User Manual

Teaching Pendant Operation (Ver: 2.0)

Copy Right

Initial Information of Manual

This manual organized by ADTECH (SHENZHEN) TECHNOLOGY CO., LTD.

Editor of manual：

Version：V2.1

Manual Range

This manual mainly makes an overall introduction about RPB06 FelxPendant, including monitor\program\installation wizard\debugging tools\system information\parameters\alarm handing:

- Monitor: coordinates and trajectory monitor;
- Program: mainly introduces how to build a project;
- Installation wizard: mainly introduces how to set robotic body parameters, such as robot length, reduction ratio , direction and so on;
- Debugging tool: mainly introduces some quick tools for debugging;
- Parameters: mainly introduces parameters about movement, communication and so on;
- Alarms handing: mainly introduces how to deal with some alarms occurred in robot running.

Precaution

※Transport and storage

- Product package iteration of no more than six
- It is not available in the product box on the climb, stand or place heavy objects
- Cannot use drag the cables attached to the product or handling products
- No collision, scratching the Panel and display screen
- Product box should avoid wet, dry and the rain

※Opening inspection

- After opening the packaging please confirm whether you purchased the product
- Check whether the products in transit damage
- Control list identifies whether the part is complete, there is no damage
- Product model, lack accessory or transport damage, please contact with me

※Wiring

- To participate in connections and inspection personnel must have the appropriate skills for professionals
- Products must be reliable earthling, grounding resistance should be less than 4 ohms; you cannot use the neutral (zero line) instead of ground
- Wiring must be properly and firmly, so as not to lead to product failure or unexpected consequences
- And surge absorption diode must be connected in accordance with the regulations are connected with, otherwise you will damage
- Plug or opens the front of the chassis; you must cut off the power supply

※Maintenance

- Must cut off the power before repair or replacement of components;
- Should check the faults when a short circuit or overload occurs, and make sure that faults have been solved before restart to run robot again;
- Cannot pass off frequently, if required to re-apply after a power failure, separated by at least 1 minute.

※Others

- Do not open the Cabinet without permission,
- Long when not in use, please cut off the power.
- To pay special attention not to let dust, iron powder into the controllers.
- Output relay if the use of solid state relays shall be freewheeling diode in parallel in the relay coil. Check if the power supply meets the requirements, put an end to the controller is burnt out.
- Life of the controller temperature has much to do with the environment, if the processing temperature is too high, please install the cooling fan. Controller working ambient temperature range between 0 ℃-60 ℃.
- Avoid high temperatures, humidity, dust or corrosive gas environments.
- Shake strongly to add buffer rubber Rails.

※Maintenance

Under normal conditions of use (environment conditions: average 30 ℃, load 80%, running 12 hours a day), please press the following items for routine checks and regular checks.

Daily Check	Daily	● Recognition of environmental temperature, humidity, dust and foreign bodies ; ● There are no abnormal vibrations; ● To ensure that the vent is not yarn plug, etc
Period Check	1 year	● Substantial part is loose or not ● Terminal block damage

Since the robot system is more complex, dangerous. The manual records and security-related precautions, please strictly observe transactions as recorded.

- **Safety Precautions and mark**

Mark		The meaning of mark
	Danger	Use wrongly, it will lead to a dangerous situation, causing serious injury or death.
	Caution	Use wrongly, It will lead to a dangerous situation that may cause personal injury or damage to equipment which caused material damage.
	Ban	Absolutely unenforceable
	Force	Must be implemented

- **Danger** 

Please do not use this system in the flammable and explosive environment.	
	Likely to cause injuries or fire.

-

Please follow the instructions drawings or wiring.	
	Prone to electrical shock and damage the motor.

-

In an energized state, do not arbitrarily pull the plug, in the operating state; do not touch the robot operation site.	
	Easy electric shock, causing personal injury.

-

Energized state, not for wiring, maintenance and other operations, be sure to power at least 5 minutes before proceeding.	
	Easy electric shock.

-

Please place robot controller and robot body firmly stand on the ground.

	When the fault occurs easily lead to electric shock, fire incident, easy to mistake

●

Non professional person, please do not open the robot controller case, please do not use hand to touch the drive and control of internal components	
	Easy electric shock

●

The energized state, do not touch the power plug of the robot controller	
	Easy electric shock

●

Please do not damage, press of cable heavily or cable suspended heavy load.	
	Easy electric shock

●

The energized state, do not plug off the port of robot controller.	
	Easy electric shock and short circuit

●

The running state, do not pull out the terminal of robot controller.	
	Easy electric shock and short circuit

●

- **Caution** 

Please caution the radiation of the motor of robot controller、robot body and accessories.	
	Vulnerable to burn

-

When a fault occurs, the power supply must be cut off, the cause is identified and removed, and the low speed running equipment should be removed.	
	If there is residual adverse factors, easy cause malfunction.

-

When using the controller and the robot body, do not exceed the specifications.	
	Easily cause damage to the product.

-

When the robot is handling, it needs to be fixed with the attached fixed tool.	
	To prevent the lifting arm, due to robot arm moving cause accidents.

-

Before installation, operation, maintenance check, be sure to read the instructions carefully, according to the instructions in the steps	
	Easy electric shock, catch fire

-

Power supply voltage, power capacity must be specified by the company's specifications.	
	Improper use of equipment failure, easy to catch fire.

-

Please correct use of the correct control of each other to robot controller and robot.	
	Failure-prone

-

Regularly maintenance and inspection work for robot controller	
	Ignoring maintenance and inspection, are important causes of equipment failure and accidents

Do not place heavy objects on the product	
	Easy to damage

Please correct wiring according to the instructions in the wiring	
	Wrong wiring easily lead to incorrect wiring or robot drive control machine damage or cause a fire

When an exception occurs, please stop immediately	
	Prone to electric shock, injury, fire

When in need of repair, please contact our company, do not attempt to disassemble	
	Could easily lead to malfunction

Do not strike	
	Could easily lead to malfunction

- **Ban** 

Robot operation, the officer is not allowed to stand in the area of robot motion.	
	Major disability incidents occur.

Banned in the workplace stacked hinder the operation of the robot equipment.	
	When the device is abnormal, likely to cause injury.

Prohibit the handheld emergency stop switch on the teaching pendant short.	
	Robot accident or not functioning properly, you need an emergency stop switch, stop operation of the equipment.

Prohibited without recording the instructions, incorrect operation.	
	Improper operation will bring a malfunction of the device.

Other than operator personnel is prohibited near the equipment	
	Touch dangerous parts can cause injury or serious accidents

When the accident occurred, to cut off the power, clear bad reasons	
	Adverse residual reason, the robot may malfunction, causing adverse consequences.

Prevent users from unauthorized replacement parts and carry out reconstruction	
	It will reduce system performance and may malfunction

Do not remove the cleanup by yourself	
	Easily lead to fire, electric shock
Do not place the product stored in leaking, water, gas and other hazardous environments	
	Failure-prone

✧ Mandatory 

Avoid direct sunlight when you save	
	Could easily lead to malfunction

Use within a predetermined range	
	Easily lead to burnout, failure

During operation of the device must be switched off guard	
	If open the protective cover could cause electric shock, the risk of disability

Operators should adequately trained	
	Improper operation can cause equipment to malfunction, resulting in injury or major disaster

Manual teaching, if the robot is not in the specified direction of movement, immediately press the emergency stop, stop equipment operation	
	Prone to accidents and failures

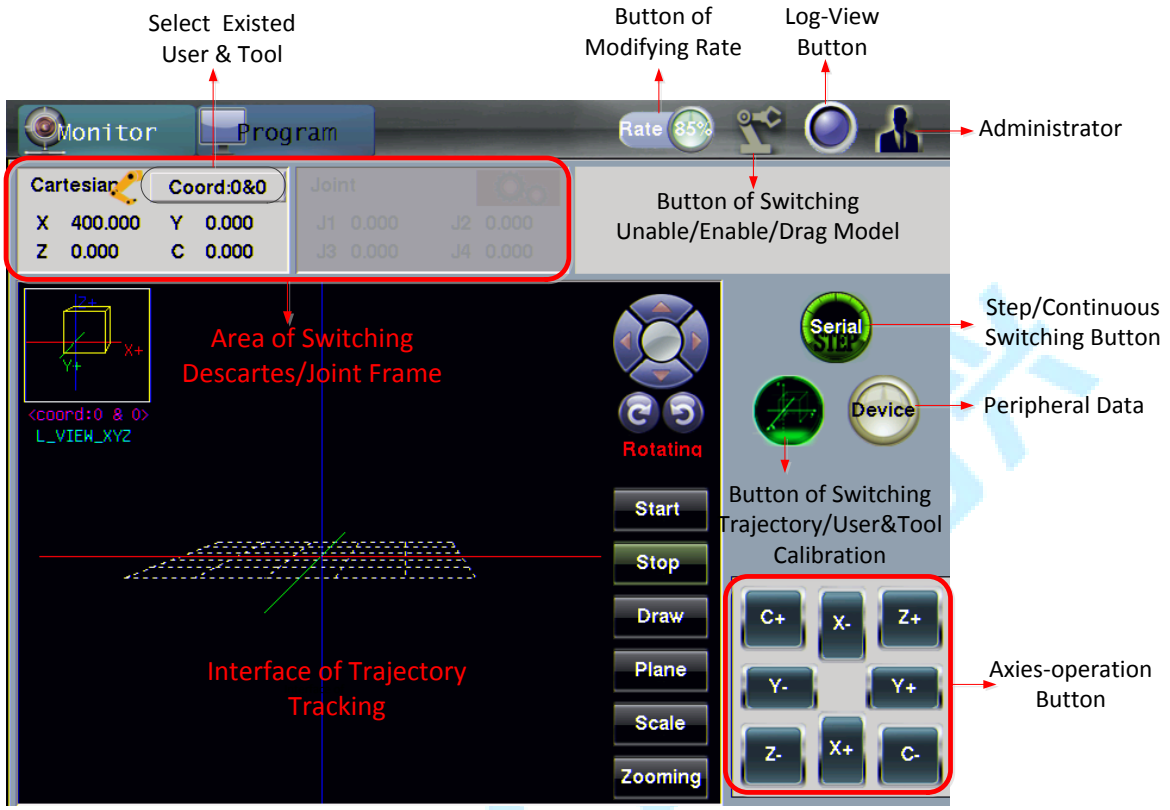
Be sure to use the specified power line wires	
	Prone to fire and malfunction

Safety Rules

- Before starting the operation, you should know that all the tasks in accordance with the robot programmed to be executed;
- Robots running in automatic mode, any movement of its personnel are not allowed to enter reach areas;
- When the need for programming, testing and maintenance work, shall robot under manual mode;
- When commissioning the robot into the work area shall carry the teach pendant, to prevent others from malfunction;
- When the robot for a long time does not work, the fixture should not place items shall be empty machine;
- After a power outage must close the main power switch on the robot, and remove the tool holder on;

Catalogue

1 List of Monitor Interface



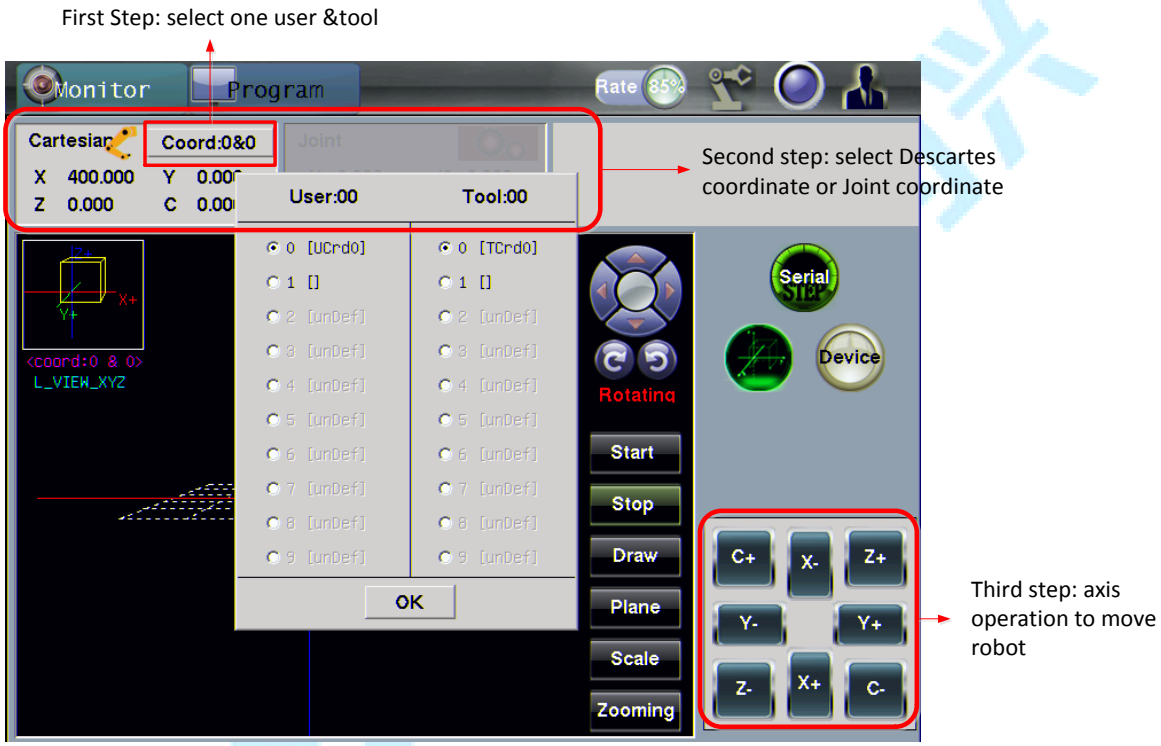
Some icons in this specification are named:

Icon	Name	Function
	Little orange-people	Be used to call the Project management Interface
	Robot	Be used to view state of the robot (Enable / Disable / Light-drag)
	Administrator	Be used to call interfaces of Parameters, SysInfo, Debug and Setup.
	Log ball	Be used to enter the interface of recording alarms

1.1 Manual Descartes/Joints

Descartes position refers to the actual X/Y/Z/C coordinates which are relative to the robot origin under the current coordinate system; Joint position refers to actual coordinates of J1/J2/J3/J4 axies under the current coordinate system. Cartesian or joint coordinate system can be switched by clicking on the Cartesian or Joint area. Three basic steps can be followed to operate in descartes/joint coordinate system:

- Select a corresponding user and tool coordinate in existing users and tools.
- Select deacartes coordinate or joint coordinate;
- Corresponding axis operations to move robot.



For Descartes/joints manually, it involves some other operations, such as continuous/step switching, rate changes, and so on.

Tip:

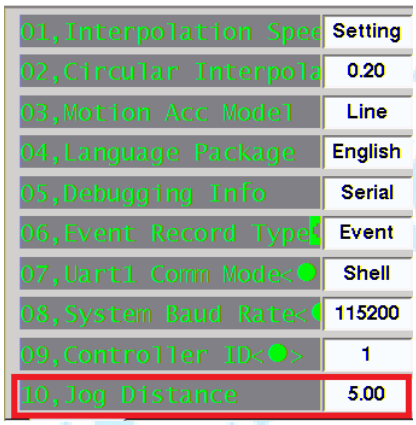
- Manual continuous/step movement determines the manual positioning accuracy;
- Rate is a global variable which affects manual and auto speed.

1.2 Manual Continuous/Single Step Movement

Click “ 

” button to switch continuous and single step movement. Here are some instructions:

- the single step involves parameters setting of jog diatance (default to 5.00), single-step model by distance divided into three: 0.10 1.00 and 5.00 (custom);
- under the Cartesian coordinate system, for X/Y/Z axes, length units are millimeter (mm); for C-axis, length unit is °;
- Under joint coordinates system, for X/Y/C axes, length unit are °, for Z-axis, length unit is millimeter (mm).



Tip:

- Continuous function is used to quickly locate an appointed position in manual mode;
- Switch to single step and select an appropriate feed for high precision on positioning.

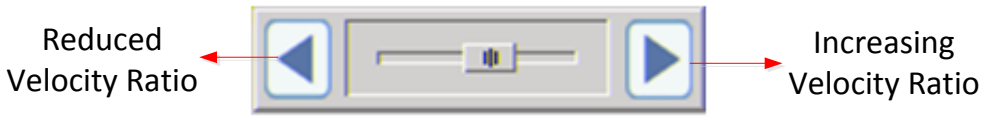
1.3 Rate Modification

Rate: auto or manual rate are speed percentage referred to the current speed set in parameters. Rate description:

- Rate variable is global, namely manual and automatic operation is called 1 time rate;
- Rate affect the actual speed of manual and automated runs;
- Manual actual speed is speed multiplied by the ratio manually, for example: setting J2 axis speed is 200, manually, such as the current rate is 50%, so the manual speed of current J2: 200*50%=100;
- Automatic grinding speed is the current speed multiplied by the ratio of the program;
- Manual and automatic speed needed in the parameter interface settings, including int erpolation speed and velocity.

Click “ 

” diagram and come out the menu for ratio setting. Use left and right button to increase or decrease the ratio.



Tips

- In any interface, operates can press “F7” key to decrease rate and press “F8” key to increase rate;

1.4 Robot State Switch

Robot has three states: disable, enable and light-drag state. Both disable and enable state can be used to move robot in automatic and manual mode; light-drag only applies to manual mode. Robot “  ” icon, which is used to switch robot between three states：

- Disable state is the default (icon color is gray);
- In manual mode, Light-touch the robot chart to switch the enable state (chart from grey to green);
- Press and hold robot figure to switch light-drag mode (figure from gray to yellow);
- Three states switches are in relation to non-enabled mode.


Disable: Robot is in a state of off-line simulation


Enable: Robot is in a state of on-line simulation


Light-drag： Easy to move robot manually

Tip:

- If you want to push the robot to a teaching position in manual mode, robot can be switched to light-drag mode;
- Enable robot manually to relieve light-drag mode.

1.5 Real/Virtual Position Switch

The gear has two states: open and close, which are respectively corresponding to the virtual and real position of robot.

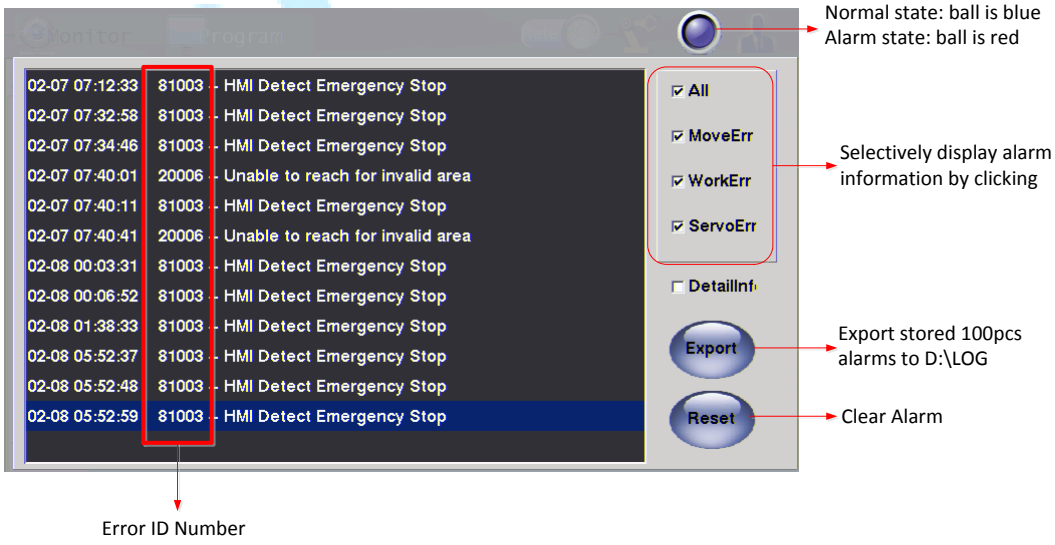
Click “  ” button to switch robotic virtual and actual position. It records the virtual position when two gears separates（  ）; and it records real position when two gears closes（  ）.

Tip:

- In some demonstration operation, you can switch gears closed (red) to obtain the real position of robot.
- In the light mode , the gear should be closed if obtain the actual robot’s position;
- For offline simulation, the gear should be separated if want to view motion trajectory in trajectory monitoring interface.

1.6 Log View

Click log“  ”diagram，switch to log interface which can show the recording alarms and latest 12pcs messages：

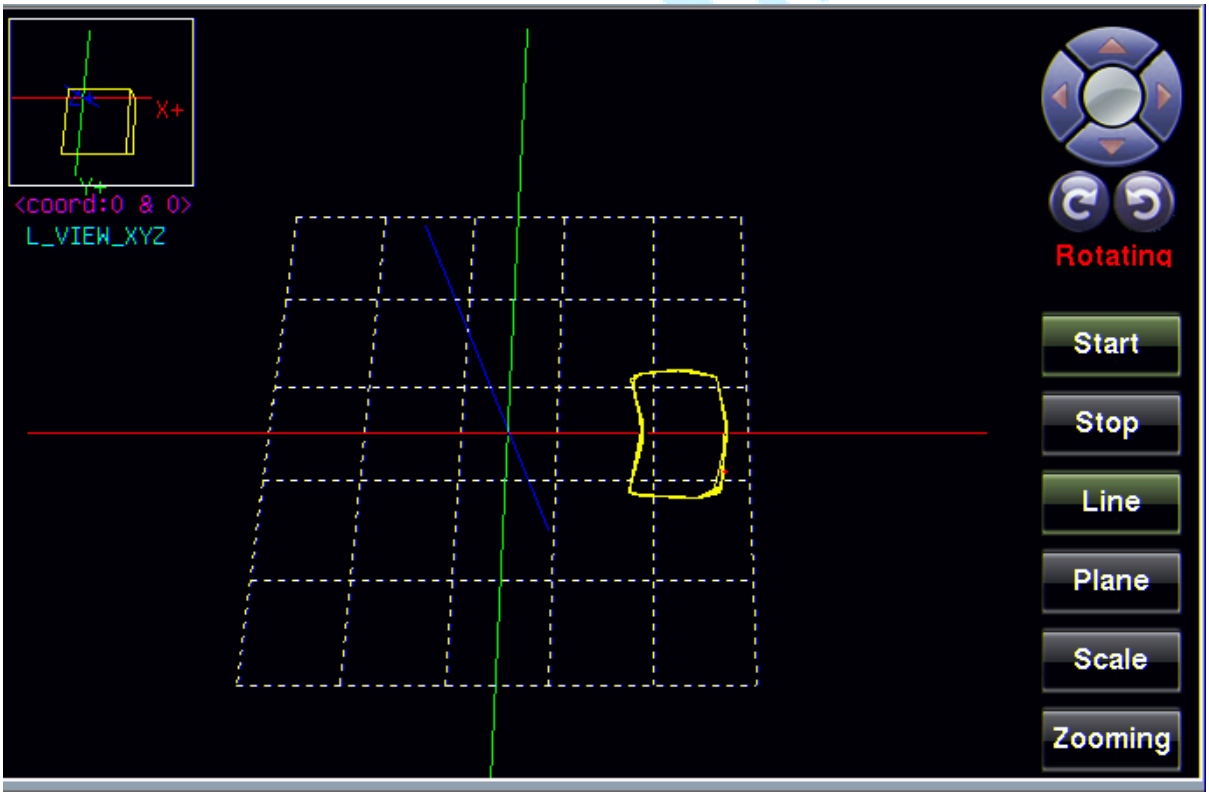


Tip:

- According to alarm records, it is easy to analyze causes of alarm, then to solve it.
- In any interface, press “F4” button to visit this interface to view alarm ID and content.
- If the alarm has been excluded, alarms can be cleared by the “reset” button of the alarm interface or the “reset” button of the indicator interface.
- In this alarm interface, 100 pieces’ alarms stored can be exported to D:\LOG directory by pressing “Export” button;
- Alarm number starts with 1 (1****), which stands for servo alarm; Alarm number starts with 2 (2****), which stands for motion alarm; Alarm number starts with 4 (4****), which stands for operation alarm; Alarm number starts with 8 (8****), which stands for system alarm;

1.7 Trajectory Tracking

Tracking interface is primarily for trajectory simulation of running programs. In the running process, it is intuitive to see trajectory of the end of the robot.



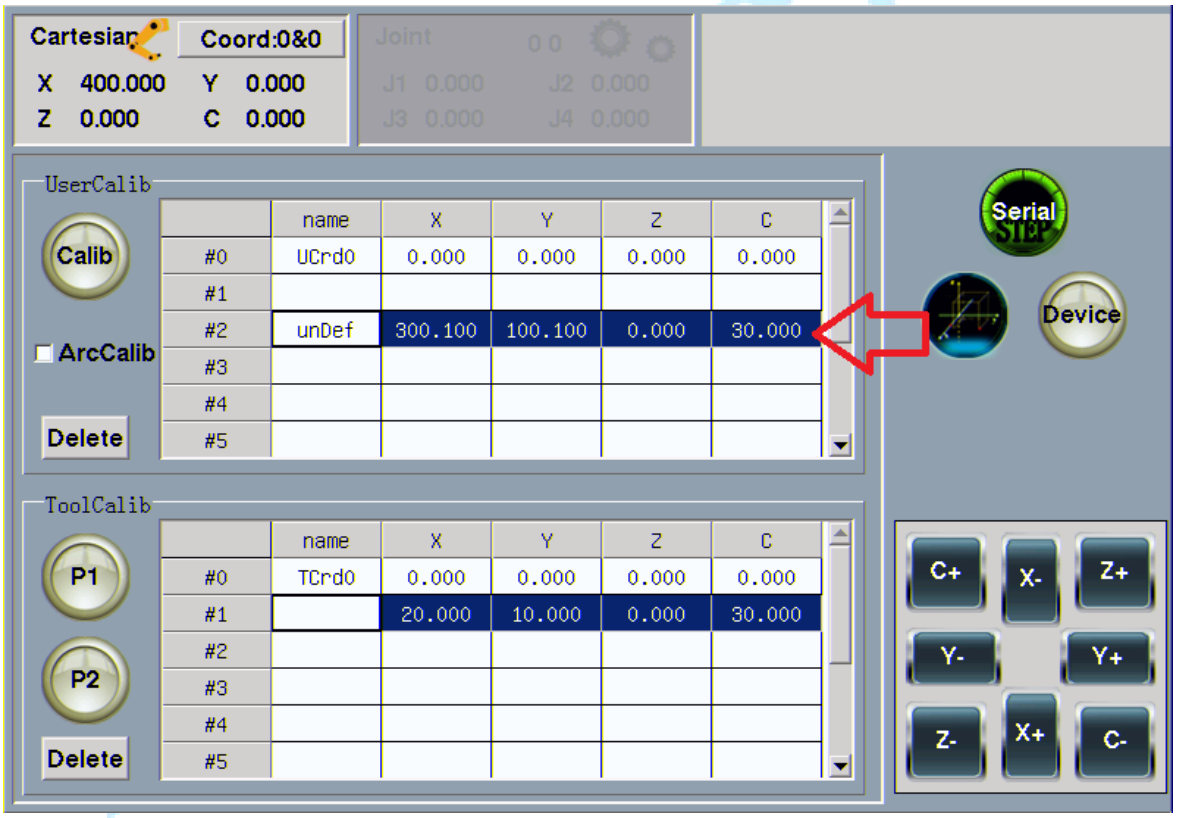
Tip:

- Tracking is often used in automatic mode to preview whether the trajectory is correct.
- For offline simulation, the gear should be separated ( ) if want to view motion trajectory in trajectory monitoring interface.

1.8 User/Tool Coordinate Calibration

When the base frame is not a reference zero, user coordinate systems can be easily measured the points' location when operates teaching position and calculations. RC400 controller can contain 10 user coordinate systems, in which user 0 is default as base frame of robot. User 1-9 can be set manually or generated directly by three -point method.

When a fixture is added at the end of a robot, trajectory of the movement will not be referred to the center of flange, but to end of the fixture. Tool frame will make teaching and programming more flexible. 10 tool frames can be contained in RC400 controller in which tools 0 is default. Tool 1~9 can be set manually or generated directly through two-points teaching method. In the monitor interface, click on "  "chart to enter user/tool calibration interface.



1.8.1 User Coordinates Calibration

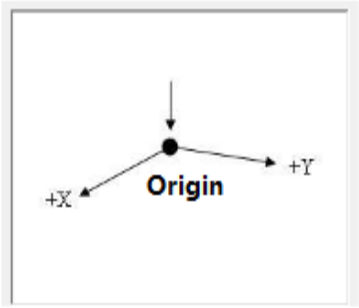
User coordinates calibration steps:

1) Select a user number from 1 to 9 (the line color of selected user number will mark as blue);

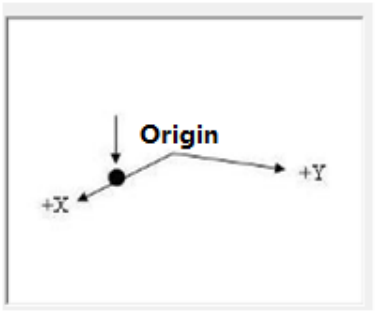
2) Click " 

" diagram to enter user coordinate calibration interface;

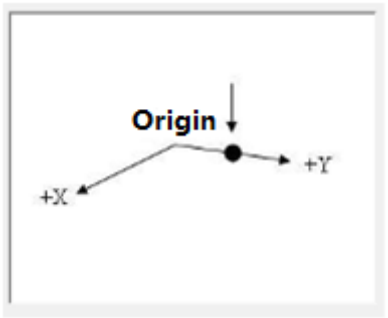
3) Select “Org” in “UserCalib” interface; Manually adjust the end of the robot to overlap the origin of the user coordinate system under Descartes coordinate system; Then click on “Teach” to assign the current robot’s position to “Org”.



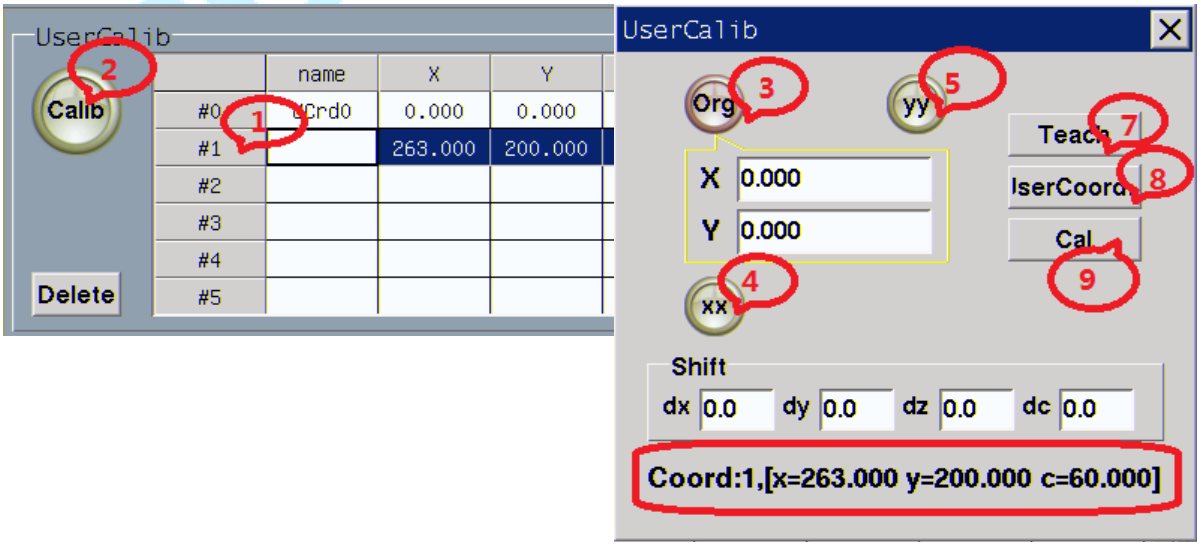
4) Select “xx” in “UserCalib” interface; Then move along the x-direction of the workpiece to reach a appropriate position; Then click on “Teach” to assign the current robot’s position to “xx”. Notice that C-axis is forbidden to be rotated, or it will lead errors during calculation.



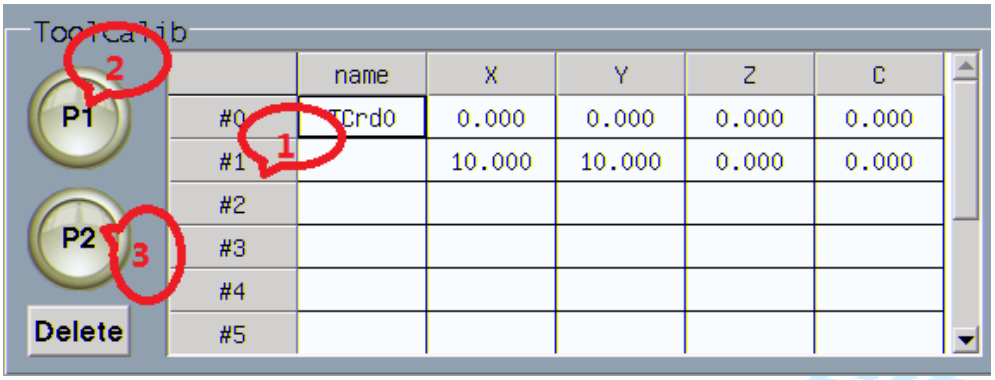
5) Select “yy” in “UserCalib” interface; Then move along the x-direction of the workpiece to reach a appropriate position; Then click on “Teach” to assign the current robot’s position to “yy”. Notice that C-axis is forbidden to be rotated, or it will lead errors during calculation.



6) After org/xx/yy is taught completely, then click “Cal” to generate user coordinates. View results of generated user coordnates (X,Y,Z,C). Specific orders are as follow：1,2, 3,7,4,7,5,7,8,9.

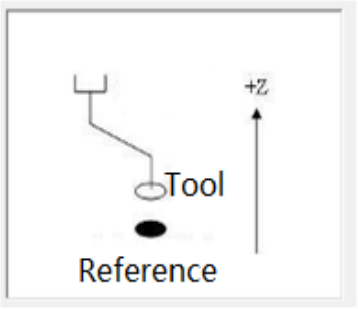


1.8.2 Tool Coordinates Calibration

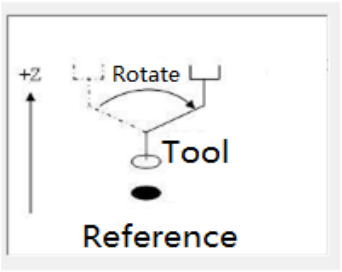


Calibration steps of tool coordinates are as follows：

1. Select a tool from 1~9 which are not used(the line color of selected tool number will mark as blue);
2. Two-points teaching method, in **left-hand** coordinate, adjusting the robot tool tip coinciding with the reference point, click on the "P1" (the current position assignment value for P1 points);



3. Under Right-hand frame, adjust the tool tip again coinciding with the reference point, click on the "P2"(location assigned to the P2). Calculates the tool parameters (X/Y/Z/C) records in the selected row.



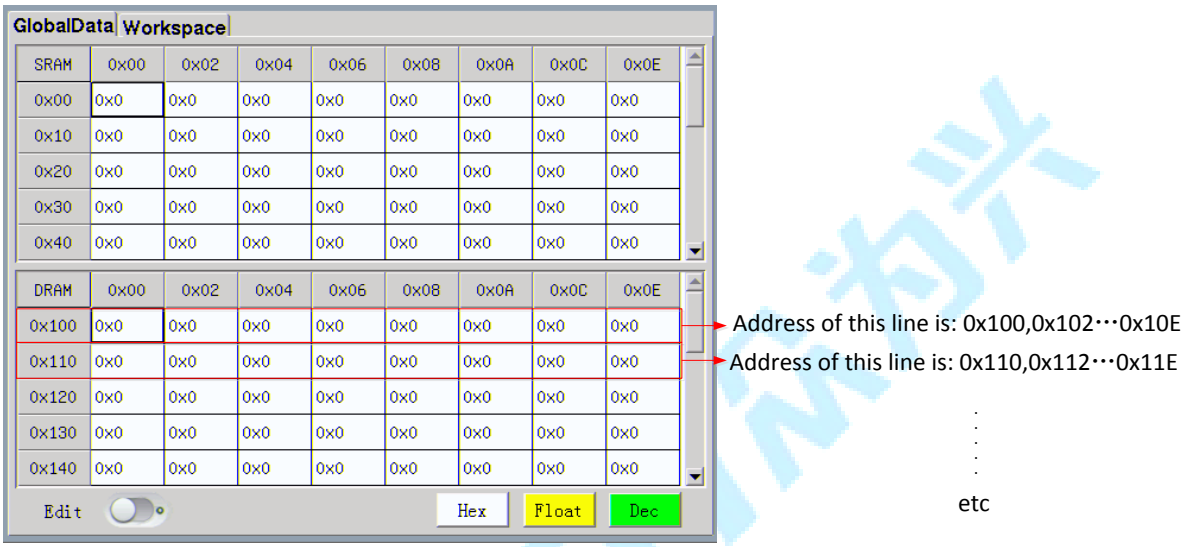
1.9 External Device

1.9.1 Global Data

Click " 

" to enter external setting interface which process external PLC and RC400 controller for Modbus communication data memory. There are two kinds of storage methods: **SRAM** (Static RAM) and **DRAM** (Dynamic RAM). SRAM is nonvolatile memory, which means that the stored data will not be lost in case of power off; Contrarily, DRAM is a volatile memory, which means that the stored data will be lost in the case of power off.

RC400 controller communicates with external devices through Modbus, RC400 controller is used as a slave station and the external device is used as a master station. Length of stored data is 32 bits, and each data is occupied with 2-length address. Both SRAM and DRAM can store 128 data, in which memory address of SRAM is from address 0 to 254 and memory address of DRAM is from 256 to 510.

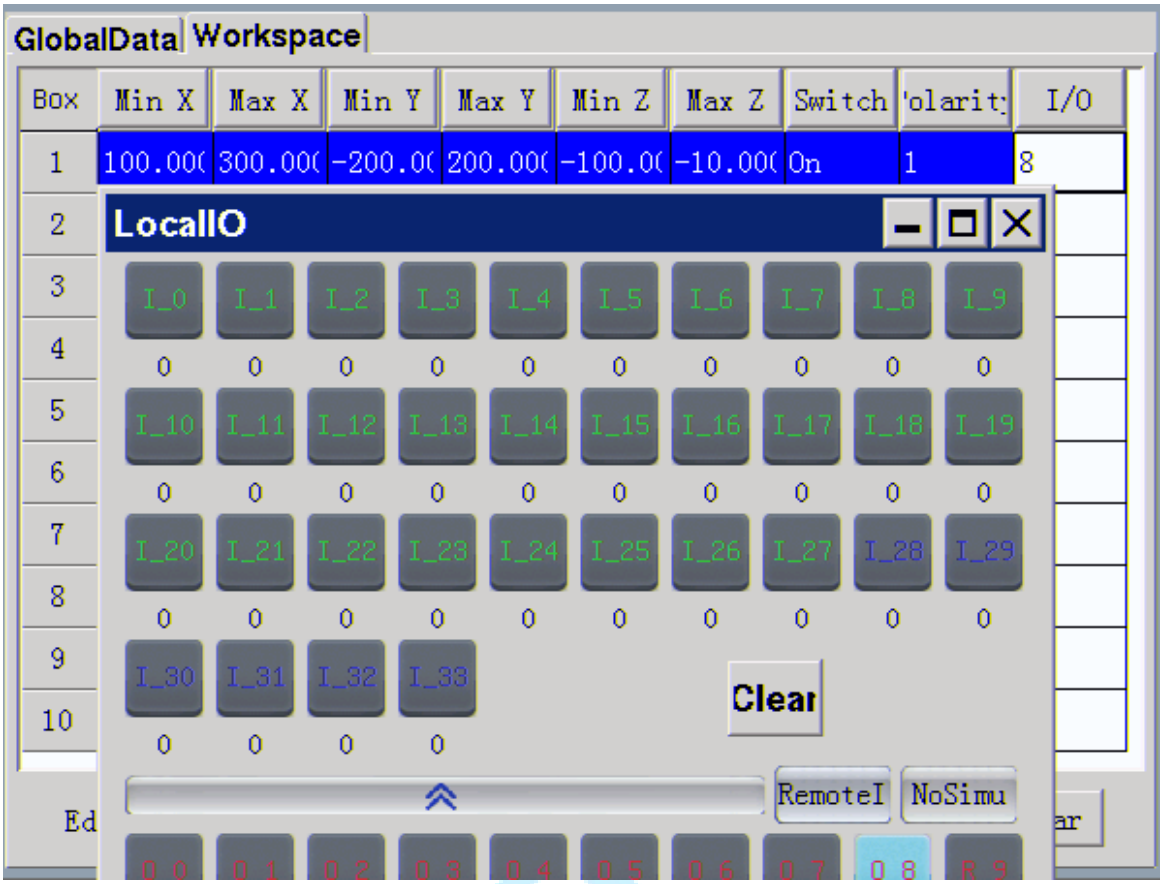


Tip:

- The type of read data should be consistent with the type of PLC data written to the controller. For example, if the type of data written to controller is float, then they must be read in the form.
- In AR program, operators can use **publicwrite** command to write data to corresponding address, and use **publicread** command to read data from corresponding address.
- When the robot is slave station, the relevant functional address can refer to the **Modbus manual**.

1.9.2 Work Space

Work Space: When the robot is normal, the end effector can be the maximum range of space activities, also known as safe space.

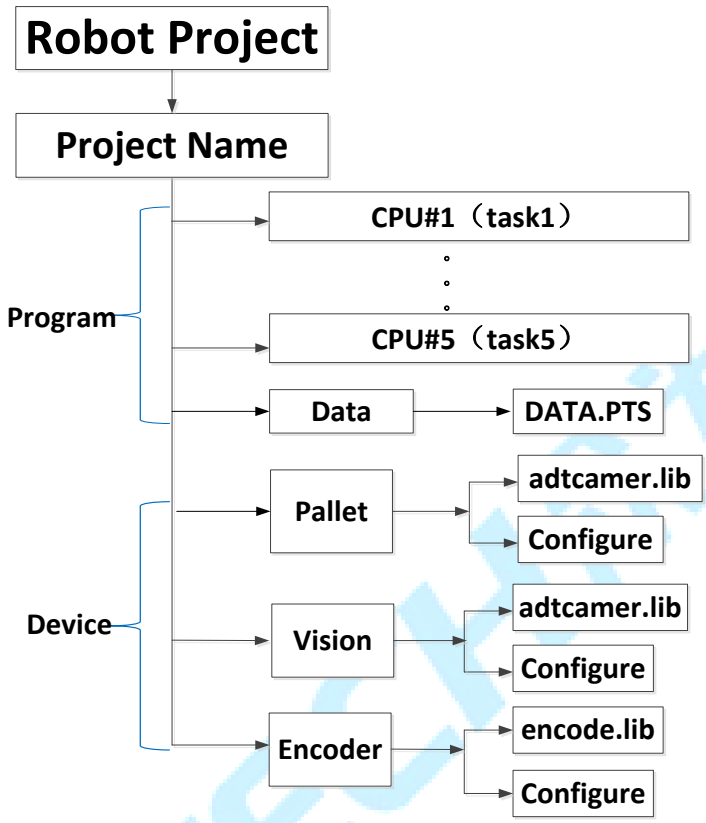


Tip:

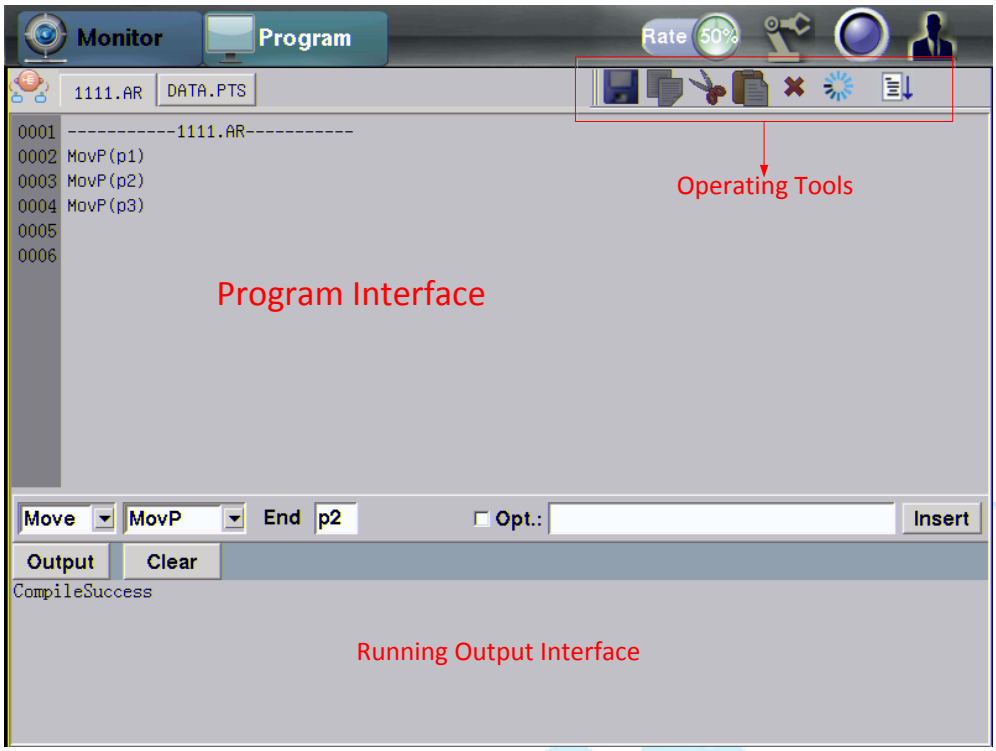
- Set the appropriate X/Y/Z range according to the application process;
- "**Switch**" has two operations: On and Off, in which **On** means to use WorkSpace function, Off means to not use WorkSpace function.
- **"Polarity"** has two state： **0** and **1**，where 0 represents the position of the end of the robot beyond the set workspace, the corresponding output port will open, 1 represents the position of the end of the robot in the set workspace, and the corresponding output port will be opened.
- **"I/O"** sets the corresponding output port according to the actual electrical wiring.

2. Programming

RC400 controller programming is mainly around the project tree：



Programming interface：



2.1 Project

- Robot project is managed in a form of project, which contains configurations of all devices (visual communication, external encoder and pallet) and programming (each CPU task program);
- It is convenient to copy one project from one controller to another controller with same type.

2.1.1 Build Minimum Project

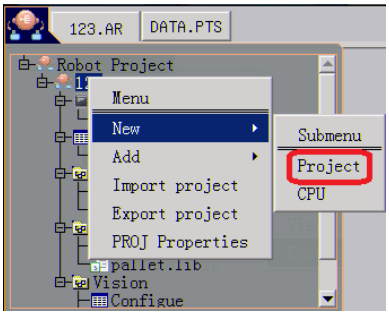
Here, we establish a minimum project to demonstrate its operation and application; a minimum project includes a CPU and a point table (DATA.PTS).

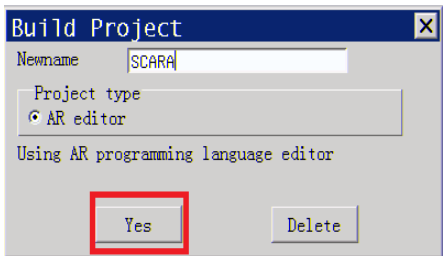
2.1.1.1 New-built

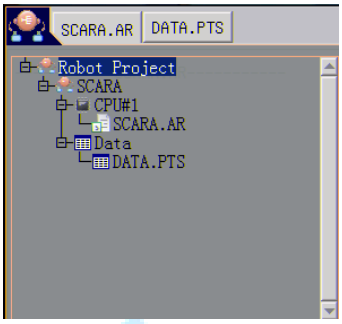
Steps to establish a new minimum project are as below:

1. Click the small orange ball “  ” figure to pop up a “Robot Project” menu;
2. In “Robot Project” menu , long press an existing project name (Assuming 123) to pop up a “Menu” list;
3. Select “New” to pop-up “submenu” list;
4. Select “Project” in the “sub-menu” list to pop-up “Build Project” dialog box;
5. In “New Project” dialog box, type a new name (Assuming SACRA), then “Yes”. So

the framework of called SCARA minimum project has generated, then you will need to configure CPU #1 and teach some points.

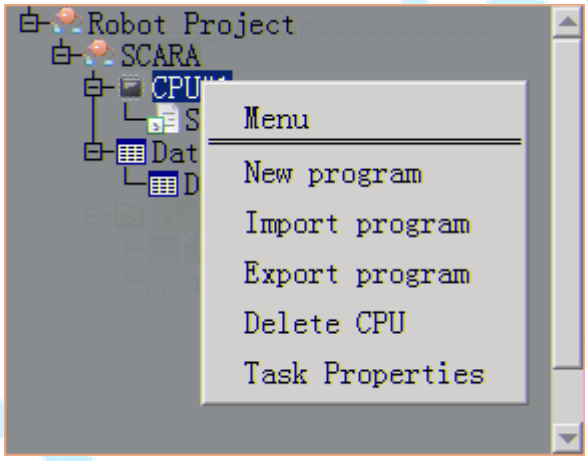






2.1.1.2 CPU#1 Stting

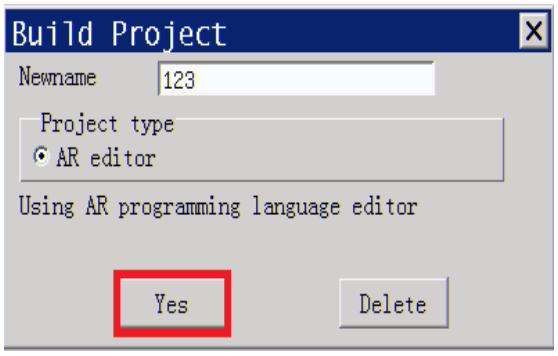
CPU#1's mission is to perform some motion commands, delay command, IO, and user &&tool coordinate system settings. CPU#1 setting is including new/import/export programs, delete CPU and task properties. Press "CPU #1" to pop up "Menu" list:

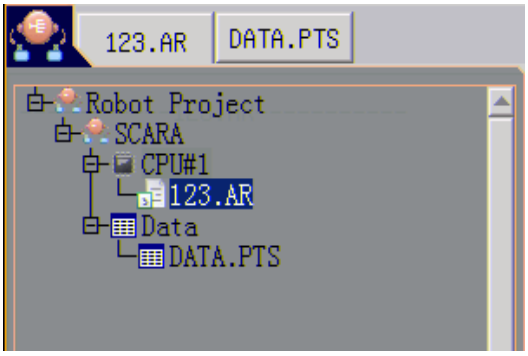


➢ **New Program**

It is suit for some simple testing programs, such as point, line, arc, arch and some simple motion commands. Specific steps are as follows:

1. Select the "New Program" in "Menu" list to pop-up "Build Project" dialog box, then type a new name (Assuming 123), then "OK". For example, to achieve to run a square in 123.AR, then you need to teach some points and write AR programming.





2. **Teach point**. Open the "DATA.PTS" file and select P001*1 (if selected, this line becomes black), then move the robot to (368, 80, -10, -113.401) position; Next, click "Teach" to assign this point to P001. And then teach P002/P003/P004 with the same ways, thus four points are recorded in "DATA.PTS" list, and then click the save "  " button.

	Name	X	Y	Z	C	User	Hand
P0000	HOME	400.000	0.000	0.000	0.000	0	Right
P0001		360.000	80.000	-10.000	-113.401	0	Left
P0002		200.000	80.000	-10.000	-113.401	0	Left
P0003		200.000	-80.000	-10.000	0.000	0	Left
P0004		360.000	-80.000	-10.000	-113.401	0	Left
P0005*							
P0006*							
P0007*							
P0008*							
P0009*							

Edit

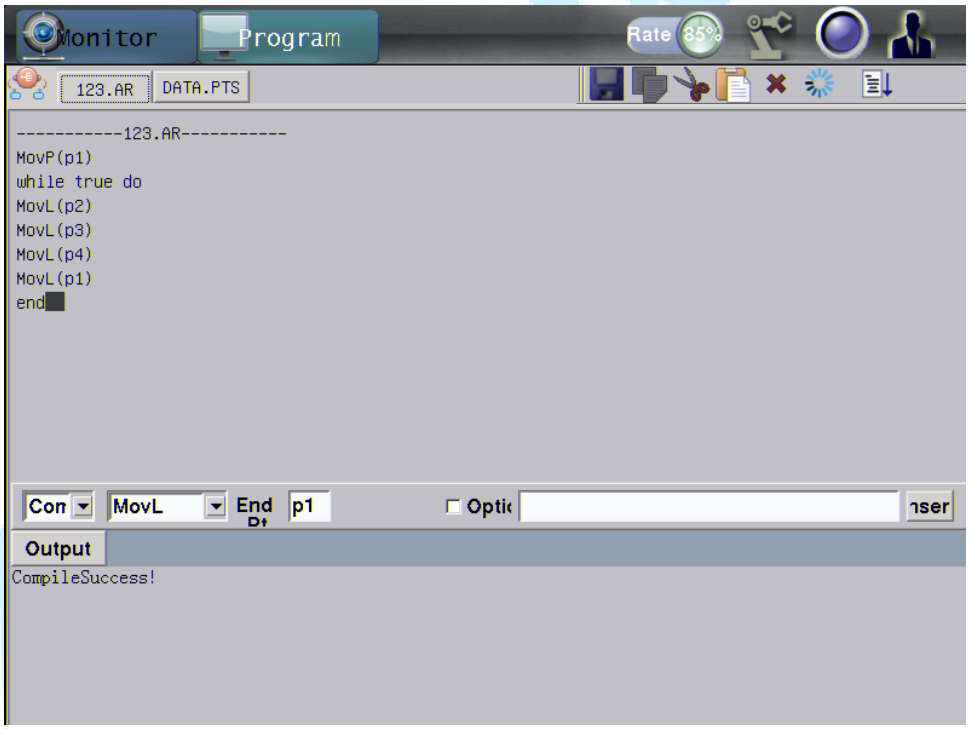
Tips：P000 is fixed robot's zero point which cannot be modified. Usually, tracking this point can quickly find zero point.

Taught points can be processed. For example, long press "P0001" to the pop-up "Handle Pt" (handle point) menu list, including Delete Pt, Line Copy, Line Paste, and Movp to Pt (track this point with **MovP** command).

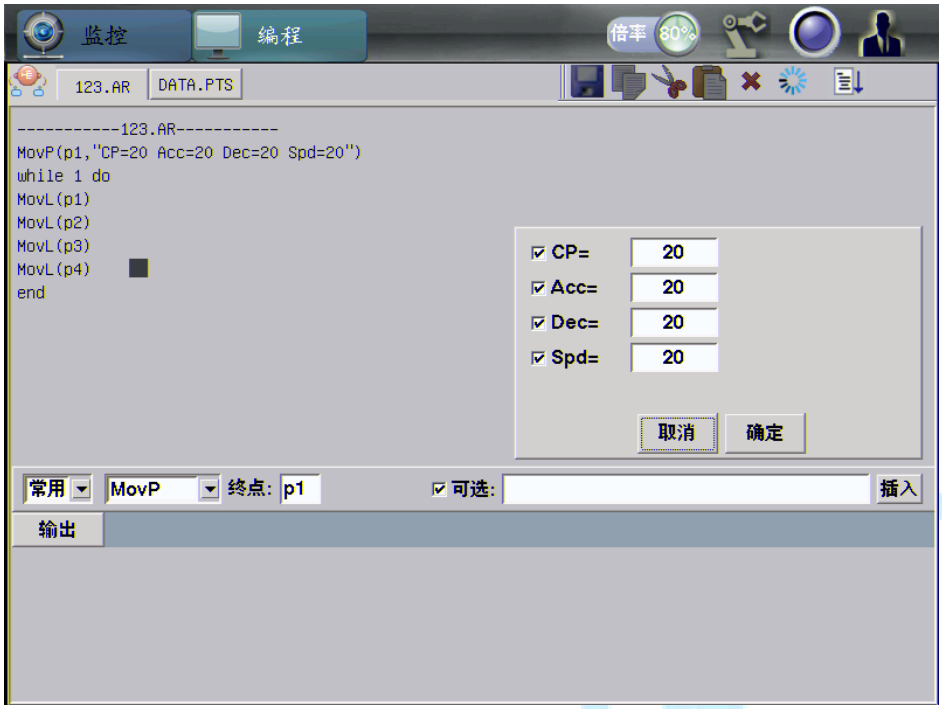
	Name	X	Y	Z	C	User	Hand
P0000	HOME	400.000	0.000	0.000	0.000	0	Right
P0001		60.000	80.000	-10.000	-113.401	0	Left
P0002		00.000	80.000	-10.000	-113.401	0	Left
P0003		00.000	-80.000	-10.000	0.000	0	Left
P0004		60.000	-80.000	-10.000	-113.401	0	Left
P0005*							
P0006*							
P0007*							
P0008*							
P0009*							

Handle Pt
Delete Pt
Line Copy
Line Paste
Movp to Pt

3. AR programming；unfold “123.AR”，Then insert the square movement commands, as below:



For some commands, such as MovP/MovL/MArchP/MArc et al., they are related to some optional parameters. Take **MovP** as an example, which includes CP/Acc/Dec/Spd.



CP	Optional parameter (0~100), which specifies whether smoothly move to target.
Acc	Optional parameter (1~100), which specifies percentage of acceleration to move to target.
Dec	Optional parameter (1~100)，which specifies percentage of deceleration to move to target.
Spd	Optional parameter (1~100), which specifies percentage of speed to move to target.

Optional parameters set for other movement commands can refer to AR language manual.

- **Export Program**

You want to back up one AR language to a U-disk though export program operation, for example back up 123.AR to U-disk, specific steps are as follows:

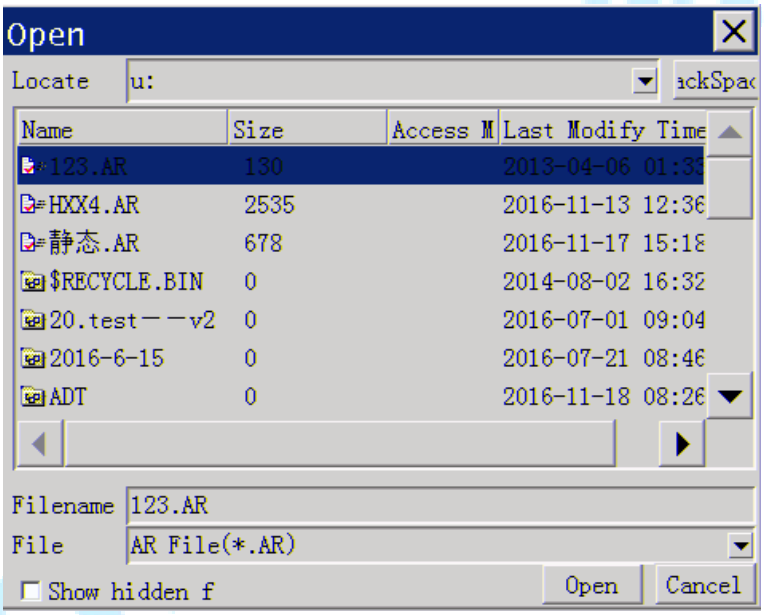
1. Insert one U-disk to the bottom of the teach pendant or MEN port;
2. Press “CPU#1” to pop up a “menu” list, then select “Export program” to enter “Save” interface;

3. Find “u:” in “Locate” drop-down list, then click “Save”.

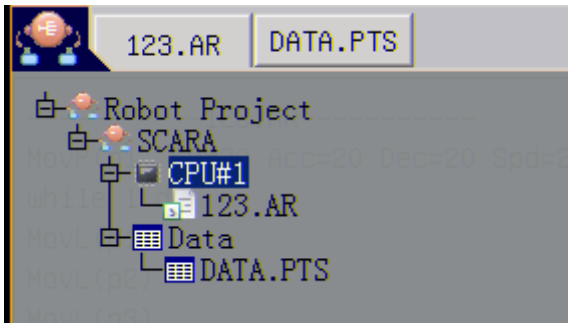
➢ **Import program**

If one project is very complex (maybe up to 100 lines or more), it is inconvenient to insert these commands on teach pendent. In this case, it is better to edit AR language using LuaEditor, and then export it (assuming 123.AR) to controller. Specific steps are as follows:

1. Import 123.AR to a U-disk;
2. U drive into the bottom of the teach pendant or USB interface controller side MEM port;
3. Press “CPU#1” to pop-up “menu” screen, then select “Import program” to enter “Open” interface;
4. Find “123.AR” from “u:” in “Locate” drop-down list, then click “Open”.



If the following screen shot, the program is successfully imported.

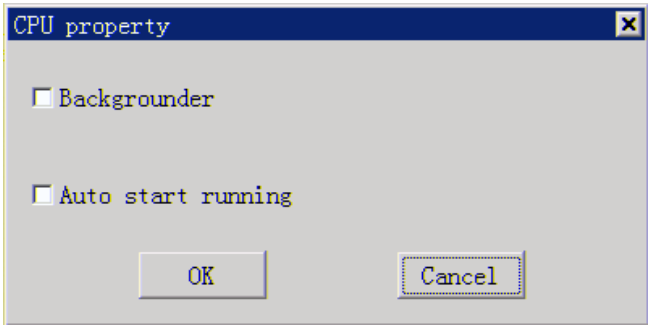


5. Teach some points in DATA.PTS, which are used in 123.AR

➢ Delete CPU

This operation is only used for several CPU in one projct.

➢ Task Properties



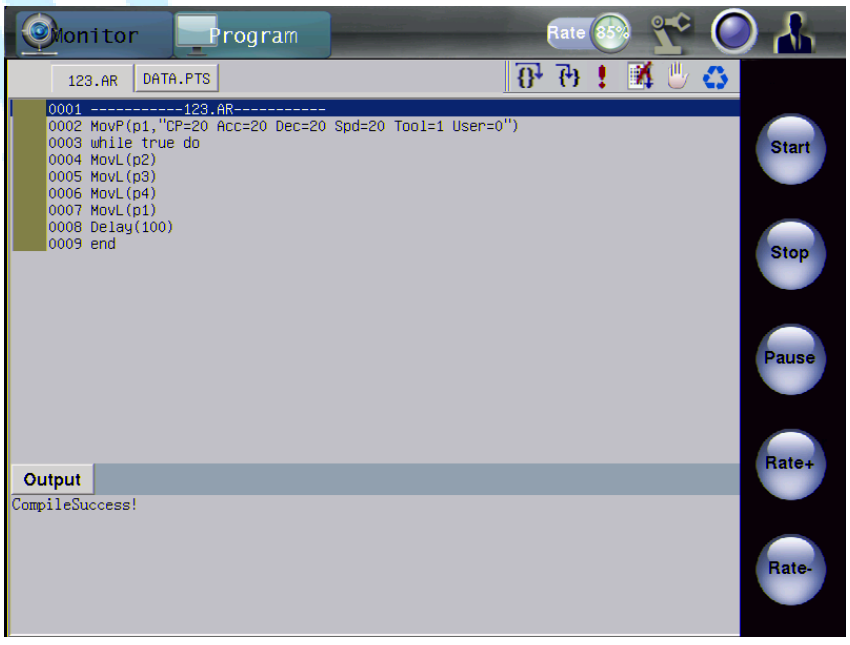
- Backgrounder：if one CPU is set as Backgrounder, it is not affected by working state of the system. This case is generally applied for several CPUs in one project.
- Auto start running: the CPU will run automatically when power off and then power on if the key of flexpendant stays at Auto(A) state

2.1.2 Test Running

If program is compiled correctly, you can test running. For safety, you should operate robot with off-line simulation firstly, then which means that program will run but the robot does not move; then view movement trajectory to judge whether program's logic is right and points is within robot's working range. The speed ratio 50% is suitable when off-line simulation.

➢ Off-line simulation:

1. Key stays at automatic (A) model;
2. Robot icon "  " is gray. For off-line simulation, click "Start" button to run 123.AR and view trajectory from monitor interface.



Descriptions of some buttons are in following table:

	Single segment debugging
	Step through each line of code as it runs
	Start running the program (as with start button function)
	Stop running the program (and stop button function)
	Add breakpoints
	Delete breakpoints

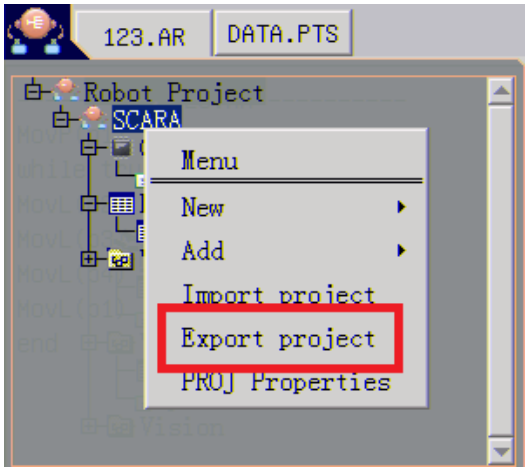
➢ Online Simulation

1. Key stays at automatic (A) model;
2. Enable the robot "  " and click "Start" to run AR.123, then robot will move to the corresponding positions.
3. Press "Rate+" or "Rate-" to increase or decrease the speed ratio;

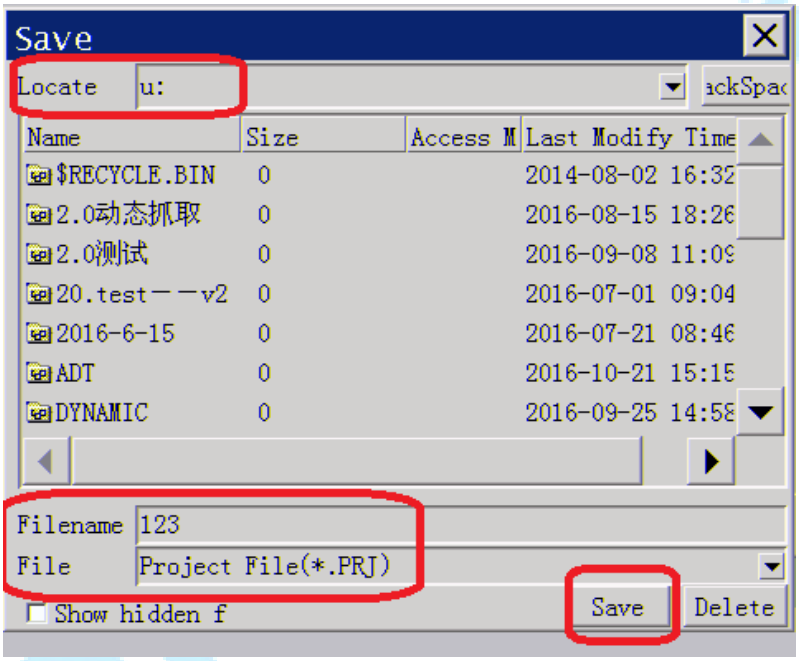
2.1.3 Export Project

Operation of exporting project is used for saving a having been built project. Then import the saved project to other robots to do the same process in order to save time and improve efficiency. For example, export the **SCARA** project of section 2.1.1 to a U-disk by following steps:

1. Insert a U-disk into the bottom of the teach pendant or MEM port of RC400 controller;
2. Press project name "SCARA" to pop up a "Menu" list, and select "Export project" to enter "Save" dialog;



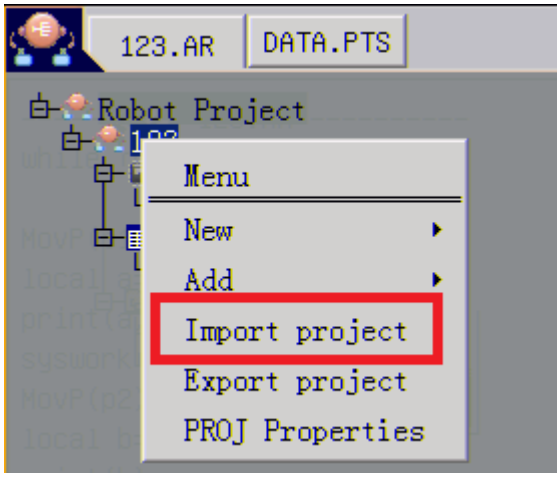
3. Find “u:” in “Locate” drop-down list, then click “Save” to export project completely.



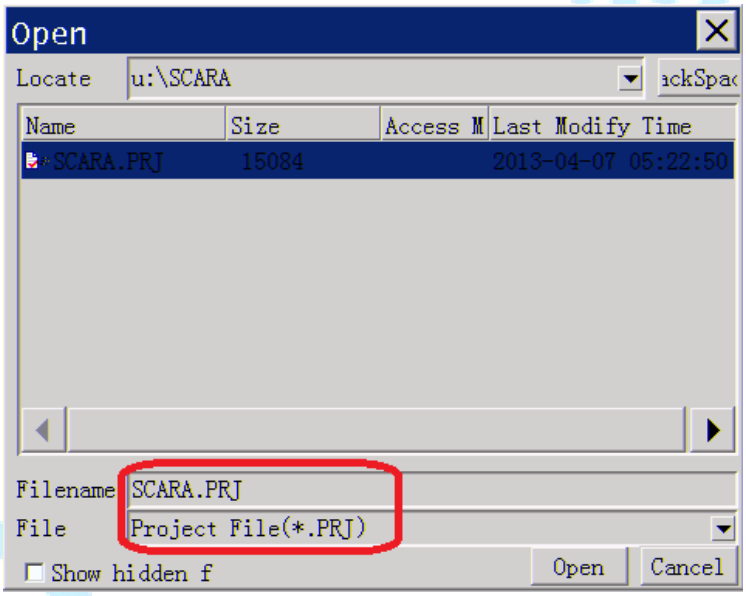
2.1.4 Import Project

Operation of import project is used for a having been tested project which can be directly imported to controller to run. Specific steps are as follows:

1. Insert a U-disk into the bottom of the teach pendant or MEM port of RC400 controller;
2. Press the current project name (assumed to be 123) to pop-up a “Menu” list, then select “Import project” to enter “Open” dialog box:

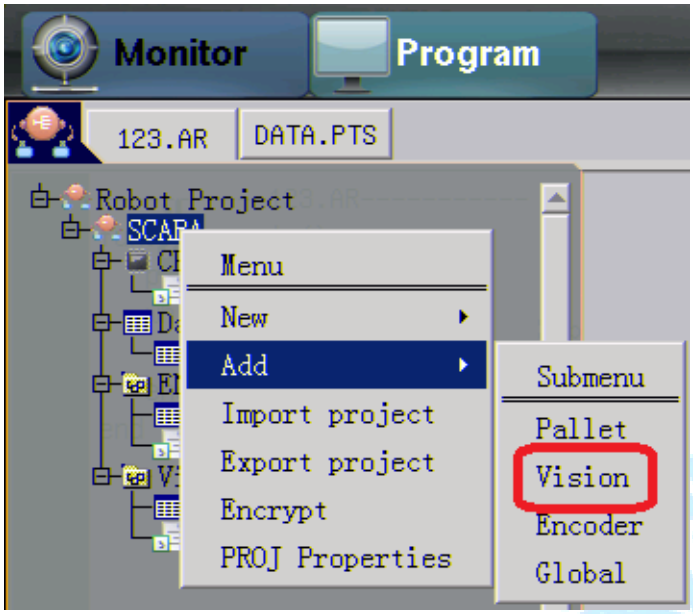


3. Find the imported project in “u:” which is located in “Locate” drop-down list; then click “Open” to finish this operation. Notice that the type of imported file must be end up with **.PRJ**



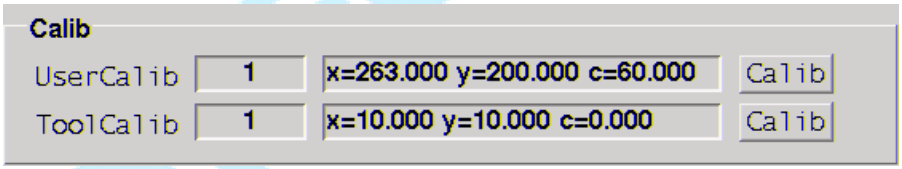
2.2 Vision

For Many occasions, robot is needed to communicate with visual device (cameras) to receive visual data sent from vision, and then operates the corresponding motion to complete the process requirements. ADT-RC400 controller can be used in three types of visual applications: static vision, dynamic visual and follow vision. Firstly, add the vision to the directory of robot project, and then open the visual configuration interface to configure some visual parameters required.

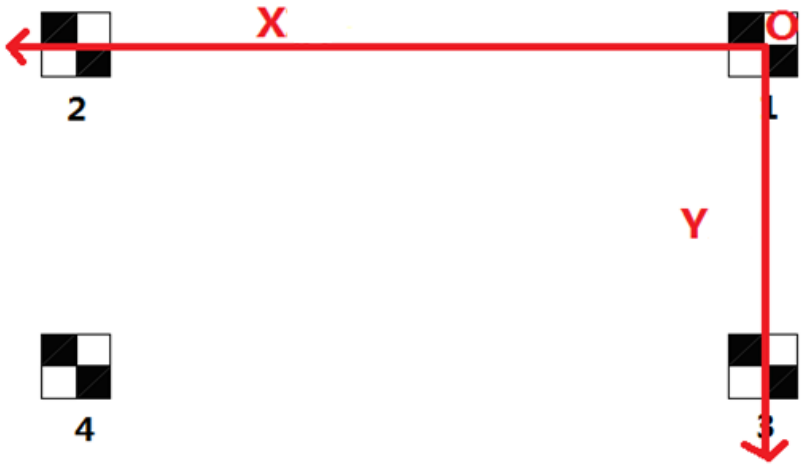


2.2.1 Static Vision

Static vision refers to a camera fixed at one place, which is triggered by IO or a soft command to take pictures and send data over the network to the controller. In the interface of visual configuration, click “New” to write the name of the camera (CAM0 ~ CAM9) and select the camera type “static”, then press “OK”. Next, you need to calibrate the user coordinate system && tool coordinate system and set basic parameters of static visual.

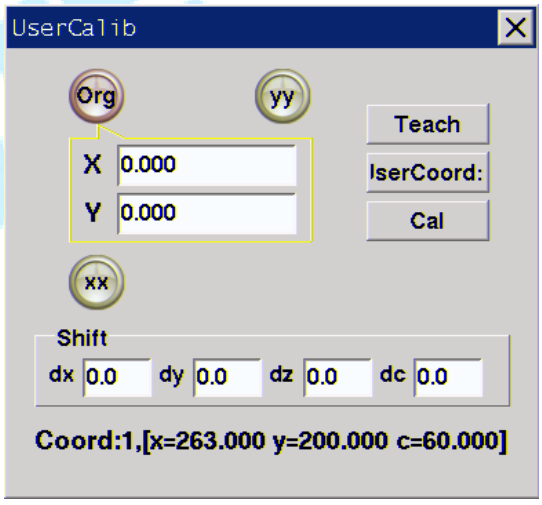


1. **User coordinate system calibration**. Calibration purpose is to establish a relationship between the vision coordinate system and the robot coordinate system. Provided that the visual system has its own calibration a visual coordinates (XOY), as shown below, that is pixel coordinate conversion to metric units(mm)



Click “calibration” to enter the “UserCalib” interface:

- Select the “Org”, then move the robot to the origin O of visual coordinates, then click “Teach”;
- Select “xx”, then move the robot to a point in the direction of the X axis of the visual coordinates, then click “Teach”;
- Select “yy”, then move the robot to a point in the direction of the Y axis of the visual coordinates, then click “Teach”;
- Click “UserCrd:1” button to select a user number from 1 to 9, then press “OK”;
- Click “Calcu”. Thus one user calibration has been completed.



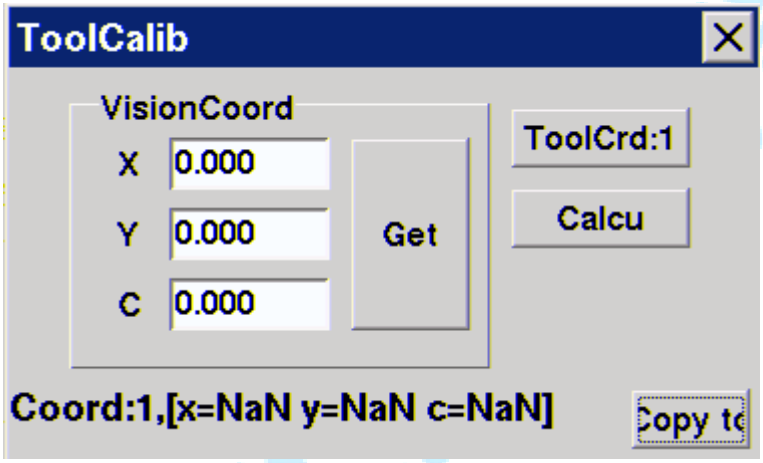
Tips: if a camera can return the coordinates which is referred to base coordinate of robot, the calibration of user coordinate can be ignored.

2. Tool coordinate calibration

Tool coordinates calibration is calibrated by means of visual coordinate. Notice that

Descartes coordinate system must be switched to the same user which is set in user coordinate calibration.

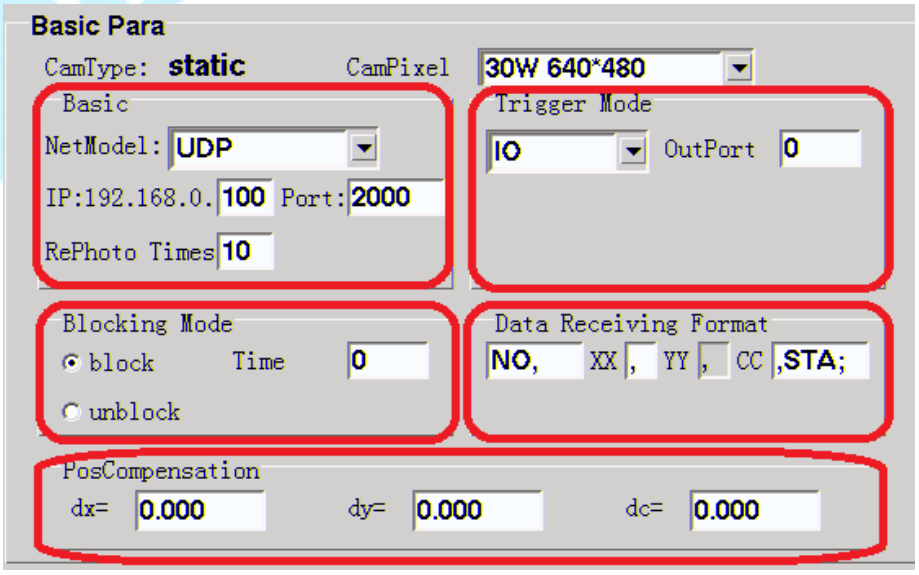
- Click “calibration” to enter the “ToolCalib” interface;
- Create a visual recognition template, then manually write the visual coordinates X/Y/C of template to the corresponding “VisionCoord”;
- Move the robot to ensure that the end of the tool to grab this template with appropriate position and attitude;
- Click “ToolCrd: ” to select a tool number from 1 to 9, then press “OK”;
- Click “Cal”, then the tool calibration is completed.



Note: function of “Copy to” is used for saving the calibrated tool result to DATA.PTS.

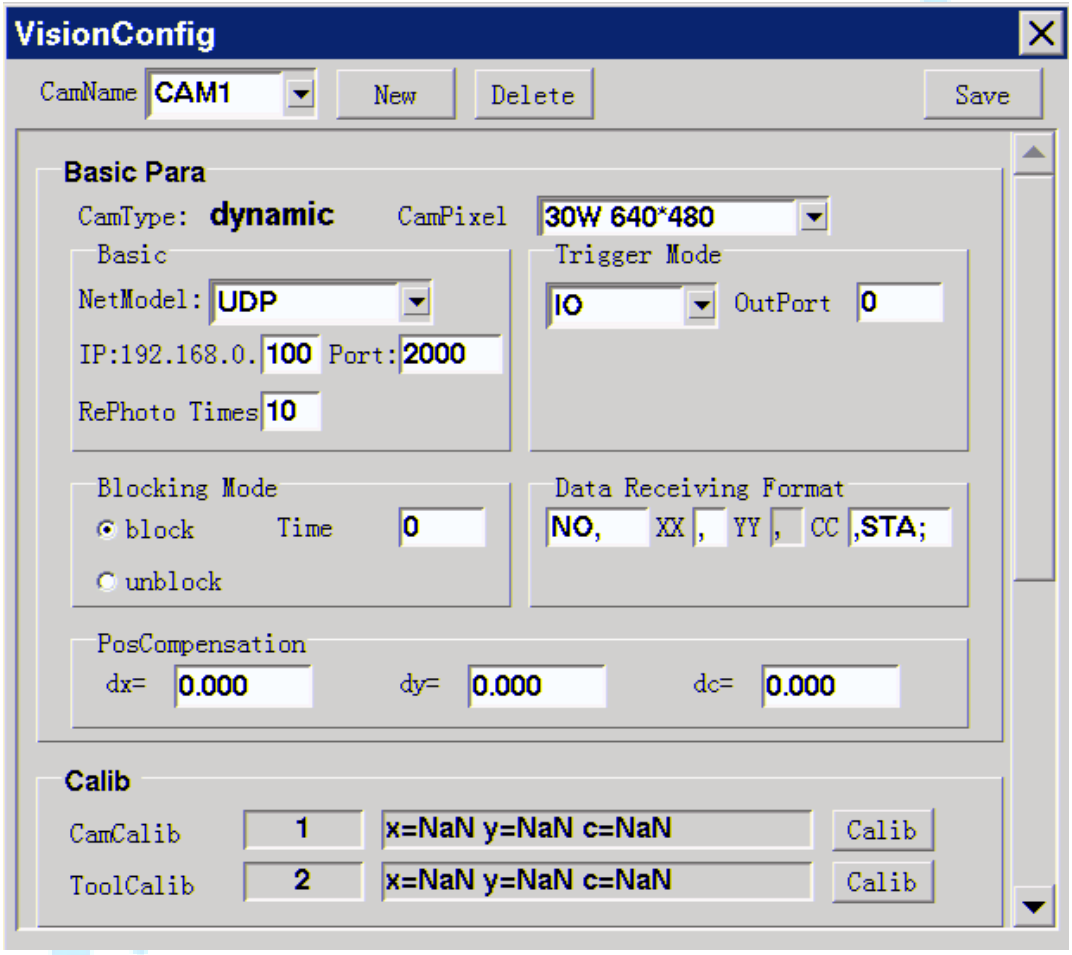
3. Basic Parameter Setting

The parameter setting includes visual NetModel(UDP/TCP_Server/TCP_Client), IP&&Port, Trigger Mode (IO: hard trigger or Network: soft trigger), Blocking mode (block or unblock), Data Receiving Format and PosCompensation. Specific setting can refer to **static vision instruction**.



2.2.2 Dynamic Vision

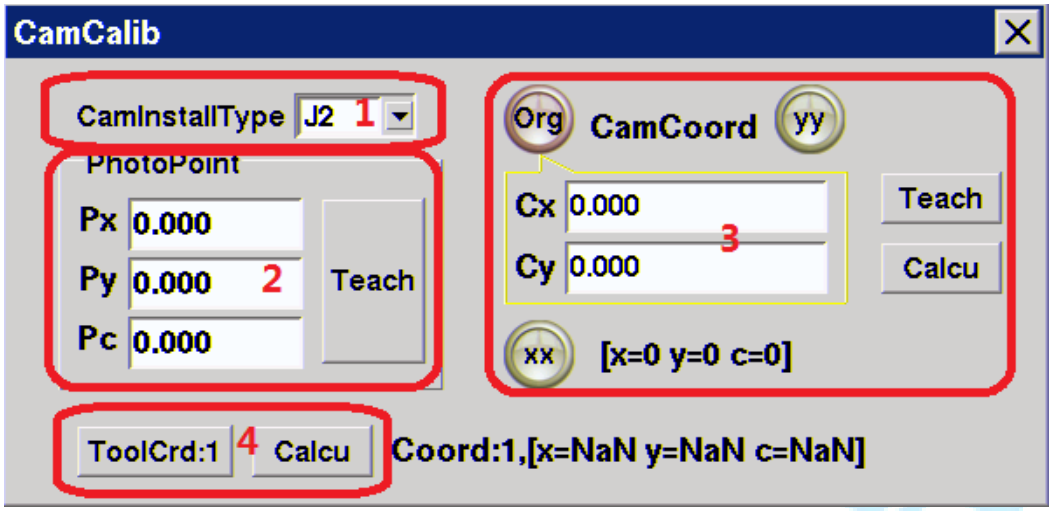
Dynamic camera is fixed on the robot arm (J2 or J4 axis), and which will move along with robot moving. So it is called as dynamic vision. In the visual configuration interface, click “new”, then write a camera name (CAM0~CAM9) and select the camera type “dynamic”, and then press “OK”. The configuration of dynamic vision includes camera-tool calibration (CamCalib), fixture-tool calibration (ToolCalib) and basic parameter configuration (Basic Para).



➢ Camera-tool calibration

Corresponding to the end of the robot, the dynamic camera acted as a tool, so a key step is to build a relationship between robot and the camera. Click “Calib” to enter “CamCalib” interface.

1. Select the type of camera installed(CamInstallType): J2 or J4 axis;



2. Fix the calibration paper, and move robot to obtain the photo point (**PhotoPoint**). Please pay attentions:
   1) Note that the position should not exceed the scope of the robot.
   2) Click "teach" to assign current robot's position to **PhotoPoint**.

3. Calibrate the relationship between the camera and the paper. Provided that the camera has set up a visual coordinate system XOY:
   1) Select the "Org", then move the robot to the origin O of visual coordinates, then click "Teach";
   2) Select "xx", then move the robot to a point in the direction of the X axis of the visual coordinates, then click "Teach";
   3) Select "yy", then move the robot to a point in the direction of the Y axis of the visual coordinates, then click "Teach";

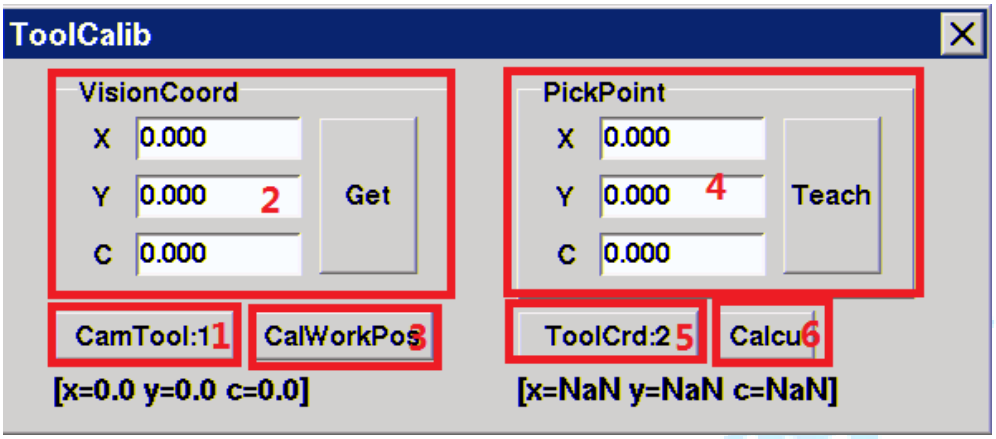
4. Calculate the camera tool
   1) Click "ToolCoord: " to select a tool number;
   2) Press "Cal" to obtain the camera tool.

➢ Fixture-tool calibration(ToolCalib)

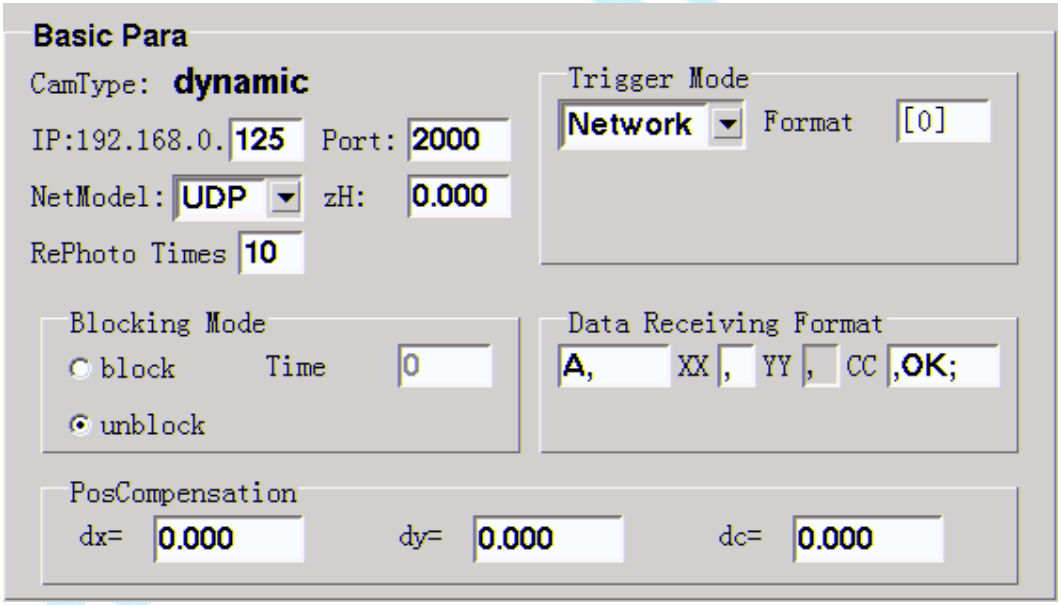
1) Click "camTool" to select a tool which is generated in Camera-tool calibration process;
2) Manually write visual coordinate of a piecework to "VisionCoord" list;
3) Press " CalWorkPos" to calculate the piecework's coordinate corresponding to robot's base coordinate system;
4) Move robot to pick the piecework using the end of fixture which is installed at the end of the robot; Then click "Teach" to assign current robot's coordinate to

"PickPoint" point;

5) Press "ToolCrd: " to select another tool which is different from "CamTool" tool;
6) Click "Calcu" to calculate the fixture tool.

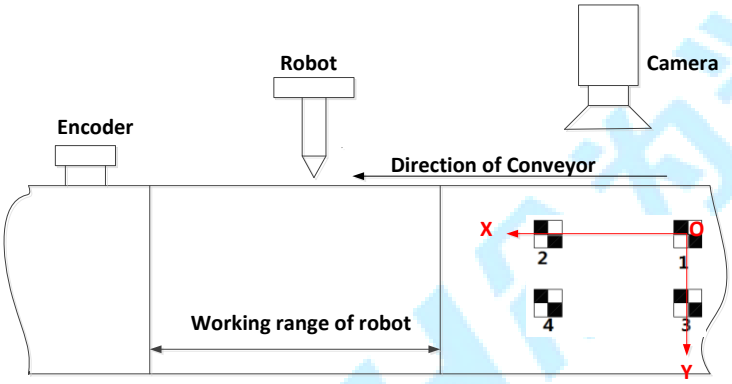


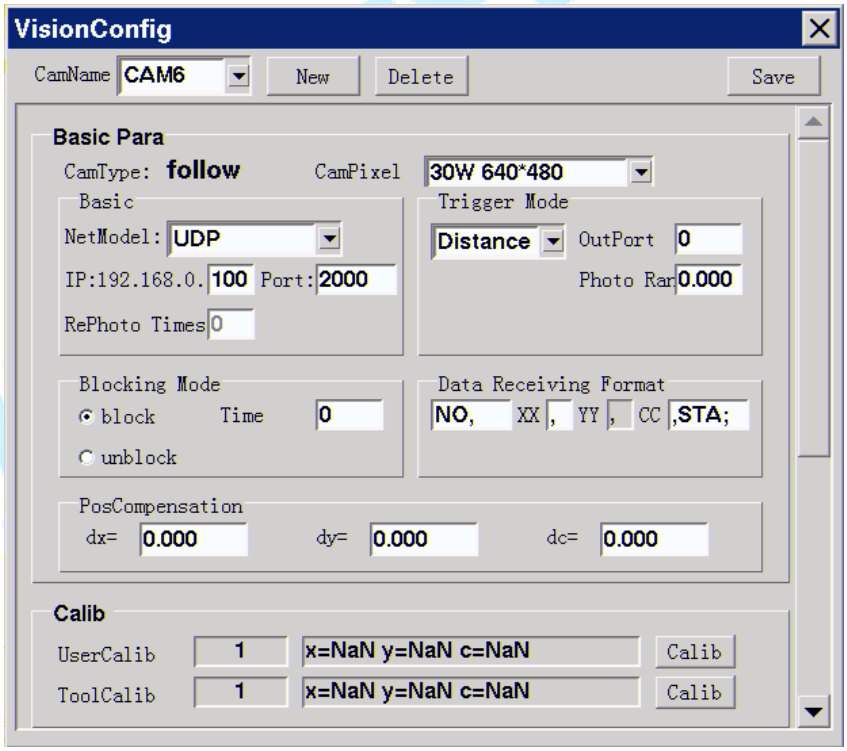
➢ Basic parameter setting

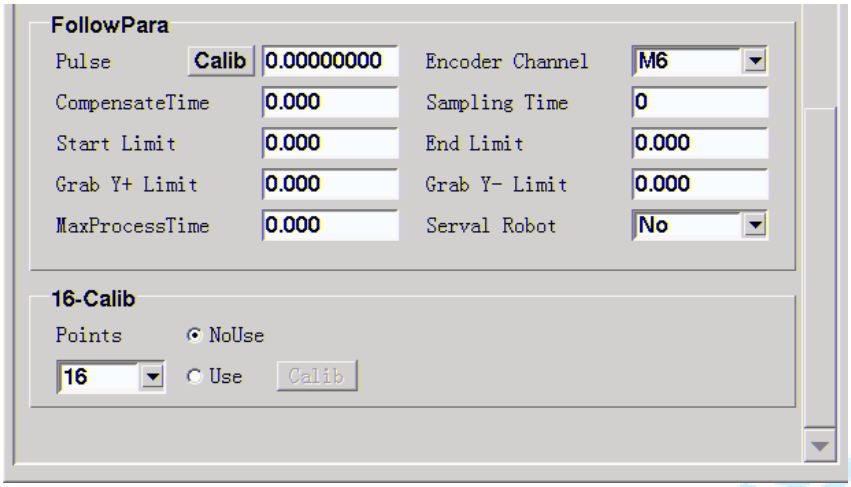


2.2.3 Follow Vision

With the help of vision and encoder, follow vision is used for grasping piecework put on a moving belt conveyor. This application needs some external equipment: belt conveyor, encoder (fixed at conveyor), a camera, and needle. In the interface of visual configuration, click “New” to write the name of the camera (CAM0 ~ CAM9) and select the camera type “follow”, then press “OK”. Then, you need to calibrate the user coordinate system && tool coordinate system, and set basic parameters of static visual and parameters of follow vision (FollowPara).



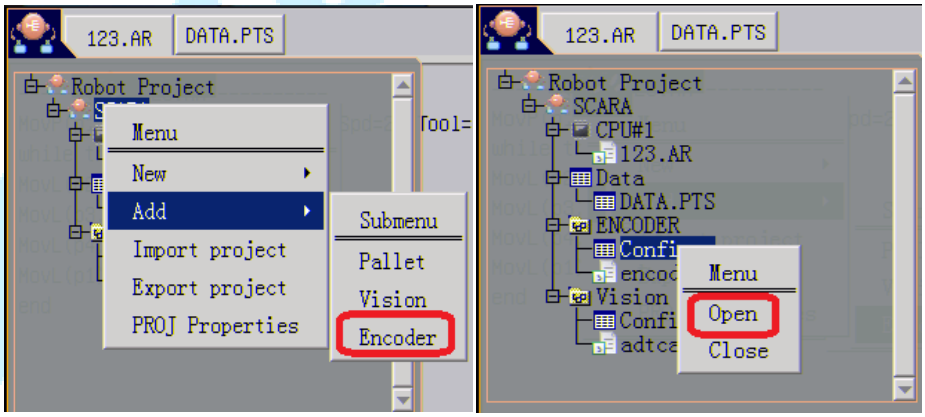


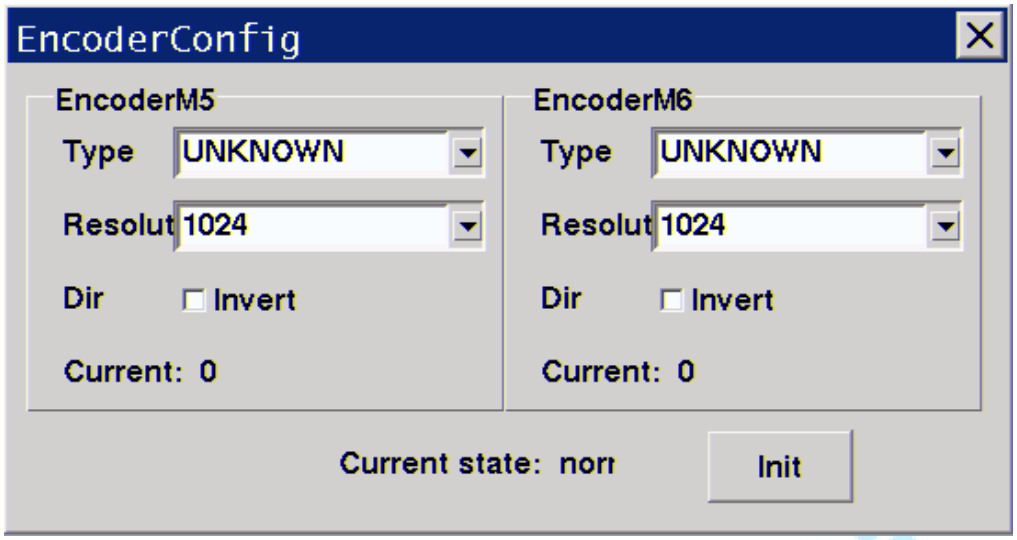


2.3 Encoder

An encoder is an indispensable external device for follow grasping process, which can give real-time feedback of the distance of the object on the conveyor belt:

1. Long press the current project name, pop-up menu interface, click “add”;
2. Select “Encoder” in the pop-up “Submenu” interface, so an encoder device has added to the current project;
3. Long press “Configue” in “ENCODER” list, then click “Open” to enter “EncoderConfig” interface;
4. In the “EncoderConfig” interface, set the type and resolution of the encoder connected to controller (M5 or M6 port of encoder).




EncoderConfig
EncoderM5
Type
UNKNOWN
Resolut
1024
Dir
Invert
Current: 0
EncoderM6
Type
UNKNOWN
Resolut
1024
Dir
Invert
Current: 0
Current state: norr
Init

3. Installation Wizard

Light administrator icon “  ” to enter the 【Param】/【SysInfo】/【Debug】/【Setup】 interface. At this moment, the color of “Setup” icon is gray  ; then it is required to obtain the login authority. Four levels are included: Worker/Operator/Admin/Factor, in which worker has lowest authority and factor has highest authority. For different levels, it has different tasks:

- Worker can only operate some icons on the flexpedant, and cannot modify any parameters;
- Operator has authority to modify some parameters in【Param】 list. However, they have no authority to upgrade program and modify parameters in 【Setup】;
- Administrator (Admin) and factor have authority to do any operation if it is possible.

From lower authority to higher authority, three cases are included:

Case1: Work to Factory/Operator to Factory/Admin to Factory

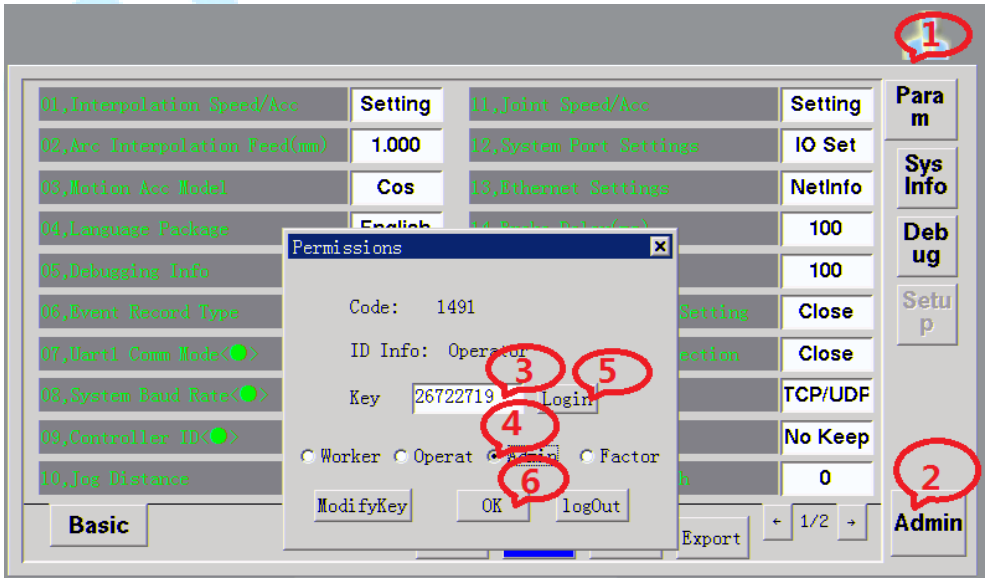
[Key]: 1101(Hex) is 4353(Decimal), then do [or operation] with current code (Decimal); operation result is key;

Case2: Work to Admin/Operator to Admin

[Key]:26722719

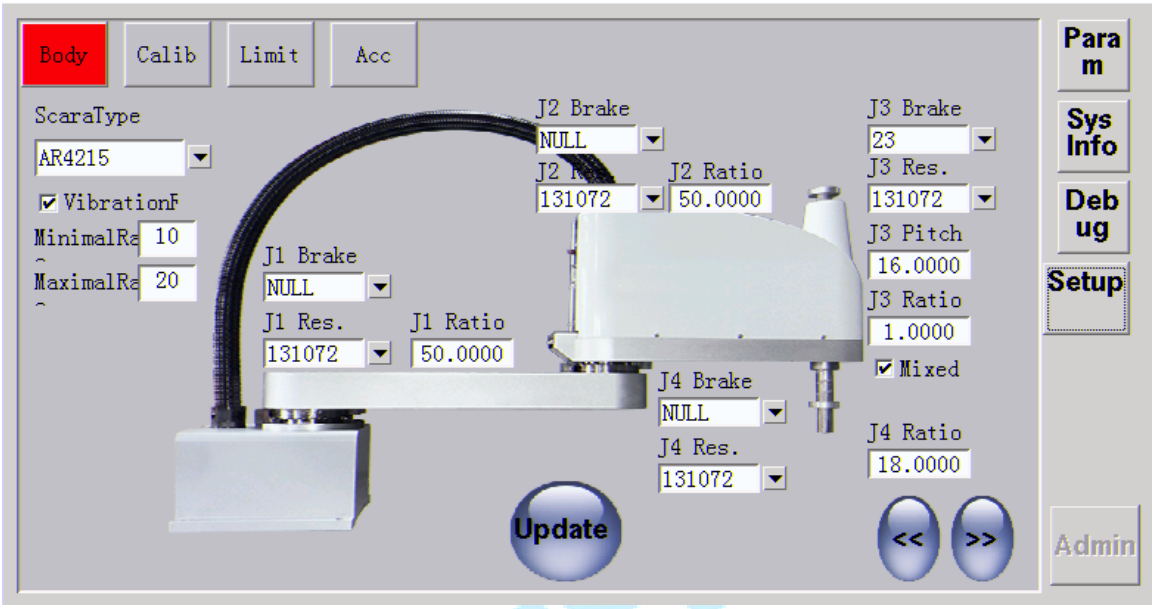
Case3: Work to Operator

[Key]:26722719

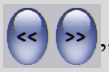


3.1 Robot Body

The robot installation involves four axis brake output port, encoder resolution, reduction ratio, third axis' pitch, and whether third axis and four axis pitches being compound. Click "Update" button to complete the configuration.



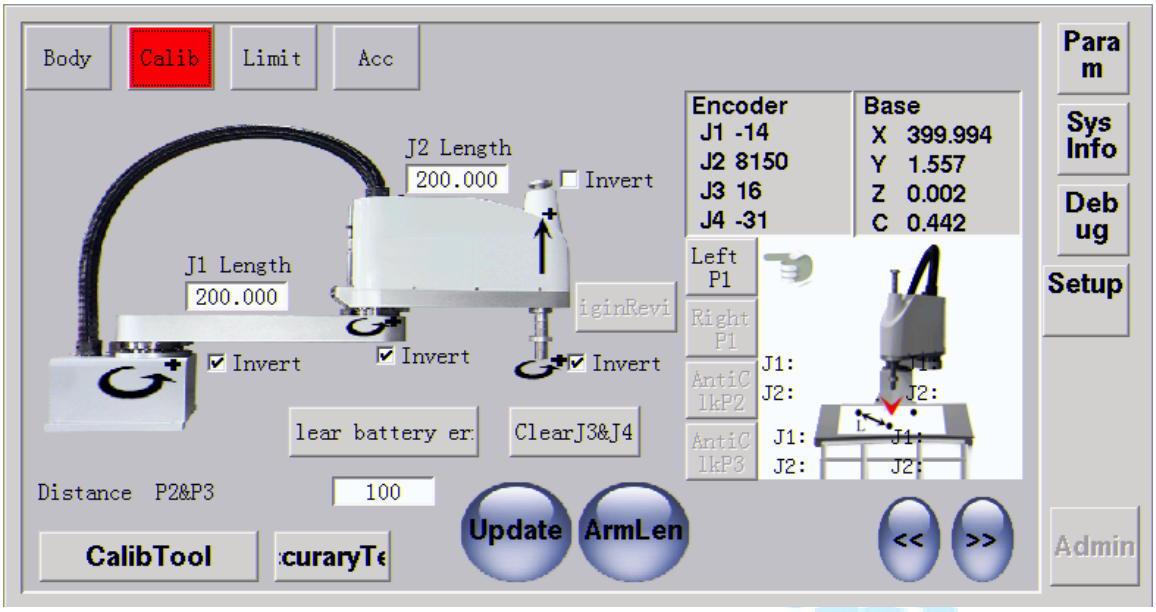
Tips:

- According to the actual model used in the field, then select correct robot type from "ScaraType" pull-down menu; It will pop up a "ScaraType" reminder: This operation will cause robot parameters to revert to default value, and ensure that robot type is ****, continue?, if robot type is correct, then click "Yes".
- The resolution of the encoder, the reduction ratio of the reducer and the pitch of Z-axis should be written according to the actual motor situation;
- The brake is connected to the Relay1~Relay4 which are respectively corresponding to output ports OUT23~OUT26;
- Click the "Update" button to complete update of above parameters;
- Through the left and right buttons " 

" to switch the installation of the three interface.

3.2 Calibration

In calibration interface, it contains to calibrate arms' length of J1&J2 axes, direction configuration of the four axes and clearing encoder.



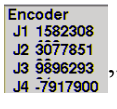
3.2.1 Direction Setting Principle

- For rotating axes(J1,J2,J4), anti-clockwise is positive direction and clockwise is negative direction;
- For up-down axis(J3), up is positive direction and down is negative direction;
- If the direction of then corresponding axis motion is opposite to the specified direction in the actual testing process, the corresponding axis should be "Invert" or "Not Invert";
- After setting the direction, click the "Update" button. For whole set of equipment (body + controller) bought from ADTECH, the directions are already set up and so no need to modify.

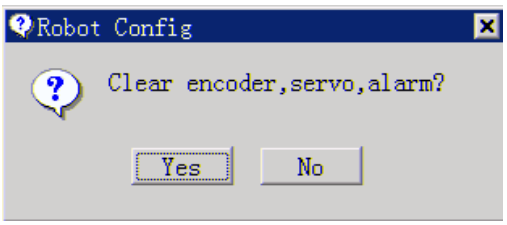
3.2.2 Clear Battery Error

- If alarm is【**11042：J1Battery Err**】, click "Clear battery err" button to release this alarm;
- If alarm is【**11090：Warning of Battery low voltage**】, which shows that the corresponding encoder' s battery is low, please change a new battery.

3.2.3 Clear encoders' value

(1) Four axes: clear all axes' encoder at the same time. Light click " 

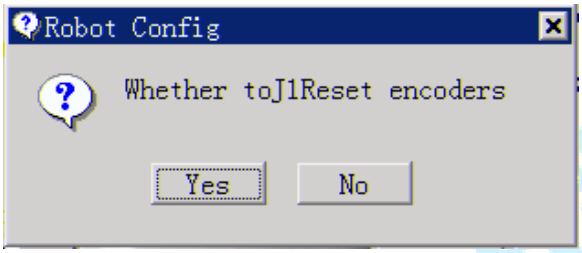
" to pop up a message box:



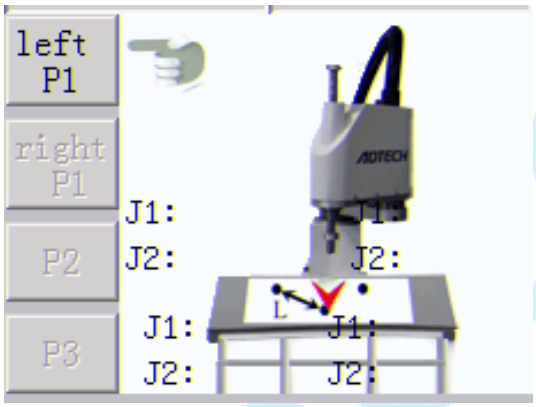
Press “Yes” to clear encoder, servo, alarm. This case is applied for roughly calibrating the home position of the robot once home has lost.

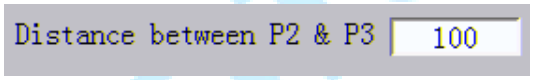
(2) Only J3&J4: Click “Clear J3&J4” button to clear encoders of J3 and J4 axis. This case is applied for J3 or J4 exceeded the soft limit.

(3) Single axis：Only to clear corresponding encoder value of single axis at one time. For example, if clear J1 encoder value, always press “J1 ****” until pop up a message box “Whether to J1Reset encoders” and then press “Yes” to clear.



3.2.4 Length and Origin Calibration





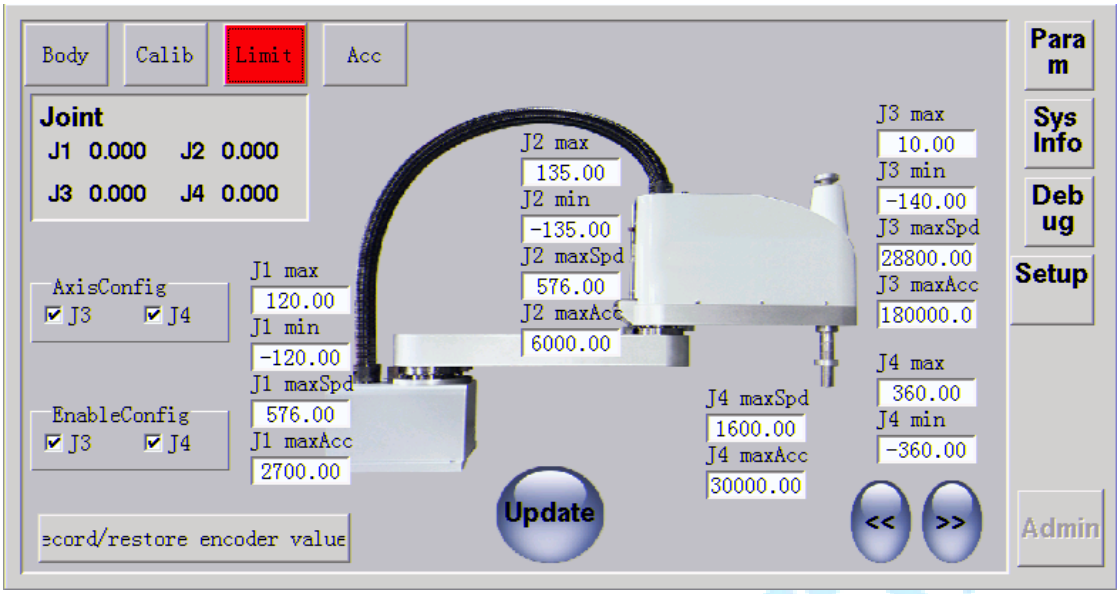
Calibration Steps:

1. Prepare an paper with equilateral triangle(P1/P2/P3), which installed within range of the robot;
2. Robot changed into light drag model;
3. Move robot to P1 with left hand, then press “left P1”;
4. Move robot to P1 with right hand, then press “right P1”;
5. Manually write the distance between P2&P3;
6. Move the robot to P2, then press “P2”;
7. Move the robot to P3,then press “P3”;
8. click “ArmLen” button to calculate arm length;
9. At last, click “Update” to finish calibration

3.3 Limit Setting

3.3.1 Limit for Position\Speed\Acceleration

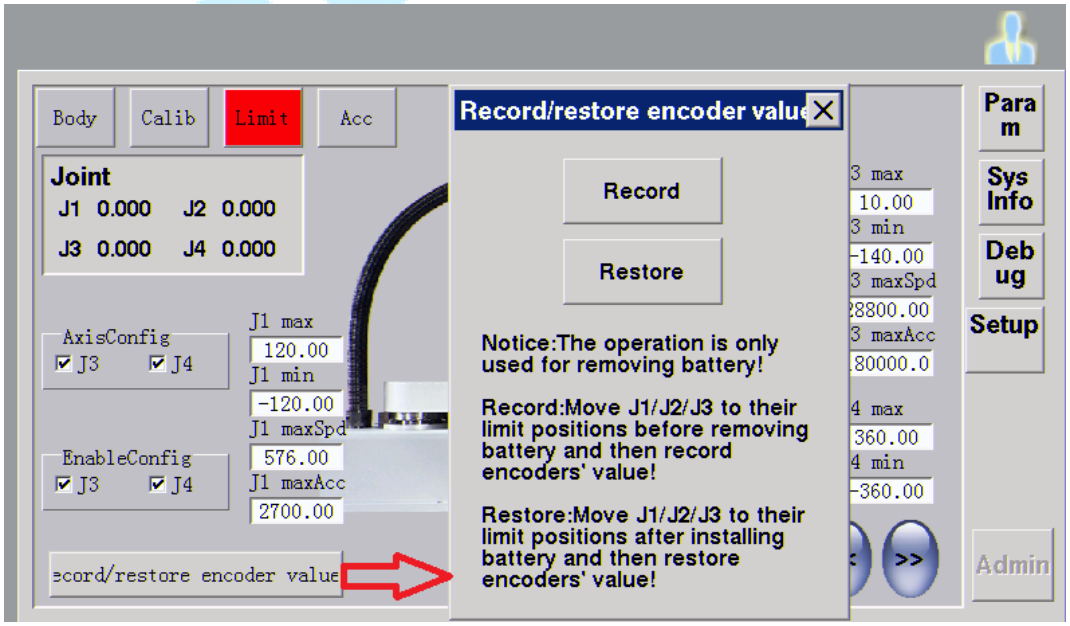
In this interface, positive and negative of S J1&J2&J3&J4 axes, maximal speed and acceleration of each axis are set. After setting, click on “Update” to finish configuration.



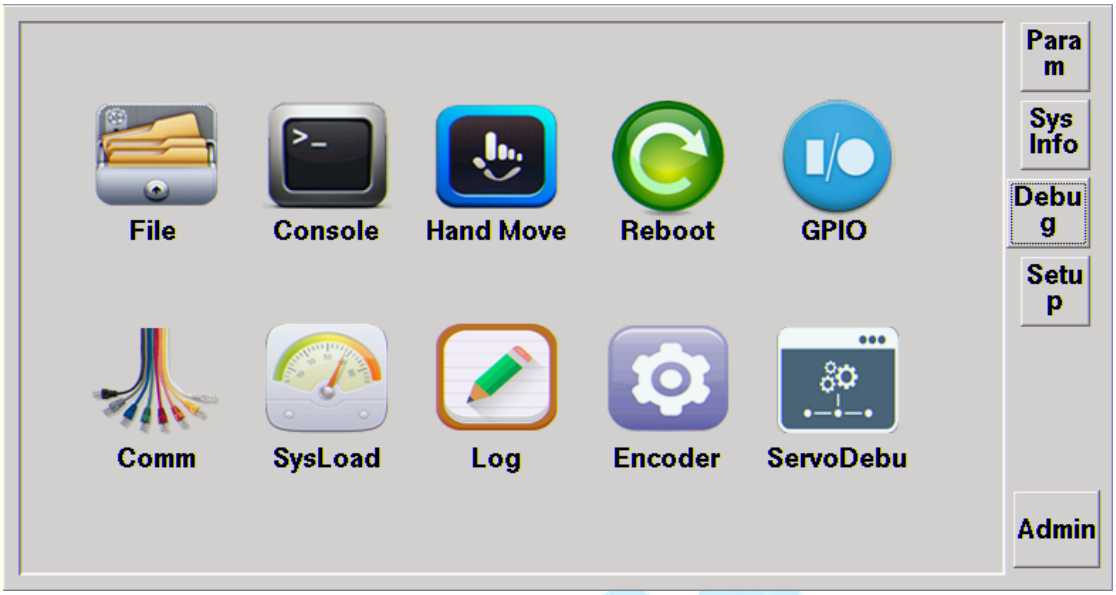
Tips:

- Maximal speed of each axis can be calculated to refer to formula: (Maximum rotation speed of motor) *360/(60*Ratio);
- The maximum acceleration of each joint is set as 8~10 times of the maximum speed of then corresponding axis;
- For axis configuration（AxisConfig）and enable configuration (EnableConfig), J3 and J4 are checked by default. If robot has only X/Y/Z axis then remove the J4 axis; If robot has only X/Y/C axis then remove the J3 axis;

3.3.2 Record and Restore Encoder Value for Removing Battery



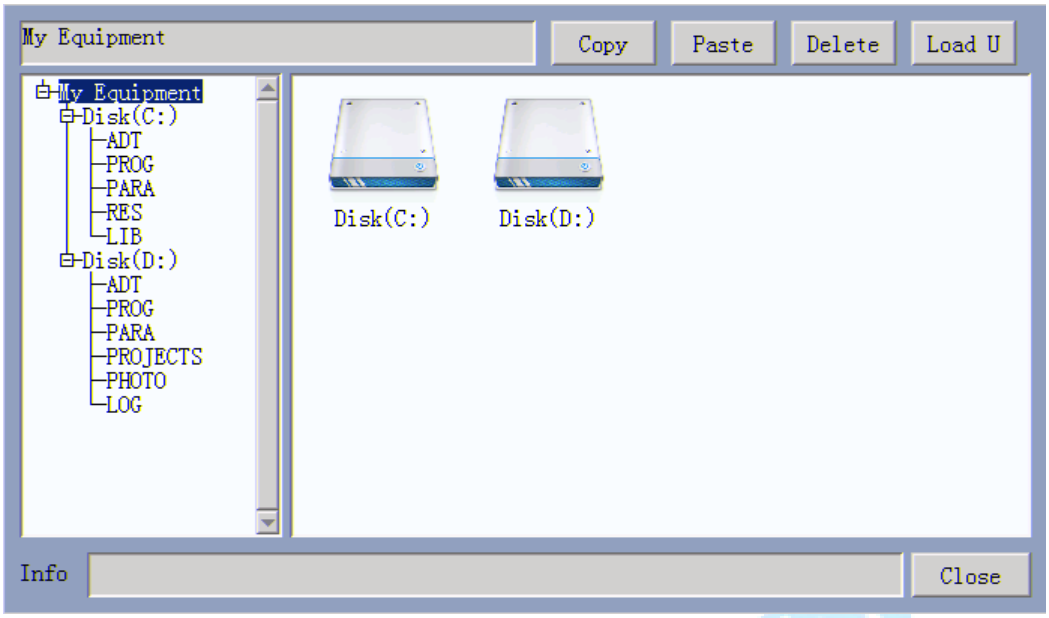
4. Debugging Tools



Debugging tools are some auxiliary tools in the robot debugging process, including file management tool(**file**), system debugging information(**Console**), manual debugging (**HandMove**), GPIO, communication station(**Comm**), encoder information(Encoder) and Servo debugging(**ServoDebug)**.

4.1 File Management Tool

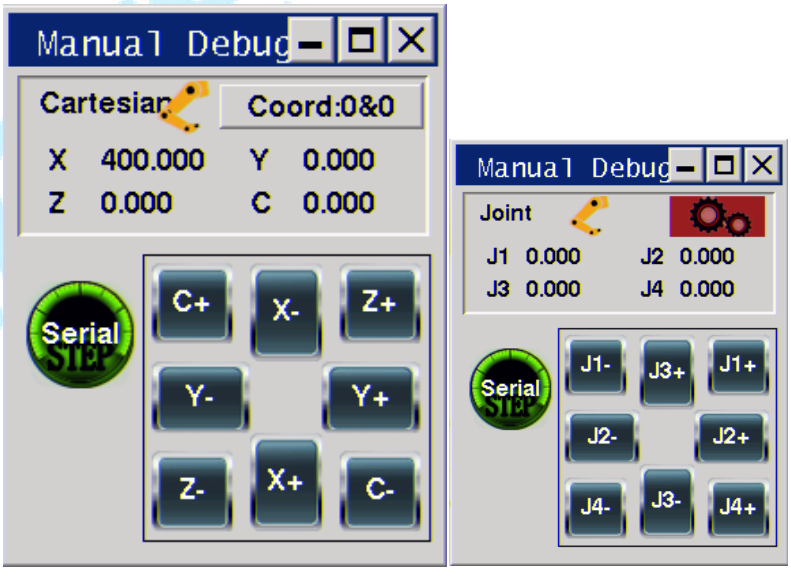
This tool is responsible for U-disk operation, including copy, paste and delete. If you need to insert the U disk operation, please click “Load U”.



Tips:

- Robot support U-disk(256M~16G) with 2.0 version;
- File management can only be used in manual mode;
- If want to consult some files in Disk(C:) using FTP connection, you need to copy these files from Disk(C:) and then paste into Disk(D:).

4.2 Manual Debugging Tool



Tips:

- In any interface, press “F2” to call this tool to view the current joint coordinates and Cartesian coordinates. For example, if want to see whether the actual position is consistent with the position taught in AR program when debug in single step, you can

use this tool;

- By clicking the coordinates of the displayed area to switch the "Cartesian&&Joint" coordinates, or you can also choose the corresponding coordinate system, or small gear, to switch to the actual and virtual location of the display.
- In manual mode, the tool will be popped up with operational button to move robot.

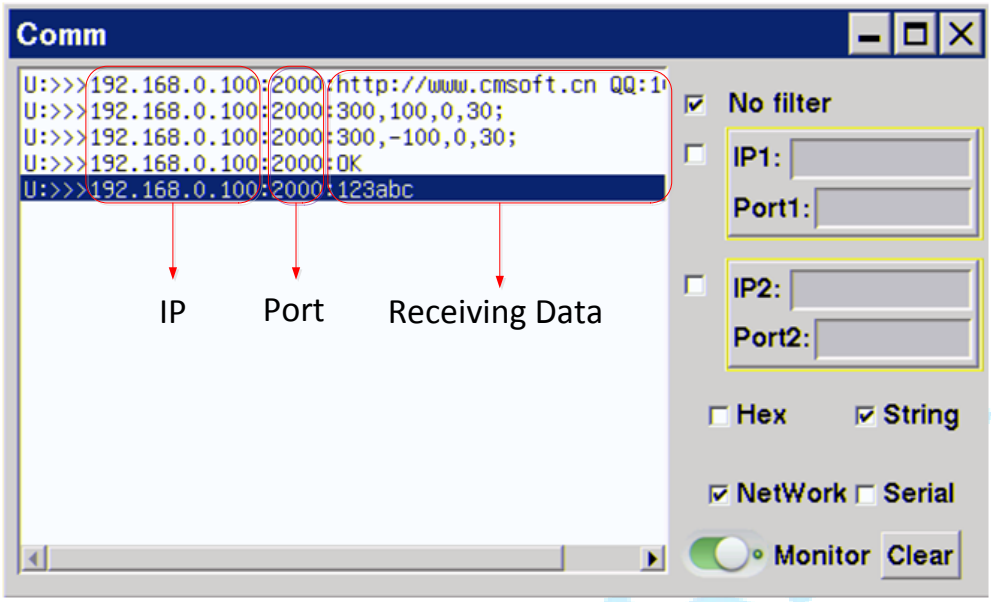
4.3 GPIO Tool

- **I_0~I_27** are corresponding to IN0~IN27 on input(ADT-9137) board;
- **I_28~I_33** are corresponding to IN28~IN33 in 16cores IO of overload connector;
- **O_0~O_17** are corresponding to OUT0~OUT17 on output (ADT-9125) board;
- **R_9,R_18** are respectively corresponding to relay (SVST_A,SVST_B) and relay (EMSST_A,EMSST_B);
- **O_19~O_22** are corresponding to OUT19~OUT22 in 16cores IO of overload connector;
- **O_23~O_26** are respectively corresponding to relay1(OUT23), relay2(OUT24), relay3(OUT25), realy4(OUT26)

Tips:

- In any interface, press "F6" to view state of each IO;
- **Sky-blue** color means that inputs or outputs are open, and **gray** means that inputs and outputs are close;
- GPIO tool has two functions: monitor and simulation;
- Monitor: you can see the real state of input/output;
- Simulation: click the "**Simu**" button, thus you can manually open inputs. So operators can debug program in the case of no wiring.

4.4 Communication Station Tool



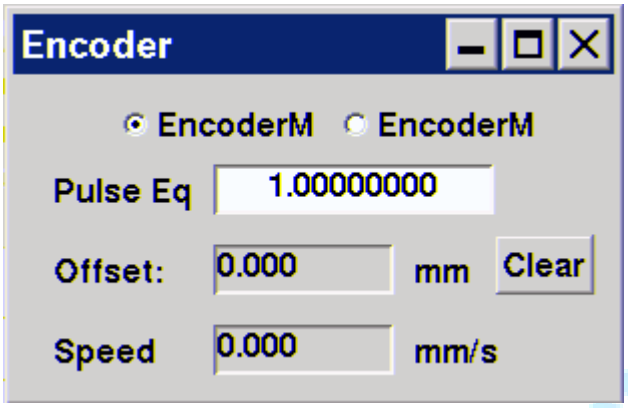
Tips:

- Press "F5" to call this interface to communication information;

"Comm" is used to monitor whether network/serial communication is connected successfully.

- And it can be used for judge whether the received data is normal or not;
- For the head of the monitoring data, **"<<<"** represents send**, "**>>>**"**means receive;
- You can configure the display format for the string or Hex by ticking the appropriate selection;
- Choose the **"No filter" / "IP1, IP2"** the way to capture the data after the screening. This application is mainly used in the background when many communication equipment, we need to observe a certain IP data, this time on the need to use the IP filter function. The operation method is also very simple, select the corresponding IP data, and then click the check IP, screening conditions will be automatically set up.

4.5 Encoder



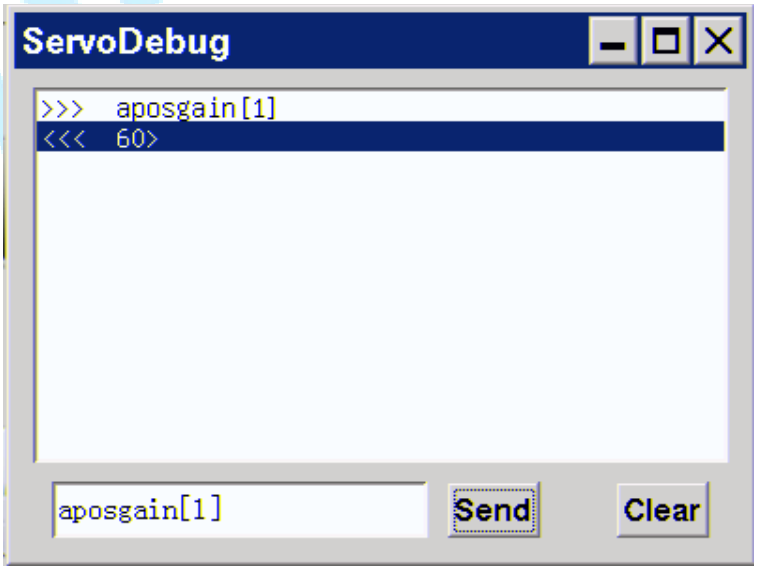
Tips:

- Encoder function only applies to conveyor following application;
- In any interface, operators can press "F1" button to call this tool to view **pulse equivalent** of encoder and conveyor's **offset** and **speed**;

4.6 Servo Debugging

The function of **Servo Debugging** is to obtain or modify the value of a servo parameter through the FlexPendant.

- Obtain the value of a servo variable. Specific steps are as follows:
  (1) Insert servovariable name in the servo debugging interface;
  (2) Click "**Send**" button to obtain the value of servo variable, and then variable value will be automatically obtained and displayed.
  Sending format：**servo variable**，**for example**：**aposgain[1]**

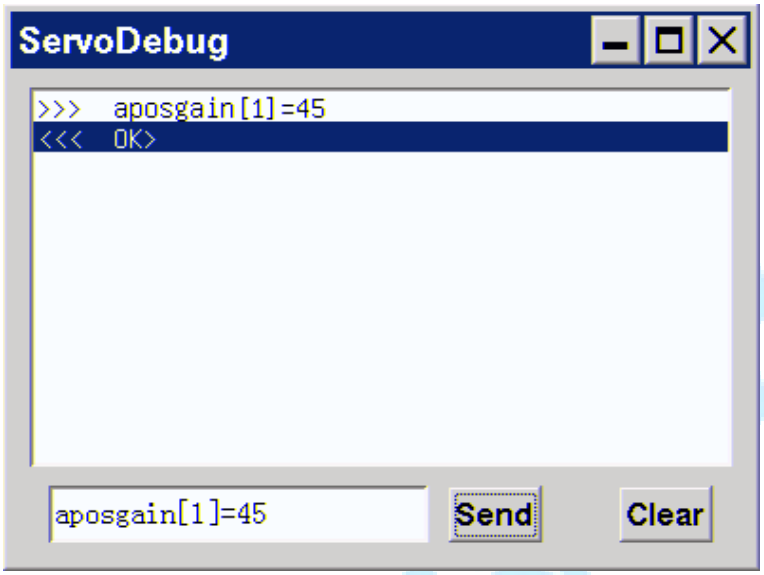


- Modify the value of a servo variable. Specific steps are as follows:
  (1) Insert the servo variable name and its modified value in servo debugging

interface;

(2) Click “Send” button to send the modified value and system will return “OK”.

Sending format：**servo variable = value,** for example：aposgain[1]=60



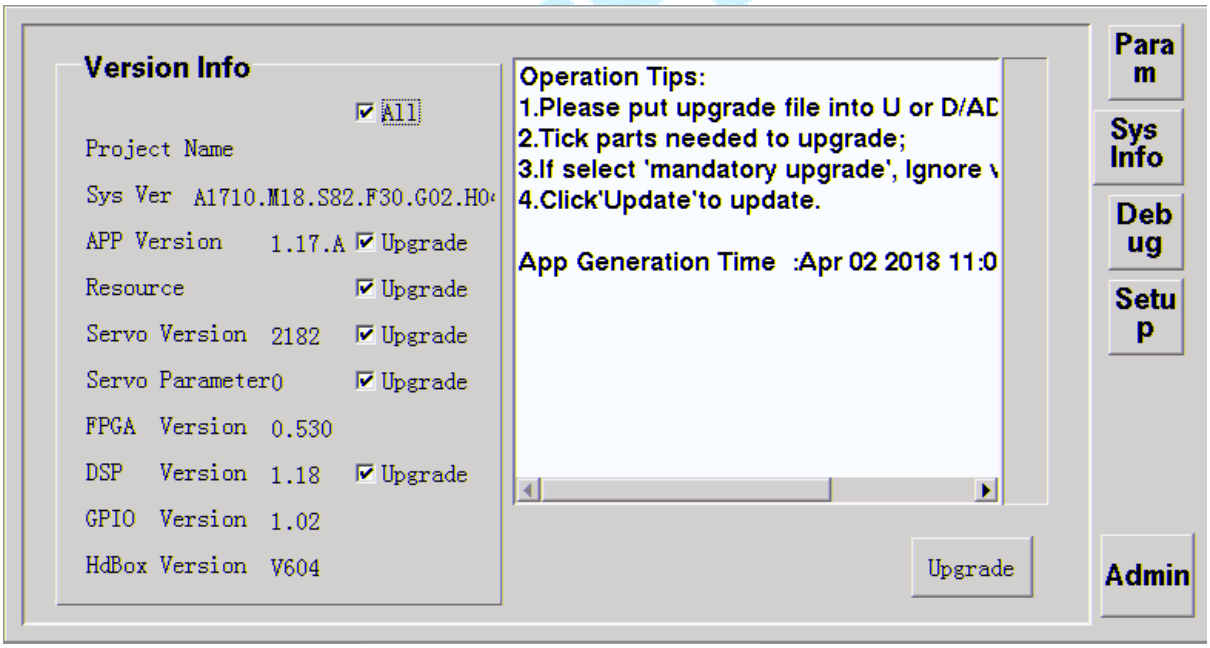
Tips:

- This tool can only be used to obtain or modify the value of a certain servo parameter and cannot be used to monitor some characteristic curves.
- Modification of the corresponding servo parameters must be modified under the guidance of the professional servo engineer;

5. System Information

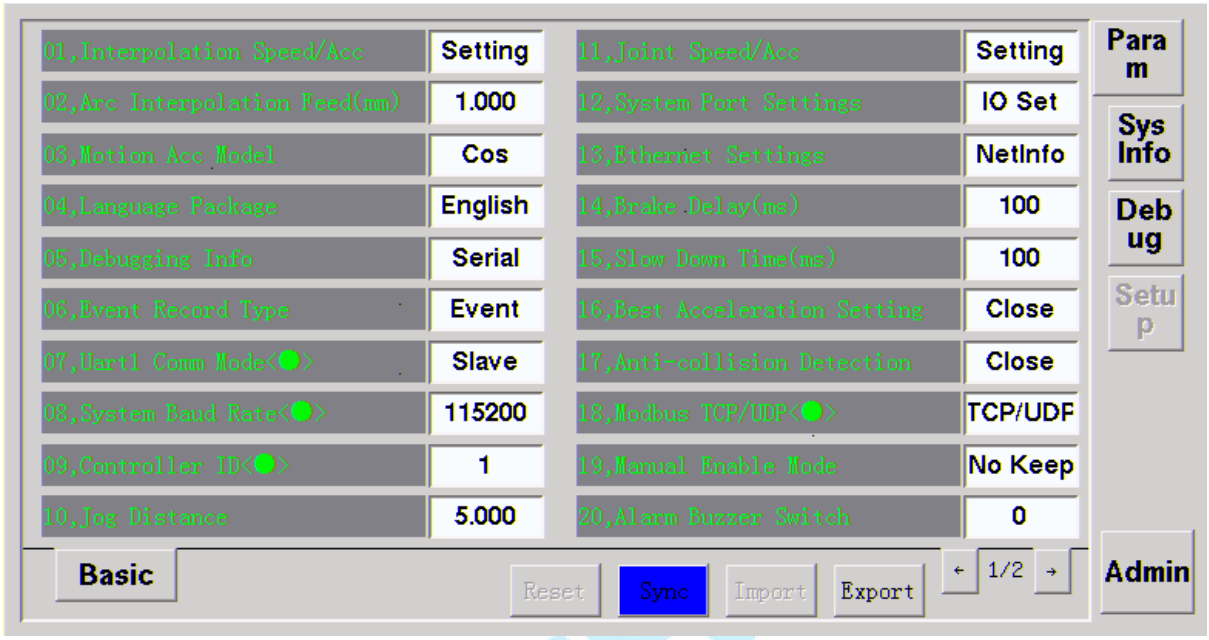
The system information is the software version information of each function module of the display system. Click on "  " figure, then press "SysInfo" button to enter upgrading interface of system. Specific upgrading steps are as follows:

- Upgrading operations must be carried out in **manual** mode;
- Pack application program (ADTROM.BIN), DSP program (Motion.bin), servo program (servo.bin) , resource package (RC400.ncp) and Servo parameter (****.par) in **ADT** file;
- Visit D-disk of robot controller through FTP communication and replace **ADT** file with the new one.
- Press "Admin" to obtain administration permission (26722719);
- Tick "All" (or tick one of them), and then press "Upgrade" button. It will take about 2 minutes~3 minutes to complete upgrade after clicking "Upgrade".
- After upgrade, remember to restart the controller. Then judge whether the upgrade is successful or not through version number.



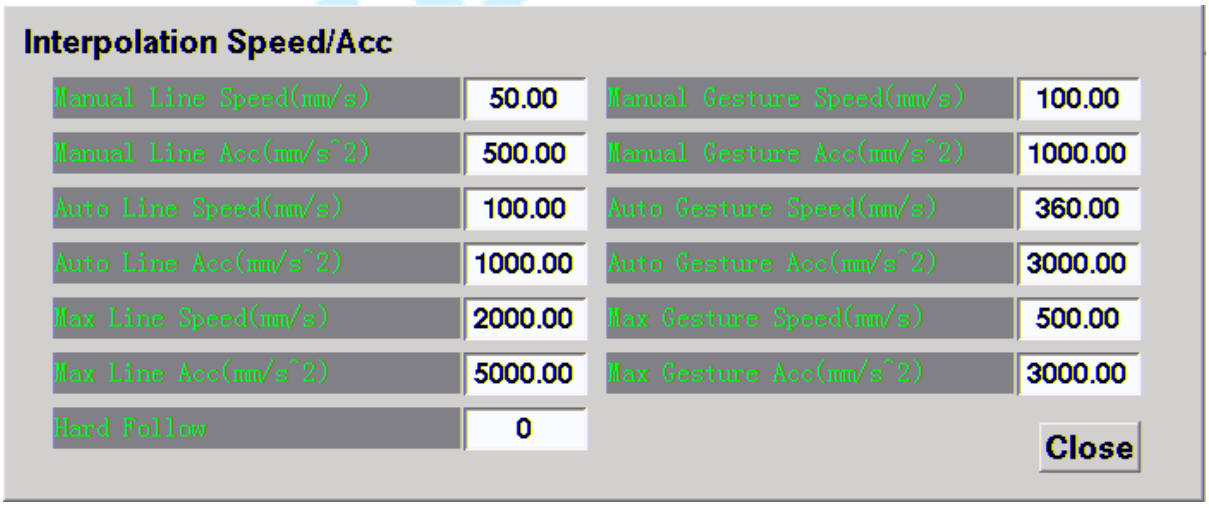
6 Parameter

Many parameters of the RC400 controller are configured in this interface.



01, Interpolation Speed/Acceleration

Click “Setting” in the interpolation Speed/Acceleration column to enter the interface of interpolation speed/ Acc.



- Manual Linear Speed: manual interpolation speed of X/Y/Z axis under the Descartes coordinate system
- Manual Linear Acc: manual interpolation acceleration of X/Y/Z axis under the Descartes coordinate system;

- Manual Gesture Speed: manual interpolation speed of C axis under the Descartes coordinate system；
- Manual Gesture Acc: manual interpolation acceleration of C axis under the Descartes coordinate system;
- Auto Line Speed: automatic interpolation speed of X/Y/Z axis under the Descartes coordinate system;
- Auto Line Acc: automatic interpolation acceleration of X/Y/Z axis under the Descartes coordinate system;
- Auto Gesture Speed: automatic interpolation speed of C axis under the Descartes coordinate system;
- Auto Gesture Acc: automatic interpolation acceleration of C axis under the Descartes coordinate system;
- Max Line Speed: maximum speed of interpolation of line and arc for X/Y/Z axis;
- Max Line Acc: maximum acceleration of interpolation of line and arc for X/Y/Z axis;
- Max Gesture Speed: maximum speed of interpolation of line and arc for C axis;
- Max Gesture Acc: maximum acceleration of interpolation of line and arc for C axis;
- Hard follow: 0 is close; 1 is open;

02, Arc Interpolation Feed (mm): Arc resolution accuracy;

03,Motion Acc Model: LinearModel/CosineModel/ExponentModel;

04, Language Package: current language package used in system(**controller is needed to be restarted after switching another language**);

06, Event Record Type: Including **ServoEvent, MoveEvent, and ActionEvent**;

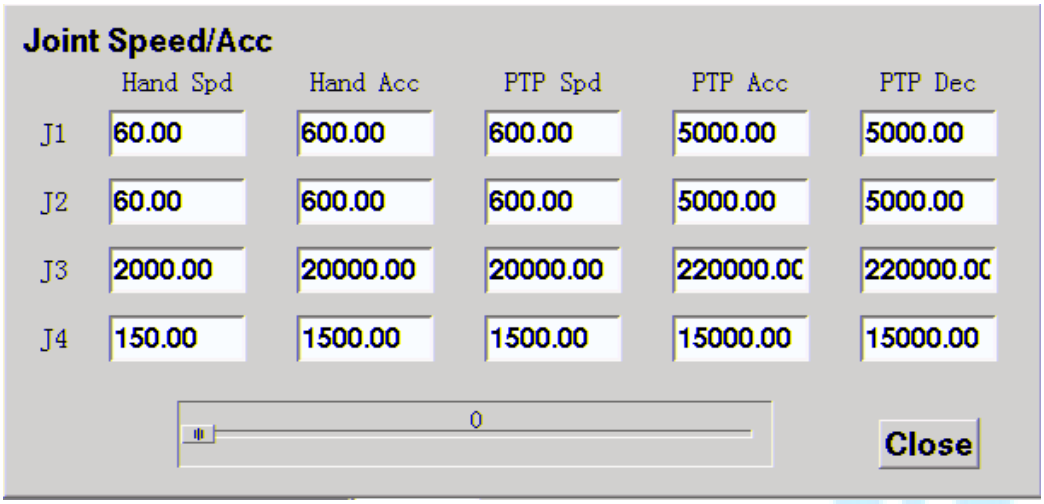
07,Uart1 Comm Mode: Asynchronous receiver transmitter, including **Shell, ModbusSlave(**Modbus communication, RC400 controller is slave station**), ModbusPoll(**Modbus communication, RC400 controller is poll station**) , and No protocol(**Serial communication**)**;

08, System Baud Rate: COM2 baud rate which can also be modified in the program;

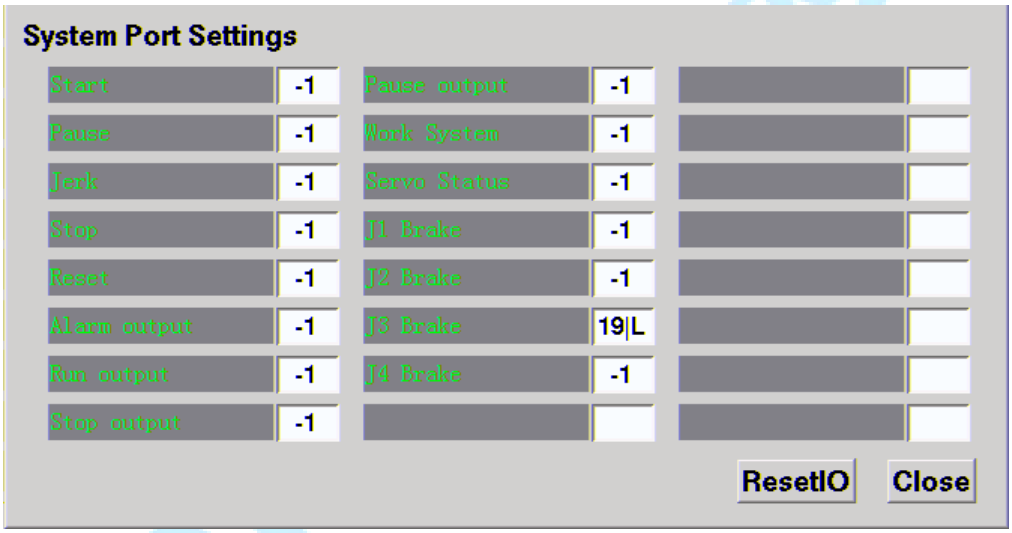
09, Controller ID: Configure the station number of controller for Modbus communication;

10, Jog Distance: Define the maximum value of a single step movement (default 5);

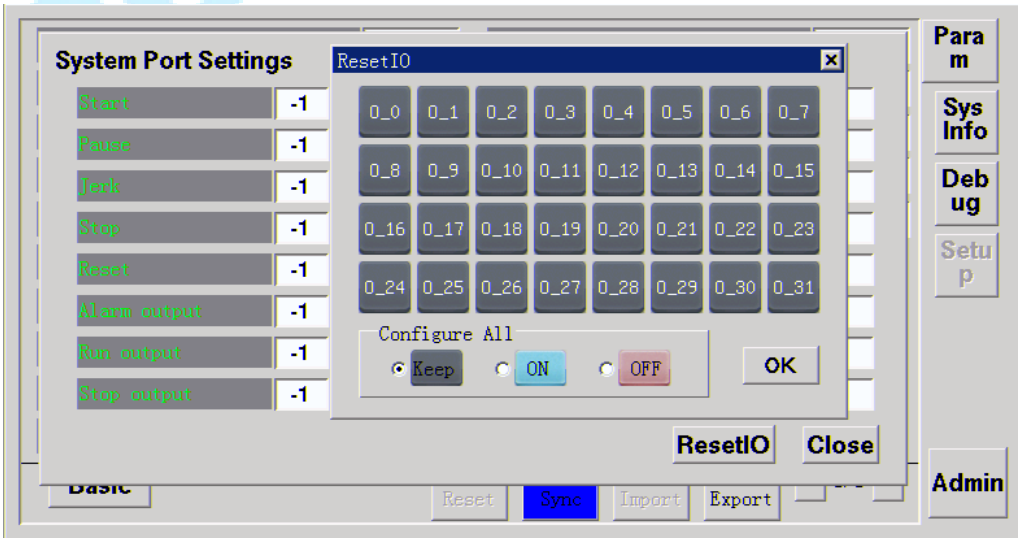
11, Joint Speed/Acc: configuration of manual joint speed, maximum speed of the point-to-point movement, and maximum acceleration;



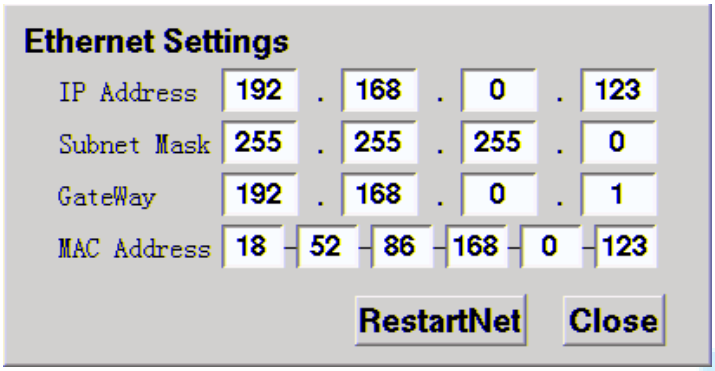
12, System Port Settings: for configuring the effective level of some inputs/outputs port, including the start, emergency stop and other integrated functions;



Click “ResetIO” to enter ResetIO interface. In this interface, you can open(ON) or close(OFF) all outputs.



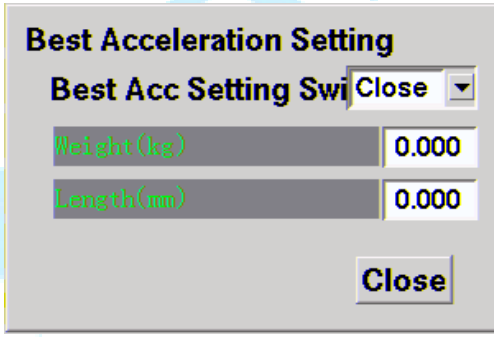
13, Ethernet Settings: Configure system network IP Address, Subnet Mask address, Gateway, and MAC Address;



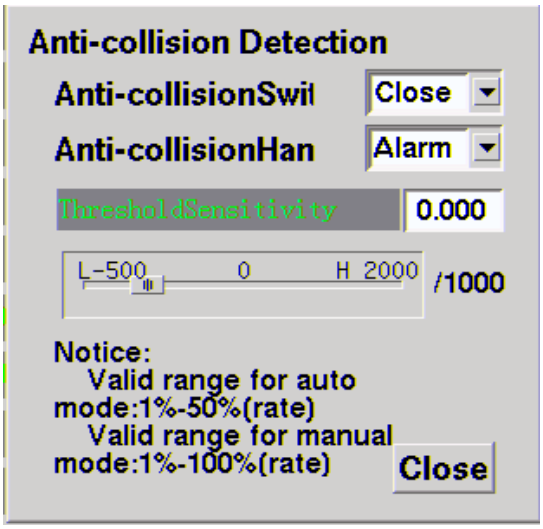
14, Brake Delay(ms): setting time of brake delay;

15, Slow Down Time(ms): time of stopping the movement when the robot detects the emergency stop signal.

16,Best Acceleration Setting: By setting load weight installed at the end of robot and clamp length and in combination with dynamic parameters set in acceleration interface within the installation wizard interface to calculate best acceleration (currently this function is only applicable to AR4215 model).This function is closed by default.



17,Anti-collicsion Setting: Collision detection function. Some corresponding parameter shoud be set in following dialog:



Anti-collision Switch： close（no use）、open （use）；

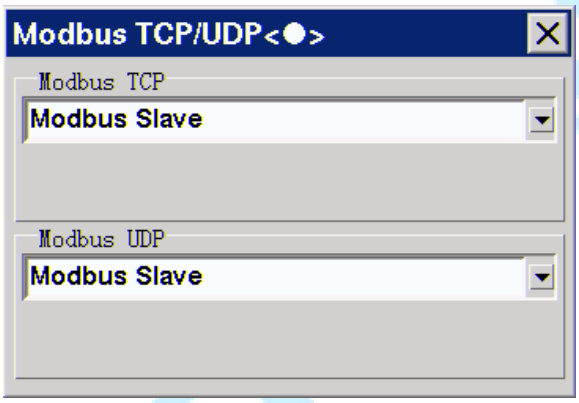
Anti-collision Handle： After the collision, the robot responds in either way: Alarm \Stop\ Pause;

Threshold Sensitivity： A sensitivity factor for collision detection (range is -0.5~2) . Specific value should be set according to robot model \load and speed used in the application.

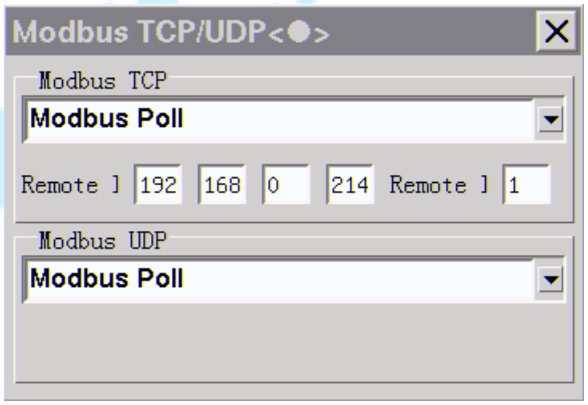
Notice： valid speed rate for auto mode is 1%~50%，and valid speed rate for manual mode is 1%~100%；

18，Modbus TCP/UDP<>: it is used for robot and other peripherals interacting through Modbus TCP/UDP communication.

(1) When robot is slave station, the corresponding parameters should be set as follows:



(2) When robot is Poll station, the corresponding parameters should be set as follows:



19, Manual Enable Mode: Keep、No Keep。Keep: if enable robot by hand, the robot will keep enable state if release enable key; No Keep: robot will lose enable state if release enable key.

20, Alarm Buzzer Switch: this parameter is used to set whether the buzzer will ring when an alarm is generated. 0：close (this function is off by default)； 1：open;

Tips:

- After changing the value of the corresponding parameters, you need to click the “Sync” button;
- Click “Export” button to export parameters for backup;

- If you want to do “Reset” and “Import” operation, you need to acquire “Admin” permission.

7 Alarms Handling

- There may come some alarming phenomenon when RC400 controller is in the use for some security protections; each alarm has a corresponding alarm code and related faulty content.
- For actual use, to avoid unnecessary damage and safety problems, we should immediately stop running robot when an alarm appears. Refer to the error ID to eliminate errors one by one, then continue to restart robot.

Error ID		
11003	:	Encoder is not connected
	Analysis	Selected encoder type in servo software is wrong or motor encoder wiring of motor is connected wrong.
	Handle	● Check if the encoder type selection is correct in the servo software. ● Refer to the encoder wiring in the electrical manual to check whether the encoder wiring is correct.
11007	:	Motor stuck
	Analysis	The possible reasons for this alarm are: protection conditions of stuck in servo software are set too strict; motor with brake, but brake is not open; the selected motor is in low power for heavy load; Mechanical clamping.
	Handle	Firstly, amplify the stuck protection conditions in servo software; If the alarm still exists, then check whether the mechanical structure is stuck; If there is normal, maybe motor power does not match.
11008	:	Bus voltage is too high
	Analysis	Bus voltage is instability
	Handle	Power loads in day and night of a factory are different;

		Generally, bus voltage will rise in the evening, so it is better to check whether the bus voltage set in servo protection parameters is correct.
11009	:	Bus voltage is too low
	Analysis	Bus voltage is instability
	Handle	Bus voltage will decline when robot run with load or high speed. In this case, it maybe causes an alarm for bus voltage being too low; You can change the "Minimal allowed bus voltage" to 180V. if the alarm still exists, please contact manufacture.
11013	:	A phase current is too high
11014	:	B phase current is too high
11015	:	C phase current is too high
	Analysis	Motor's phase current exceeds the protection range.
	Handle	● Check whether motor's power wiring is correct. ● If power wiring is right, you can decrease speed or reduce the load to see whether the alarm is relieved; If the alarm is cleared which means that the load is too heavy or the running speed is over the maximal allowed velocity.
11016	:	Motor current is too high
	Analysis	The actual current of the motor exceeds the protection range
	Handle	Check whether power cable wiring is correct
11020	:	Position deviation is over limit
	Analysis	The position deviation exceeds maximal allowed position error.
	Handle	● Check whether the maximal allowed position error set in the protection parameter is too small (5~10 times of the actual position deviation should be set). ● Position loop gain is set improperly: you can increase position loop gain appropriately under the condition of ensuring no mechanical jitter. ● Acceleration is set unreasonable: you can reduce acceleration or deceleration.
11021	:	Velocity deviation
	Analysis	The velocity deviation exceeds the limit

	Handle	● Check whether the power cable wiring is correct.
		● Check whether the maximal allowed velocity error set is too small (should be set as 5~10 times of the actual speed deviation).
		● Velocity loop parameter setting is not appropriate: in the case, increase the gain of velocity loop appropriately to ensure that running robot has no noise. ● Check whether the shielding line of power cable is connected reliably and check whether the motor with brake is connected with a brake plate filter.
11027	**:**	IPM module error
	Analysis	Module abnormal
	Handle	Please contact the manufacturer
1028	**:**	Selected encoder type is not supported
	Analysis	Encoder type is not correct
	Handle	Check whether the encoder type selected in the servo software is correct, and please contact manufacture to ensure whether RC400 controller support this type controller.
11035	**:**	Drive power supply module is disconnected
	Analysis	Abnormal power supply
	Handle	Check whether the 220V power supply has fluctuations or abnormal
19999	**:**	Encoder communication error
	Analysis	Encoder is abnormal
	Handle	Check whether the encoder wiring is correct, the encoder shield wire connection is reliable.
19998	**:**	BISS protocol encoder communication error
	Analysis	Encoder exception
	Handle	● Check whether the encoder wiring is correct, the encoder shield wire connection is reliable. ● For magnetic encoder, if the battery has low voltage under the condition of alarms not being cleared, it will also cause this alarm; in this case, you need to change a new battery, and then clear the alarm by command form. Notice that the robot is required to calibrate the origin again.

11090	:	Warning of low Battery voltage
	Analysis	Battery of the encoder is abnormal
	Handle	Check whether the battery is in low voltage. If the battery is in low battery, please change a new one. Notice that the robot should be in on power when replace the battery in avoid of the origin being lost. If the battery isn't with low battery without pressure, please check whether the battery connection is loose.
11036	:	overload
	Analysis	The actual current of the motor exceeds the overload protection range
	Handle	● If the speed is reduced, the motor run normally, which indicates that the load is too heavy or type of motor isn't fit. In this case, you need to robot's running speed or change another motor.
11307	:	Motor overload of 1.2 times
11308	:	Motor overload of 1.5 times
11309	:	Motor overload of 2 times
11040	:	Motor overload of 2.5 times
11041	:	Motor overload of 3 times
	Analysis	Motor current exceed the current limit and continue for a period
	Handle	If reduce speed, motor running normally. It shows that the load is too heavy or selected motor does not be matched or deceleration set is inappropriate. In this case, it is better to reduce speed or change another motor with higher power.
11042	:	Battery error
	Analysis	Error alarm about multi loop information of motor
	Handle	● After installation of absolute encoder with the battery, you need to clear the battery error alarm (FlexPandent with an interface to clear this alarm) when the robot starts for the first time. ● If this error comes up when not first time use after installation, it shows that the origin has been.
11043	:	Error alarm of CRC checksum

	Analysis	Encoder data is abnormal
	Handle	Check whether the encoder line is connected wrong or check whether shield line of encoder is not connected.
11057	**：**	Input speed of pulse is too large
	Analysis	Speed of sending pulse for controller is over the protection range
	Handle	● Check whether the maximum allowable speed of servo protection parameter is reasonable; ● Check whether the pulse sent by controller is normal.
11058	**：**	Bus between FPGA and DSP is abnormal
	Analysis	Data bus or address bus between FPGA and DSP is abnormal
	Handle	Please contact factory

Error ID		
20005	**：**	No axis existing
20004	**：**	Axis used conflict
	Analysis	Error in axes' parameters
	Handle	Check whether parameters in AR program are set correctly.
20006	**：**	Unable to reach for invalid area
	Analysis	The target position is not in the reasonable working range of the robot. It is also possible that some positions are belonging to singular points, if so, it also report this alarm when move robot with straight line.
	Handle	● Determine whether the target position is outside the range of robot's motion, or in the singular point position. ● If the position data is imported from somewhere, it is required to check whether the arm lengths are the same.
20009	**：**	Unable to track motion for singular region
	Analysis	Singular point refers to interference region of the robot body. This warning is generally generated when check whether the current point is reasonable before moving to it. Usually due to move robot with a line movement, and the current point stay in the zero point or interference.

	Handle	Change the line command to point-point or arch movement. The current point out the critical point (manual arm all in a line, on behalf of the critical point), and then execute the motion instructions
20010	**:**	Unable to track motion for different hand
	Analysis	The target position and the current position are not in the same hand while performing the line motion.
	Handle	To modify the current hand or target's hand to ensure that they are in the same hand.
20013	**:**	Interpolation queue is full, please wait
20014	**:**	Event queue is full, please wait
20016	**:**	Undefined Order
	Analysis	Operating environment is abnormal
	Handle	Please contact the manufacturer
20018	**:**	External IO Trigger Alarm
	Analysis	The system is equipped with external emergency stop, and the emergency stop signal is detected to be effective, which leads to the protection of the alarm.
	Handle	Check whether external emergency stop is effective. Check whether the emergency stop port and the effective level is set reasonable
20019	**:**	Motion Stop
	Analysis	Self locking protection alarm, which needs to be cooperated with other alarm information at the same time to analyze it.
	Handle	● According to other alarm information to determine the reason.
20020	**:**	Security detection of ARM system is abnormal, and DSP is self protection
	Analysis	For abnormal ARM running, so DSP watchdog creates an alarm to enter self protection
	Handle	Please contact the manufacturer
20021	**:**	J1 Soft Limit

20022	:	J2 Soft Limit
20023	:	J3 Soft Limit
20024	:	J4 Soft Limit
	Analysis	Operating position is out of range
	Handle	Check whether the set range is reasonable
20025	:	Motor enable error
	Analysis	Disable error during movement
	Handle	Cannot be carried out enable or disable operation; check whether the operation is in compliance with the specification.
20026	:	External encoder communication error
20027	:	External encoder battery low voltage warning
20028	:	External encoder battery warning
	Analysis	External encoder (M5 or M6) is abnormal
	Handle	If it is 20026-error, check whether the connection is reliable and shielding is good. If the battery is low voltage, you need to change the battery. Please pay attention, the controller must be on power when change a new battery in avoid of losing the origin of the robot.
		●

Error ID		
41001	:	Task Timeout
	Analysis	Operating environment is abnormal
	Handle	Please contact the manufacturer
41002	:	HMI Connection Failed
	Analysis	HMI communication cannot work properly, may be due to the version of the reasons or bad connection.
	Handle	Check the MCU version number and the welding line of the

		connecting head of teach pendent.
41003	:	HMI Detect Emergency Stop
	Analysis	HMI emergency stop detection is effective.
	Handle	Observe whether it is really effective; if so, clockwise rotate the emergency stop switch to pop up and then press “Reset” button to relieve this alarm.
41004	:	Detect the external scram
	Analysis	System is configured with an external emergency stop IO, and this IO is effective.
	Handle	● If there is an external emergency stop, you need to relieve the external emergency stop signal, and then press “reset” within the alarm interface. ● If the parameter is wrong, you can modify port number and active level of the IO.
41006	:	Abnormal DSP running time
41006	:	Failed to create task
	Analysis	Running environment is abnormal
	Handle	Please contact the manufacturer