CCR-I Sine Wave Constant Current Regulator

Operation Manual

Please read this manual carefully before construction, installation and operation of the product.

Please keep this manual properly for further reference.

This manual is subject to change without prior notice.

Airsafe Airport Equipment Co., Lt

Revision Description

No.	Description	Version No.	Revised by	Approved by	Date
1	First release	V1.0	W.M / L.YX	X.CL	25/01/2021
2	Update some pictures and explanations in the document	V1.1	L.YX	X.CL	13/04/2021
3	Update the ordering number of spare parts	V1.2	L.YX	X.CL	27/04/2021

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1.0 Foreword

ICAO *Airport Service Manual* Part 9 “Airport Maintenance Practices” and FAA AC150/5345-26 *Maintenance of Airport Visual Aid Facilities* are the highest criterions for on-site installation and maintenance of such lighting fixtures. This manual was compiled with considerable reference to these two criterions.

The content stated in this manual is extremely important and must be carefully read by constructors before installation and use. After properly understanding the entire content of this manual, the construction should be carried out in strict accordance with the methods specified herein, to ensure the correct and safe installation and use of the product.

Relevant personnel must strictly follow safety criterion. Any personnel without specialized training are strictly prohibited from touching the equipment. In any case live operation should be avoided. Construction or maintenance personnel should be aware of relevant first-aid knowledge in order to prevent emergencies.

1.1 Illustrations and Meanings

- The following illustrations will appear in this manual where necessary to remind construction or maintenance personnel or attention.
- Please continue reading the following instructions after properly understanding the meanings of these illustrations.

■ To remind that the behavior may cause serious injury or death.
※ Specific instructions will be given in the box

■ To remind that the behavior may cause injury to the person or damage to the product.
※ Specific instructions will be given in the box

■ To notify that the behavior is prohibited.
※ Specific instructions will be given in the box

1.2 Safety Rules and Notices

1.2.1 Safety Rules

■ Installation or maintenance should be strictly following accordance with the instructions in this manual.
※ Prevent human body from electric shock due to accidental touch

■ Non-professional electricians are strictly forbidden to maintain electrical faults of the equipment.
※ May cause electric shock or other personal accidents.

■ Insulated gloves should be worn when unplugging light fixtures for live work
※ To prevent threaten to personal safety caused by electric arc at the joint.

■ It is strictly forbidden to touch the internal parts of the equipment by hand while working.
※ Accidents such as electric shock and high voltage shock may occur

■ Electrostatic discharge before operation and maintenance.
※ Some parts of the equipment may be dangerous to the human body

■ Strictly prohibit open or short circuit at work
※ It may cause equipment alarm.

■ Strictly prohibit non-professionals from disassembling and assembling components of this system
※ May cause device system failure.

■ It is recommended that the user read the manual thoroughly before ordering.
※ May result in incorrect order or inaccurate number of system accessories.

1.2.2 Notices

1. Safety warning

a. Do not touch electrified parts to prevent electric shock from threatening to life safety.

b. Arc sparks may damage eyes, skin, etc.

c. Improper use will damage the Sine Wave Constant Current Regulator and connected equipment.

■ Do not touch the device with wet hands.
※ Possible accidents such as electric shock.

2. Prevent electric shock

Exposed conductors or output connectors inside the regulator and grounded live devices may cause electrical shock to people. Therefore, qualified operators are required to ensure that the regulator is fully grounded, to use appropriate safety clothing, and to operate safely. It is not recommended to repair or maintain the regulator in wet places. When working in wet or sweat conditions is unavoidable, an insulated rubber pad should be placed under your feet and insulated gloves should be worn.

■ Non-professional electricians are strictly forbidden to maintain electrical faults of equipment.
※ May cause electric shock or other personal accidents

■ Electrostatic discharge before operation and maintenance.
※ Some parts of the equipment may be dangerous to the human body.

3. Attention

Before operating and maintaining the equipment, make sure to read and understand the operation manual carefully, and ensure that every operator should have read the manual. The following precautions must still be strictly followed.

(1) Keep away from live lines

During operation and maintenance, the safety rules for airport electrical equipment must be observed. Do not replace the load or other components in the circuit when the light circuits is powered, nor open the device control panel door at will, nor touch the metal parts in the cabinet at will.

(2) Electrostatic discharge

a. If a soldering iron is used for repairs, its exposed part must be grounded.

b. Electronic modules and components must be stored and transported in conductive packaging.

c. Electronic modules and components are not allowed to come into contact with highly insulating materials such as plastic cloth and synthetic fiber clothing.

d. When touching electronic modules or components, the electrostatic charge must be eliminated first.

e. When replacing the module, the power must be cut off first, and then the static electricity must be released.

■ Electrostatic discharge before operation and maintenance.

※ Some parts of the equipment may be dangerous to the human body.

(3) Nameplate check

Each sine wave constant current regulator has a product nameplate. Before using the equipment, check the nameplate parameters to ensure that they are consistent with the actual parameters.

1.3 Quality assurance and responsibility

The manufacturer will be responsible for free maintenance or replacement of any defects in design, material or process during the normal use of the equipment for one year after installation but not more than 15 months from the date of delivery according to the warranty period specified in the bidding document. However, the manufacturer shall not be liable for the damages caused by incorrect maintenance methods and improper operation. The manufacturer's compensation is limited to the damaged parts and does not involve other losses of the user.

2.0 Introduction

The sine wave constant current regulator is used for the power supply, current adjustment and control of the airport's navigation aid light series circuit, and provides safe and reliable visual guidance for the aircraft to take off and land.

2.1 Working Principle

The CCR-I series of sine wave constant current regulator uses IGBT AC-AC high-frequency conversion technology to perform high-frequency conversion of power grid voltage. According to the current feedback value of the output circuit, the duty cycle of IGBT is adjusted, so as to achieve the purpose of constant current. The output sine chopper outputs the complete sine wave after filtering by the filter. The schematic diagram is shown in 2-1.

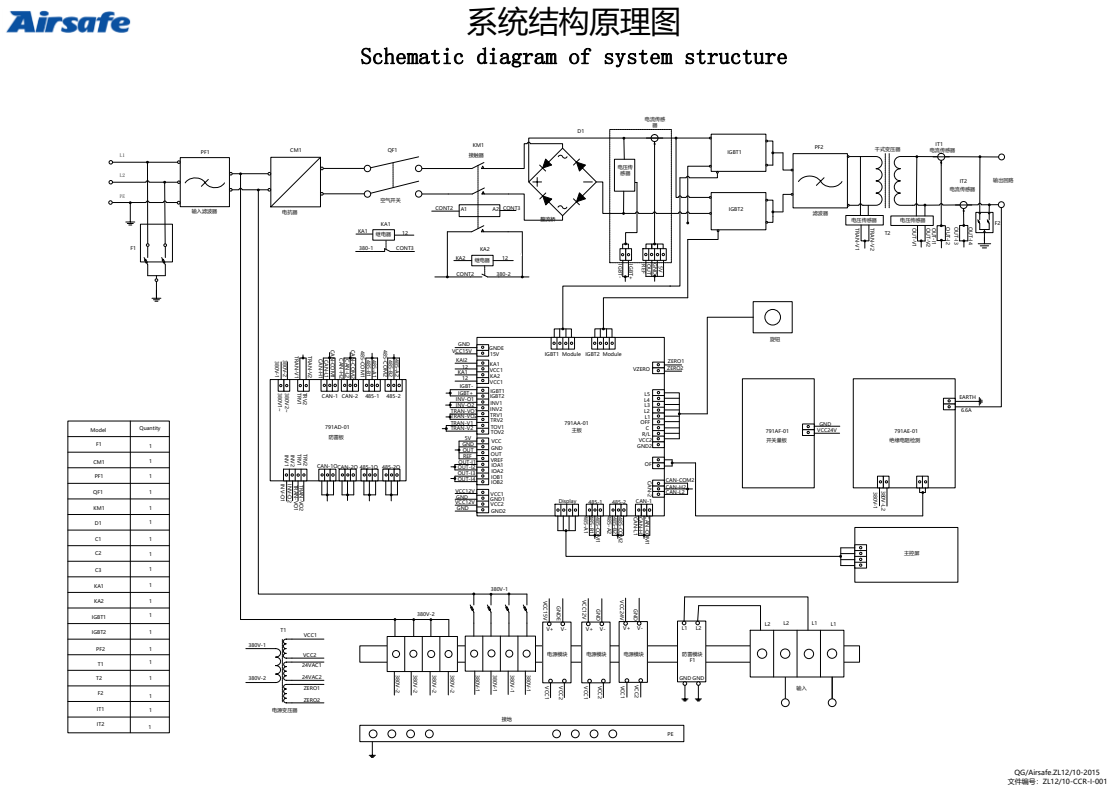
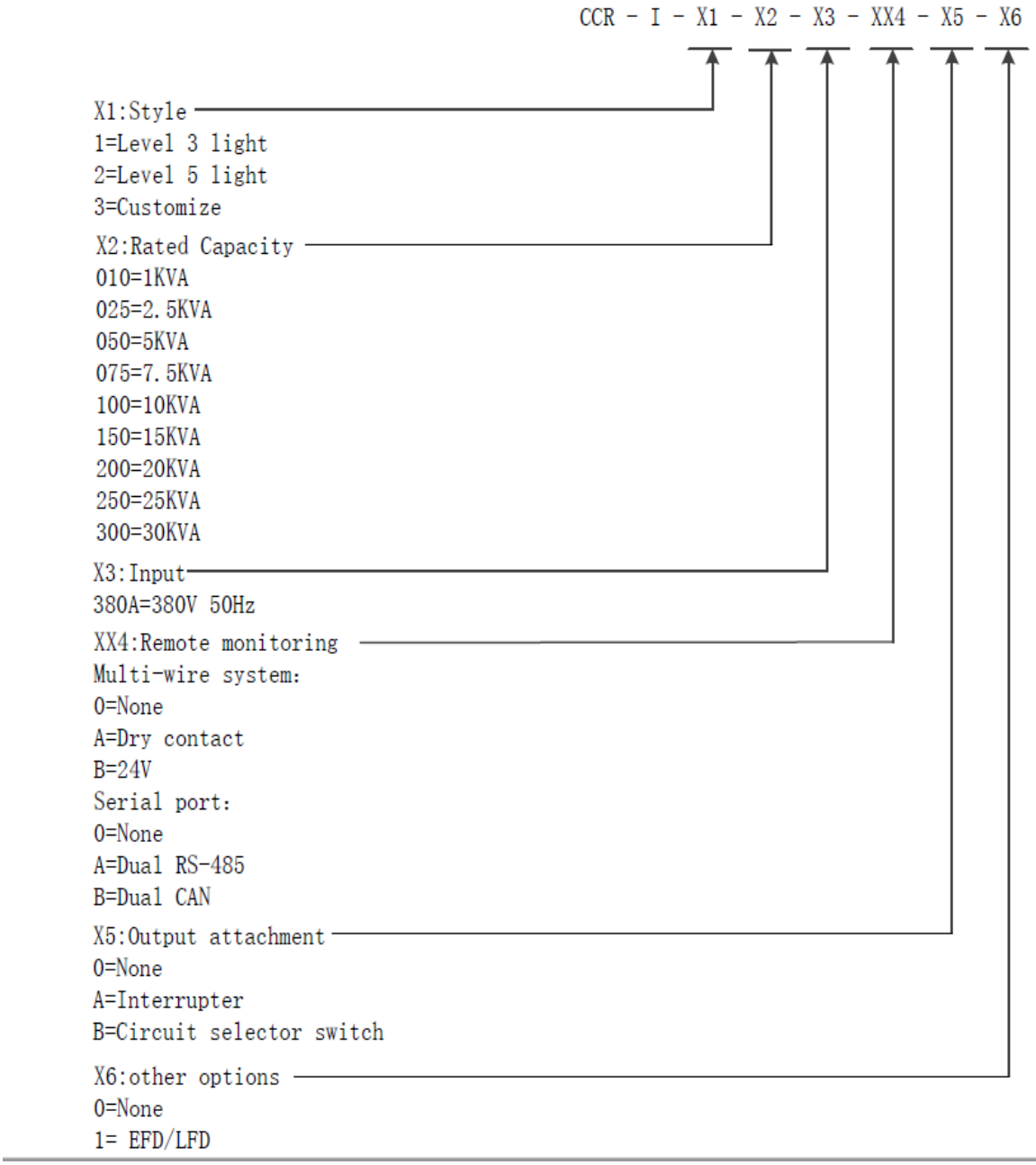


Figure 2-1 System schematic

2.2 Product model description

The sine wave constant current regulator CCR-I series has nine types of capacities: 1KVA, 2.5KVA, 5KVA, 7.5KVA, 10KVA, 15KVA, 20KVA, 25KVA, 30KVA, and the corresponding models are described as follows;



2.3 Application Environment

a: Altitude: 0 to 3000m (according to user requirements, products for 3000 to 5000m altitude can be provided).

b: Temperature: indoor temperature 0℃ to 55℃.

c: Humidity: not more than 95% (no condensation).

2.4 Application conditions

Power condition: 380VAC±10%, 50HZ±5Hz.

2.5 Features

The sinusoidal constant current regulator adopts IGBT as the core technology of high frequency AC control, and is specially used for dimming the airport navigation lighting system. This product has the following features:

1. High frequency AC-AC conversion technology with IGBT as the core is adopted to output sine wave with small current harmonic, high overall efficiency and power factor, providing safer and more reliable visual guidance for aircraft take-off and landing;
2. With soft start and soft turn off functions, it can extend the serive life of the lighting fixture.
3. The regulator achieves preset current stability within 500ms, and the adjusting speed can be reached under short circuit, resistive load and inductive load. Use a wide-angle LCD main control touch screen, allowing on-site configuration without any accessories.
4. The equipment layout adopts modular layout, with good versatility, high maintainability and high structural reliability
5. The software can quickly respond to various fault information and protect the shutdown in time for various unexpected situations
6. With standard redundant dual CAN , dual 485 communication interfaces and switch design to achieve matching control with switching cabinet and

monitoring system

7. Equipped with an insulation detection unit module, which can detect the insulation status of the light load circuit cable in real time
8. Equipped with an emergency brightness light level control knob switch to achieve operation and control in an emergency
9. Equipped with a memory card, which can record warning, alarm, and abnormal events in real time.
10. With FAA and IEC standard remote control interface, it can realize remote node control.
11. With FAA and IEC standard remote control interfaces, remote node control can be realized.

2.6 Product specifications and standards

This product complies with the following standards or technical specifications. For dated standards or technical specifications, only the dated version applies to this document. For undated standards and technical specifications, the latest version (including all amendments) is applicable to this document.

1. China Civil Aviation Industry Standard MH/T 6010-2017 Constant Current Regulator.
2. International Civil Aviation Organization Airport Design Manual Part 5.
3. International Electrotechnical Commission IEC 61822 Constant Current Regulator.
4. Technical requirements for FAA AC 150/5345-10 constant current regulator and monitor
5. China's civil aviation industry standard MH/T 5001-2013 civil airport flight area technical standards;

6. Annex 14 of the Convention on International Civil Aviation-Volume I of "Aerodromes";

2.7 Appearance

The appearance of the sine wave constant current regulator is shown in 2-2.

Figure 2-2 Sine Wave Constant Current Regulator

2.8 Dimension

According to the Figure 2-3, it is the standard appearance of the sine wave constant current regulator. If there is any discrepancy between the actual product and the schematic diagram, the actual product shall prevail. The main operation control screen is on the front of the device, which is convenient for operation and observation. The input power supply cable should be connected to the input terminal of the rail at the front of the device. The output cable should be connected to the output terminal of the device, the front and rear doors of the device must be opened when wiring.

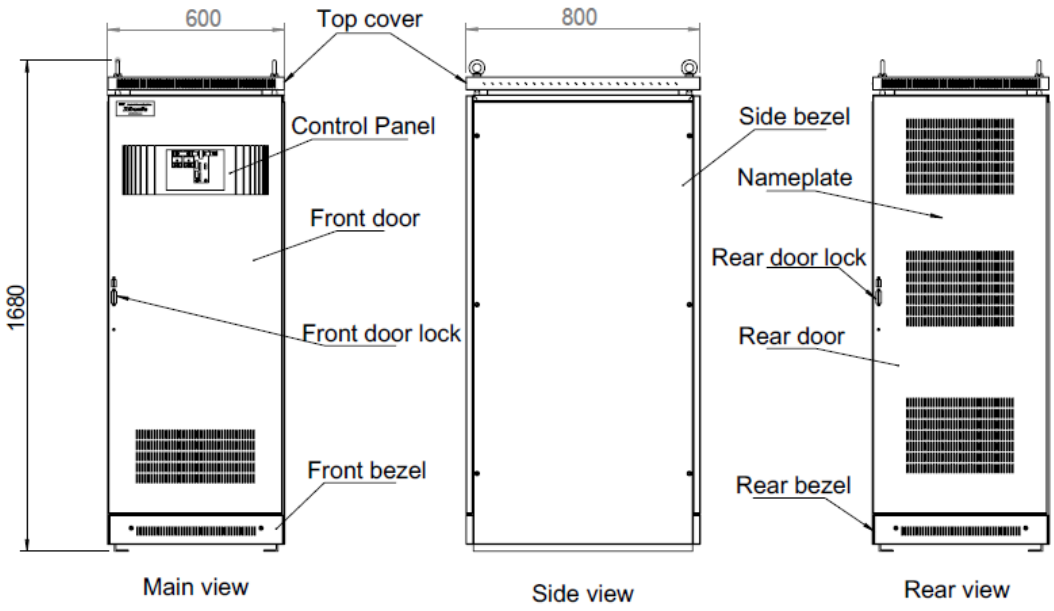


Figure 2-3 Appearance Diagram of CCR

2.9 Module location distribution

The position distribution of the sine wave constant current regulator module is shown in Figure 2-4.

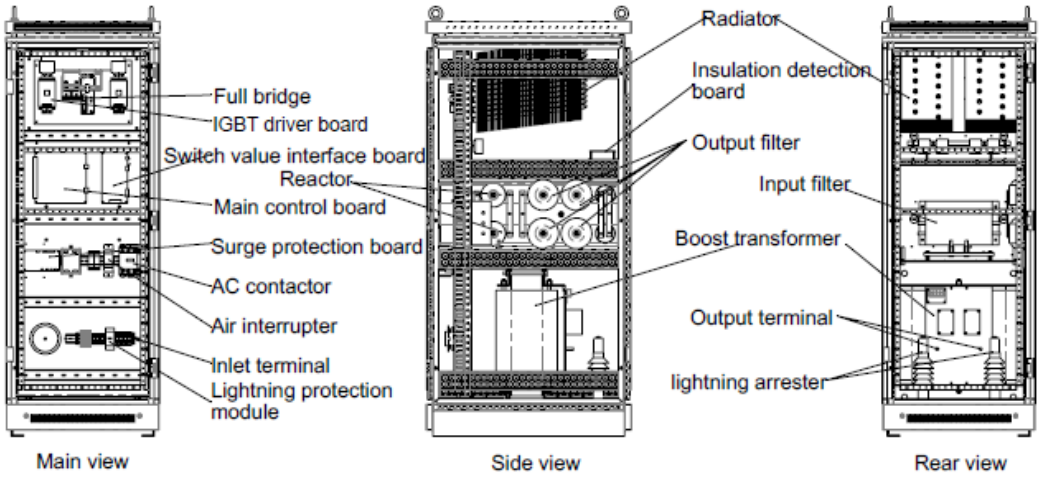


Figure 2-4 Internal module distribution diagram of CCR

3.0 CCR-I Installation

3.1 Notice before installation

Before installation, you should have a thorough understanding of the CCR-I installation requirements. Before installation, read through this manual to understand the basic steps of installing the CCR cabinets and electrical connections, including installation tools, site requirements, etc. And be familiar with the electrical characteristics of this CCR system, to avoid the improper installation of the system and affect the normal operation of the system.

■ Installation requirements of CCR must be understood before installation.

※ May cause casualties or damage to CCR.

※ Detailed understanding of the system before installation is importantAny inadvertent negligence in details may cause system failure.

3.2 Installation Tools

Choosing the right tool not only ensures the correctness and reliability of the system, but also reduces unnecessary safety accidents. The Special Tool listed in the table can be purchased from the manufacturer or distributor. Universal tools are available on local hardware market. Please pay attention to measurement range during procurement. Specific references are given in Table 3-1.

Table 3-1 Screwdriver selection and torque matching table

Serial No.	Screw Type	Tool	Torque
1	M10	Torque wrench with 17# sleeve	25 N·m
2	M8	Torque wrench with 13# sleeve	20 N·m
3	M6	Torque wrench with 10# sleeve Force measuring screwdriver with cross screwdriver (PH2)	8 N·m
4	M5	Force measuring screwdriver with cross screwdriver (PH2) 3mm internal hexagonal wrench	3 N·m
5	M4	Force measuring screwdriver with cross screwdriver (PH2)	1.5 N·m
6	M3	Force measuring screwdriver with cross screwdriver (PH1)	0.63 N·m

■ Please use a force-limiting wrench or other special tools to install the lighting fixtures.

※ Informal tools may cause damage to fasteners or personal injury

3.3 CCR Installation

Equipment installation environment:

1: The equipment should be placed in a well-ventilated place to avoid problems such as dust, humidity and high temperature.

2: The grounding should be level and firm.

3: The rear door of the equipment should be more than 0.8m away from the wall or shield to facilitate the connection and maintenance of the relevant personnel, as shown in Figure 3-1;

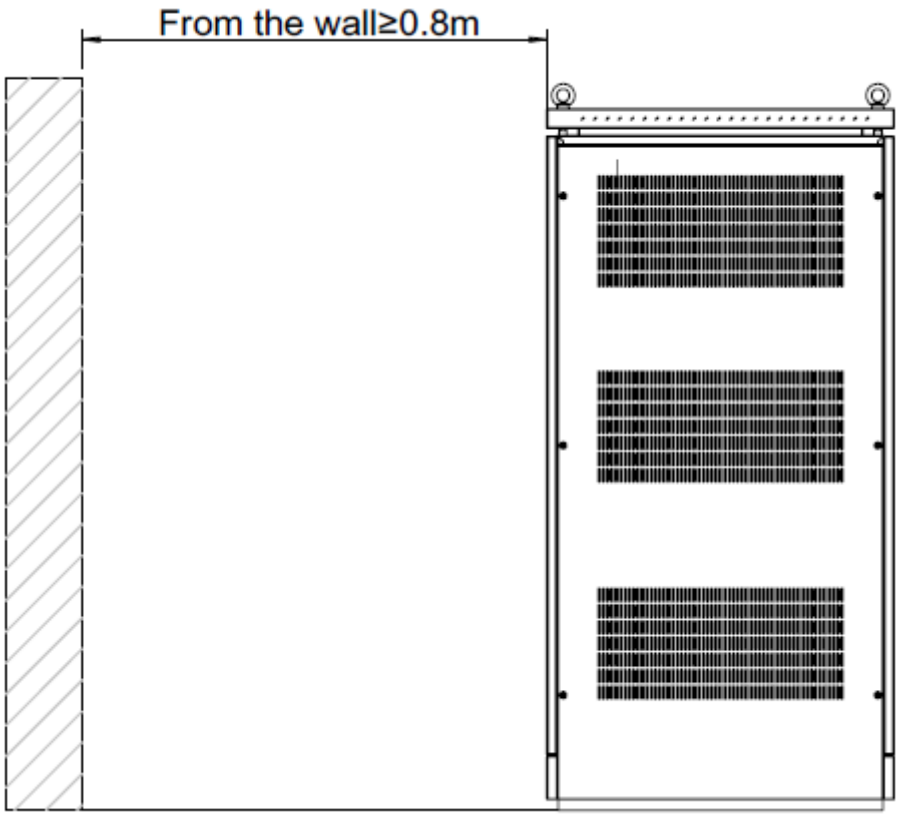


Figure 3-1 Distance between the rear door of CCR and the real object

4: It is recommended to reserve a wiring trench under the CCR, and the groove for installing the CCR is recommended to reserve a width of 500mm. The input and output cables are routed in and out from the bottom. The installation diagram is shown in Figure 3-2.

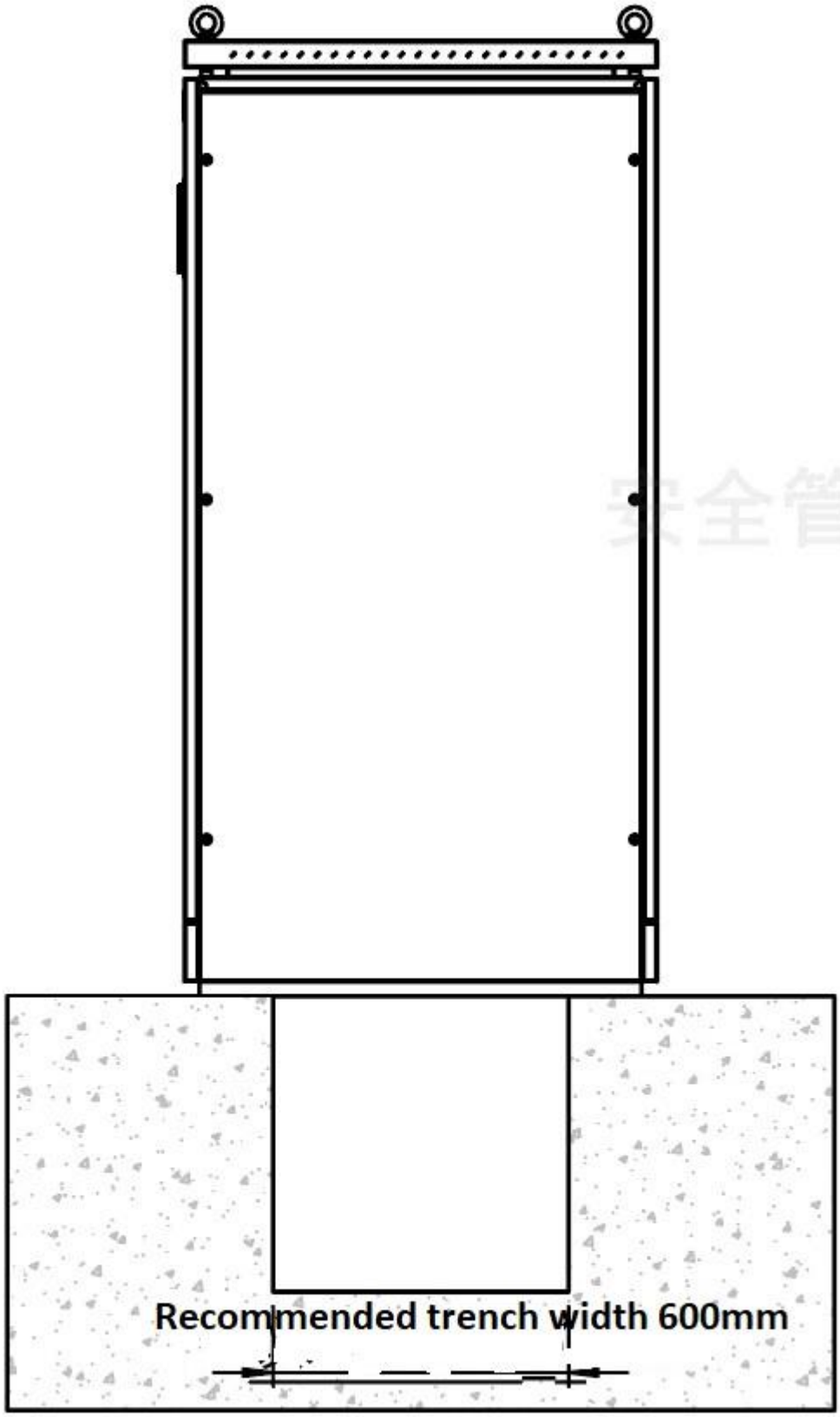


Figure 3-2 Schematic diagram of CCR installation
Suggested groove width is 600mm and depth is 1000mm.

3.4 Electrical Wiring

The input cable, input cable grounding wire, output cable, and output cable grounding wire should enter from the bottom of CCR. The input cable and input cable grounding wire should enter from the input cable inlet hole, and the output current and output current grounding wire should enter from the output cable connection hole, as shown in Figure 3-3.

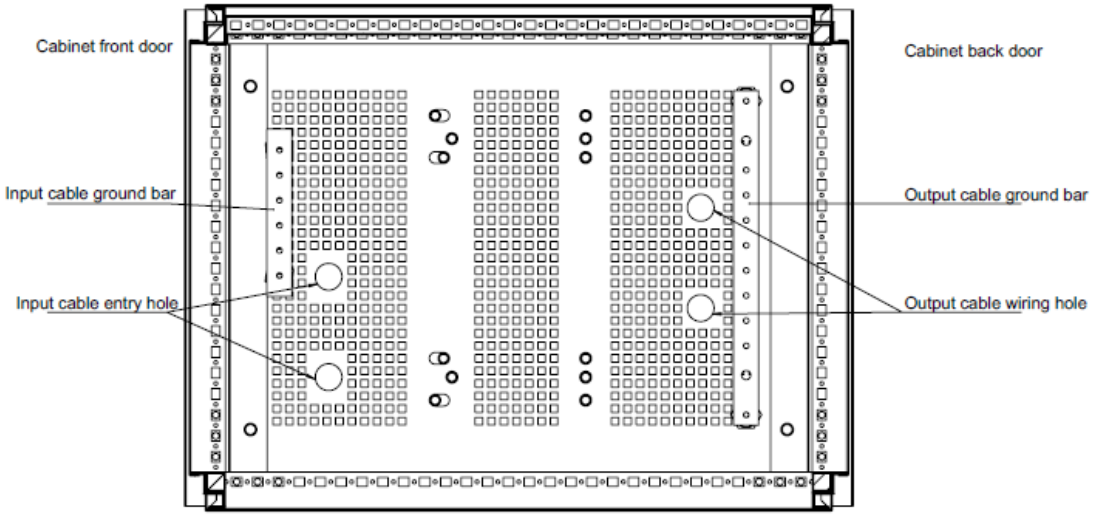


Figure 3-3 cable wiring hole of CCR

3.4.1 Input cable wiring

The selection of the power cable diameter of the CCR should be based on the total power of the CCR. The specific selection should be made with reference to Annex 1. Enter the power supply cable through the input cable inlet hole at the bottom of the CCR, and connect it to the input terminal block, corresponding to the L1 and L2 terminals, and the grounding wire to the input cable grounding rows. If the power supply cable is shielded, the shielding layer should be connected to the input cable grounding rows, as shown in Figure 3-4.

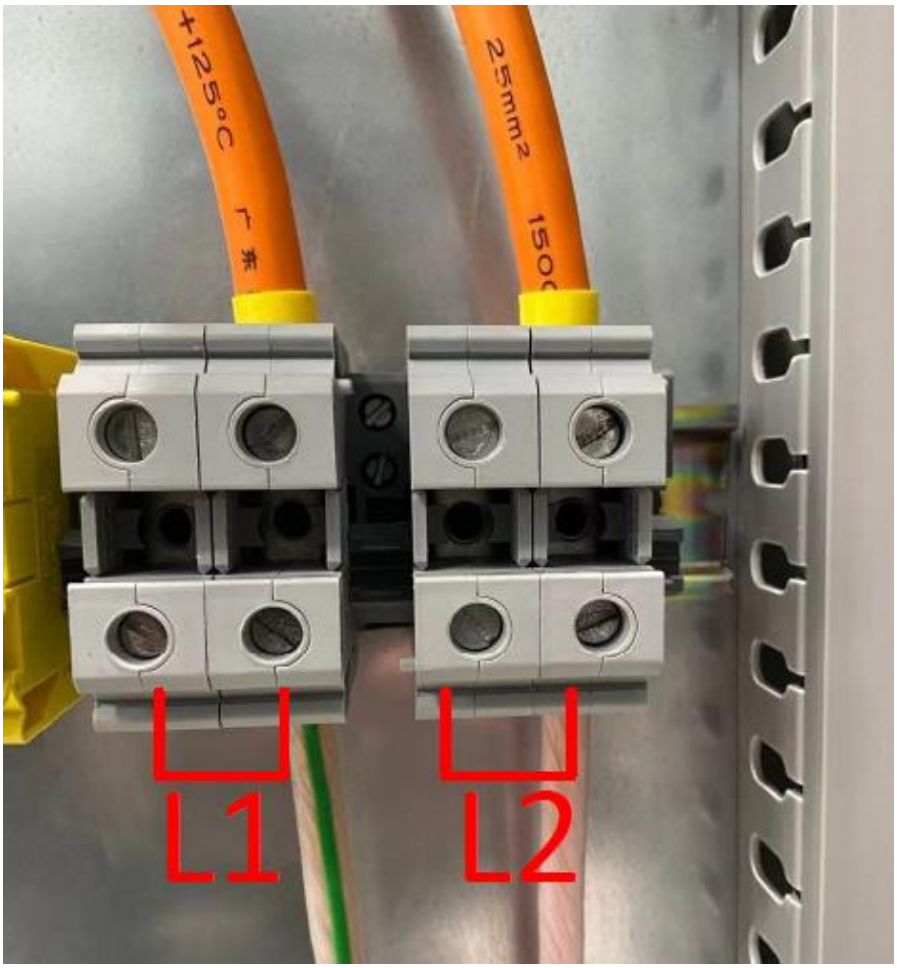


Figure 3-4 Input power supply wiring diagram

The ground wire of the input cable is connected to the ground bar of the input cable as shown in Figure 3-3.

■ Make sure that the power supply is off when wiring.
※ Prevent high pressure from harming human body

※ Install the lamp with a force-limiting wrench or other special tool Informal tools may cause fastener damage or injury.

3.4.2 Output cable wiring

The output cable enters through the output current entry hole at the bottom of the CCR, and is grounded at the output terminal of the CCR. The output loop cable should be shielded, and the shielding layer needs to be connected to the grounding row of the output cable, as shown in Figure 3-5.

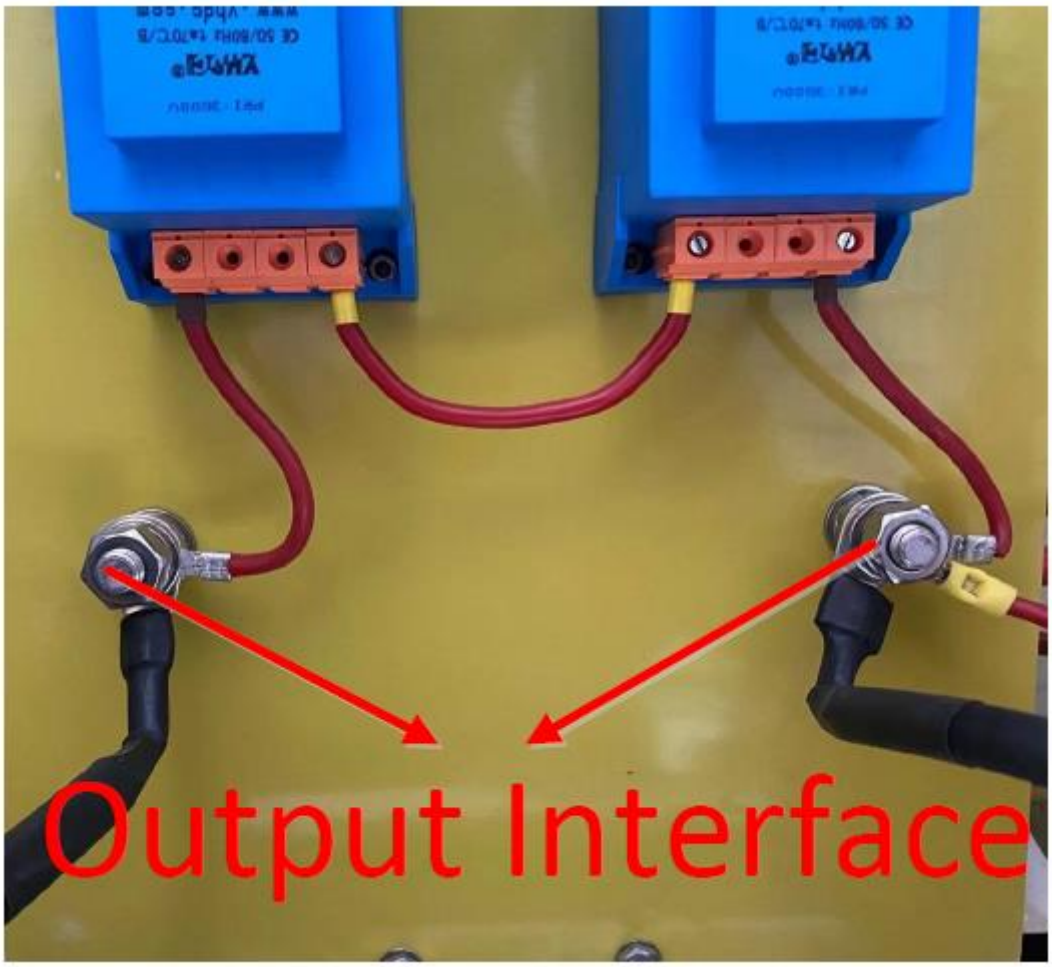


Figure 3-5 Schematic diagram of CCR output wiring

■ Make sure that the power supply is off when wiring.
※ Prevent high pressure from damaging human body.

■ Please use force limiting wrench or other special tools to install light fixtures.
※ Informal tools may cause fastener damage or personal injury.

3.4.3 CCR ground wiring

The input ground wire of the CCR is connected to the corresponding wiring block according to the instructions, and the ground wires are connected to the ground copper bar. Please refer to and comply with local electrical standards. The grounding of CCR is shown in Figure 3-6.

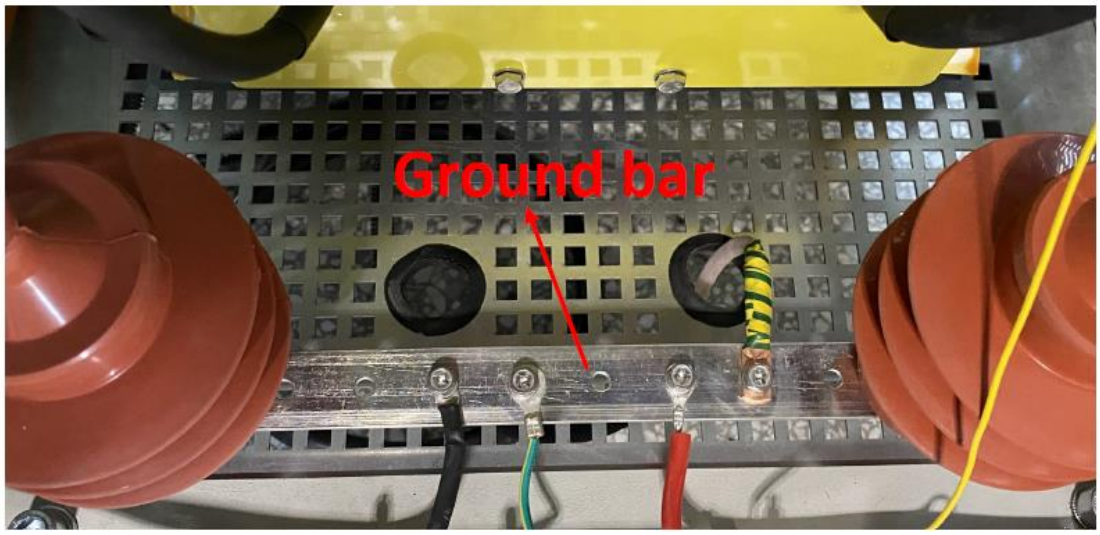


Figure 3-6 Wiring diagram of CCR ground bar

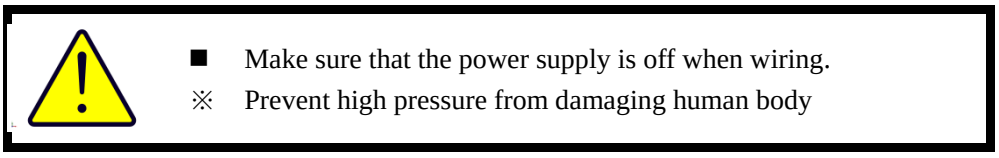
■ Make sure that the power supply is off when wiring.
※ Prevent high pressure from damaging human body.

3.5 Monitoring signal wiring

When monitoring the CCR, shielded cable should be selected, and the cable shielding layer should be connected to the grounding copper bar in the CCR.

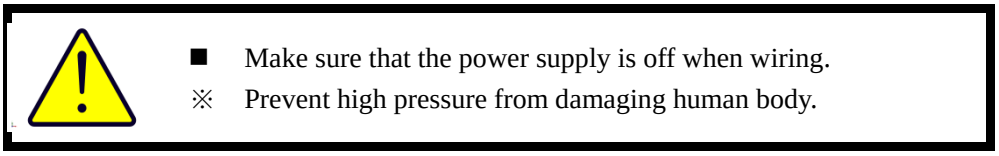
3.5.1 CAN wiring

When monitoring or communication control of the CCR is required, shielded cable should be selected, which should not exceed 2mm^2. The cable shielding layer should be connected to the internal grounding of the CCR. The specific wiring diagram is shown in Figure 4-3.



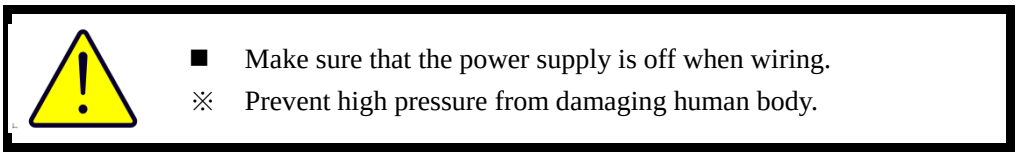
3.5.2 RS485 wiring

When monitoring or communication control of the CCR is required, shielded cable should be selected, which should not exceed 2mm^2. The cable shielding layer should be connected to the internal groundingof the CCR. The specific wiring diagram is shown in Figure 4-4.



3.5.3 Switch wiring

When monitoring or communication control of the CCR is required, the selected cable should not exceed 2mm^2. See Table 4-2 to 4-5 for the specific wiring diagrams.



4.0 Device function description

4.1 Output current brightness level description

The software in the sine wave CCR has been set according to the relevant output current standards, and the number of brightness levels can be adjusted according to customer needs. The allowable range of output current at all brightness levels is ±0.1A of the nominal value. Different brightness levels and corresponding currents are shown in Table 4-1.

Table 4-1 Output current and brightness level

Brightness level of CCR	Standard current（A rms）	Preset current range（A）
1	2.8	2.79 to 2.81
2	3.4	3.30 to 3.50
3	4.1	4.00 to 4.20
4	5.2	5.10 to 5.30
5	6.6	6.50 to 6.70

1.8A is not specified in Table 4-1, among which 1.8A is the non-illumination brightness level. The user can adjust and set the non-illumination brightness level current with step of 0.1A each time as needed.

4.2 Monitoring function description

The monitoring CPU on the main control board of the sine wave CCR is mainly used to monitor the status of each point, which mainly includes:

1. Output current

The output terminal of the CCR has a corresponding current sensor to obtain the current signal and feed it back to the main control board. Then display on the main control screen.

2. Output voltage

The output terminal of the CCR has a corresponding voltage sensor to obtain the voltage signal and feed it back to the main control board. Then display on the main control screen.

3. Secondary open circuit

When the CCR detects that the output current is lower than the set current value, the main control screen will send a secondary open-circuit alarm and disconnect the main contactor within 1 second, which is a protective shutdown. This protective shutdown action can only be manually reset and eliminated locally.

4. The output current does not match the brightness level

When the CCR detects that the output circuit current does not conform to the current standard range of the selected brightness level, the main control screen will generate a warning message.

5. Overcurrent

When the output current of the CCR exceeds the preset current value and exceeds the specified over-current time, the CCR will give an alarm and automatically shut down the CCR. When continuously detecting 5% of the output current brightness level 5 (6.6A), the CCR will alarm and shut down within 3 to 5 seconds. When continuously detecting 25% of the output current brightness level 5 (6.6A), the CCR will sound an alarm within 1 second and shut down.

6. Input voltage

When the CCR is turned on while the brightness level is off, if the input voltage is lower than the preset threshold value, an alarm will be given, and the brightness level can be turned on normally;

During the working condition of the brightness level, if the input voltage is lower than the preset threshold value, the CCR will send out an alarm, while continues to work normally;

When the CCR is turned on while the brightness level is off, if the input voltage is higher than the preset threshold value, the CCR will send out an alarm, while the brightness level can be turned on normally;

During the working condition of the brightness level, if the input voltage is higher than the preset threshold value, the CCR will send out an alarm, while continues to work normally;

7. Load information

The CCR can calculate the active power, power factor and current crest factor of the brightness level through the load capacity and output current of the series circuit.

4.3 Remote control function

The CCR has three types of remote control interface options;

First: Multi-line control

Second: Dual CAN bus

Third: Dual RS485 bus

Users can use the above three interfaces to realize remote monitoring and control of the CCR at control stations such as towers and lighting stations, and realize the acquisition of corresponding information status and brightness level control of the CCR.

4.3.1 Multi-wire control switch interface

The multi-wire switch interface for monitoring and remote control signal of the CCR is shown in J1, J2, J3, and J6 from figure 4-1.

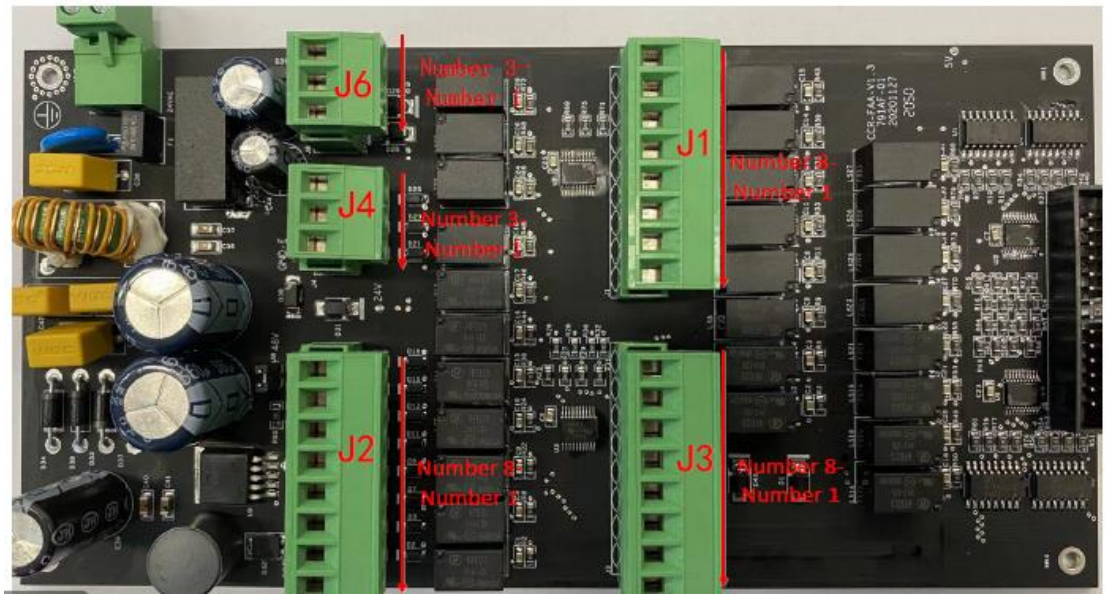


Figure 4-1 Schematic diagram of multi-wire switch interface

Table 4-2 Schematic diagram of interface between the CCR and monitoring unit (CAAC)

Terminal number	Mark	Host machine	Spare machine
J2-1 Pin	J2-1	On/off	
J2-2 Pin	J2-2	Turn on to brightness level 5	
J2-3 Pin	J2-3	Turn on to brightness level 4	
J2-4 Pin	J2-4	Turn on to brightness level 3	
J2-5 Pin	J2-5	Turn on to brightness level 2	
J2-6 Pin	J2-6	Turn on to brightness level 1	
J3-1 Pin	J3-1	On/off state detection	
J3-8 Pin	J3-8	Output current does not match the brightness level	
J1-4 Pin	J1-4	Output power drop more than 10%	
J1-5Pin	J1-5	Defective lighting fixtures rate exceeds preset limit	

J1-7Pin	J1-7	Insulation value exceeds the preset limit	

Note: the CCR is defined as the host machine, and the external device is defined as spare machine.

Table 4-3 Schematic diagram of interface between the CCR and monitoring unit (FAA)

Terminal number	Mark	Host machine	Spare machine
J6-1 Pin	J6-1	Internal power supply	
J6-2 Pin	J6-2	External power supply	
J6-3 Pin	J6-3	Public terminal	
J2-1 Pin	J201	On/off	
J2-2 Pin	J2-2	Turn on to brightness level 5	
J2-3 Pin	J2-3	Turn on to brightness level 4	
J2-4 Pin	J2-4	Turn on to brightness level 3	
J2-5 Pin	J2-5	Turn on to brightness level 2	
J2-6 Pin	J2-6	Turn on to brightness level 1	

Note: the CCR is defined as the host machine, and the external device is defined as spare machine.

Table 4-4 Schematic diagram of interface between the CCR and monitoring unit (IEC)

Terminal number	Silkscreen logo	Host machine	Spare machine
J2-1 Pin	J2-1	On/off	

J2-2 Pin	J2-2	Turn on to brightness level 5	
J2-3 Pin	J2-3	Turn on to brightness level 4	
J2-4 Pin	J2-4	Turn on to brightness level 3	
J2-5 Pin	J2-5	Turn on to brightness level 2	
J2-6 Pin	J2-6	Turn on to brightness level 1	
J2-7 Pin	J2-7	Low current	
J2-8 Pin	J2-8	Circuit selector switch	
J3-1 Pin	J3-1	On/off state detection	
J3-2 Pin	J3-2	Local/Remote	
J3-3 Pin	J3-3	Brightness level 5	
J3-4 Pin	J3-4	Brightness level 4	
J3-5 Pin	J3-5	Brightness level 3	
J3-6 Pin	J3-6	Brightness level 2	
J3-7 Pin	J3-7	Brightness level 1	
J3-8 Pin	J3-8	Output current does not match the brightness level	
J1-1 Pin	J1-1	Secondary open circuit	
J1-2 Pin	J1-2	Output current overcurrent	
J1-3 Pin	J1-3	Turn on to low current	
J1-4 Pin	J1-4	Circuit selector failure	
J1-5 Pin	J1-5	Defective lighting fixtures warning	
J1-6 Pin	J1-6	Defective lighting fixtures warning	
J1-7 Pin	J1-7	Insulation warning	
J1-8 Pin	J1-8	Insulation alarm	
J6-1 Pin	J6-1	Internal power supply	
J6-2 Pin	J6-2	External power supply	

J6-3 Pin	J6-3	Public terminal	

Note: the CCR is defined as the host machine, and the external device is defined as spare machine.

Table 4-5 Schematic diagram of interface between the CCR and switch cabinet

Terminal number	Silkscreen logo	Host machine	Spare machine
J6-1Pin	J6-1	Internal power supply	
J6-3Pin	J6-3	Public terminal	
J1-1Pin	J1-1	Switch to local brightness level 2	
J1-2Pin	J1-2	Switch to local brightness level 3	
J1-3Pin	J1-3	Switch to local brightness level 4	
J1-4Pin	J1-4	Switch to local brightness level 5	
J1-5Pin	J1-5	Switch to cabinet No. 1 status signal terminal	
J1-6Pin	J1-6	Switch to cabinet No. 2 status signal terminal	
J1-7Pin	J1-7	Switch to cabinet No. 3 status signal terminal	
J1-8Pin	J1-8	Switch to cabinet No. 4 status signal terminal	
J2-1Pin	J2-1	Switch to cabinet No. 1：Remote control boot status detection terminal	
J2-2Pin	J2-2	Switch to cabinet No. 2：Remote control boot status detection terminal	
J2-3Pin	J2-3	Switch to cabinet No. 3：Remote control boot status detection	

		terminal	
J2-4Pin	J2-4	Switch to cabinet No. 4：Remote control boot status detection terminal	
J3-1Pin	J3-1	Switch the state to on/off	
J3-2Pin	J3-2	Switch to local/remote control detection terminal	
J3-3Pin	J3-3	Switch cabinet brightness level 5	
J3-4Pin	J3-4	Switch cabinet brightness level 4	
J3-5Pin	J3-5	Switch cabinet brightness level 3	
J3-6Pin	J3-6	Switch cabinet brightness level 2	
J3-7Pin	J3-7	Switch cabinet brightness level 1	
J3-8Pin	J3-8	Switch to local brightness level 1	

4.3.2 CAN bus remote control interface

The CCR provides a dual-channel CAN serial communication interface, which can be used in single-channel or dual-channel conditions according to actual needs, and can realize complete remote control function. The interface board is shown in Figure 4-2.

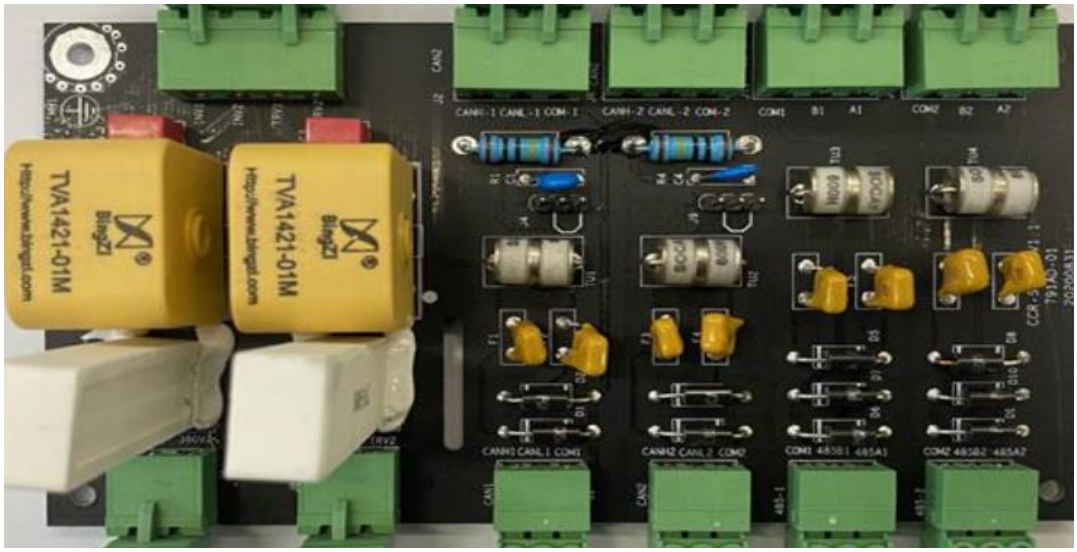


Figure 4-2 Serial interface board

The detailed wiring of CAN communication is shown in Figure 4-3. CAN communication uses a three-core shielded cable, and the specific cable thickness is recommended in Appendix 1. Among them, in CAN1, the blue cable is used for CANH-1, the brown cable is used for CANL-1, and the black cable is used for CANCOM-1; while in CAN2, the blue cable is used for CANH-2, the brown cable is used for CANL-2, and the black cable is used for CANCOM- 2.

■ Make sure that the power supply is off when wiring.
※ Prevent high pressure from damaging human body.

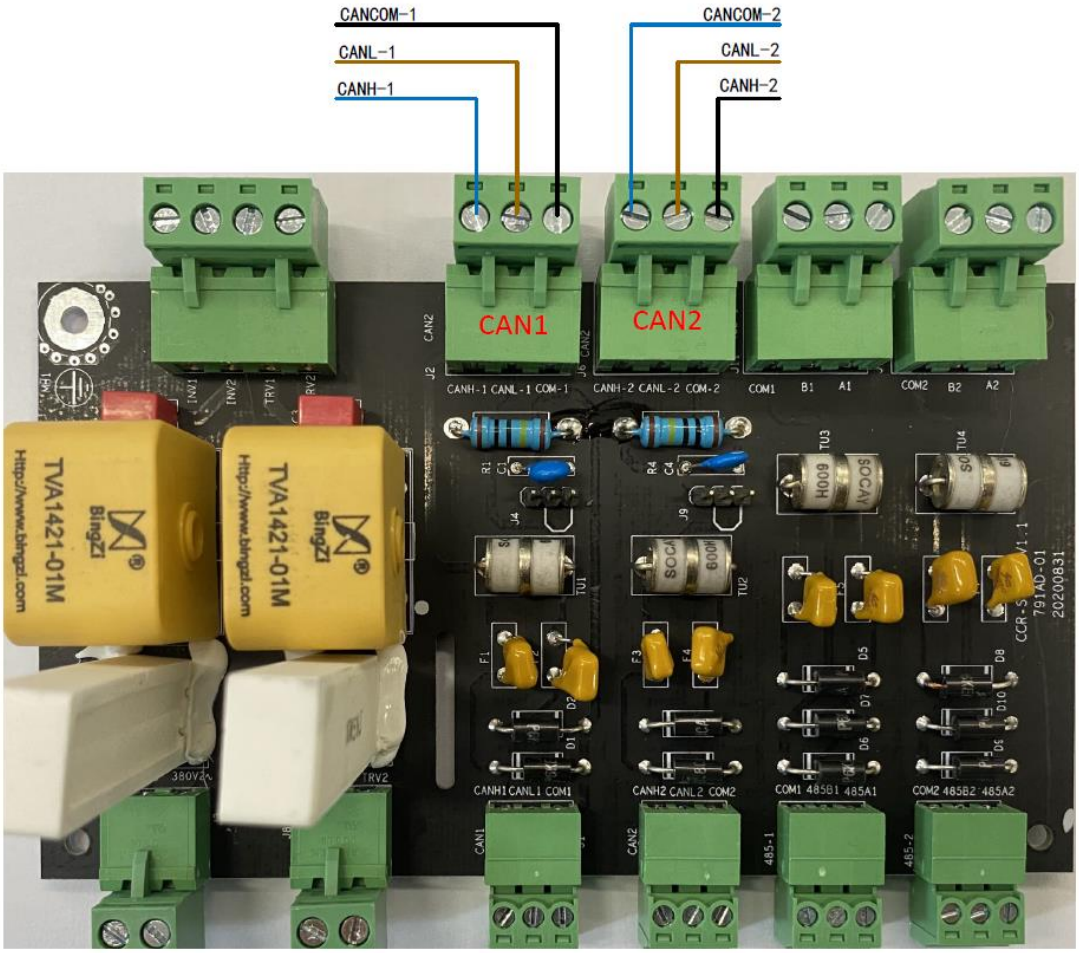


Figure 4-3 CAN communication interface wiring diagram

4.3.3 RS485 bus remote control interface

The CCR provides dual RS485 bus communication interfaces, which can be used in single or dual channels according to actual needs, and can achieve complete remote control functions. The interface board is shown in Figure 4-2.

The detailed wiring is shown in Figure 4-4. RS485 communication adopts a three-core shielded cable, and the specific cable thickness is recommended in the detailed introduction in Appendix 1. Among them, in RS485-1, the blue cable is used for RS485-A1, the brown cable is used for RS485-B1, and the black cable is used for RS485-COM1, in RS485-2, the blue cable is used for RS485-A2, the brown cable is used for RS485-B2, and the black cable is used for RS485-COM2.

■ Make sure that the power supply is off when wiring.

※ Prevent high pressure from damaging human body.

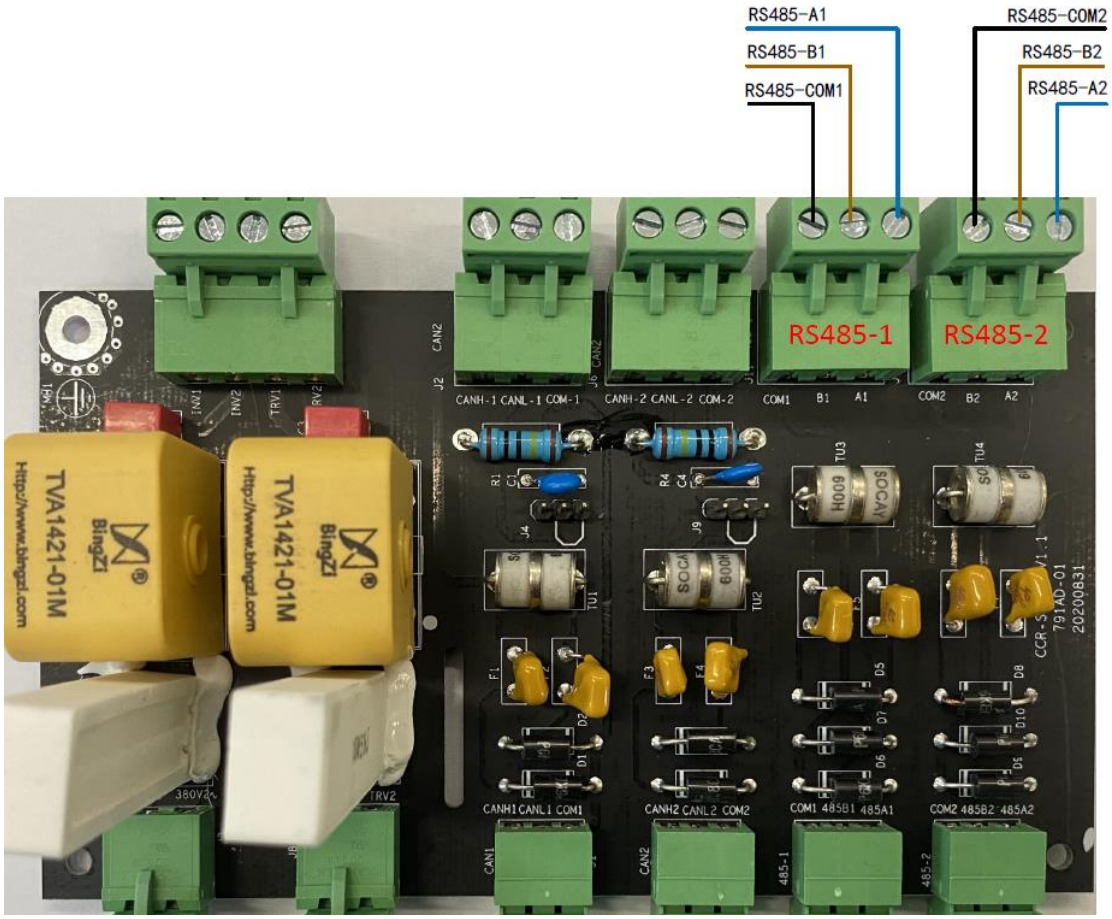


Figure 4-4 RS485 bus interface wiring diagram

4.4 Lighting fixture detection function

4.4.1 Restrictions

a. The power of each load in the output series circuit is the same.

b. The power of the isolation transformer in the output series circuit is the same.

c. The rated power of the lamps in the output series circuit is the same.

4.4.2 Tolerance scope

The Tolerance scope of defective light detection is as follows:

a. When the number of defective lighting fixtures is within 10% of the total number, the tolerance scope is less than 1%.

b. When the number of defective lighting fixtures is within 10% -20% of the total number, the tolerance scope is less than 2%.

4.4.3 Warnings and Alarms

The warning and alarm threshold limits for defective light detection can be adjusted and set on the main control screen of the CCR. If in actual operation, it is detected that the number of defective lights in the load circuit exceeds the warning or alarm limit, the main control screen of the CCR will give corresponding information prompts.

4.5 Insulation resistance detection function

The CCR is equipped with an insulation resistance detection module as an optional accessory. It is to load a certain DC voltage between the output loop cable core and the earth, and calculate the corresponding insulation resistance value by detecting the leakage current between the cable core and the earth in real time. The

preset detection range of the insulation resistance value of the CCR is 10KΩ to 5GΩ. When the insulation resistance value is lower than the preset warning and alarm value, the corresponding alarm and warning information will be generated on the main control screen of the CCR.

■ It is strictly forbidden to touch the insulation monitoring board under working conditions.

※ Touching high voltage will cause electric shock and threaten personal safety

5.0 Operation method of Constant current regulator

The operation of the CCR is divided into the operation of the main control screen and the emergency operation of the knob. When the main control screen fails to operate, the knob can be used for emergency operation, and the maintenance personnel shall be contacted to solve the fault.

The main control screen interface is divided into main interface, warning, alarm and several parameter interfaces. Each interface has buttons for brightness level adjustment, remote control local switching, and display of output current and output voltage.

The screen selected for the CCR is a resistive touch screen, which requires a certain amount of pressure to trigger the buttons, so the operator is recommended to use fingernails

5.1 Main interface

The main interface of the main control screen is shown in Figure 5-1.

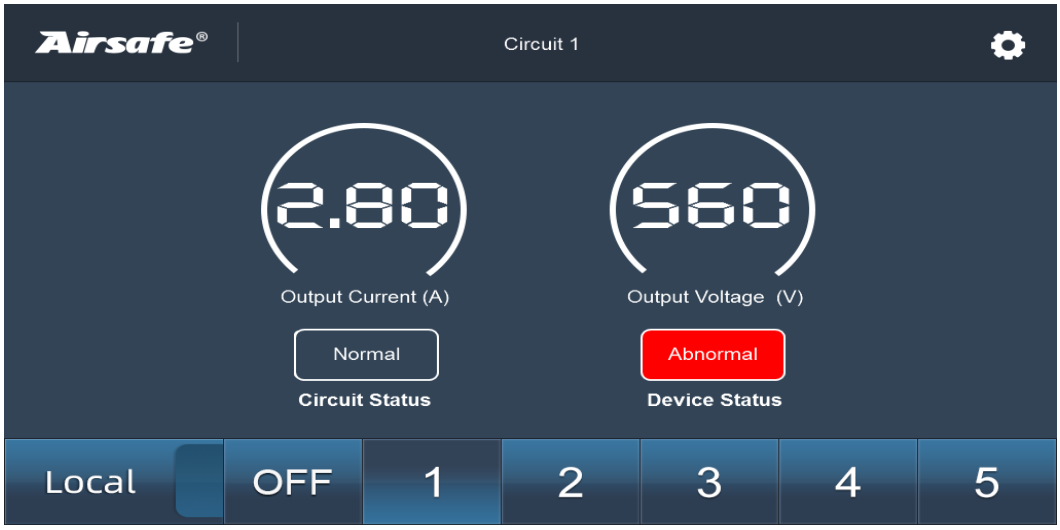


Figure 5-1 Main interface of the main control screen

Click the gear button in the upper right corner to enter the operating parameter interface, and click the word "normal" or "abnormal" above the loop status and device

status to enter the warning interface.

There is a circuit name display on the top of the interface, the factory default is "Loop 1". The user can enter the "Accessory Settings" interface to modify the circuit name after entering the password.

When the loop status is normal, the word "Normal" will be displayed above the loop state; when the loop is faulty, such as open circuit, over-current, etc., the background above the loop state will turn red and display the word "Abnormal", and the buzzer will buzz to alarm. When the device status is normal, the word "Normal" is displayed at the top of the device status; when the device fails, such as a communication failure of the main control board, the ambient temperature exceeds the limit, etc., the background above the device status will turn red and the word "abnormal" will be displayed. At this time, the buzzer will buzz to alarm.

5.2 Warning and alarm interface

If a warning or alarm occurs, the background of the corresponding entry will turn red, and the word "abnormal" will be displayed, accompanied by a buzzer. Click the red area of the corresponding item of warning or alarm, the red area will turn orange. When all the red areas turn orange, the buzzer will be silenced. The warning interface is shown in Figure 5-2.

Figure 5-2 Alarm interface

Refer to Table 5-1 for details on the determination of alarms contained in the main control screen.

Table 5-1 Alarm phenomenon judgment table

No.	Name	Phenomenon	Display
1	Power voltage	Grid voltage is not within the allowable range with abnormal buzzer	
		Grid voltage is not within the allowable range	Abnormal
		Grid voltage is normal	Nomal
2	Power frequency	Grid frequency is not within the allowable range with abnormal buzzer	
		Grid frequency is not within the allowable range	Abnormal
		Grid frequency is normal	Nomal
3	Current does not match the brightness level	Output current does not match the brightness level with abnormal buzzer	
		Output overcurrent>5% mute abnormal	Abnormal
		Output current is normal	Nomal

4	VA drops 10%	Output power drops more than 10% with abnormal buzzer	
		Output power drops by more than 10%	Abnormal
		Output power is normal	Nomal
5	Insulation resistance	Insulation resistance is not within the allowable range with abnormal buzzer	
		Insulation resistance is not within the allowable range	Abnormal
		Insulation resistance is normal	Nomal
6	Ambient temperature	Ambient temperature is not within the allowable range with abnormal buzzer	
		Ambient temperature is not within the allowable range	Abnormal
		The ambient temperature is normal	Nomal
7	Relative humidity	Relative humidity is not within the allowable range with abnormal buzzer	
		Relative humidity is not within the allowable range	Abnormal
		Relative humidity is normal	Nomal
8	Defective light exceeds limit	The number of defective lights exceeds the allowable range with abnormal buzzer	
		The number of defective lights exceeds the allowable range	Abnormal
		The number of defective lights is normal	Nomal
9	Main control board communication	The communication between the main control board and the monitoring system is abnormal with abnormal buzzer	
		The communication between the main control board and the monitoring system is abnormal	Abnormal
		The communication between the main control board and the	Nomal

		monitoring system is normal	

The alarm interface of the main control screen is shown in Figure 5-3.

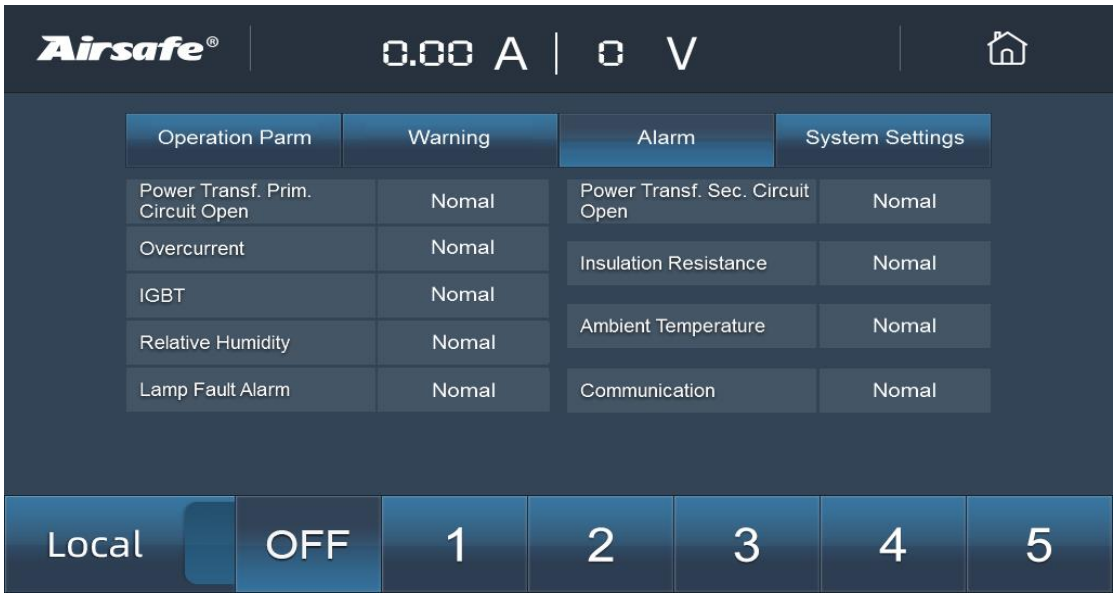


Figure 5-3 Alarm interface

Refer to Table 5-2 for details on the determination of alarms contained in the main control screen.

Table 5-2 Alarm phenomenon judgment table

No.	Name	Phenomenon	Display
1	Primary open circuit	Primary open circuit with abnormal buzzer	
		Primary open circuit	Abnormal
		Normal	Nomal
2	Secondary open circuit	Secondary open circuit with abnormal buzzer	
		Secondary open circuit	Abnormal
		Normal	Nomal
3	Output overcurrent	Output current >25% or Output current >5% with abnormal buzzer	
		Output current >25% or Output current >5%	Abnormal

		Normal	Nomal
4	Insulation overrun	Insulation resistance is not within the allowable range with abnormal buzzer	
		Insulation resistance is not within the allowable range	Abnormal
		Normal	Nomal
5	IGBT	IGBT malfunction with abnormal buzzer	
		IGBT malfunction	Abnormal
		Normal	Nomal
6	Ambient temperature	Ambient temperature is not within the allowable range with abnormal buzzer	
		Ambient temperature is not within the allowable range	Abnormal
		Normal	Nomal
7	Environment humidity	Environment humidity is not within the allowable range with abnormal buzzer	
		Environment humidity is not within the allowable range	Abnormal
		Normal	Nomal
8	Defective light exceeds limit	The number of defective lights exceeds the allowable range with abnormal buzzer	
		The number of defective lights exceeds the allowable range	Abnormal
		Normal	Nomal
9	Main control board communication	The communication between the main control board and the monitoring system is abnormal with abnormal buzzer	
		The communication between the main control board and the monitoring system is abnormal	Abnormal
		Normal	Nomal

5.3 Operating parameter interface

The operating parameters of the CCR are mainly divided into two interfaces, as shown in Figures 5-4 and 5-5.

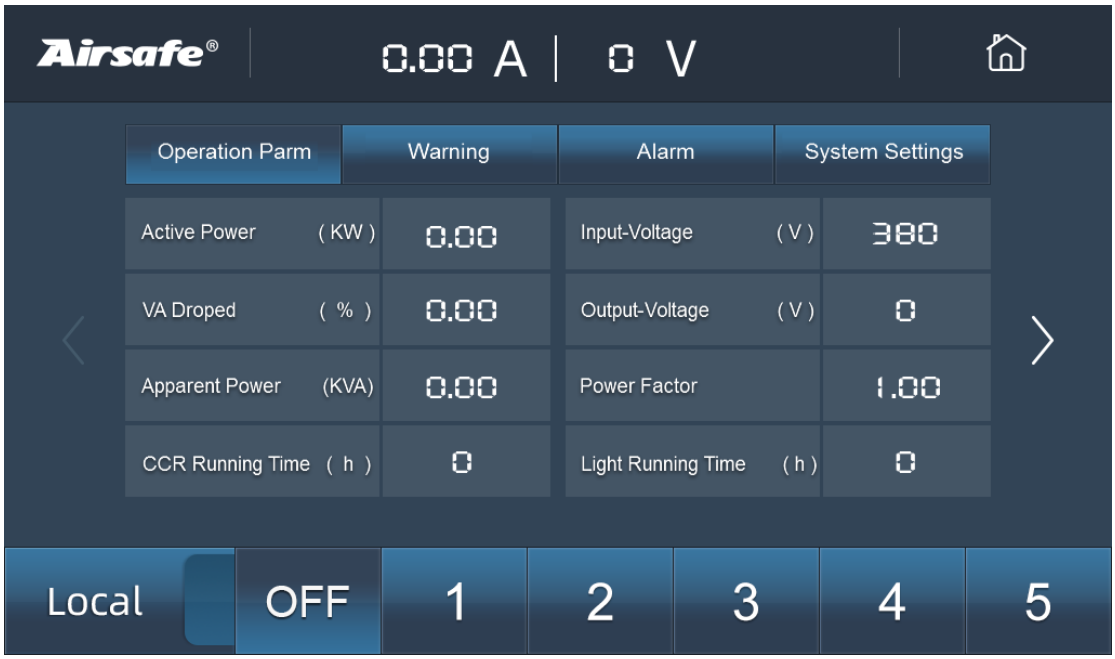


Figure 5-4 Operation parameter interface 1

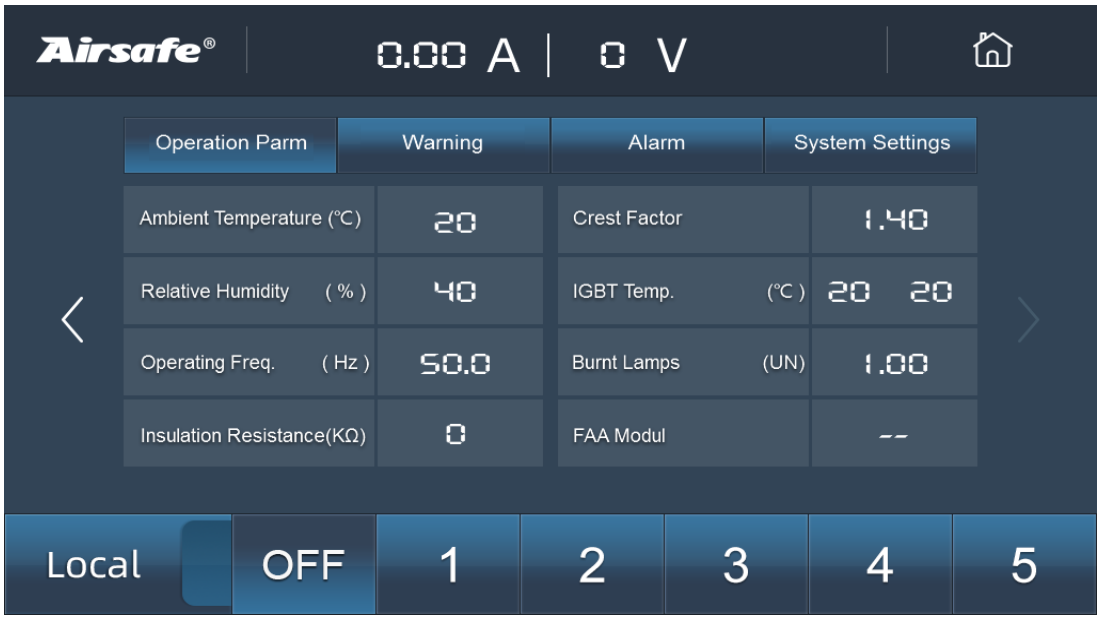


Figure 5-5 Operation parameter interface 2

The detailed content of the operating parameter interface is shown in Table 5-3.

Table 5-3 Details of the run test interface

NO.	Name	Details	Content
1	Active power	Load active power	0.00～99.99KW
2	Input voltage	CCR supply voltage	0～999V
3	Volt-ampere drop	Percentage of output power drop	0～99.99%
4	Output voltage	The output voltage collected by the CCR	0～9999V
5	Total power	Total load power	0.00～99.99KW
6	Power factor	Load power factor	0～9.99
7	Equipment running time	Equipment running time	0～99999h
8	Light source usage time	Light source usage time	0～99999h
9	Ambient temperature	Ambient temperature	0～999i
10	Crest factor	Load crest factor	0～9.9
11	Ambient humidity	Ambient humidity	0～100%
12	IGBT Nuclear temperature	Split left and right nuclear temperature display	0～999i
13	Grid frequency	CCR power grid frequency	0～99.9Hz
14	Number of broken lights detection	Number of bad lights detected by CCR	0～999 个
15	Insulation resistance	Load resistance to ground	0～99999999Ks
16	FAA Module	--	--

5.4 System parameter setting interface

The parameter setting interface requires the correct password to be entered. The default password is 123456 when it leaves the factory. The parameter setting interface is divided into four sub-pages: basic setting, threshold setting, additional setting and advanced setting.

Figure 5-6 Basic setting interface

The basic setting details of the basic parameter interface are shown in Table 5-4.

Table 5-4 Details of the basic parameter interface

No.	Name	Description	Content
1	Non-illumination brightness level	Dark current	NONE/1.8A～2.5A
2	Capacitive switch	---	On/off
3	Language	Language interface	Chinese/English
5	Light source use time reset	Reset	On/off
6	Equipment operation time reset	Reset	On/off
7	Factory settings	Factory default parameters	On/off
8	Duration of defective light	Alarm after the defective light lasts for a certain period of time	0-99s

The threshold parameter interface is mainly divided into CAAC, FAA, IEC and user-defined. The operation interface will have parameters set according to the corresponding CCR standard. If the user needs to modify the operation value according to his actual needs, click the "customize" button to enter the page to modify by himself. After clicking modify, a successful modification interface will pop up to indicate that the parameter has been modified successfully.

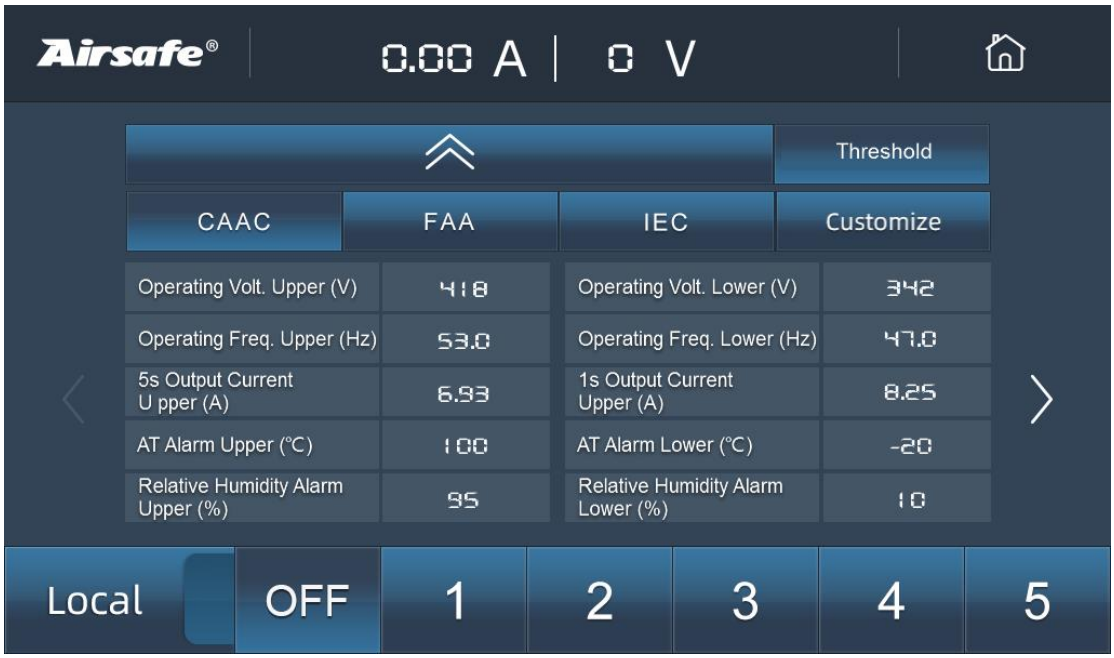


Figure 5-7 Threshold parameter interface 1

The details of threshold parameter interface 1 are shown in table 5-4.

Table 5-4 details of threshold parameter interface 1

No.	Name	Description	Content
1	Upper limit of grid voltage	Upper limit of grid voltage	220～550
2	Lower limit of grid voltage	Lower limit of grid voltage	100～380
3	Upper limit of grid frequency	Upper limit of grid frequency	50.0～80.0
5	Lower limit of grid frequency	Lower limit of grid frequency	30.0～60.0
6	Upper limit of current alarm within 5s	Upper limit of current in 5s	6.7～7.0
7	Upper limit of current alarm within 1s	Upper limit of current in 1s	8.0～8.40
8	Upper limit of ambient temperature alarm	Upper limit of ambient temperature	80～120
9	Lower limit of ambient temperature alarm	Lower limit of ambient temperature	-40～-10
10	Upper limit of ambient humidity alarm	Upper limit of ambient humidity	90～95
11	Lower limit of ambient humidity alarm	Lower limit of ambient humidity	5～10

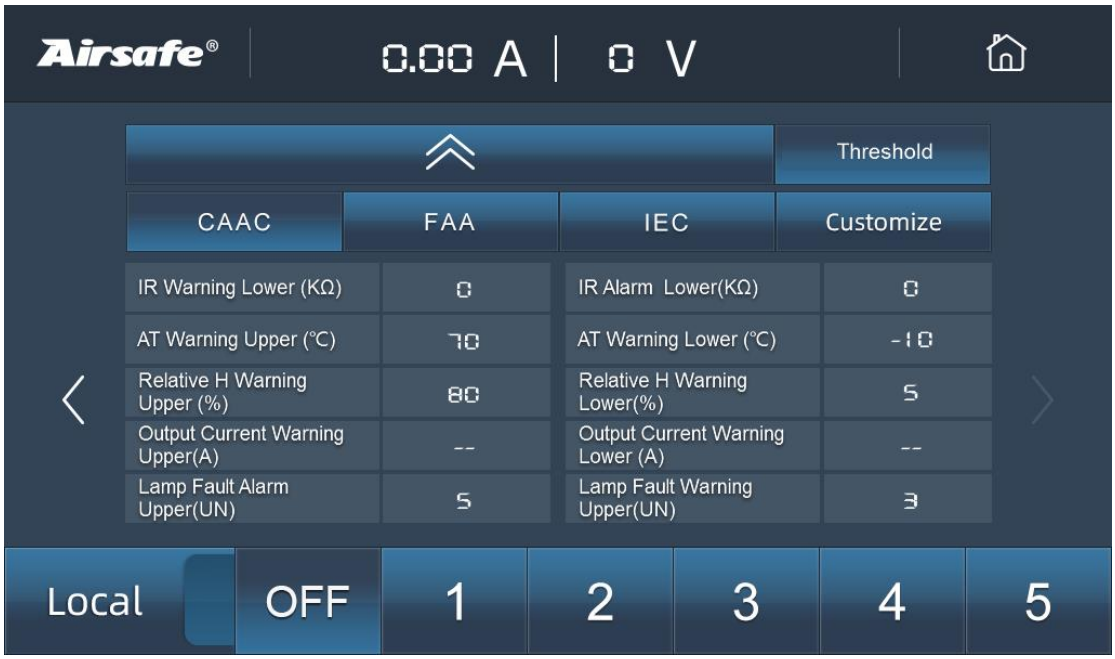


Figure 5-8 threshold parameter interface 2

The details of threshold parameter interface 2 are shown in table 5-5.

Table 5-5 details of threshold parameter interface 2

No.	Name	Description	Content
1	Upper limit of insulation resistance warning	Upper limit of insulation resistance	0～99999999KΩ
2	Lower limit of insulation resistance warning	Lower limit of insulation resistance	0～99999999KΩ
3	Upper limit of ambient temperature warning	Upper limit of ambient temperature	60～80
5	Lower limit of ambient temperature warning	Lower limit of ambient temperature	-10～0
6	Upper limit of ambient humidity warning	Upper limit of ambient humidity	70～95
7	Lower limit of ambient humidity warning	Lower limit of ambient humidity	5～50
8	Upper limit of output current warning	Upper limit of output current	---
9	Lower limit of output current warning	Lower limit of output current	---
10	Alarm for the upper limit of the number of defective lights	Upper limit of the number of defective lights	0～200
11	Alarm for the lower limit of the number of defective lights	Lower limit of the number of defective	0～200

		lights	

Figure 5-9 Accessory setting interface

The factory default password of the CCR is "123456". If the user needs to modify the password, click the "Annex" button to enter the corresponding interface. First click on the original password display column, and a data input window will pop up. The original password must be entered correctly. If you enter an error, an error warning window will pop up. After the original password is entered correctly, click the new password display window, enter the password you want to set, and click confirm. Finally, a successful modification window will pop up.

The loop information column refers to the information indicating the position of the airport navigation aid light control loop that can be controlled by the CCR, and the user can write the corresponding location information according to the specific location. Click the edit window, the "keyboard" window will pop up, and then enter the corresponding information with maximum 20 characters, after the input is complete, click OK, return to the main interface, you can see the location information will be displayed in the upper display column.

Figure 5-10 Advanced settings interface

The detailed content of the advanced setting interface is shown in Table 5-6.

Table 5-6 Details of Advanced Settings Interface

No.	Name	Description	Content
1	Baud rate	If CCR is equipped with a serial interface accessory, the baud rate needs to be set	1200, 2400, 4800, 9600, 38400, 115200
2	Data bits	Support data bits	5, 6, 7, 8
3	Check digit	Check category	None, odd parity, even parity
5	Stop bit	stop bit	1, 1.5, 2
6	Equipment power	Rated power of CCR with different capacity	1KVA, 2.5KVA, 5KVA, 7.5KVA, 10KVA, 15KVA, 20KVA, 25KVA, 30KVA
7	Remote monitoring ID	If CCR is equipped with a serial interface accessory, the remote control ID needs to be set	1254
8	No alarm	----	Yes, no
9	CAN baud rate	If CCR is equipped with CAN communication interface accessories, the can baud rate needs to be set	5K, 10K, 50K, 125K, 250K, 500K, 1M

5.5 Calibration interface of defective lighting fixture detection

User "Light detection and calibration" button in the Annex interface to enter the defective light detection and calibration interface.

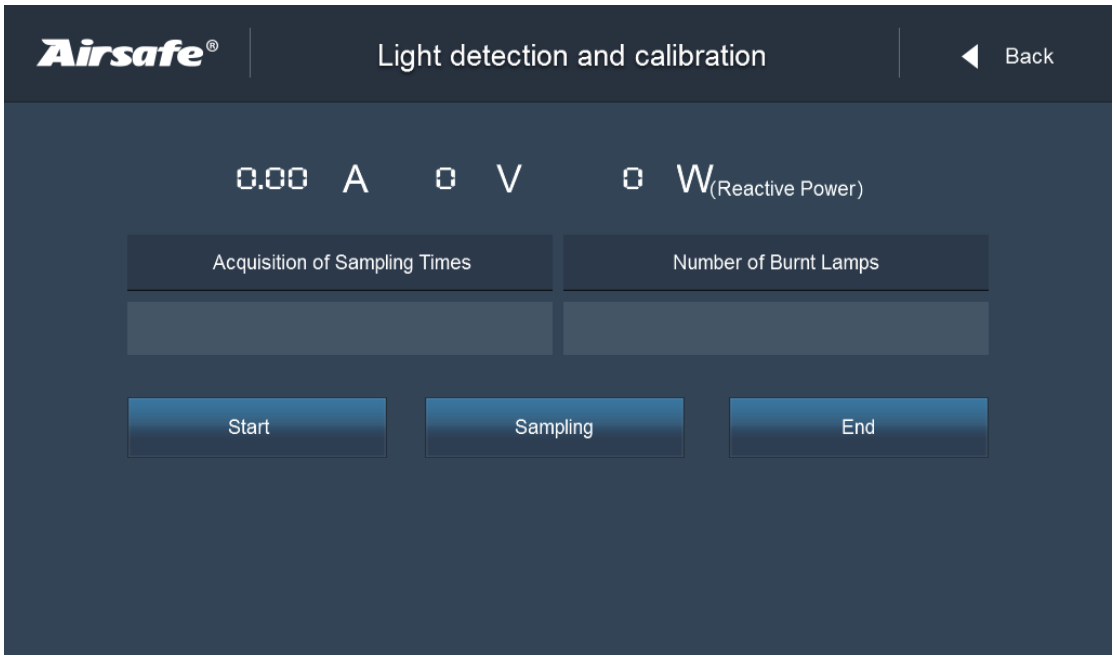


Figure 5-11 Light detection and calibration interface

The detailed light detection and calibration interface is shown in Table 5-7.

Table 5-7 Light detection and calibration interface

No.	Name	Description	Content
1	Collected times	---	0 to 10
2	Corresponding number of defective lights	---	0 to 200

When performing the defective light detection and calibration, first ensure that the output load of a single lamp power and the power of the isolation transformer matched by the lamp are consistent, then turn on the CCR to brightness level four, and then see the defective light calibration interface, as shown in Figure 7-11.

First: After the current is stable, click the start button of collection. At this time, the number of collections column will display 0, and the display column of the

number of defective lights will display 1; then unplug 1 light, click the collection button, and click the collection button 3 times. After the click, the number of acquisitions column will display 1, and the number of corresponding defective lights will become 2. At this time, the first collection is over;

Second: Unplug 2 lights, and then change the display column of the number of corresponding defective lights to 3. At this time, click the collection button 3 times consecutively. After the collection is completed, the display column of the collected display will change to 3, the number of defective lights changes to 4, at this time the second collection is over;

Third: Unplug the 2 lights, and then change the corresponding defective lights display column to 5, click the collection button 3 times consecutively. At this time, the collected display column will change to 4, and the corresponding number of defective lights will display 6. At this time, the third collection is over;

Fourth: Click the collection completed button to complete the detection and calibration of the defective light, and then return to the main interface;

Fifth: Check the number of defective lights by entering the number of defective lights column in the operation test interface.

Note: Carry out the calibration procedure of the defective lights according to the above-mentioned procedure, unplug the lights 3 times, each time the number is 1, 2, and 2 respectively. If you click the collection button less than or more than 3 times, it must restart the calibration.

■ Wear insulating gloves when pulling out lighting fixtures when working with electricity.

※ Prevent the electric arc at the joint from threatening personal safety.

6.0 CCR test process

6.1 Short circuit test

The short circuit test must be carried out before the CCR is tested under load. The steps are as follows:

Step 1: disconnect the input power supply of the CCR, ensure that the CCR is in no-power state, and short the output terminal of the CCR with a wire larger than $4mm^2$.

Step 2: power on the CCR.

Step 3: after the main control screen communicates normally, turn on the brightness level to 1, measure the current on the short line of the output end with the current clamp instrument, then compare the current value displayed on the main control screen of the CCR with the current value measured by the current instrument, and observe whether the measured value is within ± 0.1A of the standard current of the selected brightness level.

Step 4: if the test under brightness level 1 is consistent, test the current from brightness level 2 to 5 with the same method.

Step 5: if each brightness level is consistent, turn off the brightness, and power off.

Step 6: remove the short wiring at the output end of the CCR.

■ It is strictly forbidden to touch the internal parts of the equipment with hands when CCR is working.

※ It may cause electric shock, high voltage electric shock and other accidents.

6.2 On-load test

The on-load test should be carried out after the short-circuit test ，and the on-load

test can ensure that the load lamps are in good condition. The main steps are as follows:

Step 1: cut off the input power of the CCR, and connect the light cable of the series circuit to the output end of the CCR.

Step 2: When the CCR is on power, after the main control screen communicates normally, turn on the brightness level to level 1, measure the current value of the series circuit with the current clamp instrument device, compare the current value displayed on the main control screen of the CCR, and observe whether the output current of the CCR is within the + 0.1A range of the selected brightness level standard current.

Step 3: If the test is in accordance with the brightness level 1, the current level is tested in the same way from current level 2 to 5 in turn.

Step 4: if each brightness level matches, then turn off the CCR light level and finally turn off the power.

■ No open or short circuit at work
※ May cause device alarm

■ It is strictly forbidden to touch the internal parts of the device by hand while working.
※ Accidents such as electric shock and high voltage shock may occur

6.3 Open circuit test

The open circuit test should be carried out after the load test is finished, the main steps are as follows:

Step 1: cut off the input power supply of the CCR and disconnect the output transformer without connection.

Step 2: When the CCR is on power, turn on the brightness level to level 1 after the main control screen communicates normally. At this time, you will hear the main contactor disconnected. There will be a second open circuit alarm message on the main control screen, indicating that the open circuit test is normal.

Step 3: If the test is in accordance with the brightness level 1, the current level is tested in the same way from the brightness level 2 to 5 in turn.

Step 4: if each brightness level is matches, then turn off the brightness, and finally turn off the power.

Note: it is not allowed to conduct open circuit test under normal brightness level operation, because the sudden open circuit of the CCR under normal operation will produce high voltage arc at the output end, which may cause electric shock and affect personal safety.

■ It is strictly forbidden to open or short circuit at will on site under working conditions.

※ May cause device alarm

■ It is strictly forbidden to touch the internal parts of the device by hand while working.

※ It may cause electric shock, high voltage electric shock and other accidents.

6.4 Insulation resistance test

The insulation resistance test of the CCR is based on the condition that the output series circuit is well connected, the main steps are as follows:

First: Connect the output series circuit of the CCR when the CCR is powered off.

Second: the CCR is normally powered on without switching on the brightness level.

Third: View the insulation resistance value in the operation parameter column of the main control screen directly (because the CCR has been calibrated before leaving the factory, no secondary calibration is required).

■ It is strictly forbidden to touch the internal parts of the device by hand while working.

※ Accidents such as electric shock and high voltage shock may occur

7.0 Maintenance of CCR

7.1 Daily inspection and maintenance

Special Reminder: Untrained personnel should not operate and maintain the equipment without authorization.

Airport daily maintenance personnel should strictly follow the relevant regulations to do their daily maintenance work, and ensure the best condition of the sine wave CCR.

■ Installation or maintenance should be carried out in strict accordance with the instructions in this instruction manual

※ Prevent human body from electric shock due to accidental touch

7.1.1 Daily inspection

1. Appearance inspection

a. Dust on top and inside of the device.

b. Check the wiring, ground wire, output load wiring, and input wiring.

c. Tighten screws everywhere.

d. Check if there are any abnormalities in the devices on the printed circuit board.

2. Functional check

a. Check if the current of each brightness level of the CCR is correct.

b. Check the working status of the CCR at each brightness level.

c. Check the local remote control function of the CCR.

d. Check the abnormal protection function of the CCR.

■ Non-professional electricians are strictly forbidden to maintain electrical faults of the equipment

※ May cause electric shock or other personal accidents

7.1.2 Daily maintenance

The basic daily maintenance steps are as follows:

1. Make sure that the power supply of the CCR is disconnected and live operation is strictly prohibited. Open the front door of the control cabinet and conduct electrostatic discharge first.
2. Check whether the wiring, grounding wire, load connection and input connection are loose or not.
3. Check whether the connecting wires of each module are loose and whether there is any damage to the wires everywhere.
4. Check if there are any abnormalities in the devices on the printed circuit board;
5. After checking, close the control door and power on again.

■ Strictly prohibit open or short circuit at work

※ May cause equipment alarm

■ Strictly prohibit non-professionals from disassembling and assembling components of this system

※ May cause device system failure

7.2 Warning and Alarm Information Decision

For all alarm and alarm information interface of the CCR, please refer to the alarm pages of the detailed master screen. Table 7-1 lists the alarm and alarm events attributed to various problems after occurrence, and the description of the operating status of the CCR under corresponding conditions.

Table 7-1 Alarm information table

No.	Alarm information	Fault problem	CCR operating status
1	Primary open circuit	Open circuit	Protective shutdown
2	Secondary open circuit	Series circuit open	Protective shutdown
3	Overcurrent	Current exceeds 5% of 6.6A	Protective shutdown
		Current exceeds 25% of 6.6A	Protective shutdown
4	IGBT Error	IGBT Breakdown	Protective shutdown
		IGBT Overcurrent breakdown	Protective shutdown
5	Communication failure	Pass failure between main control boards	Protective shutdown
		Communication failure between main control board and insulation detection board	No effect, normal operation
6	Defective light alarm	The number of defective lights in the series circuit exceeds the preset alarm value	No effect, normal operation
7	Defective light alarm	The number of defective lights in the series circuit exceeds the preset alarm value	No effect, normal operation
8	Abnormal grid frequency	Frequency is higher than normal	No effect, normal operation
		Frequency is lower than normal	No effect, normal operation

9	Abnormal grid voltage	Input voltage exceeds 10%	No effect, wonexceeds ationmallth
		Input voltage is lower 10%	No effect, wonis lower tionmallth
10	Current doesnnis lower tionmall	The output current under the selected current level does not meet the requirements	No effect, normal operation
11	Insulation value alarm	The insulation resistance value is lower than the preset alarm value	No effect, normal operation
12	Insulation value alarm	The insulation resistance value is lower than the preset alarm value	No effect, normal operation
13	Output power VA drop 10%	The series circuit load power drop exceeds 10%	No effect, normal operation

■ Non-professional electricians are strictly forbidden to maintain electrical faults of equipment

※ May cause electric shock or other personal accidents

■ Electrostatic discharge before operation and maintenance

※ Some parts of the equipment may be dangerous to the human body

7.2.1 Information indication judgment

1. IGBT drive module information judgment

When the two LED indicators on the IGBT drive module, the physical indicators are shown in Figure 7-1. The specific instructions are as follows:

D13 is green and D16 is red, indicating that the module is normal.

D13 is green, D16 does not show bright which means IGBT failure.

D13 does not bright, which means the IGBT is not powered.

Figure 7-1 IGBT drive module information indication

2. Main control board information judgment

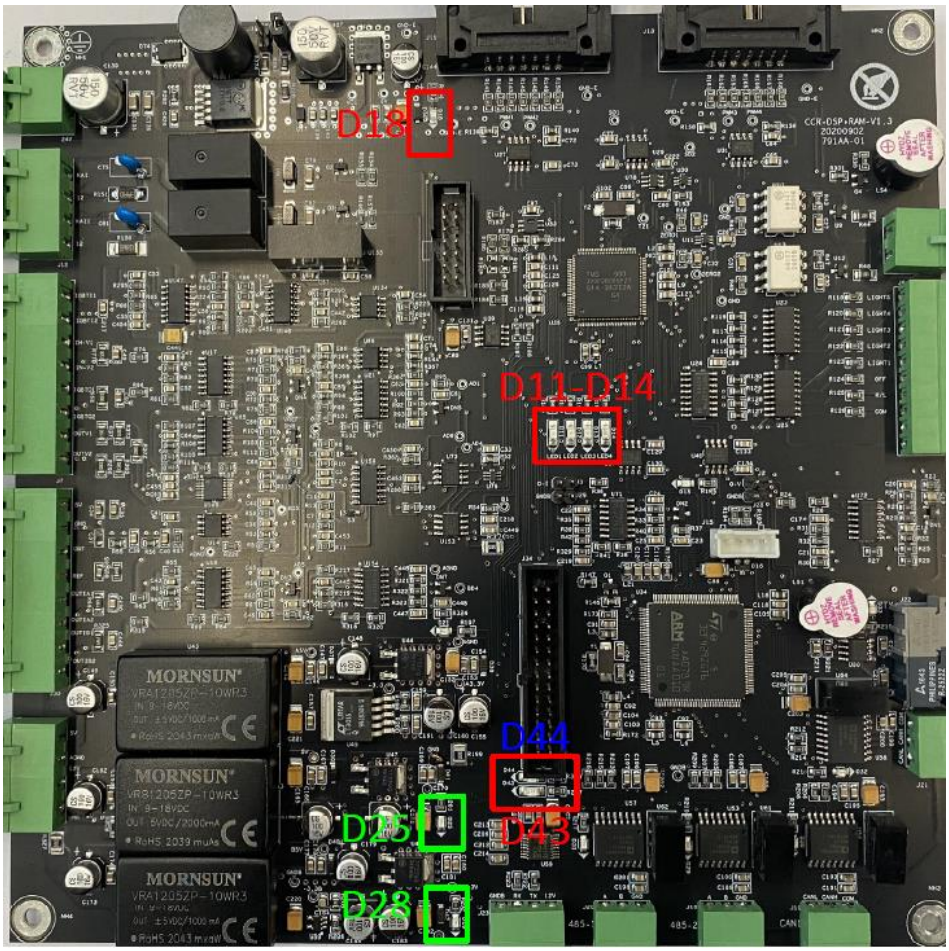


Figure 7-2 Mainboard indicator information

On the main control board, when a fault occurs, it can visually observe the LED indication information everywhere. The specific information is determined as follows:

D25 is steady green, indicating that the power supply is normal. When it off, which means power supply failure.

D28 is steady green, indicating that the power supply is normal. When it off, which means power supply failure.

D18 is steady green, indicating that the power supply is normal. When it off, which means power supply failure.

D11 is steady red, which means IGBT failure or Hall sensor failure. When it off, which means no failure.

D12 is steady red, indicating that the output circuit is short-circuited. When it off, which means no fault.

D12 is steady red, indicating that the output circuit is open-circuited. When it off, which means no fault.

When D14 flashes green quickly (more than 1s/time), it means that the communication is normal. When it off, it means the communication is faulty.

When D14 flashes green slowly (1s/time), which means the emergency knob is working.

When D44 flashes blue, which means communication is normal.

When D43 flashes red, which means the communication is abnormal.

■ When checking various information instructions on the circuit board, it is forbidden to touch with hands or other objects

※ Prevent electric shock

7.3 Maintenance

7.3.1 Notices

Untrained personnel are not allowed to repair and operate the equipment. If the CCR suddenly stops output during operation, it may be caused by conditions such as output current overcurrent, output series circuit open, and input grid voltage too low. When checking the equipment, please place the dimmer in the local and off state. If the shutdown operation is not performed during maintenance, it may cause electric shock. On the other hand, when the power supply of the device is suddenly restored, it may cause the CCR to work automatically again, resulting in the risk of electric shock to the human body.

■ Non-professional electricians are strictly prohibited from maintaining electrical faults of the equipment

※ May cause electric shock or other personal accidents

7.3.2 Preparation before maintenance

Before overhauling, please visually check the following:

a. Whether the power supply is normal.

b. Whether the input cable wiring, output cable wiring and other wires are loose.

c. Observe the display content of the main control screen of the dimmer and view the detailed information of alarms and alarm failures.

d. Whether each component shows signs of burnt.

e. Whether the output terminal wiring is open.

The maintenance of CCR equipment is mainly to replace spare parts. Some components in the CCR device cannot be disassembled and repaired by self. If there is a problem, it must be replaced. The internal components and circuit boards of the power unit are damaged and cannot be repaired on site.

Communicate with relevant sales personnel about the operation, repair or maintenance of the CCR. When contacting, please provide the CCR equipment model, factory number, and approximate date of receipt.

7.4 Analysis and elimination of common faults

CCR faults are mainly divided into the following categories:

1. The CCR cannot be turned on. (Table 7-2)

Table 7-2 The dimmer cannot be turned on

No.	Phenomenon	Error analysis	Error solution
1	The main control screen off, and the main control board indicator off	a. Loose power supply cable wiring b. The fuse is burned out	a. Check whether the CCR input terminal wiring is firm b. Check whether the fuse of the input terminal block is damaged
2	The red indicator LED1 on the motherboard is always on	a. IGBT Module failure b. Hall transducer failure c. Main control board	a. Replace IGBT module b. Replace bridge rectifier module c. Replace the main control board
3	Display abnormal grid voltage alarm	The supply voltage is low The supply voltage is high	Check the power supply at the input of the CCR
4	Show that the main contactor is not closed	a. Main control board b. Main contactor c. Intermediate relay d. Main contactor control circuit	a. Replace the main control board b. Replace the main contactor c. Replace the intermediate relay d. Check whether the main contactor wiring is loose

2. After the CCR is turned on, the main contractor is disconnected. (Table 7-3)

Table 7-3 Sudden output interruption after the dimmer is turned on

No.	Phenomenon	Error analysis	Error solution
1	Display the secondary open circuit alarm	Output series circuit failure	a. Check whether the series circuit is open

			b. Check the number of broken lights in the loop
2	LED1 on the main board is on	a. IGBT Module failure b. Hall transducer failure	a. Replace the IGBT driver board b. Replace the Hall transducer
3	Display abnormal grid voltage alarm	a. The input voltage of the dimmer is too low or too high b. Main control board failure	a. Check the power supply voltage of the CCR input b. Replace the main control board or replace the input voltage sensor circuit board
4	Display abnormal frequency alarm of grid	The grid frequency is low or high	Check the power supply frequency of the CCR input
5	CCR display over-current alarm	a. Motherboard failure b. Current sensor failure c. Monitoring board failure d. The main control screen is calibrated incorrectly	a. Replace the main control board or monitoring board b. Replace the current sensor module c. Change the light level of the CCR and check whether the current of other light levels is accurate d. The main control screen re-calibrates the current

3. There will be an alarm or warning after the CCR is turned on at the dimming level. (Table 7-4)

Table 7-4 Alarm or warning of CCR

No.	Phenomenon	Error analysis	Error solution
1	Grounding resistance fault alarm	The insulation resistance of the series circuit is lower than the alarm value	a. Check the insulation condition of the series circuit b. Re-calibrate the insulation resistance on the main control screen c. Replace the insulation detection drive board
2	Bad light alarm	The number of broken lights in the series circuit exceeds the preset alarm value	Check the number of bad lights in the series circuit
3	Abnormal grid voltage	The grid voltage is low or high	a. Check the input voltage of the CCR b. Is the CCR calibrated to the grid voltage correctly

4	Abnormal grid frequency	The grid frequency is low or high	Check the grid frequency at the input of the CCR
5	Output current alarm	The output current of the CCR is not within the standard range at the corresponding light level	a. Check the series loop current b. Calibration dimmer control current
6	Bad light alarm	The number of broken lights exceeds the warning limit	Check the number of bad lights in the series circuit
7	Earth resistance fault warning	Circuit insulation value exceeds warning limit	a. Check the insulation value of the series circuit b. Replace the insulation detection board
8	The volt-ampere drop than 10%	Load change	Check the series circuit impedance and the number of broken lights
9	Communication failure	a. Communication board failure b. No voltage zero crossing signal c. The power supply is faulty	a. Replace the main control board b. Replace the switching power supply

7.5 Replacement of CCR parts

When there are parts in the CCR system that are damaged or fail, the parts should be disassembled and replaced in time. As part replacement must disassemble some related parts of the CCR, any error may cause undesirable consequences. The factory requires users to pay attention to the following warnings. Be careful during disassembly and assembly, replace damaged parts as required, and ensure the performance of the disassembled CCR.

1. Replacement of IGBT drive parts

According to the analysis of fault information in Chapter 7.4, when the IGBT drive fails, parts need to be replaced. The steps are as follows:

i. Ensure that the dimmer is in a power-off state.

ii. Ensure that the air switch is off state.

iii. Remove the protective plate of the CCR, and remove the four screws marked

in Figure 7-3.

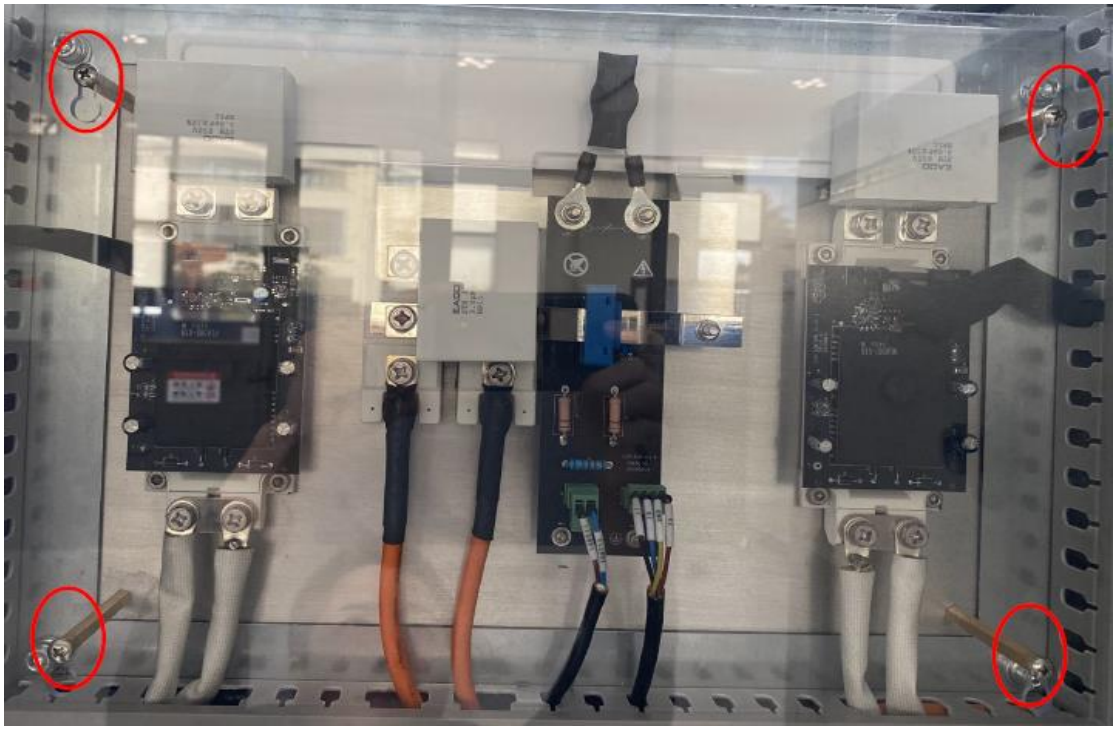


Figure 7-3 Disassembly of the protective plate

iv. Use a multi-meter to measure the voltage in the DC voltage range of Figure 8-4, No. 1-2, No. 3-4, No. 5-6, and the voltage must be lower than 10V before proceeding to the next operation, otherwise the capacitance Residual electricity may cause electric shock.

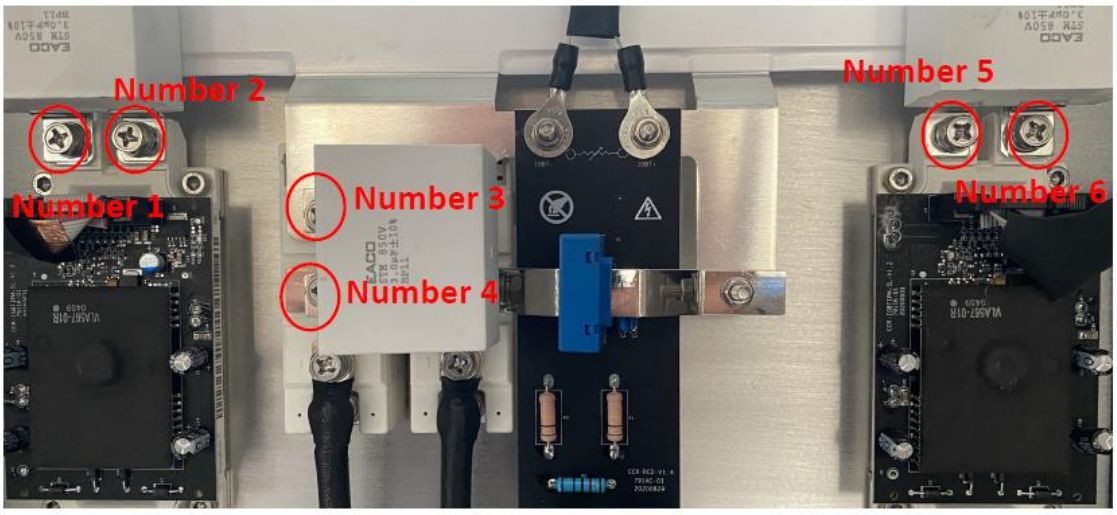


Figure 7-4 Test voltage point

v. First pull out the cable plug of IGBT driver, then remove the four screws at

No. 1 and No. 2 indication, and finally remove the four screws at No. 3 indication, as shown in Figure 7-5.

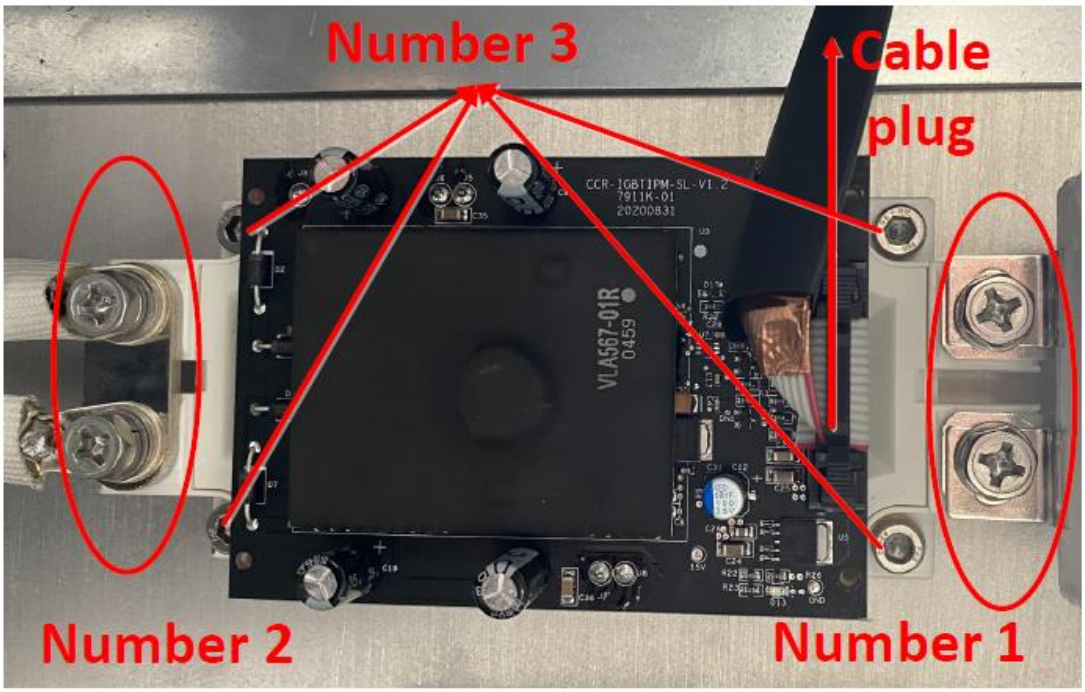


Figure 7-5 IGBT drive parts replacement diagram

vi. The new IGBT driver can be disassembled in reverse according to the steps of disassembly. During the installation, the torque of the screw driver shall refer to the requirements of Annex II.

■ It is strictly forbidden for non-professionals to disassemble the system components

※ It may cause equipment system failure

■ Carry out the electrostatic discharge before replacing the parts.

※ Some parts of the equipment may be dangerous to human body

■ Please use a force-limiting wrench or other special tools to install the lighting fixtures.

※ Informal tools may cause damage to fasteners or personal injury

2. Replacement of varistor parts

When determining that the varistor is faulty, parts need to be replaced. The steps are as follows:

Step 1. It is completely consistent with the step 1-4 of IGBT driver parts replacement, and it shall be carried out according to the requirements;

Step 2. Remove the two nuts shown in Figure 7-6;

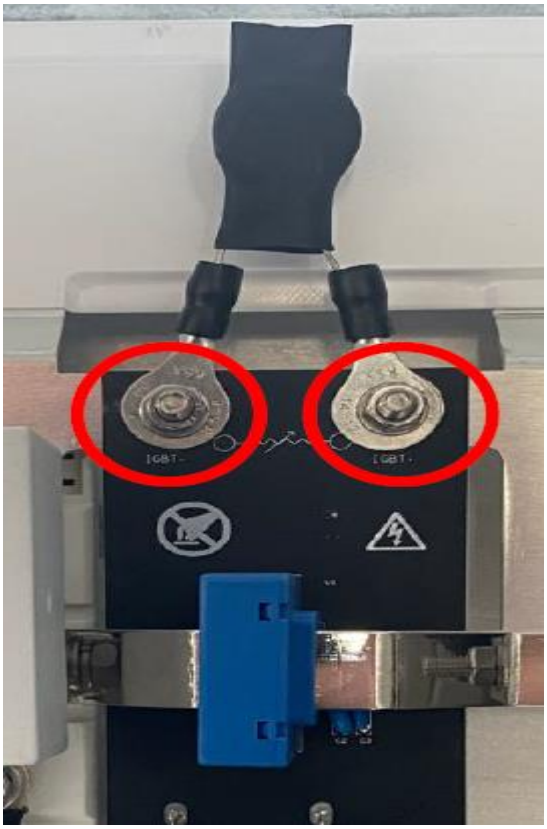


Figure 7-6 replacement of varistor parts

Step 3: the new varistor parts can be disassembled in reverse according to the disassembly steps. During the installation process, the torque of the screw driver shall refer to the requirements of Annex II.

■ It is strictly forbidden for non-professionals to disassemble the system components

※ It may cause equipment system failure

■ Carry out the electrostatic discharge before replacing the parts.
※ Some parts of the equipment may be dangerous to human body

■ Please use a force-limiting wrench or other special tools to install the lighting fixtures.
※ Informal tools may cause damage to fasteners or personal injury

3. Replacement of rectifier bridge parts

When the fault of rectifier bridge is determined, the components need to be replaced. The steps are as follows:

Step 1: It is completely consistent with the step 1-4 of IGBT driver parts replacement, and it shall be carried out according to the requirements;

Step 2: Remove the screw shown in Figure 7-7;

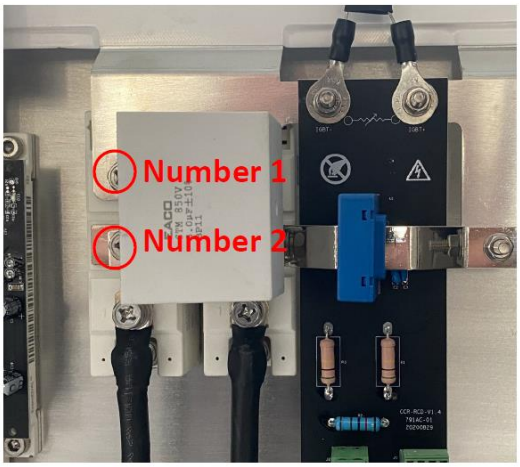


Figure 7-7 replacement of bridge rectifier

Step 3: according to figure 7-8, remove all the marked screws in order.

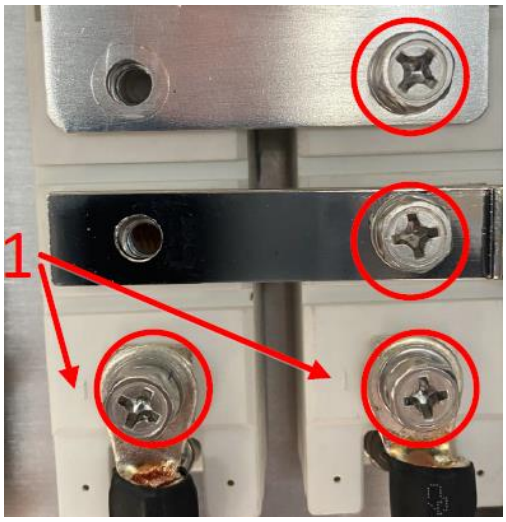


Figure 7-8 replacement of rectifier bridge parts

Step 4: the new rectifier bridge parts can be disassembled in reverse according to the steps. During the installation process, the torque of the screw driver shall refer to the requirements of Annex II. Pay attention to the direction of the rectifier bridge during installation, with the "1" character in Figure 9-8 facing down.

■ It is strictly forbidden for non-professionals to disassemble the system components

※ It may cause equipment system failure

■ Carry out the electrostatic discharge before replacing the parts.

※ Some parts of the equipment may be dangerous to human body

■ Please use a force-limiting wrench or other special tools to install the lighting fixtures.

※ Informal tools may cause damage to fasteners or personal injury

8.0 Ordering of spare parts

The table in this section lists the standard order numbers for equipment and/or parts. The factory accepts ordering as a whole, as well as individual order for parts. When ordering, please contact the manufacturer or distributor according to the order number listed in the table below.

For some important parts, the manufacturer recommends to purchase from the original manufacturer to ensure the various indicators of the system.

■ The factory recommends that the user read the manual thoroughly before ordering

※ May cause order errors or inaccurate number of system accessories

8.1 List of spare parts

8.1.1 Components order

No.	Part	Order number	Remarks
1	IGBT driver board	7911K	
2	Main control board	791AA	
3	Switch value interface board	791AF	
4	Voltage and current acquisition board	791AF-A	5-10KVA
5		791AF-B	15-20KVA
6		791AF-C	25-30KVA
7	Rectifier bridge	48CC1 485CC2	5-10KVA 5-10KVA
8	Current sensor board	791AB	
9	Power lightning protection module	48C11	
10	Fuse	Fuse 5x20x3A	
11	Switching power-24	7914N	
12	Switching power -15	7914J	
13	Switching power -12	7914K	
14	Power transformer	7914K	

15	Touch-type main control screen	791A7	
16	Varistor	485AH	

8.1.2 Accessories Order

Component Name	Sub-component Name	Order No.	Suggested Qty	Applied to
Main contactor	AC Contactor 40	485A6	1	5-10KVA
	AC Contactor 65	485AM	1	15-20KVA
	AC Contactor 96	485AO	1	25-30KVA
Air switch	Air switch 32A	48C51	1	5-10KVA
	Air switch 40A	48C52	1	15KVA
	Air switch 63A	48C53	1	20KVA
	Air switch 80A	48C55	1	25KVA
	Air switch 125A	48C54	1	30KVA
Lightning arrester	HMYGS-3/9.9	485AF-10	2	5-10KVA
	HMYGS-5/13.6	485AF-20	2	15-20KVA
	HMYGS-6/19.8	485AF-30	2	25-30KVA
Filter capacitor	SRP-450-37-MS	48A07	4	15-30KVA
	STM-1200V-0.22uF	48A01	3	5-10KVA
	STM-850-2uF	48A02	3	15-20KVA
	STM-850-3uF	48A03	3	10-20KVA
	STM-850-4.7uF	48A04	3	25-30KVA
	STM-700-3uF	48A05	4	5-20KVA
	STM-700-5uF	48A06	4	25-30KVA

Note 1: For the specification column of the order number, different rated capacity CCR may use different devices, so be aware of the rated power of the

equipment used before purchasing.

Note 2: The number of spare parts for CCR is recommended to be at least 10% of the total number of CCR with the same rated power.

Note 3: If the number of CCR with the same rated capacity is less than 10, it is recommended to stock up according to a set of spare parts.

9.0 Packaging, transportation and storage

9.1 Device packaging and weight

CCR-I series sine wave constant current CCR equipment packaging box parameters are shown in Table 9-1.

Table 9-1 Parameters of CCR device packing box

Rated Power （KVA）	Size（mm） L×W×H	Net Weight （Kg）	Gross Weight （Kg）
1	650×850×1700	200	230
2.5	650×850×1700	240	270
5	650×850×1700	280	310
7.5	650×850×1700	320	350
10	650×850×1700	360	390
15	650×850×1700	400	430
20	650×850×1700	400	470
25	650×850×1700	480	510
30	650×850×1700	520	550

9.2 Device transportation method

According to factors such as transportation distance, equipment quantity, and delivery cycle, properly packaged products can choose railway transportation, road transportation, air transportation, and shipping transportation.

9.3 Product storage

The product should be stored in a dry and ventilated place which should away from heat sources and no corrosive gas. The storage condition should be checked

regularly

9.4 Product delivery and receiving

The CCR must be thoroughly tested and inspected by the appropriate personnel before ex-factory, and prepared for transportation according to the requirements of safe transportation. However, in the actual transportation process, the fixed modules or parts on the CCR device may still be loose due to vibration and bumps, so the following inspections are required:

1. Visually inspect the shipping equipment packaging box for damage. If damage is found, the transporter is required to check the transportation situation in time and record the corresponding problems.
2. If the packing box is intact, for avoid damage to equipment, please try to be careful during the disassembling.
3. After unpacking the packaging box, visually check whether the appearance of the equipment is damaged, such as panel paint, dents, etc., and check whether there are loose modules and loose connections in the equipment. If the transportation is damaged, it should claim for compensation. If you need assistance in the claim process, please contact Shanghai Airsafe Airport Equipment Co., Ltd.

Note: Please keep the packing box used for transportation until the equipment has been put into use and it is confirmed that it is working properly.

■ The equipment should be handled carefully
※ The equipment is heavy and may cause injuries

■ Care should be taken when handling equipment
※ Landing or collision will result in damage to parts or injuries to personal

Appendix I. Selection of system power cable and communication cable

Power cables:

1. 380VAC, Suggested form for supporting cables and usable lengths for single-phase power supply

Equipment capacity specifications	Input terminal wiring cable
5KVA	10mm^2
10KVA	10mm^2
15KVA	16mm^2
20KVA	16mm^2
25KVA	25mm^2
30KVA	25mm^2

2. CAN communication cable

CAN communication cables	Cable specifications	Transmission distance	Shield
3 core，Single wire 2-4mm2	ASTP-120Ω 3×2mm²	Max 3KM	✔

Note: Single core is composed of multiple strands of copper wire

3. 485 communication cable

485 communication cables	Cable specifications	Transmission distance	Shield
3 core，Single wire 2-4mm^2	ASTP-120Ω 3×2mm²	Max 3KM	✔

Note: Single core is composed of multiple strands of copper wire

4. Switch value interface wiring cable:

Switch value interface wiring cable	Transmission distance	Cable specifications	Shield
Single wire 1-4mm^2	Max 4KM	Max 3KM	×

Note: Single core is composed of multiple copper wires

The right of final interpretation of this manual is reserved by Airsafe Airport Equipment Co., Ltd.

Thanks for your choosing and using AIRSAFE product!

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