User Manual

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Energy Storage ESS

Version: 1.0

1. Introduction

This energy storage system can provide power to connected loads by utilizing PV power, utility power and battery power and store surplus energy generated from PV solar modules for use when needed. When the sun has set, energy demand is high, or there is a black-out, you can use the energy stored in this system to meet your energy needs at no extra cost. In addition, this energy storage system helps you pursue the goal of energy self-consumption and ultimately energy-independence.

Depending on different power situations, this energy storage system is designed to generate continuous power from PV solar modules (solar panels), battery, and the utility. When MPP input voltage of PV modules is within acceptable range (see specification for the details), this energy storage system is able to generate power to feed the grid (utility) and charge. This energy storage system is only compatible with PV module types of single crystalline and poly crystalline. Do not connect any PV array types other than these two types of PV modules to the energy storage system. Do not connect the positive or negative terminal of the solar panel to the ground. See Figure 1 for a simple diagram of a typical energy storage system.

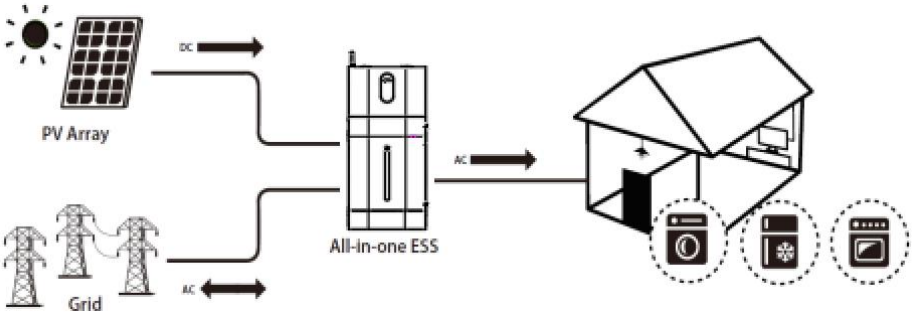


Figure 1 Energy storage System Overview

2. Important Safety Warning

Before using please read all instructions and cautionary markings on the unit and this manual. Store the manual where it can be accessed easily.

This manual is for qualified personnel. The tasks described in this manual may be performed by qualified personnel only.

General Precaution-

Conventions used:
WARNING! Warnings identify conditions or practices that could result in personal injury;
CAUTION! Caution identify conditions or practices that could result in damage to the unit or other equipment connected.

CAUTION! In high temperature environment, the surface of this inverter could be hot enough to cause skin burns if accidentally touched. Ensure that this inverter is away from normal traffic areas.

CAUTION! Use only recommended accessories from installer. Otherwise, disqualified tools may cause fire, electric shock, or injury to persons.

CAUTION! To reduce risk of fire hazard, do not cover or obstruct the cooling fan.

CAUTION! Do not operate the Inverter if it has undergone a sharp blow, been dropped, or damaged in any way. If the Inverter is damaged, please call for an RMA (Return Material Authorization) request.

CAUTION! AC breaker, DC switch and Battery circuit breaker are used as disconnect devices and these disconnect devices shall be easily accessible.

Before working on this circuit

- Isolate inverter/Uninterruptible Power System (UPS)
- Then check for Hazardous Voltage between all terminals including the protective earth.

Risk of Voltage Backfeed

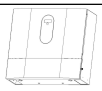
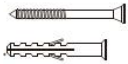
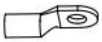
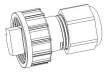
3. Unpacking & Overview

3-1. Packing List

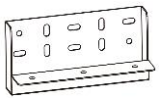
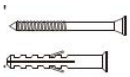
Before installation, please inspect the unit. Be sure that nothing inside the package is damaged. To guarantee goods in good condition during transportation, we offer separate packages for inverter and battery unit.

Inverter Package

You should receive the following items inside of package:

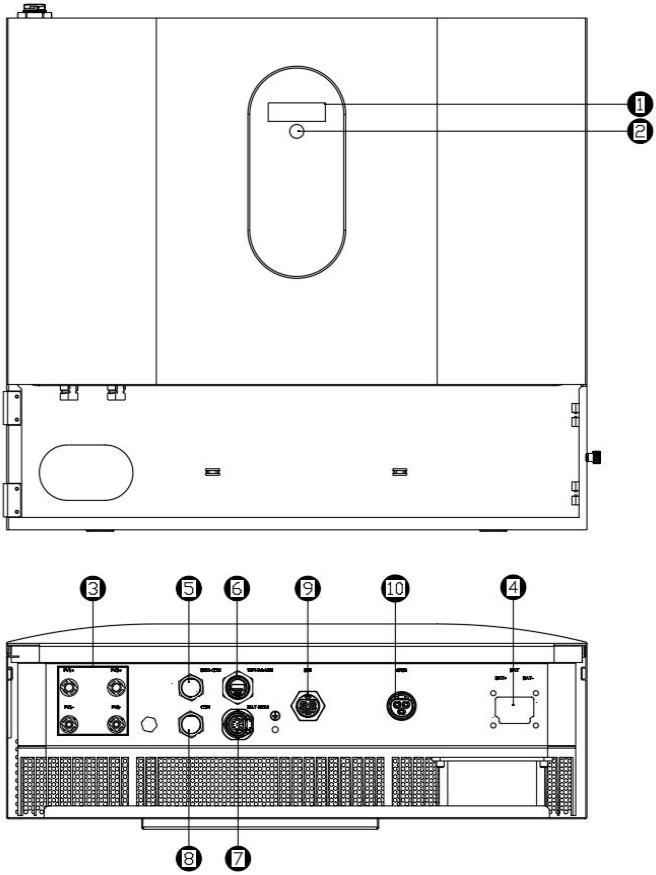
 Inverter module	 PV connector x 2	 Mounting screws x 4	 Manual
 WiFi antenna	 Communication Connector	 PE OT Terminal	 Connector*1
 Energy meter	 OT Terminal	 Connector*1	 Communication Connector*2
 Inverter communication line			

Battery

 Battery module	 Battery cable #B-B	 Top-bracket	 L-shape plate x 2
 RJ45 cable	 Mounting screws x 4	M4 Flat-head screws*3	 Base*1

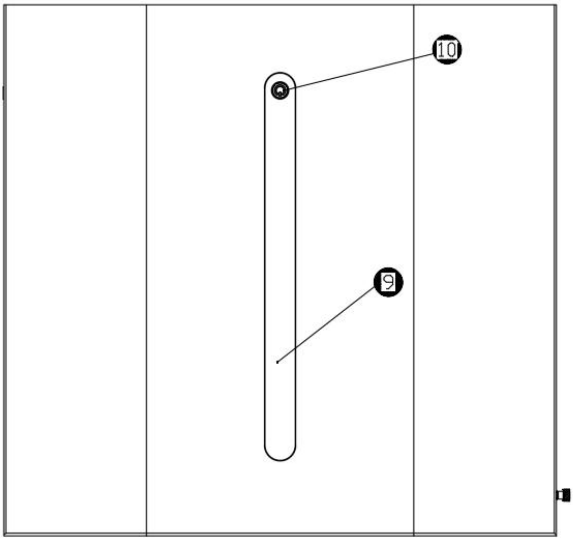
3-2. Product Overview

Inverter Module

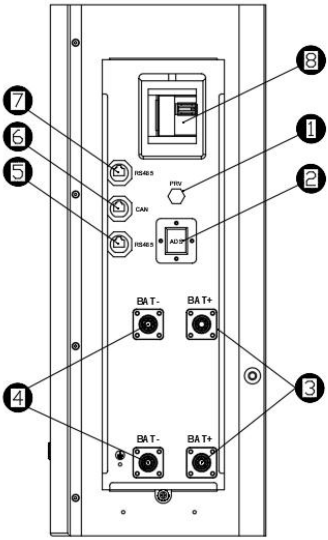


1.LED
2. Button
3. PV
4. BAT
5. DRM-COM
7. BAT-COM
8. COM
9. EPS
10. GRID

Battery Module



Front view



Side view

1. Explosion proof valve
2. Dial switch
3. Output terminal
4. Output terminal
5. RS485B Port
6. CAN RS485A bus Port
7. RS485B Port
8. Power Switch
9. LED

4. Installation

4-1. Selecting Mounting Location

Consider the following points to install the energy storage system:
Installation Environment Requirements

1. Do not install the equipment in a place near flammable, explosive, or corrosive materials.
2. Install the equipment on a surface that is solid enough to bear the inverter weight.
3. Install the equipment in a well-ventilated place to ensure good dissipation. Also, the installation space should be large enough for operations.
4. The equipment with a high ingress protection rating can be installed indoors or outdoors. The temperature and humidity at the installation site should be within the appropriate range.
5. Install the equipment in a sheltered place to avoid direct sunlight, rain, and snow. Build a sunshade if it is needed.
6. Do not install the equipment in a place that is easy to touch, especially within children's reach. High temperature exists when the equipment is working. Do not touch the surface to avoid burning.
7. Install the equipment at a height that is convenient for operation and maintenance, electrical connections, and checking indicators and labels.
8. Install the equipment away from electromagnetic interference.

WARNING!! Remember that this inverter is heavy so please be careful when removing it from the package.

4-2. Mounting The System

Installation to the wall should be fixed with proper screws. After that, the device should be bolted on securely.

The energy storage system can only operate in a CLOSED ELECTRICAL OPERATING AREA. Only service personnel can enter this area.

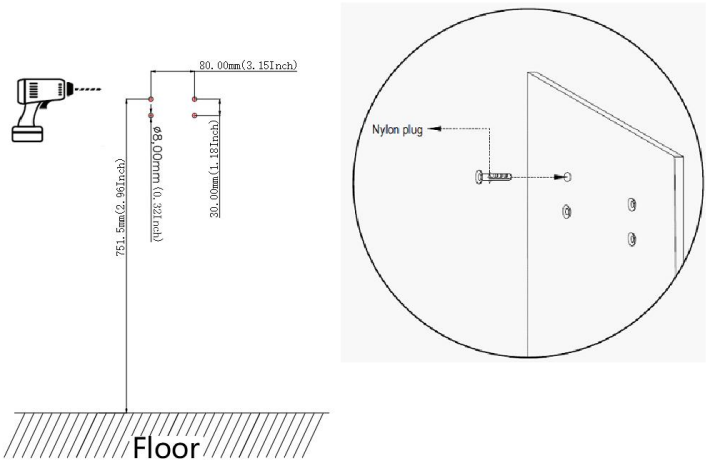
WARNING!! FIRE HAZARD.
SUITABLE FOR MOUNTING ON CONCRETE OR OTHER NON-COMBUSTIBLE SURFACE ONLY.

Installation Tool Requirements

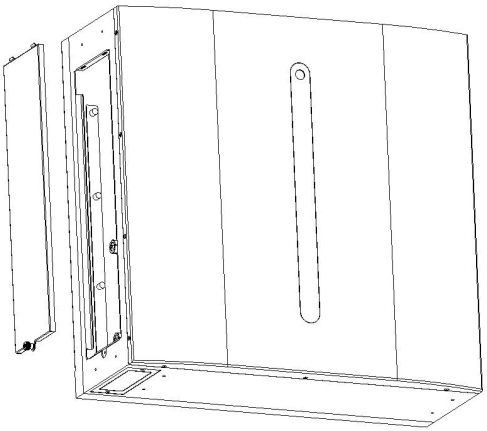
The following tools are recommended when installing the equipment.Use other auxiliary tools on site if necessary

This energy storage system should be installed battery modules first on the bottom and then inverter module on the top.

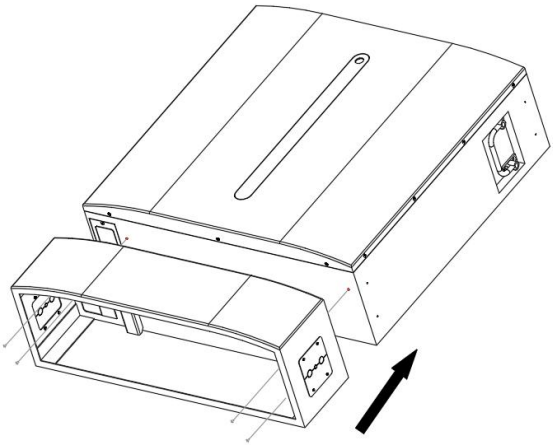
Step 1: Use Ø10mm drill to drill holes at a depth about 50mm, The holes pitch are as follows: (Install the nylon-plug after drilling is completed)



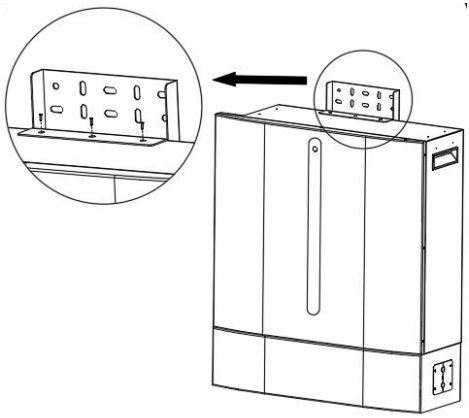
Step 2: Remove side cover of battery module first.



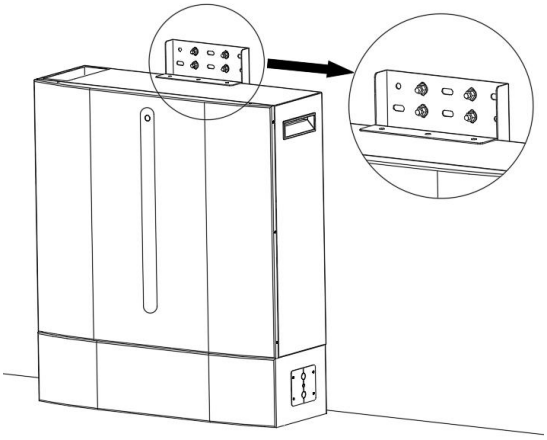
Step 3: Lay the battery pack flat, connect the base to the battery pack with 4 screws.



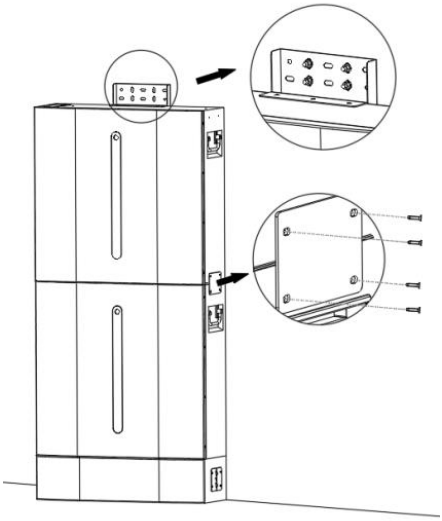
Step 4: Fix Top-bracket of the battery module separately with three flat-head screws as shown in the chart.



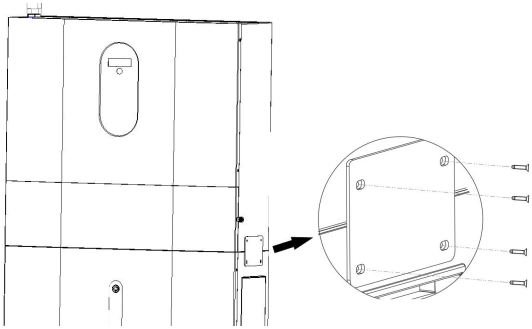
Step 5: Mounting the Top-bracket with four screws on the wall.



Step 6: When the battery needs to be used in parallel, the maximum connection is 6units, but we recommend to use 2-4 units according to application. The application needs power and communication connections as below, choose suitable accessories:



Step 7: Put the inverter module on the top of second battery module. Then, fix two L-shape plates to the second battery module with four round-head screws.



5. Wiring Connection

Before connecting all wires, be sure that side covers of inverter and battery modules are removed. This step should be executed before modules are installed to the wall.

5-1. Grid Connection

5-1-1. Preparation

Before connecting to AC utility, please install a **separate** AC circuit breaker between surge protection device (SPD) and AC utility. This will ensure the inverter can be securely disconnected during maintenance and fully protected from over current of AC input.

NOTE: The overvoltage category of the AC input is III. It should be connected to the power distribution.

WARNING! For safety and efficiency, it's very important to use appropriate cables for grid (utility) connection. To reduce risk of injury, please use the proper cable size recommended below.

Suggested cable requirement for AC wire

Nominal Grid Voltage	230VAC
Conductor cross-section (mm^2)	6
AWG no.	10

5-1-2. Connecting to the AC Utility

Step 1: Check the grid voltage and frequency with an AC voltmeter to see if it's same as the "VAC" value on the product label.

Step 2: Turn off the circuit breaker.

Step 3: Remove insulation sleeve 10 mm from three conductors and shorten phase L and neutral conductor N for 3 mm. Refer to chart 1.

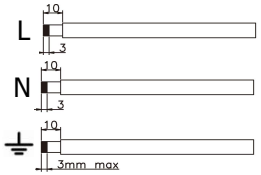


Chart 1

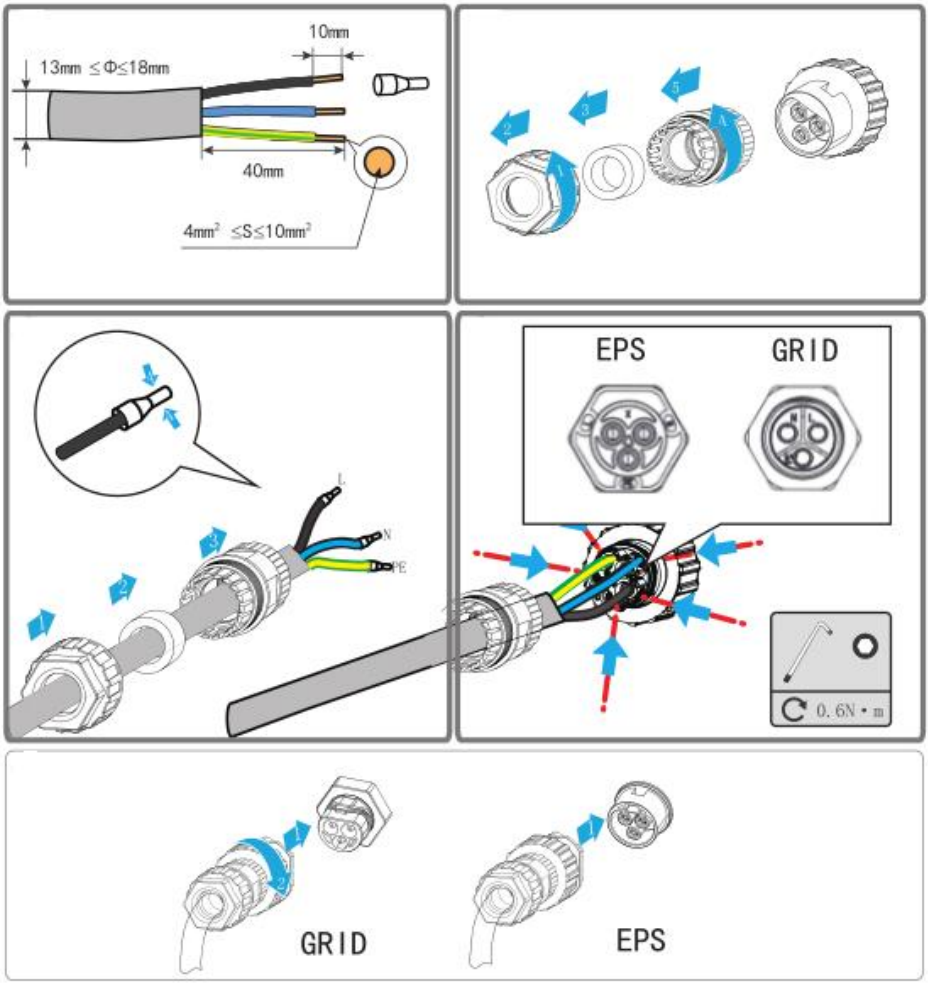
Step 4: Connect wires according to the polarities indicating on terminal block. Be sure to connect PE protective conductor **(G)** first.

L→LINE (brown or black)

N→Neutral (blue or white)

G→Ground (yellow-green)

Step 5: Make sure the wires are securely connected.
The reference tightening torque is 2N.m.



5-2. PV Module (DC) Connection

CAUTION: Before connecting to PV modules, please install **separately** DC circuit breakers between inverter and PV modules.
NOTE1: Please use 750VDC/30A circuit breaker.
NOTE2: The overvoltage category of the PV input is II.

Please follow the steps below to implement PV module connection:

WARNING: Because this inverter is non-isolated, only three types of PV modules are acceptable: single crystalline and poly crystalline with class A-rated and CIGS modules.
To avoid any malfunction, do not connect any PV modules with possible current leakage to the inverter. For example, grounded PV modules will cause current leakage to the inverter. When using CIGS modules, please be sure NO grounding.
CAUTION: It's requested to use PV junction box with surge protection. Otherwise, it will cause damage on inverter when lightning occurs on PV modules.

Step 1: Check the input voltage of PV array modules. The acceptable input voltage of the inverter is 360VDC-600VDC (with rated load). This system is applied with two strings of PV array. Please make sure that the maximum current load of each PV input connector is 16A.

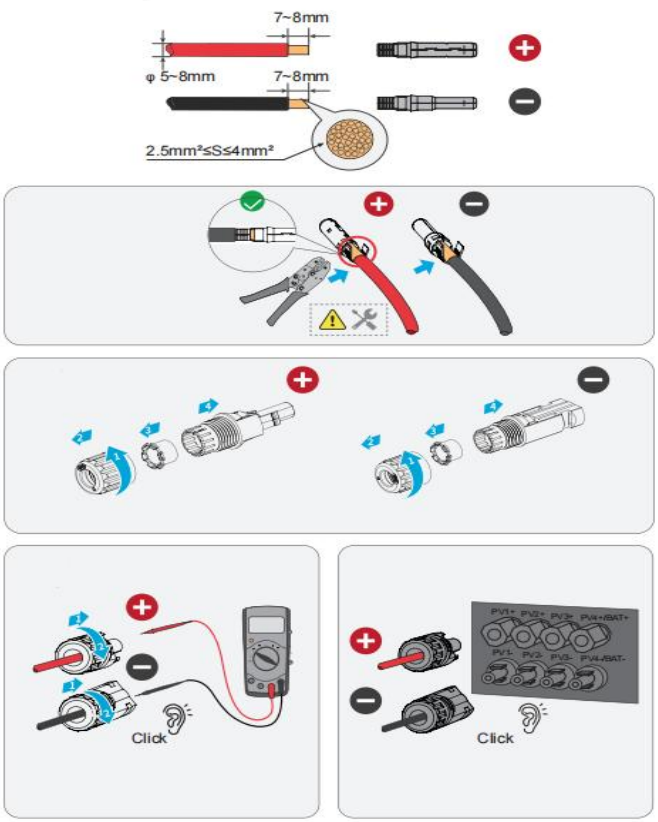
CAUTION: Exceeding the maximum input voltage can destroy the unit!! Check the system before wire connection.

Step 2: Disconnect the circuit breaker and switch off the DC switch.
Step 3: Assemble provided PV connectors with PV modules by the following steps.

Components for PV connectors and Tools:

Female connector housing	
Female terminal	
Male connector housing	
Male terminal	
Crimping tool and spanner	

Prepare the cable and follow the connector assembly process:
Strip one cable 8 mm on both end sides and be careful NOT to nick conductors.



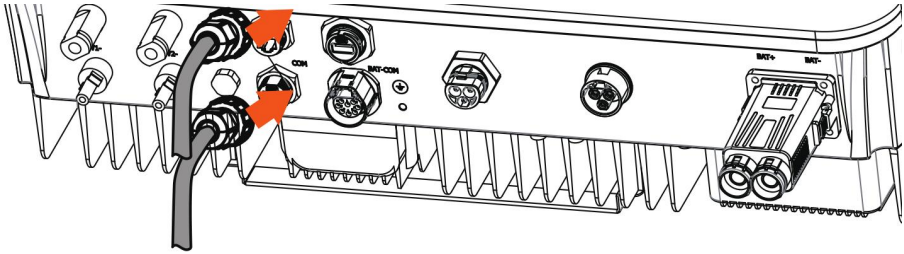
Step 4: Check the correctness of the polarity of connection cable on PV modules and PV input connectors. Then, connect positive pole (+) of connection cable to positive pole (+) of PV input connector. Connect negative pole (-) of connection cable to negative pole (-) of PV input connector.

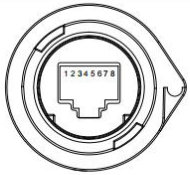
WARNING! For safety and efficiency, it's very important to use appropriate cables for PV module connection. To reduce risk of injury, please use the proper cable size as recommended below.

Conductor cross-section (mm^2)	AWG no.
4~6	10~12

CAUTION: Never directly touch the terminals of inverter. It might cause lethal electric shock.

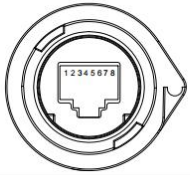
Step 5: inverter Communication Function





DRM-COM

NO.	Function
1	COM/DRMO
2	3V3_DRM
3	DRM4/8
4	DRM3/7
5	DRM2/6
6	DRM1/5
7	NC
8	NC



COM

NO.	Function
1	RSD_2
2	RSD_1
3	BACKUP_RS485_B
4	BACKUP_RS485_A
5	BAT_CAN_H
6	BAT_CAN_L
7	NC
8	NC

5-3. Battery Connection

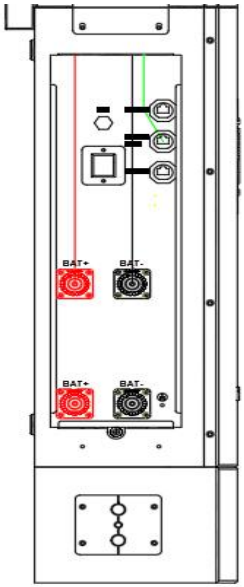
CAUTION: Before connecting to battery modules, please **disconnect** the DC breaker between inverter and batteries.

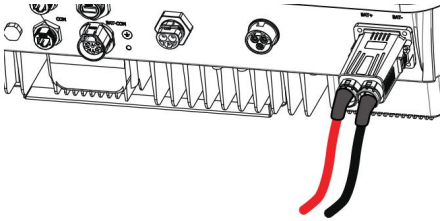
Single battery connection

Step 1: Use supplied two battery cables #B-B (supplied in battery module package). Follow the polarity of battery printed near the battery terminal! Simply plug battery cable to battery terminals on inverter module and battery module as shown in the chart.

ORANGE cable to the positive terminal (+)

BLACK cable to the negative terminal (-)

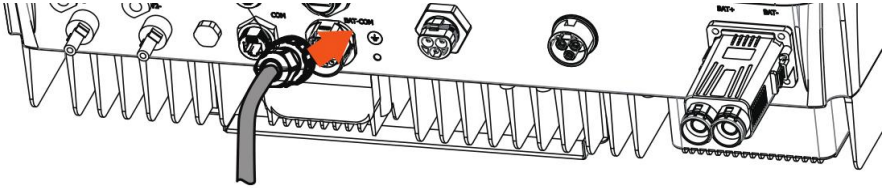


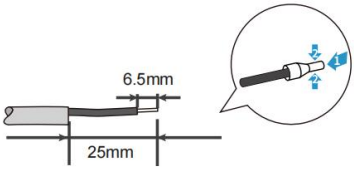


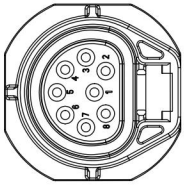
WARNING! Wrong connections may damage the unit permanently.

Step 2: Make sure the wires are securely connected.

Step 3: Insert the supplied RJ45 cable (from inverter module package) into the BAT-COM port on the inverter module. The other end connects to CAN port on the first battery module.







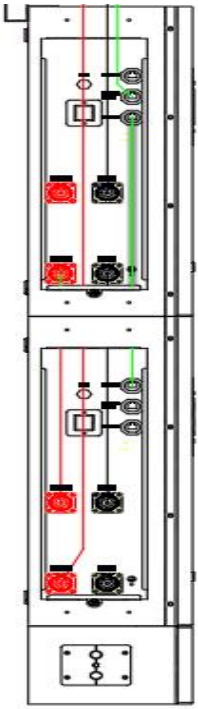
NO.	Function
1	BAT_CAN_H
2	BAT_CAN_L
3	NC OR GND
4	NC OR +12V
5	METER_RS485_B
6	METER_RS485_A
7	NC OR BACKUP_RS485_B
8	NC OR BACKUP_RS485_A

Step 3: Multiple battery connection

If there are more battery modules to connect, use supplied battery cable #B-B (inside of battery module package) to connect the first battery module and second battery module as shown below chart. Follow the polarity of battery printed near the battery terminal!

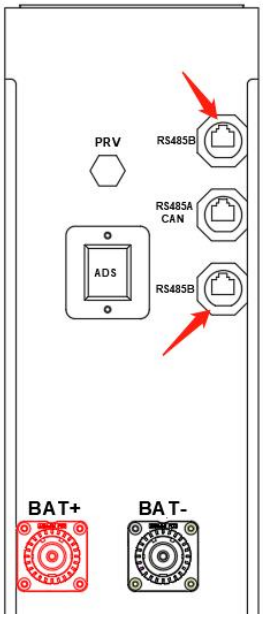
ORANGE cable to the positive terminal (+)

BLACK cable to the negative terminal (-)



Step 4: Insert the supplied RJ45 cable (from battery module package) into the

extension port on the first battery module. The other end connects to extension port on the second battery module.



Step5: After all wiring installation is complete, set up ID for each battery module. The ID code for each battery module MUST be unique. Not the same number for 2 battery modules in parallel system. Refer below chart for the details.

	#1	#2	#3	#4	#5	#6
0	OFF	OFF	OFF	OFF	OFF	OFF
1	ON	OFF	OFF	OFF	OFF	OFF
2	OFF	ON	OFF	OFF	OFF	OFF
3	ON	ON	OFF	OFF	OFF	OFF
4	OFF	OFF	ON	OFF	OFF	OFF

6. Specifications

Type designation	YP ESS3KLV05EU1	YP ESS5KLV10EU1	YP ESS6KLV20EU1
PV Input			
Recommended max. PV input power	8700 Wp	10000 Wp	11000 Wp
Max. PV input voltage	600V		
Startup input voltage	40V	40V	40V
Rated PV input voltage	360V	360V	360V
MPP voltage range	40-560V	40-560V	40-560V
No. of independent MPP inputs	2	2	2
No. of PV strings per MPPT	1\1	1\1	1\1
Max. PV input current	32A(16A/ 16A)	32A(16A/ 16A)	32A(16A/ 16A)
Short-circuit current of PV input	40A(20A/20A)	40A(20A/20A)	40A(20A/20A)
AC Input and Output			
Max. AC input power from grid	8700 VA	10000 VA	11000 VA
Rated AC output power	3680 W	5000 W	6000 W
Max. AC output apparent power	3680 VA	5000 VA	6000 VA
Rated AC output current	16 A	21.8 A	26. 1 A
Max. AC output current	16.7 A	22.8 A	27.3 A
Rated AC voltage	220V/230V/240V		
AC voltage range	154V-276V		
Rated grid frequency	50Hz/60Hz		
Grid frequency range	45~55Hz/55~65Hz		
Harmonic (THD) (of rated power)	<3%		
Power factor at Rated power	>0.99		
Adjustable power factor	0.8 leading to 0.8 lagging		
AC Type	L/N/PE		
Efficiency			
Max. efficiency	97.50%	97.70%	97.70%
European efficiency	97.00%	97.30%	97.30%
Protection & Function			
LVRT	**Yes**	**Yes**	**Yes**
Grid monitoring	Yes	Yes	Yes

DC reverse polarity protection	Yes	Yes	Yes
AC short-circuit protection	Yes	Yes	Yes
Leakage current protection	Yes	Yes	Yes
Surge Protection	Yes	Yes	Yes
DC switch (PV)	Yes	Yes	Yes
Battery charging and discharging fuse	Yes	Yes	Yes
Battery input reverse polarity protection	Yes	Yes	Yes
Battery Data			
Battery type	Li-ion battery		
Battery voltage	40-59 V		
Max. charge current	100 A		
Max. discharge current	100 A		
Max. charge power	5000 W	5000 W	5000 W
Max. discharge power	5000 W	5000 W	5000 W
Mechanical and environment-related parameters			
Dimensions(W*H*D)	600*365*180mm		
Weight	≤25kg		
Mounting method	Wall-mounting bracket	Wall-mounting bracket	Wall-mounting bracket
Topology(PV/battery)	Transformerless / Transformerless	Transformerless / Transformerless	Transformerless / Transformerless
Degree of protection	IP65	IP65	IP65
Operating ambient temperature range	-25℃~60℃,No derating below 45 ℃	-25℃~60℃ ,No derating below 45 ℃	-25℃~60℃ ,No derating below 45 ℃
Allowable relative humidity range	0~100%	0~100%	0~100%
Cooling method	Natural convection	Natural convection	Natural convection
Max. operating altitude	4000m	4000m	4000m
Display	LED	LED	LED
Communication	RS485/CAN/WLAN	RS485/CAN/WLAN	RS485/CAN/WLAN
DI/DO	DI×1/DO×1/DRM	DI×1/DO×1/DRM	DI×1/DO×1/DRM
PV connection type	MC4	MC4	MC4
Battery connection type	MC4	MC4	MC4
AC connection type	Screws & Fasteners	Screws & Fasteners	Screws & Fasteners
EPS Data (off-grid mode)			
Rated voltage	220V/230V/240V(±2%)		
Frequency range	50Hz/60Hz(±0.5%)		
Total hamonic factor output voltage	≤2%		
Switch time to emergency mode	≤10 ms		

Rated output power	5000 W /5000 VA	5000 W /5000 VA	6000 W /6000 VA
Peak output power	8400 VA, 10s	8400 VA, 10s	8400 VA, 10s