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350-00082-03



ES SERIES USER MANUAL



HYBRID 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, electricity will be drawn from the public grid.

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

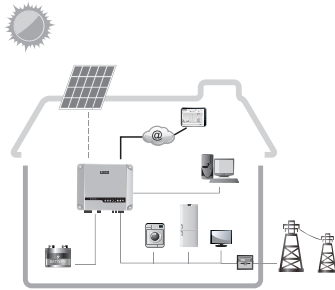


Figure 1-1 Basic hybrid PV system overview

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.



Components of the product can be recycled.



Danger of high voltage and electric shock!



This side up; the package must always be transported, handled and stored in such a way that the arrows always point upwards.



Danger of hot surface!



No more than six (6) identical packages may be stacked on each other.



Product should not be disposed as household waste.



The package/product should be handled carefully and never be tipped over or slung.



CE Mark



Keep dry; the package/product must be protected from excessive humidity and must be stored under cover.



Signals danger due to electrical shock and indicates the time (5 minutes) to allow after the inverter has been turned off and disconnected to ensure safety in any installation operation.

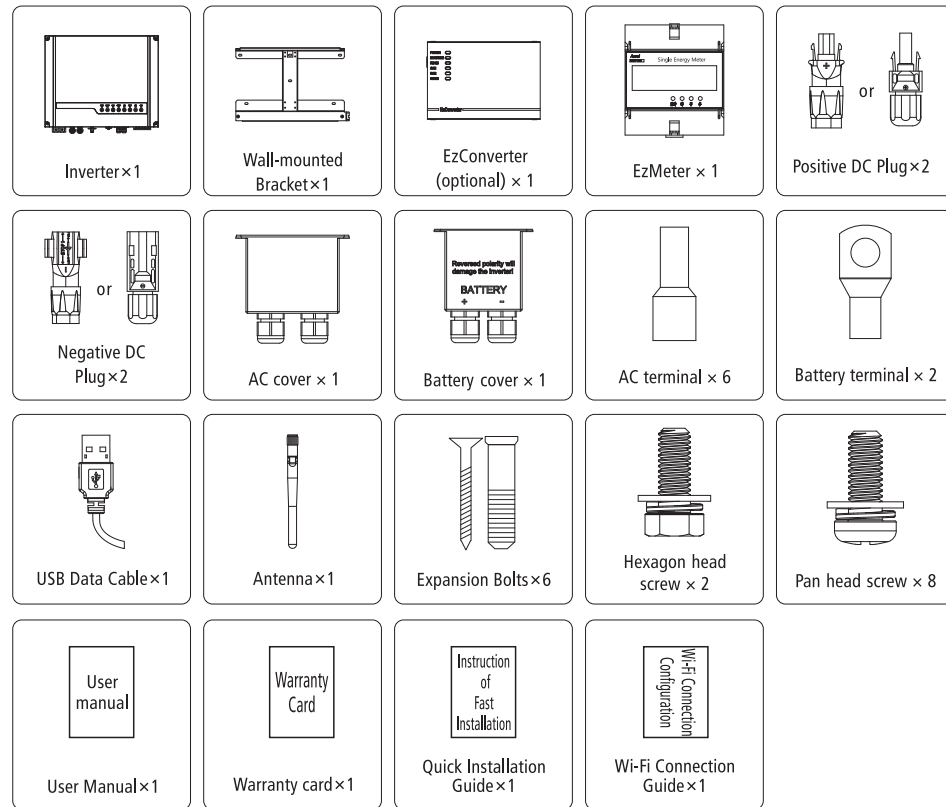
2.2 Safety

- Installation, maintenance and connection of inverters must be performed by qualified personnel, in compliance with local electrical standards, wiring rules and the requirements of local power authorities and/or companies (for example : AS 4777 and AS/NZS 3000 in Australia).
- 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.
- When exposed to sunlight, the PV array generates dangerous high DC voltage. Please operate according to our instructions, or it will result in danger to life.
- PV modules should have an IEC61730 class A rating.
- 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 before maintaining. Completely isolate the inverter should : Switch off the DC switch, disconnect the PV terminal, disconnect the battery terminal, and disconnect the AC terminal.
- Prohibit to insert or pull the AC and DC terminals when the inverter is running.
- In Australia, the inverter internal switching does not maintain the neutral integrity, neutral integrity must be addressed by external connection arrangements like the example proposed in the diagram 4.10.
- In Australia, the output of backup side in switchbox should be labeled 'main switch UPS supply', the output of normal load side in switchbox should be labeled 'main switch inverter supply'.

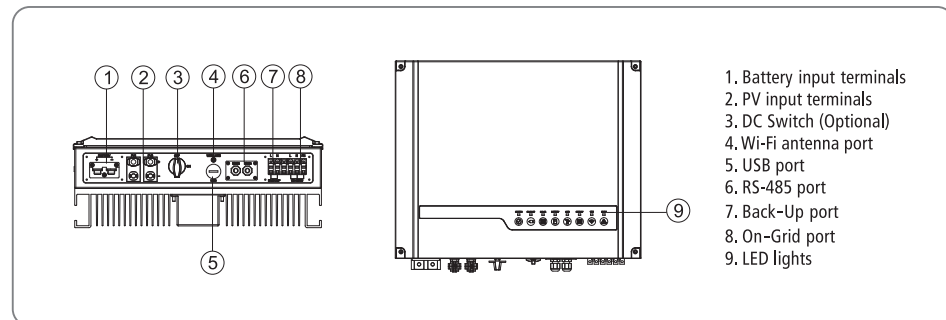
3 Installation

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:



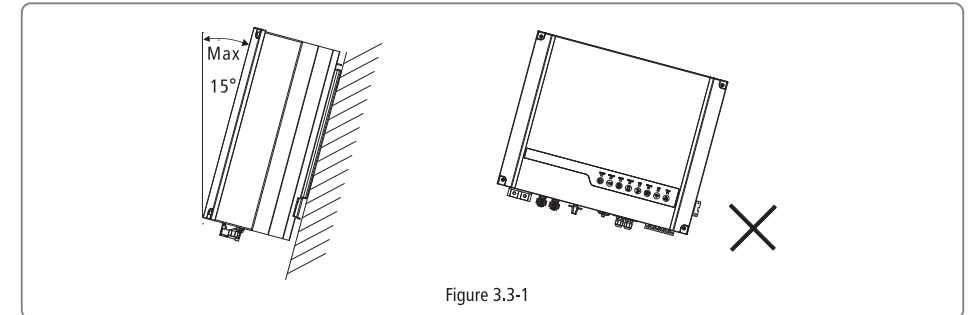
3.2 Product Overview



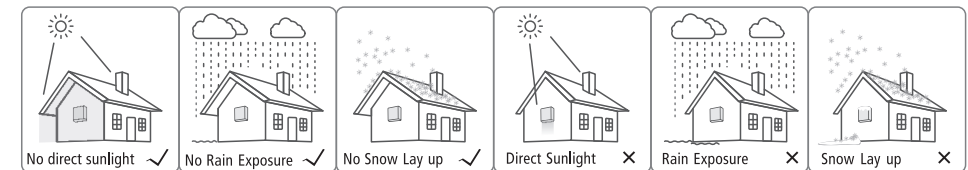
3.3 Selecting The Mounting Location

Mounting location should be selected based on the following aspects:

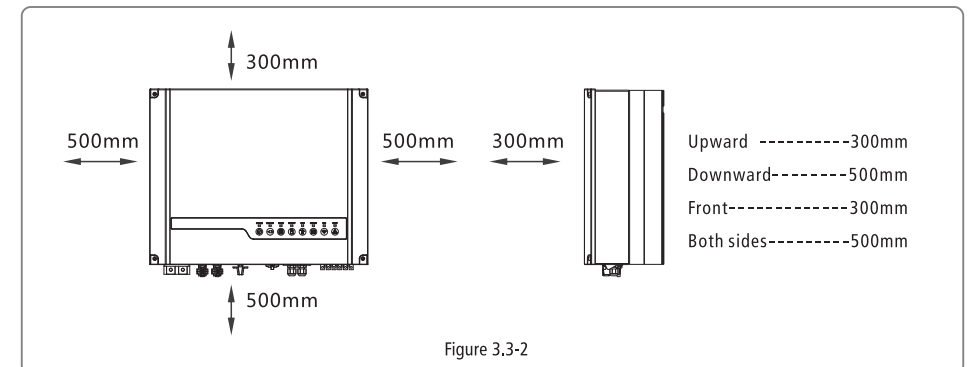
- The installation method and mounting location must be suitable for the inverter's weight and dimensions.
- Mount on a solid surface.
- Select a well ventilated place sheltered from direct sun radiation.
- Install vertically or tilted backward by max 15°. The device cannot be installed with a sideways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



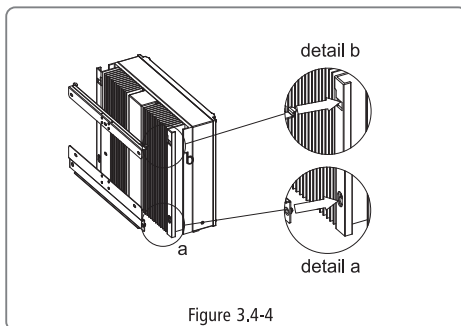
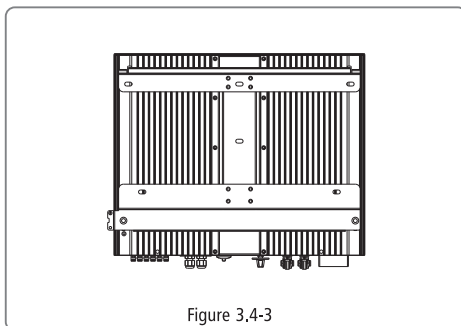
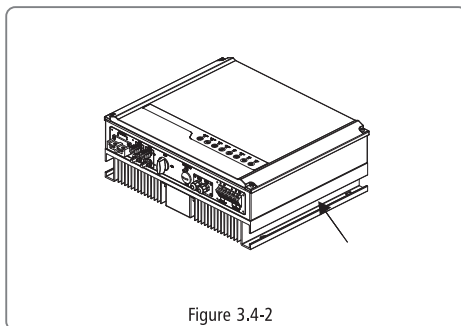
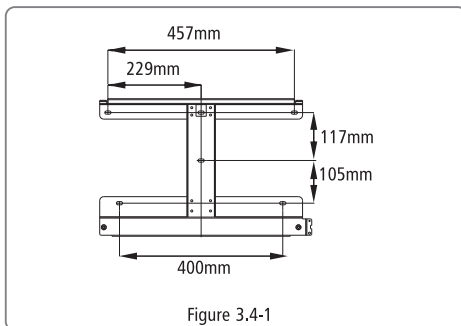
- In consideration of heat dissipation and convenient dismantlement, the minimum clearances around the inverter should be no less than the following value:



⚠ 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-mounted bracket on the wall with six expansion bolts in accessory bag.
3. Carry the inverter by holding the heat-sink two sides. 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.



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.



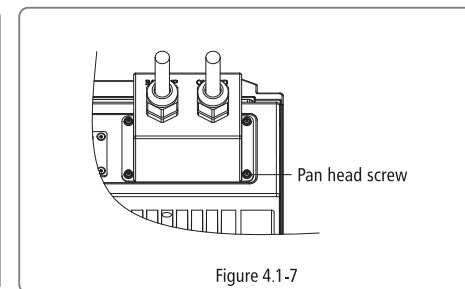
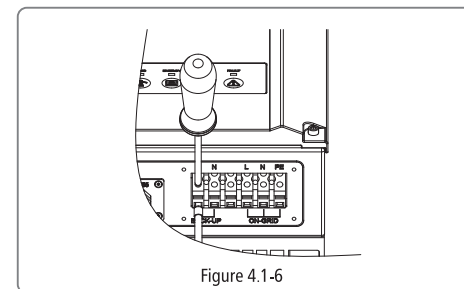
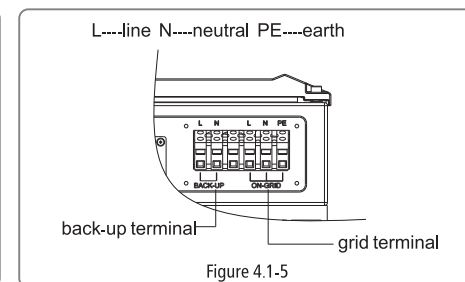
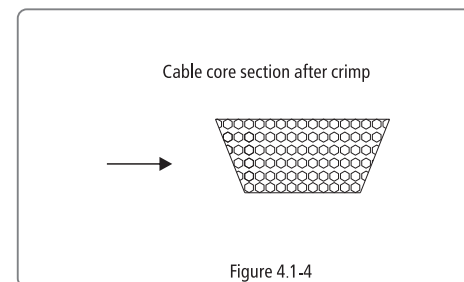
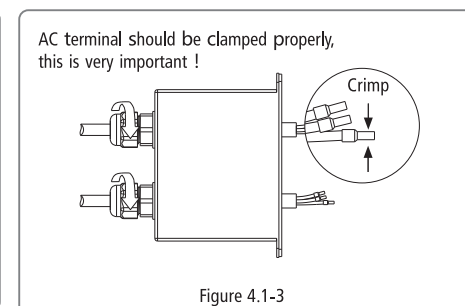
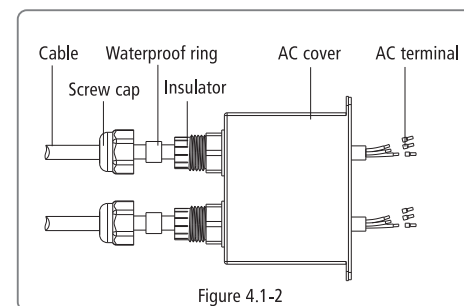
It's very important for system safety and efficient operation to use appropriate cable for AC connection. To reduce risk of injury, please use the proper recommended cable size. Refer to Figure 4.1-1.

	Grade	Description	Value
	A	O.D.	11~12mm
	B	Conductor Material Sectional Area	6mm ²
	C	Bare Wire Length	10mm around

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 (Suggest: diameter of the cutter bar is 4mm, torsion:8~12Kg-f.cm), 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.



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 DC plugs in accessory bag.
- The minimum insulation resistance to ground of the PV pannels must exceed 19.33k Ω , there is a risk of shock hazard if the requirement of minimum resistance is not met.

There are two types of DC plugs, SUNCLIX and MC4 or H4 series. Please refer to Figure 4.2-1.



Figure 4.2-1

Installation instruction of SUNCLIX please refer to Figure 4.2-2.

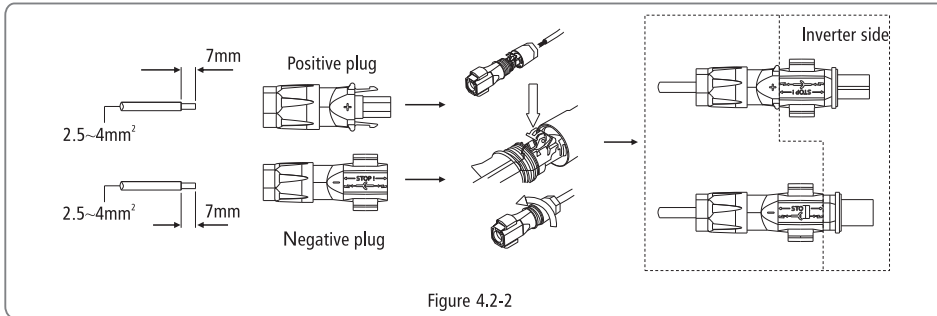


Figure 4.2-2

Installation instruction of MC4 and H4 please refer to Figure 4.2-3.

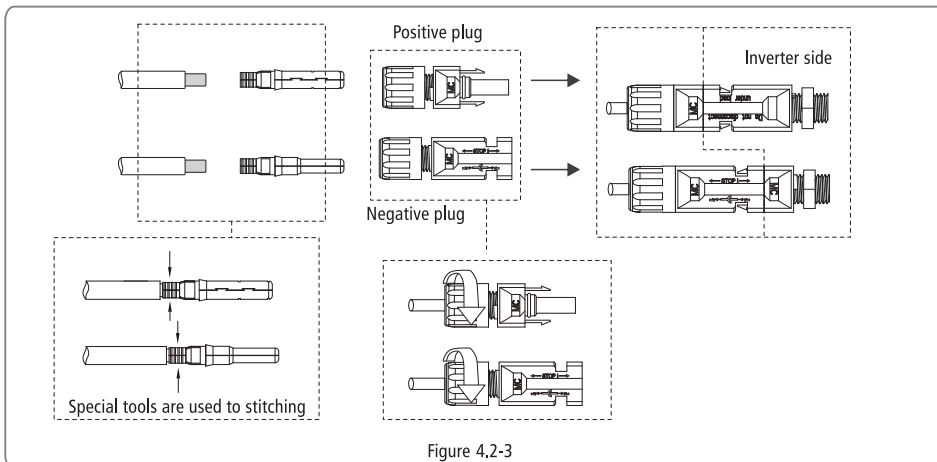


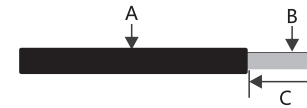
Figure 4.2-3

4.3 Battery Connection

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



- Reversed polarity will damage the inverter!
- 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.



Grade	Description	Value
A	O.D.	10~12mm
B	Conductor Material Sectional Area	20~25mm²
C	Bare Wire Length	10mm around

Figure 4.3-1

- Suggestion: if the battery is to be installed indoor, for details please refer to battery manufacture's user manual.
- Suggestion: Batteries must be installed with a distance to each other, details please refer to battery manufacture's user manual.
- As for the number of cells used, it will be decided by customer's choice, the choice must comply with the followed requirement: the rated voltage is 48V.

Please follow below steps to implement battery connection:

- Check the nominal voltage of batteries. The nominal output voltage should meet GoodWe product Spec.
- Disconnect DC breaker between inverter and battery.
- Disconnect screw cap from insulator.
- Disconnect waterproof ring from insulator.
- 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.
- Compress the terminal head by professional tool and screw down screw cap slight. Refer to Figure 4.3-3, Figure 4.3-4.
- Put battery terminals into the corresponding holes (Red to the positive terminal; Black to the negative terminal.) and fasten them by screwdriver and spanner (recommended torsion:50~70Kg-f.cm), 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.
- Screw down screw cap again.
- An earth wire terminal is set on the left side of the inverter. If necessary, it can be connected to earth wire. Refer to Figure 4.3-8

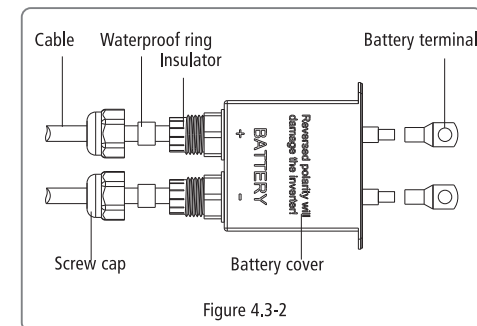


Figure 4.3-2

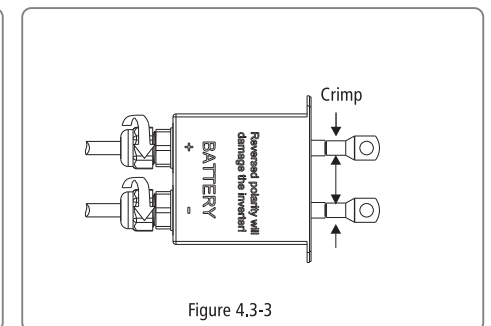


Figure 4.3-3

Cable core section after crimp

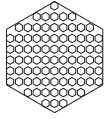


Figure 4.3-4

⊕----red cable ⊖----black cable

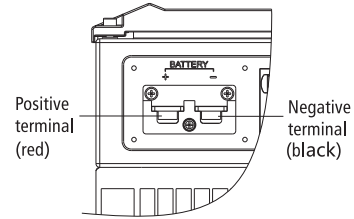


Figure 4.3-5

Hexagon head screw

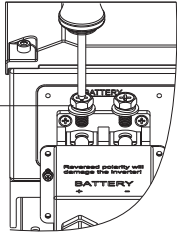


Figure 4.3-6

Pan head screw

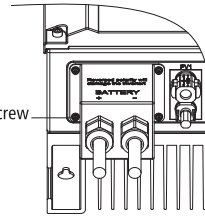


Figure 4.3-7

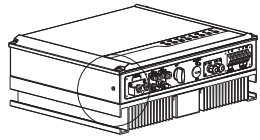
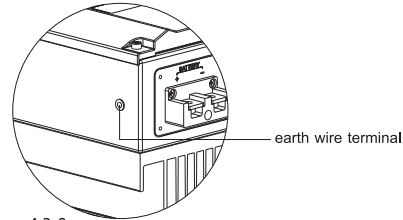


Figure 4.3-8



4.4 RS-485 Connection

RS-485 interfaces are used for EzConverter and EzMeter communication. The cable length should not exceed 100m. For the connection methods of RS-485 please refer to chapter 4.5, chapter 4.6.

Please follow below steps to implement RS-485 connection of inverter side:

- Remove RS-485 waterproof assembly from inverter.
- Disconnect screw cap from insulator.
- Disconnect waterproof ring from insulator.
- Put the cable through the components in this order: screw cap, waterproof ring, insulator, RS-485 cover. Refer to Figure 4.4-1.
- 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 4.4-1.
- Put crystal head insert into the corresponding inner slots of inverter.
- Fasten RS-485 waterproof assembly to inverter.
- Screw down screw cap again.

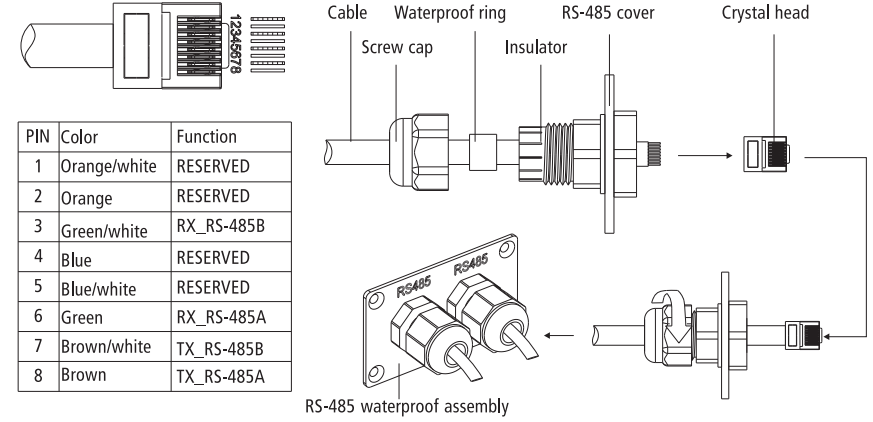


Figure 4.4-1

4.5 EzMeter Connection

EzMeter can detect the current magnitude and direction, to control the working condition of inverter. Inverter and EzMeter communication via RS-485, The cable length should not exceed 100m.

For the connection method of Type 1 EzMeter refer to Figure 4.5-1.

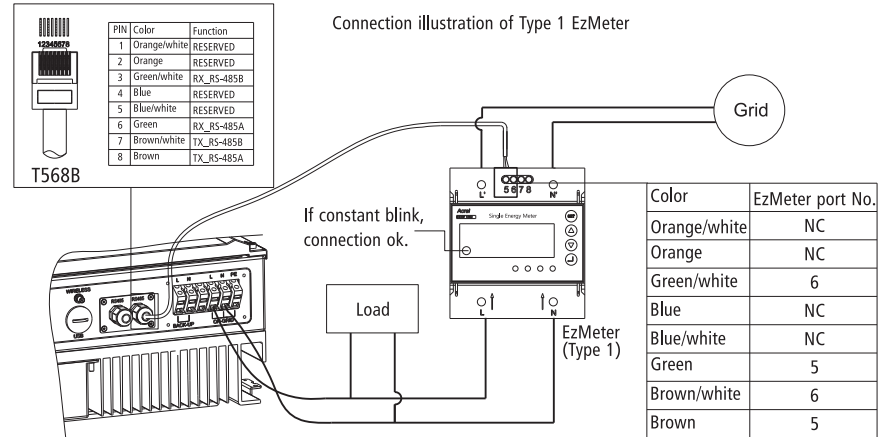
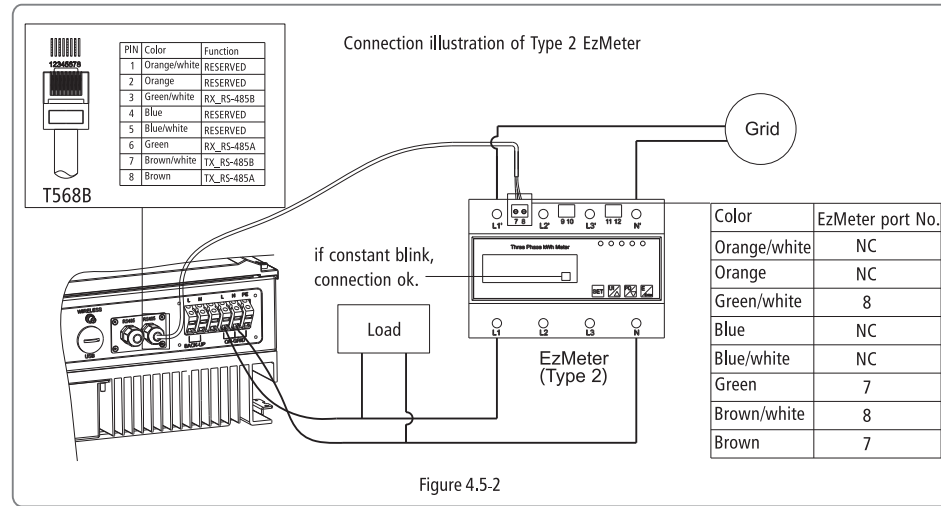


Figure 4.5-1

For the connection method of Type 2 EzMeter refer to Figure 4.5-2.



Users don't need to operate EzMeter, make sure It can be used after the connection.

4.6 EzConverter Connection (optional)

It is needed to configure EzConverter if lithium battery is used in the system, to communicate with battery BMS.

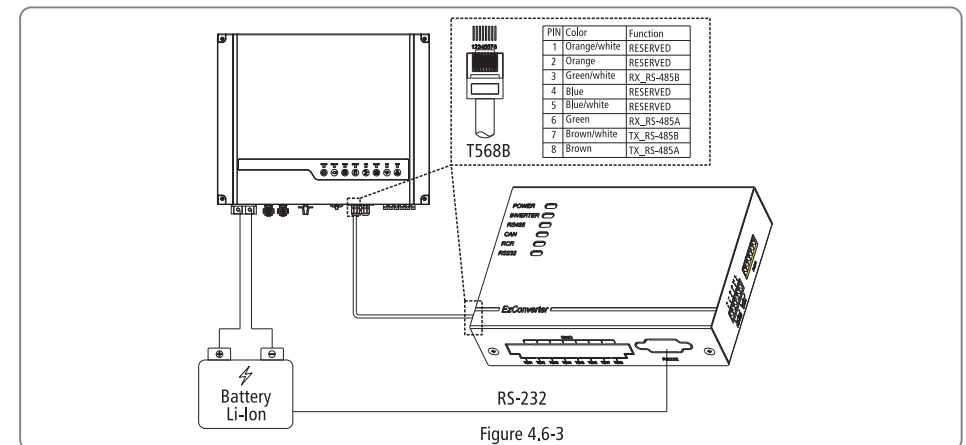
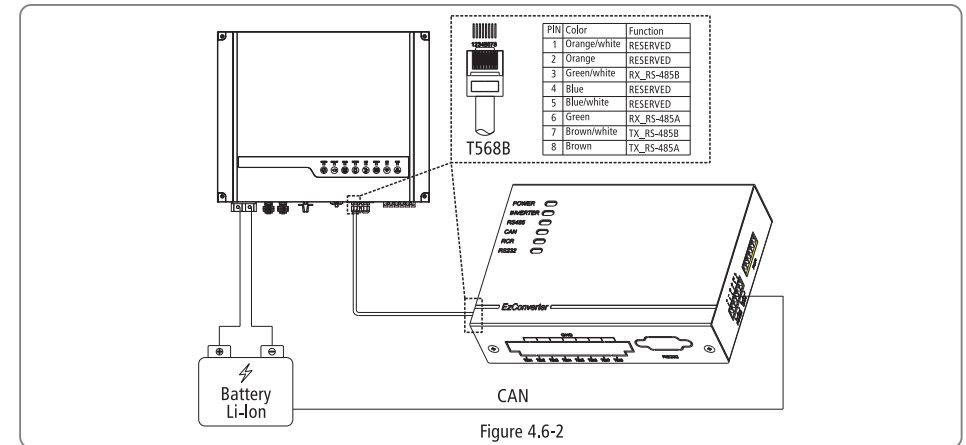
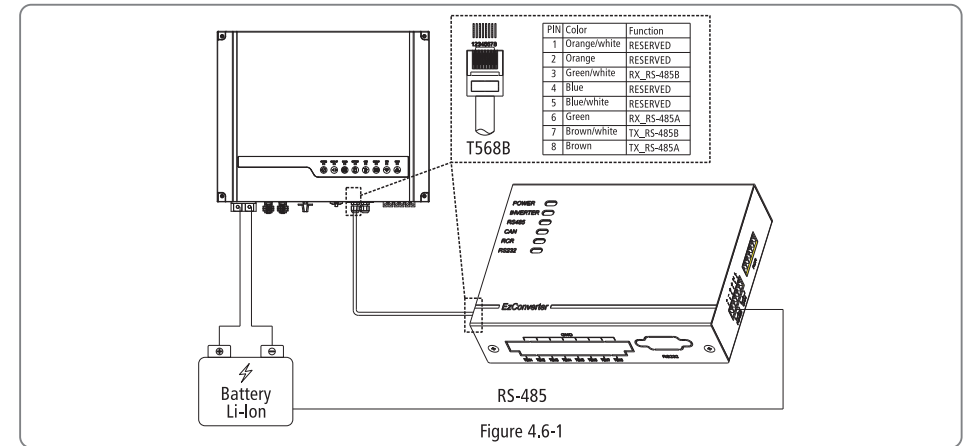
Inverter and EzConverter communication via RS-485, lithium battery and EzConverter communication via RS-485 or CAN or RS-232 (depend on Li-Ion battery communication type).The cable length should not exceed 2m.

Choose corresponding dial-up circuit of lithium battery, according to dial-up protocol comparison table 4.6-1 of lithium battery from user manual.

Switch State					Function
Switch 1	Switch 2	Switch 3	Switch 4	Switch 5	
OFF	OFF	OFF	OFF	OFF	Reserved
OFF	ON	ON	ON	ON	BMS communication protocol for Alpha lithium battery

Table 4.6-1

- Lithium battery communication connects to EzConverter via RS-485 interface if lithium battery communication protocol is RS-485. Refer to Figure 4.6-1.
- Lithium battery communication connects to EzConverter via CAN interface if lithium battery communication protocol is CAN. Refer to Figure 4.6-2.
- Lithium battery communication connects to EzConverter via RS-232 interface if lithium battery communication protocol is RS-232. Refer to Figure 4.6-3.



EzConverter work status as below table4.6-1.

TABLE4.6-1			
Silk-Screen	LED Color	EzCoverter Status Note	LED Display Status
Power	Green	Powered on	Constant on
Inverter	Yellow	Communicate with Inverter	Blink
RS-485	Yellow	Communication OK	Blink
CAN	Yellow	Communication OK	Blink
RCR	Yellow	Received command from RCR	Blink
RS-232	Yellow	Communication OK	Blink

4.7 Wi-Fi Connection

Install the antenna to inverter. Refer to Figure 4.7-1.

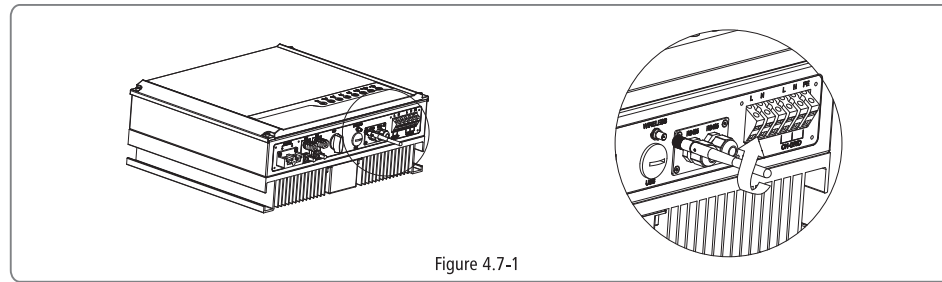


Figure 4.7-1

4.8 Wi-Fi Reset & Reload

Wi-Fi reload function is used to change the Wi-Fi configuration to default value. Please reconfigure the Wi-Fi as per Wi-Fi configure illustration after using the function.

- Long press(more than 5s, less than 8s) the touch switch until the LED Wi-Fi displays "Blink 0.5s on 0.5s off", stop pressing and Wi-Fi reset is successful. Refer to Figure 4.8-1
- Long press(more than 20s, less than 30s) the touch switch until the LED Wi-Fi displays "Blink 0.5s on 0.5s off" twice, stop pressing and Wi-Fi reload is successful. Refer to Figure 4.8-1.

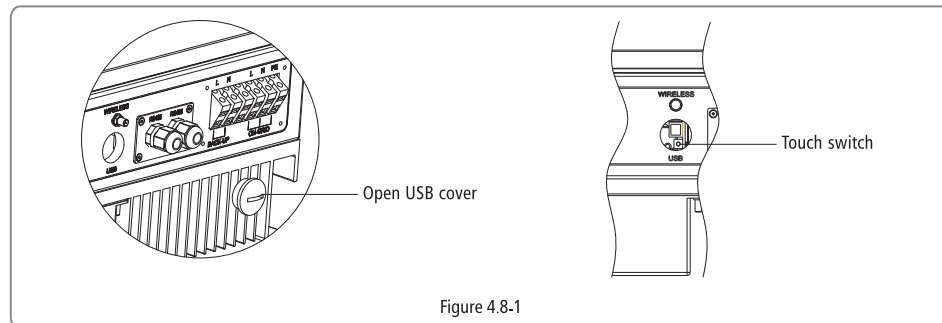


Figure 4.8-1

4.9 USB Connection

The USB communication is used for firmware update only !

Please follow below Figure 4.9-1 to implement USB connection:

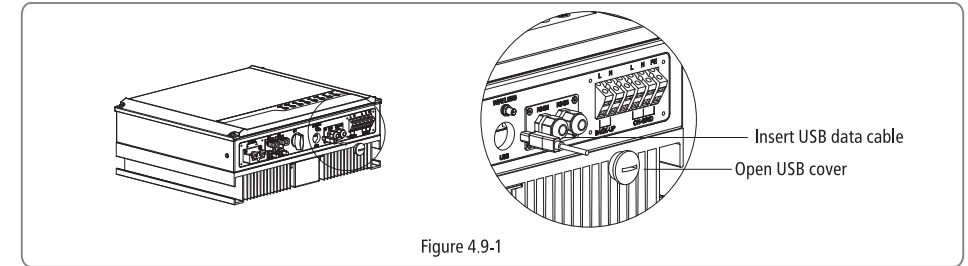
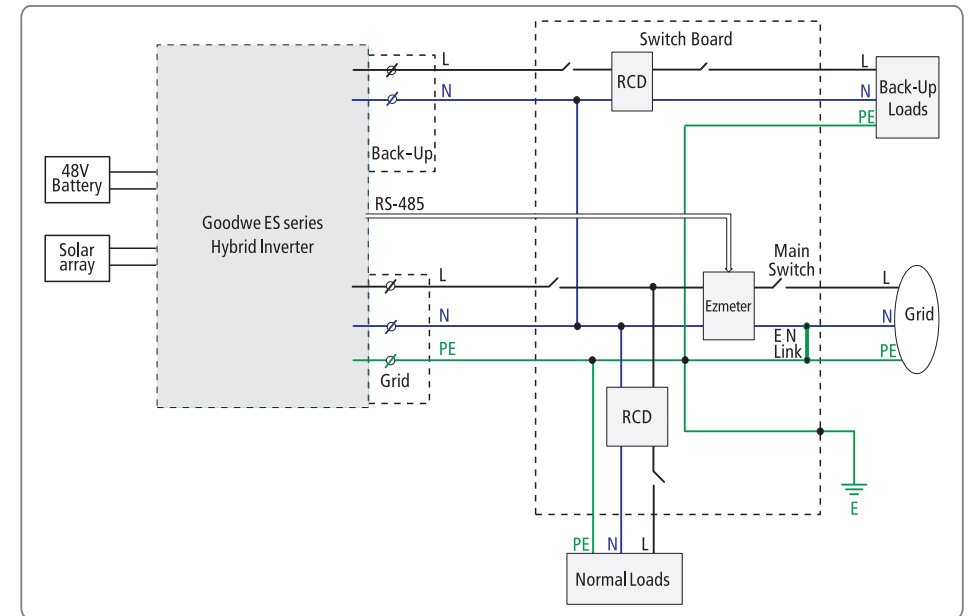


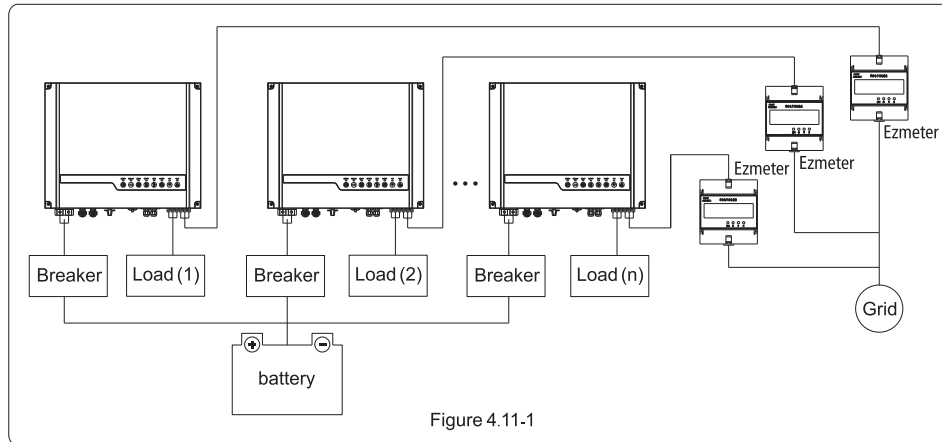
Figure 4.9-1

4.10 System Connection Diagram



Note: Not all overcurrent protection devices are included in diagram. this diagram is for Australia.

4.11 Processing method of one battery connect multiple inverters



One single battery with large capacity connect multiple inverters

Advantages: when unbalance of demand and supply appears between loads and PV in a system, the more energy from the PV side will be used in other loads, which achieves more energy for self-use.

Attention: Set the capacity of the battery as 1/n through EzManage, detail refer to 6.2(4) Battery Setting. For example, the Battery capacity is 1000Ah, connect 4 inverters, each inverter should be setted 250Ah.

Suggestion: Put a breaker in every wire respectively when connect to the battery.



In any case, 2 inverters Back-Up port can not parallel, otherwise it will damage the inverter.

5 LED Lights Illustration

SYSTEM	BACK-UP	SOLAR	BATTERY	GRID	ENERGY	Wi-Fi	FAULT
Green	Green	Blue	Blue	Blue	Yellow	Yellow	Red

INDICATOR	STATUS	EXPLANATION
SYSTEM		ON = SYSTEM IS READY
		BLINK = SYSTEM IS STARTING UP
		OFF = SYSTEM IS NOT OPERATING
BACK-UP		ON = BACK-UP IS READY / POWER AVAILABLE
		OFF = BACK-UP IS OFF / NO POWER AVAILABLE
SOLAR		ON = SOLAR INPUTS #1 AND #2 ARE ACTIVE
		BLINK 1 = SOLAR INPUT #1 IS ACTIVE / #2 IS NOT ACTIVE
		BLINK 2 = SOLAR INPUT #2 IS ACTIVE / #1 IS NOT ACTIVE
		OFF = SOLAR INPUT #1 AND #2 ARE NOT ACTIVE
BATTERY		ON = BATTERY IS CHARGING
		BLINK 1 = BATTERY IS DISCHARGING
		BLINK 2 = BATTERY IS LOW / SOC IS LOW
		OFF = BATTERY IS DISCONNECTED / NOT ACTIVE
GRID		ON = GRID IS ACTIVE AND CONNECTED
		BLINK = GRID IS ACTIVE BUT NOT CONNECTED
		OFF = GRID IS NOT ACTIVE
ENERGY		ON = CONSUMING ENERGY FROM GRID / BUYING
		BLINK 1 = SUPPLYING ENERGY TO GRID / ZEROING
		BLINK 2 = SUPPLYING ENERGY TO GRID / SELLING
		OFF = GRID NOT CONNECTED OR SYSTEM NOT OPERATING
Wi-Fi		ON = Wi-Fi CONNECTED / ACTIVE
		BLINK 1 = Wi-Fi SYSTEM RESETING
		BLINK 2 = Wi-Fi ROUTER PROBLEM
		BLINK 4 = Wi-Fi SERVER PROBLEM
		OFF = Wi-Fi NOT ACTIVE
FAULT		ON = FAULT HAS OCCURRED
		BLINK = OVERLOAD OF BACK-UP OUTPUT / REDUCE LOAD
		OFF = NO FAULT

6 EzManage Illustration

ES Series inverter has no LCD screen, it can be controlled via the APP software (EzManage). For IOS System, please go to AppStore to search for "EzManage", then download and install it. For Android System, please go to google play to search for "EzManage", then download and install it. Besides, it can be also installed by scanning the QR code on the back cover.

When ES hybrid inverter is working, please use mobile devices to select the SSID of inverter (Factory defaults is Solar - WiFi, and initial password is 12345678. If any questions, please refer to Wi-Fi Connection Guide). After accessing inverter's Wi-Fi network, you can open the App and operate the inverter.

7. Work Modes

ES series inverters have the following main work modes based on different conditions:

<p>Mode1 : Energy produced by the PV system is preferred for local load. And the excess energy is first used for charging batteries, then feeding to the grid.</p>	
<p>Mode2 : If there is no PV, battery energy is used for local load first, the grid also can supply when the battery capacity is not enough.</p>	
<p>Mode3 : If the grid is fault or there is no grid, the system can still work, PV and batteries supply energy for local load.</p>	
<p>Mode4 : The battery can be charged by the grid, time and power of battery charging can be set up flexibly.</p>	

8 Error Messages

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

Table 8-1 is the Description of Error Message

Error message	Description
Utility Loss	Grid disconnected
Fac Failure	Grid frequency no longer within permissible range
PV Over Voltage	Overvoltage at DC input
Over Temperature	Overttemperature 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
SPI Failure	Internal communication failure
DC Bus High	Overhigh BUS voltage
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
Battery Over Temperature	Battery Over Temperature
Battery Under Temperature	Battery Under Temperature
Battery Cell Voltage Differences	Li-Ion Battery Cell Voltage Differences
Battery Over Total Voltage	Li-Ion Battery Over Total Voltage
Battery Discharge Over Current	Battery Discharge Over Current
Battery Charge Over Current	Battery Charge Over Current
Battery Under SOC	Battery Capacity Low
Battery Under Total Voltage	Battery Under Total Voltage
Battery Communication Fail	Battery Communication Fail
Battery Output Short	Battery Output Short

Table 8-1

9 Technical Parameters

Model	GW5048D-ES	GW3648D-ES
Solar		
* Max. DC power(W)	5400	4200
Max. DC voltage (V)	580	580
MPPT voltage range (V)	125~550	125~550
Starting voltage (V)	125	125
Max. DC current (A)	15/15	15/15
DC overcurrent protection(A)	20	20
No. of DC connectors	2	2
No. of MPPTs	2(can parallel)	2(can parallel)
DC overvoltage category	Category II	
DC connector	SUNCLIX / MC4/ H4 (Optional)	
Battery		
Battery Type	Lead-acid or Li-Ion	Lead-acid or Li-Ion
Norminal Voltage (V)	48	48
MAX Discharge power (W)	4600	3600
MAX Charge power (W)	2300, programmable	2300, programmable
Battery capacity (Ah)	>=100 (depending requirement)	>=100 (depending requirement)
Charging curve	3-stage adaptive with maintenance	3-stage adaptive with maintenance
Charging voltage	57V, programmable	57V, programmable
Battery temperature compensation	included(Li-Ion)	included(Li-Ion)
Battery voltage sense	integrated	integrated
Current shunt	integrated	integrated
AC Output Data		
Norminal 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
AC overcurrent protection(A)	30	24
Norminal AC output	50/60Hz; 230Vac	
AC output range	45~55Hz/55~65Hz; 180~270Vac	
AC output (Back-up)	230Vac ±2%, 50Hz (60Hz Optional)±0.2%, THDv<3%(linear load)	
THDi	<1.5%	
Power factor	0.9 leading~0.9 lagging	
Grid connection	Single phase	
AC overvoltage category	Category III	
Efficiency		
Max. efficiency	97.6%	97.6%
Euro efficiency	97.0%	97.0%
MPPT adaptation efficiency	99.9%	

Model	GW5048D-ES		GW3648D-ES
Protection			
Residual current monitoring unit	Integrated		
Anti-islanding protection	Integrated		
DC switch(PV)	Integrated (optional)		
AC over current protection	Integrated		
Insulation monitoring	Integrated		
Certifications&Standards			
Grid regulation	VDE-AR-N 4105, VDE 0126-1-1, G59/3, AS4777.2/3		VDE-AR-N 4105, VDE 0126-1-1, G83/2, AS4777.2/3
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		EN61000-6-1, EN61000-6-2, EN61000-6-3, EN61000-6-4, EN61000-3-2, EN61000-3-3
General Data			
Dimensions (WxHxD)	516*440*184mm		516*440*184mm
Weight (kg)	30		28
Mounting	Wall-mounted Bracket		
Ambient temperature range	-25~60°C (>45°C derating)		
Relative humidity	0~95%		
Moisture location category	4K4H		
Max. operating altitude	2000m		
Protection degree	IP65		
Environment category	Outdoor & indoor		
External environment pollution degree	Grade1、 2、 3		
Topology	Transformerless		
Standby losses(W)	<8		
Cooling	Nature convection		
Noise emision(dB)	<25		
Display	LED light & APP		
Communication	USB2.0; Wi-Fi		

*It is recommended that the total peak power of PV strings should not exceed 130% of maximum DC power of inverter listed in the table.

**BACK-UP Load configure specification :

Inductive load: Single inductive load max power ≤1.5kW, Total inductive load power ≤2.5kW;

For example :Such as Air conditioner、Washer、Electric motor etc is inductive load;

Capacitive Load :Total capacitive load power ≤3.0kVA;

For example :Such as computer、Switch power etc is capacitive load;

Note

Overvoltage category definition

Category I : applies to equipment connected to a circuit where measures have been taken to reduce transient overvoltage to a low level.

Category II : applies to equipment not permanently connected to the installation. Examples are appliances, portable tools and other plug-connected equipment;

Category III: applies to fixed equipment downstream of and including, the main distribution board. Examples are switchgear and other equipment in an industrial installation;

Category IV: applies to equipment permanently connected at the origin of an installation (upstream of the main distribution board). Example are electricity meters, primary overcurrent protection equipment and other equipment connected directly to outdoor open lines.

Moisture location category definition

Moisture parameters	Level		
	3K3	4K2	4K4H
Temperature Range	0 ~ +40°C	-33 ~ +40°C	-20 ~ +55°C
Humidity Range	5% ~ 85%	15% ~ 100%	4% ~ 100%

Environment category definition

Outdoor : the ambient air temperature is -20~50°C, Relative humidity range is 4 % to 100 %, applied to PD3

Indoor unconditioned: the ambient air temperature is -20~50°C, Relative humidity range is 5 % to 95%, applied to PD3

Indoor conditioned: the ambient air temperature is 0~40°C, Relative humidity range is 5 % to 85%, applied to PD2

Pollution degree definition

Pollution degree 1: No pollution or only dry, non-conductive pollution occurs. The pollution has no influence.

Pollution degree 2: Normally only non-conductive pollution occurs. Occasionally, however, a temporary conductivity caused by condensation must be expected.

Pollution degree 3: Conductive pollution occurs, or, dry, non-conductive pollution occurs which becomes conductive due to condensation which is expected.

Pollution degree 4: Persistent conductive pollution occurs, for example, the pollution caused by conductive dust, rain and snow.

10 Certificates



IEC62109-1 IEC62109-2 VDE-AR-N 4105