(Pulse Axis) How to Move a Servo Motor

This tutorial uses the M controller HCM511S-32MT4-D and servo HN-Y7FA040A-S.
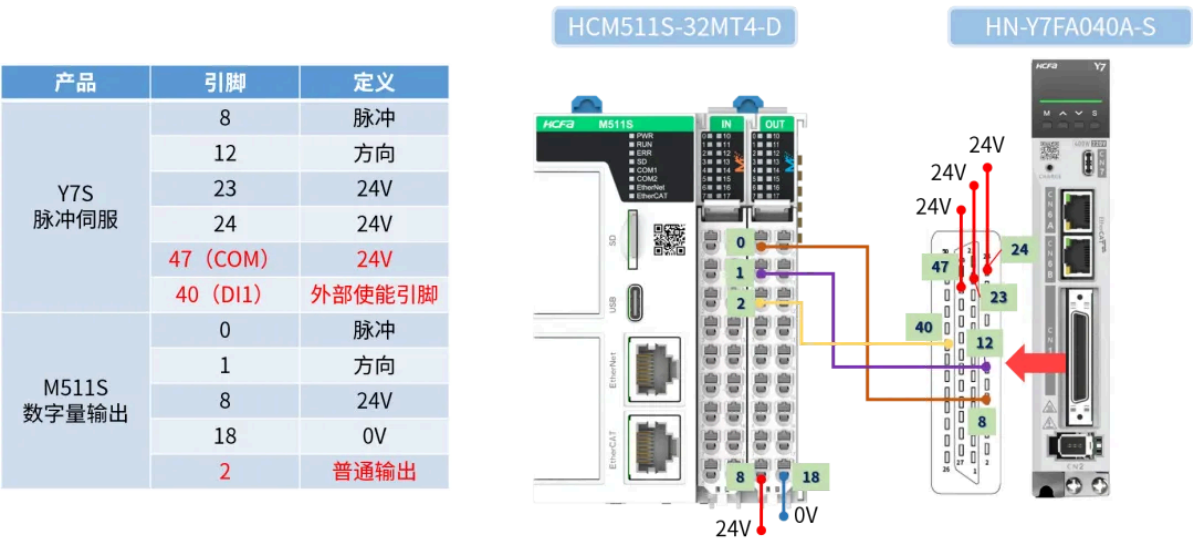
Pulse Wiring Introduction

(1) Y7S pulse servo

[Internal Enable Wiring] Servo Enable Parameter Settings (using DI1 terminal as an example): DI function code 1 is the servo enable function code, so configure DI1 with function code 1. Setting Pn50A.1 to 7 indicates that the servo ON (/S-ON) is always fixed to "valid," meaning the servo is enabled upon power-up.
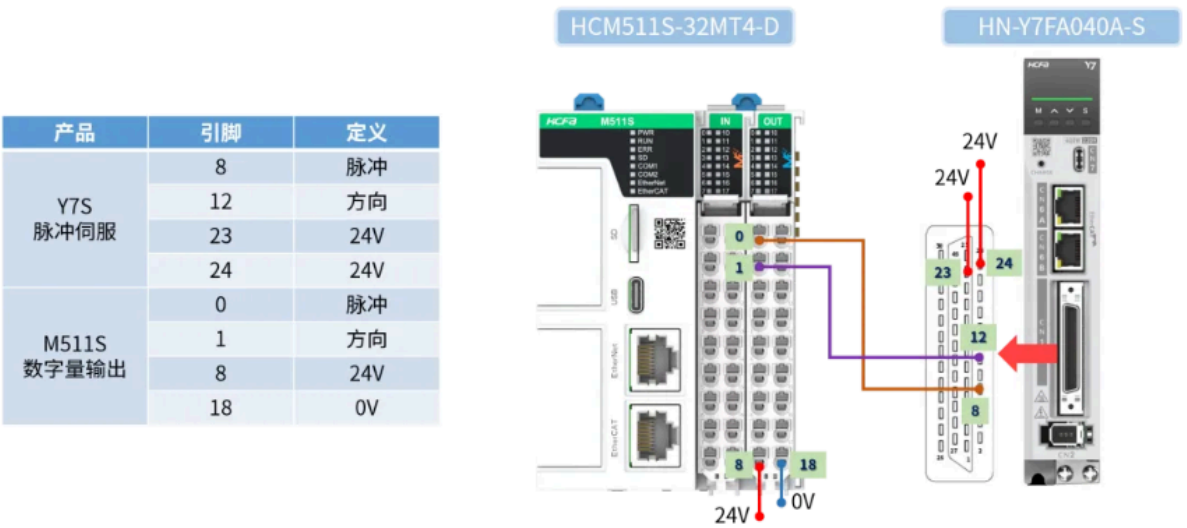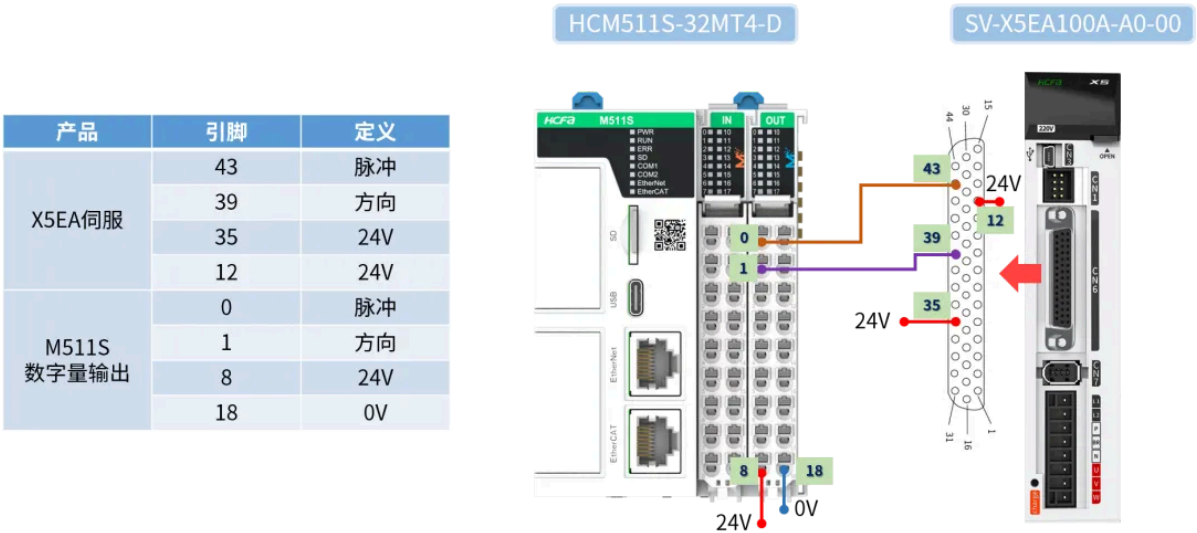

产品	引脚	定义
Y7S 脉冲伺服	8	脉冲
	12	方向
	23	24V
	24	24V
M511S 数字量输出	0	脉冲
	1	方向
	8	24V
	18	0V

[External Enable Wiring] Servo Enable Parameter Settings (using DI1 terminal as an example): DI function code 1 is the servo enable function code. Configure DI1 with function code 1. The DI common terminal is pin 47, connected to 24V. Set Pn50A.1 to the parameter of the corresponding pin (using 0 as an example here), indicating that the pin is giving a signal and the servo is enabled.

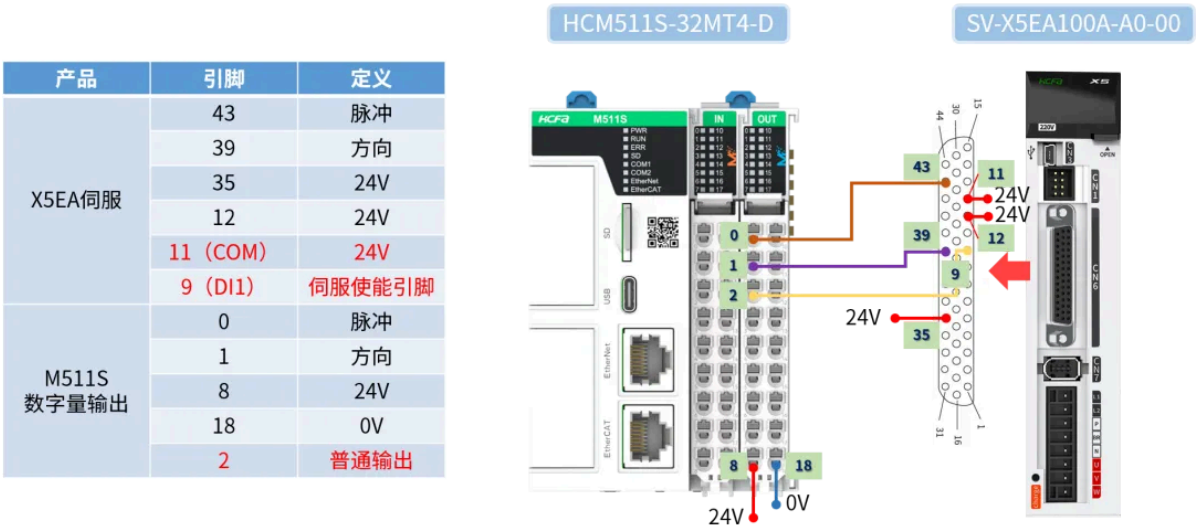| 产品	引脚	定义
Y7S 脉冲伺服	8	脉冲
	12	方向
	23	24V
	24	24V
	47（COM）	24V
	40（DI1）	外部使能引脚
M511S 数字量输出	0	脉冲
	1	方向
	8	24V
	18	0V
	2	普通输出

(2) X5EA servo

[Internal enable wiring] Servo enable parameter setting (taking DI1 terminal as an example): DI function code 1 is the servo enable function code, and DI1 is configured with function code 1. Setting P04.11 to 1 means that the servo is enabled upon power-up.
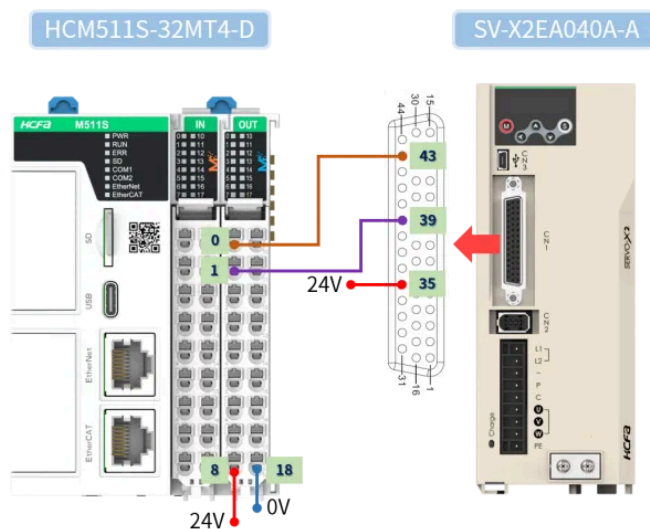
产品	引脚	定义
X5EA伺服	43	脉冲
	39	方向
	35	24V
	12	24V
M511S 数字量输出	0	脉冲
	1	方向
	8	24V
	18	0V

[External Enable Wiring] Servo Enable Parameter Settings (using DI1 terminal as an example): DI function code 1 is the servo enable function code. Configure DI1 with function code 1. The DI common terminal is pin 11, connected to 24V. Setting P04.11 to 0 indicates that the DI1 terminal receives a signal and the servo is enabled.

| 产品	引脚	定义
X5EA伺服	43	脉冲
	39	方向
	35	24V
	12	24V
	11（COM）	24V
	9（DI1）	伺服使能引脚
M511S 数字量输出	0	脉冲
	1	方向
	8	24V
	18	0V
	2	普通输出

(3) X2EA servo

[Internal enable wiring] Servo enable parameter setting (taking DI1 terminal as an example): DI function code 1 is the servo enable function code, and DI1 is configured with function code 1. Setting P04.11 to 1 means that the servo is enabled upon power-up.

产品	引脚	定义
X2EA伺服	43	脉冲
	39	方向
	35	24V
M511S 数字量输出	0	脉冲
	1	方向
	8	24V
	18	0V

[External Enable Wiring] Servo Enable Parameter Settings (using DI1 terminal as an example): DI function code 1 is the servo enable function code. Configure DI1 with function code 1. The DI common terminal is pin 11, connected to 24V. Setting P04.11 to 0 indicates that the DI1 terminal receives a signal and the servo is enabled.

产品	引脚	定义
X2EA伺服	43	脉冲
	39	方向
	35	24V
	11（COM）	24V
	9（DI1）	伺服使能引脚
M511S 数字量输出	0	脉冲
	1	方向
	8	24V
	18	0V
	2	普通输出
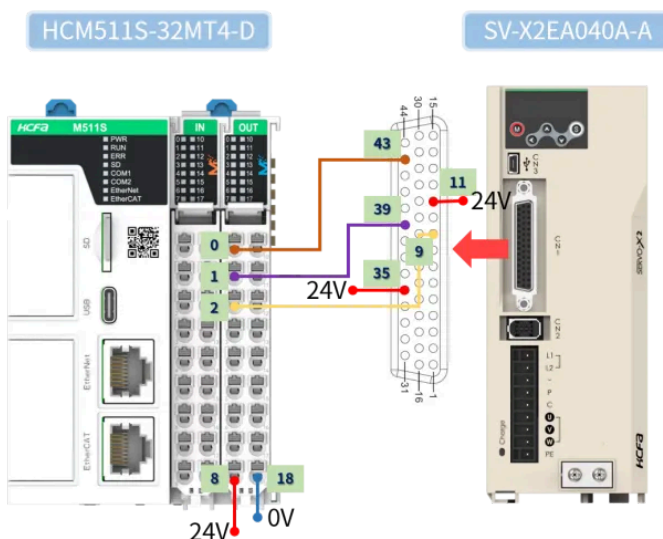
Sysctrl Studio project configuration
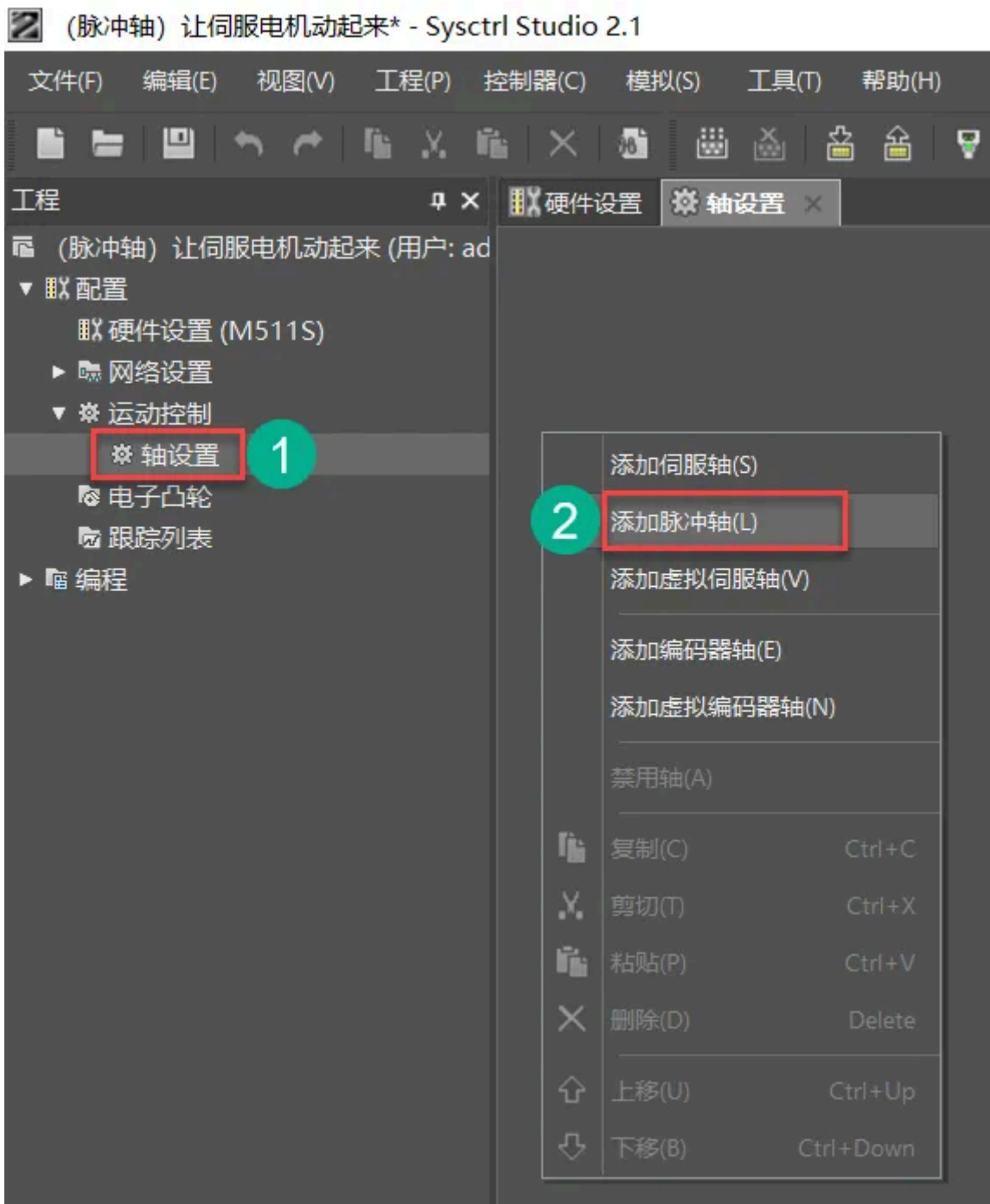
Basic settings:

Step 1: Hardware Setup

  Double-click to open the software Sysctrl Studio and create a new project. Click [Hardware Settings] >> [High-speed Pulse Output] >> [High-speed Output Channel 1]
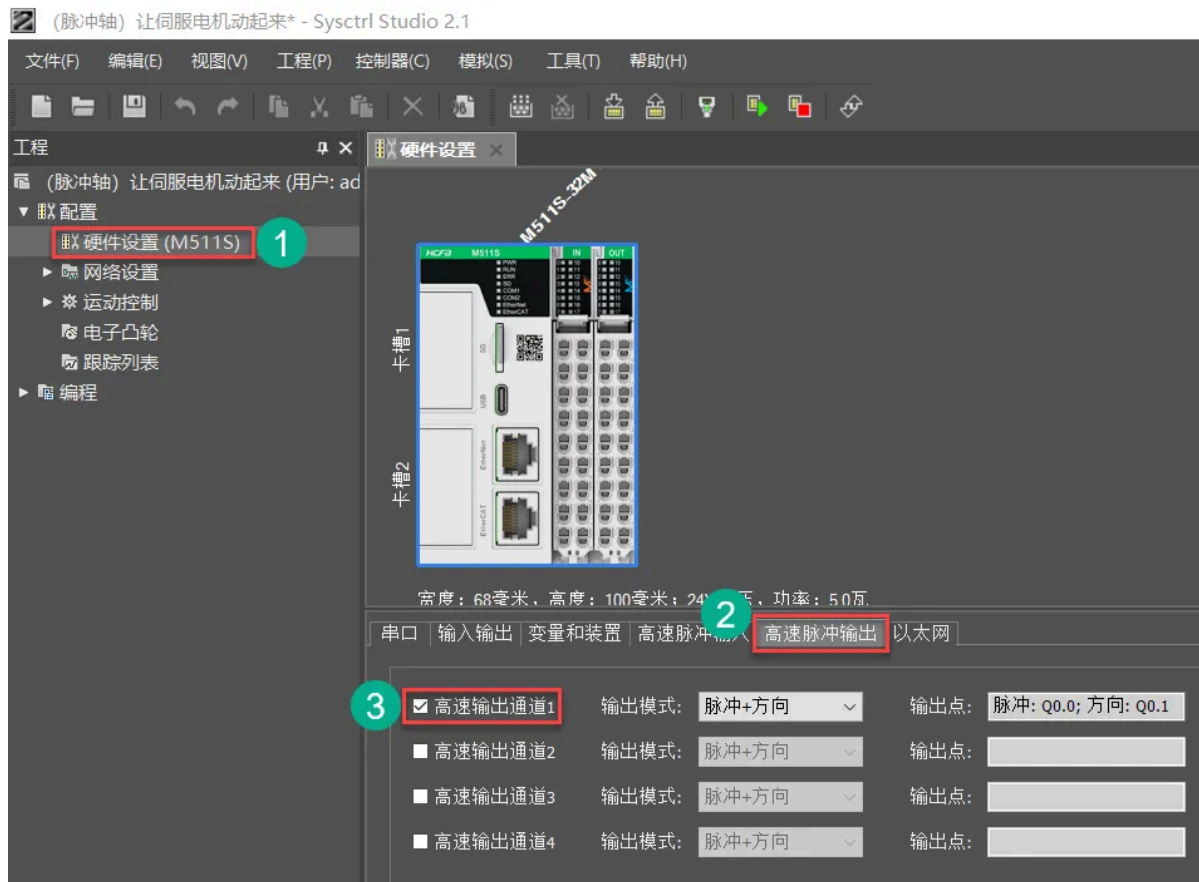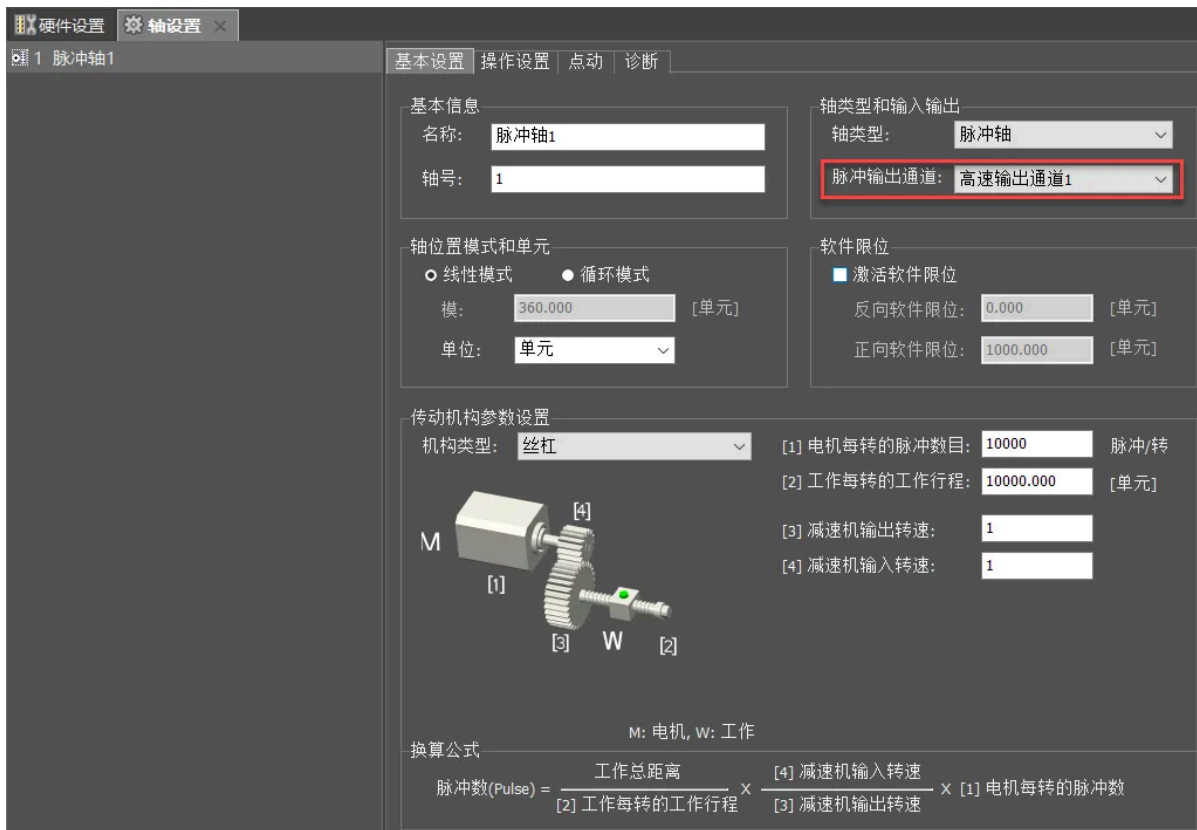
Step 2: Add a pulse axis

  Click [Motion Control] >> [Axis Settings] >> right click on the blank space and click [Add Pulse Axis]

Step 3: Associate the device

 [Pulse output channel] Select high-speed output channel 1

Step 4: Mechanism parameter configuration

[1] Number of pulses per motor revolution

  For example: the corresponding parameter (the number of command pulses required for the motor to rotate one circle) is set to 10000

①Y7S pulse servo

  Set the electronic gear ratio. Y7EA is equipped with a 23-bit motor and 10,000 pulses per revolution. The relevant parameters are set as follows:

  Set Pn20E (Electronic Gear Ratio - Numerator) to 8388608 and Pn210 (Electronic Gear Ratio - Denominator) to 10000

②X5EA servo

  Set the number of command pulses required for the motor to rotate one circle. 10,000 pulses are required for one circle. The relevant parameters are set as follows:

  P00.08 is set to 10000

③X2EA servo

  Set the number of command pulses required for the motor to rotate one circle. 10,000 pulses are required for one circle. The relevant parameters are set as follows:

  P00.08 is set to 10000

[2] Working distance per 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 10.

伺服电机	齿轮箱输入	丝杆滑块
连轴器	齿轮箱 连轴器	丝杆
齿轮箱输入	N:M	

电机每转一圈需要的脉冲数目
[1] 电机每转的脉冲数目: 10000 脉冲/转

减速机的减速度比
[3] 减速机输出转速: 1
[4] 减速机输入转速: 10

终端机构的工作行程
[2] 工作每转的工作行程: 10.000 [单元]
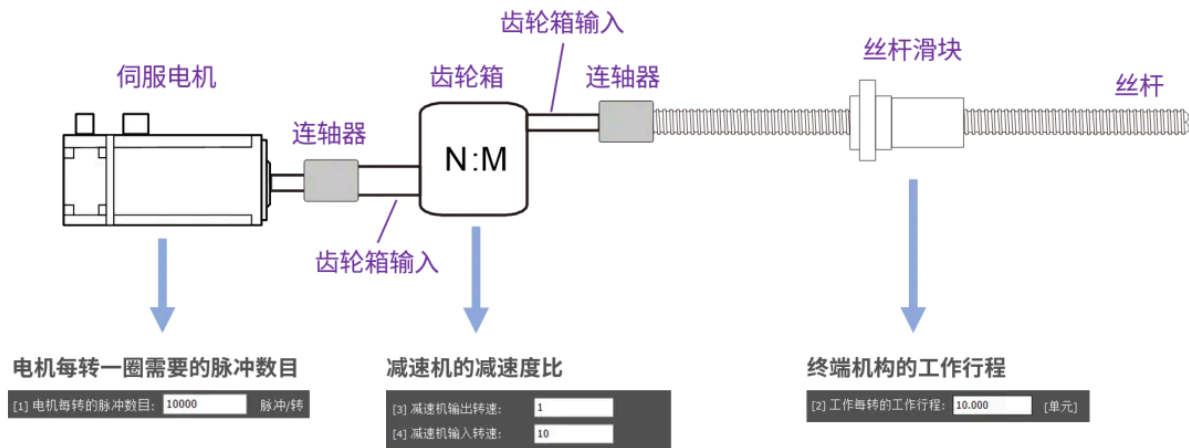
The parameter configuration completion interface is as follows

基本设置 | 操作设置 | 点动 | 诊断

基本信息
名称: 脉冲轴1
轴号: 1

轴类型和输入输出
轴类型: 脉冲轴
脉冲输出通道: 高速输出通道1

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: 10000 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

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

Programming control of motor operation

Note: The pulse axis cannot be enabled or disabled in the jog debugging interface. You need to enable the servo before testing in the jog debugging interface.

(1) Click [Jog] and enter the appropriate jog speed, acceleration, and deceleration in the jog window.

(2) Enter the monitoring state. Click [Forward] or [Reverse], and the current axis status information will be displayed in the axis status window.


Programming control of motor operation

(1) When you create a new project, there will be a default POU. The default task type is event trigger, and the default event selection is motion event. The motion control function block needs to be called in the motion event type to function properly. If there is no motion event task, the program-free control of the motor's running part will not function properly.
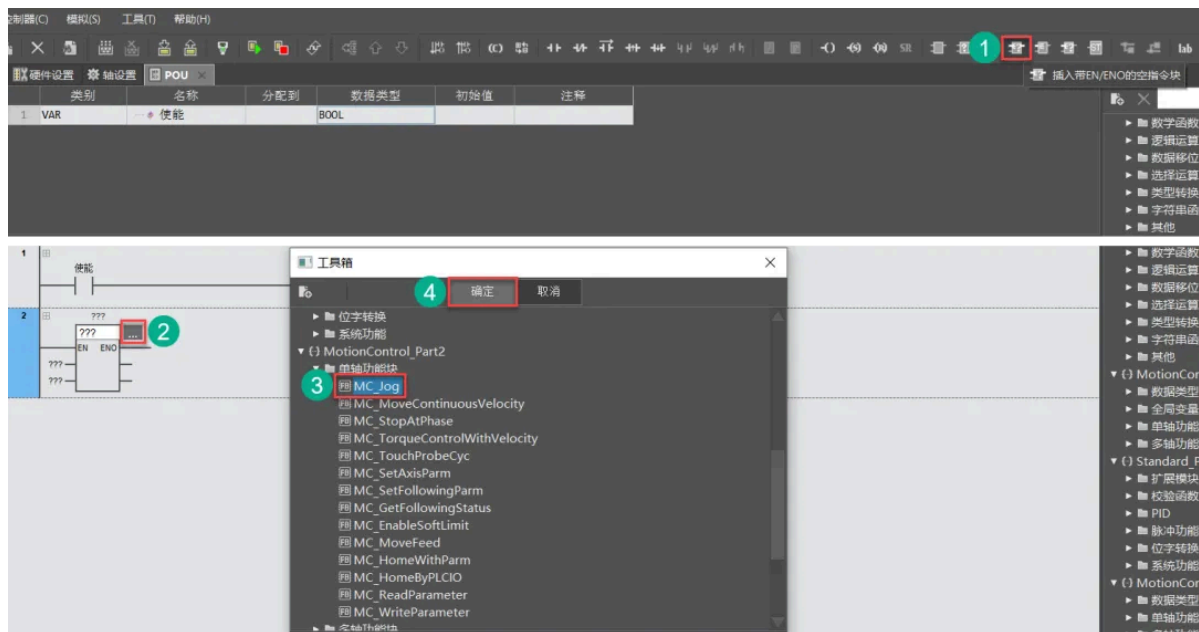
(2) Set the enable variable
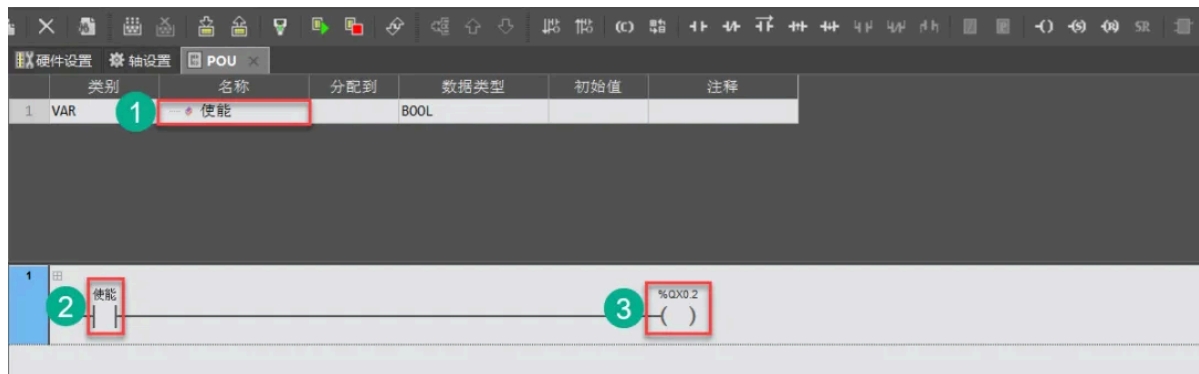
(3) Add a network
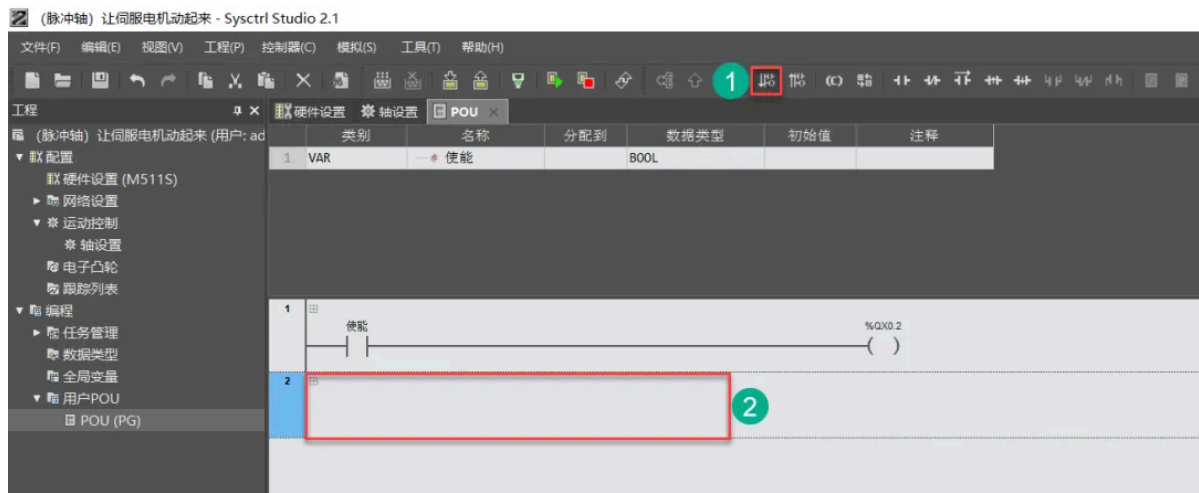
(4) Insert the MC_Jog function block

(5) Set the MC_Jog function block input pin

■ 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
JogForward	Jog forward	BOOL	TRUE or FALSE	FALSE	Set to TRUE, control the axis to move forward Set to FALSE, stop forward movement
JogBackward	Jog backward	BOOL	TRUE or FALSE	FALSE	Set to TRUE, control the axis to move backward Set to FALSE, stop reverse movement
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]

[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"*.

■ Output variable

Name	Meaning	Data type	Valid range	Description
Done	Completed	BOOL	TRUE or FALSE	TRUE when jogging stops
Busy	Executing	BOOL	TRUE or FALSE	TRUE when the instruction is executed
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.

Right click on the function block and select Create Input Variable
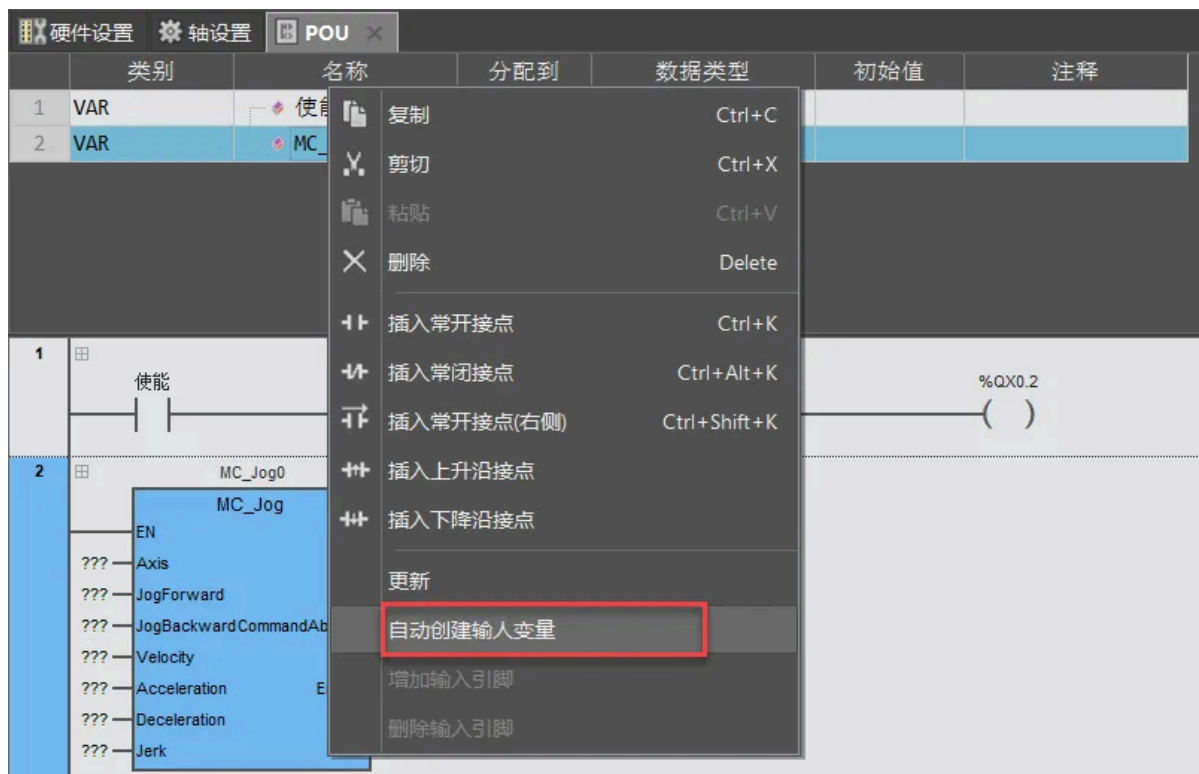
Set initial values for some variables in the function block

	类别	名称	分配到	数据类型	初始值	注释
1	VAR	使能		BOOL		
2	VAR	MC_Jog0		MC_Jog		
3	VAR	MC_Jog0_Axis		USINT	1	
4	VAR	MC_Jog0_JogForward		BOOL		
5	VAR	MC_Jog0_JogBackward		BOOL		
6	VAR	MC_Jog0_Velocity		LREAL	10	
7	VAR	MC_Jog0_Acceleration		LREAL	1000	
8	VAR	MC_Jog0_Deceleration		LREAL	1000	
9	VAR	MC_Jog0_Jerk		LREAL	10000	

(6) Download the project to the controller, enter the monitoring state, and perform testing.