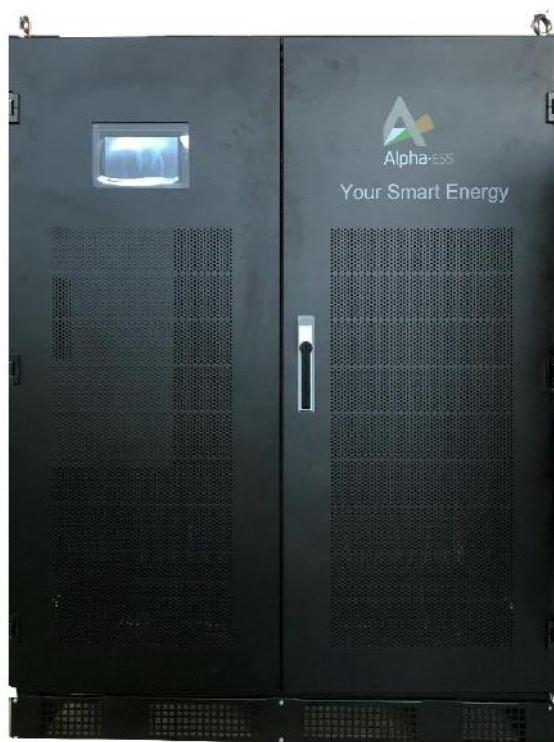




Installation, Operation & Maintenance Manual

Energy Storage System (ESS)

Storion-T30



V02

IMPRINT

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Nov. 12, 2018

Copyright Statement

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Version Information

Version	Date	Content	Author
V01	Sept 28 th , 2018	First edition	Elijah
V02	Nov 20 th , 2018	Add some safety instruction. Change partial structure. Modify some details.	Elijah

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1. Introduction

1.1 Brief Introduction

This manual applies to the Storion-T30 Li-ion Battery Energy Storage System (BESS) and covers these main aspects:

(1) Definition of Parts

Introduces the product components of the T30 system.

(2) Safety introduction

Introduces the product application, operating notes and qualification required of operators of T30 Li-ion battery energy storage system.

(3) Product description

Describes product appearance, product characteristics, system composition and major functions of T30 system.

(4) System installation

Installation guidance for the T30 system.

(5) Operation

Introduces the operation of T30 system.

(6) Routine maintenance

Introduces recommended maintenance schedules for the T30 system.

(7) Trouble-shooting

Fault finding guide for the T30 system, reasons for faults, and the processing method.

1.2 Definition of Components

(1) Battery modules (Model: M48112-S)

Each Battery module is made up of a Battery monitoring circuit, Battery Equalization Circuit, Electrical Connectors, Communication Interfaces, thermal management devices and multiple Battery cells. Each Battery cell is a Lithium iron phosphate cell - LiFePO₄ (LFP), a basic unit constituted by electric poles and electrolytes and each cell is independent and closed.

(2) Battery Management System BMS (Model: HV900112)

The BMS electronically monitors the operating information of cells, battery modules and system measurements such as voltage, current, temperature, protective parameter of batteries, evaluating the state of charge (SOC), the state of health (SOH) and cumulative processed energy, protecting batteries for safety, etc.

(3) Inverter (Model: Storion-T30-INV)

The inverter is of a modular design and sits within the cabinet itself. It's rated at 30kW and has been type tested to VDE 4105, G59/3 and AS/NZS 4777.2. It has an AC/DC bidirectional module which charges the DC batteries but also allows the batteries to discharge and provide an AC three phase supply to building loads.

(4) EMS Module

The Energy Management System Module monitors and logs system data, provides Alpha cloud access in turn providing efficient control of battery and inverter.

2. Safety Instructions

2.1 Symbols

	It indicates a hazardous situation which if not avoided, could result in death or serious injury!
	Danger of high voltage and electric shock!
	Danger of hot surface!
	Refer to the operating instructions.
	The product must not be disposed of in household waste
	Storion-T30 will be touchable or operable after minimum 5 minutes of being turned off or totally disconnected, in case of any electrical shock or injury.
	The product conforms to CE standard.
	Do not puncture, impact, mutilate this unit or put it into the fire. It can lead explosion.
	Please wash your hands after using the battery.
	Warning: hazards due to batteries.
	The installation and maintenance work should be handled with professional person/s, who is/are knowledgeable about batteries.
	Installation and maintenance reference to this installation and maintenance manual.
	Do not expose to sparks or flame



Keep out of reach of children



The product must not be disposed of in household waste;



Dispose of it through environmentally friendly collection centres.

2.2 Manual Keeping

This manual contains important information about installing and operating the AlphaESS system. Before installing and operating, please read it very carefully.

The BESS should be installed and operated in strict accordance with the description in this manual, to avoid causing damage or loss to equipment, personnel and property. This manual should be kept carefully for maintenance and operation.

2.3 General Precautions



DANGER

Danger to life due to high voltages and electric shock.

Since the system will be performing under high voltage circumstances, there's risk of electric shock or burning from improper actions.

- Do not touch the terminals and conductors connected to grid circuits unless necessary.
- Do not open and operate the equipment except qualified personnel.
- Do not wipe the system with wet cloth.
- Have the system installed and commissioned by qualified and authorized personnel only.
- Prior to any operation on the BESS or the battery pack, disconnect the BESS from all voltage sources as described in item 5.3.5 Power-off Procedures.
- Following the safety instructions strictly for connection to the grid.



WARNING

Risk of chemical burns from electrolyte or toxic gases.

All types of damage to the battery pack may lead to a leakage of electrolyte or flammable gases.

- Do not install the system in any environment with temperature lower than -10°C or higher than 50°C, and humidity over 85%.
- Do not touch the system with wet hands.

- Do not put any heavy objects on top of the system.
- Do not damage the system in such ways as dropping, deforming, impacting, cutting or penetrating with sharp objects.
- Do not install or operate the system in potentially explosive atmospheres.
- Do not install the BESS in areas where flammable materials are stored.
- If moisture has penetrated the system (e.g. due to a damaged enclosure), do not install or operate the system.
- Fasten the system to prevent from tipping with restraining straps in your vehicle when transporting.
- The transportation of AlphaESS Storion-T30 must be carried out by certified logistic company and personal.
- A certified ABC fire extinguisher with minimum capacity of 2kg must be carried along when transporting.
- It is prohibited to smoke inside the vehicle or nearby the vehicle when loading and unloading.


CAUTION
Risk of injury from mishandling of the equipment!

The instructions in this manual must always be followed when transporting and installing the system. Improper operations may lead to electric shock, burns, contusion, etc.

Without permission, any damages to equipment caused by unauthorised modification or disassembly of the system (or equipment) will not be covered by warranty

2.4 Operator Requirements

An Operator is an authorised person who installs, commissions, maintains or repairs the BESS.

The operators should be familiar with the whole storage system including the working principle of the system.

For safety reasons any work completed on the BESS should be completed by two competent personnel.

It is strictly prohibited for any maintenance when equipment is on.

2.5 Live Line Measurement

High voltage in the cabinet may cause vital electric shock when touched by accident. Equipment protection must be taken in live line measurements (e.g.: insulation gloves).

The measuring equipment should be connected and used correctly to ensure personnel safety. When measuring, at least two workers are needed.

If failure occurs during live measurement, see 2.7.1 Emergency Handling Plan or more details.

2.6 Operation After Power Failure

The battery system belongs to the energy storage system, so it stores fatal high voltage even if the DC side is disconnected, touching the output of the battery modules is strictly prohibited.

The Inverter can also hold fatal voltage on both the DC and or AC side after disconnection, so it must be tested by using a suitably calibrated voltage tester for safety reasons before an operator works on the equipment.

2.7 Emergency Procedure

When the T30 Battery energy storage system appears to be running abnormally you can turn off the grid connected main switch directly feeding the BESS and turn off all load switches within the BESS, closing the switch of the moulded case circuit breaker (MCCB) of the BMS (HV900112) at the same time. To prevent a potentially fatal personal injury, if you want to repair or open the machine after the power is switched off please measure the voltage at the input terminals with a suitably calibrated voltage tester.

Before working on this equipment, please confirm that there is no grid electric supply to the BESS!

The upper cover plate cannot be opened until the DC-link capacitance inside the battery modules discharges completely about 15 minutes later.

2.7.1. Emergency Handling Plan

1. Disconnect the AC breaker.
2. Check the control power supply. If it is OK, return the power supply to find out the reason.
3. Please record every detail related to the fault, so AlphaESS can analyse and solve the fault. Any operation of equipment during a fault is strictly forbidden, please contact Alpha as soon as possible.
4. As battery cell contains little Oxygen inside and all cells have got explosion-proof valve, explosion hardly happens.
5. When the indicator light on the BMS (HV900112) shows a red fault, check the fault type through the communication protocol, and contact our after-sales service personnel for advice.

2.7.2. Hazards

If there's electrolyte leakage, please avoid any contact with the leaking liquid or gas. If one is exposed to the leaking substance, please follow the actions described in below immediately:

Inhalation: Evacuate the contaminated area, and seek medical attention.

Eye contact: Rinse eyes with running water for 5 minutes, and seek medical attention.

Contact with skin: Wash the affected area thoroughly with soap and water, and seek medical attention.

Ingestion: Induce vomiting, and seek medical attention.

2.7.3. Fire

If a fire breaks out in the place where the battery pack is installed, take the following countermeasures:

Fire extinguishing media

Respirator is not required during normal operations.

Use Novec 1230, FM-200 or dioxide extinguisher for batteries.

Use an ABC fire extinguisher, if the fire is not from battery and has not spread to it yet.

Fire-fighting instructions

1. If fire occurs when charging batteries, if it is safe to do so, disconnect the battery pack circuit breaker to shut off the power to charge.
2. If the battery pack is not on fire yet, extinguish the fire before the battery pack catches fire.
3. If the battery pack is on fire, do not try to extinguish but evacuate people immediately.

 There may be a possible explosion when batteries are heated above 150° C. Besides, when the battery pack is burning, it may generate poisonous gases. Please do not approach.

Effective ways to deal with accidents

On land: Place damaged battery into a segregated place and call local fire department or service engineer.

In water: Stay out of the water and don't touch anything if any part of the battery, inverter, or wiring is submerged.

Do not use submerged battery again and contact the service engineer.

2.8 Warning Signs

The T30 BESS warning sign contains important information for the system to operate safely, and it is strictly prohibited to be torn or damaged. Ensure that the warning sign is always clear and visible. The signs should be replaced immediately when damaged.

2.9 Locating of Safety Warning Signs

While installing, maintaining, commissioning or repairing the BESS, to prevent un-authorized personnel causing incorrect operation or an accident, obvious safety signs should be located

at the main BESS switch/isolator and any local BESS switch/isolator in case of accidents caused by false switching. Warning signs or tapes should be also located near the operational areas. Keys of the system must then be pulled out after maintenance or operation and kept safe.

2.10 Measuring Equipment

For ensuring the electrical parameters to match requirements, related measuring equipment is required when the system is being connected or tested.

2.11 Electrostatic Protection

Contact or improper operation or testing of the printed circuit board or any other electrostatic-sensitive device (ESD) components may result in damage to the device. Unnecessary contact should be avoided.

2.12 Moisture Protection

It is very likely that moisture may cause damages to the system.

Do not open the cabinet door when the humidity is larger than 85%.

Repair or maintaining activities in wet weather should be avoided or limited.

2.13 Minimum Personal Protection Equipment

For the safety of operators to the system, personal protective equipment is required. During the operation, following protective equipment is required:

No.	Item	Notes
1	Work clothes	
2	Protective shoes	
3	Protective glasses	

When doing maintenance works such as checking cables or wires, measuring voltage, replacing small electrical parts or cleaning modules and brackets, as minimum the following protective equipment is required:

No.	Item	Notes
1	Work clothes	
2	Protective shoes	
3	Protective glasses	
4	Insulated gloves	For touching live parts

i **Note:** All metal tools during maintenance should be insulated.

When replacing modules, the following protective equipment is required:

No.	Item	Notes
1	Work clothes	
2	Protective shoes	
3	Protective glasses	
4	Insulated gloves	For touching live parts

i **Notes:** When replacing modules, the stacking machine should be used carefully in case that the modules may fall down. All workmen are suggested to wear high-safety and high strength protective shoes to protect their feet.

3. Product Description

The AlphaESS Storion-T30 energy storage system is an on-grid system designed for self-consumption at certain periods or for load shifting. The overall system connection diagram is shown in the Figure 3.1.

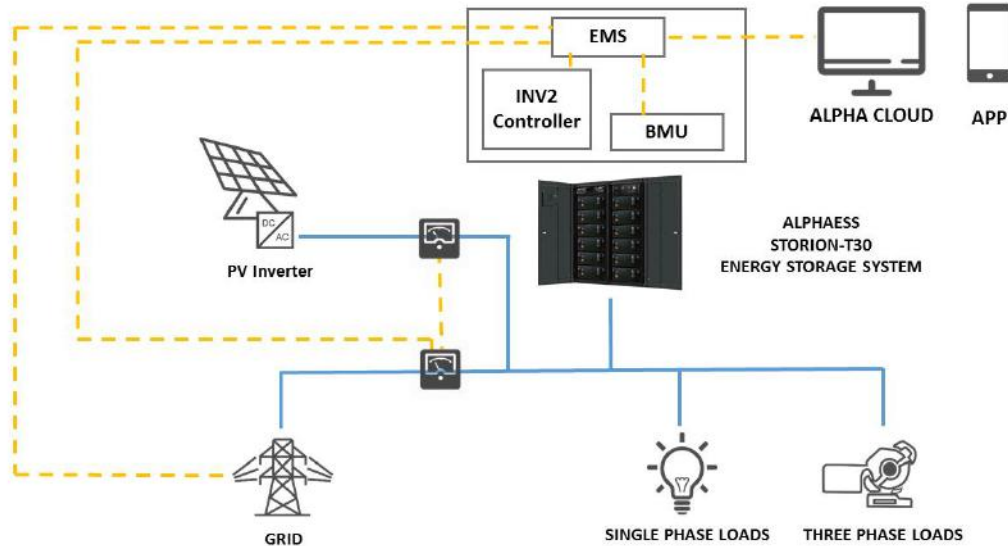


Figure 3.1 System application diagram

3.1 System Schematic

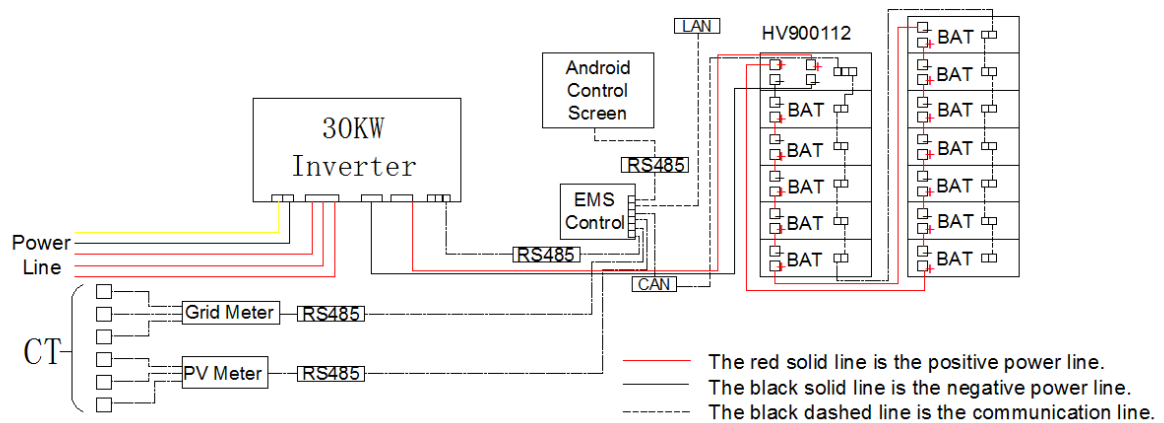


Figure 3.2 System schematic

3.2 Product Appearance

Figure 3.3 is the visual appearance of the storage system and Table 1 shows the cabinet layout.

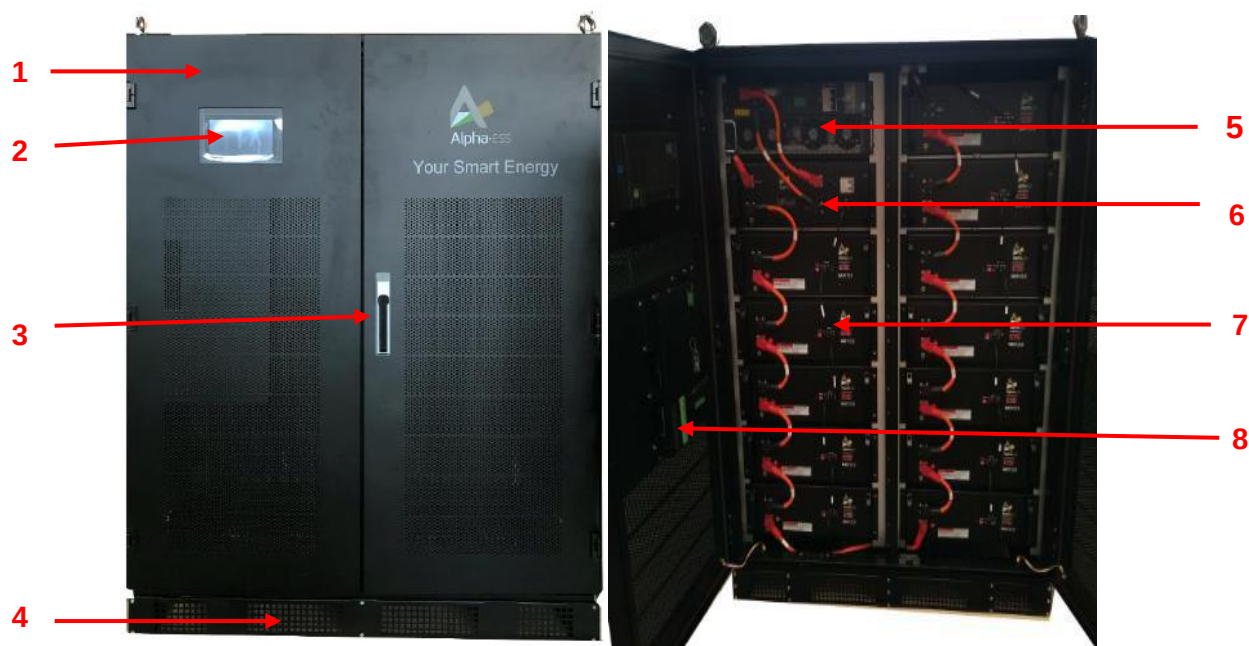


Figure 3.3 Appearance of the product

Table 1 Cabinet composition

Item	Components
1	BESS Cabinet
2	Android display screen
3	Cabinet door handle
4	Lampstand
5	Inverter Model: Storion-T30-INV
6	Battery management unit (BMU) Model: HV900112
7	Battery Module M48112-S
8	EMS module

3.3 Product Characteristics

LiFePO4 batteries produced by AlphaESS have a longer lifespan as well as a higher reliability, which is able to satisfy applications of energy storage systems.

The system is highly modular designed, and it is easier to assemble, transport and maintain.

The system has a three-level BMS and is readily allowed for system expansion.

The system adopts full time balancing technology so that the consistency of batteries and modules can be well ensured.

The system is designed as a removable cabinet which is compact in structure, flexible, and convenient for installation and testing. It is also suitable to the working environment, and is able to satisfy different kinds of applications.

The system has current balance technology between strings in case of circulating current or unbalanced power.

The system has relatively developed thermal management technology so that the consistency of system environment can be ensured.

The system has functions of remote monitoring and local controlling.

The system realizes flexible scheduling of electric power system through communication among BMS, the inverter and the monitoring system.

3.4 Component Parameters

3.4.1. Cabinet

Table 2 Cabinet parameters

Cabinet	
Manufacture	AlphaESS
Model Name	T30 Standard Cabinet
Dimensions (L x W x H)	1180 x 730x 1550 mm
Weight	180 kg
Quantity	1
Ventilation	e.g. natural,

3.4.2. Inverter

3.4.2.1 Product Instruction

Storion-T30-INV is an energy storage inverter. It has AC/DC modules. It can transform the grid electricity and charge batteries. The AC/DC module is bidirectional so that the DC electricity from batteries can also be transformed into three-phase AC electricity to supply loads.

3.4.2.2 Appearance

Figure 3.4 shows the Inverter front cover.



Figure 3.4 Inverter front cover

3.4.2.3 Interface definitions

Table 3 Inverter interface definition

Position	Description	Position	Description
1	DC-	6	Communication interface
2	DC+	7	Display screen
3	Ethernet	8	AC Switch
4	LED-Run	9	Ac side connection (L1, L2, L3, N)
5	LED-Fault	10	Earthing point

3.4.2.4 Technical Parameters

Table 4 Inverter parameters

Inverter	
Max. AC Input Current	43 .3A
Nominal AC Input Voltage	400 V
Battery Voltage Range	200 ~ 750 V
Max. Charge/Discharge Current	90 A
Max. Charge/Discharge Power	30 kW
Phase	Three-Phase
Rated Voltage	400 V
Grid Voltage Range	340 ~ 460 V
Rated Frequency	50/60 Hz
Dimension (W x D x H)	440 mm x 550 mm x 173 mm
Weight	30kg
Grid Regulation	VDE-AR-N 4105, E DIN VDE V 0124-100, G59/3-2, AS/NZS 4777.2
Safety	IEC 62477-1, IEC62040-1-1,

EMC	EN 61000-6-2, EN 621000-6-4
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3.4.3. Battery System

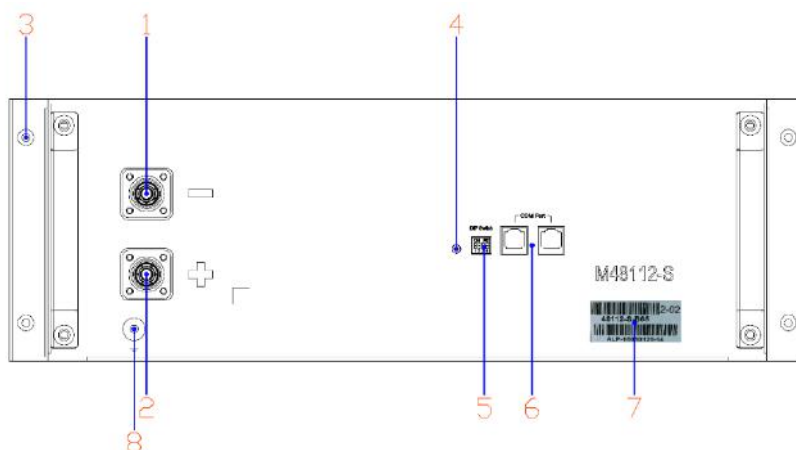
Table 5 Battery system parameters

Item	Description	Parameter	Remark
1	Max. DC Power	30 kW	
2	Energy storage capacity	According to the project situation	Ambient temperature is 30°C, measured at DC side
3	Continuous discharge current	112 A (1C)	
4	DC voltage range	580 ~ 675V(12 Batteries)	
5	Communication interface	RS485, CAN2.0	

3.4.3.1 M48112-S



Figure 3.5 Battery appearance


Figure 3.6 Battery front cover
Table 6 Battery interface definition:

No.	Description	No.	Description
1	Battery negative pole	5	Dip switch
2	Battery positive pole	6	COM port (CAN) x 2
3	Earthing point x 4	7	Information label
4	LED light	8	Earthing point (Reserved)

The dip switch of M48112-s defines the serial number. Please see the detailed description in the following table.

Table 7 Dip switch definition of M48112-S

Serial Number	Dip Switch	Serial Number	Dip Switch	Serial Number	Dip Switch
1		5		9	
2		6		10	
3		7		11	
4		8		12	

Table 8 Battery technical parameters:

No.	Item	Technical parameter	Remarks
1	Battery model	M48112-S	
2	Assembly method	16S2P	
3	Nominal voltage	51.2 V	
4	Voltage range	48 ~ 58 V	
5	Nominal capacity	112 Ah	Max. charge / discharge current 1C
6	Nominal stored energy	5.734 kWh	
7	Work power consumption	0.4752 W	
8	Dormant power consumption	1.52 mW	Battery dormant state
9	Max. charge/discharge current	112 A	Constant current mode
10	DC internal resistance	< 20 mΩ	Factory default
11	Transportation/storage temperature range	-20 ~ 45 °C	
12	Charge work temperature range	0 ~ 50 °C	
13	Discharge work temperature range	-10 ~ 50 °C	
14	Communication mode	CAN	
15	Weight	62 ± 2.0 kg	
16	Size (W x D x H)	490.6 x 611.3 x 159.7(±5) mm	
17	Humidity	15% ~ 85%	

3.4.3.2 HV900112

HV900112 front cover is as in Figure 3.7 shown.

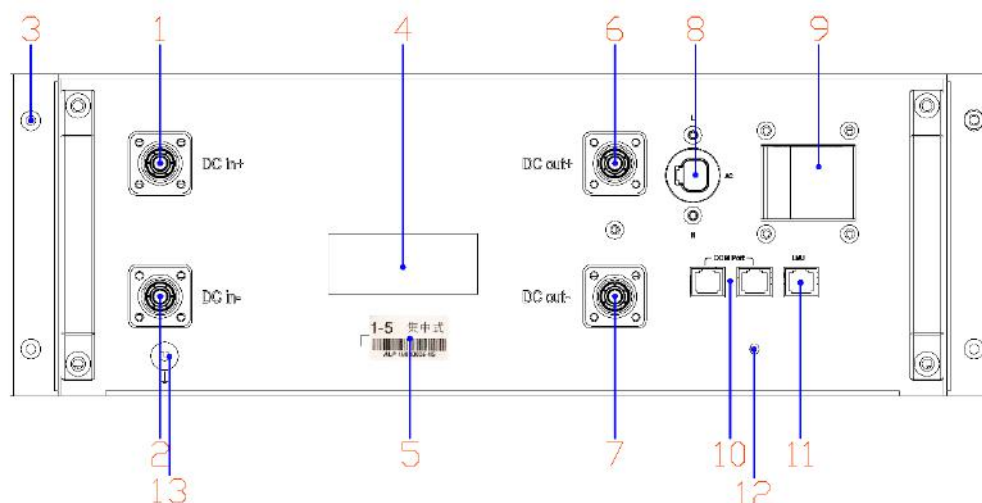


Figure 3.7 HV900112 front cover

Table 9 HV900112 interface definition

No.	Description	No.	Description
1	DCin+	7	DCout-
2	DCin-	8	AC input(Auxiliary power)
3	Earthing point x 4	9	AC Air switch(Auxiliary power)
4	Moulded case circuit breaker	10	BMU COM port (CAN) x 2
5	Information label	11	LMU COM port (CAN)
6	DCout+	12	LED light
		13	Earthing point (reserved)

Table 10 HV900112 technical parameters

No.	Item	Technical parameter	Remarks
1	High-voltage control box	HV900112	
2	Working voltage range	200 ~ 900 V	
3	Rated current	112 A	
4	Dimensions (W x D x H)	494.6 x 552.6 x 162 ± 5mm	
5	Weight	20 kg	
6	Power consumption	<10 W	

4. Installation

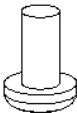
4.1 Installation Precautions

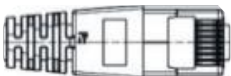
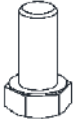
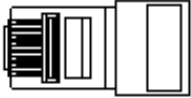
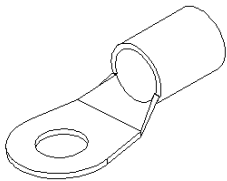
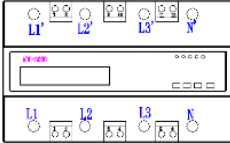
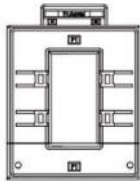
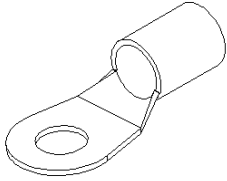
The following sites are not allowed for installation:

- Sites which are salty and where humid air can penetrate.
- Flooded areas.
- Earthquake areas –additional security measures are required here.
- Sites that are higher than 3000 meters above the sea level.
- Sites with explosive or potentially explosive atmosphere.
- Sites with extreme changes of ambient temperature.
- Sites with highly flammable materials or gases.

4.2 Packing List

Table 11 Packing List

M48112-S			
			
4 x M6*16	4 x M6 Gouding Serrated Washer	1 x 130 mm Power Cable black-red, BAT-BAT	1 x Communication cable 280 mm, BAT-BAT
Cabinet			
			
1 x 130 mm Power Cable black-black, BAT-HV	1 x 2120 mm Power Cable red-red, BAT-HV	1 x 2300 mm Power Cable black-red, BAT-BAT	1 x Communication cable 2200 mm, BAT-HV900112

			
1 x Terminal Resistance	1 x M6 Nut	4 X M12 Hex Nut	4 X M12*25 Hex Screw
			
12 X RJ45 Connectors	4 X Cable Bond (SC10-5)	Cable Tie	2 x ADL3000-N/CT
			
6 x AKH-0.66/K K-30*20 400/5A-NCT	1 X Cable Bond (HUP10-6) For Cabinet Grounding		

4.3 Installation

4.3.1. Installation of Cabinet

4.3.1.1 Removing Cabinet

Figure 4.1 shows the cabinet Installation position limits

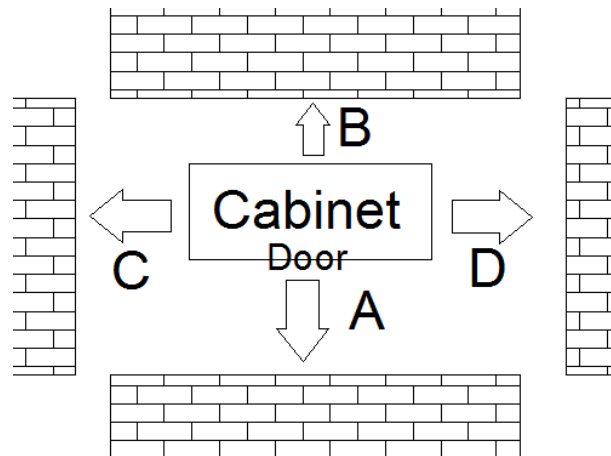


Figure 4.1 Installation position limit

A	"≥1,000mm, ensure that the front door of the cabinet can be fully opened. There is sufficient space for cold air to enter. Users can conveniently insert and extract the module and operate."
B	"≥500mm, ventilation and heat dissipation should be ensured. Users can have sufficient space for maintenance."
C, D	"≥1,000mm, ensure that the sides of the cabinet can be fully accessed. Ventilation and heat dissipation should be ensured. Users can have sufficient space for maintenance."

The final installed position of the T30 should have the minimum distances from any peripheral walls as highlighted in the above table to ensure that the doors can be fully opened and closed, and the side panels can be accessed conveniently. There should also be sufficient space for module insertion and extraction, normal heat dissipation and user's operation.

4.3.1.2 Positioning Steps

Step1: Remove the cabinet from the delivery truck using a forklift truck or suitable lifting tool as per Figure 4.2.

 **Note:** In an environment with sufficient space.



Figure 4.2 Remove the cabinet

Step2: Remove the protective film and protective cardboard from the cabinet (Figure 4.3).



Figure 4.3 Removal of protective materials

Step3: Use a forklift or suitable lifting tool to remove the cabinet from the pallet.

Step4: Use a forklift or suitable lifting tool to transport the cabinet to the desired installation position. (Figure 4.4)



Figure 4.4 Adjust the position of cabinet

4.3.1.3 Cabinet Earthing & Bonding

After the cabinet is in its final installation position, open the two front doors of cabinet, remove all the cables, CT meter and accessories package tied to the cabinet.

Figure 4.5 shows two wingnuts, rotate counter clockwise to loosen the cable entry cover plate, the plate is pushed in the direction shown by the red arrow, the grounding cable, communication wiring and electrical supply cable are penetrated through the cable entry, the plate is then pushed back, and the wingnuts on both sides are locked. the grounding/bonding resistance should be less than 4 ohms

Then fasten the grounding cable (from the accessories package of cabinet) to the grounding bolt using an M6 nut.

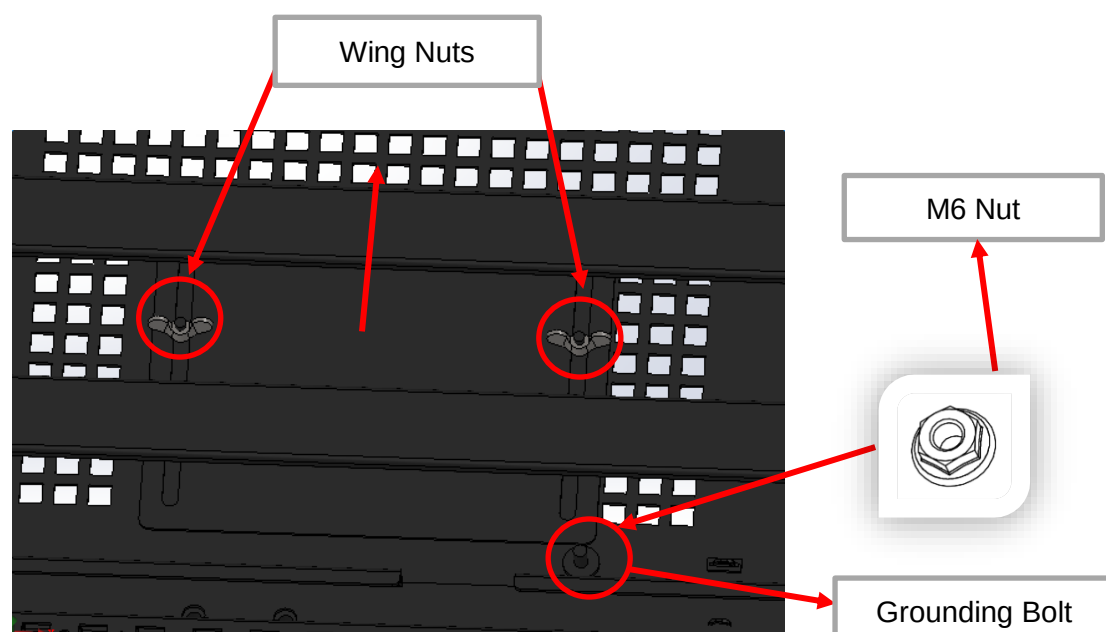


Figure 4.5 Pushed the baffle

4.3.2. Inverter Installation

Inverter modules should be fitted, tested and in place prior to delivery for ease of install.

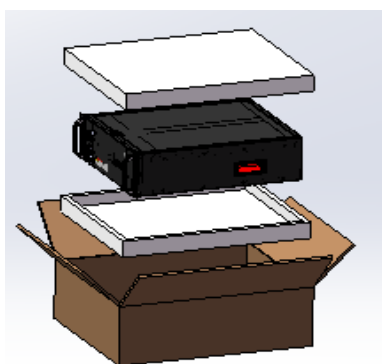
4.3.3. HV900112 Installation

BMS module should be fitted, tested and in place prior to delivery for ease of install.

4.3.4. Battery Installation

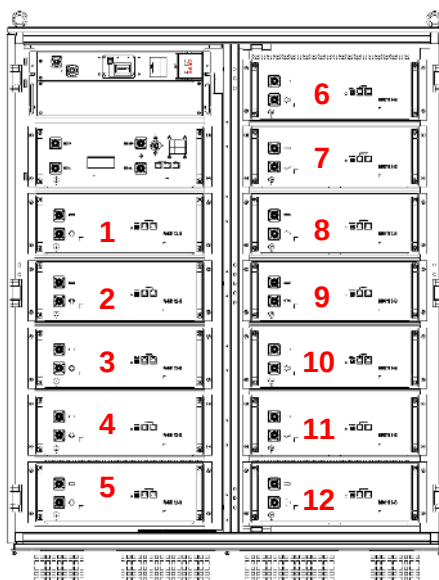
Note: When installing the battery, be careful not to touch the cables inside the cabinet.

Follow the following steps to install the battery:



Step 1: Remove the battery from packaging.

Step 2: Check the Battery Number on the cover

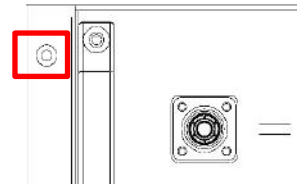


Step 3: Put the batteries in the cabinet with the serial number sequence of 01, 02, 03...12 as the above figure shows.

 **Warning:** All of the battery group number in the same battery cluster shall be the same. When you are installing batteries, please handle gently to avoid scratches because of the heavy weight of the battery.

Step 4: Use the screws and the grounding joint rings in battery packing list to fix every battery on the cabinet.

 **Note:** Suggested screw torque: 5N·M.



Step 5: After completing battery installation, check that the battery is installed in the correct sequence.

4.4 Battery Module Wiring

4.4.1. DC-Cabling

The inverter is shipped with the HV900112 in the cabinet.

Power cables to be connected from HV900112 to Inverter as shown in Figure 4.6.

Please connect other DC power cables between Batteries, Batteries and HV900112 as shown in Figure 4.6. The short cable links for the Battery modules can be found in the Parts Packing list. The long cables are shipped by being tied to the BESS cabinet.

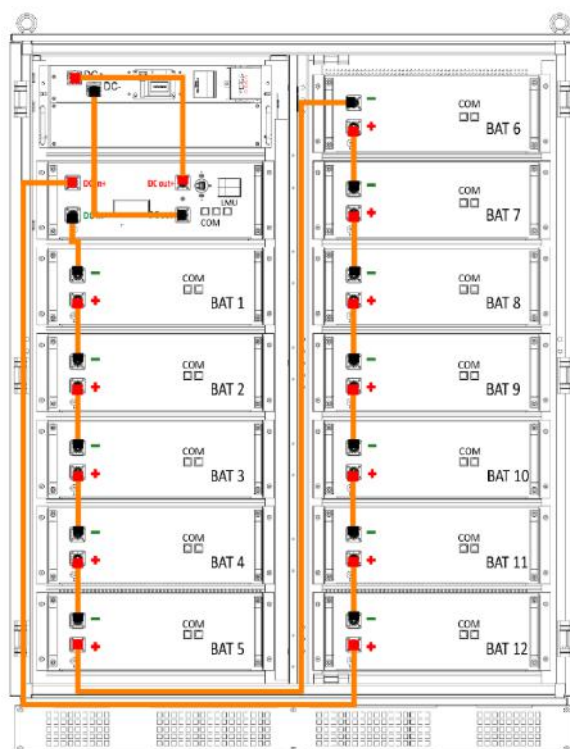


Figure 4.6 DC Cabling

i Notes: You can hide the long cables in the cabinet wire casing. And when connecting the battery power cables, pay attention to plugging the plug of the corresponding color into the socket of the battery, red to red, black to black.

4.4.2. Communication-Cabling

Connect the communication cables between Batteries, Battery and HV900112 following figure in the Figure 4.7.

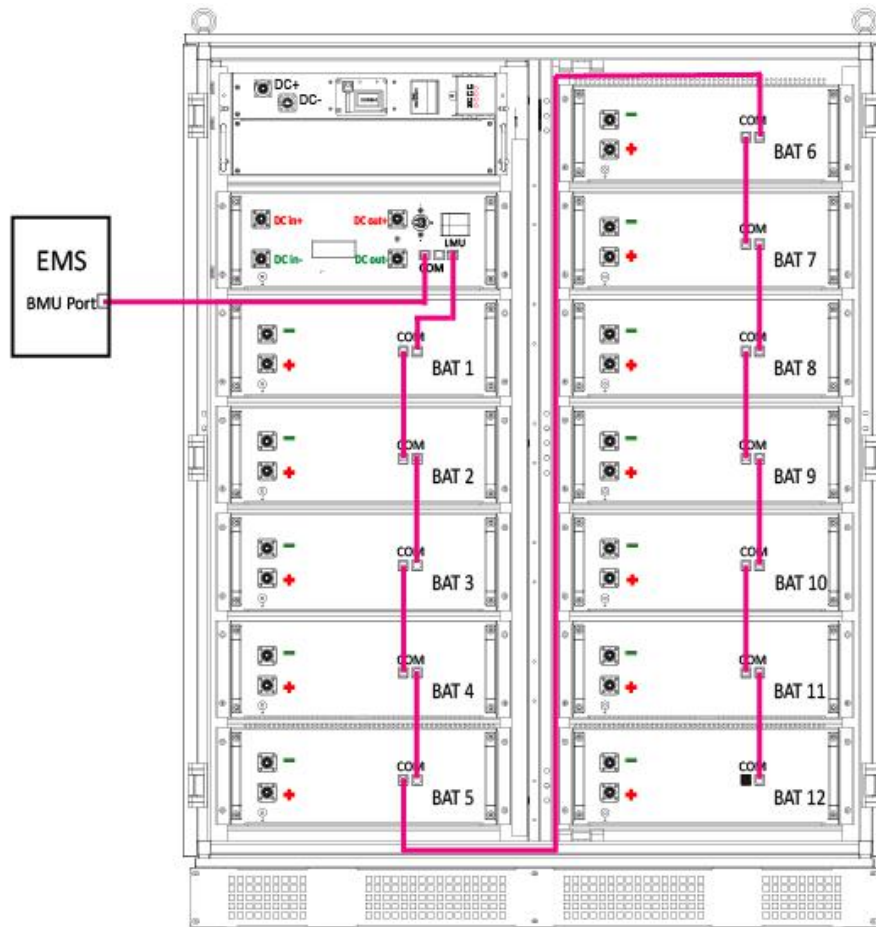


Figure 4.7 Communication-Cabling

Take the terminal residence from HV900112 and insert it into the COM port of the last M48112-S battery. You can find detail information in Figure 4.8.

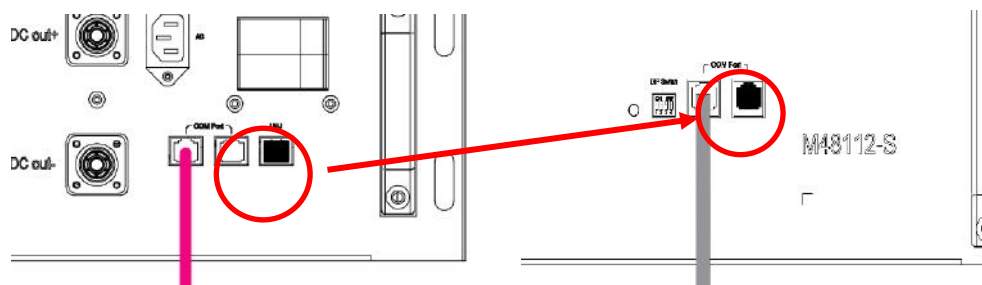


Figure 4.8 Terminal resistance in one of the M48112-S

Note: Please check and make sure that all of the COM ports on the battery packs except the last one in each battery cluster are connected with communication cables, and the COM port on the last battery pack is inserted with a terminal resistance.

4.5 Power Meter Installation

The power meter ADL-3000CT should be installed and connected into an enclosure or suitable distribution box. These CTs are 400A, and the ratio is 80. The ratio has already been set.

4.5.1. With PV

Figure 4.9 shows the grid meter and the PV meter connection diagram if PV panels and a PV inverter are used.

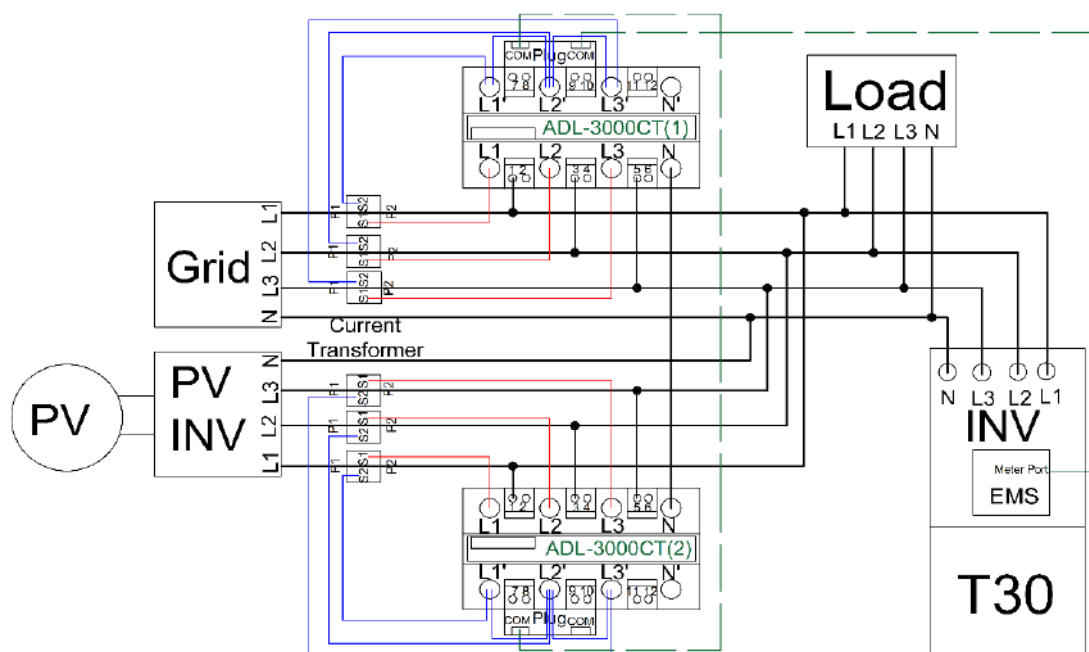


Figure 4.9 CT meters connection diagram-with PV

Note: When connecting CTs, pay attention to the current directions. P1 should be nearest to the grid or the PV-inverter.

4.5.2. Without PV

Figure 4.10 shows the grid meter connection diagram if PV panels and a PV inverter are not used. The power meter should be fitted behind the grid but before any load.

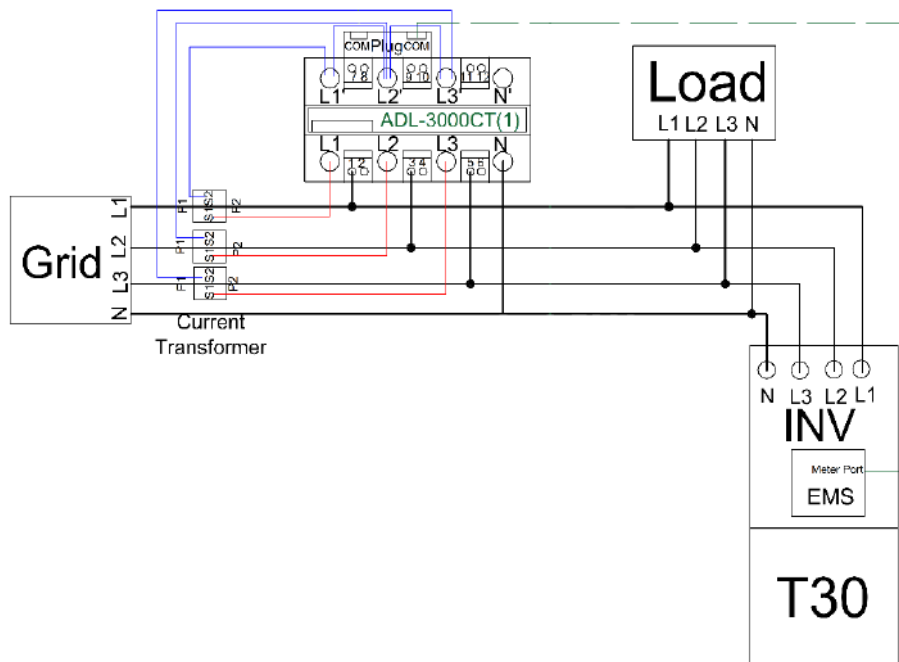


Figure 4.10 CT meter connection diagram-without PV

i Note: When connecting CTs, pay attention to the current directions. P1 should be nearest to the grid.

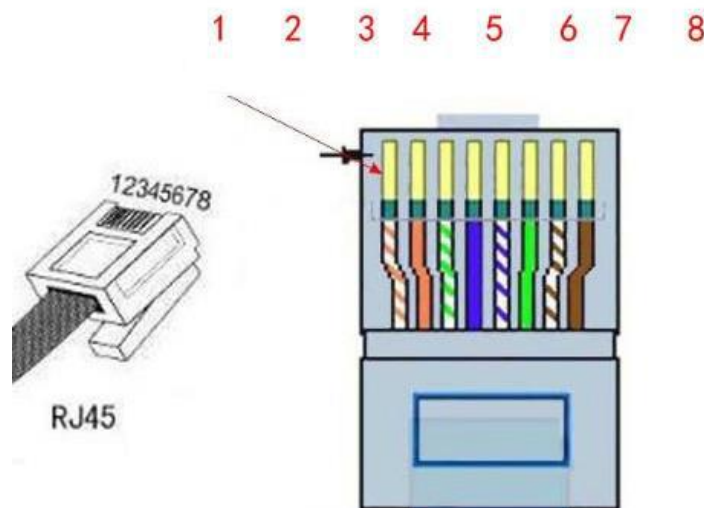


Figure 4.11 RJ45 Connectors

i Notes: Mesh connection according to the 568B standard: cables should be sorted by color before connecting. From left to right, the white and orange one, the orange one, the white and green one, the blue one, the white and blue one, the green one, the white and brown one and the brown one, as shown in Figure 4.11.

4.5.3. Connection of CT meter ADL-3000CT(1) - grid side

Please connect CT “S1” to Meter L1, CT “S2” to Meter L1’. Please connect CT “S1” to Meter L2, CT “S2” to Meter L2’. Please connect CT “S1” to Meter L3, CT “S2” to Meter L3’.

4.5.4. Connection of CT meter ADL-3000CT(2) - AC side of PV-INV

By connecting L1, please connect CT “S1” to Meter L1, CT “S2” to Meter L1’. By connecting L2, please connect CT “S1” to Meter L2, CT “S2” to Meter L2’. By connecting L3, please connect CT “S1” to Meter L3, CT “S2” to Meter L3’.

4.5.5. CT Meter and LAN Communication Cabling

The communication connections are as shown in Figure 4.9 on previous page as a green dotted line.

The communication cable connection process to connect to the EMS is shown in the following steps are as follows:

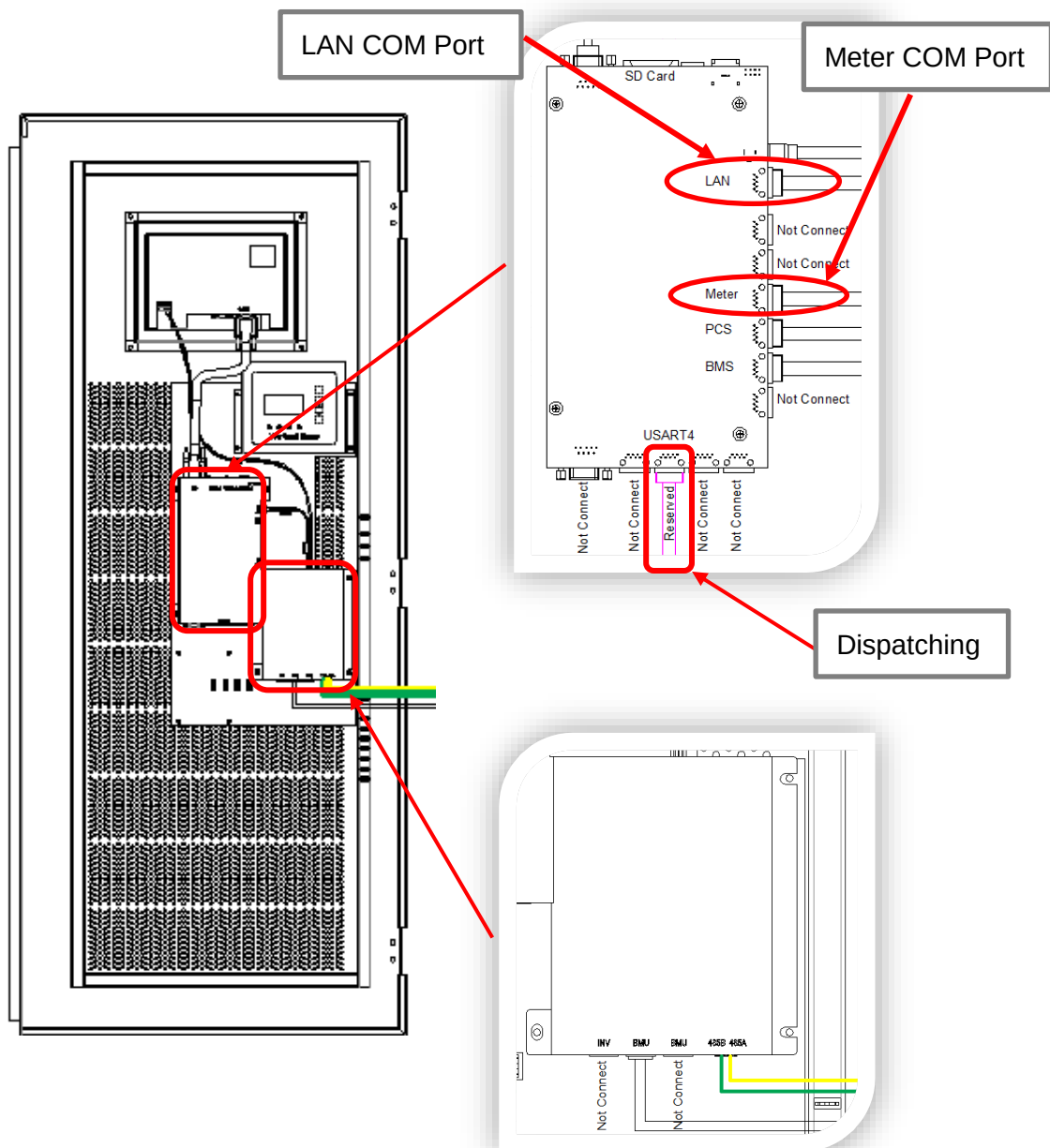


Figure 4.12 Connection LAN and Meter communication cables

Step 1: Connect the LAN communication cable between the LAN COM port of EMS board and the router as per Figure 4.12.

Step 2: Connect the Meter communication cable between the Meter COM port of EMS board and the power meter as Figure 4.12.

Step 3: If you need dispatching functionality, you can insert your dispatching module into the USART4 socket as shown in the Figure 4.12.

Note: The inserted SD card holds all the data of the system, and if you remove the SD card, all the data would be lost.

4.6 Inverter Wiring

Step 1: Remove the plastic protective cover at the connection point.

Step 2: Remove the power cable bond from the packing list of cabinet and attach the cable bond to the power cable from the grid as shown in Figure 4.13.

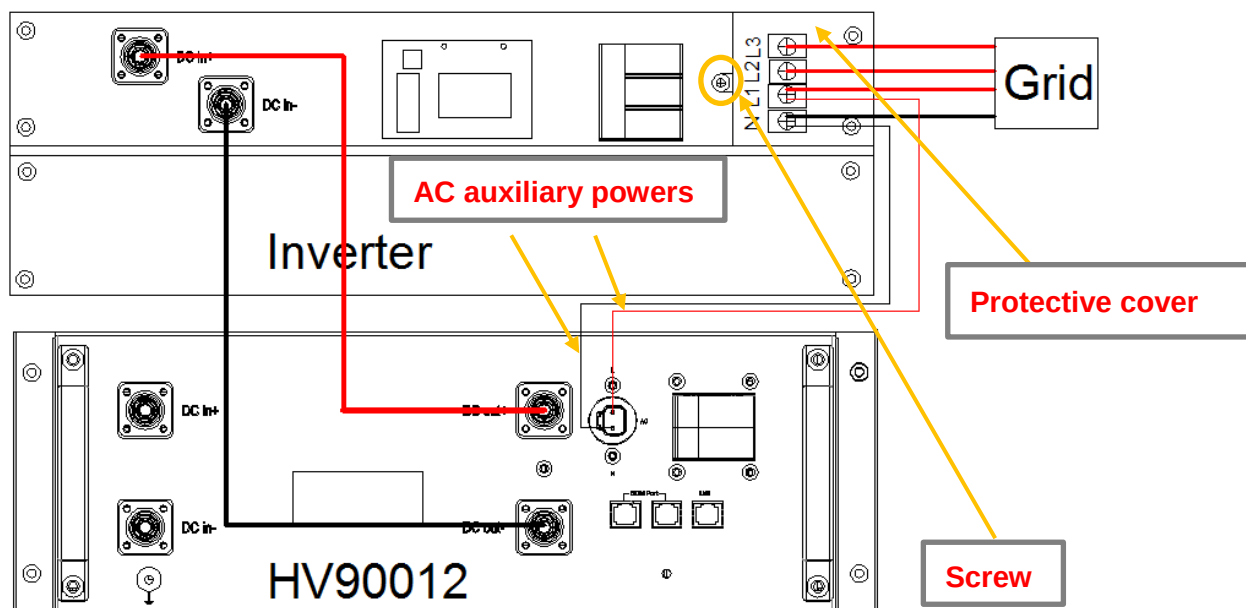


Figure 4.13 AC auxiliary power cables connection

Step 3: Take the L and N auxiliary power cables away from the T30-INV. After that connect the L1, L2, L3 and N power cables to the inverter, the cables shall be routed through the cable way (wire casing) as shown in Figure 4.14. In view of the requirements of connecting cables, single or multiple cables with suitable diameter shall be selected. A 10 mm² cable with copper core is suggested for each phase.

Notes: The role of the auxiliary power is to supply the electronic components inside the HV900112. The auxiliary source line is in parallel with the AC side power line flowing into the inverter. Therefore, even though the auxiliary source line is very small in diameter, it does not pose any danger.

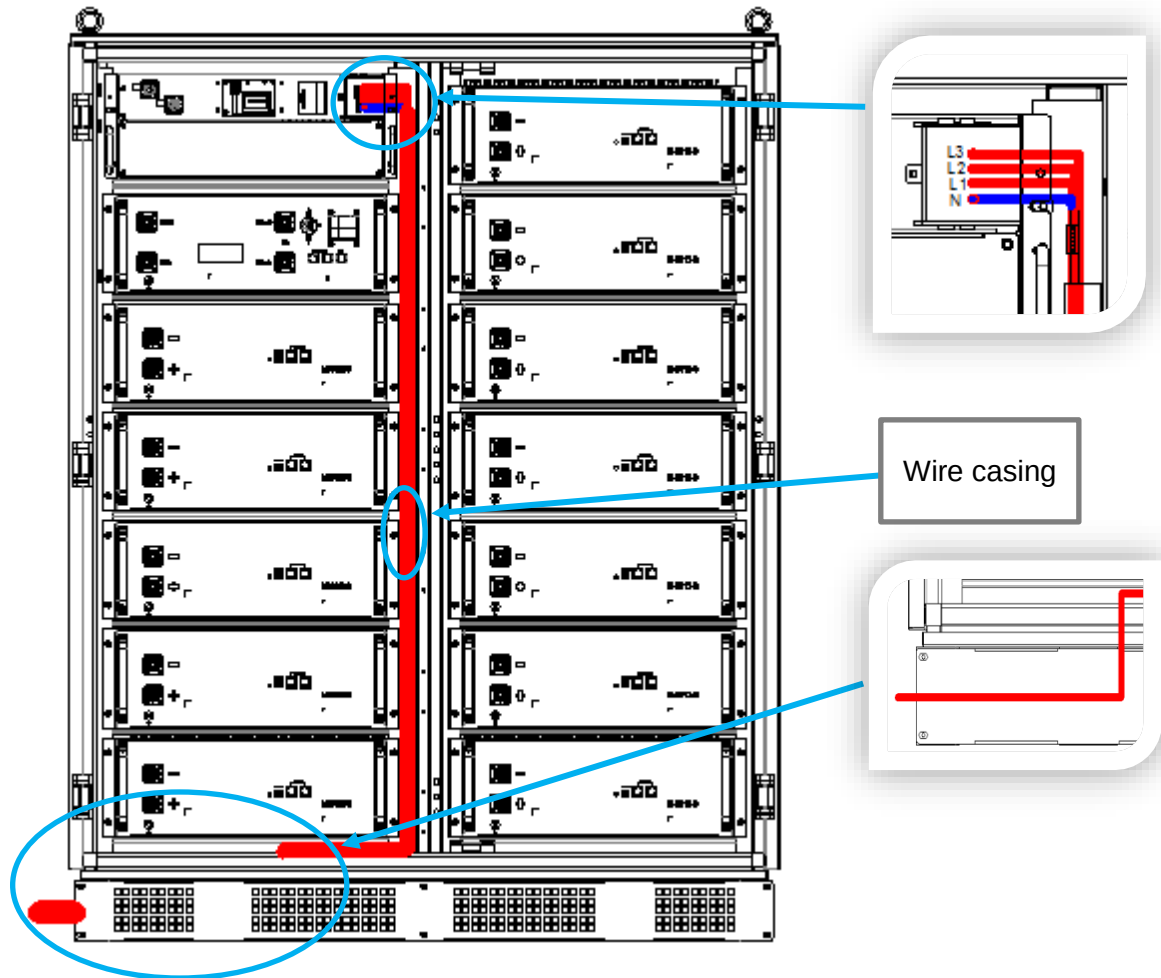


Figure 4.14 AC Power Cable Connection

Step 4: Please connect the two AC auxiliary power cables. The end of them are connected to the AC auxiliary power interfaces of HV900112 (already connected in advance) and the other end are connected to the L1 and N port of the inverter. Please connect red cable to inverter L1, black cable to inverter N.

Note: After placing the auxiliary power cable bond above the power cable bond, tighten the screw. Suggested screw torque: 2.6 N·M.

Step 5: Final step is to re-fit the plastic protective cover at the connection point that was removed at step 1.

The completed installation of Storion-T30 system is shown in Figure 4.15.



Figure 4.15 Completed installation of T30 System

5. Operation

5.1 Check Before Operation

Before operation please check the equipment according to the following procedure steps:

If no sign of damage is inspected visually outside the inverter module and all the battery switch, PV switch and load switch, diesel engine switch are in the "OFF" position, you will:

Step 1: Check whether the incoming supply to the Battery Energy Storage System and the AC output wiring is normal and whether the earthing measurement to the system is adequate.

Step 2: Check whether the incoming supply connection polarity is correct.

5.2 Power-on Procedures

The system must be turned on in the correct sequence to avoid any damage occurring.

Step 1: Turn on the moulded case circuit breakers of HV900112 in each cluster respectively.

From left to right: OFF- triggered position-ON.



Figure 5.1 Moulded case circuit breaker in switch-off status

Step 2: Turn on the AC air switch of HV900112. If there is an AC main switch, turn it on.



Figure 5.2 AC switch in switch-on status

Step 3: After powering-on the LED's on the Battery modules and BMS (HV900112) start flashing.

Step 4: After two minutes, the BMS (HV900112) relay is automatically closed and the DC port of the device is powered on.

Step 5: After the system is powered on, it will be switched on automatically if there are no errors or warnings and the inverter display is on.

Step 6: Switch on the AC circuit breaker and the system should work normally.

Step 7: Normal system operation should then be observed.



WARNING: After power on, the system will be working with high voltage. Don't touch any parts inside the equipment.

5.3 Android Introduction and Set up

5.3.1. Running

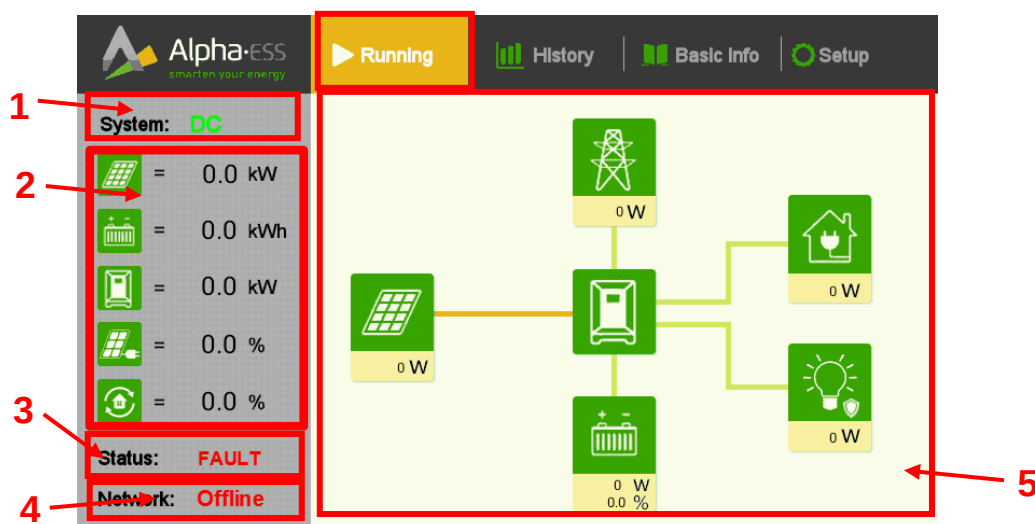


Figure 5.3 Running interface

After the initial interface, the system enters the running interface, as shown in Figure 5.3.

The information displayed within the running page includes:

Item	Description
1	System Mode
2	From top to bottom: PV capacity (If PV is connected), battery capacity, inverter capacity, self-consumption rate and self-sufficient rate.
3	System Status (Normal/Fault)
4	Internet Status (Online/Offline)
5	Running Diagram

1. System Mode: Displays the current operating mode of the system.
2. System parameters, from which you can observe the energy parameters of the system and the energy utilization rate of the system.

Warning & Fault			Return	
Time	Date	Message		
13:46	2015/05/18	Inverter Disconnect		
13:46	2015/05/18	BMS Disconnect		
			(1)	

Message Records					Save	
	Time	Date	Clear Alarm Date	Clear Alarm Time	Message	
1	13:45:47	2015/05/18	2015/05/18	13:46:26	System not set	
2	13:46:47	2015/05/18			Inverter Disconnect	
3	13:46:47	2015/05/18			BMS Disconnect	
					(2)	

Figure 5.4 System status interface

3. By clicking the status you can see the message as shown in Figure 5.4. List (1) shows current warnings, faults or errors, then list (2) shows already resolved warnings, faults or errors. This information can also be saved by pressing the save button, and it is stored in the system USB or SD card.

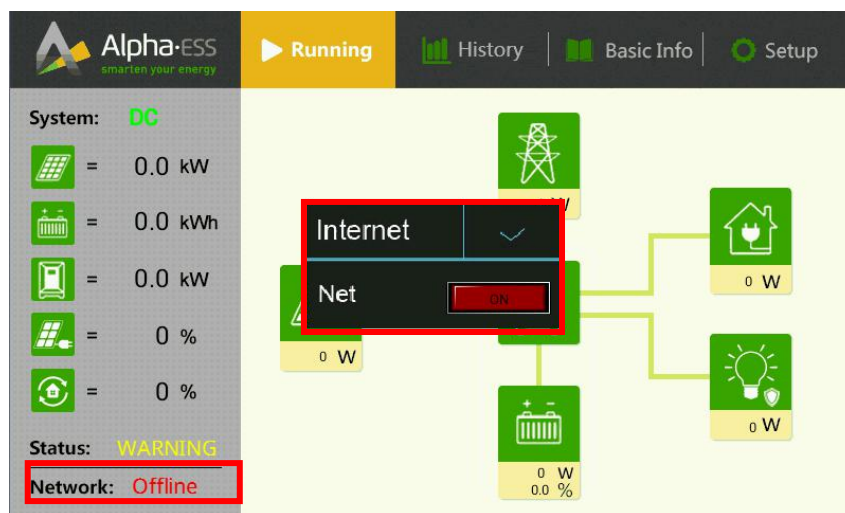


Figure 5.5 Internet status interface

4. Click the field "Network" to switch on or off the internet connection to your storage system. Please make sure your system is connected to the internet.

5.3.2. History

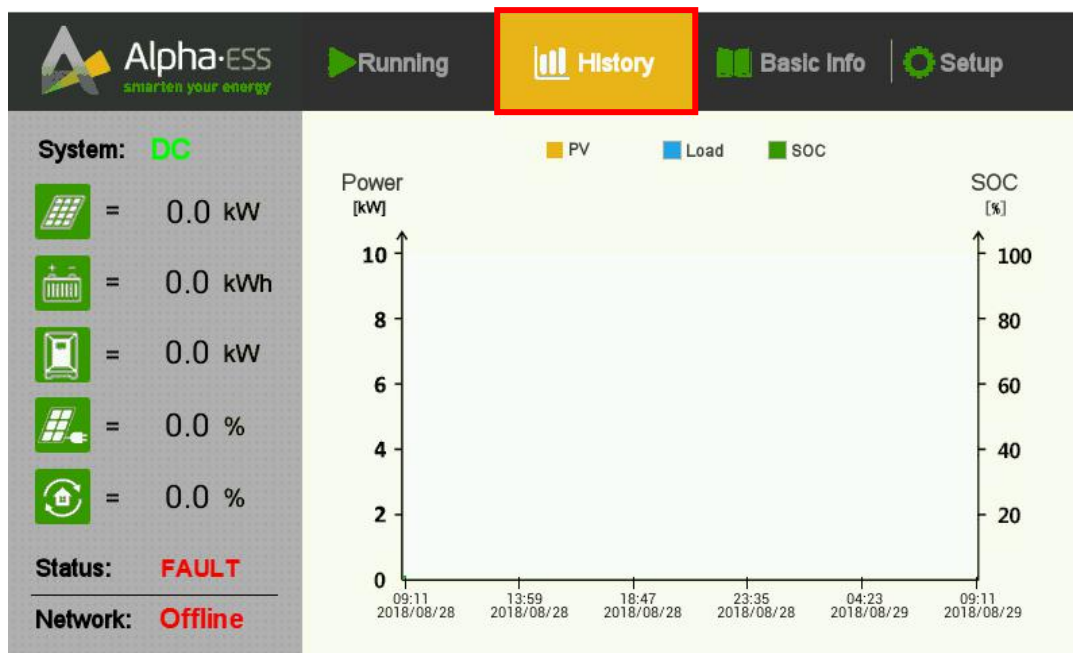


Figure 5.6 History interface

“History” shows 24 hours of historical data for “Load” and “SOC” (State of charge) at a given time

5.3.3. Basic Information



Alpha-ESS

smarten your energy

▶ Running

|



History



Basic Info



Setup

System: DC



=

0.0 kW



=

0.0 kWh



=

0.0 kW



=

0.0 %



=

0.0 %

Status: FAULT

Network: Offline

EMS Serial Number		Version
		----- 
Battery Model		Version
(1)	BMU	0.00 
	LMU	0.00 
Inverter Model		Version
-----		0.00 
Meter Model		Version
-----		----- 

Web: www.alpha-ess.com

E-mail: info@alpha-ess.com

Alpha Energy Storage Solution Co., Ltd.

Figure 5.7 Basic information interface

The “Basic Information” section shows the component model of your system (1) and the Firmware version its using (2).

5.3.4. Set Up

5.3.4.1. Command

This section is open for Alpha engineers for after sales service use only.

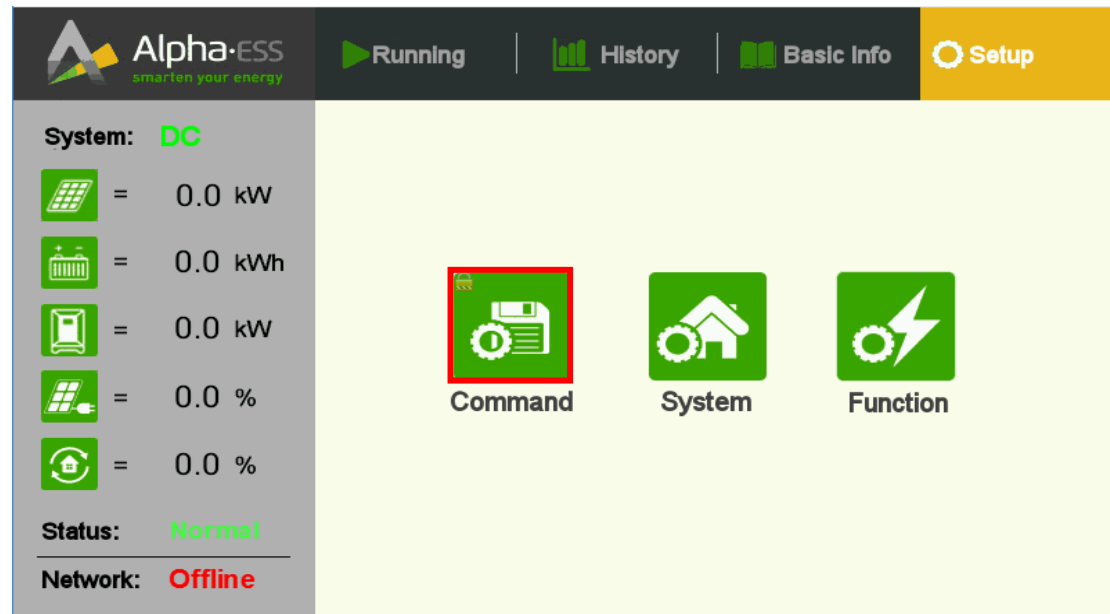


Figure 5.8 Command interface

5.3.4.2. System

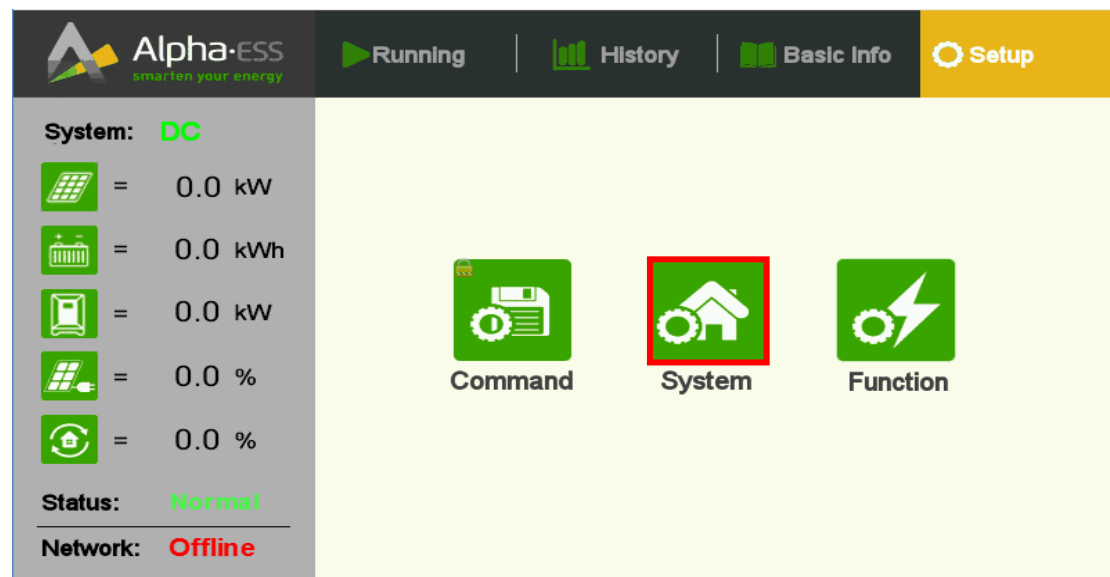
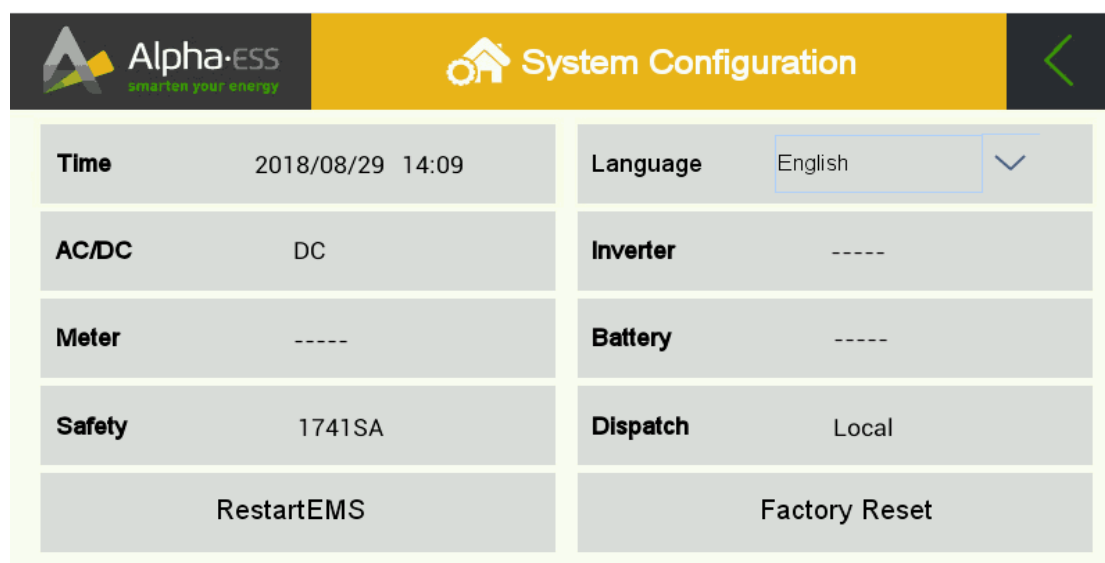


Figure 5.9 Press “System”

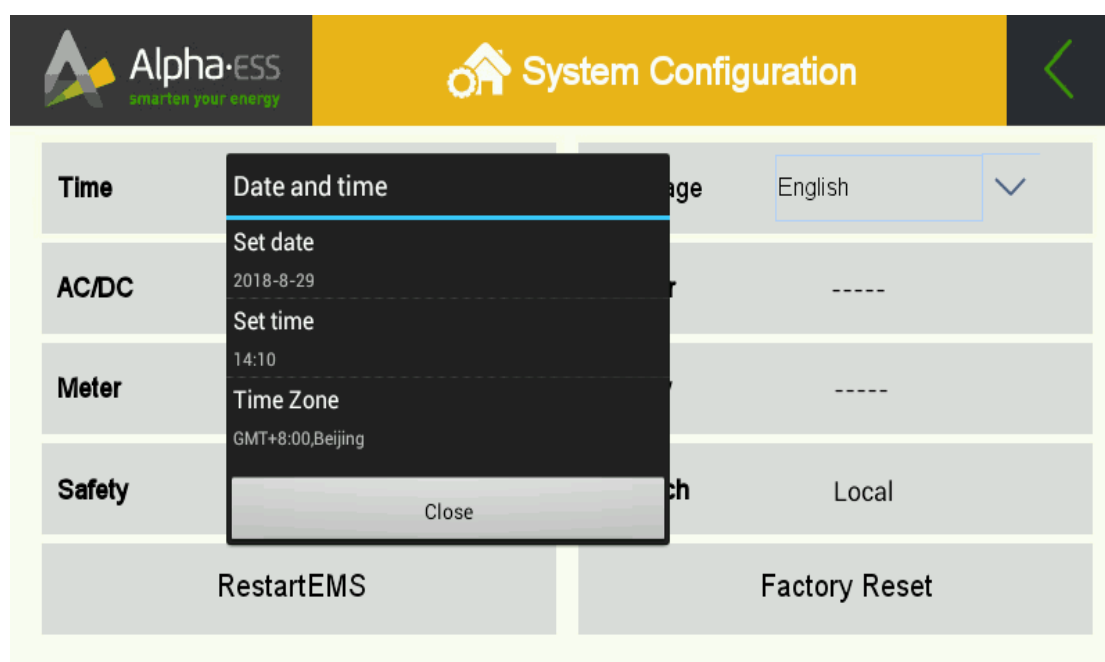
Press "System" to enter the system display.



The System Configuration interface features a top header with the Alpha-ESS logo on the left, a central orange bar with a house icon and the text "System Configuration", and a green back arrow on the right. Below the header is a grid of configuration options:

Time	2018/08/29 14:09	Language	English v
AC/DC	DC	Inverter	----
Meter	----	Battery	----
Safety	1741SA	Dispatch	Local
RestartEMS		Factory Reset	

Figure 5.10 System interface



The Set-up time interface shows the same System Configuration grid as Figure 5.10, but with a modal dialog box open over the "Time" field. The dialog box has a black background and contains the following text:

Date and time

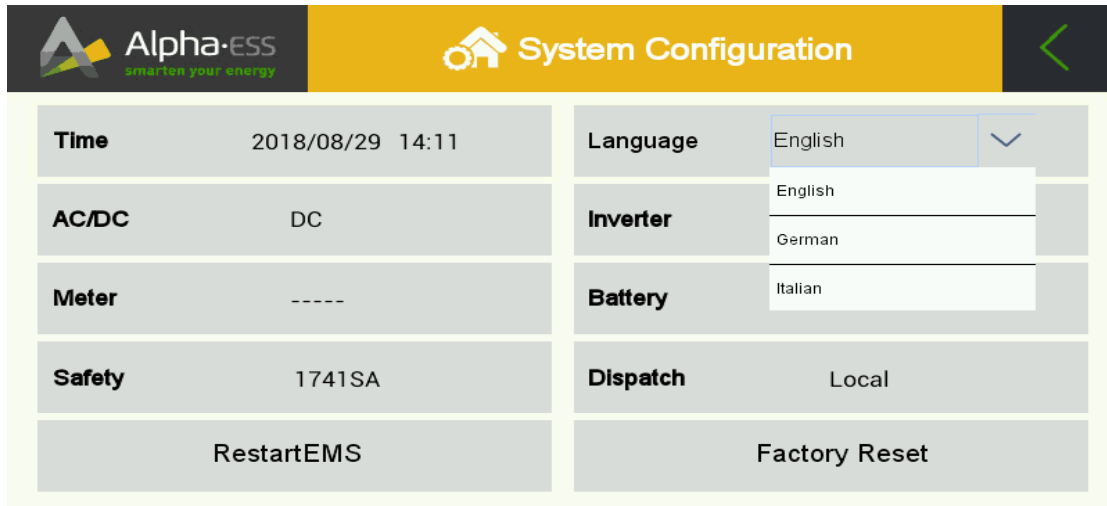
Set date
2018-8-29

Set time
14:10

Time Zone
GMT+8:00,Beijing

Figure 5.11 Set-up time interface

Press "Time" to set the date, time, zone, then click "Close".

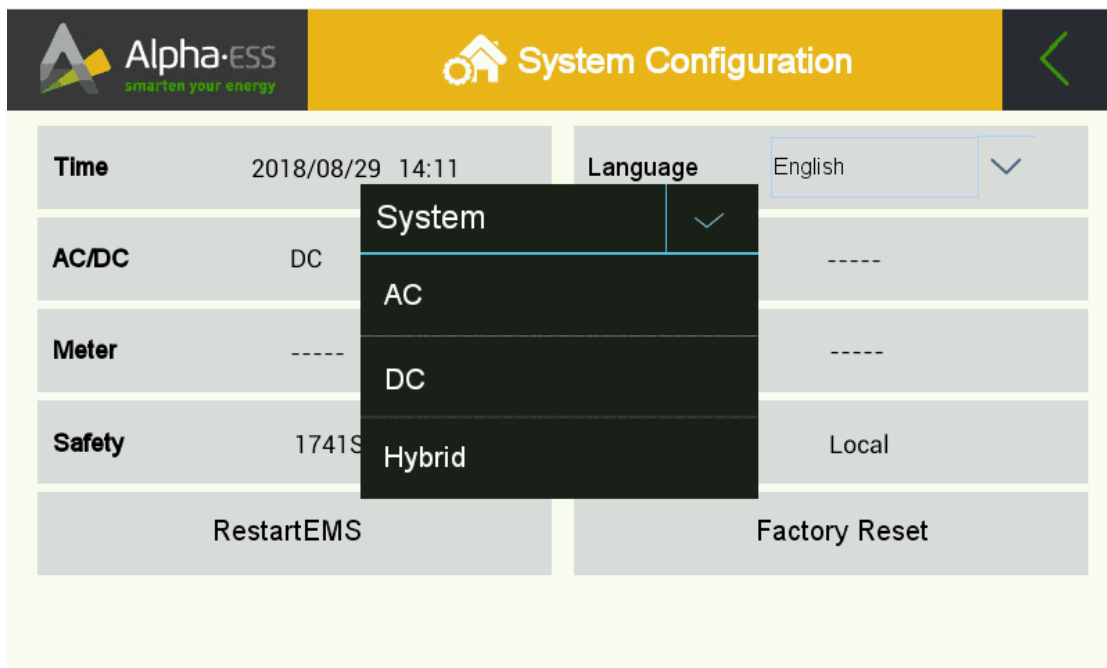


The screenshot shows the 'System Configuration' screen of the Alpha-ESS interface. The top bar includes the Alpha-ESS logo and a home icon. The main content area is a grid of configuration options. The 'Language' option is highlighted with a dropdown menu showing 'English', 'German', and 'Italian'. Other options include 'Time', 'AC/DC', 'Meter', 'Safety', 'Inverter', 'Battery', 'Dispatch', 'RestartEMS', and 'Factory Reset'.

Time	2018/08/29 14:11	Language	English
AC/DC	DC	Inverter	English
Meter	----	Battery	German
Safety	1741SA	Dispatch	Italian
RestartEMS		Factory Reset	

Figure 5.12 Set-up language

Press “Language” to set the language of the user.



The screenshot shows the 'System Configuration' screen of the Alpha-ESS interface. The top bar includes the Alpha-ESS logo and a home icon. The main content area is a grid of configuration options. The 'AC/DC' option is highlighted with a dropdown menu showing 'System', 'AC', 'DC', and 'Hybrid'. Other options include 'Time', 'Language', 'Meter', 'Safety', 'Inverter', 'Battery', 'Dispatch', 'RestartEMS', and 'Factory Reset'.

Time	2018/08/29 14:11	Language	English
AC/DC	DC	System	System
Meter	----	AC	AC
Safety	1741S	DC	DC
RestartEMS		Hybrid	Hybrid
RestartEMS		Factory Reset	

Figure 5.13 Set-up system mode

Press “AC/DC” to set the system mode. T30 system only supports the AC Mode, and it can automatically identify the type of meter, inverter and battery by the system.

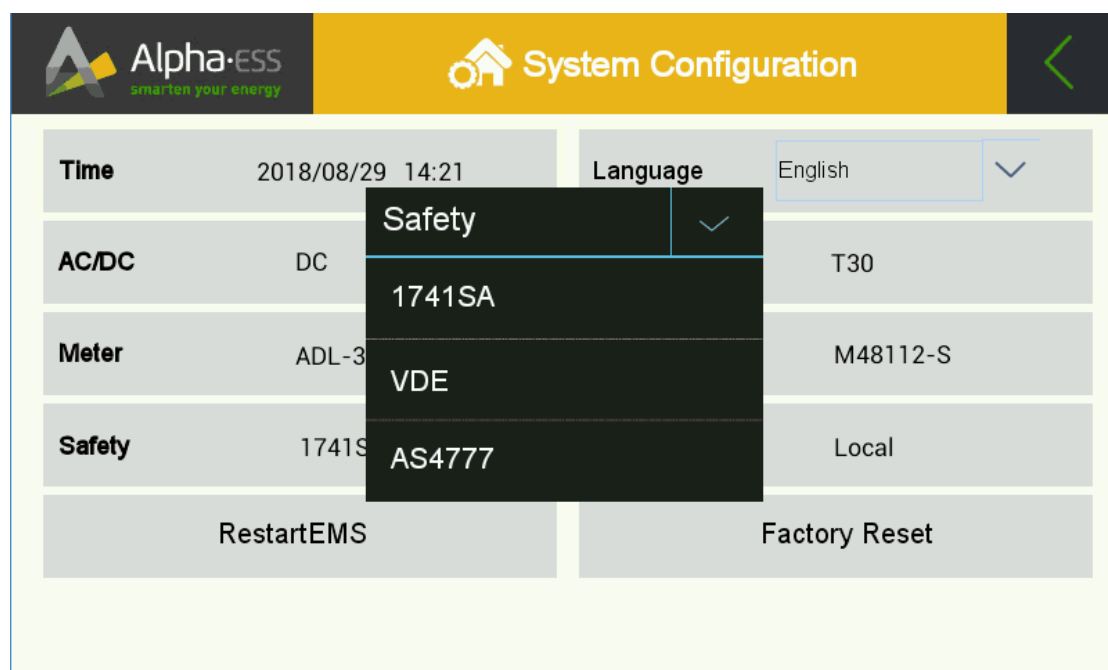


Figure 5.14 Safety interface

Click "Safety" to select the safe country; you can select the appropriate country according to your country. 1741SA is the American standard. VDE is the German standard. AS4777 is the Australian standard.

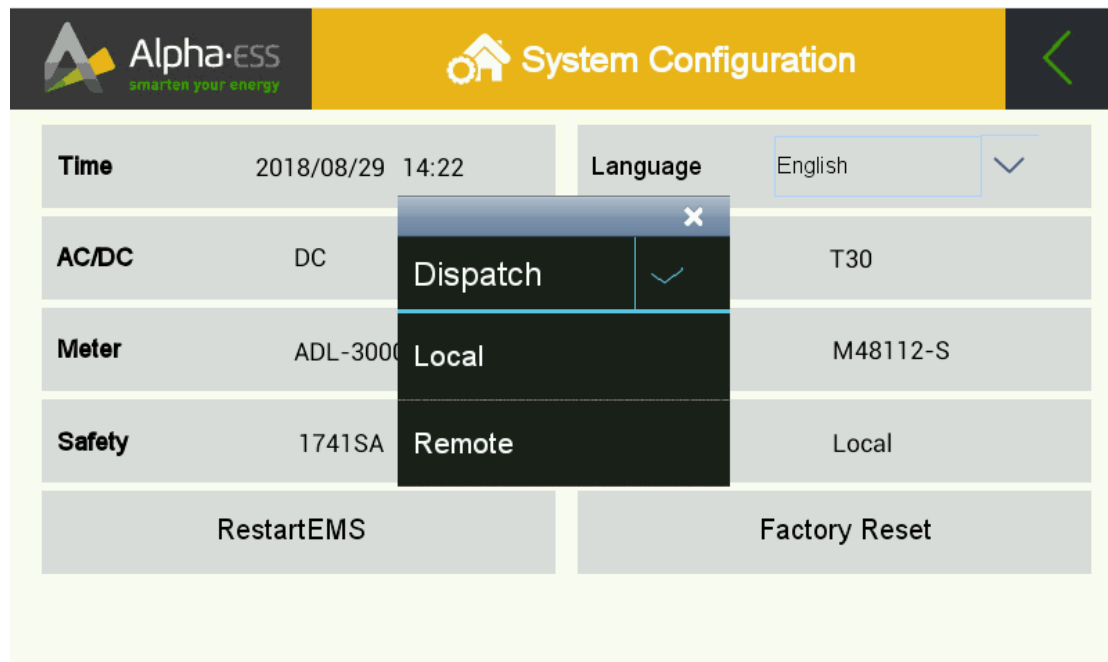
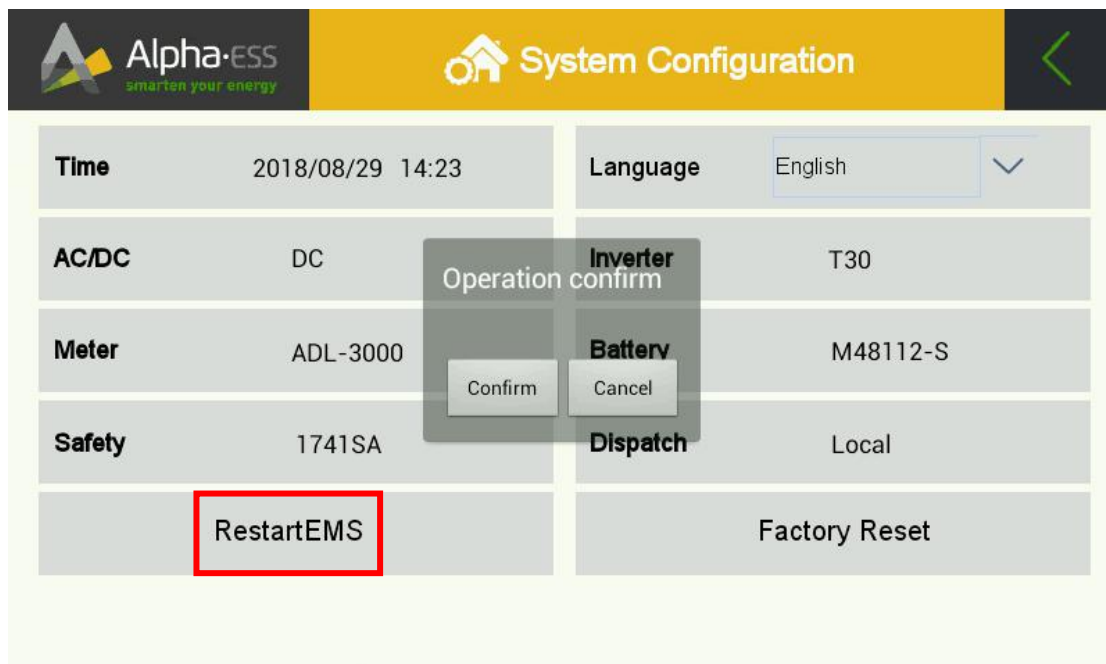
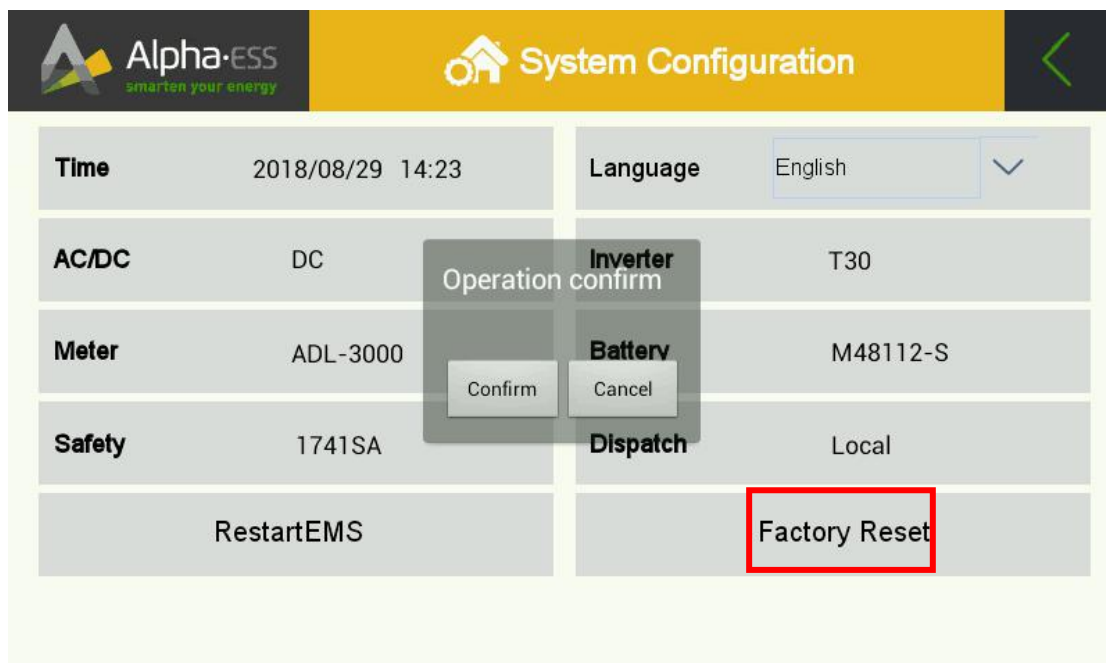


Figure 5.15 Dispatch interface

Click "Dispatch" to select the dispatch mode, you can choose between "Remote" and "Local" dispatch. "Remote" is for external control while "Local" is internal (Alpha) control.

**Figure 5.16 Restart EMS interface**

If you require to restart the EMS at any time click the "Restart EMS" button then "Confirm" to start the reset.

**Figure 5.17 Factory reset interface**

If you require a factory reset, click "Factory Reset" and then confirm to start the reset.



Note: If you confirm a factory reset all the factory settings are restored, and all data on the system will be cleared.

5.3.4.3. Function

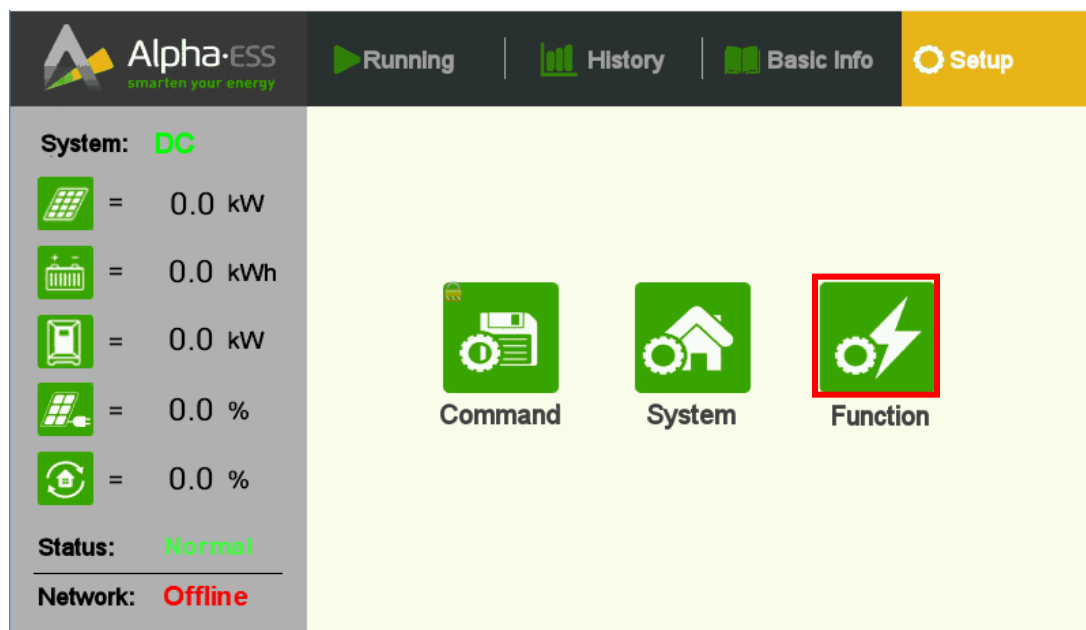


Figure 5.18 Press “Function”

Select the highlighted icon “Function” to access the settings of the function configuration.

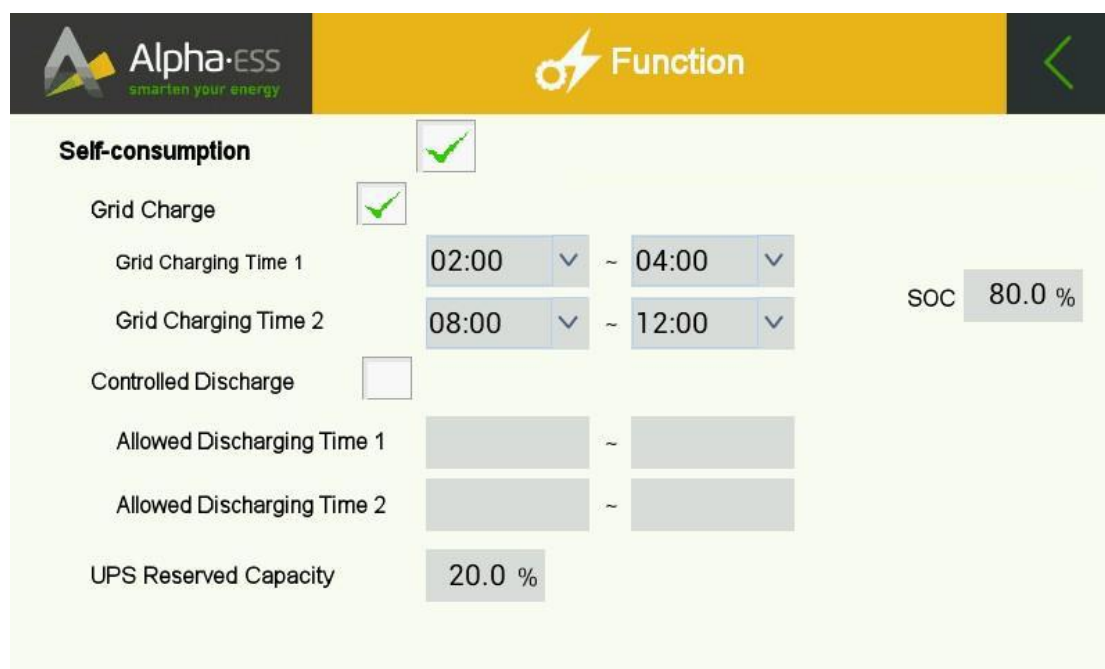


Figure 5.19 Function interface

Customers can select “Self-consumption” mode and “Grid Charge” mode and “Controlled Discharge” mode.

Choose “Grid Charge” and “Controlled Discharge” to charge and discharge the device according to the time period you need to select.

To prevent battery from over discharge, you can set the remaining SOC of the device in “Controlled Discharge” mode by selecting “UPS reserved capacity”. It needs to be min 10 percent.

i **Note:** The “Self-consumption” mode is suitable for normal grid situation with less frequent outage.

5.3.5. Power-off Procedures

The system shall be powered OFF as per the following steps:

Step 1: turn off the AC switch of the inverter.

Step 2: turn off the AC air switch on HV900112.

Step 3: turn off the moulded case circuit breaker (MCCB) on HV900112.

i **Note:** Check that all of the switches are off. The system will be switched on automatically if it is still powered after 5 min.

5.4 Online Monitoring

5.4.1. Access/Registering

You can create a new account on our webserver for the normal monitoring. In addition, a part of our warranty is based on this connection to our webserver.

The data produced prior to registration can be synchronized to the webserver.

Please use the following steps:

Step 1: Open the portal: www.alphaess.com.

Step 2: Please fill in “Username”, “Password” and click “Login” if you have already registered.

If not, please register by filling in the following webform.

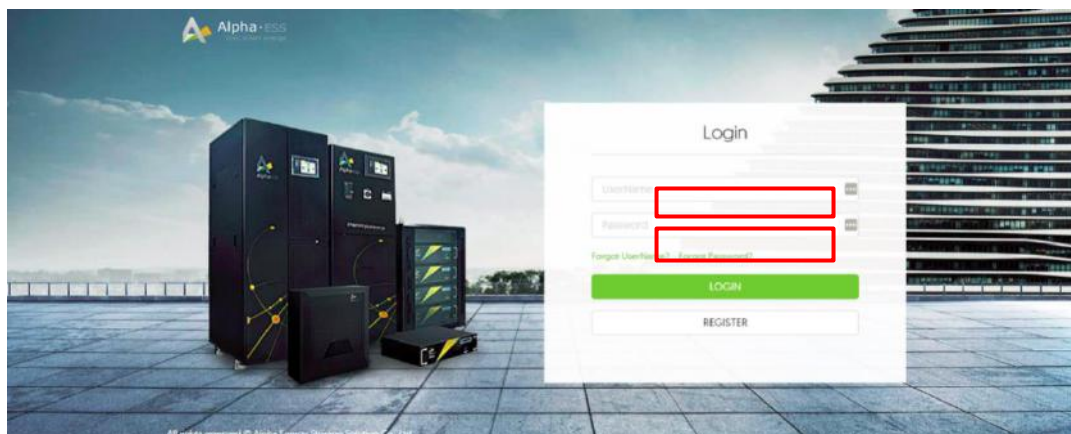
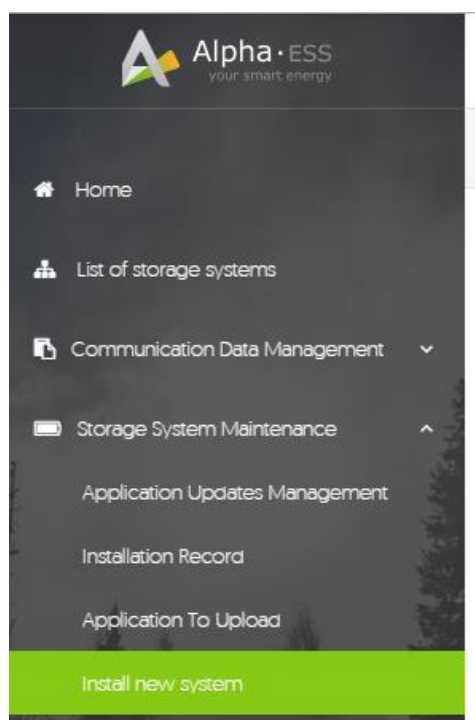


Figure 5.20 Monitoring login interface

5.4.2. Registering License



Click install new system to register the license.

Figure 5.21 Menu for installer

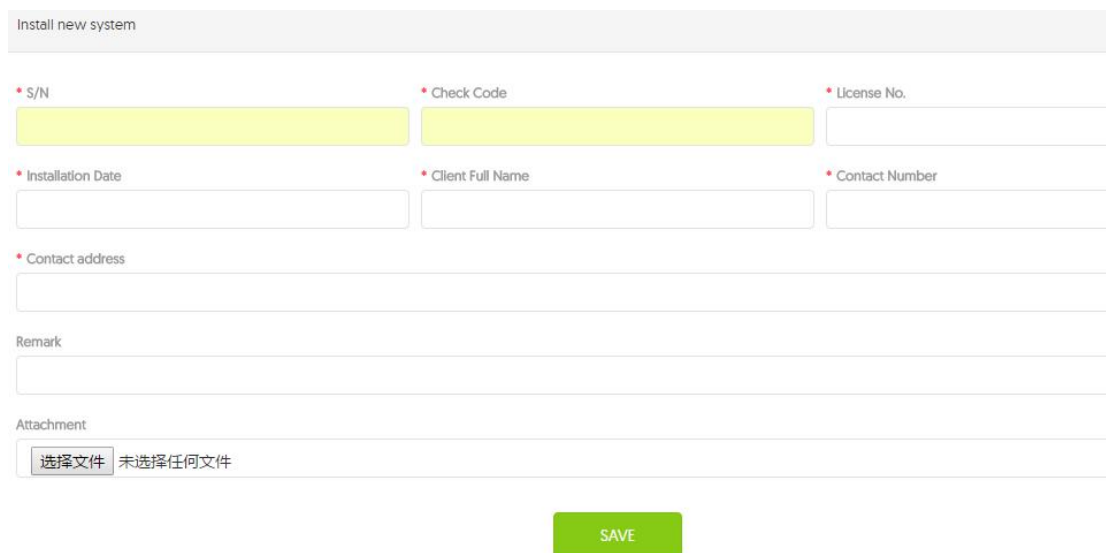


Figure 5.22 System registering interface

Input **S/N** (serial number), **Check Code**, **License No.**, **Date**, **Name**, and **Contact No.** to complete the registering process.

6. Routine Maintenance

6.1 Maintenance Precautions

If the BESS is out of operation for repair, maintenance, relocation or decommissioning, the following notes should be paid attention to:



DANGER: Improper maintenance of the equipment may result in personal injury or equipment damage. The user must strictly follow the steps below before performing any operations:

- Related safety standards and specifications should be followed in operation, repair, maintenance, relocation or decommissioning.
- Disconnect all the electrical connections so that the equipment cannot be powered on.
- Wait at least 10 minutes after disconnection to make sure that the residual voltage of capacitors are down to a safe value.
- Use a suitably calibrated voltage tester to ensure the equipment is completely disconnected.



CAUTION: Only qualified and authorized personnel can maintain the energy storage system. Please do not allow any unrelated personnel to enter the maintenance site! Two people should always be present while completing operation, repair, maintenance, relocation or decommissioning.

- Temporary warning signs or barriers must be posted during electrical connection and maintenance work to prevent unrelated persons from entering the area where electrical connections or maintenance are carried out.
- Appropriate protective measures should be taken while working on the BESS system for operation, repair, maintenance, relocation or decommissioning, see section 2.13 for PPE required when completing these tasks
- The batteries need to be charged to 30%~50% SOC rate when the whole system is not energised/in use (meaning, the batteries has not been charged for two weeks or longer), in case of over discharge.
- If the system is not performing normally because of incorrect operating procedure, please try to turn off all switches and restart the system following the right procedures as described in the manual; if the system cannot be turned on successfully, please turn off all switches and contact AlphaESS service in a timely manner.
- The equipment can only be restarted after fault is cleared.
- Wait for at least 1min to restart the system from a complete power failure.
- The equipment does not contain spare parts. If any replacement service is required, please contact with AlphaESS service.
- Do not replace any components of this equipment without authorization. The company will not bear any warranty or joint liability for the losses caused thereby.

- Do not leave tools, parts, etc. in the energy storage system when carrying out repairs or maintenance work, otherwise it may damage the equipment or cause safety risks.
- Please contact us in time if there are any conditions that could not be explained in the manual.

6.2 Maintenance Plan

The maintenance plan can be done in the following steps:

- Check to confirm if cables/wire connections are secure to the correct torque settings.
- Check if any cables/wires are showing signs of ageing or have been damaged.
- Check the cable insulation is not damaged.
- Check to confirm whether all cable terminations are secure, and terminal connections haven't got any signs of overheating.
- Check to confirm that ground/bonding connections are secure.
- Check integrated machine grounding connection.
- Check DC input connections are secure.
- Check AC output connections are secure.
- Check communication cable connections are secure.
- Check AC / DC switch, fan.

6.2.1. Operating Environment

(Visual inspection to be completed every six months)

1. Carefully observe whether the battery system equipment is ineffective or damaged;
2. When the system is running, listen to the system for any abnormal noise.
3. Check whether the voltage, temperature and other parameters of the battery and other equipment parameters are normal during system operation.

6.2.2. Equipment Cleaning

(Every six months to one year, depending on the site environment and dust content, etc.)

1. Ensure that the ground is clean and tidy, keep the maintenance and access route clear, and ensure that the warning signs and guidance signs are clear and intact.
2. Monitor the temperature of the battery modules and clean the battery modules if necessary.
3. Check the heat ventilation grill of the BESS system and clean away any dust attached to ensure the smooth flow of air to ventilate the BESS system.

6.2.3. Cable, Terminal and Equipment Inspection

(Every six months to one year)

1. Check to confirm that cables/wire connections are secure and to the correct torque settings.

2. Check if any cables/wires are showing signs of ageing or have been damaged.
3. Check whether any cable securing ties have fallen off within the system enclosure.
4. Check to confirm whether all cable terminations are secure, and terminal connections haven't got any signs of overheating.
5. Monitor the voltage, temperature and events on the EMS module, and see if the BLMU's collection line, connection terminal, terminal block, communication line connection are secure and not damaged.
6. Check whether the EMS module of the system equipment, monitoring system and other related equipment are the correct component/module, correctly fitted and not damaged at all.
7. Check that the grounding/bonding of the equipment is adequate, the grounding/bonding resistance should be less than 4 ohms.

7. Troubleshooting

7.1 Battery and BMS troubleshooting

7.1.1. Error Type

Alarm	Displayed in EMS	Processing method
Cell temperature difference fault	Cell-Temp-Diff	Contact with Alpha service
Balancer fault	Balancer Err	Contact with Alpha service
Module charge over current fault	Chrg-Ov-Curr	Contact with Alpha service
Module discharge over current fault	Disch-Ov-Curr	Contact with Alpha service
Pole over temperature fault	Pole-Ov-Temp	Contact with Alpha service
Cell over volt fault	Cell-Ov-Volt	Contact with Alpha service
cell volt difference fault	Cell-Volt-Diff	Contact with Alpha service
cell discharge under temperature fault	Disch-Low-Temp	Contact with Alpha service
Cell under volt fault	Cell-Low-Volt	Contact with Alpha service
Insulation resistan fault	IR_Fail	Contact with Alpha service
LMU Communication fault	Commu_fail_LMU	Check communication connection between batteries (LMU and LMU), battery and HV900112 (LMU and BMU)
Cell over temperature fault	Cell-Ov-Temp	Contact with Alpha service
Cell charge under temperature fault	Chrg-Low-Temp	Contact with Alpha service
Wire beam fault	Wire-Harness-Err	Contact with Alpha service
Relay fault	relay Err	Contact with Alpha service
Temperature sensor fault	Temp-Sen-Err	Contact with Alpha service

7.2 EMS Troubleshooting

7.3 Inverter Troubleshooting

Fault code	Alarm	Processing method
0	Power overvoltage	This fault is caused by the instantaneous condition of the power network. The inverter will come to normal in a short time. If the fault still exists, please contact Alpha service

1	Power undervoltage	This fault is caused by the instantaneous condition of the power network. The inverter will come to normal in a short time. If the fault still exists, please contact Alpha service
2	Power overfrequency	This fault is caused by the instantaneous condition of the power network. The inverter will come to normal in a short time. If the fault still exists, please contact Alpha service.
3	Power underfrequency	This fault is caused by the instantaneous condition of the power network. The inverter will come to normal in a short time. If the fault still exists, please contact Alpha service.
4	Unbalanced Grid	Wait for the inverter to come to normal. If the fault still exists, please contact Alpha service.
5	Grid Reverse	Check the phase sequence connection of the grid and restart after correction.
6	Islanding	1. Check to confirm if the grid is reliable. 2. Check the circuit breaker for normal closure If the fault still exists, please contact Alpha service.
8	GND fault	Check the grounding wiring; If the fault still exists, please contact Alpha service.
A	Over-temp 1 (Internal ambient temperature is too high)	1. Check if the fan is working properly; 2. Check if the output exceeds the rated value; If the fault still exists, please contact Alpha service.
16	Auxiliary Power Fault	Auxiliary power supply is below 15V; Wait for the inverter to come to normal; If the fault still exists, please contact Alpha service.
2B	Over-Load	Overload on the AC side of the inverter, need to reduce the load, otherwise the inverter will enter into the state of overtime shutdown. If the fault still exists, please contact Alpha service.