



## **Installation and Connection Instruction Manual for GR Painting Robot Series.**

Version No. : ZL-GR6150-001-V1

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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.

## Copyright and Brand name

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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.

|                                                                                                         |                                                                                                                                           |
|---------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| <br><b>Danger</b>      | <b>Danger! This warning means death might occur, if an operation is not properly performed.</b>                                           |
| <br><b>Caution</b>     | <b>Caution! This warning means death or severe physical injury might occur, if an operation is not properly performed.</b>                |
| <br><b>Attention</b>  | <b>Attention! This warning means minor physical injury or minor material damage may occur, if an operation is not properly performed.</b> |
| <br><b>Important</b> | <b>Important! This warning means special attention should be paid to a certain operation.</b>                                             |

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.

## Contents

|                                                                            |    |
|----------------------------------------------------------------------------|----|
| Chapter One Safety .....                                                   | 1  |
| 1.1 Application guide .....                                                | 1  |
| 1.2 Safety precautions .....                                               | 1  |
| Chapter Two Handling and product confirmation .....                        | 2  |
| 2.1 Product packaging and unloading .....                                  | 2  |
| 2.2 Preparation before installation and connection .....                   | 2  |
| 2.3 Installation environment requirements .....                            | 2  |
| 2.4 Product confirmation .....                                             | 3  |
| Chapter Three Installation and connection of robot body .....              | 3  |
| 3.1 Requirements for installation site of body .....                       | 3  |
| 3.2 Robot body handling .....                                              | 4  |
| 3.2.1 Handling precautions .....                                           | 4  |
| 3.2.2 Handling methods .....                                               | 5  |
| 3.3 Fixation of robot body .....                                           | 6  |
| 3.4 Cable connection between robot body and control cabinet .....          | 10 |
| 3.5 Robot wrist end tool installation .....                                | 12 |
| Chapter Four Installation and connection of robot control cabinet .....    | 15 |
| 4.1 Installation requirements of control cabinet .....                     | 15 |
| 4.2 Installation and connection instructions of control cabinet .....      | 17 |
| 4.2.1 Brief introduction of external installation of control cabinet ..... | 17 |
| 4.2.2 Introduction to internal installation of control cabinet .....       | 22 |

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|                                                                                 |    |
|---------------------------------------------------------------------------------|----|
| 4.3 Daily maintenance .....                                                     | 26 |
| 4.3.1 Replace the fuse .....                                                    | 27 |
| 4.3.2 Replace the drive.....                                                    | 29 |
| 4.4.3 Replace the radiator fan .....                                            | 31 |
| 4.3.4 Replace the cooling fan of the drive .....                                | 32 |
| 4.3.5 Check and replace the dust filter.....                                    | 33 |
| Chapter Five Installation and connection of robot explosion proof cabinet ..... | 35 |
| 5.1 Precautions for robot explosion protection .....                            | 35 |
| 5.2 Introduction of explosion proof electric cabinet.....                       | 35 |
| 5.3 Cable and gas circuit connection of explosion proof cabinet .....           | 37 |
| 5.3.1 Explosion proof cable connection.....                                     | 37 |
| 5.3.2 Gas circuit connection of explosion proof cabinet .....                   | 38 |



## 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 installation and connection operation of our GR6150 spraying robot. Before the installation and operation of the equipment, please 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. 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. If you have any other questions, please contact the relevant after-sales personnel of CMA (WUHU) Robotics Company Limited

### 1.2 Safety precautions

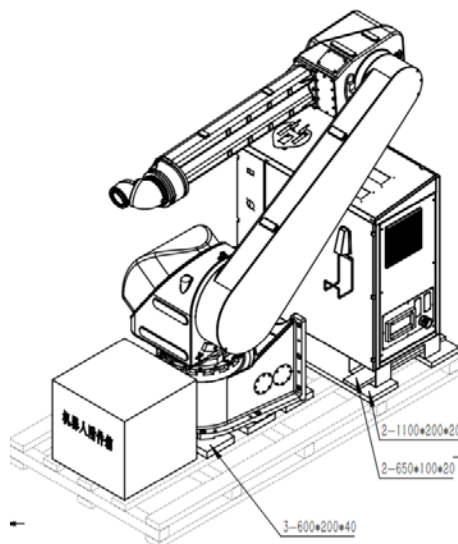
For all operations of installation and connection, please strictly observe the following:

- Before transporting the robot, clean the passage to the installation position and remove all unnecessary objects.
- Only people with forklift and crane operation qualification are allowed to move / transport robots, control cabinets, walking axis, etc.
- During transportation, never approach or walk under the lifting robot, control cabinet, walking axis and related equipment.
- Do not stay on the robot arm, control cabinet and walking axis during transportation, and do not touch or support them manually.
- The lifting robot is to hook the wire rope to the lifting ring and make sure that the ring is not loose.
- As the robot is composed of precise components, please protect the robot from collision and impact during transportation

## Chapter Two Handling and product confirmation

### 2.1 Product packaging and unloading

GR6150 robot is packed with wooden pallet. The control cabinet, explosion-proof cabinet and accessory box of the robot are all placed on a complete wooden pallet and protected by vacuum moisture-proof tin foil bag. When loading and unloading, the forklift is used to lift and load on the transport vehicle or unload from the transport vehicle. The transport package is shown in the figure below:



### 2.2 Preparation before installation and connection

Before installing the robot, the following inspection items must also be carried out:

- Before moving the robot, please check the stability of the robot.
- Visually check the robot for obvious damage and make sure it is not damaged.
- Ensure that the lifting device used is suitable for handling the specified robot weight.
- If the robot is not installed directly, it must be stored according to the robot storage environment requirements.
- Ensure that the expected operating environment of the robot meets the requirements of the robot operating environment.
- Before transporting the robot to its installation site, please ensure that the site meets the ground installation requirements.

### 2.3 Installation environment requirements

Before installing the control cabinet and the robot body, the storage environment and working environment of the robot must meet the following conditions:

- ☐ The working environment temperature of the robot should be between 0 °C and 40 °C;
- ☐ The temperature of robot storage environment should be between - 10 °C and 55 °C;
- ☐ The humidity of robot storage environment must be lower than dew point (relative humidity below 10%);
- ☐ The vibration of robot mounting base should be less than 0.5g;
- ☐ There should be no large electrical noise source (such as welding equipment, etc.) near the robot;
- ☐ The robot body has explosion-proof protection and can be installed in the dangerous

spraying environment;

- ☐ The robot control cabinet does not have explosion-proof function and must be installed in a safe environment isolated from the dangerous area;
- ☐ The installation position of the control cabinet should be able to see the movement of the robot body clearly;
- ☐ The robot and the control cabinet are made up of precision parts. Do not collide in the process of handling.

## 2.4 Product confirmation

GR6150 spraying robot standard model delivery list is as follows:

| GR6150 robot packing list |                                                       |                                                                                                                                                                                                                                          |              |       |                  |
|---------------------------|-------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|-------|------------------|
| Sequ<br>ence              | name                                                  | Configuration type                                                                                                                                                                                                                       | quantit<br>y | unit  | remark           |
| 1                         | Robot body                                            | Standard configuration                                                                                                                                                                                                                   | 1            | Set   |                  |
| 2                         | Robot control cabinet                                 | Standard configuration                                                                                                                                                                                                                   | 1            | Set   |                  |
| 3                         | Explosion proof cabinet                               | Standard configuration                                                                                                                                                                                                                   | 1            | Set   |                  |
| 4                         | Cable connecting robot body with control cabinet      | Encoder line                                                                                                                                                                                                                             | 1            | Set   |                  |
| 5                         |                                                       | Power line                                                                                                                                                                                                                               | 1            | set   |                  |
| 6                         |                                                       | Ground line                                                                                                                                                                                                                              | 1            | Piece |                  |
| 7                         | air pipe connecting body with explosion proof cabinet | φ6                                                                                                                                                                                                                                       | 1            | Piece |                  |
| 8                         |                                                       | φ10                                                                                                                                                                                                                                      | 1            | Piece |                  |
| 9                         |                                                       | φ16                                                                                                                                                                                                                                      | 1            | Piece |                  |
| 10                        | Teach pendant and cable                               | Standard configuration                                                                                                                                                                                                                   | 1            | Set   |                  |
| 11                        | Robot pin                                             | Standard configuration                                                                                                                                                                                                                   | 1            | Set   |                  |
| 12                        | Instruction manual                                    | Standard configuration                                                                                                                                                                                                                   | 1            | Set   | E-version        |
| 13                        | Factory inspection report                             | Enterprise standard                                                                                                                                                                                                                      | 1            | Piece |                  |
| 14                        | Product certificate                                   | Enterprise standard                                                                                                                                                                                                                      | 1            | Cocy  |                  |
| 15                        | Robot accessories                                     | Accessory box                                                                                                                                                                                                                            | 1            | Piece |                  |
| 16                        | 380V main power aviation plug in socket               | Standard configuration                                                                                                                                                                                                                   | 1            | Set   | In accessory box |
| 17                        | Zero point bolt                                       | Standard configuration                                                                                                                                                                                                                   | 1            | Piece | In accessory box |
| 18                        | Others                                                | The color of the body is green; Fuse (in robot control cabinet: 5A, 10A glass tube fuse 2 each; 2A glass tube fuse 5; 2A, 32A fusible core (2 each); An electrical schematic diagram and three spare aviation plug sockets are attached. |              |       |                  |

Note: the above is the standard configuration list, excluding the customized model, which is subject to the actual GR6150 robot packing list.

## Chapter Three Installation and connection of robot body

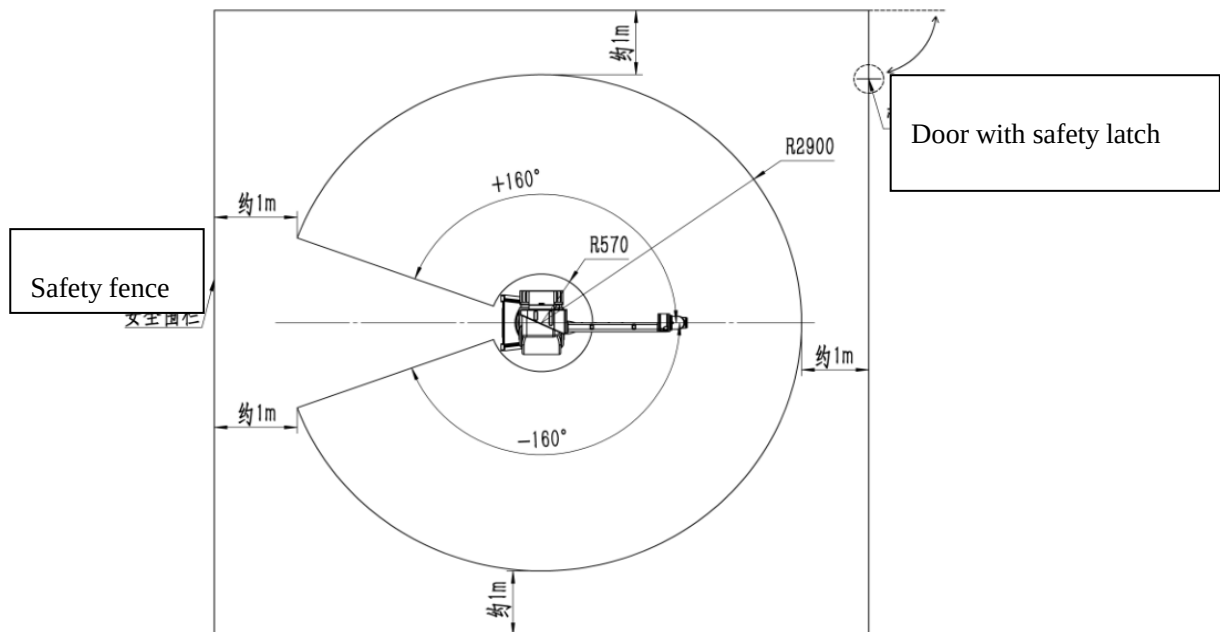
### 3.1 Requirements for installation site of body

GR6150 robot body is equipped with explosion-proof function as standard, and its body can be installed

to work in the environment with explosion risk. Please refer to the explosion-proof certification mark for details.

When installing the robot body, please install it at the position meeting the following conditions:

- The working area of robot body should be protected by safety fence, and the entrance and exit of safety fence should be equipped with safety lock



- The flatness of the robot installation plane should be within 0.5mm;
- Ensure that the installation foundation and bracket have enough rigidity;
- GB 50040-1996 code for design of power machine foundation.

## 3.2 Robot body handling

### 3.2.1 Handling precautions

The following contents are the precautions in robot handling operation. Please fully understand the following contents before safe operation:

|                                                                                                |                                                                                                                                                                                                                                                                                                                         |
|------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <br>Attention | <p>The handling of robots and control devices must be carried out by qualified personnel for hook, lifting operation, forklift, etc. If the operators do not master the correct skills to carry out the operation, it may lead to overturning, falling and other accidents.</p>                                         |
| <br>Attention | <p>When handling the robot and control device, please confirm the weight and steps according to the method recorded in the manual. If the operation cannot be carried out according to the specified method, the robot and control device may overturn or fall during the handling process, resulting in accidents.</p> |
| <br>Attention | <p>When handling and installing, pay attention to avoid damaging the wiring. In addition, after the assembly of the device, protective measures such as covering with protective cover should be taken to avoid damage to wiring by operators and forklifts.</p>                                                        |

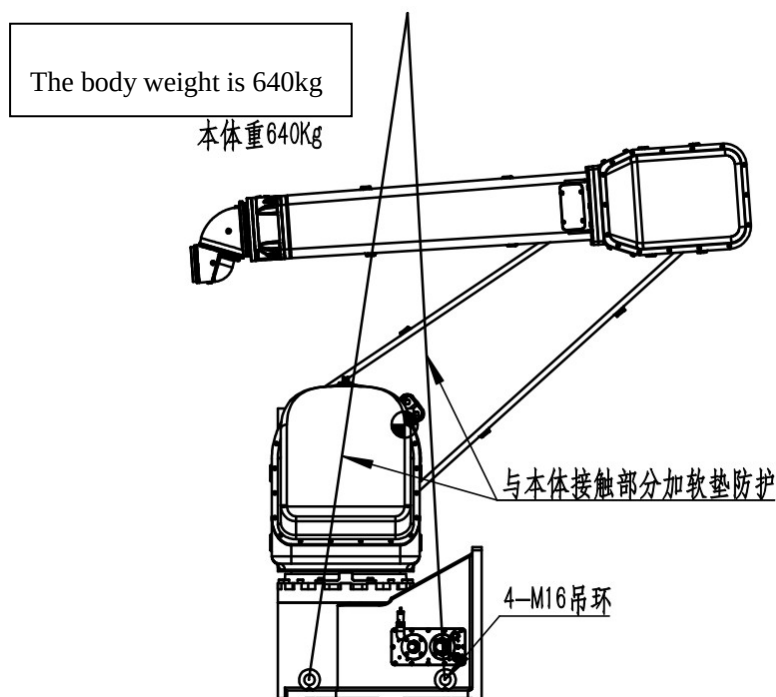
### 3.2.2 Handling methods

When handling robot, the angle of each axis of handling attitude is set as follows:

| Position      | 1 axis | 2 axis | 3 axis | 4 axis | 5 axis | 6 axis |
|---------------|--------|--------|--------|--------|--------|--------|
| Joint angle/° | 0      | +52    | -56    | 0      | 0      | 0      |

#### (1) Handling method 1:

Install 4 M10 lifting ring screws on the main frame and lift it with four steel cables. It is suggested that the length of the steel cable should not be less than 3m, and rubber hose should be put on the contact part between the steel cable and the main body of the robot for protection.



Cushion protection is added to the contact part with the body.

4-M10 lifting ring

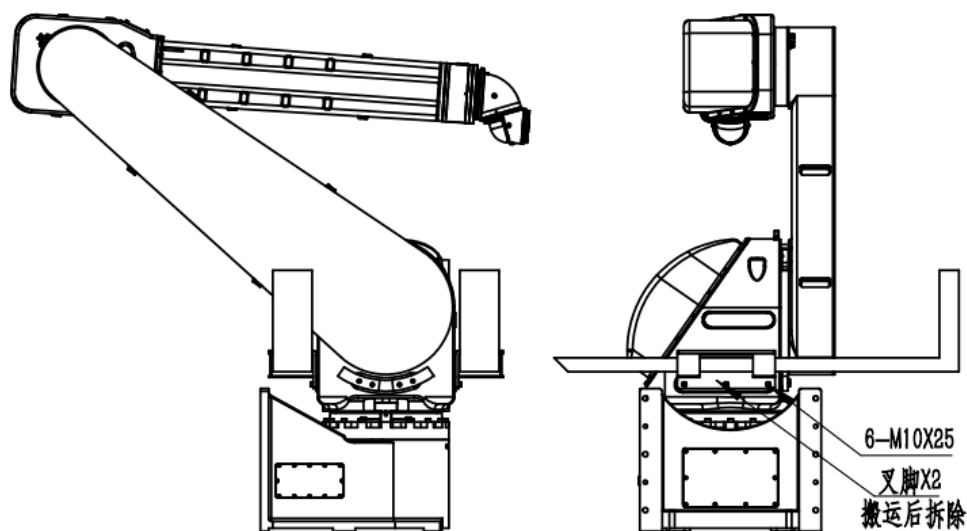


Attention

In the figure above, there are no other devices installed on the terminal actuator and mechanical arm, so please pay more attention once other devices are installed.

## (2) Handling method 2:

Use forklift for handling.



Removal of fork X2  
after handling



Attention

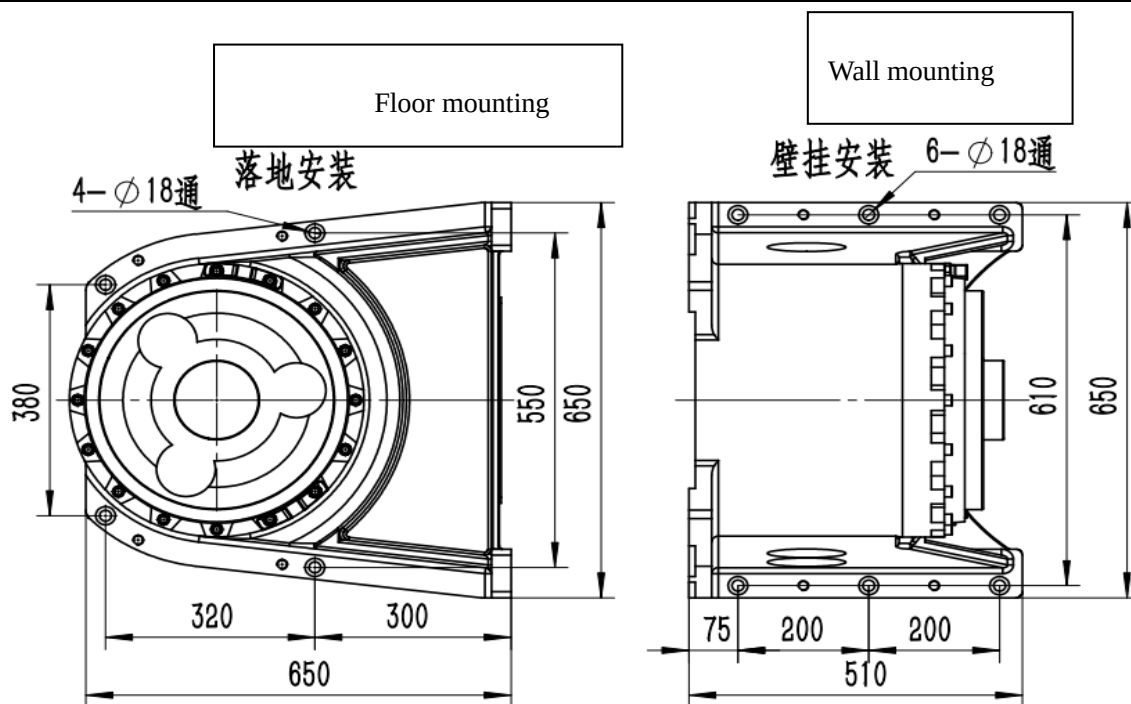
When handling, please install and use the fixed fixture!

When using other handling methods instead of crown block and forklift, please pay attention to that the robot arm and motor cannot be subjected to external force!

After unpacking and installing, always remove the handling fixture and rubber pad!  
The fixed fixture is needed for future robot handling. Please keep it properly!

## 3.3 Fixation of robot body

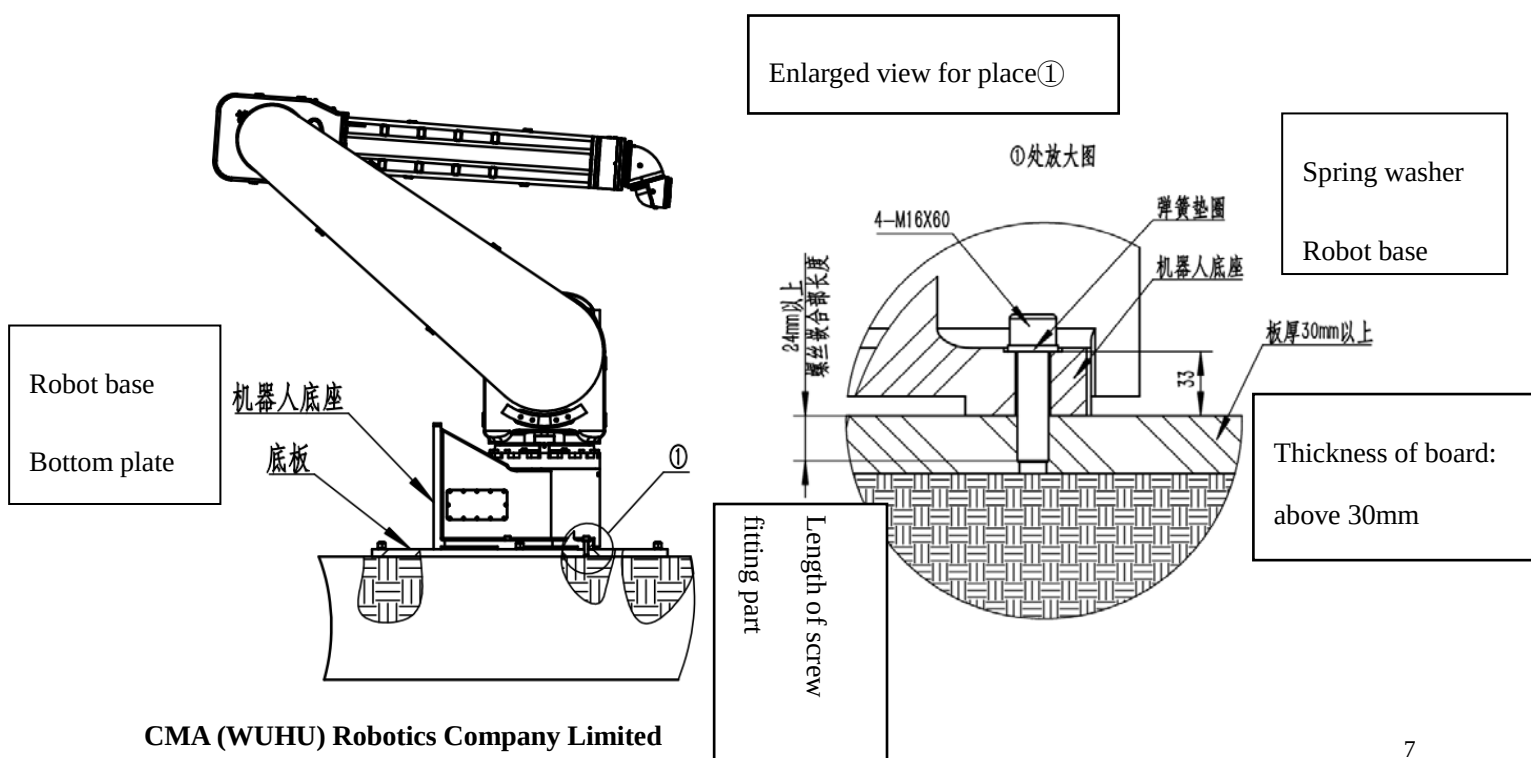
In order to maintain the best function of the robot in normal operation, the fixation and foundation (or mounting platform) of the robot base must be able to bear the self- weight of the robot with its fixture and the reaction force during acceleration and deceleration. When the flatness of the robot mounting surface is not good, the robot may be deformed or damaged. Please ensure that the flatness of the robot mounting surface is less than 0.5mm.

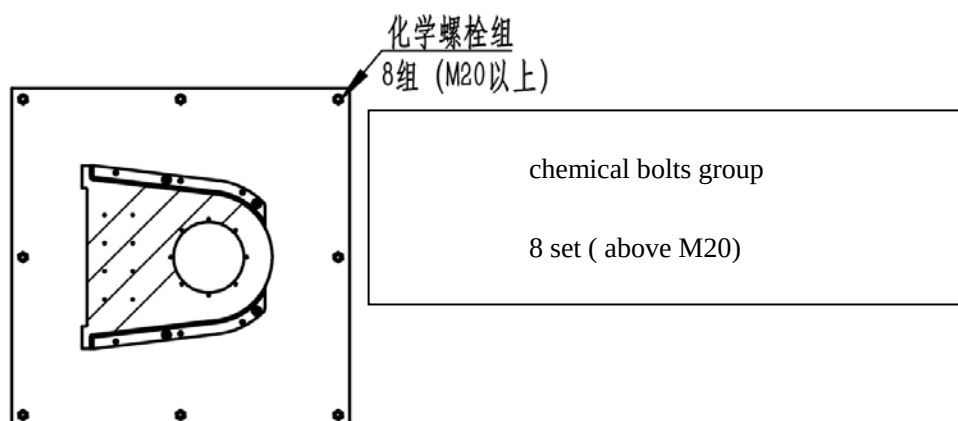


Size of robot base

**(1) Floor mounting**

First fix the bottom plate on the ground. We recommend that the thickness of the bottom plate should be more than 30mm, and use 8 chemical bolts above M16 to fix the bottom plate on the ground. The base of the robot is firmly fixed on the base plate through its four mounting holes with M16 socket head screws (the screw length must ensure that the screw length reaches 1.5 times of the nominal diameter of the thread). In order to prevent the socket head screws from loosening during the operation of the equipment, please fully fix and prevent loosening according to the method of "robot installation example" in Figure below.





“Robot installation example”

|                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                     |
|--------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <br><b>Attention</b> | <p><b>Too long or too short screw for fixing robot base will cause bad fixing accident!</b></p> <p><b>The connection strength of chemical bolts depends on the strength of concrete. When the strength of concrete is insufficient, it can be strengthened by the following methods:</b></p> <p><b>Increase the number of chemical bolt group;</b></p> <p><b>Increase the embedded depth of chemical bolts;</b></p> |
|--------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

## (2) Bracket installation

When the height of the bracket is less than 600mm, its fixing mode is similar to the ground installation mode, which is divided into two parts: robot base installation, bracket and ground installation;

When the height of the bracket is more than 600mm, the connection strength between the support and the ground should be strictly checked to ensure that the connection between the support and the ground is safe and reliable;

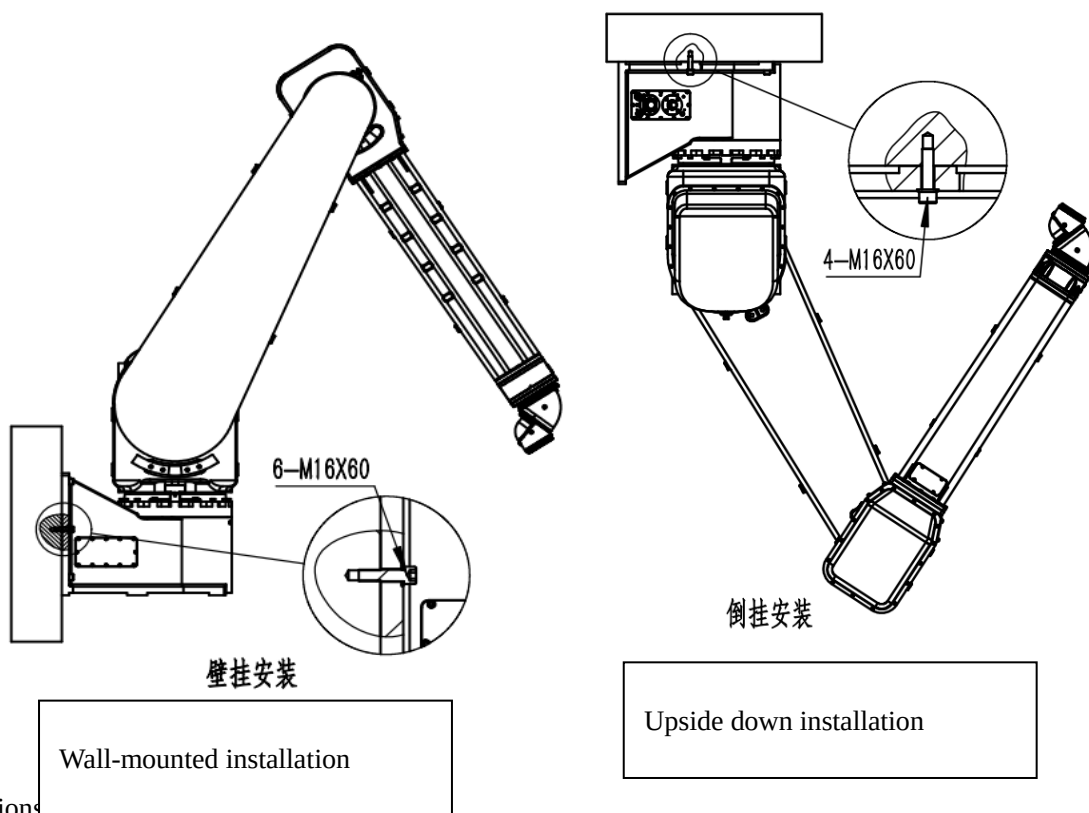
|                                                                                                         |                                                                                                                                                                                                                                                                                                                                     |
|---------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <br><b>Attention</b> | <p><b>Increase the embedded depth of chemical bolts; The specification, quantity and embedded depth of chemical bolt group can be increased appropriately;</b></p> <p><b>To improve the strength of concrete foundation, the strength of concrete foundation is higher than that of corresponding chemical bolt components;</b></p> |
|---------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

## (3) Wall-mounted / upside down installation

In order to ensure safety, the following precautions should be taken during upside down and wall mounted installation:

- (1) Ensure the safety and reliability of the mounting bracket ( mounting wall surface);
- (2) Grade 12.9 strength screws shall be used for connection and the tightening torque of screws shall meet

requirements of the pre-tightening force for screws of this specification



Specifications

|                                            |                                                   |
|--------------------------------------------|---------------------------------------------------|
| Mounting hole                              | 4-φ18 or 6-φ18                                    |
| Fixed component<br>(length is recommended) | M16x60<br>Strength grade: 12.9                    |
| Tightening torque<br>(recommended)         | 318Nm                                             |
| Flatness of mounting surface               | ≤0.5mm                                            |
| Flat pad(recommended)                      | Material S45C, solidity: HRC38-45, thickness: 4mm |

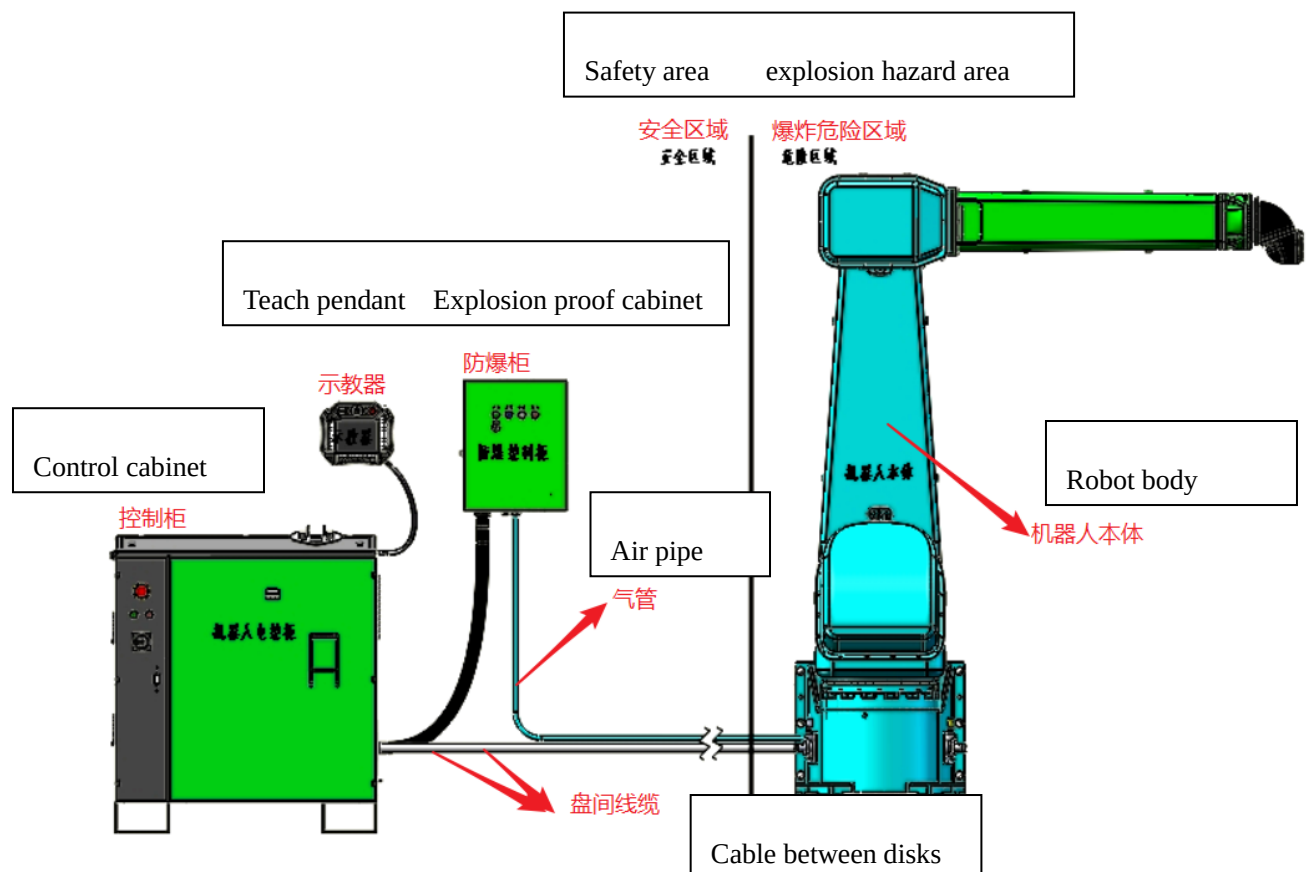


Attention

**Please ensure that the flatness of the mounting plane of the robot base is ≤ 0.5mm, otherwise the robot may be damaged.**

### 3.4 Cable connection between robot body and control cabinet

The cable between the robot body and the control cabinet is mainly composed of two parts, power cable (including brake cable) and encoder cable, each of which is a flexible cable. Therefore, in the layout process, try to avoid cable twisting, winding, etc. At the same time, to avoid the interference of power line to encoder line, the power line cable and encoder line cable are respectively placed in their own independent line slot. The connection is shown in the figure below:

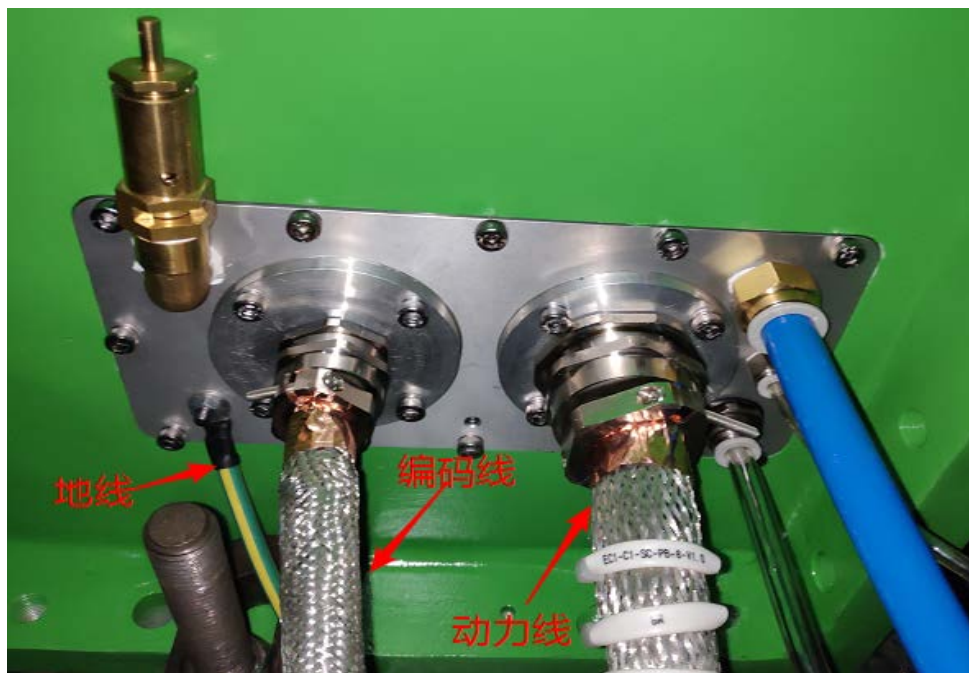


There are two aviation plug-in places on the right side of the robot control cabinet. The figure below shows the physical diagram of power cable (including brake wire) and encoder cable aviation plug-in terminal of robot control cabinet. The left side of the figure is an encoder cable connected with the driver in the control cabinet; The right side of the aviation plug-in line is a power line (including the brake wire), which is connected with the driver power port in the control cabinet. Both of the aviation plug-in wires will be connected with the relevant interfaces under the robot body base.



Plug-in socket of electric control cabinet encoder line

Plug-in socket of electric control cabinet power line



Ground-line

encoder-line

power line

### 3.5 Robot wrist end tool installation

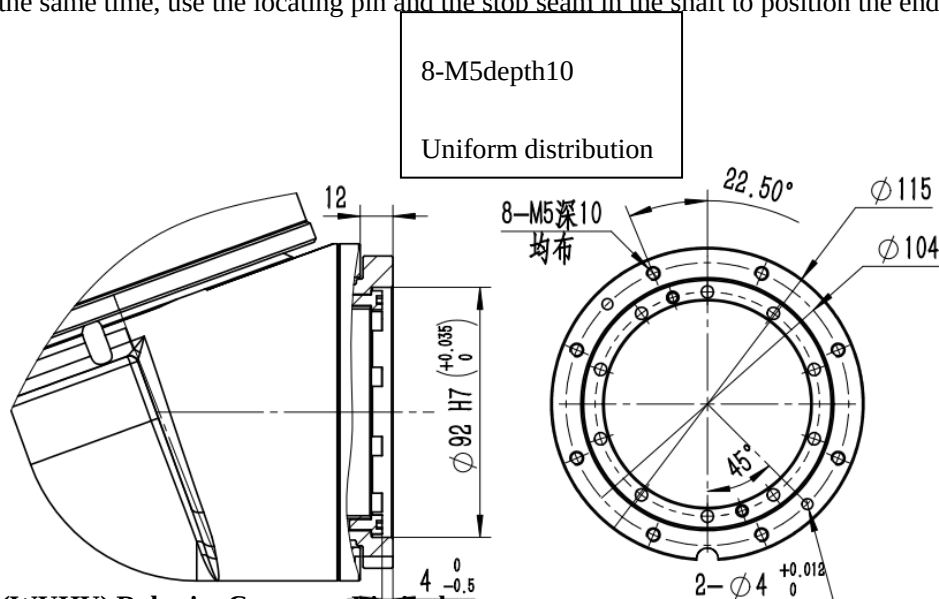


Attention

When installing tools for the robot, it must be confirmed that the power supply of the robot control cabinet and the main power supply have been cut off, and the installation must be carried out according to the relevant installation requirements.

#### 1) Dimension of flange surface for wrist end mounting

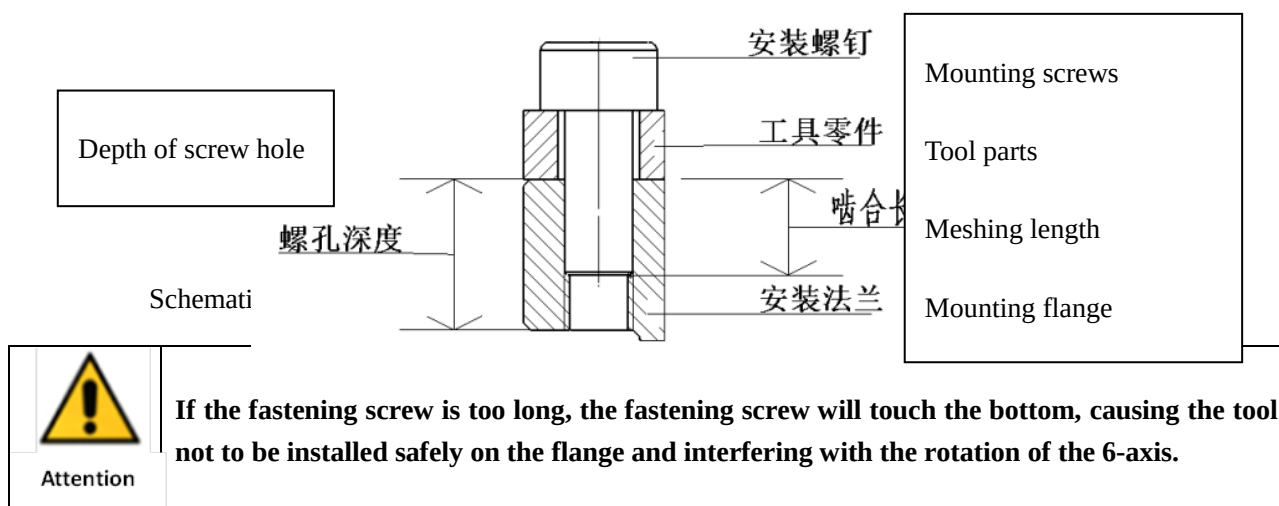
The flange of the mounting tool is at the end of the robot's wrist. The installation interface is shown in the figure below, on the flange  $\phi 104$  threaded hole on the circumference, tighten the fastening screw. At the same time, use the locating pin and the stop seam in the shaft to position the end tool.



## Flange dimensions of end load mounting

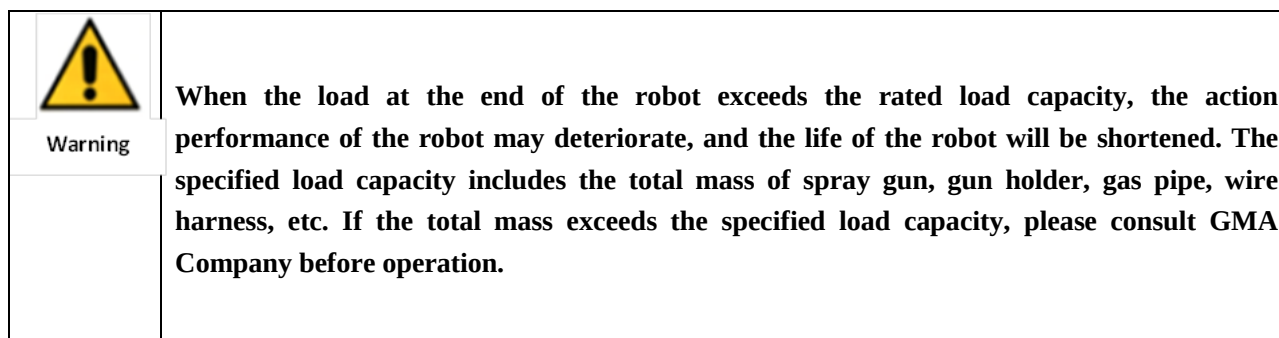
### 2) Description of fixing screw

Please select the length of the fixed screw according to the depth of the screw hole of the mounting flange to ensure the reliable threaded connection, as shown in the figure below. At the same time, tighten the screw in the threaded hole according to the specified torque shown in the appendix "screw tightening torque table".



### 3) Description of fixing screw and load specification for wrist shaft

- (1) The maximum load capacity of the end of the robot includes the total weight of the spray gun, mounting bracket and other devices, and the maximum load of the GR6150 end is 15kg;
- (2) Strictly abide by the robot manual on the robot load weight, each wrist axis (J4, J5, J6) load torque and load inertia limit.

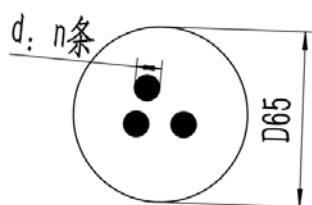


### 4) Load capacity of technology arm

For the load on the process arm, the load mass  $M \leq M_{\max}$ , and the maximum load mass  $M_{\max} = 15\text{kg}$ .

#### 5) Spraying air pipe and wire harness in wrist

(1) The empty diameter in the wrist is  $\phi 65\text{ mm}$ . It is recommended that the plot ratio of the built-in air pipe in the wrist should be less than 25%. Plot ratio is calculated according to the following formula.



$$\text{容积率} = \frac{\frac{d^2}{4} \pi n}{\frac{D^2}{4} \pi} \times 100 [\%]$$

气管截面积    手腕内腔截面积

Plot ratio =

Cross sectional area of air pipe    Cross sectional area of wrist cavity



Attention

1. As calculated above, if the total cross-sectional area of the air pipe exceeds 25% of the cross-sectional area of the wrist inner aperture, the life of the air pipe will be shortened. Even if the plot ratio is less than 25%, the air pipe life will be shortened with the wrist posture angle. Therefore, before starting the operation, please fully check and test all the air pipes and their arrangement.
2. If the plot ratio exceeds 25% or the diameter  $\geq \phi 12$ , before operation, please consult CMA company.

(2) Polyester amine is recommended as the material for the internal air pipe.



Attention

**The use of non- polyester amine air pipe may significantly shorten their life.**

(3) When installing a built-in air pipe in the wrist, be sure to lubricate the whole air pipe, such as Vaseline. Please check the built-in air pipe regularly, and replace it with a new one in case of failure or damage. Inspection cycle: once every 500 hours, air pipe replacement cycle (recommended standard): once every 10000 hours.



Attention

**The above replacement cycle is only a recommended standard, not the life cycle of air pipe.**

## **Chapter Four Installation and connection of robot control cabinet**

This chapter describes the installation and connection of the control cabinet of the spraying robot. The relevant wiring harness and components in the cabinet have been assembled and connected before delivery, and passed the inspection of our quality inspection and process personnel. If you find any problems with the assembly and wiring, please contact the after-sales or the relevant technical personnel of our company in time. It is forbidden to assemble the wiring without permission. Our company will not be responsible for the related accidents caused by this.

### **4.1 Installation requirements of control cabinet**

1. Transportation: moving electric cabinet for long distance needs to use forklift to lift the electric cabinet away from the supporting plate and place it on the ground. The minimum load of forklift is 300kg and the maximum width between forks is 700mm; After being placed on the ground, a small range of movement can be moved and placed to the final position by using a pallet carrier. As shown in the figure below:

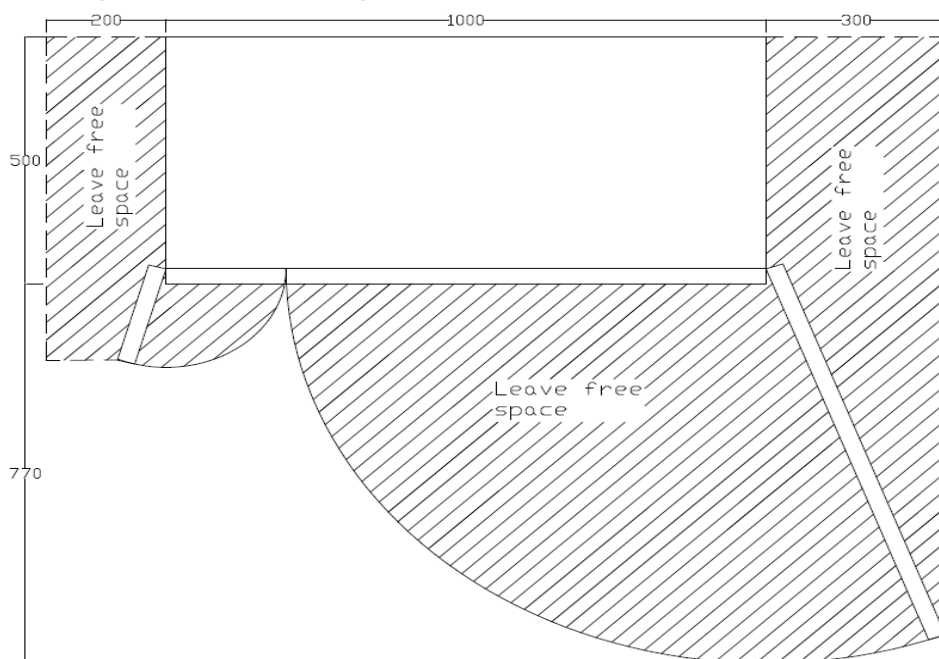


2. The robot control cabinet must be placed in the area with external safety protection measures (for example, it is defined as peripheral protection device), and the cabinet must not be placed outdoors;

3. Do not place any objects in front of the electric cabinet, ensure that there is enough space in front of the electric cabinet, so that the staff can easily touch the operation control panel, and at the same time, it is convenient for the operator to observe the robot when standing in front of the control panel;

4. When the machine is in operation, the door of the electric cabinet must be kept locked, and the key must be kept by professional technicians;

5. When the electric cabinet is fixed in position, the installation area must be kept clean and tidy, marked in the shadow of the figure, as shown in the figure below;



Note:

(1) On the left side of the control cabinet is the air inlet of the fan, and the USB, Ethernet debugging ports and the power supply inlet line aerial plug of the electric cabinet are located on this side.

(2) In front of the control cabinet is the switch door of the electric cabinet, on which there are the switch of the electric cabinet and related buttons. Generally, the switch door of the electric cabinet is not allowed to open. If it is opened, it must also be opened by professional technicians. On the one hand, it is to protect the components, on the other hand, there is strong electricity in the cabinet to protect the personal safety of operators.

(3) The right side of the control cabinet is the air outlet of the cooling fan, which is connected with the encoder cable, power cable and explosion-proof cable of the robot body. The cable aviation plug socket is also located on this side.

## 4.2 Installation and connection instructions of control cabinet

### 4.2.1 Brief introduction of external installation of control cabinet



The figure above shows the main external components of GR6150 robot control cabinet, which are as follows:

- A. Electric cabinet switch (ON-OFF);
- B. Panel button (the maximum button on the upper side is emergency stop button, the red button on the left side is alarm indication, and the white button on the right side is servo power on confirmation);
- C. Ethernet, remote control and USB debugging port;
- D. Teaching box;
- E. Teach pendant interface;

- F. Fan in cabinet;
- G. Coding cable, power cable, explosion-proof cable and other aviation plug-in ports;
- H. The main power supply aviation plug-in port of the electric cabinet and the air inlet of the electric cabinet;

The details are as follows:



Electric cabinet switch and panel button



Installation and layout of relevant components on the left side of electric cabinet



Installation and layout of relevant components on the right side of electric cabinet

Among them, A, B, C, E, F, H and other components have been installed when the cabinet is delivered from the factory. Only the teaching box, coding cable, power cable (including holding brake), explosion-proof cable and power supply aviation plug port of the cabinet need to be installed at the customer's site.

The three-phase four wire system is adopted in the aviation plug port of the power supply of the electric cabinet to improve the safety performance. The safety devices such as transformer and fuse are connected

with the power module in the control cabinet to supply power to the robot body and related components. The specific wiring is shown in the figure below.



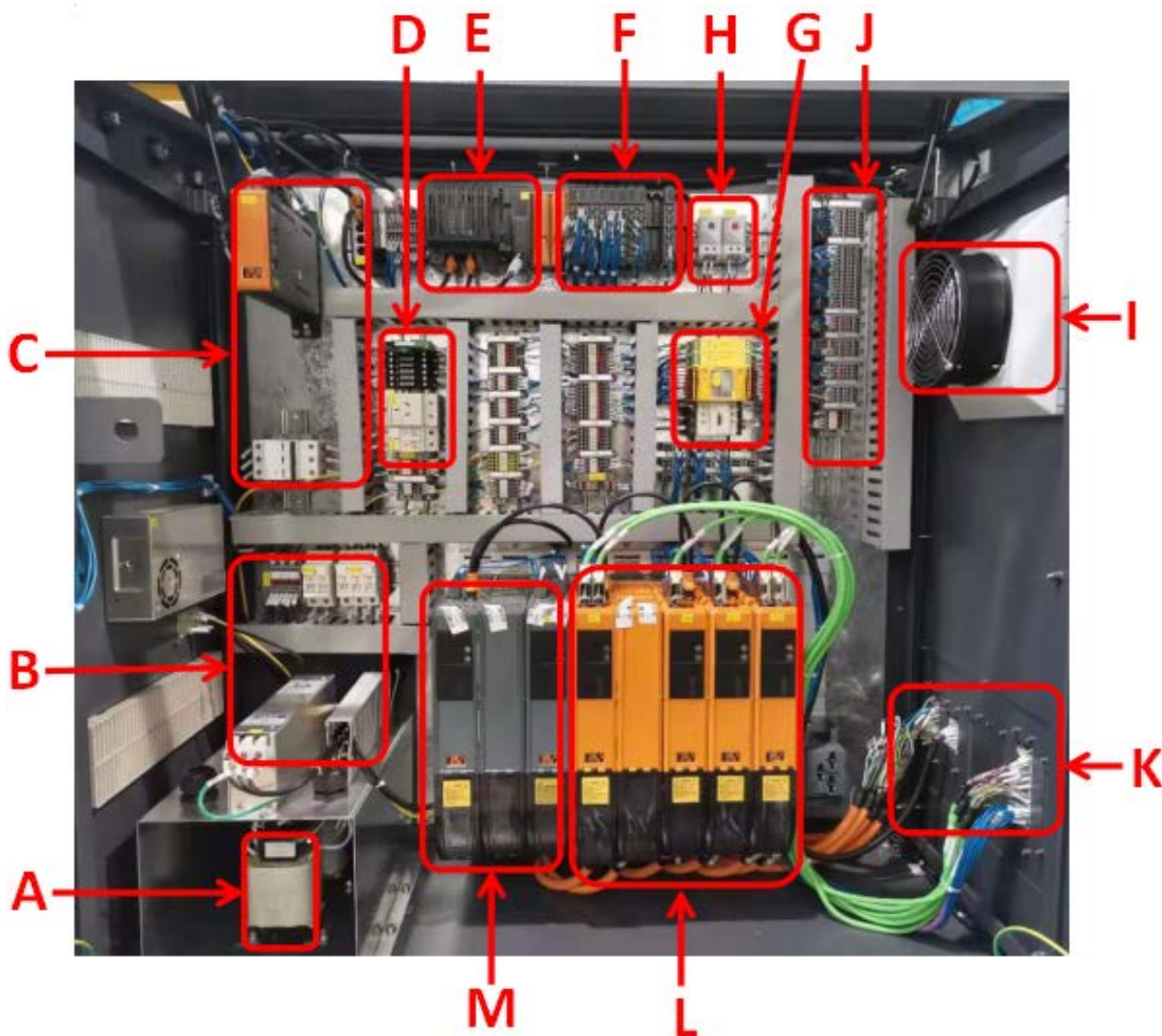
The connection between the coding cable, the power cable aviation plug in port and the robot body has been described above, and will not be introduced here. The wiring between the teaching box and the control cabinet is as follows. Connect the connector of the teach pendant with the connector of the teach pendant reserved on the upper right side of the control cabinet and tighten it. The real object is shown in the following figure:



Huatu teach pendant

#### 4.2.2 Introduction to internal installation of control cabinet

When the robot control cabinet is delivered from the factory, the installation and wiring of various internal components have been completed. After the installation of the cabinet is completed on site, the relevant professional personnel will carry out the test. Generally, there will be no wiring problems. If there are related problems, the on-site commissioning personnel can adjust or contact the relevant technical personnel of the company according to the electrical schematic diagram delivered with the electric cabinet. The following figure shows the layout and wiring diagram of the internal components of the control cabinet



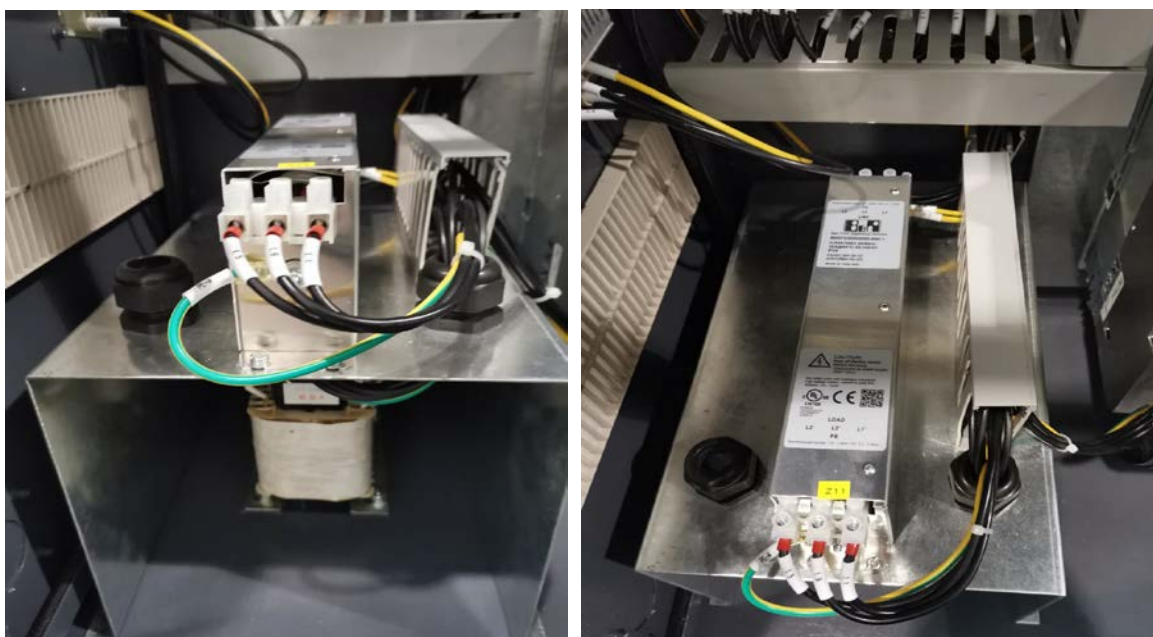
Layout and wiring diagram of internal components in control cabinet

The main components of the control cabinet are A ~ H related components

- A. Transformer (input 380V, output 220V);
- B. Filter + main power fuse protector (32A);
- C. Electric cabinet switch + industrial controlling computer + switch;
- D. 24 V fuse protector in cabinet (4 piece of 2A, 1 piece of 7.5A) + reserved socket;

- E. Controller;
- F. I / O input and output module;
- G. Safety PLC + safety relay + contactor;
- H. Temperature sensor;
- I. Fan;
- J. Terminal block;
- K. Power (including brake) aviation plug - Orange cable, coded aviation plug - Green + blue cable, explosion-proof aviation plug - black cable;
- L. Driver;
- M. Power module;

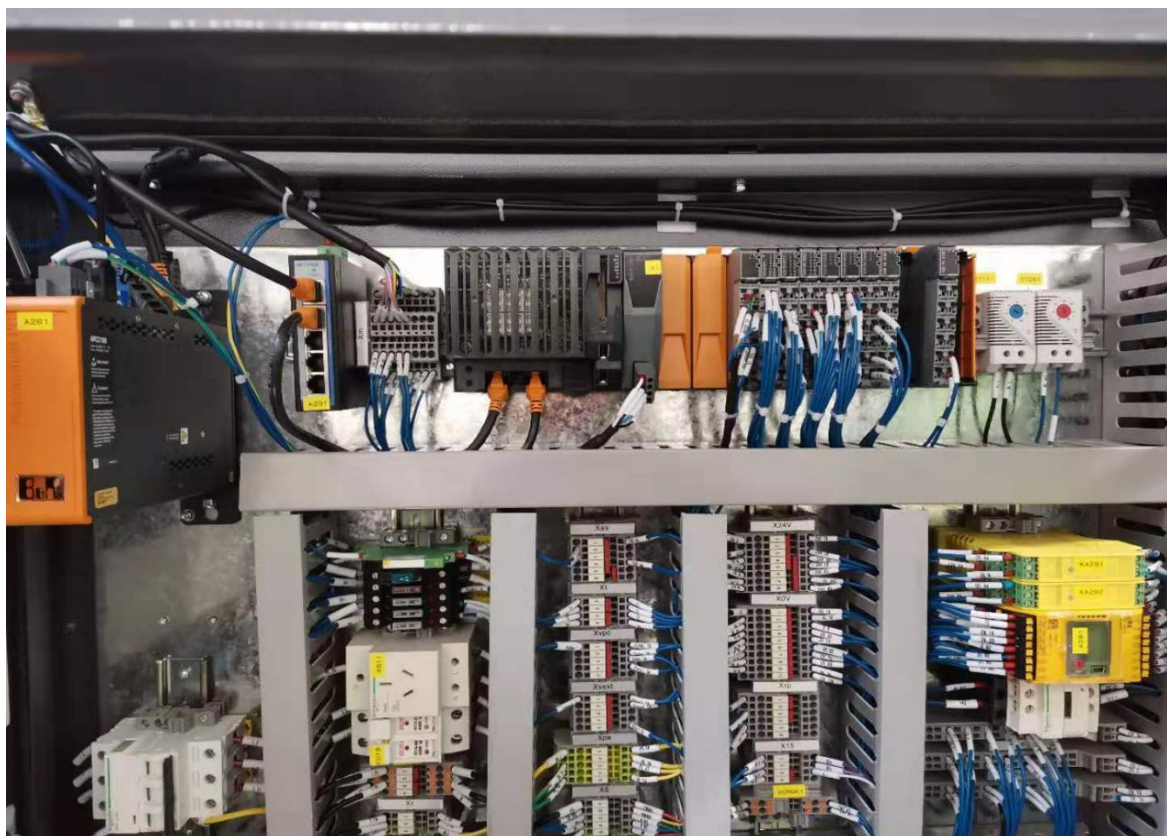
The specific wiring of related components is shown in the figure below:



Detailed wiring and layout in cabinet 1



Detailed wiring and layout in cabinet 2



## Detailed wiring and layout in cabinet 3



## Detailed wiring and layout in cabinet 4



## Detailed wiring and layout in cabinet 5



Detailed wiring and layout in cabinet 6

### 4.3 Daily maintenance

The work related to the replacement of parts described can be carried out according to the instructions of the after-sales service department, and generally qualified personnel can carry out the work, which does not necessarily need the personnel of CMA(Wuhu) Robotics Technology Co., Ltd.

|                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|----------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  <p>Warning</p> | <ul style="list-style-type: none"> <li>➤ <input type="checkbox"/> All maintenance work must be carried out after the robot stops and the power is cut off.</li> <li>➤ <input type="checkbox"/> This work must be carried out by properly trained personnel and precautions must be taken to avoid accidental restart and electric shock.</li> <li>➤ <input type="checkbox"/> In case of failure, please contact CMA Wuhu Robot Technology Co., Ltd. at any time to provide relevant suggestions on how to solve this problem, or contact your engineer for maintenance.</li> <li>➤ <input type="checkbox"/> According to the relevant standard (IEC en 60204-1), when the robot parts and related electrical equipment are replaced or changed, the relevant test work must be carried out again.</li> <li>➤ <input type="checkbox"/> Without prior written permission, and due to repair or other work caused by property damage or personal injury, CMA Wuhu Robot Technology Co., Ltd. denies all</li> </ul> |
|----------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|  |                              |
|--|------------------------------|
|  | <b>related compensation.</b> |
|--|------------------------------|

The operation contents are as follows:

- Replacement of structural parts of equipment
- Adjustment, repair or replacement of electrical system components
- Maintenance of safety equipment and warning equipment
- Adjustment, repair or replacement of control system components
- Any other work without regard to the above

Routine maintenance work that does not conform to the routine needs to be carried out by authorized professional service personnel, who can be contacted through the manufacturer. In addition, other non-routine maintenance work includes dealing with emergencies, such as:

- ☐ Sudden breakage
- ☐ Regular maintenance

#### 4.3.1 Replace the fuse

The following table gives the code number of fuse (fuse core) and possible trouble:

| label | Fault                                                 |
|-------|-------------------------------------------------------|
| FU11  | The main power of the cabinet is not connected        |
| FU12  | The cabinet fails to connect                          |
| FU32  | The mobile panel or monitor cannot be turned on       |
| FU33  | Conveyor synchronous encoder cannot count             |
|       | System management encoder cannot count                |
|       | There is no voltage output signal on the junction box |
| FU34  | Robot I / O module not powered up                     |
| FU35  | External device input failure                         |

Steps of replacing fuse (fuse core)



Replace fuse 1

- Turn off the power supply of the electric cabinet and open the cabinet door.
- Locate the fuse and replace it.
- Fuse FU11 and FU12 are above the transformer.



Replace fuse 2

- The sheet fuse fu31, fu32, fu33, fu34, fu35 are located next to the general isolator and are equipped with a red LED lamp.
- The LED lights up when the fuse is blown.



Replace fuse 3

- Open the fuse cover
- Hold the 10x38 fusible core and pull it out
- Insert a new fusible core (32A) of the same model and put on the protective cover.



- Remove the blown fuse
- Insert a new fuse of the same type

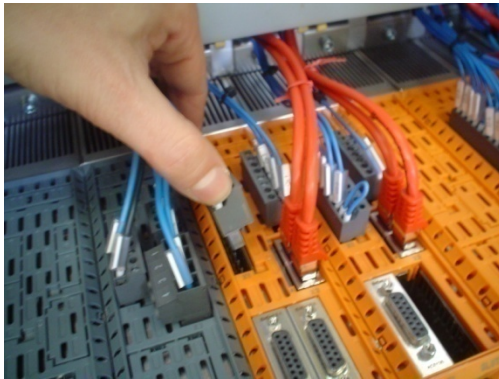
## Replace fuse 4



Warning

Referring to the rated current of the actual fuse and the design on the electrical schematic diagram, the same type of product must be used to replace the fuse (fuse core) to prevent accidents.

### 4.3.2 Replace the drive



Replace drive step 1

- Enable connection end (blue line)
- Ethernet connection terminal (red cable in the figure, other colors may also be used)
- Feedback connector (blue line)



Replace drive step 2

- ☐ Disconnect the terminals at the bottom of all drives
- ☐ Motor cable connection terminal (Orange)
- ☐ Brake cable connection terminal (gray)



- Use No. 5 Allen key to loosen the fastening bolts as shown in the figure.

## Replace drive step 3



- Use No.5 T-handle Allen key to loosen the bolt as shown in the figure

## Replace drive step 4



- Lift the drive, pull it out from below and remove it completely.

## Replace drive step 5



- Insert the new drive into the old drive slot and hook it to the top of the backplane. The arrow in the picture indicates the slot of the drive that needs to be hooked.

## Replace drive step 6



- Tighten the two M6 bolts with No. 5 Allen key. Do not use a torque greater than 5 Nm.
- ☐ Re-connect all disconnected cables as soon as possible.

Replace drive step 7



- Open the hinge cover and set the address of the drive as shown in the table below.

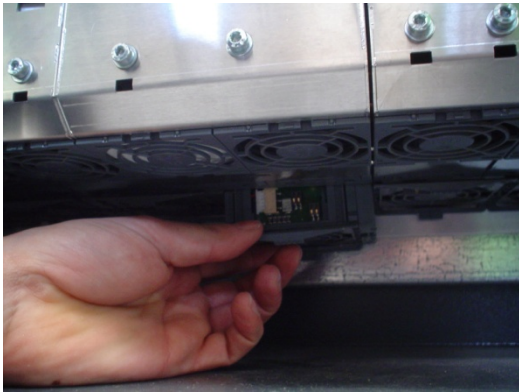
Replace drive step 8

#### 4.4.3 Replace the radiator fan



- Turn off the power supply of the electric cabinet and open the cabinet door
- The cooling fan of the radiator are all inside (on the first line)
- Press in the two clips indicated by the arrow

Replace radiator fan step 1



- The cooling fan will eject naturally from the installation position.
- When the fan falls, you need to hold it with your hand and gently remove it
- Insert the new cooling fan into the original installation position

Replace radiator fan step 2

#### 4.3.4 Replace the cooling fan of the drive



- Turn off the power supply of the electric cabinet and open the cabinet door
- Follow the instructions for replacing the drive in the previous section to disassemble the fan of the drive that needs to be replaced.
- Push out the two covers as shown in the figure.
- Take out the fan

Replace driver fan step 1



- Remove the fan and be careful not to break the wire during removal

Replace driver fan step 2



- Press the fastener on the bottom of the fan cable.
- Once you remove the old fan, replace it with a new one and re-connect the power cord in the drive
- Reposition the fan
- Review the drive

Replace driver fan step 3

#### 4.3.5 Check and replace the dust filter



- Remove the protective barrier by hand

Check and replace the dust filter step 1



- Check the status of the dust filter

Check and replace the dust filter step 2



- If the filter accumulates too much dust, replace it in time.
- Install the protective grille

Check and replace the dust filter step 3

## Chapter Five Installation and connection of robot explosion proof cabinet

### 5.1 Precautions for robot explosion protection

The company's spraying robot has explosion-proof function, using internal pressurization and internal safety mechanism and other protection methods. In order to ensure safe operation, the following instructions must be strictly observed.

|                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <p>1. The explosion-proof spraying robot realizes its explosion-proof function by sealing and pressurizing. Before opening the pressurized seal shell, you must follow the guidance of professional and technical personnel.</p>                                                                                                                                                                                                                                                                                        |
| <p>Warning</p>                                                                    | <p>(1) Without the guidance or supervision of professional and technical personnel, it is not allowed to loosen the fastening screw of pressurization chamber.</p>                                                                                                                                                                                                                                                                                                                                                      |
|                                                                                   | <p>(2) When the robot has been powered on, do not open the shell of the pressurization chamber.</p> <p>2. Install the robot control cabinet and explosion-proof control cabinet in a safe area without explosion possibility. When entering the robot working area for maintenance, spot inspection, robot adjustment, spraying system adjustment, etc., be sure to turn off the main power supply, close the gas supply valve, and confirm that there is no residual pressure in the relevant gas supply pipeline.</p> |

### 5.2 Introduction of explosion proof electric cabinet

#### 1. Introduction of explosion proof cabinet

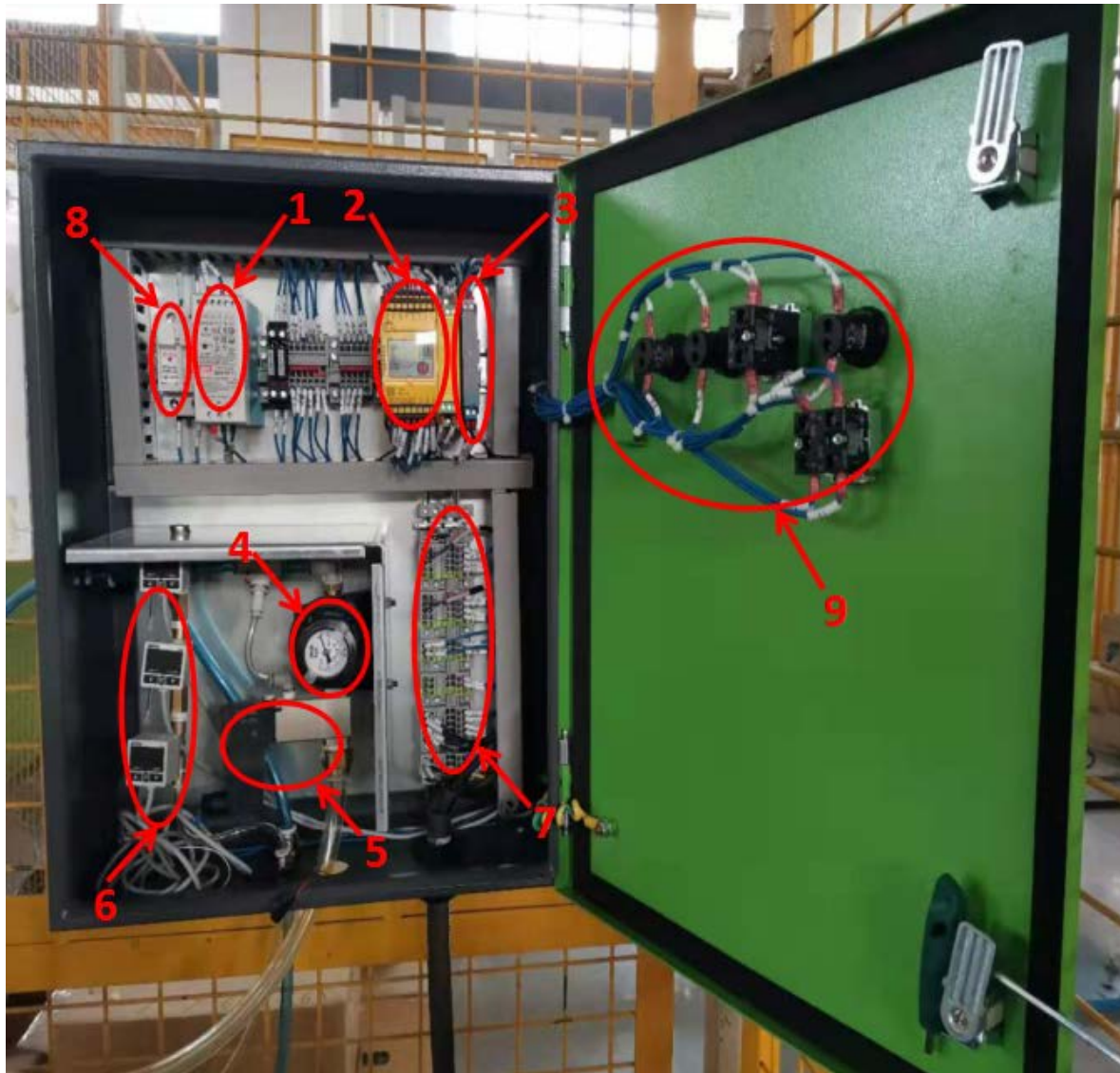


Above:

- 1—— power on switch of explosion-proof cabinet, power on explosion-proof cabinet through knob;
- 2 —— switch indicator of explosion proof cabinet;
- 3 —— work start button of explosion proof cabinet;

- 4 — constant voltage indicator of explosion proof cabinet;
- 5 — fault indicator of explosion-proof cabinet;

## 2. Introduction to the interior of explosion proof cabinet



- 1 -- power supply module;
- 2 -- Safety PLC + safety relay (Pilz safety PLC + Phoenix safety relay);
- 3 -- explosion proof barrier;
- 4 -- air pressure regulating valve;
- 5 -- intake solenoid valve;
- 6 -- digital pressure gauge;
- 7 -- each wiring terminal;
- 8 -- fuse;
- 9 -- button wiring in cabinet;

When the explosion-proof electric cabinet is delivered to the factory, the assembly and wiring

between various internal components have been completed. After the installation and fixation of the electric cabinet on the customer's site, the explosion-proof aviation plug-in cable can be connected to the aviation plug interface reserved in the control cabinet. The test shall be conducted by relevant professionals. Generally, there will be no wiring problems. If there are any related problems, the on-site commissioning personnel can adjust or contact relevant technical personnel of CMA according to the electrical schematic diagram delivered with the electric cabinet.

## **5.3 Cable and gas circuit connection of explosion proof cabinet**

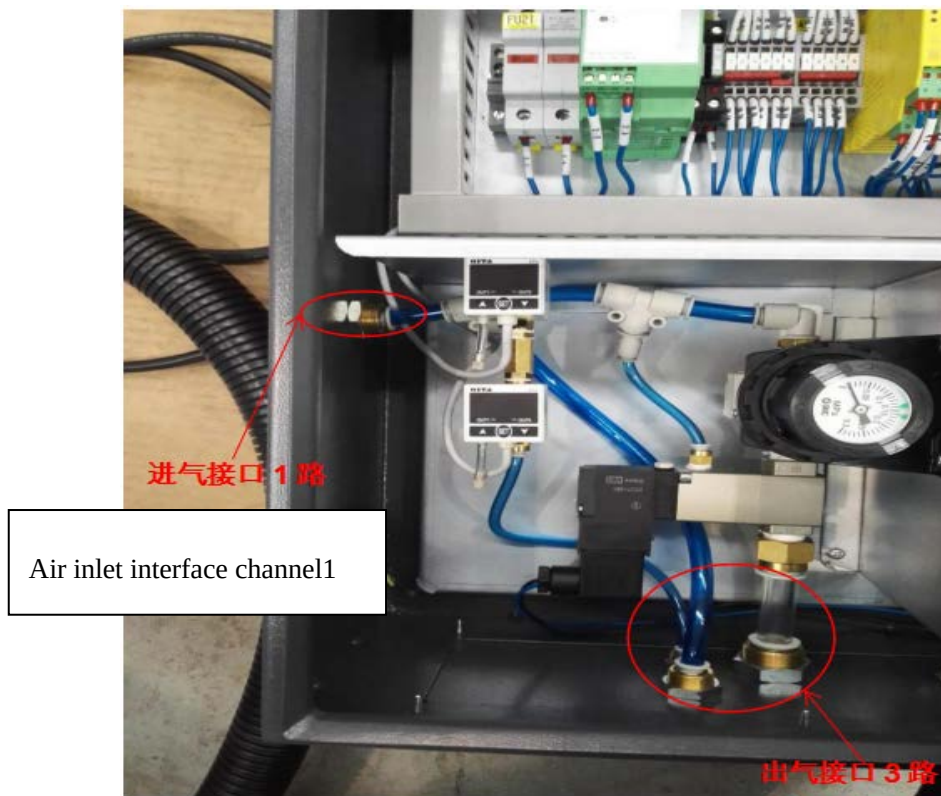
### **5.3.1 Explosion proof cable connection**

The explosion-proof cabinet and the 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 control cabinet. The details are as follows:



### 5.3.2 Gas circuit connection of explosion proof cabinet

The gas circuit connection of explosion-proof cabinet includes two parts: the first part is the 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:



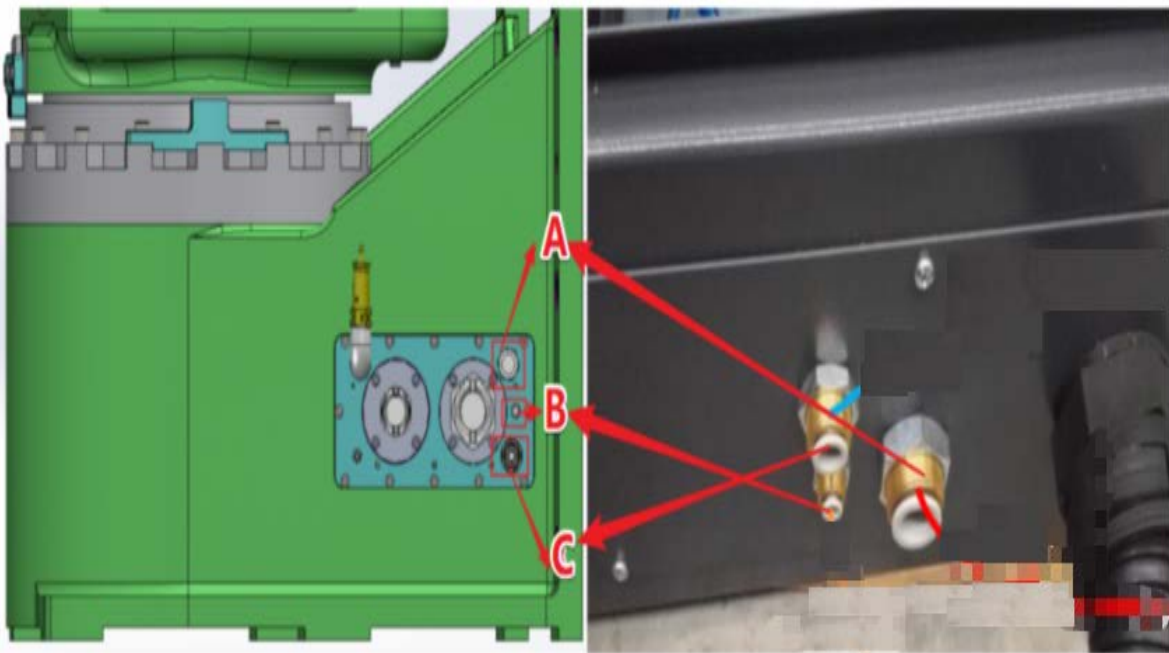
The air inlet interface 1 channel is mainly connected with the air pipe of the clean air compression pipe as shown in the following figure:



**Warning**

**Before the main gas circuit is connected to the explosion-proof cabinet, it is necessary to filter, dry and lubricate.**

The 3-way air outlet interface of explosion-proof cabinet is mainly connected with 3 reserved air pipes of robot body. The three outlet ports of explosion-proof cabinet are numbered A, B and C respectively, corresponding to the three reserved gas pipe ports on the robot body, with diameters of 16mm, 6mm and 10mm respectively, and the size is easy to distinguish; Among them, A is connected to the 16mm air pipe interface, B is connected to the 6mm air pipe interface, and C is connected to the 10mm air pipe interface. The specific connection is shown in the figure below:



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