FLYFINE
Innovative Reliable Energy Pioneer

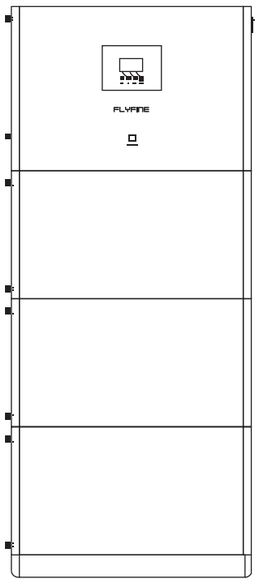
User Manual

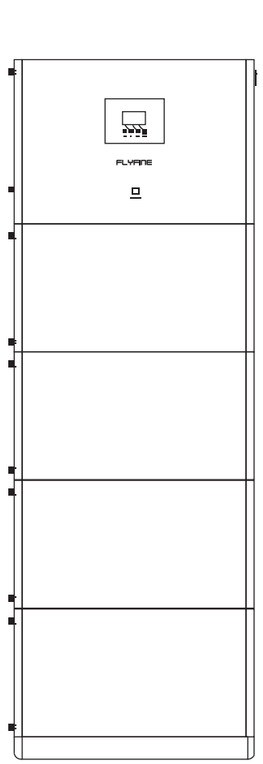
Single Phase Off Grid All In One ESS

FBA5120B/FBA10240B/FAB15360B/FAB20480B

FLYFINE
Innovative Reliable Energy Pioneer

FLYFINE DIGITAL ENERGY CO.LTD





About This Manual

The manual primarily encompasses product information, along with installation, operation, and maintenance guideline. It will refer to the device as the “ESS” unless otherwise specified.

- Target Group

  This manual is intended for professional technicians who have responsibilities for the installation, operation, and maintenance of inverters, as well as user who need to check inverter parameters.

  Installation Requirements:

  The installation of the ESS should only be carried out by professional technicians who meet the following requirements.

➢ Possess knowledge of electronics, electrical wiring, and mechanical expertise, and be familiar with electrical and mechanical schematics.

➢ Have received professional training related to the installation and commissioning of electrical equipment.

➢ Capable of promptly responding to hazards or emergencies that may arise during the installation and commissioning process.

➢ Familiar with local standards and relevant safety regulations pertaining to electrical systems.

➢ Thoroughly read this manual and understand the safety instruction associated with the operations.

- Symbols

  This manual incorporates crucial safety instructions that are emphasized using specific symbols. These symbols are employed to ensure the safety of individuals and property during product usage or to assist in maximizing product performance efficiently.

  It is essential to thoroughly comprehend the significance of the warning symbols to enhance your utilization of the manual.

Change History

Changes between document issues are cumulative, meaning that each subsequent document issue includes all the changes made in earlier issues.

V1.0(2024-08-20)

This version is the first official release.

Contents

1. Safety Instructions

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.

Conventions used:

WARNING!

Warnings identify conditions or practices that could resuil in personal injury;

CAUTION!

Caution identify conditions or practices that could result in damage to the unnit or other equipment connected.

WARNING

- Avoid operating the product and cables (including but not limited to product movement, installation, operation, powering up, maintenance, and working at heights) under harsh weather conditions such as lightning, rain, snow, and level 6 or stronger wind.
- In case of fire, evacuate the building or the area where the product is located and immediately contact the fire department. Under no circumstances should re-entry into the burning area be attempted.

NOTICE

- Ensure that the product and terminals are securely fastened using the specified torque and appropriate tools. Failure to do so may result in product damage, and any resulting damage will not be covered by the warranty.
- Familiarize with the correct usage of tools to prevent injury to individuals or damage to the device.
- Maintain the device with sufficient knowledge of this manual and use proper tools.
- The safety instructions provided in this manual are supplementary and may not encompass all precautions that should be followed. Always consider the actual on-site conditions when performing operations.
- We will not be held liable for any damages caused by the violation of general safety operation requirements, general safety standards, or any safety instructions stated in this manual.
- When installing, operating, and maintaining the product, comply with local laws and regulations. The safety precautions provided in this manual serve as supplements to local laws and regulations.

1.1 Unpacking and Inspection

WARNING

Before decommissioning the device, carefully inspect all safety signs, warning labels, and nameplates to ensure they are in place and clearly visible. These signs and labels should not be removed or covered at any time.

NOTICE

Upon receiving the product, conduct a thorough inspection to verify the condition of the device's appearance and structural components. Additionally, compare the contents of the packaging with the ordered product to ensure consistency. If there are problems with the above inspection items, do not install the device and contact your distributor first. If the problem persists, contact us for further assistance.

1.2 Installation Safety

DANGER

- Before installation, ensure that there is no electrical connection present.
- Before drilling, take precautions to avoid any water or electrical wiring in the wall.

CAUTION

Improper installation can result in personal injury!

- If the product supports hoisting for transportation using hoisting tools, it is strictly prohibited for anyone to remain under the product.
- When moving the product, take into account its weight and maintain balance to prevent tilting or falling.

NOTICE

Prior to operating the product, it is crucial to inspect and verify that the tools to be used have undergone regular maintenance.

1.3 Electrical Connection Safety

DANGER

Before making electrical connections, it is essential to ensure that the ESS is undamaged to prevent potential dangers!
Before electrical connections, confirm that all switches connected to the ESS are set to the "OFF" position to avoid the risk of electric shock!

DANGER

The PV string generates a lethal high voltage when exposed to sunlight. Please observe the following safety precautions during electrical connections.

- Operators must wear appropriate personal protective equipment.
- Use a measuring instrument to verify that cables are voltage-free before touching DC cables.
- Adhere to all safety instructions provided in relevant documents concerning PV strings.

DANGER

There is a risk of high voltage inside the ESS that can be life-threatening. Please take note of the following precautions!

- Use specialized insulation tools during cable connections.
- Follow and strictly adhere to the warning labels on the product and the safety instructions.
- Respect all safety instructions stated in this manual and other relevant documents.

DANGER

Batteries deliver electrical power and can cause burns or fire hazards when short-circuited or incorrectly installed. Lethal voltages are present at the battery terminals and cables connected to the ESS. Avoid touching the cables and terminals to prevent severe injuries or death.

WARNING

- Damage to the product resulting from incorrect wiring is not covered by the warranty.
- Electrical connections should be performed by professionals.
- All cables used in the PV generation system must be securely attached, properly insulated, and adequately sized.

WARNING

Ensure to check the positive and negative polarity of the PV strings and connect the PV connectors to the corresponding terminals only after confirming the correct polarity. During the installation and operation of the ESS, prevent the positive or negative poles of PV strings from short-circuiting to the ground to avoid AC or DC short-circuits that could lead to equipment damage. Such damage is not covered by the warranty.

NOTICE

Comply with the safety instructions regarding PV strings and adhere to the regulations applicable to the local grid.

1.4 Operation Safety

DANGER

- Do not touch the enclosure of the ESS while it is running.
- It is strictly prohibited to plug or unplug any connectors on the ESS while it is running.

- Avoid contact with any terminals of the ESS while it is running to prevent electric shock.
- Do not disassemble any parts of the ESS while it is running, as it may result in electric shock.
- Refrain from touching any hot parts of the ESS, such as the heat sink, while it is running to avoid burns.
- If the ESS is equipped with a DC switch, do not operate it while it is running to prevent device damage or personal injury.

1.5 Maintenance Safety

DANGER

There is a risk of ESS damage or personal injury resulting from incorrect service procedures!

- Prior to performing any service work, disconnect the grid-side AC circuit breaker and check the status of the ESS. If the ESS indicator is off, wait until nighttime before disconnecting the DC switch. If the ESS indicator is on, you can directly disconnect the DC switch.
- After the ESS has been powered off for at least 10 minutes, use a professional instrument to measure the voltage and current. Only when there is no voltage or current detected, and operators are wearing proper protective equipment, can they proceed with operating and maintaining the ESS.
- Even if the ESS is shut down, it may still be hot and cause burns. Wear protective gloves before operating the ESS after it cools down.

DANGER

Touching the power grid or the contact points and terminals on the ESS connected to the power grid can result in electric shock!

- The power grid side may have voltage. Always use a standard voltmeter to ensure there is no voltage before touching.

CAUTION

To prevent misuse or accidents caused by unauthorized personnel, prominently display warning signs or designate safety warning areas around the product.

NOTICE

To avoid the risk of electric shock, refrain from performing any maintenance operations beyond those described in this manual. If necessary, contact your distributor first. If the issue persists, contact us for maintenance. Failure to do so may result in losses that are not covered by the warranty.

1.6 Disposal Safety

WARNING

Please dispose of the product in accordance with the applicable local regulations and standards to prevent property losses or injuries.

2. Product Description

2.1 System Introduction

This energy storage system can provide power to connected loads by utilizing photovoltaic power, utility power, and battery power, and store the remaining energy generated by photovoltaic solar modules for use when needed. When the sun sets, energy demand is high, or there is a power outage, you can use the energy stored in the system to meet your energy needs at no additional cost. In addition, this energy storage system can help you achieve your goals of energy self consumption and ultimate energy independence.

According to different power conditions, the energy storage system aims to generate continuous electricity through photovoltaic solar modules (solar panels), batteries, and utilities. When the MPP input voltage of the photovoltaic module is within an acceptable range (detailed information can be found in the specifications), the energy storage system can supply power to the load and charge the battery pack. This energy storage system is only compatible with single crystal and polycrystalline silicon photovoltaic module types. Do not connect any photovoltaic array type to the energy storage system, except for these two types of photovoltaic modules. Do not ground the positive or negative terminals of the solar panel. A simple schematic diagram of a typical energy storage system is shown in Figure 1.

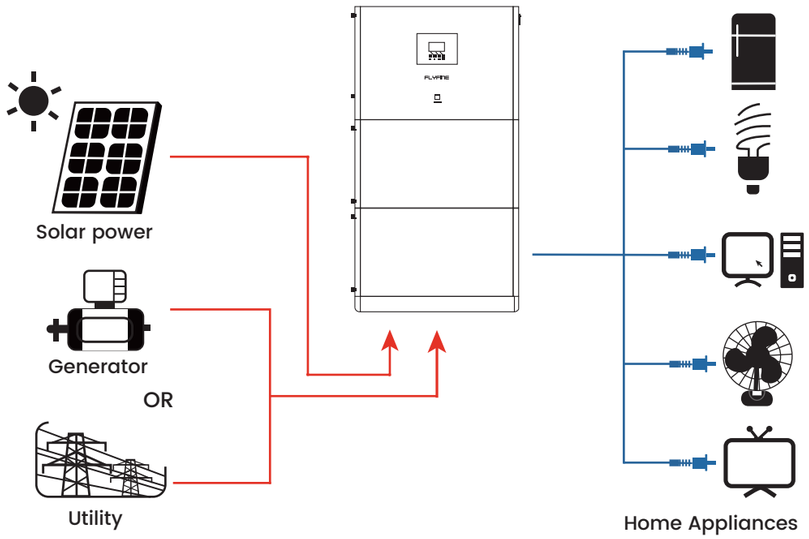


Figure 2-1 Energy storage System Overview

WARNING

- Operate the ESS only with PV strings having class II protection (IEC 61730, application class A). Avoid grounding the positive or negative poles of the PV strings to prevent damage to the ESS.
- Warranty does not cover damages caused by faulty or damaged PV installations.
- Only use the ESS as described in this document; any other use is not permitted.
- During installation and operation, ensure that the positive and negative polarities of PV strings and batteries do not short-circuit to the ground to avoid equipment damage. Warranty does not cover damage resulting from such short-circuits.
- Avoid short-circuiting the main port during operation to prevent severe damage to the ESS or power distribution system. Such damage is not covered by the warranty.

NOTICE

- In a TT utility grid, ensure that the N line voltage to ground is 30V or below.
- The system is not suitable for powering life-sustaining medical devices, and it does not guarantee main power in all situations.
- The ESS is designed for the specific scenarios described in this manual.

2.2 Product Introduction

Model Description

The model description is ws (take FBA5120B as an example):

FBA5120B: All-in-one Energy Storage System

5120:51.2Vdc 100Ah Low Voltage Battery

include one battery PACK or 5kWh Battery

Appearance

The image shown here is for reference only. The actual product received may differ.

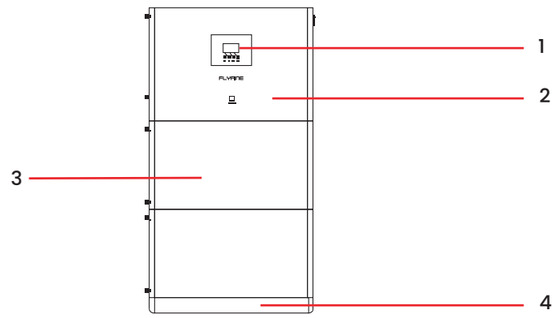


Figure 2-2 ESS Appearance

NO.	Name	Description
1	LCD indicator panel	Indicates the current operating state of the ESS.
2	Off-gird inverter	Indicates the current operating state of the inverter.
3	Battery	A Li-ion battery
4	Base	

Dimensions

The following table shows the dimensions of the ESS.

Model	W(mm)	H(mm)	D(mm)
FBA10240B	640	1180	191.5
FAB15360B	640	1520	191.5
FAB20480B	640	1860	191.5

2.3 Off-gird inverter

2.3.1 LED Panel

The operation and display panel, shown in below chart, is on the front panel of the inverter. It includes three indicators, four function keys and a LCD display, indicating the operating status and input/output power information.

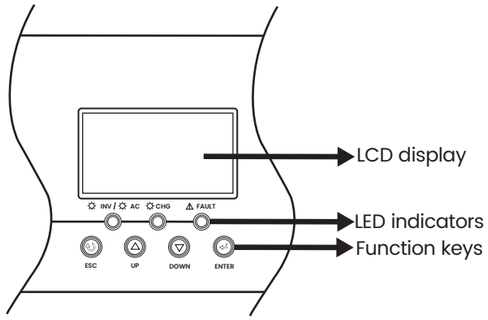


Figure 2-3 LCD Panel

LED Indicator

LED Indicator			Messages
☀ AC / ☀ INV	Green	Solid On	Output is powered by utility in line mode.
		Flashing	Output is powered by battery or PV in battery mode.
☀ CHG	Green	Solid On	Battery is fully charged.
		Flashing	Battery is charging.
⚠ FAULT	Red	Solid on	Fault occurs in the inverter.
		Flashing	Warning condition occurs in the inverter.

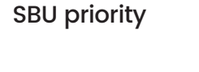
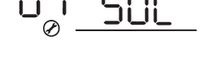
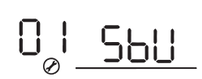
Function Keys

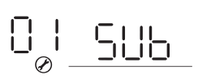
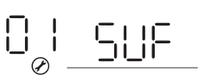
Function Keys	Description
ESC	To exit setting mode
UP	To go to previous selection
DOWN	To go to next selection
ENTER	To confirm the selection in setting mode or enter setting mode

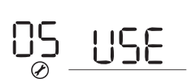
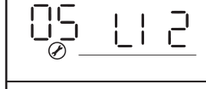
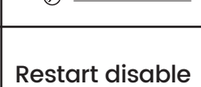
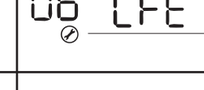
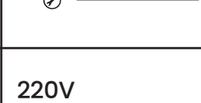
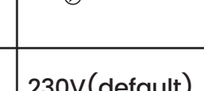
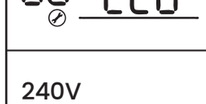
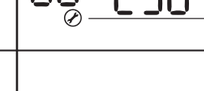
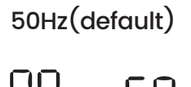
LCD Setting

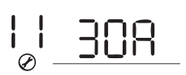
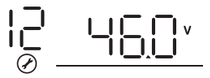
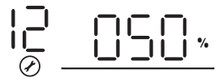
After pressing and holding ENTER button for 3 seconds, the unit will enter setting mode. Press "UP" or "DOWN" button to select setting programs. And then, press "ENTER" button to confirm the selection or ESC button to exit.

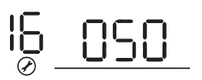
Setting Programs:

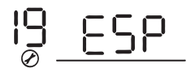
Program	Description	Selectable option	
01	Output source priority: To configure load power source priority	Utility first (default) 	Utility will provide power to the loads as first priority. -Solar and battery energy will provide power to the loads only when utility power is not available.
		Solar first 	Solar energy provides power to the loads as first priority. If solar energy is not sufficient to power all connected loads, battery energy will supply power the loads at the same time. Utility provides power to the loads only when any one condition happens: -Solar energy is not available Battery voltage drops to either low-level warning voltage or the setting point in program 12.
		SBU priority 	Solar energy provides power to the loads as first priority. If solar energy is not sufficient to power all connected loads, battery energy will supply power to the loads at the same time. Utility provides power to the loads only when battery voltage drops to either low-level warning voltage or the setting point in program 12.

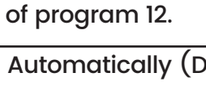
		SUB priority 	Solar energy is charged first and then power to the loads. If solar energy is not sufficient to power all connected loads, Utility energy will supply power to the loads at the same time.
		SUF priority 	If solar energy is sufficient to all connected loads and charge battery, the solar energy could feedback to the grid If solar energy is not sufficient to power all connected loads, utility energy will supply power to the loads at the same time.
02	Maximum charging current: To configure total charging current for solar and utility chargers. (Max. charging current = utility charging current + solar charging current)	60A (default) 	If selected, acceptable charging current range will be from Max. AC charging current to Max. charging current of SPEC，but it shouldn't be less than the AC charging current （program 11）
03	AC input voltage range	Appliances (default) 	If selected, acceptable AC input voltage range will be within 90-280VAC.
		UPS 	If selected, acceptable AC input voltage range will be within 170-280VAC.
		Generator 	If selected, acceptable AC input voltage range will be within 170-280VAC and compatible with generators. Note: Because generators are unstable, maybe the output of inverter will be unstable too.

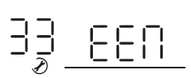
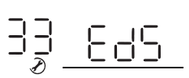
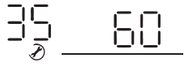
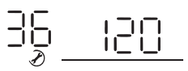
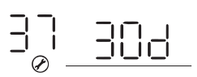
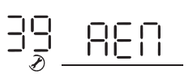
05	Battery type	AGM(default) 	Flooded 
		User-Defined 	If “User-Defined” is selected, battery charge voltage and low DC cut-off voltage can be set up in program 26, 27 and 29.
			Support PYLON US2000 Protocol 3.5 Version
			Standard communication Protocol form inverter supplier
06	Auto restart when overload occurs	Restart disable 	Restart enable(default) 
07	Auto restart when over temperature occurs	Restart disable 	Restart enable(default) 
08	Output voltage	220V 	230V(default) 
		240V 	
09	Output frequency	50Hz(default) 	60Hz

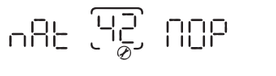
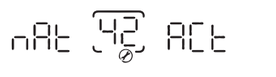
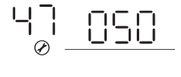
10	Auto bypass When selecting “auto”, if the mains power is normal, it will automatically bypass, even if the switch is off.	manual(default) 	auto 
11	Maximum utility charging current	30A(default)  If selected, acceptable charging current range will be within 2- Max. AC charging current of SPEC.	
12	Setting voltage or SOC percentage back to utility source when selecting “SBU” (SBU priority) in program 01.		46V (default) Setting range is from 44.0V to 57.2V for 48v model, but the max setting value must be less than the value of program13.
			If Lix is selected in program 5. Default 50%, Setting range is from 5% to 50%, but the minimum setting value must be more than the value of program 29
13	Setting voltage or SOC percentage back to battery mode when selecting “SBU” (SBU priority)in program 01.	Battery fully charged  (default)	Setting range is from 48V to full (the value of program26-0.4V), but the max setting value must be more than the value of program1.
			Setting range is from 60% to 100%

16	Charger source priority: To configure charger source priority	If this inverter/charger is working in Line, Standby or Fault mode, charger source can be programmed as below:	
		Solar first 	Solar energy will charge battery as first priority. Utility will charge battery only when solar energy is not available.
		Solar and Utility (default) 	Solar energy and utility will charge battery at the same time.
		Only Solar 	Solar energy will be the only charger source no matter utility is available or not.
		If this inverter/charger is working in Battery mode, only solar energy can charge battery. Solar energy will charge battery if it's available and sufficient.	
18	Buzzer mode	Mode1 	Buzzer mute
		Mode2 	The buzzer sounds when the input source changes or there is a specific warning or fault
		Mode3 	The buzzer sounds when there is a specific warning or fault

		Mode4(default) 	The buzzer sounds when there is a fault
19	Auto return to default display screen	Return to default display screen (default) 	If selected, no matter how users switch display screen, it will automatically return to default display screen (Input voltage/output voltage) after no button is pressed for 1 minute.
		Stay at latest screen 	If selected, the display screen will stay at latest screen user finally switches.
20	Backlight control	Backlight on (default) 	Backlight off 
23	Overload bypass: When enabled, the unit will transfer to line mode if overload occurs in battery mode.	Bypass disable 	Bypass enable(default) 
25	Modbus ID Setting	Modbus ID Setting Range： 001(default)~247 	
26	Bulk charging voltage (C.V voltage)	If self-defined is selected in program 5, this program can be set up. But the setting value must be more than or equal the value of program27. Increment of each click is 0.1V. Default 56.4V, setting range is from 48.0V to 62.0V.	

27	Floating charging voltage	If self-defined is selected in program 5, this program can be setup. Default 54.0V, setting range is from 48.0V to the value of program 26	
29	Setting cut off voltage point or SOC percentage percentage on the second output (OP2)	If program 5 is setting as follow, this program can be set up, Low DC cut-off voltage will be fixed to setting value no matter what percentage of load is connected. 1.If self-defined is selected in program 5, default value is 42.0V, setting range is from 40.0V to the voltage of program 31. 2.If Lix is selected in program 5 and communication between the inverter and battery is successful, default value is 20%, setting range is from 3% to the SOC of program 31.	
31	Setting cut off voltage point or SOC percentage percentage on the Main output (OP1)	If program 5 is setting as follow, this program can be set up, low DC cut-off voltage will be fixed to setting value no matter what percentage of load is connected. 1.If self-defined is selected in program 5, default value is 44.0V, setting range is from the voltage of program 29 to 54.0V, the setting value must be less than the value of program12. 2.If Lix is selected in program 5 and communication between the inverter and battery is successful, default value is 22%, setting range is from the SOC of program 29 to 30%, the setting value must be less than the value of program 12.	
32	Bulk charging time (C.V stage)	Automatically (Default): 	If selected, inverter will judge this charging time automatically.
		5 min 	The setting range is from 0 min to 900 min. Increment of each click is 5 min.
		900 min 	
		If “USE” is selected in program 05, this program can be set up.	

33	Battery equalization	Buzzer mode 	Buzzer mode 
		If “Flooded” or “User-Defined” is selected in program 05, this program can be set up.	
34	Battery equalization voltage	Default 58.4V. Setting range is from floating voltage ~ 62V. Increment of each click is 0.1V.	
35	Battery equalized time	60min (default) 	Setting range is from 0 min to 900min.
36	Battery equalized timeout	120min (default) 	Setting range is from 0min to 900 min.
37	Equalization interval	30days (default) 	Setting range is from 1 to 90 days.
39	Equalization activated immediately	Enable 	Disable (default) 
		If equalization function is enabled in program 33, this program can be set up. If “Enable” is selected in this program, it’s to activate battery equalization immediately and LCD main page will shows “  ”. If “Disable” is selected, it will cancel equalization function until next activated equalization time arrives based on program 37 setting. At this time, “  ” will not be shown in LCD main page..	

41	Automatic activation for lithium battery		Disable automatic activation (default)
			When Program05 is selected “LIx” as lithium battery and when the battery is not detected, the unit will activate automatically the lithium battery at a time. If you want to activate automatically the lithium battery， you must restart the unit.
42	Manual activation for lithium battery		Default: disable activation
			When Program05 is selected “LIx” as lithium battery, when the battery is not detected, If you want to activate the lithium battery at a time, you could selected it.
43	Setting the second output (OP2) function	Turn on(Default): the second output is available	Turn off: the second output is unavailable
46	Maximum discharge current protection		Default OFF Disable current discharge current protection function
			When the grid exists, the battery stops discharging when the discharge current reaches the set value, and the grid supplies power to the load. When the grid does not exist, an alarm will be raised, but the battery will still discharge. The setting range is from 20A to 500A
47	Setting the OP2 overload warning point	50%(default) 	Set the OP2 overload warning point. If the set value is exceeded, 22 warnings will be displayed. Setting range is from 10% to 100%

2.4 Setting for Lithium Battery

Lithium Battery Connection

If choosing lithium battery for the inverter, you are allowed to use the lithium battery only which we have configured. There're two connectors on the lithium battery, RS485 port of BMS and power cable.

1). Assemble battery terminal based on recommended battery cable and terminal size (same as Lead acid, see section Lead-acid Battery connection for details).

2). Connect the end of RS485 port of battery to BMS(RS485) communication port of inverter.

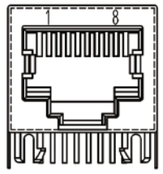
Lithium battery communication and setting

if choosing lithium battery, make sure to connect the BMS communication cable between the battery and the inverter. This communication cable delivers information and signal between lithium battery and the inverter. This information is listed below:

- Re-configure charging voltage, charging current and battery discharge cut-off voltage according to the lithium battery parameters.
- Have the inverter start or stop charging according to the status of lithium battery.

Connect the end of RS485 of battery to RS485 comvmunication port of inverter

Make sure the lithium battery RS485 port connects to the inverter is Pin to Pin, the communication cable is inside of package and the inverter RS485 port pin assignment shown as below:



Pin number	RS485 Port
PIN1	RS485-B
PIN2	RS485-A
PIN7	RS485-A
PIN8	RS485-B

After connecting, you need to finish and confirm some settings as follow:

1)Select program 05 as lithium battery type.

2)Confirm program12/13/29/31/41/42 setting value.

Note: Program 43/44/45 are only available with successful communication, they will replace the Program 12/13/29 function, at the same time, program 12/13/29 become unavailable.

LCD Display

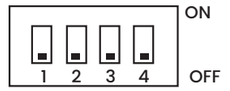
If communication between the inverter and battery is successful, there is some information showing on the LCD as follow:

NO.	Description	Remark
1	Communication successful icon	Li
2	Max lithium battery charging voltage	Li
3	Max lithium battery charging current	
4	Lithium battery discharging is forbidden	Li will flash once every 1 second
5	Lithium battery charging is forbidden	Li will flash once every 2 second
6	Lithium battery SOC(%)	

2.5 Battery

2.5.1 BMS Comm. Address

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.

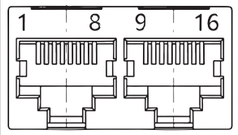
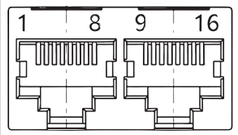


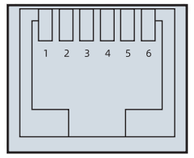
Address	Dial switch position			
	#1	#2	#3	#4
0	OFF	OFF	OFF	OFF
1	ON	OFF	OFF	OFF
2	OFF	ON	OFF	OFF
3	ON	ON	OFF	OFF
4	OFF	OFF	ON	OFF
5	ON	OFF	ON	OFF
6	OFF	ON	ON	OFF
7	ON	ON	ON	OFF
8	OFF	OFF	OFF	ON
9	ON	OFF	OFF	ON
10	OFF	ON	OFF	ON
11	ON	ON	OFF	ON
12	OFF	OFF	ON	ON
13	ON	OFF	ON	ON
14	OFF	ON	ON	ON
15	ON	ON	ON	ON

BMS Comm. Address

2.5.2 BMS Comm. Interface

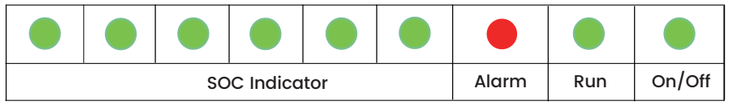
If there is any change in the pin position of the communication line, the customer shall be notified in writing or provided with supporting communication wire.

		RS485-8P8C upright RJ45 socket		RS485-8P8C upright RJ45 socket	
Parallel communication		RJ45pin	defined declaration	RJ45pin	defined declaration
		1, 8	RS485-B	9, 16	RS485-B
		2, 7	RS485-A	10, 15	RS485-A
		3, 6	GND	11, 13	GND
		4, 5	NC	12, 13	NC
		RS485-8P8C upright RJ45 socket		RS485-8P8C upright RJ45 socket	
External communication (RS485/CAN)		RJ45pin	defined declaration	RJ45pin	defined declaration
		1, 8	RS485-B1	9, 10, 11, 14, 16	NC
		2, 7	RS485-A1	12	CAN-L
		3, 6	GND	13	CAN-H
		4, 5	NC	15	GND

Communication with host computer		RS232 upright RJ11 socket			
		RJ11pin	defined declaration	RJ11pin	defined declaration
		1	NC	4	RX
		2	NC	5	GND
		3	TX	6	NC

2.5.3 SOC Indicator& Status Indicator Guides

Battery Status:



BMS LED flash and buzzer mode:

MODE	ON	OFF
Led Flash1	0.25S	3.75S
Led Flash2	0.5S	0.5S
Led Flash3	0.5S	1.5S
Buzzer1	0.25S	0.25S
Buzzer2	0.25S	2S
Buzzer3	0.25S	3S

Battery Capacity

O: LED OFF
F2: LED Flash2
L: LED Light

MODE	Charge						Discharge					
SOC(%)	L6	L5	L4	L3	L2	L1	L6	L5	L4	L3	L2	L1ava
	●	●	●	●	●	●	●	●	●	●	●	●
0-16.6	O	O	O	O	O	F2	O	O	O	O	O	L
16.6-33.2	O	O	O	O	F2	L	O	O	O	O	L	L
33.2-49.8	O	O	O	F2	L	L	O	O	O	L	L	L
49.8-66.4	O	O	F2	L	L	L	O	O	L	L	L	L
66.4-83	O	F2	L	L	L	L	O	L	L	L	L	L
83-100	F2	L	L	L	L	L	L	L	L	L	L	L
RUN LED	L						Flash(flash 3)					

BMS LED Status Mode:

O: LED OFF
F1: LED Flash1
F2: LED Flash2
F3: LED Flash3
L: LED Light

System status	RUN status	ON/OFF	RUN	ALM	SOC						REMARK
		●	●	●	●	●	●	●	●	●	
Power off	SLEEP	O	O	O	O	O	O	O	O	O	All led Off
Stand by	NORMAL	L	F1	O	Lighting for SOC						stand by mode
	ALARM	L	F1	F3							Low volt alarm
CHARGE	NORMAL	L	L	O	Lighting for SOC(The LED flash2, while it isthe high SOC) Alarm LED do not flash,when the BMS into OVP mode.						
	ALARM	L	L	F3							
	OVP	L	L	O	L	L	L	L	L	L	No chargeing, in standby
	OTP,OCP Fail	L	O	L	O	O	O	O	O	O	Stop charge
Discharge	NORMAL	L	F3	O	Lighting for SOC						
	ALARM	L	F3	F3							
	UVP	L	O	O	O	O	O	O	O	O	Discharge Off
	OTP,OCP, SCP,invert connect, Fail	L	O	L	O	O	O	O	O	O	Discharge Off
FALL		O	O	L	O	O	O	O	O	O	NO Charge or discharge

2.5.4 Battery Management

Li-ion battery are compatible with the PV ESS, further battery models will be made compatible in the future. To optimize battery lifespan, the ESS will conduct battery charging, discharging, and maintenance activities based on the battery status information received from the Battery Management System (BMS).

NOTICE

The suggested parameters provided in this section are subject to updates and revisions as a result of product advancements. For the most up-to-date information, please consult the manual provided by the battery manufacturer.

State Definition

To prevent excessive charging or discharging of the battery, three battery statuses have been defined based on different voltage ranges. Please refer to the table below for more details.

SOC definition	Port Voltage / SOC		
	Empty	Normal	Full
By default	SOC＜10%	10%~95%	SOC=100%

NOTICE

If the battery has remained unused or has not been fully charged for an extended period of time, it is advisable to manually perform a full charge every 15 days. This practice helps to maintain the battery's lifespan and optimal performance.

3. Unpacking and Storage

3.1 Unpacking and Inspection

The product undergoes comprehensive testing and rigorous inspection prior to shipment. However, there is still a possibility of damage occurring during transit. Therefore, it is essential to conduct a thorough inspection upon receiving the product. Please follow these steps:

- Examine the packaging case for any visible signs of damage.
- Verify the contents of the delivery to ensure completeness, referring to the packing list.
- After unpacking, carefully inspect the inner contents for any signs of damage.

If any damage or incompleteness is detected, promptly contact us or the transport company. It is advisable to provide photographs of the damage to facilitate the resolution process. It is important not to discard the original packaging case. When decommissioning the product, it is recommended to store it in the original packaging case for safekeeping.

NOTICE

Upon receiving the product, it is important to conduct a thorough inspection to ensure its integrity and avoid any potential damage. Please follow these steps:

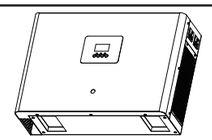
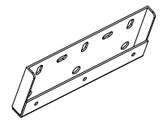
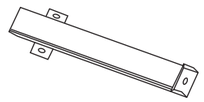
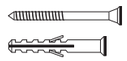
- Examine the appearance and structural parts of the device for any signs of damage.
- Verify that the contents of the package match the items listed on the packing list. Ensure that you have received the correct product.

- If any issues or discrepancies are found during the inspection, refrain from installing the device and immediately contact your distributor for assistance. If the problem persists or your distributor is unable to resolve the issue, promptly reach out to us for further support.

When unpacking the product, exercise caution to avoid causing any damage, especially if using tools. Take care to handle the product with care and ensure that no unintentional harm is inflicted upon it.

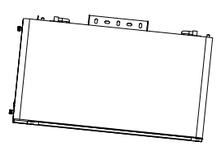
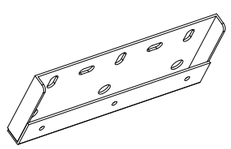
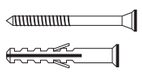
3.2 Scope of Delivery

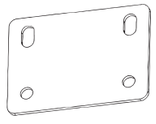
Hybird Inverter:

			
A	B	C	D
			
E	F	G	H

Iterm	Name	Quality
A	Off-grid inverter	1
B	Top Bracket	1
C	Installing support	1
D	Manual	1
E	M8 Mounting screws	5
F	M4 combination screw	3
G	Negative connecting piece	1 (Standard equipment above 10 KWh capacity)
H	Positive output line	1 (Standard equipment above 10 KWh capacity)

Battery:

			
A	B	C	D

			
E	F	G	H

Iterm	Name	Quality
A	Battery Module	1~4
B	Base	1
C	Top Bracket	1~4
D	M8 Mounting screws	4~16
E	M4 combination screw	7~28
F	Negative connecting piece	1~4
G	Positive connecting piece	1 ~4
H	Fixed connecting piece	1 ~4

3.3 Product Storage

To ensure the proper storage of the ESS Product when it is not immediately installed, please adhere to the following guidelines:

- Store the ESS Product in its original packing case, ensuring the desiccant is kept inside.
- Maintain a storage temperature between -30°C and +70°C at all times.
- Maintain a storage relative humidity between 0% and 95%, ensuring it is non-condensing.
- If stacking storage is necessary, ensure that the number of stacking layers does not exceed the limit indicated on the outer side of the packing case.
- Keep the packing case upright during storage.
- If the ESS Product needs to be transported again, ensure it is properly packed before loading and transporting.
- Avoid storing the product in areas susceptible to direct sunlight, rain, or strong electric fields.
- Avoid placing the product near items that may affect or damage it.
- Store the product in a clean and dry location to prevent dust and water vapor from causing erosion.
- Avoid storing the product in areas with corrosive substances or at risk of being accessed by rodents and
- insects.
- Conduct periodic inspections, at least once every six months.

  If any signs of insect or rodent bites are detected, promptly replace the packaging materials.

  If the product has been stored for more than a year, it is necessary to have it inspected and tested by professionals before putting it into operation.

NOTICE

It is crucial to store the ESS in accordance with the specified storage requirements. Failure to meet these requirements may result in product damage, and it's important to note that such damage caused by improper storage is not covered by the warranty. To ensure the safekeeping of the ESS and maintain warranty coverage, please adhere to the storage guidelines provided.

4. Mechanical Mounting

WARNING

Respect all local standards and requirements during mechanical installation.

4.1 Safety during Mounting

DANGER

Make sure there is no electrical connection before installation.Before drilling, avoid the water and electricity wiring in the wall.

WARNING

The performance of the system can be affected by an inadequate installation environment. To optimize system performance, please consider the following:

- Install the ESS in a well-ventilated area to promote proper airflow and heat dissipation.
- Ensure that the heat dissipation system or vents of the ESS are not obstructed by objects or debris.
- Avoid installing the ESS in environments where flammable or explosive materials are present, as well as areas prone to smoke accumulation.

CAUTION

Improper handling may cause personal injury!

- When moving the ESS, be aware of its weight and keep the balance to pre□vent it from tilting or falling.
- Wear proper protective equipment before performing operations on the ESS.
- The bottom terminals and interfaces of the ESS cannot directly contact the ground or other supports. The ESS cannot be directly placed on the ground.

By following these guidelines, you can help maintain an optimal installation environment and ensure the reliable performance of the ESS.

4.2 Location Requirements

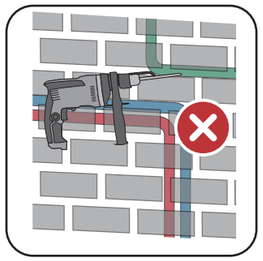
To ensure safe operation, long service life, and expected performance, it is important to select an optimal mounting location for the ESS. Consider the following guidelines:

- Install the ESS in a location that allows for easy electrical connection, operation, and maintenance. This will facilitate access to the ESS for any necessary maintenance or troubleshooting tasks.

4.2.1 Environment Requirements

- Ensure an installation environment free from flammable or explosive materials.
- Choose a location that is not accessible to children to ensure their safety.

- Ensure that the ambient temperature and relative humidity of the installation site meet the specified requirements.
- To prolong the service life of the ESS, avoid direct exposure to sunlight, rain, and snow. Consider installing them in sheltered areas to provide protection from these elements.



- Ensure proper ventilation for the ESS with adequate air circulation.
- Due to operational noise, it is not recommended to install the ESS in living areas.

4.2.2 Carrier Requirements

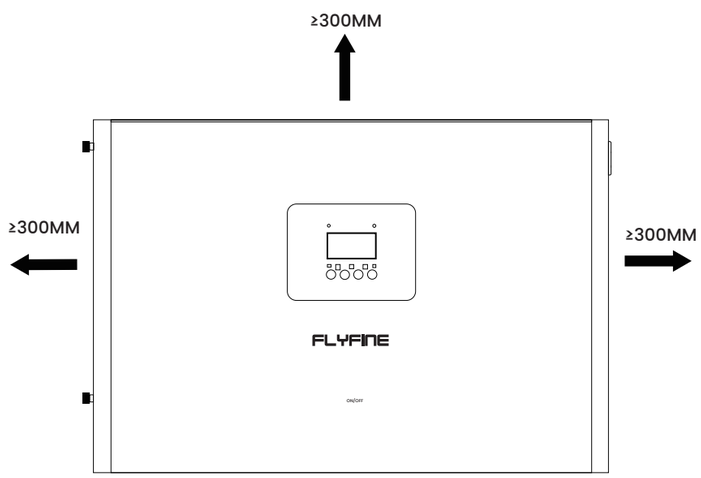
The mounting structure for the ESS must adhere to local/national standards and guidelines. The installation surface should be sufficiently sturdy to support four times the weight of the ESS and be suitable for its dimensions (e.g., cement walls, plasterboard walls, etc.).

4.2.3 Angle Requirements

The ESS should be installed in a vertical position. It should never be installed horizontally, tilted forward or backward, or upside down.

4.2.4 Clearance Requirements

Allow ample clearance around the ESS to ensure proper heat dissipation. Install the ESS at a suitable height for convenient viewing of the LED indicator and easy access to the operating switch(es).



4.3 Installation Tools

Installation tools include but are not limited to the following recommended ones. If necessary, use other auxiliary tools on site

4.4 Moving the ESS

When transferring the ESS to the installation location, please adhere to the subsequent guidelines:

- Maintain constant awareness of the ESS's weight.
- Employ the handles situated on both sides of the ESSto lift it.
- Mobilize the ESS with the assistance of one or two individuals or with the aid of an appropriate transportation device.
- Ensure that the equipment is securely fastened before releasing it.

CAUTION

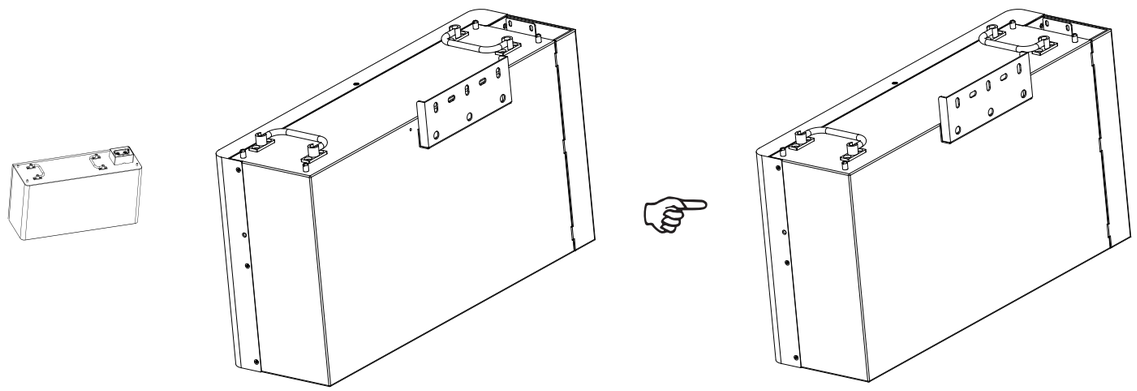
Please exercise caution to prevent personal injuries while handling the ESS. Adhere to the following guidelines:

- Ensure an adequate number of personnel are assigned to carry the ESS based on its weight, and installation personnel should wear appropriate protective gear like impact-resistant shoes and gloves.
- Take note of the ESS's center of gravity to prevent tilting during handling.
- Avoid placing the ESS directly on a hard surface, as it may damage the metal enclosure. Instead, use protective materials such as a sponge pad or foam cushion underneath the ESS.
- When moving the ESS hold it by the designated handles and avoid gripping the terminals for transportation.

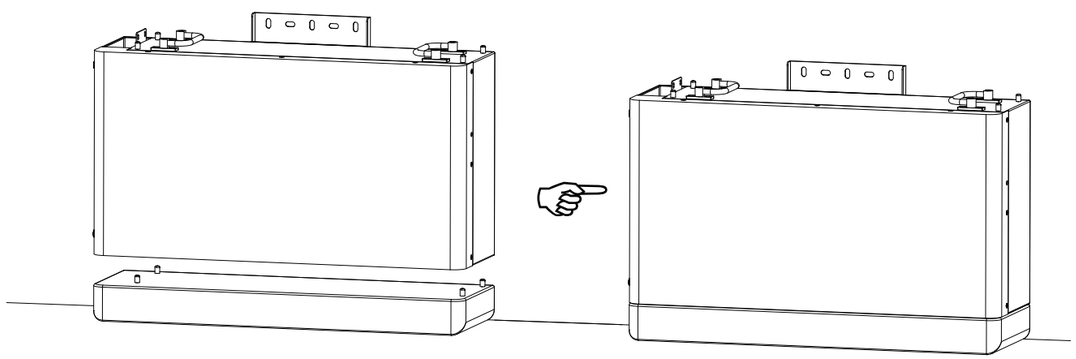
4.5 Installing the ESS

> ⚠ Note:
> This ESS should be installed battery modules first on the bottom and then inverter module on the top.

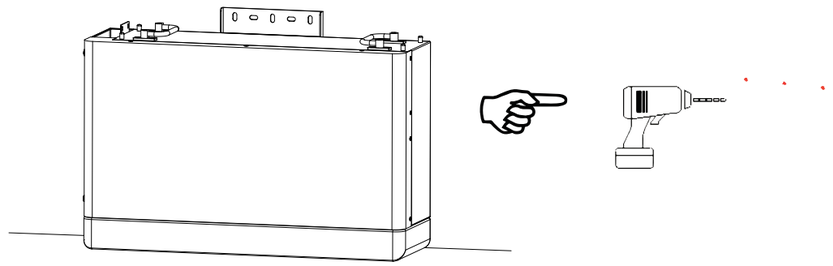
Step 1 : First, fix the lug and the battery module with M4 head screws

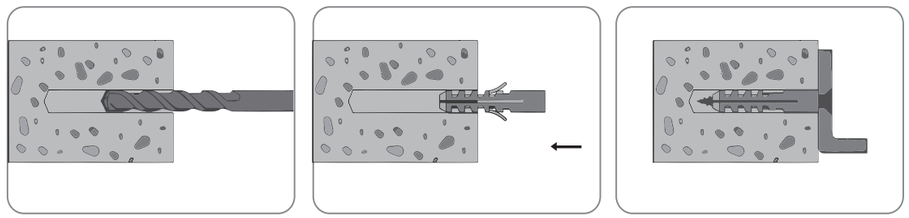


Step 2 : Place the base in a suitable position, align the battery with the positioning pin on the base, and place it on top. Move the fixed bracket to the wall.

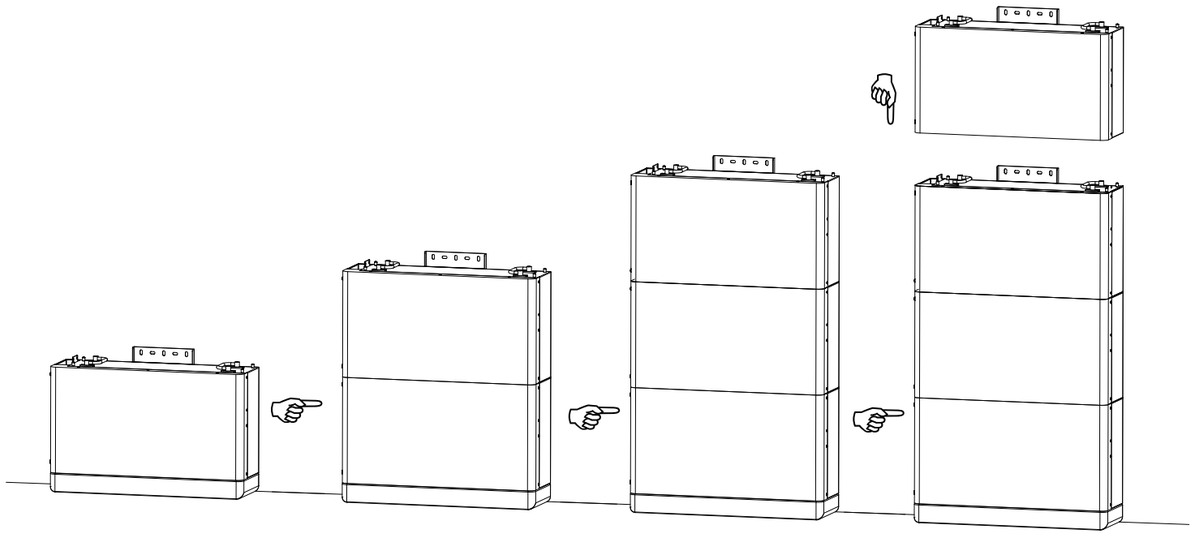


Step 3 : After marking the wall with a marker, remove the battery pack. Drill a hole with a diameter of 10 on the wall using an impact drill, with a depth of 60MM. Knock the yellow rubber plug into the hole. Move the battery to the perforated wall and secure it with screws.

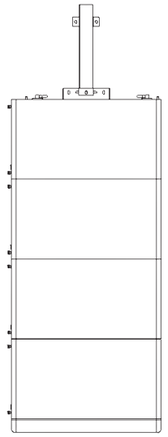




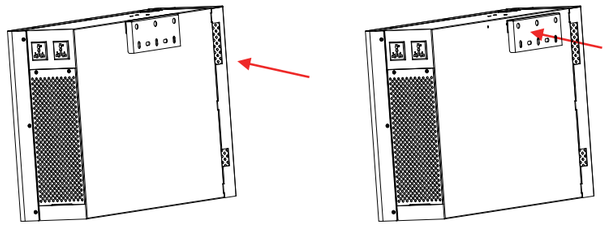
Step 4 : Follow Step 4 to install the remaining battery packs in turn。（Note: The middle screw of the fourth battery pack is temporarily not locked）



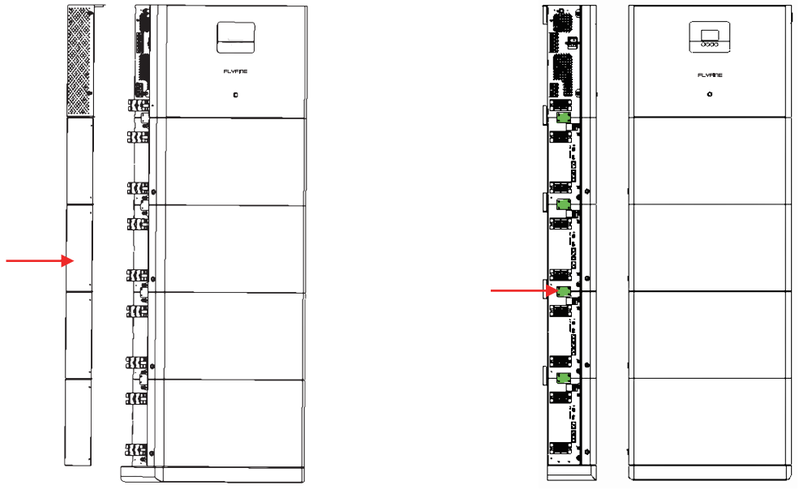
Step 5 : Install the positioning accessories on the top surface of the battery pack. Then fix the ESS hanger to the wall with screws.as shown in the figure:



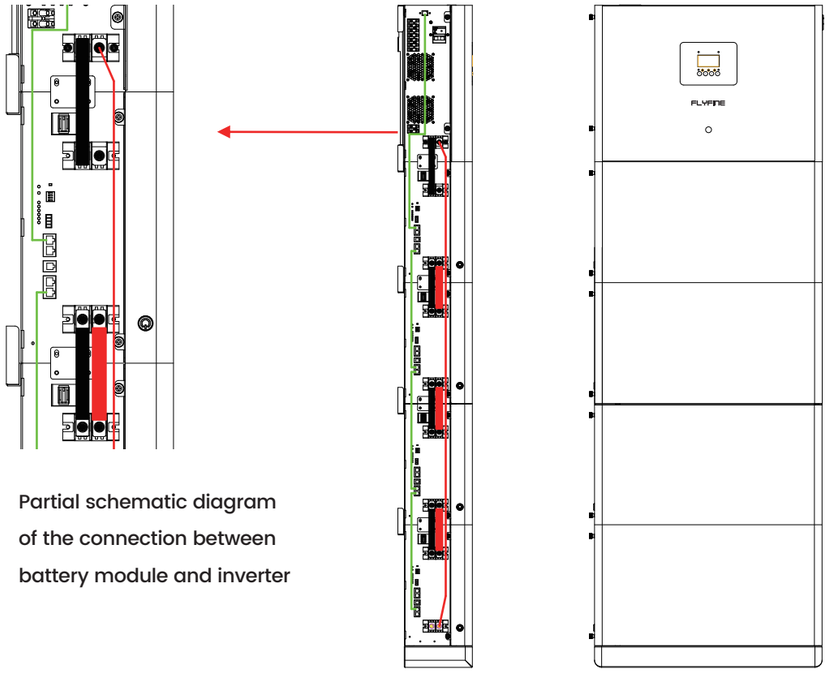
Step 6 : Screw the inverter fixing bracket to the inverter box.as shown in the figure



Step 7 : Place the inverter on top of the battery pack. Open the left side cover of the inverter and battery module, and then connect the battery module to the battery module through a fixed connector. The battery module is fixed to the inverter. As shown in the figure:



Step 8 : Connect the battery modules through a busbar connector as shown in the diagram. Before connecting, ensure that the battery pack is turned off. The communication lines between the battery modules are plugged into the RS485B communication port. The communication lines between the battery module and the inverter are plugged into RS232 and COM ports respectively. (Note: Equipment needs to be grounded)



Partial schematic diagram of the connection between battery module and inverter

5. ELectrical Connection

5.1 Safety Instructions

DANGER

The PV string produces extremely high voltage when exposed to sunlight, which can be lethal.
Operators must wear appropriate personal protective equipment during electrical connections.
Before touching any DC cables, ensure that they are voltage-free using a measuring instrument.
Follow all safety instructions provided in the relevant documents regarding PV strings.

DANGER

- Prior to electrical connections, ensure that the ESS switch and all switches connected to the ESS are set to the "OFF" position to avoid the risk of electric shock.
- Verify that the ESS is undamaged and all cables are voltage-free before performing any electrical work.
- Do not close the AC circuit breaker until the electrical connection is complete.

WARNING

Product damage resulting from incorrect wiring is not covered by the warranty.

- Electrical connections should only be carried out by professionals.
- Operators must wear proper personal protective equipment during electrical connections.
- All cables used in the PV generation system must be securely attached, adequately insulated, and correctly sized.

NOTICE

All electrical connections must adhere to local and national/regional electrical standards

- Cables used by the user must comply with the requirements of local laws and regulations.
- Connection of the ESS to the grid requires permission from the national/regional grid department.

NOTICE

- All unused terminals must be covered with waterproof covers to maintain the protection rating.
- After completing the wiring, seal the cable inlet and outlet holes with fireproof/waterproof materials such as fireproof mud to prevent the entry of foreign matter or moisture, which may affect the long-term operation of the ESS.
- Adhere to the safety instructions related to PV strings and the regulations concerning the utility grid.

Note:

1. The cable colors shown in the figures in this manual are for reference only. Select cables according to the local cable standards.
2. 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.

5.2 Utility Grid Connection

5.2.1 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 ESS can be securely disconnected during maintenance and fully protected from over current of AC input.

NOTICE

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

WARNING

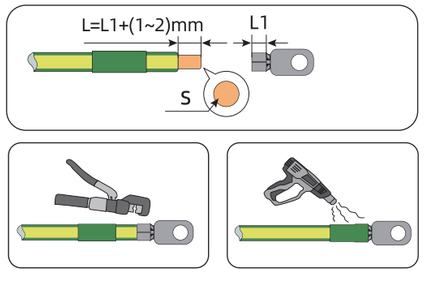
For safety and efficiency, it's very important to use appropriate cables for grid (utility) connection. To reduce risk of injury, please use the proper cable size recommended below.

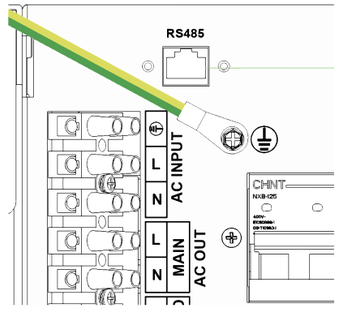
Suggested cable requirement for AC wire

Nominal Grid Voltage	230VAC
Conductor cross-section (mm2)	6
AWG no.	10

5.2.2 Connecting to the AC Utility

Step 1 : equipment ground.

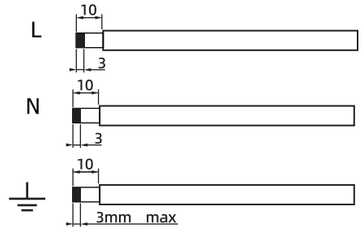




Step 2 : Check the grid voltage and frequency with an AC voltmeter to see if it's same as the "VAC" value on the product label.

Step 3 : Turn off the circuit breaker.

Step 4 : Remove insulation sleeve 10 mm from three conductors and shorten phase L and neutral conductor N for 3 mm.



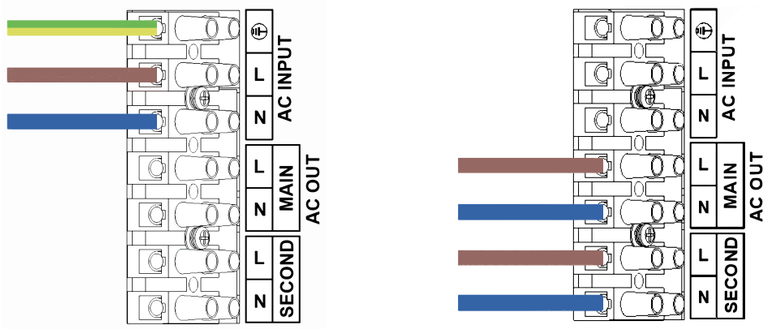
Step 5 : Connect wires according to the polarities indicating on terminal block. Be sure to connect PE protective conductor (G) first.

L→LINE (brown or black)

N→Neutral (blue or white)

G→Ground (yellow-green)

Step 6 : Make sure the wires are securely connected.The reference tightening torque is 0.6N.m.



Remark:

1). The main output usually carries heavy loads which make the battery discharge time faster, the heavy loads are such as air-conditioners, heaters, motors and so on.

2). The second output usually carries light loads which make the battery discharge time longer, the light loads are such as lights, computers, fans and so on.

3). Normally, the cutoff point of second out is lower than main-out, so that the light loads will not be cut off power.

5.2.3 PV Module (DC) Connection

CAUTION: Before connecting to PV modules, please install separately a DC circuit breaker between inverter and PV modules.

WARNING: It's very important for system safety and efficient operation to use appropriate cable for PV module connection. To reduce risk of injury, please use the proper recommended cable size as below. Please follow the steps below to implement PV module connection:

Model	Wire Size	Cable(mm2)	Torque value(max)
TG-ESS6-5LV1/5LV2/5LV3/5LV4	1×10AWG	6	1.4~1.6 Nm

PV Module Selection:

When selecting proper PV modules, please be sure to consider below parameters:

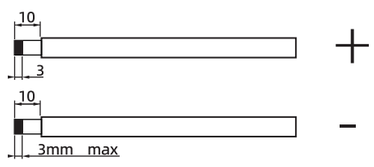
1.Open circuit Voltage (Voc) of PV modules not exceeds max. PV array open circuit voltage of inverter.

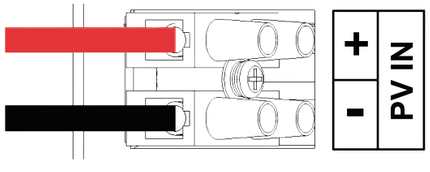
2.Open circuit Voltage (Voc) of PV modules should be higher than min. battery voltage.

Solar Charging Mode	
INVERTER MODEL	6.2KVA
Max. PV Array Open Circuit Voltage	500DC
PV Array MPPT Voltage Range	60VDC~500VDC
Max. PV INPUT CURRENT	27A

Take the 450Wp and 550Wp PV module as an example. After considering above two parameters, the recommended module configurations are listed in the table below.

	SOLAR INPUT	Q'ty of panels	Total input power	Inverter Model
Solar Panel Spec. (reference) - 450Wp -Vmp: 34.67Vdc -Imp: 13.82A -Voc: 41.25Vdc -Isc: 12.98A	3 pcs in serial	3 pcs	1,350W	6.2KVA
	4 pcs in serial	4 pcs	1,800W	
	5 pcs in serial	5 pcs	2250W	
	6 pcs in serial	6 pcs	2700W	
	7 pcs in serial	7 pcs	3150W	
	8 pcs in serial	8 pcs	3600W	
	9 pcs in serial	9 pcs	4050W	
	10 pcs in serial	10 pcs	4500W	6.2KVA
	11 pcs in serial	11 pcs	4950W	
	12 pcs in serial	12 pcs	5400W	
	6 pieces in serial and 2 sets in parallel	12 pcs	5400W	6.2KVA
	8 pieces in serial and 2 sets in parallel	14 pcs	6300W	
	SOLAR INPUT	Q'ty of panels	Total input power	Inverter Model
Solar Panel Spec. (reference) - 550Wp -Vmp: 42.48Vdc -Imp: 12.95A -Voc: 50.32Vdc -Isc: 13.70A	3 pcs in serial	3 pcs	1,650W	6.2KVA
	4 pcs in serial	4 pcs	2200W	
	5 pcs in serial	5 pcs	2750W	
	6 pcs in serial	6 pcs	3300W	
	7 pcs in serial	7 pcs	3850W	
	8 pcs in serial	8 pcs	4400W	6.2KVA
	9 pcs in serial	9 pcs	4950W	
	4 pieces in serial and 2 sets in parallel	8 pcs	4400W	6.2KVA
	5 pieces in serial and 2 sets in parallel	10 pcs	5500W	
	6 pieces in serial and 2 sets in parallel	12 pcs	6600W	





Step 6 : Check correct polarity of wire connection from PV modules and PV input connectors. Then, connect positivepole (+) of connection wire to positive pole (+) of PV input connector. Connect negative pole (-) ofconnection wire to negative pole (-)of PV input connector.Make sure the wires are securely connected.

Recommended tool:4mm blade screwdriver

6. Commissioning

6.1 Inspection before Commissioning

Before starting the ESS, please ensure the following checklist items are checked:

- Confirm that all equipment has been installed securely and in accordance with the manufacturer's instructions.
- Verify that the DC switch(es) and AC circuit breaker are in the "OFF" position.
- Ensure that the ground cable is properly and securely connected.
- Check that the AC cable is correctly and reliably connected.
- Verify that the DC cable is properly and securely connected.
- Confirm that the communication cable is properly and securely connected.
- Seal any vacant terminals to prevent dust or moisture ingress.
- Ensure that no foreign items, such as tools, are left on top of the machine or inside the junction box (if applicable).
- Verify that the AC circuit breaker is selected according to the requirements specified in the manual and local standards.
- Check that all warning signs and labels on the ESS are intact and legible.

It is essential to complete these checks before starting the ESS to ensure safe and reliable operation.e.

6.2 Powering on the System

If all checklist items have been verified and meet the requirements, follow the following steps to start the ESS: Step 1: Open the battery start switch and circuit breaker switch Step 2: Open the inverter start switch. Step 3: Turn on the AC circuit breaker located between the ESS and the power grid. Step 4: The ESS will start normally. Observe the LED indicator light on the ESS to ensure that it is working properly. For an introduction to the LED screen and its indicator definitions, refer to the 2.3.1LED Board section in the manual.

--End

6.3 Fault Reference Code

Fault Code	Fault Event	Icon on
01	Over temperature of inverter module	
02	Over temperature of DCDC module	
03	Battery voltage is too high	
04	Over temperature of PV module	

05	Output short circuited.	
06	Output voltage is too high.	
07	Overload time out	
08	Bus voltage is too high	
09	Bus soft start failed	
10	PV over current	
11	PV over voltage	
12	DCDC over current	
13	Over current or surge	
14	Bus voltage is too low	
15	Inverter failed (Self-checking)	
18	Op current offset is too high	
19	Inverter current offset is too high	
20	DC/DC current offset is too hig	
21	PV current offset is too high	
22	Output voltage is too low	
23	Inverter negative power	

6.4 Warning Indicator

Warning Code	Warning Event	Audible Alarm	Icon flashing
02	Temperature is too High	Beep three times every second	
04	Low battery	Beep once every second	
07	Overload	Beep once every 0.5 second	
10	Output power derating	Beep twice every 3 seconds	
14	Fan blocked	None	
15	PV energy is low	Beep twice every 3 seconds	
19	Lithium Battery communication is failed	Beep once every 0.5 second	
21	Lithium Battery over current	None	
22	OP2 is overload	None	
E9	Battery equalization	None	
bP	Battery is not connected	None	

7. System Decommissioning

7.1 Disconnecting the ESS

7.1.1 Disconnecting the ESS

CAUTION

To ensure safety and prevent the risk of burns, it is important to follow proper procedures when operating or performing maintenance on the ESS. Please adhere to the following steps to disconnect the ESS from the AC and DC power sources:

Step 1: Disconnect the external AC circuit breaker that supplies power to the ESS. Make sure to secure it against accidental reconnection.

Step 2: Wait for approximately 10 minutes to allow the capacitors inside the ESS to completely discharge. This step is crucial to ensure that no residual electrical charge remains.

Step 3: Use a current clamp to verify that the DC cable is free from any electrical current. This is an important safety measure to prevent any potential shocks or hazards.

Please remember to wear protective gloves when operating the ESS, even after it has been shut down and allowed to cool down. In addition, always follow safety guidelines and refer to the manufacturer's instructions for specific procedures and precautions related to maintenance and service work on the ESS.

--End

7.1.2 Dismantling the ESS

CAUTION

Risk of burn injuries and electric shock!

Do not come into contact with any internal live components until at least 10 minutes have elapsed after disconnecting the ESS from the utility grid and PV input.

> for specific procedures and precautions related to maintenance and service work on the ESS.

Step 1: Disconnect all cables from the ESS in reverse order as described in the "Electrical Connection" section.

Step 2: Disassemble the ESS following the reverse steps outlined in the "Mechanical Mounting" section.

Step 3: If needed, remove the wall-mounting bracket from the wall.

Step 4: If the ESS will be stored for future use, please refer to the "ESS Storage" section for proper conservation guidelines.

--End

7.1.3 Disposal of the ESS

Users are solely responsible for the proper disposal of the ESS.

WARNING

Please ensure that the ESS is disposed of in accordance with the relevant local regulations and standards to prevent any property losses or casualties.

NOTICE

Certain components of the ESS may pose a risk of environmental pollution. Please adhere to the disposal regulations for electronic waste that are applicable at your installation site when disposing of these components.

7.2 Decommissioning the Battery

To decommission a Li-ion battery after the ESS has been decommissioned, follow these steps:

Step 1: Disconnect the DC circuit breaker located between the battery and the ESS.

Step 2: Disconnect the communication cable that connects the battery to the ESS.

Step 3: Wait for approximately 1 minute to allow for any residual voltage to dissipate. Then, use a multimeter to measure the voltage at the battery ports.

Step 4: If the battery port voltage is zero, proceed to disconnect the power cables from the battery module.

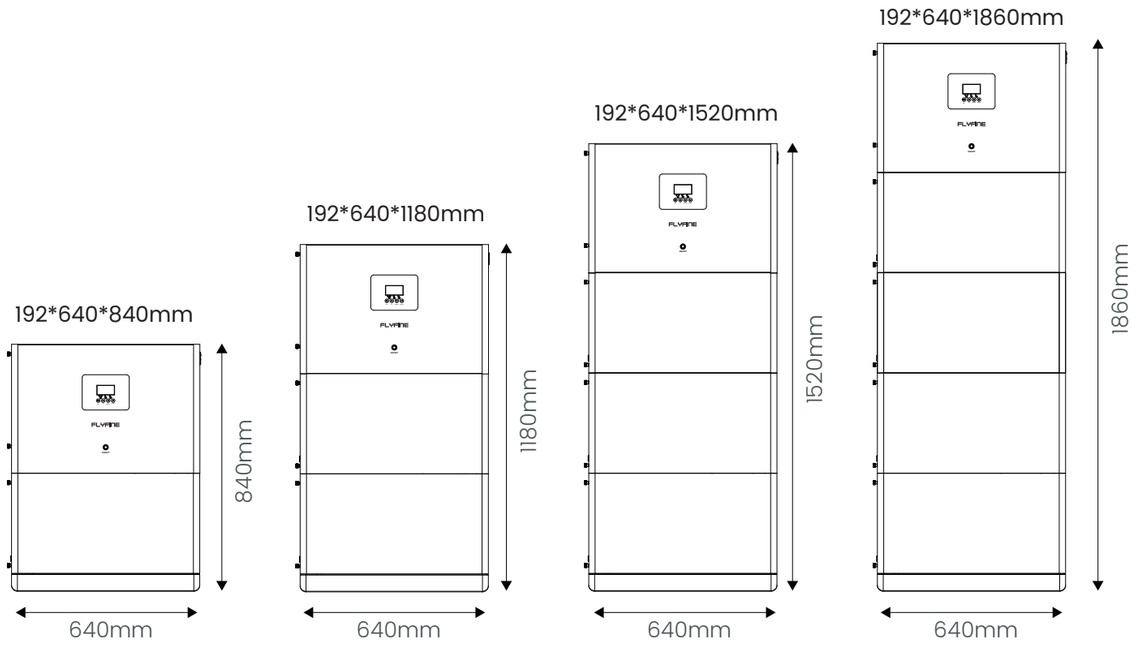
Note: It is important to exercise caution and follow proper safety procedures when handling and decommissioning batteries.

--END

CAUTION

We do not assume liability for the disposal of the battery. The responsibility for proper battery disposal rests with the user. Please ensure that the battery is disposed of in accordance with applicable local regulations and standards to avoid any property damage or harm.

8. Product Size



9. Appendix

9.1 Technical Data

MODEL	FBA5120B	FBA10240B	FAB15360B	FAB20480B
Phase	1-phase			
Maximum PV Input Power	6500W			
Rated Output Power	6200W			
Max. PV Array Open Circuit Voltage	500VDC			
PV Array MPPT Voltage Range	60Vdc~500Vdc			
Max. Input Current	1/27A			
Max. Charging Current(PV)	120A			
Nominal Input Voltage	230Vac			
Max AC Input Voltage	300Vac			
Nominal Input Frequency	50Hz / 60Hz (Auto detection)			
Output Voltage Regulation	230Vac±5%			
Output Frequency	50Hz or 60Hz			
Peak Efficiency	94%			
Nominal DC Input Voltage	48Vdc			
Cold Start Voltage	46.0Vdc			
No Load Power Consumption	<55w			
Max Charging Current (PV+AC)(@ VI/P=230Vac)	120Amp			
Max Charging Current (AC) (@ VI/P=230Vac)	80Amp			
Floating Charging Voltage	54Vdc			
Overcharge Protection	63Vdc			
PHYSICAL				
Communication Port	RS232WIFI/GPRS/LITHIUM BATTERY			
Dimension,D*W*H(mm)	192*640*840	192*640*1180	192*640*1520	192*640*1860
Weight (Kg)	64	113	162	211