

Orion ESS

USER MANUAL

HV Battery System
Orion-9.9/14.9/19.9/24.9/29.9
192-576V

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Statement of Law

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Please note that the product can be modified without prior notification.

Revision History

Revision NO.	Revision Date	Revision Reason
1.0	2023.07.27	First Published

1 Introduction

Brief Introduction

Orion is a high voltage battery storage system based on lithium iron phosphate technology, and it's one of the new energy storage products developed and produced by Dyness. it can be used to support reliable power for various types of equipments and systems. Orion is especially suitable for application scene of high power, limited installation space, restricted load-bearing and long cycle life.

Product Properties

- The whole module is non-toxic, non-polluting and environmentally friendly;
- Anode material is made from LiFePO4 with safety performance and long cycle life;
- Battery management system (BMS) has protection functions including over-discharge, over-charge, over-current and high/low temperature;
- The system can automatically manage charge and discharge state and balance current and voltage of each cell;
- Flexible configuration, multiple battery modules can be in serial for expanding voltage and Capacity.
- Adopted self-cooling mode rapidly reduced system entire noise;
- The module has less self-consumption, up to 6 months without charging; no memory effect, excellent performance of shallow charge and discharge;
- Working temperature range is from 32 to 122°F , with excellent discharge performance and cycle life;
- Small size and light weight, standard module is comfortable for installation and maintenance;

Product identity definition

	ORION9.9	ORION14.9	ORION19.9	ORION24.9	ORION29.9
Nominal Energy/kWh	9.9	14.9	19.9	24.9	29.9
Nominal Voltage/V	192	288	384	480	576
Nominal Capacity/Ah	52	52	52	52	52
Ambient Temp/°F	32~122	32~122	32~122	32~122	32~122
NEMA Grade	4X	4X	4X	4X	4X
Protective Class	I	I	I	I	I
Short-circuit Current/A	6000	6000	6000	6000	6000
Short-circuit Time/ms	2	2	2	2	2

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Figure 1-1 System nameplate

Dyness ENERGY STORAGE SYSTEM	
Module	LFP Lithium Ion Battery
Type	HV9652
Capacity/Voltage	52Ah/96V
Total Storing Energy	4.99kWh
Charge Voltage	105~108V
Max. Discharge Power	3.8kW
Series Number	
Manufacture Date	

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Figure 1-2 Battery module label



Battery voltage is higher than safe voltage, direct contact with electric shock hazard.



Be careful with your actions and be aware of the dangers.



Read the user manual before using.



The scrapped battery cannot be put into the garbage can and must be recycled by professional personnel or institutes.



After the battery life is terminated, the battery can continue to be used after it recycled by the professional recycling organization and do not discard it at will.

2 Product Specification

System Performance Parameter

Table 2-1 The parameter of Orion system

System List	ORION9.9	ORION14.9	ORION19.9	ORION24.9	ORION29.9
Module Type	LFP	LFP	LFP	LFP	LFP
Total Storing Energy [kWh]	9.98	14.97	19.97	24.96	29.95
Usable Capacity [kWh]	8.98	13.47	17.97	22.46	26.96
Recommend Depth of Discharge	90%	90%	90%	90%	90%
Max Depth of Discharge	90%	90%	90%	90%	90%
Module configuration	2 Series	3 Series	4 Series	5 Series	6 Series
Voltage Range[Vdc]	168~219	252~328	336~438	420~547	504~656
Battery System Voltage (Vdc)	192	288	384	480	576
Battery System Capacity (Ah)	52	52	52	52	52
Battery System Charge Voltage (Vdc)	219	328.5	438	547.5	657
Battery System Charge Current [A] (Standard)	10.4	10.4	10.4	10.4	10.4
Battery System Charge Current [A] (Normal)	26	26	26	26	26
Battery System Charge Current [A] (Max)	40	40	40	40	40
Battery System Discharge lower-Voltage (Vdc)	168	252	336	420	504
Battery System Discharge Current [A] (Standard)	10.4	10.4	10.4	10.4	10.4
Battery System Discharge Current [A] (Normal)	26	26	26	26	26
Battery System Discharge Current [A] (Max)	40	40	40	40	40
Battery System Max. Charge & Discharge Current [A] (when used in communication with the inverter)	40	40	40	40	40
Discharge condition	14~122°F	14~122°F	14~122°F	14~122°F	14~122°F

System List	ORION9.9	ORION14.9	ORION19.9	ORION24.9	ORION29.9
Charge condition	32~122°F	32~122°F	32~122°F	32~122°F	32~122°F
Max. Discharge Power [kW]	7.98	11.52	15.36	19.20	23.04
Max. Charge & Discharge Power [kW] (when used in communication with the inverter)	7.97	11.52	15.36	19.20	23.04
Short Circuit Current [kA]	1.5	1.5	1.5	1.5	1.5
Enclosure Protection	NEMA 4X	NEMA 4X	NEMA 4X	NEMA 4X	NEMA 4X
Battery Module Name	HV9652	HV9652	HV9652	HV9652	HV9652

Battery Module

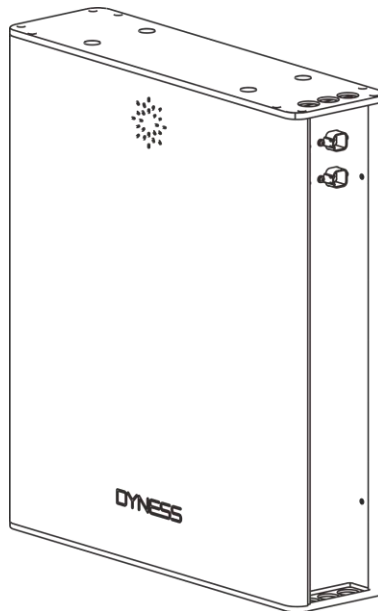


Figure 2-1 Battery module

Table 2-2 Product parameters

Module Name	HV9652
Cell Technology	Li-ion(LFP)
Battery Module Capacity (kWh)	4.992
Battery Module Voltage (Vdc)	96
Battery Module Capacity (Ah)	52
Battery Module Cell Quantity (pcs)	30
Battery Cell Capacity (Wh)	166.4
Battery Cell Voltage (Vdc)	3.2
Battery Cell Capacity (Ah)	52
Battery Module Cell Quantity in Series (pcs)	30
Battery Module Charge Voltage (Vdc)	109.5

Battery Module Charge Current (Standard) [A]	10.4
Battery Module Charge Current (Normal) [A]	26
Battery Module Charge Current (Max.) [A]	40
Battery Module Discharge lower-Voltage (Vdc)	84
Battery System Discharge Current (Standard) [A]	10.4
Battery Module Discharge Current (Normal) [A]	26
Battery Module Discharge Current (Max.) [A]	40
Dimension (W*H*D, in)	21.3*24.3*6.5
Communication mode	CAN
Pollution Degree (PD)	II
Ambient Temperature(°F)	32~122
Enclosure Protection	NEMA 4X
Weight (lbs)	127.9

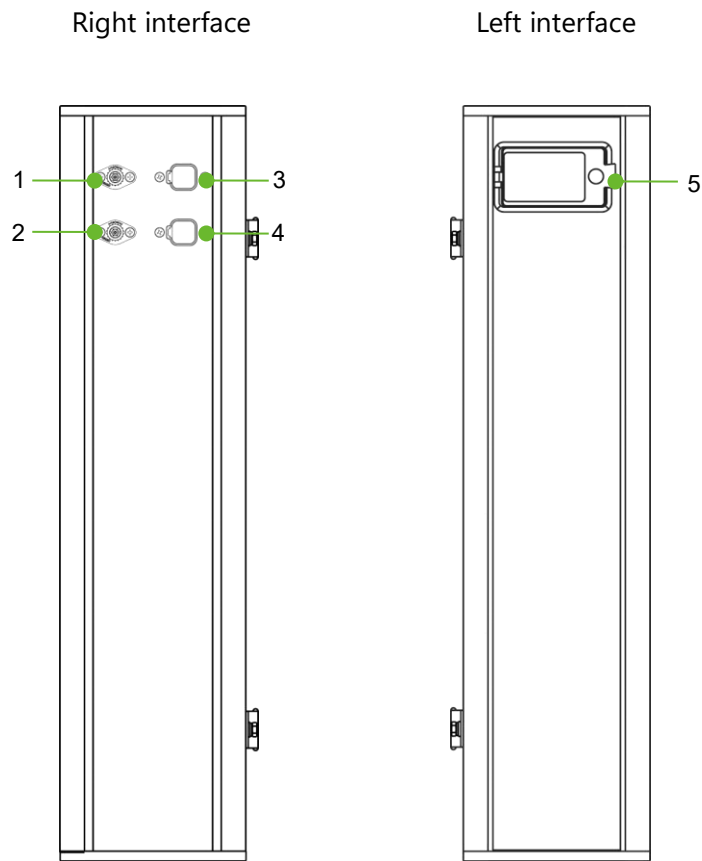
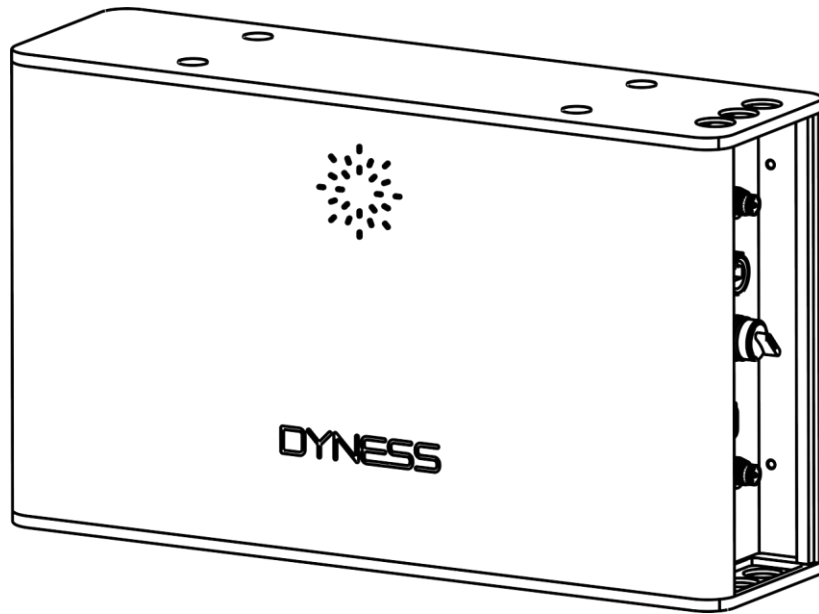


Figure 2-2 Interface Definition

Table 2-3 Interface Definition

Item	Name	Definition
1	Positive socket	The battery DC output positive pole, which is connected to the positive pole of the inverter through the cable
2	Negative socket	The battery DC output negative pole, which is connected to the negative pole of the inverter through the cable
3	COM in	<p>When the system is used independently: The CAN socket is connected to the BDU CAN interface through the communication cable.</p> <p>When the system is used in parallel: This CAN communication socket is connected to the COM OUT interface of the previous battery through communication cable. (Factory default CAN communication mode)</p>
4	COM out	<p>When the system is used independently: This CAN socket is a reservation interface</p> <p>When the system is used in parallel: This CAN communication socket is connected to the COM IN interface of the next battery through communication cable. (Factory default CAN communication mode)</p>
5	DC breaker	Circuit protection

Battery Controller



BDU right interface

BDU left interface

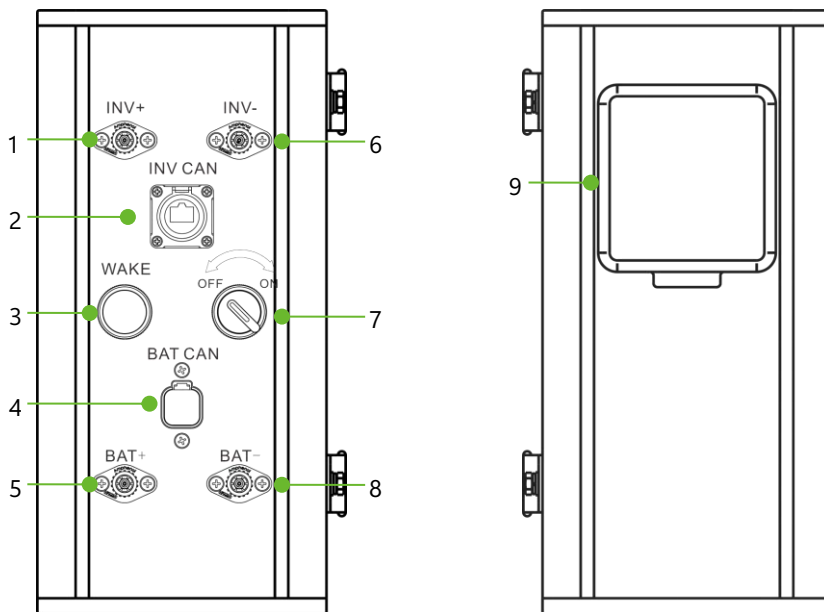



Figure 2-3 BDU interface

Table 2-4 Interface Definition


Item	Name	Definition
1	External Positive socket	Connect battery system with Inverter positive terminal
2	EXT-CAN Communication Port	RJ45 communication port between the battery system and inverter

Item	Name	Definition
3	Power Wake Button	Long press this button 10S to start the battery system
4	Internal CAN Communication Port	RJ45 communication port between the battery and BDU
5	Internal Positive socket	Connect battery with BDU positive terminal
6	External Negative socket	Connect battery system with Inverter negative terminal
7	Power On switch	Turn on the switch to power the BMS system
8	Internal Negative socket	Connect battery with BDU positive terminal
9	DC Breaker	The master switch of the battery system, you must switch on it before switching on power on&power wake switch; Short circuit protection.

 **CAUTION**

When the DC breaker is tripped off because of over current or short circuit, must wait after 30min to turn on it again, otherwise may cause the breaker damage.

Power On Button: Generally when it is at ON state, you can't turn off it during normal running condition.

 **DANGER**

Ensure Power On Switch is turned on before waking up the battery. Otherwise it will affect automatic checking process and cause danger.

DO NOT turn off the "Power On Switch" during normal running condition, only in emergency case it could be turned off directly. Otherwise will cause this battery string current surge by another battery strings.

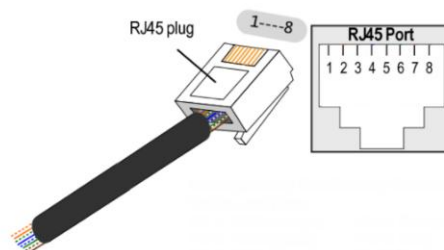


Figure 2-4 "EXT-CAN" port pin

Table 2-5 Definition of "EXT-CAN" port pin

PIN	Color	Definition
PIN1	Orange/White	Reserved
PIN2	Orange	XGND
PIN3	Green/White	Reserved
PIN4	Blue	CANH
PIN5	Blue/White	CANL
PIN6	Green	NC

3 Installation and Configuration

Environmental Requirement



DANGER

Cleanliness

The battery system has high voltage connectors. The environment condition will affect the isolation performance of the system.

Before installation and system power on, the dust and iron scurf must be removed to keep a clean environment. And the environment must have certain anti-dust ability.

Dust and humidity condition shall be periodic checked during the system continuous operation.

Fire-extinguisher System

The room must be equipped with fire-extinguisher system for safety purpose. The fire system needs to be regularly checked to be in normal condition. Refer to the using and maintenance requirements, please follow local fire equipment guidance.

Grounding System

Make sure the grounding point for battery system is stable and reliable before the battery installation. If the battery system is installed in an independent equipment cabin (e.g. container), must make sure the grounding of the cabin is stable and reliable.

The resistance of the grounding system must $\leq 100\text{m}\Omega$.



CAUTION

Temperature

Orion system working temperature range: $32\sim 122^{\circ}\text{F}$; Optimum temperature: $64.4\sim 86^{\circ}\text{F}$;

Out of the working temperature range will cause the battery system over / low temperature alarm or protection which may lead to the cycle life reduction.

Cooling System

It is essential to equip a cooling system to keep the battery system in a relevant temperature range.

Out of the working temperature range will cause the battery system over/low temperature alarm or protection which may lead to the cycle life reduction.

Heating System

It is essential to equip a heating system to keep the battery system in a relevant temperature range. If the environment is lower than 32°F , the system may be shut down for protection purpose. It is necessary to open the heating system at first.

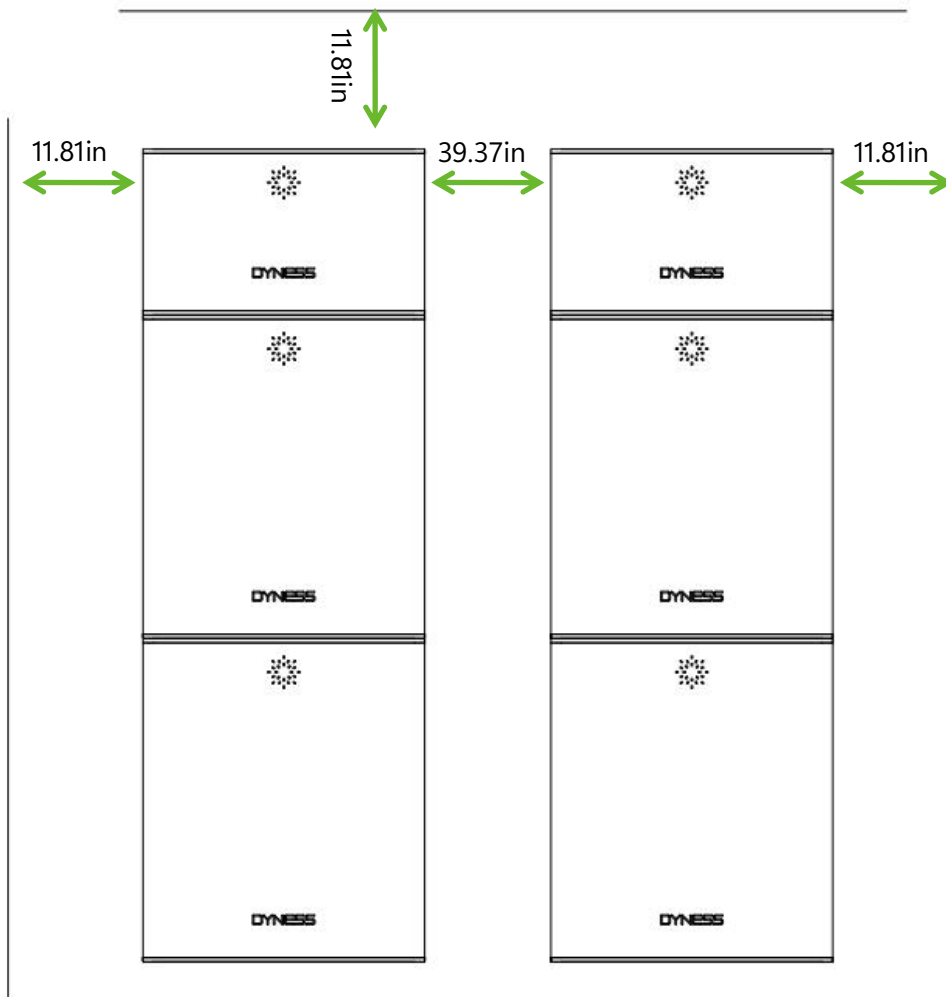
Out of the working temperature range will cause the battery system over / low temperature alarm or protection which may lead to the cycle life reduction.

Installation clearance requirements

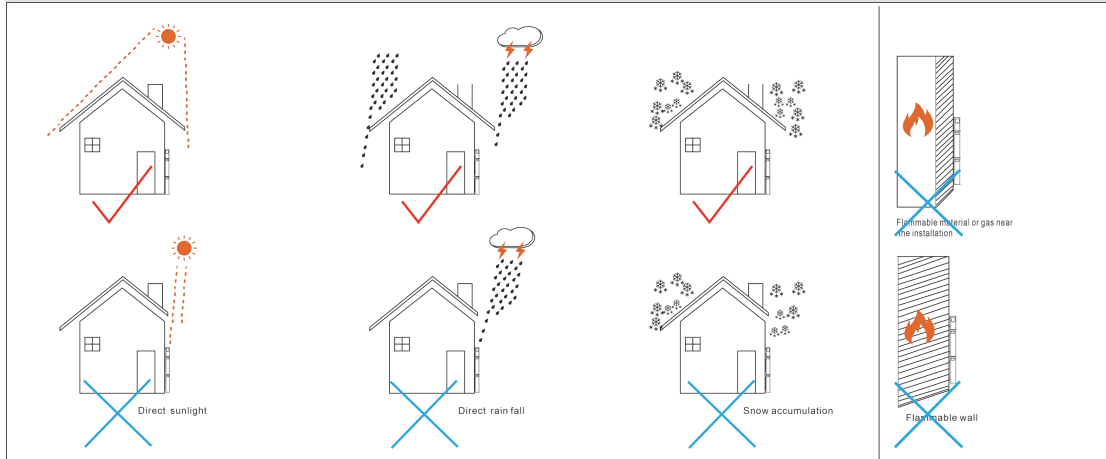


DANGER

Please note that the battery should be installed with a minimum safe clearance from the surrounding equipment or battery. Please refer to the minimum clearance diagram below.



Installation location precautions



Tools

The following tools are required to install the battery pack:

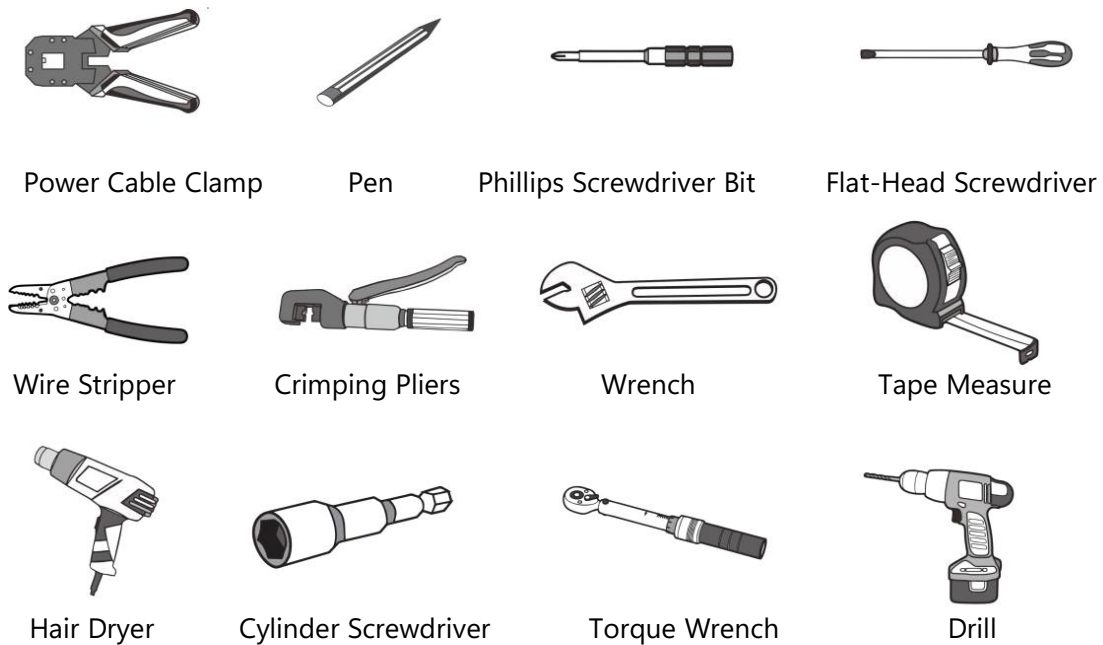


Figure 3-1 Installation tools

NOTE:

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

Safety Gear

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



Insulated Gloves



Safety Goggles

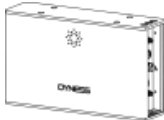


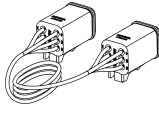



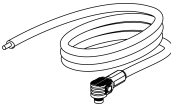






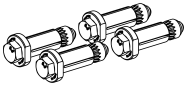
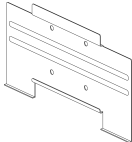
Safety Shoes

Unpacking inspection

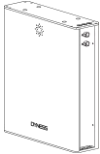
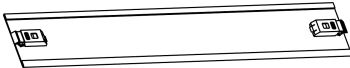
1. When the equipment arrives at the installation site, loading and unloading should be performed according to the rules and regulations, to prevent from being exposed under sunlight. Battery should not be installed in direct sunlight. Please refer to Section 3.3
2. Before unpacking, the total number of packages shall be indicated according to the shipping list attached to each package, and the case shall be checked for good condition.
3. In the process of unpacking, handle with care and protect the surface coating of the object.
4. Open the package, the installation personnel should read the technical documents, verify the list, according to the configuration table and packing list, ensure objects are complete and intact, if the internal packing is damaged, should be examined and recorded in detail.

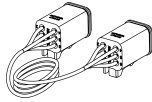
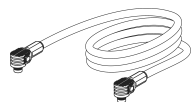

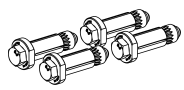
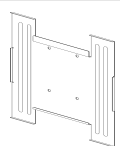
Packing list (BDU)

Item	Specification	Quantity	Figure
Orion BDU	21.3*12.4*6.5in	1 PCS	
Side cover	11.8*4.3in	2	
Communication cable to inverter	Standard, Black /L6.6ft /RJ45 plug at both sides	1 PCS	
Communication cable to battery	Black /L8in	1	
Module cable-positive	Red /8AWG/L8in	1	

Module cable-negative	Orange /8AWG/L9.8ft	2	
Terminal	OT4-6	1	
User Manual	30page	1	
Power cable connector	To negative pole of BDU	1	
Power cable connector	To negative pole of battery	1	
Power cable	Positive cable 8AWG, red, 6.6ft	1	
Power cable	Negative cable 8AWG, black, 6.6ft	1	
Anchor bolts	M8*60	4	
Bracket	TP304 21.6*11.2in	1	

Packing list (Battery)

Item	Specification	Quantity	Figure
Battery Module HV9652	96V/52Ah 21.3*24.3*6.5in	1	
Side cover	23.6*4.3in	2	

Communication cable	Black /L8.2ft	1	
Serial cable	Orange /8AWG/L8.2ft	1	
Terminal	OT4-6	1	
Anchor bolts	M8*60	4	
Bracket	TP304 21.6*24.4in	1	

Installation





































BDU1+BAT2 (9.98Kwh)	 H:3.1 ft W:3.6 ft	 H:5.1 ft W:1.8 ft	 H:3.1 ft W:3.6 ft					
BDU1+BAT3 (14.97Kwh)	 H:3.1 ft W:5.4 ft	 H:3.1 ft W:5.4 ft	 H:5.1 ft W:3.6 ft	 H:5.1 ft W:3.6 ft	 H:5.1 ft W:3.6 ft	 H:5.1 ft W:3.6 ft	 H:5.1 ft W:3.6 ft	 H:5.1 ft W:3.6 ft
BDU1+BAT4 (19.97Kwh)	 H:3.1 ft W:7.2 ft	 H:3.1 ft W:7.2 ft	 H:5.1 ft W:5.4 ft	 H:5.1 ft W:5.4 ft	 H:5.1 ft W:5.4 ft	 H:5.1 ft W:5.4 ft	 H:5.1 ft W:3.6 ft	 H:5.1 ft W:3.6 ft
	 H:5.1 ft W:5.4 ft	 H:5.1 ft W:5.4 ft	 H:5.1 ft W:5.4 ft	 H:5.1 ft W:5.4 ft				
BDU1+BAT5 (24.96Kwh)	 H:3.1 ft W:9.0 ft	 H:3.1 ft W:9.0 ft	 H:5.1 ft W:5.4 ft	 H:5.1 ft W:5.4 ft	 H:5.1 ft W:5.4 ft	 H:5.1 ft W:5.4 ft		
BDU1+BAT6 (29.95Kwh)	 H:3.1 ft W:10.8 ft	 H:3.1 ft W:10.8 ft	 H:5.1 ft W:5.4 ft	 H:5.1 ft W:5.4 ft	 H:5.1 ft W:5.4 ft	 H:5.1 ft W:5.4 ft		
						 H:5.1 ft W:5.4 ft		

Figure 3-2 Wall mounting layout

Step 1

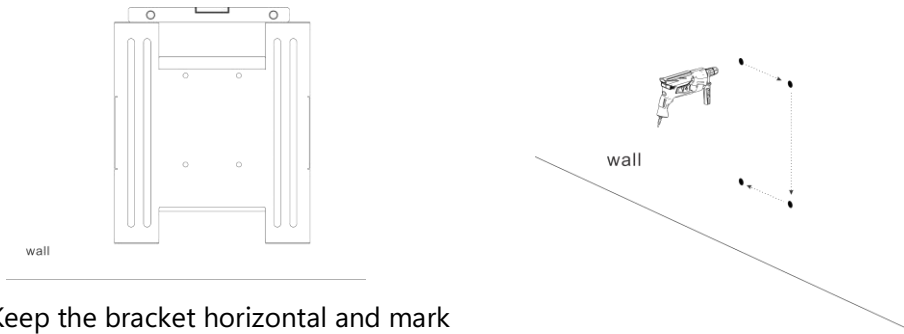
Select a layout for the Wall-mounting Installation.

Step 2

Decide the position of the Bracket.

Step 3

Drill holes in the wall for the anchor bolts (Drill bit diameter 0.4 in). The drilling depth should be at least 2.4 in.



Keep the bracket horizontal and mark the mounting hole with a marker

Step 4

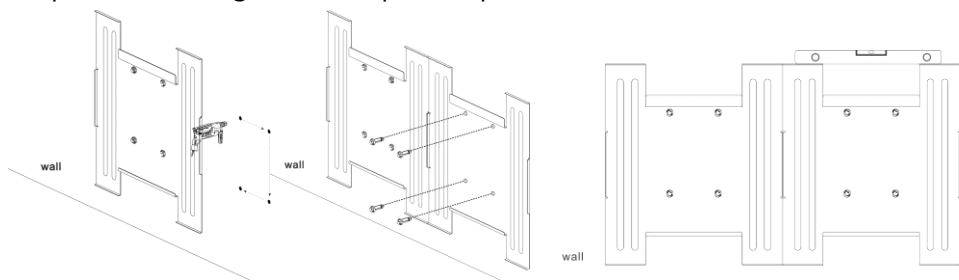
Drive and pre-tighten the anchor bolts into the holes in the wall through the screw holes on the bracket.



Check the balance and fully fasten the bolts to the wall.

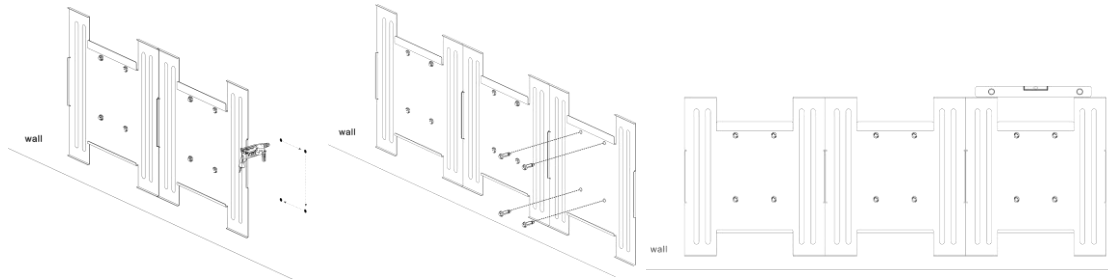
Step 5

Install the second bracket. Place the second bracket on the side of the installed bracket to keep the same height. Then repeat steps 3 and 4.



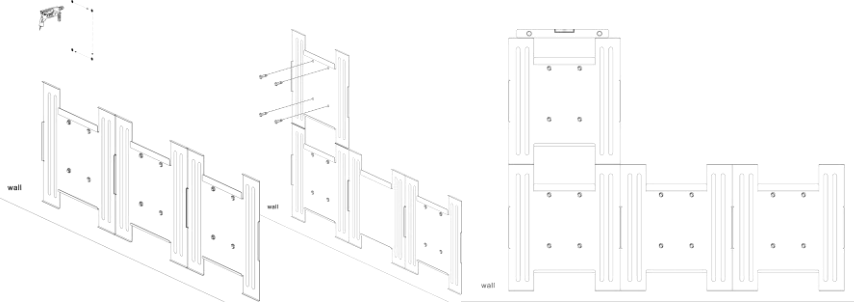
Step 6

Place the third bracket on the side of the installed bracket, keeping the horizontal direction consistent. Then repeat steps 3 and 4.



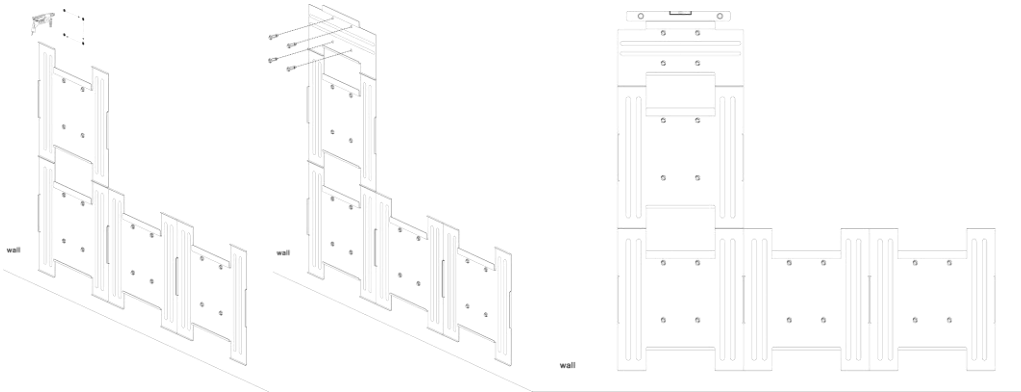
Step 7

Place the fourth bracket above the first bracket, keeping the vertical direction consistent. Then repeat steps 3 and 4.



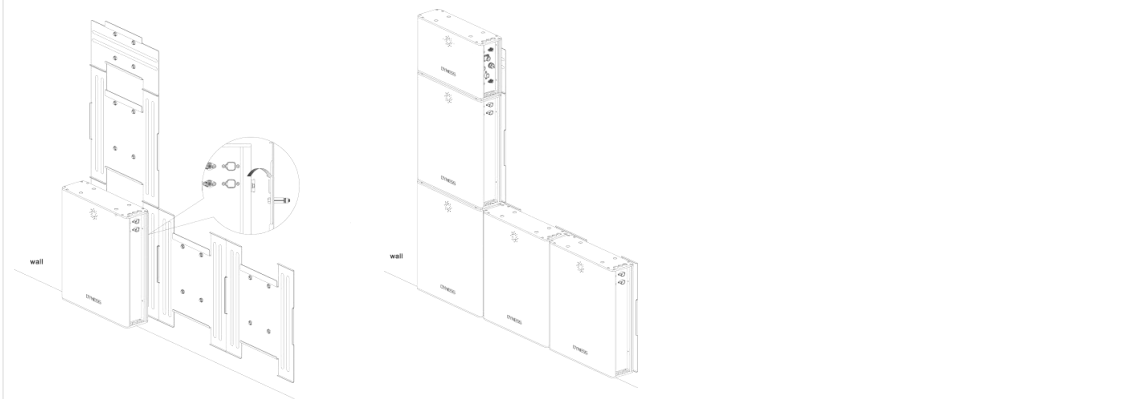
Step 8

Install the BDU bracket. Place the BDU bracket according to the selected layout. Then repeat steps 3 and 4.



Step 9

Assemble the battery to the Wall Mounting Bracket.



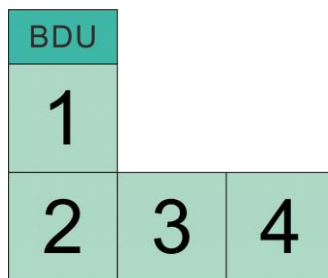
WARNING

Single battery module is 127.9lbs. It's necessary to arrange more than 1 person to install battery module if without lifting equipment, more than 2 persons when install battery module in higher position..

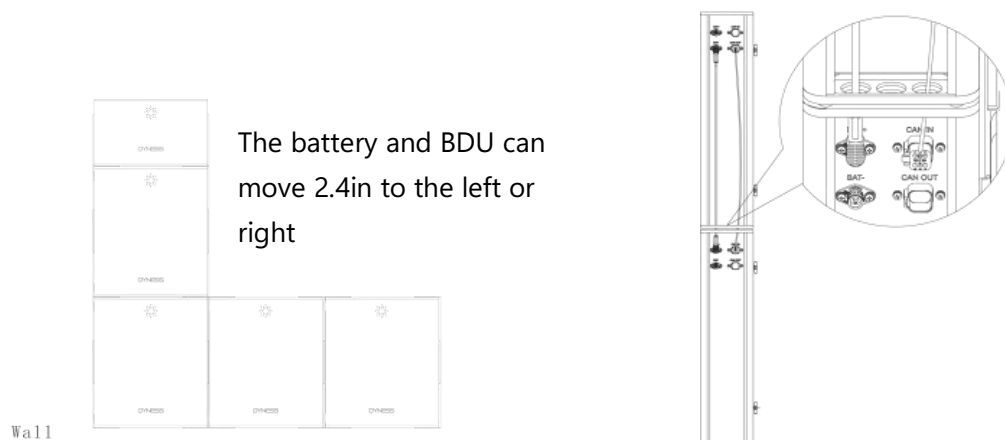
Cable Connection and self-test

Series connection between the battery

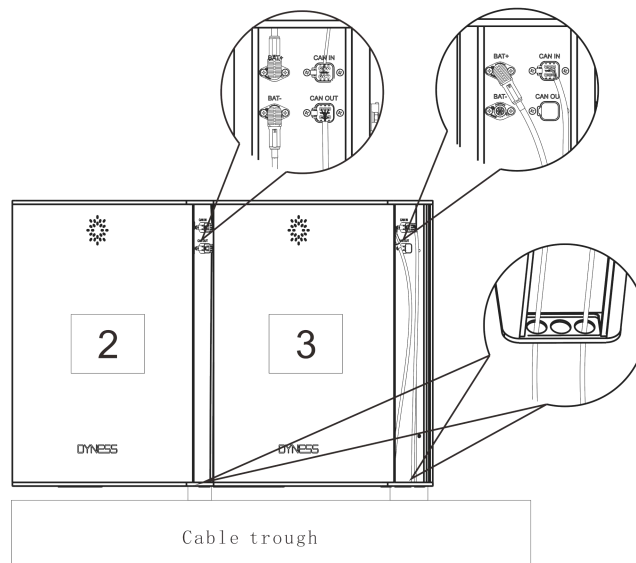
- Refer to the selected layout and confirm the battery serial number.



- The negative pole of 1 # battery is connected to the positive pole of 2 # battery. 1# battery CAN OUT is connected to 2# battery CAN IN.



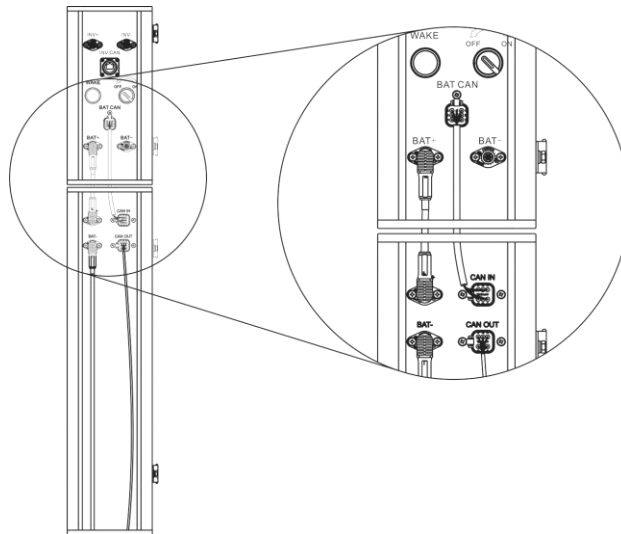
- The negative pole of 2 # battery is connected to the positive pole of 3 # battery. 2# battery CAN OUT is connected to 3# battery CAN IN.



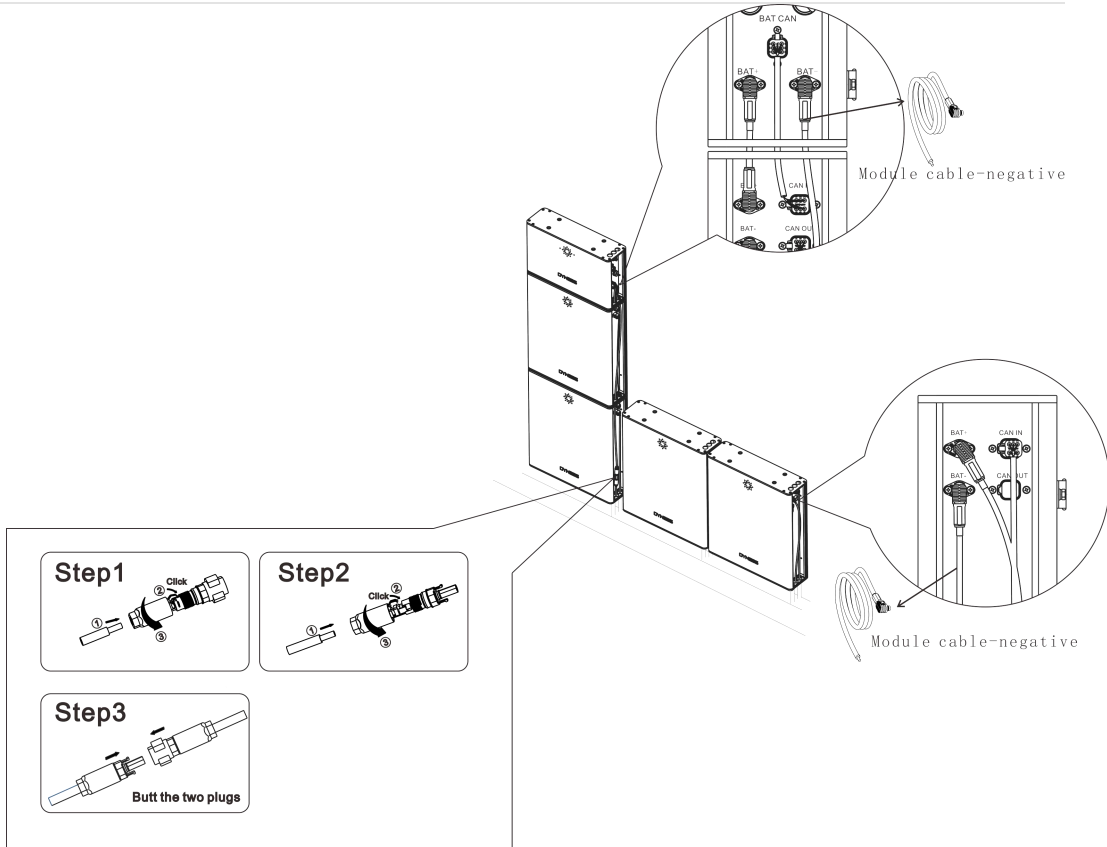
- Repeat the previous step, connect the negative pole of 3 # battery to the positive pole of 4 # battery. 3# battery CAN OUT is connected to 4# battery CAN IN.

Connection between battery system and BDU

- The positive pole of 1 # battery is connected to the positive pole of BDU. BDU BAT CAN is connected to 1# battery CAN IN.

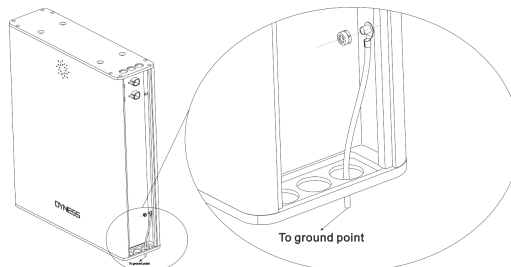


- The negative pole of 4 # battery is connected to the negative pole of BDU. Since the distance between the two negative sockets is too far, two Module cable-negative are required for butt joint. One is connected to the BDU negative pole socket, and the other is connected to the 4# battery negative pole socket. Select an appropriate location as the docking point



Grounding wire connection

Each battery has an independent grounding wire, which needs to be connected to the grounding point.



CAUTION

Additionally required mounting material (not included in the scope of delivery):

- 1. Conduit (conduit size 1")
- 2. Grounding cable (Recommend 11AWG)

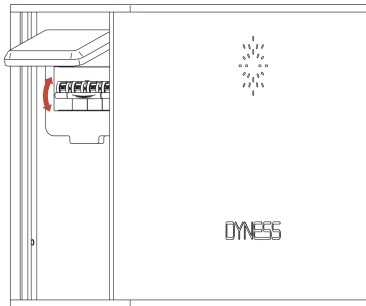
All cables must not be exposed. Use cable conduit for exposed cables

DANGER

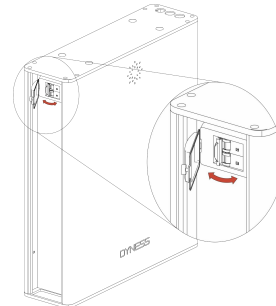
The battery system is high voltage DC system. Must make sure the grounding surface of the battery is stable and reliable.

Battery system self-test

- Switch on the DC breaker of the BDU and battery.

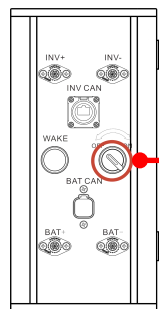


BDU



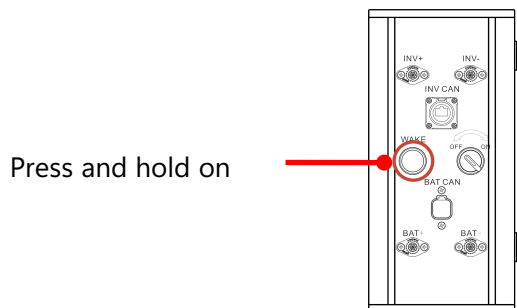
BATTERY

- Switch on the "POWER ON" switch



Turn the switch to the "ON" position

- Press the "POWER WAKE" button for about 10secs



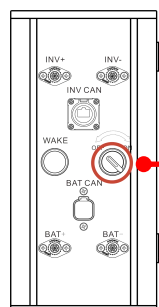
Press and hold on

- Check the system output voltage

Use a multi-meter to measure the output voltage on the positive and negative ports of the BDU

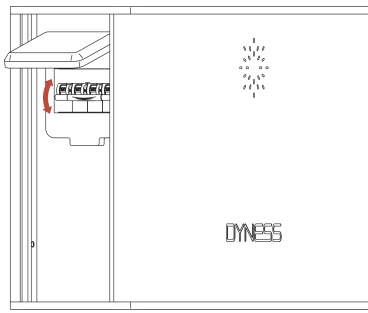
The output voltage should conform to the voltage range in the table "P3 Table 2-1 The parameter of Tower system".

- Switch off the "POWER ON" switch.

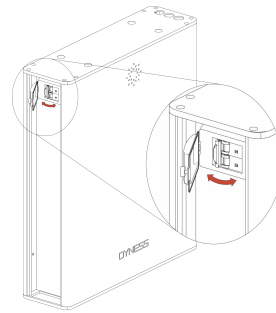


Turn the switch to the "OFF" position

- Switch the BDU & battery "DC BREAKER" to the "OFF" state.



BDU



BATTERY

Connecting inverter



DANGER

The voltage of the battery is too high, please pay attention to do self-protection during the measurement.



CAUTION

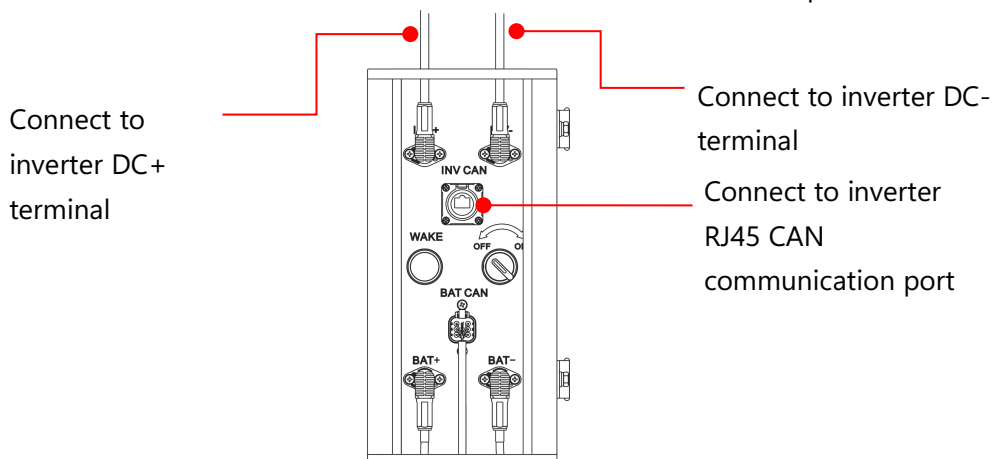
A external DC Breaker that operates both positive and negative conductors simultaneously between the BDU and inverter on the power cable is recommended. After waking up the BDU and ensure that the BDU is pre-charged, you can turn on it.



DANGER

Please confirm that the battery system is in the off state before connecting. It may cause electric shock to personnel and damage to the inverter if connect the battery directly without power off.

- Connect External Power Cable to the inverter
(If that 6.6ft power cable is not long enough, please find another power cable of the same specification, the length cannot be longer than 9.8ft.)
- Connect the EXT-CAN communication cable to the inverter RJ45 CAN port.



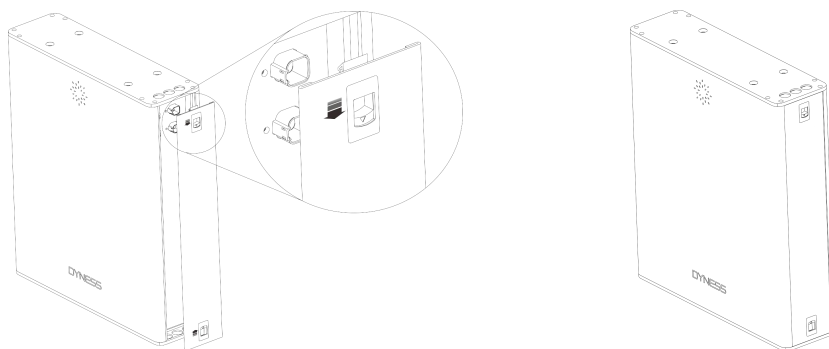
**WARNING**

Double check all the power cables and communication cable. Make sure the voltage of the Inverter is in the same level with the battery system.

- Switch on the inverter, to make sure all the power equipments can work normally.
- Start the battery system.

Side cover installation

Press the clip, place the side cover and release the clip.



4 Maintenance

Trouble Shooting



DANGER

The Orion battery system is a high voltage DC system, operated by professional and authorized person only.

Before check the failure, must check all the cables connection. Switches are right or not (refer to section 3.8), and if the battery system can be woken up normally.

No	Problem	Possible Reason	Solution
1		The DC breaker of the BDU didn't be turned on	Turn on the DC breaker of BDU
2	The battery has no voltage output, and "POWER ON"/"POWER WAKE" Light is off.	The "POWER ON" switch of the BDU box was not switched on	Switch on the "POWER ON" button
3		Battery is in sleep state.	Long press the "POWER WAKE" button for about 10S
4		The fuse in the BDU box is faulty	Replace fuse
5		Battery gets into over-discharged protection	Charge the battery to relieve the protection state
6		The relay in BDU is faulty	Replace a new BDU directly
7	When the battery is connected to the inverter, the DC breaker trips automatically	The circuit between the battery and the inverter has a short circuit point	Check whether there is a short circuit in the circuit between the battery and the inverter; Check if the inverter is faulty
8	Communication failure between battery and inverter	The wrong battery model type is selected on the inverter	Select correct battery model type on the inverter

Replacement of Battery Controller (BDU)

- Turn off the whole battery system. Ensure the Negative terminal and Positive terminal have no power. The shut-down progress refers to section 3.8
- Remove the power cord and communication cord on the BDU, and then remove the BDU from the system.
- Replace the BDU with a new one. Then connect the power cord and communication cable.

Battery Maintenance



DANGER

The maintenance of battery only can be operated by professional and authorized person. you need turn off the battery system firstly when you do some maintenance items.

Voltage Inspection:

[Periodical Maintenance] Check the voltage of battery system through the monitor software. Check whether the system voltage is normal or not. For example: Check Single cell's voltage is out of rated range or not.

Voltage Inspection:

[Periodical Maintenance] Check the SOC of battery system through the monitor software. Check the SOC of battery string is normal or not.

Cables Inspection:

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

Balancing:

[Periodical Maintenance] The battery system will become unbalanced if have not be charged fully for a long time. Solution: Perform the balancing maintenance (fully charged) every 3 month. Generally this maintenance progress needs to be completed when external devices such as the monitor software and battery and inverter are in good communication.

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 Storage Recommendations

- For long-term storage (more than 3 months), the battery cells should be stored in the environment: temperature range of 45~113°F, relative humidity <65% and contains non-corrosive gas .
- The battery module should arranged in range of 45~113°F, dry, clean and well ventilated environment. The battery should be charged to 50~55% SOC before storage.
- It is recommended to active the battery system (discharge and charge) every 3 months, and the longest duration of storage without charge and discharge cannot exceed 6 months.



CAUTION

The cycle life of the battery will have relative heavily reduction if not follow the above instructions to store the battery for a long term.

6 Shipment

Battery module will pre-charged to 50% SOC or according to customer requirement before shipment. The remaining capacity of battery cell is determined by the storage time and condition after shipment.

- The battery modules meet the UN38.3 certificate standard.
- In particular, special rules for the carriage of goods on the road and the current dangerous goods law, specifically ADR (European Convention on the International Carriage of Dangerous Goods by Road), as amended, must be observed.



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