User Manual

BY-D1200 Series Intelligent Lifter

Version 1.8

2022-05

Backyard D1200 Lift Column/2021

SUMMARY OF DOCUMENT REVISIONS			
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5	2021/2/27	LJZ	RS V1.4
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7	2021/6/16	LJZ	RS V1.6
8	2021/11/1	KCW	RS V1.7
9	2022/5/14	KCW	RS V1.8

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1.0 PREFACE

1.1 GENERAL MATTERS

Thank you for using BY-D1200 product, this product is suitable for various collaborative/industrial robots and other motion control equipment, it can be used for packaging palatalization, AGV matching lifting column, research institute with robot lifting equipment and other applications which need to lift device in vertical direction.Please pay attention to the following tips before using thisproduct:

- Before using, please read this manual carefully and operate correctly based on full understanding.
- Keep the manual safe and accessible at all times.
- As for the basic operation of the device, there are other relevant records. Please read and understand carefully before using it and then operate it correctly.

1.2 SAFETY MATTERS

Non-compliant use may cause potential hazards, so the users of BY-D1200 are required to assess safety risks when using the device.These potential safety risk factors include;

- Shocks due to improper location Settings
- Impact when running at high speed
- Potential impact of robot mounted on lifting post

Non-compliant application types can also cause potential hazards.When the following types of applications are involved, our company does not recommend those use, so please evaluate with caution.

- Outdoor use, use involving potential chemical contamination or electronic interference, or use other than those specified in the product catalog and manual.
- Nuclear power equipment, incineration systems, rail and aviation, vehicles, medical devices, recreational facilities, safety equipment, and other facilities subject to administrative or independent industry regulations.
- Systems, instruments and devices that endanger the safety of life and property.
- Water, electricity and gas supply system, or 24 hours continuous operation system and other high reliability requirements of equipment.

1.3   A particular language

The serial number	The name of the	accept
1	Lifting column	Refers to BY-D1200 intelligent lifting column
2	Control box	Refers to the BY-D1200 micro-control box
3	URCap	URcap means UR robot companion software package
4	PolyScope	Refers to the UR robot software system
5	Cobots	Refers to collaborative robots

1.4   Robot matching and compatibility

BY-D1200 intelligent lifting column, and Universal Robots/Elite Robots/Aubo Robots etc, those Cobots are directly compatible with BY-D1200 lifting column. For example the URCAP software package is provided to support UR Robots with direct control or signal feedback, the top flange directly matches UR CB3 and E series Robots, to achieve plug and play function on installation.

- Universa Robots

- Elite Robots

- Jaka Robot

- TM robot

- Aubo Robot

- And soon.

If there are other types of robots which are not on the list, the lifting column controller can provide standard Modbus TCP interface, or directly contact our company to provide technical support.

2.0   HARDWARE INSTALLATION

2.1   EQUIPMENT THAT

BY-D1200 products, the standard packaging has covered all the corresponding parts to adapt the robot.The main components are:the controller and lifting column, the standard air plug is used between controller and lifting column for power supply and signal communication, as follows:

Figure 1 Component diagram1 Table 1

Detailed product details1

The serial number	The name of the	describe	The number of
1	Lifting column	BY-D1200 body and flange	1
2	Control box	Intelligent lifting column and robot control unit	1
3	Control handle	It is used to control the rise and fall of the lifting column	1
4	The power cord	24Vdc power supply connection for controller box	1
5	screw	For fixing screw holes on the upper and lower flanges of BY-D1200	A number of
6	USB disk	Software and owner's manual	1

2.2 The contour map

BY-D1200 intelligent lifting column, is electrical driving lifting column.The column adopts a compact design to minimize the weight of the body, while improving the push and torque, especially suitable for the use of lifting platform and collaborative robots.The outline of lifting column is as follows
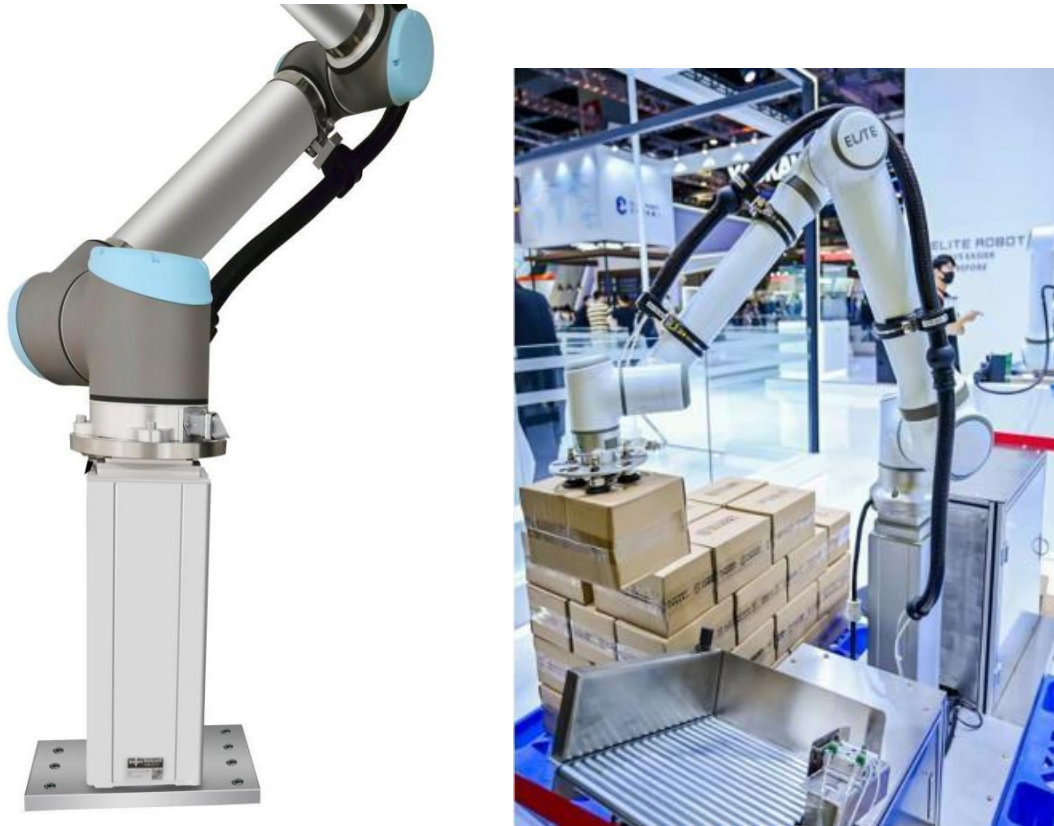
Figure 2 BY-D1200 outline drawing2

2.3 THE DETAILED DIMENSION

The intelligent lifting column itself has been reserved for flange connection holes and equipped with top flange conversion flange to match the robots.For the top, bottom and side installation dimensions of the intelligent lifting column , refer to Figure 3 Top, bottom and installation dimensions diagram of BY-D1200 (with custom flange plate), for the control box dimension refers to Figure 4 BY-D1200 control box size diagram
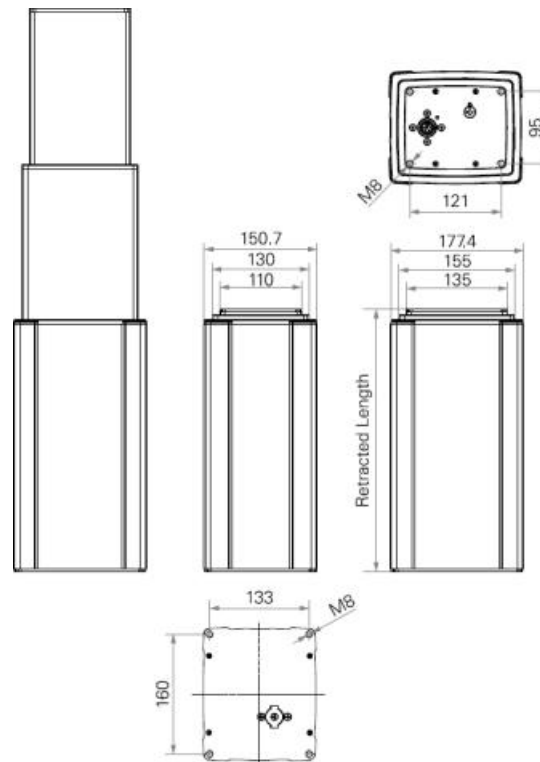
Unit: mm

Figure 3 BY-D1200 Top, bottom, and mounting dimensions diagram (with custom flange plate)

Note: The top of the lifting column has a flange transfer plate specially matched with UR robot, which is an additional optional part. The flange will be installed according to the robot model planned to be matched by the custome. In addition, the default standard flange is shown in FIG. 3 Top, bottom and installation size diagram of BY-D1200 (with custom flange plate).
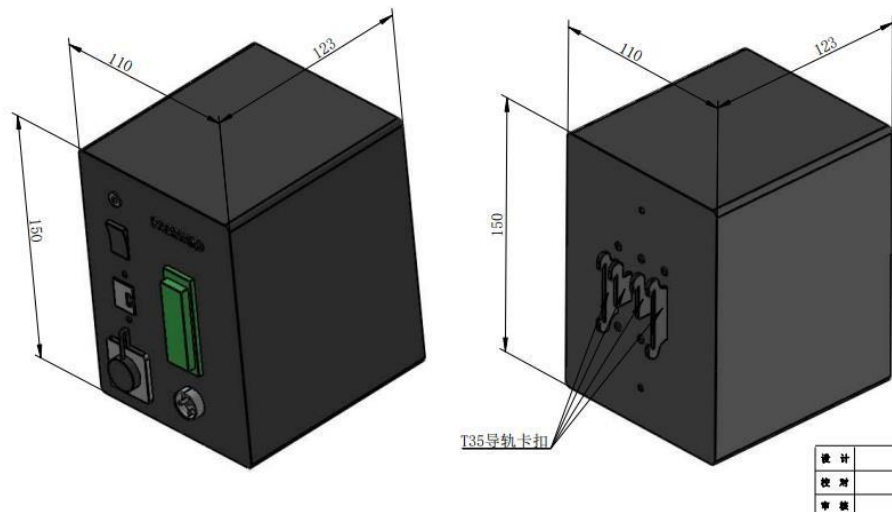
Figure 4 BY-D1200 control box size diagram4

The lifting column is equipped with a standard controller, as shown in the figure above.The lifting column is mounted with T35 guide rail buckles.

2.4   HARDWARE CONNECTION

2.4.1 Lifting column installation

When installing the lifting post, firstly put the lifting post upright, paying attention to the thin end facing up and the thick end facing down.

There are two steps when installing.

- Step 1, install the bottom flange connection

When installing, make the base retaining connection plates in advance according to the lifting column drawings.The corresponding flange hole specification position on the base of the lifting column body is M8.

- Step 2 Install the top flange connection

When installing, make the top retaining connection plate in advance according to the lifting column drawings if the customer has the own flange to match a robot.The corresponding flange hole specification on the top of the lifting column body is M8.

Safety matters:

- Make sure the screws are properly installed and securely in place.

- Make sure to assemble safely using tools and that there is no danger of parts accidentally falling during assembly.

- Make sure to align the Fran correctly and there is no risk of pinching your hands

- Attach with screws at the bottom and generally fix from the bottom up.

2.4.2 Control box connection

All you need to do when connecting the control box is to connect the corresponding wiring.

- Connect the control cables for the lifting posts. After the lifting post is installed, the control cable can be connected to the control box through the lifting post. Along the manipulator body, use cable ties or special cable fixed guide grooves to fix. The end of the control cable is connected to the control box.

- Connect the control handle to the control box, the control handle is used for debugging and manual control. The black button lifting post goes up and the white button lifting post goes down.

- Power connection. The lifting column is DC 24VDC and large, which requires direct access to 24VDC power supply and requires an external power supply capacity >250W. The power supply connectors of the lifting column are 24V - input and 0V-input, respectively connected to the corresponding 24VDC and OVDC.

- Ethernet connection. The Robot and lifting column control box communication is based on Ethernet connection. Connect the lifting column control box to the robot control cabinet using a network cable with a standard RJ45 connector.

Safety Considerations:

1. Make sure the lifting column control box, lifting column, and cable are not in contact with liquid. A damp control box can cause death.

2. Control boxes and lifting posts should not be exposed to dust or humidity beyond IP20 levels Pay close attention to environments with conductive dust.

Table 2 Introduction of the control box interface 2

| No.	The name of the	describe
1	Ethernet port	An Ethernet connection for connecting a robot or PC
2	Lifter interface	For connecting control box to lifting column
3	Joystick	Lifting column manual control box (can be omitted when not needed)
4	The power supply plug	Control box power supply, power range 24VDC, 10A
5	DIx	DI 1 is Normally closed short-circuit, it can be externally controlled with by a relay to stop when necessary (The third and fourth pins from the right are the emergency stop short-circuit normally closed). The
6	DOx	Backup, internal use only

FIG. 5 Lifting column control box5

Figure 6 Lifting column and control handle

2.5   MANUALLY CONTROL

The manual control box uses a three-core plug, which can be directly connected to the manual control box delivered with it.If you need to connect the external control, refer to the control chart as follows:
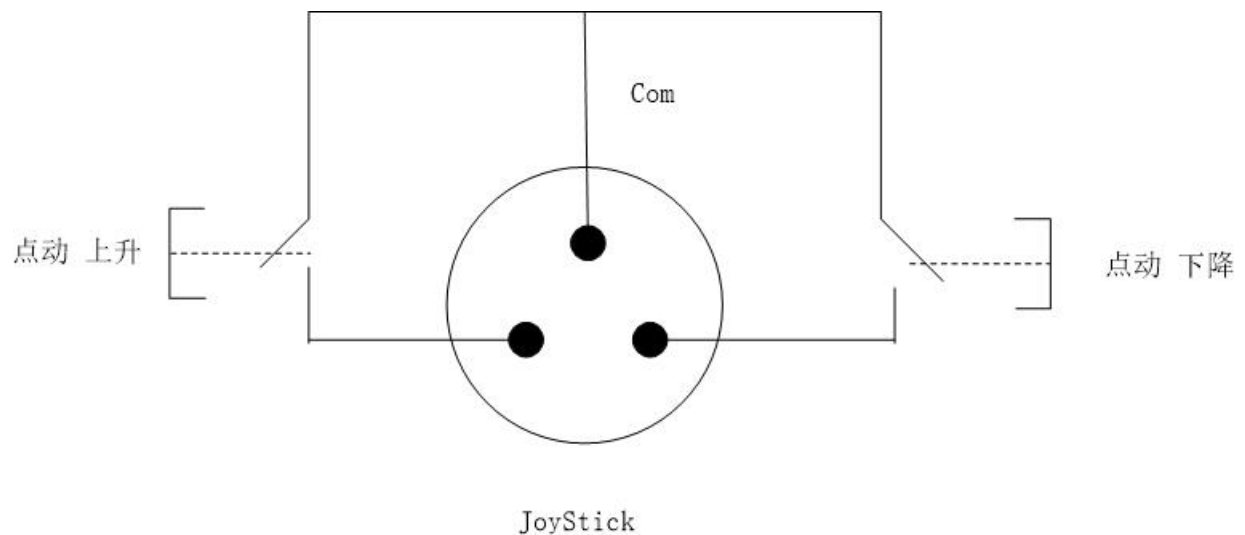
3.0 THE SOFTWARECONFIGURATION

3.1 COMMUNICATIONINTERFACE

BY-D1200 lifting column control box provides ModbusTCP Server interface, the function list is as follows:

address	Access permissions	Function code	variable	The name of the	The scope of	note
100	R/W	0x03/0x06	target_pos	Target Location Settings	0-1000.	Target position (mm), 40mm is 40.It takes effect immediately after setting.
0	W	0x05	go_up	Inching up	0, 1,	Dot move to rise, set to true when lifting column rises.
1	W	0x05	go_down	Point to move down	0, 1,	Point to move up, set to true when the lifting column drops (rise and fall interlock rise at the same time without action).
2048	R	0x02	Is_moving	Lifting post movement sign	0, 1,	Lift column to get 24V display as true.(The lifting column will automatically cut off the current at the upper and lower limit)
2049	W	0x05	Zero_actual_pos	Lift column encoder current value cleared to zero	0, 1,	When the zero position of the lifting column is lost, move the lifting column moving mode to the lowest position.In this case, set the position true and then false.Observe that the "current actual position" parameter will change to 0.
110	R	0x03	actual_pos	Actual location		Lifting column actual position unit 1mm, low precision
115	R	0x03	height_exact	Physical height		Lifting column physical height unit 1mm, low precision
120	R	0x03	actual_pos_exact	Real time location		The actual position of lifting column unit 0.1mm(when using soft zero, the actual value above soft zero is: read the value X0.1, return the value below soft zero 64536-65536 corresponding to -1000-0, you can convert the negative number after X0.1)
125	R	0x03	height_exact	Physical height		Physical height unit of lifting column 0.1mm
130	R	0x03	RT_target_pos	Real-time target location	0-1000.	Real-time target position value, as an indication that the target position has been reached.For example, when the "target position setting" is 100, it is found that the "real-time target position" value is also 100, the target instruction is completed.

140	R/W	0x03/0x06	Upper_limit	Position limit	0-1000.	Position upper limit, default value 1000 Restore default value after power restart.
						Automatically change the target to the upper limit value when the setting position is greater than the upper limit value.
150	R/W	0x03/0x06	Lower_limit	Position the lower limit	64536-65535.	Lower limit of location, default value 64536 Restore default value after power-off restart. Automatically change the target position to the lower limit when the setting position is less than the lower limit.
2	W	0x05	e_stop	Emergency stop	0, 1,	Normally closed signal, lifting column stops when set to false.
160	R/W	0 x03/0x06	Mode_Sel	Mode selection status	10 and 20	10, manual control box control mode; 20, remote control mode. In the manual control box control mode, TARGEt_pos input in the address table is invalid and can only be controlled manually.Remote control: Robot or PLC control over Ethernet.

Table 3 ModbusTCP address table3

3.2 THE IP ADDRESS CONFIGURATION

The default IP address of the control box is 192.168.1.5, the customer can change a different IP address using a software provided by BY company when it is inquired.

Configure the customer's computer in the same Network segment, you can click BY Network Configuration to change the IP address.

Figure 7 IP address change software of lifting column

3.3 EXAMPLE OF ELITE ROBOT

The Elite Robot uses the Lua script to match the Elliot Robot ecosystem. The BY company provides BY-D1200 lifting column complete drive script, which can realize plug and play.

Driver script import

USB drive import method

1. Put the lifting. Lua file in the directory of the RBCTRL /luadir folder, and then put the folder in the thumb drive.

2. Insert the thumb drive into the robot controller

3. On the robot demonstrator, select System -> USB Drive to Local -> Script Upgrade at the top left corner

4. Select User Craft -> Scripts in the upper right corner of the robot instructor and turn on Lifting.

SSH login import method

The Elite controller supports SFTP transfer, so we can put the lifting. Lua file in the/RBCTRL /luadir/ folder in the robot system via SFTP transfer

You can use SFTP software, such as secure_FX, moba_xterm, ftpSurf software You can also

use VScode or notepad++, which comes with the IDE

Robot ProgramDescription

D1 corresponds to the target position, such as lifting column range 0 -500 mm.When $D0==1$ is set, the lifting column starts to run, and the parameter of the target position of the lifting column needs to be set.When the lifting column reaches the target position, the D0 variable is equal to 0 again.

Example program:

		program description
NOP	Star tprogram
SET Dl 100	set target position 100mm
SET D0 1	the lifting column begins to move
WAIT D0 = 0	waiting to target position

| END | END program

3.4   EXAMPLE URCAP CONTROL

The UR robot can be controlled by Modbus TCP in the same way as the example in chapter 3.2, or control by URCAP directly. Here is an example of control by URCAP software.

When URCAP way is used, first copy the URCAP software package on the USB flash drive and install the URCAP software package in the robot teaching device. Note that after the installation, the robot will be prompted to restart, as shown in the following figure
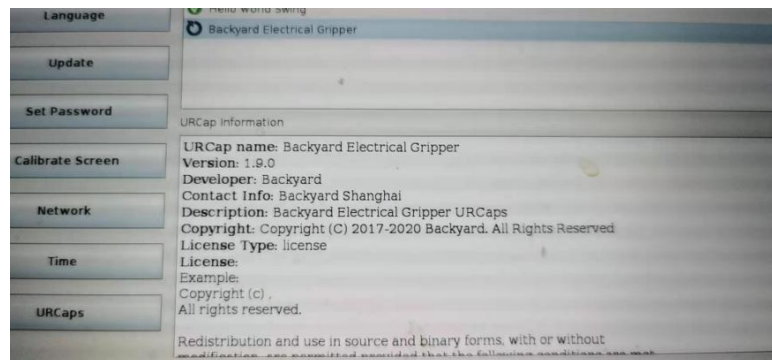

Figure 8 URCAP installation of the robot8

After URCAP is installed, in the robot command selection box, there will be a command block that lifts and directly controls the robot. Its function is similar to other commands of the robot, which can be directly inserted in the program.On the diagram below

sert

| Basic | Advanced | Wizards | URCaps |

| BY_eGripper | BY_eLifter |
| Hello World | |

dit

Figure 9 Robot URCAP command9

After inserting and lifting BY_eLifter, click the Command button in the robot program to directly input the lifting height. If you need to lift more than one height, you need to insert more than one BY_e Lifter button.On the diagram below

| Command | Graphics | Structure | Variables |

BY_eLifter

Action Arguments

TargetPosition: [0] mm   (The range is 1-500mm)

Perform immediately

Status

Current Position:

Target Position:

Running Status

B◄✛►Y Backyard
巴毅自动化

Figure 10 Robot URCAP command configuration10

3.5 EXAMPLE OF MODBUS TCP COMMUNICATION

For the robots other than Elite Robots and Universal Robots, the BY-D1200 is compatible with the standard MODBUS TCP protocol. This example takes UR CB series robot as an example to introduce the operation and use of lifting column. Other robots have MODBUS TCP interface can be configured with a similar operation.

3.5.1 IP configuration on the robot controller and lifting column controller

In order to be able achieve communication between the robot and BY-D1200 control box , firstly set the robot and intelligent lifting column control box in the same network segment, the control box IP is fixed with default 192.168.1.5, so the robot IP needs to be configured as 192.168.1.xxx (XXX is not 4 between 0 and 254).

If the robot is successfully connected to the lifting column control box, the status on the robot shows that the connection is successful.Figure 11 Robot IP setting Figure 11 Robot IP setting11

Figure 11 Robot IP setting11

3.5.2 Robot communication parameter Settings

The Modubus Tcp parameter is a parameter that must be set for the communication between the robot and the lifting column controller.The following is the robot ModbusTCP client interface you need to configure, each ModbusTCP address as follows. After the configuration is complete, you can operate the lifting column through ModbusTCP.

For example, if we want the robot to go to a 150mm height position, we need to enter 150 in the value of the target_pos .The lifting column will immediately run to 150mm.

During actual use, the lifting column may move continuously with a stop in different position. At this time, we can click GO_up and GO_down to raise or lower the lifting column.It is important to note that the register output value of the robot Modbus client is continuously sent to the lifting column.When we want to use GO_UP and GO_DOWN to move the lifting posts after using TARGEt_POS mobile robot, we need to first click the refresh button of the robot Modbus client interface (see the red circle below) and then operate GO_UP and GO_down. The robot will not go back to the previous "target position Settings" aftermoving.

Figure 12 BY-D1200 Parameter setting interface12

3.5.3 Robot Program

After setting the communication parameters, use the set and wait instructions to control the lifting column action normally.
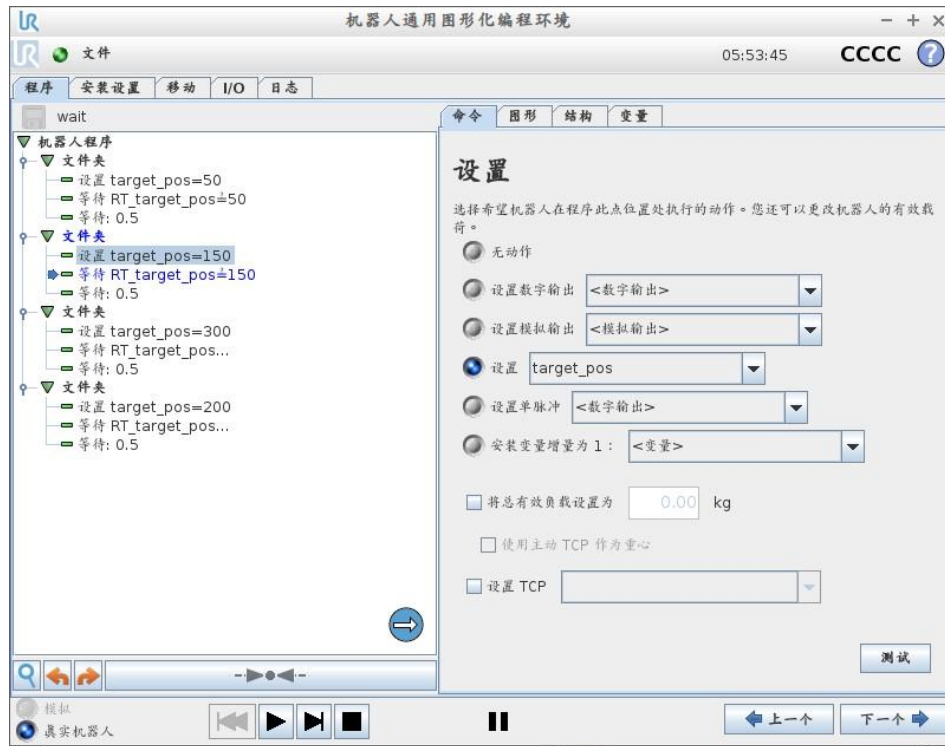

FIG. 13 Robot programreference13

3.6 OTHER ROBOT CONTROL MODES

BY-D1200 lifting column, currently with common robots on the market, with cases including at least:

Universa Robots Alite

Robots Saving Card

Robot TM robot

Sobo Robot

And soon.

The common communication function is Modbus TCP, which can meet the use of this kind of robot.For detailed interface information, see 3.5MODBUS TCP Communication Control Example。

3.7 SOFT ZEROFUNCTION

In addition to the basic functions of the lifting column, when some special functions are needed, you can refer to the following advanced functions. It is optional software function and are not necessarily be used in real applications.

3.7.1 Soft zero setting:

Lifting column zero can be set randomly by the user, you can set any height of the lifting column to zero, that is ' soft zero'. After this setting, you can read the height of lifting column relative to the current soft zero position. And set the target position above and below the soft zero according to this soft zero. Use the following variables to indicate the physical height and the height relative to the soft zero.

Height_exact is the physical height position and this value is maintained without power.

Actual_pos_exact is the height relative to the soft zero, above the soft zero 0 - 1000, below the soft zero read - 1000-0, since the Modbus register requires positive values for negative values,64536-65536 corresponds to - 1000-0.

If you want to know the actual physical height of the lifting column.Set the zero position twice as follows to obtain the physical height and hold the value without power.

Step 1: Click GO_Down to make the lifting column move to the lowest position, click ZerO_ACTUal_pos switch twice, and observe the Height_exact value to ensure that the value is zero.

Step 2: Move the lifting column to the position where the zero is needed, click Zero_ACTUal_pos once, at which point the value of actualPOS_exact becomes zero and the value of Height_exact remains the same.This completes the setup of the physical zero and the program soft zero.

3.7.2 Run height assignment

The lifting position to be performed can be set based on the soft zero position . Here's how to set it up:

To set 200mm above the soft zero, you can directly assign TARGEt_pos to 200; To set 200mm below soft zero, which is -200mm, the target_pos is assigned a value of - 200(the Modbus register automatically converts to a positive number which is - 200+65536).

3.7.3 Upper and lower limit settings

You can assign values directly to Upper_limit and Lower_limit to set the upper and lower limits based on soft zeros. For example, to set the upper limit for soft zeros to 200mm, you can assign Upper_limit to 200; To set the lower limit of soft zero to 200mm, which is -200mm, you can set Lower_limit to -200(the Modbus register will automatically convert to a positive number, which is - 200+65536).

For range of motion setting, the controller has default upper limit of 1000 and lower limit of -1000 (i.e. 64536), the register can be modified online, but the power will restore the default value.

When using GO_UP or the joystick to control the lifting column, the height of the lifting column can exceed the setting range of the upper and lower limits, but the lifting column will automatically return to the limit after the command is withdrawn.

3.7.4 Soft stop

The lift column E_stop is a soft emergency stop and defaults to true for Boolean types.When set to false, the liftpost will stop running.Restore the setting to true and continue to perform the movement as logical.
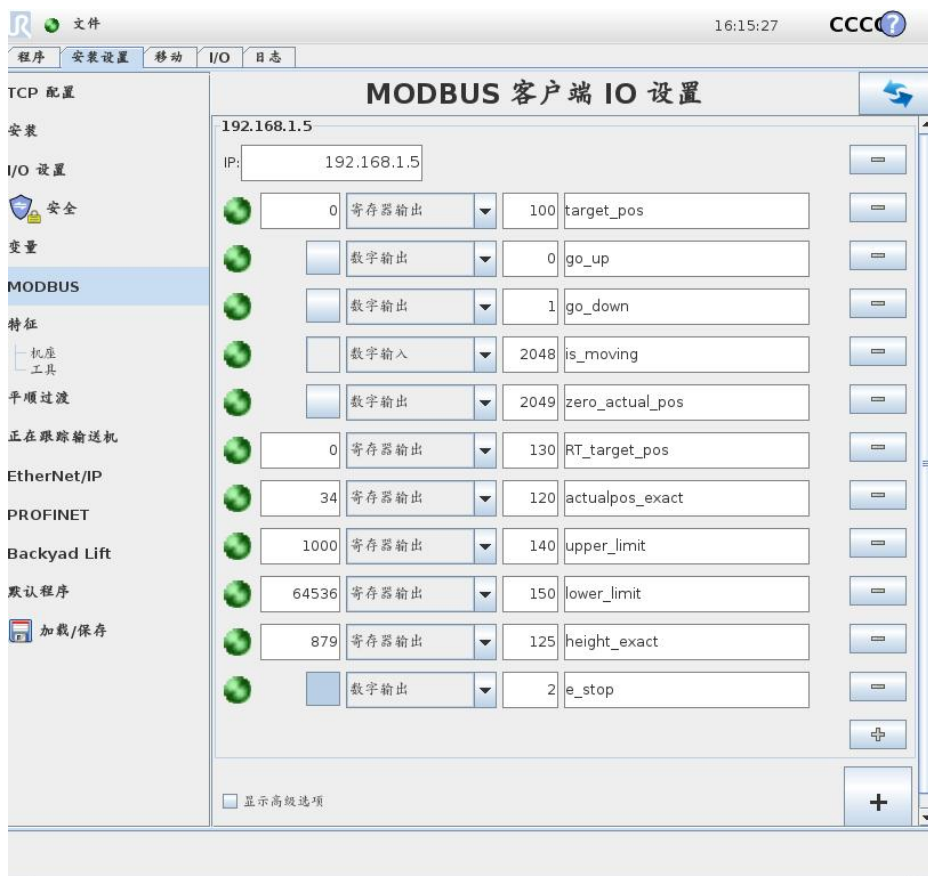

Figure 14 Robot client setup14

Manual

3.8 CONTROL CONSIDERATIONS

The lifting column control can be either manually or by Ethernet communication.In general, only one type of control is selected. After using Ethernet control lifting column, if you need to manually control to a new height, you need to refresh the register category in the robot Modbus TCP configuration interface, so that the robot can update the manual control information, otherwise the robot will default to use the port control data, back to the initial position.

For example, when using UR robot, if the manual controller needs to be controlled by Modbus TCP, the Modbus address list needs to be refreshed. This is because the Modbus has multiple devices written to the register, and the latest register needs to be updated.

Figure 15. Robot MODBUS register refresh15

In addition, the communication resources of UR robot Modbus client are limited. Adding too many addresses may lead to delay (indicator yellow) or unavailability (indicator gray)

3.9 Others

For the questions other than the manual illustrates, pls contact us.

Commercial&Tech support:

sales@backyard-auto.com

www.backyard-auto.com

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