RC300 Robot Manipulator Control System

Manufacturers' Manual

(1st Edition)

(For three axes cantilever robot manipulator)

Weihong Electronic Technology Co., Ltd.

Preface

About This Manual

This manual is intended for manufacturers. If you use the CNC system for the first time, you need to read through the manual. If you are experienced with the system, you can search for the desired information via the contents.

With 11 chapters, this manual can be divided into 5 parts, as follows:

1) Part 1: preface, introducing the precautions about transportation and storage, installation, wiring, debugging, usage, and so on. You need to read them carefully beforehand to ensure safe operations.

2) Part 2: hardware, including chapter 1 and chapter 10. Chapter 1 gives introductions to system configurations, dimensional drawings of each component, wiring diagrams as well as connection diagram. Chapter 10 lists parameter settings of various brand drivers and wiring diagrams of the drivers.

3) Part 3: introduction to software operations, including chapter 2~5 and chapter 7~9. This part illustrates functionalities and corresponding software interfaces, as well as related parameter information. It helps users to acquaint with operational units and commands.

4) Part 4: maintenance, including chapter 6. This chapter introduces maintenance information of the software.

5) Part 5: appendix, including chapter 11, the software license agreement accordingly.

Applicable Product Model

This manual is applicable to RC300 robot manipulator control system. Refer to the table below for details:

Product Model	Remarks
RC300 Robot Manipulator Control System	Based on embedded industrial control platform, RC300 is an integrated CNC system independently developed by WEIHONG ELECTRONIC TECHNOLOGY CO., LTD. It can provide customers with a whole set solution for machine tending, applied to the control of three axes servo robot manipulator. Thanks to combination control of both handheld end and control system end, RC300 features agile operations, comprehensive functions in delicate design.

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Revision History

You can refer to the following table for the revision records of each edition.

Date	Edition	Revision Contents
2015.11	R1	Released for the first time.

Precautions

Precautions can be divided into caution and warning according to the degree of loss or injury in case of negligence or omission of precautions stipulated in this manual.

CAUTION :general info, mainly for informing, such as supplementary instructions and conditions to enable a function. In case of negligence or omission of this kind of precautions, you may not activate a function. Note that in some circumstances, negligence or omission of even this kind of precautions could cause physical injury or machine damage.

WARNING :warning info which you must comply with. In case of negligence or omission of this kind of precautions, you may suffer physical injury, or even death, machine damage or other losses.

⚠ WARNING

1) Precautions Related to Storage and Transportation

➢   The products should be transported properly in terms of the weight;

➢   An excess of specified quantity of stacking products is prohibited;

➢   Climbing, standing or placing heavy loads on the products is prohibited;

➢   Dragging or carrying the products via cables or devices connected to them is prohibited;

➢   Keep away from moisture in storage and transportation.

2) Precautions Related to Installation

➢   Only when this equipment installed in the qualified electricity cabinet can it be used. The construction of the cabinet must reach IP54 grade of protection;

➢   Paste sealing strips on the joint of the cabinet to seal all the cracks;

⚠ WARNING

- Cable entry should be sealed while easy-to-open on the spot;

- A fan or heat exchanger should be adopted for the heat dissipation and air convection of the cabinet;

- If a fan is adopted, air strainer is a must in air inlet or air outlet;

- Dust or cutting fluids may have access to the CNC device via the tiny cracks and tuyere. Therefore it is necessary to pay attention to the surroundings and air flow direction of the air vent to make sure that the outflow gas is towards pollution source;

- 100 mm space should be preserved between the back of the CNC device and the cabinet wall for plugging cable connected with the device and the ventilation & heat dissipation in the cabinet;

- Space between this device and other equipment should also be preserved according to the requirements;

- The product should be installed firmly and without vibration. During installing, casting, knocking, striking, or loading on the product is forbidden;

- To reduce electromagnetic interference, power-supply components used should be above AC or DC 50V and the space between cable and CNC device should be preserved above 100mm;

- It will be better if CNC device is installed at a position facilitating debugging and maintenance.

3) Precautions Related to Wiring

- Only qualified people are allowed to participate in the wiring and checking;

- The CNC device should be grounded reliably and grounding resistance should be less than 4 ohm. Neutral line is absolutely not allowed to replace earth wire. Otherwise, it may result in malfunction of the device due to the interference;

- Wiring should be firm and steady, or disoperation may occur;

- Voltage values and positive & negative polarity of any connection plug should be in accordance with specifications set forth in the manual, or it may result in breakdowns such as short circuit and permanent damage to the device;

- To guard against electric shock or CNC device damage, fingers should keep dry before plugging or touching switch;

- The connecting wire should not be damaged and squeezed, or the leakage or short circuit may occur;

⚠️WARNING

➢ It is prohibited to plug or open the chassis of CNC device when power on.

4) Precautions Related to Running & Debugging

➢ Parameters setting should be checked before running, since wrong setting may lead to accidental movements;

➢ Modification to parameters should be within the allowable range, or such breakdowns as unsteady running and machine damage will occur.

5) Precautions in Use

➢ Before power-on, please make sure that the switch is on blackout to avoid occasional start-up;

➢ Please check the electromagnetic compatibility during electrical design in order to avoid or reduce electromagnetic interference to the CNC device. A low pass filter should be employed to reduce electromagnetic interference if there are other electrical devices nearby;

➢ It is not allowed to frequently power on and power off. It is recommended to power up the machine again at least one (1) minute later after power failure or blackout.

🔔CAUTION

1) Precautions Related to Product and Manual

➢ Matters related to restrictions and functions available stipulated in the manuals issued by the machine manufacturer is prior to those in this manual;

➢ This manual assumes adding all optional functions, which you must confirm through manuals issued by the machine manufacturer;

➢ Please refer to manuals issued by the machine manufacturer for the instructions of machine tools;

➢ Functions, and software interfaces vary with the system and the version of software. Before using the system, you must confirm specifications.

2) Precautions When Opening the Package

➢ Please make sure whether the products are what you have ordered;

🔔 CAUTION

➢ Check if the products are damaged in transit;

➢ Check if the components and accessories are damaged or missing in terms of the detailed list;

➢ Please contact us promptly if product discrepancy, accessory missing or transit damage occurs.

Contents

1. About RC300 Robot Manipulator Control System

1.1 Brief Introduction

Based on embedded industrial control platform, RC300 is an integrated CNC system independently developed by WEIHONG ELECTRONIC TECHNOLOGY CO., LTD. It can provide customers with a whole set soltuion for machine tending, applied to the control of three axes servo robot manipulator. Thanks to combination control of both handheld end and control system end, RC300 features agile operations, all-round functions in delicate design.

RC300 system adopts graphic programming, conversational operation screens, which makes it easy to use and set. Subprograms of stacking, returning to standby point and rapid placing can be called or nested directly, satisfying possible various and complicated requirements of stacking and placing in the field. Varied brands of servo motor can be used together to realize quick pickup of products and accurate postioning. Functions such as atuomatic error detection and recording of error contents as well as breakdown time make it easy for operators to maintain it. With time registration function which adopts hardware encryption, customer rights can be safegurded to the largest extent.

Hardware Support

- **Display:** 7" color LCD
- **Memory**: 128M
- **Flash**:256M

System Characteristics

- Conversational options setting

Conversational option setting is adopted. Once disoperation is done, the system will prompt instantly to ensure safety. In addition, multiple languages including Chinese and English can be switched, which makes settings and operations simple and understandable.

- Professional programming for robot manipulator

Programming for robot manipulator is ease to learn thanks to all graphic displaying screens, HMI teach-in program, and powerful teach-in editing ability (commands such as jump, judge, compare and mathematical computations can be supported in program editing).

- Easy-to-understand PLC logic control

Robot motion and PLC is closely integrated, making program development more flexible, joint control of peripheral automation devices in secondary machining more effective.

- Intelligent servo control capability

Complicated and elaborate curve interpolation in multiple axes motion is embedded, with which motion paths can be parsed efficiently, velocity and acceleration be adjusted as wish, external signals be received and responded in real-time manner, positional info of all axes and parameters related to restricted area be compared and computed, and error diagnosis and troubleshooting be clearly presented. In addition, servo motors of various brands can be used together to achieve servo motion control in high-speed and high-precision manner, meeting requirements such as rapid placement and accurate positioning.

- Massive storage for mold information

Up to 6000 groups of mold data, 500 step sequences of main program are available to copy and delete. Step sequence for each subroutine is infinite and up to 100 subroutines can be called. With such massive storage capacity, time for condition check or setting during molds exchange can be minimized to a large extent.

- Direct embedment of classical programs

Proven subroutines for stacking, returning to standby point, rapid placing and the like can be called and nested directly. Besides, abundant control functions and selection screens are offered, improving repeatability of frequently-used programs.

- Supporting USB backup and upgrade

Mold data can be uploaded or downloaded by removable flash disk, making the program a high portability. Backup of software, subroutines, parameter settings are available for importation and exportation, or further upgrade and functional extension, greatly improving added value of the machine.

- Automatic error detection

It detects faults and errors automatically and records error details and their occurrence time, making it convenient for repairing and maintenance.

- Automatic calculation of cycles

It calculates accumulated running times automatically to facilitate maintenance and equipment management.

- Supporting Chinese characters input

When setting information related to program name, teach-in command, screensaver text and leaving-factory info, Chinese characters input is supported.

Functionality Outline

- Intelligent administration

Five passwords of different security level can be set to clarify different level of operations and settings, making machine management easier and more convenient.

● Making molds plan

The number of molds to be processed is settable, that is, you can make molds plan, and when the planned number of molds are finished, warning will occur. Furthermore, tips will appear in warning screen, facilitating manufacturing schedule tracing and arrangement.

● Recording operation change

Changes of such information as parameter settings and operations can be recorded, facilitating error tracing of the machine.

● Making maintenance plan

A reasonable maintenance plan can be made to prompt users to take good care of relevant parts of machine when certain number of molds is finished or certain time has elapsed.

● Troubleshooting at error

Users are entitled to check detailed information anytime error occurs, and figure out counter measures as quick as possible, in order to minimize the breakdown time.

● Jiggle function

With the function, modifications to parameters such as time, velocity-related parameters can be enabled without stopping in auto mode. Besides, position of axis can be adjusted in minor way.

● I/O displaying and replacement function

Users are entitled to observe status of I/O ports in manual mode or auto mode, which is very helpful in error diagnosis and maintenance. Assuming I/O error has occurred, you also can replace the port in I/O mapping screen, to minimize breakdown time.

● Debugging function in single-step/single-cycle manner

After program prepared, users can conduct debugging in single-step or single-cycle manner in relatively low speed to verify the accuracy and rationale of the program.

● Time registration function

Hardware encryption is adopted to administrate registration time to guarantee customers' rights and interest.

1.2 Specifications

Power supply:	Single phase 220VAC 50/60HZ
Power consumption:	It depends on machine model.
Control power specification:	AC input 170~264V; DC output 24V 3A
Ambient temperature (operating):	0~50°
Ambient humidity (operating):	35%~75%
Ambient temperature (storage):	-10°C~60°C
Input:	32 input ports
Output:	32 output ports (including 8 relay output ports)
Servo motor:	It depends on machine model.
Servo driver:	It depends on machine model.
Controller:	RC300
Handheld panel:	7'' LCD touch screen

1.3 Dimensions of Control Box and Terminal Board
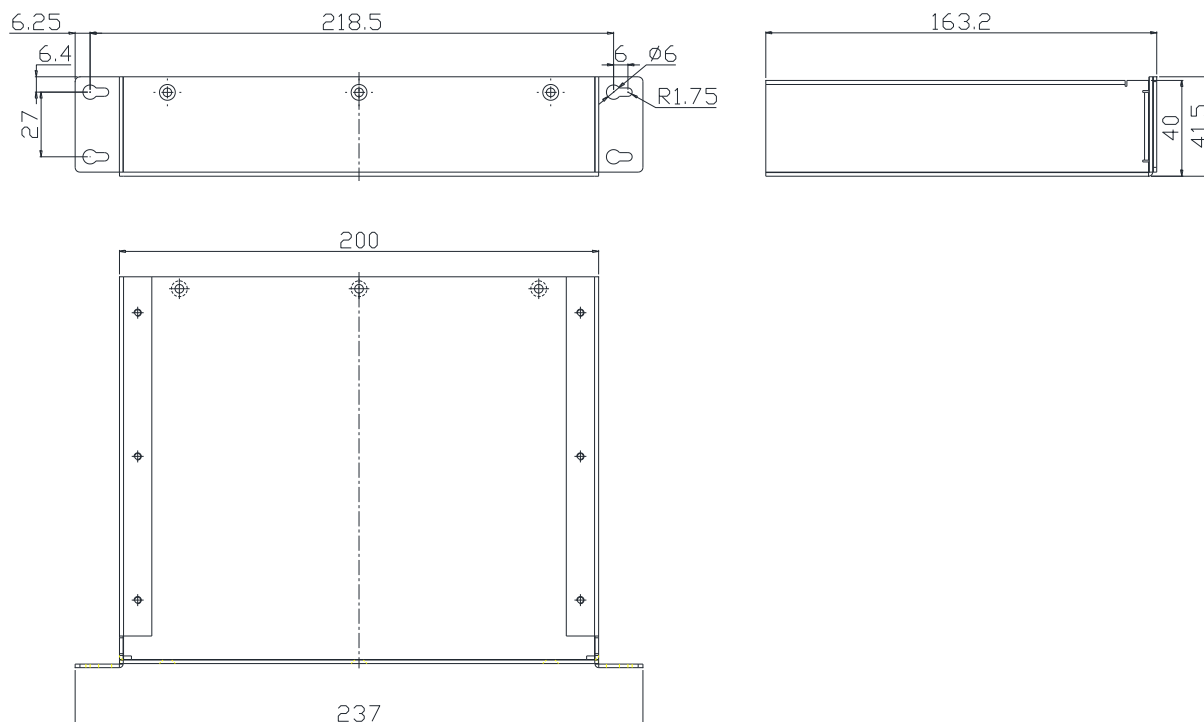
Fig. 1-1 Dimensional drawing of bottom cover of the RC300 control box
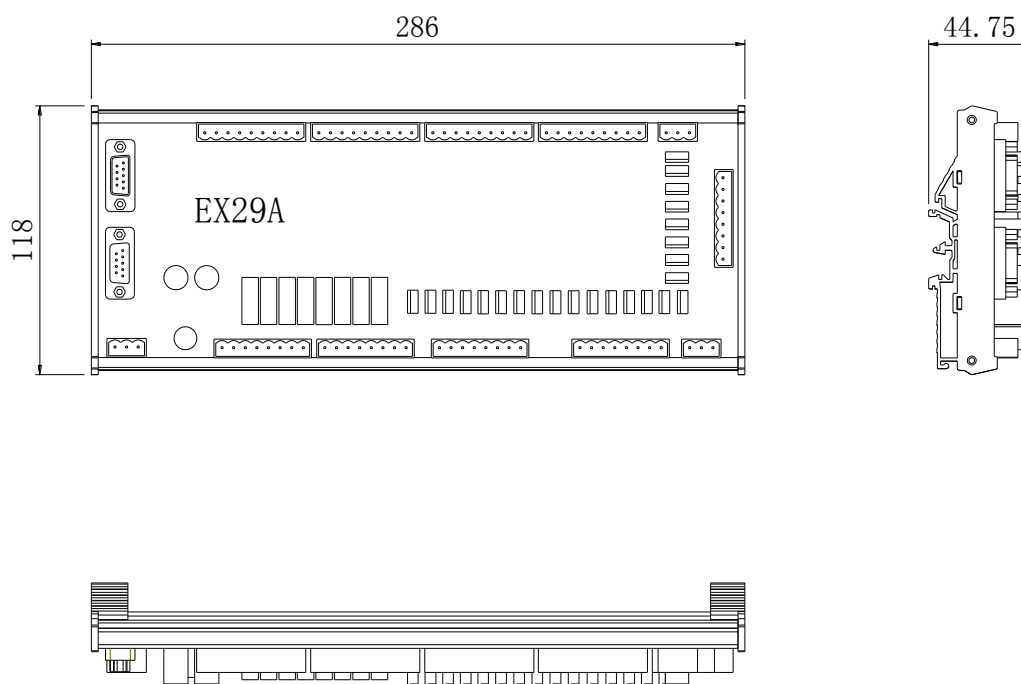
EX29A

Fig. 1-2 Dimensional drawing of EX29A terminal board

1.4 Electrical Assembly Diagram

⚠ **CAUTION**
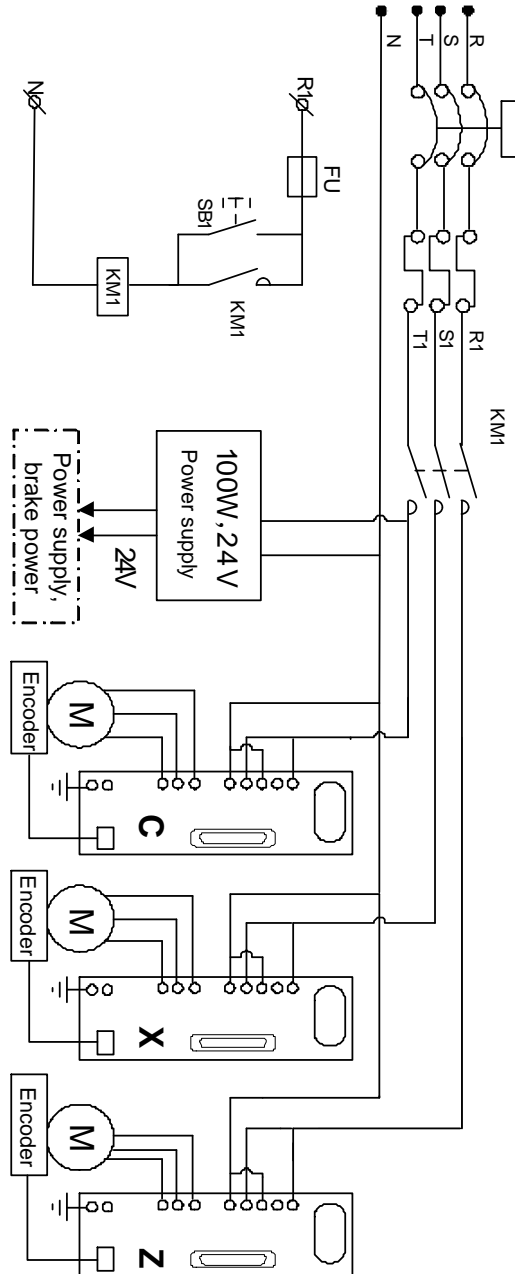
Incremental type of driver and motor are used for three axes cantilever robot manipulator.

1.5 Introduction to Interfaces on Main Control Box

Interfaces and their descriptions on the main control box are as shown in figure below :

USB interface， used to connect with removable flash disk with update software or files, in order to update the system.

Used to connect with the handheld operational panel, a LCD touch screen, which can be used to operate, set parameters and edit programs.

Driver interfaces, used for connection with C-axis/X-axis/Z-axis driver.

(C/X/Z axes are allocated in three axes configuartion)

LAN interface, used for remote control.

Used for connection with the terminal board.

Power interfaces. DC 24V power supply is required.

1.6 Schematic Diagram of Handheld Operational Panel

Wire	Pin	Signal
Red + Black	1	GND
Red	7	+5V
Green + Black	2	GND
Green	8	+5V
Blue + Black	3	GND
Blue	9	+5V
Orange	4	TXD
Yellow	5	ESTOP
Brown	6	RXD

DB9 Female

for twisted-pair
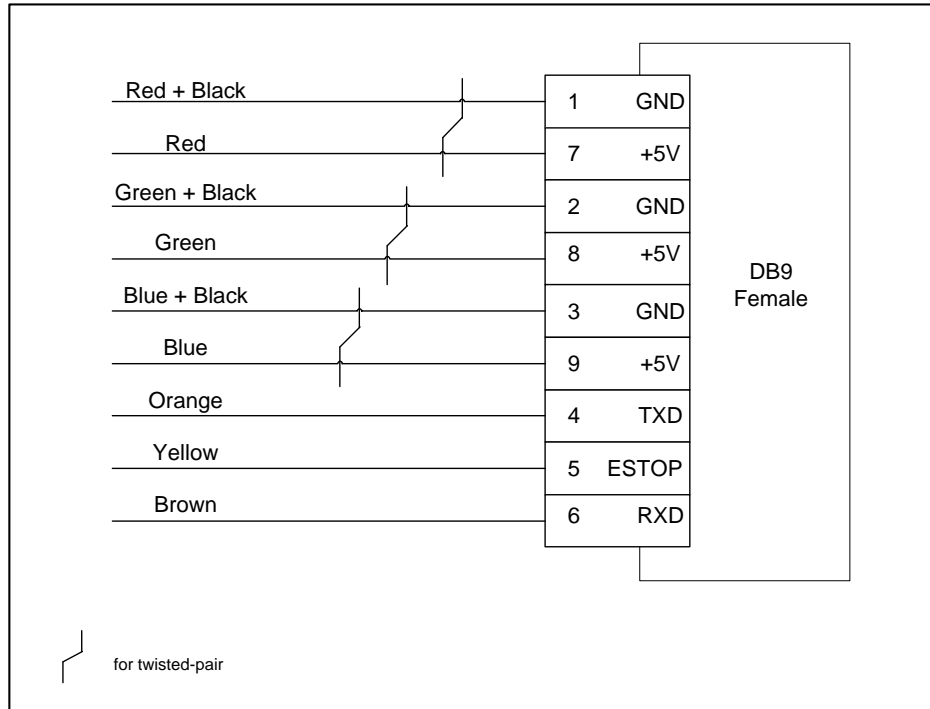
1.7 Terminal Board and I/O Port List

1.7.1 Terminal Board of I/O Ports

| Downlink | Uplink |

GND
GND
+24V

Grapple cylinder clamp — Y1
Grapple cylinder unclamp — Y2
Inspection cylinder — Y3
Part feeder cylinder open — Y4
Part feeder cylinder close — Y5
Y6
Y7
Y8
Y9
Y10
Y11
Y12
Y13
Y14
Y15
Y16 — Reserved
Y17
Y18
Y19
Y20
Y21
Y22
Y23
Y24

X1 — Part exchange permission signal
X2 — Part detection signal
X3 — Cylinder clamp confirm signal
X4 — Cylinder unclamp confirm signal
X5 — Qualified signal
X6 — Feeder signal
X7 — Part presence signal
X8 — Part loading error
COM1

X9–X15 — Reserved
X16 — Low pressure alarm
COM2

X17–X23 — Reserved
X24 — Product inspection signal
COM3

X25 — Reserved
X26 — Reserved
X27 — Positive limit switch of C-axis
X28 — Negative limit switch of C-axis
X29 — Positive limit switch of X-axis
X30 — Negative limit switch of X-axis
X31 — Positive limit switch of Z-axis
X32 — Negative limit switch of Z-axis
COM4

+24V / GND / GND — Master Slave — +24V / GND / GND

Y25 Y26 Y27 Y28 Y29 Y30 Y31 Y32

Part absence indicator
Manipulator IDLE indicator
Manipulator error indicator
RUNNING indicator
Buzzer
Blow
Peripheral output
Finished part count

┌─────────────────┐
│ 🔔 **CAUTION** │
└─────────────────┘

1. Connection method of "COM": for terminal board of NPN type, COM port is connected with active low, while for terminal board of PNP type, COM port is connected with active high.

2. Every 8 input ports share one COM port, and there are 32 input ports on terminal board EX29A, which can be divided into 4 groups. Therefore, there are 4 COM ports altogether.

3. Output ports Y1~Y8 are relay output, corresponding to 16 terminals on the terminal board, and every 2 ports in neighborhood control one output. You can do as follows in wiring: connect port 1, 3, 5, 7, 9, 11, 13, and 15 all with active low or all with active high; and port 2, 4, 6, 8, 10, 12, 14, 16 with corresponding output signals.

1.7.2 I/O Ports List

L+ L-

X 01	Part exchange permission signal
X 02	Part detection signal
X 03	Cylinder clamp confirm signal
X 04	Cylinder unclamp confirm signal
X 05	Qualified signal
X 06	Feeder signal
X 07	Part presence signal
X 08	Part loading error
COM 1	
X 09	
X 10	
X 11	
X 12	Reserved
X 13	
X 14	
X 15	
X 16	Low pressure alarm
COM 2	
X 17	
X 18	
X 19	
X 20	Reserved
X 21	
X 22	
X 23	
COM 3	
X 24	Inspection signal
X 25	Reserved
X 26	Reserved
X 27	Positive limit switch of C-axis
X 28	Negative limit switch of C-axis
X 29	Positive limit switch of X-axis
X 30	Negative limit switch of X-axis
X 31	Positive limit switch of Z-axis
X 32	Negative limit switch of Z-axis
COM 4	

Magnetic reed switch — X 22
Magnetic reed switch — X 23

Proximity switch — X 27
Proximity switch — X 28
Proximity switch — X 29
Proximity switch — X 30
Proximity switch — X 31
Proximity switch — X 32

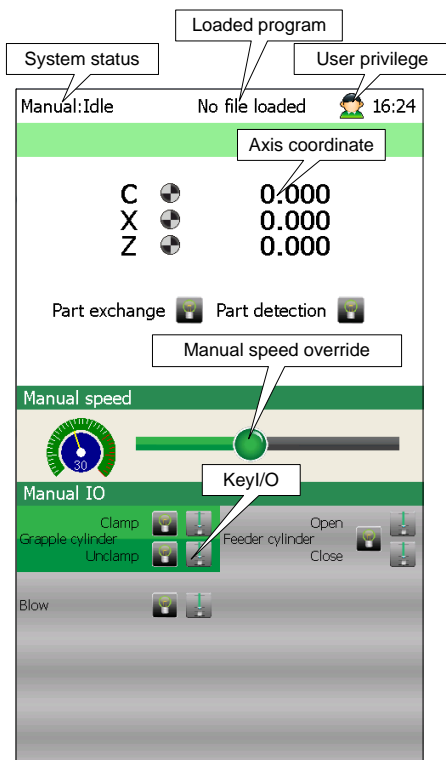|	L+	
		Y 01 Grapple cylinder clamp
		Y 02 Grapple cylinder unclamp
		Y 03 Inspection cylinder
		Y 04 Feeder cylinder open
		Y 05 Feeder cylinder close
		Y 06
		Y 07
		Y 08
		Y 09
		Y 10
		Y 11
		Y 12
		Y 13
		Y 14
		Y 15 Reserved
		Y 16
		Y 17
		Y 18
		Y 19
		Y 20
		Y 21
		Y 22
		Y 23
		Y 24
		Y 25 Part absence indicator
		Y 26 Manipulator IDLE indicator
		Y 27 Manipulator RUNNING indicator
		Y 28 Manipulator error indicator
		Y 29 Buzzer
		Y 30 Blow
		Y 31 Peripheral output
		Y 32 Finished part count

2. Software Operations

2.1 About Software Interface

2.1.1 Layout of Displaying Screen

As shown on the left side, here is the introduction to a reference setting screen :

➢ System status: when the system is in RUNNING status, many menu tabs are beyond available for access, nor the program can be edited. However, in auto mode, jiggle function, timing modification and velocity adjustment and the like are available.

➢ User's privilege: different privilege administrate differed operation scope.

➢ Loaded program: it displays the name of currently running program.

➢ Manual speed: or jog speed. You can adjust the moving speed of axes in manual mode by dragging the slide.

2.1.2 Introduction to Displaying Color

● Text in black: contents can only be viewed and beyond modification.

● Text in red background: contents of alarming event.

● Text in yellow background: contents of warning event.

● Text in green background: contents of notification or prompt.

● I/O points in yellow : the active input ports or output ports.

● I/O ports in grey : the inactive or dummy input ports or output ports.

2.1.3 Pop-up Menus

Whatever system status is, or operation screen is, or IO status screen is, a menu dialog box will pop up the moment button [菜单] (Menu) is pressed, where you can select desired function (say manual mode, auto mode, edit, maintenance, alarm or parameter, etc) to activate by clicking the touch screen, and press ◀ ▶ arrow buttons or (OK) button to confirm.

If the [Menu] button is pressed by mistake, you can press [ESC] button or click blank space on the touch screen to close the menu tab.
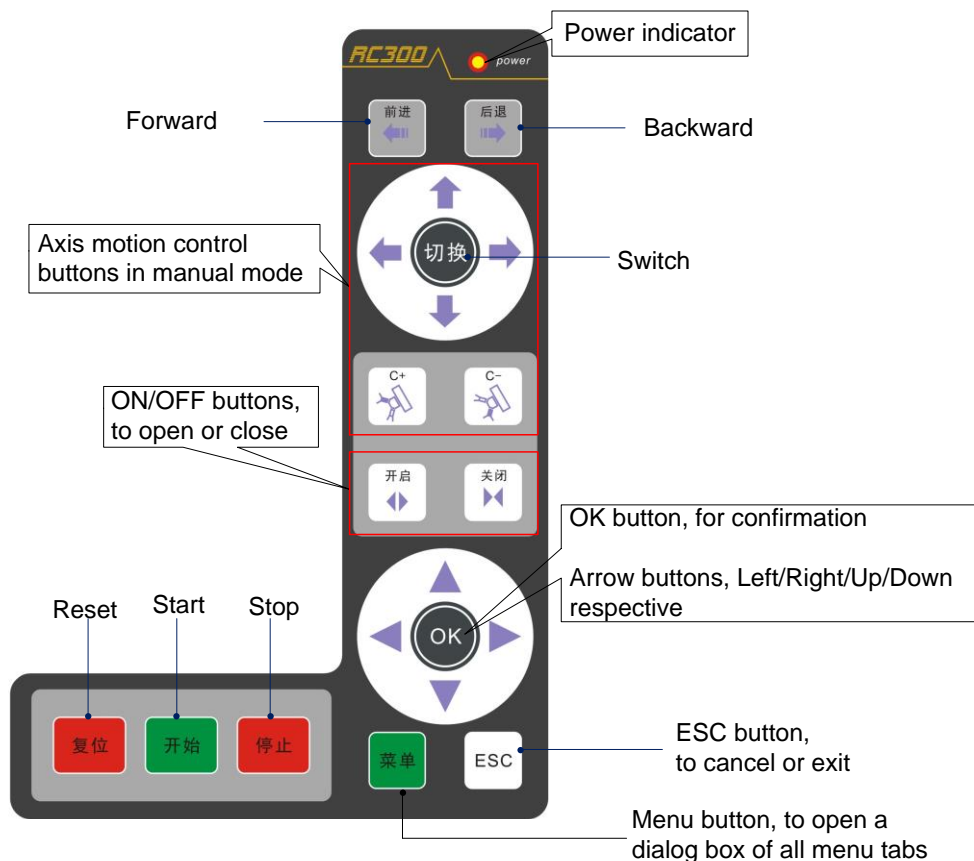
2.2 About the Operational Panel

Fig. 2-1 Illustration of the operational panel

See Fig. 2-1 for the operational panel. Because no English version of key panel has been made, here is brief introduction to each button.

➢ Reset : used to reset the system, namely, to clear system warnings and alarm events, etc.

➢ Start : used to initiate machining after the system is started or a currently editing program is saved.

➢ Stop : used to stop machining instantly when a program is being executed. Note that this button is unavailable whenever there is a pull-down menu list on the screen.

2.3 User's Privilege Setting
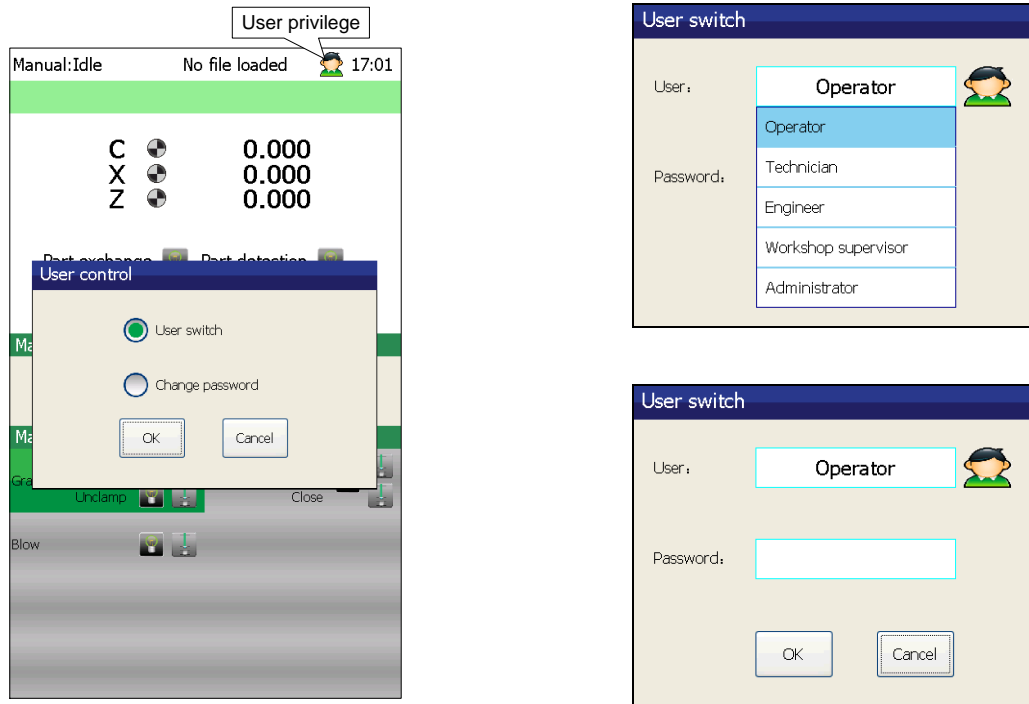
Follow steps below to switch among different user's privilege:

1st, Click on icon   to open a dialog box named "User control", where you can select the item "User Switch";

2nd, A dialog box named "User switch" pops up, and select the identity;

3rd, Enter login password to check your identity;

4th, Click [OK] button, and you can return to operation screen to check change of user's privilege.

Here is brief introduction to available functions for different identities.

➢ Operator: As an operator, you can check the system status, conduct some basic operations, but cannot change parameter settings.

➢ Technician: As a technician, you are able to check the system status, edit programs or modify settings of parameters related to robot manipulator.

➢ Engineer: As an engineer, you are entitled to update the system and modify settings of all parameters except those related to production management.

➢ Workshop supervisor: As a workshop supervisor, you can update the system and modify settings of all parameters related to robot manipulator.

➢ Administrator: Note that this privilege is exclusively used by the system service engineer.

2.4 Chinese Input Method

As shown in figure on the left, Chinese input function is a newly added function in cantilever series robot manipulator, with which Chinese characters can be entered.
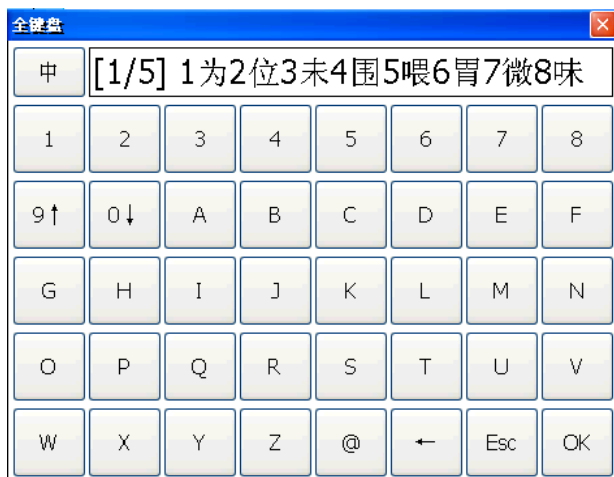
➢ You can input Chinese characters when naming/editing the program, or making comments on the program, making marks in line teaching, editing texts shown on screensaver or inputting serial number or model info of leaving-factory information.

➢ After keyboard is activated, as shown on the left, click "中" and switch to English input method, with "EN" for upper case and "en" for lower case.

➢ After Chinese input method ("中") is selected, you can input Chinese characters. Enter pinyin (Chinese romanization) first and press [OK] , then you can select the target Chinese character in the options area.

➢ Key "9 ↑" is used to turn to previous group of Chinese characters, and "0 ↓" is used to turn to next group of options. Number key "1~8" is for the selection. For instance, entering number 1 means selecting the Chinese character next to it.

3. System Startup&Shutdown and Homing

3.1 How to Start Up the System

- Make sure air supply device is well connected, and check pressure gauge. The pressure should be within range of 4~5kg.

- Make sure the control system and lathe is well connected.

- Has emergency stop occurred?

- Turn main power supply switch to ON, and power up the system to initiate the system running.

- The First 5 seconds is system booting time, with screen displaying in blue background.

- If system communication is successful, homing (returning to the machine origin) screen will be displayed. You can conduct homing operation.

- If system gives no response, screen will prompt communication failure. Power off the control system and re-power on 10 seconds later.

- If any warning or alarm occurs, turn to I/O mapping screen under maintenance menu tab and check if polarities of the ports are correct or not.

3.2 How to Shut Down the System

- Stop all operations, and stall the robot manipulator at a safe position.

- Turn main power supply switch to OFF.

- Note that period between system startup and shutdown should not be too short; otherwise, it may shorten lifespan of the control system.

3.3 Homing

- After homing is enabled, if the homing direction is opposite to the limit switch direction, you need to invert the setup value of homing direction parameter.

- On homing screen, you can click on the axis name and make it returning to the machine origin alone.

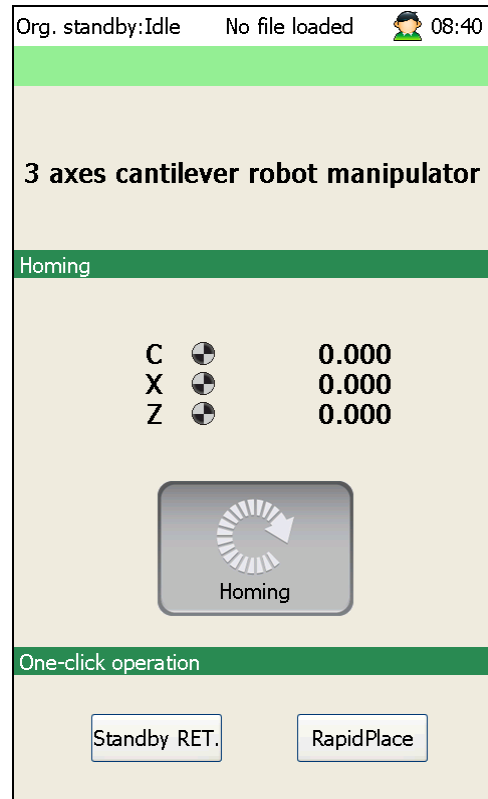● After homing is completed, it jumps to screen as shown below (right). You can click buttons [Standby RET.] and [RapidPlace] to make the manipulator return to the standby point (a fixed position defined by the user) or obtain rapid placement by one-click.

Homing:Idle	ROBOT	11:29

3 axes cantilever robot manipulator

Homing

Axis	Coor
C	0.000
X	0.000
Z	0.000
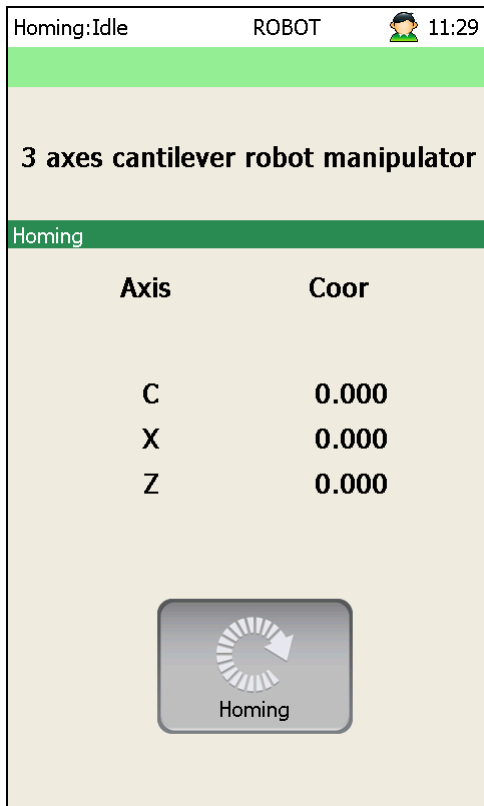
Homing

Before homing (Not returned to the machine origin)

Org. standby:Idle	No file loaded	08:40

3 axes cantilever robot manipulator

Homing

C	0.000
X	0.000
Z	0.000

Homing

One-click operation

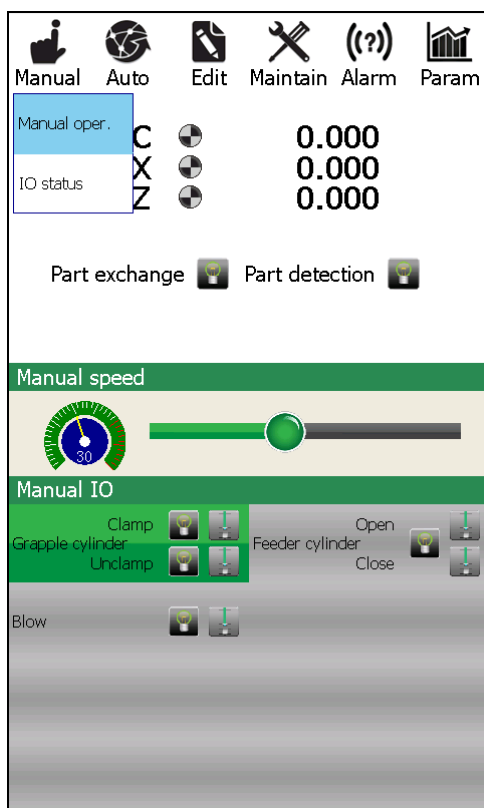Standby RET.   RapidPlace

After homing

4. Manual Mode VS Auto Mode

4.1 Manual Mode

4.1.1 Pop-up Menu List under Manual Tab

➢ Manual operation : select the item to access manual operation screen. In manual mode, all automatic signals should be turn OFF ; otherwise, manual operation cannot be enabled.

➢ I/O status : slecting this item can view running states of I/O ports in real-time manner. However, note that I/O status cannot be modified here.

➢ Manual operations on axes : on manual screen, you can control X axis motion by buttons, control Z axis motion by buttons and control C axis motion by buttons .
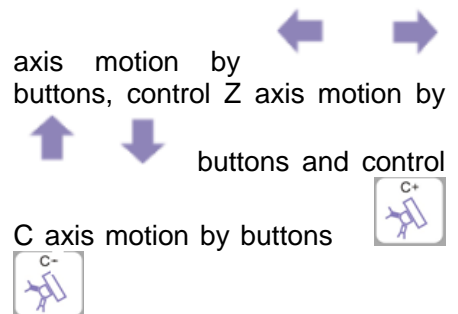
4.1.2 Introduction to Manual Operation Screen
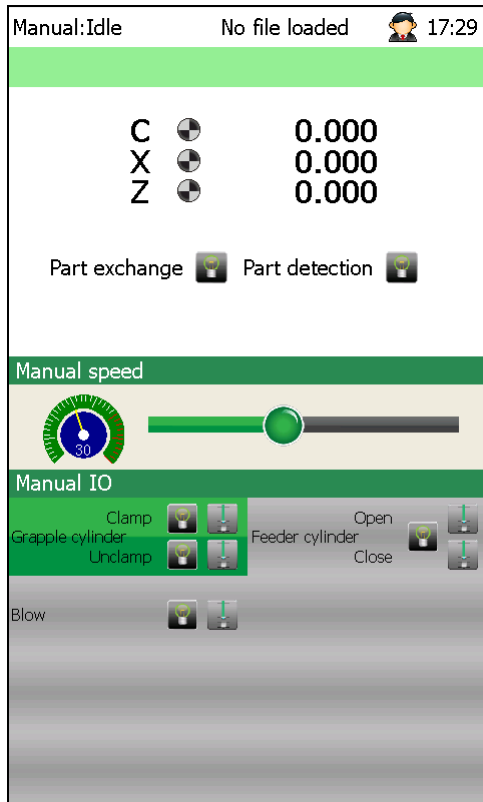
You can activate manual operation screen by pressing [Menu] button on the panel first, and clicking [Manual]---[Manual oper.] in succession next. As shown on the left part.

➢ Before conducting manual operations, you need to turn OFF signal of machining automatic machining ; otherwise, manual operation is unavaiable.

➢ Click axis motion control buttons on the panel to make the axis move at jog speed.

➢ Stoke of each axis refers to the software travel limit, which is limited by the parameter setting.

➢ Manual speed : or jog speed, its override is 30% by default, with adjusting range 1% ~ 70%.

➢ Manual I/O ports : you can use arrow direction buttons or click on touch screen directly to select the target I/O port, and press [开启] [关闭] (means Open/Close or ON/OFF respectively) buttons or click the screen again to complete turn ON/OFF the port.
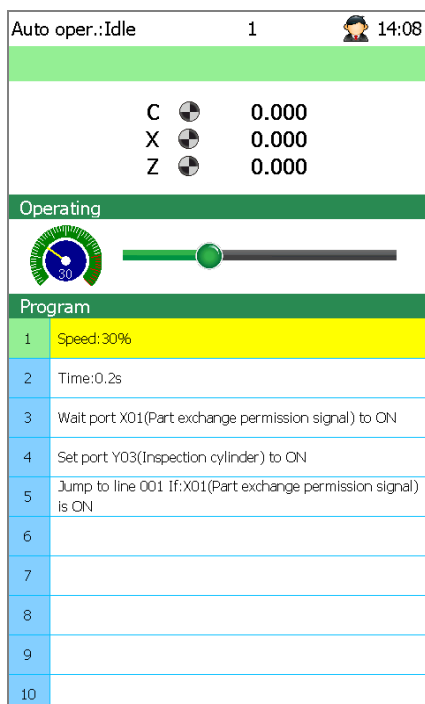
4.2 Auto Mode

4.2.1 Pop-up Menu List under Auto Tab
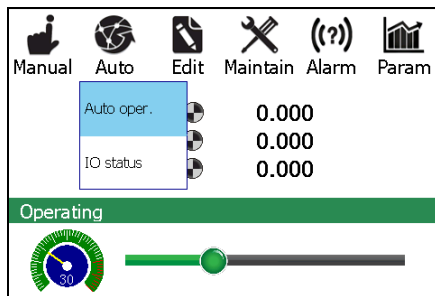
You can activate auto mode by pressing [Menu] button on the panel first, and clicking Auto tab next. As shown on the left.

➢ If homing has not been completed during system startup, auto mode cannot be enabled.

➢ After homing is completed, you can directly click [Start] button to initiate program running if the program needs no revision.

➢ Before enabling auto running, you need to switch the machine to full automation status, where manual operation is prohibited.

➢ On program editing dialog box, you can directly press [Start] button on the panel to initiate program exection after it is saved.

4.2.2 Introduction to Auto Operation Screen

➢ Press [Menu] button on the panel and click Auto tab succesively to activate auto mode.

➢ As shown on the left, lower part of the screen displays program information. Number of current program line is shown in green background, and its content is shown in yellow background. When the ongoing program line changes, their background colors will change at the same time.

(I) Jiggle mode

Auto oper.:Idle	ROBOT	👤 11:35
Enter into instruction edit jiggle mode		

Auto oper.:Idle	ROBOT	👤 11:35
Enter into instruction edit jiggle mode		

C ⊕	0.000
X ⊕	0.000
Z ⊕	0.000

Operating

Program

| 1	Jog:C_0.000 X_0.000 Z_0.000
2	Speed:99%
3	Wait port X01(Part exchange permission signal) to ON
4	Jog:C_50.000 X_100.000
5	Jog:Z_500.000
6	Set port Y04(Feeder cylinder open) to ON
7	Time:0.2s
8	Jog:Z_2.000
9	Jog:C_120.000 X_1300.000
10	Jog:Z_800.000

➢ In auto running process, press [OK] button to access the jiggle mode.

➢ You can use arrow buttons on the panel or select the program to edit by clicking on touch screen, and press [ESC] button to exit jiggle mode.

➢ Directly click on the program block, and a dialog box where you can make adjustment will pop out automatically.

➢ For commands which cannot be modified, warning text will appear on the screen, as "You are not entitled to modify the teach-in command here."

➢ With jiggle function activated, target position in jogging, jog speed, timing information as well as related I/O port can be modified.

➢ After jiggle function is activated, items such as part exchange permission signal, machine second startup, calculation, jump function can not be modified, please note that.

➢ After jiggle funciton is activated, the program keeps automatic running.

(II)   Breakpoint resume (or resume from the interrupted point)
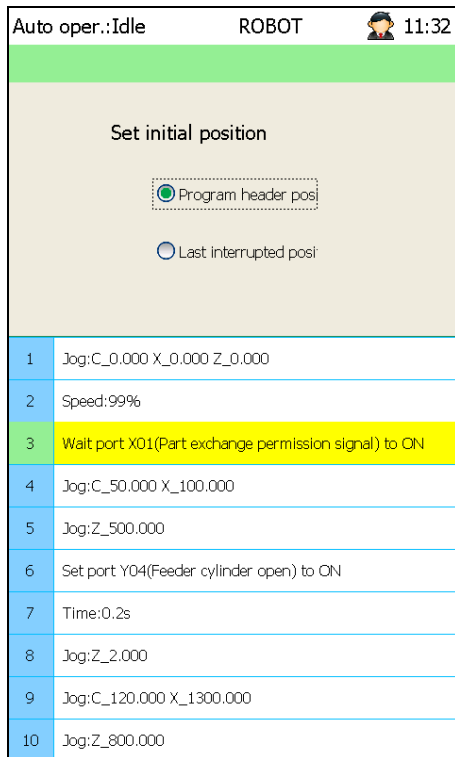
> ➢ How to enable the breakpoint resume function : before program execution, when options as shown on the left is offered, press [OK] button to make your choice and [ESC] button to cancel the selection.

> ➢ For subroutines such as homing, program modification, re-power on, re-load a program file, etc, program execution starts from the first program line by default whenever above subroutines is initiated by press [Start] button on the panel.

4.3 Displaying I/O Port Status
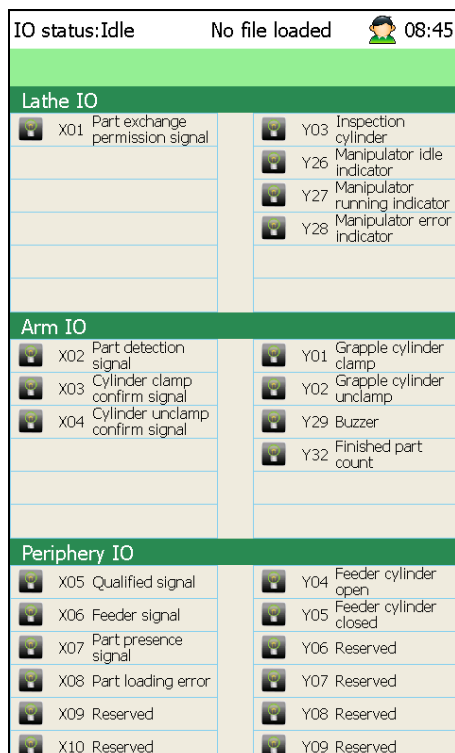
You can press [Menu] button on the panel first and click Manual/Auto tab next on the touch screen to turn the display to I/O status screen.

> ➢ On the I/O status screen, you can obtain real-time information of I/O ports. A port with a yellow indicator refers to an active port (namely, a input port receives input signal, or an output port delivers signal). On the contrary, a port with a grey indicator refers to an inactive port whose status is OFF.

> ➢ Physical address (the address assigned by the software) of I/O port corresponds to its address on terminal board respectively. For this reason, you can check status on I/O stauts screen directly for troubleshooting.

> ➢ If I/O status is inconsistent with actual situation, you can turn to I/O mapping screen to correct its polarity.

5. Edit

5.1 Pop-up Menu List under Edit Tab
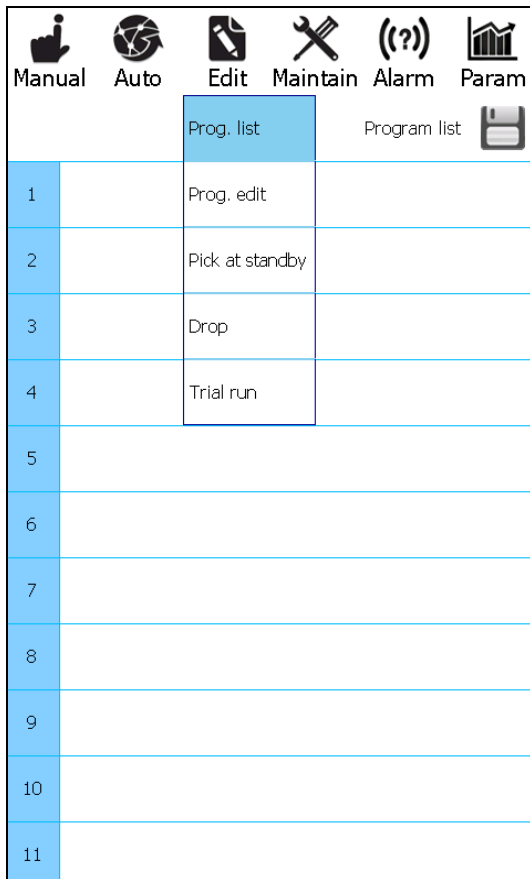
- ➢ As shown on the left part, program list refers to a collection of programs which have been loaded into the system. You can create a new program, search a program and save the program, etc.

- ➢ Program editing : you can edit the selected program.

- ➢ Pick at standby : you can set the speed moving to standby position, the coordinates of the position, speed and position to place the part, etc.

- ➢ Drop : you can set the product inspection position, interval, times as well as the control method of chuck, etc.

- ➢ Trial run : you can obtain information such as speed range, timing etc during tiral run. Besides, you can set the trial run method.

5.2 Program List
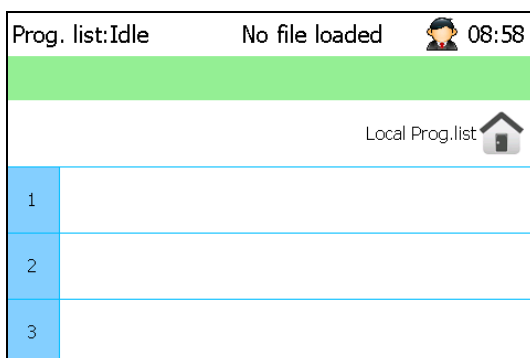
- ➢ The newly created teach-in program can be checked on the program list screen, where you can view the program, save it and load it to the system whenever it is needed.

5.2.1 New
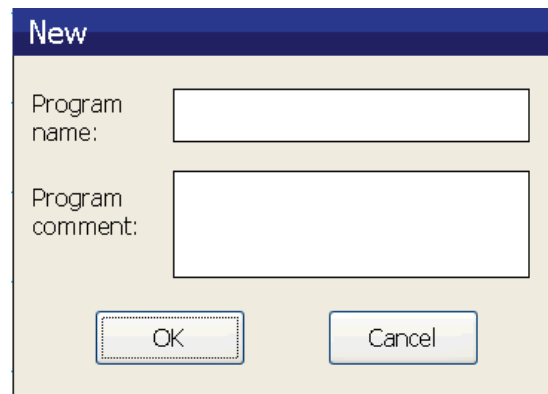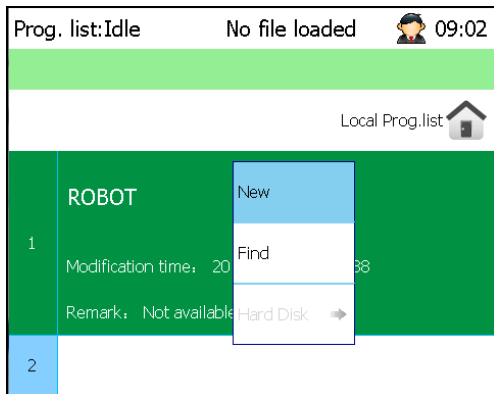
➢ How to create a new program :

Press [Menu] button on the panel → Click on Edit tab → Click on the pop-up menu list and select Program list → Click and select Local → Select New → Input the program name on the pop-up dialog box → Input memo or remark if needed → Click [OK] or press [Enter] button → Creation of a new program is completed.

➢ Select the newly created program file, press [OK] button to load it into the system, and press [OK] button again to make it editable.

5.2.2 Find
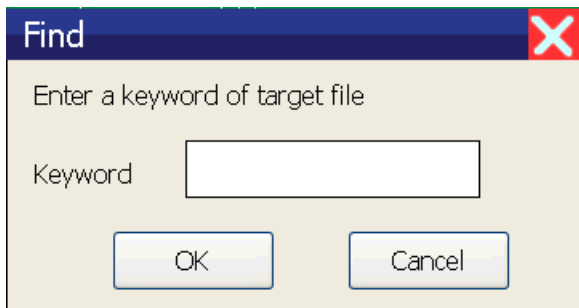
➤ As shown on the left, you can input the desired program name, and click [OK] or press [Enter] button on the panel for confirmation.

5.2.3 Save
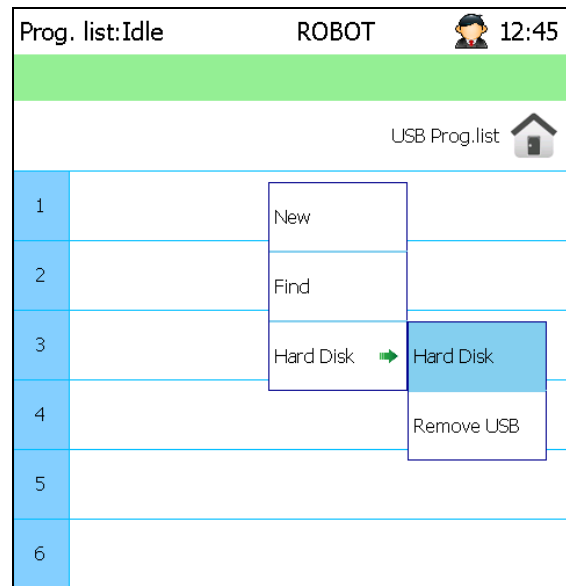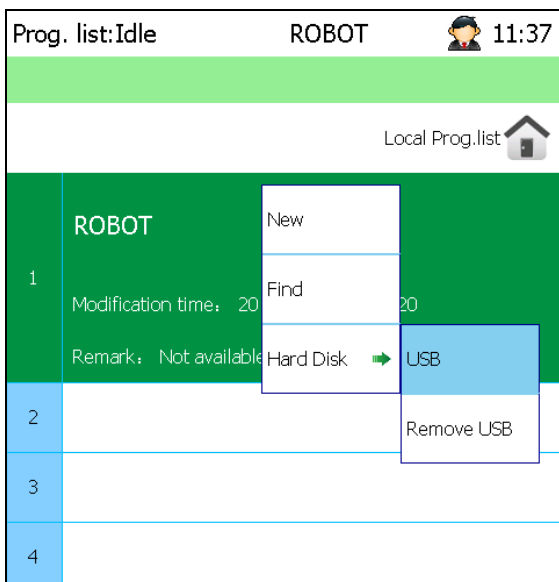
➤ Storage device covers "Local" and USB removable flash disk. The former is a built-in storage device of the system, and the latter is removable flash disk.

➤ When a program stored in removable flash disk is in usage, USB disk removal is prohibited; otherwise, the program cannot be executed.

➤ Program either in local memory or removable flash disk can be saved as a program stored to the other storage by pressing [OK] button after it is selected.

5.2.4 Program Setting

Prog. list:Idle   No file loaded   09:12

Local Prog.list

		Load		
	ROBOT	Rename		
1	Modification t		20 09:01:38	
	Remark： No	Delete		
2		Save as ➡		
3		Encrypt		
4				
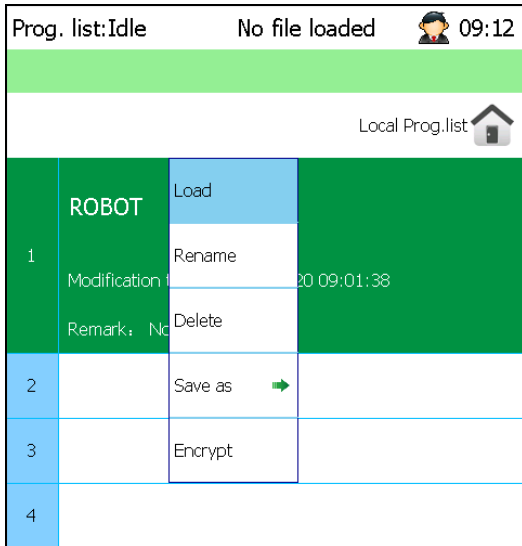
Turn to the program list screen, and press Up/Down buttons on the panel or directly click on touch screen to select the program to be set. A sub-menu list as shown on the left part will pop up by pressing [OK] button, where you can conduct following operations on the selected program.

➢ Load : load the program into the system.

➢ Rename : modify the name of the program.

➢ Delete : remove the program from the list.

➢ Save as : save the program to local memory or USB removable flash disk.

➢ Protect : Encrypt the program.

5.3 Program Editing

Prog. edit:Idle   ROBOT   10:01

Program list

1	Speed:30%	
2		
	Add ➡	
3	Modify	1 + 1.000
4	Delete	t exchange permission signal) to ON
5		If:X01(Part exchange permission signal)
	Cut	
6	Copy	#1==1.000
7	Paste	tandby RET.(1005)
8		
9		
10		
11		

➢ On the program editing screen, you can press Up/Down buttons on the panel or directly click on touch screen to select the prog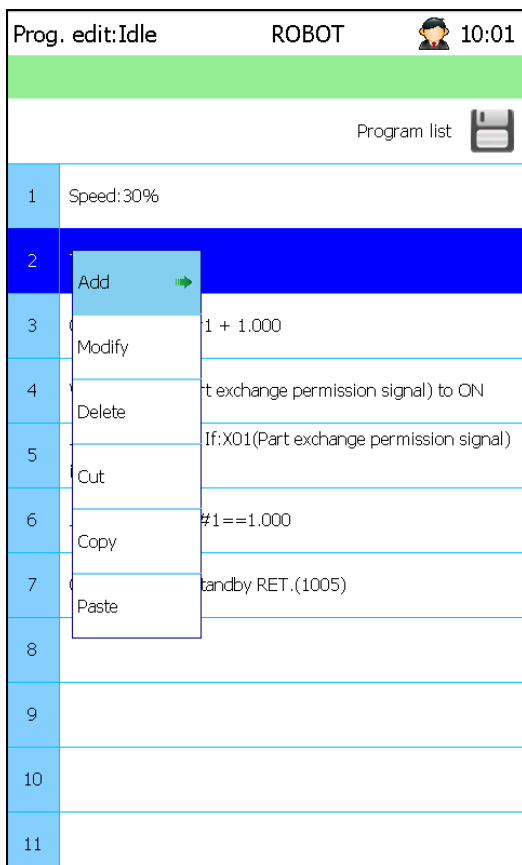ram. Then press [OK] button or click on the program block for a long time to open the dialg box, where you can conduct following operations to the program block : New, Modify, Delete, Cut, Copy and Paste.

5.3.1 Add
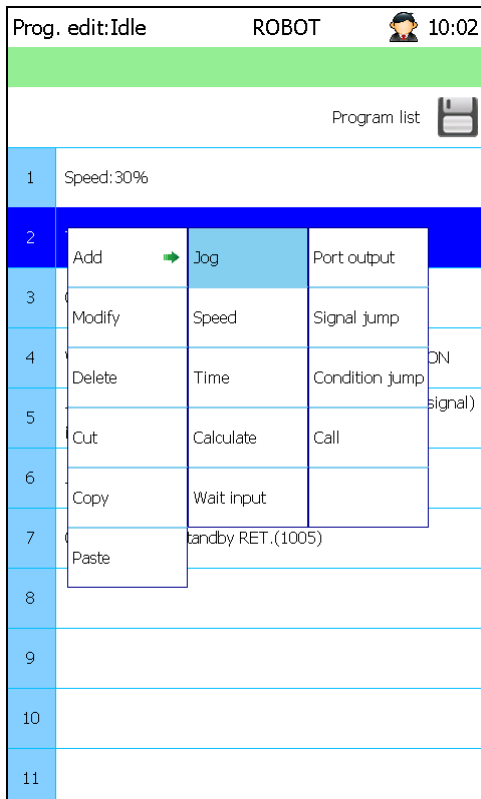
> ➢ Add : Click Add on the dialog box, and select command which needs to be added.

> ➢ Click on the block which needs to be inserted, and press [OK] button or click on the block for a long time to open a secondary dialog box.

5.3.2 Jog
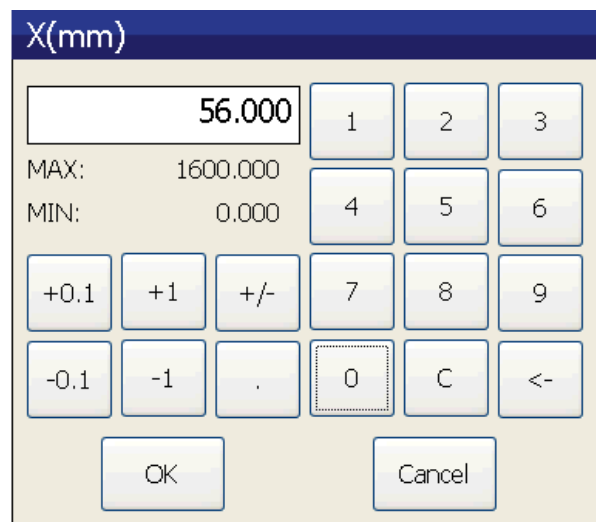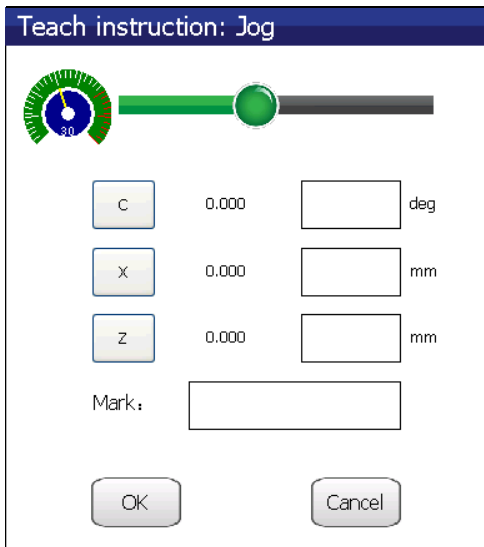
> ➢ Note that the jog travel (decided by the Maximum and Minimum values) cannot exceed the positive/negative software limits. And their units are mm and deg by default.

> ➢ By draggging the jog speed slide, you can set differed speed for each axis.

> ➢ For those axes which should be inactive, you can click on the axes names and hide it.

5.3.3 Speed

Teach instruction: Speed

Moving [30] %

OK   Cancel
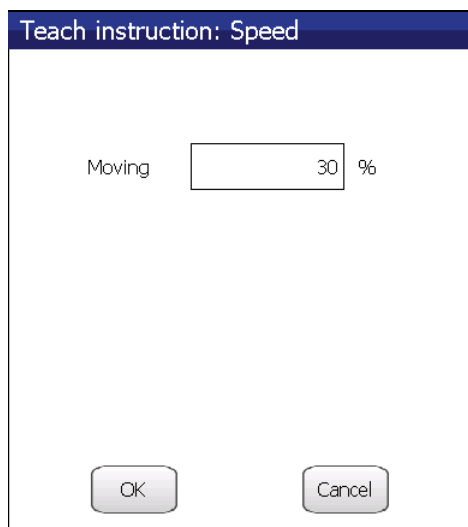
➢ With speed setting function, multiple ranges of speed can be set during program editing.

➢ Note that the speed before a speed setting command is decided by the setting value of auto run, and the speed after the command is decided by this speed setting value, as shown on the left part.

➢ The speed setting shares the same effect on speed override adjustment in auto run.

5.3.4 Timing

Teach instruction: Time

Delay： [0.2] Second

OK   Cancel
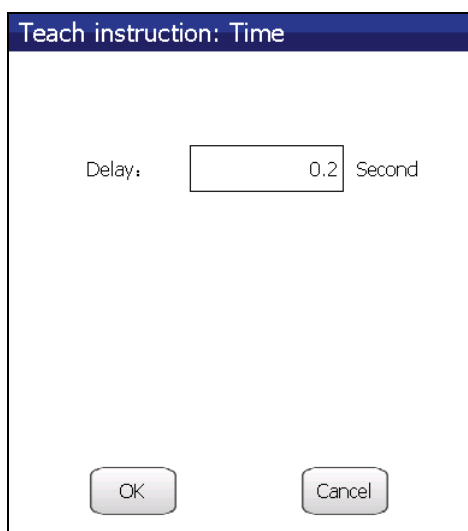
➢ Time delayed should be within 0~9.99 seconds. You can set a timing command during program editing to realize time delay function.

5.3.5 Wait Input

> ➢ During program running, wait input signal is at ON or OFF.

> ➢ If the status of wait port keeps unchange, the program will keep wait for the status change.

> ➢ Press Up/Down/Left/Right arrow buttons on the panel or PgUp/PgDown button on the screen to select the port.

5.3.6 Port Output

> ➢ During program running, make the status of output port ON or OFF.

> ➢ Press Up/Down/Left/Right arrow buttons on the panel or PgUp/PgDown on the screen to select the port.

5.3.7 Jump

It is divided into two types : signal jump and conditional jump. Refer to followings for details.
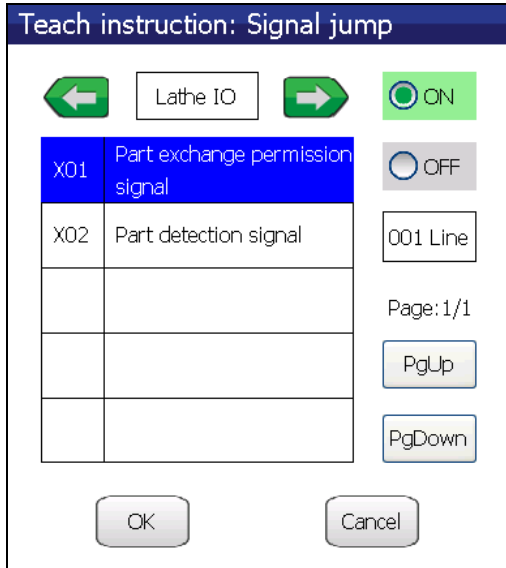
➢ Set the signal on the dialog box and set the target program line number to which needs to jump.

➢ When jump command is finished, the program will jump to the line set and continue execution automatically.
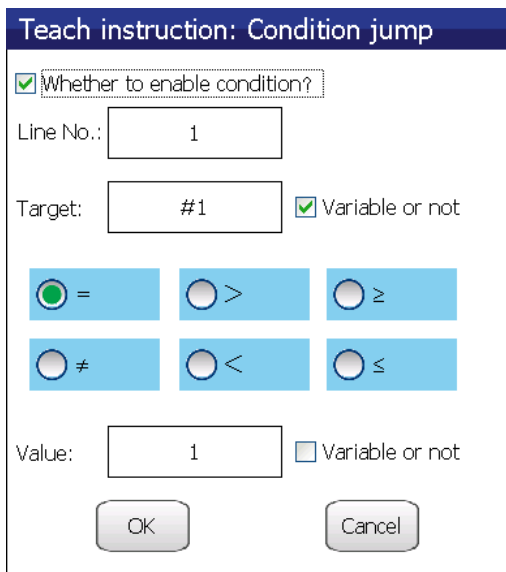
➢ Line No. : set the target program line number in the input box. Note that if item "Whether to enable condition ?" is unchecked, the system will execute jump without any precondition.

➢ Target : set the internal register address in the input box. Note that the target address needs to be within the range of #1 ~ #999.

➢ Logic condition : select the logic condition to be enabled in the area.

➢ Variable or not : it is used to specify a variable address for the internal register, to realize synchronous update.

5.3.8 Call

Teach instruction: Call

1/1

○ Standby RET.
○ RapidPlace
○ Pose check
○ Pose non-check
○ Custom subroutine

OK   Cancel
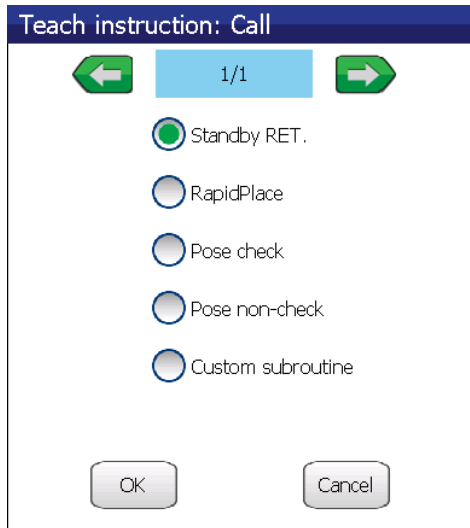
➢ Call : it is used to call a subroutine during program editing to execute some special function.

➢ Return to standby point : Arms of the manipulator get to the standby position. Note that axes returning order needs to be adjusted in accordance with actual structures of machine.

➢ Rapid place : subroutine of Rapid place can be called directly after parts exchanged, which can place the finished parts, samples or defective parts in order as parameter settings.

➢ Pose check/non-check : to check or not to check the poses of arms.

➢ Custom sunroutine : you can make a subroutine to realize a special function. Here is a subroutine of Rapid place, for reference only.

```
O"FAST PUT"            " Rapid place
M801 "|M|Auto run 3"
G905 G90 G00 X=#11612 Y=#11614 F=#11610
G906
IF(#11907) G906 H=#PLC.x19 P1 L=#11917
IF(#SYNTIMEOUT<0) M801"func//:_OnAlarmON?arg1=43036"
G906
G905 G90 G00 Z=#11613 F=#11606
M17
```

5.3.9 Calculate

Teach instruction: Calculate

Target: #1   ☑ Variable or not

Calculate: ● +   ○ −   ○ *   ○ /
            ○ INC ○ DEC ○ MOD
Logic: ○ AND ○ OR   ○ NOT ○ XOR
Settings: ○ MOV ○ SET ○ CLR

Value: 1   ☐ Variable or not

OK   Cancel
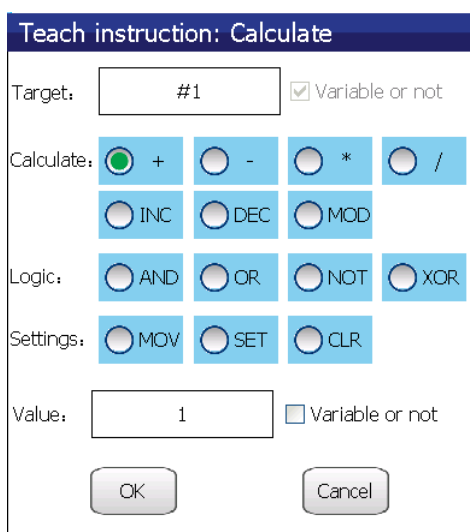
➢ Calculate : it is used to realize relatively complicated conditional jump function via algorithm and logic operation.

➢ Target : set internal register address in the input box, within range of #1 ~ #999.

➢ Setup value : it is the basic value, which can either be quantitative variable or variable. Note that in logic operation, only 0 or 1 can be used.

➢ Variable or not : you can specify a variable address for the internal register which will be updated in synchrony.

➢ Code list :

INC: the value of variable increases by 1 once the command is executed.
DEC: the value of variable decreses by 1 once the command is executed.
MOV: variable assignment.
SET: set the variable to 1 after the program running is finished.
CLR: set the variable to 0 after the program running is finished.

5.4 Pick at Standby

- ➢ Standby speed : set the pick speed and upward moving speed of Z axis at standby position.

- ➢ Standby position : set positions of all axes at standby. Subroutine of Return to standby position can be called during program editing to make axes return to the standby position.

- ➢ Place speed : set Z axis placing speed.

- ➢ Rapid place position : you can place the part to the specified position quickly. Note that the position cannot exceed the positive/negative travel limits of machine.

5.5 Drop
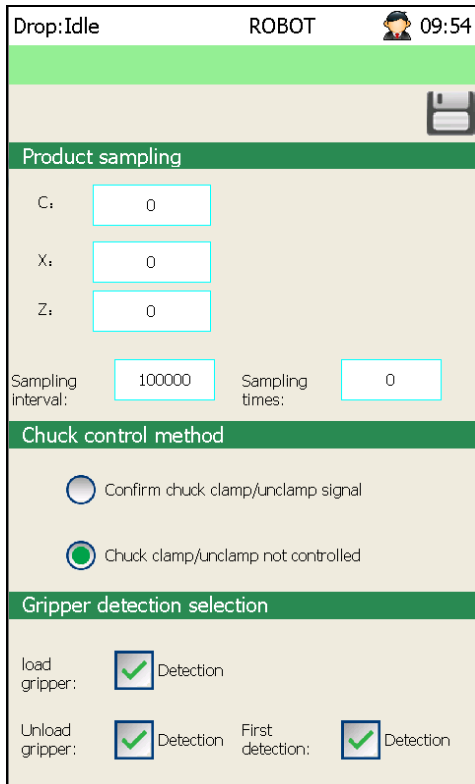
➢ Product sampling : set sampling position, interval and sampling times of all axes.

➢ Chuck control method : make your own choice of chuck clamp/unclamp signal confirmation and the control of chuck.

➢ Gripper detection signal : whether to detect the loading/unloading gripper or not. It ensures the signal is valid and reliable. For unloading gripper, you can make it detect for the first part.

5.6 Trial Run
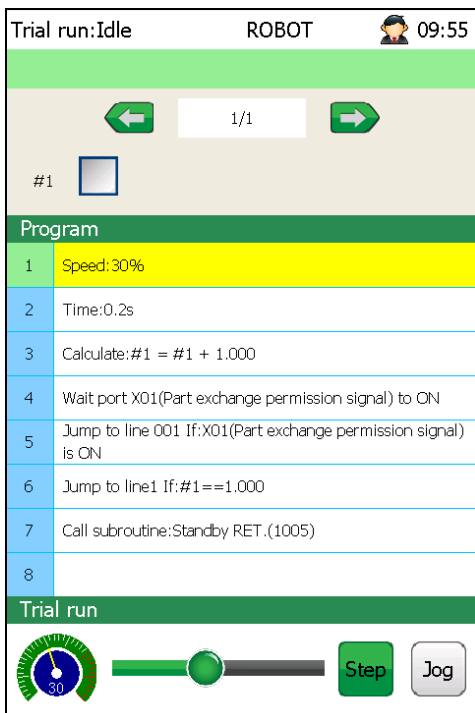
➢ Speed override should be set within range of 1% ~ 70%. Note that jiggle function is unavailable during trial run.

➢ You need to switch to manual mode in trial run.

➢ "Step" : in this mode, only one program line can be executed at one time.

➢ "Jog":in this mode, program lines will be executed in loop, namely from the begining to the end position of the program.

6. Maintenance

6.1 Pop-up Menu List under Maintain Tab
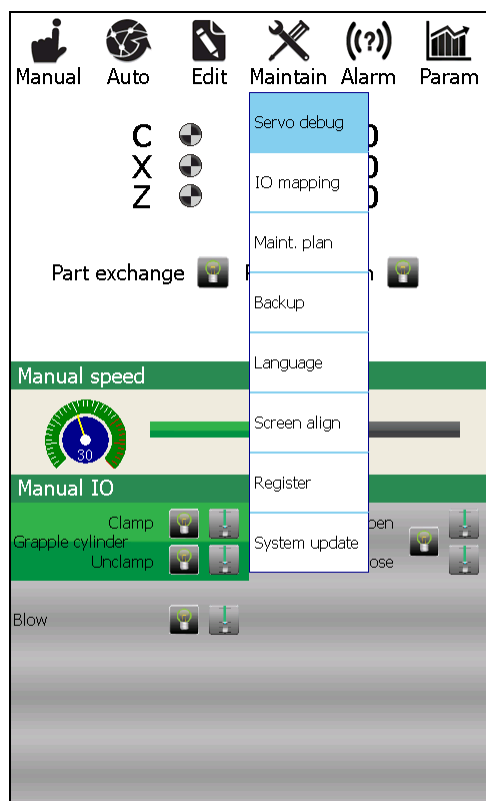
➢ Servo debug : it displays real-time running status as well as data of the servo system.

➢ I/O mapping : it is used to adjust matching situations of I/O ports. I/O alarms appearing at system startup can be set here.

➢ Maint. plan : it sets maintenance time as well as mechanical components to be served.

➢ Backup : you can import or export system files with help of USB removable flash disk.

➢ System update : you can upgrade the system here.

6.2 Servo Debug

Servo debug:Idle	ROBOT		10:13
Servo info			
	C	X	Z
Servo alarm	⚪	⚪	⚪
Servo enable	🔴	🔴	🔴
Encoder origin	⚪	⚪	⚪
Positive limit	⚪	⚪	⚪
Negative limit	⚪	⚪	⚪
Origin signal	⚪	⚪	⚪
Machine coor	0.000	0.000	0.000
Pulse	0	0	0
Encoder fdbck	0	0	0
Servo error	0	0	0

➢ It displays real-time information of axes and active parameters.

➢ When limit alarm or origin signal alarm occurs, the corresponding indicators will be shown in green.

➢ You can obtain servo system running data in synchrony by information displayed on the screen.

6.3 IO Mapping

IO mapping:Idle		ROBOT		👤 10:14

	◀	Inputs	▶	

DI NO.	Polarity	PLC add.	Test	Desc.
1 ⚪	NC	0	OFF	Part exchange permission signal
2 ⚪	NC	1	OFF	Part detection signal
3 ⚪	NC	2	OFF	Cylinder clamp confirm signal
4 ⚪	NC	3	OFF	Cylinder unclamp confirm signal
5 ⚪	NC	4	OFF	Qualified signal
6 ⚪	NC	5	OFF	Feeder signal
7 ⚪	NC	6	OFF	Part presence signal
8 ⚪	NC	7	OFF	Part loading error
9 ⚪	NC	8	OFF	Reserved
10 ⚪	NC	9	OFF	Reserved

IO mapping:Idle		ROBOT		👤 10:15

	◀	Outputs	▶	

DO NO.	Polarity	PLC add.	Test	Desc.
1 🔴	NC	0	OFF	Grapple cylinder clamp
2 🔴	NC	1	OFF	Grapple cylinder unclamp
3 🔴	NC	2	OFF	Inspection cylinder
4 🔴	NC	3	OFF	Feeder cylinder open
5 🔴	NC	4	OFF	Feeder cylinder closed
6 🔴	NC	5	OFF	Reserved
7 🔴	NC	6	OFF	Reserved
8 🔴	NC	7	OFF	Reserved
9 🔴	NC	8	OFF	Reserved
10 🔴	NC	9	OFF	Reserved

➢ Input port mapping : port polarity can be set, status and description of the port can be viewed, and physical address of the port can be modified.

➢ Output port mapping : output signal can be mandatory fed out through an output port. Besides, information such as status, description and physical address can be modified.

6.4 Maintenance Plan

Maint. plan:Idle   ROBOT   10:19

Settings

No.	Maint. items
1	Oil
2	Regulator-lubricator combination drain
3	Check sucker, fixture and holder
4	Check status of mounting screw
5	Check connection of machine and upper control
6	Clean vacuum generator
7	Remove dust in electric cabinet
8	Reliability check of electrical connection
9	
10	

➢ Maintenance can be executed in forms of time and times, that is, you can set a time period (with unit of day) or set total maintenance times which will be accumulated on basis of current times, in order to make your own maintenance plan.

➢ On maintenance screen, you can directly click on the service item or press [OK] button to set maintenance method and make maintenance plan. After the item and plan are set, they will appear on the list.

➢ On maintenance state screen, you can directly click on the touch screen or press [OK] button to conduct maintenance in advance ; or you can conduct post maintenance when planned time or times is due.

➢ After maintenance is completed this time, the system will automatically figure out the next maintenance time.

6.5 Backup

Backup:Idle   ROBOT   10:20

Idle

1.Select upper/lower control
⦿ Upper backup   ◯ Lower backup

2.Select import/export
⦿ Import   ◯ Export

3.Select file imported from/exported to USB
☐ System param
☐ Config file

4.Select operation as follows

Transfer   Cancel

➢ Select the file or software backup which needs to be imported or exported.

➢ Files contain public file（PUBLIC.DAT）, PLC program, system parameters（including servo parameter）, IO configuration file, maintenance plan file, alarm log file (note the alarm log file cannot be imported), man machine software backup and driver software backup, etc.

➢ Turn to backup screen, insert the USB removable flash disk into the controller, select the file to be imported or exported, and click [Transfer] to transmit the file or [Cancel] to undo file transmission.

6.6 Screen Correction
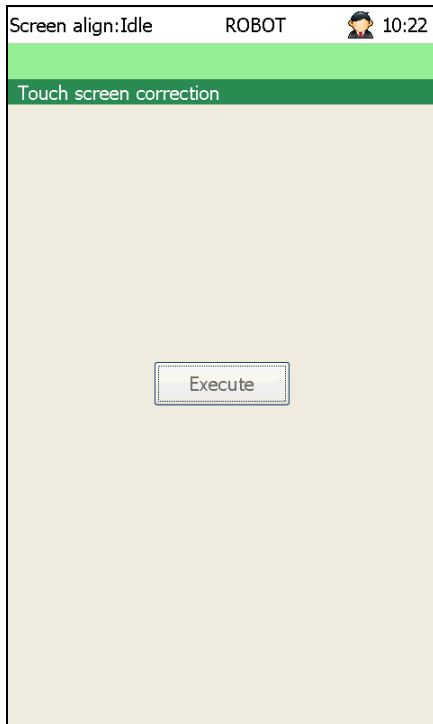
> ➢ As shown on the left, click [Execute] or [OK] button on the panel to correct the screen.

6.7 Registration
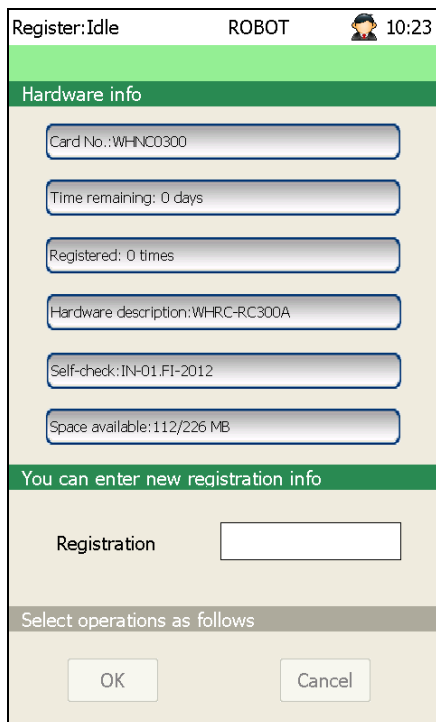
> ➢ Information related to hardware is displayed here, which is beyond modification.
>
> ➢ After registration code is entered and confirmed, a dialog box prompting successful registration or registration failure will appear.
>
> ➢ After registration, remaining usage time and registered times will change accordingly.

6.8 System Upgrade
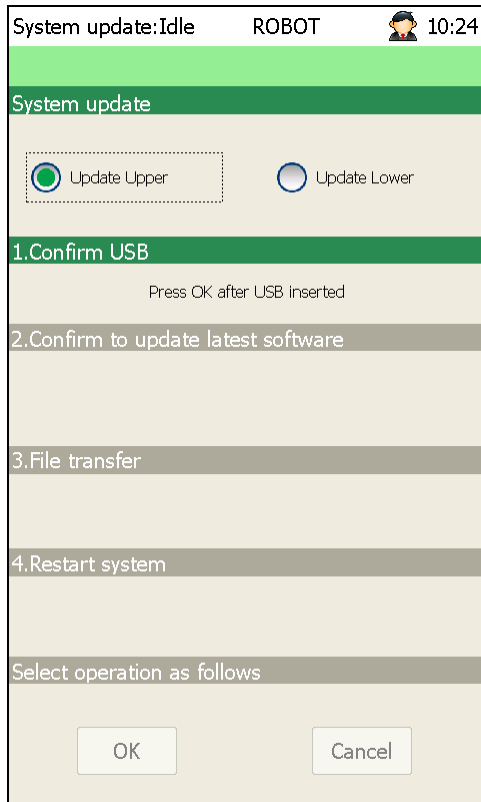
- ➢ There are four steps to complete system upgrading, specifically, confirmation of USB device → checking update file version → file transmission → restarting the control system.

- ➢ The currently being executed step sequence is shown in green background. Click [OK] to confirm or [Cancel] to cancel.

- ➢ You can select the file stored in USB removable flash disk to update.

- ➢ If versions of update files in USB is lower than that of current file in the system update fails and stops.

7. Alarm

7.1 Pop-up Menu List under Alarm Tab
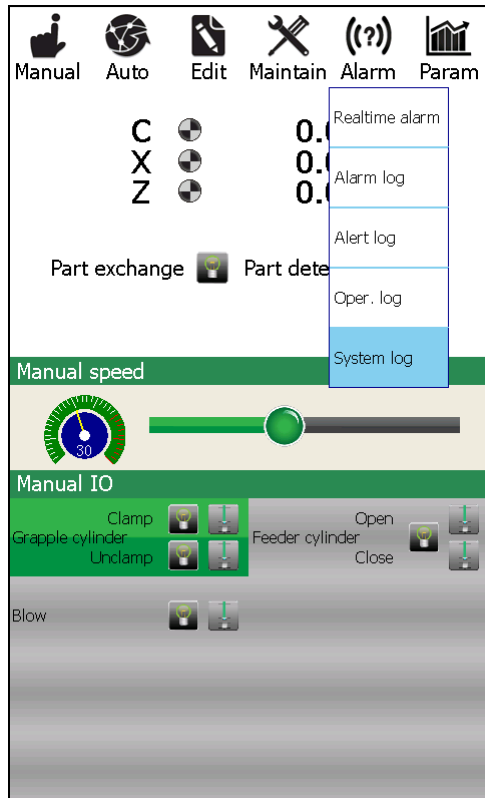
- ➢ Real-time alarm : it records the active alarm events of the manipulator, which cannot be cleared before it is settled.

- ➢ Alarm log : it records all history alarm information during manipulator running.

- ➢ Alert log : it records all history warning information during manipulator running.

- ➢ Operation log : it records such information as modification to programs.

- ➢ System log : it records information such as system running time and status, etc.

7.2 Real-time Alarm

➢ The active or ongoing error information will be shown on the real-time alarm screen.

➢ After the alarm is cleared, you can press [Reset] button on the panel to reset the system.

7.3 Alarm Log

➢ The screen presents errors which have occurred.

➢ You can press [OK] button on this screen to inquire classified errors.

➢ When inquiring classified error, you can set inquiry condition as Time or Type.

7.4 Alert Log

- ➢ Real-time alert screen records all on-going errors, specifically, warning information.
- ➢ Conduct operation as prompt when warning occurs.

7.5 Operation Log

- ➢ Process of setting or modification to system parameters or items can be recorded on the screen, which will be a great help for error diagnosis and troubleshooting.
- ➢ Information such as time and date, as well as operation remarks can be recorded.

7.6 System Log

System log:Idle	ROBOT	10:40

No.	System info
1	2015-11-20 9:04 RC300 Lower control abnormal start
2	
3	
4	
5	
6	

➢ System startup time, system update or backup can be traced on the screen.

➢ Information such as time and date, as well as system information can be recorded.

8. Parameter

8.1 Pop-up Menu List under Parameter Tab
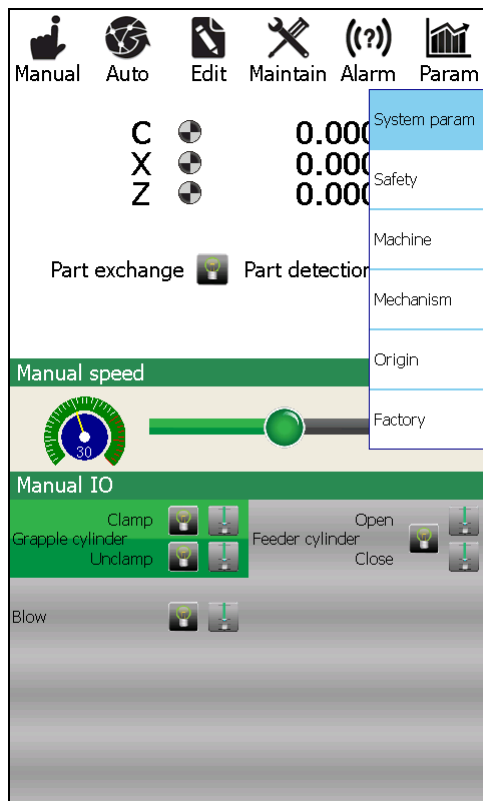
➢ System parameter : it sets system parameters which corresponds to basic functions.

➢ Safety : it sets screensaver, system clock, etc.

➢ Machine parameter : it sets direction and speed of each axis, etc.

➢ Mechanism : you can select the components and their mechanical characteristics as actual situation.

➢ Origin : it sets parameters related to origin returning, including returning direction, speed as well as offset of each axis.

➢ Factory : you can check and obtain information of hardware, software, versions as well as leaving factory date.

8.2 System Parameter
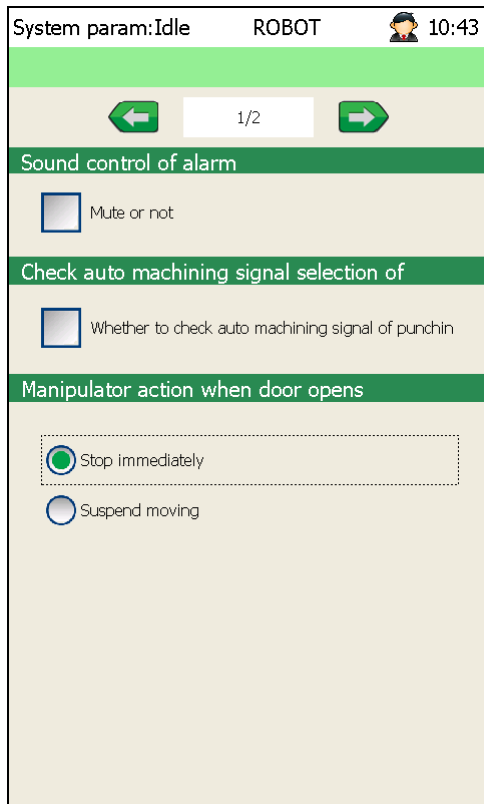
> ➢ Sound at alarm : you can decide whether it is mute or not when alarm occurs.

> ➢ Related signal check before auto run : you can decide whether the auto machining signal of lathe will be checked or not.

> ➢ Manipulator action when door opens : avaiable action options of the manipulator when door opens during running are immediate stop and pause.
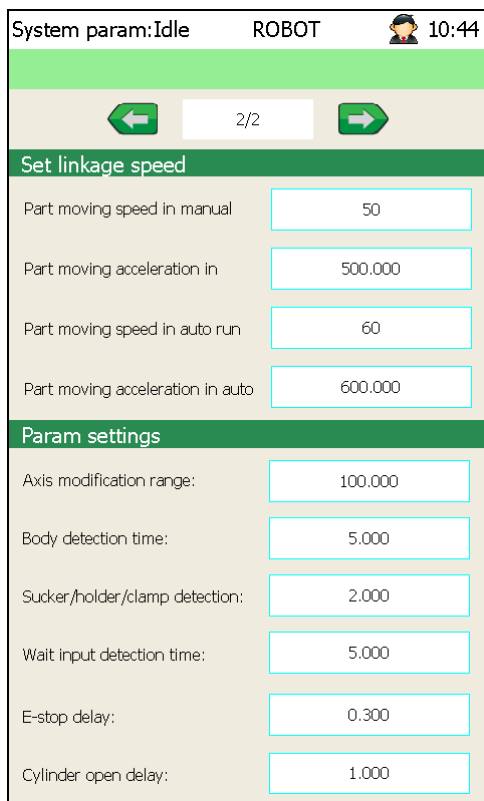
> ➢ Axis modification range : it refers to the maximum value of an axis after jiggle function is enabled in auto run.

> ➢ Manipulator detection time : the manipulator will detect execution status of each function, and alarm will occurs whenever error detection time exceeds the set value.

> ➢ Suck/holder/clamp detection time : it detects part signal of load gripper and unload gripper.

> ➢ Wait input detection time : it sets the signal detection time of wait port. Within the setup time, if there is signal input, program will go and execute the next line ; otherwise, alarm will occur.

> ➢ E-stop delay : the delayed time of emergency stop.

> ➢ Cylinder ON/OFF delay : it sets the delayed time of feeder cylinder open.

8.3 Safety

- ➢ Clicking on the time on screen opens a dialog box where you can manually input date and time.

- ➢ Screensaver time and backlight off time can be freely defined. When set to 0, it refers to non-activation of screensaver and backlight off function.

- ➢ Default setting is 10 minutes. That is, backlight will be turned off in 10 minutes and screensaver will be turned on.

- ➢ Setup time of backlight off should be longer than that of screensaver ; otherwise, screensaver effect cannot be displayed.

- ➢ You can custom subtitles or texts shown on the screensaver.

- ➢ Font color : it sets color of texts on the screensaver.

8.4 Machine Parameter

When setting machine parameters, keep touching the parameter on the screen with finger for 600ms or more before removing, and a dialog box will pop out. Note that modifications to some parameters take effect after restarting the system (there will be prompt).

No.	Value	Name
N12101	0	C motor rotary direction
N12102	0	C encoder direction
N12103	5	C motor deceleration ratio
N12104	100	C driving gear diameter
N12105	10000	C pulses per motor circle
N12106	360	C positive limit
N12107	-360	C negative limit
N12108	5000	C encoder max. dynamic error
N12109	0	C Startup speed
N12110	1	Whether to enable C encoder feedback

No.	Value	Name
N12111	0	Enable absolute encoder of C axis
N12112	4000	C acceleration
N12113	0	C smoothing time
N12114	100	C inching speed
N12115	1000	C auto run speed
N12116	0.2	Pulse equivalent of C axis
N12117	0	Enable C axis backlash compensation
N12118	0.002	C backlash compensation value

➢ Motor rotary direction : 1 for positive direction or forward direction, and 0 for negative direction or reversal direction. Set it as actual situation.

➢ Encoder direction : it sets the servo driver direction fed back from the encoder, with default value 0.

➢ Motor deceleration ratio : it is of the same significance with electronic gear ratio of the driver. Set it the same value of that of eclectonic gear ratio, whose default value is 5.

➢ Driving gear diameter : it needs to be adjusted as actual data. Default value is 100.

➢ Pulse per motor circle : it refers to number of pulses needed to make the motor rotate one revolution. For a large setup value, the shorter the moving distance is, the more precise the position will be ; while for a small setup value, the longer the moving distance is, the more precise the position will be.

➢ Positive/negative travel limit : it refers to the maximum allowable distance can an axis move in positive/negative direction. The software will prompt alarm if the value is exceeded.

➢ Max. Encoder dynamic error : it refers to the maximum error of the encoder feedback. A

smaller setup value gets more precise result (Default value is 5000).

➤ Startup speed : it rerfers to the speed can be achieved starting from 0 without acceleration, with default value 0.

➤ Enable encoder feedback : during servo running, the encoder transmit real-time running status of the servo motor to the servo driver, and the driver will make self-adjustment according to feedback data. (Defalut value is 1, namely, encoder feedback function is enabled by default.)

➤ Enable absolute encoder : it sets whether to enable absolute encoder or not, with default value 0.

➤ Acceleration : larger accerleration gets more swift response from the manipulator. (Default value is 4000).

➤ Smoothing time : longer smoothing time gets more steady and smooth servo motor running. (Default value is 0).

➤ Inching speed : it sets the benchmark speed in inching motion. (Default value is 100).

➤ Auto run speed : it sets the benchmark speed in auto running. (Default value is 1000).

➤ Pusle equivalent : larger pulse equivalent gets larger maximum feedrate of the manipulator. (Default value is 0.2).

➤ Enable backlash compensation : it sets whether to enable backlach compensation or not. (Default value is 0).

➤ Backlash compensation value : it sets the backlash compensation value. (Default value is 0.002).

➤ Driving gear diameter : it refers to the difference between setup value and actual measured value of driving gear. You can make correction as follows :

   1) In manual mode, make each axis move at a certain distance via operational panel, and get distance data shown on the screen.

   2) Measure actual distance of each axis movement with a tape.

   3) Set estimated value of driving gear to 100mm, and linear distance in auto run to 200mm.

➤ Formula is as below:

$$\text{Actual value of driving gear} = \frac{\text{Actual measured value}}{\text{Setup value}} \times \text{Estimated value of driving gear}$$
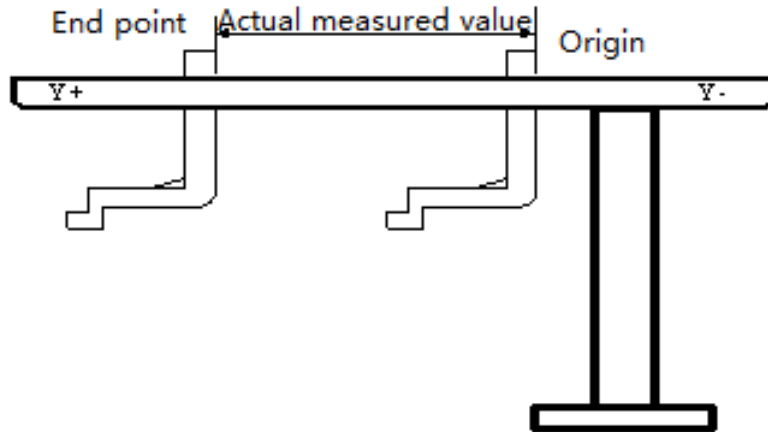
8.5 Mechanism Feature
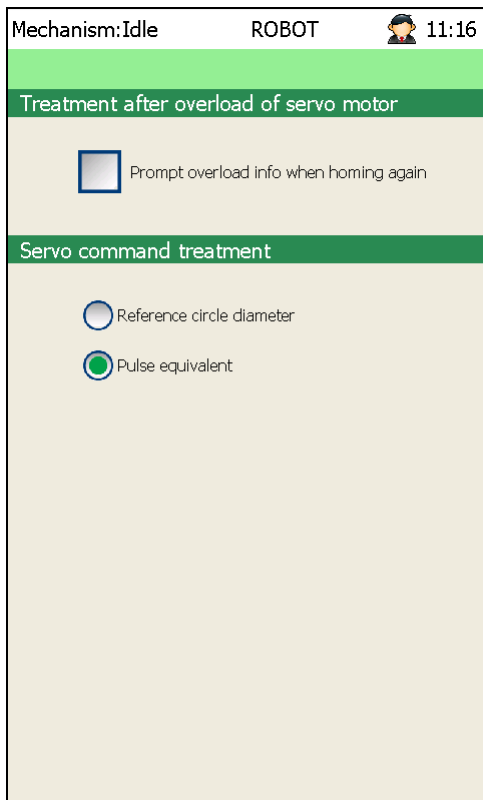
➢ Mechanism detection : you can decide whether overload information will be prompted or not when returning to the origin again.

➢ Servo command treatment : you can select reference circle diameter or pulse equivalent to deal with servo command.

8.6 Parameters Related to Origin

No.	Value	Name
N12001	1	C origin return direction
N12002	0	C origin return offset
N12003	50	C origin return section 1 speed
N12004	10	C origin return section 2 speed
N12005	0	C machine REF. point (0: Negative limit, 1: Origin)
N12006	0	C return mode (0: Near point, 1: Phase Z pulse)

Status bar: Origin:Idle ROBOT 11:15 — C

Modification to parameters takes effect the next time returning to the origin.

➢ Origin return direction : 1 for positive direction and 0 for negative direction. Default setup value is 1.

➢ Origin return offset : after the sensor receives origin signal, the axis moves towards the reversal direction at the offset distance. Default value is 0.

➢ Origin return section 1 speed : it refers to the coarse positioning speed during returning to the origin, with default value 50.

➢ Origin return section 2 speed : it refers to the fine positioning speed during returning to the origin, with default value 10.

➢ Machine reference (REF.) point : 1 for the origin signal and 0 for negative limit.

➢ Return mode : it sets the returning method, 0 for near point, and 1 for Z phase pulse. Default setting is 0.

8.7 Factory

➢ System info : in this area, information of control system name, OS version, CPU clock frequency, memory, sofware type, man machine software version, PLC version etc, can be obtained.

➢ Factory : in this area, you can obtain or modify information such as robot manipulator model, serial number as well as leaving factory date.

9. Alarm List and Counter Measures

9.1 Alert (Warning)

No.	Contents	Remark
01	Load of file failed, reload it in idle status!	File can only be loaded into the system in IDLE status.
02	No file loaded, cannot execute the operation!	
03	System type does not match with platform!	The write information does not match with the software.
04	File import failed!	
05	File export failed!	
06	Lower control does not detect USB!	
07	Production quantity reaches set cycle times!	The quantity set in production plan has been reached.
08	Please refuel the bin!	
09	C collides with positive soft limit!	
10	C collides with negative soft limit!	
11	X collides with positive soft limit!	
12	X collides with negative soft limit!	
13	Z collides with positive soft limit!	
14	Z collides with negative soft limit!	

9.2 Alarm

No.	Contents	Remark
01	Low air pressure	Air pressure is lower than 3kg. Please adjust the pressure or check air pipeline.
02	Bad load gripper clamp signal	Please check detection position of reed switch and the wiring
03	Bad unload gripper clamp signal	
04	Bad load gripper unclamp signal	
05	Bad unload gripper unclamp signal	
06	Man machine E-stop	Please remove E-stop error of operation panel, and press [Reset] button to continue
07	C axis servo alarm	Please check the servo driver and

No.	Contents	Remark
08	X axis servo alarm	motor
09	Z axis servo alarm	
10	Too large D-value between C instruction and feedback	Please check settings of parameters related to servo driver and motor, and the wiring with the servo system.
11	Too large D-value between X instruction and feedback	
12	Too large D-value between Z instruction and feedback	
13	Lower control does not detect USB	
14	Lower control failed to copy update files	
15	Lower control failed to update, check whether update files complete	
16	C axis collides with positive limit	
17	C axis collides with negative limit	
18	X axis collides with positive limit	
19	X axis collides with negative limit	
20	Z axis collides with positive limit	
21	Z axis collides with negative limit	
22	Abnormal connection to the 1st terminal board	
23	Bad cylinder unclamp signal	
24	Bad cylinder clamp signal	
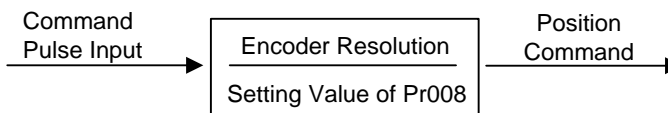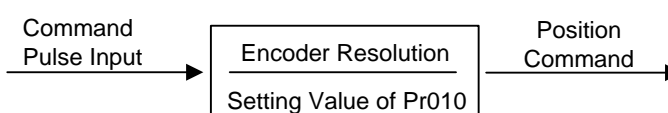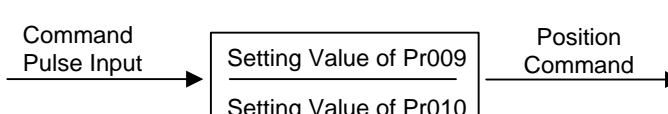
10. Driver Parameters and Wirings

10.1 Driver Parameters

10.1.1 Parameter Setting of WISE Servo Driver

Para. No.	Function	Value	Description
Pr528	LED initial status	6	Monitor if the number of sent and received pulses is correct by setting this parameter. In Weihong control system, the correct quantity of pulse sent by control card is detected by pulse inspection in order to determine whether there is electrical interference.
Pr008	Command pulse No. per motor circle	0	When it is set to "0", parameters Pr009 and Pr010 are valid.
Pr009	1st numerator of command pulse frequency division/ multiplication	Need calculation $0 \sim 2^{30}$	Typical value: pitch 5 mm, encoder resolution 10000, deceleration ratio 1:1, pulse equivalent 0.001 mm: Pr009＝10000
Pr010	Denominator of command pulse frequency division /multiplication	Need calculation $0 \sim 2^{30}$	Pr010＝pitch 5mm/ pulse equivalent 0.001mm＝5000 Pr009/Pr010=10000/5000=2/1
Pr011	Output pulse No. per motor revolution	2500 (Default value)	Typical value: pulse equivalent 0.001, deceleration ratio 1:1, pitch 10mm, set this parameter to 2500; when pitch is 5mm, set the parameter to 1250.
Pr100	1st position loop gain	480 (Default value)	Unit: 0.1/s. Set it according to the actual situation.
Pr101	1st velocity loop gain	270 (Default value)	Unit: 0.1Hz. Set it according to the actual situation.
Pr102	1st velocity loop integration time constant	210 (Default value)	Unit: 0.1ms. Set it according to the actual situation.

When the value of Pr008 is not "0", it should be calculated according to the following formula:

$$\text{Command pulse No. per motor circle} = \frac{\text{Screw pitch}}{\text{Pulse equivalent} * \text{Deceleration ratio}} = \frac{5mm}{0.001mm/p} = 5000$$

That is to say, when screw pitch is 5mm and pulse equivalent is 0.001, the value of Pr008 is 5000.

Attached list: the relationship among parameters Pr008, Pr009 and Pr010

Pr008	Pr009	Pr010	Description
$0\sim2^{20}$	— (No influence)	— (No influence)	Command Pulse Input → [Encoder Resolution / Setting Value of Pr008] → Position Command As shown above, the process is undergone in terms of the setting value of Pr008, not affected by the settings of Pr009 and Pr010.
0	0	$0\sim2^{30}$	Command Pulse Input → [Encoder Resolution / Setting Value of Pr010] → Position Command When the values of Pr008 and Pr009 are both set to "0", as shown above, the process is undergone in terms of the setting value of Pr010.
	$0\sim2^{30}$	$0\sim2^{30}$	Command Pulse Input → [Setting Value of Pr009 / Setting Value of Pr010] → Position Command When the value of Pr008 is "0", but the value of Pr009 is not "0", as shown above, the process is undergone in terms of the setting values of Pr009 and Pr010.

10.1.2 Parameter Setting of PANASONIC MINAS A5 Servo Driver

Para. No.	Function	Value	Description
Pr5.28	LED initial status	6	Monitor if the number of sent and received pulse is correct by setting this parameter. In Weihong control system, the correct quantity of pulse sent by control card is detected by pulse inspection in order to determine whether there is electrical interference.
Pr0.01	Select control mode	0	0: position control 1: velocity control 2: torque control
Pr0.05	Selection of command pulse input	XX	0: photo-coupler input (PULS1,PULS2,SIGN1,SIGN2) 1: Exclusive input for line driver (PULSH1,PULSH2,SIGNH1,SIGNH2) Note: generally, 1 is selected for this parameter.
Pr0.07	Command pulse input mode setup	3	Set command pulse input mode: pulse + direction, negative logic.
Pr0.08	Command pulse counts per one motor revolution	0	When it is set as "0", parameters Pr0.09 and Pr0.10 are valid.

Para. No.	Function	Value	Description
Pr0.09	1st numerator of command pulse frequency multiplication	Need calculation	Range: $0\sim2^{30}$. Typical value: pitch 5 mm, encoder resolution 10000, shaft coupling direct drag, pulse equivalent 0.001 mm: Pr0.09＝10000
Pr0.10	Denominator of command pulse frequency multiplication	Need calculation	Pr0.10＝pitch 5mm/ pulse equivalent 0.001mm＝5000 Pr0.09/Pr0.10=10000/5000=2/1
Pr0.11	Output pulse No. per motor revolution	2500	Range: $1\sim262144$, decided by PG division ratio. Assuming that pulse equivalent being 0.001, deceleration ratio 1:1, and pitch 10mm, set the parameter to 2500; when the pitch is 5mm, set it to 1250.

When the value of Pr0.08 is not "0", it can be calculated in terms of the following formula:

$$\text{Command pulse No. per motor circle} = \frac{\text{Screw pitch}}{\text{Pulse equivalent} * \text{Deceleration ratio}} = \frac{5mm}{0.001mm/p} = 5000$$

When screw pitch is 5mm and pulse equivalent 0.001mm/p, the value of Pr0.08 is "5000".

Attached list: the relationship among parameter Pr0.08, Pr0.09 and Pr0.10.

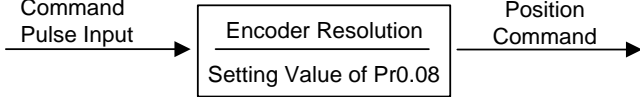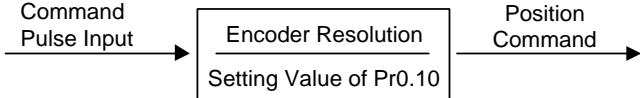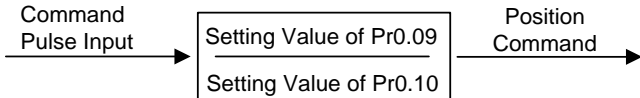| Pr0.08	Pr0.09	Pr0.10	Description
$0\sim2^{20}$	— (No influence)	— (No influence)	Command Pulse Input → [Encoder Resolution / Setting Value of Pr0.08] → Position Command The process shown above is undergone in terms of the setting value of Pr0.08, not affected by the settings of Pr0.09 and Pr0.10.
0	0	$0\sim2^{30}$	Command Pulse Input → [Encoder Resolution / Setting Value of Pr0.10] → Position Command When the values of Pr0.08 and Pr0.09 are both set as "0", as shown above, the process is undergone in terms of the setting value of Pr0.10.
	$0\sim2^{30}$	$0\sim2^{30}$	Command Pulse Input → [Setting Value of Pr0.09 / Setting Value of Pr0.10] → Position Command When the value of Pr0.08 is "0", but the value of Pr0.09 is not "0", as shown above, the process is underdone in terms of the setting values of Pr0.09 and Pr0.10.

10.1.3 Parameter Setting of YASKAWA Σ-V Servo Driver

Para. No.	Function	Value	Description
Fn010	Parameter input	0000	Set [0000]: modification to user parameters [PnXXX]

Para. No.	Function	Value	Description
	prohibition setting		and part of auxiliary function parameters [FnXXX] permitted. Set [0001]: modification to user parameters [PnXXX] and part of auxiliary function parameters [FnXXX] prohibited.
Pn000	Function selection basic switch 0	0010	Bit 0: Set 0, positive rotation at positive rotation command; Bit 1: Set 1, position control mode (pulse sequence command).
Pn200	Format selection switch of position control command	0005	Bit 0: Set 5, select the instruction mode as "pulse + direction", negative logic.
Pn50A	Input signal selection 1	8100	Bit 1: Set 0, Servo ON /S-ON, input from the 40th pin; Set 7, Servo ON all the time. Bit 3: Set 8, positive rotation not used and signal input (P-OT) prohibited.
Pn50B	Input signal selection 2	6548	Bit 0: Set 8, negative rotation not used and signal input (N-OT) prohibited.
Pn50F	Input signal selection 2	0300	Set it when servo motor with brakes. Bit 2: Set 3, brake interlock signal "/BK" is output from CN1-29, CN1-30 to control 24V relay used for brake.
Pn50E	Output signal selection 1	0211	Set it when servo motor with brakes. To avoid of CN1-29 and CN1-30 being used for other function and leading to brake ineffective, 3 is not allowed to appear in the 4 digits.
Pn506	Brake instruction-servo OFF time delay	Depended	Set it when motor with brakes Default setting is "0", setting unit is ms.
Pn20E	Electronic gear ratio (Numerator)	Need calculation	$$\frac{Pn20E}{Pn210} = \frac{\text{Encoder resolution} \times \text{Pulse equivalent} \times \text{Deceleration ratio}}{\text{Screw pitch}}$$ For example, screw pitch 5mm, 20-bit encoder, coupling direct drag, pulse equivalent 0.001mm, $$\frac{Pn20E}{Pn210} = \frac{2^{20} \times 0.001}{5} = \frac{1048576}{5000} = \frac{131072}{625},$$ When pitch is 10mm, $$\frac{PN20E}{PN210} = \frac{1048576}{10000} = \frac{65536}{625},$$ For a rotary axis with 13-bit encoder and deceleration ratio as 60:1, $$\frac{PN20E}{PN210} = \frac{2^{13} \times 0.001 \times 60}{360} = \frac{8192}{6000} = \frac{512}{375}.$$
Pn210	Electronic gear ratio (Denominator)	Need calculation	
Pn212	Encoder allocated pulse No.	Need calculation	Range: $16 \sim 2^{30}$, decided by PG division ratio. Assuming that pulse equivalent being 0.001, deceleration 1:1, pitch 10mm, set the parameter to 2500; when the pitch is 5mm, set the parameter to 1250.

10.1.4 Parameter Setting of DELTA ASDA-A Servo Driver

Para. No	Function	Format	Value	Description
P0-02	Driver status display		02	Monitor if the number of sent and received pulse is correct by setting this parameter. In Weihong control system, the correct quantity of pulse sent by control card is detected by pulse inspection to determine if there is electrical interference.
P1-00	External pulse input type	ZYX	102	X=2: pulse + direction Z=1: negative logic
P1-01	Control mode setup	ZYX1X0	0000	Z=0: during control mode switching, DIO is maintaining the set value. Since switching control mode is not used, Z=0. Y=0: forward rotation (CCW) (in terms of load). X1X0=00: position control mode.
P1-32	Motor stop mode selection	YX	00	Y=0: when there is no servo enabled, motor dynamic brake occurs; Y=1: motor is free. X=0: motor stops instantly, X=1: motor stops with deceleration.
P1-44	Electronic gear ratio (Numerator) (N1)	$1\sim32767$	Need calculation	N1/M= encoder pulses × 4× pulse equivalent× mechanical deceleration ratio/ pitch Representative value: encoder pulses=2500, pitch=5mm, pulse equivalent=0.001, deceleration ratio=1, calculation as below: N1/M= 2500×4×0.001/5 = 2 / 1, N1=2, M=1; When the multi-electronic gear ratio is not used, P2-60~ P2-62 are not required.
P1-45	Electronic gear ratio (Denominator) (M)	$1\sim32767$	Need calculation	
P2-10	Digital input pin DI1	X2X1X0	101	X1X0=01: digital input (DI1=SON), corresponds to 9th pin of CN1. X2=1: set DI1 input as NO (normally open) a-contact point.
P2-15	Digital input pin DI6	X2X1X0	100	Default setting of DI6 and DI7 are NC (normally closed) limit signal input pins; driver cannot run without being connected to pin 32 and pin 21 of CN1. X2=1: set DI6 and DI7 input as NO (normally open) a-contact points. X1X0=00, limit signal input of the driver is not used.
P2-16	Digital input pin DI7	X2X1X0	100	
P2-17	Function setting for digital input pin DI8	X2X1X0	100	External EMG stop input is not used.
P2-21	Function setting for digital output pin DO4	X2X1X0	108	DO4 corresponds to pin 1 & pin 26, used as clamping-position brake signal of Z-axis; X2=1: set DO4 output as NO (normally open) a-contact point; X2=0: set DO4 output as NC (normally closed) b-contact point; X1X0=08: set pin 1 and pin 26 as BK+ and BK- respectively.
P2-22	Function setting for	X2X1X0	007	DO5 corresponds to pin 28 & pin 27, used as servo alarm signal.

Para. No	Function	Format	Value	Description
	digital output pin DO5			X2=0: set DO5 output as NC (normally closed) b-contact point. X1X0=07: set pin 28 and pin 27 as ALRM+ and ALRM- respectively.
P2-51	Servo ON (SON) setup		0	0: Servo ON must be triggered by numerical input signal. 1: when servo is powered, if there is no alarm signal, servo will be automatically on. Set 1 when there is no SON signal wire.

10.1.5 Parameter Setting of DELTA ASDA-B Servo Driver

Para. No.	Function	Format	Value	Description
P0-02	Driver status display		02	Monitor if the number of sent and received pulse is correct by setting this parameter. In Weihong control system, the correct quantity of pulse sent by control card is detected by pulse inspection in order to determine whether there is electrical interference.
P1-00	External pulse train input type	ZYX	102	X=2: pulse + direction; Z=1: negative logic.
P1-01	Set control mode	YX1X0	000	Y=0: forward rotation (CCW) (from the view of load) Y=1: the rotation direction is reversed. X1X0=00: position control mode
P1-32	Motor stop mode	YX	00	Y=0: when there is no servo enabled, motor dynamic brake occurs; Y=1: motor is free. X=0: motor stops instantly; X=1: motor stops with deceleration.
P1-44	Electronic Gear Ratio (Numerator) (N1)	1～32767	Need calculation	N1/M= mechanical deceleration ratio × 4 × encoder pulses × pulse equivalent / pitch. Representative value: encoder pulses=2500, pitch =5mm, pulse equivalent=0.001 mm/p, deceleration ratio = 1, calculation as below: $N1 / M = 2500 \times 4 \times 0.001/5 = 2/1$, N1=2, M=1; When the multi-electronic gear ratio is not used, P2-60 ~P2-62 are not required.
P1-45	Electronic Gear Ratio (Denominator) (M)	1～32767	Need calculation	
P2-10	Digital input pin DI1	X2X1X0	101	X1X0=01: digital input (DI1 = SON) corresponds to 17th pin of CN1. X2=1: set DI1 input as NO (normally open) a-contact point.
P2-15	Function setting for digital input pin DI6	X2X1X0	100	Default factory setting of DI6 is NC (normally closed) limit signal input; driver can't run without being connected to pin 32 and pin 31 of CN1. X2=1: set DI6 input as NO a-contact point. X1X0=00, limit input of driver is not used.
P2-18	Function setting for digital output DO1	X2X1X0	108	DO1 corresponds to the 16th pin, as clamping-position brake signal of Z-axis; X2=1: set DO1 output as NO a-contact point;

Para. No.	Function	Format	Value	Description
				X2=0: set DO1 output as NC b-contact point; X1X0=08: set the 16th pin as BK+.
P2-20	Function setting for digital output DO3	X2X1X0	007	DO3 corresponds to pin 1, used as servo alarm signal. X2=0: set DO3 output as NC b-contact point; X1X0=07: set pin 1 as ALRM+.

10.1.6 Parameter Setting of DELTA ASDA-B2 Servo Driver

Para. No.	Function	Format	Value	Description
P0-02	Driver status display		02	Monitor if the number of sent and received pulse is correct by setting this parameter. In Weihong control system, the correct quantity of pulse sent by control card is detected by pulse inspection in order to determine whether there is electrical interference.
P1-00	External pulse train input type	ZYX	102	X=2: pulse + direction; Z=1: negative logic.
P1-01	Set control mode	ZYX1X0	0000	Z=0: during control mode switching, DIO is maintaining the set value. Since switching control mode is not used, Z=0; Y=0: forward rotation (CCW) (from the view of load); Y=1: the rotation direction is reversed. X1X0=00: position control mode
P1-44	Electronic Gear Ratio (Numerator) (N1)	1～32767	Need calculation	N1/M= mechanical deceleration ratio × 4 × encoder pulses × pulse equivalent / pitch. Representative value: encoder pulses=40000, pitch =5mm, pulse equivalent=0.001, deceleration ratio = 1, calculation as below: N1 / M = 40000×4×0.001/5 = 32/1, N1=32, M=1; When the multi-electronic gear ratio is not used, P2-60 ~P2-62 are not required.
P1-45	Electronic Gear Ratio (Denominator) (M)	1～32767	Need calculation	
P1-46	Set detector output pulse No.	20 ～ 40000	Need calculation	The value is decided by PG division ratio. Assuming that pulse equivalent is 0.001, deceleration ratio 1:1, pitch 10mm, sets the parameter to 10000; when pitch is 5mm, sets the parameter to 5000.
P2-10	Digital input pin DI1	X2X1X0	101	X1X0=01: digital input (DI1 = SON) corresponds to 9th pin of CN1. X2=1: set DI1 input as NO (normally open) a-contact point.
P2-15	Function setting for digital input pin DI6	X2X1X0	000	Default factory setting of DI6 and DI7 is NC (normally closed) limit signal input; driver can't run without being connected to pin 32 and pin 31 of CN1.

Para. No.	Function	Format	Value	Description
				X2=0: set DI6 and DI7 inputs as NC b-contact point. X1X0=00, limit input of driver is not used.
P2-16	Function setting for digital input pin DI7	X2X1X0	000	
P2-17	Function setting for digital input pin DI8	X2X1X0	000	External EMG stop input is not used.
P2-18	Function setting for digital output pin DO1	X2X1X0	108	DO1 corresponds to pin 6 & pin 7, used as clamping-position brake signal of Z-axis; X2=1: set DO1 output as NO (normally open) a-contact point; X2=0: set DO1 output as NC (normally closed) b-contact point; X1X0=08: set pin 6 and pin 7 as BK- and BK+ respectively.
P2-22	Function setting for digital output pin DO5	X2X1X0	007	DO5 corresponds to pin 28 & pin 27, used as servo alarm signal. X2=0: set DO5 output as NC b-contact point. X1X0=07: set pin 28 and pin 27 as ALRM+ and ALRM- respectively.

10.2 Wiring Diagram of Diver

10.2.1 Wiring Diagram of WISE Servo Driver

Weihong DB15 Driver Interface WISE Servo CN20 50P HD Plug

+24V	6		47	+24VIN
ALM	8		40	SRV-ON
SON	9		31	ALM+
CLR	10		44	A-CLR
GND	15		1	GND
			32	ALM-
PUL+	11		7	PULS
PUL-	12		8	/PULS
DIR+	13		11	SIGN
DIR-	14		12	/SIGN
A+	1		33	PAO
A-	2		34	/PAO
B+	3		35	PBO
B-	4		36	/PBO
C+	5		19	PCO
C-	7		20	/PCO

Figure 1 without brake lines

Note: twisted pair for differential signals

Weihong DB15 Driver Interface WISE Servo CN2 50P HD Plug

+24V	6		47	+24VIN
ALM	8		40	SRV-ON
SON	9		31	ALM+
CLR	10		44	A-CLR
GND	15		1	GND
			32	ALM-
PUL+	11		7	PULS
PUL-	12		8	/PULS
DIR+	13		11	SIGN
DIR-	14		12	/SIGN
A+	1		33	PAO
A-	2		34	/PAO
B+	3		35	PBO
B-	4		36	/PBO
C+	5		19	PCO
C-	7		20	/PCO

BK+（Red） 29 BRK-OFF+

Z-axis Brake Line 30 BRK-OFF-

BK-（Black）

Figure 2 with brake lines

Note: twisted pair for differential signals.

10.2.2 Wiring Diagram of PANASONIC AC Servo Driver (A5)

Weihong DB15 Driver interface   Panasonic MINAS-A5 Servo 50P HD Plug

Signal	Pin		Pin	Signal
A+	1		21	0A+
A-	2		22	0A-
B+	3		48	0B+
B-	4		49	0B-
C+	5		23	0Z+
C-	7		24	0Z-
PUL+	11		44	PULS1
PUL-	12		45	PULS2
DIR+	13		46	SIGN1
DIR-	14		47	SIGN2
+24V	6		7	COM+
ALM	8		37	ALM+
SON	9		29	SRV-ON
CLR	10		31	A-CLR
GND	15		41	COM-
			36	ALM-
		Red	11	BRKOFF+
		Z-axis Brake Line	10	BRKOFF-
		Black	50	FG
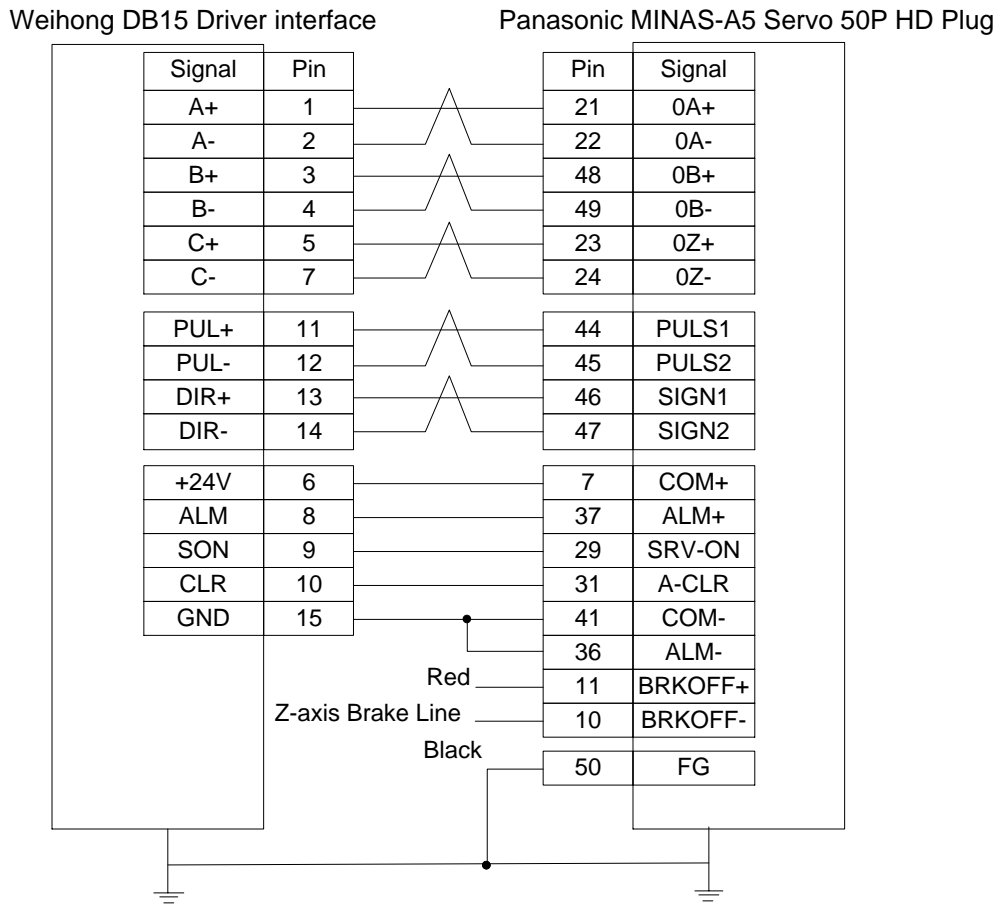
10.2.3 Wiring Diagram of YASKAWA Σ-V Servo Driver

Weihong DB15 Driver Interface   SGDM Servo CN1 50P HD Pins

Signal	Pin		Pin	Signal
A+	1		33	PA0
A-	2		34	/PA0
B+	3		35	PB0
B-	4		36	/PB0
C+	5		19	PC0
C-	7		20	/PC0
PUL+	11		7	PULS
PUL-	12		8	/PULS
DIR+	13		11	SIGN
DIR-	14		12	/SIGN
+24V	6		47	+24V
ALM	8		31	ALM+
SON	9		40	/S-ON
CLR	10		44	/ALM-RST
GND	15		32	ALM-
			1	SG

Red

Z axis brake line

	29	S-RDY+/BK+
	30	S-RDY-/BK-

Black

Figure 1
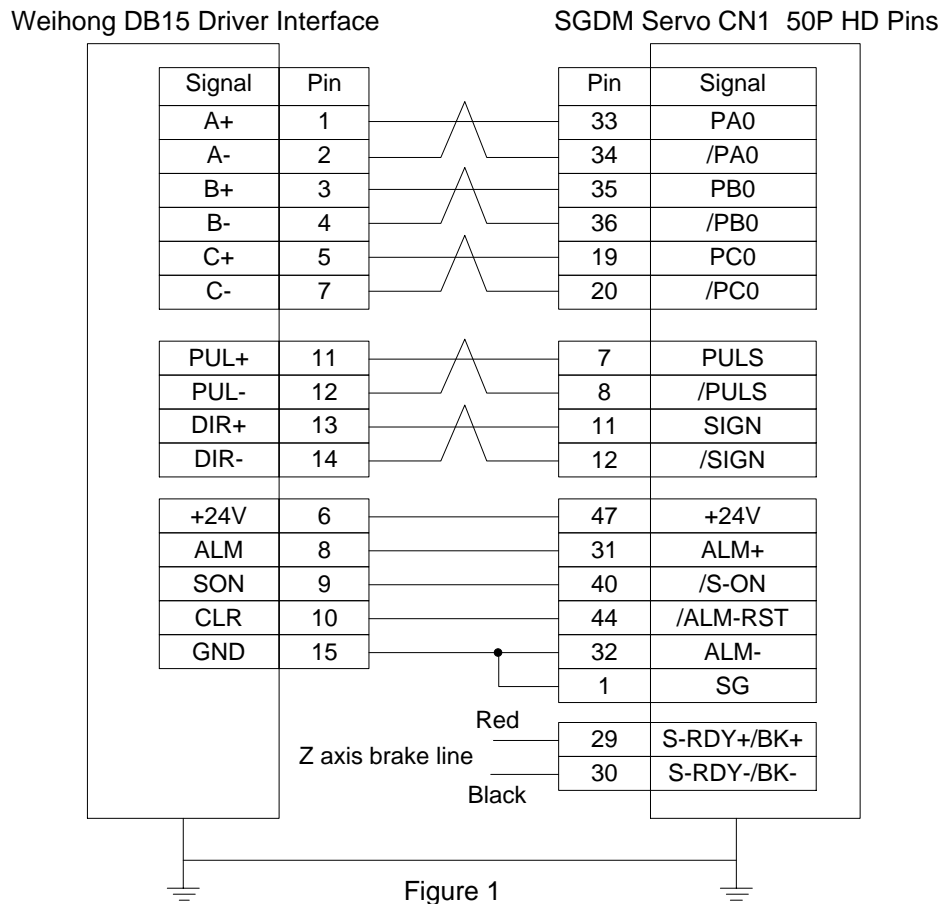
10.2.4 Wiring Diagram of DELTA Servo Driver (A/B/B2)

Weihong DB15 Driver Interface   DELTA ASDA-A Servo 50P

Signal	Pin		Pin	Signal
A+	1		21	OA
A-	2		22	/OA
B+	3		25	OB
B-	4		23	/OB
C+	5		50	OZ
C-	7		24	/OZ
PUL+	11		43	PULSE
PUL-	12		41	/PULSE
DIR+	13		36	SIGN
DIR-	14		37	/SIGN
+24V	6		11	COM+
ALM	8		28	DO5+ ALRM
SON	9		9	DI1 SON
CLR	10		33	DI5 ARST
GND	15		45	COM-
			30	DI8 EMGS
			27	DO5-
			47	COM-
		Red	1	DO4+
		Z-axis Brake Line	26	DO4-
		Black		

Figure 1
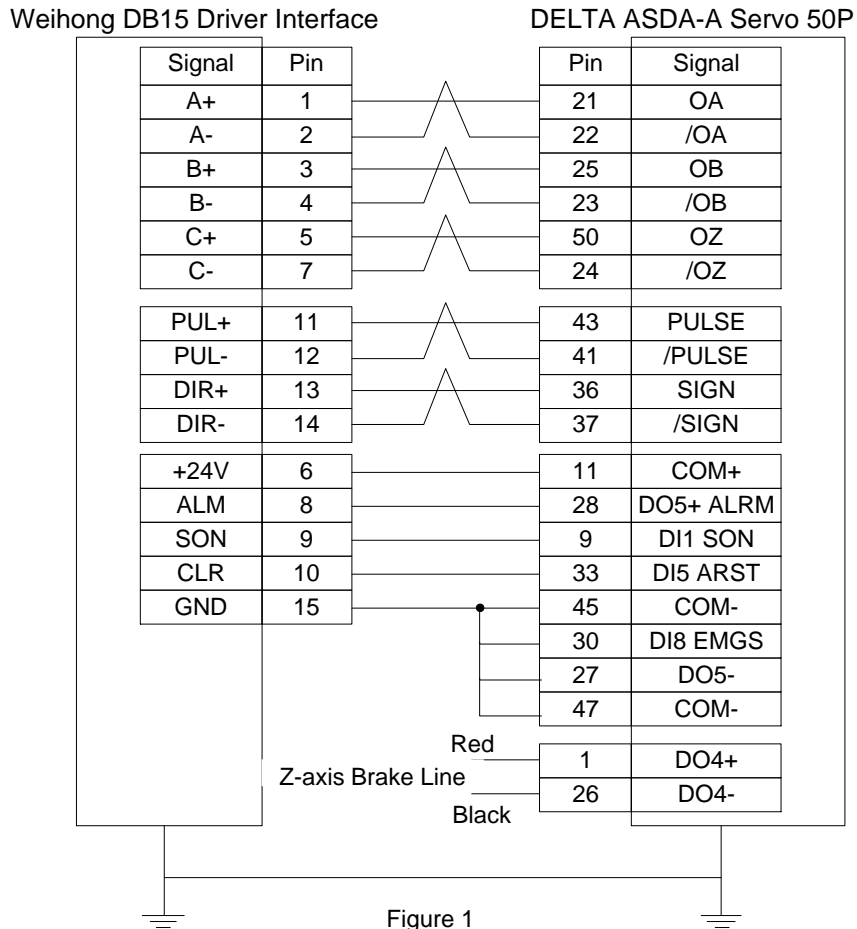
Weihong DB15 Driver Interface   DELTA ASDA-B DB25 (Two-line Pinholes)

Signal	Pin
+24V	6
ALM	8
SON	9
CLR	10
GND	15

Pin	Signal
4	COM+
17	DI1 SON
1	DO3+ ALM
18	DI2 ARST
13	COM-

Signal	Pin
PUL+	11
PUL-	12
DIR+	13
DIR-	14

Pin	Signal
22	PULSE
21	/PULSE
20	SIGN
19	/SIGN

Signal	Pin
A+	1
A-	2
B+	3
B-	4
C+	5
C-	7

Pin	Signal
10	OA
23	/OA
12	OB
11	/OB
24	OZ
25	/OZ

Red

Z-axis Brake Line

| 16 | DO1+ |
| 13 | COM- |

Black

Figure 2
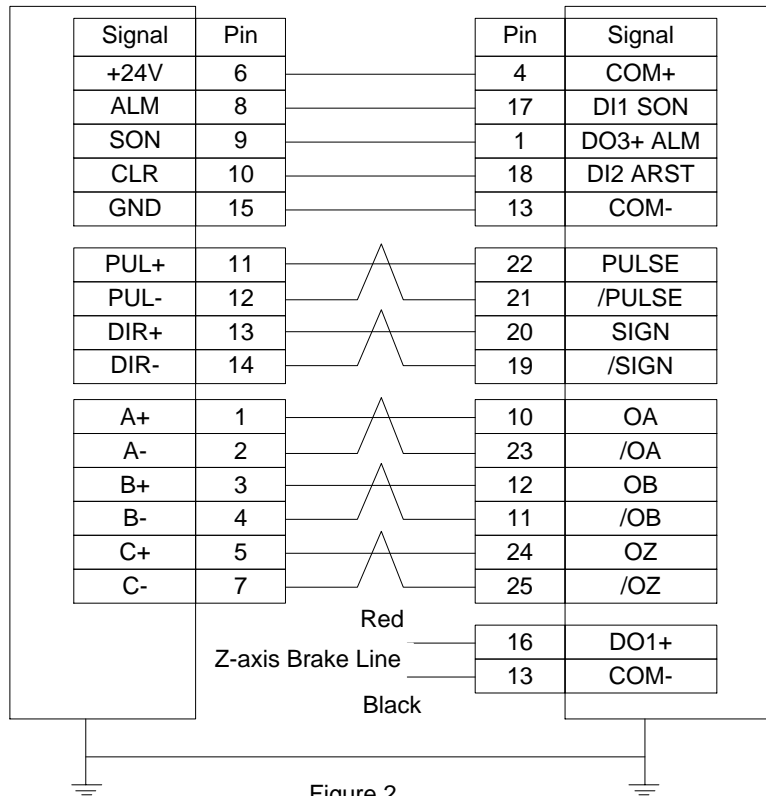
Weihong DB15 Driver Interface   DELTA ASDA-B2 DB25(Two-line Pinholes)

Signal	Pin
+24V	6
ALM	8
SON	9
CLR	10
GND	15

Pin	Signal
11	COM+
9	DI1 SON
28	DO5+ ALRM+
33	DI5 ARST
14	COM-
27	DO5- ALRM-

Signal	Pin
PUL+	11
PUL-	12
DIR+	13
DIR-	14

Pin	Signal
41	PULSE
43	/PULSE
37	SIGN
39	/SIGN

Signal	Pin
A+	1
A-	2
B+	3
B-	4
C+	5
C-	7

Pin	Signal
21	OA
22	/OA
25	OB
23	/OB
13	OZ
24	/OZ

Bk+ (Brown)

Z-axis Brake Line

| 7 | DO1+ |
| 6 | COM- |

BK- (Black)

Note: twisted pair cable used for differential signals

Figure 3

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