PYLONTECH

Rechargeable Li-ion Battery
UF5000 Series Operation Manual

This manual introduces UF5000 from Pylontech. Please read this manual before use and follow the instructions carefully during the installation process. Any confusion, please contact Pylontech for advice and clarification.

Contents

1. Symbols

⚠️	Caution! Warning! Reminding. Safety related information. Risk of battery system failure or life cycle reduces.
🚫	Do not reversely connect the positive and negative port.
🚫	Do not place near open flame.
🚫	Do not place at the children or pet touchable area.
⚠️	Warning electric shock.
⚠️	Warning Fire. Do not place near flammable material.
📖	Read the product and operation manual before operating the battery system!
⏚	Grounding.
♻️	Recycle label.
CE	The certificate label for EMC/CE.

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

2. Safety Precautions

⚠️ **Reminding**

1) It is important and necessary to read the user manual carefully before installing or using battery. Failure to do so or to follow any of the instructions or warnings in this document can result in death, serious injury, electrical shock or battery damage, potentially rendering the battery inoperable.
2) If the battery is stored for long time, it is required to be recharged every six months, and the SOC should not be less than 90%.
3) Battery needs to be recharged within 12 hours after being fully discharged.
4) DO NOT install the product in outdoor environment, or an environment out of the operation temperature or humidity range listed in manual.
5) DO NOT expose cables outside.
6) DO NOT reversely connect power terminals.
7) All the power terminals must be disconnected for maintenance.
8) If there is any abnormality, please contact the supplier within 24 hours.
9) DO NOT use cleaning solvents to clean the battery.
10) DO NOT expose the battery to flammable or harsh chemicals or vapors.
11) DO NOT paint any part of the battery, including any internal or external components.
12) DO NOT connect the battery with PV solar wiring directly.
13) DO NOT insert any foreign object into any part of battery.
14) The warranty claims are excluded for direct or indirect damages due to items above.

2.1 Before Connecting

⚠️ Warning

1) After unpacking, please check the product and packing list first, if the product is damaged or lack of parts, please contact the local retailer.
2) Before installation, be sure to cut off the grid power supply and make sure the battery is in power-off mode.
3) Wiring must be done correctly, without mistaking the positive and negative cables, and ensuring no short circuit with external devices.
4) DO NOT connect the battery with AC power directly.
5) The embedded BMS in the battery is designed for 51.2 VDC. DO NOT connect battery in series.
6) The battery must be grounded with a resistance of less than 0.1Ω.
7) Make sure that the electrical parameters of battery system are compatible with related equipment.
8) Keep the battery away from water and fire.

2.2 In Using

1) If the battery system needs to be moved or repaired, the power must be cut off and the battery must be completely shut down.
2) DO NOT connect the battery with different type of battery.
3) DO NOT connect batteries with faulty or incompatible inverter
4) DO NOT disassemble the battery (QC tab removed or damaged).
5) In case of fire, dry powder fire extinguisher or vast amount of water can be used.
6) DO NOT open, repair or disassemble the battery unless by staff from Pylontech or authorized by Pylontech. We do not undertake any consequences or related responsibility due to violation of safety operation or violation of design, production and equipment safety standards.

3. Introduction

UF5000 lithium iron phosphate battery is a new type of energy storage product developed and produced by Pylontech, which can provide reliable and high power for various types of equipment and systems.

3.1 Features

1) Built-in soft-start function which reduces current strike when the inverter needs to start from battery.
2) Dual active protection on BMS level.
3) Automatic address setting when connected to the same group.
4) Supporting upgrading the battery module from upper controller via CAN or RS485 communication.
5) Enabling 95% depth of discharge, available for the inverter which completely follows Pylontech latest protocol.
6) Non-toxic, non-pollution and environmentally friendly.
7) Cathode material made from LiFePO4 with safety performance and long cycle life.
8) Battery management system (BMS) with protection functions including over-discharge, over-charge, over-current and high/low temperature.
9) Automatically managing charging and discharging state and balancing voltage of each cell.
10) Flexible configuration and multiple battery modules in parallel for expanding capacity and power.
11) Adoption of self-cooling mode which rapidly reduces system entire noise.
12) The module has less self-discharge, up to 6 months without charging it on shelf, no memory effect, excellent performance of shallow charge and discharge.
13) Small size and light weight, the standard 19-inch embedded designed module is easy to install and maintain.

3.2 Specifications

UF5000 :: PYLONTECH

452.6

442

30

161

482.6

465

117.48

8.4

10.4
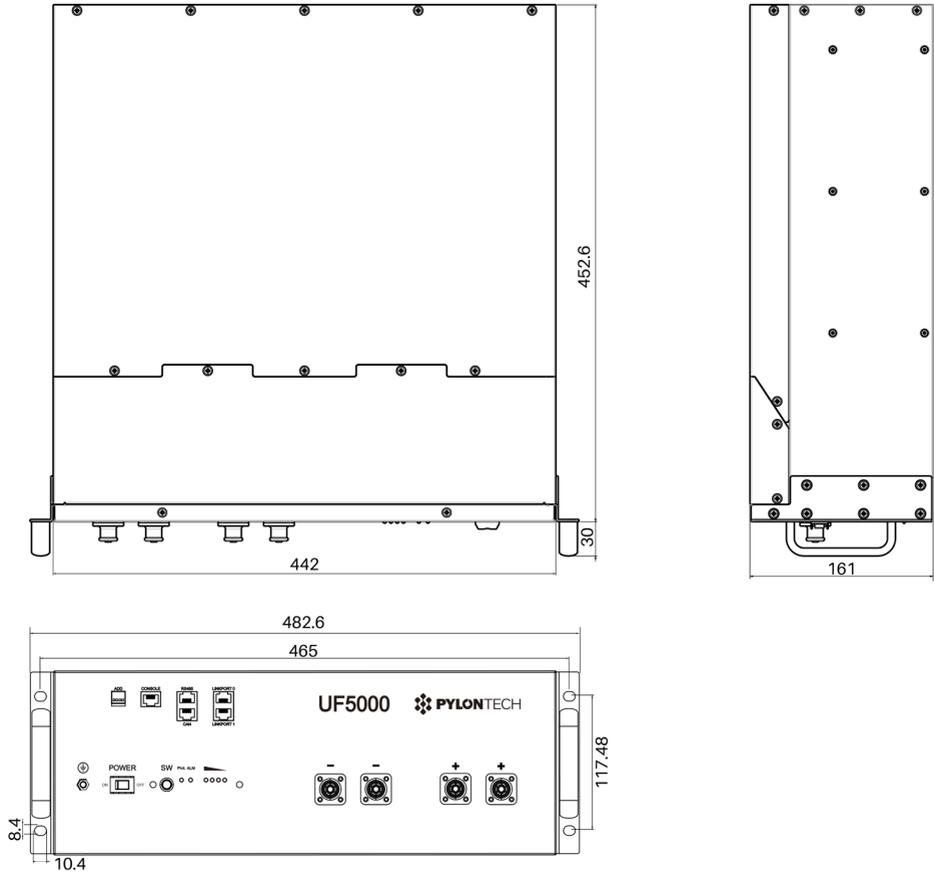
（Unit: mm）

| Basic Parameters	UF5000
Nominal Voltage (VDC)	51.2
Nominal Capacity (Wh)	5120
Usable Capacity (Wh)	4864
Depth of discharge (%)	95
Dimensions (mm)	442(W) x 452.6 (D) x 161(H)
Weight (Kg)	42
Discharge Voltage (VDC)	45.6 ~ 56.8
Charge Voltage (VDC)	56 ~ 56.8
Recommended Charge/Discharge Current (A) *	100
Maximum continuous Charge/Discharge Current (A) *	100
Peak Charge/Discharge Current (A)	105 ~ 119 @15 minutes
	120 ~ 200 @15 seconds
Communication	RS485, CAN
Configuration (maximum quantity in one battery group)	20
Working Temperature(°C)**	-10 ~ 55 Charge
	-10 ~ 55 Discharge
Storage Temperature (°C)	-20 ~ 60
Short current/duration time (A/1ms)	< 2,000
Cooling type	Natural
Protective class	I
IP rating of enclosure	IP20
Humidity(%, RH, No Condensation)	5 ~ 95
Altitude(m)	≤4000
Certifications	IEC62619, UN38.3, RoHS, Reach, WEEE, EMC/CE
Design life (year) (25°C /77°F)	15
Cycle Life (25°C /77°F) ♣	> 6,000

* The maximum continuous operation current is recommended for a battery cell temperature within 10~40°C. Exceeding this temperature range will result in lower operation current.

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

♣ Operation Cycle Life is defined based on specific operation conditions. For more details, please consult check with Pylontech service team.

3.3 Equipment interface
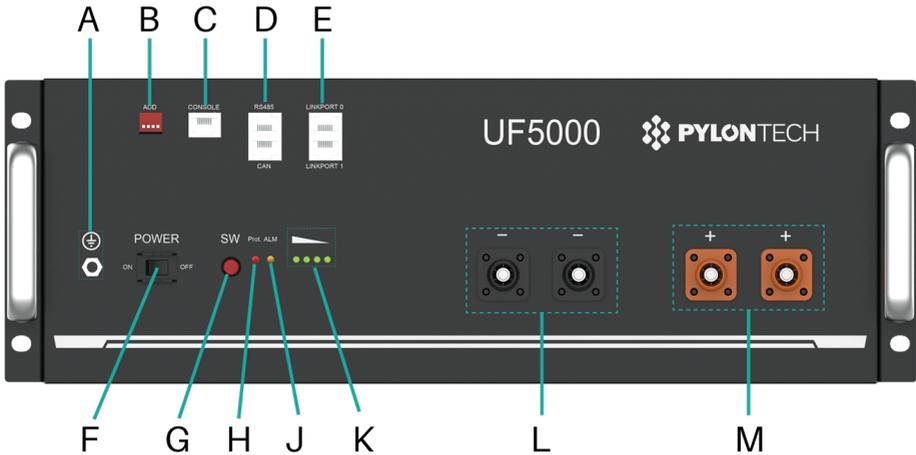
A. Grounding Point	B. Add (Switch)	C. Console	D. RS485/CAN
E. Link Port 0/1	F. Power Switch	G. Start	H. Protection(Prot.)
J. Alarm(ALM)	K. SOC	L. Power Terminal(s) -	M. Power Terminal(s)+

A. Grounding Point

To connect the grounding cable.

B. Add(Switch)

Dip1: RS485 baud rate: 1: 9600; 0: 115200. After it is changed, please restart the battery.

Dip2 ~ 4: Based on design of BMS, the dip switch is deployed physically reversely.

For instance:

Dip1	Dip2	Dip3	Dip4	The corresponding position of switch	Status
0	0	0	0		RS485:115200 CAN terminal resistance: connected
1	0	0	0		RS485:9600 CAN terminal resistance: connected

C. Console

For the manufacturer or professional engineer to debug or service.

Pin1	Pin2	Pin3	Pin4	Pin5	Pin6	Pin7	Pin8
-	-	232-TX	-	-	232-RX	-	232-GND

D. RS485/CAN

RS485: 9600 or 115200 bps. Recommended 60Ω. To inverter or slave battery.

CAN: 500 Kbps. Recommended 60Ω. To inverter or upper battery.

E. Link Port 0, 1

For communication between multiple parallel batteries.

Definitions of RJ45 Port Pin

	RS485	CAN
Pin1	These pins shall be NULL.	
Pin2	If not, may influence communication	
Pin3	between BMS and inverter.	
Pin4	-	CAN-H
Pin5	-	CAN-L
Pin6	CAN-GND	CAN-GND
Pin7	485A	-
Pin8	485B	-
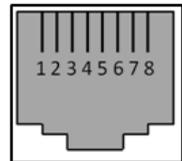
RJ45 Port
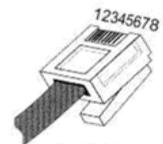
RJ45 Plug

F. Power Switch

ON: Power On.

OFF: Power Off, for storage or shipping.

G. Start (SW)

ON: Press more than 0.5s to start the battery.

OFF: Press more than 0.5s to turn off the battery.

H. Protection

Protection light: RED LED indicates that the battery is under BMS protection, combined with SOC LEDs to show which kind of protection in detail. More details can be found in the following "LED Status Indicators" table.

J. Alarm (ALM)

Alarm light: YELLOW LED indicates that the battery has alarm, combined with SOC LEDs to indicate which kind of alarm in detail. More details can be found in the following "LED Status Indicators" table.

K. SOC

SOC lights: 4 green LEDs indicate the battery's current capacity.

L& M. Power Terminals (+/-)

Power cable terminals: there are two pair of terminals with same function, one is connected s to equipment, the other is connected in parallel to other battery modules for capacity expansion.

Lock Button →

⚠ **Caution:** For power cables with self-locked connectors, keep pressing this Lock Button while pulling out the power plug.
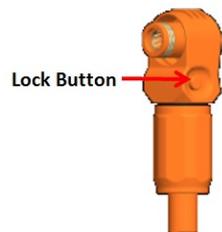
LED Status Indicators

It`s important to check the detailed alarm/protection definitions according to the following table for trouble-shooting and maintenance service.

Condition	Protect	ALM	100~76%	75~51%	50~26%	25~0%	Description
Turn off	●	●	●	●	●	●	All LED lighting until battery is Off.
Power off	-	-	-	-	-	-	
Turn on	●	●	●	●	●	●	Flash once.
Idle			●				Only current SOC status LED slowly flashes.
Charge				●			Only current SOC status LED solid.
Discharge			100-76%●●●● → 75-51%●●● → 50-26%●● → 25-0%●				Residual SOC LEDs flash per second.
Alarm	-	●	Show SOC				Alarm: high current.
Alarm	-	▊	Low SOC (SOC ≤ 5% or single cell voltage ≤ 2.9 V).				
Protection	●		●				Charge MOS OFF. Possible reason: charging over current; Over Voltage.
Protection	●			▊			Discharge MOS OFF. Possible reason: discharging over current; Low Voltage; Short circuit; Reverse polarity.
Protection	●		●	▊			Charge and discharge MOS all OFF. Possible reason: Over/Low Temperature; MOS Over Temperature; BMS error.
Protection	▊		Show SOC				Internal communication error, Address assignment error.
Protection	●	●					**Critical failure**: MOSFAIL; FUSE broken.
●: flash 1.5s off/0.5s on			▊/▊/●: flash 1s off/1s on			● / ● / ● : constant lighting	

BMS basic function

Protection and alarm	Management and monitor
Charge/Discharge End	Cells Balance
Charge Over Voltage	Intelligent Charge Model
Discharge Under Voltage	Charge/Discharge Current Limit
Charge/Discharge Over Current	Capacity Retention Calculate
High/Low Temperature(cell/BMS)	Administrator Monitor
Short Circuit	Operation Record
	Power Cable Reverse
	Soft start of inverter

4. Safe Handling of Lithium Batteries

4.1 Schematic diagram of solution

4.2 Labels

4.3 Safety Gear

It is recommended to wear the following safety gear when dealing with the battery.

| Insulated gloves | Safety goggles | Safety shoes |

4.4 Tools

| Wire cutter | Crimping modular plier | Screwdriver |

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 of the available tools except their tips with electrical tape.

5. Installation and Operation

⚠️ **Caution**

1) According to local electric safety and installation policy, a suitable disconnection device between battery system and inverter could be installed.
2) All the installation and operation must follow local electric standards.

5.1 Package Items

Unpack and check:

### 1) For battery module package:

- Battery Module
- 2 x 210 mm 4 AWG power cables
- 1 x 210 mm RJ45 communication cable
- 1 x 1000 mm 6 AWG grounding cable
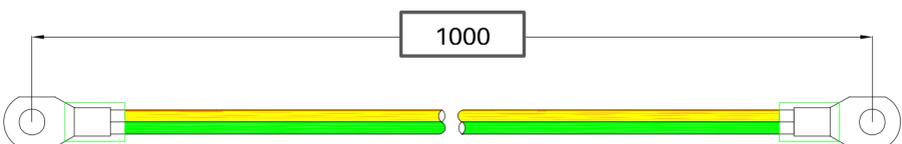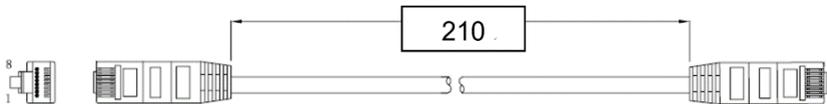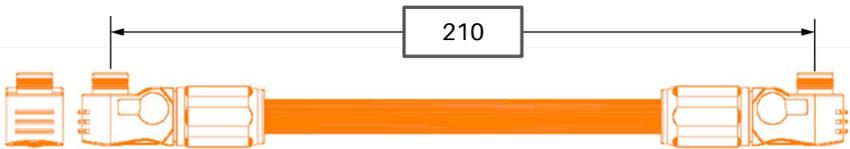
2) For External cable kits:

NOTE: Power and communication cables connected to the inverter belong to an **External Cable Kit, NOT included in battery carton box.** They are in another **extra** small cable box. If there is anything missing, please contact the local dealer.

- 2 x 2000 mm power cables (4 AWG, peak current capacity **120 A,** constant **100 A**) and communication cable for each energy storage system.

- 1 x 3000 mm RJ45 communication cable, specification as below:
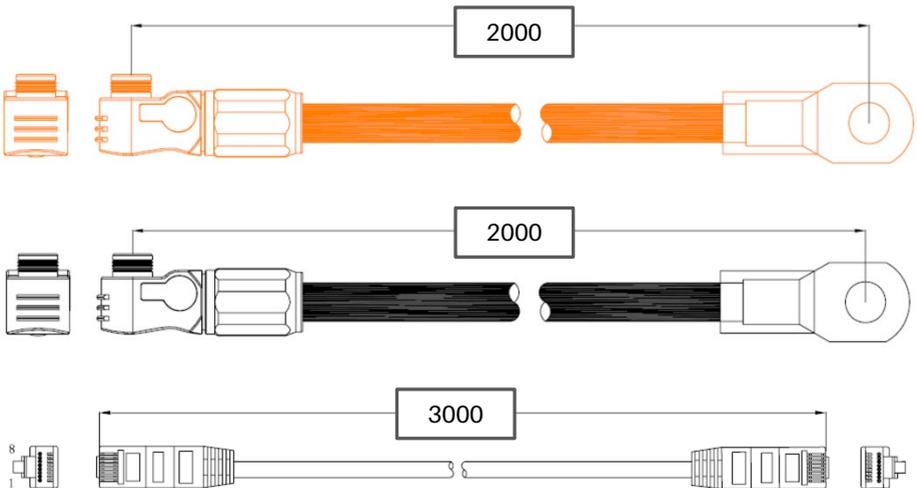
SN of RJ45cable	Mark	Pin	Description
WI0SCAN30RJ1	With blue mark: Battery-Inverter	1~3: NULL 4~8: pin to pin	For connection to inverter and HUB.

For the external cables, the length should be less than 3 meters.

5.2 Installation Location

⚠️ **Caution**

If the ambient temperature is out of the operating range, the battery stops working to protect itself. The optimal temperature range for the battery module operation is 10°C to 40°C. Frequent exposures to harsh temperatures may deteriorate the performance and life of the battery.

Make sure that the installation location meets the following conditions:
1) The area is completely waterproof.
2) The floor is flat and level.
3) There are no flammable or explosive materials.
4) The ambient temperature is within the range from 0°C to 50°C.
5) The temperature and humidity are maintained at a constant level.
6) There is minimal dust and dirt in the area.
7) The distance from heat source is more than 2 meters.
8) The distance from air outlet of inverter is more than 0.5 meters.
9) The installation areas should be protected from direct sunlight.
10) There are no mandatory ventilation requirements for the battery module, but please avoid of installation in confined area. The aeration shall avoid of high salinity, humidity or temperature.

5.3 Installation Direction

NOT allowed:
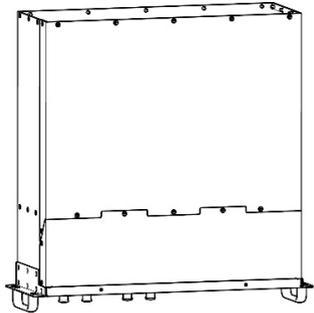
☒ Upside down	
☒ *Caution:* DO **NOT** stack modules together directly.	
☒ Installed only by two handles is **NOT** allowed.	
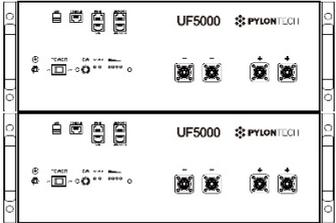
Recommended:

|	
☑ 	☑ *Caution:* Make sure that there is holder for more than 42kg weight at the bottom of each module.

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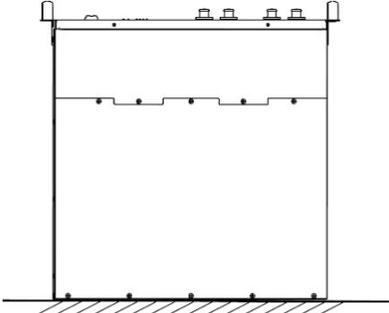
5.4 Grounding

Grounding cables should be 6 AWG or higher yellow-green cables. After connection, the resistance from battery grounding point to Ground connection point of room or installed place should be less than 0.1 Ω.

1) There should be direct metal-to-metal contact between the module surface and the rack surface. If painted racks are used, the paint should be removed from the corresponding place.
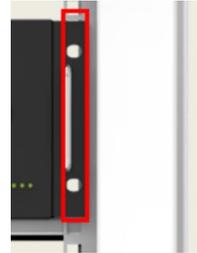
2) Connect a grounding cable to the grounding point of the modules.
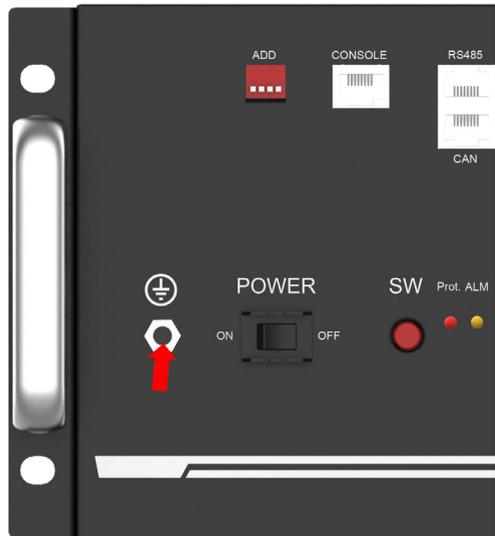
5.5 Installing batteries into the cabinet or rack

Put the battery modules into the cabinet and connect the cables.

1) Put the battery into the cabinet.
2) Fasten the 4 screws for each module.
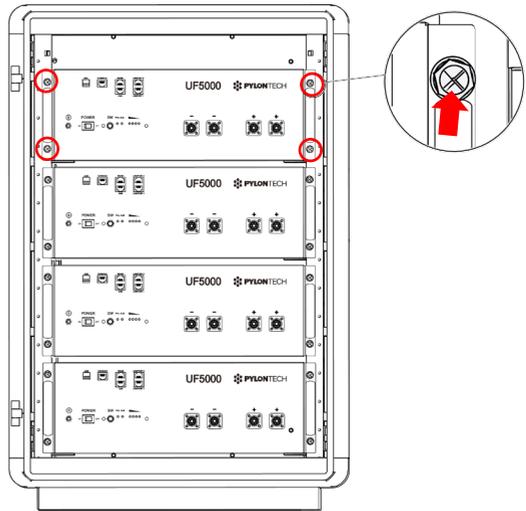
3) Connect the cables between battery modules as shown.
4) Connect the cables to inverter.
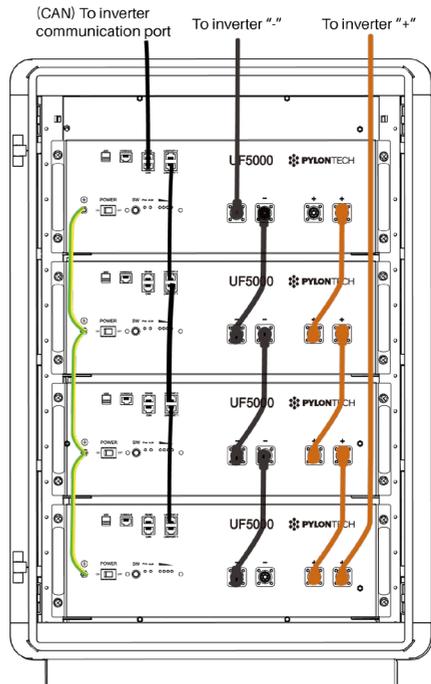
5.6 Stacking the batteries with brackets

1) Install 2 brackets on both the front and back sides of the battery as follows.
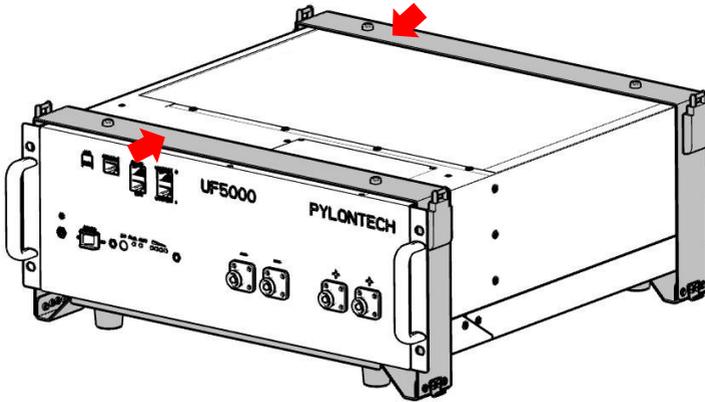
2) Stack the batteries together aligning 4 location holes. And lock the 4 buckles respectively.

NOTE: Maximum 3 batteries are allowed for stacking in one vertical row due to the load-carrying capability of the brackets.
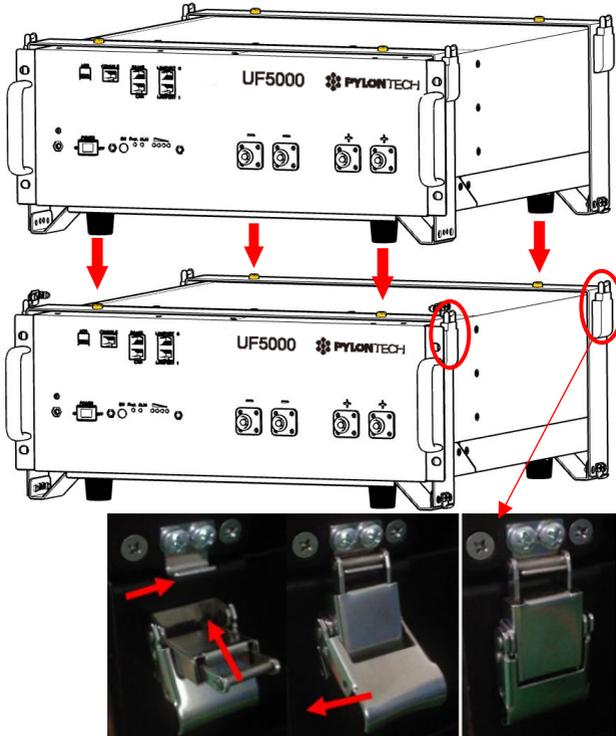
3) Connect the cables between battery modules as shown.

4) Connect the cables to inverter.

(CAN) To inverter communication port   To inverter "-"   To inverter "+"
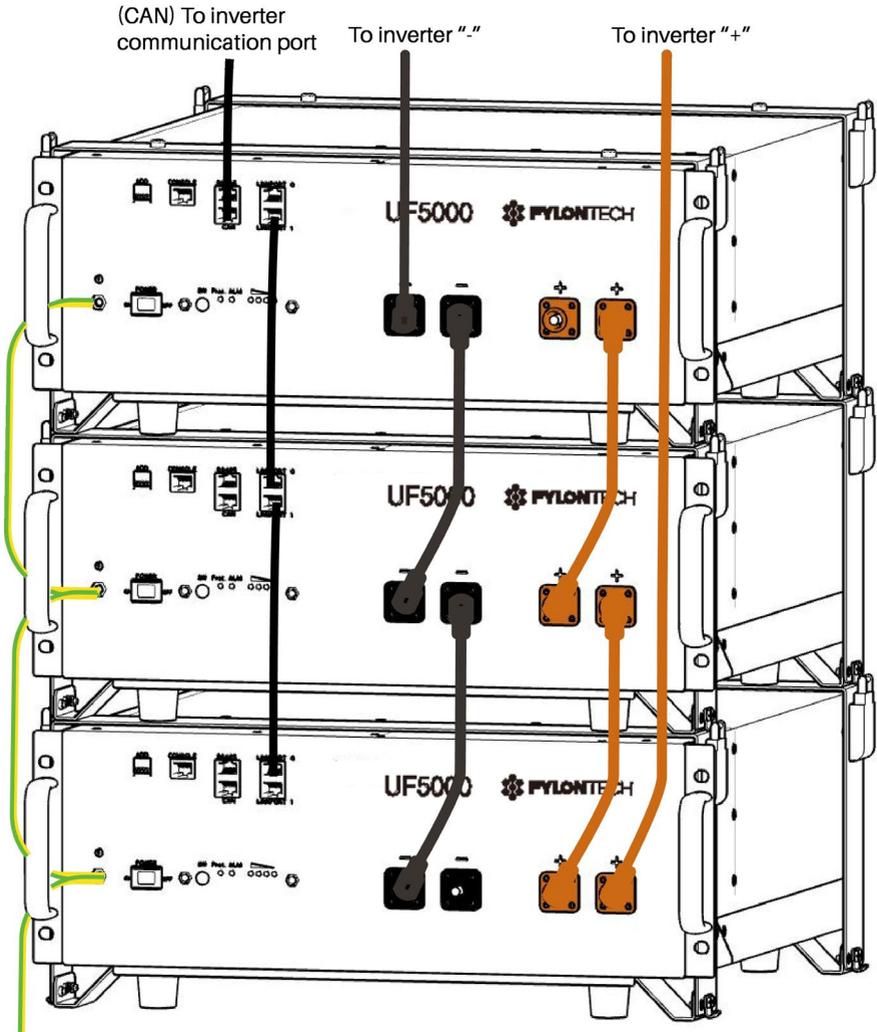
5.7 Installation of the wall mount rack

To save space, UF5000 is equipped with a wall mount rack for vertical installation as shown. For the installation procedure, please refer to the *Installation Guide of Wall Mount Rack* for detailed instructions.

NOTE: Single rack weights about 10 kg. The supporting ground or mounted wall must be strong to hold the overall weight of the battery system (about 136 kg of 3 batteries' system).
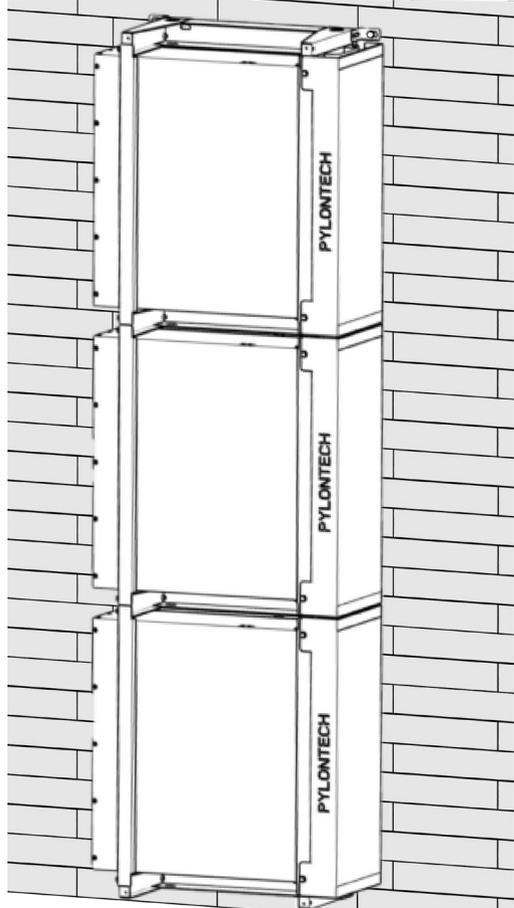
NOTE

After installation, DO NOT forget to register online for full warranty:
www.pylontech.com.cn/service/support

5.8 Suitable disconnection device

It is recommended to have a disconnection device for protection between battery system and inverter:

1) The rated voltage shall be ≥60VDC. **DO NOT** use an AC breaker.

2) The rated current should match with system design.
   The following factors should be considered:
   - the maximum DC current on inverter side.
   - the number of power cable: for instance, if there is only one pair of 4 AWG cable, the rated current of breaker shall be 125A or smaller.

3) If using a breaker, it shall be type C (recommended) or type D.
   The Icu required:
   the maximum short circuit current for calculation of each module is 2500A.
   for instance:

Battery qty.	Icu of breaker
1~4 modules	Must ≥10kA
5~8 modules	Must ≥20kA

5.9 Turning on

Double check all the power cables and communication cables between batteries and between battery and inverter. Switch ON the disconnection device between battery and inverter if available.

1) Switch on all the battery modules:
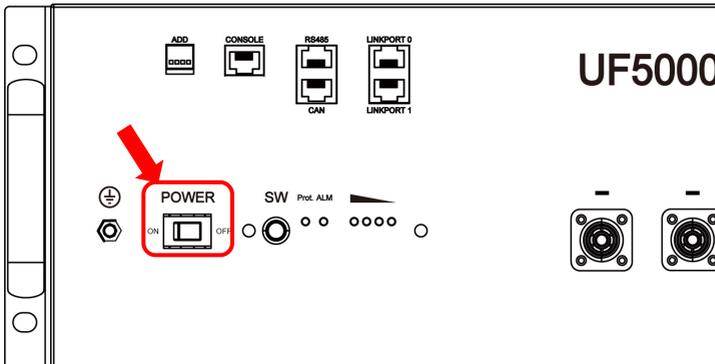
2) The one with **empty** **Link Port 0** is the **Master Battery** Module, others are slaves (1 master battery configuring maximum 19 slave batteries).
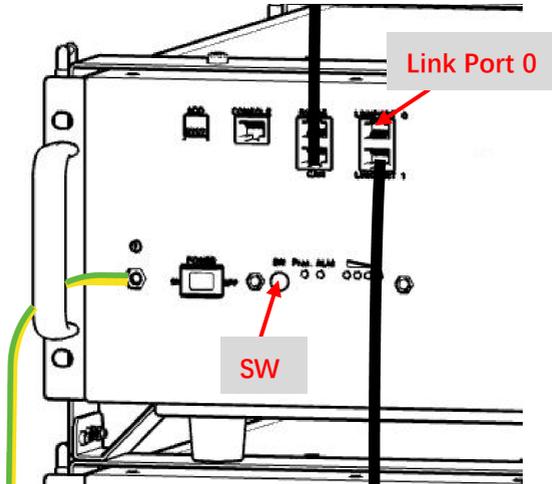
3) Press the **red SW button** of **master battery** to power on. After the master battery LED turns on, the LEDs on all the slave batteries will be on at the same time.
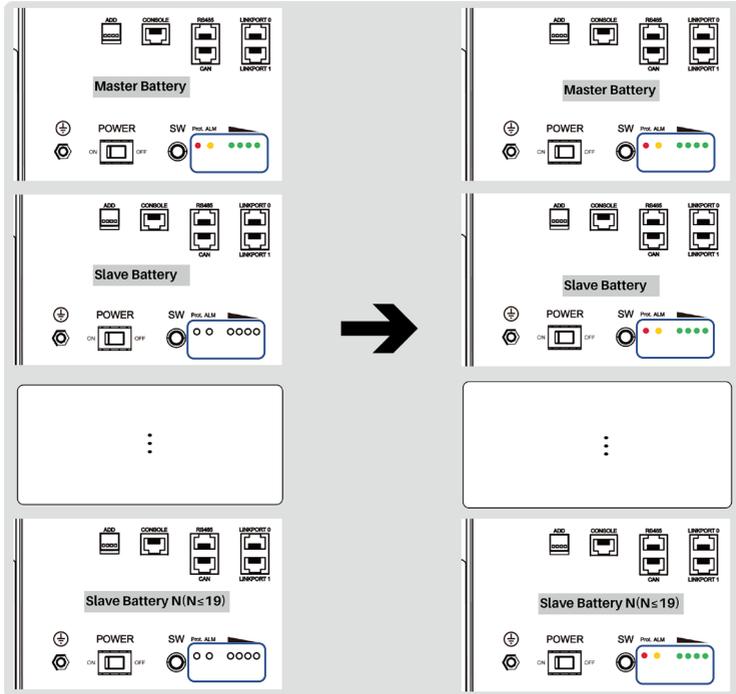
NOTE:
1) After the battery module is powered on, the soft-start function takes **3 seconds** to activate. When the soft start is complete, the battery is ready for high power output.
2) When connecting modules with different SOC/voltage in parallel during expansion or replacement, it is recommended to maintain the system in IDLE for ≥15 minutes or till the SOC LEDs become similar (≤1dot difference) before normal operation.

5.10   Turning off

1) Turn external power source off.
2) Press red SW switch of master battery. Then all batteries will be off.
3) Turn Power Switch to OFF on master battery and all slave batteries.
4) Switch off the disconnection device between battery system and inverter, if available.

6. Trouble shooting

● **Communication related problems**

Unable to communicate with inverter on compatible list.

Possible conditions:

1) RS485: baud rate. Check the dip switch1, set to correct one, and restart.
2) CAN: pin definitions. Try to connect the CAN-H, L, GND only and do not connect other pins to the inverter, using the correct cable.

● **Function related problems**

1) Whether the battery can be turned on or not
2) If the battery is turned on, check that the red light is off, flashing or lighting
3) If the red light is off, check that the battery can be charged/discharged.

Possible conditions:

1) Battery cannot be turned on or switched ON. And the lights are all not lighting or flashing when pressing the red SW.
a) Capacity too low, or module over discharged.

   Solution: use a charger or inverter to provide 51.2~56.8 V voltage.
   If the battery can be turned on, then keep charging the module and use monitor tools to check the battery log.
   Depending on the different battery terminal voltages, take the following 2 methods:
   - If the battery terminal voltage is ≤45 VDC, use ≤0.05 C to slowly charge the module to avoid affecting SOH;
   - If battery terminal voltage is >45 VDC, use ≤0.5 C to charge.

   If the battery cannot start, turn off and repair the battery.

2) The battery can be turned on, but red light is on, and the battery cannot charge or discharge. If the red light is on, it means that system is abnormal. Please check the following values:
b) Temperature: If the temperature is above 60°C or under -10°C, the battery will not work.

   Solution: move battery to the normal operating temperature range between 0°C and 50°C.

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c) Current: If the current exceeds 100 A, the battery protection will be activated.
   Solution: Check whether current is too large, and if it is, change the settings on power supply side.

d) High Voltage: If the charging voltage is above 57.6 V, battery protection will be activated.
   Solution: Check whether voltage is too high. And if it is, change the settings on power supply side. And discharge the module.

e) Low Voltage: When the battery discharges to 45 V or less, battery protection will be activated.
   Solution: Charge the battery till the red light is turned off.

f) High Cell voltage: The module voltage is lower than 56.8 V, SOC LEDs are not all on. When discharging the module, the protection disappears.
   Solution: Keep charging the module by 56~56.8 V or keep the system cycle. The BMS can balance the cell during cycling.

3) Unable to charge and discharge with red LED on. The temperature is 0~50°C. Use charger to charge, not possible. Use load to discharge, not possible.

g) Under permanent protection. The single cell voltage is higher than 4.2 V or lower than 1.5 V; Or single cell temperature is higher than 80°C.
   Solution: Switch off the module and contact your local distributor to repair.

4) Unable to charge and discharge without red LED off. The temperature is 0~50°C. It is impossible to use charger to charge and load to discharge.

h) Fuse broken.
   Solution: Switch off the module and contact your local distributor for repair.

5) Buzzer rings and Protect LED red.

i) Over voltage protection.
   Cell voltage higher than 3.9 V or module voltage higher than 59.5 V.

   Solution: Battery system requires properly established communication with inverter and correct settings on inverter to run safely. Check that the

setting of the inverter or charger, the charge voltage should be 56~56.8 VDC; Check whether the communication between battery system and inverter is established; Check whether the ADD switch on battery module is set correctly.

Under this condition, the BMS remains functional without damage. Just leave the module switched OFF and wait for the battery voltage to drop down naturally (15 minutes) and then restart. If then no alarm comes out, this means the module is ready for work.

j) Reverse connection of cables.
Solution: Power off all batteries and inverters. Disconnect breaker. Check the cable connection and disconnect all power cables. Check that the power port is damaged. Then try to turn on the single module without any cable connected. If there is no alarm, then it is reverse connection of cables. Switch off the module and contact your local distributor.

k) MOSFAIL.
Solution: Power off all batteries and inverters. Disconnect breaker. Check the cable connection and disconnect all power cables. Check that the power port damaged. Check the setting of inverter or charger. Check the communication between inverter and battery system.
Try to turn on the single module without any cable connected. If the buzzer still rings, switch off the module and contact your local distributor.

6) After switching on, the module turns on directly.
l) BMS failure.
Solution: Switch off the module and contact your local distributor.

Excluding the points above, if the faulty still cannot be located, turn off battery and contact your local distributor.

7. Emergency Situations

Caution: Damaged batteries may leak electrolyte or produce flammable gas.

Problem	Description		Action
Leaking Batteries	If the battery pack leaks electrolyte, avoid contacting with the leaking liquid or gas. If anyone is exposed to the leaked substance, immediately perform the actions.	Inhalation.	Evacuate the contaminated area and seek medical attention.
		Contact with eyes.	Rinse eyes with flowing water for 15 minutes and seek medical attention.
		Contact with skin.	Wash the affected area thoroughly with soap and water, and seek medical attention.
		Ingestion.	Induce vomiting and seek medical attention.
Fire	The battery cell is catching fire.		1. Firstly, cut off the external power supply. 2.Then use vast of water for suppression. 3. After extinguishing the fire, soak the battery in water and contact Pylontech or an authorized dealer.
	The cabling or other component (not battery cell) is catching fire.		1. Firstly, cut off the external power source. 2. Then use dry powder fire or carbon dioxide extinguisher for suppression.
Wet Batteries	The battery module is wet or submerged in water.		1. Cut off all power switch on inverter side. 2. DO NOT let people access it, and contact Pylontech or an authorized dealer for technical support.
Damaged Batteries	Damaged batteries are dangerous and must be handled with the utmost care. They are not fit for use and may pose a danger to people or property.		If the battery pack seems to be damaged, pack it in its original container, and then return it to Pylontech or an authorized dealer.

8. Remarks

8.1 Recycle and disposal.

If a battery (normal condition or damaged) needs disposal or needs recycling, follow the local recycling regulation (i.e. Regulation (EC) № 1013/2006 among European Union) to process, and use the best available techniques to achieve a relevant recycling efficiency.

Li-ion ▬

8.2 Storage, Maintenance and Expansion

1) It is required to charge the battery at least once every 6 months, ensure that the SOC is charged to higher than 90% for this charge maintenance.

2) It is suggested to check the connection of power connector, grounding point, power cables and screws every year after installation. Make sure that there is no loose, no broken, no corrosion at connection points. Check the installation environment such as dust, water, insect etc. Make sure that it is suitable for IP20 battery system.

3) A new battery module can be added onto an existing system at any time. Make sure that the new battery is acting as the master. The new module, due to a higher SOH may have a difference on SOC with existing system, but it will not affect the parallel connection system performance.

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