光伏组件级优化器
PV Optimizer

用户手册
USER MANUAL
PVO-C370/C450/C600/C800

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目录

1 基本概述

1.1 手册概述

本用户手册详细介绍了光伏组件级优化器系列产品（下述简称“优化器”）的功能特性和应用安装方法。在安装和使用设备之前，请先仔细阅读用户手册中的声明、要求和注意事项。

1.2 读者对象

本用户手册适用于设备安装工程师、技术支持工程师、销售工程师和电站业主等人员。

1.3 修订记录

序号	内容	文档版本	发布时间
1	创建文档，新增产品型号C800内容	V1.0.0	2023.09.25
2	新增优化器产品型号C600内容	V1.1.0	2023.10.25
3	新增优化器产品型号C370、C450内容	V1.2.0	2023.12.07
4	更新优化器产品技术参数	V1.2.1	2024.01.23
5	更新用户手册封面	V1.2.2	2024.04.11
6	更新内容：6 功能检查	V1.2.3	2024.05.07

1.4 手册声明

本用户手册中描述的内容可能不在用户的购买或使用范围之内，用户购买或使用的产品或服务等应受到思凌科商业合同和条款的约束。

由于产品版本升级或其他原因，用户手册的内容会不定期进行更新。除非另有约定，本用户手册仅作为使用指导，其中的所有陈述、信息和建议不构成任何明示或暗示的担保。

2 注意事项

2.1 产品声明

在运输、存储、安装、操作、使用和维护产品前，请先阅读本用户手册，并开展全面的产品实施调研。产品应在符合设计规格要求的环境下使用，使用过程中应严格遵循本用户手册中要求的注意事项，遵守当地适用的法律法规、标准和规范要求。

发生以下任一情况或下述情况导致的结果，本公司不承担任何责任：

（1）因不可抗力因素导致的产品损坏和事故（如地震、洪水、火灾、战争等极端状况）；

（2）因运输条件恶劣而导致的产品损坏和事故；

（3）因存储条件恶劣而导致的产品损坏和事故；

（4）在安装和使用中，未遵守当地的法律法规，不符合当地的标准要求；

（5）非专业、未经培训的人员对产品进行操作使用；

（6）未经授权或未经允许，擅自拆卸、更改产品或者修改软件代码；

（7）在超出规定的技术参数范围外运行产品，或产品超出质保期限；

（8）用户或者第三方（非本公司原因）的疏忽、故意、重大过失、操作不当，引发的人身伤亡、财产损失等。

2.2 对操作人员的要求

1、操作人员应阅读完本用户手册，并知悉所有注意事项；

2、操作人员应掌握光伏发电系统的构成和工作原理；

3、操作人员应遵守电气系统、机械作业、高空作业等相关的安全规范和要求；

4、操作人员应遵守产品所在的国家或地区有关安全和电气的法规及相关标准；

5、操作人员应经过思凌科光伏系列产品安装操作培训，熟悉并掌握产品的操作和使用；

6、操作人员必须佩戴防护用具并做好绝缘防护，严禁穿戴易导电物品（如手表、戒指等）。

2.3 对操作条件的要求

1、设备安装前：

（1）设备存放的环境应温湿度适宜、清洁干燥、通风良好；

（2）设备应避免存放在存在大量灰尘及挥发性气体的环境中；

（3）严禁在恶劣天气下（如雷电、暴雨、大风等）安装、使用和操作设备；

（4）安装工具应具备安全性和专业性，应确保工具绝缘并牢固，不超负荷。

2、设备安装中：

（1）确保电缆连接牢固、绝缘良好；

（2）确保优化器、逆变器和电源等开关均处于关闭状态，确保组串无电压；

（3）安装中请勿触摸接线工作需要以外的其他部件。

3、设备运行时：

（1）请勿随意触摸设备，以免造成触电、烫伤或其他事故。

3 产品介绍

3.1 产品简介

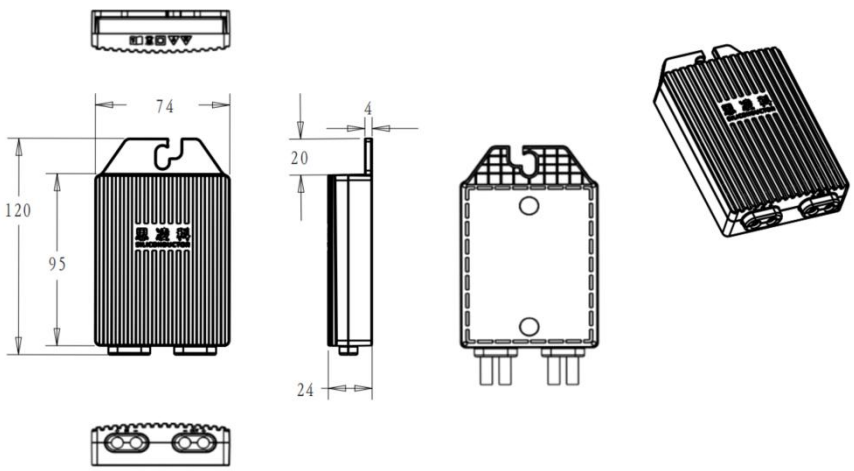
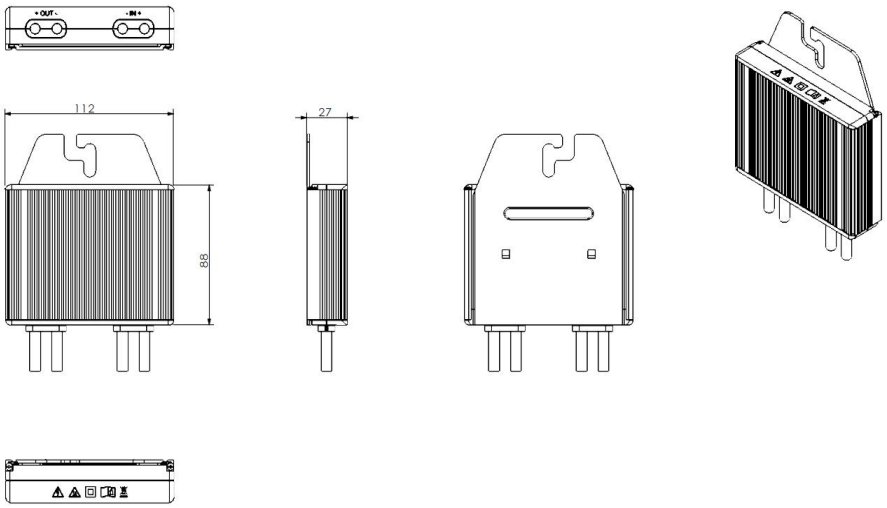
光伏组件级优化器是一款安装于光伏组件背面的 DC/DC 转换设备。光伏组件级优化器能够实时追踪光伏组件的最大功率点（MPP），减小光伏组件因外界原因（如光照弱、局部遮挡、朝向不一致等）造成的发电量损失，从而提升光伏系统的发电量。同时，本光伏组件级优化器还具备组件级关断、监控和检测等功能，能够实现光伏电站的智能运维管理。

3.2 产品型号

本用户手册主要涉及以下产品型号：

产品型号
PVO-C370-U1
PVO-C450-U1
PVO-C600-U1
PVO-C800-U1

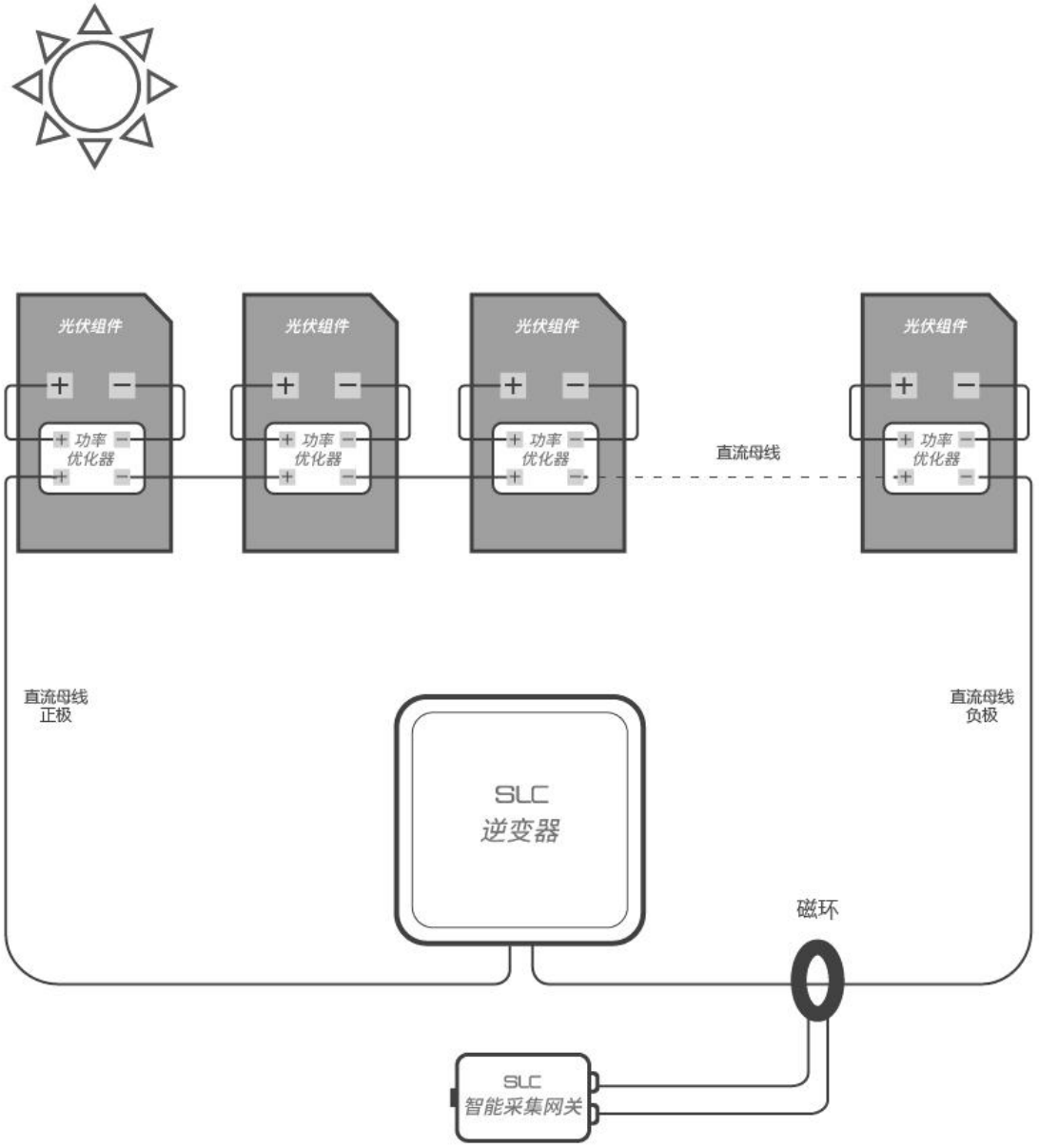
3.3 产品结构

产品型号	图示
PVO-C370-U1 PVO-C450-U1	
PVO-C600-U1 PVO-C800-U1	

3.4 图标说明

图示	含义
	当心触电
	当心烫伤
	双重绝缘
	查看说明
	报废回收

3.5 组网场景



4 现场安装

4.1 环境要求

1、请预留足够空间，合理规划优化器在光伏组件背后的悬挂位置；

2、确保优化器与光伏组件线缆以及相邻优化器之间的线缆能够正常连接；

3、优化器与逆变器间的回环距离不得超过300m（即最远端优化器距离磁环距离应小于150m，如大于此距离会导致通讯数据包丢包）；

4、禁止优化器遭遇阳光直射；

5、禁止在优化器安装区域存放易燃易爆物品；

6、禁止将优化器安装于浸水环境中。

4.2 安装前检查

1、检查外包装

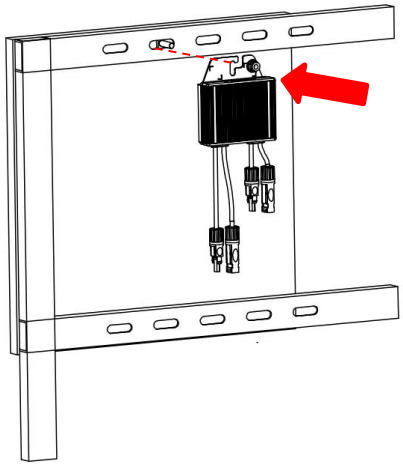
拆开外包装之前，请检查外包装是否有可见的破损，例如出现空洞、裂纹或其他可能造成内部损坏的迹象。如果有任何外包装损坏的情况，请勿拆开，并尽快联系您的经销商。

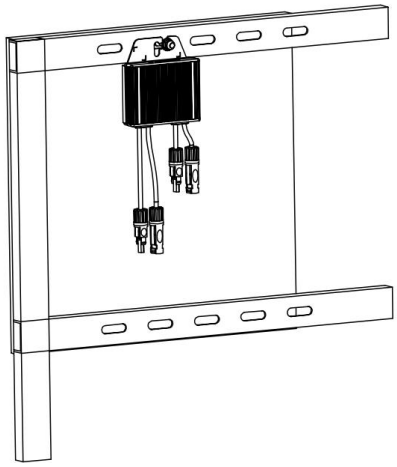
2、检查交付物

如果外包装无破损，在拆开外包装之后，请检查包装内交付物是否齐备，并检查是否有无任何明显的外部损坏。如果发现物件缺少或损坏，请尽快联系您的经销商。

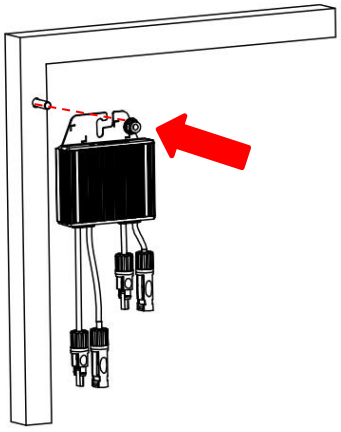
4.3 安装位置

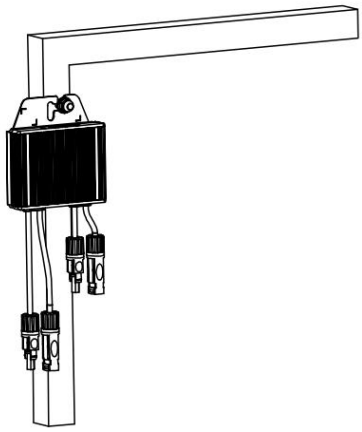
1、方案一：安装在C型钢支架上，将优化器挂在螺栓上，用螺母固定。





2、方案二：安装在光伏组件边框上，将优化器挂在螺栓上，用螺母固定。





注意：禁止将优化器安装在直接日晒，淋雨与积雪的地方，包括组件之间的空隙,全遮挡的安装点是较好的选择。关断器和上面太阳能组件之间间隔至少相隔1.5厘米。

3、其他：视电站和组件实际情况确认其他方案，不排除需要联系第三方购买配套物资的情况。

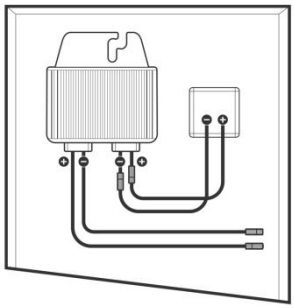
4.4 安装说明

1、确定优化器安装位置后，在优化器挂板上取一块 SN 号标签纸，粘贴在物理布局模板上。

2、优化器与光伏组件的连接：

✧ 优化器【输入（IN）】需要与光伏组件接线盒进行连接

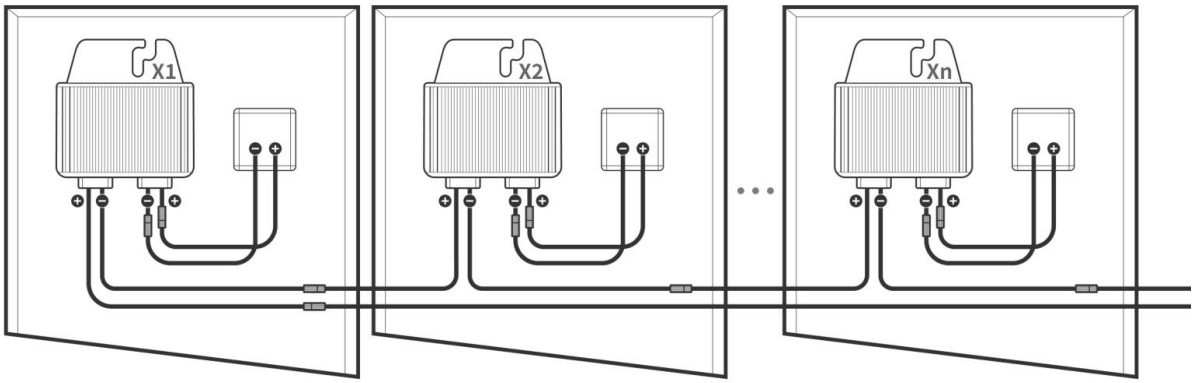
- 优化器【输入负极（IN-）】线缆与光伏组件接线盒负极连接；
- 优化器【输入正极（IN+）】线缆与光伏组件接线盒正极连接。



3、相邻优化器之间的连接：

✧ 如果一组光伏组串中已安装多个优化器（X1～Xn），那么相邻优化器之间需要握手连接

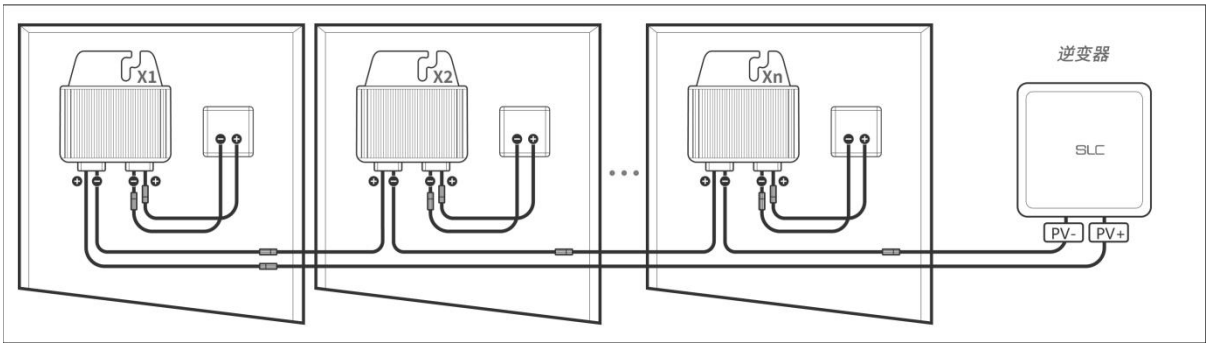
- 从左到右，以一行为单位排列优化器顺序，明确最左边的优化器X1和最右边的优化器Xn ；
- 优化器X1：预留出【输出正极（OUT+）】，把优化器X1 的【输出负极（OUT-）】和优化器X2 的【输出正极（OUT+）】连接起来；
- 优化器X2：把优化器X2 的【输出负极（OUT-）】和优化器X3 的【输出正极（OUT+）】连接起来（优化器X2 ～ 优化器Xn 的连接依此类推）；
- 优化器Xn：预留出【输出负极（OUT-）】。



4、优化器与逆变器的连接：

✧ 如果一组光伏组串中已安装多个优化器（X1～Xn），且相邻优化器之间已完成握手连接

- 将优化器X1 的【输出正极（OUT+）】连接逆变器正极（PV+）；
- 将优化器Xn 的【输出负极（OUT-）】连接逆变器负极（PV-）。



5、注意要点

✧ 请务必确认两两对接的直流连接器型号相同或相互兼容。使用不兼容型号的直流连接器进行对接，可能会导致严重后果，由此引起的设备损坏和安全事故，不在本公司责任范围内；

✧ 在任何条件下，一个组串中的所有组件的开路电压总和，不得超过逆变器最大输入电压。

✧ 安装时，线缆弯曲半径必须大于50 MM。

5 光伏智慧运维管理平台

本款光伏组件级优化器需要与**光伏智能采集网关**（下述简称“采集网关”）、**光伏智慧运维管理平台**（下述简称“光伏云平台”）等配套使用，方可实现光伏电站的智能运维管理。与配套产品的连接方式与使用详情，请参考对应产品的用户手册（请联络经销商获取或扫码下载）。

6 功能检查

当优化器和采集网关已完成配置后，可使用光伏云平台，对整套光伏组件智能运维系统进行功能检查。检查步骤如下：

6.1优化器与采集网关连通性检查

（1）一般情况下，档案导入采集网关后，采集网关会将心跳信号发送给优化器；此时开展检查，需要使用本地上位机读取采集网关下的优化器参数信息；如果能正常读取，说明优化器与采集网关之间的双向通信是正常的；

（2）打开逆变器母线直流端开关，过1分钟后，使用本地上位机读取电流信息，如能读到，说明优化器已正常合闸。

6.2故障更换

(1)使用绝缘工具，戴上防护手套，严禁穿戴易导电物品；

(2)断开采集网关交流开关或急停开关；

(3)逆变器所有直流开关打到OFF状态；

(4)逆变器端直流母线断开；

(5)确保已断开所有逆变器与电网的连接；

(6)万用表测量组串电压，确认组串电压已降至安全电压内，组串电流为0；

(7)确认组件是否正常，若正常，进行关断器拆除，并更换新的关断器。若组件异常，请更换组件；

(8)连接网关交流开关或打开网关急停开关，让网关处于正常工作模式；

(9)在上机位或光伏云平台，删除异常优化器SN地址，进入设备调测界面，选择“维护>添加/删除设备”,添加新优化器SN地址；

(10)在设备调测界面，选择“维护>监测优化器布局”,绑定新的优化器。

(11)通信连接后，确保更换优化器正常；

(12)打开逆变器直流开关，闭合逆变器交流侧与电网之间的断路器，组串工作正常。

7 技术参数

产品型号	PVO-C370-U1	PVO-C450-U1	PVO-C600-U1	PVO-C800-U1
输入参数				
额定输入功率	370W	450W	600W	800W
最大输入电压	50V	50V	80V	80V
最大输入电流	12A	15A	16A	20A
最大输入短路电流	15A	17A	18A	23A
最大效率	99.50%			
MPPT电压范围	12～50V	12～50V	12～80V	12～80V
输出参数				
最大输出功率	370W	450W	600W	800W
最大输出电压	50V	50V	80V	80V
最大输出电流	12A	15A	16A	20A
旁路输出	是			
输出关断电压	0V			
通信方式				
通信方式	HPLC（高速电力线载波通信）			
认证				
安全	IEC/EN 62109-1 IEC/EN 61000-6-1/-2/-3/-4			
常规参数				
尺寸	120mm(长)× 74mm(宽)× 24mm(厚)		112mm(长)× 88mm(宽)× 27mm(厚)	
重量 （不含线缆）	<0.5kg		<0.9kg	
输入/输出端子	MC4/兼容MC4			
输入/输出线长	客户定制			
工作温度	-40 ～ +85℃			
湿度范围	0 ～ 100%			
保护等级	IP68			
最大系统电压	1500V			
噪声	≤35 dB(A)			

CONTENTS

1 Overview

1.1 About Manual

This manual contains detailed introductions for functional performances, application & installation methods of the SLC PVO module-level optimizer series products. Before installing or using the devices, please read the instructions, requirements and precautions in the user manual carefully.

1.2 Manual Users

This manual is suitable for device Installers, O&M Staff, FAE, Technical Support Engineers, Sales Engineers and Power Station Owner.

1.3 Revision Record

No.	Contents	Version	Date of Issue
1	Create document，Newly Add content of Model: C800	V1.0.0	2023.09.25
2	Newly Add content of Model: C600	V1.1.0	2023.10.25
3	Newly Add content of Model: C370,C450	V1.2.0	2023.12.07
4	Update optimizer technical parameters	V1.2.1	2024.01.15
5	Update user manual cover	V1.2.2	2024.04.16
6	Update content： 6 Function Check & 5 Intelligent O&M Management Platform	V1.2.3	2024.05.07

1.4 Notice

All or part of the products,services and features described in the manual may not be within the purchase scope or the usage scope.The purchased products,services and features are stipulated by the commercial contracts signed between Siliconductor and the customer.

This user manual will be updated at irregular intervals and be subject to change without notice.

Unless otherwise specified, this user manual is only used as a operation guide, all statements, information and recommendations in the manual are provided "AS IS" without warranties, guarantees or representations of any kind, either express or implied.

2 Precautions

2.1 Liability Exemption

Before shipping, storage, installation, operation, use, and maintenance of the product, please read this user manual and conduct a comprehensive product implementation research. The product must be used under the conditions that complies with the design specifications; the use process shall strictly follow the precautions in this user manual, and comply with applicable local laws, regulations, standards, and code requirements.

In the event of any listed of the following, the manufacturer does not assume liability for quality warranty and product safety:

- Damage and accidents that attributed to force majeure.(including but not limited to earthquake,

flood, fire, war and other extreme conditions);

- Product damage and accidents that attributed to improper transportation conditions;

- Product damage and accidents that attributed to improper storage;

- The installation & use process does not comply with applicable local laws & regulations also does not meet the requirements of local standard;

- Non-professional, untrained personnel operate and use the device;

- Disassemble or change of products and modify the software code without authorization or permission;

- To operate devices outside the range permitted by technical parameters, use devices out of warranty period;

- Any personal injury, death, and property loss caused by action of negligent, intentional, gross negligence or improper operation of the user or a third party (not the reason of the Manufacturer).

2.2 Requirements for Operators

1 Each operator should read the user manual and be aware of the requirements and precautions;

2 Operators should master the composition and working principle of the PV power generation system;

3 Operators should comply with safety regulations and requirements related to electric systems, mechanical operation and work high above the ground scene;

4 Operators should comply with the relevant regulations and standards related to safety and electrical in the country or region where the device is used;

5 Operators should be well-trained by SLC on product installation & operating and be familiar with operation and use of devices;

6 Operators should wear personnel protective equipment and make good insulation protection; Strictly prohibit of wearing conductive metallic jewelry(such as watch and rings).

2.3 Requirements for Operational Environment

1 Before operation:

- Ensure that the devices are stored in a suitable temperature & humidity, clean & dry and well-ventilated environment;

- Avoid storing the device in an environment with large amounts of dust and volatile gases;

- Strictly prohibited to install,use and operate the devices in inclement weather.(such as lightning, rainstorm, and strong wind);

- Mounting tools should be safe and professional, which should be insulated and qualified for electrical operation and should not be overload operated.

2 During Installation:

- Ensure that the cable connections are tightly and well-insulated;

- Ensure that there is no voltage in the strings by switching off the optimizer,inverter and power supply;

- During installation, do not touch any components other than those required for wiring work.

3 During Run Time:

- Do not touch the devices intentionally to avoid electric shock, burns or other accidents.

3 Product Presentation

3.1 Product Introduction

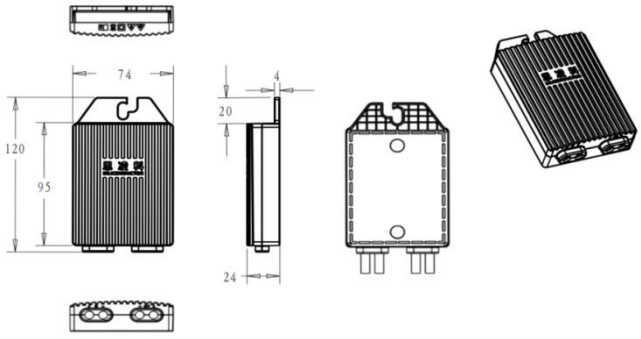
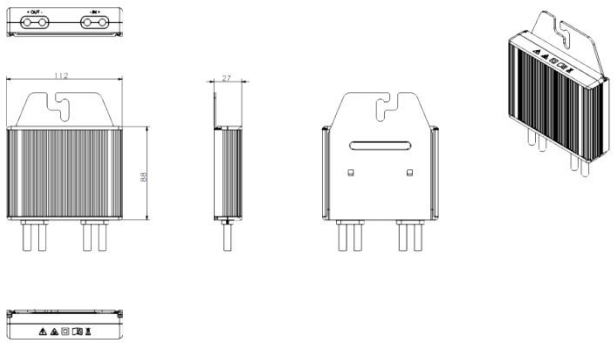
The PV module-level optimizer is a DC/DC conversion device installed on the back of a solar module. The SLC PRO Optimizer can optimize the power output and efficiency of PV system by tracking and adjusting the maximum power point (MPP) of each module in real-time. It can reduce the power generation loss that resulted from some external factors (such as weak sunlight, shading and different orientations etc.). Meanwhile, the optimizer also has functions of module-level shut-off, monitoring and detecting, which will implement O&M management of power plant in intelligent.

3.2 Product Models

This user manual mainly covers the following product models:

Models
PVO-C370-U1
PVO-C450-U1
PVO-C600-U1
PVO-C800-U1

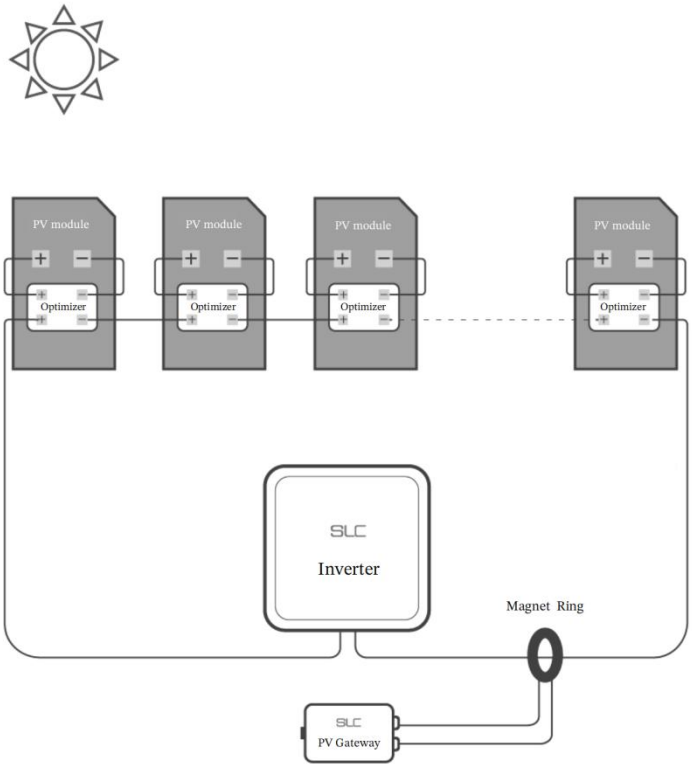
3.3 Product Structure

Model	Drawing
PV0-C370-U1 **PVO-C450-U1**	
PV0-C600-U1 **PVO-C800-U1**	

3.4 Icon Descriptions

Icons	Icon meaning
	Beware of electric shock
	Beware of burns
	Strengthen insulation
	Read instructions
	Scraped and recycle

3.5 Networking Scenarios



4 Site Installation

4.1 Matters Need Attention

1 Leave enough space and plan reasonably for the installation position on module backboard for device hanging;

2 Ensure the optimizer cables length is enough to be connected to both the module and adjacent optimizer;

3 The loop distance on HPLC communication between the optimizer and the inverter shall not exceed 300m, further on, there would probably cause communication data loss if the distance from the farthest optimizer to the magnet ring is exceed of 150m;

4 Strictly prohibited to install device directly exposure to sunlight;

5 Strictly prohibited to store flammable and explosive materials in the device installation area;

6 Strictly prohibited to install device exposed to rain or in soaking.

4.2 Open-Packaging Inspection

1 Outer Packing carton Inspection

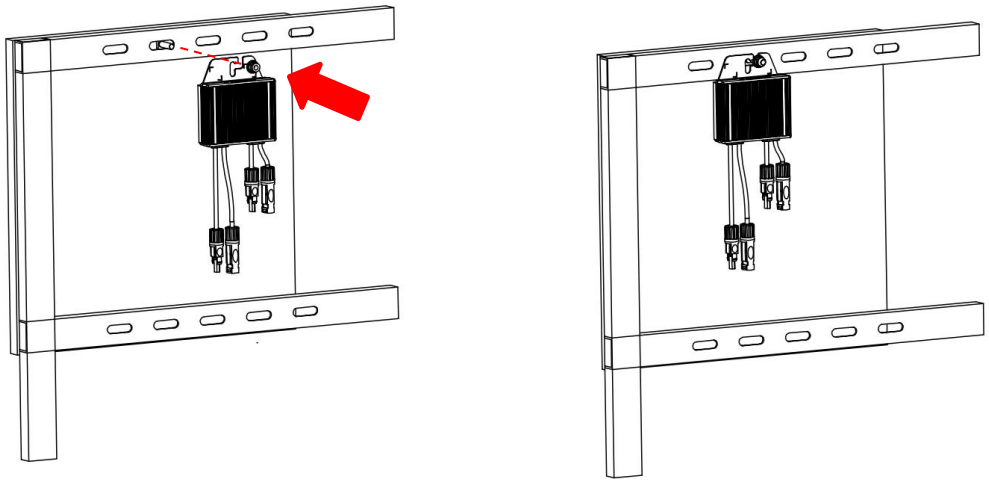
Any packaging damage (include of carton broken, hole or other bad carton conditions) may result in devices damaged in the carton. So please contact directly to your distributor and do not open the carton if you find the packaging is in bad conditions.

2 Devices Inspection

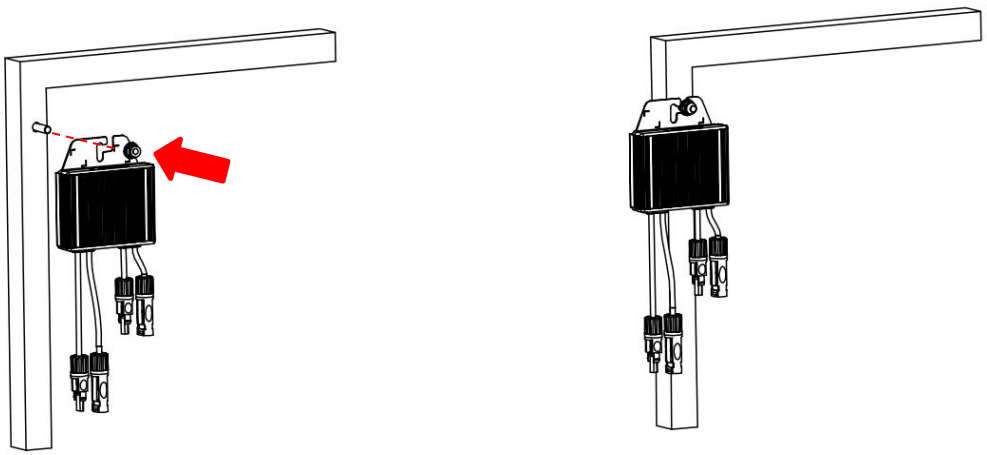
If packaging is in good conditions then open the box and check whether the inside contents are complete and intact. Any items is missing or damaged, contact your distributor as soon as possible.

4.3 Installation Position

1 Option one: Mount the optimizer on C-shaped steel brackets, use screw nuts and gasket to tighten.



2 Option two: Mount the optimizer on the frame of the PV panel, use screw nuts and gasket to tighten.



NOTE： It is prohibited to install the PV optimizer in place where is directly exposed to sunlight, rain, and snow, including gaps between modules . A fully sheltering installation point is a better choice. The space between the PV optimizer and the PV module should be at least 1.5 cm.

3 Others: Determine the installation position and method according to the actual situations of module and power station on the site and then to make purchase from appropriate supplier.

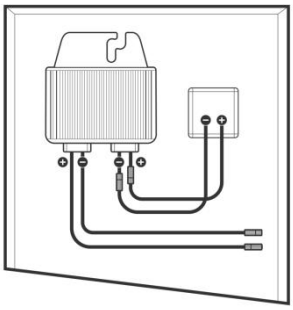
4.4 Installation Procedure

1 When the Optimizer mounting position is fixed, remove one label from clip and affix it to the corresponding location on the SN number collection paper.

2 Connection between the optimizer and the PV module:

✧ Connect optimizer input (IN) to the PV module junction box:

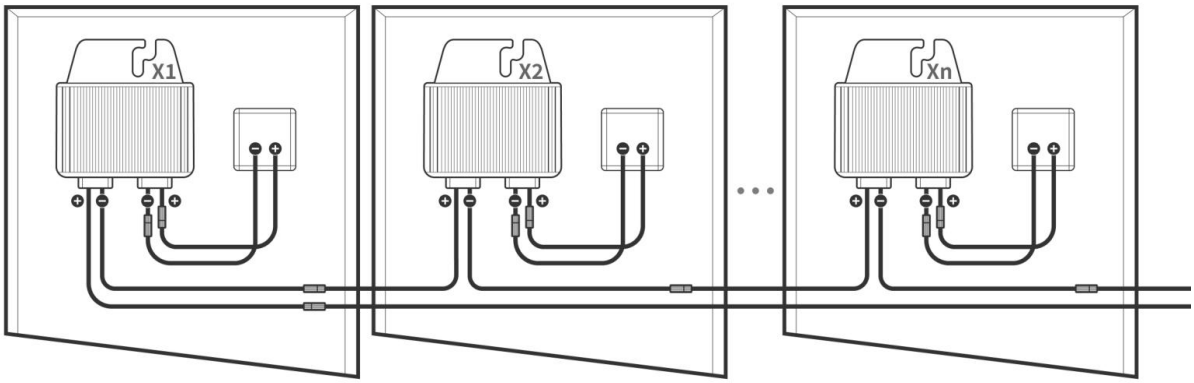
- Always connect the optimizer input negative (IN-) cable to the negative terminal of the PV module junction box;
- Always connect the optimizer input positive (IN+) cable to the positive terminal of the PV module junction box.



3 Connection between adjacent optimizer:

✧ If many optimizer (X1~Xn) are installed to corresponding PV modules and interconnected in series to be a string, handshake connections are required between adjacent optimizer:

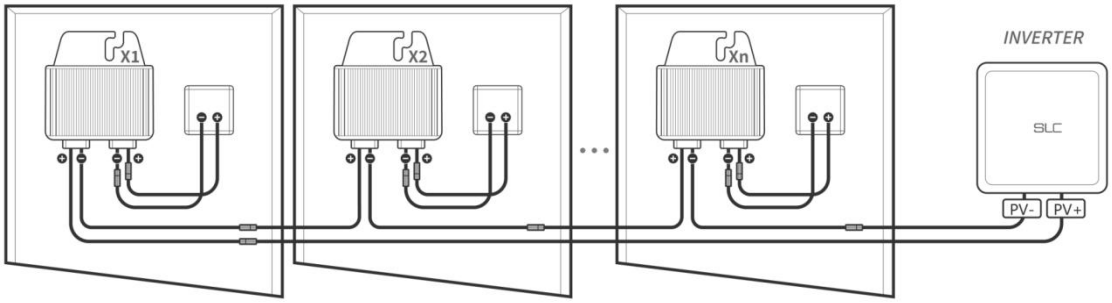
- Line up the optimizer sequence from left to right as a line, mark the leftmost unit as X1 and the rightmost unit as Xn;
- Optimizer X1: Keep the optimizer X1 output positive (OUT+) cable open up and then connect the optimizer X1 output negative (OUT-) cable to the optimizer X2 output positive (OUT+);
- Optimizer X2: Connect the optimizer X2 output negative (OUT-) cable to the output positive (OUT+) of optimizer X3 (continue this connection sequence from optimizer X3 to optimizer Xn);
- Optimizer Xn: Keep the optimizer Xn output negative (OUT-) cable open up.



4 Connection between the optimizer and the inverter:

✧ If many optimizer (X1~Xn) are installed to corresponding PV modules and interconnected in series to be a string and handshake connections have been established between adjacent optimizer:

- Connect the optimizer X1 remaining output positive (OUT+) cable to the positive terminal (PV+) of the inverter;
- Connect the optimizer Xn remaining output negative (OUT-) cable to the negative terminal (PV-) of the inverter.



5 Attention Points:

✧ Ensure that the mated connectors are the same model or are compatible with each other when connecting in pairs. Using incompatible MC4 connectors for connection may result in serious accident. Any equipment damage and safety accidents arising therefrom shall not be assumed liability by manufacturer;

✧ In any conditions, the sum of the open-circuit voltages of all modules in a string should not exceed the maximum input voltage of the inverter.

✧ During installation, the bending radius of the cable must be greater than 50 mm.

5 Intelligent O&M Management Platform

The optimizer works rely on coordinated support with PV Intelligent Data Acquisition Gateway (abbreviate as "Gateway") and Intelligent O&M Management Platform (abbreviate as "Cloud Platform"),etc., in order to achieve intelligent operation and maintenance management of PV power

stations. For the connection method and usage details with the supporting products, please refer to the user manual of the corresponding product (please contact the distributor to obtain or scan the QR code to download).

6 Function Check

When the optimizer and the gateway have been configured, the PV cloud platform can be used to perform functional checks on the entire photovoltaic module intelligent operation and maintenance system. The check steps are as follows：

6.1 Connectivity Check With The Gateway

- In general, after the SN file is imported into the gateway, the gateway will send a “keep alive” signal to the optimizer. Meanwhile the optimizer activation will be triggered and implemented of testing, adjustment and allocation by data acquisition from optimizer under the gateway through local upper computer software.If the data can be read normally, it refer to that the two-way communication between the optimizer and the gateway is running properly；

- Then switch on the inverter and wait for 1 minute, if the circuit data can be read by the local upper computer, it indicates the optimizer is working normally in power-on state.

6.2 Faulty Units Replacement

-Use insulated tools, wear protective gloves, and strictly prohibit wearing conductive items;

- Switch off the AC power supply or press the emergency stop down to power off the gateway;

-Turn all inverter DC switches to the OFF position;

-Then disconnected the inverter from the PV system;

-Ensure that all inverters are disconnected from the power grid;

-Measure the string voltage with a multi-meter to confirm that the string voltage has dropped to a safe voltage, and the string current is 0;

-Inspection on the PV modules firstly, if the module be tested in proper state, then replace a new optimizer. Otherwise replace the PV modules;

-Power on AC switch or screw on emergency stop to activate the gateway.;

-Delete the abnormal optimizer SN number by either upper computer or cloud platform then select "Maintenance>Add/Remove Device" to add a new optimizer SN number into through the Cloud platform debugging interface;

- In the device debugging interface, select "Maintenance>Monitor optimizer Layout" and bind a new optimizer;

-After two ways communication has been tested normal, Then indicate the replaced optimizer runs properly.

-Switch on the inverter DC switch, and turn on the AC switch between the inverter and the power grid, then indicate the string works normally.

7 Technical Specifications

Model	PVO-C370-U1	PVO-C450-U1	PVO-C600-U1	PVO-C800-U1
Input				
Rated Input Power	370W	450W	600W	800W
Max. Input Voltage	50V	50V	80V	80V
Max. Input Current	12A	15A	16A	20A
Max. Input Short-Circuit Current	15A	17A	18A	23A
Max. Efficiency	99.50%			
MPPT Voltage Range	12～50V	12～50V	12～80V	12～80V
Output				
Output Power	370W	450W	600W	800W
Max. Output Voltage	50V	50V	80V	80V
Max. Output Current	12A	15A	16A	20A
Bypass Output	Yes			
Output Shut-off Voltage	0V			
Communication				
Communication Method	HPLC (High-Speed Power Line Carrier Communication)			
Certification				
Safety	IEC/EN 62109-1 IEC/EN 61000-6-1/-2/-3/-4			
Weight and Overall Dimension				
Dimensions	120mm(length)× 74mm(width)× 24mm(thickness)		112mm(length)× 88mm(width)× 27mm(thickness)	
Weight (excluding cables)	<0.5kg		<0.9kg	
Input/Output Terminals	MC4/Compatible with MC4			
Input/Output Cable Length	Customer Customization			
Operating Temperature	-40 ～ +85℃			
Humidity Range	0 ～ 100%			
Protection Rating	IP68			
Maximum System Voltage	1500V			
Noise	≤35 dB(A)			

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