

A simple user program

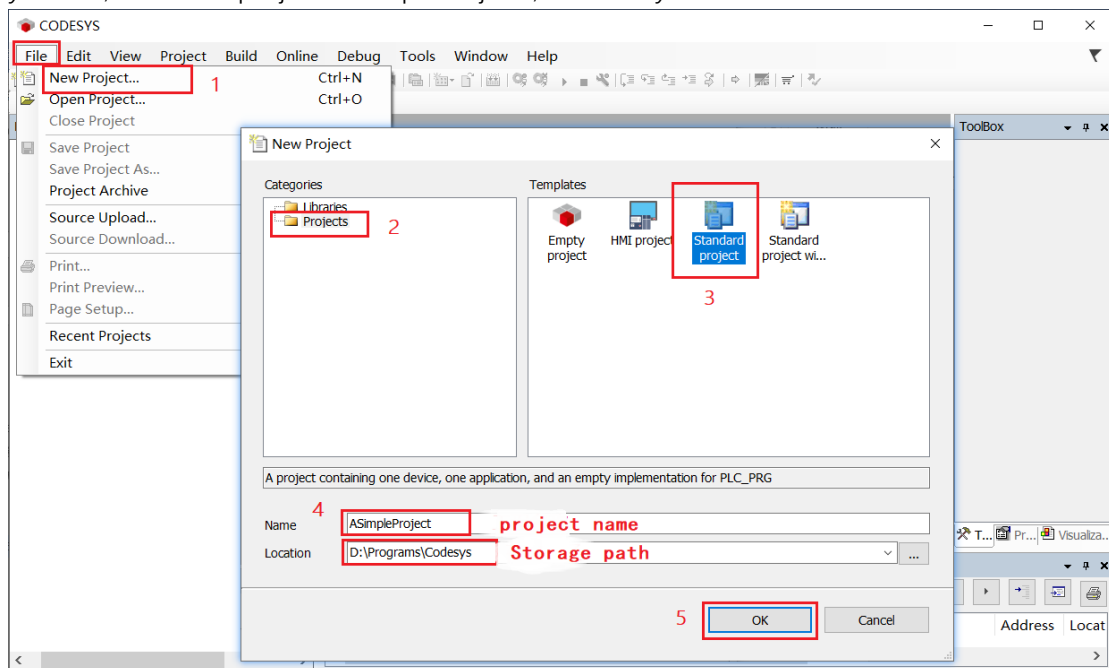
In order to make users familiar with the software more quickly and hands-on programming, this chapter will demonstrate how to use CODESYS to create a simple EtherCAT bus project, use VE motion controller, and control VECServo (Vekoda bus servo) through EtherCAT bus to complete the application. Function, position mode operation and stop.

Note: The project is not a standard template, and the content is for reference only.

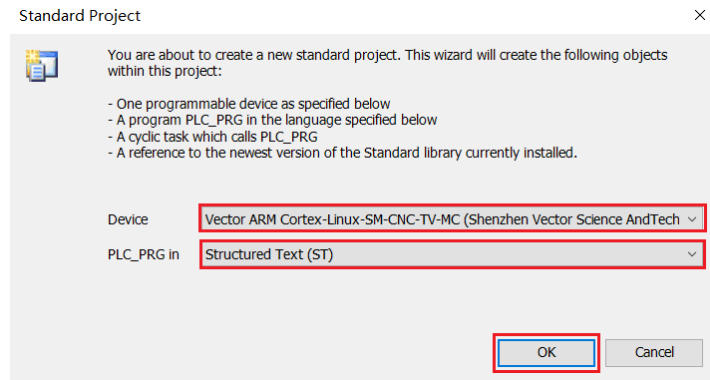
1.1 Create a project and download and debug

1.1.1 New standard project

1) After the software is opened, click "File" "New Project", a dialog box will pop up, select "Projects", select "Standard Project" as the project type, select the project path by yourself, name the project "ASimpleProject", and finally click "OK"



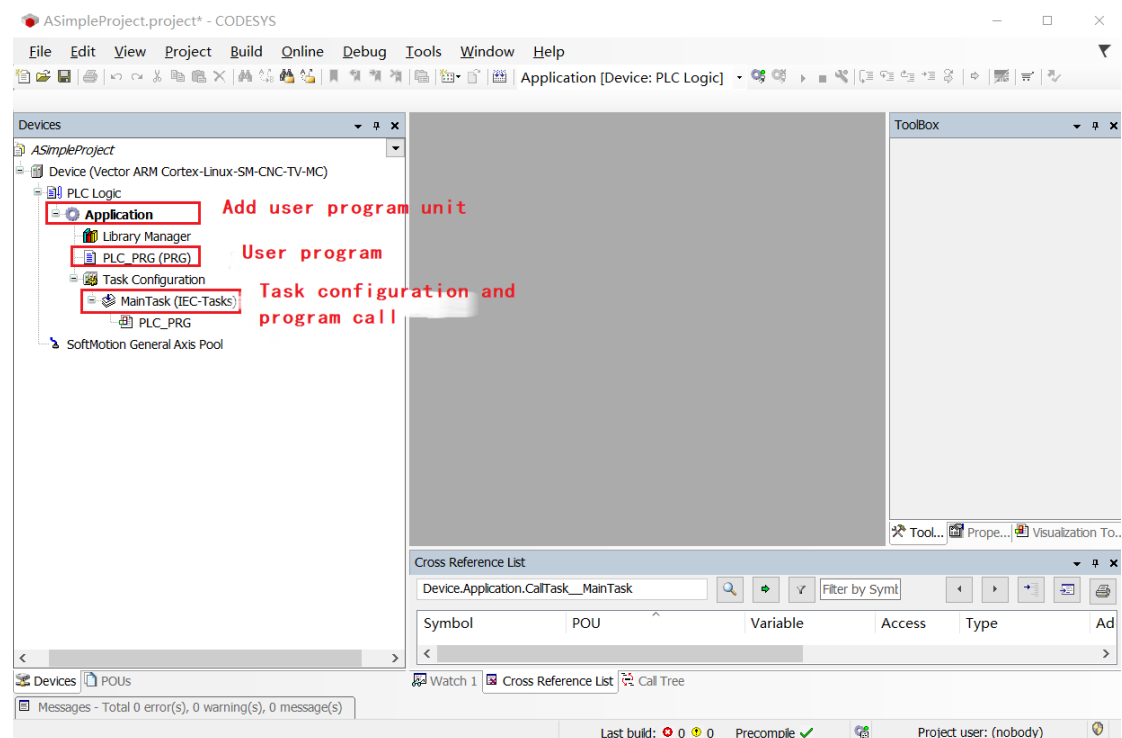
2) Enter the standard project interface, the user can select the equipment type and programming language of the project. As shown below:



Equipment: select the model of the main module, select Vector ARM Cortex-Linux-CNC-TV-MC (embedded platform controller, need to install XML description file: Vector ARM Cortex-Linux-SM-CNC-TV-MC.xml, Please refer to the installation device description file for the installation method), or CODESYS Softmotion RTE V3 x64 (soft platform controller for real-time control).

Programming language: ST, users can also choose other programming languages. Once selected, it can still be modified after entering the project.

Click "OK", as shown in the figure after the establishment is completed

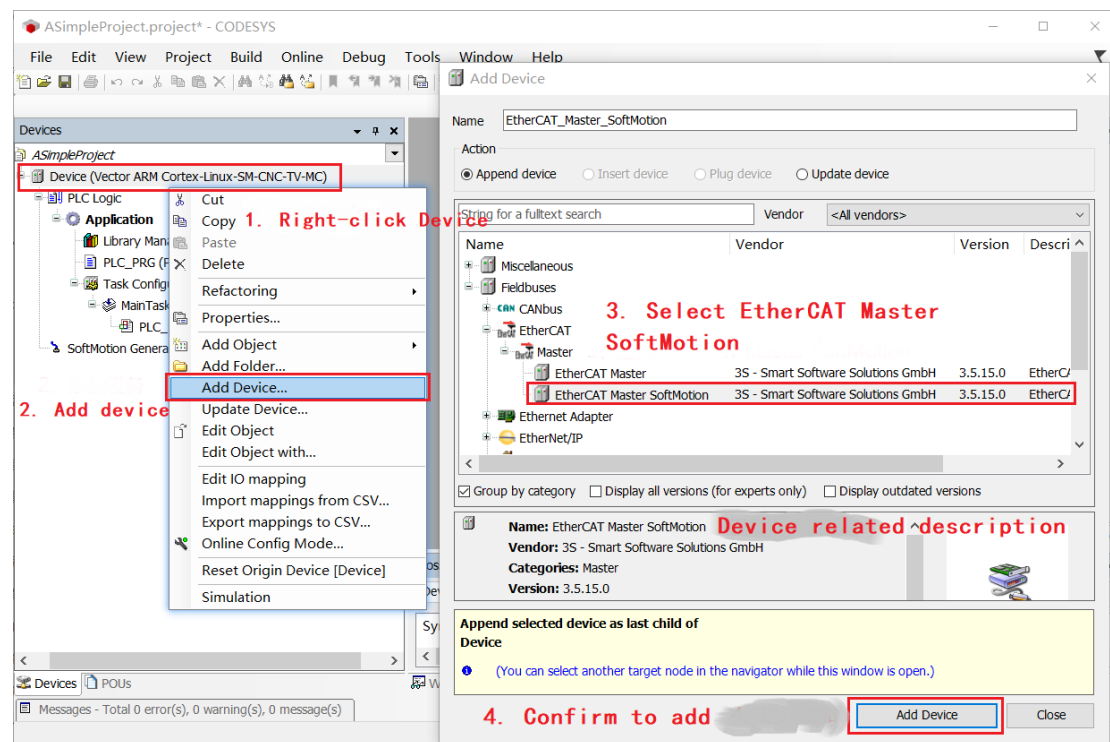


1.1.2 System configuration and parameter setting

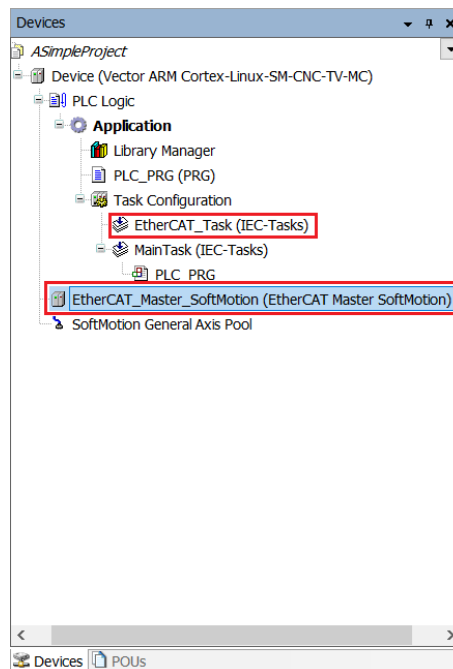
Add EtherCAT_Master_Softmotion

EtherCAT Master Softmotion is an EtherCAT master module with real-time motion

control. Specific adding method: right click "Device Add Device EtherCAT Master Softmotion OK", add EtherCAT master



After adding as shown in the figure, the system will allocate an EtherCAT_Task at the same time, and the related parameters of the EtherCAT task can be configured.

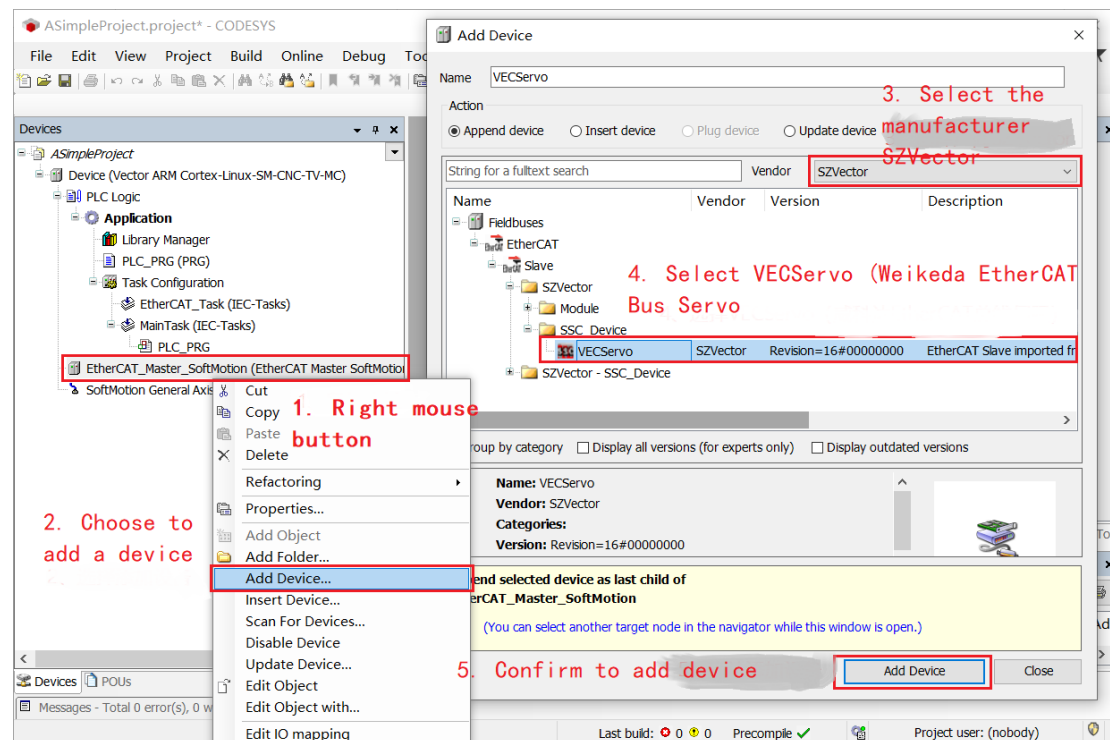


Add VECServo

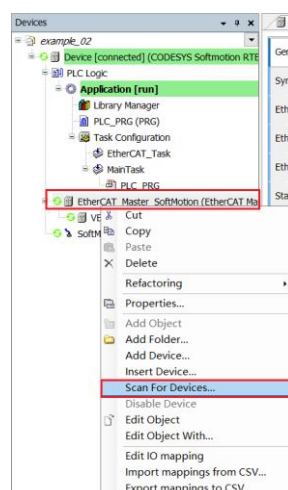
After adding the master station equipment, add the slave station equipment under the

changed master station. The added equipment here is "VECServo (Vekoda EtherCAT bus type servo)". The description file (.XML) of the servo device must be installed before adding. For the installation process, refer to 2.2.5 Installing the device description file. The specific adding method is as follows:


1) If you are offline without connecting to the master station, you can right-click "EtherCAT_Master_Softmotion Add Device" to find the corresponding manufacturer and device model in the device pop-up window: "SZVector SSC_Device VECServo", click OK to add the device.



If you are in the online status of logging in to the master station, you can also right-click "EtherCAT_Master_Softmotion Scan For Devices" and add it by scanning.

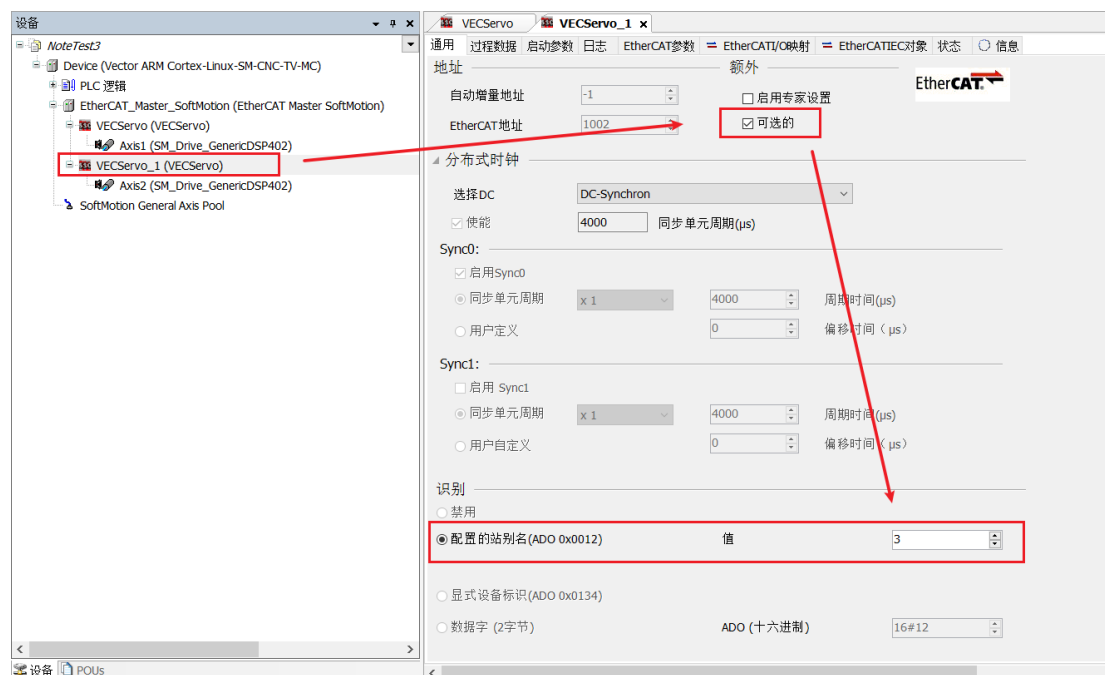
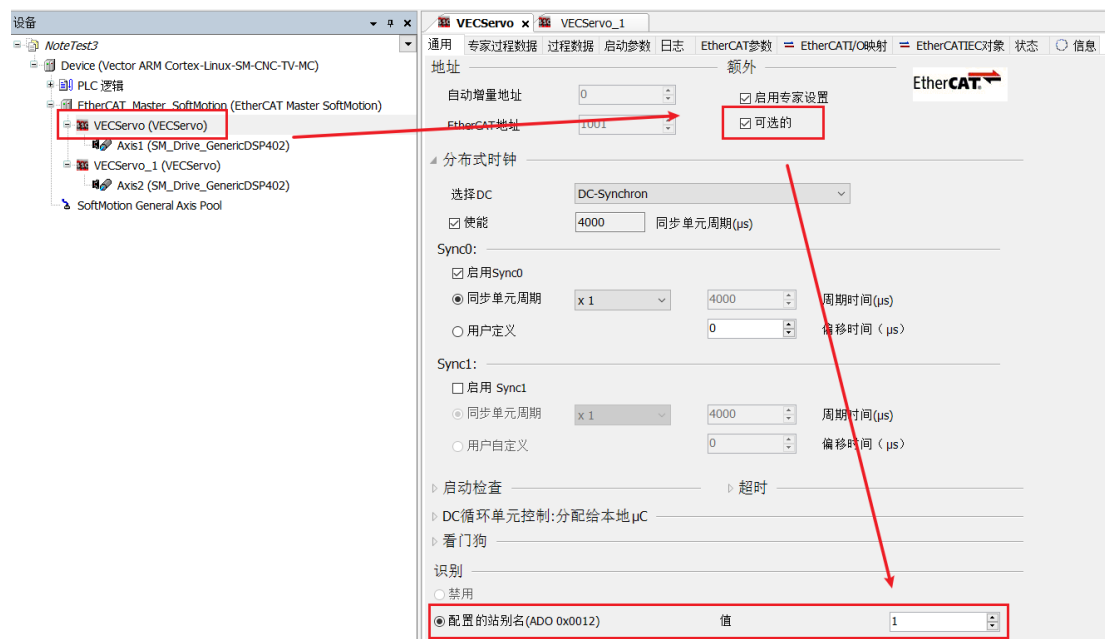


Note: The node address of the device is automatically assigned by default, that is, the node address is assigned from the shortest distance to the farthest distance from the host. In this example, the default setting is not modified.

Address		Additional	
AutoInc Address	0	<input type="checkbox"/> Enable Expert Settings	EtherCAT 
EtherCAT Address	1001	<input type="checkbox"/> Optional	

If you need to manually assign node addresses, you can refer to the following method, taking VC bus servo as an example:

a) Assign the address according to the following figure: check the "optional" in the additional place from the station, and then fill in the station number (1-65535) for the configured station alias)



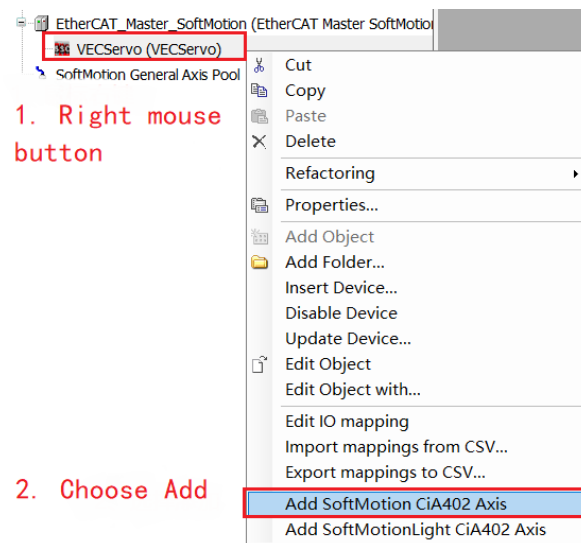
b) Set the parameters P08.41 (servo station number) of the two servos to 1 and 3 respectively, and reset the servos or power on again.

c) Then log in to the device to download the program. If the connection is not successful the first time, reset and re-run.

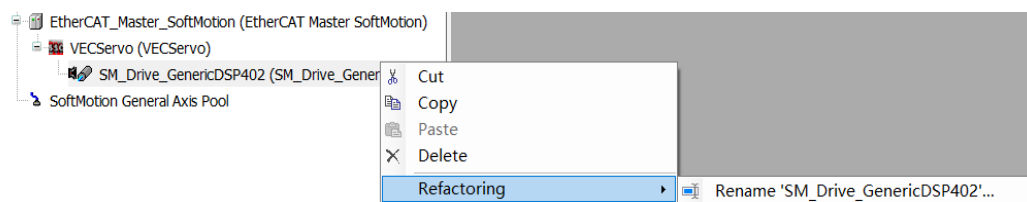
d) According to the above settings, as long as the alias of the slave station is the same as the alias of the background project configuration, it can run regardless of the order.

Add CiA402 Axis

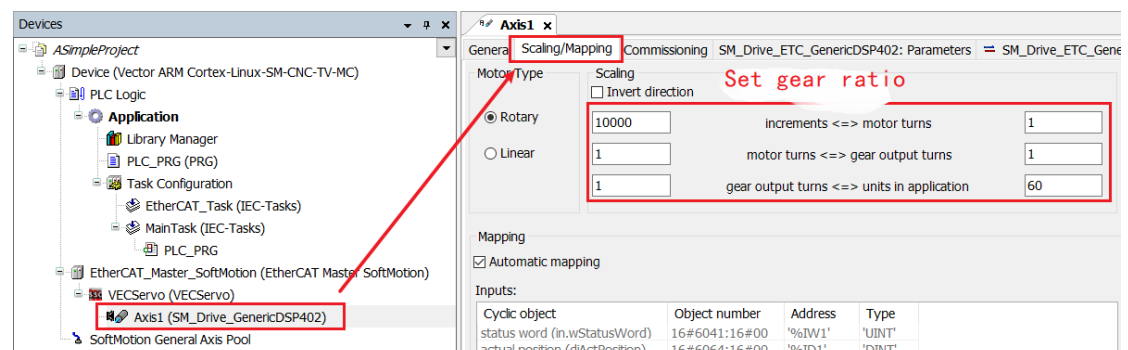
1) Associated operation between equipment and axis, add method: right click "VECServo Add SoftMotion CiA402 Axis", add motion control axis, as shown in the figure below.



After adding, as shown in the figure below, in order to facilitate programming, rename the axis to "Axis1"



2) Set the control related parameters, double-click Axis1, open the parameter configuration page, and set the gear ratio.

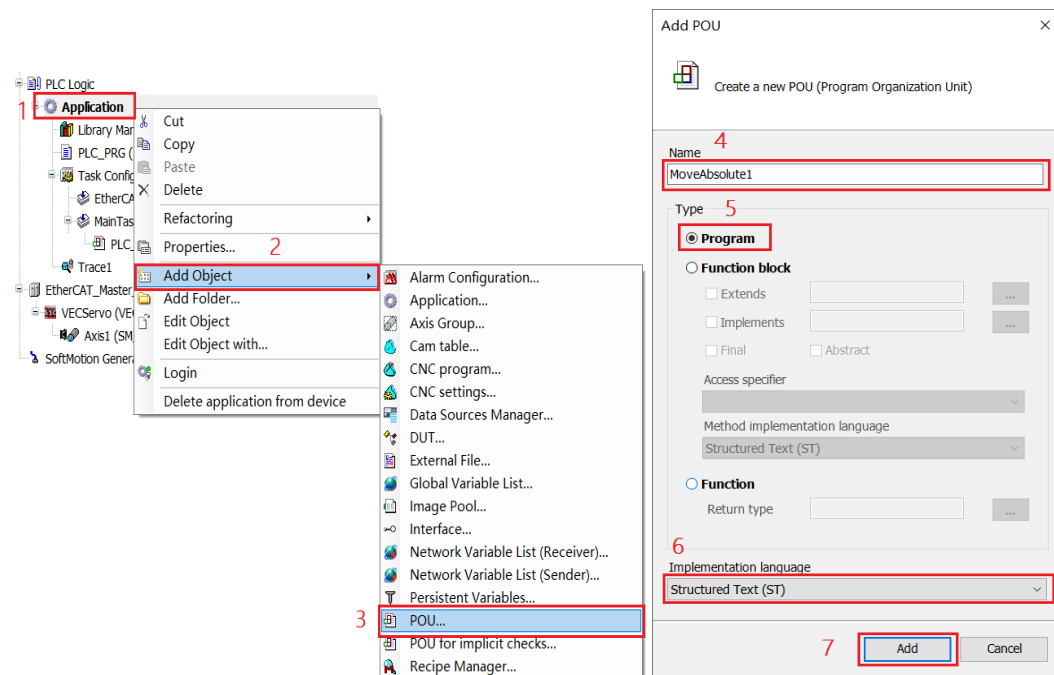


1.1.3 1.1.3 User control program writing

Write a program here to make the controller control the servo motor to execute the absolute position command to make a reciprocating motion.

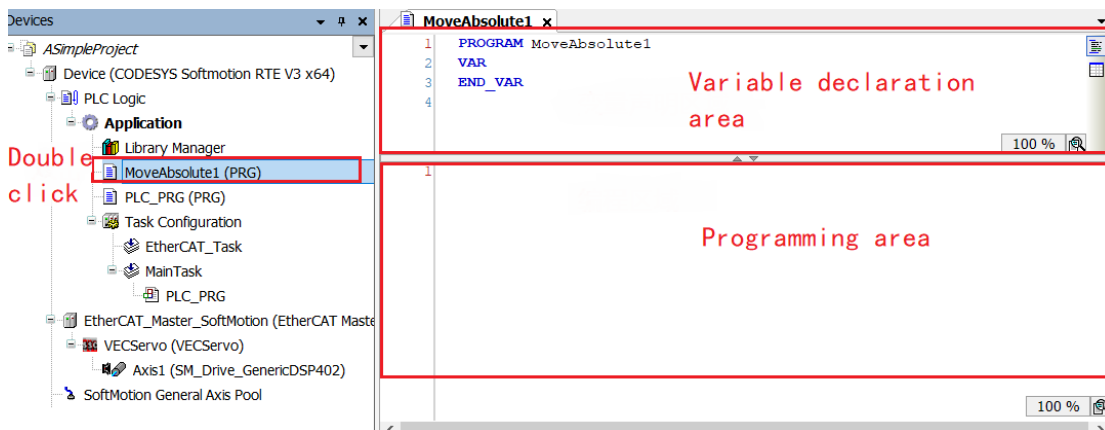
Create an object

As shown in the figure below, right-click "Application Add Project POU", name the new POU "MoveAbsolute" in the pop-up window, select "Program" as the type, select "Structured Text (ST)" as the programming language, and click "OK", Finish adding.



Open the programming environment


Double-click to open "MoveAbsolute", as shown in the figure below. The programming interface includes a variable declaration area and a programming area.

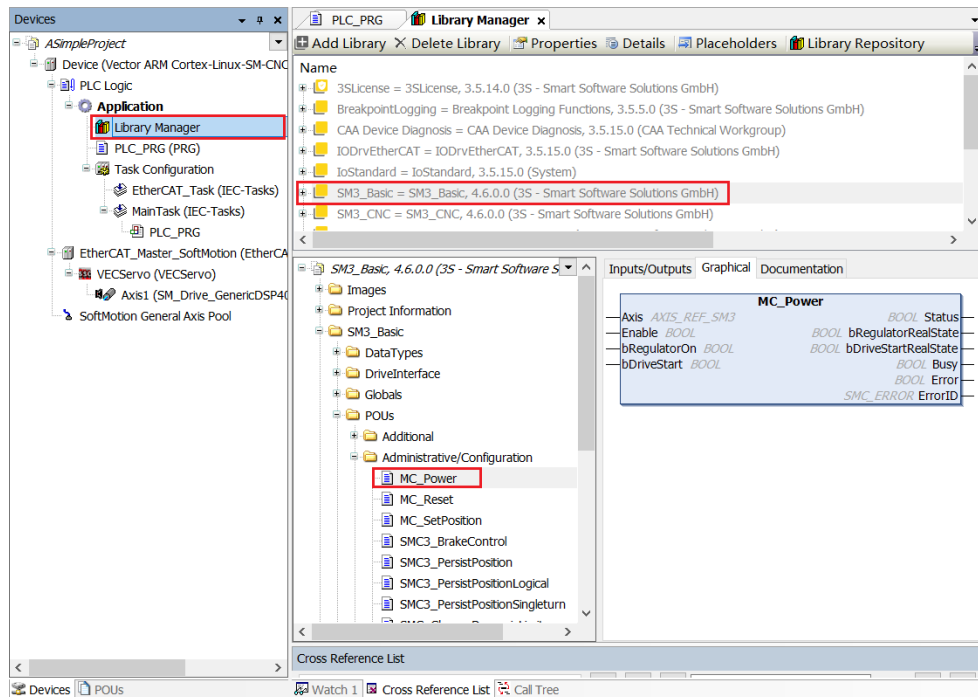


Define variables

Add variables in the variable declaration area, the variable declaration code is as follows.

```
PROGRAM MoveAbsolute1
VAR
    iStatus:INT;
    Power:MC_Power;      //使能模块
    MoveAbsolute:MC_MoveAbsolute; //绝对位移模块
    p:REAL:=180; //位移值
    ActPos:LREAL; //实际位置值
END_VAR
```

Need to pay attention to here, the project  **Library Manager** Whether the library "SM3_Basic" is added to the library, it is generally added by default. If it is not added, you need to manually right-click "Library Manager Add Library", find the library "SM3_Basic" and select Add, or you can add more by this method Library.



Programming

Add a program in the programming area as follows. (Program function: When the program is executed, the servo is immediately enabled, and after the servo is successfully enabled, the motor is controlled to move back and forth between the position P and the starting point 0.)

```
CASE iStatus OF
0:      //上电自动使能伺服
    Power(Axis:=Axis1, Enable:=TRUE, bRegulatorOn:=TRUE, bDriveStart:=TRUE );
    IF Power.Status THEN
```



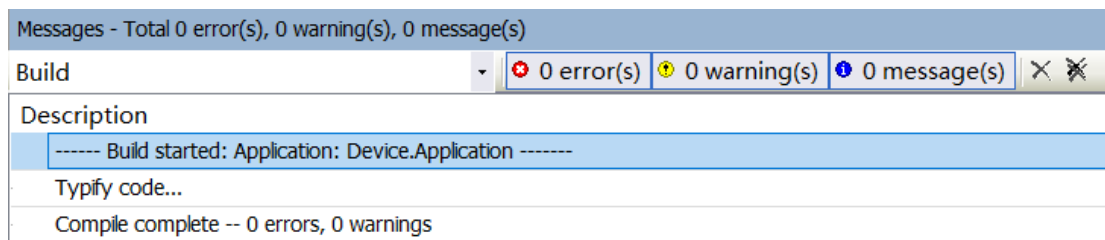
```

        iStatus:=iStatus+1;
    END_IF
1:          //走绝对位移, 运行到 P 处
    MoveAbsolute(Axis:=Axis1, Execute:=TRUE, Position:= p, Velocity:=100 , Acceleration:= 100,
Deceleration:=100 );
    IF MoveAbsolute.Done THEN
        MoveAbsolute(Axis:=Axis1, Execute:= FALSE);
        iStatus:=iStatus+1;
    END_IF
2:          //走绝对位移, 运行回到 0 处
    MoveAbsolute(Axis:=Axis1, Execute:=TRUE, Position:= 0, Velocity:=100 , Acceleration:= 100,
Deceleration:=100 );
    IF MoveAbsolute.Done THEN
        MoveAbsolute(Axis:=Axis1, Execute:= FALSE);
        iStatus:=1;
    END_IF
END_CASE

ActPos:= Axis1.fActPosition;      //读取实际位置值

```

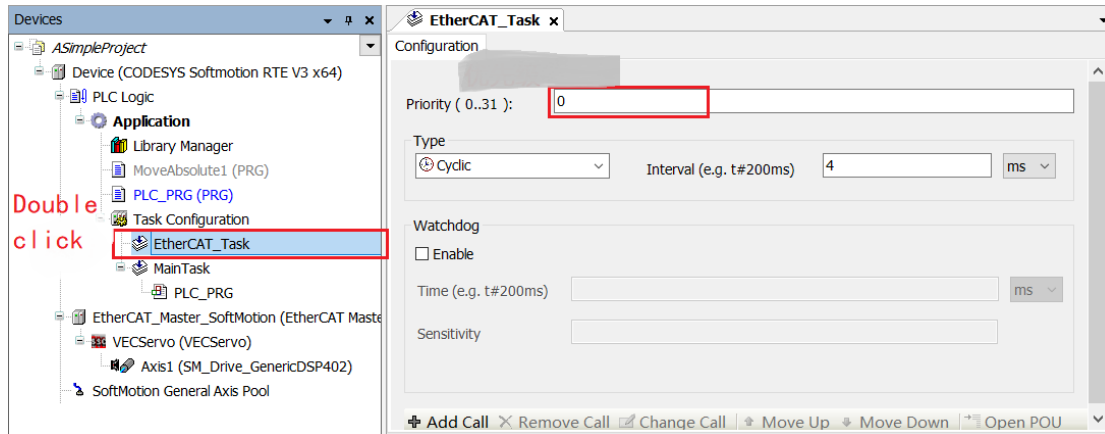
After the program is written, click compile  , Confirm that the writing is correct.



1.1.4 Bus and task cycle

Bus Mission Week

When adding EtherCAT Master SoftMotion, the project will automatically add the bus task EtherCAT_Task, set the bus execution mode, cycle period and task priority (0~31, 0 is the highest level), here EtherCAT_Task priority is set to 0, other tasks, For example, the priority of Main_Task is set to 1~31.

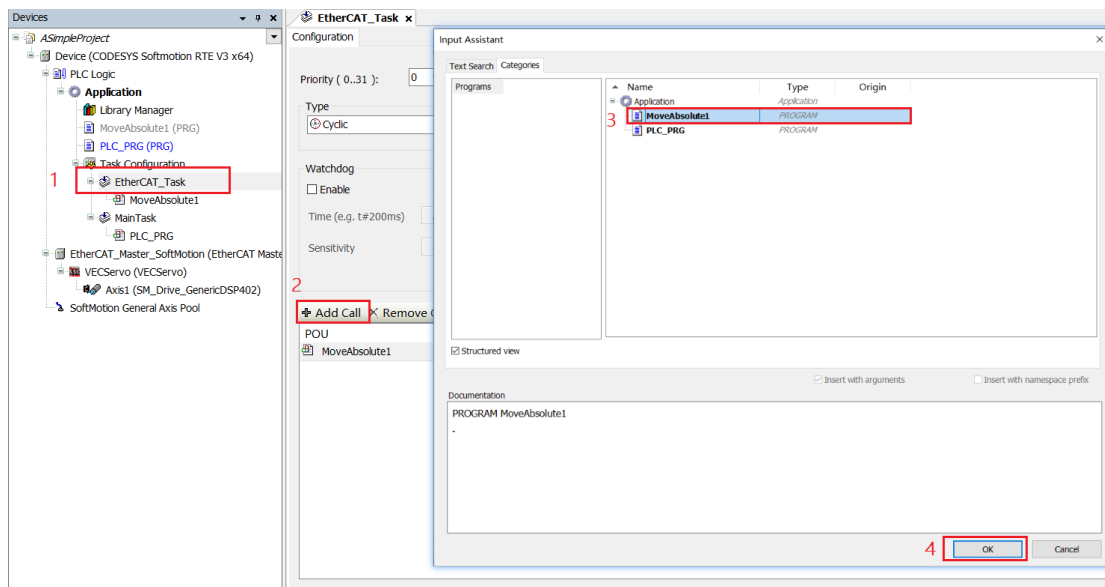


Program task cycle

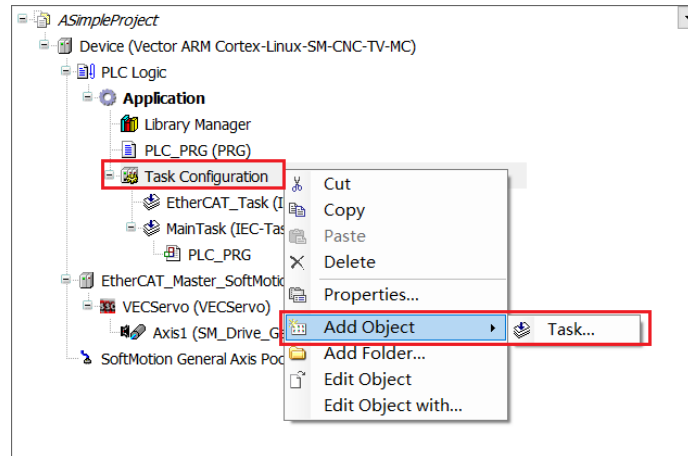
After the program is written, you need to add the program to the task and configure the task.

POU related to motion is recommended to be added to EtherCAT_Task, POU related to logic or calculation is recommended to be added to other tasks (such as Main_Task, when the project is created, a program "PLC PRG" and a task "Main Task" have been established by default. And the "PLC PRG" has been added to the "Main Task").

The newly created POU object "MoveAbsolute" needs to be manually added to the EtherCAT_Task task. The method of adding is as follows, double-click "EtherCAT_Task Add Call", select "MoveAbsolute1", and click "OK".



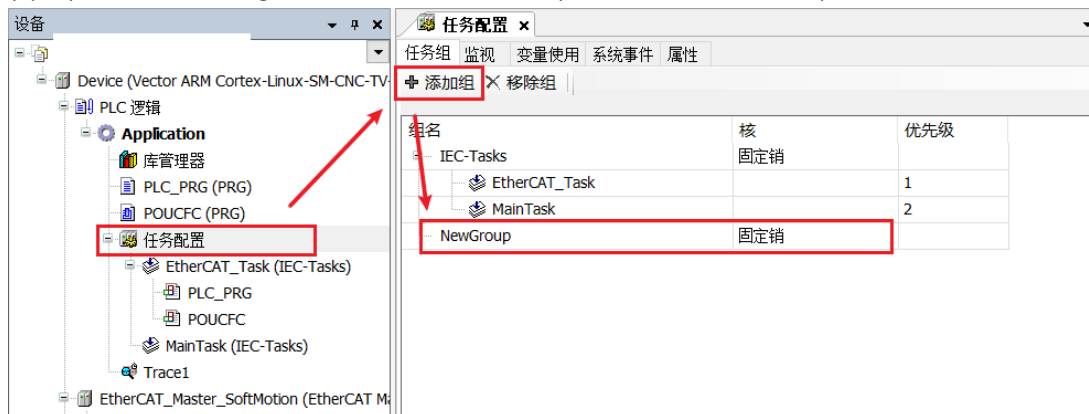
In addition to the default tasks, you can also add new tasks by yourself. The adding method is as follows: right-click "Task Configuration" and select "Add Project Task" to add a new task. Double-click the task to configure the task.



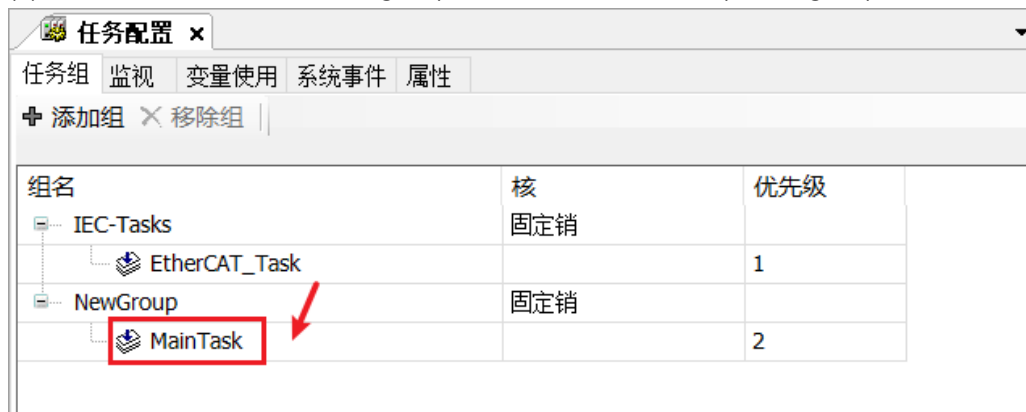
1.1.5 Task sub-core

The VE motion controller adopts a four-core design. In order to run the bus more smoothly, the bus tasks can be divided into cores. Proceed as follows

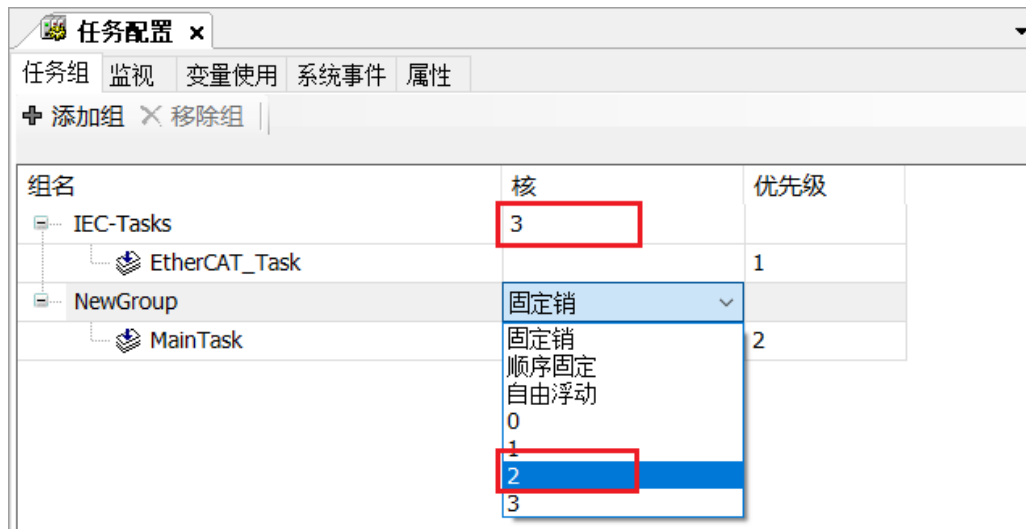
(1) Open "Task Configuration", click Add Group, and add "NewGroup"



(2) Add other tasks to the new group, EtherCAT_Task is a separate group



(3) EtherCAT_Task is allocated to the third core, and other tasks are allocated to the second core to ensure the stable operation of EtherCAT tasks



Notice:

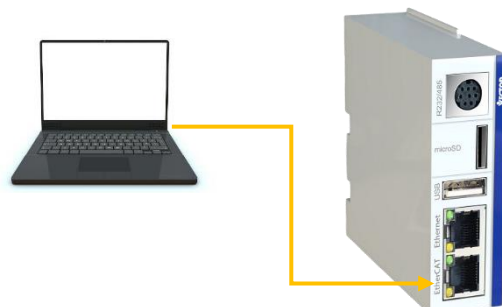
When setting tasks for Modbus devices, they cannot be added to EtherCAT_Task, but need to be added to other tasks.

1.1.6 Logging in to the device

Connect the controller

Run the CODESYS environment on the PC and establish a communication link with the VE controller, which can download the user program, start and stop and monitor the operation of the user program, view or modify the parameters, and so on.

At present, you can log in to the VE controller through the LAN local area network. The PC and the VE controller can be directly connected to the VE controller through a one-to-one connection through a network cable; it can also be connected through a router or a hub. In this case, one PC and multiple One VE controller is online, or multiple PCs can access the same VE controller.



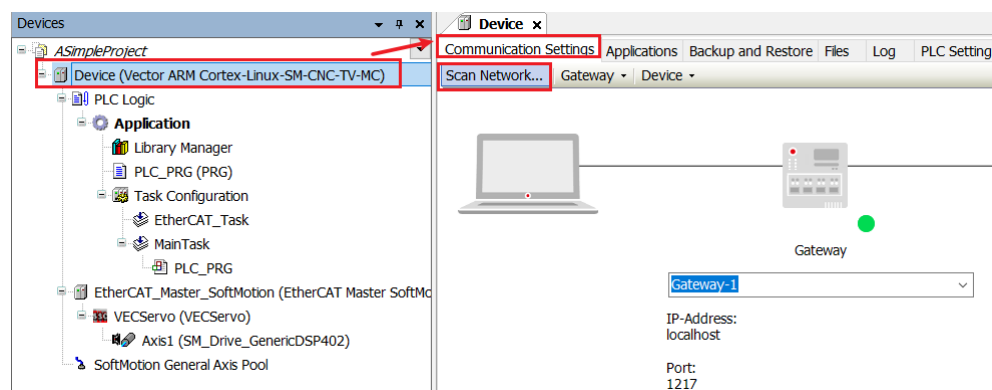
By default, the IP addresses of both the PC and the VE controller must be in the same network segment to log in to the VE controller, otherwise the VE controller will not be scanned in CODESYS. The factory default IP address of the VE controller is 192.168.1.123. If the IP address of the PC is 192.168.1.xxx, (where xxx means the range of 1~254, but not the same

as the IP address of the VE controller), then CODESYS The VE controller can be scanned, and data can be exchanged with it, user program download, operation monitoring, etc. can be performed. If the IP of the VE controller has been modified artificially and its address is not in the IP address network segment where the PC is located, and the PC cannot be accessed, the IP address of the VE controller can be restored to the factory default IP address: 192.168.1.123, and then the PC Modify the address of the machine to 192.168.1.xxx, and after establishing a one-to-one connection with it, you can modify the address of the VE controller to the desired IP network segment address.

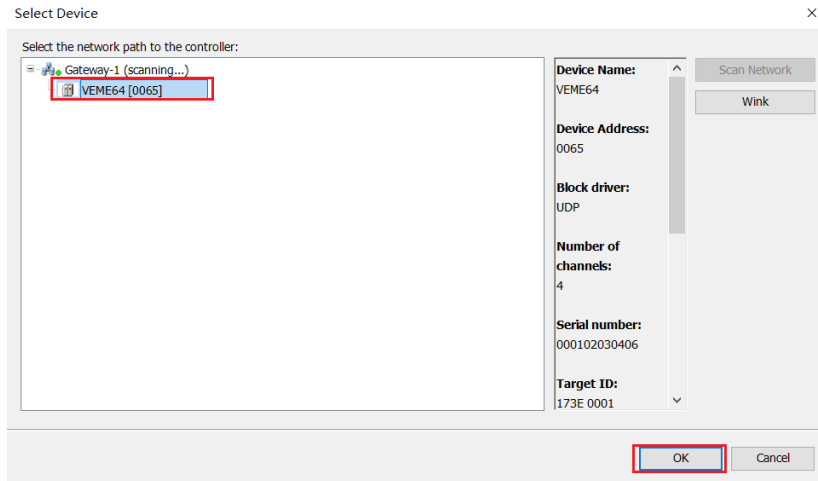


Scannet

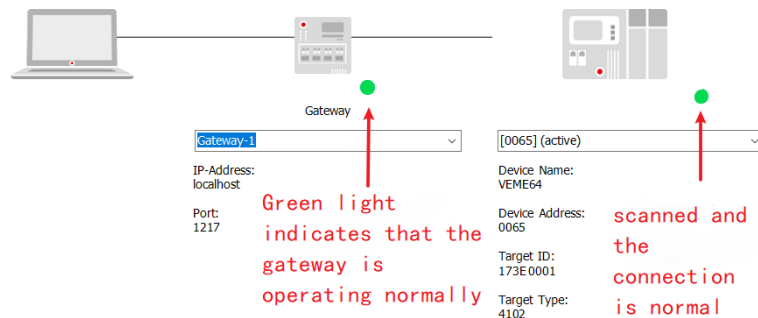
Double-click "Device" in the project tree, and the following interface will pop up



On this screen, click the "Communication Setting Scan network" label, and the following interface will pop up. After scanning the VE controller, click its name on the left side of the window, and you can see its profile information on the right side of the window. Click OK to connect equipment:

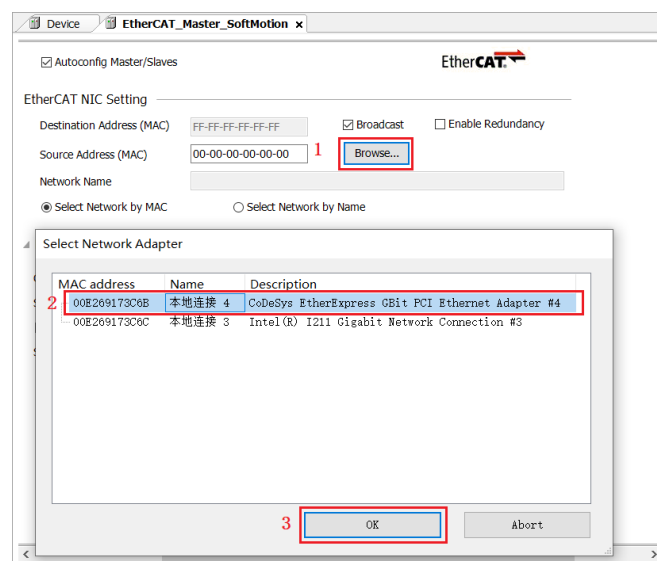


After logging in, you can modify the device name according to your needs and change it to a device name that is easy to identify, which can be easily identified. It is very helpful in applications with multiple controllers.



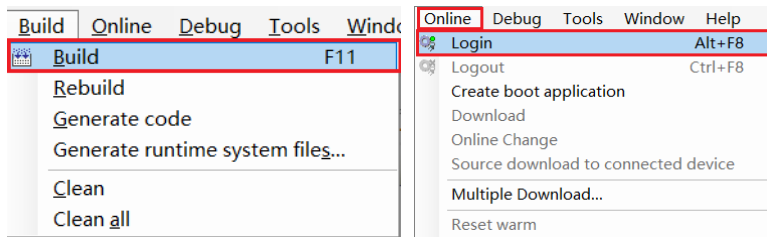
Set the bus control network port

Double-click "EtherCAT_Master_SoftMotion" to set the EtherCAT network card, as shown in the figure, click "Browse", select the name of the EtherCAT network card in the pop-up window (connect to the server network port), and click "OK"

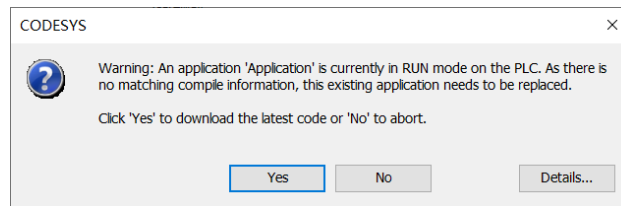


Login to download

Click "Build"  , After the compilation and troubleshooting are correct, click "Login" 

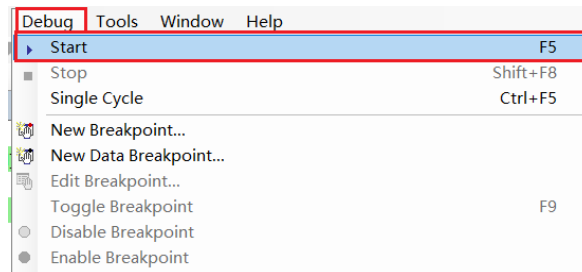


A dialog box pops up, select "Yes" to download the program to the controller.

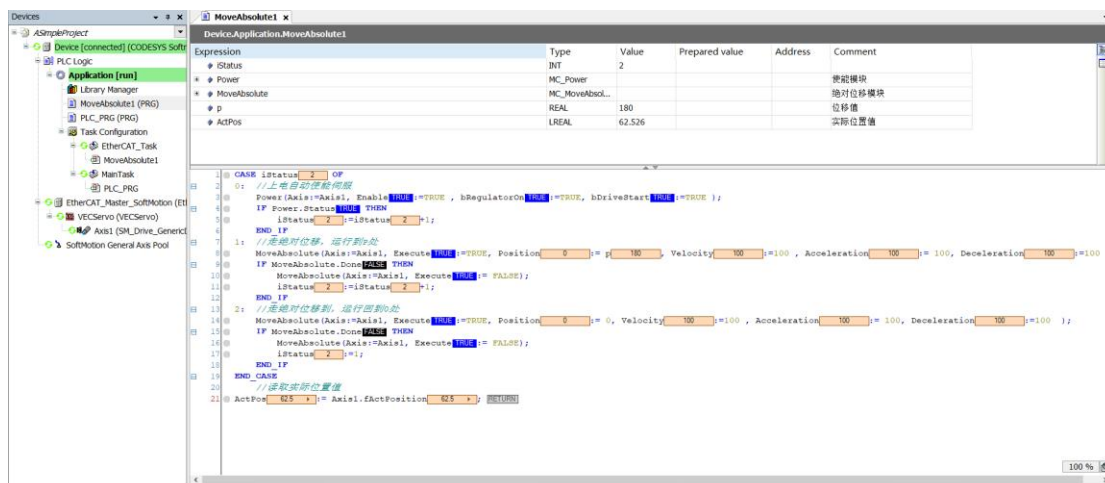


1.1.6 Start debugging

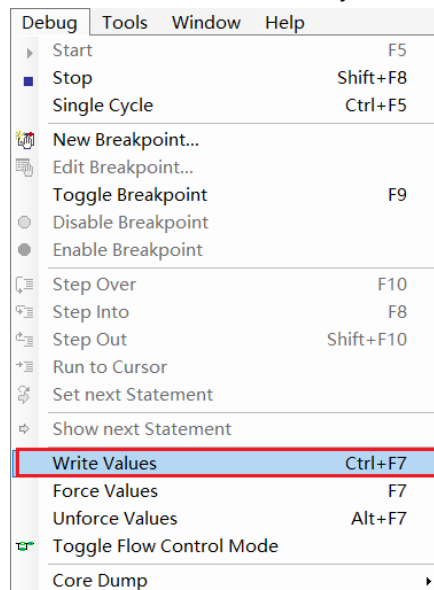
After logging in successfully, select "Debug Start", and the controller starts to run..



Turn on "MoveAbsolute" and the program runs as shown in the figure below. After the program is executed and the servo is enabled, the motor will move back and forth between the position P and the starting position 0.



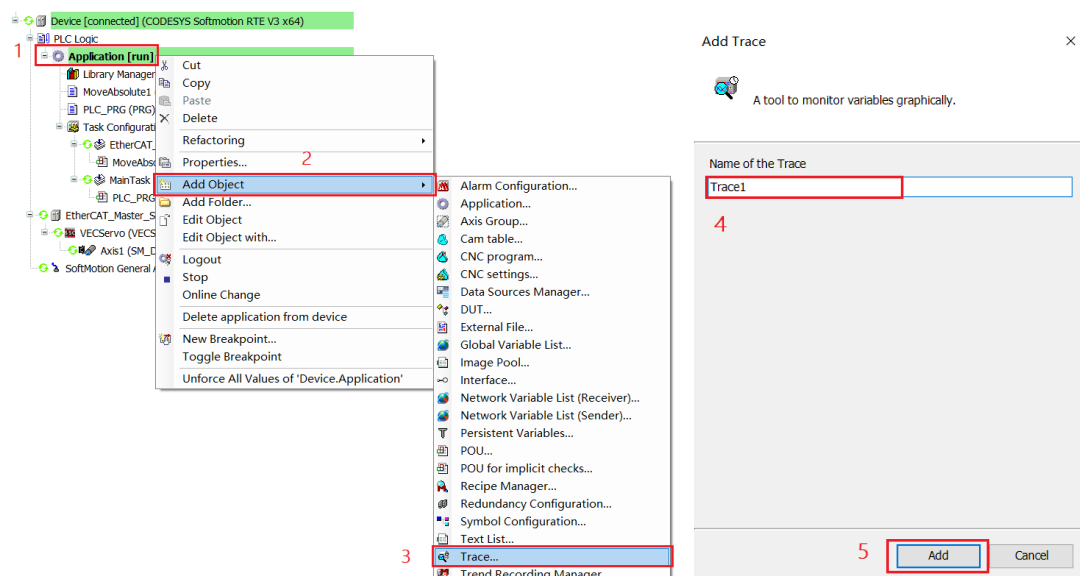
Modify the value of position P online: click the preset value "Prepared Value" of the variable "P" and enter the value "360", then select "Debug Write Values" or the shortcut key "Ctrl+F7" to change the value Write to "Value" to modify the value of variable "P" online.



1.1.7 1.1.7 Add Trance Tracking

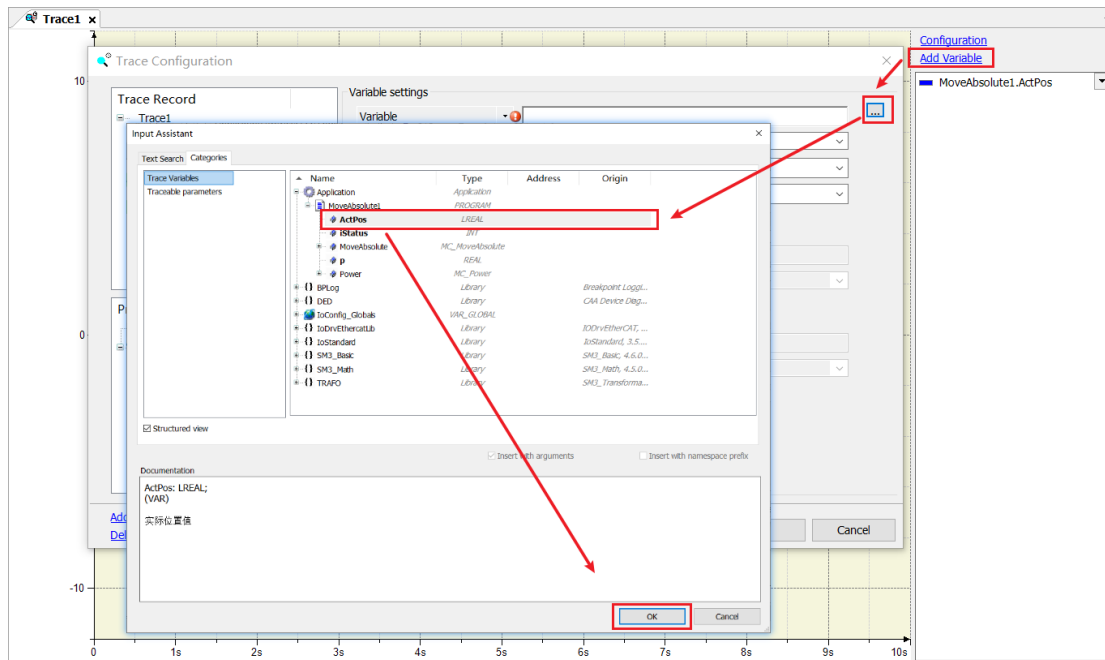
Add Trance

In order to observe the changes of the servo axis position more intuitively, a logic analyzer is added here to record the movement curve. Right-click "Application", select "Add object Trance", a dialog box will pop up, name and click "Add" to add Trance (tracking), as shown below.

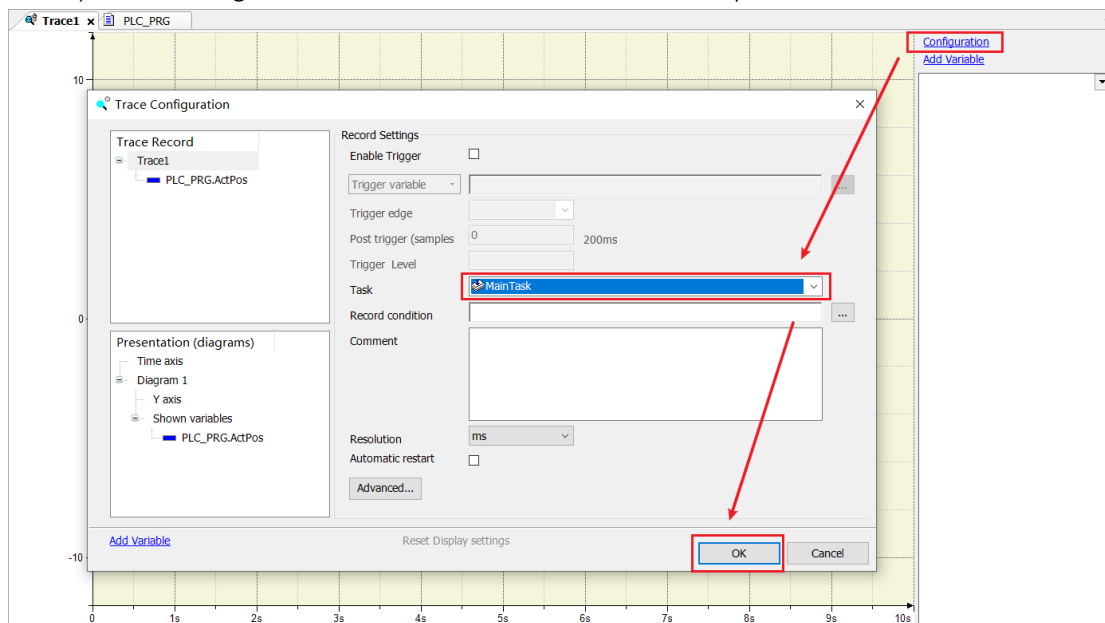


Configure Trance

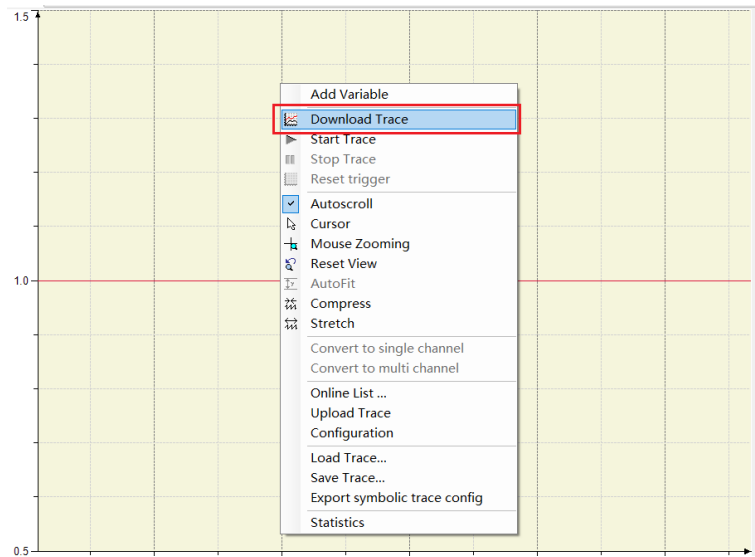
1) Click Add_Variable (add variable), select the button, find the variable "ActPos" in the variable pop-up window, and click "OK" to add it to the tracker.



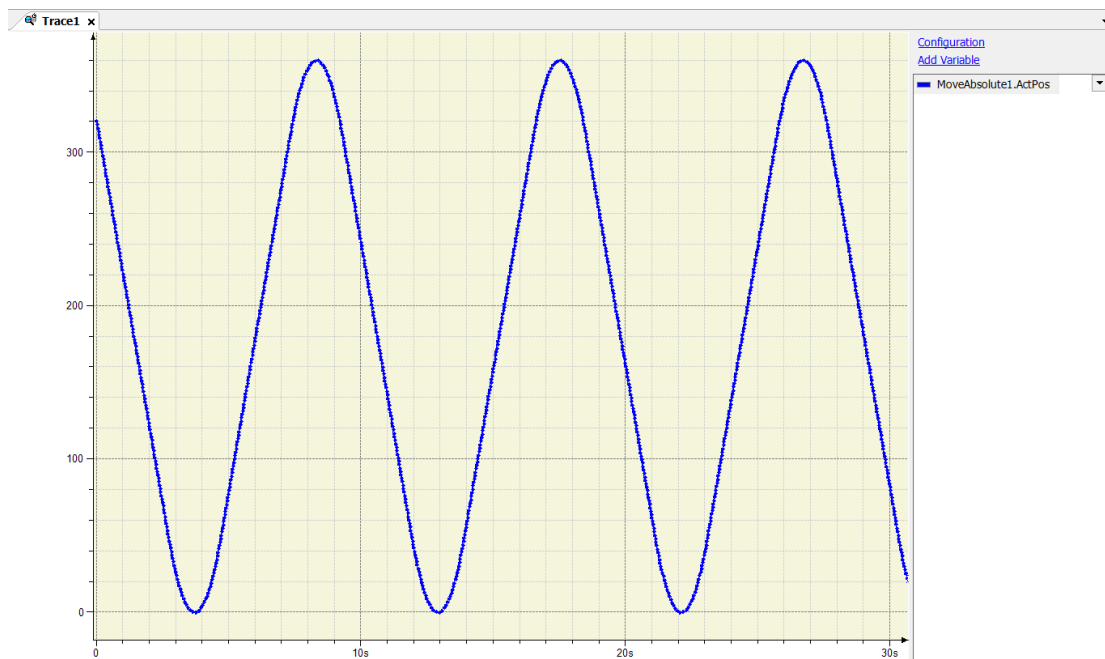
2) Click "Configuration", select "Main Task" in the Task option, and click "OK";



3) Right-click the blank interface of the oscilloscope and select "Download Trace" to download the trace;



4) The actual position curve of Axis1 is printed as follows.



1.1.8 1.1.8 Stop debugging

After debugging, you can click "Debug Stop" to stop executing the program

