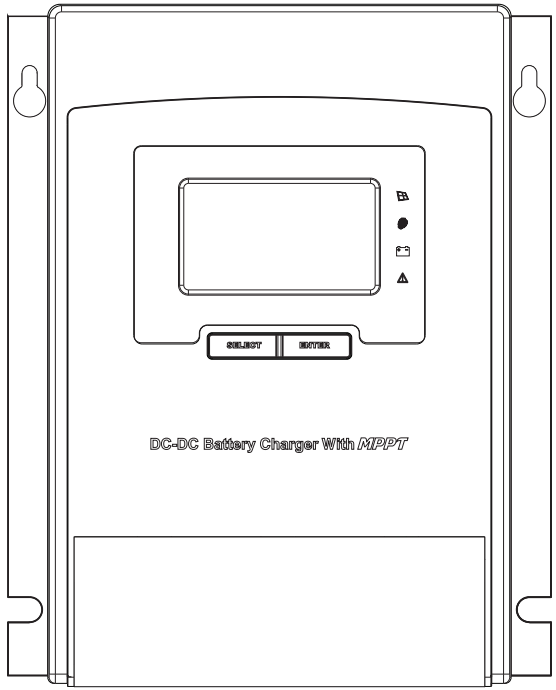
User's Manual of DC/DC DC & MPPT Solar Charging Controller



Code：106221

Instructions Version: V1.02 subject to change without prior notice

Dear users,
Thank you for choosing our product!

Safety Instructions

1. As this controller deals with voltages that exceed the top limit for human safety, do not operate it before reading this manual carefully and completing safety operation training.

2. The controller has no internal components that need maintenance or service, thus do not attempt to disassemble or repair the controller.

3. Install the controller indoors, and avoid component exposure and water intrusion.

4. During operation, the radiator may reach a very high temperature, therefore install the controller at a place with good ventilation conditions.

5. It's recommended that a fuse or breaker be installed outside the controller.

6. Before installing and wiring the controller, make sure to disconnect the photovoltaic array and the fuse or breaker close to the battery terminals.

7. After installation, check if all connections are solid and reliable so as to avoid loose connections that may give rise to dangers caused by heat accumulation.

Warning: means the operation in question is dangerous, and you should get properly prepared before proceeding.

Note: means the operation in question may cause damage.

Tips: means advice or instruction for the operator.

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1.Product Profile

1.1 Product Overview

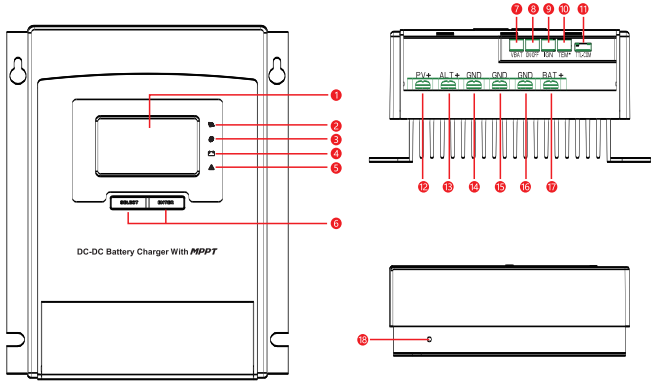
MD Series DC/DC&MPPT solar charging controller is based on multi-phase synchronous rectifier technology and advanced MPPT control algorithm, adopting all-digital intelligent design, which has fast response speed, high reliability and high industrialized standard. Polyphase synchronous rectifier technology can ensure high conversion efficiency under any charging power, and greatly improve the energy utilization of the system; the industry-leading PowerCatcher MPPT technology realizes the maximum energy tracking of solar panels, so that it can quickly and accurately track the maximum power point of solar panels in any environment and obtain the maximum energy of solar panels in real time.

This Product is a DC/DC intelligent charger for vehicle or ship system. Applied in the dual-battery system, the system integrates the respective merits of alternator（automobile）power generation and photovoltaic power generation, and a variety of charging methods are ingeniously designed and combined to effectively ensure that the power lof the dual-battery system is sufficient al the time. Solar energy and alternator（automobile）can charge the backup battery simultaneously, and can charge the backup battery independently. In addition, solar energy can charge the starting battery under specific conditions.

1.2 Product Features

- PowerCatcher MPPT technology is still available for tracking the maximum power point of solar cells in a complex environment; and compared with conventional MPPT technology, PowerCatcher has faster response speed and higher tracking efficiency, which can reach 99.9%.
- The design of polyphase synchronous rectifier Buck-Boost circuit makes it have high DC/DC conversion efficiency up to 98% in both high and low power ranges.
- The backup battery supports a wide variety of batteries such as sealed, colloidal, open-type, lithium battery and custom battery.
- Support a wide variety of alternator（automobile）such as intelligent generator and conventional alternator(automobile), and automatically identify alternator(automobile) types through ignition signals.
- With a variety of charging modes, such as photovoltaic charging backup battery alone, alternator (automobile) charging backup battery alone, photovoltaic and alternator(automobile) charging backup battery at the same time, photovoltaic charging startup battery and soon.
- With the function of line loss compensation of backup battery charging voltage, which makes the battery charging voltage control more accurate.
- With backup battery temperature sampling function, lead-acid battery support temperature compensation and effectively prolonging battery life.
- With automatic derating function for high-temperature charging.
- TTL communication which can provide technical support of communication protocol to facilitate users' secondary development and application.
- Support external remote switch to control charging.
- Built-in Bluetooth module can monitor and set parameters through mobile APP.
- High-quality aluminum radiator and high-temperature derating processing can ensure reliable and efficient operation in each work environment.

1.3 Interface Description



SN	Designation	SN	Designation
①	Display Screen (with backlight)	⑩	Backup battery temperature sampling interface
②	PV indicator	⑪	TTL Communication Interface
③	alternator (automobile) indicator	⑫	Positive interface of solar cell
④	Backup battery indicator	⑬	Positive interface of alternator (starting battery)
⑤	Alarm indicator	⑭	Negative interface of solar cell
⑥	Operation key	⑮	Negative interface of alternator (starting battery)
⑦	Backup battery voltage compensation interface	⑯	Backup battery negative interface
⑧	Remote switch interface	⑰	Backup battery positive interface
⑨	Ignition signal interface	⑱	Grounding port

1. The negative electrode of solar cell, alternator (starting battery) and backup battery are of common negative electrode design;
2. See below for indicator definition, interface definition, key function and interface description.

1.4 Introduction to MPPT Technology

Maximum Power Point Tracking (MPPT) System is an advanced charging technology which can output more energy by adjusting the work state of electrical module. Due to the nonlinear characteristic of solar array, there is a maximum energy output point (MPP) of an array on its curve, conventional controllers (switch charging technology and PWM charging technology) can not keep charging the battery at this point, so they can not obtain the maximum energy of solar array. However,solar controllers with MPPT control technology can track the MPP of the array all the time to obtain the maximum energy to charge the battery. Taking the 12V system as an example: since the peak voltage (Vpp) of solar cell is about 17V and the battery voltage is about 12V, the voltage of solar cell is about 12V when an ordinary charging controller is charging, and the maximum power has not been fully exerted.

Take a 12V system as an example. As the solar panel's peak voltage (Vpp) is approximately 17V while the battery's voltage is around 12V, when charging with a conventional charge controller, the solar panel's voltage will stay at around 12V, failing to deliver the maximum power. However, the MPPT controller can overcome the problem by adjusting the solar panel's input voltage and current in real time, realizing a maximum input power.

Compared with conventional PWM controllers, the MPPT controller can make the most of the solar panel's max. power and therefore provide larger charging current. Generally speaking, the latter can raise the energy utilization ratio by 15% to 20% in contrast with the former.

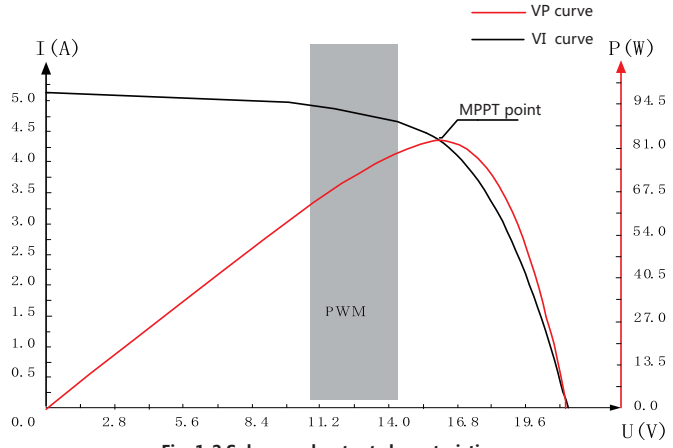


Fig. 1-2 Solar panel output characteristic curve

Due to the different ambient temperature and illumination conditions, the MPP often changes. Our MPPT controllers can adjust the parameters from time to time according to different conditions, so that the system is always near the maximum working point. The full process is completely automatic and does not require any adjustment by the user.

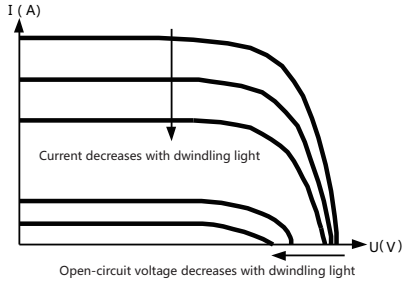


Fig. 1-3 Relation between solar panel output characteristics and illumination

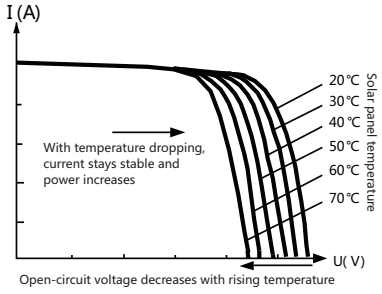


Fig. 1-4 Relation between solar panel output characteristics and temperature

1.5 Introduction to Charging Phase

1.5.1 Lead-acid battery charging

The Controller will adopt three-stage charging for the backup battery of lead-acid type,and a full charging process shall include: bulk charge (BULK), Equalization/Boost Charge(EQUALIZE/BOOST) and floating charge (FLOAT). The charging curve is as follows:

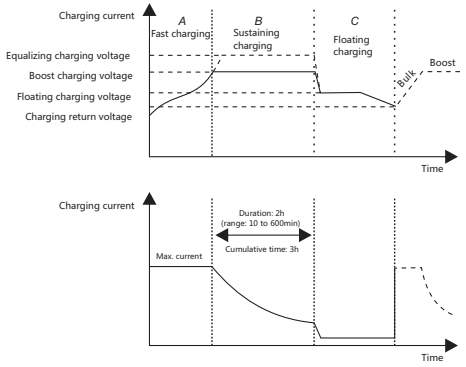


Fig. 1-5 Charging Curve of Lead-acid Battery

➢ **Bulk Charge(BULK)**

In the bulk charging stage, when the battery voltage has not reached the set value of full voltage (i.e., equalization/boost voltage), the Controller will perform MPPT charging to provide the maximum solar energy to charge the battery. Once the battery voltage has reached the preset value, constant voltage charging will be performed.

➢ **Equalization/Boost Charge (EQUALIZE/BOOST)**

When the battery voltage has reached the set value of the sustaining voltage, the Controller will perform charging at a constant voltage, in this process, MPPT charging will not continue, and the charging current will gradually decrease over time. Equalization/Boost Charge is divided into equalization charge and boost charge, and these 2 charging processes are not repeated, and equalization charging is started once every 30 days a month.

➢ **Equalization charge(EQUALIZE)**

Some types of batteries are regularly charged equally, and this can stir electrolyte, balance battery voltage and complete chemical reaction. Equalization charging will increase the charging voltage to be higher than the standard complementary voltage and gasify the battery electrolyte. Equalization charging time is 120 min (by default). Equalization charging and boost charging will not be repeated in one process of fully charging so as to avoid excessive overflow gas or overheating of the battery.

➢ **Equalization Charge**

Warning: Explosion Risk!

Gas can be generated during equalization charging and the battery cartridge must be well ventilated without foreign matters.

Notice: Equipment Breakdown!

Excessive charging and excessive gas evolution may damage the battery plate, resulting in shedding of active substance on the battery plate. If the equalization charging voltage is too high or the duration is too long, the battery will be damaged. Please strictly follow the technical specifications of battery.

➢ **Boost Charge(BOOST)**

Generally, the default duration of the boosting charging stage is 2h. Customers can also adjust the holding time and the preset value of the boost voltage point as actually needed. When the duration has reached the set value, the system will switch to floating charge.

➢ **Floating Charge(FLOAT)**

Floating charge can keep the battery voltage near the floating charging voltage. In the floating charge stage, the battery will be charged with very weak current to ensure that the battery is kept in the full-charged state.

In the stages of equalization charge, boost charge and floating charge, when the battery voltage is as low as "the boost recovery voltage", the System will exit the current charging stage and re-enter the BULK charging stage. As the charging proceeds, the battery voltage will slowly rise and the current will drop and then re-enter the constant voltage stage.

1.5.2 Lithium Battery Charging

The Controller will adopt two-stage charging for the backup battery of lithium type: the first is the bulk charging (BULK) stage, i.e. under the condition of limiting the maximum charging current, solar energy and alternator（automobile）energy are maximized, and the battery voltage is rapidly increased to the set charging voltage; then the charging will enter the constant voltage stage till the battery is fully charged, and the charging current will gradually decrease in the constant voltage charging stage.

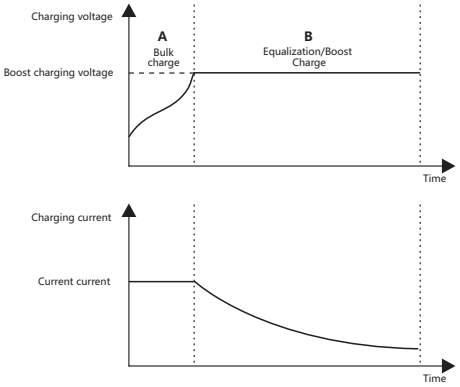


Fig. 1-6 Schematic Diagram of Lithium Battery Charging Stage

2.Product Application

2.1 Spec Chart

Parameter		Value	
Model		MD1230N05	MD1250N05
Backup Battery System Voltage		12V	
Backup Battery Voltage Range		9~16V DC	
Backup Battery Type		Sealed Battery, Gel Battery, Vented Battery, Lithium Iron Phosphate Battery, User-defined Battery	
Rated Charging Current		30A	50A
Maximum PV Input Voltage		55V DC	
Max. power point voltage range		17~36V	
Maximum PV Input Current		27A	45A
Solar Panel Charging Mode		Buck MPPT	
MPPT Efficiency		> 99%	
PV input power is recommended		400W	700W
alternator (Starter Battery) System Voltage		12/24V	
Starter Battery Type		Lead-acid Battery	
Maximum alternator Input Voltage		32V DC	
Maximum alternator Input Current		35A	60A
alternator Voltage Range	Conventional alternator	13.2 ~ 16V/26.4~32V DC	
	Intelligent (Euro 6 Standard) alternator	12 ~ 16V/24~32V DC	
alternator charging mode		Buck , Boost , Buck-Boost	
Alternator output power is recommended	12V Backup Battery	400W	700W
PV charges the starter battery	Charging Voltage	13.8V	
	Charging Current	≤15A	≤25A
No-load loss		<0.6W	
Maximum Charging Conversion Efficiency		98%	
Temperature compensation factor		-3mV/ ℃/2V (Default value, the value of lead-acid battery can be set) ;No temperature compensation function for lithium battery	
Communication method		TTL	
Protection Function		Overcharging Protection, Overcurrent Protection, Overtemperature Protection, alternator Reverse Connection Protection, Solar Panel Reverse Connection Protection,Backup battery Reverse connection protection,Anti-reverse Charging Protection at night	
Operating temperature		- 35℃ ~ 65℃	
Altitude		≤3000m	
Waterproof level		IP32	
Product dimensions		221*175.8*92.4mm	

2.2 Battery Type Default Parameters

Default parameter table of each battery type

Parameters \ Battery type	Sealed lead acid battery SLD (default)	Colloidal lead -acid battery GEL	Open-type lead-acid battery FLD	Lithium iron phosphate battery LFP	Custom battery USER (default as SLD)
Overvoltage break voltage	16.0V	16.0V	16.0V	16.0V	9.0 ~ 17.0V
Overvoltage recovery voltage	15.0V	15.0V	15.0V	15.4V	——
Equalization voltage	14.6V	——	14.8V	——	9.0 ~ 17.0V
Boost voltage	14.4V	14.2V	14.6V	14.4V	9.0 ~ 17.0V
Float charge voltage	13.8V	13.8V	13.8V	——	9.0 ~ 17.0V
Booster recover voltage	13.2V	13.2V	13.2V	13.2V	9.0 ~ 17.0V
Overdischarge recovery voltage	12.6V	12.6V	12.6V	12.6V	9.0 ~ 17.0V
Undervoltage recovery voltage	12.2V	12.2V	12.2V	12.3V	——
Undervoltage alarm voltage	12.0V	12.0V	12.0V	12.1V	9.0 ~ 17.0V
Overdischarge voltage	11.1V	11.1V	11.1V	11.1V	9.0 ~ 17.0V
Boost duration	120 min	120 min	120 min	——	10 ~ 600 min
Equilibrium duration	120 min	——	120 min	——	0 ~ 600 min
Equalization charging interval	30 d	——	30 d	——	0 ~ 250 d
Temperature compensation (mV/℃/2V)	-3	-3	-3	0	0、-3 、 -4 、 -5

Note: Please strictly follow the technical specifications and safety recommendations provided by the battery manufacturer to set relevant parameters.

2.3 Indicator Definitions and Description

2.3.1 Indicator Definitions

SN	Indicator Definitions
①	PV Charge Indicator
②	alternator(automobile) indicator
③	Backup battery indicator
④	Alarm indicator

2.3.2 PV Charge Indicator

Indicator Color	Indication Mode	Description
Red	Normally ON	MPPT charging
	Slow flashing	Boost charging
	Single flashing	Floating charge
	Flashing	Equalization Charge
	Double flashing	Current-limit charging
	Extinction	Not charging

2.3.3 alternator(automobile) indicator

Indicator color	Indication mode	Description
Red	Normally ON	The alternator(automobile) will charge the backup battery.
	Slow flashing	The solar energy will charge the starting battery.
	Flashing	alternator over-voltage
	Extinction	Not charging

2.3.4 Backup Battery Indicator

Indicator color	Indication mode	Description
Red	Normally ON	The battery voltage is normal.
	Slow flashing	Battery over-discharge
	Flashing	Battery over-voltage

2.3.5 Alarm Indicator

Indicator color	Indication mode	Description
Red	Extinction	The System is normal.
	Normally ON	System Alarm

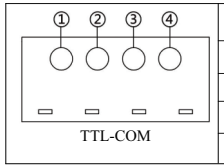
2.4 Press Keys

Press Key 1-SELECT;
Press Key 2-ENTER
Under any menu, pressing and holding ENTER will enter the parameter setting menu, pressing ENTER will adjust the parameter value, pressing SELECT will switch different setups; pressing and holding ENTER will save and exit the setting mode.

2.5 TTL Communication Interface

Users can use Modbus Protocol to monitor data and set parameters of the Controller through this Port.
1) Default Baud Rate of 9600bps; parity bit: no data bit: 8bit; stop bit: 1bit
2) Output specification of communication power: (12V±3V)/100mA

The interface is defined as follows:



SN	DEFINITION
①	VCC Communication Power Output
②	RX Controller Data Receiver
③	TX Controller Data Transmitter
④	GND

2.6 Backup Battery Temperature Sampling Interface

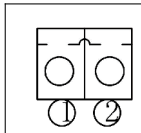
By connecting the temperature probe to Interface ⑩, the real-time temperature of the battery can be sampled, and the default is 25℃ if the temperature probe is not connected; if the temperature probe is connected, the battery temperature will be sampled for high and low temperature protection of the battery or temperature compensation of charging voltage of lead-acid battery.

Connection Method: connect the temperature sensor terminal to Interface ⑩, and fix the temperature sensor on the battery surface.

2.7 Ignition Signal Interface

The starting charging voltage of intelligent alternator(automobile) is different from that of conventional alternator.If it is an intelligent generator, it is necessary to connect the ignition signal line to IGN terminal. The starting charging voltage of conventional alternator is 13.2V. The starting charging voltage of intelligent generator is 12.0V. It is also allowed to connect only one positive wire here.

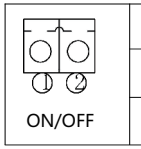
The interface is defined as follows:



SN	DEFINITION
①	+
②	−

2.8 Remote Switch Interface

The external switch can control whether the Controller can activate charging, the switch short-circuit can start charging and switching-off can stop charging.

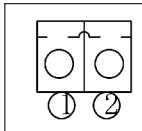


SN	DEFINITION	Remarks
①	+	Short-circuiting can enable charging and switching-off can can disable charging.
②	−	

2.9 Backup Battery Voltage Compensation Interface

For the reason of configuration, the charging power is high and the diameter of wire from the battery to the Controller is slightly smaller, causing the battery voltage collected by the Controller to be higher than the actual voltage at the battery end, resulting in the battery not fully charged; to a certain extent, through the battery voltage sampling wire, the battery terminal voltage can be collected more accurately and the differential voltage compensation can be output in time, so that the battery terminal can get a more reasonable charging voltage. Connect the positive and negative electrodes of the battery to the positive and negative electrodes of the battery voltage sampling terminal ⑥ respectively through the voltage compensation wire. Pay attention to connect positive with the left and negative with the right.

The interface is defined as follows:

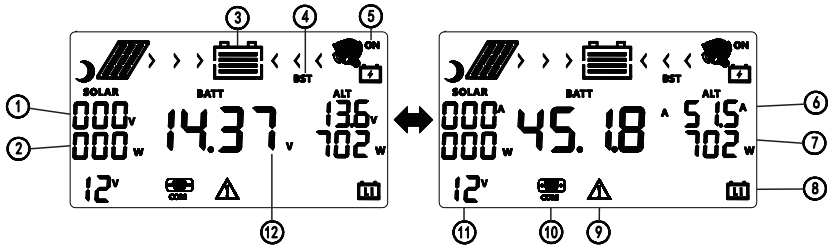


SN	DEFINITION
①	+
②	−

3. Product Operation and Display

3.1 Main Page

The main interface of LCD screen dynamically displays the real-time operation data (voltage/current /power), charging status, system information, etc., and automatically switches the real-time voltage and current every 10s.

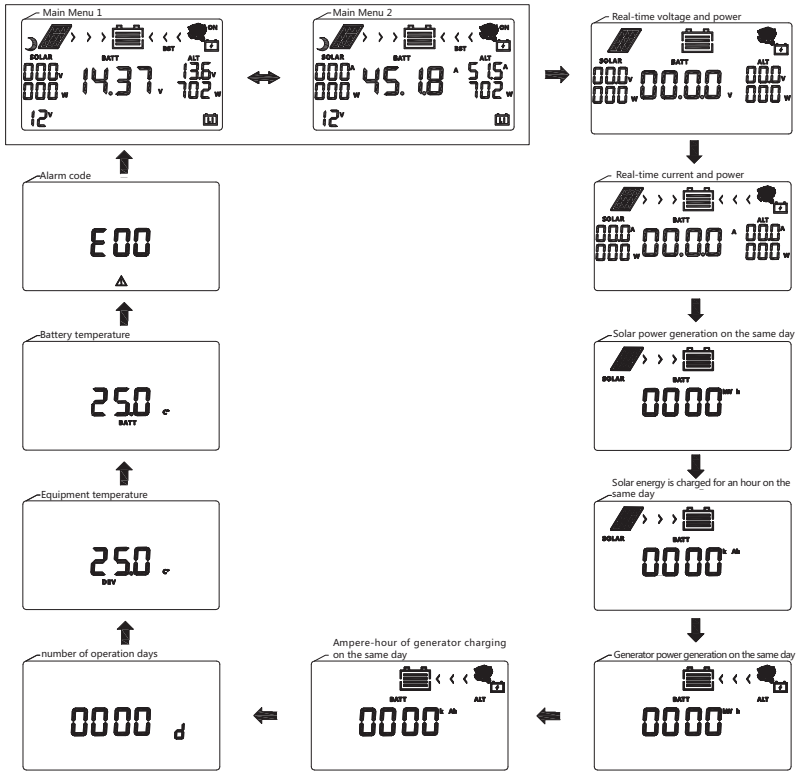


No	Description	No	Description
①	Photovoltaic module voltage/current	⑦	alternator(automobile) charging power
②	Real-time charging power of photovoltaic module	⑧	Backup battery type
③	Back-up battery charge	⑨	Backup battery type
④	Charging mode	⑩	Communication connected prompt
⑤	Alternator(automobile) start-up/shut-down prompt	⑪	System voltage
⑥	Alternator(automobile) charging current/voltage	⑫	Backup battery voltage/current

3.2 Menu Browsing

Press [SELECT] for entry to menu browsing, and check the real-time voltage, real-time current, photovoltaic power generation watt-hours, photovoltaic power generation ampere-hours, alternator(automobile) power generation watt-hours, alternator(automobile) power generation ampere-hours, number of equipment operation days, equipment temperature, backup battery temperature and alarm code in turn.

Note: The recording rule of equipment operation days is that after the photovoltaic voltage has become lower than 5V and the alternator(automobile) has failed to work for 2h, the recorded number will be increased by one day.



3.3 Parameter Settings

① In the main interface, press [ENTER] for a long time for entry to the parameter setting interface;

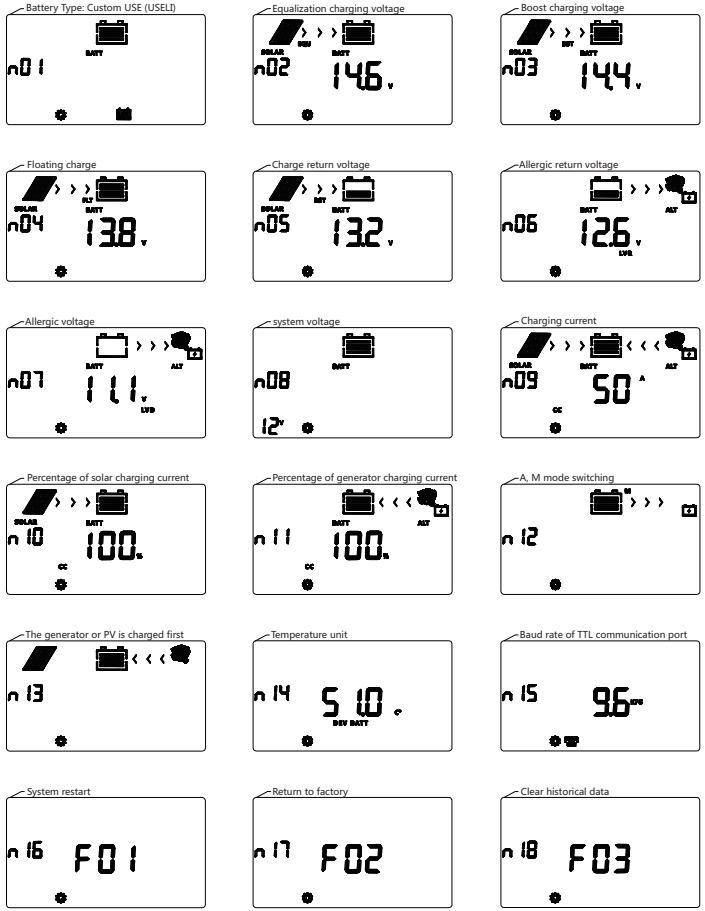
② After entering the interface, press [SELECT] briefly to browse n01~n16 parameters;

③ If you need to modify the parameter, press [ENTER] briefly, then the parameter will flash;

④ Press [SELECT] briefly to adjust the parameter;

⑤ Press [ENTER] briefly to confirm the parameter;

⑥ Press and hold [ENTER] or return to the main interface if no operation for 10s.



Parameters	Setting Instructions
n01	Backup battery type selection, can be set to FLD, SLD, GEL, LI, USE, USELI.
n02	Equalization charging voltage, USE battery type can be set, ranging from 9V to 17V
n03	Boost charging voltage, USE and USELI battery types can be set, ranging from 9V to 17V
n04	Float charging voltage, USE battery type can be set, ranging from 9V to 17V
n05	Charging return voltage, USE, USELI battery type can be set, ranging from 9V to 17V
n06	Over-discharge return voltage, USE and USELI battery type can be set, ranging from 9V to 17V
n07	Over-discharge voltage, USE and USELI battery type can be set, ranging from 9V to 17V
n08	System voltage
n09	Charging current to be set from 0A to rated charging current
n10	Photovoltaic charging current percentage to be set from 0 to 100%
n11	Percentage of alternator(automobile) current to be set from 0 to 100%
n12	Start the battery charging mode, where A stands for automatic mode; M stands for manual mode.
n13	Backup battery charging mode, photovoltaic priority or generator priority
n14	Temperature unit, optional ℃ or ℉
n15	TTL communication baud rate to be set from 4,800 to 115,200kps
n16	System Reboot
n17	Restore factory settings
n18	Clear up history

Remarks:

1. Items n02~n07 can only be adjusted when the battery type is set to USE or USE LI mode, and other battery types are displayed as fixed values.
2. The charging method of starting the battery
can be selected for item n12. Among them, mode A is an automatic mode, which requires the participation of photovoltaic to charge the starting battery. The M mode is a manual mode. After switching to the M mode, the backup battery can be forced to charge the starting battery for 60 seconds within 3 minutes after the M mode takes effect, and automatically switch back to the A mode after overtime.
3. Items n09, n10 and n11:

◆ When only photovoltaic charging is used, the total charging current is: I_1= set current n09*percentage of photovoltaic charging current n10 ;

◆ When only the generator is charged, the total charging current is: I_2= set current n09*generator charging current percentage n11 ;

◆ When photovoltaic and generator are charged at the same time, the total charging current is $(I_1+I_2)/2$.

3.4 System Alarms

System Alarm	Meaning	Description
E0	No fault	
E1	Backup battery over-discharge	Indicator Prompt
E2	Backup battery over-voltage	No charging
E3	Backup battery under-voltage	The indicator shows normal charging
E6	Equipment over-temperature	Derating charging according to over-temperature strategy
E7	Battery over-temperature	No charging
E8	Excessive solar panel power	Current-limit charging
E10	Solar panel over-voltage	No charging
E15	Battery disconnected or lithium battery feed protection	
E19	Battery low-temperature	No charging
E22	alternator over-voltage	The alternator(automobile) neither charges nor discharges
E23	Excessive alternator power	Current-limit charging

3.5 Common Problems and Solutions

Phenomenon	Possible Problems	Solution
After the backup battery is connected for energizing, there is no response and the indicator lamp is not ON	A.Wrong or loose connection of backup battery B. Lithium battery protection	A1. Please check whether the connection of backup battery wires is correct and reliable; B1. Connect a solar panel or a alternator(automobile) to charge and activatethe lithium battery.
the Controller cannot charge the backup battery through the solar panel during the daytime.	A. Wrong or loose wiring with the solar panel B. The solar panel being blocked C. Error in Backup Battery System Voltage Level Setting	A1. Please check whether the connection of solar panel wires is correct and reliable; B1. Ensure that the solar panel is not blocked; C1. The system voltage level set by the Controller is identical with the actual battery voltage level used.
The backup battery cannot be charged by the alternator(automobile) while the vehicle is running.	A. Wrong or loose wiring of alternator (automobile) B. Error in Backup Battery System Voltage Level Setting	A1. Please check whether the connection of alternator (automobile) wires is correct and reliable; B1. The system voltage level set by the Controller is identical with the actual battery voltage level used.

4. Product Installation

4.1 Precautions for Installation

- ◆ Be very careful when installing the battery. Wear protective glasses when installing the open-type lead-acid battery. Once contacting the acid solution of battery, please rinse with clear water in time.
- ◆ Avoid placing any metal object near the battery against short-circuiting.
- ◆ Acid gas may be generated when the battery is charged so as to ensure good ventilation of surroundings.
- ◆ The battery may produce combustible gas, please stay away from sparking.
- ◆ Direct sunlight and rainwater infiltration should be avoided during the outdoor installation.

- Virtual junctions and corroded wires may cause great heat, melt the insulation of wire, burn the surrounding material, and even cause fire. Therefore, it is necessary to ensure that all connectors are tightened, and wires are preferably fixed with ties to avoid loose connectors caused by shaking of wires during mobile applications.
- Once the System is connected, the output voltage of the component may exceed the safe voltage of human body. In the process of operation, attention shall be focused on using insulating tools and ensure that hands are dry.
- The battery terminals on the Controller can be connected with either a single battery or a group of batteries. Subsequent instructions in the Manual are for use with a single battery,but also applicable to systems with a group of batteries.
- Please follow the safety recommendations of battery manufacturers.
- The System's connection wire shall be selected according to the current density no more than 4A/mm2.
- Ground the Controller earth terminal.
- It is forbidden to connect the battery in reverse, which will cause irreversible damage in the process of installation.

4.2 Reference for Wire and Fuse Type Selection

The wiring and installation methods must comply with national and local electrical specifications.

PV, alternator(automobile) and battery wiring specifications must be selected according to rated current.Please refer to the following table for wire and fuse specifications:

Type	Maximum input current/A of PV terminal	PV-terminal wire gauge (mm2/AWG)	PV Fuse Spec/A	Maximum input current/A of alternator terminal	Alternator -terminal wire gauge (mm2/AWG)	Alternator-terminal fuse spec/A	Alternator-terminal fuse spec/A	Back-up battery-terminal wire gauge (mm2/AWG)	Backup Battery-Terminal Fuse Spec/A
MD1230N05	27A	6	40~50A	35A	6	50~60A	30A	6	40~50A
MD1250N05	45A	9	60~70A	60A	12	80~90A	50A	10	60~70A

4.3 Installation and Wiring

Warning: Danger of Explosion! NEVER install the Controller and open the battery in the same closed space! Do not install it in a closed place where battery gas may accumulate.

Warning: Danger of High Voltage! Photovoltaic arrays may produce high open-circuit voltage, so please be sure to disconnect the circuit breaker or fuse before wiring and be careful in the process of wiring.

Warning: Danger of electric shock! We strongly recommend fuses or open circuits on the PV array side, alternator(automobile) side and battery side.

Notice: When installing the Controller, ensure enough air flowing through the heat sink of the Controller, and reserve at least 150mm space above and below the Controller for natural convection. If installed in a closed box, ensure reliable heat dissipation through the case.

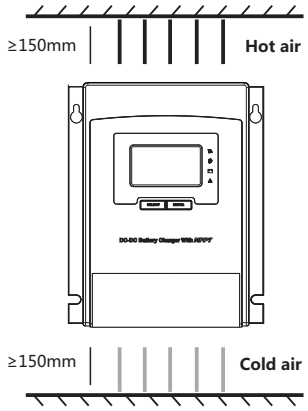


Fig. 4-1 Installation and Heat Dissipation

Step 1: Select the installation position

Avoid installing the Controller in a place with direct sunlight, high temperature and easy to water flooding, and ensure good ventilation around the Controller.

Step 2: Fix the suspension screws

Mark the installation position according to the mounting size of the Controller, bore 2 holes with appropriate size for mounting at the 2 marks, and fix the screws on such 2 holes.

Step 3: Fix the Controller

Align the Controller fixing hole with 2 screws fixed in advance, then hang them up, and then fix 2 screws below.

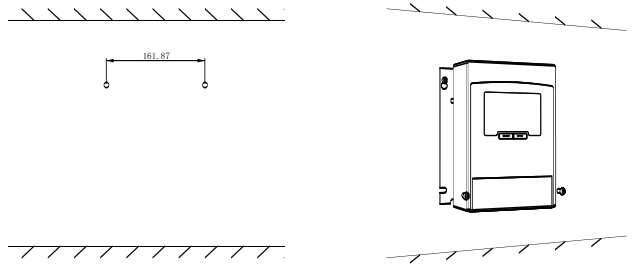


Fig. 4-2 Fixing the Controller

Step 4: Connect the Wire

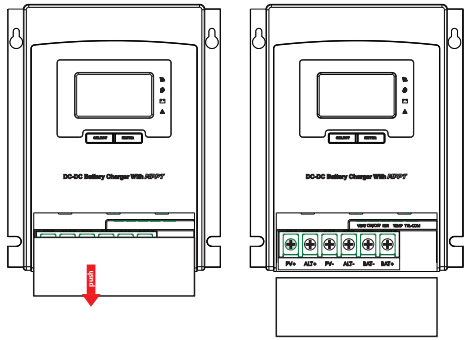
4.1 Crimping: select wire with appropriate specification according to the system configuration, and press one end of the wire to the standard copper terminal;

4.2 Wiring: Connect the wiring hole of copper terminal into the wiring port corresponding to the Controller.

Step 1: Push open the black terminal cover in the direction of [push] arrow in the following left picture;

Step 2: Access the corresponding interface according to the screen mark of each terminal, and pay attention not to connect the positive and negative in reverse;

Step 3: Finish the wire and push them into the front cover of the black terminal.



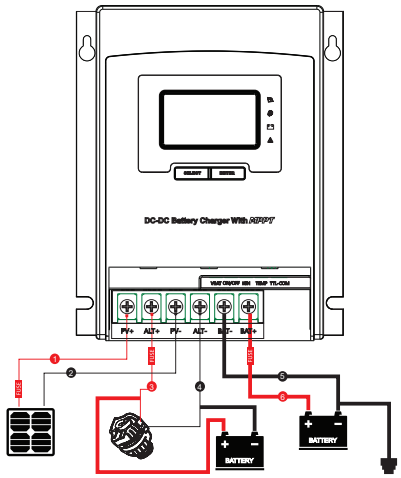


Fig. 4-3 Wiring Sequence

Warning: Danger of electric shock! We strongly recommend connecting fuses or circuit breakers at the photovoltaic array end, load end and battery end to prevent electric shock hazard in the process of wiring or misoperation, and ensure that the fuses or circuit breakers are disconnected before wiring.

Warning: Danger of High Voltage! Photovoltaic arrays may produce high open-circuit voltage, soi please be sure to disconnect the circuit breaker or fuse before wiring and be careful in the process of wiring.

Warning: Danger of Explosion! If the positive and negative terminals of the battery and the wire connected to the positive and negative terminals, short-circuiting would cause fire or explosion. Please be careful.

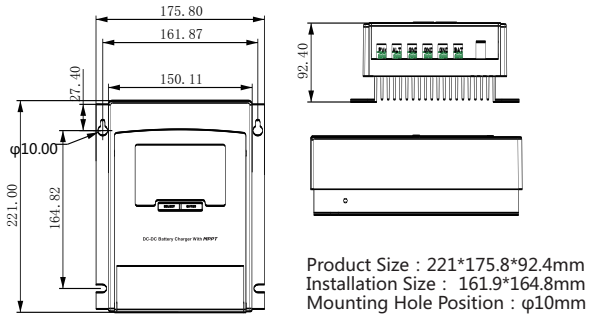
Please connect the battery first, then the battery panel, and finally the load and connect "+" first and then "-" in the process of wiring.

When all power wires are connected firmly and reliably, check whether the wiring is correct and whether the positive and negative are wrongly connected once again. Once confirmed and found no error, connect the battery fuse or circuit breaker first, and observe whether the LED indicator light is lit. If not lit, please cut off the fuse or circuit breaker immediately and then check whether the wire is connected correctly.

If the battery is energized normally, connect the battery panel again. If the sunshine is sufficient, the charging indicator of the Controller will be normally on or flashing and start charging the battery.

Note that the installation position of battery fuse should be as close to the Controller as possible, and the recommended installation distance should not exceed 150mm.

5. Product Size



Product Size：221*175.8*92.4mm
Installation Size： 161.9*164.8mm
Mounting Hole Position：φ10mm