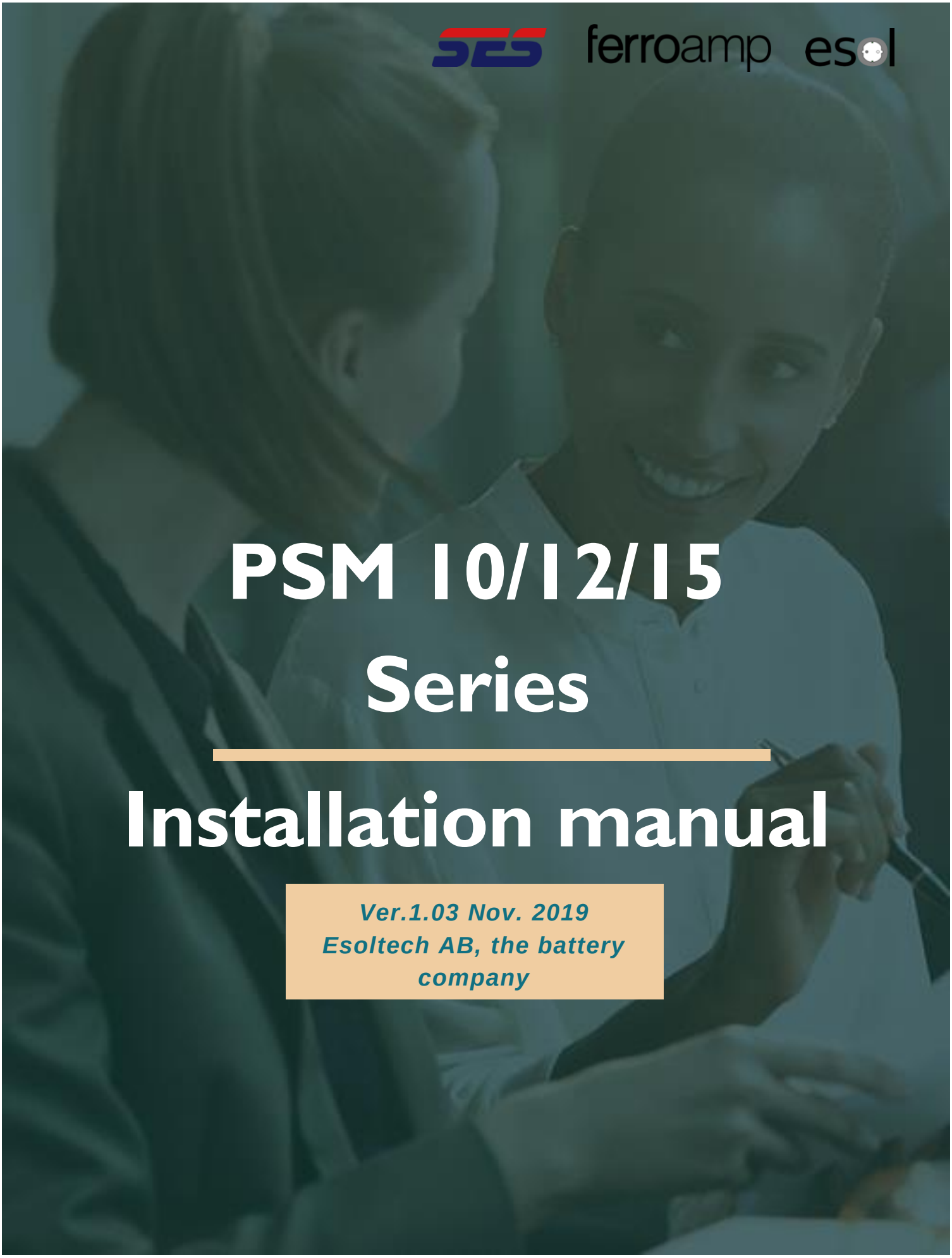


PSM 10/12/15 Series

Installation manual

Ver.1.03 Nov. 2019
Esoltech AB, the battery company

TABLE OF CONTENTS

WARNING

- Read through the instruction manual before installation.
- Electrical installation shall be performed by an authorized electrician in accordance with electrical standards and safety precautions
- Some component may need to be assembled before electrical installation.
- Do not open the enclosure of the electrical components. Warranty is void if the products has been modified.
- Plug in the jumper brick (battery modules) only when the system is ready to power up.

The FerroAmp PSM 10/12/15 series high performance energy storage system is designed to be installed and operated together with the EnergyHub system with the patented Adaptive Current Equalization (ACE) technology.

FerroAmp *Ferroamp Elektronik AB is a research-driven platform company that builds smart integrated energy system for home and industry. The FerroAmp ACE technology is patented under PCT WO2012050501 (A1).*

SES *Sunwoda Energy Solution Co., Ltd is a professional energy storage solution provider with 20 years' know-how in battery industry. SES is a subsidiary of the listed Sunwoda Electronic Co., Ltd (SZ 300207) established in 1997. SES is a manufacture powerhouse with it headquarter in Shenzhen, China.*

ESOL *ESOLtech AB, the battery company, is based in Stockholm. A company of doer brings knowledge into reality.*

1. LIST OF COMPONENTS

The PSM 10/12/15 series high performance energy storage system comes with the following components:

- Cabinet
- Battery modules
- Battery controller modules
- Energy Storage Optimizer (ESO)
- Accessories box

Knowing your system components:

Battery module *4 pcs (PSM10)* *5 pcs (PSM12)* *6 pcs (PSM15)*	
Battery controller module *1 pcs*	
Energy storage optimizer *1 pcs (6kW, PSM10)* *2 pcs (12kW, PSM12/15)*	
The Cabinet	see picture on the index page
The Accessories box	see the list of accessories

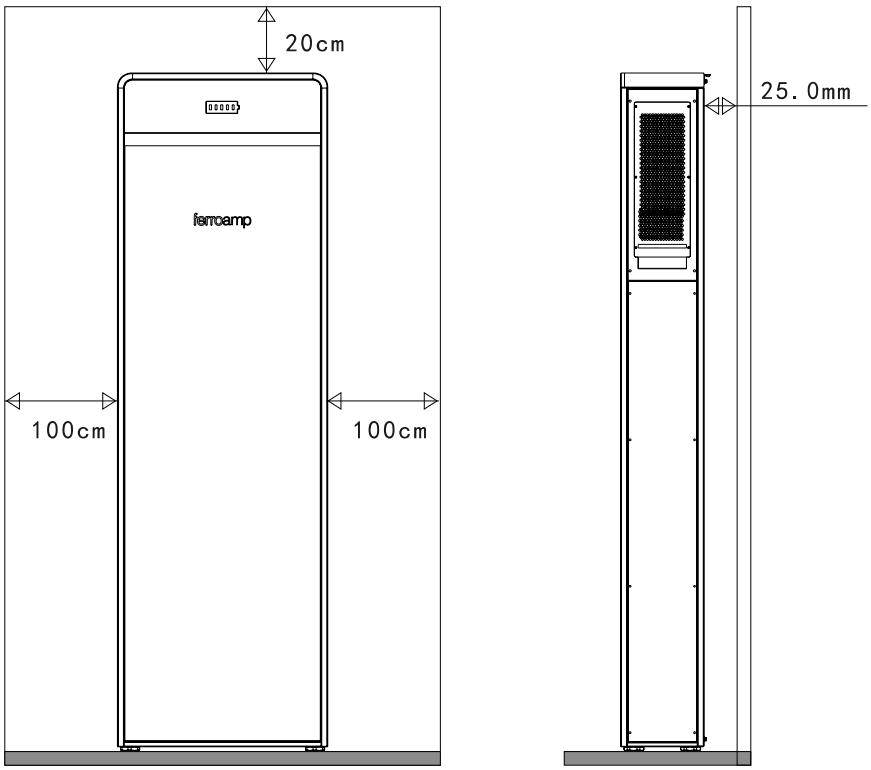
List of accessories:

Item no.	Description	quantity	note
1	Installation manual	1	This manual
2	Battery Module Comm. Cable	7	
3	Battery Module Power cable	7	
4	Battery Module Jumper Brick (in battery packing)	6	
5	Battery Module Mounting Bolts (in battery packing)	18	M5
6	Wall mounting bolts	2	
7	Wall mounting assembly (in cabinet packing)	1	
8	Wall mounting assembly bolts (in cabinet packing)	2	
9	Power Cable ESO - Battery controller	2	
10	Battery controller Power cable 230VAC	1	
11	Comm. cable: from ESO to Battery controller	1	RJ45
12	Grounding cable for ESO	1	
13	ESO Adaptor (in ESO packing)	1	
14	ESO Adaptor fixing bolts (in ESO packing)	6	M3
15	ESO front panel (in ESO packing)	1	
16	ESO front panel fixing bolts (in ESO packing)	8	M2

2. CABINET ASSEMBLY

The cabinet is pre-assembled. The PSM cabinet is designed to be installed and used indoor only. Before installation, please make sure that:

- the ambient temperature is 0 – 45 deg. (recommended 25 deg.);
- the relative humidity ranges 0-95%;
- there is enough space around the cabinet to enable a safe installation.



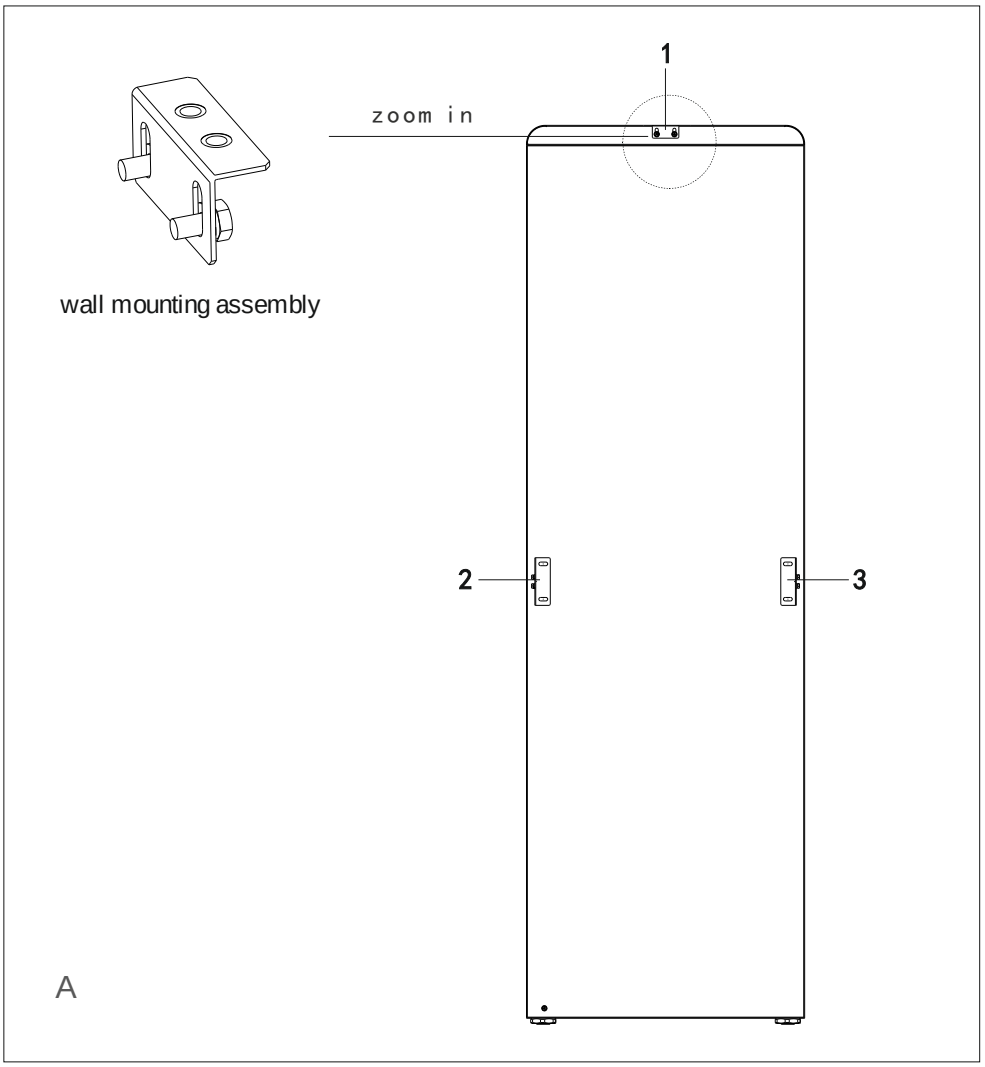
Note: the measurement in the diagram is not to the scale

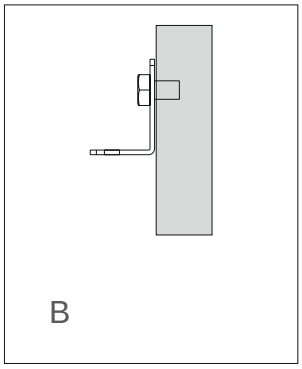
2.1 Wall mounting:

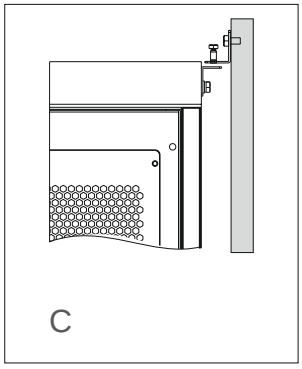
Clear the wall. Measure the distance from the floor to the spot on the wall where mounting assembly shall be fixed.

- **Figure A:** The wall mounting assembly can be attached to 3 locations on the cabinet. The cabinet is shipped with the assembly preinstalled at location 1.
- **Figure B:** Fix the wall mounting piece to the wall.
- **Figure C:** Move the cabinet to the wall and fasten the fixing bolts to make sure the cabinet is secured.

Please refer to Section 2.3 for the adjustment of the feet.

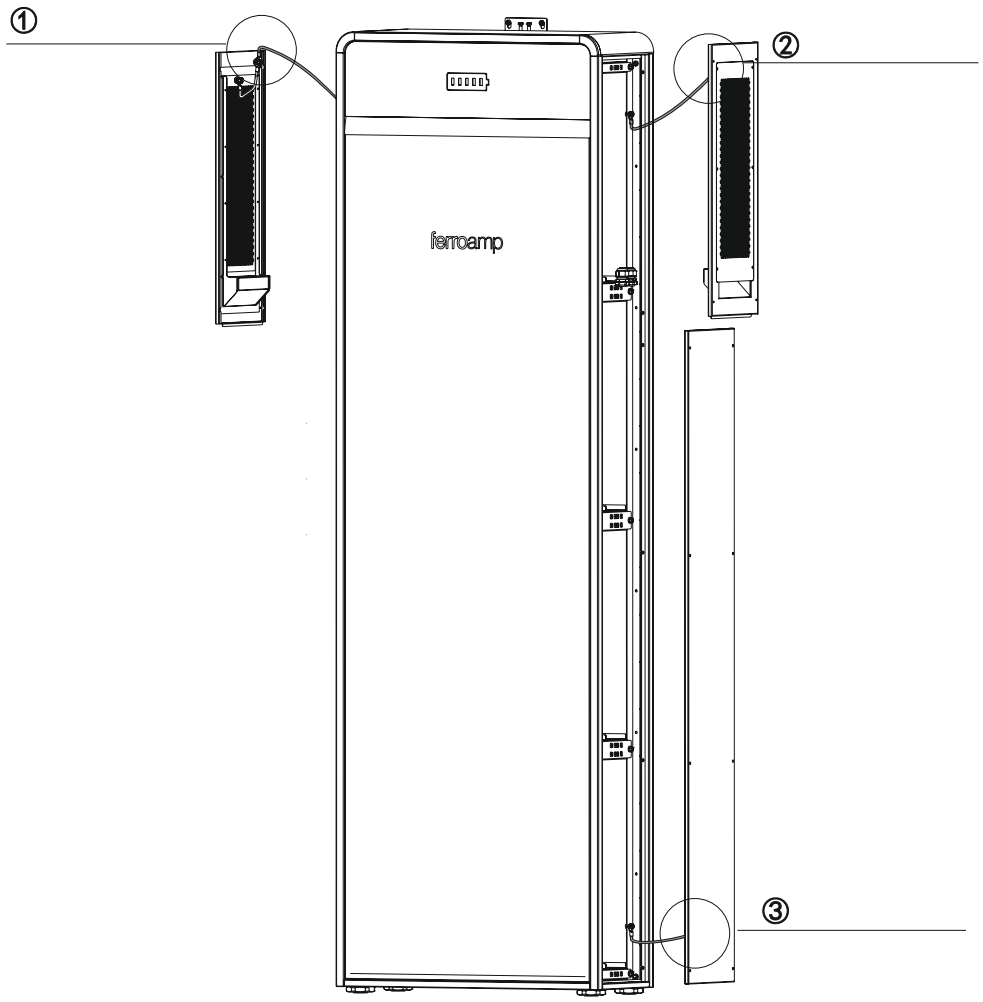




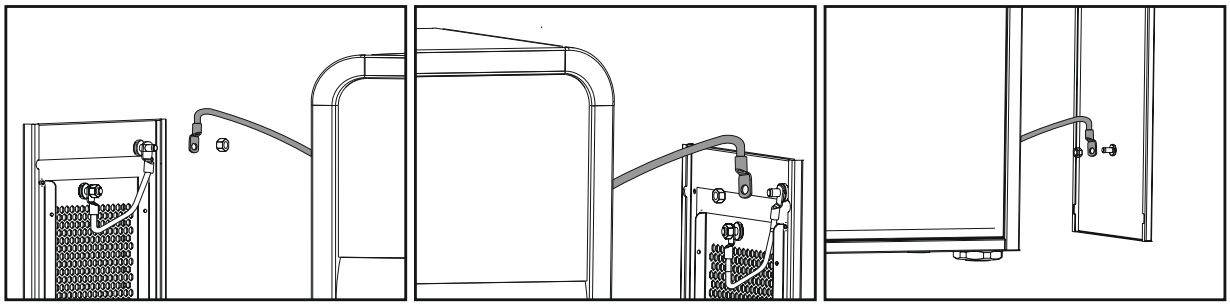


2.2 Removing the side panels

The cabinet has a symmetric design meaning that the panels on the left-hand-side are identical and exchangeable to the ones on the right.

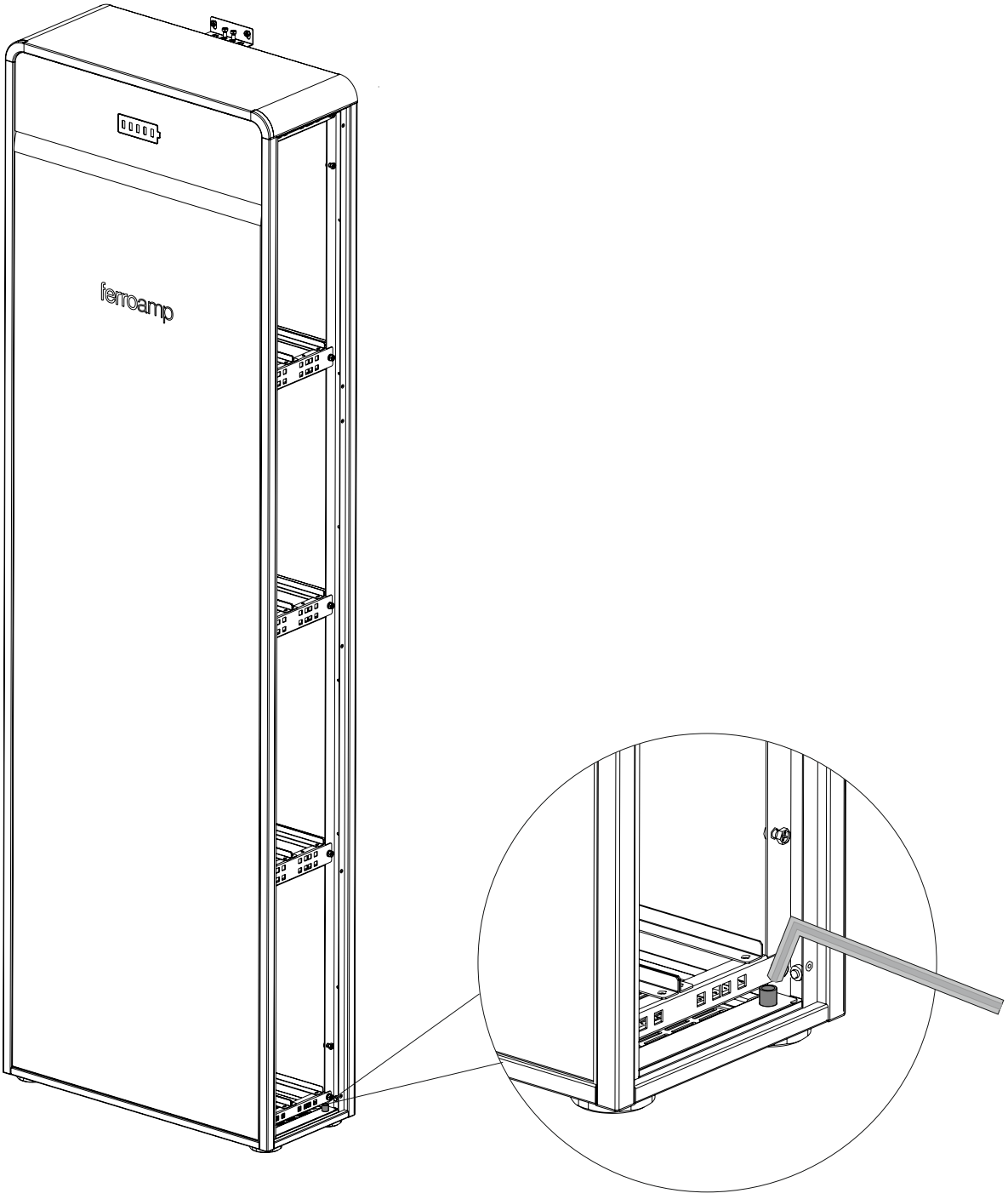


The diagram shows the upper side panels and one of the lower side panels are removed. Detach the grounding cable for installation clearance. The following shows the details of removing the grounding cables.



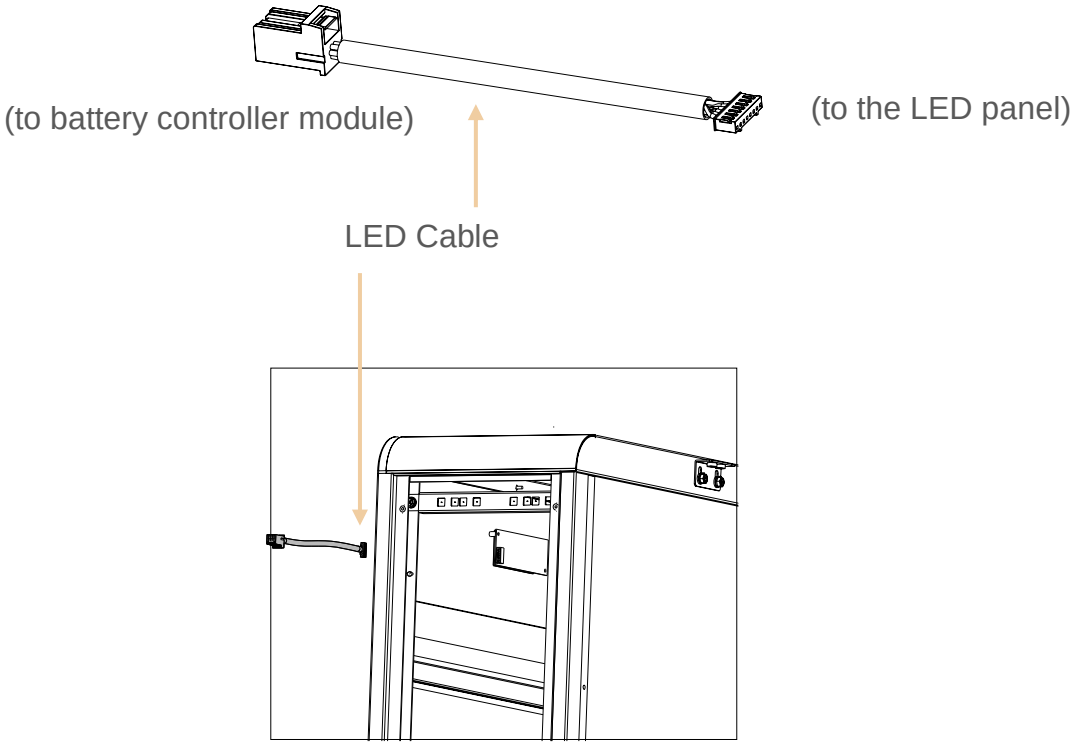
2.3 Adjusting the feet

There are 4 adjustable feet and the sockets are accessible when removing the side panels. Using the hex key (5mm) to adjust the height of the feet.

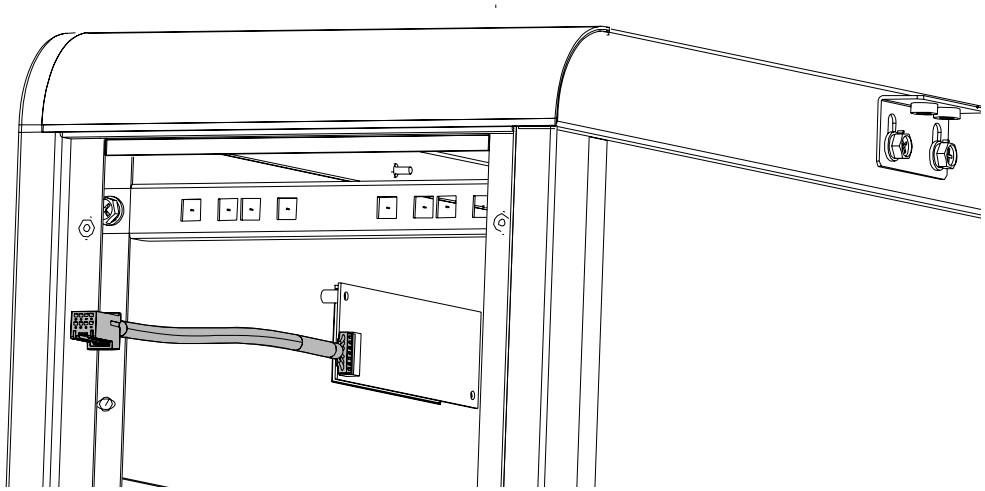


2.4 Cable for LED panel

Connecting the LED cable to the LED connector socket inside the cabinet as indicated below:



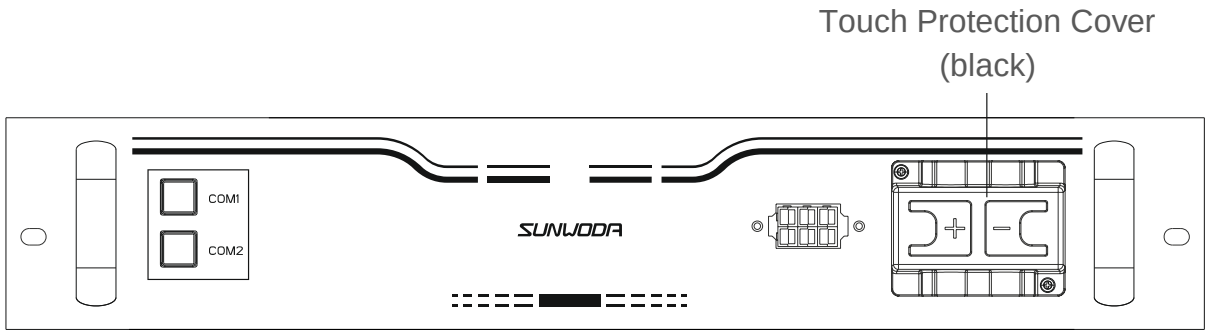
There is only one direction the cable can be inserted firmly. The following picture shows finished LED cable connection. The other end of the cable is to be connected to the battery controller module **(See also Section 3.2)**.



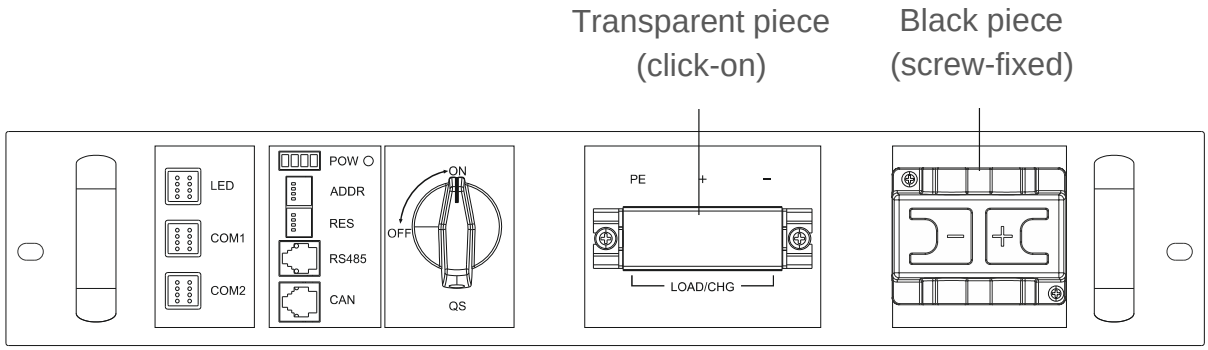
3. BATTERY AND CONTROLLER MODULES

Both the battery module and the battery controller box are shipped with protection covers preinstalled.

Battery module:



Battery controller box:

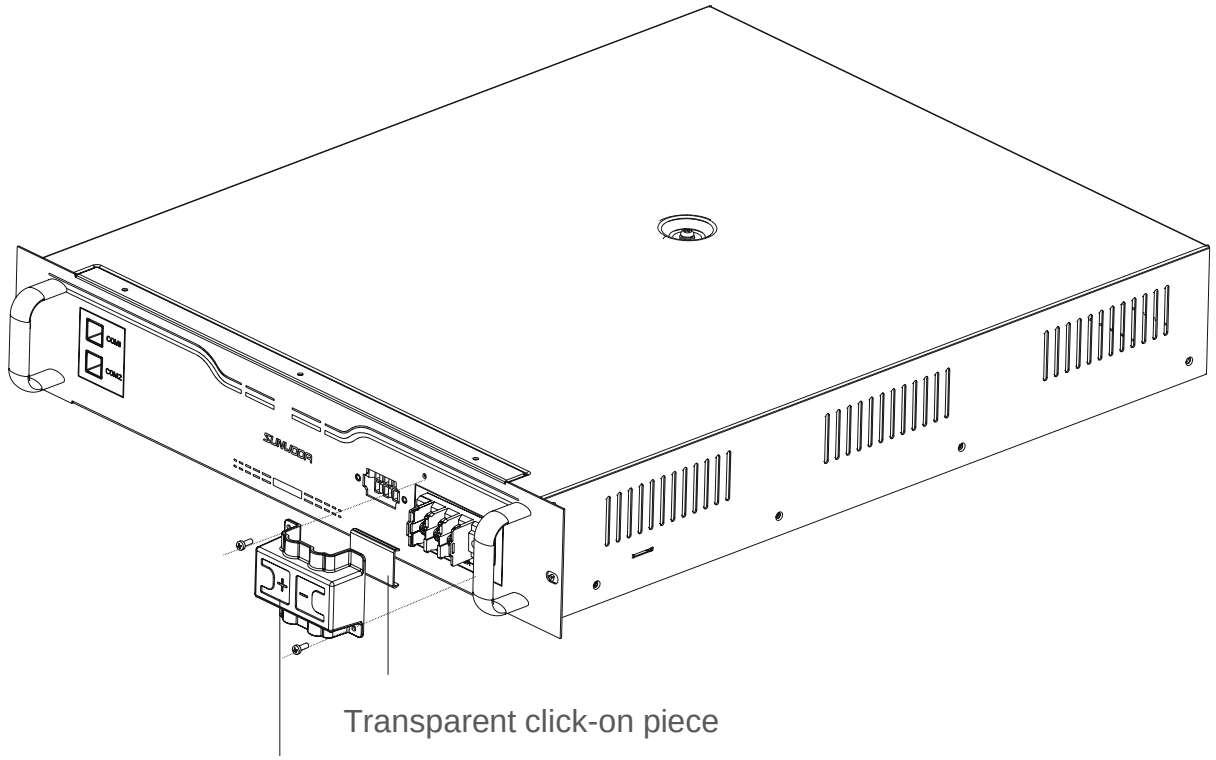


The PSM system is shipped with one battery controller module and 4 - 6 battery modules depending on system configuration.

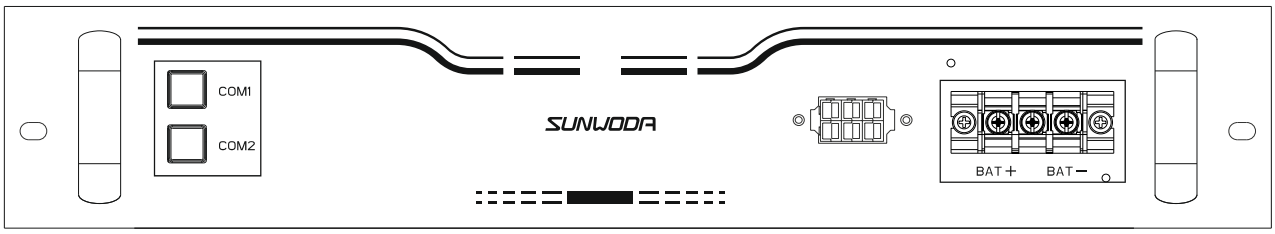
Make sure to remove the preinstalled protection cover before installation.

3.1 Touch Protection Covers

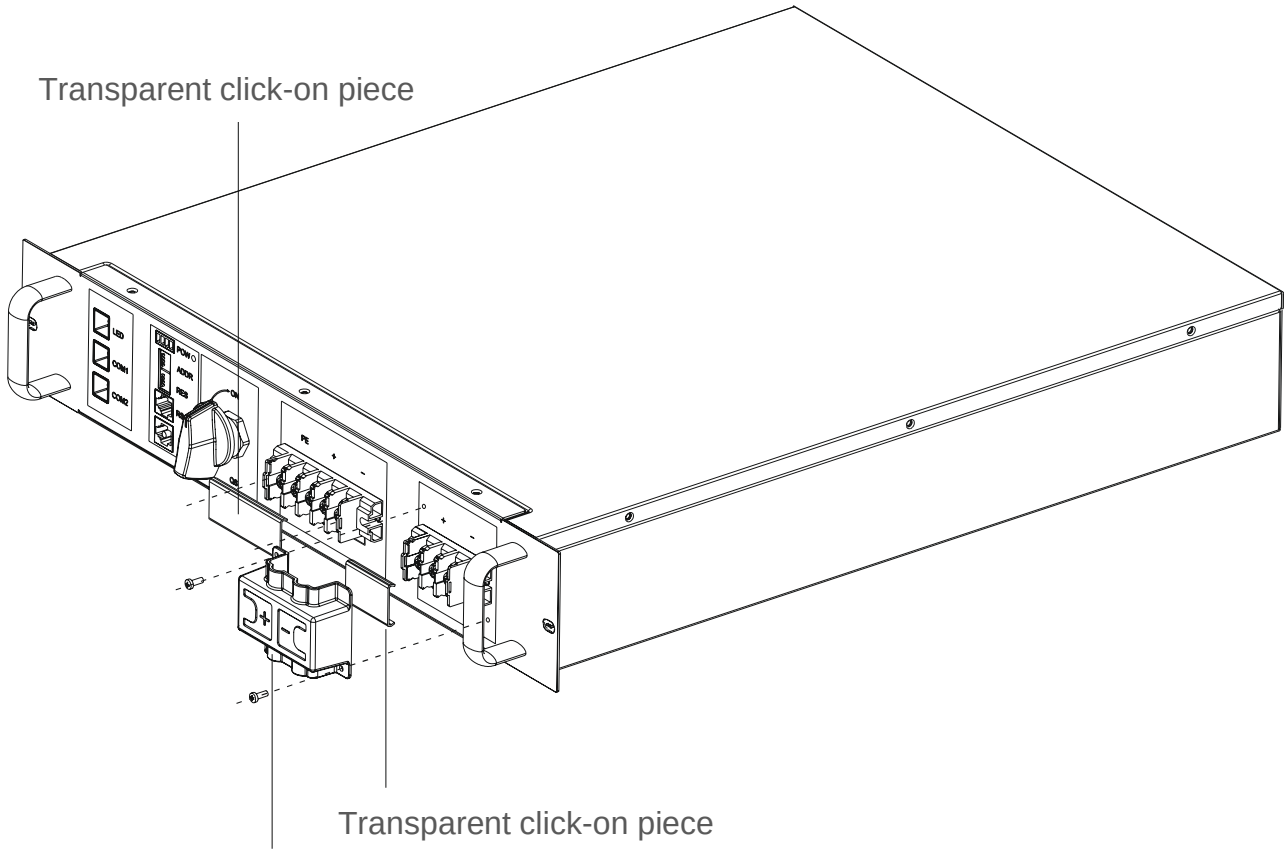
For battery module:



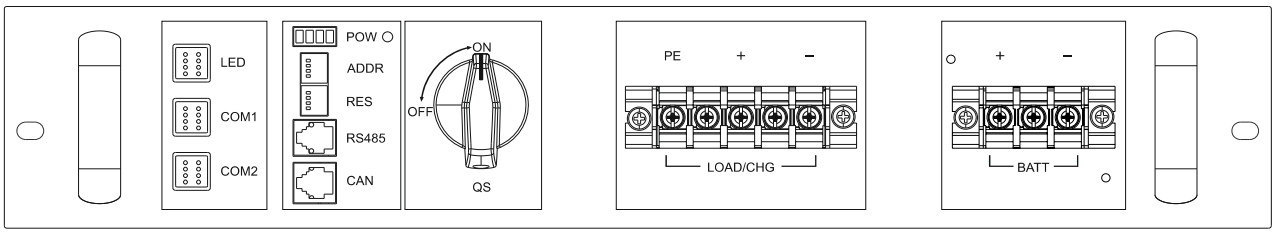
The battery module with the protection covers removed:



For the battery controller module:

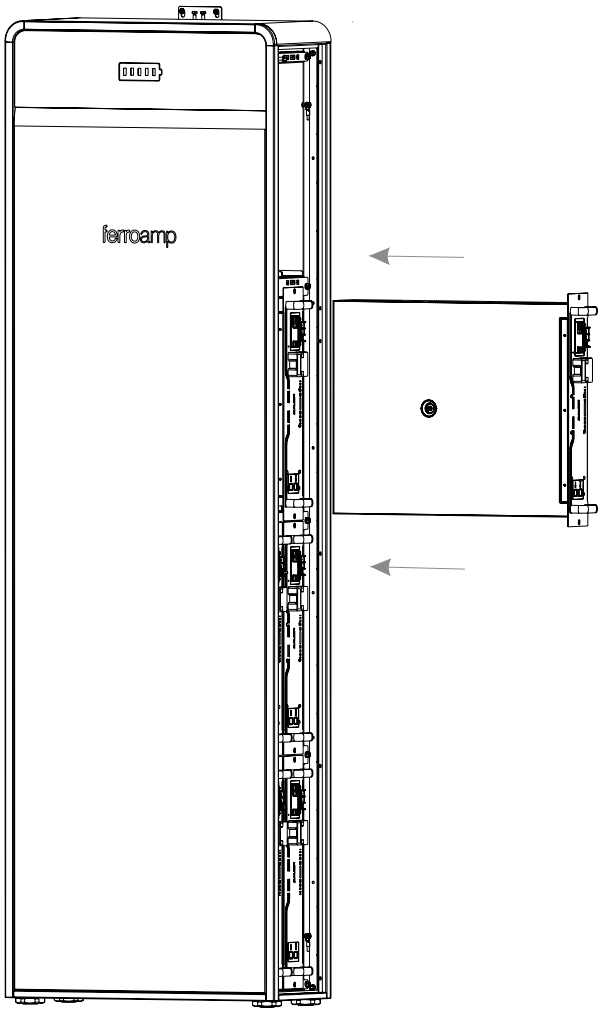


The battery controller module with the protection covers removed.



3.2 Insert the battery modules

The battery shall be inserted **one by one from the bottom** of the cabinet.



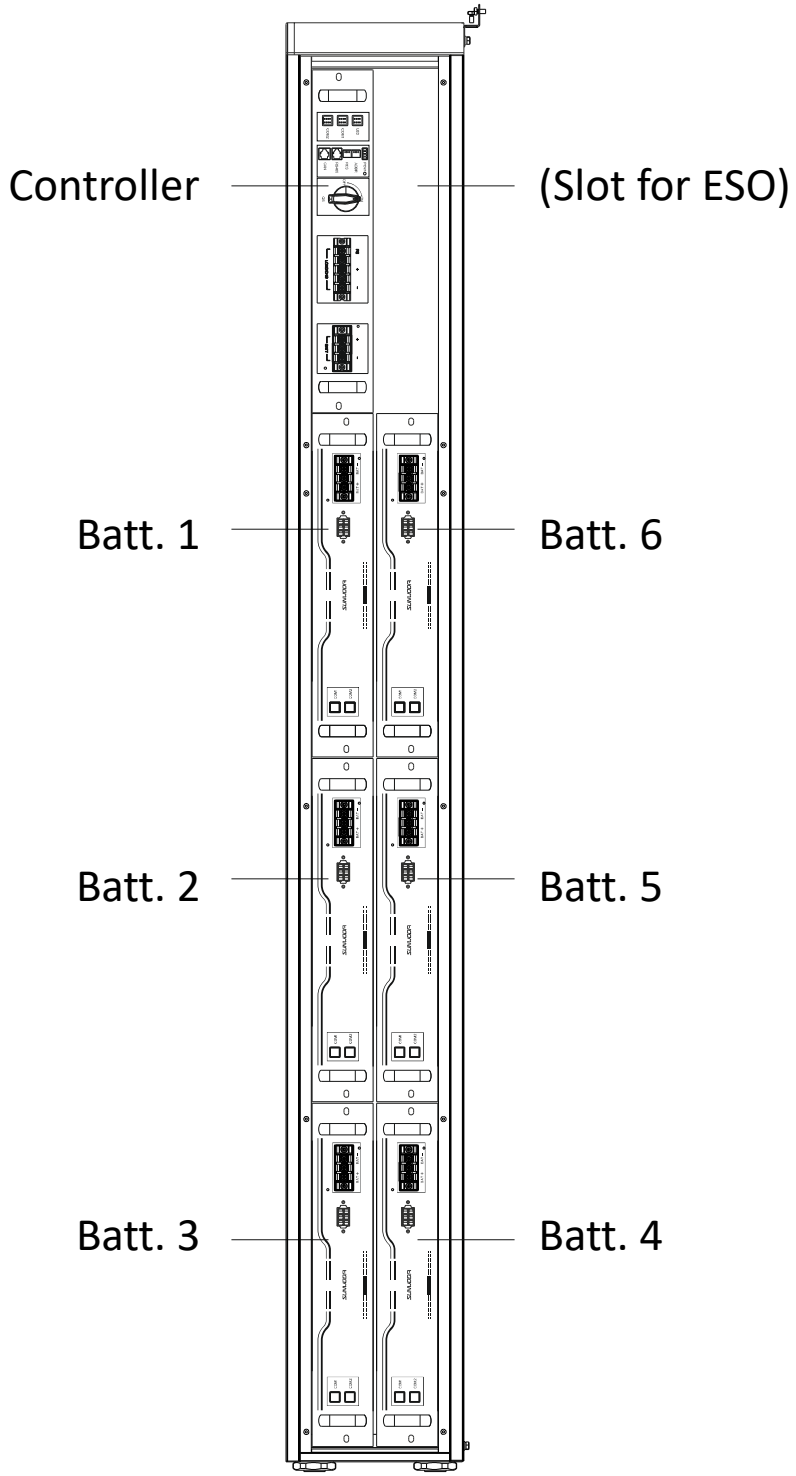
Make sure all the bolts for the inserted module fastened before installing the next module.

Install the controller module after all the battery modules are done.

Pay special attention not to block the Cable for LED panel (**Section 2.4**) whose connection is to be done in **Section 3.3**.

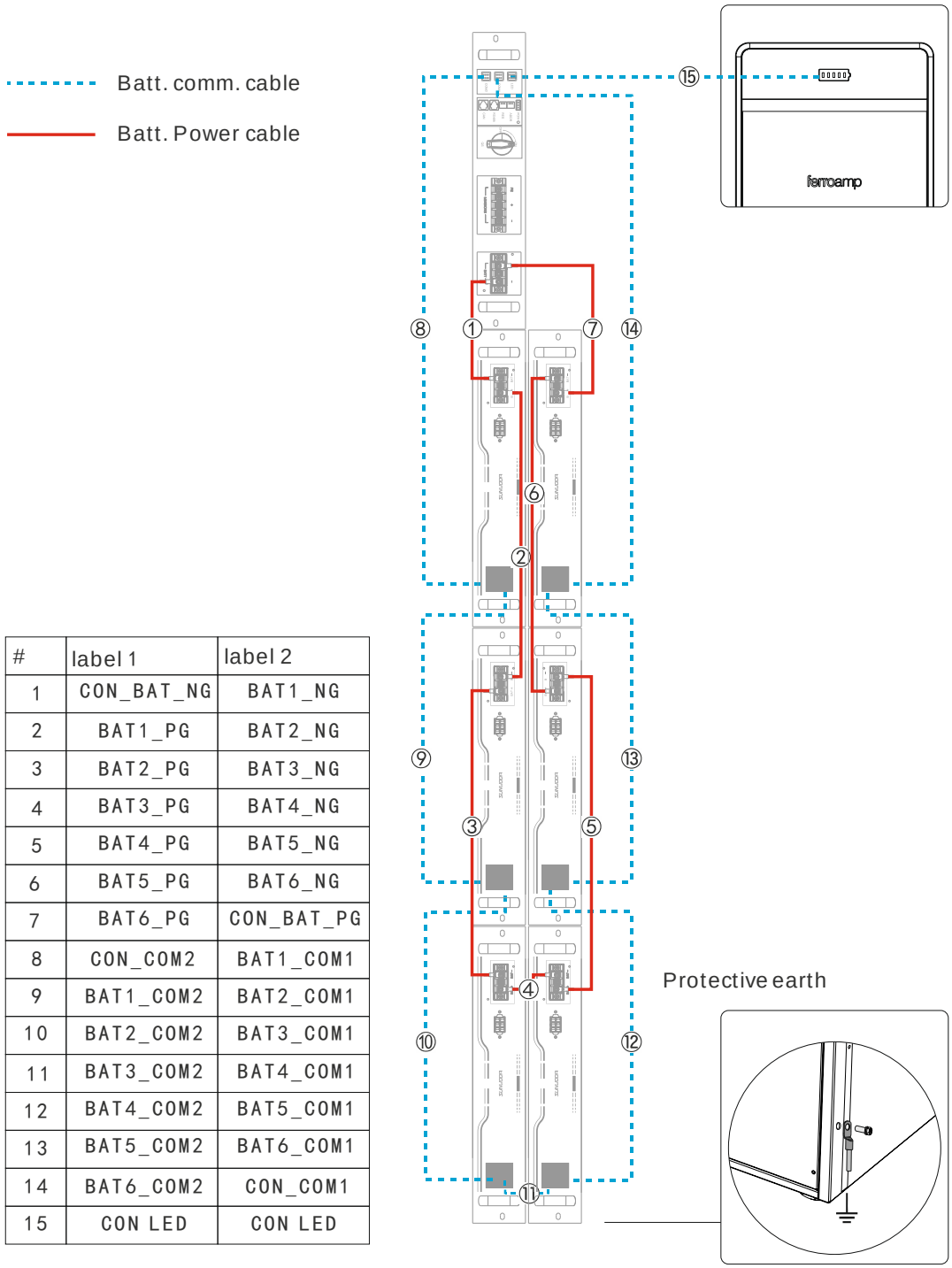
The following is a side view of the system (15kWh) after insertion of the battery and controller modules.

Make sure all the bolts fastened before proceeding for safety installation.

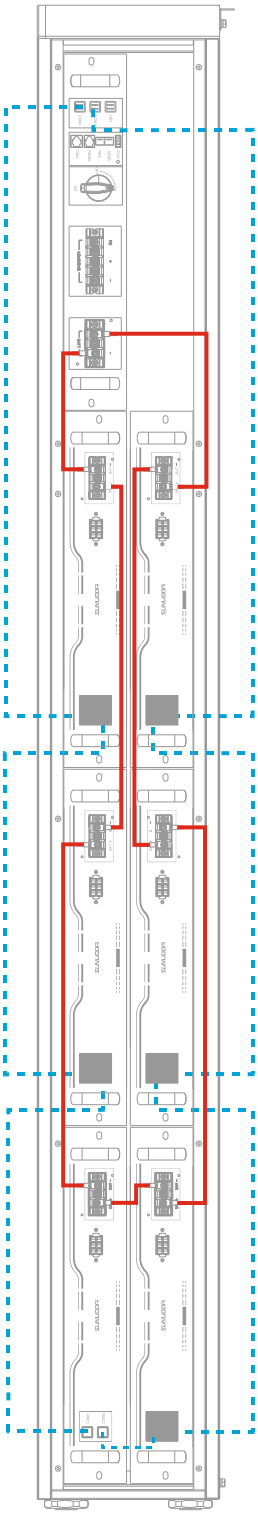


3.3 Cable Installation

3.3.1 Connection overview and the numbering of the cables (**PSM15**):



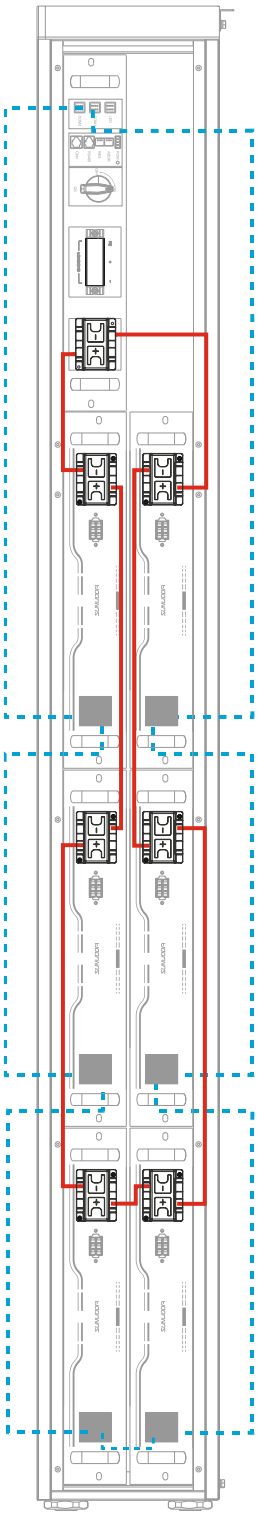
#	label 1	label 2
1	CON_BAT_NG	BAT1_NG
2	BAT1_PG	BAT2_NG
3	BAT2_PG	BAT3_NG
4	BAT3_PG	BAT4_NG
5	BAT4_PG	BAT5_NG
6	BAT5_PG	BAT6_NG
7	BAT6_PG	CON_BAT_PG
8	CON_COM2	BAT1_COM1
9	BAT1_COM2	BAT2_COM1
10	BAT2_COM2	BAT3_COM1
11	BAT3_COM2	BAT4_COM1
12	BAT4_COM2	BAT5_COM1
13	BAT5_COM2	BAT6_COM1
14	BAT6_COM2	CON_COM1
15	CON LED	CON LED



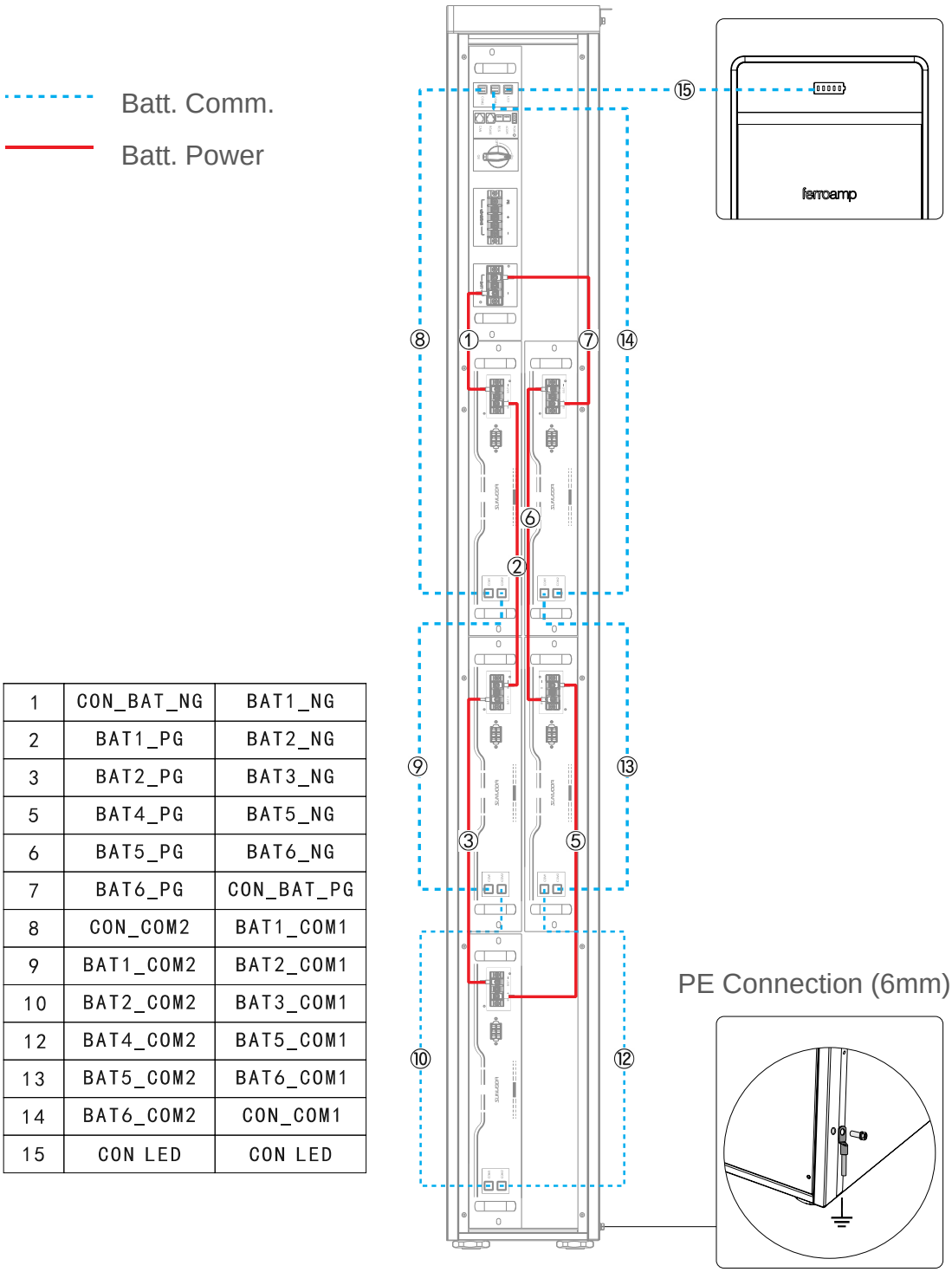
Sort the cables according to the list above and install the cables according to the numbering. As indicated in the left-hand side figure:

- Connect the power cables (solid line)
- Connect then the communication cables (dashed line)

Install the battery module protection covers (**Section 3.1**) back. After the installation the system looks like the figure on right-hand side.

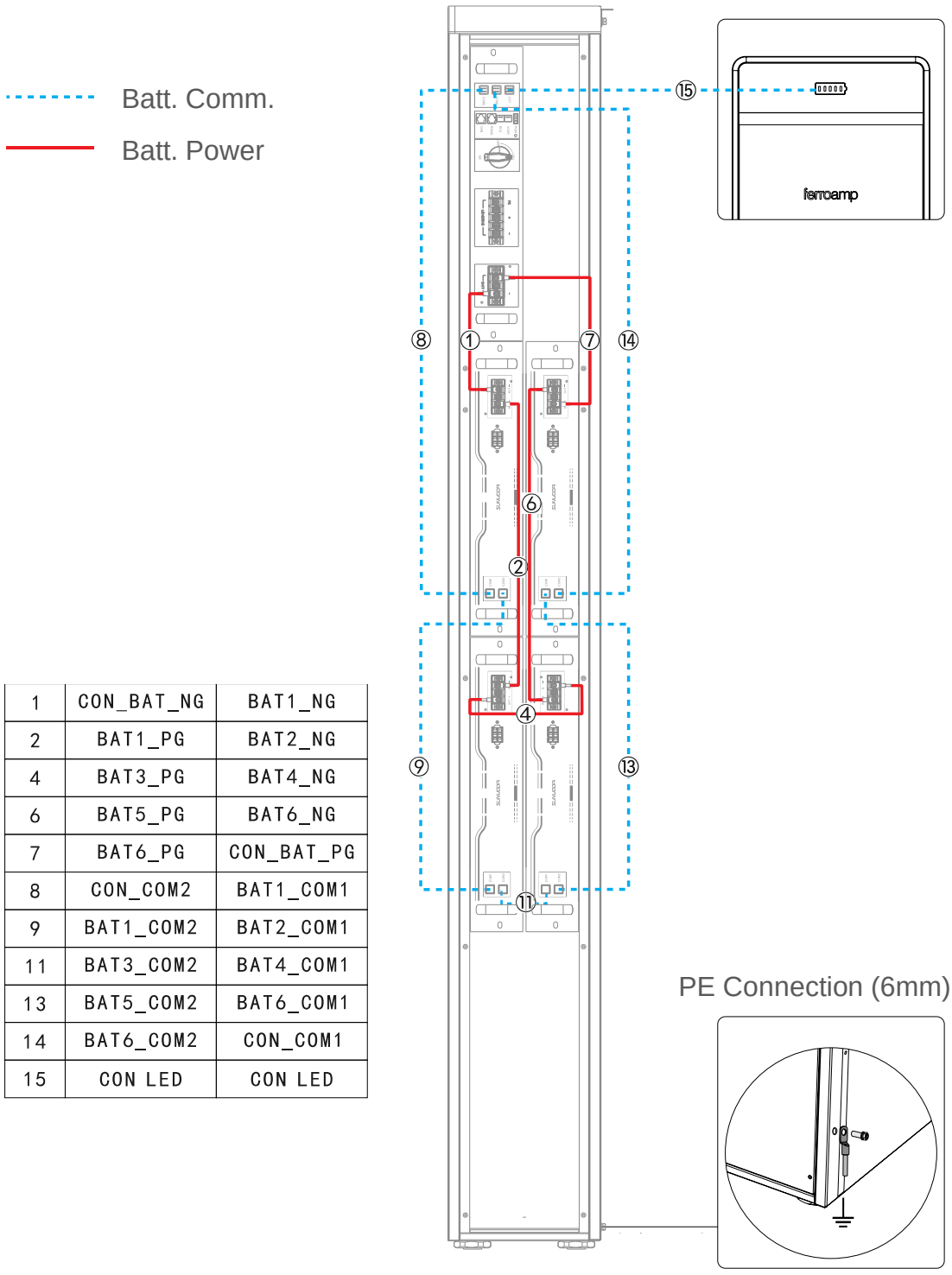


3.3.2 Connection overview and the numbering of the cables (**PSM12.5**):



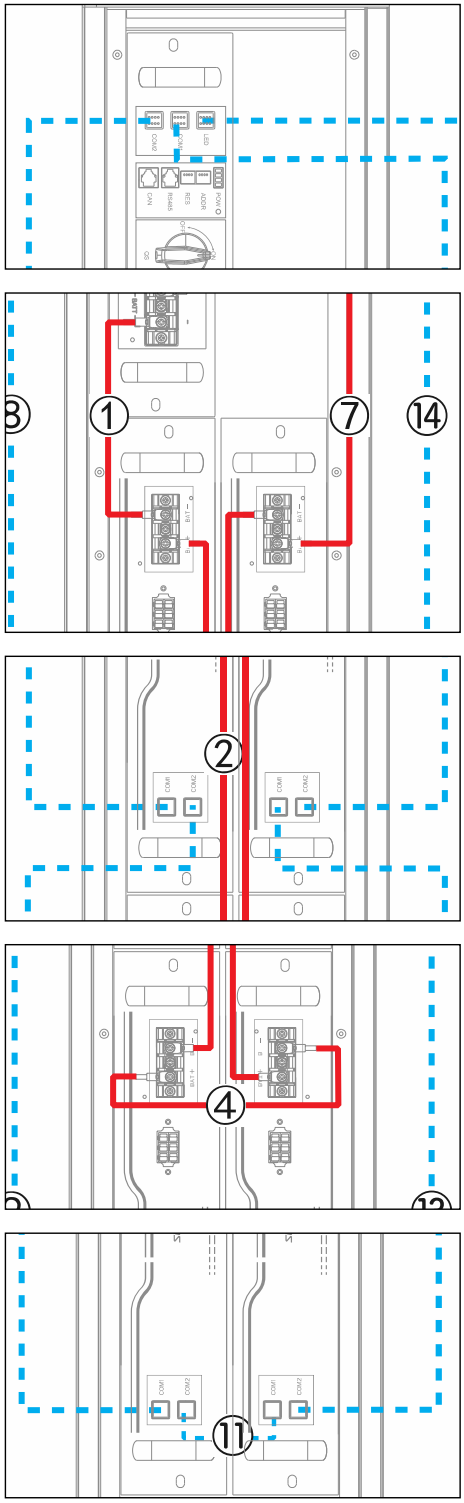
1	CON_BAT_NG	BAT1_NG
2	BAT1_PG	BAT2_NG
3	BAT2_PG	BAT3_NG
5	BAT4_PG	BAT5_NG
6	BAT5_PG	BAT6_NG
7	BAT6_PG	CON_BAT_PG
8	CON_COM2	BAT1_COM1
9	BAT1_COM2	BAT2_COM1
10	BAT2_COM2	BAT3_COM1
12	BAT4_COM2	BAT5_COM1
13	BAT5_COM2	BAT6_COM1
14	BAT6_COM2	CON_COM1
15	CON LED	CON LED

3.3.3 Connection overview and the numbering of the cables (**PSM10**):



1	CON_BAT_NG	BAT1_NG
2	BAT1_PG	BAT2_NG
4	BAT3_PG	BAT4_NG
6	BAT5_PG	BAT6_NG
7	BAT6_PG	CON_BAT_PG
8	CON_COM2	BAT1_COM1
9	BAT1_COM2	BAT2_COM1
11	BAT3_COM2	BAT4_COM1
13	BAT5_COM2	BAT6_COM1
14	BAT6_COM2	CON_COM1
15	CON LED	CON LED

Zoomed in:



4. ESO MODULE

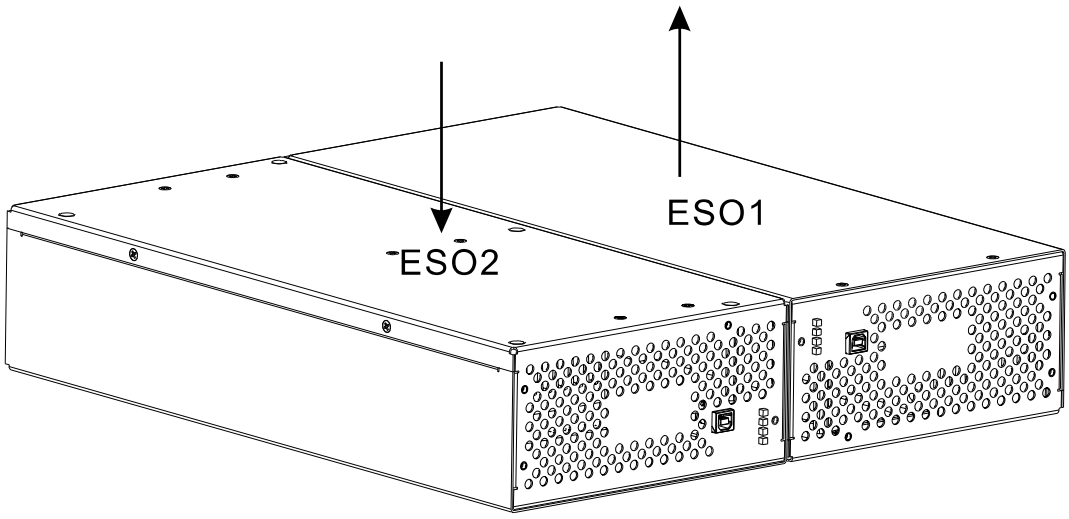
Depending on the system configuration, one or more ESO modules are shipped alongside with your PSM system. The ESO module is shipped in a cardboard package without pre-assembly. Each ESO module resembles a rectangular metal box.

Please skip to **4.2** if ESO is shipped pre-assembled.

4.1 ESO assembly

The following instruction applies to the two-ESO system with a nominal power of 12kW.

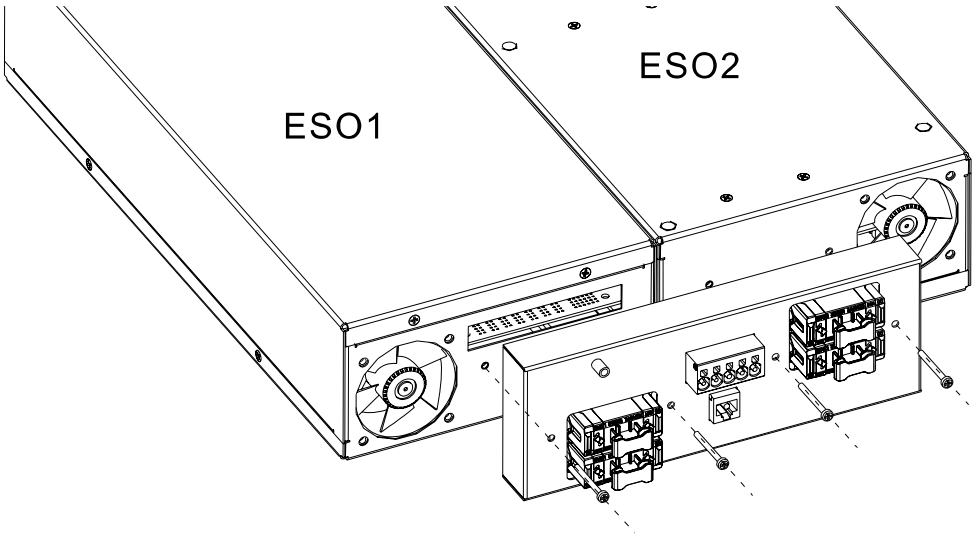
Lay the two ESO modules side by side on a flat surface. Make sure the second one (ESO2) have the bottom metal enclosure facing upward as indicated in the picture below.



Note that the weld nuts are visible from the ESO bottom metal enclosure.

Install the ESO adaptor:

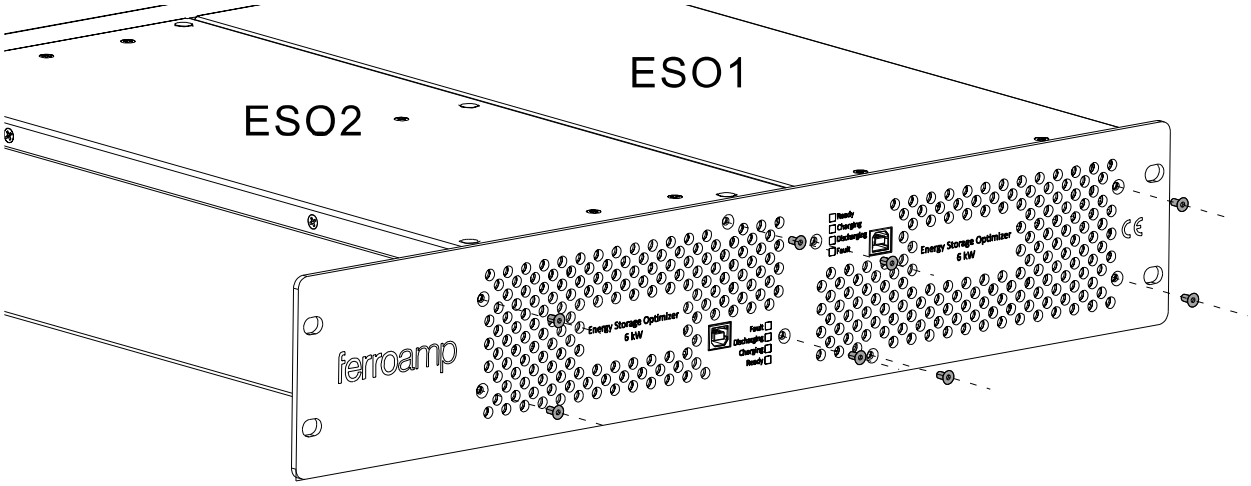
- firmly insert the adaptor into the sockets
- fasten the screws (4 pcs)



Note: do not lift the ESO off the supporting surface during the assembly

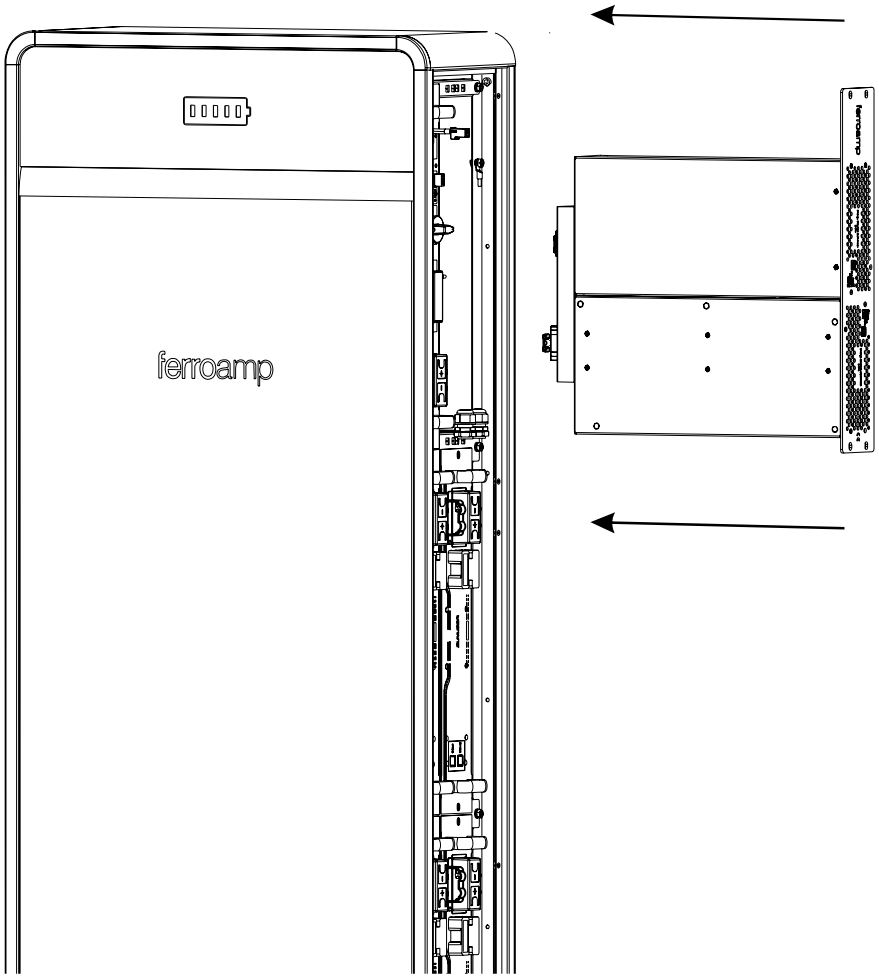
Install the ESO front plate.

- Carefully align the ESO front plate to the
- Pay specially attention to the LED prismatic piece
- Fasten the screws (8 pcs)



4.2 Insert the ESO

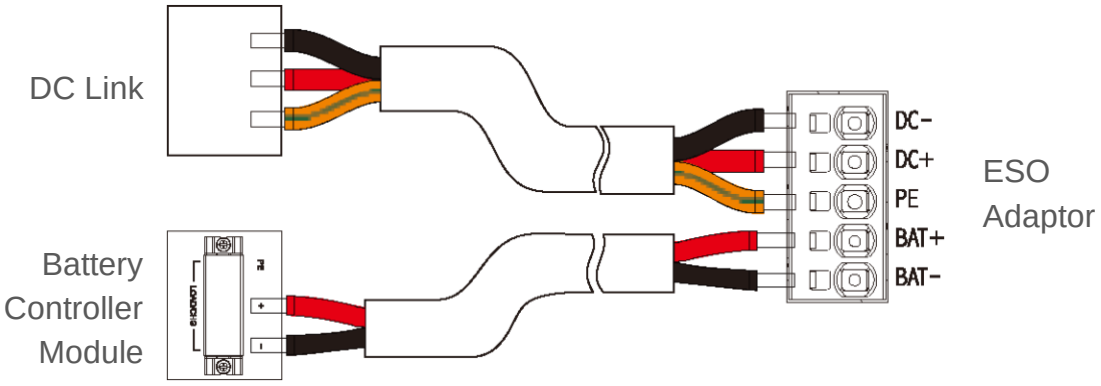
Insert the assembled ESO sideways and fasten the bolts.



4.3 Cable installation

Power cables

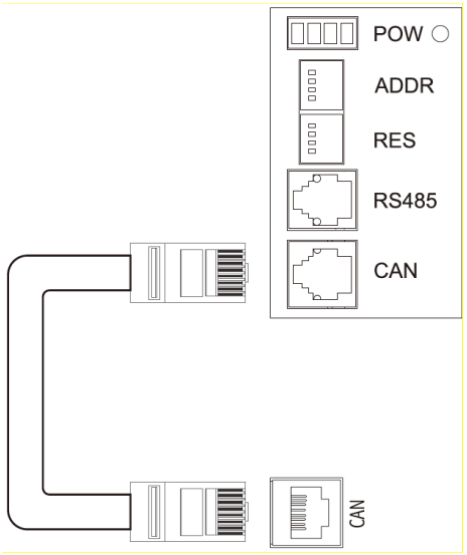
The following diagram shows the power cable connecting the ESO to the battery controller module and to the DC-link.



We recommend that the DC-Link cable to be connected only when installing the external cable. The external cable installation is covered in **Section 5.**

Communication cable

The communication between ESO and the battery controller module is through a standard RJ45 cable (ethernet cable). The connection is showed as below.

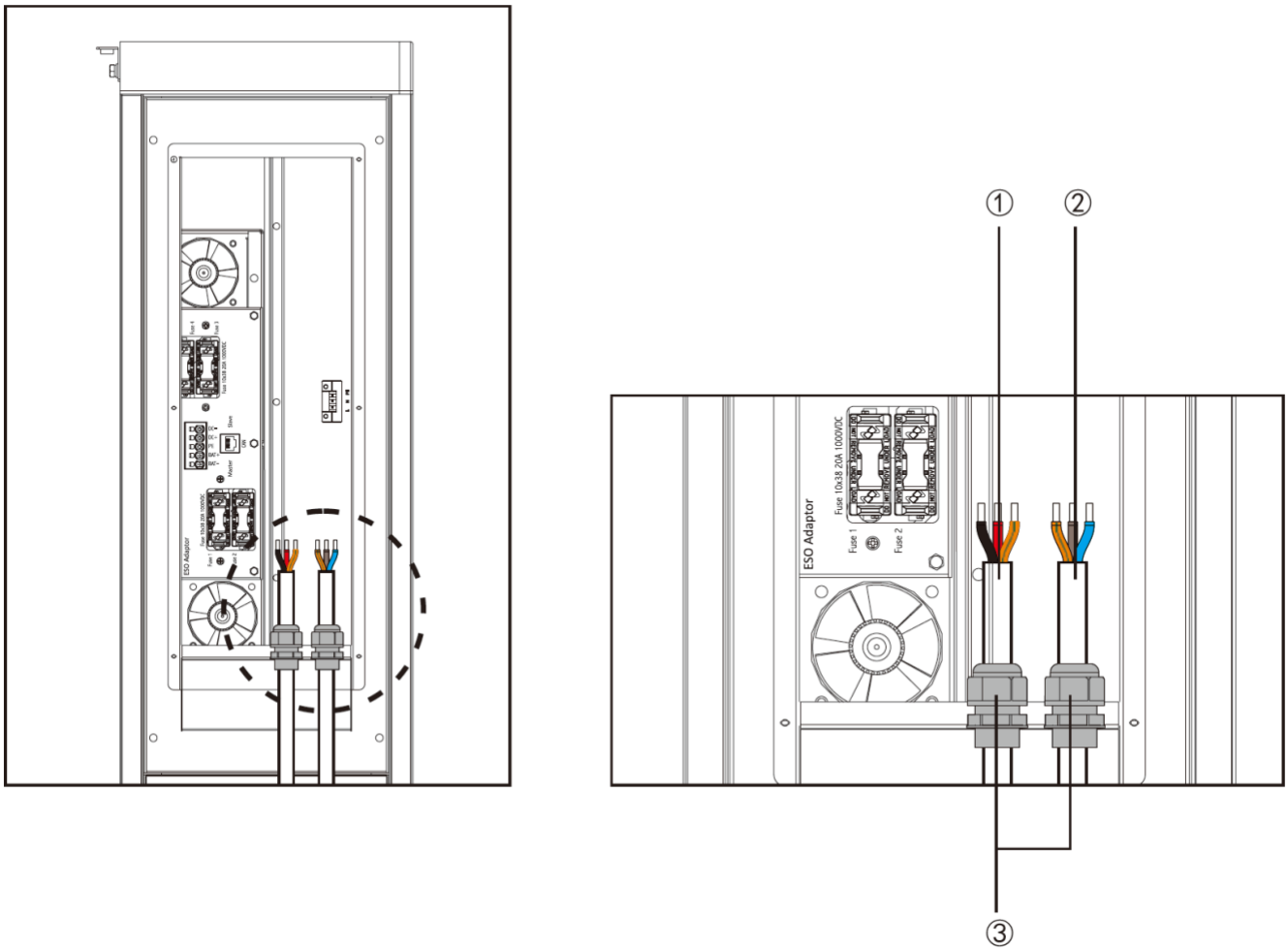


5. EXTERNAL CABLE

PSM system has two external cables:

- One DC-Link cable connecting to the FerroAmp EnergyHub
- One AC cable connecting to single phase wall socket (230VAC)

The following diagram shows a typical external cable installation.

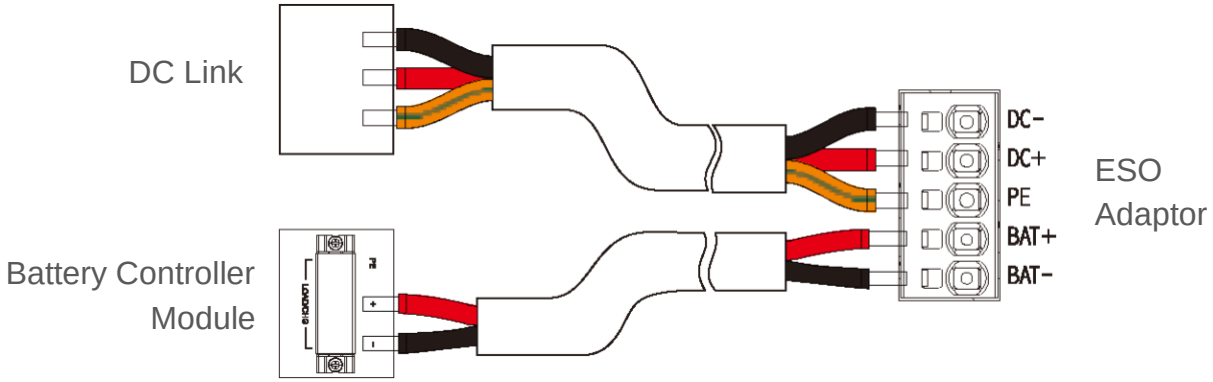


In the diagram (side panel removed):

(1) DC-Link cable
(2) AC230 cable
(3) cable gland (to be fastened after the installation)

5.1 DC-Link cable

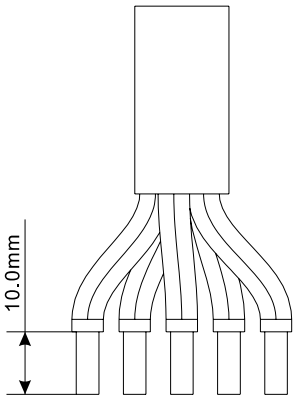
The ESO comes with a **Phoenix Contact 5P socket** on the back of ESO adaptor for easy cable installation. The socket is seen on the righthand side in the diagram below.



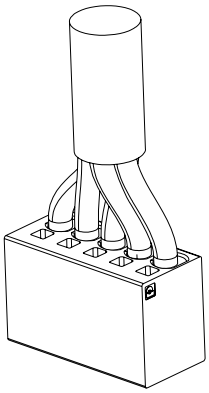
Consider sorting out the cable before connection.

To connect the cable:

- Prepare the cable according to the following diagram.
- Install one cable at a time, apply force evenly and gently in the direction towards the cable socket, make sure each cable is fully inserted.
- Once fully inserted, the cable is locked inside the socket.

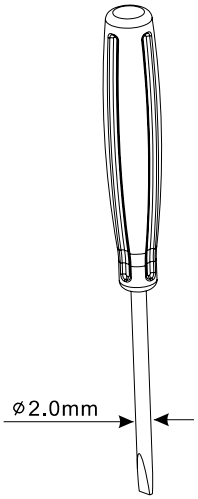


Note: if properly inserted, the installed cable cannot be removed without using a tool. Properly installed cable looks like the one in the following.

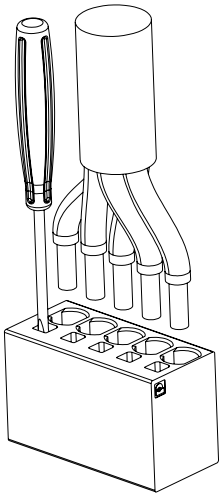


To remove an installed cable:

- use a flat-blade screwdriver (2mm),

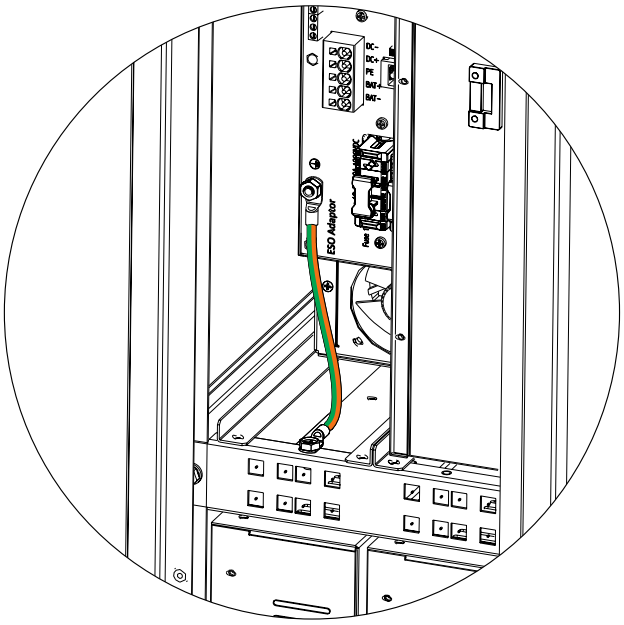


- firmly insert the flat-blade into the locking-releasing hole next to the cable socket (diagram below)
- Pull out one cable at a time until all cables are fully detached



The PE cable

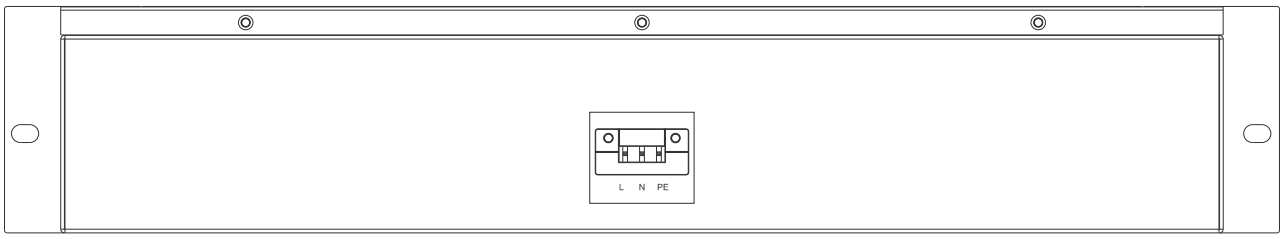
Connect the PE cable to metal bar inside the cabinet.



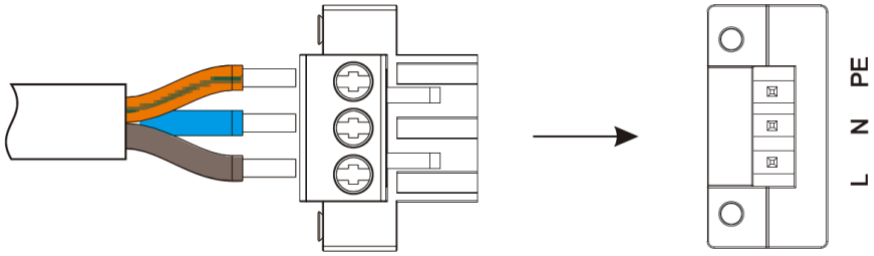
5.2 AC cable

Only for controller model H100030H-P02

The module comes with a cable terminal block in the box. The back of the controller looks like below.



- Build the cable / peel off the insulation (approx. 1.0 cm)
- Insert the cable into the terminal block* as indicated (figure below)
- Plug in the terminal block and fasten the screws (flat-blade 2mm)



Note*: an alternative terminal block (PLTB2.5-BF-SP) with a push-release mechanism instead of fastening bolt may also be found in the package

Please consult electrician for the AC power cabling.

5.3 Cable gland

Check all the external cabling before tightening the cable gland.

Make sure no tension is built when fastening the cable gland.

6. FINAL CHECK AND FINISHING UP

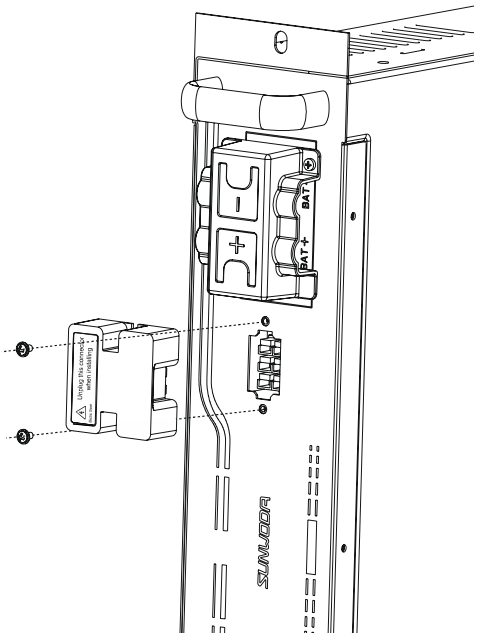
Check and make sure all the cable connection is done properly. Consider the following checklist:

- Cables on the front side of battery modules
- Cables on the back side of the ESO (no empty socket)
- Cables on the front side of controller module
- Protection covers on both the battery and controller modules

6.1 Jumper bricks

Both the battery and the controller module come with jumper bricks for safety consideration.

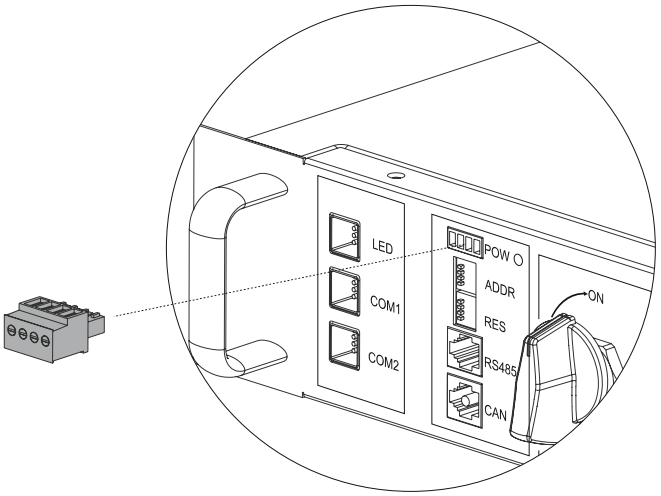
The battery is physically cut off from the internal circuit if the jumper brick is removed. Install the batter jumper brick according to the following diagram.



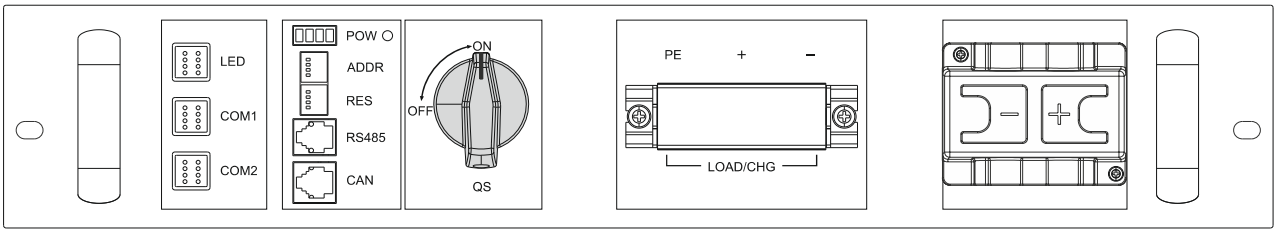
Make sure all the screws are properly fastened.

The battery controller comes with a green jumper that needs to be installed. The power to the controller is cut off if the jumper is removed.

Insert the jumper according to the following diagram



The battery controller has no power output if the QS breaker is switched off. The QS breaker on the battery controller module is switched to **ON** by default.



Make sure all the jumpers, switches done properly according to instructed.

6.2 Finishing up

It is the last step of the installation. Put back all the side panels in reverse order they were removed. Make sure all the screws are properly fastened.

Note: the PSM system does not come with any switch.

The LED lights up when plugging the AC plug into a wall socket. You may hear click which indicate the system initiates self-diagnosis. Your PSM system is now ready.

Contact your system administrator for a proper setting of the PSM in your FerroAmp Portal system.

After a proper configuration, the PSM system will be displayed as a battery in your Portal. The PSM is automatically controlled by the EnergyHub through the Portal.

7. MORE INFORMATION

7.1 Trouble shooting

LED indicator (★ is flashing, ★★ is flashing quickly, ● is always on and the flashing frequency is 1Hz)

States description		LED 1	LED 2	LED 3	LED 4	LED 5	Remarks
Power off							Lights off
Self-inspection							LED flashing
Charging	SOC 0% - 20%	★					LED1-LED5 flashing
	SOC 21% - 40%	●	★				LED2-LED5 flashing
	SOC 41% - 60%	●	●	★			LED3-LED5 flashing
	SOC 61% - 80%	●	●	●	★		LED4-LED5 flashing
	SOC 81% - 100%	●	●	●	●	★	LED5 flashing
	Over vol. warning	★	●				
	Over temp. warning	★		●			
	Over current warning	★	●	●			
	Over vol. protection	★★	●				
	Over temp. protection	★★		●			
	Over current protection	★★	●	●			
Discharging	SOC 0% - 20%	●					
	SOC 21% - 40%	●	●				
	SOC 41% - 60%	●	●	●			
	SOC 61% - 80%	●	●	●	●		
	SOC 81% - 100%	●	●	●	●	●	
	Under vol. warning	★			●		
	Over temp. warning	★	●		●		
	Over current warning	★	●	●	●		
	Under vol. protection	★★			●		
	Over temp. protection	★★	●		●		
	Over current protection	★★	●	●	●		
Error		★	★	★	★	★	

Manufacture supplied information

1. Battery Module

   Model No. H102025M-S with High-voltage Control Module

2. Battery controller module

   HV control module H100030H-P01 (off-grid)

   HV control module H100030H-P02 (AC powered)

7.2 Datasheet

	DC coupled energy storage		
PSM System Model *	**PSM 10 / 4 (8)**	**PSM 12.5 / 5 (10)**	**PSM 15 / 12**
Storage capacity, W_{NOM}	10 kWh	12.5 kWh	15 kWh
Maximum power rating, P_{MAX}	4 kW (8kW)	5 kW (10kW)	12 kW
Battery voltage, V_{NOM}	410 V	512 V	614 V
Maximum cont. battery charge current, I_{BAC}	20 A		
Maximum cont. battery discharge current, I_{BAD}	20 A		
Electrical roundtrip efficiency incl. DC/DC converter	93 % typical		
Cycle life	6000 cycles @ 80% DOD, EOL capacity 70%		
Cell chemistry	LiFePO4		
Maximum battery potential to ground	1000 Vpk		
Battery fuses	20 A, 1000 V, 10x38 mm gPV		
SOC precision	≤ 5 %		
Standby consumption incl. DC/DC converters	≤ 5 W (10 W)		≤ 10 W
Protection functions	Over voltage, over temperature, over current, isolation fault, pre-charge protection, short-circuit protection		
DC-nanogrid			
Number of included ESO DC/DC converters	1 (2)		2
DC bus voltage, V_{DC}	760 V (nominal)		
DC bus voltage range, V_{DC}	720 – 800		
Maximum DC bus current, $I_{DC(max)}$	10 A / 20 A	10 A / 20 A	20 A
DC bus connection	3-wire (DC+, DC-, PE)		
DC bus communication	Narrow band power line communication (PLC)		
Physical			
Dimensions H x W x D	1550 x 630 x 250 mm	2050 x 630 x 250 mm	
Weight	140 kg	Up to 210 kg	
Color	Black		
Installation			
Ambient temperature	0°C – 40°C		
Humidity	10 – 90% RH non condensing		
Degree of protection	IP 20		
BMS Power supply	230 VAC, max 40 W		
Compliance			
Battery safety	EN 62619, UN38.3		
LVD	EN 62477-1		
EMC	EN 61000-6-3, EN 61000-6-2		

* the data in parenthesis refers to model shipped with 2 ESOs