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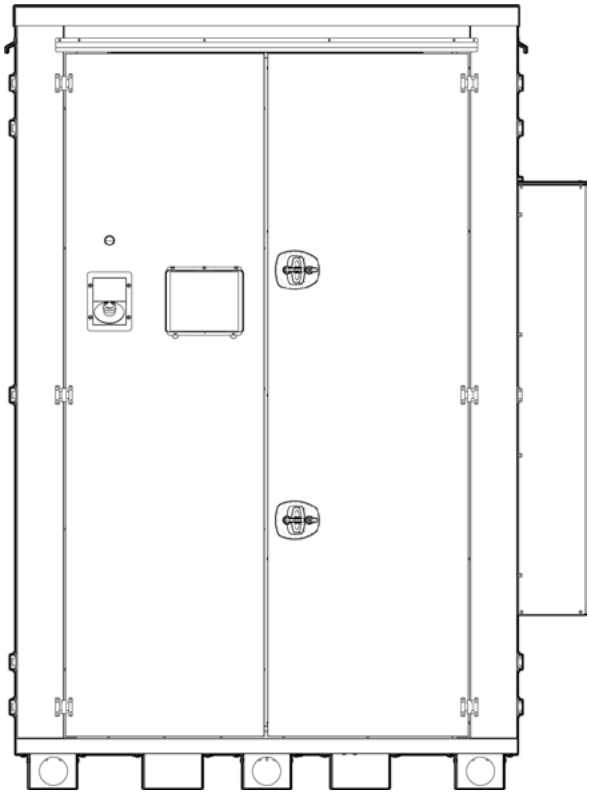

PWR.vault - 100-220

Large Storage Inverter System

Operation Manual

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TM045 Rev.zer

This manual introduces the Energy zeroCO_2 XL Shell 220.

zeroCO_2 XL Shell 220 is a large storage solution applicable to commercial, industrial and utility scale plants, both new construction and as a retrofit for existing plants. It can also manage entire energy communities.

The solution involves connecting an alternating current power source to 30 or 60 kW power converters to manage the charging and discharging phases of a 220 kWh storage, acting as a diaphragm between the instantaneous load curve and the availability of the energy source, two trends that are unlikely to coincide for renewable sources.

Requiring an alternating current source as input, zeroCO_2 XL Shell 220 is compatible with photovoltaic inverters, wind turbines and renewable or non-renewable electricity generators.

The EMS on-board computer allows you to implement management logics customized for the type of application: increase in self-consumption, peak shaving.

Read this manual before installing your system and follow the instructions carefully during the installation process.

If in doubt, contact the supplier immediately for advice and clarification.

Commissioning: the start-up of the system is to be carried out strictly by Energy S.p.A. personnel and can take place on site or remotely, subject to commercial agreements stipulated during the order.

Upon receipt of goods, contact Energy S.p.A. support. to agree on commissioning.

Table of Contents

1.0 GENERAL INFORMATIONS

1.1 About this manual

Please read the entire contents of this manual carefully. It contains important information about the installation and operation of zeroCO_2 XL Shell 220.

Energy S.p.A. assumes no responsibility for damage resulting from failure to comply this manual. This manual is an integral part of the product and applies exclusively to zeroCO_2 - XL Shell 220.

The installer and operator must have unrestricted access to these instructions at all times. The installer must be familiar with this manual and follow all instructions.

Keep all safety information and instructions for future reference and pass them on to subsequent users of the product.

The latest version of the product's operating instructions can be found in the download area on www.energyspa.com.

1.2 User description

This manual is intended for technical personnel trained and qualified in the installation, maintenance and repair of large storage inverter systems.

The activities described in this manual should only be performed by qualified and authorized technical personnel.
Technical staff must possess the following skills:

- Knowledge of how the product works and is used.
- Training on the prevention and management of hazards and risks associated with the installation and use of inverters, storage systems and industrial electrical systems.
- Training for the installation and commissioning of inverters, storage systems and industrial electrical systems.
- Knowledge of applicable safety regulations and standards.
- Knowledge of and adherence to this manual and all safety information.

1.3 Permitted uses of the system

zeroCO_2 XL Shell 220 is a large storage solution that enables:

- self-consumption;
- peak shaving;
- Feed-in of energy into the grid in a controlled manner;

zeroCO_2 XL Shell 220 may only be used within the intended power range and under the intended ambient conditions.
Improper use may result in injury or even death to the user or third parties. Property damage to the system and other equipment may also occur. zeroCO_2 XL Shell 220 can therefore only be used for its intended purpose.

All components fitted to zeroCO_2 XL Shell 220, upstream or downstream of the zeroCO_2 XL Shell 220, must meet the standards and guidelines in force in the country of installation.

It is forbidden to connect different types of batteries into the system unless authorized by the supplier.

1.4 Disclaimer

Any use other than as described in “1.3 Permitted System Uses” or that goes beyond the stated intended purpose, is considered inappropriate. The manufacturer assumes no liability for damage resulting from this.

Modifications to zeroCO_2 XL Shell 220 are prohibited. zeroCO_2 XL Shell 220 can only be used when its operation is guaranteed in conditions of safety and perfect technical efficiency.

Any case of misuse will result in the revocation of the manufacturer’s warranty and general liability.

Only qualified and authorized technical personnel can open zeroCO_2 XL Shell 220.

Work that could affect the network of the company providing the electrical service at zeroCO_2 XL Shell 220 installation site may only be carried out by qualified and authorized technical personnel. This includes changes to the factory preset parameters. Technical personnel must always comply with the regulations of the company providing the electrical service.

The factory settings may only be changed by qualified and authorized technical personnel. In doing so, all requirements must be met.

1.5 De initions

BESS: “Battery Energy Storage system”. Electrical energy storage system based on electrochemical Li-ion batteries (LFP). Given the capacity of the individual battery, the total number of modules used defines the capacity of the system.

BMS: “Battery Management System”. System for monitoring and managing the charge /discharge of a Li-ion battery (LFP); allows entire strings of batteries to charge and discharge in a balanced way, avoiding imbalances, in favor of the efficiency of the system and the expected life for the modules themselves.

SOH: “State of health”. It is the percentage health status of a battery compared to the condition of early life. SOH of a battery is physiologically reduced over its useful life. SOH may suffer degradation over time in relation to non-optimal, prolonged and / or repeated conditions of use.

SOC: “State of charge”. The percentage of charge of a battery. The operating range of the battery is delimited by a minimum SOC below which the discharge is not forced , and by a maximum SOC beyond which the charge is not forced. SOC of a battery can undergo a momentary reversible variation dictated by instantaneous operating conditions such as operating temperature and working speed.

PCS: “Power Conversion System”. AC/DC conversion module for electrical power. With an AC input/output and a DC output/input, the conversion can have a dual direction, allowing, depending on the phase, to charge (to accumulate electricity) or discharge the batteries (to self-consume by covering the loads and / or feeding electricity into the network).

EMS: “Energy Management System”. Intelligent system for energy management in the plant that monitors, collects instantaneous operating data downto the voltage levels and temperature values of each cell, communicates with the devices and coordinates their operation to make the entire system effective and efficient, allows remote supervision and control through a web interface on a Cloud platform.

RACK: Standardized system for the physical installation of hardware, IT, electronic or electrical components that make up the zeroCO2 XL Shell 220 system and ensure easy installation, access, maintenance and safety.

The zeroCO2 XL Shell 220 rack contains:

- 30 or 60 kW power converter
- Electrical devices
- On-board electronics and functional parts for system logic and power management
- 14 LiFePO4 batteries for a total storage capacity of 220 kWh.

2.0 SAFETY

2.1 Safety requirements and general information

zeroCO_2 XL Shell 220 is a system that works at dangerous voltage levels both on the AC side and on the DC side, it must be installed exclusively by qualified personnel and authorized. Read all safety instructions carefully before any operation and always observe them when working with the system.

The equipment has been built according to the strictest accident prevention standards and is equipped with safety devices suitable for the protection of components and operators.

For installations in contexts and methods other than those indicated in this manual, please contact Energy S.p.A.

Energy S.p.A. declines all responsibility in the event that the regulations for correct installation are not complied with and is not responsible for the systems upstream or downstream of the equipment supplied by it.

The information given in the manual does not replace the safety provisions and technical data for installation and operation reported directly on the product, nor the safety regulations in force in the country of installation and the rules dictated by common sense. The manufacturer is available to train or train its personnel, both on-site and on-site, under conditions to be contractually defined.

Refrain from using the equipment if any malfunction is found.

Avoid any precarious repairs. Repairs should only be carried out with original spare parts that must be installed according to the intended use. Responsibilities arising from commercial components are delegated to the respective manufacturers.

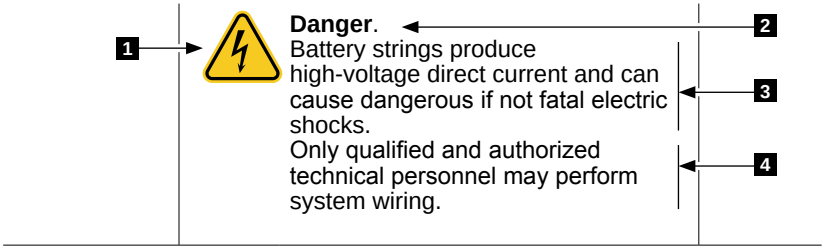
2.2 Categories of symbols

1 Prohibition 2 Warning 3 Mandatory

- Prohibition symbols provide information regarding prohibited behaviors or actions.
- Warnings identify and alert you to the presence of potential hazards.
- Mandatory signs indicate that a particular course of action must be taken.

2.21 Warnings

Warnings refer to mortal hazards. Serious injury can occur that can lead to death. Each warning consists of the following elements:



1 Warning Symbol
2 Keyword
3 Type of hazard
4 Corrective Action

Keywords 2 used in the manual to identify the severity of the hazard:

- **Danger.** Indicates a direct hazard with a high level of risk, which, when it is not avoided, may result in death or serious injury..
- **Warning.** Indicates a hazard with a moderate level of risk, which, when it is not avoided, may result in death or serious injury..
- **Caution.** Indicates a hazard with a low level of risk, which, when it is not avoided, may result in minor or slight injury or property damage.

2.3 Warnings about this product

The following precautions are essential to ensure the safety of workers and preserve the proper functioning of Energy S.p.A. equipment.

Warning.
Do not reverse connection the positive and negative.

Warning.
Do not place near open flame.

Warning.
Do not place at the children and pet touchable area.

Danger.
Dangerous or lethal tension.
There are high levels of voltage within the live components of the product. Direct contact with live components will result in death or serious injury due to electric shock.
Only qualified and authorized technical personnel may perform system wiring.
Always disconnect the inverter from the power source and control grid when voltage is not required to perform work on the system.
After turning off the inverter, wait at least 15 minutes before opening it to allow the capacitors to be fully discharged.
If it is necessary to intervene with the system live, wear personal protective equipment appropriate to the corresponding risk category.
The risk category varies depending on the area of the inverter.
Always carry out work in accordance with the specified regulations.
Do not touch any live components.
Observe all warning messages on the product and in the documentation.
Observe all safety information from the module manufacturer.
The system should not be used with lids or doors open.

Danger. The energy stored in the batteries is electrochemical. Even when the system is switched off or disconnected, the residual energy of the battery modules cannot be avoided. Improper use or handling can cause dangerous if not lethal electric shock.

Danger. The electrical panel works with temporarily with high voltage direct current and alternating current at dangerous voltage levels and can cause dangerous if not lethal electric shocks. Only a qualified person can perform the wiring of the system.

Danger. For installation, qualified personnel must refer to this manual and the safety rules provided in the official language and applied in the country where the installation takes place.

Danger.
Do not pull out the connectors while the system is running!
Disconnect all multiple power sources and verify that there is no voltage.

Danger.
Disconnect all terminals before the maintenance phase.

Danger. Before proceeding to remove covers and/or guards from the equipment, make sure that the voltage has been completely removed and allow the time indicated on the label to allow the components to cool and the internal capabilities to discharge safely.

Danger. Avoid wearing clothing or accessories that could ignite fire or create electrostatic charges. It is recommended to use the clothing and protective equipment provided by the employer for personal safety.

Danger.
The equipment is not equipped to work in explosive environments or environments with particular flammable conditions.

Caution.
Do not open or deform the battery modules and the electrical panel, otherwise the product will be out of warranty.

Caution. Improper settings or maintenance can permanently damage the system. Incorrect inverter parameters will lead to battery or system failure/damage

Caution. In the event of a prolonged period of inactivity, the batteries must be recharged every six months to a charge level (SOC) of not less than 90%. The battery must be recharged within 12 hours, when it has been completely discharged.

Caution.
It is forbidden to insert any foreign object into any part of the system.

Caution.
Do not use solvents to clean the system.
Do not expose the system to flammable or aggressive chemicals or vapors.

Caution.
Do not paint any part of the system, including internal or external components.

Caution.
Do not connect the system or battery directly to photovoltaic panels.

Caution.
Do not expose system cables to the external environment

Caution. Please take extra care after switching off the equipment as some surfaces may become overheated (e.g.: transformers, accumulators, coils, etc.) with possible burn hazards. Be sure to touch only the safe, cooled parts to avoid accidents

Warning. When operating the system, it is mandatory to wear personal protective equipment (PPE) such as Class 0 RC category insulating gloves, rubber boots, and protective goggles.

Warning. The maintenance technician must ensure that he prevents others from reactivating the equipment during maintenance and must promptly report any abnormalities or damage due to wear or aging, in order to restore the correct safety conditions.
Always pay attention to the working environment, ensuring sufficient lighting and adequate space to ensure escape routes in case of need.

Caution. Be aware that the noise emitted by the equipment may exceed the legally permissible limits (less than 80 dBA). In these cases, wear hearing protection to protect the hearing of personnel.

Caution. It is very important and necessary to read the user manual (in accessories) carefully before installing or using the system. Failure to follow these instructions or the warnings in this document may result in electric shock, serious injury or death, or may damage the battery, potentially rendering it unusable.

The Customer and/or installer must provide adequate instruction to operators and persons who may approach the equipment.

It is essential to highlight risky conditions, such as magnetic fields, dangerous voltages, high temperatures, the possibility of electric shocks, and other hazards, including through the use of signs or visual signals.

The labels on the equipment must be kept intact and in good condition. They must not be removed, damaged, soiled or concealed in any way.

Labels should be cleaned periodically and kept in sight at all times. They should not be covered or hidden by foreign objects such as rags, boxes, equipment, etc.

It is important to note that the technical data given in the manual do not replace the information on the labels on board the equipment. These labels provide essential information regarding the safety and proper operation of the equipment.

2.4 System labels

Signs and labels are applied to the housing of the inverter. These signs and labels may not be altered or removed

	**Recycle label.**
	**Label for Waste Electrical and Electronic Equipment (WEEE) Directive (2012/19/EU)**
	**CE Marking.**
	**The certificate label for Safety by TÜV SÜD.**
	**The certificate label for Safety by TÜV Rheinland.**

2.5 Residual risks

Despite warnings and safety systems, there are always some residual risks that cannot be eliminated. These risks are listed in the table below along with some tips for preventing them.

RISK ANALYSIS	REMEDY
Noise pollution due to installations in unsuitable environments or where staff work permanently.	Re-evaluate the environment or installation location.
Inadequate ambient ventilation that causes overheating of the equipment and discomfort to people stationed in the environment.	Restore the appropriate environmental conditions and ventilate the room.
External atmospheric agents such as water infiltration, low temperatures, high humidity, etc.	Ensure that the environmental conditions of the system are maintained.
Overheating of surfaces at temperature (transformers, accumulators, coils, etc.) with risk of burns. Louvers and/or equipment cooling systems clogged.	Use proper personal protective equipment and wait for cooling before accessing the equipment.
Poor cleanliness resulting in compromised cooling system and/or difficulty reading safety labels.	Clean the equipment, labels, and work environment properly.
Accumulation of electrostatic energy with possible dangerous electrical discharges.	Make sure the devices have drained their power before taking action.
Insufficient staff training.	Request a supplementary course.
Temporary handling and positioning of the equipment.	Use caution and restrict access to the installation area.
Accidental disconnection of quick-connect connectors with the equipment in operation or incorrect connections with potential for the generation of electric arcs.	Use caution and inhibit access to the installation area.

It is recommended to follow the safety instructions given in this manual.

2.6 Grounding Requirements

Warning. High leakage current!
The system must be grounded prior to electrical connection via the ground terminal.

- When installing the system, you must first ground it. When disassembling the system, the ground cable must be removed last.
- Do not damage the grounding conductor.
- The system must be permanently connected to the grounding protection cable. Before commissioning, the electrical connections should be checked to ensure that the system has been reliably grounded.

Caution.
Warranty claims for direct or indirect damage due to conduct that does not comply with the above are excluded.

2.7 Reference standards

DESCRIPTION	CODE
Secondary Lithium Battery Safety Standard	IEC62619, IEC63056, IEC62477-1, IEC 62040-1
Battery Cell Safety Standard (UL)	UL1642, UL1973, UL9540A
Lithium Battery Safety Standard (VDE)	VDE-AR-E 2510-50:2017
Safe Transportation Standard	UN38.3
Electromagnetic Compatibility (EMC)	CE EMC 2014/30/EU CE EMC IEC 61000
UKCA EMC Standard (Batteries)	BS EN IEC 61000-6-2:2019 BS EN IEC 61000-6-2:2005 BS EN IEC 61000-6-4:2007+A1
Safety Standard for Electrical Devices	IEC62477-1 CE LVD 2014/35/EU EN 61439-1 CEI EN 60204 CEI 64-8
Connection Standard Compliance	EN 50549 CEI 0-16 G99 VDE-AR-N 4110 UE 2016/631 GLV172-02

2.8 Before connection

- After Have received the goods open the packaging check the product e the list of materials contained. If the product is damaged or has missing parts, contact your local dealer.
- Before installation, be sure to cut off the mains power and that the battery is in off mode.
- Make sure there are no short circuits with external devices.
- It is forbidden to connect the battery and AC power directly..
- The BMS is designed for a maximum value of 1000V DC. Do not connect batteries in series to the BMS.
- The battery must be well grounded, the resistance must be ≤100mΩ.
- Keep the battery away from water and fire.

2.9 During the use

- If the system (batteries and BMS) must be moved, interrupt AC power (if any) and DC.
- It is forbidden to connect different types of batteries in the same system unless authorized by the supplier.
- It is forbidden to connect batteries with defective or incompatible inverters.
- It is forbidden to dismantle the battery (tab QC Removed o damaged).
- In case of fire, only dry powder extinguishers can be used, liquid extinguishers are prohibited.
- Do not attempt to open, disassemble or repair the battery: this can only be done by authorized technical personnel. We decline any consequence or liability related to the violation of safety operations or standards of design, production, safety of equipment.

3.0 INTRODUCTION

3.1 Product presentation

zeroCO_2 XL Shell 220 is a large storage solution based on Pylontech HM5A180F high-voltage storage batteries (LFP). It is applicable to commercial, industrial and utility scale plants, both new construction and as retrofits for existing plants. It can also manage entire energy communities.
The solution involves connecting an AC power source to PCS 30 or 60 kW power converters to charge and discharge, at different times, up to 220 kWh of storage batteries.

In this way zeroCO_2 XL Shell 220 manages the charging and discharging phases of the storage system which can alternate according to the needs and convenience: accumulate energy in the moments of surplus production (compared to the demand of the loads) and make it available at times when demand is highest, acting as a diaphragm between the instantaneous load curve and the availability of the energy source.

Requiring input a source exclusively in three-phase alternating current in low voltage, zeroCO_2 XL Shell 220 is compatible with photovoltaic inverters, wind turbines and generators of electricity from renewable or non-renewable sources in line with their operating parameters.

The EMS on-board computer allows you to implement smart management logics, customized, according to the type of application: increased self-consumption, peak shaving.

zeroCO_2 XL Shell 220 is particularly suitable for application scenarios that require high power peaks, large energy storage to be implemented in new or existing plants, limited installation space, reliability and long service life.

ATTENTION: some of the accessories available in the catalog are essential to ensure the correct functionality of the system.

For any doubt or need, please contact the sales department of Energy S.p.A.

3.1.1 Schematic diagram solution

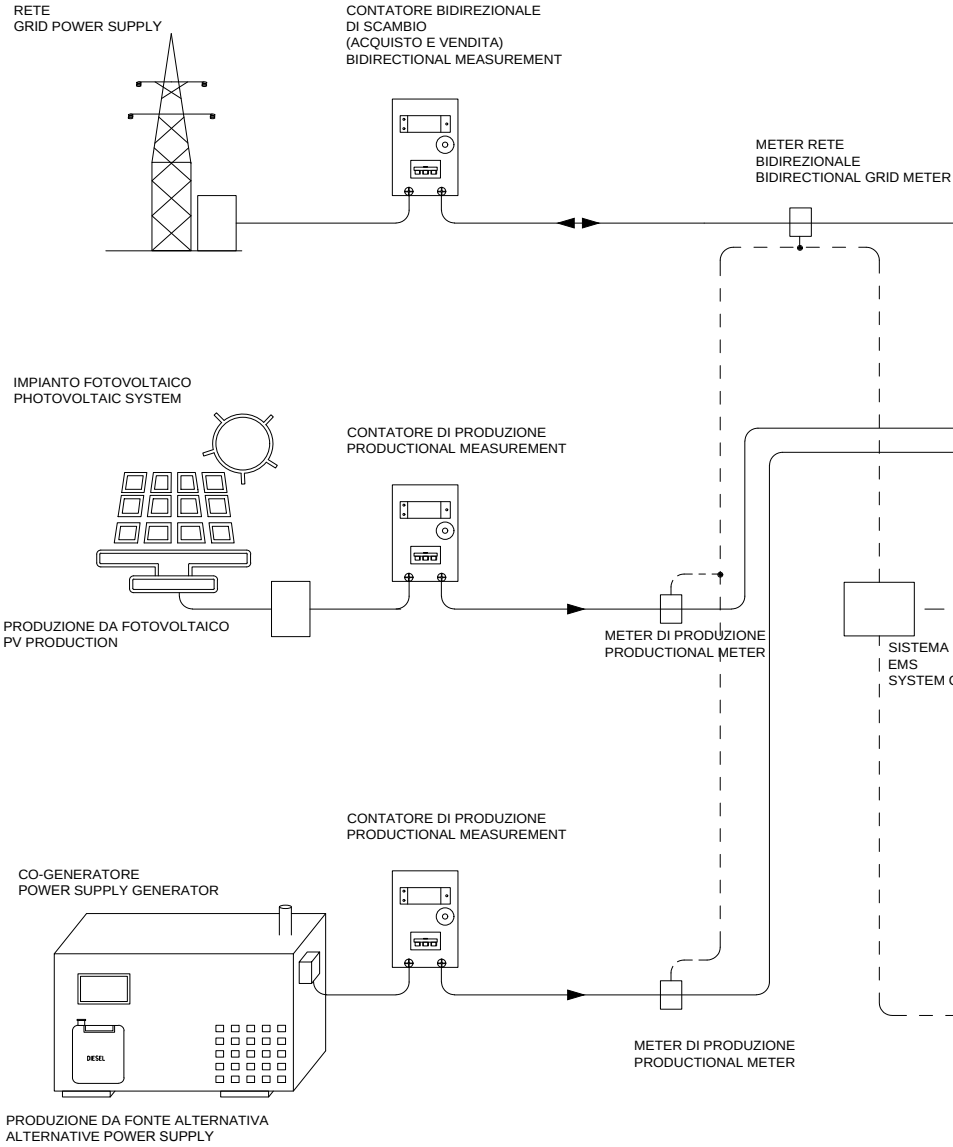
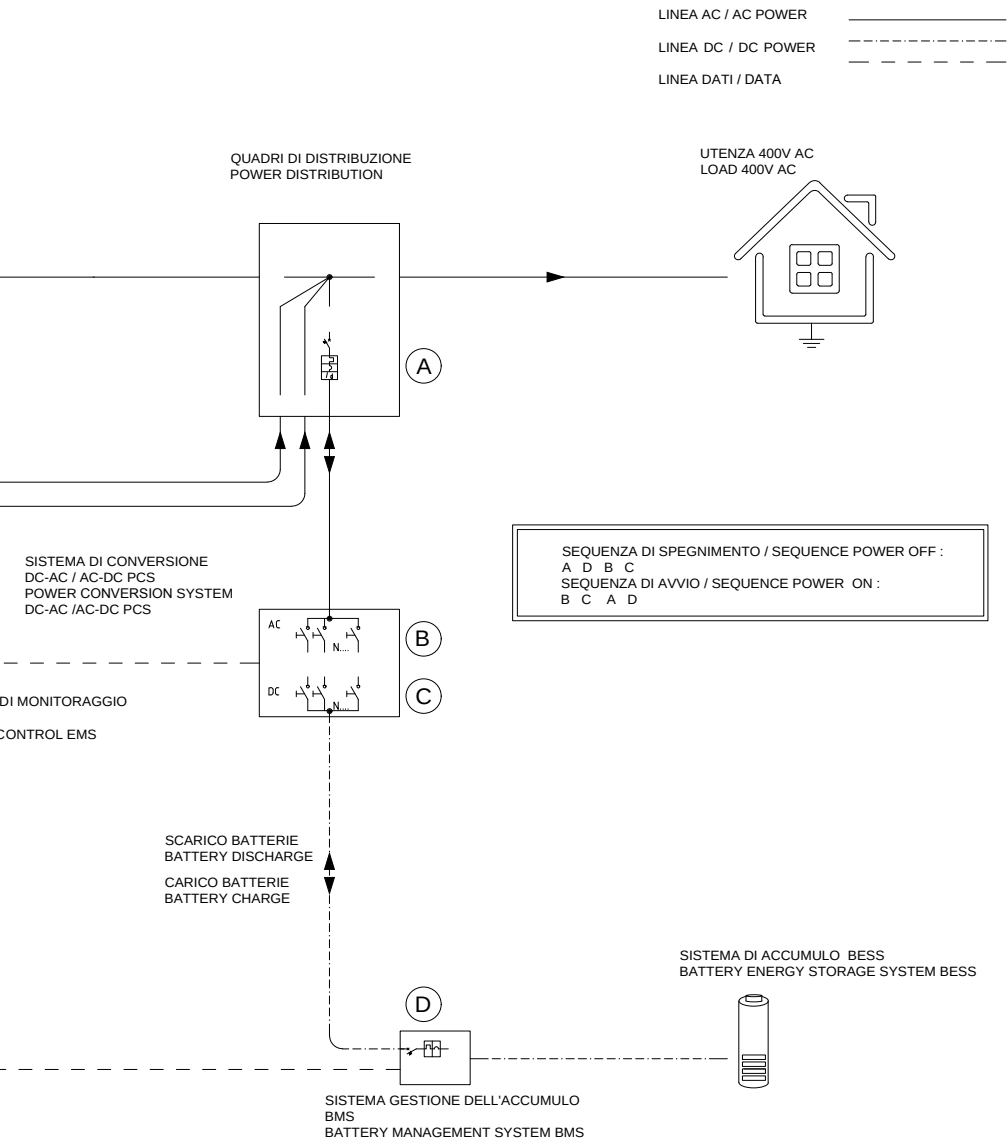


Fig. 3.1


LINEA AC / AC POWER
LINEA DC / DC POWER
LINEA DATI / DATA
QUADRI DI DISTRIBUZIONE
POWER DISTRIBUTION
UTENZA 400V AC
LOAD 400V AC
A
SISTEMA DI CONVERSIONE
DC-AC / AC-DC PCS
POWER CONVERSION SYSTEM
DC-AC /AC-DC PCS
AC
DC
B
C
SEQUENZA DI SPEGNIMENTO / SEQUENCE POWER OFF :
A D B C
SEQUENZA DI AVVIO / SEQUENCE POWER ON :
B C A D
DI MONITORAGGIO
CONTROL EMS
SCARICO BATTERIE
BATTERY DISCHARGE
CARICO BATTERIE
BATTERY CHARGE
SISTEMA DI ACCUMULO BESS
BATTERY ENERGY STORAGE SYSTEM BESS
D
SISTEMA GESTIONE DELL'ACCUMULO
BMS
BATTERY MANAGEMENT SYSTEM BMS

3.1.2 Working logic

When ordering, the system must be configured as follows:

1. One zeroCO_2 XL Shell 220.
2. An energy meter [(1)] to be connected downstream of the exchange meter to detect moment by moment the electrical energy withdrawn or fed into the network.
3. At least one energy meter [(2)] equal to the previous one but to be connected downstream of the source of alternating current production to detect moment by moment the electricity produced.

For their installation needs, the customer can specify the location of the air conditioner, choosing between the left or right side of zeroCO_2 XL Shell 220.

Caution. It is possible to connect up to three meters on the production side to group diversified or physically distant sources (eg strings of photovoltaic panels working on different inverters).

By measuring the energy produced and in exchange with the network, and always knowing the status of the batteries through communication with each BMS, the EMS controls the charge / discharge and calculates the load by difference, satisfying the request. Depending on the desired working modes for the system, zeroCO_2 XL Shell 220 can concentrate its operation on:

- Self-consumption: Consists in the dedicate the more possible the power Produced from source to meet the demand of the load moment by moment.
- Peak shaving: the intervention of batteries and production source makes it possible to reduce the power purchased from the grid at times when the load has a higher demand, which results into a flattening of the grid withdrawal curve.
- Energy trading: it consists in optimizing the feeding of energy into the grid during the various price time slots, maximizing the resulting remuneration.

(1) Available as an accessory.
(2) Available as an accessory

3.2 System architecture and operation

3.2.1 zeroCO$_2$ XL Shell 220

The zeroCO$_2$ XL Shell 220 rack is supplied assembled, wired and tested in the factory, ready for installation and is configured with:

1. Operator panel.
2. EMS
3. MBMS, Device for connecting and managing one or more high voltage battery strings in parallel.
4. Ethernet communication switch.
5. PCS 30 or 60 kW for managing active power.
6. AC side breaker for the PCS module.
7. AC terminal block for connection to the generation park, loads and the electrical grid.
8. DC side breaker for the PCS module.
9. Magnetothermal switch for powering the auxiliary devices mentioned above.
10. Power sockets for the auxiliary devices mentioned above, which are powered independently directly from the system.
11. Emergency button (press to release).
    PCS technology is transformerless.

AC side, zeroCO$_2$ XL Shell 220 is equipped with a 5-wire three-phase alternating current interface (3Ph+N+PE) in low voltage that allows connection to the rest of the plant (production, loads, electricity grid) and makes it compatible with renewable power plants (photovoltaic with inverter, wind etc ...) or non-renewable, pre-existing or new construction.
DC side XL Shell 220 is equipped with a two-pole direct current interface (+ and -) which allows it to be connected in parallel to the battery storage.

Caution. zeroCO$_2$ XL Shell 220 cannot be connected directly to strings of photovoltaic modules, but it is necessary to interpose an inverter with the sole purpose of converting the direct current supplied by the photovoltaic park into alternating current required as input by the system.

Caution. To protect the system, install a 300mA differential circuit breaker, type A or type AC, upstream. For the nominal current value, refer to the wiring diagram provided and the maximum current values given in the technical data table.

3.2.2 zeroCO_2 XL Shell 220 capability curve

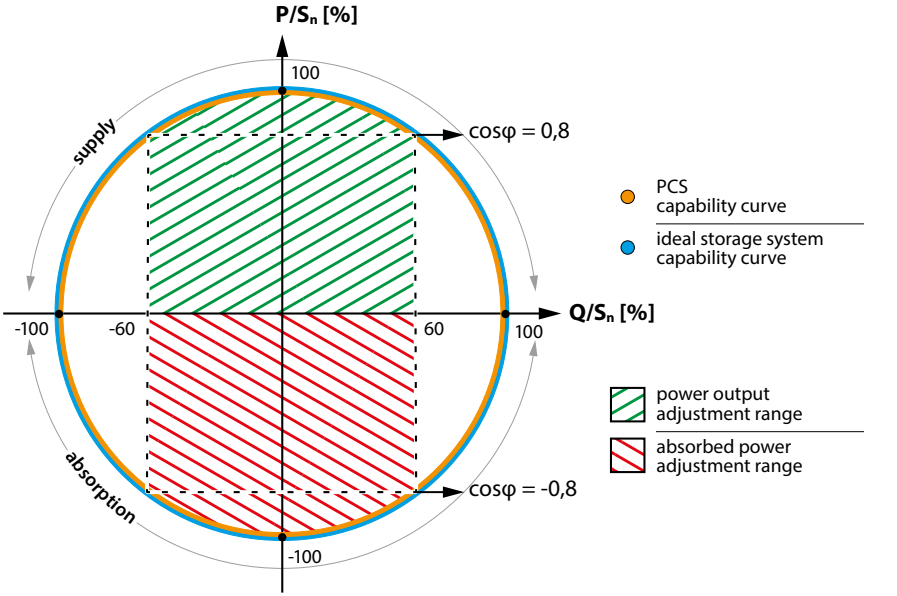
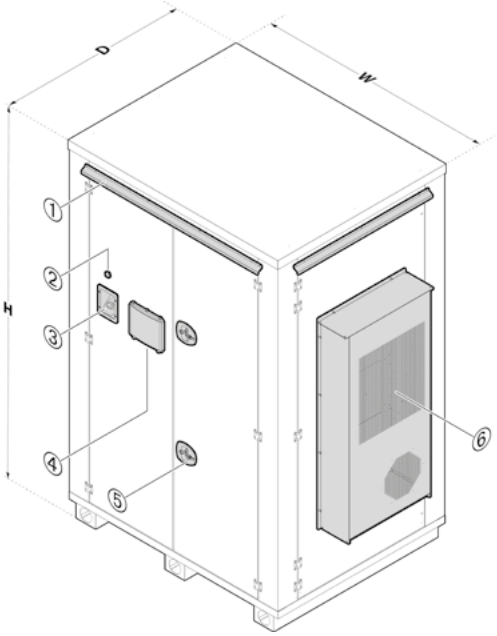


Fig. 3.2 - zeroCO_2 XL Shell 220 capability curve
P/Sn%: ratio between active power P and nominal apparent S_n
Q/Sn%: ratio between reactive power Q and nominal apparent S_n
The values are expressed as a percentage.

The capability curve shown is intended only for zeroCO_2 XL Shell 220 and compatibly with the state of charge of the batteries according to the power supply/ absorption regime.
The capability curve must be composed with the curves of other generators, if present in the system.

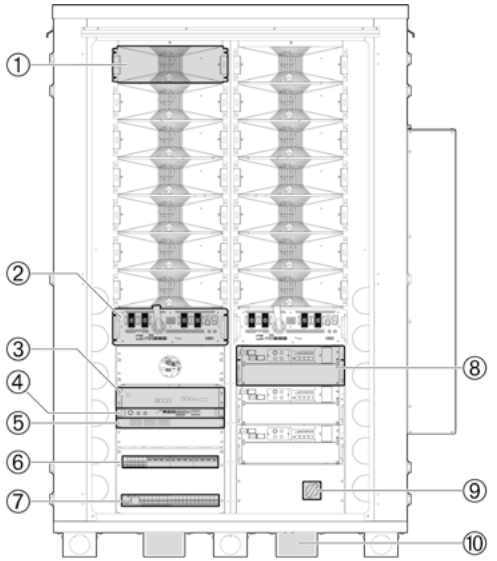
3.2.3 zeroCO_2 XL Shell 220 dimensions



DESCRIPTION

1. Rain guards
2. Information LED
3. Emergency button
4. Display
5. Handles
6. Air conditioning

Fig. 3.4 - The position of the air conditioning (left or right side) is at the customer's discretion.



DESCRIPTION

1. Battery module
2. BMS
3. EMS
4. MBMS
5. SWITCH
6. Breaker
7. Breaker
8. PCS
9. General Breaker
10. Forklift openings

Fig. 3.5 - XL Shell 220 content

3.2.4 Parameters zeroCO_2 XL Shell 220

zeroCO_2 - XL Shell 220	**100K**	**120K**
Dimensions [WxHxD, mm]	1610x2500x1325	
Weight [kg]	3500	3600
PCS Topology	Trasformerless	
AC parameters		
Rates/apparent power [kW/kVA]	90 / 99	120 / 132
AC input type	5 wire (3Ph + N + PE)	
Number and maximum connection cable section per phase [mmq]	1 x 10/35 (L1, L2, L3, N, PE)	
Voltage range [V]	400 (±10%)	
Rated/Max electric current [A]	±89 / 100	
Rated frequency [Hz]	50/60	
Power factor	0,8 ~ 1 (Leading / Lagging)	
Current DC component [%]	≤ 0,5	
Harmonic content THDi [%]	≤ 3	
AC/DC start function	Sì	
Current switching time [ms]	≤ 10	
Conversion efficiency [%]	≥ 97	
short duration permissible short-circuit current [kA]	6 (1")	
DC parameters		
Rated power [kW]	90	120
Voltage range [V]	150 - 750	680 - 1000
Rated / Max Electrical Current [A]	±216 / ±270	±144 / ±176
Voltage and current measurement accuracy [%]	±1	
Voltage and current limiting feature	Si	
Energy Storage		
Battery module	HM5A180F	
BMS controller	S1500M5A180E	
Battery module quantity [N]	14	
Module efficiency [%]	95	
System nominal voltage [V]	64 x N	
System charge/discharge voltage range [V]	680 / 1000	
Nominal/usable capacity [kWh]	N x 15,7 ~ N x 14,1	
Depth of discharge DOD [%]	90% (8 - 98% SOC)	

zeroCO₂ - XL Shell 220	100K	120K
Condizioni ambiente		
Working temperature range [°C]	0 ~ 50 (Derating over 45°C)	
Working humidity range [RH%]	<95 (without condensation)	
Storage temperature range [°C]	-20 ~ +60	
Storage humidity range [RH%]	0 ~ 95 (without condensation)	
PCS module cooling	Forced convection (fan with smart regulation to reduce consumption and noise)	
System cooling	Air-cooled monoblock unit	
Altitude [m]	<3000	
Communication		
Communication interfaces	RS485, LAN, WAN,CAN, ModBus RTU, TCP/IP	
Safety		
IP protection rating	IP54	
EMC	BT 2014/35/CE - 2014/30/CE	
MTBF (Medium Time expected Between Failures) [h]	100000	
Compliance with connection standards	CEI 0-21, CEI 0-16	
Warranty [years]	2	
Operating life [years]	15+	
Lithium Battery Transport Certificate / Transport Requirements	UN38.3 / ADR	

zeroCO₂ XL Shell 220 contains 14 Pylontech high voltage Li-ion (LFP) batteries model HM5A180F and the BMS, forming a single storage of 220 kWh nominal. The battery modules are connected in series inside the rack and the entire ring connected in parallel to the BMS controller that manages the entire string.
A 30 or 60 kW PCS allows the power conversion, managed by the on-board electronics.
zeroCO₂ XL Shell 220 is supplied assembled and ready for installation.

4.0 TRANSPORT

Caution.
Failure to comply with the transport and storage requirements described in this manual may void the warranty..

4.1 Transport Methods and Requirements

zeroCO_2 XL Shell 220 can be transported by road and by sea.
The compact structure and design facilitate lifting and make transport easier.

For road transport, it is recommended to use a semi-trailer with a low platform and adequate load capacity.

All devices in zeroCO_2 XL Shell 220 are installed and secured before leaving the factory, allowing lifting and transport as a single unit.

Warning. Throughout the entire loading, unloading, and transport process, it is necessary to comply with the operational safety regulations of the country/region where the installation is located.

All tools used during transport and storage operations must be properly maintained.

All personnel involved in loading, unloading, and handling operations must have received appropriate training, particularly in safety. Throughout the loading, unloading, and handling process, it is important to always keep in mind the mechanical parameters (overall dimensions and weight) of zeroCO_2 XL Shell 220.

For the transport of zeroCO_2 XL Shell 220, the following conditions must be met:

- All doors must be locked.
- If zeroCO_2 XL Shell 220 needs to be transported on slopes, additional traction may be necessary.
- Remove all existing or potential obstacles along the route, such as tree branches, cables, etc.
- zeroCO_2 XL Shell 220 should be transported and handled in good weather conditions.
- In the lifting area, designate a restricted access area for authorized personnel only and ensure adequate warning signage is installed.
- To avoid excessive tilting during road transport, it is important to use ropes to secure the equipment to the vehicle.

5.0 STORAGE

zeroCO_2 XL Shell 220 has an IP54 protection rating. If the installation does not occur immediately after delivery, it is crucial to store it properly:

- **Safety Signage:** Clearly mark the storage area with appropriate safety signage.
- **Temperature and Humidity:** Ensure the storage temperature is between -20°C and +60°C and the relative humidity is between 0% and 95%, without condensation.
- **Storage Ground:** Store zeroCO_2 XL Shell 220 on dry, clean, and solid ground with sufficient load capacity. The ground should be flat, without water, bumps, or vegetation.
- **Protection Against Dust and Water:** Adequate protective measures must be taken to prevent the system from being exposed to environmental conditions unsuitable for the IP54 protection rating.
- **Maintenance:** Regularly check zeroCO_2 XL Shell 220 and the internal devices, at least once every six months.

Following these guidelines ensures the optimal protection and preservation of zeroCO_2 XL Shell 220 until its installation.

6.0 GENERAL INSTALLATION REQUIREMENTS

zeroCO_2 XL Shell 220 is overall heavy. Before starting the construction of the foundations, it is necessary to thoroughly examine the installation site, taking into account primarily the geological and climatic conditions. The design and construction of the foundations should only begin after verifying that all requirements are met.

Improperly constructed foundations can cause significant issues during the installation of zeroCO_2 XL Shell 220, affecting the opening and closing of doors and the overall operation of the system. Therefore, the foundations of zeroCO_2 XL Shell 220 must be designed and built according to specific standards to ensure mechanical support, cable passage, and future maintenance.

6.1 Location and Space

- Installation Area: The area must be prepared to accommodate the number of cabinets as per order, with additional space for maintenance and safe access.
- Accessibility: The area must be easily accessible for the transportation and installation of the cabinets.

6.2 Load and Bearing Capacity

- Load Capacity: The foundations must support the combined total weight of all the cabinets, ensuring an adequate load capacity with a safety margin. See “11.0 Sizing of the Bearing Base” on page 46.
- Weight Distribution: The weight distribution must be uniform to avoid excessive stress on specific points of the foundations.
- zeroCO_2 XL Shell 220 must be installed on a flat and even ground. The bearing base on which the system is installed must be sized to have a load capacity at least equal to the total weight of the system (total weight of all the zeroCO_2 XL Shell 220 rack).
- **For the load sizing of the bearing base intended for the installation of a single zeroCO_2 XL Shell 220, it is recommended to consider a minimum value of 2000 kg/m².**

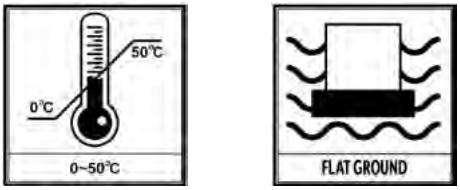


Fig. 6.1 - Temperature range 0° - 50°C, install on flat and uniform ground.

Avvertenza. zeroCO_2 XL Shell 220 must be placed in a restricted access area. For correct handling it is necessary to use a forklift with adequate load capacity. For installation, please refer to this manual, the provided electrical diagrams, and any related technical documentation.

7.0 RECEIVING, LIFTING, AND HANDLING

7.1 Safety Precautions

Avvertenza. It is strictly forbidden to stand within 6-10 meters of the lifting areas! It is absolutely prohibited to stand under the arm or the workstation during the entire handling process.

Avvertenza. Use high-visibility signal tapes to clearly delineate the handling area and provide physical barriers to prevent unauthorized access.

Attenzione.
All safety requirements must be met.

Attenzione.
It is forbidden to handle multiple cabinets simultaneously.

Attenzione.
zeroCO_2 XL Shell 220 is designed to be handled exclusively by a forklift.
The cabinet is equipped with pockets that allow the forks of the forklift to be fully inserted. The cabinet structure is reinforced at the fork grip points, so that it can support the weight without deforming. The lifting device chosen must be appropriate for the site conditions and must have an adequate load capacity

Attenzione.
During lifting, devices must remain stable and should not tilt. Use a weight and load control system.

Attenzione.
Take all necessary auxiliary measures to ensure safe and smooth lifting of the devices.

7.2 Lifting

During the lifting of the devices, each phase of the operation must be performed according to the following instructions:

- Avoid any dragging: zeroCO_2 XL Shell 220 must be lifted vertically, without dragging it on the ground.
- After placing zeroCO_2 XL Shell 220, lower it gently and firmly. It is absolutely forbidden to position zeroCO_2 XL Shell 220 by swinging the lifting tools.
- The location of zeroCO_2 XL Shell 220 must be solid and flat, with a good drainage system, free of obstacles or protrusions.

For proper and safe lifting and handling of the cabinet, see “10.0 Lifting Points” on page 44.

These guidelines are crucial to ensure the safety of personnel and the integrity of the devices.

7.3 Work Environment Control for the Storage System

7.3.1 Cleaning

Danger. The battery system is equipped with high-voltage connectors. If cleaning is necessary, it will be mandatory to isolate the system.
Before installing and powering up the system, dust and any processing scraps must be removed to maintain a clean environment. The system cannot be installed in typical desert geographical areas without adequate protection from sand.
After a long period of operation, it is necessary to check for moisture and/or dust.
In the case of a significant presence of humidity and / or dust is found, it will be necessary to stop the system and provide for the cleaning of the same, in particular the ventilation channels.

Pericolo. The power connectors should be handled carefully due to the presence of high DC voltage produced by the battery modules connected in series (the battery module always has a residual voltage).

7.3.2 Temperature

Caution.
Working temperature range of zeroCO_2 XL Shell 220: 0° - 50°C; optimum temperature: 10°C - 40°C.
There are no mandatory ventilation requirements for the battery module, but please avoid installation in confined areas. Aeration should avoid conditions of high salinity, humidity or temperature.

Caution. Outside the expected working temperature range, the system will activate the alarm and temperature protection. The continuation of this condition will result in a further reduction in the life of the battery system. If necessary, it will be advisable to install a cooling or heating system to maintain the ranges indicated for the operating temperature of the system.

7.3.3 Fire-fighting system

Danger. For safety purposes, zeroCO_2 XL Shell 220 is equipped with a fire prevention system. The normal condition of the fire protection system must be checked regularly. It is advisable to contact the Fire Brigade for the local directives to which the fire prevention system must comply. Follow the instructions given on the means suitable for extinguishing the fire and which can be used for these products. Refer to the fire system documentation.

7.3.4 Installation place checking

Danger. Before installing the system it is necessary to ensure that the ground on which it rests is stable and safe.
The resistance of the grounding system must be ≤100mΩ.

7.3.5 Safety area

A free area sufficient to allow access to the individual battery and routine maintenance must be maintained around the system.

7.4 zeroCO₂ XL Shell 220

Al ricevimento zeroCO₂ XL Shell 220 si presenta così imballato:

- Strato di polietilene espanso di 5mm avvolto in senso longitudinale.
- Angolari paracolpi in cartone;
- Strato di film estensibile avvolto in senso longitudinale;

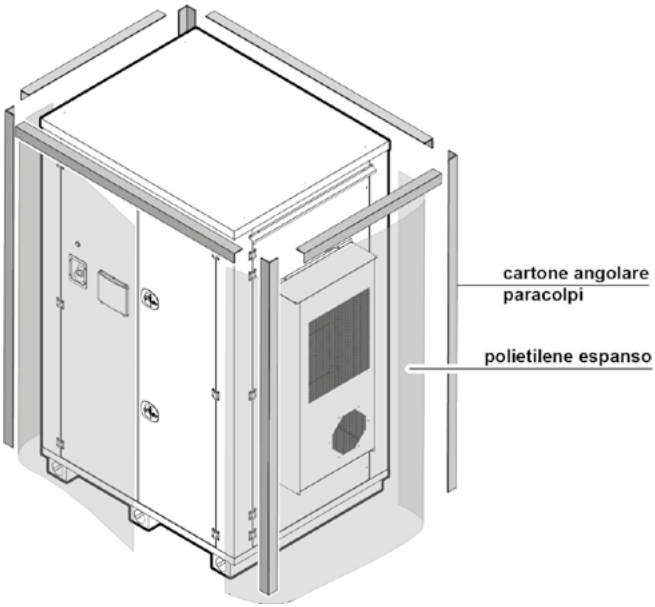


Fig. 7.1 - Receiving

7.4.1 Handling and unpacking

Use a forklift to handle the zeroCO_2 XL Shell 220. The bottom of the zeroCO_2 XL Shell 220 has holes (pockets) for the forklift forks. Handle the zeroCO_2 XL Shell 220 using these holes.

Make sure to meet the following requirements:

- The forklift must have an adequate load capacity.
- The length of the forks must be compatible with the dimensions and weight of the zeroCO_2 XL Shell 220.

Insert the forks of the forklift into the fork pockets located on the bottom of the zeroCO_2 XL Shell 220 (T, Fig. 7.2). The forks must be completely inserted into the pockets of the zeroCO_2 XL Shell 220 up to the maximum depth. This ensures the stability of the load during transport and prevents the risk of tipping or falling.

Transport and positioning of the zeroCO_2 XL Shell 220 must be done slowly and stably. A test transport is recommended.

- Position the zeroCO_2 XL Shell 220 in a stable, well-drained and obstacle-free location.

Warning.
The weight of the packaged product is approximately 3600 kg and may be unstable..

Warning. At least three people are required to handle the zeroCO_2 XL Shell 220:

- an operator with appropriate training and certification in the use of a forklift truck;
- two assistants on the ground to monitor the load and guide the forklift operator, ensuring that the load remains stable and that the surrounding area is free of obstacles.

- Position the zeroCO_2 XL Shell 220 near the installation area and extend the forklift forks.
- Remove the layer of stretch film along the entire height of the package at one of the four corners, remove the cardboard bumper corners and the layer of expanded polyethylene.

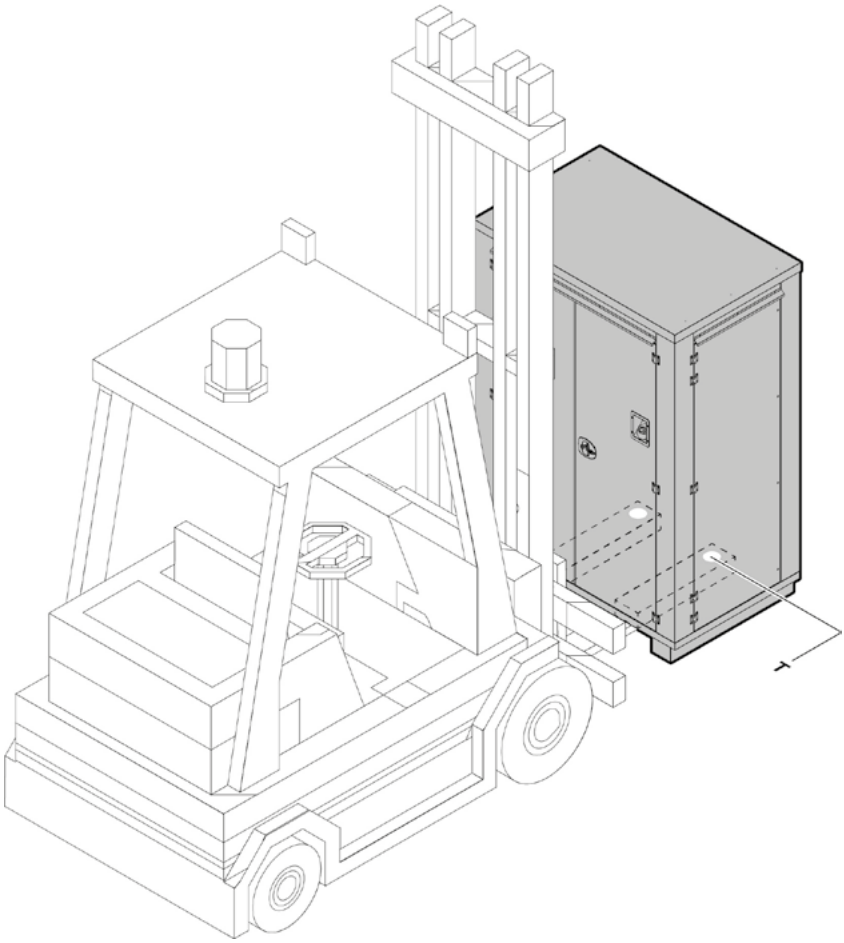


Fig. 7.2 - XL Shell 220 handling via fork pockets (T)

8.0 INSTALLATION

8.1 Installation tools

			
Cutter	Crimp	Cable ties	Screwdriver
			
Screwdriver	Adjustable wrench	Socket wrench	Multimeter

Tab. 8.1 - Tools needed to install the battery pack.

Caution. Use properly insulated instruments to avoid accidental electric shock or short circuits.
If insulated instruments are not available, cover all exposed metal surfaces, except the tips, with insulating tape.

8.2 Personal protective equipment

We recommend that you wear the following safety equipment when handling system components.

Dielectric gloves for live work

Safety glasses

Safety shoes

Helmet

Warning. The power terminals of the battery system are crossed by high-voltage DC. The system must be installed in a restricted area and must be operated only by qualified and authorized personnel.

Warning.
The single battery module weighs 115 kg. Manual handling is FORBIDDEN. Use only suitable lifting devices and follow the required safety procedures.

Danger. The plugs and sockets of the power cables must be connected respecting the color, as indicated in this manual and the wiring diagram supplied with the system. Reversing the link can cause personal injury or damage to property.

Danger.
Do not short-circuit the positive and negative poles of the system.

Caution.
An incorrect connection of the cables will cause a system failure.

8.3 Fixing zeroCO_2 XL Shell 220 to the ground

The XL SHELL 220 system has an overall mass that makes it difficult to move involuntarily. However, for safety and stability reasons, especially in the presence of vibrations, accidental inclinations or seismic loads, fixing to the ground using mechanical anchoring devices is recommended.
The fixing methods described here refer to the standard configuration of XL SHELL 220 and its lower structural plinths.
For the choice of the installation area, please refer to chapter “6.0 General installation requirements” on page 36, which defines the environmental, accessibility and structural support conditions required.

8.3.1 Fixing holes

XL SHELL 220 is equipped with three plinths, each with a Ø90 mm through hole, closed with a cap, accessible from the front and rear.
Each plinth is equipped with two Ø20 mm fixing holes, located near the front and rear sides.

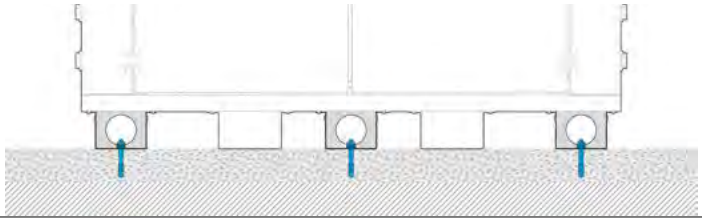


Fig. 8.1 - XL Shell 220 front view

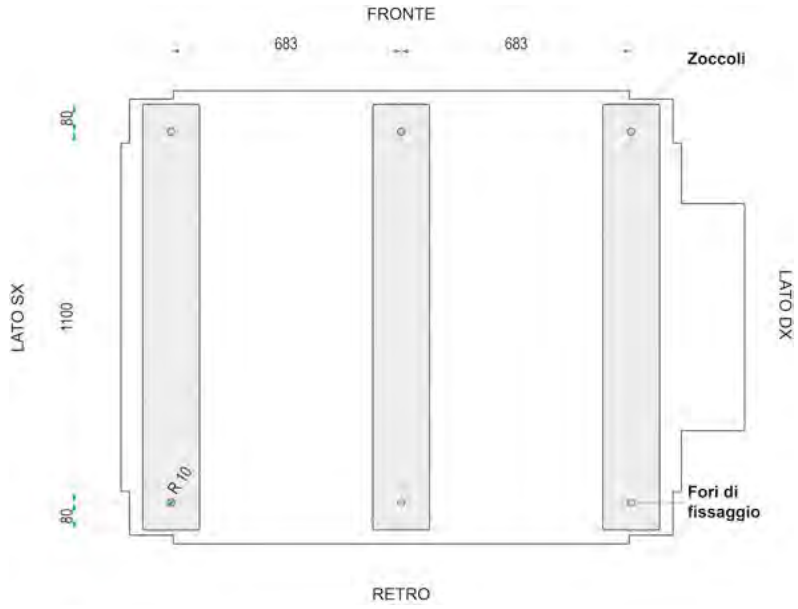


Fig. 8.2 - XL Shell 220 view from below

8.3.2 zeroCO_2 XL Shell 220 fixing

Before starting drilling and fixing operations, prepare the necessary materials including: mechanical expansion anchors or chemical anchors certified for structural loads on concrete, threaded screws in galvanized steel or stainless steel A2/A4, diameter M12 or M14, recommended length ≥ 120 mm, depending on the depth of the anchor and the washer, oversized flat steel washers, internal diameter compliant with the screw used, self-locking nuts or nuts with integrated grower washer.

Proceed as follows:

- Identify a flat and resistant area, compliant with the indications in chapter “6.2 Load and capacity of the support base” on page 37.
- Identify and mark the fixing points on the ground based on the position of the holes in the plinths (see chapter “8.3.1 Fixing holes”).
- Drill six holes in the ground (two for each plinth) with a diameter compatible with the chosen anchors. The depth of the holes must be adequate for the length of the screws.
- Insert the plugs into the holes. Leave the plugs free for the subsequent insertion of the screws.
- Move XL SHELL 220 into position, using suitable lifting equipment (see chapter “7.0 Reception, lifting and handling” on page 37).
- Precisely align the holes of the three plinths with the previously installed plugs.
- Remove the Ø90 mm caps located at the front and rear of each plinth to allow access to the fixing holes.
- Insert the M12/M14 threaded screws into the holes with a length suitable for the depth of the plug and upper protrusion for tightening.
- Insert the washers and complete the installation with self-locking nuts, tightening with a torque wrench according to the torque recommended by the plug manufacturer.
- Reposition and close the caps on the access holes of the plinths.

8.4 zeroCO_2 XL Shell 220 electrical connection

Warning. Always refer to the wiring diagram supplied with the system for the connection details according to the configured system. Incorrect connection may cause personal injury.

Warning. Do not short-circuit the positive and negative poles of the system. Incorrect connection of the cables will cause a system failure.

Work on the front side of the rack for AC connections.

1. Open the right door of XL Shell 220 to access the terminal block (Fig. 8.3).
2. Prepare the necessary material:
   – an AC power cable of the 3Ph + N + PE type with ferrule terminals;
   – the Ethernet cables and the Meter cable;
   – the cable glands in adequate quantity and of compatible dimensions with the cables used.
3. Unscrew the 4x M6 screws and remove the front panel with the handle of the disconnect switch (Fig. 8.4).
4. Unscrew the 2x M6 screws and remove the cable entry plate at the base of the cabinet (Fig. 8.5).

   Note. Machining is required to match the diameter of the cable entry plate holes to the size specifications required by the cables and glands to be installed.

5. Use a drill with a suitable bit or a conical reamer to enlarge the existing holes in the cable entry plate. The diameter of the holes must be sufficient to install the chosen cable glands, ensuring a safe passage for each cable. Remove any burrs or metal residue after machining.
6. Insert the main body of each cable gland (following the manufacturer's instructions) through the holes in the plate.
7. Screw the locking nut on the inside of the plate to secure the cable gland.
8. Working from underneath the cabinet, pass all cables through the opening created by the removal of the plate and then into the respective cable glands, bringing them up to the height of the bars (Fig. 8.6).
9. Secure the cable glands by tightening the locking nut on the outside of the plate to ensure cable stability and a hermetic seal that protects against the ingress of moisture and dust.
10. Set the AC busbar plate main switch to OFF (QSG, Fig. 8.7).
11. Connect the earth cable (PE, Fig. 8.7)
12. Connect the 4x 3ph + N cables to the AC busbars respecting the 3 phase sequence (L1, L2, L3, N, Fig. 8.7).
13. Connect the Meter A+/B- cable (M, Fig. 8.7).
14. Connect the Ethernet cables to the RJ45 ports (W, S2, S3, Fig. 8.8):
    – WAN for the main connection;
    – SHELL2 and SHELL3 for parallel communication between systems, if applicable.
15. Reposition the cable passage plate at the base of the cabinet and secure it with the 2x M6 screws (Fig. 8.5).
16. Reposition the front panel with the handle of the disconnector and secure it with the 4x M6 screws (Fig. 8.4).
17. Close the cabinet door (Fig. 8.3).

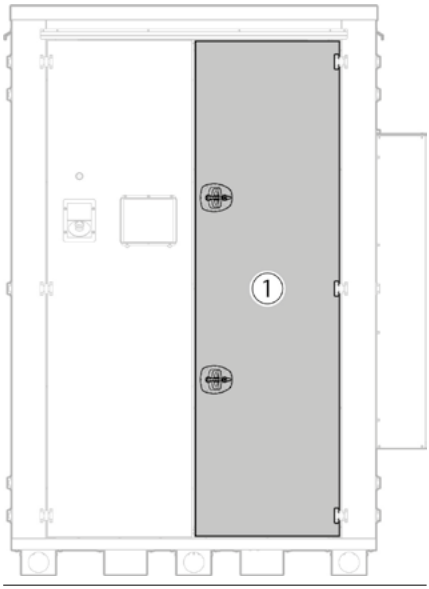


Fig. 8.3 - Door opening

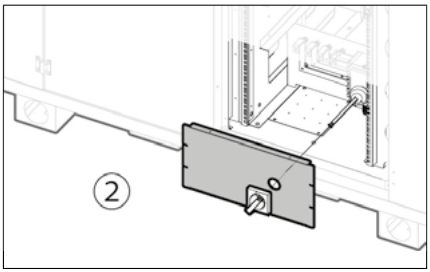


Fig. 8.4 - Front panel removal

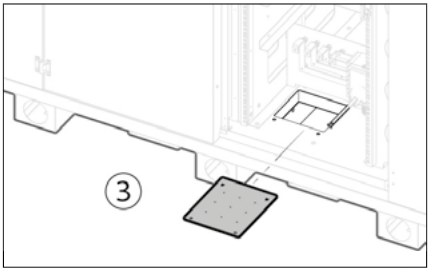


Fig. 8.5 - Cable passage plate removal

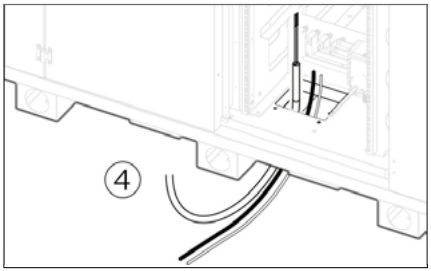


Fig. 8.6 - Cable routing

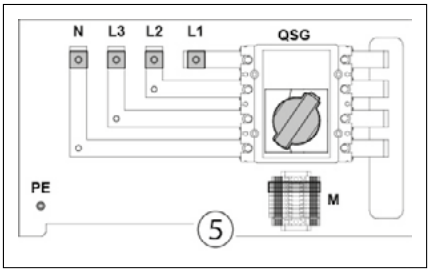


Fig. 8.7 - AC bar plate

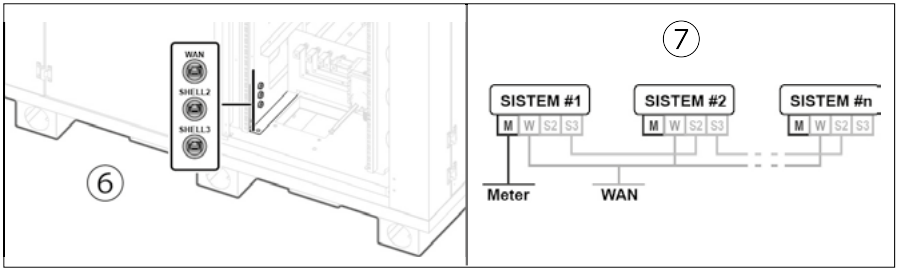


Fig. 8.8 - Communication cable connection

8.5 Commissioning of battery modules

Lithium-ion batteries are classified as Class 9 dangerous goods according to UN 38.3, which requires the safe transportation of these batteries.
To ensure compliance with relevant safety standards and regulations, the zeroCO_2 XL Shell 220 is shipped with the batteries physically installed but not electrically connected, while ensuring that the system can be safely transported without the risk of accidental discharge or other hazards.
To complete the electrical connection of the zeroCO_2 XL Shell 220, refer to chapter “8.5.3 Connecting BMS and Battery Modules” on page 40.

Model	HM5A180F
Cell technology	LiFePO4 (LFP)
Battery module energy [kWh]	15,68
Battery module voltage [VDC]	64
Battery module capacity [Ah]	245
BMU power [W]	3
Battery module fan power [W]	15,6
Dimensions [WxHxD, mm]	460x160,5x900
Protection class	IP20
Weight [kg]	115
Operating life cycle [cycles]	>7000 (*)
Operating temperature [°C]	0 - 50
Storage temperature [°C]	-20 - 50
Transport certificate	UN38.3

(*) The cycle duration is defined based on specific operating conditions, for further details please consult the Energy S.p.A. support team.

Warning.
The battery module weighs 115 kg. Manual handling is PROHIBITED. Use only suitable lifting devices and follow the required safety procedures.

Danger.
The battery module weighs 115 kg: its fall can cause serious injury or death.
Use extreme caution when lifting and handling.
Never stand under a lifted load.
Ensure that the module is properly secured to the lifting device before handling.
Keep the work area clear and prohibit access to unauthorized personnel.

8.5.1 Battery module interface

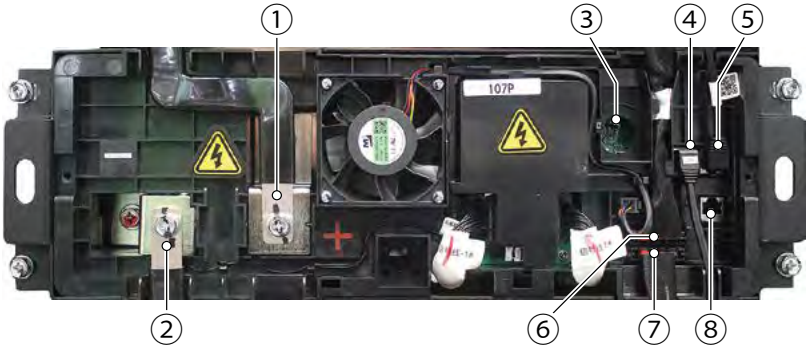


Fig. 8.9 - HM5A180F

1. **B+ power terminal**
   Connect battery in serial at power side.
2. **B– power terminal**
   Connect battery in serial at power side.
3. **Status led.** shows the battery module's status:
   verde = normal, **rosso** = abnormal.
4. **Link Port 0.** Link Port 0, 1 Communication Terminals: (RJ45 port), CAN communication, between multiple serial battery modules and control module.
5. **Link Port 1.** Link Port 0, 1 Communication Terminals: (RJ45 port), CAN communication, between multiple serial battery modules and control module.
6. **DC Port 0**. DC Port 0, 1 Terminals: the terminal is 4 pin of DC supply, which consists of 2 pins of 12V for BMU power supply, and 2pins of 24V for fan power supply. DC Port 0 for DC power input, DC Port 1 for DC power output.
7. **DC Port 1**. DC Port 0, 1 Terminals: the terminal is 4 pin of DC supply, which consists of 2 pins of 12V for BMU power supply, and 2pins of 24V for fan power supply. DC Port 0 for DC power input, DC Port 1 for DC power output.
8. **RS232 terminal**. Console Communication Terminal: (RJ45 port) follows RS232 protocol, for manufacturer or professional engineer to debug or service..

PIN	Link Port 0/1	RS232
1	—	—
2	GND	—
3	—	TX
4	CANH	—
5	CANL	—
6	—	RX
7	—	—
8	—	GND

Tab. 8.2 - PIN definition

8.5.2 Control module

Model	S1500M5A180E
Related Product	zeroCO_2 XL Shell 220
BMS Power Supply [V,Hz]	100~305VAC / 50~60Hz
System Operating Voltage [V]	0~1500
Charging Current (Maximum) [A]	180
Instantaneous Power During Relay Engagement [W]	65.4
Dimensions WxHxD [mm]	460x160x858
Communication	Modbus RTU/CAN/LAN
Protection Class	IP20
Weight [kg]	32
Operating Life [years]	15+
Operating Temperature [°C]	-20~65
Storage Temperature [°C]	-40~80

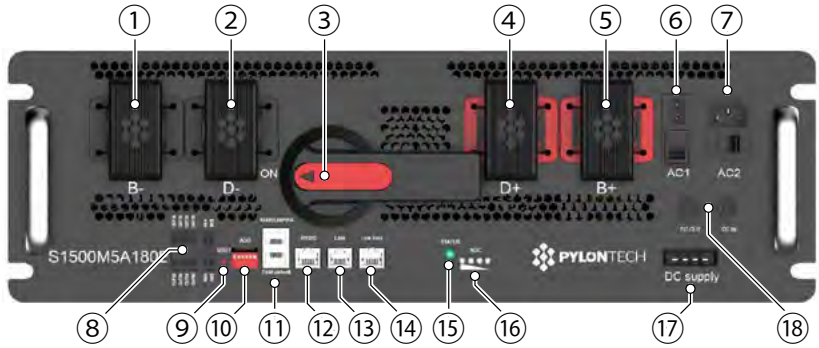


Fig. 8.10 - Modulo di controllo S1500M5A180E

1. **B- power terminal**
   Connect to battery module in serial.
2. **D- External Power Terminals**
   Connect battery system to the PCS.
3. **Circuit breaker.** Controls the Circuit breaker ON/OFF, and carries out shunt tripping function when system is overcurrent or short circuit.
4. **D+ External Power Terminals**
   Connect battery system to the PCS.
5. **B- power terminal**
   Connect to battery module in serial

6. **AC1 IN and power switch.** AC Socket and Control Module Power Switch: External power supply for Control Module, has Australia, Europe or U.S. standard AC Power input socket. Power Switch to control ON/OFF. Applied with UPS system. For the AC IN plug for BMS power supply, it`s suggested to connect to UPS power supply.
7. **AC2 IN and power switch.** AC Socket and FAN Power Switch: There're Australia, Europe, UK and US standard AC power input sockets for external power supply. Power Switch to control ON/OFF. Fan power supply shall be connected to AC power grid. Refer to chapter 2.2.3 for fan power consumption..
8. **Dry Contact**
   Dry Contact Terminal: provides 2 input and 4 output dry contact signal.

IN/OUT	Function	Default State and Action
IN1	Reserved	Always close
IN2	Emergency stop	Always close, power relay open when signal received
OUT1	Stop charging	Always close, when suggested charge current is "0" shall open
OUT2	Stop discharging	Always close, when suggested discharge current is "0" shall open
OUT3	Error	Always close, when system error activated shall open
OUT4	Current limit	Always close, when current limit ≤5A activated shall open

9. **Reset.** Reset Button: Long press this button to restart the battery system.
10. **ADD.** ADD: 6 bits dial switches to manually distribute the communication address of the battery system. Down position is OFF, means "0". Up position is ON, means "1". 1st to 5th bits are for address, and the 6th bit dial switch supports a 100Ω CANBUS terminal resistance.
11. **CAN/RS485.** CAN Communication Terminal: (RJ45 port) follows CAN protocol, for communication between battery system and inverter. RS485 Communication Terminal: (RJ45 port) follows Modbus RTU protocol, for communication between battery system and inverter.
    LinkPortA/LinkPortB. Link Port A: Used for cascade communication between BMSs, when battery string amount≤6, and communication between first battery string's BMS and MBMS. Link Port B: Used for cascade communication between BMSs, when battery string amount≤6..
12. **RS232**. Console Communication Terminal: (RJ45 port) follows RS232 protocol, for manufacturer or professional engineer to debug or service..
13. **LAN.** Console Communication Terminal: (RJ45 port) follows Modbus TCP/IP protocol, used for communication between MBMS, switcher or upper controller.
14. **Link Port**. Link Port Communication Terminal: (RJ45 port) follows internal protocol, for communication between multiple serial battery modules and control module.

PIN	CAN	RS485	RS232
1	—	—	—
2	GND	—	—
3	—	—	TX
4	CANH	—	—
5	CANL	—	—
6	—	GND	RX
7	—	RS485A	—
8	—	RS485B	GND

15. **STATUS.** shows the battery module's status:
    GREEN=Run, **RED**=Alarm and Protection.
16. **SOC.** Battery capacity indicators: 4 green lights, each light represents 25% capacity.
17. **DC Supply**
    Integrated with 12VDC for BMU and 24VDC for fans power supply, connects to battery module..
18. **DC OUT** Power supply for MBMS, to connect with MBMS' 12VDC IN.
    DC IN Back-up 12VDC power supply port for BMS.

Attention.

An AC breaker shall be installed externally for AC short-circuit protection. The specifications of the breaker shall meet the system's parameters. Refer to the system parameters table.

Battery Status	Mode	LED		capacity SOC				Description
		●	●	●	●	●	●	
Shut Down		off	off	off	off	off	off	All off
sleep	normal	L2	off	off	off	off	off	Indicates Sleep Mode, to save the power
idle	normal	●	off	off	off	off	off	Indicates save power mode
	allarm	off	●	off	off	off	off	Indicates the battery voltage or temperature is high or low
	protec.	off	●	off	off	off	off	Indicates the battery voltage or temperature is over or under
charge	normal	●	off	highest capacity indicator LED flashes (L2), others lighting				The highest capacity indicator LED flashes (L2), others lighting, horse race lamp when SOC□= DODH;
	allarm	off	●					
	protec.	off	●	off	off	off	off	Stop charging, STATUS(red) lighting
discharge	normal	L2	off	Indicate based on capacity				Indicate based on capacity
	allarm	off	L2					
	protec.	off	●					Stop discharging, STATUS(red) lighting
abnormal	power on fault	off	L4	off	off	off	off	Stop charging/discharging, STATUS(red) lighting
	other fault	off	●	off	off	off	off	
	STL fault	off	L2	L2				MCU self-check problem

Tab. 8.3 - status led.

Note: The flashing instructions.
L2=0.5" on and 0.5" off, L4=1" on and 1" off.

8.5.3 Cables connection

Danger.
Do not short-circuit the positive and negative poles of the battery system.

Caution.
An incorrect connection of the cables will cause a system failure.

Caution. Always consult the wiring diagram supplied with the system for the connection detail depending on the system configured. An incorrect link can result in personal injury.

Proceed to the connection between batteries as per the following general procedure.

1. **BMS-Battery No. 1 serial connection:**
   Connect the RJ45 “LinkPort” port of the BMS to the “LinkPort0” port of Battery No. 1 (Fig. 8.11), use the LAN cable supplied with the rack.
2. **Serial connection between batteries:**
   Connect the RJ45 “LinkPort1” port of each battery to the “LinkPort0” port of the next Battery (Fig. 8.12), use the LAN cable supplied with the rack.
   Proceed in this way until the last battery..
3. **Electrical connection:**
   - Connect the DC power supply of the BMS to the terminals of the PCS (Fig. 8.13).
   - Connect the BMS and battery No. 1 in parallel by connecting the orange B+ terminals of the BMS and the orange B+ of the battery using the orange/orange quick connector terminal cable supplied with the rack (1-Fig. 8.14).
   - Connect the batteries in series by connecting the black B- terminal of each battery to the orange B+ terminal of the next battery using the black/orange quick connector terminal cable supplied with the rack (2-Fig. 8.14).
     Proceed in this way until the last battery.
4. **Connection between consecutive columns:**
   for the DC connection and the serial connection of adjacent columns, use the longer cables supplied with the rack (Fig. 8.15 and Fig. 8.16).
5. **Parallel closure between batteries and BMS:**
   connect B- of the last battery and B- of the BMS, using the black quick connector double terminal cable, length 2 m, supplied with the rack (Fig. 8.17).

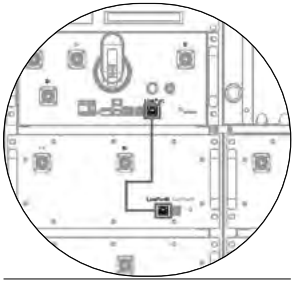


Fig. 8.11

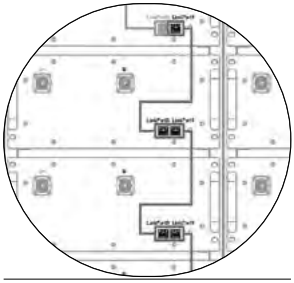


Fig. 8.12

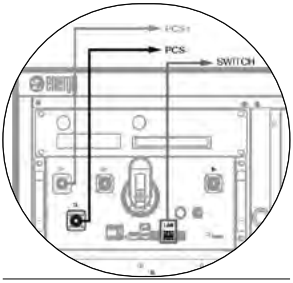


Fig. 8.13

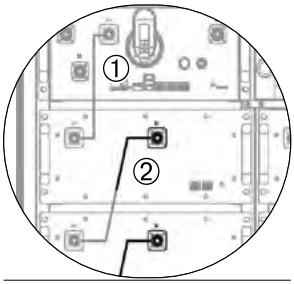


Fig. 8.14

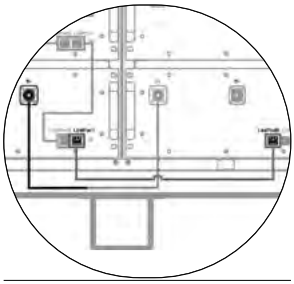


Fig. 8.15

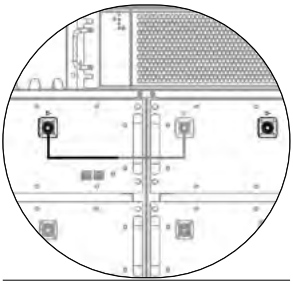


Fig. 8.16

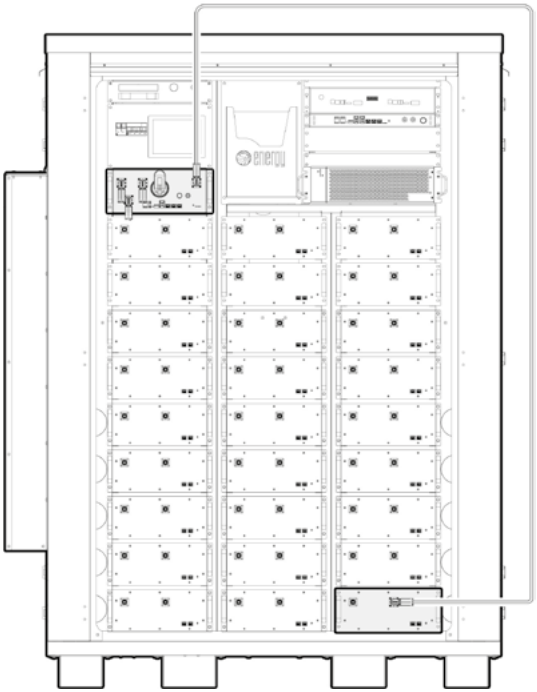


Fig. 8.17 - Parallel closure between batteries and BMS

8.5.4 ADD Switch BMS Settings

Each BMS on zeroCO_2 XL Shell 220 is equipped with a 6-bit setting system that allows you to manually set the communication address. The lower position is OFF and means “0” (zero). The upper position is ON and means “1” (one). Bits 1 to 5 manage the address. The 6th bit provides support for a 120Ω resistor (terminal resistance).

The BMS bits must be set as follows.

- **Communication settings between MBMS and BMS via Ethernet protocol (max 10 battery strings).**
  The first five BMS bits must be set as shown in Tab. 8.4. The BMS terminal resistance must be OFF.
  The address is configured following the ASCII encoding: (“X” is the terminal resistance).

Battery String	Address Bit
1	10000X

Tab. 8.4 - BMS ADD Switch settings.

8.6 Rain guards installation

To ensure that the internal components of the zeroCO_2 XL Shell 220 system are protected from water infiltration, rainproof flashings must be installed on each side of the cabinet. The flashings divert rainwater away from the openings, preventing moisture damage and maintaining the integrity of the system.
Rain flashings and the M6 screws required for installation are supplied standard with the zeroCO_2 XL Shell 220 system.

Installation Procedure:

- Place the flashings.
  - Identify the mounting points on each of the four sides of the cabinet, located above the doors.
  - Position the rain flashing over the mounting points, ensuring that the protruding portion is oriented outward to properly divert rainwater.
- Attach the flashings.
  - To secure each pair of rain shields, use 4x M6 screws (long side) and 3x M6 screws (short side).
  - Align the holes in the rain shields and screw the screws into place (Fig. 8.18).
- Final Check.
  - After securing all four rain shields, check that they are secure and correctly aligned.
  - Ensure that there are no gaps between the cabinet and the rain shields where water could enter.
  - Perform a weather strip test, if possible, to verify the effectiveness of the protection system.

Note: Correct installation of the rain shields is essential to ensure the longevity of the zeroCO_2 XL Shell 220 system. Ensure that all steps are followed carefully to avoid future damage due to water ingress.

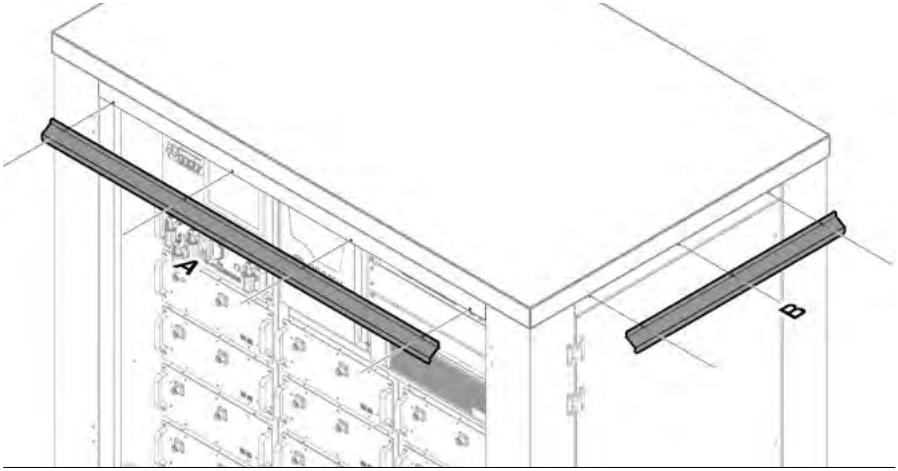


Fig. 8.18 - Rain guards installation

9.0 SYSTEM POWER ON AND OFF

9.1 System Power On

Caution.
Before powering up the system, double check all power and communication cables. Check the following:

- Make sure the main distribution panel switch is in the OFF position.
- Make sure the main distribution panel switch on the zeroCO_2 XL Shell 220 is in the OFF position (battery circuit power supply).
- Make sure the AC main distribution panel switch on the zeroCO_2 XL Shell 220 is in the OFF position.
- Make sure the magnetothermal main distribution panel switch on the zeroCO_2 XL Shell 220 is in the OFF position and that the installation and connection procedures indicated in this manual have been performed correctly.

Operations for powering up the system:

1. Set the AC main distribution panel switch 1 on the zeroCO_2 XL Shell 220 to the ON position.
2. Set the main distribution panel switch to the ON position.
3. Proceed to switch on the MBMS on the zeroCO_2 XL Shell 220 by moving the switch to the ON position and verify via the green light of the status LED that the MBMS is working correctly.
4. Move the BMS disconnect switch on the zeroCO_2 XL Shell 220 to which ADD Switch Number 1 has been assigned to the ON position (battery circuit power supply).
5. Hold down the Start button on the BMS for 5” until the acoustic warning sounds. The BMS will now perform the self-diagnosis of the group.
6. Wait for the self-diagnosis of the battery group on the zeroCO_2 XL Shell 220. The process takes 10”, at the end of which the status LEDs will emit a green light for all modules if passed successfully, a red light for modules that encounter an error or fault.

Warning. In the event of an error during the self-diagnosis, it is necessary to perform the debugging before moving on to the next step.
Contact Energy S.p.A. support to perform the debugging procedure.

Warning. To start a second BMS, following the first, it is essential that the self-diagnosis of the previous group has been successfully completed.

Warning. After installation or restart after a long period of inactivity, it is necessary to perform a complete recharge of the entire storage system.
It will be necessary to recharge regularly (every 3 months) even during continuous operation. This activity will be managed automatically thanks to the communication between the storage system and EMS.

Warning. In case of absence of communication between the MBMS and the upstream controllers, the system will not work correctly.

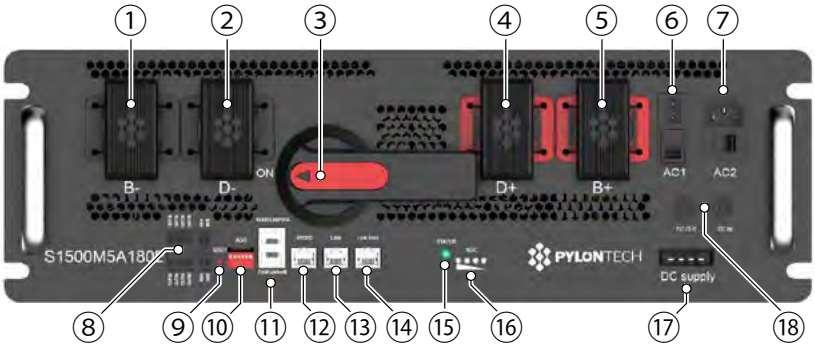


Fig. 9.1 - S1500M5A180E control module
breaker (3), status led (15).

Fig. 9.2 - MBMS

9.2 System Power Off

Warning.
In the event of a fault, before maintenance or in the event of long periods of inactivity, perform the shutdown procedure described in this chapter.

Operations for shutting down the system:

1. Switch off the MBMS on board the zeroCO_2 XL Shell 220 by turning the switch to the OFF position.
2. Set the main distribution panel disconnect switch to the OFF position.
3. Set the BMS disconnect switch on board the zeroCO_2 XL Shell 220 to which ADD Switch Number 1 has been assigned to the OFF position (battery circuit power supply).

Warning. Contact assistance to replace any faulty modules. If the battery module is replaced, before returning to use the system in normal operation, it is necessary to charge/discharge the module by bringing it to the same voltage as the others in the system. This operation is necessary to prevent the BMS from remaining busy for a long time in the battery module balancing activity.

Warning.
During normal operation do not open DC disconnect switches to avoid induced transient current spikes in battery strings that remain active.

10.0 WORK LOGIC AND CLOUD MONITORING

10.1 Work logic

The logics implemented in the EMS allow multiple possible working modes for the plant, as described in this paragraph.

Caution. It is always necessary to agree on the desired method before the commissioning phase by contacting the sales office and the assistance office of Energy S.p.A.

Caution.
Even when the plant has already started, it is possible at any time to change the working mode by contacting the Energy S.p.A. service office.

The possible working methods are:

4. **SELF-USE DISCHARGE**
   The energy produced is used directly to meet the load; If this is in surplus, the surplus is used to charge the batteries, if this is in deficit, the missing part is taken from the network.
   The system tends never to discharge the batteries in order to favor the direct consumption of the energy produced; the alternation of charge and discharge is therefore managed through time schedule.
   With this way of working, the focus of the plant is self-consumption.

5. **CONSTANT POWER**
   In this operating mode, the system is forced to charge or discharge the batteries at the set power value.
   With the variation of the state of charge of the batteries, the power is modulated to follow the maximum value that they can guarantee in their charging condition.

Caution. In the absence of the Energy meter accessories on the production side and on the mains side, the system can only work in CONSTANT POWER mode.

10.2 Cloud platform monitoring

EMS allows you to keep the entire system under control in real time and interact remotely at any time. Access is via Internet browser and can therefore be reached from a PC, tablet or smartphone. Before the commissioning phase, Energy's technical assistance takes care of creating the user account, implementing and customizing the platform as well as the working methods, based on the plant specifications agreed with the customer.

Caution. It is necessary to agree before start-up, with the assistance of Energy S.p.A. the desired mode of operation, as described in the previous paragraph, since this is completed at the software level directly on the web platform.

Caution.
Before commissioning, it is necessary to communicate to Energy S.p.A. assistance the desired username and password for the user account to be created.

Once the start-up of the plant has taken place, the web account is ready, and for the customer it is possible to access the portal, viewing the monitoring in real time.

To access, and to use the service, follow the following:

- Open any Internet browser.
- Position on bar of research URL.
- Type the following address and press enter:
  https://app.zeroCO$_2$.cloud/authentication/signin
- The Login screen to the monitoring cloud zeroCO$_2$ EMS will now open (Fig. 8.1):

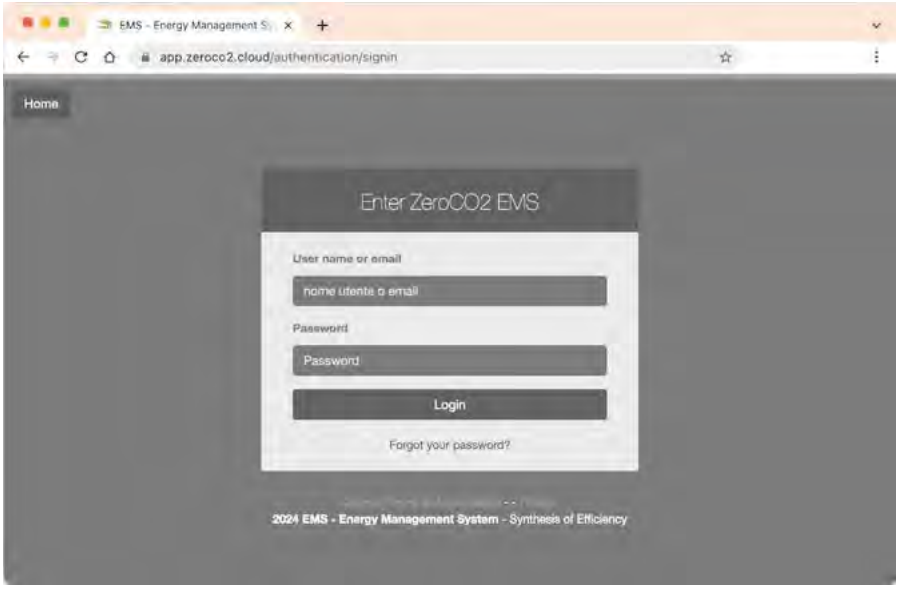


Fig. 10.1 - Login screen

- Insert the name user (or the address email) e the password Press releases for Access to zeroCO$_2$ monitoring cloud2 EMS. Confirm with a click on the Login button (Fig. 8.2).

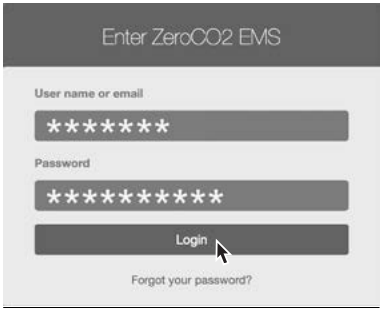


Fig. 10.2 - Enter credentials

- This will give you access to the customer plant portal (Fig. 8.3).

Fig. 10.3 - Portal screen

The page will show by default the “Dashboard” for monitoring the plant.
The Dashboard shows, moment by moment, the power flows within the system, symbolizing each of the components by means of different icons:

	Production Park
	Storage
	Exchange with network
	Load

A moving cursor indicates the direction of the power flow in real time, to or from the components of the system, depending on a different convention concerning the direction of travel, its color and the sign of the indicated power value.

(green cursor): positive power value which by convention concerns: Production, Feed-in, Load absorption, Batteries being charged.

(orange cursor): negative power value which by convention concerns: Purchase from the mains, Batteries being discharged.

Caution. A cursor color that disagrees with the flow directions described above indicates an incorrect connection direction for the amperometric transformers of the measuring meters.

- **Photovoltaic**
  Moment by moment, it shows the kW produced by the production park.

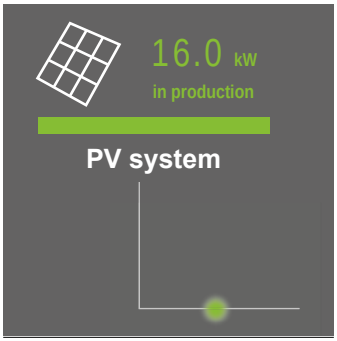


Fig. 10.4 - Photovoltaic production

Cursor	Direction	Power	Description	Meaning
	outgoing from photovoltaic	Positive	in production	Power output

Caution. By definition, a generator such as a photovoltaic park can only supply and not absorb power. Therefore, a cursor of a different color and in the opposite direction indicates incorrect wiring of the current transformers of the measuring meters downstream of the inverter.

- **Storage**
  Moment by moment, it shows the kW exchanged with the storage.

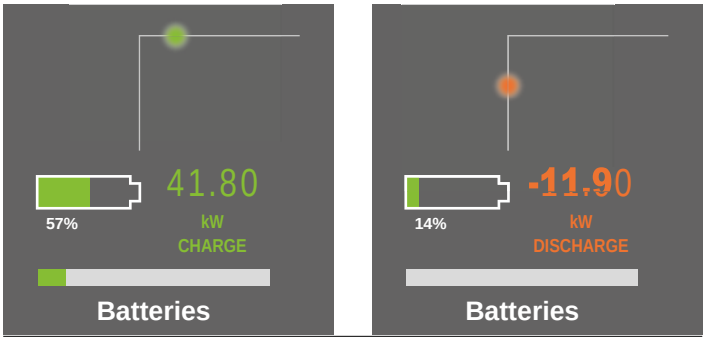


Fig. 10.5 - Storage

Cursor	Direction	Power	Description	Meaning
	Battery-powered input	Positive	Charge	Power charging to batteries
	output from the battery	Negative	Discharge	Battery discharge power

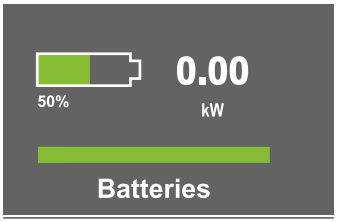


Fig. 10.6 - Photovoltaic production

When the power exchanged with the storage is zero or close to 0 kW, no cursor appears.

This means that the storage is “steady” and is not contributing to the energy flows of the system.
In this case, the storage can be in two different states referred to as IDLE and SLEEP.

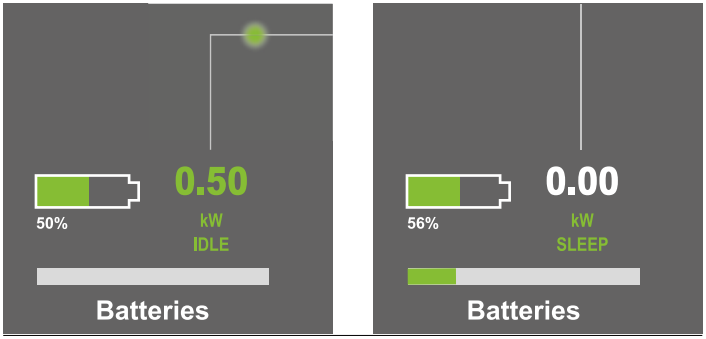
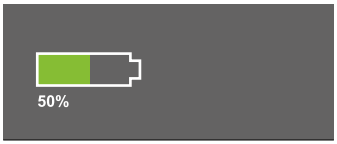


Fig. 10.7 - Storage not working

On-screen description	Meaning
IDLE	The working conditions do not allow to contribute, but he is ready to leave as soon as they fall within the operational ranges: Ex.1 = In a time slot “Discharge” is at a charge percentage lower than minimum SOC. Ex.2 = In a time slot “Charge” is at a charge percentage higher than maximum SOC.
SLEEP	Remote OFF command was given manually



The greener the icon, the more charged the batteries are.
The value below the icon indicates the percentage charge status in the battery.

Fig. 10.8 - SOC

- **Exchange with the network**
  Moment by moment, it shows the kW exchanged with the network.

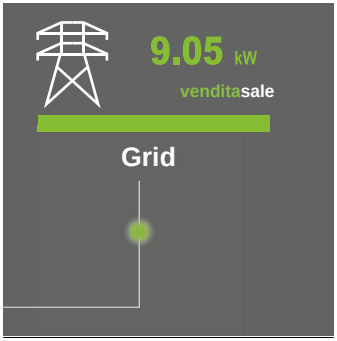


Fig. 10.9 - Exchange with the network

Cursor	Direction	Power	Description	Meaning
	Network input	Positive	Sale	Power fed into the grid
	Outgoing from the net	Negative	Purchase	Power taken from the grid

- **Loads**
  Moment by moment, it shows the kW absorbed by the loads.

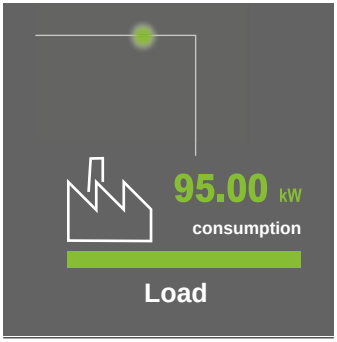


Fig. 10.10 - Load

Cursor	Direction	Power	Description	Meaning
	Incoming user	Positive	Consumption	Power absorbed by loads

Caution. By definition, an electrical load can only absorb and not deliver power. Therefore, a slider of different color and in the opposite direction indicates incorrect wiring of the current transformers of the measuring meters.

The central console accounts for energy values in a time interval selected by the user (Fig. 8.11). The “Energy Sold Price “ field refers to the cumulative profit, and is presented only if the plant works in trading mode.

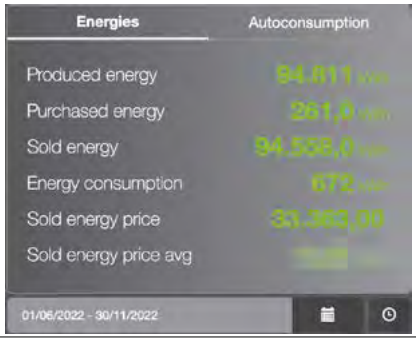


Fig. 10.11 - Energy

By clicking on the calendar icon, you can change the time interval on which to display the values, choosing from some proposed periods, or selecting a custom period.

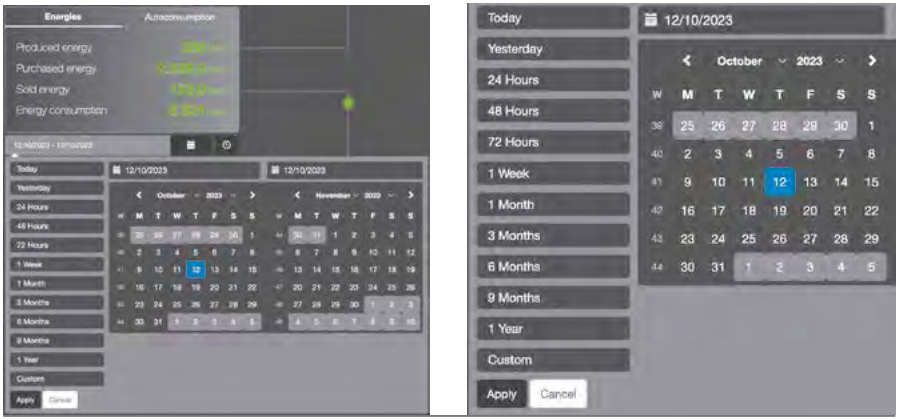


Fig. 10.12 - Calendar

With a click on the “Self-consumption” section you go to view the data of self-consumed energy in the set period.

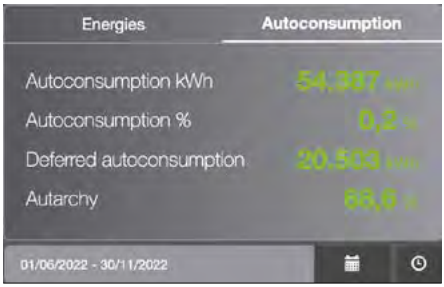


Fig. 10.13 - Energy

On the right side of the dashboard, the statuses of each zeroCO_2 XL Shell 220 device and the time elapsed since the last status change are listed in real time:

- EMS on-board computer status and set working mode.
- Battery storage status.
- Status of power converters.

Fig. 10.14 - System Status

Just below you can see the historical commands launched to the various components:

- EMS on-board computer status and set working mode.
- Battery storage status.
- Status of power converters.

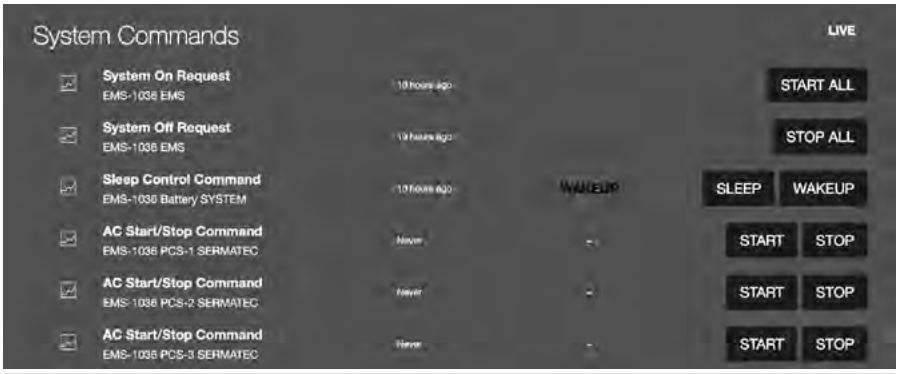


Fig. 10.15 - System Commands

With click on the “Scheduler” section (Fig. 8.16) you can see the alternation of the charging and discharging phases of the storage, on a today, daily basis (customizing the calendar date, 1 and 2 Fig. 8.17), of the last 3 days or of the last 7 days.

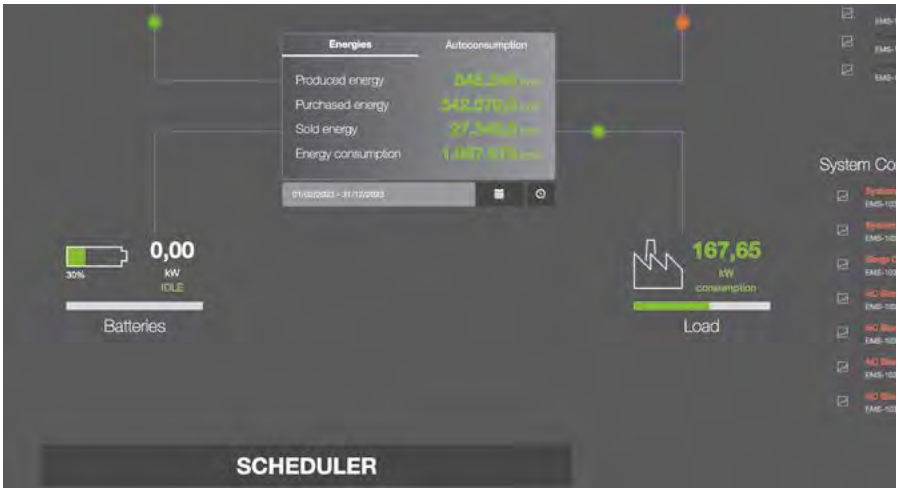


Fig. 10.16

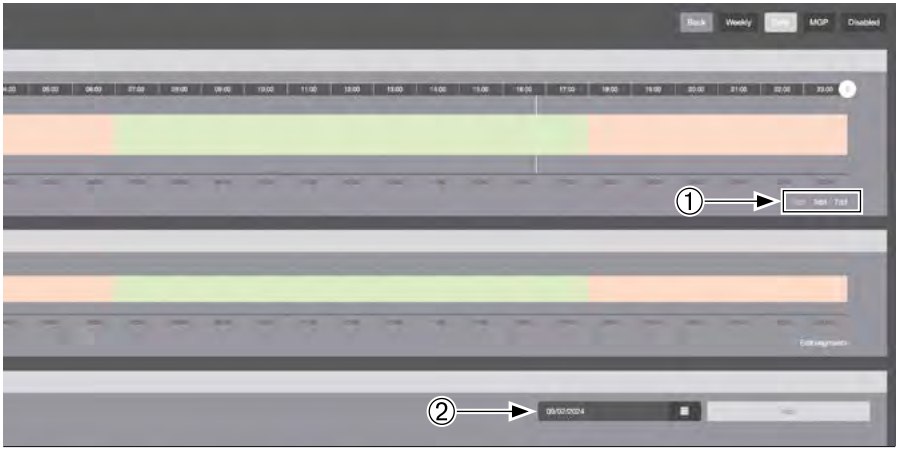


Fig. 10.17 - EMS Schedule

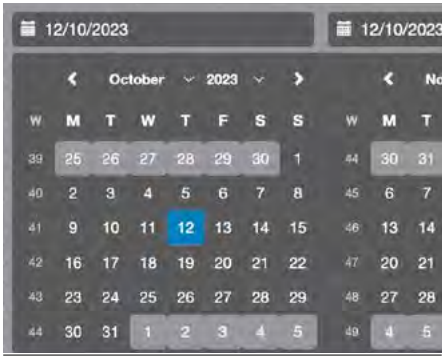


Fig. 10.18 -

Fig. 10.19 -

Fig. 10.20 -

Returning to the main dashboard, and scrolling under the “Scheduler” button, you can see the trend of the quantities in play. The width of the time interval on which to view the trend can be chosen by the user by clicking on the “Custom” button and accessing the calendar. Alternatively, it is sufficient

Select with the mouse cursor the amplitude you want to view directly on the graph.

Placing the mouse inside the Cartesian diagram (1, Fig. 8.21) You have the legend, and the reading of the instantaneous values.

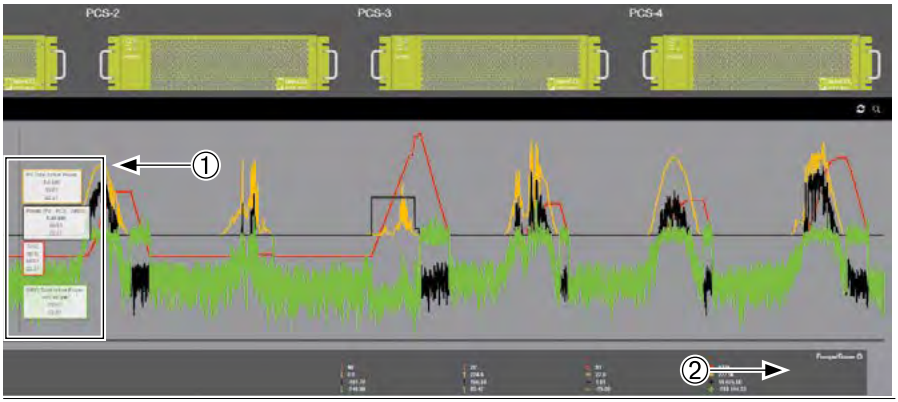


Fig. 10.21 -

- PV Total Active Power = Power Produced by photovoltaic.
- Power (PV-PCS-GRID) = Power supplied by the zeroCO_2 XL Shell 220 in charge or discharge (depending on whether positive or negative).
- SOC = Battery State of charge.
- GRID Total Active Power = Power exchang

From this point of the screen, you can also view the status of the PCS modules: with flashing green LEDs, the module is correctly running, with red LEDs corresponding to error status.
The same LEDs and ignition modes are physically located on the PCS module.

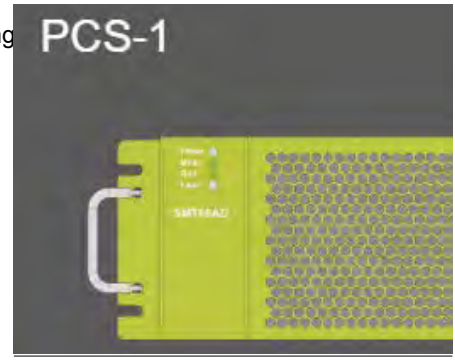


Fig. 10.22 -

By clicking on the PCS widget you have access to the summary of the operating data of the single module (AC data, DC data, internal temperature, status summary etc.).

Fig. 10.23 -

From the left menu, in the “ALARMS” tab, it is finally possible to view any alarms and errors in progress, or the historical log, on a period of time that can still be set by the user from the calendar icon:

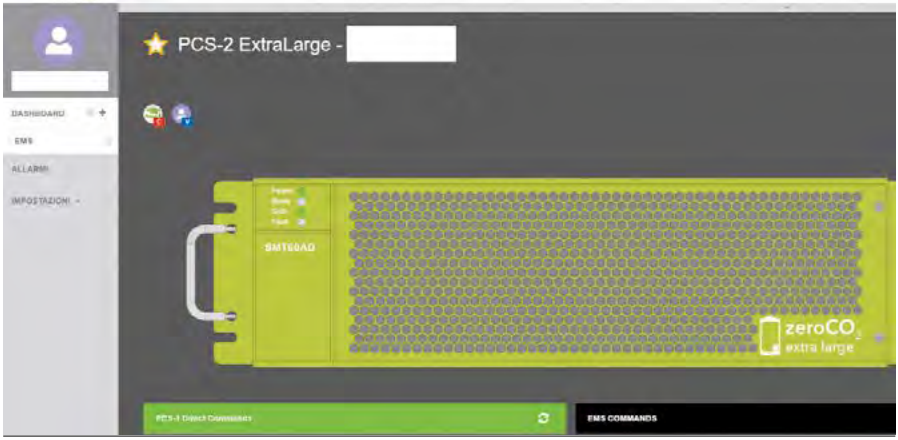


Fig. 10.24 -

11.0 TOUCH SCREEN CONTROL PANEL

11.1 Dashboard overview

In the main dashboard the user can view the general information and status of the zeroCO_2 - XL100 such as:

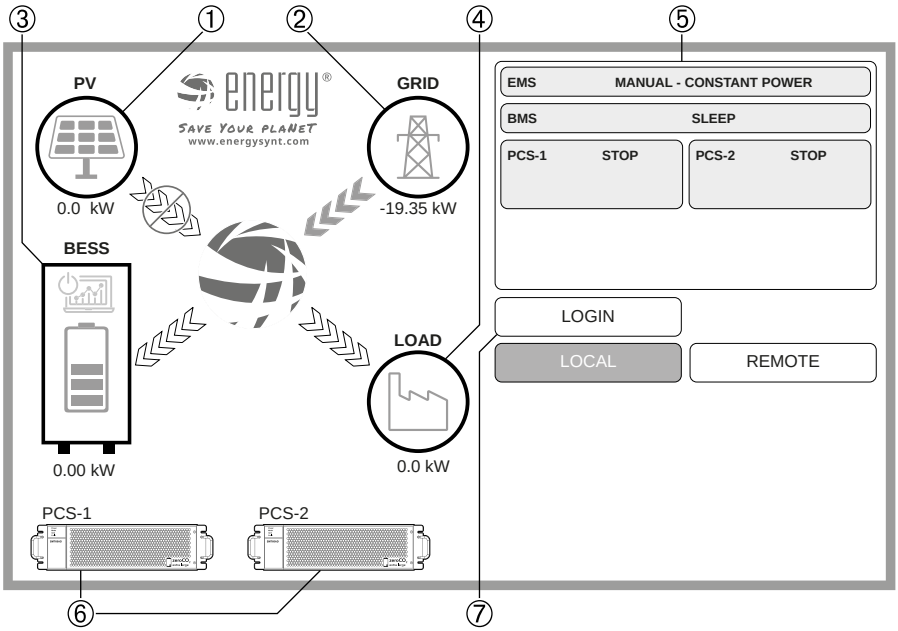


Fig. 11.1 - Dashboard overview

1. PV power production (if the PV electric meter is connected);
2. Grid meter reading (positive power means “import”, negative means “export”) is the reading on the electric meter installed in the exchange point;
3. Battery status and SOC (positive power means “battery charging”, negative means “battery discharging”);
4. Load power consumption (calculated by the EMS, no electric meter needed for this)
5. Top right corner:
   - EMS status;
   - BMS status;
   - PCS status.
6. PCS informations;
7. Login button to access local control.

- By clicking on the BESS icon (3, Fig. 9.1) the panel will show all the informations about each battery pile as shown in Fig. 9.2:

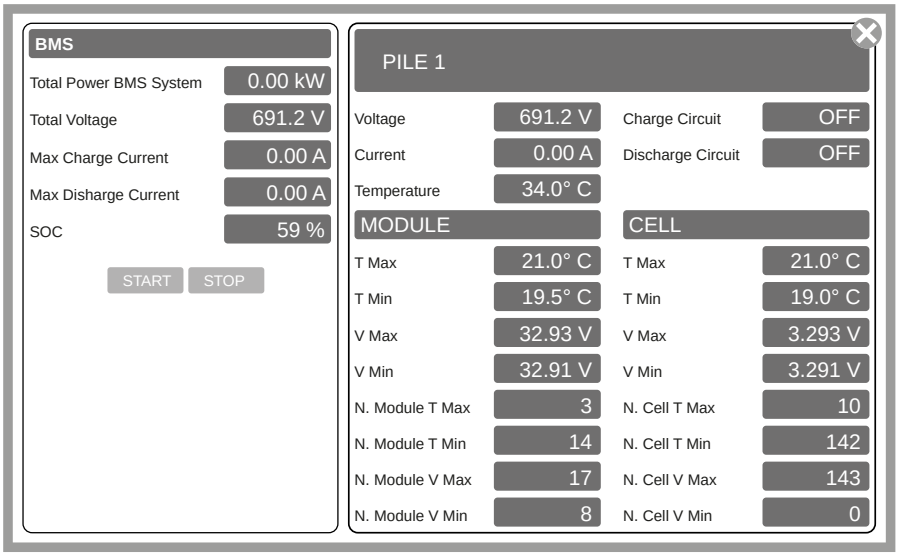


Fig. 11.2 - Battery pile informations

- By clicking on each PCS icon (6, Fig. 9.1) the panel will show all the informations about the corresponding PCS as shown in Fig. 9.3.

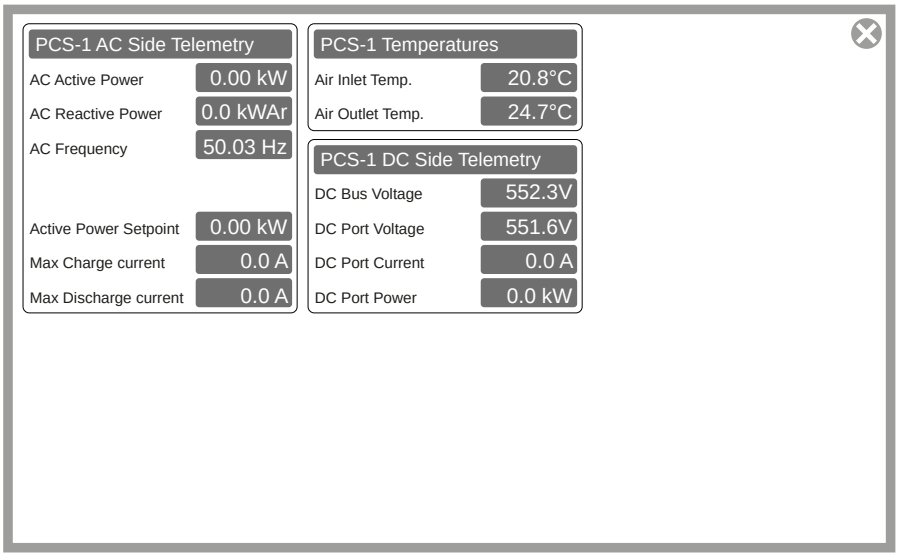


Fig. 11.3 - PCS informations

11.2 Local control

In order to enable the local control to manually operate the zeroCO_2 XL Shell 220 click the “Login” button (7, Fig. 9.1 at page 68). The following window will pop up:

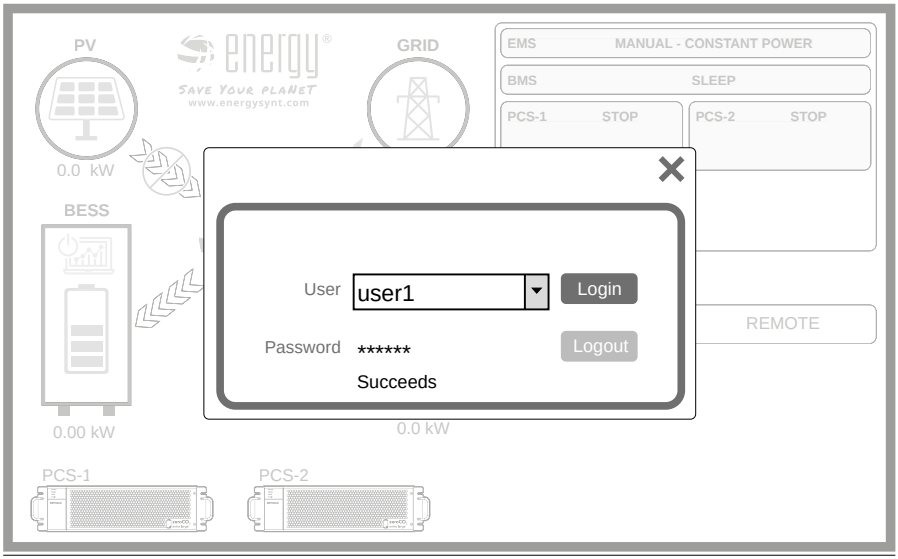


Fig. 11.4 - Login screen

- Click on “Password” and write the default password: **299792**.
- Click the “Enter” button, then “Login”. The Local operation dashboard will be visible after that.

The display will show window shown in Fig. 9.5.

In this dashboard the user can give Start/Stop commands for each PCS included in the system (1, Fig. 9.5) and control the BESS operation by clicking “Start All” or “Stop All” (2, Fig. 9.5).

Please note that “Stop all” will also put the BESS in “Sleep” status, “Start all” will act as a “Wakeup” command . This command will automatically also turn in “ON” or “OFF” status for all the PCSs in the system and it may take maximum one minute to complete the procedure

“Power Setpoint” is used to manually set the power on the AC side at which the system will operate, just as the BESS visualization positive power will mean that the BESS will be charged, negative means that the BESS will be discharged (3, Fig. 9.1 at page 68).

To change the “Power Setpoint” click on the power value and write the desired value as shown in Fig. 9.6.

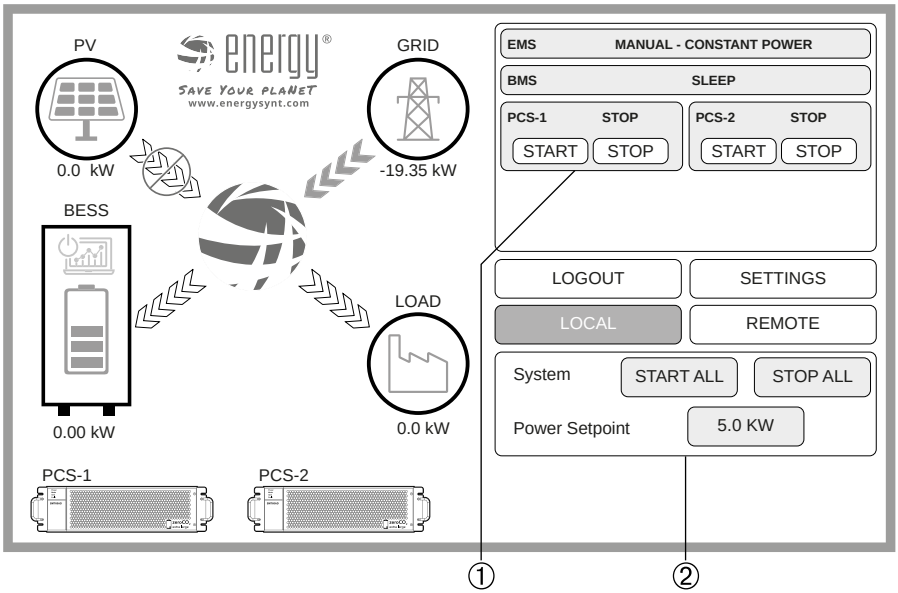


Fig. 11.5 - Local control screen

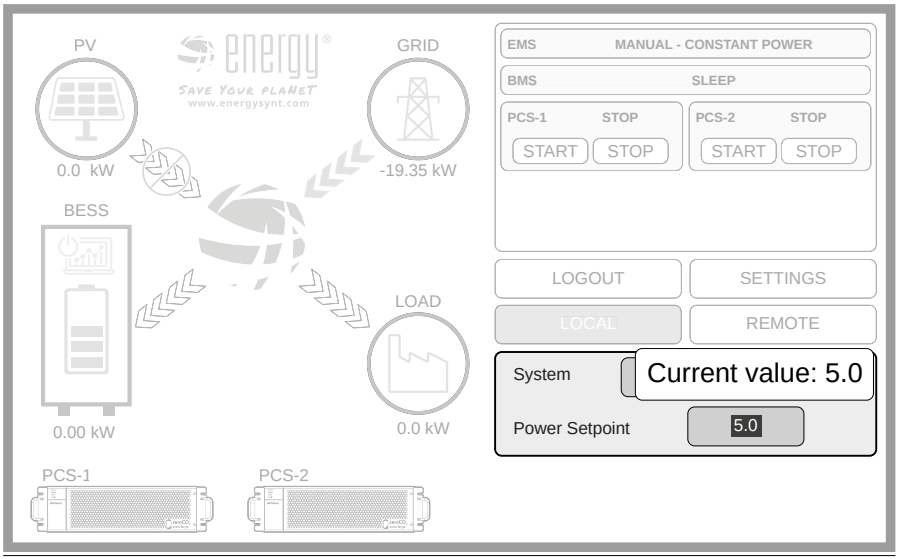


Fig. 11.6 - Power Setpoint settings

11.3 Settings Menu

After Login In (Fig. 9.4 at page 70), click “Settings” (1, Fig. 9.7) to access the Scheduler settings for the zeroCO_2 XL Shell 220 (Fig. 9.8).

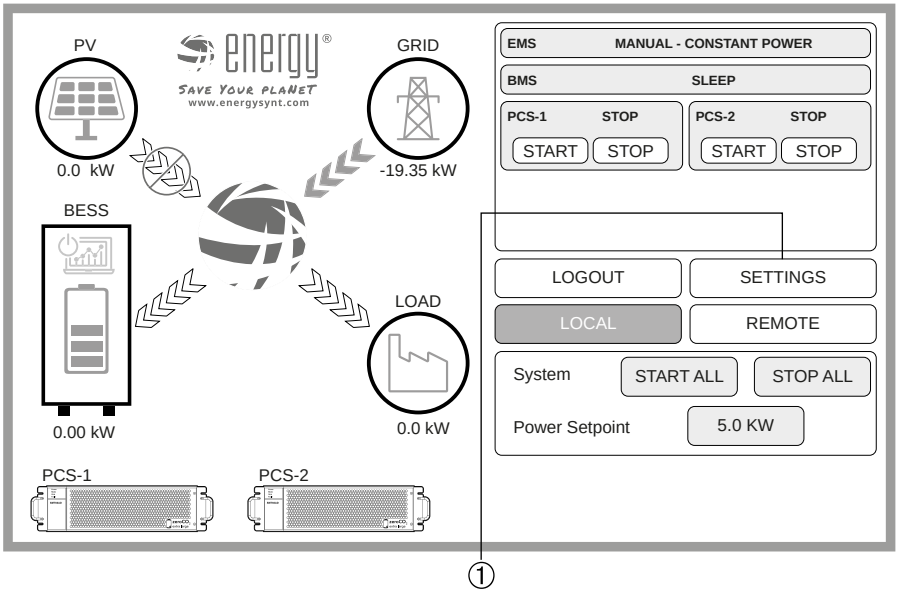


Fig. 11.7 - Local control screen

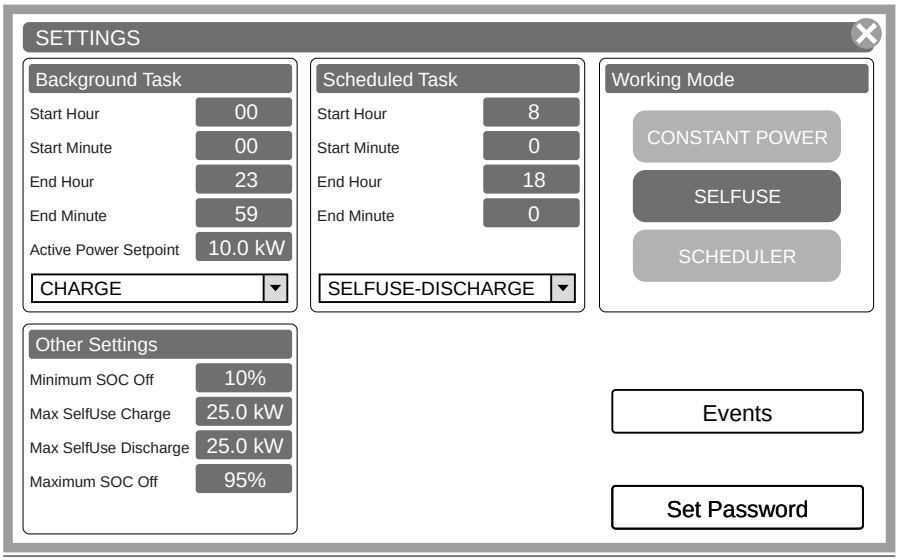


Fig. 11.8 - Scheduler settings

11.3.1 Background Task

Background Task: It's the default set for XL Shell 220, options are:

- **OFF**.
- **CHARGE**: Charges the batteries at the "Max SelfUse Charge" Power, regardless if PV power is available or not.
- **DISCHARGE**: Discharges the batteries at the "Max SelfUse Discharge" Power, regardless the Load.
- **SELFUSE CHARGE**: Charges the batteries with the production excess instead of exporting to the grid. During this period the batteries can never be discharged.
- **SELFUSE DISCHARGE**: Discharges the batteries following the load consumption instead of buying energy from the grid. During this period the batteries can never be charged.

To select the working mode click on the selection and pick the desired one.
To change operating period click on the hour or minute selection and write the desired value.

11.3.2 Scheduled Task

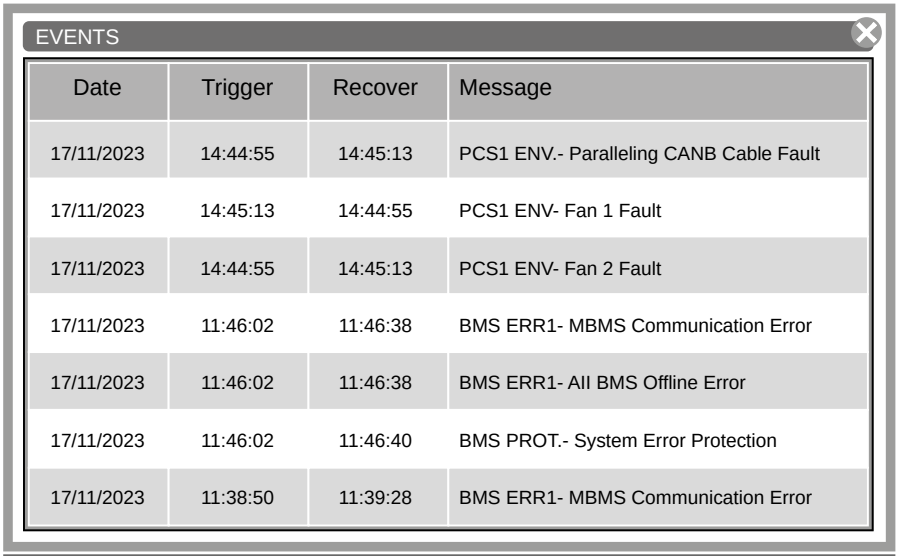
Scheduled Task: It's a programmable period of time to make system change its working mode. For this program are available the same settings of the Background Task

11.3.3 Working Mode

- **Constant Power**: The system will operate with the settings made in the Main Dashboard page, meaning it will follow the setpoint chosen by the user.
- **Selfuse**: The system will NOT follow the background/scheduled tasks, it will charge or discharge the batteries following the reading of the Grid meter, if energy is being exported the batteries will be charged and the opposite way if the energy is being imported..
- **Scheduler**: The system will operate following the Background and Scheduled tasks in the respective time intervals.

11.3.4 Other Settings

- **Minimum SOC off**. Batteries will never discharge lower than this SOC percentage.
- **Max SelfUse Charge**. The maximum power that the system will use to charge the batteries during Self Use time.
- **Max SelfUse Discharge**. The maximum power that the system will use to discharge the batteries during Self Use time.
- **Maximum SOC**. In “self use charge” mode, when the BESS SOC is higher than this percentage and the BMS sets “Maximum Charging Current” to 0 A the BESS will be set to “Sleep” condition in order to prevent self consumption. Once the task of the system changes the BESS will automatically receive a “Wakeup”.
- **Set password**. Set Password: Inside this menu the user can change the login password for the “user1” account.
- **Events**. Event log as shown in Fig. 9.9.



Date	Trigger	Recover	Message
17/11/2023	14:44:55	14:45:13	PCS1 ENV.- Paralleling CANB Cable Fault
17/11/2023	14:45:13	14:44:55	PCS1 ENV- Fan 1 Fault
17/11/2023	14:44:55	14:45:13	PCS1 ENV- Fan 2 Fault
17/11/2023	11:46:02	11:46:38	BMS ERR1- MBMS Communication Error
17/11/2023	11:46:02	11:46:38	BMS ERR1- AII BMS Offline Error
17/11/2023	11:46:02	11:46:40	BMS PROT.- System Error Protection
17/11/2023	11:38:50	11:39:28	BMS ERR1- MBMS Communication Error

Fig. 11.9 - Event log

12.0 PERIODIC MAINTENANCE OF THE SYSTEM

Danger. Periodic maintenance of the system should only be performed by qualified and authorized personnel. It is a good idea to carry out a periodic inspection of the system, with both visual and operating parameters checked.

12.1 Voltage Inspection

Check the battery system voltage using the cloud monitoring system. Check for any abnormal voltage in the system. Example: Single cell voltage is too high or too low.

12.2 SOC Inspection

Control the charge level (SOC) of the system using the cloud monitoring system. Check for anomalies in the charge level (SOC) of the battery string.

12.3 Cable Inspection

Visually inspect all cables in the system. Check for loosening, signs of deterioration or wear.

12.4 Balance

The battery strings will be unbalanced if they are not fully charged for a long time. Solution: every 3 months you should do the maintenance of the balance (full charge). Normally, this task will be handled automatically thanks to the communication between MBMS and EMS.

12.5 Output Relay Inspection

Under low load (low current) conditions, check the output relay OFF and ON to check if the relay emits a click; This indicates that the relay can turn off and on normally.

12.6 History inspection

Analyze the cloud monitoring alarm list for anomalies. In case of malfunctions or failures, contact Energy S.p.A. support.

12.7 Shutdown and maintenance

It is recommended to perform every 12 months shutdown, routine maintenance and restart in order to maintain optimal system efficiency.

12.8 Recycling

NOTE. In case a damaged battery needs to be recycled, you must follow local recycling regulations (e.g. Regulation (EC) Nº 1013/2006 of the European Union) to develop and use the best available techniques to achieve significant recycling efficiency.

The BMS's, the zeroCO_2 XL Shell 220 and/or all its components, fall into the category of electrical equipment and Electronic. They must therefore be disposed of in compliance with WEEE regulation 2012/19/EU.

13.0 REMARKS

13.1 Storage tips

For long-term storage (more than 3 months), battery cells should be kept in a dry environment (relative humidity <65%), clean, well ventilated, free of corrosive gases and with a temperature between -20°C~60°C.

Before storage, the battery must be charged to 50~55% SOC; It is recommended to activate the battery chemistry (discharge and charge) every 3 months.
The longest period of inactivity without discharge charging phases should not exceed 6 months.

Caution.
Battery life will be greatly reduced if you do not follow the above instructions for long-term storage.

13.2 Capacity expansion

In the case of Rack M1-22 with a battery number of less than 21, the number of modules can be increased.

Contact the sales department of Energy S.p.A. as this requires remote reprogramming of EMS, and the provision of new module and complementary cable kits.

To add modules, the system must be completed as described in chapter “6.2 System turn OFF” at page 74 and perform the power-on procedure as described in chapter “6.1 System turn ON” at page 74 when the module is installed.

Make sure the system is fully charged before adding a new module. In a serial connection system, the new module, even if it has a higher SOH, will adapt to the SOH condition of the existing system.

14.0 EXPEDITION

Before shipment the battery module will be precharged to 100% or according to customer requirements. After shipment and before charging, the capacity

The remaining battery cell will be determined by the time and storage conditions.

- Modules battery Meet the norm of certification UN38.3.
- In particular, the special rules for the carriage of goods by road and the current legislation on dangerous goods must be observed, specifically the ADR (European Convention on the International Carriage of Dangerous Goods by Road) and subsequent amendments.
  Contact the vendor for more information.

Energy S.p.A. reserves the right to modify the product and the following manual without notice.

15.0 SYSTEM INSTALLATION AND POWER-ON PROGRESS LIST

	CONDITION	REFERENCE
□	The environment meets all technical requirements:	chapter 7.3 at page 30
□	Cleanliness, Temperature, Fire protection	chapter 7.3.4 at page 30
□	Selection of the installation site	chapter 8.0 at page 34
□	Installation zeroCO_2 XL Shell 220	chapter 8.4 at page 38
□	Electrical connection zeroCO_2 XL Shell 220	chapter 8.5 at page 40
□	Commissioning of the battery modules	chapter 8.5.3 at page 45
□	Battery connection	chapter 8.5.3 at page 45
□	Connect the external power +/- cable between each BMS and the connection cabinet	chapter 8.5.3 at page 45
□	Connect the communication cables of each battery string	chapter 8.5.4 at page 47
□	Set the BMS switches (address assignment)	chapter 8.4 at page 38, 8.5.3 at page 45 and 8.5.4 at page 47
□	Recheck that all power, communication and earth cables are installed correctly and that the switch settings are correct	chapter 9.1 at page 50
□	Turn ON, one at a time, first the AC and then the DC disconnect switches of zeroCO_2 XL Shell 220	chapter 9.1 at page 50
□	Turn ON the disconnect switch of the general distribution panel	chapter 9.1 at page 50
□	Turn ON the MBMS in zeroCO_2 XL Shell 220	chapter 9.1 at page 50
□	Turn ON the BMS. The battery string will self-diagnose, and if successful, it will enter into self-check mode. If there is an error during self-diagnosis, you need to debug the error before proceeding to the next step.	chapter 9.1 at page 50
□	The first installation should automatically perform full charging. The MBMS will activate parallel operation after it has established communication with the BMS. When the voltage difference between a string and the others is within the maximum limit imposed by the MBMS, it will start working in parallel with the other active ones. If the BMS status LED is green, it means that the string is in parallel.	

16.0 SYSTEM SHUTDOWN PROGRESS LIST

	CONDITION	REFERENCE
□	Turn OFF the system's main switch	chapter 9.2 at page 51
□	Turn OFF the MBMS	chapter 9.2 at page 51
□	Turn OFF the BMS	chapter 9.2 at page 51
□	Turn OFF all the AC and then DC disconnectors of zeroCO$_2$ XL Shell 220 one at a time	chapter 9.2 at page 51

17.0 COMMON FAILURES IN EMS CLOUD

zeroCO$_2$ XL Shell 220

Alarm	Description
Overvoltage	Overvoltage
Undervoltage	Undervoltage
Overcurrent	Overcurrent
OverTemperature	Excessive temperature
UnderTemperature	Excessively low temperature
Grid Phase Sequence Warning	Three-phase sequential linking error
DC side Port Under Voltage Warning	DC undervoltage
DC side Port Over Voltage Warning	DC overvoltage
DC BUS total voltage Low Warning	DC undervoltage from batteries
DC BUS total voltage High Warning	DC overvoltage from batteries
Grid Frequency Low Warning	AC mains subfrequency
Grid Frequency High Warning	AC mains overfrequency
Grid Voltage Low Warning	AC mains undervoltage
EPO Fault	Activated emergency mushroom
Inverter Undervoltage Warning	DC side undervoltage PCS module
Inverter Overvoltage Warning	DC side overvoltage PCS module
Fan 3 Fault	Fan failure 3
Fan 2 Fault	Fan failure 2
Fan 1 Fault	Fan failure 1

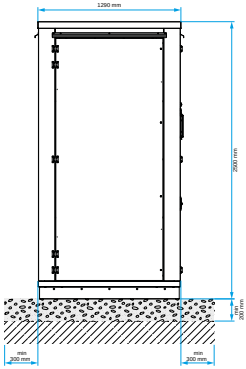
NOTE: The alarm is detected and indicated in the alarm section of EMS Cloud, both at the cell level, at the module level, and for the entire stack. See chapter “10.0 Working logics and cloud monitoring” on page 52.

18.0 ACCESSORY

Order code	Description	Function	Quantity
	HM5A180F	battery module	1
90900754	fire alarm		1
90900315	Eastron 3-Phase Meter Kit with External CTs Consisting of Eastron SDM630MCT and Three ESCT-T24-5 Transformers	Measures energy production and energy exchange (if sufficient low voltage side) to activate automatic operating logics of the EMS	1 exchange, 1 to 3 production
90900305	Eastron SDM630MCT 3-Phase Meter Modbus RS485 MID for External Sensors ESCT-XXX-5	As an alternative to 90900315. With 90900305 the CTs are not Energy supply scope. The choice is left to the customer depending on the power needs of the system.	

19.0 SIZING OF THE BASE

Left side view



Access Area
Keep the required space
next to the installation

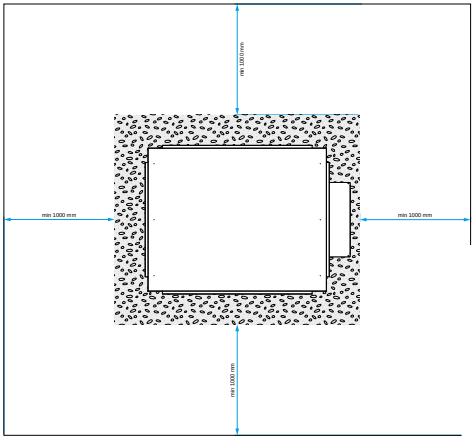
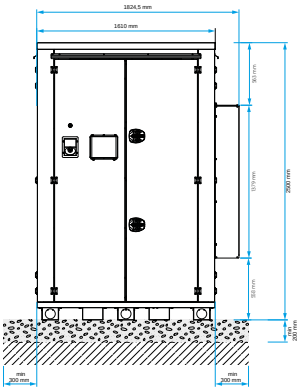
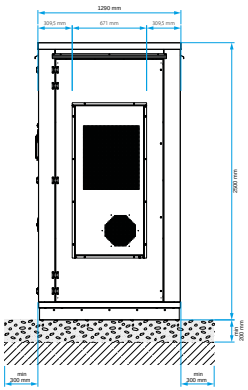


Fig. 19.1

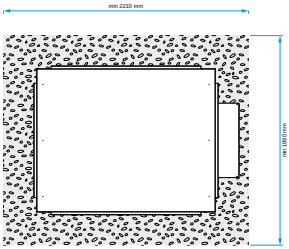
Front view



Right side view



Top view



Install the unit on a foundation made with reinforced concrete obtained with uniform pouring of material.
Use the following charachteristics for the construction and
the installation area:

1. Compact ground - Minimum payload 1 kg / cm2
2. Minimum Thickness of the foundation = 200 mm
3. Concrete type = C 25 / 30
4. Type of reinforcement =
   - Double Electro welding steel mesh d.8 20x20
   - Steel B450C
   - Overlay 2 steel meshes for every direction

20.0 POWER AND COMMUNICATION CABLE ENTRY

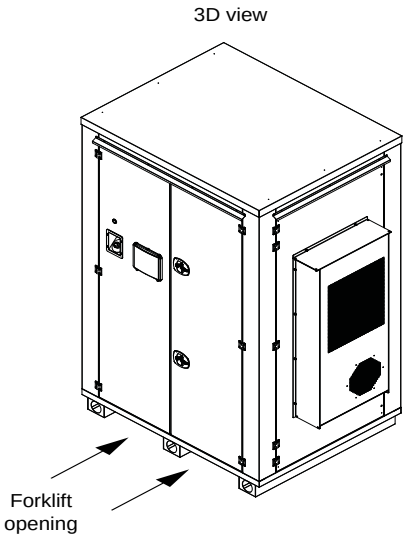
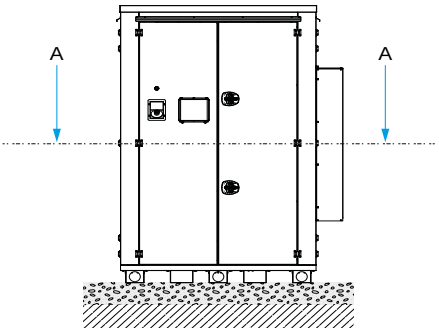
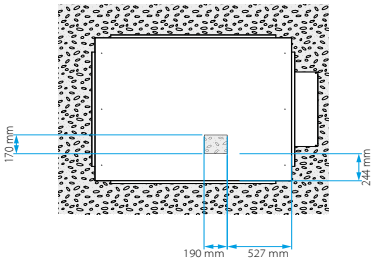


Fig. 20.1

Front view



section A



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