XOLTA

XOLTA BAT-80 AC

User manual

Contents

Chapter 1: About this user manual

The purpose of this document is to provide the operator of BAT-80 AC with an overview of system installation, functionality, service, maintenance, and operation.

The document is organized as follows:

- Chapter 2: Safety and legal terms - covers important safety information, legal terms, and provides the list of actions to be taken during an emergency.
- Chapter 3: BAT-80 AC system overview - introduces the main features of BAT-80 AC, including available hardware configurations and key specification parameters. You will also be introduced to safety measures and protection schemes applied in the system.
- Chapter 4: System operation and functionality - describes available operating modes and operating states.
- Chapter 5: API access - provides a list of telemetry signals accessible via the API and Modbus TCP.
- Chapter 6: Receiving and installing the system – provides information about system installation, maintenance, and location requirements.
- Chapter 7: Service and maintenance - addresses routine actions and troubleshooting during the operational system lifetime.
- Chapter 8: Decommissioning - describes the end-of-life procedure for BAT-80 AC.
- Chapter 9: Long-term storage - describes the requirements and procedure for long-term storage.
- Chapter 10: Terminology - a glossary for looking up terms used in this manual.

1.1 Disclaimer

XOLTA have taken all necessary precautions to ensure that the information in this manual is accurate and up to date. The system is designed to ensure that an installed XOLTA battery energy storage system, along with all associated functionalities, operates safely under predefined operating conditions.

All XOLTA products are certified according to recognized national and international standards. It is essential that you thoroughly read the manuals and product descriptions relevant to the XOLTA battery energy storage system, and any battery extension, as provided by XOLTA, and use the system only in accordance with these documents.

XOLTA is not liable for any damage or loss resulting from use that is contrary to the manuals and product descriptions and is solely liable for damage caused by the Product in accordance with the rules of the Danish Product Liability Act regarding consumer purchases.

1.2 Copyright

 XOLTA reserves the right to make changes to the products

described in this manual at any time without notice. This manual may be photocopied or otherwise distributed only to the extent that is necessary for correctly operating and installing a XOLTA battery energy storage system.

Chapter 2: Safety and legal terms

2.1 Intended use

BAT-80 AC is a stationary energy storage system designed to be installed outside in an industrial environment free of salty mists and other aggressive atmospheres. Only a skilled electrician trained in XOLTA products may install BAT-80 AC. Place the BAT-80 AC according to the instructions of the Installation Manual. This includes the guidance for correct lifting and transportation of the product. It is strongly recommended to consult local authorities or fire department to verify that an installation site is fit for purpose of energy storage.

The product is to be operated within the specified conditions given in this manual and the associated product data sheet.

Only XOLTA trained personnel may perform service and maintenance on the product's interior. There are no intended service actions for the operator and end user inside the product.

The BAT-80 AC is only intended for stationary installation. Any other installation is strictly forbidden and is considered unintended use. Using the product to other purposes than storage of electrical energy is also considered unintended use.

> **Note**: To get a materials safety data sheet in Danish or English, follow one of these links:
>
> - MSDS document in Danish: https://xolta.com/wp-content/uploads/80-DK.pdf.
> - MSDS document in English: https://xolta.com/wp-content/uploads/80-US.pdf.

2.2 Important safety instructions

Only a XOLTA trained electrical installer may install and perform service on BAT-80 AC. XOLTA accepts no liability for property damage or injury caused by system modification or repairs performed by unqualified personnel, without XOLTA approval, or failure to follow the following important safety instructions.

This chapter uses the following symbols:

 Warning - indicates a dangerous situation which, if not avoided, could result in death or injury.

 Caution - indicates a situation where damage to the equipment or injury may occur.

> **Important**: Read the entire document carefully before installing or using BAT-80 AC.

You will find the following symbols on the product:

Symbol	Description
	To ensure correct installation and operation, read this manual carefully before using the product.
	This manual describes general warnings that must be observed. Read the manual carefully before using the product.
	BAT-80 AC contains high voltages that can cause serious injury or death.
	Wait at least 5 minutes after disconnecting the system from the power supply before opening the battery. Opening of internal components may require more than 20 minutes before the inverter capacitors are completely discharged. **Important**: The product contains energized batteries. Power in the battery modules will remain indefinitely after disconnecting the power.
	The product contains batteries with toxic electrolytes.
	The electrolytes can be flammable.
	The product contains electronics and batteries that must be handled separately from other waste.

Table 2-1 - Symbols

2.2.1 Risks

Risk	Guidance
 **Risk of explosion**	• Do not apply any external force to BAT-80 AC. • Avoid physical damage to the battery. Keep BAT-80 AC away from places where it may accidentally be physically damaged. • Do not place BAT-80 AC where there is fire.

Risk	Guidance
 **Risk of fire**	• Keep the system away from flammable objects and heat sources. • Do not expose the battery system at any time to ambient temperatures higher than 50°C. • Do not clean the outside of the rack using pressurized water. • Do not operate BAT-80 AC after mechanical or electrical damage.
 **Risk of electrical shock**	• High voltages are present on both AC and DC cables. Even if BAT-80 AC is disconnected from the grid, the battery cells can still hold a charge, creating a risk of death or serious injury because of electrical shock. Report any external cable or wire damage to XOLTA or your local XOLTA trained electrical installer. • BAT-80 AC must be grounded to avoid risk of electrical shock. If you see any signs of the opposite, contact your XOLTA system supplier for further investigation. • Do not touch uninsulated wires. • Do not clean the outside of the rack using pressurized water. • Never use a system if it is defective, damaged, or broken. Contact your XOLTA system supplier. • Never attempt to disassemble, repair, modify the product, or use it in any way other than as described in this manual. Repairs or replacement of components must only be performed by a XOLTA trained electrical installer. No operator serviceable parts inside. • Never immerse BAT-80 AC in water or other fluids. • During servicing in rainy conditions, use covers to prevent water from entering the rack. • Do not operate BAT-80 AC after mechanical or electrical damage. • Do not open the service door yourself for any reason. There are no parts inside to be serviced by you. Only a XOLTA trained electrical installer may do that.
 **Risk of damage**	• Do not expose the battery system to temperatures below -25° C or higher than 50° C. Such exposure will result in irreversible degradation of the battery cells. • Do not block or in any way obstruct the air intakes or outlets as this will lead to improper product operation or problems with thermal management. See also *Minimum clearance space between battery racks.* on page 40. • Do not place any objects on top of the rack or within the required clearance space around the rack.

Risk	Guidance
	• Do not clean the outside of the rack using pressurized water. Using pressurized water increases the risk of water ingression to the interior of the battery, and it can cause the system to short-circuit. • Do not operate BAT-80 AC after mechanical or electrical damage as this may cause the system to short-circuit. • The XOLTA cabinet should always be placed in a level vertical position during operation. The rack must not be tilted by more than 15 degrees from a vertical position during transportation.

Table 2-2 - Risks and guidance

2.2.2 Other precautions


Other precautions to take:

- Do not use this product for any purpose other than what is described in this document.
- An unpleasant smell can indicate electrolyte leakage from the battery cells. In this case, switch off the system and contact your XOLTA system supplier immediately. To avoid health issues, ventilate the room if possible and avoid inhaling the odour.
- BAT-80 AC is heavy. Use suitable lifting equipment.
- Do not paint any part of the product.
- For storage longer than a month, charge the product to 30-40 % **SoC**[1], disable backup functionality, and disconnect it from the grid. Observe warranty conditions.

> **Note**: For more information, see *Prepare for long-term storage* on page 58.

- Dispose of the product in accordance with local regulations.

2.3 What to do in an emergency?

BAT-80 AC is designed to meet strict safety standards. It monitors essential parameters of the battery system and protects the battery from damage. The main battery safety measures are presented in the table below.

[1]State of charge

Main safety measures in BAT-80 AC	
✓	Lithium Iron Phosphate battery cells with excellent safety performance.
✓	State of the art battery management system (BMS) ensuring over-/under voltage and over/under temperature monitoring for each individual battery cell.
✓	Redundant battery cut-off contactor controlled by the **BMS**[1].
✓	Temperature sensors monitoring the battery system temperature.
✓	Active battery current control depending on battery cells temperature, voltage, and state of charge.
✓	System diagnostics, error handling. and automatic grid connection or disconnection controlled by the site controller.
✓	Battery air humidity monitoring and condensation prevention system.
✓	AC and DC protective fuses.

Table 2-3 - Main safety measures

Despite all these built-in safety measures, emergencies can still occur. In such emergencies, the actions to take are described in the table below.

> **Note**: In some situations, you are required to turn off the system by disconnecting it from the power supply.

Emergency	Action
Leakage	• Avoid any contact with leaking liquid or gas:

[1]Battery management system

Emergency	Action
The battery pack might leak toxic electrolyte. Electrolyte is corrosive and odorous.	• If electrolyte is inhaled, move away from exposure to fresh air immediately. Use oxygen if available. Get medical attention. • If your skin is exposed to electrolyte, remove any contaminated clothes and rinse skin with plenty of water for 15 minutes. Get medical attention. • If your eyes are exposed to electrolyte, irrigate thoroughly with water for at least 15 minutes. Get medical attention. • If you ingest electrolyte, wash your mouth with water and drink plenty of water. Get medical attention. • If the system is installed indoors, do not enter the room. • Ventilate the room if possible. • Contact your XOLTA system supplier.
Fire Fire may occur because of mechanical damage or external sources of heat and fire. Hazardous fumes such as carbon dioxide, carbon monoxide, and hydrocarbons are emitted during battery fires.	• Disconnect the power from BAT-80 AC, if possible, without getting close to the battery and without inhaling fumes. • Never try to extinguish a battery fire yourself. If battery cells catch fire, then only qualified firefighting personnel with appropriate protective equipment should attempt to extinguish the fire. Keep away from any battery fire and contact your local fire department. • If components other than battery cells catch fire, then ABC or carbon dioxide extinguishers can be used to extinguish the fire. • Keep away from the battery and contact the fire department. • Even if exposed to fire outside of the battery rack, do not attempt to operate it before it has been inspected by a XOLTA trained electrical installer.
Immersion in water Immersing BAT-80 AC in water may cause short-circuit, electrical shock, and permanent damage to the battery system. The same applies if the rack is flooded during extreme weather conditions.	• Do not try to access the battery rack. • Disconnect the power, if possible, without getting close to the battery rack. • Never use a XOLTA system that is or has been flooded. • Keep away from the battery rack and contact your XOLTA system supplier.
Damaged battery Any sign of mechanical or elec-	• Never use a damaged battery system again.

Emergency	Action
trical damage, abnormal behaviour of or its peripheral components should be treated with extreme caution.	• Disconnect the power. • Keep away from the battery and contact your XOLTA system supplier. • Do not attempt to operate the system before it has been inspected by a XOLTA trained electrical installer.

Table 2-4 - Emergencies and actions

2.4 Certified electrical installers with XOLTA training

XOLTA provides appropriate training to electrical installers for XOLTA systems. Only certified electrical installers with proper XOLTA training may install and commission XOLTA systems. Contact XOLTA for a list.

2.5 Safe disposal of Lithium-ion batteries

Only an authorized electrician should uninstall a XOLTA system. You must treat lithium-ion batteries as hazardous waste and never dispose of them with regular waste. Always follow local regulations when disposing of batteries and electronics.

The transportation of batteries is subject to special regulations, and you must always observe these regulations. When transporting batteries, treat them as dangerous goods according to local regulations. For more information, refer to the transportation regulations under the UN3480 shipping and handling classification for lithium-ion batteries.

You can return a XOLTA system at the end of its functional life to the original seller or to the dealer of your new residential battery.

2.6 Cyber security

The battery energy storage system connects to local communications networks outside the control of XOLTA. It is therefore the sole responsibility of the owner or operator to ensure that all appropriate measures are taken to mitigate any unauthorized access to or interference with the product through the local connection. XOLTA and its affiliates are not liable for damage or losses related to such security breaches.

2.7 Voiding of warranty

Please refer to XOLTA's Terms and Conditions document delivered by XOLTA. The document describes the terms and conditions for the product warranty.

The warranty for the product does not apply to, and XOLTA will not be responsible for, any defect, loss or damage to any product caused if:

- The XOLTA **BESS**[1] is not continuously connected to the internet via LAN cable, meaning that XOLTA cannot monitor the performance of the product.
- The XOLTA BESS has not been stored, transported, set up, or installed in an appropriate and professional manner in accordance with technical standards and regulations, in accordance with the respective Installation Manual, or instructions of XOLTA. This also includes expose to vibrations.
- The XOLTA BESS has been operated contrary to its intended use or contrary to the instructions in the relevant documentation.
- The XOLTA BESS has been disconnected for more than 30 consecutive days in an environment where it was exposed to temperatures, humidity, or corrosion levels outside the limits specified in the section Key specifications or in the Product Datasheet.
- The XOLTA BESS was out of service for a continuous period of more than six months after the initial installation due to the fault of the owner.
- The XOLTA BESS was disconnected for a continuous period of more than 30 days after the initial installation due to the owner's own circumstances or actions.
- The XOLTA BESS has run continuously with high or full power forcing the system to have more than one charging cycle during a period of 24 hours measured as energy throughput in kWh.
- The XOLTA BESS has not been serviced properly and professionally according to technical standards or XOLTA's maintenance instructions.
- The XOLTA BESS has been improperly altered or otherwise tampered with by the owner or any third party.
- An over-voltage has occurred in the power grid to which the XOLTA BESS is connected.
- The XOLTA BESS has been exposed to force majeure - including but not limited to lightning, fire, earthquake or natural disaster - or harmful environmental conditions, such as air pollution, salt-water, sulphur corrosion, or other events outside the reasonable control of XOLTA.
- Any loss, theft, or damage caused by water, fire, or extreme weather conditions, any wear and tear or cosmetic damage.

> **Note**: For a complete list of circumstances under which the warranty does not apply, see section 29. Exclusions of Warranty in the Terms and Conditions document.

[1] Battery energy storage system

Chapter 3: System overview

3.1 Introduction to BAT-80 AC

BAT-80 AC is a modular, cloud-connected multipurpose stationary energy storage system. The **BESS**[1] is designed for a wide range of ambient temperature conditions which makes it suitable for outdoor installation as-is without any additional enclosure (or container). The system is designed for various operation modes. For more information, see *Operation modes* on page 26.

Main features

- **Lift and drop**: Simple installation and commissioning. The system requires only grid connection, internet and electricity meter connections.
- **All in one**: All components of the system are integrated into a single cabinet. This includes the battery cells, the power conditioning system (PCS), the thermal management system (TMS), the battery management system (BMS), the battery protection unit (BPU), the multi rack battery control system and the energy management system (EMS).
- **Outdoor operation capability**: The mechanical casing of the system is designed to be effective up to enclosure rating IP45, related to dust and water jet ingress.
- **Modularity**: The system is configurable to specific needs. Several XOLTA battery racks can be connected and operated in parallel increasing power and energy capacity anytime required.
- **Backup**: The system can provide load backup function in case of grid outage. This function requires an additional XOLTA backup unit.
- **Multi-purpose**: The system is designed for a range of standard applications, from increasing renewable self-consumption of renewable energy to supporting EV charging as well as supporting the local grid frequency and voltage.
- **XOLTA Cloud connection**: The system is integrated with the XOLTA Cloud environment. It allows for system monitoring, advanced control, remote system configuration, data acquisition, and safe data storage on servers within the European Union.
- **Safety**: The system is designed to offer exceptionally high operational safety including state-of-the-art battery management system, intrinsically safe lithium-iron phosphate battery chemistry, multi-layer and redundant protection systems which all ensure maximum system safety under various operating conditions.
- **Low total cost of ownership**: This is achieved by the high system round-trip efficiency, low standby losses, minimal operational and maintenance costs and intelligent energy management.
- **Site controller**: This works as a multi battery rack control system and an EMS that manages the entire XOLTA BESS site. It provides multi battery rack management, charge and discharge power management, monitoring to assure safe system operation, communication with all system peri-

[1] Battery energy storage system

pherals, communication with **DSO**[1], data acquisition, communication with the XOLTA Cloud, system diagnostics, and error handling.

- **Thermal management system**: The system is equipped with an efficient active air thermal management system designed to keep all critical components within their safe operating temperature in various climate regions.
- **Peripherals**: Possibility of integrating external energy meters and other peripherals.

3.2 Hardware description

This section describes the various hardware components of BAT-80 AC. The figure below shows the schematic drawing of the BESS.

At the top, the **TMS**[2] ventilates the entire system by drawing air from the front and expelling it through the rear. Twenty serially connected battery packs provide the system's energy capacity. A primary **BMS**[3] monitors and protects all battery cells, working in tandem with secondary BMS units installed on each battery pack. The rack's bottom section houses the inverters and the **BPU**[4], which contains relays and the primary BMS. These components are mounted on a drawer for convenient service access. Further details about the BPU are provided below.

[1]Short for "distribution system operator", also known as "electricity distribution company". This is the company responsible for operating, maintaining, and developing the electrical distribution network, ensuring a reliable supply of electricity to end-users, and facilitating the integration of renewable energy sources and other distributed energy resources.
[2]Thermal management system
[3]Battery management system
[4]Battery protection unit

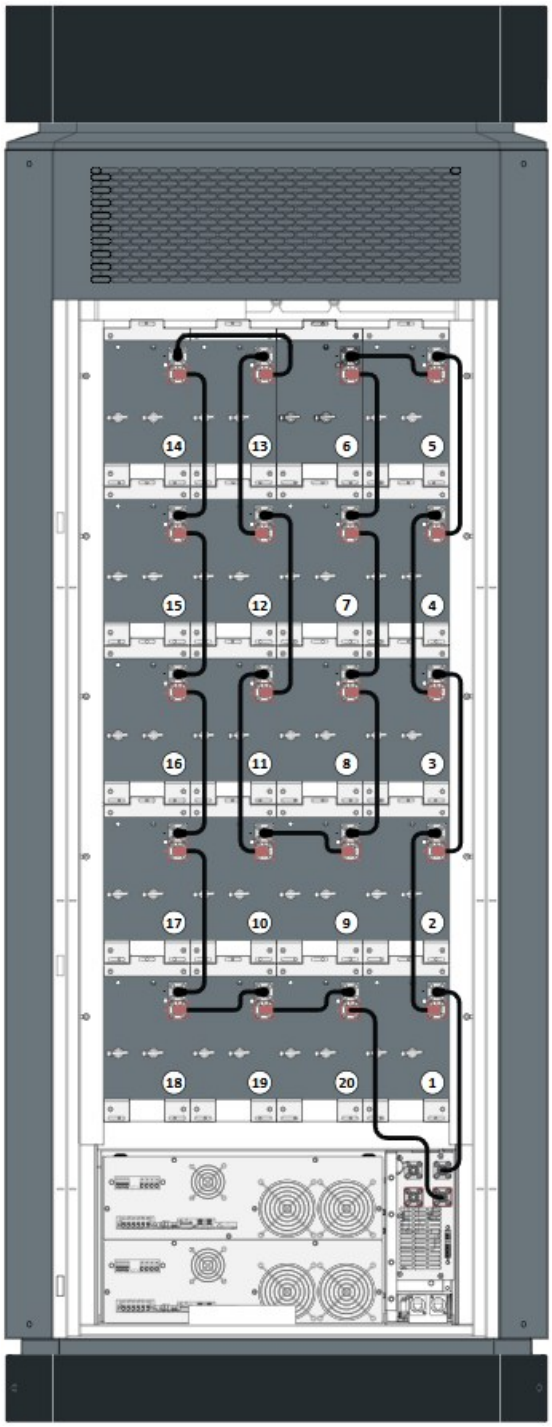


Figure 3-1 - Illustration of the hardware components

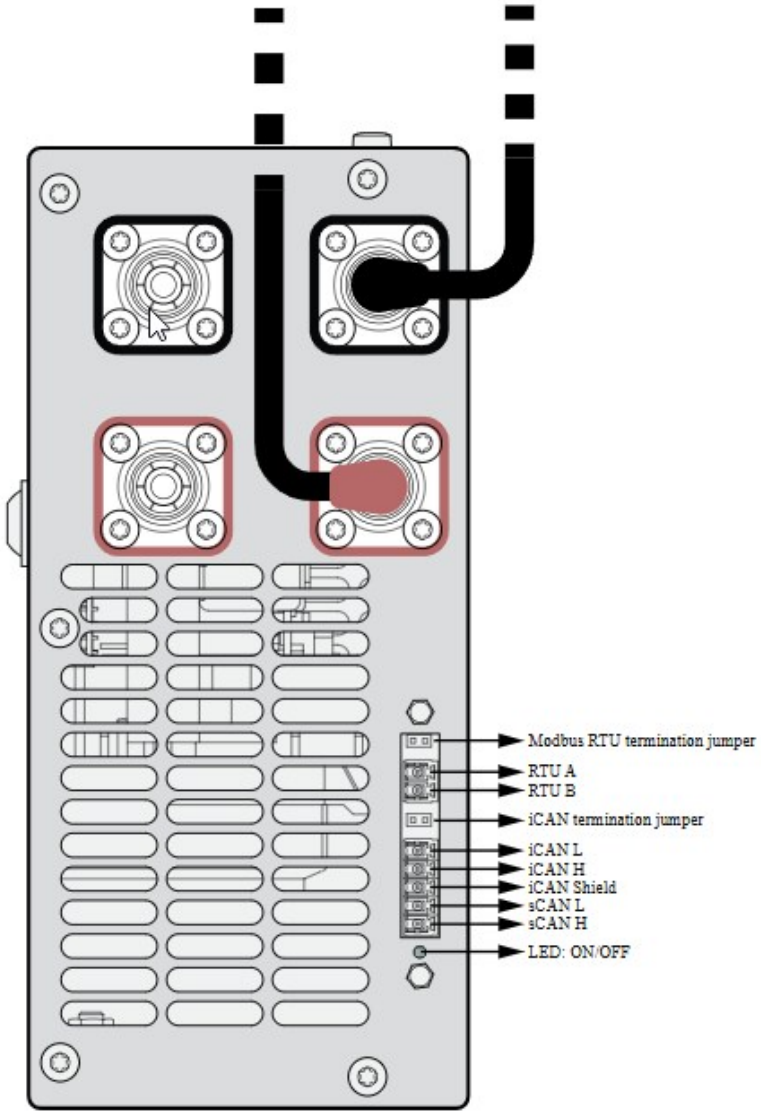


Figure 3-2 - BPU front view.

The site controller, installed in the BPU, connects to the Cloud via the Ethernet port. This port also enables communication between neighboring racks when they operate together. Using an isolated **CAN**[1] bus (iCAN), the site controller communicates with the BMS. Additionally, it governs the activation of the thermal management system by monitoring cell conditions, outdoor air temperature, and humidity.

The BPU serves as the connection point for various peripherals, including external energy meters. These meters can communicate via Modbus RTU or Modbus TCP protocols. The following ports are available:

[1]Controller area network

- **Modbus RTU**: Connect Modbus RTU meters to the port shown in the second figure above. If not in use, terminate the port with an external jumper.
- **Modbus TCP**: Connect Modbus TCP meters to the external switch.
- **sCAN port**: Reserved for internal use during BESS maintenance.
- **iCAN port**: Intended only for non-standard installations; terminate it with an external jumper under normal circumstances.
- **SPI port**: Facilitates communication between the BMS, the Main Control Unit (MCU), and the Cell Monitoring Units (CMUs) within each battery pack.

The BPU operates on a single-phase 230 VAC+N+PE power supply. The LED diode serves as the BPU power indicator.

Depending on the specific installation requirements, you can terminate both Modbus RTU and iCAN buses using external jumpers.

3.3 System safety

3.3.1 Safety measures

BAT-80 AC meets all requirements for the safe operation of lithium-ion batteries in industrial applications. A state-of-the-art **BMS**[1] protects the BESS by monitoring essential battery parameters such as cell voltage, current, and temperature to ensure safe operation. It also tracks key metrics like the State of Charge (SoC) and balances the battery cells to maximize energy utilization and performance.

A **BPU**[2] adds another layer of safety by shielding the battery and inverter from potentially harmful conditions. The BPU includes redundant contactors, controlled by the BMS, and fast-acting redundant battery fuses. The BMS continuously monitors the state of the contactors to ensure reliability.

To maintain proper operating temperatures and ensure long-term system safety, each battery pack is equipped with four temperature sensors, totaling 80 sensors for the entire system. This extensive sensor network quickly detects local temperature gradients, ensuring equal cell performance and protecting the system during its lifetime. If cell or ambient temperatures exceed a defined range, the site controller monitors the thermal performance and initiates power or current de-rating to prevent overheating.

The site controller also handles converter error management and automatically connects or disconnects battery racks as needed.

Mechanically, the BESS is housed in a specially designed, vandal-resistant, closed metal enclosure. Multiple layers of mechanical protection prevent fire propagation between battery modules, even in the extremely rare case of a battery thermal runaway.

[1]Battery management system
[2]Battery protection unit

For added safety, an external emergency stop button can be installed as an optional feature. When pressed, it disconnects the battery racks from the grid. An electrician should install the emergency stop button during the connection of the BESS to the grid.

3.3.2 Internal electrical protection schematics

The figure below illustrates the protection scheme used inside the BESS. The protection schematics include the following main components:

- One fast DC fuse located in each battery pack.
- Two fast DC fuses located in the BPU.
- Two DC contactors controlled by the BMS - 2 contactors per BPU. The BMS monitors the state of the contactors.
- One 16A AC fuse for protecting the BPU power supply.

All metallic parts of the battery rack, battery packs and BPU are grounded. In addition, all battery converters provided as a part of the BESS are grounded and protected - over current, overvoltage, over temperature protection -to ensure safe operation of the **PCS**[1].

[1]Power conditioning system

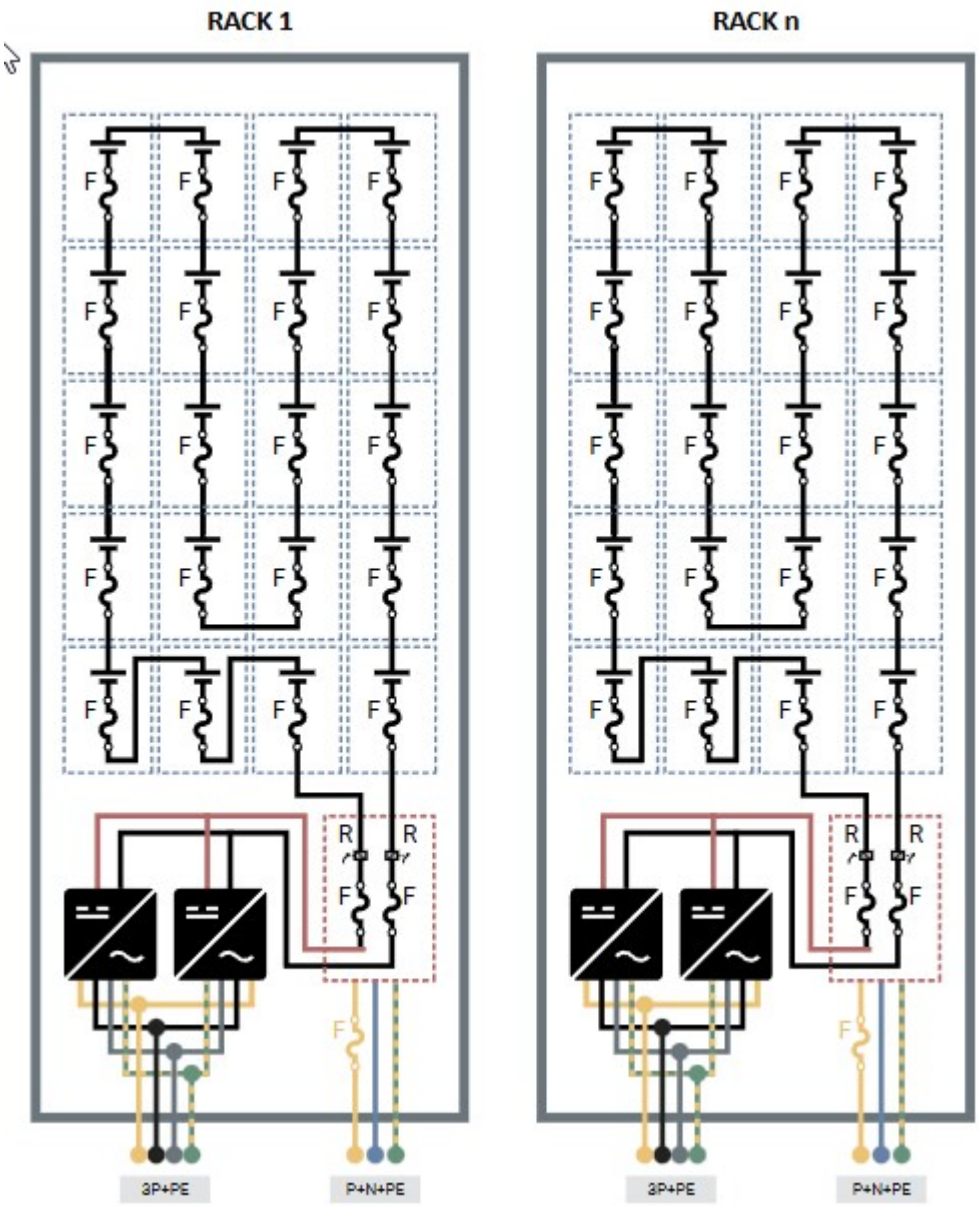


Figure 3-3 - Electrical protection schematics

3.4 Versions of BAT-80 AC

BAT-80 AC is available in four power configurations. The different versions are shown in the table.

Version	Maximum power rating	Electrical connection
BAT-80 AC/25 kW	25 kVA	3P+N+PE
BAT-80 AC/30 kW	30 kVA	3P+PE
BAT-80 AC/50 kW	50 kVA	3P+N-PE
BAT-80 AC/60 kW	60 kVA	3P-PE

Table 3-5 - Versions of BAT-80 AC

3.5 Key specifications

Technical properties	BAT-80AC/25 AND BAT-80AC/50	BAT-80AC/30 AND BAT-80AC/60
Power (charge/discharge)	25 kVA or 50 kVA	30 kVA or 60 kVA
Over voltage category[1]	III	
Optional backup functionality	Yes	No

[1]The level of transient overvoltage the battery energy storage system can withstand based on its location in the electrical installation. It ranges from OVC I (low exposure, electronic devices) to OVC IV (high exposure, utility connections). Transient protection is achieved through a surge protection device.

Technical properties	BAT-80AC/25 AND BAT-80AC/50	BAT-80AC/30 AND BAT-80AC/60
Power delivery	500ms *95 % of maximum power enabling ancillary service (**FFR**[1], **FCR-D**[2], **FCR-N**[3], **FCR**[4])	
Nominal energy	80 kWh	
Usable capacity	73 kWh	
Battery chemistry	Li-ion LFP	
Nominal battery voltage	768 V DC	
Battery voltage range	720-840 V DC	
Grid connection voltage	3 x 400V AC **Note**: Higher voltage levels feasible with transformer.	
Battery system efficiency	96,6 % **Note**: 100 % DoD, 15 kW round-trip efficiency (only battery) at 25° C.	
Standby power consumption	12 W	
Maximum thermal management	Cooling 2000W, Heating 300W	
Ambient operating tem-	-20°C to 45°C	

[1]Short for "Fast Frequency Response". FFR provides rapid active power support to counteract significant frequency drops, acting faster than traditional FCR. It is often used to address high-inertia grids or during large, sudden power imbalances.
[2]Short for "Frequency Containment Reserve for Disturbances". FCR-D is activated during larger, more significant frequency disturbances that fall outside the range of normal operations. It provides a stronger, more targeted response to prevent the grid frequency from falling below critical thresholds.
[3]Short for "Frequency Containment Reserve - Normal". FCR-N is a subtype of FCR designed to handle smaller frequency deviations during normal grid operation. It ensures continuous frequency stabilization within a defined tolerance band.
[4]Short for "Frequency Containment Reserve". FCR is a primary frequency response service that stabilizes grid frequency deviations by automatically balancing generation and consumption within seconds after a disturbance. It is the first line of defense to maintain grid frequency near its nominal value.

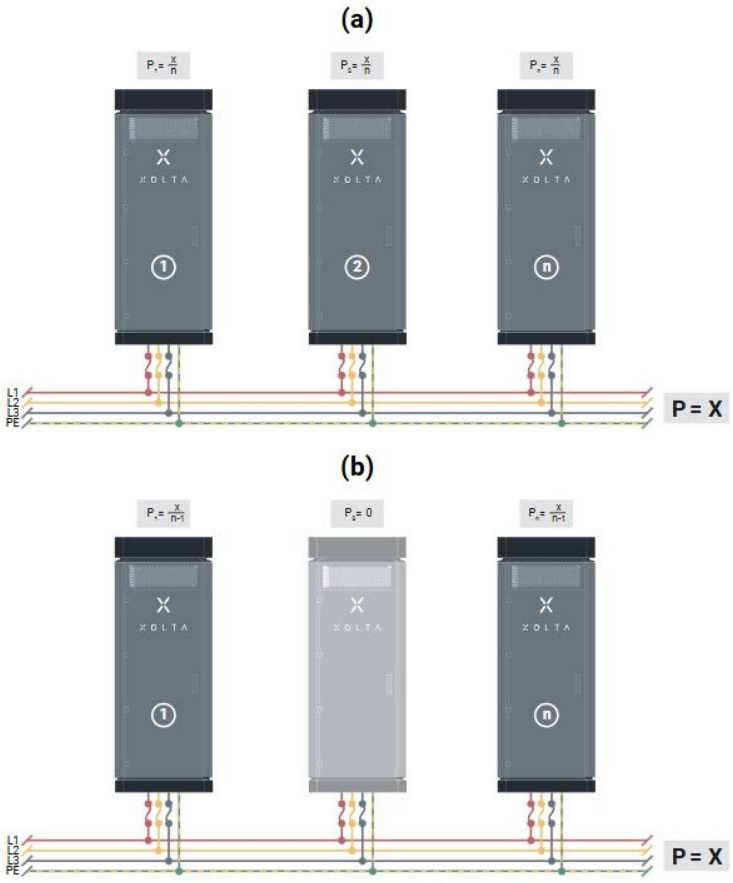
Technical properties	BAT-80AC/25 AND BAT-80AC/50	BAT-80AC/30 AND BAT-80AC/60
perature	**Note**: Power derating may occur.	
Parallel coupling	Ability to couple multiple racks in parallel	
Cabinet	Coated, vandal resilient steel enclosure	
Dimensions	D800 mm x W845 mm x H2210 mm	
Weight	995 kg per rack	
Standards and compliance		
System certification	CE: Safety, health and environment	
	UN38.3 classification for safe transportation	
	Low voltage directive: 2014/35/EU EMC Directive – 2014/30/EU According to: EN61010-1:2010, EN61010-1:2010/A1:2019 EN61010-12010/A1/AC:2019 and EN61326-1:2013	
Supported grid codes	**Common standards**	
	TF331 A+B	
	50549-1 (with local country deviations VDE4105 and VDE4110)	
	Individual standards	
	TOR A + B	
	AS4777.2	G99
	UL1741	
	UNE	
Protection rating	IP45	
Environment/Safe disposal required	480 kg industrial, Li-on LFP battery content 750 g refrigerant R134a	
Performance warranty	10 years / 70 %	

Table 3-6 - Key specifications

Chapter 4: System operation and functionality

4.1 Multi-rack solution

The BESS is a distributed system of independent AC-coupled battery racks capable of functioning as one unit. This system architecture offers superior redundancy and resiliency. In practice it means that one or more racks can be out of service, while the remaining racks will bear the potential workload - limited to the maximum power of all available racks - and continue operating with no interruption. This is illustrated below. A balancing algorithm prevents SoC deviation between racks by unevenly distributing the power during normal operation based on the individual rack SoC.



The illustrations above show how multi-rack power distribution works:

1. The total power setpoint (P = X) is divided among individual racks based on their power capacity and state of charge. This means P = P1 + P2 + ... + Pn.

2. If one or more racks fail unexpectedly, the remaining working racks will keep operating. The power will be redistributed among them to meet the total requested power. The total delivered power remains P = P1 + P2 + Pm + … + Pn, where Pm = 0 for any non-functioning rack, as long as the other racks can make up the difference.

4.2 Operation modes

The BAT-80 AC operation modes are described in the next sections.

Renewable support	Grid support	Backup	Direct battery control
Max self-consumption	Frequency support	Full load backup	External cloud control
Grid tariff optimization (**ToU**[1])	Voltage support		Local **Modbus**[2] control
	Peak shaving		

Table 4-7 - Operation modes

4.2.1 Renewable support

4.2.1.1 Maximizing solar self-consumption

The goal of the maximizing solar energy self-consumption mode is to help battery owners make the most of renewable energy, primarily from solar power. Solar energy production often happens during the day, when households typically use less electricity. BAT-80 AC stores this extra solar energy and releases it later, when household energy needs are higher than what solar panels are producing, as shown in the figure below. In this mode, the battery charges when solar energy production exceeds household demand, and discharges when demand is greater than solar production. By using this mode, BAT-80 AC owners can increase their use of renewable energy and reduce their energy bills.

[1]Time of Use

[2]Serial communication protocol developed by Modicon

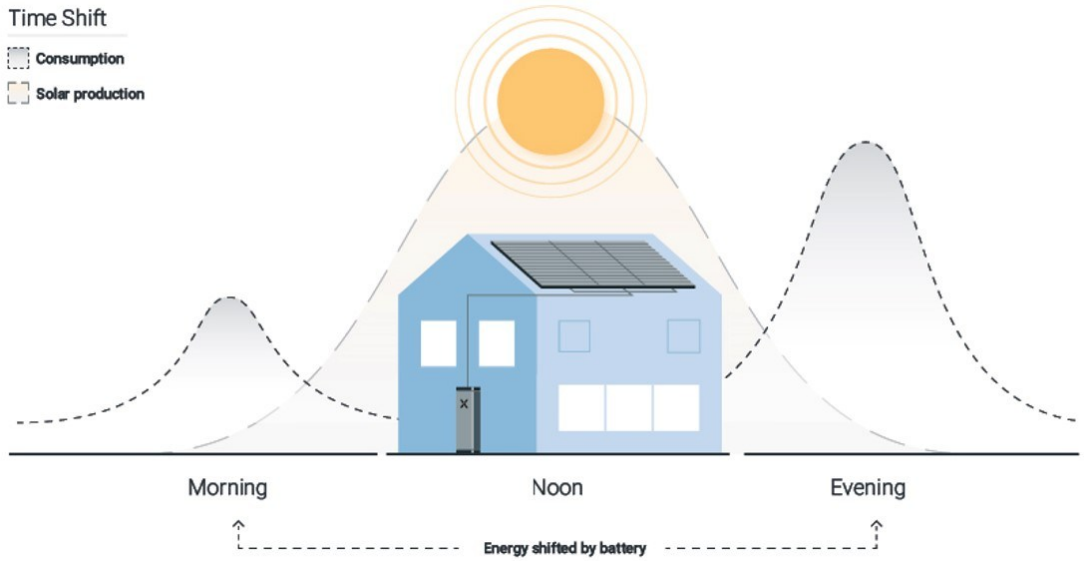


Figure 4-4 - Maximizing solar self-consumption

4.2.1.2 Grid tariff optimization

Grid tariff optimization is based on the Time of Use pricing model and is only available in markets with dynamic pricing. This optimization uses an advanced algorithm that builds on the solar self-consumption mode, incorporating additional factors such as weather forecasts, historical energy consumption, and electricity prices. The main goal is to minimize electricity costs for the BESS owner.

The BESS identifies periods of high and low electricity prices throughout the day. The system aims to save costs by avoiding grid imports during high-price periods and charging the battery during low-price periods, while also maximizing the use of solar energy. By using this mode, BESS owners can expect further reductions in their energy bills compared to the solar self-consumption mode, thanks to the price differences throughout the day. This feature is designed for customers with variable electricity tariffs.

The BESS also considers the weather forecast and historical consumption patterns to determine whether charging from the grid makes sense, and if so, how much energy should be stored during low-price periods.

The figure shows an example of grid tariff optimization. The top figure highlights high- and low-price periods, while the bottom figure shows the planned charging schedule based on weather forecasts and past consumption data.

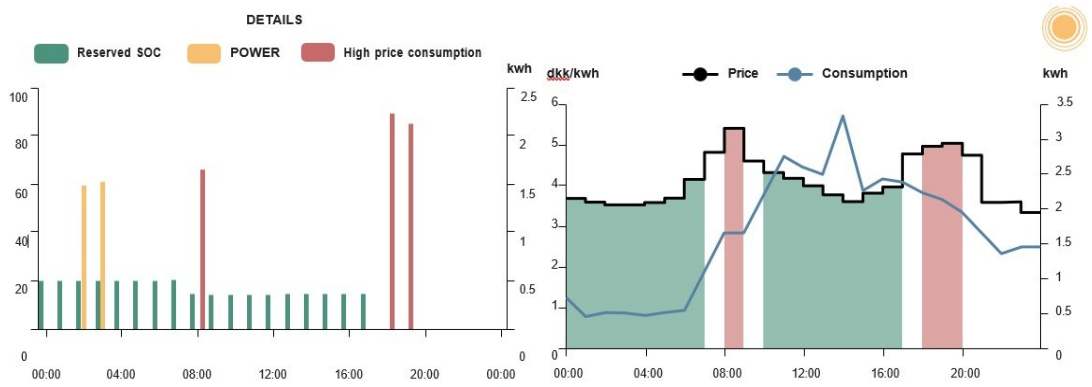


Figure 4-5 - Grid tariff optimization

4.2.2 Direct Battery Control

Operating BAT-80 AC using the direct control modes described in this section may be subject to special commercial and operational terms. Contact XOLTA support for more information at support@xolta.com.

4.2.2.1 External Cloud Control

In this control mode, BAT-80 AC responds to power setpoints provided by external systems. An API interface enables the BESS operator to set active power (P) and reactive power (Q) commands in all four quadrants. This mode is designed for advanced operators who wish to implement their own control algorithms, and it is also used for functional checks during system commissioning.

There are two formats for external control:

- **Single Setpoint** - the system operates based on a single setpoint, where only one value serves as input at a time.
- **Schedule** - the system follows a predefined schedule with one or multiple values.

4.2.2.2 Local Modbus control

BAT-80 AC can be fully controlled and monitored through external equipment, such as a PLC or customer **EMS**[1], using the standardized **Modbus**[2] communication protocol. BESS operators can connect to the system via the local Modbus TCP server running on the BESS controller. To enable the Modbus TCP server feature or obtain the detailed Modbus interface guide, please contact support@xolta.com.

All safety features for battery protection, such as power derating, are designed to prevent damage to the battery, even in case of incorrect operation.

[1]Energy management system
[2]Serial communication protocol developed by Modicon

Power setpoints (P) can be constrained by the maximum apparent input and output power of the inverters, the battery's state of charge (SoC) limitations, and local grid capacity. Reactive power setpoints (Q) are limited by the power factor and the system's total apparent power.

> **Note**: Grid code requirements (e.g., mandatory unity power factor) might restrict Q control.

- Positive power setpoints indicate battery charging.
- Negative power setpoints indicate discharging.
- Positive Q-setpoints represent the BESS injecting inductive reactive power.
- Negative Q-setpoints represent the BESS absorbing capacitive reactive power.

For information about API documentation, see *API access* on page 36.

4.2.3 Full load backup

BAT-80 AC has full load backup capabilities with the addition of a backup power application. When a grid outage is detected, the BESS automatically enters black start mode and switches to grid-forming mode. The backup system continuously monitors the grid state and seamlessly transitions between on-grid and backup modes as needed.

BESS owners can use the web app to monitor the system's backup mode, configure backup parameters, and control whether the system transitions automatically between on-grid and backup modes.

XOLTA provides the necessary auxiliary equipment required for backup operation. A detailed document explaining the backup functionality is available upon request.

4.2.4 Grid support

Grid support refers to a range of core grid ancillary services that help maintain the stability, reliability, and efficiency of the grid, in compliance with local electricity market regulations. BAT-80 AC is designed to be compatible with these services, allowing external providers to control it for grid support functions.

BAT-80 AC supports these core ancillary services:

- *Frequency support*.
- *Voltage support*.

BAT-80 AC also support these additional grid support mechanisms that help reduce stress on the grid and minimize grid fluctuations:

- *Load following*.
- *Peak shaving*.

4.2.4.1 Frequency support

BAT-80 AC supports the grid frequency services **FCR**[1], **FFR**[2], **FCR-N**[3], and **FCR-D**[4]. The BESS can respond fast to power requests implementing 95 % of the requested power within 500 ms.

> **Note**: For specific requests about frequency support services, contact XOLTA support at support@xolta.com.

4.2.4.2 Voltage support

Grid voltage support is an operational mode intended to support stabilization of the local grid voltage. Depending on the grid status, the BESS provides different control mechanisms to minimize the local grid voltage variations. This is shown in the figures below.

[1]Short for "Frequency Containment Reserve". FCR is a primary frequency response service that stabilizes grid frequency deviations by automatically balancing generation and consumption within seconds after a disturbance. It is the first line of defense to maintain grid frequency near its nominal value.
[2]Short for "Fast Frequency Response". FFR provides rapid active power support to counteract significant frequency drops, acting faster than traditional FCR. It is often used to address high-inertia grids or during large, sudden power imbalances.
[3]Short for "Frequency Containment Reserve - Normal". FCR-N is a subtype of FCR designed to handle smaller frequency deviations during normal grid operation. It ensures continuous frequency stabilization within a defined tolerance band.
[4]Short for "Frequency Containment Reserve for Disturbances". FCR-D is activated during larger, more significant frequency disturbances that fall outside the range of normal operations. It provides a stronger, more targeted response to prevent the grid frequency from falling below critical thresholds.

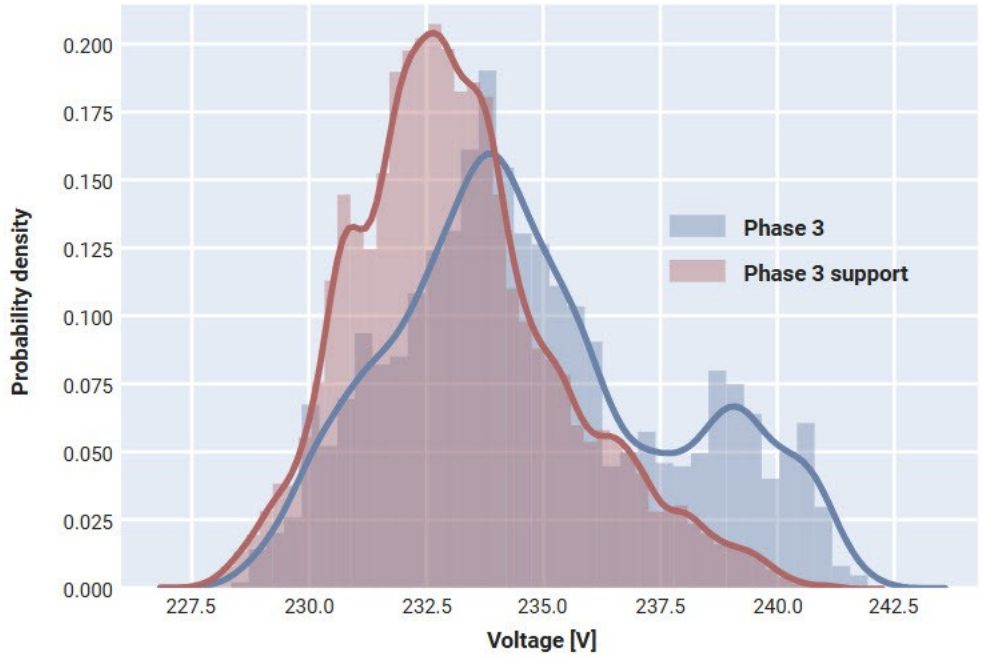


Figure 4-6 - Example of grid voltage distribution with and without grid voltage support mode

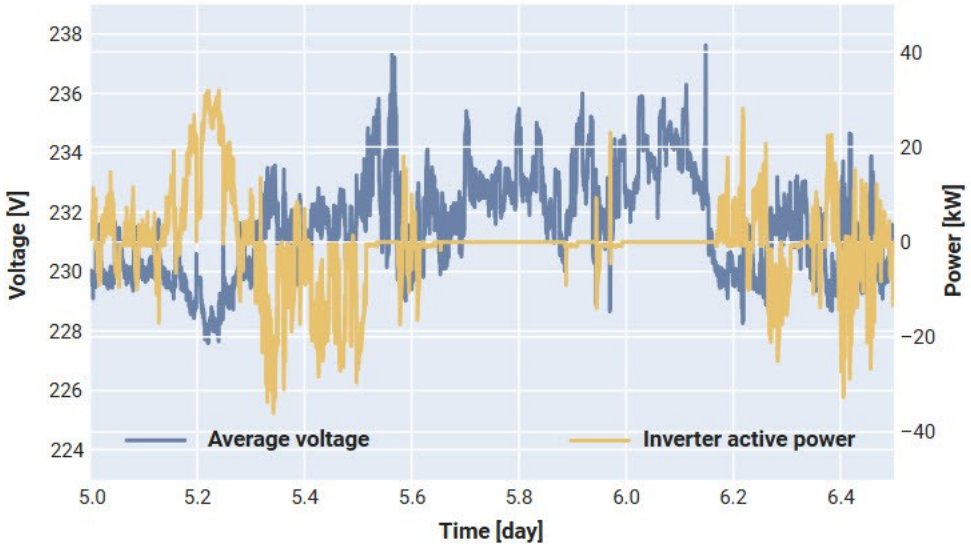


Figure 4-7 - Variations in grid voltage and the corresponding active power output of the BESS when operating in grid voltage support mode.

4.2.4.3 Load following

Load following is an operational mode in which the BESS dynamically adjusts its output to match the real-time power demands of one or more user-specified loads. The system continuously mon-

itors the load profile and responds by delivering or absorbing power as needed to maintain a balance between supply and demand.

4.2.4.4 Peak shaving

In this mode, the BESS is designed to reduce peak energy demand and supply from the grid, helping to lower the overall electricity costs for the BESS owner. Users can configure both the grid import and export limits through the web application.

When the site's power consumption exceeds the configured grid import limit, the BESS discharges to ensure the average power over a 15-minute interval stays within the grid connection limit. Similarly, the BESS charges to limit excessive grid feed-in from renewable energy production, maintaining balance and compliance with the set thresholds.

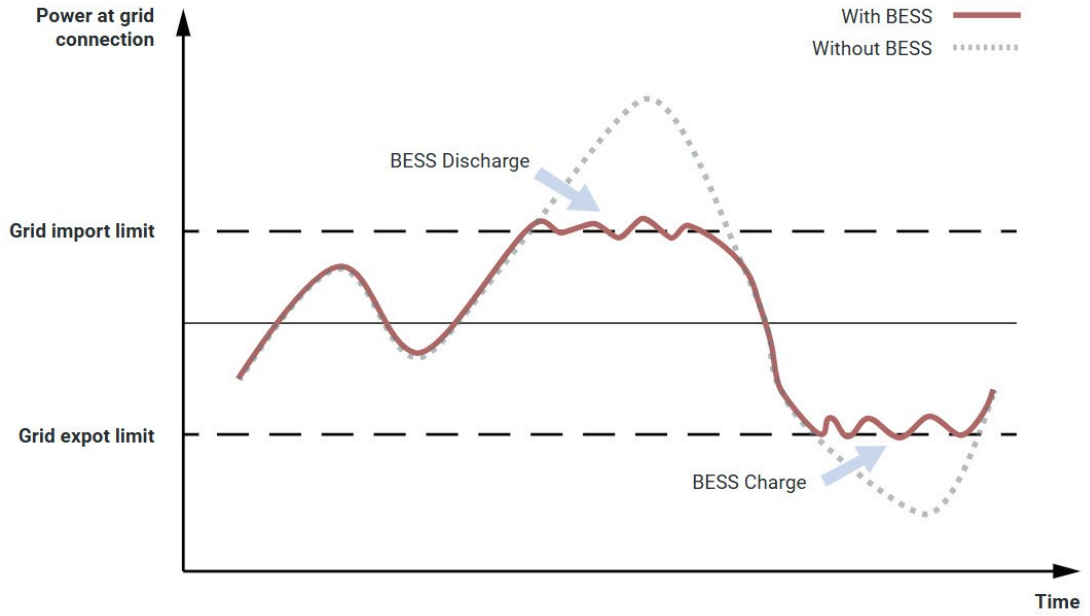


Figure 4-8 - When the BESS operates in peak shaving mode

4.3 Site controller state machine

The Site Controller (SC) is a finite-state machine with three distinct states:

- *Sleep state* (idle)
- *Run state* (active)
- *Error state*

Transitions from one state to the other occur through intermediate sequential procedures as shown in the diagram:

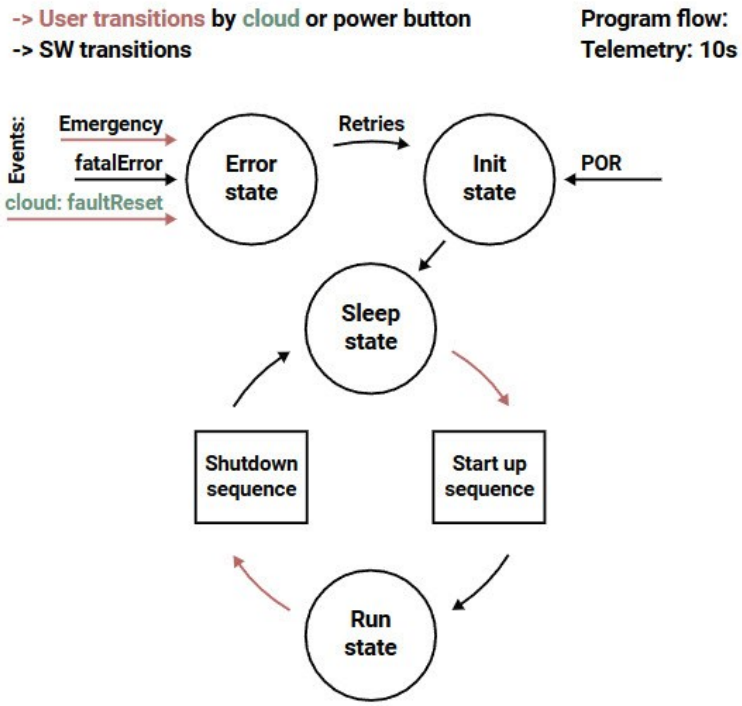


Figure 4-9 - System state diagram

4.3.1 Site controller states

4.3.1.1 Sleep state

In the sleep state, the system is idle. This means that it only monitors and transmits battery vitals and waits for a request to activate. In this state, the DC contactor of the battery is open. The inverter is inactive - the **IGBT**[1]s are off - with both the AC and DC contactors open. After a 20 minutes period of system inactivity, the BMS is disabled and turned off to further minimize energy loss.

When a change request occurs, the system can be active and ready to receive and inject power within a few seconds.

4.3.1.2 Run state

The run state is the operational state of the BESS. In this state, the system can receive and send power from and to batteries according to the associated algorithms defined by the operation mode chosen by the BESS owner. For an overview of the operation modes, see *Operation modes* on page 26.

[1]Insulated gate bipolar transistor

If the system is not in any of the grid support modes and is inactive (inverter P,Q = 0) for a period of more than 20 seconds, it will automatically transition to the sleep state.

4.3.1.3 Error state

If a fault is detected, the system will immediately switch to the error state. A series of actions will then occur:

- Immediate shutdown of inverter, DC and AC contactors open.
- BMS is disabled, DC relay open.
- Report error to the XOLTA cloud.

If the fault can be resolved internally, then the system will return to the state it was in when the error was identified and carry on the task it was previously executing.

4.3.2 Transitional sequences

4.3.2.1 Initialization

Accessible from **POR**[1] or from the error state in the event of a fault reset as shown in the diagram in the topic *Site controller state machine* on page 32. During this sequence, the following happens:

- Check of all communication lines of **ESS**[2], internal - serial buses - and external - could and energy meters.
- Status check of all devices.
- In case of error, reset the device showing the error.
- Activate **BMS**[3].

Once the sequence is complete, the system automatically transitions to the *Sleep state*.

4.3.2.2 Startup

Accessible from sleep state and transitions the system to the *Run state*. During this sequence, the following occurs:

- The inverter is activated.
- BESS DC contactors close.
- AC and DC contactors of inverter close.

4.3.2.3 Shutdown

Accessible from the run state and transitions the system to the *Sleep state* on the previous page. During this sequence, the following occurs:

---

[1]Power on reset
[2]Energy storage system
[3]Battery management system

- Inverter is de-activated.
- AC and DC contactors of the inverter open.
- BESS DC contactors open.

4.4 Monitoring the BESS

With the XOLTA web app, you can monitor the **BESS**[1], for example, view real-time information about your energy sources - how much energy comes from the solar panels, grid, and batteries. You can also view the battery charge level, energy consumption, estimates of savings in costs and CO2, and much more.

The web app also gives you configuration options, for example, you can configure the policies to control when your system purchases, stores, and uses electricity, and at what times and prices.

> **Note**: To view the web app manual:
>
> - In English, click here: https://doc.servicex.dk/xolta/web-app/en-us/default.htm.
> - In Danish, click here: https://doc.servicex.dk/xolta/web-app/da-dk/default.htm.

[1] Battery energy storage system

Chapter 5: API access

XOLTA can enable operators to receive BESS device specific telemetry data and control a device directly by using an API. The API is a set of REST endpoints that provide user access to device data via a Cloud service.

Contact support@xolta.com for information about API access. A written agreement must be made to obtain time limited access.

The API provides the possibility of sending commands to a device, for example, querying about device or site status and receiving historical telemetry data for a system. Historical data is available in 10s resolution without statistics and [1, 10 and 60] minute resolutions.

> **Notes**:
>
> - To view the API definition, follow this link: https://external.xolta.com/index.html.
> - To view the general API manual, follow this link: https://doc.servicex.dk/xolta/api/en-us/pdf/xolta-api-manual.pdf.
> - To view the grid service API manual, follow this link: Grid service operation API manual.

The table below provides a list of typical telemetry signals:

Name	Unit	Description
BMS cell temperature	Degrees Celsius	Minimum and maximum cell temperature across all racks.
BMS cell voltage	V	Minimum and maximum cell voltage in the racks, including total battery rack voltage
State of charge	%	The state of charge of the device trimmed between 0 and 100.
Air inlet temperature	Degrees Celsius	Temperature of the cooling inlet air across all racks.
Shunt temperature	Degrees Celsius	Temperature measurement of the shunt sensor inside the BPU across all racks.
Shunt current	A	DC current of the battery.
Inverter active power	kW	Active power of the inverter.
Inverter reactive power	kW	Reactive power of the inverter.

Name	Unit	Description
Calculated consumption	kW	Active power consumed by load and auxiliaries on the site/system, for example, the cooling and BPU. **Note**: Metered values are only available if the meter is operated by XOLTA.
Meter grid	kW	Net power injected/absorbed from the grid at Point of Common Coupling and measured by a power meter. **Note**: Metered values are only available if the meter is operated by XOLTA.
Meter PV	kW	Active power produced by the PV system and measured by a power meter. **Note**: Metered values are only available if the meter is operated by XOLTA.

Table 5-8 - Telemetry signals available through the API

Tip: There is no need to open any ports in a firewall to gain access to monitor or control a device behind a firewall.

Chapter 6: Receiving and installing BAT-80 AC

This section covers the delivery inspection and provides an overview of the installation and connection process for BAT-80 AC. For detailed step-by-step installation instructions, refer to the installation manual.

6.1 Inspect the delivery

Each BAT-80 AC unit is delivered as a fully-assembled rack.

BAT-80 AC has been thoroughly inspected and tested before shipping. Upon delivery, immediately perform a visual inspection of the rack and its packaging to ensure everything is in good condition. If you notice any visible damage to the rack or its packaging, report it immediately to the carrier, delivery personnel, or XOLTA Support. Include photo documentation.

Each XOLTA system and its major sub-components are equipped with an identification nameplate displaying the serial number, device ID, and other unique identifiers. Be sure to mention these identifiers when contacting XOLTA Support.

6.2 Site requirements

- BAT-80 AC is intended for outdoor use and is protected up to IP45.
- The ambient temperature in the installation area should be within the range -20°C to +45° C.
- Make sure that BAT-80 AC is adequately ventilated and that you observe the clearance requirements.
- Do not immerse BAT-80 AC in water or exposed to high pressure water jets.
- Do not expose BAT-80 AC to high temperatures, flames, or physical force impacts.
- Do not expose BAT-80 AC to environments with a **C3 classification**[1] or above.
- Make sure the underlying foundation and ground can support the weight of BAT-80 AC.
- All BAT-80 AC racks should be level (±0,5°) and secured to the plinth and the underlying foundation.
- BAT-80 AC should always be placed on the north side to minimize direct sunlight, which may affect the system's performance.

[1] A corrosion category based on ISO 12944, indicating a moderate level of environmental corrosion risk. It applies to urban and industrial areas with moderate sulfur dioxide pollution or coastal areas with low salinity.

Warning

Do not install BAT-80 AC in areas subject to the following conditions:

- Areas prone to earthquakes.
- Altitudes more than 2000 meters above sea level.
- Areas prone to flooding, open flames, explosion, and extreme changes of ambient temperature.

6.3 Clearance requirements

You must adhere to the minimum clearance distances on all sides of the BAT-80 AC racks when planning for installation. These clearance distances ensure optimal operation of the thermal management system and provide enough space for a XOLTA trained electrical installer to service the BESS.

Minimum clearance distances	
Side clearance	300 mm
Clearance between battery racks	200 mm
Frontal clearance	1000 mm
Back clearance	300 mm
Top clearance	1000 mm
Foundation leveling	±0,5°

Table 6-9 - Minimum clearance distances

Notes:

- That the first rack in a row must have at least 300 mm free space to the left of the rack when facing the rack. This allows access for service of all components.
- Please make sure to follow the site requirements, but always take local conditions into consideration.

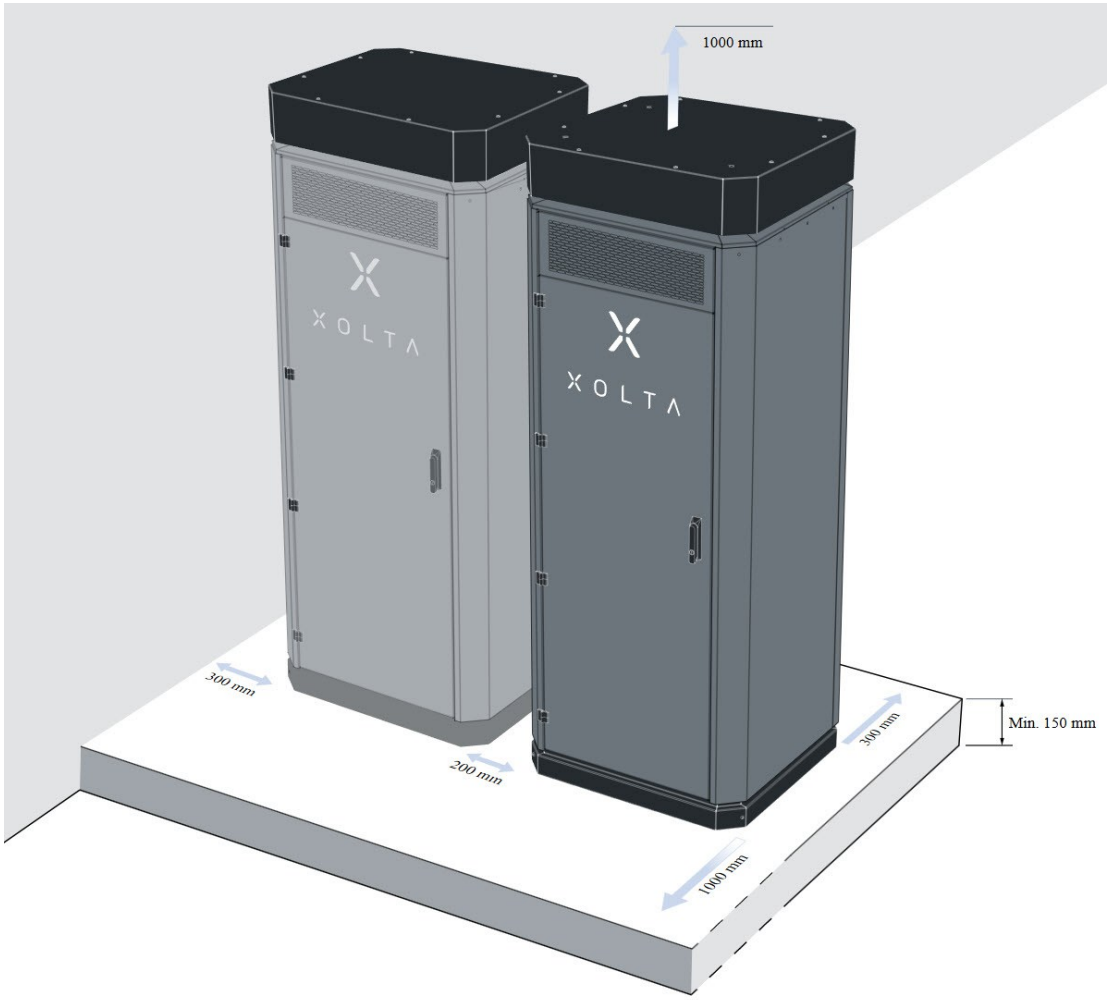


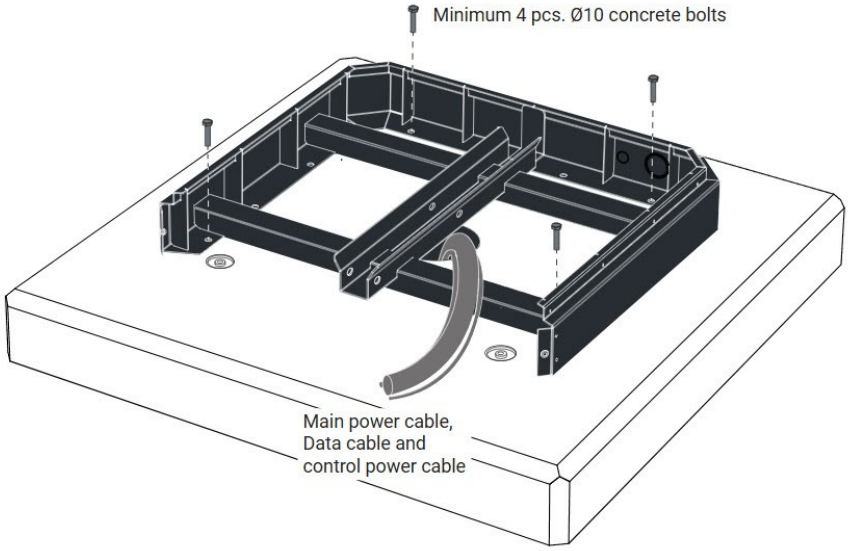
Figure 6-10 - Minimum clearance space between battery racks.

6.4 Install BAT-80 AC

This section provides a simplified guide to installing BAT-80 AC. For detailed information, see the *BAT-80 AC Installation Manual*.

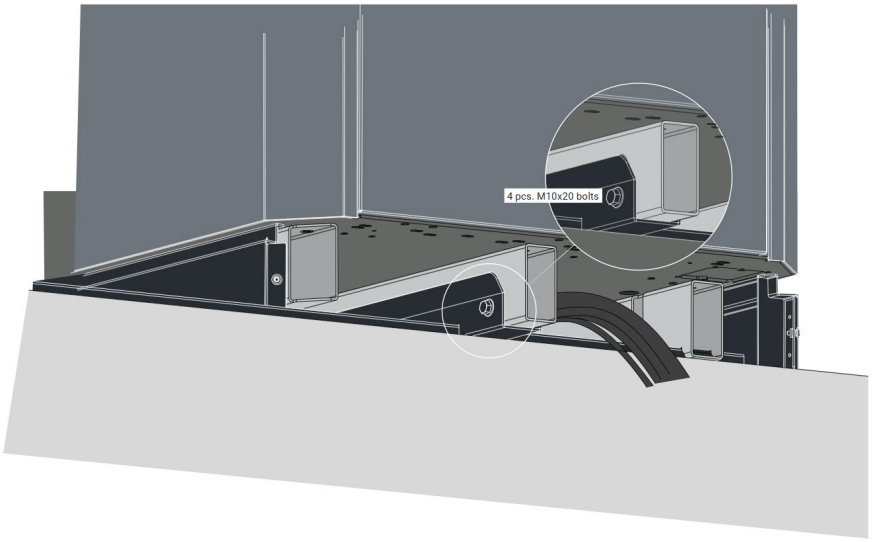
Steps:

1. Mount the base onto the plinth, with the base front taken off. For information about alternative cable routing, see the installation manual.

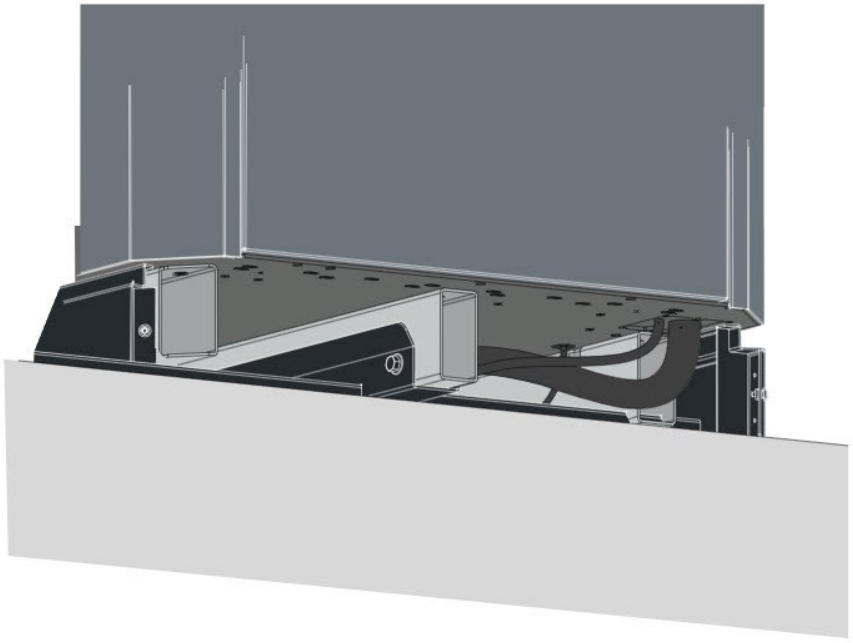


2. Place the battery rack onto the base using a forklift or crane.

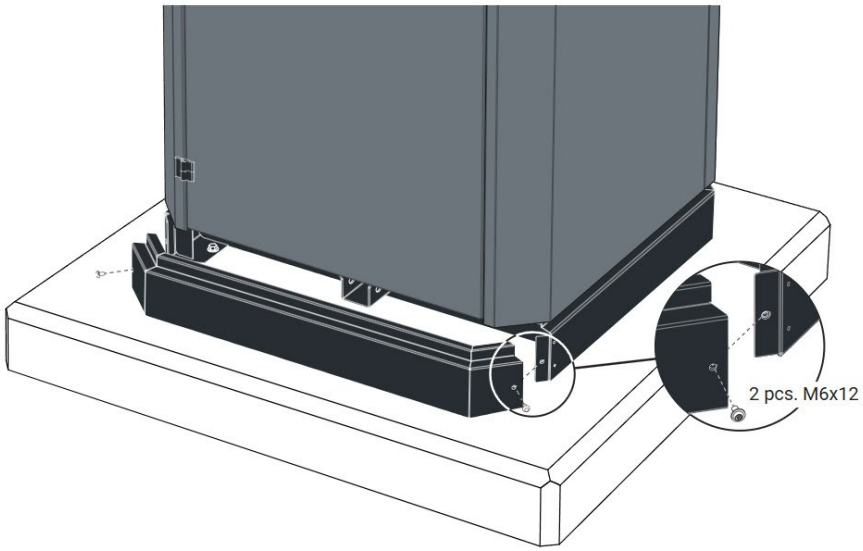
3. Fasten the four M10x20 bolts to secure the battery rack to the base.



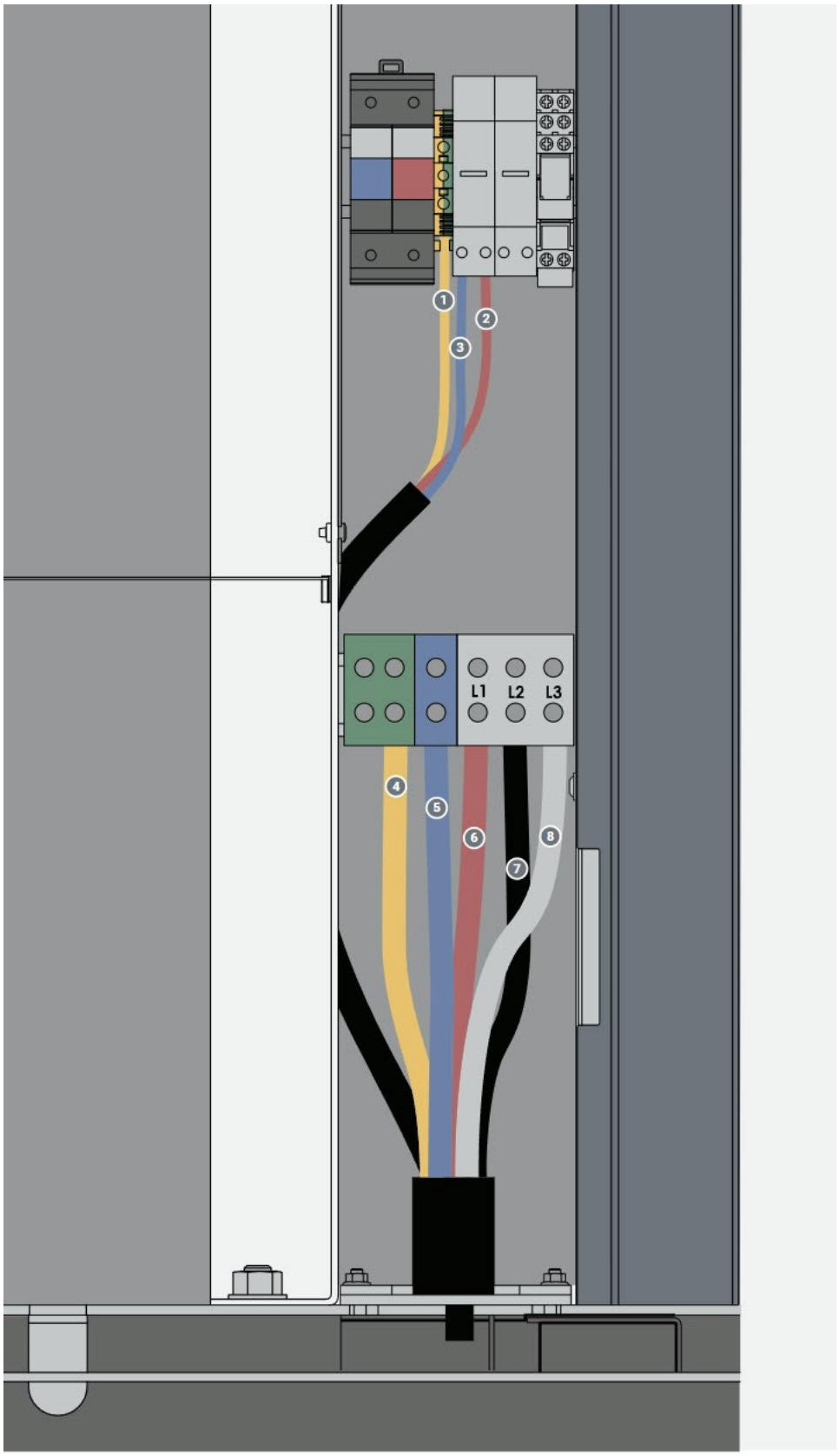
4. Route the main power cable, control power cable, and data cable into the BAT-80AC rack.



5. Attach the base front.



6. Connect BAT-80 AC to the grid and internet.


1
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6.5 System operation

BAT-80 AC is intended to be operated from the XOLTA Cloud or via an **API**[1]. For information about the available operation modes and operation states, see *Operation modes* on page 26.

[1]Short for "Application Programming Interface". A set of commands and protocols that enables different software applications to interact and exchange data by defining how requests and responses should be structured.

Chapter 7: Service and maintenance

7.1 Maintenance

Proper maintenance of will prolong the operational life of the system.

> **Warning**
>
> Only a XOLTA trained electrical installer may undertake service work involving high voltage components. Failure to comply with this may result in injury or even fatal accidents. Any unauthorized work on BAT-80 AC will void the product and performance warranty.
>
> Before doing any service work on BAT-80 AC, disconnect it from any power source. Even a de-energized BAT-80 AC rack can cause injury or even death.

7.1.1 Maintenance intervals

In addition to BAT-80 AC's own continuous monitoring of vital parameters, you should schedule an annual service check. Only a XOLTA trained electrical installer with adequate knowledge regarding electricity and batteries should perform this check. If in doubt, contact your local XOLTA supplier.

7.1.2 Annual check of the BESS

- Clean or exchange the main air filter if required.
- Clean and check main door seal for any signs of breakage or leaking.
- Check for moisture inside the rack.
- Maintenance of fans:
- Check that all fans are operating with no abnormalities, such as excess vibration or noise.

> **Note**: Check this while the system is running.

- Remove dust and residues from fans.
- Check air in-lets and exhaust air outlets are free from residue or any obstructions.
- Check for any signs of corrosion.
- Check for loose connections and signs of burns.
- Ensure the electrical connections to the grid are securely tightened.
- Check for leakage of electrolyte.
- Measure ground resistance and ensure it complies with local regulations.

- Verify that the surge arrester (**SPD**)[1] protecting the control power circuit is functioning properly. Replace if necessary.
- Retighten all screws on the door lock system.

7.2 Replacing maintenance parts

7.2.1 Replace the primary cooling fans

BAT-80 AC has two primary fans for thermally controlling the system. One external fan and one internal. Both fans have a lifetime of approximately 40.000 operation hours or an age of four years.

Replace fans before they exceed the indicated lifetime or if the fans are damaged to ensure optimal cooling and longevity of the BESS.

> **Note**: Because both fans are placed deep inside BAT-80 AC, only XOLTA trained electrical installer may replace the fans.

7.2.2 Replace the inverter fans

In addition to the two primary fans, the inverters have separate fans for cooling. The inverter fans have a lifespan of 40000 operating hours or an age of four years.

Replace the inverter fans if they have exceeded their lifespan, or if they are damaged.

> **Note**: Because of the complexity of this operation, only a XOLTA trained electrical installer may replace the fans.

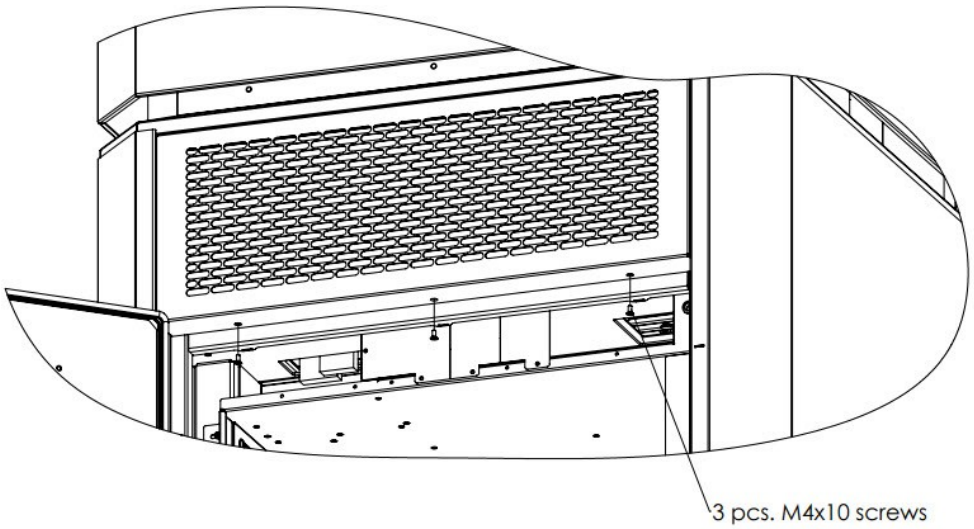
7.2.3 Replace the main air filters

BAT-80 AC contains four main filters: two for the front and two for the rear. These filters are crucial for maintaining the system's optimal performance and extending its lifespan. If the filters become excessively dirty and cannot be cleaned, or if they are damaged, replace them. The replacement procedure is outlined below. To reassemble, simply follow the steps in reverse order.

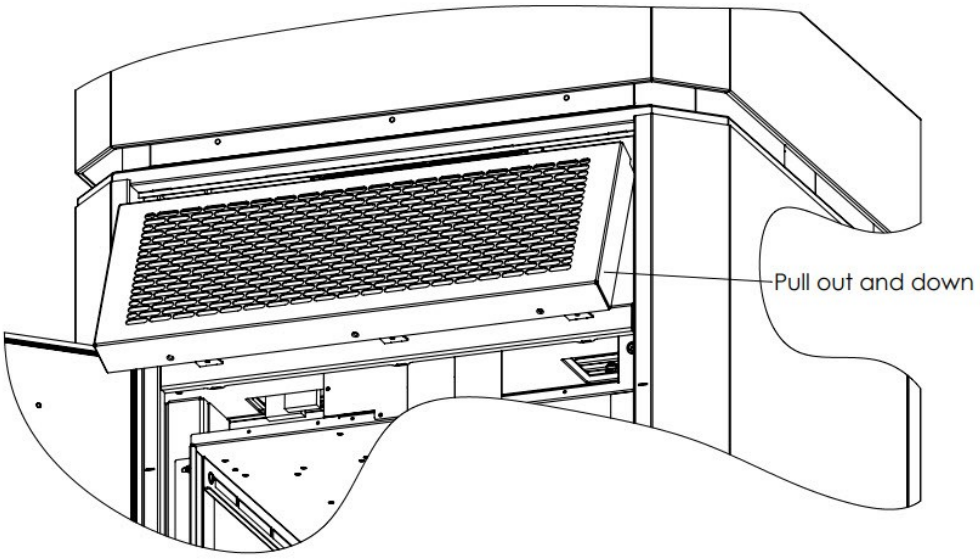
Steps:

[1] Short for "Surge Protection Device". A device designed to protect batteries and other electrical components from voltage spikes or surges, for example, because of lightning strikes. It's installed between the power supply and the battery it's protecting. When a surge occurs, the device either diverts the excess voltage to the ground or limits it to a safe level that won't damage the system.

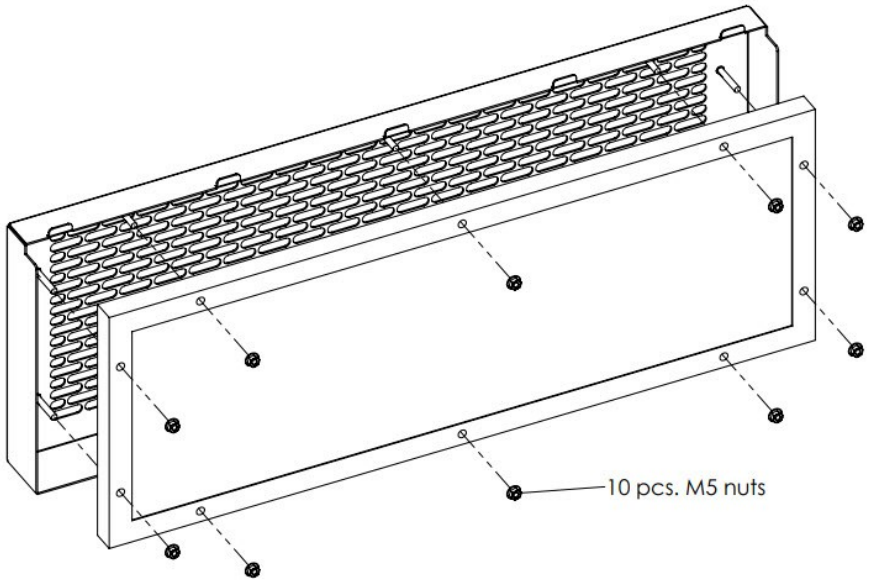
1. Remove the front bottom filter and bracket:
1. Unscrew the three M4x10 screws.



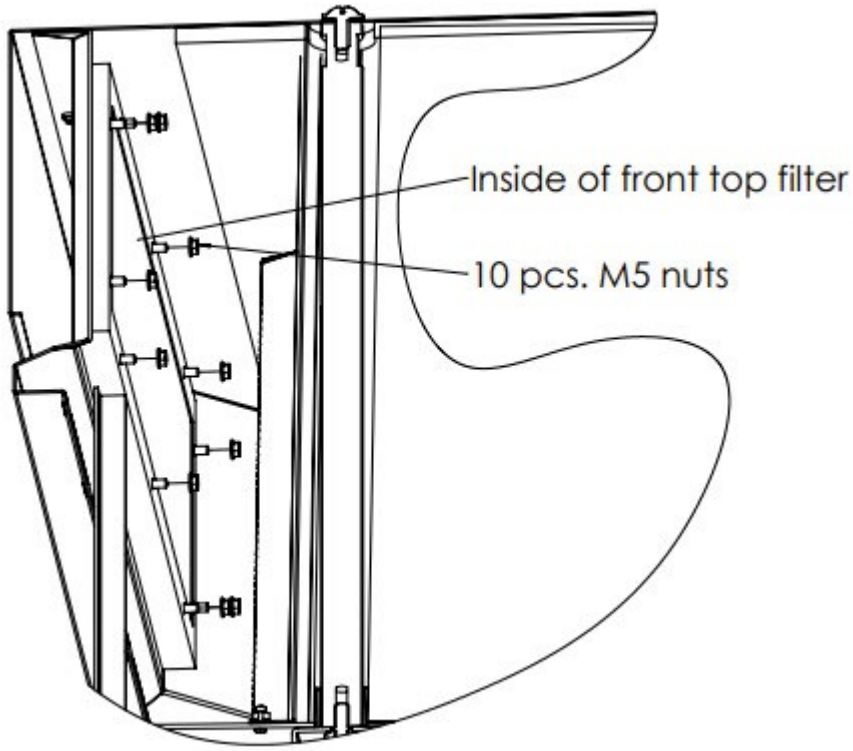
2. Pull the filter with bracket out and down.



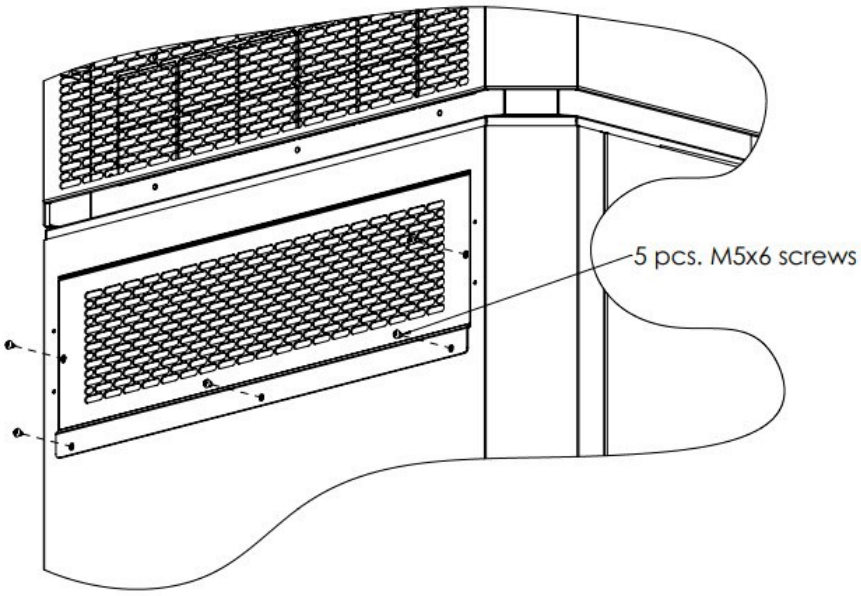
3. Detach the filter from the bracket by unscrewing the 10 M5 nuts.



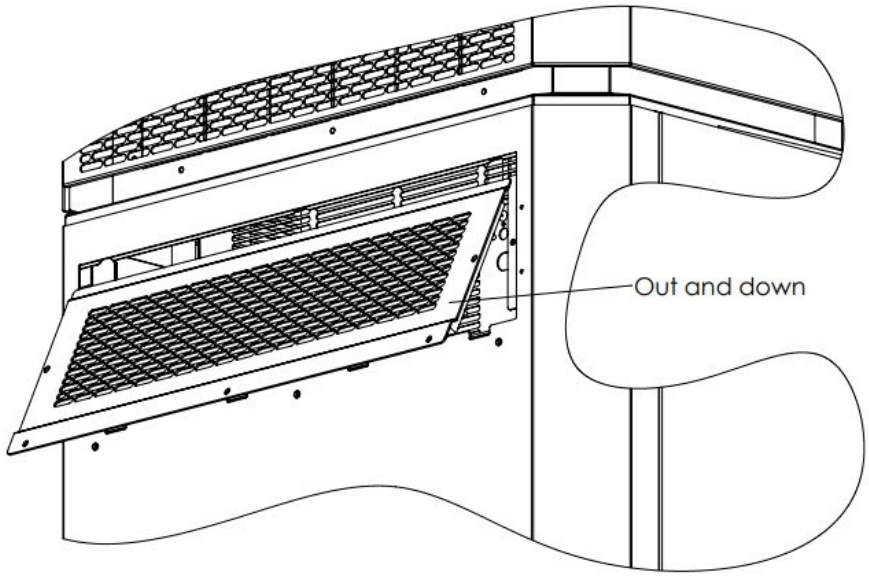
2. Remove the front top filter by unscrewing the 10 M5 nuts



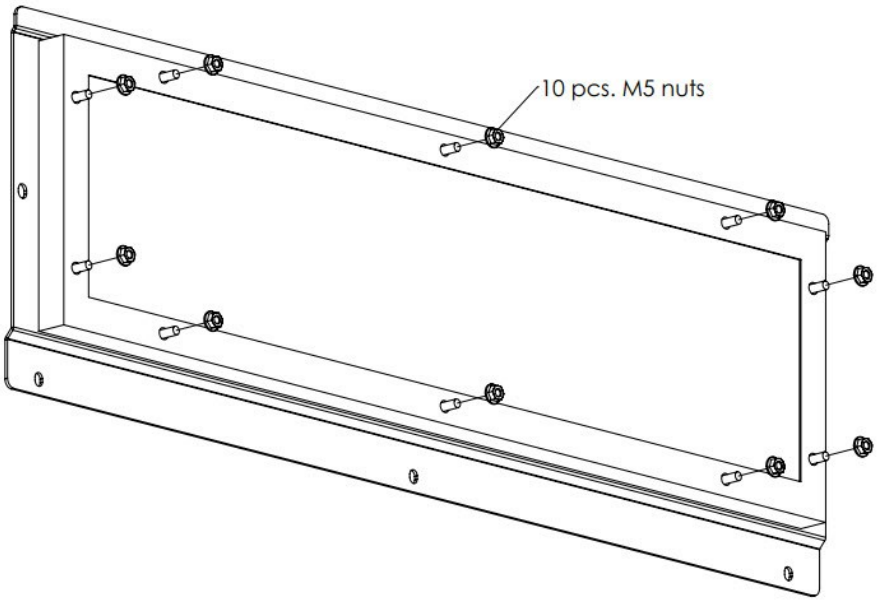
3. Remove the rear bottom filter and bracket:
1. Unscrew the five M5x6 screws.



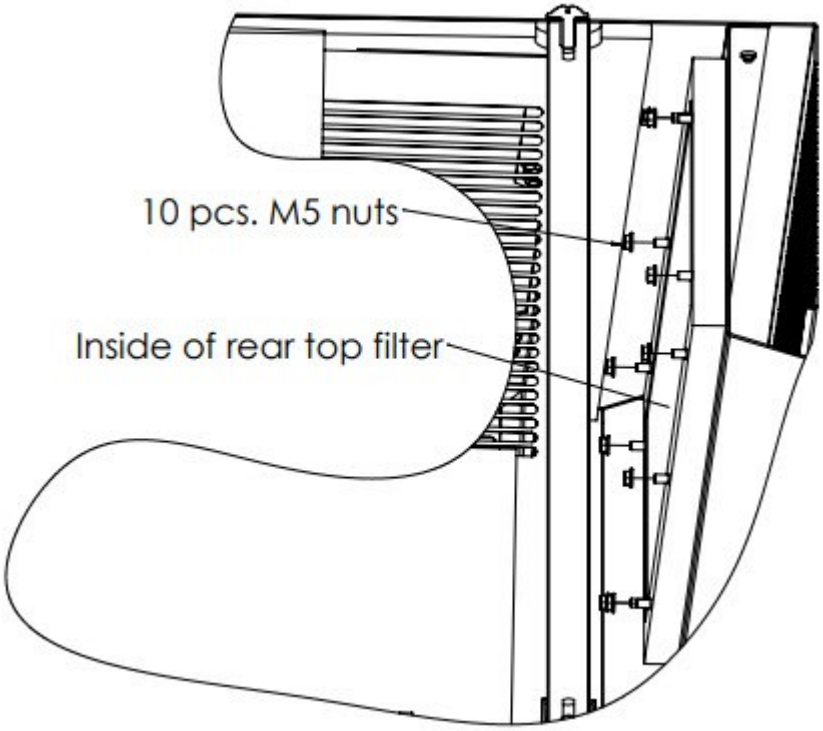
2. Pull the filter with bracket out and down.



3. Detach the filter from the bracket by unscrewing the 10 M5 nuts.



4. Remove the rear top filter by unscrewing the 10 M5 nuts inside of the rear top filter.



7.3 Fault finding and troubleshooting

Below is a list of common faults and possible solutions. If in doubt, contact XOLTA support. Before contacting XOLTA support, please verify the following:

- 3-phase power is available.
- Control power (230V) is available.
- The **RJ45**[1] connection cable has internet access.
- All fuses and breakers are closed.
- Your device ID.

Indicator	Common fault reason	Possible solution
No access to BAT-80 AC via XOLTA cloud or the web API.	The control power (230V) is missing.	Verify the control power and ethernet is present.
	No connection to the ethernet.	Verify the RJ45 is plugged in, and the cable isn't damaged.
The inverter LED is flashing red.	Inverter is in error state because of **Modbus**[2] communication fault.	Reenable the Modbus communication between the **BPU**[3] and inverter.
	Inverter 3-phase is missing.	Verify that all three phases are working, and all connections are tightened.
System in error via the XOLTA cloud or **API**[4].	-||-	Contact XOLTA support.
Water inside of BAT-80 AC.	Damage to the door seal.	The door seal should be replaced. Contact XOLTA for instructions.
	Damage to surrounding sealing.	Repair the sealing.
Fans don't work when the system is running for longer periods of time.	Faulty fan	Check if *Forced fan off* has been enabled. Replace the fan if a system restart does not solve the problem.

[1]Short for "Registered Jack 45". A standardized connector used for Ethernet networking, featuring an 8P8C (8 Position, 8 Contact) design. It is commonly found on twisted-pair cables like Cat5e and Cat6, enabling connections between devices such as computers, routers, and switches. RJ45 supports high-speed data transmission and adheres to wiring standards like TIA/EIA-568.
[2]Serial communication protocol developed by Modicon
[3]Battery protection unit
[4]Short for "Application Programming Interface". A set of commands and protocols that enables different software applications to interact and exchange data by defining how requests and responses should be structured.

Indicator	Common fault reason	Possible solution
Noisy fan	The fan is damaged or blocked.	Inspect for debris or obstructions and replace the fan if necessary.

Table 7-10 - Fault finding and troubleshooting

> **Note**: If the table above did not help you solve the problem, please contact XOLTA support at support@xolta.com or +45 35 153 123.

7.4 List of spare parts

Here is a list of the most common spare parts:

Spare part	Product number
Front bottom filter	002119
Front top, rear bottom and top filter	002111
Door gasket	001998
Bottom gasket for **AC-unit**[1]	002148
AC-unit	002116
Top gasket for AC-unit	002101
Door locking system	001990
Surge arrester[2]	002135
Battery and **BPU**[3] fuse 200 A	000993
Internal fan	001934
24 V power supply	001943

[1]An air-cooling unit in the battery energy storage system used to absorb and transfer heat inside the battery unit.
[2]A type of surge protection device (SPD) used in electrical power systems to limit voltage surges and divert excess current safely to the ground, preventing damage to equipment during events like lightning strikes or switching surges.
[3]Battery protection unit

Spare part	Product number
Trumpf inverter - AC 3025	001529
ABB inverter – 30 kW	001170
Battery pack 105 Ah	101210
BPU[1]	101211

Table 7-11 - Spare parts for BAT-80 AC

> **Note**: If you have questions or need additional information about spare parts, contact XOLTA support.

[1] Battery protection unit

Chapter 8: Decommissioning

BAT-80 AC is built with a modular design, allowing for easy disassembly of any component. For safety reasons, only a XOLTA trained electrical installer may decommission the BESS.

8.1 Prepare BAT-80 AC for decommissioning

To prepare BAT-80 AC for decommissioning:

- Discharge BAT-80 AC to SoC = 0 %.
- Make sure the BESS is electrically fully disconnected at the main switchboard.
- Wait 20 minutes to make sure all the electric components are fully discharged.
- Disconnect all the black and orange Amphenol DC connectors on the front of the battery packs and the BPU.
- Disconnect the BMS communication cables from the battery packs.
- Disconnect AC cables inside the battery racks: 3P+E main grid connection and 1P+N+E (auxiliary connection).
- Disconnect all cables from the BPU.
- Disconnect all cables from the inverters.

8.2 Decommision the battery packs

Unscrew the three screws on the front of each battery pack to remove it. Slide the module out. You can send it to a decommission agent for further separation and division into fractions for re-use or shredding to recover valuable metals.

8.3 Decommission the electronic parts

BAT-80 AC has an inverter tray at the bottom of the rack. Remove the inverter tray and rack cabling from the rack and handle them as electronic waste.

The heating elements are located in the top part of the cabinet. Remove them after handling everything else. Handle the heating elements as electronic waste.

> **Note**: Recycle the empty rack as steel metal.

8.4 Decommission the AC unit

Lift the **AC unit**[1] out from the top by removing all the screws on the top of BAT-80 AC. After removing the top, unbolt the AC unit from each side at the base.

Handle the AC unit according to local regulations regarding the refrigerant **R134A**[2], which has a weight of 750 g. Ensure proper disposal or recycling of the refrigerant to comply with environmental safety standards.

[1] An air-cooling unit in the battery energy storage system used to absorb and transfer heat inside the battery unit.
[2] A type of refrigerant used in air conditioning and refrigeration systems.

Chapter 9: Long term storage

If you need to store a BAT-80 AC rack disconnected from the grid for more than 30 days, you must meet the following requirements to maintain the product warranty.

9.1 Storage location requirements

Ensure that the chosen storage location meets the following criteria:

- Complies with local fire regulations regarding the storage of flammable and hazardous materials.
- Maintains a temperature range of 5–25 °C.
- Keeps relative humidity below 60% (non-condensing) during storage.
- Provides protection against rodents and other pests.
- Is a corrosion-free environment, avoiding exposure to salty mists or other corrosive substances.

9.2 Prepare for long-term storage

Before storing BAT-80 AC in a suitable location, ensure that:

- The **SoC**[1] of BAT-80 AC is between 30 % and 40 %.
- If BAT-80 AC is connected to the grid, disconnect the control power fuses at the input terminal.
- If BAT-80 AC is not connected to the grid, a XOLTA trained certified electrical installer is required to verify that the BAT-80 AC rack has an SoC value suitable for storage.
- If possible and it's still available, reassemble the wooden crate with anti-tilt supports that the product was originally delivered in.

9.3 Storage procedure

To maintain the product warranty for BAT-80 AC during storage, every six months, check the cell voltage every six months to ensure:

- Each individual cell is within the range of 3.10 V to 3.25 V.
- The battery pack voltage is within the range of 37.10 V to 39.00 V.
- The BAT-80 AC system voltage is within the range of 744.00 V to 780.00 V.

[1] State of charge

Note:

- Only a XOLTA trained certified electrical installer may charge a disconnected BAT-80 AC rack.
- If the battery voltage is outside these ranges, charge BAT-80 AC to bring the system to the recommended voltage or SoC.

If the system is connected to the grid, perform a charge cycle as recommended, ensuring the SoC ends within the range of 30% to 40%.

Chapter 10: Terminology

This section describes the terms and abbreviations used in this manual.

AC
Alternating current

AC unit
An air-cooling unit in the battery energy storage system used to absorb and transfer heat inside the battery unit.

API
Short for "Application Programming Interface". A set of commands and protocols that enables different software applications to interact and exchange data by defining how requests and responses should be structured.

Battery protection unit
A unit containing switches and fuses for battery protection .

BESS
Battery energy storage system

black start mode
A system operation mode in which the battery energy storage system independently generates power without external grid support, allowing it to restart other power generation sources and restore grid operations following a blackout. See also “grid forming mode”.

BMS
Battery management system

BoL
Beginning of life

BPU
Battery protection unit

C3 classification
A corrosion category based on ISO 12944, indicating a moderate level of environmental corrosion risk. It applies to urban and industrial areas with moderate sulfur dioxide pollution or coastal areas with low salinity.

CAN
Controller area network

CMU
Cell monitoring unit of n-BMS

Controller area network
Serial communication protocol developed by Bosch.

DC
Direct current

de-energize
To disconnect or isolate the battery energy storage system from any power source to prevent the flow of current. A de-energized battery might still be partially or fully charged.

DoD
Depth of discharge

DSO
Short for "distribution system operator", also known as "electricity distribution company". This is the company responsible for operating, maintaining, and developing the electrical distribution network, ensuring a reliable supply of electricity to end-users, and facilitating the integration of renewable energy sources and other distributed energy resources.

EES
Energy storage system

EMS
Energy management system

EoL
End of life

FCR
Short for "Frequency Containment Reserve". FCR is a primary frequency response service that stabilizes grid frequency deviations by automatically balancing generation and consumption within seconds after a disturbance. It is the first line of defense to maintain grid frequency near its nominal value.

FCR-D
Short for "Frequency Containment Reserve for Disturbances". FCR-D is activated during larger, more significant frequency disturbances that fall outside the range of normal operations. It provides a stronger, more targeted response to prevent the grid frequency from falling below critical thresholds.

FCR-N
Short for "Frequency Containment Reserve - Normal". FCR-N is a subtype of FCR designed to handle smaller frequency deviations during normal grid operation. It ensures continuous frequency stabilization within a defined tolerance band.

FFR
Short for "Fast Frequency Response". FFR provides rapid active power support to counteract significant frequency drops, acting faster than traditional FCR. It is often used to address high-inertia grids or during large, sudden power imbalances.

grid forming mode
An operational mode where a battery energy storage system actively controls voltage and frequency, creating a stable grid environment and maintaining power balance, even in the absence of external grid input or under weak grid conditions. See also “black start mode”.

GUI
Graphical user interface

IGBT
Insulated gate bipolar transistor

Inverter power rating
The inverter power rating indicates the maximum amount of power the inverter can deliver to the load or grid under specified conditions. It is measured in kilovolt-amperes (kVA) and determines the system’s capacity to convert and supply electrical energy.

IP
Ingress protection code according to International Electrochemical Commission

Maximum power point tracker
A crucial component in photovoltaic systems that optimizes the performance of solar panels by maximizing the power they can deliver under varying conditions. It is typically part of a solar charge controller or inverter.

MCB
Miniature Circuit Breaker

MCU
Main Control Unit of n-BMS

Meter
A digital device that has been physically installed and is awaiting connection to the XOLTA server, measuring and recording real-time electricity consumption, generation, and grid interaction for efficient energy management in a battery storage system. Synonym: smart meter.

miniature circuit breaker
A circuit protection device that protects against overcurrent and short circuits.

MODBUS
Serial communication protocol developed by Modicon

MPPT
Maximum power point tracker

n-BMS
Battery Management System from Lithium Balance A/S

NTC
Negative temperature coefficient thermistor

OVC
Short for "over voltage category". The level of transient overvoltage the battery energy storage system can withstand based on its location in the electrical installation. It ranges from OVC I (low exposure, electronic devices) to OVC IV (high exposure, utility connections). Transient protection is achieved through a surge protection device.

Over voltage category
The level of transient overvoltage the battery energy storage system can withstand based on its location in the electrical installation. It ranges from OVC I (low exposure, electronic devices) to OVC IV (high exposure, utility connections). Transient protection is achieved through a surge protection device.

PCS
Power conditioning system

Peak shaving
The process of reducing short-term high power demand (peak loads) by using energy storage or alternative power sources to lower electricity costs and relieve grid stress.

photovoltaic
A technology that converts sunlight directly into electricity. It's a way of generating energy by using solar panels that capture sunlight and turn it into usable power for homes, businesses, or devices.

POR
Power on reset

PV
Photovoltaic also know as solar energy

R134A
A type of refrigerant used in air conditioning and refrigeration systems.

RCBO
Residual Current Breaker with Overcurrent.

RCCB
Residual Current Circuit Breaker.

RCD
Residual current device

residual current breaker with overcurrent
A circuit protection device that combines the functions of RCCB and MCB into a single device.

residual current circuit breaker
A circuit protection device that detects earth faults or residual currents.

residual current device
A circuit protection device that detects leakage currents and cuts off the power to prevent electric shocks.

RJ45
Short for "Registered Jack 45". A standardized connector used for Ethernet networking, featuring an 8P8C (8 Position, 8 Contact) design. It is commonly found on twisted-pair cables like Cat5e and Cat6, enabling connections between devices such as computers, routers, and switches. RJ45 supports high-speed data transmission and adheres to wiring standards like TIA/EIA-568.

SC
Site controller

SoC
State of charge

SPD
Short for "Surge Protection Device". A device designed to protect batteries and other electrical components from voltage spikes or surges, for example, because of lightning strikes. It's installed between the power supply and the battery it's protecting. When a surge occurs, the device either diverts the excess voltage to the ground or limits it to a safe level that won't damage the system.

Surge arrester
A type of surge protection device (SPD) used in electrical power systems to limit voltage surges and divert excess current safely to the ground, preventing damage to equipment during events like lightning strikes or switching surges.

surge protection device
A device designed to protect batteries and other electrical components from voltage spikes or surges, for example, because of lightning strikes. It's installed between the power supply and the battery it's protecting. When a surge occurs, the device either diverts the excess voltage to the ground or limits it to a safe level that won't damage the system.

TCO
Total cost of ownership

TCP
Transmission control protocol

time of use
A pricing model used by utility companies where electricity rates vary depending on the time of day, day of the week, or season. Under TOU, electricity is typically more expensive during peak demand periods (when usage is high) and cheaper during off-peak times

(when demand is lower). This pricing structure encourages consumers to shift their energy use to off-peak periods to lower costs and reduce strain on the electrical grid.

TMS
Thermal management system

ToU
Time of Use

XOLTA

About XOLTA

XOLTA is a Danish company specializing in the development and production of advanced battery systems for energy storage. The solutions are designed for both residential households and businesses, enabling efficient solar energy storage and energy consumption optimization. XOLTA's products promote energy efficiency, reduce dependency on the power grid, and support a sustainable future.

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