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# **FMC4030 three-axis motion controller Instructions for use**

Project: FMC4030 three-axis motion controller

Compiled by: R&D Department

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Version: 2001

Version number	Modification time	Version Description	Modified by
one thousand and sixteen	October 30, 2021	First release	ZJC
two thousand and one	March 1, 2024	Removed shell command functionality; Optimize the TCP communication part; Optimize some mechanical movements, etc	LJ

## Overview

The FMC4030 controller belongs to a pulse type controller, which uses a 32-bit ARM chip as the main controller. The output frequency of each axis can reach up to 200KHz, and the internal pulse counting function is integrated to achieve precise position and speed control of stepper or servo motors.

This controller has communication functions such as 232, 485, EtherNet, etc. It can interact with the upper computer, touch screen, and other devices for data exchange to achieve control purposes.

This controller has 4 digital inputs and 4 digital outputs, which can be used to control conventional external devices. Supports three-axis positive and negative limit switches (NPN-NO).

This controller supports motion control functions such as single axis

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control, two axis linear interpolation, three axis linear interpolation, and two axis arc. Support Chinese script programming, support secondary development, provide development libraries such as DLL and Lib, and support programming for Windows and Linux systems.

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# Hardware configuration

## 1. Hardware interface

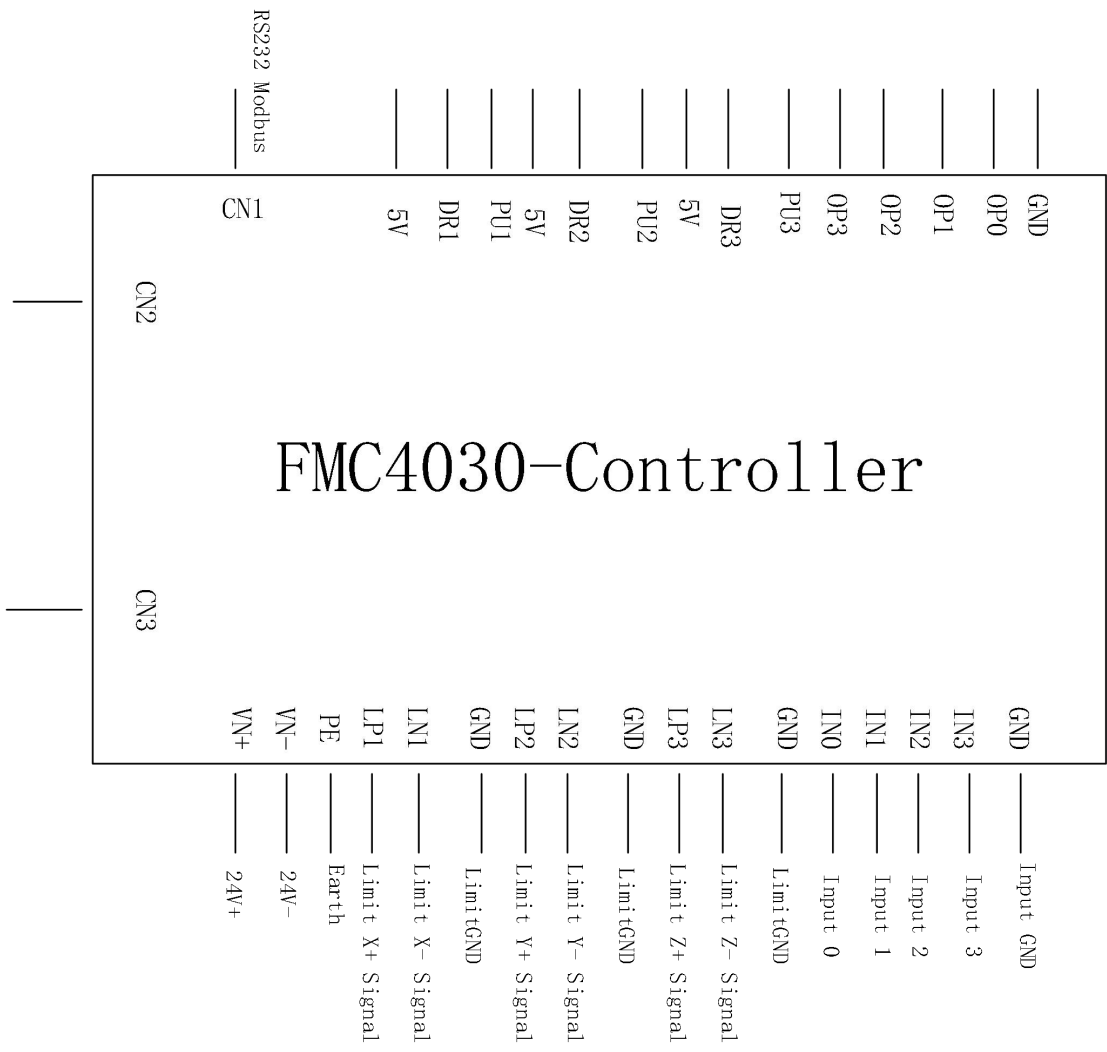
type	explain	quantity
source	24V DC power supply	one
Limit switch	24V NPN-NO type	six
Control signal 5V power supply	Power supply provided to the drive	three
Pulse signal	Pulse signal	three
Directional signal	Dir signal	three
input	24V input, effective at low levels	four
output	24V open drain output	four
EtherNet interface	Used for upper computer communication	one
232 (DB9)	Used for touch screen or upper computer communication	one
232 (RJ45)	Used for serial port debugging	one
485 (RJ45)	Used for interaction with other devices	one

All the above interfaces have undergone static electricity testing and can pass the 8KV static electricity level test. The maximum output current carrying capacity is 300mA.

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## 2. Hardware wiring

The hardware wiring diagram of FMC4030 controller is shown below

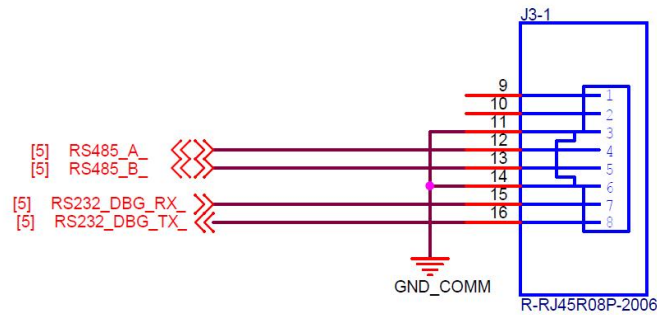


**Figure 1 Schematic diagram of FMC4030 interface**

The CN1 interface is connected using the DB9 interface, with pin 2 being the sender and pin 3 being the receiver.

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The CN2 interface is connected using a standard RJ45 Ethernet



cable, and the pins are defined as follows:

**Figure 2 CN2 Interface Definition**

The CN3 interface uses a standard RJ45 network cable to connect to a computer or router. The default IP address of the controller is **192.168.0.30**, and the default port number is **8088**.

The wiring diagram for pulse signals and limit signals is as follows:

Taking the X-axis as an example:

(1) Pulse signal wiring



**Figure 3 Pulse signal wiring**

(2) Positive limit switch wiring

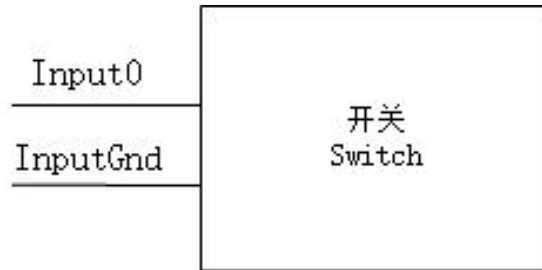


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**Figure 4 Wiring of Positive Limit Switch**

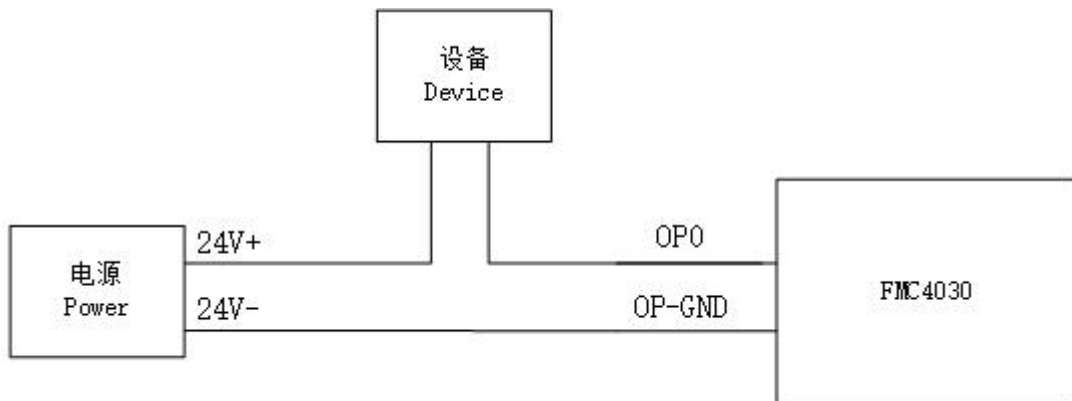
Negative limit and other axis limit switches, and so on.

(3) Input port wiring, taking Input0 as an example



**Figure 5 Input Port Wiring**

(4) Output port wiring, taking OP0 as an example



**Figure 6 Output Port Wiring**

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# Introduction to Three Functions

## 1. Communication connection

### (1) Ethernet communication

This communication method is the main communication method for the controller. The CN3 interface of the controller is connected to the computer network card, router, and switch through a network cable. The default IP address of the controller is 192.168.0.30. The PING tool can be used for communication testing. Before conducting the communication



test, it is necessary to ensure that the computer network card and controller are in the same network segment. Set up the computer as shown below.

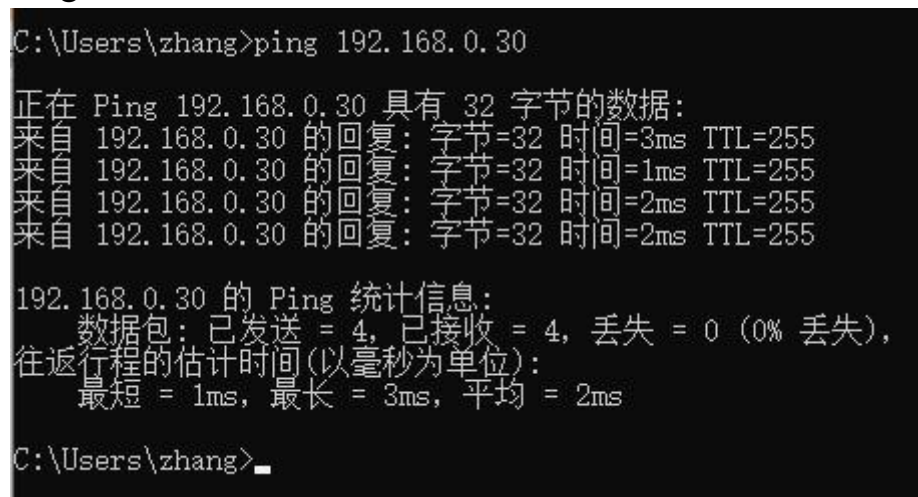


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## Figure 7 Computer Network Segment Settings

After setting up, you can use the CMD tool to enter the following commands for testing

Ping 192.168.0.30- t



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C:\Users\zhang>ping 192.168.0.30

正在 Ping 192.168.0.30 具有 32 字节的数据:
来自 192.168.0.30 的回复: 字节=32 时间=3ms TTL=255
来自 192.168.0.30 的回复: 字节=32 时间=1ms TTL=255
来自 192.168.0.30 的回复: 字节=32 时间=2ms TTL=255
来自 192.168.0.30 的回复: 字节=32 时间=2ms TTL=255

192.168.0.30 的 Ping 统计信息:
    数据包: 已发送 = 4, 已接收 = 4, 丢失 = 0 (0% 丢失),
往返行程的估计时间(以毫秒为单位):
    最短 = 1ms, 最长 = 3ms, 平均 = 2ms

C:\Users\zhang>_
```

Figure 8 Ping Tool Test

If the above information appears, it indicates that the communication between the controller and the computer is normal. Next, use the upper computer software provided by our company (Fuyu Controller WorkStudio. exe) for connection control.

**Note:** After successfully connecting to the controller, it is necessary to interact with the controller for data within 1 minute. If there is no data interaction with the controller after more than 1 minute, the controller will timeout and actively disconnect the client. You need to click on the connect controller again.

### (2) 232 (DB9 interface) communication

This interface adopts a DB9 female head interface and should be equipped with non crossing data cables for DB9 male heads 2 and 3 for

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connection.

This interface is generally used for connecting configuration screens and other devices, using the Modbus communication protocol. It can also be used to communicate with a computer via USB to 232 data cable for secondary development.

### (3) 485 communication

This interface is located on data lines 4 and 5 of CN2 and can be used to control our company's FSC-2A single axis controller and other devices with 485 communication. It is generally not used as a communication interface for secondary development.

## 2. Introduction to upper computer software

This controller provides upper computer controller software, which runs on the Windows operating system and is 32-bit. It uses the VC++2012 runtime library, so it is necessary to install the VC++2012 runtime library (already included in the software package) before use.

This software does not require installation and can be run directly in the package folder. Please do not move the exe file elsewhere, otherwise there may be a problem of not being able to find the library.

### (1) Connection

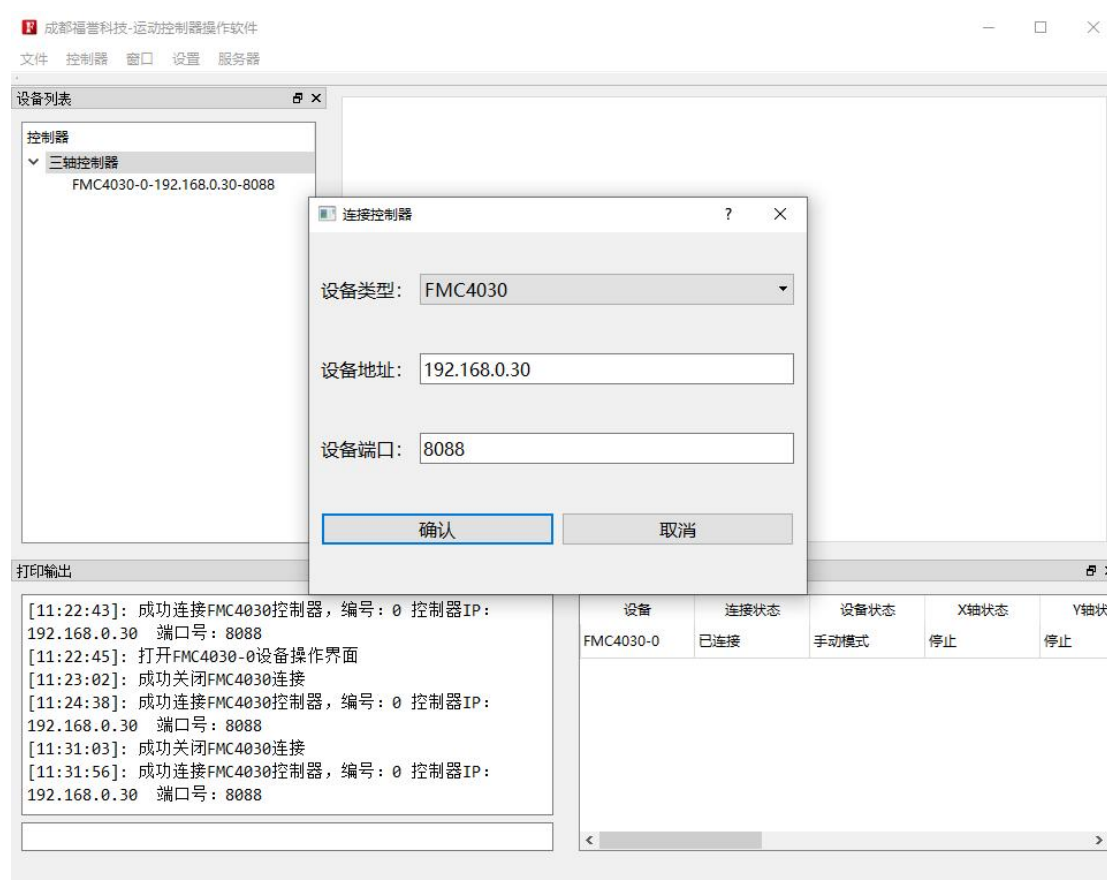
名称	修改日期	类型	大小
Program	2021/10/9 11:03	文件夹	
FMC4030-1015.bin	2021/9/16 14:59	BIN 文件	284 KB
FMC4030-Dll.dll	2021/9/23 13:44	应用程序扩展	23 KB
FMC4030-Dll.h	2021/9/6 15:22	C/C++ Header F...	8 KB
FMC4030-Dll.lib	2021/9/23 13:44	Altium Library	10 KB
FMC4030二次开发库详解V1.0.pdf	2021/6/23 12:42	Adobe Acrobat ...	409 KB
FMC4030使用说明V1.0.pdf	2021/6/24 16:50	Adobe Acrobat ...	372 KB
FMC4030自动控制指令表说明.pdf	2021/7/22 10:20	Adobe Acrobat ...	364 KB
Fuyu-Controller-WorkStudio.exe	2021/9/23 13:50	应用程序	18,739 KB
接口1.jpg	2021/7/12 10:03	JPG 文件	6,195 KB
接口2.jpg	2021/7/12 10:03	JPG 文件	5,331 KB
接口3.jpg	2021/7/12 10:03	JPG 文件	5,760 KB

**Figure 11 Schematic of folder content**

(1) Connecting the controller

Double click to open the software and enter the main interface. As the computer network card IP address has already been set, it needs to be kept in the same network segment as the controller.

After opening the software, find the controller option in the menu bar and select the connection controller to start



**Figure 12 Connecting the controller**

In the connection controller interface shown in the above figure, follow the default parameters. If the controller IP and port parameters have been modified, set them according to the modified parameters. Click confirm to connect the controller.

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After connecting the controller, it will display FMC4030-0-192.168.0.30-8088 under the three-axis controller item in the device list on the left. This software can connect multiple controllers, and the information includes the number, IP address, and port number of each controller for differentiation.

### **Figure 13 Controller Operation Interface**

In the above interface, there are four large areas, including:

Device List: Display the currently connected controllers and the operation interface for opening the corresponding controllers

Operation interface: Perform a series of operations on the selected controller

Print out: Output current operation information and error prompts

Status monitoring: monitoring the connection status of various controllers and the motion status of each axis

#### **(2) Controller operation**

In the controller operation interface, it is mainly divided into two parts: one is the real-time display of the position and speed of each axis, and the other is the operation of the controller

##### **1. Single axis JOG**

On this subpage, you can individually control the motion of each

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axis, including relative motion, absolute motion, and zero return motion

Taking the X-axis as an example:

Relative motion: Set parameters such as target position, velocity, acceleration, deceleration, etc., all in mm/s. Clicking on relative motion will cause displacement at the current position, and the positive and negative of the target position can control the positive and negative rotation of the axis. If the set target position exceeds the software limit, it will be limited to the set value by the software.

Absolute motion: Set parameters such as target position, velocity, and acceleration. Clicking on absolute motion will calculate how much distance and direction to move based on the set target position and point 0.

Return to zero motion: After setting parameters such as return to zero speed, return to zero acceleration and deceleration, return to zero direction, and return to zero detachment distance, click X to start the return to zero motion. The return to zero direction in the return to zero motion is represented by 1 using the positive limit as the trigger switch for return to zero, and 2 using the negative limit as the trigger switch for return to zero. The positive limit is located far from the motor end, and the negative limit is located near the motor end. The return to zero detachment distance represents the distance that the slider moves away from the limit switch after the return to zero is completed. It is recommended not to set it to 0 to avoid interference with the slider position during the hardware limit of the limit switch. In the process of

returning to zero, if the limit switch is not triggered for a long time, the return to zero will be terminated. In order to protect the module from continuous impact, the return to zero time can be set as a timeout in the parameter settings to ensure the safety of the return to zero, in milliseconds.

2. Imputation motion

This controller supports two axis linear interpolation, three axis linear interpolation, and two axis circular interpolation movements.

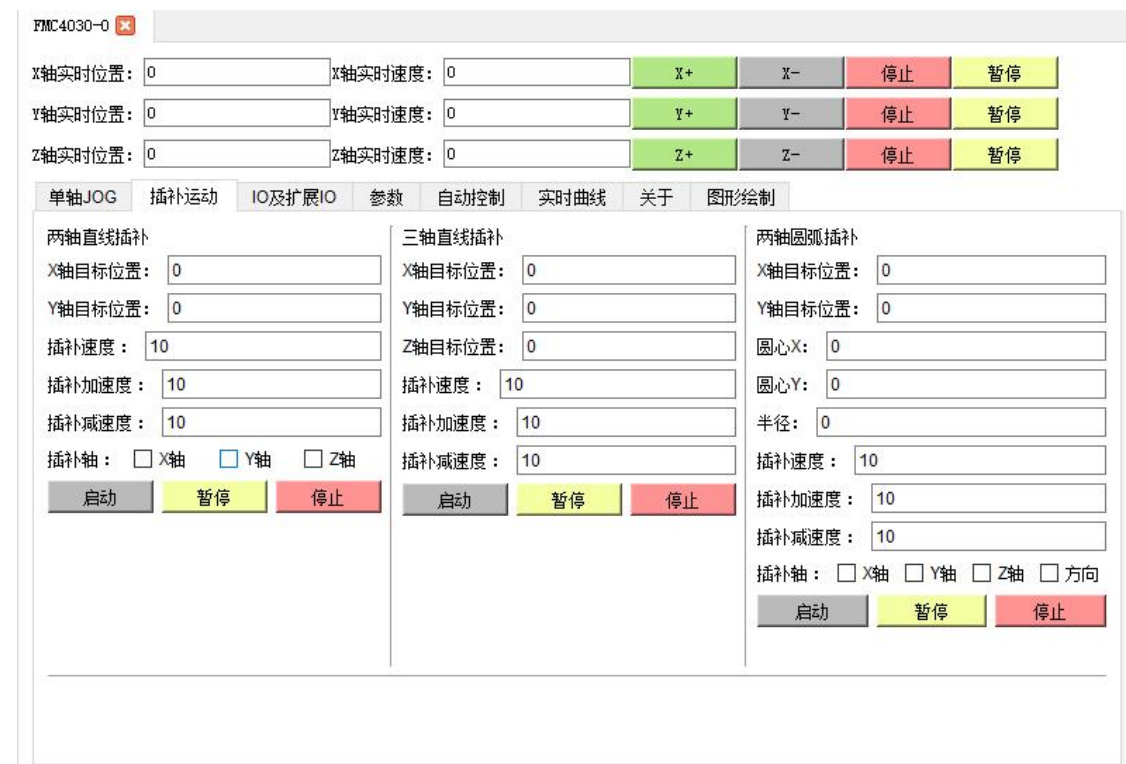


Figure 14 Interpolation Motion Sub Interface

Two axis linear interpolation: Set the X-axis target position and Y-axis target position, where X and Y are not the actual X-axis and Y-axis. Set parameters such as interpolation speed, interpolation acceleration, and interpolation deceleration. Select the two actual axes that need to be moved in the interpolation axis options, and then click start to start the

linear interpolation of the two axes.

Three axis linear interpolation: The parameters are the same as those of two axis linear interpolation, but there is no need to select the interpolation axis.

Two axis circular arc interpolation: Set parameters such as X-axis target position, Y-axis target position, center X coordinate, center Y coordinate, radius, etc. After selecting the interpolation axis, click start to perform circular arc interpolation motion.

### 3. IO and IO expansion

In this sub interface, you can control the input and output IO ports of



the controller, as well as external expansion IO, 485 bus drive control integrated devices, etc.

**Figure 15 IO and Expansion IO Sub Interface**

Local IO represents the operation of the controller's built-in four

inputs and four outputs. IN0-IN3 represents the input status. If selected, it indicates that the input port is at a low level and is a valid input. The input port status can only be viewed and cannot be selected. The output port can be selected. After selection, the corresponding output port outputs a low level, the corresponding output circuit conducts, and the external device circuit also conducts accordingly, achieving the purpose of controlling external devices.

The limit signal represents the positive and negative limit triggering status of each axis. Each axis has two hardware limit switches, positive and negative. If the limit switch is triggered, this status box will be selected.

In the extended IO, there is no content in the default interface. You need to click on the new IO device and set it according to the configuration before the corresponding device will be displayed. (Not currently available).

In the parameter interface, various parameters of the controller can

FMC4030-0

X轴实时位置: 0X轴实时速度: 0X+X-X-停止暂停

Y轴实时位置: 0Y轴实时速度: 0Y+Y-Y-停止暂停

Z轴实时位置: 0Z轴实时速度: 0Z+Z-Z-停止暂停

单轴JOG插补运动IO及扩展IO参数自动控制实时曲线关于图形绘制

设备参数

ID: 1232波特率: 115200485波特率: 115200IP: 192.168.0.30Port: 8088

X轴参数

导程: 10细分: 5000回零超时时间: 10000

软限位正极限: -1软限位负极限: 700

Y轴参数

导程: 10细分: 5000回零超时时间: 10000

软限位正极限: -1软限位负极限: 200

Z轴参数

导程: 10细分: 5000回零超时时间: 10000

软限位正极限: -1软限位负极限: 200

上传参数

下载参数

复位参数



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be adjusted.

### **Figure 16 Parameter Sub Interface**

The first time entering this interface, there are no parameters by default. After manually clicking on upload parameters, the interface will display the internal parameters of the controller. After modifying the parameters, click to download the parameters. The internal parameters of the controller will be modified and will not be lost when powered off.

The device parameters include: ID, 232 baud rate, 485 baud rate, IP address, and Port port number. The ID is used for 232 communication. The hardware interface corresponding to the 232 baud rate is the CN1 (DB9) interface

Axis parameters include: lead, subdivision, reset timeout time, soft limit positive limit, soft limit negative limit, etc.

The zero return timeout is used for the zero return movement, which stops due to not triggering the limit switch for a long time. The unit is ms.

The default software limit is: software positive limit 200, software negative limit 200. If you want to cancel the software limit, set either positive or negative software limit to a negative number. If you forget to configure the IP address and cannot communicate with the upper computer, you can also press the reset button on the controller. At the same time, the red light will light up to restore the factory default configuration of the device parameters.

## 5. Automatic control

FMC4030-0

X轴实时位置: 0 X轴实时速度: 0 X+ X- 停止 暂停

Y轴实时位置: 0 Y轴实时速度: 0 Y+ Y- 停止 暂停

Z轴实时位置: 0 Z轴实时速度: 0 Z+ Z- 停止 暂停

单轴JOG 插补运动 IO及扩展IO 参数 自动控制 实时曲线 关于 图形绘制

1	2	3	4	5	6
1 设置单轴运动参数	0	100	200	200	
2 启动单轴绝对运动	1	500			
3 等待轴运行完成	0				
4 启动单轴绝对运动	1	0			
5 等待轴运行完成	0				
6 跳转至	2				

开始运行 停止运行 打开文件 新建文件 保存文件 删除文件 新建行 删除行 上移此行 下移此行 编译程序 下载程序

**Figure 17 Automatic Control Sub Interface**

Script programs can be written on this interface to achieve automatic operation of the controller. Firstly, it is necessary to create a new file. The file name cannot be in Chinese and the length of the file name cannot exceed 8 characters.

Then, in the above interface, select New Program Row to create a new row in the table. The first step is to select the instruction in the first column, which does not require manual input. Double clicking on the corresponding input box will pop up a dropdown box, where you can select the instruction you want to use. 2. Columns 3, 4, and 5 are all parameter columns, while column 6 is a comment and does not participate in program operation.

The specific instructions and parameters of each instruction can be

found in the instruction manual "FMC4030 Automatic Control Instruction Table Explanation".

After writing the file, first save the file and choose the save path. The save path cannot contain Chinese characters, and try to choose a sub folder under the folder where the software is located for easy management. After saving, click on the compile program and it will prompt that the compilation is complete to download the program.

After successful download, there will be corresponding information in the print output window. At this time, select the downloaded file from the drop-down box above the "Start Run" button to click "Start Run". To stop running, click "Stop Running".

## 6. Real time curve



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### **Figure 18 Real time curve sub interface**

This interface is used to display the actual operating speed of each axis in the form of a graph. (Not yet open for use).

#### **7. About**

This interface displays the version and version information of the controller, and can also be used to upgrade the controller online in this interface.

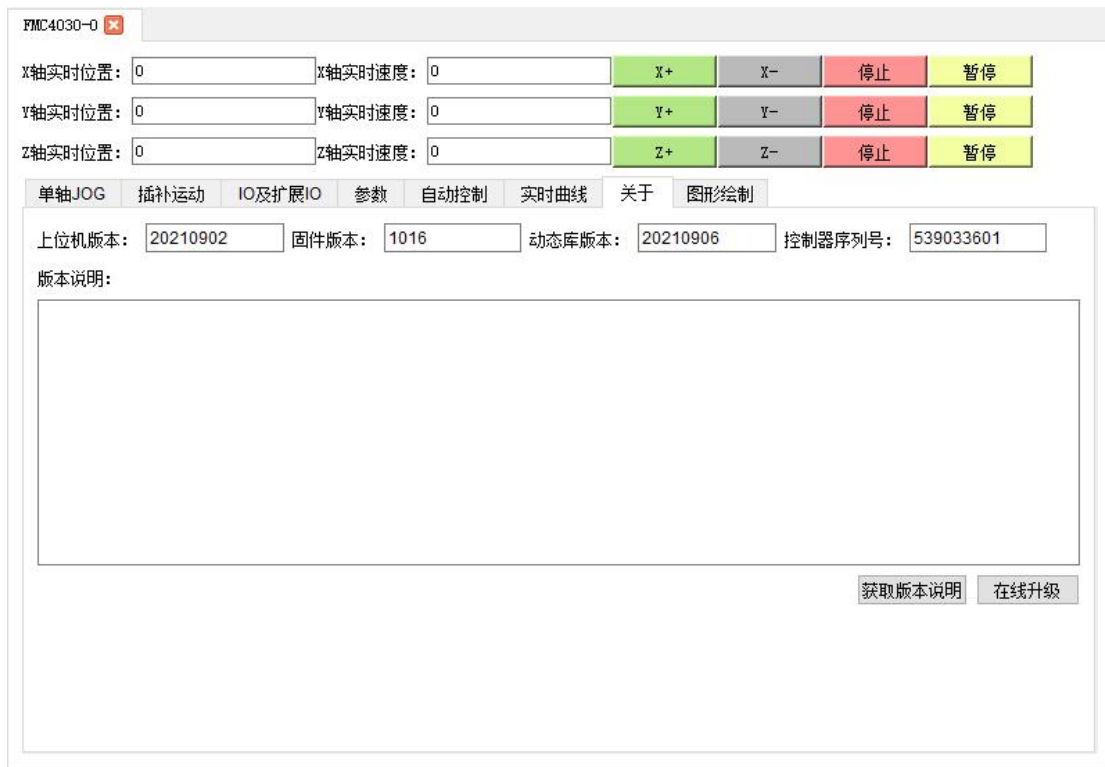
The interface includes information such as the upper computer version, firmware version, dynamic library version, and controller serial number.

Upper computer version: Refers to the software version information

Firmware version: Refers to the internal program version number of the controller

Dynamic library version: Refers to the version number of the secondary development library. As this software is also developed based on dynamic libraries, the corresponding version number will also be displayed

Controller serial number: After passing the factory production inspection, a unique serial number will be assigned to label this controller



**Figure 19 About Subinterfaces**

Get version instructions button: After connecting to the server, the data will be downloaded and displayed from the server. The server function is temporarily unavailable.

Online upgrade, after clicking, the upgrade file selection will be carried out. This is for upgrading the internal program of the controller, and the upgrade file is generally in the format of "FMC4030-1015. bin". Among them, 1015 represents the firmware version, which should be consistent with the firmware version in the software interface.

## 8. Graphic drawing

(Not yet open)