



Explosion Protection Manual for GR Painting Robot Series.

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CMA

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Supplier of Intelligent Painting Robots

Statement

Thank you for purchasing the painting robots designed by CMA (WUHU) Robotics Company Limited (CMA, in short). The contents stated in the manual are directly related to your safety, lawful rights and responsibilities. Please ensure to read through the manual and correctly set the operation parameters before use. Any operation that does not strictly follow the instructions or the warnings of the manual might lead to physical injury or property damage. All rights for explanation are reserved by CMA.

This manual is intended for technical reference only which makes no warranty to the entire application of the robot system. Therefore, CMA accepts no responsibility for any accident, damage or industrial copyright dispute that follows the use of the application system. It is strongly recommended that all the professionals involved in operation, teaching, maintenance, and inspection should take CMA special training before being authorized to use the robots.

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The manual should be well kept during the life circle of the robot. An optional copy can be ordered from CMA if the original one is damaged or lost. The address of the new owner is required to be reported to CMA if the robot is resold or transferred.

This manual is an indispensable part of the whole manual collection and all the professionals involved in operation, teaching, maintenance, and inspection are required take CMA special training on the knowledge instructed by the following manuals:

- ☐ ZL-GR-001-V1: Safety Manual for GR Painting Robot Series.
- ☐ ZL-GR-002-V1: Maintenance Manual for GR Painting Robot Series.
- ☒ ZL-GR-003-V1: Explosion Protection Manual for GR Painting Robot Series.
- ☐ ZL-GR-004-V1: Remote Assistance Manual for GR Painting Robot Series.
- ☐ ZL-GR-005-V1: IO Communication Instruction Manual GR Painting Robot Series.
- ☐ ZL-GR-006-V1: Program Editor Instruction Manual for GR Painting Robot Series
- ☐ ZL-GR6150-001-V1 Installation and Connection Instruction Manual for GR6150 Painting Robot.
- ☐ ZL-GR6150-002-V1 Mechanical Operation and Maintenance Manual for GR6150 Painting Robot.
- ☐ ZL-GR6150-003-V1 Electrical Operation and Maintenance Manual for GR6150 Painting Robot.
- ☐ ZL-GR6150-004-V1: Electrical Schematic Diagram for GR6150 Painting Robot.

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About the Manual

The target readers of the manual include professionals involved in robot operation, maintenance and technical service. This manual intends to explain how to use the program editor for all the GR painting robots designed by CMA. The warning pictograms are classified into four categories, “danger”, “caution”, “attention” and “important” respectively. These warnings are relevant to safety and must be observed.

 Danger	Danger! This warning means death might occur, if an operation is not properly performed.
 Caution	Caution! This warning means death or server physical injury might occur, if an operation is not properly performed.
 Attention	Attention! This warning means minor physical injury or minor material damage may occur, if an operation is not properly performed.
 Important	Important! This warning means special attention should be paid to a certain operation.

Warnings titled by “attention” might also lead to severe consequence in different cases. Therefore it is strongly recommended that anything titled by “attention” should be handled with extreme caution.

- Please read the manual and the files attached carefully and master all the required knowledge about the robot and the safety instructions before use.
- A cover or safety shield is taken out only for the purpose of illustration. Please ensure to restore the cover or safety shield before any operation.
- The figures and photos contained in this manual are for the purpose of illustration only and they might be different from the product purchased.
- The manual is subject to change without prior notice for the purpose of product improvement, specification change and instruction update.
- The manual will be reissued and a new version number will be specified if the contents are renewed.

- Contact the service department with the information printed on the back cover to purchase a new manual if the present one is damaged or lost.
- CMA is not responsible for any consequence caused by any unauthorized modification or change of the robot.

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Chapter One Safety

1.1 Application guide

According to the relevant national and local laws, regulations and regulations, safety is the most basic concern when using industrial systems including robots. In the accidents of personal injury and property loss caused by the use of robots, the factories using robots are responsible. Therefore, in addition to understanding this manual and its related materials, we must understand all relevant health and safety regulations and standards, and be sure to comply with them.

This manual introduces the connection and using method of explosion-proof electric cabinet of spraying robot GR series. Before any operation, be sure to read and fully understand the relevant contents of this manual and safety manual, and strictly abide by all safety regulations. As a general rule, the safety related information recorded in this manual does not cover all aspects of robot application system. Therefore, when using the robot, we should take necessary safety measures according to the actual situation of the system and its application environment, and strictly abide by them.

This manual introduces the necessary information for the correct use of explosion-proof electric cabinet. See the following for the specific contents, which shall be read by qualified technical personnel. In order to install and use the equipment safely and reliably, first of all, it is required to carry out correct safety training according to the manual, and only distribute the document to qualified personnel with necessary relevant knowledge and understanding of correct operation methods. Before you read and fully understand this manual, please be careful not to carry out any operation. The company will not be responsible for any accident or injury caused by following only one part of this manual.

The product corresponding to the manual has no fault in the initial state when it leaves the factory, and has all safety configurations after debugging. In order to maintain the normal and safe operation of the robot, it must be operated according to the method specified by the manufacturer. The normal and safe operation of robot requires reasonable transportation, correct storage and careful operation. The manual can be scheduled for individual delivery, but it is still part of the product delivery. If you have any other questions, please contact the relevant after-sales personnel of CMA (Wuhu) Robotics Technology Co., Ltd.

1.2 Introduction to some symbols

Before installation and connection, please read this manual and other attached documents, and carry out relevant operation after fully mastering equipment knowledge, safety information and all precautions. In this manual, special attention should be paid to the following symbols. In order to ensure the correct and safe installation, connection and use of explosion-proof cabinet products, and prevent production accidents, personal injury and property loss, please follow the information expressed by the following symbols.

 Danger	Danger! This warning means death might occur, if an operation is not properly performed.
 Caution	Caution! This warning means death or server physical injury might occur, if an operation is not properly performed.
 Attention	Attention! This warning means minor physical injury or minor material damage may occur, if an operation is not properly performed.
 Important	Important! This warning means special attention should be paid to a certain operation.

In addition, this manual only gives the explanation of some particularly important symbols and corresponding icons. There may be some symbols or icons not marked in this manual at the operation site. Therefore, in the use of this manual for related work, it also needs to refer to the actual working environment and operation situation.

In order to ensure the safety of each work, please read and fully understand the safety manual and some safety illustrations in relevant laws, regulations and related materials. Meanwhile please take appropriate safety measures for each work so as to maintain the safety of yourself and your colleagues. In case of emergency, if properly handled, the injury can be greatly reduced.

1.3 Precautions in installation and connection

For all operations of explosion-proof cabinet installation and connection, please strictly abide by the following items, and refer to the requirements of relevant domestic and international standards (GB 11291.1-2011 / ISO10218-1:2006).

1. Please read and understand all manuals, specifications and other relevant documents provided by CMA before operation. At the same time, confirm that all safety measures are in place and effective.
2. During operation, in order to prevent metal parts such as explosion-proof cabinet or peripheral equipment from bumping and stabbing, the personnel participating in operation shall take the following protective measures:
 - (1) Wear work clothes and gloves suitable for operation action and operation content. Take off your hands when working with rotating parts

- (2) Wear safety shoes, which should have insulation, built-in metal cover and other functions.
- (3) Wear safety helmet. The helmet should be breathable, firm and comfortable to ensure long-time operation. During operation, avoid unnecessary safety risks caused by taking off the helmet due to air tightness and other reasons.
3. Only inert gas or industrial compressed air (clean and dry) can be used as the input gas of explosion-proof cabinet. Since the material of the external material is uncertain, the filter must be used.
4. The set pressure of the pressure reducing valve in the explosion-proof cabinet shall not exceed 0.05 ~ 0.07mbar.



Caution

The components configuration and wiring of the explosion-proof cabinet are set by the manufacturer and cannot be replaced at will; The company will not be responsible for the related accidents and property losses caused by dismantling or replacing without permission.

1.4 Claim of responsibility

The damage of explosion-proof equipment caused by any one or more of the following reasons is not within the scope of responsibility and warranty:

1. Wrong use of booster cabinet;
2. Improper installation and maintenance of booster cabinet;
3. Use defective safety device or unstable and unqualified safety device on booster cabinet;
4. Privately handle the pressure cabinet or its components;
5. Transportation, storage, installation, use or maintenance without following the instructions in this manual;
6. Unauthorized modification of individual parts or the whole system;
7. Improper maintenance or other human negligence;

Chapter Two structure and principle of explosion proof cabinet

2.1 Overview

Our spraying robot adopts internal pressurized explosion-proof type, and carries out explosion-proof design for spraying robot. In order to ensure safe use and operation, the following instructions must be strictly observed.

2.1.1 Appearance of explosion proof cabinet

The external structure and layout of the explosion-proof cabinet are shown in the figure below:

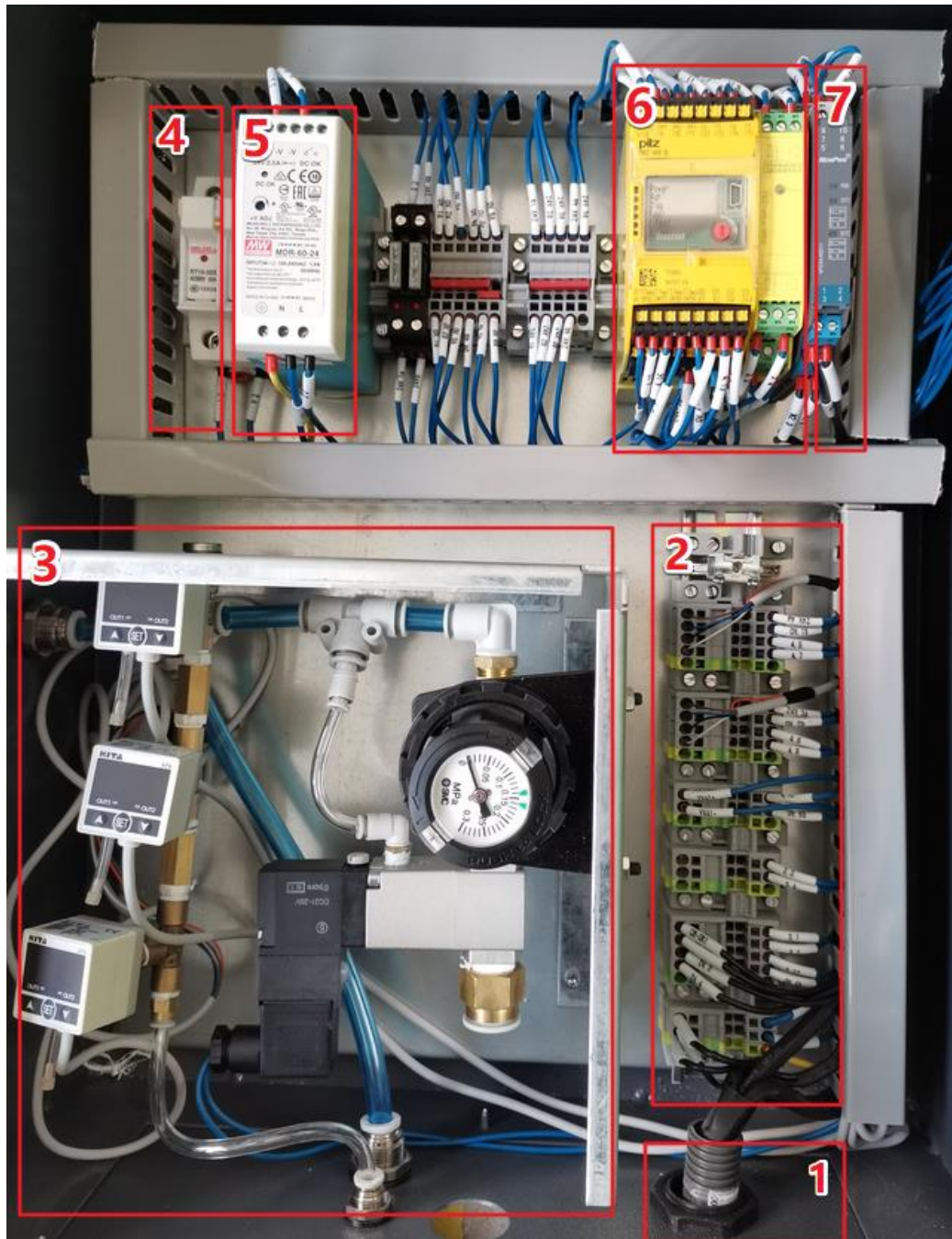


1. Power on switch of explosion-proof cabinet, power on explosion-proof cabinet through knob;
2. Indicator light of explosion proof cabinet switch;
3. Start button of explosion proof cabinet;
4. Explosion proof cabinet constant pressure indicator;
5. Explosion proof cabinet fault indicator light;

2.1.2 Introduction of internal structure of explosion proof cabinet

The internal structure, layout and wiring of explosion-proof electric cabinet are shown in the figure

below:



1. Connector of aviation plug-in cable;
2. Wiring Terminal;
3. Gas path module;
4. Fuse;
5. Power module;
6. Safety PLC + safety relay (Pilz safety PLC + Phoenix safety relay);
7. Explosion proof barrier;

2.2 Installation and connection of explosion proof cabinet

When installing and connecting the explosion-proof cabinet, please pay attention to the following matters:

1. During the operation, the ambient temperature should be between 0 °C and 40 °C with 95% no condensation at constant temperature;
2. During handling and maintenance, it should be - 10 to 55 °C and 95% no condensation at constant temperature;
3. Humidity must be lower than dew point (relative humidity below 10%);
4. Places with less dust, powder, lampblack and water;
5. Inflammables, corrosive liquids and gases are not allowed in the operation area;
6. Places with low vibration or impact energy to explosion-proof cabinet (vibration below 0.5g);
7. There is no potential risk of collision with mobile equipment (such as forklift);
8. The explosion-proof cabinet shall be installed together with the electric control cabinet in a safe area, within 2m from the electric control cabinet;

2.2.1 Connection of aviation plug- in cable in explosion proof cabinet

When the robot is delivered, the aviation plug-in cable and explosion-proof cabinet are delivered separately, so the electrical personnel are required to correctly connect the aviation plug-in cable with the wiring terminal in the explosion-proof cabinet.

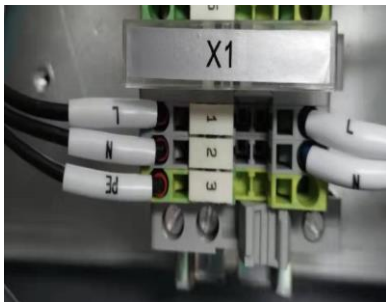
There are three bundles (11 wires) of aviation plug-in wiring: bundle A is the power line of explosion-proof cabinet; B. C two bundle wires are signal transmission lines, and the actual diagram is as follows:



1、Connection of bundle A

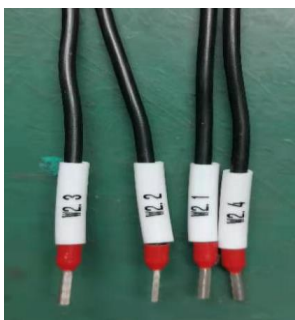


- ◆ Bundle A is the power line of explosion-proof cabinet;
- ◆ It includes three wires: L, N, PE;
- ◆ Connected to X1 terminal block of explosion-proof cabinet;



- ◆ Line L connects 1 IN on the left side of X1 wiring terminal;
- ◆ Line N connects 2 IN on the left side of X1 wiring terminal;
- ◆ Line PE connect 3 IN on the left side of X1 wiring terminal;

2、Connection of Bundle B



- ◆ Bundle B is the signal line of flow meter;
- ◆ It includes four lines: W2.1 ~ W2.4;
- ◆ Connect with the explosion-proof barrier in the cabinet;



- ◆ Wire w2.1 is connected to terminal 1 of explosion-proof barrier;
- ◆ Wire w2.2 is connected to terminal 2 of explosion-proof barrier;
- ◆ Wire w2.3 is connected to terminal 3 of explosion-proof barrier;
- ◆ Wire w2.4 is connected to terminal 4 of explosion-proof barrier



- ◆ Bundle B line is solenoid valve switch and signal feedback line;
- ◆ It includes three wires: 24. 3, 24. 4, CR-OK and CR-OK2;
- ◆ Connected to X2 terminal block;

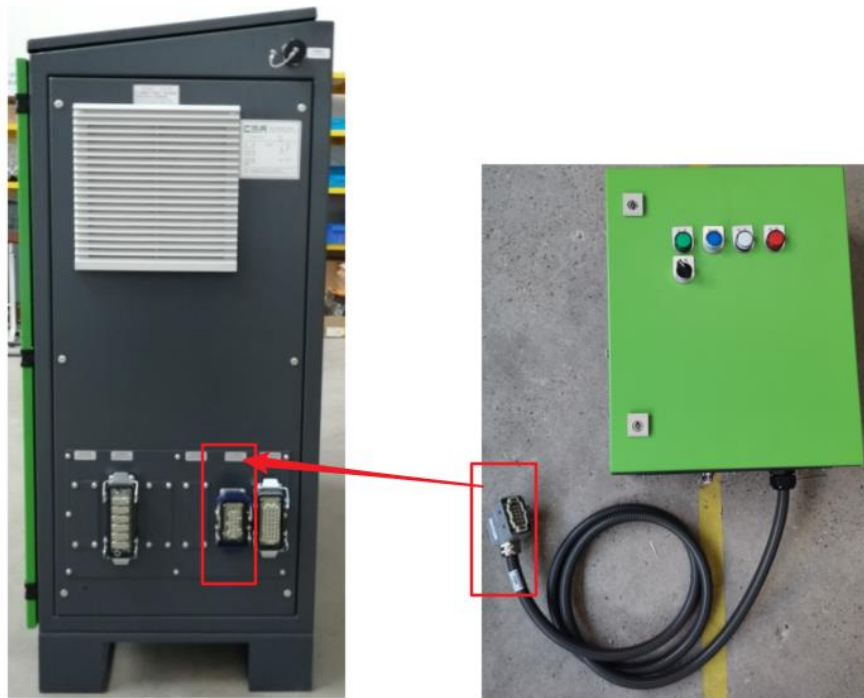


- ◆ Line CR-OK1 connects 1 IN on the left side of X2 wiring terminal;
- ◆ Line CR-OK2 connects 2 IN on the left side of X2 wiring terminal;
- ◆ Line 24.3 connects 3 IN on the left side of X2 wiring terminal;
- ◆ Line 24.4 connects 4 IN on the left side of X2 wiring terminal;

3、Connection of Bundle C

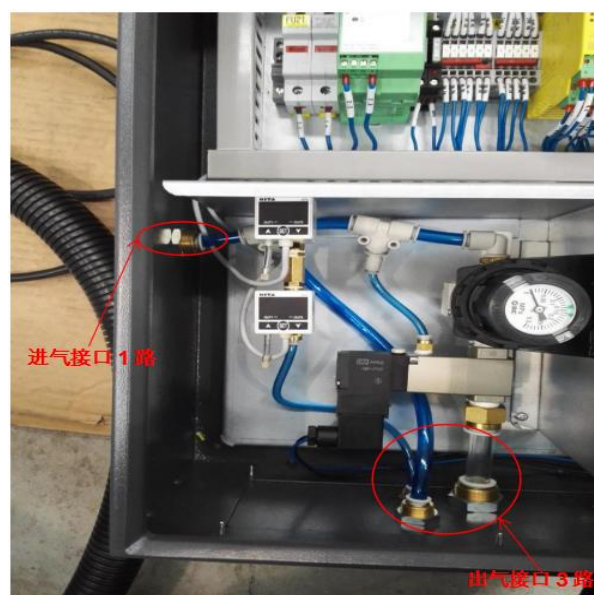
2.2.2 Connection of explosion proof aviation plug- in cable

The explosion-proof cabinet and the electric control cabinet are connected by aviation plug-in cable. After the explosion-proof cabinet is installed and fixed at the customer's site, the explosion-proof aviation plug-in cable can be connected to the reserved aviation plug-in interface of the electric control cabinet. The details are as follows:



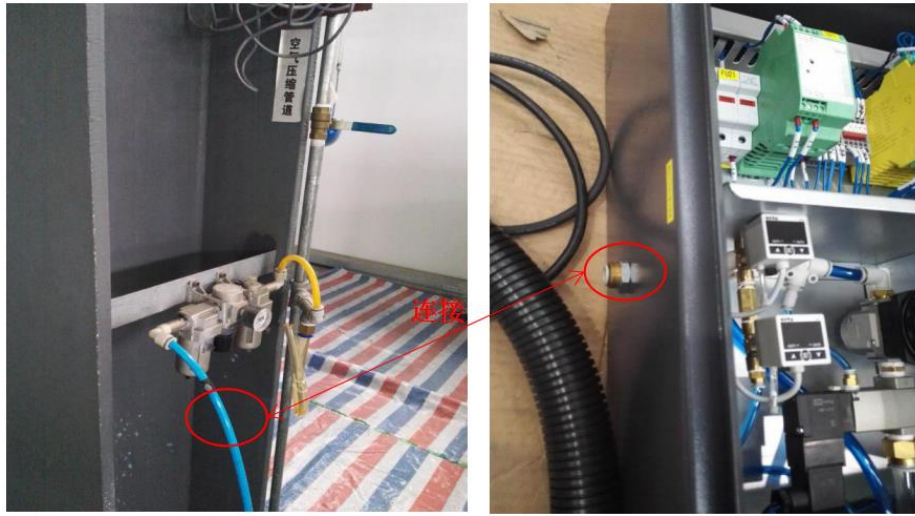
2.3 Gas circuit connection of explosion proof cabinet

The gas circuit connection of explosion-proof cabinet includes two parts: the first part is the main air inlet interface (connected with the gas supply pipeline), and the second part is the air outlet interface (connected with the robot body). The real object is shown in the figure below:



Channel 1 of air inlet port is mainly connected with clean air compression pipe, and the diameter of the

pipe is 10 mm, as shown in the figure below.



Attention

Before the main gas path is connected to the explosion-proof cabinet, it must be filtered, dried and lubricated by the triplet.

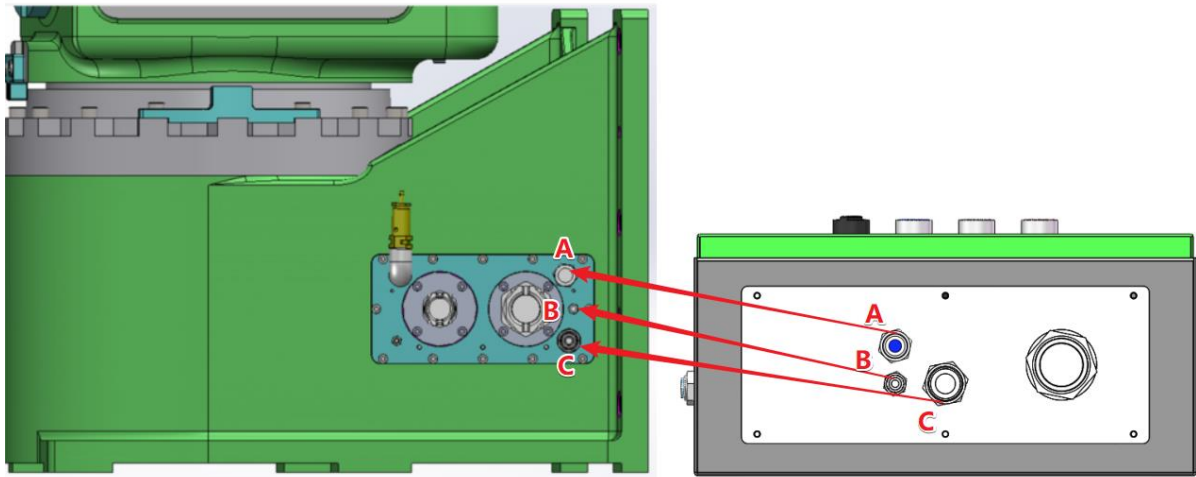
Channel 3 of air outlet port of the explosion-proof cabinet is located under the explosion-proof cabinet and connected with the three gas pipe ports reserved on the robot body. The diameters are 6 mm, 10 mm and 16 mm respectively, and the size is easy to distinguish.

Among them: A is connected with a 10 mm gas pipe port, which is used to provide high-pressure gas for peripheral spray gun with a pressure of 5 ~ 6 bar

B connect the 6mm air pipe port for chamber pressure detection, with the pressure of 0.6 ~ 0.7bar

C is connected with 16mm air pipe port for purging and air intaking, with pressure of 0.6 ~ 0.7bar

The specific connection is shown in the figure below:



Chapter Three Operation procedures of explosion-proof electric cabinet

This chapter describes the using steps and operation methods of our explosion-proof electric cabinet. See the following for details. Before you read and fully understand this manual, please be careful not to carry out any operation. The company will not be responsible for any accident or injury caused by following only a certain part of this manual.

3.1 The starting method of explosion-proof cabinet is as follows



Step one:

Rotate the main switch of the electric control cabinet of the robot to ON position.



Step 2:

Turn on the power knob 1 of the explosion-proof cabinet to power on the explosion-proof cabinet;



Step 3:

Observe whether the switch light of explosion-proof cabinet is on

(the normal state is that the switch light is green.);

**Step 4:**

Press the start button,

At this time, the blue light of the start button is always on

Start to inflate the robot body;

**Step 5:**

Open the electric cabinet door and observe the internal gas circuit condition of the explosion-proof cabinet.

Observe the pressure value of the pressure reducing valve, which is between 0.06~0.07Mpa MPa under normal conditions;

Observe pressure digital change on the digital display pressure gauge. It should continue to rise, pressure reducing valve pressure value;

When two OUT light of safety barrier are on around 1 minute, close the explosion-proof cabinet door and observe that the blue light of the start button should flash normally.

**Step 6:**

When the cleaning is finished, start button of the blue light stops flashing.

The constant voltage lamp is always on, and the explosion-proof function starts and works normally



Attention

When the explosion-proof function fails, the red fault light is always on!

**Caution**

Components and related wiring in explosion-proof cabinet shall not be replaced or changed without permission!

Chapter Four Troubleshooting of explosion proof cabinet

4.1 Troubleshooting of explosion proof cabinet

This section introduces some common faults and corresponding troubleshooting methods in the use of explosion-proof cabinet. In case of any failure not mentioned in this manual, please contact our after-sales service personnel or professional technical personnel in time, and do not repair without permission. Our company will not be responsible for any related accident or property loss.

Fault	Possible reason	Solution	Repair personnel
Booster cabinet does not start	No power supply	Check power supply line	Equipment maintenance personnel
	The fuse core is damaged	Check wiring, replace fusible core	Equipment maintenance personnel
	No gas supply	Check the connection of air supply line	Equipment maintenance personnel
The blue indicator does not light up after the start button is pressed	Insufficient air pressure	Check the air supply line and pressure gauge, and display 0.05-0.07Mpa normally	Equipment maintenance personnel
		Check whether the air pipe is leaking	Equipment maintenance personnel
	Excessive air leakage	Check whether the robot body air leaking	CMA technicians
	Solenoid valve failure	Check delivery valve YV42	CMA technicians

4.2 Troubleshooting examples of explosion proof cabinet

Example 1:

After pressing the start button, the start light is always on and does not flash for a long time, indicating that the

First: open the cabinet door and observe whether the value of pressure valve and digital display pressure gauge is correct.

If it is not right, adjust the pressure valve to make the intake pressure around 0.05 ~ 0.07MPa.

Secondly: observe the safety barrier indicator light in the explosion-proof cabinet, and check whether the three lights are on.

If the PWR light is not on, it shows the wiring is not correct, and

timing cleaning
cannot be started.

professional and technical personnel are required for maintenance.

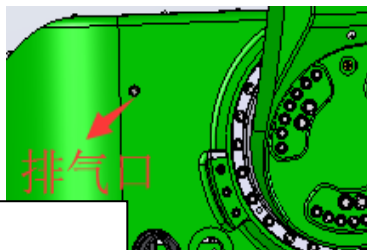
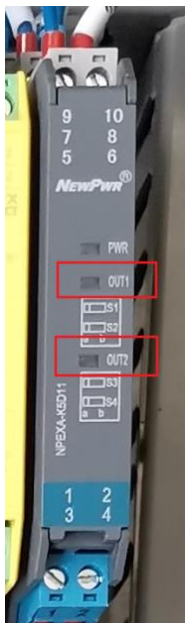
If the OUT1 and OUT2 lights are not on, the timing is not started, and the robot body needs to be checked for air leakage. If there is obvious air leakage, it needs to be sealed.

Example 2:

OUT1 and OUT2 lights
are not on.

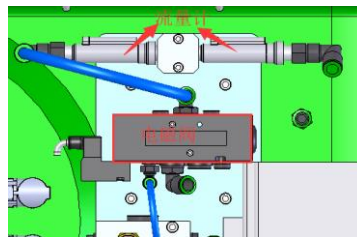
And the body has no
obvious air leakage.

First, check whether the exhaust port of the body is blocked. When cleaning, a large amount of gas should be discharged from the exhaust port. If no gas is discharged, it means that the solenoid valve is not opened or the internal air pipe is not connected properly.



exhaust port

Secondly, if a large amount of gas is discharged from the exhaust port, but the OUT1 and OUT2 lights are not on, or only one light is on, it may be that the flowmeter is wrongly installed and wired or the flowmeter is damaged, so the swivel cover needs to be opened for inspection.





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