

# **Installation instructions**

solar off grid system

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# 1、 Product description

## (1) Introduction for Donper solar off-grid tied system

Solar energy off-grid power generation system is a kind of clean energy product, this product can break away from power grid, generate electricity independently, it make use of the photovoltaic effect of PV module to change the luminous energy to electricity. It can supply life power for the district lack of or no electricity.

Product Features:

- 1) Safe and reliable, Working without noise, no mechanical rotating components, low failure rate and long service life.
- 2) The system are environmental protection and beautiful, not affected by geographical location limit, Easy install, and it is convenient to move.
- 3)It is very convenient to combine with constructions, no need to lay the electricity transmission line in advance , it can reduce the cost of setting the long distance transmission cable and very friendly to surroundings
- 4) Working voltage stability, the power quality is high, widely applied in all kinds of electric facility, so it is very suitable to be a kind of electric power in country side, farm, Mountains, the islands, highway Etc. and it can also be used as an emergency power supply.
- 5) The cost performance of system configuration is high, combined with the local sunshine resources and electrical loads, and then,optimize the whole designing, make sure all the power supply is normal

## (2) System configuration and classification

### 2.1 System configuration and principle

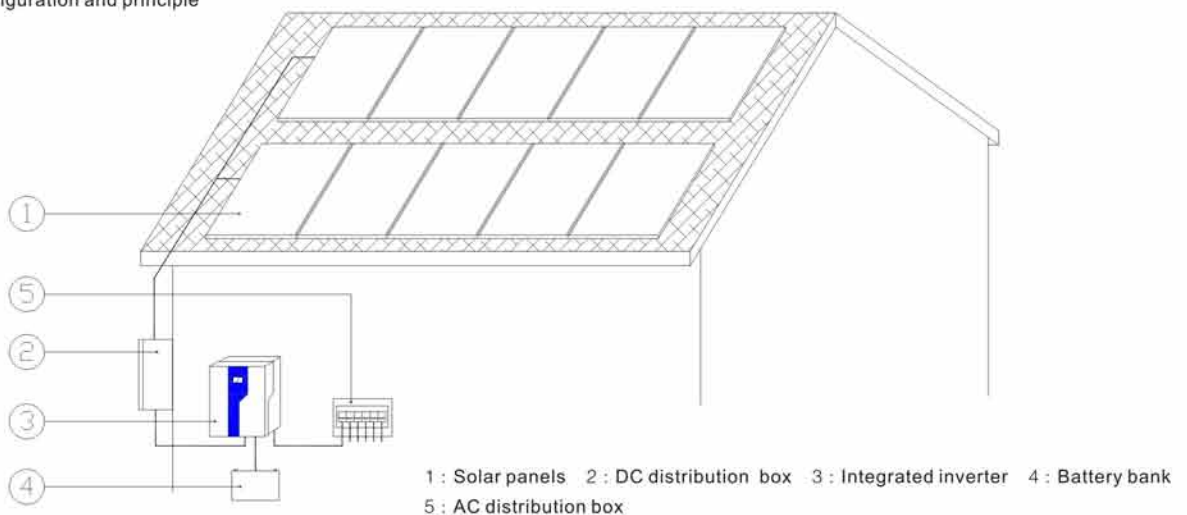


Figure 1 : System schematic diagram

This system contains solar panels, DC distribution box, Integrated inverter ( or controller and inverter ) , battery bank and AC distribution box.

The operating principle of this system: a: Solar panel ① Receive the sun's luminous energy and transform it into DC electricity. b: DC distribution box② collect DC electricity , and deliver it into integrated inverter ③. c: Inverter transform the DC electricity into AC electricity. And the AC distribution box collect the AC electricity. d: Meanwhile, the spare power will be store at battery bank by integrated inverter ③. e: PV array will not work during night or rainy days, and Battery bank④ will provide energy to integrated inverter ③, to keep the system running.

### 2.2 System classification

When the user choosing the off-grid tie inverter from Donper Solar, please check the information as below:

2.2.1 Please check your roof firstly, the location will be sloping roof or flat roof. As below:



Figure 2: Sloping roof



Figure 3: Flat roof

2.2.2 The system can be classified into discrete system and All-in-One for system. As following in Figure 4 and Figure 5:

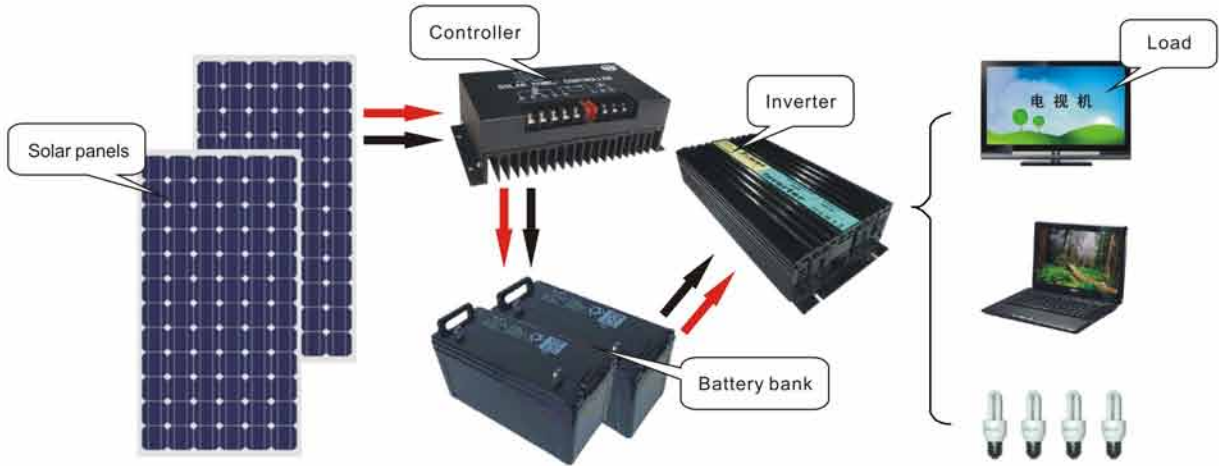


Figure 4 Discrete system

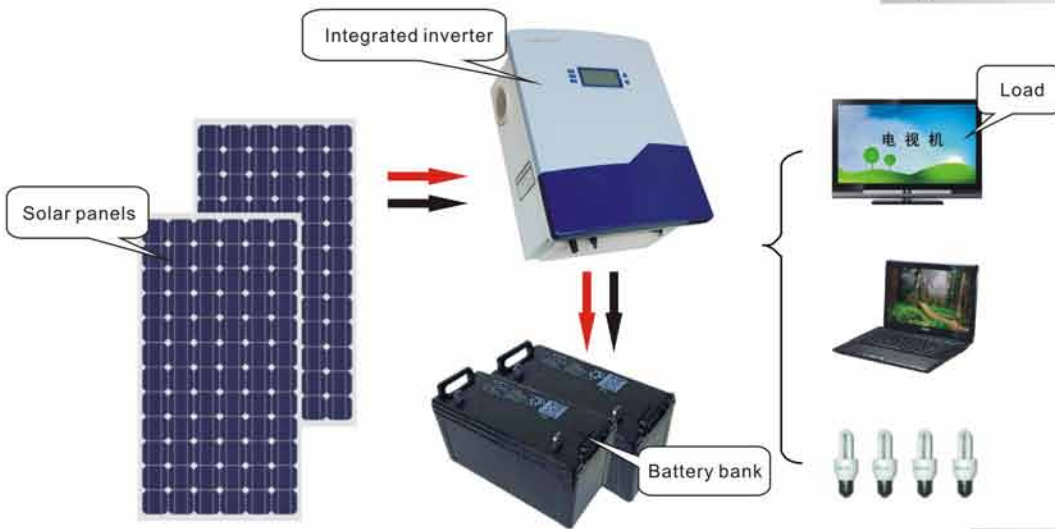


Figure 5 All-in-One for system

2.2.3 Power supply mode can be divided into independent style and utility-backup style(As Figure 6 show).This utility-backup system have two power supply. One is solar power generation,and the other is AC power from Utility. The system automatic shift to AC power when the battery bank is empty.



Figure 6 utility-backup style

## 2、Pre-installation preparation

### (1) Out of box audit

Please check the product according to the packing list, also carefully check if there is any damage on the package and appearance. If any damage, you can take a photo as evidence and send to us.

### (2) Tools preparation

Before installation, please prepare the tools, such as pliers, hammers, screwdriver, hexagonal wrench, adjustable wrench, measuring tape, utility knife, adhesive tape, test pencil, multimeter, etc. The details as the right figure shown, in addition, we will recommend you to prepare a hand held electric drill before installation, which is used to drill holes and fasten the bolts and screws.



Figure 7 Packaged combination of tools (reference)

### (3) Protective equipment

#### 3.1 Preparation

To ensure safety and prevent accidents, please wear and prepare the following protective gear before installation as figure 8 shown.

- Safety helmet, sunglasses
- Safety belt
- Non-slip shoes
- Tool bag



Figure 8 Safeguard procedures schematic

#### 3.2 Electric-shock safeguard

The output voltage for PV modules is about 35V, after series connection, the total voltage will over human safety voltage. The the following effective countermeasure for protection against electric shock as figure 9 shown.

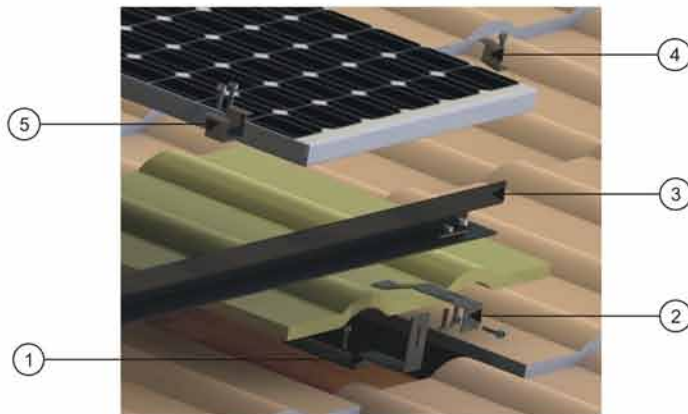
- Please cover the visor on the PV modules surface to keep out the sunlight.
- No operating in rainy day.



Figure 9 Electric-shock safeguard schematic

### 3. System installation

(1) Installation for sloping roof bracket



No.	item name
①	Embedded fittings
②	Adjusting block
③	Fixed beam
④	Side briquetting
⑤	Middle briquetting

Figure 10 Installation for sloping roof bracket

1.1 Accessory for bracket

Pic.	Code	item name	Specification
	①	Embedded fittings	Before installation and fixing the embedded fittings, please confirm the embedded position, then take off the tile and fix the embedded fitting on the beak of the roof with expansion bolt
	②	Adjusting block	It is used for adjust the tile height and position for beam.
	③	Fixed beam	It is used for installing PV modules.
	④	Side briquetting	It is used to fix the bottom of beam and the side of the last PV module.
	⑤	Middle briquetting	It is used to fix the PV module on the beam.

1.2 Installation Steps for bracket

<p><b>a) Confirm the installation position according to the size of PV modules and bracket.</b></p>	
<p>Note:</p> <ul style="list-style-type: none"> <li>• At first please confirm the installation position;</li> <li>• And install the modules facing south;</li> <li>• And the tiling can bear the weight of the PV modules.</li> </ul>	
<p><b>b) Take off the tile to install the bracket</b></p>	
<p>Notice&amp;step:</p> <ul style="list-style-type: none"> <li>• To be careful when installing on the roof;</li> <li>• And take off the tile lightly.</li> </ul>	

c) The installation of embedded fittings(No.1)	
<p>Notice&amp;step:</p> <ul style="list-style-type: none"> <li>• Place the bracket in right location;</li> <li>• Prepare M8×30 self-drilling screws;</li> <li>• Prepare an electric drill;</li> <li>• Push the screw vertically and then fasten it.</li> </ul>	
Cover the tile after finishing the installation	
<p>Please note:</p> <ul style="list-style-type: none"> <li>• Cover the tile.</li> <li>• Check the gap of each tile, to avoid leaking.</li> </ul>	
d) The installation of the adjusting block(No.2)	
<p>Notice&amp;step :</p> <ul style="list-style-type: none"> <li>• Put the adjusting block on the embedded fittings;</li> <li>• Connect the M8 × 30 hexagon socket screw with the M8 nut;</li> <li>• Fasten the bolt with wrench.</li> </ul>	
Then install the other No. 1,2 accessories	
<p>Notice&amp;step :</p> <ul style="list-style-type: none"> <li>• Ensure the quantity and position.</li> <li>• Install the accessoires according to the above steps.</li> </ul>	
e) The installation of fixed beam(No.3)	
<p>Notice&amp;step :</p> <ul style="list-style-type: none"> <li>• Differentiate the upper fixed beam and under fixed beam before installation;</li> <li>• Connect the fixed beam with M8×30 bolt and M8 nuts;</li> <li>• Fasten the bolt with wrench.</li> </ul>	
Then install other fixed beam	
<p>Notice&amp; step :</p> <ul style="list-style-type: none"> <li>• Fasten the fixed beam and adjusting block by bolts.</li> </ul>	

## (2) The installation of solar panel

### 2.1 Precautions

As the solar panel is glass-surfaced, please note the caution tips below when installing it:

Do not install it in rainy days	Do not use fire during the installation process	Never step or sit on the glass surface of the solar modular	Do not strike it	Do not fix it with nail

2.2 Installation step

a) The placement of the PV modular	
<p>Notice&amp;step :</p> <ul style="list-style-type: none"> <li>• Please handle with care so as to avoid the damage of the PV modular;</li> <li>• Make sure the PV modular face the same direction;</li> <li>• Place the PV modular on the top of the fixed beam.</li> </ul>	
b) The installation of the side beam(No.4)	
<p>Notice&amp;step :</p> <ul style="list-style-type: none"> <li>• Fix the downside of the PV modular with side beam(No.4);</li> <li>• Fasten the fixed beam(No.3) with side beam(No.4) with bolt;</li> <li>• Connect the M8 x 30 hexagon screw with the M8 nut;</li> <li>• Fasten the bolt with M8 hexagon wrench.</li> </ul>	
Then fasten the upper side of PV panel	
<p>Then fasten the upper side of PV panel;</p> <ul style="list-style-type: none"> <li>• Firm both sides with briquetting in the same method mentioned in step b.</li> </ul>	
c) The installation of middle beam(No.5)	
<p>Notice&amp;step;</p> <ul style="list-style-type: none"> <li>• Fix the first piece of modular and the second one with a middle briquetting;</li> <li>• Installation steps are some with step b.</li> </ul>	
d) Finish the installation of other moduls in the row using the same procedure	
<p>Notice&amp;step;</p> <ul style="list-style-type: none"> <li>• Connect other moduls in order;</li> <li>• Fix adjacent moduls with middle beam(No.5);</li> <li>• Fix the moduls at both sides of the bracket with side beam(No.4).</li> </ul>	

(3) Installation and connection of battery

3.1 installation location:

- Install it in airy indoors.
- No fire and heat source nearby.
- The ambient temperature should not higher than 25°C.
- The place should be solid and flat.
- Install it in the place where is out the reach of children.

3.2 Install it in airy indoors

It should be equipped brackets if the system is higher than 48V, please check the picture.



Figure 11 The brackets for batteries(depends on goods)



3.2 The placement of the battery

Place the battery piece by piece on the bracket. Handle with care to avoid the damage of the battery shell caused by collision. Shown as the picture on the right:



Picture 12 Battery bank

3.3 The connection of battery

- Please remember that the red battery terminal is the positive pole and the black one is the negative pole when connecting the battery.

Discriminate the positive pole and negative pole	
<p>First discriminate the the positive pole and negative pole; generally, the red battery terminal is positive pole and the black one (or blue one) is negative pole.</p> <p>Note: do not short-circuit the anode, which can lead to the unrecoverable damage to the battery, even the safety accident.</p>	

- In some circumstance, the battery terminal is adopted for fast connection. As shown in picture 13.
- Use the wire that fixed with connecting nose at both ends for connection when there are many pieces of batteries that needed to be connected. Shown as the picture 14.



Picture 13 battery terminal



Picture 14 : connection wire of the battery

- Battery connection steps:

3.3.1 adopt an battery terminal for fast connection if the battery group  $\leq 4$ :

connect the battery in series	
<p>Clamp the positive pole(the red) of one battery to the negative pole(the black or blue) of another one with a battery terminal. Shown as the picture on the right.</p>	

3.3.2 adopt a connecting nose for connection if the battery group  $\geq 4$ :

Batteries Series	
<p>Clamp the positive pole (the red) of one battery to the negative pole (the black or blue) of another one with a connecting nose. Shown as the picture on the right.</p> <p>Note: the battery voltage is 12V. Please determinate the needed battery series (divide the system rated DC voltage by 12, then we can get the series number).</p>	
48V system series	
<p>Connect four pieces of battery in series in the method mentioned above, then the system voltage would turn into 48V.</p> <p>The system that above 48V can also adopt the above method.</p>	

**(4) Installation of integrated inverter**

4.1 installation location

- Install it in airy indoors
- No magnetic field interference nearby
- The wall should be solid and flat
- Install it to the height above 1.5 meter which is out the reach of children

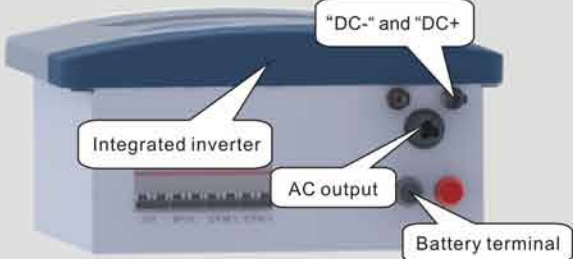
4.2 installation steps

a) Marking and boring	
<ul style="list-style-type: none"> <li>• Map out the installation position and measure the distance between each hole. Mark them out with marking pen.</li> <li>• Boring the mark with an electric drill. The diameter of the hole is 10mm and the depth of it is about 50mm.</li> </ul>	
then install the expansion bolt	
<p>Drill the four marked holes on the wall in order. Then drive the M8×30 expansion bolt into the hole.</p>	

b) "Wall-hook" installation	
Fasten the (Wall-hook) to the wall by expansion bolt.	
c) Integrated inverter installation	
	
Please note the four back holes are locked well with "Wall-hook" (as above image).	





### (5) System electrical connection

This means cables connection of PV array output, battery terminal. DC terminal&AC terminal etc, whole system will be running after electricity bus is connected.

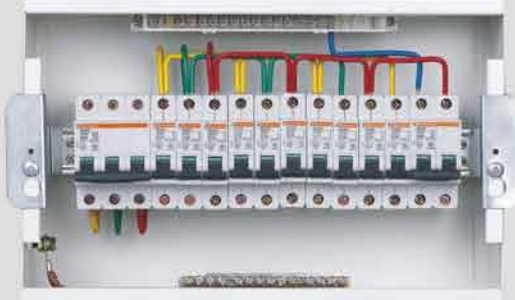

系统电气连接	
<p>Following below steps to install:</p> <ul style="list-style-type: none"> <li>• Connect positive&amp;negative terminals into integrated inverter terminal.</li> <li>• Connect load lines into AC output of integrated inverter.</li> <li>• Connect PV array output into "AC-"&amp;"AC+" of integrated inverter.</li> </ul> <p>Note: Ensure Switch off when installing cables.</p>	

Follow more details operation as below:  
5.1 Battery& Integrated inverter connection

a) Empty bus line of battery's positive&negative terminal.	
Series batteries, left the last positive terminal and negative terminal. these two terminal will be connected with Integrated inverter.	

<p>And then, Use multimeter to measure the open-circuit voltage of the series battery, the result should drop in 1.05 times~1.2 times of rated voltage. Start next step if no fault.</p>	
<p>b) prepare bus cables for battery.</p>	
<p>Choose the bus cable length according to the distance between battery bank and integrated inverter. Check right image, Red is positive pole cable, Black is negative pole cable. both ends of cables will be matched with M8 copper wire nose.</p>	
<p>c) Integrated inverter connection</p>	
<p>Connect the cables of battery bank by M8 copper wire nose</p>	
<ul style="list-style-type: none"> <li>• Connect bus cables of battery to integrated inverter.</li> <li>• Red cable connect positive pole, Black cable connect negative pole.</li> </ul> <p>Note: Confirm switch off when installing cables.</p>	

## 5.2 Loads & integrated inverter connection

<p>a) Prepare AC distribution box</p>	
<p>The loads with solar electricity using must be connect with a separate AC distribution box, as right image. Warn: The line of solar power electricity load can not be mixed with other type line. The electricity switch and line of AC distribution box should be operate by specialist.</p>	
<p>b) Prepare bus line of AC output.</p>	
<ul style="list-style-type: none"> <li>• Match an 3*2.5mm²BVVB to the aviation plug, strip 10-15mm at the end of the line.</li> <li>• The length of bus line is confirmed by installation situation.</li> </ul>	

<b>b) Connection of integrated inverter</b>	
<p>Insert the aviation plugs to the integrated inverter.</p> <p>Note: Confirm and make sure the AC output switch are in power off state before connection.</p>	
<b>c) Connection of AC distribution box</b>	
<ul style="list-style-type: none"> <li>• Connect the end of aviation plug wire (peel 10~15mm of wire) to the AC distribution box.</li> <li>• Notice the live line, null line and earth line.</li> <li>• Make sure the all the switch are in power off state before connection.</li> </ul>	

5.3 Connection between solar panel and integrated inverter

<b>a) Neaten the output wire of solar panel</b>	
<p>Put the positive and negative pole of wire on the surface of solar panel.</p>	
<b>b) Assemble solar panel</b>	
<ul style="list-style-type: none"> <li>• Series connect the solar panel.</li> <li>• Neaten the wire after solar panels are series connection and tighten by ribbon.</li> <li>• The positive pole of the first solar panel and negative pole of the last solar panel are used as the output bus line, connect to the integrated inverter by using MC4 connector with connecting cable.</li> </ul>	
<p>Notice:</p> <p>There are several groups after series connect the solar panels, If match with the header box, insert the corresponding series connecting group to the terminal of header box. If there is no header box, parallel connect the each series connecting group.</p>	
<b>c) Preparation of PV bus line</b>	
<ul style="list-style-type: none"> <li>• Use the proper length of PV bus line according to distance between solar array and integrated inverter. (the length of bus line matched is 15 meters, the user can lengthen the bus line if needed).</li> <li>• Well connect the bus line and positive and negative pole of solar panels by using MC4 connector, pave the line according to the structure of house.</li> </ul> <p>Note: pay attention to the positive and negative pole.</p>	

**d) Connection of integrated inverter**

Well connect the bus line and positive and negative pole of solar panels to the integrated inverter by using MC4 connector.



Please well check after system connection completed, active according to the wiring order.

## 4、The daily maintenance and troubleshooting

### (1) Daily maintenance

The user can arrange time for system inspection flexibly. It is recommended to check the system once a month. Please refer the checking list below and contact us or local agent for help if disfunction arise.

Item	visual inspection
PV array	<ul style="list-style-type: none"> <li>• Check if there is dirt or damage on the surface.</li> <li>• Check if the outside wiring is damaged.</li> <li>• Check if the bracket is corroded, rust or loosen.</li> <li>• Check if the ground wire is damaged or loosen.</li> </ul>
Distribution box	<ul style="list-style-type: none"> <li>• Check if the surface is corroded or rust.</li> <li>• Check if the outside wiring is damaged or loosen.</li> <li>• Check if the ground wire is damaged or loosen.</li> </ul>
Grid tie inverter	<ul style="list-style-type: none"> <li>• Check if the surface is corroded or rust.</li> <li>• Check if the outside wiring is damaged or loosen.</li> <li>• Check if the ground wire is damaged or loosen.</li> <li>• Check if there are strange noise or smell during the operation and if the filter net of the air-vent is obstructed.</li> <li>• Check if there the installation environment is wet, high-temperature, intense magnetic field.</li> </ul>
Grounding	<ul style="list-style-type: none"> <li>• Check if the wire is damaged or loosen.</li> </ul>

### (2) Common failures and troubleshooting

Failures	Reason	Solution
NO AC output	<ul style="list-style-type: none"> <li>• No power in the battery</li> <li>• AC output short circuit protection</li> <li>• Overload</li> <li>• Equipment failure</li> </ul>	<ul style="list-style-type: none"> <li>• Charge the battery then turn on.</li> <li>• Check the load line and reactive the system.</li> <li>• Turn off the high power load.</li> <li>• Call after-sale department.</li> </ul>
No charging	<ul style="list-style-type: none"> <li>• Dust or obstruction on the solar panel</li> <li>• Bad contact of wire</li> </ul>	<ul style="list-style-type: none"> <li>• Clean the solar panel.</li> <li>• Well connect the wire.</li> </ul>
System unstable working	<ul style="list-style-type: none"> <li>• High-intensity magnetic field nearby</li> <li>• High power inductive load frequently active</li> </ul>	<ul style="list-style-type: none"> <li>• Move or add shield.</li> <li>• Turn off the high power inductive load.</li> </ul>
Sustaining power is not enough	<ul style="list-style-type: none"> <li>• Not full charge the battery</li> <li>• The working temperature of battery is too low</li> <li>• Battery failure</li> </ul>	<ul style="list-style-type: none"> <li>• Charge the battery.</li> <li>• Keep the working temperature at about 25℃.</li> <li>• Change the battery.</li> </ul>



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