PYLONTECH


# Lithium Phosphate Energy Storage System

# Force-H3 Operation Manual

This manual introduces Force-H3 from Pylontech. Force-H3 is a high voltage Lithium-Ion Phosphate Battery storage system.

Please read this manual before you install the battery and follow the instructions carefully during the installation process.

In case of any confusion, please contact the supplier immediately for advice and clarification.

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# 1.0 SAFETY

Force-H3 is a high voltage DC system, operated by skilled/qualified personnel only. Read all safety instructions carefully prior to any work and observe them at all times when working on 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.

## 1.1 Skills of Qualified Personnel

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 this manual and other related documents;
- knowledge of the local regulations and directives.

## 1.2 Simbols

| | |
|---|---|
|  | **DANGER**<br>**Lethal voltage!**<br>**Battery strings will produce DC power and can cause a lethal voltage and an electric shock.**<br>**Only qualified person can perform the wiring of the battery strings.** |
|  | **Warning**<br>**Risk of battery system damage or personal injury.**<br>**Do not pull out the connectors while the system is working!**<br>**De-energize from all multiple power sources and verify that there is no voltage.** |
|  | **Caution**<br>**Risk of battery system failure or life cycle reduces.** |
|  | **Read the product and operation manual before operating the battery system!** |
|  | **Danger! Safety!** |
|  | **Warning electric shock!** |
|  | **Do not place near flammable material** |

| | |
|---|---|
|  | **Do not reverse connection the positive and negative.** |
|  | **Do not place near open flame.** |
|  | **Do not place at the children and pet touchable area.** |
|  | **Recycle label.** |
|  | **Label for Waste Electrical and Electronic Equipment (WEEE) Directive (2012/19/EU)** |
|  | **CE Marking** |
|  | **The certificate label for Safety by TÜV SÜD.** |

**Danger.**
Batteries deliver electric power, resulting in burns or a fire hazard when they are short circuited, or wrongly installed.

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

**Warning.** Do not open or deform the battery module, otherwise the product will be out of warranty scope.

**Warning.** Whenever working on the battery, wear suitable personal protective equipment (PPE) such as rubber gloves, rubber boots and goggles.

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

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

**Caution.** Incorrect inverter parameters will lead to a further faulty/damage to battery.

**Caution.** It is very important and necessary to read the user manual carefully (in the accessories) before installing or using battery. Failure to do so or to follow any of the instructions or warnings in this document can result in electrical shock, serious injury, or death, or can damage battery, potentially rendering it inoperable.

- If the battery is stored for long time, it is required to charge them every six months, and the SOC should be no less than 90%.
- Battery needs to be recharged within 12 hours, after fully discharged.
- Do not install the product in outdoor environment, or an environment out of the operation temperature or humidity range listed in manual.
- Do not expose cable outside.
- Do not connect power terminal reversely.
- All the battery terminals must be disconnected for maintenance.
- Any foreign object is prohibited to insert into any part of battery.
- Do not use cleaning solvents to clean battery.
- Do not expose battery to flammable or harsh chemicals or vapors.
- Do not paint any part of battery, include any internal or external components.
- Do not connect battery with PV solar wiring directly.
- Please contact the supplier within 24 hours if there is something abnormal.
- The warranty claims are excluded for direct or indirect damage due to items above.

## 1.3 Before connection

- After unpacking, please check product and packing list first, if the product is damaged or lack of parts, please contact the local retailer.
- Before installation, be sure to cut off the grid power and make sure the battery is in the switched-off mode.
- Wiring must be correct, do not mistake the positive and negative cables, and ensure no short circuit with the external device.
- It is prohibited to connect the battery with AC power directly.
- Battery system must be well grounded and the resistance must be less than 100mΩ.
- Please ensure the electrical parameters of battery system are compatible to related equipment.
- Keep the battery away from water and fire.

## 1.4 During the use

- If the battery system needs to be moved or repaired, the power must be cut off and the battery is completely shut down in advance.
- It is prohibited to connect the battery with different type of battery.
- It is prohibited to put the batteries working with faulty or incompatible inverter.
- It is prohibited to disassemble the battery (QC tab removed or damaged).
- In case of fire, only dry powder fire extinguisher can be used, liquid fire extinguishers are prohibited.

## 1.5 Abbreviations Used in this Manual

**Pylontech:** Pylon Technologies Co., Ltd.

**QC:** “Quality Control”. Quality Control ensures that finished products comply with technical and operational specifications.

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

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

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

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

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

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

**UPS:** “Uninterruptible Power Supply”. The Uninterruptible Power Supply is a device that provides emergency power to critical loads in the event of a power outage

**PMU:** “Power Management Unit”. The Power Management Unit manages and regulates the distribution of electrical energy within the system, optimizing the use of available power and protecting the system from overloads or other anomalies.

**CMU:** “Control Management Unit”. The CMU is the central unit that ensures that all components of the energy storage system work together in a safe and coordinated manner. The CMU interfaces with the Battery Management System (BMS) and other management units such as the Energy Management System (EMS) and the Power Management Unit (PMU) to coordinate the flow of energy and maintain the balance between battery charging and discharging.

# 2.0 SYSTEM INTRODUCTION

## 2.1 Product Introduction

Force-H3 is a high voltage battery storage system based on lithium iron phosphate battery, which is one of the new energy storage products developed and produced by Pylontech. It can be used to provide reliable power for various types of equipment and systems. Force-H3 enables multiple strings parallel operation feature, which provides tremendous flexibility in system design and configuration. Force-H3 is especially suitable for those application scenes which require flexible capacity extension, high power output, limited installation space, restricted load-bearing and long cycle life.

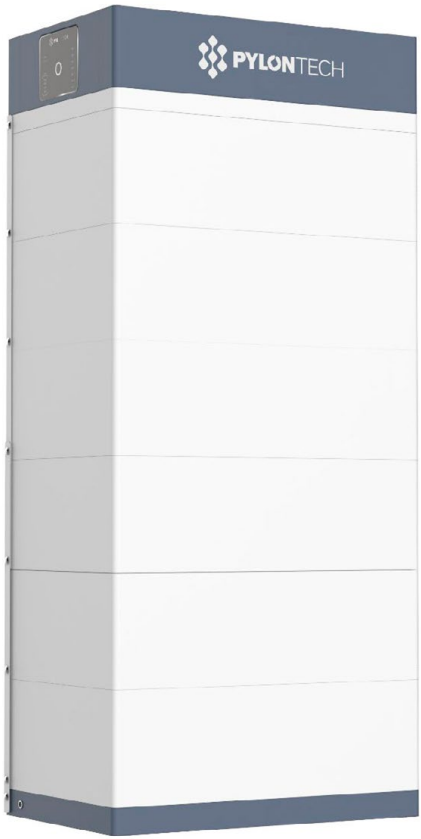



Fig. 2.1 - The above picture is just for reference. The quantity of the battery modules is based on your practical system.

## 2.2 Single string system parameters

| MODEL | Force-H3 | | | | | |
|---|---|---|---|---|---|---|
| Cell technology | Li-ion (LFP) | | | | | |
| Battery module quantity [pcs] | 2 | 3 | 4 | 5 | 6 | 7 |
| Battery system voltage [V] | 204.8 | 307.2 | 409.6 | 512 | 614.4 | 716.8 |
| Battery system capacity [kWh/Ah] | 10.24/50 | 15.36/50 | 20.48/50 | 25.6/50 | 30.72/50 | 35.84/50 |
| BMS module name | FC1000 | | | | | |
| Battery module name | FH10050 | | | | | |
| Battery system max charge voltage [V] | 230.4 | 345.6 | 460.8 | 576 | 691.2 | 806.4 |
| Battery system min discharge voltage [V] | 185.6 | 278.4 | 371.2 | 464 | 556.8 | 649.6 |
| Battery System Capacity [A] | 50 | | | | | |
| Battery Module Capacity [A] | 50 | | | | | |
| Battery Module Voltage (Vdc) | 102.4 | | | | | |
| Charge / discharge test current [A] (*) | 10 | | | | | |
| Battery system charge/discharge current [A] | 50 | | | | | |
| Battery system max charge/ discharge current [A] | 55 @15" | | | | | |
| Short circuit evaluation [A] | <3000 @2ms | | | | | |
| Efficiency [%] | 96 | | | | | |
| Depth of Discharge [%] | 95 | | | | | |
| Communication bus | CANBUS/Modbus RTU | | | | | |
| Operation temperature [°C] (**) | -10 ~ 55 | | | | | |
| Storage temperature [°C] | -20 ~ 60 | | | | | |
| Humidity [%] | 5 ~ 95 | | | | | |
| Altitude [m] | <4000 | | | | | |
| Altitudine [m] | IP55 | | | | | |
| Operation life [years] | 15+ | | | | | |
| Transport certificate | UN38.3 | | | | | |
| Environmental certification | RoHS, Reach, WEEE | | | | | |
| Product certificate | UL1973, IEC62619, IEC63056, IEC62040-1, VDE-AR-E 2510-50, UL9540A, CE RED, CE LVD | | | | | |
| Dimensions 540x350xH [mm] | 530 | 700 | 870 | 1040 | 1210 | 1380 |
| Weight [kg] | 92 | 131 | 170 | 209 | 248 | 287 |

*(*) Current value used to determine the capacity of the battery during test*

*(**) 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.*

## 2.3 Multi-strings System Parameters (Max. 6 Strings per System)

For multi-strings operation, please make sure:

- the battery type in the whole system is the same;
- the battery amount of each string is the same.

| Product Type | Force-H3 in multi-strings | | | | |
|---|---|---|---|---|---|
| Battery System string amount(pcs) | 2 | 3 | 4 | 5 | 6 |
| Battery System Voltage [Vdc] (1) | 204.8 / 307.2 / 409.6 / 512 / 614.4 / 716.8 | | | | |
| Battery System capacity [Ah] | 100 | 150 | 200 | 250 | 300 |
| Standard Battery System Operation Current [A] (2) | 14.8 | 22.2 | 29.6 | 37 | 44.4 |
| Normal Battery System Operation Current [A] | 80 | 120 | 160 | 200 | 240 |
| Max Battery System Operation Current [A, @15'] | 110 | 165 | 220 | 275 | 330 |
| Normal P-Combiner 3/6-V2 Operation Current [A] | 50 (3) | | 100 (4) | | |
| Normal P-Combiner 3/6-V2 Operation Current [A, @15"] | 80 (3) | | 160 (4) | | |

**Importante**: DO NOT use P-Combiner-HV-3/6-V2 or similar concept of multi-strings connection method in case the multiple battery strings need to be operated independently.

*(1) The Battery System Voltage varies depending on battery amount in serial per string*

*(2) Current value used to determine the capacity of the battery during test.*

*(3) The current is based on BMS theoretical operation current. If using P-Combiner 3-V2 as the combiner box of the multi-strings` battery system wiring connection, the max. continuous operation current is 50Amps, max. peak operation current is 80Amps for 15 seconds. Please make sure the real operation current not exceed the combiner box power rating.*

*(4) The current is based on BMS theoretical operation current. If using P-Combiner 6-V2 as the combiner box of the multi-strings` battery system wiring connection, the max. continuous operation current is 100Amps, max. peak operation current is 160Amps for 15 seconds. Please make sure the real operation current not exceed the combiner box power rating..*

## 2.4 Battery Module Specifications

Fig. 2.2 - FH10050 Battery Module

| Model | FH10050 |
|---|---|
| Cell Technology | Li-ion (LFP) |
| Battery Module Capacity (kWh / Ah) | 5.12/50 |
| Dimensions WxHxD [mm] | 540x350x170 |
| Weight [kg] | 39 |
| Battery Module Voltage [V] | 102.4 |
| Battery Cell Voltage [V] | 3.2 |
| Battery Cell Capacity [Ah] | 50 |
| Battery Module Serial Cell Quantity | 32 |
| Operation Cycle Life [5] | 8000 |
| Operation Temperature [°C] [6] | -10 ~ 55 |
| Storage Temperature [°C] | -20 ~ 60 |
| Operation Life [years] | 15+ |
| Transfer Certificate | UN38.3 |

Tab. 2.1 - Battery module parameters

*(5) Operation Cycle Life is defined based on specific operation conditions, for more details please check with Pylontech service team.*

*(6) 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.*

## 2.5 Control Module Specifications


Fig. 2.3 - BMS FC1000 Controller

| Model | FC1000 |
|---|---|
| Related Product | FH10050 |
| Controller Working Voltage (Vdc) | 80-1000 |
| System Operation Voltage (Vdc) | 172.8-921.6 |
| Charge Current (Ampere, Max.@15min) | 55 |
| Discharge Current (Ampere, Max.@15min) | 55 |
| Self-consumption (W) | <16 |
| Dimensions (WxHxD, mm) | 540x350x150 |
| Weight (kg) | 12 |
| Communication Protocol | CANBUS/Modbus RTU |
| Operation Life (anno) | 15+ |
| Operation Temperature [°C] | -10-55 |
| Storage Temperature [°C] | -20-60 |

Tab. 2.2 - Control Module Parameters

### 2.5.1 Control Module Display Panel

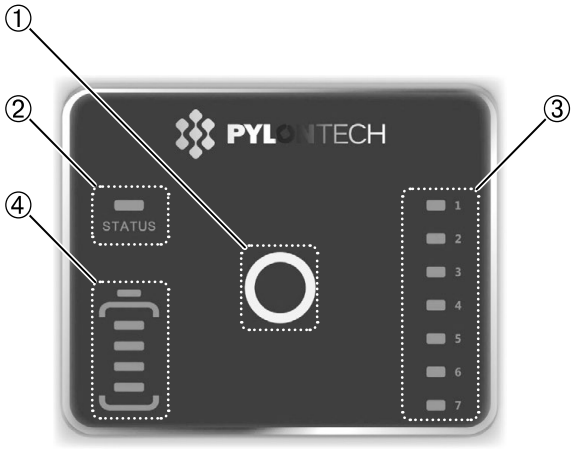



Fig. 2.4 - BMS FC1000 Display controller

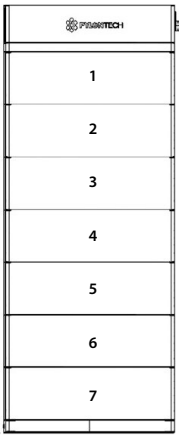



Fig. 2.5 - Force-H3

1. **BUTTON LED**
   - Short Press: Display the LED panel for 20sec.
   - Long Press 1 (about 5~10 secs):
     When System Status LED fast flashes blue, release the button, then it is 115200 baud rate of RS485;
     When System Status LED fast flashes orange , release the button, then it is 9600 baud rate of RS485.
     **Note:** If a special protocol (except Pylontech Protocol) is selected, follow 'Long Press 2', then the baud rate changing described here is ineffective.
   - Long Press 1 (>10 secs):
     Communication Protocol Selection, for details please check with Pylontech service team. Communication Protocol Selection Guidance.
2. **STATUS LED.** Read "Tab. 2.3 - LED Indicators Instructions" at page 17.
3. **BATTERY MODULE STATUS LED**
   - Each Status LED (1~7) represents one individual battery module from number 1 (the one right beneath the control module) to number 7 (the one next to the base), as shown in Fig. 2.5.
   - If your system has less than 7 battery modules, the Status LED without corresponding battery will be always OFF.
     Blue light: Normal.
     Orange light: Individual module alarm or protection occurs.
     See "5.2 Trouble shooting" at page 48

**4. SYSTEM CAPACITY STATUS LED**

Indicate the system SOC. Each LED indicates 25%SOC.

| CONDITION | STATUS | | NOTE |
|---|---|---|---|
| Self-checking | Blue, Flashing | All flashing | |
| Self-checking failure | Orange, Slow flashing | Off | See “5.2 Trouble shooting” at page 48 |
| Black start success | Blue, fast flashing | Off | |
| Black start failure | Orange, fast flashing | Off | See “5.2 Trouble shooting” at page 48 |
| Communication Lost or BMS error | Orange, solid | Indicating SOC, Blue, solid | See “5.2 Trouble shooting” at page 48 |
| Idle | Blue, slow flashing | Indicating SOC, Blue, solid | |
| Charge | Blue, solid | Indicating SOC, Blue, solid | |
| Floating charge | Blue, solid | All flashing, horse race lamp | |
| Discharge | Blue, flashing | Indicating SOC, Blue, solid | |
| System sleep | Blue, flashing | Off | Battery module status off |

Tab. 2.3 - LED Indicators Instructions

- Flashing: 0.5s ON/0.5s OFF.
- Slow flashing: 2.0s ON/1.0s OFF.
- Fast flashing: 0.1s ON/0.1s OFF.

### 2.5.2 Control Module Interface Panel

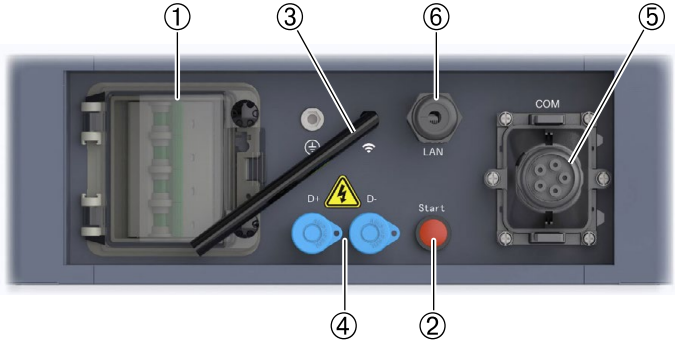



Fig. 2.6 - Control Module Interface Panel

1. **Power Switch (under the protection cover)**
   ON: Power Switch ON, able to turn on battery system by Start Button. OFF: Power Switch OFF, able to turn off system completely, no power output.

**Caution.** If the power switch is tripped off due to over current or short circuit, be sure to wait more than 30mins, then you can turn it on again; otherwise it may cause damage to the switch.

**Note.** After using the power switch, lock the protection cover by tightening the two screws on the cover to make it water-proof.

2. **Start Button**
   press this button and hold more than 5 secs until the buzzer rings to turn on the controller.

**Multi-strings starting sequence.**
Please start up the last string (from communication structure, the last slave string, see the table blow) of battery system first, one by one to the first string which shall be started up lastly. Details as below table.

| Communication Structure | Starting Sequence |
|---|---|
| Master string | Last Start up |
| Slave string 1 | 5th Start up |
| Slave string 2 | 4th Start up (if has) |
| Slave string 3 | 3rd Start up (if has) |
| Slave string 4 | 2nd Start up (if has) |
| Slave string 5 | 1st Start up (if has) |

Tab. 2.4 - Multi-strings starting sequence

BMS of the rack with Link Port 0 EMPTY is defined as the Master string, which communicates with the inverter or upper controller. In one system, there's ONLY ONE Master string, the rest are defined as the slave strings.

Black start function: When the system is turned on, and relay is OPEN, press the Start Button more than 10 secs. Then relay will be CLOSE for about10mins without communication (depending on conditions).

**Multi-strings Black Start:** Black start operation is ONLY needed to be performed on Mater string. And it will close circuit for one of the strings within the system for 10mins. The slave string black start function is ONLY controlled by master string.

### 3. WIFI

| | |
|---|---|
| Manufacturer: | Pylon Technologies Co., Ltd. |
| Address: | Stabilimento 8, No.505 Kunkai Road, JinXi Town, 215324 Kunshan City, Provincia di Jiangsu, RPC |
| Importer | Energy S.p.A. |
| Address: | Piazza Manifattura 1, 38068 Rovereto (TN) - Italy |
| Wireless Max. Output Power | 15dBm |
| Operating frequency | 2412-2472 MHz |
| Gain of antenna | Max 3dBi |
| Modulation system | DBPSK/DQPSK/CCK(DSSS)<br>BPSK/QPSK/16QAM/64QAM(OFDM) |
| Modulating Repetition | 1Mbps/2Mbps/5.5Mbps/11Mbps (DSSS)<br>6Mbps/9 Mbps/12 Mbps/18 Mbps/24 Mbps/36 Mbps/48 Mbps/54 Mbps (OFDM)<br>MCS0~MCS7 (802.1 1n 20MHz) |
| Channel spacing | 5 MHz |
| Type of antenna | 2.4G IPEX-SMA |

**NOTA:** For network connection, please san the QR code below to get Network Connecting Instructions or contact Pylontech service team for further quest.

4. **Power Terminals (+/–)**
   Connect power cables of battery system with Inverter.
   During multi-strings operation, you can select P-Combiner-HV-3-V2 (up to 3 strings, max.50Amps) or P-Combiner-HV-6-V2 (up to 6 strings, max.100Amps) for connection.
   For more details of P-Combiner, please check with your distributor or Pylontech service team.
5. **Communication Terminals (RS485 / CAN / RS232 /Link0 / Link1)**
   Before connecting the communication terminals, loosen the two screws on the cover as follows, then you will see the communication terminal as follows. Following instructions are for your reference.

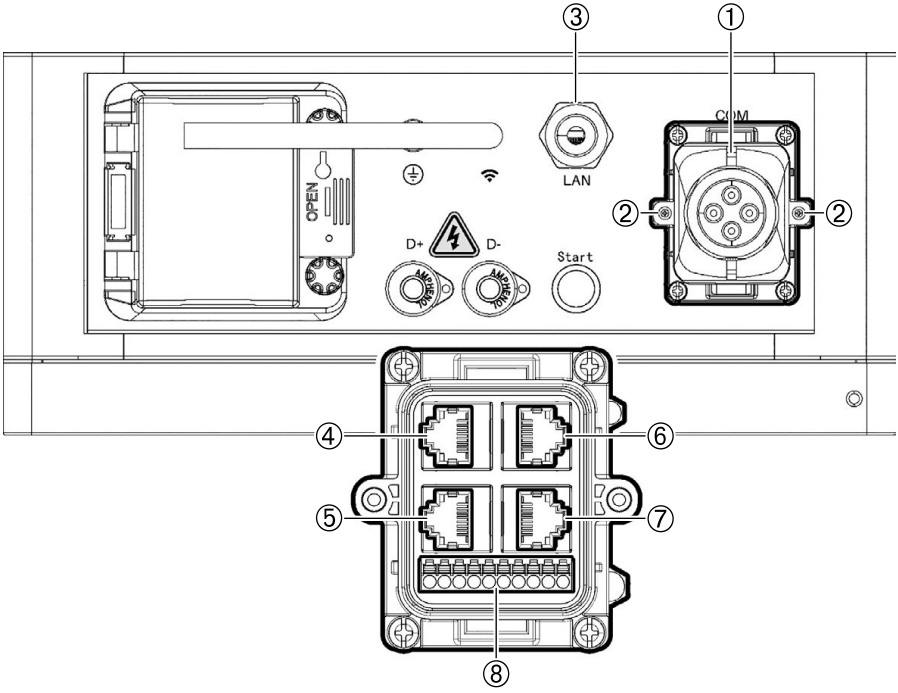


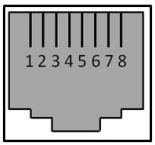

Fig. 2.7 - Communication Terminals

– **LAN** (3, Fig. 2.7) Used for where the Wi-Fi signal is not good or there is no Wi-Fi. To connect to the online portal directly through a network cable (another side to the internet router.
– RJ45 **Link 0** e **Link 1** (4 and 5, Fig. 2.7) (RJ45 port) designed only for multi-strings operation, connecting from the first BMS Link 1 to second BMS Link 0, then from second BMS Link 1 to third BMS link 0 (if has), all the way to the last BMS Link 0. The BMS with Link Port 0 EMPTY is defined as the Master string, which communicates with the inverter or upper controller..

**NOTE**: For multi-strings operation, please firstly make sure the communication cables between multiple BMSs are properly connected between Link 1 and Link 0, prior to the startup process.

– CAN Communication Terminal: (RJ45 port) follows CAN protocol, for communication between battery system and inverter.
– RS485 Communication Terminal: (RJ45 port) follows MODBUS 485 protocol, for communication between battery system and inverter.

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



RJ45 Port

RJ45 Plug

Tab. 2.5 - RJ45 pin port

– 8, Fig. 2.7:

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|
| – | + | GND | H | L | IN+ | IN– | TX | RX | GND |
| E-STOP | | CAN | | | SMA | | RS232 | | |

Tab. 2.6 - Assignment Table

E-STOP: Emergency stop feature is default inactivated. If you need to use such function, please contact Pylontech service team.
IN+/IN-: PIN6/PIN7 terminals are used for SMA inverter Enable Line feature, for more details please check with Pylontech service team.

- **RS232 Communication Terminal: for manufacturer or professionals to debug or service**
  If you have RS232 debug tool (DB9 – USB – RJ45) provided by PYLONTECH before, PIN8~10 here corresponds to PIN3, PIN6 and PIN8 of RJ45.
  If you use a new RS232 debug tool (DB9 – USB), the Pin 8~10 here corresponds to PIN 2,3,5 of DB9 terminal.

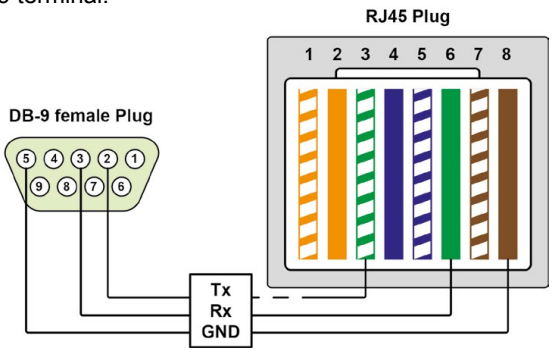



Fig. 2.8 - RS232 - RJ45

| PIN 1-10 | RJ45 |
|---|---|
| PIN 8 | PIN 3 (Green and white) |
| PIN 9 | PIN 6 (Green) |
| PIN 10 | PIN 8 (Brown) |

Tab. 2.7 - RJ45

| PIN 1-10 | RS232 |
|---|---|
| PIN 8 | PIN 2 |
| PIN 9 | PIN 3 |
| PIN 10 | PIN 5 |

Tab. 2.8 - RS232

- For communication cables connection for PIN1~10 terminal station, please follow the steps below:
  - Dismantle the two screws from the communication protection cover (1, Fig. 2.9);
  - Unscrew the plastic nut from the cover (2, Fig. 2.10);
  - Take out the rubber plug(s) from the rubber pad (3, Fig. 2.11);
  - Insert the communication cable into the hole (4, Fig. 2.11);
  - Extract the terminal plug from the terminal socket (5, Fig. 2.12).
  - Follow the instructions of Pin 1~10 Assignment Table (see “Tab. 2.6 - Assignment Table” at page 21), and insert the cable terminal into the corresponding pin of the terminal plug. You can use a screwdriver as shown (8, Fig. 2.12) or your finger to press the button.
  - After cables connection, insert the terminal plug into the terminal socket (5, Fig. 2.12);
  - REMEMBER to install the rubber plugs back in the EMPTY holes of the rubber pad to guarantee water resistance of the cover;
  - screw it back the plastic nut from the cover (2, Fig. 2.10);
  - reposition the protection cover and secure it to the control module with the appropriate screws (1, Fig. 2.9).

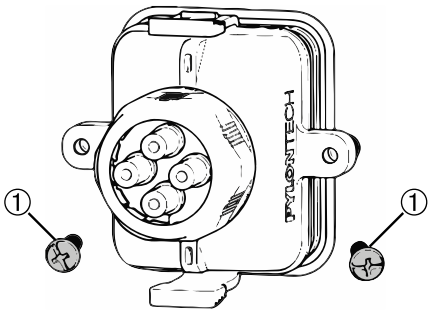



Fig. 2.9 - protection cover screws

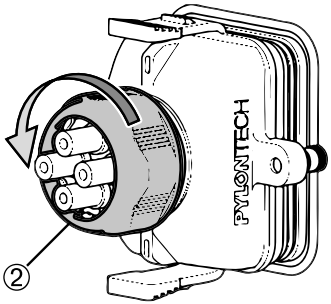



Fig. 2.10 - plastic nut

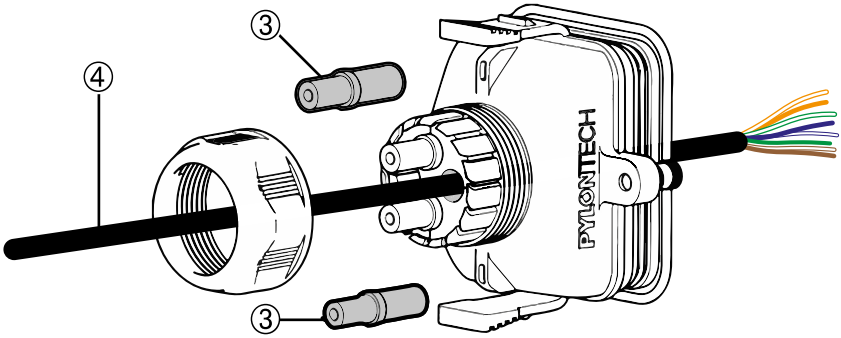



Fig. 2.11 - cable hole

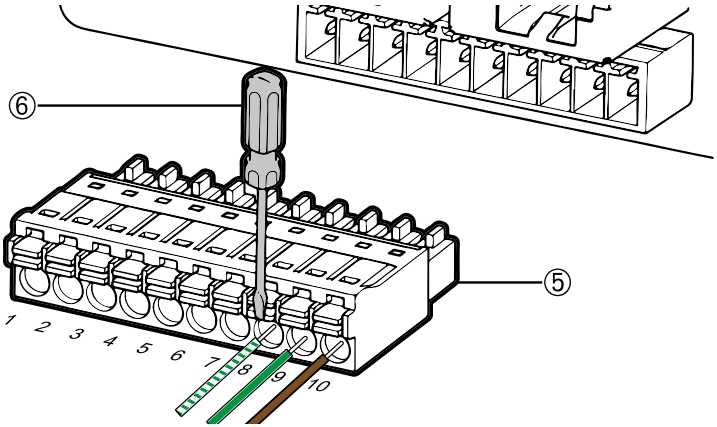



Fig. 2.12 - terminal plug

## 2.6 System Diagram

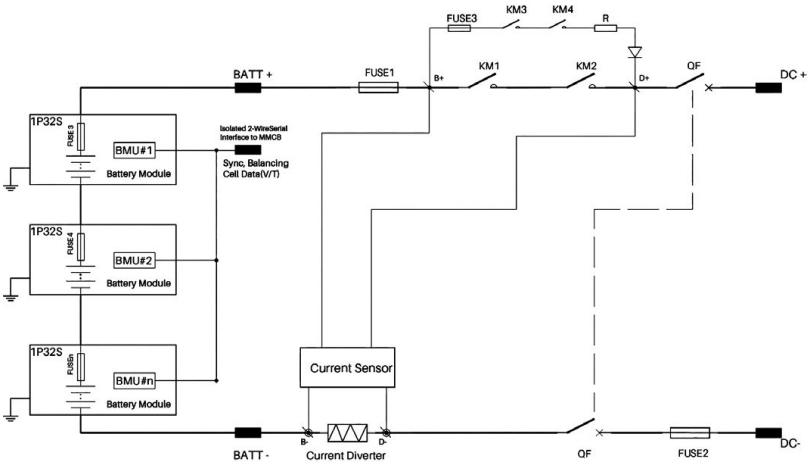



Fig. 2.13 - System Diagram.

# 3.0 INSTALLATION

## 3.1 Tools

| | | | |
|---|---|---|---|
|  |  |  |  |
| Wire Cutter | Crimping Modular Plier | Cable Ties | Screw Driver |
|  |  |  |  |
| Electric Screw Driver | Adjustable Wrench | Isolating nut drivers | Multimeter |

Tab. 3.1 - Tools needed to install battery pack.

**Danger.** 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.

## 3.2 Safety Gear

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

| | | | |
|---|---|---|---|
|  |  |  |  |
| Insulating gloves | Safety goggles | Safety shoes | Helmet |

## 3.3 System Working Environments Checking

### 3.3.1 Cleaning

**Danger!** Before installation and system power on, the dust and iron scurf must be removed to keep a clean environment. The system cannot be installed in desert area without an enclosure to prevent from sand.

Battery module has active DC power at terminals all the time. Be careful to handle the modules

### 3.3.2 Temperature

**Caution.** Force-H3 system working temperature range -10° ~ 55°C; Optimum temperature: 18°C e 28°C.
There are no mandatory ventilation requirements for the battery module, but please avoid installation in confined areas. Avoid high salinity, humidity or high temperature conditions.

**Caution.** The IP rating of Force-H3 system is IP55. But please avoid frost or direct sunlight. Out of the working temperature range will cause the battery system high / low temperature alarm or protection which will further lead to the cycle life reduction. According to the environment requirements, a cooling system or heating system should be installed when necessary.

### 3.3.3 Fire-extinguisher System

**Danger.** Fire-extinguisher system must be equipped for safety purpose.
The fire system needs to be checked regularly to ensure a normal working status. Regarding to the using and maintenance requirements, please follow local fire equipment guidance.

### 3.3.4 Grounding System

**Warning.** Before the battery installation be sure the grounding point of the basement is stable and reliable. If the battery system is installed in an independent equipment cabin (e.g. container), make sure the grounding of the cabin is stable and reliable. The resistance of the grounding system must be ≤100 mΩ**.**

### 3.3.5 Safety area

Minimum clearance to heat source shall be more than 2 meters.
Minimum clearance between battery strings shall be more than 0.3 meters.

## 3.4 Handling and Placement

**Warning.** The battery pile's power terminals has high DC voltage. It must be installed in a restricted access area; Force-H3 is a high voltage DC system, operated by qualified and authorized personnel only.

**Warning.** Single battery module is 39kg. The battery module must be handled by more than 2 personnel if there're no handling tools.
The weight of the base is light, which a single person can handle with.

- Force-H3 system working temperature range: -10°C~55°C; Optimum temperature: 18°C~28°C. DO NOT expose the battery system to direct sun light. It is suggested to build sunshade equipment. In cold area a heating system is required.
- Force-H3 system must not be immersed in water. The battery base cannot be exposed to rain or other water sources. As a suggestion, the base's height shall be >300mm above the ground.
- The support surface should have sufficient load capacity to support the weight of whole battery system (130~300kg).
- Force-H3 system bust be installed on a fixed and flat support surface.
- **When sizing the load of the support base intended for the installation of a single Force-H3 system, it is recommended to consider a minimum value of 2060 kg/m².**

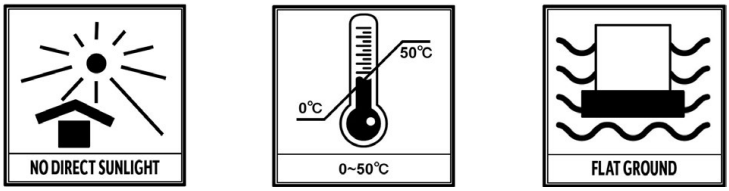



Fig. 3.1 - Do not expose to direct sunlight, temperature range -10°C ~ 55°C, install on flat and even ground.

## 3.5 Packing List

| FC1000 Battery Controller | Set |
|---|---|
| FC1000 Battery Controller | 1 |
| Force-H3 basement (540*350*40, mm) | 1 |
| 3M black external communication cable (RJ45) | 2 |
| 1.5M black internal communication cable (RJ45) | 1 |
| 3M DC+ red external power cable (8AWG) | 1 |
| 3M DC- black external power cable (8AWG) | 1 |
| 1M yellow-green grounding cable (10AWG) | 1 |
| M4 screws for fixing brackets | 18 |
| M8 bolts for fixing basement | 6 |
| M6 screws for fixing ground cable | 1 |
| Product Manual | 1 |
| Warranty card | 1 |
| Qualified Certificate Card | 1 |
| Communication protocol setup manual | 1 |
| 571.5 mm left bracket. For up to 3 battery modules installation | 1 |
| 571.5 mm right bracket. For up to 3 battery modules installation | 1 |
| 706.6 mm bracket. For up to 4 battery modules installation | 2 |
| Anti-Toppling Bracket | 2 |
| M4 screws for fixing the battery module and control moduel | 2 |
| Dismantle tool | 1 |
| Moisture-proof desiccant | 1 |

| FH10050 Battery Module | Set |
|---|---|
| FH10050 battery module | 1 |
| Qualified Certificate Card | 1 |
| Moisture-proof desiccant | 1 |

No additional kits are needed for Force-H3 installation.

## 3.6 Mounting and Installation of the Battery Rack Basement

The base must be fixed securely on the support surface with 4pcs M8×60 expansion bolts.

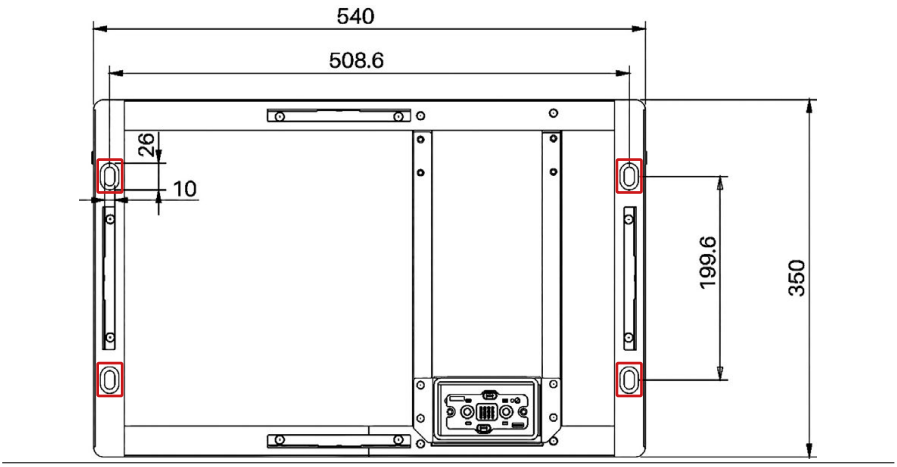



Fig. 3.2 - Battery rack base holes' (circled in red) bitmap (unit: mm)

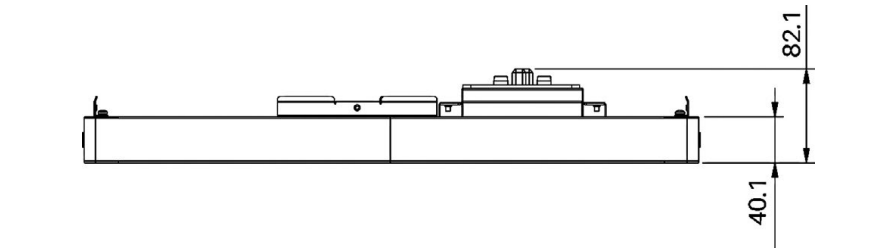



Fig. 3.3 - Battery rack basement bitmap (unit: mm)

## 3.7 Installation of the Battery Module onto the Base

**Warning:** Single battery module is 39kg. The battery module must be handled by more than 2 personnel if there're no handling tools.

- Lift the two handles on the battery module as blow, making sure the battery not tilting to one side (1, Fig. 3.4).
- Adjust to keep the connector of the battery (2, Fig. 3.5) align with the connector of the base (4, Fig. 3.5). Slowly put down the battery, fitting it properly onto the base (3, Fig. 3.5) prestando attenzione all'allineamento dei rispettivi connettori (4, Fig. 3.5).
- Continue to install the left battery modules one by one onto the existing battery (Fig. 3.6, Fig. 3.7).

**Nota:** Max. 7 battery modules to be installed in one system.

**Danger.** When battery is connected together with the base, the internal socket still has high voltage DC power from serial connected battery modules

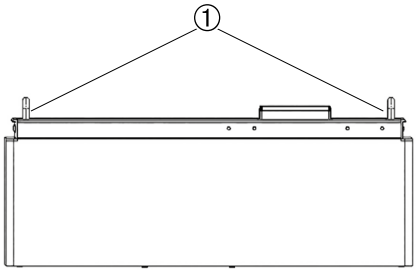



Fig. 3.4 - Battery module handles

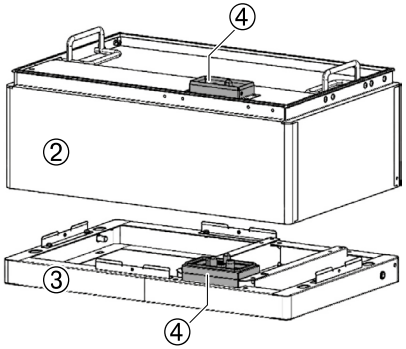



Fig. 3.5 - Battery Module onto the Base

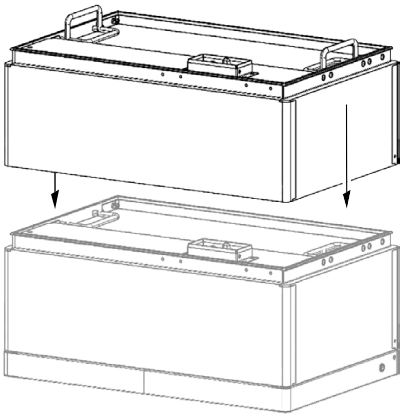


Fig. 3.6 - Module pile up

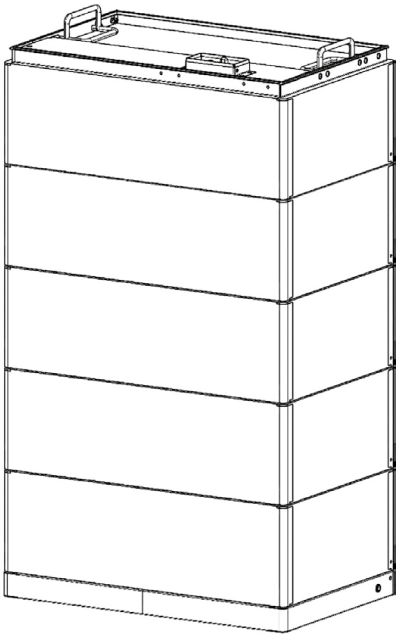


Fig. 3.7 - five module system

## 3.8 Battery Modules and Control Module (BMS) Pile up

After installation of the battery module, lift up the control module (BMS), adjusting to make its connector align with the connector of the battery module.

- Slowly place down the control module (BMS) on the installed battery module (Fig. 3.8).

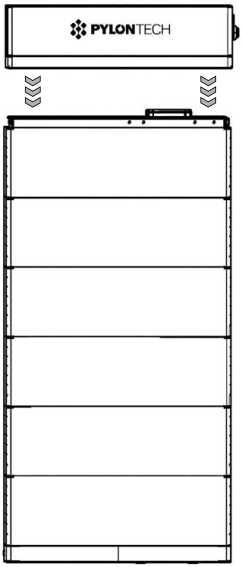



Fig. 3.8 - BMS pile up

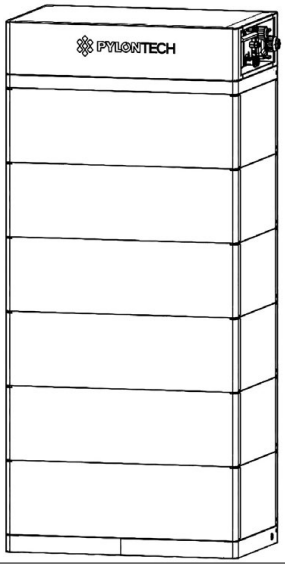



Fig. 3.9 - Sistem completed

**Nota:** The above picture is just for reference. The quantity of the battery modules is based on your practical system.

## 3.9 Installation of the Metal Brackets for the System

In control module's package, there are 2pcs short and 2pcs long metal brackets. Fix these metal brackets at both back sides of the battery modules (see the illustration on the right, Fig. 3.10 e Fig. 3.11).

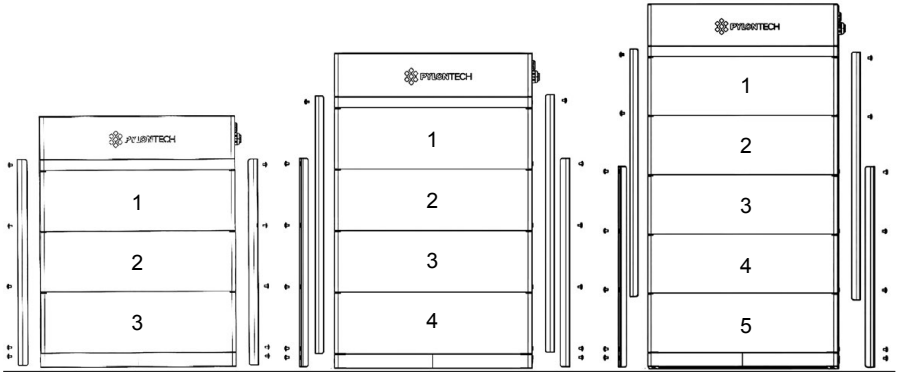



Fig. 3.10 - 3, 4 and 5 module BESS

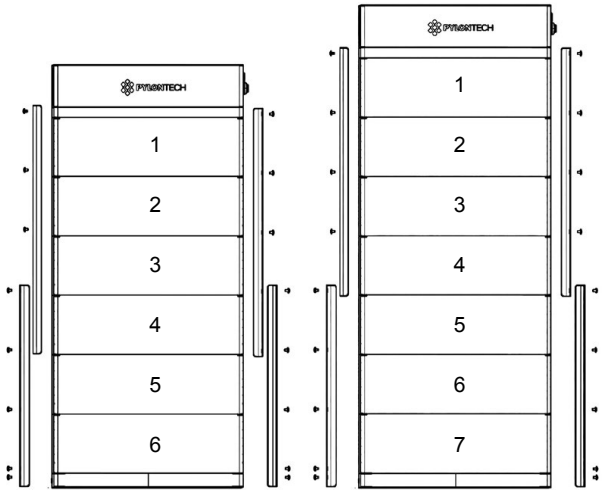



Fig. 3.11 - 6 and 7 module BESS

## 3.10 Installation of the Anti-Toppling Brackets for the System

Force H3 system is equipped with two anti-toppling brackets as follows.
Such brackets act as an alternative of ground mounting of the battery system.
Customers can choose either of the following methods for the system installation:

- Ground mounting with 4*M8 expansion bolt to the support surface (see section “3.6 Mounting and Installation of the Battery Rack Basement” at page 29).
- Bracket mounting with 2*M8 expansion bolt to the wall (Battery system still needs to beplaced on the support surface for supporting the overall weight.)

As long as the installation area meets the requirement of the installation site (see section “3.4 Handling and Placement” at page 27), in either case the installation stability is guaranteed.

**The detailed installation process with such brackets are as follows:**

- Put the base along the wall and reserve 40mm distance between back of the base and thewall (Fig. 3.13).
- Follow the steps described above correctly to install all the battery modules, BMS and brackets (“3.7 Installation of the Battery Module onto the Base” at page 30).
- IMPORTANT: When installing the metal brackets at the back side, ALWAYS remain the two connecting points between brackets and BMS unlocked shown as below. (1, Fig. 3.14).
  Follow the illustrations below, firstly fit the anti-toppling brackets on back sides of the BMS, then use M4 screws to fix (3, Fig. 3.15). REMEMBER to fit the brackets on both sides of BMS, same with following steps.
- Mark the central points of the slotted holes at both sides on the wall (4, Fig. 3.16).
- Dismantle the brackets on both sides. Aligning the central points, drill two holes (≥60mm depth) in the wall with a drilling tool, and clean the holes (5, Fig. 3.17).
- Embed the two M8 expansion bolts into the holes respectively (6, Fig. 3.17).
- Fit the brackets across the M8 expansion bolts on both sides, then fix the brackets on the BMS with M4 screws (3, Fig. 3.15).
- Fix the M8 nut (a) across the 8mm flat gasket (c) and spring washer (b), with 12~13Nm torque. Repeat this step for the other bracket (Fig. 3.18).

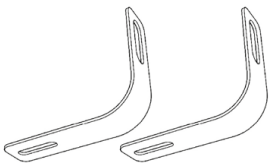


Fig. 3.12 - Anti-Toppling Brackets

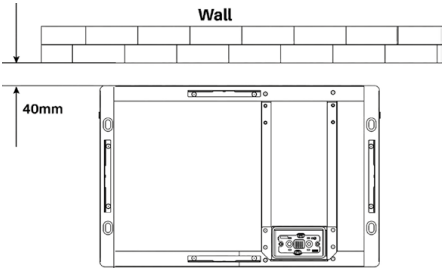



Fig. 3.13 - Wall distance

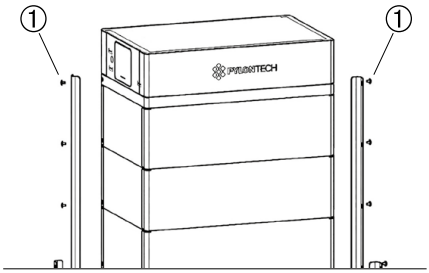



Fig. 3.14 - Metal Brackets screws

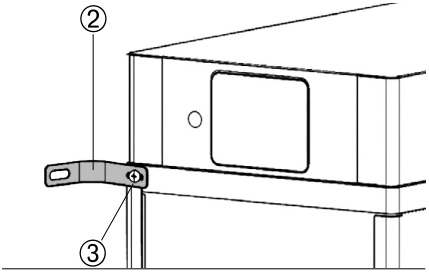



Fig. 3.15 - Metal Brackets fixing points

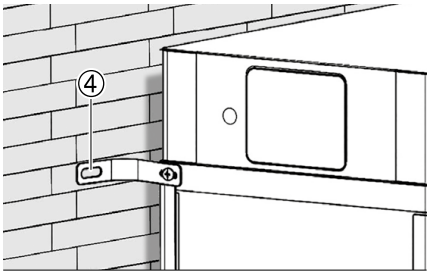



Fig. 3.16 - Central points holes

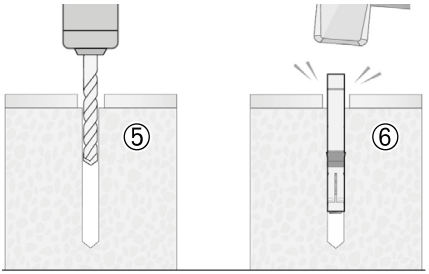



Fig. 3.17 - drill two holes and embed the two expansion bolts

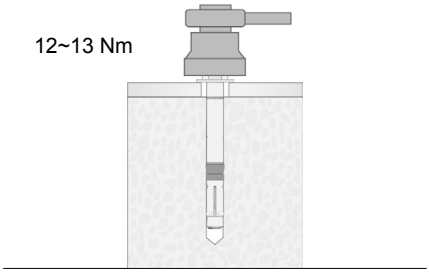



Fig. 3.18 - Nut torque

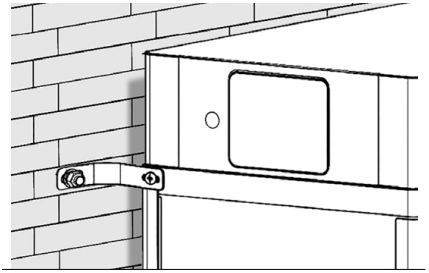


Fig. 3.19 - Sistem fixed

## 3.11 Cables Connection

**Danger.** The battery system is high voltage DC system. Make sure the grounding is fixed and reliable.

**Danger:** No short circuit or reverse connection of the battery system's positive and negative ports.

**Caution:** Wrong communication cables connection will cause the battery system failure..

### 3.11.1 Grounding

The Force-H3 modules has 3 grounding points a follows (1, 2, 3, Fig. 3.20).

**Warning.** Grounding cable must be≥10AWG. The cable shall be copper with yellow-green color.

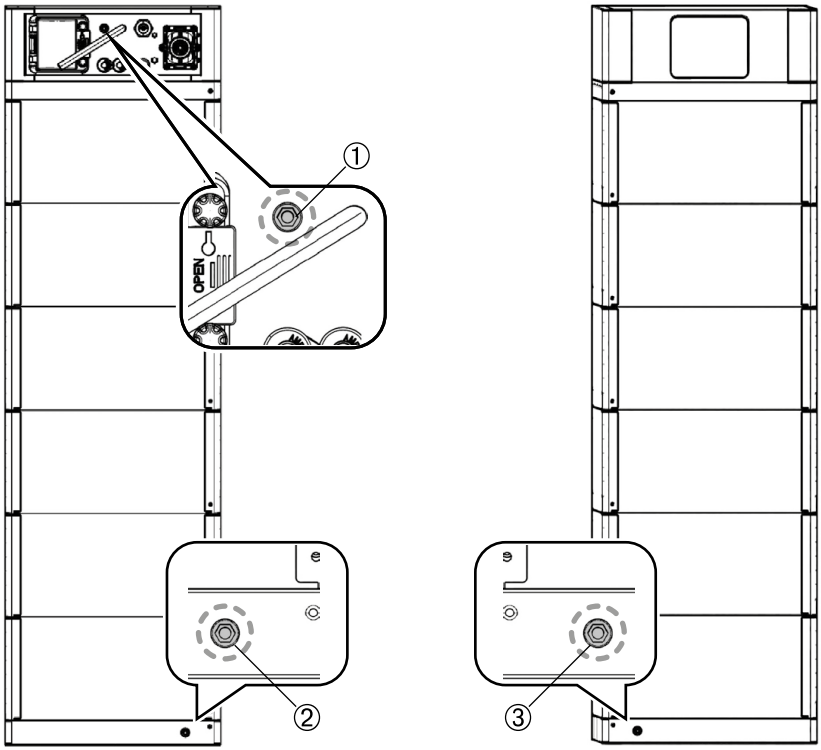



Fig. 3.20 - Grounding points

### 3.11.2 Cables

**Caution:** Power cables use water-proofed connectors. To disconnect, it is required to use a special tool (in the accessory bag), shown as the picture. Do not pull out the cables directly

**NOTE:** Communication cable uses RJ45 connector and water-proof cover(M19-RJ45) matched with controller connection port

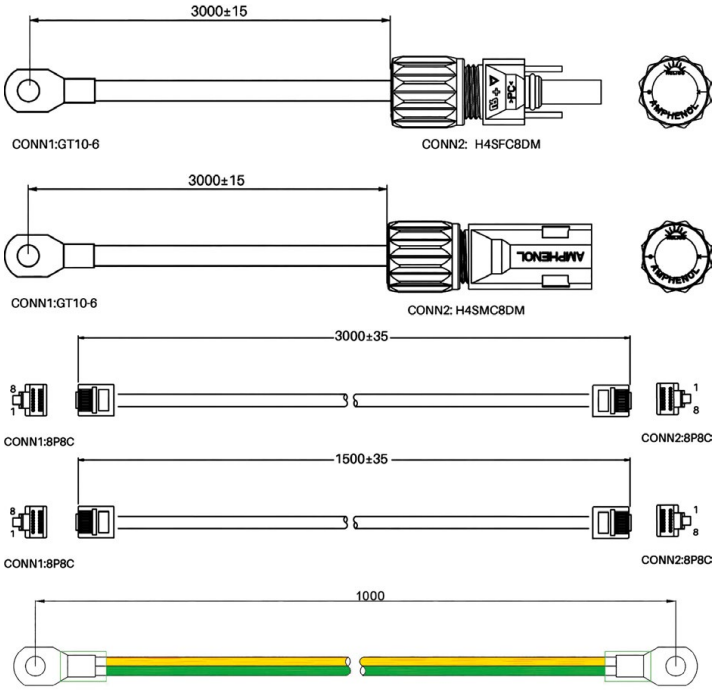



Fig. 3.21 - Cables

## 3.12 Multi-strings' Battery Wiring Diagram

### 3.12.1 Wiring diagram of 3 strings` system (String qty.≤3)

- It`s suggested to use P-Combiner-HV-3-V2 for up to 3 strings, max. 50Amps continuous operation. See chapter "2.3 Multi-strings System Parameters (Max. 6 Strings per System)" at page 13.
- IMPORTANT: DO NOT use P-Combiner-HV-3/V2 or similar concept of multi-strings connection method in case the multiple battery strings need to be operated independently.
  NOTE: Make sure to have the D+ & D- plugs into the combiner box properly.

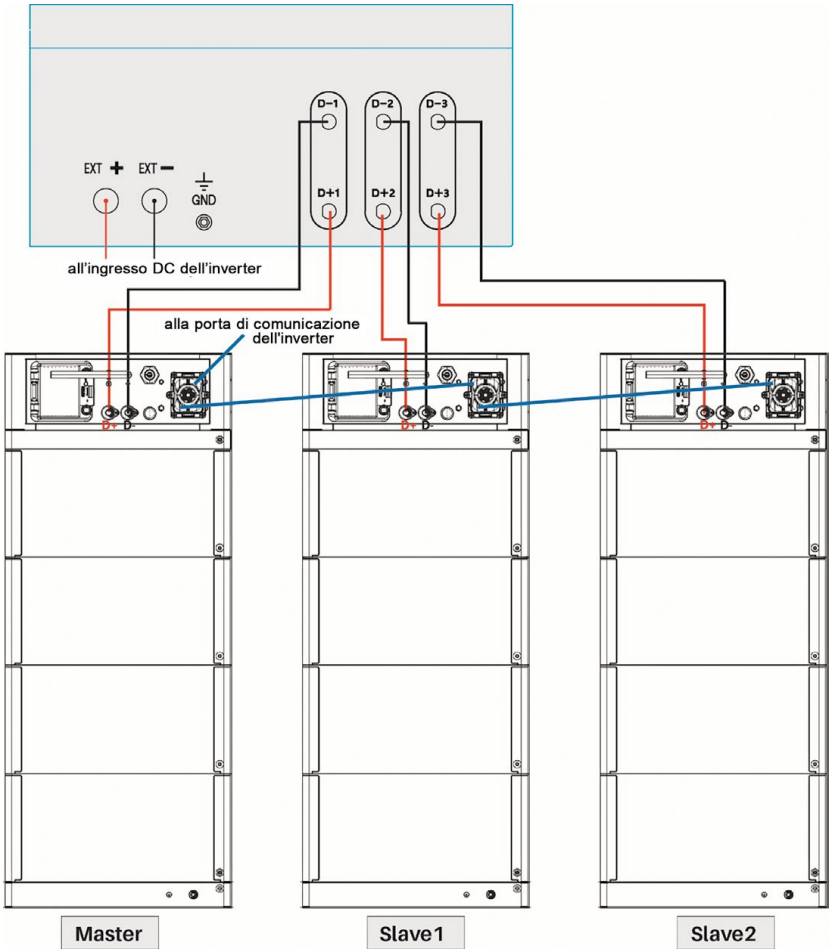



Fig. 3.22 - Wiring diagram of 3 strings` system (String qty.≤3)

### 3.12.2 Wiring diagram of multi strings' system (3<String qty.≤6)

- It`s suggested to use P-Combiner-HV-6-V2 for up to 6 strings, max.100Amps continuous operation.
- IMPORTANT: DO NOT use P-Combiner-HV-6-V2 or similar concept of multi-strings connection method in case the multiple battery strings need to be operated independently.
- NOTE: Make sure to have the D+ & D- plugs into the combiner box properly.

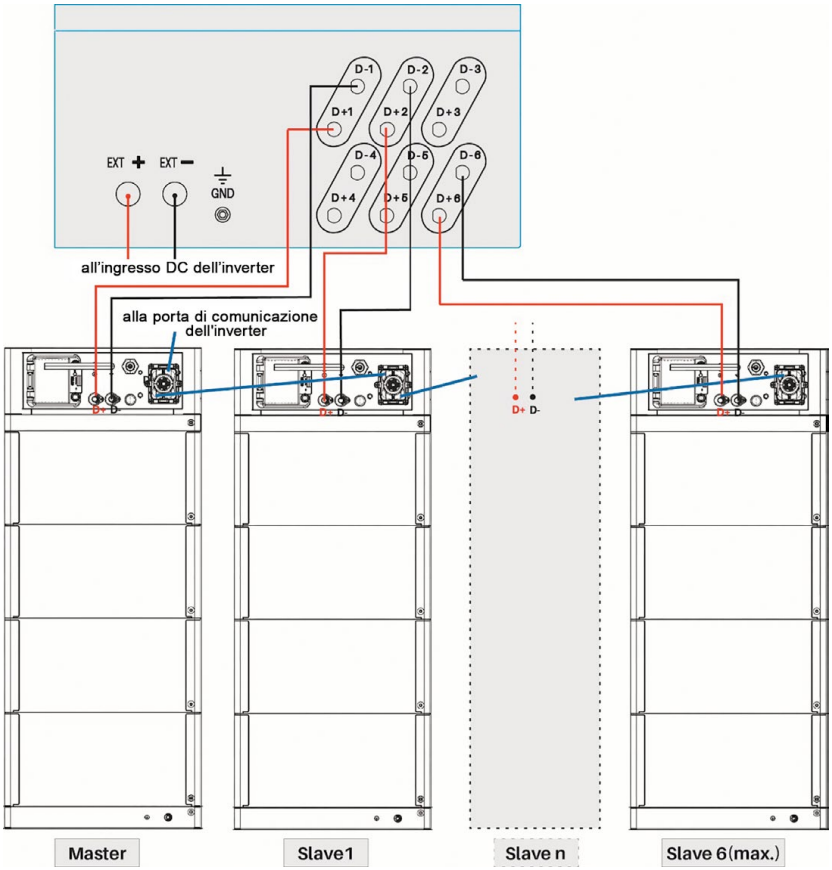



Fig. 3.23 - Wiring diagram of multi strings' system (3<String qty.≤6)

### 3.12.3 Communication Cables Connection of Master and Slave Battery Strings

The communication for master/slave string connection shall use a 8pin pin-pin RJ45 cable, connecting from the first BMS Link 1 to second BMS Link 0, then from second BMS Link 1 to third BMS link 0(if has), all the way to the last BMS Link 0. The BMS with Link Port 0 EMPTY is defined as the Master string. Select either CAN or RS485 on the master string for further connection with the inverter or upper controller.

The slave strings` CAN/RS485 Port is ineffective in this case.

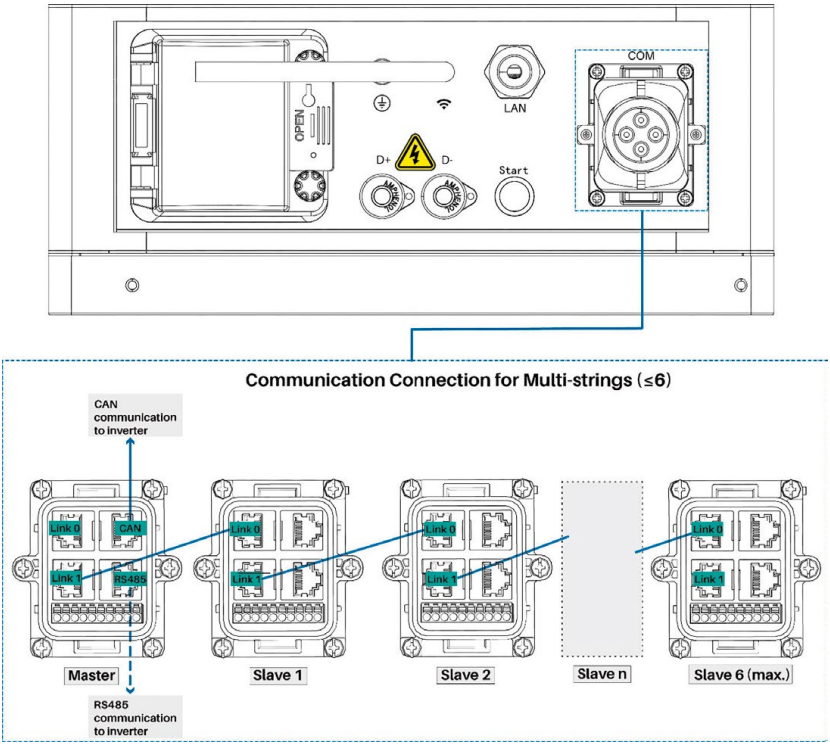



Fig. 3.24 - Communication Cables Connection of Master and Slave Battery Strings

## 4.0 SYSTEM POWER ON / SYSTEM POWER OFF

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

### 4.1 Single String System Power On

**System Power On Procedure:**

1. Check the grounding is connected.
2. Check all the cables are connected correctly.
3. If necessary, turn on the switch for battery on the inverter or the switch between inverter and battery system. If possible, turn on AC or PV power source to wake up the inverter
4. Open the protection cover of Power Switch on the control module (BMS). And turn on Power Switch (1, Fig. 4.1).
5. Press Start Button (2, Fig. 4.1) or at least 5 seconds or until buzzer rings. Battery takes 10-30s for self-checking..
   If the inverter is powered by AC or PV source, most types inverters can set up communication with BMS automatically, in this case, the BMS will close relay and system is ready for work.

   After 30" from the automatic check, if the BMS STATUS LED (2, Fig. 4.2) is solid orange or the BMS system charge level LED (4, Fig. 4.2) is solid blue, it will be necessary to start the inverter via the battery system.
   In this case, press the Start Button for at least 10 secs, till the Status LED lighting Blue and fast flashing. Then the battery will perform black start to support the inverter. After the inverter is started and communication is set, the BMS is ready for work.

   If the battery has been configured to a different communication protocol, please follow LED Long Press 2 guidance. Make sure to select the correct protocol and restart BMS to enable the communication with inverter.

   For information on the BMS display and setting the communication protocols, see chapter "2.5.1 Display panel" on page 16.

**Caution:** If the breaker is tripped off due to over current or short circuit, be sure to wait more than 30mins, then it can be turned on again; otherwise it may cause damage to the breaker.

**Warning:** If there is any failure during the self-check process, be sure to debug the failure prior to next step. If the "STATUS" LED shows orange from the beginning, it means there is failure in the battery string. In this case, the Power Relays in BMS will open, and debugging must be done first.

NOTE: The LED lamp will be off in 20secs without any operation

**Caution:** During the first time starting, the system requires full charge process for SOC calibration purpose.

**Caution:** After long time storage without charging, it is suggested to fully charge the whole Battery Energy Storage System (BESS) prior to installation. Depending on the SOC level, regularly every 6 months' full charge is requested during continuous operation as well. it will be handled automatically by the communication between BESS and external device.


Fig. 4.1 - FC1000 control module


Fig. 4.2 - FC1000 control module

## 4.2 Multi-strings System Power On

**System Power On Procedure**

1. Check grounding is connected.
2. Check all cables are connected correctly, especially the Link 1 / Link 0 between master and slave strings.
3. If necessary, turn on the switch for battery on the inverter or the switch between inverter and battery system. If possible, turn on AC or PV power source to wake up the inverter.
4. Open protect cover of Power switch. And turn on power switch on the control module (BMS) of all the strings (1, Fig. 4.3).
5. From the last string, press start button (2, Fig. 4.3) for at least 5 seconds or until buzzer rings for start-up. Then further turn on each string one by one follow below table, the start-up interval between each strings shall less than 30secs.
   See “Tab. 2.4 - Multi-strings starting sequence” at page 18.
6. After all strings start-up, the battery system takes 30sec for self-checking.
   A questo punto l’inverter imposta automaticamente la comunicazione con il BMS (funzione tipica della maggior parte dei modelli di inverter attivati da una sorgente a corrente alternata o da fotovoltaico), il BMS chiude il relè e il sistema è pronto per funzionare.

   If the inverter is powered by AC or PV source, most types inverters can set up communication with BMS automatically. In this case, the BMS will close relay and system is ready for work.

   If after 30sec self-checking the LED becomes as follows, this means the inverter needs to be powered on by the battery energy.
   In this case, press and hold the Start button for at least 10s, till the Status LED lighting Blue and fast flashing. Then battery will perform black start to support inverter. After the inverter is started and communication is established, the BMS is ready for work.

   If the battery has been configured to a different communication protocol, please follow LED Long Press 2 guidance. Make sure to select the correct protocol and restart BMS to enable the communication with inverter.

   For information on the BMS display and setting the communication protocols, see chapter “2.5.1 Display panel” on page 16.

**Caution:** If the breaker is tripped off due to over current or short circuit, be sure to wait more than 30mins, then it can be turned on again; otherwise it may cause damage to the breaker.

**Warning:** If there is any failure during the self-check process, be sure to debug the failure prior to next step. If the “STATUS” LED shows orange from the beginning, it means there is failure in the battery string. In this case, the Power Relays in BMS will open, and debugging must be done first.

NOTE: The LED lamp will be off in 20secs without any operation

**Caution:**
During the first time starting, the system requires full charge process for SOC calibration purpose.

**Caution:** After long time storage without charging, it is suggested to fully charge the whole Battery Energy Storage System (BESS) prior to installation. Depending on the SOC level, regularly every 6 months' full charge is requested during continuous operation as well. it will be handled automatically by the communication between BESS and external device.


Fig. 4.3 - FC1000 control module

## 4.3 System Power Off

**System Power On Procedure**

**Danger:** When any failure occurs or there is a need for service, the battery storage system must be powered off at first..

1. Turn off inverter or power supply on DC side.
2. Turn off the switch between PCS and battery system.
3. Turn off the "Power Switch" of the all BMSs (1, Fig. 4.3).

**Caution:** Before replace the battery module for service, make sure to charge/ discharge the existing battery module voltage similar to the replaced one. Otherwise the system needs long time to do balance for this replaced battery module..

**Caution:** When restart is required for any troubleshooting steps, make sure to restart the entire system (every BMS within the system). Please do not only restart partially of the BMS within the system, which will further lead to error

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

# 5.0 MAINTENANCE

## 5.1 System Debug

This system debug is for BESS (Battery Energy Storage System). BESS debug can't be performed alone. It must be operated with configured inverter, UPS, PCS and EMS system together..

| Debug Step | Instructions |
|---|---|
| Preparations for debug. | Turn on the BESS, referring to Section 4. It is NOT ALLOWED to turn on the load before turning on the whole BESS.<br>Remark: Except the BESS, if other equipment has its own system power on procedure, be sure to follow its specific operation manual. |
| Working together with inverter | (1) Check the communication cable connection and make sure the cable order on battery and inverter side are matched. All undefined pins are suggested to be empty.<br>(2) Check the baud rate of inverter. The default value of battery CAN is 500kbps, MODBUS 485 is 9600bps. If necessary, change the baud rate of RS485.<br>(3) Check the terminal resistance CAN 120 Ω, 485 120 Ω<br>(4) If necessary, check the setting on inverter or control box has right parameters and brand of battery. And check the information of BESS shown on inverter is correct. |

## 5.2 Trouble shooting

**Danger:** The Force-H3 is a high voltage DC system, operated by qualified and authorized personnel only.

**Danger:** Before checking the failure, be sure to check all the cables connection and check if the BESS can be turned on normally.
Check the environment first

| Problem | Possible Reason | Solution |
|---|---|---|
| No power output, no LED on | Too short time for pressing Start button. | Press and hold at least 5s to turn on. Press and hold at least 10s for black start. |
| | The button battery in controller is missing or has failure. The power supply in control module (BMS) has failure. | Change the control module. |
| | The battery voltage is too low. | Make sure there are at least 2 battery modules. |
| | The connector of base has failure or the base is not connected. | Make sure the base in connected properly and change base if necessary. |
| After turning on, Status LED slow flashing orange. Others off. | Self-checking failure. DC side has a voltage, but voltage difference with the battery system is higher than 20V. | Make sure no DC voltage or set correct DC voltage before pressing Start button. Follow power on process to turn on. |
| | BMS internal failure. | Use debug tool/Wi-Fi monitoring to further analysis or change the control module. |
| Status LED fast flashing orange, others off. | The time interval after latest black start is too short. | Wait more than 5 minutes and try black start again. |
| | The battery system under error condition such as: temperature or current protection or other errors, thus no response to black start. | Make sure no other protection factors. Or use debug tool for further analysis. |
| Buzzer ring continues | Relay adhesion or failure. | Completely disconnect battery system with any DC source then make a restart. If problem still exists, then replace the controller. |

Tab. 5.1 - Trouble shooting

| Problem | Possible Reason | Solution |
|---|---|---|
| Status LED solid orange. Battery module LED blue solid. | Communication lost with inverter | Check the communication cable PIN and wiring is correct. Check the inverter communication settings |
| | Over current protection. | Check DC side. And wait until BMS release protection. |
| | Control module failure. | Use debug tool for further analysis or change the control module. |
| Status LED solid orange. Battery module exists LED in orange solid | Over/ under temperature protection. | Check environment temperature. And wait BMS release. |
| | Over voltage protection. | Check DC charge voltage setting or wait BMS release. |
| | Under voltage protection. | Perform black start function, and then charge the system. |
| | Battery module BMS failure | Use debug tool for further analysis or change the battery module. |
| All LED blue but no output. | Fuse fusing | Change the control module |
| Other failure | Cell failure or electrical board failure. Or debug tool is needed for further analysis. | If you still can't debug the failure, please contact with distributor or Pylontech. |

Tab. 5.1 - Trouble shooting

**Nota.** Nel caso in cui, a seguito dell'individuazione di un guasto, si renda necessario sostituire un componente, spegnere la stringa di batterie prima della sostituzione per evitare lo scaricamento del sistema dovuto all'autoconsumo.

## 5.3 Replacement of Main Components

**Danger.** The Force-H3 is a high voltage DC system, operated by qualified and authorized personnel only.

**Danger.** Before replacing the main components, turn off the maintenance battery string's power first. Make sure the D+ and D- terminals are without power. Refer to section "4.3 System Power Off" at page 45.

**Warning:** Single battery module is 39kg. The battery module must be handled by more than 2 personnel if there're no handling tools.

**Danger.** When battery is connected together with the base, the internal socket still has high voltage DC power from serial connected battery modules

### 5.3.1 Replacement of Battery Module

- Charge existing module to full (SOC 100%). Make sure new battery module is 100% SOC as well.
- Turn off the whole battery string's power. Make sure to confirm the D+ and D- terminals are without power. Refer to section "4.3 System Power Off" at page 45.
- Dismantle D+ and D- Power cables (4, Fig. 5.1), Communication cable (5 e 6, Fig. 5.1) and Grounding cable (3, Fig. 5.1).
- Dismantle the control Module's fix screws on the left and right.
- Dismantle the fix metal brackets.
- Remove the control module.
- Alzare le due maniglie della batteria (1, Fig. 5.2) e, agendo contemporaneamente, sollevare il modulo assicurandosi che non si inclini da un lato.
  Rimuovere uno alla volta ogni modulo batteria posto sopra al modulo da sostituire.
- Remove the control module and each battery module one by one.
- Pile up the new battery module. And install back the battery modules and control module.
- Fix back the two screws on the control Module's. And Install back the fix metal brackets.
- Install back Grounding cable, Communication cable and the D+ and D- Power Cables.
- Turn on this battery string. Refer to section "4.1 Single String System Power On" at page 42.

### 5.3.2 Replacement of Control Module (BMS)

- Turn off the whole battery string's power. Make sure to confirm the D+ and D- terminals are without power. Refer to section "4.3 System Power Off" at page 45.
- Dismantle D+ and D- Power cables (4, Fig. 5.1), Communication cable (5 e 6, Fig. 5.1) and Grounding cable (3, Fig. 5.1).
- Dismantle the control Module's fix screws on the left and right (same as 5.2.1).
- Dismantle the fix metal brackets (same as 5.2.1).
- Remove the control module.
- Pile up the new control module.
- Fix back the two screws on the control Module's. And Install back the fix metal brackets.
- Install back Grounding cable, Communication cable and the D+ and D- Power Cables.
- Turn on this battery string. Refer to section "4.1 Single String System Power On" at page 42.

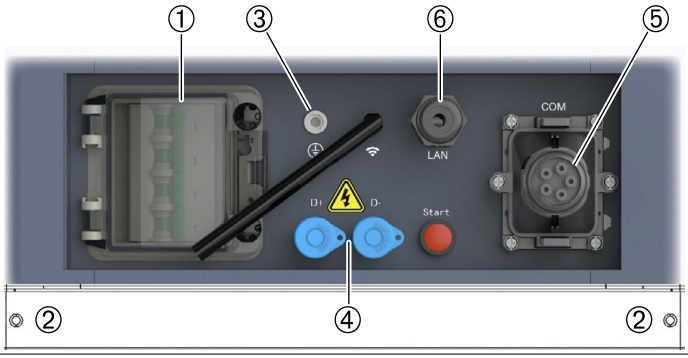



Fig. 5.1 - FC1000 control module

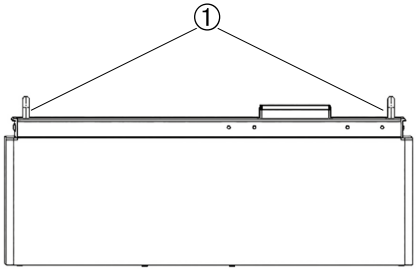



Fig. 5.2 - Battery module handles

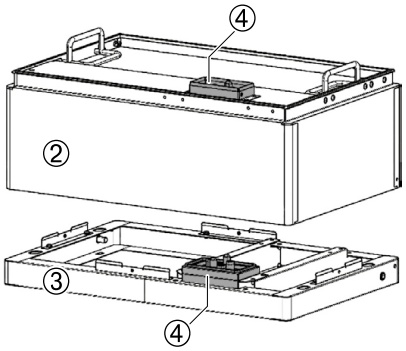



Fig. 5.3 - Battery Module onto the Base

## 5.4 Battery Maintenance

**Danger.** The maintenance of battery must be done by qualified and authorized personnel only.
Some maintenance items must turn off at first.

### 5.4.1 Voltage Inspection:

[**Periodical Maintenance**] Check the voltage of battery system through the monitor system. Check the system whether exist abnormal voltage or not. For example: Single cell's voltage is abnormal high or low.

### 5.4.2 SOC Inspection

[**Periodical Maintenance**] Check the SOC of battery system through the monitor system. Check the battery string whether exist abnormal SOC or not.

### 5.4.3 Cables Inspection

[**Periodical Maintenance**] Visual inspect all the cables of battery system. Check the cables has broken, aging, getting loose or not.

### 5.4.4 Balancing

[**Periodical Maintenance**] The battery strings will become unbalance if long time not be full charged. Solution: every 3 months should do the balancing maintenance (charge to full), normally it will be done automatically by the communication between system and external device.

### 5.4.5 Output Relay Inspection

[**Periodical Maintenance**] Under low load condition (low current), control the output relay OFF and ON to hear the relay has click voice, that's mean this relay can off and on normally.

### 5.4.6 History Inspection

[**Periodical Maintenance**] Analysis the history record to check has accident (alarm and protection) or not, and analysis its reason.

### 5.4.7 Shutdown and Maintenance

[**Periodical Maintenance**]
Some system function must be maintenance during the EMS restart, it is recommended to maintenance the system every six months.

### 5.4.8 Recycle

**NOTE.** Damaged batteries may leak electrolyte or produce flammable gas.
In case a damaged battery needs recycling, it shall follow the local recycling regulation (e.g., Regulation (EC) Nº 1013/2006 among European Union) to process, and using the best available techniques to achieve a relevant recycling efficiency.

# 6.0 REMARKS

## 6.1 Storage

For long-term storage, e.g. if it needs to be stored for a long time (more than 6 months), the battery modules are highly suggested to be stored in the temperature range of 5~45°C, relative humidity <65% and corrosive-gas-freed environment. Before storage the battery should be charged to 50~55% SOC.

It is recommended to discharge and charge the battery every 6 months, charge to full and discharge to 50%. The longest discharge and charge interval shall not exceed 12 months.

**Caution.** If you don't follow the above instructions for long term storage, the battery cycle life will decrease heavily.

## 6.2 Capacity Expansion

A new battery module can be added onto the existing system at any time. Please make sure the existing system is being fully charged before adding a new module. In a serial connection system, the new module, even has a higher SOH, shall follow the system's worst SOH condition module to perform.

# 7.0 SHIPMENT

Before shipment, single battery module will be pre-charged to 100%SOC or according to customer requirements. After delivered on-site, the remaining battery capacity is determined by the storage time and condition.

- The battery modules meet the UN38.3 certificate standard.
- In particular, local rules and policies (e.g. ADR: European Agreement concerning the International Carriage of Dangerous Goods by Road) for the product transportation shall be complied with.

Contact the supplier for more information.

Please note that the product and this manual are subject to change without notice.

## INSTALLATION AND SYSTEM POWER ON PROCESS LIST

| | ITEM | REMARK |
|---|---|---|
| ☐ | The environment is meets all technical requirements.<br>3.3.1 Cleaning<br>3.3.2 Temperature<br>3.3.3 Fire-extinguisher System<br>3.3.4 Grounding System<br>3.3.5 Clearance | Chapter 3.3 at page 26 |
| ☐ | Selection of installation sites. | Chapter 3.4 at page 27 |
| ☐ | Battery base is installed follow the technical requirements. | Chapter 3.6 at page 29 |
| ☐ | Battery modules installation. | Chapter 3.7 at page 30 |
| ☐ | Battery system are fixed. | Chapter 3.8 at page 32 |
| ☐ | Control Module (BMS) and Battery Module are installed well. | Capitoli 3.9 at page 33 and 3.10 at page 34 |
| ☐ | Connect D+ and D- between BMS to the inverter/ PCS or confluence cabinet. | Chapter 3.11.1 at page 36 |
| ☐ | Connect the grounding cable. | Chapter 3.12 at page 38 |
| ☐ | Double check all the power cables, communication cables, grounding cable are installed well. | Chapter 3.11 at page 36 |
| ☐ | Switch the external power or inverter/PCS on, ensure all the power equipment can work normally. | Chapter 4.0 at page 42 |
| ☐ | The first installation should do full charging progress automatically.<br>If the status LED of BMS turns to blue, it means this battery string is in operation. | |

## SYSTEM POWER OFF PROCESS LIST

| | ITEM | REMARK |
|---|---|---|
| ☐ | Soft-off the inverter through inverter's control panel. | Chapter 4.3 at page 45 |
| ☐ | Turn off the switch between inverter and this battery string (Force-H3), or turn off the power switch of inverter, to make sure no current through this battery string. | Chapter 4.3 at page 45 |
| ☐ | Turn off the "Power Switch" of the BMS. | Chapter 4.3 at page 45 |


Imported by:
**Energy S.p.A.**
Piazza Manifattura 1
38068 Rovereto (TN) - Italy
Tel: +39 049 2701296
email: service@energysynt.com
web: www.energyspa.com

PYLONTECH

**Pylon Technologies Co., Ltd.**
No. 73, Lane 887, ZuChongzhi Road,
Zhangjiang Hi-Tech Park
Pudong, Shanghai 201203, China
**T** +86-21-51317699
**E** service@pylontech.com.cn
**W** www.pylontech.com.cn