



GOODWE

your solar engine

ES Series User Manual



GOODWE
your solar engine

HYBRID PV

INVERTER

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1. Introduction

GoodWe ES series inverters (hybrid) are bidirectional which apply to PV system with battery to store energy.

Energy produced by the PV system is used to optimize self-consumption; excess energy is used to charge the batteries, and then fed into the public grid when the PV energy is adequate,

When PV energy output is insufficient to support connected loads, the system automatically get energy from the batteries if battery capacity is abundant. If the battery capacity is insufficient to meet own consumption requirements, load get electricity from the public grid.

GoodWe ES series inverter is design for both indoor and outdoor use.

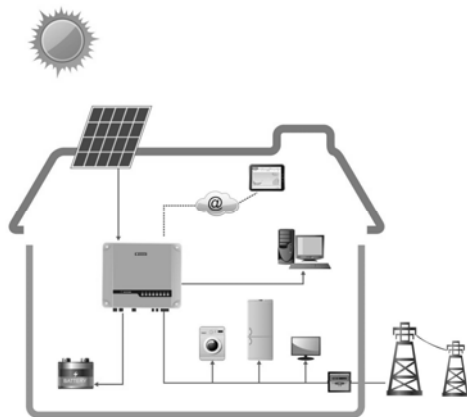


Figure 1-1 Basic hybrid PV system overview

2. Important Safety Warning

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












The ES series inverter of Jiangsu GoodWe Power Supply Technology Co. Ltd. (hereinafter referred to as GoodWe) strictly conforms to related safety rules in design and test.

Safety regulations relevant to the location shall be followed during installation,

operation and maintenance.

Improper operation may have a risk of electric shock or damage to equipment and property.

2.1 Symbols

	Caution! - Failure to observe a warning indicated in this manual may result in injury.
	Danger of high voltage and electric shock!
	Danger of hot surface!
	Product should not be disposed as household waste.
	This side up; the package must always be transported, handled and stored in such a way that the arrows always point upwards.
	Components of the product can be recycled.
	Fragile; the package/product should be handled carefully and never be tipped over or slung.
	No more than 6 identical packages may be stacked on each other.
	Keep dry; the package/product must be protected from excessive humidity and must be stored under cover.
	CE Mark
	Residual voltage exists in the inverter; before commencing any maintenance, at least 5 minutes must be allowed for the capacitor in the inverter to fully discharge.

2.2 Safety

- Installation, maintenance and connection of inverters must be performed by

qualified personnel, in compliance with local electrical standards, regulations and the requirements of local power authorities and/or companies.

- To avoid electric shock, DC input and AC output of the inverter must be terminated at least 5 minutes before performing any installation or maintenance.
- The temperature of some parts of the inverter may exceed 60°C during operation. To avoid being burnt, do not touch the inverter during operation. Let it cool before touching it.
- Ensure children are kept away from inverters.
- Do not open the front cover of the inverter. Apart from performing work at the wiring terminal (as instructed in this manual), touching or changing components without authorization may cause injury to people, damage to inverters and annulment of the warranty.
- Static electricity may damage electronic components. Appropriate method must be adopted to prevent such damage to the inverter; otherwise the inverter may be damaged and the warranty annulled.
- Ensure the output voltage of the proposed PV array is lower than the maximum rated input voltage of the inverter; otherwise the inverter may be damaged and the warranty annulled.
- PV modules should have an IEC61730 classA rating. If the maximum AC mains operating voltage is higher than the PV array maximum system voltage, PV modules should have a maximum system voltage rating based upon the AC mains voltage.
- If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.
- Completely isolate the inverter should : Switch off the DC switch, disconnect the PV terminal, disconnect the battery terminal, and disconnect the AC terminal.
- Completely isolate the inverter before maintaining. Not to enter other areas of the inverter when maintaining!
- Prohibit to insert or pull the AC and DC terminals when the inverter is running
- Electrical Installation & Maintenance shall be conducted by licensed

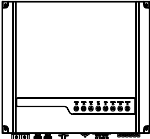
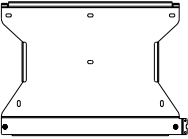
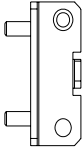
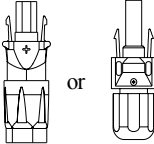
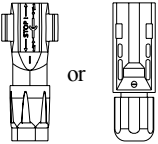
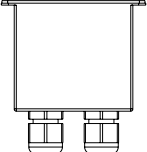
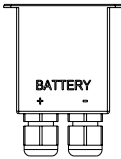

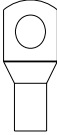


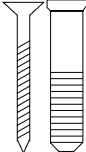
electrician .

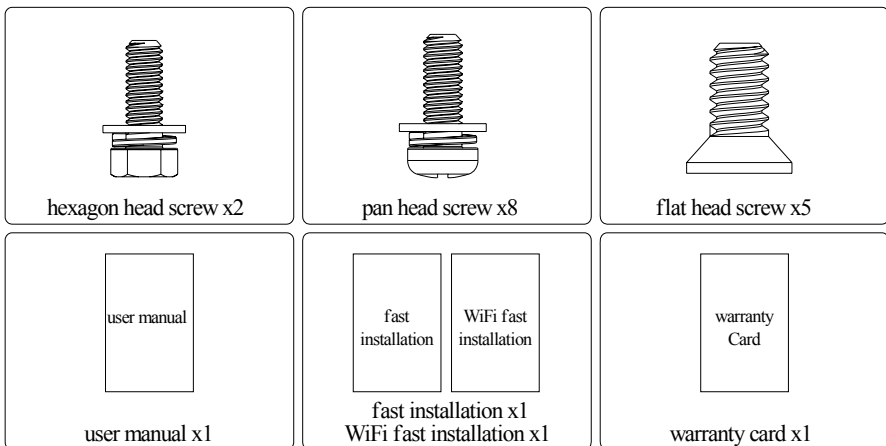
- Machine shipping to Australia shall comply with Australia National Wiring Rules.

3. Installation

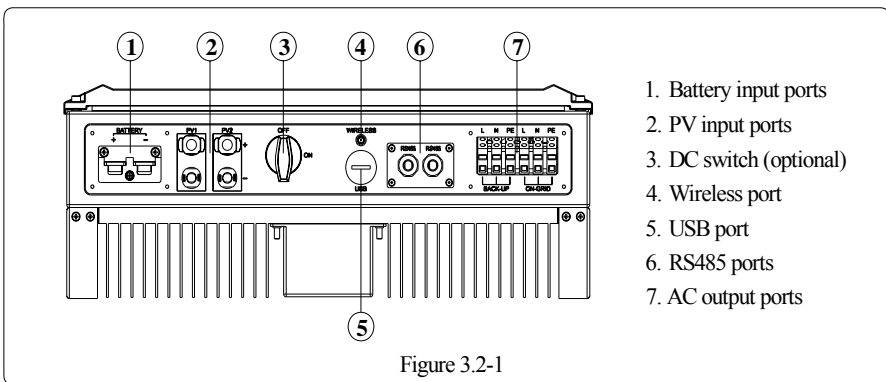
3.1 Packing List

Before installation, please inspect the unit. Be sure that nothing inside the package is damaged. You should have received the following items inside of package:

 inverter x1	 wall-mounted bracket x1	 lock plate x1
 positive PV plug x2	 negative PV plug x2	 AC cover x1
 battery cover x1	 AC terminal x6	 battery terminal x2
 USB data cable x1	 antenna x1	 expansion bolt x6



3.2 Product Overview

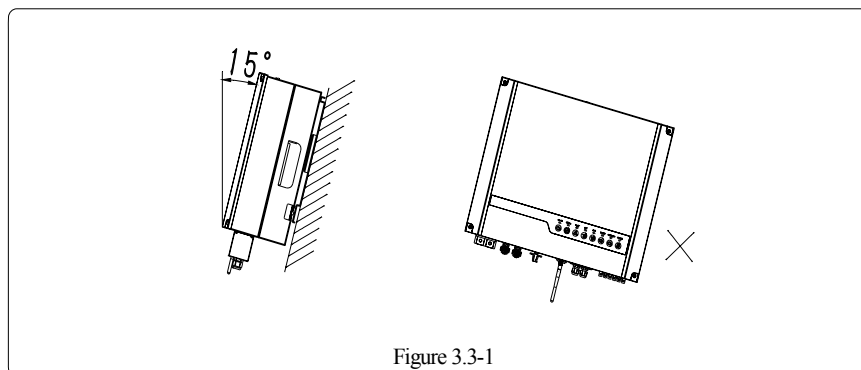


3.3 Selecting The Mounting Location

Mounting location should be selected based on the following aspects:

- The installation method and mounting location must be suitable for the inverter's weight and dimensions.
- Mount on a solid surface.
- Select a well ventilated place sheltered from direct sun radiation.
- Install vertically or tilted backward by max 15°. The device cannot be

installed with a sideways tilt. The connection area must point downwards. Refer to Figure 3.3-1.



- In order to achieve optimal performance, the ambient temperature should be lower than 45 °C.
- For the convenience of checking the LED lights and possible maintenance activities, please install the inverter at eye level.
- Inverters should NOT be installed near inflammable and explosive items. Any strong electro-magnetic equipment should be kept away from installation site.
- Product label and warning symbol shall be clear to read after installation.
- Please avoiding direct sunlight, rain exposure, snow lay up when installing.

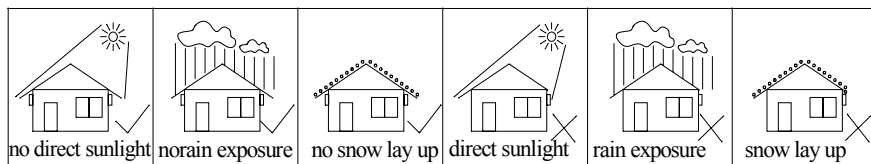


Figure 3.3-2

- In consideration of heat dissipation and convenient dismantlement, the minimum clearances around the inverter should be no less than the following value:

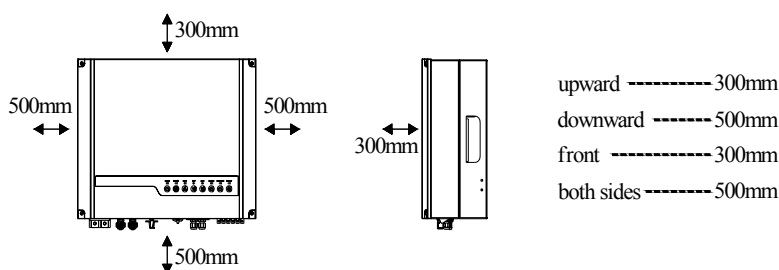


Figure 3.3-3

3.4 Mounting



Remember that this inverter is heavy! Please be carefully when lifting out from the package.

1. Use the wall-mounted bracket as a template and drill 6 holes on the wall, 10 mm in diameter and 80 mm deep. Refer to Figure 3.4-1.
2. Fix the wall mounting bracket on the wall with six expansion bolts in accessory bag.
3. Carry the inverter by holding the handles. Refer to Figure 3.4-2.
4. Place the inverter on the wall-mounted bracket. Refer to Figure 3.4-3、 Figure 3.4-4.
5. Fix the inverter with the lock plate in accessory bag. Refer to Figure 3.4-5.
6. Use flat head screw in accessory bag and a padlock to fix the lock plate on the wall-mounted bracket. Refer to Figure 3.4-6.

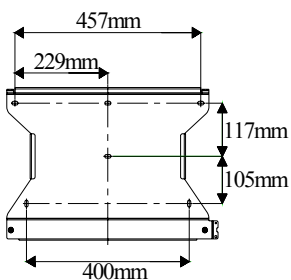


Figure 3.4-1

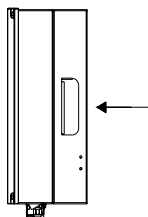


Figure 3.4-2

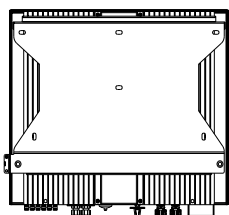


Figure 3.4-3

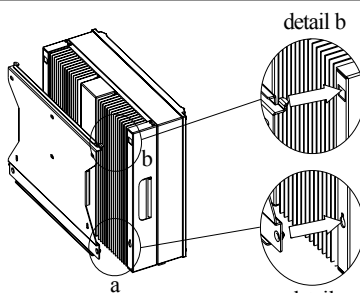


Figure 3.4-4

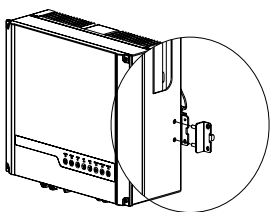


Figure 3.4-5

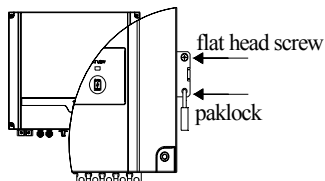


Figure 3.4-6

4. Electrical Connection

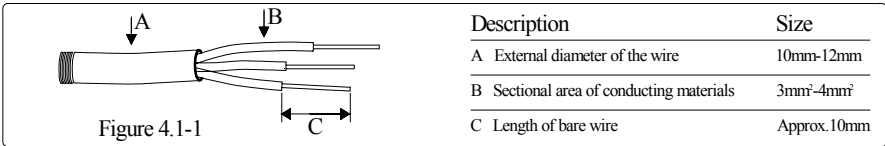
4.1 AC Output Connection

Before connecting to Grid and Load, please install a separate AC breaker (250VAC/30A) between inverter and Grid. This will ensure the inverter can be

securely disconnected during maintenance.



It's very important for system safety and efficient operation to use appropriate cable for AC connection. To reduce risk of injury, please use the proper recommended cable size. Refer to Figure 4.1-1.



Please follow below steps to implement AC connection:

1. Check the grid voltage and frequency at the connection point of the inverter. It should meet GoodWe product Spec.
2. Measure the impedance between neutral cable and earth cable, make sure it is not excess than 10 ohm.
3. Disconnect AC breaker between inverter and Grid.
4. Disconnect screw cap from insulator.
5. Disconnect waterproof ring from insulator.
6. Put the cable through the components in this order: screw cap, waterproof ring, insulator, AC cover and AC terminal. Refer to Figure 4.1-2.
7. Compress the terminal head by professional tool and screw down screw cap slight. Refer to Figure 4.1-3、 Figure 4.1-4.
8. Insert AC terminals into the corresponding holes and fasten them by screwdriver, then fasten AC cover with pan head screws in accessory bag. Refer to Figure 4.1-5、 Figure 4.1-6 、 Figure 4.1-7.
9. Screw down screw cap again.

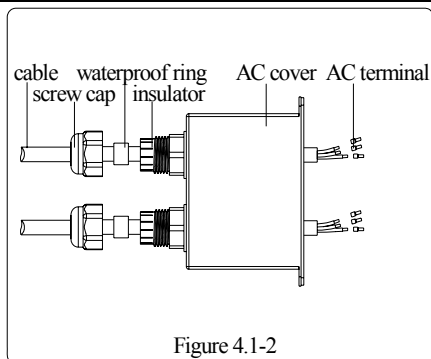


Figure 4.1-2

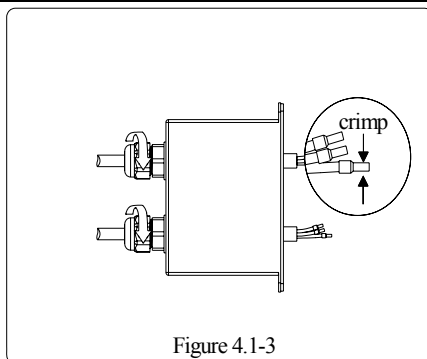


Figure 4.1-3

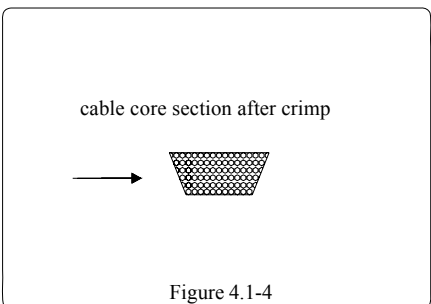


Figure 4.1-4

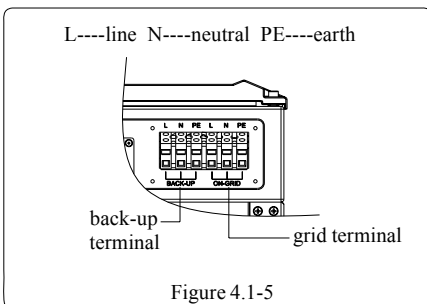


Figure 4.1-5

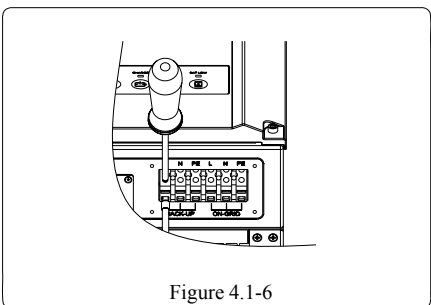


Figure 4.1-6

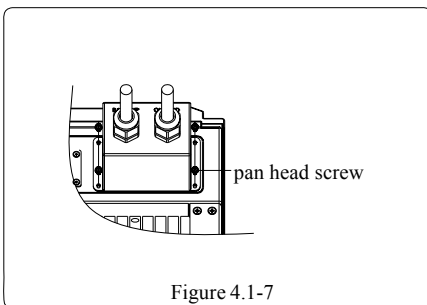


Figure 4.1-7

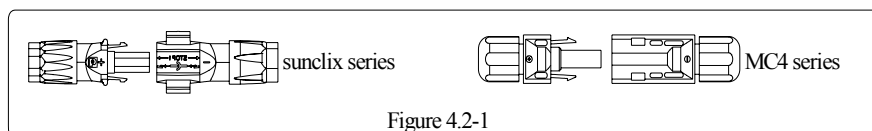
4.2 PV Connection



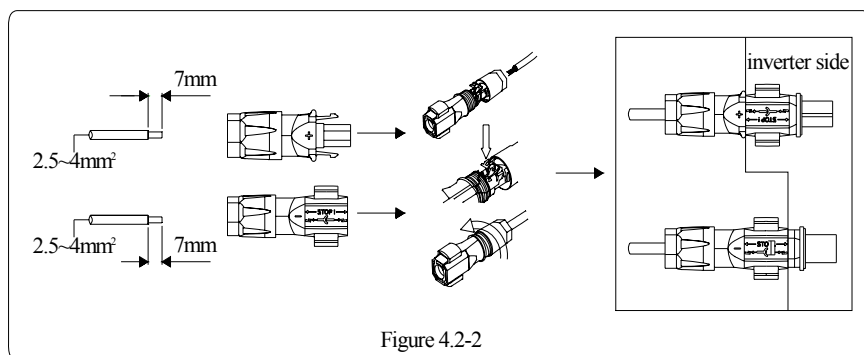
- Before connecting the PV panels, ensure the plug connectors have the correct polarity. Incorrect polarity could permanently damage the inverter.

- Check the short-circuit current of the PV string. The total short-circuit current must not exceed the inverter's maximum PV current.
- PV array should not be connected to the grounding conductor.
- Must be use PV plugs in accessory bag.
- The minimum array insulation resistance to ground that system designer or installer must meet when selecting the PV panel and system design, based on the minimum value that the design of the PV functional grounding in the inverter was based on. The minimum value of the total resistance 19.33k Ω that the system must meet. There is a risk of shock hazard if the total minimum resistance requirement is not met.

There are two types of PV plugs----sunclix series and MC4 series. Refer to Figure 4.2-1.



The installation method of sunclix series Refer to Figure 4.2-2.



The installation method of MC4 series Refer to Figure 4.2-3.

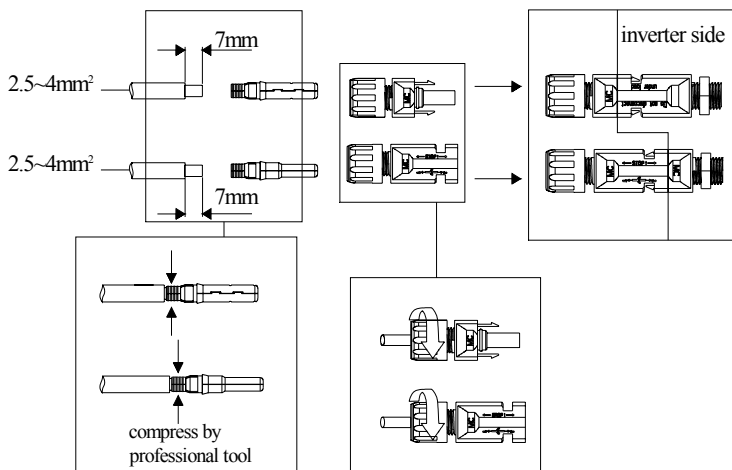


Figure 4.2-3

4.3 Battery Connection

Before connecting to battery, please install a separate DC breaker (60A for GW3648D-ES and 120A for GW5048D-ES) between inverter and battery. This will ensure the inverter can be securely disconnected during maintenance.



- Be aware of electric shock and chemical hazards!
- It is a normal phenomenon that electric arc occurs when connecting battery to the inverter without use a DC breaker.
- It's very important for system safety and efficient operation to use appropriate cable for battery connection. To reduce risk of injury, please use the proper recommended cable size. Refer to Figure 4.3-1.

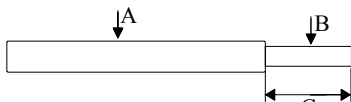


Figure 4.3-1

Description	Size
A External diameter of the wire	10mm-12mm
B Sectional area of conducting materials	20mm²-25mm²
C Length of bare wire	Approx. 10mm

- Before connecting to battery, please install a separate DC breaker (60A for GW3648D-ES and 120A for GW5048D-ES) between inverter and battery.

This will ensure the inverter can be securely disconnected during maintenance.

- Suggestion: The battery be installed indoor, details please refer to battery manufacture's user manual.
- Suggestion: The battery be installed with a distance to each other, details please refer to battery manufacture's user manual.
- About the number of cells used, it will be decided by customer's choice, the choice comply with the followed requirement: the total voltage is 48V, the max capacity is 500Ah.

Please follow below steps to implement battery connection:

1. Check the nominal voltage of batteries. The nominal input voltage should meet GoodWe product Spec.
2. Disconnect DC breaker between inverter and battery.
3. Disconnect screw cap from insulator.
4. Disconnect waterproof ring from insulator.
5. Put the cable through the components in this order: screw cap, waterproof ring, insulator, battery cover and battery terminal. Refer to Figure 4.3-2.
6. Compress the terminal head by professional tool and screw down screw cap slight. Refer to Figure 4.3-3、 Figure 4.3-4.
7. Put battery terminals into the corresponding holes and fasten them by screwdriver and spanner, then fasten battery cover with pan head screws in accessory bag. Refer to Figure 4.3-5、 Figure 4.3-6 、 Figure 4.3-7.
8. Screw down screw cap again.

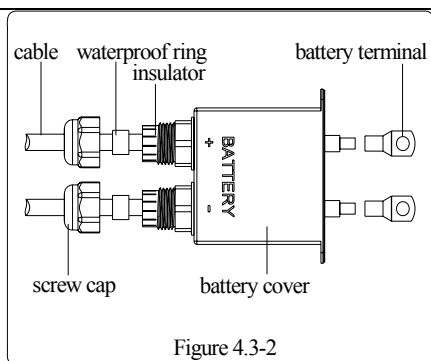


Figure 4.3-2

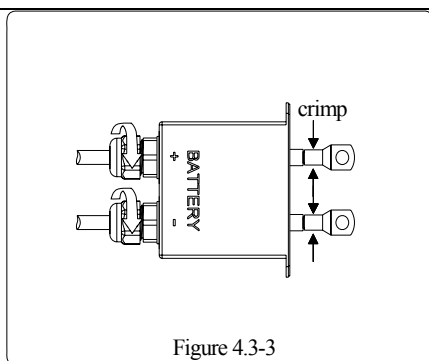


Figure 4.3-3

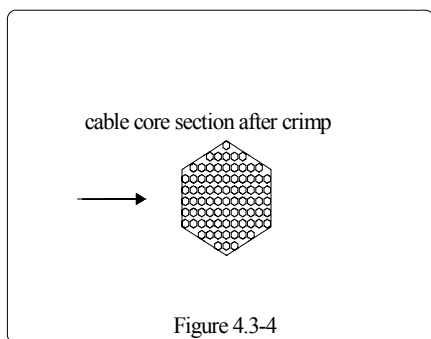


Figure 4.3-4

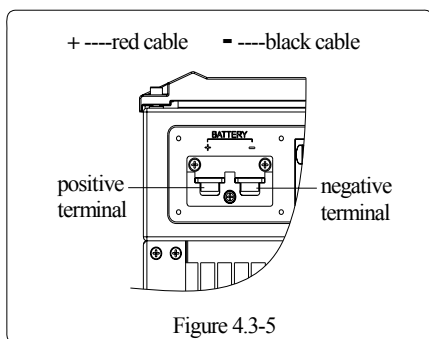


Figure 4.3-5

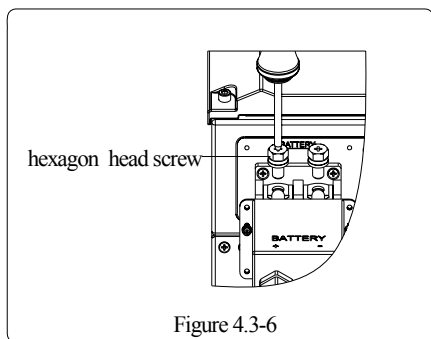


Figure 4.3-6

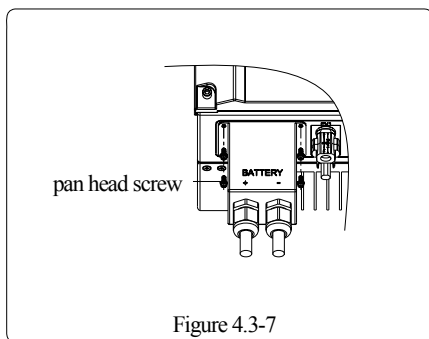


Figure 4.3-7

4.4 RS485 Communication Connection

An RS485 interface is used for Li-ion and EzMeter communication. The cable length should not exceed 800m. The connection method of RS485 refer to Figure 4.4-1.

EzMeter is a equipment for energy measurement developed by GoodWe

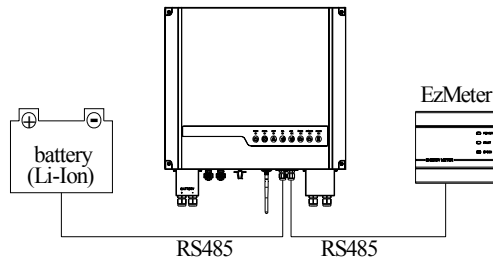


Figure 4.4-1

Please follow below steps to implement RS485 connection:

1. Remove RS485 waterproof assembly from inverter.
2. Disconnect screw cap from insulator.
3. Disconnect waterproof ring from insulator.
4. Put the cable through the components in this order: screw cap, waterproof ring, insulator, RS485 cover. Refer to Figure 4.4-2.
5. Put cable cores insert into the corresponding slots and compress the crystal head by professional tool, then screw down screw cap slight. Refer to Figure 4.4-2.
6. Put crystal head insert into the corresponding inner slots of inverter.
7. Fasten RS485 waterproof assembly to inverter.
8. Screw down screw cap again.

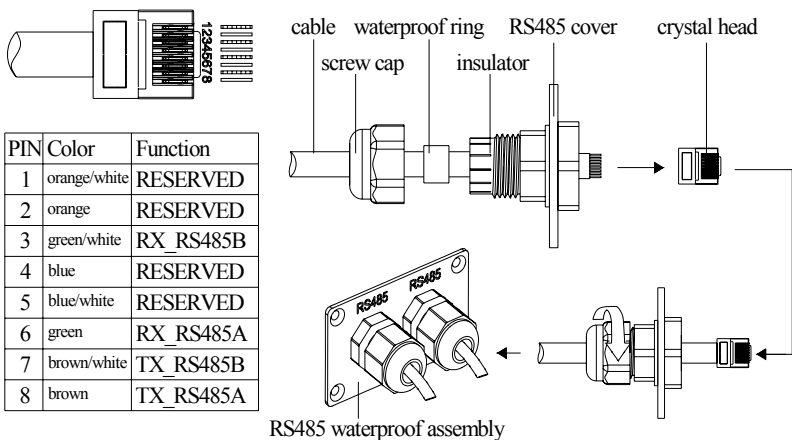


Figure 4.4-2

4.5 WiFi Communication Connection

Install the antenna to inverter. Refer to Figure 4.5-1.

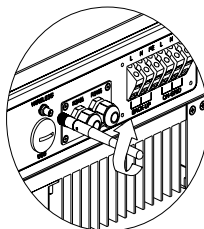
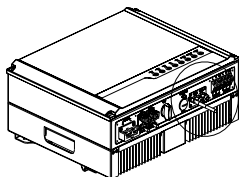


Figure 4.5-1

4.6 USB Communication Connection

The USB communication is used for firmware update only!

Please follow below Figure 4.6-1 to implement USB connection:

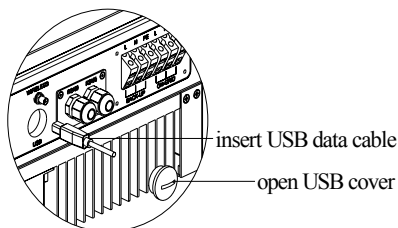
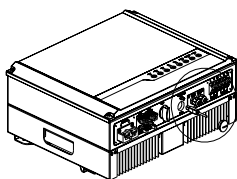


Figure 4.6-1

5. LED Lights Illustration

Inverter Status	LED Color	Inverter Status Note	LED Display Status
Wifi	Yellow	WIFI link NG	Blink 1s on 1s off
		WIFI link OK,Internet NG	Blink 2.5s on 2.5s off
		WIFI link OK,Internet OK	Constant on
Normal	Green	Normal	Constant on
		Checking	Blink 0.5s on 0.5soff
Fault	Red	Fault	Constant on
Sale	Green	Generate to grid	Constant on
Buy	Yellow	Consumption from grid	Constant on
Charge	Green	Battery Charging	Constant on
Discharge	Green	Battery Discharging	Constant on
Battery Low	Red	Battery Low / Bad / Disconnect	Blink 0.5s on 0.5soff

6. Error Messages

An error message will be displayed on the Monitor if a fault occurs.

Table 6-1 Description of Error Message

Error message	Description
---------------	-------------

Utility Loss	Grid disconnected
Fac Failure	Grid frequency no longer within permissible range
Consistent Failure	Machine parameter consistent fault
Device Failure	Device internal fault
PV Over Voltage	Overvoltage at DC input
Over Temperature	Overtemperature on the case
Isolation Failure	Ground insulation impedance is too low
Ground I Failure	Overhigh ground leakage current
Relay-Check Failure	Relay self-checking failure
DC Injection High	Overhigh DC injection
EEPROM R/W Failure	Memory chip failure
SCI Failure	Internal communication failure
DC Bus High	Overhigh BUS voltage
Ref 2.5V Failure	2.5V reference voltage failure
AC HCT Failure	Output current sensor failure
GFCI Failure	Detection circuit of ground leakage current failure
Vac Failure	Grid voltage no longer within permissible range

7. Specifications

Model name	GW5048D-ES	GW3648D-ES
Solar		
Max. DC power(W)	5400	4200
Max. DC voltage (V)	580	
MPPT voltage range (V)	125~550	
Starting voltage (V)	125	

Max. DC current (A)	15/15	
No. of DC connectors	2	
No. of MPPTs	2(can parallel)	
DC connector	SUNCLIX / MC4 (Optional)	
Battery		
Battery Type	Lead-acid or Li-Ion	Lead-acid or Li-Ion
Battery voltage range (Vdc)	40-60	
MAX Discharge power (W)	4600	2300
Charge current (A)	5-50 A continuous, programmable	
Battery capacity (Ah)	100~500Ah(depending requirement)	
Charging curve	3-stage adaptive with maintenance	
Charging voltage	57V	
Battery temperature compensation	included(Li-Ion)	
Battery voltage sense	integrated	
Current shunt	integrated	
AC Output Data		
Normal AC power(W)	4600	3600
Max. AC power(W)	4600	3600
Peak power(Back-up)(W)	1.5x Pnom, 10sec	1.5x Pnom, 10sec
Max. AC current(A)	20	16
Normal AC output	50/60Hz; 230Vac	
AC output range	45~55Hz/55~65Hz; 180~270Vac	
AC output (Back-up)	230Vac ±2%, 50Hz ±0.2%, THDv<3%(linear load)	
THDi	<1.5%	
Power factor	0.9 leading~0.9 lagging	
Grid connection	Single phase	
Efficiency		
Max. efficiency	97.6%	97.6%
Euro efficiency	97.0%	97.0%
MPPT adaptation efficiency	>99.5%	
Protection		
Residual current monitoring unit	Integrated	
Anti-islanding protection	Integrated	
DC switch(PV)	Integrated	

AC over current protection	Integrated
Insulation monitoring	Integrated

Certifications&Standards		
Grid regulation	VDE4105, VDE 0126-1-1+A1, G83/2, G59/2, AS4777.2/3, IEC62109-2	
Safety	IEC62109-1&-2, AS3100, IEC62040-1	
EMC	EN61000-6-1, EN61000-6-2, EN61000-6-3, EN61000-6-4, EN61000-3-11, EN61000-3-12	
General Data		
Dimensions (WxHxD)	516*440*184mm	
Weight (kg)	30	28
Mounting	Wall bracket	
Ambient temperature range	-20~60℃（>45℃ derating）	
Relative humidity	0~95%	
Max. operating altitude	2000m	
Protection degree	IP65	
Topology	Transformerless	
Standby losses(W)	<8	
Cooling	Nature convection	
Noise emision(dB)	<25	
Display	LED light & APP	
Communication	USB2.0; RS485;WIFI;CAN	
Standard warranty(years)	5/10/15/20/25(optional)	

8. Certificates





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