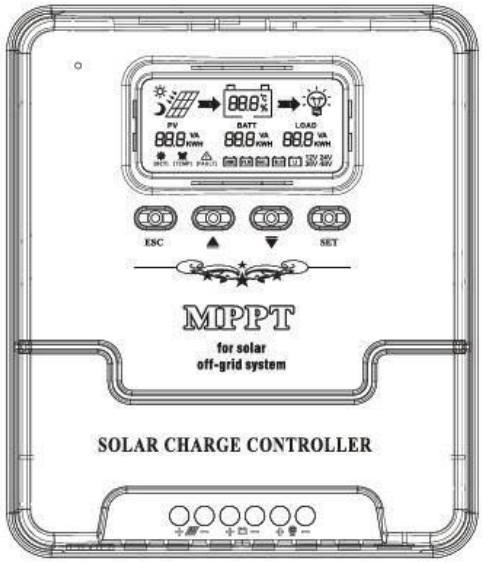
CM-D SERIES MPPT SOLAR CHARGE CONTROLLER

USER MANUAL

CM-D10 / CM-D20 / CM-D30 / CM-D40 / CM-D50 / CM-D60



Model	CM-D10	CM-D20	CM-D30	CM-D40	CM-D50	CM-D60
Storage battery voltage	12V/24V auto					
Maximum PV voltage	50V V OC		100V V OC			
Charging current	10A	20A	30A	40A	50A	60A
Discharge current	20A					
USB output	5V*3A					

Safety Instructions

Read this manual completely before installation, wiring, commissioning, or maintenance.

- *As this controller operates at a voltage exceeding the safe voltage limit for the human body, please read this manual carefully before operation. Only operate the controller after all required safety procedures and precautions have been properly completed.*
- *Do not disassemble the controller; there are no user-serviceable parts inside.*
- *Install indoors in a dry, well-ventilated location.*
- *The controller must be installed indoors. Do not expose internal components, and ensure that no water enters the controller.*
- *Install suitable DC-rated fuses or circuit breakers in the battery, PV, and load circuits.*
- *Disconnect PV generation and battery power before installation or maintenance.*
- *Verify polarity and tighten all terminals securely. Loose connections may overheat and cause fire.*

1. Product Introduction

1.1 Overview

This product continuously monitors the power output of the solar panels and tracks the Maximum Power Point (MPP) in real time, ensuring that the system operates at maximum power output for efficient battery charging. Designed for off-grid solar photovoltaic (PV) systems, it coordinates the operation of the solar panels, battery, and loads, serving as the core control unit of the off-grid PV system.

This product uses an LCD display to show the operating status, operating parameters, control parameters, and other information. Users can conveniently view various parameters using the buttons and modify the control parameters as required to meet the requirements of different system configurations.

The controller features comprehensive electronic fault self-diagnostic functions and advanced electronic protection mechanisms, which help minimize the risk of damage to product components caused by incorrect installation or system faults.

1.2 Key Features

• Adopts advanced dual-peak or multi-peak tracking technology. When the solar panels are partially shaded or some of the panels are damaged, multiple peaks will appear on the I-V curve, and the controller can still accurately track the maximum power point.

• Built-in maximum power point tracking algorithm can significantly improve the energy utilization efficiency of the photovoltaic system, with charging efficiency approximately 25% higher than that of conventional PWM charging.

• A combination of multiple tracking algorithms enables the controller to accurately track the optimal operating point of the I-V curve within an extremely short period of time.

• MPPT tracking efficiency can reach up to 99.9%.

• Adopts advanced digital power technology, with circuit energy conversion efficiency of up to **[value missing in the original text]**.

• Supports charging programs for various types of batteries, including gel batteries, sealed batteries, flooded batteries, and lithium batteries.

• Features a current-limiting charging mode. When the solar panel power is too high and the charging current exceeds the rated current, the controller automatically reduces the charging power so that it operates at the rated charging current.

• Supports instantaneous high-current startup of capacitive loads.

• Supports automatic battery voltage recognition.

• Features an LCD fault display, making it convenient for users to identify system faults.

• Features a built-in over-temperature protection mechanism. When the temperature exceeds the preset value of the device, the charging current decreases linearly as the temperature rises, thereby reducing the temperature rise of the controller and preventing damage to the controller due to excessive temperature.

• Features temperature compensation, automatically adjusting the charging and discharging parameters to extend battery service life.

• Comprehensive electronic protection functions.

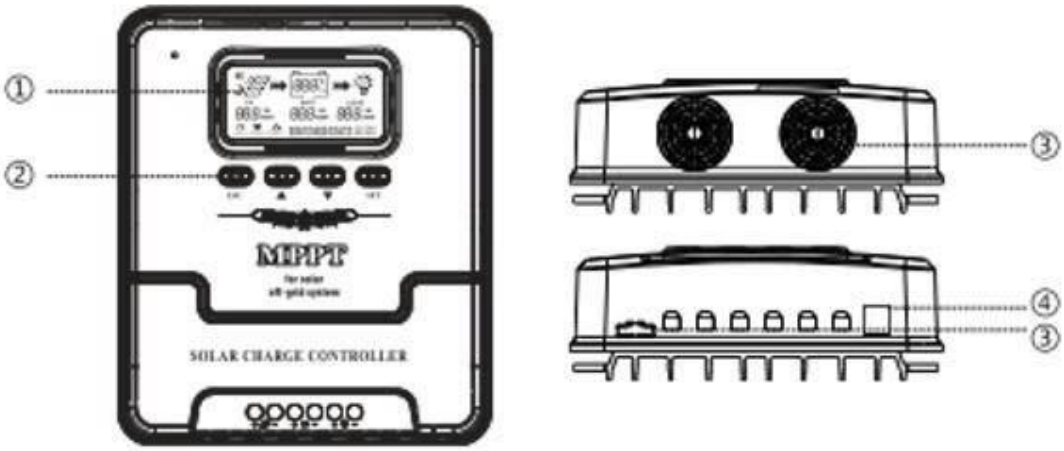
• Uses a metal enclosure for better heat dissipation.

• Lithium battery **[content missing in the original text]** charging function.

• Supports charging with high PV input withstand voltage, which allows smaller-gauge solar wiring to be used and reduces overall system cost.

• Models supporting communication protocols are available as an option to meet communication requirements in different applications.

1.3 Product Structure



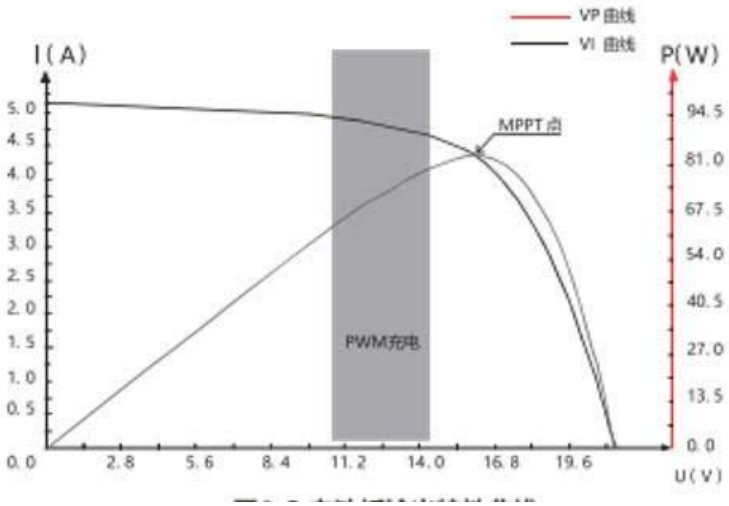
No	Name
1	LCD display
2	Operating keys
3	Cooling vents
4	USB output

1.4 Introduction to Maximum Power Point Tracking Technology

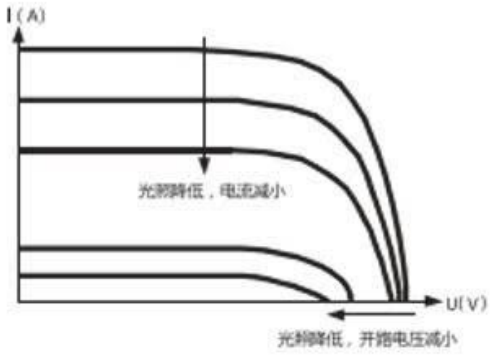
Maximum Power Point Tracking (MPPT) is an advanced charging technology that adjusts the operating state of the electrical module so that the solar panel can output more electrical energy. Because of the nonlinear characteristics of the solar array, there is a maximum energy output point (maximum power point) on its curve. Conventional controllers (switching charging technology and PWM charging technology) cannot maintain battery charging at this point, and therefore cannot obtain the maximum energy from the solar panel. A solar charge controller with MPPT control technology can track the maximum power point of the array at all times to obtain the maximum energy for charging the battery.

Taking a 12V system as an example, because the peak voltage (Vpp) of a solar panel is approximately 17V while the battery voltage is approximately 12V, when a conventional controller charges, the solar panel voltage is around 12V and does not fully utilize the maximum power point. The MPPT controller can overcome this problem by adjusting the input voltage and current of the solar panel from time to time to achieve the purpose of maximum input power.

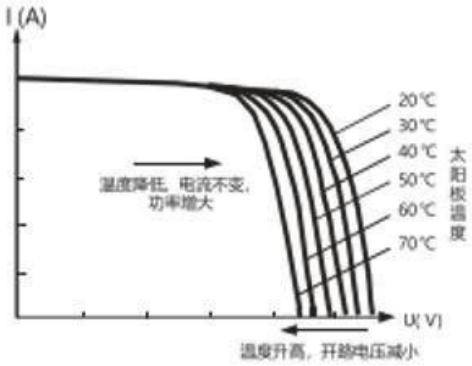
Compared with conventional PWM controllers, MPPT controllers can utilize the maximum power of the solar panel, and therefore can provide a larger charging current. In general, MPPT can improve energy utilization by approximately 25% compared with PWM controllers.



At the same time, because ambient temperature and illumination conditions differ, the maximum power point changes frequently. The company's MPPT controller adjusts parameters from time to time according to different conditions so that the system remains near the maximum power point. The entire process is completely automatic and requires no user adjustment.



Relationship Between Solar Panel Output Characteristics and Irradiance



Relationship Between Solar Panel Output Characteristics and Temperature

2. Product Installation

2.1 Installation Precautions

Installing the battery requires great care. When installing an open-type lead-acid battery, wear protective goggles. If you come into contact with battery acid, rinse immediately with clean water.

Do not place metal objects near the battery to prevent the battery from short-circuiting.
Acidic gas may be generated when the battery is charged. Ensure that the surrounding environment is well ventilated.
The battery may generate flammable gas. Keep away from sparks.
When installing outdoors, avoid direct sunlight and rain.
Loose connection points and corroded wires may generate excessive heat, melt the insulation layer of the wires, burn surrounding materials, and even cause fire. Therefore, make sure that the connectors are tightened. It is best to secure the wires with cable ties to avoid loose wires caused by shaking during mobile applications.
The voltage at the system connection terminals may exceed the safe voltage for the human body. During operation, use insulated tools and keep hands dry.
The battery terminals on the controller can be connected to either one battery or a battery bank. The subsequent instructions in the manual are based on a single battery, but they are also applicable to a battery-bank system.
Follow the battery manufacturer's safety recommendations.
The system connection wires should be selected according to a current density not greater than 4A/mm².
Ground the controller grounding terminal.

2.2 Cable Specifications

The wiring method must comply with national and local electrical codes. The battery and load cable specifications must be selected according to the rated current. Refer to the following table for cable specifications:

Model	Rated Charging Current	Rated Load Current	Battery Cable	Load Cable
CM-D10	10A	20A	3mm²	5mm²
CM-D20	20A	20A	5mm²	5mm²
CM-D30	30A	20A	6mm²	5mm²
CM-D40	40A	20A	8mm²	5mm²
CM-D50	50A	20A	10mm²	5mm²
CM-D60	60A	20A	12mm²	5mm²

2.3 Installation and Wiring

WARNING: Risk of explosion! Never install the controller in a sealed space together with an open-type battery! Do not install it in an enclosed place where battery gas may accumulate.

WARNING: High-voltage danger! The photovoltaic array may generate a very high open-circuit voltage. Disconnect the circuit breaker before wiring and be very careful during wiring.

CAUTION: During installation, ensure sufficient air can pass through the controller heat sink. Leave at least 150 mm of space above and below the controller to ensure natural convection heat dissipation. If installed in a sealed enclosure, ensure reliable heat dissipation through the enclosure.

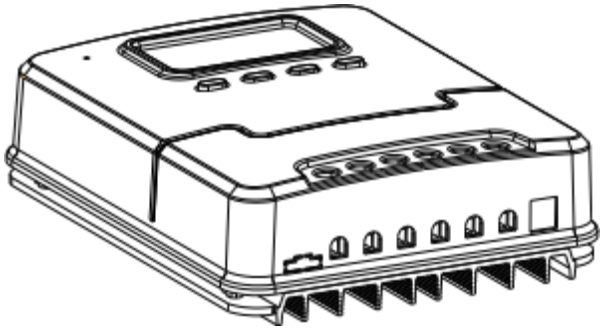


Installation and Heat Dissipation

Step 1: Select the installation location. Avoid installing the controller in a place exposed to direct sunlight, high temperature, or easy water ingress, and ensure good ventilation around the controller.

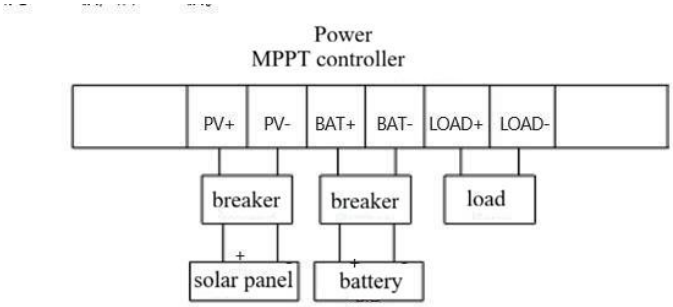
Step 2: Fix the mounting template. First place the controller in a suitable position, then mark the mounting positions and drill four appropriately sized mounting holes at the four marks.

Step 3: Fix the controller. Align the controller with the four pre-drilled mounting holes and install the screws.



Step 4: Wiring

For installation safety, first connect the battery, then the solar panel, and finally the load. Please note that the positive and negative poles of the wiring must not be reversed. Wiring sequence: “+” first, then “-”.



① Connect the Load

WARNING: Risk of electric shock! We strongly recommend installing fuses or circuit breakers at the PV-array terminal, load terminal, and battery terminal to prevent electric-shock hazards during connection or operation. Before connection, ensure that the fuses or circuit breakers are in the open state.

WARNING: High-voltage danger! The photovoltaic array may generate a very high open-circuit voltage. Disconnect the circuit breaker before wiring and be very careful during wiring.

WARNING: Risk of explosion! Once the positive and negative poles of the battery or the wires connected to the positive and negative poles are short-circuited, fire or explosion may occur. Be very careful during operation.

② Connect Power

When all power connections are securely and reliably connected and the wiring is confirmed to be correct with correct polarity, first close the battery fuse or circuit breaker. The LCD screen will display. If there is no display, immediately disconnect the fuse or circuit breaker and check whether the wiring is correct.

If the battery power supply is normal, then connect the solar panel. If there is sufficient sunlight, the controller charging indicator will flash and begin charging the battery.

After the battery and photovoltaic connection are completed, finally close the load fuse or circuit breaker. At this time, manual mode can be used to test whether the load ON/OFF function is normal. See the load operating modes and operation section for details.

WARNING: When the controller is charging normally, disconnecting the battery connection may have an adverse effect on the DC load and may even damage the load.

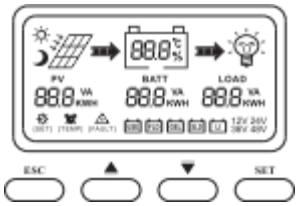
WARNING: Within ten minutes after charging stops, reverse battery connection may damage internal components of the controller.

Notes:

1) The cable between the battery and the controller should be installed as short as possible; a recommended distance of no more than 150 mm is shown in the original manual.
2) The controller will compensate the charging voltage according to ambient temperature. The reference temperature is 25°C.
3) If an inverter is connected to the system, connect the inverter directly to the battery and do not connect it to the controller load terminal.

3. Product Operation and Display

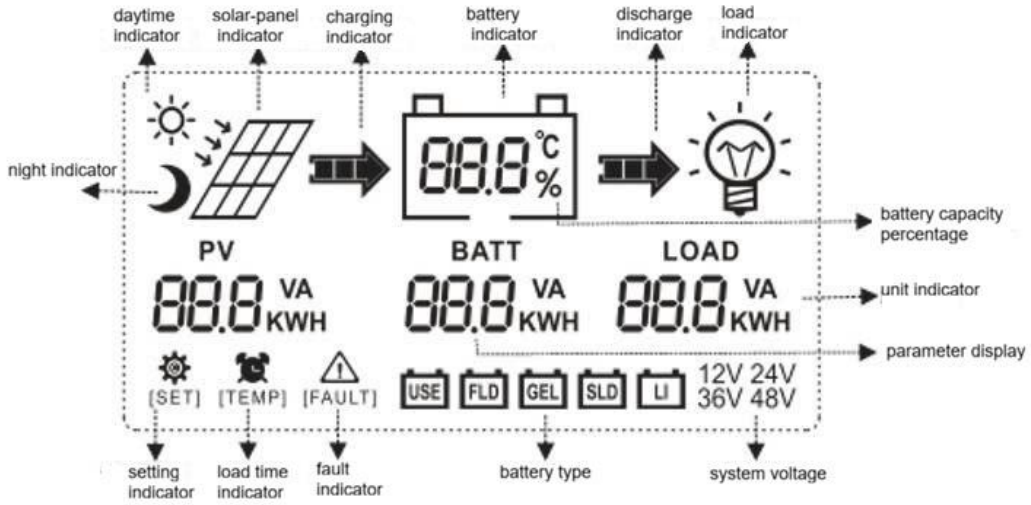
3.1 Key Operation



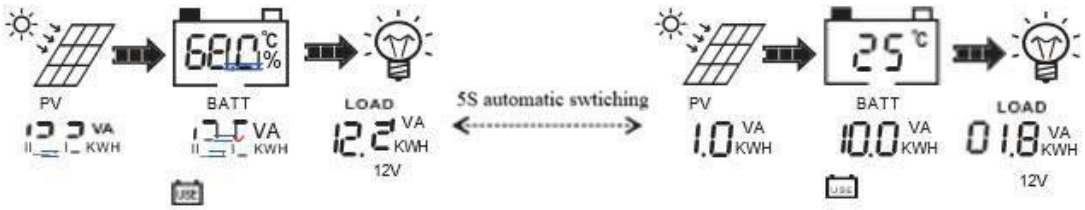
Key	Function
ESC	Switch the load ON/OFF and exit parameter setting.
▲ UP	On the main screen, turn to the previous parameter; in setting mode, increase the data.
▼ DOWN	On the main screen, turn to the next parameter; in setting mode, decrease the data.
SET	Enter setting / confirm / save. Hold for 10 seconds to enter parameter setting.

3.2 LCD Startup and Main Screen Display

Main-screen indicators shown in the original manual: daytime indicator, solar-panel indicator, charging indicator, battery indicator, discharge indicator, load indicator, night indicator, battery capacity percentage, unit indicator, parameter display, setting indicator, load timer indicator, fault indicator, battery type, and system voltage (12V / 24V / 36V / 48V).

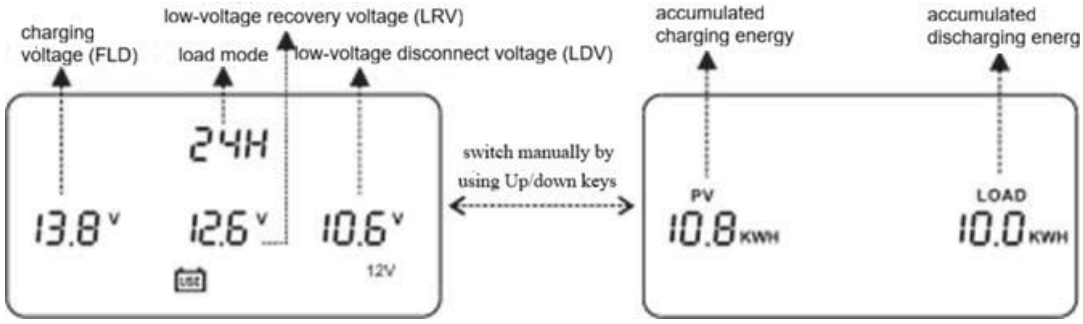


3.3 Main Screen Display Introduction



On the main screen, the display automatically switches every 5 seconds between the battery-capacity screen and the temperature screen.

Note: Detection parameters cycle automatically on the main interface



System setting parameters

Energy parameters

3.4 Introduction to Load Modes

This controller has three load operating modes. The mode parameters are as follows:

Mode	Description
Light-control timing mode (1H-23H)	When there is no sunlight, the battery voltage is lower than the light-control ON voltage; after the controller detects this delay, it turns on the load. The load is turned off after the set time.
Pure light-control mode (0H)	The load turns on at night and turns off during the day.
Always-on mode (24H)	The load output remains continuously on; this mode is suitable for loads requiring 24-hour power supply.

Note: In the above three modes, the load can be turned ON/OFF by pressing the relevant key. The next day, the load operates according to the mode set in the controller.

3.5 System Parameter Setting

Restore factory defaults: On the main screen, press and hold the SET and ESC keys simultaneously for 5 seconds to restore the charging settings and load settings to factory values.

Enter setting screen: On the main screen, press and hold SET to enter the setting screen. The display shows the relevant symbol flashing, and the controller enters the setting state.

Battery type setting: On the setting screen, select the battery type by pressing SET. Select the required battery type when the corresponding battery-type icon flashes. If there is no key operation for 10 seconds, the controller automatically exits and saves the set parameters.

Charging parameter setting: On the setting screen, press SET to select the parameter to be set. The selected parameter icon flashes. Press UP or DOWN to adjust the parameter. Note: When the set battery type is FLD, GEL, or SLD, the charging parameters cannot be set.

System voltage setting: On the setting screen, press SET to select the system voltage type “36V 48V”. When the corresponding system-voltage icon flashes, press UP or DOWN to select the required system voltage. There are four system-voltage options: 12V, 24V, 36V, and 48V. The charging parameters are multiplied accordingly: 12V ×1, 24V ×2, 36V ×3, 48V ×4.

Load Setting

On the setting screen, press SET to select the load type. When the corresponding parameter icon flashes, press UP or DOWN to adjust the parameter. If there is no key operation for 10 seconds, the controller automatically exits and saves the set parameter.

CAUTION: After the system voltage is set, the controller must be powered on again; otherwise, it may operate under an abnormal system voltage. The controller allows the user to set parameters according to actual conditions. Parameter setting must be completed under the guidance of a professional. Incorrect parameters may cause the system to operate abnormally. See Table 3 for the setting contents.

No.	Description	Parameter Range	Default
1	Battery type	Sealed battery / Flooded battery / Gel battery / Lithium battery	Sealed battery
2	Battery grade / system voltage	12V / 24V	AUTO
3	Charging voltage	10.0 - 20.0V	13.8V
4	Low-voltage recovery voltage	9.0 - 20.0V	12.6V
5	Low-voltage disconnect voltage	9.0 - 20.0V	10.6V

3.6 Abnormal Display and Settings

When a system fault occurs in the controller, the fault indicator icon “FAULT” will be displayed.

Display / Indicator	Fault Description
Solar panel icon	Solar-panel overvoltage; the solar-panel indicator flashes.
Battery icon	Battery flashes; battery-system parameter setting error.
Load / lamp icon	LED flashes; load overcurrent or short-circuit protection.

4. Product Protection Functions and System Maintenance

4.1 Introduction to Protection Functions

- Waterproof protection - Waterproof rating: IP21.
- PV input power limiting protection - When the PV input power is greater than the rated power, the controller limits the solar-panel power within the rated power range to prevent excessive current from damaging the controller. The controller enters current-limited charging.
- PV input overvoltage protection - When the PV input voltage is higher than the rated voltage, the controller automatically disconnects the PV input.
- PV input undervoltage protection - When the PV-array input voltage is lower than the battery voltage, the controller stops charging; when the voltage returns to normal, charging automatically resumes.
- PV input reverse-polarity protection - When the PV array is connected with reverse polarity, the controller will not be damaged. After correcting the wiring error, it will continue to operate normally.
- Load short-circuit protection - After the load is short-circuited, the load will delay and protect the output.
- Load overcurrent protection - When the load current exceeds the rated value, the controller protects the output.
- Load overload protection - When the connected load is excessively large or a short circuit occurs, and after a certain delay the controller automatically turns on the load; when an output short circuit occurs, the output can be restored after manual release.
- Night anti-reverse-current protection - Prevents the battery from discharging through the solar panel at night.
- TVS lightning protection.
- Over-temperature protection - When the controller temperature exceeds the set temperature, the controller reduces charging power or stops charging, as shown in the original manual.

4.2 System Maintenance

- To maintain long-term good working performance, it is recommended to carry out the following inspections at least twice a year.
- Confirm that the controller is securely installed in a clean and dry environment.
- Check whether the airflow and heat dissipation around the controller are unobstructed; remove dirt or debris from the heat sink.
- Check all exposed conductors for insulation damage, discoloration, corrosion, burning, drying, or insect damage; repair or replace wires as necessary.
- Check whether the display and equipment operation are consistent. Pay attention to any fault or error indications and take corrective measures when necessary.
- Check all wiring terminals for corrosion, insulation damage, signs of high temperature/burning, or discoloration, and tighten terminal screws.
- Check for dirt, nesting insects, and corrosion, and clean as required.
- If the lightning arrester has failed, replace it promptly to prevent lightning damage to the controller or other user equipment.

WARNING: Risk of electric shock! Before performing the above operations, make sure that all power supplies to the controller have been disconnected, and then carry out the corresponding inspection or operation.

5. Product Specifications

5.1 Electrical Parameters

Parameter	CM-D10	CM-D20	CM-D30	CM-D40	CM-D50	CM-D60
System voltage	12V/24V automatic recognition					
No-load consumption	≤0.4W					
Maximum PV input voltage	55V VOC			100V VOC		
Battery voltage	9-32V					
Maximum power point voltage range	Battery voltage +2V to 50V			Battery voltage +2V to 100V		
Rated charging current	10A	20A	30A	40A	50A	60A
Rated load current	20A					
USB output	5V/3A					
Maximum PV input power	120W/12V; 240W/24V	240W/12V; 480W/24V	360W/12V; 720W/24V	480W/12V; 960W/24V	600W/12V; 1200W/24V	720W/12V; 1440W/24V
Conversion efficiency	≤98%					
MPPT tracking efficiency	>99%					
Temperature compensation coefficient	-2mV/°C/2V (default)					
Operating temperature	-10°C to +65°C					
Protection rating	IP21					
Electromagnetic compatibility	Complies with EN61000, EN55022, EN55024					
Communication method	RS485 optional					
Altitude	≤3000 m					
Net weight	376g		946g		1226g	
Gross weight	500g		1148g		1428g	
Product dimensions	130×130×58mm		186×186×67mm		218×186×67mm	
Package dimensions	170×158×88mm		236×216×95mm		260×216×95mm	
Outer-carton dimensions	495×355×465mm		470×440×305mm		535×485×235mm	
Packing specification	30 units/carton		12 units/carton		10 units/carton	

5.2 Battery Charging Voltage Parameters

Battery Type	Sealed Lead-Acid Battery (GEL as printed)	Sealed Lead-Acid Battery (SLD)	Flooded Lead-Acid Battery (FLD)	User (Custom)	Lithium Battery (LI)
System Voltage	Auto	Auto	Auto	Auto/12/24	12/24
Equalization Voltage (EQU)	14.2V	14.6V	14.8V	---	---
Boost Voltage (BST)	14.2V	14.4V	14.6V	---	---
Float Voltage (FLD)	13.8V	13.8V	13.8V	Defined by GEL	Defined by GEL
Recovery Voltage (LRV)	12.6V	12.6V	12.6V	Defined by GEL	Defined by GEL
Low-Voltage Disconnect (LDV)	11.1V	11.1V	11.1V	Defined by GEL	Defined by GEL

When USER battery is selected as the custom battery type, the system voltage parameters must be consistent with the connected battery. Under the custom-battery charging parameters, the settings are as follows: Charging voltage > Recovery voltage > Low-voltage disconnect voltage.