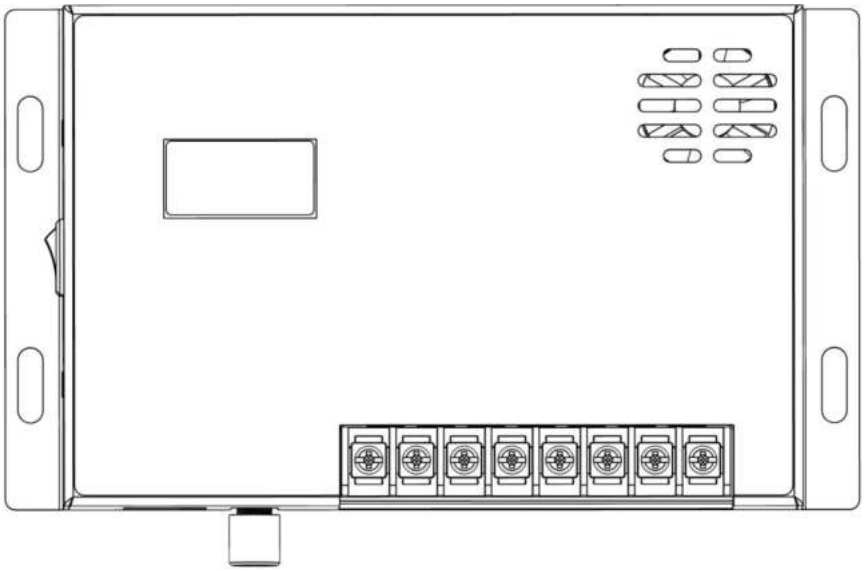
# MPPT Solar Charge Controller User Manual

## Model: A24PA

**For 12V/24V platform batteries (NMC, LiFePO4, lead-acid, custom), buck type Intelligent dual-power switchover / Mains DC supplementary charging / Low-light statistics threshold / Multiple load modes (Auto, Remote, Intermittent, Street light) Industry-first ultra-compact design with integrated ATS system**



**One more station of guarantee for your product, no worries, intelligent switchover**

**Manual version: V1.3. Subject to change without notice; contact sales for the latest electronic documents**

Thank you very much for choosing our product!

## Safety Instructions

1. Since the voltage applicable to this controller exceeds the human body safety voltage, please read this manual carefully and complete safety operation training before operating this controller.

2. There are no user-serviceable parts inside the controller. Do not disassemble or repair the controller by yourself.

3. Install the controller indoors to avoid component exposure and prevent water from entering the controller.

4. Install the controller in a well-ventilated place; the heatsink can get very hot during operation.

5. It is recommended to install a suitable fuse or circuit breaker outside the controller.

6. Before installing and adjusting the controller wiring, be sure to disconnect the PV array and the fuse or circuit breaker near the battery terminals.

7. After installation, check that all wiring connections are tight to avoid danger from heat accumulation caused by loose connections.

**Warning: This operation is dangerous. Be sure to make full safety preparations before operation.**

**Caution: This operation is destructive.**

**Tip: Suggestions and tips for the operator.**

Table of Contents

**1. Product Introduction** ..... **1**
1.1 Product Overview ..... 4
1.2 Product Features ..... 4
1.3 Appearance and Interfaces ..... 5
1.4 Introduction to MPPT Technology ..... 6
**2. Technical Specifications** ..... **7**
**3. DIP Switch and Power On/Off Instructions** ..... **8**
**4. TTL / RS485 Comm., External 12V Output, Pin Definition** ..... **8**
**5. Fan Temperature Control** ..... **8**
**6. FAQs and Troubleshooting** ..... **9**
**7. Display Interface** ..... **9**
**8. Product Installation** ..... **11**
8.1 Installation Precautions ..... 11
8.2 Installation Steps ..... 11
**9. Protection Functions** ..... **12**
**10. System Maintenance** ..... **12**
**11. Product Dimensions** ..... **12**
**12. Communication Protocol** ..... **13**
12.1 Basic Communication Configuration ..... 13
12.2 Register Addresses ..... 13
**13. Appendix Tables** ..... **15**
13.1 Function Table ..... 15
13.2 Fault Table ..... 15
**14. System Wiring Diagram** ..... **15**

# 1. Product Introduction

## 1.1 Product Overview

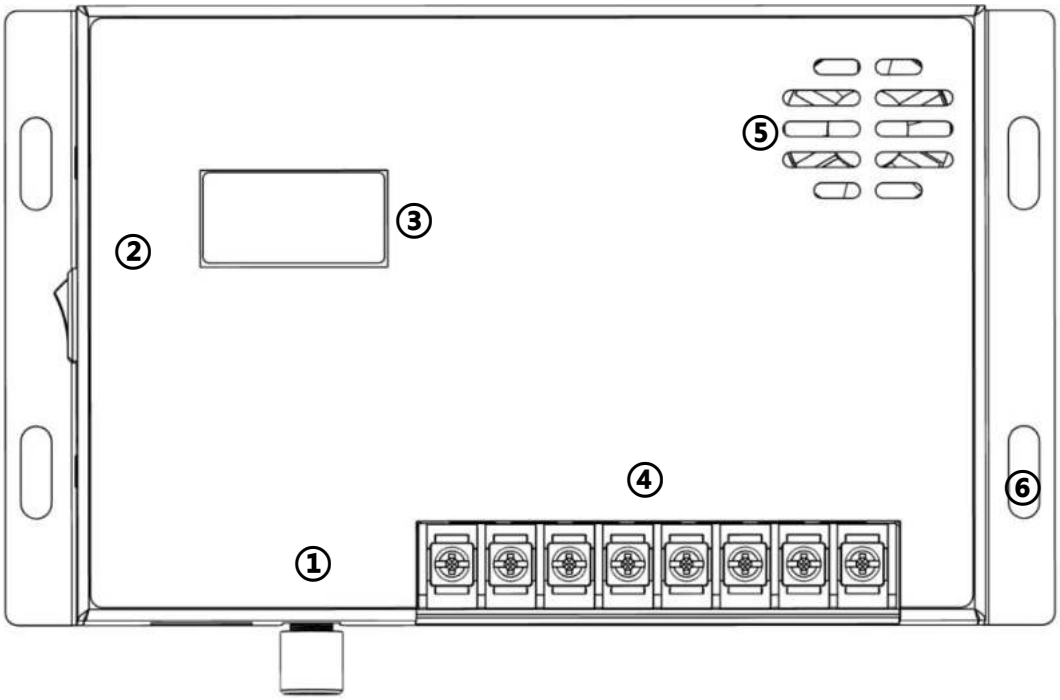
The A24PA controller adopts industry-leading MPPT maximum power tracking technology to achieve maximum energy tracking of the solar panel, allowing it to quickly and accurately track the maximum power point of the solar cells in various environments, obtain the maximum energy of the panel in real time, and significantly improve the energy utilization rate of the solar system. It is widely used in off-grid PV systems to manage the solar panel, battery and load, and is the core control component of off-grid PV systems. The controller has complete software and hardware fault detection and protection functions to minimize product damage caused by installation errors and system faults. Highlight: the A24PA has a built-in ATS switching system. Its small size integrates an automatic dual-power switching system and an MPPT system, and the auxiliary charging power is as large as its own MPPT charging power. Efficiency reaches >96%~99%. If the battery lacks enough energy to power the system overnight due to daytime environmental conditions, the A24PA will automatically switch mains DC to supply the battery until fully charged, then stop automatically, ensuring a stable and reliable system. The A24PA cleverly reuses the internal DC/DC converter hardware, saving cost. Users can set low-light charging statistics for cloudy/rainy days: if the set charge amount is not reached within the threshold time, DC (mains) charging is forced; the forced DC charging time threshold is also configurable.

## 1.2 Product Features

- Adopts MPPT maximum power point tracking technology with tracking efficiency up to 99.9%.
- Industry's first MPPT controller with integrated ATS system.
- Auxiliary power can be configured to start or stop the ATS system based on battery voltage.
- The auxiliary power replenishment level is configurable to make rational use of solar energy and reduce mains replenishment.
- Supports full-power charging and discharging simultaneously.
- Supports multiple battery types such as sealed, gel, flooded (open), lithium and custom.
- Supports lithium and lead-acid battery activation.
- Supports charging current setting.
- Supports full-charge setting.
- Supports temperature compensation.
- Supports parallel charging.
- Supports multiple load working modes (Auto / Intermittent / Street light / Remote control).
- Supports capacitive and inductive loads.
- Supports saving historical data.
- Supports RS485 communication with standard Modbus protocol; baud rate settable (default 9600bps).
- Supports TTL communication with standard Modbus protocol; baud rate settable (default 9600bps).
- Supports Bluetooth and Ethernet communication (optional).
- Complete charging/discharging protection mechanisms: over-voltage, over-current, overload, over-temperature, short circuit, etc.
- High-quality aluminum heatsink, forced-air cooling and high-temperature derating ensure reliable, efficient operation in various environments.

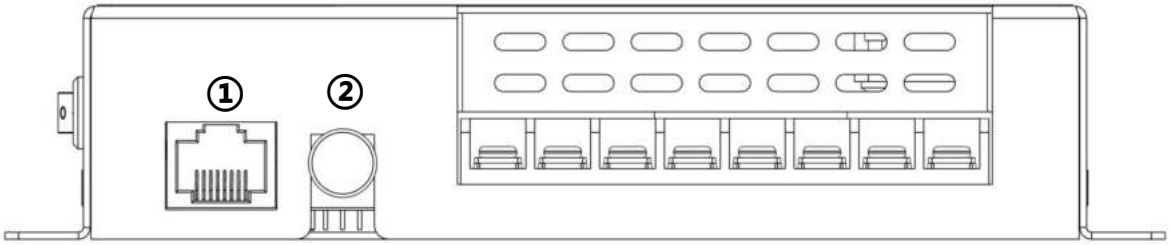
## 1.3 Appearance and Interfaces

Front Panel Interfaces




| No. | Function Description | Remarks |
|---|---|---|
| ① | Parameter-setting encoder knob | See DIP switch chapter for details |
| ② | Start button | Side rocker switch |
| ③ | Display screen | |
| ④ | Load port; Battery port; PV input port; Aux power port | Terminal barrier |
| ⑤ | Fan air outlet | Do not block |
| ⑥ | Earth screw hole | |

Side Interfaces




| No. | Function Description | Remarks |
|---|---|---|
| ① | RS485 communication port | See other chapters for pin definition |
| ② | Encoder knob button | |

The A24PB series maximum power point tracking (MPPT) system is an advanced charging technology that makes solar cells output more energy by adjusting the working state of the electrical module. Due to the nonlinear characteristics of the PV array, there is a maximum power point on its curve. Traditional PWM charging technology cannot maintain charging at this point, and thus cannot obtain the maximum energy of the panel. However, a solar controller with MPPT control technology can always track the maximum power point of the array to charge the battery with the maximum energy. Taking a 12V system as an example, the peak voltage (Vpp) of the solar panel is about 18V, while the battery voltage is about 12V; with a common charge controller, the panel voltage during charging is around 12V, and the maximum power is not fully utilized. An MPPT controller can overcome this problem by adjusting the panel input voltage and current in real time to maximize the input power. Compared with traditional PWM controllers, an MPPT controller can exploit the maximum power of the solar cells and provide a larger charging current; generally MPPT improves energy utilization by 20%~30% over PWM.

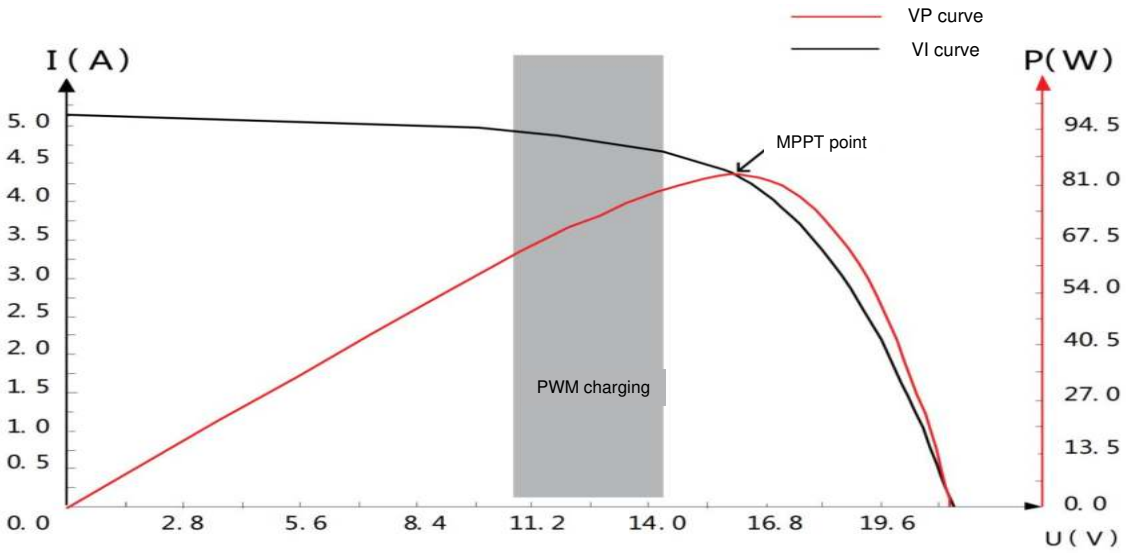



**Fig. 1-2 Panel Output Characteristic Curve**

Due to ambient temperature and light conditions, the maximum power point changes frequently. Our MPPT controller can adjust parameters according to conditions in real time so that the system always operates near the maximum power point. The whole process is fully automatic and requires no user adjustment.

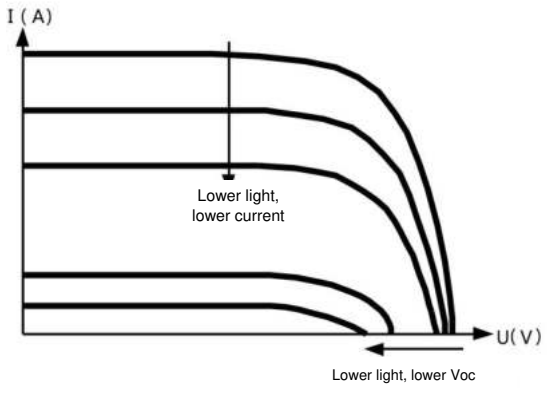



**Fig. 1-3 Panel Output vs. Light Intensity**

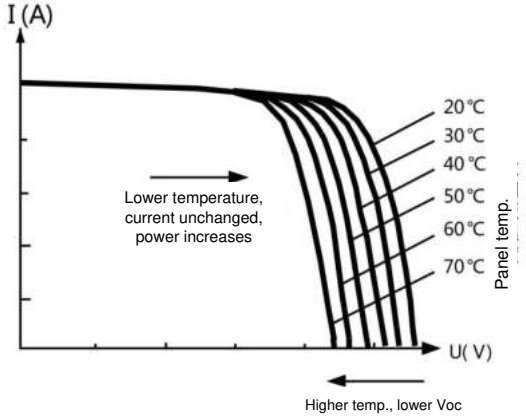
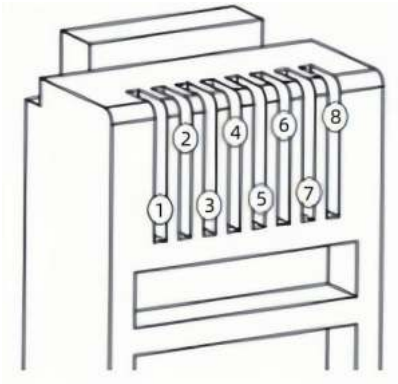



**Fig. 1-4 Panel Output vs. Temperature**

# 2. Technical Specifications

| Product model | **A24PA** |
|---|---|
| Static consumption | ≤30mA |
| Battery type | NMC / LiFePO4 / Lead-acid / Gel / Other (independently configurable via host software) |
| Battery voltage | 12V/24V platform |
| System mode | Buck |
| Rated battery charging current | 14.5A |
| Max. PV input current | 12A |
| Max. solar panel power | 300W |
| Max. PV open-circuit voltage (Voc) | <56V (system withstand 63V) |
| Recommended PV max-power voltage (Vmp) | 18V~50V (recommended for 24V system) |
| AUX input voltage | <52V |
| Max. input current | 12A |
| Max. input power | 12V/180W, 24V/300W |
| Max. system withstand voltage | 63V (±2%); over-voltage will damage the system |
| MPPT tracking efficiency | >99.9% |
| MPPT tracking speed | <1ms |
| Charging conversion efficiency | >96% |
| Rated load current | 12A |
| Load working mode | Manual mode, Auto mode (independently configurable via host software) |
| Charging working mode | Activation / Trickle / CC / CV |
| Battery charging temp. control settable | √ |
| Temperature protection | √ |
| Battery activation | √ |
| Load overload / short-circuit protection | √ |
| TTL communication | √ |
| RS485 communication | √ |
| External 12V supply (<300mA) | √ |
| Display screen | √ |
| SOC display support | √ |
| Charging power settable | √ |
| Battery cell count configurable | √ |
| Bluetooth support (external, optional) | √ |
| Ethernet support (external, optional) | √ |
| Auto-save settings | √ |
| Supported baud rates | 4800/9600/14400/19200/38400/56000/57600/115200, default 9600 (change requires host software) |
| Backlight adjustment | √ |
| Protection functions | PV over-voltage, PV reverse-connection, PV short-circuit, night reverse-charging, input power limiting, over-temperature, load short-circuit, load overload, battery over-voltage / over-discharge, battery reverse-connection protection |
| Operating ambient temperature | - 35℃~65℃ |
| Ingress protection | IP32 |
| Cooling method | Natural convection, forced air |
| Dimensions | L x W x H 97x170x37mm |
| Weight | 0.5kg |
| LiFePO4 battery support | 3~8 cells |
| NMC battery support | 3~7 cells |
| Lead-acid / gel battery support | 1~2 cells |
| Other batteries | User-defined under/over-voltage points (set 10V~30V via host software) |

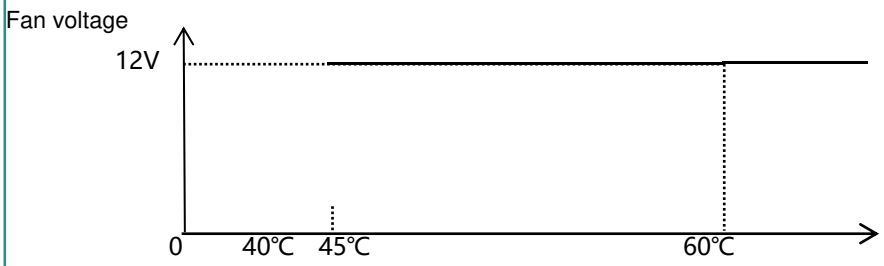
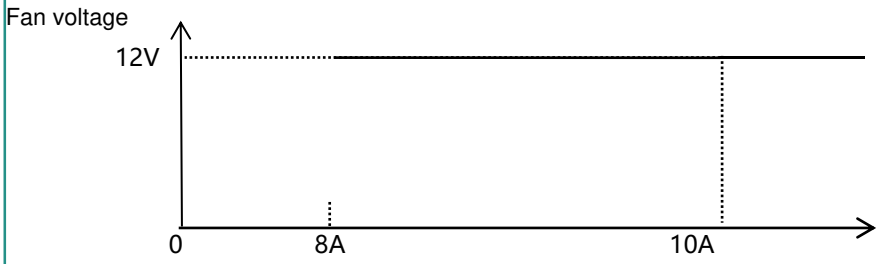
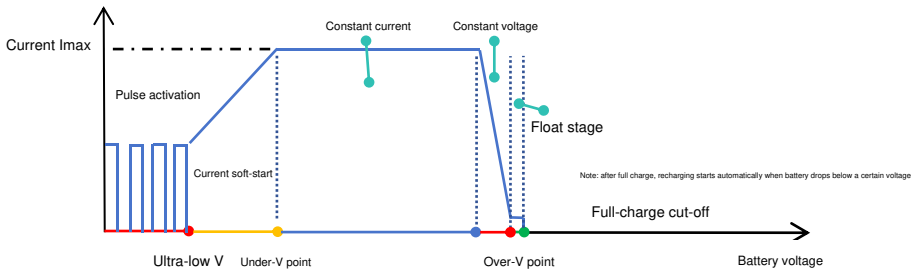
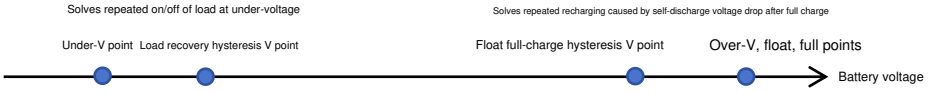
## 4. TTL / RS485 Communication, External 12V Output, Pin Definition




| No. | Definition |
|---|---|
| ① | 485-A |
| ② | 485-B |
| ③ | 12V |
| ④ | GND |
| ⑤ | Unused |
| ⑥ | Unused |
| ⑦ | TTL-TXD |
| ⑧ | TTL-RXD |

Note: The 12V output provides up to 300mA; exceeding it may damage the port.

## 5. Fan Temperature Control

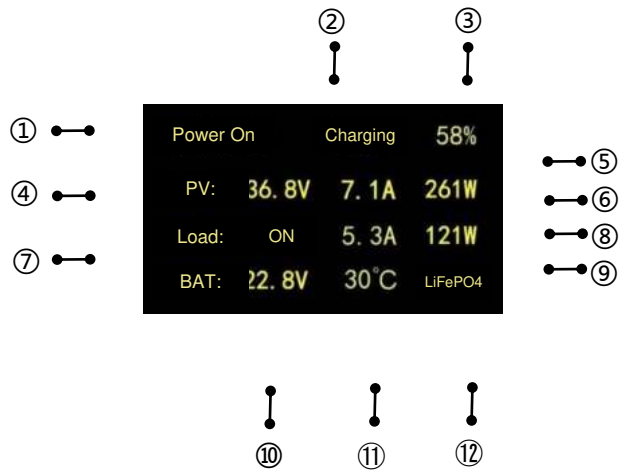
| No. | Fan Start Logic Diagram |
|---|---|
| During PV charging |   |
| When PV is not charging, fan starts with discharge load current |   |
| Six-stage current charging |   |
| Custom settings |   Users can set this parameter properly according to their battery characteristics for better battery protection and system reliability |

# 6. FAQs and Troubleshooting

| Symptom | Solution |
|---|---|
| Indicator and LCD screen off | Check whether the battery and solar panel are connected correctly |
| PV has voltage but no voltage output at battery terminal | Disconnect the battery and check whether it has voltage; if not, enable battery activation in system settings. (During activation, battery reverse-connection protection is not supported) |
| Battery type and cell count cannot be changed while MPPT is working | Changing the battery type will change the over-voltage and under-voltage protection points! |
| Charging power cannot reach the rated value | The system adopts current limiting and constant temperature control;<br>Check whether the charging power has been reset;<br>Whether the voltage difference between PV panel and battery is too large. |
| Some loads fail to start | Set the short-circuit load time via host software to adapt to different external loads |
| Other problems or unsolvable anomalies | Restore factory settings in the settings interface, then reconfigure the system parameters according to the system configuration. Be cautious! |
| No response when battery is connected | 1. Check whether the fuse was blown by previous reverse connection; replace the fuse or contact the manufacturer for repair |
| Fan does not rotate | 1. Check whether the fan is blocked by foreign objects; clean the air duct regularly.<br>2. If the fan still does not rotate after cleaning, contact after-sales for fan replacement. |

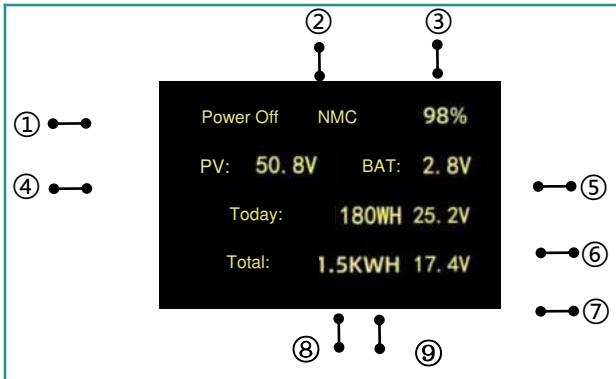
# 7. Display Interface

## 7.1 Power-on Display Interface




| |
|---|
| (1) Power-on status display |
| (2) System status (charging, discharging, protection) |
| (3) SOC display |
| (4) Alternately displays PV voltage and aux power voltage |
| (5) PV charging current |
| (6) PV charging power |
| (7) Load start status |
| (8) Load output current |
| (9) Load output power |
| (10) Battery voltage |
| (11) Battery temperature (not displayed if no NTC connected) |
| (12) Battery type (NMC, LiFePO4, lead-acid, other) |

## 7.2 Power-off Display Interface




| |
|---|
| (1) Currently powered off |
| (2) Battery type currently set to NMC |
| (3) Battery SOC |
| (4) Alternately displays PV / aux power voltage |
| (5) Battery voltage |
| (6) Battery over-voltage protection point / ATS start voltage |
| (7) Battery under-voltage protection point / ATS stop voltage |
| (8) Today's energy generation |
| (9) Historical energy generation |

7.3 Power-off Display Interface

System off -> long press to enter settings interface

| Setting | Parameter | Remarks |
|---|---|---|
| Charging priority | PV (PV priority), Aux (Aux priority) | |
| PV power | 25~600W | |
| Aux power | 25~480W | |
| Activation mode | Disable, Trickle, Pulse | |
| Activation voltage | 0V~30V | |
| Battery type | NMC, LiFePO4, Lead-acid, Gel, Sodium, Other | |
| Cell count | 1~8 cells | |
| Over-voltage protection | 10.0V~30.0V | |
| Full-charge recharging | 10.0V~30.0V | |
| Load protection | 10.0V~30.0V | |
| Load recovery | 10.0V~30.0V | |
| Load mode | Remote, Auto, Intermittent, Street light | |
| Baud rate | 4800~115200 | |
| Device address | 01H~255H | |
| Backlight time | 0~999S | |
| Aux start | 10.0V~30.0V | |
| Aux stop | 10.0V~30.0V | |
| Low-light statistics | 0~999min | |
| Statistics threshold | 1~999WH | |
| Forced aux time | 1~999min | Can start when low-light statistics is not 0 |
| Int. load high time | 1~999min | Intermittent load output high time |
| Int. load low time | 1~999min | Intermittent load output low time |
| Int. load mode | High-Low, Low-High | |
| Light start level | 0.0V~50.0V | |
| Light start delay | 1~999min | |
| Light on time | 1~999min | |
| Language | 0 (Chinese), 1 (English) | |
| Short-circuit time | 0~999 | |

# 8. Product Installation

## 8.1 Installation Precautions

- Be very careful when installing batteries. Wear protective goggles when installing flooded lead-acid batteries; if battery acid is contacted, rinse immediately with clean water.
- Do not place metal objects near the battery to prevent short circuits.
- Charging may produce acidic gas; ensure good ventilation around the environment.
- The battery may produce flammable gas; keep away from sparks.
- For outdoor installation, avoid direct sunlight and rain ingress.
- Loose connections and corroded wires can generate great heat, melt wire insulation, burn surrounding materials and even cause fire. Ensure all connectors are tightened and wires are fixed with cable ties to prevent loosening from wire shaking in mobile applications.
- During system connection, the array output voltage may exceed human safety voltage. Use insulated tools and keep hands dry.
- The battery terminals on the controller can connect to a single battery or a battery bank. The following descriptions assume a single battery, but they also apply to battery bank systems.
- Follow the battery manufacturer's safety recommendations.
- Connect the controller's ground terminal to earth
- Reverse battery connection during installation is prohibited; it will cause irreversible damage.

## 8.2 Installation Steps

Wiring and installation must comply with national and local electrical codes. Select wire gauge by rated current, typically 5A/mm².

**Step 1: Choose the installation site**

Avoid installing the controller in places with direct sunlight, high temperature or water ingress; ensure good ventilation around it.

**Step 2: Fix the hanging screws**

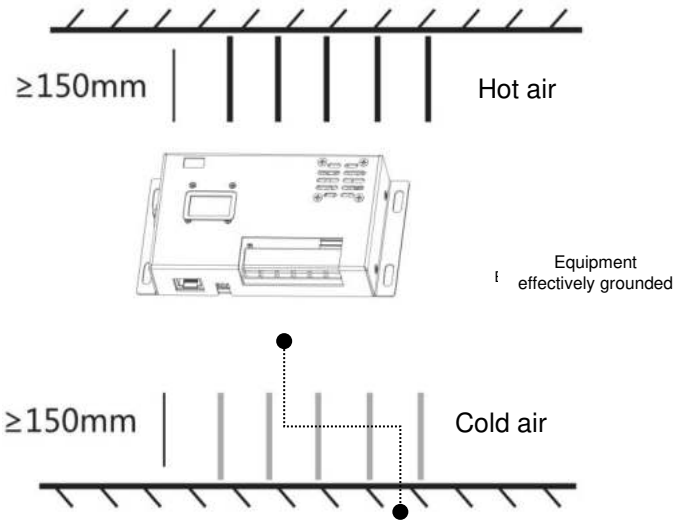
Mark the position according to the controller dimensions, drill 2 suitable mounting holes at the marks and fix the screws in the two holes.

**Step 3: Mount the controller**

Align the controller mounting holes with the 2 pre-fixed screws, hang it on, then fix the two lower screws.

**Step 4: Fix the earth wire**

Lock a wire with the side screw of the controller and connect the other end effectively to earth (e.g. tied to a buried metal block), so leakage, static and lightning currents are conducted to earth.



## 9. Protection Functions

- Device over-temperature protection

  When the internal temperature exceeds the set value, charging power is automatically reduced or even shut off, further slowing the internal temperature rise.

- Battery over-temperature protection

  Battery over-temperature protection requires an external battery temperature sensor. When battery overheating is detected, charging stops; when the battery temperature falls 5 degrees below the set value for 2 seconds, charging resumes automatically.

- Input over-power protection

  When panel power exceeds rated power, the controller limits charging power within the rated range to prevent damage from excessive current; the controller enters current-limited charging.

- PV input voltage too high

  If the PV array input voltage is too high, the controller will automatically cut off PV input.

- PV input reverse-connection protection

  If the PV array polarity is reversed, the controller will not be damaged and will work normally after the wiring is corrected.

- Night reverse-charging protection

  Prevents the battery from discharging through the solar panel at night. Note: no battery reverse-connection protection function

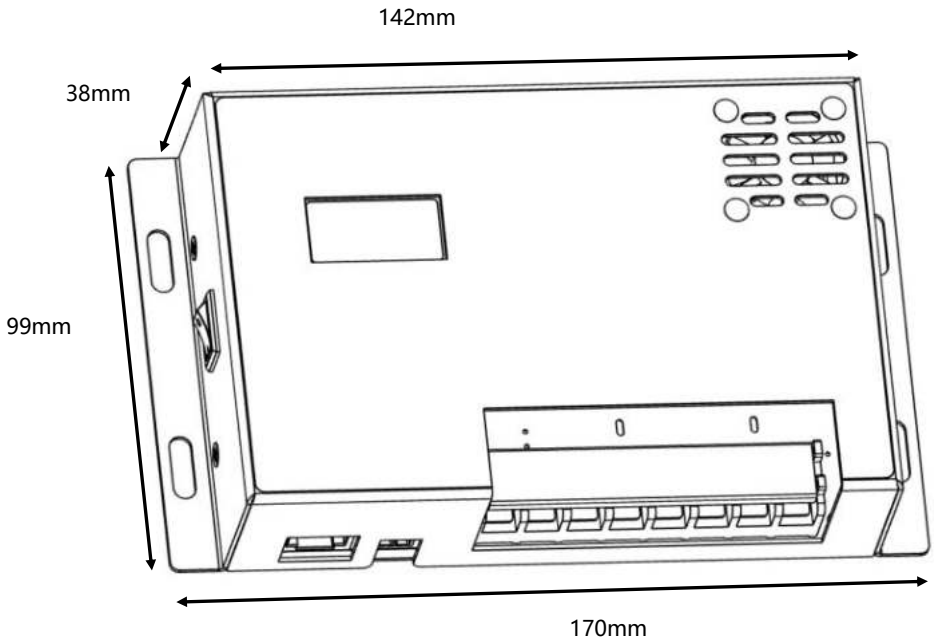
## 10. System Maintenance

To keep the controller at its best performance, regular checks of the following items are recommended.

- Take corrective measures promptly when abnormal faults or error prompts are found.
- Check terminals for corrosion, insulation damage, high temperature, burning/discoloration, case deformation, etc.; repair or replace in time.
- Repair or replace wires that are exposed, damaged or have degraded insulation.
- Clean dirt, nesting insects and corrosion in time.

**Warning: Electric shock hazard! Before the above operations, make sure all power supplies of the controller are disconnected! Non-professionals must not operate without authorization.**

## 11. Product Dimensions



# 12. Communication Protocol

## 12.1 Basic Communication Configuration

| | | | | |
|---|---|---|---|---|
| Transmission mode | RTU | Protocol std / function code | 0x02 Read one or more input statuses | Bit-wise read |
| Baud rate | Default 9600bps | This protocol is based on the <standard MODBUS protocol>. The host cyclically requests data from slaves; slaves receive the request and reply with data. | 0x03 Read holding registers | Read as 16-bit words |
| Parity | None | | 0x04 Read a register | Read as 16-bit words |
| Data bits | 8bit | | 0x05 Write a coil status | Bit-wise write |
| Stop bits | 1bit | | 0x06 Write a holding register | Write as 16-bit words |
| Frame interval | No less than 3.5 byte times | | 0x10 Write multiple holding registers | Write as 16-bit words |
| Frame length | 200 bytes | When the communication module detects an error other than a CRC error, it must reply to the host; the MSB of the function code is set to 1; 01 illegal function, 02 illegal data address 03 illegal data value, 04 server device failure | | |
| Max. slave response time | 350 byte times | | | |
| Min. host polling interval | 400 byte times | | | |

## 12.2 Register Addresses

Register address table: read with function code 0x03, set with function code 0x06. The addresses below are the same as those in actual message frames; no offset or other conversion is needed

| Address (decimal) | Meaning | Bytes | R/W | Example | Description |
|---|---|---|---|---|---|
| 40000 | Device model | 2 | R | 12422 | A24PA |
| 40001 | Software version | 2 | R | 10 | V1.0 |
| 40002 | Hardware version | 2 | R | 10 | V1.0 |
| 40003 | Max. supported power | 2 | R | 580 | 580W |
| 40004 | Max. input/output current | 2 | R | 1820 | PV:10A,BAT:12A |
| 40005 | PV buck heatsink temperature | 2 | R | 25 | Current system temperature 25°C |
| 40006 | PV NTC status | 2 | R | 0 | 0~7 |
| 40007 | BAT NTC status | 2 | R | 0 | 0~7 |
| 40008 | Reserved | 2 | R | Unused | Reserved |
| 40009 | Reserved | 2 | R | Unused | Reserved |
| 40010 | Charging stage | 2 | R | 3 | 1: Activation, 2: Trickle, 3: CC, 4: CV |
| 40011 | Charging status | 2 | R | 1 | 0: Not charging, 1: Charging |
| 40012 | Full-charge status | 2 | R | 1 | 0: Not full, 1: Full |
| 40013 | Current load status | 2 | R | 1 | 1: Starting, 0: Off |
| 40014 | BUCK heatsink temperature | 2 | R | 50 | 50°C (accuracy 1°C) |
| 40015 | Reserved | 2 | R | Unused | Reserved |
| 40016 | Low-light statistics time setting | 2 | R/W | 50 | 50min |
| 40017 | Low-light statistics energy threshold | 2 | R/W | 300 | 300Wh |
| 40018 | Forced DC start | 2 | R/W | 30 | 30min |
| 40019 | DC input voltage | 2 | R | 3624 | 36.24V (accuracy 0.01V) |
| 40020 | PV input voltage | 2 | R | 5098 | 50.98V (accuracy 0.01V) |
| 40021 | DC or PV input current | 2 | R | 275 | 2.75A (accuracy 0.01A) |
| 40022 | DC or PV input power | 2 | R | 100 | 100W (accuracy 1W) |
| 40023 | DC or PV heatsink temperature | 2 | R | 20 | 20 (accuracy 1°C) |
| 40024 | PV fault code | 2 | R | 0 | See fault table 1 |
| 40025 | Battery output voltage | 2 | R | 2256 | 22.56V (accuracy 0.01V) |

| | | | | | |
|---|---|---|---|---|---|
| 40026 | Battery output current | 2 | R | 12 | 1.2A |
| 40027 | Battery output power | 2 | R | 100 | 100W |
| 40028 | Battery heatsink temperature | 2 | R | 25 | 25°C (accuracy 1°C) |
| 40029 | Battery fault code | 2 | R | See fault table 2 | See fault table 2 |
| 40030 | Load output current | 2 | R | 18 | 1.8A |
| 40031 | Load output power | 2 | R | 125 | 125W |
| 40032 | Fan start status | 2 | R | 0 | 0: Off, 1: On |
| 40033 | Historical charging WH high | 2 | R | H+L (unit WH) | Historical total energy WH |
| 40034 | Historical charging WH low | 2 | R | | |
| 40035 | Current SOC value | 2 | R | 982 | 98.2% |
| 40036 | Reserved | 2 | R | Unused | Reserved |
| 40037 | Today's energy generation | 2 | R | 855 | 855WH |
| 40038 | MPPT working mode | 2 | R | 0 | See function table 2 |
| 40039 | Remote load switch | 2 | R/W | 0 | 1: Load on; 0: Load off |
| 40040 | PV max. input voltage | 2 | R | 560 | 56.0V |
| 40041 | PV min. input voltage | 2 | R | 140 | 14.0V |
| 40042 | User-set max. charging power | 2 | R/W | 100 | 100W (limit of PV max. charging power setting) |
| 40043 | Reserved | 2 | R/W | Unused | Reserved |
| 40044 | PV stop working temperature setting | 2 | R/W | 70 | 70℃ |
| 40045 | Current PV fan-start temperature | 2 | R | 40 | 40°C fan starts |
| 40046 | Device communication address | 2 | R/W | 01 | Comm address: 01H (01~255) |
| 40047 | Battery max. charging voltage setting | 2 | R | 1440 | 25.2V (auto-assigned by system per DIP switch) |
| 40048 | Battery min. discharging voltage setting | 2 | R | 1120 | 17.6V (auto-assigned by system per DIP switch) |
| 40049 | Reserved | 2 | R/W | Unused | Reserved |
| 40050 | Battery discharge high-temp. setting | 2 | R/W | 60 | >60°C stops load output |
| 40051 | Battery discharge low-temp. setting | 2 | R/W | -10 | <-10°C stops load output |
| 40052 | Battery charge high-temp. setting | 2 | R/W | 45 | >45°C stops battery charging |
| 40053 | Battery charge low-temp. setting | 2 | R/W | 0 | <0 stops battery charging |
| 40054 | Reserved | 2 | R/W | Unused | Reserved |
| 40055 | Set battery type | 2 | R | 0 | 0: NMC, see function table 1 |
| 40056 | Set battery cell count | 2 | R | 6 | NMC 6 cells |
| 40057 | Power on | 2 | R/W | 1 | 0: Generation disabled, 1: Enabled (default) |
| 40058 | Battery activation setting | 2 | R | 0 | 0: Activation (default for A24PA) |
| 40059 | Baud rate | 2 | R/W | 0 | 1:9600 (default) 0~7 (4800~115200) |
| 40060 | Backlight time | 2 | R/W | 60 | 60S (default) (not supported on some models incl. A24PA) |
| 40061 | Screen lock | 2 | R/W | 0 | 0: Unlock, 1: Lock (not supported on some models incl. A24PA) |
| 40062 | Set ATS charging power | 2 | R/W | 100 | 100W (unit 1W) (default) |
| 40063 | User-set battery over-voltage | 2 | R/W | 260 | 26.0V(100~170) |
| 40064 | User-set battery under-voltage | 2 | R/W | 200 | 20.0V(75~140) |
| 40065 | User-set load short-circuit time | 2 | R/W | 100 | 100*20(us) (adjust per external load) |
| 40066 | ATS system start voltage | 2 | R/W | 220 | ATS starts when battery voltage < 22.0V |
| 40067 | ATS system stop voltage | 2 | R/W | 240 | ATS stops when battery voltage > 24.0V |
| 40068 | Set load start hysteresis | 2 | R/W | 1000 | 1000mV |

| | | | | | |
|---|---|---|---|---|---|
| 40069 | Full-charge recharge voltage difference setting | 2 | R/W | 1000 | 1000mV (recharge voltage difference after full-charge voltage drops from float) |
| 40070 | Pulse activation flag | 2 | R | 1 | 1: Battery activation in progress |

# 13. Appendix Tables

## 13.1 Function Table

| Function Table 1 (decimal) | | |
|---|---|---|
| NMC Battery | NMC lithium battery | 0 |
| LFP Battery | LiFePO4 battery | 1 |
| PAB Battery | Lead-acid battery | 2 |
| GEL Battery | Gel battery | 3 |
| | | |
| OTH Battery | Other battery | 5 |
| ERR | Error configuration | 8 |

| Function Table 2 (decimal) | | |
|---|---|---|
| MPPT->BAT | Solar panel to battery charging | 0 |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

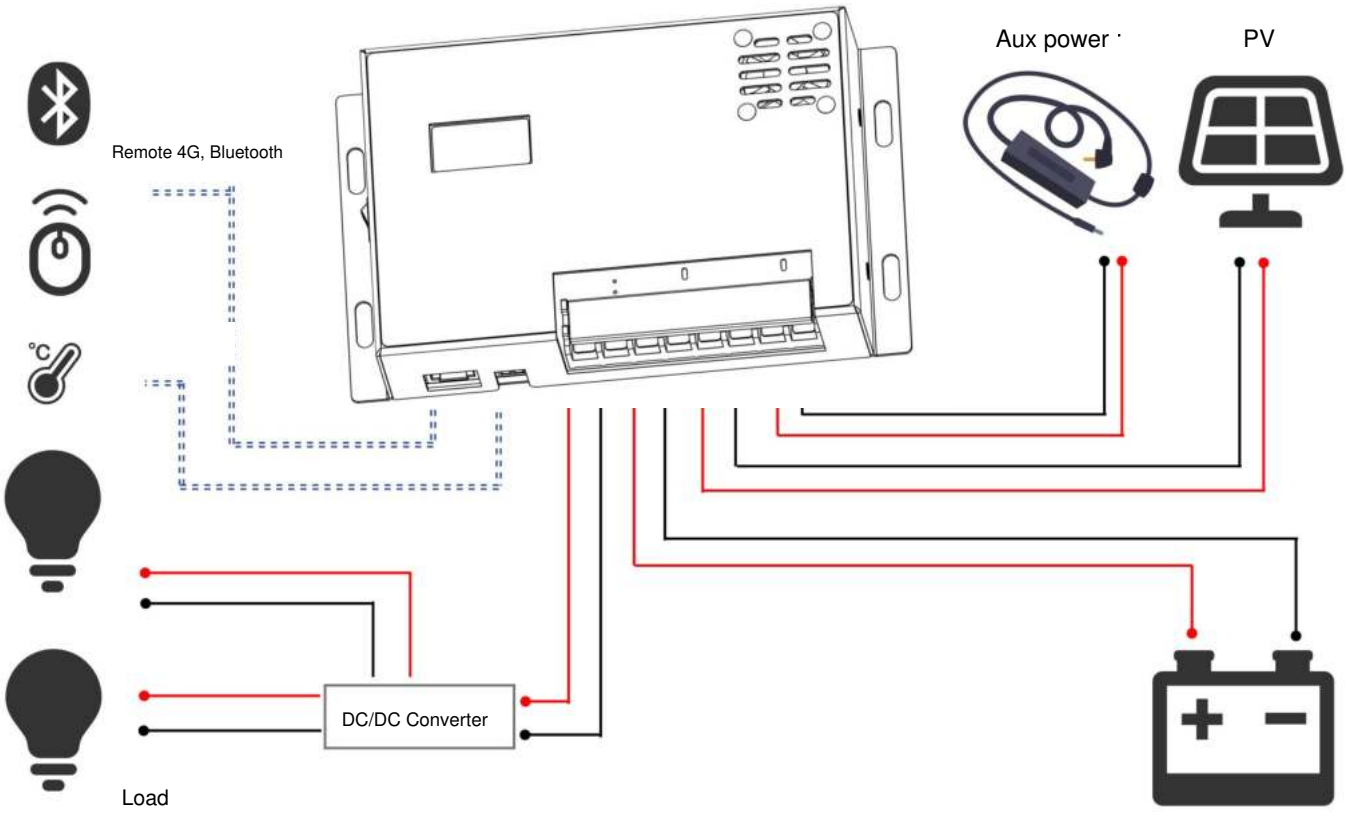
## 13.2 Fault Table

| Fault Table 1 (decimal) | | | |
|---|---|---|---|
| Panel over-voltage | 1 | Panel short circuit | 128 |
| Panel under-voltage | 2 | | |
| System over-temperature | 4 | | |
| Temperature sensor fault | 8 | | |
| Panel over-current | 16 | | |
| Panel over-power | 32 | | |
| Current sensor fault | 64 | | |

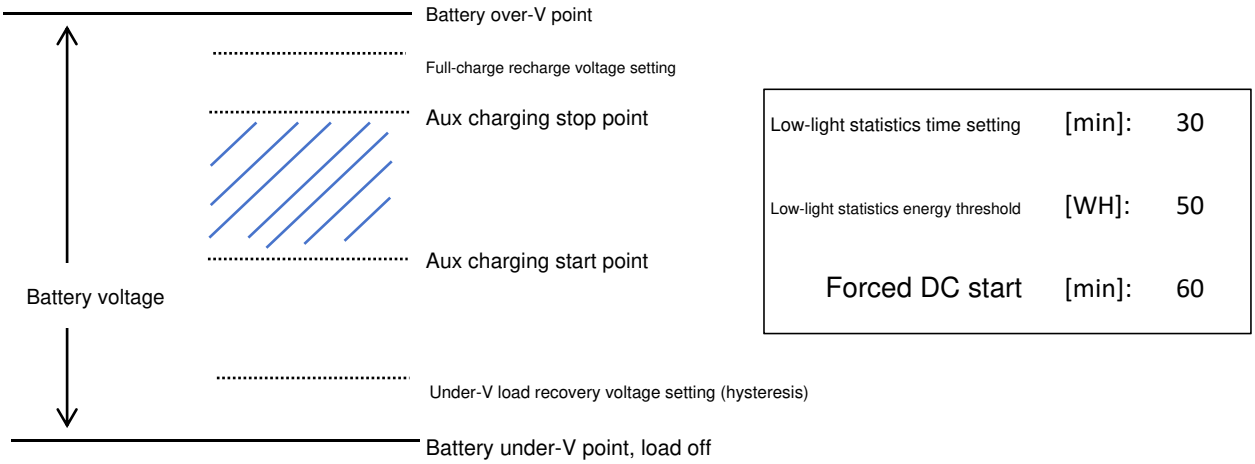
| Fault Table 2 (decimal) | | | |
|---|---|---|---|
| Battery over-voltage | 1 | Battery current sensor fault | 128 |
| Battery under-voltage | 2 | Battery short circuit | 256 |
| Battery over-temperature | 4 | Load over-current (level 1) | 512 |
| Battery low temperature | 8 | Load over-current (level 2) | 1024 |
| Temperature sensor fault | 16 | Load short circuit | 2048 |
| Battery over-current | 32 | Load current sensor fault | 5096 |
| Battery overload | 64 | Battery configuration error | 10192 |
| Charging DIP fault code | 20384 | | |

# 14. Application Wiring Diagram

A24PA (MPPT+ATS)



## 15. How PV Priority Achieves a Never-Power-Off System




### PV Priority (Must-read for users)

After the user sets the aux start/stop voltages and the DIP switch sets PV as the first charging priority, when PV has no power and the battery voltage is below the aux charging start point, the aux source directly takes over charging until the battery voltage reaches the aux charging stop point, then stops charging. Within the aux charging interval, if PV suddenly has power, the system automatically switches back to PV charging mode and stops aux charging, keeping the optimized PV preference. As is well known, the open-circuit voltage of a PV panel remains consistent on cloudy or even rainy days. At such times, since both aux and PV voltages exist, PV charging current is very weak on cloudy or rainy days, and the current supplying external loads from the battery may exceed the charging current, causing the battery voltage to drop lower and lower, even to depletion, while the aux source still cannot intervene. This is because PV voltage always exists and the user chose PV priority.

The solution is that the user can set:

"Low-light statistics time setting": e.g. 30 minutes (max. 300 minutes)

"Low-light statistics energy threshold": e.g. 50Wh (max. 1000Wh)

"Low-light forced DC start time": e.g. 60 minutes (max. 300 minutes)

If PV charging does not reach 50Wh within 30 minutes, mains DC forcibly takes over for 60 minutes, then PV charging resumes, and so on in a cycle! Proper adjustment of these parameters allows optimized system operation, fearless of cloudy, overcast, rainy days or night, achieving a truly never-power-off system.