Flexible Sorting Robot

用户手册

User Manual

User Manual

Flexible Sorting Robot

Model No:

QFS-AH61K-2016 QFS-AH61K-2620
QFS-AH61K-3224 QFS-AH61K-3929
QFS-AH61K-4735 QFS-AH62K-2016
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QFS-AH62K-3929 QFS-AH62K-4735

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QKM Technology (Dongguan) Co., Ltd.

Preface

Thank you for purchasing the equipment solutions provided by QKM!

This manual describes the matters needing attention for proper use of the equipment.

Read this manual carefully before using the equipment.

Please keep this manual properly for future reference.

Overview

This manual provides detailed description of the basic information, principle description, system operation guidance, troubleshooting and maintenance guidance of the equipment so that users can fully understand and properly use the equipment.

Target readers

This manual applies to:

Customer Engineer	Technical Support Engineer
Application Engineer	Installation & Debugging Engineer

Signs and their meanings

The signs in this document clearly indicate any dangers, warnings, cautions and notes that may occur while users perform the operations described in this manual. Pay attention to the following signs when they appear in the document.

The signs in this manual are described in the table below:

Figures	Description
	It indicates an imminently hazardous situation, which, if not avoided, will result in death or serious injury.
	It indicates that a potentially dangerous situation would occur and cause personal injury or robot damage if it is not avoided.

	It indicates that an unpredictable situation would occur and cause robot damage, performance degradation, data loss, etc. if it is not avoided.
	It gives the description on key information and operation tips.

Trademark statement

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Disclaimer

QKM takes no responsibility for direct, indirect, special, incidental or corresponding losses or liabilities resulted from the improper use of this Manual or the product.

The contents of this document are subject to change any time due to product upgrade or other reasons. QKM reserves the right to change the product, specifications and other documents in this manual without prior notice. To know about the latest information of this product, please visit QKM's website for downloading.

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The version history records the description of each document version update. The most recent version of the document contains the updated contents of all previous document versions.

Document version	Issued on	Revised content
V1.0.0	June 25, 2023	The first version of the document was released.

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Chapter 1 Safety Precautions

This chapter describes the safety precautions for the production line. Please read this manual carefully before using. Improper use of the equipment may cause injuries to operators and damage to the system, and even cause personal deaths. Users shall strictly follow the safety regulations of the equipment. QKM shall not be responsible for any personal and equipment losses caused by illegal operations.

Personnel who use this equipment for system operation and maintenance shall be trained by QKM or relevant institutions or shall have the same professional skills.

Personnel must read this manual carefully before conducting operation, maintenance, teaching, programming and system development of the equipment and use it in strict accordance with the safety specifications.

1.1 General safety

Operation and maintenance personnel shall comply with local regulations or specifications. The safety precautions in this manual only serve as a supplement to safety specifications.

- Personnel responsible for installation, operation and maintenance of QKM equipment must receive rigorous training to understand all safety precautions and proper methods of operation and maintenance before operating and maintaining the equipment.
- Use the equipment and its component products in an environment that meets the design specifications. Otherwise, the equipment may fail.
- Before operating and maintaining the equipment, be sure to know the exact location of emergency stop device of the equipment in the workplace and ensure that the E-stop button can be quickly pressed in case of an emergency.
- Before starting and operating the equipment, ensure that personnel are outside the working area and safety fence of the movement mechanism of the equipment. If any person accidentally enters the motion area of the operating mechanism or directly contacts the robot, dangerous accidents may be caused.
- In case of an emergency, please quickly press the E-stop button and ask professionals for first aid treatment according to the Company's internal procedures.

- Users should follow the instructions marked on the equipment to avoid entering dangerous working areas. If any person accidentally enters the motion area of the equipment or contacts the robot, personal injury and equipment damage accidents may be caused.
- Do not change the hardware facility of the equipment, otherwise the equipment may be damaged or users may be injured.
- Do not plug or unplug the power and communication wires and cables during normal operation of the equipment.
- Users should carry out regular inspection and maintenance of the equipment according to the manual and related requirements and timely replace faulty parts to ensure safe operation and service life of the equipment.

1.2 Precautions for safe operation

Operators should operate the equipment with correct understanding of safety precautions and mastery of using methods.

- Be familiar with the location of E-stop button before operating the equipment, and the E-stop button can be quickly pressed in case of a sudden emergency.
- When the power is turned on to start the equipment, pay attention to check and ensure that personnel are outside the equipment operating range to prevent accidents.
- When controlling the equipment or handling exceptions through GUI, ensure that there are no people or objects in the working range that interfere with the movement of the robot or conveyor belt.
- Press the E-stop button in case of an emergency. Do not press the E-stop button when the equipment is operating normally.
- When the equipment is operating (green or yellow light of four-color light is on), it is forbidden to get close to the robot and other moving parts to avoid serious injuries such as impact injury and hand crush injury.
- When the equipment is operating (green or yellow light of four-color light is on), it is forbidden to extend your hand into moving parts such as conveyor belt, sprocket, chain, cylinder and guide rail to avoid mechanical injury.
- When the equipment is operating (green or yellow light of four-color light is on), it is forbidden to throw foreign matters into the equipment, which will cause equipment damage or personal casualty.
- Please stop the equipment before troubleshooting.

1.3 Safety Maintenance

The equipment is electrically charged equipment. Maintenance professionals shall not change the line at random, otherwise it would cause personal injury or damage to the equipment.

- During equipment maintenance, it is strictly prohibited to wear watches, bracelets, bangles, rings and other easily conductive items or clothing accessories that are easy to cause entanglement.
- Each equipment module needs to be connected to the main ground wire of the factory for proper grounding to prevent static electricity damage; be sure to use special insulated tools for maintenance.
- Make sure that the entire equipment system is in a safe environment before daily check and regular maintenance of the equipment.
- Be sure to turn off the main power supply and disconnect the air source when maintaining the electrical system of the equipment.
- Before maintaining mechanical parts of the equipment, make sure that the equipment is in a stop state (red light of the four-color light is on) or in a power-off state and all moving parts are already in a stop state.

1.4 Requirements for equipment working environment

- The working temperature of the equipment is -10℃ ~ 40℃. The equipment cannot work properly if the temperature is too low or too high.
- The working humidity of the equipment is 20% ~ 75%. The equipment cannot work properly if the humidity is too low or too high.
- The air pressure of the equipment is 0.5~0.7 MPa. The equipment cannot work properly if the air pressure is insufficient.
- There should be no corrosive gas, explosive gas or liquid in the application site of the equipment.
- The altitude of the application site should be less than 1,000 m, otherwise the equipment cannot work properly.
- Anti-vibration measures should be taken for the machine since vibration will affect the working accuracy of the equipment.
- When carrying the equipment with a forklift, the porter should wear protective gloves, and handle it smoothly. Parabolic operation is strictly prohibited to avoid injury.

Chapter 2 Product Overview

The equipment is used for quick sorting of materials. The direct vibration feeding bin is adopted to feed the vibrating plate. The vibrating plate vibrates the products and the top camera identifies the direction of materials in the vibrating plate. If the materials meet the set requirements, the robot will grab and load them into trays after being identified by the flying trigger.

2.1 System composition

The overall dimensions of the equipment are shown in Figure 2-1:

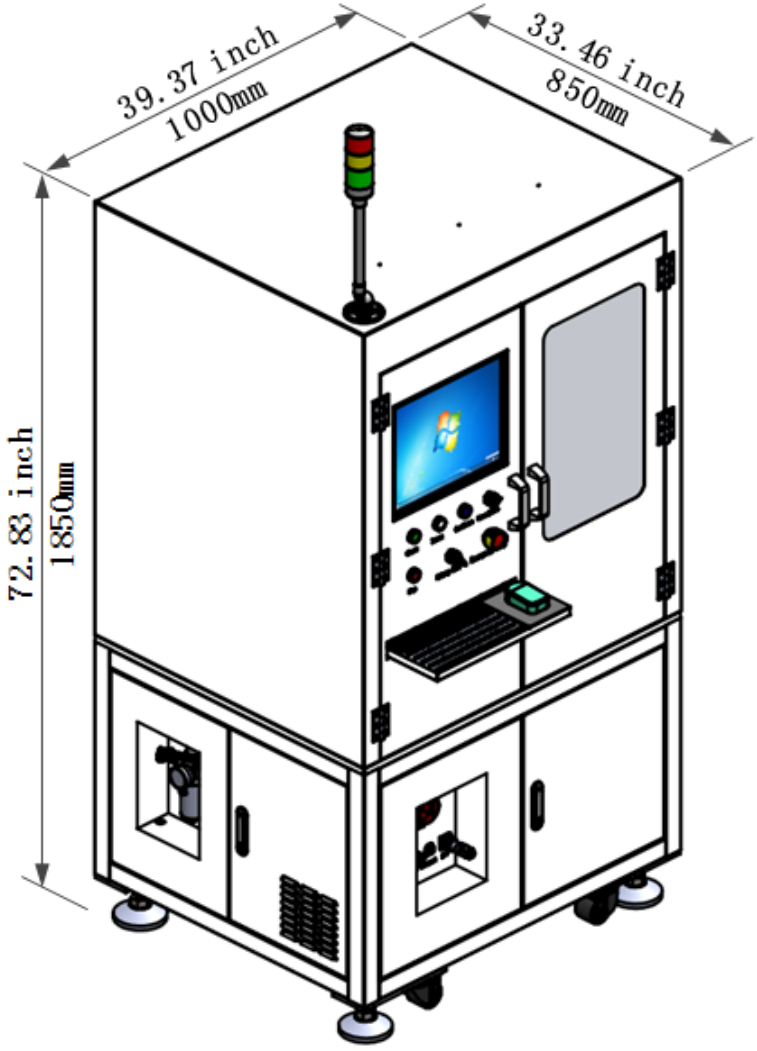


Figure 2-2 Overall dimensions of the equipment

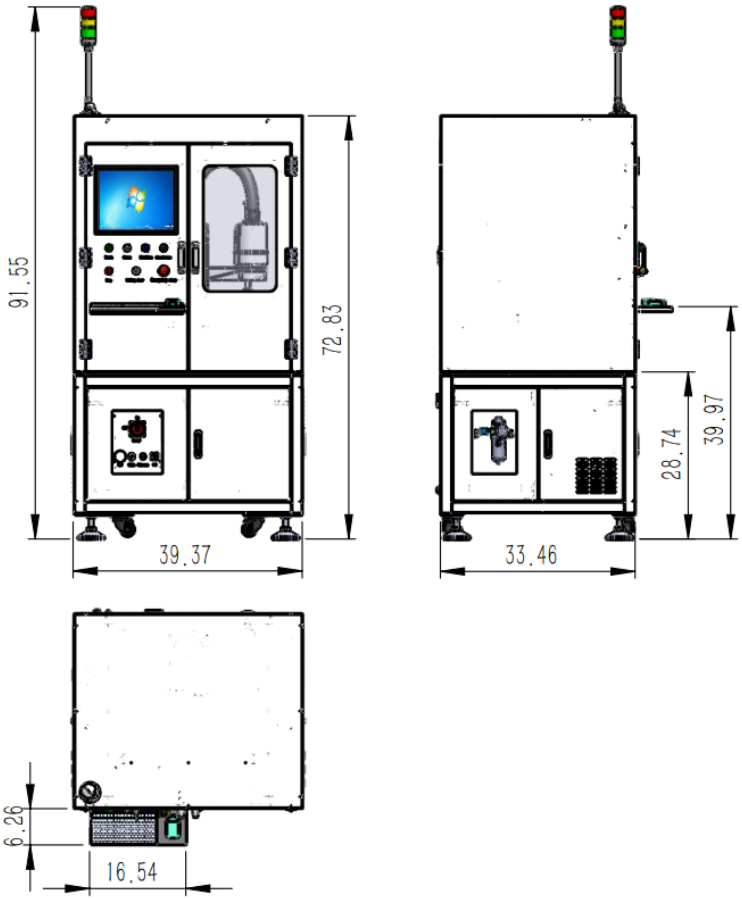


Figure 2-3 Three views of the equipment

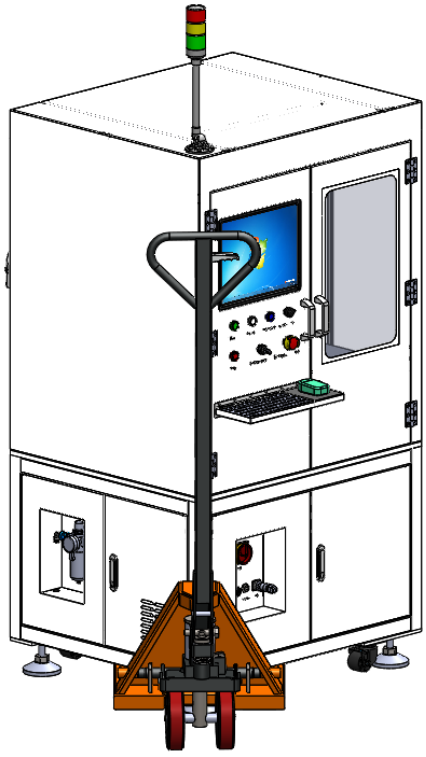


Figure 2-4 Schematic diagram of equipment handling operation

The equipment rack module is divided into upper rack assembly (see Figure 2-4) and lower rack assembly (see Figure 2-5)

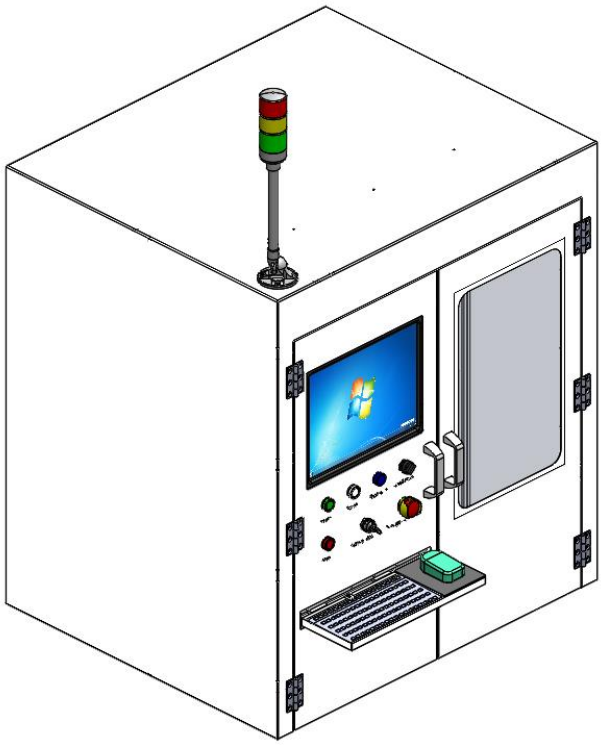


Figure 2-5 Upper rack assembly

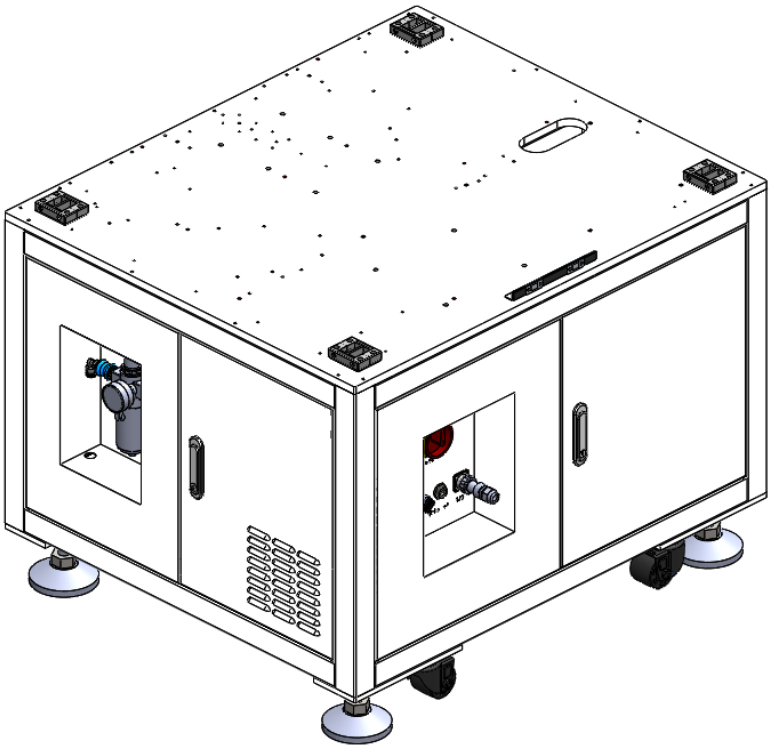


Figure 2-6 Lower rack assembly

Introduction to equipment comlocation: Main modules of the equipment (see Figure 2-6) include the feeding bin, vibrating plate, camera of flying trigger, top camera, top light source and four-axis robot, which are organically connected with each other to achieve orderly grabbing, loading into trays and assembling of finished products.

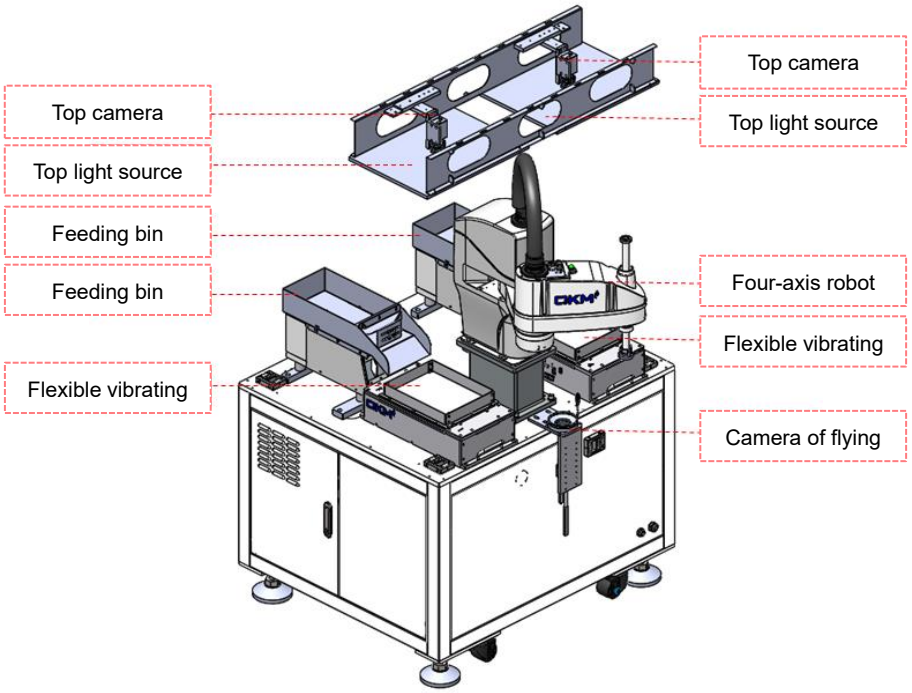


Figure 2-7 Lower rack assembly

2.2 Description of equipment function and performance:

2.2.1 Overall rack module

- The overall rack is welded by square tube and sheet metal, in a color of RAL9003.
- The inner wall of the upper rack of the equipment adopts soundproof design, with a noise reduction effect.
- The combination of air source devices is adopted, with good air pressure regulation characteristics.
- It is equipped with controllable lighting to adapt to all-day operation.

2.2.2 Functional module

- It is equipped with double vibrating plates for feeding, so that product components can be assembled or placed onto trays;

- Anti-vibration design is adopted for the installation of vibrating plate and feeding bin to avoid resonance;
- Four-axis robot is adopted to quickly grab and load the products into trays;
- Camera of flying trigger is adopted to achieve quick picture taking with flying trigger for assembly and positioning;
- The direct vibration feeding bin is adopted and top camera is used to identify whether there is material shortage in the vibrating plate, to achieve automatic feeding;
- The feeding bin has the material shortage alarm function to remind users of manual loading;

2.3 Equipment technical parameters

The technical parameters of the equipment are shown in Table 2-1:

Table 2-2 Technical parameters

SN	Item	Name and specification	Notes
1	Overall dimensions	1000mm×850mm×1850mm	
2	Robot weight	300kg	
3	Rated voltage	AC220V	
4	Rated current	8A	
5	Rated power	1.5KW	
6	Equipment frequency	50/60Hz	
7	Rated input air pressure	0.5~0.7MPa	

2.3.1 Operating state

To facilitate users to know the operating state of the equipment, the three-color warning light of the equipment represents different operating states. The appearance of the warning light is shown in Figure 2-7, and the functions represented by different states are shown in Figure 2-7:

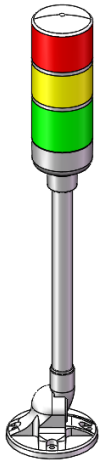


Figure 2-8 Alarm warning light

NOTE

- The appearance icon of the alarm light is for reference only, and specific configuration is subject to the actual appearance of the alarm light at each workstation.
- Different colors displayed by the alarm light indicate different states of the system.

Table 2-3 Function description of warning light

Qty	State description
1 pcs	"Green light on" - indicating that the equipment system is in normal operating state "Yellow light on" - indicating that the equipment system is in a suspended state "Red light on" - indicating that the equipment system is in a fault state "Yellow light flashes with an alarm" - indicating that the equipment system is in a warning state

2.3.2 Emergency stop device

When the equipment is turned on, please rotate in the direction of the arrow to ensure that the emergency stop button is in the pop-up state. The emergency stop button can be directly pressed when there is an anomaly or an emergency stop is required. Before operating and maintaining the equipment, be familiar with the specific location of the emergency stop device in the workplace. The appearance of the emergency stop button is shown in Figure 2-8.

Figure 2-9 Emergency stop button

Chapter 3 Workflow

3.1 Equipment layout

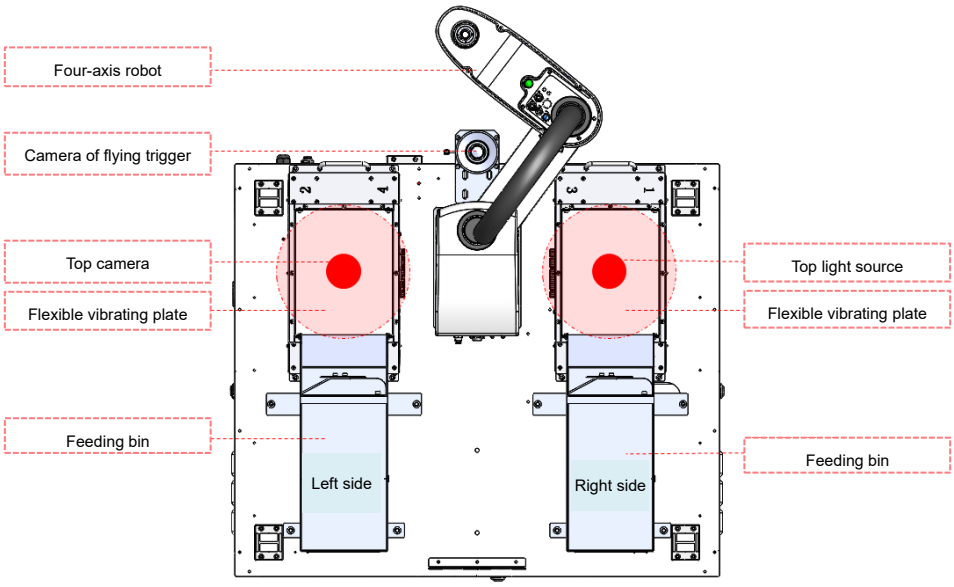


Figure 3-1 Double plate layout

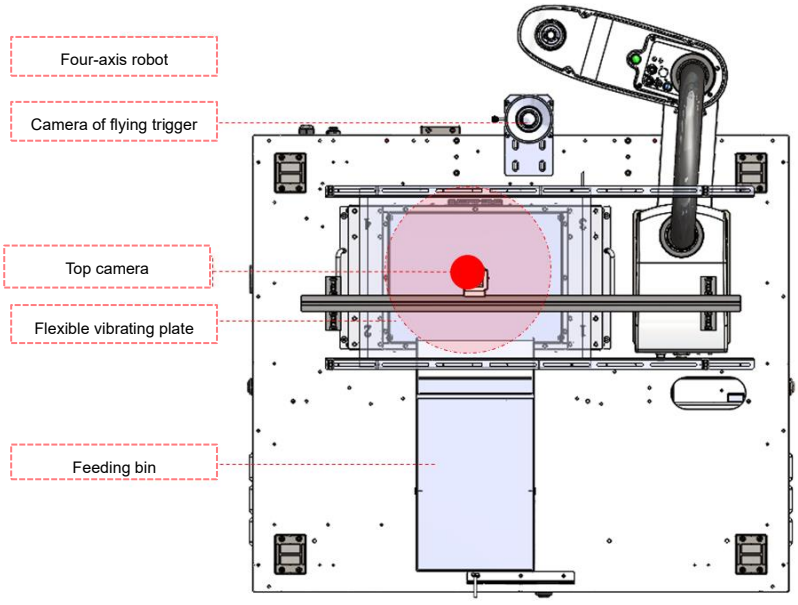
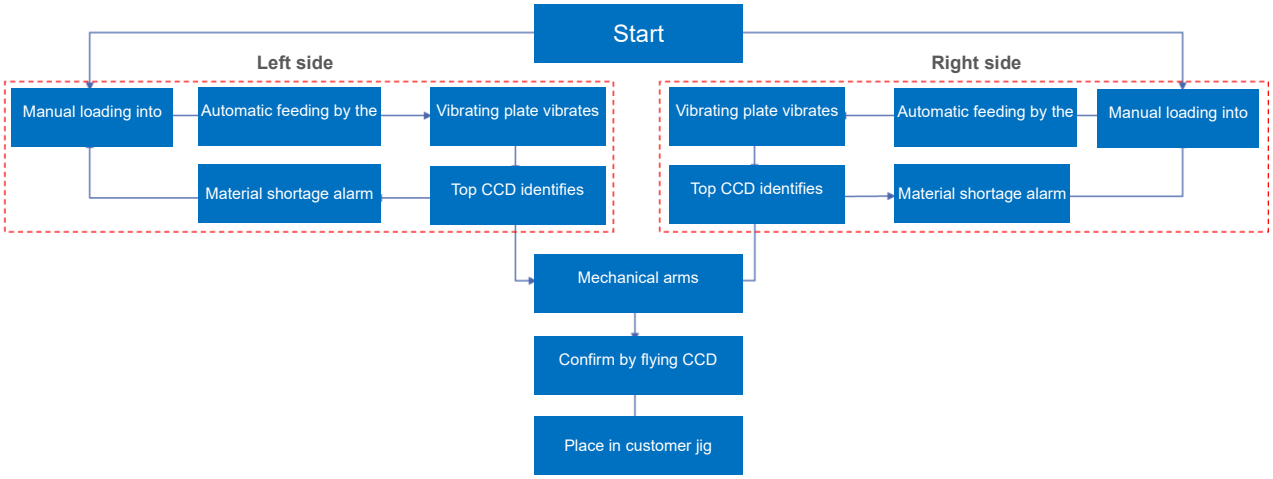


Figure 3-2 Single plate layout

3.2 Action flow

Action flow:



Description:

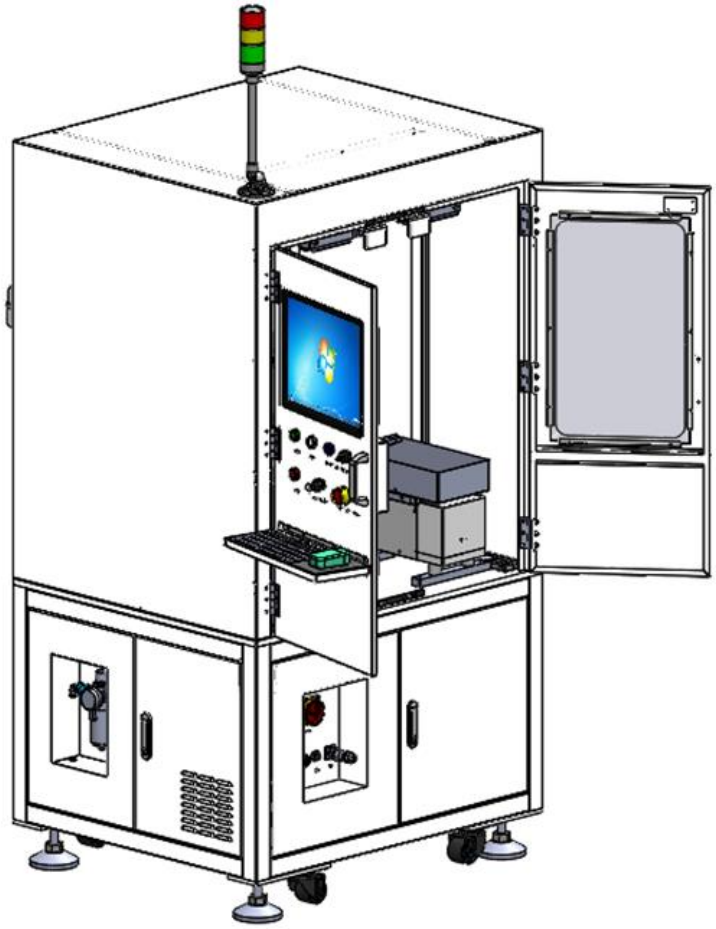
1. Manually put the materials into the left and right feeding bins respectively.

2. When there are insufficient materials in the feeding bin, it will give an alarm to remind users to replenish materials in time.

3. The top camera identifies the direction of materials in the vibrating plate, and the robot will grab the materials meeting the set requirements.

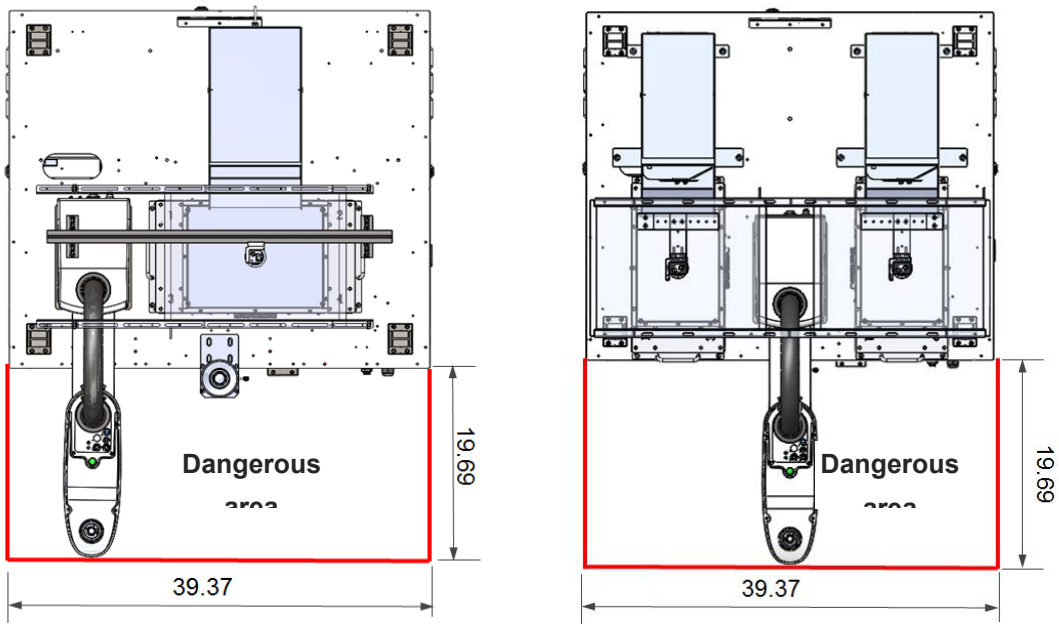
4. After the robot grabs the materials, it takes pictures with the camera of flying trigger for confirmation and then performs placement/assembly.

3.3 Loading and unloading actions



1. Before manual loading, open the front safety door lock before opening the safety door;
2. When manually unloading materials in the feeding bin, be careful to handle them gently and do not drop them directly from the air.

3.4 Safety protection area



The red area above is the connecting area of the equipment with the customer's equipment. The customer's connecting equipment should include this area in the safety protection range. If there is no connecting equipment, it is a dangerous area during equipment operation and personnel are prohibited from entering.

Chapter 4 Description of GUI Function

4.1 Function introduction

The intelligent robot - flexible sorting host computer software consists of 7 types of information, including operation parameter setting, robot IO, fixed location teaching, camera calibration, visual engineering editing, visual teaching and equipment status display, meeting the use requirements of product manual control, product management, production data management and viewing. According to different product applications, it is used to quickly import into production, to display working condition in data, and assist in optimizing working parameters in time.

"Equipment status display" is the content presented on the main interface of host computer, as shown in the following figure, which is divided into equipment operating status, real-time visual processing results, action flow log, alarm and exception log, production quantity and CT display.

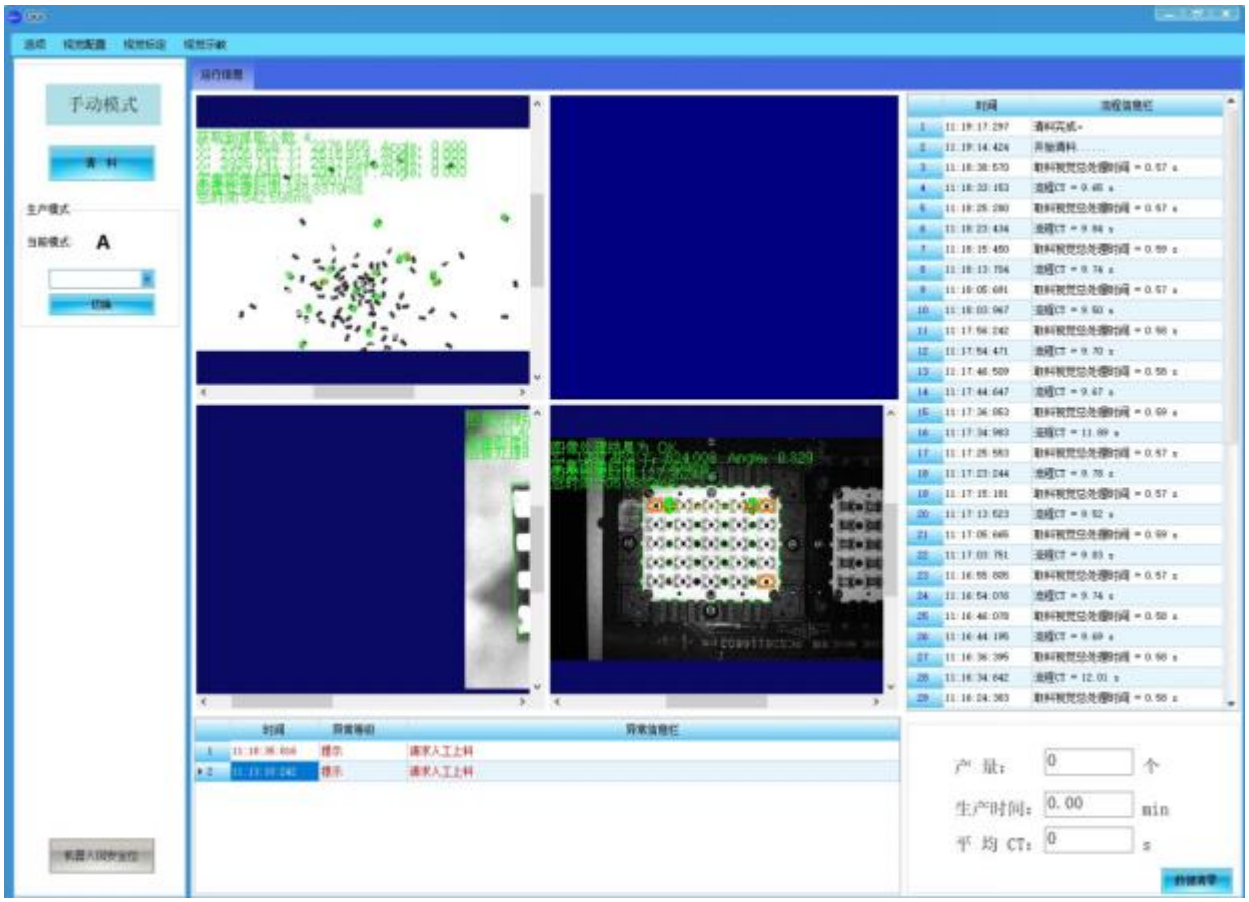


Figure 4-1 Main screen

4.2 Program startup

The equipment program consists of two parts: the host computer program and the robot program. In the case of producing product A, the first step is to select product A when the host computer program starts, and the second step is to select and start the product A sorting program by the robot program.

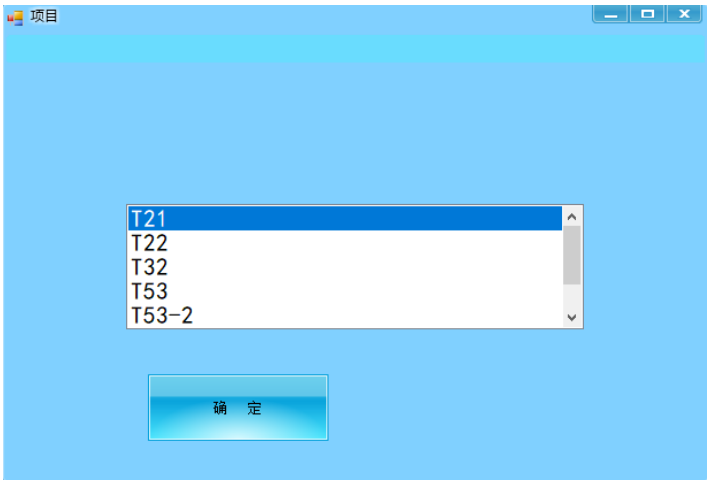


Figure 4-2 Host computer for starting the program

4.3 I/O operation

It is necessary to jog the equipment to meet the functional verification requirements in the product debugging stage or under other requirements. The "Robot IO" interface provided by this software, as its name implies, refers to detection and control of input and output signals of the equipment, including the real-time viewing of the status of 52 input signals and 50 output signals of the equipment, as well as the manual switch control of 50 output signals.

Figure 4-3 IO monitoring

4.4 Camera calibration

Camera calibration is to calibrate the relationship between image coordinate and robot coordinate. Regarding this machine, camera calibration involves three aspects:

Top visual calibration of the vibrating plate, which is used to identify the location and direction of material after taking pictures, so as to accurately grasp the target material from the unordered material pile at a specific angle;

Bottom visual calibration, which is used to identify the angle and location of the material passing through the suction nozzle above the camera by taking pictures. Due to the small visual field, it can achieve high accuracy and make up for the coarse accuracy defect of picking materials by the vibrating plate in the scenarios with large visual field;

Hand-eye visual field calibration, which is used to visually locate the placement location through the hand camera, and perform location compensation by combining the deviation correction results of the bottom camera, so that the product can be accurately placed in the placement location.

For this equipment, the calibration in terms of the above three aspects has been

completed at delivery. Recalibration is required only if there is any location offset due to the disassembly of relevant camera or suction nozzle or if there is any change in the focusing of camera.

Figure 4-4 Camera calibration

4.5 Product debugging

The software is compatible with different product sorting application scenarios. For new products, visual identification, working location, and the relative relationship between vision and positioning are all different. Therefore, product debugging is needed when new products need to be sorted on the equipment. Product debugging is mainly divided into 5 steps: location teaching - visual engineering editing - visual teaching - test run - parameter optimization.

The bottom of the screen is designed with a hardware knob, which has two gears: "automatic" and "manual". Start the product debugging step in the "manual" mode.

4.5.1 Location teaching

Click "Option" - "Location teaching" in the menu to enter the location teaching interface, and all the locations stored in the robot will be loaded. Through this interface, it is possible to meet the requirements of "update", "save" and "moving in place" of each location.

Generally speaking, only the following locations are needed:

LocSafe: Safe location, which is generally in the central area of equipment working range because of the machine layout.

LocMid: Approximately middle area between the picking tray and the flying picture taking location, which is used for transition.

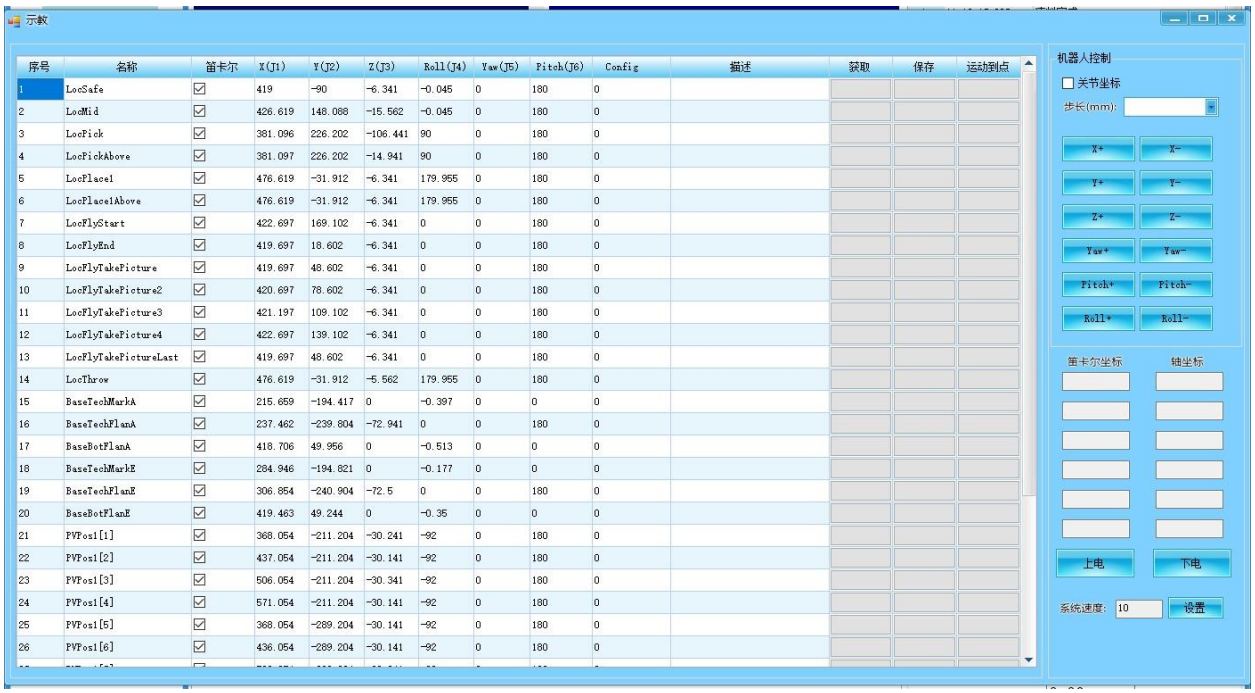
LocFlyStart: Starting location of flying picture taking.

LocFlyEnd: Ending location of flying picture taking. Note that there is only an offset of XY from the starting position.

LocFlyTakePictureX (X is 1-4): Flying picture taking location of suction nozzles 1-4, note that it is in the same straight line as the starting location.

PVPos1[X] (X is 1-10): The charging tray is compatible with at most 10 trays, corresponding to the picture taking locations of 10 trays.

The other locations are basically updated in the process of "visual teaching" and reserved for the next step.



序号	名称	笛卡尔	X(J1)	Y(J2)	Z(J3)	Roll(J4)	Yaw(J5)	Pitch(J6)	Config	描述	获取	保存	运动到点
1	LocSafe	☑	419	-90	-6.341	-0.045	0	180	0				
2	LocMid	☑	426.619	148.088	-15.562	-0.045	0	180	0				
3	LocPick	☑	381.096	226.202	-106.441	90	0	180	0				
4	LocPickAbove	☑	381.097	226.202	-14.941	90	0	180	0				
5	LocPlace1	☑	476.619	-31.912	-6.341	179.955	0	180	0				
6	LocPlace1Above	☑	476.619	-31.912	-6.341	179.955	0	180	0				
7	LocFlyStart	☑	422.697	169.102	-6.341	0	0	180	0				
8	LocFlyEnd	☑	419.697	18.602	-6.341	0	0	180	0				
9	LocFlyTakePicture	☑	419.697	48.602	-6.341	0	0	180	0				
10	LocFlyTakePicture2	☑	420.697	78.602	-6.341	0	0	180	0				
11	LocFlyTakePicture3	☑	421.197	109.102	-6.341	0	0	180	0				
12	LocFlyTakePicture4	☑	422.697	139.102	-6.341	0	0	180	0				
13	LocFlyTakePictureLast	☑	419.697	48.602	-6.341	0	0	180	0				
14	LocThrow	☑	476.619	-31.912	-5.562	179.955	0	180	0				
15	BaseTechMarkA	☑	215.659	-194.417	0	-0.397	0	0	0				
16	BaseTechPlanA	☑	237.462	-239.804	-72.941	0	0	180	0				
17	BaseBotPlanA	☑	418.706	49.956	0	-0.513	0	0	0				
18	BaseTechMarkE	☑	284.946	-194.821	0	-0.177	0	0	0				
19	BaseTechPlanE	☑	306.854	-240.904	-72.5	0	0	180	0				
20	BaseBotPlanE	☑	419.463	49.244	0	-0.35	0	0	0				
21	PVPos1[1]	☑	368.054	-211.204	-30.241	-92	0	180	0				
22	PVPos1[2]	☑	437.054	-211.204	-30.141	-92	0	180	0				
23	PVPos1[3]	☑	506.054	-211.204	-30.341	-92	0	180	0				
24	PVPos1[4]	☑	571.054	-211.204	-30.141	-92	0	180	0				
25	PVPos1[5]	☑	368.054	-289.204	-30.141	-92	0	180	0				
26	PVPos1[6]	☑	436.054	-289.204	-30.141	-92	0	180	0				

Figure 4-5 Location teaching

4.5.2 Visual engineering editing

Click "Visual configuration" in the menu to enter the visual configuration submenu, which includes three visual types: tray vision, inversion vision and placement vision. When entering any one of the visions, the interface layout is consistent. However, for the objects executed by the function, the corresponding visual engineering of "grasping image" or "processing image" is filtered based on the selection for the purpose of simplifying the selection. For example, if "placement vision" is selected, the operations corresponding to the "Take single picture" and "Image processing" buttons are all related to the hand-eye camera after entering the interface.

In addition, the file menu in the top left corner contains 4 submenus: run image acquisition engineering, calibrate image acquisition engineering, run visual engineering and calibrate visual engineering, which respectively correspond to grasping image and processing image, and visual functions under actual running or calibration conditions. Users can edit the engineering after entering the menu.

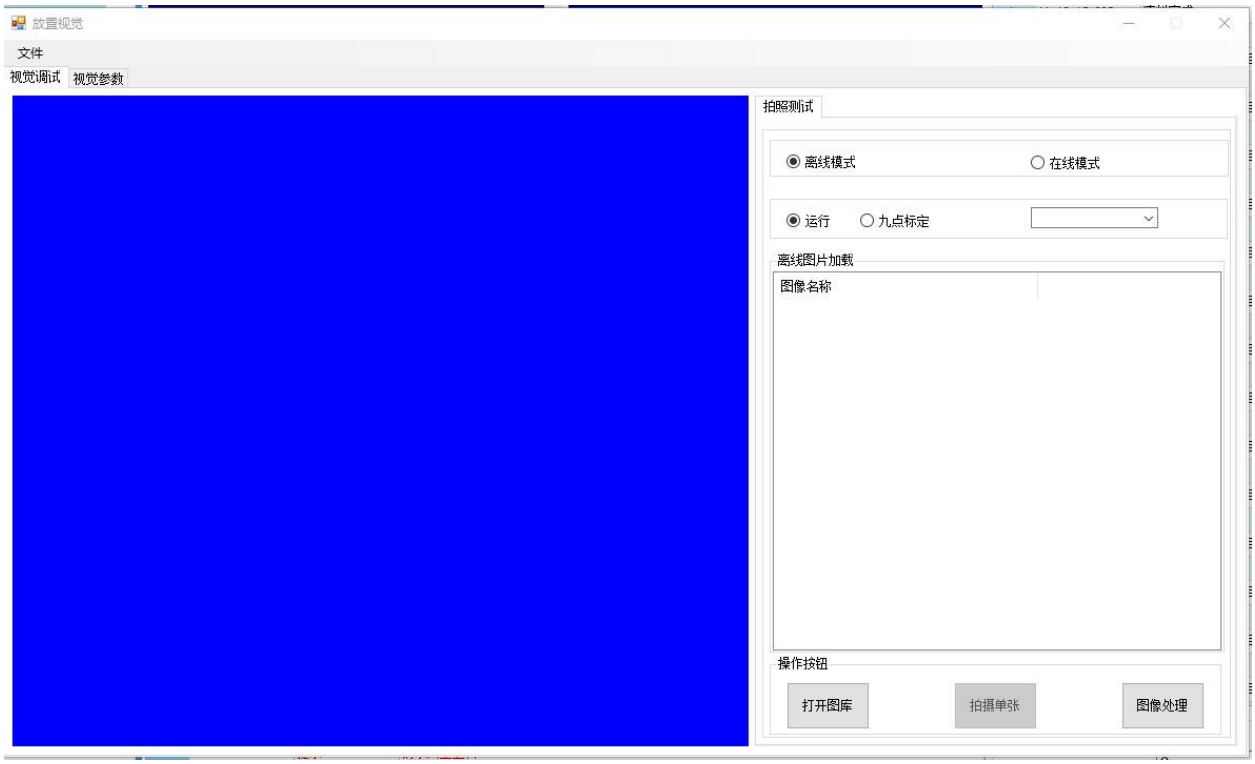


Figure 4-6 Visual engineering editing

4.5.3 Visual teaching

This step is divided into two scenes: first, visually assist in picking materials with the top camera, and second, correct placement deviation with the bottom camera +

hand-eye camera. The purpose of visual teaching is to clarify the relationship among incoming material location, placement location, material picking effect and flying picture taking location under the condition of fixed hardware, and complete the deviation correction calculation of specific materials according to the actual situation during actual operation to ensure the placement accuracy.

Through top camera teaching, in the case of completing "tray vision" in the previous section, we can accurately take pictures and calculate the physical location of materials. Here we only conduct teaching of suction nozzles 1-4 respectively:

1) Click the "Take pictures" button to calculate the target location of the material
2) Click the "Move up" button to move above the target based on the calculation result
3) Click the "Record" and "Save" buttons, finely adjust the picking location based on the calculated location, and then save it.

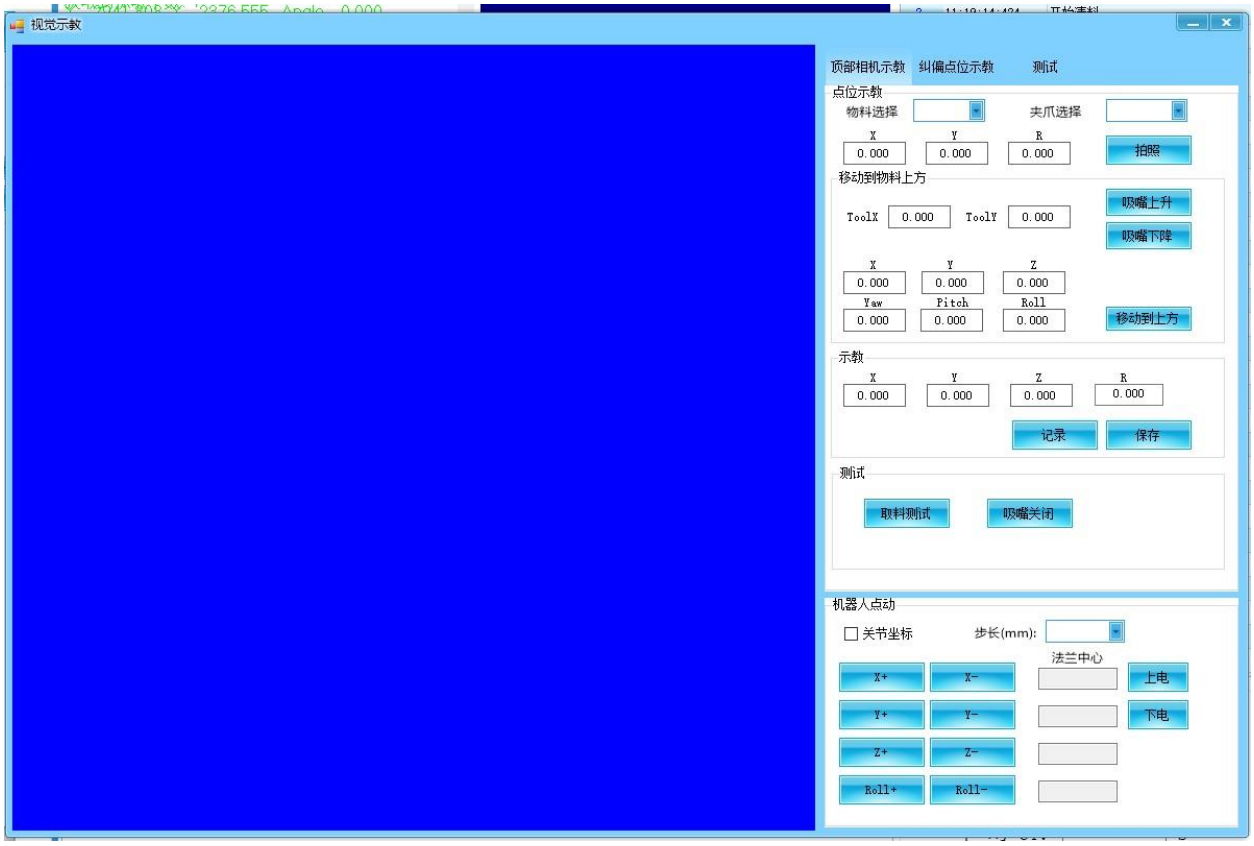


Figure 4-7 Top camera teaching

Through deviation correction location teaching, in the case of completing "inversion vision" and "placement vision" in the previous section, we can accurately take pictures and calculate the placement location of materials. Here we only need to select one suction

nozzle for teaching:

1）Through the "location teaching" interface, move the robot to the picture taking location (PVPos1[1]) of 1# tray, click the "Take picture" button of "Hand-eye vision to obtain material location", and calculate the placement location of the Y-direction vertex location of 1# tray (the placement location where the charging tray is closest to the robot base). Click the "Send" button of "Hand-eye vision to obtain material location" to save it to the robot file.

2）Through the "Location teaching" interface, move the robot to the flying picture taking location (LocFlyTakePicture), and then gradually move the 1# suction nozzle above the placement location identified in the previous step through the XY jog function of the interface (remember not to rotate the angle).

3）Place a material at this placement location to lower the cylinder, and then finely adjust the robot to make the suction nozzle stop at the center of material surface.

4）Click the "Record" and "Send" buttons of "Gripper sucks material" to save it to the robot file.

5）Through the "Location teaching" interface, lift the cylinder, move the robot to the flying picture taking location (LocFlyTakePicture), and click the "Take pictures at the bottom" and "Camera alignment" buttons on the "Test" tab to automatically adjust the image center to the center of visual field.

6）Click the "Record" and "Send" buttons of "Move material to the center of bottom correction camera" to save it to the robot file.

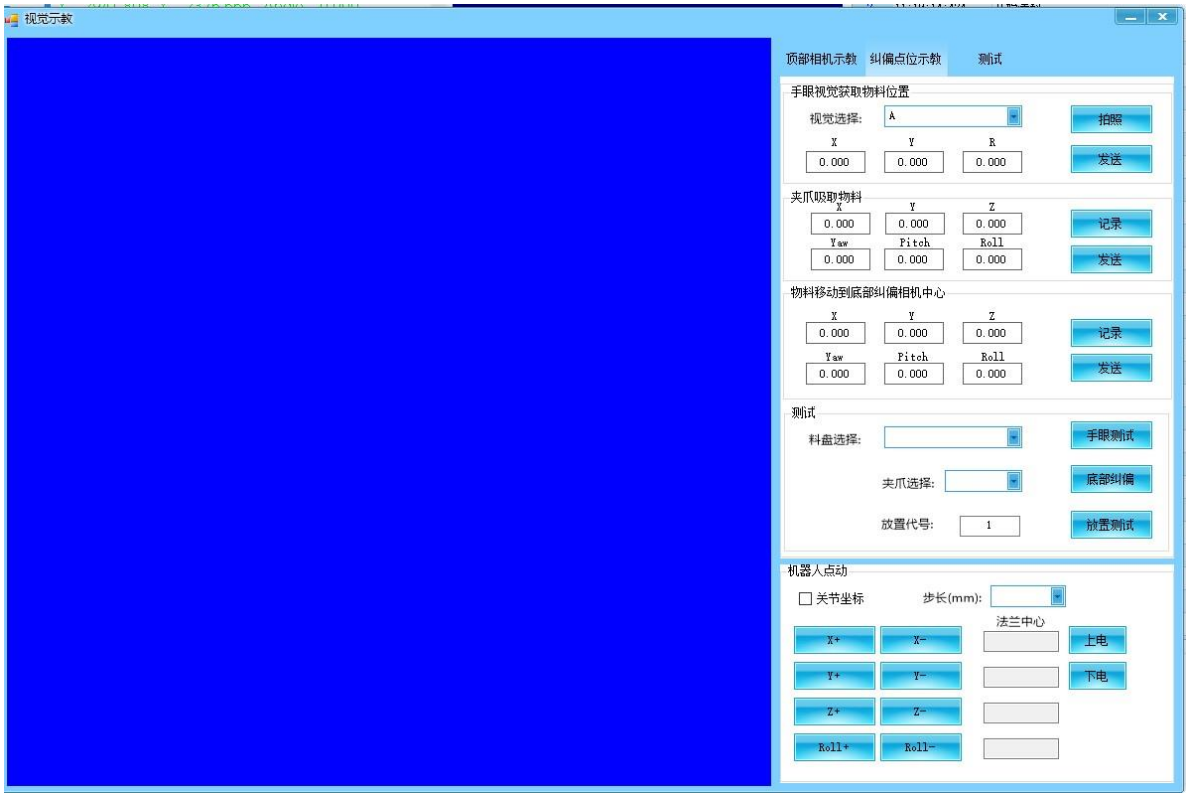


Figure 4-8 Deviation correction location teaching

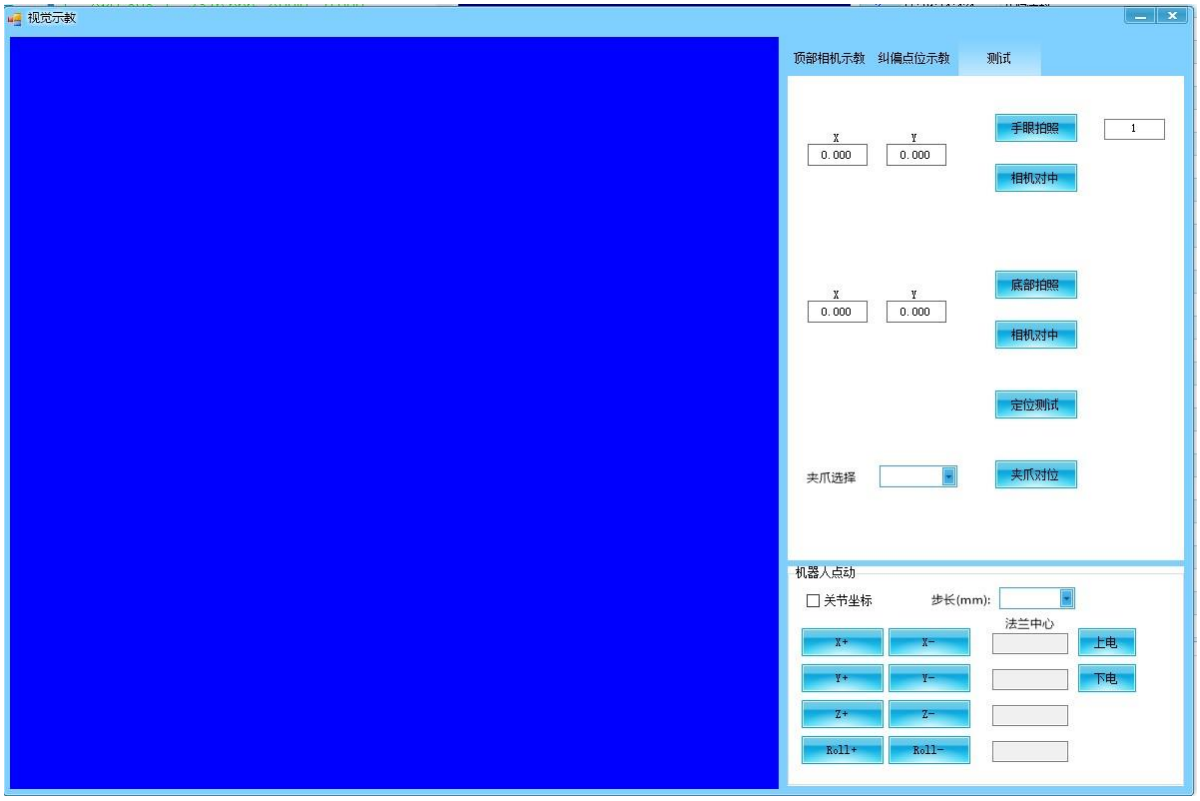


Figure 4-9 Teaching test

4.5.4 Test run

At this step, the debugging of the new product has been basically completed. Just turn the "automatic"/"manual" hardware knob at the bottom of equipment screen to "automatic" mode, and the equipment will start the full-automatic sorting process.

4.5.5 Parameter optimization

There may be minor deviation in the placement location after the test run, because there is deviation in the "Deviation correction location teaching" in Section 4.5.3, and the effect can be optimized through location compensation.

Click the "Option" - "Parameter setting" menu in the main interface to enter the parameter setting interface. Here, it is possible to compensate the locations of the three vertices at the placement location, so as to calculate the actual locations of all locations in the array.

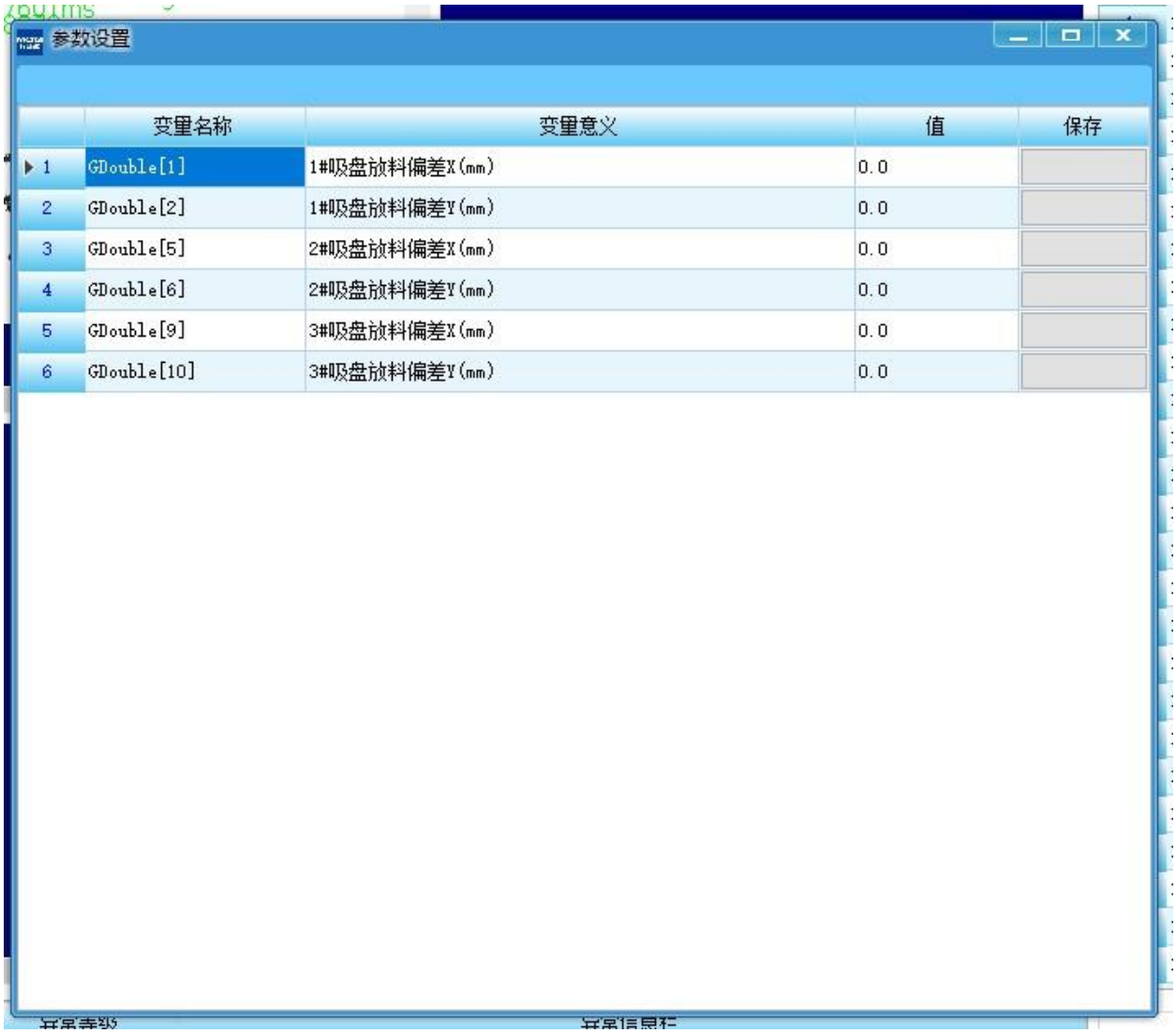


Figure 4-10 Parameter optimization

Chapter 5 Equipment Operating Instructions

5.1 Check before startup:

Be sure to check whether the emergency stop button, material status, air pressure value and safety protection status meet the requirements before turning on the equipment. Otherwise, it will cause equipment failure or other losses when starting the equipment.

Please check the equipment condition according to the following requirements before turning on the equipment:

1. Check whether the emergency stop button of the equipment is pressed. If so, rotate and reset the emergency stop button in the direction of the arrow.

2. Check the equipment status to ensure that all components of the equipment are securely installed and electrical connection is correct.

3. Check the equipment status to ensure that there are no messy materials in the feeding zone and the materials are placed correctly.

5.2 Power on and connect air source to the equipment

When turning on the equipment, observe whether there are people or objects blocking the movement mechanism within the working range of the equipment to avoid danger.

Step 1 Power on the equipment

1. Open the door of electric control cabinet in the workstation respectively, turn the power-on air switch upwards to set it to ON, and then close the cabinet door.

Figure 5-1 Power on the equipment system (I)

2. Rotate the master control switch on the side of the equipment and set it to ON.

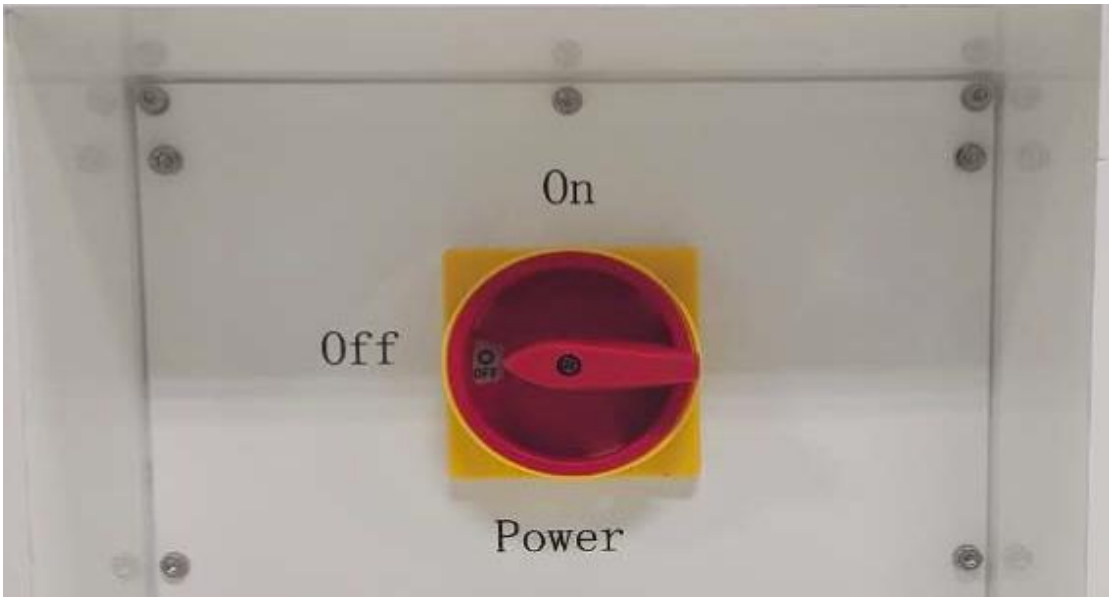


Figure 5-2 Power on the equipment system (II)

Step 2 Connect air source to the equipment

1. Press down and rotate the air pressure switch knob clockwise. When the air pressure gauge shows the air pressure as shown in the figure, it means that the air source has been connected to the equipment normally.

Figure 5-3 Connect air source to the equipment

Chapter 6 Troubleshooting

This chapter lists the possible causes and handling methods of common electrical anomalies of the equipment. Users can quickly locate the corresponding possible causes and fault handling methods in this chapter through the fault description prompted by GUI. The first step for fault handling is to confirm safety, and "pause" operation is suitable for temporary fault handling. It is necessary to stop the whole station system if the fault cannot be repaired in a short time. Please contact the Company's professional technical personnel if the complex fault cannot be resolved.

The first step for fault handling is to confirm safety, and "pause" operation is suitable for temporary fault handling; it is necessary to stop the whole station system if the fault cannot be repaired in a short time.

6.1 Handling of electrical faults

Electrical anomalies include no sensor signal, no motor action, etc. Refer to 6-2 for handling of common faults.

Table 6-1 Handling of electrical anomalies

Error code location	Fault description	Possible Cause	Solutions
/	Detection failure of magnetic switch on cylinder	1. Wiring error 2. Magnetic switch is not adjusted in place 3. Problem of I/O board	1. Correct the wiring 2. Adjust the magnetic switch in place 3. Check the I/O input board
/	Detection failure of optical fiber sensor	1. The detection distance on the amplifier is not adjusted properly 2. The mode switch of the amplifier is selected incorrectly 3. Wiring error	1. Adjust the detection distance knob to the appropriate location 2. Readjust the mode according to actual usage 3. Correct the wiring

6.2 Handling of alarm exceptions

The handling of common alarm exceptions of the equipment is shown in Table 6-2:

Table 6-2 Handling of alarm exceptions

Error code location	Fault description	Possible Cause	Solutions
1	Alarm of emergency stop button being pressed	1. Wiring error 2. The emergency stop button is pressed 3. Problem of PLC or I/O board	1. Correct the wiring 2. Pull out the emergency stop button 3. Check the I/O input board of the robot
2	Safety door alarm	1. Wiring error 2. The safety door and lock are opened 3. Problem of PLC or I/O board	1. Correct the wiring 2. Close the safety door and lock 3. Check the I/O input board of the robot
3	Abnormal interaction of the robot	1. The network cable is not connected properly 2. The robot is not powered on 3. The robot fails 4. The host computer is abnormal	1. Check the network cable 2. Power on the robot 3. Check the robot 4. Check the host computer
4	Alarm that the material is not taken away by the robot	1. The optical fiber sensor is abnormal 2. Material is not taken away 3. Problem of I/O input board of the robot	1. Check the optical fiber sensor 2. Take the material away manually 3. Check the I/O input board of the robot
5	The robot is not in the left-hand posture	1. The robot action is abnormal 2. The robot posture is artificially moved	1. Check the robot action 2. Move the robot to a left-hand posture
6	Alarm of sensor anomaly of robot gripper clamping location	1. Wiring error 2. Magnetic switch is not adjusted in place 3. The cylinder action is not in place 4. Problem of I/O input board of the robot	1. Correct the wiring 2. Adjust the magnetic switch in place 3. Check the cylinder action 4. Check the I/O input board of the robot
7	Alarm of sensor anomaly of robot gripper clamping location	1. Wiring error 2. Magnetic switch is not adjusted in place 3. The cylinder action is not in place 4. Problem of the robot or I/O board	1. Correct the wiring 2. Adjust the magnetic switch in place 3. Check the cylinder action 4. Check the I/O input board of the robot

8	Alarm of robot initialization anomaly	1. The robot is not powered on 2. Robot system anomaly 3. Abnormal interaction	1. Power on the robot 2. Restart the equipment 3. Check the network cable

Chapter 7 Routine Maintenance

Routine maintenance is a kind of preventive maintenance, which means that maintenance personnel periodically carry out inspection and maintenance during normal operation of equipment to timely find and remove hidden faults.

Personnel responsible for maintaining the equipment shall determine the maintenance cycle according to the actual local conditions, perform routine inspection and maintenance of the equipment, find faults and resolve them in a timely manner.

7.1 Maintenance inspection

7.1.1 Routine maintenance inspection

Table 7-1 Equipment routine maintenance checklist

Item	Inspection content	Inspection result	
1	The surface of the equipment is clean, free of oil stain, yellow bubble and rust	Yes	No
2	The interior of the equipment is clean and free of sundries and dirt	Yes	No
3	The pipelines, wires and air pipes of the equipment are neat and intact, and the screws, buttons and lighting lamps are intact	Yes	No
4	Whether the equipment starts normally, and whether there is abnormal shaking and noise, etc.	Yes	No
5	Whether the air pressure display of the air source assembly of equipment is normal and whether there is air leakage	Yes	No
6	Whether the solenoid valve control assembly of the equipment and the cylinders at all locations move normally and smoothly without abnormal noise	Yes	No
7	Whether the conveyor line motor and module of the equipment are powered on normally and whether they operate normally and smoothly without abnormal noise	Yes	No

8	The protective cover, limit and safety device of the equipment are complete, firm and available	Yes	No

7.2 Equipment maintenance

This section provides the maintenance guidance for various mechanical motion mechanisms, electrical sensors, motors and other components.

7.2.1 Maintenance of mechanical moving parts

Refer to Table 7-2 for the maintenance of mechanical moving parts and the required tools and materials.

Table 7-2 List of the maintenance of mechanical moving parts

Maintenance item				
SN	Inspection and maintenance item	Reference standard	Exception handling	Required tools/materials
1	Timing belt	Whether the timing belt is loose	Adjust the tensioning mechanism with a wrench	Allen wrench
2	Timing belt	Whether there are cracks, missing teeth, etc.	Replace the timing belt	Allen wrench, circlip plier
3	Guide rod, bearing	Whether the guide rod extends and retracts smoothly without abnormal noise	Clean the surface of guide rod and apply lubricating oil	Brush, lubricating oil
4	Circlip	Whether the movable pallet is quickly reset	Replace the circlip	Allen wrench, circlip plier

7.2.2 Electrical maintenance

Refer to Table 7-3 for the electrical maintenance and the required tools and materials;

Electrical function of the equipment

SN	Inspection and maintenance item	Cycle	Reference standard	Exception handling	Required tools/materials
1	Emergency stop	Daily	Whether the function is normal	Check the circuit to make the signal normal	Cross screwdriver ; wire stripping pliers
2	Equipment connection	Daily	Firm and good without falling-off	Check each connecting plug	Vice jaw; hex wrench
3	Safety door switch	Daily	Induction detection is normal	Check the circuit	Straight screwdriver ; wire stripping pliers

Table 7-3 List of electrical maintenance

7.3 Maintenance of wearing parts

Wearing parts are commonly used spare parts. Maintenance personnel should periodically inspect them according to the contents of maintenance inspection, and replace any damaged ones in time.

7.3.1 Mechanical wearing parts

Refer to Table 7-4 for the list of mechanical wearing parts

Table 7-4 List of mechanical wearing parts

SN	Name	Specification/drawing number	Qty	Purpose
01	Translucent panel	1-QF0001-02-03-03	2	Vibrating plate
02	Blank below			
03				
04				
05				

7.3.2 Electrical wearing parts

Refer to Table 7-5 for the list of electrical wearing parts

Table 7-5 List of electrical wearing parts

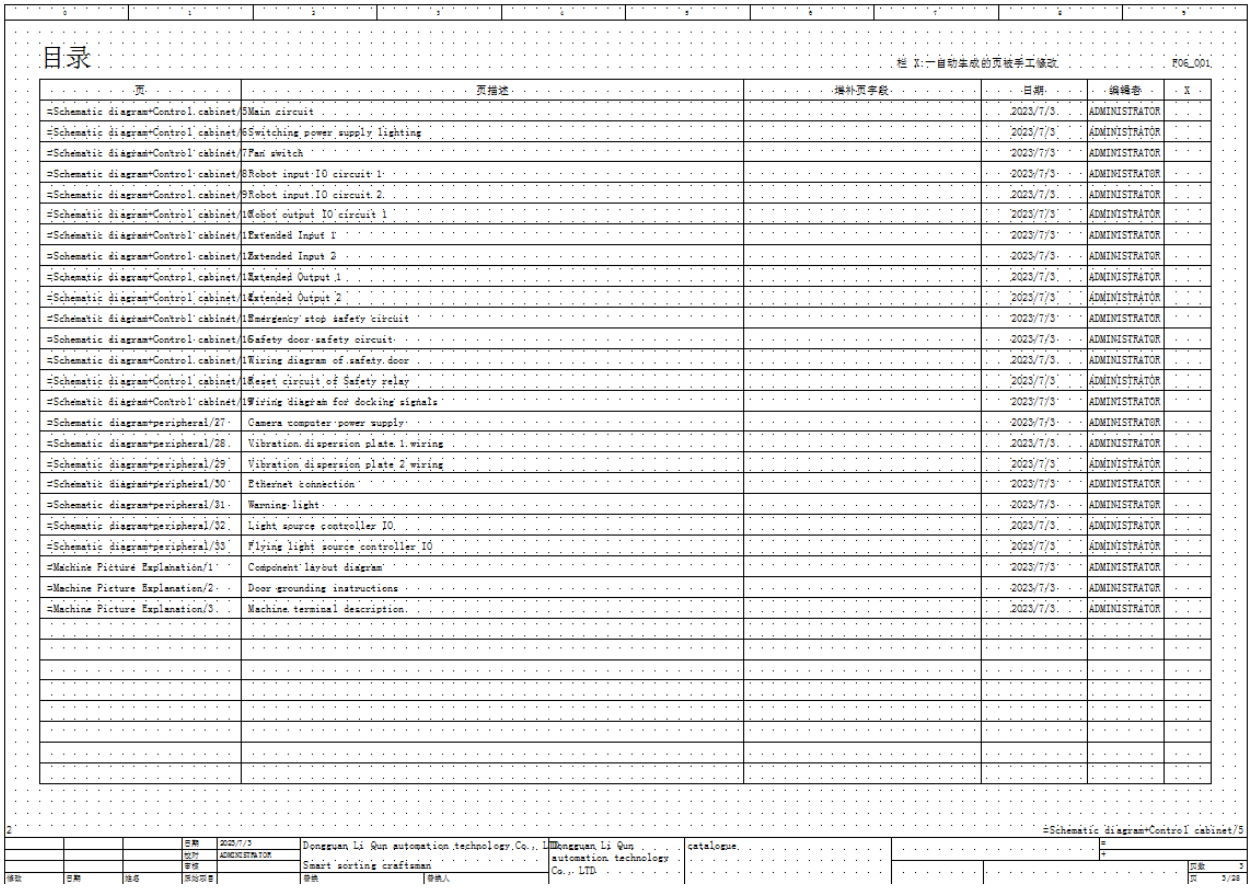
SN	Name	Specification/drawing number	Qty	Purpose
01	Fuse	Fuse, 10A	1	Line protection

Quality assurance and after-sales service

1. The warranty period is 12 months from the date when the acceptance certificate is signed or 18 months from the date when the equipment is shipped (whichever is the earlier), and the equipment is provided with free maintenance and after-sales service.
2. If the equipment fails under normal operating conditions during the warranty period, free maintenance and replacement of damaged parts will be provided. If the maintenance cost of equipment failure caused by operation against rules is not covered by free maintenance, the cost of maintenance and replaced parts will be charged.

Appendix A Electrical schematic diagram

A.1 Electrical schematic diagram



目录

页	页描述	增补页字段	日期	编辑者	X
=Schematic diagram+Control cabinet/5	Main circuit		2023/7/3	ADMINISTRATOR	
=Schematic diagram+Control cabinet/6	Switching power supply lighting		2023/7/3	ADMINISTRATOR	
=Schematic diagram+Control cabinet/7	Fan switch		2023/7/3	ADMINISTRATOR	
=Schematic diagram+Control cabinet/8	Robot input IO circuit 1		2023/7/3	ADMINISTRATOR	
=Schematic diagram+Control cabinet/9	Robot input IO circuit 2		2023/7/3	ADMINISTRATOR	
=Schematic diagram+Control cabinet/10	Robot output IO circuit 1		2023/7/3	ADMINISTRATOR	
=Schematic diagram+Control cabinet/11	Extended Input 1		2023/7/3	ADMINISTRATOR	
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=Schematic diagram+Control cabinet/18	Reset circuit of Safety relay		2023/7/3	ADMINISTRATOR	
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=Schematic diagram+peripheral/27	Camera computer power supply		2023/7/3	ADMINISTRATOR	
=Schematic diagram+peripheral/28	Vibration dispersion plate 1 wiring		2023/7/3	ADMINISTRATOR	
=Schematic diagram+peripheral/29	Vibration dispersion plate 2 wiring		2023/7/3	ADMINISTRATOR	
=Schematic diagram+peripheral/30	Ethernet connection		2023/7/3	ADMINISTRATOR	
=Schematic diagram+peripheral/31	Warning light		2023/7/3	ADMINISTRATOR	
=Schematic diagram+peripheral/32	Light source controller IO		2023/7/3	ADMINISTRATOR	
=Schematic diagram+peripheral/33	Flying light source controller IO		2023/7/3	ADMINISTRATOR	
=Machine Picture Explanation/1	Component layout diagram		2023/7/3	ADMINISTRATOR	
=Machine Picture Explanation/2	Door grounding instructions		2023/7/3	ADMINISTRATOR	
=Machine Picture Explanation/3	Machine terminal description		2023/7/3	ADMINISTRATOR	

Figure 0-1

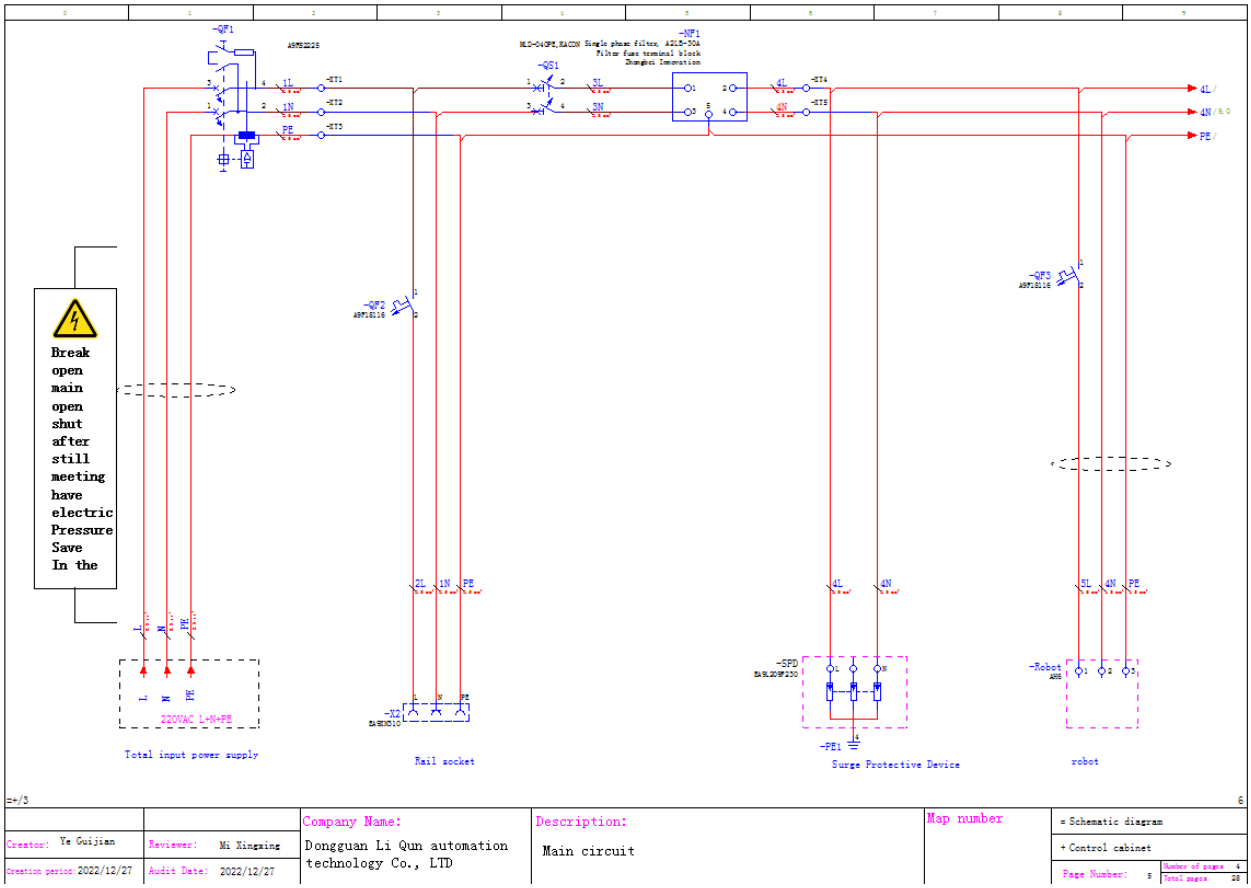

Break open main open shut after still meeting have electric Pressure Save In the
Total input power supply
Rail socket
Surge Protective Device
robot
Company Name:
Dongguan Li Qun automation technology Co., LTD
Description:
Main circuit
Map number
Creator: Ye Guijian
Reviewer: Mi Xingxing
Creation period: 2022/12/27
Audit Date: 2022/12/27

Figure A-0-2

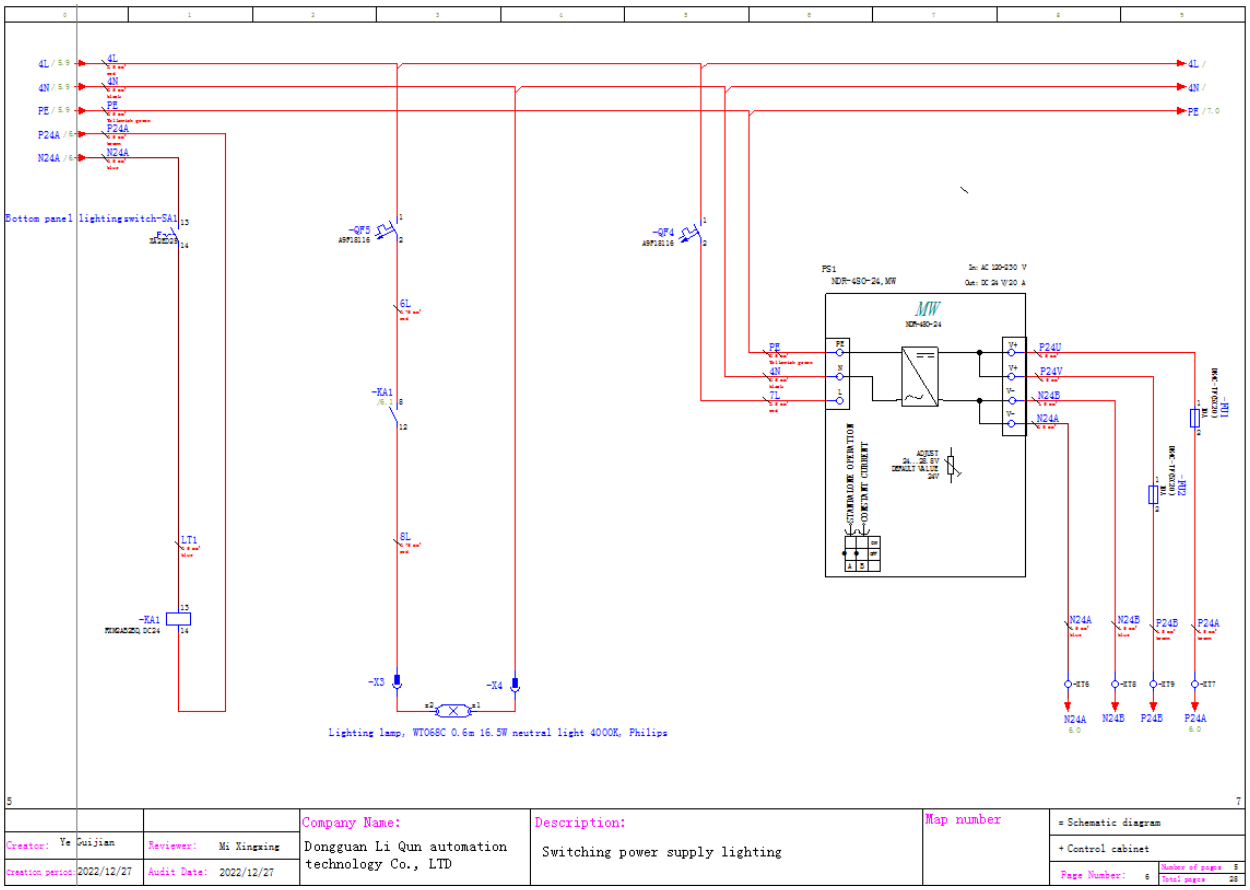

Bottom panel lightingswitch-SA1
-QF5
-QF4
-KA1
-KA2
LT1
-X3
-X4
Lighting lamp, WT068C 0.6m 16.5W neutral light 4000K, Philips
Company Name:
Dongguan Li Qun automation technology Co., LTD
Description:
Switching power supply lighting
Map number
Creator: Ye Guijian
Reviewer: Mi Xingxing
Creation period: 2022/12/27
Audit Date: 2022/12/27
= Schematic diagram
+ Control cabinet

Figure A-0-3

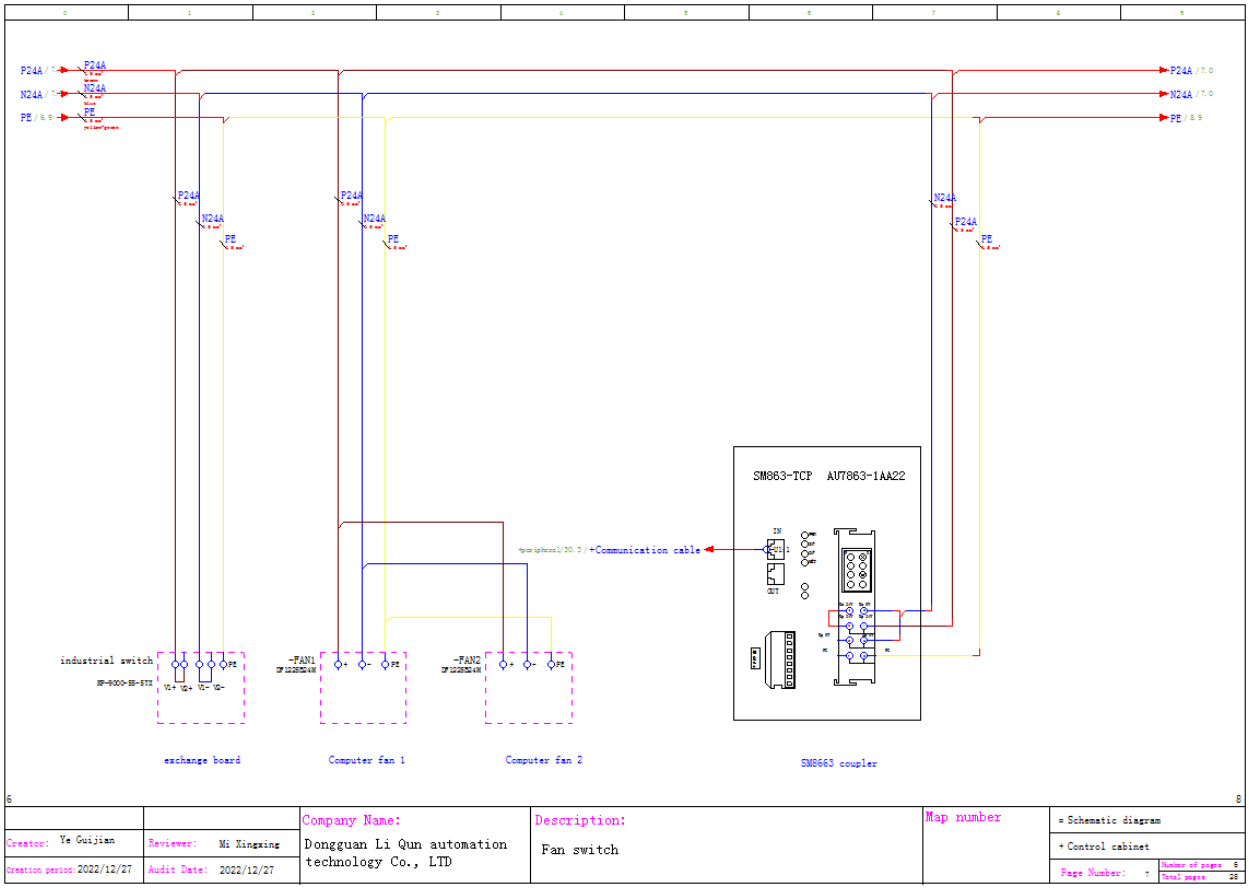

SM863-TCP AU7863-1AA22
industrial switch
-FAN1
-FAN2
exchange board
Computer fan 1
Computer fan 2
SM8663 coupler
Company Name:
Dongguan Li Qun automation technology Co., LTD
Description:
Fan switch
Map number
Creator: Ye Guijian
Reviewer: Mi Xingxing
Creation period: 2022/12/27
Audit Date: 2022/12/27
= Schematic diagram
+ Control cabinet

Figure 0-4

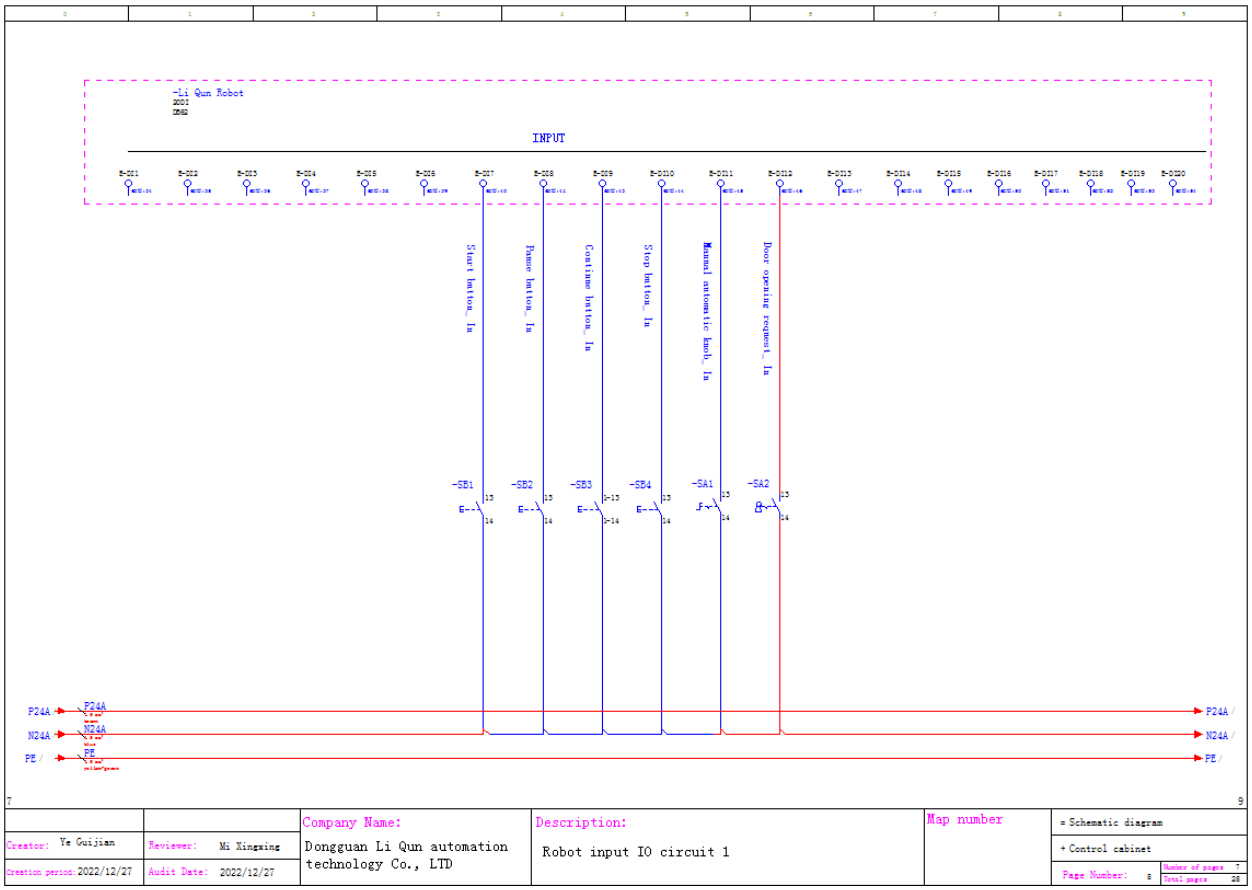


Figure A-0-5

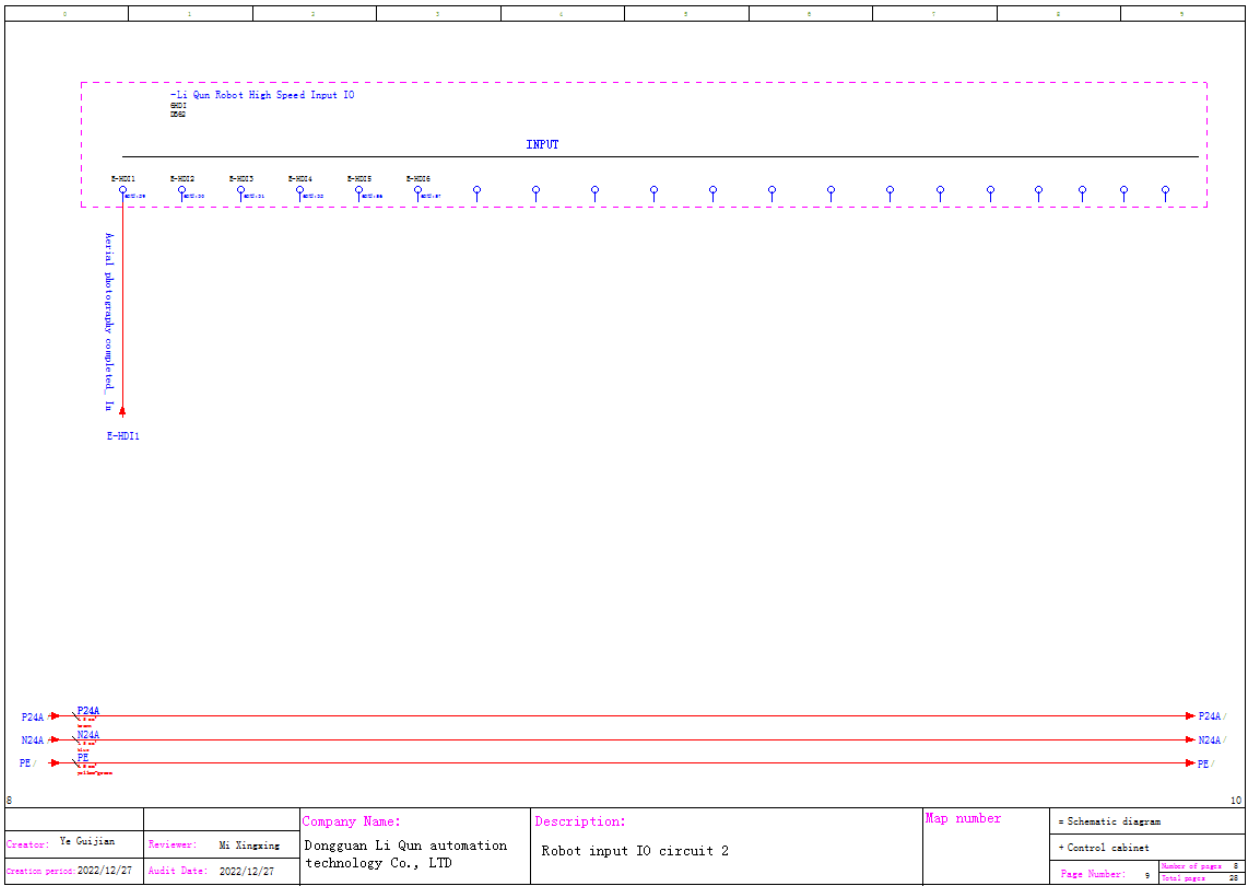

-Li Qun Robot High Speed Input IO
INPUT
E-HDI1
P24A
N24A
PE
Company Name:
Dongguan Li Qun automation technology Co., LTD
Description:
Robot input IO circuit 2
Map number
Creator: Ye Guijian
Reviewer: Mi Xingxing
Creation period: 2022/12/27
Audit Date: 2022/12/27

Figure 0-6

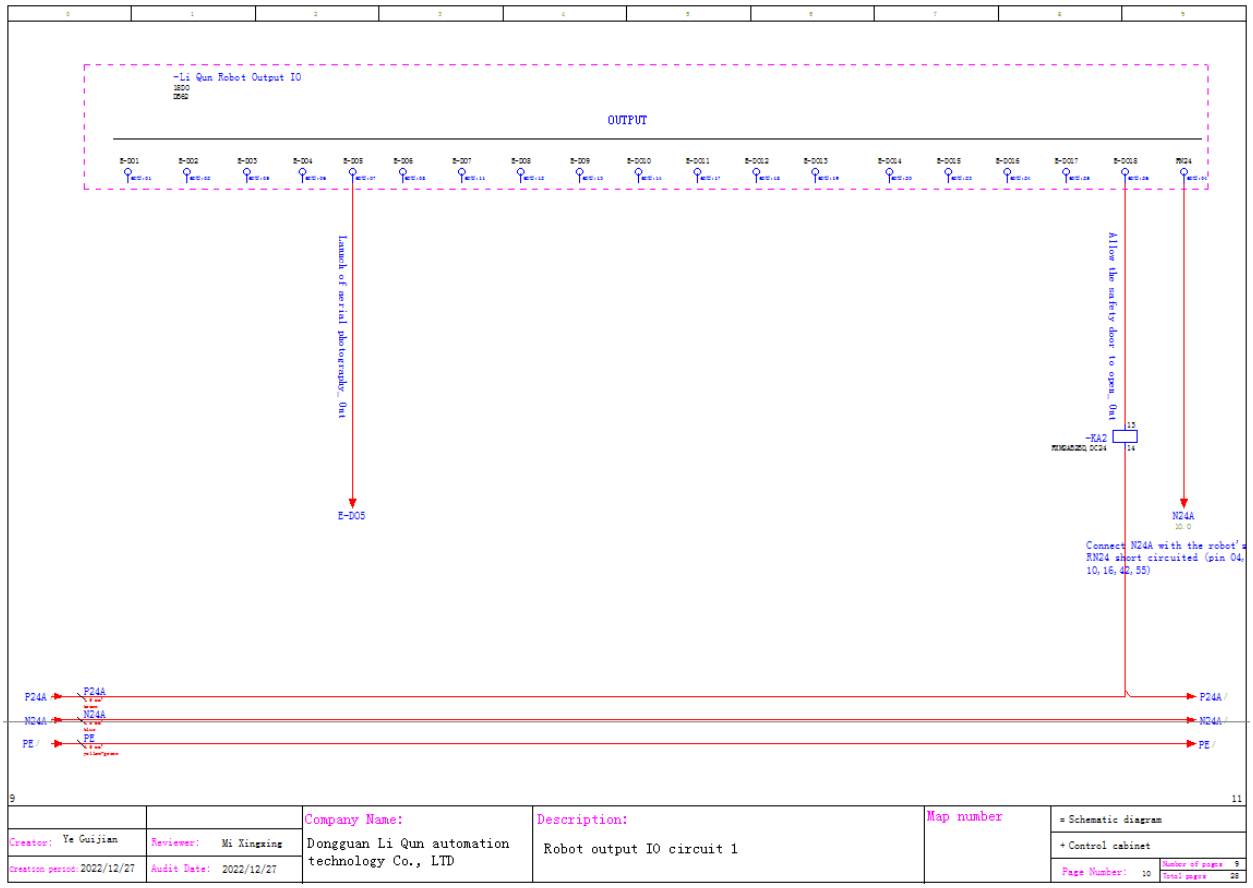

-Li Qun Robot Output IO
OUTPUT
E-DO5
-KA2
N24A
P24A
N24A
PE
Company Name:
Dongguan Li Qun automation technology Co., LTD
Description:
Robot output IO circuit 1
Map number
Creator: Ye Guijian
Reviewer: Mi Xingxing
Creation period: 2022/12/27
Audit Date: 2022/12/27

Figure 0-7

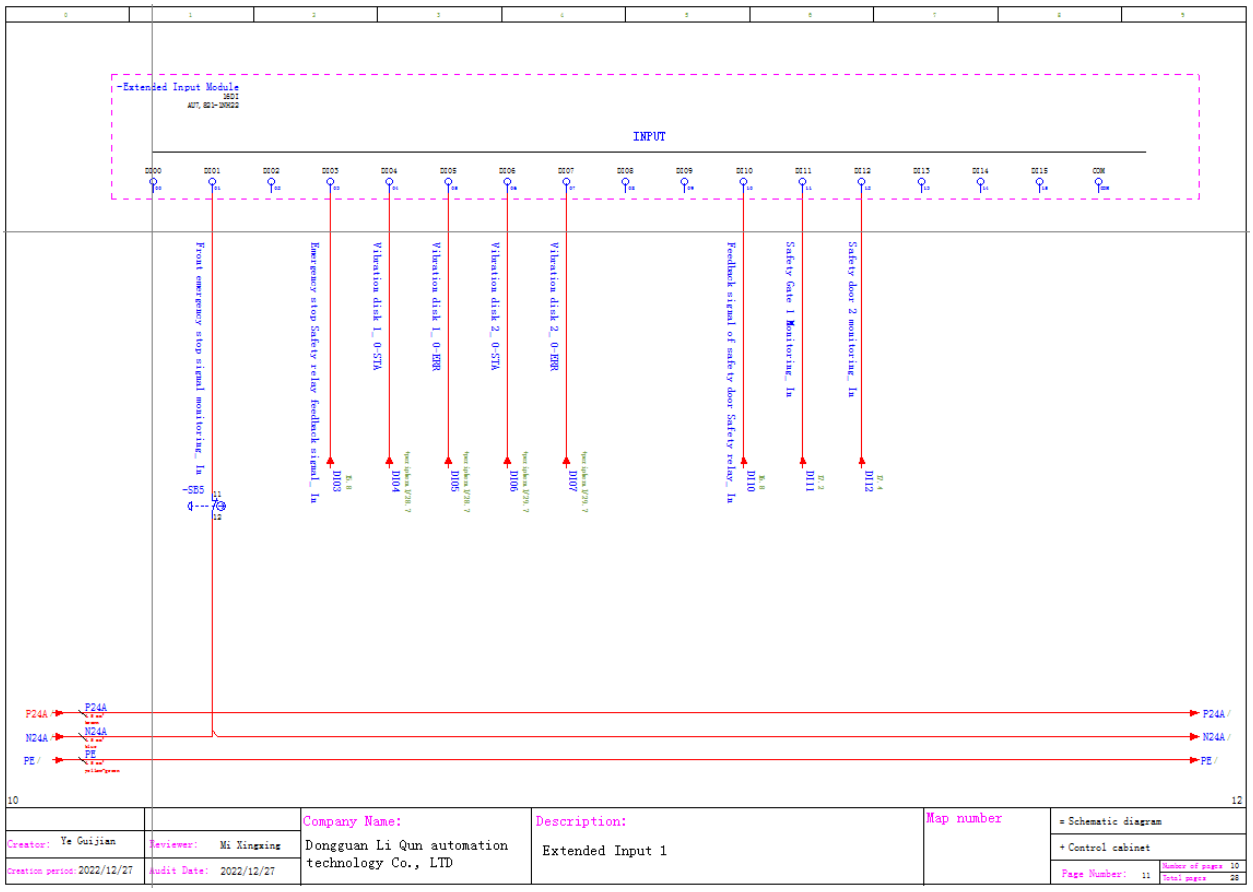


Figure 0-8

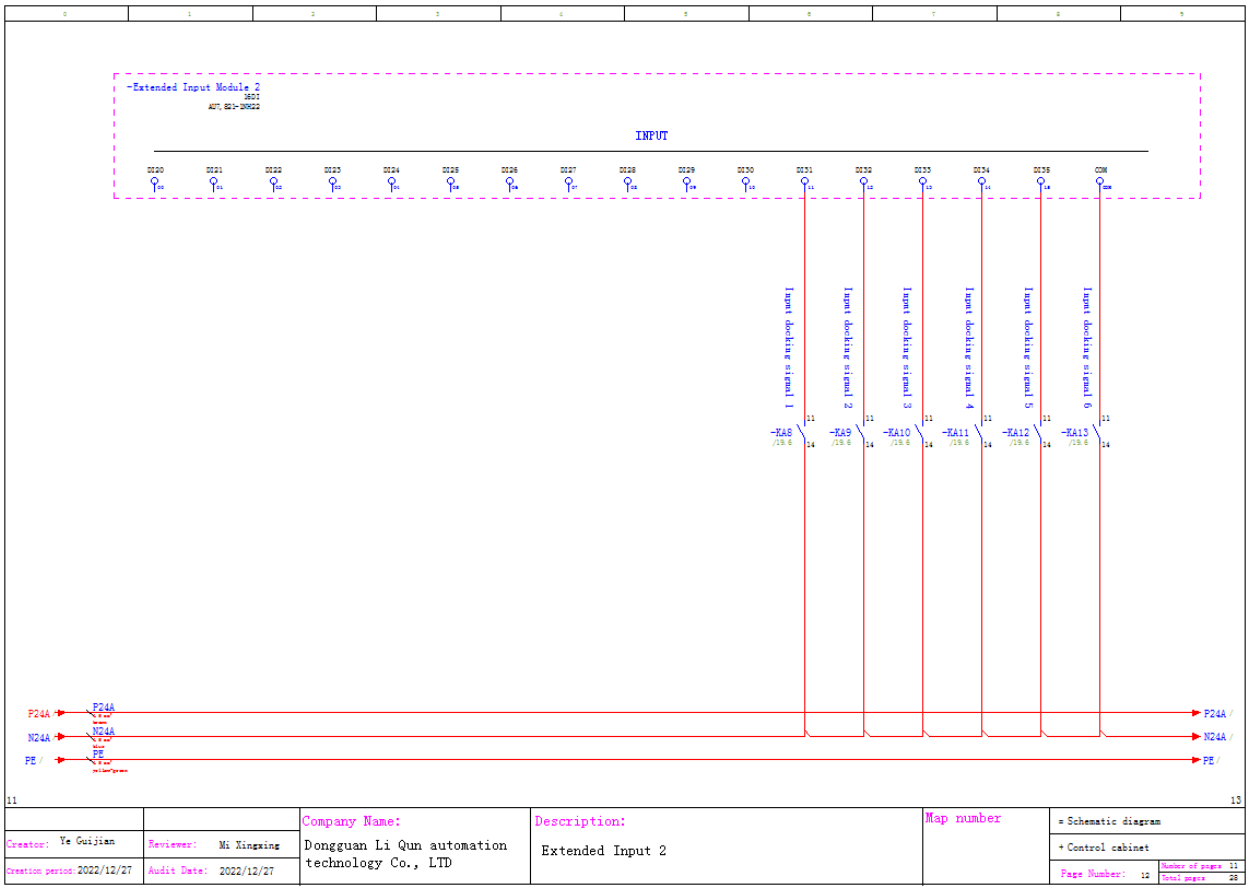

-Extended Input Module 2
INPUT
I020
I021
I022
I023
I024
I025
I026
I027
I028
I029
I030
I031
I032
I033
I034
I035
COM
Input docking signal 1
Input docking signal 2
Input docking signal 3
Input docking signal 4
Input docking signal 5
Input docking signal 6
-KA8
-KA9
-KA10
-KA11
-KA12
-KA13
P24A
N24A
PE
11
13
Company Name:
Dongguan Li Qun automation technology Co., LTD
Description:
Extended Input 2
Map number
Creator: Ye Guijian
Reviewer: Mi Xingxing
Creation period: 2022/12/27
Audit Date: 2022/12/27
= Schematic diagram
+ Control cabinet
Page Number: 12
Number of pages 11
Total pages 28

Figure A-0-9

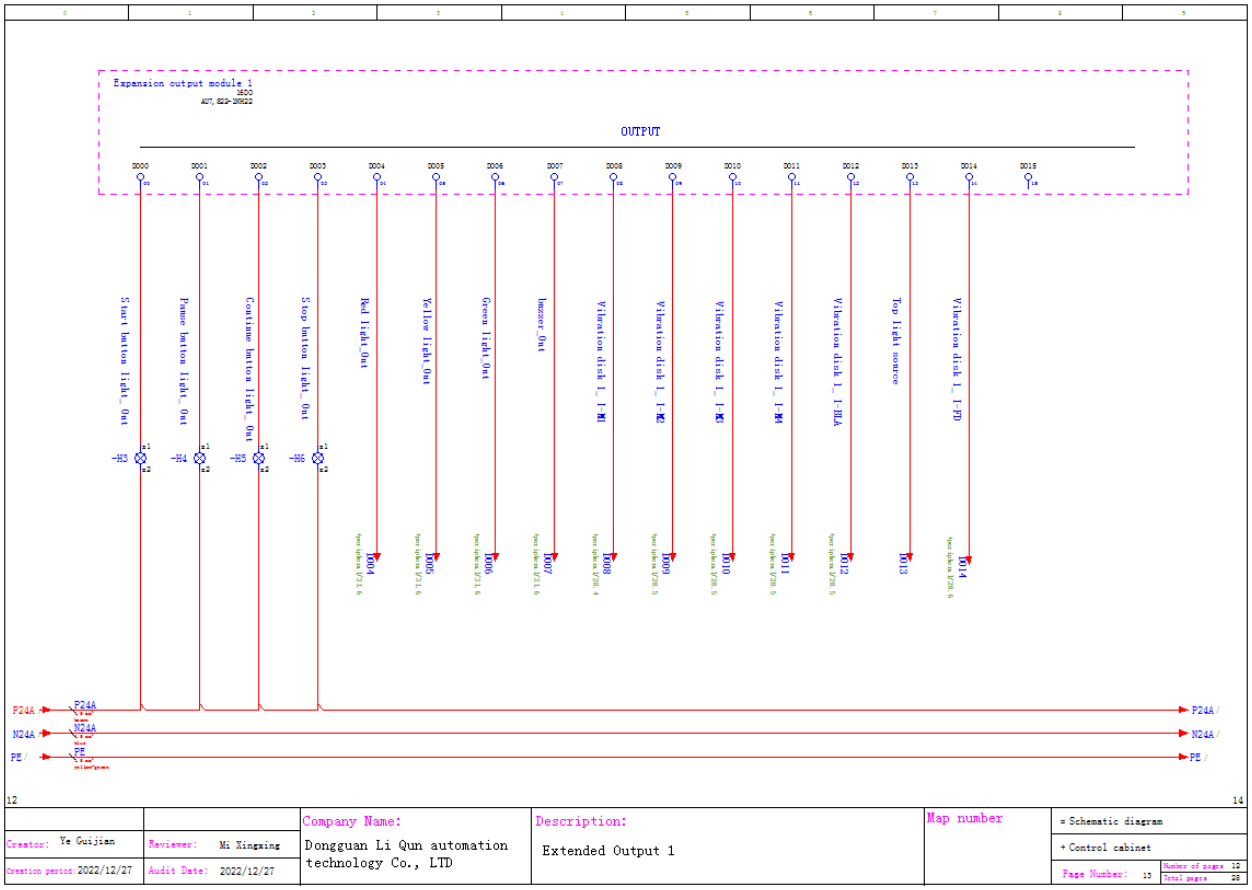


Figure A-0-10

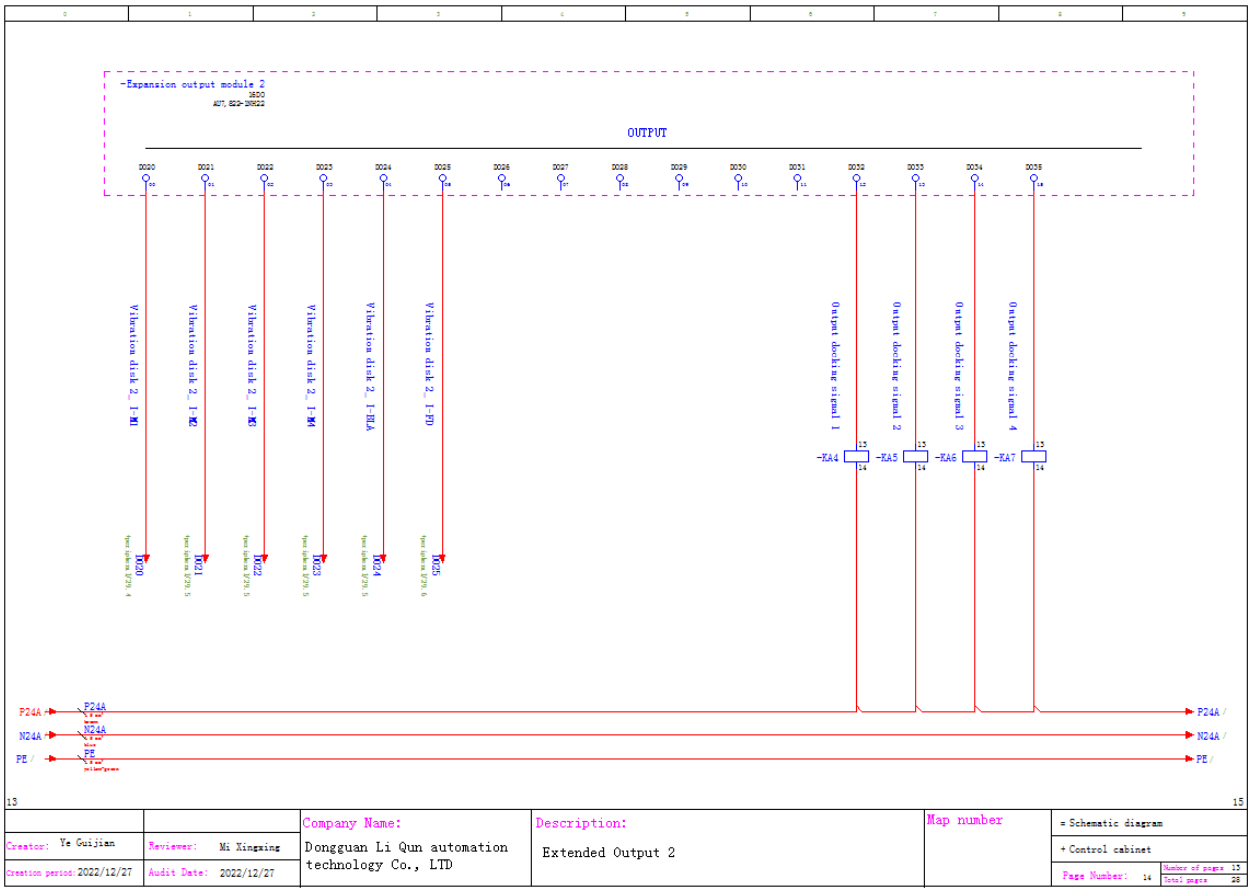


Figure A-0-11

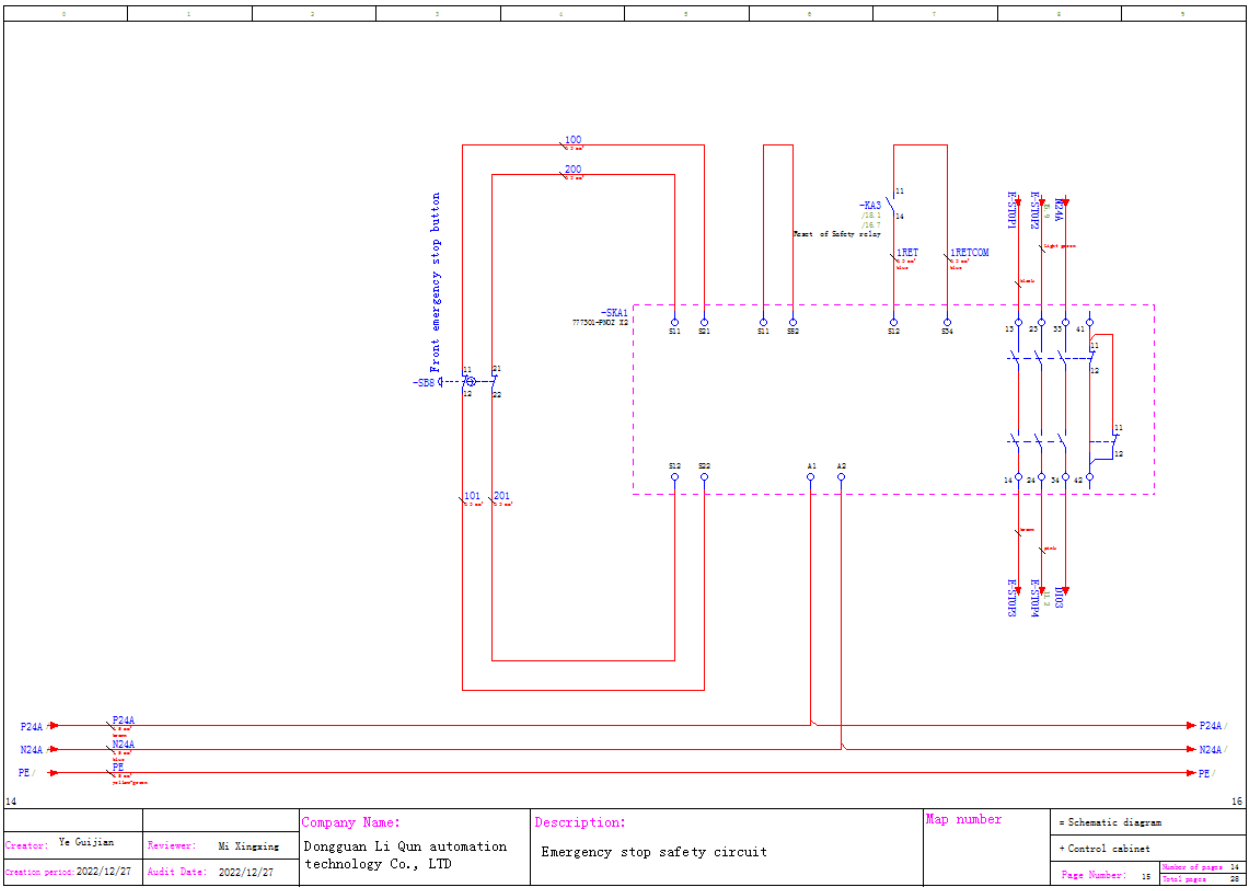


Figure A-0-12

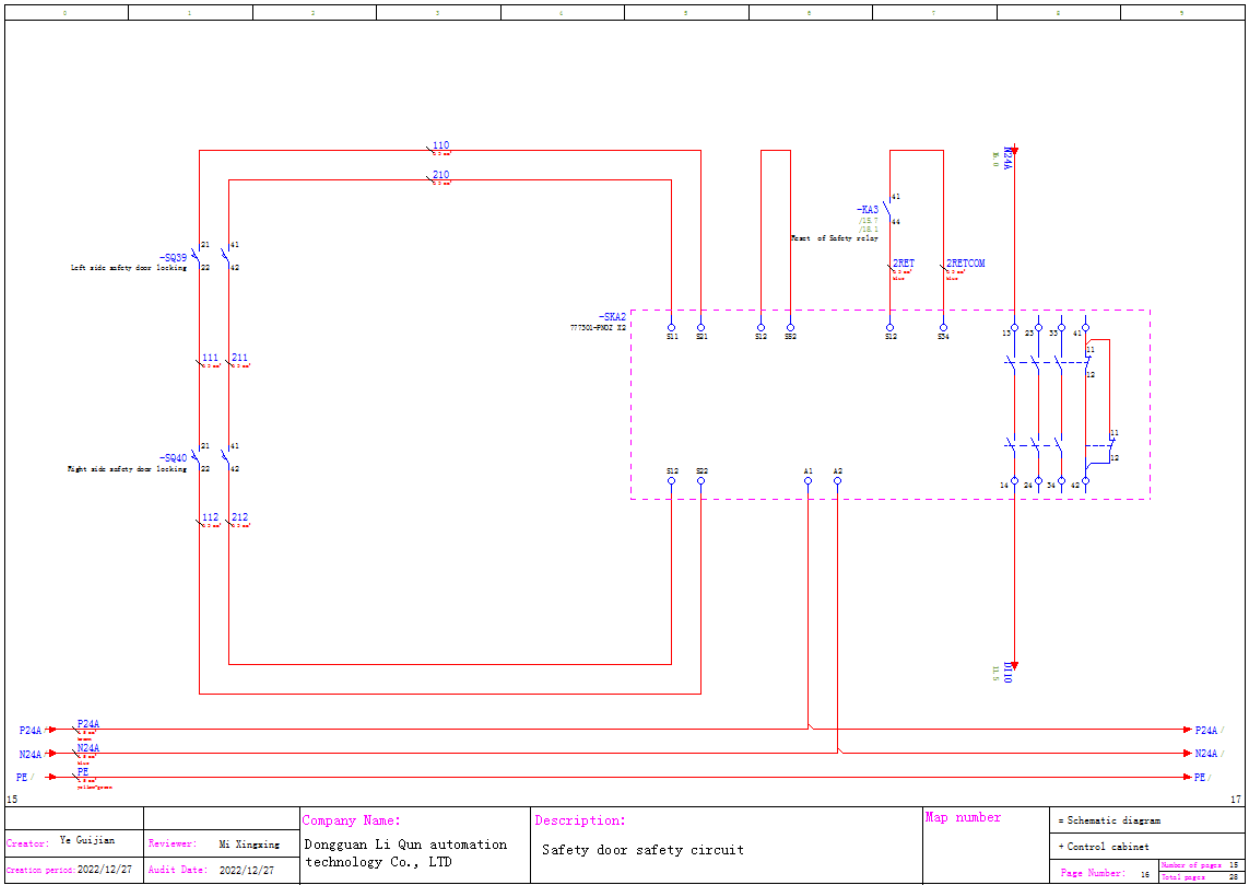

110
210
-SQ39
Left side safety door locking
111
211
-SQ40
Right side safety door locking
112
212
-KA3
Reset of Safety relay
2RET
2RETCOM
-SKA2
P24A
N24A
PE
DI0
Company Name:
Dongguan Li Qun automation technology Co., LTD
Description:
Safety door safety circuit
Map number
Schematic diagram
Control cabinet
Creator: Ye Guijian
Reviewer: Mi Xingxing
Creation period: 2022/12/27
Audit Date: 2022/12/27
Page Number: 16
Number of pages 15
Total pages 28

Figure A-0-13

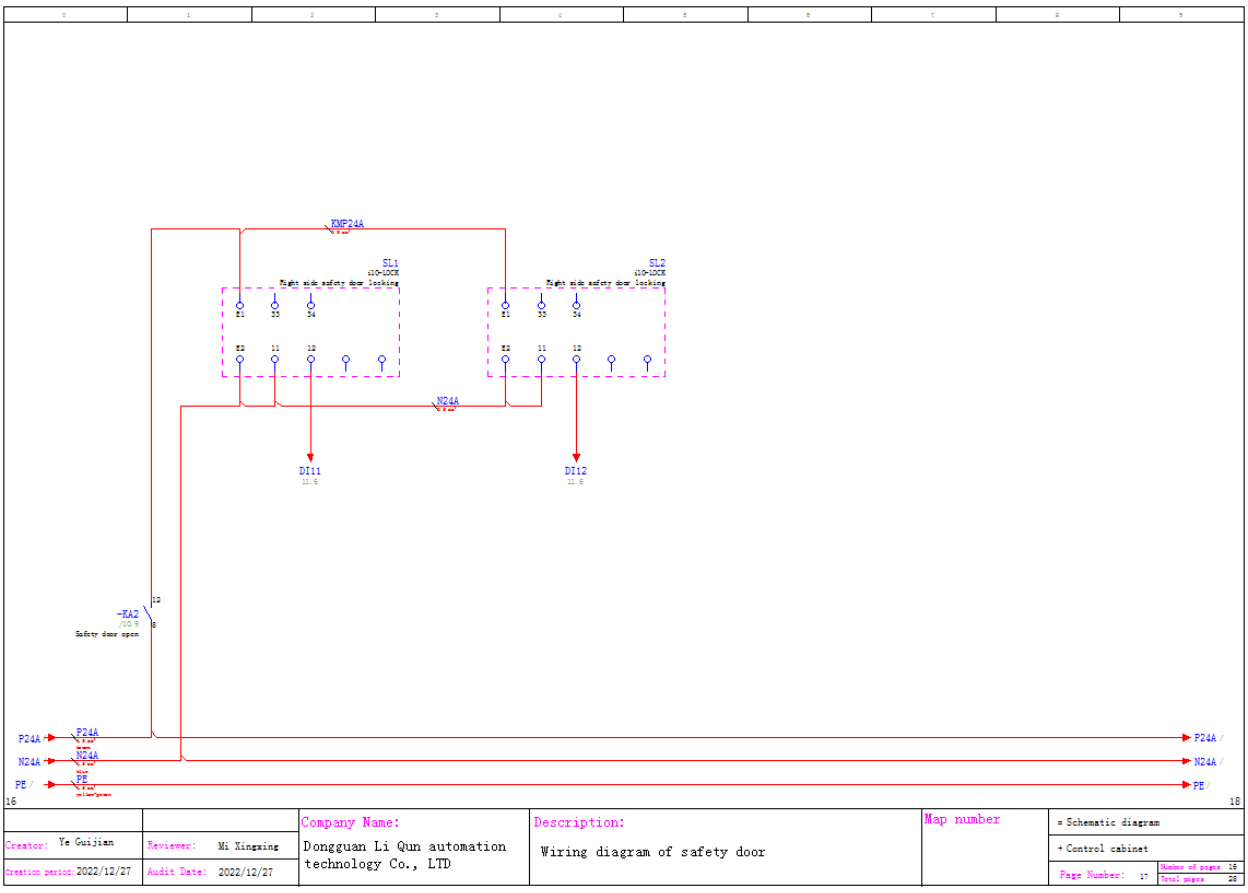

KMP24A
SL1
SL2
Right side safety door locking
N24A
DI11
DI12
-KA2
Safety door open
P24A
PE
Company Name:
Dongguan Li Qun automation technology Co., LTD
Description:
Wiring diagram of safety door
Map number
Schematic diagram
Control cabinet
Creator: Ye Guijian
Reviewer: Mi Xingxing
Creation period: 2022/12/27
Audit Date: 2022/12/27
Page Number: 17
Number of pages 16
Total pages 28

Figure A-0-14

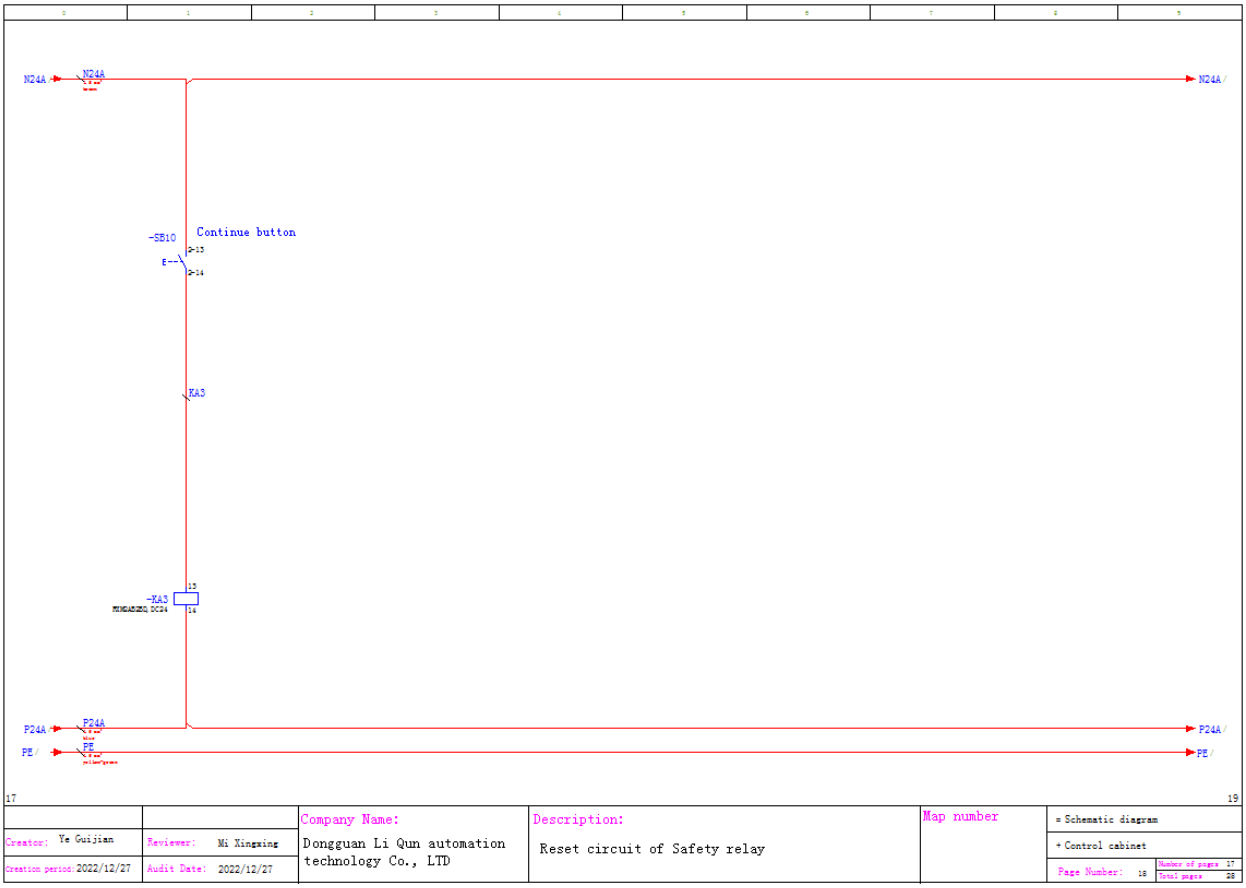


Figure A-0-15

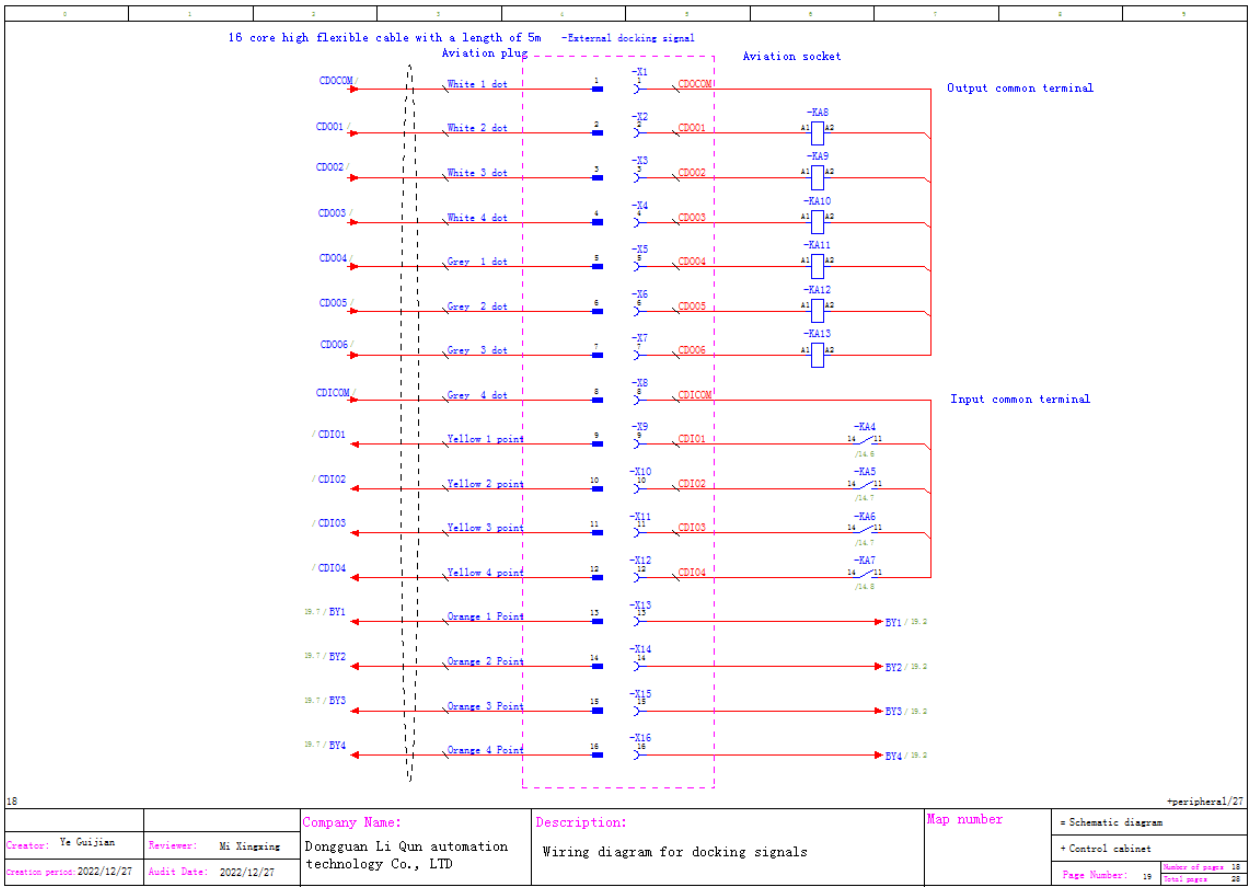


Figure A-1-2

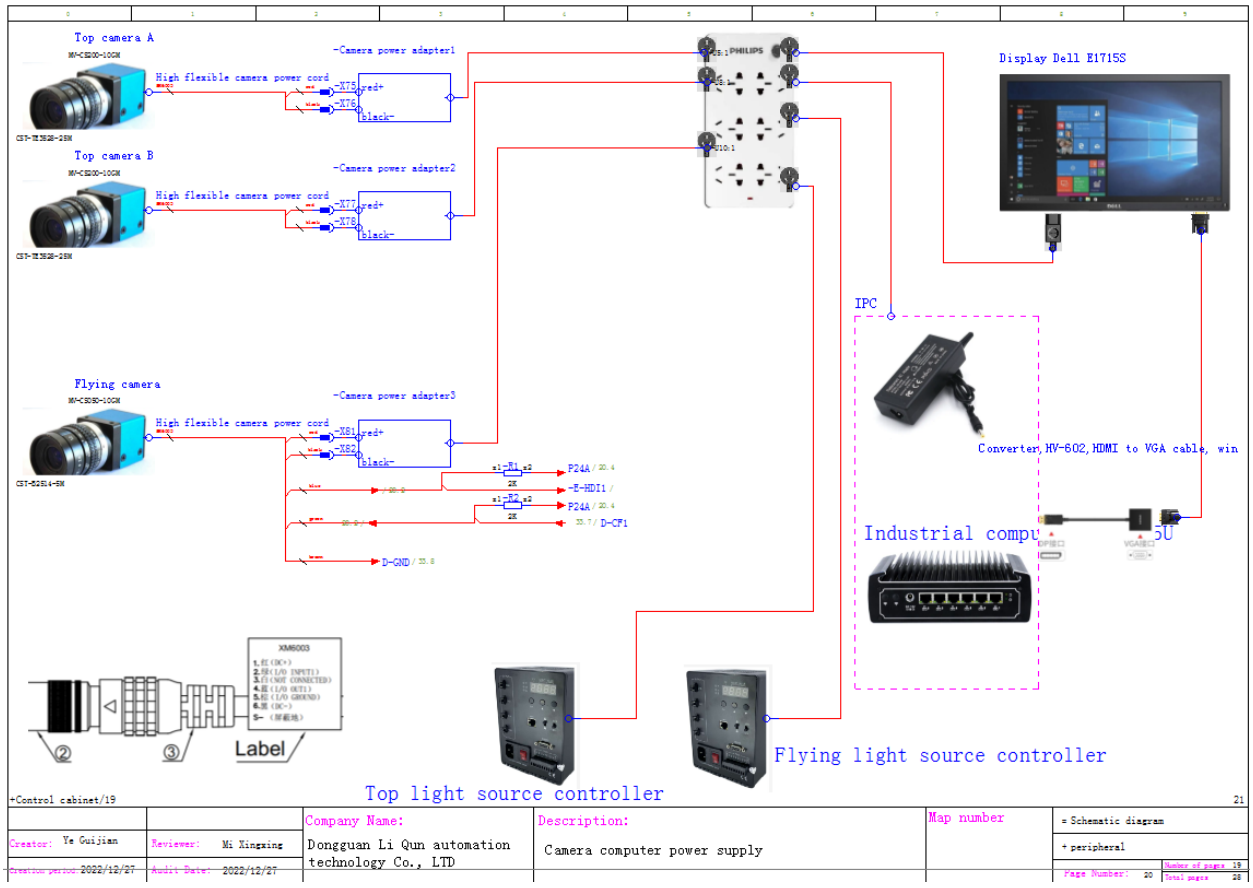


Figure A-0-16

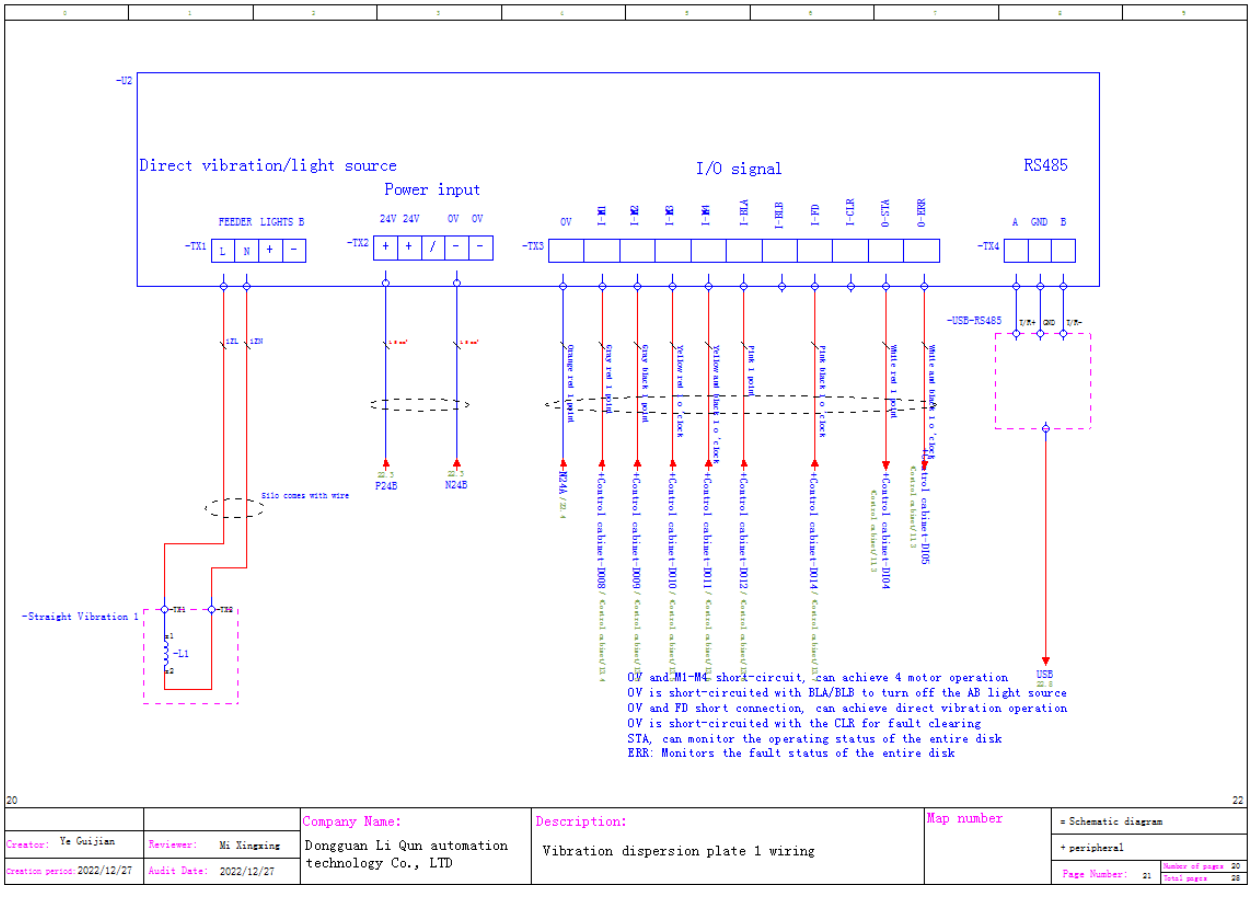


Figure A-0-17

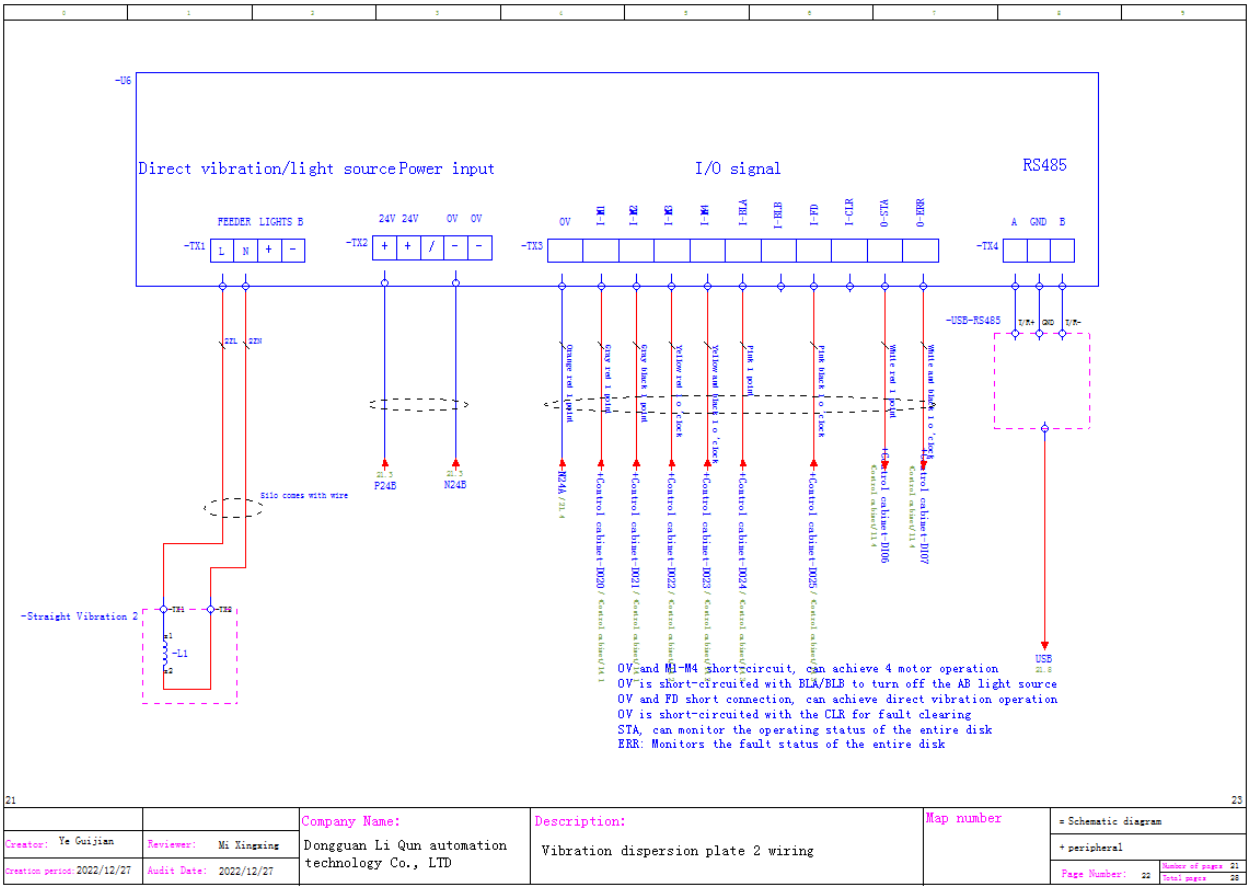


Figure A-0-18

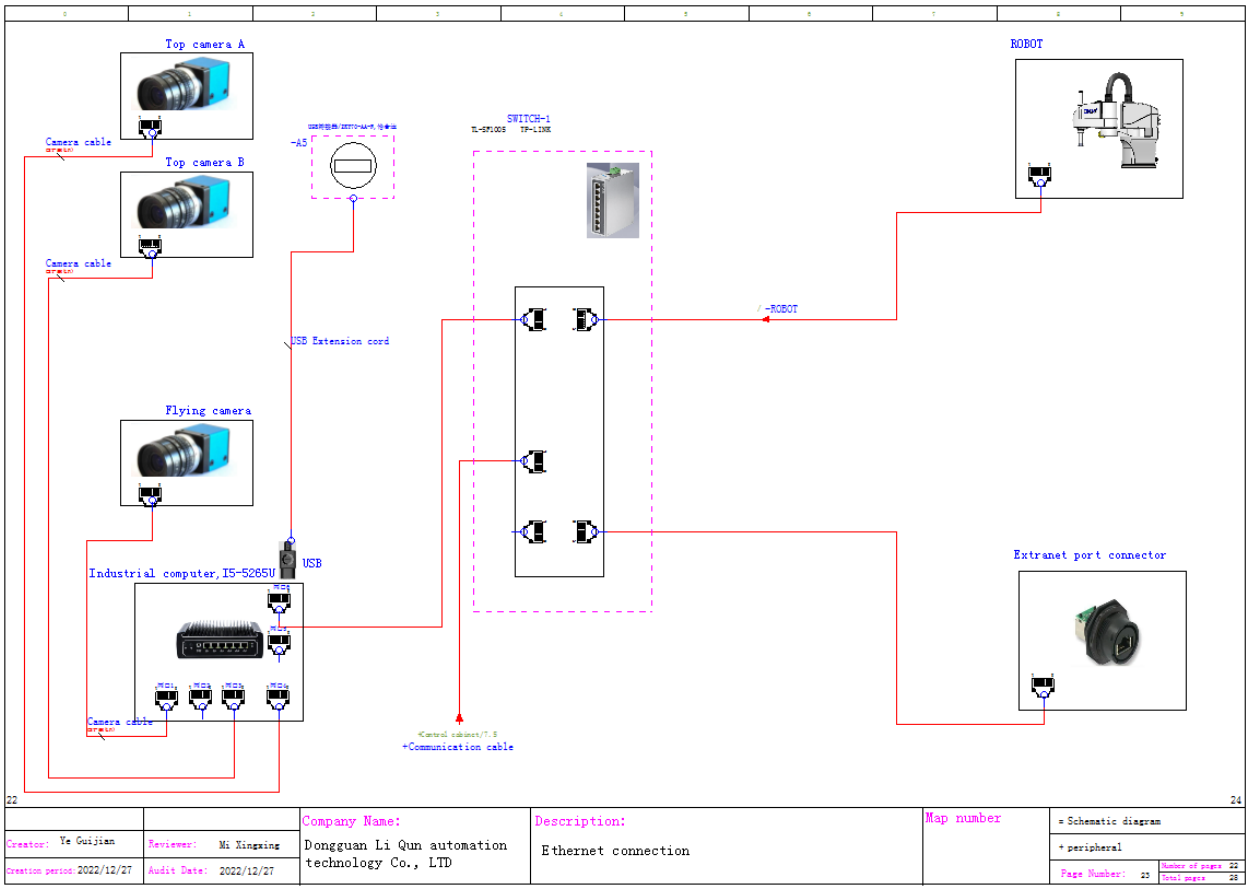


Figure 0-19

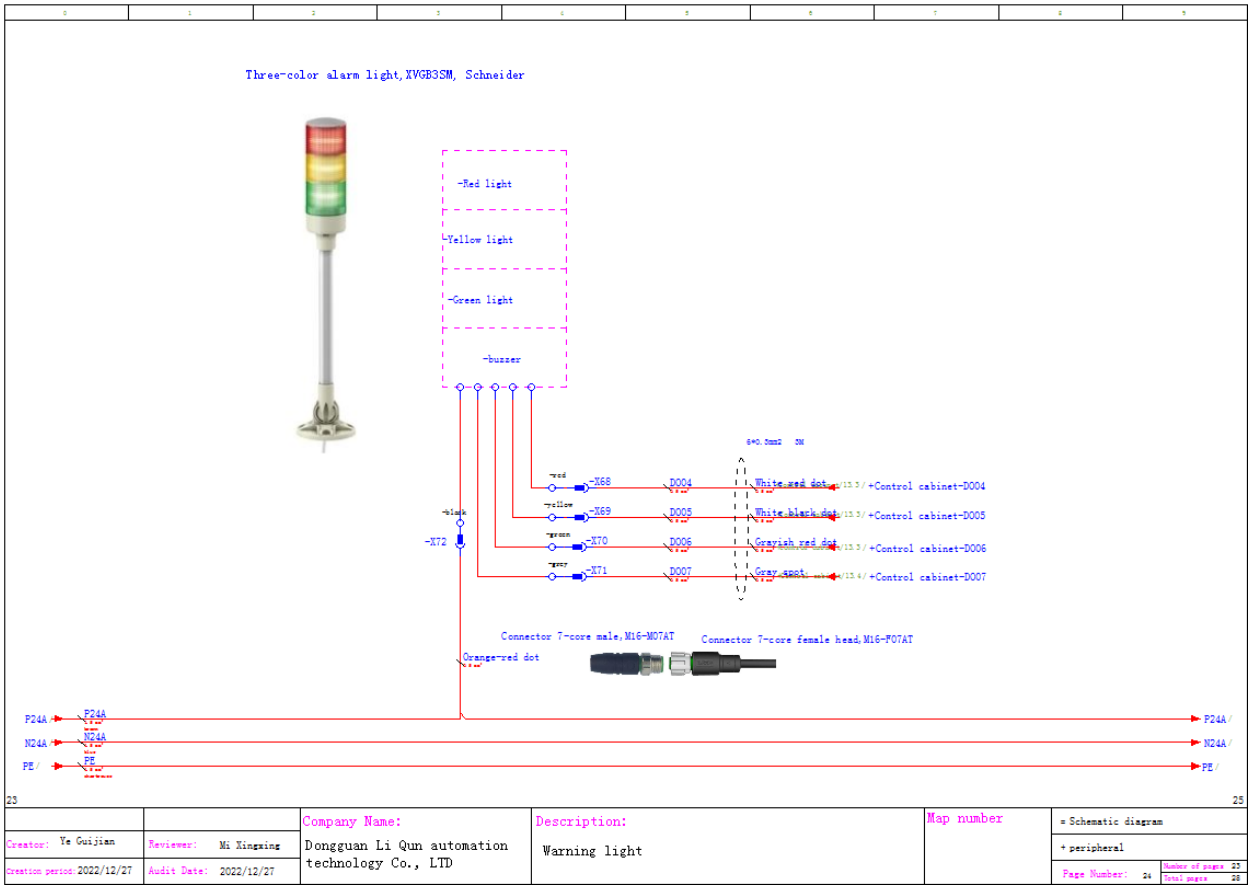


Figure 0-20

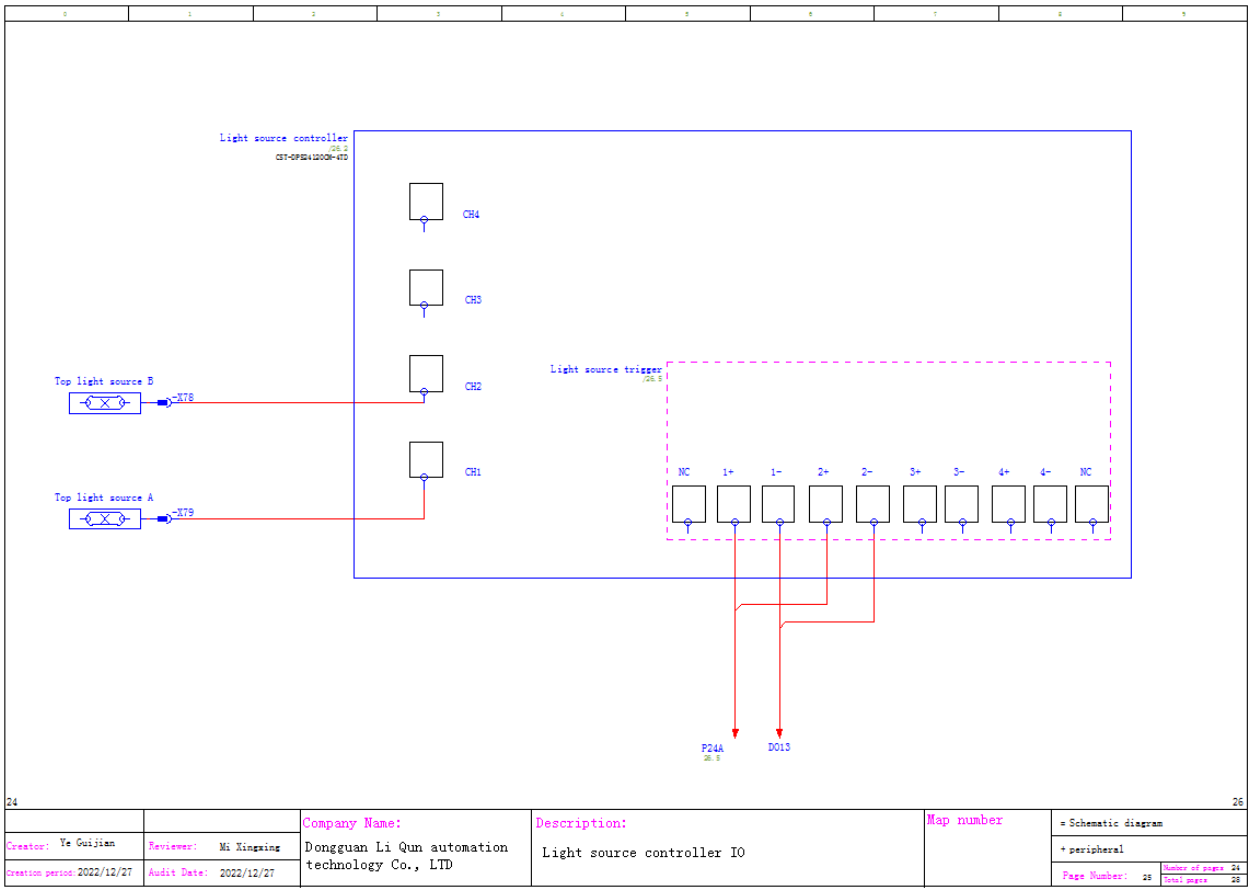


Figure 0-21

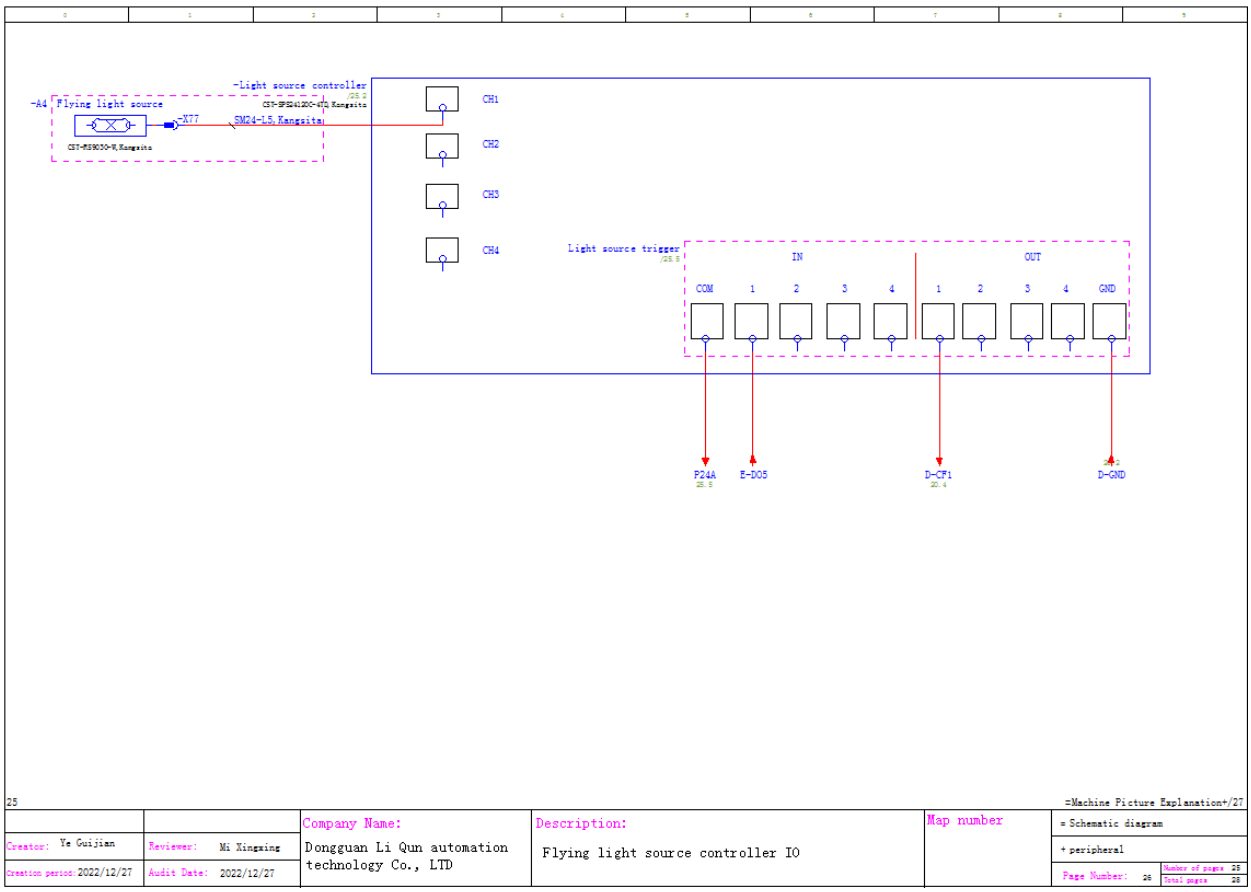


Figure A-0-22

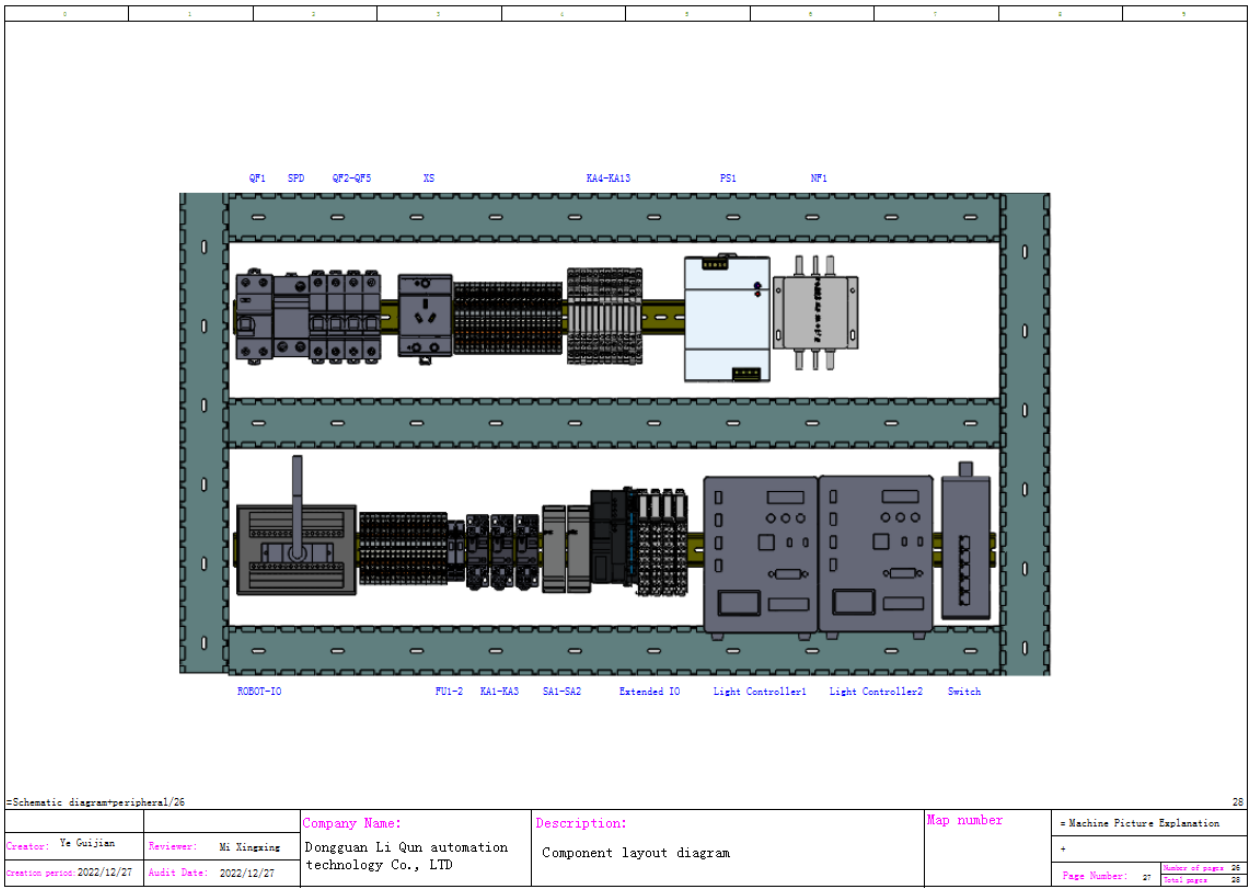

QF1
SPD
QF2-QF5
XS
KA4-KA13
PS1
NF1
ROBOT-IO
FU1-2
KA1-KA3
SA1-SA2
Extended IO
Light Controller1
Light Controller2
Switch
=Schematic diagram+peripheral/26
28
Company Name:
Dongguan Li Qun automation technology Co., LTD
Description:
Component layout diagram
Map number
= Machine Picture Explanation
+
Creator: Ye Guijian
Reviewer: Mi Xingxing
Creation period: 2022/12/27
Audit Date: 2022/12/27
Page Number: 27
Number of pages 26
Total pages 28

Figure A- 0-23

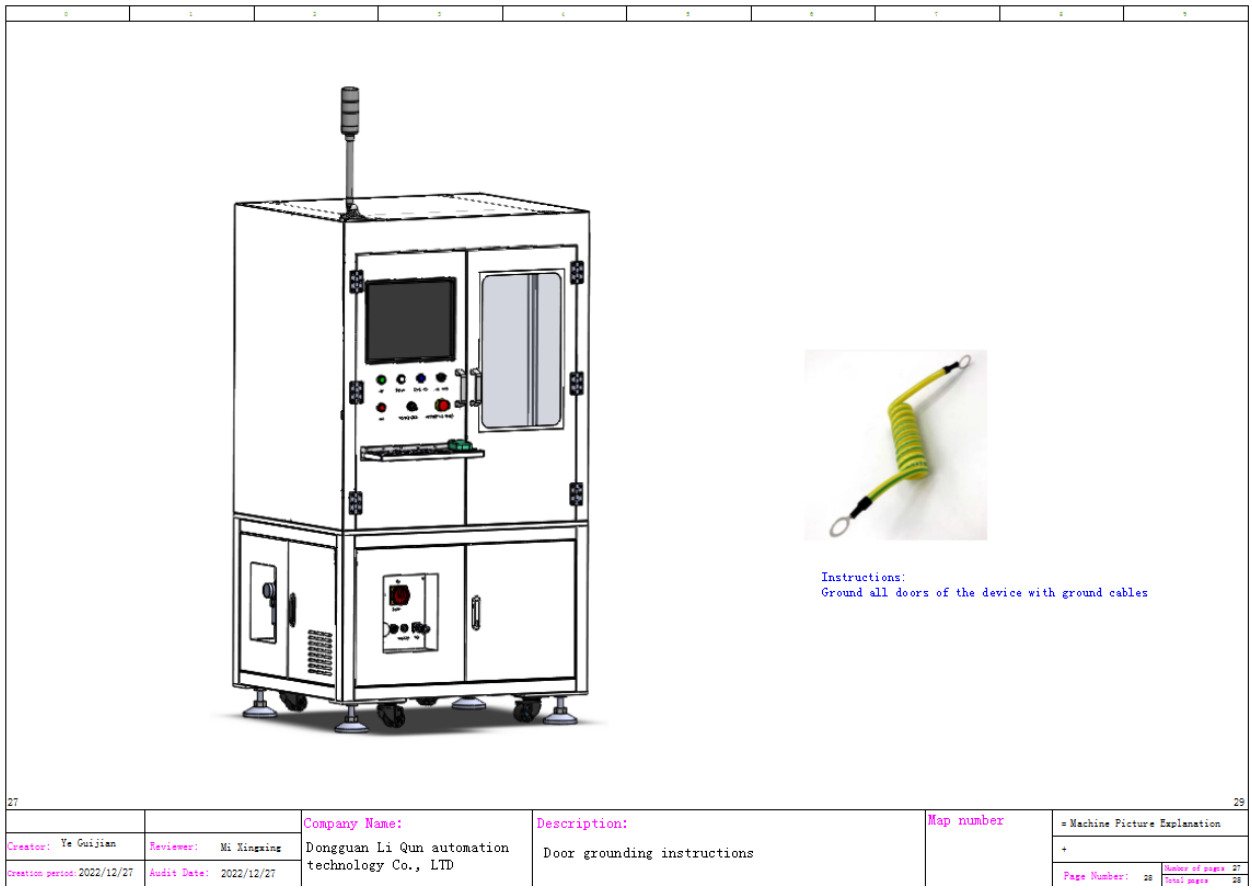

Instructions:
Ground all doors of the device with ground cables
27
29
Company Name:
Dongguan Li Qun automation technology Co., LTD
Description:
Door grounding instructions
Map number
= Machine Picture Explanation
+
Creator: Ye Guijian
Reviewer: Mi Xingxing
Creation period: 2022/12/27
Audit Date: 2022/12/27
Page Number: 28
Number of pages 27
Total pages 28

Figure A-0-24

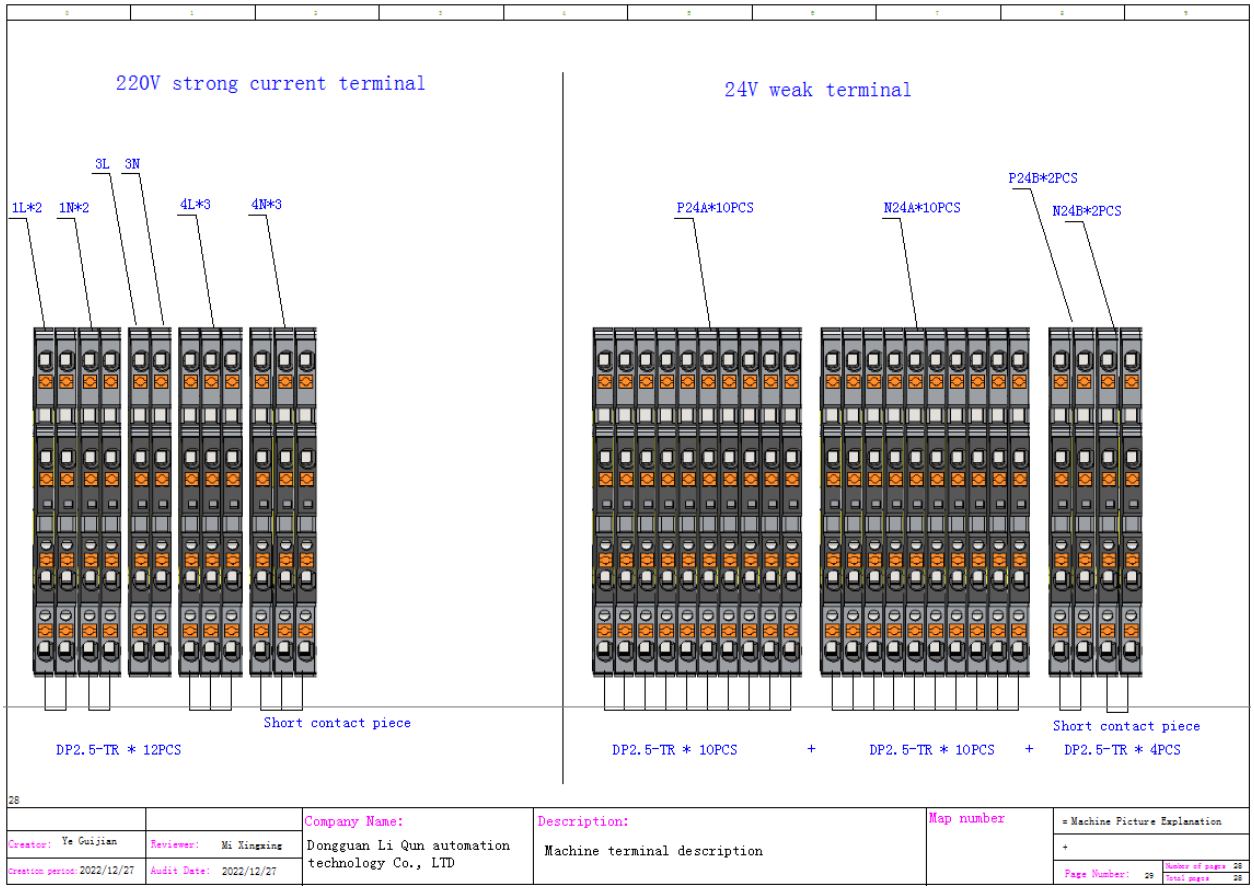
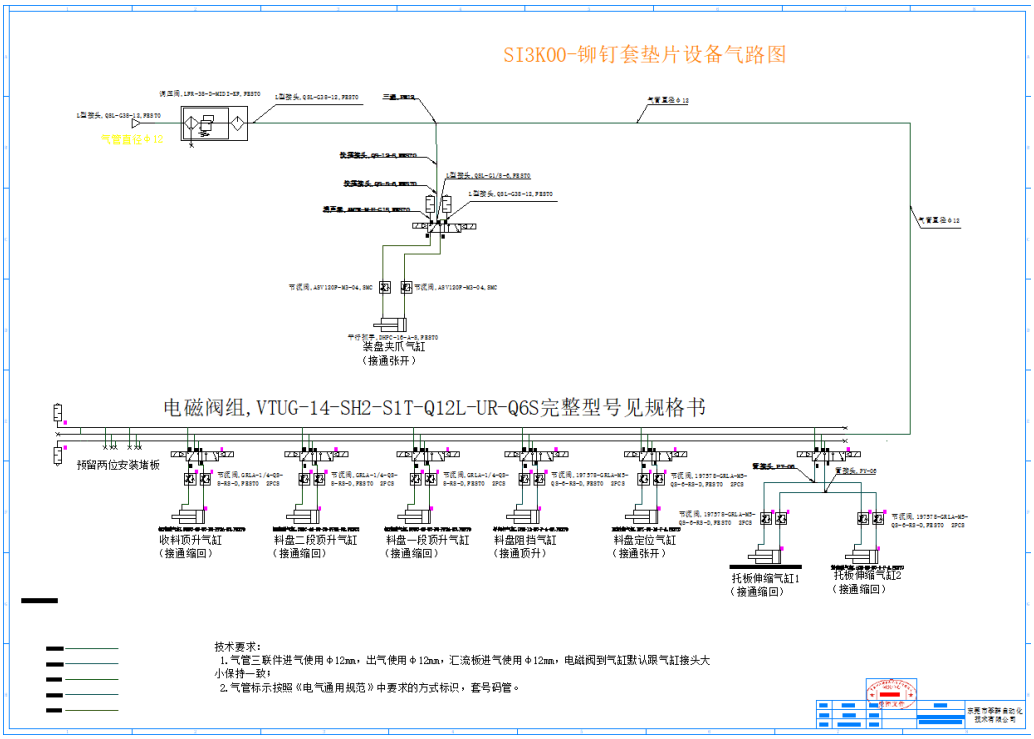


Figure 0-25

Appendix B Schematic diagram of air circuit



SI3K00-铆钉套垫片设备-气路图.dwg

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