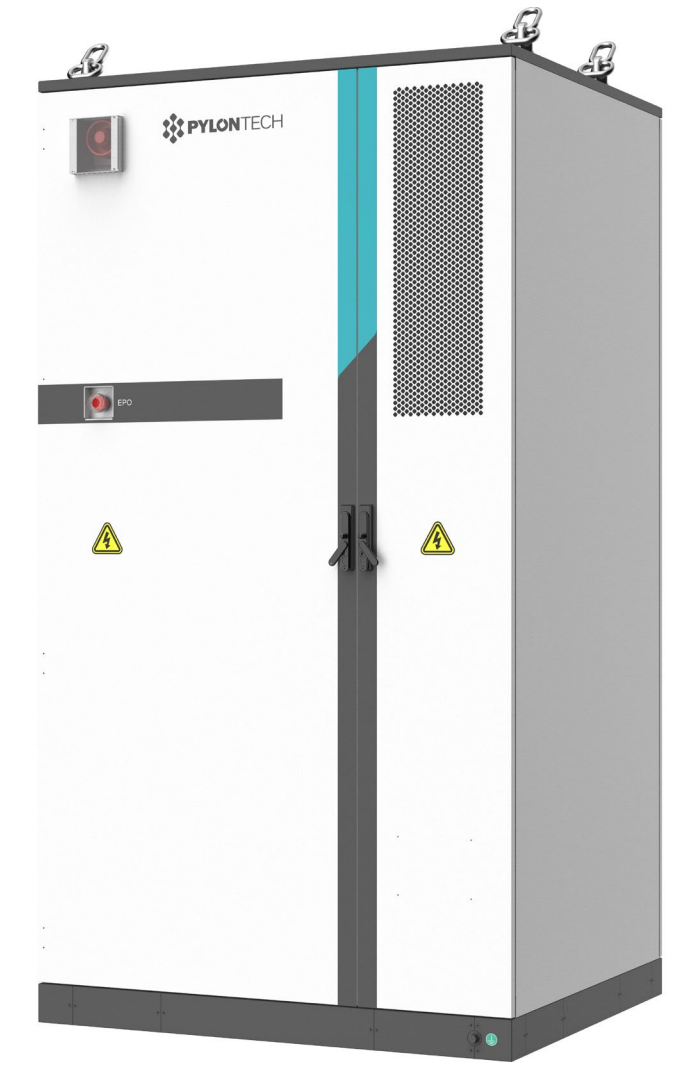




Optim US-A1-M1C-A-100/108-EU

Lithium Iron Phosphate Battery Energy Storage System

User Manual

Information Version: 1.0

Legal Information

Copyright©2024 Pylon Technologies Co., Ltd. All rights reserved.

Any reproduction or distribution of this manual or any part of this manual, or any uploading of this manual to a third party website, in any form by any means, without the prior written consent of Pylon Technologies Co., Ltd., is prohibited.

Disclaimer

The Manual contains instructions for the use of the product. All the pictures and charts in this manual are for description and explanation only. Pylon Technologies Co., Ltd. reserves the right to change the information in the manual which is subject to change without further notice.

Please read this manual carefully before using the product and keep this manual for further reference. Failure to use the product in accordance with the manual may result in serious injuries, property damages and may void the warranty, for which Pylon Technologies Co., Ltd. shall not be liable.

Pylon Technologies Co., Ltd. makes no representations or warranties express or implied, with respect to all the information in this manual.

In the event of any conflicts between this manual and the applicable law, the latter prevails.

The final interpretation of this manual belongs to Pylon Technologies Co., Ltd.

Contents

1	Information about this manual.....	1
1.1	Purpose	1
1.2	Product Model Description	1
1.3	Explanation of Symbols	2
1.4	Abbreviations in this Manual.....	2
2	Safety	3
2.1	Symbols	3
2.2	Personal Requirements.....	5
2.3	General Requirements.....	6
2.4	Equipment Label Protection.....	7
2.5	Establishment of Safety Warning Signs.....	7
2.6	Precautions for Maintenance or Repairs.....	7
2.7	Electrostatic Protection.....	8
2.8	Moisture Protection.....	8
3	System Introduction	9
3.1	System Overview.....	9
3.2	System Description.....	10
3.3	System Specifications	11
3.4	Reference standards.....	12
3.4.1	System Related Standards.....	12
3.4.2	Battery Related Standards.....	12
3.5	System Diagram.....	13
3.6	System Components.....	15
3.6.1	Outdoor Cabinet.....	20
3.6.1.1	Outdoor Cabinet Overview	20
3.6.1.2	Outdoor Cabinet Parameters.....	20
3.6.2	Battery String	21
3.6.2.1	Specifications of the Battery String	21
3.6.2.2	Battery Module.....	22
3.6.2.3	Control Module.....	23
3.6.3	MBMS	26
3.6.3.1	Basic Parameters of the MBMS.....	26
3.6.3.2	Interface Panel of the MBMS.....	26

3.6.4	PCS	29
3.6.4.1	Interface Panel of the PCS.....	29
3.6.4.2	Display Panel of the PCS	30
3.6.5	UPS (SP1K-W).....	32
3.6.5.1	Display Panel of the UPS.....	32
3.6.5.2	Interface Panel on the rear	34
3.6.6	Air Conditioner.....	36
3.6.7	Safety Features.....	37
4	Mechanical Installation and Electrical Wiring	38
4.1	Checking Before the Installation	38
4.2	Preparing Tools and Instruments.....	38
4.3	Selecting the Installation Sites.....	40
4.3.1	Working Environment Requirements.....	40
4.3.2	Installation Space Requirements.....	40
4.3.3	Installation Foundation Requirements.....	42
4.4	Handling of the Cabinet	44
4.5	Mechanical Installation Steps	45
4.6	Electrical Wiring	46
4.6.1	Cable requirements	46
4.6.2	Bolt Torque	46
4.6.3	Electrical Connection Procedure	46
4.6.3.1	Grounding	47
4.6.3.2	Battery Energy Storage System Wiring.....	48
4.6.3.3	AC Side Cable Wiring	49
4.7	Communication Wiring	51
5	Commissioning	52
5.1	System Status	52
5.1.1	Battery String Status.....	52
5.2	System Turning On	53
5.3	System Debug	56
6	Maintenance	57
6.1	System Turning Off	57
6.2	Routine Maintenance.....	58
6.2.1	Battery Maintenance.....	61
6.2.2	PCS Maintenance.....	62

6.2.2.1	Routine Maintenance.....	62
6.2.2.2	Fan Maintenance.....	62
6.2.2.3	Clearing and cleaning.....	65
6.2.3	Air-conditioner Daily Maintenance.....	65
6.3	Trouble Shooting.....	67
6.3.1	Battery String Trouble Shooting.....	67
6.3.2	PCS Trouble Shooting.....	69
6.3.3	UPS Trouble Shooting.....	71
6.3.4	Air Conditioner Trouble Shooting	72
6.3.4.1	Alarm List	72
6.3.4.2	Fault Check	73
6.3.4.3	Fault Check Reset	73
6.4	Emergency Disposal (EPO)	74
7	Shipment and Storage.....	75
7.1	Shipment.....	75
7.2	Storage	75

1 Information about this manual

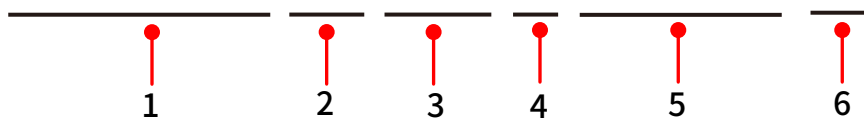
1.1 Purpose

This manual describes the Optim US-A1-M1C-A-100/108-EU Lithium Iron Phosphate Battery Energy Storage System (hereinafter referred to as "the system" unless otherwise noted) from Pylontech in terms of its overview, installation, commissioning, maintenance, etc.

Please read this manual before installing the battery and follow the instructions carefully during installation. In case of any confusion, please contact Pylontech immediately for advice and clarification (Contact information can be found on the back cover of the manual).

1.2 Product Model Description

Optim US-A1-M1C-A-100/108-EU



No.	Designation	Description
1	Product Series	Optimus Series
2	"A" represents type of the cabinet system. "1" represents the quantity of the battery string in the system.	"A" represents "All in one cabinet." "1" represents the there's one battery string in the system.
3	Battery model used in the product	The product uses M1C battery.
4	Product Version	Version A
5	The rated power of the PCS (in kW) The rated energy (in kWh) of the system	The rated power of the PCS is 100 kW. The rated energy of this system is 108 kWh.
6	Sales territory	The product is aimed in European market.

1.3 Explanation of Symbols

Symbol	Description
	Danger: Indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury.
	Warning: Indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury.
	Caution: Indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.

1.4 Abbreviations in this Manual

Abbreviation	Designation
Pylontech	Pylon Technologies Co., Ltd.
AC	Alternating Current
DC	Direct Current
PCS	Power Conversion System
BMS	Battery Management System
BMU	Battery Management Unit
MCCB	Moulded Case Circuit Breaker
SOC	State of Charge
SOH	Battery State of Health, in percent
UPS	Uninterruptible Power Supply
BESS	Battery Energy Storage System
EMS	Energy Management System
PMU	Power Management Unit
CMU	Control Management Unit
SPD	Surge Protecting Device
GND	Ground
EU	European Union
DOD	Depth of Discharge
MBMS	Master Battery Management System
MCU	Microcontroller Unit

2 Safety

2.1 Symbols

	Read the manual before installing and operating the battery system.
	General warning label indicating potential hazards.
	Warning: electric shock.
	Warning: flammable materials.
	Do not connect the positive and negative reversely.
	Keep away from flame or ignition sources.
	Keep away from children.

	Grounding
	Recycle label.
	Label for Waste Electrical and Electronic Equipment (WEEE) Directive (2012/19/EU).

2.2 Personal Requirements

This system is only operated by authorized personnel. Read all safety instructions carefully prior to any work and follow these instructions at all times when working with the system.

Incorrect operation or work may cause:

- Injury or death to the operator or a third party.
- Damage to the system hardware and other properties belonging to the operator or a third party.

Qualified personnel must have the following skills:

- Training in the installation and commissioning of the electrical system, as well as the dealing with hazards.
- Knowledge of the manual and other related documents.
- Knowledge of the local regulations and directives.

2.3 General Requirements

DANGER

Danger: Battery strings will produce high voltage DC power and can cause a lethal voltage and an electric shock. Only qualified personnel can perform the wiring of the battery strings.

DANGER

Danger: Lethal voltages are present in the battery terminals and cables. Severe injuries or death may occur if you touch the cables and terminals.

WARNING

Warning: Pulling out the connectors while the system is working could lead to battery system damage or personal injury. Do not pull out the connectors while system is in operation. De-energize all multiple power sources and verify that there is no voltage.

WARNING

Warning: Whenever operating the battery system, wear suitable personal protective equipment (PPE) such as rubber gloves, rubber boots and goggles.

WARNING

Warning: For this system, working temperature is -25°C~ 45°C and the optimum temperature is: 10°C~ 40°C. Out of the working temperature range may cause the battery system over/low temperature alarm or protection which will further lead to the cycle life reduction. It will affect the warranty terms as well.

WARNING

Warning: For battery installation, the installer shall refer to NFPA70 or similar local installation standard for operation.

CAUTION

Caution: Improper settings or maintenance can permanently damage the battery.

There is high voltage in the system, and any accidental contact may lead to fatal electric shock. Be sure to observe the following when working with the system:

- Tag and lock the working area.
- There must be an escort to ensure personal safety.

2.4 Equipment Label Protection

- The warning labels on the outside and inside of the cabinet of this product contain important information for safe operation of this product. It is strictly prohibited to remove or damage them.
- This product is fitted with a nameplate that contains important information about the parameters related to the product. It is strictly prohibited to tear or damage it.

2.5 Establishment of Safety Warning Signs

When installing, performing routine maintenance, repairing, etc. on this product, to prevent uninvolved persons from approaching and causing accidental operations or accidents, please observe the following:

- Establish visible signs at all circuit breakers for this product to prevent accidents caused by accidental closing of the circuit breaker.
- Establish warning signage or set up safety caution tape near the operating area.
- Always remove the cabinet door key and keep it in a safe place after operations such as maintenance or overhaul.

2.6 Precautions for Maintenance or Repairs

The product can be taken out of operation smoothly by performing the shutdown operation. When performing maintenance or overhaul operations on the equipment, please observe the following:

- Ensure that this product is not accidentally repowered.
- Use a multimeter to ensure that the product is completely free of electrical charge internally.
- Ensure the proper grounding connections.
- Cover potentially energized parts of the operating section with insulation using a cloth made of insulating material.
- Ensure that escape routes are completely clear throughout maintenance and repair.

2.7 Electrostatic Protection

- Contact or improper handling of printed circuit boards or other static-sensitive components can cause damage to the device.
- Avoid unnecessary contact with the circuit board.
- Observe electrostatic protection norms, such as wearing anti-static bracelets.

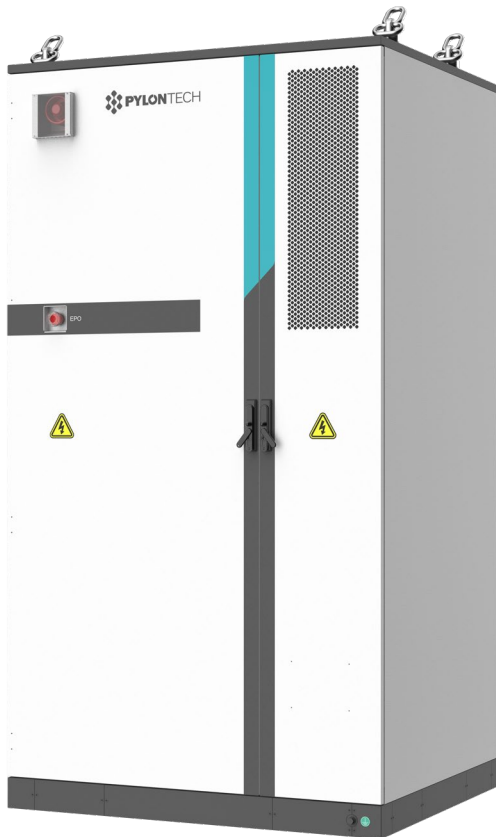
2.8 Moisture Protection

- Do not open the cabinet door when the air humidity is >95%.
- Avoid installation operations in rainy or humid weather conditions.
- Intrusion of moisture will most likely damage the product.

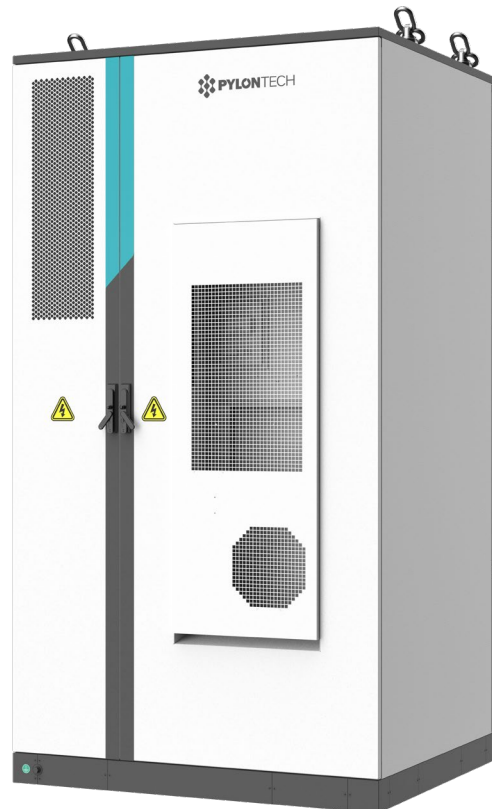
3 System Introduction

3.1 System Overview

The Optim US-A1-M1C-A-100/108-EU is a high voltage battery storage system based on lithium iron phosphate battery. This system is especially suitable for industrial and commercial application scenarios such as grid peak shaving and valley filling, power capacity increase, photovoltaic storage charging system, and backup power.



Front View



Rear View

NOTE: The above pictures are for reference only, the appearance of the product is subject to the actual delivery.

3.2 System Description

The outdoor integrated battery energy storage system connects the power grid with the storage battery through the energy storage PCS and realizes the bidirectional energy transfer between the DC battery of the battery energy storage system and the AC grid by applying the principle of AC/DC conversion. It is realized through the control strategy:

- Charging and discharging management of the battery system.
- Tracking the power of the load on the grid side.
- Control of the charging and discharging power of the battery energy storage system, off-grid operation, and so on.

Main functions of the product

- Peak reduction and valley filling: it is realized by charging and discharging from the energy storage system in accordance with the requirements of the local electricity tariff with a fixed duration.
- Anti-backflow function: EMS adjusts the charging and discharging power of energy storage in real time by sampling the power of the grid to prevent backflow to the grid.
- Demand management: EMS adjusts the charging and discharging power of the energy storage system to avoid over-limit of the user's transformer.
- Local control and remote communication control.

3.3 System Specifications

Specifications	Item	Description
System General Data	External Dimensions	1300 ± 5 (W) x 2485 ± 5 (H) x 1150 ± 5 (D)
	Weight (kg)	2000 (including battery)
	Working Temperature Range (°C) *	-25 ~ 45
	Protection Class	IP55
	Altitude (m)	2000
	Relative Humidity	0-95% RH, non-condensing
	Noise (dB)	65 @ 1 meter
	Fire Fighting Method	Aerosol
	Air Conditioner	3kW Cooling; 2kW Heating
	Anti-Corrosion	C5 (Air Conditioner C4H)
	Communication Type	Modbus TCP/IP, Modbus RTU, CAN
DC Side Data	Battery Type	Li-ion (LFP)
	Battery Model	Powercube-M1C
	Nominal Capacity (kWh)	108.9 kWh
	Battery Module Qty.	23 (maximum Qty. for 108.9 kW)
	DC Voltage Range(V)	621 ~ 828 (for 23 modules' configuration)
	Maximum Operation Current (A)	158
	Efficiency	95%
PCS DC/AC Data On-grid Mode	Rated AC Power (KW)	100
	Rated AC Output Voltage(V)	230V/400VAC, 3W+N+PE
	Rated AC Output Frequency (Hz)	50
	Max. AC Current(A)	145A (Linear Load)
	Overload Capacity	120 kW@ 60 seconds
	AC PF	1.0 (Lagging)~ 1.0 (Leading)
	CEC Efficiency	97.3% (Peak 98.1%)
	Isolation Type	Non-isolation
	Response Time (0-100% Pn)	70 milliseconds
	Response Time (Charge-Discharge)	100 milliseconds

* In high (>40°C) or low temperature (<10°C) environment, the charging and discharging power of the battery system will be limited according to BMS operation logic.

3.4 Reference standards

3.4.1 System Related Standards

No.	Description	Code
1	Swedish legislation regarding requirements of grid connection	EIFS 2018:2*
2	UN38.3 Safe Transport Standard	UN3480

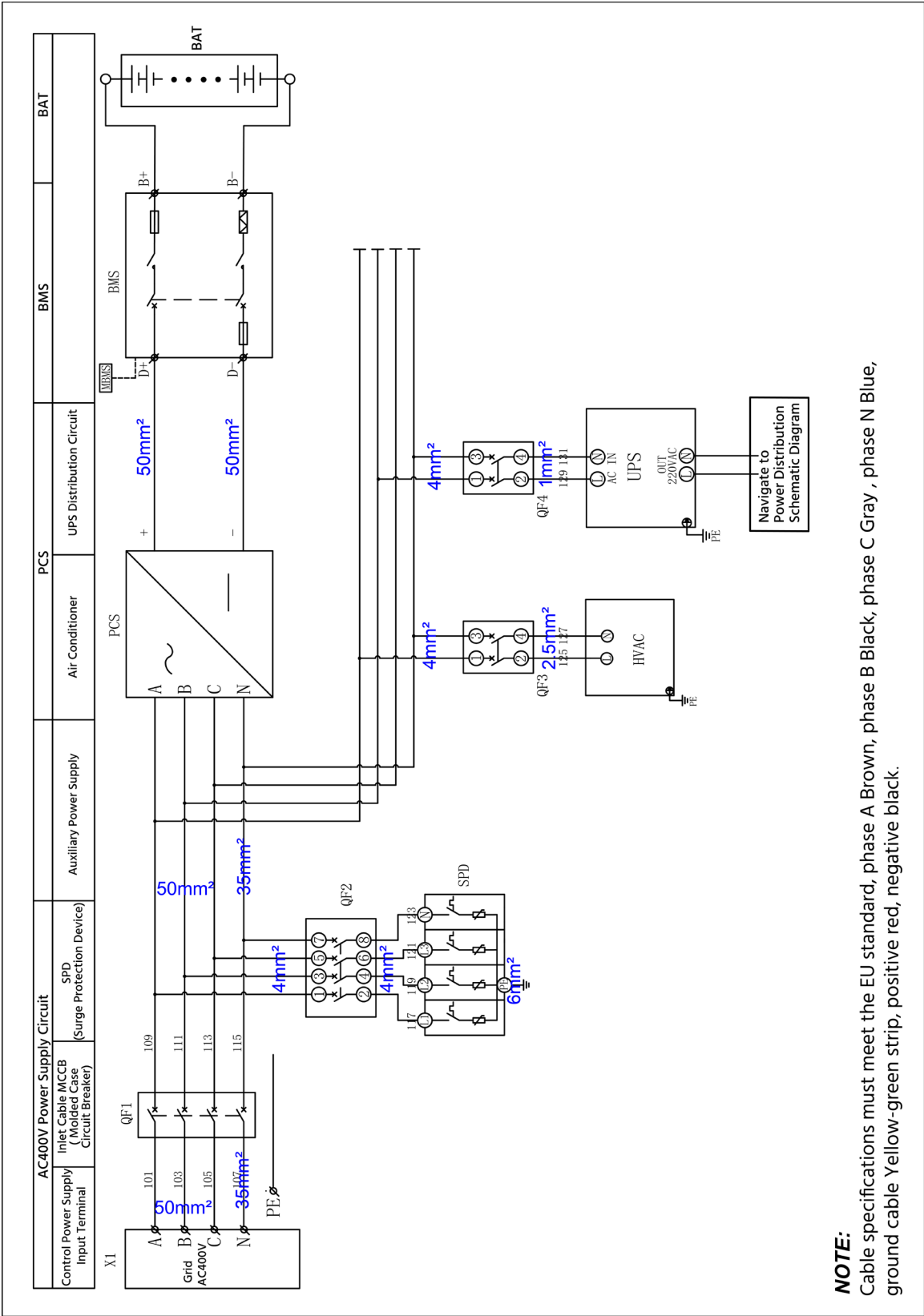
3.4.2 Battery Related Standards

No.	Description	Code
1	Safety Standard for Secondary Lithium Batteries	IEC62619 IEC63056 IEC62477-1 IEC62040-1
2	UN38.3 Safe Transport Standard	UN38.3
3	CE EMC Standard CE EMC Directive 2014/30/EU	EN IEC 61000-6-1:2019 EN IEC 61000-6-2:2019 EN 61000-6-3:2007+A1 EN 61000-6-4:2007+A1 IEC 61000-6-1:2016 IEC 61000-6-2:2016 IEC 61000-6-3:2006+A1 IEC 61000-6-4:2018
4	UCKA Standard	BS EN IEC 61000-6-2:2019 BS EN 61000-6-2:2005 BS EN 61000-6-4:2007+ A1
5	Battery Cell SafetyStandard	UL1642
6	Battery Cell SafetyStandard	UL1973
7	Battery Cell SafetyStandard	JIS C 8715-2
8	Battery Safety Standard	UL9540A*
9	Safety Standard for Electrical Devices CE LVD Directive2014/35/EU	IEC62477-1
10	Safety Standard for Lithium-ion Battery (US)	UL1973
11	Safety Standard for Lithium Battery (Germany)	VDE-AR-E 2510-50:2017

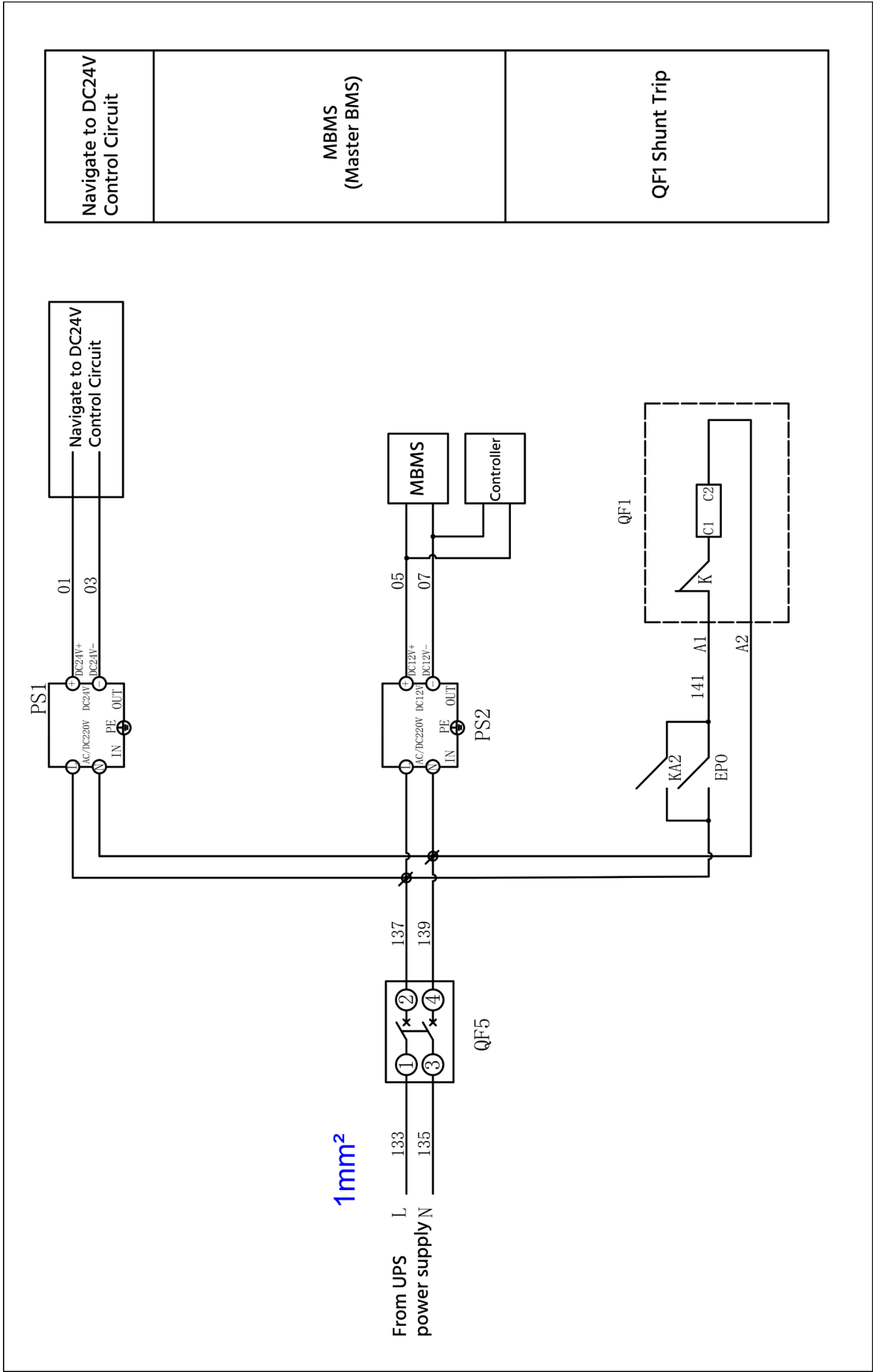
* The PCS is undergoing EIFS certification test.

3.5 System Diagram

Electrical Schematic Diagram



Power Distribution Schematic Diagram



3.6 System Components

Figure	Description	Location	Figure	Description	Location
①	Outdoor Cabinet	Figure 1	⑫	Air Conditioner	Figure 3
②	Fly Net		⑬	Fly Net	
③	EPO (Emergency Power OFF Switch)		⑭	Aerosol Can	Figure 4
④	Sound-light Alarm		⑮	Smoke Detector	
⑤	PCS		⑯	Wiring Terminal Block	
⑥	SPD		⑰	Micro Circuit Breaker (QF3~QF5)	
⑦	Micro Circuit Breaker (QF2)		⑱	24V Switching Mode Power Supply (PS1)	
⑧	MCCB (QF1)	Figure 2	⑲	12V Switching Mode Power Supply (PS2)	
⑨	AC Input Terminal Connector (X1)		⑳	UPS	
⑩	BMS (Battery Control Module)		㉑	Smoke Detector	
⑪	Battery Module		㉒	Temperature Detector	

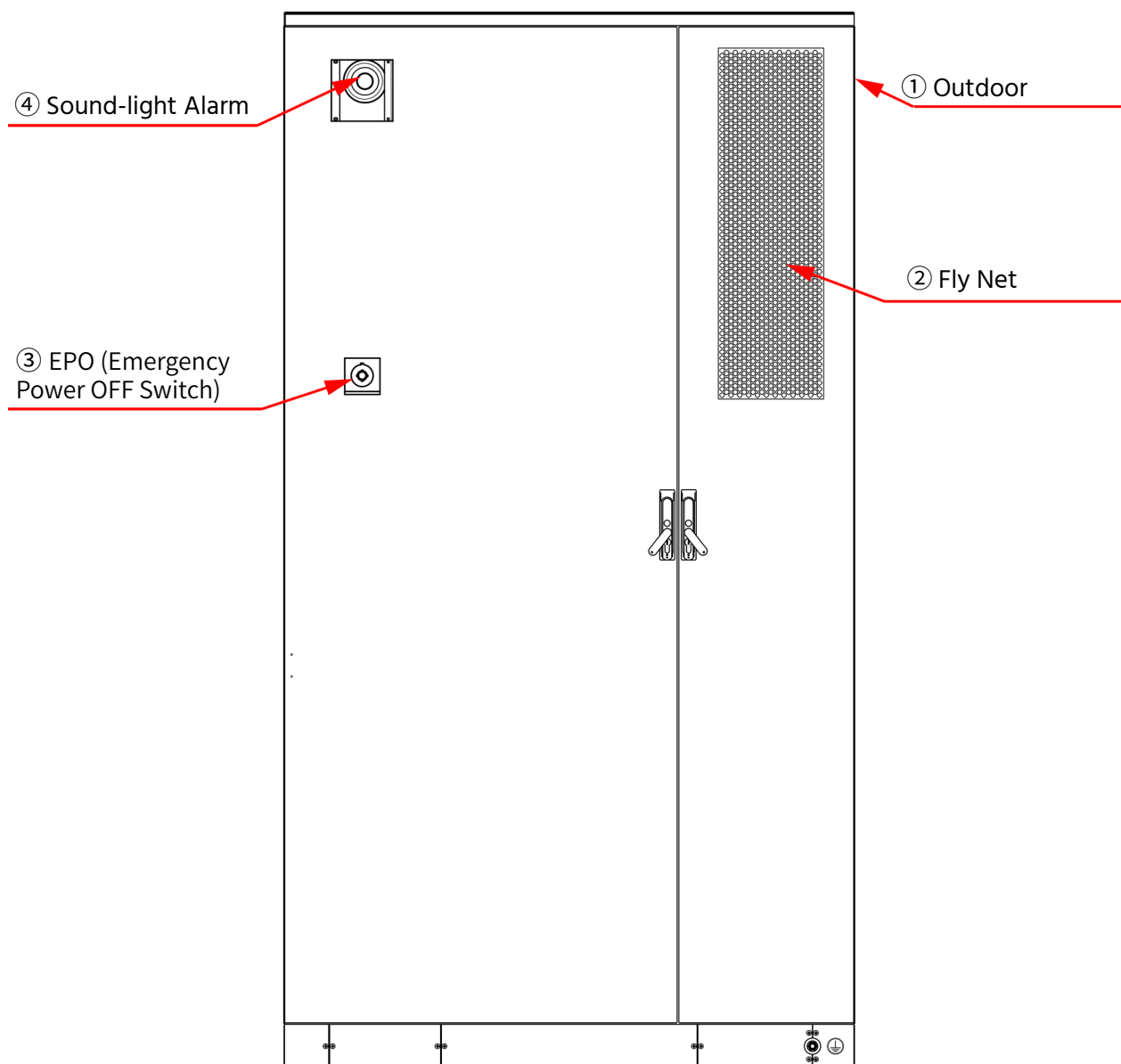


Figure 1-Front View (door closed)

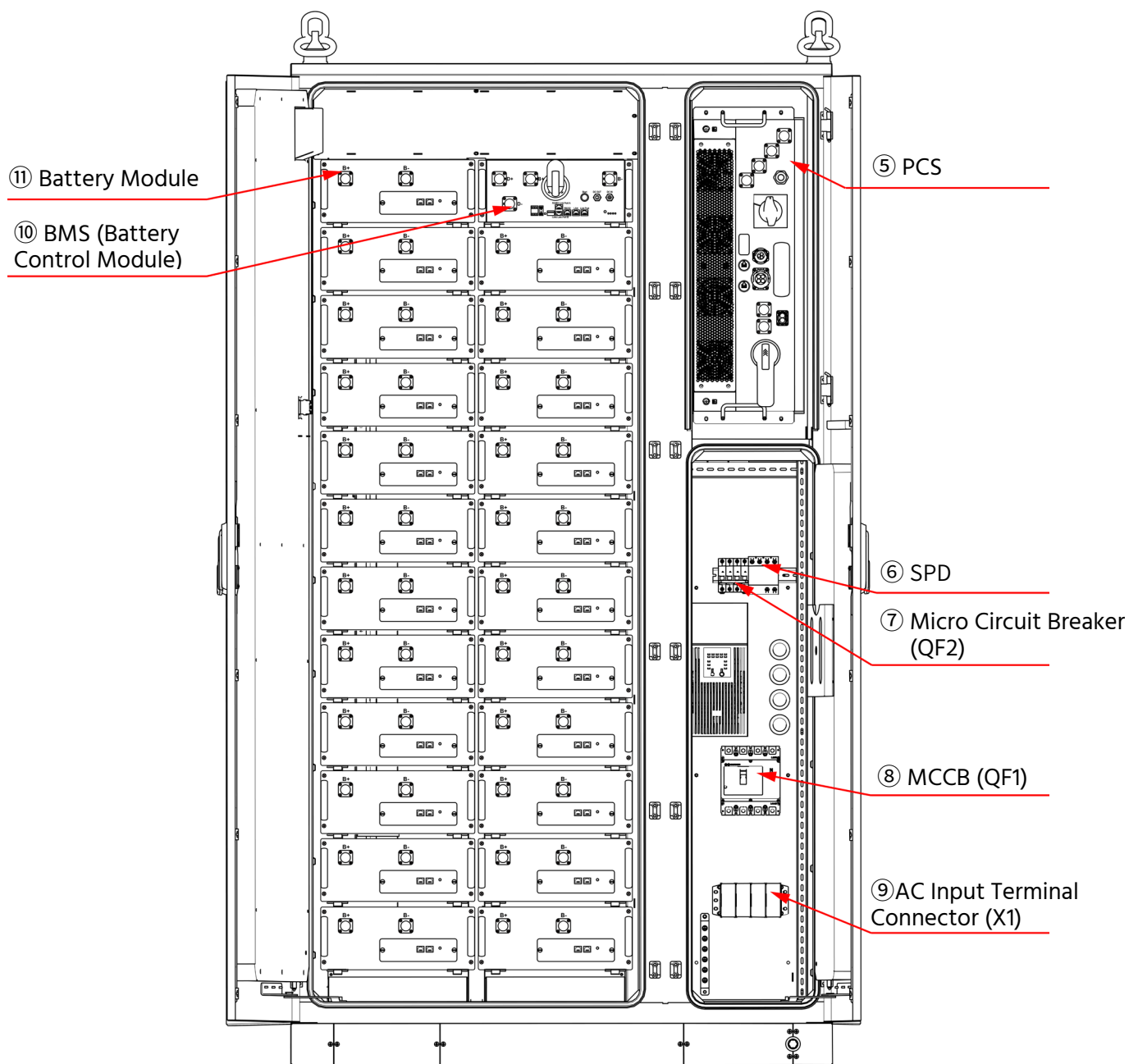


Figure 2-Front View (door open)

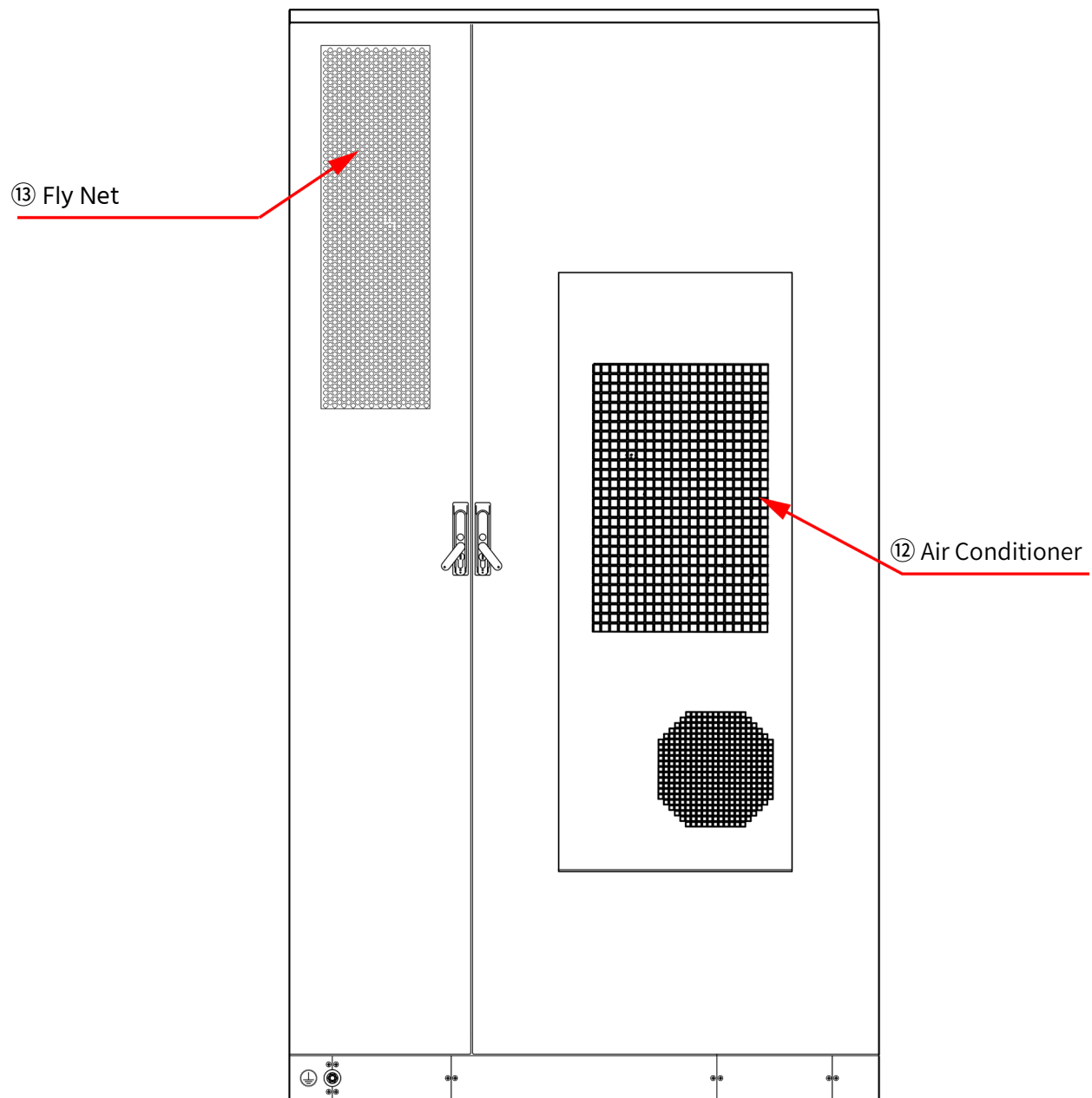


Figure 3-Rear View (door closed)

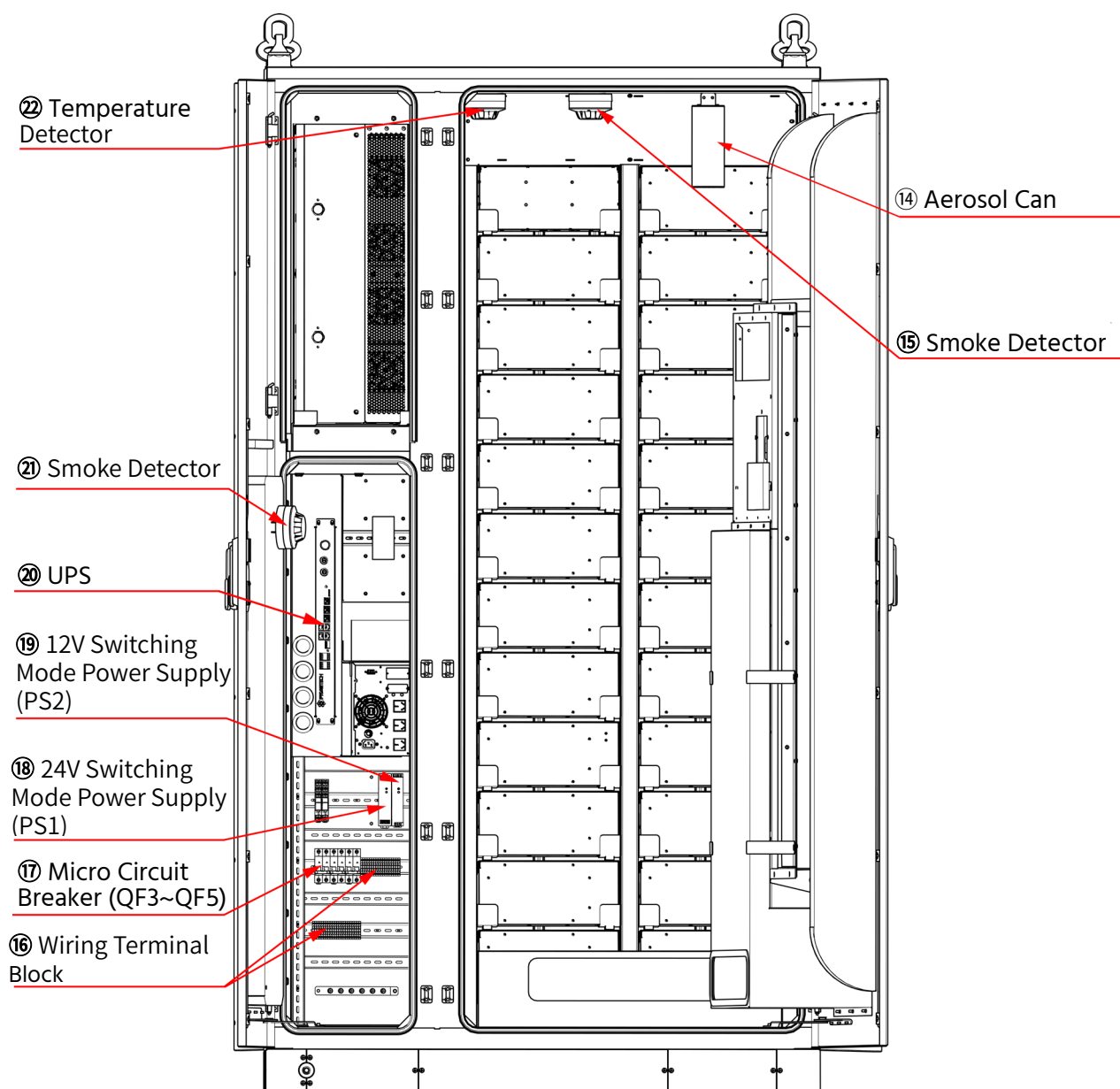
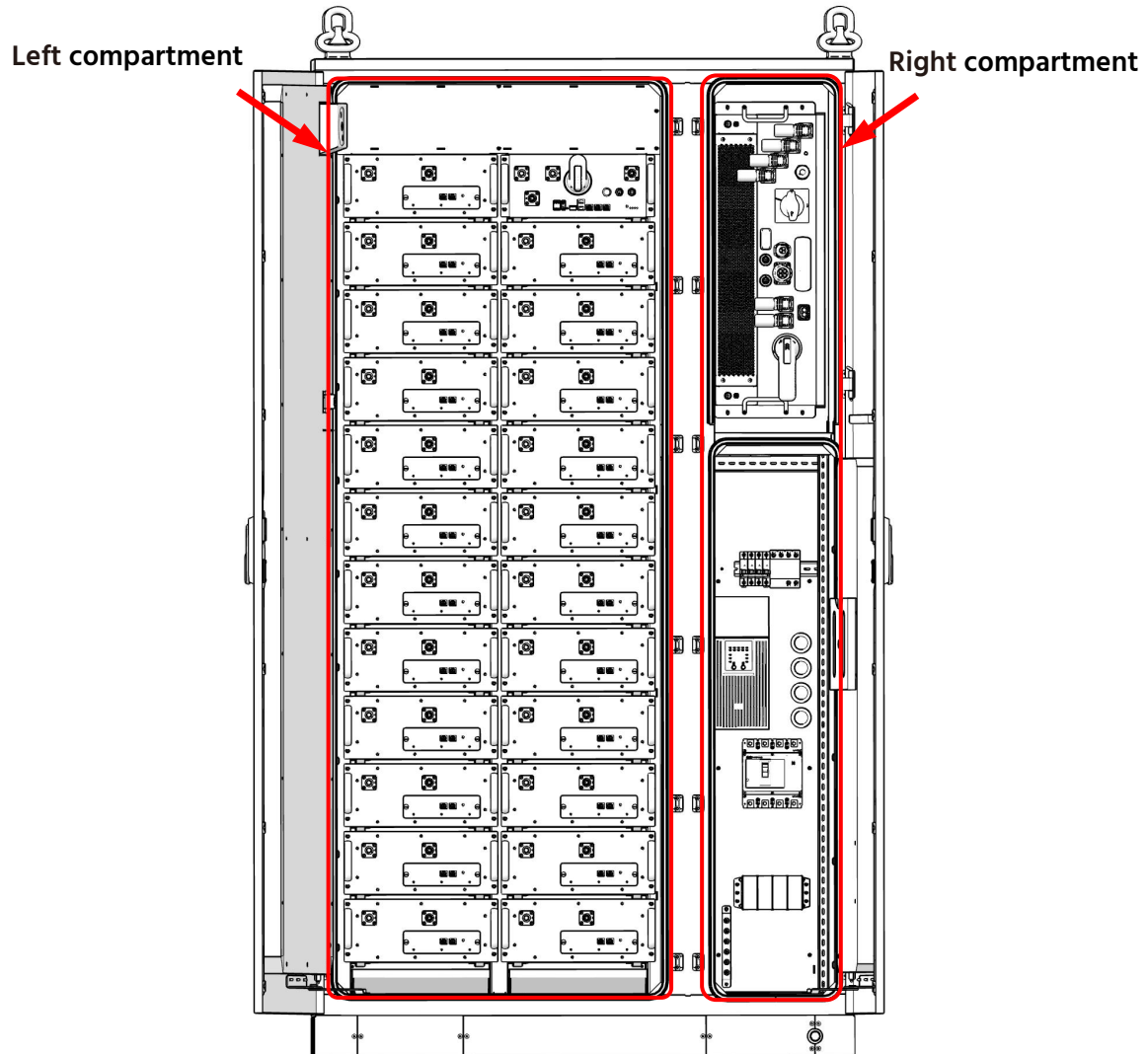


Figure 4-Rear View (door open)

3.6.1 Outdoor Cabinet

3.6.1.1 Outdoor Cabinet Overview

The outdoor battery cabinet is divided into left and right compartments. The left compartment mainly includes energy storage battery system, fire protection system, etc. And the right compartment is mainly for power supply, distribution system, communication control system, etc.



3.6.1.2 Outdoor Cabinet Parameters

Item	Parameters
Dimensions (mm)	1300±5 (W) x 2485±5 (H) x 1150±5 (D)
Color	RAL9003
IP Rating	IP55
Corrosion Resistance Grade	C5
Maintenance	Front and back doors available
Safety Precautions	Outdoor lock

3.6.2 Battery String

The battery system consists of one string of 108.9 kWh battery system. And one battery string contains 23 battery modules and 1 battery control module (BMS).

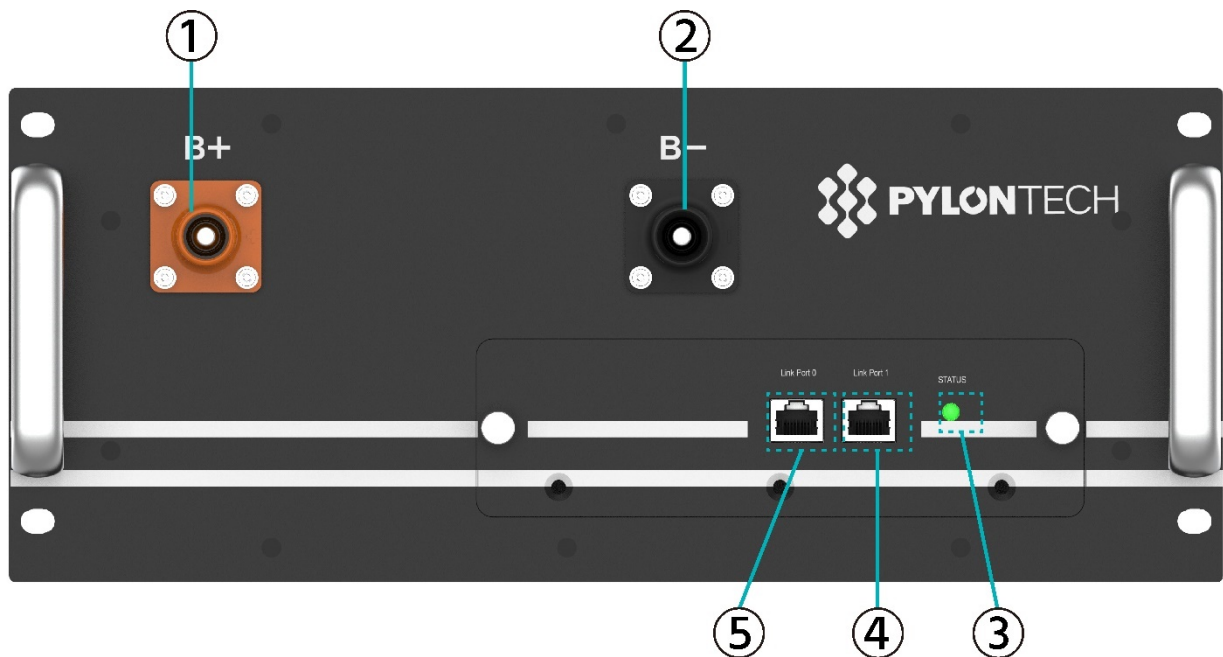
3.6.2.1 Specifications of the Battery String

Product Type	PowerCube-M1-C
System Voltage (VDC)	<1000
Battery Module Type	SC1000-200J-C
Control Module Type	H32148-C
Nominal Voltage (VDC)	736 (23 pcs battery module)
Rated Capacity (Ah)	148
Total Storage Energy (kWh)	108.9
Charge Upper Limit Voltage	828
Discharge Lower Limit Voltage	621
Nominal Current (Amps)	74
Maximum Continuous Current (Amps)	148
Peak Current (Amps)	220@15 seconds
Over Current/Duration (Amps/millisecond)	8000/2
Communication type	CANBUS/Modbus RTU/TCP/IP
Round-trip efficiency (% ,@1C-rate)	95
Depth of Discharge (%)	95
Operation cycle life*	>7,000
Operation Life (year)	15+
Cooling type	Natural cooling
Certification	UL1973, UL9540A, IEC62477-1, IEC62040-1, IEC62619, IEC63056, UKCA, CE LVD, CE EMC, UN38.3, VDE-AR-E 2510-50

* Cycle life is defined based on specific operation conditions, for more details please check with Pylontech service team.

3.6.2.2 Battery Module

Battery Module Front Interface



Item	Description	Item	Description
①	Power Terminal B+	④	Link Port 1
②	Power Terminal B-	⑤	Link Port 0
③	Status Light		

①② Power Terminals B+/B-

Connects battery in serial at power side.

③ Status Light

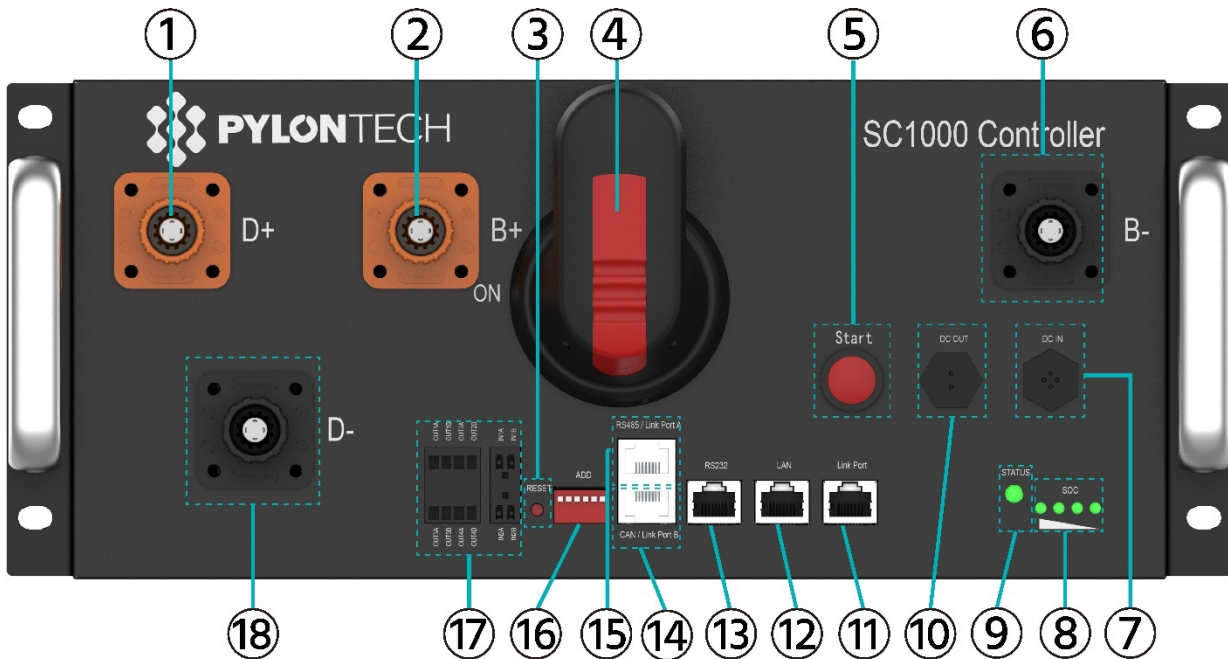
Shows the status of battery module (Normal ●, Abnormal ●).

④⑤ Link Port 0/1

Communication Terminal: (RJ45 port), CAN communication, between multiple serial battery modules and control module.

3.6.2.3 Control Module

Control Module Front Interface



Item	Description	Item	Description
①	Power Terminal (D+)	⑩	DC OUT
②	Power Terminal (B+)	⑪	Link Port
③	RESET (button)	⑫	LAN
④	Isolating Switch	⑬	RS232
⑤	Start (button)	⑭	CAN/Link Port B
⑥	Power Terminal (B-)	⑮	RS485/ Link Port A
⑦	DC IN	⑯	ADD
⑧	SOC (light)	⑰	Dry Contact
⑨	STATUS (light)	⑱	Power Terminal (D-)

① ⑱ Power Terminal D+/D-

External Power terminal: Connects battery system to the PCS.

② ⑥ Power Terminal B+/B-

Connects battery modules in series.

③ RESET (button)

Long press this button to restart the battery system.

④ Isolating Switch

Controls the high voltage DC power output ON/OFF after the control module is powered on.

⑤ Start(button)

press “Start” button more than 5 seconds until the buzzer rings, to turn on the control module.



Power on: Press and hold $\geq 5\text{sec}$ till the buzzer rings

Mise sous tension: Appuyez et maintenez $\geq 5\text{sec}$
jusqu'à ce que le buzzer sonne

Black start function: If long press (>10 seconds) the “Start” button 30 seconds AFTER the control module is powered on. The “STATUS” light will become green which means black start function is enabled and relay will close and output for 10 minutes.

⑦ DC IN

(12VDC Input) back-up 12VDC power supply port.

⑧ SOC (light)

Battery Capacity Indicator: 4 green lights and each light represents 25% capacity.

Refer to *Table of LED Indicators Instructions* in *section 5.1.1* for details.

⑨ STATUS (light)

Shows the status of battery module (Normal ●, Abnormal ●).

Refer to *Table of LED Indicators Instructions* in *section 5.1.1* for details.

⑩ DC OUT

12VDC Output: Power supply for MBMS, to connect with MBMS' 12VDC IN.

⑪ Link Port

Link Port Communication Terminal: (RJ45 port) follows internal protocol, for communication between multiple serial battery modules and control module.

⑫ LAN

Console Communication Terminal: (RJ45 port) follows Modbus protocol, used for communication between MBMS, switches or upper controller.

⑬ RS232

Console Communication Terminal: (RJ45 port) follows RS232 protocol, for manufacturer or professional engineer to debug or service.

⑭ CAN/Link Port B (RJ45 Port)

CAN (for external communication) follows CAN protocol, for communication between the battery system and the PCS.

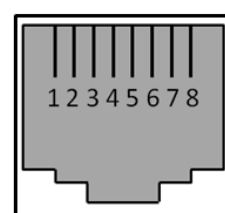
Link Port B (for internal communication): used for cascade communication between the BMSs.

⑮ RS485/Link Port (RJ45 Port)

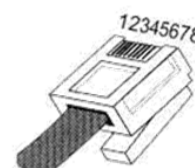
RS485 (for external communication) follows Modbus RTU protocol, for communication between the battery system and the PCS.

Link Port A (for internal communication): used for cascade communication between the BMSs.

No.	CAN	RS485	RS232
1	---	---	---
2	GND	---	---
3	---	---	TX
4	CANH	---	---
5	CANL	---	---
6	---	GND	RX
7	---	RS485A	---
8	---	RS485B	GND



RJ45 Port



RJ45 Plug

⑯ ADD

6-bit dial switches to manually distribute the communication addresses of the battery system. Lower position is OFF, means "0". Upper position is ON, means "1". 1st bit to 5th bit are for address, and the 6th bit dial switch supports a 120Ω resistance.

⑰ Dry Contact

(Dry Contact Terminals): provide 2 input and 4 output dry contact signals.

Dry Contact Terminal

In/Out	Function	Open and close state
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 $\leq 5A$ activated shall open.

3.6.3 MBMS

The outdoor cabinet communicates with the outer system through MBMS.



3.6.3.1 Basic Parameters of the MBMS

Item	Specification
Power Supply for MBMS	DC 12V
Self-consumption Power-Relay Off (W)	10
Dimensions (W x D x H, mm)	442×190×43.6
Communication Protocol	MODBUS RTU\CAN\LAN
Weight (kg)	2
Operation Life (year)	15+

3.6.3.2 Interface Panel of the MBMS

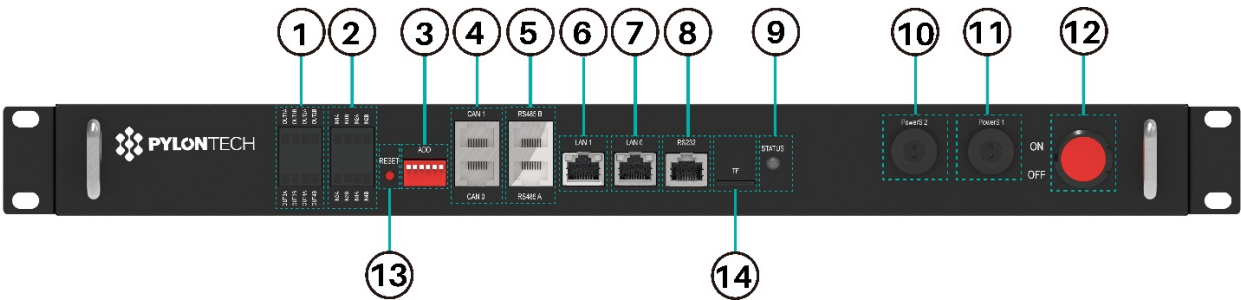


Figure	Description	Figure	Description
①	Dry Contact 1	⑧	RS232
②	Dry Contact 2	⑨	Status (LED)
③	ADD Switch	⑩	PowerS 2
④	CAN 1/ CAN 0	⑪	PowerS 1
⑤	RS485 B/RS485A	⑫	ON/OFF witch
⑥	LAN 1	⑬	RESET (button)
⑦	LAN 0	⑭	TF

①② Dry Contact

Dry Contact Terminal: provides 4 input and 4 output dry contact signal.

In/Out	Function	State and Action
In1	Reserved	Always open.
In2	UPS Failure Alarm	Always open, turn closed when signal received.
In3	Smoke Detector or Temperature Detector Alarm	Always open, turn closed when signal received
In4	Reserved	Always open.
Out1	Breaker trip control	Always open, when change from open to closed, Relay KA2 energized, breaker QF1 trips
Out2	Reserved	Always open.
Out3	Reserved	Always open.
Out4	Reserved	Always open.

③ ADD

ADD: 6-bit dial switches to manually distribute the communication address of the battery system. Lower position is OFF, which means "0". Upper position is ON, which means "1". 1st bit to 4th bit switches are for address, and the 5th and the 6th bit dial switches support a 120Ω resistance (Terminal Resistance).

④ CAN 0 & CAN 1

CAN Communication Terminal: (RJ45 port) follows CAN protocol, for communication between battery system and PCS. CAN 0 connects to BMS, CAN 1 connects to external equipment.

⑤ RS485 A & RS485 B

RS485 Communication Terminal: (RJ45 port) follows Modbus RTU protocol, for communication between battery system and PCS or external equipment.

⑥ LAN 1 Port

Console Communication Terminal: (RJ45 port) defined as external communication port (for max. 16 strings' external communication using), connects to PCS.

⑦ LAN 0 Port

Console Communication Terminal: (RJ45 port) defined as internal multi-strings' communication port (for max. 16 strings' internal communication using), combined with Ethernet switch for further connection to BMS.

⑧ RS232 Terminal

Console Communication Terminal: (RJ45 port) follows RS232 protocol, for manufacturer or professional engineer to debug or service.

⑨ Status (LED)

Console Communication Terminal: (RJ45 port) follows RS232 protocol, for manufacturer or professional engineer to debug or service.

⑩ PowerS 2

For 12VDC power supply to MBMS.

⑪ PowerS 1

For 12VDC power supply to MBMS.

⑫ ON/OFF Switch

For control MBMS ON and OFF.

⑬ RESET Button

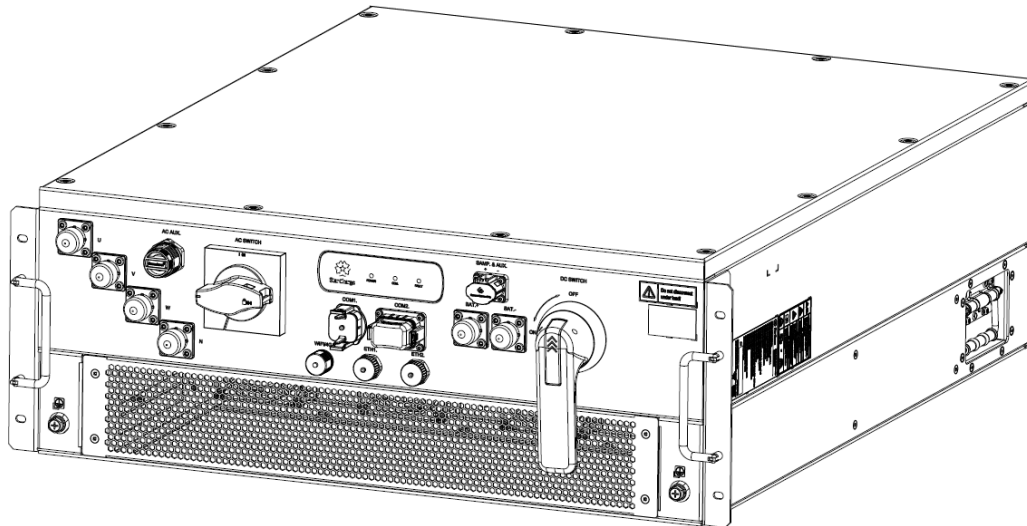
Press to restart the MBMS.

⑭ TF

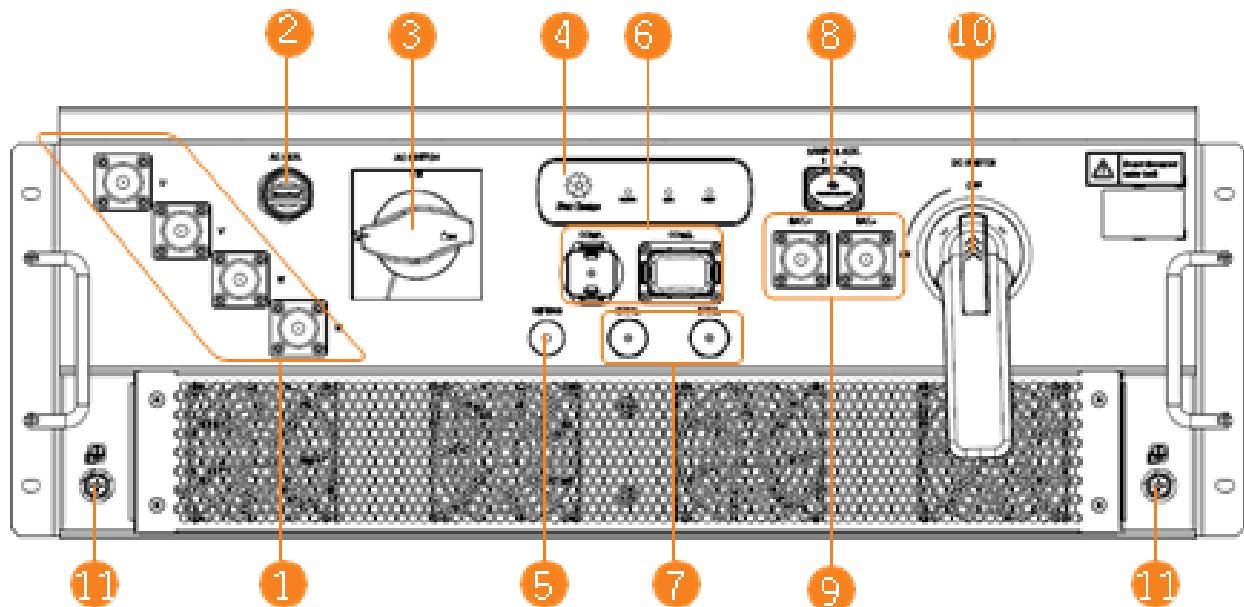
To insert TF card.

3.6.4 PCS

The PCS is a bidirectional PCS that realizes the charge and discharge control of the energy storage battery. It is an important part of the smart grid, which can regulate power resources and ensure the normal operation of the grid. On one hand, the PCS can invert the direct current of the energy storage battery into alternating current to supply power to the load or input into the grid; on the other, the PCS can rectify the alternating current of the grid into direct current to charge the energystorage battery.

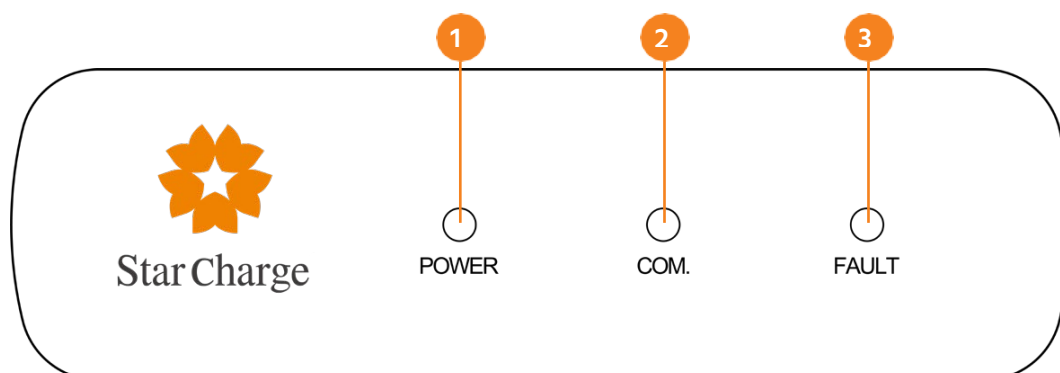


3.6.4.1 Interface Panel of the PCS



No.	Item	Description
1	Grid interface AC (U/V/W/N)	AC input connection
2	AC AUX. (AC auxiliary power supply interface)	Output interface for supplying AC power to loads within the energy storage cabinet
3	AC SWITCH (AC molded case circuit breaker)	Switch for connecting to the grid
4	Display panel	Indicates the machine status
5	Wi-Fi/4G (interface)	Communication dongle interface
6	COM1. COM2. (Communication and dry contact interface)	External communication and dry contact
7	ETH1. ETH2. (Ethernet Interface, currently not enabled)	Ethernet communication wiring (currently not enabled)
8	SAMP&AUX. (Voltage sampling and DC auxiliary power supply)	Battery voltage sampling and DC auxiliary power supply output wiring
9	BAT+. BAT-. (Battery interface)	DC input connection
10	DC Isolator Switch	Connection switch with battery
11	Protective earthing point	Connection point for protective earthing

3.6.4.2 Display Panel of the PCS



Description of LED indicators on the LED panel

No.	Item	Display Color	Description
1	POWER	Green	Running Status Indicator
2	COM.	Green	Communication Indicator
3	FAULT	Red	Fault alarm Indicator

Status description of the indicator board

LED Indicator	Color	State	Meaning	Explanation
①POWER	Green	On (Solid)	On Grid	The PCS is in on-grid operation mode.
		Blink (1s on, 1s off)	Off Grid	The PCS is in off-grid operation mode.
		Fast Blink (0.2s on, 0.2s off)	Self-check or pre-synchronization	The PCS is in self-check or grid synchronization.
		Slow Blink (1s on, 4s off)	Power supplied but not running.	The PCS is not running, but auxiliary power is supplied.
		Medium Slow Blink (1s on, 2s off)	Standby	The PCS is in standby operation mode.
		Off (Solid)	No power or fault	The device has a fault or no auxiliary power is supplied.
②COM.	Green	Slow Blink (1s on, 4s off)	CAN Communication	The device receives CAN data.
		Medium Slow Blink (1s on, 2s off)	ECB Communication	The device receives ECB data.
		Blink (1s on, 1s off)	IOT Communication	The device receives IOT data.
		Fast Blink (0.2s on, 0.2s off)	Firmware Upgrade	The PCS is undergoing a firmware upgrade.
		Off (Solid)	No Data Interaction	The PCS does not receive communication data.
③FAULT	Red	Fast Blink (0.2s on, 0.2s off)	Earth fault	The PCS has earth fault.
		On (Solid)	ARC fault	The PCS has ARC fault.
		Blink (1s on, 1s off)	Significant fault	The PCS has significant fault.
		Slow Blink (1s on, 4s off)	Minor fault	The PCS has minor fault.
		Off (Solid)	No fault	The PCS has no fault.

3.6.5 UPS (SP1K-W)

The electrical cabinet is equipped with UPS to supply power for computers, MBMS, control cabinet secondary, power distribution cabinet ammeter and other loads, so as to ensure that the system can still operate for a period of time in case of grid power failure, and enable the system off grid operation.

3.6.5.1 Display Panel of the UPS

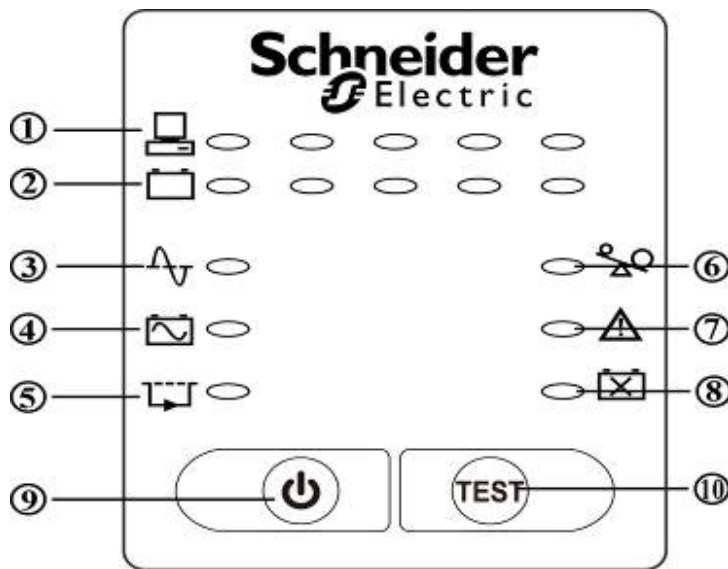
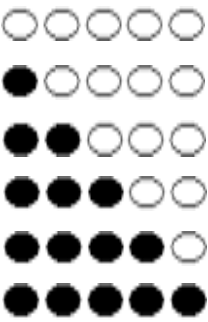


Figure	Indicator LED/ Button	Description
1	Load Capacity Indicator LED	Six levels to indicate the Load Capacity: <5% — All LEDs off 5%~25% — L1 LED ON 25%~45% — L1 and L2 LEDs ON 45%~65% — L1 to L3 LEDs ON 65%~85% — L1 to L4 LEDs ON >=85% — All LEDs ON
2	Battery Capacity Indicator	Five levels to indicate the Battery Capacity: <24% — L1 LED ON 24%~48% — L1 and L2 LEDs ON 48%~72% — L1 to L3 LEDs ON 72%~96% — L1 to L4 LEDs ON >=96% — All LEDs ON

2	Input Voltage Indicator	Six levels to indicate the input voltage: <192V—— All LEDs off 192~210V——L1 LED ON 210~229V——L1 and L2 LEDs ON 229~248V——L1 to L3 LEDs ON 248~266V——L1 to L4 LEDs ON >=266V——All LEDs ON	
3	Online Mode Indicator LED	The UPS uses grid power to realize dual power supply conversion between power supply and connected devices. That is, it works in online mode.	
4	Battery Power Supply Indicator LED	The UPS uses batteries to supply power to connected devices. That is, it works in battery mode.	
5	Bypass power supply Indicator LED	The UPS uses bypass power to supply power to connected devices. That is, it works in bypass mode.	
6	Overload Indicator LED	The UPS detects that the load exceeds the rated output power.	
7	Fault Indicator LED	The UPS detects an internal fault.	
8	Battery Replacement Indicator LED	The battery is disconnected, or the battery needs to be replaced.	
9	ON/OFF button of the UPS	After pressing this button for one second, the UPS will perform the following actions according to the current working mode: 1) If the UPS is not turned on and the grid is normal, the UPS will be enabled to enter online mode. 2) If the UPS is not turned on and the grid is abnormal, the UPS will be enabled to enter battery mode. 3) If the UPS is in online mode, the UPS will shut down and stop power supply. 4) If the UPS is in battery mode, the UPS will shut down and stop power supply.	

10	Battery self-check /Display input voltage/Mute button	1) Battery self-check function: In online mode, about 3 seconds after pressing this button, the UPS starts battery self-check. 2) Display input voltage function: In bypass mode and online mode, about 0.5 seconds after pressing this button, the UPS switches the battery capacity indicator to the input voltage indicator, and switches back to the battery capacity indicator 5 seconds later. 3) Mute function: In battery mode, after about 0.5 seconds after pressing this button, the UPS will turn off the buzzer. NOTE: The buzzer can be turned on manually after it is muted.
----	---	---

3.6.5.2 Interface Panel on the rear

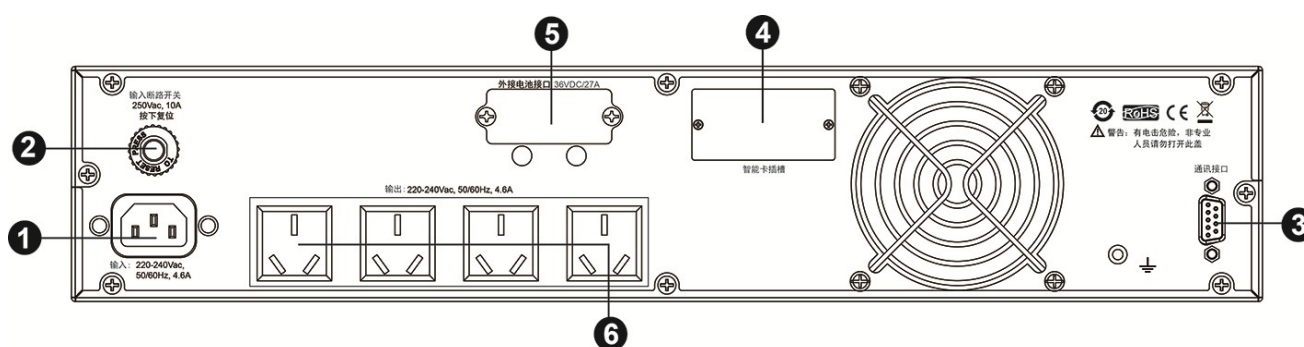


Figure	Functional Component	Description
1	Input Socket	IEC input port: Connect the UPS to the grid using the power cable delivered with the device. 1K and 2K UPS 10A input socket, 3KVA UPS 16A input socket.
2	Input Circuit Breaker	When overload occurs, press this button to reset the input circuit breaker.
3	RS232 Interface	Enables the UPS to communicate with the power management software through the serial communication cable so as to realize monitoring and management of the UPS.
4	Smart Slot	Used to install optional SNMP card (network management card), Relay I/O card, Modbus card to achieve more advanced communication and monitoring functions. After the SNMP card is selected, you can also select the EMD card to monitor the ambient temperature and humidity.
5	External battery	Connect the external battery to the UPS using the external battery

	connector	connection cable delivered with the device de. (Only available for the device with extended warranty.
6	Output Socket	10A. connects electronic devices such as computers, monitors or printers to these outlets.
7	Output Circuit Breaker	10A switch. When overload occurs, please first reduce the connected load devices and then press this button to reset the input circuit breaker.
8	Output terminal block	Use hard wires to connect AC devices.

CAUTION

Caution: When the first time the battery is used, it takes five hours to charge the battery. If the charge time is less than 5 hours, the battery discharge time will be reduced.

3.6.6 Air Conditioner

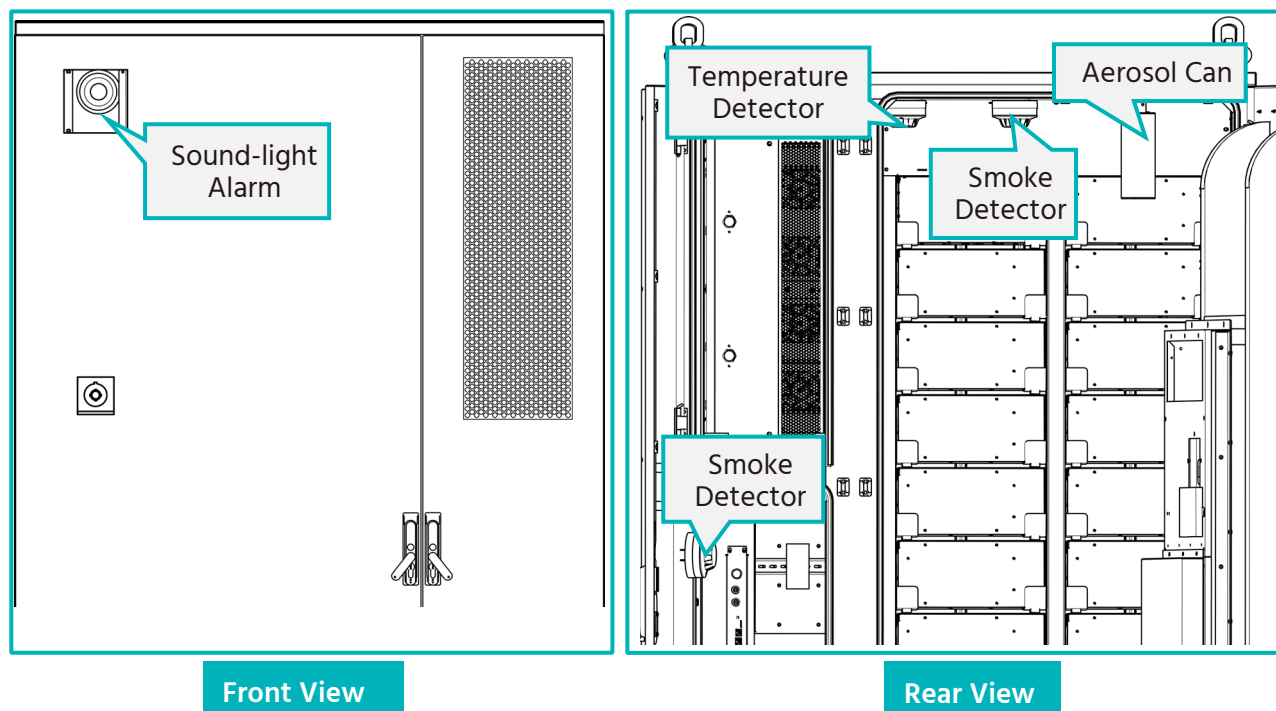
The outdoor cabinet is equipped with industrial air conditioner to control the temperature and humidity of the battery compartment.

The specific parameters of the air conditioning are as follows:

Item	Parameter
Air conditioner Model	GA-30BQ-A/Z
Cooling Capacity (w)	3.0 kW
Heating Capacity (w)	2.0 kW
Power Cooling	1.285 kW
Power Heating	2.155 kW
Power Internal fan	163 W
Air volume	900 M ³ /h
Refrigerant	R134a/1100g
Power	1~230V/50HZ
Condensation air supply on the outdoor side	Bottom in and top out
Cooling environment	-10~50 (°C)
Heating environment	>-35 (°C)
Compressor type	Rotary
Dimensions (see attachment for details)	550 x 300 x 1350 mm
Weight (single unit)	90 kg
IP protection level (inside and outside)	IP55
Power cord specifications	3x4AWG
Power MCB power	2P, D16A

3.6.7 Safety Features

This system is equipped with the safety features, e.g. fire suppression system, smoke detectors, temperature detector, battery system over temperature protection, etc. When a fire or other emergency occurs or the temperature reaches certain point, aerosols will be released from the can to suppress the fire. At the same time, the sound-light alarm will alarm until the system is powered off.



Specifications of Aerosol Can

Item	Parameter
Product Model	JAD300-U01
Dimensions of the Aerosol Can (mm)	$\varnothing 76\text{mm}(\pm 0.2\text{mm}) \times 192\text{mm} (\pm 1\text{mm})$
Aerosol Discharge Duration (second)	15 (± 5) seconds
Aerosol Discharge Lag Time (second)	≤ 2 seconds
Thermal Clearance of Discharge Nozzle	0.7 meters ($< 200^\circ\text{C}$); 1.3 meters ($< 75^\circ\text{C}$)
Weight (g)	2320g ($\pm 2\%$)
Agent	Agent model: C6 ; Agent quality: 300g ($\pm 6\text{g}$)
Start Mode	Electric Start
Safety current of Electric Initiator	600mA ($\pm 2\text{mA}$) , 300 seconds non-operating
Detonation current of the Electric Initiator	Reliable minimum starting current $\geq 900\text{mA}$ can detonate 100% instantly (It is normal when starting with the higher current than safe current)
Rated Current of the Electric Initiator	Rated ignition current 2A/ 5millisecond
Feedback Signal	On-off quantity signal
Effective Life (year)	15

4 Mechanical Installation and Electrical Wiring

4.1 Checking Before the Installation

Checking the Outer Packing

After receiving the product, check the outer packing for damage, such as holes, cracks, deformation and so on. If any damage is found, contact us as soon as possible.

Checking Deliverables

After unpacking the battery, check that the deliverables are complete. If any item is missing or damaged, contact us as soon as possible.

4.2 Preparing Tools and Instruments

Tools and Instruments

Type	Tools and Instruments		
Installation	 Wire Cutter	 Crimping Modular Plier	 Cable Ties
	 Screwdriver Set	 Electric Screwdriver	 1000VDC Multimeter

Type	Tools and Instruments		
	 Adjustable Wrench	 Isolated Nut Drivers 1500V	
Personal protective equipment (PPE)	 Anti-arc flash suit	 Safety goggles	 Safety shoes

NOTE: Use properly insulated tools to prevent accidental electric shock or short circuits. If insulated tools are not available, cover the entire exposed metal surfaces with available insulated alternatives, except their tips, with electrical tape.

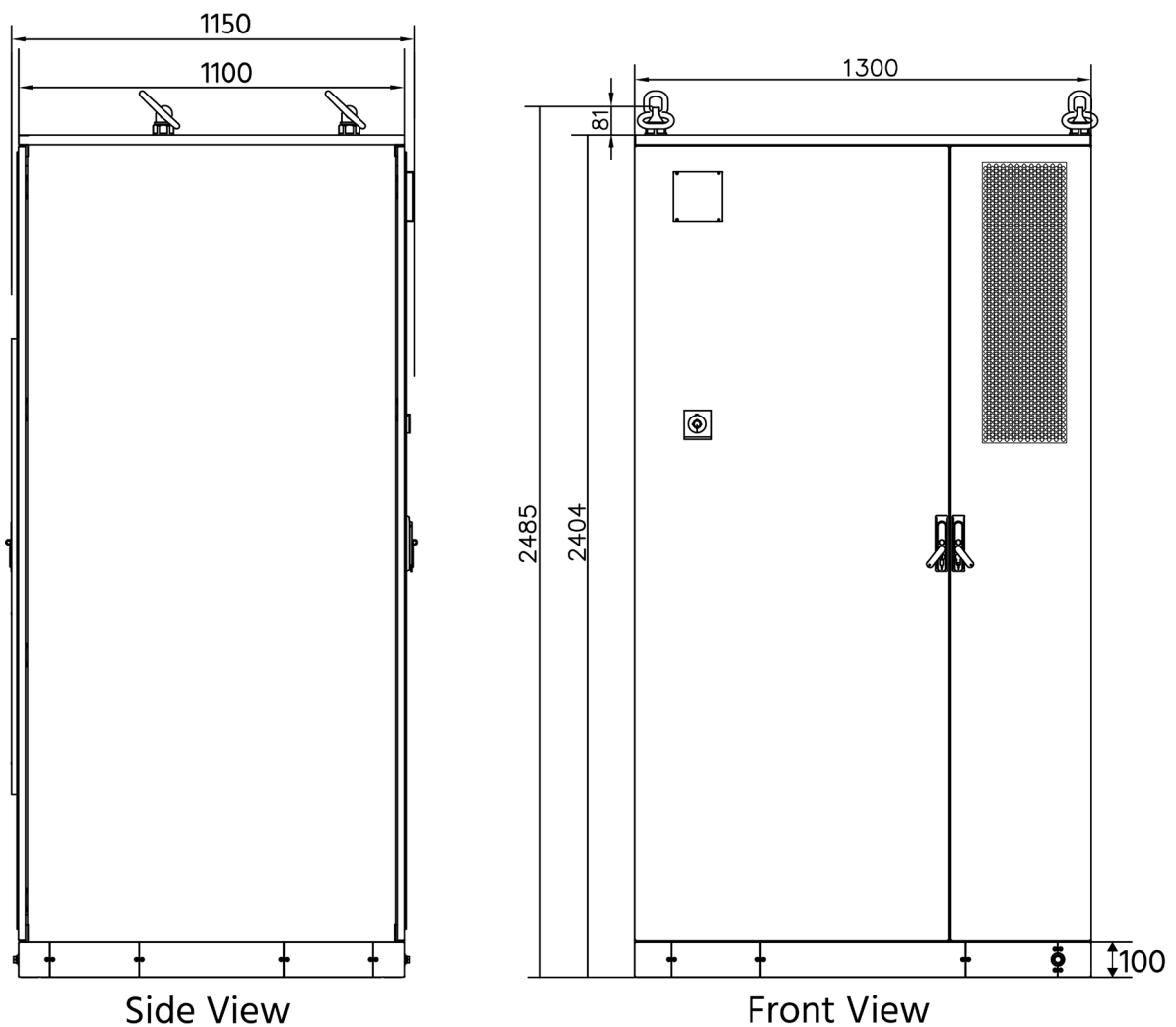
4.3 Selecting the Installation Sites

4.3.1 Working Environment Requirements

- The ambient temperature should be guaranteed between $-25 \sim 45^{\circ}\text{C}$ to ensure that the indoor cabinet can operate properly. A heating or cooling system may be needed when necessary.

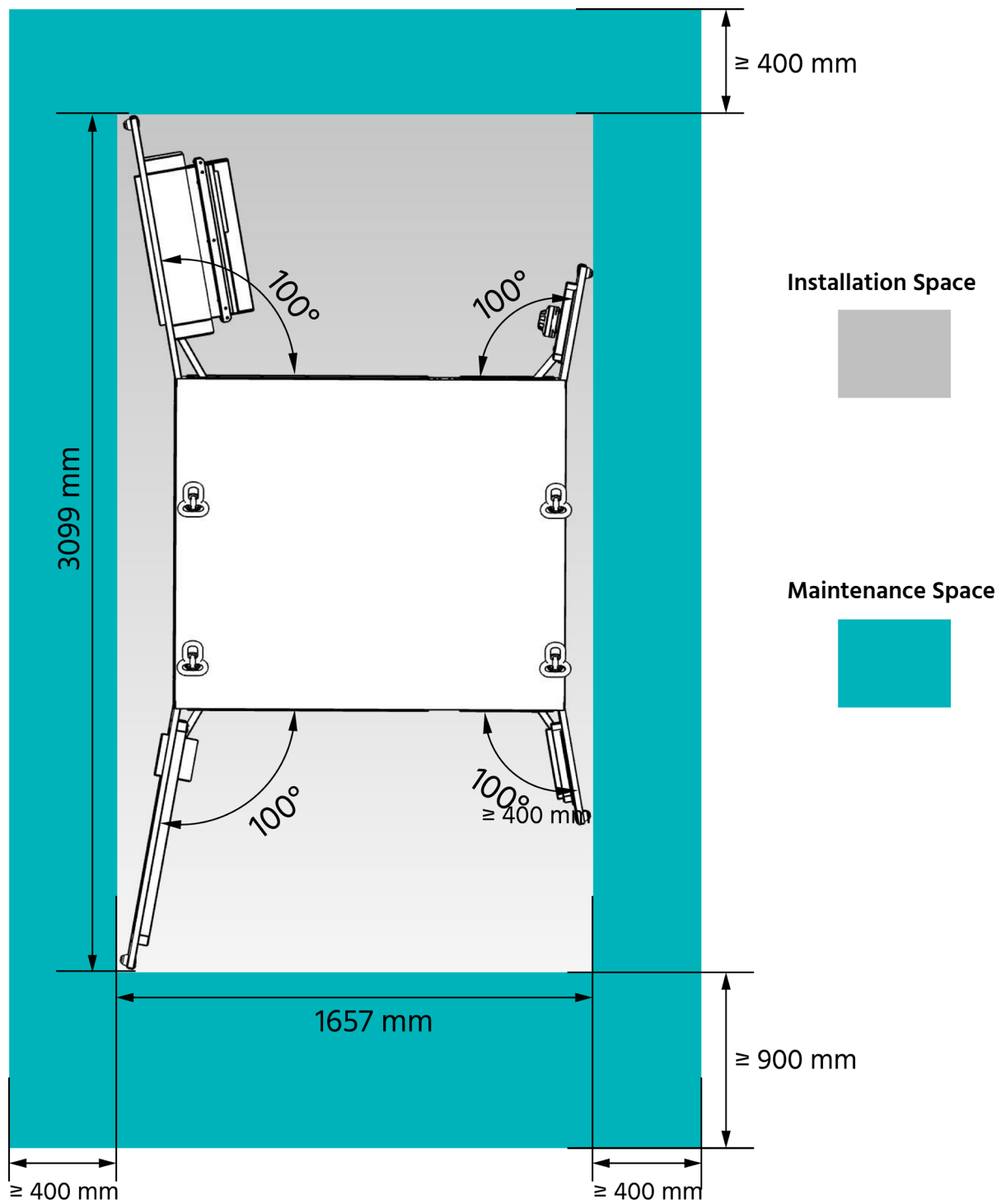
4.3.2 Installation Space Requirements

- The external dimensions of the cabinet are $1300 \pm 5 \text{ mm(W)} \times 2485 \pm 5 \text{ mm (H)} \times 1150 \pm 5 \text{ mm (D)}$. And the installation site must have enough space to place the equipment.



(Unit: mm)

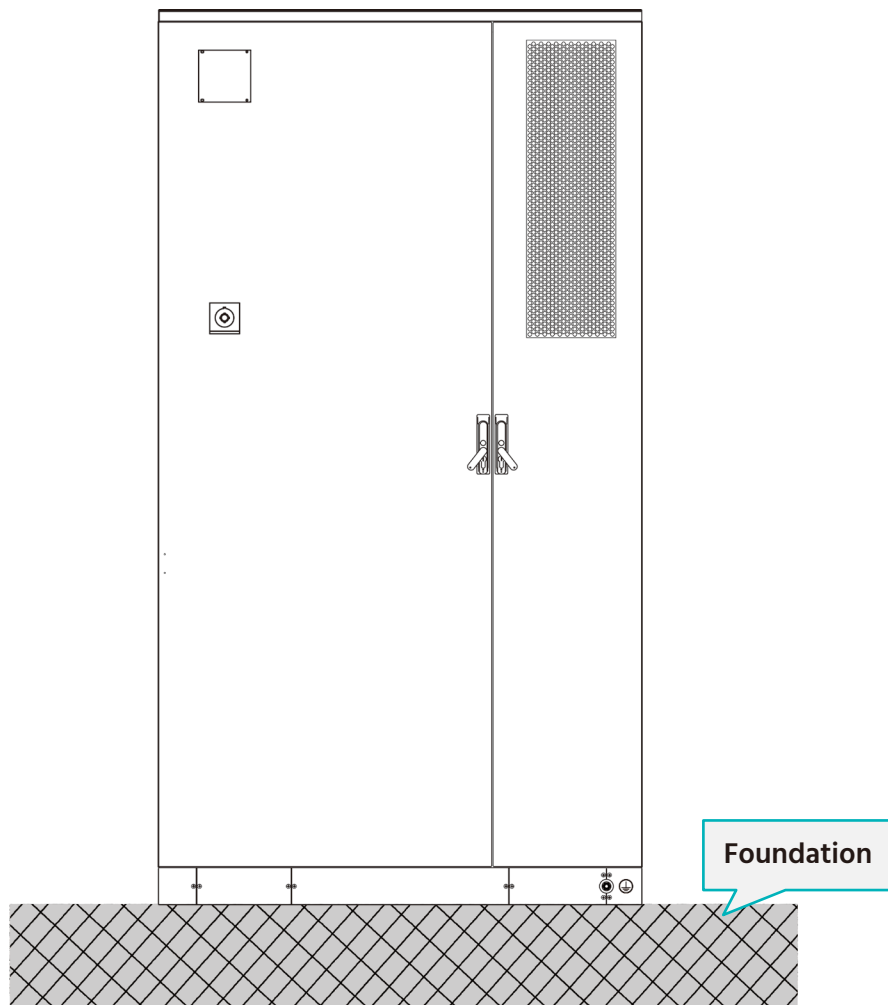
- The installation space for a single cabinet system is shown below (recommended spacing).



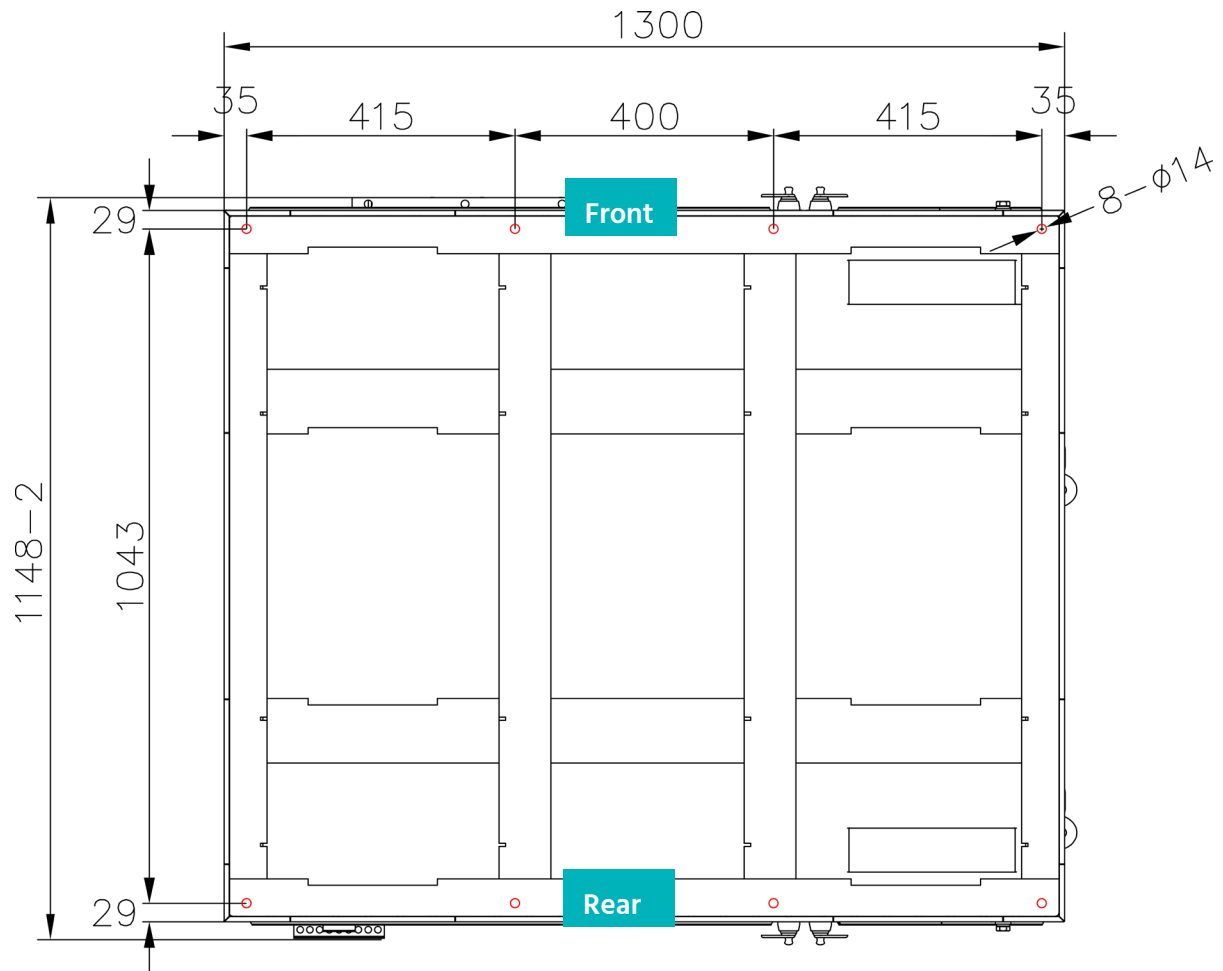
4.3.3 Installation Foundation Requirements

The installation site needs to meet the following requirements:

- The installation foundation should be able to bear the total weight of the whole outdoor cabinet system (about 2000kg).
- The installation foundation should be concrete or channel steel support structure, which should be flat, firm, safe and reliable. The installation foundation must meet the following height requirements, whichever is higher:
 - above the highest water level in the history of the area; or
 - at least 300mm above the level ground



- The cabinet is fixed at the bottom, and holes should be pre-opened on the installation site in accordance with the fixed holes at the bottom of the cabinet. See the drawing below.



Positioning holes at the bottom of the cabinet (Unit: mm)

⚠ WARNING

Warning: The inlet and outlet holes in the lower part of the outdoor cabinet need to be sealed with fireproof mud after the cable is connected.

And the entire outdoor cabinet base needs to be sealed with fireproof mud, waterproof and insect-proof.

4.4 Handling of the Cabinet

The outdoor cabinet can be transported by crane or forklift.

DANGER

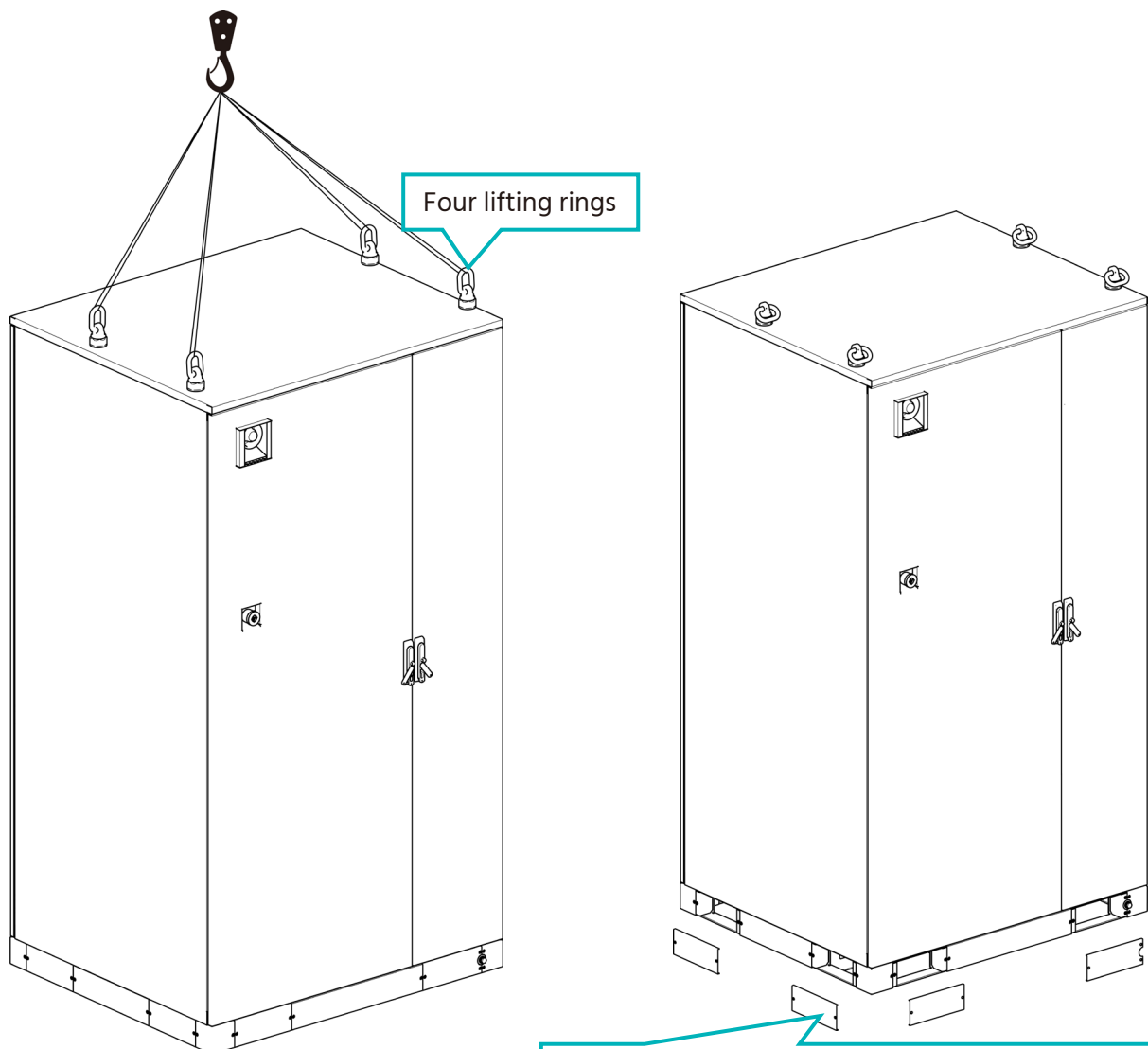
Danger: Pay attention to the falling risk which can cause severe injury or death. Do not stand under a lifted load. Make sure no unauthorized personnel are in the vicinity of a lifted load.

CAUTION

Caution: Pay attention to the center of gravity when lifting or forking the cabinet and keep the moving process slow, smooth and balanced.

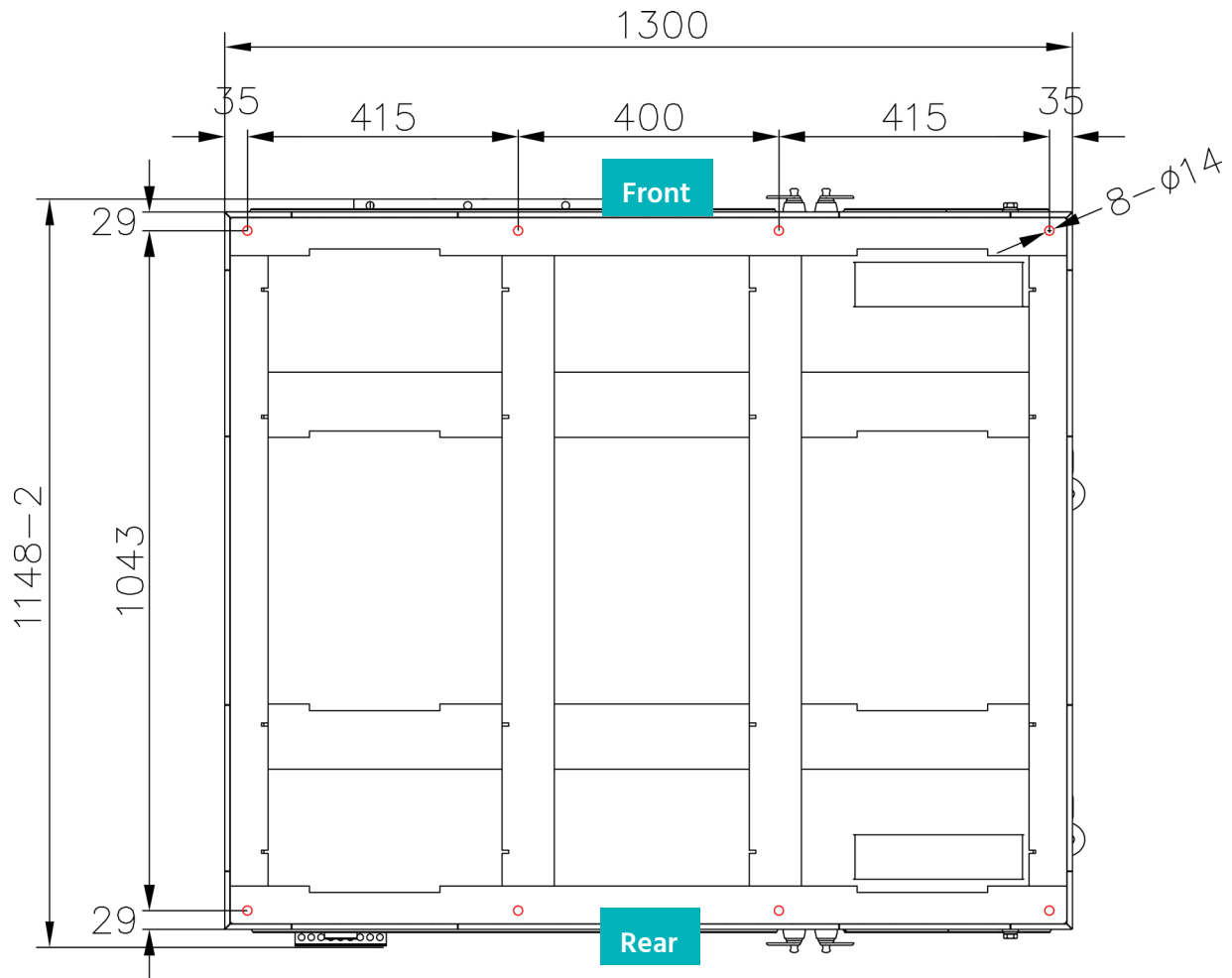
During the moving process, the equipment should not be tilted at an angle of more than 5° and should not be suddenly lowered or lifted.

Positions of the lifting rings and forklift slots



4.5 Mechanical Installation Steps

1. Before installation, make sure that the mounting dimensions of the foundation are consistent with the mounting holes of the Cabinet bottom base, as shown in the figure below.
2. Use a crane or forklift to place the cabinet on the mounting foundation, aligning the 8 mounting holes (marked in red).



Positioning holes at the bottom of the cabinet (Unit: mm)

3. Use expansion bolts to secure the cabinet to the foundation.

4.6 Electrical Wiring

4.6.1 Cable requirements

The wire diameter of the cables used in the outdoor cabinet must be selected in accordance with the maximum current of the AC side and DC side, and there must be a residual reservation.

Please follow the cable specifications below.

Cable	Wire Diameter Requirements	Terminal Model
AC Side Phase A	50mm ²	SC50-10
AC side phase B	50mm ²	SC50-10
AC side phase C	50mm ²	SC50-10
AC side N phase	35mm ²	SC35-10
Ground PE-Cable	16mm ²	SC16-6
Ground PE - galvanized flat iron	6x 80 mm	/
External Ethernet communication cable	Ultra Category 6 shielded cable	RJ45
External RS485 cable	Twisted shielded cable $\geq 1 \text{ mm}^2$	E1008

4.6.2 Bolt Torque

When fixing electrical cables, make sure that the cable terminals are completely tightened with the copper bars or terminal blocks to avoid heating or even fire of the cables caused by poor contact, and the following torque requirements should be met when the cables are connected:

Screw	M3	M4	M5	M6	M8	M10	M12	M16
Torque (N•m)	0.9	2	4	7	17	35	55	119.5

4.6.3 Electrical Connection Procedure

DANGER

Danger: This system is a high voltage DC system, operated by qualified and authorized person only.

DANGER

Danger: When wiring the cables, ensure that the energy storage system DC side and AC side are all disconnected.

DANGER

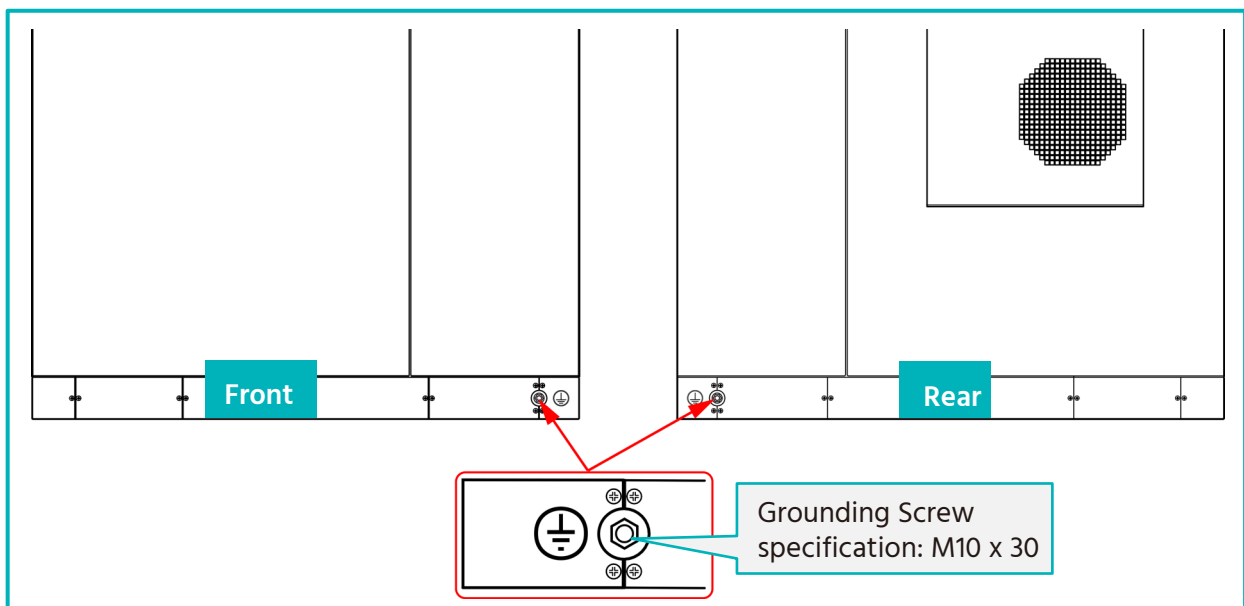
Danger: Whenever operating the system, wear suitable personal protective equipment (PPE) such as rubber gloves, rubber boots and goggles.

4.6.3.1 Grounding

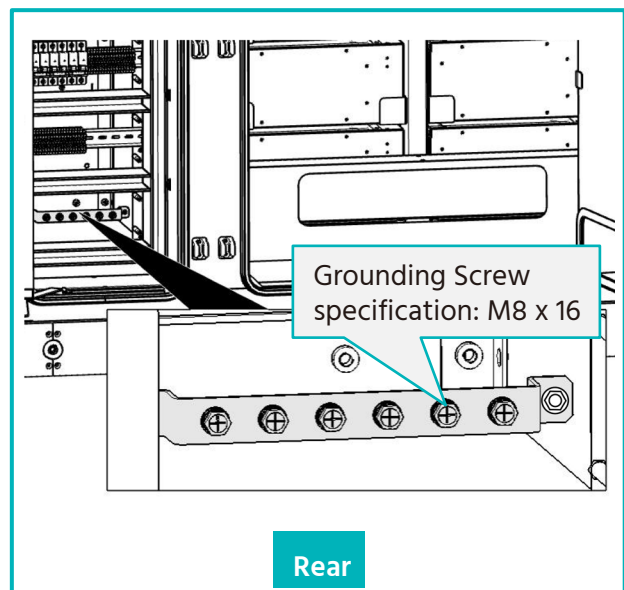
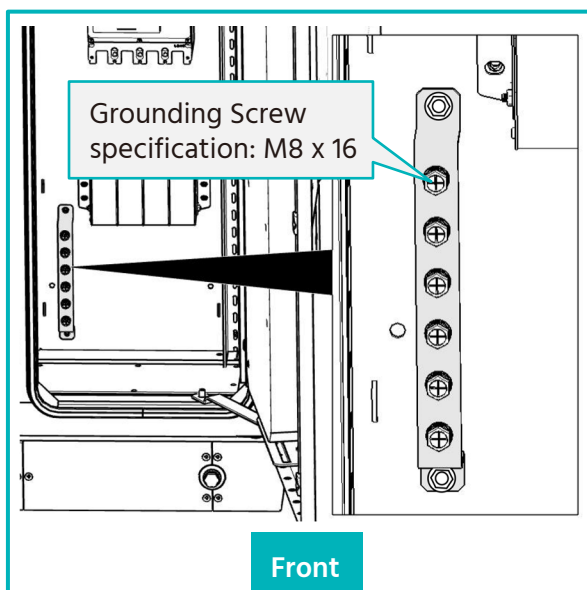
DANGER

Danger: Life-threatening electric shock may occur if the grounding is insufficient or absent. Before installation, make sure that the grounding points of the battery energy storage system are stable and reliable.

- PE (to the ground): Choose one of the two grounding points for cabinet grounding.

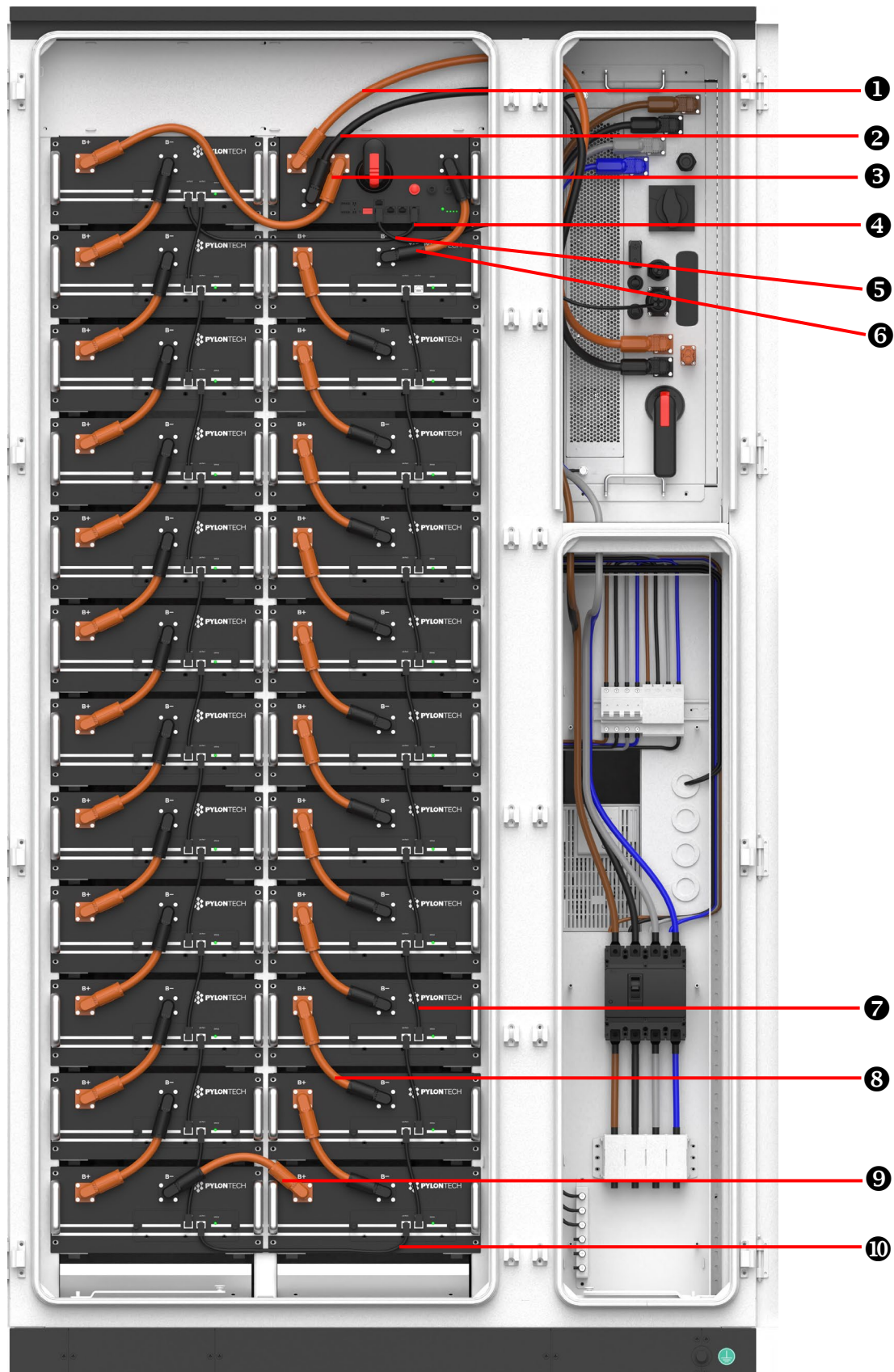


- Grounding copper bar: Grounding cable(s) connected to grounding bar inside the cabinet.



4.6.3.2 Battery Energy Storage System Wiring

During transportation, each battery module is disconnected. The cables need to be connected when they arrive at the site. Please refer to following diagram for wiring connection.

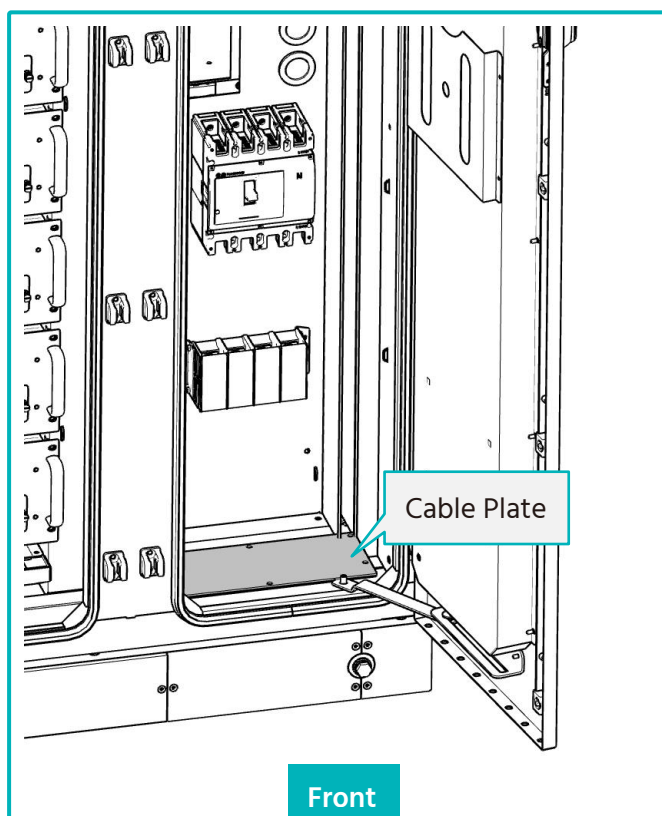


❶	Power Cable + (control module to PCS, referring to <i>section 3.6.4</i>)	❸	Power Cable - (battery module and BMS connection)
❷	Power Cable - (control module to PCS, referring to <i>section 3.6.4</i>)	❹	Battery cascade communication cable (127 mm)
❸	Power Cable + (battery module and BMS connection)	❺	Power Cable (battery module upper and lower serial connection) (250 mm)
❹	Communication Cable (battery module and BMS connection) (440 mm)	❻	Power Cable (battery module left and right rack serial connection) (280 mm)
❺	Communication Cable (control module CAN port to MBMS CAN 0, referring to <i>section 4.7</i>)	❼	Battery cascade communication cable (410 mm)

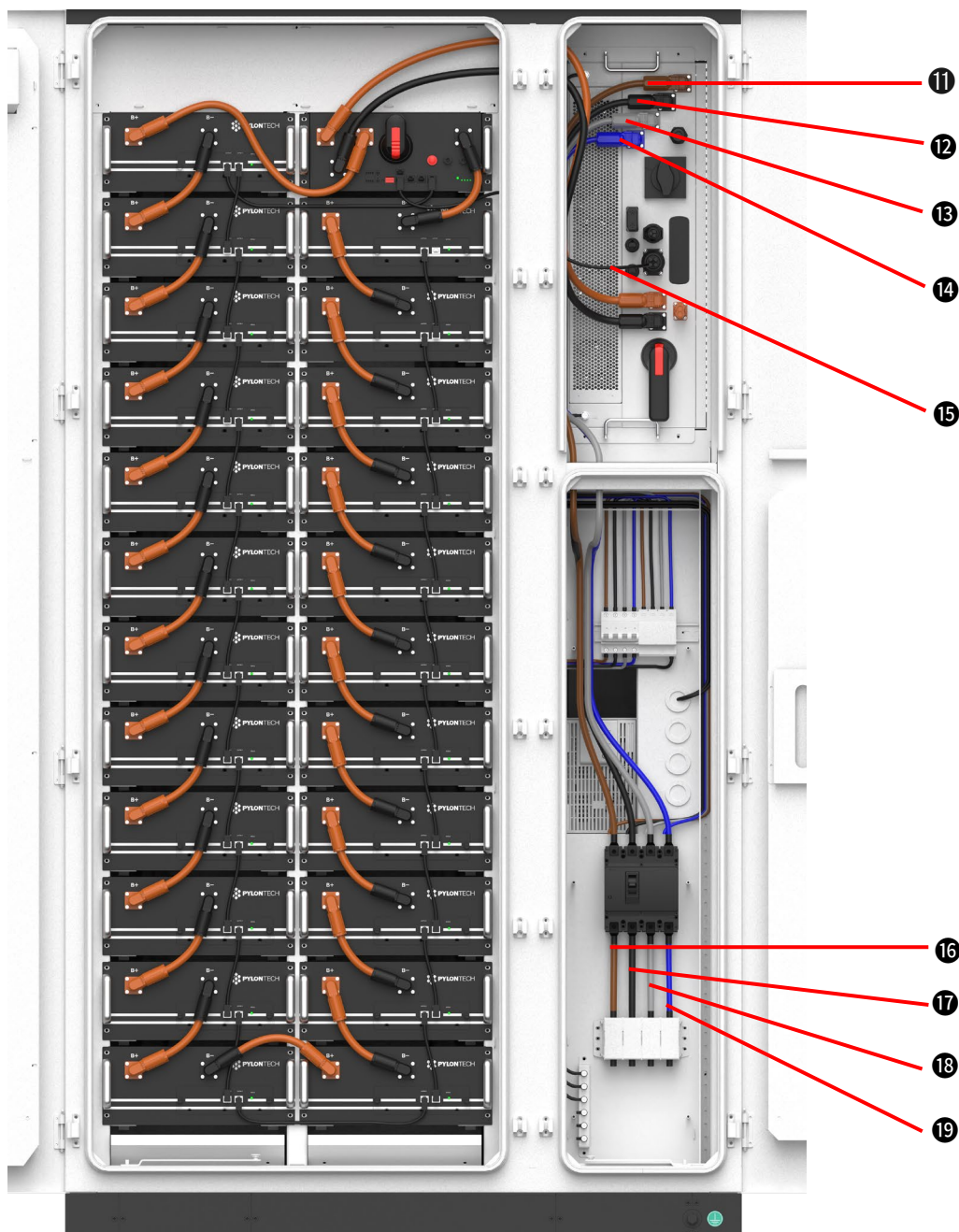
NOTE: For more detailed specifications of the cables, please refer to the separate *M5 battery operation product manual*.

4.6.3.3 AC Side Cable Wiring

1. Cut holes in the cable plate for feeding AC side wires. The sizes of the holes should meet requirements of the wires' diameters.



2. Feed the AC cables through the holes in the cable plate. According to the labeling, connect the cables of each phase sequence in turn, three opposite sequences are not allowed.

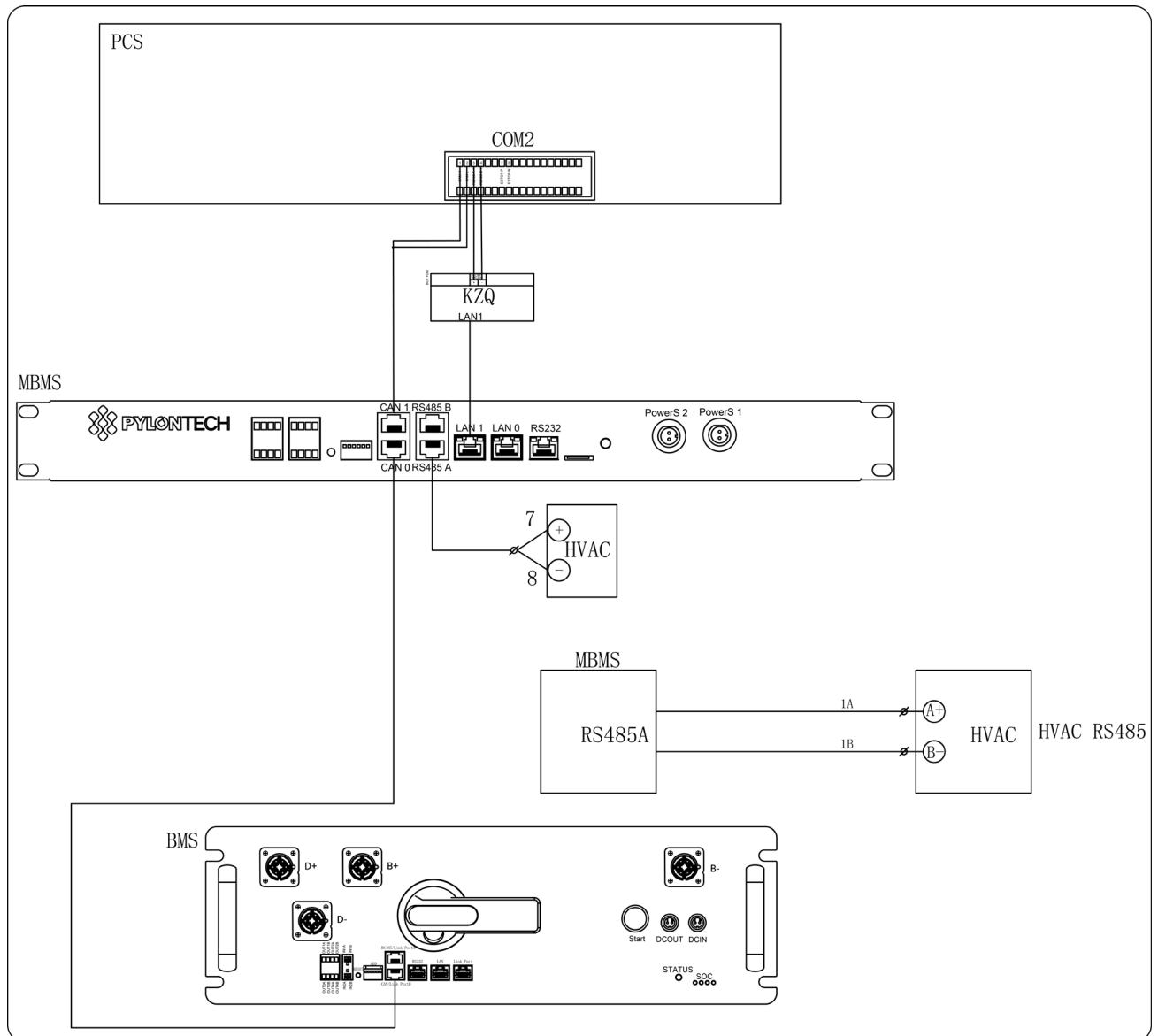


⑪	Power Cable (PCS to QF1 _U_)	⑯	Power Cable (X1 to QF1 _U_)
⑫	Power Cable (PCS to QF1 _V_)	⑰	Power Cable (X1 to QF1 _V_)
⑬	Power Cable (PCS to QF1 _W_)	⑱	Power Cable (X1 to QF1 _W_)
⑭	Power Cable (PCS to QF1 _N_)	⑲	Power Cable (X1 to QF1 _N_)
⑮	Communication Cable (PCS communication port to MBMS CAN 1, referring to <i>section 4.7</i>)		

3. After finish wiring, ensure that all connections are correct, and there is no overlap and no stress between the wires and sheet metal. Finally seal the gap part with fireproof mud.

4.7 Communication Wiring

Please see the following communication schematic diagram for communication wiring.



5 Commissioning

5.1 System Status

5.1.1 Battery String Status

The battery string status can be viewed through the “STATUS” LED and “SOC” indicators on the BMS of the battery string. Following are the details:

“STATUS” LED: shows the status of battery module (RUN●, Alarm and Protection●).

“SOC” Indicators: 4 green lights and each one represents 25% capacity.

Table of LED Indicators Instructions

Battery Status	Protection/ Alarm/ Normal	STATUS (green)	STATUS (red)	Capacity SOC				Descriptions
		●	●	●	●	●	●	
Shut Down		Off	Off	Off	Off	Off	Off	All off
Sleep	Normal	Flash1	Off	Off	Off	Off	Off	Indicates Sleep Mode, to save the power.
Idle	Normal	Light	Off	Off	Off	Off	Off	Indicates save power mode.
	Alarm	Light	Off	Off	Off	Off	Off	Indicates the battery voltage or temperature is high or low.
	Protection	Off	Light	Off	Off	Off	Off	Indicates the battery voltage or temperature is too high or too low.
Charge	Normal	Light	Off	The highest capacity indicator LED flashes (flash 1), others lighting				The highest capacity indicator LED flashes (flash 1), others lighting, horse race lamp when $SOC \geq DODH$.
	Alarm	Light	Off					
	Protection	Off	Light	Off	Off	Off	Off	Stop charging, STATUS (red) lighting
Discharge	Normal	Flash1	Off	Indicate based on capacity				Indicate based on capacity
	Alarm	Flash1	Off					
	Protection	Off	Light	Off	Off	Off	Off	Stop discharging, STATUS (red) lighting.
Abnormal	Power On Fault	Off	flash 2	Off	Off	Off	Off	Stop charging/discharging, STATUS (red) lighting.
	Other Fault	Off	light	Off	Off	Off	Off	
	STL Fault	Off	flash 1	flash 1				MCU self-check problem.

NOTE: The flashing instructions:

flash 1 - 0.5 seconds light / 0.5 seconds off.

flash 2 – 1 second light / 1 second off.

5.2 System Turning On

WARNING

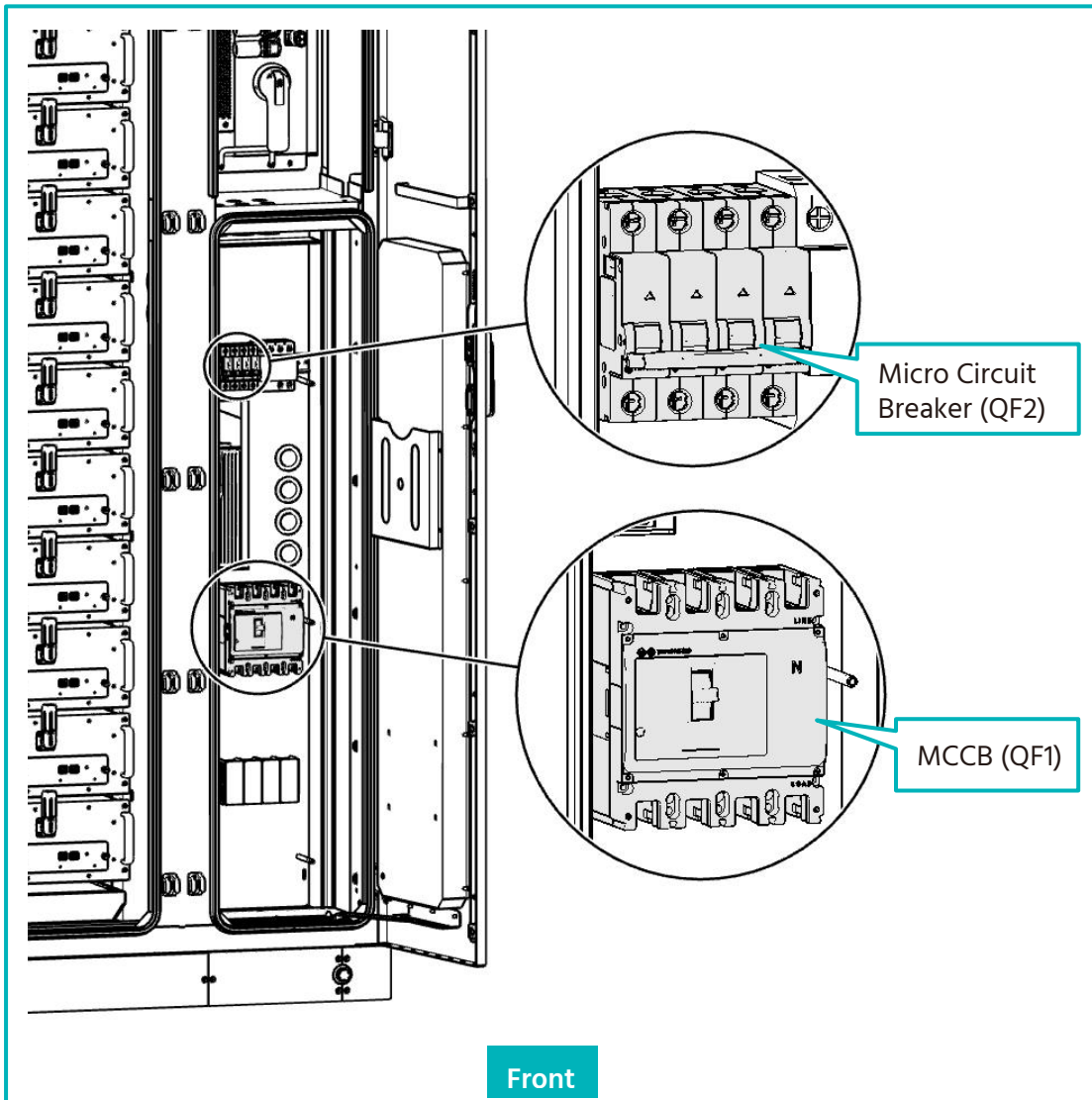
Warning: Double check all the power cables and communication cables. Ensure that the voltage of the PCS matches the voltage of the battery system. Check to make sure that all the power switches are OFF.

WARNING

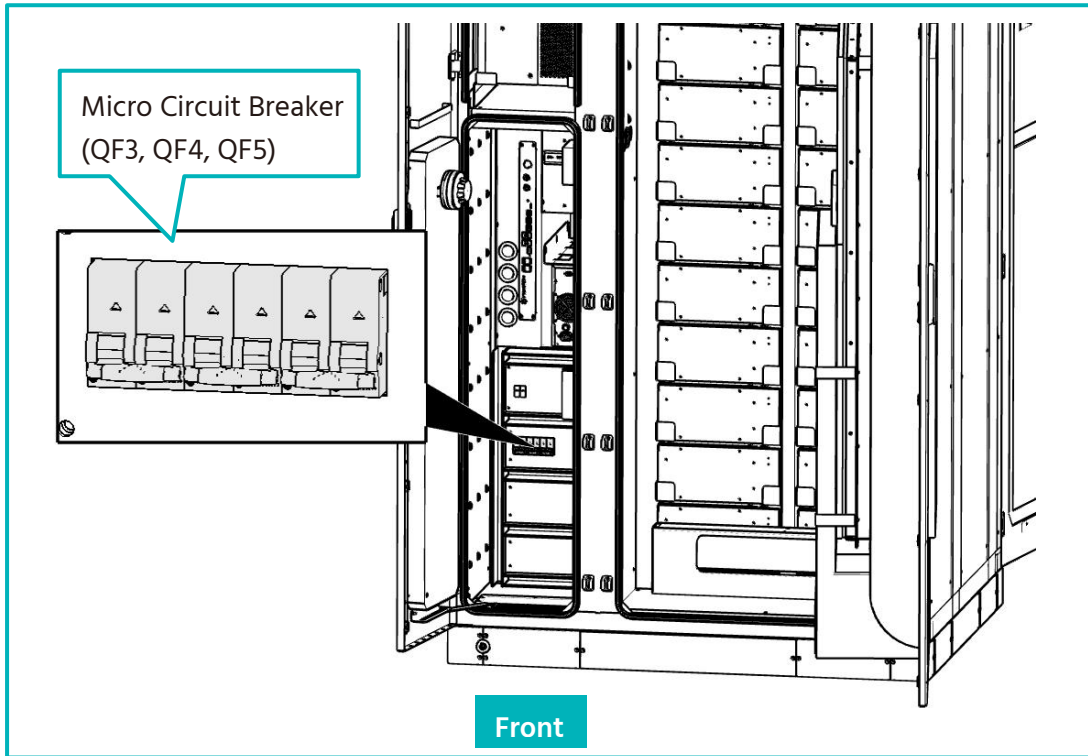
Warning: The external switches or breakers between PCS and battery string must be off before the battery system power on. Make sure that all micro circuit breakers in the cabinet are off.

Procedure

1. Switch on the MCCB (QF1), and the light of the Switching Mode Power Supply.
2. Switch on the Micro Circuit Breaker (QF2)



3. Switch on the micro circuit breaker QF3 of the air conditioner power supply, and the air conditioner will start automatically.
4. Switch on the UPS input micro circuit breaker QF4. After the UPS is powered on, press the power button (⏻) on the display panel for 1 second to turn on the UPS.
5. Switch on the circuit breaker QF5. And the LEDs on the switching Mode Power Supply (PS1 and PS2) will light up, see *section 3.6 Figure (18), (19)*.



6. Turn on the BMS according to the following operation.

(1) Set the isolating switch(①) to "ON" of the BMS.



(2) Press the "Start" button(②).

Press and hold the Start Button for more than 5 seconds until the buzzer rings, the "Status" led on the front panel will light on if the start-up is successful.



Power on: Press and hold $\geq 5\text{sec}$ till the buzzer rings
Mise sous tension: Appuyez et maintenez $\geq 5\text{sec}$ jusqu'à ce que le buzzer sonne

CAUTION

Caution: DO NOT long press (> 10 seconds) the start button 30 seconds after the BMS is powered on, or it will go into "BLACK-START" mode.

Instructions of the battery system start process:

The battery string system will enter self-check mode automatically if it powers on successfully. If the BMS and all battery modules are working normally, every status LED will light green. That means self-check is passed, which will be finished within 10 seconds.

Black-start function:

If long press (> 10 seconds) the start button 30 seconds after the BMS is powered on, the start function will be enabled, and the "STATUS" led will turn green. If "STATUS" led remains red, the black start function is failed to activate. And it is needed to long press the start button again. System will close relay and output for 10 minutes.

WARNING

Warning: If the black-start function is enabled, the terminals of D+ and D- will be electricity dangerous with high DC voltage output.

NOTE:

- If the status LED light red **30 seconds** after the BMS is powered on, it doesn't indicate there is a failure. It means that the BMS can't receive communication from upper-level equipment.
- If the status LED light red **from the beginning**, it indicates that there is a failure of the battery.

WARNING

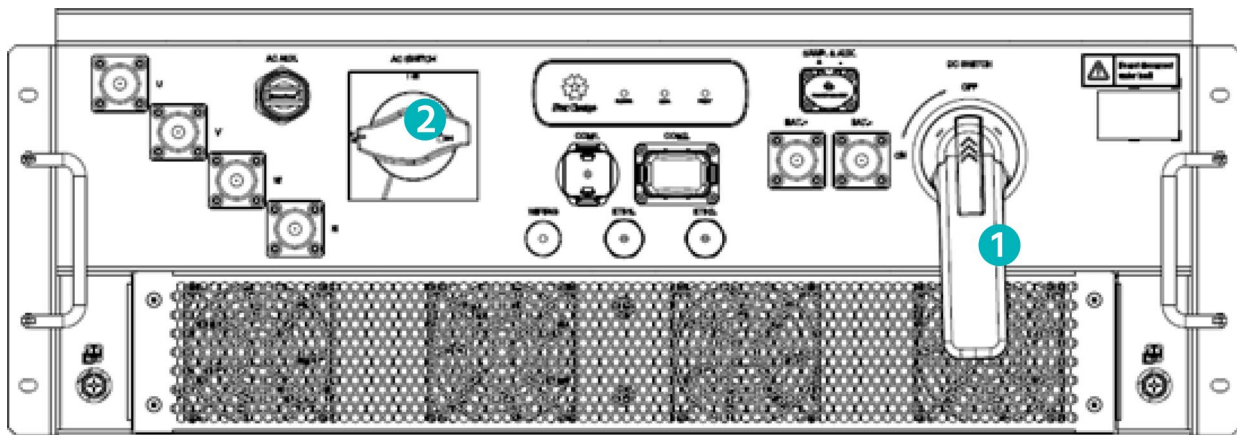
Warning: If there is any failure during the self-check, be sure to debug the failure prior to next step.

7. Switch on the MBMS and after the BMS is turned on. The "STATUS" LED will light green.



8. The Power Relays in BMS will be close automatically after 3 minutes' self-check of MBMS. The "STATUS" LED of the BMS will light green.
9. Turn on the PCS following the steps below:
 - (1) Close the DC isolation switch(①). After closing the DC isolation switch, the Power indicator on the energy storage PCS panel starts to flash approximately 3 seconds later and gradually return to a slow flashing state.

(2) Close the AC molded case circuit breaker(②).



(3) Upon receiving the startup command, the energy storage PCS initiates the startup process. The startup process takes about 75 seconds without faults. After the startup is complete, the Power indicator on the panel of the energy storage PCS is solid on. After the energy storage PCS is started, a power command can be sent to adjust the output power of the PCS.

NOTE:

- When starting up for the first time, it is necessary to fully charge the battery for SOC calibration.
- After installing or restarting the system when it is not used for a long time, the entire energy storage system should be firstly fully charged.

5.3 System Debug

Debug Step	Actions
Preparations for debug	Turn on the BESS system, referring to <i>section 5.2</i> . Remark: Besides the BESS, if other equipment has its own system starting up steps, be sure to follow its own system operation manual.
System function test	(1) Check to make sure the power supply from the UPS is working normally. (2) Communication Test: Check that if the communication between the BESS system and communicated devices are normal.
Trial operation test.	After the system is powered on, run the system a period as a test to check it works properly.

6 Maintenance

DANGER

Danger: This system is a high voltage DC system, operated by qualified and authorized person only.

NOTE: Before maintenance or long-term storage, ensure to turn the system off.

6.1 System Turning Off

1. Turn off the PCS following the steps below:
 - (1) Disconnect the AC molded case circuit breaker.
 - (2) Disconnect the DC isolation switch.
2. Turn off the Isolating Switch of the BMS.
3. Turn off the Power Switch of the MBMS.
4. Disconnect the "QF5".
5. Press the power button on the display panel for 1 second to turn off the UPS.
6. Disconnect the "QF4" and "QF3" breakers in the cabinet one by one.
5. Switch off the micro circuit breaker (QF2).
6. Switch off the MCCB (QF1).

CAUTION

Caution: Before changing the battery module for service, be sure to charge/discharge the replaced battery at the same open circuit voltage as the other ones in the battery module system. Otherwise, the system needs long time to do balance for this new battery module.

WARNING

Warning: Do not turn off the isolating switch during normal running status (unless emergency). Otherwise, it will cause current surge to the rest battery strings. Be sure to turn off the PCS first prior to turning off the isolating switch in normal running condition.

6.2 Routine Maintenance

Due to the influence of ambient temperature, humidity, dust, vibration, etc., the internal components of the system or equipment will be aged or worn, which will lead to the potential failure of the system or equipment. Therefore, it is necessary to carry out routine maintenance on the system to ensure its normal operation and service life.

After the system is out of operation, you must wait at least 10 minutes before carrying out maintenance or overhaul operations on the system.

After the system is shut down, pay attention to:

- Ensure that the system is not accidentally re-powered on.
- Use a multi-meter to check that the system is completely shut down.
- The possible live parts adjacent to the operating part shall be covered with insulating cloth.
- Ensure that the escape routes are completely unblocked during the whole process of maintenance.

Recommended Schedule of Routine Maintenance Table

Inspection Content	Inspection method	Maintenance Intervals
System operation status and environment	(1) Observe the appearance of the energy storage system for damage or deformation. (2) Check whether there is any abnormal sound in the operation of the energy storage system. (3) Check whether the parameters are correct during system operation. (4) Check whether the main devices are normal. (5) Check whether the humidity and dust in the environment around the energy storage system, and all air inlet filters are functioning properly.	Every 6 months.
System cleanliness	(1) Check the cleanliness of the components. (2) Check the cleanliness of the fly nets. (3) If necessary, a compressed air machine must be used to clean the system. NOTE: The system must be powered off when cleaning dust.	Every 6 months to 1 year (depending on the dust content of the environment in which it is used).
Power circuit connection check	(1) Check power cable connections for looseness and retighten to the torque specified above. (2) Check power cables and control cables for damage, especially cut marks on the skin in contact with metal surfaces. (3) Check that the insulating wraps of the power cable terminals are not detached.	Officially run for six months, then every six months to one year thereafter.

Terminal and wiring connection check	(1) Check whether the control terminal screws are loose and tighten them with a screwdriver. (2) Check whether there is any color change in the wiring copper or screws. (3) Visually inspect the connections such as equipment terminals and the distribution of wiring. (4) Check the main circuit terminals for poor contact and screw locations for signs of overheating.	Officially run for six months, then every six months to one year thereafter.
Circuit breaker maintenance	(1) Routine inspection of all metal components for corrosion. (2) Annual inspection of contactors (auxiliary switches and micro-switches) to ensure that they are in good mechanical working order. (3) Check the operating parameters (especially voltage and insulation).	Officially run for six months, then every six months to one year thereafter.
SPD check	(1) Annual inspection of cable connection to ensure that they are in good mechanical working order. (2) Check the operating parameters (especially voltage and insulation).	Every 6 months to 1 year
Battery maintenance	(1) Perform normal charging and discharging operations on the battery system to check whether there are any abnormalities in the operating status of the battery, and to check whether the battery system indicator status is normal. (2) It is recommended that the battery be fully charged and equalized on a regular basis.	Every 6 months to 1 year
Aerosol fire extinguisher inspection	When the fire extinguishing equipment is in normal working condition, it is necessary to check the starting device (JR10 starter box, etc.) to make sure that the line is normal. The fire extinguishing equipment is maintenance-free for its own validity period.	Officially run for six months, then every six months to one year thereafter.
Air conditioner maintenance	(1) Check whether the temperature of the air outlet is close to the cooling setting value, $\pm 2^{\circ}\text{C}$. (2) Check the degree of dust at the air inlet and outlet. And use a compressed air machine to clean and treat the dust at the air conditioner inlet and outlet.	
Safety Functions	(1) Check the stop function of the emergency stop button. (2) Simulate a shutdown and check shutdown signal communication. (3) Check the body warning signs and other equipment markings and replace them if they are found to be blurred or damaged.	Officially run for six months, then every year thereafter.

Specifications of electrical parts (needs maintenance)

Part Name	Specification
SPD (Surge Protecting Device)	DS44-400/4P/20KA/AC400V

6.2.1 Battery Maintenance



Danger: The power must be turned off prior to any maintenance of the battery.

Voltage Inspection

Check the voltage of battery system through the monitor system. Check if the system is abnormal voltage. For example: Single cell's voltage is abnormally high or low.

SOC Inspection

Check the SOC of battery system through the monitor system. Check if the battery string is abnormal SOC.

Cable Inspection

Visual inspect all the cables of battery system. Check if the cables are broken, aging, or getting loose.

Balancing

The battery strings will become unbalanced if not full charged for a long time. The balancing maintenance (full charged) should be done every 3 months and is usually done automatically by communication between the system and external device.

Output Relay Inspection

Under low load condition (low current), switch the output relay to OFF and ON to hear the clicking sound, which means this relay can be turned off and on normally.

History Inspection

Analyze the history records to check if there is an accident (alarm and protection) and analyze the reasons.

Environment Inspection

Check the installation environment such as dust, water, insect etc.

6.2.2 PCS Maintenance

6.2.2.1 Routine Maintenance

Safety inspections should be conducted by technical personnel at least every 12 months, who must have received sufficient training and possess knowledge and practical experience. The data should be recorded in the device log. If the device cannot function properly or if any testing fails, it must be repaired. During the use of the PCS, the responsible person should regularly check and maintain the machine. The required actions are as follows:

- Check if the heat sink at the back of the PCS has accumulated dust and dirt, and clean the machine if necessary. This work should be carried out regularly.
- Check if the indicator light of the PCS is normal at least every 6 months.
- Check input and output lines for damage or aging at least every 6 months.
- Clean the PCS panel at least every 6 months and check its safety.



Warning: Only professionals should perform these operations.

6.2.2.2 Fan Maintenance



Warning: Before starting the maintenance, it is necessary to turn off the PCS and disconnect all power inputs of the PCS.

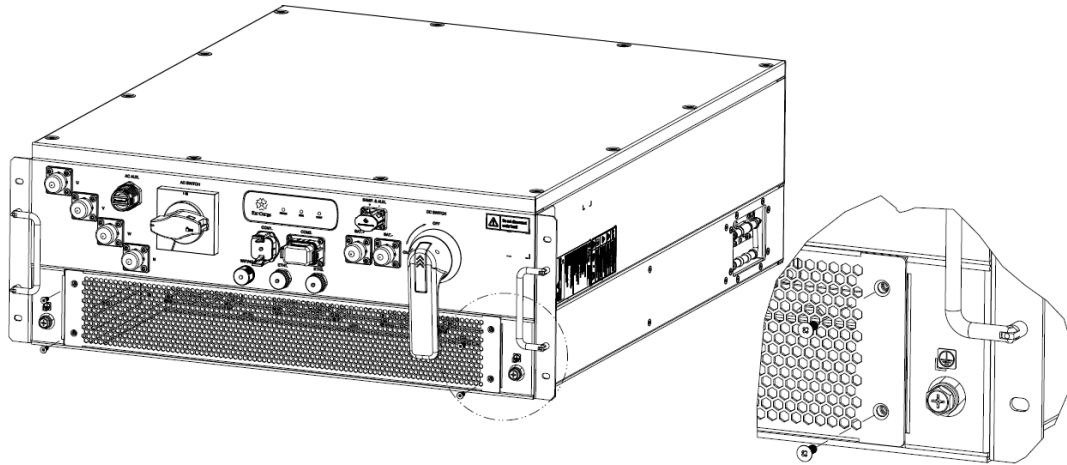
Wait for at least 30 minutes until the capacitor inside the PCS is fully discharged before performing maintenance work.

Only professional electrical personnel can perform fan maintenance and replacement.

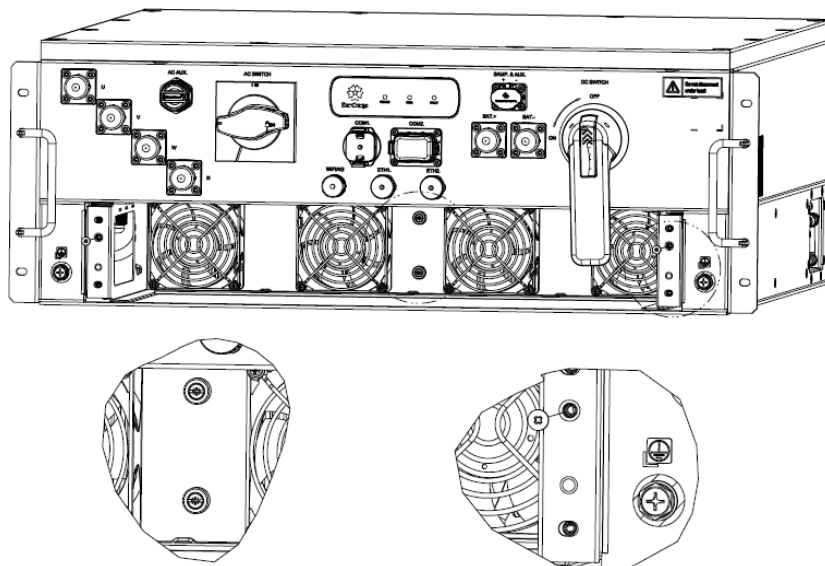
The built-in fan of the PCS cools and dissipates heat during its operation. If the fan cannot work normally, the PCS cannot be effectively cooled, which will affect the efficiency of the PCS or cause derating operation. Therefore, it is necessary to keep the fan clean and replace the damaged fan in time. Fan cleaning and replacement steps are as follows:

Step 1: Turn off the PCS.

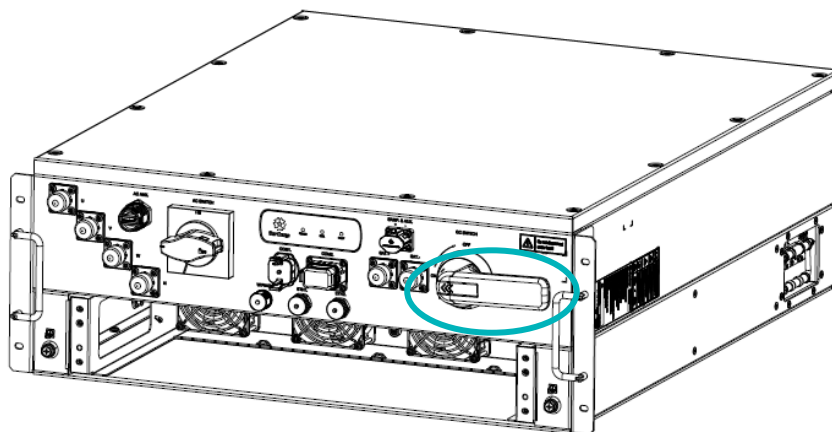
Step 2: Loosen the screws on the air inlet panel on the front side of the PCS with a recommended torque of $1.5 \text{ N} \cdot \text{m}$. Remove the air inlet panel as shown in the following figure.



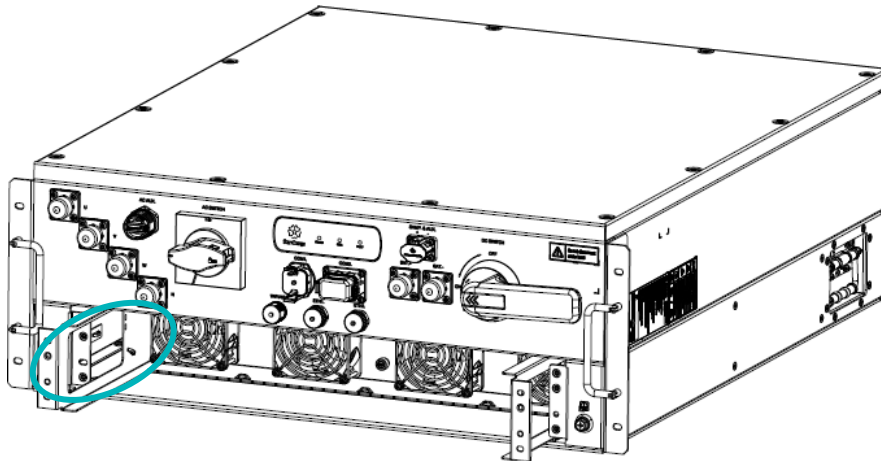
Step 3: Loosen the fixing screws on the fan bracket and the anti-loosening screw in the middle with a recommended torque of $1.5 \text{ N} \cdot \text{m}$, as shown in the following figure.



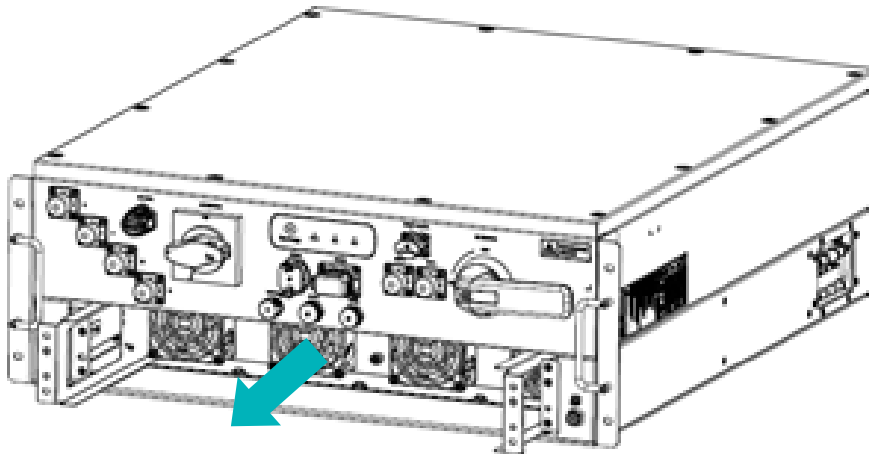
Step 4: Rotate the disconnect switch handle to horizontal, as shown below.



Step 5: Pull the fan bracket outwards, and release the connection interface of the fan, as shown below.



Step 6: Gently pull the fan module outward, as shown below.



Step 7: Use a brush or vacuum cleaner to clean the fan or replace the damaged fan. The fan should be installed with a torque of $1.5\text{N} \cdot \text{m}$.

Step 8: After maintenance is completed, reinstall the fan module into the PCS in reverse order, tighten the screws, and restart the PCS.

6.2.2.3 Clearing and cleaning

Before installation and commissioning, regularly clean the dust and sundries in the terminals and mesh openings of the PCS.

After installation and commissioning, regularly check ventilation and air exhaust facilities. Cleaning once every three months is recommended.

6.2.3 Air-conditioner Daily Maintenance

Item	Content
AIR FILTER (If supplied)	Air filter is used for preventing the matters (such as dust, dirt, soot) block the condenser and evaporator. The heat exchangers in blocked will make capacity decrease and unit being in trouble. The air filter should be cleaned or replaced regularly. The cleaning time is according to the working environment. Tap the surface of filter to get rid of the thick blockage firstly, then clean the filter by the warm water with detergent. Dry out the filter before using.
HEAT-EXCHANGER	The period of heat-exchanger cleaning is longer than air filter cleaning in time. Use the nylon brush to clean the fins and tubes of heat-exchanger when cleaning. Before brushing you can use the vacuum and compressed air to clear the fins and tubes.
HEAT-EXCHANGER	The period of heat-exchanger cleaning is longer than air filter cleaning in time. Use the nylon brush to clean the fins and tubes of heat-exchanger when cleaning. Before brushing you can use the vacuum and compressed air to clear the fins and tubes.
DRAIN-PIPE	It is ought to check the drain-pipe often. The blockage of pipe will make the condensed water poor drainage and leakage of unit.
OUTDOOR UNIT	The outdoor unit needs to be checked and the surface of the heat-exchanger should be cleaned each quarter. If the unit is installed in the heavy oil, smoke and dusty place, the heat exchangers must be cleared by professional technician regularly. That ensure the heat-exchanger working in normal, otherwise unit life will be reduced.

ATTENTION

1. Don't put the tinder near the unit when it is running.
2. Turn off the power supply when the unit doesn't work in long time.
3. Don't adjust temperature settings frequently and it will cause damage to the air conditioner.
4. Don't start the AC by force with the unit in error. Restart the AC after troubleshooting.
5. It is must to turn off the AC and cut down the power before cleaning the AC.
6. Don't use water to flush unit directly.
7. Don't repair in unit operation.
8. Don't take down the fan net cover. The high-speed fans make danger to you.
9. Don't damage the fins of the heat exchanger.
10. Don't set the cooling temperature below 18°C.
11. Advised cooling temp range is 26~30°C; Advised heating temp range is 15~23°C.
12. Don't open the window and door for long time that will increase cooling load of the unit.
13. Clean the air filter in regular. Cleaning cycle depends on the environment.

ALARM

If any abnormal (such as burning), please switch off the power supply and contact the plant to ask for help. Continuing to use the AC in this case may damage the unit and cause electric shock or fire accident. Maintenance can be carried out by professional staff only. It must be cut off all the power before repairing.

6.3 Trouble Shooting

The common faults and solutions during the commissioning of the energy storage system are shown in the following sections. If the problems cannot be solved according to this manual, please contact us. We need the following to help you better.

- Product serial number, production date.
- Manufacturer, model, and configuration information of the equipment.
- Simple fault description.
- Failure site photos.

6.3.1 Battery String Trouble Shooting

Battery String Failure

- Section A before starting up:

Failure Mode	Possible Reason	Solution
Battery system doesn't start up after correct wiring connection and starting procedure.	Power cable issue	1. Check the wiring connection and connectivity of the power cables.
	Internal cable issue	2. Open BMS case, check the connectivity and reliability of the internal power supply cables.
	PMU issue	3. Open BMS case, use multimeter to check PMU 12VDC output and CMU LEDs. If neither is on, please swap the PMU.
	Other error	4. If the problem persists, contact Pylontech service engineer.

- Section B During operation:

Error Code checked from BMS (Modbus protocol Appendix IV or CAN ID 0*4250&0*4290):

*The 'Failure Definition' and 'Failure Mode' column is reference from Pylontech Modbus protocol Appendix IV Error code 1 bit to present.

Failure Type	Failure Definition	Possible Reason	Solution
External	Input RV Err (Bit4)	D+ D- reversely connected	Check the external power cables of the polarity and connection.
External	DCOV Err input over voltage error (Bit3)	D+ D- voltage extremely higher than battery system voltage.	Check that if the PCS's voltage matches the battery system.
External	Emergency stop (Bit13)	Command by external device via dry contactor.	Command by external device, not an error actively reported by battery system.
Current Leakage	Current Leakage Error (Bit21)	Current Leakage >25mA	With insulation gloves, disconnect the battery system and contact Pylontech service engineer.
Self-test	Self-test module Initial Error (Bit16)	Self-test failed.	1. Restart the battery system. 2. If the problem persists, contact Pylontech service engineer.
Self-test	Self-test module coulomb error (Bit15)	Self-test failed.	Contact Pylontech service engineer.
Self-test	Self-test module detecting amount error (Bit14)	Self-test failed.	Contact Pylontech service engineer.
Self-test	Safety check failure (Bit11)	Chip self-test failed.	1. Restart the battery system. 2. If the problem persists, contact Pylontech service engineer.
Self-test	Self-test volt error (Bit10)	Battery cell voltage measurement mismatch with DCBUS voltage measurement.	Restart the battery system. Check the connectivity and reliability of the power and communication cables. Swap the current measurement board or BMS. If the problem persists, contact Pylontech service engineer.
Battery cell	Battery damage error (Bit6)	Battery cell voltage measured at <2.0V.	Restart the battery system. Swap out the RED LED battery module. Use multimeter to measure the battery module power terminal voltage, if it is the same as the BMS reading value, then it's a true cell damage. Otherwise please swap the BMU of the module.

6.3.2 PCS Trouble Shooting

Fault Information	Solution
Auxiliary power supply fault	Disconnect the AC molded case circuit breaker and the DC isolation switch. After the indicator lights are off, close the AC molded case circuit breaker, close the DC isolation switch, and check again.
Bus bar voltage fault	Disconnect the AC molded case circuit breaker and the DC isolating switch. After the indicator lights are off, close the AC molded case circuit breaker, close the DC isolation switch, and check again.
Excessive DC component	Wait for one minute after the PCS is reconnected. Shutdown, disconnect the AC molded case circuit breaker and disconnect the DC isolation switch. After the indicator lights are off, close the AC molded case circuit breaker, close the DC isolation switch, and check again.
Insulation resistance detection fault	Disconnect the AC molded case circuit breaker and disconnect the DC isolation switch. After the indicator lights are off, close the AC molded case circuit breaker, close the DC isolation switch, and check again.
Grid voltage fault	Wait for the grid to return to normal, and the system will reconnect. Check if the grid voltage and frequency meet the standard.
Grid frequency fault	Wait for the grid to return to normal, and the system will reconnect. Check if the grid voltage and frequency meet the standard.
Grid reconnection fault	Wait for the grid to return to normal, and the system will reconnect. Check if the grid voltage and frequency meet the standard.
Internal communication fault	Disconnect the AC molded case circuit breaker and disconnect the DC isolation switch. After the indicator lights are off, close the AC molded case circuit breaker, close the DC isolation switch, and check again.
Pre-synchronous fault	Disconnect the AC molded case circuit breaker and disconnect the DC isolation switch. After the indicator lights are off, close the AC molded case circuit breaker, close the DC isolation switch, and check again.
Overcurrent fault	Disconnect the AC molded case circuit breaker and disconnect the DC isolation switch. After the indicator lights are off, close the AC molded case circuit breaker, close the DC isolation switch, and check again.
Phase lock fault	Shutdown and power off the energy storage system, disconnect the distribution circuit breaker. Check if the grid interface wiring is normal. Check if the grid voltage and frequency meet the standard.
Battery voltage fault	Check if the battery voltage exceeds the normal range. If the battery voltage exceeds the normal range, please check the battery cluster.

Overttemperature fault	Check if the ambient temperature is within the allowable range of the PCS.
Fan Fault	Disconnect the AC molded case circuit breaker and disconnect the DC isolation switch. After the indicator lights are off, close the AC molded case circuit breaker, close the DC isolation switch, and check again.

- Please check the fault code of the PCS. If a message is displayed, please note it before proceeding further.
- Try the solutions shown in the table above.
- If the PCS indicator light does not on, please check the following to ensure that the current state of the installation allows the device to operate normally:
- Whether the PCS is located in a clean, dry and well-ventilated place. Whether the DC input switch is closed.
- Whether the cable size is appropriate.
- Whether the input and output connections and wiring are in good condition.
- Whether the indicator light and communication stick are connected correctly and not damaged.

Contact Customer Service for further assistance with system installation details and the model and serial number of the product.

6.3.3 UPS Trouble Shooting

Problem and Possible Reason		Solution
The UPS can't be started.	The battery connection is incorrect.	Check that the battery connector is properly connected.
	NOT pressing the ON/OFF button.	Press the ON/OFF button to turn on the UPS.
	The UPS is not connected to the grid.	Check that both ends of the power cable between the UPS and the grid are securely connected.
	The voltage is too low or there's no grid voltage.	Use a table lamp to check the grid power supply connected to the UPS. If the light is very dim, check the grid voltage.
The UPS can't be shut down.	NOT pressing the ON/OFF button.	Press the ON/OFF button to turn off the UPS.
	Internal fault of the UPS.	DO NOT attempt to use UPS. Unplug the UPS and send it for repair in time.
UPS cannot provide the expected backup time.	The UPS battery was weakened by a recent power outage or the battery is at the end of its working life.	Charge the battery. The battery should be recharged after a long period of power outage. Frequent use or the high temperature operation will reduce the battery's working life. If the battery is at the end of its working life, consider replacing the battery even though the indicator LED has not yet lighted up.
Bypass overload alarm, UPS makes continuous alarm sound.	Overload of the UPS.	The connected device exceeds the maximum load specified in the technical specifications. The alarm will continue until the overload is eliminated. Disconnect unnecessary devices from the UPS to resolve overload issues.
Failure LED lights up.	Internal fault of the UPS.	DO NOT attempt to use UPS. Turn off the UPS and send it for repair in time.
Battery replacement indicator LED lights up.	(A short beep sounds every two seconds.) The battery is disconnected.	Check that if the battery connector is intact.
	Too low battery power.	Charge the battery for 24 hours. Then perform a self-check. If the problem persists after recharging, replace the battery.
	(The UPS makes a short beep for one minute and the battery replacement LED lights up. UPS repeats the alarm every 5 hours.) Battery self-check fails.	Perform a self-check procedure after 24 hours of battery charging to confirm the condition of battery replacement. If the battery self-test is successful, the alarm will stop and the LED light will go off.

Despite the presence of grid power, the UPS still runs on batteries.	The grid voltage is too high, too low, or unstable. Generators powered by cheap fuel cannot provide a stable voltage.	Switch the UPS to another electrical outlet. Test the input voltage according to the grid voltage display.
On-line LED light	No LED lights up.	The UPS is running on battery or is not started.
	LED flashes.	The UPS is performing internal self-check.

6.3.4 Air Conditioner Trouble Shooting

6.3.4.1 Alarm List

Name	Action	Reset
Indoor temp sensor	All the devices stop except blower.	Auto
Indoor humidity sensor	All the devices stop except blower, compressor and heater.	Auto
Condensing temp sensor	Alarm, compressor and condensing fan stop. (relay signal)	Auto
Environment temp sensor	Alarm, compressor and condensing fan stop. (analog signal)	Auto
Evaporating temp sensor	Alarm, compressor and condensing fan stop. (relay/analog signal)	Auto
High indoor temperature	Alarm	Auto
Low indoor temperature	Alarm	Auto
High indoor humidity	Alarm	Auto
Low indoor humidity	Alarm	Auto
Compressor PH (Refrigerant high pressure)	Alarm. Turn off compressor and condensing fan (relay/analog signal). Reset automatically if err happens ≤ 3 times in one hour. If err happens over 3 times in one hour, reset manually.	Auto/Manual
Compressor PL (Refrigerant low pressure)	Alarm. Turn off compressor and condensing fan (relay/analog signal). Reset automatically if err happens ≤ 3 times in one hour. If err happens over 3 times in one hour, reset manually.	Auto/Manual
High condensing temp	Alarm. Turn off compressor and condensing fan (relay/analog signal).	Auto
Smoke alarm	Alarm. Unit stops.	Manual

Power fault	Alarm. Unit stops.	Manual
Fan overload	Alarm. Unit stops.	Manual
Heat protection	Alarm. Turn off the heater. And the blower continues to work.	Auto
Low coil temp	Alarm. Turn off compressor and condensing fan (relay/analog signal).	Auto
3-phase	Unit stops.	Auto
Humidifier err	Alarm	Auto
Ref. leakage		Auto/Manual/Stop
Forced heating room temperature ultra-high	In the forced heating mode, when the indoor temperature is detected to be $\geq$ [forced heating protection] for 10 seconds, the fault is reported and the power is cut off for heating. When the indoor temperature is $\leq$ [forced heating protection] - 3 degrees, or exit the forced heating mode, the fault is reset automatically	Auto
Forced refrigeration room temperature ultra-low	In the forced cooling mode, when the indoor temperature is detected to be $\leq$ [forced cooling protection] for 10 seconds, the fault is reported and the compressor is stopped. When the indoor temperature is $\geq$ [forced cooling protection] + 3 degrees, or exit the forced cooling mode, the fault is reset automatically.	Auto

NOTE: High pressure switch and compressor overload protector are series in D12 port (terminal 14) of controller, so compressor overload and high-pressure lead to fault of "compressor PH".

6.3.4.2 Fault Check

Fault information will eject automatically. If err happen. Press  in homepage enter "fault page" to check the unset faults.

6.3.4.3 Fault Check Reset

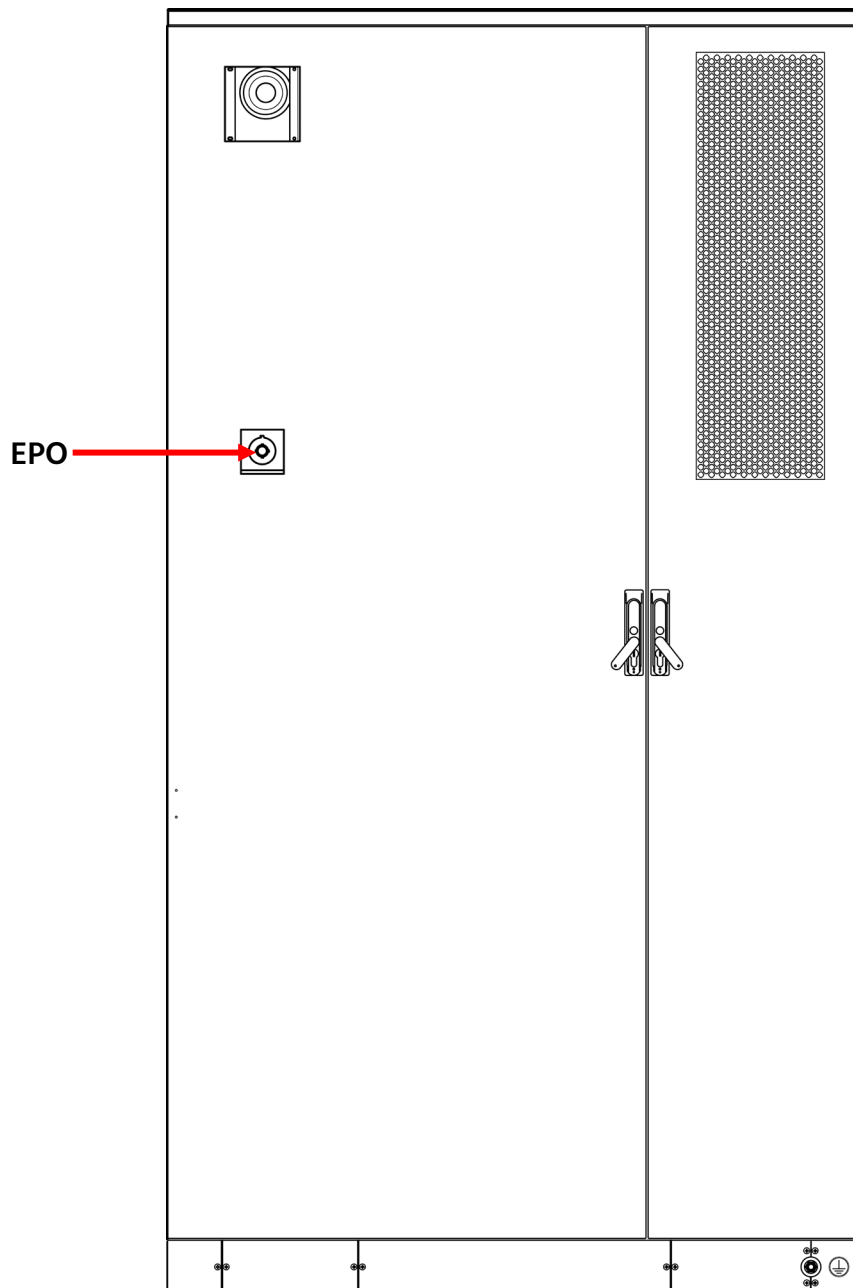
Press  to reset when AC running.

All the faults reset by power off.

 Please reset after removing the fault.

6.4 Emergency Disposal (EPO)

In case of fire or any situation beyond the control of anyone, please immediately press the emergency power off button (EPO) to stop the system. DO NOT touch the EPO during normal operation. To restore the system, firstly rotate the EPO button in the operating direction on the door to make the button pop up, and then power on the system according to the power on steps.



7 Shipment and Storage

7.1 Shipment

The outdoor battery cabinet is handled by forklift or hoisting.

- The indoor battery cabinet is transported with battery. Therefore, ALWAYS avoid violent impact during handling.
- It should be fixed firmly during transportation, and no displacement is allowed in the carriage.
- During transportation, it should be placed and transported in strict accordance with the vertical direction, the tilt angle $\leq 15^\circ$. DO NOT transport the cabinet horizontally or sideways to avoid device vibration.
- DO NOT transport the cabinet with flammable, explosive, and corrosive items during transportation.
- DO NOT store the cabinet in an open warehouse during transit.
- DO NOT expose the cabinet to rain, snow or liquid substances.

Single cell's SOC shall remain around 55% according to customer requirement before shipment.

The remaining capacity of battery, after shipment and before charging, is determined by the storage time and condition.

The battery modules should meet the UN38.3 certificate standard. In particular, special rules for the carriage of goods on the road and the current dangerous goods law should be observed.

7.2 Storage

Before storage the battery should be charged to 50~55% SOC.

For long-term storage, e.g. if it needs to be stored for a long time (more than 3 months), the battery should be stored in the temperature range for 5~45°C, relative humidity <65% clean, well-ventilated, and corrosive-gas-freed environment.

It is recommended to discharge and charge the battery every 3 months, and the longest discharge and charge interval shall not exceed 6 months.

CAUTION

Caution: If not following the above instructions for long term storage of the battery, the cycle life will decrease relative heavily.



Pylon Technologies Co., Ltd.

5/F, No.71-72, Lane 887, ZuChongzhi Road,
China (Shanghai) Pilot Free Trade Zone,
Pudong, Shanghai 201203, China

T +86-21-51317699 | **F** +86-21-51317698

E service@pylontech.com.cn

W www.pylontech.com.cn