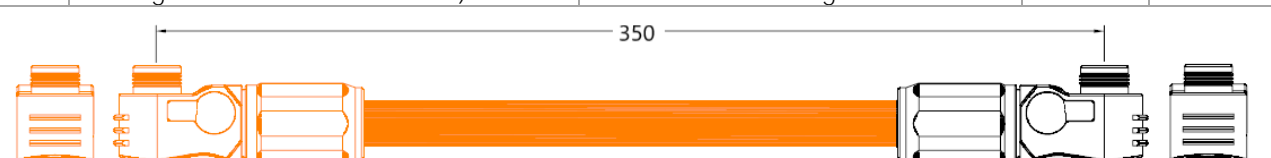
Figure 3-6: Overview of DC power cabling

ID	Components	Description	Unit	Quantity
A	Connection cable	Orange/0.24 m/1/0AWG/ Connection 1× orange & 1× black	Pcs.	23



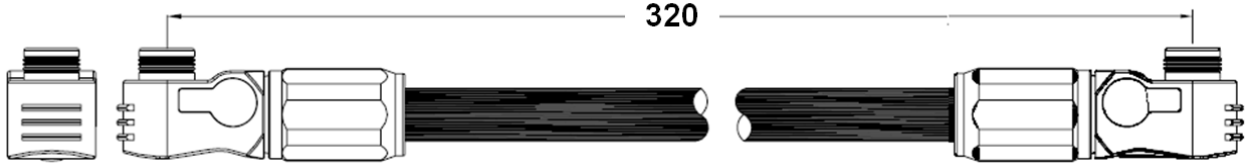
The DC connection between the left and right module racks is established with a slightly longer power cable:

ID	Components	Description	Unit	Quantity
B	Connection cable (battery module left and right rack serial connection)	Orange/0.35 m/1/0AWG/ Connection 1× orange & 1× black	Pcs.	1



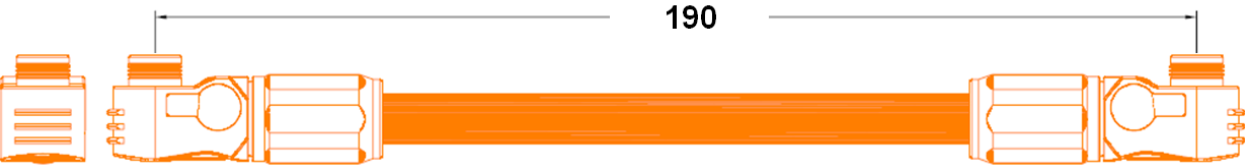
The DC connection B- from the last battery module to B- on the BMS is established using a slightly longer power cable (black ⇔ black):

ID	Components	Description	Unit	Quantity
C	Connection cable	Black/0.32 m/1/0AWG/ Connection 2× black	Pcs.	1



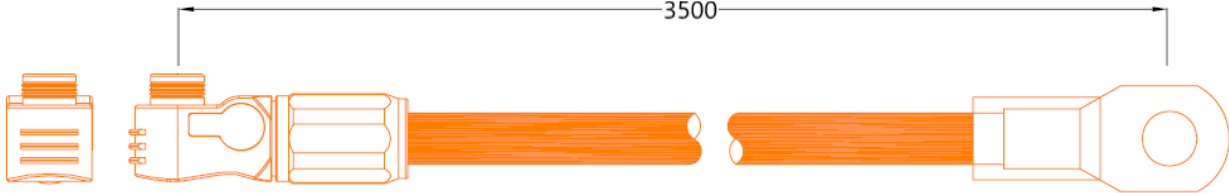
The DC connection B+ from the BMS to the B+ of the first battery module is made using a short power cable (orange ⇔ orange):

ID	Components	Description	Unit	Quantity
D	Connection cable	Orange/0.19 m/1/0AWG/ Connection 2× orange	Pcs.	1




The DC connection between the BMS and ConnectionBox is established using the DC plus / DC minus cables supplied:

ID	Components	Description	Unit	Quantity
E	+DC connection cable	Orange/3.5 m/1/0AWG/ Phoenix terminal/50-8 terminal	Pcs.	1



F	-DC connection cable	Black/3.5 m/1/0AWG/ Phoenix terminal/50-8 terminal	Pcs.	1
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The DC power connection to the BMS is made at the "DC+ supply line" and "DC- supply line" connections as shown in the following diagram.

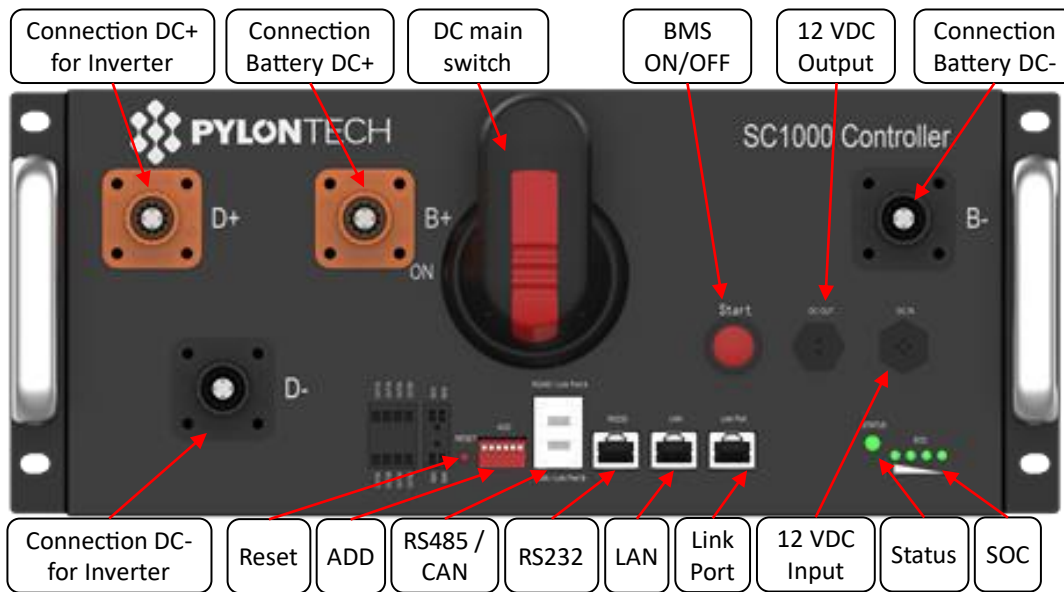


Figure 3-7: BMS - Communication and power connections

3.3.4 Connecting the Network Access Line

By default, the BSO is integrated into the network/internet via an available internet connection provided by the customer. Alternatively, a router with a stable LTE connection can be installed. The network cable is fed through the right-hand rubber grommet and connected to a free port on the switch.

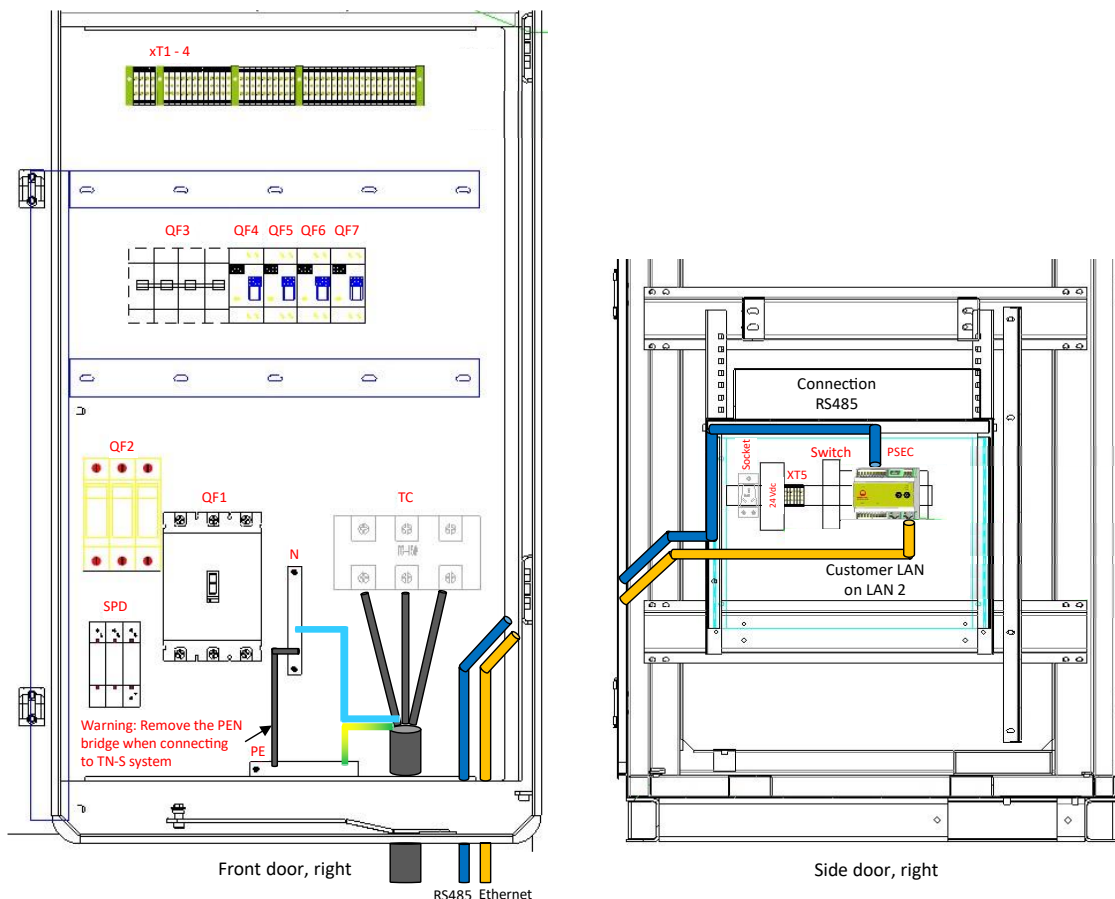


Figure 3-8: Connection to customer LAN and RS485

3.3.5 Pramac Smart Energy Controller (PSEC) Connection

The energy management system (PSEC) is already installed in the appliance on a standard top-hat rail. The space requirement on the top-hat rail of the controller itself is 6 DU. The integrated 24 V power supply unit is installed next to the controller and is used to supply the controller with power. The controller has 4 plug-in card slots, which were selected specifically for the product. The PSEC-DMXX equipment variant shown here has a plug-in card with 4× digital IO and a plug-in card with RS485 bus.

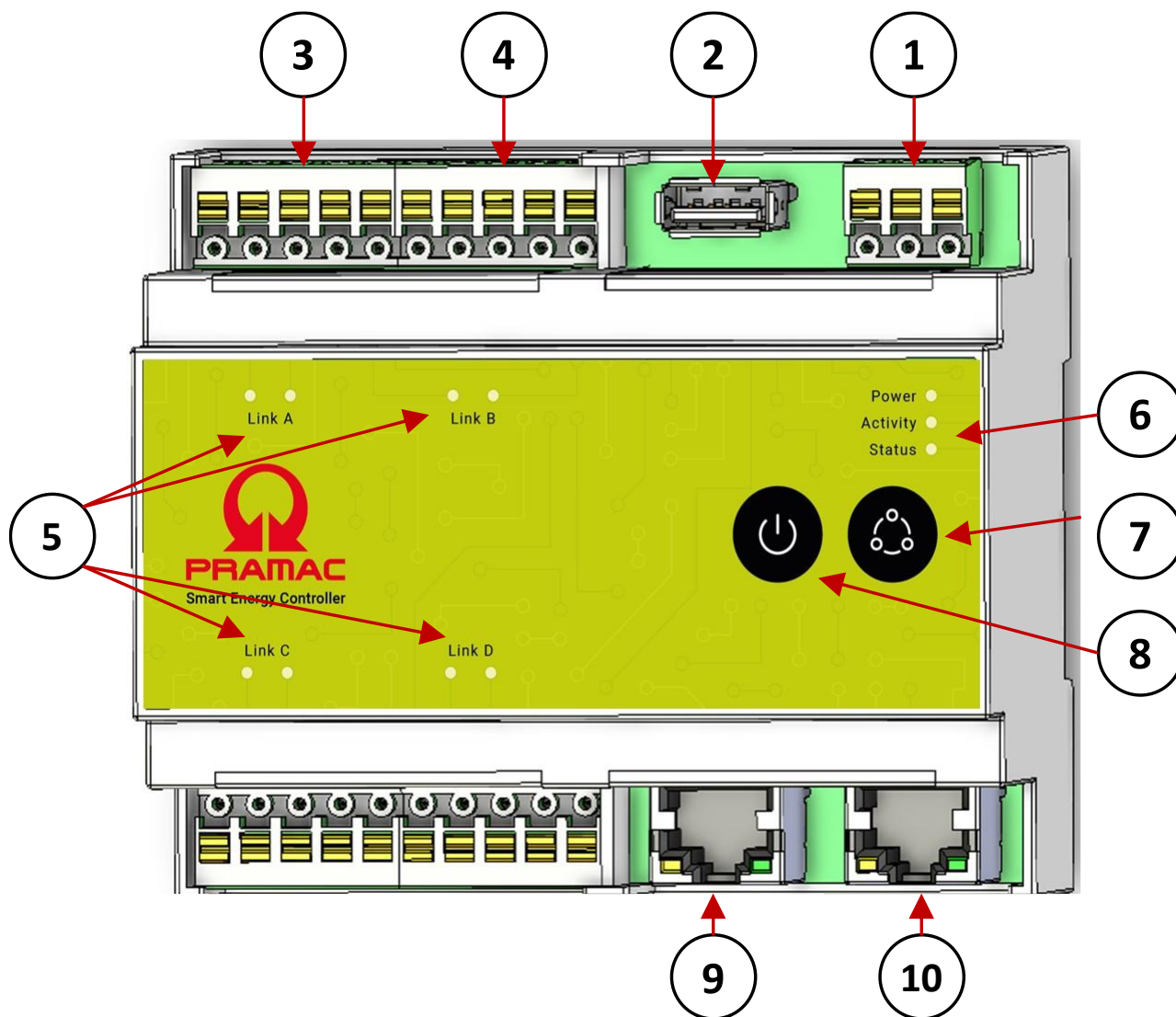


Figure 3-9: Overview: PSEC

No.	Description	No.	Description
1	10 ... 24 VDC power supply	6	Status display: Power / Activity / Status
2	USB-A 2.0	7	Confirm button
3	Link Port A → 4× Digital IO	8	ON/OFF button
4	Link Port B → Modbus RTU (RS485)	9	LAN1 - internal network
5	Status LED Link Port A / B / C / D	10	LAN2 - external customer network with internet connection

3.3.6 Energy Meter Connection via RS485

The energy meter is preferentially connected to the grid connection point of the BSO. The energy meter can be mounted and installed on a standard top-hat rail in a switch cabinet.



REMARK

The scope of delivery of the energy meter does not include a current measuring transformer.

These can be ordered as an option. The operating instructions are enclosed. It describes the menu navigation and the setting of the transmission ratio.

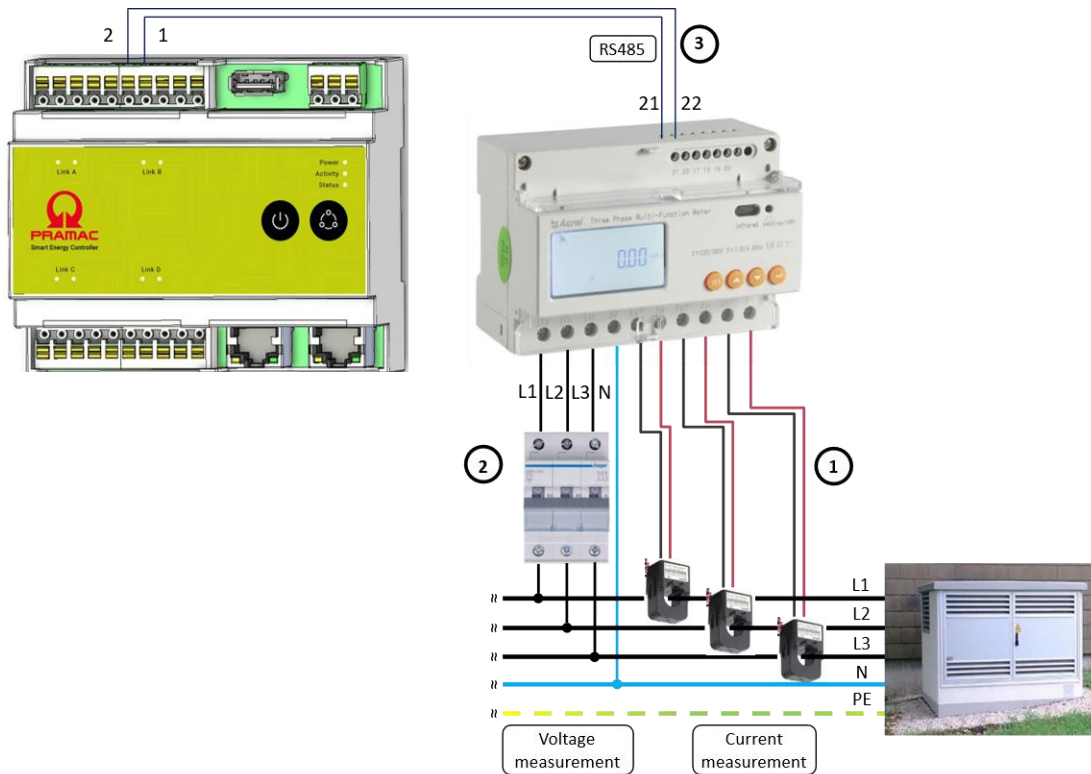


Figure 3-10: Connection of energy meter via RS485

No.	Description
1	A transformer is required for each phase for current measurement. It must be ensured that the direction of the current arrow is uniform and follows the direction of the arrow from the mains connection to the consumer.
2	The voltage measurement must be fused separately, see "Figure 3-10: Connection of energy meter via RS485". For this purpose, the customer must install a 3-pole circuit breaker or a 3-pole thermal fuse in the sub-distribution board in which the energy meter is also installed.
3	Connect the RS485 bus to terminals 21 and 22 on the energy meter.

The RS485 cable is fed through the same rubber grommet as the network cable on the customer side. The energy meter is connected to Link Port B (terminals 1 and 2) on the energy management system (PSEC).

NOTE

- It is important that transformer 1 is connected with phase L1 to Ua (Ia, Ia* and terminal 1) and analogously L2 and L3, and that the direction of rotation for L1, L2, L3 is maintained.
- Only use shielded and twisted cables for Ethernet cabling. We recommend bus cables or network cables of type CAT6/CAT7.
- The fuse is not included in the scope of delivery. The dimensioning of the fuse protection and the conductor cross-sections must be designed by the customer.
- Observe the direction of the counting flow:
Install the PV meter and grid meter in the correct counting direction: Supply + / Feed-in -.

3.3.7 Energy Meter Connection via RJ45

An energy meter is also integrated via Ethernet at the grid connection point to which the BSO is connected (see "Figure 3-11: Connecting energy meter via Ethernet").



REMARK

The scope of delivery of the energy meter does not include a current measuring transformer.

These can be ordered as an option. The operating instructions are enclosed. It describes the menu navigation and the setting of the transmission ratio.

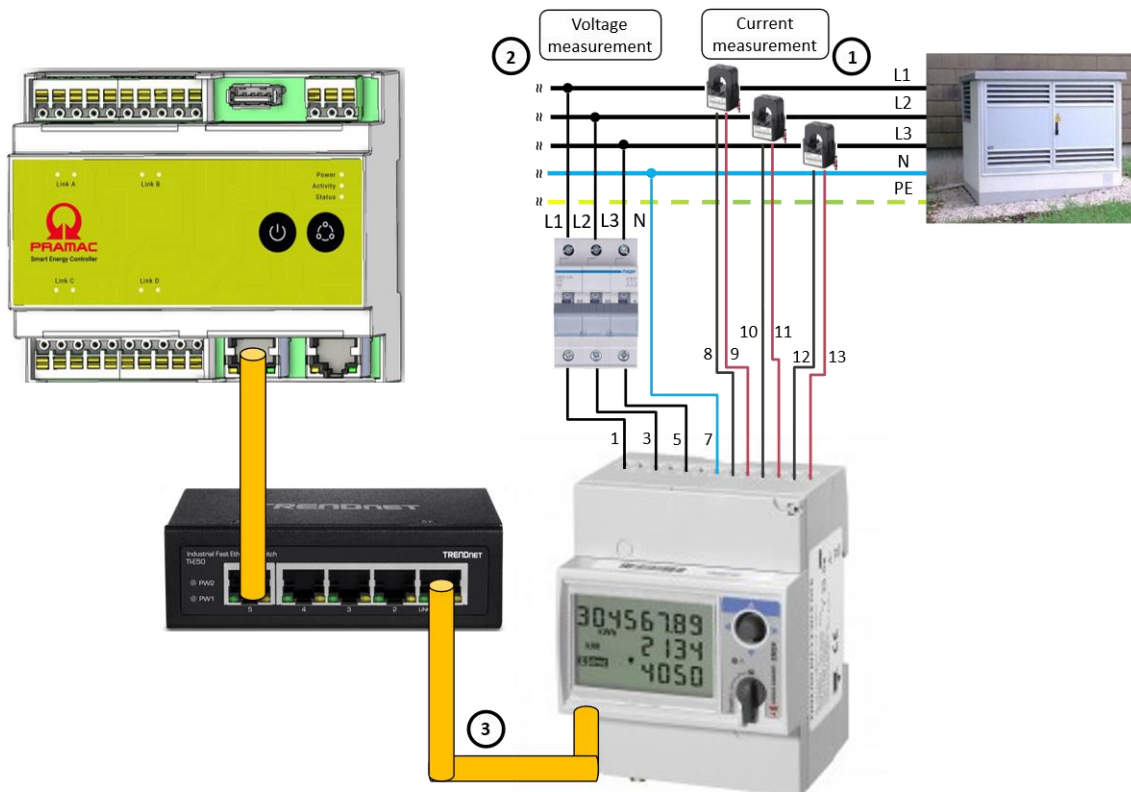


Figure 3-11: Connecting energy meter via Ethernet

No.	Description
1	A transformer is required for each phase for current measurement. It must be ensured that the direction of the current arrow is uniform and follows the direction of the arrow from the mains connection to the consumer.
2	The voltage measurement must be fused separately, see "Figure 3-11: Connecting energy meter via Ethernet". For this purpose, the customer must install a 3-pole circuit breaker or a 3-pole thermal fuse in the sub-distribution board in which the energy meter is also installed.
3	Ethernet connection from energy meter to switch.

NOTE

- It is important that transformer 1 is connected with phase L1 and analogously L2 and L3, and that the direction of rotation for L1, L2, L3 is maintained.
- Only use shielded and twisted cables for Ethernet cabling. We recommend network cables of type CAT6/CAT7.
- The fuse is not included in the scope of delivery. The dimensioning of the fuse protection and the conductor cross-sections must be designed by the customer.
- Observe the direction of the counting flow:
Install the PV meter and grid meter in the correct counting direction: Supply + / Feed-in -.

The electrical connection of the BSO is now complete.

4 Initial Switch-On and Configuration

4.1 Before Operation

To ensure safe operation of the BSO, the following tests are required after installation and wiring have been completed:

1. Check that the installation environment of the device meets the requirements,
2. that the installation clearances are sufficient to ensure normal maintenance of the appliance,
3. that the device is firmly connected to the foundation,
4. that the DC power cables are connected correctly,
5. that the positive and negative poles are connected correctly,
6. that the phase sequence of U = L1, V = L2 and W = L3 are connected on the AC side.

NOTE



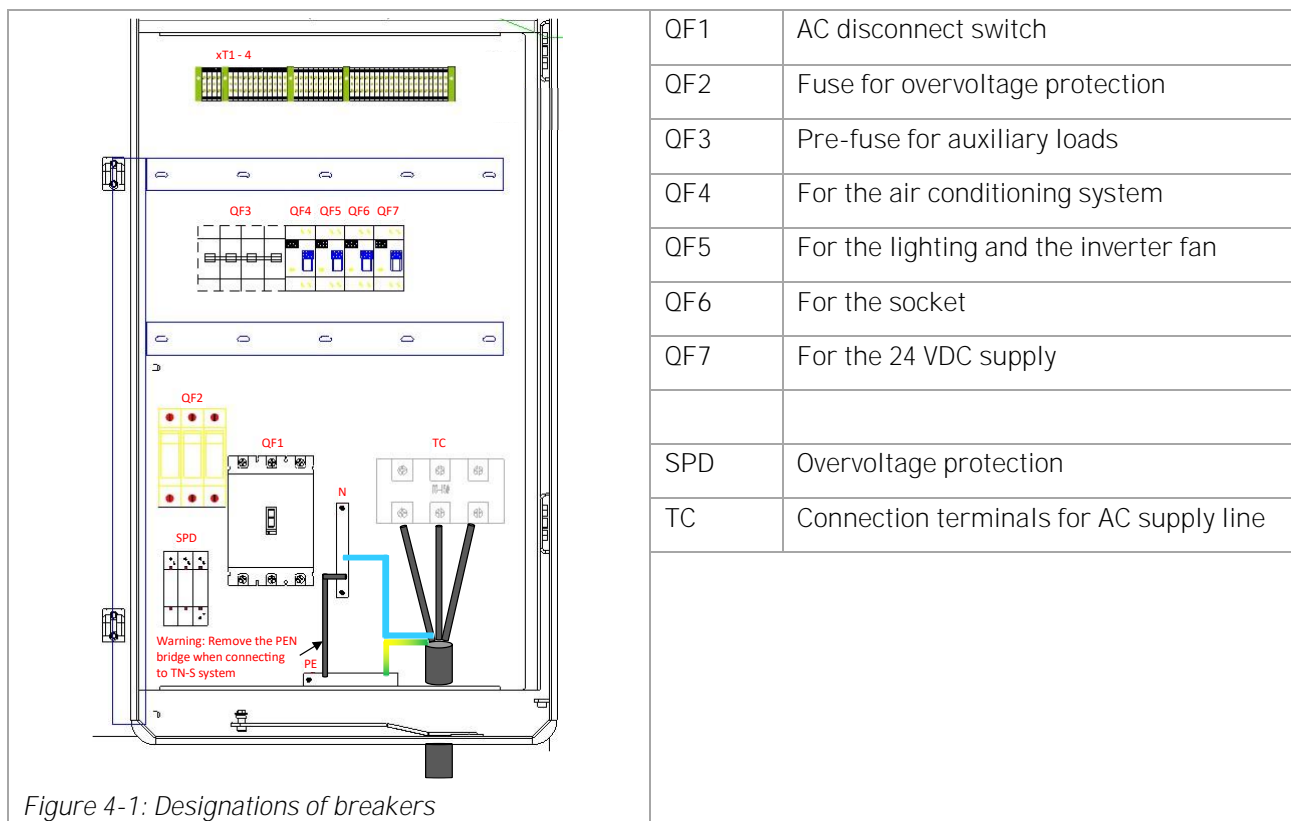
- Checklist BEFORE commissioning

4.2 Switching On the BSO

1. Switch on the main AC supply for the Battery Storage Outdoor at the transfer point.
2. Use a multimeter to check that voltage is present at the TC terminal strip.
3. Check that a clockwise rotating field is present at the AC connection of the BSO.

The individual steps for switching on the BSO are described below:

4. Close AC disconnect switch QF1.
 - The inverter display BATTERY and GRID light up and flash.
 - The air conditioner starts up with a slight delay.
 - All other circuit breakers are closed on delivery.



4.3 Configuration of the Battery Inverter

The battery inverter is switched on by switching on the AC disconnect switch QF1 in the main distribution board of the BSO.

When activated, the battery inverter performs the following steps:

- Internal tests (e.g. relay test).
- Checks the connection conditions for the AC grid and the battery storage system.

The inverter will not yet switch to operating mode as the DC disconnect switch of the battery rack is still open and the network configuration has not yet been completed.

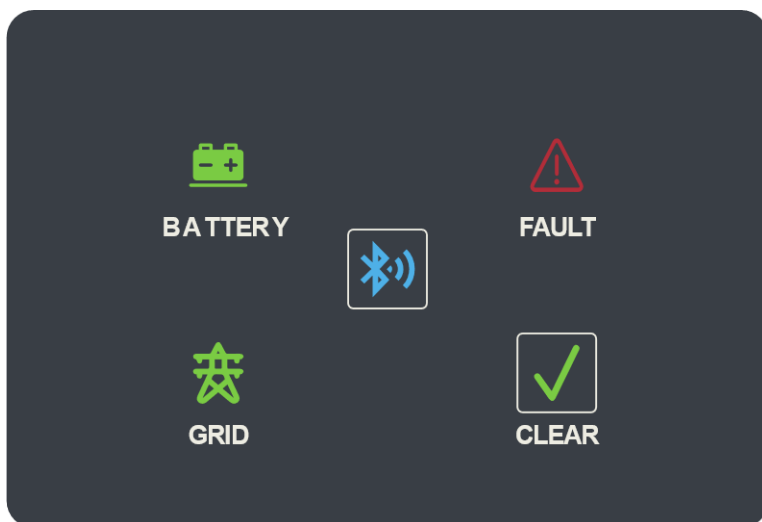


Figure 4-2: Display of battery inverter

The network configuration of the inverter can be performed using the PBI Connect app via Bluetooth or via a laptop with the PBI Connect PC software.

Download the PBI Connect app via Google Play or the iOS App Store.

PBI Connect can be downloaded from www.pramac-storage-systems.com.

4.3.1 Configuration via Bluetooth

All the necessary settings can be configured using the PBI Connect mobile app for iOS or Android platforms. To do so, proceed as follows:

1. Install PBI Connect on the mobile device.
2. GPS and Bluetooth must be active and authorisations for the app must be set.
3. Press the Bluetooth button on the inverter display.
 - The Bluetooth button LED flashes blue.
 - The inverter is automatically paired and displayed in the PBI Connect app.

When the inverter is started for the first time, the initial setup screen with the following settings is displayed in PBI Connect:

- Country of installation (DE/AT/CH etc.)
- Network policy (if more than one for the selected country) (VDE AR-N 4105/4110/TOR Type A producers, etc.)
- Nominal mains voltage
- Date and time

Optional settings:

- Limitation of continuous power
- Signal for remote switch-off
- Network settings for RS485

4.3.2 Configuration via Ethernet

The PBI Connect PC software can be used to carry out firmware updates and set country-specific inverter parameters. The connection between the PC and the inverter can be established via Ethernet.

FUNCTIONS
Firmware update
Export of inverter data
Feed-in conditions; voltage and frequency
Ramp-up time in the event of a mains fault
Monitoring the mean value voltage
Monitoring the phase conductor voltage
Frequency-dependent power reduction
Monitoring the instantaneous voltage (quick switch-off)
Monitoring the instantaneous frequency
Provision of reactive power ($\cos \varphi$)
Switch-on times
K-factor (Fault Ride Through)

4.4 Configuration of the Energy Meter

The energy meter is configured via RS485 or via Ethernet and can be read in the respective manual.

NOTE

The respective transformer ratio must still be set.

C_t is calculated as follows:
$$C_t = \frac{\text{Transformer}_{\text{maximum current}}}{\text{Transformer}_{\text{rated current } 5 A}}$$

4.5 Switching on the Battery Rack

NOTE

Before switching on the battery rack, check that both the DC power cabling and the network cabling are correct.

1. Switch on the battery rack by turning the DC disconnect switch to the "ON" position.
2. Press the red start button for approx. 5 seconds until the buzzer sounds. See "Figure 4-3: Overview of front side of battery rack" below.

- 1. Turn on the "Isolating Switch":



- 2. Press the "Start Button":



Figure 4-3: Overview of front side of battery rack

The BMS automatically carries out a self-test.

If the BMS and all battery modules are functioning normally, each STATUS LED lights up green, i.e. the self-test was successful. The self-test is completed within 5 seconds.

If the STATUS LED lights up red after 30 seconds, a communication error may have occurred. To do this, check the communication connection on the BMS and switch / router.

Table 4-1: Explanation of LED display

STATUS – Battery	Protection / Alarm / Normal	STATUS (green)	STATUS (red)	Capacity (SOC)				Description
		●	●	●	●	●	●	
Switched off		Off	Off	Off	Off	Off	Off	Completely switched off
Sleep	Normal	Flashing 2 ¹⁾	Off	Off	Off	Off	Off	Displays sleep mode to save energy.
Idle	Normal	On	Off	Off	Off	Off	Off	Displays the energy saving mode.
	Alarm	On	Off	Off	Off	Off	Off	Indicates that the battery voltage or temperature is high or low.
	Protection	Off	On	Off	Off	Off	Off	Indicates that the battery voltage or temperature is too high or too low.
Charge	Normal	On	Off	The highest capacity indicator LED flashes (Flashing 2 ¹⁾), the others are permanently lit				The highest capacity indicator LED flashes (Flashing 2 ¹⁾), the others are lit
	Alarm	On	Off					
	Protection	Off	On	Off	Off	Off	Off	Stop charging process, STATUS (red) lights up
Discharge	Normal	Flashing 2 ¹⁾	Off	Indication of capacity (%)				Capacity display in 25 % increments
	Alarm	Flashing 2 ¹⁾	Off					
	Protection	Off	On	Off	Off	Off	Off	Stop discharge, STATUS (red) lights up
Malfunction	Switch-on fault	Off	Flashing 4 ²⁾	Off	Off	Off	Off	Charge/discharge stop, STATUS (red) lights up
	Other malfunction	Off	On	Off	Off	Off	Off	
	STL error	Off	Flashing 2 ¹⁾	Flashing 2 ¹⁾				MCU self-test problem

NOTE

Flashing types

¹⁾ Flashing 2: 0.50 s On | 0.50 s Off

²⁾ Flashing 4: 1.00 s On | 1.00 s Off

4.6 Commissioning the Pramac Smart Energy Controller (PSEC)

The PSEC has local monitoring. This can be accessed via a LAN (Ethernet) connection to port "LAN 1" (OT network).

The initial credentials are: admin/admin.

The address for access via browser is: "http://192.168.42.1" or "http://energy.controller".

1. Connection with laptop to internal network LAN 1 (via switch).
2. Enter the IP address of the PSEC in the web browser and confirm with "ENTER".

NOTE



- All further steps for commissioning the PSEC can be found in the online manual.



REMARK

Use the link: https://docs.pramac.energy/en/installation_guide or the following QR code to view the next steps.



Figure 4-4: QR code for registration

4.7 Calibrating the Active Sensors

Final step for commissioning the BSO 50-88/109:
Calibrate the CO and H₂ sensor.

The sensors are preset during production and must be reset to the respective ambient air.
Both sensors only display characters in Chinese script.

1. Press the "SET" button on the remote control supplied.



Figure 4-5: Remote control for sensors

2. Use the "Up/Down" buttons to set the password "1 1 1 1" and confirm with "OK".
3. Press the "Down" button until the lettering shown below can be identified.



Figure 4-6: Zeroing the sensors

4. Confirm with "OK".
 - Zeroing has been performed.
The zeroing is also indicated by an audible beep.
5. Press "Exit" on the remote control to end calibration.

4.8 Switching Off the BSO

WARNING



Only switch the BSO on again after it has been switched off for at least 2 minutes to ensure that the internal capacitors are fully discharged.

Only then can the product be put back into operation.

1. Check BSO for current charging or discharging mode.
Otherwise, the BSO is in standby mode and the AC and DC currents are 0 A.
2. Switch off QF1.
3. Switch off QF4 to QF7.
4. Switch off the battery rack by turning the DC isolator switch on the rack BMS to the "OFF" position.

WARNING

Do not turn off the DC disconnect switch during normal operation.
This can cause high currents in other battery strings.

5 Maintenance Information

Due to the influence of ambient temperature, humidity, dust and vibration, the devices in the BSO age and wear out, which can lead to potential failures in the BSO. Regular maintenance is therefore necessary to ensure normal operation over the service life. All measures and methods that help to ensure that the BSO remains in good operating condition fall within the scope of maintenance work.

5.1 Maintenance of BSO

The following tables list the recommended maintenance work and routine intervals.

Table 5-1: Maintenance BSO housing

TASKS	DETAILS	INTERVAL
Operating status and environment	<ul style="list-style-type: none"> Visual inspection of the system. Check the outdoor cabinet for damage or deformation. Check the BSO for noticeably loud operating noises. 	1/a
Safety labelling on the BSO	Check warning signs and markings on the outdoor enclosure.	1/a or As required

Table 5-2: Maintenance battery area

TASKS	DETAILS	INTERVAL
Operating status and environment	<ul style="list-style-type: none"> Visual inspection of the battery area. Check components for damage, moisture and deposits. Clean with compressed air if necessary. 	1/a
Checking the electrical connections / terminal and cable connections	Visual inspection of the cable connections and terminals.	1/a
Air outlet guard Exhaust air fan	<ul style="list-style-type: none"> Carry out a visual inspection. Remove the air outlet cover and clean the air outlet filter mat. 	1/a

Table 5-3: Maintenance inverter area

TASKS	DETAILS	INTERVAL
Operating status and environment	<ul style="list-style-type: none"> Visual inspection of the inverter area. Check components for damage, moisture and deposits. Clean with compressed air if necessary. 	1/a
Checking the electrical connections / terminal and cable connections	Visual inspection of the cable connections and terminals.	1/a
Air inlet on the front and rear of the BSO housing	<ul style="list-style-type: none"> Dismantle the Louver. Visually inspect the Louver. If heavily soiled, clean with compressed air. Visual inspection of the air inlet filter mats. If heavily soiled, clean with compressed air or replace. 	1/a
Fan (exhaust air)	Checking the fan for function and conspicuously loud operating noises.	1/a
Air outlet at the rear of the BSO housing	Visual inspection of the Louver. If heavily soiled, clean with compressed air	1/a

5.2 Maintenance of PBI 50K-PC and PBI 88K-PC Battery Inverters

The following table lists the maintenance measures to be carried out and intervals for the battery inverter.

Table 5-4: Maintenance inverter PBI 50K-PC / 88K-PC

TASKS	DETAILS	INTERVAL
WR fan	Check the inverter fan for function and conspicuously loud operating noises.	1/a or As required
Heat sink	Visual inspection of the heat sink and cleaning with compressed air if necessary.	1/a or As required
Air outlet plate	Visual inspection. If heavily soiled, clean with compressed air or replace.	1/a or As required
Checking the electrical connections / terminal and cable connections	Visual inspection of the cable connections and terminals.	1/a

NOTE

* Shorter maintenance intervals may be required (depending on location and ambient conditions).

5.3 Air Conditioner Maintenance

Regular maintenance work must be carried out to ensure normal operation of the air conditioner.

WARNING

All maintenance work should be carried out by qualified personnel.

Please disconnect the power, communication and alarm output cables of the air conditioner before each maintenance and only reconnect them after the maintenance has been completed.

Table 5-5: Maintenance air conditioner / fan

TASKS	DETAILS	INTERVAL
Checking the electrical connections / terminal and cable connections	Visual inspection of the cable connections and terminals.	1/a
Air inlet / outlet and condenser	Carry out a visual inspection. If heavily soiled, clean with compressed air.	1/a or As required
Anomalies on the fan	Checking the fan for function and conspicuously loud operating noises.	1/a
Condensation water drain	Carry out a visual inspection. Clean if clogged.	1/a

5.4 Maintenance of fire protection equipment / extinguishing tube

The fire protection device on the back of the battery system must be maintained regularly.

Table 5-6: Maintenance of fire protection equipment / extinguishing tube

TASKS	DETAILS	INTERVAL
Visual inspection	Visual inspection of the extinguishing tube.	1/a

6 Dismantling and Recycling

6.1 Dismantling

The BSO is dismantled as described below:

1. Switch off the BSO (see Chapter "4.8 Switching Off the BSO").

CAUTION



There is residual voltage in the inverter!

Before opening the appliance, the operator should wait 2 minutes to ensure that the capacitor is completely discharged.

2. Unplug and remove the communication cable from the PSEC / switch / router.
3. Dismantle and remove the energy meter incl. transformer at the grid transfer point.
4. Disconnect and remove the AC supply in the connection area of the BSO.
5. Loosen the earthing connection on the housing.
6. Loosen the fastening screws of the BSO and lift the BSO off the foundation using a crane/forklift and remove it.

6.2 Recycling

6.2.1 Recycling Battery Racks

Damaged batteries can leak electrolyte or produce flammable gas. If a damaged battery needs to be recycled, the local recycling regulations (i.e. Regulation (EC) No. 1013/2006 of the European Union) must be complied with.

If the battery modules are obviously damaged, contact an authorized expert or the Pramac Storage Systems GmbH service department.

6.2.2 Recycling Battery Inverters

NOTE



The packaging and the replaced parts are to be disposed of in accordance with the regulations of the country in which the product is installed.

The PBI 50K-PC / 88K-PC battery inverter must not be disposed of with normal household waste.

Pramac Storage Systems GmbH offers its customers a free return service for the professional disposal of old appliances at its company headquarters in 72793 Pfullingen.

The PBI 50K-PC / 88K-PC battery inverter is RoHS-compliant. For a full return, please contact our customer service at service.pss@pramac.com.

Registration according to ElektroG

By law, every manufacturer and distributor of electrical appliances is obliged to register and maintain a corresponding WEEE number.

This reads: DE 17567286

7 Quality Assurance

WARRANTY

The current warranty terms can be downloaded from the website www.pramac-storage-systems.com.

Disclaimer

If a fault occurs with the BSO during the warranty period, please contact your installer or supplier. In the event of faults for which the manufacturer is responsible, Pramac Storage Systems GmbH will provide a replacement or repair free of charge within the warranty period.

Any defect caused by the following circumstances is not covered by the manufacturer's warranty. The dealers or distributors are responsible and authorised by Pramac Storage Systems GmbH for the following investigation:

- Product modified, design changed or parts replaced that have not been authorised by Pramac Storage Systems GmbH.
- Modifications or repair attempts and deletion of the serial number or seals by a technician who is not employed by Pramac Storage Systems GmbH.
- Failure to observe the user manual, the installation instructions and the maintenance instructions, improper use or misuse of the device.
- Non-compliance with local safety regulations (e.g. VDE standards in Germany).
- The product was stored improperly and damaged during storage by the dealer or the end user.
- Transport damage (including paint scratches caused by movement inside the packaging during transport). A claim must be submitted directly to the insurance company as soon as the packaging has been unloaded and such damage has been detected.
- The system is operated outside the specified temperature window or the system is insufficiently ventilated.
- The maintenance procedures relating to the product were not followed as specified.
- Damage caused by external factors or force majeure (violent or stormy weather, lightning, overvoltage, fire, etc.).

8 Technical Support

If you have followed the troubleshooting procedure and have not been able to solve your problem, you can contact the Pramac Storage Systems GmbH service team as follows:

Germany: +49 (0) 7121-159-77-0

Website: www.pramac-storage-systems.com

Download data sheets, manuals, certificates, firmware update files, etc. here.

E-mail: info.pss@pramac.com



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