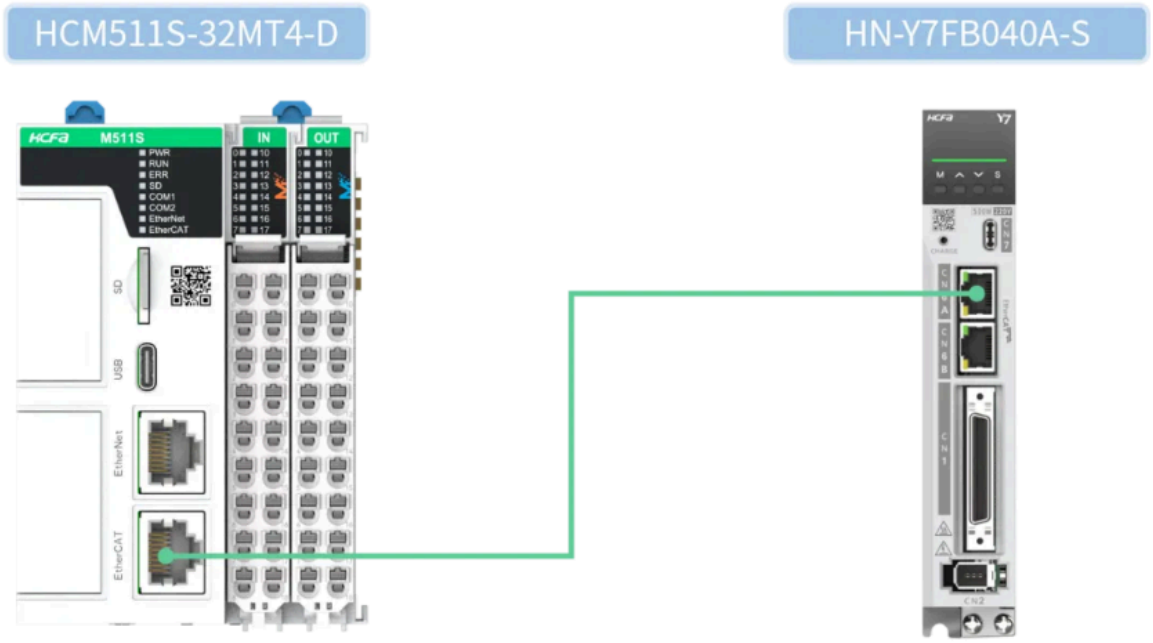
M Series Tutorial: Stop Command

Communication connection

This tutorial uses the M controller HCM511S-32MT4-D and servo HN-Y7FB040A-S. The connection method is shown in the figure below.

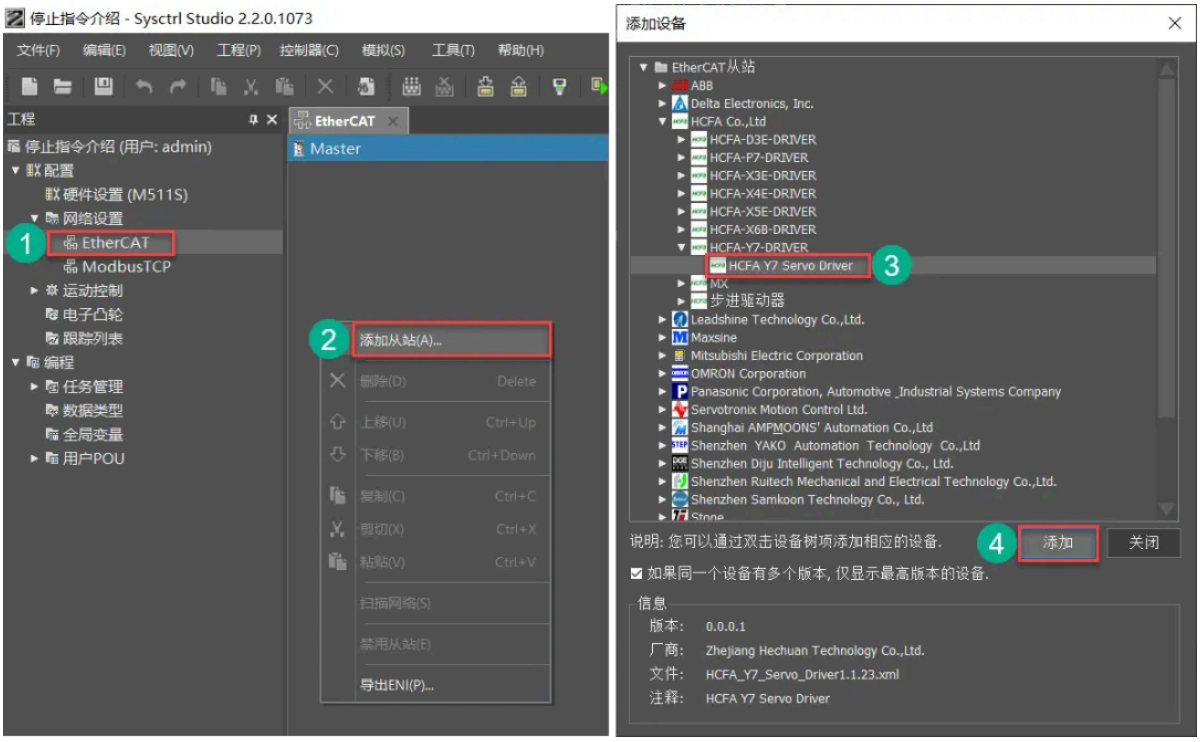


Sysctrl Studio project configuration

Basic Settings

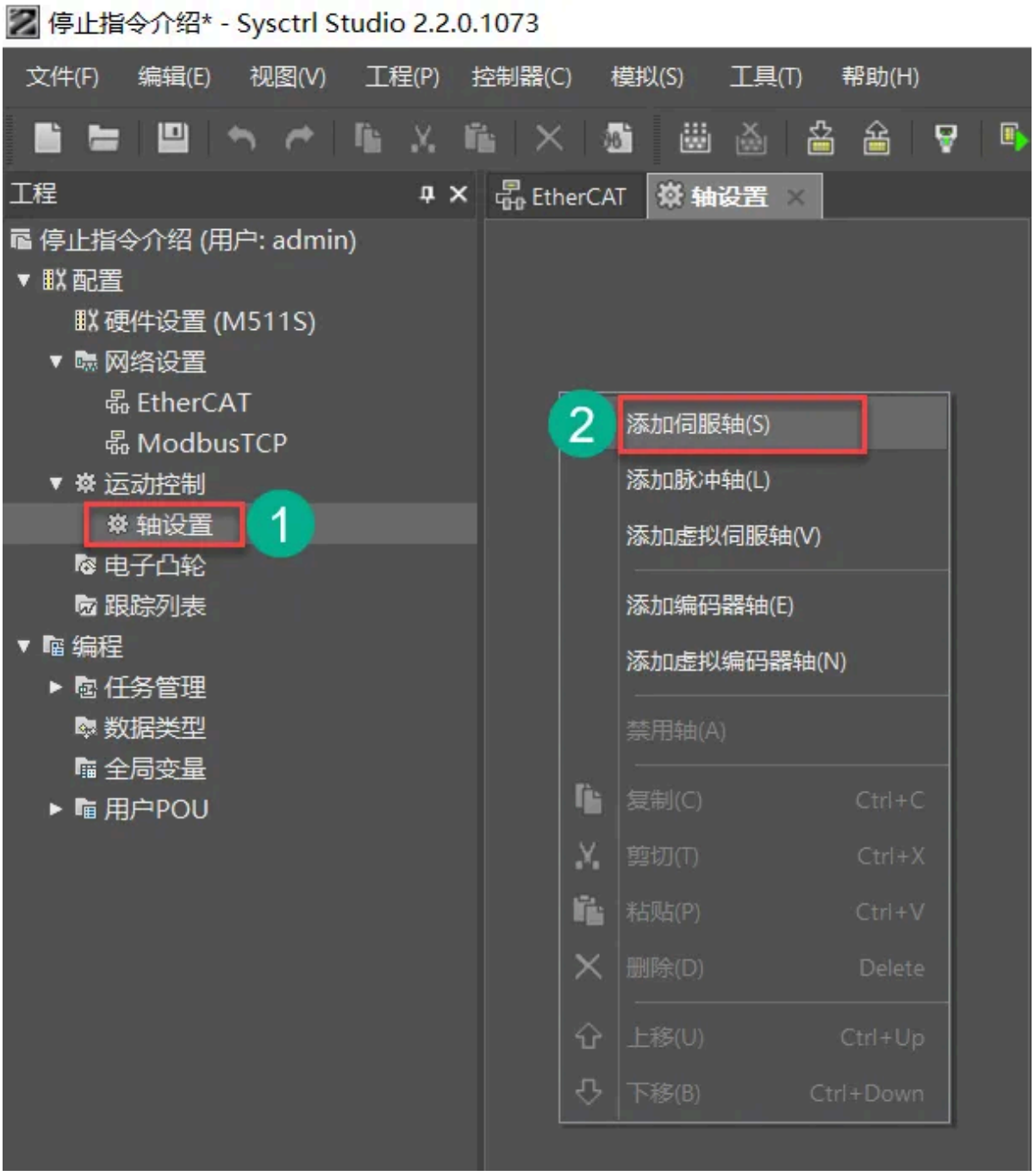
Step 1: Add a slave

Double-click to open the Sysctrl Studio software and create a new project. Click [Network Settings] >> [EtherCAT] >> [Add Slave] >> Select the servo slave to be added >> [Add]



Step 2: Add Servo Axis

Click [Motion Control] >> [Axis Settings] >> Right-click on the blank area and click [Add Servo Axis]



Step 3: Associate the device

Click [Associate to Device...], select the servo to be associated, and click [OK].

Step 4: Mechanism parameter configuration

[1] Number of pulses per motor revolution

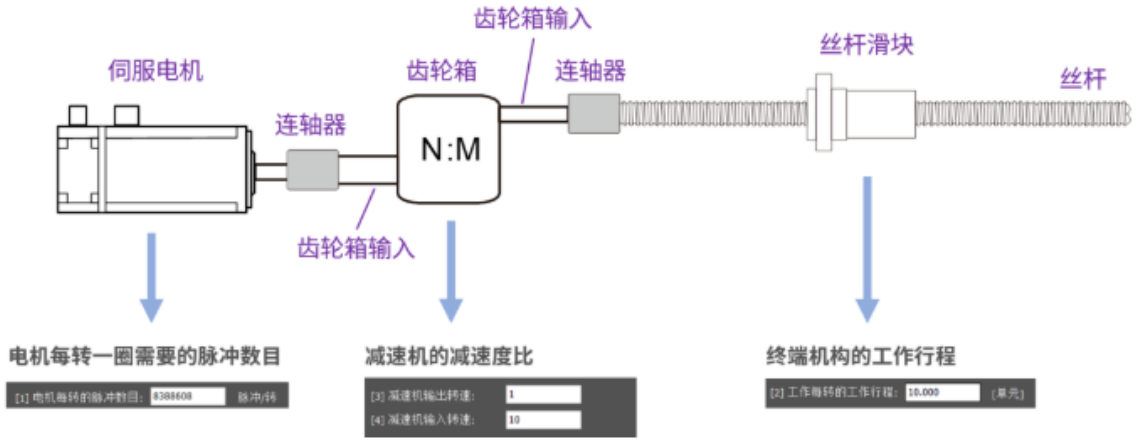
Determined by the motor encoder resolution

[2] Working distance per working revolution

For example, if the screw pitch is 10mm, the mechanism lead is 10mm, and the unit is mm. In the motion instruction, the unit of the position parameter is mm, and the unit of the speed parameter is mm/s.

[3] Reducer output speed, [4] Reducer input speed

For example, if the speed ratio of the reducer is 10:1, the output speed is set to 1 and the input speed is set to 10.



The parameter configuration completion interface is as follows

基本设置 | 原点返回设置 | 操作设置 | 点动 | 诊断

基本信息

名称: 伺服轴1

轴号: 1

轴类型和输入输出

轴类型: 伺服轴

关联到设备... 1001 (HCFA Y7 Servo Driver)

轴位置模式和单元

线性模式 循环模式

模: 360.000 [单元]

单位: 单元

软件限位

激活软件限位

反向软件限位: 0.000 [单元]

正向软件限位: 1000.000 [单元]

传动机构参数设置

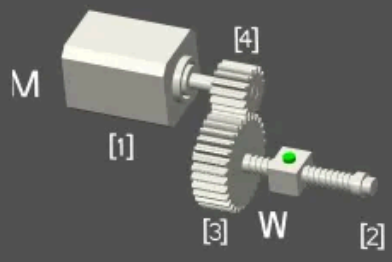
机构类型: 丝杠

[1] 电机每转的脉冲数目: 8388608 脉冲/转

[2] 工作每转的工作行程: 1.000 [单元]

[3] 减速机输出转速: 1

[4] 减速机输入转速: 1

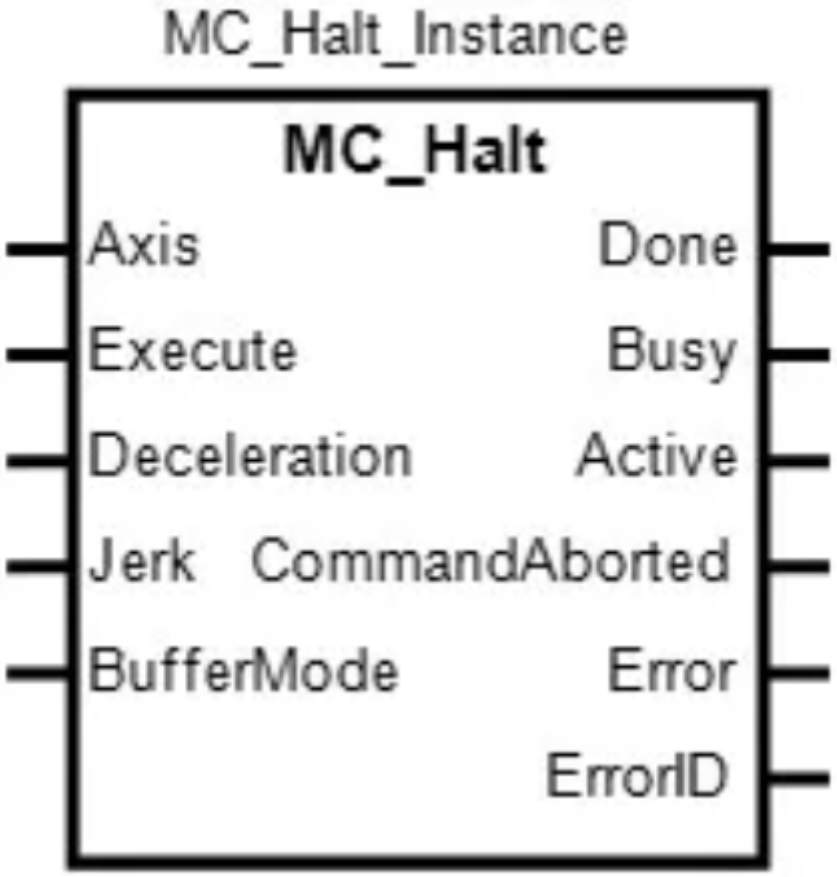


M: 电机, W: 工作

换算公式

$$\text{脉冲数(Pulse)} = \frac{\text{工作总距离}}{\text{[2] 工作每转的工作行程}} \times \frac{\text{[4] 减速机输入转速}}{\text{[3] 减速机输出转速}} \times \text{[1] 电机每转的脉冲数}$$

MC_Halt (Stop Command)



(1) Instruction description

① Functional description

The control axis decelerates and stops at the set deceleration rate. The deceleration rate and jerk are set by the command input variable.

②Pin Description

■ Input variable

Name	Meaning	Data type	Valid range	Default	Description
Axis	Axis number	USINT	Depend on model	Required field	Specify the axis number of the control axis
Execute	Start	BOOL	TRUE or FALSE	FALSE	Execute the instruction when the rising edge of the parameter is detected
Deceleration	Deceleration	LREAL	Positive number	Required field	Specify deceleration *1 (Unit: travel unit/second²) *2
Jerk	Jerk	LREAL	Positive number	Required field	Specify jerk *1 (Unit: travel unit/second³) *2
BufferMode	Buffer mode	MC_Buffer_Mode	0: mcAborting 1: mcBuffered	0	Set the buffer mode between two instructions*3 0: aborted 1: buffered

*1: For the relationship among Velocity, Acceleration, Deceleration, and Jerk, please refer to the *"Parameter description of motion control instructions "*.

*2: For a detailed introduction to instruction units, please refer to the *"Parameter unit of motion control instructions"*.

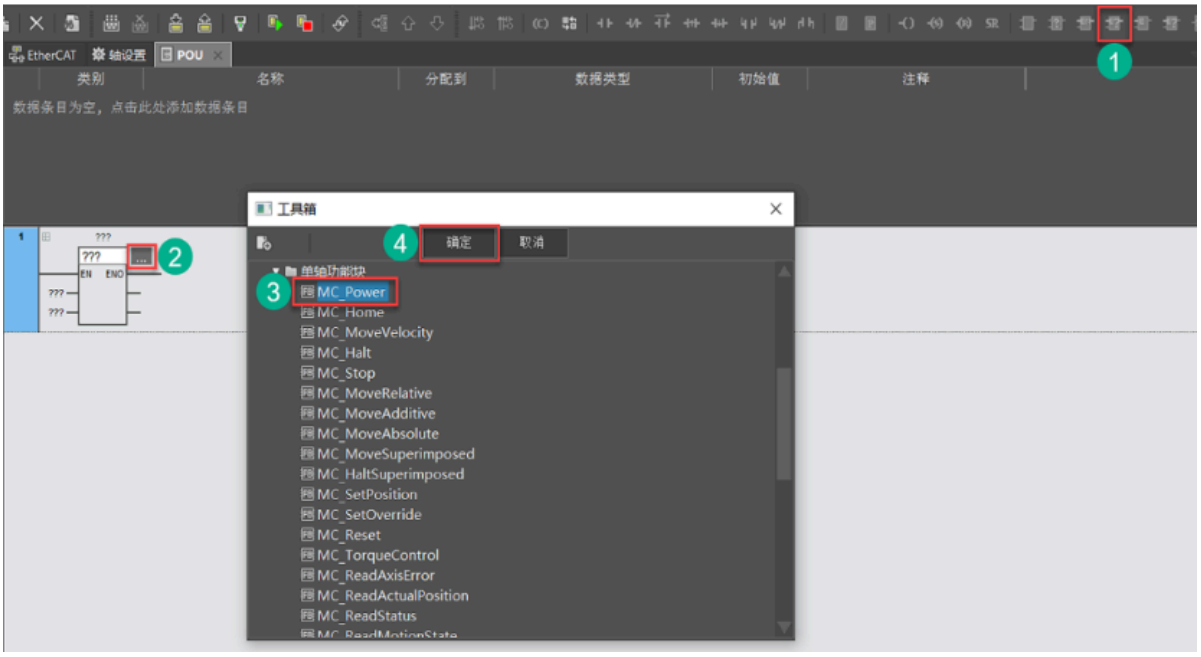
*3: For a detailed introduction to BufferMode, please refer to the *"Buffer mode during multi-starting of the same axis"*.

■ Output variable

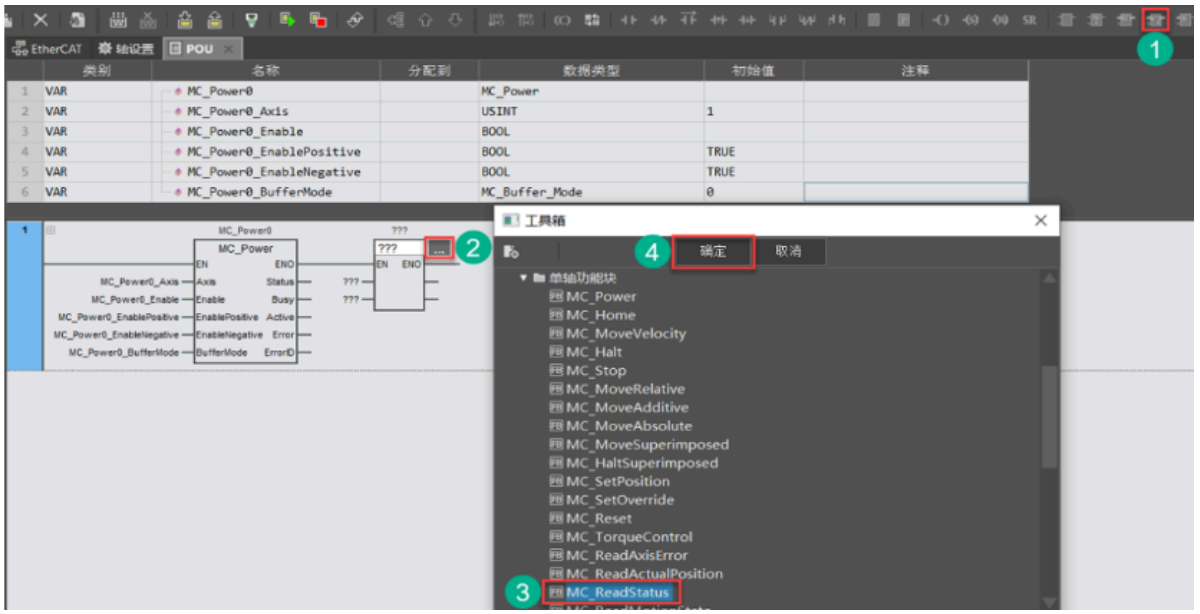
Name	Meaning	Data type	Valid range	Description
Done	Completed	BOOL	TRUE or FALSE	TRUE when the instruction is completed
Busy	Executing	BOOL	TRUE or FALSE	TRUE when the instruction is executed
Active	Under control	BOOL	TRUE or FALSE	TRUE when the axis is under control
CommandAborted	Aborted	BOOL	TRUE or FALSE	TRUE when the instruction is aborted
Error	Error	BOOL	TRUE or FALSE	TRUE when there is an error
ErrorID	Error code	WORD	0~65535	Refer to "instruction error code description" for the meaning of the output error code value when an instruction execution error occurs.

(2) Instruction test

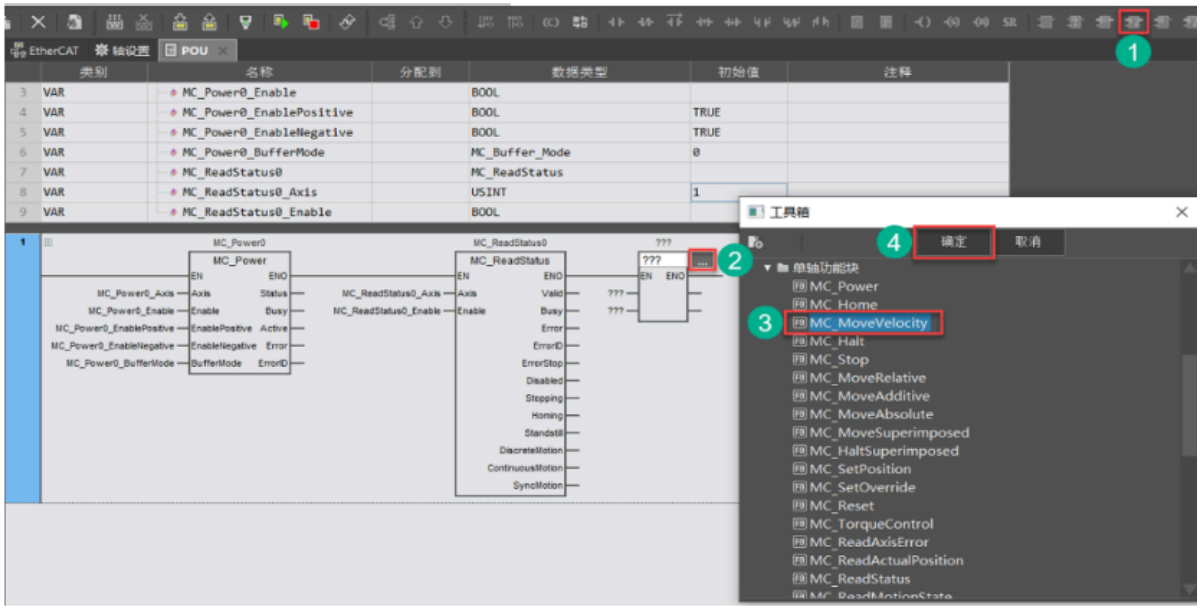
①Open the default POU and insert the MC_Power function block



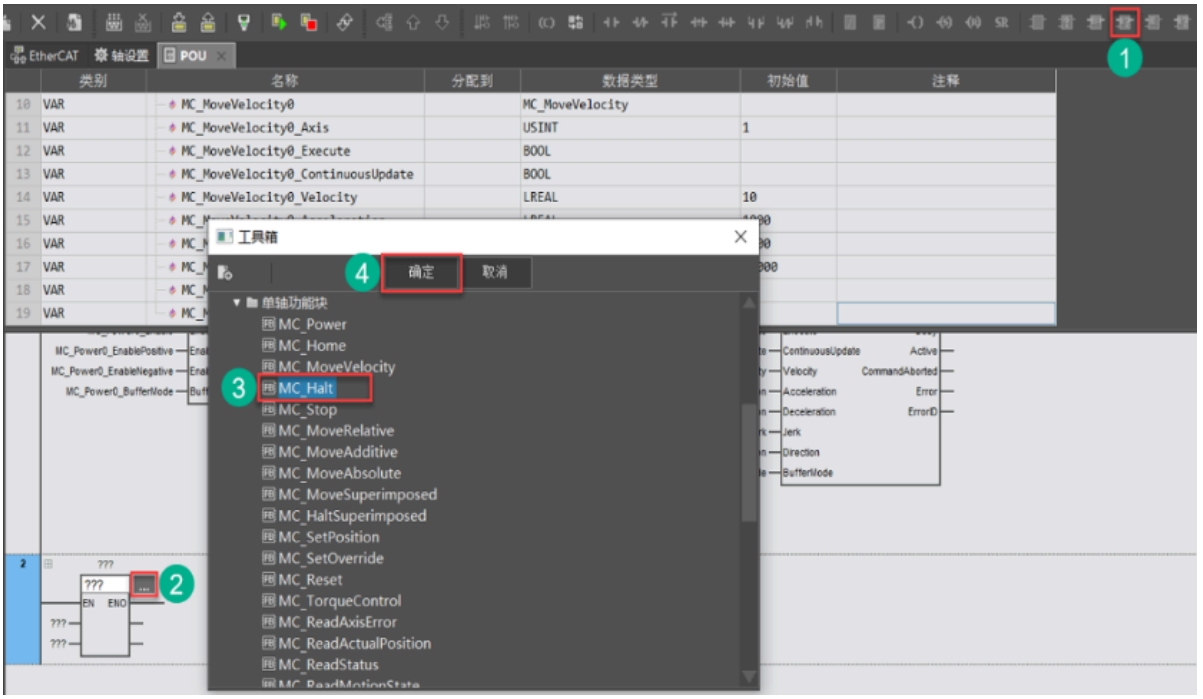
②Insert MC_ReadStatus function block to monitor axis status



③Insert the MC_MoveVelocity function block



④Add network and insert MC_Halt function block



After the settings are completed, download the project to the controller.

⑤Perform MC_Halt function block test (the following are consecutive steps)

a. Trigger axis monitoring instruction MC_ReadStatus function block

Result: The axis is in the Disabled state.

b. Trigger the axis to enable the MC_Power function block

Result: The axis changes to the Standstill state

c. Trigger the MC_MoveVelocity function block

Result: The axis runs in the forward direction at a speed of 10 and the axis state changes to ContinuousMotion.

d. Trigger the MC_Halt function block

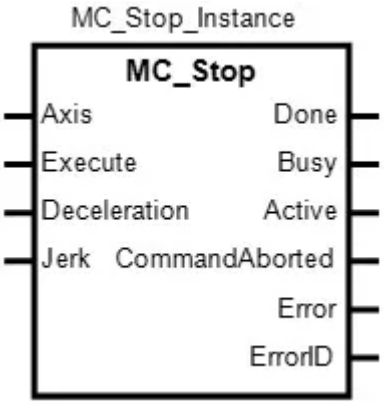
Result: The axis stops running immediately, and the axis state changes to DiscreteMotion (positioning action) state first, and then to Standstill (stop) state.

e. Trigger the MC_MoveVelocity function block again

Result: The axis runs in the forward direction at a speed of 10 and the axis state changes to ContinuousMotion.

[Note] It can be seen that there is no need to reset the Execute pin of the MC_Halt instruction. The axis can continue to be controlled by executing other motion control instructions.

MC_Stop (Stop and Lock Instruction)



(1) Instruction description

① Functional description

The control axis decelerates and stops at the set deceleration rate. After stopping, the axis state will be locked in the stopped state.

②Pin Description

■ **Input variable**

Name	Meaning	Data type	Valid range	Default	Description
Axis	Axis number	USINT	Depend on model	Required field	Specify the axis number of the control axis
Execute	Start	BOOL	TRUE or FALSE	FALSE	Execute this instruction when Execute is TRUE
Deceleration	Deceleration	LREAL	Positive number	Required field	Specify deceleration *1 (Unit: travel unit/second²) *2
Jerk	Jerk	LREAL	Positive number	Required field	Specify jerk *1 (Unit: travel unit/second³) *2

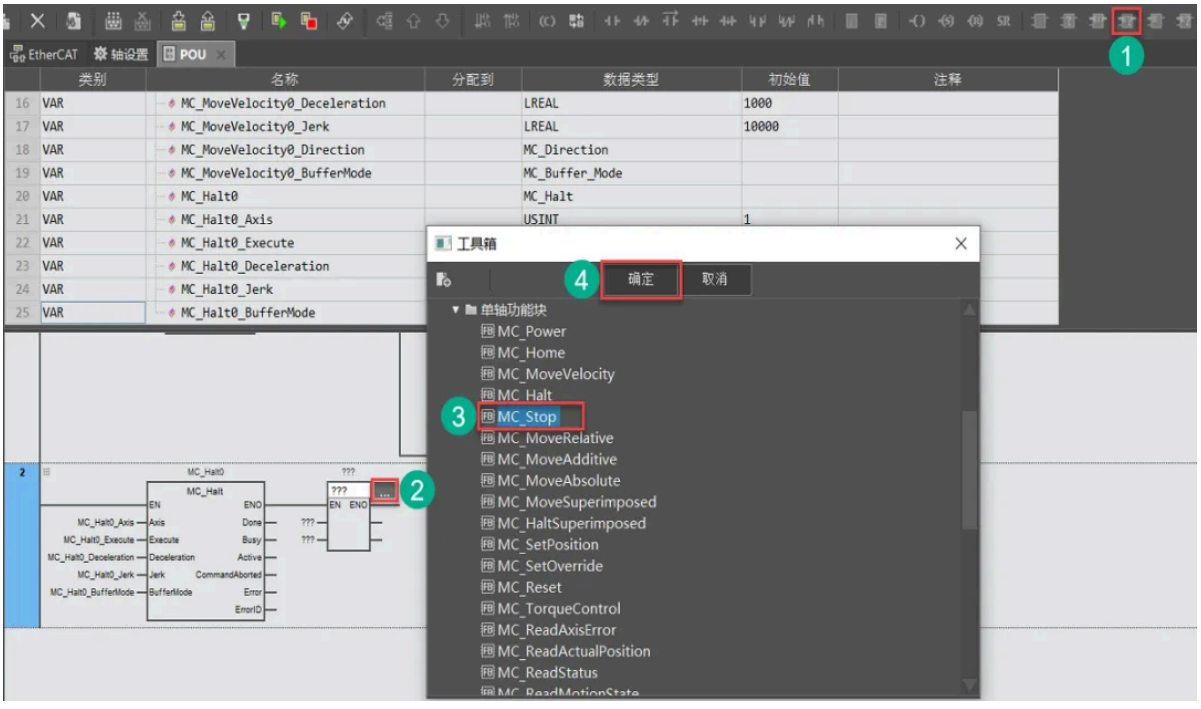
*1: For the relation among Velocity, Acceleration, Deceleration and Jerk, please refer to *"Parameter description of motion control instructions"*.
*2: For details of the instruction units, please refer to *"Parameter unit of motion control instructions"*.

■ **Output variable**

Name	Meaning	Data type	Valid range	Default
Done	Completed	BOOL	TRUE or FALSE	TRUE when the instruction is completed
Busy	Executing	BOOL	TRUE or FALSE	TRUE when the instruction is executed
Active	Under control	BOOL	TRUE or FALSE	TRUE when the axis is under control
CommandAborted	Aborted	BOOL	TRUE or FALSE	When an instruction is aborted, it becomes TRUE
Error	Error	BOOL	TRUE or FALSE	TRUE when the instruction is aborted
ErrorID	Error code	WORD	0~65535	Refer to "*instruction error code description*" for the meaning of the output error code value when an instruction execution error occurs.

(2) Instruction test

①Insert MC_Stop function block



After the settings are completed, download the project to the controller.

②Perform MC_Stop function block test (the following are consecutive steps)

a. First trigger the axis monitoring instruction MC_ReadStatus function block

Result: The axis is in the Disabled state.

b. Trigger the axis to enable the MC_Power function block

Result: The axis changes to the Standstill state

c. Trigger the MC_MoveVelocity function block

Result: The axis runs forward at a speed of 10 and the axis changes to the ContinuousMotion state.

d. Trigger the MC_Stop function block

Result: The axis stops running immediately and the axis state changes to Stopping (deceleration stop) state

e. Trigger the MC_MoveVelocity function block again

Result: The axis is still in the Stopping (deceleration stop) state, and the MC_MoveVelocity function block will report an error with error code **5377** (indicating that the state machine is restricted and cannot execute this function. Refer to the instruction state machine execution rules).

f. Set the Execute of the MC_Stop function block to FALSE

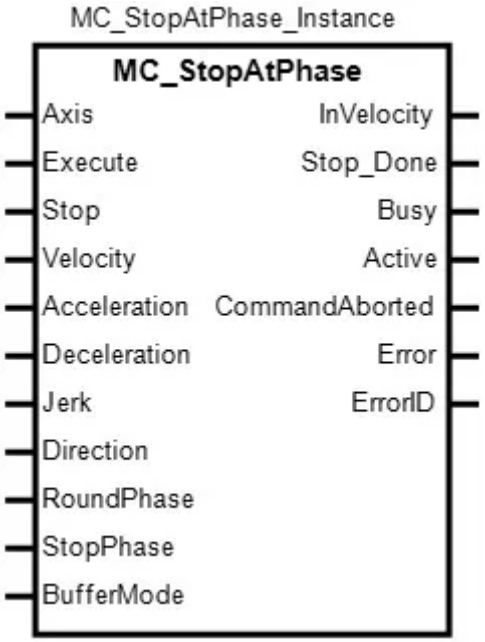
Result: The axis is still in the stopped state, and the axis state changes to Standstill.

g. Trigger the MC_MoveVelocity function block again

Result: The axis runs forward at a speed of 10, and the axis state changes to ContinuousMotion (continuous motion) state

[Note] During the execution of the MC_Stop function block, the axis is locked and cannot execute other instructions. Only when the trigger pin Execute of the MC_Stop function block is set to FALSE will the axis be unlocked and return to the stopped state.

MC_StopAtPhase (stop command at a specified phase)



(1) Instruction description

① Functional description

The controlled axis stops at the specified phase.

②Execution process

Step 1: The rising edge of the input parameter Execute triggers the execution of the instruction and controls the axis to move at the set speed (speed control).

Step 2: During the execution of the instruction, the rising edge of Stop triggers the stop action, and the axis will eventually stop at the specified phase.

③Pin Description

■ **Input variable**

Name	Meaning	Data type	Valid range	Default	Description
Axis	Axis number	USINT	Depend on model	Required field	Specify the axis number of the control axis
Execute	Start	BOOL	TRUE or FALSE	FALSE	When the rising edge of this parameter is detected, control the specified axis to accelerate to the target velocity set by Velocity according to the set input variable and continue to operate
Stop	Stop	BOOL	TRUE or FALSE	FALSE	When the rising edge of this parameter is detected, the specified axis begins to decelerate and stop, with the final stop position being the phase specified by StopPhase
Velocity	Target velocity	LREAL	Positive number	Required field	Specify target velocity *1 (Unit: travel unit/second) *2
Acceleration	Acceleration	LREAL	Positive number	Required field	Specify acceleration*1 (Unit: travel unit/second^2) *2
Deceleration	Deceleration	LREAL	Positive number	Required field	Specify deceleration *1 (Unit: travel unit/second^2) *2
Jerk	Jerk	LREAL	Positive number	Required field	Specify jerk *1 (Unit: travel unit/second^3) *2
Direction	Direction	MC_Direction	1: mcPositiveDirection 3: mcNegativeDirection	1	When the rising edge of the Execute parameter is detected, the direction of axis operation 1: Positive direction 3: Negative direction
RoundPhase	Round phase	LREAL	Positive number	Required field	The value of StopPhase, which is used to calculate the period of StopPhase, is calculated by dividing the axis command position by RoundPhase

StopPhase	Stop phase	LREAL	0~RoundPhase setting value	0	The value of the stopping phase of the specified axis is calculated by dividing the axis command position by the RoundPhase (period)
BufferMode	Buffer mode	MC_Buffer_Mode	0: mcAborting 1: mcBuffered 2: mcBlendingLow 3: mcBlendingPrevious 4: mcBlendingNext 5: mcBlendingHigh	0	Set the buffer mode between two instructions*3 0: aborted 1: buffered 2: buffer at low velocity 3: buffer at the previous velocity 4: buffer at the next velocity 5: buffer at low velocity

*1: For the relationship among Velocity, Acceleration, Deceleration, and Jerk, please refer to the *"Parameter description of motion control instructions"*.

*2: For a detailed introduction to instruction units, please refer to the *"Parameter unit of motion control instructions"*.

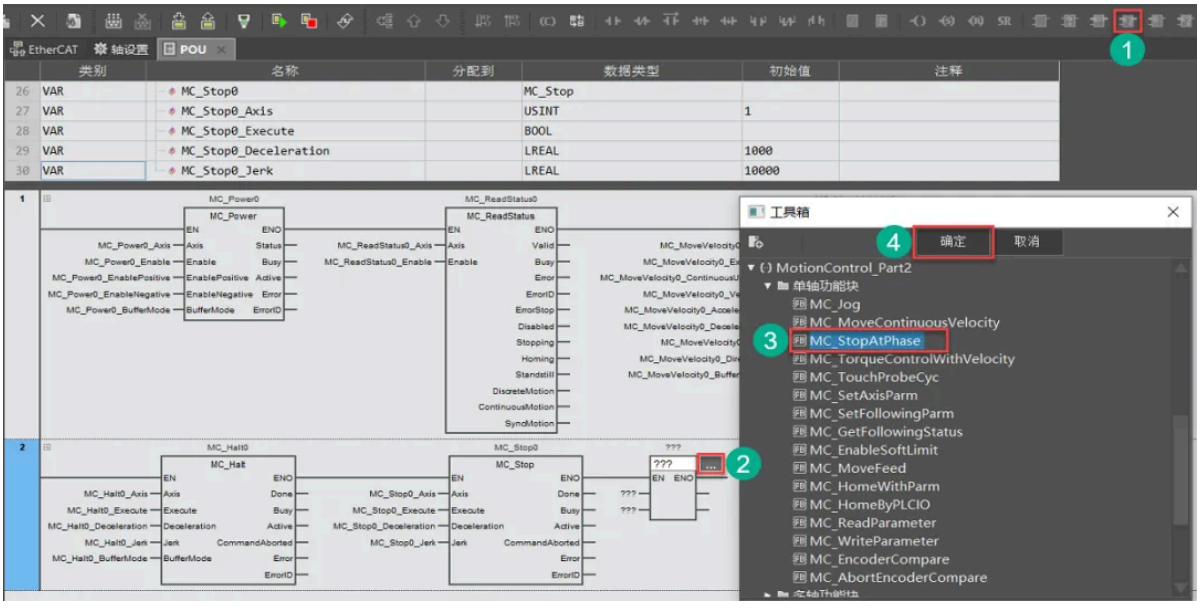
*3: For a detailed introduction to BufferMode, please refer to the *"Buffer mode during multi-starting of the same axis"*.

■ **Output variable**

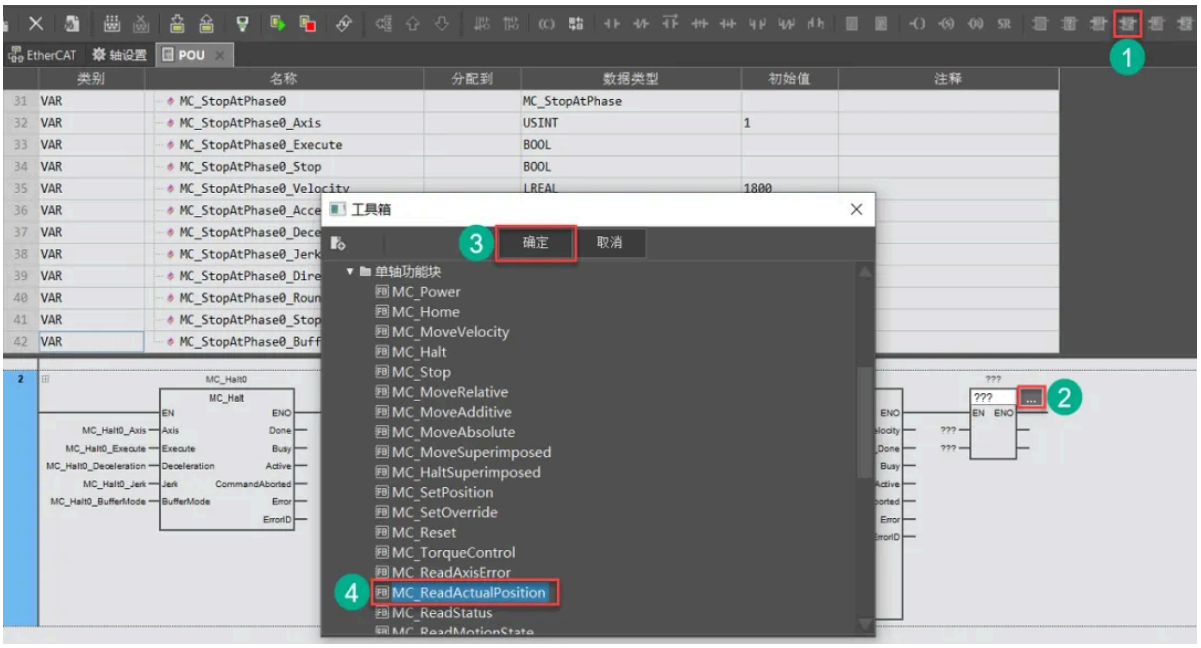
Name	Meaning	Data type	Valid range	Default
Invelocity	Target velocity reached	BOOL	TRUE or FALSE	TRUE when the axis instruction velocity reaches the target velocity
Stop_Done	Reaching the specified phase	BOOL	TRUE or FALSE	TRUE when the specified axis position reaches the specified phase
Busy	Executing	BOOL	TRUE or FALSE	TRUE when the instruction is executed
Active	Under control	BOOL	TRUE or FALSE	TRUE when the instruction controls the axis
CommandAborted	Aborted	BOOL	TRUE or FALSE	TRUE when an instruction is aborted
Error	Error	BOOL	TRUE or FALSE	TRUE when there is an error
ErrorID	Error code	WORD	0~65535	Refer to "instruction error code description" for the meaning of the output error code value when an instruction execution error occurs.

(2) Instruction test

①Insert the MC_StopAtPhase function block



②Insert the MC_ReadActualPosition function block



③Set mechanism parameters

a. Select "Loop Mode"

b. Select "Disc" for the mechanism type

c. When using this command, generally set RoundPhase and the "working stroke per revolution" in the software to the same value

After the settings are completed, download the project to the controller.

④Perform MC_StopAtPhase function block test (the following are the consecutive steps)

a. Trigger the MC_ReadStatus function block and the MC_ReadActualPosition function block

Result: The axis is in the Disabled state.

b. Trigger the axis to enable the MC_Power function block

Result: The axis changes to the Standstill state

c. Trigger the MC_MoveVelocity function block (Velocity=3600)

Result: The axis runs in the forward direction at a speed of 3600, and the axis state changes to ContinuousMotion.

d. Trigger MC_StopAtPhase function block Execute (Velocity=1800)

Result: The axis runs in the forward direction at a speed of 1800, and the axis state is still in ContinuousMotion.

e. Trigger MC_StopAtPhase function block Stop

Result: The axis runs forward at a speed of 1800 until it reaches the specified phase 180. The axis state first changes to DiscreteMotion (positioning action) state and then changes to Standstill (stop) state.

f. To better reflect the MC_StopAtPhase instruction to control the axis to stop at the specified phase, modify the StopPhase value of the MC_StopAtPhase function block to 300, triggering the MC_MoveVelocity function block (Velocity=3600)

Result: The axis runs in the forward direction at a speed of 3600, and the axis state changes to ContinuousMotion.

g. Trigger MC_StopAtPhase function block Execute (Velocity=1800)

Result: The axis runs in the forward direction at a speed of 1800, and the axis state is still in ContinuousMotion.

h. Trigger MC_StopAtPhase function block Stop

Result: The axis runs forward at a speed of 1800 until it reaches the specified phase 300. The axis state first changes to DiscreteMotion (positioning action) state and then changes to Standstill (stop) state.

[Description] This instruction can control the stop angle of the axis by setting the stop phase value of the function block.