LINOVISION

SOLAR-CMP10A

User Manual

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Contents

1.Products Introduction

1.1 Products Description

The SOLAR-CMP10A series MPPT solar controller employs maximum power point tracking (MPPT) technology to achieve real-time optimization of the solar panel's operating point, thereby maximizing the power transfer from the photovoltaic (PV) system to the battery. This significantly enhances PV charging efficiency. The controller's precise regulation of charging current and voltage makes it particularly suitable for lithium battery charging applications, especially in small off-grid solar power systems.

Additionally, the controller offers multiple operation modes, including automatic, light-controlled, and manual modes, as well as a test mode designed for engineering installation and commissioning.

1.2 Main Features

1. MPPT Technology Compatible with Gel, AGM, Lithium, and Other Battery Types
2. Peak Conversion Efficiency Reaches up to 98%
3. High Tracking Efficiency of 99%
4. Automatic 12V/24V System Detection
5. Time-Based Load Control with Timer and Dimmer Functionality
6. Maximum Output Efficiency of 96%
7. Aluminum Housing for Enhanced Cooling Performance
8. Optional Motion Sensor Functionality

1.3 Technical Parameters

MPPT Solar Charge Controller (Waterproof)	
Model	SOLAR-CMP10A
System voltage	12/24V Auto
Load Parameter	
Max boost output voltage	17~55v/12V(27~55V/24V)
Rated output current	10A
Typical efficiency	98%
Over Load Capability	110% normal run, 125% 1min, 150% 20s
PV Parameter	
Max PV Output power	170W12V/340W24V
Max PV open circuit voltage	100V
Max PV current	10A
Battery Parameter	
Type of Battery	AGM
Max Battery voltage	34V
Main charge voltage	14.2V
Boost charge voltage*	14.6V
Float charge voltage	13.6V
Equalization charge voltage	14.6V
Over Discharge voltage	11.1V
Reconnect voltage	12.6V
Temp. compensation	4mV/33.8°F/2V(4mV/°C/2V)
Others	
External Communication	RS485/9600bps
Self-consumption	<14mA
low voltage protect	30% energy

Over Term	185°F(85℃)
Dimensions (L*W*H)	3.46*3.46*0.82″(88*88*21mm)
Net weight	1.124lb(510g)
Enclosure	IP67
Working temperature	-40°F to +131°F(-40℃ to +55℃)
Note: Technical data for 12V system at 77°F(25℃), x2 in 24V system	

1.4 Dimension

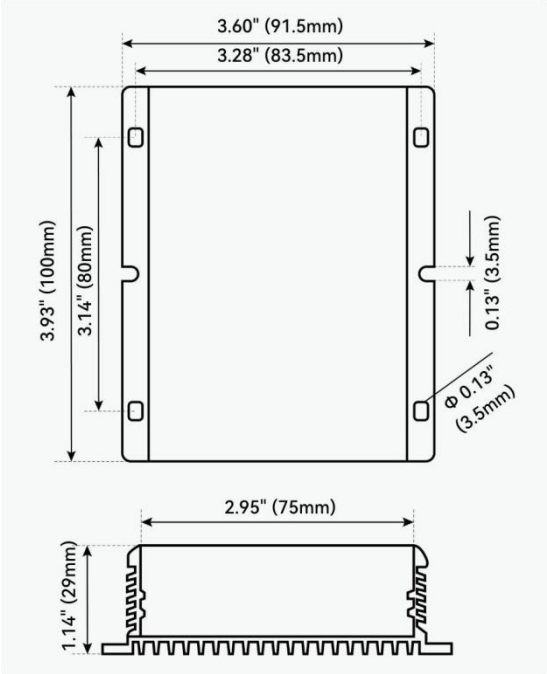
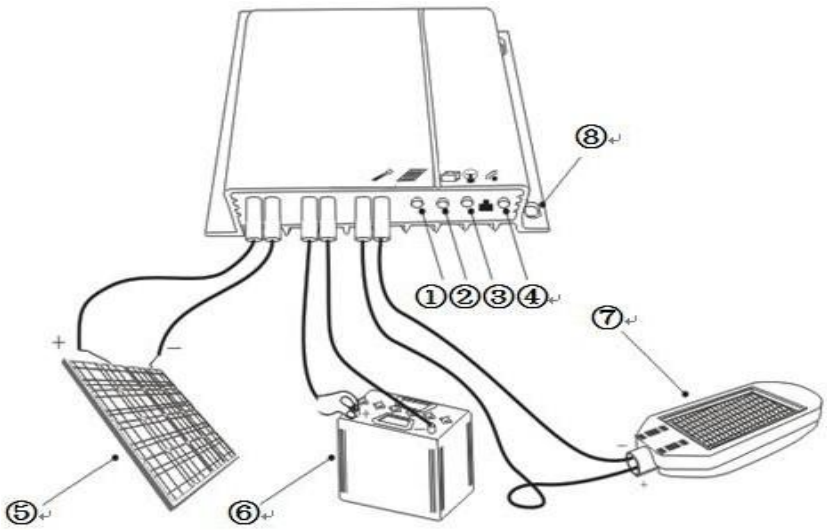


Figure 1.4 CMP10A appearance

2. Installation

2.1 Panel Installation



①PV indicator (green ②Battery indicator (red/green) ③Load indicator (yellow) ④IR communication connector

⑤PV connection terminal ⑥Battery connection terminal ⑦Load connection terminal ⑧Installation hole

2.2 LED Indicators

A. PV Indicator

Color	Indication	Working State
Green	On Solid	PV is charging Battery
Green	Flash Fast	Battery Over Voltage,refer to Trouble shooting.
---	OFF	PV voltage is low

B. Battery Indicator

Color	Indication	Working State
Green	On Solid	Battery is Normal
Green	Flash	Battery is full
Yellow	On Solid	Battery is under voltage

Red	On Solid	Battery is over-discharged, turn off Load auto

C. Load Indicator

Color	Indication	Working State
Yellow	On Solid	Load is ON
--	OFF	Load is off
Yellow	Flash Fast	Load short circuit or open circuit
Yellow	Flash Slow	Load string number is too low Or overload limited power output

2.3 Installation of the Controller

Install the controller in a location free from direct sunlight, high temperatures, and risk of immersion. Pay special attention to the radiator beneath the device, which is designed to reduce the operating temperature during full-power operation. Ensure that no obstructions impede heat dissipation, allowing for effective cooling through natural convection. For installations in confined spaces, such as lamp posts, orient the radiator fins along the airflow direction to optimize heat dissipation.

2.4 Connection method

A commonly recommended connection method used by professional electricians is outlined below. Please connect each wire of the controller according to standard procedures.

All supplied wires for the controller come with pre-cut insulation, facilitating easy stripping during connection and preventing short circuits caused by contact between exposed wires. During installation, please follow the steps below and avoid removing the insulation from all six wires simultaneously.

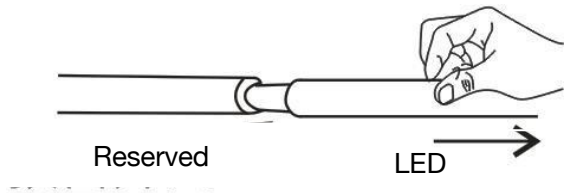


Figure 2.4.1 First step during wiring – wire stripping

Interconnect the copper wires from the controller lead and the load lead by crossing them, then twist the rear sections tightly around each other. This wiring method ensures a large contact area and high connection strength, thereby providing a reliable long-term connection. Ensure that all connectors are securely tightened. For mobile applications, it is advisable to secure the wires with cable ties to prevent connector loosening due to wire vibration.

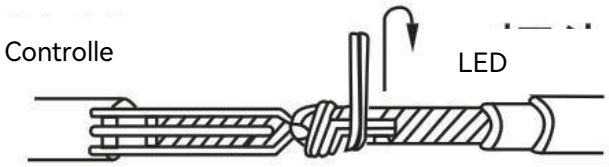


Figure 2.4.2 Second step during wiring - connection

Wrap the exposed parts of the wires with waterproof insulation tape. To ensure long-term reliability, use high-pressure rubber self-adhesive tape as the inner layer and electrical tape as the outer layer. Implement measures to prevent aging and detachment of the electrical tape, which could lead to short-circuit accidents in humid and hot environments over extended periods.

Figure 2.4.3 Third step during wiring – wrapping of insulation layers

Standard wiring is essential for ensuring long-term reliable system operation. Loose or unstable wire connections can result in excessive resistance, leading to overheating at connection points. In such cases, the insulation on the wires may prematurely age, which can subsequently cause short circuits, open circuits, and other failures.

2.5 Connection Steps

For safety reasons, please complete the wiring in the following order:

1. Load Connection
2. Battery Connection
3. Solar Panel Connection

1. Load Connection:

As the controller has not yet started operation, there will be no response from the controller after connecting the load.

2. Battery Connection:

Before connecting the battery, ensure that the battery voltage is higher than 9V to initiate controller operation. For a 24V system, ensure the battery voltage is not lower than 18V. After completing the battery connection, the controller will start working. Approximately 10 seconds later, the load will automatically turn on to confirm correct wiring.

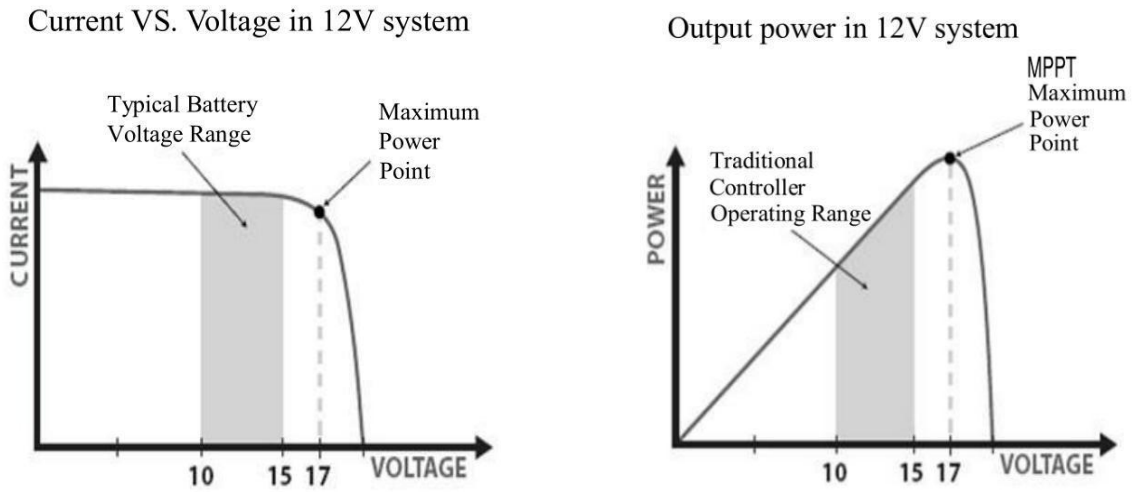
3. Solar Panel Connection:

The controller supports both standard 12V and 24V solar panel components, as well as those with an open-circuit input voltage not exceeding the specified maximum input voltage. Ensure that the voltage at the highest power point of the solar panels is not lower than the battery voltage.

3. Instruction

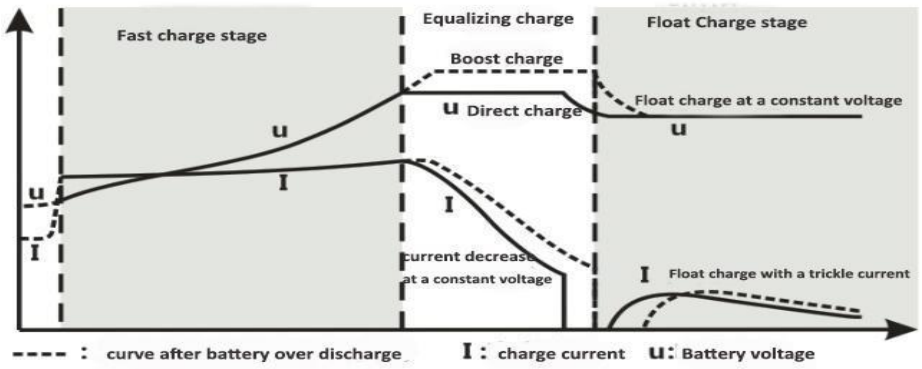
3.1 Charge Description

The controller employs Maximum Power Point Tracking (MPPT) technology to extract the maximum power from the solar modules. The tracking algorithm is fully automatic and requires no user adjustment. MPPT technology continuously tracks the array's maximum power point voltage (Vmp), which varies with weather conditions, ensuring optimal power harvesting throughout the day.



Charging of Lead-Acid or Gel Batteries:

The controller manages battery charging according to predefined charging profiles for different types of cells. If the cell type configured in the controller is lead-acid or gel battery, the entire charging process consists of three stages: fast charge, equalization charge, and float charge.



3.1.1 Lead Acid or Gel battery

a. Trickle Pre-Charge Stage:

At the beginning of the charging process, if the battery voltage is too low, the controller initiates a trickle pre-charge stage to protect the battery from damage caused by high current impacts. During this stage, the controller charges the battery with a small current. Once the battery voltage has sufficiently improved, the controller transitions to the fast charge stage.

b. Fast Charge Stage:

When the battery voltage has not yet reached the set threshold, the controller provides maximum solar power to charge the battery. During the fast charge stage, the solar panel and battery are directly connected, with the solar panel voltage clamped at the battery voltage.

c. Equalization Charge Stage:

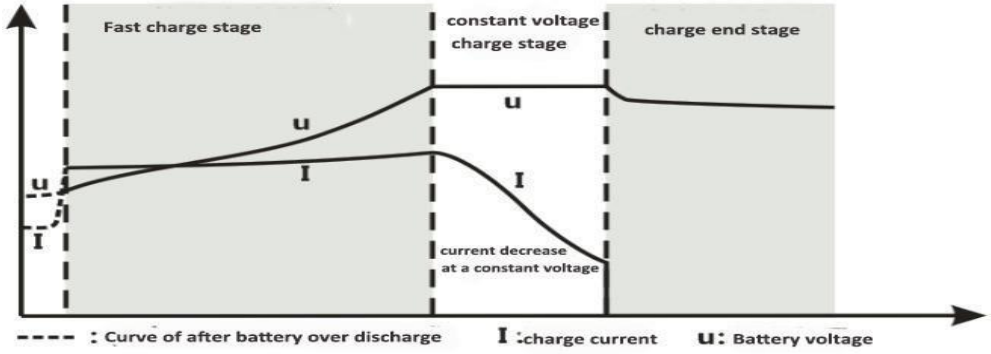
Once the equalization charge voltage is reached, pulse width modulation (PWM) is activated. The controller maintains the battery voltage at the set level to prevent overcharging. This stage typically lasts for 2 hours before transitioning to the float charge stage.

d. Float Charge Stage:

In this phase, the battery requires minimal additional power. However, the controller continues to provide a weak charging current to meet the power consumption needs of small loads and compensate for self-discharge. This ensures that the battery remains in a fully charged state, extending its service life.

Charging of Lithium battery:

When the battery type selected is lithium, the controller adjusts its charging profile to accommodate the specific charging characteristics of lithium batteries.



3.1.2 Lithium battery

a. Trickle Pre-Charge Stage:

At the beginning of the charging process, if the battery voltage is too low, the controller initiates a trickle pre-charge stage to protect the battery from damage caused by high current impacts. During this stage, the controller charges the battery with a small current. Once the battery voltage has sufficiently improved, the controller transitions to the fast charge stage.

b. Fast Charge Stage:

When the battery voltage has not yet reached the set threshold, the controller provides maximum solar power to charge the battery. During the fast charge stage, the solar panel and battery are directly connected, with the solar panel voltage clamped at the battery voltage.

c. Constant-Voltage Charge Stage:

Once the battery voltage reaches the predefined level, the constant-current charge phase ends, and the controller enters the constant-voltage charge phase. As the charging process continues, the current gradually decreases from its maximum level based on the battery's saturation degree. For a single-string battery, this charge voltage is typically set to 4.2V. The specific voltage should be adjusted according to the parameters provided by the battery manufacturer. (Note: C represents the ratio between the cell's nominal capacity and the charging current. For example, for a cell capacity of 1000mAh, 1C means a charging current of 1000mA.)

d. Charge Termination Stage:

During the constant-voltage charge phase, the controller monitors the charging current. When the charging current drops to the end-of-charge current, typically 0.02C, the charging process is terminated.

3.2 Discharge Description

Discharge Operation Mode:

The SOLAR-CMP10A series controller is designed to operate automatically and unattended, following predefined operational modes.

3.2.1 Manual work mode

Manual Mode:

When used in an independent power system, the controller defaults to "manual ON/OFF" mode. By pressing the F1 button on the RC-3 remote control, users can manually activate or deactivate the controller output. If the controller is restarted, its operating status will remain unaffected.

3.2.2 Auto work mode

Automatic Operation with Two Modes:

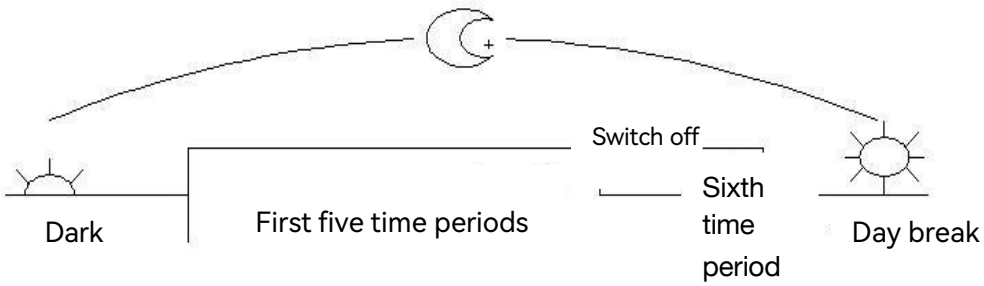
The controller supports both light control mode and automatic mode, which can be used in conjunction with the LED driver to manage solar street lights. When the PV voltage remains continuously higher than the set light control voltage for more than two minutes (adjustable between 20 seconds and 10 minutes), the controller determines that the system is in daytime mode. Conversely, when the PV voltage remains continuously lower than the set light control voltage for more than two minutes, the controller determines that the system is in nighttime mode.

a. Light-Control Mode:

In this mode, the controller automatically closes the output during the daytime and opens the output at night.

b. Automatic Mode:

In this mode, the controller closes the output during the daytime and allows the output to operate in six different periods at night. The sixth period corresponds to the morning light period.



3.2.3 Test

Testing Mode:

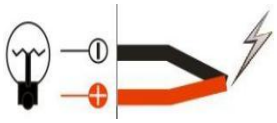
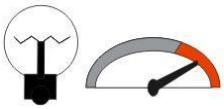
This mode is designed for system testing and closely mirrors the complete light-control mode. The primary difference is the elimination of the delay time before optical signal determination, while all other functions remain intact. This facilitates the verification of proper system functionality during installation and testing.

4. Trouble Shooting

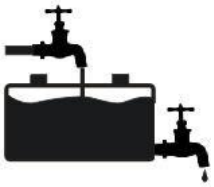
Phenomenon	Analysis	Solutions
1. During the daytime, the PV indicator remains dark.	There is an error in the connection of the solar panel cables.	1. Verify the correctness of the solar panel cable connections.

2. During the daytime, the load is active. 3. The load operates exclusively throughout the night.		2. Disconnect the solar panel cables from the solar controller, measure the open-circuit voltage (Voc), and then reconnect them.
The load indicator is flashing rapidly, and the LED lamp is not functioning.	1. The LED lamp cable is either open-circuited or short-circuited. 2. The LED lamp is either damaged or the connection between the LED chips does not meet the driver's specified range.	1. Reverify the correctness of the LED lamp cable connections. 2. Disconnect the LED lamp cables, then reconnect them.
The load indicator is flashing rapidly, and the LED lamp is also flashing.	After the LED lamp is powered on, it operates for a few seconds before turning off, and then the LED lamp begins to flash rapidly.	The series connection of LED chips exceeds the controller's output range. Please ensure that the number of LED chips in series is within the specified limits and refer to the parameter table for proper adjustment of the LED chip connections.
The load indicator is flashing slowly.	The output power exceeds the controller's rated power.	Reduce the output current.

5. Protection

	Load Fault: In the event of any short circuit or open circuit in the controller's load connections, the controller will automatically provide protection, and the load indicator will flash rapidly. The system periodically detects the load fault to determine if it has been resolved. If the fault persists for more than 7 minutes, the controller will cease attempting to switch on the load until the next day, or until maintenance personnel have eliminated the fault and initiated a manual switch-on operation.
	Overpower Protection: When the load power exceeds the rated power by 5%, the controller will activate the power protection mode to prevent potential damage.
	Overcharge Protection: When the battery voltage during charging exceeds the safe threshold, the controller will automatically disconnect the charging circuit to prevent potential damage to the battery.
	Overdischarge Protection: When the battery voltage drops below the safe threshold during discharge, the controller will automatically disconnect the load output to protect the battery.
	PV Module Reverse Polarity Protection: In the event of reverse polarity connection of PV modules (not recommended), the controller will not be damaged and will resume normal operation once the wiring errors are corrected.

	Battery Polarity Protection: In the event of reverse polarity connection of the battery (not recommended), the controller will not be damaged and will resume normal operation once the

	wiring errors are corrected.
	Temperature Sensor Fault Protection: In the event of a short circuit or damage to the temperature sensor, the controller will default to operating at 25°C. This prevents potential errors and damage to the battery that could result from inaccurate temperature compensation.
	Overcurrent Protection: The system provides overcurrent protection with a 60-second delay when the current exceeds 1.25 times the rated current, featuring inverse time lag characteristics.

6. Communication Protocol

1. Protocol Specification

This protocol is suitable for communication control of the SOLAR-CMP10A device.

2. Agreement Content

2.1 Hardware Interface:

The hardware interface is a 485 interface with red line A and blue line B, operating in half-duplex mode.

2.2 Baud Rate:

The baud rate is set to 9600 bps, with 8 data bits, 1 stop bit, and no parity.

2.3 Signaling Types:

There are four types of signaling: read parameters, write parameters, state control, and response.

2.4 Message Format:

The message format consists of prefix + signaling type + data length + data + checksum. Each component is described as follows:

- Prefix: One byte in length, indicating the transmitting device number. 0x40 represents the CMP10A terminal, while 0x20 refers to the sending set.
- Signaling Type: One byte in length, with the following values:
- 0x01: Read CMP10A terminal parameters.
- 0x02: Write CMP10A terminal parameters.
- 0x03: Clear abnormal state instruction. If there is no abnormal state and the CMP10A terminal is in manual mode, it remains unchanged; if there is no abnormal state and the CMP10A terminal is not in manual mode, it enters test mode upon receiving a test instruction.

- Data Length: One byte in length, representing the actual byte length of the subsequent data.
- Data: The length is defined by the Data Length field and contains the CMP10A controller parameters (refer to the attached table).
- Checksum: One byte in length, calculated as the sum of prefix + command + data length + data bytes, retaining only the lowest byte.

2.5 Signal Response Modes:

- When the master device issues a read instruction, the controller responds with the requested data (see the message read example).
- When the master device issues a write instruction, the controller confirms the write operation (see the message write example).
- When the master device issues a state control command, the controller executes the command without providing a response.

2.6 Data format:

Schedule: Definition of the Data Area

When the CMP10A terminal responds to a read command from the master device, it must include all data fields specified in the table and none can be omitted.

The word	order	DL	data field	Accumulation and verification
Terminal device 0x40 Master control device 0x20	0x01 Read the command 0x02 Write the command 0x03 Load switch reverse or abnormal state clear or test command 0x24 Read status	Data area data length N bytes	Data 1 Data 2... Data N	Accumulation: prefix + command + data length + data 1 + data 2 +.....+ Data N, take the last byte of the cumulative sum.

When the master device sends the write command to the CMP10A terminal, all data bits in the table must be included and cannot be omitted.

Data shall be defined in order in the table, in the following format.

Write command		
The main control equipment is sent		
order	Functional representation	Content definition
0	The word	0x20 Master device sent
1	order	0x02 Write instructions
2	DL	39 Data 0x27
3	Product model	Fix to 0x00
4	maximumoutput	Fix to 0x00
5	The first time	High four byte hours, four lower ten digits of minutes, after the same. Example 0x12 represents 1 hour and 20 minutes
6	First time current	0 is 150 mA 1 is 200 mA; and so on, for every 1 increase in this value, the corresponding output current increases by 50 mA.255 for 0 mA, 254 for 50 mA and 253 for 100 mA
7	The second time	Four bytes higher represent hours, and four lower indicate ten digits in minutes
8	Second period current	0 is 150 mA 1 is 200 mA; and so on, for every 1 increase in this value, the corresponding output current increases by 50 mA.255 for 0 mA, 254 for 50 mA and 253 for 100 mA
9	The third time	Four bytes higher represent hours, and four lower indicate ten digits in minutes
10	Third period current	0 is 150 mA 1 is 200 mA; and so on, for every 1 increase in this value, the corresponding output current increases by 50 mA.255 for 0 mA, 254 for 50 mA and 253 for 100 mA
11	intelligent control	0x00 off 0x01 mode 1

		0x02 Mode 2
12	advanced setup	0x00 off 0x01 open
13	Load control mode	0x01 Manual mode 0x02 auto-mode mode 0x03 Debug mode 0x04 Pure light control mode
14	Light control delay time	Minutes; such as 0x10, representing 16 minutes
15	Optical control voltage	0x01 is for the 0.1V,59=5.9V
16	Battery type	0x01 colloid 0x02 lead acid 0x03 custom 0x04 lithium battery
17	Overvoltage voltage	0x01 is for the 0.1V,170=17.0V
18	Over and over voltage	0x01 is for the 0.1V,111=11.1V
19	Over-put back voltage	0x01 is for the 0.1V,126=12.6V
20	Raise the charging voltage	0x01 is for the 0.1V,146=14.6V
21	floating charge voltage	0x01 is for the 0.1V,136=13.6V
22	Power supply priority	The default value is 00
23	The fourth time	Four bytes higher represent hours, and four lower indicate

		ten digits in minutes
24	Fourth period current	0 is 150 mA 1 is 200 mA; and so on, for every 1 increase in this value, the corresponding output current increases by 50 mA.255 for 0 mA, 254 for 50 mA and 253 for 100 mA
25	The fifth time	Four bytes higher represent hours, and four lower indicate ten digits in minutes
26	Fifth period current	0 is 150 mA 1 is 200 mA; and so on, for every 1 increase in this value, the corresponding output current increases by 50 mA.255 for 0 mA, 254 for 50 mA and 253 for 100 mA
27	The sixth time	Four bytes higher represent hours, and four lower indicate ten digits in minutes
28	Load sleep output power	0 is 150 mA 1 is 200 mA; and so on, for every 1 increase in this value, the corresponding output current increases by 50 mA.
29	Sensor enabling period	The highest bit of binary code indicates the on / off state of the sensor function at a time, 1 on 0 off.1111 1111 means that the sensor is valid during all periods, 0111 1111 means that the sensor is invalid in the first period and the remaining periods are valid.
30	Current in the sixth period	0 is 150 mA 1 is 200 mA; and so on, for every 1 increase in this value, the corresponding output current increases by 50 mA.255 for 0 mA, 254 for 50 mA and 253 for 100 mA
31	System voltage level	0x01 is 12V (valid only if the battery type is lithium battery) 0x02 for 24V
32	charging voltage	0x01 is 0.1V,140=14.0V (valid only if battery type is lithium battery)
33	charging current	0x01 is 0.1A,100=10.0A (valid only if battery type is lithium battery)
34	Charging end current	0x01 is 0.1A,3=0.3A (valid only if battery type is lithium battery)

35	Manufacturer setting	Fix to 0x00
36	Customer Settings	Fix to 0x00
37	Protocol version number	Fix to 0x00
38	Charging high temperature protection	65 for 77°F(25℃) 40 for 32°F(0℃)
39	Charging low temperature protection	65 for 77°F(25℃) 40 for 32°F (0℃)
40	Discharge high temperature protection	65 for 77°F(25℃) 40 for 32°F(0℃)
41	Discharge low temperature protection	65 for 25℃ 40 for 0℃
42	Accumulation and verification	

Read the state

The main control equipment is sent

order	Functional representation	Content definition
0	The word	0x20 Master device sent
1	order	0x24 Read the state instruction
2	DL	0x02 No data bits
3	Sensor status	0x00 still 0x01 trigger
4	Customer code	

5	Accumulation and verification	
Terminal equipment sent		
order	Functional representation	Content definition
0	The word	0x40 The terminal equipment is sent
1	order	0x24 Read the state instruction
2	DL	The 0x2E 46-bit data
3	accumulator voltage H	120 representation 12V
4	accumulator voltage L	
5	Battery status	0x00 overrelease 0x01 underpressure 0x02 normal 0x03 charging limit 0x04 overpressure 0x09 over temperature protection
6	load current H	15 representation 0.15A
7	load current L	
8	load voltage H	350 representation 35V
9	load voltage L	
10	Load status	0x00 off 0x01 on 0x02 open circuit protection 0x06 straight through protection 0x09 short circuit protection 0x0A Overload protection 0x11 overload warning
11	Optical cell current H	50 indicates that 5A OxFF indicates the invalid data
12	Optical cell current L	
13	Optical cell voltage H	200 representation 20V
14	Optical cell voltage	

	L	
15	Optical cell status	0x00 battery cell low voltage, 0x01 battery voltage high, 0x02 battery reaches charging voltage, 0x03 battery overvoltage, 0x0A charge overcurrent
16	external temperature	65 representation 25℃
17	Internal temperature	65 representation 25℃
18	Working days L	1 indicates 1 day
19	Overtimes (16 days)	1 represents 1 time
20	Today's discharge quantity is H	
21	Today's discharge quantity, L	1 representation 1WH
22	Yesterday the discharge quantity is H	
23	Yesterday the discharge quantity L	1 representation 1WH
24	Accumulated discharge quantity H	
25	Accumulated discharge quantity: L	1 representation 1KWH
26	Today's charge level is H	

27	Today's charge level is L	1 indicates that 1WH OxFF indicates the invalid data
28	Yesterday the charge is H	
29	Yesterday, the charge quantity is L	1 indicates that 1WH OxFF indicates the invalid data
30	Accumulated charge quantity: H	
31	Accumulated charge quantity: L	1 indicates that 1KWH OxFF indicates the invalid data
32	Working days H	
33	Battery power H	--
34	Battery power L	--
35	Battery allowance	0~100 1 represents 1%
36	The number of overlets is H	1 Show 1 time
37	The number of overlets L	
38	Overpressure number H	1 Show 1 time
39	Overpressure number L	
40	Number of underpressure: 16 days	1 Show 1 time
...	continue to have...	
49	Accumulation and verification	

Remote control command		
The main control equipment is sent		
order	Functional representation	Content definition
0	The word	0x20 Master device sent
1	order	0x05 Remote control command
2	DL	0x04 Quad digit data
3	Remote mode switch	0 Close 1 open
4	load switch	0 Close 1 open
5	output power	0~100%。Maximum percentage of current value set for the active period For example, if 1 time period 150mA 2 time period 1000 mA, the rest of the time period is 00.00 output Power is set to 50. The actual output power is 100050 / 100 = 500mA
6	heartbeat time	0x01 indicates 1 min.60 indicates 60 min. After the telecommunication command is sent successfully The controller starts time. During the set heartbeat time, if the controller is not there again Receiving the communication command, then exit the remote control mode to run automatically.
7	Accumulation and verification	
Terminal equipment sent		
order	Functional representation	Content definition

0	The word	0x40 The terminal equipment is sent
1	order	0x05 Remote control command
2	DL	0x01 1-bit data
3	Set success	0x01
4	Accumulation and verification	0x47

Clears up the historical data command		
The main control equipment is sent		
order	Functional representation	Content definition
0	The word	0x20 Master device sent
1	order	0x28 Remote control command
2	DL	0
3	Accumulation and verification	0x48