

JAKA

JAKA Robot

User Manual

Hardware Section



JAKA MiniCobo

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User Manual

JAKA MiniCobo V1.4

Robot Body No. _____

Controller No. _____

Note:

The definition of robot follows the international ISO standards and relevant regulations of the national standards to protect the safety of operators. We DO NOT recommend directly applying the robot body on the occasion that the working object is human body. However, when the robot user does need to concern human body as robot's work object, it is necessary to configure a safe, reliable, fully tested and certified safety protection system for the robot body, on the premise that the user fully evaluates the safety of the personnel. All the measures are to protect personnel safety.

All content in this User Manual is the exclusive property of JAKA Robot Co., Ltd. (Hereinafter collectively called as JAKA), and shall not be used in any form without the written permission of JAKA.

The user manual will be updated and improved regularly by JAKA. And contents of it will be changed without prior notification. Please check carefully the actual product information before using this manual.

The information contained in the User Manual is not a commitment of JAKA. And JAKA is not responsible for any errors that may occur in this Manual and not responsible for any accidental or indirect damages caused by using this Manual and products it introduces. Please read this Manual carefully before installing and using the robot.

The pictures in this Manual are for reference only, please refer to the actual product.

If the robot is modified or disassembled, JAKA will not be liable for after-sales service.

JAKA also reminds the user that safety equipment must be used and the safety provisions must be in compliance with, when using and maintaining the JAKA robot.

The Programmer of JAKA robot and the Designer & Debugger of the robot system must be familiar with JAKA robot's programming mode and system application installation.

Manual Instructions

This manual mainly includes precautions for the safe operation of the robot, mechanical and electrical interfaces, installation and maintenance, how to use JAKA APP software, and so on.

The users of this manual should have received basic mechanical and electrical training, which will contribute to the installation and use of the robot.

More Information

For more information, please scan the QR code on the right to visit our official website www.jaka.com.



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Introduction

JAKA MiniCobo robot will whole heartedly serve you. Imagine what you desire. And do what you want.



All series of JAKA robots innovatively use a new control mode, which is mobile intelligent terminal plus APP, to connect with the robot body. One mobile terminal can control several robot bodies. Meanwhile, the operator does not need to master a professional programming language. The only thing he need to do is guiding the robot manually to complete the programming. So, human-machine collaboration is easier. And the working efficiency is improved greatly.

is a small six-axis robot, with a payload of 1Kg. It is a robot developed by JAKA, which is applied to new business, education, industry and other scenarios

Product List

When you purchase a whole set of JAKA MiniCobo robot, the package list you receive is as follows:

No.	Name	Quantity
1	JAKA MiniCobo Robot	1
2	JAKA MiniCab Controller and control handle	1
3	24VDC power adapter	1
4	Power cord and connecting cable	1
5	JAKA certificate	1
6	JAKA MiniCobo User Manual	1
7	After-sales service warranty card	1

Chapter 1 Safety Specification

1.1 Introduction

This chapter mainly introduces the safety principles and specifications that shall be obeyed when using robots and robot systems. Users shall carefully read the safety related contents in this manual and strictly obey them. Operators shall be fully aware of the complexity and danger of the robot system and pay special attention to the contents related to warning signs.

1.2 Safety Warning Signs Description

The following warning signs are used to describe the hazard levels stipulated in this manual. Please strictly observe the safety contents.



Warning:

This sign indicates a potentially dangerous when using electricity, which, if not avoided, can cause personal injury or serious damage to the equipment.



Warning:

This sign indicates a potentially dangerous situation, which, if not avoided, can cause personal injury or serious damage to the equipment.



Warning:

This sign indicates a hot surface that may cause danger. If touched, it may cause personal injury.

1.3 Safety Precautions

The main content of this section is related to safety items that need to be paid attention to during installation and use. Please read carefully.



1. First, the robot must be installed in accordance with the instructions and precautions in this manual.

2. The installation height of the power cut-off switch is 0.6m~1.9m, in order to guarantee that the power supply can be cut off in time and conveniently in event of an accident.

3. When using the robot for the first time, it is necessary to check the integrity of the robot's protection system, as well as the safety of the operation to ensure that there is no damage of it.

4. Personnel with robot operation qualifications are required to check each safety function and ensure that the parameters and procedures are correct, before starting the robot.



1. Professional debugging personnel are required to install and debug the robot in accordance with the specifications.

2. The setting and modification of robot parameters must be performed by authorized personnel.

3. Do not switch on/off the power supply system frequently.

4. When the robot load exceeds the set range, it will stop moving to prevent damage to the robot and injury to the operator. Because JAKA robot controller has the collision detection function. If the operator uses his own controller or active closes the protection function, he has to bear his own risk.



1. Ensure that robot's arms and tools are installed correctly.

2. Ensure that robot arm has enough free movement space.

3. Do not connect the safety equipment to the normal I/O interface, to avoid injury.

4. Ensure the correct installation settings (such as the installation angle of the robot, the weight in the TCP, the TCP offset, and the safety-related configuration) are configured. Save the installation file and load it into the program.

5. The end-effector connected to the tool end must not have sharp edges. Before operating, make sure that all personnel are outside the reach of the robot.

6. Connecting different machinery may increase the risk or introduce new risks. Always conduct a comprehensive risk assessment for the entire installation procedure.

7. Do not tamper with the robot without authorization. The changes to the robot may cause unknown danger that the integrator cannot predict. If the robot is modified in any methods, JAKA does not take any responsibility.



1. The robot body and the controller will generate heat when they are working. After high-load operation, DO NOT touch the robot when it is just stopped to avoid burns.

2. When the controller is working, heat will be generated. Do not touch the controller's heat radiating fins to avoid burns.



1. When robot is connected to the machine which can cause damage to it, it is recommended to check all the functions of the robot and the robot program separately. To check the robot program, it is recommended to use temporary waypoints outside the workspace of other machinery

2. A strong magnetic field can damage the robot. Do not expose the robot in a permanent magnetic field.

1.4 General warnings and reminders



1. Operators who use the robot system are strictly prohibited from wearing loose clothes and jewelry. Operators with long hair should make sure that their hair is tied up.

2. During the operation of the equipment, even if the robot seems to have stopped, it may be in state of being about to move because it is waiting for the start signal. In this state, the robot should also be regarded as in motion.

3. During the operation of the robot, ensure that the controller power cord and the robot power cord are reliably connected. It is strictly forbidden to plug or unplug the power supply and terminals when the power is on in the working mode.

4. A warning line should be drawn on the ground to mark the range of motion of the robot, so that the operator can understand the range of motion of the robot including holding tools (manipulators, tools, etc.).

5. Ensure that safety measures (such as guardrails, ropes, or protective screens) are taken near the robot operating area to protect the operator and surrounding personnel. The locks should be set according to the requirements, except for the personnel responsible for the operation, other personnel are not allowed to touch the power supply of the robot.

6. In emergency or abnormal situations such as people are caught by the robot or besieged by the robot, after pressing the E-STOP button, the joint can be forced to move by pushing or pulling the robot arm. Manual movement of the robot arm without electric drive is limited to emergency situations and may cause joint damage.

1.5 Responsibility and Risk

Liability

This manual does not involve all applications of how to design, install and operate a robot, nor does it involve all peripherals equipment that may affect the safety of the robot system.

The integrator of JAKA have responsibility to ensure that relevant feasible laws and regulations of country are obeyed, to make sure that there is no significant risk in the whole robot application.

All safety information contained in this manual shall not be regarded as a guarantee of JAKA. Even if all safety instructions are complied with, injury or damage, which caused by an operator, may occur.

JAKA will constantly strive to improving the reliability and performance of our robot products. Our company will not be responsible for any error or missing information in this manual. And we reserve the right of final interpretation of this manual.

Risk

When there is interactive relationship between the operator and robot, there must be direct or indirect body contact. During the contact, operators must have sufficient self-protection awareness. And integrators need to carefully consider the operating conditions when using our company's robots for customers. The followings are

dangerous situations may occur:

- Robots may fall and injure the personnel when they are transported;
- Injuries caused by screw loosening of the fix bolt in robot;
- When the robot is working, it may pinch fingers and hurt people;
- Injury caused by malfunction of robot which is not repaired in time;
- There may be dangerous when using sharp end-effectors or tool connections;
- Robots may injure people when operating in toxic or corrosive environments.

1.6 Use Purpose

JAKA MiniCobo are mainly aimed at commercial application scenarios, especially suitable for commercial or light industry, such as new retail, education, 3C manufacturing, processing of light parts, loading and unloading, etc. JAKA MiniCobo is only allowed to be used under specified conditions and environments.

JAKA MiniCobo has special safety rating features, which are specially designed for collaborative operation. That is to say, the robot can work without guardrails, or can work with humans. Cooperative operation is only for non-hazardous applications, that is, tools, workpieces, obstacles and other machines. All those applications have undergone a risk assessment for specific applications, and have been proved that they do not have major hazards.

Any use or application that is contrary to the intended use is not allowed. Those include but not limit to the followings:

- Used in an environment where there is a possibility of explosion such as dust;
- Used in life-related occasions;
- Used without making a risk assessment;
- Used when the reviewed performance level is unqualified;
- The operation is outside the allowable operating parameters.

1.7 Emergency

When an emergency occurs, press the E-STOP button to immediately stop all movements of the robot. Emergency shutdowns shall not be used as a risk mitigation measure, but E-STOP may be regarded as a secondary protection equipment.

1.8 Precautions for Transportation and Handling

The robot needs to be packed in its original packaging box during transportation, to ensure that the equipment is stable and in a dry environment.

When the robot is hoisted, corresponding measures shall be taken to locate the robot to avoid damage caused by accidental movement.

When moving the robot from its packaging to the mounting position, hold the robot tightly until all the bolts on the base of the robot are fastened.



Note:

1. Make sure that your back or other parts of your body are not overloaded when you lift the device. Use appropriate hoisting equipment. JAKA is not responsible for the personal injury caused during the transportation of the equipment.
2. Make sure to strictly follow the installation instructions when installing the robot.

Chapter 2 Welcome to use JAKA MiniCobo

Before reading this chapter, make sure that you have read and fully understood the Safety Specifications in Chapter 1.

This chapter will quickly introduce the basic composition of JAKA MiniCobo and how to use it. For detailed mechanical specifications, electrical specifications, and software operations, please refer to other chapters.

During use this robot, if you need quick help, please call our quick consultation hotline: **400-006-2665**.

2.1 JAKA MiniCobo Overview

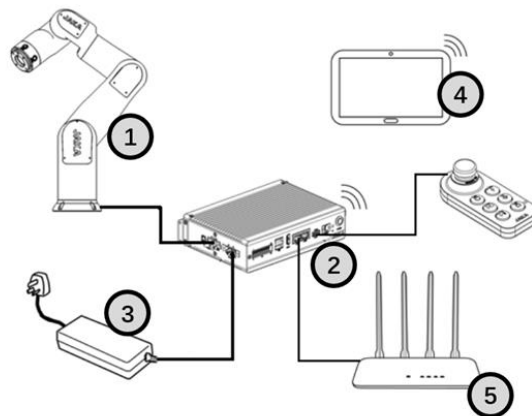


Figure 2-1 Overview of Robot Overview

As shown in Figure 2-1, JAKA MiniCobo mainly includes:

(1) Robot Body: Main moving components, to achieve the desired movement of the user. At the same time, in the end of the robot body (robot base side), there is a ring indicator light which indicates the state of the robot. in the end of tool end flange (end-effector side), there are buttons for dragging and programming, and a TIO interface for connecting tools.

(2) Controller and Operation Handle: They are the control system of the robot. JAKA's robot controller is equipped with a user-friendly handle to control the robot's operation and emergency stop.

(3) DC power supply: The controller uses 24VDC input, just use the standard 24VDC power adapter.

(4) Operation Terminal (Optional or user-owned): A device used by operator to perform programming, setting, and other operations.

(5) Router and network cable, etc. (Optional or user-owned): Several robot controllers can be networked through router. The LAN1/2 interface port of the controller can be connected to a router. And the operating terminal can also be connected to this router to control all networked robots.

2.2 Operation Terminal

JAKA provides JAKA MiniCobo series robot operation software, which is developed based on Android system, and the recommended hardware configuration of this software is shown in Table 2-1:

Terminal Type	Tablet Computer
Operation system	Android 8.0 and above
Processor	Kirin 695 or Snapdragon 660 and above
Storage capacity	32GB
System memory	4GB
Screen size	8.0 inches and above
Network communication	Wifi

Table 2-1 Operation Terminal Configuration Table

When purchasing JAKA MiniCobo, users can either request to purchase operation terminals (optional) or use their own tablets.

2.3 Robot Body

The main body of the MiniCobo is shown in Figure 2-2. The robot body includes 6 rotary joints and two connecting arm rods, which are the big arm and the forearm. The robot base is equipped with indicator lights to show the status of the robot, and the outer side of the end-effector flange is equipped with two buttons.

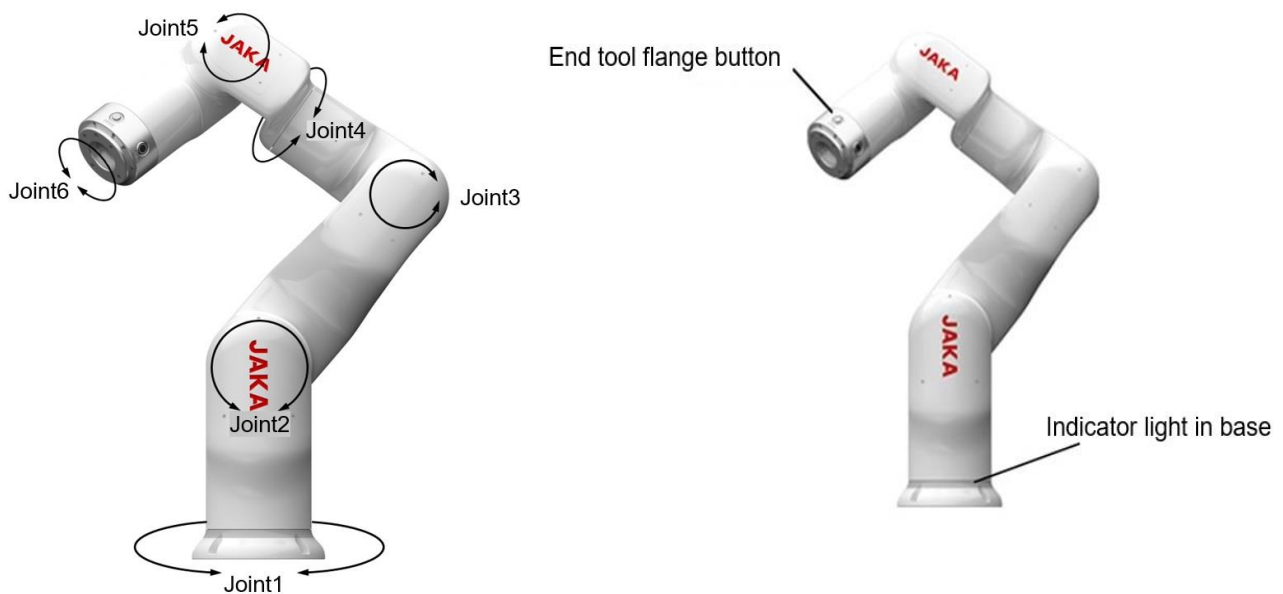


Figure 2-2 MiniCobo Body

2.3.1 Robot Indicator Lights

JAKA MiniCobo is equipped with indicator lights on the base of it.

The position of the ring indicator is shown in Figure 2-2, and the meaning of the color indication is shown in Table 2-2.

Table 2-2 LED Status Indicator

Color	Operating Status
Blue	Power-on, but not enable
Green	Enable is OK
Red	Error
Yellow	Drag mode
Yellow fast flashing	Pause mode

2.3.2 End tool flange button and interface

JAKA MiniCobo is equipped with a tool IO interface and two buttons on the side of the end tool flange. The buttons are a drag button (FREE) and a record point button (POINT), as shown in the figure 2-3.

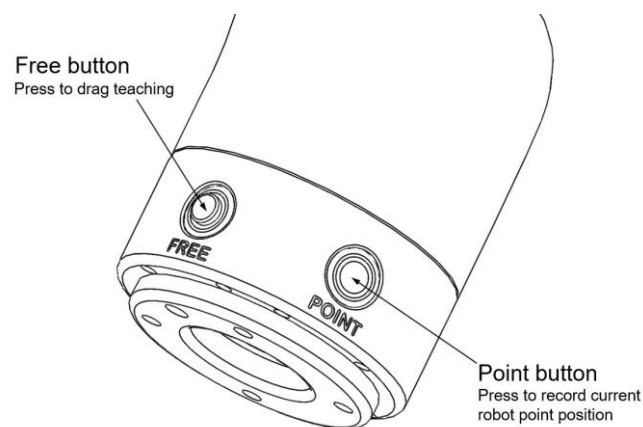


Figure 2-3 FREE and POINT Buttons

For detailed description of Tool IO, please refer to Chapter 4 "Electrical Interface".

When the drag button is pressed, the robot enters the drag teaching mode. In this mode, the user can directly drag the robot to the desired point.

The record point button needs to be used with the robot operating software. When the record point button is pressed, the operating software will record the corresponding position.



Notes:

To use the drag button, the operator should fully evaluate the possible risks. And he must make sure that the end load, TCP parameters, and the robot installation posture are correctly configured. Otherwise, it may cause personal injury or equipment damage.

2.4 Controller and its handle

The controller of JAKA MiniCobo contains various electrical interfaces. For detailed information, please refer to Chapter 4 "Electrical Interface".

The controller provides a control handle. The operator can start the robot only through the control handle without using APP, after writing and setting the default loading operation program.

The control handle sends control commands to the controller through a combination of buttons. The function of the button combination is described as follows:

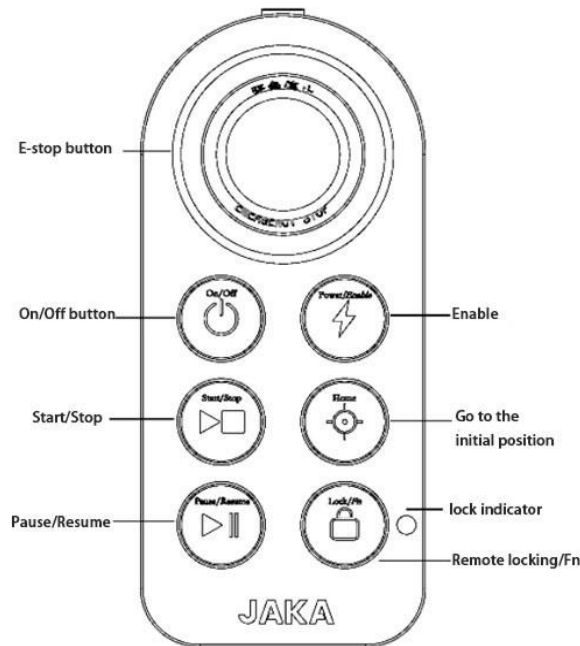


Figure 2-4 Handle Function Description

Table 2-3 Handle Buttons Function Description

Power on	Power on: Short press the On/Off button for 1s and then release. The buzzer rings, and the controller powers on. Shutdown: Long press the On/Off button for more than 3s. The handle rings 6~7 times, and the controller powers off.
Enable	Power on the robot: If it is not power on, release the Lock button, short press the Enable button to power up robot. Power off the robot: When the power is on, short press the Enable button to power off the robot. Enable the robot: When the power is on, hold press the Lock button, at the same time, short press Enable button. Disable the robot: When the robot is enabled, hold press the Lock button, at the same time, short press Enable button.
Termination	Terminate program operation: Short press Stop button to start loading the default program, and after it moving to the initial position of the program, execute the default program. Terminate program operation: When the robot program is running, short press the Stop button to terminate the program.
Home	Reset: After the robot is enabled, when the program is not running, press continuously Home button to control the robot to move to default position. When the robot moves to the default position, keep pressing Home button and the lock indicator light turns to blue breathing state.
Pause	Pause: During the automatic operation of the robot, press Pause button, the program stop execution. Recover: When the machine is suspended, press Recover button, the program

	recover execution.
Lock	Lock handle: Long press the Lock button for 3s and the lock indicator light turns to orange breathing state. Unlock handle: Long press the Lock button for 3s and the lock indicator lights is extinguished Combined functions: Other buttons can be combined using with the Lock button.
Lock indicator lights	Locked state: When in a locked state, the lock indicator light turns to orange breathing state. All buttons are invalid except the Unlock button. The robot can be controlled through the App. Unlocked state: When in the unlocked state, the lock indicator light is extinguished and the handle can be used. At that time, the APP interface is grey, the robot cannot be controlled by APP.
E-STOP button	For emergency stop. Note: The emergency stop button is only used in emergency situations and cannot be used as a general power-off device.

Note:

When power is on, press any button, and the handle buzzes twice a second.

During the power-on process, JAKA LOGO lamp on the handle flashes red, blue and green alternately in breathing light, accompanied by three buzzes. Then JAKA LOGO lamp turns orange and waits for the IPC (Industrial Computer) to go online. When the controller program is running normally, the JAKA LOGO lamp turns in blue breathing light. After the robot is enabled, the lamp turns in green breathing light.

When you are using the handle to operate the robot, please make sure that the robot you are operating is in your sight. And you should follow relevant safety regulations to prevent injury to people or damage to equipment around the robot.

Chapter 3 Mechanical Specification

The robot is mainly composed of six joints and arm rods (as shown in Figure 3-1). The base is used to connect the robot body and the mounting base, and the tool-end is used to connect the robot to end-effector. The end-effector can do translation and rotation movements in the working space of the robot. The following chapter will introduce the basic items that should be noticed when installing each part of the robot system.

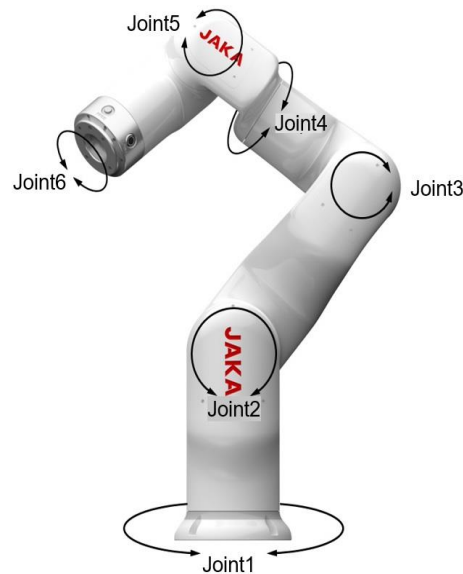


Figure3-1 Structure diagram of JAKA MiniCobo body

3.1 Robot Workspace

3.1.1 Overall Dimensions of robot

The practicality picture and overall dimensions of JAKA MiniCobo robot and MiniCab controller are shown in Figure 3-2 and Figure 3-3. Range of motion of the robot must be taken into consideration during installation, so as not to injure circumjacent personnel and equipment.



Figure 3-2 The practicality picture of JAKA MiniCobo and MiniCab controllers

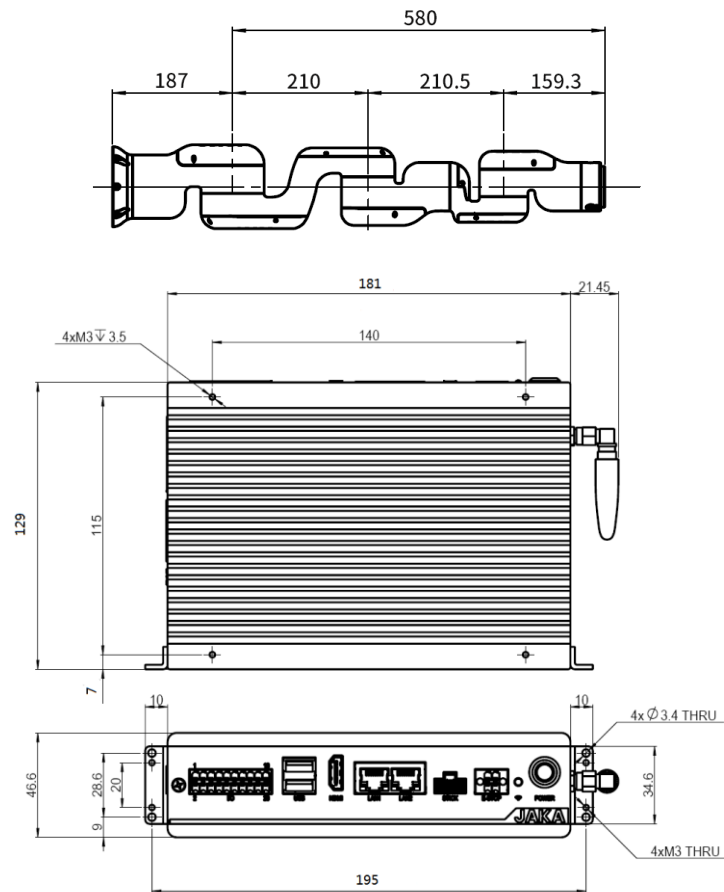


Figure 3-3 Overall Dimensions of JAKA MiniCobo and Minicab controllers

3.1.2 Robot Workspace

The working space of JAKA MiniCobo robot is shown in Figure 3-4. When selecting installation position of the robot, accessible working region should be fully considered.

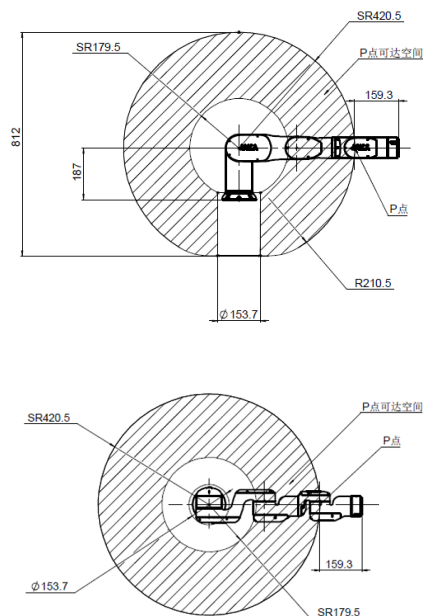


Figure3-4 JAKA MiniCobo Workspace

3.2 Installation

3.2.1 Concise Installation Method

1. Determine the working range of the robot;
2. Install robot body on the mounting base;
3. Install the required end-effector on the end flange of the robot.

3.2.2 Important Safety Instructions

	Warning: 1. Make sure that the robot arm is correctly and safely installed in place. 2. The installation surface must be shockproof and have sufficient bearing capacity.
	Warning: 1. Make sure that the end-effector are correctly and safely installed in place. 2. Ensure that the end-effector is safe, and there will be no danger caused by accidental falling parts.
	Warning: 1. Make sure that the controller and cables are not in touch with liquid, otherwise there will be a risk of electric shock. 2. The controller must not be exposed to dust, humidity or an environment that exceeds IP20 for a long time.



Notes:

The robot should not be installed in a liquid or humid environment.

3.2.3 Robot Body Installation

The JAKA MiniCobo robot can be installed in any posture. As is shown in Figure 3-5, there are three typical installation methods: normal-mounted, upside-down, and side-mounted.



Figure 3-5 Typical Installation Methods

To install the robot, JAKA MiniCobo uses 4 M6 screws through 4 $\varnothing 6.6$ mm through holes on the robot base. It is recommended to tighten these screws with a torque of 15.3Nm. Please install the robot on a solid, flat mounting base. The base surface can bear at least 612Nm of torque and at least 500N of pressure. In addition,

the base should be vibration-isolated. Figure 3-6 shows the robot mounting holes. All measured values are in unit of mm.

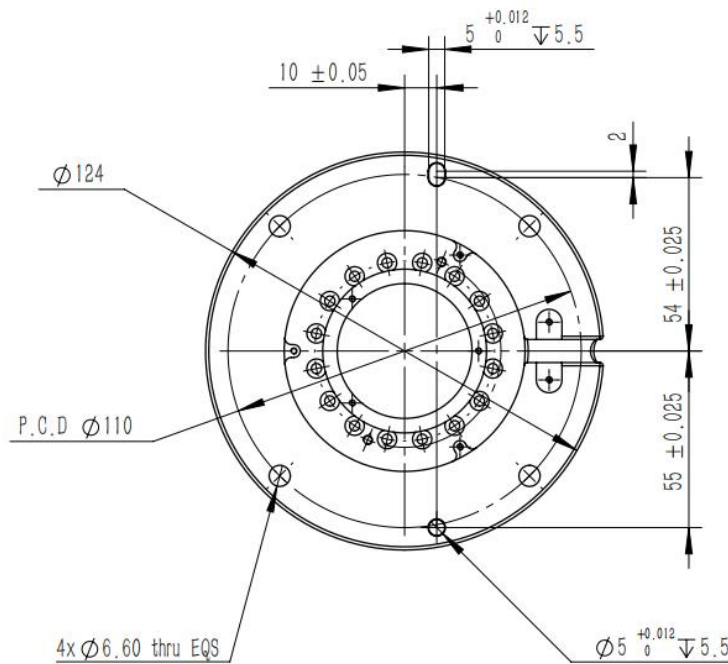


Figure 3-6 JAKA MiniCobo Base Installation Outline Dimensions

3.2.4 End Tool Installation

The end flange of the JAKA MiniCobo robot has four M6 screw holes, which can be used to fix end-effector in the robot. It is recommended to tighten the M6 screws during installation, with a torque of 15.3Nm. If you need fixing tools with high-precision, you can also use Ø6mm pin hole on the flange. Figure 3-7 shows the drilling position and screw installation position, all measured values are in unit of mm.

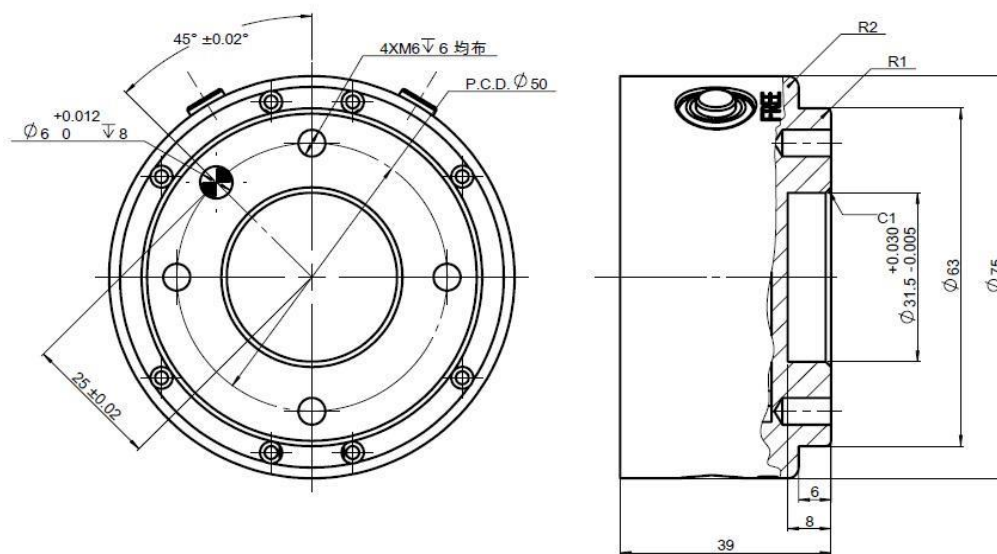


Figure 3-7 End-effector Installation Dimensions

3.3 Technical Specifications

1.JAKA MiniCobo robot technical specifications

Robot model: JAKA MiniCobo			
Product Features	Payload	1.0kg	
	Weight	9.4kg	
	Working radius	580mm	
	Repeatability	±0.1mm	
	Degree of freedom	6	
	Programming	Graphical programming, drag-and-drop programming (like Scratch programming)	
	Teach pendant type	Mobile terminal (PAD/mobile) APP	
	Collaborative operation	According to GB 11291.1-2011	
Motion Range and Speed	Robotic arm	Motion range	Maximum speed
	Joint 1	±360°	180°/s
	Joint 2	±125°	180°/s
	Joint 3	±130°	180°/s
	Joint 4	±360°	180°/s
	Joint 5	±120°	180°/s
	Joint 6	±360°	180°/s
	Maximum speed of tool end	/	1.5m/s
Physical properties and others	Classic power consumption	Average 150W	
	temperature range	0-50°C	
	IP code	IP40	
	Robot installation	Any angle installation	
	Tool I/O port	Digital input 2 Digital output 2 Analog input 2	
	Tool I/O power supply	24VDC	
	Installation Base diameter	124mm	
	Material	Aluminum alloy, PC	
	Size of Tool I/O	M8	
	Length of Robot connection cable	6m	

2.Controller technical specifications:

Controller	IP code	IP20
	Controller I/O port	7 input and output multiplexing channels
	Controller I/O power supply	24VDC
	Communication method	TCP/IP, Modbus TCP, Modbus RTU
	Power supply	24VDC
	Controller size	180×46.6×128mm(W*H*D)
	weight	1.1kg
	Material	Steel, aluminum alloy

3. 220V AC-DC power adapter

Specification	GST280A24-C6P,MW
Rated voltage	24VDC
Rated current	11.67A
Current range	0~11.67A
Rated power (maximum)	280.08W
Ripple and noise (maximum)	200mVp-p
Voltage accuracy	±3%
Linear regulation rate	±1%
Load regulation rate	±3%

Chapter 4 Electric Parameters

4.1 Introduction

This chapter mainly describes the absolute limit parameters of MiniCab and the recommended operating conditions. When using the robot and MiniCab controller, users shall follow the recommended electric parameters. Reaching or exceeding the limit parameters may cause damage to the controller hardware.

4.2 Absolute Limit Parameter

Table 4-1 Electric Limit Parameters

		Minimum value	Maximum value ^{(1) (2)}	Unit
VL+	Logic power supply voltage	-0.3	40	V
VP+	Power supply voltage	-0.3	40	V
V _{UDIO_COM+}	Common terminal voltage of Integration interface	-0.3	30	V
I _{UDIO_24V}	Output current of Integration interface	0	2.7	A
I _{UDIOx}	Single channel output current of Integration interface	0	2	A
V _{busRS485}	RS485 bus withstand voltage	-70	70	V

Note:

(1) Exceeding the values listed in the "Absolute Limit Parameters" may cause permanent damage to the equipment. These values are limit values. It is recommended that the functional operation of the device is performed under these limit conditions. Any conditions other than the "Recommended Operating Conditions" are not allowed.

(2) All voltage values, except for bus voltage, are related to the GND.

4.3 Recommended Operating Conditions

Table 4-2 Recommended Operating Conditions

		Minimum value	Typical value	Maximum value	Unit
VL+	Logic power supply voltage	20 ⁽¹⁾	24	30	V
VP+	Power supply voltage	20 ⁽²⁾	24	30	V
I _{RMS}	Average operating current			8	A
I _{peak}	Output peak voltage		12	20 ⁽³⁾	A
I _{UDIOx}	User interface single channel output current		1		A
	Ambient Temperature	0		50 ⁽⁴⁾	°C
	Atmospheric		1		Bar
	Altitude		1000		m
	Relative humidity	10		90	%RH

Note:

(1) The minimum logic voltage can start the logic functions of the controller, but the output value of UDIO_24V depends on the logic supply voltage.

(2) The power supply mainly provides power source to the robot. Generally, the robot will start undervoltage protection when $\leq 20V$.

So, when inputting the minimum voltage value, it is necessary to consider the abnormality caused by voltage loss and voltage sag.

(3) The peak value of the output current is related to the adapted robot model and working status.

(4) When the controller is working, its surface will be hot. So, it is necessary to use the controller in an environment with good ventilation and heat dissipation conditions.

4.4 Typical Power Consumption

Test condition: 25℃, 24V logic voltage, 24V robot power supply, not connecting robot and integrated interface, handle connected

Table 4-3 Typical Power Consumption

Parameter	Test operation conditions	Minimum value	Typical value	Maximum value	Unit
Shutdown consumption			1	5	W
Power on			12	30	W
Power on the robot				30	W

4.5 Computer Configuration

Table 4-4 Computer Configuration

CPU	Main frequency: 2GHz. Turo frequency: 2.4GHz
RAM	DDR3L 2G
Hard-disk	32GB (with larger memory options)
Computer interface	HDMI. USB3.0 x1. USB2.0 x1. Ethernet x2

Chapter 5 Definition of Interface

MiniCab has user interfaces on the front panel and side panel. On the front panel, there are 20PIN integrated I/O interface, USB, HDMI, LAN, handle and E-STOP interface, Wi-Fi status indicator and On/Off button.

On the side panel, there area power input interface, a robot body interface, 2.4G Wi-Fi antenna, and an internal integrated routing reset button.

Table 5-1 Interface Definition Description

Interface Name	Quantity	Description
UDIO	7	7-channel digital interface, NPN type, Input/Output can be configured
RS485	2	Two routes: Master and Slave
USB	2	USB3.0*1. USB2.0*1
HDMI	1	Used for external display devices
LAN1	1	Internally integrated routing interface, 100 MB Ethernet interface
LAN2	1	10M/100M/1000M adaptive Ethernet interface
DC_INPUT	1	Logic & power DC power input interface
ROBOT	2	Robot body power supply and CAN communication interface

5.1 Front Panel Interface

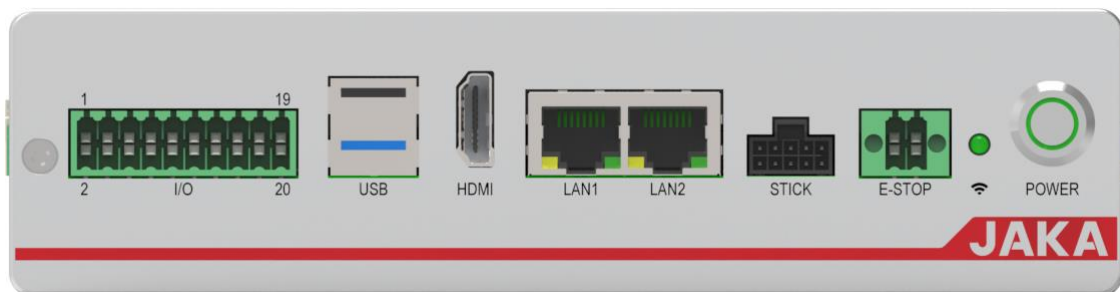


Figure 5-1 Diagram of Front Panel

5.1.1 Integrated Interface (I/O)

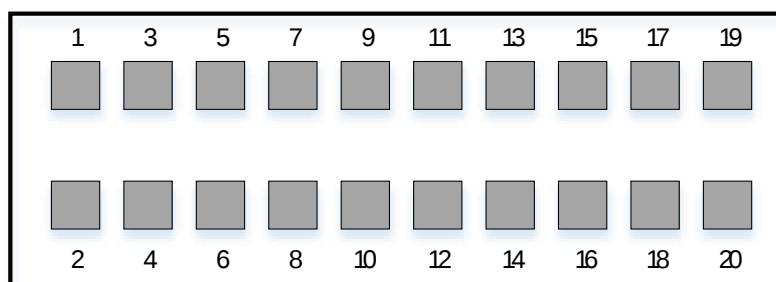


Figure 5-2 Diagram of Integration I/O Interface

The user integration I/O interface uses a double row of 3.5mm spacing pluggable terminal, which integrates rich interfaces for users.

The specific interface pins are defined as follows:

Table 5-2 Pin Definition of Integrated Interface

No.	Signal Name	Signal Type	Description
1	UDIO_24V	PO	Integrated interface 24V power output, with internal integrated 2.7A overcurrent protection function
2	UDIO_COM	PI	Positive common terminal of user interface power, default external short circuit to PIN1
3	UDIO_24V	PO	Integrated interface 24V power output, same as PIN1
4	GND	PO	User interface power logic ground
5	Remote_OFF	I	Remote shutdown control input, connecting to 24V to trigger shutdown operation
6	GND	PO	User interface power logic ground, same as PIN4
7	UDIO4	I/O	I/O multiplexing channel 4, or safety I/O channel 2 (NPN type)
8	Remote_ON	I/O	Remote startup control input, connecting to external +24V power to trigger startup operation
9	UDIO3	I/O	I/O multiplexing channel 3, or safety I/O channel 2 (NPN type)
10	UDIO7	I/O	I/O multiplexing channel 7, or safety input channel 3 (NPN type)
11	UDIO2	I/O	I/O multiplexing channel 2, or safety I/O channel 1 (NPN type)
12	UDIO6	I/O	I/O multiplexing channel 6, or safety input channel 3 (NPN type)
13	UDIO1	I/O	I/O multiplexing channel 1, or safety I/O channel 1 (NPN type)
14	UDIO5	I/O	I/O multiplexing terminal channel 5, NPN type
15	Reserved_CANH	IO	For internal debugging only
16	Reserved_CANL	IO	
17	MasterBus_RS485A	IO	RS485, master station interface
18	MasterBus_RS485B	IO	Usually used to extend RS485 interface of I/O board card
19	SlaveBus_RS485A	IO	RS485, slave station interface
20	SlaveBus_RS485B	IO	Usually used for external PLC and other equipment communication

5.1.2 Handle Interface (STICK)

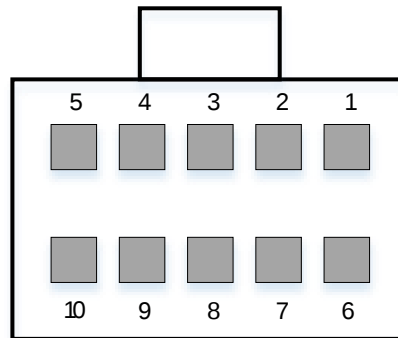


Figure 5-3 Diagram of Handle Interface

MiniCab handle interface is defined as follows ⁽¹⁾,

Table 5-3 Definition of Handle Interface

Pin Serial No.	Signal	Signal Type	Description
1	24V	PO	Handle power output
2	PBn	I	3.3V logic signal input, low level trigger controller switch operation
3	BP_CANL	IO	Handle and controller communication CAN signal
4	BP_CANH	IO	Handle and controller communication CAN signal
5	ESTOP_BP_C1	PO	Connected to pin 1 internally (24V)
6	ESTOP_BP_PC1	I	24V logic input, high level indicates that emergency stop is normal.
7	ESTOP_BP_C2	PO	Connected to pin 1 internally (24V)
8	ESTOP_BP_PC2	I	24V logic input, high level indicates that emergency stop is normal.
9	Reserved	-	System reservation
10	GND	PO	Logic ground

Note:

(1) Only used to connect JAKA BP handle. External interface cannot be reformed arbitrarily.

5.1.3 Emergency Stop Interface (E-STOP)

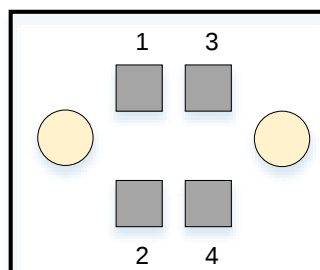


Figure 5-4 Diagram of E-STOP Interfac

The external E-STOP input interface uses double rows of 3.5mm spacing pluggable terminals. If this interface does not externally connect to emergency stop, the Pin1, Pin2, Pin3 and Pin4 shall be short-connected by wires. The factory-default setting is short connection. Interface definitions of it are as follows:

Table 5-4 Pin Definitions of E-STOP Interface

Pin Serial No.	Signal	Signal Type	Description
1	VCC_24V	PO	Internal logic power 24V output
2	ESTOP1	I	E-STOP input 1, default short connected to PIN1
3	VCC_24V	PO	Internal logic power 24V output
4	ESTOP2	I	E-STOP input 2, default short connected to PIN3

5.2 Side-panel Interface

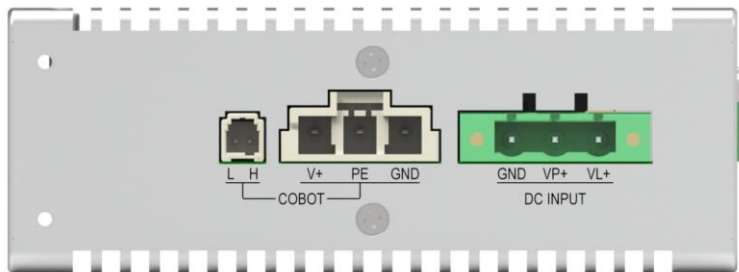


Figure 5-5 Diagram of Side Panel

5.2.1 Power Interface

The power interface there is divided into two power circuits: logic power VL+ is the pin of the internal logic power supply of the controller; robot power VP+ is the power supply voltage of the robot body; meanwhile, VP+ can also supply power for the internal logic power.

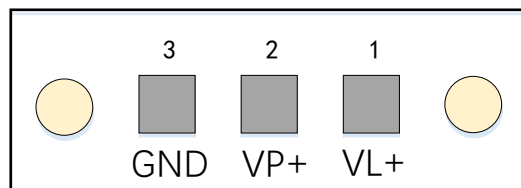


Figure 5-6 Diagram of Power Interface

Interface definitions of it are as follows:

Table 5-5 Pin Definitions of Power Interface

Pin Serial No.	Signal	Signal Type	Description
1	VL+	PI	Logic power input
2	VP+	PI	Robot power input
3	GND	PI	0V input

The robot power supply input can supply power for the robot body, and can also supply power for the logic circuit in the controller. When the logic power supply and robot power supply do not need to be separated, just

connect pin 2 and pin 3. To meet the requirement of current carrying capacity, it is recommended to use cable larger than 14AWG or 1.63mm².

5.2.2 Robot Interface

The ROBOT port is the terminal of the robot body. Both terminals in it support the function of fool-proof with latch. JAKA provides adaptive cables for it.

5.3 Tool Input and Output Interface

TIO (Tool Input and Output) is on the side of robot end flange which includes 2 digital inputs, 2 digital outputs, 2 analog inputs, and could be reused as RS485 communication. Please see 5.3.1 for the detailed pin definition. The wire definition is shown as Figure 5-7.

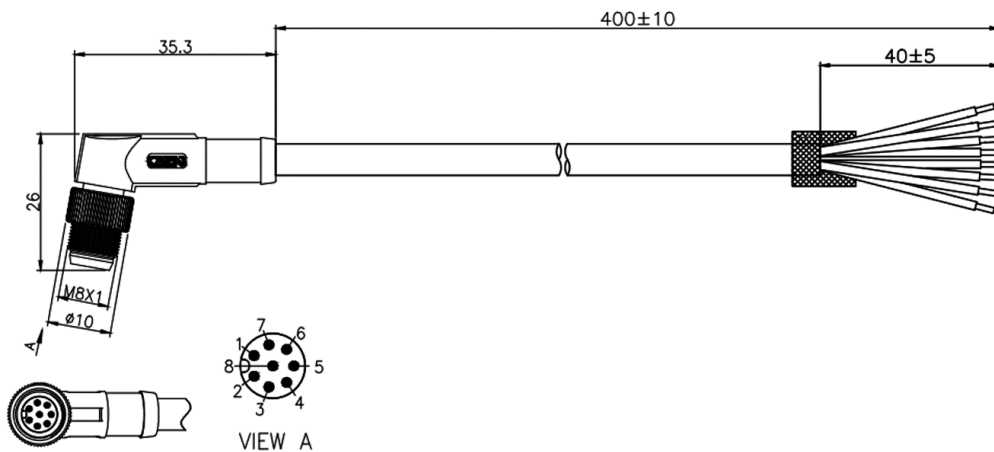


Figure 5-7 Wire definition of TIO cable

5.3.1 TIO Pin Definition

The TIO pin definition is described in Table 5-1.

Table 5-1 TIO pin definition

Pin No.	Definition	I/O	Color	Description
1	+24V	-	Red	Positive pole of 24V power supply. Max. current for continue working is 1A
2	DI1	I	Blue	Digital input 1, NPN/PNP configurable
3	DI2	I	Green	Digital input 2, NPN/PNP configurable
4	DO1/RS485A_1	I/O	Yellow	Digital output 1, NPN/PNP configurable Reconfigure as RS485 Channel 1+
5	DO2/RS485B_1	I/O	Orange	Digital output 2, NPN/PNP configurable Reconfigure as RS485 Channel 1-
6	AIN1/RS485A_2	I/O	Brown	Analog input 1 Reconfigure as RS485 Channel 2+
7	AIN2/RS485B_2	I/O	White	Analog input 2 Reconfigure as RS485 Channel 2-
8	GND	-	Gray	Ground of 24V power supply

1. TIO Analog Input

TIO supports 2 channels of analog voltage input. The range of voltage input is 0-10V, the analog input positive is connected to AIN1/AIN2, and negative is connected to GND in the internal circuit of the TIO board.

2. TIO Digital Input

TIO supports 2 channels of digital input, which can be configured as NPN or PNP by JAKA App. For the details of operation, please refer to the software manual.

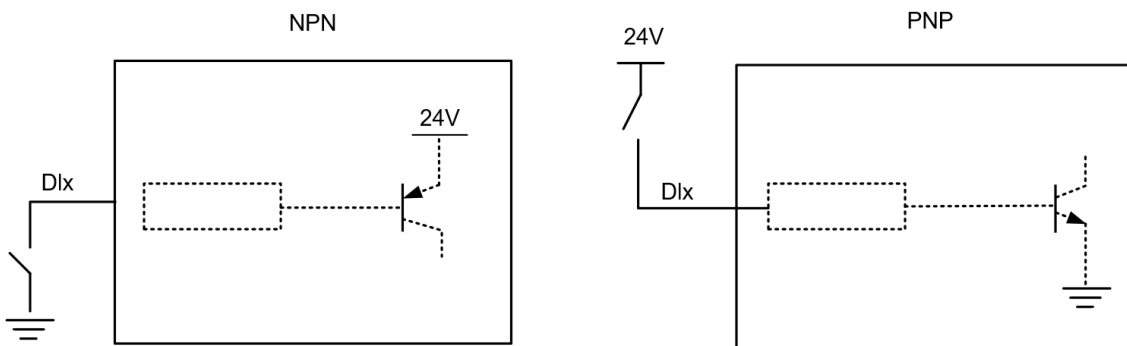


Figure 5-8 TIO digital input interface circuit

(a) Dry Contact Input

When the digital input is configured as NPN, one end of the dry contact input (switch-type input) is connected to the negative electrode of 24V power (grey wire) in the TIO, and the other end is connected to the digital input (blue or green wire) as shown in Figure 5-9.

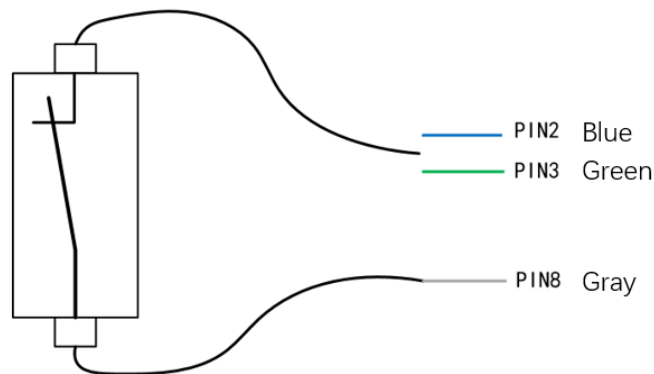


Figure 5-9 Dry contact input (NPN)

When the digital input is configured as PNP, one end of the dry contact input (switch-type input) is connected to the positive electrode of 24V power (red wire) in the TIO, and the other end is connected to the digital input (blue or green wire) as shown in Figure 5-10.

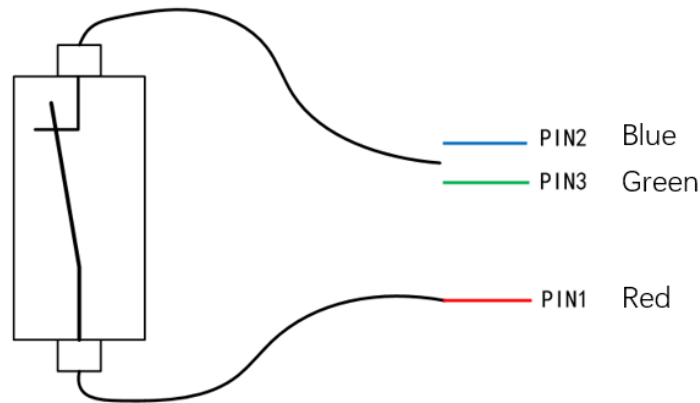


Figure 5-10 Dry contact input (PNP)

(b) NPN Input

The connection method of NPN-type digital input is shown in Figure 5-11: V+ is connected to the positive electrode of 24V power (red wire), 0V is connected to the negative electrode 24V power (gray wire), and the signal wire is connected to the digital input (blue or green wire).

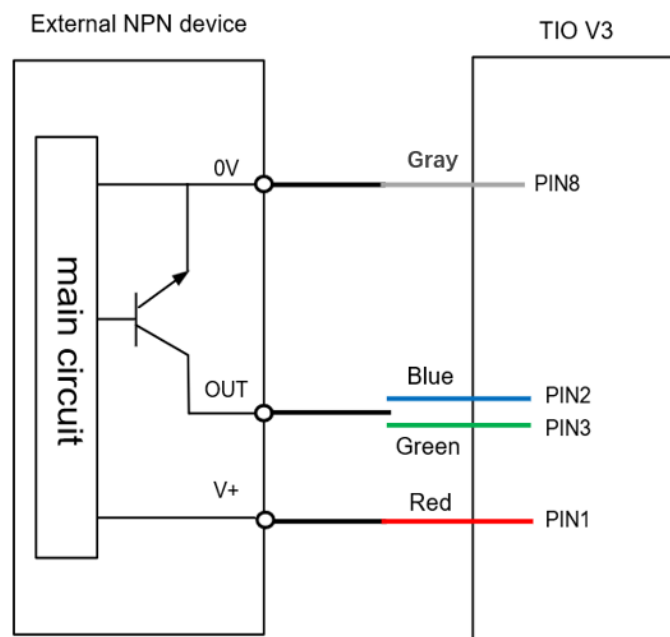


Figure 5-11 NPN-type input

(c) PNP Input

The connection method of PNP-type digital input is shown in Figure 5-12 : V+ is connected to the positive electrode of 24V power (red wire), 0V is connected to the negative electrode of 24V power (gray wire), and the signal wire is connected to the digital input (blue or green wire).

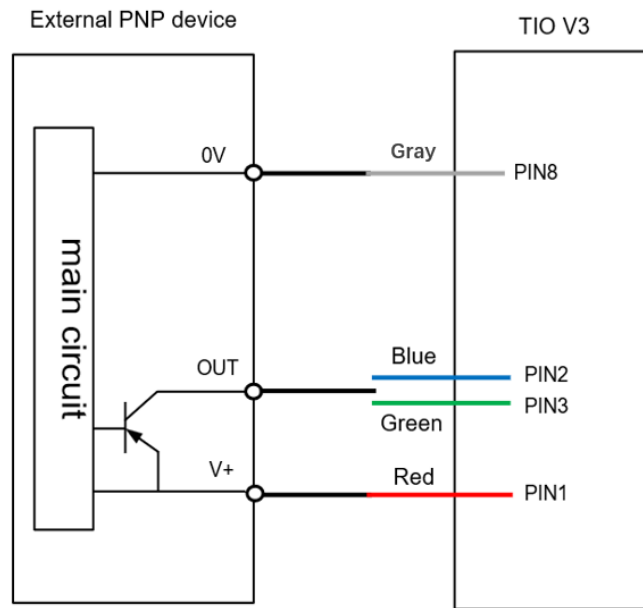


Figure 5-12 PNP-type input

3. TIO digital output interface circuit

If the digital output is configured as NPN, the open collector is used for output, and the maximum continuous current output is 500mA.

As shown in Figure 5-13, the connection method is that:

- The digital output (yellow or orange wire) is connected to a load.
- The V+ of the external device is connected to positive electrode of TIO power (red wire)
- The 0V of the external device is connected to negative electrode of TIO power (gray wire).

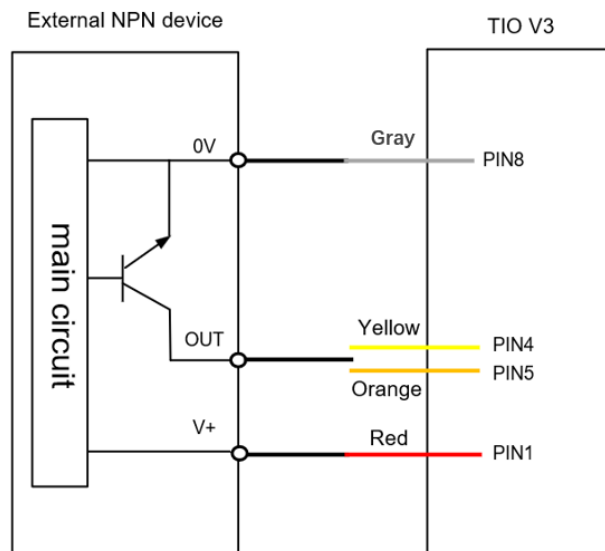


Figure 5-13 NPN-type output

If the digital output is PNP output, the open collector is used for output, and the maximum continuous current load capacity is 500mA.

As shown in Figure 5-14, the connection method is that:

- The digital output (yellow or orange wire) is connected to a load.
- The V+ of the external device is connected to positive electrode of TIO power (red wire)
- The 0V of the external device is connected to negative electrode of TIO power (gray wire).

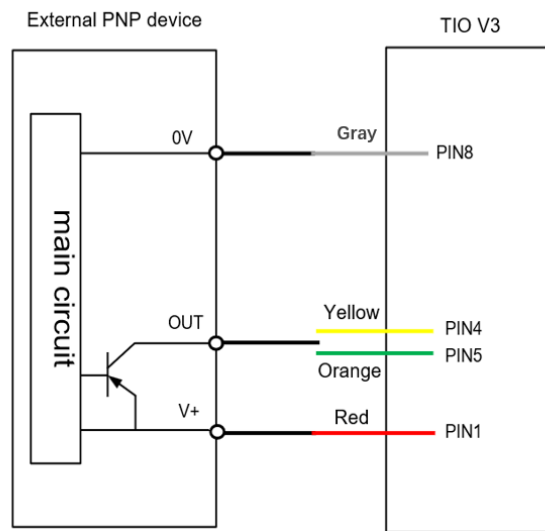


Figure 5-14 PNP-type output

4. RS485 signal circuit

If RS485 function is configured, the wiring method is shown in Figure 5-15.

- The RS485+ of an external device is connected to RS485+ (yellow or brown wire)
The RS485- of an external device is connected to RS485- (orange or white wire)
- The V+ of an external device is connected to the 24V power positive electrode (red wire)
- The 0V of an external device is connected to the 24V power negative electrode (gray wire).

The maximum communication baud rate is 2.25Mbps.

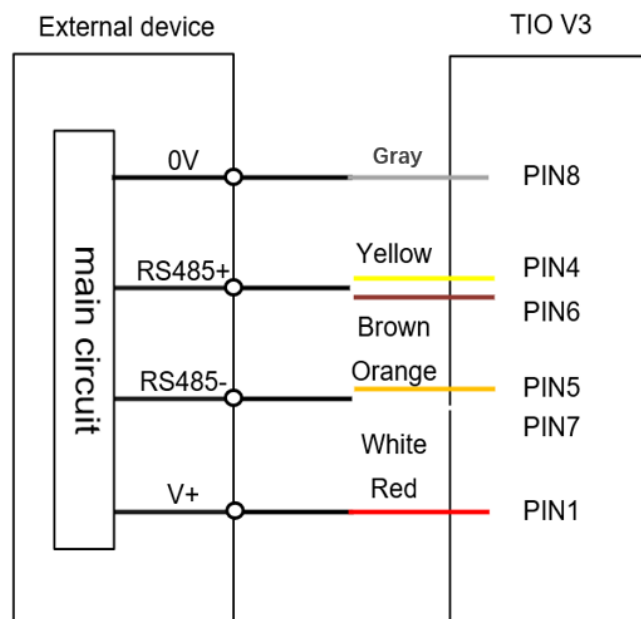


Figure 5-15 RS485 wiring

Chapter 6 Minicab Detailed Introduction

6.1 Overview

JAKA MiniCab is optimized for integrated applications, especially concept of easy to use. All those characteristics is integrated into user devices. It can be used and matched with JAKA MiniCobo and JAKA Zu® series robot.

6.2 Function Application

This section is mainly to guide users to use JAKA MiniCab to control robot, so that the customers can use this controller more easily. At the same time, it involves the knowledge of robot operation. Please refer to user's manual of the robot for detailed information.

6.2.1 Robot Interface of MiniCab

MiniCab power interface includes three input terminals: robot logic power supply input VL+(Pin1), robot body power supply input VP+(Pin2) and common negative GND(Pin3).

The VP+ and VL+ inputs are supplied to the MiniCab logic circuit through internal diodes. So, usually you just need to plug with VP+ and GND externally.

In case of emergency, VP+ must be disconnected, simultaneously, the controller logical power supply should keep powering on, you can connect logic power to VL+ separately.

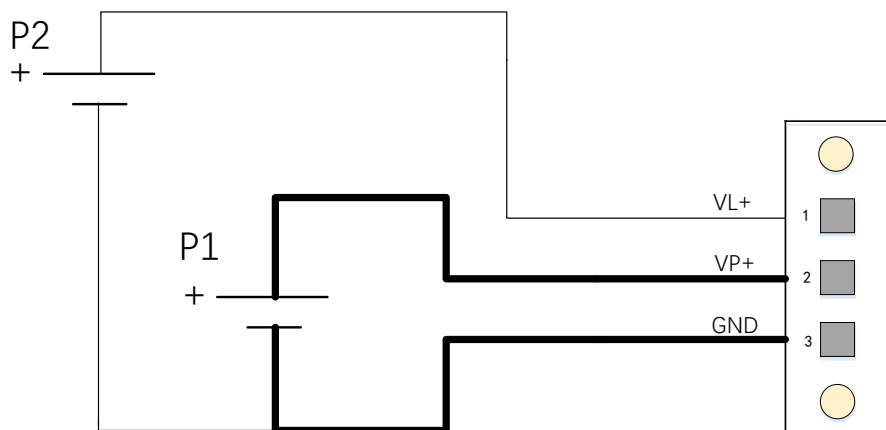


FIG. 6-1 Diagram of Power Supply Wiring

1、The requirement of Power port P1 (power supply) for different models of robot is shown in the table below:

Table 6-1 Description of Power Supply Requirements

Adapted models		MiniCobo
P1	Rated voltage	24VDC
	voltage range	20~30VDC ⁽¹⁾
	Current range	0~12A
	Peak power	280W
	Recommended model	GST280A24,MW

2、The requirement of Power port P2 (logic power) is shown in the following table:

Table 6-2 Description of Logic Power Requirements

P2	Rated Voltage	24VDC
	Voltage range	20~30VDC ⁽³⁾
	Typical power	12W
	Maximal power	≤30W

Note:

1) 20VDC for MiniCobo body is the under-voltage threshold value, excluding 20VDC.

2) This is only a recommended power supply model. Customers can purchase a power supply of the same specification. At the same time, the peak power is related to the robot load and usage scenarios. In the table, there marks the maximum required value.

3) If both VP+ and VL+ inputs are lower than 24VDC, the "UDIO_24V" output will be lower than 24VDC.

6.2.2 Emergency Stop

As for MiniCab, in addition to the emergency stop button on the handle, the panel supports a separate E-STOP connector. The factory default for it is short-circuiting to the internal 24V. The user can remove the short-circuit strips and connect them to external switch. The wiring diagram of the single switch/multiple switches are as follows:

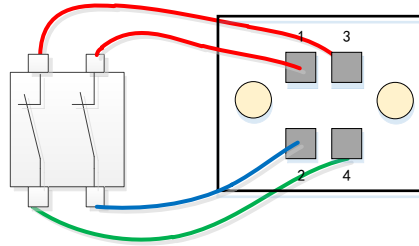


Figure 6-2 Emergency stop - single-circuit switch

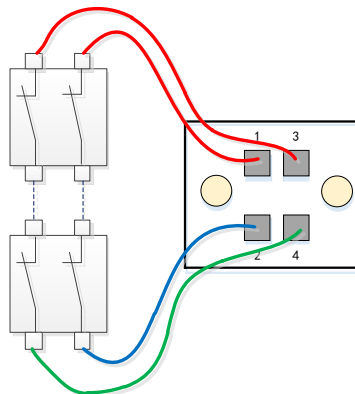


Figure 6-3 Emergency stop - multiple-circuit switch

6.2.3 Switch-on/off

After powering MiniCab for 4 seconds, MiniCab can be powered on. There are three ways to switch the machine on/off:

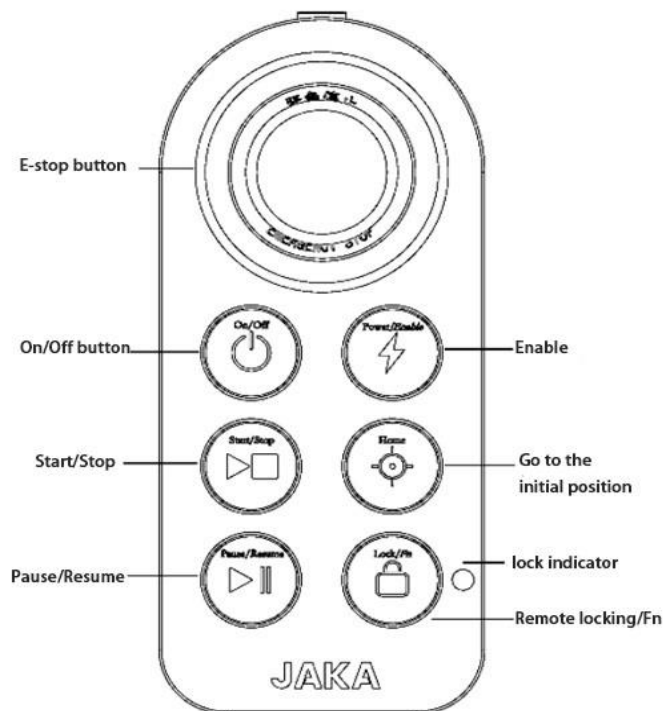


Figure 6-4 Handle Control Box

1. Switch on and off via the user handle:

Power-on: Short press the power button for 1s and then release. The buzzer rings and the controller is turned on.

Shutdown: Long press the power button for more than 3s. The handle rings 6~7 times, and the controller is turned off.

For detailed information, please refer to the handle operation method in the product user manual.

2. Front-panel POWER button:

Power-on: Short press the POWER button for 1s and release. The controller is powered on.

Shutdown: Long press the POWER button for 3s. The controller is powered off.

3. Remote switch on/off interface

The remote switch on/off interface on the integrated I/O port can be used for switch on/off operation. When the external on/off button is used, the self-recovery/spring button switch must be chosen, otherwise the remote switch on/off operation may fail.

Power-on operation: Remote Power-on requires the user to separately equip with external DC24V power supply to connect the positive pole of power supply to PIN8 (Remote_ON) interface and the negative pole to PIN6 (GND). The following is the wiring diagram of the remote switch. After pressing K1 for about 1s then release. And the controller will be powered on.

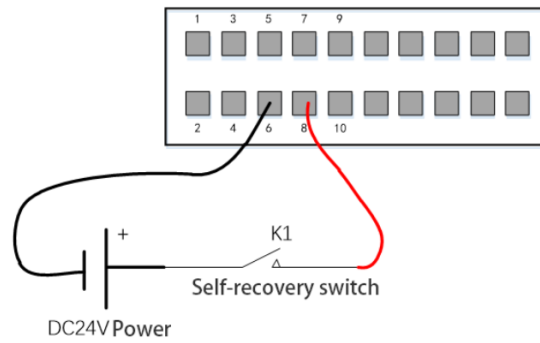


Figure 6-5 Remote_ON - Using External Power Source

Power-off operation: Remote shutdown operation requires to connect the positive pole of power supply to PIN5 (Remote_off) interface and the negative pole to PIN6 (GND). External power supply or internal UDIO_24V can be used. Long press K2 for more than 3s then release. And the controller will be power off.

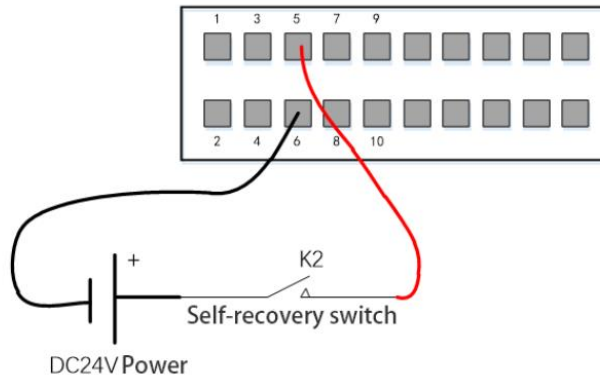


Figure 6-6 Remote_OFF - Using External Power Source

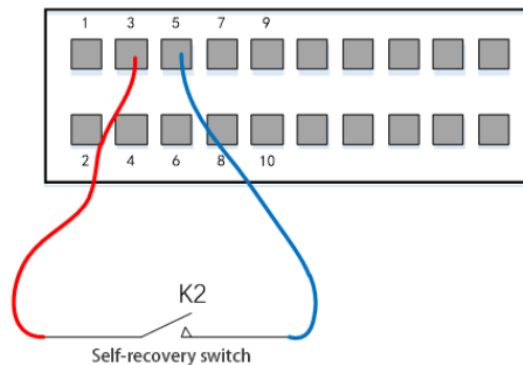


Figure 6-7 Remote_OFF - Using Internal Power Source

6.2.4 LED State Indicator

JAKA robot is equipped with status indicators on the handle and panel. The color of the light is related to the status of the robot. The following is a comparison of LED lights and status indicated.

Table 6-3 LED Status Indicator

Color	Operating Status
Blue	Power-on but not enable
Green	Enable is OK
Red	Error
Yellow	Drag mode
Yellow fast flashing	Pause mode

6.2.5 Integrated UDIO

The integration interface has 7 channels of IO, and each channel of UDIO_x has the function of NPN input and NPN output. Users can select each channel separately in the APP upper-computer.

1. DI Digital Input:

UDIO_COM	Low level range
24V	0~7V

When configured as DI, it is an NPN type input, and will be effective when UDIO_1(PIN13) is short-connected to GND(PIN6). When using internal UDIO_24V, please short connect PIN1 and PIN2 by default. The typical wiring diagram is as follows:

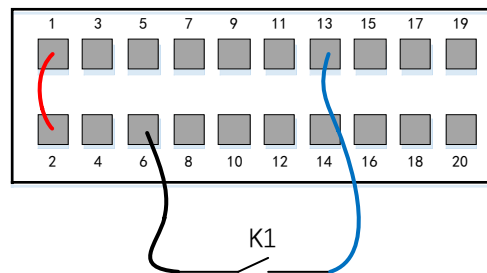


Figure 6-8 Wiring Diagram with UDIO_x as DI

2. DO Digital Output:

When configured as the digital output interface DO, it is NPN-type output, which uses an Open Collector output internally. And it is connected with a freewheeling diode, which supports the output current capacity up to 1A. When using internal UDIO_24V, the typical wiring diagram is as follows:

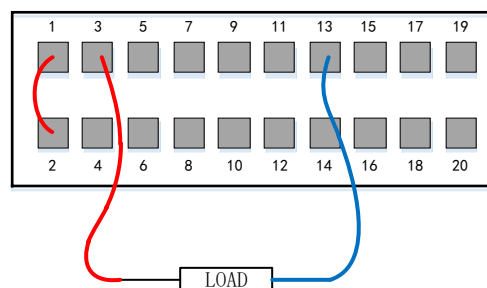


Figure 6-9 Wiring Diagram with UDIO_x as DO

3. Safety I/O Interfaces

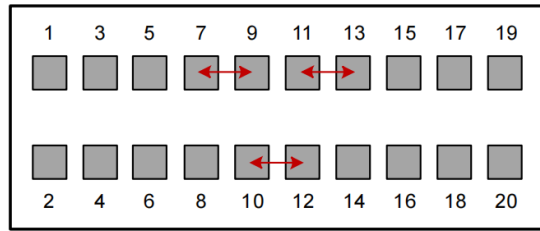


Figure 6-10 Wiring diagram when UDIO_x is used as a safety I/O

The safety I/O function is only supported in software versions 1.7.1.37 and above. Therefore, before using the safety I/O function, an upgrade is required. The version requirements are as follows:

Type	Version
App	1.7.1.37 and above
Controller	1_7_1_36 and above
PSCB	03_02_PR and above
Servo	R3196 and above

For update steps, please refer to the software user manual. Contact JAKA technician to obtain the update installation package.

To ensure the safety function of the robot, the digital I/O interfaces I/O_1, I/O_2, I/O_3, I/O_4, I/O_6, and I/O_7 in the control cabinet can be configured as dedicated safety I/O. Among them, I/O_6 and I/O_7 can only be configured as safety DI, and can only be configured for protective stop function. The other four channels can be configured as safety DI or safety DO. The electrical specifications of the safety I/O interfaces are the same as the digital I/O interfaces. The safety I/O is designed with dual redundancy, so if one channel fails, the safety function still works. Therefore, when wiring, a pair of safety I/O should be connected simultaneously. For example, when connecting I/O_1, I/O_2 must be connected at the same time. The pairing relationship of the safety I/O is as follows:

Table 6-4 Safety I/O pairing relationship

DI	DO	Interface
DI1 & DI2	DO1 & DO2	PIN13 & PIN11
DI3 & DI4	DO3 & DO4	PIN9 & PIN7
DI6 & DI7		PIN12 & PIN10

Taking the DI1 & DI2 as an example, the wiring diagram is as follows (When using internal UDIO_24V, please short PIN1 and PIN2):

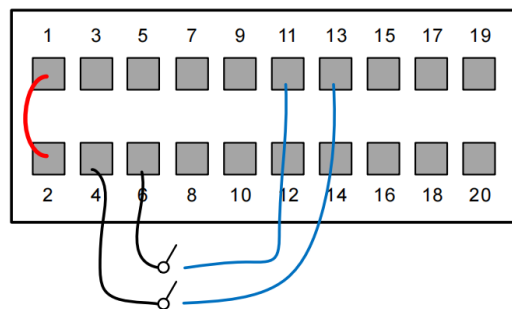


Figure 6-11 Wiring diagram when DI1 & DI2 are used as safety inputs

6.3 Braking Voltage Setting

The MiniCab has integrated voltage brake circuit to relieve the EMF(electromotive force) generated by the robot during deceleration and braking. When user uses the external power supply, it needs to be configured to avoid overvoltage protection which will cause power-off or damage the controller. When setting the braking voltage, you need to power off the robot body before operation. The setting path is as follows:

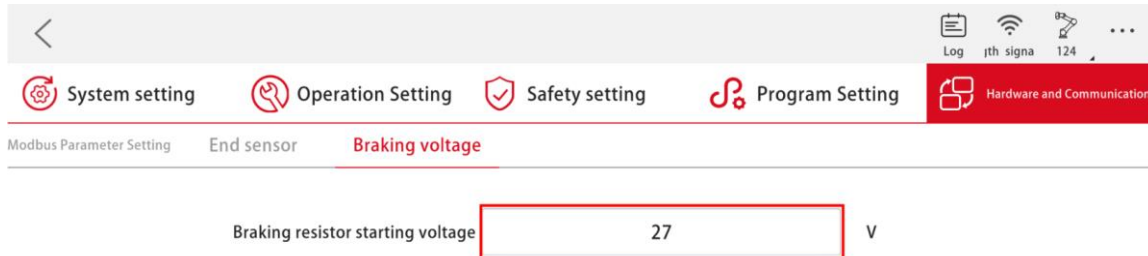


Figure 6-10 Braking Voltage Setting Paths

The relationship between the voltage setting value V_{Brake} and the input voltage V_{IN} is $V_{Brake} \geq (V_{IN} + 3)V$, according to the commonly used input voltage type, the recommended setting value and the power supply type correspondence table are as follows:

Power type	Voltage V_{IN}	Braking resistor starting voltage V_{Brake}
24V module power supply	24V	27V

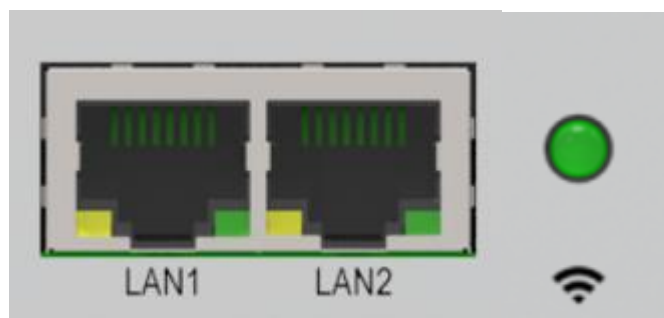
Note:

- (1) When the set $V_{Brake} < (V_{IN} + 1)V$, the internal logic will perform power-on protection, and the APP will prompt "the body voltage or voltage configuration is abnormal";
- (2) When using a lithium battery power distribution system, it is prohibited to charge the battery during power-on procedure.

6.4 Network Settings

6.4.1 Introduction to Network Interface

MiniCab provides 2 network ports, LAN1 and LAN2, wherein LAN1 supports 10M/100M and LAN2 supports 10M/100M/1000M self-adaptation, as shown in Figure 6-11:



6-11 Network Ports and Wi-Fi Indicator Light

Note:

When LAN interface is physical connected and data interchanged, in the LAN port, there is ACT orange light flashing. Meanwhile, the nearby green LINK indicator light is internal suspended, which is not considered as physical connection for the port.

6.4.2 Wi-Fi

MiniCab has its own Wi-Fi hotspot, which is set to no password by factory default settings. Users can connect to MiniCab through wireless terminals. When MiniCab is powered on, the Wi-Fi indicator on the right side of the panel lights up. When connected to Wi-Fi, the Wi-Fi indicator flashes. Then, MiniCab and the robot body can be controlled by the JAKA APP. The name of Wi-Fi hotspot keeps consistent with the MiniCab number. If you need to change the Wi-Fi name, add the login password, etc., please contact the technical service personnel of JAKA.

6.4.3 Network Configuration

a) LAN1 Configuration

LAN1 port is 10M/100M adaptive network port, and the factory-default configuration is 10.5.5.x segment; When connecting to the LAN1 port, the device IP address shall be configured within the range of 10.5.5.101~10.5.5.254 segment; or configure the device to get the IP address in dynamic acquisition mode.

Note: If the device used does not support IP address modification, it is recommended to connect the device to the LAN2 port. And configure the LAN2 port IP address with the same network segment as the device used. If LAN2 network port is occupied, there is no other port to use except for LAN1 port, please contact JAKA technical service personnel to modify LAN1 network.

b) LAN2 Configuration

LAN2 port is 10M/100M/1000M self-adaptive network port. The factory-default configuration is to get IP address in dynamic acquisition mode. Users can login JAKA APP and configure it with static IP with the path as follows: Setting - System Setting - Network Setting. The configuration interface is as follows:

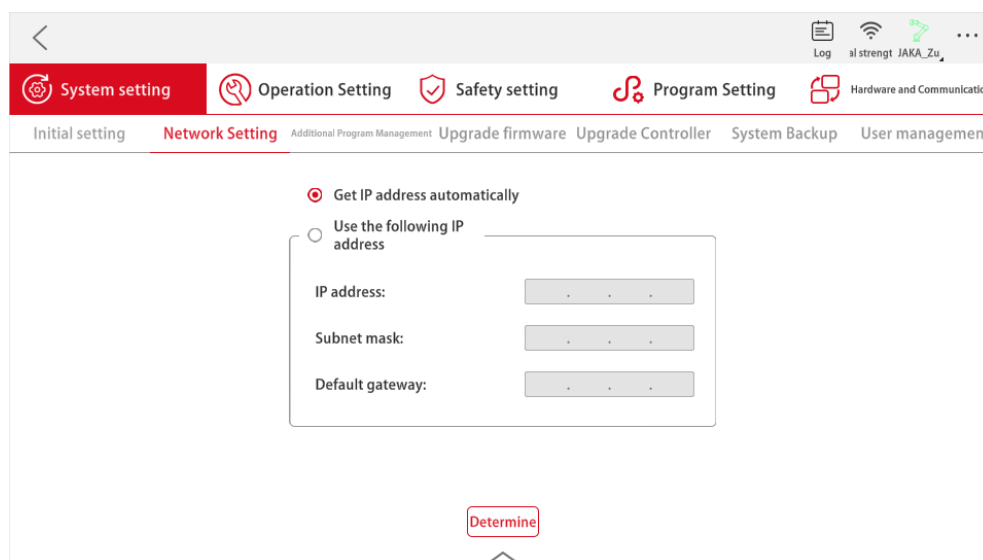


Figure 6-12 LAN2 Network Configurations

Note:

1. Please do not set IP address network segment of the LAN2 port in the same segment as the one of LAN1 ports. Otherwise, it may cause login failure.
2. If LAN2 port must be set in 10.5.5.x network segment, please contact JAKA technical service personnel to modify the LAN1 network port.

c) Reset Settings

When you forget the Wi-Fi name and password and cannot connect to the MiniCab, this MiniCab supports hardware reset function. The reset button is located on the side antenna. You need to press and hold the button for more than 10s to reset the Wi-Fi. At this moment, the Wi-Fi gateway address will be reset, please contact the technical service personnel of JAKA for specific settings and configuration.

Chapter 7 Design Standards and Certification

7.1 Certification Description

7.1.1 Third-Party Certification

JAKA MiniCobo is certified by the following inspection agencies.

	SGS	JAKA robot has passed the safety certification of the notified agency, SGS, which complies with the EU machinery directive 2006/42/EC. You can find the copy of the SGS safety certificate in 7.2.
---	------------	--

7.1.2 Manufacturer Test Certification

	JAKA	JAKA's robot undergo continuous internal factory tests and type testing procedures.
---	-------------	---

7.1.3 Declaration According to EU Directives

JAKA's robot have been certified according to the following directives.

2006/42/EC	Machinery Directive (MD)	JAKA MiniCobo meet the basic requirements of the CE-MD、CE-EMC、CE-RED directives.
2014/30/EU	Electromagnetic Compatibility (EMC)	

7.2 Certificates and Reference Standards

7.2.1 CR Certification

JAKA MiniCobo Robot, has passed the CR certification to be in line with the requirements of its standards for collaborative robots and industrial robots. The testing standards and the certificates are as follows:

ISO 10218-1:2006 Robots for industrial environments - Safety requirements - Part 1: Robots

IEC 60204-1:2016 Safety of machinery. Electrical equipment of machinery. Part 1: General requirements

ISO 12100:2010 Safety of machinery - General principles for design - Risk assessment and risk reducer

ISO/TS 15066:2016 Robots and robotic devices — Collaborative robots

ISO13849-1:2015 Safety of machinery - Safety-related parts of control systems - Part 1: General principles for design

GB/T 38326-2019 Industrial, scientific and medical robots Electromagnetic compatibility Immunity testing

GB/T 38336-2019 Industrial, scientific and medical robots - Electromagnetic compatibility - Emission methods of measurement and limits



TILVA CERTIFICATE FOR PRODUCT CERTIFICATION

NO.TILVA202327008014

APPLICANT: JAKA Robotics Co.,Ltd.
 ADDRESS: Building6,No.646,Jianchuan Road,Minhang District,Shanghai,China
 MANUFACTURER: JAKA Robotics Co.,Ltd.
 ADDRESS: Building6,No.646,Jianchuan Road,Minhang District,Shanghai,China
 FACTORY: Changzhou JAKA Intelligent Equipment Ltd.
 ADDRESS: 1 st Floor,East part of Building 10,No.377,South Wuyi Road,Wujin National Technology Industrial Development Zone,China

PRODUCT NAME: JAKA MiniCobo Cobot
 MODEL: JAKA MiniCobo
 SPECIFICATION: Rated Voltage:20-60VDC
 STANDARDS AND TECHNICAL REQUIREMENTS: ISO 10218-1:2006、IEC 60204-1:2016、ISO 12100-2010、ISO/TS 15066-2016、ISO 13849-1:2015、GB/T 38326-2019、GB/T 38336-2019
 MODES: Testing, Initial Facility Inspection, Surveillance

The above products meet the requirements of the product certification implementation rules CR-1-05:2021 and are hereby issued this certificate. The validity of the certificate is maintained according to the regular supervision of the issuing authority.




Issued date: 2023-02-02
 Date of expiry: 2028-02-01

Approver: _____

TILVA Certification Technology (Shanghai)Co.,Ltd.
 No.505, Wuning Road, Shanghai, P. R. China 200063
<http://www.tilva.com>

7.2.2 CE EMC Certification

JAKA MiniCobo、 JAKA MiniCab control cabinet has passed the CE EMC (Electromagnetic Compatibility) Directive, in line with its relevant requirements, the test standards and certification certificates are as follows:

EN 61000-6-4:2019 Electromagnetic compatibility (EMC) - Part 6-4: Generic standards - Emission standard for industrial environments

EN 61000-6-2:2019 Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity for industrial environments

**SGS-CSTC Standards Technical Services Co., Ltd.**

VERIFICATION OF COMPLIANCE

Verification No.: SHEM210901040501MDC

Applicant: Shanghai JAKA Robotics Ltd.

Address of Applicant: Building 6, No.646 Jianchuan Road, Minhang District, Shanghai,China

Product Description: JAKA MiniCobo

Model No.: JAKA MiniCobo

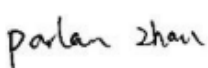
Sufficient samples of the product have been tested and found to be in conformity with

Test Standards: EN IEC 61000-6-4:2019
EN IEC 61000-6-2:2019

As shown in the

Test Report Number(s): SHEM210901040501

This verification of EMC Compliance has been granted to the applicant based on the results of the tests, performed by laboratory of SGS-CSTC Standards Technical Services Co., Ltd. on the sample of the above-mentioned product in accordance with the provisions of the relevant specific standards under Directive 2014/30/EU. The CE mark as shown below can be used under the responsibility of the manufacturer, after completion of an EU Declaration of Conformity and compliance with all relevant EU Directives.


Parlan Zhan
Laboratory Manager





Date: 2022-01-07

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**SGS-CSTC Standards Technical Services
Co., Ltd.**

VERIFICATION OF COMPLIANCE

Verification No.: SHEM210800982701MDC
Applicant: Shanghai JAKA Robotics Ltd.
Address of Applicant: Building 33-35, No.610 Jianchuan Road, Minhang District, Shanghai
Product Description: JAKA Zu MiniCab
Model No.: MiniCab
Sufficient samples of the product have been tested and found to be in conformity with
Test Standards: EN IEC 61000-6-4:2019
EN IEC 61000-6-2:2019
As shown in the
Test Report Number(s): SHEM210800982701

This verification of EMC Compliance has been granted to the applicant based on the results of the tests, performed by laboratory of SGS-CSTC Standards Technical Services Co., Ltd. on the sample of the above-mentioned product in accordance with the provisions of the relevant specific standards under Directive 2014/30/EU. The CE mark as shown below can be used, under the responsibility of the manufacturer, after completion of an EU Declaration of Conformity and compliance with all relevant EU Directives.

Parlam Zhan

Parlam Zhan
Laboratory Manager



Date: 2021-12-08

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7.2.3 CE MD Certification

JAKA MiniCobo、 JAKA MiniCab control cabinet has passed the EU CE MD (Machinery Directive) to be in line with its relevant requirements. The testing standards and the certificates are as follows:

EN ISO 10218-1:2011 Robots and robotic devices - Safety requirements for industrial robots - Part 1: Robots

EN 60204-1:2018 Safety of Machinery Electrical Equipment of Machines Part 1: General Requirements

EN ISO 12100:2010 Safety of machinery - General principles for design - Risk assessment and risk reduction

SGS

VERIFICATION OF MD COMPLIANCE

No.: MD SHES2109018034MD
Applicant: Shanghai JAKA Robotics Ltd.
Building 6, No.646 Jianchuan Road, Minhang District, Shanghai, China
Manufacturer: Same as applicant
Product Description: JAKA MiniCobo
Model No.: MiniCobo
Rating: 100-240V~ 47-63Hz, max 150W
Load capacity: 1kg, Max. reach: 576.3mm
Protection against Electric Shock: Class I
Additional Information (if any): --
Sufficient samples of the product have been tested and found to be in conformity with
Test Standard: EN ISO 10218-1:2011
EN 60204-1:2018
EN ISO 12100:2010
as shown in the
Test Report Number(s): SHES210901803401-01/02/03

This Verification of MD Compliance has been granted to the applicant based on the results of tests, performed by Laboratory of SGS-CSTC Standards Technical Services Co., Ltd. on sample of the above-mentioned product in accordance with the provisions of the relevant harmonized standards under the Machinery Directive 2006/42/EC. The CE mark as shown below can be affixed, under the responsibility of the manufacturer, after completion of an EC Declaration of Conformity and compliance with all relevant EC Directives. The affixing of the CE marking presumes in addition that the conditions in the Directives are fulfilled.

CE

Andrew Zhai
Technical Manager
SGS-CSTC

2021-12-31

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SGS

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SGS

VERIFICATION OF COMPLIANCE

No.: LVD SHES2108017204MD
 Applicant: Shanghai JAKA Robotics Ltd.
 Building 6, No.646 Jianchuan Road, Minhang District,
 Shanghai, China
 Manufacturer: Same as applicant
 Product Name: JAKA Zu MiniCab
 Product Description: Robot controller served by an offboard AC-DC adaptor
 Model No.: MiniCab
 Rating: 100-240 V~, 47-63 Hz, max 12 W
 Protection against Electric Shock: Class I
 Additional Information: --
 Sufficient samples of the product have been tested and found to be in conformity with
 Test Standard: EN 60204-1:2018
 as shown in the
 Test Report Number(s): SHES210801720401

This Verification of Compliance has been granted to the applicant based on the results of tests, performed by Laboratory of SGS-CSTC Standards Technical Services Co., Ltd. on sample of the above-mentioned product in accordance with the provisions of the relevant harmonized standards under the Low Voltage Directive 2014/35/EU. The CE marking as shown below can be affixed, under the responsibility of the manufacturer, after completion of an EC Declaration of Conformity and compliance with all relevant EC Directives. The affixing of the CE marking presumes in addition that the conditions in annexes III and IV of the Directive are fulfilled.

CE

Andrew Zhai
 Technical Manager
 SGS-CSTC

2021-12-31

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Member of SGS Group (Société Générale de Surveillance)



7.2.5 RoHS Certification

JAKA MiniCobo and JAKA MiniCab have passed the EU RoHS 2.0 (2011/65/EU) and the revised directive (EU) 2015/863, and meet the relevant requirements of the EU RoHS 2.0 and the revised directive. The test standards and certification certificates are as follows:



Test Verification of Conformity

Verification Number: 220400574SHA-001-V1

On the basis of the referenced test report(s), sample(s) tested of the below product have been found to comply with the standards harmonized with the directives listed on this verification at the time the tests were carried out. Other standards and Directives may be relevant to the product. This verification is part of the full test report(s) and should be read in conjunction with it <them>.



Once compliance with all product relevant CE mark directives are verified, including any relevant e.g. risk assessment and production control, the manufacturer may indicate compliance by signing a Declaration of Conformity themselves and applying the mark to products identical to the tested sample(s).

Applicant Name & Address:	Shanghai JAKA Robotics Ltd. Building 6, No. 646, Jianduan Road, Minhang District, Shanghai, China.
Product Description:	JAKA MiniCobo
Models/Type References:	JAKA MiniCobo
Manufacture:	Changzhou JAKA Intelligent Equipment Ltd. 1st Floor, East part of Building 10, No. 377, South Wuyi Road, Wujin National
Standard(s)/Directive(s):	RoHS Directive 2011/65/EU and (EU)2015/863 of the European Parliament and of the Council with regard to the restriction of the use of certain hazardous substances in electrical and electronic equipment.
Verification Issuing Office Name & Address:	Intertek Testing Services Shanghai Building No.86, 1198 Qinzhou Road (North), Shanghai 200233, China
Test Report Number(s):	220400574SHA-001



Signature

Name: Wenjia Gu
Position: Senior Manager
Date: 26 August 2022

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Intertek
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GFT-OP-11b (ex-January-2018)

Test Verification of Conformity

Verification Number: 220200220SHA-V1

On the basis of the referenced test report(s), sample(s) tested of the below product have been found to comply with the standards harmonized with the directives listed on this verification at the time the tests were carried out. Other standards and Directives may be relevant to the product. This verification is part of the full test report(s) and should be read in conjunction with it <them>.

Once compliance with all product relevant  mark directives are verified, including any relevant e.g. risk assessment and production control, the manufacturer may indicate compliance by signing a Declaration of Conformity themselves and applying the mark to products identical to the tested sample(s).

Applicant Name & Address:	Shanghai JAKA Robotics Ltd. Building 6, No. 646, Jianchuan Road, Minhang District, Shanghai, China.
Product Description:	JAKA Zu MiniCab
Models/Type References:	MiniCab
Standard(s)/Directive(s):	RoHS Directive 2011/65/EU and (EU)2015/863 of the European Parliament and of the Council with regard to the restriction of the use of certain hazardous substances in electrical and electronic equipment.
Verification Issuing Office Name & Address:	Intertek Testing Services Shanghai Building No.86, 1198 Qinzhou Road (North), Shanghai 200233, China
Test Report Number(s):	220200220SHA-001



Signature

Name: Wenjia Gu
Position: Senior Manager
Date: 26 August 2022

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7.2.6 KCs Certification

JAKA MiniCobo have passed the KCs Certificate.



자율안전확인 신고증명서

신청인	사업장명	JAKA Robotics Co., Ltd.	사업장관리번호	2023E110081
	사업자등록번호	023E110081	대표자 성명	Mingyang Li
	소재지	Building 6, No.646 Jianchuan Road, Minhang District, Shanghai, China		
자율안전인증대상 기계 · 기구명				
			산업용로봇	
형식(규격)		JAKA MiniCobo	용량(등급)	
			6 axis	
자율안전확인번호		23-AB2EQ-00326		
제조사		Changzhou JAKA Intelligent Equipment Co., Ltd.		
소재지		No.377 South Wuyi RD, Wulin National Technology Industrial Development Zone, Changzhou, Jiangsu, China		

「산업안전보건법」 제89조제1항 및 같은 법 시행규칙 제120조제3항에 따라
자율안전확인 신고증명서를 발급합니다.

2023년 06월 21일

한국산업안전보건공단 이사장







Chapter 8 Maintenance and Repair

All safety instructions in this manual shall be strictly followed during maintenance and repairing operation.

Repairing operation shall be implemented by authorized system integrators or JAKA staff.

The operation of replaced parts, which shall be returned to JAKA, should be in accordance with regulations in the service manual.

8.1 Safety Instructions

After the maintenance and repairing operation, verification shall be made to ensure the level of security, which is required by the service regulation. Verification shall comply with valid national or local safety laws and regulations. At the same time, all safety functions shall be tested to see if they are working properly.

The purpose of maintenance and repair work is to ensure the normal operation of the system or to help restoring the system to normal operation in case of failure. Repairing work includes both troubleshooting and actual maintenance work.

The following safety procedures and warnings shall be followed during operation of the robot or controller:



Danger:

1. Do not change any information in the software security configuration. If the security parameters change, the entire robot system shall be considered as a new system, which means that all security audit processes, such as risk assessment, have to be updated.

2. Replace the failed part with a new one of the same part number or an equivalent part approved by JAKA.

3. Reactivate all forbidden security measures as soon as above-mentioned operation is done.

4. Record all maintenance operations and keep them in the technical documentation related to the whole robot system.



Danger:

1. Removing the main input cable from the bottom of the controller can ensure that power supply is cut off. Switch off other power sources, which the robot or controller are connected to. Take necessary precautionary measures to prevent others from reconnecting robot or controller to system power supply during maintenance period.

2. Check the ground connection before restarting the system.

3. Please follow the ESD regulations when disassembling robots or controller.

4. Avoid disassembling the power supply system in the controller. Because, after the controller is powered off, high voltage may still remain in power supply system for several hours.

5. Avoid water or dust to enter the robot or controller.

8.2 Maintenance Items and Cycles

In order to maintain high performance of the robot for a long time, maintenance inspection shall be carried out regularly. Maintenance schedule must be planned by overhaul persons. And the maintenance schedule should be implemented effectively. As for maintenance items, please refer to the following table.

In addition, overhauling shall be done after 20,000 hours of operation or every four years (the shorter period time prevails). If the maintenance and adjustment method is not clear, please contact JAKA Service Department.

Cycle			Maintenance items	Maintenance essentials	Location
Routine	3 months	1 year			
●			Robot Body	Verify whether or not the reserved position of robot in program is deviated	All body
	●		Cleaning Robot Body	Wipe off dirt. Clear dust, powder, cutting pieces, etc.	All body
	●		Main bolts	All the bolts exposed outside the robot should be tightened, and the tool mounting bolts should also be tightened. Paint all the exposed bolt. (see the specified tightening torque table)	All body
●			Motor	Identify abnormal heating and abnormal noise.	All-axis
●			Brake	Verify that the robotic arm or tool does not drop, when servo power is ON/OFF	All-axis
	●		Reducer	Identify abnormal vibration, abnormal noise and oil leakage	All-axis
	●		Tool	Apply force Back and Forth, Up and Down, Left and Right to the tool end. Make sure your hand can not feel clearance by shaking.	Axis No.6

Table of specified fastening torque for bolts

Nominal thread	Bolt with hexagon socket	Stainless steel bolts with hexagonal socket
M2	0.5 Nm	0.4 Nm
M3	2.4 Nm	1.47 Nm
M4	5.4 Nm	3.4 Nm
M5	9 Nm	6.9 Nm
M6	15.3 Nm	11.8 Nm
M8	37 Nm	28.4 Nm

The fastening torque will be different according to the types of base material or bolt. If it is not shown in the text or figure, please follow the tightening torque in this table.

Verification code	Examination cycle			Maintenance			Examination area	Check Items	Check/handling method
	Routine	Every 3 months	Every year	4 years	5 years	8 years			
1	●						External surface of controller	Spatter, dust and other impurities attached	Visual inspection and cleaning
2	●						Filter	Whether or not there is dirt or blockage	Visual inspection, cleaning, replacement
3		●		●		●	Cables	Check if there is any damage, fragmentation or joint disconnecting.	Visual inspection, tightening. Replacement when cable broken.
4						●	Overhauling		

(Note) Please use a soft cloth to wipe off the dust when cleaning. DO NOT use devices such as air blowers to blow away dust. Because wind pressure will cause dust to enter the fan, and the blades will rotate at a speed exceeding the specified speed, which may cause the fan to malfunction or affect its lifetime. Please use the vacuum cleaner only on the blade part, do not vacuum the rotating part and the main body. This may cause the fan to malfunction or affect its lifetime.

8.3 Replacement and storage of parts

When changing the parts of robot control device, please comply with the following precautions for safe operation.

	- Any modification of our products is strictly prohibited. - Fire, malfunctions, and incorrect actions caused by modification may result in personal injury or damage to machines. - Any loss caused by the modification of our products will not be covered by our warranty.
	In order to prevent electric shock, please close the circuit breaker in advance and cut off the main power supply when replacing components.
	- When replacing components, please cut off the main power supply for 5 minutes in advance. - There is a risk of electric shock due to residual charge in the base plate and electrolytic capacitor. - DO NOT work with wet hands. - When electric shock occurs, it will cause serious injury or death to operation personnel.

	1. Replacement operations shall be carried out by specific operators. 2. Electric shock or accidental clamping by robot will result in serious injury or death.
	1. There are a large number of connection interfaces between PCB base plates. When replacing components, be cautious to avoid mis-connection or missing connection. 2. If electric shock and fire occurs, it may cause serious injury or death to operation personnel.
	1. When replacing components, do not damage the wiring or pull the interface to avoid damaging them. 2. When replacing, do not touch the electronic parts, contact parts of the circuit and interface of the PCB base-plate. Hold the edge of the PCB base plate. 3. If touched PCB plate carelessly, it may cause electric shock, which leads to serious injury or death.
	In maintenance and inspection work, when robot controller switch on the power supply, please DO NOT expose inside of the robot controller to direct sunlight, searchlights, etc., otherwise it will cause malfunctions or wrong actions.
	1. Before the operation, operators shall release static electricity in advance. 2. Anti-static wrist bands are very effective. 3. Direct touching of electrical components without taking any precautions may cause malfunction to electrical components.
	After the operation completed, it shall be confirmed that there is no gap or cable clamped. After that, re-install controller shell. If there is gap, dirt or dust may enter inside of the controller, which will lead to malfunction.

8.3.1 Cleaning and replacement of parts and components

Filter cleaning and replacement:

- a. Cut off power supply of the controller.
- b. Remove screw nut of the filter cover.
- c. Clean the dust sticking to the filter by blowing out it. Dust should be blown out from inside of the controller to outsider during cleaning. When there is dirt, use warm water or neutral detergent to clean it. Replace it, if it cannot be cleaned.

d. Installation should be carried out in the reverse order of removal.

e. When cleaning with warm water or neutral detergent, it should be fully dried before installation.

8.3.2 Storage of parts and components

According to the life and use frequency of the components, the recommended spare parts are divided into A and B categories for management.

Maintenance parts-A: Main maintenance parts prepared for daily maintenance and inspection

- A-1: Important backup parts
- A-2: Regular replacement parts/recommended spare parts

Maintenance parts-B: Maintenance parts prepared when purchasing several machines

- B-1: Parts purchased from JAKA

In order to maintain normal operation, the above-mentioned A-1 and A-2 are the minimum essential parts required, and it is recommended to prepare a whole set of them. In addition, PCB board should use highly reliable components. Please pay attention to the following points during storage.

- Storage temperature $-10^{\circ}\text{C}\sim+50^{\circ}\text{C}$

In order to maintain its reliability during long-term storage, it is recommended to maintain the temperature within $25^{\circ}\text{C}\pm 10^{\circ}\text{C}$. Please avoid sudden temperature changes (Above $10^{\circ}\text{C}/\text{h}$).

- Storage humidity 20%RH ~85%RH

In order to maintain its reliability during long-term storage, it is recommended to maintain the humidity within 45%~65%. Avoid condensation or mildewed during storage.

- Anti-static

It is easy to generate static electricity when stored in extremely dry conditions, and the impact of static discharge may damage the semiconductor. Please store them in an anti-static bag.

- Other environmental conditions

Please store them in an environment where no toxic gas, dirt, and less dust. Do not place heavy objects on it during storage.

8.4 Commitment of After-sales Service

I. Our company will provide users with the following equipment warranty and maintenance services:

Equipment provided by our company: The equipment shall have warranty period of 1 year from the date of acceptance upon arrival of the equipment. In the warranty period, our company is liable for maintenance of the equipment failure. After receiving the user's equipment failure report, if the fault is caused by our equipment, our company will be liable for providing warranty services and prompt troubleshooting. If the fault is caused by one of the following circumstances, it will not be included in the free warranty service. The user shall pay the expenses of the equipment cost. But our company will assist in troubleshooting as soon as possible to restore the equipment to normal condition:

1. The user does not follow the operation procedures;
2. Equipment damage caused by users;
3. Failure caused by other force majeure factors (such as lightning strike, earthquake, flood, etc.)

Within one-year warranty period, our company provides free maintenance services for users. When the warranty expires, our company will continue procedures of after-sales service as follows:

1. The content and format of service application and support service implementation report shall be determined by consultation with user's company. And the user's company and our company shall designate relevant responsible person respectively.

2. If require support service, the user's company should fill in a service application, fax it to our company.

In case of emergency, user's company can directly call for service by service hot line.

II. Scope and content of support services

Our company promise to providing maximum technical services throughout and in all aspects of the project, including: Hardware maintenance support service and software training support service.

1. Hardware maintenance support service: Our company promises that we will be liable for the maintenance of any equipment within the warranty period of the equipment. During that time, the user will not pay any fees (except for mechanical damage and fault caused by the user's incorrect operation). After the equipment warranty expires, our company will sign the relevant agreement with user's company to determine the payment method, maintenance responsibility, maintenance method, and guarantee to perform the maintenance liabilities.

2. Software training support services: Our company promises to provide users with one time free training (specific number of times can be changed according to the contract) within the warranty period of the equipment. After the expiry of the equipment warranty, our company will sign the relevant agreement with the user to determine the payment method, and guarantee to perform the follow-up service liabilities.

III. After-sales service telephone number and contact information

- E-mail: Support.china@JAKA.com
- Telephone: 021-80392665

Information requested

- Robot Serial No.
- Software Version Number
- Detailed fault description
- Attached log file

Chapter 9 Quality Assurance

9.1 Product Quality Assurance

Without prejudice to any claim agreement that user (customer) may have with the distributor or retailer, manufacturer shall provide the customer "Product Quality Assurance" on the terms as below:

If new equipment and its components have defects due to poor manufacturing and/or materials within 12 months after their commissioning (up to 15 months if transportation time is included), JAKA shall provide necessary spare parts. And the user (customer) shall be responsible for assign personnel to replacement work. The replacement should use spare parts with latest technology level. If the equipment defects are caused by improper handling and/or failure to follow the relevant information described in the User Manual, this "Product Quality Assurance" shall be null and void. This "Product Quality Assurance" does not apply to or extend to maintenance (such as installation, configuration, software download) performed by an authorized distributor or user (customer). The user (customer) must provide the purchase receipt and purchase date as valid evidence to enjoy the "Product Quality Assurance". A claim under this "Product Quality Assurance" shall be valid within the warranty time and within the next two (2) months after the "Product Quality Assurance" has expired. The device or component that is replaced or returned to JAKA belongs to JAKA company. Any other claims arising from equipment or in connection with the equipment are not covered by this "Product Quality Assurance". In this "Product Quality Assurance", any item is not trying to restrict or exclude the legal rights of user (customer). Also, in this "Product Quality Assurance", any item is not trying to restrict or exclude manufacturer's liability for death or injury caused by their negligence. The duration of this "Product Quality Assurance" shall not be extended by the services provided under the terms of this "Product Quality Assurance". Under the principle of not avoiding this "Product Quality Assurance", JAKA reserves the right to charge the user (customer) for replacement or maintenance. The foregoing provisions do not imply a change in burden of proof, and do no profit loss to the user (customer). In the event of defective equipment, JAKA shall not be liable for any damage or loss resulting therefrom, including but not limited to production loss or damage to other production equipment.

9.2 Disclaimer

JAKA is committed to improving the reliability and performance of our products and therefore reserve the right to upgrade our products without prior notice. JAKA strives to ensure the accuracy and reliability of the contents of this manual, but is not responsible for any error or missing information therein.

Appendix

Safety Function Table

SF	Item	Description	Assessment Results	Response Time	Category
SF1	ESTOP with the ESTOP Button on the Control Stick	Pressing the Emergency Stop Button on the control stick will result in a category 1 stop. Robot immediately decelerates to stop, and the power supply of robot will be cut off when all joints enter stand-still condition. If the two safety digital input signals differ, the emergency stop will be triggered.	PL d/Cat. 3	250ms	Cat. 1 stop
SF2	ESTOP with External ESTOP Button	This safety function is initiated by an external device using safety digital inputs. The category 1 stop is triggered when the external connections are LOW. Robot immediately decelerates to stop, and the power supply of robot will be cut off when all joints enter stand-still condition. External emergency stop input can only be bypassed by short circuit. If the two safety digital input signals differ, the emergency stop will be triggered.	PL d/Cat. 3		Cat. 1 stop
SF3	Safeguard (Protective) Stop	This safety function is initiated by an external device using safety digital inputs. The category 2 stop is triggered when the external connections are HIGH. Robot decelerates following the programmed trajectory, eventually all joints enter stand-still condition (while the robot remains enabled). Safeguard stop input can only be bypassed by short circuit. If the two safety digital input signals differ, the safeguard stop will be triggered.	PL c/Cat. 2	500ms	Cat. 2 stop
SF4	Joint Position Limits (Soft Axis Limits)	Each joint can have its own limit. Exceeding the joint position limit will result in a safety state.	PL c/Cat. 2	250ms	Cat. 1 stop
SF5	Joint Speed Limit	Each joint can have its own limit. Exceeding the joint speed limit will result in a safety state.	PL c/Cat. 2		Cat. 1 stop
SF6	Joint Torque Limit	Each joint can have its own torque limit, which is a factory setting and can't be configured by the user. Exceeding the joint torque limit will result in a safety state.	PL c/Cat. 2		Cat. 1 stop
SF7	Joint Power Limit	Each joint can have its own power limit, which is a factory setting and can't be configured by the user. Exceeding the joint power limit will result in a safety state.	PL c/Cat. 2		Cat. 1 stop
SF8	Power Limit	This function monitors the mechanical power	PL c/Cat. 2		Cat. 1 stop

SF	Item	Description	Assessment Results	Response Time	Category
		of the robot's motion (sum of the product of torque and angular velocity for each joint). Limiting the mechanical power of the robot can reduce the collision forces in a collision, and this function may have an impact on the robot's motion speed. Exceeding the robot power limit will result in a safety state.			
SF9	TCP Speed Limit	Allowed upper limit for TCP (Tool Center Point) speed can be defined to prevent robot motion from exceeding such limit (excluding Hand-guided Mode). If the TCP speed exceeds the limit during robot motion, it will result in a safety state.	PL c/Cat. 2		Cat. 1 stop
SF10	Tool Orientation Limit	Allowable range for tool orientation movements can be defined for the robot. If the tool orientation exceeds the specified range limit during motion, it will result in a safety state.	PL c/Cat. 2		Cat. 1 stop
SF11	TCP Position Limit (Safety Planes)	Multiple safety planes can be defined to restrict the range of motion for the robot. If the robot's tool position exceeds the defined safety planes, it will result in a safety state.	PL c/Cat. 2		Cat. 1 stop
SF12	TCP Position Mismatch Limit	TCP real position and instruction position are calculated and compared. It will result in a safety state if the error value exceeds the position mismatch limit.	PL c/Cat. 2		Cat. 1 stop
SF13	Hand-guided Mode TCP Speed Limit	Allowed TCP (Tool Center Point) speed limit for Hand-guided mode can be defined. If the TCP speed exceeds this limit in Hand-guided mode, it will result in a safety state.	PL c/Cat. 2	500ms	Cat. 2 stop
SF14	Collision Protection	Collision is estimated by multiple methods, such as joint torque, joint position mismatch and TCP position mismatch. Detection of collision will initiate a safety state.	PL c/Cat. 2		Cat. 2 stop
SF15	Additional Emergency Stop Input	Configurable additional emergency stop safety digital input. This safety function is initiated by an external device using safety digital inputs. The category 1 stop is triggered when the external connections are HIGH. Robot immediately decelerates to stop, and the power supply of robot will be cut off when all joints enter stand-still condition. If the two safety digital input signals differ, the emergency stop will be triggered.	PL d/Cat. 3	250ms	Cat. 1 stop
SF16	Additional Safeguard Stop Input	Configurable additional safeguard stop safety digital input. This safety function is initiated by an external device using safety digital inputs. The category 2 stop is triggered when the external	PL c/Cat. 2	500ms	Cat. 2 stop

SF	Item	Description	Assessment Results	Response Time	Category
		connections are HIGH. Robot decelerates following the programmed trajectory, eventually all joints enter stand-still condition (while the robot remains enabled). If the two safety digital input signals differ, the safeguard stop will be triggered.			
SF17	Safeguard Reset Input	Configurable safeguard stop state reset safety digital input. This safety function is initiated by an external device using safety inputs. Transitioning the external connections from HIGH to LOW will exit the protective stop state. If the two safety digital input signals differ, it will fail to reset the safeguard stop.	PL c/Cat. 2		Reset from Cat.2 stop
SF18	Reduced Mode Input	Configurable reduced mode safety digital input. This safety function is initiated by an external device using safety inputs. The reduced mode is triggered when the external connections are HIGH. The reduced mode will have an impact on the status of the following safety function limit settings: TCP speed, TCP force, robot momentum, robot power. If the two safety digital input signals differ, the reduced mode will be triggered.	PL c/Cat. 2		Reduced mode
SF19	ESTOP Button State Output	Configurable emergency stop status safety digital output. When the Emergency Stop Button on the control stick is pressed, the dual digital outputs are HIGH. Note that emergency stop with External Estop Button and additional emergency stop input do not affect this output.	PL d/Cat. 3		Two-channel output signals with high impedance state
SF20	System ESTOP State Output	Configurable emergency stop status safety digital output. When the robot enters an emergency stop state, the dual digital outputs are HIGH. The emergency stops from the Estop Button on the control stick, ESTOP with External Estop Button, or additional emergency stop inputs all have an impact on the output.	PL d/Cat. 3	250ms	Two-channel output signals with high impedance state
SF21	System Safeguard State Output	Configurable system safeguard stop status safety digital outputs. When the robot enters the protective stop mode, the dual digital outputs are HIGH.	PL d/Cat. 2	500ms	Two-channel output signals with high impedance state
SF22	Robot Moving Output	Configurable motion status safety digital outputs. Whenever the robot is moving (motion underway), the dual digital outputs are HIGH. Outputs are LOW when there is no movement.	PL d/Cat. 3		Two-channel output signals with high impedance state
SF23	Robot Not Stopping Output	Configurable motion status safety digital outputs. Whenever the robot is stopping (in the process of stopping or in a stand-still condition) the dual digital outputs are LOW.	PL d/Cat. 3	100ms	Two-channel output signals with high impedance

SF	Item	Description	Assessment Results	Response Time	Category
		When outputs are HIGH, the robot is not in the process of stopping and not in a stand-still condition.			state
SF24	Robot Reduced Mode Output	Configurable reduced mode safety digital outputs. Whenever the robot is in reduced mode, the dual digital outputs are HIGH.	PL d/Cat. 3	500ms	Two-channel output signals with high impedance state
SF25	Robot Not in Reduced Mode Output	Configurable not in reduced mode safety digital outputs. Whenever the robot is NOT in reduced mode, the dual digital outputs are HIGH.	PL d/Cat. 3		Two-channel output signals with high impedance state
SF26	TCP Force Limit	The safety function continuously calculates the torque allowed for each joint to stay within the defined force limit for the TCP. The joints control their torque output to stay within the allowed torque range. When the torque output exceeds the limit, it will result in a safety state.	PL c/Cat. 2		Cat. 2 stop
SF27	3-Position Enable Input	Configurable 3-Position Enable safety digital input. This safety function is initiated by an external device using a safety input. The 3-Position enable limit is triggered when the external connections are HIGH. If the two safety digital input signals differ, the 3-Position enable limit will be triggered.	PL c/Cat. 2		Cat. 2 stop

JAKA Website



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