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JAKA Robot
User Manual - Hardware Section

JAKA Zu MiniCab

JAKA Robot
User Manual

JAKA Zu MiniCab v1.1

Cabinet No.:_____

ⓘ Note:

The definition of collaborative robots (Cobot) follows the international ISO standards and national standards to protect the safety of operators. We do not recommend directly applying the robot to situations where the object of operation is a human body. However, when robot users or application developers do need to involve the human body in the robot operation, they need to configure a safe and reliable, fully tested and certified security protection system for the robot to protect the safety of human beings on the premise that the user or application developers can fully evaluate the safety of human beings.

The content contained in this User Manual is the exclusive property of Shanghai JAKA Robot Technology Co., LTD (Hereinafter collectively referred to as JAKA), and shall not be used in any form without the written consent of JAKA.

The user manual is subject to revision and improvement on a regular basis by JAKA and its contents are subject to change without prior notice. Please carefully check 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 for any accidental or consequential damages caused by the use of this Manual and the products it introduces. Please read this Manual carefully before installing and using the product.

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 observed when using and maintaining the JAKA robot.

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

Manual Instructions

This manual mainly includes precautions for safe use of robot controller, mechanical and electrical interfaces, installation and maintenance, and JAKA Zu software usage.

Users of this manual shall have received basic mechanical and electrical training, which will be more helpful to the installation and use of the robot.

More Information

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

Content

Introduction

JAKA Zu® MiniCab is a new compact robot controller that can be used with the existing JAKA Zu® series of collaborative robots and is wholeheartedly at your service. Minding your mind.

JAKA robot uses the control mode of mobile intelligent terminal plus APP to connect with the robot arm. And one mobile terminal can control several robot arms. Operators do not need to master professional programming language and can easily complete the programming by manually controlling the robot. In this way, the man-machine collaboration can be more leisurely, which greatly improves the production efficiency.

MiniCab is a compact robot controller based on wide voltage DC power supply. It can be seamlessly integrated into the existing infrastructure and can provide powerful performance for more application scenarios. With Wi-Fi hotspot, it can be widely used in AGV, composite robot and other mobile platforms, and support intensive deployment.

Product List

When you purchase a JAKA Zu® MiniCab robot controller separately, the package list you receive is as follows:

Name	Quantity
JAKA Zu MiniCab	1
Handle assembly	1
Power supply, emergency stop, IO plug and pull terminal	3
Wi-Fi antennas	1
Hangers and matching bolts	2
Rail installation assembly (Optional)	1

Specifications

Weight	1.1kg
Dimensions (W × H × D)	180×46.6×128mm
Ambient Temperature	0-50℃
Protective class	IP20
Materials	Aluminum alloy steel
Power	DC30V~60V
Communication Ways	TCP/IP. Modbus TCP. Modbus RTU
I/O Port	7 segment I/O multiplexing
I/O Power Supply	24V

Chapter 1 Safety Specification

1.1 Introduction

This chapter mainly introduces the safety principles and specifications that shall be observed when using robots or robot systems. Users shall carefully read the safety related contents in this manual and strictly follow 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 use of 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

This chapter is intended to protect the operator and point out the related matters that need to be paid attention to during the first installation. Users need to read the safety warnings in this manual carefully, but there are still many possibilities, and many descriptions of them cannot be exhaustive. We have described various situations as much as possible.

	1. Professional debugging personnel are required to install and debug the MiniCab and the robot in accordance with the specifications. 2. The setting and modification of robot parameters shall be carried out by authorized personnel and unauthorized personnel shall be prevented from changing parameters.

3. If the operator uses his/her own electric control cabinet, he/she shall bear the risks.

⚠️	1. Do not connect safety devices to a normal I/O interface to avoid injury. 2. Make sure that the correct installation settings (such as the robot installation angle, the quality in TCP, the TCP offset, the security-related configuration) are performed, and the installation file is saved and loaded into the program. 3. Tools and obstacles shall not have sharp corners or points. Make sure all personnel are out of reach of robots. 4. Connecting different machines may aggravate the danger or introduce new risks. A comprehensive risk assessment shall be conducted throughout the installation at all times. 5. The controller uses DC voltage input. Please use the DC power supply in a standard way. When using battery power, you need to consider the related risks brought by the battery. 6. For the precautions of the robot, please refer to the specific model.
♨️	1. The robot and MiniCab will generate heat when they are working. Do not touch the robot when it stops and you can only touch it after the power is off for about 1 hour. 2. MiniCab will generate heat and do not put your hand on the shell of MiniCab.

1.4 Responsibility and Risk

Liability

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

The integrator of JAKA bears the liability to ensure that the applicable laws and regulations of the relevant country are followed to ensure that there is no significant risk in the complete robot application.

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

The JAKA product will consider the safety design and be adapted to the operation handle and the user emergency stop interface for the safe operation in case of an emergency. Please use it in accordance with the product requirements. The company will not be liable for the safety problems caused by the unauthorized disassembly and modification of the emergency stop interface.

JAKA will constantly strive to improve the performance and reliability of the company's robots. The Company will not be liable for any errors or missing information in this manual, and reserves 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 contact, operators must have sufficient self-protection awareness, and integrators need to carefully consider the operating conditions when using the company's robots for customers. The following dangerous situations may occur:

When handled, the robot fell and injured the personnel;

Injuries caused by loose fixing bolts of the robot;

When the robot is working, it may pinch fingers and hurt people;

Injury caused by the failure of robot which is not repaired in time;

There may be dangerous situations when using sharp end effectors or tool connections;

Robots can injure people when operating in toxic or corrosive environments.

1.5 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 may be considered as a secondary protection.

1.6 Precautions for Transportation and Handling

The robot/controller needs to be fixed in its original packaging during transportation to ensure that the equipment is stable and kept dry.

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 until all the bolts on the base of the robot are fastened.

 Note:

1. Make sure your back or other parts of your body are not overloaded when you are lifting the device. Use suitable lifting equipment. JAKA is not liable for the damage caused during the transportation of the equipment.

2. Ensure that installation instructions are strictly followed during robot installation.

Chapter 2 Welcome

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

This chapter will provide a quick introduction to JAKA Zu MiniCab's basic components and usage as a preliminary understanding of the robot. For detailed mechanical and electrical specifications and software operation manual, please refer to other chapters.

During use, if you need quick help, please call our quick enquiry hotline: **400-006-2665**

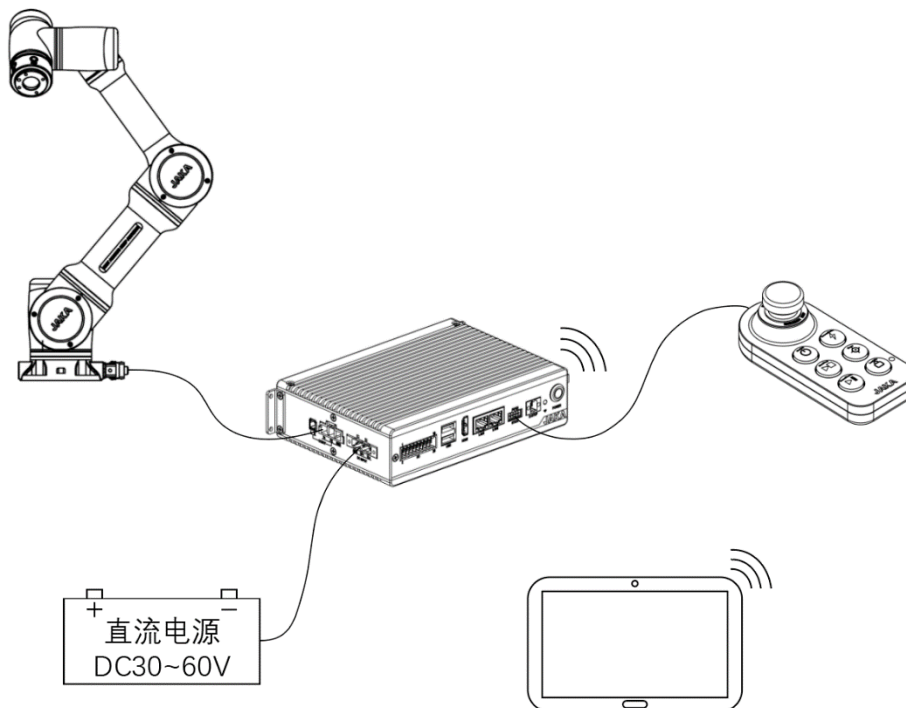## 2.1 Typical Application Schematic Diagram

Figure 2-1 Typical MiniCab Application

As shown in Figure 2-1, the JAKA Zu MiniCab controller adopts the mode of wireless interconnection and integrates the function of Wi-Fi hotspot internally. It needs to include the following parts when in use:

Operating Terminal: The device for users to perform programming, setting, and other operations.

Robot Body: Main moving parts to achieve the desired action of the user. At the same time, the robot end is equipped with a ring indicator light indicating the status of the robot, buttons for dragging and programming, and an I/O interface for connecting tools, namely the TIO interface.

Operating Handle: The controller is equipped with user-friendly handle to control robot operation and emergency stop operation.

DC Power： The controller adopts DC voltage input, supports DC 30-60V wide voltage range, and can use 48V battery or DC module power supply as input source.

2.2 Composite Robot Application

Figure 2-2 Typical Application Diagram of Composite Robot

As shown in Figure 2-2, the JAKA Zu MiniCab controller can be used with mobile platforms such as AGV, and the 48V power battery inside the AGV can be used to provide power, which is compact in size with an easy and simple integration.

2.3 Operation Terminal

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

Table 2-1 Operating Terminal Configuration Table

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	Wi-Fi

When purchasing JAKA Zu series collaborative robots, users can also request to purchase operation terminals or use their own tablets.

2.4 Electric Control Cabinet and Control Stick

The controller provides a keypad handle that can be used to start the robot without using the APP when

![JAKA 节卡 logo]

the running program is written and loaded by default.

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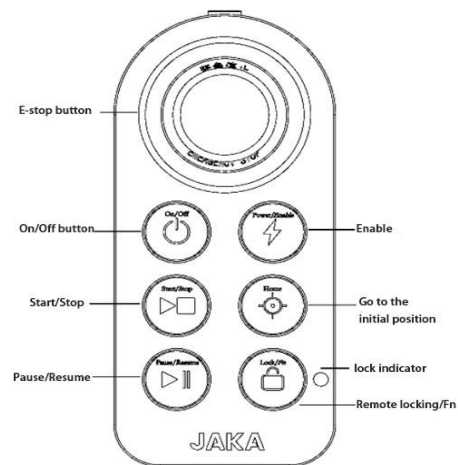

Table 2-2 Handle Function Description

Power on	**Poweron:** Short press the power button for 1s and then release. The buzzer rings, and the electric control cabinet turns on. **Shutdown:** Long press the power button for more than 3s. The handle rings 6~7 times, and the electric control cabinet turns off.
Enable	**Power on the robot:** If the power is not turned on, short press the button to electrify the robot. **Power off the robot:** When the power is on, short press the button to turn the robot off. **Enbale the robot:** When the power is on, short press the Lock key + Enable key. **Disable the robot:** When the robot is enabled, short press the Lock key + Enable key.
Termination	**Terminate program operation:** Short press the Stop button to start the loaded default program, and after it moving to the initial position of the program, execute the default program. **Terminate program operation:** In the robot running program, short press to terminate the program.
Reset	**Reset:** After the robot is enabled, when the program is not running, press continuously to control the robot to move to the set default position. When the robot runs to the default position, keep pressing and lock the prompt light to blue breathing light.
Suspension	**Pause:** During the automatic operation of the robot, press Pause program execution. **Recover:** When the machine is suspended, press Recover program execution.
Lock	**Lock handle:** Long press the Lock button for 3s and the lock indicator light flashes orange. **Unlock handle:** Long press the Lock Key for 3s and the locking prompt lights are switched off. **Combined functions:** Other keys can be used with the Lock Key.
Locking prompt lights	**Locked state:** When in a locked state, the light flashes orange. All buttons are invalid except the Unlock button. The robot can be controlled through the App. **Unlocked state:** When in the unlocked state, the lights are off and the handle can be used. When the APP interface is grey, the robot can no longer be controlled.
E-STOP button	**For emergency stop.** Note: The E-STOP button is only used in the case of an emergency and shall not be used as a general PowerOff device.

Note:

- When the power is on, press any key, and the handle buzzes twice a second.
- During the power-on process, LOGO lamp first flashes red, blue and green alternately, accompanied by three buzzes, and then LOGO lamp flashes orange and waits for the IPC to go online. When the controller program is running normally, the LOGO lamp flashes blue. After the robot is enabled, the LOGO lamp flashes green.
- When you are using the handle to operate the robot, please make sure that the robot you are operating is within sight, and follow relevant safety regulations to prevent injury to people or damage to equipment around the robot.

Chapter 3 Mechanical Specification

MiniCab is compact in design, featured with small size and high integration. It is mainly used in conjunction with the JAKA products and peripheral accessories.

Figure 3-1 Product Appearance Rendering

3.1 Outline Dimension

The dimensions of JAKA Zu MiniCab are shown in Figure 3-2. Standard accessories include side lugs, which support panel mounting and base mounting. At the same time, if the guide rail installation is needed, the guide rail installation component is optional.
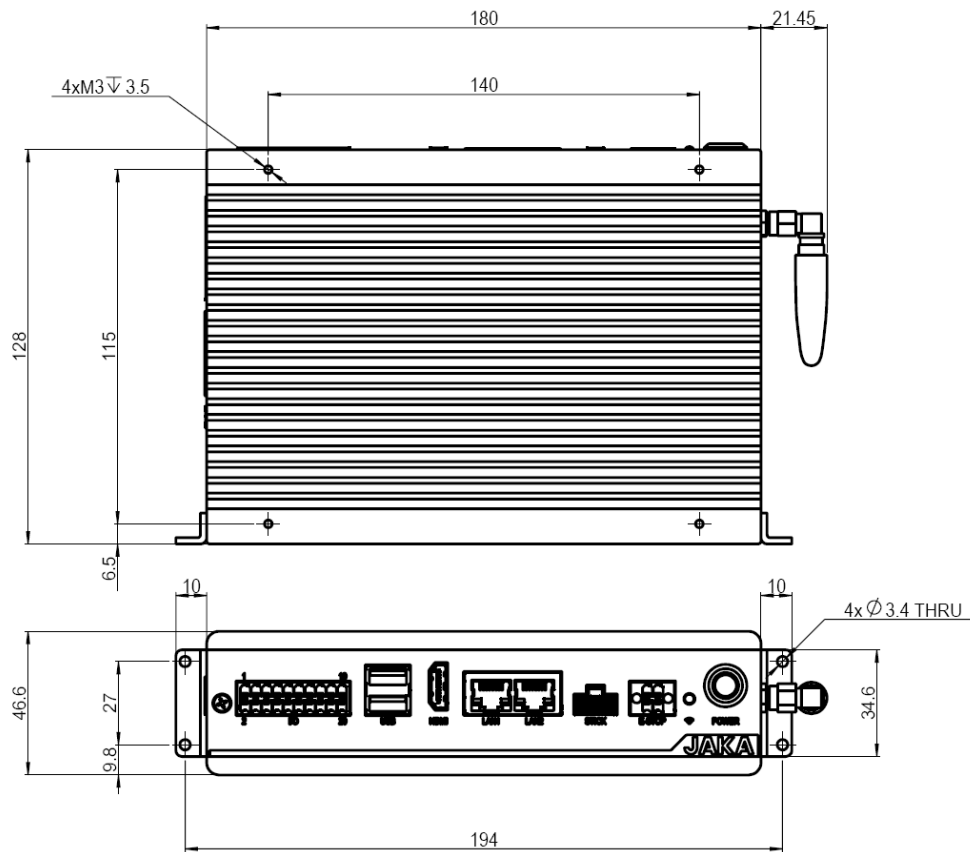
Figure 3-2 Outline Dimensions and Installation Hole Bitmap

3.2 Installation

3.2.1 Installation Method

MiniCab shall be installed reliably before use. Here are three ways to install:
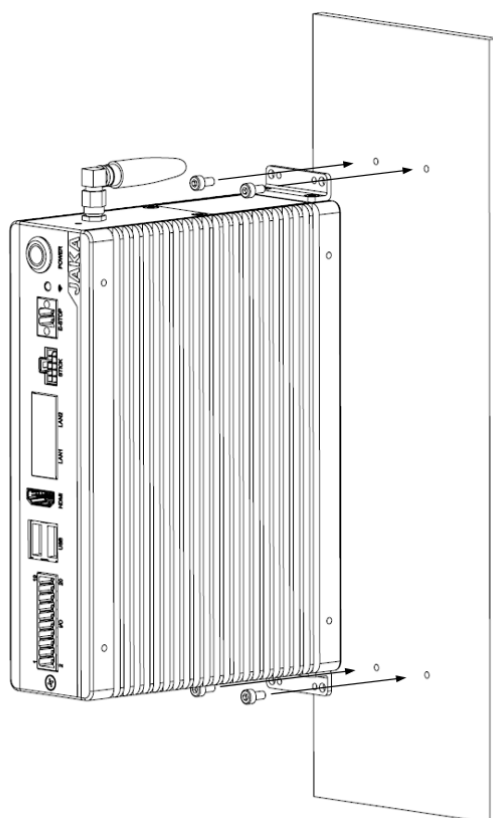
3.2.1.1 Rear Lug Mounting

Figure 3-3 Rear Lug Mounting Diagram

The upper and lower lugs are factory default configuration, and the installation method is shown in Figure 3-3. 4 M3 bolts shall be selected for fixing parts, and the spacing of mounting holes is shown in Figure 3-2. When the fixed plate is a moving platform, in order to reduce the impact of moving vibration on MiniCab, it is recommended to add a rubber gasket between the MiniCab and the fixed plate.
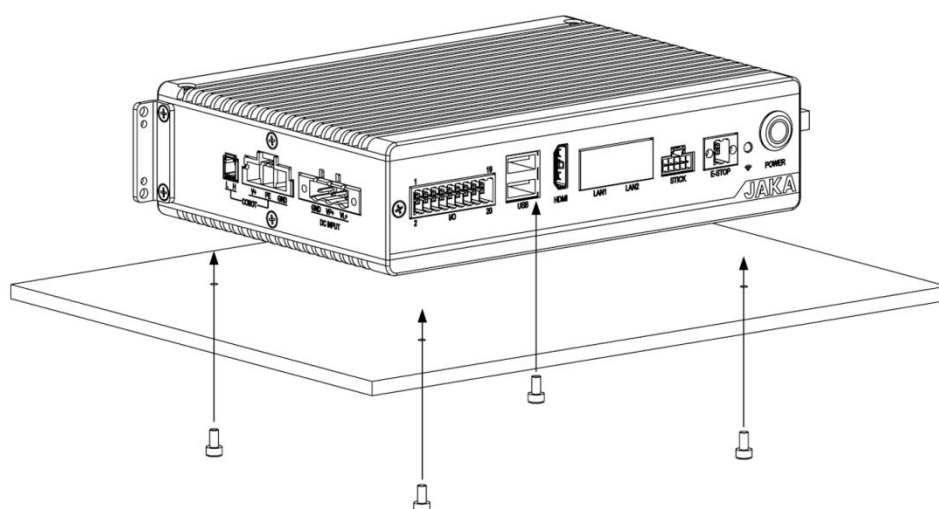
3.2.1.2 Base Installation

Figure 3-4 Base Installation Schematic Diagram

MiniCab supports the bottom mounting and fixing mode, as shown in Figure 3-4. 4 M3 bolts are selected for fixing, and the size data of the bottom mounting hole are shown in Figure 3-2. When the fixed plate is a moving platform, in order to reduce the impact of moving vibration on MiniCab, it is recommended to add a rubber gasket between the MiniCab and the fixed plate.

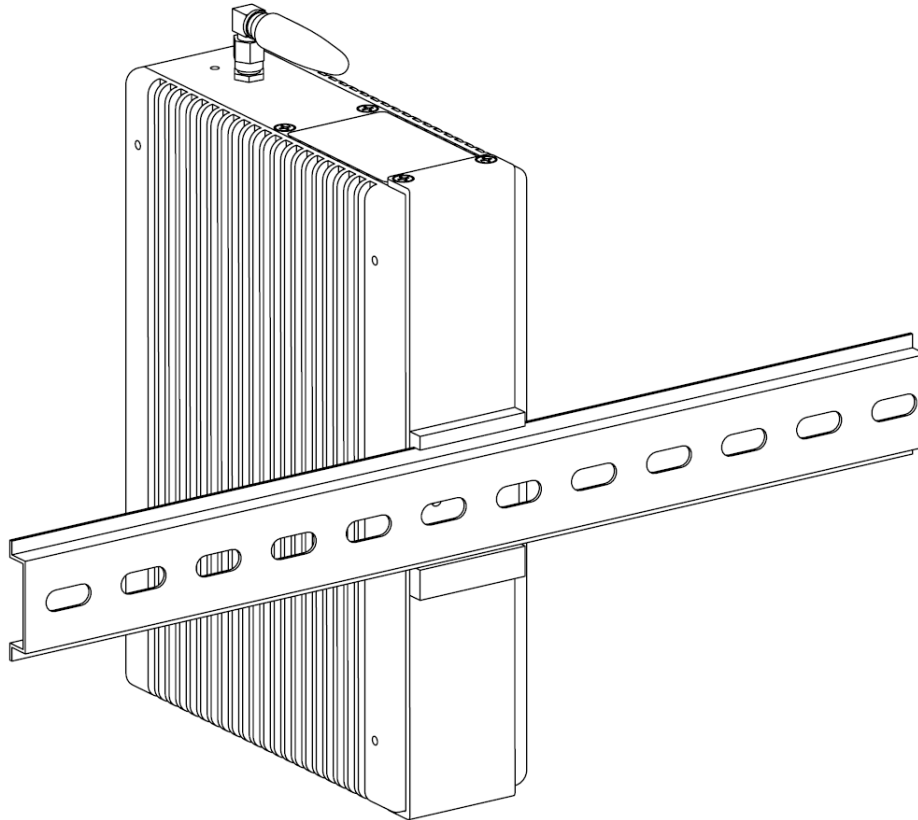3.2.1.3 Rear Guiderail Installation

Figure 3-5 Rear Guiderail Installation Diagram

MiniCab also supports rear installation of national standard guiderail, and the guiderail buckle is optional. When there is a need for rear guiderail installation, please contact the technical service personnel of JAKA to prepare before shipping or arrange a redelivery.

3.2.2 Installation Environment Requirements

MiniCab needs to be installed in a dry place with good ventilation and cooled by natural convection; when there is a large amount of heat generated in the use scenarios, such as high-speed running, heavy load or frequent braking, an external fan is required to cool the MiniCab. In order to ensure the MiniCab can be cooled by a fan and natural convection, please refer to Figure 3-6 for installation, and reserve a distance of more than 100mm between each MiniCab (heat dissipation requirement), and reserve a distance of more than 50mm on both sides of the longitudinal direction.
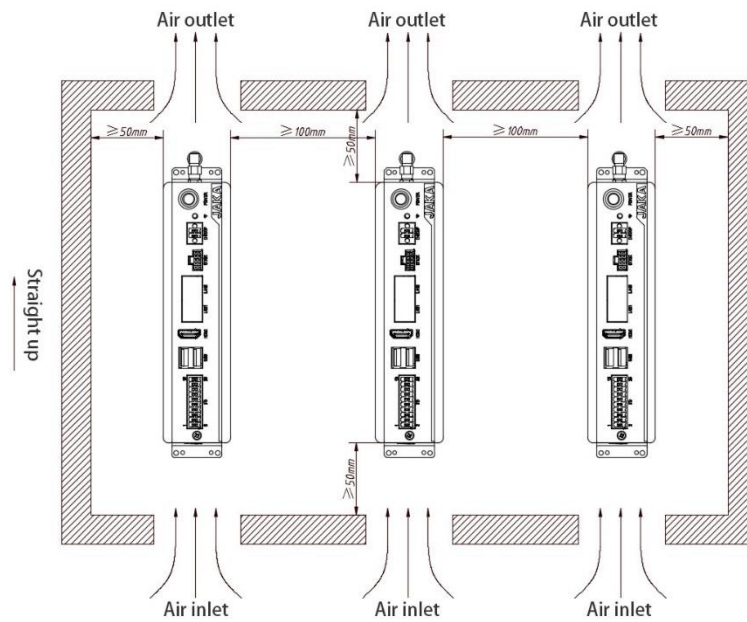
Figure 3-6 Installation with Space Reserved

Note:

- Do not install in damp or water spattering environment;
- Do not use the equipment in the enclosed environment, which will cause high temperature, shorten service life and even damage the equipment;
- Keep away from heat sources such as stoves;
- Do not use the product near corrosive and flammable gases, combustibles, such as hydrogen sulfide, chlorine, ammonia, sulfur, chlorinated gases, acids, bases, salts, etc.;
- This product is used at altitudes below 1000m, and please de-rate if the altitude is above 1000m.

Chapter 4 Electric Parameters

4.1 Introduction

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

4.2 Absolute Limit Parameter

Table 4-1 Electrical Limit Parameters

		Minimum value	Maximum value [1] [2]	Unit
VL+	Logic power supply voltage	-0.3	70	V
VP+	Power supply voltage	-0.3	70	V
V_{UDIO_COM+}	Integration interface common terminal voltage	-0.3	30	V
I_{UDIO_24V}	Integration interface output current	0	2.7	A
I_{UDIOx}	Integration interface single channel output current	0	2	A
$Vbus_{RS485}$	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 represent limits and it is not recommended that the functional operation of the device be performed under these conditions or any other conditions other than the "Recommended Operating Conditions".

(2) All voltage values except bus voltage are related to the grounding.

4.3 Recommended Usage Conditions

Table 4-2 Recommended Operating Conditions

		Minimum value	Typical value	Maximum value	Unit
VL+	Logic power supply voltage	18[1]	48	60	V
VP+	Power supply voltage	32[2]	48	58	V
I_{RMS}	Average operating current			20	A
I_{peak}	Output peak voltage		40	60[3]	A
I_{UDIOx}	User interface single channel output current		1		A
	Ambient Temperature	-10		50[4]	℃
	Atmospheric		1		Bar
	Altitude		1000		m
	Relative humidity	10		90	%RH

Note:

![JAKA 节卡 logo]

(1) The minimum logic voltage can enable the logic functions related to the controller, but the output size of UDIO_24V depends on the logic supply voltage.

(2) The power electricity mainly supplies power to the robot. Generally, the robot will be protected under voltage when ≤30V. Therefore, the anomaly caused by voltage loss and drop shall be considered when the minimum value is input

(3) The peak value of the output current is related to the model and working status of the adapted robot. Zu12 and Zu18 models are recommended to be used when de-rating.

(4) The controller produces a hot surface during operation, which is required to be used in well-ventilated and heat-dissipating conditions.

4.4 Typical Power Consumption

Test condition: 25℃, 48V logic voltage, 48V robot power supply, robot and integrated interface not connected, 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	The main frequency is 2GHz and the Turo frequency is 2.4GHz
RAM	DDR3L 2G
Hard-drives	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. The front panel includes 20PIN integrated I/O, USB, HDMI, LAN, handle and E-STOP interface, Wi-Fi status indicator and On/Off button.

The side panel includes a 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 I/O can be configured
RS485	2	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
COBOT	2	Robot power supply and CAN communication interface

5.1 Front Panel Interface
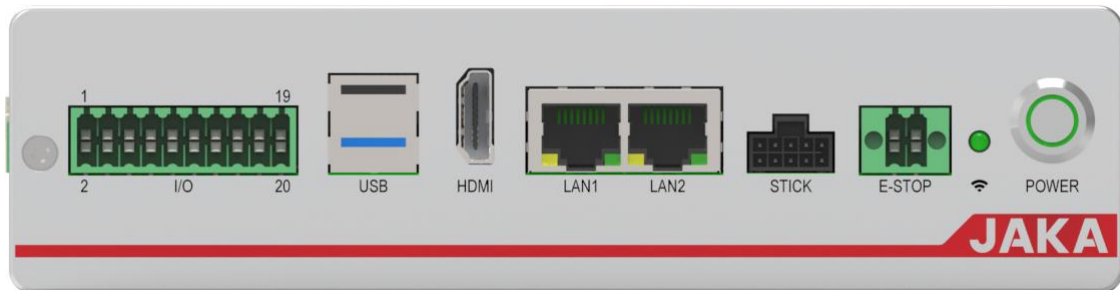
Figure 5-1 Diagram of Front Panel

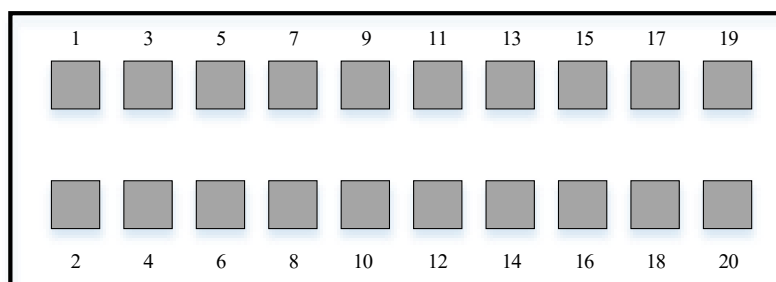### 5.1.1 Integrated Interface (I/O)

Figure 5-2 Diagram of Integration Interface

The user integration interface uses a double row of 3.5mm pluggable terminal to integrate rich interfaces for users.

The specific interface pins are defined as follows:

Table 5-2 Pin Definition of Integrated Interface

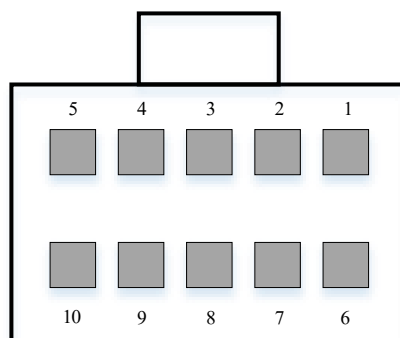| No.	Signal Name	Signal Type	Description
1	UDIO_24V	PO	Integrated interface 24V power output, internal integrated 2.7A overcurrent protection function
2	UDIO_COM	PI	Common terminal of user interface power, default external short connect to PIN1
3	UDIO_24V	PO	Integrated interface 24V power output, same 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 terminal channel 4, NPN type
8	Remote_ON	I/O	Remote startup control input, connecting to the external +24V power to trigger startup operation
9	UDIO3	I/O	I/O multiplexing terminal channel 3, NPN type
10	UDIO7	I/O	I/O multiplexing terminal channel 7, NPN type
11	UDIO2	I/O	I/O multiplexing terminal channel 2, NPN type
12	UDIO6	I/O	I/O multiplexing terminal channel 6, NPN type
13	UDIO1	I/O	I/O multiplexing terminal 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 the 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 Zu BP handle. External interface cannot be modified arbitrarily.

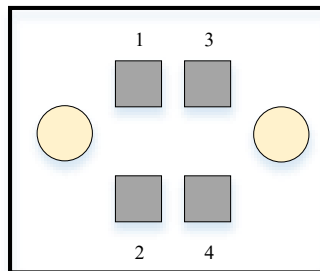### 5.1.3 Emergency Stop Interface (E-STOP)

Figure 5-4 Diagram of E-STOP Interface

The external E-STOP input interface adopts double rows of 3.5mm spacing interchangeable wiring terminals. In case of external emergency stop, the Pin1, Pin2, Pin3 and Pin4 shall be short-connected by wires. The factory-default setting is short connection. Interface definitions are as follows:

Table 5-4 Pin Definitions of E-STOP Interface

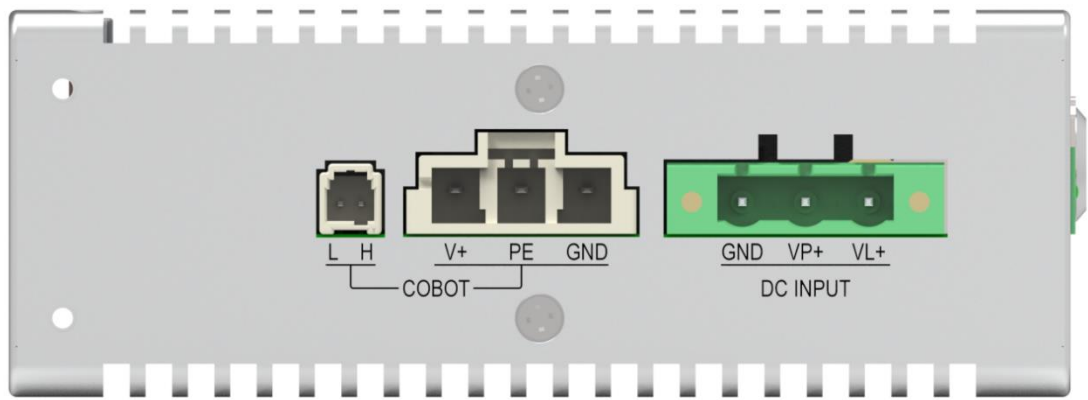| Pin Serial No.	Signal	Signal Type	Description
1	VCC_24V	PO	Internal logic power 24V output
2	ESTOP1	I	E-STOP input 1, default short connected to PIN1
3	VCC_24V	PO	Internal logic power 24V output
4	ESTOP1	I	E-STOP input 2, default short connected to PIN3

5.2 Side-panel Interface

Figure 5-5 Diagram of Side Panel

5.2.1 Power Interface

The power interface is divided into two power circuits: logic power VL+ is the pin of the internal logic power supply of the controller; power VP+ is the power supply voltage of the robot arm; meanwhile, VP+ can also supply the internal logic power supply. Interface definitions are as follows:
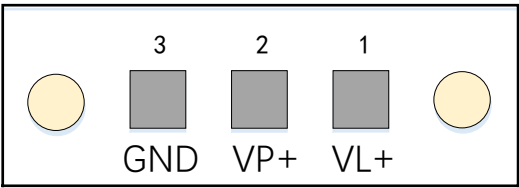

Figure 5-6 Diagram of Power Interface

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 arm, and can also supply power for the logic circuit in the control cabinet. When the logic power supply and robot power supply do not need to be separated, just connect pin 2 and pin 3; In order to meet the current carrying capacity, it is recommended to use cable14AWG or 1.63mm² and above .

5.2.2 Robot Interface

The COBOT port is the terminal of the robot arm. Both terminals support the function of anti-freeze latch. JAKA provides adaptive cables.

Chapter 6 Detailed Introduction

6.1 Overview

JAKA Zu MiniCab is optimized for integrated applications, with a special focus on ease of use when integrated into user devices. It can be used and integrated with JAKA Zu® series robot.

6.2 Function Application

This section is mainly used to guide users to use JAKA Zu MiniCab to control the robot so that the customers can use this controller more easily. At the same time, it involves the knowledge of robot use. Please refer to the specific robot user manual in detail.

6.2.1 Electrical Service Requirements

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

The VP+ and VL+ inputs are supplied to the MiniCab logic circuit via diodes. So you usually just need to plug in VP+ and GND externally.

If it is necessary to disconnect VP+ in case of emergency and if you do not want to disconnect the controller logically, the logic power can be separately connected at VL+.
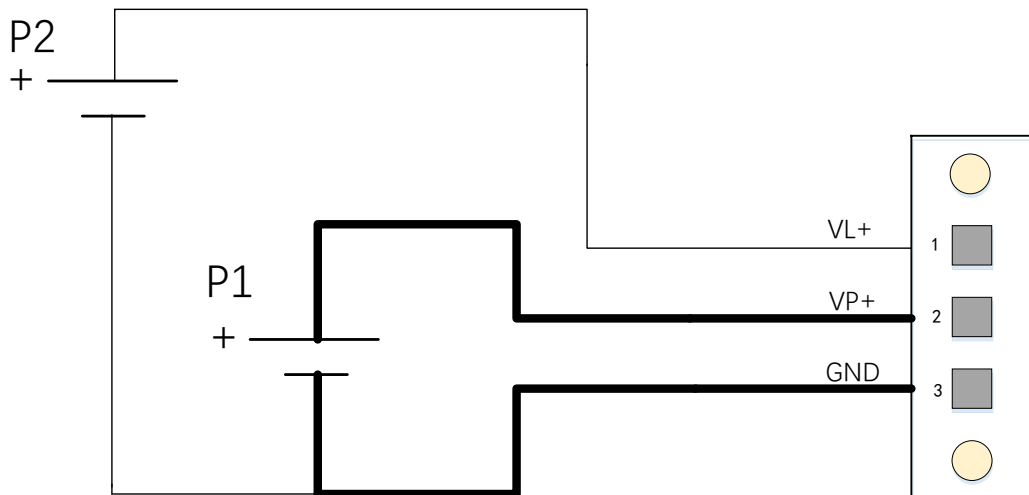

FIG. 6-1 Diagram of Power Supply Wiring

1、The power P1 (motive power) required for different models is shown in the table below:

Table 6-1 Description of Motive Power Requirements

Adaptive model		Zu3	Zu7	Zu12	Zu18
P1	Rated Voltage	DC48V			
	Voltage	DC30~60V[1]			

	range			
	Current range	0~18.75A	0~37.5A	0~62.5A
	Peak power	900W	1800W	3000W
	Recommended type	RSP-1000-48*1	RSP-1000-48*2	RSP-1000-48*3[2]
	Battery dimension	Use 48V lithium battery		

2、 Power P2 (logic power) to be adapted is required as shown in the following table:

Table 6-2 Description of Logic Power Requirements

	Rated Voltage	DC48V
P2	Voltage range	DC18~60V[3]
	Typical power	12W
	Maximal power	≤30W

Note:

(1) DC30V is not included, for the Zu series robot arm, 30V is the under voltage threshold;

(2) This is only the recommended power model. Customers can choose and purchase power of the same specification. Meanwhile, the peak power will be affected by the robot load and the use scenarios. What is noted here is the maximum value that satisfies.

(3) If both VP+ and VL+ inputs are lower than DC26V, "UDIO_24V" output will be lower than 24V.

6.2.2 Emergency Stop

In addition to the E-STOP button in the handle, the panel supports a separate E-STOP connector, which is short-connected to the internal 24V by default. The user can remove the short-connecting wire and connect the external switch. The wiring diagram of single-circuit switch/multi-circuit switch is as follows:
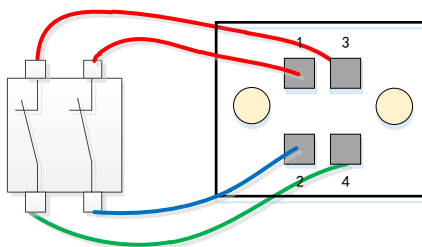

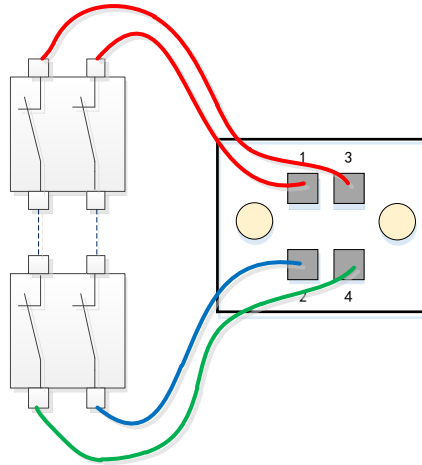Figure 6-2 Emergency stop - single-circuit switch

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 and off:

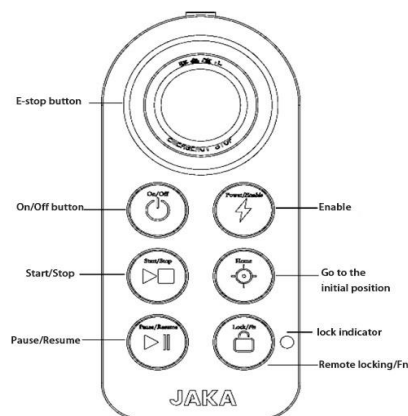1. Switch on and off via the user handle:

Figure 6-4 Handle Control Box

Poweron: Short press the power button for 1s and then release. The buzzer rings and the electric control cabinet turn on.

Shutdown: Long press the power button for more than 3s. The handle rings 6~7 times, and the electric control cabinet turns off.

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

2. Front-panel POWER button:

Poweron: Short press the POWER button for 1s and release. The electric control cabinet is powered on.

Shutdown: Long press the POWER button for 3s. The electric control cabinet 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 machine button is used, the self-recovery/spring button switch shall be used, otherwise the remote switch on/off operation may fail.

Power-on operation: Remote PowerON requires the user to separately provide 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, it will be released and the electric control cabinet will be turned on.
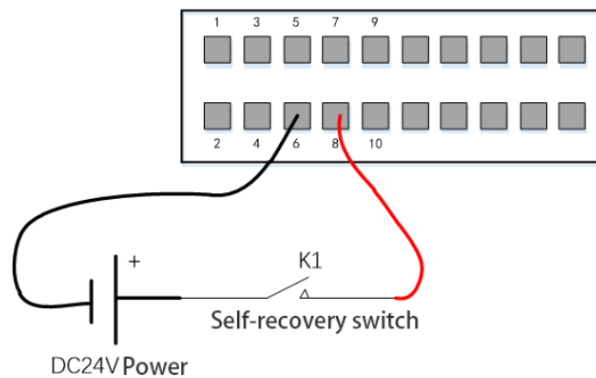

Figure 6-5 Remote_ON - Using External Power Source

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 and release and the electric control cabinet will be shut down.
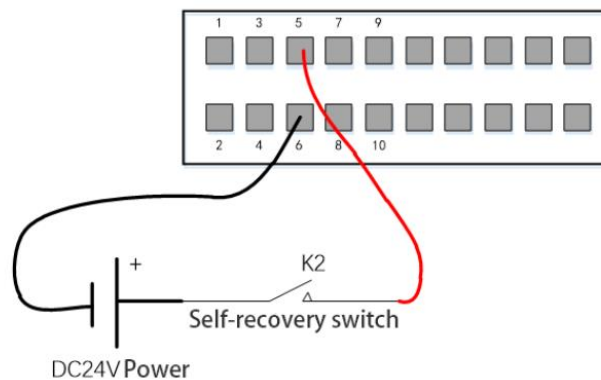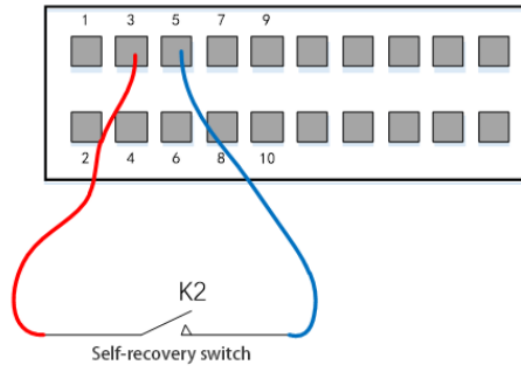

Figure 6-6 Remote_OFF - Using External Power Source

Figure 6-7 Remote_OFF - Using External Power Source

6.2.4 LED State Indicator

For the JAKA Zu Cobot, the status indicator light is equipped on the handle and the panel. The color of the light reflects the status of the robot. The following is the connection between the LED light and status.

Table 6-3 LED Status Indicator

Color	Operating Status
Blue	The power is not enabled
Green	Enable is OK
Red	Error
Yellow	Free-drive mode
Yellow fast flashing	Hold 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 host computer of the APP.

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, short connect PIN1 and PIN2 by default. The typical wiring diagram is as follows:
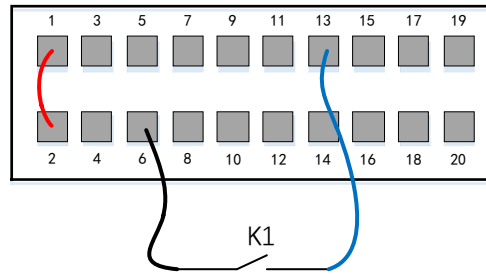
Figure 6-8 Wiring Diagram with UDIO_x as DI

2. DO Digital Output:

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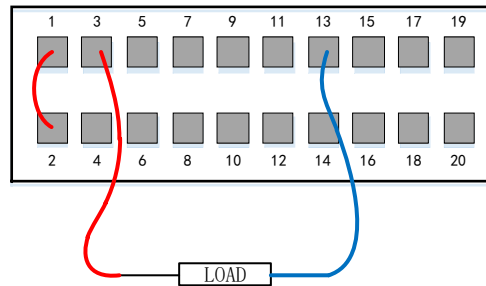

Figure 6-9 Wiring Diagram with UDIO_x as DO

3. Dual channel redundant security architecture

MiniCab isolates UDIO internally. When high safety performance is required, UDIO1 and UDIO2,UDIO3 and UDIO4,UDIO5 and UDIO6 can be combined into three I/O pairs to ensure that MiniCab can detect relevant signals in case of emergency.

6.3 Brake Voltage Setting

The MiniCab has an integrated voltage brake circuit to relieve the EMF generated by the robot during deceleration and braking. When the user uses the external power supply, it needs to be set to avoid overvoltage to protect the power or damage to the controller. When setting the braking voltage, you need to power off the robot arm before operation. The setting path is as follows:
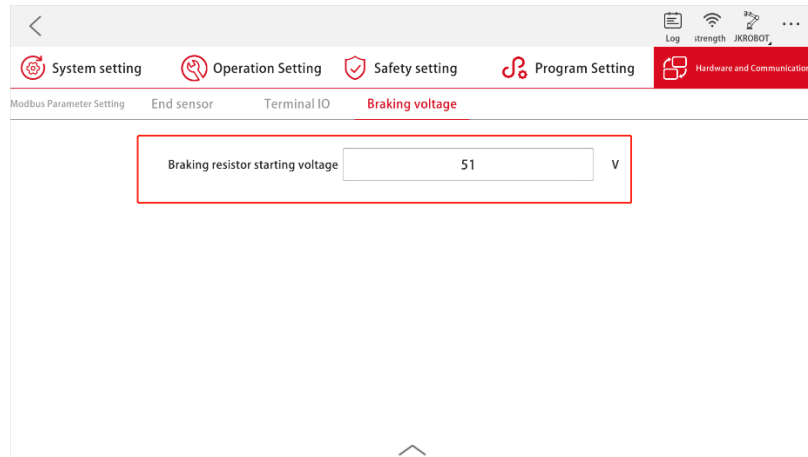
Figure 6-10 Brake Voltage Setting Paths

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 Supply Type	Voltage V_{IN}	Brake resistor starting voltage V_{Brake}
Module supply	48V	51V
48V lithium battery	54.6V	58V

Note: When $V_{Brake} < (V_{IN}+1)V$ is set, the internal logic will be powered on and the APP will prompt "Robot arm voltage or voltage configuration is abnormal".

6.4 Network Settings

6.4.1 Introduction to Network Interface

MiniCab provides 2 network ports, namely LAN1 and LAN2, wherein LAN1 supports 10M/100M and LAN2 supports 10M/100M/1000M self-adaptation, as shown in Figure 6-11:
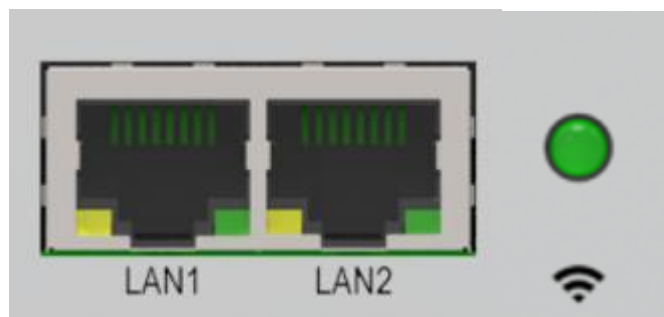
6-11 Network Ports and Wi-Fi Indicator Light

6.4.2 Wi-Fi

MiniCab has its own Wi-Fi hotspot, which is set to password-less by default. Users can connect to MiniCab through wireless terminals. When the MiniCab is powered on, the Wi-Fi indicator on the right side of the panel lights up and when connected to Wi-Fi, the Wi-Fi indicator flashes. MiniCab and the robot arm can be controlled through the JAKA Zu APP. The Wi-Fi hotspot name is 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 network port is 10M/100M adaptive network port, and the factory-default configuration is 10.5.5.x; 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;Or configure the device to get the IP address dynamically.

Note: If the device does not support IP modification, it is recommended to connect the device to the LAN2 port and configure the LAN2 port IP address to the same network segment as the device. If LAN2 network port is occupied and LAN1 network port has to be used, please contact JAKA technical service personnel to modify LAN1 network.

b)　LAN2 Configuration

LAN2 network port is 10M/100M/1000M adaptive network port. The factory-default configuration is to get IP address dynamically. Users can login JAKA Zu APP and configure it with static IP with the path as follows: Setup - System Setup - Network configuration for settings. The configuration interface is as follows:

Figure 6-12 LAN2 Network Configurations

Note: 1. Please do not set LAN2 network segment with the same IP address as LAN1 network segment, otherwise you will be unable to log in.

2. If LAN2 must be set as 10.5.5.x, please contact JAKA technical service personnel to modify LAN1 network port.

c) Reset Settings

When you forget the Wi-Fi name and password and cannot connect to MiniCab, this MiniCab supports hardware reset. The Reset button is located at the side antenna and requires a long press of more than 10s for Wi-Fi reset. At this time, the Wi-Fi gateway address can be redirected. Please contact JAKA technical service personnel for details.

Chapter 7 Maintenance and Repair

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

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

The parts shall be returned to JAKA according to the service manual.

7.1 Safety Instructions

Verification shall be made to ensure the level of security required for the service after the maintenance and repairing operation. 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 electric control cabinet:

	Danger:
⚠️	1. Do not change any information in the software security configuration. If the security parameters change, the entire robot system shall be considered 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 part of the same part number or an equivalent part approved by JAKA. 3. Reactivate all disabled 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 entire robot system.
	Danger:
⚠️	1. Remove the main input cable from the side of the cabinet to ensure complete power failure. Disconnect other power sources from the robot or the electric control cabinet. Take necessary precautions to prevent others from reconnecting to the system during repairing operation. 2. Check the ground connection before restarting the system. 3. Please follow the ESD regulations when disassembling robots or electric control cabinet. 4. Avoid water or dust from entering the robot or electric control cabinet.

7.2 Maintenance Items and Cycles

In order to maintain high performance of the robot for a long time, maintenance inspection shall be carried out. The responsible of maintenance shall develop a maintenance plan and carry out the maintenance work practically. Please refer to the following table for maintenance items.

In addition, overhauling shall be required after 20,000 hours of operation or every four years (the shorter period prevails). If the maintenance and adjustment method is unclear, please contact our Service Department.

Cycle			Maintenance items	Maintenance essentials	Location
Routine	3 months	1 year			
●			Robot Body	Verify whether the storage position of the program is deviated	All
	●		Robot Body Clearance	Wipe off dirt, and clear dust, powder, cutting pieces, etc.	All
	●		Main bolts	All the bolts exposed outside the robot shall be tightened, and the tool mounting bolts shall also be applied for paint fixing (see the specified tightening torque table)	All
●			Motor	Confirmation of abnormal heating and abnormal sounds	Holoaxial
●			Brake	Verify that the robotic arm or tool does not drop, when the servo power is ON/OFF	Holoaxial
	●		Reducer	Confirmation of abnormal vibration, abnormal sound and oil leakage	Holoaxial
	●		Tool	Apply force to the front, back, left, right, up and down of the tool to make sure your hand doesn't feel shaking	Shaft 6

Table of specified fastening torque for bolts

Nominal	Hexagonal bolt	Hexagonal SUS bolt
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 vary 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 part	Check Items	Check/handling method
	Routine	Every 3 months	Every year	4 years	5 years	8 years			
1	●						Outside of control unit	Spatter, dust and other impurities attached	Visual verification and cleaning

2		●		●		●	Cables	Make sure there is no breakage or damage Joint loosing	Visual inspection Tightening If the cable is obviously broken, please replace it
3						●	Overhauling		

(Note) Wipe the dust with a soft cloth when cleaning. Do not use the blower or other equipment to blow away the dust.

7.3 Replacement and Preservation of Components

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

⚠️	1、 Any modification of our products is strictly prohibited. 2、 Fire, malfunctions, and incorrect actions due to modification may result in personal injury or damage to machines. 3、 Any loss caused by the modification of our products will not be covered by our warranty.
⚡	1、 In order to prevent electric shock, please close the circuit breaker in advance and cut off the main power supply when replacing components.
⚡	1. Please replace the parts after cutting off the main power supply for 5 minutes. 2. There is a risk of electric shock due to the residual charge in the substrate and electrolytic capacitor. 3. Do not work with wet hands. 4. When electric shock occurs, it will cause serious injury or death.
⚡	1. Replacement operations shall be carried out by designated operators. 2. Electric shock or accidental clamping of a robot will result in serious injury or death.
⚡	1. There are a large number of connection interfaces between the printing substrates. Be cautious when replacing parts to avoid incorrect or missing insertion. 2. If electric shock and fire occurs, it will cause serious injury or death.
⚡	1. When replacing, do not damage the wiring or pull the interface to damage it.. 2. When replacing, do not touch the electronic parts of the printed substrate and the contact parts of the circuit and interface. Hold the edge of the printing substrate. 3. If touched carelessly, it could cause an electric shock that could lead to serious injury or death.

	1. In order to perform maintenance and inspection work, when the power must be turned on with the door of the robot electric control cabinet open, please do not expose the inside of the robot electric control cabinet to direct sunlight, searchlights, etc., otherwise it will cause malfunctions or wrong actions.
	1. Before the operation, operators shall release the static electricity in advance. 2. Antistatic wrist bands are very effective. 3. Direct touching of electrical components without taking any precautions may cause electrical components to malfunction
	1. After the completion of the operation, it shall be confirmed that there is no gap or cable clamped. After that, reinstall the shell. If there is a gap, dirt and dust may enter the electric control cabinet, which will lead to malfunction.

7.3.1 Preservation of Components

According to the service life and service frequency of parts, it's recommended to divide spare parts into A and B for management.

Maintenance Part·A: Major maintenance components prepared for daily maintenance and inspection

➤ A-1: Essential spare parts

➤ A–2: Parts regularly replaced/Spare parts recommended

Maintenance Part·B: Maintenance components prepared when purchasing multiple sets

➤ B-1: Parts purchased from JAKA

In order to maintain normal operation, A-1 and A-2 above mentioned are the minimum essential components required. It is recommended to prepare 1 complete set. In addition, highly reliable components are provided for printing substrates; please note the following points while keeping.

➤ Storage Temperature -10°C to +50°C

For long-term storage, in order to maintain its reliability, it is recommended to keep the temperature within 25℃±10℃. Avoid such a sudden temperature change if possible.

(10℃/h and above).

➤ Storage humidity 20 ~ 85%RH

For long-term storage, in order to maintain its reliability, it is recommended to keep the humidity within 45 ~ 65%. Keep away from dew condensation or mildew.

➤ Anti-static

It is easy to generate static electricity when kept in extremely dry conditions. The shock of electrostatic discharge may damage the semiconductor. Please store it in an anti-static bag.

➤ Other environment condition

Please keep it in an environment that does not produce poisonous gas, dirt and dust. Do not place heavy objects on it during storage.

7.4 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 enter the 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 company's 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 bear the expenses of the equipment cost, but our company will assist in troubleshooting as soon as possible to restore the equipment to normal:

1. The user does not follow the operating procedures;

2. The user causes the equipment damage;

3. Failure caused by other force majeure factors (such as lightning strike, earthquake, flood, etc.)

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

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

2. If support service is needed, the user's unit is required to fill in a service application, fax to our company, and can directly call for service in case of emergency.

II. Scope and content of support services

Our company is committed 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, and the user will not bear any fees (except mechanical damage and fault caused by the user's incorrect operation). After the equipment warranty expires, our company will sign the relevant agreement with the user to determine the charging 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 free training (specific 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 charging 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 8 Quality Assurance

8.1 Product Quality Assurance

Without prejudice to any claim agreement that user (customer) may have with the Distributor or retailer, the Manufacturer shall provide the customer "Product Quality Assurance" on the terms set out 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 is included), JAKA shall provide necessary spare parts, and the user (customer) shall be responsible for assign personnel to replace or repair related parts with another part of the 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 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 filed within two (2) months after it becomes apparent that the "Product Quality Assurance" has not been performed. The ownership of the device or component that is replaced or returned to JAKA belongs to JAKA. Any other claims arising from or in connection with the equipment are not covered by this "Product Quality Assurance". Nothing in this "Product Quality Assurance" shall attempt to limit or exclude the legal rights of the user (customer) or the manufacturer's liability for death or injury resulting from 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". Without prejudice to the principle of 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 the burden of proof to the detriment of 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.

8.2 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 seeks to ensure the accuracy and reliability of the contents of this manual, but is not responsible for any error or omission of information therein.

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