The most practical robot controller

Make the most ideal and practical product to serve CNC world

NEWKer-i6 Robot Controller

Operation Manual

CHENGDU NEWKer CNC-TECHNOLOGY CO., LTD

Contents

Chapter 1 Safety

Pay attention:

Before using the controller (Including install、work、transportation、maintain、detection), please read this manual carefully, after knowing all knowledge about safety.

Dangerous, could be injured or death!

Pay attention, could be injured!

Must follow the noticed!

Must forbid doing!

Even some places without "Attention" or "Danger",but also need to be pay attention and very carefully.

Danger

- **Before operating, press the Emergency button on the upper right corner.**

- **Before remove Emergency, need to solve the accident.**

- **Before using teach function in the motion range of robot,please follow the steps:**

- Keeping in the front to watch the robot.
- Follow the steps.
- Please be careful in case of robot move to you.
- Please make sure the safe place in case of accident.

- **Must make sure there is no person in the motion range of robot,the operator should be in safe place**:

- When powering up the robot
- Using teach function
- Try to run

Please press emergency if somebody get in the motion range of robot or some accident happens.

Must be sure when operating

The operator knows how to operate.

Knows how it works.

Knows how dangerous it is.

★Need detect before using teach function.

The motion of robot is no abnormalities.

The original point is right or not.

The external accessory equipment is no abnormalities.

★The controller need to take care and put it to the fixed place after using

If the controller is falling down, it will cause robot motion to damage equipment or get somebody injury.

Safety operation

1、All operators need to know all function of robot and the safety operation.

2、Make sure there is no dangerous before running.

3、Must press emergency and power off when in the motion area.

4、 Should watch and be careful when programming in case of press emergency in time.

5、 No gloves when using teach function or move in manual,make sure it is in low speed.

6、Must know the function and how to stop the external accessory equipment.

7、Never trust the robot is stop, it maybe wait the signal to work the next program.

Chapter 2 Summary

NEWker-i8 robot controller use the international embedded bus type,the controlling circuit use the newest industrial high speed ARM CPU、Mass programming FPGA technology, multilayer PCB, the whole machine adopts high integration chip and surface mount element, the structure is more compact and reasonable, and better ensure the reliability and stability of the system.The software is module designed, to suit the different structure, industrial application requirements.The robot controller can realize vertical multi joint robot,vertical articulated parallelogram robot, vertical multi joint robot, L wrist shaped vertical multi joint robot, spherical wrist robot, Delta robot ,pole coordinate robot and so many kinds. It is widely used and could be worked in handling, welding, spraying, palletizing, cutting, polishing,welding and so on.

The controller adopts bus structure with absolute motors, simple structure, practical and reliable.Use 800X600 TFT LCD technology, LED got uniform brightness and long service life.

2.1 Functional Characteristics

1) Structure optimization algorithm, adapt to the various kinds of robot;
2) Modular functions, to adapt to a variety of applications;
3) 8 axis control, could realize the auxiliary axis(walking axis, position control)；
4) Adapt multi loop absolute motor;
5) Embedded bus type, easy and expand function;
6) 48x32 input and output points,edit PLC online;
7) all kinds of robot process function, simplify the programming and operation;
8) TCP function, tracking function of weld seam;
9) Security module structure, strong practicability, high reliability.

2.2 Technical Parameter

Axis	6 axis robot + 2 axis accessory axis
Controller	8 inch TFT-LCD, touch, mode switch, safe switch, emergency
Motor	Bus absolute type
Connection	1）48x32 input and output points; 2）2 ways for analog 0-10V output; 3）1 way for quadrature input of encoder; 4）6 ways for output of brake motor;

	5）The special terminal for robot connection; 6）RS232, RS485, used for driver communication 7）EtherCAT communication
Operation	Teach、Reappear、Remote;
Programme	Keyboard、Teach、Technique;
Motion	Point to point、Straight、Arc;
Instruction	Motion、Logic、Calculation、Technique,also could use the code of CNC controller；
Coordinate system	Joint Coordinate、User Coordinate、Tool Coordinate、World Coordinate
PLC	Ladder graph,8000 steps;
Alarm	Emergency、Driver alarm、Safety maintenance、Arcing abnormal、coordinate system abnormal;
Type of robot	1） vertical multi joint serial robot; 2） vertical articulated parallelogram robot; 3） vertical multi joint L shape wrist robot; 4） Polar&Cartesian coordinate robot; 5） Rectangular coordinate robot; 6） SCARA robot； 7） Delta robot； 8） Special robots；
Application	Handling, welding, spraying, palletizing, cutting, polishing, forging, casting and so on

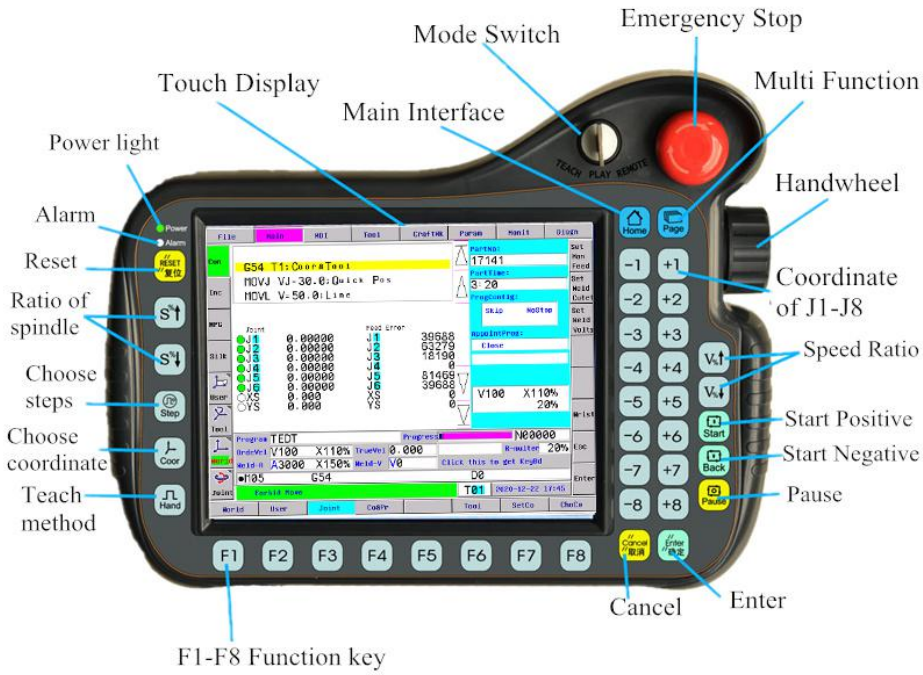
If the operation is wrong with our controller to cause some accident,read the manual and operate carefully, must follow the steps from manual,otherwise the result is no relations with our company!!!

Chapter 3 Operation

3.1 Summary

Knowing the parameter of controller.edit program, teach function,reappear function will be easy to use robot.

3.2 Controller

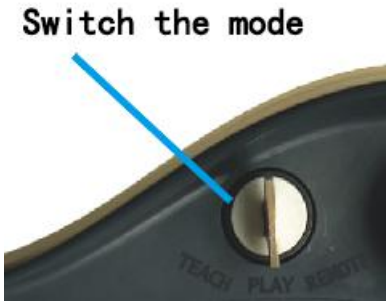


3.3 Function

3.3.1 Emergency

Pay attention: Usage for emergency need match with the circuit, must be safe and reliable,otherwise it can't stop.

3.3.2 Switch the mode



Usage for choosing the mode of operating the robot, total 3 kind of mode:Teach function, reappear, remote.

3.3.3 Safety switch

Safety switch is on back of controller, when the switch is pressed in the middle, the robot could move in Teach mode; If press it hard or loose it, the robot will stop, the controller will stop giving the signal.

Note:The switch got total 3 gears, the outermost and the innermost could stop the robot, only in middle gear, could robot move.

Pay attention:

1. To be safe, safety switch should be kept pressed during axis homing, otherwise homing process will be interruptted!

2. To be safe, safety switch should be kept pressed during trial running! otherwise trial running will be interruptted!

3. The person can't be in the motion range of robot,the robot will move when the press is in the middle, in case of accident.

3.3.4 Handwheel

There are 3 gears could be chosen,0.001，0.01，0.1,chosen by 

The handwheel also could be used in program,it means use handwheel to run the program, move handwheel positive, the program will run forward, move handwheel negative, the program will run backward.

3.3.5 Function

<Reset>, to stop program; <RESET> can works in abnormal conditions or when executing program should be ended.

Pay attention: Reset may close some output(Relate with PLC), be careful

<Enter>;

<Cancel>;

Main interface；

Multiple Function, could choose “program” “parameter” “compensation” “diagnosis” interface;

Choose the incremental value in teach function or handwheel mode;

Select the coordinate system in teach function, could choose “Joint” “User” “Tool” “World”

F1-F8 Function；

The program will start forward in reappear mode;

The program will start backward in reappear mode;

Pay attention: The robot will move when press Start. Must be carefully.

<Pause>, the program will pause when pressing this button.

To choose each axis of robot in teach function.

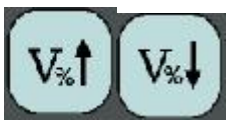
3.3.6 Ratio adjustment

（1）Rapid ratio

Use VJ= to specify the rapid ratio. For example, VJ=90, but the ratio can't be over 100%.

In PLAY mode, Rapid ratio is used adjust rapid speed.

（2）Feeding Ratio



Total 16 gears includes 0%～150%. Feeding ratio is used to adjust MOVJ speed during MOVJ execution.

（3）Ratio of electric current

Total 16 gears includes 5%～150%, Ratio of electric current can be used to adjust welding current AA during welding.

3.4 Teach operation

Switch the key into mode of TEACH, press in the middle of safety switch, then could move each axis.

Be noticed when operating：

1）Keep watching in front of robot

2）Must follow the steps；

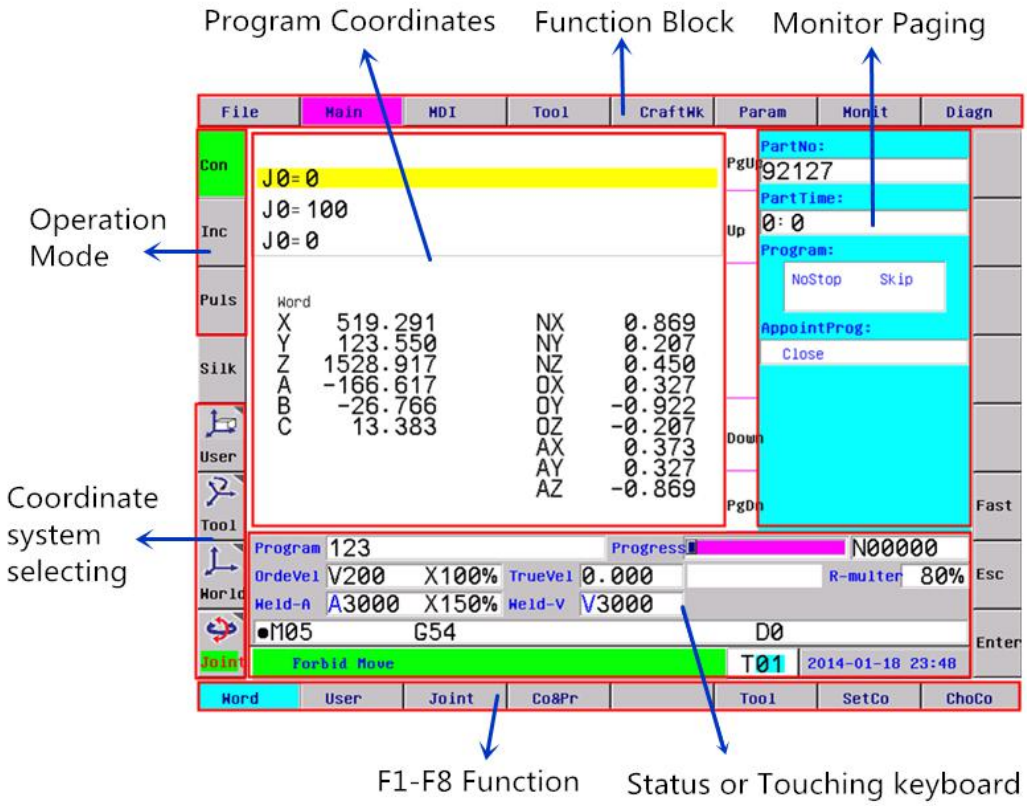
3）Think a plan in case of the robot will run to person to get injury；

4）Make sure the safety place；

5）The wrong operation may get somebody injury；

The controller use the first level operation, easy and fast, got full of information.

The controller is power up and enter the main interface, or press<Home> to enter main interface.



Press lower half of screen,it will show or hide the touch keyboard. The areas around the screen are function block or status monitoring block, which can be performed by corresponding touch keys.

“File”: edit, revise, compile,delete, copy user program and files.

“Main”: main interface, processing interface in auto and manual mode.

“MDI”: edit program and execute it immediately.

“Tool”: is used to modify tool compensation parameter if tool coordinates offset.

“Craftwk”: set and change technique parameters.

“Param”: set and change parameters.

“Monit”: convert monitoring interface among coordinates, processing instruction and processing status.

“Diagn”: input and output debugging, monitor and modify PLC.

Coordinate displaying: display world, user and joint coordinates.

Program displaying: display user program.

Status display or Touch keyboard: display of alarm, program name, instructions, status, coordinates. Meanwhile, this area is touch keyboard also, gentle touching will convert between status and keyboard.

When press<F1> in main interface, it will enter into World Coordinate interface, this is the world coordinate of Tool endpoint(TCP coordinate). and when press <Monit> on the top block, there is also world coordinate, but this is world coordinate of J6 flange endpoint.

The Teach function is used for adjust the coordinate of robot and the motion of accessory axis to programme.

Adjust position of touch screen:If buttons on touch keyboard are incorrect, please press”6” or <Pause> in Password interface and press enter, then reboot the controller.

3.4.1 Button in Teach mode

(1)“F” or “V”：Set the feeding speed of Joint；linear coordinate unit:mm/min; joint coordinate unit:degree/s.

(2)<HAND>：Switch “Continuous”、“ Incremental”、“Handwheel”.

In “Incremental” or “Handwheel” mode, press <Step> to switch different steps: “0.001/0.01/0.1/1.0” or “x1/x10/x100”.

(3)“S”：Set the speed of the first spindle (The first analog output), the max value is up to the Speed parameter No.43. or run “S”/”AA” in MDI to set spindle speed(analog output).

In welding robot, welding current output(A) is performed through runing “SS” in MDI, and welding voltage(V) is through running (VV) in MDI.

(4)“I”：Modify the incrental value in incremental mode.

(5)“T”：Set the number of the current tool and TCP point in world coordinate as the base point of tool set.

(6)“V↑”：The ratio of feeding speed will increase 10% by pressed once, total 16 gears in 0—150%.

In Auto mode, if <Fast> is pressed, it will adjust the rapid ratio by 10%.

(7)“V↓”：The ratio of feeding speed will decrease 10% by pressed once, total 16 gears in 0—150%.

In Auto mode, if <Fast> is pressed, it will adjust the rapid ratio by 10%.

(8)“S↑”：The ratio of spindle speed will increase 10% by pressed once, total 16 gears in 5—150%. for welding robot, it will be used to increase welding current by 10%.

(9)“S↓”：The ratio of spindle speed will decrease 10% by pressed once, total 16 gears in

5—150%. for welding robot, it will be used to decrease welding current by 10%.

(10)“R”： The current user coordinate backs to zero point, input “XYZABC78” correspond to “XYZABCXsYs” go back to zero point，if input “0”, then all axis go back. If the robot is equipped with incremental encoder motor and mechanical home switch, then J1-J6/Xs/Ys back to home switch(X0/Y0/Z0/A0/B0/C0/XS0/YS0).

To be safy, sfety switch need to be kept pressing during homing, otherwise homing stops.

(11)<F7 Set coordinate >：In user coordinate system（G54.1-G54.48/G54-G59）to set the value of（G54.1-G54.48/G54-G59）, update the value of coordinate system; Use “MDI” or <F8> to set the user coordinate system（G54.1-G54.48/G54-G59）.

3-points method to set user coordinate system: P1 as original point 0, P2 as the direction of +X, P3 as the direction of +Y.

(12)Coordinate Feed：Press “+1、-1、+2、-2、+3、-3、+4、-4、+5、-5、+6、-6、+7、-7、+8、-8” correspond to J1-J6，Xs、Ys to move positively and negatively.

(13) In Teaching mode, press “Silk” + “S↑” to output M03, press “Silk” + “S↓” to output M04, then quit without pressing.

(14)“<F6> Tool”, used for making sure the coordinate in tool coordinate system.

Two methods to set tool coordinate of 6 axis robot: 3-points and 5-points.

(A) 3-points：P1P2P3 for changing the motion of robot and keep the TCP point to be the same position, the motion of 3-points tool coordinate is the same as motion of electrical connection coordinate system.(The coordinate system of the 6th axis flange of robot).

(B) 5-points：P1P2P3 are the same as 3-points, but the motion of tool coordinate system is settled by P3P4P5. P3 means the original potion, P4 means the direction of +X, P5 means the direction of +Z. P4 and P5 need to setting in the world coordinate system.

Press “Start” or “Back” on the right side of screen during set process, the statues will show “O”, then press “12345” to adjust the speed to back to the point set the last time, easy to modify. After once operation, this function will be closed automatically.

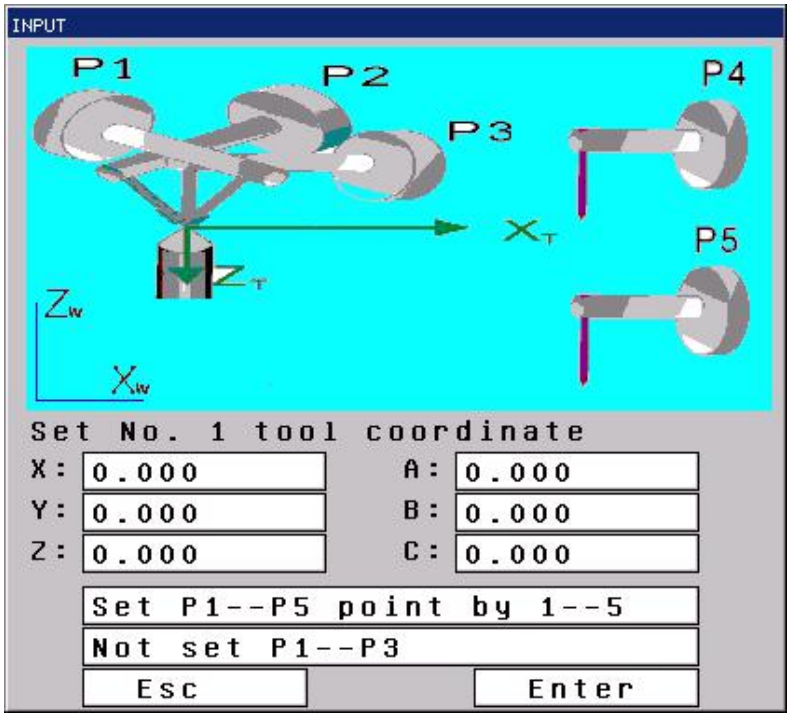
The posture of P3P4P5 in 5-points need to be the same(Value of ABC in world coordinate should be the same) [The interface needs to be without N letter]. So it is necessary to convert into the world coordinate system after setting of P3, then move the robot to set P4 in the direction of X axis and P5 in the direction of Z axis.

During the TCP setting, number 1-5 corresponds to point1-5, if press 0, all of existing setting will be cleared.

After input P1P2P3 3 points in tool set, the controller will calculate the position and posture of tool coordinate in world coordinate, if 3 points is too near, then it can’t be exist P1P2P3, the controller can’t calculate the value, it will delete P2P3 automatically.

XYZ of tool set mean the original point of tool coordinate in world coordinate, ABC mean the 3 axis posture in space(position and direction) of tool coordinate in world coordinate.

Pay attention:P1P2P3 in 3-points need be different posture;But the tool posture of P3P4P5 in 5-points need to be on the same straight line with correcting device(It is fine if it isn’t straight line, just the direction of Z axis in tool coordinate is not on the same straight line with weld gun)



3.4.2 Flush function of robot

Press "-" or "," on controller, it will flush according to the MOVL mode, the speed is the speed in teach.

Press "." or "]" on controller, it will flush according to the MOVL mode, the speed is the rapid speed of each joint.

Flush function is let the tool coordinate system parallel or perpendicular to user coordinate system or world coordinate system.

3.4.3 Switch feeding mode of wrist joint

The world coordinate or user coordinate in teach mode, press "N"in main interface could switch the feeding mode of wrist joint.

1） When the interface shows N letter, it means move XYZ is the motionofJ1J2J3 of world coordinate or user coordinate in teach mode, the J4J5J6 will not move,it means not consider the change of robot posture in the end, just consider the flange position of robot in the end.In the same time, interface of user coordinate show the flange of robot in user coordinate. In the same time, interface of world coordinate show the flange of robot in world coordinate.

2） When <Wrist> is not pressed in Teach mode, it means in world coordinate or user coordinate, the endpoint posture of robot will be keep the current status when move XYZ, the endpoint position of robot will be keep the current position when move ABC. The interface of user coordinate will show usercoordinate of TCP. The interface of world coordinate will show world coordinate of TCP.

3.4.4 Calibration or tool set of robot

Firstly, move J4J5J6 in Joint coordinate, or move A or B or C of world coordinate in

wrist feeding mode to modify the posture(Only J4J5J6 move, J1J2J3 will not). The posture of P1 is more important during tool setting, the axis of weld gun need perpendicular to workpiece. Move X or Y or Z to the target point in world coordinate in wrist feeding mode(only J1J2J3 move, J4J5J6 will not move).

3.4.5 Choose coordinate system

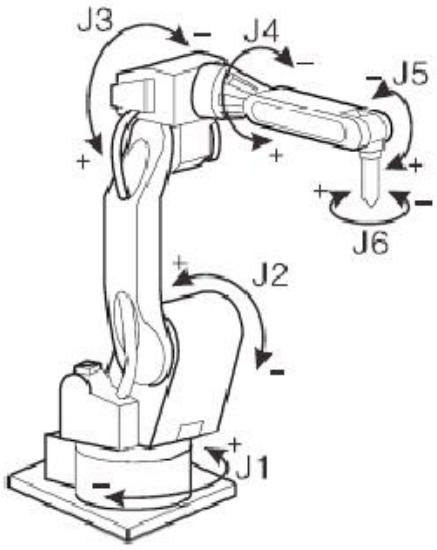
Press 

to choose the coordinate system, in the teach mode,could choose “Joint coordinate” “User coordinate” “Tool coordinate” “World coordinate”;

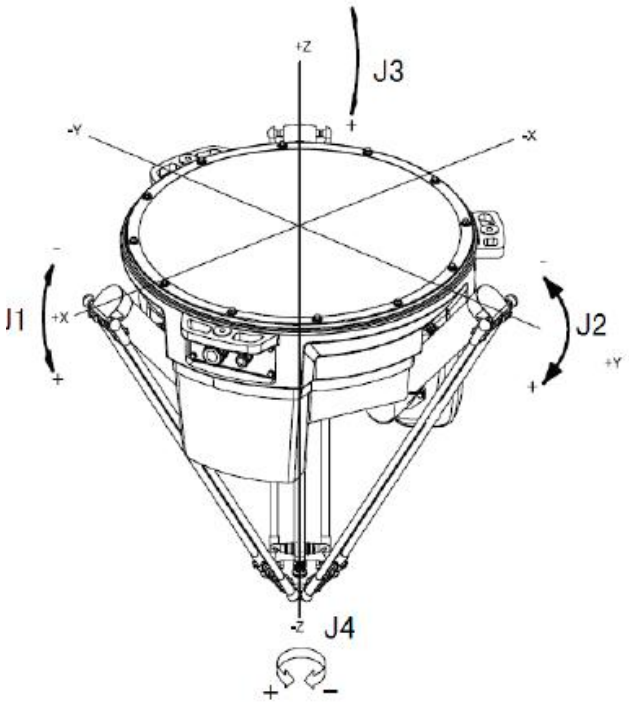
1）Joint coordinate system

The robot move along the each axis line, all used coordinate system named joint coordinate system. The joint coordinate system is settled down when robot is settled down, can’t change.

The controller can support many kinds of robot, please look up to the definition of robot to make sure the motion direction of each joint coordinate system, for example:



Six axis serial joint robot



4 axis Delta robot

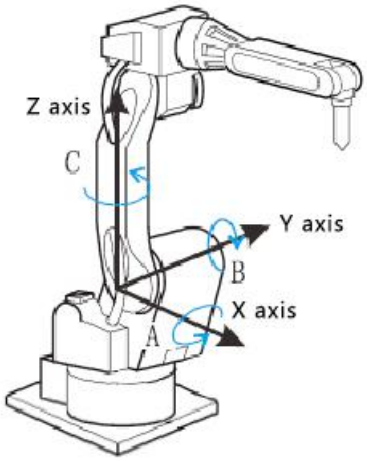
4 axis rotary joint palletizing robot

2）World coordinate system

World coordinate of robot, named right angle coordinate, also named ground coordinate, the same as robot coordinate in cnc controller. Different kind of robot correspond to different direction of right angle coordinate, the different right angle coordinate correspond to different original position.

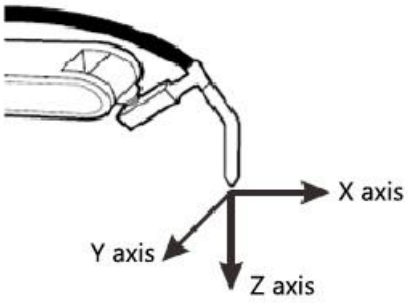
After setting the relative parameter of robot, the zero point and direction can be made sure, can't modify the right angle coordinate if not to modify the parameter.

Wherever the robot, it can along X axis, Y axis, Z axis move parallelly. For 6 axis robot, it also could rotate A, B, C, A axis rotate around X axis, B axis around Y axis, C axis rotate around Z axis, according to the right-hand rule.



3）Tool coordinate system

The tool coordinate is the same as tool set coordinate in cnc controller, tool coordinate make the effect direction of the tool in flange of robot wrist as Z axis, and define the coordinate as the tip point of tool. No.0 tool coordinate is the base tool coordinate, can't be modified.

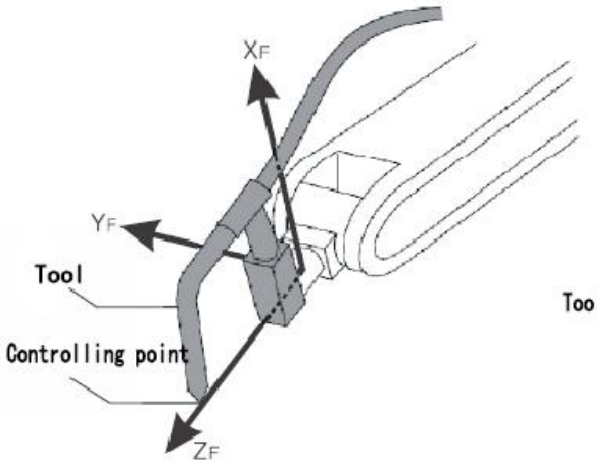


So the direction of tool coordinate is changing when the wrist is moving.

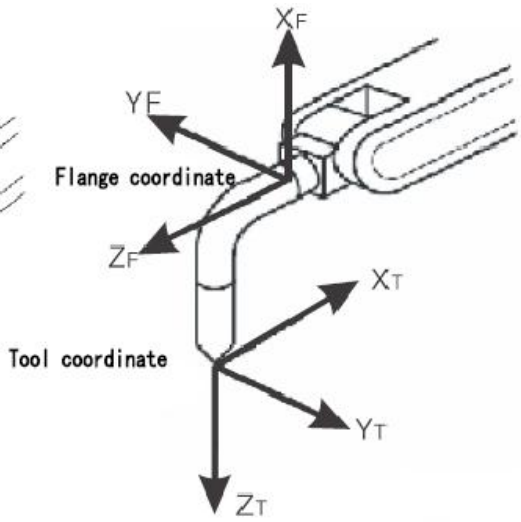
The tool coordinate move according to the direction of tool, no relative with position of robot or posture, so it is better to move parallelly so that not to change the posture of tool.

The robot carries out the straight line interpolation, the circular interpolation and so on interpolation movement need to input the right size information of tool, position of definition controlling point. Build tool coordinate is by the different data of 6 groups of end robot, the controller will calculate the position of tool controlling point.

Use tool check is input the coordinate of tool controlling point of flange. As the following:



Tool size is based on the end robot coordinate



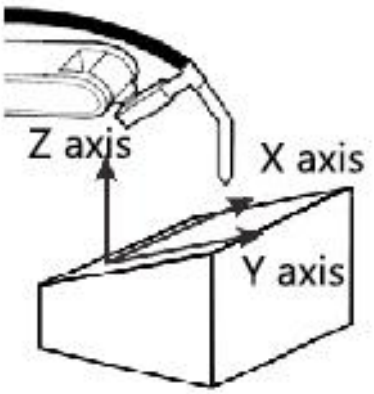
The relation between tool coordinate and end flange coordinate

4）User coordinate system

The robot move parallel to the specified each axis in user coordinate. User coordinate is the same as workpiece coordinate in CNC controller.

In other coordinate system except joint coordinate, all could just change the posture of tool, no need to change the position of tip point tool(controlling point), named invariant movement of controlling point.

G53 user coordinate is the base, can't be modified, the same as right angle coordinate. User coordinate could be set by G54/G55/G56/G57/G58/G59/ G54.1-G54.48



The usage for joint and world coordinate, use the switch for changing the mode,and then use +/- to move the robot or programme.

User and tool coordinate need 2 conditions, use the suitable coordinate number,change into suitable coordinate system. After these conditions, you can use Teach function to programme in this coordinate.

Pay attention: The coordinate you choose will be taken into the teach program when editing in the teach mode, so need to make sure the correct coordinate system.

3.5 Reappear(PLAY) operation

Switch the mode into reappear (PLAY) position.

PLAY mean reappear the current editing or teaching program. The controller could work in any point, from any line to work. If work from any point or any line, then need edit with absolute coordinate. Reappear function can't work with teach.

Select the running program: Press "↑""↓" to select the program and press "C".

To change to coordinate: Press "F1""F2""F3" to change"world coordinate" "User coordinate" "All coordinate".

3.5.1 Start

Choose "Single or continuous"：Press "F4 single" to switch.

"Continuous" means after pressing "start", the program will run until to the end or stop instruction.

"Single" means only run the current segment of program, press "start" again to run the next segment.

3.5.2 Start from any line

(1) Start from real line：

Press "-" to input the number of line in reappear mode, press Enter to make sure,or Press"↑、↓" to select the program line in status of reappear coordinate, this line will be the start line. **It will starts from the input line when press "start".**

Pay attention：

1、This line is the real line of the program, not the line is specified by N.

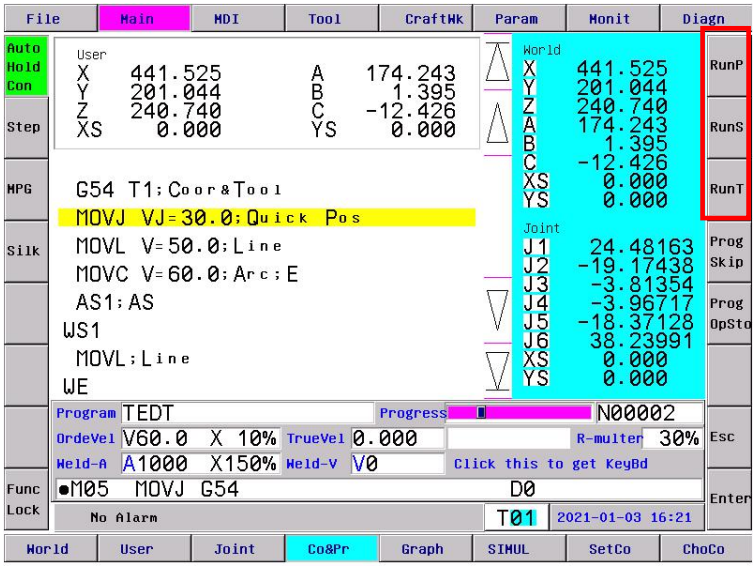
2、Start from the real line, the default line is the line when pause the program, so that user could operate easily.

(2) Start from marked line：

The controller could start the program from the marked line. Press "N" in reappear mode and input the number of line which be marked, press enter to make sure. It will start from the number of line you enter when pressing start.

(3) Start from tool line

The controller can start program from the some tool number line. Press "tool number start" in the reappear mode, it will prompt a dialog, input tool number, and press enter. When pressing ENTER, program will start from tool number line.



3.5.3 Program start

First change into reappear (PLAY) position, there are two ways.

（1）Press “Start” on panel or connect external “RUN” signal.

（2）Press “Back”, the program goes back (No.14 parameter in other parameter need to be 40).

3.5.4 Program stop

Program stop:

（1）Instructions M00、M01、M02、M30、M20；

（2）Press “Single” to move a segment and stop；

（3）Connect external “HALF” signal, the program will pause；

（4）Press “Reset” to stop all motion of robot.

3.5.5 Real-time control in reappear mode

（1）Modify rapidly：By VJ instruction；

（2）Feeding speed：Press “V↑” “V↓”. changed by 10%.

（3）Spindle speed：Press “S↑” “S↓”. changed by 10%.

（4）Stop in process：Press “Single” in continuous mode, it will finish the current segment and wait for the next signal.

（5）Pause：Press “Pause” or connect external “HALT” to pause. Press “Run” or “Start”, it will continue; Press “Reset”, it will quit the status of reappear, at the same time, the program will go back to the first line.

（6）Keep feeding：When it is pause（external HALT、press “Pause” or “Single”）,change the mode into “Teach”, keep feeding in reappear, could adjust the coordinate, change the mode into “PLAY” mode, press “Start”, it will move to the point of pause and continue to work.

（7）Quit process：Press “Pause” during process, or press “Reset” during keep feeding.

3.5.6 MDI

Press “ MDI” to enter MDI mode in “Teach” or “PLAY”. “MDI” mode is input segment of program, run segment of program, press “Back” in the process to quit, press “Start” to run.

3.5.7 Handwheel

Press “Hand” in “PLAY”, it will goes in handwheel process mode, the program will run by handwheel. F speed and ratio of feeding according to the speed of handwheel rotate. Usually this method is used to try to work with program.

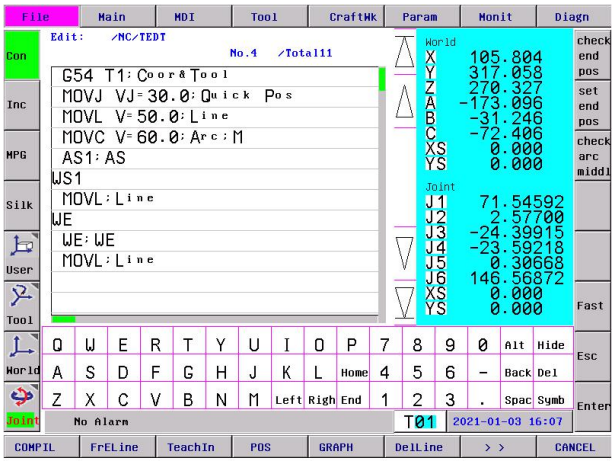
3.5.8 Trial run

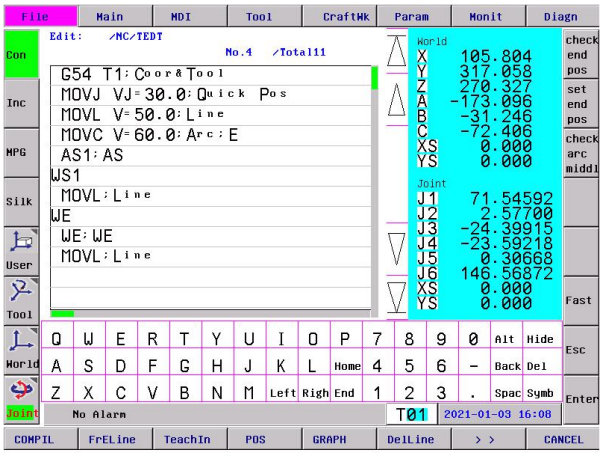
In the interface of program edition, one line of program where cursor locate will be executed when “start” is pressed once(either auto mode or manual mode). The segment name on the screen will be “ RUN-TEST” during test run. Such flow control language as GOTO, WHILE, IF will not be executed in test run mode. Once the program is edited, it will come into force immediately.

Trial run applies to check if the coordinates of editing point is exact in program. Run mode can be converted by Process parameter P20, when P20=2, it means program stops at the current line. When P20=4, it means program goes to next line automatically.

If Process parameter P20=34 or 36, when press **Start and hold press**, controller will run current line continually, when release **Start** button, controller will stop movement, and if press **Start** again, current line will continue.

During test run Arc, namely MOVC line, if add “;M” at the end of MOVC line, and press **Start**, controller will move to middle point of arc directly, instead of running full arc; if add “;E” at the end of MOVC line, and press **Start**, controller will move to end point of arc directly, instead of executing full arc. After running one time, system will delete “M” or “E” automatically.



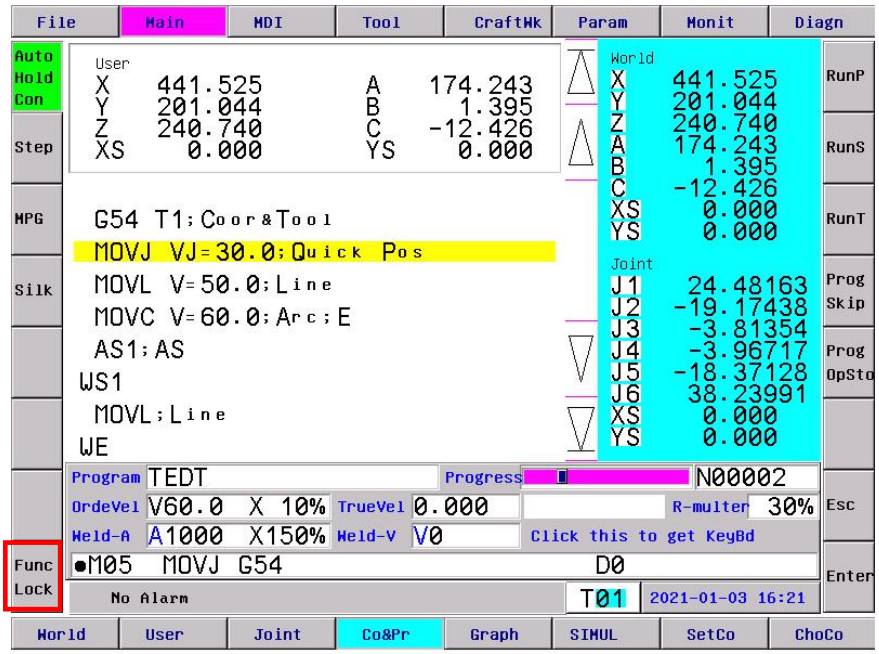


Attention: to be safety, only if safety switch is pressed, can trial run goes on. Once safety switch is unpressed, operation stops.

3.5.9 Function Lock

Before process work piece, if user want to check program movement only, please press

function lock button to disable all technique instruction and output command.



3.6 Remote control and Appointment function

3.6.1 Remote control

Remote mode: refers to control robot away from robot controller. Applying to many robots are connected together to be controlled remotely, and operator is far away from the robot position.

The “start”,”back”,”pause” on the panel are disabled in remote mode, only remote control by signal RUN and signal HALT.

Process parameter P17 is used to define the remote controlling, to choose the executing program by input points[D2-D7(+4...+128) corresponding to X26-X31, D8-D13(+256...+32768) corresponding to X16-X23].

To choose the executing program by input points. For example, if process parameter P17 is set as +4+8=12, when X26 or X27 is effective, to choose program HIDEFILEX26 or X26, or HIDEFILEX27 or X27. that is all about remote control.

3.6.2 Appointment function

The reservation function is enabled by Process parameter P21 after the main program is finished. The quantity of reservation program which can be started is 10(corresponding to input points: X28,X29,X32-X39). Start method of reservation can be, 1 means start, +2 means loop execution, +4 means no input detection. Details is in the section 3.12.13.

3.7 Safety operation and alarm

3.7.1 Emergency stop

The controller will stop all motion of robot when pressing this button, the controllers show emergency and wait for pressing up the button. M67 output the effective signal when No.19 parameter in other parameter set as effective.

It is the best to run “M500” to read the position of motor again if press this button when robot is working, because it maybe cause the position change.

3.7.2 Reset

The controller will stop all operation when pressing this button.

3.7.3 Alarm

The screen will show the tip of alarm, the light will be red, the movement and program will stop, need to make detection to clear. Other Parameter No.19 set as effective, M67 outputs effective signal.

3.8 Parameter

Press “Page” to enter. The parameter includes “Processing” “Speed” “Axis” “Macro”

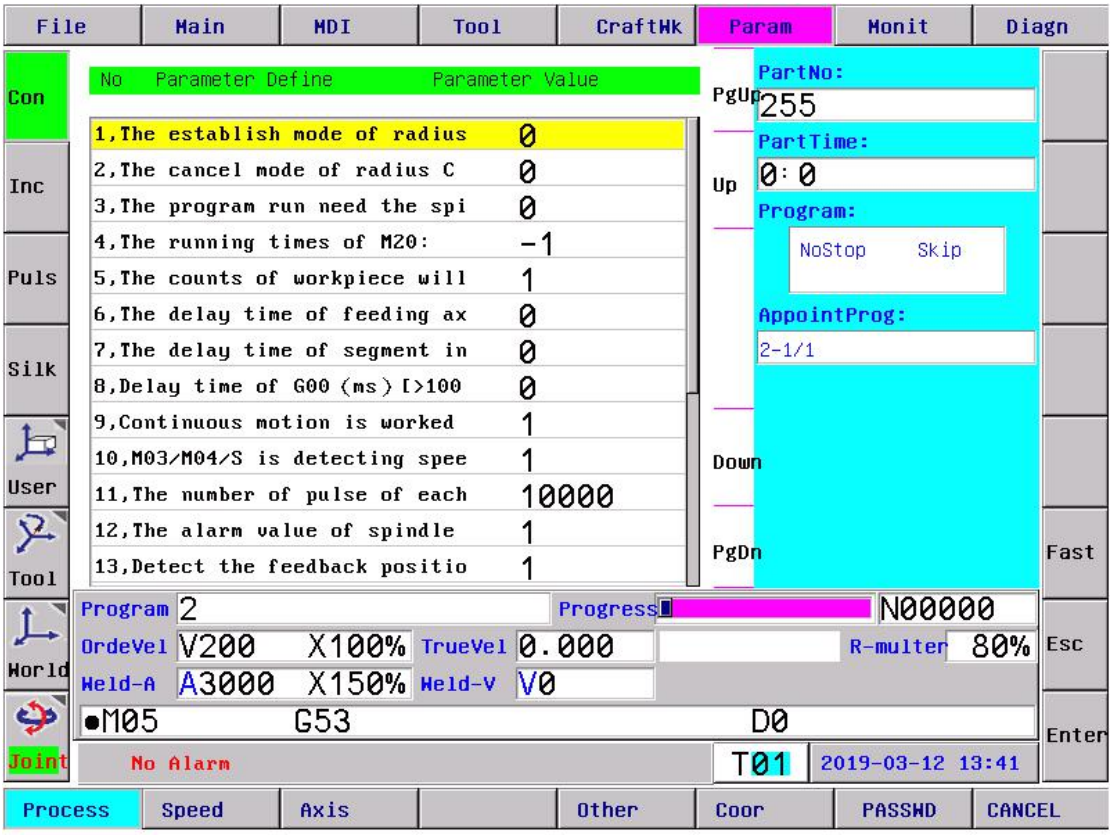
"Other" "Coordinate" "PASSWD".

Note：

1. Value of all bit parameters are counted from right to left, different bit corresponds to different function.

Format: D9|D8|D7|D6|D5|D4|D3|D2|D1|D0

2. The instruction of controller contains parameter of CNC controller, so there is some parameter about CNC.



3.8.1 Processing parameter

★、1，The establish mode of radius C compensation

The establish mode of radius C compensation in G41/G42, 0 means A type, 1 means B type.

★、2，The cancel mode of radius C compensation

Set the cancel mode of radius C compensation in G41/G42, 0 means A type, B means B type.

★、3，The program run need the spindle rotate[1 means Yes, 0 means No]

For interlock between program and spindle, to set if detect rotation of spindle or not while program running.

If set as 1, the spindle needs rotate when program running(Need detect the encoder

rotation when it is M03); Set as 0, then no need to detect.

★、4，The running times of M20

The loop times of M20 in program, infinite loop when it is minus.

★、5, The counts of work piece will be counted automatically[1 means Yes, 0 means No]

Reappear counts of program, if it is 1, the count of work piece will add by one automatically when running M30, M20, M02.

★、6,The delay time of feeding axis to go reversal(ms)

Set it as 0 when it is highly requirement.

★、7，The delay time of segment in G01/G02/G03(ms)(>100 effective)

This parameter solves the overcut problem in the corner.

★、8，Delay time of G00（ms）(>100 effective)

★、9,Continuous motion is worked in G00[16 means Yes, 1 means No]

If set as 16, then it will not reduce, continuous work.

★、10,Instruction M03/M04/S is detecting the rotation speed of spindle to the requirement(0 means detect M69 relay, 8 means detect the feedback of encoder)

When setting as effective, must detect the rotation speed of spindle and wait for the speed to the requirement and run the next segment of program.

★、11, The number of pulse of each round of spindle encoder.(4 times the number of encoder)

★、12, The alarm value of spindle encoder(Diagnosis value)[>10 effective]

Set it as the same as the diagnosis value.

★、13, Detect the feedback position of spindle(1 means Yes, 0 means No)

Set it whether to detect the feedback signal of spindle position, the spindle encoder signal. 1 means to detect, 0 means not to detect.

The parameter applies to functions about speed of spindle such as real rotate speed and feeding value. Precondition of these function is feedback signal of spindle encoder matching with spindle by transmission ratio of one to one.

★、14,Set the error of encoder feedback detection(rpm)

The error range between the real speed and the set speed.

★、15,G41/G42 tool compensation or not(2131970 means detect strictly,34818 means not to detect,6326274 means read ahead rapidly)

★、16,From the end of the last segment program if start from the middle line.[8 means Yes, 0 means No]

Set as 8, it will starts from the end of the last segment program.

★、17, Start the program by the input point [D2-D7(+4...+128) correspond to X26-X31, D8-D15(+256...+32768) correspond to X16-X23]

Set as +4+8=12，when X26 or X27 is effective to choose the program HIDEFILEX26 or X26 or HIDEFILEX27 or X27.

★、18，The protection time of screen(minutes)(<2 not to protect)

When under main interface and no dialog, and if P18>2 minutes, controller will enter in screen protection, any key to quit.

★、19，The maximum waiting time of detection instruction such as

M18xx/M28xx/WAT(unit:ms)[when>=10, valid]

Example: when the parameter is set as 2000, WAT+X16 means if X16 signal has not been detected for 2 seconds, it will alarm.

★、20，Program trial mode[2 means stops at current line, 4 means go to next line after a line is finished, +32:Press run button move release run button stop]

★、21，Booking run program setting

★、22，Read the number of missing pulses at the position of feed shaft encoder before running the program[>5]

The detected over-proof of pulse before program running is over this value, then read encoder position again.

★、23, Boot monitoring page[10:Standard,11:Coordinates,12:GM code] (Stamping robot set to 12).

The monitoring page of controller when booting. If the robot is for stamping, set as 12.

★、23, Font size of program when booting.[0 normal, 1 reverse].

★、24,Programming interface characters show size boot status [0:normal,1:inversion]

★、25,CNC system mode is taught and executed according to the robot programming mode[0:no,1:is]

★、35,Default coordinate(3-9 for G53-G59,10-57 for G54.1/48,other power outages to save)

3.8.2 Speed parameter

★、1-6,The speed of J1-J6 MOVJ(degree/s)

The most speed of J1-J6 MOVJ in rapidly speed instruction

★、7,8,G00 speed of Xs,Ys axis(mm/min)

The max speed G00 of XsYs axis

★、9,The max feeding speed in teach(mm/min)

Pay attention: Set as 50% to make sure the safety.

★、10,The max feeding speed in PLAY(mm/min)

The max is 30000

To make sure the efficiency, could set this to bigger than G00.

★、11,Default speed of MOVL/MOVC(mm/min)

If the first interpolation not specifies the speed, this will be the speed in PLAY.

★、12,The speed of idle running(mm/min)

★、13a, Feeding speed in teach(mm/min)

The range: The max feeding speed in teach

Pay attention: Press F or V to set in teach, it will refresh this value

★、14,The speed of spindle in teach(rpm)

Pay attention: Press S or A to set in teach, it will refresh this value

★、15,The initial speed of feeding axis(mm/min)

If the running speed of feeding axis is lower than this, it will reach to the speed directly, if the running speed of feeding axis is higher than this, the start speed with this and reach to the set speed.

Pay attention:

This value is relative to the equipment of robot, not suitable will cause accident or fault.

★、16,The max variety value of feeding axis speed(mm/min)

In case that speed of feeding axis changed when setting interpolation of multi-axis consecutive track, to insure the max variety of all axis speed while interpolating resultant speed. It means if increment of variety over the value, it will accelerates (or decelerates), if less than the value, it will reach directly. The value applies for contributing consistency of multi-axis consecutive track interpolation.

★、17,Limit the speed of G1G2G3[1 mean Yes, 0 means No]

To limit the max speed of all joints during interpolation. 1 refers to limited, 0 refers to unlimited.

★、18-25,The max speed of XYZABCXsYs axis in G1G2G3(mm/min)

★、26,The acceleration and deceleration constant in PLAY[>=500]

Normally not to set this parameter, it just needs to be set when there is a big difference between PLAY and teach.

★、27,The speed when handwheel is stop(mm/min)[>18]

The bigger value is, the sooner it will be stop.

★、28,The acceleration and deceleration constant of handwheel[500--30000]

The bigger value, the sooner will be faster and slower.

★、29,The acceleration and deceleration constant of handwheel runs program [>500]

The range is 500-32000, the bigger value is, the sooner it elevates and decreases.

Pay attention: Invalid when lower than 500, each axis will work according to the normal.

★、30,The speed of handwheel in G00(mm/min)[>10]

The speed of handwheel in idle running.

Pay attention: Invalid when lower than 500, each axis will work in G00 according to the normal.

★、30-1, initial speed of handweel in play mode(mm/s)

★、31,The type of acceleration and deceleration[0 means straight line,8 means curve line(S type)]

Pay attention: The set is relative with driver, normally, step type use curve, servo use straight line.

★、32,The initial acceleration and deceleration constant in curve type[>=10]

The bigger value is, the sooner it accelerates.

Pay attention: Effective bigger than 10.

★、33,Quadratic constant of acceleration and deceleration in curve[>=10]

The bigger value is, the sooner it accelerates

Pay attention: Effective bigger than 10.

★、34,The max acceleration and deceleration constant in curve[>=500]

The bigger value is, the sooner it accelerates

Pay attention:It is effective when bigger than 500, otherwise only use straight line.

★、35-42,The speed backs to reference point of XYZABCXsYs axis (mm/min) [>1]

★、42-1/42-8, J1-J6XsYs axis return reference Point reverse speed (mm/s)

Used to define the reverse speed of J1-J6XsYs axis afer reach reference point

★、43,Welding zero current (A)

★、44,Welding maximum current(A)

★、44-1,Minimum current corresponding to output analog voltage(mV)

★、44-2,Maximum current corresponding to output analog voltage(mV)

★、45,Welding zero voltage(V)

★、46,Welding maximum voltage(V)

★、46-1,Minimum voltage corresponding to output analog voltage (mV)

★、46-2,Maximum voltage corresponding to output analog voltage value(mV)

Set the analog output of welding voltage, namely current and voltage corresponding to 0-10V instruction voltage.

Welding maximum current(A) refers to current when the ***first*** channel analog outputs the maximum voltage(as +10V), welding zero current refers to current when the ***first*** channel analog outputs 0V. in other words, they correspond from welding zero voltage to maximum voltage when the ***first*** analog path outputs 0-10V.

Welding maximum voltage(V) refers to voltage when the ***second*** channel analog outputs the maximum voltage(as +10V), welding zero voltage refers to current when the ***second*** channel analog outputs 0V. in other words, they correspond from welding zero voltage to maximum voltage when the ***second*** analog path outputs 0-10V.

For example, Speed parameter P43=50, P44=150,P44-1=0, P44-2=10000, then AA50-AA150 output 1-10V correspondingly, AA50 outputs 0V, AA100 output 5V;

P45=100 , P46=500 , P46-1=0,P46-2=10000,VV100-VV500 output 0 ～ 10V correspondingly, VV100 outputs 0V, VV200 output 2.5V;

Pay attention: in program, S/AA means current , SS/VV means voltage.

★、48-51,Interpolation compensation in Arc(+1 means length compensation +2 means fixed loop compensation is specified by G17G18G19,+4 means from center of circle to the end point which is IJK,+8 means the compensation way B of interpolation is specified by parameter)

When D3=0, A type: When interpolation compensation of arc reversal, the speed of compensation is effective with reversal interpolation value, the bigger value, the faster speed to make sure tool will not pause, but the compensation speed can't over 10000mm/min;

+8(D3 bit), B mode: When interpolation compensation of arc reversal, the compensation speed is specified by No.49-No.51 parameter.

+1(D0 bit): Length compensation mode is B mode，otherwise is A mode. A mode is

always compensating in Z axis, B mode is specified by G17/G18/G19, G17 compensate Z, G18 compensate Y, G19 compensate X.

+2(D1 bit): The fixed loop mode is B mode, otherwise is A mode. A mode is always compensate in Z axis, B mode is specified by G17/G18/G19, G17 compensate Z, G18 compensate Y, G19 compensate X.

+4(D2 bit): IJK is coordinate from the end point to centre of circle in arc programme, plus 4 means the IJK is to the end point in G02 G03, otherwise is to start point.

★、52,The start reduce speed in hard limit(mm/min)

Used to set the speed when motor start to reduce speed in hard limit. Servo needn't reduce, set as 1 normally.

★、53,Active speed pre-treatment function[1 means Yes, 0 means No]

Set as 1 to active, set as 0 not to active.

★、54-58,Start the smooth function(+4 means teach;+8 means handwheel;+16 means program in PLAY)

The range is 50-100, smaller value corresponds the faster reduce, but bigger vibration. The time constant is set by No.55-No.58.

★、100-105,The max speed of J1-J6 in teach when not in joint coordinate system(deg/min)[>1]

Not in joint coordinate means world coordinate or user coordinate.

★、106-111,The max speed of robot J1-J6(deg/min)[>1]

★、112-115,The additional ratio of robot handwheel in world, user, tool coordinate[1-10]

Maybe the robot work discordant for nonlinearity, set this value will be better, No.113-No.115 have the same function.

★、116-123,The starting speed of robot J1-J6 XsYs(deg/min)[>=1]

Set initial speed when J1-J6 XsYs starting to work, also the end speed when reduce the speed. If the running speed of feed axis is lower than this value, there is no process to raise or reduce speed, if over the value, acceleration start from the value.

★、124-131,The max variety value of robot J1-J6 XsYs(deg/min)[>1]

Mainly set this to insure max variety increment of all axis during interpolating resultant speed in case of speed change in continuous track interpolation. Applies to coherence of

multi-axis interpolating continuously.

★ 、 132-146,The acceleration and deceleration constant of robot J1-J6 XsYsXYZABC(deg/min)/s)[>1]

The range: 1-99999.

Pay attention: The value is relative with robot equipment; wrong set will cause some fault or accident. Usually, the heavier the payload, the smaller value.

3.8.3 Axis parameter

★、1,Soft limit

[D2 means X axis;D3 means Y axis;D4 means Z axis;D5 means A axis;D6 means B axis;D9 means C axis;D10 means Xs axis;D11 means Ys axis;1 means not limit;D12 means MOVE;D14 means no limit in changing tool]

Set each axis in each bit. 1 means valid soft limit in corresponding bit, 0 means invalid.

Format: D15|D14|……|D1|D0.

Example: If set soft limit of X axis, then set as:00000100

★、2-17,The max movement in positive and negative direction of XYZABCXsYs axis(mm)

This value is based on the world coordinate system.

★、18-29,The max movement in positive and negative direction of J1-J6(deg)

The value is based on the joint coordinate system.

★、30-37,Reversal interpolation compensation of J1-J6 Xs Ys(um)

To set the reversal interpolation of transmission gear when axis move reversal. System will invoke the value to compensate when reversal movement of the axis.

★、38-42,The direction signal of J1-J5[1 means normal, 0 means reversal]

If the value is 0, the joint will move to reversal direction from instruction. Otherwise if it is 1, the direction is the same to instruction.

★、43,The reversal direction signal of J6 Xs Ys(+2 means J6,+4 means Xs axis,+8 means Ys axis)

Set as 0 means reversal direction, set as 1 means the same as direction is specified.

★、44,Close the electrical gear of feeding axis[1 means Yes, 0 means No]

★、45-56,The numerator and denominator of electrical gear of J1-J6(1-999999)

numerator=10000 * Reduction ratio；

denominator =36000000；

★、57-60,The numerator and denominator of Xs Ys axis(1-999999)

numerator =10 * Reduce ratio；

denominator=Screw pitch；

★、61,The requirement for feeding axis back to zero point

[1 means no need, 0 means prompt, 8 means force, 9 means super force]

Set as 0 means no need, system will not prompt and limit when power on.

Set as 1 means prompt, system will prompt but no limit when power on.

Set as 8 means force, system will prompt when power on, and if no operation of back reference point, it will refuse to execute program.

Set as 9 means super force, motion system of feeding axis will prompt when power on, and if no operation of back reference point, it will refuse to execute motion.

★、61-1,The type of feeding axis back to zero point[0 means detect zero point reversal; 1 means not detect zero point reversal; 2 means]

Few methods for setting detection switch and zero pulse signal of motor encoder when each axis is backing to zero point:

Set as 0: When backing to zero point, crush to the reference switch, running reversal after the switch is off, then detect the zero pulse signal of motor encoder.

Set as 1: When backing to zero point, crush to the reference switch, running reversal after the switch is off.

Set as 2: When backing to zero point, crush to the reference switch, continue to run after the switch is off, then detect the zero pulse signal of motor encoder.

Set as others:When backing to zero point, crush to the reference switch, continue to run after the switch is off.

According to the circuit to set, normally suggest to set as 0 or 2, if not to detect the zero pulse signal of motor encoder, the accuracy will be worse, it only base on switch of reference point.

★、61-2,Bit parameter of the direction of backing to zero point[D2 means X; D3 means C(Y); D4 means Z; D5 means A; D6 means B; D7 means B; D8 means C; D9 means Xs; D10 means Ys] 1 means negative, 0 means positive

Exclusive setting of direction and sequence for every axis.

Example: If X axis need back to zero point negative, set as: 000000100

★、61-3, Normal close bit parameter of the switch of backing to zero point

D0 means X, D1 means Y, D2 means Z, D3 means A, D4 means B, 1 means normal close,

0 means normal open.

Example: If X, Y, Z axis are all Normal Close switch, set as:000000111

★、61-4/61-9, The offset after X/Y/Z/A/B/C is backing to zero point(10um)

★、61-11/61-16, The coordinate after J1-J6 is backing to zero point(Degree)

★、62,Floating zero point

[D3 means X axis; D4 means Y axis; D5 means Z axis; D6 means A axis; D7 means B axis; D8 means C axis; D9 means Xs axis; D10 means Ys axis; 1 means floating zero point, 0 means mechanical zero switch]

★、63-70,Set the floating zero point in world coordinate system of XYZABCXsYs axis

Set this parameter as the current coordinate of XYZABCXsYs axis, each axis goes back to zero point to here.

If no mechanical zero point, set it as floating zero point. System will locate the zero point rapidly in operation of back to zero point.

★、71-76,Function of XsYs axis[0 means straight line,1 means rotation]

★、214, Follow the axis(7/8/9,17/18/19,27/28/29/D5..D13=1/ means A axis follow X/Y/Z, C axis follow X/Y/Z, B axis follow X/Y/Z)

★、220, Full pulse controlling channel of the first spindle(Positive 81-86 correspond to XYZABC axis , Negative 91-96 correspond to XYZABC axis)

★、221, The number of the first spindle pulse in each circle

★、222, Increasing and decreasing speed of the first spindle which is full pulse control(rmp/2ms)

★、223, Full pulse controlling channel of the second spindle(Positive 81-86 correspond to XYZABC axis , Negative 91-96 correspond to XYZABC axis)

★、224, The number of the second spindle pulse in each circle

★、225, Increasing and decreasing speed of the second spindle which is full pulse control(rmp/2ms)

★、300,The number of bus bits of bus motor encoder

If the encoder is 17bits bus absolute encoder, set as 17.

★、401-406,J1-J6 home switch input point[1000+No.]

For example, if J1 home switch input is X201, then set P401=1201.

3.8.4 Other parameter

★、1,Filter constant of input signal

[+256+512+1024 correspond to X0-X7, the filter is 2/4/8ms, +2048+4096+8192 correspond to the filter 2/4/8ms of other signal]

Filter for input points, for example: input 256 correspond to X0-X7 filter 2ms,input 2304 correspond to all input point filter 2ms.

★、2,The band switch of feeding axis[1 means yes, no means no]

Reserve, this controller must set as 0.

★、3,The band switch of spindle[1 means yes, no means no]

Reserve, this controller must set as 0.

★、4,The type of handwheel[1 means held,0 means panel]

Reserve, this controller must set as 0.

★、5、Lubricate automatically

0 means effective, 1 means invalid

Pay attention: This is set according to the running time

★、6、The time of lubrication(10ms)

M32 to keep the effective time.Unit: 10ms.

★、7、The interval time of lubrication(s)

The valid interval time between two M32 (s)

★、8,Detection of door switch(X29)[0 means not detect,1 means detect]

Pay attention: 1. X29 to realize the function.

2. After setting as detect, when X29 is effective, coordinate could move in teach function, but program will be pause in PLAY.

★、9,Door switch[0 means Normal Open, 1 means Normal Close]

★、10,Bit parameter

D1=1 clear to 0; D2=1 space ;D5=0 close spindle; D6 speed; D8=1 save M10 when

power on;D10=1 arrange; D12=1 skip is invalid; D13=1 back to zero is invalid

The format：D15D14……D1D0.

D0 bit：Default as 1, can't change.

D1 bit：Set as 1 means the number of workpiece clear automatically when power on, set as 0 means keep.

D2 bit：Set as 1 means insert space into letters automatically when editing the program, set as 0 means not insert.

D3 bit：Default as 0, can't change.

D4 bit：Default as 0, can't change.

D5 bit：Set as 1 means not stop spindle rotation and cooling when pressing RESET, 0 means stop, default is 0.

D6 bit：Set as 1 means each axis work according to own speed, work with nonlinear trajectory when executing G00, 0 means simultaneous, reach at the same time. Default is 1.

D7 bit：Default as 0, can't change.

D8 bit：Set as 1 means save the status M10/M11 of spindle loose or tight when power off, recover this status when power on again. Set as 0 means spindle will be tight automatically when power on.Default is 1.

D9 bit：Default as 1, can't change.

D10 bit：Set as 1 means the number of line is arranged automatically when programming.

D11 bit：Set as 1, the output analog of the first spindle is the same time from the first, second spindle channel, the function of the second spindle is valid.

D12 bit：Set as 1, shield the skip function, "/" in front of the segment means invalid.

D13 bit：Default as 0, can't change.

D14 bit：Default as 0, can't change.

D15 bit：Set as 1, the tool set show the relative value, otherwise it shows the absolute value.

Pay attention: This parameter includes the bit which can't be changed. If change this bit, it will cause some problems with controller.

★、11,The incremental value of editing program number

if user want to count program lines automatically, just need to set P11=1.

★、12,The operation mode of delete[0 means delete the behind,1 means delete the forward]

★、13,Teach mode[0 means MOVJ/MOVL/MOVC,1 means G0/G1/G6]

★、13-1,automatically generate comments when teaching[0: Yes, 1: No]

if it is 0, system will generate comments automatically behind instructions during teaching program.

★、13-2,Type of circular arc center when teaching[0:G5/G6 IJK,1:G2/G3 R]

Used to set the arc teaching mode.

0 means G5/G6 IJK format, IJK is incremental distance between center and arc start point;

1 means G2/G3 R format, R is center coordinate.

★、13-3,The middle row shows whether to insert a row automatically [0:insert ,1:modify]

Used to set insert mode when teach program;

0 means insert a line between current line and next line;

1 means cover and modify current line.

★、14,Back function of running program[+8 means the handwheel, +32 means the back button of panel, +64 means enable welding machine during backing, +128 means drag mode]

To set the way of executing program as through hand wheel in auto mode, if it is +8 means hand wheel enabled, positive rotating means run program forward, negative rotating means run program backward;

+32 means panel button(Start&Back) enabled, otherwise run forward and backward identically if press Start&Back;

+64 means arc welding machine will start during back movement;

+128 means enable drag mode of controller(only if robot has drag function). In this mode, driver enable signal will be off, and robot can move freely, that means drag endpoint of robot to specified point, controller will read position of motor and record the position as teaching point.

+513 means enable mpg selection function, when rotate mpg, cursor will move up or down;

For example, if set it as 96, then when press <Back>, welding machine will be activated while robot is moving backward.

★、15,The inner parameter of system[6 means automatically,7 means press, 8 means allow import,9 means clear]

Method of start-up logo. 6 means showing logo and enter into main interface, 7 means enter into main interface by button. 8 means allow to install logo picture, 9 means clear logo picture.

If input PALLET, then delete the depalletizing file palletbase.txt、 paltlayout.txt、 palletcurr.txt.

★、16,Emergency alarm[0 means normal open,1 means normal close]

Set the input point X209 of emergency button.

★、17,Lubrication alarm[0 means Normal Open,1 means Normal Close]

Set the input point X09 of lubrication alarm.

★、18,Output of running(M69 runs,M65 stop)[0 means invalid,1 means valid]

When controller is running, and P18=1, it will output signal, M69(Y04) means running, M65(Y02) means stop.

Pay attention: This signal could be the status of robot according to the equipment of robot.

★、19,Alarm output(M67)[0 means invalid, 1 means valid]

Pay attention: This signal could be the status or protection of robot according to the equipment of robot.

★、20,The brake time of spindle(10ms)

The time of M05, the less time the faster to brake, the longer time the slow to brake.Unit:10ms.

★、21,Long signal of spindle brake[0 means long signal, 1 means short signal]

★、22,The interlock between spindle rotation and chuck[1 means Yes,0 means No]

Consider for safety, set as 1 will be safer.

★、23,The brake of motor is work or not[1 means check the X40 when motor with brake, 0 means without brake]

If without brake, then set as 0(at this time, X40 could be used for other function)；If set as 1,then motor with brake, controller check the X40 signal, it means the circuit is normal, otherwise there is some problems, please check the problem and solve.

★、25, Driver J1-J4 alarm(ALM)[1 means normal open, 0 means normal close]

Used to set the method of driver J1-J4 alarm, input into alarm signal ALM.

★、26, Driver J5J6XsYs alarm(ALM1)[1 means normal open, 0 means normal close]

Used to set the method of driver J5J6XsYs alarm, alarm signal is input into ALM1.

★、27, Welding gun collision alarm(ALM3)[1 means normal open, 0 means normal close]

Used to set the method of driver Welding gun collision alarm, Alarm signal is input into ALM3.

★、28,Whether the safety switch is effective if the manual zero/test run is effective[1:work,0:not work]

★、29,Whether to configure an integrated drive[1:Yes,0:No]

If connect with NEWKer 6 axis integrated driver, please set P29=1, to make sure only when driver works normal, can controller output Y05 to control motor brake.

★、30,Language of controller[1 means Chinese, 0 means English]

★、31,Logical of robot I/O[1 means start,0 means stop]

Set the status of inner PLC, 1 means start(100ms), 0 means stop, the total of PLC is 8000 steps at the most.

Pay attention: This parameter usually be test parameter, set as 1 in actual use, otherwise the motion of robot could be wrong.

★、32,Logical of robot high speed I/O[0 means stop, 18 means start with high speed, 28 means super speed]

Super speed means 2ms, high speed means 8ms.

Pay attention: This parameter usually be test parameter, set as 1 in actual use, otherwise the motion of robot could be wrong.

★、35,Soft limit is effective in teach when no back to zero[1 means Yes,0 means No]

Pay attention:The set of parameter is relative with safe operation.

★、36,Time[Year-Month-Day-Hour-Minute]

For example: June 6,2016 6：06 AM, then input 2016-06-06-06-06

★、37,Communication rate of serial port

Baud rate：0=7200；1=9600；2=14400；3=19200；4=38400；5=57600；6=115200

Attention: 1、The bigger value, the faster, but more unstable.

2、The baud rate of both side of communication must be the same.

★、38,ModBus station number of serial port in OPC function[odd parity 10000+station number, even parity20000+ station number, no parity30000+ station number]

Communication protocol adopts RTU mode in industry standard ModBus protocol, the system will return the current parameter value, received request for transmission of parameter number from PC.

PC connects with CNC system by RS232 port. If RS232 is converted into RS485 by converter, the connection between one PC and multiple controller could be realized, then each controller need setting station number to distinguish from each other. Details refer to manual of OPC function.

★ 、39，40，Special parameter

★、41,Backup the current parameter

Pay attention: Press this parameter twice to backup.

★、42,Restore the parameter which is backup

Pay attention: The parameter will be recover after set this parameter.

★、200-204,The error of J1-J6/Xs/Ys axis between feedback pulse and running pulse, alarm when pulse is [>1]

Bigger than 1 is valid. Press "G" to clear the feedback position ,clear position, clear the alarm.

P200/P201/P202/P203/P204 correspond to J1-J6/XS/YS

★、205-209,The tracking error of J1-J6/Xs/Ys alarm(pulse)[>1]

Bigger than 1 is valid.Press "G" to clear the feedback position ,clear position, clear the alarm.

P205/P206/P207/P208/P209 correspond to J1-J6/XS/YS

★、210-214,Numerator of electrical gear of J1-J6/Xs/Ys[automatic calculate: L screw(um) line number of M encoder]

When system is equipped with feedback function of axis position, the parameter is numerator of electrical gear, screw(um) and line number of encoder also could be input. For example: Screw pitch is 6mm, encoder is 2500 rate, then input: L6000M2500. P210/P211/P212/P213/P214 correspond to J1-J6/Xs/Ys.

Special attention:

1)、Please input electrical numerator and denominator of each axis firstly according to LxxxxMxxxx mode；

2)、Read the encoder data through the serial port must set according to this mode.

3)、This controller set as 10000

★、215-219,Denominator of electrical gear of J1-J6/Xs/Ys[automatic calculate: L screw(um) line number of M encoder]

When system is equipped with feedback function of axis position, the parameter is denominator of electrical gear, screw(um) and line number of encoder also could be input. For example: Screw pitch is 6mm, encoder is 2500 rate, then input: L6000M2500.P215/P216/P217/P218/P219 correspond to J1-J6/Xs/Ys.

★、300-303,Feeding axis with or without absolute motor

[J1-D2,J2-D3,J3-D4,J4-D5,J5-D6,J6-D7,Xs-D8,Ys-D9,0 means No, 1 means Yes]

Format: D15|D14|D13|D12|D11|D10|D9|D8|D7|D6|D5|D4|D3|D2|D1|D0

When the Joints are installed with absolute encoder motor, this parameter is used to match absolute encoder, then communicate with driver through Modbus.

P301 is multiturn low l6 bits memory address of absolute driver (if connect Newker driver, please set as 92);

P302 is multiturn high l6 bits memory address of absolute driver(if connect Newker driver, please set as 91),

P303 is single turn low l6 bits memory address of absolute driver(if connect Newker driver, please set as 90).

Special case:

P303=-999999(single-turn 32 bits/multiturn 16 bits), P301 multiturn, P302 single turn;

P303=-999977(single-turn 32 bits/multiturn 32 bits), P301 multiturn, P302 single turn;

P302=-999966(single-turn 16 bits/multiturn 16 bits), P301 multiturn, P303 single turn;

When P301 is negative value, it means multiturn 32bits. For example,

P301= -5632, means read multiturn 32bits data from driver address 5632.

Attention:

The communication address of driver:1-8 correspond to J1-J6/Xs/Ys axis.

★、304-308,The pulse of each circle of absolute encoder in J1-J6/Xs/Ys axis

When it is absolute motor, this parameter is used to set absolute encode pulse unit per circle. If motor is 17bits absolute encoder, then set it as 131072. if motor is 23bits absolute encoder, then set it as 8388608. P301-308 corresponding to J1-J6/Xs/Ys.

★、309-313,The coordinate correspond to each circle of absolute encoder in J1-J6/Xs/Ys axis(nm)

if set as minus, then reverse the direction of coordinate counting. For example: J1-J6 are rotary axis, it is 360000000, P309-313 corresponding to J1-J6/Xs/Ys.

For example, [rotate J1 by 10 degrees, and J1 go to 10 degree, then run M501 in MDI, and check if J1 coordinate changes, and repeat above steps another 2 times, if the coordinate before and after running M501 changes very little,] like the 3rd bit after point, the direction is correct. But if the coordinate before and after running M501 changes very differently, that means counting direction is reversed, please set P309= -36000000, and repeat steps[] again.

P309/P320=360000000/Reduction ratio.

★、314,The multicycle offset of absolute encoder of J1-J6/Xs/Ys axis[Input E to clear]

When controller is equipped with absolute motor, the parameter is used to set absolute multicycle offset, input E to clear, applying to overflow of coordinate value by multicycle value.

This parameter is used to clear multiturn value and set current position as home position.

P314/P315/P316/P317/P318 correspond to J1-J6/XS/YS

★、319,The current/speed/torque address of absolute driver(284/283/435)

Used to switch status display of driver. 284 means current, 283 means speed, 435 means torque. Press “F3” in main interface to show status of driver.

★、320-324, denominator of coordinate correspond to each circle of absolute encoder of J1-J6/Xs/Ys axis

When controller is equipped with absolute motor, the parameter is set as denominator of coordinate correspond to each circle, namely mechanical reduction ratio.

For example: The reduce ratio of J1 is 121, then No.320=121.

★、330,Function of controller and interface(11 means weld;12 means palletizing;13 means spraying; 14-18 means stamping: 14 single machine; 15 first machine; 16 not the first machine; 17 Standby; 18 one match double)

Controller function figuration, 11 means welding robot; 12 means palletizing robot; 13 means spraying robot; 14-18 means stamping robot, when P330=14-18, there is program model menu in program interface, it will pop up dialog after pressing, input option according to message, it will generate corresponding program.

When P330>=1, the main interface will show “hidden keyboard”, otherwise, it will show spindle speed graph or SP value.

★、367, Reverse the inner coordinate calculation of robot joint (+4;+8;+16:32;+64;+128)

D2=1 then +4 reversal calculate coordinate of J1； D3=1 then +8 reversal calculate coordinate of J2；D4=1 then +16 reversal calculate coordinate of J3；D5=1 then +32 reversal calculate coordinate of J4； D6=1 then +64 reversal calculate coordinate of J5； D7=1 then +128 reversal calculate coordinate of J6.

★、368-373,The inner calculate offset of robot J1-J6 coordinate(1/1000 degree)

When the zero point of robot changed, the parameter is used to set inner calculate offset. P368/P369/P370/P371/P372/P373correspond to J1-J6.

★、374,The coordinate of robot J1-J6 reduction(+4;+8;+16:32;+64;+128)

D2=1 then +4 correspond to J1 to reduction； D3=1then +8 correspond to J2 to reduction；D4=1 then +16 correspond to J3 to reduction；D5=1 then +32 correspond to J4 to reduction；D4=1 then +64 correspond to J5 to reduction；D7=1 then +128 correspond to J6 to reduction.

★、375-385,Coupling function of robot(+4 means J1J2; +8 means J3J4; +16 means J4J5; +32 means J5J6; +64 means J4J6)

D2=1 then +4 means J1J2 coupling，P376,P377 is the numerator and denominator；

D3=1 then +8 means J3J4 coupling，P378,P379 is the numerator and denominator；

D4=1 then +16 means J4J5 coupling，P380,P381 is the numerator and denominator；

D5=1then +32 means J5J6 coupling，P382,P383 is the numerator and denominator；

D6=1 then +64 means J4J6 coupling，P384,P385 is the numerator and denominator；

D7=1 then +128 means J2J3 coupling，P386,P387 is the numerator and denominator；

★、451,Controlling mode of robot(100--9999)

Attention: This is inner control mode parameter, cannot be changed. Please confirm type and configuration of robot before delivery

1): the standard CNC controller, could control the feeding and unloading, also could be held engraving controller.Supporting all process technique in Cartesian coordinates.

2): 2 axis SCARA robot, J1 and J2 are rotary axis；

3): 3 axis Cartesian coordinate robot, J1J2J3 are linear axis;

4): 3 axis SCARA, J1 and J2 are Rotary axis, J3 is linear axis to control moving up and down；

5): 3 axis SCARA robot, J1 and J2 are rotary axis;

6): 4 axis rotary joint non parallelogram robot；

7): 4 axis rotary joint parallelogram robot；

8): 4 axis palletizing parallelogram robot, the same as RMD robot of GSK；

9): 4 axis stamping robot;

10): 4 axis SCARA;

11): 4 axis SCARA, J1J2J3 are rotary axis, J4 is linear axis for moving up and down;

12): 4 axis Cylindrical robot,if set as 474, in the manual mode, only joint coordinate and tool coordinate are valid, and cannot move in the direction of X axis.

13): 4 axis Delta robot；

14): 5 axis SCARA；

15): 5 axis SCARA, J1J4J5 are rotary axis, J2J3 are linear axis;

16): 5 axis serial joint robot

17): 6 axis/8 axis serial joint robot；

18): 6 axis/8 axis parallelogram robot；

19): 6 axis/8 axis non-spherical wrist robot, J5 and J6 have offset distance d6；

20): 6 axis/8 axis non-spherical wrist robot, J5 and J6 have offset distance e6；

21)： 6 axis/8 axis non-spherical wrist robot, J5 and J6 have offset distance d6 and e6；

22): 6 axis/8 axis collaborative robot;

23): 6 axis/8 axis L shaped wrist robot,

24): 6 axis SCARA robot；

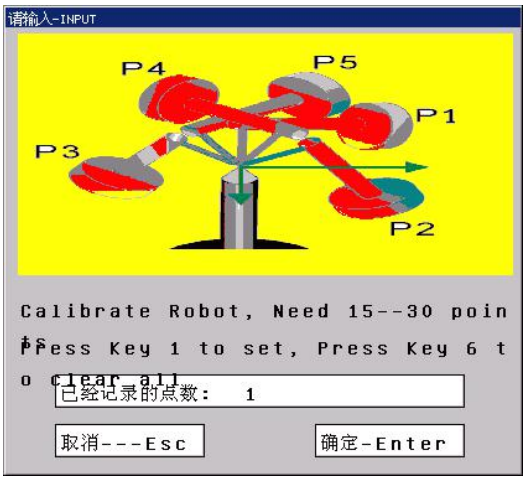
25): 6 axis rotary joint robot, J2 and J3 are linear axis, J1,J4,J5,J6 are rotary axis.

★、460,Calibration of robot

The zero point need very high accuracy, otherwise the error is big, need very precise to make the right zero point, this is the common method, it is the best to use professional equipment to measure.

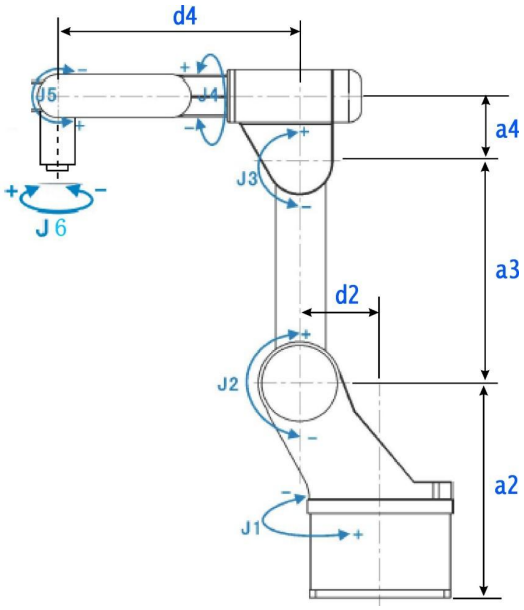
The structural error of robot itself may lead to error of TCP. In order to narrow error down, we need to calibrate robot through 15-30 points method.

To find a fixed endpoint at the 6th axis terminal of robot and another endpoint on the workbench, then change the posture of robot to find and record 15-30 endpoints of 6th axis terminal, all of which aim at the fixed point on the workbench.



★、461-482 Connecting rod and the error compensation.(specified in Debugging section)

(1) Connecting rod of six degree of freedom joint and the error compensation

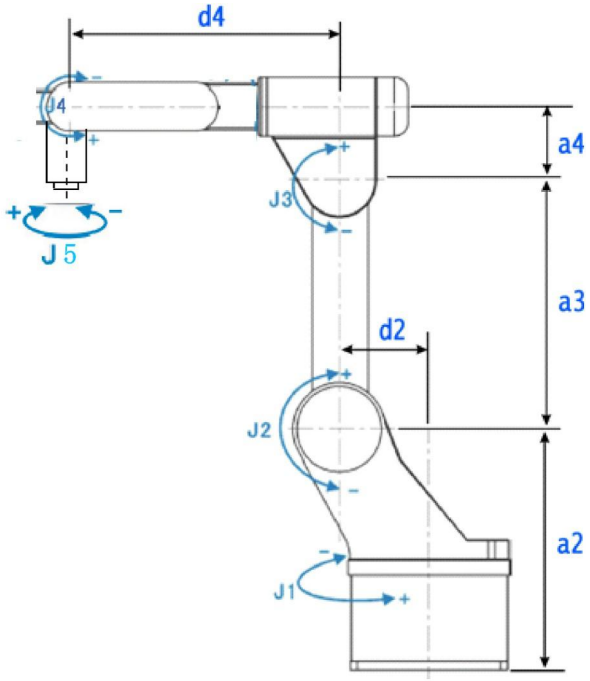


Robot 1: 6 axis serial joint robot(No.451=600/602/603/604)

Pay attention: a2 needn't to be set, e2 be set as 0; only if J5 and J6 have offset value, P360 should be set.

★、351, Link rod parameter1(um)a2
★、352, Link rod parameter2(um)a3
★、353, Link rod parameter3(um)a4
★、354, Link rod parameter4(um)d2
★、355, Link rod parameter5(um)d4
★、356, Link rod parameter6(um)e2
★、360, Link rod parameter10(um)d6
★、361, Link rod parameter11(um)e6
★、461, The error compensation of No.351(nm)a2
★、462,The error compensation of No.352(nm)a3
★、463,The error compensation of No.353(nm)a4
★、464,The error compensation of No.354(nm)d2
★、465,The error compensation of No.355(nm)d4
★、466,The error compensation of No.356(nm)e2
★、470,The error compensation of No.360(nm)d6
★、471,The error compensation of No.361(nm)e6

(2) Connecting rod of five degree of freedom joint and the error compensation



Robot 2: 5 axis serial joint robot(No.451=549)

★、352, Link rod parameter2(um)a3

★、354, Link rod parameter4(um)d2

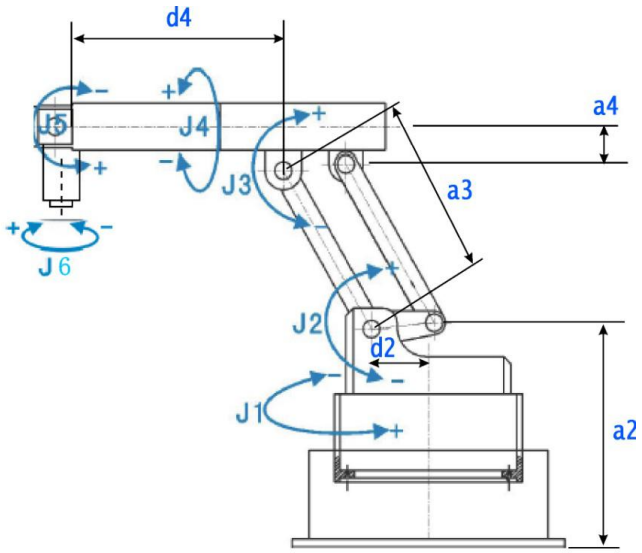
★、355, Link rod parameter5(um)d4

★、462,The error compensation of No.352(nm)a3

★、464,The error compensation of No.354(nm)d2

★、465,The error compensation of No.355(nm)d4

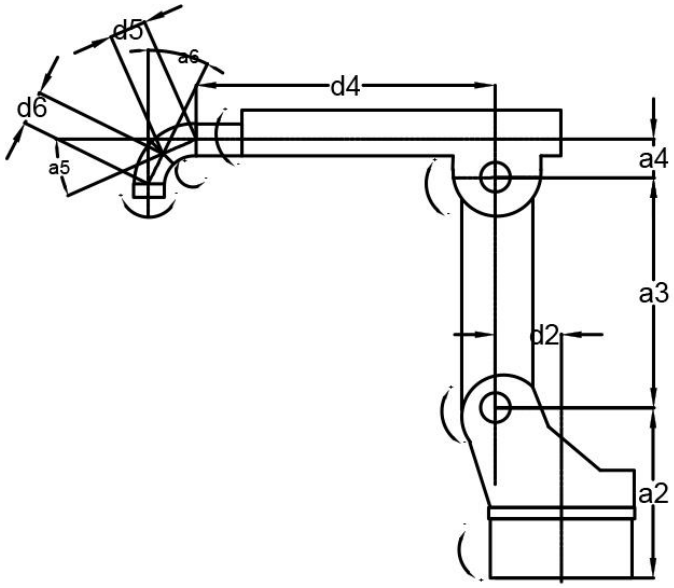
(3) Connecting rod of 6 axis parallelogram robot and the error compensation



Robot 3: 6 axis parallelogram robot(P451=601)

Attention:a2 can be ignored, e2 is set as 0, others are the same to (1).

(4) Connecting rod of 6 axis spray robot and error compensation



★、351, Link rod parameter1(um)a2

★、352, Link rod parameter2(um)a3

★、353, Link rod parameter3(um)a4

★、354, Link rod parameter4(um)d2

★、355, Link rod parameter5(um)d4

★、356, Link rod parameter6(um)e2

★、357, Link rod parameter7(1/1000degree)a5

★、358, Link rod parameter8(um)d5

★、360, Link rod parameter10(um)d6

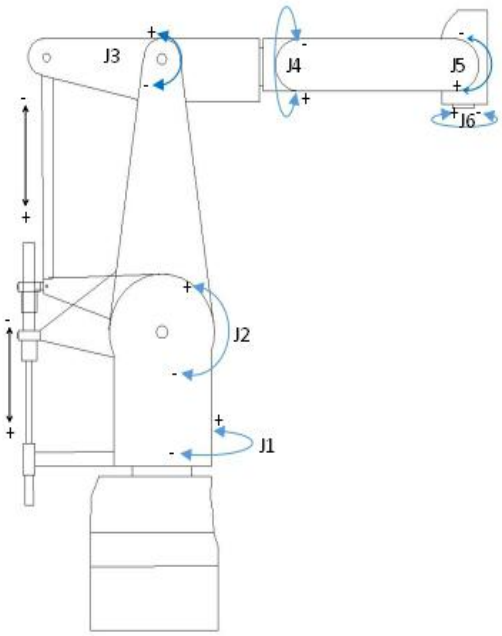
★、361, Link rod parameter11(1/1000degree)a6

Note:

a5 is inclination angle between rotary center of J4 and J5;

a6 is inclination angle between rotary center of J5 and J6;

(5) Connecting rod of 6 axis special robot and error compensation



P451=609

★、351, Link rod parameter1(um)a2

★、352, Link rod parameter2(um)a3

★、353, Link rod parameter3(um)a4

★、354, Link rod parameter4(um)d2

★、355, Link rod parameter5(um)d4

★、356, Link rod parameter6(um)e2

★、359, Link rod parameter9(um)a8

★、364, Link rod parameter14(um)d8

★、365, Link rod parameter15(um)a9

★、366, Link rod parameter16(um)a9

★、P367=0

Attention:

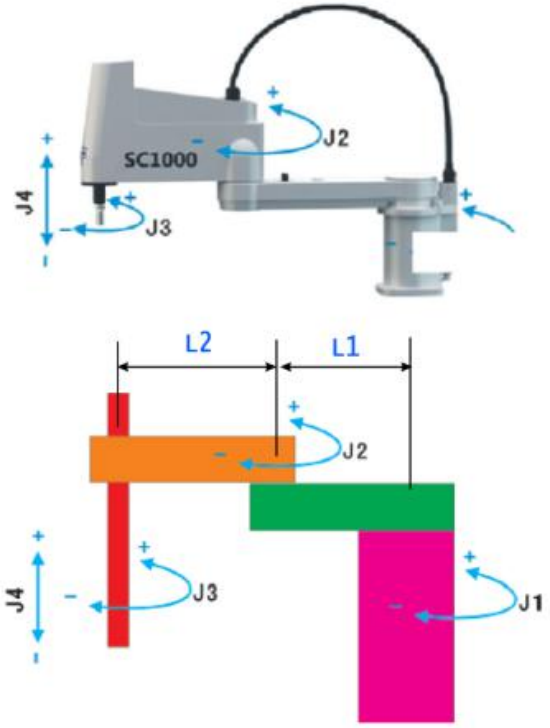
1. P369, The inner calculate offset of robot J2 coordinate(um)=J2 linear axis side length of triangle;

2. P370, The inner calculate offset of robot J2 coordinate(um)=J2 linear axis side length of triangle;

3. when J2 linear axis moves in positive direction, J2 rotary axis should move up;

4. when J3 linear axis moves in positive direction, J3 rotary axis should move up.

(6) Connecting rod of four degree of freedom SCARA robot and error compensation



Robot 5: Four axis SCARA robot(P451=464)

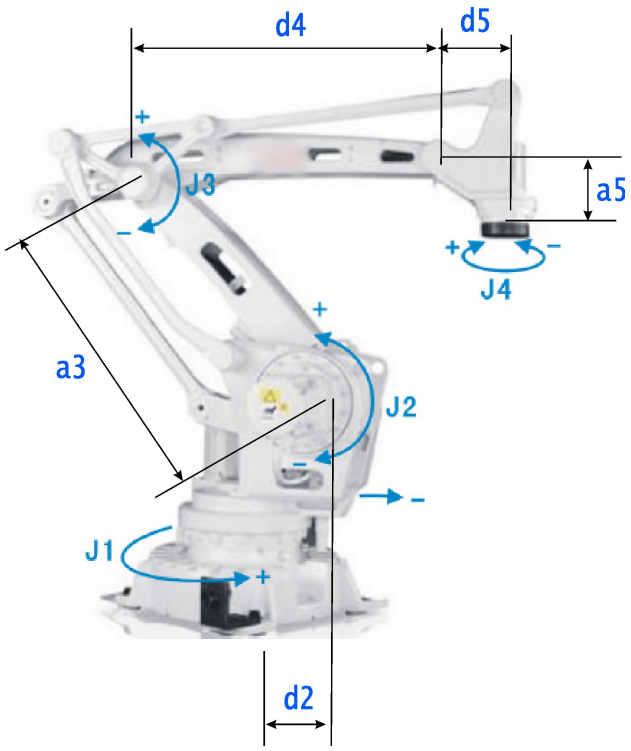
★、351, The connecting rod parameter 1(um)L1

★、352, The connecting rod parameter 2(um)L2

★、461, The error compensation of No.351(nm)L1

★、462, The error compensation of No.352(nm)L2

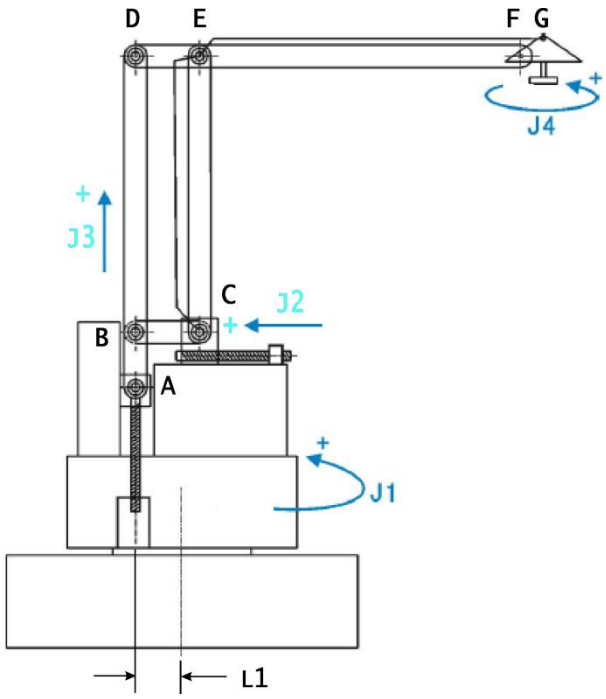
(7) Connecting rod of four degree of freedom rotation joint palletizing and error compensation



Robot 6: Four axis rotation joint palletizing robot(P451=441)

★、352, The link rod parameter 2(um)a3
★、354, The link rod parameter 4(um)d2
★、355, The link rod parameter 5(um)d4
★、357, The link rod parameter 7(um)a5
★、358, The link rod parameter 8(um)d5
★、462, The error compensation of No.352(nm)a3
★、464, The error compensation of No.354(nm)d2
★、465, The error compensation of No.355(nm)d4
★、467, The error compensation of No.357(nm)a5
★、468, The error compensation of No.358(nm)d5

(8) Four axis connecting rod of palletizing parallelogram robot and the error compensation



Robot 7: Four axis connecting rod of palletizing parallelogram robot（P451=442）

Attention:

1. J1,J4 are rotary axis, J2,J3 are linear axis;
2. mechanical structure must be LEF/LDE=LBD/LAB, otherwise, it cannot be calculated;
3. robotic rod parameter as follow:

★、351, The connecting rod parameter 1(um)L1

★、352, The connecting rod parameter 2(um)LEF

★、353, The connecting rod parameter 3(um)LDE

★、354, The connecting rod parameter 4(um)LGF

★、355, The connecting rod parameter 5(um)LAB

★、461, The error compensation of No.351(nm)L1

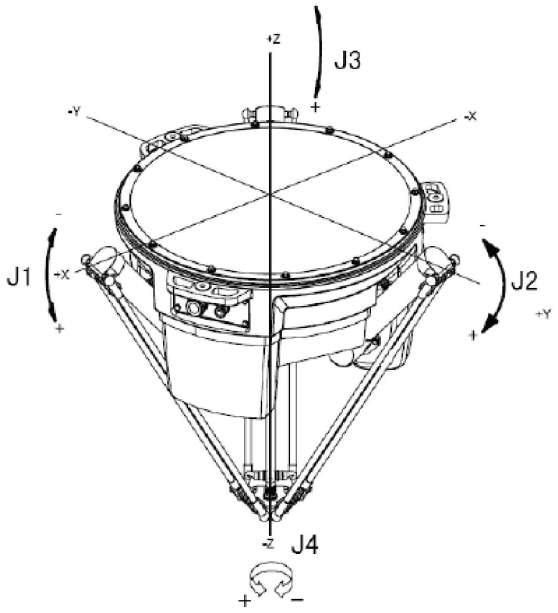
★、462, The error compensation of No.352(nm)LEF

★、463, The error compensation of No.353(nm)LDE

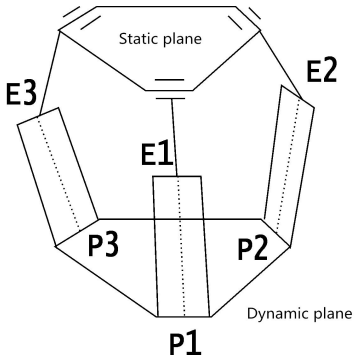
★、464, The error compensation of No.354(nm)LGF

★、465, The error compensation of No.355(nm)LAB

(9) Four degree of freedom Delta and the error compensation

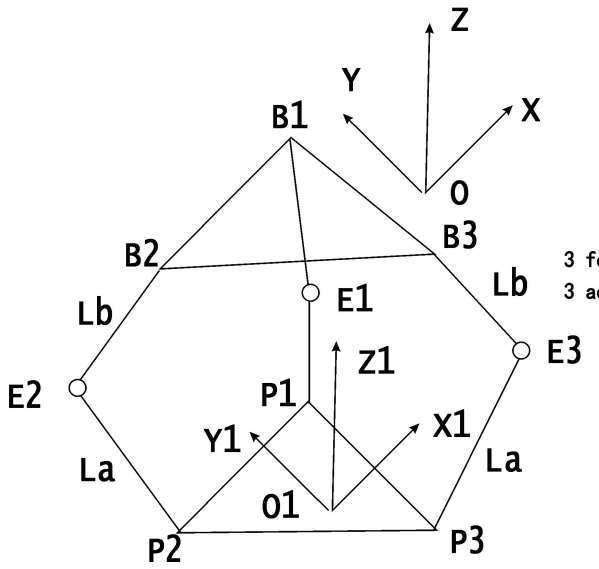


Robot 8-1 Four axis Delta(P451=480)



Kinematic model of virtual lever: Effects of three parallelogram allows dynamic plane move in the direction of XYZ without rotary.

Robot 8-2 Four axis Delta(P451=480)



3 follower levers:EiPi, length:La;
3 active levers:BiEi, length:Lb;

Robot 8-3 Four axis Delta(P451=480)

La means the length of follower lever, Lb means the length of active lever;

Rmax means the size of static platform(The centre of static platform to the vertex of equilateral triangle in static platform);

rmax means the size of moving platform(The centre of moving platform to the vertex of equilateral triangle in moving platform).

★、351, The connecting rod parameter 1(um)La

★、352, The connecting rod parameter 2(um)Lb

★、354, The connecting rod parameter 4(um)Rmax

★、355, The connecting rod parameter 5(um)rmin

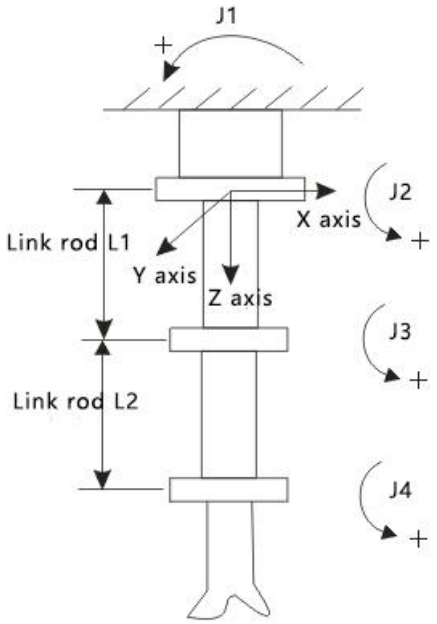
★、461, The error compensation of No.351(nm)La

★、462, The error compensation of No.352(nm)Lb

★、464, The error compensation of No.354(nm)Rmax

★、465, The error compensation of No.355(nm)rmin

(10) Four axis Cylindrical robot rod and error compensation



Robot 9: 4 axis Cylindrical robot(P451=474)

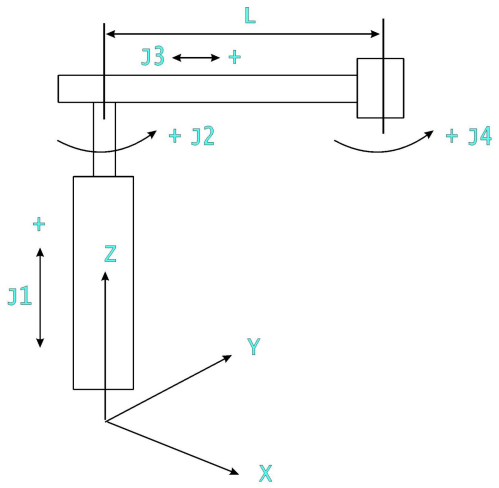
★、351,The connecting rod parameter 1(um)L1

★、352,The connecting rod parameter 2(um)L2

★、461,The error compensation of No.351(nm)L1

★、462,The error compensation of No.352(nm)L2

（11）Four axis stamping robot

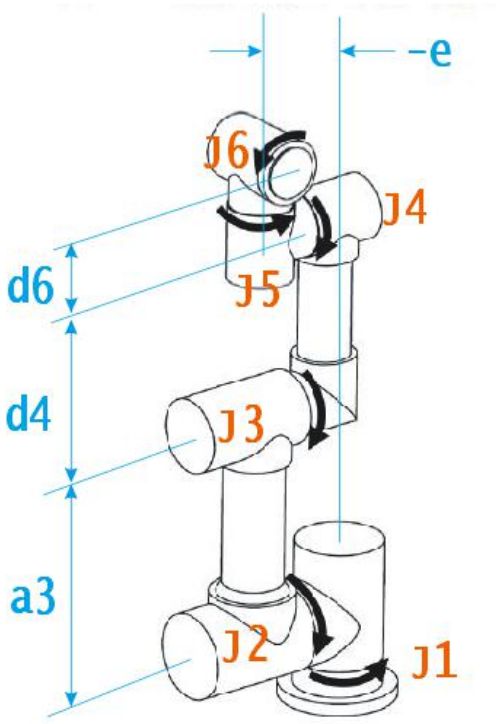


Robot 10: 4 axis pressing robot(P451=443)

1. XYZ is world coordinate system;
2. J1,J3 are linear axis, J3,J4 are rotary axis;
3. When set the joint coordinate of J3, please ensure that J3 coordinate value is equal to length L, namely superpose J4 on J1 to clear the coordinate of J3, move J3 to make axes of J4 and J2 overlapped, then joint coordinate of J3 will be cleared.

J3 joint coordinate can not be negative, and limit parameter should be positive;

(12) Collaborative robot rod and error compensation parameter



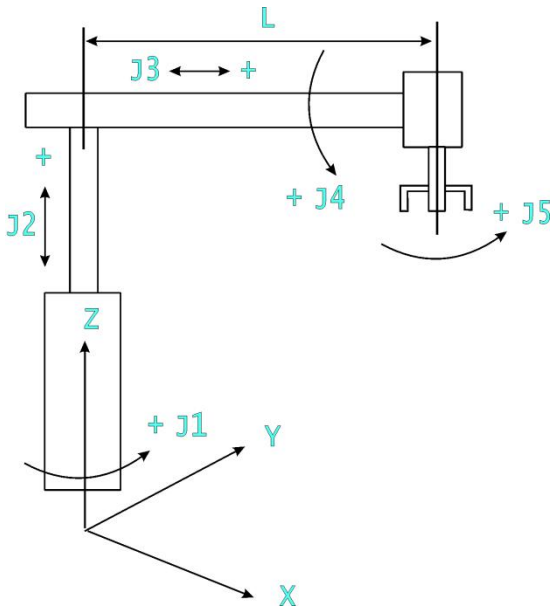
Robot 11: 6-axis collaborative robot(P451=606)

★、351,The link rod of robot parameter 1(um)a2,L1,La，set as 0；

★、352,The link rod of robot parameter 2(um)a3,L2,Lb，set as 3；

★、353,The link rod of robot parameter 3(um)a4，set as 0；
★、354,The link rod of robot parameter 4(um)d2,,Rmax，set as 0；
★、355,The link rod of robot parameter 5(um)d4,,rmin，set as d4；
★、356,The link rod of robot parameter 6(um)e2，set as -e2；
★、357,The link rod of robot parameter 7(um),a5，set as 0；
★、360,The link rod of robot parameter 10(um),d6，set as d6；
★、361,The link rod of robot parameter 11(um),e6，set as 0；
★、461-467,the error compensation of link rod parameter1-10(nm), set as 0；
★、470,471,the error compensation of link rod parameter10,11 (nm),set as 0；

（13）5 axis special SCARA robot



Robot-12 5 axis special SCARA robot(P451=458)

1. XYZ is world coordinate system;
2. J2J3 are linear axis, J1J4J5 are rotary axis;
3. When set the joint coordinate of J3, please ensure that J3 coordinate value is equal to length L, namely superpose J4 on J1 to clear the coordinate of J3, move J3 to make axes of J4 and J2 overlapped, then joint coordinate of J3 will be cleared.

J3 joint coordinate can not be negative, and limit parameter should be positive;

4. Other Parameter P367-P373=0.

（14）The error compensation of each joint

★、477, The error compensation of robot J1 joint(1/1000000 degree)
★、478, The error compensation of robot J2 joint(1/1000000 degree)
★、479, The error compensation of robot J3 joint(1/1000000 degree)

★、480, The error compensation of robot J4 joint(1/1000000 degree)

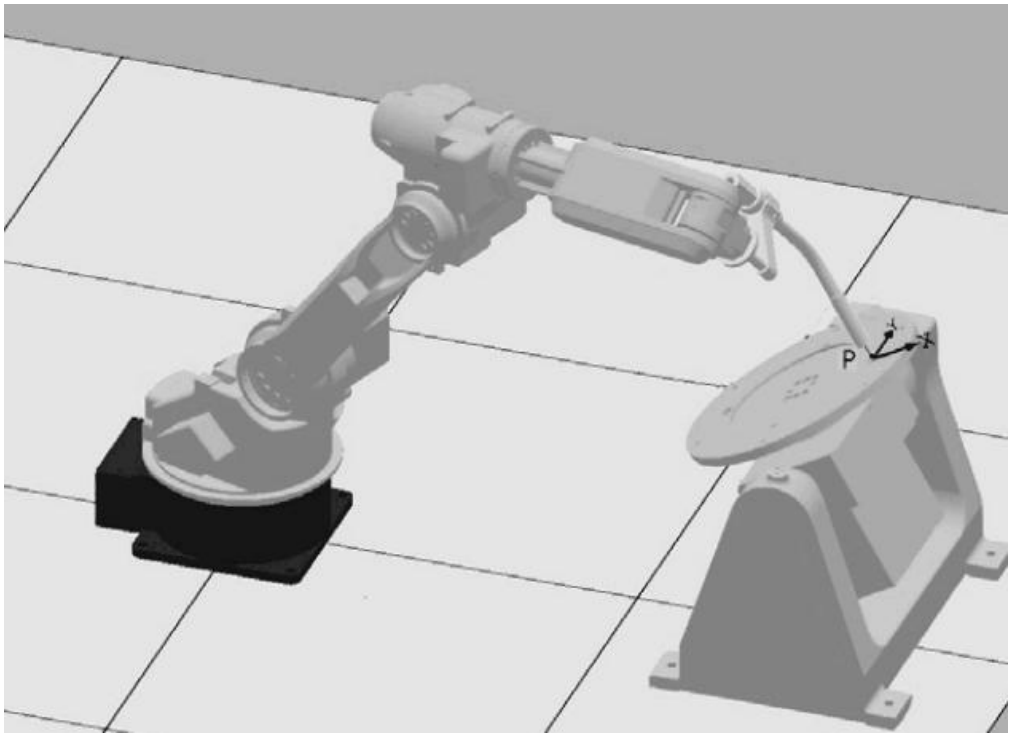
★、481, The error compensation of robot J5 joint(1/1000000 degree)

★、482, The error compensation of robot J6 joint(1/1000000 degree)

★、488,Open and Close Coordinate system of positioner[0-M600; 1-M601; 2-M602]

★、489,Set coordinate system of positioner

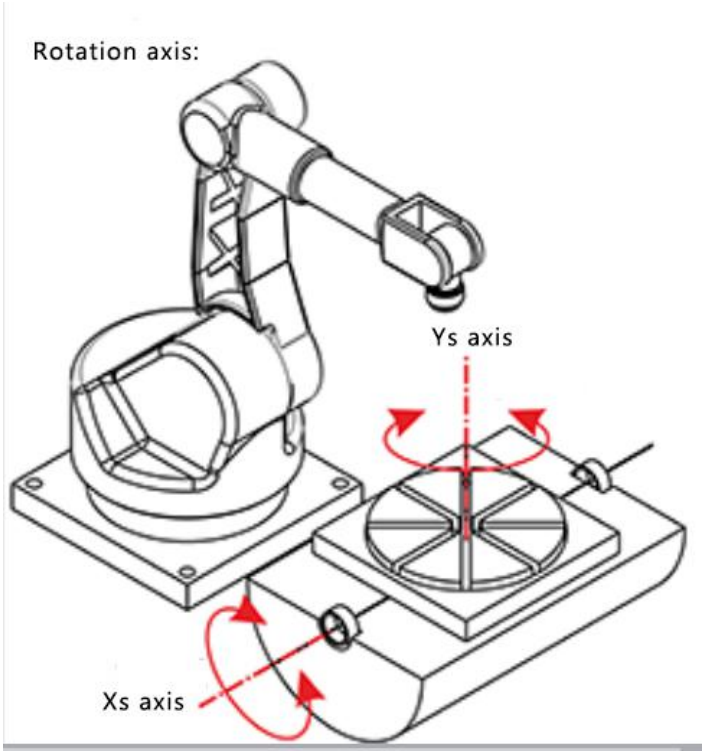
When the robot is used to weld, the axis XS,YS are use to control motion of positioner.



(1) Collaboration function of positioner:

Positioner coordinate system is convenient for user to run teach mode when the position is placed anywhere. Since the positioner coordinate system is set, robot will move around the specified positioner coordinate system.

Positioner coordinate refers to a specified coordinate system based on positioner. Positioner coordinate system will rotate according to positioner, TCP tool is specified a position and a gesture. The Collaboration function of positioner makes robot move according to rotation of positioner and coordinate system, to keep the position and the gesture of TCP tool in coordinate system. In teach mode, the collaboration function makes teaching more convenient and ensure the best angle of welding gun during the welding. The instruction of collaboration function should be edited in program.



★、490,Set the Xs world coordinate of positioner P3P4P5 point(um)

★、491,X position of positioner(um)

★、492,Y position of positioner(um)

★、493,Z position of positioner(um)

★、494,A gesture of positioner(degree)

★、495,B gesture of positioner(degree)

★、496,C gesture of positioner(degree)

★、497,Reversal calculate the coordinate of positioner(Xs+6;Ys+8)

No.489 to set the coordinate, set as 3 with single positioner, set as 5 with double positioner to generate No.490-No.496.

To find a reference point, and move the robot to make the TCP point of tool point at the reference point, the press the number button 1 to set the point as the P1; then rotate axis XS by a angle, move the robot, let the TCP point of tool point at the reference point, then press the number button 2 to set the point as P2; then rotate axis XS by a angle again, move the robot, let the TCP point of tool point at the reference point, then press the button 3 to set the point as P3. For single axis positioner, only the three points can finish positioner coordinate system.

For double axis positioner, after the setting of P3, keeping Axis XS, rotate Axis YS by a angle, then let the TCP point of tool point at reference point and press button 4 to set it as P4; then rotate Axis YS by another angle(keeping Axis XS), and move robot to point the TCP point at reference point, and press the number button 5 to set it as P5. Finally, the positioner coordinate system is set.

Press “Start”or “Back” on the right side of screen during setting process, the status will show “O”, and press “12345”to back to the last setting point with the current joint speed in manual, so that modify easier. Press “Start” to open or close this function, after finish once, this function will close automaticall.

After setting, use M601 or M602 to use the function of positioner, rotate XS axis to check it is the same as the move direction of robot or not, if not the same, then reversal calculate +6(D1, D2=1). Use M602 to rotate YS axis to check it is the same as the move direction of robot or not, if not the same, then reversal calculate +8(D3=1).

(2) Positioner collaborative function: Other Parameter 497, reversal calculate the coordinate of positioner(Xs+6; Ys+8;+32: Xs or XsYs is line axis), +32 mean linear axis

collaborative function. When only one line collaborative axis, it is only necessary to set P1 and P2. target the tcp at the fixed point P1, then move Xs axis for a distance, move tcp to target at the same point P2. Now open the collaborative function, and move Xs to check if the tcp will follow, if direction is reversal, then revise P497. when there are 2 linear collaborative axis, it is necessary to set P1,P2,P3, the method is the same as that of single collaborative axis.

Pay attention:

1. If there are 2 positioner axis, XS and YS should be vertical intersection, Ys axis is supposed to be installed on Xs axis (YS should be rotation axis, XS should be roll axis).

2.when positioner coordinate system valid, XYZABC of current user coordinate system is invalid.

3.If the teaching program needs to run under M601/M602, then teaching point searching and recording should be finished under M601/M602.

4.positioner coordinate system should be shut down and under M600 before setting positioner coordinate by 3-point or 5-point method.

5. in positioner coordinate dialog, press number 1-5 to set P1-P5 point, and press number 0 to clear the set points.

(3) positioner coordinate system replaces user coordinate

If user coordinate is replaced by positioner coordinate, when positioner rotates, it also means user coordinate rotates. G54.48 is fixed as positioner coordinate system, then it will be unavailable for user coordinate.

Network Function of System

★、500,Internet[0 means close, 1 means open, 8 means open automatically]

★、501,IP address of gateway

Set as you want, it is better to keep first three numbers the same to address in LAN, for example: 192.168.1.1.

★、502,IP address

It is better to keep first three numbers the same to address in LAN, for example: 192.168.1.103

★、503,MAC address

Make sure every piece should be different address, for example:255:255:255:1

★、504,IP address of internet service

The IP address of computer, It is better to keep first three numbers the same to address in LAN, for example: 192.168.1.13

Wi-Fi function of USB internet: The network card of USB use **EP-N8508GS** and **BL-LW05-AR5**, others cannot supported currently. The install steps as follows:

1. Install ES browser on Android phone;
2. Open internet of ES browser -->Remote manager-->Set；
3. Set the number of port to be 3721 or 2121 or 2221
4. Set the root directory and select the internal storage of the cellphone
5. Setting up a management account with anonymity
6. Set the code to be GBK mode
7.Open the remote manager (put the IP address shown into the parameter No.561)

If there isn't Wi-Fi signal, could use Hotspot of cellphone to form LAN:

1.Open internet of ES browser -->Internet manager-->Create internet hotspot
2.Use defined hotspot, set the user name and code
3.Input the name and code to No.562 and No.563 parameter
4.Quit remote manager and enter remote manager (put the IP address shown into the parameter No.561)

The operation method of entering the FTP server folder on the controller:

1、Press "N" in the program interface(or shift+N).

2、After entering the FTP server folder, press the "N" key (or F6 key) to exit the FTP server folder according to the same operation above.

The advantage of using FTP to transfer files is that you can see the contents of PC folder on the system, and you can freely choose the files you want to transfer, which is more convenient to use. You can use anonymous login FTP server (no need to set parameter P565, P566), you can also use FTP username and password, FTP username and password using the original wired network FTP username and password.

When the system is connected to the wireless WIFI and the wired Ethernet at the same time, when the FTP server is opened, the wireless WIFI is preferred, and the parameters in the system are as follows:

★、561.The IP address of FTP server of the WiFi hot spot [based on the value of the FTP server in the cell phone, such as 192.168.2.206]

★、562. Wifi username
★、563. Wifi Password
★、564. Wifi hot spot
★、565. FTP username
★、566. FTP password

★、591,One key to set stepper type

Applies to case where the stepper equipment is installed in robot. To set the current

parameters as parameter of factory default stepper motor. The parameter mainly adjusts the part parameters of speed and motor's specification.

Attention: the parameter is usually used in robot debugging.

★、592,One key to set servo type

Applies to case where the servo equipment is installed in robot. To set the current parameters as parameter of factory default servo motor. The parameter mainly adjusts the part parameters of speed and motor's specification.

Attention: the parameter is usually used in robot debugging.

★、600, Control type(4000-4099 means etherCAT, 6000 means Modbus, 6001 means 1-6 axis use Modbus, 6002 means 3 axis use Modbus)

When set as 6000, it means all of J1-J6, Xs,Ys are ModBus absolute motor; if set as 6001, it means J1-J6 are Modbus motor with absolute encoder, Xs,Ys are POWERLink bus type motor with absolute encoder; if set as 6002, it means J3 is ModBus motor with absolute encoder, the rest are POWERLink bus type motor with absolute encoder.

When set as 400-4099, it is used to control the motor by EtherCAT, setting as following:

(A) Auxiliary relay:

M325 detect state of collision; M329 enter into drag mode.

Under collision alarm, press "R" to to refresh alarm(reset current alarm) in the alarm interface of diagnosis, the collision will be removed.

(B) Zero setting

Before setting the zero point of joints coordinates. move the joints onto zero graduation, input EE in the multiturn clear parameters to clear the servo position feedback of all joints, then power on, and input E in the multiturn clear parameters to clear all of joints coordinates.

(C) Drag mode

To convert into drag mode by outside input point X45 in the interface of manual mode(the robot itself support drag function). In this mode, driver enable signal will be off, and robot can move freely, that means drag endpoint of robot to specified point, controller will read position of motor and record the position as teaching point.

(D) Other parameter setting

★、600,Control type(4000-4099: etherCAT, 6000: Modbus, 6001: J1-6 Modbus, 6002: J3 Modbus) ， set as 4003；

★、601,etherCAT position loop gain coefficient，set as 40；

★、602,etherCAT Thread machining position loop gain coefficient , set as 40；

★、603,etherCAT position in place allowable difference(number of motor encoder)，set as:10005；

When position control type is periodical(0x6060=9), the value should be more than

10000.(position loop gain coefficient is invalid anymore)

When position is control type is PID(0x6060=9), the value need to be less than 800,(position loop gain coefficient is valid)

The parameter can be modified real-time, the value of 0x6060 will be displayed on LED of Maxsine driver, such as OP8rn or OP9rn.

In etherCAT bus mode, if define the position loop PID in controller, following two parameter need to setting:

601.etherCAT position loop gain coefficient

602.etherCAT Thread machining position loop gain coefficient.

Attention: periodical position controlling is recommended(0x6060=8, it will be better if P603 is over 10000)

★、610,etherCAT electronic gear common denominator，set as: 10000；

★、611,etherCAT J1 electronic gear molecule, set as:65536；

★、612,etherCAT J2 electronic gear molecule, set as:65536；

★、613,etherCAT J3 electronic gear molecule, set as:65536；

★、614,etherCAT J4 electronic gear molecule, set as:65536；

★、615,etherCAT J5 electronic gear molecule, set as:65536；

★、616,etherCAT J6 electronic gear molecule, set as:65536；

★、617,etherCAT J7 electronic gear molecule, set as:65536；

★、618,etherCAT J8 electronic gear molecule, set as:65536；

★、620,etherCAT station number[>=10 valid], set as 12345678；

★、621,EtherCAT servo driver type [>=1 valid](1 means Maxsine, Aecon/Invt/Estun/STEP/Xinje, 2 means Sanyo Denki/Panasonic A5, 3 means Enpu ,4 means Yakotec/Thinkvo/Panasonic A6/Yuhai, 5 means bichannel Thinkvo, 6 means Tsino-dynatron, 7 means Zhenzheng/+3Eura/+4Dorna/Kinco+6DVS , 8 means Jotong/Weide)

Example: 7777777773 means Eura driver; 7777777774 means Dorna/Kinco driver; 777777776 means DVS driver.

If the 9th byte is 5, it means delay 1 minutes before communication after power on, for example, P621=666666665 means when connect Tsino-dynatron driver, delay 1 minute before communication in order to make sure driver initializes normally.

Notes for Thinkov bichannel driver:

P620 station number corresponds to last station number of bichannel driver, instead of first one. For example, J1J2 axis corresponds to 2, J2J3 corresponds to 3;

P621 driver type should be set one number for corresponding to each channel, can not be one number correspond 2 channel. For example:

<1> if connect 4pcs of bichannel driver: P620=2468, P621=555555555;

<2> if connect 3pcs of bichannel driver: P620=246, P621=555555;

<3> if connect 1pcs bichannel+1pcs single channel+1pcs bichannel: P620=235, P621=55455;

<4> if 1pcs bichannel+1pcs single channel+1pcs bichannel+1pcs single channel: P620=2356, P621=554554;

<5> if 1pcs bichannel+1pcs single channel+1pcs bichannel+1pcs single channel+1pcs bichannel: P620=23568,P621=55455455.

★、622,etherCAT J1 collision threshold，set as: 1000；

★、623,etherCAT J2 collision threshold，set as: 1000；

★、624,etherCAT J3 collision threshold，set as: 1000；

★、625,etherCAT J4 collision threshold，set as: 1000；

★、626,etherCAT J5 collision threshold，set as: 1000；

★、627,etherCAT J6 collision threshold，set as: 1000；

(E) Electronic gear setting of System

There is two-stage electronic gear in EtherCAT system, the first stage is electronic gear of original pulse system, and the second stage is EtherCAT electronic gear. Then the superposition of both stages will be final electronic gear.

Suppose the reduction ratio of reducer is:

J1：81，J2：81，J3：81，J4：100，J5：100，J6：80

When electronic gear of system is 1:1, 1 pulse means 1/100000 degree for J1-J6, namely 100000 pulse/degree.

Then the original electronic gear ratio(the first stage) is:

J1: numerator 810000 / denominator 36000000. method: 10000*81=810000.

J2: numerator 810000 / denominator 36000000. method: 10000*81=810000.

J3: numerator 810000 /denominator 36000000. method:10000*81=810000.

J4: numerator 1000000 /denominator 36000000. method:10000*100=1000000.

J5: numerator 1000000 /denominator 36000000.method: 10000*100=1000000.

J6: numerator 800000 /denominator 36000000.method: 10000*80=800000.

Servo driver:

J1-J6: the electronic gear ratio of driver should be 65536 units of data from system when motor turns one circle.

The second-stage electronic gear(EtherCAT electronic gear): numerator:65536, denominator:10000

In EtherCAT system, we need to make command pulse from driver and feedback pulse from motor corresponding when motor turns one cycle, so both the command pulse and feedback pulse should be 65536 units.

Note of Other parameter P620.etherCAT station number setting[>=10 valid]

In etherCAT bus system, Station number 1-8 means XYZABCXsYs feed axis.as to servo spindle, when station number bases on driver, 9 mean the first spindle, 10 means the second spindle; when station number bases on main station system, 9 means the first spindle, the second spindle is unable to set, the case as follows:

1) If the station number of servo driver is not 0, then the main station system parameter is

invalid, and XYZABCXsYs axis depends on station number by follow station;

2) If the station number of servo driver is 0, then its station number will be set by main station system parameter, it refers to follow station number(1-8 feeding axis,9 spindle)from the main station sequentially. There are 9 follow stations at most(8 feeding axis and 1 spindle). for example: 134529.(nine figures at most) means the connection sequence from main station is X axis, Z axis, 4th axis, 5th axis,Y axis, the first spindle. Then connection of remote IO module is unlimited.

3) If the station number of servo driver is 0 and station number is not set in the main station system, then the sequence is XYZABCXsYs according to wires connection. Now remote IO module only can be connection with terminal of wire, otherwise, station number is mistaken.

Attention: when set the station number of follow station, no matter from main station or from follow station, it will not refresh until the controller is rebooted.

★、900.User-defined dialog box[1: invalid, 4: part valid; 12: totally valid; +256: display user coordinates by USxx]

★、901. Axis go home sequence(>9)[6 bits, 1/2/3/4/5 is X/Y/Z/A/B, last bit must be 0]

The sequence of joints homing in manual mode.

★、994. the number of controller

★、995. the number of robot

★、996. the number of user defined

3.8.5 Coordinate system

The parameter includes multiple coordinate system, namely 6 user coordinate system and 1 world coordinate system G53. 1 program could set 1 user coordinate system, also could set multi user coordinate systems, which could be changed by moving its original point.

Use G54 to G59 could set 54 coordinate system（G54 -G59、G54.1-G54.48), the original point of 54 user coordinate system could be changed in interface of setting coordinate system.

Overall modification of user coordinate system G54--59 could be finished in dialog box of coordinate system deviant in parameter:

1) Input Axxx means the axis of all coordinate system deviate overall, for example, input A12.5 means the coordinate system of current modifying items deviates by 12.5 mm.

2) Input E means reset, input Exxx means input absolute deviant.

3) Input EA means reset the overall axis of all coordinate system,input EAxxx means the axis of all coordinate system input the deviant.

4) In arbitrary coordinate system of X axis, input EALL means reset all deviant of all axis of coordinates.

★、1-0,The current group of user coordinate system[G54-G59]

P1-1/P1-9 corresponds to coordinates in user coordinate system, for example, if set it as 54,

then P1-1/P1-9 is specifying coordinate of G54.

★、1-1/1-9, X of user coordinate system G54-G59(mm)[Input incremental, E means absolute]

★、2-0,The current group of user coordinate system[G54.1-G54.48]

★、2-1,X of user coordinate system G54.1-G54.48(mm)[Input incremental, E means absolute]

★、1. X(mm) of user coordinate system G54 [Input incremental, E means absolute]
P1-8 means XYZABCXsYs of user coordinate system G54(mm)

★、11. X(mm) of user coordinate system G55 [Input incremental, E means absolute]
P11-18 means XYZABCXsYs of user coordinate system G55(mm)

★、21. X(mm) of user coordinate system G56 [Input incremental, E means absolute]
P21-28 means XYZABCXsYs of user coordinate system G56(mm)

★、31. X(mm) of user coordinate system G57 [Input incremental, E means absolute]
P31-38 means XYZABCXsYs of user coordinate system G57(mm)
★、41. X(mm) of user coordinate system G58 [Input incremental, E means absolute]
P41-48 means XYZABCXsYs of user coordinate system G58(mm)

★、51. X(mm) of user coordinate system G59 [Input incremental, E means absolute]
P51-58 means XYZABCXsYs of user coordinate system G59(mm)

★、61. X(mm) of user coordinate system G54.1 [Input incremental, E means absolute]
P61-151 means XYZABCXsYs of user coordinate system G54.1-G54.10(mm)

Operation：

1、Build the user coordinate system

Usually in status of teach：

(a) Press “F8” or “F5” to choose the corresponding user coordinate system(G54-G59).

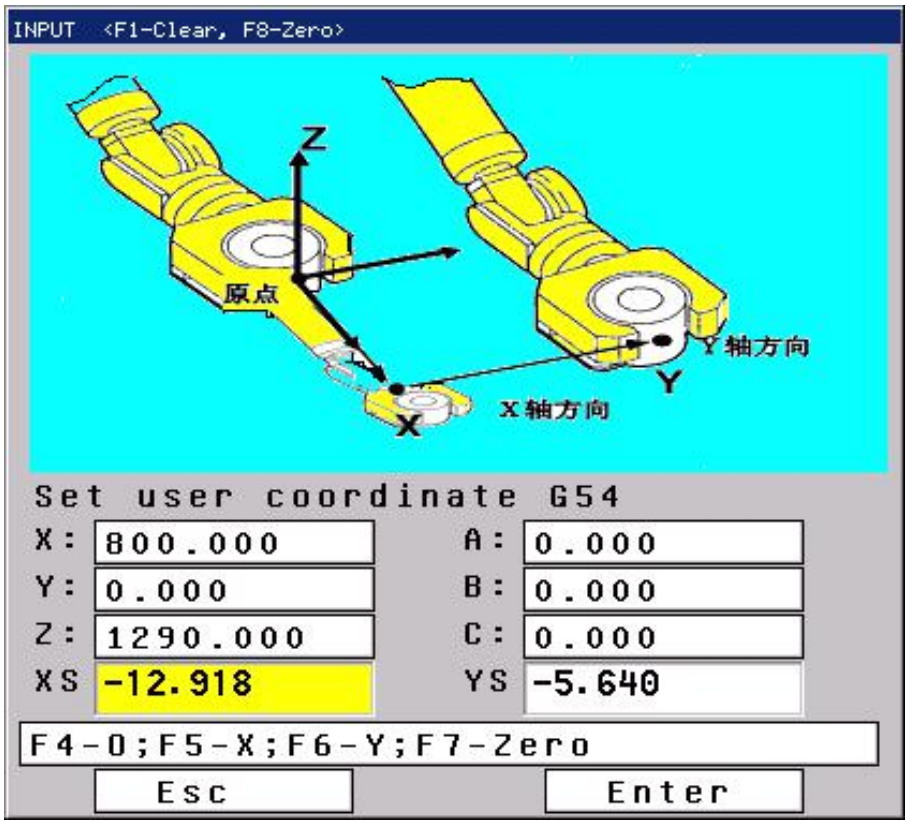
(b) Move coordinate to the fixed position(so that to measure the position), measure the point to the position of zero point in user coordinate system

（c） Press “F7” , set P1P2P3 points(correspond to F4 F5 F6 keys).

3-points: P1 is original point, P2 is the direction of +X, P3 is the direction of +Y.

Could press “Start”button or “Back”on the right side of screen when setting, the status will shows “0”, then press F4F5F6 to back to the point the last time set, adjust easily. Press “Start” to open and close this function, it will be closed after operation.

After setting user coordinate system, the coordinate parameter will shows the value, this value is the offset of zero point in user coordinate and world coordinate.



2、Offset of user coordinate system

If still need adjust after setting：

Choose the corresponding axis in interface of coordinate system, press enter, input the offset(incremental, example:offset 10mm negative, then input -10), input E and absolute offset. Press enter to adjust.

Note：

1、After modifying the parameter, refresh the coordinate system.

2、The value in brackets is the offset so that operator to check and adjust easily.

3.8.6 Password

In case of the parameter can't be modified, the controller adopt the classified authority code. Including "CNC factory" "Machine factory" "User". "CNC" arrange inner parameter; "Machine" arrange the equipment and electrical parameter of robot; "User" arrange the technique, function and working.

Initial arrangement of authority is, "CNC" authorized, "Machine"and "user" unauthorized. If want to enable this function, need use initial code to open, and set the new code, the initial code will be invalid when setting the new code, must remember the code.

★、1，The protection of "CNC"

Inner parameter, unable to operate.

★、2，The protection of “Machine”

Since the parameter enabled, parameters about configuration of machinery will be under the shield. It cannot be operated till the parameter is disabled.

The initial code is “NEWNEW”.

★、3，The protection of “User”

Since the parameter enabled, parameters about processing will be under the shield. It cannot be operated till the parameter is disabled.

The initial code is “KERKER”.

★、4，Modify the code of “CNC”

★、5，Modify the code of “Machine”

★、6，Modify the code of “User”

Above the three parameter apply to change new code, change the new code again need to input old code first.

★、7，Work time of controller

Starting using time of controller, unable to operate.

★、8，Version of software

3.9 Technique parameter

Including welding, palletizing technique etc, press”craftwork” to convert, press it twice will shift to next page.

3.9.1 Welding technique

★、1-0,The basic technique parameter in welding[0-9]

Arc weld instruction AS* to be invoked parameter group.

★、1-1,Basic technique group: Open the function of “Back” or not[8 means open, other means closed]

Set as 8 means, press “Back” got the back function. The back function means if arc breaking happens(X0 invalid) during arc welding with MOVL or MOVC instructions, robot will back for a distance then restart arc start instruction AS*, and continue arc welding process.

★、1-2,Basic technique group: The back distance of restart(um)

Only available if back function is enabled, refers to the automatic back distance after arc breaching during arc welding.

★、1-3,Basic technique group: The speed of restart(mm/min)

Only available if back function is enabled, refers to the automatic back speed after arc

breaching during arc welding.

★、1-4,Basic technique group: The detection times of cladding

Definition: when sold wire sticks on the workpiece before execution of AE*, it is necessary to clad to separate solder wire and workpiece. When times of cladding is over the st value, it will alarm ad quit. When the parameter is equal or less than 0, it is unnecessary to detect cladding(X03), but it will execute cladding once.

★、1-5,Basic technique group: weld mode [1:MIG-VA, 2:MIG-VW, 3:TIG-A, 4: TIG-AW]

★、1-6,Basic technique group: Open the scrape function or not[8 means open, others mean closed]

Scrap function open means, after execution of AS*, keep running for a distance to ensure arc strike when output of arc starting is effective. If arc strike succeeds in scrape range, then back to start point and execute welding; if arc strike fails then alarm and quit. Scrap function close means, after execution of AS*, when output of arc starting is effective, wait for a period to check if arc strike succeeds or not, if succeed then weld, if fail then alarm and quit.

★、1-7,Basic technique group: The scrape distance in weld(um)

★、1-8,Basic technique group: The backing speed of scrape in weld(mm/min)

★、1-9,Basic technique group: Starting of arc and arc extinction:+2 means the starting of arc is specified; +4 means arc extinction is specified.

★、1-10,Basic technique group: The voltage of starting of arc

★、1-11,Basic technique group: The current of starting of arc

★、1-12,Basic technique group: The voltage of welding port treatment

★、1-13,Basic technique group: The current of welding port treatment

★、1-14,Basic technique group: The voltage of after treatment

★、1-15,Basic technique group: The speed of solder wire go back(mm/min)

★、1-16,Basic technique group:The time of gas purge(ms)

★、1-17,Basic technique group: The present time of delivery gas(ms)

★、1-18,Basic technique group: The detection time of electrical arc(ms)

★、1-19,Basic technique group: Starting time(ms)

★、1-20,Basic technique group: Time of behind delivery gas(ms)

★、1-21,Basic technique group: Time of welding port treatment(ms)

★、1-22,Basic technique group: Time of behind treatment(ms)

★、1-23,Basic technique group: Delay time of cladding detection instruction(ms)

★、1-24,Basic technique group: Delay time of cladding detection (ms)

★、1-25,Basic technique group: Time of cladding detection(ms)

★、1-26,Basic technique group: Welding fixed trim[5-900]

The fixed ratio of MOVL/MOVC between AS and AE, range is 5-900. if beyond the scope, feed speed ratio will be ratio percentage in main interface.

★、101. Open interruption of wire feeding or not(M03)[0 means open, 1 means close]

★、102. Total period(unit:10ms)

★、103.Wire feeding time(unit:10ms)

★、104. Detecting time of successful arc starting[X0 valid](unit:10ms)

Over the time means successful arc starting. And this period is included in P1-18.

★、105.Detecting time of successful arc extinction[X0 invalid](unit:10ms)

Over the time means successful arc extinction. And this period is included in P1-24.

3.9.2 weaving welding technique

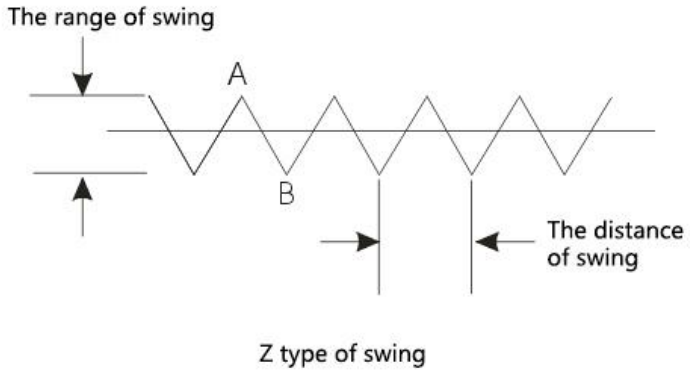
★、2-0,The group number of weaving in weld[0--9]

Starting instruction WS* invokes parameter groups from 0 to 9.

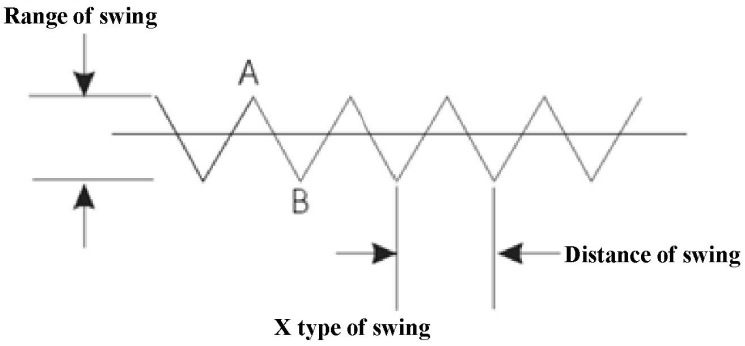
★、2-1,Weaving mode[1 mean Z type; 2 means circle type, 3 means X type]

The types of weaving weld, 1 refers to weaving in the shape of “Z”, 2 refers to circular weaving. If weaving plane is vertical on Z axis of tool coordinate system, direction of Z axis corresponds to direction of welding gun during the setting of tool coordinates. If only set P1, P2, P3, the direction of welding gun P3 signifies Z axis in tool coordinate. If set P4, P5, the

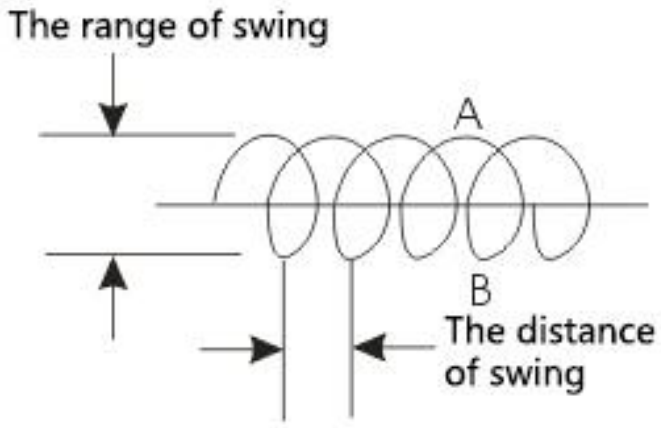
direction from P3 to P4 signifies X axis, and direction from P4 to P5 signifies Z axis in tool coordinate system.



Z type of swing



X type of swing



Circle type swing

★、2-2,Distance of weaving(um)

Distance between every two weaving segments.

★、2-3,Extent of weaving(um)

Distance between two weaving points from A to B.

★、2-4,The pause time at A point(ms)

Weave weld to A point and the pause time(ms).

★、2-5,The pause time at B point(ms)

Weave weld to B point and the pause time(ms).

★、2-6,Circular swing direction(0 means reversal, 1 means normal)

★、2-7,Swing direction determination mode [8:Always vertical Z direction, Others:determined by tool coordinates]

3.9.3 Searching technique

★、3-0,Search technique group[0--9]

★、3-1,Search technique group: Mode and type

To set mode and type of search. 1 means one-dimensional search; 2 mean two-dimensional search; 3 mean three-dimensional search; 4 means one-dimensional and rotary search; 5 means two-dimensional and rotary search; 6 means three-dimensional and rotary search; 7 means circumcentre search.

One-dimensional search: to search a point in the direction of X or Y or Z.

Two-dimensional search: to search a point in the direction of XY or YZ or XZ respectively.

Three-dimensional search: to search a point in the direction of XYZ respectively.

One-dimensional and rotary search:to search two points in the direction of X and Y;the first point is used to calculate translation, the angle between line on XY and on workpiece will be rotation.

Two-dimensional and rotary search:to search two points in the direction of X and Y respectively;

Three-dimensional and rotary search:to search two points in the direction of X and Y respectively, and search one point in the direction of Z;

Circumcenter search: to search two points in the direction of X and one point in the direction of Z; or to search two points in the direction of Y and one point in the direction of X. To calculate the center of circle according to the three points through circumcenter. Then conclude offset value by comparing the calculated center with the center of calibrated workpiece.

★、3-2,Search technique group: The distance of search(um)

★、3-3,Search technique group: The speed of search(mm/min)

★、3-4,Search technique group: The back speed of search(mm/min)

★、3-5,Search technique group: Input point of searching detection (+1000 means waiting valid jump. +2000 means waiting invalid jump)

To set Input point of searching detection by parameter 3-5. For instance, X12 is set as

1012, denotes that if X12 is valid, searching is finished.

★、3-7,Secondary Search and Automatic Return (4:Secondary search , 8:Automatically return)

To set if back to start point after search one time. Otherwise go to next point directly.

★、3-8,Backward distance before secondary search (um)

★、3-9,The speed of secondary search (mm/min)

3.9.4 Arc tracking technique

★、4-0. The group number of arc tracking parameter in weld[0--4]

★、4-1,Compensation mode (+4:Left&right;+8:Upper&lower;+16:Left&right analog;+32:Upper&lower analog;+64:analog address exchange)

★、4-2,Welding arc tracking: Left and right compensation Detecting IN1 address (1000+X number)[Left&right reference voltage]

★、4-3,Welding arc tracking: Left and right compensation Detecting IN2 address (1000+X number)[Left&right reference voltage range of error]

★、4-4,Welding arc tracking: Upper and lower compensation Detecting IN3 address (1000+X number))[Upper&lower reference voltage]

★、4-5,Welding arc tracking: Upper and lower compensation Detecting IN4 address (1000+X number)[Upper&lower reference voltage range of error]

★、4-6,Welding arc tracking : 01 Left and right compensation value(um)[Left&right max-compensation value lower than reference analog quantity]

When input point IN1, IN2 is 01, it is left/right offset compensation.

★、4-7,Welding arc tracking :10 Left and right compensation value(um)[Left&right max-compensation value higher than reference analog quantity]

When input point IN1, IN2 is 10, it is left/right offset compensation.

★、4-8,Welding arc tracking:01 Upper and lower compensation value(um)[Upper&lower max-compensation value lower than reference analog quantity]

When input point IN3, IN4 is 01, it is right/down offset compensation.

★、4-9,Welding arc tracking:10 Upper and lower compensation value(um)[Upper&lower max-compensation value higher than reference analog quantity]

When input point IN3, IN4 is 10, it is right/down offset compensation.

★、4-10,Welding arc tracking:Compensated acceleration[Compensation per 2 ms](um)

It is offset compensation value per 2ms, namely compensation acceleration.

★、4-11,Welding arc tracking:Analog mode Left&right compensated acceleration coefficient

★、4-12,Welding arc tracking:Analog mode Upper&lower compensated acceleration coefficient

Arc tracking is used to do compensation according to changing of input point IN1-IN4(changing of welding seam) during welding.

Arc tracking also can convert analog signal into 12-bit digital signal, input point X16-X27 and X28-X39 can be used for detection. According to changes of digital signal, controller will correct welding seam continuously.(Attention: if X16-X39 is occupied, then corresponding PLC need to be deleted)

Note for analog-signal arc tracking:

1> Default analog input signal of left/right compensation is X16-X27;

Default analog input signal of up/down compensation is X28-X39;

If 4-1=1, input address of left/right and up/down will be exchanged.

2> when 4-11 or 4-12 < 10, compensation(um) acceleration per interpolation circle(2ms) will be fixed as 4-10. Otherwise, compensation(um) acceleration per interpolation circle(2ms) should be calculated as following formula:

Abs(current analog value - reference analog value)*compensation acceleration*compensation acceleration coefficient/1000;

reference analog value means P4-2/P4-4, compensation acceleration means P4-10, compensation acceleration coefficient means P4-11/P4-12. when result value is bigger that 10 times of P4-10, it will be limited within 10 times value of P4-10.

3> P4-3/P4-5 means if difference between current analog value and reference analog value is less that value of P4-3/4-5, then keep current compensation value.

4> the analog signal is converted in 12-bit digital signal, so maximum analog voltage corresponds to 4095, minimum voltage corresponds to 0. analog value in parameter refers to digital value, range 0--4095.

3.9.5 Laser tracking technique

★、5-0.Welding laser tracking technique group number[0-3]

Instruction LS* is used to invoke the laser tracking technique group. The group number is from0-3.

★、5-1. laser tracking technique group: communication mode[0 means serial port 0, 1 means serial port 1, 6 means network UDP, 7 means network TCP];

★、5-2. laser tracking technique group: searching range[um];

★、5-3. laser tracking technique group: searching speed[mm/min];

★、5-4. laser tracking technique group: search back speed[mm/min]

★、5-5. laser tracking technique group: search interval(ms);

★、5-6. laser tracking technique group: selection of weld mode

★、5-7. laser tracking technique group:periodic time(ms) for search time communication processing

★、5-8. laser tracking technique group:periodic time(ms) for search time communication processing during tracking(ms)[determines tracking sensitivity]

★、5-9. laser tracking technique group: station number in serial port mode; port number in network mode;

★、5-10. laser tracking technique group: Baud rate of serial port(fixed setting: the data bites is 8, the stop bites is 1, no parity)

[0=7200; 1=9600; 2=14400; 3=19200; 4=38400; 5=57600; 6=115200]

★、5-11. laser tracking technique group: mode(+4 means compensate left and right, +8 means compensate up and down, +32 means calibration compensation, +64 means full calibration compensation).

Coordinate system calibration: define several points(usually 3 points), input position XYZ and posture ABC of current TCP into laser tracker, matching tractor coordinate system with controller user coordinate. Then the feedback of XYZABC from tracker will be position XYZ and posture ABC of TCP point in user coordinate of controller, and perform coordinate system compensation.

+32 means calibration compensation: compensate XYZ only, and feedback XYZ 3 group 16 bit coordinate value from tracking.

+64 means full calibration compensation, compensate position XYZ and posture ABC, and feedback XYZABC 6 group 16 bit coordinate value from tracking.

★、5-12. laser tracking technique group: numerator of left and right compensation ratio[could be minus]

★、5-13. laser tracking technique group:denominator of left and right compensation ratio[could be minus]

★、5-14. laser tracking technique group: numerator of up and down compensation ratio[could be minus

★、5-15. laser tracking technique group: denominator of up and down compensation ratio[could be minus]

★、5-17. laser tracking technique group: max value of left and right compensation

★、5-18. laser tracking technique group: max value of up and down compensation

★、5-20. laser tracking technique group: compensation acceleration [compensation value/2ms](um)

★、5-21. Laser tracking process group: Compensation acceleration multiplier coefficient

When P5-21 less than 10, each interpolation period acceleration is P5-20, otherwise, the period acceleration is: (original offset value from tracker)*P5-20*P5-21, when the result is bigger than 10 times of P5-20 value, it will be limited within P5-20 value.

★、5-22. laser tracking technique group: left and right deviation feedback is less than this value think weld alignment.

★、5-23. laser tracking technique group: up and down deviation feedback is less than this value and the weld alignment is considered.

★、5-24.laser tracking technique group: track the step of reproduction[>5] (um)

When P5-24>5, P5-25 and P5-26 works.

★、5-25,laser tracking technique group:Tracking the speed multiplier during scanning%[>=20]

When P-24>5, the seam scanning speed=programmed speed*P5-25/100

★、5-26,laser tracking technique group: Track the speed at which the reproduction mode returns the starting point of the welding(mm/min)

When P5-24>5, laser tracking technique group: the speed backing to start point of welding.

★、5-27,laser tracking technique group: the lift height when back welding start point in tracking reproduction.

When P5-24>5, the lifting height of welding gun back start point after scanning.

★、5-27,laser tracking technique group: the drop height when stating welding in tracking reproduction

When P5-24>5, the drop height of welding gun after backing start point.

3.9.6 Match

★、Welding current matching setting

Set corresponding welding current of the 1st analog 0-10V output

★、Welding voltage matching setting

Set corresponding welding voltage of the 2nd analog 0-10V output

3.9.7 Pallitizing technique

Referring to command PA**, PW**.

★、601,The basic parameter of depalletizing

★、602,The teach for piling point of depalletizing

★、603,The teach for approach and back point of depalletizing

★、604,The special set for each floor layout number of depalletizing

★、605,The special set for each floor height of depalletizing

★、606,The set or teach for special regular layout data of depalletizing

★、607,The set or teach for special ruleless layout data of depalletizing

★、608,The set or teach for special floor with special approach and back point

★、609,Copy data of some number depalletizing

★、610,Copy data of some number layout mode

★、611,Delete the data of some number depalletizing

★、612,Delete the data of some number layout mode

★、613,The M instruction before depalletizing(880--889)

★、614,The M instruction when depalletizing to point 1(880--889)

★、615,The M instruction when depalletizing approach to the summing point to offset(880--889)

★、616,The M instruction when depalletizing approach to the summing point(880--889)

★、617,The M instruction when depalletizing back to the summing point to offset(880--889)

★、618,The M instruction when depalletizing back to point 1(880--889)

★、620, Decode the current status of palletizing (total stack,layer number,line number,stack number within the current layer)

Display and set current total stack, current layer, current column, current stack number.

3.9.8 Point data

★、501,Check the data of position point

Read data of position, invoke number 0—499 of parameter

★、502,Adjust the data of position point

Adjust data of position, invoke number 0—499 of parameter

★、503,Save the data of the current position point[Pay attention to the current tool number and user coordinate system]

Save data of position, invoke number 0—499 of parameter

Pay attention: The current tool number and user coordinate system.

★、504,Check the data of movement value

Check movement refers to SN* invokes data of parameter group, "*" means invoke number 0—99.

★、505,Modify the data of movement value

Modify movement refers to SN* invokes data of parameter group, "*" means invoke number 0—99.

★、506,Calculate the data of movement value according to the two position point[Pay attention to the current tool number and user coordinate system]

Modify the data is specified by SN*. According to No.501-No.503 to calculate moving value and save in parameter group.

3.9.9 Vision technique

★、6-0,Group number of visual process parameter group[0--3]

★、6-1,Visual technology groups: means of communication

[0:RS232-0; 1:RS232-1; 6:NETwork TCP; 7:NETwork UDP]

0 means RS232, 1 means RS485, 6 means NEWTwork TCP, camera system is server, controller is client.

★、6-2,Visual technology groups: For serial:station numbers, for network: port number

★、6-3,Visual technology groups: Serial Baud rate(data:8,stop:1, no parity)

[0=7200; 1=9600; 2=14400; 3=19200; 4=38400; 5=57600; 6=115200]

★、6-4,Visual technology groups:VD Maximum waiting time(ms)

★、6-5,Visual technology groups:Get Visual data X offset(um)

★、6-6,Visual technology groups:Get Visual data Y offset(um)

★、6-7,Visual technology groups:Get Visual data Z offset(um)

If the grab is dynamic, appropriate offset value will help in grabbing workpiece successfully. For instance, at the beginning offset value can be 0, then run program to measure difference between grabbing position and real position of workpiece, and input the offset value in above 3 parameters. To modify offset vale to grab workpiece appropriately.

The point data will be saved through feedback XYZABC coordinate by VD command adding XYZ offset value. For example if received data by command VD12 is X10Y20Z40C50, and offset is X-6Y5Z8, then the coordinate data saved in Point 12 will be X4Y25Z48C50.

★、6-8,Visual technology groups:Transmission band speed during dynamic grabbing(mm/min)[>5]

If P6-8<5, it means what VD command received is static data, if P6-8>5, it means what VD received is dynamic data.

★、6-9,Visual technology groups:Communication data format with visual system(12:ASCII, 15:ASCII floating number)

If P6-9=12, transmission data will be ASCII format（unit: um&1/1000 degree）, visual system is TCP Server, and controller is TCP guest.

If P6-9=15，transmission data will be ASCII format(unit: mm&degree), visual system is TCP Server, and controller is TCP guest.

Based on value, if with sign - will flip value, it means transmit data incrementally, otherwise means absolutely. For example, P6-9=-5 means transmit incremental value by non-ASCII code, P6-9=-12 means transmit incremental value without decimal point by ASCII code, whose unit is um and 1/1000 degree.

★、6-10,Visual technology groups:VT instruction simultaneously valid output point[1000+No.:AB, 2000+No.:time](1030/1031 refers to Y30/Y31)

when execute VT, the output point controlling camera to take picture and record the shooting time. Once received date by VD, close the output point automatically. The default output point in controller is Y30/Y31. if need to change it into another point, please delete the corresponding output column in PLC. For example, if set the parameter as 1022 to control Y22, then delete following column in PLC;

if the parameter is set as [1000+number], controller will calculate distance from the shooting moment according to the AB signal feedback, that means higher accuracy. The direction of distance is defined by parameter 6-8, negative value means negative direction.

if the parameter is set as [2000+number], controller will calculate distance from the shooting moment according to the time difference, that means lower accuracy. The direction of distance is defined by parameter 6-8, negative value means negative direction.

★、6-11,Visual technology groups: the detection input point of the workpiece to the photographing position[1000+No.,2000+No.Auto]

When P6-11=2000+No., controller will not only detect X No. Input point when VT, but also in any time, then when the input point is valid, controller will execute VT automatically.

When equipped with the detect switch for detecting work piece arriving at camera positioning, controller need to detect this input point before VT execution. If did not install the detecting switch, unnecessary to set P6-11. the detecting time is defined by Process parameter P19, if over P19 time, it will alarm.

3.9.10 Tacking/Spraying technique

★、7-0,the group number for the tracking parameter group[0--3]

The group number invoked by tracking instruction TK*, group number 0-3.

★、7-1,Tracking encoder line number

Pulse number per circle of tracking encoder(resolution).

★、7-2,The tracking encoder rotates around the transmission belt and moves the distance(um)

The distance of conveyor belt in X direction when tracking encoder rotates one circle.

★、7-3,Position point number of XYZC in front of the work piece

Specify the position point number of received XYZC user coordinate, and target X coordinate is current X coordinate. If there is visual system connected, coordinate will be generate from visual system, otherwise it need to be set in advance.

★、7-4,Attract X-to-offset distance(um)

Offset value in the X direction of user coordinate before grabbing work piece.

Attention:

If there is a detection switch for work piece arrival, the offset value is following grabbing, it should be small;

If there is not detection switch for work piece arrival, the offset value is pursuing grabbing, it should be a little bigger.

★、7-5,Attract Z-to-offset distance(um)

Offset value in the Z direction of user coordinate before grabbing work piece.

★、7-6,Speed to YZC(mm/s)

Speed of locating at YZC before grabbing.

★、7-7,Grasp the M instruction executed by the workpiece(880--889)

Arrive at XYZC position specified by P7-6, immediately execute user-defined M code by P7-7 to grab work piece, this M code just include OUT instruction to output, do not use any waiting instruction. If the application is spraying, it means enable spraying function. For example, if set it as 880, then it will execute ProgramUser0.

★、7-8,The distance of offset along the X after grasping the workpiece(um)

Offset value in the X direction of user coordinate after grabbing work piece.

★、7-9,The distance along the Z when lifting the workpiece(um)

Offset value in the Z direction of user coordinate when lifting work piece.

★、7-10,The distance offset along the X direction when the workpiece is lifted(um)

Offset value in the X direction of user coordinate when lifting work piece.

★、7-11,The input point at which the workpiece arrives is detected[High speed:1000+No.Low speed:2000+No.]

Set the input point to detect work piece arrival, for example, 1041 means detect X41 as work piece arrival. If not set, then controller will detect encoder Z signal as input signal. When set as low speed detecting(2000+No.), detecting time is defined by Process parameter P19, if detecting time over the time in P19, it will alarm.

★、7-12,The X coordinate of the workpiece arriving at the detection switch(um)

when equipped with detection switch, this parameter is used to set the X coordinate of detection switch, and it should include the diameter of work piece. For example, if current coordinate is -50, diameter of work piece is 30, then this parameter should be -80. controller will calculate encoder AB pulse number of belt following movement after arrival of work piece according to this parameter, then robot move.

★、7-13,The distance(um)at which the synchronous X-direction offset is achieved before the workpiece is gripped(um)[>10]

When parameter value is more than 10, it is synchronization method, means before grabbing, robot rapidly moves to position of work piece, then tracking AB signal according to X/Z offset by P7-4/P7-5 and grabbing work piece synchronously.

When parameter value is less than 10, it is waiting method, means waiting for work piece arriving at robot statically, then tracking AB signal according to X/Z offset by P7-4/P7-5 and grabbing work piece synchronously.

If there is no arrival detection signal and P7-13 is more than 10, following parameter is available.

★、7-14,Control of X direction range of grasping workpiece [+2 negative limit;+4 positive limit; +8:alarm]

If D1=1(means +2), parameter P7-15 is valid. When work piece is out of negative limit, robot will waiting for work piece coming into work scope and grab it synchronously.

If D2=1(means +4), parameter P7-16 is valid. When work piece is out of positive limit and D3=1(means +8), controller will prompt alarm and quit program, or process according to TK instruction. if P instruction is attached with TK, then firstly locate at target XYZ position before executing TK, and judge that work piece is out of positive limit, then skip to the line specified by P, if no P, then execute sequentially.

Example:

TK1 P200 means execute TK1 to grab work piece and find it out of work range,

locate at target YZC position, then skip to line N200.

★、7-15, Negative limit value of X direction for grasping workpiece(um)

★、7-16, Grasp the positive limit value of the X direction of the workpiece (um)

3.9.11 Driver Parameter

The driver parameter works with NEWKer NK series drivers only. Press 7 and input 1 means read all driver parameters.

★、8-0,Current drive parameter setting shaft[1--8]

Choose the Axis No. to modify parameter, 1-8 means J1-J6/Xs/Ys.

★、8-1,Modify the current axis parameter password(11:valid,Others:invalid)

Only when P8-11=11, can the following parameter be modified. Details refer to driver manual.

★、8-8,Current loop proportional gain

Set motor current loop proportional gain, the bigger value sets, the faster current gain becomes. When motor vibrates or squeals, increase the P8-8; if the motor is small power and becomes hot, decrease P8-8.

★、8-9,Speed loop proportional gain

St motor speed loop proportional gain, the bigger value sets, the higher gain is, and the stronger rigidity becomes, but easier to vibrate; if without squeal, the bigger value is better.

★、8-10,Position feed-forward gain

Set position feed-forward gain, the bigger value is, the higher gain is, and the stronger rigidity becomes, but easier to vibrate; if without vibration, the bigger value is better.

★、8-11,Position loop proportional gain

Set motor Position loop proportional gain, the smaller value set, the smoother motor rotates, but the worse rigidity becomes; the bigger value set, the faster position orients, the smaller following offset becomes, the stronger rigidity becomes, but easier to vibrate or overshoot; if without vibration or overshoot, the bigger value is better.

★、8-31,Driving alarm overload percentage

Used to set the overload percentage alarm, if the load is over the value of motor torque*P8-13/100, driver will alarm.

★、8-32,Rated current of motor(0.1A)

Set current motor rated current.

★、8-33,Rated torque of motor(0.1NM)

Set current motor rate torque.

★、8-44,Current loop filter constant

Set motor motor current loop filter constant, the smaller value is, the louder motor current squeal becomes. If motor inertia is big, and mechanical part has vibration squeal, increase P8-44.

★、8-34,Zero position motor encoder

★、8-35,Motor pole logarithm

★、8-48,Driving control parameters(12:Current initialization current)

When driver works abnormally, set P8-48=12, to initialize current and driver parameter.

★、8-51,Check the encoder alarm [0:Yes,1:No]

★、8-57,Number of motor coder lines

2517 means 17 bit multi-turn, 2523 means 23 bit multi-turn, 17 means 17 bit single turn, 23 means 23 bit single turn.

★、8-59,Motor stop current locking ratio

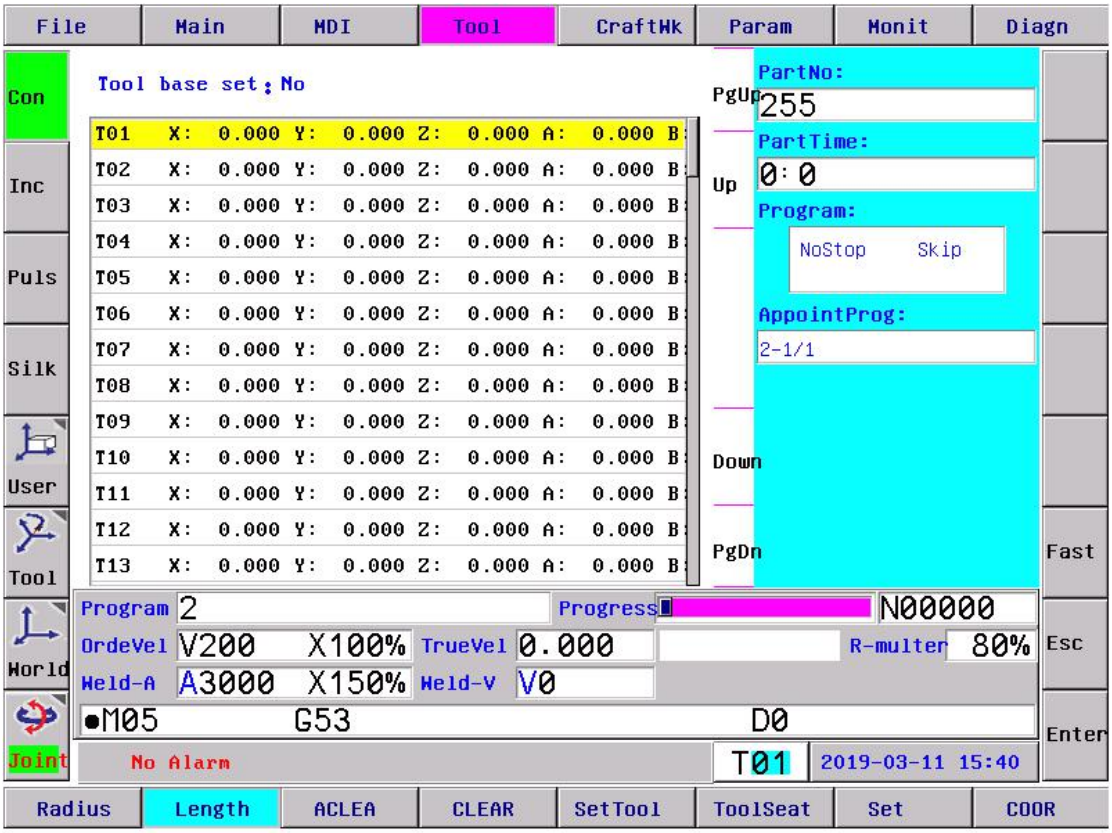
Attention: Other parameter P29=1, to make sure when driver works well, controller will output Y05 signal to control motor brake.

6 axis 10kg robot driver default parameter:

	J1/1.5Kw	J2/1.5Kw	J3/1Kw	J4/200W	J5/200W	J6/200W
P8-8	330	330	330	150	150	150
P8-9	200	200	100	120	100	100
P8-10	100	60	100	60	100	100
P8-11	100	60	100	60	100	100
P8-31	50	50	40	15	15	15
P8-32	50	50	40	6	6	6
P8-44	40	40	40	40	40	40

3.10 Parameter of tool compensation

Tool compensation interface, including “Radius compensation” “Length” “Clear all value” “Clear current value” “Set tool” “Toolseat” “Set”, total 7 functions, correspond to press “F1-F7” to enter corresponding interface， press “Esc” to back the primary menu interface.



3.10.1 Radius compensation

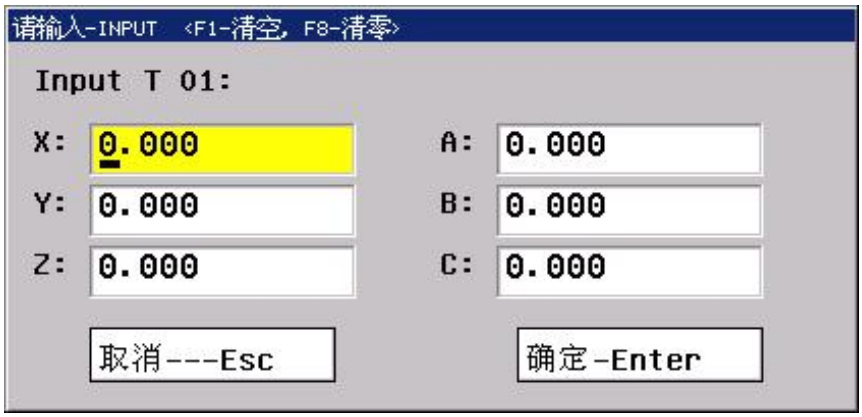
Press “F1 radius compensation” in interface of tool set. Set the radius of tool, it’s compensation of CNC controller.

Method: Press “↑” “↓” to make cursor move to the corresponding tool and press “Enter” to popup a dialog box, import corresponding tool radius(Absolute value), press “Enter” at last.

3.10.2 Length compensation

Press “F2” to enter length of redeem interface. The parameter is used to modify the length which is adopt or reset the length.

Method: Press “↑” “↓” to make cursor move to the corresponding tool and press “Enter” to popup a dialog box, input the requested value.



Initialize the tool radius and the method of length compensation：

Press “F3”(Clear all to be 0), or “F4”(The current to be 0)

3.10.3 Tool set(Redeem)

To build and set the tool coordinate system. To ensure the position and posture of tool coordinate system in flange coordinate system by P1,P2P,P3,P4,P5. Fix an end effector on robot, move the robot to the same point according to dialog box by different posture as possible, then set P1, P2, P3. P1P2P3 specify the original point of tool coordinate system. P4 specifies direction of X axis, P5 specifies direction of Z axis.

Two methods of setting coordinate system of 6 freedom angle robot: 3-points and 5-points.

（A）3-points：P1P2P3 to change the different posture of robot, the tool posit TPC point should be kept the same position, the posture in 3-points is the same as the posture of electrical connection.(The sixth flange coordinate of electrical wrist).

（B）5-points：P1P2P3 is the same as 3-points, but the posture of 5-points need P3P4P5 to make sure.P3 means the original position of tool coordinate posture, P4 means direction of +X tool coordinate posture, P5 means direction of +Z tool coordinate posture.

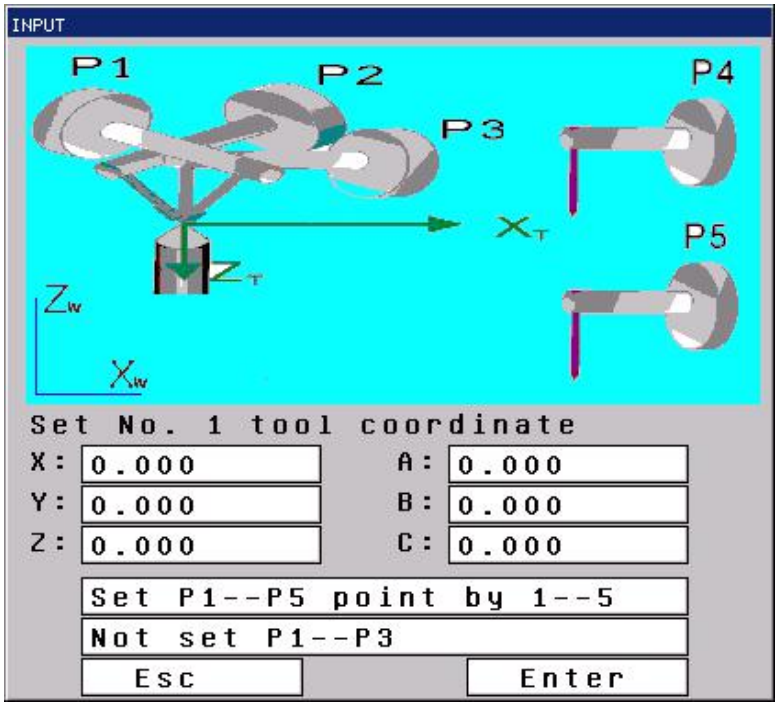
Press “Start”button or “Back”on the right side of screen in the set process, the statues will show “O”, then press “12345” to adjust the speed to back to the point set the last time, easy to modify. After once operation, this function will be closed automatically.

The posture of P3P4P5 in 5-points need to be the same(Value of ABC in world coordinate should be the same) [The interface needs to be without N letter]. So it is necessary to convert into the world coordinate system after setting of P3, then move the robot to set P4 in the direction of X axis and P5 in the direction of Z axis.

After input P1P2P3 3 points in tool set, the controller will calculate the position and posture of tool coordinate in world coordinate, if 3 points is too near, then it can’t be exist P1P2P3, the controller can’t calculate the value, it will delete P2P3 automatically.

XYZ of tool set mean the original point of tool coordinate in world coordinate, ABC mean the 3 axis posture in space(position and direction) of tool coordinate in world coordinate.

Pay attention:P1P2P3 in 3-points need be different posture;But the tool posture of P3P4P5 in 5-points need to be on the same straight line(It is fine if it isn’t straight line, just the direction of Z axis in tool coordinate is not on the same straight line with weld gun)



3.10.4 Table for tool-case

Press “F6” in redeem interface. To set the tool-case type when radius of tool is compensating.

Method： Press “↑”“↓” to chose the number of tool and press “Enter”, input the type of tool-case will be fine.

Press “F1” to initialize the tool-case type of all tool.

3.10.5 Set the number of tool

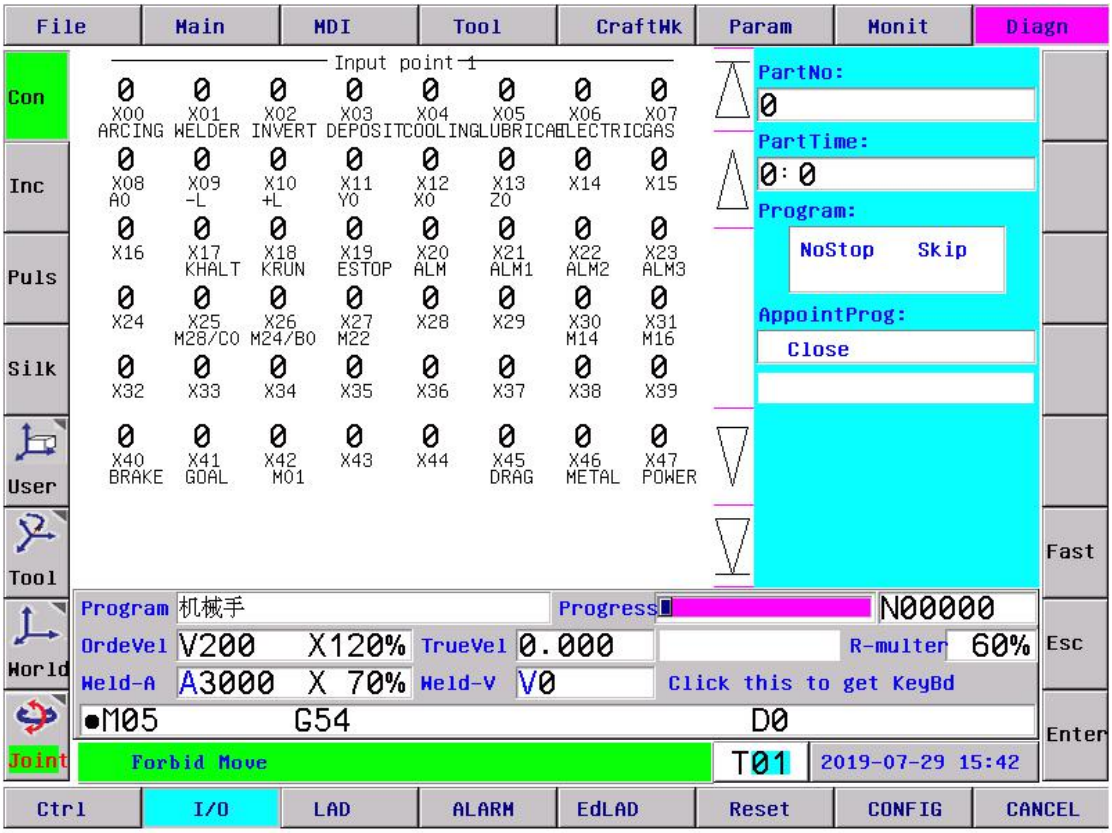
Press “F7” in redeem interface to arrange the total quantity of tools, could set as 99 tools at the most.

3.11 Diagnosis

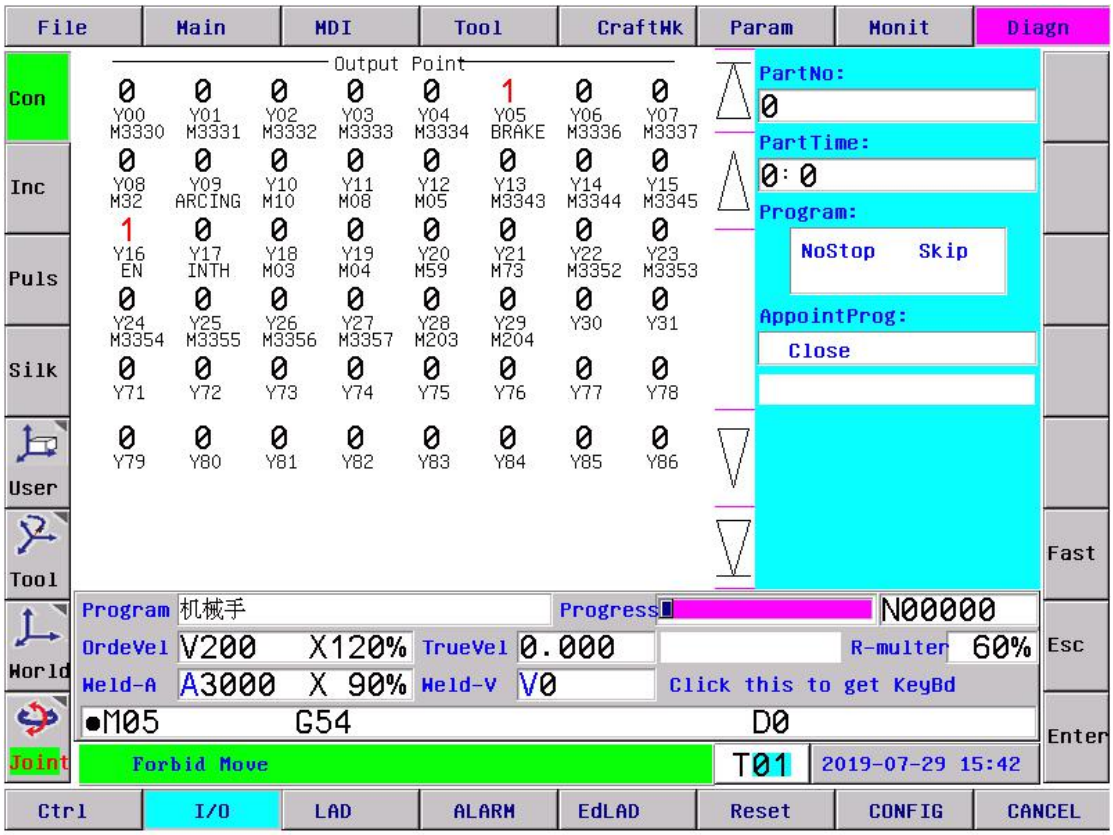
Press “Diagn” to enter this interface.

Could check all input, output and alarm. Press “F2 I/O” and “page up””page down” to check input and output point. Press “F4” to check alarm.

Input signal interface, 1 means effective, 0 means invalid.

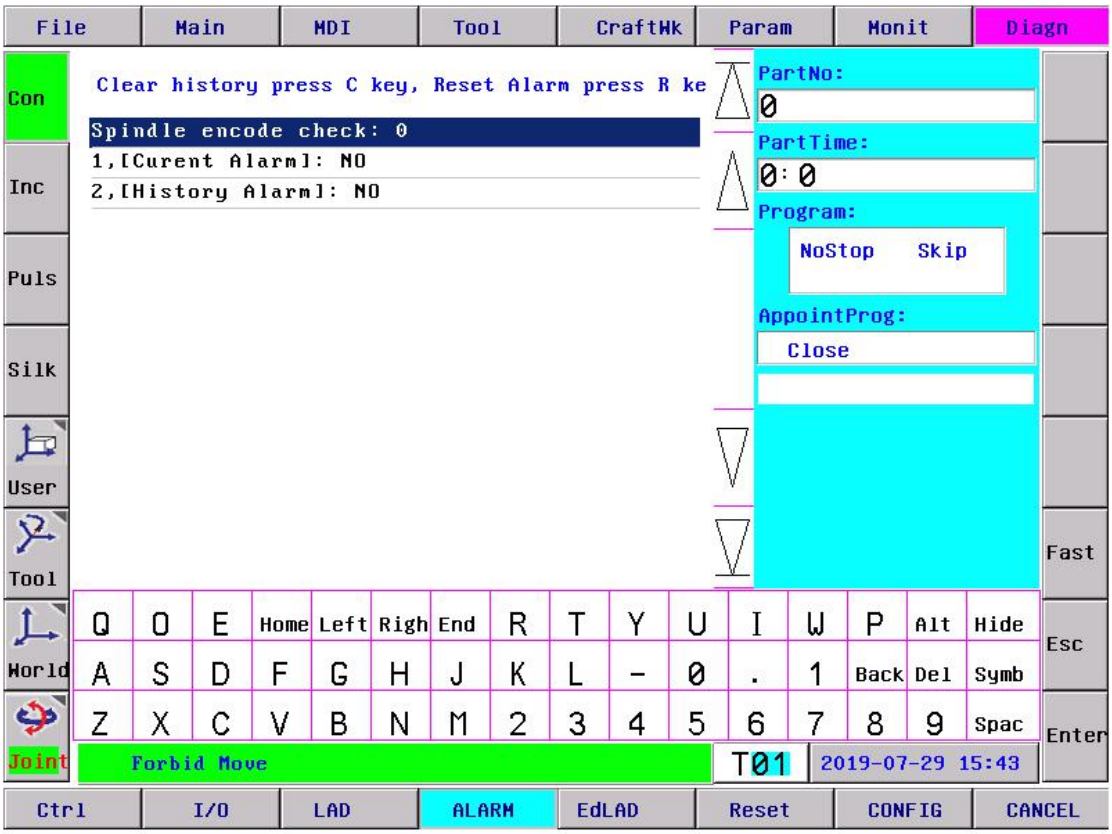


Input signal interface, 1 means effective, 0 means invalid.



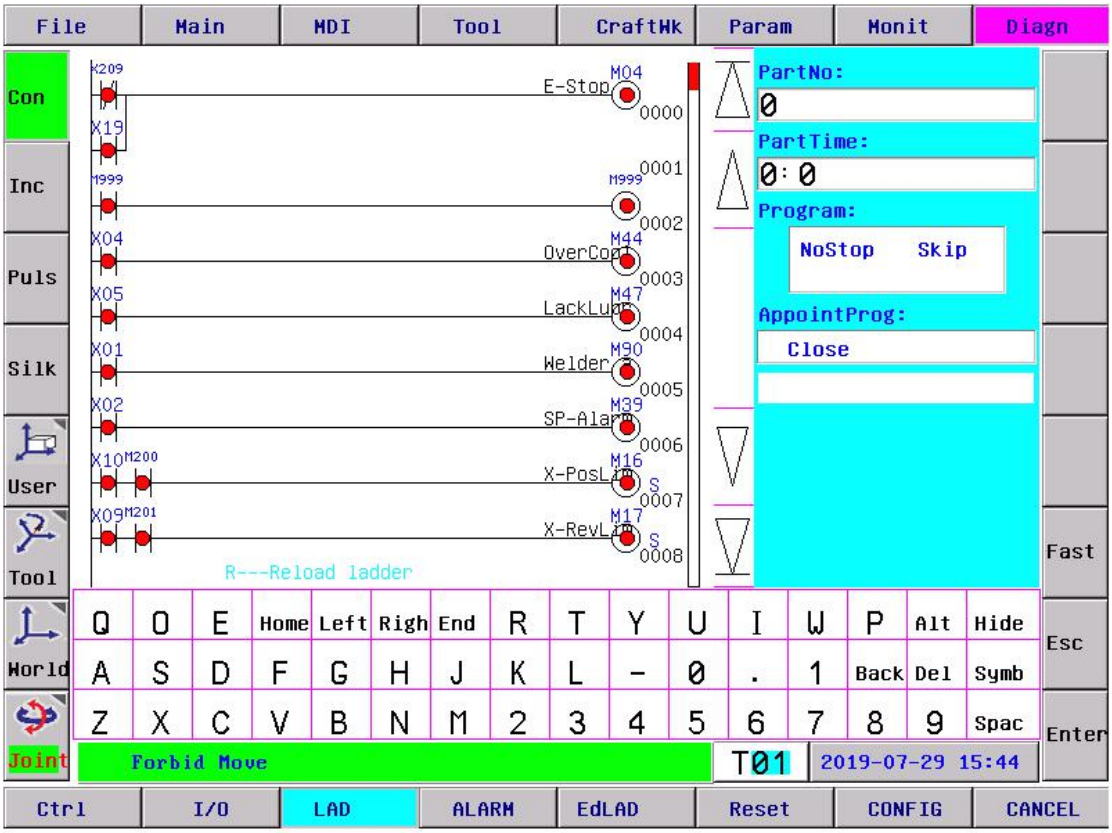
Alarm information interface

The first line in this interface shows the number of spindle encoder, the number of current and historical alarm information is record total 10, the superfluous part is clear automatically, only shows 10 alarm information recently.



Check and edit PLC

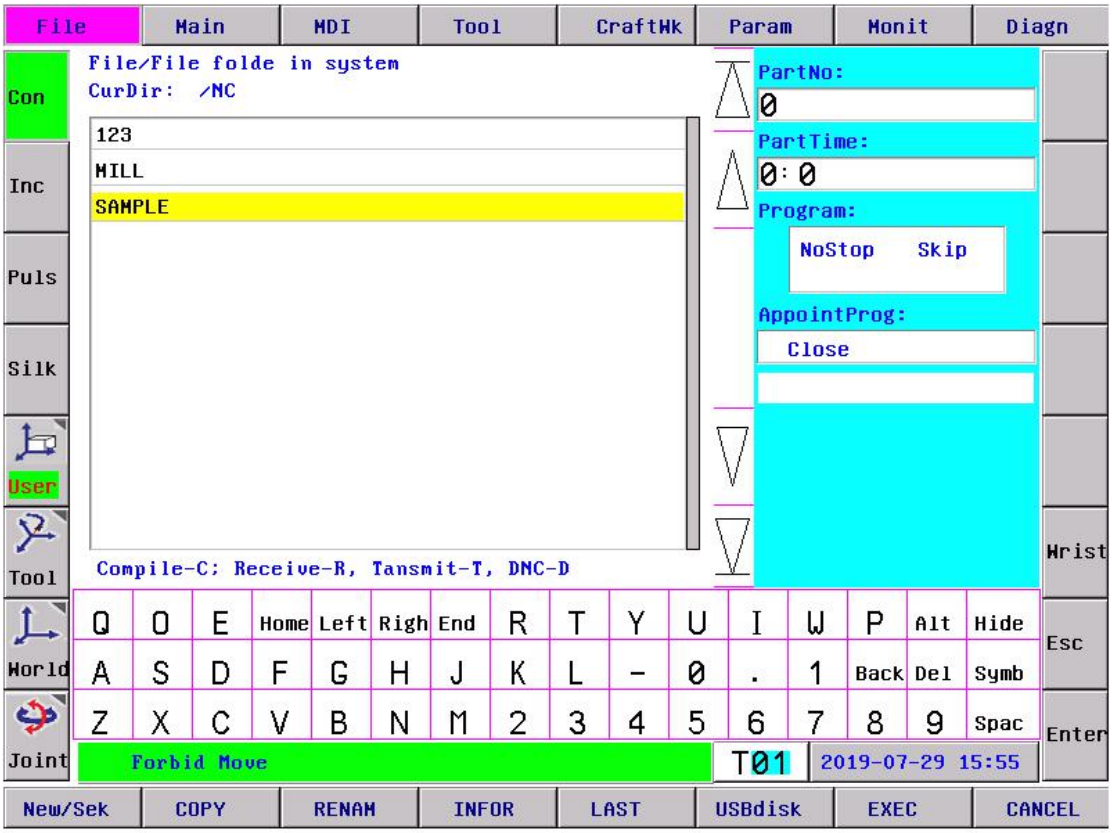
Press “F3” to check PLC, “F5” to edit, “S” to search. After finishing edit, please restart the controller.If immediate execution is necessary, press “R”.



3.12 Operation of program

Press “File” to enter into the program interface.

Program management is the same as file management, the storage of the system is 128M(The max could be expand to 32G) bits to contain program and there is no limit for quantity of program. Programming adopts full screen operation.



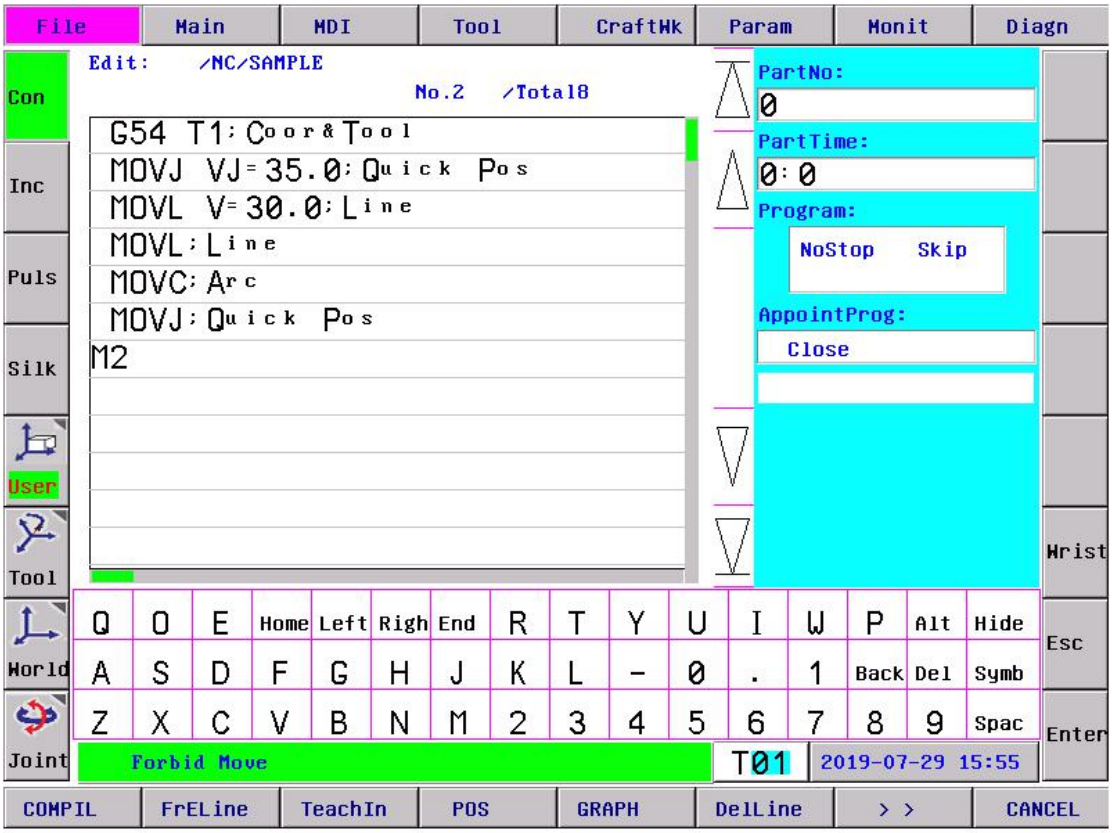
Center part of screen for program display，current program is showed by reverse display, press “PgUp”、“PgDn” to choose program, and then press“Enter”to edit current program. Functional keys“F1、F2、F3、F4、F5、F6、F7、F8” include：“new file/search”、“copy”、“rename”、“information”、“last grade”“USB disc”、“execute program”、“cancel”.

3.12.1 Editing

Select “New file/search” to popup a dialog box to import the name of program, if the name is existent, the quondam program is called up; If the name is nonexistent, the system will build a new file.

The name of program can be number, letter or mix, the length is 100 bits.

The system doesn’t allow the namesake, build a new program or select a program and press “Enter” to enter the editing interface.



The screen prompt the editing program name at the top left corner in the editing status; The left is the content, the right is the information for machine status, the operation in the editing status as follows:

(1) The current cursor locate:

Press “up”or “down” to move the cursor to any position of program content

Press "Pgup" to the last page.

Press "Pgdn" to the next page.

(2) Character modification: Delete the character at the position of the cursor, then enter the new character.

(3) The character insertion: Enter a new direct character at the cursor position. When the input is the letter,the letter in front of automatically generating space. If you want to enter a space, first enter a letter, and then delete this letter.

(4) The character deletion: Press "Del" directly at the cursor position

(5) Insert the line: Press "Enter" directly, insert a line in front of the current line if the cursor is at the first line, otherwise insert a line after the current line.

(6)Edit the position data of program line

“Home in touch screen”: If not at the head of line, press this button, it will backs to the head of line, if at the head of line, it will shows the data of the current position.

“End in touch screen”: If not at the end of line, press this button, it will goes to the end of line, press again, it will shows the data of the current position, and could be modified.

This button will be useless if there isn’t data of current position.

(7)“F7>>”The next page：

The first page of function：

A、“F1”：Compile the current program.

B、“F2”：To the first line or the last line of program.

C、“F3”：Teach function, could press “F2/F4/F5” to record the current user coordinate of XYZABCXsYs.

the mode of teach could be devided into two methods by P13 parameter:one is generate MOVJ/MOVL/MOVC instruction；Another is generate G0/G1/G6 instruction.

F2：When in the first line, press this mean this line is the first line of PLAY, otherwise it will generate MOVJ/MOVL/MOVC or G0/G1/G6 instruction.

F3：Teach, be used to open and close the teach function.

F4：Record the end point, used to record the end point of straight line interpolation and arc interpolation, generate MOVL/MOVC instruction or G1/G6. When cursor stay on arc instruction line, if press F4<SetEnd>, the current point will be the endpoint of arc(start point and middle point will not change). it will prompt after successful change.

F5：The middle point of arc, record the middle point of arc, after pressing this button, it will shows MOVC..... or G6 I**J**K** , to prompt user the next end point position of arc. When cursor stay on arc instruction line, if press F5<ArcMid>, the current point will be the middle point of arc(start point and end point will not change). it will prompt after successful change.

Pay attention：

(1) If use MOVJ/MOVL/MOVC instruction, press “F2” or “F4” to input VJ=or V= or PL=, press Enter, these value will be left.

(2) The beginning of program must use MOVJ or G0,otherwise if the starting point is not the same, the trajectory will be different.

(3) linear instruction modification: in cursor line press <SetEnd>, the current point will be endpoint of line.

(4) arc instruction modification: When cursor stay on arc instruction line, if press F5<ArcMid>, the current point will be the middle point of arc(start point and end point will not change). if press F4<SetEnd>, the current point will be the endpoint of arc(start point and middle point will not change). it will prompt after successful change.

(5) coordinate check: move cursor to end of line, and press End to check coordinate of current instruction.

Steps：

（1）Press “F3” to open teach function；

（2）Press “F2”；

（3）Move to the starting point, Press “F2”；

（4）Move to the next point according to the trajectory and requirement：

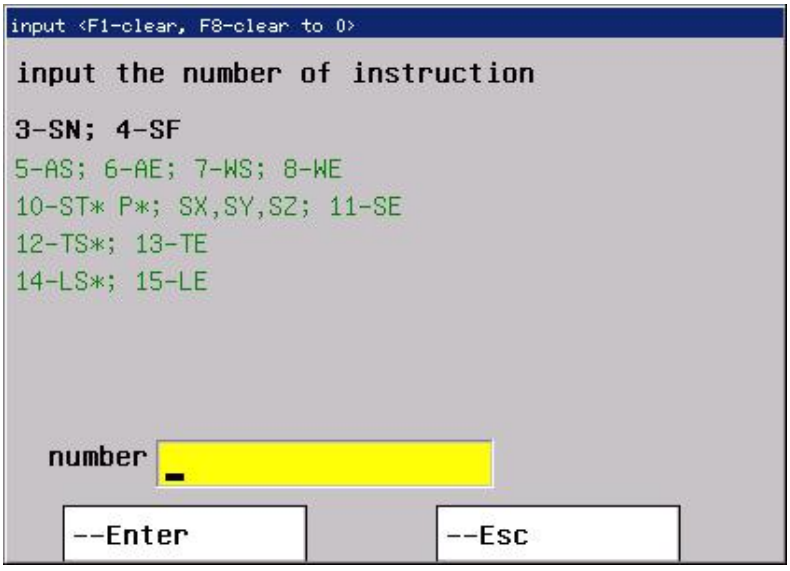
A）Rapid instruction： Press “F2” to input the rapid ratio and position level. It will generate rapid instruction MOVJ.

B）Straight line instruction：Press “F4” to input feeding speed, position level and position point, to generate straight line instruction MOVL.

C）Arc instruction：Press “F5” to record the centre of arc, move to the end point of arc, press “F4” to input feeding speed, position level and position point, it will generate arc line instruction MOVC.

D、“F4”：Locate to the specified line.

E、“F5”：To input number to choose instruction in graphic dialog.



（1）Input 3 to use translation instruction SN*, * means the number of group it will use in technique parameter 0-99. It can be checked and modify by No.501-No.506 technique parameter.

SN*,SF instruction can let robot generate translation motion, be used in palletizing and

flitting, could make programme easier.

（2）Input “4” to close the translation function SF.

（3）Input “5” to execute instruction AS*,execute the corresponding program ProgramUser0（User could edit this file as they want）.“*” means it will invoke 0-9 group of technique parameter, could be checked and modified by No.1-0/No.1-9 technique parameter.

（4）Input “6” to the end of arc welding instruction AE*, execute the corresponding program ProgramUser1（User could edit this file as they want）。

（5）Input “7” to the start of swing welding instruction WS*, “*” means it will invoke 0-9 group of technique parameter, could be checked and modified by No.2-0/No.2-9 technique parameter.

WS*，WE instruction mean it will swing when execute MOVL and MOVC according to the parameter, used when weld bead is very wide.

（6）Input “8” to end of swing welding instruction AE*.

（7）Input “10” to call searching start instruction ST*P*, * behind ST means searching group number, * behind P means translation data group number which records searching result.

（8）Input “11” to call searching end instruction SE.

（9）Input “12” to call arc tracking start instruction TS*, * behind TS means technique group number.

（10）Input “13” to call searching end instruction TE.

（11）Input ”14” to call instruction LS* to turn on laser function, * behind LS means technique group number.

（12）Input “15” to call instruction LE to turn off laser function.

F：“F6”：Delete the current line.

G、“F7”：The first, second page to choose.

H、“F8”：Chang between Chinese and letters.

The second page：

A、“F1”：Delete segment of program.

B、“F2”：Copy the program.

C、“F3”：Arrange the program.

D、“F4”：Search the specified letters.

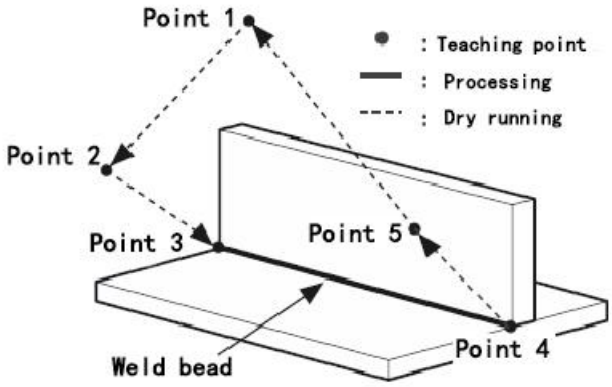
E、“F5”：Replace the specified letters.

F、“F6”：Replace the specified letters with all content.

G、“F7”：Choose the first or second page.

H、“F8”：convert between Chinese character and letters.

3.12.2 Teach of welding programme



G54 T1 ； G54 user coordinate system, T1 tool coordinate system
AA1000 ； Welding current correspond to output analog 3.33V
VV1500 ； Welding voltage correspond to output analog 5V
MOVJ VJ=80.0 PL=9.0 ； Smoothness PL=9, 80% move rapidly to program point 1
MOVJ VJ=50.0 PL=9.0 ； Smoothness PL=9, 50% move rapidly to program point 2
MOVJ VJ=25.0 PL=0 ； Smoothness PL=0, 25% move rapidly to program point 3
AS3 ； Start arc weld, the third group technique
MOVL V=100 PL=0 ； From program point 3 with arc weld to point 4, speed is 100mm/min
AE3 ； End of arc weld
MOVJ VJ=50.0 PL=9.0 ； Smoothness PL=9，50% move rapidly to program point 5
MOVJ VJ=50.0 PL=9.0 ； Smoothness PL=9，50% move rapidly to program point 1
M02 ； The end

3.12.3 Copy

Press “↑ ↓” in program main interface to select program which need to copy and press “F2” to popup a dialog box to import a new name of program, to copy which is the same content but different name so that to modify, rename and back-up copy.

3.12.4 Delete

Press “↑ ↓” in program main interface to select program which need to delete and press “Del” to delete the program.

Pay attention：The operation of delete need to be careful, it can’t be recovery after deleting.

3.12.5 Rename

Press “↑ ↓” in program main interface to select program which need to rename and press “F3” to popup a dialog box to import a new name.

3.12.6 Information

Press “↑ ↓” in program main interface to select program which need to check and press

"F4" to popup a dialog box to check the size of program and the remainder space of the system.

3.12.7 Folder management

You can build a file in this system, Press "F1" in program main interface to import a file name and press "." to build a folder and it will prompt a "folder" after the name.

Move the cursor to the file name and press "Enter" to open to build a new file or folder in it.

Press "F5" go to the last folder.

Move the cursor to the file name and press "Del" to delete the folder.

3.12.8 Select program running in auto mode

Press "↑ ↓" in program interface to select a program and press "F7" to select the program and switch into the last interface.

3.12.9 Program communication

The system could adopt the RS232 serial port to deliver files.

(1) Delivery (Send)

Deliver the selected program in this system to another system or to PC to save. Press "↑ ↓" in program main interface to select program and press "T" to deliver, press "Reset" to interrupt in the deliver process.

(2) Reception

Receive the selected program in another system or PC (Must be text file form). Press "R" to import the name of received program into the dialog box in program main interface,then press "Enter". Press "Reset" to interrupt during receive process.

Pay attention: 1. Using the exclusive communication software to deliver program in User's PC.

2. The speed of deliver of PC must be the same as the speed of receive, defeat otherwise.

3. The length of RS232 can't over 10 meters.

4. The number of serial port must be the same as the system setting.

5. Editing program of PC must be text file form.

3.12.10 U-disk management

To exchange files of parameter or program with other system or PC by U-disk. It also can upgrade or back-up the software or parameter in system.

Pay attention: The name of folder can't have space symbols.

Press "F6" to enter the U-disk management interface in program main interface when U-disk connects the USB port. Press "F6" again to back to the system interface.

A. The processing program management

Copy files or folder of U-disk into system

After connecting the U-disk, press "F6" to enter the U-disk directory in program main

interface. Press "↑ ↓" to move cursor to select file or folder to copy and press "F4" to popup a dialog box to import name, press "Enter" to confirm. If there is the same name of program in the system, it will popup a dialog box to ask if cover the file or folder or not.

Press "R" to copy all the programs in USB into system.

Copy files or folder of system into U-disk

Press "↑ ↓" to move cursor to select file or folder and press "F6", press "F3" to pop up a dialog box to import name in U-disk interface and press "Enter" to confirm. If there is the same name of program in the system, it will pop up a dialog box to ask if cover the file or folder or not.

Press "T" to copy all the program in system into USB.

Pay attention: Before unplugging the U-disk must return to the display system of program files directory interface. (Exit U-disk interface)

Otherwise the date which is copied just now will be lost.

The name of folder can't have space symbol when using U-disk.

B. Using U-disk to manage parameter and system software

The system could use U-disk to deliver files or system software to upgrade and update, back-up files and parameter, the method of operation is as follows:

Using U-disk to copy parameter and system software into system(Upgrade, update).

First U-disk inserts the USB port and press "Page" to enter the main interface, press "F6" to show the files in U-disk. Press "↑ ↓" to move the cursor to select a folder which is going to be copied into system and press " Enter" to open it, press "F2 Restore" to import password when appearing the files and press "Enter" to confirm, wait for seconds to copy the parameter successfully. Press "F6" to exit U-disk after copying successfully, restart the system, the system will reloads the new files to upgrade the parameter.

Pay attention: The parameter is better to be derived into a separate folder in U-disk to protect controller from core file being destroyed for mistaken operation.

To derive or back-up parameter files into USB-disk

Firstly, USB-disk inserts the USB port and press "Page" to enter the main interface, press "F6" to show the files in U-disk. Press "F1 Backup" to input the password and press "Enter" to confirm, waif for seconds to derive successfully. The parameter in system is already derived into U-disk. Press "F6" to exit U-disk.

Pay attention: The U-disk is empty better to arrange the files (Parameter files is lots of about several dozens) so that derive parameter or create a folder on your computer first, open the folder before deriving，then backup the parameters into the folder.

3.12.11 Convert offline file into G code program

After send the offline file into controller, need add user coordinate system and the number of tool at the head of program, and the initial located point of each joint to make sure the posture of robot is the same. The operation: First move each joint to the initial located point of the offline file, choose the program in program interface and press "-" to pop up the dialog, input the user coordinate system G and the number of tool T, VJ, PL, press "Enter", it will generates the same name file which is RBT. If the file is .DXF or .dxf, it will be G code file.

When generate G code file, it will generate the head code and end code according to if there is HEADXF.TEX and ENDDXF.TXT files(headdxf.txt and enddxf.txt) in current file directory.

Attention: head code and end code file must be in current file directory.

3.12.12 The operation for FTP server file

If the controller connect with Internet or Wi-Fi, could enter folder of FTP server.

1. Press “N” in program interface.
2. After entering folder of FTP server, press “N”(or F6) as the above operation to quit.

The advantage of FTP: You can see the contents of the PC folder on the controller , and you can choose the files you want to transfer freely, and it is more convenient to use it.

3.12.13 Program appointment

In the main interface of Program, pressing “M” or change Processing parameter No.21 to set program reservation.

(1) the first dialog is use to set if enable program reservation function.the specification is as follows:

Set as 1 means enable the program reservation function, and before execution of Program 1--10 sequentially, it will detect the corresponding auxiliary relays M362-M371(X28,X29, X32-X39), only if valid then execute, otherwise, keep standby. Meanwhile, system will prompt, once the corresponding relay is valid, controller will invalidate it, then execute the program. In this will,will the reservation stop till the last program finished. The system will not run until next press of “Run”.

Set as 3 means the same function with 1, but it will be loop, after the last program finished, it will skip to the first one repeatedly.

Set as 5 means the same function as 1. but it will not detect the corresponding relays M362-M371(X28,X29, X32-X39), execute program directly.

Set as 7 means the same function as 3, but it will not detect the corresponding relays M362-M371(X28,X29, X32-X39), execute program directly.

Set as 9 means enable the program reservation function, and execute program according to the validation sequence of corresponding relays M362-M371, controller will display the validation sequence of relays M362-M371(X28,X29, X32-X39). For example: displaying 532a7, means it will execute program No.5, No. 3, No2, No.10, No.7 sequentially. (a means No.10 reservation program).

Set as 12 means enable the program reservation function, and execute program according to the validation sequence of corresponding relays M362-M371, and record the sequence. controller will display the validation sequence of relays M362-M371 (X28,X29, X32-X39). Besides, controller will scan relay statues circle. For example: displaying 532a7, means it will

execute program No.5, No. 3, No2, No.10, No.7 sequentially. (a means No.10 reservation program).

Set as 0 means stop the reservation program function.

Set as DEL and enter, it will clear all settings of reservation.

(2) in the program directory interface, pressing A will set the current program as reserved program, then set sequence and times of the program according to dialog.

when enable the reservation program function, it will prompt message, for example, “reservation 3-2/4”, means reserved program No.3 is executing by 2 times, totally 4 times.

when enable the reservation program function, M20 will be ineffective.

when enable the reservation program function, pressing key “RUN”, system will automatically execute total reserved programs repeatedly.

Besides, there is another easy method to reserve program:

Functional addition of instruction M02,M20,M30: add P address character to specify a program’s path and name in the same line, it will stop executing program and convert into specified one.

For example:

M02 PASD123 stop the executing program, and set file ASD123 as executing program;

M20 PASD123 stop the executing program, and set file ASD123 as executing program and run it immediately.

M30 PASD123 stop the executing program, and set file ASD123 as executing program;

3.12.14 Program Template

When Other Parameter P330=14-18(Stamping), there is a Program template section in program interface, press the button to pop up dialog, after input value and enter, it will generate corresponding program template.

The name of program generated from template automatically will be marked with "-mould-". The filename with "-mould-" means that the program created by the template. Program will not automatically insert a line when it records a coordinate point in middle line, but only records the coordinate point in the current line and retains all the original annotations.

Stamping moving(palletizing) template program: HIDEFILE-PRESS-MOVE.TXT

Stamping single machine template program: HIDEFILE-PRESS-SOLO.TXT

Stamping feeding template program: HIDEFILE-PRESS-UP.TXT

Stamping blanking template program: HIDEFILE-PRESS-DOWN.TXT

Stamping one with two template program: HIDEFILE-PRESS-DOUBLE.TXT

These five template program can be modified according to actual needs. Only when press "F" to enter the controller factory password to show it, then can it be modified.

Chapter 4 Programming

Industrial robot is the automatic device which performs according to technique program in advance. Program is used to define the routine and auxiliary performance by robot instruction on requests of processing technique. Perfect robot program will not only perform the motion function according to drawing, but also reach the reasonable application and play the full role of robot system. So it is vitally important to program well. The section introduces instructions and usage of the system, play pay for your full attention.

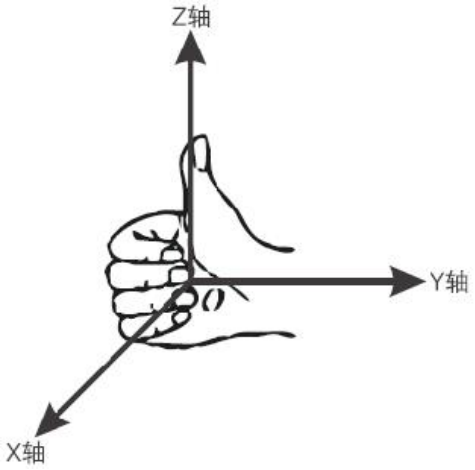
Note: This robot controller could use the instruction of CNC milling controller, please check the instruction of CNC milling with milling controller manual.

4.1 Basic conception

Segment: Made by the instruction and date.(Program line)

Program: Run all program lines according to the logic.

User-coordinate system: The establishment of user coordinate system is based on the right-handed spiral rule. The Descartes rectangular coordinate system is used as the programming standard coordinate system (the following figure), and the positive direction of Z is in the thumb direction of X to Y rotation. When the workpiece coordinates are established, the positive direction of Z is usually far away from the workpiece, so it is necessary to consider the edge of the X and Y direction in the establishment of the workpiece coordinates.



Two methods to set user coordinate system:

1 、Press “F8” in teach status；

2 、Use G54/G54.1-G54.48/G55/G56/G57/G58/G59 instruction；

Must use these methods if use absolute value.

Programme with absolute coordinate： **Absolute coordinate** is relative to the original point of processing. Use G90 instruction, X、Y、Z、A、B、C、Xs、Ys.

For example：G00 G90 X200 Y200 Z300

Relative coordinate: Also named incremental coordinate, means the direction and direction from the end point to starting point.Relative coordinate means the motion position relative with the in front position, not relative to the fixed position. Use G91, X、Y、Z、A、B、C、Xs、Ys.

For example：G00 G91 X200 Y200 Z300

The minimum unit：0.001mm.

Mode instruction： Means keep the status, not only work in this program, but also the behind program until the other mode instruction replace it.

Maybe there are multi mode instructions, such as M03, M04, M05 are mode, it is a mode group. Only be one of them in any time, because of the only status, the mode instruction invoked initially is called initial mode. such as M05.

Stop mode: Such as M30, it means end, back to the starting status, transfer all of mode instruction into initial mode.

Non-mode: Without keep function, only working in this program.

4.2 Programme instruction

4.2.1 Programme

（1）Multi instructions: Could be multi instructions in one program line, but the same group instruction can’t be in the same program line.

（2）You can edit the sequence as you want

Example: M03 G01 X20 Y-30 Also could be: G01 Y-30 X20 M03

（3）The same instruction cannot appear twice in one program line.

（4）Can’t be irrelevant data or parameter in the same program line.

（5）0 in front of the instruction could be omitted, example: G01 M03, also could be G1 M3.

（6） Start from any point and any line, after changing tool, must use absolute programme.

（7）Non-mode instruction only works in the specified program line, example: G04.

（8）Mode instruction is always working before the same group appear.

4.2.2 Instruction of robot controller

(1) Analog output AA/S,VV/SS

AA means welding current; S could be this meaning.

VV means welding voltage; SS could be this meaning.

AA and VV could be edited in the same line, but S and SS can’t be the same line.

AA/S output the first analog 0～10V，VV/SS output the second analog 0～10V.

(2) Start arc welding AS*

Start arc welding: AS*. if welding technique parameter No.1-9=+6, controller will execute the corresponding user-defined program ProgramUser0(User could edit this file as needed).

"*" means invoke the group number 0-9 of technique parameter, correspond to No.1-0.

If execute this instruction, program will invoke the preset arc welding parameter.

Example:

AS1 ; Use group 1 technique parameter of arc welding technique to start

…… ; The route of arc welding

AE1 ; The end

Pay attention: This instruction need to be one line, can't be with other instruction in one line.

(3) End instruction of arc welding AE*

Execute the corresponding program ProgramUser1(User could edit this file as needed).

(4) Start swing welding WS*, T.I.G Welding:WS99

Starting instruction of swing welding: WS*

"*" means the group number 0-9 of technique parameter, correspond to No.2-0.

If execute this instruction, program will invoke the preset swing welding parameter.

Example:

WS2 ; Use group 1 technique parameter of swing welding technique to start

…… ; The route of swing welding

WE ; The end

T.I.G Welding:WS99

Format: P specifies the time of point weld(time:s); Q specifies the distance(unit:mm); R specify the distance with idle run.(unit:mm)

(5) End instruction of swing and T.I.G welding WE

WS*, WE swing according to the parameter when executing MOVL and MOVC, be used for wide weld bead.

(6) Motion instruction of robot (MJ/ML/MC/MCA)

a, Joint: MJ or MOVJ or G0.

b, Straight line: ML or MOVL or G1.

c, Arc:MC/ MCA P6 or MOVC/MOVCA P6 or G6.

If P6 is inserted in program, the posture of arc processing will be defined by posture at the start teach point, the postures at middle teach point and end teach point will be ignored. And if arc is big, J6 will be limited, please attention to it.

For example: MOVC/MOVCA P6.

If P6 is not inserted in program, posture of arc processing will transform from the start teaching point to the end teach point successfully, the posture at middle point will be ignored.

Joint motion: MJ or MOVJ or G0 or ML or MOVL or or G1. Could be specified by joint coordinate value of each axis, incremental programme with G91, absolute programme with G90. Format: MOVEJ J1=*** J2=*** J3=*** J4=*** J5=*** J6=***. J0=0 means J1=0 J2=0 J3=0 J4=0 J5=0 J6=0. MJ or MOVJ can't be omitted in joint movement for 6 axis robot .

Data of position is hidden when setting as robot mode(Other parameter P13 to be 0), but if set as other mode, then it will shows(Other parameter P13 to be 1).

Pay attention：

1）30000 lines at the most if use MOVJ/L/C instruction in teach.

2） When a point set as to be the middle point of circle arc, its posture will be ignored.

3） The first point of program must use MOVEJ to specify, if starting point dislocated at joint coordinate, it will cause the configuration of controller is different in each time.

(7) Speed V/F

Use V= to specify the feeding speed. Unit is mm/s, example V=120. Also could use F to specify, the unit is mm/min.

Use V= in G0 or MJ or MOVJ, it will prompt error.

If this is mode code, works all the time.

(8) Rapid Override of Speed VJ

Use VJ= to specify the rapidly feeding ratio. Example VJ=90, but the ratio can't be over 100%.

If not specify by VJ=, then it will work according to the ratio on controller.

Use VJ= in G0 or MJ or MOVJ, it will prompt error.

This is non-mode code, only work in the current segment.

(9) Variable PL

Use PL= to specify the continuous variable between the segments, the smaller the more accuracy, PL=0 means the speed is 0 to transition.

This instruction could be used in any segments.

This is non-mode code, only work in the current segment.

(10) Start translation SN*

"*" means the group number 0-99 of technique, corresponding No.501-No.506 parameter.

(11) End translation SF

SN*,SF specify the robot to transit, flitting, palletizing.

(12) Start searching position ST* P*

The "*" behind ST means the group number of parameter in this research[0--9];

The "*" behind P means the data number of transition in this research[0--99];

It will clear the transition which is behind P when executing this code.

(13) End searching SE

(14) Search in straight running

Instruction:

SX search in the direction of X axis, laser searching in the direction of X and Z

SY search in the direction of Y axis;

SZ search in the direction of Z axis;

The number behind SX/SY/SZ means the repeat times, controller will calculate the average, the most times is 9, only once if no number. For example, SX5; SY6; SZ4; SY; SX.

Example1:

G54 T1 ; Specify the user coordinate system and tool number

MOVJ ;Locate to the starting point of search

ST2 P3 ;Start searching, invoke parameter group 2, it will be saved into data number 3 of transition data

MOVL ; Locate to the starting point of search

MOVL SX ; Search in the direction of X axis, the MOVL point of this line is resultant point of calibrated workpiece, system will orient according to this point and starting point.

MOVL ; Locate to another starting point of search

MOVL SY3 ; Search in the direction of Y axis(Repeat 3 times), the MOVL point of this line is resultant point of calibrated workpiece, system will orient according to this point and starting point.

SE ; End searching

MOVJ ; Locate to the middle point

SN3 ; Specify the number 3 of position offset data

AS4 ; Start arc welding

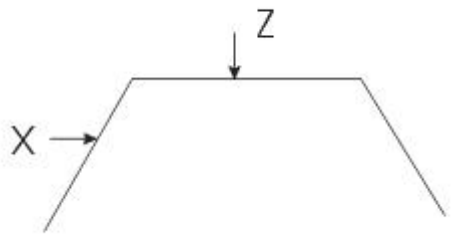
MOVL ; Execute straight line weld, according to teach point of calibrated workpiece.

MOVL ; Execute straight line weld, according to teach point of calibrated workpiece.

AE4 ; End arc welding

SF ; Close position offset

Example2: Special search method, slash searching in the X direction:



G54 T1; Specify user coordinate system and tool number
MOVJ; Locate at the original point;
ST1 P1; Invoke searching parameter group No.1, and save the result in translation group No.1;
MOVL; Locate at the start point of searching;
MOVL SZ; Search in the Z direction, MOVL point is searching result point of calibrated workpiece;
SE; Search ends;
SN1; Specify position translation group No.1;
MOVL; Locate at another start point of searching;
SF; Close the position offset;
ST1 P2; Invoke searching parameter group No.1, and save the result in translation group No.2;
MOVL SX; Search in the X direction, MOVL point is searching result point of calibrated workpiece;
SE; Search ends;
PX2=PX2+PX1; Assign the result that translation value No.1 plus value No.2 to the translation value No.2, combine offset values of both.
MOVL; Locate at the middle point.
SN2; Specify position offset group No.2;
AS4; Start arc welding;
MOVL; Execute straight bead welding according to teach points of calibrated workpiece;
MOVL; Execute straight bead welding according to teach points of calibrated workpiece;
AE4; Arc welding ends;
SF; Close the position offset.

(15) Starting arc tracking TS*

The "*" behind TS means the group number of parameter in this research[0--9].

(16) End arc tracking TE

Example:

G54 T1; specify user coordinate system and tool number.
MOVJ; locate at the starting point.
TS2 ; invoke user parameter group 2 to start arc tracking.
MOVL; execute straight bead welding.
MOVL; execute straight bead welding.
TE; end arc tracking.

(17) Open laser function: LS*

"*" behind LS refers to parameter group number[0-4] in the searching.

(18) Close laser function: LE

Execute laser searching instructions:

SX search in the direction of X axis;

SY search in the direction of Y axis;

SZ search in the direction of Z axis;

SX3 search in the direction of X axis, if failed, then return and search again, 3 times at most.

SY5 search in the direction of Y axis, if failed, then return and search again, 5 times at most.

Start laser tracking: TS* is similar to arc tracking, but the invoking parameter group is laser tracking parameter group instead of arc tracking parameter group.

End laser tracking: TE is the same to end arc tracking instruction.

Attention:

1.laser searching only can work in the direction of left/right and up/down, so the X definition of user coordinate should accord to left/right direction of laser searching, and Z definition accords to up/down direction of laser searching.

2.when laser tracking technique parameter 5-24 track the step of reproduction[>5](um) is valid, system will not execute AS and AE instruction firstly, it will execute the program between TS and TE, and record the tracking data in file TrackDataFile.txt. Then back to command TS, invoking tracking data from the file, then execute welding function. The speed of search tracking is programmed speed*P5-25.

Sample:

Use CRNT laser tracker as example. TCP communication, P500=8, P502=192.168.2.2, P504=192.168.2.2, P5-1=6, P5-9=502;

Procedure as following:

1. robot move to start point and turn on laser, then enable laser tracker(open the data communication between controller and laser tracker), set reading sensor offset value per

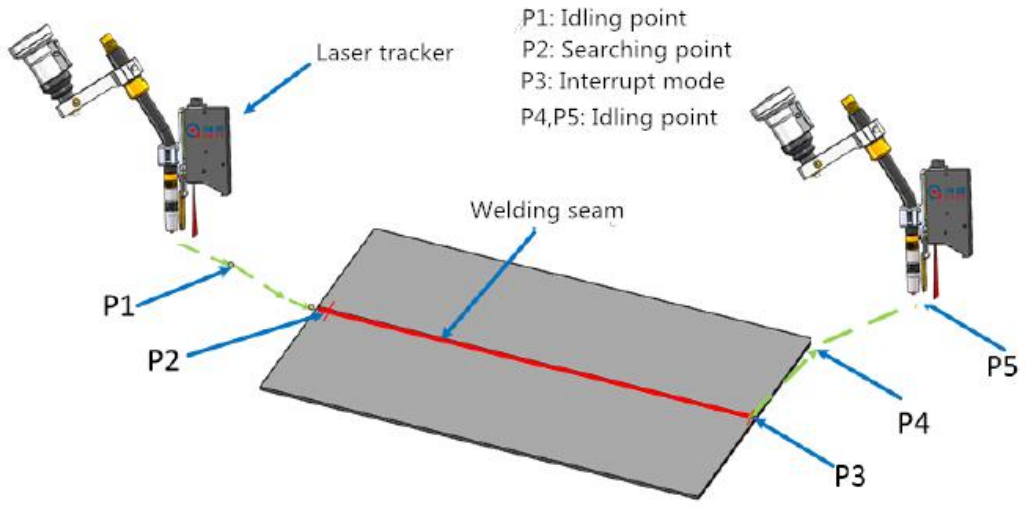
50ms, robot start to compensate in-place;

2. read alignment signal while read offset value. When read alignment signal successfully, robot go forward and enter into real-time tracking mode, compensating in process.

3. when laser rays arrive ate P3 point, controller enter into interrupt mode, stop accessing data from sensor.

4. when arriving at P4 point, close enable signal and turn off laser.

A full tracking cycle ends.



<1> open Laser function: LS*/LS*C

1. Turn on laser tracker 34 3F 00 00 00 09 03 10 00 04 00 01 02 00 FF (15 bytes)
   Return 34 3F 00 00 00 06 03 10 00 04 00 01 (12 bytes)
2. Enable 34 3F 00 00 00 09 03 10 00 05 00 01 02 00 FF (15 bytes)
   Return 34 3F 00 00 00 06 03 10 00 05 00 01 (12 bytes)
3. welding line mode: 34 3F 00 00 00 09 03 10 00 05 00 01 02 00 FF(15 bytes)
   Return 34 3F 00 00 00 06 03 10 00 05 00 01 (12 bytes)

CRNT laser tracker has 17 types of mode:

1. Joint Seam; 2. Right Lap Welding; 3. Left Lap Welding; 4. Fillet Welding; 5. inner fillet welding; 6. Oblique fillet welding; 7. Wide Seam Inner; 8. Wide Seam Outside; 9. Large Wide Seam; 10. Sheet Center; 11. Cross Line; 12/13/14/15/16/17: corresponding to High Reflective mode of 1/2/3/5/6/4 types.

4. if LS*C full calibration, send internet initialization sign to laser tracker(res=0);
   Send: **Robot,res,Frame,No,R,X,Y,Z,Rx,Ry,Rz**;
   Robot is default as 1.
   res: communication sign bit, range 0-10;
   0: internet initialize sign, when controller connect upper computer, set as 0.
   1/7: robot calibrate 1st/7th point;

8: calibration finished, get result;

9-10: reserved.

Frame: coordinate system type, range 0-3;

0: Bas, basic coordinate;

1: Robot, robot coordinate system;

2: Tool, tool coordinate system;

3: User, user coordinate.

No: tool coordinate system No., range 1-10, current tool coordinate system number.

R: coordinate system rotary direction, range 1-12, till now, x-y-z and z-y-x rotary direction is R=1 or R=5.

X,Y,Z,Rx,Ry,Rz: coordinate data x,y,z,rx,ry,rz, unit:mm.

Back: Robot,res,rel_r[1],rel_r[2],rel_r[3],rel_r[4],rel_r[5],
rel_r[6],rel_r[7],rel_r[8],rel_r[9],rel_t[1],rel_t[2],rel_t[3];

Sample:

(1) Initialization:

Send 1,0,3,1,5,944.000,380.004,1500.888,-160.005,-0.000,-0.000

Back 1,0,3,1,5,0,0,0,0,0,0

(2) Calibrate 1st point:

Send 1,1,3,1,5,944.000,380.004,1500.888,-160.005,-0.000,-0.000

Back 1,1,3,1,5,0,0,0,0,0,0

……

(3) Calibration result:

Send 1,8,3,1,5,944.000,380.004,1500.888,-160.005,-0.000,-0.000

Back 1,8,0.9888,0.1148,-0.0948,-0.9728,0.9801,0.1726,0.1279,
0.1615,0.9804,-6.998,-27.390,24.154;

<2> Auto calibration program

G54 T1 ;invoke user coordinate and tool number.

MOVJ ;auxiliary movement, can be omitted.

LS1C ;invoke the group No.1 laser parameter to activate laser tracker, and enable auto calibrate mode, initialize sign.

MOVL ;auxiliary movement, can be omitted.

MOVL L1 ;L1 means after executing MOVL/MOVJ, calibrate 1st point, upload position and posture to laser tracker.

MOVL ;auxiliary movement, can be omitted.

MOVJ L2 ; calibrate 2nd point, upload position and posture to laser tracker

MOVJ ;auxiliary movement, can be omitted.

MOVJ L3 ; calibrate 3rd point, upload position and posture to laser tracker

MOVJ L4 ; calibrate 4th point, upload position and posture to laser tracker

MOVL L5 ; calibrate 5th point, upload position and posture to laser tracker

MOVL L6 ; calibrate 6th point, upload position and posture to laser tracker

MOVJ L7 ; calibrate 7th point, upload position and posture to laser tracker

LE ; receive calibration result from tracker and save, then close laser.

Calibration result is saved in the user program root dictionary, available for checking and copy. File name is LASER-CALIBRATE-01.TXT, the number 01 means Tool No.1, and it is 12, means Tool No.12. File format is as following:

1,0,3,1,5,1000.818,1321.032,789.065,37.981,87.676,55.101;

1,0,3,1,5,0,0,0,0,0,0;

1,1,3,1,5,100.88,131.032,78.065,37.91,8.676,5.101;

1,1,3,1,5,0,0,0,0,0,0;

1,2,3,1,5,0.818,1321.02,789.065,37.981,7.676,55.1;

1,2,3,1,5,0,0,0,0,0,0;

1,3,3,1,5,1000.818,1321.032,789.065,37.981,87.676,55.101;

1,3,3,1,5,0,0,0,0,0,0;

1,4,3,1,5,8000.818,321.032,789.065,37.981,87.676,55.101;

1,4,3,1,5,0,0,0,0,0,0;

1,5,3,1,5,10.818,1321.032,789.05,37.981,87.676,55.101;

1,5,3,1,5,0,0,0,0,0,0;

1,6,3,1,5,88.818,1321.02,789.065,37.981,8.676,55.101;

1,6,3,1,5,0,0,0,0,0,0;

1,7,3,1,5,0.818,11.032,78.065,37.98,87.66,5.91;

1,7,3,1,5,0,0,0,0,0,0;

1,8,3,1,5,10.818,131.02,78.05,3.981,8.676,0.101;

1,8,0.9888,0.1148,-0.0948,-0.9728,0.9801,0.1726,0.1279,0.1615,0.9804,-6.998,

-27.390,24.154;

<4> Execute laser searching: SX

SX searching in the direction of X and Z axis[direction of Tool TCP point in user coordinate.]

Continuously send request for reading seam alignment signal to laser tracker, data is as follows:

Send: 46 63 00 00 00 06 03 03 00 08 00 01 (read alignment,12 bytes)

Return: 46 63 00 00 00 05 03 03 02 00 FF (11 bytes)

If feed back 00 FF, that means seam is alignment, otherwise it is not alignment;

When feed back the data of alignment seam, save offset value into translation parameter No.90, for following calling.

<4> Open laser tracking: TS*

Require to read current left/right and up/down offset value, data is as follows:

Send 46 63 00 00 00 06 03 03 00 00 00 02 (read offset,12 bytes)

Return 46 63 00 00 00 07 03 03 04 00 2C 00 C8 (13 bytes)

Controller will compare the searching result saved in translation parameter No.90 with real-time left/right and up/down offset value to do real-time movements.

<5>Close laser tracking: TE

Send 34 3F 00 00 00 09 03 10 00 05 00 01 02 00 00 (close enable,15 bytes)

Return 34 3F 00 00 00 06 03 10 00 05 00 01 (12 bytes)

<6> Close laser function: LE

Send 34 3F 00 00 00 09 03 10 00 04 00 01 02 00 00(close laser, 15 bytes)

Return 34 3F 00 00 00 06 03 10 00 04 00 01 (12 bytes)

Sample Program:

G54 T1; specify user coordinate system and tool number

MOVJ; locate at original point

LS2; open laser function, invoke the second group of laser function parameter.

MOVL; move to start point of searching.

MOVL SX3; search in the direction of X and Z direction, MOVL is start point of welding, also laser alignment point. system will orientate direction according to this point and searching start point, and calculate translation value according to this point and searching result point.

TS2; invoke the second group of laser parameter to start laser tracking.

AS4; Start arc welding:

MOVL; execute linear welding;

MOVL; execute linear welding;

AE4; end arc welding;

TE; close laser tracking;

LE; close laser function.

Attention:

1. When technique parameter P5-24>5, it means do scanning firstly, then welding, in case of solder wire touch work piece, when wire move to start point of seam, welding gun should lift certain distance like 10mm, then press "calibrate", welding gun will drop this distance during welding(technique parameter P5-28=10000).

2. Calibrate point is record point by searching command, start point of seam also, and the point is taught as: MOVL SX; after record this line, position cursor to last line and move tool coordinate system X only to search start point, record search start point line: MOVL.

(19) Start multi-layer surfacing: MP*

(a) Command MP1: offset surfacing in the left and right direction:

I specifies left and right offset value each time(plus and minus)[unit:mm], **L** specifies offset times, **Q** specifies offset acceleration(default is 16).

(b) Command MP1: offset surfacing in the up and down direction:

I specifies up and down offset value each time(plus and minus)[unit:mm], **L** specifies offset times, **Q** specifies offset acceleration(default is 16).

(c) Command MP3: firstly offset surfacing left and right, then up and down in every layer.

I specifies left and right offset value each time(plus and minus)[unit:mm];

K specifies up and down offset value each time(plus and minus)[unit:mm];

Q specifies offset acceleration(default is 16);

L specifies offset times left and right;

J specifies offset times up and down.

(d) Command MP4: firstly offset surfacing up and down, then left and right in every layer.

I specifies left and right offset value each time(plus and minus)[unit:mm];

K specifies up and down offset value each time(plus and minus)[unit:mm];

Q specifies offset acceleration(default is 16);

L specifies offset times up and down;

J specifies offset times left and right.

(e) Command MP5: three-time surfacing to V-shaped groove;

I specifies left and right offset value each time(plus and minus)[unit:mm];

K specifies up and down offset value each time(plus and minus)[unit:mm];

Q specifies offset acceleration(default is 16).

(20) End multi-layer surfacing: ME

Sample1: multi-layer surfacing

```
G54 T1;          specify user coordinate and tool number;
MOVJ;            positioning at the start point ;
MP1 I2.35 L4 Q20;    offset surfacing left and right, offset 2.35mm each time,
                 execute 4 times, offset acceleration is 20;
MOVL;            move to start point;
AS4;             start arc welding;
MOVL;            execute linear welding;
MOVL;            execute linear welding;
AE4;             end arc welding;
ME;              end multi-layer surfacing.
```

Sample 2: Mixture of laser tracking and multi-layer surfacing

```
G54 T1;          specify user coordinate and tool number;
MOVJ;            positioning at the start point;
LS2;             open laser tracing function, and invoke parameters of the laser
    tracking technique group No.2;
MOVL;            move to start point of searching;
```

MOVL SX5; Searching in the direction of X axis and Z axis, MOVL point will be start welding point of calibration work piece;
TS2; invoke parameters of the laser tracking technique group No.2, and start tracking;
MP1 I2.35 L4 Q20; offset surfacing left and right, offset 2.35mm each time, execute 4 times, offset acceleration is 20
MOVL; move to start point;
AS4; start arc welding;
MOVL; execute linear welding;
MOVL; execute linear welding;
AE4; end arc welding;
ME; end multi-layer surfacing;
TE; end laser tracking;
LE; close laser function.

(21) Open Visual function: VS*

"*" behind VS refers to parameter group number[0-3] in the Visual parameter. Visual system calibration is required before usage of visual function, to correspond coordinate value from visual system with coordinate of robot TCP point in current user coordinate system. Conveyor belt is defined as positive direction of X axis.

(22) Close Visual function: VE

(23) Visual function controlling instruction: VT*

"*" behind VT refers to instruction code to visual system;

When execute VT, output point by P6-10 used to control camera to shoot will be valid, and record current time as shooting time. Then invalidate that output point after execution of VD.

(24) Visual function controlling instruction: VD* P-

"*" behind VD refers to position point number of received data from visual system in controller; P means in certain time(defined by P6-4), if no coordinate data return from visual system, then skip to P line.

Close the output point specified by P6-10 meanwhile executing VD.

Visual system calibration is required before usage of visual function, to correspond coordinate value from visual system with coordinate of robot TCP point in current user coordinate system.

Sample of static grabbing:

G54T1
MOVJ; position at original point
VS1; invoke visual parameter group No.1 and open visual function

N10

G311 XS1000 G91 F100 P1015; XS is conveyor belt, the switch X15 of detecting workpiece arrival.

VT4; send control instruction 4 to visual system, it means apply for access to XYZC position data

VD12; save XYZC position data into position point No.12

G01 XS100 G91 F800 ; workpiece move out of photo area, offset value is 100, input into visual technique parameter 6-5

MOVL PT12 V=120; move linearly to position point N0.12 specified by PT

W-12; move down by 12mm

M880; execute user-defined M code to grab workpiece

W12; move up by 12mm

MOVL; move to teaching point

M881; execute user-defined M code to unclamp workpiece

MOVL; move to teaching point

GOTO 10; jump to N10 line and repeat

VE; close visual function

M02; End

(25) Tracking instruction: TK* P*

The number* behind TK is tracking group number[0-3]; before using visual function, we need to calibrate visual system to make sure the coordinate from visual system match with tool TCP point coordinate in current user coordinate.

P* means when controller execute TK* to grab work piece, but it is out of work range, robot will locate at target YZC position and skip to P line automatically.

(26) Spray/Thread controlling MT/G32

MT/G32 U_ V_ W_ A_ B_ C_ K_; Tracking spray, K is convey belt moving distance(thread pitch) per revolution of encoder, UVWABC is spraying distance(mm) in the direction of XYZABC.

MT Spraying instruction, not detect encoder zero position；

G32 Thread processing, detect encoder zero position, if input L2046, the same as MT instruction, not detect encoder zero；

For example:

MOVJ; Position at starting point

MOVL; move above the fixed point, waiting for spraying

TK0; Execute tracking function

MT K_ U_ ; Tracking spray, K is convey belt moving distance(thread pitch) per

revolution of encoder,U is spraying distance(mm) in the direction of X axis.

M881; Execute user-defined M code to close spraying function(default Y22=0)

MOVL; Move to teaching position

M20; Repeat above program

(27) Read current user coordinate PK***

Example: PK5 means set the current user coordinate position of robot as the data of fifth point in controller.

(28) Translation calculation PX***=PT***-PT***

Example: PX3=PT5-PT6 means the number 5 position of robot minus the number 6 position, the result as the number 3 transition data.

(29) Translation plus and minus PX***=PX***+PX*** and PX***=PX***-PX***

Example： PX3=PX3+PX8 means the No. 3 translation value of robot plus the No. 8 translation value, the result as the number 3 transition data.

PX3=PX5-PX7 means the No. 5 translation value of robot minus the No. 7 translation value, the result as the No. 3 transition data.

Multiplication and division of translation, for example:

PX3=PX3*8 means No.3 translation data multiply 8, then assign to No.3;
PX3=PX5/7 means divide No.3 translation data by 7, then assign to No.3;
PX3R means reset XYZABCXsYs value of No.3 translation;
PX12R means reset XYZABCXsYs value of No.12 translation;
PT12X=I3 X value of 12th position increase 3 based on original value;
PT13Y=I-6 Y value of 13th position decrease 6 based on original value;
PT14Z=I-4 Z value of 14th position decrease 4 based on original value;
PT12X=8 X value of 12th position is assigned as 8;
PT13Y=-9 X value of 13th position is assigned as -9;
PX12X=I5 X value of 12th position increase 5 based on original value;
PX13Y=I-9 Y value of 13th position decrease 9 based on original value;
PX19Z=I8 Y value of 19th position decrease 8 based on original value;
PX12X=8 X value of 12th position is assigned as 8;
PX13Y=-12 Y value of 13th position is assigned as -12;
PX12XS=I5 Xs value of 12th position increase 5 based on original value;
PX13YS=I-9 Ys value of 13th position decrease 9 based on original value;
PX12XS=8 Xs value of 12th position is assigned as 8;
PX13YS=-12 Ys value of 13th position is assigned as -12;
PX3=PX2 Assign XYZABCXsYs value of 3rd position as 2nd position;
PX12=PX5 Assign XYZABCXsYs value of 12th position as 5th position;

Sample:

Ys

25	26	27	28	29	30
19	20	21	22	23	24
13	14	15	16	17	18
7	8	9	10	11	12
1	2	3	4	5	6

↑ Ys

→ Xs

```
#500=0; #500 is used to count cell quantity
WHILE[#500LT60]DO1;cell welding program repeat 60times
#501=#500-7
#502=#500-13
#503=#500-19
#504=#500-25
#505=#500-31
#506=#500-37
#507=#500-43
#508=#500-49
#509=#500-55
IF[#501 EQ0]GOTO10;in cell No.7, Xs offset 0, Ys offset 500
IF(#502 EQ0)GOTO10;in cell No.13, Xs offset 0, Ys offset 500
IF(#503 EQ0)GOTO10;in cell No.19, Xs offset 0, Ys offset 500
IF(#504 EQ0)GOTO10;in cell No.25, Xs offset 0, Ys offset 500
IF(#505 EQ0)GOTO10;in cell No.31, Xs offset 0, Ys offset 500
IF(#506 EQ0)GOTO10;in cell No.37, Xs offset 0, Ys offset 500
IF(#507 EQ0)GOTO10;in cell No.43, Xs offset 0, Ys offset 500
IF(#508 EQ0)GOTO10;in cell No.49, Xs offset 0, Ys offset 500
IF(#509 EQ0)GOTO10;in cell No.55, Xs offset 0, Ys offset 500
GOTO20
N10
PX0XS=0;
PX0YS=I500;
N20
SN0; call translation technique No.1
G54 T1;single cell welding program
  MOVJ VJ=20.0;
  MOVL V=100.0;
  MOVL V=100.0;
  SF;
PX0XS=I500; Xs offset 500 after each cell finished.go to next cell
#500=#500+1; counting plus 1.
END1
```

(30) Programme for specified position(MJ/ML/MC PT***)

MOVJ or MJ PT*** means rapidly locate to the position specified by PT address

according to the joint coordinate mode.

MOVL or ML PT*** means move to the position specified by PT address according to the straight line mode.

MOVC or MC PC*** PT*** means move to the position specified by PT address according to the circle arc mode, PC address specify the centre of circle arc.

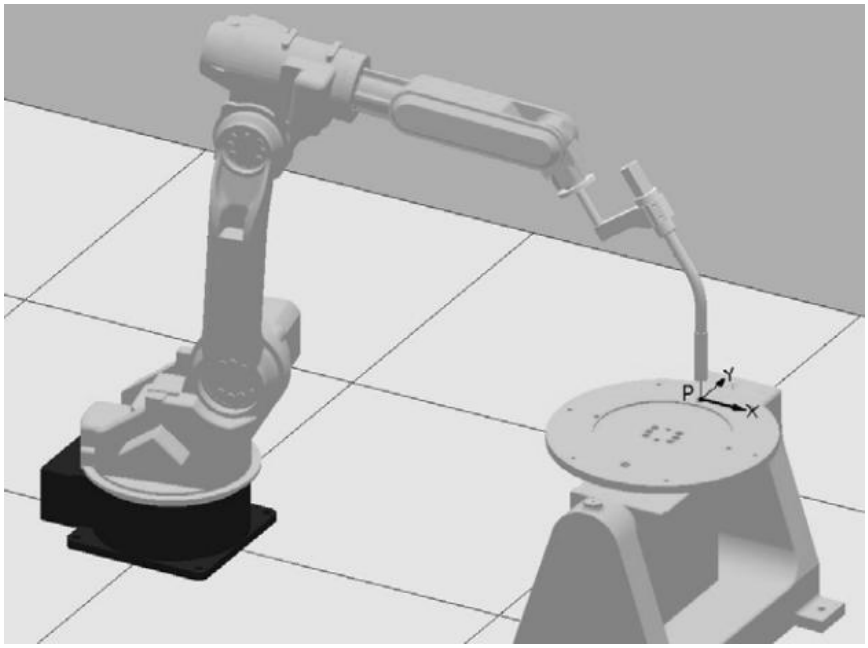
Pay attention:The tool number and user coordinate system is the same as the tool number and user coordinate system in program when reading the position data of robot.

(31) Function of positioner

User instruction：M601 open a positioner axis function of XS.

User instruction：M602 open two positioner axis function of XS and YS.

User instruction：M600 Closed the function of positioner.



Parameter：

488, Close and Open of positioner coordinate system
[0-M600,1-M601,2-M602]

489，Set coordinate system of positioner

490，The world coordinate of XS when setting P3P4P5 coordinate of positioner (um)

491，The position of positioner in X(um)

492，The position of positioner in Y(um)

493，The position of positioner in Z(um)

494，The posture of positioner in A(degree)

495，The posture of positioner in B(degree)

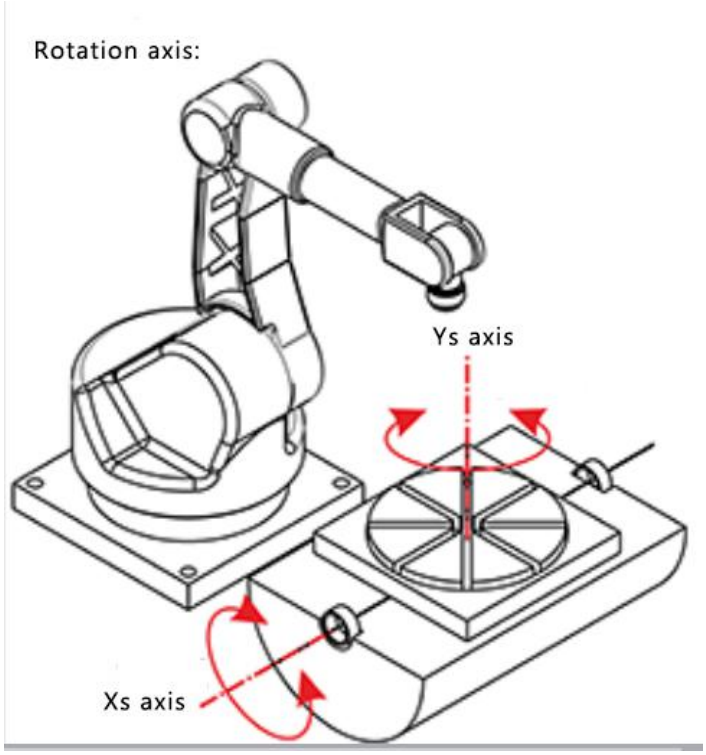
496，The posture of positioner in C(degree)

497，Calculate reversal with coordinate of positioner(XS+6;YS+8)

<1> Collaboration function of positioner:

Positioner coordinate system is convenient for user to run teach mode when the position is placed anywhere. Since the positioner coordinate system is set, robot will move around the specified positioner coordinate system.

Positioner coordinate refers to a specified coordinate system based on positioner. Positioner coordinate system will rotate according to positioner, TCP tool is specified a position and a gesture. The Collaboration function of positioner makes robot move according to rotation of positioner and coordinate system, to keep the position and the gesture of TCP tool in coordinate system. In teach mode, the collaboration function makes teaching more convenient and ensure the best angle of welding gun during the welding. The instruction of collaboration function should be edited in program.



By parameter“489,Set coordinate system of positioner”Set 3-points(single axis positioner) and 5-points(double axis positioner), it will regenerate the No.490-No.496 parameter.

To find a reference point, and move the robot to make the TCP point of tool point at the reference point, the press the number button 1 to set the point as the P1; then rotate axis XS by a angle, move the robot, let the TCP point of tool point at the reference point, then press the number button 2 to set the point as P2; then rotate axis XS by a angle again, move the robot, let the TCP point of tool point at the reference point, then press the button 2 to set the point as P3. For single axis positioner, only the three points can finish positioner coordinate system.

For double axis positioner, after the setting of P3, keeping Axis XS, rotate Axis YS by a angle, then let the TCP point of tool point at reference point and press button 4 to set it as P4; then rotate Axis YS by another angle(keeping Axis XS), and move robot to point the TCP point at reference point, and press the number button 5 to set it as P5. Finally, the positioner coordinate system is set.

Could press “Start”button or “Back”on the right side of screen when setting, the status will show “O”, then press “12345”, it will back to the position which is set the last time with the current manual speed, press “Start” to open and close, it will be closed automatically after once.

Once finish setting, use M601 or M602 to open the function of positioner, rotate XS axis to see the direction of robot is the same or not, if not the same, then the parameter of calculate reversal +6(D1, D2=1). Use M602 to open the function, rotate YS to see the direction of robot is the same or not, if not the same, then the parameter of calculate reversal+8(D3=1).

<2> Linear Axis collaborative function: Other Parameter 497, reversal calculate the coordinate of positioner(Xs+6; Ys+8;+32: Xs or XsYs is line axis), +32 mean linear axis

collaborative function. When only one line collaborative axis, it is only necessary to set P1 and P2. target the tcp at the fixed point P1, then move Xs axis for a distance, move tcp to target at the same point P2. Now open the collaborative function, and move Xs to check if the tcp will follow, if direction is reversal, then revise P497. when there are 2 linear collaborative axis, it is necessary to set P1,P2,P3, the method is the same as that of single collaborative axis.

Pay attention:

1. If there are 2 positioner axis, XS and YS should be vertical intersection, Ys axis is supposed to be installed on Xs axis (YS should be rotation axis, XS should be roll axis).

2.when positioner coordinate system valid, XYZABC of current user coordinate system is invalid.

3.If the teaching program needs to run under M601/M602, then teaching point searching and recording should be finished under M601/M602.

4.positioner coordinate system should be shut down and under M600 before setting positioner coordinate by 3-point or 5-point method.

5. in positioner coordinate dialog, press number 1-5 to set P1-P5 point, and press number 0 to clear the set points.

<3> positioner coordinate system replaces user coordinate

If user coordinate is replaced by positioner coordinate, when positioner rotates, it also means user coordinate rotates. G54.48 is fixed as positioner coordinate system, then it will be unavailable for user coordinate.

(32) Whole operation of depalletizing PW**

Before executing PW**, controller will execute PR** once automatically to reset the current value.

Note:

1） The macro variable of depalletizing #9001--#9099 correspond to total count of each depalletizing group, all finished if it is negative number.

2) The macro variable of depalletizing #9101--#9199 correspond to the current layer number of each depalletizing group.

3) The macro variable of depalletizing #9201--#9299 correspond to the current row number of each depalletizing group.

4) The macro variable of depalletizing #9301--#9399 correspond to the current column number of each depalletizing group.

5) The macro variable of depalletizing #9401--#9499 correspond to the current stack number of each depalletizing group.

(33) Reset the current value of depalletizing PR**

Pay attention：

1）If the number is 9999, then controller finished the Reset;

2）The current value of depalletizing includes the current line, column, layer, stack, total stack;

(34) Whole operation of once depalleziting PA**

After finishing PA**, need to execute PR** to reset, then execute PA**.

(35) Choose user coordinate system（G54.1-G54.48/G54-G59）

G53/US0 World coordinate system

G54/US1 user coordinate system 1

G54.1/G54.48 user coordinate system54.1/54.48

G55/US2 user coordinate system2

G56/US3 user coordinate system3

G57/US4 user coordinate system4

G58/US5 user coordinate system5

G59/US6 user coordinate system6

Other parameter P900, +256 means display G54-G59 by USxx, otherwise display G54-G59 by Gxx.

(36) Choose tool coordinate system(T01-T99)

T01 Number 1 tool coordinate system

T01 Number 2 tool coordinate system

……

T01 Number 99 tool coordinate system

(37) Programme mode(G90/G91) and positioning mode(G64/G60)

Two kinds of movement: Absolute and incremental. User G90 and G91 to specify,in absolute, it's coordinate of end point. In incremental, it's movement distance.

Pay attention: Absolute programme of rotation axis is calculated with proximity, incremental programme is calculate according to program.

G60: accurate positioning instruction (mode instruction)

G64: smooth instruction (mode, initial state)

(38) Rapidly locate(G00)

Format：G00 X-Y-Z-A-B-C-Xs-Ys-

Note：X，Y，Z，A，B，C，Xs，Ys, could use absolute or incremental to programme. Point out value of movement and direction.

Each axis goes rapidly to the end point in G00 separately. Also could use linkage mode: through P10 parameter D6=0 to set.

The speed of G00 is set by speed parameter.

(39) Interpolation of straight line(G01)

Format: G01 X-Y-Z-A-B-C-Xs-Ys- F-

Note: X，Y，Z，A，B，C，Xs，Ys, could use incremental or absolute to programme.The speed is specified by F.

Feeding speed of G01 F could be modified by feeding ratio on panel, the range is 0％～150％.

G01 could be edited as G1.

(40) Circle arc in 3D space G06

Format: G06 L88 I_ J_ K_ X_ Y_ Z_ (means whole circle instruction)

I_ J_ K_ means incremental coordinate of the first middle point based on start point(unit: mm)

X_ Y_ Z_ means coordinate of the second middle point(G90 is absolute, G91 is incremental)(unit: mm)

Format: G06 X__ Y__ Z__ I__ J__ K__ F__

Function: If don't know the center and radius of circle arc in 3D space. But 3 points is known on arc, then could use G06, could make sure the direction of arc by the starting point, end point and the third point between them.

Note: G06 is mode code；

I: The coordinate from the middle point to the starting point of circle arc(X)(direction)；

J:The coordinate from the middle point to the starting point of circle arc(Y)(direction)；

K: The coordinate from the middle point to the starting point of circle arc(X) (direction).

Pay attention:

1) Middle point：Point Between the starting point and the end point on circle arc;

2) If three points on the same line, it will alarm;

3) I=0, K=0 and J=0 when not specify; If not specify three points, it will alarm.

4) I、J、K like the I, J, K in G02/G03 which is from center to the starting point;

For example:

```
G54
G0 X10 Y28 Z10
G06 X30 Y98 Z10 I5 J-6 K-5 F100
X130 Y198 Z120 I55 J-86 K-65
G0X0Z0
M02
```

(41) Intersecting line instruction MOVCI/MCI

MOVCI or MCI means intersecting line instruction(need to teach P1P2P3 points);

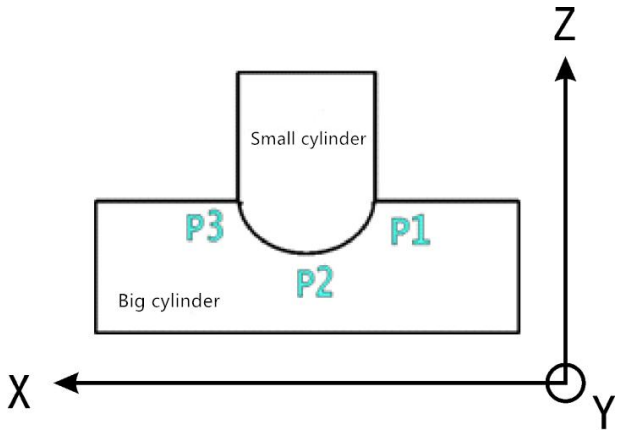
MOVC L93/L94 means intersecting line instruction(need to teach P1P2P3 points);

MC L93/L94 means intersecting line instruction(need to teach P1P2P3 points);

MOVCI L93/L94 means intersecting line instruction(need to teach P1P2P3 points);

MOCI L93/L94 means intersecting line instruction(need to teach P1P2P3 points);

The teach point P1P2P3 are like the following, they can be both positive and negative sequence in the direction of axis.



Attention:

With MOVCI/MCI/G5/G6, only half of intersection can be programmed once, full intersection line needs two lines of program. With G2/G3 L93, full intersection can be programmed once. Till now, intersection line instruction only support one cylinder being perpendicular to another cylinder.

Definition rules of User(workpiece) coordinate system:

For MOVCI/MCI, axis of small cylinder is Z axis direction, axis of big cylinder is X axis direction.

For G6 L93, axis of small cylinder is Z axis direction, axis of big cylinder is X axis direction.

For G17 L93 G2/G3/G5, axis of small cylinder is Z axis direction, axis of big cylinder is X axis direction.

For G18 L93 G2/G3/G5, axis of small cylinder is Y axis direction, axis of big cylinder is Z axis direction.

For G19 L93 G2/G3/G5, axis of small cylinder is X axis direction, axis of big cylinder is Y axis direction.

For the intersection line specified by G2/G3/G5/G6, when change L93 into L94, definition rule will change;

For MOVCI L94/MCI L94, axis of small cylinder is Z axis direction, axis of big cylinder is Y axis direction.

For G6 L94, axis of small cylinder is Z axis direction, axis of big cylinder is Y axis direction.

For G17 L94 G2/G3/G5, axis of small cylinder is Z axis direction, axis of big cylinder is Y axis direction.

For G18 L94 G2/G3/G5, axis of small cylinder is Y axis direction, axis of big cylinder is X axis direction.

For G19 L94 G2/G3/G5, axis of small cylinder is X axis direction, axis of big cylinder is Z axis direction.

(42) Delay(G04)

Applying to delaying for certain time before other motions during process.

Format：G4 Xxx unit:second

TMxx unit: millisecond

Function: Every axis stop and mode instruction keeps working when carry out this instruction, after delaying the specified time then execute the next program segment.

Instruction:

1. The unit of P delay time is ms(Millisecond)
2. The unit of X and U delay time are S.
3. Example:

G04 X2.5； pause for 2.5s.

TM2300; pause by 2300ms

Pay attention: Also could set P7 processing parameter to eliminate the over cutting.

(43) Return to zero(G28/G281-G288/G301-G308)

```
G28     ; all axis return to zero of G53
G281    ;only X return to zero of G53
G282    ;only Y return to zero of G53
G283    ;only Z return to zero of G53
G284    ;only A return to zero of G53
G285    ;only B return to zero of G53
G286    ;only C return to zero of G53
G287    ;only Xs return to zero of G53
G288    ;only Ys return to zero of G53
G301    ;X axis return to zero of user coordinate system
G302    ;Y axis return to zero of user coordinate system
G303    ;Z axis return to zero of user coordinate system
G304    ;A axis return to zero of user coordinate system
G305    ;B axis return to zero of user coordinate system
G306    ;C axis return to zero of user coordinate system
G307    ;Xs axis return to zero of user coordinate system
G308    ;Ys axis return to zero of user coordinate system
```

If equipped with incremental servo type motor and the home type is in mechanical way, then use G281/G282/G283/G284/G285/G286 corresponds to J1/J2/J3/J4/J5/J6 (X0/Y0/Z0 /A0 /B0/C0) back to mechanical zero point..

(44) Program loop instruction (G22--G800)

G22 is program circulation instruction; G800 is an instruction to end circulates. But G22 must be used with G800 for repeated processing. L means circulation times, the range is 1-99999. The circulation instruction can nest.

```
Format：  G22 L2          ; begin
            :
            :             ; circulating
          G800            ; end
```

(45) Go back the start point of program (G26/G261-G268）

```
Format ：  G26    ; ZXY all go back starting point of program.
           G261   ; X go back starting point.
           G262   ; Y go back starting point.
           G263   ; Z go back starting point.
           G264   ; A go back starting point.
           G265   ; B go back starting point.
           G266   ; C go back starting point.
           G267   ; Xs go back starting point.
           G268   ; Ys go back starting point.
```

(46) Memory the current point(G25)

Format：G25； To remember the coordinate of X Y Z A B C Xs Ys

(47) Return to the memorial point(G61/G611-G618)

Used to return to the memorial point by G25.

```
Format：   G61   ； Return to X Y Z of memorial point
           G611  ； Return to X of memorial point
           G612  ； Return to Y of memorial point
           G613  ； Return to Z of memorial point
           G614  ； Return to A of memorial point
           G615  ； Return to B of memorial point
           G616  ; Return to C of memorial point
           G617  ; Return to Xs of memorial point
           G618  ; Return to YS of memorial point
```

Note: G61 goes back with G00 speed to memorial point of G25.

(48) Detect skip(G31、G311)

Format：

```
G31 X_ Y_ Z_ A_ B_ C_ Xs_ Ys_F_ P_      ; if no signal, No alarm
G311 X_ Y_ Z_ A_ B_ C_ Xs_ Ys_F_ P_     ; if signal, alarm
MOVL V=20 G31 P1014; if X14 is on during robot moving, jump to next line;
MOVL V=20 G31 P331014; if X14 is on during robot moving, jump to line marked
```

N33;

MOVL V=20 G31 P2014; if X14 is off during robot moving, jump to next line;

MOVL V=20 G31 P332014; if X14 is off during robot moving, jump to line marked N33;

The difference between G31 and G311 is if detect signal failed, G311 will alarm, G31 will not and continue running.

Data behind P: Number of line+(X00/X39+1000 or 2000)， 1000 means availability and skip,2000 mean if invalidation then skip.

For example：G31 X50 Z100 F100 P331022; if X22 availability then goes to N33.

G311 X50 Z100 F100 P2021; if X21 invalidation then goes to next line. If X21 is always valid, it will alarm all the time.

Pay attention: Number X00-X47 could be checked on the Diagnosis interface.

(49) M Function

Y05：Output of motor with brake, X40 is the input point to detect brake;

M03：Feeding welding wire or spindle rotate CW, output Y18；

M04：Back welding wire or spindle rotate CCW, output Y19；

M05：Stop welding or spindle, output Y12；

M203：The second spindle rotate CW, output Y28；

M204：The second spindle rotate CCW, output Y29；

M205：The second spindle stop, close Y28, Y29；

M11/M10：Loosen/Tighten tool, output Y10；

M08/M09：Cool switch on/off, output Y11；

M32/M33：Lubrication on/off, output Y08；

M59/M58：Huff on/off, output Y20；

M71/M70: welding start/end, output Y09; X00 is detection input of arc welding.

M73/M72：Cladding switch on/off, output Y21, X02 is detection input of cladding；

M3330/M4330：User-defined output 0 on/off, output Y00；

M3331/M4331：User-defined output 1 on/off, output Y01；

M3332/M4332：User-defined output 2 on/off, output Y02；

M3333/M4333：User-defined output 3 on/off, output Y03；

M3334/M4334：User-defined output 4 on/off, output Y04；

M3336/M4336：User-defined output 6 on/off, output Y06；

M3337/M4337：User-defined output 7 on/off, output Y07；

M3343/M4343：User-defined output 13 on/off, output Y13；

M3344/M4344：User-defined output 14 on/off, output Y14；

M3345/M4345：User-defined output 15 on/off, output Y15；

Enable signal of drive EN: Controller is ready then output Y16；

Reset signal of drive INTH: Output Y17 when rest driver alarm；

OUT output instruction: +Y30/+Y31/+Y74/-Y30/-Y31/-Y74;

M3352/M4352：User-defined output 22 on/off, output Y22；
M3353/M4353：User-defined output 23 on/off, output Y23；
M3354/M4354：User-defined output 24 on/off, output Y24；
M3355/M4355：User-defined output 25 on/off, output Y25；
M3356/M4356：User-defined output 26 on/off, output Y26；
M3357/M4357：User-defined output 27 on/off, output Y27；

Pay attention: M3330-M3361, M4330-M4361 can't be in the same line

M14/M15：（Pxxxx） Check X30 valid/invalid(Start from Nxxx line if there is P);
M16/M17：（Pxxxx） Check X31 valid/invalid (Start from Nxxx line if there is P);
M22/M23：（Pxxxx） Check X27 valid/invalid (Start from Nxxx line if there is P);
M24/M25：（Pxxxx） Check X26 valid/invalid (Start from Nxxx line if there is P);
M28/M29：（Pxxxx） Check X25 valid/invalid (Start from Nxxx line if there is P);
WAT+/- ：User-defined input valid or invalid, X0-X47, total 48 ways；
M1xxx: wait for auxiliary relay being valid, example: M1076 means wait for M76 being valid;
M2xxx: wait for auxiliary relay being invalid, example: M1078 means wait for M78 being invalid;
M3xxx: set auxiliary relay as valid, example: M3330 means set M330 as valid;
M4xxx: set auxiliary relay as invalid, example: M3331 means set M331 as invalid
M38xx: Set output point Yxx is valid, example: M3809 means set Y09 as valid;
M48xx: Set output point Yxx is invalid, example: M4807 means set Y07 as invalid;
M18xx: Wait for input point Xxx being valid and run the next step, example: M1809 means wait input X09 valid and run the next.
M28xx: Wait for input point Xxx being invalid and run the next, example: M2807 means wait input X07 invalid and run the next.
M18xx Pxx: According to Xxx; Runs when valid; Skip to Pxx when invalid;
Example: M1809 P234 means if input X09 is valid then run the next, skip to P234 when X09 is invalid.
M28xx Pxx: According to Xxx; Runs when invalid; Skip to Pxx when valid;
Example: M2807 P456 means input X07 is invalid and run the next, skip to P456 when X07 is valid.
Process parameter P19, set M18xx/M28xx/WAT max waiting time before alarm(ms)[>=10 valid]
M97 Pxxx: skip and starts from Nxxx program line；
M98：Pxxx Lyyy to use sub program xxx, times is yyy；
M99：Back to use sub program；
M87: Number of work piece plus 1 if Processing parameter No.5 = 0；
M00：Pause

M01：Program conditional stop, input valid X41 and execute M01 then program pause；

M02：Program end；

M30：M05、M09 program end；

M20：Repeat the program automatically；

M133: driver rotate by specified speed(multiple of 30), for example: M133 XS60;

M500：Read joint coordinate of absolute motor J1-J6 Xs Ys；

M501-M508：Read joint coordinate of the encoder of J1-J6XsYs separately；

M312-M319：Clear the current user coordinate of XsYsABCXYZ separately；

M412-M419：Clear the joint coordinate of J6XsYsJ4J5J1J2J3 respectively；

(50) Subprogram M97、M98、M99

Unconditional skip

M97 Pxxx skip to the line number which is specified by P without addition；

Use sub program

In this controller the subroutine should be an independent program.

M98 Pxxx Lyyy unconditionally call subroutine instruction. P is to specify the name and path of subroutine call, L refers to the calling times for address of subroutine.

The M98 instruction can be omitted, format: PP file name, the file name can be hidden files, the first character of hidden files must be "HIDEFILE" at the beginning. Such as the file "HIDEFILE01", this program in the program area is not displayed, can use the instruction M98/G65 PHIDEFILE01 or M98/G65 P*01 or PP*01 or PPHIDEFILE01 when calling.

For example:

P sub/1390 means subroutine is tmp/NC/sub/1390

Note:

1.tmp/NC/ is the system's default path, sub is a folder for the following

2.The subroutine must be a independent program.

3.Method of the main program in USB calls the subroutine in USB: P[or P].

For example:

M98 P[A1234 means calling the subroutine A1234 in USB;

M98 P]SS12 means calling the subroutine SS12 in USB;

PP[FFDE means calling the subroutine FFDE in USB;

It needs to write the path of file if call the subroutine in folder of USB.

There must be space in front of L(Subroutine calling times). Return to the next program segment of main program when subroutine running to the end.If the program contains a fixed sequence or repeated pattern, then the sequence or pattern can be compiled to subroutine to save in memory storage in order to programme easily, the subroutine can be called by main program which is also can be called by another subroutine.

M99 is an instruction of ending subroutine return, must have this instruction to end the subroutine.

Pay attention:

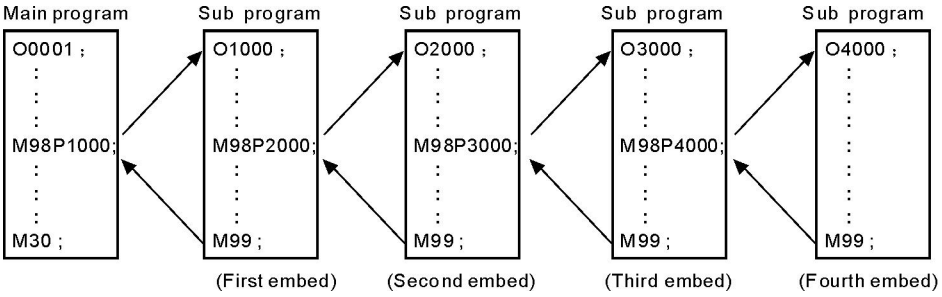
1) M99 in the main program is the same as M02;

2) M99 with P in the main program is the same as M97;

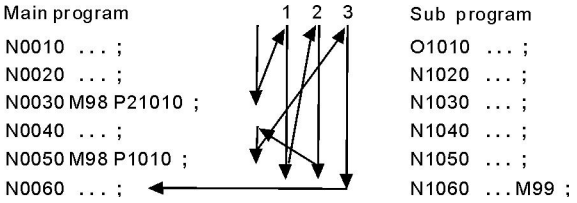
3) M99 returns to main program call in subroutine is in the next line;

4) M99 with P in the subroutine returns to P program line in main program;

The Sub-program can embedded call as follow :



For example:



The calling instruction can be used for 9999 times at the most.

(51) Macro program

1.Input instruction: WAT

Waiting for the input port X valid or invalid instruction

Format: WAT+ (-) X

Note: "+" to means the input is effective;

"-" means the input is invalid;

"X" means the input port X00-X47; see the I/O diagnosis;

2.The output instruction: OUT

Set the output port Y is valid or invalid instruction

Format: OUT +(-)Y

Note: "+" means the output is effective;

"-" means the output is invalid;

"Y" means the output port Y00-Y31; see the I/O diagnosis;

3. Variable and assignment: =

1) #0--#20 local variable: local variables only can be used to store data in macro program, such as a result of operation, when power is off, the local variables are initialized to the empty. The argument assignment to the local variable when calling the macro program.

2) #21--#999 global variables: The meanings are the same in different macro program.

When power is off, the variable #21--#100 is initialized to zero, the variable #101--#999 data is saved not to lose even if the power is off.

3) #1000-- system variable: the system variables are used to change various data when reading the running CNC. For example, the current position and the compensation of tool.

Special note: macro variables #100--#155 and #190--#202 have been used by the system, users can not use.

4)The I/O variables:

#1800: X00-X07（D0-D7）

#1801: X08-X15（D0-D7）
#1802: X16-X23（D0-D7）
#1802: X16-X23（D0-D7）
#1803: X24-X31（D0-D7）
#1804: X32-X39（D0-D7）
#1805: X40-X47（D0-D7）
#1806: X60-X67（D0-D7）
#1808: Y00-Y15（D0-D15）
#1809: Y16-Y31（D0-D15）
Format:#i=Expression

4.The arithmetic and logic operation

Table:

Function	Format	Note
Definition	#i = #j	
Addition Subtraction Multiplication Division	#i = #j + #k ; #i = #j - #k ; #i = #j * #k ; #i = #j / #k ;	
Sin Asin Cos Acos Tan Atan	#i = SIN(#j) ; #i = ASIN(#j); #i = COS(#j) ; #i = ACOS(#j); #i = TAN(#j); #i = ATAN(#j);	90.5 degrees mean 90 degrees 30 minutes
Square root Absolute value Rounding off Round down Round up Natural logarithm Exponential function	#i = SQRT(#j); #i = ABS(#j) ; #i= ROUND(#j); #i = FIX(#j); #i = FUP(#j); #i = LN(#j); #i = EXP(#j);	
Or Exclusive or And	#i = #j OR #k ; #i = #j XOR #k ; #i = #j AND #k ;	Executing with binary system

5. Unconditional transfer: GOTO N

Transfer to the program line with sequence number n, appears error when specifying beyond the 1-99999, could use expression to specify the sequence number.

For example: GOTO 5, GOTO #100

6.Conditional transfer: IF (Conditional expression) GOTO or THEN

If the conditional expression specified is met, execute this segment; if the conditional expression specified is not meet, execute the next segment.

For example: IF (#100 EQ 2) THEN #100=5

IF (#101 GT 2) GOTO 6

Operation meaning:

EQ equal
NE not equal
GT greater than >
GE greater than or equal
LT less than <
LE less than or equal

7. Loop: WHILE (conditional expression) DO 1, 2, 3

Specifies a conditional expression in front of WHILE. When the specified conditions are met, execute the program between DO and END. Otherwise, turn to the program line after END. Cycle of the embed is 3 at the most.

For example:WHILE （#100 LT 3）DO 1
……
WHILE （#103 EQ 5）DO 2
……
WHILE （#200 GE 20）DO 3
……
END 3
……
END 2
……
END 1

8. Non-mode to call macro program:G65

Format: G65 P- L- <A-B-C-..... Argument passing data >

P is the name of macro program, L is the calling times,A B C are argument, the name of argument as follows:

#0->A、#1->B、#2->C、#3->D、#4->E、#5->F、#6->H、#7->I、#8->J、#9->K、 #10->M、#11->Q、#12->R、#13->S、#14->T、#15->U、#16->V、#17->W、#18->X、 #19->Y、#20->Z.

Special attention: The address G、L、N、Q、P can't be used in argument.

For example:

Main program:9000
G00 X0 Z0
G65 P8000 L1 A5 B6
G0 X0 Z0
M30
Macro program:8000
N1 #2=#0+#1
N2 IF （#2 EQ 10）GOTO 4
N3 GOO X#2
N4 G00 Z#1
N5 M99 ; Return

9.Mode to call macro program:G66 G67

G67 instruction is to cancel G66 instruction.The format is the same as G65.

For example:

Main program:9000
G00 X0 Z0
G66 P8000 L2 A5 B6
A8 B1
A9 B10
G67
M30
Macro program:8000
N1 #2=#0+#1
N2 IF （#2 EQ 10）GOTO 4
N3 GOO X#2
N4 G00 Z#1
N5 M99 ；Return

10、Prompt dialog

Format: MSG(parameter) or MSG[parameter]; if parameter is information string, pause.

Pay attention：This instruction usually be used in NC program(not macro).

After prompting dialog, controller switch into pause status automatically.

Format： STAF(parameter) or STAF[parameter]; not pause if the parameter is information string.

(52) User-defined macro program（G101—G170，M880—M889）

Must use PC to edit and copy into controller.

1、G101-G170 is macro program of G code, correspond to ProgramGxxx, use instruction of robot controller.

2 、 M880-M889 is inner macro program, correspond to macro ProgramUser0 — ProgramUser9, including inner macro programs of robot controller：

1）Output：OUT

Format：OUT+(-/A)Y(M)**+

Note：“+” means output effective；

“-” means output invalid；

“A” means output reversal(effective to invalid, invalid to effective)；

For example：OUT+Y5-Y7+Y9+Y11-Y15

Mean：Y5,Y9,Y11 output effective; Y7,Y15 output invalid

For example：OUT+M12-M13+Y14+Y8-Y16

Mean：M12,Y14,Y8 output effective; M13,Y16 output invalid

2）Wait instruction：WAT

Wait X, Y, M effective or invalid

Format：WAT+(-)X(Y/M)**+(-)X**+(-)X**+(-)X**+(-)X**+(-)X**

Note：“+” wait for effective；

“-” wait for invalid；

Y or M only to be one or none, X could be used many times.

2.1, The longest time of WAT：MAXWAT

Format：MAXWAT****

Note：The range is 0-99999, unit is ms.

Controller will alarm and quit the running program when time is over.

If value is 0 or MAXWAT instruction alone means the function is disabled, namely no limit in the longest time.

2.2, Hold time for meeting condition of WAT：HOLDWAT

Format：HOLDWAT****

Note：The range is 0-99999, unit is ms.

If value is 0 or HOLDWAT instruction alone means the function is disabled, namely no limit in the hold time.

2.3,The longest wait mode：MODWAT

This instruction work with MAXWAT

Format: MODWAT1/MODWAT2/MODWAT3/MODWAT4;

Default: MODWAT1。

MODWAT1 the controller will alarm and quit when time is over;

MODWAT2 the controller will alarm and continue to run;

MODWAT3 not alarm and quit when time is over;

MODWAT4 not alarm and continue to run.

For example: Wait for 5 seconds to get X0 signal failed, it will alarm No.9

```
MODWAT4
MAXWAT5000
WAT+X0
IF (-X0) THEN
OUT+M89
ERREXIT
ENDIF
```

3）Delay: PAUS

Format：PAUS****

Note：The range is 0-99999, unit is ms.

4）Assignment：=

Assignment for variable

Format：=

Example：#251=890.34

5）Prompt dialog

Format：MESSAGEBOX(parameter 1);parameter 1 is information string.

Also could be abbreviated as MSG(parameter 1).

6）Information of changing tool

Format：STATUSINFO(parameter 1);parameter 1 is information string.

Also could be abbreviated as STAF(parameter 1).

Pay attention: If only use STATUSINFO or STAF or STATUSINFO() or STAF() , it will close the current prompt.

7）Condition instruction: execute if meet condition, otherwise skip.

Format：IF (Relay or input point or macro variable) THEN

ENDIF

+Mxx means relay is effective.

-Mxx means relay is invalid.

+Xxx means input point is effective.

-Xxx means input point is invalid.

+Yxx means output point is effective.

-Yxx means output point is invalid.

+#xx means macro variable is not 0.

-#xx means macro variable is 0.

8）Move coordinate axis

Format：MOVE(parameter G, parameter F, parameter XYZABCXsYs, parameter W)

The first parameter is G90 or G91 to specify it is relative or absolute；

F to specify the speed, XYZABCXsYs to specify the coordinate of machine；

W to specify some input signal satisfy the condition, it will stop,

for example:W+5 means it will stop when X5 input point is effective.

9）Set the current user coordinate and save

Format: SETWK(parameter XYZABCXsYs);

10）Go to some line：GOTO xx

11）Return：RETURN

Chapter 5 User Technique

5.1 Technique for weld

Main introduction about operation, parameter and program path of welding.

Setting: Including <Equipment> and <Main setting>.

Equipment: Be used for<Swing weld>,<Parameter>and<Condition for points>.

Main setting: Be used for <Setting for equipment>and<Main setting>。

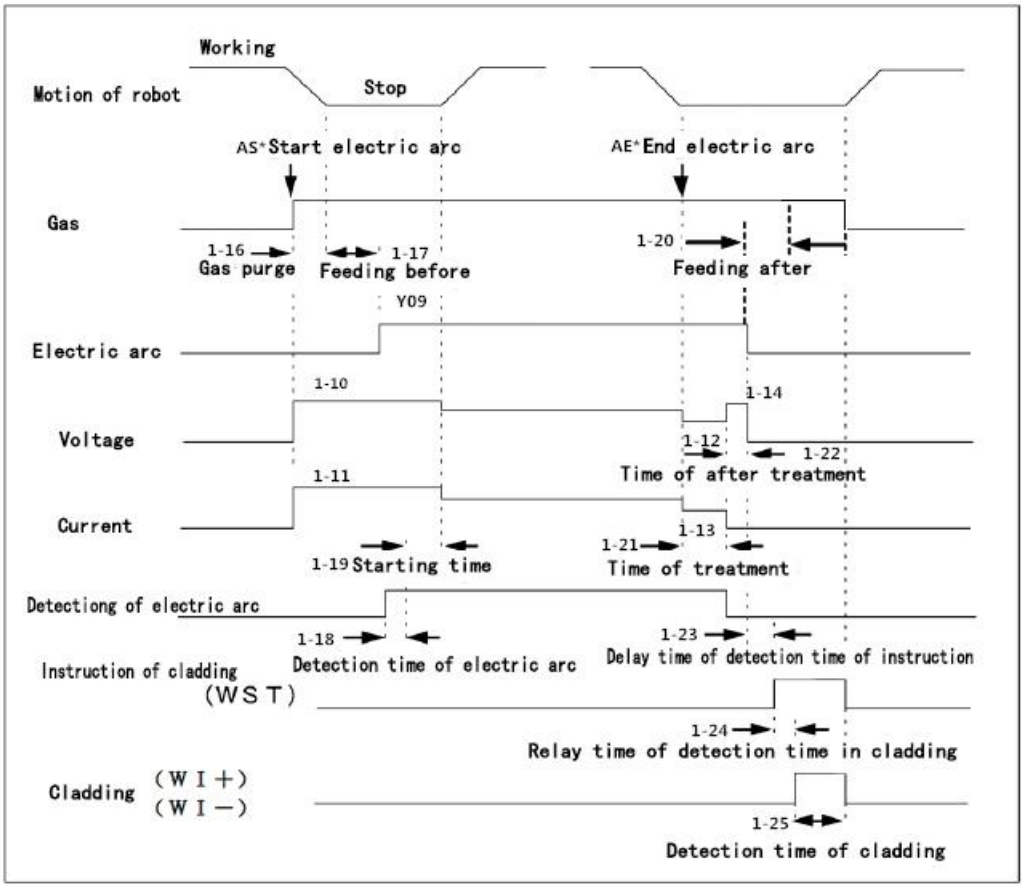
It will works with tool coordinate and user coordinate.

5.1.1 Relative parameter

Other parameter

★、330,Interface and function of controller(11 Welding;12 Palletizing;13 Painting; 14 Polishing)

(1) welding technique (Please check 3.8.4 technique parameter)



★、1-0,The basic technique parameter in welding[0-9]

Arc weld instruction AS* to be invoked parameter group.

★、1-1,Basic technique group: Open the function of “Back” or not[8 means open, other means closed]

Set as 8 means, press “Back” got the back function. The back function means if arc breaking happens(X0 invalid) during arc welding with MOVL or MOVC instructions, robot will back for a distance then restart arc start instruction AS*, and continue arc welding process.

★、1-2,Basic technique group: The back distance of restart(um)

Only available if back function is enabled, refers to the automatic back distance after arc breaching during arc welding.

★、1-3,Basic technique group: The speed of restart(mm/min)

Only available if back function is enabled, refers to the automatic back speed after arc breaching during arc welding.

★、1-4,Basic technique group: The detection times of cladding

Definition: when sold wire sticks on the workpiece before execution of AE*, it is necessary to clad to separate solder wire and workpiece. When times of cladding is over the set value, it will alarm ad quit. When the parameter is equal or less than 0, it is unnecessary to detect cladding(X03), but it will execute cladding once.

★、1-5,Basic technique group: weld mode [1:MIG-VA, 2:MIG-VW, 3:TIG-A, 4: TIG-AW]

1. MIG-VA:

Use AA to specify the current of weld, also could use S.

Use VV to specify the voltage of weld, also could use SS.

AA and VV could be in the same instruction, but S and SS can’t

2.MIG-VW:

Use AA to specify the speed of feed and back guide wire

Use VV to specify the voltage of weld, also could use SS.

AA and VV could be in the same instruction, but S and SS can’t

3.TIG-A:

Use AA to specify the current of weld, also could use S.

4.TIG-AW:

Use AA to specify the speed of feed and back guide wire

Use VV to specify the current of weld, also could use SS.

AA and VV could be in the same instruction, but S and SS can’t.

★、1-6,Basic technique group: Open the scrape function or not[8 means open, others mean closed]

Scrap function open means, after execution of AS*, keep running for a distance to ensure arc strike when output of arc starting is effective. If arc strike succeeds in scrape range,

then back to start point and execute welding; if arc strike fails then alarm and quit. Scrap function close means, after execution of AS*, when output of arc starting is effective, wait for a period to check if arc strike succeeds or not, if succeed then weld, if fail then alarm and quit.

★、1-7,Basic technique group: The scrape distance in weld(um)

★、1-8,Basic technique group: The backing speed of scrape in weld(mm/min)

Only available if scrape function is on, the speed of backing welding start point after striking arc successfully.

★、1-9,Basic technique group: Starting of arc and arc extinction:+2 means the starting of arc is specified; +4 means arc extinction is specified.

Starting of arc means the progress of instruction AS*,arc extinction means the progress of instruction AE*.

When setting as user-defined, the basic technique No.1-10 and No.1-25 are useless, the progress of Starting of arc is controlled by ProgramUser0, the progress of arc extinction is controlled by ProgramUser1, edited by user.

If it isn't user-defined, the progress of starting of arc:

Process of arc starting defined in software:

1>, Output of huff is valid

2>, The output voltage of starting of arc is specified by basic technique group No.1-10
The output current of starting of arc is specified by basic technique group No.1-11

3>，Waiting time of air clean is specified by basic technique group No.1-16(ms)

4>，Waiting time of feeding air is specified by basic technique group No.1-17(ms) 5>，Output of starting of arc is valid

6>，Waiting time of electrical arc detection is specified by basic technique group No.1-No.18(ms)

7>，If not open the scrape function, it will check the strike arc is success or not, it will quit if not success.
If open the scrape function, it will ignore this step.

8>，Restore the output voltage and current of user programme.

9>，Output of feeding solder wire is valid[M03/Y18].
Execute progress of welding automatically.

The progress of arc extinction:

1>，Close output of feeding solder wire[M05]

2>，The voltage of output weld treatment is specified by basic technique group No.1-12
The current of output weld treatment is specified by basic technique group No.1-13

3>，Waiting time of weld treatment is specified by basic technique group No.1-21(ms)

4>，The voltage of after treatment is specified by basic technique group No.1-14

5>，（A）Set the mode of welding control to be MIG-VW and TIG-AW：
The backing speed of after treatment for solder wireis specified by basic technique group No.1-15；

The output of backing solder wire is effective, the feeding output of feeding solder wire is invalid；

Waiting time of after treatment is specified by basic technique group No.1-22(ms)；

Stop backing solder wire, output of backing and feeding are both invalid, the speed is 0.

（B）Set the mode of welding controlling as MIG-VA and TIG-A：

The output analog current of weld will be 0；

Waiting time of after treatment is specified by basic technique group No.1-22.

6>，Stop arc, output of starting arc is invalid.

7>，If output of huff is valid, then execute operation as below:

Waiting time of after huff is specified by basic technique group No.1-20.

Close output of hull.

8>，If the detection of cladding is bigger than 0, then operation as below：

Set the output analog voltage as 0；

Delay the waiting time of cladding detection is specified by basic technique group No.1-23；

Output of cladding detection is valid[M73/Y21]；

Delay the waiting time of cladding detection is specified by basic technique group No.1-24 ,set should over parameter 105；

（A）Check remove cladding is successful or not[X03], the operation as below if successful：

Waiting time of cladding detection is specified by basic technique group No.1-25(ms)；

Close output of cladding detection

(B)If remove cladding is failed, then operation as below

Close output of cladding detection

If the frequency of cladding detection is over the value of parameter, it will alarm and quit, otherwise output of starting arc is valid. Back to execute 4>step;

9>, Restore the voltage and current output of user program.

Then execute the next steps of program.

★、1-10,Basic technique group: The voltage of starting of arc

★、1-11,Basic technique group: The current of starting of arc

★、1-12,Basic technique group: The voltage of welding port treatment

★、1-13,Basic technique group: The current of welding port treatment

★、1-14,Basic technique group: The voltage of after treatment

★、1-15,Basic technique group: The speed of solder wire go back(mm/min)

★、1-16,Basic technique group:The time of gas purge(ms)

★、1-17,Basic technique group: The present time of delivery gas(ms)

★、1-18,Basic technique group: The detection time of electrical arc(ms)

★、1-19,Basic technique group: Starting time(ms)

★、1-20,Basic technique group: Time of behind delivery gas(ms)

★、1-21,Basic technique group: Time of welding port treatment(ms)

★、1-22,Basic technique group: Time of behind treatment(ms)

★、1-23,Basic technique group: Delay time of cladding detection instruction(ms)

★、1-24,Basic technique group: Delay time of cladding detection (ms)

★、1-25,Basic technique group: Time of cladding detection(ms)

★、1-26,Basic technique group: Welding fixed trim[5-900]

The fixed ratio of MOVL/MOVC between AS and AE, range is 5-900. if beyond the scope, feed speed ratio will be ratio percentage in main interface.

★、101. Open interruption of wire feeding or not(M03)[0 means open, 1 means close]

★、102. Total period(unit:10ms)

★、103.Wire feeding time(unit:10ms)

★、104. Detecting time of successful arc starting[X0 valid](unit:10ms)

The time to detect X0 valid, if over the time means successful arc starting.

★、105.Detecting time of successful arc extinction[X0 invalid](unit:10ms)

The time to detect X0 invalid, if over the time means successful arc extinction.

Auxiliary relay of controlling arc starting: Valid M56 means starting of arc, otherwise it means arc extinction.

Programmable instruction: M71 refers to starting of arc, M70 refers to arc extinction.

Output point of arc starting: Y09

Auxiliary relay of controlling huff: Valid M50 means huff starting; otherwise it means huff closing.

Programmable instruction: M59 refers to huff starting, M58 refers to huff closing.

Output point of huff: Y20.

Auxiliary relay of output of cladding detection: valid M57 means open, otherwise it means close.

Programmable instruction: M73 refers to open, M72 refers to close.

Output point of cladding detection: Y21.

Auxiliary relay of input of cladding detection: valid M72 means successful cladding, otherwise it means failed cladding.

Definition of cladding: to consolidate workpieces through melted metal wire

Detection input of arc starting: X00

Detection of welding machine malfunction: X01

Detection input of cladding: X03

Detection of cooling anomaly: X04

Detection of lubrication alarm: X05

Detection of arc depletion alarm: X06

Detection of gas depletion alarm: X07

Detection of metal wire depletion: X46

Detection of power anomaly: X47

Auxiliary relay of manual feeding solder wire: M53

Auxiliary relay of manual back solder wire: M54

Auxiliary relay of stopping feeding/back: M55

Programmable instruction: M3—Feed solder wire; M4—Back solder wire;

M5—Stop feeding or backing.

Output point: Y18—Feed solder wire; Y19—Back solder wire; Y12—Stop.

If the seam is wider, weaving weld is applied. Just add the instruction WS* of starting weld in the next line of instruction AS*. The parameter of weaving weld contains 10 groups from 0 to 9, specifying by WS*, to close weaving weld by WE before the line of AE*.

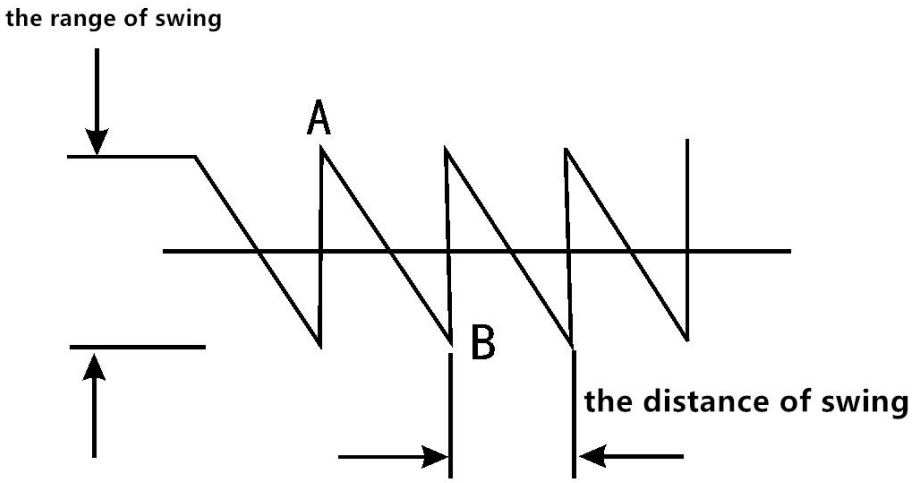
(2) **Weaving welding technique**

★、2-0,The group number of weaving in weld[0--9]

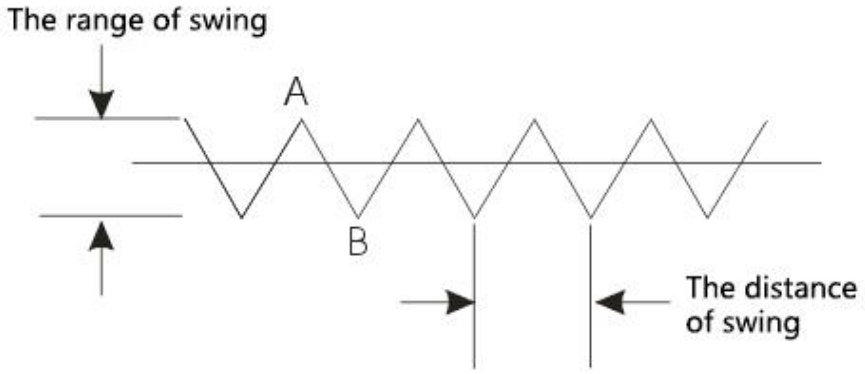
Starting instruction WS* invokes parameter groups from 0 to 9.

★、2-1,Weaving mode[1 mean Z type; 2 means circle type, 3 means X type]

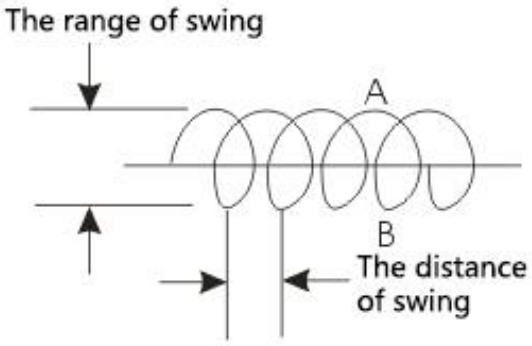
The types of weaving weld, 1 refers to weaving in the shape of “Z”, 2 refers to circular weaving. 3 refers to weaving in the shape of X. If weaving plane is vertical on Z axis of tool coordinate system, then direction of Z axis should correspond to direction of welding gun during the setting of tool coordinates(TCP). If only set P1, P2, P3, then direction of welding gun P3 signifies Z axis in tool coordinate. If set P4, P5, the direction from P3 to P4 signifies X axis, and direction from P4 to P5 signifies Z axis in tool coordinate system.



Z type of swing



X type of swing



Circle type swing

★、2-2,Distance of weaving(um)

Distance between every two weaving segments.

★、2-3,Extent of weaving(um)

Distance between two weaving points from A to B.

★、2-4,The pause time at A point(ms)

Weave weld to A point and the pause time(ms).

★、2-5,The pause time at B point(ms)

Weave weld to B point and the pause time(ms).

★、2-6,Circular swing direction(0 means reversal, 1 means normal)

Search Function:

In this mode, the workpiece is grounded while nozzle or solder wire is electrified with low voltage. During the motion of robot along searching track, if nozzle or wire contacts with workpiece, dip of electric level will generate signal of contacting, then robot stops moving and records contacting position, and rectifies path through offset value between current and specified position to calculate position of real target.

Search starting instruction: ST* P*

The number after ST specifies group number of searching [0—9]

The number after P specifies number of value data from searching result[0—99], the data corresponding to number will be deleted automatically while executing the instruction P.

Search stopping instruction: SE

Searching instruction in straight running:

SX search in the direction of X axis; laser search in the direction of X and Z

SY search in the direction of Y axis；

SZ search in the direction of Z axis；

The number behind SX/SY/SZ means the repeat times, controller will calculate the average, the most times is 9, only once if no number. For example, SX5; SY6; SZ4; SY; SX.

Example：

G54 T1 ; Specify the user coordinate system and tool number

MOVJ ;Locate to the starting point of search

ST2 P3 ;Start searching, invoke parameter group 2, it will be saved into data number 3 of transition data

MOVL ; Locate to the starting point of search

MOVL SX ; Search in the direction of X axis, the MOVL point of this line is resultant point of calibrated workpiece, system will orient according to this point and starting point.

MOVL ; Locate to another starting point of search

MOVL SY3 ; Search in the direction of Y axis(Repeat 3 times), the MOVL point of this line is resultant point of calibrated workpiece, system will orient according to this point and starting point.

SE ; End searching

MOVJ ; Locate to the middle point

SN3 ; Specify the number 3 of position offset data

AS4 ; Start arc welding

MOVL ; Execute straight line weld, according to teach point of calibrated workpiece.
MOVL ; Execute straight line weld, according to teach point of calibrated workpiece.
AE4 ; End arc welding
SF ; Close position offset

(3) Searching technique

★、3-0,Search technique group[0--9]

★、3-1,Search technique group: Mode and type

To set mode and type of search. 1 means one-dimensional search; 2 mean two-dimensional search; 3 mean three-dimensional search; 4 means one-dimensional and rotary search; 5 means two-dimensional and rotary search; 6 means three-dimensional and rotary search; 7 means circumcentre search.

One-dimensional search: to search a point in the direction of X or Y or Z.

Two-dimensional search: to search a point in the direction of XY or YZ or XZ respectively.

Three-dimensional search: to search a point in the direction of XYZ respectively.

One-dimensional and rotary search:to search two points in the direction of X and Y;the first point is used to calculate translation, the angle between line on XY and on workpiece will be rotation.

Two-dimensional and rotary search:to search two points in the direction of X and Y respectively;

Three-dimensional and rotary search:to search two points in the direction of X and Y respectively, and search one point in the direction of Z;

Circumcenter search: to search two points in the direction of X and one point in the direction of Z; or to search two points in the direction of Y and one point in the direction of X. To calculate the center of circle according to the three points through circumcenter. Then conclude offset value by comparing the calculated center with the center of calibrated workpiece.

★、3-2,Search technique group: The distance of search(um)

★、3-3,Search technique group: The speed of search(mm/min)

★、3-4,Search technique group: The back speed of search(mm/min)

★、3-5,Search technique group: Input point of searching detection (+1000 means waiting valid jump. +2000 means waiting invalid jump)

To set Input point of searching detection by parameter 3-5. For instance, X12 is set as

1012, denotes that if X12 is valid, searching is finished.

(4) **Arc tracking technique**

★、4-0,The group number of welding arc tracking[0--4]

Arc tracking instruction TS* is used to invoke parameter group.

★ 、 4-1,Compensation mode (+4:Left&right;+8:Upper&lower;+16:Left&right analog;+32:Upper&lower analog;+64:analog address exchange)

★、 4-2,Welding arc tracking: Left and right compensation Detecting IN1 address (1000+X number)[Left&right reference voltage]

★、 4-3,Welding arc tracking: Left and right compensation Detecting IN2 address (1000+X number)[Left&right reference voltage range of error]

★、4-4,Welding arc tracking: Upper and lower compensation Detecting IN3 address (1000+X number))[Upper&lower reference voltage]

★、4-5,Welding arc tracking: Upper and lower compensation Detecting IN4 address (1000+X number)[Upper&lower reference voltage range of error]

★、4-6,Welding arc tracking : 01 Left and right compensation value(um)[Left&right max-compensation value lower than reference analog quantity]

When input point IN1, IN2 is 01, it is left/right offset compensation.

★、4-7,Welding arc tracking :10 Left and right compensation value(um)[Left&right max-compensation value higher than reference analog quantity]

When input point IN1, IN2 is 10, it is left/right offset compensation.

★、4-8,Welding arc tracking:01 Upper and lower compensation value(um)[Upper&lower max-compensation value lower than reference analog quantity]

When input point IN3, IN4 is 01, it is right/down offset compensation.

★、4-9,Welding arc tracking:10 Upper and lower compensation value(um)[Upper&lower max-compensation value higher than reference analog quantity]

When input point IN3, IN4 is 10, it is right/down offset compensation.

★、4-10,Welding arc tracking:Compensated acceleration[Compensation per 2 ms](um)

It is offset compensation value per 2ms, namely compensation acceleration.

★、4-11,Welding arc tracking:Analog mode Left&right compensated acceleration coefficient

★、4-12,Welding arc tracking:Analog mode Upper&lower compensated acceleration coefficient

Arc tracking is used to do compensation according to changing of input point IN1-IN4(changing of welding seam) during welding.

Arc tracking also can convert analog signal into 12-bit digital signal, input point X16-X27 and X28-X39 can be used for detection. According to changes of digital signal, controller will correct welding seam continuously.(Attention: if X16-X39 is occupied, then corresponding PLC need to be deleted)

Note for analog-signal arc tracking:

1> Default analog input signal of left/right compensation is X16-X27;

Default analog input signal of up/down compensation is X28-X39;

If 4-1=1, input address of left/right and up/down will be exchanged.

2> when 4-11 or 4-12 < 10, compensation(um) acceleration per interpolation circle(2ms) will be fixed as 4-10. Otherwise, compensation(um) acceleration per interpolation circle(2ms) should be calculated as following formula:

Abs(current analog value - reference analog value)*compensation acceleration*compensation acceleration coefficient/1000;

reference analog value means P4-2/P4-4, compensation acceleration means P4-10, compensation acceleration coefficient means P4-11/P4-12. when result value is bigger that 10 times of P4-10, it will be limited within 10 times value of P4-10.

3> P4-3/P4-5 means if difference between current analog value and reference analog value is less that value of P4-3/4-5, then keep current compensation value.

4> the analog signal is converted in 12-bit digital signal, so maximum analog voltage corresponds to 4095, minimum voltage corresponds to 0. analog value in parameter refers to digital value, range 0--4095.

Note:

1. analog signal converted into digital will make it be more accurate and faster respond speed.

2. if feedback voltage is 0-10V, and 5V can be set as standard voltage, feedback signal to controller is 0-4095. and X38-X29 corresponds to 1st bit-12th bit;

for example:

0V feedback should be X38-X29 state: 000000000000;

5V feedback correspond to 2048, X38-X29 state should be 100000000000;

10V feedback correspond to 4095, X38-X29 state should be 111111111111;

3V feedback correspond to 1228, X38-X29 state should be 100110011000;

7V feedback correspond to 2868, X38-X29 state should be 101100110100;

the difference between 5V and 3V, 5V and 7V is 2V, corresponds to 820, so just set tolerant value P4-5=820. that mean if feedback is between 1228-2628, controller will not do compensation up and down.

(5) Laser tracking technique

★、5-0.Welding laser tracking technique group number[0-3]

Instruction LS* is used to invoke the laser tracking technique group. The group number is from 0-3.

★、5-1. laser tracking technique group: communication mode[0 means serial port 0, 1 means serial port 1, 6 means network UDP, 7 means Network TCP];

0 means serial port 0, RS232;

1 means serial port 1, RS485;

6 means network UDP, laser system is server, robot controller is guest.

7 means Network TCP

★、5-2. laser tracking technique group: searching range[um];

★、5-3. laser tracking technique group: searching speed[mm/min];

★、5-4. laser tracking technique group: search back speed[mm/min]

★、5-5. laser tracking technique group: search interval(ms);

★、5-6. laser tracking technique group: selection of weld mode

★、5-7. laser tracking technique group:periodic time(ms) for search time communication processing

★、5-8. laser tracking technique group:periodic time(ms) for search time communication processing during tracking(ms)[determines tracking sensitivity]

★、5-9. laser tracking technique group: station number in serial port mode; port number in network mode;

★、5-10. laser tracking technique group: Baud rate of serial port(fixed setting: the data bit is 8, the stop bit is 1, no parity)

[0=7200; 1=9600; 2=14400; 3=19200; 4=38400; 5=57600; 6=115200]

★、5-11. laser tracking technique group: mode(+4 means compensate left and right, +8 means compensate up and down, +32 means calibration compensation, +64 means full calibration compensation).

Coordinate system calibration: define several points(usually 3 points), input position XYZ and posture ABC of current TCP into laser tracker, matching tractor coordinate system with controller user coordinate. Then the feedback of XYZABC from tracker will be position XYZ and posture ABC of TCP point in user coordinate of controller, and perform coordinate system compensation.

+32 means calibration compensation: compensate XYZ only, and feedback XYZ 3 group 16 bit coordinate value from tracking.

+64 means full calibration compensation, compensate position XYZ and posture ABC, and feedback XYZABC 6 group 16 bit coordinate value from tracking.

★、5-12. laser tracking technique group: numerator of left and right compensation ratio[could be minus]

★、5-13. laser tracking technique group:denominator of left and right compensation ratio[could be minus]

★、5-14. laser tracking technique group: numerator of up and down compensation ratio[could be minus

★、5-15. laser tracking technique group: denominator of up and down compensation ratio[could be minus]

★、5-17. laser tracking technique group: max value of left and right compensation

★、5-18. laser tracking technique group: max value of up and down compensation

★、5-20. laser tracking technique group: compensation acceleration [compensation value/2ms](um)

★、5-21. Laser tracking process group: Compensation acceleration multiplier coefficient

When P5-21 less than 10, each interpolation period acceleration is P5-20, otherwise, the period acceleration is: (original offset value from tracker)*P5-20*P5-21, when the result is bigger than 10 times of P5-20 value, it will be limited within P5-20 value.

★、5-22. laser tracking technique group: left and right deviation feedback is less than this value think weld alignment.

★、5-23. laser tracking technique group: up and down deviation feedback is less than this value and the weld alignment is considered.

★、5-24.laser tracking technique group: track the step of reproduction[>5] (um)

When P5-24>5, P5-25 and P5-26 works.

★、5-25,laser tracking technique group:Tracking the speed multiplier during scanning%[>=20]

When P-24>5, the seam scanning speed=programmed speed*P5-25/100

★、5-26,laser tracking technique group: Track the speed at which the reproduction mode returns the starting point of the welding(mm/min)

When P5-24>5, laser tracking technique group: the speed backing to start point of welding.

★、5-27,laser tracking technique group: the lift height when back welding start point in tracking reproduction.

When P5-24>5, the lifting height of welding gun back start point after scanning.

★、5-27,laser tracking technique group: the drop height when stating welding in tracking reproduction

When P5-24>5, the drop height of welding gun after backing start point.

(6) **Position data**

★、501,Check the data of position point

Read data of position, invoke number 0—499 of parameter

★、502,Adjust the data of position point

Adjust data of position, invoke number 0—499 of parameter

★、503,Save the data of the current position point[Pay attention to the current tool number and user coordinate system]

Save data of position, invoke number 0—499 of parameter

Pay attention: The current tool number and user coordinate system.

★、504,Check the data of movement value

Check movement refers to SN* invokes data of parameter group, "*" means invoke number 0—99.

★、505,Modify the data of movement value

Modify movement refers to SN* invokes data of parameter group, "*" means invoke number 0—99.

★、506,Calculate the data of movement value according to the two position point

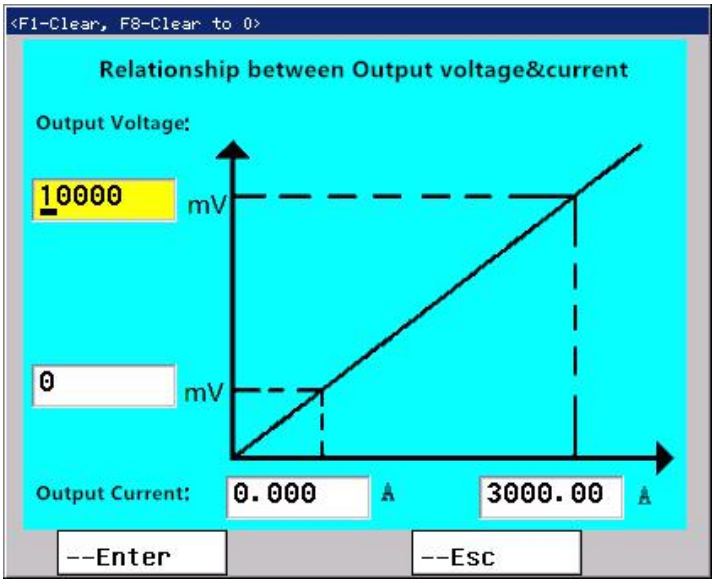
[Pay attention to the current tool number and user coordinate system]

Modify the data is specified by SN*. According to No.501-No.503 to calculate moving value and saved in parameter group.

5.1.2 Setting of welding

（1）Output the weld current, set the max analog correspond to the max output current of welder.

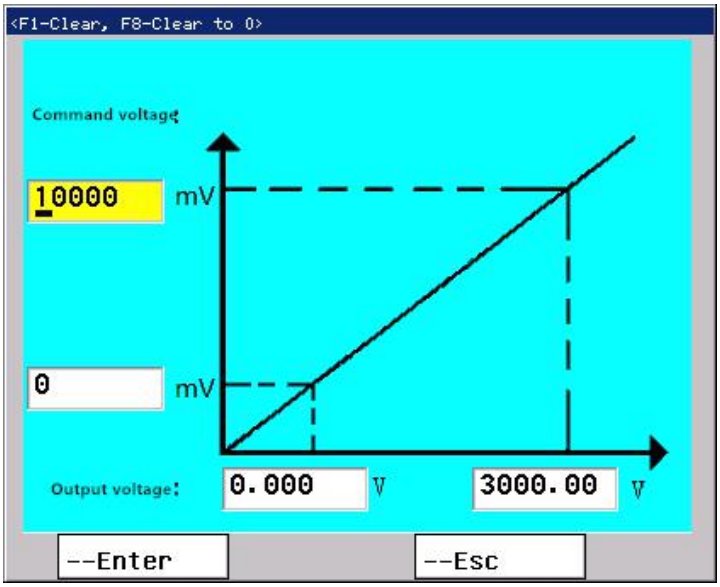
Used to set corresponding welding current of the first analog 0~10V output.



Speed parameter No.43 to set AA when output 10V.Example： P43=3000,AA1500, the controller output 5V； AA3000 the controller output 10V.

（2）Output weld voltage,set the max analog correspond to the max output current of welder.

Used to set corresponding welding voltage of the second analog 0~10V output.



speed parameter No.47 to set VV when output 10V. Example:P47=3000,VV1500 the controller output 5V to welder； VV3000 the controller output 10V to welder.

Pay attention:Analog output use separator in case of interfere.

5.1.3 Instruction of robot controller

(1) Analog output AA/S,VV/SS

AA means welding current; S could be this meaning.

VV means welding voltage; SS could be this meaning.

AA and VV could be edited in the same line, but S and SS can't be the same line.

AA/S output the first analog 0～10V， VV/SS output the second analog 0～10V.

(2) Start arc welding AS*

Start arc welding: AS*. Execute the corresponding program ProgramUser0(User could edit this file as they want).

"*" means the group number 0-9 of technique parameter, correspond to No.1-0.

The program will use the arc welding parameter.

Example:

AS1 ； Use group 1 technique parameter of arc welding technique to start

…… ； The route of arc welding

AE1 ； The end

Pay attention: This instruction need to be one line, can't be with other instruction in one line.

(3) End instruction of arc welding AE*

Execute the corresponding program ProgramUser1(User could edit this file as they want).

(4) Start swing welding WS*,T.I.G Welding:WS99

"*" means the group number 0-9 of technique parameter, correspond to No.2-0.

The program will use the swing welding parameter.

Example:

WS2 ; Use group 1 technique parameter of swing welding technique to start

…… ; The route of swing welding

WE ; The end

T.I.G Welding: WS99

Format: P specify the time of point weld(time:s); Q specify the distance(unit: mm); R specify the distance with idle run.(unit:mm)

(5) End instruction of swing and T.I.G welding WE

WS*, WE swing according to the parameter when executing MOVL and MOVC, be used for wide weld bead.

T. I.G welding refers to interrupted weld in welding area. You can save time in teaching at every welding point in this method.

Instruction: WS99

Format of instruction: WS99 P specifies time of spot welding(unit:s); Q specifies distance(unit: mm); R specifies idling distance(unit: mm).

Specific motion: welding a distance Q, then running idling a distance R, and pausing for P, execute above loop.

End instruction: WE

Example for TIG, set Q as 4mm, and R as 6mm.

(6) Start translation SN*

"*" means the group number 0-99 of technique, corresponding No.501-No.506 parameter.

(7) End translation SF

SN*,SF specify the robot to transit, flitting, palletizing.

(8) Start searching position ST* P*

The "*" behind ST means the group number of parameter in this research[0--9];

The "*" behind P means the data number of transition in this research[0--99];

It will clear the transition which is behind P when executing this code

(9) End searching SE

(10) Search in straight running

SX search in the direction of X axis； laser searching in the direction of X and Z

SY search in the direction of Y axis；

SZ search in the direction of Z axis；

(11) **Start arc tracking TS***

* behind TS means the number of tracking parameter group[0--4]

(12) **End arc tracking TE**

(13) **Open laser function:LS***

The number behind LS* refers to group number of search parameter.

(14) **Close laser function:LE**

(15) **Start multi-layer surfacing: MP***

(16) **End multi-layer surfacing: ME**

(17) **Output instruction**

Feeding tin wire：M03, output Y18 effective；

Back tin wire：M04, output Y19 effective;

Close move tin wire：M05, output Y12 effective；

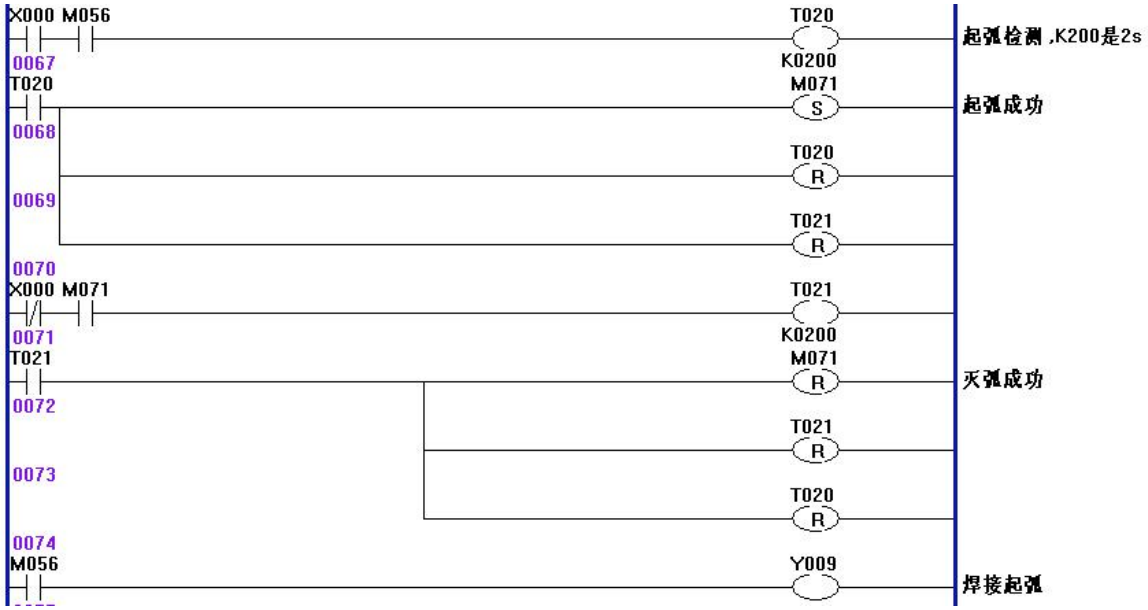
Huff open/close：M59/M59, output Y20；

Arc starting/extinction: M71/M70, output Y09

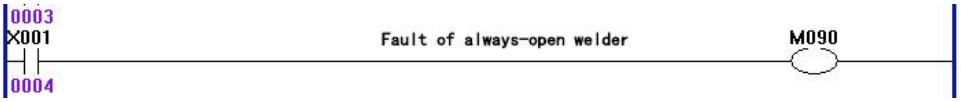
Cladding：M73/M72, output Y21, X02 is detection of cladding；

5.1.4 I/O Input and output

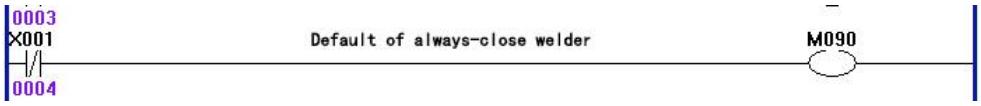
（1）X00 is detection signal of starting arc



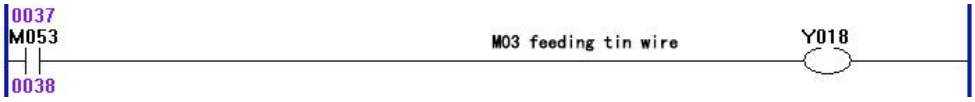
（2）X01 is alarm of welder, this is normal-open PLC



If alarm of welder is normal-closed signal, then PLC is:



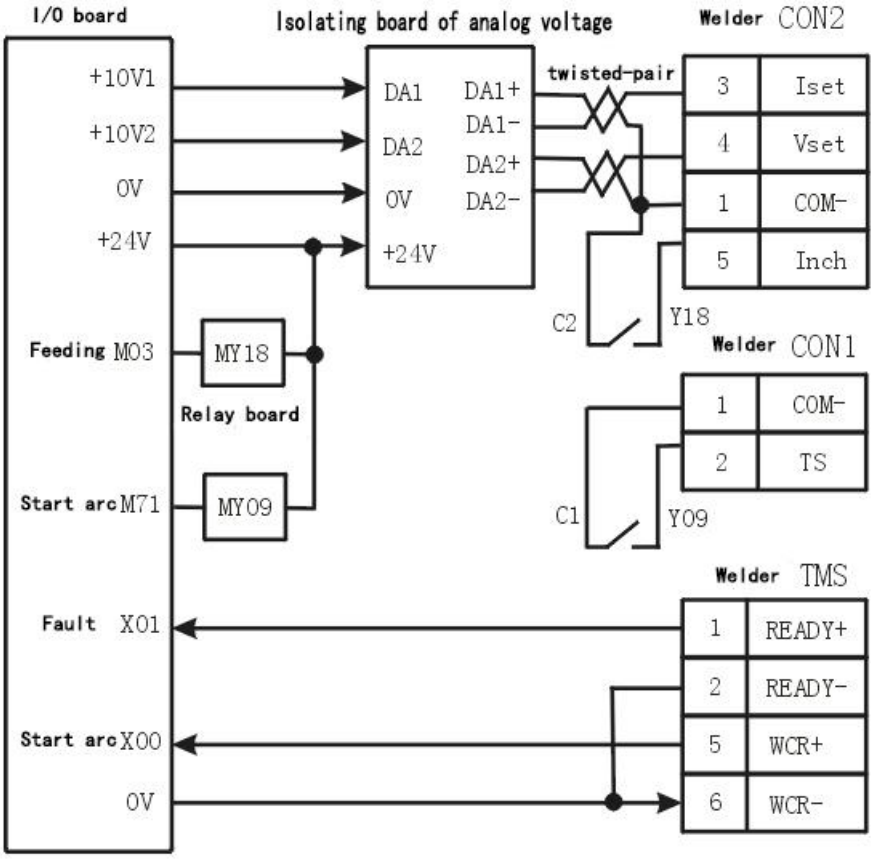
（3）M03(Y18) is output signal of feeding tin wire



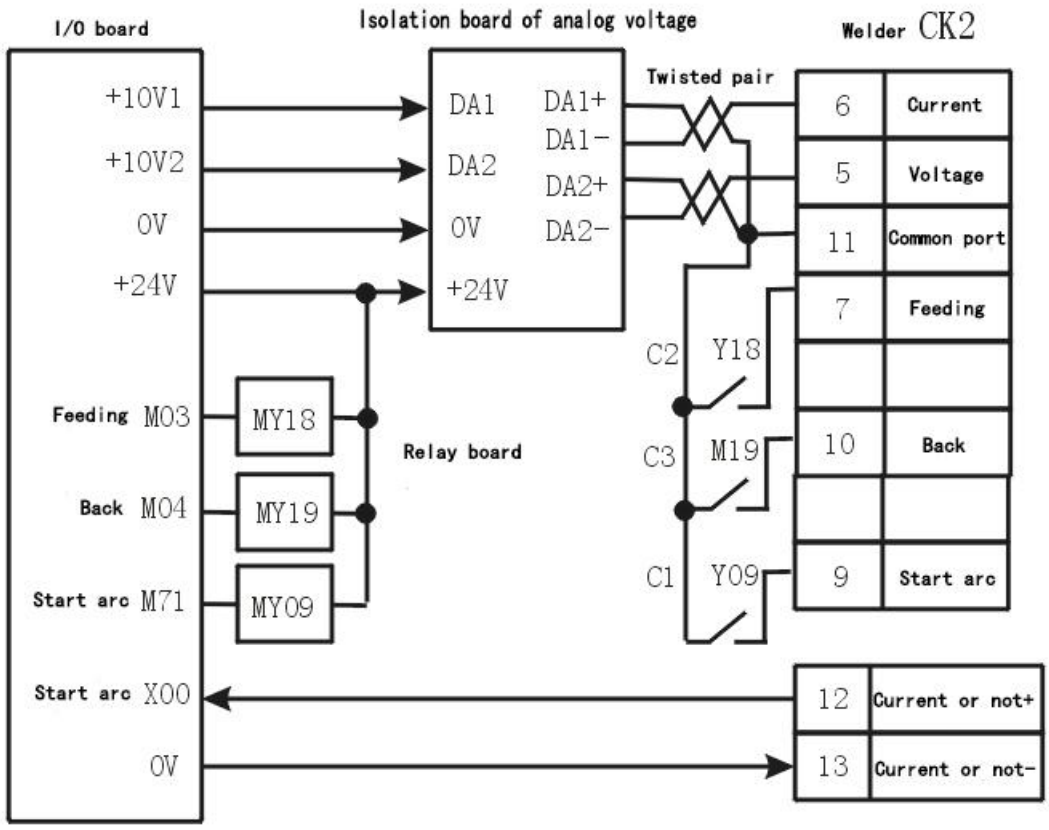
（4）M04(Y19) is output signal of back tin wire

（5）Y09 is output signal of starting arc in weld

（6）The controller connect with welder OTC CPVE-500



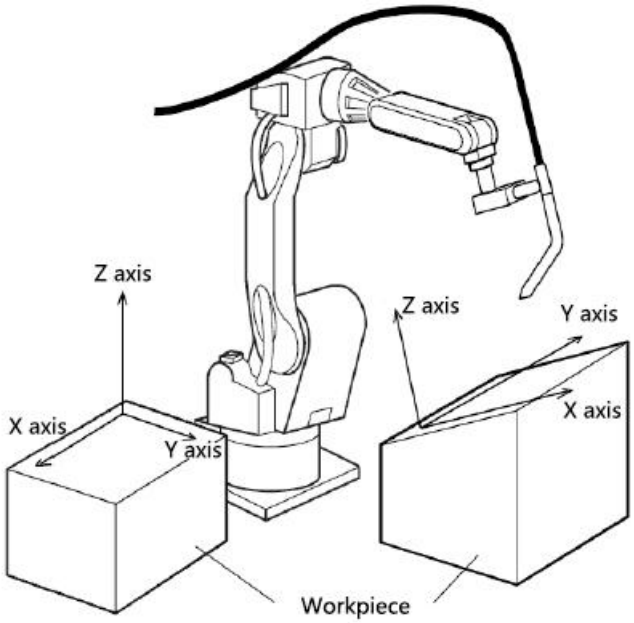
（7）The controller connect with Aotai welder MIG-350R and Megmeet WF1-50P



5.1.5 Steps of setting technique in weld

5.1.5.1 Build user coordinate system

Build user coordinate system so that programme. As follow picture, the quantities of faces need quantities of user coordinate system（got 2pcs G54,G55）.



Usually build user coordinate system with teaching status, steps as follow:

(a）Press “F8 choose coordinate” or “MDI” to choose corresponding user coordinate system（G54-G59）.

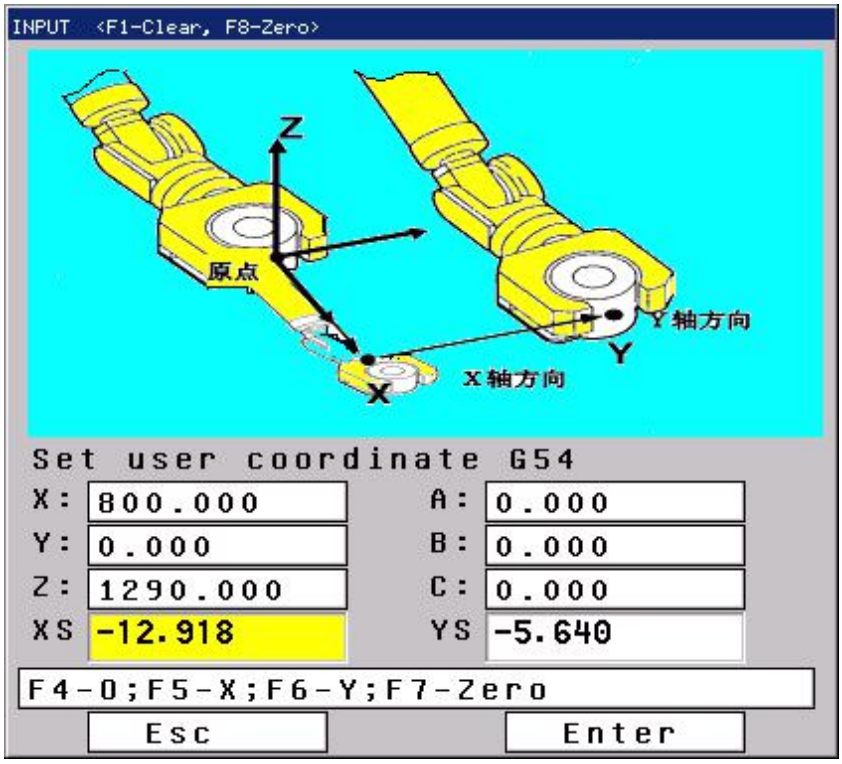
（b）Move axis to fixed position(The position is easy for measure), measure the distance from this point to the corresponding zero point of user coordinate system.

（c）Press “F7” to set P1P2P3 points(Corresponding to F4F5F6).

3-points: P1 is original point O, P2 is direction of +X, P3 is direction of +Y.

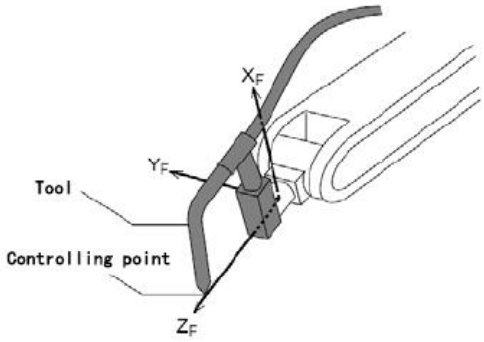
Press “Start”button or “Back”on the right side of screen, the status will show “O”, then press F4F5F6 back to the last setting point with the current joint speed in manual so that modify. Press “Start” to open or close this function, after executing once operation, it will be closed automatically.

The user coordinate system has been set already. The corresponding value will be shown in the interface of coordinate system. The value is deviation value between user coordinate system and world coordinate system.

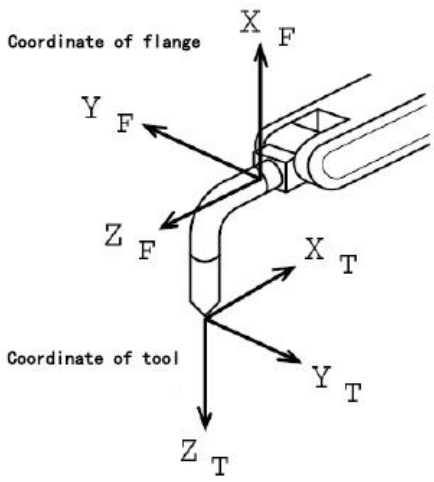


5.1.5.2 Build tool coordinate system

Build tool coordinate system is for making sure the interpolation of straight line, circle arc. Need to input right size of welder and position of defined controlling point. As follow：



Coordinate of flange



The relation between tool coordinate and flange coordinate

（1） Choose number of tool coordinate system, example: User MDI to run tool coordinate system of “T01”;

(2) Press “F6” in main interface, or press “F5” in interface of tool set.

Usually, 3-points method applies to palletizing and machine, while 5-points method applies to welding.

To build and set the tool coordinate system. To ensure the position and posture of tool

coordinate system in flange coordinate system by P1,P2P,P3,P4,P5. Fix an end effector on robot, move the robot to the same point according to dialog box by different posture as possible, then set P1, P2, P3. P1P2P3 specify the original point of tool coordinate system. P4 specifies direction of X axis, P5 specifies direction of Z axis.

（A）3-points：P1P2P3 to change the different posture of robot, the tool posit TPC point should be kept the same position, the posture in 3-points is the same as the posture of electrical connection.(The sixth flange coordinate of electrical wrist).

（B）5-points：P1P2P3 is the same as 3-points, but the posture of 5-points need P3P4P5 to make sure.P3 means the original position of tool coordinate posture, P4 means direction of +X tool coordinate posture, P5 means direction of +Z tool coordinate posture.

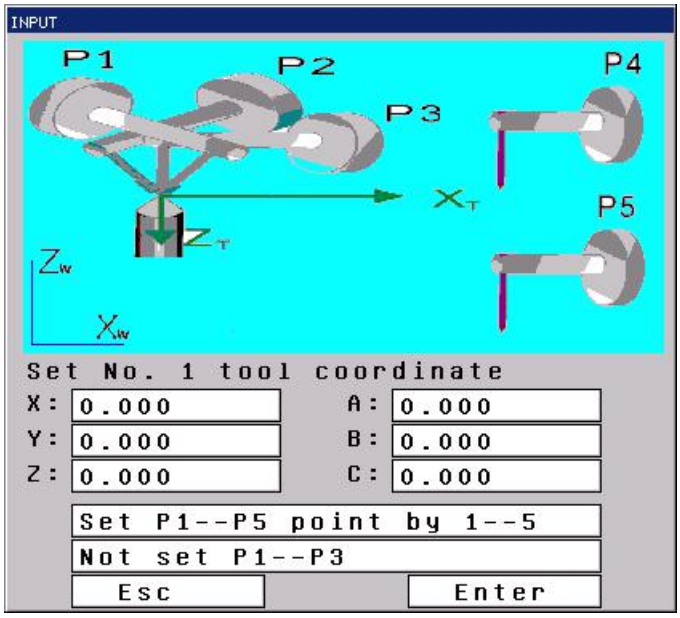
Press “Start”button or “Back”on the right side of screen during set process, the statues will show “O”, then press “12345” to adjust the speed to back to the point set the last time, easy to modify. After once operation, this function will be closed automatically.

The posture of P3P4P5 in 5-points need to be the same(Value of ABC in world coordinate should be the same) [The interface needs to be without N letter]. So it is necessary to convert into the world coordinate system after setting of P3, then move the robot to set P4 in the direction of X axis and P5 in the direction of Z axis.

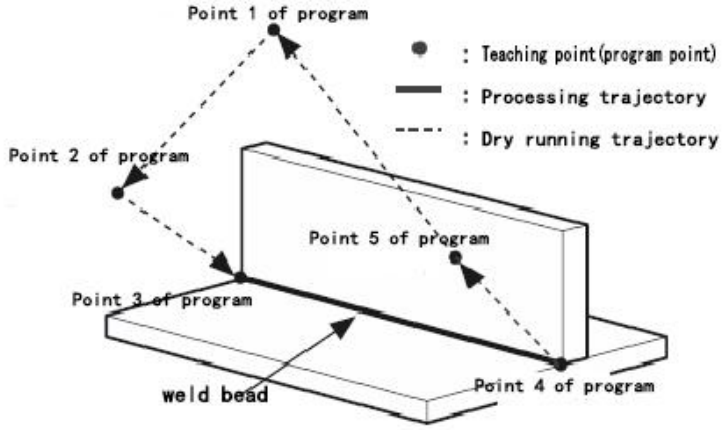
After input P1P2P3 3 points in tool set, the controller will calculate the position and posture of tool coordinate in world coordinate, if 3 points is too near, then it can’t be exist P1P2P3, the controller can’t calculate the value, it will delete P2P3 automatically.

XYZ of tool compensation set means the original point of tool coordinate in world coordinate, ABC mean the 3 axis posture in space(position and direction) of tool coordinate in world coordinate.

Pay attention:P1P2P3 in 3-points need be different posture;But the tool posture of P3P4P5 in 5-points need to be on the same straight line(It is fine if it isn’t straight line, just the direction of Z axis in tool coordinate is not on the same straight line with weld gun)



5.1.6 Example for welding



Teaching program：

G54 T1 ； G54 user coordinate system, T1 tool coordinate system

AA1000 ； The welding current correspond to output analog 3.33V of controller

VV1500 ； The welding voltage correspond to output analog 5V of controller

MOVJ VJ=80.0 PL=9.0 ； Smooth PL=9,80% rapidly move to program point1

MOVJ VJ=50.0 PL=9.0 ； Smooth PL=9,50% rapidly move to program point2

MOVJ VJ=25.0 PL=0 ； Smooth PL=0,25% rapidly move to program point3

AS3 ； Start arc weld, No.3 technique parameter

WS3 ； Start swing weld, No.2 technique parameter

MOVL V=100 PL=0 ； From program point 3 weld to program point 4 with 100mm/min

WE ； End swing weld

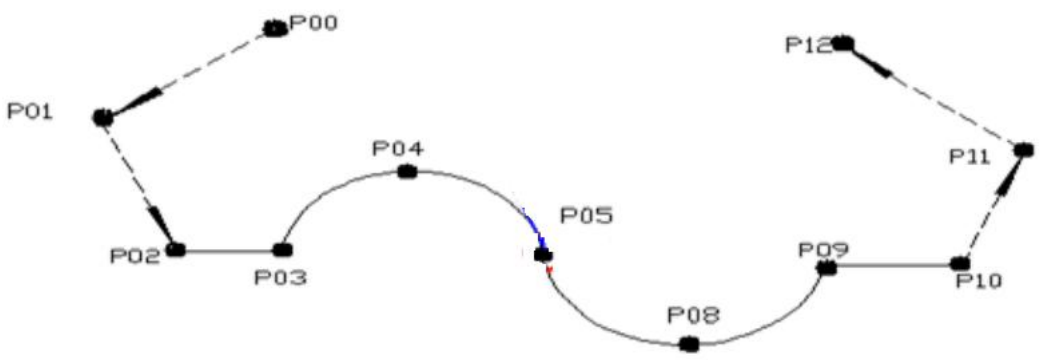
AE3 ； End arc weld

MOVJ VJ=50.0 PL=9.0 ； Smooth PL=, 50% rapidly move to program point5

MOVJ VJ=50.0 PL=9.0 ； Smooth PL=9, 50% rapidly move to program point1

M02 ； End

5.1.7 Sample for the successive direct and inverse arc welding



```
G54T1       ;invoke tool coordinate system T1 and user coordinate system G54
MOVJ         ;all joints move rapidly to P00 standby
MOVJ              ;all joints move rapidly to P01 near start point
MOVL   V=50    ;move to start point P02 in straight way
AS2              ;invoke group NO.2 basic parameter of ark strike
MOVL   V=5      ;execute welding in straight way till point P03
MOVC              ;execute welding in arc way,through P04to P05
MOVC              ;execute welding in arc way,through P08to P09
MOVL              ;execute welding in arc way till P10
AE2              ;invoke group NO.2 basic parameter of arc failure, end weld
MOVL   V=50    ;move to end point P11 in straight way
MOVJ              ;all joints rapidly move to safe position
M02              ;program completed
```

5.2 Palletizing technique

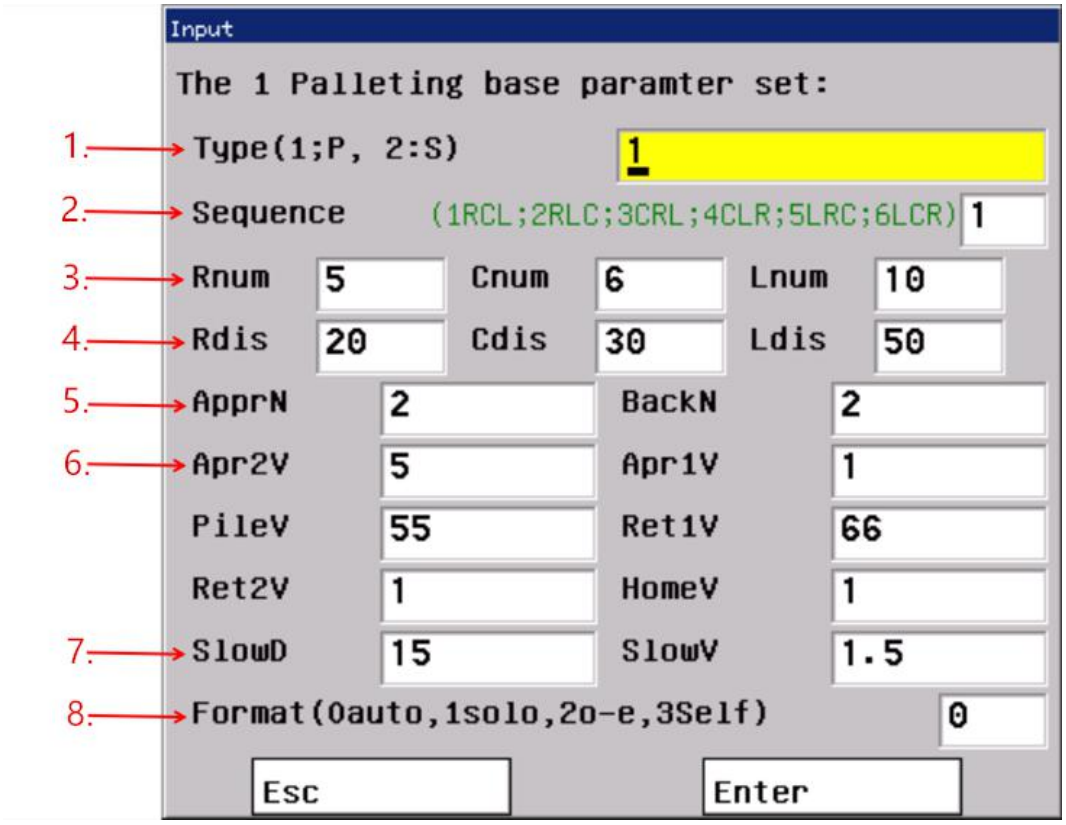
Palletizing is for arrange the product, interface of palletizing is for setting mode of arrangement, point and data.

Will use user coordinate in technique.

5.2.1 Relative parameter

1. Relative parameter of depalletizting includes number 1--99 group, user can invoke any one of them to perform depalletizing function in program.

★、601,The basic parameter of depalletizing

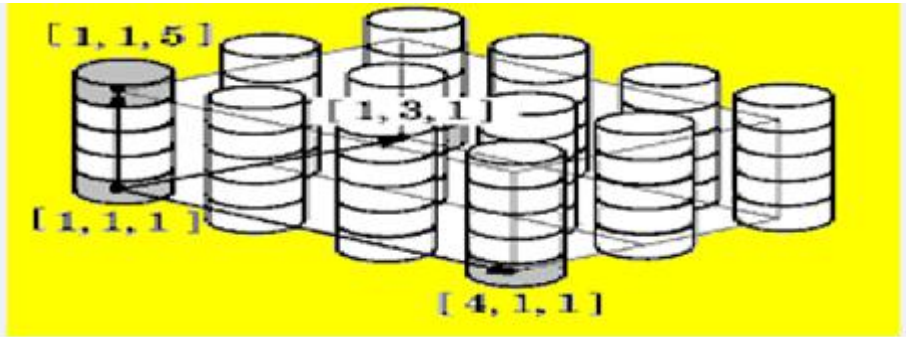


This parameter is used for basic feature. To press Enter into dialog to input number [1—99] of depalletizing parameter including:

(1) Type: palletize or depalletize, 1 means palletizing, 2 means depalletizing;

(2) Sequence of line, column and layer(only when format is 0, is the sequence default valid): to set sequence of robot operating. 1 RCL means firstly row, second column, second layer. 2RLC; 3CRL; 4CLR; 5LRC; 6LCR.

(3) Number of row, column and layer: it refers to number you need. For example, following picture means 4 rows, 3 columns and 5 layers.



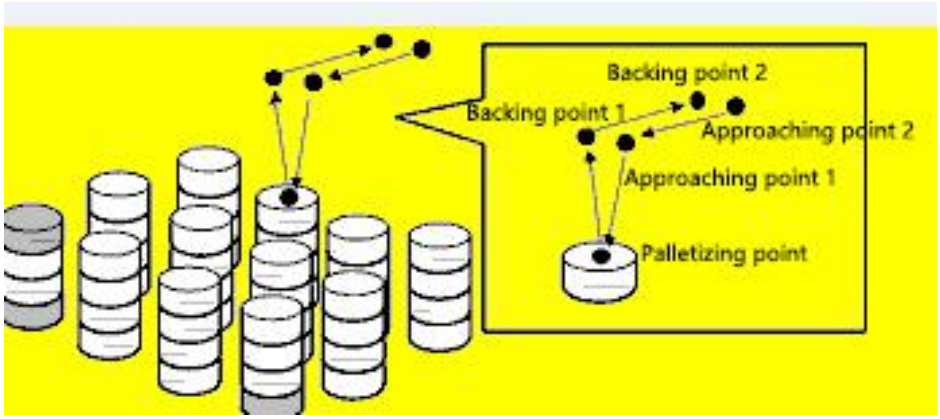
(4) Distance between lines, columns and layers;

Attention: if no specified or be specified as 0, the parameter is invalid, it will be calculated automatically according to end of teach and number of rows, columns

and layers.

(5) Number of approach point: 2 point at most;

Number of back point: 2 point at most:



(6) **Apr2V**(approaching point 2 velocity), speed from picking point to approach point 2(mm/s).

Apr1V(approaching point 1 velocity), speed from approaching point 2 to approach point 1(mm/s).

PileV(Pile Velocity), speed from approaching point 1 to pile point.

Ret1V(Return point 1 speed), speed from pile point to return point 1.

Ret2V(Return point 2 speed), speed from return point 1 to return point 2.

HomeV(Home velocity), speed from return point 2 to pile point.

Note: if set **Apr2V/Apr1V/PileV/Ret1V/Ret2V/HomeV** as positive, then robot move with MOVL command; if set them as negative, then robot move with MOVJ command.

For example; -30 means robot move by joint speed 30 degree/s under MOVJ, Usually it is better to set **PileV/Ret1V** as positive, and **Apr2V/Apr1V/Ret2V/HomeV** set as negative value.

(7) **SlowD**(Slow distance), the offset distance between pile point and slow-down point, a distance upon workpice. Unit: mm

SlowV(Slow velocity**)**, speed from pile point and slow-down point. Unit: mm/s.

(8) **Format**(Type of layout):

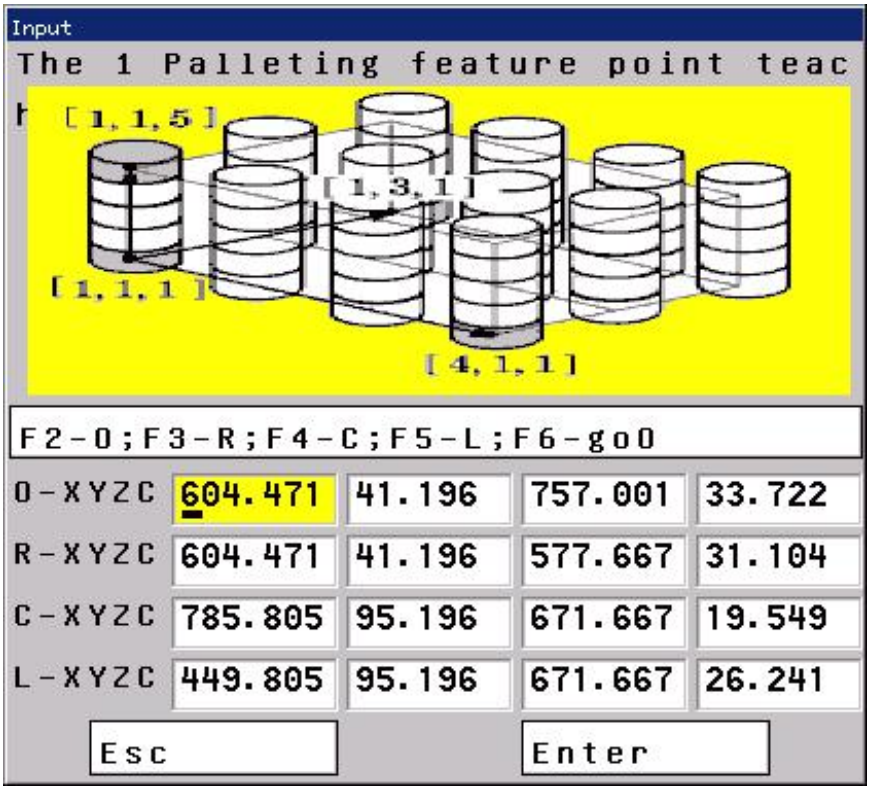
0 means parameter setting generates the same layout in every layer (posture is the same as teach posture at datum point);

1 means setting each layer the same as first layer, if no setup, then quit;

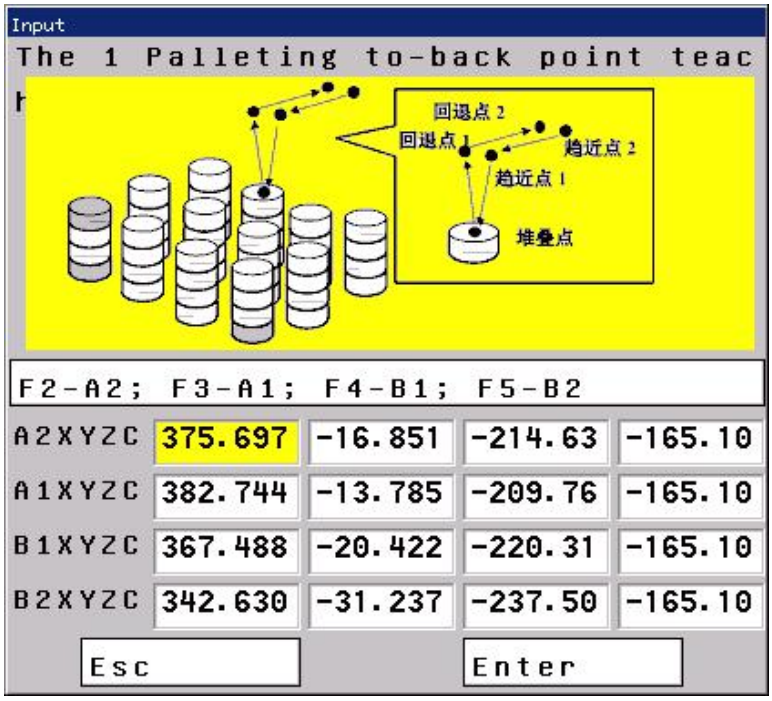
2 means different layout in odd and even layer, odd layer correspond to first layer, even layer correspond to second layer. If no setup, then quit;

3 means customization. You need specify layouts of each layer.

★、602,The teach for piling point of depalletizing(Necessary)



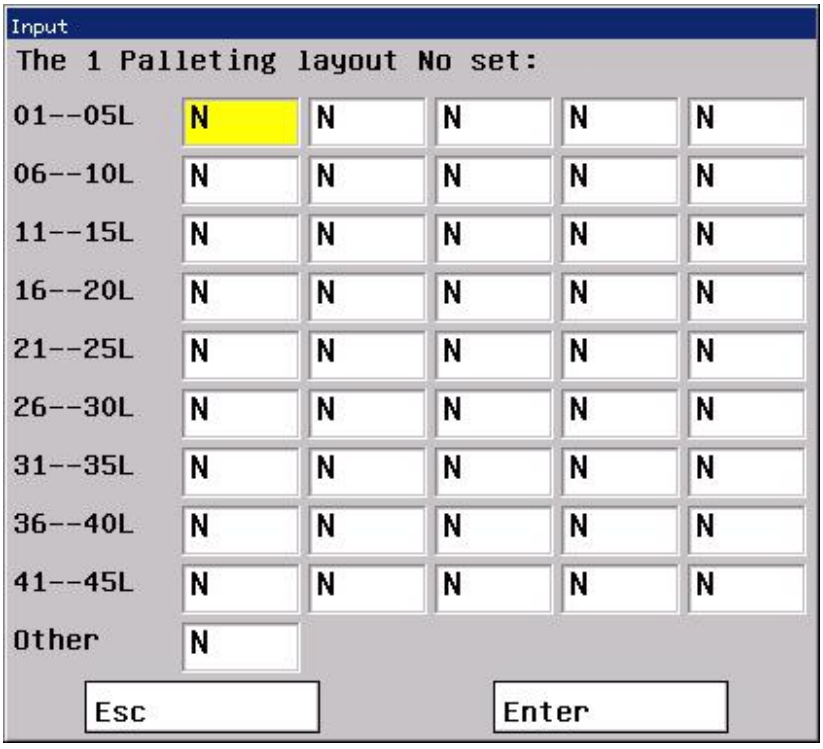
To record original point, row endpoints, column endpoint, layer endpoint in teach function. Press F2 to record original point, press F3 to record row endpoint, press F4 to record layer endpoint, press F6 to back original point(by F2).



★、603,The teach for approach and back point of depalletizing

To teach and record Approaching point 1, Approaching point 2, back point1, back point 2 in teach function. Press F2 to recorder approaching point 1, Press F3 to recorder approaching point 2, Press F4 to recorder back point 1, Press F5 to recorder back point 2.

★、604,The special set for each floor layout number of depalletizing

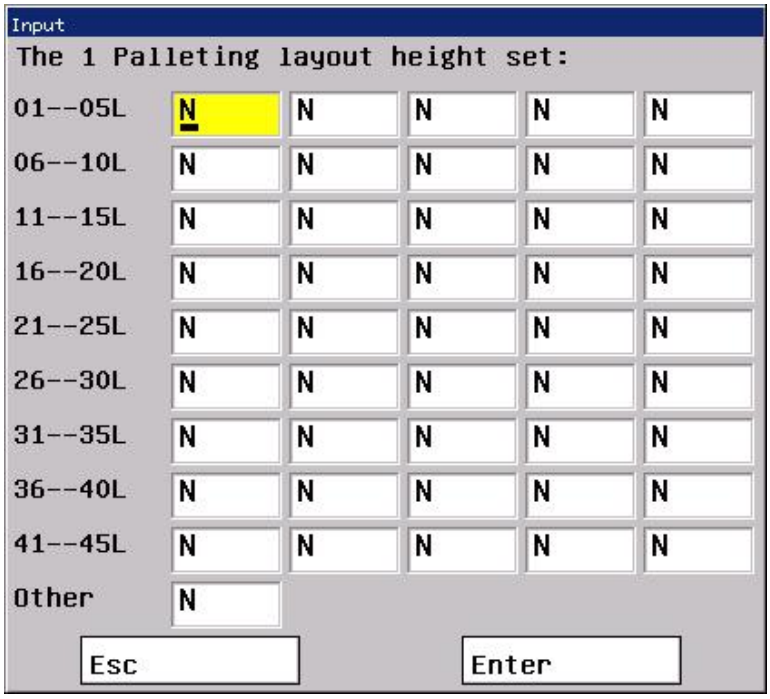


If type of layout is 0, the parameter is invalid;

If type of layout is 1, you need to set layout of the first layer(606/607);

If type of layout is 2, you need to set layout of the first and second layer(606/607);

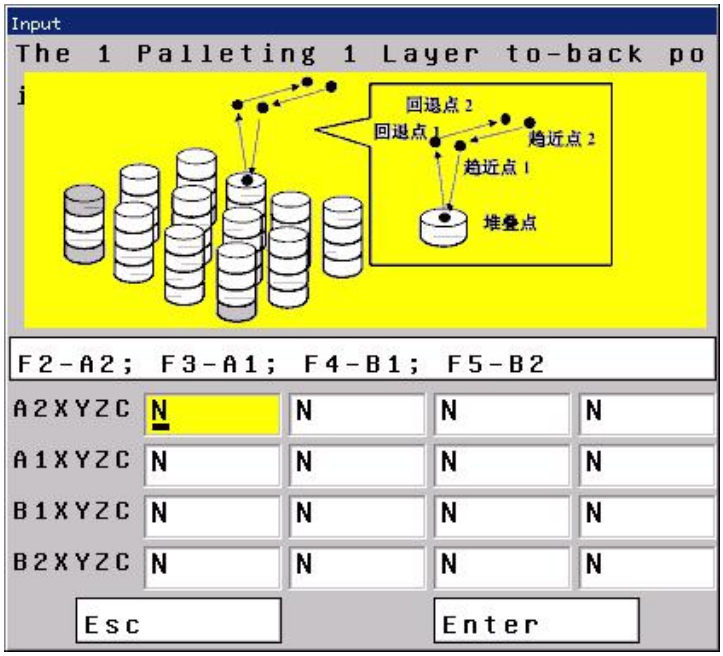
If type of layout is 3, you need to set layout of each layer(606/607).



★、605,The special set for each floor height of depalletizing

Only when height of certain layer is special, is it valid. If without setting, the controller will calculate automatically according to parameters and teach points.

★、608,The set or teach for special floor with special approach and back point

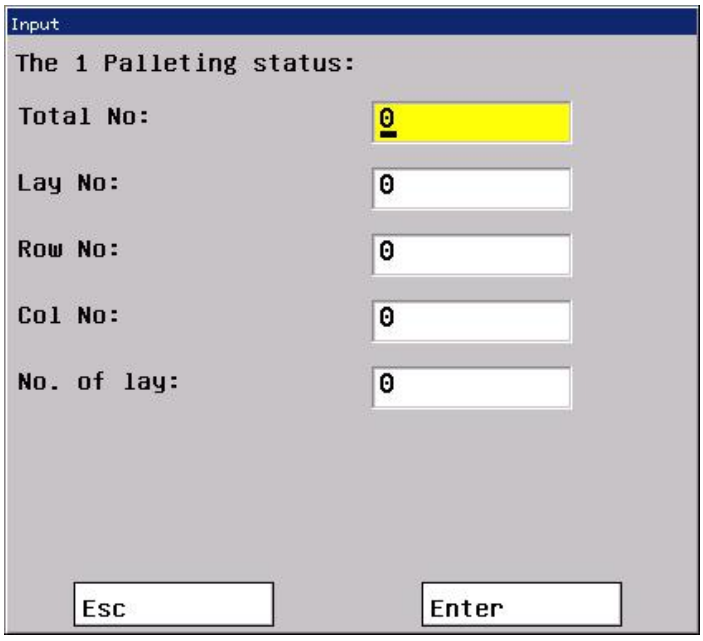


To teach approach point 1, approach point 2, back point1, back point 2 on special layer. Press F2 to recorder approaching point 1, Press F3 to recorder approaching point 2, Press F4 to recorder back point 1, Press F5 to recorder back point 2.

Add D before number to delete the setting according to prompt. For example, D5 means to delete special approach and back points in the fifth layer.

★、620, Decode the current status

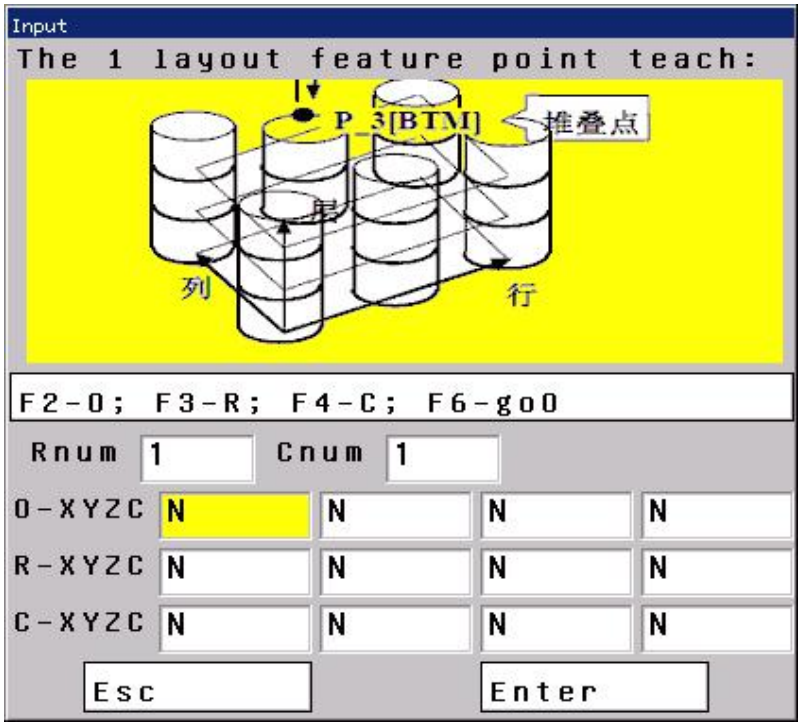
Display and set current total stacks, current layer number, current row number and stack number in current layer.



2. About setting of layout, there is 99 types of layouts including number 1--99. type

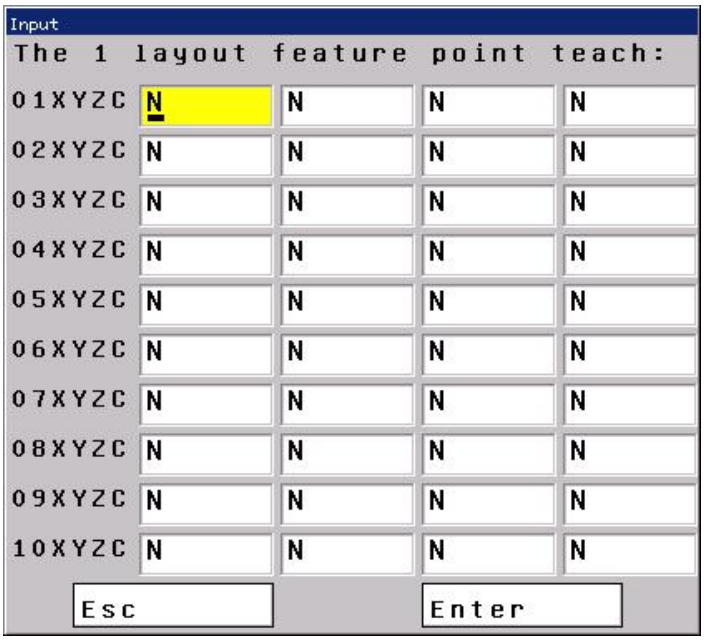
of layout refers to layout pattern in one layer. If the layout type is 0, the layout type is set unnecessarily.

★、606,The set or teach for special regular layout data of depalletizing



When layout is regular, this parameter is enabled. You need to teach original point, line endpoint, column endpoint, and number of lines and column.when the format of layout is 1or 2 or 3, it is necessary to set parameter 604 and 606, or 607.

★、607,The set or teach for special ruleless layout data of depalletizing



When layout is irregular, you need to teach the position of every workpiece, 60

workpieces are allowed at most now. Press F2 to record the coordinate of each point. Page turns by UP and Down.

3. Posture of end effector

★、613, Instruction M before movement of depalletizing(880—889)

Customer instruction M executed automatically before depalletiaing.

★、614, Instruction M at the approach point 1(880—889)

Execute depalletizing motion at the approach point 1.

★、615, Instruction M approach to the offset pilling point (880—889)

Execute depalletizing motion at the offset pilling point.

★、616, Instruction M close to the pilling point (880—889)

Execute depalletizing motion close to the pilling point.

★、617, Instruction M back to the offset pilling point (880—889)

Execute depalletizing motion back to the offset pilling point

★、618, Instruction M at the backing point 1 (880—889)

Execute depalletizing motion at the backing point 1.

For example, 880 means system will execute M880 automatically. If don't have a need, set value as 0.

M880-M889 correspond to macro program ProgramUser0-programUser9, the input/output can be edited by WAT/OUT in program[refers to system instruction(41)User-defined macro program], import it into controller after finishing edition. Output instructions as follows, for example, OUT+M330, means output of Y00 is valid.

M330:Y00; M331:Y01; M332:Y02; M333:Y03; M334:Y04; M336:Y06; M337:Y07; M51:Y08; M56:Y09; M49:Y10; M48:Y11; M343:Y13; M344:Y14; M345:Y15; M53:Y18; M54:Y19; M50:Y20; M57:Y21; M352:Y22; M353:Y23; M354:Y24; M355:Y25; M356:Y26; M357:Y27; M231:Y28; M232:Y29; M360:Y30; M361:Y31;

Macro instruction M881 Lx : x means palletizing group number(1-99).

M881 means just execute the section from PL1. to next PLx, default is L1.

M881 L2 means just execute the section between PL2. to next PLx.

M881 L0 means ignore all PLx. Execute total program.

PA2 means just execute the section between PL2. to next PLx. in program.

PA3 means just execute the section between PL3. to next PLx. In program.

The format of ProgramUser1:

```
PL1.
. . . .        ;instructions of Palletizing group No.1
PL.2
. . . .        ;instructions of Palletizing group No.2
PL3
```

. . . . ;instructions of Palletizing group No.3

The default configuration of ProgramUser0-9 as follows(user can edit ProgramUser0-9 on computer, then copy to USB and install it into controller). each program has been exampled with 10 groups palletizing instructions, if more groups than 10 are necessary, then add corresponding macro instructions.

Macro program ProgramUser0(M880) content is as follows, the instruction in M880-M883 does not include delay command after output, the rest M884-M889 includes 200ms delay after output.

```
PL1.        ;No.1 Palletizing group command
OUT+M352    ;+Y22
PL2.        ;No.2 Palletizing group command
OUT-M352    ;-Y22
PL3.        ;No.3 Palletizing group command
OUT+M353    ;+Y23
PL4.        ;No.4 Palletizing group command
OUT-M353    ;-Y23
PL5.        ;No.5 Palletizing group command
OUT-M353    ;-Y23
OUT+M352    ;+Y22
PL6.        ;No.6 Palletizing group command
OUT-M352    ;-Y22
OUT+M353    ;+Y23
PL7.        ;No.7 Palletizing group command
OUT+M352    ;+Y22
WAT+X41     ;+X41
PL8.        ;No.8 Palletizing group command
OUT+M353    ;+Y23
WAT+X42     ;+X42
PL9.        ;No.9 Palletizing group command
OUT-M353    ;-Y23
OUT+M352    ;+Y22
WAT+X41     ;+X41
PL10.       ;No.10 Paletizing group command
OUT-M352    ;-Y22
OUT+M353    ;+Y23
WAT+X42     ;+X42
RETURN;
```

Palletizing instruction will invoke default macro programs, user can edit ProgramUser0-9 on computer, copy to USB then install into controller. It is suggested to use adjacent Palletizing group, for example, use PA1 to do palletizing, and use PA2 to do depalletizing.

Palletizing group	M880	M881	M882	M883	M884	M885	M886	M887	M888	M889
PA1	+Y22	-Y22	+Y23	-Y23	-Y23 +Y22	+Y23 -Y22	-Y22 +Y23	+Y22 -Y23	-Y23 +Y22 +X41	+Y23 -Y22 +X41
PA2	-Y22	+Y22	-Y23	+Y23	-Y22 +Y23	+Y22 -Y23	-Y23 +Y22	+Y23 -Y22	-Y22 +Y23 +X42	+Y22 -Y23 +X42
PA3	+Y23	-Y23	+Y22	-Y22	+Y22 +X41	+Y23 +X41	+Y23 +X42	+Y22 +X42	+Y22 +X41	+Y23 +X41
PA4	-Y23	+Y23	-Y22	+Y22	+Y23 +X42	+Y22 +X42	+Y22 +X41	+Y23 +X41	+Y23 +X42	+Y22 +X42
PA5	-Y23 +Y22	+Y23 -Y22	-Y22 +Y23	+Y22 -Y23	+Y22	-Y22	+Y23	-Y23	-Y22 +Y23	+Y22 -Y23
PA6	-Y22 +Y23	+Y22 -Y23	-Y23 +Y22	+Y23 -Y22	-Y22	+Y22	-Y23	+Y23	-Y23 +Y22	+Y23 -Y22
PA7	+Y22 +X41	+Y23 +X41	+Y23 +X42	+Y22 +X42	+Y23	-Y23	+Y22	-Y22	+Y23	-Y23
PA8	+Y23 +X42	+Y22 +X42	+Y22 +X41	+Y23 +X41	-Y23	+Y23	-Y22	+Y22	-Y23	+Y23
PA9	-Y23 +Y22 +X41	+Y23 -Y22 +X41	-Y22 +Y23 +X42	+Y22 -Y23 +X42	-Y22 +Y23 +X42	+Y22 -Y23 +X42	-Y23 +Y22 +X41	+Y23 -Y22 +X41	+Y22	-Y22
PA10	-Y22 +Y23 +X42	+Y22 -Y23 +X42	-Y23 +Y22 +X41	+Y23 -Y22 +X41	-Y23 +Y22 +X41	+Y23 -Y22 +X41	-Y22 +Y23 +X42	+Y22 -Y23 +X42	-Y22	+Y22

4.Copy and delete data

★、609,Copy data of some number depalletizing

★、610,Copy data of some number layout mode

★、611,Delete data of some number depalletizing

★、612, Delete data of some number layout mode

5.2.2 Parameter setting for different palletizing cases

Palletizing parameter calling principle: irregular priority; so if adopt regular pattern, all irregular parameter setting should be **N**.

(1) Regular case

Just need to set P601, P602, and P603, controller will calculate pallatzing data automatically. And format should be 0 auto;

(2) Solo case

The pattern in single layer is irregular, but all layers are the same. User need to set P601, P602, P603, P604, P607. Format in P601 should be 1 solo. Then set all pattern in P604 are the same which is taught in P607.

(3) Regular Odd/Even case

The regular patter in odd layer or even layer are the same. User need to set P601, P602, P603, P604, P606. Format in P601 should be 2 O-E. Then teach feature points according to odd and even layer alternatively in P604 are the same, which is taught in P606. system will calculate patter according to P604 and P606 P601.For example, odd layer adopts patter No.1, even layer adopts patter No. 2. Besides, P605 can set height of odd and even layers.

(4) Irregular Odd/Even case

The irregular patter in odd layer or even layer are the same. User need to set P601, P602, P603, P604, P606, P607. Format in P601 should be 2 O-E. Then set pattern according to odd and even layer alternatively in P604 are the same which is taught in P607. For example, odd layer adopts patter No.1, even layer adopts patter No. 2. Besides, P605 can set height of odd and even layers, P608 can set different approaching point and back point in odd/even layers.

(5) Total irregular case

The patters in every layer are different. User need to set P601, P602, P604, P605, P606, P607. Format in P601 should be 3 self. Then teach point and posture of stack of each layer in P607, now support 60 points at most in each pattern. Then fill in different pattern number into P604. besides, if height of each layer are different, please set in P605. Then teach approaching points and back points for each layer.

5.2.3 Palletizing instruction

(1) Whole operation of depalletizing PW**

Before executing PW**, controller will execute PR** once automatically to reset the current value.

Note:

1) The macro variable of depalletizing #9001--#9099 correspond to total number of each number of depalletizing, all finished if it is negative number. For example, #9005 means the current executing stack number of palletizing group No.5.

2) The macro variable of depalletizing #9101--#9199 correspond to the current layer number of each depalletizing group.

3) The macro variable of depalletizing #9201--#9299 correspond to the current row number of each depalletizing group.

4) The macro variable of depalletizing #9301--#9399 correspond to the current column number of each depalletizing group.

5) The macro variable of depalletizing #9401--#9499 correspond to the stack number in current layer of each depalletizing group.

(2) Reset the current value of depalletizing PR**

PR** means clear the macro value of whole palletizing. For example, once adding PR1 at the beginning of Palletizing No.1 group program, if power off accidentally, when execute this program again, it will start from the first stack. But if without PR1, next time it will start from the stack which was pause before power off.

Pay attention：

1）If the number is 9999, then controller reset all of current value;

2）The current value of depalletizing includes the current row, column, layer, stack, total stack;

(3) Whole operation of once depalletizing PA**

After finishing PA**, it necessary to execute PR** to reset palletizing before execute PA** again.

5.2.3 Palletizing sample

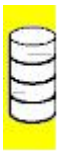
1. Sample 1

```
PR5                 ; reset the data of NO.5 depalletizing including number of rows, columns, layer, stacks and count stacks.
G54T2               ; invoke number of tool and user coordinate system
MOVJ VJ=100.0       ; quickly locate at original point
WH[#9005 GE 0]DO1   ; if macro variable of stack sum greater than or equal to 0, then do loop. If not, then finished.
....                ; insert the program you need.
PA5                 ; execute whole operation of once depalletizing group No.5
....                ; insert the program you need.
END1
```

2. Sample (for testing and debugging motion of depalletizing)

```
G54T2               invoke tool number and user coordinate system
MOVJ VJ=100.0       quickly locate at original point
PW5                 execute whole operation of depalletizing(for all workpieces)
```

3. Sample for single stack



It is enabled also to depalletize in another way that you can program by translation instruction SN* instead of above manners. Firstly you need to set a translation value PX*, then accumulate or regress the value that all has been invoked. Although this method is complex to program, it is more accessible and flexible for user.

Example(preset the translation value PX2)

```
G54T1                    ; invoke tool number and user coordinate system
MOVJ                     ; quickly locate at original point
PX3=PX2                  ; initialize PX3 by PX2
#501=1                    ; record macro variable of workpiece's quantity
WH [#501 LE 20] DO 1     ; loop statement
SN3                      ; start instruction PX3 translation
MOVL                     ; motion of robot
.....
SF                        ; end instruction PX3 translation
PX3=PX3+ PX2              ; accumulate PX2
#501=#501+1               ; accumulate quantity of workpiece
END 1
```

4. Sample: 1 robot works with 2 production line

```
G54 T1
MOVJ VJ=20;              Safety point
N10
MOVJ VJ=20;              Standby point(wait point)
M1843 P20;               Detection input for 1st line product approaching
IF(#9001LT0);
M14 P20;                 Manual confirm switch for 1st production line(X30)
M4074;                       Reset confirm switch inner relay
PR1
ENDIF
WH[#9001GE0]DO1;
.....;                   movement during palletizing
PA1;                     call palletizing technique group No.1
.....;                   movement during palletizing
END1;
GOTO10;
N20
```

```
M1844 P10;          Detection input for 2nd line product approaching
IF(#9002LT0);
M16 P20;            Manual confirm switch for 1st production line(X31)
M4075;                  Reset confirm switch inner relay
PR2
ENDIF
WH[#9002GE0]DO2
.....;              Movement during palletizing
PA2;                Call palletizing technique group No.2
.....;              Movement during palletizing
END2
GOTO10;
```

5.3 Visual Technique

Visual technique refers to locate two-dimensional workpiece(dynamic or static) on the plane through visual system. Visual system transfer X,Y and angle to controller, guiding robot to locate dynamically or statically to grab work piece. The visual function in this controller can achieve following three applications:

1. grabbing static workpiece while field of view is in robot's work range;
2. grabbing dynamic workpiece while field of view is in robot's work range;
3. grabbing dynamic workpiece while field of view is out of robot's work range.

5.3.1 Relevant parameter

★、6-0, Group number of visual process parameter group[0--3]
Visual command VS* invokes technique parameter group. Group number 0-3.

★、6-1,Visual technology groups: means of communication
[0:RS232-0; 1:RS232-1; 6:NETwork TCP; 7:NETwork UDP]
0: means communicate through RS232 port;
1: means communicate through RS485 port;
6: means communicate through TCP protocol of Network;
7: means communicate through UPD protocol of Network;
When it is 6, visual system is server, and controller is guest.

★、6-2,Visual technology groups: For serial:station numbers, for network:port number

★、6-3,Visual technology groups: Serial Baud rate(data:8,stop:1, no parity)
[0=7200; 1=9600; 2=14400; 3=19200; 4=38400; 5=57600; 6=115200]

★、6-4,Visual technology groups: VD Maximum waiting time(ms)

★、6-5,Visual technology groups: Get Visual data X offset(um)

★、6-6,Visual technology groups: Get Visual data Y offset(um)

★、6-7,Visual technology groups: Get Visual data Z offset(um)

During dynamic grabbing, appropriate offset can ensure successful grabbing. Firstly set offset value as 0, then run program to measure the offset distance between grabbing point and real point, then input the measured value into offset value, and adjust offset value to make sure grab workpiece successfully.

The data by command VD is XYZC coordinate, the point data will be the result of received coordinate plus offset value. For example, the coordinate by VD12 is X10Y20Z40C50, offset is X-6Y5Z8, then No.12 point data will be X4Y25Z48C50

★ 、 6-8,Visual technology groups: Transmission band speed during dynamic grabbing(mm/min)[>5]

If value of this parameter is less than 5, that means data by VD is static, if value is more than 5, that means data by VD is dynamic.

★、6-9,Visual technology groups:Communication data format with visual system(12:ASCII, 15:ASCII floating number)

If P6-9=12, transmission data will be ASCII format（unit: um&1/1000 degree）, visual system is TCP Server, and controller is TCP guest.

If P6-9=15，transmission data will be ASCII format(unit: mm&degree), visual system is TCP Server, and controller is TCP guest.

Based on value, if with sign - will flip value, it means transmit data incrementally, otherwise means absolutely. For example, P6-9=-5 means transmit incremental value by non-ASCII code, P6-9=-12 means transmit incremental value without decimal point by ASCII code, whose unit is um and 1/1000 degree.

★ 、 6-10,Visual technology groups:VT instruction simultaneously valid output point[1000+No.:AB,2000+No:time]

when execute VT, the output point controlling camera to take picture and record the shooting time. Once received date by VD, close the output point automatically. The default output point in controller is Y30/Y31. if need to change it into another point, please delete the corresponding output column in PLC. For example, if set the parameter as 1022 to control Y22, then delete following column in PLC;

if the parameter is set as [1000+number], controller will calculate distance from the shooting moment according to the AB signal feedback, that means higher accuracy. The direction of distance is defined by parameter 6-8, negative value means negative direction.

if the parameter is set as [2000+number], controller will calculate distance from the shooting moment according to the time difference, that means lower accuracy. The direction of distance is defined by parameter 6-8, negative value means negative direction.

★ 、 6-11,Visual technology groups:the detection input point of the workpiece to the

photographing position[1000+No.,2000+No.Auto]

When this parameter is set as [2000+number], it means not only detect this point when executing VT, but also detect it in any time. Then once this input point is valid, controller will execute VT command automatically.

When equipped with switch to detect if workpiece reach camera position, it is necessary to detect this detect input point before executing VT, if no set, it means no switch installed. Detecting time is defined by Process Parameter No.19, if over the detecting time by P19, controller will alarm.

5.3.2 Parameter setting for 1000M Net-port communication

1. Other Parameter:

P500 =8; open automatically;

P501 IP address of gateway, unnecessary to set;

P502 IP address, like 192.168.1.2;make sure unique in LAN.

P503 MAC address, 255.255.255.1;

P504 IP address of internet of service, it is the address of visual system. Make sure this address sharing the first three bit with controller ID address.

P38=0, Serial port modbus station number of OPC.

2. Vision technique parameter:

6-0,Group number of visual process parameter group[0--3]

Set as 0;

6-1,Visual technology groups: means of communication

[0:RS232-0; 1:RS232-1; 6:NETwork TCP; 7:NETwork UDP]

Set as 6 or 7;

6-2,Visual technology groups: For serial:station numbers, for network:port number

Set as 43012, try to set as a bigger value, but no more than 65535, otherwise it may be occupied.

6-4,Visual technology groups:VD Maximum waiting time(ms)

Maximum waiting time to execute VD for visual data, set as 8000;

6-11,Visual technology groups:the detection input point of the workpiece to the photographing position[1000+No.,2000+No.Auto].

5.3.3 Visual instruction

(1) Open visual function: VS*

The number* behind VS refers to technique group number[0-3]; before using visual function, we need to calibrate visual system to make sure the coordinate from visual system match with tool TCP point coordinate in current user coordinate. Define direction of workpiece transmission as positive direction of X axis.

(2) Close visual function: VE

(3) Visual function controlling: VT*

Number * behind VT refers to code of instruction sent to visual system.

The instruction data sent to visual system as follows(HEX):

01 03 00 01 00 04

The first byte 01 means visual system station number is 1(when using netport transmission, station number is fixed as 1);

The second byte 03 means ModBus instruction is 0x3, read parameter value;

The third and fourth byte are none-definition, for reserve, fixed as 00 01;

The fifth and sixth byte compound as 16-bit transferring data, the fifth byte is high 8 bit, the sixth byte is low 8 bit; the value is defined by number behind VT, for example, VT4 means the fifth byte and sixth byte are 00 04;

The seventh and eighth byte are CRC check code.

1. Definition of Special instruction VT0: synchronization time

VT0 is used to synchronize visual system time with controller time for dynamic grabbing. The instruction will send controller current time to visual time, unit is ms. When system receives VTO instruction, visual system will be subject to received time to record shooting time(photo time). then visual system will feed both coordinate and shooting time. For example,

01 05 00 01 40 C0 00 0C 43 56 71 8E

The first byte 01 means visual system station number is 1(when using netport transmission, station number is fixed as 1);

The second byte 05 means time synchronization instruction;

The third to sixth byte are second of current time, 0x000140C0 is hexadecimal number, converting into decimal 82112, that means the current time of controller is 82112 seconds;

The seventh to tenth byte are microsecond of current time, 0x000C4356 is hexadecimal number, converting into decimal 803670, that means the current time of controller is 82112 second and 803670 microsecond.

The eleventh and twelfth byte are CRC check code.

2. Definition of Special instruction VT1: synchronization coordinate

VT1 means synchronize visual system with user coordinate command under the current tool coordinate. For example, 01 06 FF F8 57 AD 00 03 C2 65 FF FA F2 09 00 02 7E 65 5F 83

The 1st byte means station number of visual system is 1(fixed as 1 by Ethernet).

The 2nd byte 06 means synchronize coordinate;

The 3rd, 4th, 5th byte refer to X coordinate, FF F8 57 AD, and high bit F means minus

value, result will be 0X100000000-0xFFF857AD=0x7A853, converting into decimal value 501843, then X coordinate is -501.843mm.

The 7th, 8th, 9th, 10th byte refer to Y coordinate, the 11th, 12th, 13th, 14th byte refer to Z coordinate, the 15th, 16th, 17th, 18th byte refer to C coordinate, the 19th , 20th byte refer to CRC check code.

(4) Visual function controlling: VD*

Number * behind VD refers to point number which saves received data in controller, P means in certain time(defined by P6-4), if receive coordinate value failed, then ship to P line;

While executing VD, the output point defined by P6-10 will be closed.

before using visual function, we need to calibrate visual system to make sure the coordinate from visual system match with tool TCP point coordinate in current user coordinate.

<1> Non-ASCII static data

When visual technique parameter P6-9 is not 12, and value of P6-8 is less than 5, it means static grabbing. The data from visual system includes XYZC position data, each position data is 32-bit number, expressed by 4 bytes, including check code, totally 18 bytes(16-bytes XYZC+2-byte CRC). For example:

FF F8 57 AD 00 03 C2 65 FF FA F2 09 00 02 7E 65 22 CA

The first to fourth byte define X coordinate, FF F8 57 AD, high byte is F, so the value is negative, result as follows: 0X100000000-0xFFF857AD=0x7A853, converts into decimal 501843, that means X coordinate is -501.843mm.

The fifth to eighth byte defines Y coordinate, the ninth to twelfth byte define Z axis coordinate, the thirteenth to sixteenth byte define C axis coordinate, the seventeenth and eighteenth byte mean CRC check code.

<2> Non-ASCII dynamic data

When visual technique parameter P6-9 is not 12, and value of P6-8 is more than 5, it means dynamic grabbing. The data from visual system includes XYZC position data and shooting time, each position data is 32-bit number, expressed by 4 bytes, including check code, totally 26 bytes(16-byte XYZC+8-byte shooting time+2-byte CRC). for example:

FF F8 57 AD 00 03 C2 65 FF FA F2 09 00 02 7E 65 00 14

The first to fourth byte define X coordinate, FF F8 57 AD, high byte is F, so the value is negative, result as follows: 0X100000000-0xFFF857AD=0x7A853, converts into decimal 501843, that means X coordinate is -501.843mm.

The fifth to eighth byte defines Y coordinate, the ninth to twelfth bytes define Z axis coordinate, the thirteenth to sixteenth bytes define C axis coordinate, the seventeenth to twentieth byte define second of shooting time, the twenty first to twenty fourth byte 0x000A412 define microsecond of shooting time. The twenty fifth and twenty sixth byte are CRC check code.

<3> ASCII data

When visual technique parameter P6-9=12, data will be transmitted by ASCII format, visual system is TCP server, robot controller is TCP guest.

Applying to obtain data from visual system: CAMTRIG

Data format from visual system:

VD(prefix)+X coordinate+space+Y coordinate+space+Z coordinate+space+C coordinate+ED(terminator)

Data is integrate, unit is micrometer or 1/1000 degree.

For example, feedback data is

VD600000 400000 900000 30000ED

Means X 600mm, Y400mm, Z9000mm, C 30 degrees.

Attention:

The data from visual system will be converted into decimal number, if the number is equal or bigger than 999999990(Hex3B9AC9F6), controller will regard data transmission failed, immediately report error or skip to the line specified by P number.

5.3.4 Visual technique sample

Sample1: Grabbing static work piece

G54T1
MOVJ; locate at start point
VS1; invoke visual technique group No.1 to open visual function
N10
VT4; send controlling instruction 4 to visual system, apply for XYZC position data
VD12 P10; save received position data at No.12 point, if received failed, skip to N10.
MOVL PT12 V=120; linearly move to No.12 point specified by PT address
W-12; move down by 12mm
M880; execute user defined M code to grab work piece, output Y22
W12; move up by 12mm
MOVL; move to taught position
M881; execute user defined M code to put work piece down, close Y22
MOVL; move to taught point
GOTO 10; skip to N10 and repeat
VE; close visual function
M02; End

Sample 2: camera is installed on robot which grabs static pieces.

G54 T1

VS1
MOVJ ; position at start point
MOVL ;the first picturing point
N100
VT1 **;**synchronize current coordinate to visual system
VT4 **;**access XYZC position data
N200
VD12 P300 ; if incremental way, then add current coordinate and save in point 12
MOVL PT12 ;move to work piece point
M880 ;grab work piece
MOVL ;move to stack point
M881 ;release work piece
GOTO 200
N300
GO G91 X200 ;next picturing point
GOTO 100
★、502,Adjust the data of position point
Check and adjust received XYZA position data.

5.3.5 Notes of Visual technique

1. before using visual function, we need to calibrate visual system to make sure the coordinate from visual system match with tool TCP point coordinate in current user coordinate;
2. robot controller use VT4 to ask camera to take picture;
3. VD* applies XYZC position date from visual system;
4. visual technique need to cooperate with tracking technique;
5. M880, M881 are macro program instruction, corresponding macro programs are ProgramUser0, ProgramUser1.

Contents of ProgramUser0:

OUT+M352 ;output valid Y22 to grab work piece
RETURN; return

Contents of ProgramUser1：

OUT-M352 ;output invalid Y22 to put work piece do
RETURN; return

Instructions Group:

M330:Y00;	M331:Y01;	M332:Y02;	M333:Y03;	M334:Y04;
M336:Y06;	M337:Y07;	M51:Y08;	M56:Y09;	M49:Y10;
M48:Y11;	M343:Y13;	M344:Y14;	M345:Y15;	M53:Y18;

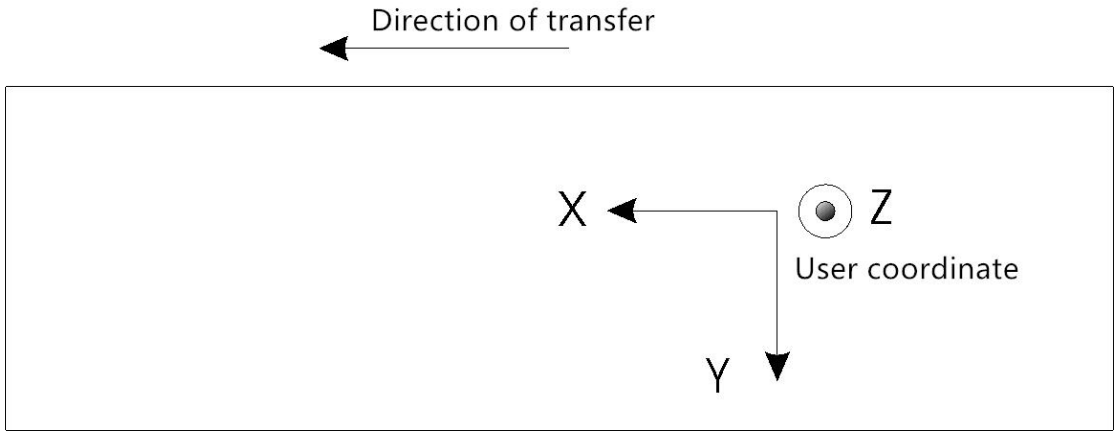
M54:Y19; M50:Y20; M57:Y21; M352:Y22; M353:Y23;
M354:Y24; M355:Y25; M356:Y26; M357:Y27; M231:Y28;
M232:Y29;

5.4 Tracking/Spraying Technique

Tracking/Spraying function requires encoder, robot will track dynamic belt to do real-time grabbing or spraying.

Equipping a proximity switch on conveyor belt, it will be triggered when work piece arrives at camera position,input signal(set by P6-11) will be valid, then camera will take picture.

The definition of user coordinate system as follows: moving direction of conveyor belt is X direction, lifting direction of work piece is Z direction.



5.4.1 Relevant Parameters

★、7-0,Track the group number for the process parameter group[0--3]

The group number invoked by tracking instruction TK*, group number 0-3.

★、7-1,Tracking encoder line number

Pulse number per circle of tracking encoder(resolution).

★、7-2,The tracking encoder rotates around the transmission belt and moves the distance(um)

The distance of conveyor belt in X direction when tracking encoder rotates one circle.

★、7-3,Position point number of XYZC in front of the work piece

Specify the position point number of received XYZC user coordinate, and target X coordinate is current X coordinate. If there is visual system connected, coordinate will be generate from visual system, otherwise it need to be set in advance.

★、7-4,Attract X-to-offset distance(um)

Offset value in the X direction of user coordinate before grabbing work piece.

Attention:

If there is a detection switch for work piece arrival, the offset value is following grabbing,

it should be small;

If there is not detection switch for work piece arrival, the offset value is pursuing grabbing, it should be a little bigger.

★、7-5,Attract Z-to-offset distance(um)

Offset value in the Z direction of user coordinate before grabbing work piece.

★、7-6,Speed to YZC(mm/s)

Speed of locating at YZC before grabbing.

★、7-7,Grasp the M instruction executed by the workpiece(880--889)

Arrive at XYZC position specified by P7-6, immediately execute user-defined M code by P7-7 to grab work piece, this M code just include OUT instruction to output, do not use any waiting instruction. If the application is spraying, it means enable spraying function. For example, if set it as 880, then it will execute ProgramUser0.

★、7-8,The distance of offset along the X after grasping the workpiece(um)

Offset value in the X direction of user coordinate after grabbing work piece.

★、7-9,The distance along the Z when lifting the workpiece(um)

Offset value in the Z direction of user coordinate when lifting work piece.

★、7-10,The distance offset along the X direction when the workpiece is lifted(um)

Offset value in the X direction of user coordinate when lifting work piece.

★、7-11,The input point at which the workpiece arrives is detected[High speed:1000+No.Low speed:2000+No.]

Set the input point to detect work piece arrival, for example, 1041 means detect X41 as work piece arrival. If not set, then controller will detect encoder Z signal as input signal. When set as low speed detecting(2000+No.), detecting time is defined by Process parameter P19, if detecting time over the time in P19, it will alarm.

★、7-12,The X coordinate of the workpiece arriving at the detection switch(um)

when equipped with detection switch, this parameter is used to set the X coordinate of detection switch, and it should include the diameter of work piece. For example, if current coordinate is -50, diameter of work piece is 30, then this parameter should be -80. controller will calculate encoder AB pulse number of belt following movement after arrival of work piece according to this parameter, then robot move.

★、7-13,The distance(um)at which the synchronous X-direction offset is achieved before the workpiece is gripped(um)[>10]

When parameter value is more than 10, it is synchronization method, means before grabbing, robot rapidly moves to position of work piece, then tracking AB signal according to X/Z offset by P7-4/P7-5 and grabbing work piece synchronously.

When parameter value is less than 10, it is waiting method, means waiting for work piece arriving at robot statically, then tracking AB signal according to X/Z offset by P7-4/P7-5 and grabbing work piece synchronously.

If there is no arrival detection signal and P7-13 is more than 10, following parameter is available.

★、7-14,Control of X direction range of grasping workpiece [+2 negative limit;+4 positive limit; 8:alarm]

If D1=1(means +2), parameter P7-15 is valid. When work piece is out of negative limit, robot will waiting for work piece coming into work scope and grab it synchronously.

If D2=1(means +4), parameter P7-16 is valid. When work piece is out of positive limit and D3=1(means +8), controller will prompt alarm and quit program, or process according to TK instruction. if P instruction is attached with TK, then firstly locate at target XYZ position before executing TK, and judge that work piece is out of positive limit, then skip to the line specified by P, if no P, then execute sequentially.

Example:

TK1 P200 means execute TK1 to grab work piece and find it out of work range, locate at target YZC position, then skip to line N200.

★、7-15,Negative limit value of X direction for grasping workpiece(um)

★、7-16,Grasp the positive limit value of the X direction of the workpiece (um)

5.4.2 Tracking instruction: TK* P*

The number* behind TK is tracking group number[0-3]; before using visual function, we need to calibrate visual system to make sure the coordinate from visual system match with tool TCP point coordinate in current user coordinate.

P* means when controller execute TK* to grab work piece, but it is out of work range, robot will locate at target YZC position and skip to P line automatically.

Definition of user coordinate direction: moving direction of conveyor belt is X direction, the direction of lifting work piece is Z axis direction.

There are 2 methods to execute TR* tracking function:

A. The first method is without the detection switch for work piece arrival, this method is usual. The first method applies to following condition:

1. visual function is open;
2. convey belt speed (P6-8) is bigger than 5;
3. parameter P6-10 is valid(example, 1031 means VT instruction output Y31);
4. the shooting time from current time is less than 25seconds.

Execution sequence is as follows:

<1> detect work-piece arrival at camera position according to tracking parameter P6-11, record encoder AB signal/shooting time, saving the received XYZC user coordinate into point specified by P7-3, but X coordinate is current coordinate instead of received X coordinate, then move to target YZC position in the speed of P7-6;

<2> calculate X offset value according current encoder AB data/current time and encoder AB data by VT4/shooting time. There are two methods: encoder AB data or time. Calculating

X offset by encoder AB data is according to P7-1 and P7-2; calculating X offset by time is according to P6-8 speed of convey belt.

If P6-10=1000+number means calculate by AB data, P6-10=2000+number means calculating by time.

<3> according to parameter P7-13, if it is bigger than 10, then synchronic encoder signal move with the offset value, if it is less than 10, then waiting for work piece arriving at robot position;

Synchronic way: P7-13>10, means before grabbing work piece, robot move to work piece position;

Waiting way: P7-13<10, means waiting for work piece arriving at robot position.

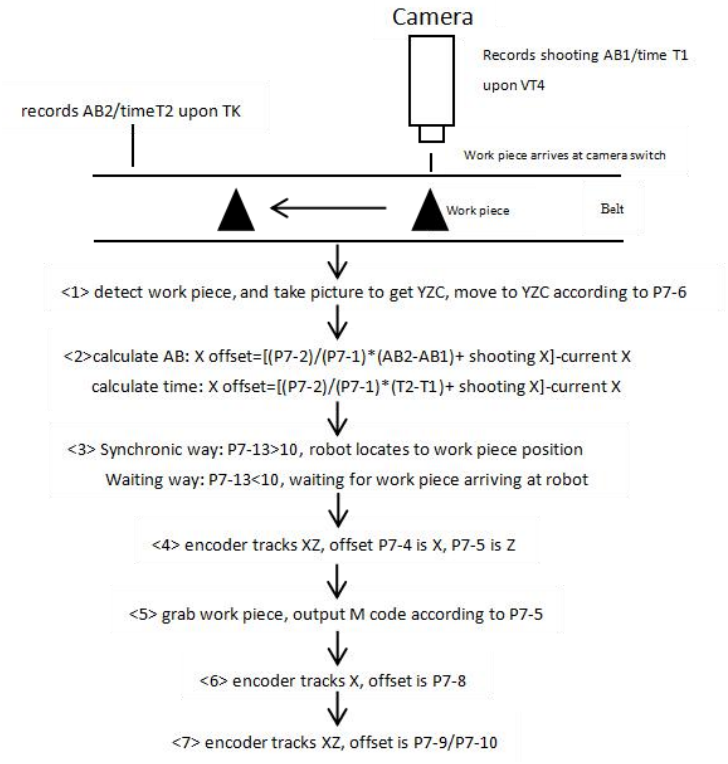
<4> after obtain XZ target position offset value according to Parameter P7-4 and P7-5, then robot moves to XZ offset position. At this moment, running speed is under control of encoder AB signal feedback. In other words, speed of conveyor belt defines moving speed of robot.

<5> arriving at target XZ offset position, robot execute user-define M code by P7-7 to grab work piece, that M code should use OUT to control output, and not include any waiting instruction.

<6> robot keeps moving for a distance in the X direction to track work piece, the distance is defined by P7-8. At this moment,running speed is under control of encoder AB signal feedback,In other words, speed of conveyor belt defines moving speed of robot.

<7> Obtain the work piece,and distance in Z direction is specified by Parameter P7-9; At the same time, distance of distance the robot moves in X direction is specified by Parameter P7-10, to perform lifting work piece diagonally.

<8> Complete the tracking process,the follow chart as bellow:



Note:

1. When there is a visual system, the proximity switch of work piece should be installed behind the visual system, to ensure that the position data XYZC of the current work piece is captured from the photo is transferred to the robot system before the work piece reaches.

2. when execute VT instructions, the output point of parameters P6-10 is valid, camera will take pictures immediately, vision system feedback data to robot, if there is data of work piece, the data will be feedback to the robot, if there is no data of work piece, it will feedback all data equal or greater than 999999990, robot will off the Y output point immediately once received all data that is equal or greater than 999999990 , waiting for 100 milliseconds, then jump back to re-execute the VT instructions and validate Y output point, repeat the above process until the correct work piece position data is received, then continue work piece grabbing action.

To ensure that the shooting time is exactly the effective time of Y output point defined by parameter when executing VT instructions, otherwise the distance to grab work piece may be inaccurate during grasping.

3. The way to grab multiple work pieces by one-time photo, after settle down the first work piece, position robot to the middle point, and jump to the VD instruction again to read data. If there is data, continue to grab the work piece downward. If not, then automatically jump to VT instruction and require to send pictures and data from the visual system again.

when capturing multiple work piece, parameter P6-4 should be set as small as possible at once, and validate P7-13, absolute value set P7-13>10.

Execute VT instruction once, the visual system feedback position data should be one more than the actual number position that contains full 999999990 to indicate the end. For example, if there is only one work piece, the visual system should send two work pieces data.The second work piece data showing 999999990 indicates there has no second work piece; If there are two work pieces and the visual system would be better send three work piece data as well, the third work piece data that is all 999999990 indicates there is no the third work piece. This makes it easier for the robot system to quickly jump from VD instructions to VT instructions efficiently, otherwise the robot system will wait for a period of time.

What's more, during the automatic execution of VT in the background, the work piece position data including full 99999990 means the photo data transmission is finished this time, following data is the next photo, in order to easily reset encoder AB pulse counting for controller.

It is better for the visual system to send the position data of multiple work piece in the X axis direction in order from large to small according to a single photo, so as to facilitate the robot to grasp in order from near to far. The moving direction of the transmission belt is the positive direction of X axis.

B. **The second method is with work piece arriving signal,** which requires the switch signal for the work piece reaching the position of robot(parameter P7-11 sets the input point, and user parameter P19 is the low-speed detection time), this method is complicated and not recommended. The following three cases are suggested to choose A method:

    1. When the visual function is off;

    2. When the absolute value of convey belt speed is less than or equal to 5 (P6-8 <5);

    3. When the visual function "VT instruction simultaneously valid output point [1000+ no.]" parameter was not set (P6-10<1000).

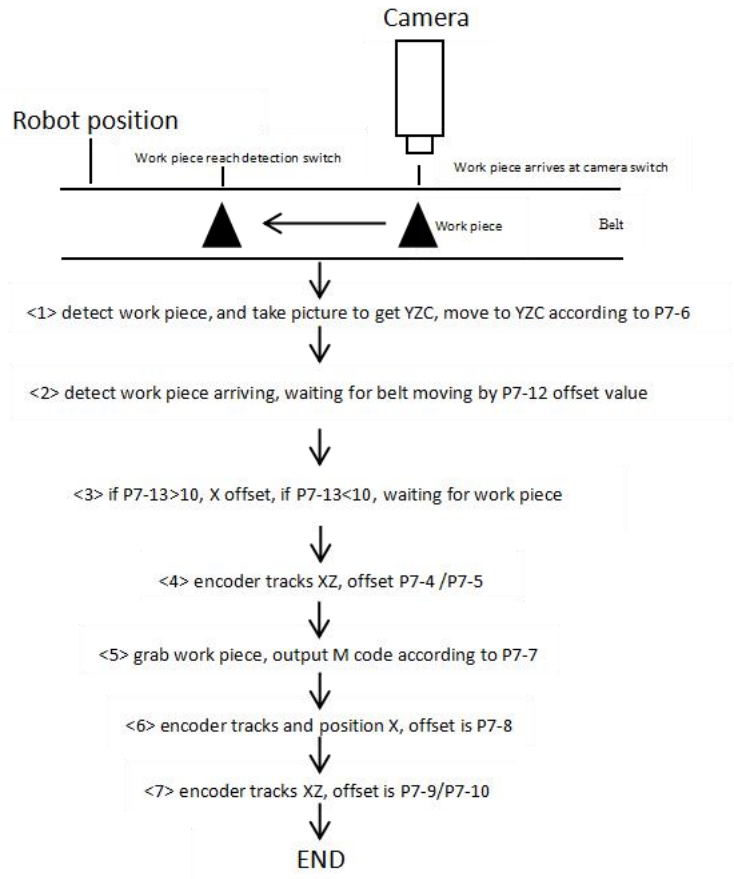
The actions sequence is as follows:

<1>. the same as (A)

<2>. According to parameters P7-12, after detecting work piece reach robot position (set the input point in parameter P7-11, user parameters P19 is low-speed detection time), robot will waiting for the conveyor belt moving for a certain distance (actually wait for detecting encoder AB signal pulse number), and during this period, robot will keep still;

<3>.<4>.<5>.<6>.<7>. same way as method (A)

<8>. Complete the tracking process.The flow chart is as follows:



Note:

1. When there is a visual system, the proximity switch of work piece should be installed behind the visual system, to ensure that the position data XYZC of the current work piece is captured from the photo is transferred to the robot system before the work piece reaches.
2. Method B and method A are only different at step <2>, and the rest steps are the same.

5.4.3 Tracking/Spray technique examples

1. Example 1: to track and grab without visual system

Tracking technique parameters Group:

P7-0 = 1; Parameter group 1

P7-1 = 1200;Encoder line number 1200

P7-2 = 10000; each turn of Encoder is 10mm

P7-3 = 12;Grabbing coordinate point of the work piece saved in the 12th point of the point position data (can be taught);

P7-4 = 50000; X offset before grabbing work piece

P7-5 = - 10000; Z offset before grabbing work piece

P7-6 = 120; The speed to the target YZC is 120mm/s

P7-7 = 880; execute M880 to grab work piece

P7-8 = 10000; X offset after grabbing the work piece

P7-9 = 10000; Z offset after lifting work piece
P7-10 = 15000; X offset after lifting work piece
Examples of application:

```
G54T2
MOVJ        ;Locate at the starting point
MOVL        ;move above the fixed point and wait to grab
TK1         ;Execute tracking function
MOVL        ;Move to teaching position
M881        ;Drop the work piece (Parameter 7-7=880)
MOVL        ;Move to teaching position
M20         ;Repeat program
```

2. Example 2: with visual system, track and grab the work piece (detect the signal of the work piece reaching the photo spot) for palletizing, ASCII format. The system send VT4 photo command once and receive VD12 command(XYZC). If the data cannot be received within defined 5 seconds, then repeat VT4 photo command.

(a) Visual technique parameters group:
P6-0 = 1; Parameter group 1
P6-1 = 6; Network TCP
P6-2 = 43012; Network port number
P6-4 = 1000; If no data received within 1 second, resend the instruction
P6-5 = 0; X direction offset (um)
P6-6 = 0; Y direction offset (um)
P6-7 = 0; Z direction offset (um)
P6-8 = 3000; the transmission belt speed in dynamic grabbing
P6-9 = 12; ASCII format
P6-10 = 1031; Output photo signal Y31
P6-11 = 1041; Signal X41 used to detect arrival of work piece at the photo point
(b) Tracking technique parameters group:
P7-0 = 1; Parameter group 1
P7-1 = 1200; Encoder line number 1200
P7-2 = 10000; Encoder each turn is 10mm
P7-3 = 12; Grabbing coordinate point of the work piece saved in the 12th point of point position data (can be taught);
P7-4= 50000; X offset before grabbing work piece
P7-5= - 10000; Z offset before grabbing work piece
P7-6= 120; The speed to reach the target YZC is 120mm/s;
P7-7= 880; execute M880 to grab work piece
P7-8= 10000; X offset after grabbing work piece
P7-9= 10000; Z offset after lifting work piece

P7-10= 15000; X offset after lifting work piece

P7-13=-80000; Synchronous mode, robot reach the work piece position rapidly

Example program:

```
G54T2
PR5     ;Reset stack data
MOVJ    ;Locate at the starting point
VS1     ;Call the first group of parameters to enable visual function
N100
VT4     ;Send control command 4 to the visual system and output Y31 photo signal
N200
VD12 P100 ;Access XYZC, if no data within 1 second or receive the end data, then
    jump to N100
TK1     ;Execute track function
MOVJ    ;Move to position where work piece places
PA5     ;palletize work piece, use M881 to place work piece
MOVJ    ;Position at intermediate point
IF [# 9005 GE0] GOTO200 ;if stack is not finished, and there are more than one work
                        piece data, then grab work piece again
VE
M02
```

3. Example 4: Spraying technique without visual system

```
G54T2
MOVJ        ;Locate the starting point
MOVL        ;move above the fixed point and wait for spraying
TK1         ;Executive tracking function
MT K_ U_    ;Tracking spraying, K is the moving distance (mm) of transmission
```

belt with one turn of encoder, and U is spraying distance (mm) along the X direction.

```
M881        ;Turn off spraying (set M880 in parameter group 7-7)
MOVL        ;Move to teaching position
M20         ;repeat program
```

5.5 Stamping Technique

There are 2 methods to exchange data in stamping technique of this controller. The first mode is through the I/O point data, which is the most widely used in the world, it features good real-time performance, high transmission rate, strong anti-interference ability, stability and reliability, but complicated wiring. The second one is communicate through the network, then

the complexity of IO points connection will be reduced and to make it be simple.The user can choose these 2 methods according to the actual situation.

5.5.1 I/O Communication Mode in Stamping Technique

(I) Relevant parameters

1. Other parameter P330(11 means welding; 12 means palletizing; 13 means spraying; 14-18 means stamping: 14 single machine; 15 first machine; 16 not the first machine; 17 Standby; 18 one match double)

Set as 14-18 means the system controls the stamping robot. After setting it as 14-18, go to program interface, there is the menu of "Module" at the bottom. Click it and a dialog box will pop up, input value according to information, press the Enter to generate the corresponding program from template.

2. Other parameter P22=0;

3. When User parameter P4=-1, the first stamping robot (Other parameter P330=14) clicks the "Single" or "Endless" button on the right side of the screen in the auto mode, all subsequent robots will change into "Single" or "Endless" circle.

4. User Parameter P23=12.

(Ⅱ) template program

Under the program interface, there is the menu of "Module" at the bottom. Click it and a dialog box will pop up. The corresponding program can be generated from the program template.

The name of program generated from module automatically will be marked with "-mould-". The filename with "-mould-" means that the program created by the template. Program will not automatically insert a line when it records a coordinate point in middle line, but only records the coordinate point in the current line and retains all the original annotations.

Stamping moving(palletizing) template program: HIDEFILE-PRESS-MOVE.TXT

Stamping single machine template program: HIDEFILE-PRESS-SOLO.TXT

Stamping feeding template program: HIDEFILE-PRESS-UP.TXT

Stamping blanking template program: HIDEFILE-PRESS-DOWN.TXT

Stamping one with two template program: HIDEFILE-PRESS-DOUBLE.TXT

These five template program can be modified according to actual needs. Only when press "F" to enter the controller factory password to show it, then can it be modified.

(1) HIDEFILE-PRESS-MOVE.TXT

G54T1;Enter into coordinate system G54 and tool T1

No record, please teach; move to standby point

M1076;/WAT+M76/WAT+X14; wait for the previous controller allowing pickup

M1070;WAT+X28; waiting for valid dead point on picking machine.

No record, please teach; move to the point above picking point

No record, please teach; move to picking point

M03; pick the work piece
M1079;/WAT+X35, waiting for picking successful
No record, please teach;move to the point above picking point
No record, please teach;go to material safety point
M3077;OUT+M77, clear the no feeding sign of the previous controller
No record, please teach; move to standby point for feeding
M2078;WAT-M78, waiting for allowing feeding
M1071;WAT+X29, waiting for valid dead point on feeding machine
No record, please teach; move to the point above feeding point
No record, please teach; move to feeding point
M04; feeding
M2079;WAT-X35, waiting for discharging successfully
No record, please teach; move to the point above feed point
No record, please teach; move to stamping safety point
M08; Open the stamping
G04P5000; pause for 0.5 seconds
M1071;WAT+X29, waiting for valid dead point on feeding machine (stamping is completed)
M09; Close stamping
M3078; OUT + M78;Set up material mark on punch machine (no feeding)
/ M20; repeat program
(2) HIDEFILE - PRESS - SOLO. TXT
(3) HIDEFILE - PRESS - UP. TXT
G54T1; Enter into coordinate system G54 and tool T1
No record, please teach; move to standby point
No record, please teach; move to the point above picking point
No record, please teach; move to picking point
M03;pick the material
M1079;WAT+M79/WAT+X35 wait for picking successfully
No record, please teach;move to the point above picking point
No record, please teach;go to material safety point
No record, please teach; move to standby point for discharging
M2078;WAT - M78;Wait for allowing picking
M1071;WAT+M71/WAT+X29 waiting for valid dead point on feeding machine
No record, please teach; move to the point above feeding point
No record, please teach; move to feeding point
M04;feeding
M2079;WAT-M79 / WAT-X35 wait for feeding successfully
No record, please teach; move to the point above feeding point
No record, please teach; move to stamping safety point

M08; start the stamping
G04P5000;pause for 0.5 seconds
M1071;WAT+M71/WAT+X29 waiting for valid dead point on the feeding machine (stamping completed)
M09; Close the stamping
M3078;The OUT + M78; Set up material mark on punch press (no feeding)
/ M20; repeat program
(4) HIDEFILE - PRESS - DOWN. TXT
G54T1; Enter into coordinate system G54 and tool T1
No record, please teach; move to standby point
M1076;M76 / WAT WAT + + X14;Wait for the previous controller allowing pickup
M1070;WAT+M70/WAT+X28 waiting for valid dead point on picking machine
No record, please teach; move to the point above picking point
No record, please teach; move to picking point
M03;pick the material
M1079;WAT+M79/WAT+X35 wait for picking successfully
No record, please teach;move to the point above picking point
No record, please teach;go to material safety point
M3077;The OUT + M77; clear the no feeding sign of the previous controller
No record, please teach; move to standby point for feeding
No record, please teach; move to the point above feeding point
No record, please teach; move to feeding point
M04; feeding
M2079;WAT-M79 / WAT-X35 wait for feeding successfully
No record, please teach; move to the point above feeding point
/ M20; repeat program
(5) HIDEFILE - PRESS - DOUBLE. TXT

(Ⅲ) definition of input and output

1. Auxiliary relay

M53 picking, instruction M03/M05, output Y18;
M54 feeding, instruction M04/M05, output Y19;
M48 stamping, instruction M08/M09, output Y11;
M49 stamping 2, instruction M10/M11, output Y10;
M50 prohibit stamping, instruction M59/M58, output Y20;
M51 prohibit stamping 2, instruction M32/M33, output Y08;
M70 picking dead point and input X28;
M71 feeding dead point and input X29;
M72 single mode, input X32;

M73 dead point 2(one with two), enter X33;
M74 single mode 2(one with two), enter X34;
M79 chuck with material, input X35;
M76 valid means allows current robot to pick (invalid means forbid to pick), input X14;
M77 valid means remove no feeding marks M78 of previous controller, output Y26.
M78 invalid means allows the current machine to feed materials (valid prohibit feeding), and output Y27.
M56/M57/M58/M59 means the information code sent to the next controller, and output Y28/Y29/Y30/Y31.
M60/M61/M62/M63 means the information code received from the previous controller, output X36/X37/X38/X39.

2. Output signal

M03/M04/M05 pick/feed/close instruction (spraying on/off), output Y18/Y19;
M08/M09 Stamping start/stop, output Y11;
M10/M11 Stamping 2 start/stop, output Y10;
M59/M58 Stamping forbidden/allowed, output Y20;
M32/M33 Stamping 2 forbidden/allowed, output Y08;
Y12 emergency stop output;
Y26 clear the no-feeding sign of previous controller. When it is effective, remove the no-feeding sign Y27 on the previous controller and connect with the previous controller X15.
Y27 no-feeding sign, when invalid, allow the current machine to feed materials (effectively prohibit feeding). when valid, allow next machine to pick materials (invalid prohibited blanking), and connect with X14 on next controller;
Y28-Y31 The code of command information sent by the first machine to the non-first machine;

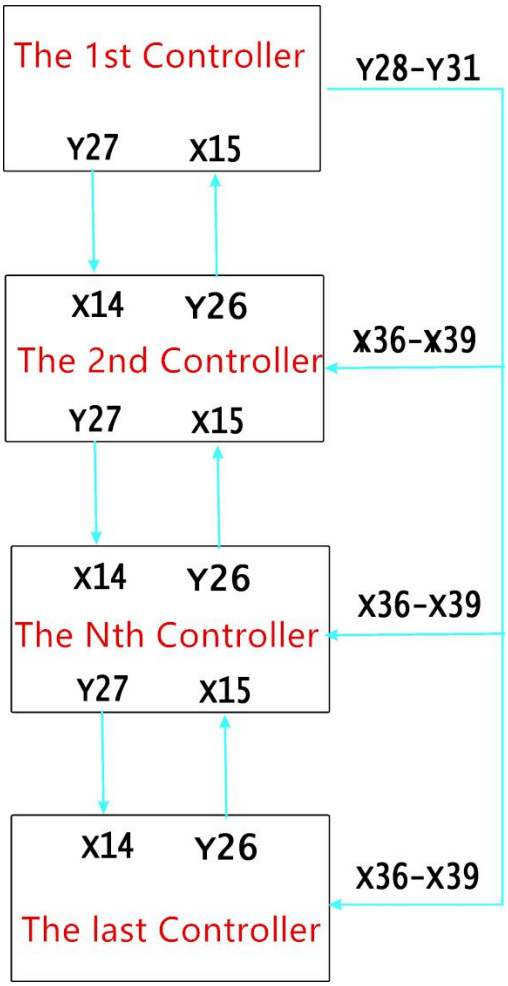
3. Input signal

X19 external emergency stop input;
X28 Dead point input on picking punch machine;
X29 dead point input on feeding punch machine;
X32 single mode signal input of punch machine;
X33 dead point input on punch machine 2(for one with two mode);
X34 single mode signal input on punch machine 2(for one with two mode);
X35 detection input of chuck with material;
X14 allow picking mark, allows the current machine to pick when it is valid (invalid forbidden material picking), and connect with previous controller outputs Y27.

X15 clear the no-feeding sign and connect next controller Y26. if valid, clear the no-feeding sign Y27;

X36-X39 the non-first machine to receive command information code from the first machine.

4. Signal control process



(1) signal exchange between the current controller and the previous controller (the first controller does not have such signal exchange) :

When X14 is valid, the current controller is allowed to pick materials(if invalid then forbidden to pick materials), and connect with outputs Y27 of previous controller.

When Y26 is valid, remove the no-feeding mark Y27 of the previous controller, and connect with X15 of previous controller;

(2) signal exchange between the current controller and the next controller (there is no such signal exchange in the last controller) :

When Y27 is invalid, current controller is allowed to feed materials from(if valid then prohibited to feed materials), and then connect with X14 of next controller.

When X15 is valid, remove the no-feeding signal Y27, and connect with Y26 of next controller;

(3) wiring requirements between the current controller and previous/next controller:
The current controller X14 is connected to the last controller Y27, and the current controller Y26 is connected to the previous controller X15;
The current controller X15 is connected to the next controller Y26, and the current controller Y27 is connected to the next controller X14;
(4) signal transmission between the first controller and all following controller:
The first controller Y28-Y31 corresponds to X36-X39 of following controllers respectively, which is used to transmit operation information like Start, Pause, Reset and other.
Signal definition is as follows: 3 means single cycle; 4 means endless cycle; 5 means Start; 6 means Pause ; 7 means Reset. When switching "single cycle", "endless cycle", "Start", "Pause", "Reset" and other operations on the first controller, all the following robots will receive the same instruction information.
Note:
After restart, it is necessary to ensure that there is no material on all punch machine before on-line operation, because after restart, all the controller's material mark(no-feeding sign)M77/M78 is invalid.

5.5.2 Network Communication Mode in Stamping Technique

(I) relevant parameters

1. Other parameter P330(11 means welding; 12 means palletizing; 13 means spraying; 14-18 means stamping: 14 single machine; 15 first machine;
16 not the first machine; 17 Standby; 18 one match double)

Set as 14-18 means the system controls the stamping robot. After setting it as 14-18, go to program interface, there is the menu of "Module" at the bottom. Click it and a dialog box will pop up, input value according to information, press the Enter to generate the corresponding program from template.

2. Other parameter P22=0;
3. When User parameter P4=-1, the first stamping robot (Other parameter P330=14) clicks the "Single" or "Endless" button on the right side of the screen in the auto mode, all subsequent robots will change into "Single" or "Endless" circle.
4. User Parameter P23=12.
5. Other parameter P500, Internet[0 means off, 1means on, 8 means start automatically, 40 means open OPC function, 552 means Stamping process adopts network communication], set as 552;

For the three or more robot systems network connection, they are connected to be a LAN through network switch. And PC is unnecessary in the LAN. The first three numbers of the IP address of parameter P502 in each controller should be the same, and the last number should be set according to the stamping order.
For example, the first controller is set as 192.168.0.1. then following controller should be:

192.168.0.2
192.168.0.3
192.168.0.4
192.168.0.5

For the two controller network, no need network switch, they can be directly connected by standard network cable.

Refer the following method to test the network. Press "P" in Diagnosis interface and input IP address to perform the Ping function.

Every control system in LAN can Ping another robot system.

Besides, when P500=552, press 9 in diagnosis interface, then input according to prompt information to send button auxiliary relay M1001 -M1127 to check communication. For example, press 9, then input 2 and input 1005, it will enable the Start button of the 2nd controller; send M3xxx or M4xxx to validate or invalidate corresponding relays. For example, press 9, input 3 and input 3078, then M78 of the 3rd controller will be valid, if input 4078, M78 will be invalid.

(Ⅱ) Template program, same as 5.5.1 (Ⅱ)

(Ⅲ) Definition of input and output

1. Auxiliary relay

M53 picking, instruction M03/M05, output Y18;
M54 feeding, instruction M04/M05, output Y19;
M48 stamping, instruction M08/M09, output Y11;
M49 stamping 2, instruction M10/M11, output Y10;
M50 prohibit stamping, instruction M59/M58, output Y20;
M51 prohibit stamping 2, instruction M32/M33, output Y08;
M70 picking dead point and input X28;
M71 feeding dead point and input X29;
M72 single mode, input X32;
M73 dead point 2(one with two), enter X33;
M74 single mode 2(one with two), enter X34;
M79 chuck with material, input X35;
M76 valid means allows current robot to pick (invalid means forbid to pick)；
M77 valid means remove no feeding marks M78 of previous controller；
M78 invalid means allows the current machine to feed materials (valid prohibit feeding).

2. Output signal

M03/M04/M05 Pick/feed/close instruction (spraying on/off), output Y18/Y19;
M08/M09 Stamping start/stop, output Y11;
M10/M11 Stamping 2 start/stop, output Y10;
M59/M58 Stamping forbidden/allowed, output Y20;

M32/M33 Stamping 2 forbidden/allowed, output Y08;

Y12 Emergency stop output;

3. Input signal

X19 External emergency stop input;

X28 Dead point input on picking punch machine;

X29 Dead point input on feeding punch machine;

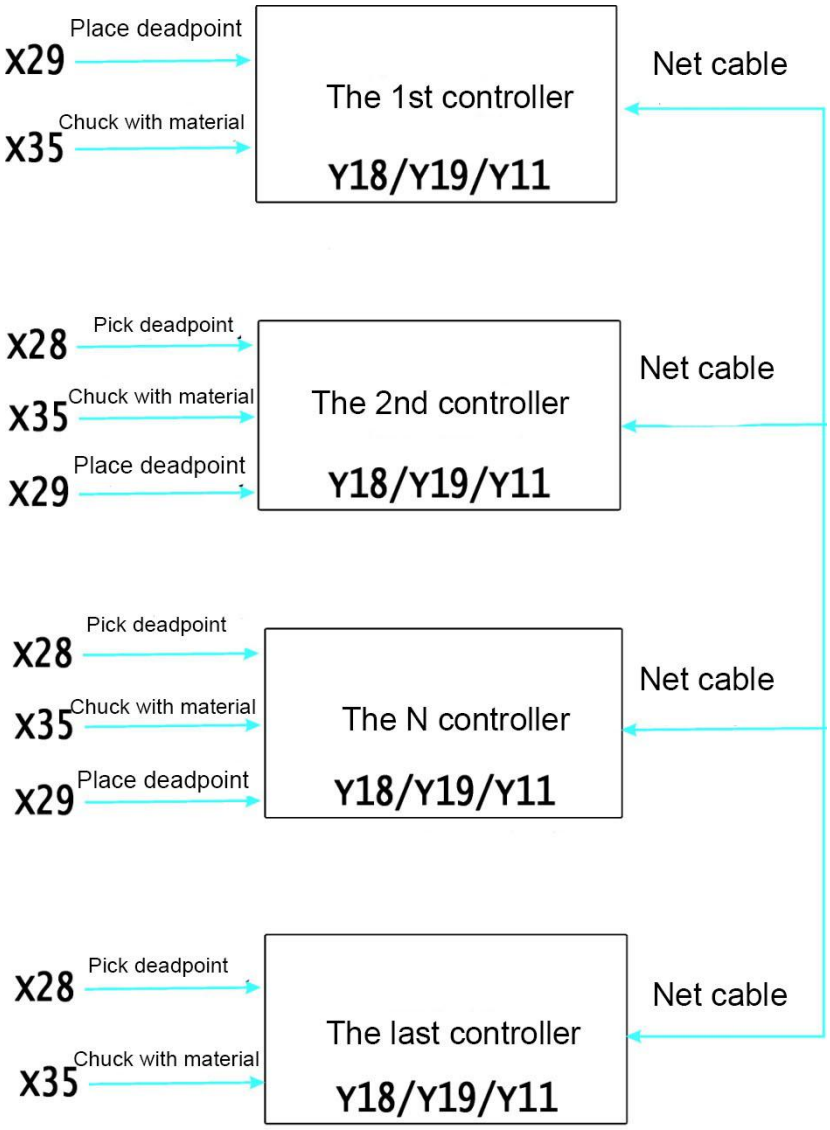
X32 Single mode signal input of punch machine;

X33 Dead point input on punch machine 2(for one with two mode);

X34 Single mode signal input on punch machine 2(for one with two mode);

X35 Detection input of chuck with material;

4. Signal control process



(1) signal exchange between the current controller and the previous controller (the first controller does not have such signal exchange) :

When executing M3077, controller will automatically send instruction to previous controller, to invalidate M78 auxiliary relay of previous controller.

(2) signal exchange between the current controller and the next controller (there is no such signal exchange in the last controller) :

When executing M3078, controller will automatically send instruction to next controller, to validate M76 auxiliary relay of next controller.

(3) signal transmission between the first controller and all following controller:

When switching "single cycle", "endless cycle", "Start", "Pause", "Reset" and other operations on the first controller, all the following robots controller will receive the same instruction information.

Note:

After restart, it is necessary to ensure that there is no material on all punch machine before on-line operation, because after restart, all the controller's material mark(no-feeding sign)M77/M78 is invalid.

5. Manual operation

(1) operation mode

In the 1st controller(Other parameter P330=14), press “Single ”/“Endle” of screen right part in auto mode, the following controllers will change at the same time.

(2) pick and place material

Press “Getup/Putdn” in screen left part, then press “S↑” means pick, “S↓” means put down.

6. Program command

(1) M3000-M3135 L1001-L1255 means validate the auxiliary relay M0-M135 of controller whose IP address corresponds to L1001-L1255 in LAN;

Example: M3078 L1024 means validate M78 of controller whose IP address is 24 in LAN.

M3071 L1255 means validate M71 of all controller in LAN. (L1255 means broadcast).

(2) M4000-M4135 L1001-L1255 means means invalidate the auxiliary relay M0-M135 of controller whose IP address corresponds to L1001-L1255 in LAN;

(3) M3001-M3127 L2001-L2255 means means validate the key auxiliary relay M1001-M1127 of controller whose IP address corresponds to L2001-L2255 in LAN;

Example: M3005 L2024 means activate “Start” button of controller whose IP address is 24 in LAN.

M3001 L2255 means stop program of all controller in LAN.(L2255 means broadcast).

(4) M3077: reset M78 invalid in last controller; and also invalidate M76 and M77 of current controller.

(5) M3078: reset M76 valid in the next controller.

Chapter 6 PLC

6.1 Function of PLC

The control system enables PLC function. It can manage all I/O ports, online logic judgment of internal auxiliary relay and count through programmable I/O, auxiliary relay and timer to detect input port and control output port and date communication with core.

Edit PLC：

①Edit PLC on controller directly；

②Edit PLC on PC（Use the PLC software of NEWKER-CNC which is NEWKER-PLC.EXE, open PLC.LAD file could be edited； After editing and saving, then lead into controller will be fine, there are 3 files: (PLC.LAD) ,(PLC.PLC), (PLC-NOTE).Then restart controller will be fine.

Execute instruction: Table of instruction

Memory of program: 10000 steps

Execute cycle: Super high-speed is 2ms, high-speed is 8ms, low-speed is 100ms

Mode: Sequence①、Cycle②

Basic: Inner relay、Timer、Counter、Input relay X、Output relay Y

Note:

① Sequential execution refers to PLC execution perform the files of instruction table step by step.

② Loop execution refers to PLC executes from the start to the end of table. It will execute from the start of table again after finished table once.

Pay attention：

1）,Input X0-X47. X0-X7 and X40-X47 could be 0V effective, also could be 24V effective (Select by pin of connection board), X8-X39 is 0V effective.

2）, Output Y0-Y31, 0V effective.

6.2 Inner relay M of PLC

	Code	Function	Note
1	M00	Forbid feeding	Forbid feeding of each axis(input) when this relay is effective

2	M01	Teach	When controller is in teaching status, this relay is effective(status)
3	M02	Just start	When controller just start, this relay is effective(status)
4	M03	Forbid PLAY	Forbid program PLAY when this relay is effective(input)
5	M04	Emergency	Emergency when it is effective(input)
6	M08	Feeding	The relay is effective when axis is feeding
7	M10	Open protection door	Protection door opens when this relay is effective(input)
8	M12	Alarm	This relay is effective when emergency or driver alarm or limited or user-defined (Input)
9	M22	Output run	The relay is effective when controller is in PLAY(output)
10	M23	Output alarm	The relay is effective when controller alarm(output)
11	M26	M01	When got M01, then this signal is pause effective(Input)
12	M32	Driver alarm of J1	Driver of J1 is alarm when this relay is effective.(Input)
13	M33	Driver alarm of J2	Driver of J2 is alarm when this relay is effective.(Input)
14	M34	Driver alarm of J3	Driver of J3 is alarm when this relay is effective.(Input)
15	M35	Driver alarm of J4	Driver of J4 is alarm when this relay is effective.(Input)
16	M36	Driver alarm of J5	Driver of J5 is alarm when this relay is effective.(Input)
17	M314	Driver alarm of J6	Driver of J6 is alarm when this relay is effective.(Input)
18	M315	Driver alarm of Xs	Driver of Xs is alarm when this relay is effective.(Input)
19	M316	Driver alarm of Ys	Driver of Ys is alarm when this relay is effective.(Input)
20	M38	Run（）	In the progress of PLAY, it will execute the program in “()” when this relay is effective.(Input)

21	M39	Alarm of spindle	Spindle is alarm when this relay is effective.(Input)
22	M44	Cooling overload	Cooling overload of motor will be alarm when this relay is effective.(Input)
23	M45	Cooling liquid	Cooling liquid will be alarm when this relay is effective.(Input)
24	M46	Lubrication overload	Lubrication overload of motor will be alarm when this relay is effective.(Input)
25	M47	Lack of lubricating	Lack of lubricating will be alarm when this relay is effective.(Input)
26	M48	Cooling	Execute cooling when this relay is effective. (output, Use M08/M09 to control)
27	M51	Lubrication	Execute Lubrication when this relay is effective. （output, Use M32/M33 to control ）
28	M53 M54 M55 M231 M232	Stop rotate CW and CCW of the first spindle Rotate CW and CCW of the second spindle	Spindle rotate CW and CCW when this relay is effective. (output , could use M04/M03/M05/M203/M204 to control)
29	M55	Spindle stop	Spindle rotate CW when this relay is effective.(output, could use M05/M03, M04 to control.)
30	M59	Output of user-defined	Correspond to M61/M60（output）
31	M63	Output of user-defined	Correspond to M63/M62（output）
32	M52	Output of user-defined	Correspond to M65/M64（output）
33	M60	Output of user-defined	Correspond to M67/M66（output）
34	M105	Output of user-defined	Correspond to M69/M68（output）
35	M56	Output of user-defined	Correspond to M71/M70（output）

36	M57	Output of user-defined	Correspond to M73/M72（output）
37	M50	Output of user-defined	Correspond to M59/M58（output）
38	M61	Output of user-defined	Correspond to M79/M78（output）
39	M49	Output of user-defined	Correspond to M11/M10（output）
40	M80-M95	User-defined No.0-No.15 alarm	The controller will be alarm correspond to PLC.(Input)
41	M114	Remote run	Run program when this relay is effective. (Input) Use external RUN button.
42	M115	Remote stop	Strop program when this relay is effective.(Input) Use external HALT button.
43	M122	Run program	Program will run automatically when this relay is effective(Status)
44	M123	Program pause	Program will be pause when this relay is effective(Status)
45	M128	Stop J1	Stop J1 when it is effective.(Input)
46	M129	Stop J2	Stop J2 when it is effective.(Input)
47	M130	Stop J3	Stop J3 when it is effective.(Input)
48	M131	Stop J4	Stop J4 when it is effective.(Input)
49	M132	Stop J5	Stop J5 when it is effective.(Input)
50	M318	Stop J6	Stop J6 when it is effective.(Input)
51	M319	Stop Xs	Stop Xs when it is effective.(Input)
52	M320	Stop Ys	Stop Ys when it is effective.(Input)
53	M200	Running status	X move positive
54	M201	Running status	X move negative
55	M202	Running status	Y move positive
56	M203	Running status	Y move negative
57	M204	Running status	Z move positive
58	M205	Running status	Z move negative
59	M206	Running status	A move positive
60	M207	Running status	A move negative
61	M208	Running status	B move positive
62	M209	Running status	B move negative
63	M210	Running status	C move positive

64	M211	Running status	C move negative
65	M212	Running status	Xs move positive
66	M213	Running status	Xs move negative
67	M214	Running status	Ys move positive
68	M215	Running status	Ys move negative
69	M824	Status of backed to zero	X backed to zero already
70	M825	Status of backed to zero	Y backed to zero already
71	M826	Status of backed to zero	Z backed to zero already
72	M827	Status of backed to zero	A backed to zero already
73	M828	Status of backed to zero	B backed to zero already
74	M829	Status of backed to zero	C backed to zero already
75	M830	Status of backed to zero	Xs backed to zero already
76	M831	Status of backed to zero	Ys backed to zero already
77	M265		Press Reset, M265 is effective, from NC layer to PLC layer, need use PLC to reset the relay.
78	M282--M289	Bus type connection	Connection status of number 1-8, normal when effective(Status)
79	M290-M297	User-defined	Execute corresponding motion when the relay is effective according to PLC (Input/Output)
80	M298--M313	User-defined	Execute corresponding motion when the relay is effective according to PLC, status could be saved after power off (Input/Output)
81	M317	Be ready	Effective when controller is ready(Status)
82	M321 M325 M329	User-defined	Execute corresponding motion when the relay is effective according to PLC (Input/Output)
83	M330--M377	User-defined	Use M3330/M4330-M3377/M4377 to control; Execute corresponding motion when the relay is effective according to PLC (Input/Output)
84	M999		High-speed or super high-speed of PLC before

85	M1014		Reset emergency, lower the speed
86	M1050		Automatically status when it is effective
87	M1069		Manual status when it is effective
88	M801		Manual home mode
89	M803		Trial running mode(during programming)

6.3 Function module of PLC

6.3.1 Counter, timer

Total 16 account(C0-C15), 80 timer(T1-T79),normal 10ms timer is T0---3,T16---31；10ms totalizer is T4---7 ,T32---47; normal 1s timer is T8---11 ,T48---63； 1s totalizer is T12---15,T64---79.

6.3.2 Basic

1、--[/]: [Basic instruction]:Negation of output winding

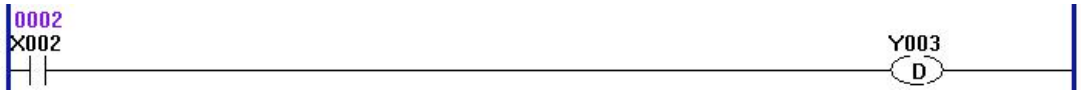
Y00 output signal when X00 is invalid.

Y00 is invalid when X00 is effective.

2、--[U]: [Basic instruction]:Up along output winding

Output Y02 when X01 is invalid to effective.

3、--[D]: [Basic instruction]:Down along output winding



Output Y03 when X02 is effective to invalid.

4、-- [US]:[Basic instruction]:Up along setting winding

Setting Y04 when X03 is invalid to effective.

5、-- [DS]: [Basic instruction]:Down along setting winding

Setting Y05 when X04 is effective to invalid.

6、-- [UR]:[Basic instruction]:Up along reset winding

Reset Y06 when X05 is invalid to effective.

7、-- [DR]: [Basic instruction]:Down along reset winding

Reset Y07 when X06 is effective to invalid.

6.3.3 Definition of logic calculation

Pay attention:1、Parameter C is always address.

2、Range of constant is 0---255.

1、CMP: Comparation of data

Conditions:

0 means 8 bits data, parameter A and B are both address;

1 means 16 bits data, parameter A and B are both address;

2 means 8 bits data, parameter A is address, parameter B is constant;

3 means 16 bits data, parameter A is address, parameter B is constant;

4 means 8 bits data, parameter A is constant, parameter B is address;

5 means 16 bits data, parameter A is constant, parameter B is address;

8 means parameter A and B are both constant.

Rules:

When parameter A>B, evaluation C(low 3 bits) is 1;

When parameter A=B, evaluation C(low 3 bits) is 2;

When parameter A<B, evaluation C(low 3 bits) is 4.

Example 1:

When condition is 0, parameter A and B are both address.

When X10 is effective, parameter A= 01000101, parameter B=00010010, A>B and evaluate R103, if R103 is 0, then R103=00000001 after evaluating.

Example 2:

When condition is 1, parameter A and B are both address.

When X10 is effective, parameter A= 000001011010000,parameter B=0000010110100000, A>B and evaluate R103, if R103 is 0,then R103=000000000000001 after evaluating.

2、MOV: Movement for data

Conditions:

0 means 8 bits data, parameter A and B are both address;

1 means 16 bits data, parameter A and B are both address;

2 means 8 bits data,parameter A is address, parameter B is constant;

3 means 16 bits data,parameter A is address, parameter B is constant;

Rules:

Evaluate parameter B to A, parameter A is always address.

parameter A is address, parameter B is constant.

When X03 is effective, parameter B=7, also 00000111, then R105=00000111 of parameter A.

3、BIT: Bit calculation

Condition: Consist 2bits.

Left bit:

1 means and;

2 means or;

3 means exclusive or;

4 means not. Evaluate A not and to C, no relative with B.

5 means move left.

6 means move right.

Right bit:

0 means 8 bits data, parameter A and B are both address;

1 means 16 bits data, parameter A and B are both address;

2 means 8 bits data, parameter A is address, parameter B is constant;

3 means 16 bits data, parameter A is address, parameter B is constant;

4 means 8 bits data, parameter A is constant, parameter B is address;

5 means 16 bits data, parameter A is constant, parameter B is address;

8 means parameter A and B are both constant.

Example: Condition is 305 means: 16bits data and exclusive or,A is constant, parameter B is address.

Rules:

（1）And: Parameter C = (Parameter A & Parameter B).

When M77 is effective, condition is 10, means and,parameter A and B are both address.

When address of parameter A 10=10000111, address of parameter B 12=01100001, address of parameter C 15=00000001.

（2）Or: Parameter C = (Parameter A | Parameter B).

When M77 is effective, condition is 20, means or, parameter A and B are both address.When address of parameter A 10=10000111, address of parameter B 12=01100001, address of parameter C 15=11100111.

（3）Exclusive or: Parameter C = (Parameter A ^ Parameter B).

When M77 is effective, condition is 30, means exclusive or, parameter A and B are both address.When address of parameter A 10=10000111, address of parameter B 12=01100001, address of parameter C 15=11100110.

（4）Not:Parameter C = (~ Parameter A).

When M77 is effective, condition is 40, means not, parameter A is address.When address of parameter A 10=10000111, address of parameter C 15=01111000。

（5）Move left: Parameter C = (Parameter A << Parameter B).(Parameter B specify the numbers of bits to move left).

When M77 is effective, condition is 50, means move left,parameter A and B are both address.When address of parameter A 10=10000111, address of parameter B 11=00000011, address of parameter C 15=00111000。

（6）Move right: Parameter C = (Parameter A >> Parameter B).(Parameter B specify the numbers of bits to move right).

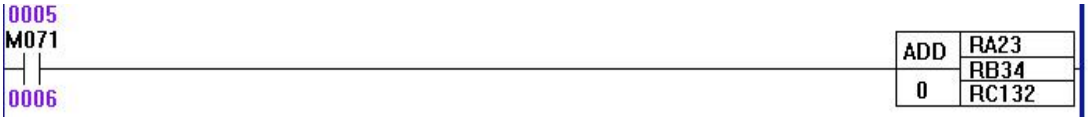
When M77 is effective, condition is 50, means move right,parameter A and B are both address.When address of parameter A 10=10000111, address of parameter B 11=00000011, address of parameter C 15=00010000.

4、 ADD: Data plus

Conditions:

0 means 8 bits data, parameter A and B are both address；

1 means 16 bits data, parameter A and B are both address;
2 means 8 bits data, parameter A is address, parameter B is constant;
3 means 16 bits data, parameter A is address, parameter B is constant;
4 means 8 bits data, parameter A is constant, parameter B is address;
5 means 16 bits data, parameter A is constant, parameter B is address;
8 means parameter A and B are both constant.
Rules:
Parameter C = Parameter A + Parameter B.



When M71 is effective, condition is 0,parameter A and B are both address.When address of parameter A 23=10000111, address of parameter B 34=01100001, address of parameter C 32=11101000。

5、SUB: Data minus

Conditions:
0 means 8 bits data, parameter A and B are both address;
1 means 16 bits data, parameter A and B are both address;
2 means 8 bits data, parameter A is address, parameter B is constant;
3 means 16 bits data, parameter A is address, parameter B is constant;
4 means 8 bits data, parameter A is constant, parameter B is address;
5 means 16 bits data, parameter A is constant, parameter B is address;
8 means parameter A and B are both constant.
Rules:
Parameter C = Parameter A - Parameter B.

When X22 is effective, condition is 0,parameter A and B are both address.When address of parameter A 30=10100000, address of parameter B 11=01100000, address of parameter C 45=01000000。

6、MUL: Data times

Conditions:
0 means 8 bits data, parameter A and B are both address;
1 means 16 bits data, parameter A and B are both address;
2 means 8 bits data, parameter A is address, parameter B is constant;
3 means 16 bits data, parameter A is address, parameter B is constant;
4 means 8 bits data, parameter A is constant, parameter B is address;
5 means 16 bits data, parameter A is constant, parameter B is address;

8 means parameter A and B are both constant.

Rules:

Parameter C = Parameter A x Parameter B.

When M70 is effective, condition is 0,parameter A and B are both address.When address of parameter A 10=10100111, address of parameter B 20=00000101, address of parameter C 15=01000011。

7、 DIV: Data divide

Conditions:

0 means 8 bits data, parameter A and B are both address；

1 means 16 bits data, parameter A and B are both address；

2 means 8 bits data, parameter A is address, parameter B is constant；

3 means 16 bits data, parameter A is address, parameter B is constant；

4 means 8 bits data, parameter A is constant, parameter B is address；

5 means 16 bits data, parameter A is constant, parameter B is address；

8 means parameter A and B are both constant.

Rules:

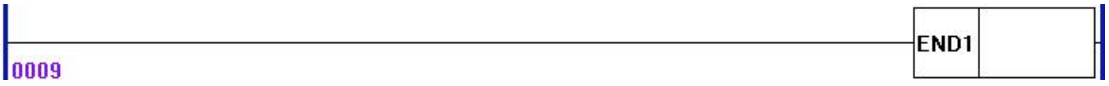
Parameter C = Parameter A/Parameter B.

When X00 is effective, condition is 0,parameter A and B are both address.When address of parameter A 1=10100111, address of parameter B 2=00000101, address of parameter C 111=00100001.

6.3.4 Process control function block

1、END1 : [Control the steps] :The end of the first level

END1 in front of PLC is high-speed, every cycle is 8ms.

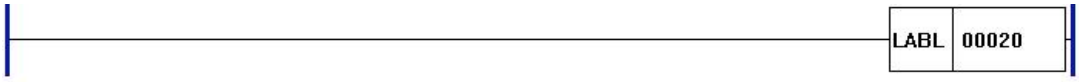


2、END2 : [Control the steps] :The end of the second level

END2in front of PLC is low-speed, every cycle is 100ms.

3、LABL : [Control the steps] :Mark of position

Specify a mark in the ladder, use JMPB to jump to this position, LABL mark.



LABL number 1-9999.

4、JUMP : [Control the steps]：With or without condition to jump

The program will jump to marked position to run. Could use the same mark in multi-jump; Can't jump over END1 or END2; Can't jump out of sub program; Could jump forward and backward.

Condition:

Not jump when M78 is invalid,execute the next segment behind the JUMP.

Jump to the marked position when M78 is effective and execute the next segment.

JUMP number 1-9999.

Note:Jump over 45-49 lines and execute 51 line when X11 is effective.

Execute 45 line when X11 is invalid.

5、CALL : [Control the steps]：With or without to use sub program

Use sub program, could use multi call instruction in the same sub program; Call instruction could be nested; Can't be used in the first level program; Sub program must be edited behind END2.

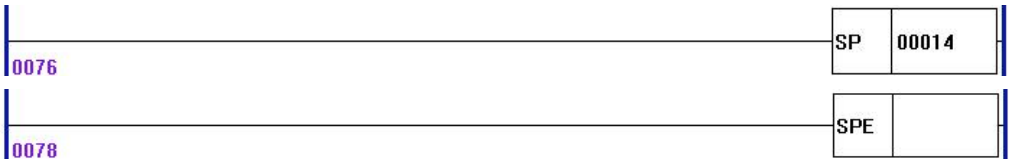
Note：Call and execute the specified sub program when M72 is effective(example CALL 16).

Execute the next instruction after executing CALL when M72 is invalid.

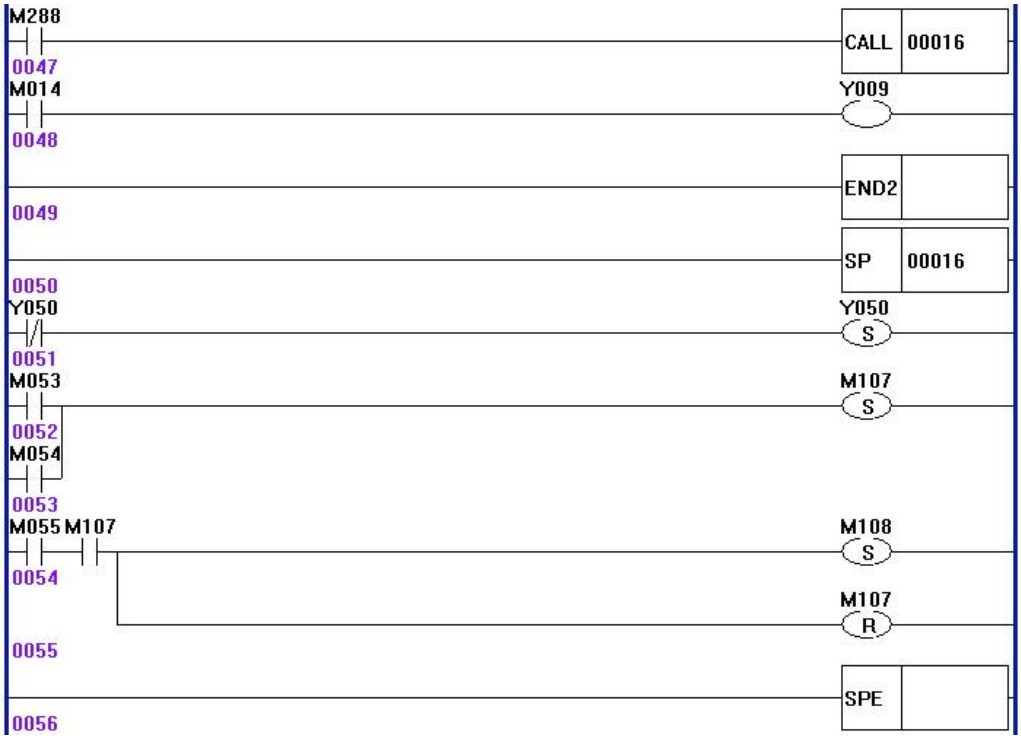
6、SP : [Control the steps] Start sub program

7、SPE : [Control the steps] End sub program

SP to generate a sub program, the number of sub program as the name of sub program, SPE is the mark of the end of sub program. When the instruction is executing, it will be back to the main program, SP and SPE to specify the range of sub program.The sub program must be edited behind END2.



SP16 sub program.



Note：Call sub program SP16 when M288 is effective.

Don not program SP16 when M288 is ineffective.

8、RETN : [Control the steps]Return from sub program

When satisfying condition of call sub program and RETN, then back to the main program directly.

When satisfying condition of call sub program, but not RETN, then finish the sub program and then back to the main program.

Note: Execute sub program SP22 when X11 is effective; Condition of RETN is satisfied when M285 is effective, then back to the main program directly and execute 13 line.

Execute sub program SP22 when X11 is effective;Condition of RETN is not satisfied when M285 is invalid, then execute 18 line of sub program to the end, then back to the main program.

6.3.5 Table of parameter address：

1、Definition of input and output parameter address：

Definition of parameter address	Parameter
1	X0-X7
2	X8-X15
3	X16-X23
4	X24-X31
7	X50-X57
8	X58-X65
9	X66-X73
10	X74-X81
13	X151-X158
14	X159-X166
15	X167-X174
16	X175-X182
17	X183-X190
18	X191-X198
31	X200-X207
32	X208-X208

51	Y0-Y7
52	Y8-Y15
53	Y16-Y23
54	Y24-Y31
55	Y50-Y57
57	Y71-Y78
58	Y79-Y80

2、Definition of parameter address of auxiliary relay：

Definition of parameter address	Parameter
101	M0--M7
102	M8--M15
103	M16--M23
104	M24--M31
105	M32--M39
106	M40--M47
107	M48--M55
108	M56--M63
109	M64--M71
110	M72--M79
111	M80--M87
112	M88--M95
113	M100--M107
114	M108--M115
115	M120--M127
116	M128--M135
117	M200--M207
118	M208--M215
119	M250--M257
120	M258--M265
121	M266--M273
122	M274--M281
123	M218--M225
124	M226--M233
125	M234--M241
126	M242--M249
127	M282--M289
128	M290--M297

129	M298--M305
130	M306--M313
131	M800--M807
132	M808--M815
151	Total of tool
153	The number of current tool-case
155	Number of target tool-case

Pay attention：

1、Odd address could use 8 bits parameter, also could use 16 bits parameter；

2、Even number only use 8 bits parameter, can’t use 16 bits parameter；

3、For 16 bits odd address, including this odd address and a parameter of even number behind；

4、Constant could be 8 bits number at the most.

Chapter 7 Connection

7.1 Character of robot controller

- High performance industrial level 32 bits ARM+DSP+FPGA
- 128M(Could be expand to 32G) user storage
- 800x600 TFT LCD touch screen
- USB connection
- Power supply of high anti-interference
- Hand held
- 48x32 I/O
- 2 ways 0-10V analog output
- 1 way orthogonal input of encoder
- 6 ways output of motor with brake

7.2 Technical index

- Number of controlling axis：J1-J8XsYs 8 axis
- Pulse value：0.001mm
- The max speed：240m/min
- Processing speed：0.01-30000mm/min
- The minimum input unit：0.001mm
- Range of programme size：± 99999.999mm
- Programme code：ISO-840 international standard
- Definition of programme coordinate system：ISO-841 international standard
- Time of fault-free on average(MTBF)：Bigger than 6000 hours

7.3 Using environment of controller：

- Power：AC 220V (+10％,-15％), frequency 50Hz±1％
- Torque of power≤150W
- Power supply must use isolation transformer
- Running temperature 5～45℃, relative humidity 40-80％
- Temperature of storage and transportation 0～55℃, relative humidity less than 90％(40℃)
- To avoid an oil mist and dust, corrosive gas, corrosion, good ventilation

7.4 Installation connection

Firstly check the controller, power, motor, electrical board is good or not.

Must save some space around, keep air circulation, the position of controller need to be easy to operate and avoid scalding when machine is working.

Leave away from strong electricity in case of interference, all input signal is the best not connect with controller directly; Must connect with ground.

Can't hot-plugging all cables when power on.

Put controller into clean and fixed position.

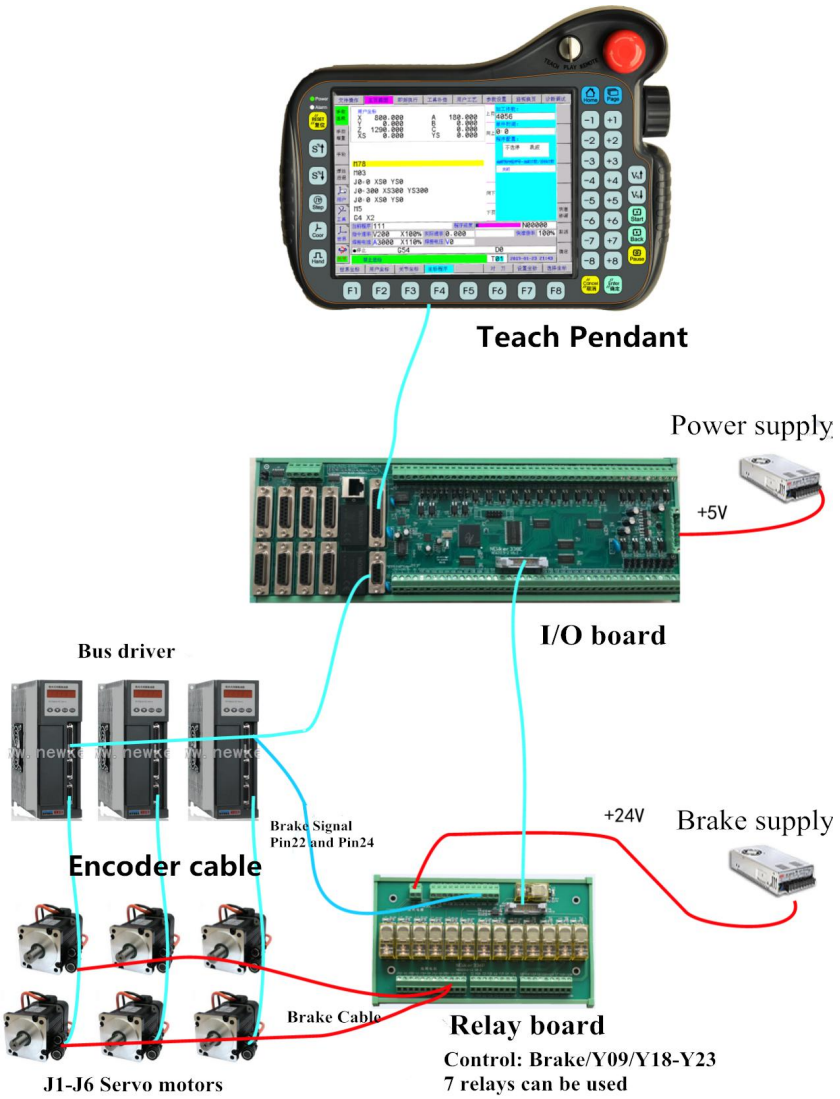
Pay attention:

1、 Controller need to install a place which got lightning-protection

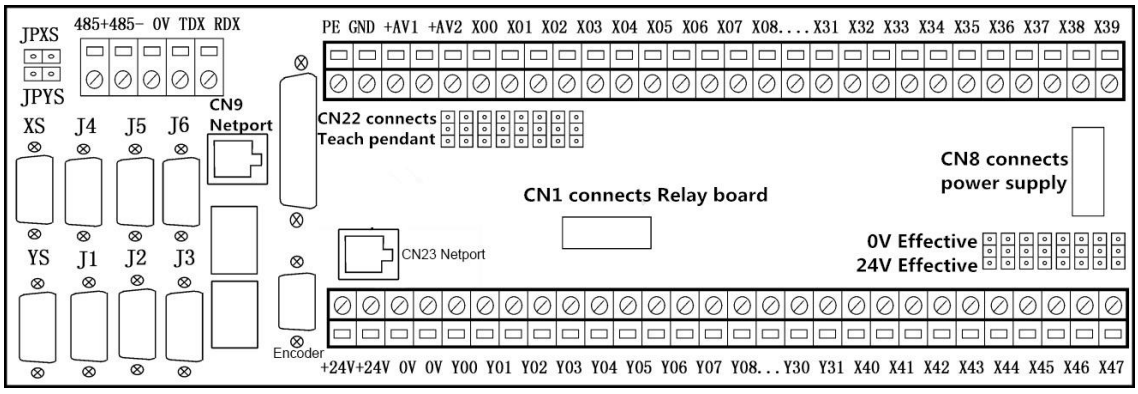
2、 Controller must be a fixed place in case of vibration

3、 Keep controller away from combustible

7.4.1 Connection diagram



(1) I/O board



1) CN22 connects with Teach pendant(robot controller).

2) CN23 connects with encoder

3) CN24 connects with POWERlink bus driver.

4) CN9 connects with 1000 Mbps Ethernet port(also can connect EtherCAT bus driver);

5) CN4 connects with 5V power supply.

6) CJ1,CJ2 connect input and output signal.

7) CJ3,CJ4 connect standard RS485 and RS232;

8) J1-J6,Xs,Ys connect with pulse type servo driver;

9) JPXS,JPYS plunger pin. When connecting with pulse type drivers, if alarm signal is normal close, and there is no JPXS and JPYS corresponding to XS axis and YS axis, JPXS,JPYS plunger pin are applicable(if there is Xs or Ys, corresponding plunger should be take off).

10) +AV1.+AV2 are isolated two-way analog 0-10V signal output, GND is signal ground, they are used to control current and voltage of welding machine.

11) CN1 connects with relay board, including：

1 relay of controller output brake control；

6 relays of controlling brake of motor；

7 relays of Y09,Y18,Y19,Y20,Y21,Y22,Y23；

Y05 is relay of controller output brake control,user can’t use it in other ways.

12) Input signal X00-X07,X40-X47 could choose +24V or 0V effective by pin. X40 is detection signal of brake of relay board, when the brake of all joints is open, X40 is valid, user cannot use this in other ways.

Attention:

PE connect terminal should be grounded in case of interfere.

1、X0: detection of start arc;

X01: malfunction of welder;

X02: alarm of converter;

X04: alarm of cooling;

X05: alarm of lubrication;

X06: alarm of no arc;

X07: alarm of no gas;

X46: alarm of no wire;

X47: alarm of power;

X20: alarm of J1-J4 driver ALM;

X21: driver J5/J6/XS/YS alarm ALM1;

X22: external alarm ALM2;

X23: welding gun collision alarm ALM3;

X17: remote pause HALT;

X18: remote start RUN;

X19: remote emergency stop ESTOP;

X40: detection of motor brake;

X42: M01(pause instruction) detect switch(X42=1, program will pause);

X45: the switch into drug mode;

X28,X29,X32-X39: detection of reservation function(10 reservation program at most);

X09: negative limit switch -L;

X10: positive limit switch +L;

X08/X11/X12/X13/X26/X25/X16/X15: home signal A0/Y0/X0/Z0/B0/C0/XS0/YS0 of A/Y/X/Z/B/C/XS/YS axis;

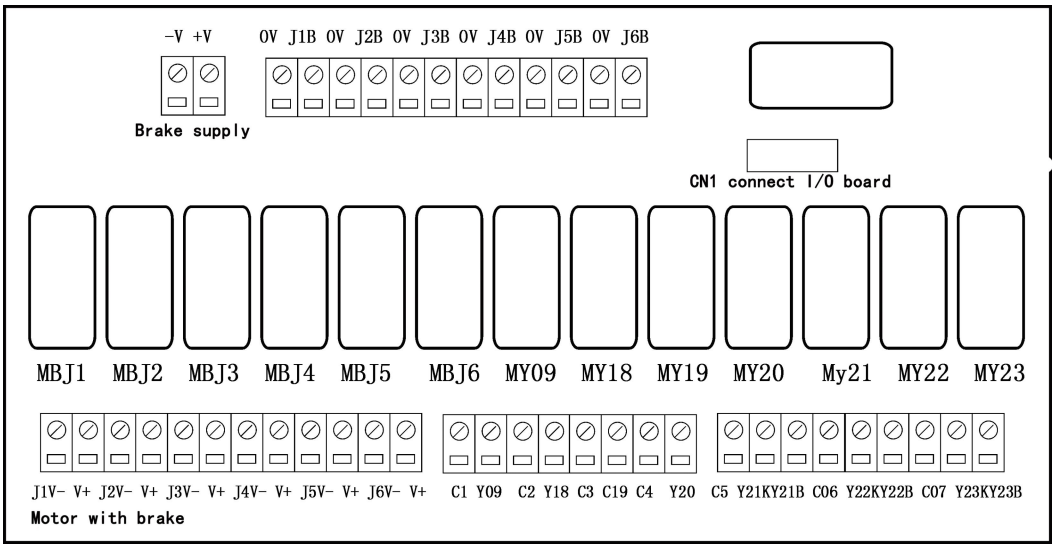
So, user could use X14, X24, X42-X44, total 6 input points.

2、Y05 is controller output brake control relay. Y16 is enable signal EN of driver, Y17 is alarm clear signal INTH of driver.

So, user could use Y00-Y04,Y06-Y15, Y18-Y31, total 29 output points.

3、 the signal may not be stable when power on, so EN enable signal must be connect to driver when use pulse type driver.

(2) Relay board



1、CN1 connect with CN1 of I/O board, control output：

Y09,Y18,Y19,Y20,Y21,Y22,Y23 user could use 7 relays.

2、0V of brake connect CN3-22 pin of driver, J1B/J2B/J3B/J4B/J5B/J6B connect with CN3-24 pin of driver(NEWKer driver).

3、-V,+V connect with brake supply.

4、J1V-/J2V-/J3V-/J4V-/J5V-/J6V-,V+ connect with brake of motors.

7.4.2 DB44 pin connector CN22 to controller's bus socket

The socket connects to CN22 of I/O Board.

CN22 Bus Pulsed Signal DB44 Pinhead(match 338E with 11+2 pairs, match 337F with 24pairs)			
Signal	338E(11+2 pairs cable)	337F(24 pairs cable)	Function
TXB+/TXB-	44/29(1st pair)	337F: Y71/Y72	100M Net B signal
TXA+/TXA-	43/28(2nd pair)	337F: Y73/Y74	100M Net A signal
+5V/0V	1/3(3rd pair)	1/3	Power
+5V/0V	1/3(4th pair)	1/3	Power
+5V/0V	1/3(5th pair)	1/3	Power
+5V/0V	2/4(6th pair)	2/4	Power
RS485+/RS485-	34/19(7th pair)	34/19	RS485 communication
TXD/RXD	6/7(8th pair)	337F: Y200/Y75	RS232 communication
RXA+/RXA-	31/16(9th pair)	337F: Y201/+24V	1000M Net A signal
RXB+/RXB-	32/17(10th pair)	337F: Y203/Y202	1000M Net B signal
PA+/PA-	33/18(11th pair)	337F: Y205/Y204	Encoder A signal
PB+/PB-	30/5(12th pair)	337F: Y207/Y206	Encoder B signal
PC+/PC-	14/15(13th pair)		Encoder Z signal
J1CP+/J1CP-		40/25	J1 Pulse
J1DIR+/J1DIR-		39/24	J1 Direction
J2CP+/J2CP-		38/23	J2 Pulse

J2DIR+/J2DIR-		37/22	J2 Direction
J3CP+/J3CP-		36/21	J3 Pulse
J3DIR+/J3DIR-		35/20	J3 Direction
J4CP+/J4CP-		42/27	J4 Pulse
J4DIR+/J4DIR-		41/26	J4 Direction
J5CP+/J5CP-		8/9	J5 Pulse
J5DIR+/J5DIR-		10/11	J5 Direction
J6CP+/J6CP-		12/13	J6 Pulse
J6DIR+/J6DIR-		14/15	J6 Direction

Attention:

NEWKer-A6 controller matches with NEWKer-337F board, 8*4 I/0 point, 8 path inputs: X200-X207, X200 is driver alarm or external alarm input, X201-X206 are J1-J6 motor home switch input signal(Axis parameter P401=1201, P406=12); 4 paths output: Y71-Y74, Y75 is driver Enable signal. Please pay attention to following points:

1. Instruction M03 controls both Y18 and Y71;
2. Instruction M04 controls both Y19 and Y72;
3. Instruction M08 controls both Y11 and Y73;
4. Instruction OUT controls Y74, for example, OUT+Y74, output Y74 valid;
5. there is no 0-10V analog output in NEWKer-A6, that means cannot match with automatic welding machine;
6. Axis parameter P401-P406=1201-1206;
7. the signal may not be stable when power on, so pulse type driver must be connected with EN enable signal.

7.4.3 DB15 pin connector J1-J6/XS/YS to pulsed driver

1. the socket connects to pulsed servo driver.

J1-J6/XS/YS pulse driver DB15 pin（7 pairs）				301H driver	302H driver
Signal	Pin	I/O	Function	DB25 Pinhead	DB25 Pinhead
CP+/CP-	1/9(1st pair)	OUT	Pulse signal	6/18	6/18
DIR+/DIR-	2/10(2nd pair)	OUT	Direction signal	7/19	7/19
EN/INTH	3/4(3rd pair)	OUT	Enable driver/ Clear alarm	23/10	302G:23/10 302H:14/=
+24V/0V	11/13(4th pair)	OUT	24V Power/0V	11/21	302G:11/21 302H:2/25
BP+/BP-	15/8(5th pair)	IN	Encoder feedback B	4/16	302G:off 302H:8/1

AP+/AP-	14/7(6th pair)	IN	Encoder feedback A	3/15	302G:off 302H:21/20
ALMB-/ALMB+	6/5(7th pair)	IN	Driver alarm normal close	13/12	13/12
ALMK+/ALMK-	12/13(7th pair)	IN	Driver alarm normal open		
RS485+/RS485-				CN2-5/6	5/17
BK+/BK-				22/24	22/24
The second channel Pulsed Driver DB15 Pinhead（4 pairs）					
CP+/CP-	1/9(1st pair)	OUT	Pulse signal		3/15
DIR+/DIR-	2/10(2nd pair)	OUT	Direction signal		4/16
BP+/BP-	15/8(3rd pair)	IN	Encoder feedback B		302G:off 302H:23/9
AP+/AP-	14/7(4th pair)	IN	Encoder feedback A		302G:off 302H:11/10
ALMB-/ALMB+	6/5(short circuit)	IN	Driver alarm normal close		

2. J1-J6 connect with Inovance S620P driver.

J1-J6 pulse driver DB15 pin（7 pairs）				S620P Driver
Signal	Pin	I/O	Function	CN1
CP+/CP-	1/9(1st pair)	OUT	Pulse signal	41/43(PULS+/PULS-)
DIR+/DIR-	2/10(2nd pair)	OUT	Direction signal	37/39(SING+/SING-)
EN/INTH	3/4(3rd pair)	OUT	Enable/Alarm reset	33/8(S-ON/ALM-RST)
+24V	11(4th pair)	OUT	24V Power	11(COM+)
BP+/BP-	15/8(5th pair)	IN	Encoder feedback B	
AP+/AP-	14/7(6th pair)	IN	Encoder feedback A	
ALMK+/ALMK-	12/13(7th pair)	IN	Driver alarm normal open	1/26(ALM-/ALM+)
336P Relay board				28/27(BK+/BK-)
338E terminal				CN3-8(GND)
338E terminal				CN3-4/5(RS485+/-)

a. Controller Other parameter P301=2886, P302=2887,
P303=-999999(single-turn 32 bit/multi-turn 16bit), P304-P309=8388608;
b. Driver parameter H0C00=station number, H0C02=3, H0C03=2, H0C01=1.

3. J1-J6 connect with RUKING SEA 2 driver:

J1-J6 pulse driver DB15 pin（7 pairs）				SEA2 Driver
Signal	Pin	I/O	Function	CN1
CP+/CP-	1/9(1st pair)	OUT	Pulse signal	17/18(PULS+/PULS-)
DIR+/DIR-	2/10(2nd pair)	OUT	Direction signal	43/44(SING+/SING-)
EN/INTH	3/4(3rd pair)	OUT	Enable/ Alarm reset	12/13(S-ON/ALM-RST)
+24V	11(4th pair)	OUT	24V Power	11(COM+)
BP+/BP-	15/8(5th pair)	IN	Encoder feedback B	26/27
AP+/AP-	14/7(6th pair)	IN	Encoder feedback A	1/2
ALMB+/ ALMB-	6/5(7th pair)	IN	Driver alarm normal close	25/24(ALM-/ALM+)
336P Relay board				23/22(BK+/BK-)
338E terminal				RS485+/-,0V

a. Controller Other parameter P301=4124, P302=4117, P303=4116;

b. Driver parameter P123=0, P124=2, P125=1,P72=625;

c. Please connect a 510Ω resistance between Rs485+ and 0V.

4. J1-J6 connects with Yasakawa Driver SGDM 2nd generation/SGD7S 7th generation.

J1-J6 pulse driver DB15 pin（7 pairs）				Yasakawa Driver
Signal	Pin	I/O	Function	CN1
CP+/CP-	1/9(1st pair)	OUT	Pulse signal	7/8(PULS+/PULS-)
DIR+/DIR-	2/10(2nd pair)	OUT	Direction signal	11/12(SING+/SING-)
EN/INTH	3/4(3rd pair)	OUT	Enable/ Alarm reset	40,42,43(S-0N, CW,CCW) /44(ALM-RST)
+24V/0V	11/13(4th pair)	OUT	24V Power/0V	47/2(COM+/GND)
PS+/PS-	15/8(5th pair)	IN	PS Signal	48/49(PS0+/PS0-)
SEN	7(6th pair)	IN	SEN signal	4(SEN)
ALMB+/ ALMB-	6/5(7th pair)	IN	Driver alarm normal close	32/31(ALM-/ALM+)

a. Controller Other parameter
P300=0001000011111101, P304/P305/P306/P307/P308=65536;

b. Driver parameter Pn000=0010, Pn002=0000, Pn200=0000,
Pn202/Pn203=4096/625;

c. When connect Yasakawa driver, Y24/Y27/Y30/Y31 are used by system,
unavailable to user.

Note:

1. Such the same signal as CP,DIR,RS485 should be covered by twisted shield pair,

the shield connects with shell.

2. RS485+/RS485-: connect to Modbus communication signal of driver, 0V must connect to GND port of driver.

3. EN/Y16: enable driver when output 0V

4. INTH/Y17: reset driver when output 0V

5. ALM/X20,ALM/X21: Inputting 0V means driver alarm, ALMK is normal open signal, ALMB is normal close signal.

ALM detect J1-J4 driver, if rest port are unconnected, their ALMB-/ALMB+ should be short circuited.

ALM1 detect J5J6XsYs driver, if rest port are unconnected, their ALMB-/ALMB+ should be short circuited.

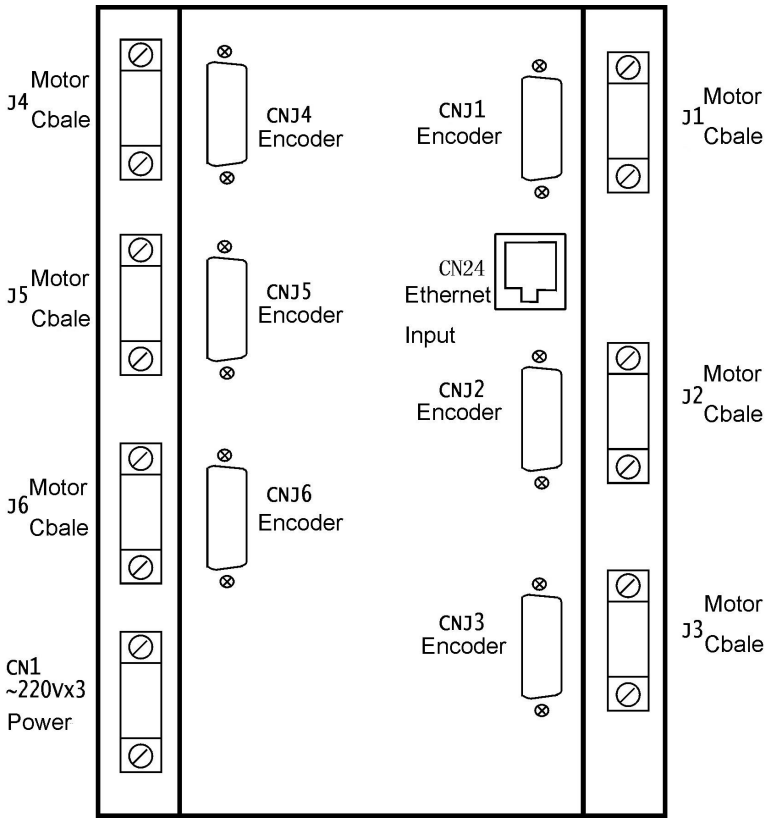
6. the signal may not be stable when power on, so pulse type driver must be connected with EN enable signal.

7.4.4 DB9 connector of CN24 to bus driver

(1)The socket connects to Ethernet port of servo driver which supports Powerlink communication protocol.

CN24 bus Ethernet signal port(2 pairs)				
Signal	Pin	I/O	Function	Standard Ethernet port
TXA-/TXA+	1/2	IN	A signal	2/1
TXB-/TXB+	3/6	IN	B signal	3/6

(2) NEWKer 6 axis integrated driver



1) CN24 connects controller PowerLink bus port;

2) CNJ1-CNJ6 connect J1-J6 motor cable and encoder cable;

3) CN1 connect 3 phase 220V power;

4) Driver parameter setting:

Press 7 and input 1 means read all driver parameters.

★、8-0,Current drive parameter setting shaft[1--8]

Choose the Axis No. to modify parameter, 1-8 means J1-J6/Xs/Ys.

★、8-1,Modify the current axis parameter password(11:valid,Others:invalid)

Only when P8-11=11, can the following parameter be modified. Details refer to driver manual.

★、8-8,Current loop proportional gain

Set motor current loop proportional gain, the bigger value sets, the faster current gain becomes. When motor vibrates or squeals, increase the P8-8; if the motor is small power and becomes hot, decrease P8-8.

★、8-9,Speed loop proportional gain

St motor speed loop proportional gain, the bigger value sets, the higher gain is, and the stronger rigidity becomes, but easier to vibrate; if without squeal, the bigger value is better.

★、8-10,Position feed-forward gain

Set position feed-forward gain, the bigger value is, the higher gain is, and the stronger rigidity becomes, but easier to vibrate; if without vibration, the bigger value is better.

★、8-11,Position loop proportional gain

Set motor Position loop proportional gain, the smaller value set, the smoother motor rotates, but the worse rigidity becomes; the bigger value set, the faster position orients, the smaller following offset becomes, the stronger rigidity becomes, but easier to vibrate or overshoot; if without vibration or overshoot, the bigger value is better.

★、8-31,Driving alarm overload percentage

Used to set the overload percentage alarm, if the load is over the value of motor torque*P8-13/100, driver will alarm.

★、8-32,Rated current of motor(0.1A)

Set current motor rated current.

★、8-33,Rated torque of motor(0.1NM)

Set current motor rate torque.

★、8-44,Current loop filter constant

Set motor motor current loop filter constant, the smaller value is, the louder motor current squeal becomes. If motor inertia is big, and mechanical part has vibration squeal, increase P8-44.

★、8-34,Zero position motor encoder

★、8-35,Motor pole logarithm

★、8-48,Driving control parameters(12:Current initialization current)

When driver works abnormally, set P8-48=12, to initialize current and driver parameter.

★、8-51,Check the encoder alarm [0:Yes,1:No]

★、8-57,Number of motor coder lines

2517 means 17 bit multi-turn, 2523 means 23 bit multi-turn, 17 means 17 bit single turn, 23 means 23 bit single turn.

★、8-59,Motor stop current locking ratio

Attention: Other parameter P29=1, to make sure when driver works well, controller will output Y05 signal to control motor brake.

6 axis 10kg robot driver default parameter:

	J1/1.5Kw	J2/1.5Kw	J3/1Kw	J4/200W	J5/200W	J6/200W
P8-8	330	330	330	150	150	150
P8-9	200	200	100	120	100	100
P8-10	100	60	100	60	100	100
P8-11	100	60	100	60	100	100
P8-31	50	50	40	15	15	15
P8-32	50	50	40	6	6	6
P8-44	40	40	40	40	40	40

7.4.5 Connection of 1000M Net-port CN9

Match with EtherCAT driver signal, please mention it when place order

CN9 bus Ethernet signal port (2 pairs)				
Signal	Pin	I/O	Function	Standard Ethernet port
TXA-/TXA+	1/2	IN	A signal	2/1
TXB-/TXB+	3/6	IN	B signal	3/6

Attention: Signal cable must be shielded twisted pair.

USB port can be expanded into Net port. Through a UGREEN USB hub which supports RJ45 LAN, USB port can be expanded into Net ports, for example, one port for connecting with EtherCat driver, another for visual system or OPC communication. And set Other parameter P500=8, means open net function when start up.

7.4.6 DB9 connector of CN23 to Encoder

CN23 Encoder Signal DB9 pin socket				
Signal	Pin	I/O	Function	Effective Level
+5V/0V	1/4	OUT	Power Ground	+5V/0V
PA+/PA-	5/7	IN	A signal	5V
PA+/PA-	3/6	IN	B signal	5V
PA+/PA-	2/6	IN	Z zero signal	5V

Chapter 8 Debugging

8.1 Steps

1、Ready before debugging；
2、Set No.56 number of driver；
3、Modify PLC according to the requirement；
4、Test the motor when power on, not alarm；
6、Relative parameter of machine：Reduction ratio、Length of link rod、coupling relation、Reversal gap；
7、Set parameter of motor in controller: Absolute encoder；
8、Zero point of robot；
9、Soft limited of each joint；
10、Power on to check the joint coordinate；
11、Set error of location；
12、Accuracy of location；
13、Backup parameter；
14、Test for working；

8.2 Ready for working

Must check the connection before debugging.

1、Make sure the power supply is correct(3 phase 380V, grounded,sectional area of cable);

2、Make sure the power supply of driver and controller is correct(Isolation,220V,sectional area of cable);

3、Make sure the voltage of motor brake is right, and it's DC voltage;

4、Make sure all signal and connection are right(Driver, encoder use Shielded twisted pair wire, other signal use normal shielded wire)

5、Check all route of connection(Especially AC power, DC24V power, encoder use 5V power);

6、Try to power on: power off controller, driver, then power on one by one.

8.3 Set parameter of driver(NEW301)

1、set password：P1=1(Default)；

2、Set P56 of driver in each joint, set as 1-8 correspond to J1-J6\Xs\Ys;

3、Save the parameters of servo driver;

Pay attention:

Restart power, the circles in front of joint coordinate need to be green, otherwise something wrong with communication, please check the parameter set and cable.

8.4 Set relevant parameters of robot

8.4.1 Controlling type of controller

A）Type of robot, it is better to make sure the type of robot before ordering. Other parameter P330 to set robot application，11 means welding, 12 means palletizing, 13 means painting, 14 means polishing.

B）Controlling mode of robot, NEWKer robot controller could control more than 20 kinds of robot, it will be showed in Other parameter No.451.

1): the gantry type robot, could control the feeding and unloading, also could be held engraving controller.

2): 2 axis SCARA robot, J1 and J2 are rotary axis;

3): 3 axis Cartesian coordinate robot, J1J2J3 are linear axis;

4): 3 axis SCARA, J1 and J2 are Rotary axis, J3 is linear axis to control moving up and down;

5): 3 axis SCARA robot, J1 and J2 are rotary axis;

6): 4 axis rotary joint non parallelogram robot;

7): 4 axis rotary joint parallelogram robot;

8): 4 axis palletizing parallelogram robot, the same as RMD robot of GSK;

9): 4 axis stamping robot;

10): 4 axis SCARA;

11): 4 axis SCARA, J1J2J3 are rotary axis, J4 is linear axis for moving up and down;

12): 4 axis Cylindrical robot,if set as 474, in the manual mode, only joint coordinate and tool coordinate are valid, and cannot move in the direction of X axis.

13): 4 axis Delta robot;

14): 5 axis SCARA;

15): 5 axis SCARA, J1J4J5 are rotary axis, J2J3 are linear axis;

16): 5 axis serial joint robot

17): 6 axis/8 axis serial joint robot;

18): 6 axis/8 axis parallelogram robot;

19): 6 axis/8 axis non-spherical wrist robot, J5 and J6 have offset distance d6;

20): 6 axis/8 axis non-spherical wrist robot, J5 and J6 have offset distance e6;

21)： 6 axis/8 axis non-spherical wrist robot, J5 and J6 have offset distance d6 and e6;

22): 6 axis/8 axis collaborative robot;

23): 6 axis/8 axis L shaped wrist robot,

24): 6 axis SCARA robot；

25): 6 axis rotary joint robot, J2 and J3 are linear axis, J1,J4,J5,J6 are rotary axis.

8.4.2 Length of link rod,No.351-No.366 other parameter, No.461 - No.476 for error compensation

Name for parameter： “a” means vertical distance between joint; “d” means horizontal distance between joint;“L” means length of link rob. a3 means the vertical distance between zero point of J2 and zero point of J3; d5 means the horizontal distance between zero point of J5 and zero point of J4; La means length of slave, Lb means length of active.

Axis parameter No.351-No.366 used set link rob of each axis, No.461-No.476 parameter to set error compensation of link rob,parameter could be different according to different structure of machine.

Details refers to section 3.8.4 other parameter P464-P482

8.4.3 Reduction ratio of machine, relative parameter No.44-No.60

1、Calculation of electrical gear of vertical multi-joint robot 1,2,3

1）、P44=0；

2）、Numerator of electrical gear：

J1-J6\Xs\Ys correspond to P45\P47\P49\P51\P53\P55\P57\P59,reduction ratio is x10000.

Example：Reduction ratio of J1 is 121,then No.45=1210000；

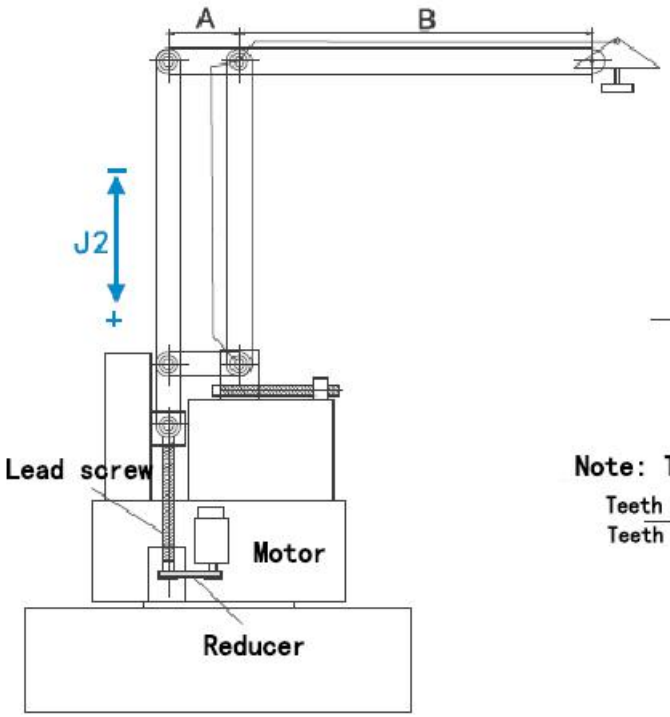
3）、Denominator of electrical gear：

A、J1-J6 correspond to P46\P48\P50\P52\P54\P56,set as 36000000；

B、Xs\Ys correspond to P58\P60, if it is ration axis then set as 36000； If it is linear axis, then set as 10000.

2、Calculation of electrical gear of palletizing robot

The setting way of J1、J4 axis is the same as robot 1-3.The set of reduction ratio of J2、J3 as follow：

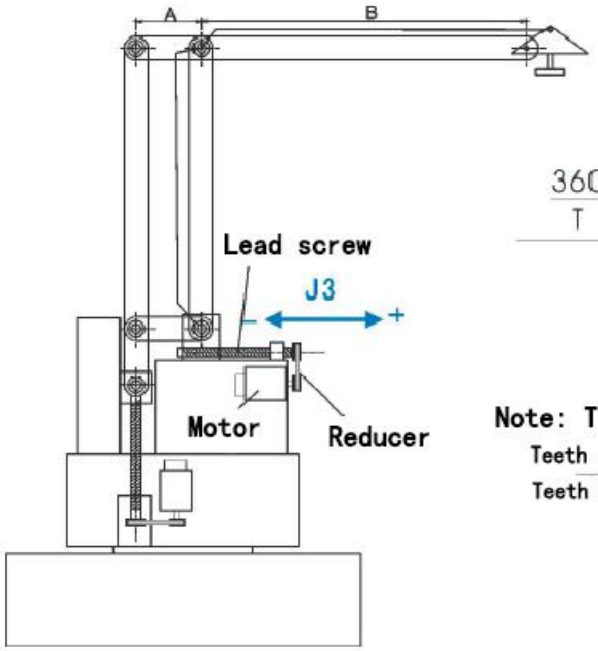


$$\frac{\frac{360}{T} \times \frac{\text{Teeth of screw}}{\text{Teeth of motor}}}{\frac{B}{A}}$$

Note: T is screw pitch, unit:mm

$\frac{\text{Teeth of screw}}{\text{Teeth of motor}}$: Reduction ratio of reducer

Calculation of reduction ratio J2 of robot 4



$$\frac{\frac{360}{T} \times \frac{\text{Teeth of screw}}{\text{Teeth of motor}}}{\frac{A+B}{A}}$$

Note: T is screw pitch, unit:mm

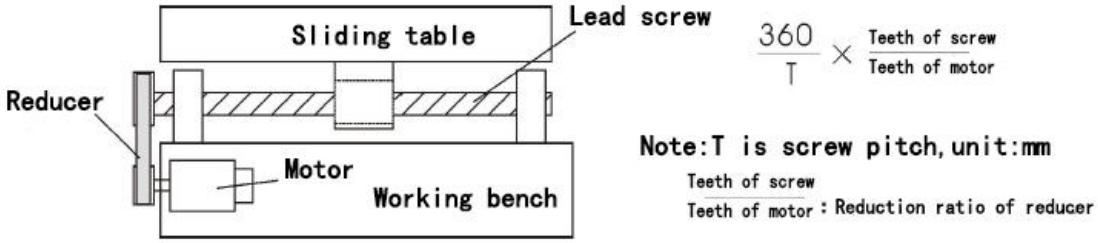
$\frac{\text{Teeth of screw}}{\text{Teeth of motor}}$:Reduction ratio of reducer

Calculation of reduction ratio J3 of robot 4

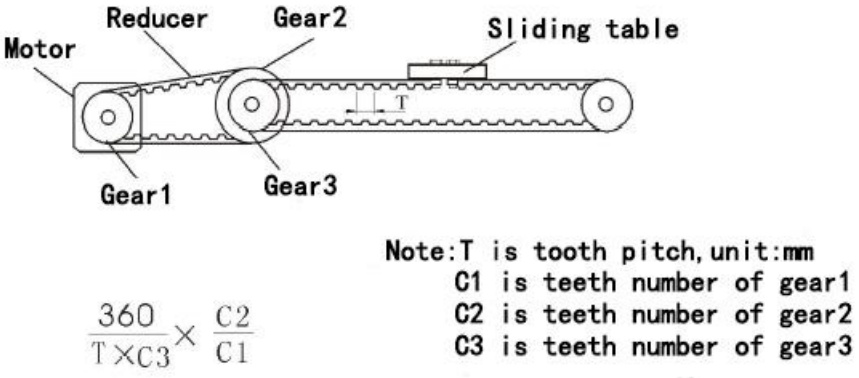
3、Calculation of electrical gear in straight line axis 4 of robot:

Straight line axis is different according to the structure, two kinds usually: Lead screw, gear drive(Synchronous pulley).

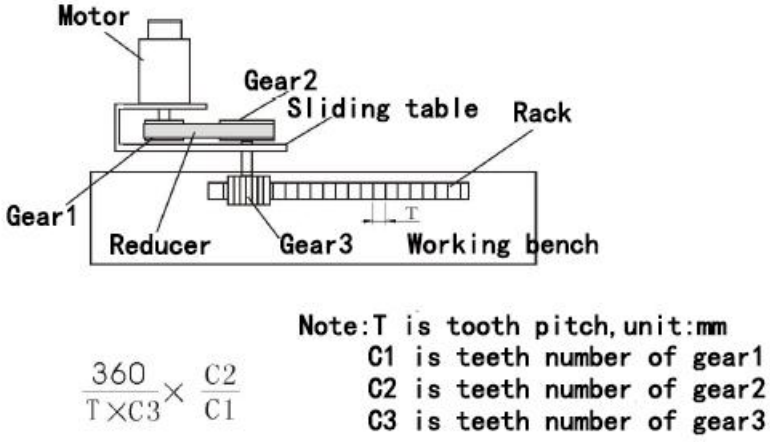
Calculation of reduction ratio of lead screw



Calculation of reduction ratio of lead screw



Calculation of reduction ratio of gear drive(Synchronous pulley)(1-3 axis of reciprocating machine is set as this)



Calculation of reduction ratio of rack drive

8.4.4 Coupling relation,relative other parameter No.375-No.385

Coupling relation of robot solve the structure problem,move an joint separately, the other joint will follow move with ratio relation, if need this joint not move,then it will give the compensation pulse to keep it stay, example: J5J6 coupling, J6 moves when J5 moving, this movement is the distance of J5 times numerator and divide by denominator.

No.P375 is parameter to enable this function.

D2=1, +4 means J1J2 got coupling relation, No.376 and No.377 is numerator and denominator of coupling；

D3=1, +8 means J3J4 got coupling relation, No.378 and No.379 is numerator and denominator of coupling；

D4=1, +16 means J4J5 got coupling relation, No.380 and No.381 is numerator and denominator of coupling；

D5=1, +32 means J5J6 got coupling relation, No.382 and No.383 is numerator and denominator of coupling；

D6=1, +64 means J4J6 got coupling relation, No.384 and No.385 is numerator and denominator of coupling;

Example:

1、J5J6 got coupling relation in vertical multi joint serial robot、parallelogram robot;

2、J4J5 and J5J6 got coupling relation in Vertical mulit-joint L wrist robot;

3、SCAR is composite lead screw, the reduction ratio is 360/T of lead screw;

4、Palletizing without coupling；

5、The 4th 5th axis got coupling in pole coordinate robot；

6、The 4th 5th axis got coupling in reciprocating machine1;

7、The 4th 5th axis got coupling in reciprocating machine2;

8.4.5 Reversal backlash, relative axis parameter No.30-No.37

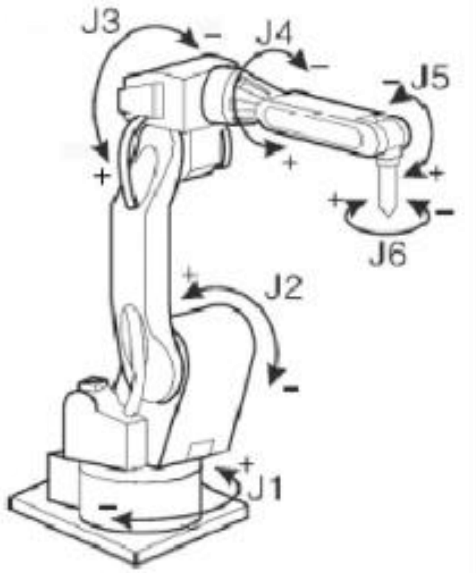
Used to set compensation when J1-J6/Xs/Ys axis move reversal, mechanical structure got backlash. When the axis involves reversal motions, system will invoke the value to compensate automatically. Unit：μm.

8.5 Controller parameter setting of joints

1、Direction of servo motor, refers to following picture

Axis P38-P43 set the motor direction of J1-J6/Xs/Ys；

Attention: when Other parameter No.451=602, and there is offset value d6 between J5 and J6, the rotary direction of Joint 6 is opposite to following picture.



2、 Mode of zero point

Axis parameter P62=11111111011, each axis as floating back-to-zero mode. If equipped with home switch, then P62=00000000011.

3、 Bus absolute function

(1) Driver type setting

Other parameter No.600 control mode(4000-4099 means etherCAT, 6000 means Modbus, 6001 means 1-6 axis use Modbus, 6002 means 3 axis Modbus)

0: all axis connect with Powerlink bus driver;

6000: all axis connect with Modbus driver;

6001: J1-J6 are Modbus driver, J7/J8 are Powerlink driver;

6002: J3 is Modbus driver, other joints are Powerlink driver;

4003: all axis connect with EtherCAT driver, P621 set driver brand.

(2) Motor encoder type

Other parameter No.300=111111110, if corresponding axis is absolute encoder motor, then set as 1, if it is incremental encoder motor, then set as 0.

(4) Address of absolute encoder

Other parameter No.301=92,No.302=91,No.303=90(if with NEWKer driver)；

(5) Pulse number per revolution of motor

If the resolution of motor encoder is 17bits, then Other parameter P304/P305/P306/P307/P308=131072, corresponding to J1-J6/Xs/Ys joint;

If the resolution of motor encoder is 23bits, then then Other parameter P304/P305/P306/P307/P308=8388608;

(6) Coordinate distance per revolution of motor

Set Other parameter P309/P310/P311/P312/P313=360000000 which correspond to J1-J6/Xs/Ys joint, if it is linear axis, set as 10000000；

(7) Denominator of coordinate distance per revolution of motor

Set Other parameter P320/P321/P322/P323/P324= reduction ratio,corresponding to J1-J6/Xs/Ys joint；

4、Direction and value of coordinate：

1）Move J1-J6 in teach mode, remember the corresponding coordinate of joint；

2）run M500 in MDI, to read the absolute coordinate to check if it is the same before and after running M501, if not the same, then change the value symbol in other parameter P309/P310/P311/P312/P313, Example: J1 coordinate changes before and after M501, and if P309=360000000, then change it into P309=-360000000;

3)Repeat step 1) 2) twice till the coordinate will not change before and after M501；

Pay attention：

The circles in front of joints coordinate should be green when using M500 to read absolute position, otherwise something wrong with the communication, please check the set and cables connection.

5、Zero point of robot joint

Move J1-J6/Xs/Ys near the zero point in teach mode, set Other parameter P314/P315/ P316/P317/P318(correspond to J1-J6/Xs/Ys axis), press “Enter”, then input “E” ,then press Enter to clear joint coordinate, and set current position as the zero point of joint. If input”EV”, multiturn absolute encoder of current axis will be cleared, and current coordinate will be machine coordinate.

6、Set soft limit of each joint

Move J1-J6/Xs/Ys to limit point, then input coordinate value into Axis parameter P18-P29 to set soft limit of each joint；

7、Set error of location and position

1）Error of location

If need make sure the location position,when PL=0 in program, controller will not continue until motors orient at the position; if PL≠0, not to wait.

This process will takes time of program, it lies on driver parameter, strong rigidity, reasonable parameter setting will make time be shorter.

Set parameter of driver, Axis parameter No.511-No.588 correspond the relative parameter of driver.

（1） P511/P521/P531/P541/P551/P561/571/P581 correspond to P8 of J1-J6/Xs/Ys driver. Proportion plus of current loop, the bigger value, the bigger current；

（2） P512/P522/P532/P542/P552/P562/572/P582 correspond to P9 of J1-J6/Xs/Ys driver, Proportion plus of speed loop, the bigger value, the bigger noise;

（3） P513/P523/P533/P543/P553/P563/573/P583 correspond to P9 of J1-J6/Xs/Ys driver, Proportion plus of feed-forward position, the bigger value, the bigger vibration;

（4） P514/P524/P534/P544/P554/P564/574/P584 correspond to P11 of J1-J6/Xs/Ys driver, Proportion plus of location loop, the bigger value, the stronger rigidity, more accuracy；

Note:

Set error of position applies to requirement for accurate location. It will keep the robot in accurate place, while providing reference for parameter of servo driver.

2）The error of position

This error is in PLAY or remote mode, the error between ideal position and the real feedback position. It will alarm and stop robot when over the set range. Relevant parameter is as following:

(1) Electrical gear of feedback

Other parameter P210-P214=10000, correspond to the numerator of J1-J6/Xs/Ys feedback electrical gear ratio；

Other parameter P215-P219=131072, correspond to the denominator of J1-J6/Xs/Ys feedback electrical gear ratio；

(2) The value of error alarm

Applied in highly requirement for accuracy, please set location error alarm, Other parameter P200-P204 correspond to J1-J6/Xs/Ys joint, once the tracking error is over set value in the process, it will alarm; Other parameter P205-P209 correspond to J1-J6/Xs/Ys, if the tracking error is over set value when stopping, it will alarm.

Pay attention：

Error of position usually be used in case of circuit fault, wrong parameter, driver malfunction to cause wrong motion leading to crush.

8、Set Other parameter P41 in controller, backup the current parameter.

After finishing all setting of controller, please set Other parameter No.41 to backup the current parameter. In the future, if customer need to restore factory reset, just needs to set press Other parameter P42.

8.6 Calibration accuracy of location and repeat location of robot

1、Preliminary calibration

In teach mode, switch into world coordinate, move X Y Z to check if it goes in straight line or not, if not straight, then need to check electrical gear of driver, instruction pulse from controller, reduction ratio, link rod parameter.

2、Accurate calibration

Edit a program to run in straight, and check if it goes straight, compared to reference .Or use measure device to check.

8.7 Continuous running test of robot

Teach and edit program with different postures of robot, continue to run it and check if the feed error of each axis is changing or not, error can't be over 2 unit changes at the same position.

8.8 Configure various brands of servo motor parameter settings

8.8.1 Maxsine Powerlink Bus type driver:

1. Controller Other parameter P304-P308 set as: 65536;

2. Maxsine driver parameter:

(1) P300= station number; P304=1; P306=2; P307=1; P027=8192; P028=16;

(2) If with multi-turn encoder, set P90=1, and initialize driver by Fn36;

(3) after modification of parameter, please save it by E-SET, then power off and restart.

8.8.2 Inovance 23 bits absolute driver IS620P:

1. Controller other parameter

P301=2886, P302=2887, P303=-999999, P304-P309=8388608;

2. Driver parameter: H0C00=station number, H0C0=2, H0C03=2, H0C26=1.

8.8.3 HCFA 17 bits absolute driver X3E:

1. Controller other parameter: P301=5408, P302=5410, P303=-999977;

2. Driver parameter: P900=Station number, P901=3, P02=2

8.8.4 Ruking 17 bits absolute driver SEA2

1. Controller other parameter: P301=4124, P302=4117, P303=4116;

2. Driver parameter: Pr123=station number, Pr124=2, Pr125=1(19200);

8.8.5 Yaskawa 17 bits absolute driver:

1. Controller Other parameter
   P300=0001000011111101, P304/P305/P306/P307/P308=65536;
2. Driver parameter Pn000=0010, Pn002=0000, Pn200=0000,
   Pn202/Pn203=4096/625;

8.8.6 INVT 17 bits absolute driver DA200:

1.Controller Other parameter:

P301=4054, P302=4030, P303=-999999, P304-P309=131072.

2. Driver parameter:

P4.01=station number, P4.03=1(19200), P4.04=2(O 8 1).

8.8.7 Delta absolute driver:

1.Controller Other parameter:

P301=102, P302=104, P303=-98, P304-P308=1280000;

2. Driver parameter:

P3-00=station number, P3-01=2, P3-02=8,P 3-03=0, P3-04=0, P3-05=1, P3-07=0, P2-69=1,P2-70=2;

8.8.8 Maxsine Absolute Driver

1. Driver parameter:

P300=station number, P301=3,P302=4,P90=1,P91=1,P27=10000,P28=1;

8.8.9 Maxsine EtherCat bus driver:

1. Driver type setting:

Other parameter P621,EtherCAT servo driver type [>=1 valid](1 means Maxsine, Aecon/Invt/Estun/STEP/Xinje/Delta, 2 means Sanyo Denki/Panasonic A5, 3 means Enpu ,4 means Yakotec/Thinkvo/Panasonic A6, 5 means bichannel Thinkvo, 6 means Tsino-dynatron, 7 means Zhenzheng/+3Eura/+4Dorna/+6DVS , 8 means Jotong).

2.Other Parameter setting of Controller

P600=4003,P601=40,P602=40,P603=10005,P610=10000,P611-P618=65536,

P620=12345678,P621=11111111,P622-P627=1000;

3. Electronic gear setting of System

There is two-stage electronic gear in EtherCAT system, the first stage is electronic gear of original pulse system, and the second stage is EtherCAT electronic gear. Then the superposition of both stages will be final electronic gear.

Suppose the reduction ratio of reducer is:

J1：81，J2：81，J3：81，J4：100，J5：100，J6：80

When electronic gear of system is 1:1, 1 pulse means 1/100000 degree for J1-J6, namely 100000 pulse/degree.

Then the original electronic gear ratio(the first stage) is:

J1: numerator 810000 / denominator 36000000. method: 10000*81=810000.

J2: numerator 810000 / denominator 36000000. method: 10000*81=810000.

J3: numerator 810000 /denominator 36000000. method:10000*81=810000.

J4: numerator 1000000 /denominator 36000000. method:10000*100=1000000.

J5: numerator 1000000 /denominator 36000000.method: 10000*100=1000000.

J6: numerator 800000 /denominator 36000000.method: 10000*80=800000.

Servo driver:

J1-J6: the electronic gear ratio of driver should be 65536 units of data from system when motor turns one circle.

The second-stage electronic gear(EtherCAT electronic gear): numerator:65536,

denominator:10000

In EtherCAT system, we need to make command pulse from driver and feedback pulse

from motor corresponding when motor turns one cycle, so both the command pulse and feedback pulse should be 65536 units.

8.9 Alarm Information

1. "**Forbid Move**"**,** will appear in following cases:

(1) no brake feedback signal(X40=0), please check if bake of motors is open. In this condition, robot cannot move in Teach/Auto/Remote mode.

(2) did not press Safety Switch(X212/X213=0) in Teach mode, in this case, robot cannot move in Teach mode.

2. "**Emergency Stop**": Emergency stop button(X209=0) on controller was pressed, or external emergency stop signal ESTOP(X19=1) is valid, under this alarm, controller will automatically clear output Y18/Y19/Y11/Y09;

3. "**Electric arc alarm**", when electric arc is used up, signal(X06=1) is valid.

4. "**Gas alarm**", when gas is used up, signal(X07=1) is valid.

5. "**Metal wire alarm**", when welding wire is used up, signal(X46=1) is valid.

6. "**Power alarm**", when power is abnormal, signal(X47=1) is valid.

7. "**Door alarm**", door switch signal is valid(X29=1).

8. "**Spindle driver alarm**", spindle driver alarm signal is valid(X02=1).

9. "**Servo J1-J4 alarm**", J1-J4 servo driver alarm is valid(X20=1), Other parameter P25 can set it be normal close/ normal open.

10. "**Servo J5J6XSYS alarm**", J5-J8 servo driver alarm is valid(X21=1), Other parameter P26 can set it be normal close/normal open.

11. "**ALM2 alarm**", external alarm2 signal is valid(X22=1).

12. "**Welding gun collision alarm ALM3**", Welding gun collision alarm ALM3 is valid(X23=1), Other parameter P27 can set it be normal close/normal open.

13. "**Welder alarm**", welding machine malfunction signal is valid(X01=1).

14. "**Reference point switch cannot be released**", incremental motor failed reaching zero point, absolute motor failed reading motor position, Axis parameter P61=1 will close this alarm.

15. "**Arc failed**", failed detecting arc starting signal(X00=0) when executing AS.

16. "**Cladding failed**", failed detecting arc end signal(X03=0) when executing AE.

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