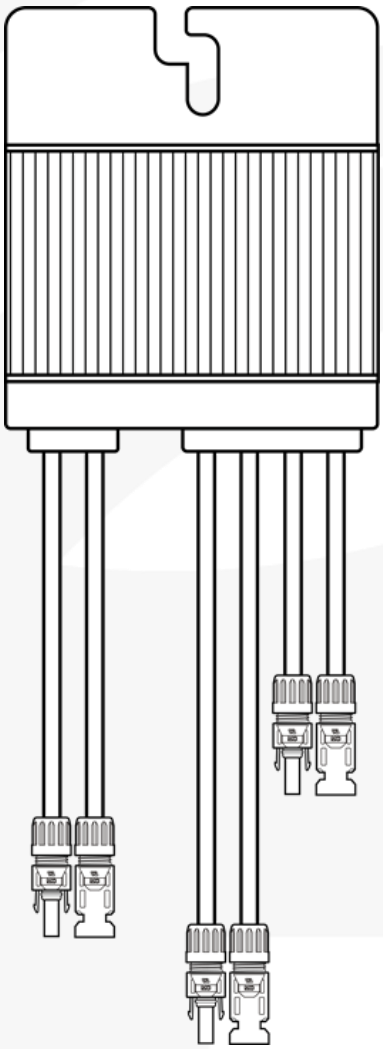
Smart PV Optimizer

SP4-1600W-AL

User Manual



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About this manual

This document describes the features, electrical parameters, and product structure of PV Optimizer.

The pictures in this article are for reference only, and the actual product shall prevail.

Scope of application

This manual is mainly for the following products:

PV Optimizer（Standard：SP4-1600W-AL）

Unless otherwise specified, the "Optimizer" is referred to hereinafter.

Intended Readers

- Sales Engineer
- Technical Support Engineer
- Maintenance Engineer

Manual use

Please read the manual carefully before using the product and keep the manual in a place where it is easily accessible.

The contents of the manual will be constantly updated and corrected, but it is inevitable that there will be slight discrepancies or errors with the actual product.

Users should refer to the actual product purchased, and can enter http://www.solarpilot.com/ or download the latest version of the brochure from your sales channel.

Symbolic conventions

In order to ensure the safety of the user's person and property when using the product, and to use the product more efficiently and optimally, the relevant information is provided in the manual and highlighted by the following symbols. The following is a list of symbols that may be used in this manual, so please read them carefully so that you can use this manual better.

DANGER	Indicates a situation with a high potential danger that, if not avoided, would result in death or serious injury to a person.
WARNING	Indicates a moderate potential hazard that, if not avoided, could result in death or serious injury to a person.
CAUTION	Indicates a low potential hazard that, if not avoided, could result in moderate or minor injury to a person.
NOTICE	It is used to convey equipment or environmental safety warning information. Failure to do so may result in device damage, data loss, reduced device performance, or other unpredictable results. "Notice" does not involve personal injury.

NOTE	Supplemental notes on key messages in the main text. The "Explanation" is not a safety warning and does not involve information about personal injury, equipment or environmental injury.

Directory

1 Safety Instructions

As a power electronic device, the optimizer must comply with relevant safety regulations during its installation, commissioning, operation and maintenance. Unreasonable use or mishandling may result in:

- Harm the life and personal safety of the operator or a third party.
- Damage to the optimizer or other property belonging to the operator or third parties.

Precautions during operation are detailed in the respective sections.

NOTE

The safety precautions in this manual cannot contain all the specifications that should be followed, and all work should be carried out in combination with the actual situation of the site.

SolarPilot is not responsible for any loss caused by not following the safety precautions in the manual.

1.1 General Security Considerations

- When carrying out all operations of this product, it is necessary to strictly follow the relevant equipment precautions and special safety instructions provided by SolarPilot. The personnel responsible for the installation and maintenance of SolarPilot equipment must first undergo strict training, understand various safety precautions, and master the correct operation methods before installing, operating and maintaining the equipment. SolarPilot shall not be liable for any violation of the general safety operating requirements and the safety standards for the use of equipment.
- Before starting the operation, please read the precautions and operating instructions of this manual carefully to avoid accidents. The "Hazards", "Warnings", "Precautions" and "Precautions" in each manual do not represent all safety precautions to be observed, and are intended to supplement the safety precautions during various operations.
- Operators should comply with local regulations and norms. The safety precautions in the manual are intended only as a supplement to local safety regulations.
- It is strictly forbidden to wear watches, bracelets, rings and other easily conductive objects on the wrist during operation.
- Special insulating tools must be used during operation.
- Torque wrenches should be used to set the screws, and red or blue logos should be used for double inspection. After the installer confirms that the screws are tightened, paint the blue logo on the screws. After the inspector confirms the tightening, it is marked in red. If the screws or bolts securing the equipment are not installed in accordance with the torque requirements, there is a risk that the equipment will come loose from the mounting.
- Installation or maintenance operations must be carried out in accordance with the sequence of the tasks and the structure and installation sequence of the equipment should not be changed without the permission of the manufacturer.
- Installation must be carried out in strict accordance with the requirements of the Quick Guide.

1.2 Statement

In the event of any of the following circumstances, SolarPilot has the right not to carry out quality assurance.

- Shipping damage.
- Damage caused by storage conditions that do not meet the requirements of the product documentation.
- Incorrect device installation and use.
- Unqualified personnel for equipment installation and use.
- Failure to follow the operating instructions and safety warnings in the product and documentation.
- Operate in harsh environments beyond product and documentation specifications.
- Operate outside the range of parameters specified in the applicable technical specifications.
- Unauthorized disassembly, alteration of the product, or modification of software code.
- Equipment damage caused by abnormal natural environment. (Force majeure, such as lightning, fire, storm, etc.))
- The warranty period has expired and the warranty service has not been extended.
- Any installation and operating environment that exceeds those specified in the relevant international standards.

1.3 Requirements for Personnel

Installation, electrical connections, maintenance, troubleshooting, and replacement operations of the optimizer must be carried out by a professional electrical technician.

- Operators need to be professionally trained.
- Operators need to read this manual in its entirety and master the safety matters related to the operation.
- Operators need to be familiar with the relevant safety regulations for electrical systems.
- The operator should be fully familiar with the composition and working principle of the entire photovoltaic grid-connected power generation system, as well as the relevant standards of the country/region where the project is located.
- Operators must wear personal protective equipment.

1.4 Identity Protection

- The warning signs on the optimizer contain important information about its safe operation, and it is strictly forbidden to tamper or damage it.
- There is a nameplate on the back of the optimizer, which contains important parameter information related to the product, and it is strictly forbidden to alter and damage it manually.

1.5 System Installation

- The optimizer is forbidden to be installed in a location where water can be submerged for a long time.
- Improper operation during the installation and operation of the optimizer may lead to fire, and it is forbidden to store flammable and explosive materials in the installation location area.
- It is forbidden to cut the cable that comes with the optimizer, otherwise the warranty will be invalid.
- When installing the optimizer, it is important to ensure that it is not electrically connected and energized.
- A certain distance should be reserved between the optimizer and surrounding objects to ensure that there is sufficient space for installation and heat dissipation.

1.6 Electrical Connections

Before making electrical connections, make sure that the optimizer is not damaged, as this could cause an electric shock or fire.

- All electrical connections must meet the country's electrical standards.
- The cables used in photovoltaic grid-connected power generation systems must be securely connected, well insulated, and of appropriate specifications.
- The optimizer output terminal blocks do not support hot swapping, otherwise, the optimizer may be damaged.

1.7 Operation

During the string operation of the optimizer, there is a high voltage, which may produce electric shock, resulting in death, serious personal injury, or serious property damage, please strictly follow the safety precautions listed in this manual and other relevant documents.

When the optimizer is running, the temperature is high and there is a risk of burns, so do not touch it.
When operating the equipment, local regulations and norms should be followed.

1.8 Maintenance and Replacement

During the string operation of the optimizer, there is a high voltage, which may produce electric shock, resulting in death, serious personal injury, or serious property damage. Therefore, before performing any maintenance work, the optimizer must be powered off and operated in strict accordance with the safety precautions listed in this manual and other relevant documents.

- Please maintain the optimizer if you are familiar with the contents of this manual and have the appropriate tools and test equipment.
- During the maintenance process, please try to avoid unrelated personnel entering the maintenance site, and temporary warning signs or fences must be erected for isolation.
- The optimizer can only be powered back on after the fault has been handled, otherwise the fault may expand or the device will be damaged.
- During maintenance, please follow the electrostatic protection specifications and wear anti-static gloves.
- If the device fails, please contact your dealer or the original factory for treatment.

2 Product Description

2.1 Fit System

SP4-1600W-AL series products belong to Optimizer for 2× PV modules , which can connect two PV modules at the input side at the same time. The PV Power Optimizer is a DC/DC conversion power supply behind the PV modules in the PV system, which increases the power generation of the PV system by continuously tracking the maximum power point (MPPT) of each PV module, and the post-stage is connected to the inverter, which converts the DC generated by the PV cells into AC power that meets the requirements of the grid and feeds it into the grid. The optimizer can be applied to the following scenarios: (1) Grid-connected photovoltaic system; (2) Off-grid photovoltaic system; (3) Optical storage system.

The optimizer cannot be connected to PV strings that require a positive or negative ground.

⚠ WARNING

- During the installation and operation of the optimizer, please ensure that the positive or negative poles of the PV string will not be short-circuited to the ground, otherwise, it may cause a DC short circuit of the optimizer, resulting in damage to the equipment, and the resulting damage will not be covered by the warranty.
- Before installing the optimizer, confirm that the component parameters meet the range required by the optimizer.

Grid-connected photovoltaic system

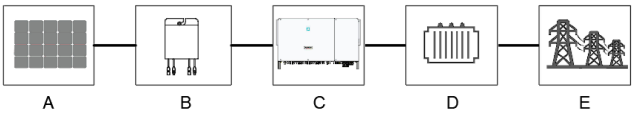


Figure 2.1-1 Application scenarios of optimizers in grid-connected photovoltaic systems

A	**PV modules**	Monocrystalline silicon; Polycrystalline silicon; Thin-film cells that do not need to be grounded.
B	**PV Optimizer**	SP4-1600W-AL.
C	**Inverter**	String inverters; Entralized inverters; Distributed inverters.
D	**Step-up transformers**	Increase the output voltage of the inverter to a level that meets the requirements of the grid.
E	**Power grid**	The grid supported by the inverter.

Off-grid PV system

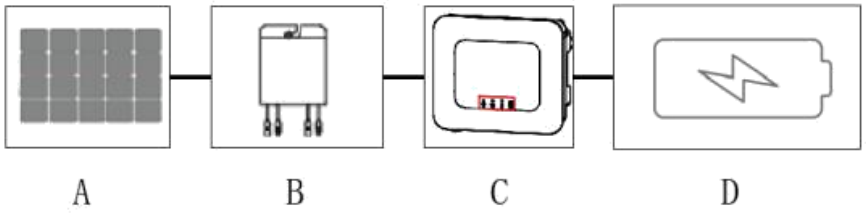


Figure 2.1-2 Application scenarios of optimizers in off-grid PV systems

A	**PV modules**	Monocrystalline silicon; Polycrystalline silicon; Thin-film cells that do not need to be grounded.
B	**PV Optimizer**	SP4-1600W-AL.
C	**Off-grid inverters**	Off-grid inverters.
D	**Battery**	Aluminum-acid batteries; Lithium batteries.

Optical storage system

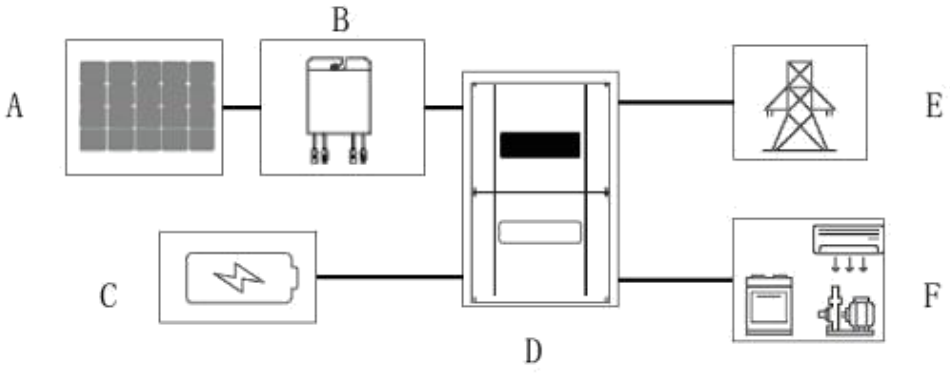


Figure 2.1-3 Application scenarios of optimizers in optical storage systems

A	PV modules	Monocrystalline silicon; Polycrystalline silicon; Thin-film cells that do not need to be grounded.
B	PV Optimizer	SP4-1600W-AL.
C	Battery	Lead-acid batteries; Lithium batteries.
D	Storage and inverter all-in-one machine	Storage and inverter all-in-one machine.
E	Power grid	The power grid supported by the storage and inverter machine.

2.2 Product Introduction

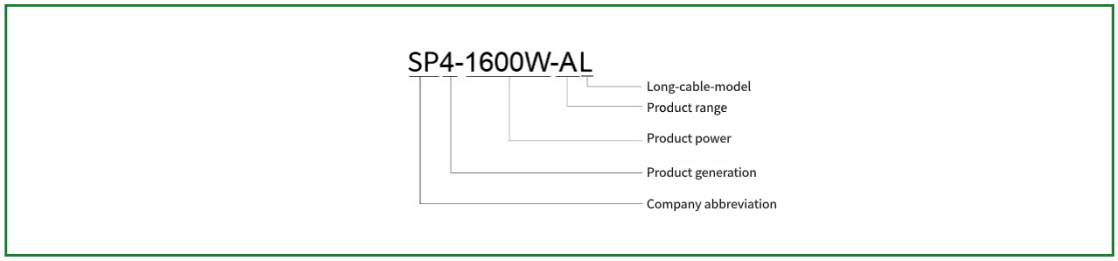
SP4-1600W-AL optimizer is an Optimizer for 2× PV modules, which can connect two PV modules at the same time on the input side, and continuously track the maximum power point (MPPT) of each PV module to increase the power generation of the PV system, and has functions such as module-level shutdown and module-level monitoring.

Features

- Component-level MPPT function: Increase the power generation of the PV system by constantly tracking the maximum power point of the PV module.
- Component-level shutdown function: Component-level voltage shutdown, fire emergency stop button activation or background control shutdown, and the optimizer can adjust the component output voltage to a safe range.
- Component-level monitoring: The optimizer detects the running status of components and implements component-level monitoring.

Model Description

The model description is as follows:



Optimizer model	Rated input power	Input 1 line length	Input 2 line length	Output line length
SP4-1600W-AL	2*800W	0.8m/0.8m	1.7m/1.7m	1.2m/1.2m

Product interfaces

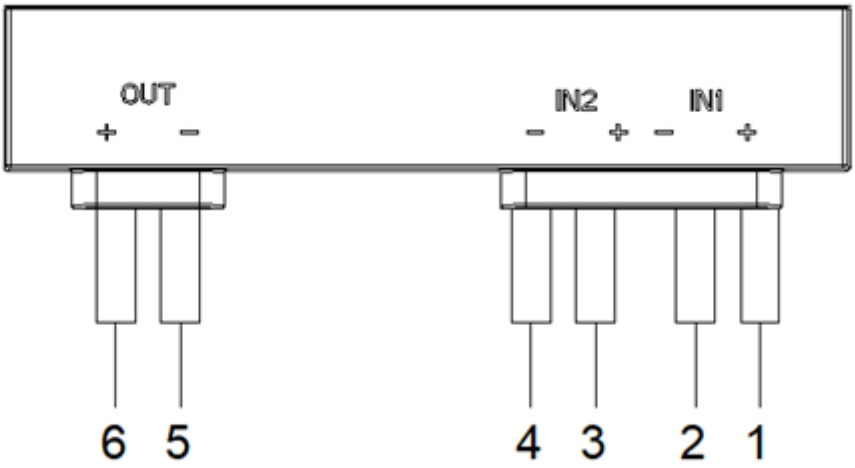


Figure 2.2-1 Schematic diagram of the optimizer interface

A	**Input 1 positive**	It is connected to the positive electrode of the output of the PV module, 0.8m long
B	**Input 1 negative**	Connect the negative electrode to the output of the PV module, 0.8m long
C	**Input 2 positive**	The positive electrode connected to the output of the PV module is 1.7m long
D	**Input 1 negative**	The negative electrode connected to the output of the PV module is 1.7m long
E	**Output negative**	Connect the negative pole of the inverter, the positive pole of the series optimizer or the module, 1.2m long.
F	**Output positive**	Connect the positive pole of the inverter, the tandem optimizer or the negative pole of the module, 1.2m long

Product dimensions

SP4-1600W-AL:

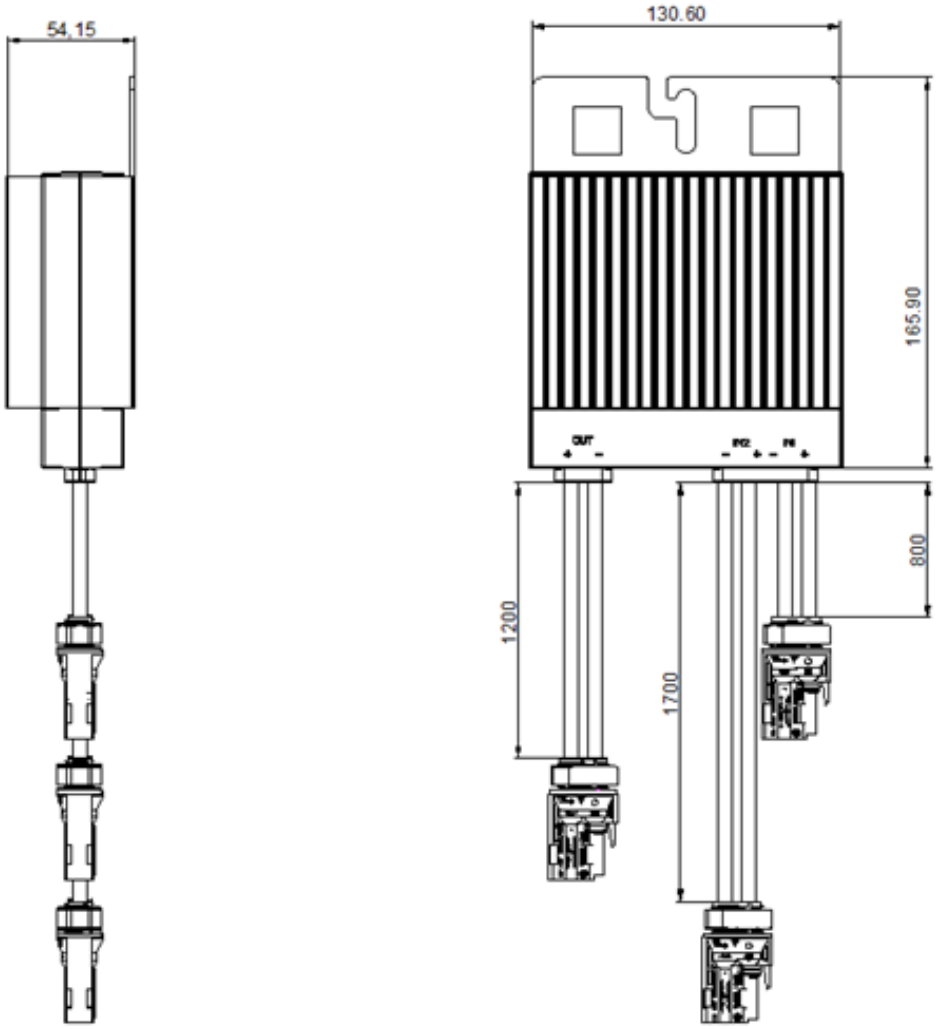


Figure 2.2-2 Optimizer dimensions

2.3 Application scenarios

NOTE

To ensure that the optimizer is successfully connected to the PV module, select a PV module with a PV module output line that meets the length of the PV module.

To minimize electromagnetic interference, it is recommended to minimize the distance between the positive and negative cables of the optimizer.

Scheme 1

Full Optimizer and Wi-SUN Gateway:

All PV modules connected to the inverter are connected to the optimizer. The solution connects all modules to the optimizer, which can achieve the maximum power output of each module, which can maximize the power generation capacity of the photovoltaic power station.

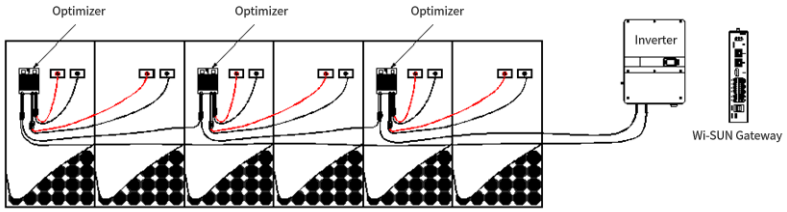


Figure 2.3-1 Wiring diagram of scheme 1

Scheme 2

Optimizer + monitoring line rapid shutdown, with Wi-SUN gateway:

PV modules with shade access optimizer, PV modules without shade access to CYGIA FlywheelAnother product: monitoring rapid shutdown (hereinafter referred to as "monitoring RSD", please refer to the corresponding user manual for details).

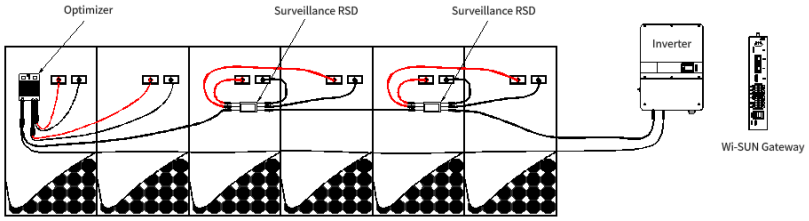


Figure 2.3-2 Wiring diagram of scheme 2

Scheme 3

Some optimizers are deployed with Wi-SUN gateways:

If there is a shading PV module access optimizer, this solution can only achieve power optimization and partial module monitoring.

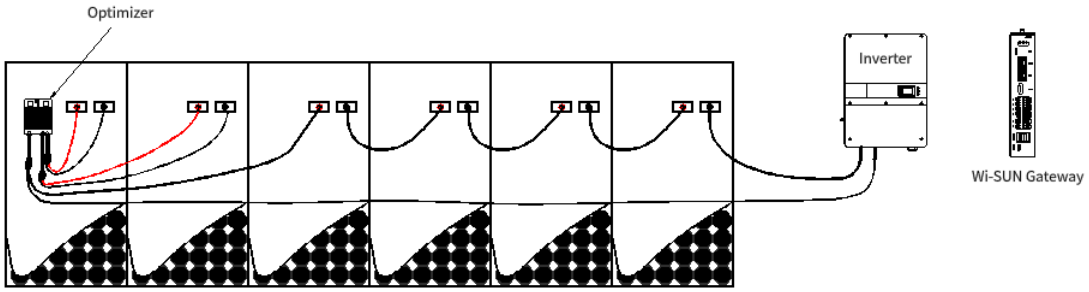


Figure 2.3-3 Wiring diagram of scheme 3

Scheme 4

Partial Deployment Optimizer:

If there is a shading PV module access optimizer, this scheme can only achieve power optimization. (If you only purchase the optimizer, you need to explain it to the marketing staff before placing an order, and the optimizer is in the shutdown state by default when it is shipped, and the output voltage is 1.2V).

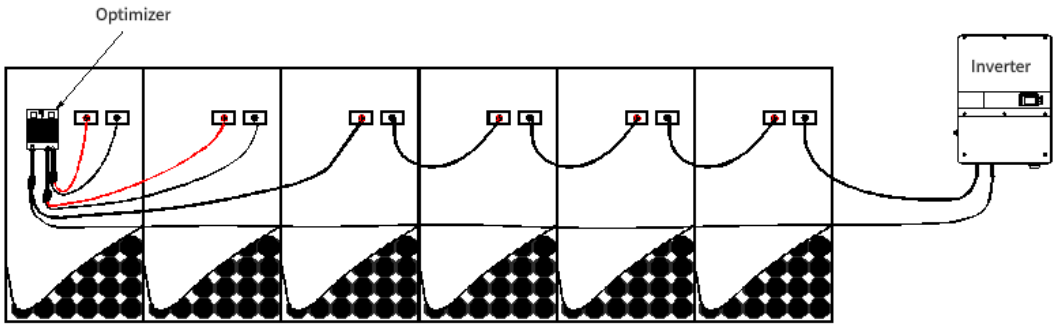


Figure 2.3-4 Wiring diagram of scheme 4

3 Product Configuration

3.1 PV modules

SP4-1600W-AL optimizer is an Optimizer for 2× PV modules, with a total of two inputs, each input can be connected to 166-type, 182-type, 210-type crystalline silicon photovoltaic modules within 800W on the market, and a total of 2 photovoltaic modules can be connected. For thin-film modules, compare the electrical parameters of the module and the optimizer in detail.

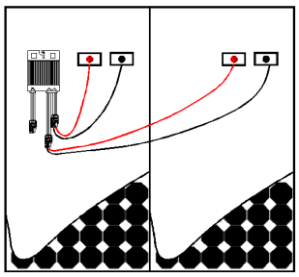


Figure 3.1-1 Schematic diagram of the optimizer and component wiring

3.2 Inverter

- SP4-1600W-AL optimizer products are compatible with most string inverters, storage-inverter machines, and centralized inverters on the market.
- The inverter with the negative or positive electrode grounded shall not be used;
- It is not recommended to use microinverters, which have overlapping functions and have the risk of reducing the power generation efficiency of the system;
- For inverters with global MPPT scanning and tracking, the global MPPT scanning and tracking function needs to be related, and there is a risk of functional conflict.

3.3 System design and configuration

For PV systems with all optimizers deployed, the modules and optimizers are paired in a 2:1 ratio, and the ratio of Wi-SUN gateway to optimizer is ≤300:1 (if there is an odd number of modules, the remaining 1 module can use the SP6-800W-A series products, or still use the SP4-1600W optimizer, and one of the inputs is not connected (take waterproof measures)).

For some PV systems that are not optimizers, the shading module and optimizer are paired in a ratio of 2:1, and the ratio of Wi-SUN gateway to optimizer is ≤300:1.

4 Unpacking and Storage

4.1 Unpacking and Inspection

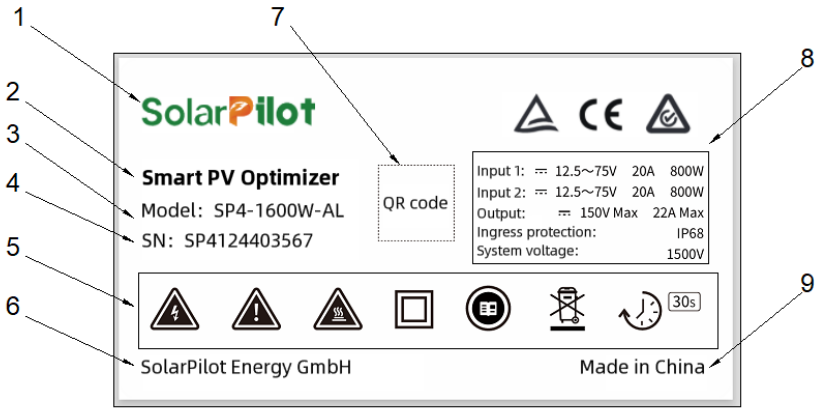
The optimizer has been fully tested and rigorously inspected before leaving the factory, but damage can still occur during transportation, please conduct a detailed inspection before signing for the product.

- Inspect the box for damage.
- Check whether the goods are complete and in accordance with the order according to the packing list.
- Unpack and inspect the internal equipment for intact.

If any damage is detected, please contact the shipping company or CYGIA Flywheel directly and provide photos of the damage to facilitate the service. Do not dispose of the original packaging of the optimizer, it is best to store it in the original box after the optimizer is dismantled.

4.2 Identifying Optimizers

The optimizer has a nameplate pasted on the back. The nameplate provides information about the optimizer's model as well as the most important parameters and certification marks.



Parameter description:

1. **SolarPilot Trademark**
2. **Optimizer product name**
3. **Optimizer model specifications**
4. **Optimizer SN code**
5. **Relevant identification**
6. **Manufacturing company: SolarPilot Energy GmbH**
7. **Product SN QR code**
8. **Related parameters**
9. **Made in China**

Nameplate identification description:

High Voltage Warning

Hazard warning

High temperature warning

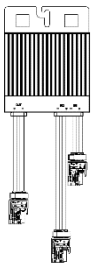
Strengthen the insulation marking

Read the instructions for the mark

WEEE mark

30-second quick break mark

4.3 Scope of supply



Optimizer

Certificate

Installation Guide

4.4 Optimizer Storage

If you don't use the optimizer right away, you need to store it in a specific environment:

- Repack in the original box to retain the desiccant.
- Storage temperature range -40°C~70°C, relative humidity range 0~95%, no condensation.
- The optimizer is stored for more than half a year and needs to be thoroughly inspected and tested by professionals before it can be put into operation.

5 Web Interface to Add Layouts

For details on how to add a layout, see *SolarPilot User Manual SP4-WiSUN-GW Gateway.*

6 Installation and Fixation

6.1 Installation Location

The position of the optimizer is on the bracket at the 50mm position where one of the two PV modules is centered ± the module, and this position can connect module 1 and module 2, without the need for additional connecting wires, otherwise additional connecting wires need to be added.

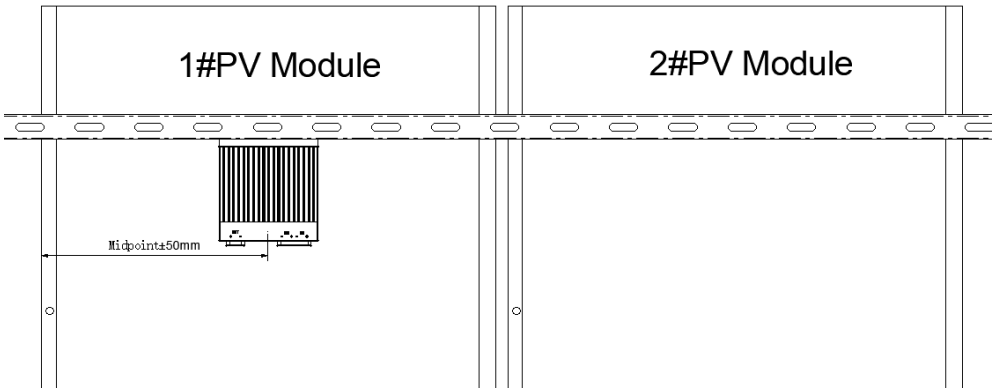
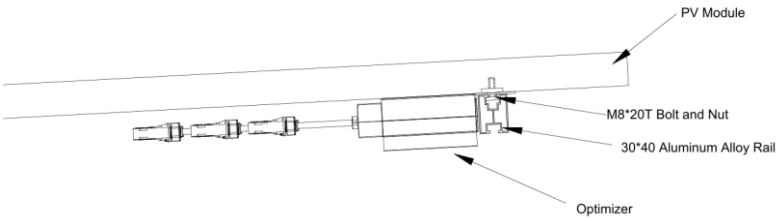


Figure 6.1-1 Schematic diagram of the installation location

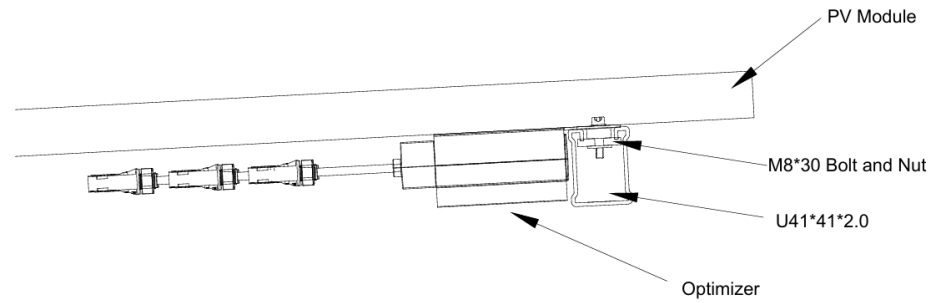
6.1 Fixation

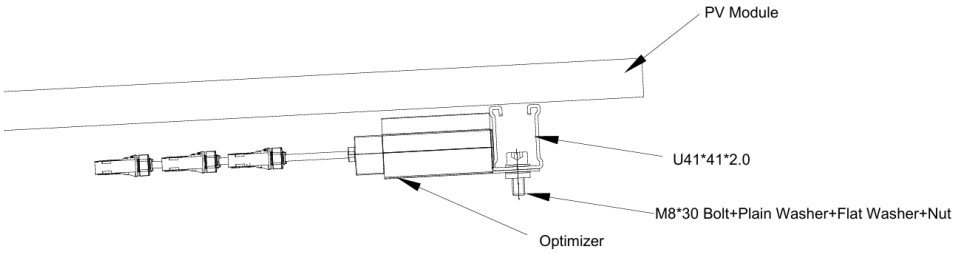
Due to the heavy weight of the SP4-1600W-AL optimizer, it is not recommended to fix the optimizer on the module frame, otherwise it is easy to cause deformation of the module frame, and it is recommended to fix the optimizer on the photovoltaic bracket.

1. **Color steel tile roofing: M8*20T bolts + nuts are required**



2. **Cement flat roof: M8*30 bolt + elastic pad*1 + flat gasket*1 + nut*1 or M8*30 bolt + rotor nut are required**





6.3 Installation Tools and Parts

1. **Insulated shoes**
2. **M6/M8 sockets**
3. **Goggles**
4. **Pincers**
5. **Wire strippers**
6. **Insulated gloves**
7. **MC4 crimping pliers**
8. **MC4 wrench**
9. **Multimeter**

7 Electrical Connections

7.1 Test Component Voltage

Turn the multimeter to the corresponding gear (60V for normal crystalline silicon modules and 200V for thin-film modules, the specific gear is determined according to the open-circuit voltage of the module and the multimeter carried), measure the module voltage with the multimeter, and the module has a voltage output, and meets the open-circuit voltage value under the irradiation condition at that time, so as to ensure that the photovoltaic module is connected to the optimizer before the group is normal.

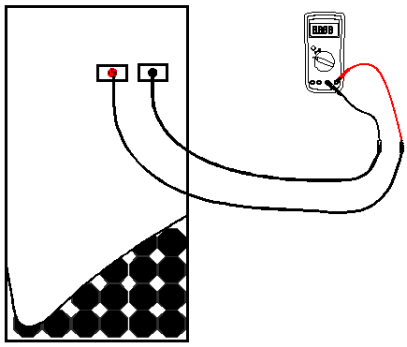


Figure 7.1-1 Schematic diagram of testing the voltage of photovoltaic modules

7.2 PV module access optimizer

After the voltage of all modules is normal, connect the PV modules to the input of the optimizer, and 1-to-2 can support the connection of two PV modules:

The optimizer input 1 is positively connected with component 1, and input 1 negative and component 1 are connected negatively;

Connect the optimizer input 2 positive and component 2 positive level, and input 2 negative and component 2 negative connection.

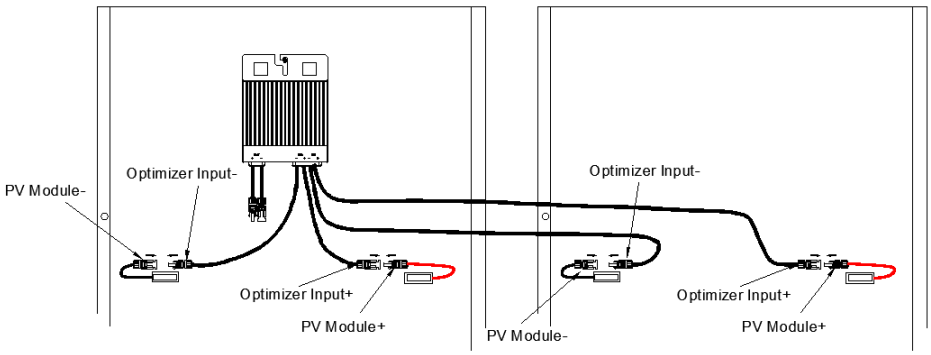


Figure 7.2-1 Schematic diagram of the optimizer connected to a PV module

If the input length of the optimizer cannot connect the components, you need to make a connection line, as shown in the following figure: (It is determined according to the current length).

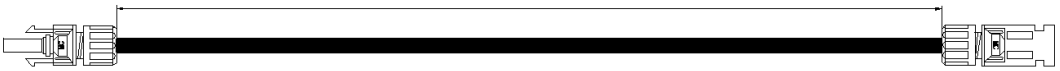


Figure 7.2-2 Schematic diagram of connecting wires

7.3 Check the Optimizer

After the component is connected to the optimizer, check whether the optimizer is normal:

- The multimeter hits the DC > 150V gear (the specific gear is determined according to the multimeter carried);
- Insert the positive pen of the multimeter into the DC connector of the positive output of the optimizer;
- Insert the multimeter negative meter pen into the DC connector of the negative output of the optimizer;
- Measure the output voltage value of the optimizer, the multimeter shows that there is a voltage value, and the value is 1.2V ±10% is normal.(Note: If you have contacted the business to turn off the shutdown state, the output voltage of the optimizer = 2 * component open circuit voltage * 0.95, for example, for a module with an open circuit voltage of 38V, the voltage is 2 * 38 * 0.95 = 72.2V).

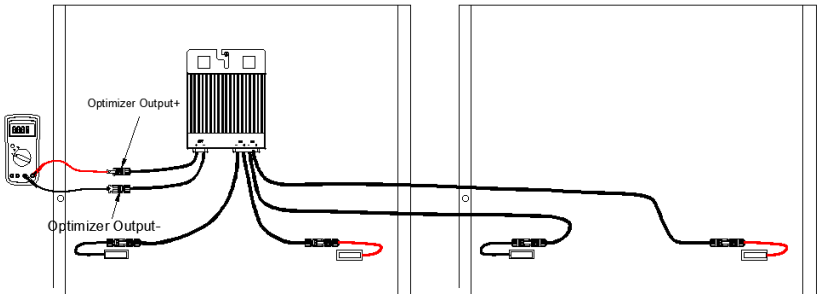


Figure 7.3-1 Schematic diagram of the output voltage test of the optimizer

7.4 Connections between Optimizers

After the output voltage of all optimizers is detected normally, the optimizers are connected according to the PV design requirements, and the output of the optimizer is connected to the negative pole of the edge optimizer (or PV module).

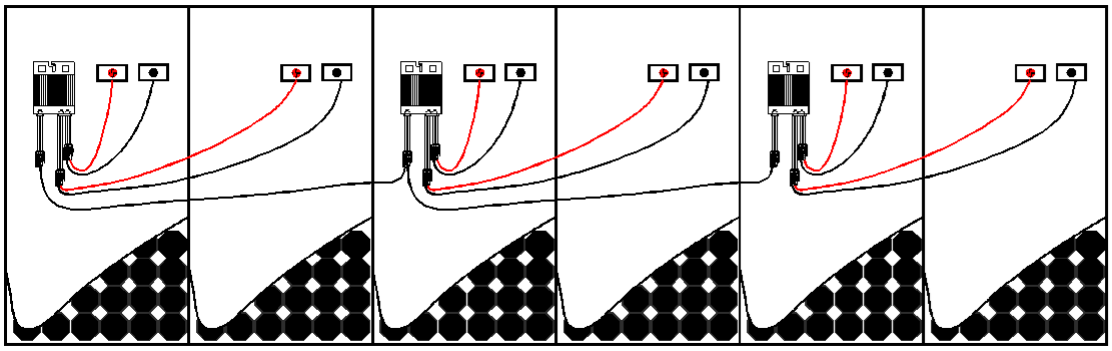


Figure 7.4-1 Schematic diagram of the optimizer connection

7.5 Test string voltage

- The multimeter hits the DC 1500V gear (adjust the gear according to the DC string voltage of the photovoltaic system, and use the 1000V gear when the system voltage is lower than 1000V);
- Insert the positive pen of the multimeter into the DC connector of the positive output of the optimizer;
- Insert the multimeter negative meter pen into the DC connector of the negative output of the optimizer;
- Measure the output voltage value of the optimizer, observe the value of the multimeter, the value ≤ 40V, and hit the multimeter to DC 60V; (Note: If the business has been contacted to close the shutdown state, the gear conversion process shall not be carried out, and the voltage shall be detected with 1500V gear).
- Measure the output voltage value of the optimizer, U Strings = N* 1.2 + M* U (If you have already contacted the business to close the shutdown state, U Strings = U* X* 0.95 + M* U).
  N: the number of optimizers
  X: The number of PV modules connected to the optimizer
  M: The number of components in the string that are not connected to the optimizer
  U: Component open-circuit voltage

For example, as shown in the figure below, 6 components (open circuit voltage 38V) are a string, 2 components are connected to 1 optimizer, and the remaining 4 are not connected to the optimizer, and the voltage at this time is U=1*1.2+4*38=153.2V. (If the business has been closed and shut down, U=2*38*0.95+4*38=224.2).

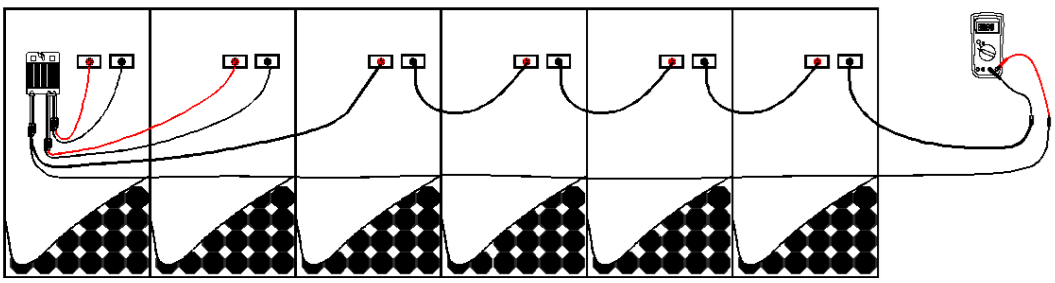


Figure 7.5-1 Optimizer string voltage test chart

7.6 Connect the inverter at both ends of the string

After the string voltage test is normal, the remaining outputs in a string are positively connected to the positive of the inverter, and the output is negative to the negative of the inverter.

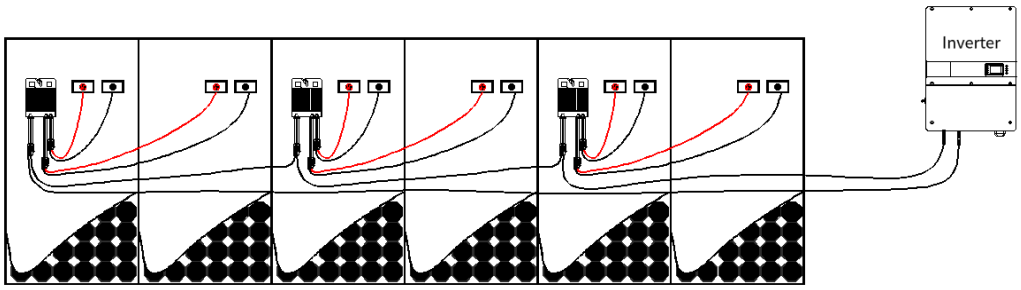


Figure 7.6-1 Schematic diagram of string access to inverter

8. APP configuration networking

For details of the operation APP, please refer to *SolarPilot User Manual SP4-WiSUN-GW.*

9 Test run

9.1 Pre-Run Checks

- All cables and accessories are properly connected and fastened.
- The cables are well distributed and well protected without mechanical damage.
- Empty terminals are sealed.
- All safety signs and warning labels are securely affixed and clearly visible.

9.2 Operate the APP to let the optimizer output voltage

You need to send a quick break recovery command on the APP, otherwise the PV system will not be able to operate normally (it will be turned off by default).

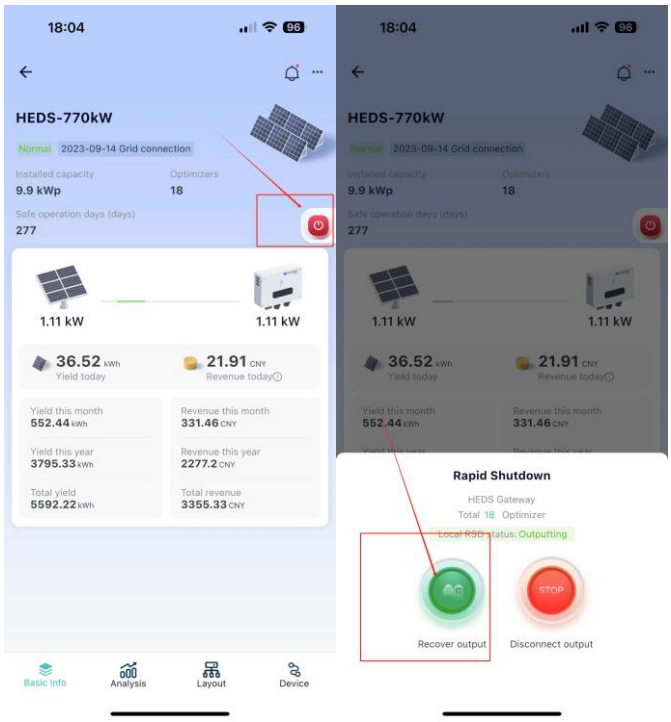


Figure 9.2-1 Output diagram of APP operation recovery

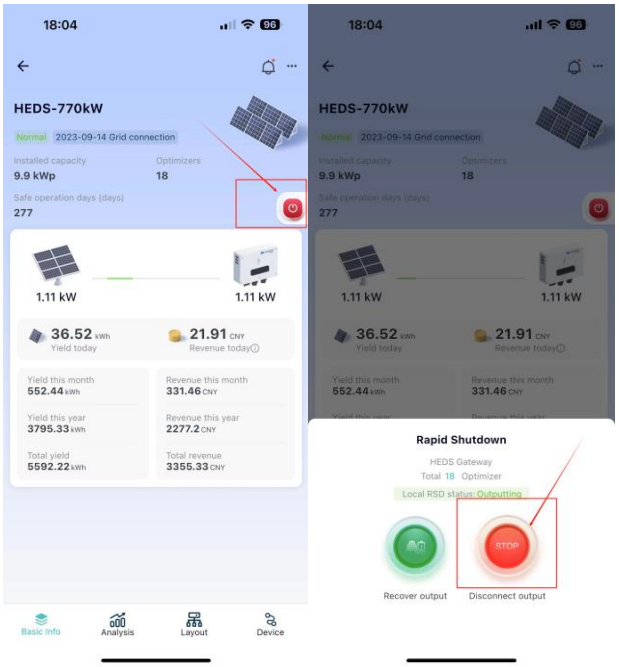
9.3 Commissioning Steps

- Step 1: Screw the DC switch on the inverter to "ON" (if the inverter does not have one).
- Step 2: If there is an AC switch between the inverter and the grid, close the switch.
- Step 3: If there is a DC switch between the inverter and the PV string, close the switch.
- Step 4: The power station will operate normally when the light is normal and the grid conditions meet the grid connection requirements.

Remote rapid shutdown (RSD) function detection

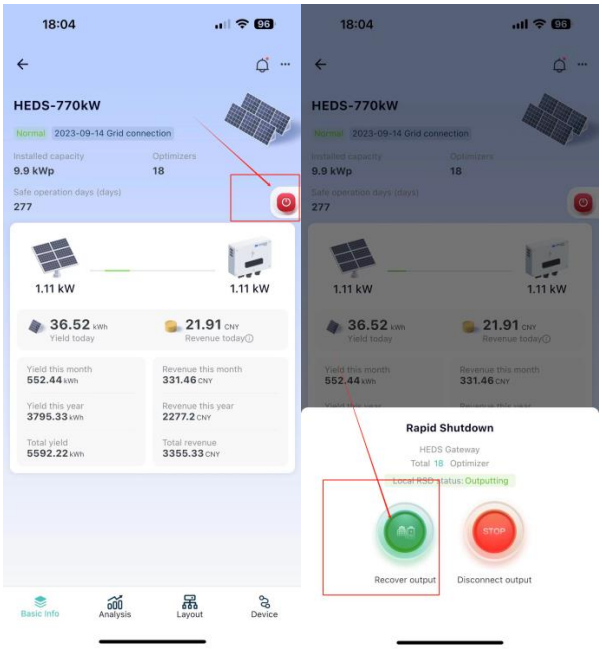
1. Issue RSD command

Use your mobile phone to send a quick shutdown command, observe the return status on the App after the command is issued , and observe whether the inverter stops working.



2. RSD recovery

After testing the quick break command, click the resume command to let the optimizer resume the output. (Important: Otherwise, the PV system will not be able to generate electricity).



Local rapid shutdown function detection

- Connect the E-STOP button to the DI1 port of the Wi-SUN gateway, Wi-SUN gateway DI1 is a fast-disconnect switching port;
- Under the premise of normal grid-connected operation, press the quick break button switch (the button is closed), and observe the input status of the inverter after 30 seconds, if the inverter stops working, and the switching DC input voltage is lower than 30V, it means that the quick break function is realized;
- After the quick break function test is completed, the quick break button is disconnected, and after 30 seconds, observe whether the DC input of the inverter is normal, and normal means that the quick break reset is successful;
- After a round of testing, nothing is abnormal.

10 Troubleshooting and O&M

- In the event of an optimizer failure, the fault message can be displayed on the mobile app interface or on the PC interface.
- The following table describes the fault codes and troubleshooting methods of all optimizers, and the model you purchased may only contain some of the fault information, when the optimizer fails, you can query the corresponding information through the fault code or alarm name on the mobile app.

Error code	Alarm Name	Cause	Possible cause	How to deal with it
400	Input 1 is undervoltaged	Input 1 voltage is insufficient optimizer startup voltage.	Irradiation is too low; Component is abnormal.	Wait for the irradiation to increase，inspect the components and replace them.
401	Input 2 is undervoltaged	Input 2 voltage is insufficient optimizer start-up voltage.	Irradiation is too low; Component is abnormal.	Wait for the irradiation to increase，inspect the components and replace them.
402	Input 1 overvoltage	Input 1 voltage exceeds the maximum input voltage of the optimizer.	The component and optimizer do not match.	Replace components or optimizers.
403	Input 2 is overvoltage.	Input 2 voltage exceeds the maximum input voltage of the optimizer.	The component and optimizer do not match.	Replace components or optimizers.
404	Input 1 is overcurrent.	Input 1 current exceeds the maximum input current of the optimizer.	The component and optimizer do not match.	Replace components or optimizers.
405	Input 2 is overcurrent.	Input 2 current exceeds the maximum input current of the optimizer.	The component and optimizer do not match.	Replace components or optimizers.
406	Input is continuously overloaded.	Input power exceeds the maximum power rating of the optimizer.	The component and optimizer do not match.	Replace components or optimizers.
407	Input 1 for overtemperature to alarm.	Input 1 overtemperature	The temperature is too high, and the optimizer is running at reduced power.	No action required
408	Input 1 is overtemperature, abnormal.	Input 1 is over-temperature, and over-temperature still occurs after running with power reduction.	The temperature is too high, the optimizer will bypass and automatically return to the normal state after the temperature is restored.	Observe the on-site environment to see if there is high temperature or poor air circulation.
409	Input 1 is over-temperature, faulty.	Input 1: More than 5 overtemperature anomalies in a short period of time.	The temperature is too high and the optimizer is bypassed, it is necessary to think that the operation is restored or the input is re-plugged and unplugged.	Send someone to the scene to see.
410	Input 2 for Overtemperature to alarm.	Input 2 is over temperature.	The temperature is too high, and the optimizer is running at reduced power.	No action required.
411	Input 2 is overtemperature, abnormal.	Input 2 is over-temperature, and over-temperature still occurs after running with power reduction.	The temperature is too high, the optimizer will bypass and automatically return to the normal state after the temperature is restored.	Observe the on-site environment to see if there is high temperature or poor air circulation.
412	Input 2 overtemperature, fault.	Input 2: More than 5 overtemperature anomalies in a short period of time.	The temperature is too high and the optimizer is bypassed, it is necessary to think that the operation is restored or the input is re-plugged and unplugged.	Send someone to the scene to see.

413	Output over-temperature and alarm.	Output is overheated.	The temperature is too high, and the optimizer is running at reduced power.	No action required.
414	Output is over-temperature, abnormal.	Output is reduced in power, and overtemperature still occurs after operation.	The temperature is too high, the optimizer will bypass and automatically return to the normal state after the temperature is restored.	Observe the on-site environment to see if there is high temperature or poor air circulation.
415	Output is overtemperature, fault.	Output is more than 5 times abnormal in a short period of time.	The temperature is too high and the optimizer is bypassed, it is necessary to think that the operation is restored or the input is re-plugged and unplugged.	Send someone to the scene to see.
416	Optimizer MOS is overheated, and an alarm is generated.	Optimizer MOS is overtemperature.	The temperature is too high, and the optimizer is running at reduced power.	No action required.
417	Optimizer MOS overtemperature, abnormal.	Optimizer MOS is over-temperature, and it still occurs after the power is reduced.	The temperature is too high, the optimizer will bypass and automatically return to the normal state after the temperature is restored.	Observe the on-site environment to see if there is high temperature or poor air circulation.
418	Optimizer MOS overtemperature, malfunction.	Optimizer MOS is over-temperature anomalous more than 5 times in a short period of time.	If the temperature is too high and the optimizer is bypassed, it is necessary to think that the operation is restored or the input is re-plugged and unplugged.	Send someone to the scene to see.
419	Output is short-circuited.	Short circuit on the output side.	There is a short circuit on the output side.	The maintenance personnel were sent to detect, and the short-circuit location was between the optimizer and the inverter.

11 Replace the optimizer

11.1 Prerequisites

Please use special insulating tools, wear insulated shoes and protective gloves before operating;

Get your new smart PV optimizer ready;

Get ready to bring your phone with the monitoring app already installed.

11.2 Procedure

- Wear protective gloves to disconnect the external AC circuit breaker and prevent reconnection due to misoperation.
- Disconnect the external DC circuit breaker and turn the DC switch of the inverter to "OFF".
- Wait at least 5 minutes until the capacitors inside the inverter are fully discharged.
- Use a current clamp to detect the DC cable and confirm that there is no current.
- Disconnect the output terminal of the optimizer.
- Disconnect the input terminal of the optimizer.
- Dismantle the old optimizer.
- Install a new optimizer.
- Perform the configuration process again.
- Power on the inverter again, open the APP to observe the monitoring status.

12 Technical Indicators

Product model：SP4-1600W-AL	
Input parameters	
Rated input power	1600W（800W / per input）
Input voltage range	25-150V（12.5V-75V / per）
Starting voltage	15V
Maximum input voltage	150V（75V / per input）
Maximum input current	20A
DC input	2 - way
Output parameters	
Maximum output power	1600W
Maximum output voltage	1500V
Maximum output current	22A
Protect function	
Bypass cut-off function	Have
Shutdown function	Have
DC overvoltage protection	Have
DC overload protection	Have
Reverse polarity protection	Have
Short-circuit protection	Have
Communication	
Communication methods	Wireless / Wi-SUN
Data collection frequency	1 minute
Wireless data transmission distance	≤500 m
General parameters	
Dimension	131 mm* 172 mm* 55 mm（width* height* thickness）
Net weight	1500 g
Ingress protection	IP68
Maximum system voltage	1500 V
Input/output terminals	1500 V DC connectors / 1500 V DC connectors
Input cable length	0.8m / 0.8m，1.7m / 1.7m
Operating temperature	-45℃ ~ 85℃
Storage temperature	-40℃ ~ 70℃
Working altitude	≤2000 m
Installation method	Fixed on bracket
HDMI	1080P
Type-C	Debug interface
Other	
Compliant to	CE、RoHS、RED
Life circle	25 years
Warranty	25 years
Off time	≤10S

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