# OP-0516 DC Charger Control Unit

Product Manual

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# Catalogue

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# 1、 Main Board Introduction

The OP-0516 DC Control Unit is a controller developed by our company specifically for DC charging piles, operating at a voltage of DC 12 V. It employs the RT-Thread embedded operating system and integrates high-capacity FLASH memory and RAM. The main control board features 22 output channels, 10 input channels, 3 analog channels, 9 communication channels, 2 insulation detection and high-voltage sampling channels, 2 control signal channels, 1 power supply channel, 1 4G communication channel, 1 Ethernet channel, 1 SD card slot, as well as reserved channels for CAN and 485 communications.

**Main Control Features:**

1. *Support for the State Grid e-Charging Platform*
2. *Supports flexible scheduling for three busbars (flexible scheduling with dual-gun configuration across four module groups)*
3. *Supports 12/24V onboard switching without external intermediate relays*
4. *Supports onboard insulation testing and onboard high-voltage sampling, eliminating the need for external insulation detectors or sampling modules.*
5. *Supports onboard metering; if no electricity meter is required, this function can be used directly without connecting a meter.*
6. *The overall layout is symmetrically distributed, facilitating wiring.*
7. *The screen and card-swiping signal lines use an RJ45 interface (network port), enabling plug-and-play functionality to prevent wiring errors.*
8. *Supports remote OTA (over-the-air updates) and remote maintenance, enabling precise issue localization to reduce operational costs*

## 1.1 Main Board Dimensions

The dimensions are 252.5 mm (length) × 130 mm (width) × 20 mm (height).

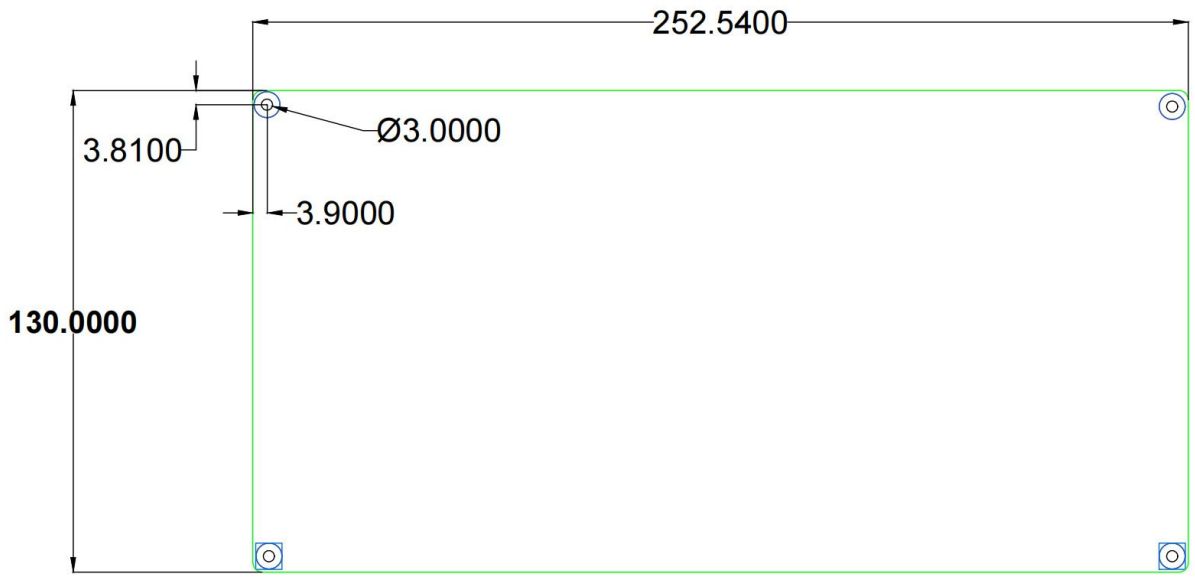



Figure 1: External Dimensions of OP-0516 (without Housing)



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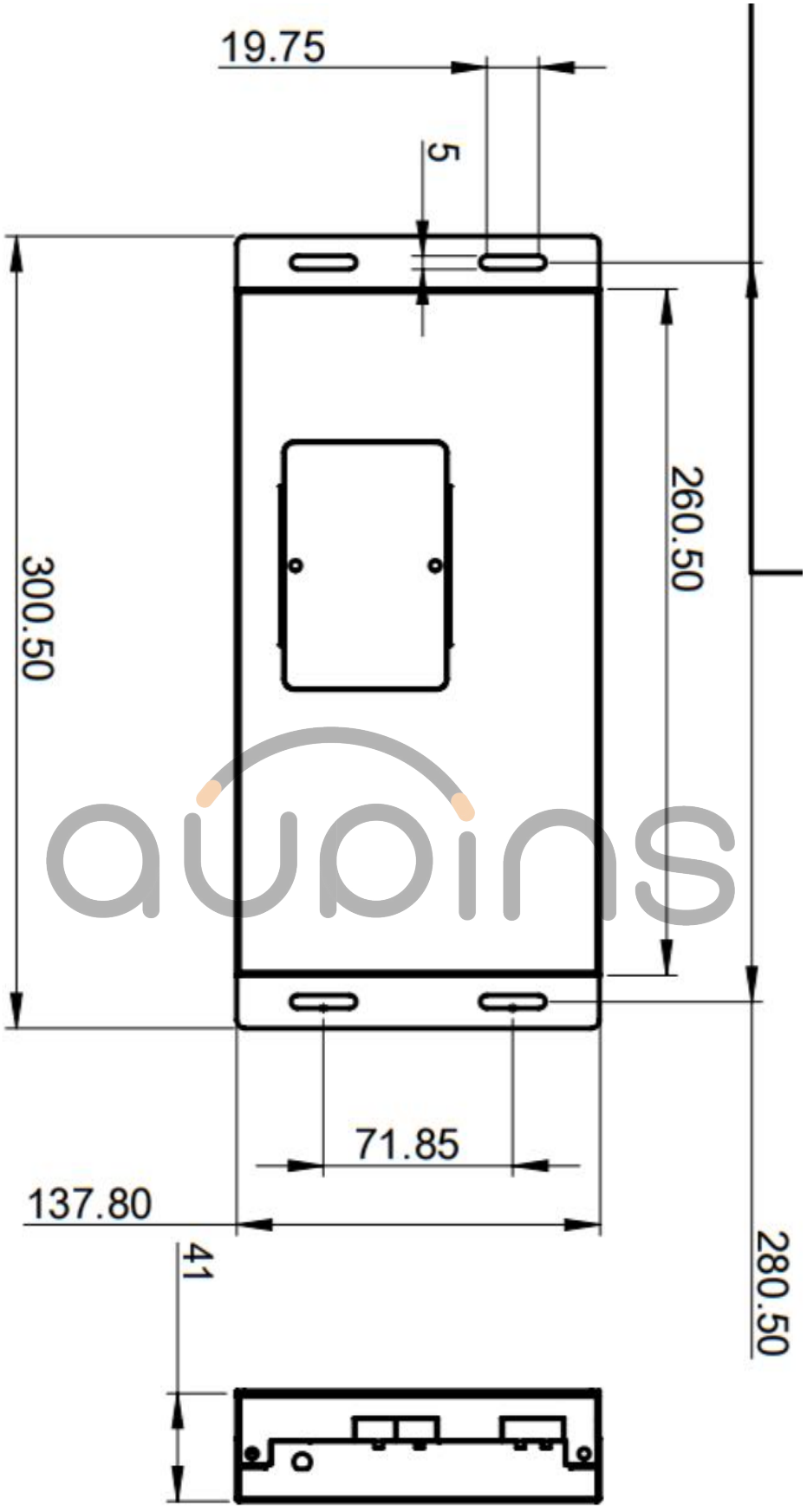



Figure 1: External dimensions of OP-0516 (with housing)

## 1.2 Main Board Side



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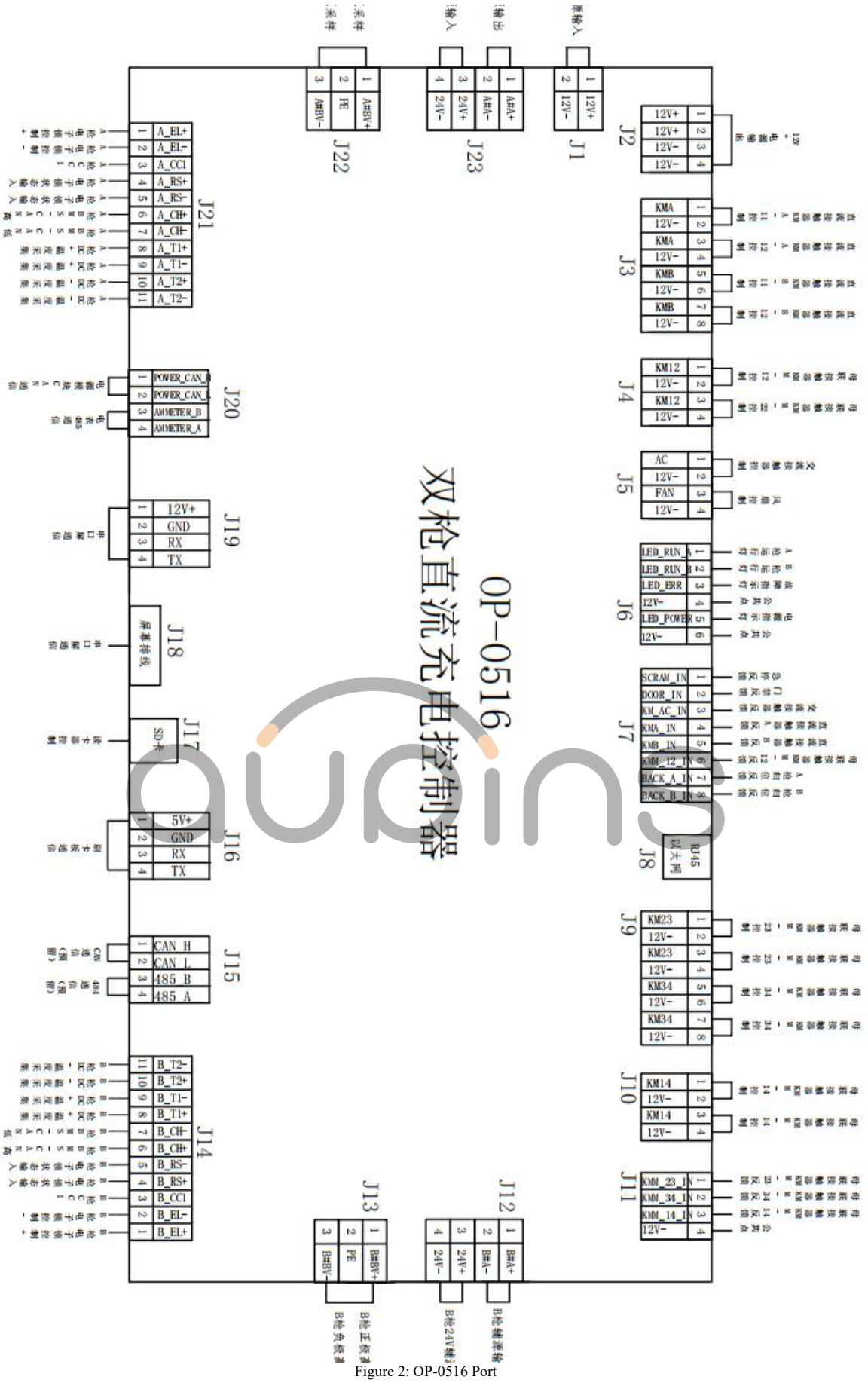



Figure 2: OP-0516 Port



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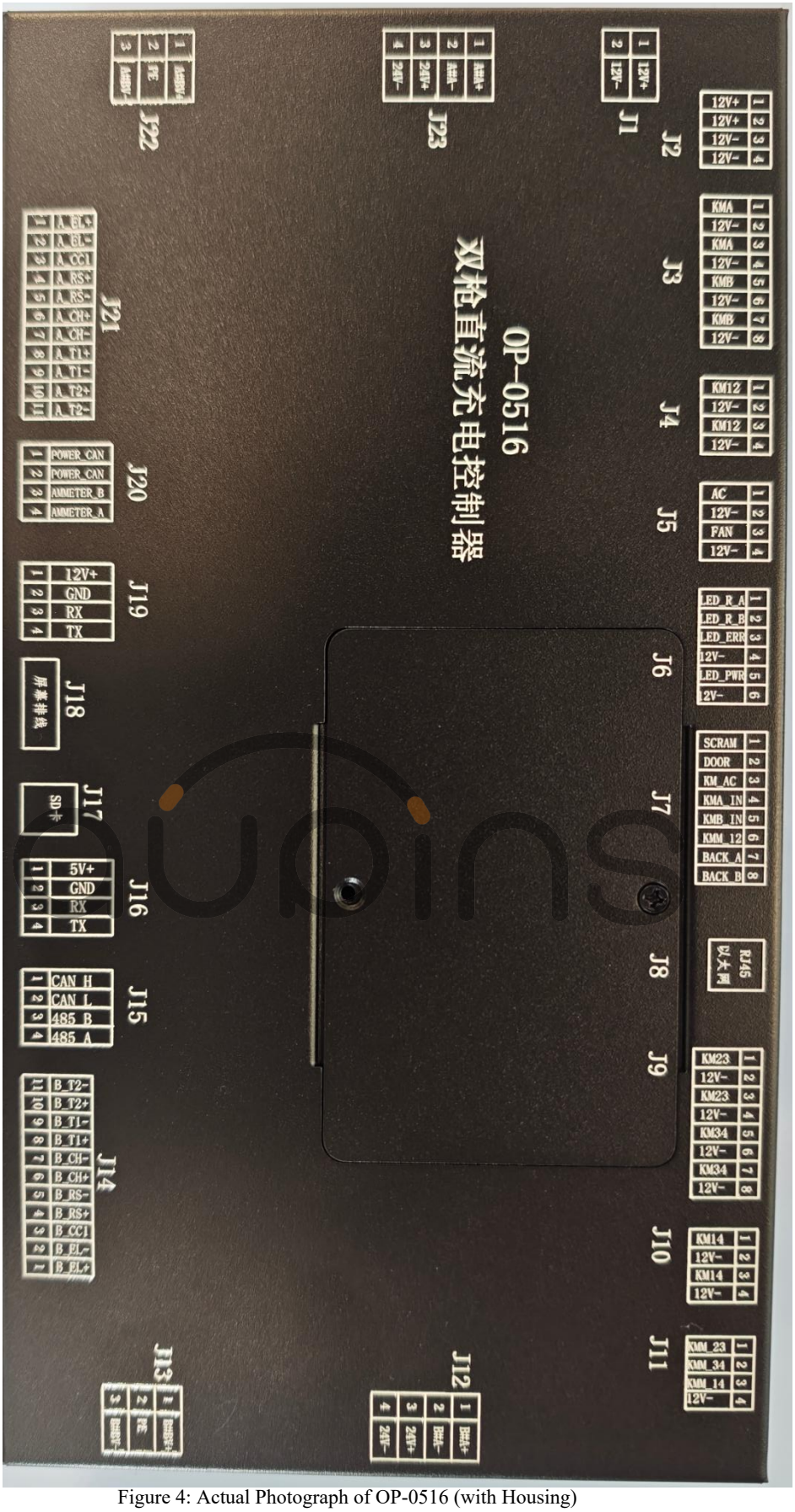



Figure 4: Actual Photograph of OP-0516 (with Housing)



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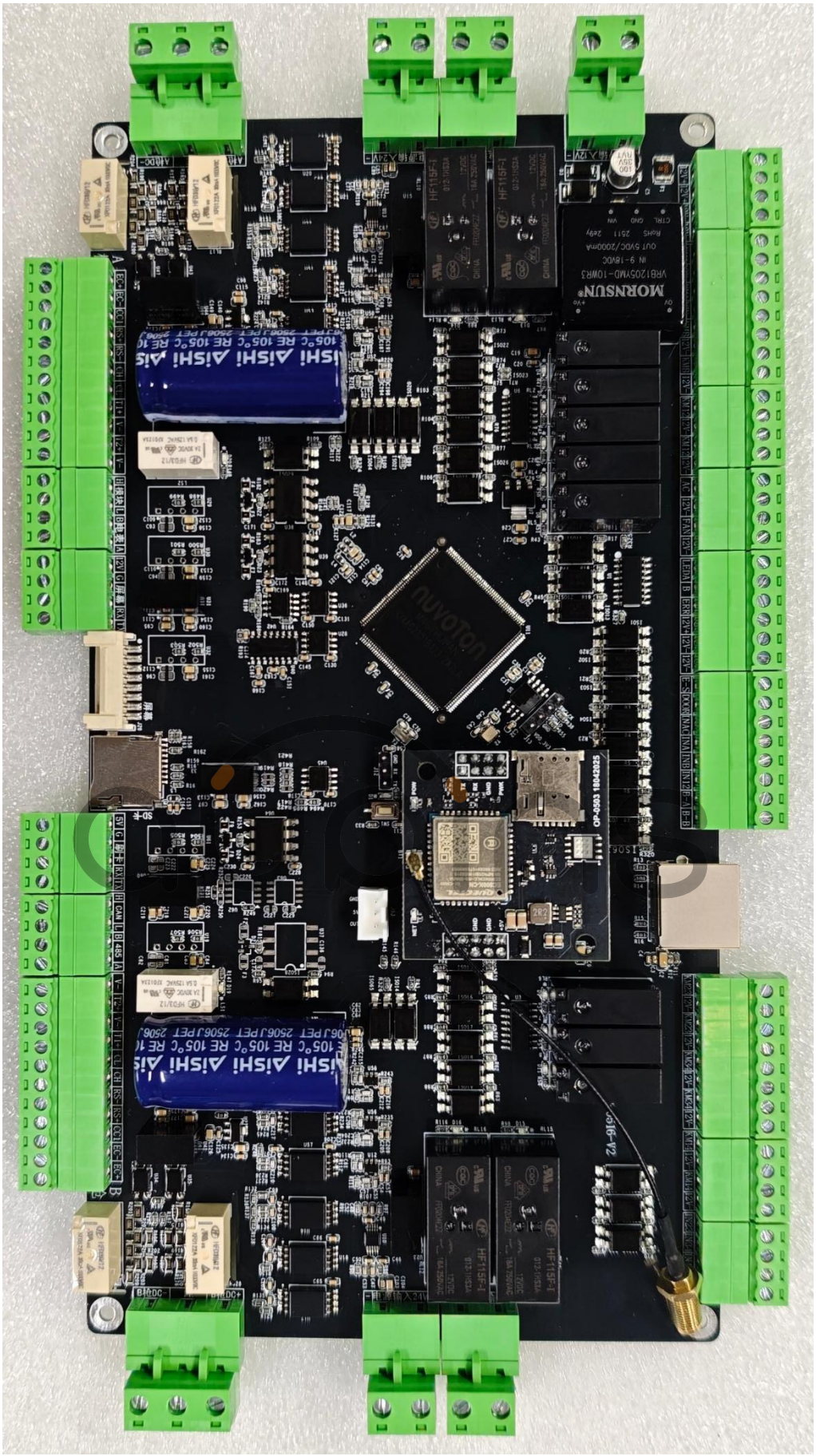



Figure 4: Actual Photo of OP-0516 (without Housing)



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## 2、 Product Function

(1) It can perform charging interactions with the BMS, control the charger's charging status, collect operational data, and automatically shut down in abnormal conditions.

(2) It can be applied to various types of DC charging stations, including single-unit single-charging, time-sharing dual-charging for a single unit, busbar-based dual-charging for a single unit, full-power distribution dual-charging for a single unit, rectifier-based modular systems, and group charging configurations.

(3) Equipped with electronic locks for charging gun control and temperature monitoring, each charging gun operates independently in terms of detection and control.

(4) Compatible with power modules from brands such as Shenghong, Yingfeiyuan, Youyou, Yonglian, Tonghe, and Xingyuan Borui;

(5) Compatible with Divin, Xinruida, and XinXian touchscreens to enable human-machine interaction functions.

(6) Supports serial card readers for card-swiping billing functionality;

(7) Integrates the functionality of two insulation detection circuits;

(8) Integrates a dual-control guidance function;

(8) Integrates a dual-channel battery voltage sampling function;

(9) Can record charging data, with a maximum of 500 entries;

(10) Equipped with backend communication capabilities, it enables wireless interaction with backend monitoring systems to transmit status updates and relevant data. Currently supported platforms include Cloud Quick Charge, Dak Cloud, Weijing Cloud, Xiaoju, and State Grid e-Charging.

(11) Integrate Ethernet functionality;

(12) Integrate and extend 4G functionality.

(13) Integrate NFC reader functionality. (Optional)

(14) The main control board supports direct connection of 12V/24V auxiliary power sources without requiring additional intermediate relays.

## 3、 Product Features

(1) High integration and compact size; integrates input/output functions, communication, analog signals, insulation detection, and control guidance into a single unit, significantly reducing the space occupied by the pile body.

(2) High electromagnetic compatibility: The EMC performance is excellent, achieving Class 4 electromagnetic compatibility.

(3) Supports multiple network backends: enables rapid deployment and monitoring of your own charging networks.

(4) High compatibility: Compatible with all vehicle models compliant with both the old and new GB/T 27930 standards; compatible with LCD screens from mainstream manufacturers; compatible with all electric meters conforming to DL/T 645 and MODBUS protocols.



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# 4、 Terminal Interface Definition

## 4.1 Working Power Supply

| Terminal Number | Order number | Pin Definitions | Brief Function Description |
|---|---|---|---|
| J1 | 1 | +12V | +12 V (Working power input) |
| | 2 | -12V | -12 V (Working power input) |
| J2 | 1 | +12V | +12 V (Power Output) |
| | 2 | +12V | +12 V (Power Output) |
| | 3 | -12V | -12 V (Power Output) |
| | 4 | -12V | -12 V (Power Output) |

## 4.2 GPRS (4G Module) & Ethernet

| Terminal Number | Order number | Pin Definitions | Brief Function Description |
|---|---|---|---|
| Built-in | / | | Wireless Communication Module Socket |
| J8 | 1 | RJ45 | Ethernet |



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### 4.3 Accessory Power Supply

| Terminal Number | Order number | Pin Definitions | Brief Function Description |
|---|---|---|---|
| J23 | 1 | A#A+ | A-gun auxiliary power supply positive terminal |
| | 2 | A#A− | Negative terminal of the auxiliary power supply for Gun A |
| | 1 | 24V+ | 24V auxiliary power supply positive input |
| | 2 | 24V− | 24V auxiliary power supply positive input |
| J12 | 1 | B#A+ | Positive terminal of the B-gun auxiliary power supply |
| | 2 | B#A− | Negative terminal of the B-gun auxiliary power supply |
| | 1 | 24V+ | 24V auxiliary power supply positive input |
| | 2 | 24V− | 24V auxiliary power supply positive input |

### 4.4 Gunshot

| Terminal Number | Order number | Pin Definitions | Brief Function Description |
|---|---|---|---|
| J21 | 1 | A#EL+ | A-gun electronic lock power supply positive terminal |
| | 2 | A#EL− | The negative terminal for power supply of the A-gun electronic lock |
| | 3 | A#CC1 | A-gun Charging Connection Confirmation |
| | 4 | A#RS+ | A-gun Electronic Lock Feedback: |
| | 5 | A#RS− | A-gun Electronic Lock Feedback: |
| | 6 | A#CAN2_H | The A gun has a BMS CAN high signal with a 120 Ω resistor. |
| | 7 | A#CAN2_L | The A gun has a BMS CAN low signal with a 120 Ω resistor. |
| | 8 | A#T1+ | A-Shoot DC Temperature |
| | 9 | A#T1− | A-Shoot DC Temperature |
| | 10 | A#T2+ | A-gun DC + Temperature |
| | 11 | A#T2− | A-gun DC + Temperature |
| J14 | 1 | B#T2− | B-gun DC+ Temperature |



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| | | | |
|---|---|---|---|
| | 2 | B#T2+ | B-gun DC+ Temperature |
| | 3 | B#T1- | B-gun DC-Temperature |
| | 4 | B#T1+ | B-gun DC-Temperature |
| | 5 | B#CAN2_L | The B-gun BMS has a low CAN signal resistance of 120 Ω. |
| | 6 | B#CAN2_H | The B-gun BMS has a high CAN signal resistance of 120 Ω. |
| | 7 | B#RS- | B-gun Electronic Lock Feedback: |
| | 8 | B#RS+ | B-gun Electronic Lock Feedback: |
| | 9 | B#CC1 | B-gun Charging Connection Confirmation |
| | 10 | B#EL- | Negative terminal for power supply of the B-gun electronic lock |
| | 11 | B#EL+ | Positive terminal for power supply of the B-gun electronic lock |

### 4.5 Enter/Exit

| Terminal Number | Order number | Pin Definitions | Brief Function Description |
|---|---|---|---|
| J6 | 1 | SCRAM_IN | Emergency Stop Feedback |
| | 2 | DOOR_IN | Access Control Feedback |
| | 3 | KM_AC_IN | AC Contactor Feedback |
| | 4 | KMA_IN | A. Feedback from DC contactors K1 and K2 |
| | 5 | KMB_IN | B-gun DC contactor K1/K2 feedback |
| | 6 | KMM_12_IN | Mother-line DC contactor 12 feedback |
| | 7 | BACK_A_IN | A: Feedback on the gun being returned... |
| | 8 | BACK_B_IN | B-gun Return Feedback: The B-gun has been returned to its original location. |
| J11 | 1 | KMM_23_IN | Mother-line DC contactor 23 feedback |
| | 2 | KMM_34_IN | Mother-line DC contactor 34 feedback |
| | 3 | KM_14_IN | Mother-line DC contactor 14 feedback (reserved) |



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| | | | |
|---|---|---|---|
| | 4 | 12V- | Common point |
| J3 | 1 | KMA | The A-series DC contactors K1 and K2 are used for control. |
| | 2 | 12V- | |
| | 3 | KMA | |
| | 4 | 12V- | |
| | 5 | KMB | B-gun DC contactor control for K1 and K2 |
| | 6 | 12V- | |
| | 7 | KMB | |
| | 8 | 12V- | |
| J4 | 1 | KM12 | Mother contactor 12 controls |
| | 2 | 12V- | |
| | 3 | KM12 | |
| | 4 | 12V- | |
| J5 | 1 | AC | AC Contactor Control |
| | 2 | 12V- | Common point |
| | 3 | FAN | Fan Control |
| | 4 | 12V- | Common point |
| J6 | 1 | LED_RUN_A | A Gun Operation Indicator Light |
| | 2 | LED_RUN_B | B-gun Operation Indicator Light |
| | 3 | LED_ERR | Trouble light |
| | 4 | 12V+ | Power supply point for the indicator light |
| | 5 | LED_POWER | Power light |
| | 6 | 12V- | Reserve |
| J9 | 1 | KM23 | Mother contactor 23 controls |
| | 2 | 12V- | |



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| | | | |
|---|---|---|---|
| | 3 | KM23 | |
| | 4 | 12V- | |
| | 5 | KM34 | Mother contactor 34 controls |
| | 6 | 12V- | |
| | 7 | KM34 | |
| | 8 | 12V- | |
| | 1 | KM14 | Mother contactor 14 controls (reserved) |
| | 2 | 12V- | |
| | 3 | KM14 | |
| | 4 | 12V- | |

### 4.6 Communication

| Terminal Number | Order number | Pin Definitions | Brief Function Description |
|---|---|---|---|
| J15 | 1 | CAN_H | CAN Communication (Reserved) |
| | 2 | CAN_L | |
| | 3 | 485_B | 485 Communication (Reserved) |
| | 4 | 485_A | |
| J16 | 1 | 5V+ | Card Reader Board Communication |
| | 2 | GND | |
| | 3 | RX | |
| | 4 | TX | |
| J18 | 1 | Screen wiring terminal | Serial Port Screen Communication |
| J19 | 4 | 12V+ | Serial Port Screen Communication |
| | 5 | GND | |
| | 6 | RX | |



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| | | | |
|---|---|---|---|
| | | TX | |
| J20 | 1 | POWER_CAN_H | Power Module CAN Communication Level High |
| | 2 | POWER_CAN_L | Low CAN communication speed for the power module |
| | 3 | AMMETER_485_B | Electric Meter 485 Communication B |
| | 4 | AMMETER_485_A | Electric Meter 485 Communication A |



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## 4.7 Insulation Detection and High-Voltage Sampling

| Terminal Number | Order number | Pin Definitions | Brief Function Description |
|---|---|---|---|
| J23 | 1 | A#BV+ | A-gun DC+ (connected between the battery terminal and K1/K2) |
| | 2 | PE | Earth wire |
| | 2 | A#BV− | A-gun DC (connected between the battery terminal and K1/K2) |
| J13 | 1 | B#BV+ | B-gun DC+ (connected between the battery terminal and K1/K2) |
| | 2 | PE | Earth wire |
| | 2 | B#BV− | B-gun DC connector (connected between the battery terminal and K1/K2) |



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# 5 Wiring Reference Diagram

## 5.1 Electrical Circuit Diagram

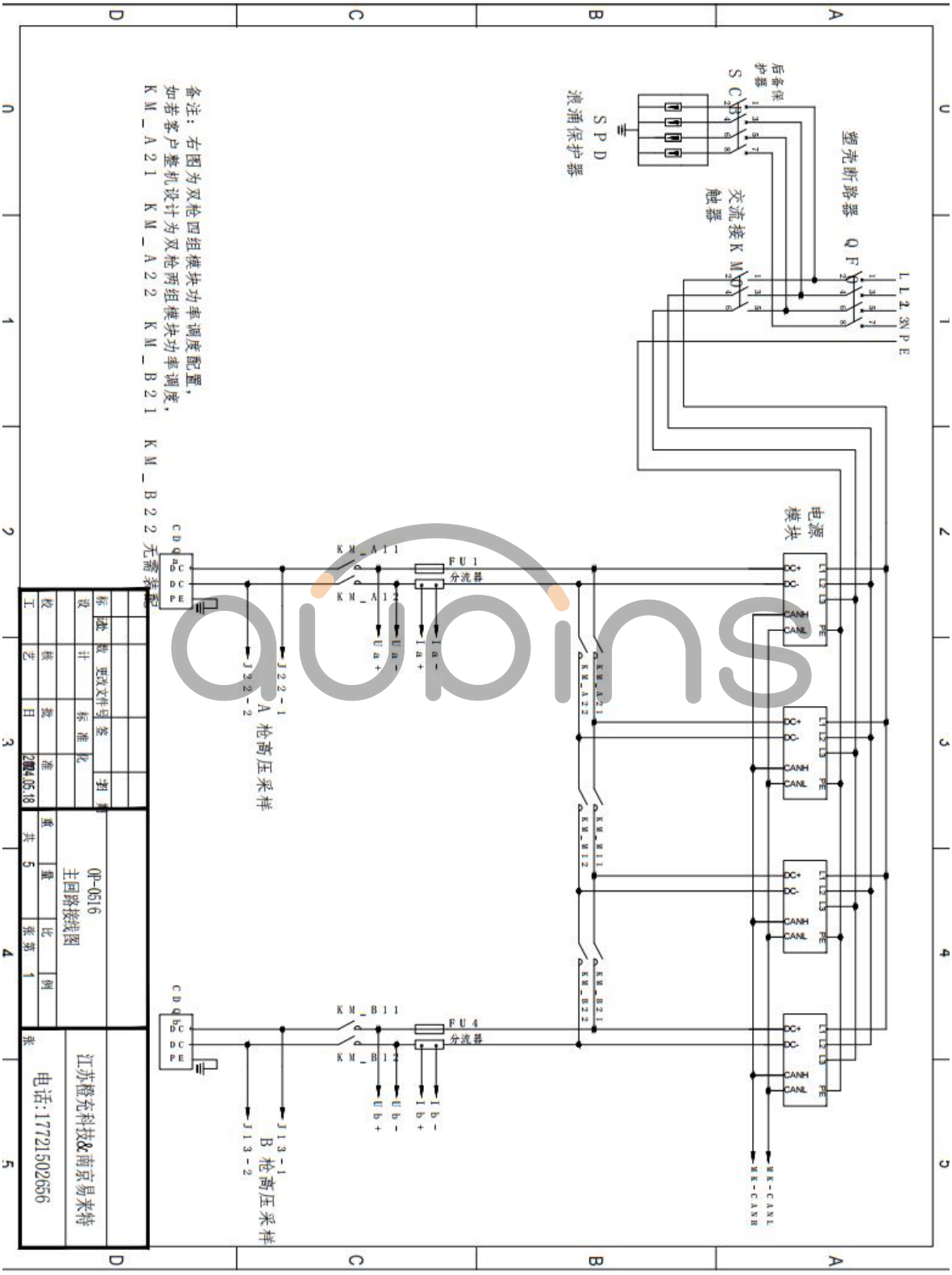



Figure 1. Electrical Circuit Diagram 1



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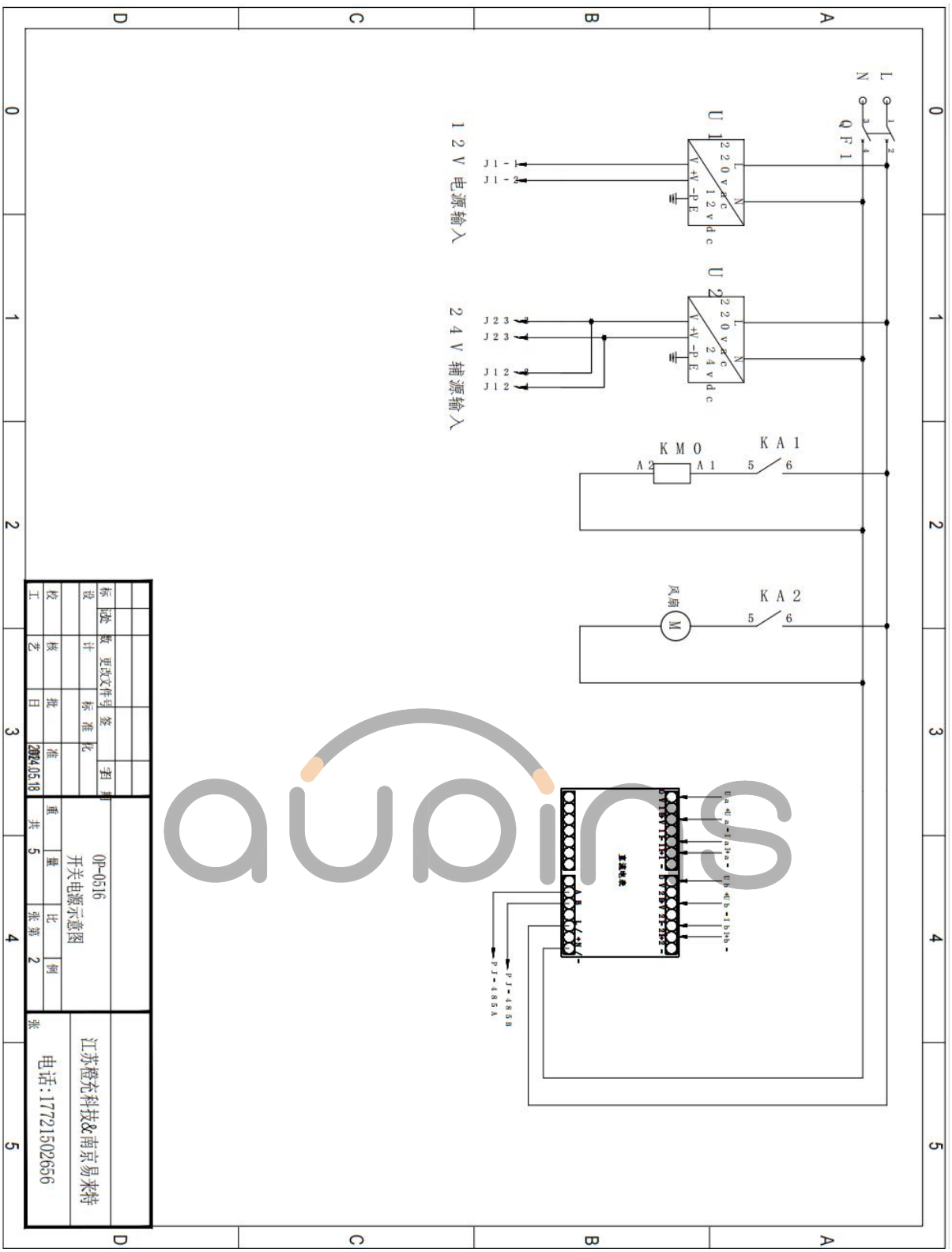



Figure 2. Electrical Circuit Diagram 2



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## 5.2 Main Control Output Diagram

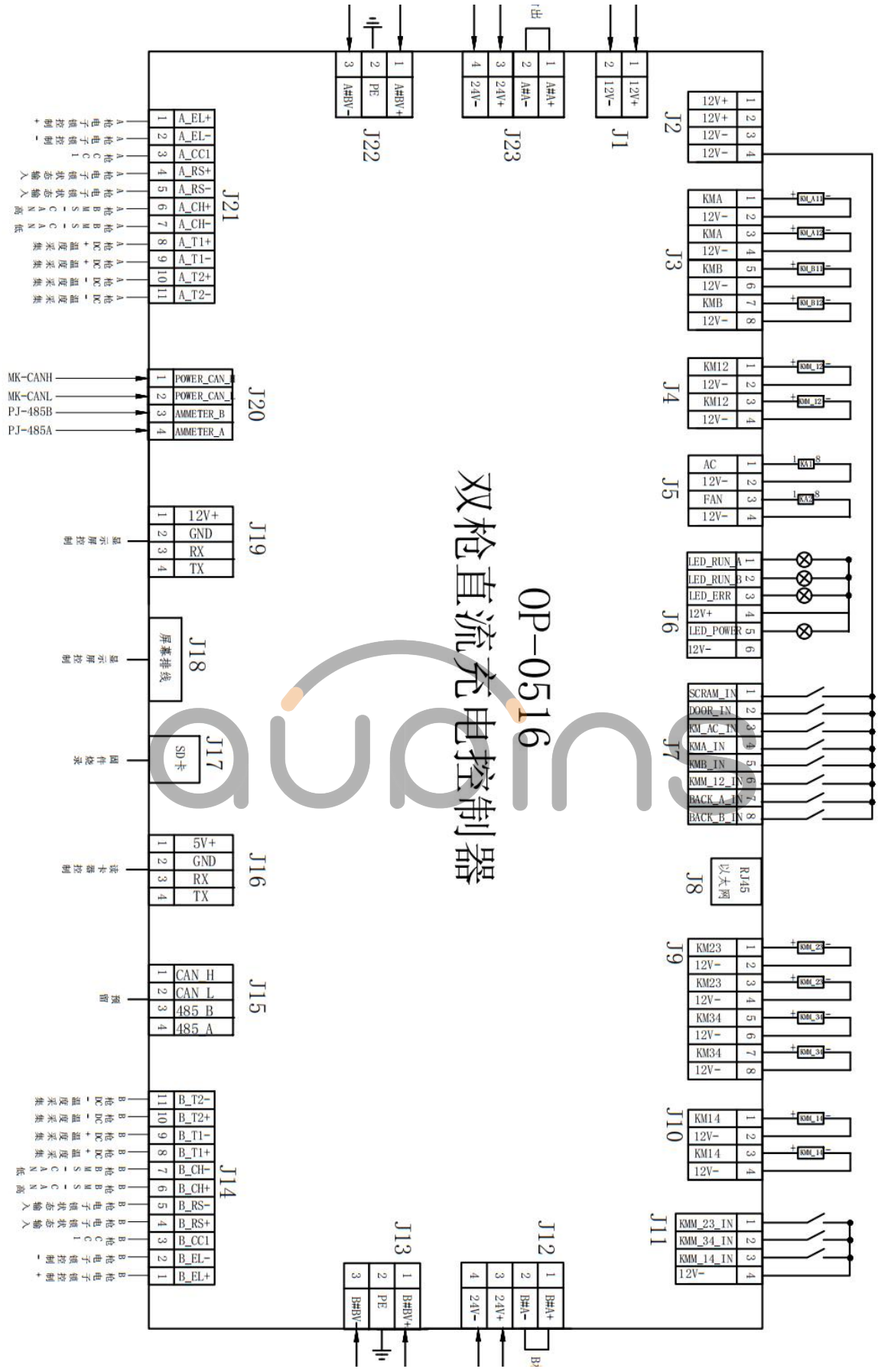



Figure 2. Main Control Output Diagram



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## 5.3 Card Reading Board – Screen – Main Control Circuit Diagram

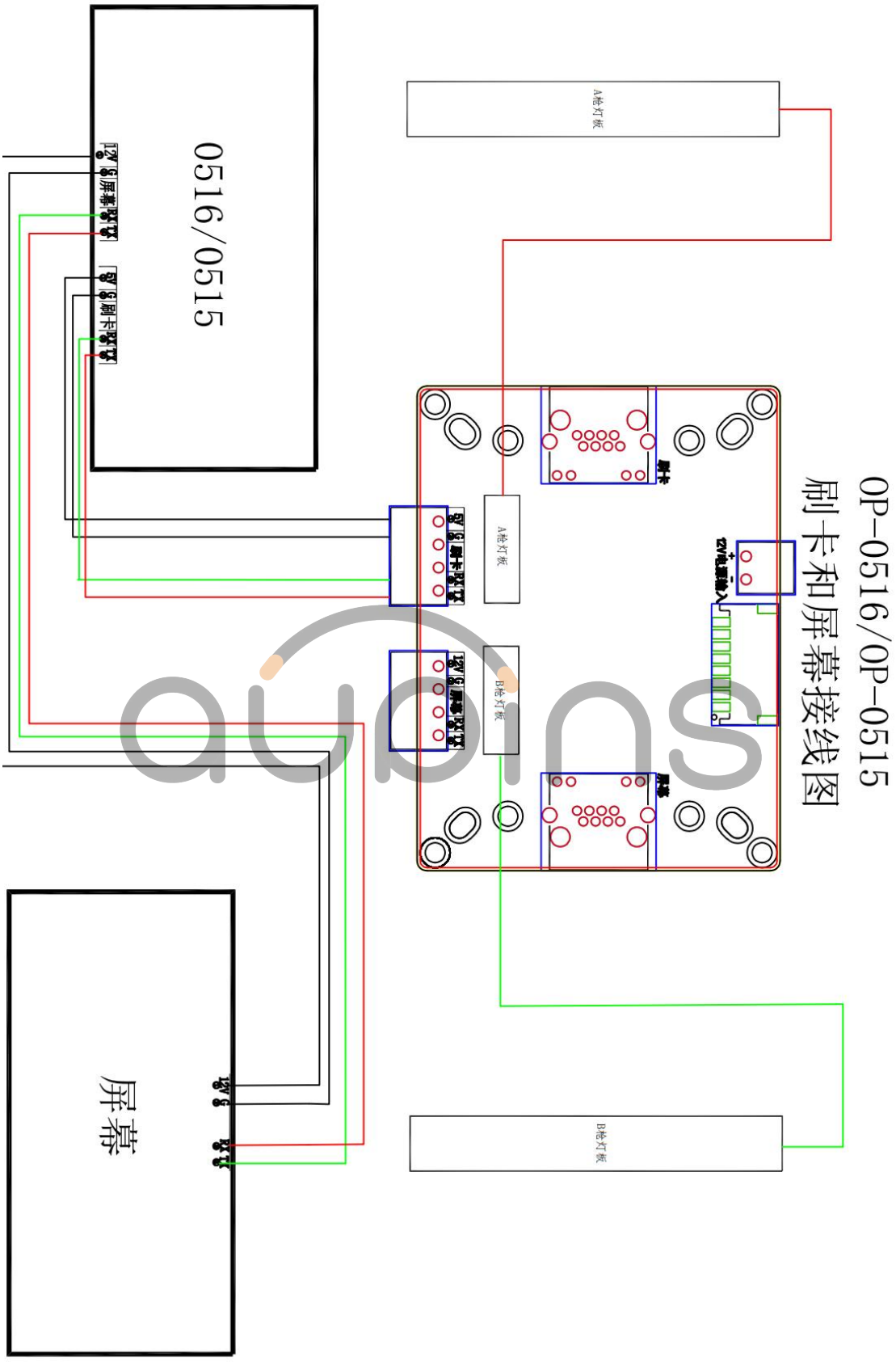
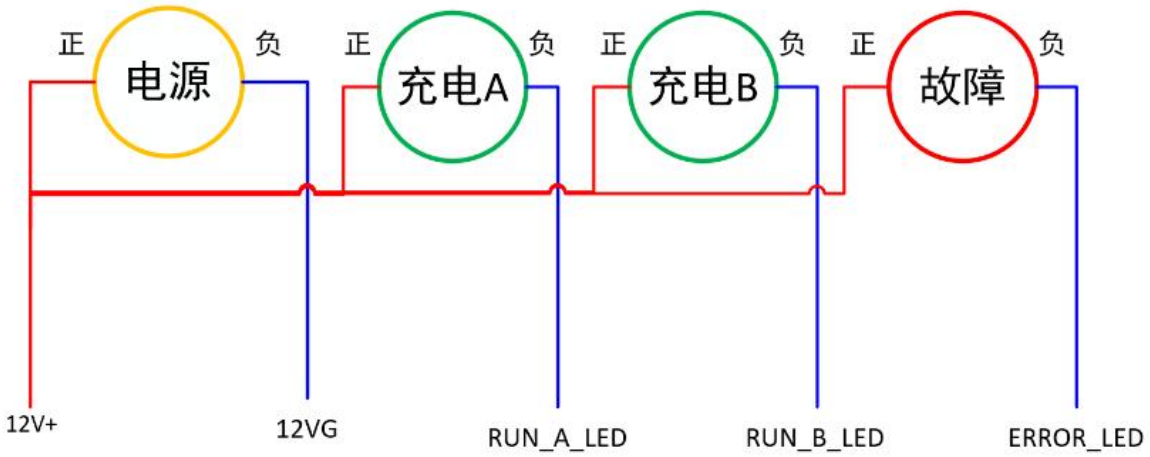



Figure 4. Card Reader Board – Screen – Main Control Circuit Diagram



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## 5.4 Indication Light Connection Method




Bulb Connection Method



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Light Strip Connection Method

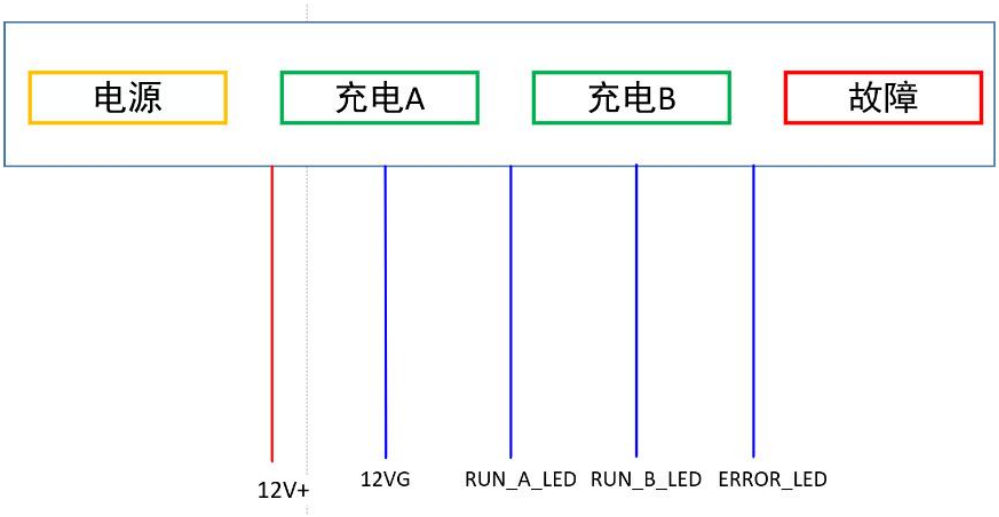



Figure 6. Connection Method Between the Main Controller and the Charging Station Indicator Light

（1）Bulb Connection Method:

Use the common-anode connection method: connect all light bulbs' positive terminals to 12V and their negative terminals to the corresponding outlets.

The indicator light on the controller is powered by a transistor with polarity; therefore, wiring must strictly follow the port specifications shown on the diagram, otherwise the light will malfunction.

Manufacturers can customize the color of LED beads as needed.

（2）Light Strip Connection Method

The light strip employs a common-anode design.

Design the light strip with a rated voltage of 12 V and a current of 50 mA. Exceeding these parameters may damage the corresponding electronic components.

The indicator light on the controller is powered by a transistor with polarity; therefore, wiring must strictly follow the port specifications shown on the diagram, otherwise the light will malfunction.

Manufacturers can customize the color of the LEDs as needed.

## 5.5 Key Points

**1. The insulation detection function requires proper grounding; the PE wire at terminal J22 or J 13 must be connected, otherwise leakage issues cannot be detected.**

**2. The vehicle body shares the same ground connection as the charging station. To determine the charging signal status, the main control board requires a ground connection (the PE wire at terminal J22 or J13 must be grounded).**



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# 6 Power Module Configuration Instructions

This main controller supports modules from brands including Infini, Youyou, Yonglian, Shenghong, Tonghe, and Xingyuan Borui, and theoretically can accommodate all modules compliant with both the Infini protocol and the State Grid protocol. The following examples illustrate its application with an Infini 20 kW module and a Youyou 30 kW State Grid module respectively.

## 6.1 Infineon Module

This main controller adopts a **fixed grouping mode**, where all codes within the same group are identical, making dialing convenient and error-free.

For example, consider a 120 kW dual-gun charging station using Infineon 75050 modules that employs a dual-module power supply configuration. In this case,**all module code selectors in Group 1**(corresponding to digit 6 on the code panel) must be set to active position (by turning from bottom to top), and **all code selectors in Group 2**(corresponding to digit 5) must also be set to active position, as shown in the figure below:

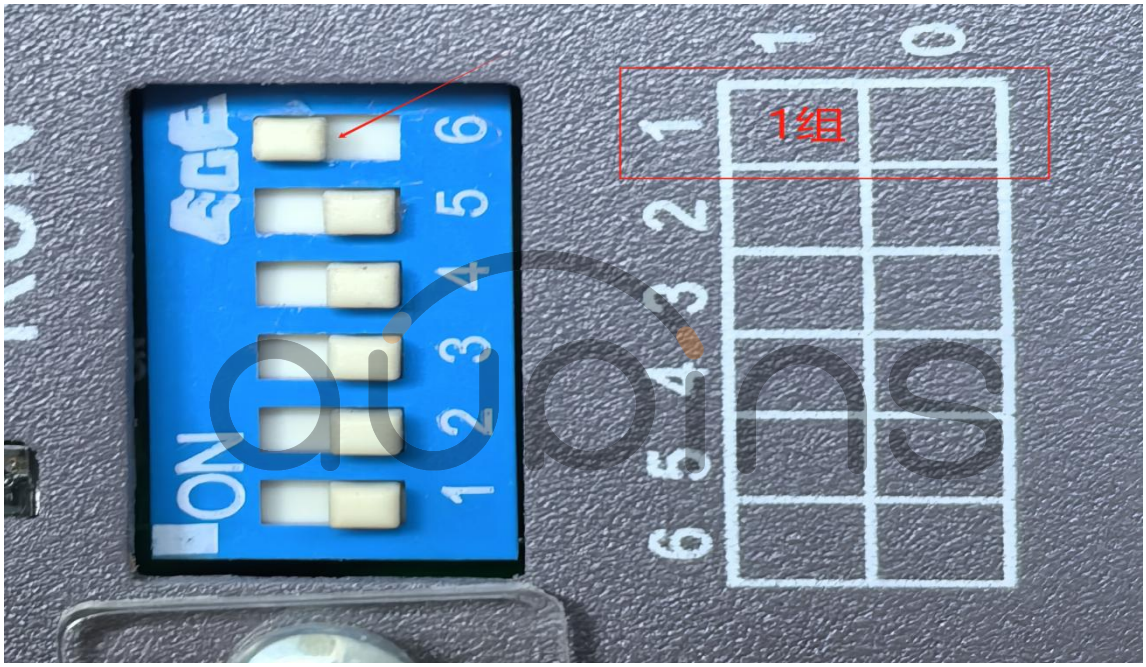



Figure 7. Code Assignment Method for Group 1



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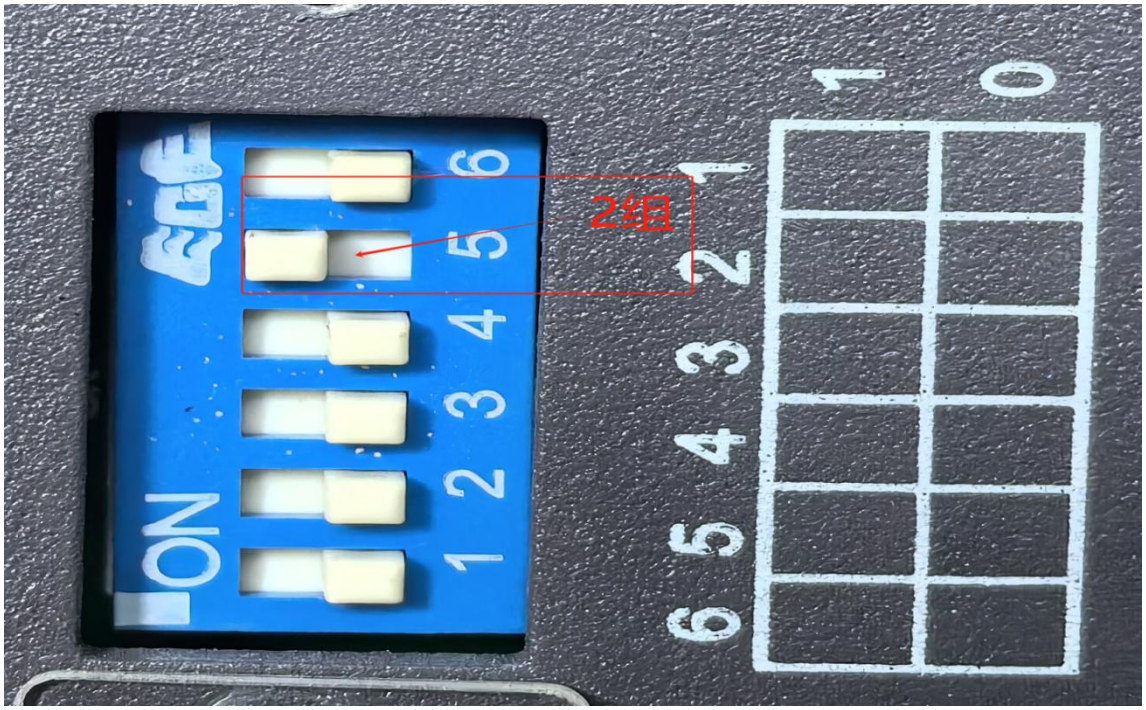



Figure 8. Code Assignment Method for Group 2

## 6.2 Youyou Grid Module

The address configuration for all State Grid modules is largely identical. Taking the Youyou 30 KW module as an example, addresses are set via an LED display: the first module in Group 1 starts decoding from 0x80, while the first module in Group 2 starts from 0x88. As shown in the figure below:




Figure 9. Address Settings for the First Module in Group 1



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Figure 10. Address Settings for the First Module in Group 2



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# 7 Electric Meter Configuration

This product complies with the DL/T 645-2007 standard and is theoretically compatible with all meters that meet this specification. Currently supported brands include Yada, Yinglida, Kedari, Ruiyin, Kaixian, and Ankerui.

**The default configuration on the meter side is as follows:**

Baud rate： 2400bps

verification mode： even parity check

Device Address: A Gun: 0x01, B Gun: 0x02

Take the Yinglida electricity meter as an example:

1 Route: 000001-> Route 2 Route: 000002------> Route 1 Route: 22400-------> Route 2 Route: 22400

1 Bus slave address--2 Bus slave address--1 Bus parity check sum baud rate--2 Bus parity check sum baud rate



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# 8 Revision Record

| Date | Modifying Person | Description |
|---|---|---|
| 2024/08/05 | Win | First Release |
| 2024/10/20 | Win | Add wiring reference diagram for the indicator light |
| 2025/02/06 | Win | Add a definition description for input/output terminals |
| 2025/04/08 | Win | Instructions for setting the code on the power module |
| 2025/09/08 | Win | Error Correction Line Diagram |
| 2025/09/12 | Win | Update Shell Size |
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# 9 Disclaimer

(1) Our company will continuously upgrade and iterate the product, with corresponding changes to the equipment specifications and parameters of subsequent versions. This document provides an introduction to the control unit of this system; the screenshots, data, and descriptions presented herein shall not serve as acceptance criteria for the physical device.

(2) Users of this product must possess certain professional skills and knowledge of charging infrastructure. Customers are required to carefully read the user manual and wiring diagrams. This product is designed to assist customers in accelerating product development. All procedures, documents, test results, solutions, support materials, and information provided during service are for reference only; customers have the right to disregard them or modify them as needed. The Company does not provide any guarantees regarding completeness or reliability. The Company shall not be liable for any special, incidental, or indirect losses arising from customer use under any circumstances.



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