

# MC600 Motion Controller

(V 2.0 2009-8-4)

## Operation Manual



Zolix Instruments Co., Ltd.

# Thanks for using Zolix products !

Please read this introduction carefully before using. And kindly please contact Zolix office in Beijing or local office if you have any questions and suggestions.

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## Appendix A MC600 Communication Protocol

## 1 Description

The MC600 motion controller is a new multi-functional, performance and cost-effective product for measurement and position control. MC600 series are designed for Motorized Stages、Motorized Rotary stages and Motorized Goniometric Stages. MC600 can control 4-axis / 2 axis position of point-to-point movement system. Excellent performance of the built-driven stepper motor driver or AC servo motor driver. Simplified installation and improved reliability. Friendly interface, a wealth of function parameters. Flexible command-line communication, to make system integration easier and efficient. Three-axis linear interpolation and two-axis circular interpolation can be achieved.

- Using 32-bit DSP processor, achieved high-precision dynamic control. Digital PID closed-loop control, ensuring a precise speed control and position control. Step driver to be sub-128, ensuring the smooth low speed stepper accurate positioning capacity. The use of servo motors to meet the requirements of high-speed movement.

- Point to point and increment operation Mode

- ◆ Point to point: Rapid positioning to the target location. Accelerate the experimental process.

- ◆ Increment: Applicable to those need for reciprocating positioning in a number of target locations. Operation of a button you can reach the target location.

- Meet on a number of motorized stages and motorized rotary stages joint control.

- According to the needs to choose pulses, angle, mm, microns. Realizing internal automatic conversion.

- ◆ pulses: The basic unit of controller.

- ◆ angle: Show the angle Displacement.

- ◆ mm/microns: Show the Linear displacement.

- X, Y, Z and T axes have closed-loop control functions(grating/rotary encoder ). So that position and orientation are more accurate.

- Back to origin position velocity, Initial velocity, Constant velocity , acceleration and Software position limit of each axis can be set respectively. Meet the different Control environment needs: If the system requires a shorter response time, you can set large initial velocity or acceleration; If the system requirements for smooth movement, you can set large initial velocity or acceleration; If the system requirements constant velocity movement, you can choose constant speed mode.

- Any position can be set to be the user working origin position.

The convenience of setting zero position to simplify the user's operation. Combination of photoelectric sensor with advanced Searching algorithm greatly enhanced the accuracy of the physical zero.

- Real-time read the control system logical position, real position, drive speed and the acceleration during the movement.

- 16 I / O can be programmed to be external input or external trigger. When the I / O is set to internal output, it can be used as the movement stop or implementation of specific procedures interrupt signal.

When the I / O is set to input. These I / O as interface hardware of the control box to monitor the state of the external equipment.

- The customer can use the ZolixMC ActiveX for programming. Facilitate the realization of the demand for a variety of motion control.

The customer can also use the MC software to program Simple motion control program. And it is easily to set movement and positional parameters. Compared with self-developed, it can greatly reduce the workload.

- 240X128 Dot-matrix LCD, which Shows more information. WINDOWS menu-style design, the parameters can be easily set.

- ◆ Multi-level menu, simple parameter setting, fast operation.
- ◆ Show X, Y, Z, T four positional parameters at the same time.
- ◆ Choice of different operation modes (Open-loop / closed-loop mode).
- ◆ Show each axis operation unit.

- Parameters can be stored and with memory function in case of power-down.

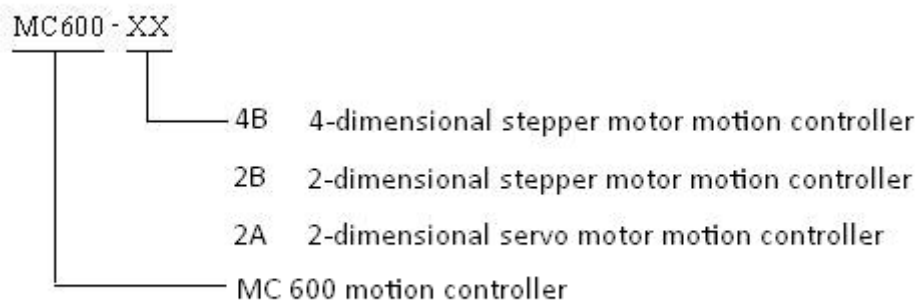
To simplify the process.

Once set , motorized stages screw lead and motorized rotary stages radius of gyration and so on can be stored in the MC600 motion controller.

### ● Rocker Accessories

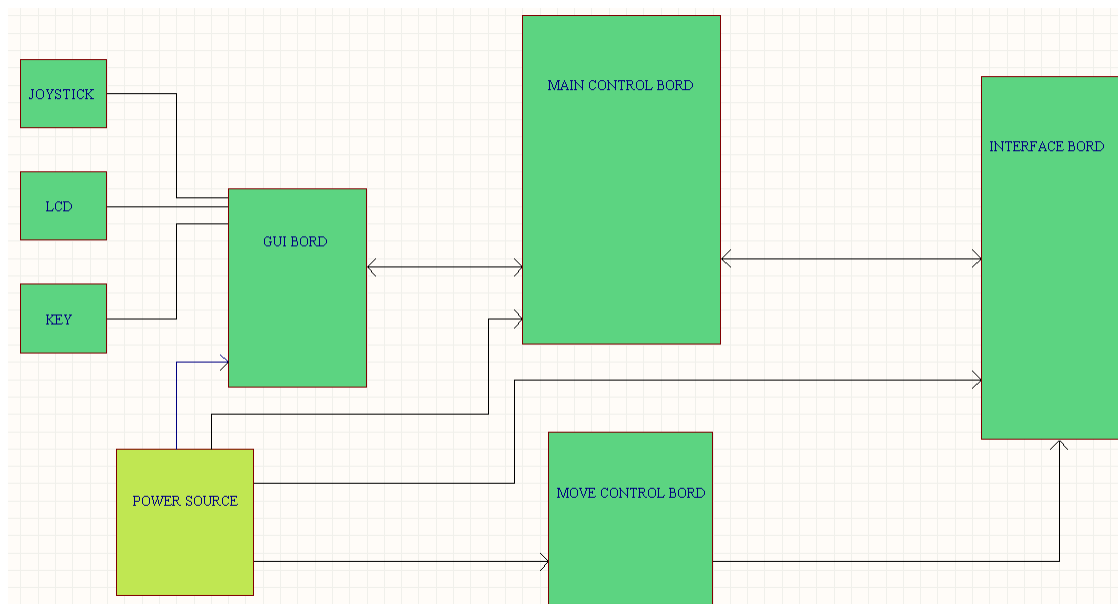
Manually scanning movement and target tracking can be easily carried out in three directions, making the control to be more flexible and convenient. The rocker has three-dimensional. By front, back, left and right swing, clockwise and counterclockwise rotary realizes manually control. This is very convenient for Distance pre-location.

Model explanation:

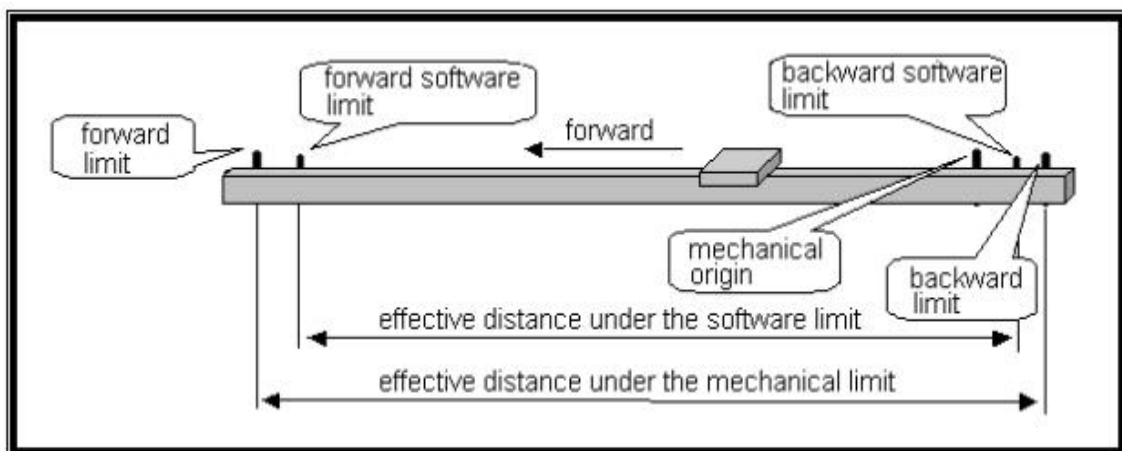


## 2 Principle Introduction

### 2.1 Block diagram

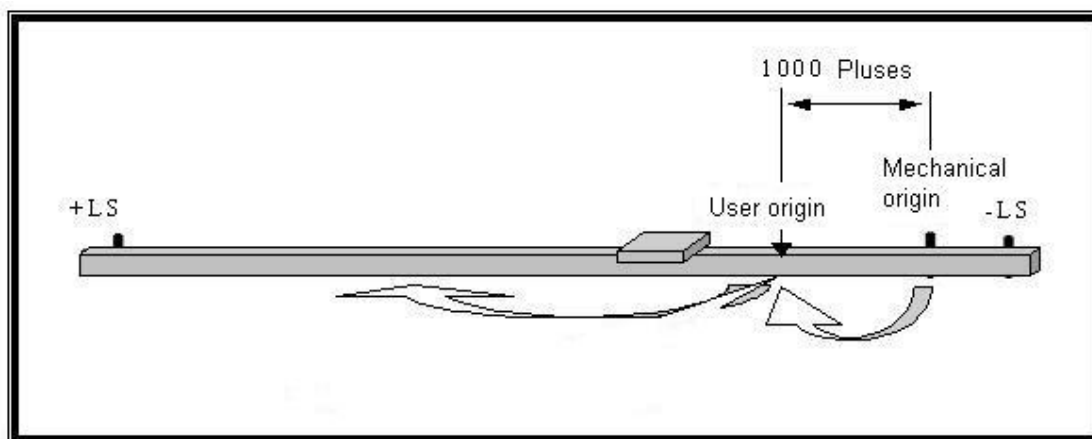


### 2.2 Limit explanation



The forward and backward limit is the mechanical limit switch. The forward and backward software limit are all appointed by computer.

### 2.3 Origin explanation and setting guide



Generally, the working origin is the starting point of working table. The current position is the default working origin(Absolute coordinates is 0) when power on the controller. Due to the limited mechanical accuracy, we suggest that you'd better let the stage work from the photoelectric switch origin.

**3 Specifications**

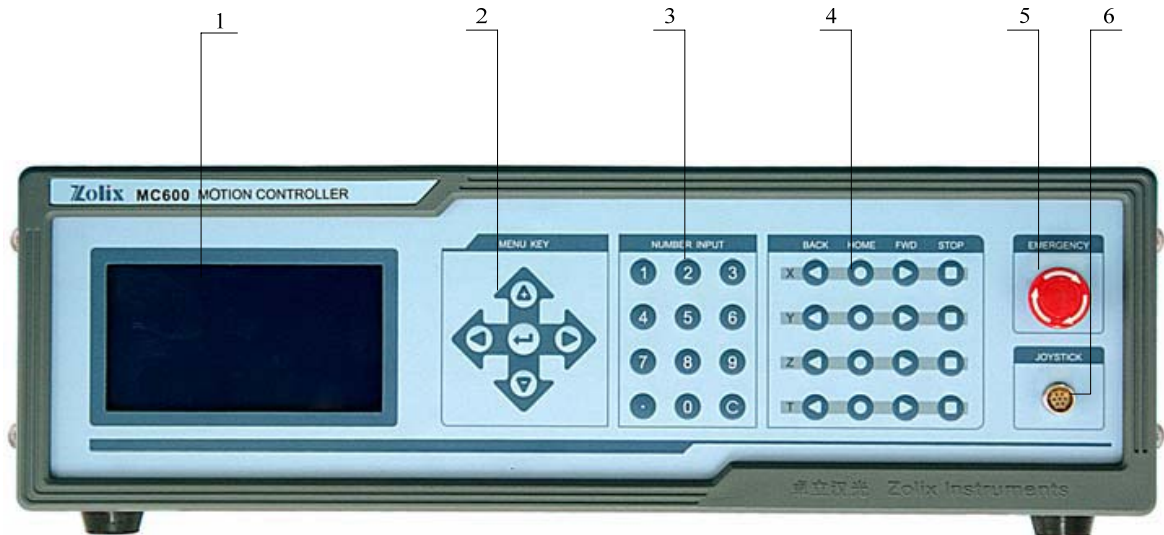
LCD screen	Monochrome LCD screen, 240X128 , Blue screen.
Chip	TMS320F2812(controller chip) MCX314As(movement chip)
FLASH ROM	128K
SDRAM	128K
USB	2.0
Output	4-way pulse, Optical coupler isolation, 4 channel
Maximum output frequency	4MHz
Pulse output frequency error	< 0.1%
Pulse output mode	Pulse+Direction, Pulse+Pulse
Interpolation	Arbitrary 2-3 axes linear interpolation. Arbitrary two-axis circular interpolation
Continuous interpolation function	Support
Deceleration or Accelerated mode	Linear or S Curve
Logical position counter	32
Parameters read real-time during the movement	Logical position, Actual position、driver speed, Acceleration
Detection of the position signal of each axis	Each axis has the independent detection signal sensor input for the left and right limits and zero.
Input	8 optical coupler input
Encoder input	4-axis encoder, AB phase pulse optical coupler input.
output	8-channel optical coupler open collector output



Protocol	RS232, USB2.0
Power	AC110V / 220V
Handle function	Intuitive manual features, control XYZ directions, speed governing in 8 gears.
Power	110V AC / 220V AC +/- 10% 45-65Hz
Power consumption	< 150 W
Operation temperature	0℃—60℃
Store temperature	-20℃—80℃
Operation humidity	20%—95%
Store humidity	0%—95%

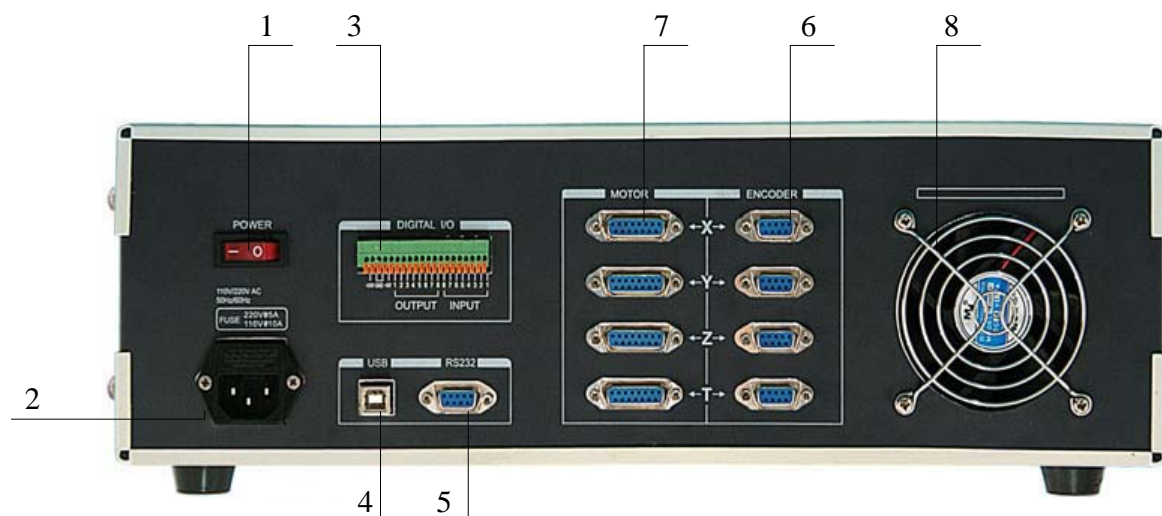
## 4 Function introduction

### 4.1 Front panel

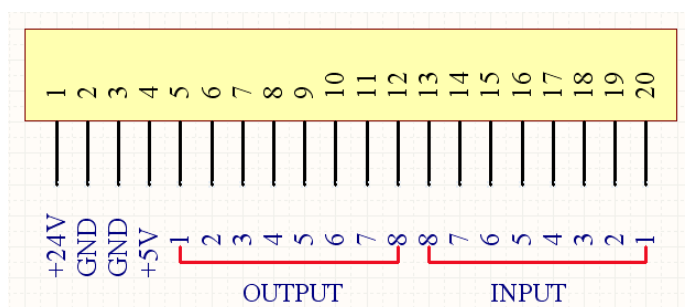


- 1) Display: 240×128 large LCD displays, back lighting. Display all the MC600 information
- 2) Menu control area: Up(↑) and down(↓) keys are generally used to switch the menu, when you input the digital, the up key means positive and the down key means negative. Right key is generally used to enter the next menu. Left key is generally used to return the menu. **ENTER** is generally used to switch the option and confirm the input.
- 3) Numeric keypad: Used to enter numerical values. **C** key to cancel the latest operation.
- 4) Motion control area: **BACK** used to make the table go to the negative directions. **FWD** used to make the table go to the positive directions. **HOME** used to make the table go home. **STOP** used to make the table stop.
- 5) **STOP**: Used to stop all operations.
- 6) Joystick interface.

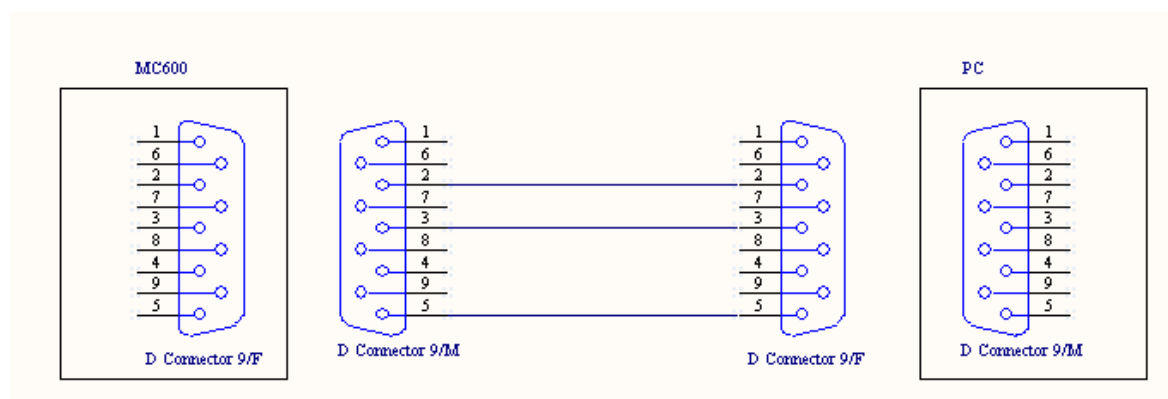
### 4.2 Rear panel



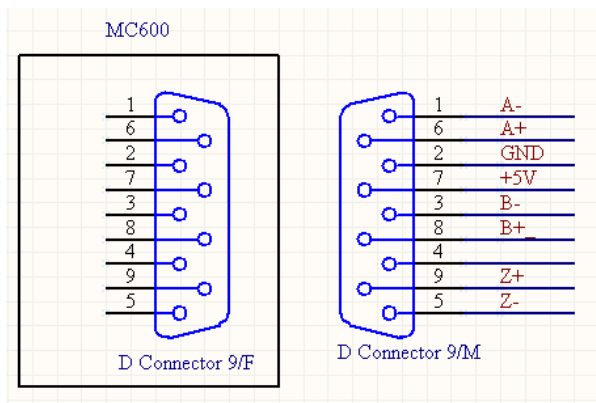
- 1) Power switch
- 2) Input power outlet: AC 110V / AC 220V (NOTE When you want to change the power supply type AC 110V or AC 220 V, you need to open the case and switch the power supply DIP switch location. That should be operated by professionals.
- 3) IO: the user can define the function of IO ports. The interface definition is shown below.



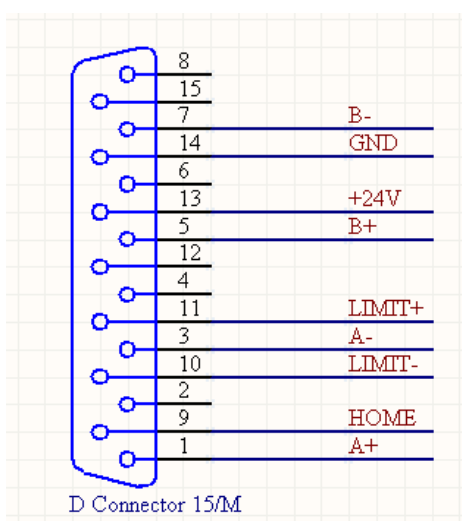
- 4) USB
- 5) RS232, the interface definition is shown below.



- 6) Grating interface. The interface definition is shown below.



7) Table interface. The interface definition is shown below.



Motor Interface defination:

15 PIN CON      9 PIN CON

1, 2-----6 motor A+

3, 4-----7 motor A-

5, 6-----8 motor B+

7, 8-----9 motor B-

9-----5 NC

10-----2 zero sensor

11-----3 NC

13-----1 24V

14-----4 GND

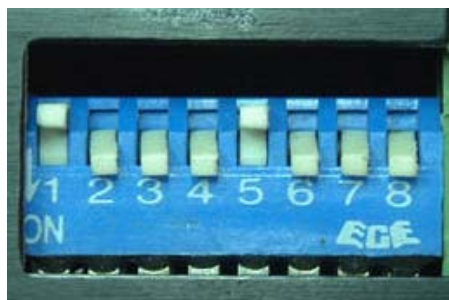
8) Fan.

### 4.3 Stepper motor driver setting

The default subsection of the stepper motor driver is 8 subsection. If you want to adjust the subsection, you should open the case and set the subsection according to the MA335 driver instruction. If the driver is not MA335, please contact ZOLIX. The MA335 driver appearance.



The switch for setting the current and subsection, down is ON.



Current settings please follow the following table.

Current SW1—SW3( 8 levels ):			
Current	SW1	SW2	SW3
1.3A	on	on	on
1.6A	off	on	on
1.9A	on	off	on
2.2A	off	off	on
2.5A	on	on	off
2.9A	off	on	off
3.2A	on	off	off
3.5A	off	off	off

Subsection settings please follow the following table.

Microstep SW5—SW8				
Micro	SW5	SW6	SW7	SW8
2	off	on	on	on
4	on	off	on	on
8	off	off	on	on
16	on	on	off	on
32	off	on	off	on
64	on	off	off	on
128	off	off	off	on
5	on	on	on	off
10	off	on	on	off
20	on	off	on	off
25	off	off	on	off
40	on	on	off	off
50	off	on	off	off
100	on	off	off	off
125	off	off	off	off

Please set the value according to your need, and confirm that the values you set are same with the MC600. the subsection is associated with the Motorized Stages movement open-loop resolution. Conversion formula is as follows.

Stages: Open-loop resolution = leading screw lead mm / (steps of stepper motor each cycle \* subdivision )

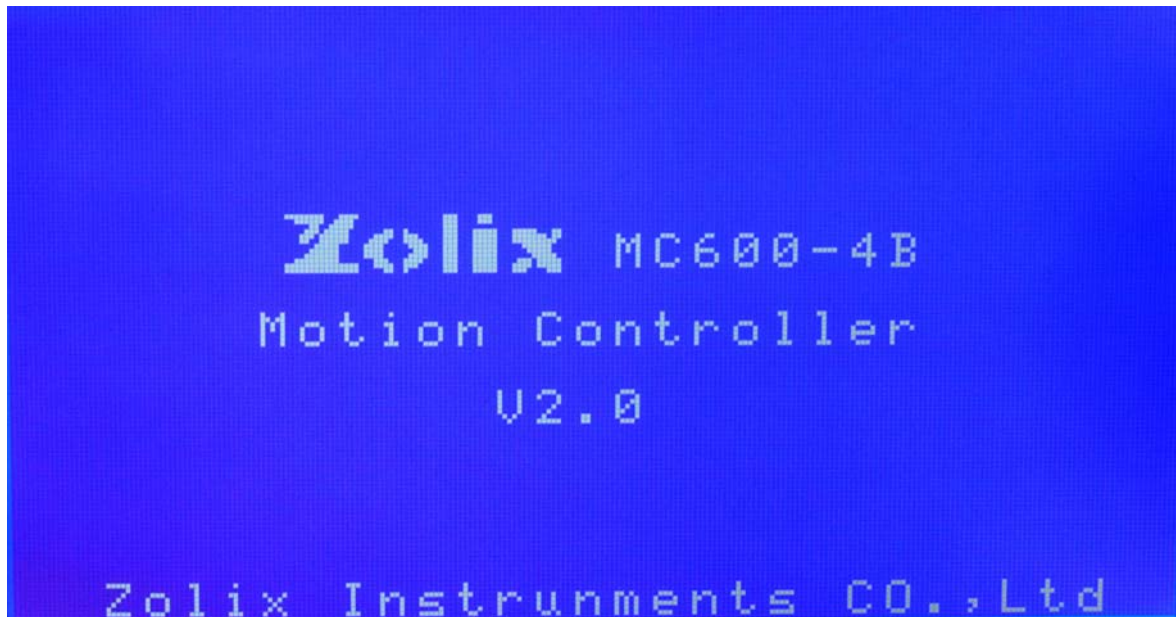
Rotary stage: Open-loop resolution = 360 / (steps of stepper motor each cycle \* subdivision \* transmission ratio)

NOTE: minimum distance of movement must be greater than the resolution. In closed-loop mode, if the encoder resolution is 1  $\mu$  m, then the resolution of the open-loop must be less than 1  $\mu$  m.



## 5 Menu Introduction

After starting up, the LCD screen will display welcome screen.



The welcome screen will display the manufacturer and trademarks, model, product name, firmware version. Then the motion controller is initialized and self-tested, that will take 2 to 6 seconds. After that the LCD will display the basic information.

O	X:0	PP
O	Y:0	PP
O	Z:0	PP
O	T:0	PP

The first row characters show the axis working state. If the front character is “O”, that means the stage in the open-loop mode. If the front character is “C”, that means the stage is in the close-loop mode.

The second row characters show the stages axis. If the stage is translation stage, the stages axis will be shown in capitalized English letters “X”“Y”“Z”“T”. If the stage is Rotary stage, the stages axis will be shown in Greek letters “α” “β” “γ” “θ”.

0	A:0	PP
0	Y:0	PP
0	Z:0	PP
0	T:0	PP

After the stage axis is the coordinate value, you can type 10 numbers.

**NOTE**, this coordinate value dose not have the memory function, the default value is 0.

After the coordinate value is the unit of the coordinate, such as PP (pulses), mm, um, deg.

**NOTE**: if it is translation stage, you can not choice deg as the unit, and if it is Rotary stage, you cannot choice mm or um as the unit.

0	X:0	mm
0	Y:0	PP
0	Z:0	PP
0	T:0	PP

In this interface, the user can control different keys to control the stages movement.

**BACK**: The stage moving to the negative direction.

**HOME**: The stage moving home.

**FWD**: The stage moving to the positive direction.

**STOP**: Stop stage stop.

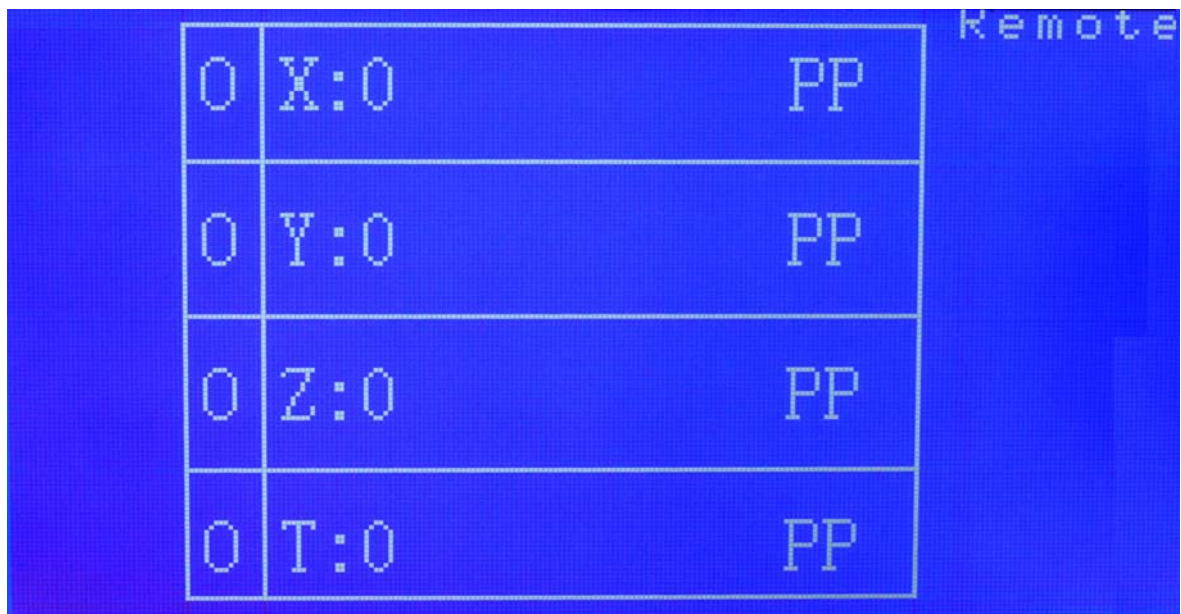
NOTE: there are two movement modes, one is the fixed-length mode, and another one is continuous mode. For the fixed-length mode, when you press the motion control key, the stage



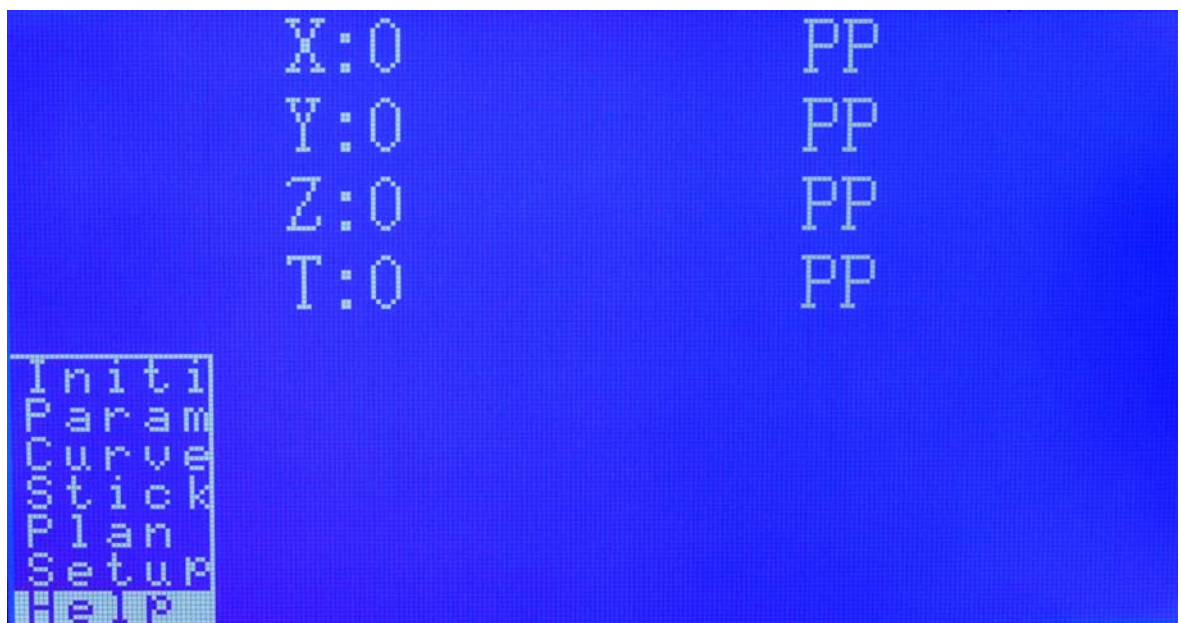
moves a fixed distance that is the default motion mode. For the continuous mode, when you press the motion control keys, the stage will move all the time until pressing the motion control keys again or pressing the **stop**.

There are three modes for homing. One is to use the negative limit switch to home, another one is to use the special zero-position switch, and the last one is to go to the user zero-position. The setting method please sees the following sections.

If the LCD displays the **Remote** on the left, which indicates that the MC600 is the remote control mode at this time. And all the motion control keys are failure. The stages are controlled by the PC.



In the basic information display interface, press the **Right-key** in the menu control keys, you can enter the **main menu** interface.



The screen will still display the basic information of the stages. And the **main menu** always



appears on the left of the screen, as shown above.

Initi: stage parameter setting.

Param: Operation parameters setting

Curve: Multi axis linear interpolation or circular interpolation

Stick: the stages controlled by the joystick.

Setup: motion controller working mode setting

Help: display help information

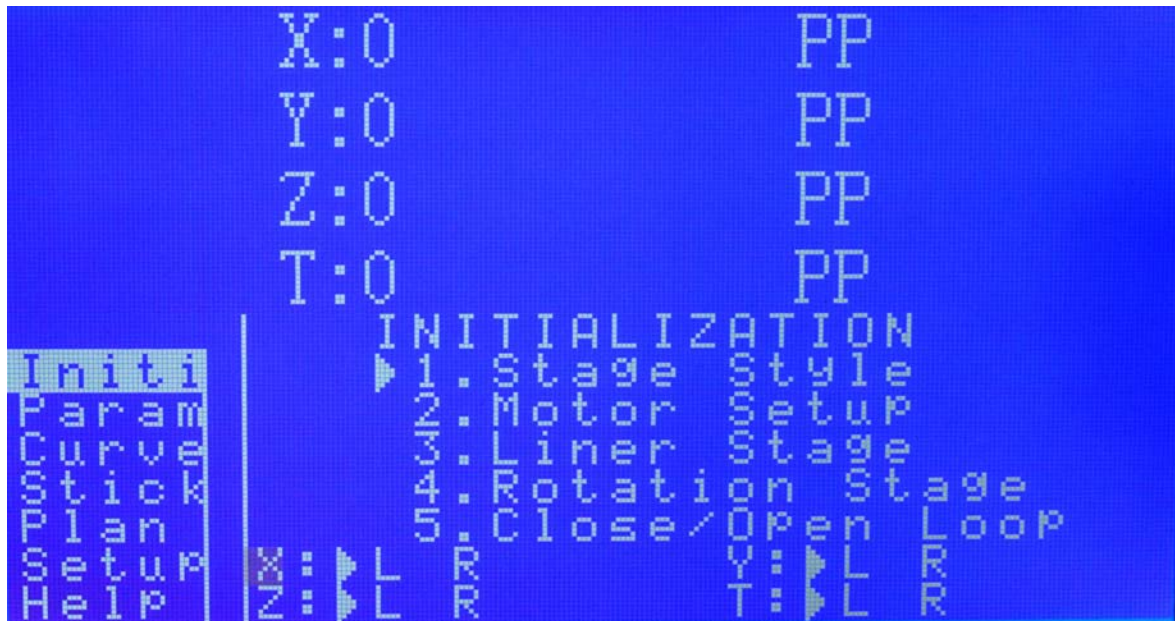
Press the up or down keys in the Menu control area, you can move the white border, and then press the **Right key** to enter that menu, press the **Left key** to exit that menu.

### 5.1 Initialization



Press the ↑ to move ►, press the **Right key** to enter that menu, press the **Left key** to exit that menu.

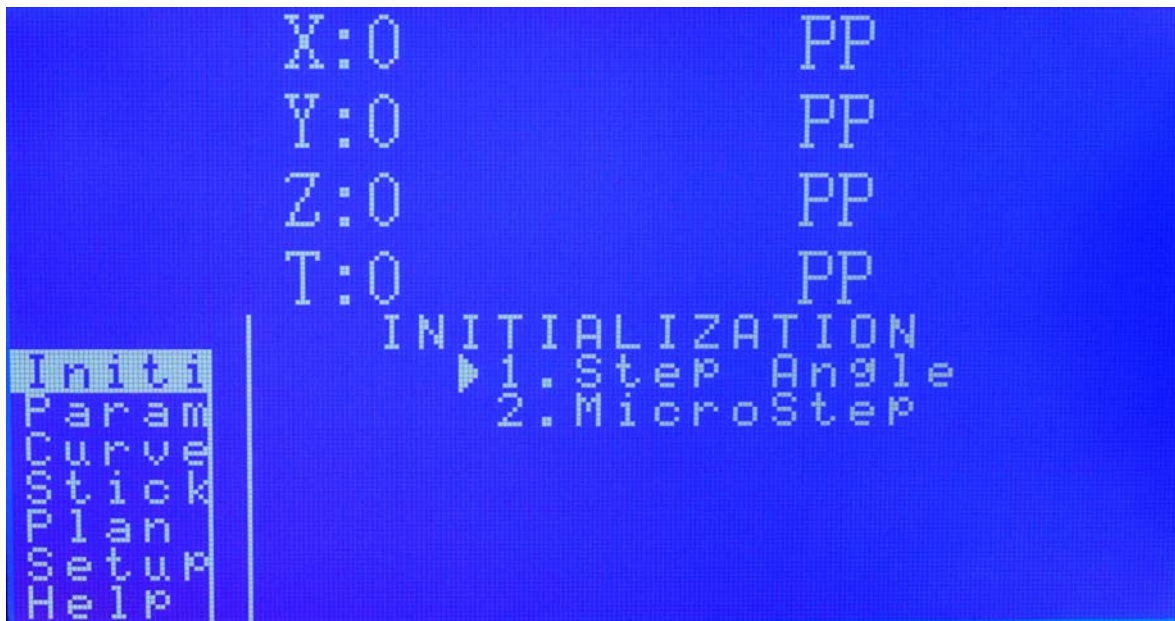
## 5.1.1 Stage Style setting



Press ↓ or ↑ to switch the stage, press **Enter** to save the setting. Press the **Left key** to return to the previous menu. NOTE: **L** (translation stage), **R** (Rotary stage).

NOTE: when you are setting the mode of the stage, the motion control keys are failure.

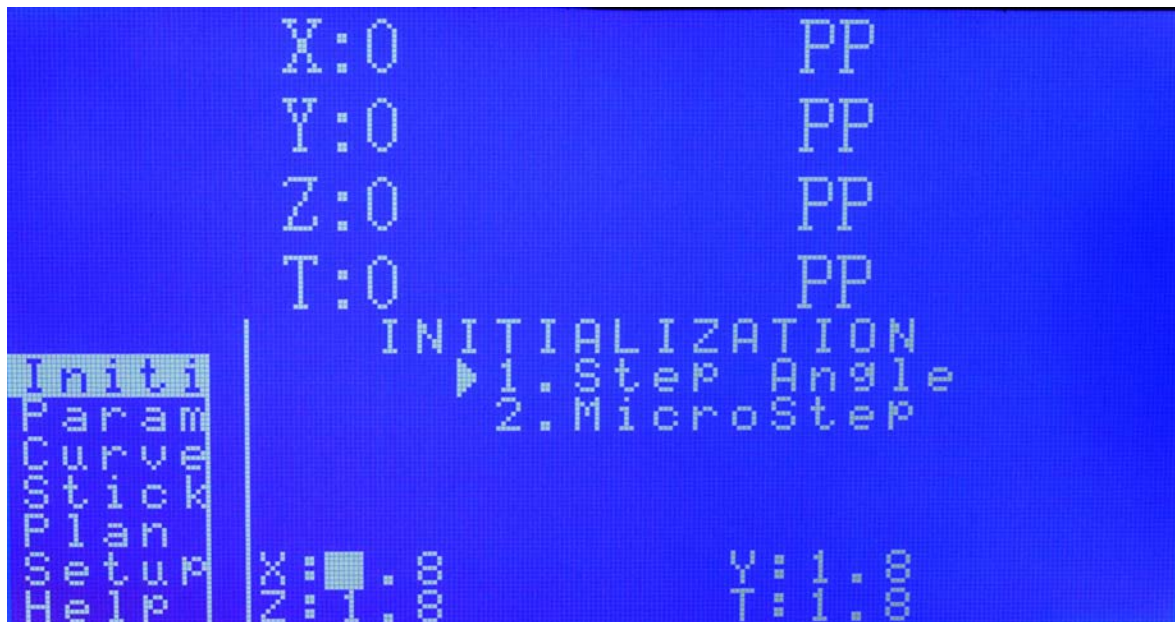
## 5.1.2 Motor Setup



This menu used to set the motor parameters. Press the ↓ or ↑ to move the □, press the **Right key** to enter that menu, press the **Left key** to exit that menu.

## 1) Step Angle setting

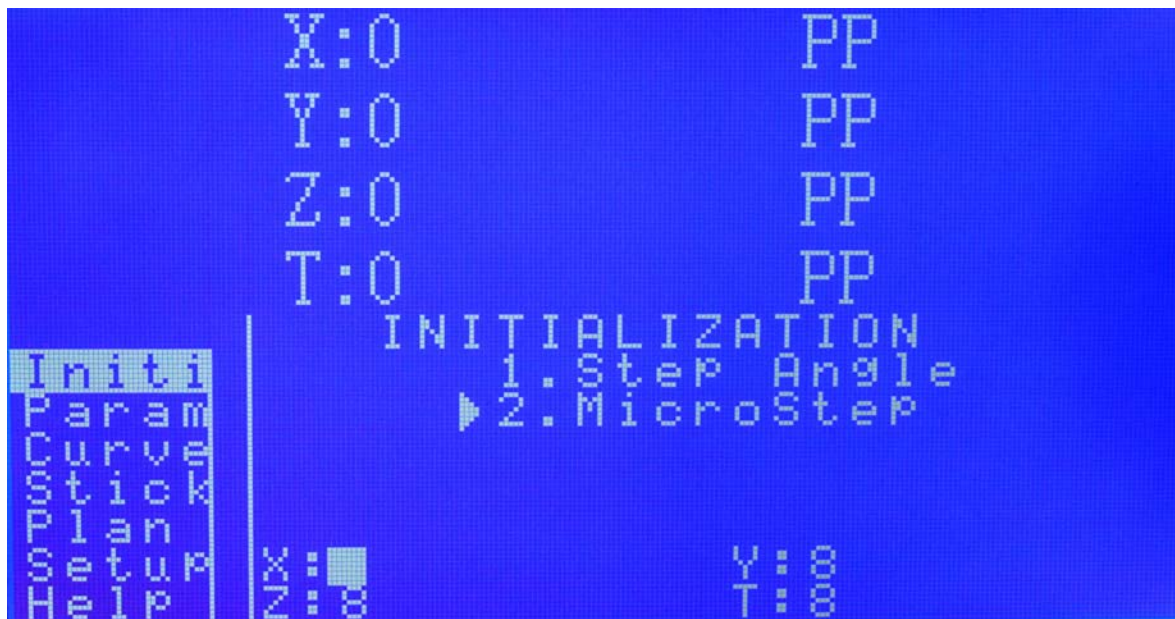




Press ↓ or ↑ to switch the stage, press **Enter**, then type the number (step Angle unit is °) in the **Numeric keypad**. Press the **Left key** to return to the previous menu. If need to edit the numbers, press the **C** in the **Numeric keypad** then press **Enter**.

NOTE: when you are setting the parameters, the motion control keys are failure.

## 2) Micro Step( driver subsection setting )



Press ↓ or ↑ to switch the stage, press **Enter**, then type the number (step Angle unit is °) in the **Numeric keypad**. Press the **Left key** to return to the previous menu. If need to edit the numbers, press the **C** in the **Numeric keypad** then press **Enter**.

NOTE: when you are setting the parameters, the motion control keys are failure.

## 5.1.3 Liner Stage



This menu used to set the parameters of the translation stage. Press the  $\downarrow$  or  $\uparrow$  to move the  $\blacktriangleright$ , press the **Right key** to enter that menu, press the **Left key** to exit that menu.

### (1) Stage Pitch setting



Press  $\downarrow$  or  $\uparrow$  to switch the stage, press **Enter**, then type the number (step Pitch unit is mm/r) in the **Numeric keypad**. Press the **Left key** to return to the previous menu. If need to edit the numbers, press the **C** in the **Numeric keypad** then press **Enter**.

NOTE: when you are setting the parameters, the motion control keys are failure.

### (2) Stage Distance setting

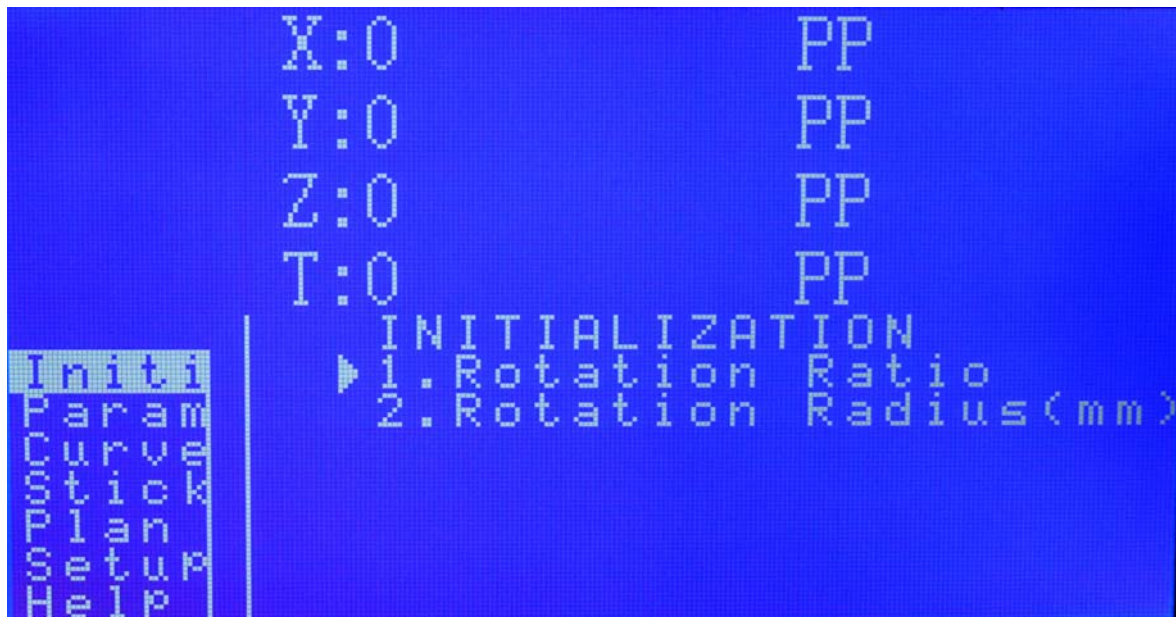




Press  $\downarrow$  or  $\uparrow$  to switch the stage, press **Enter**, then type the number (step Pitch unit is mm) in the **Numeric keypad**. Press the **Left key** to return to the previous menu. If need to edit the numbers, press the **C** in the **Numeric keypad** then press **Enter**.

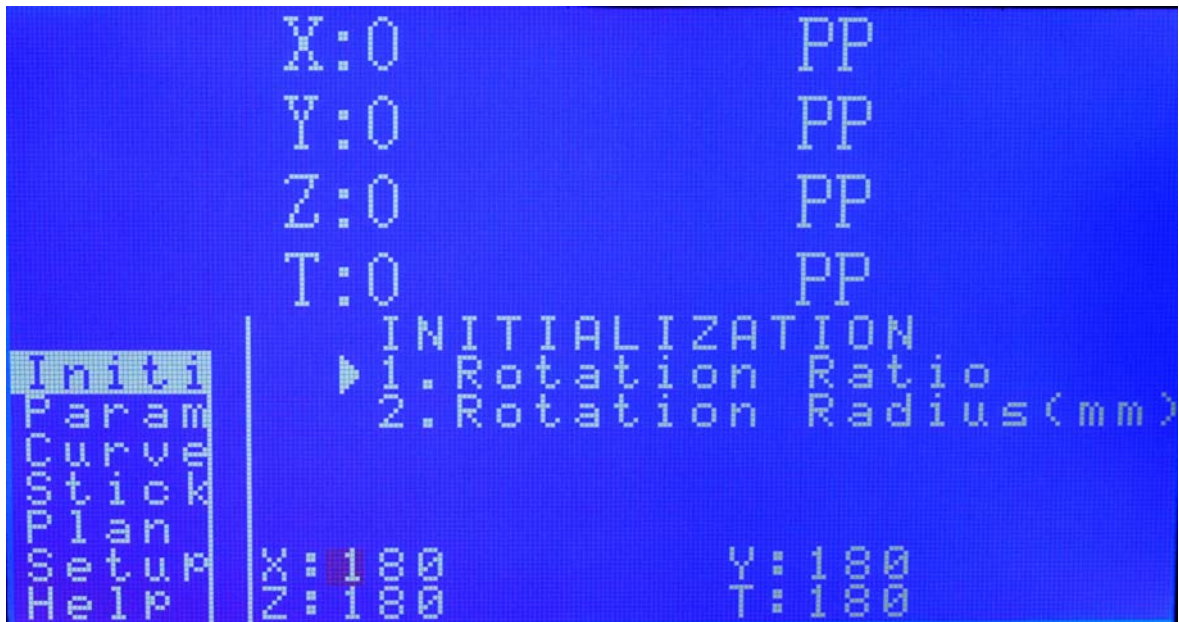
NOTE: when you are setting the parameters, the motion control keys are failure.

## 5.1.4 Rotary Stage setting



This menu used to set the parameters of the rotary stage. Press the  $\downarrow$  or  $\uparrow$  to move the  $\blacktriangleright$ , press the **Right key** to enter that menu, press the **Left key** to exit that menu.

### 1) Rotary Ratio setting



Press ↓ or ↑ to switch the stage, press **Enter**, and then type the number in the **Numeric keypad**. Press the **Left key** to return to the previous menu. If need to edit the numbers, press the **C** in the **Numeric keypad** then press **Enter**.

NOTE: when you are setting the parameters, the motion control keys are failure.

## 2) Rotary Radius setting

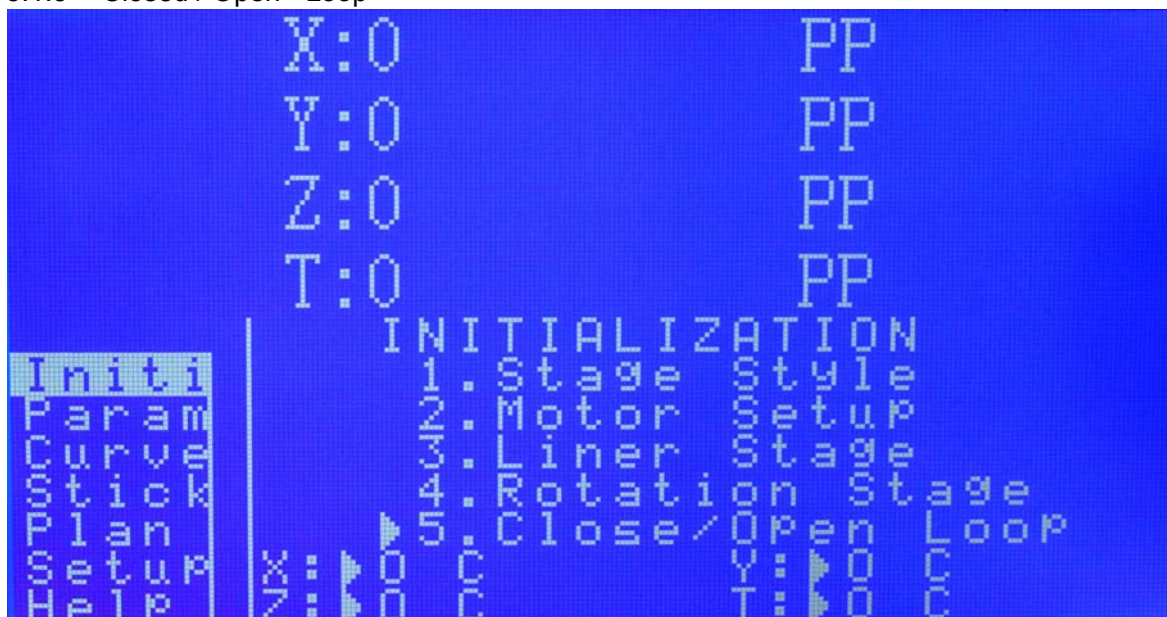


Press ↓ or ↑ to switch the stage, press **Enter**, then type the number (the unit is mm) in the **Numeric keypad**. Press the **Left key** to return to the previous menu. If need to edit the numbers, press the **C** in the **Numeric keypad** then press **Enter**.

NOTE: when you are setting the parameters, the motion control keys are failure.



## 5.1.5 Closed / Open - Loop



Press ↓ or ↑ to switch the stage, press **Enter** to change the stage mode. Press the **Left key** to return to the previous menu. NOTE, **O** ( open-loop) **C** (closed-loop).

## 5.2 Parameter setting



This menu used to set the parameters of the stage. Press the ↓ or ↑ to move the ►, press the **Right key** to enter that menu, press the **Left key** to exit that menu.

## 5.2.1 Dynamic Parameter



This menu used to set the parameters of the stage. Press the ↓ or ↑ to move the ►, press the **Right key** to enter that menu, press the **Left key** to exit that menu.

## (1) Speed setting



Press ↓ or ↑ to switch the stage, press **Enter**, and then type the number (you can set different units) in the **Numeric keypad**. Press the **Left key** to return to the previous menu. If need to edit the numbers, press the **C** in the **Numeric keypad** then press **Enter**.

NOTE: when you are setting the parameters, the motion control keys are failure.

## (2) Initial Speed setting





Press ↓ or ↑ to switch the stage, press **Enter**, and then type the number (you can set different units) in the **Numeric keypad**. Press the **Left key** to return to the previous menu. If need to edit the numbers, press the **C** in the **Numeric keypad** then press **Enter**.

NOTE: when you are setting the parameters, the motion control keys are failure.

### (3) Acceleration setting



Press ↓ or ↑ to switch the stage, press **Enter**, and then type the number (you can set different units) in the **Numeric keypad**. Press the **Left key** to return to the previous menu. If need to edit the numbers, press the **C** in the **Numeric keypad** then press **Enter**.

NOTE: when you are setting the parameters, the motion control keys are failure.

## 5.2.2 Static Parameter



This menu used to set the parameters of the stage. Press the ↓ or ↑ to move the ►, press the **Right key** to enter that menu, press the **Left key** to exit that menu.

## 1) Set User Origin



Press ↓ or ↑ to switch the stage, press **Enter**, and set the current physical location to the user origin. Press the **Left key** to return to the previous menu.

## 2) Limit+, the positive software limit setting





Press ↓ or ↑ to switch the stage, press **Enter**, then type the number ( you can set different units ) in the **Numeric keypad**, press ↓ to type the +, press ↑ to type -. Then press the **Left key** to return to the previous menu. If need to edit the numbers, press the **C** in the **Numeric keypad** then press **Enter**.

NOTE: when you are setting the parameters, the motion control keys are failure.

3) Limit- : the negative software limit setting



Press ↓ or ↑ to switch the stage, press **Enter**, then type the number ( you can set different units ) in the **Numeric keypad**, press ↓ to type the +, press ↑ to type -. Then press the **Left key** to return to the previous menu. If need to edit the numbers, press the **C** in the **Numeric keypad** then press **Enter**.

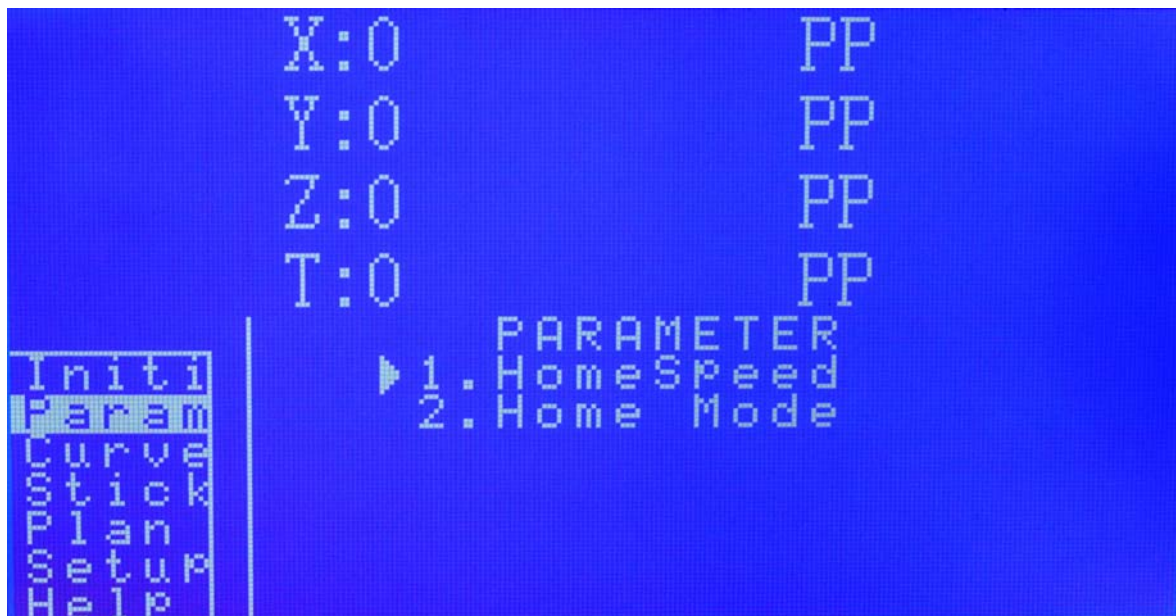
4) Encoder Resolution setting



Encoder parameter refers to the pulses which the encoder output when the stage moves 1  $\mu\text{m}$ . For example, for the 1 $\mu\text{m}$  resolution encoder, when the stage moves 1 $\mu\text{m}$ , the encoder output 1 pulse. For the 0.1 $\mu\text{m}$  resolution encoder, when the stage moves 1 $\mu\text{m}$ , the encoder output 10 pulses.

Press  $\downarrow$  or  $\uparrow$  to switch the stage, press **Enter**, then type the number (the unit is pp/mm) in the **Numeric keypad**. Then press the **Left key** to return to the previous menu. If need to edit the numbers, press the **C** in the **Numeric keypad** then press **Enter**.

### 5.2.3 Home Parameter



Press the  $\downarrow$  or  $\uparrow$  to move the  $\blacktriangleright$ , press the **Right key** to enter that menu, press the **Left key** to exit that menu.

#### 1) Home Speed setting





Press ↓ or ↑ to switch the stage, press **Enter**, and then type the number (you can set different units) in the **Numeric keypad**. Then press the **Left key** to return to the previous menu. If need to edit the numbers, press the **C** in the **Numeric keypad** then press **Enter**.

## 2) Home Mode setting



Press ↓ or ↑ to switch the stage, press the **Enter** to change the stage mode. Then press the **Left key** to return to the previous menu.

**NOTE:** Pz Physics, using the negative limit switch to go home.

Oz Zero, using the special zero-position switch to go home.

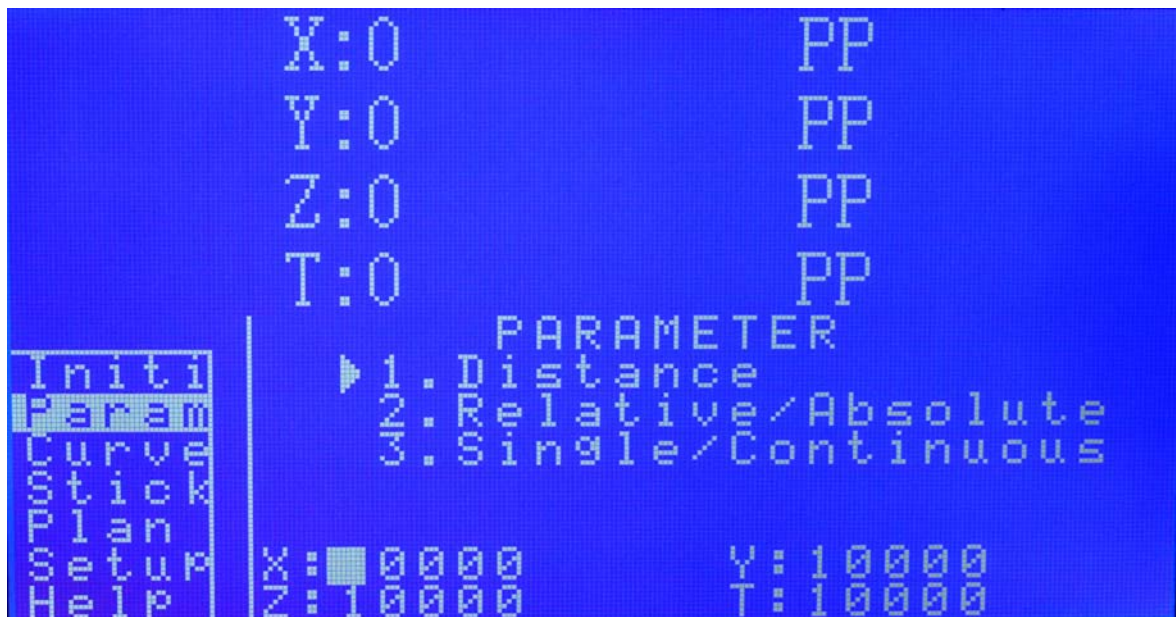
Uz User, back to the user home.

## 5.2.4 Run Mode



Press the ↓ or ↑ to move the ►, press the **Right key** to enter that menu, press the **Left key** to exit that menu.

## 1) Distance, moving coordinate setting



In relative operating mode, that **Distance** is the relative distance which stages move when you press the motion control keys. In absolute mode, that **Distance** is the endpoint absolute coordinate of the stage movement.

Press ↓ or ↑ to switch the stage, press **Enter**, and then type the number ( you can set different units ) in the **Numeric keypad**. Then press the **Left key** to return to the previous menu. If need to edit the numbers, press the **C** in the **Numeric keypad** then press **Enter**.

## 2) Relative/Absolute





Press the ↓ or ↑ to move the ►, press the **Right key** to enter that menu, press the **Left key** to exit that menu.

RD Relative motion mode

AD Absolute motion mode

3) Single/Continuous: running mode

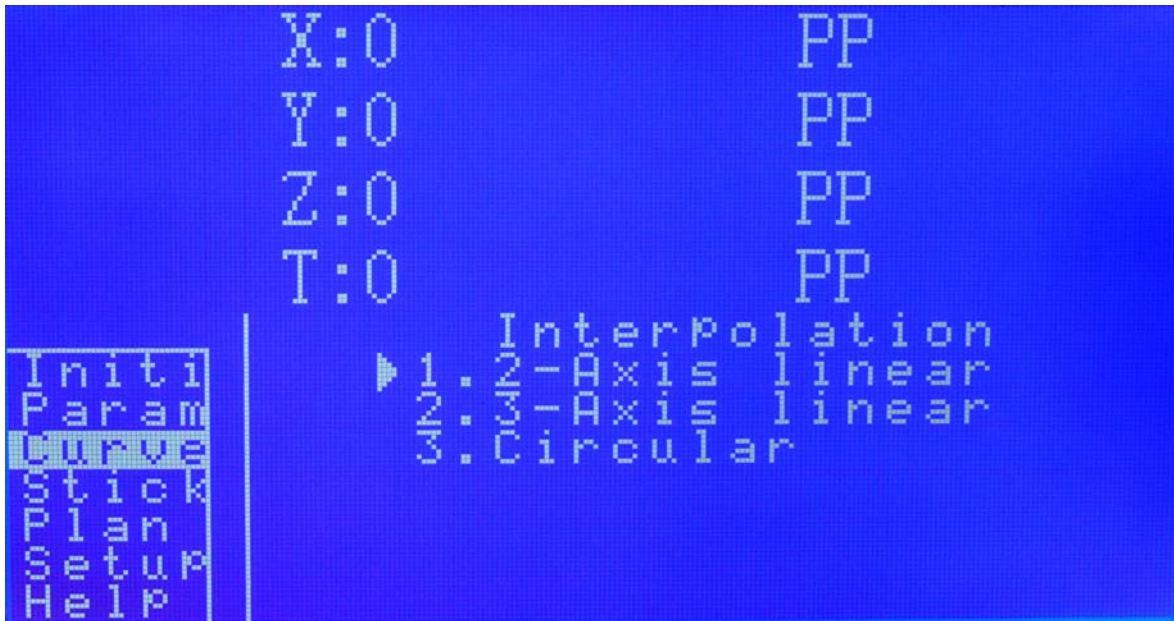


Press the ↓ or ↑ to switch the stage, press the **ENTER** to set the stage mode, press the **Left key** to exit that menu.

SD Single mode, not continuous movement.

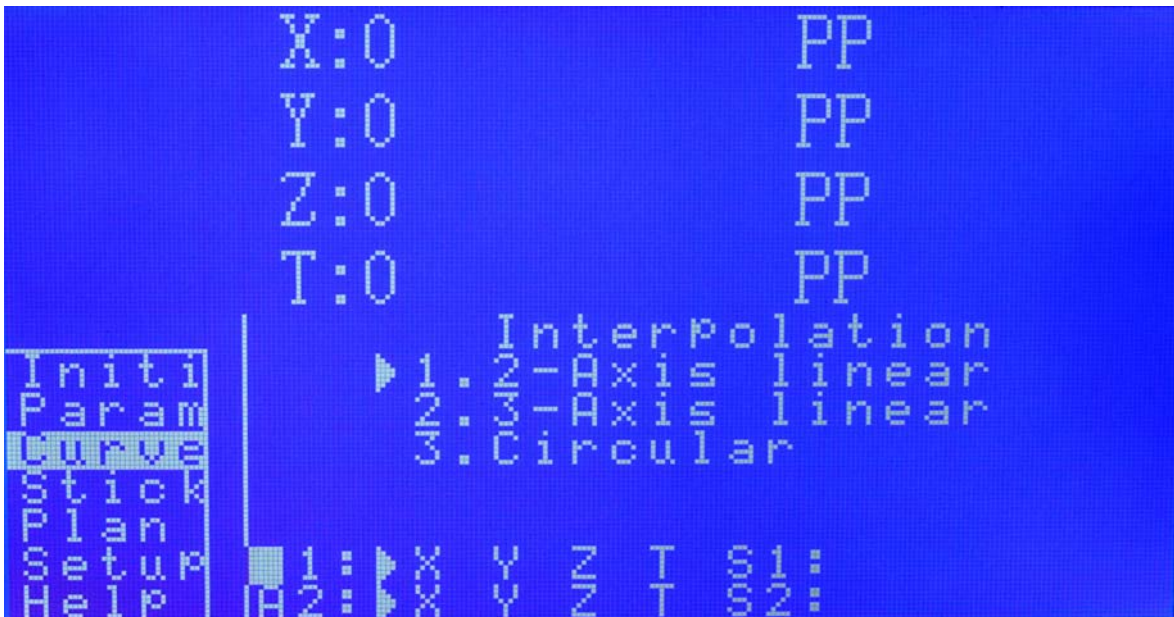
CD Continuous movement mode.

## 5.3 Multi-axis linear interpolation or circular interpolation (Curve)



Press the ↓ or ↑ to move the ►, press the **Right key** to enter that menu, press the **Left key** to exit that menu.

### 5.3.1 2-Axis linear

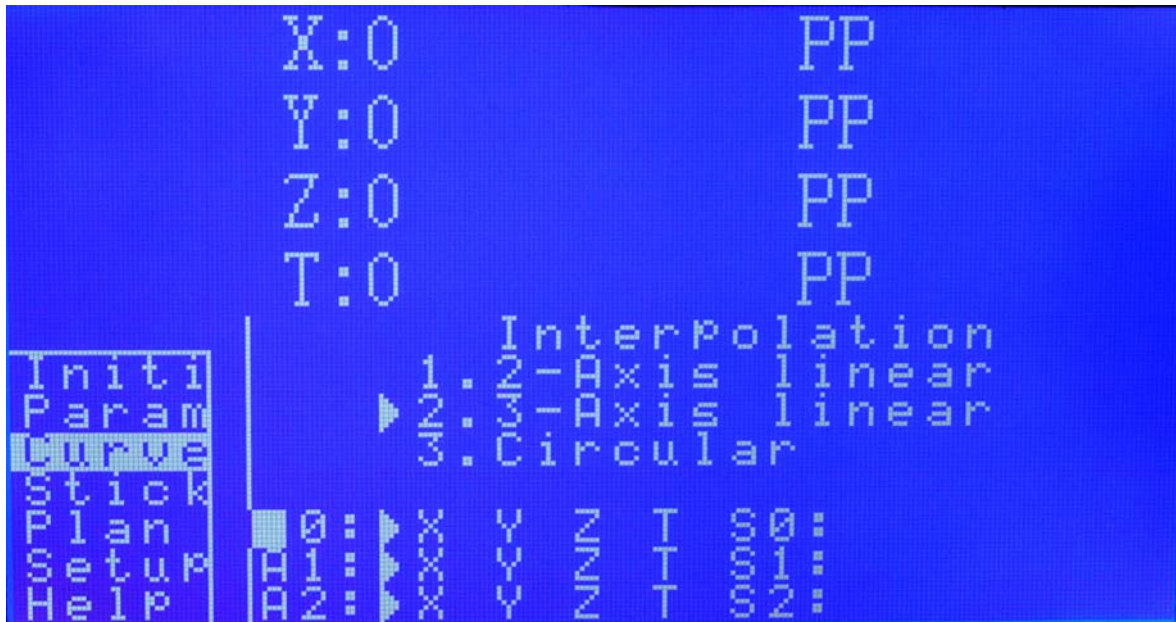


**A1** and **A2** are the axis involved in the interpolation. Using the ↓ or ↑ to choice the axis, and press the **ENTER** to switch. **S1** and **S2** are the relative endpoint coordinate of **A1** and **A2**.

**NOTE** The **A1** and **A2** can not be the same axis. The **S1** and **S2** are the relative coordinate, can be positive or negative.



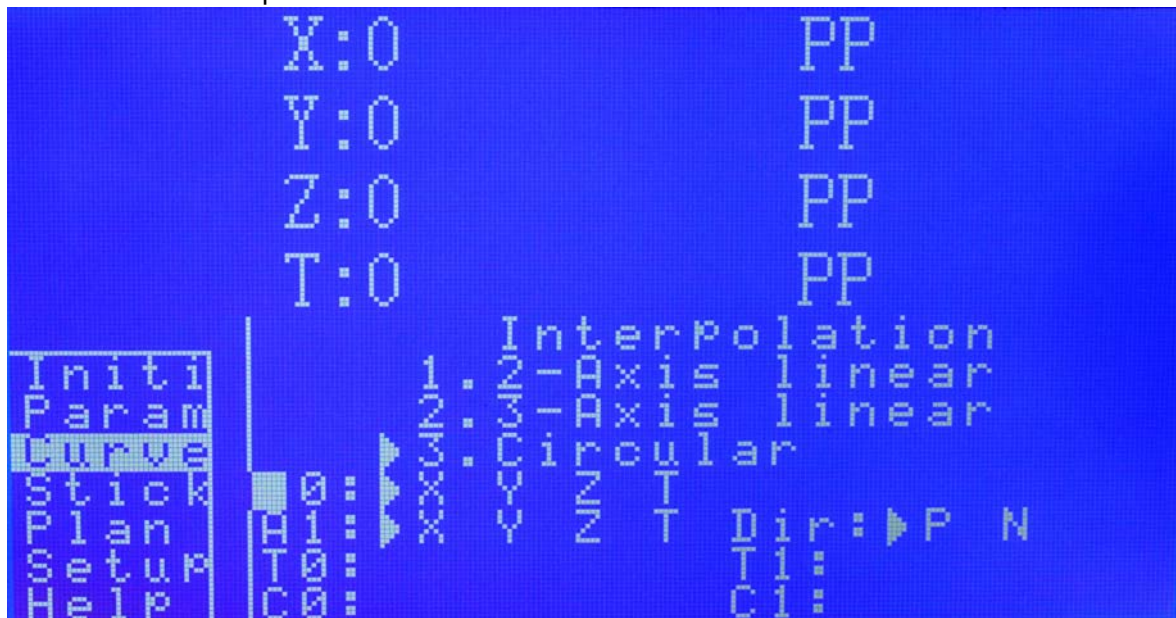
## 5.3.2 3-Axis linear



**A0**, **A1** and **A2** are the axis involved in the interpolation. Using the ↓ or ↑ to choice the axis, and press the **ENTER** to switch. **S0**, **S1** and **S2** are the relative endpoint coordinate of **A0**, **A1** and **A2**.

**NOTE:** The **A0**, **A1** and **A2** can not be the same axis. The **S0**, **S1** and **S2** are the relative coordinate, can be positive or negative.

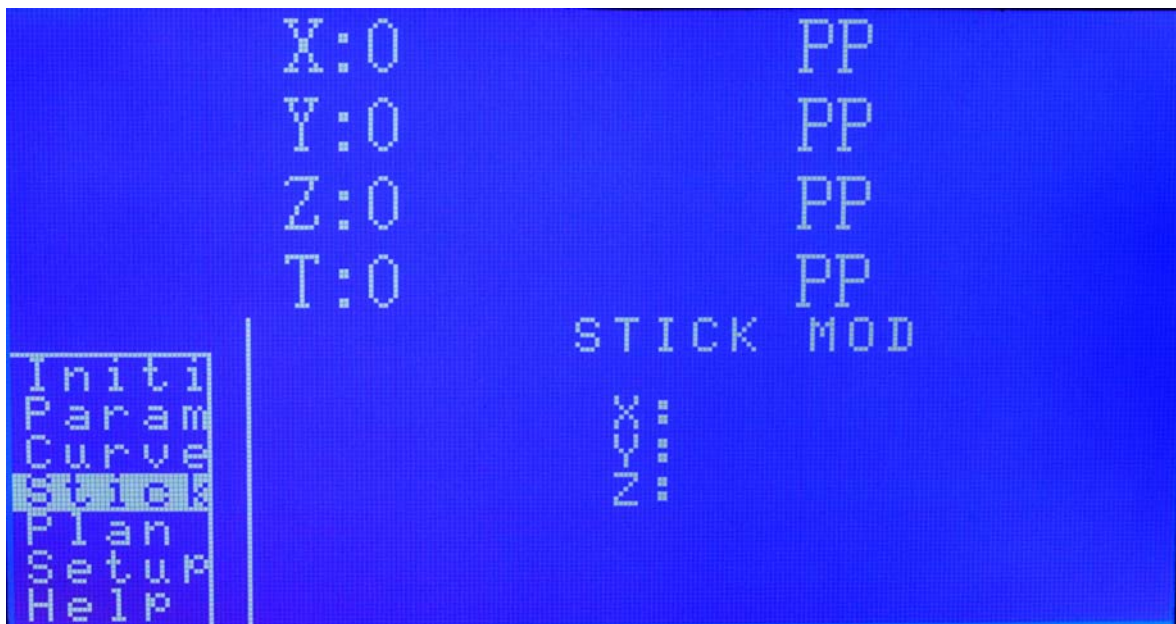
## 5.3.3 Circular Interpolation



**A0** and **A1** are the axis involved in the interpolation. Using the ↓ or ↑ to choice the axis, and press the **ENTER** to switch. **Dir** is the direction of interpolation motion, **P** means positive, **N** means negative. **T0** and **T1** are the relative coordinate of endpoint on the **A0**, **A1**. **C0** and **C1** are the relative coordinate of the circle center on the **A0**, **A1**.

**NOTE,** The **A0** and **A1** can not be the same axis. The **T0**, **T1** and **C0**, **C1** are the relative coordinate, can be positive or negative.

## 5.4 Stick



When enter the **Stick** mode, please press the small button on the joystick for zero calibration. Then you can control the stages motion by joystick. The **left and right** direction corresponds to the positive and negative direction of the **X** Axis. The forward and back direction corresponds to the positive and negative direction of the **Y** Axis. Clockwise and counterclockwise rotary corresponds to the positive and negative direction of the **Z** Axis. With different movement extent of the rocker, there are different speed for the stages. The larger extent of the rocker, the faster the speed. Each Axis has eight gears for each direction. The first gear corresponds to that Axis initial speed, the eighth gear corresponds to that Axis movement speed. And that could be displayed on the screen real time.

## 5.5 Plan

MC600 has the **PLAN** function. Based on the supporting of the movement commands and setting commands, adding the delay, wait, judge processes operation commands, makes the MC600 operational plans having the same functions with G Code, ladder diagram and other industrial processes languages.

### 5.5.1 Operation introduction

#### 1) Write the code

Create a new \*.txt file in the SD card's root directory. Name the file with 8-bit number. Then edit the commands in the file.

**NOTE:** Each command line must end with a newline.

For example:

```
GoPosition x,o,r,n,1000
```

```
GoPosition x,o,r,p,1000
```

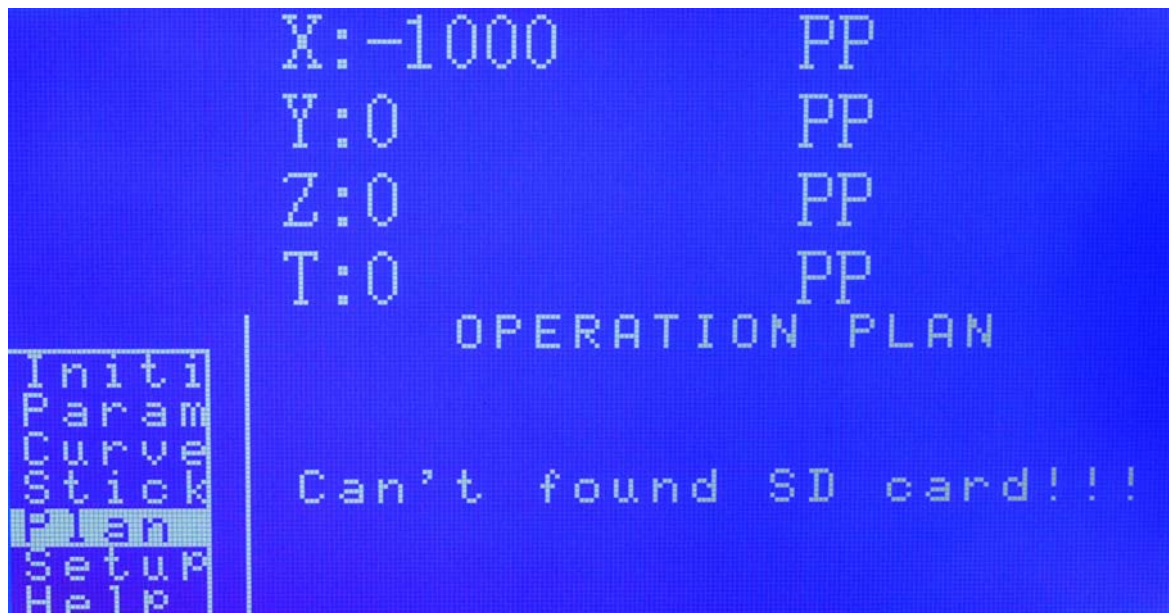
The above command means the 1000PP reciprocating.



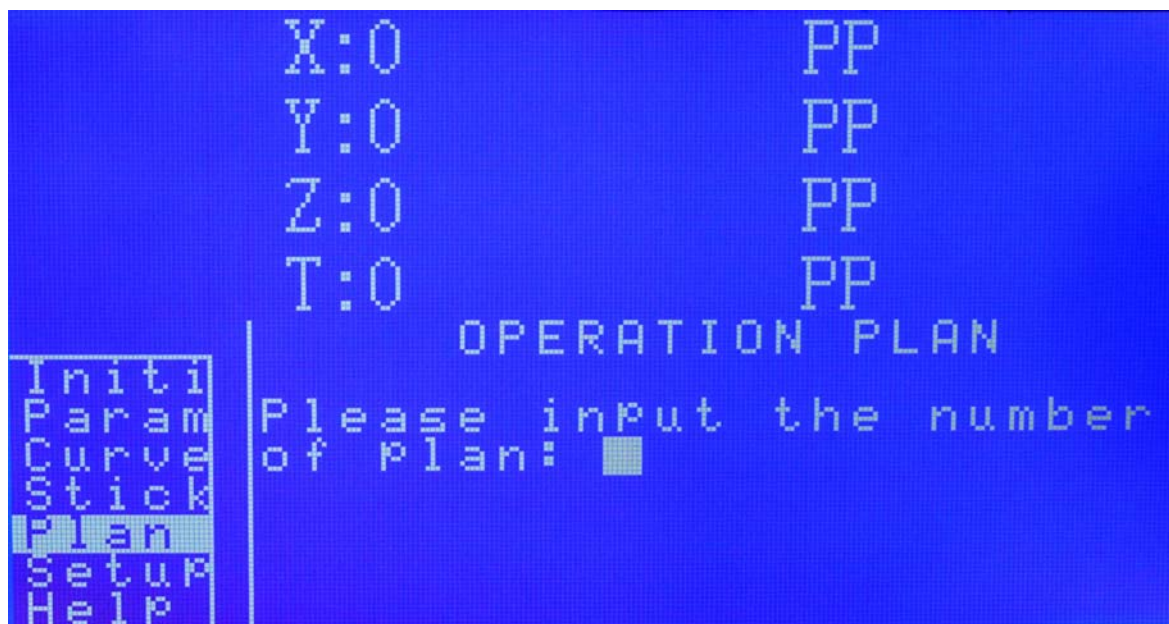
**NOTE:** the command file size should be not more than 4,294,967,295 bytes.

2) Open the motion case lid.

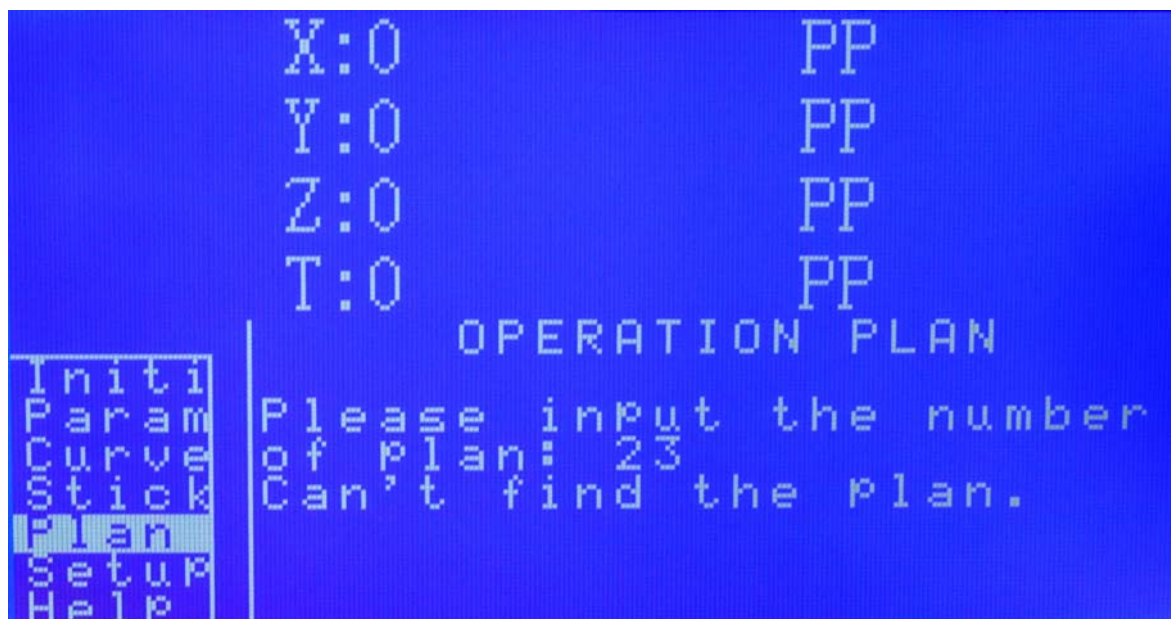
Insert the SD card into its slot. Then enter the **PLAN** option. If the SD card is damaged or has been not plugged well, the **Can't found SD card!!!** will appear on the screen.



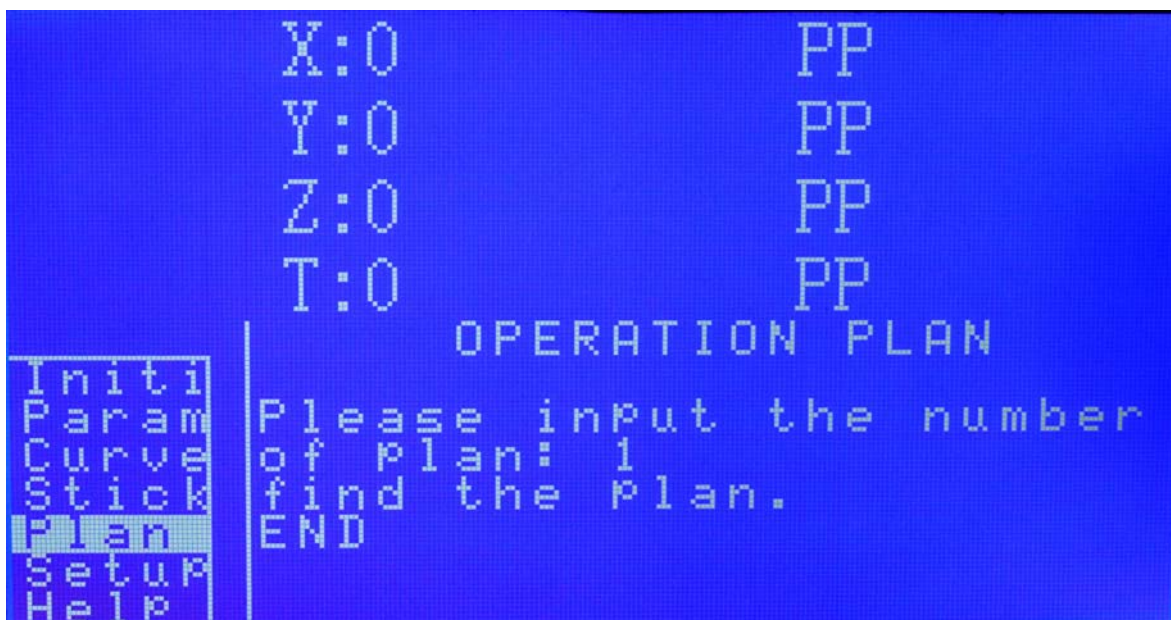
Under normal conditions, the screen will show **Please input the number of plan.**



According to the prompting, type the **PLAN** serial number of the file. If the system cannot find the **PLAN** files, **Can't find the plan** will appear on the screen.



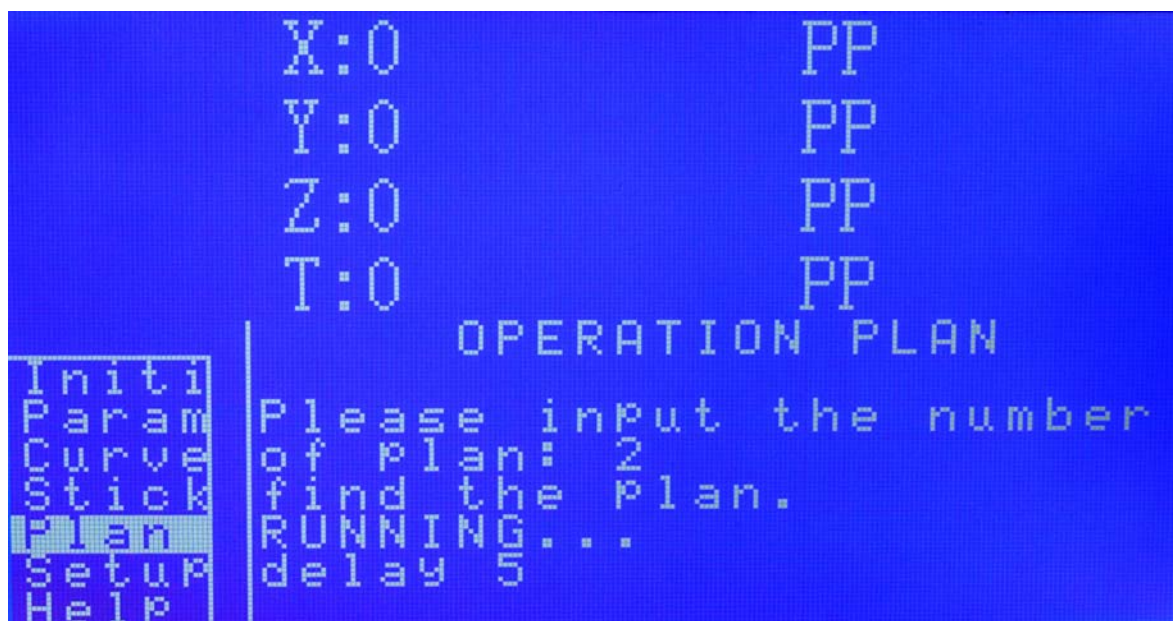
If the system finds the **PLAN** files, the screen will display **find the plan**.



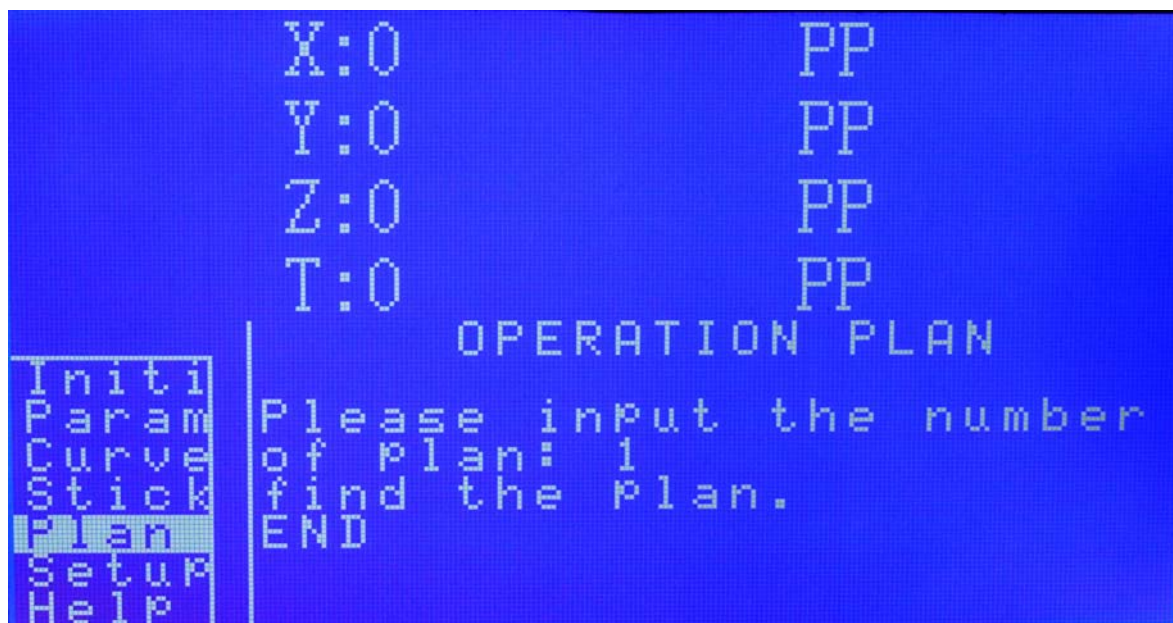
3) Run the Code command

During the process, the screen will display **RUNNING...**

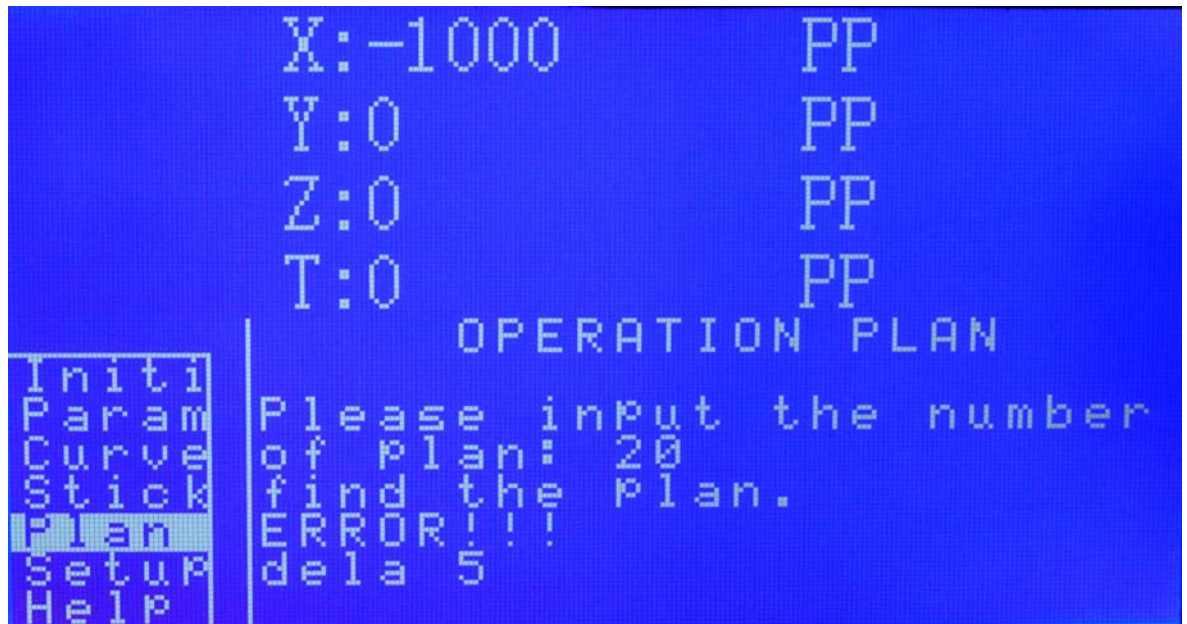




After that command is finished, the screen will show **END** and the running command.



If the command is wrong, the screen will display **ERROR!!!** and the wrong information, meantime the **PLAN** will stop.



During the **PLAN**'s operation, the axis of the forward, backward, zero and stop key are invalid. Using the ↑ to start over again, using the ↓ to end that motion, using the ← to exit the **PLAN**, using the middle button to pause. In all command operations are consistent. Those operations will take effect only until the current command ended.

When the **PLAN** is suspended, the screen will display **PAUSE**, the axis of the forward, backward, zero and stop key are activated. The ↑, ↓ and ← are invalid, using the middle button to continue.

When the **PLAN** is finished, the screen will display **END**. The axis of the forward, backward, zero and stop key are activated. Using the ↑ to start the last one **PLAN**, using the ↓ to choose the new **PLAN**, using the ← to exit the motion plan menu.

### 5.5.2 Supplementation Command Description

In order to identify the process command, motion command and setting command, there is a # before the supplementation command, which just can be used in the motion plan, can not be used in the remote control mode.

#### 1) Command: #delay x

Description: delay command, the unit of x (0~65535) is second.

Remark: That command can stop the process for a while. For example, in the Closed Loop motion, the stages need time to steady the location. So we recommend delaying 3~5s.

Example:

GoPosition x,o,r,n,1000

#delay 5

GoPosition x,o,r,p,1000

That command means that stage falls back 1000PP, after delaying 5s, it goes forward

1000PP.

2) Command: #until x

Description: Waiting command. On the rear panel, there is an 8-input port. Judging the level value of the input port, when the level value is same with the setting value, continue to operate next command, or the process will waiting here. The x has two formats, one is the whole value(0~255), another one is the single pin level(when judging the level of single pin, must be marked with @ , the range is 1~8, meaning the eight pins of the input port. When the level of the pin is high level, it satisfies the condition ).

Remark: the default input port level is high level, when there is no signal, the whole value is 255.

Example 1

```
GoPosition x,o,r,n,10000
```

```
#until 254
```

```
GoPosition x,o,r,p,5000
```

That command means the stage falls back 10000PP, when the input value is 254, it will go forward 5000PP.

Example 2

```
GoPosition x,o,r,n,10000
```

```
#until @1
```

```
GoPosition x,o,r,p,5000
```

That command means the stage falls back 10000PP, when the 1# Pin of the input is high level, it will go forward 5000PP.

3) Command: #until\_non x

Description: waiting command. It has the same function with *until*, but the waiting condition is different. When the input port level is different with the setting level or when the pin is low level, it satisfies the condition.

Sample 1

```
GoPosition x,o,r,n,10000
```

```
#until_non 255
```

```
GoPosition x,o,r,p,5000
```

That command means the stage falls back 10000PP, when the value of input port is not 255, it will go forward 5000PP.

Sample 2

```
GoPosition x,o,r,n,10000
```

```
#until_non @1
```

```
GoPosition x,o,r,p,5000
```

That command means the stage fall back 10000PP, when the 1# Pin of the input is low

level, it will go forward 5000PP.

4) Command: #loop x.....#end\_loop

Description: recycle command. It will recycle the command between #loop x and #end\_loop. The x is the number of cycles with the range of 0~65535.

Remark: when the x is 0, it will recycle again and again.

Sample 1

GoPosition x,o,r,p,10000

#LOOP 3

GoPosition x,o,r,n,1000

GoPosition x,o,r,p,1000

#END\_LOOP

GoPosition x,o,r,n,10000

For that command the stage will fall back 10000PP first, then take 3 times reciprocating motion, then go forward 10000PP.

Sample 2

#LOOP 0

GoPosition x,o,r,n,1000

GoPosition x,o,r,p,1000

#END\_LOOP

The stage will recycle again and again.

5) Command: #if x.....#end\_if

Description: condition judgment. It will run the command between #if x and #end\_if when the level is same with the setting value by judging the input level. Or it will jump those commands. There are two formats for the x, one is the whole number(0~255), another one is single pin level(when judging the level of single pin, must be marked with @ , the range is 1~8, meaning the eight pins of the input port. When the level of the pin is high level, it satisfies the condition ).

Sample 1:

GoPosition x,o,r,n,10000

#if 254

GoPosition x,o,r,p,5000

GoPosition x,o,r,n,5000

#end\_if

GoPosition x,o,r,p,10000

For that command, the stage will fall back 10000PP first when the input is 254, then it will take a recycle motion for 5000PP. Then it will go forward 10000PP.

Sample 2:

GoPosition x,o,r,n,10000



```
#if @1
```

```
GoPosition x,o,r,p,5000
```

```
GoPosition x,o,r,n,5000
```

```
#end_if
```

```
GoPosition x,o,r,p,10000
```

For that command, the stage will fall back 10000PP first when the 1# pin is high level, the stage will take a recycle motion for 5000PP. Then it will go forward 10000PP.

6) Command: #if\_non x.....#end\_if

Description: waiting command. It has the same function with if, but the waiting condition is different. When the input port level is different with the setting level or when the pin is low level, it satisfies the condition.

Sample 1:

```
GoPosition x,o,r,n,10000
```

```
#if_non 255
```

```
GoPosition x,o,r,p,5000
```

```
GoPosition x,o,r,n,5000
```

```
#end_if
```

```
GoPosition x,o,r,p,10000
```

That command means the stage falls back 10000PP, when the value of input port is not 255, it will go forward 5000PP.

Sample 2:

```
GoPosition x,o,r,n,10000
```

```
#if_non @1
```

```
GoPosition x,o,r,p,5000
```

```
GoPosition x,o,r,n,5000
```

```
#end_if
```

```
GoPosition x,o,r,p,10000
```

For that command, the stage will fall back 10000PP first when the 1# pin is low level, the stage will take a recycle motion for 5000PP. Then it will go forward 10000PP.

7) Command: \*.....

Description: comment line. All the characters after \* would not be dealt with.

Note: the \* must be on the front of the comment line.

### 5.5.3 Code Samples

Sample 1:

```
GoPosition x,o,r,n,10000
```

```
#if @1
```

```
GoPosition x,o,r,p,5000
```

```
#if @2
GoPosition x,o,r,p,5000
GoPosition x,o,r,n,5000
#end_if
GoPosition x,o,r,n,5000
#end_if
GoPosition x,o,r,p,10000
```

That is a condition judging nesting sample, it can nest 32 layers.

Sample 2:

```
#LOOP 2
GoPosition x,o,r,p,10000
#LOOP 3
GoPosition x,o,r,n,1000
GoPosition x,o,r,p,1000
#END_LOOP
GoPosition x,o,r,n,10000
#END_LOOP
```

That is a looping nesting sample, it can nest 32 layers.

Sample 3:

```
#LOOP 0
#if_non @1
GoPosition x,o,r,n,1000
#end_if
#if_non @2
GoPosition x,o,r,p,1000
#end_if
#END_LOOP
```

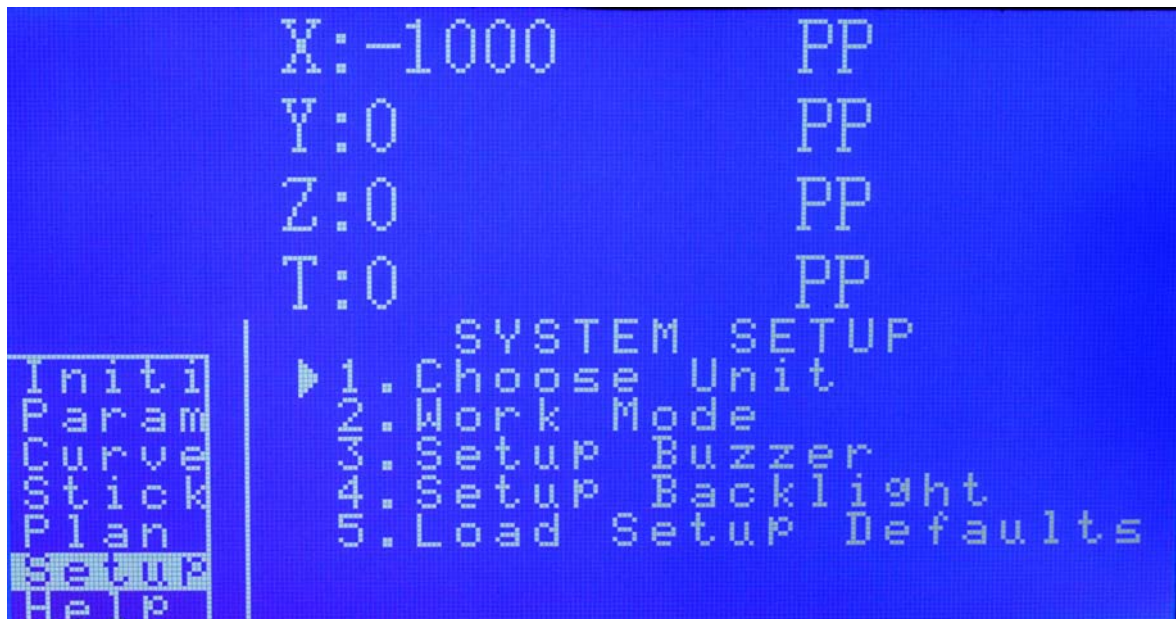
This is an example of nested determine to loop.

Sample 4:

```
GoPosition x,o,r,n,1000
#if_non @1
#LOOP 3
GoPosition x,o,r,n,500
GoPosition x,o,r,p,500
#END_LOOP
#end_if
GoPosition x,o,r,p,1000
```

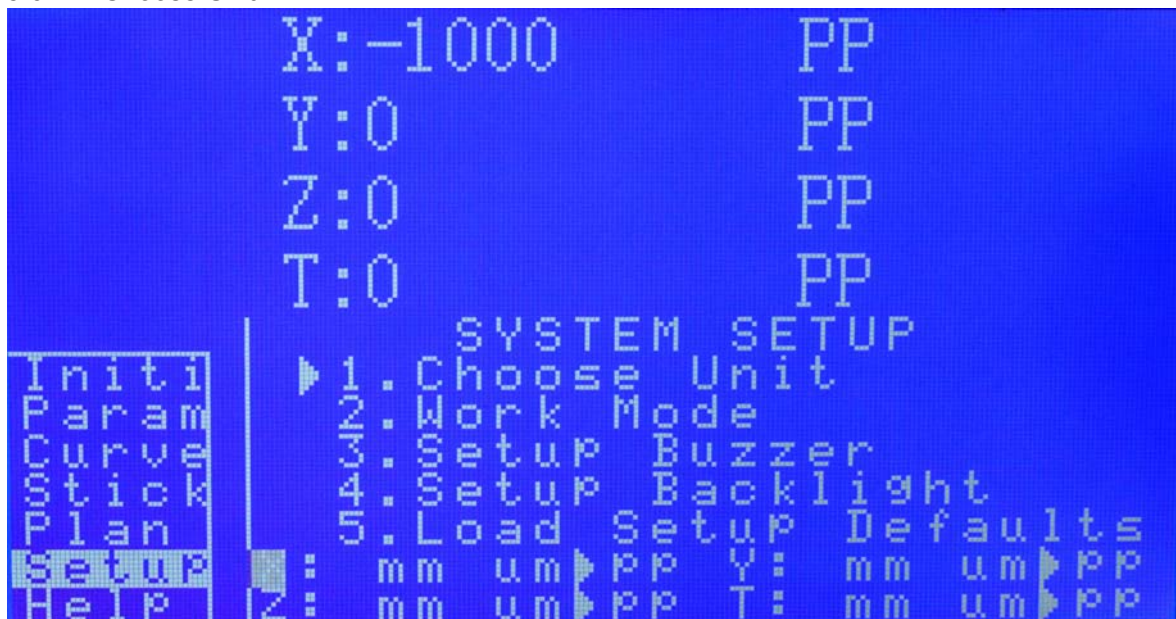
This is an example of nested loop to determine.

## 5.6 Motion controller working mode setting (Setup)



Press the ↓ or ↑ to move the ►, press the **Right key** to enter that menu, press the **Left key** to exit that menu.

### 5.6.1 Choose Unit



Press the ↓ or ↑ to switch the stages, press **Enter** to change the setting of the stage. Press **Left** to return to the previous menu.

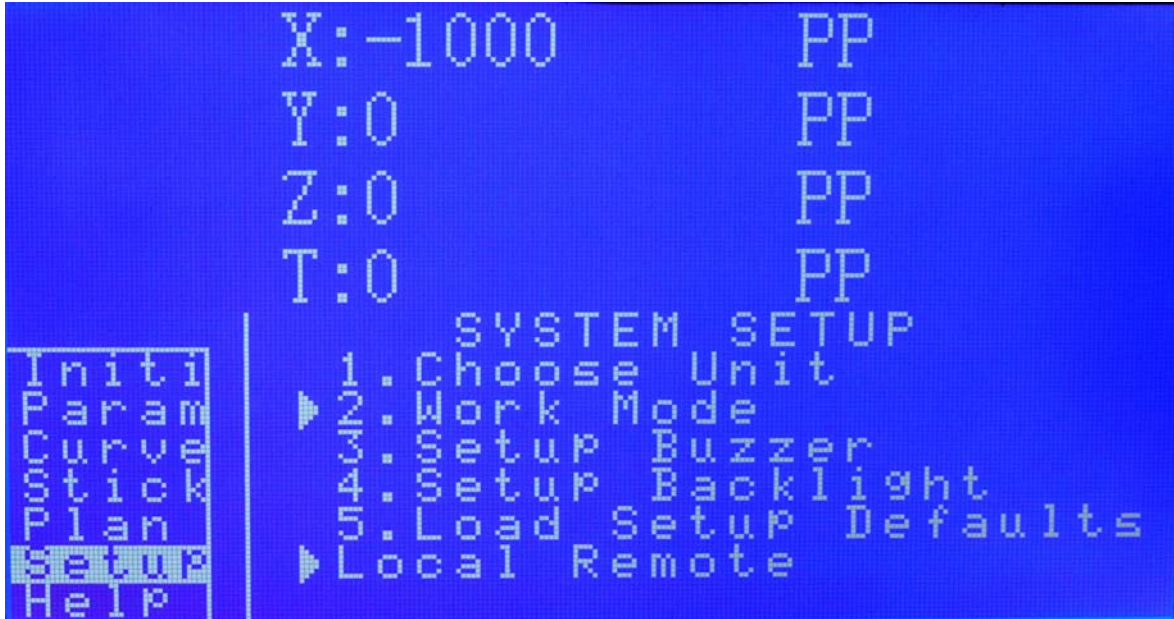
mm: millimeter

um: micrometer

pp: pulse



## 5.6.2 Work Mode



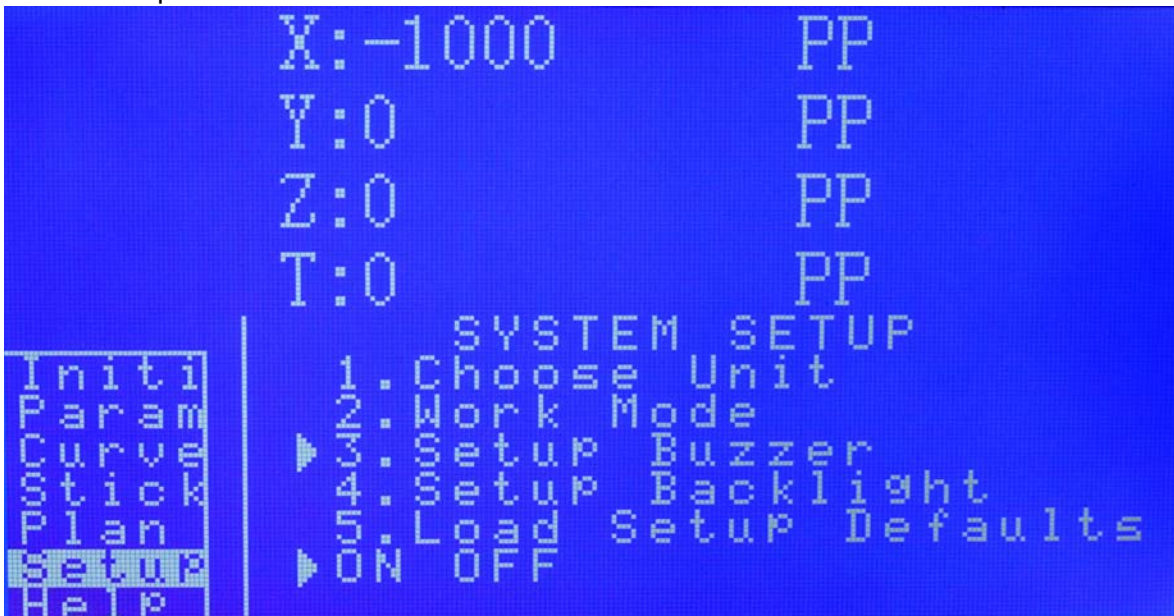
Press the ↓ or ↑ to switch the stages, press *Enter* to change the setting of the stage.  
Press *Left* to return to the previous menu.

**Note:**

Local means the local control mode. In that mode, the motion controller is controlled by the front panel, the remote communication control is invalid.

Remote means the remote control mode. In that mode, the motion controller is controlled by the remote communication, the front panel control is invalid.

## 5.6.3 Setup Buzzer



Press **Enter** to change the setting. Press **Left** to return to the previous menu.

## 5.6.4 Setup Backlight



Press **Enter** to change the setting. Press **Left** to return to the previous menu.

## 5.6.5 Back to Factory Default



Enter, and restart the motion controller, all of the parameters will back to Factory defaults.

## 5.7 Help





## 6 MC600 communication protocol

See Appendix A 《MC600 communication protocol》.

## 7 MC600 Factory defaults

### 7.1 Stage parameter

- (1) stage type: L (Translation Stages )
- (2) Screw Lead: 4 mm
- (3) stepping angle: 1.8 deg
- (4) Subdivision: 16
- (5) Transmission ration: 180
- (6) rotary stages radius: 50mm
- (7) Translation Stages full-travel: 1000mm
- (8) Stages working mode: O (open-loop)

### 7.2 Running parameter

- (1) Run-axis speed: 5000 PP/S
- (2) Run-axis initial speed: 1800 PP/S
- (3) Accelerated speed: 11000 PP/S
- (4) Backing to original speed: 2000 PP/S
- (5) Run-axis unit: PP( pulse )
- (6) Home mode: Py(using negative limit switch to go home)
- (7) MC600 mode: Local

### 7.3 Position parameter

- (1) Run-axis positive software limit: 99999999 PP
- (2) Run-axis negative software limit: -99999999 PP

### 7.4 linear scale : 1 pp/um



**8 Formula introduction**

The number of steps per revolution of the stepper motor =  $360 / \text{stepping angle}$

Pulse equivalent: Displacement or rotary amount generated by a single pulse. That is the control resolution.

Translation stage: Pulse equivalent =  $\text{screw lead (mm)} / (\text{The number of steps per revolution of the stepper motor} * \text{subdivision})$

Rotary stage: Pulse equivalent =  $360 / (\text{The number of steps per revolution of the stepper motor} * \text{subdivision} * \text{transmission ratio})$

Stage actual speed (mm/second) =  $\text{speed} * \text{Pulse equivalent}$

Pulse Number → angular metric

Rotary amount (deg) =  $((\text{Pulse} / \text{Subdivision}) * \text{step angle}) / \text{Transmission ratio}$

Pulse Number → Displacement(mm)

Displacement(mm) =  $((\text{Pulse} / \text{Subdivision}) * \text{step angle}) / 360 * \text{screw lead}$

Displacement(mm) → Pulse Number

Pulse Number =  $(\text{Displacement} * \text{Subdivision} * 360) / (\text{step angle} * \text{screw lead})$

Angle → Pulse Number

Pulse Number =  $(\text{Angle} * \text{subdivision} * \text{Transmission ratio}) / \text{step angle}$

## **9    Unpacking Procedure**

### **9.1 Visual examination**

Please do the following inspection for all packing box.

Check whether the packaging is intact outside the equipment; there are situations, such as damage, soaks, out of shape, etc.

If shipping damage is noticed at delivery, please inform Zolix Or Representatives immediately.

### **9.2 Unpacking procedures**

Please open the packing box and make sure Do-Not use the heavy-duty tools or opens rudely.

With the proper tool according to the direction shown on the packing box so as not to cause inside equipment to be damaged.

Do not use the silt housing or other protrusions for lifting.

### **9.3 After unpacks**

Please inspect for previously hidden damages or corrosions and inform Zolix and carrier immediately.

Based on contract and packing list, check specification, mode, and quantity.

Have above-mentioned situation please report immediately to Zolix or representatives

Please keep all packing material at least six months for extra transportation.

## **10   Warning**

### **Warning !!!**

**Power Supply AC220V**

**Never open the case when it is in operation!**

**Never touch the internal plugs with power on!**

**11 CE Declaration of Conformity**

Manufactured by: Zolix Instrument Co., Ltd

Applicable Standards:	Generic Immunity	EN 50082-1 : 1992
	Generic Emission	EN 50081-1 : 1992
	Electrical Safety Standards	EN 61010-1 : 1993

Zolix Instrument Co., Ltd **certifies that this equipment conforms to the protection requirements of the above Directives.**



**12 Certifications and Warranty**

Zolix Instruments Corporation (Zolix) certifies that this instrument was thoroughly tested and inspected and found to meet the specifications furnished by Zolix when it was shipped from the factory.

Zolix Instruments Corporation (Zolix) instruments and accessories are warranted for a period of one full year from date of delivery to be free from defects in material and to conform to the specifications furnished by Zolix. The corporation's obligation under this warranty is limited to servicing or adjusting an instrument returned to the factory, prepaid, and to repairing at the factory any part or parts thereof. All purchased items carry the original manufacturers' warranty.

Zolix Corporation shall not be liable for consequential damages resulting from accident, alteration, and improper installation, operation on low or excessive voltages or use in violation of the operating instructions furnished by Zolix.

If any defect appears within the warranty period, the purchaser shall promptly notify Zolix. No material will be accepted for repair or replacement without prior authorization from Zolix. Upon such authorization and in accordance with instructions of Zolix, parts, materials or equipment for which repair or replacement is requested shall be returned to Zolix for examination, with shipping charges prepaid by the purchaser. Final determination as to whether a product or part is actually defective rests with Zolix Instruments Corporation. In such cases where necessary repairs are not covered by this warranty, an estimate of repair charges will be submitted to the purchaser before servicing the equipment.

Zolix Instrument Corporation reserves the right to make changes or improvement upon its products without imposing any obligations upon it to install the same upon its products previously manufactured.

This warranty is expressly in lieu of all other obligations or liabilities on the part of Zolix, and Zolix neither assumes, nor authorizes any other person to assume for then other obligations or liability in connection with the sale of equipment manufactured by Zolix Instruments Corporation.

### 13 Packing List

Model: **MC600**--\_\_\_\_\_

Name: **Motion Controller**

Serial Number: \_\_\_\_\_

#### Products list

No.	Products name	Amount
1	□MC600 Motion Controller	1
No.	Accessories	Amount
1	Standard Power Supply Cable	1
2	Step motor interface cable (DB15-DB9)	□2 □3 □4
3	RS232 cable	1
4	USB cable	1
No.	Tools and Facilities	Amount
No.	Documents	Amount
1	MC600 Motion Controller Operation Manual	1
2	CD	1
2	Conformity certificate	1

**Checker Name and Checking Date:**

## Appendix A MC600 Communication Protocol

### 1. Syntax of Commands

- 1.1 ASCII codes are used in this protocol and the commands and parameters are case insensitive.
- 1.2 Communication command = command code + " " + Parameter 1, Parameter 2, ..., Parameter n.
- 1.3 All instructions end with the enter code denoted by "↵" this then tells the instrument that the instruction is complete for processing.
- 1.4 Querying command " Parameter setting command+?".
- 1.5 After MC600 receiving and implementing the command it will return OK.
- 1.6 Querying return: Parameter setting command+' '+ Parameter+ OK. Between the different parameters are " , ".
- 1.7 "↵" means the carriage return character, "↓" means newline character.
- 1.8 E01: Communication error, illegal command received or communication time-out.
- 1.9 Definition of Variables:   i,j,k,l   Integer values  
                                  m,n,p,q   Long integer values  
                                  x,y,z   Floating Point values  
                                  s       String
- 1.10 Serial baud: 19200bps
- 1.11 Data format: No parity checking, 8 Data, 1 parity bit. ( N, 8 ,1 ).

### 2. Instrument Connection: Hello

Instrument Connection ( Hello ). After initialization MC600 will test this command first. MC600 would not perform other commands without receiving that command. After MC600 received Hello, it would return OK↵. Before that if it received other commands, it would return E00↵.

### 3. Parameter Setting Commands

#### 3.1 Stage setting parameter

##### 3.1.1 Set stages type

Command: SetStageStyle axis, style↵



Parameter Description: unsigned char axis //stage axis No. =X, =Y, =Z, =T

unsigned char style //stage type =T, =R

MC600 returns: OK✓ //right

E01✓ //wrong

### 3.1.2 Set stages screw lead

Command: SetStagePitch axis, pitch✓

Parameter Description: unsigned char axis // stage axis No. =X, =Y, =Z, =T

float pitch //screw lead range 1<pitch<1000 mm

MC600 returns: OK✓ //right

E01✓ //wrong

### 3.1.3 Set stages step angle

Command: SetStageStepAngle axis, angle✓

Parameter Description: unsigned char axis // stage axis No. =X, =Y, =Z, =T

float angle //step angle range 0.1 deg<angle<4.0 deg

MC600 returns: OK✓ //right

E01✓ //wrong

### 3.1.4 Set subdivision

Command: SetStageMicroStep axis, step✓

Parameter Description: unsigned char axis // stage axis No. =X, =Y, =Z, =T

int step //subdivision range 1<= step <=500

MC600 returns: OK✓ //right

E01✓ //wrong

### 3.1.5 Set transmission ratio

Command: SetStageDriveRat axis, rat✓

Parameter Description: unsigned char axis // stage axis No. =X, =Y, =Z, =T

int rat // transmission ratio range 1<= rat <=400

MC600 returns: OK✓ //right

E01✓ //wrong

### 3.1.6 Set rotary stage radius

Command: SetStage Radius axis, radius✓

Parameter Description: unsigned char axis // stage axis No. =X, =Y, =Z, =T

int radius //rotary stage radius range 1<= radius <=2000mm

MC600 returns: OK✓ //right

E01✓ //wrong

### 3.1.7 Set stage travel

Command: SetStageDistance axis, distance✓

Parameter Description: unsigned char axis // stage axis No.=X, =Y, =Z, =T

float distance // stage travel range 10<= distance <=5000 mm

MC600 returns: OK✓ //right

E01✓ //wrong

### 3.1.8 Set the stage working mode

Command: SetStageWorkState axis, workstate✓

Parameter Description: unsigned char axis // stage axis No.=X, =Y, =Z, =T

char workstate //working mode =O open loop, =C close loop.

MC600 returns: OK✓ //right

E01✓ //wrong

## 3.2 Running Parameter

### 3.2.1 Set axis speed

Command: SetSpeed axis, speed✓

Parameter Description: unsigned char axis // stage axis No.=X, =Y, =Z, =T

float speed // stage axis speed range according to the unit.

MC600 returns: OK✓ //right

E01✓ //wrong

### 3.2.2 Set axis initial speed

Command: SetInitSpeed axis, initspeed✓

Parameter Description: unsigned char axis // stage axis No.=X, =Y, =Z, =T

float initspeed // stage axis initial speed range according to the unit.

MC600 returns: OK✓ //right

E01✓ //wrong

### 3.2.3 Set Accelerated speed

Command: SetAccSpeed axis,accspeed✓

Parameter Description: unsigned char axis // stage axis No.=X, =Y, =Z, =T

float accspeed // accelerated speed range according to the unit.

MC600 returns: OK✓ //right

E01✓ //wrong

### 3.2.4 Set home speed

Command: SetHomeSpeed axis,homespeed✓

Parameter Description: unsigned char axis // stage axis No.=X, =Y, =Z, =T

float homespeed // home speed range according to the unit.

MC600 returns: OK✓ //right

E01✓ //wrong

### 3.2.5 Set the unit of the stage axis

Command: SetUnit axis,unit✓

Parameter Description: unsigned char axis // stage axis No.=X, =Y, =Z, =T

char unit //unit =m mm, =u um, =s step, =d deg

MC600 returns: OK✓ //right

E01✓ //wrong

### 3.2.6 Set the Home mode

Command: Setsechhome axis,mode✓

Parameter Description: unsigned char axis // stage axis No.=X, =Y, =Z, =T

char mode //Home mode =1 mode 1 ; =2 mode 2

Mode 1: using the mechanical limit switch to home.

Mode 2: using the photo-switch to home.

MC600 returns: OK✓ //right

E01✓ //wrong

### 3.2.7 Set MC600 working mode

Command: Setworkmode mode✓



Parameter Description: char mode //home mode =R remote mode, =L local mode

MC600 returns: OK✓ //right

E01✓ //wrong

### 3.3 Position Parameter

#### 3.3.1 Set the current position to the origin of axis

Command: SetUserOrigin axis, 0✓

Parameter Description: unsigned char axis // stage axis No.=X, =Y, =Z, =T

MC600 returns: OK✓ //right

E01✓ //wrong

#### 3.3.2 Set axis positive software limit

Command: SetUserPositiveLimit axis, positivelimit✓

Parameter Description: unsigned char axis // stage axis No.=X, =Y, =Z, =T

float positivelimit // positive software limit range

MC600 returns: OK✓ //right

E01✓ //wrong

#### 3.3.3 Set axis negative software limit

Command: SetUserNegativeLimit axis, negativelimit✓

Parameter Description: unsigned char axis // stage axis No.=X, =Y, =Z, =T

float negativelimit // negative software limit range

MC600 returns: OK✓ //right

E01✓ //wrong

### 3.4 Linear scale parameter

Command: SetEncoderResolution axis, resolution✓

Parameter Description: unsigned char axis // stage axis No.=X, =Y, =Z, =T

Float resolution //Linear scale resolution range 1<=resolution<=100

MC600 returns: OK✓ //right

E01✓ //wrong

## 4. Running instruction

### 4.1 Return to the working origin

Command: GoOrigion axis✓

Parameter Description: unsigned char axis // stage axis No.=X, =Y, =Z, =T  
// motor stopping motion

MC600 returns: OK✓ //right

E01✓ //wrong

#### 4.2 Return to mechanical origin

Command: GoHome axis✓

Parameter Description: unsigned char axis // stage axis No.=X, =Y, =Z, =T  
// motor stopping motion

MC600 returns: OK✓ //right

E01✓ //wrong

#### 4.3 Open loop / Close loop mode

Command: GoPosition axis,workstate,state,dir, x✓

Parameter Description: unsigned char axis // stage axis No.=X, =Y, =Z, =T

Char workstate // Open loop or Close loop mode =C close loop =O open loop

Char State //moving mode =A Absolute displacement, =R Relative displacement

Char dir //moving direction =P Positive direction, =N Negative direction

Float x //moving amount

// motors stop running

MC600 returns: OK✓ //right

E01✓ //wrong

#### 4.4 Interpolation running control

##### 4.4.1 Two-axis linear interpolation

Command:GoInterpolationline2 axis1,s1,axis2,s2✓ //axis1 and axis2 linear interpolation

Parameter Description: char axis1, axis2 // stage axis No.=X, =Y, =Z, =T

float s1,s2 //Displacement with direction

// motors stop running

MC600 returns: OK✓ //right

E01✓ //wrong

##### 4.4.2 Three-axis linear interpolation

Command: GoInterpolationline3 axis1,s1,axis2,s2,axis3,s3✓ //axis1, axis2, axis3  
linear interpolation

Parameter Description: char axis1, axis2 // stage axis No.=X, =Y, =Z, =T

float s1,s2 ,s3 // Displacement with direction

// motors stop running

MC600 returns: OK✓ //right

E01✓ //wrong

### 4.4.3 Two-axis circular interpolation

Command: GoInterpolationArc axis1, axis2, target\_posx, target\_posy,cen\_posx,  
cen\_posy, arc\_dir✓

Parameter Description: char axis1, axis2 // stage axis No.=X, =Y, =Z, =T

float target\_posx, target\_posy,cen\_posx, cen\_posy // Target point with  
direction and centre coordinates

char arc\_dir //Arc interpolation direction =1 CW direction, =0 CCW direction.

// motors stop running

MC600 returns: OK✓ //right

E01✓ //wrong

### 4.5 IO output control

Command: portOutput outputb✓ // Set output port level.

Parameter Description: string (char) output.

output: 0 = low level, 1= height level

D7	D6	D5	D4	D3	D2	D1	D0
OUT7	OUT6	OUT5	OUT4	OUT3	OUT2	OUT1	OUT0

MC600 returns: OK✓ //right

E01✓ //wrong

### 4.6 Stop axis moving.

Command: STOP AXIS

Parameter Description: char axis // stage axis No. =X, =Y, =Z, =T

MC600 returns: OK✓ //right



E01✓ //wrong

### 5. Querying parameter instruction

#### 5.1 Querying position

Command: Position? axis✓

Parameter Description: unsigned char axis // stage axis No. =X, =Y, =Z, =T

MC600 returns:

Position axis x ok✓ // axis coordinate x

E01✓ //error

#### 5.2 Query axis running parameters

##### 5.2.1 Query run-axis speed

Command: SetSpeed? axis✓

Parameter Description: unsigned char axis // stage axis No. =X, =Y, =Z, =T

MC600 returns: SetSpeed axis speed OK✓ //right

// running-axis speed

E01✓ //wrong

##### 5.2.2 Query run-axis initial speed

Command: SetInitSpeed? axis✓

Parameter Description: unsigned char axis // stage axis No. =X, =Y, =Z, =T

MC600 returns: SetInitSpeed axis initspeed OK✓ //right

//string(float) initspeed // run-axis initial speed range 10<=

initspeed <=5000 mm

E01✓ //wrong

##### 5.2.3 Query run-axis accelerated speed

Command: SetAccSpeed? axis✓

Parameter Description: unsigned char axis // stage axis No. =X, =Y, =Z, =T

MC600 returns: SetAccSpeed axis accspeed OK✓ //right

// string(float) accspeed // run-axis accelerated speed range

10<= accspeed <=5000 mm

E01✓ //wrong

#### 5.2.4 Query run-axis speed of backing to origin

Command: SetHomeSpeed? axis✓

Parameter Description: unsigned char axis // stage axis No. =X, =Y, =Z, =T

MC600 returns: SetHomeSpeed axis homespeed OK✓ //right

// string(float) homespeed Query run-axis speed of backing  
to origin range 10<= homespeed <=5000 mm

E01✓ //wrong

#### 5.2.5 Query run-axis unit

Command: SetUnit? axis✓

Parameter Description: unsigned char axis // stage axis No. =X, =Y, =Z, =T

MC600 returns: SetUnit axis unit OK✓ // right

// string(char) unit //unit =m mm, =u um, =s step, =d deg

E01✓ //wrong

#### 5.2.6 Query run-axis home mode

Command: Setsechhome? axis✓

Parameter Description: unsigned char axis // stage axis No. =X, =Y, =Z, =T

MC600 returns: Setsechhome axis mode OK✓ //right

E01✓ //wrong

// char mode //home mode =1 mode 1, using the negative limit switch.

=2 mode 2, using the positivity limit switch.

#### 5.2.7 Query MC600 working mode

Command: Setworkmode? ✓

MC600 returns: Setworkmode mode OK✓

Parameter Description: char mode //home mode =R remote mode, =L local  
mode

MC600 returns: OK✓ //right

E01✓ //wrong

### 5.3 Query run-axis position parameter

#### 5.3.1 Query run-axis working origin

Command: SetUserOrigin? axis✓

Parameter Description: unsigned char axis // stage axis No. =X, =Y, =Z, =T

MC600 returns: SetUserOrigin axis origin OK✓ //right

// string(float) origin // working origin range

E01✓ //wrong

### 5.3.2 Query run-axis positive software limit

Command: SetUserPositiveLimit? axis✓

Parameter Description: unsigned char axis // stage axis No. =X, =Y, =Z, =T

MC600 returns: SetUserPositiveLimit axis positivelimit OK✓ //right

// string(float) positivelimit // positive software limit range

E01✓ //wrong

### 5.3.3 Query run-axis negative software limit

Command: SetUserNegativeLimit? axis✓

Parameter Description: unsigned char axis // stage axis No. =X, =Y, =Z, =T

MC600 returns: SetUserNegativeLimit Axis negativelimit OK✓ //right

// string(float) negativelimit // negative software limit range

//

E01✓ //wrong

## 5.4 Query axis basic parameter

### 5.4.1 Query stage type

Command: SetStageStyle? axis✓

Parameter Description: unsigned char axis // stage axis No. =X, =Y, =Z, =T

MC600 returns: SetStageStyle axis style OK✓ //right

// unsigned char style //stage type =T, =R

E01✓ //wrong

### 5.4.2 Query stage screw lead

Command: SetStagePitch? axis✓

Parameter Description: unsigned char axis // stage axis No. =X, =Y, =Z, =T

MC600 returns: SetStagePitch axis pitch OK✓ //right

// string(float) pitch

E01✓ //wrong

#### 5.4.3 Query stage step angle

Command: SetStageStepAngle? axis✓

Parameter Description: unsigned char axis // stage axis No. =X, =Y, =Z, =T

MC600 returns: SetStageStepAngle axis angle OK✓ //right

// string(float) angle

E01✓ //wrong

#### 5.4.4 Query subdivision

Command: SetStageMicroStep? axis✓

Parameter Description: unsigned char axis // stage axis No. =X, =Y, =Z, =T

MC600 returns: SetStageMicroStep axis step OK✓ //right

// string(int) step

E01✓ //wrong

#### 5.4.5 Query stage transmission ratio

Command: SetStageDriveRat? axis✓

Parameter Description: unsigned char axis // stage axis No. =X, =Y, =Z, =T

MC600 returns: SetStageDriveRat axis rat OK✓ //right

// string(int) rat

E01✓ //wrong

#### 5.4.6 Query rotary stage radius

Command: SetStage Radius? axis✓

Parameter Description: unsigned char axis // stage axis No. =X, =Y, =Z, =T

MC600 return: SetStage Radius axis radius OK✓ //right

// string(int) radius

E01✓ //wrong

#### 5.4.7 Query stage travel

Command: SetStageDistance? axis✓

Parameter Description: unsigned char axis // stage axis No. =X, =Y, =Z, =T



MC600 return: SetStageDistance axis distance OK✓ //right

// string(float) distance

E01✓ //wrong

### 5.4.8 Query stage working mode

Command: SetStageWorkState? axis✓

Parameter Description: unsigned char axis // stage axis No. =X, =Y, =Z, =T

MC600 return: SetStageWorkState axis workstate OK✓ //right

// string(char) workstate

E01✓ //wrong

### 5.5 Query motion controller IO state

Command: Portiobyte?✓ // Query motion controller IO

MC600 returns: Port\_output n; // Return IO state

//16 IO, high-8 for the output port, low-8 for the input port, expressed in an unsigned integer.

//Output return value is the value set by user. Input return value is the actual input level.

//0 = low level, 1 = high level.

D15	D14	D13	D12	D11	D10	D9	D8
OUT7	OUT6	OUT5	OUT4	OUT3	OUT2	OUT1	OUT0

D7	D6	D5	D4	D3	D2	D1	D0
IN7	IN6	IN5	IN4	IN3	IN2	IN1	IN0

E01✓ //wrong

### 5.6 Query linear scale parameter

Command: SetEncoderResolution? axis✓

Parameter Description: unsigned char axis // stage axis No. =X, =Y, =Z, =T

MC600 returns: SetEncoderResolution axis resolution OK✓ //right

// resolution axis linear scale resolution

E01//wrong

## 6. Contact information

When the MC600 is power on for the first time, after the system initialization is completed, it will upload the READY to PC. Before that the MC600 dose not respond to any commands.

**7. Error**

7.1 E00: No connection between MC600 and PC, please send "Hello".

7.2 E01: Communication error, illegal command received or communication time-out.

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