M Series Tutorial Torque Control Instructions

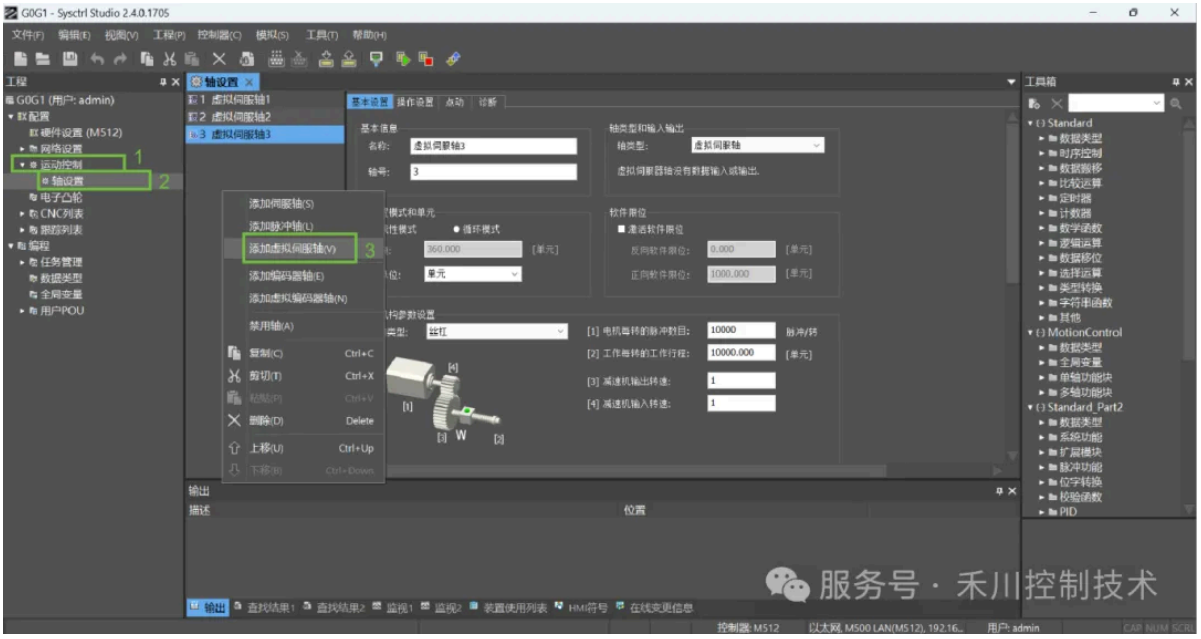
Software: Sysctrl Studio (PLC programming software)

Hardware: M series controller (taking M511S as an example)

Servo (taking HN-Y7FB040A-S as an example)

Communication connection

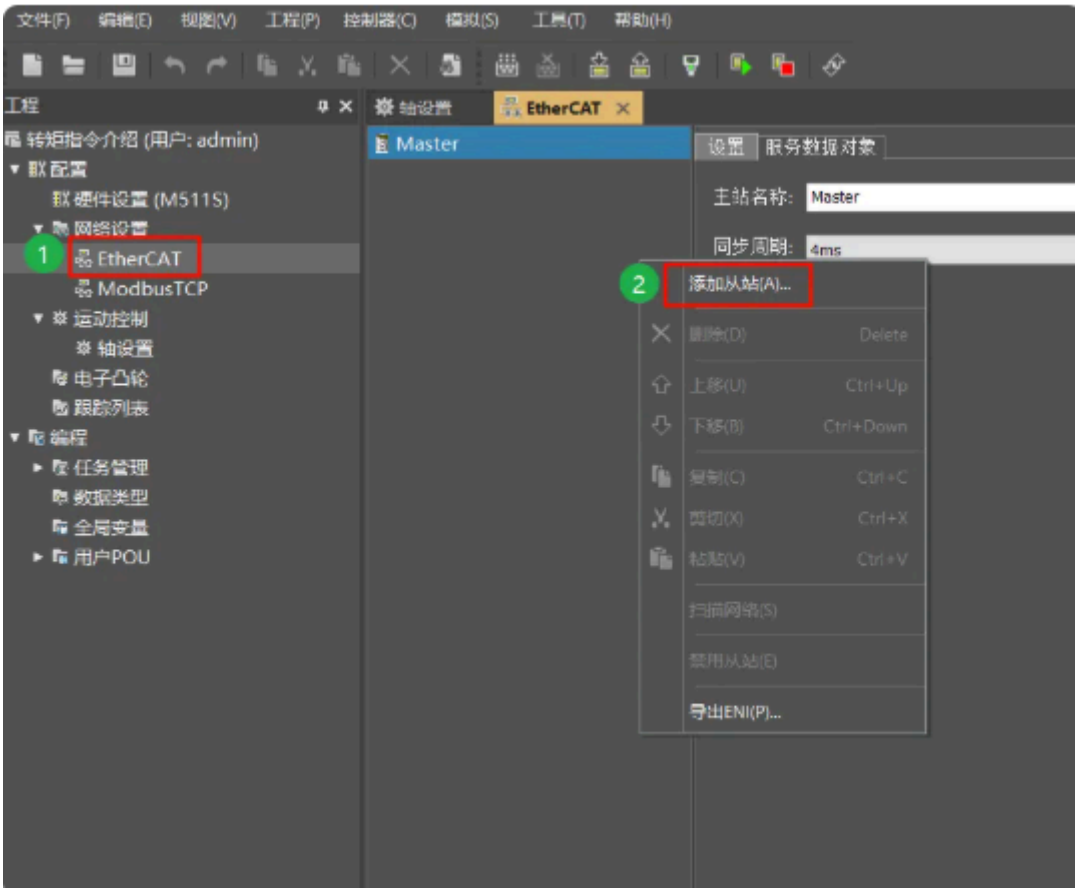
This tutorial uses the M controller HCM511S-32MT4-D and servo HN-Y7FB040A-S. The connection method is shown in the figure below



Sysctrl Studio project basic configuration

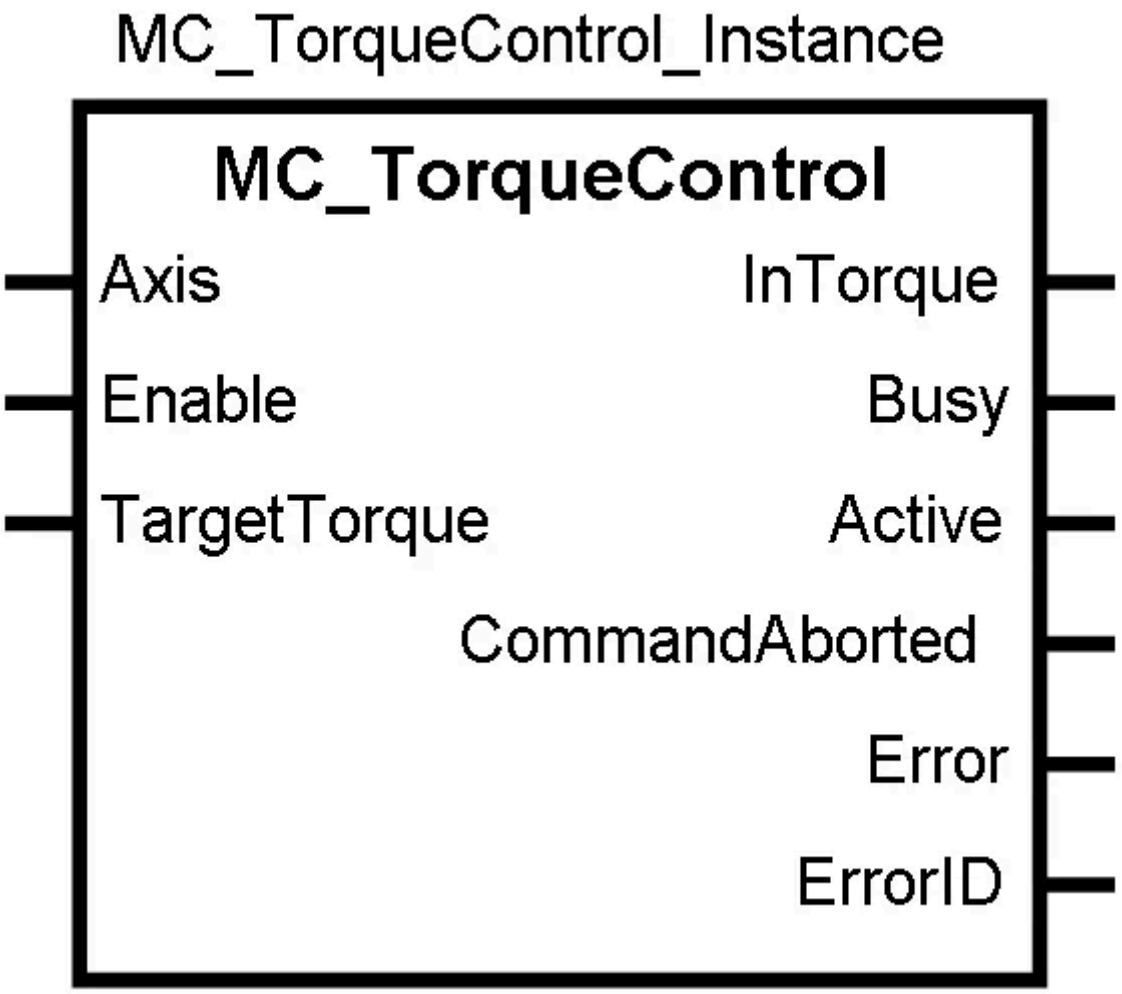
Basic Settings

[Add slave station] >> [Add servo axis] >> [Related equipment] >> [Mechanism parameter setting]



Torque control command

MC_TorqueControl (torque setting command)



① Functional description

This instruction is used to control the axis to work in torque mode and change the axis torque value in real time. The maximum speed of the servo axis in torque mode depends on the speed of **16#6080**, **16#607F**, or the minimum of the two.

②Pin Description

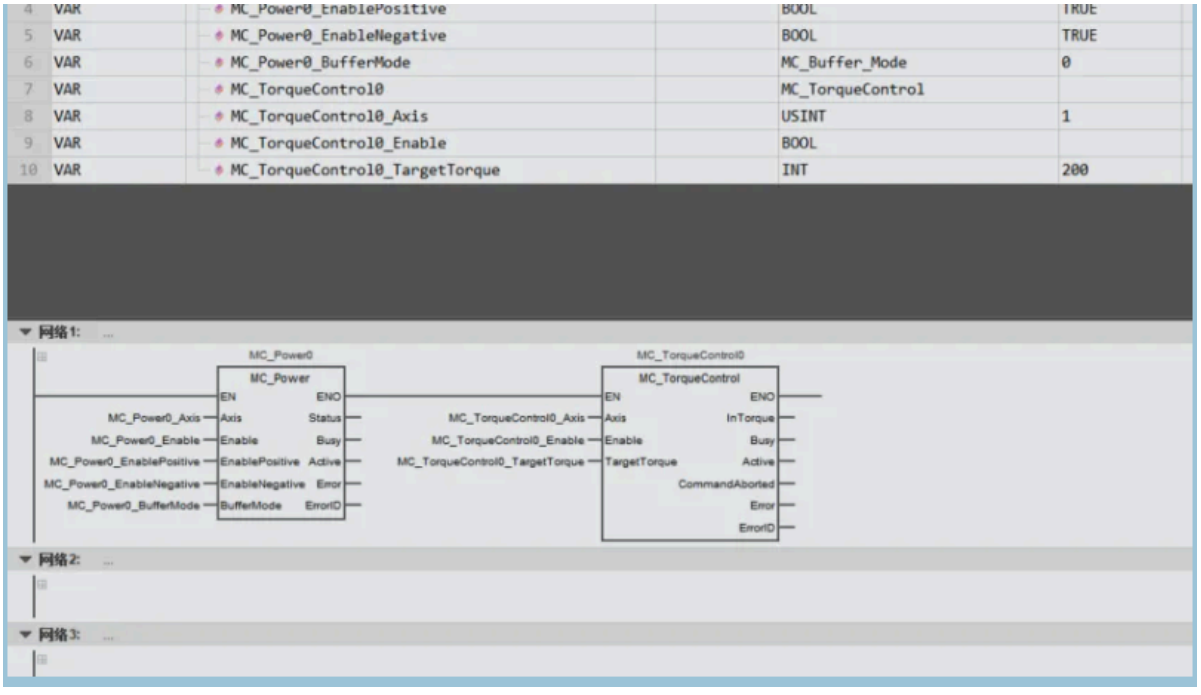
■ **Input variable**

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
Enable	Enable	BOOL	TRUE or FALSE	FALSE	TRUE: The Servo Drive enters torque mode and transmits the target torque to the Servo Drive FALSE: Servo Drive exits torque mode and enters CSP mode
TargetTorque	Target torque	INT	Positive number, Negative number, 0	0	Specify the target torque transmitted to the Servo Drive in increments of［0.1%］, specify a percentage of the rated torque, i.e., the rated torque is 100.0%. If the target torque is set to 30, it means that the target torque is set to three percent of the rated torque, and if Enable is set to TRUE, the value of this parameter is transmitted to the drive in real time.

■ **Output variable**

Name	Meaning	Data type	Valid range	Description
InTorque	Target torque reached	BOOL	TRUE or FALSE	TRUE when the controller's instruction torque to the drive reaches the target torque
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 ins truction execution error occurs.

Project Settings



MC_TorqueControl function block test

a. Set servo SDO parameter 16#6080 to 600, enable the axis, and trigger the MC_TorqueControl function block.

Result: The servo enters torque mode, the axis runs at a speed of 10 (600 rpm), and the AxState online value changes from 1 (Standstill) to 14 (Torque state)

b. Change the value of MC_TorqueControlWithVelocity0_Torque to 20

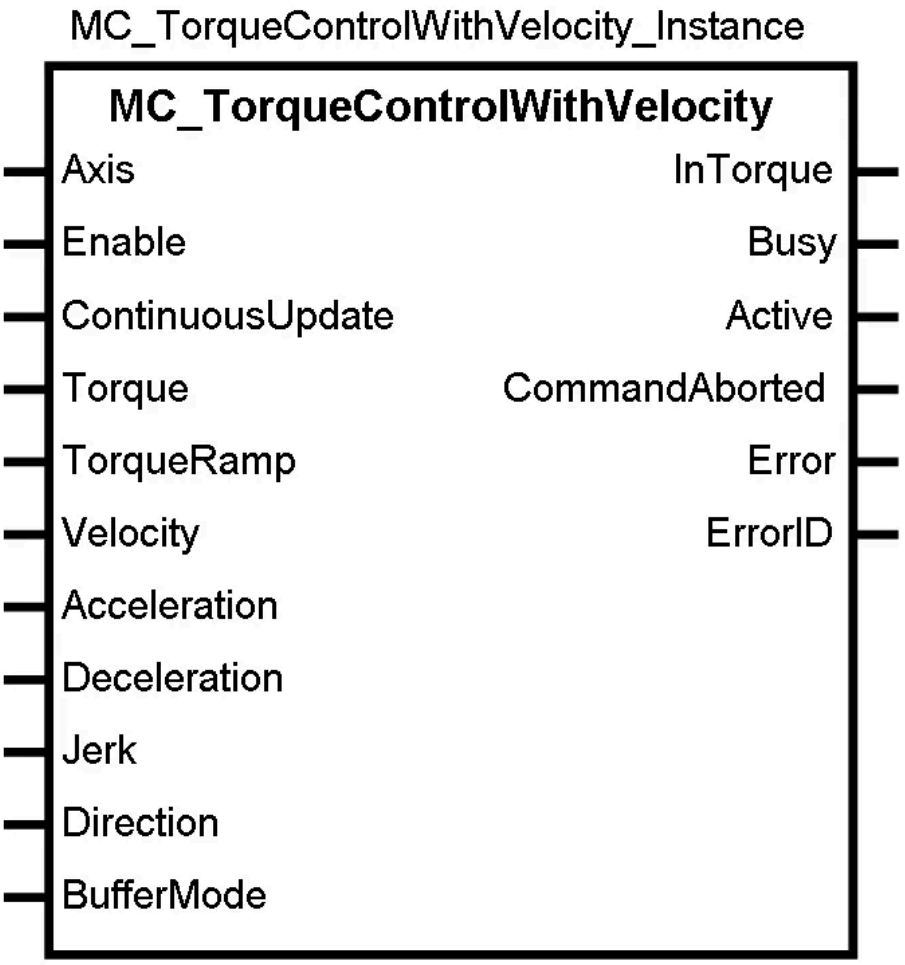
Result: The set torque is less than the torque required for the axis to run, and the axis stops running.

c. Close the MC_TorqueControl function block

Result: The axis exits torque mode and enters CSP mode. The axis stops running and the AxState online value changes from 14 (torque state) to 1 (Standstill-stop state).

[Note] The maximum speed of the servo axis in torque mode depends on the minimum speed of 16#6080, 16#607F, or the other two .

MC_TorqueControlWithVelocity (torque control instruction with speed limit)



① Functional description

This instruction is used to control the axis to work in torque mode, change the torque value of the axis in real time, and limit the speed of the axis.

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
Enable	Enable	BOOL	TRUE or FALSE	FALSE	TRUE: The Servo Drive enters torque mode and transmits the target torque to the Servo Drive FALSE: Servo Drive exits torque mode and enters CSP mode
ContinuousUpdate	Continuous update	BOOL	TRUE or FALSE	FALSE	Reserved
Torque	Target torque	INT	Positive number, Negative number, 0	0	Specify the target torque to output to the Servo Drive in increments of [0.1%], specify a percentage of the rated torque, i.e., the rated torque is 100.0%. If the target torque is set to 30, it means that the target torque is set to three percent of the rated torque, and if Enable is set to TRUE, the value of this parameter is transmitted to the drive in real time
TorqueRamp	Torque ramp	LREAL	Positive number, Negative number	Required field	Rate of change from the current set torque to the changed set torque (unit: ‰/s)
Mode	Limiting speed parameter selection	INT	0, 1	0	0: Velocity is associated with the Servo internal parameter 16#6080; 1: Velocity is associated with Servo internal parameter 16#607F;
Velocity	Velocity limit	LREAL	Positive number	Required field	When the MC_TorqueControlWithVelocity instruction controls an axis, the velocity of the limit axis cannot exceed this value. When the value of Mode is different, the servo parameter associated with this parameter is different, no matter which servo parameter is selected, the unit of this parameter is: Travel unit/s.
Acceleration	Acceleration rate	LREAL	Positive number	Reserved	Reserved
Deceleration	Deceleration rate	LREAL	Positive number	Reserved	Reserved
Jerk	Jerk	LREAL	Positive number	Reserved	Reserved
Direction	Direction	MC_Direction	1：mcPositiveDirection 3：mcNegativeDirection	1	Specify the direction of rotation of the axis. 1: Positive direction 3: Negative direction
BufferMode	Buffer mode	MC_Buffer_Mode	0：mcAborting	Reserved	Reserved

■ Output variable

Name	Meaning	Data type	Valid range	Description
InTorque	Target Torque Reached	BOOL	TRUE or FALSE	TRUE when the target torque is reached
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 while 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.

Instruction Test

Project Settings

MC_TorqueControlWithVelocity **function block test** (following are the sequential steps)

a. Enable the axis and trigger the MC_TorqueControlWithVelocity function block

Result: The servo enters torque mode and runs forward at a speed of 10 stroke units/second. The AxState online value changes from 1 (Standstill) to 14 (Torque state).

b. Change the value of MC_TorqueControlWithVelocity0_Torque to 20

Result: The set torque is less than the torque required for the axis to run, and the axis stops running.

c. Change the value of MC_TorqueControlWithVelocity0_Velocity to 15, and change the value of MC_TorqueControlWithVelocity0_Torque back to 100

Result: The servo runs in the forward direction at a speed of 15 stroke units/second

d. Close the MC_TorqueControlWithVelocity function block

Result: The axis exits torque mode and enters CSP mode. The axis stops running and the AxState online value changes from 14 (torque state) to 1 (Standstill-stop state).

[Note]

The differences between the MC_TorqueControl and MC_TorqueControlWithVelocity instructions are as follows: The MC_TorqueControl instruction cannot limit the maximum speed of an axis. When using the MC_TorqueControl instruction, the maximum speed of an axis is determined by the minimum of 16#6080, 16#607F, or the two. The MC_TorqueControlWithVelocity instruction can limit the maximum speed of an axis through a function block (by associating 16#6080/16#607F).