

# USER GUIDE

IVGM4648/5048

*Hybrid solar inverter*



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## About This Manual

The manual mainly describes the product information, guidelines for installation, operation and maintenance. The manual cannot include complete information about the photovoltaic (PV) system.

## How to Use This Manual

Read the manual and other related documents before performing any operation on the inverter. Documents must be stored carefully and be available at all times. Contents may be periodically updated or revised due to product development. The information in this manual is subject to change without notice. The latest manual can be acquired via our website at <http://www.felicitysolar.com> for latest version.

## Safety Introductions

This chapter contains important safety and operating instructions. Read and keep this manual for future reference.

- Before using the inverter, please read the instructions and warning signs of the battery and corresponding sections in the instruction manual.
- Do not disassemble the inverter. If you need maintenance or repair, take it to a professional service center.
- Improper reassembly may result in electric shock or fire.
- To reduce risk of electric shock, disconnect all wires before attempting any maintenance or cleaning. Turning off the unit will not reduce this risk.
- Caution: Only qualified personnel can install this device with battery.
- Never charge a frozen battery.
- For optimum operation of this inverter, please follow required specification to select appropriate cable size. It is very important to correctly operate this inverter.
- Be very cautious when working with metal tools on or around batteries. Dropping a tool may cause a spark or short circuit in batteries or other electrical parts, even cause an explosion.
- Please strictly follow installation procedure when you want to disconnect AC or DC terminals. Please refer to "Installation" section of this manual for the details.
- Grounding instructions - this inverter should be connected to a permanent grounded wiring system. Be sure to comply with local requirements and regulation to install this inverter.
- Never cause AC output and DC input short circuited. Do not connect to the mains when DC input short circuits.

## 1. SAFETY & WARNING

This manual provides relevant information with icons to highlight the physical and property safety of the user to avoid device damage and physical injury. The Symbols used in this manual are listed as below:

Symbols	Name	Instruction
	Danger	Serious physical injury or even death may occur if not follow the relative requirements
	Warning	Physical injury or damage to the devices may occur if not follow the relative requirements
	Electrostatic sensitive	Damage may occur if not follow the relative requirements
	Hot surface	Sides of the device may become hot. Do not touch.
	Earth terminal	The inverter must be reliably grounded.
	Caution	Ensure that DC and AC side circuit breakers have been disconnected and wait at least 5 minutes before wiring and checking.
NOTE	Note	The procedures taken for ensuring proper operation.
	CE mark	The inverter complies with the CE directive.
	EU WEEE mark	Product should not be disposed as household waste.

## 2. Product Introduction

Felicity Solar IVGM4648/5048 is a multifunctional inverter, combining functions of inverter, solar charger and battery charger to offer uninterruptible power support with portable size. Its comprehensive LCD display offers user configurable and easy accessible button operation such as battery charging, AC/solar charging, and acceptable input voltage based on different applications.

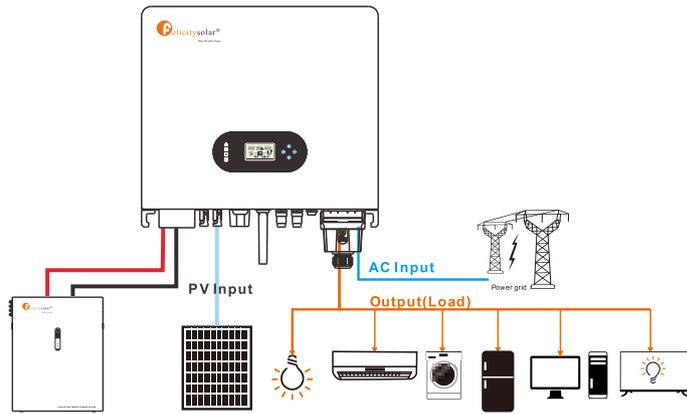
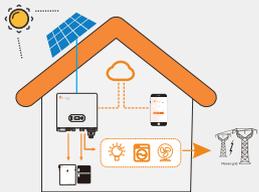


Figure 2.1-1 Block diagram of hybrid solar inverter system

## 2.1 Operation Modes

IVGM system normally has the following operation modes based on your configuration and layout conditions.

**Mode 1:** The energy produced by the PV system is used to optimize self-consumption. The excess energy is used to recharge the batteries, the rest is exported to grid.



**Mode 2:** When there is no PV, and the battery is sufficient, it can supply the load together with grid power.



**Mode 3:** When grid fails, the system automatically switches to Back-Up mode. The Back-Up load can be supported by PV and battery.



**Mode 4:** There is no PV, the battery is low, and the battery is charged through the grid.



## 2.2 Products overview

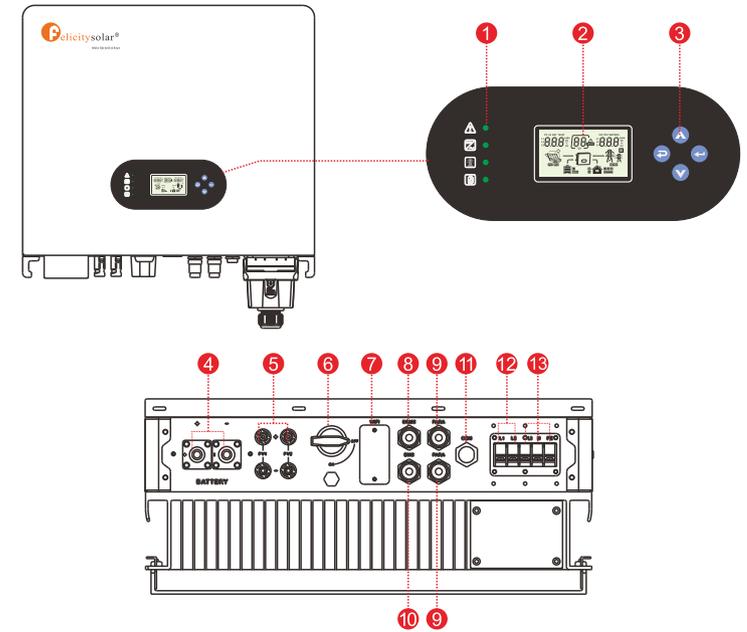


Figure 2.2-1 Products overview

- |                             |                            |                      |
|-----------------------------|----------------------------|----------------------|
| 1. Inverter Indicators      | 6. DC switch               | 10. BMS port         |
| 2. LCD display              | 7. WIFI Communication port | 11. COM port         |
| 3. Button                   | 8. DRMS port               | 12. Back-up terminal |
| 4. Battery connection port  | 9. PARA port               | 13. On-grid terminal |
| 5. PV input connection port |                            |                      |

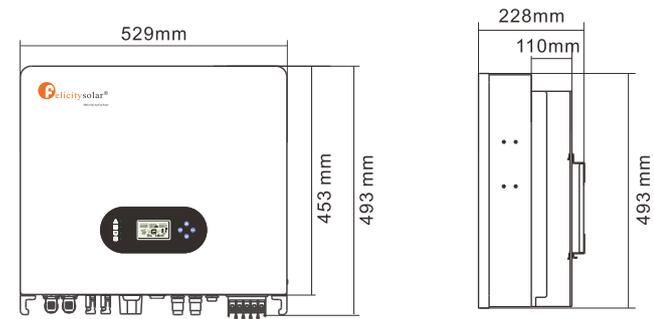


Figure 2.2-2 Inverter dimensions

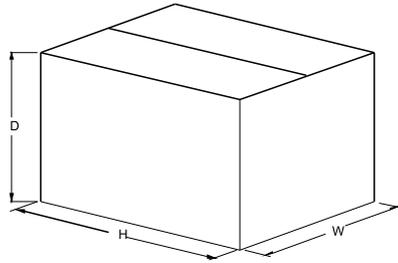


Figure 2.2-3 Paper packages dimension

Table 2-4 Packages dimension and gross weight

Model	H (mm)	W (mm)	D (mm)	Net Weight (KG)	Gross Weigh (KG)
IVGM4648/5048	632	585	315	34.8	40.0

### 3 Installation

#### 3.1 Packing List

The inverter 100% strictly inspected before package and delivery. Please check the product package and fittings carefully before installation.

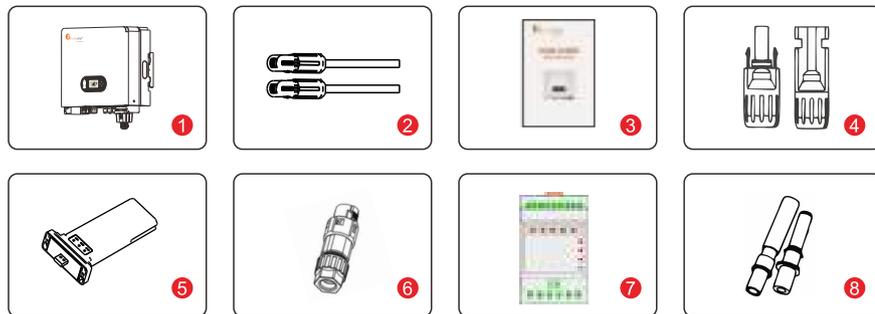


Figure 3.1-1 Packing List

Table 3.1-1 Detailed delivery list

No.	Name	Quantity
1	Inverter	1
2	Battery connector	1 pair
3	Operation manual	1
4	DC connector	2 pairs
5	WiFi module	1
6	COM connector	1
7	Meter+CT(optional)	1
8	Expansion Bolts	5

#### 3.2 Installation tools



Figure 3.2-1 Installation tools

#### 3.3 Installation Environment

- ◇ Choose a dry, clean, and tidy place, convenient for installation
- ◇ Ambient temperature range: -25°C ~ 60°C
- ◇ Relative humidity: 0 ~ 100% (non-condensed)
- ◇ Install in a well-ventilated place
- ◇ No flammable or explosive materials close to inverter
- ◇ The AC overvoltage category of inverter is category III
- ◇ Maximum altitude: 2000m



•Inverter cannot be installed near flammable, explosive or strong electro-magnetic equipment.

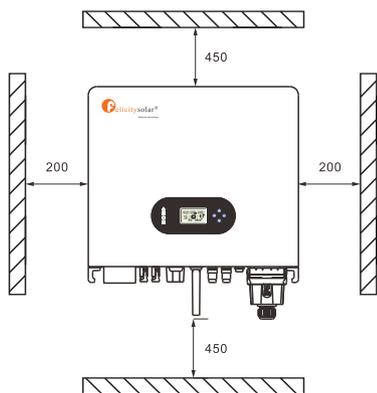


Figure 3.3-1 Installation space of one inverter

Ensure there is sufficient space for heat-releasing. Generally, space requirement should be met as below:

Table 3-3-1 Detailed installation space

	Minimum clearance
Lateral	200mm
Top	450mm
Bottom	450mm

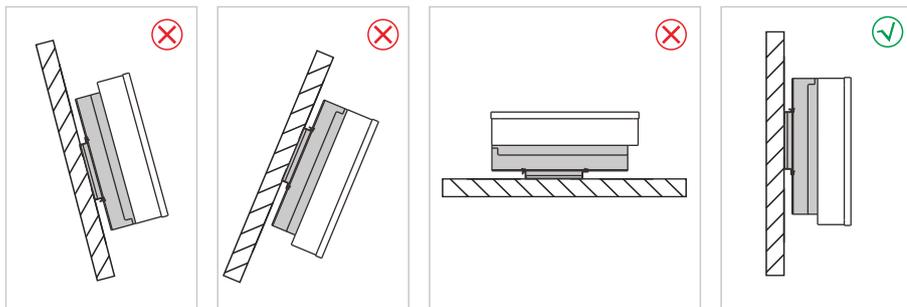


Figure 3.3-2 Installation position



•Do not open the cover of the inverter or replace any part as incomplete inverter may cause electric shock and damage the device during operation.

The installation of inverter should be protected under shelter from direct sunlight or badweather like snow,rain, lightning etc.

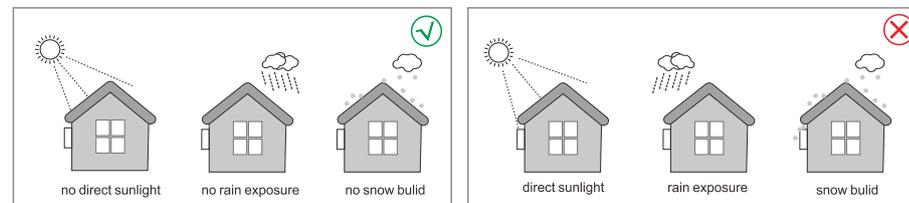


Figure 3.3-3 Installation position

### 3.4 Mounting



•The inverter is heavy, please be careful when removing it from the package.

The inverter is suitable for mounting on concrete or other non-combustible surface only.

**Step 1.** Please use the mounting bracket as a template to drill 5 holes in the right positions (10mm in diameter, and 80mm in depth). Use M8 expansion bolts in accessory box and fix the mounting with a 12mm drill bracket onto the wall tightly. The installation of inverter support is shown in Figure 3.4-1.

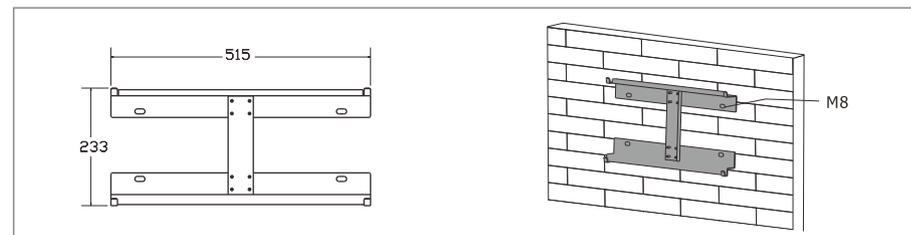


Figure 3.4-1 Install the inverter hanging plate

**Step 2.** Lift the inverter to fix it on the installation bracket, We can prevent theft by locking. See Figure 3.4-2.

NOTE

•Be careful when mounting because the inverter is very heavy.

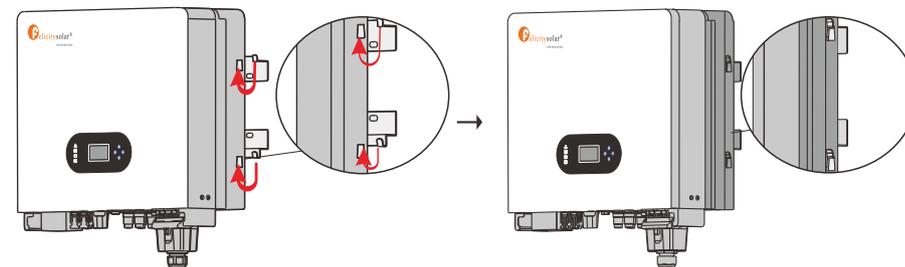


Figure 3.4-2 Installing an Inverter

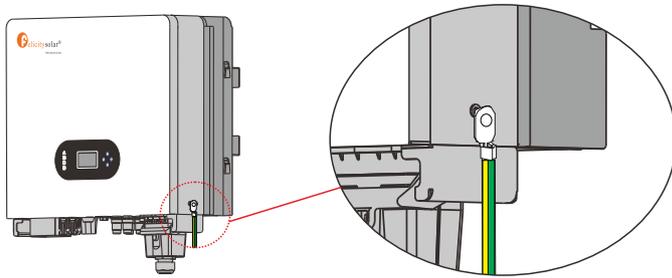


Figure 3.4-3 Rack earth(Ground wire locked by M5)

## 4 Electrical Connection

- ◇ High voltages in power conversion circuits. Lethal hazard of electric shock or serious burns.
- ◇ All work on the PV modules, inverters, and battery systems must be carried out by qualified personnel only.
- ◇ Wear rubber gloves and protective clothing (protective glasses and boots) when working on high voltage/high current systems such as INVERTER and battery systems.

### 4.1 PV Connection

Before connecting PV panels/strings, please make sure requirements are followed as below:

- (1) The total short-circuit current of PV string must not exceed inverter's max DC current.
- (2) The minimum isolation resistance to ground of the PV string must exceed 19.33kΩ in case of any shock hazard.
- (3) PV string could not connect to earth/grounding conductor.
- (4) Use the right PV plugs in the accessory box.

Wire Size	Cable(mm)
12AWG	7

#### Step 1. Prepare PV positive and negative power cables

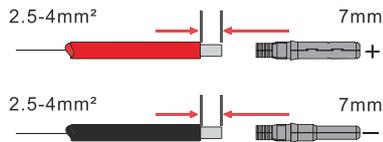


Figure 4.1-1 pv cables and pv plugs

#### Step 2. Connect PV cables to PV connectors. See Figure 4.1-2.

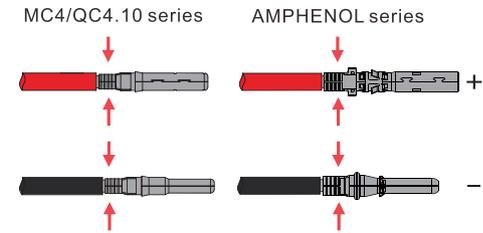


Figure 4.1-2 PV cables to PV connectors

#### NOTE

- PV cables must be tightly crimped into the connectors.
- For Amphenol connector, the limit buckle cannot be pressed.
- There will be a "click" sound if connectors are inserted correctly into PV plugs.

#### Step 3. Screw the cap on and plug it onto inverter side. There will be a click sound if connectors are inserted correctly into PV plugs. See Figure 4.1-3.

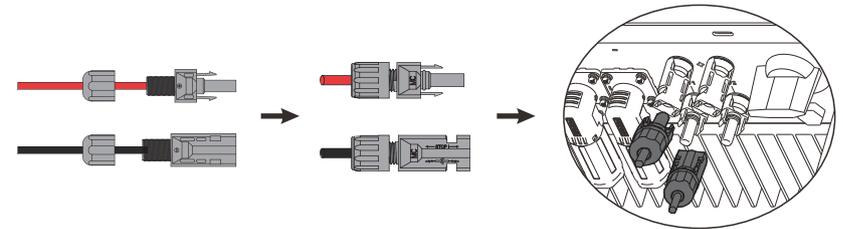


Figure 4.1-3 The PV plug is connected to the inverter



- The polarity of PV strings cannot be connected reversely, otherwise the inverter could be damaged.

### 4.2 Battery Connection

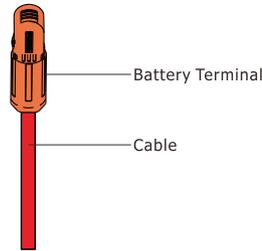
Please be careful about any electric shock or chemical hazard. Make sure there is an external DC breaker (125A) connected to the battery without build-in DC breaker.



- The polarity of battery cannot be connected reversely, otherwise the inverter could be damaged.

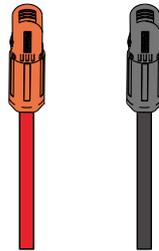
Wire Size	Cable(mm)
1/0AWG	25

**Step 1.** Prepare battery cables and accessories, and route the battery power cable through the battery cover. Use accessories box accessories, battery power cable 20-35mm<sup>2</sup>.



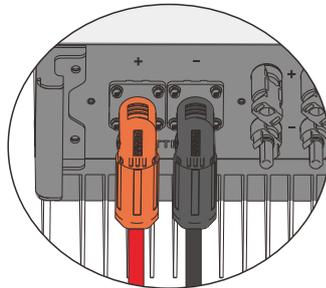
**Figure 4.2-1** Battery cable and battery case

**Step 2.** Make battery terminals. Strip cable coat, revealing 10mm length of metal core. Use special crimper to compress battery terminal tightly.



**Figure 4.2-2** The battery terminal

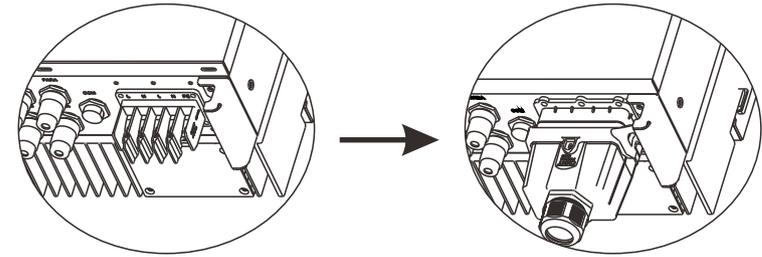
**Step 3.** Connect the battery terminal to the inverter. Ensure that the battery polarity is connected correctly.



**Figure 4.2-3** The battery terminal is connected to the inverter

## 4.3 On-Grid & Back-Up Connection

An external AC breaker is needed for on-grid connection to isolate from grid when necessary. The requirements of on-grid AC breaker are shown as below.



**Figure 4.3-1** Install AC cables for the inverter



• Don't connect the PE wire wrong.

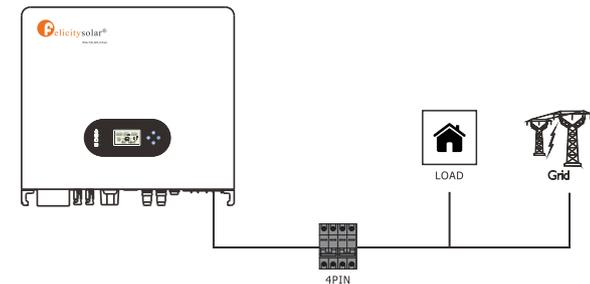
Table 4.3-1 : Recommended table of AC circuit breakers

INVERTER MODEL	AC BREAKER SPECIFICATION
IVGM4648/5048	40A/230V,2P

**NOTE**

• The absence of AC breaker on back-up side will lead to inverter damage if an electrical short circuit happens on back-up side.

1. On the AC side, the individual breaker should be connected between inverter and Grid but before loads. See Figure 4.3-2.



**Figure 4.3-2** Ac breaker connection



• Make sure the inverter is totally isolated from any DC or AC power before connecting AC cable.

**Step 1.** Prepare the terminals and AC cables as below. See Figure 4.3-3.



**Figure 4.3-3** Ac connection line

Table 4.3-2 : Ac cable specifications

Grade	Description	Value
A	Outside diameter	13-18 mm
B	Separated wire length	20-25 mm
C	Conductor wire length	7-9 mm
D	Conductor core section	4-6 mm

**Step 2.** Using the terminals in the accessory box, pass the AC cable through the terminal cover. See Figure 4.3-4.

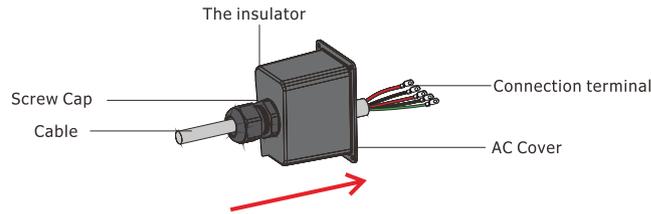


Figure 4.3-4 The AC cable passes through the terminal cover

**Step 3.** Install the AC connection terminal on the cable. See Figure 4.3-5.

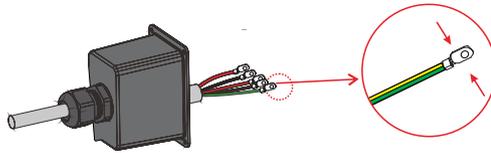


Figure 4.3-5 Install ac connection terminals

**NOTE**

- The absence of AC breaker on back-up side will lead to inverter damage if an electrical short circuit happens on back-up side.

**Step 4.** Connect the combined AC cable to the AC terminal of the inverter, tighten the cable to a torque of 2.0 N.m to 2.5 N.m, and then lock the AC cover. See Figure 4.3-6.

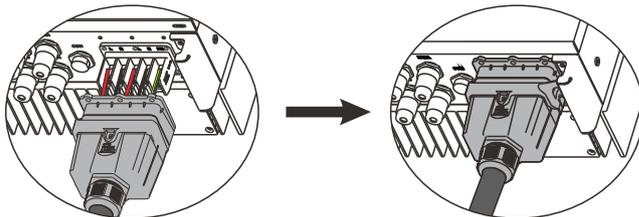


Figure 4.3-6 Install ac connection terminals

### 4.4 Smart Meter & CT Connection

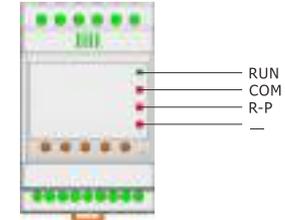


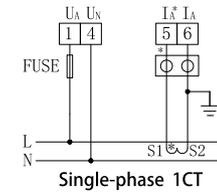
Figure 4.4-1 Smart Meter

Table 4.4-1 :Smart Meter LED Indications

STATUS	OFF	ON	Blinking
Run (Green)	The instrument is not running	/	The instrument is running normally
Com (Red)	The instrument is not communicating	/	The instrument is in communication status
R-P (Red)	Positive power	Negative power	/
- (Red)	/	Negative value indicator lamp	/

Connection Mode

The connection diagram on the instrument housing shall prevail in case of any discrepancies with it.



It is recommended to use 0.5A or 3A for the fuse in the connection diagram;



- Make sure the inverter is totally isolated from any DC or AC power before connecting AC cable.

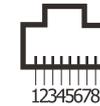


Figure 4.4-2 RS485 interface

Table 4.4-2 :RS485 interface

NO.	1	2	3	4	5	6	7	8
Function	485A	485B	485A	GND1	GND1	485B	NC	NC

The Smart Meter with CT in product box is compulsory for IVGM system installation, used to detect grid voltage and current direction and magnitude, further to instruct the operation condition of IVGM inverter via RS485 communication. See Table 4.4-3.