https://cltsn.fastech-motions.com/en

FASTECH
Fast Accurate Smooth Motion



Programmable Automation Controllers
MELSEC MX Controller



Ezi-STEP® Micro Stepping System CC-Link IE TSN 4X

Connection Guide

MELSEC MX Controller and Ezi-STEP® Micro Stepping System CC-Link IE TSN 4X

Mitsubishi Electric Products
MXR300-16 / MXR300-32 / MXR300-64
MXR300-128 / MXR300-256 / MXF100-8
MXF100-16

FASTECH Products
Ezi-STEP CC-Link IE TSN 4X

Before you begin

- Thank you for using our company's products.
- The Ezi-STEP CC-Link IE TSN 4X is a stepping motor unit consisting of a driver equipped with a 32-bit high-performance ARM processor and various motors. It is used as a remote station on a CC-Link IE TSN network.
- The Ezi-STEP CC-Link IE TSN 4X is an industrial product. Please do not use it for any other purpose. Our company shall not be liable for any damages incurred due to non-compliance with this instruction.
- This connection guide provided by our company explains how to connect the Ezi-STEP CC-Link IE TSN 4X to Mitsubishi Electric's MELSEC MX controller. It covers CSP+ file registration, system configuration, parameter settings, and programming methods.
- Before writing the PLC program, be sure to read this connection guide, understand its contents accurately, and use the product correctly.
- This connection guide is subject to change without notice. For the latest version, please refer to our company's CC-Link IE TSN website (https://cltsn.fastech-motions.com/en).

Manual Information

- The Ezi-STEP CC-Link IE TSN 4X manual can be downloaded from the FASTECH website.
  https://cltsn.fastech-motions.com/en/download/quick

Manual Name	Manual Number
[Manual][CC-Link IE TSN][Ezi-STEP 4X] Micro Stepping System	
[Connection Guide][CC-Link IE TSN][MELSEC MX Controller][Ezi-STEP 4X]	

- The MELSEC MX Controller Manual can be downloaded from the Mitsubishi Electric website.
  https://www.mitsubishielectric.com/fa/index.html

Manual Name	Manual Number
MELSEC MX Controller (MX-R Model) User's Manual	SH-082640
MELSEC MX Controller (MX-R Model) Programming Manual	SH-082643
GX Works3 Operating Manual	SH-081214

Terminology

- This section covers terms used in the connection guide.

Terminology	Description
CC-Link IE TSN	An open network that adopts 'TSN (Time-Sensitive Networking)', an extension of the standard Ethernet specification, enabling simultaneous processing of real-time control and information from other open networks.
Master station (Manager station)	The station that manages the entire network, capable of performing cyclic and transient transmission with all stations. The MELSEC MX controller corresponds to this role.
Remote station	A station that performs cyclic transmission of bit-level I/O signals and word-level I/O data, and also supports transient transmission. The Ezi-STEP CC-Link IE TSN 4X corresponds to this.
PDO	Abbreviation for Process Data Object. A collection of application objects periodically transmitted between multiple CANopen nodes.
Object	Various data held by device stations corresponding to CANopen.

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1. Overview

1-1. Overview

- **MELSEC MX Controller and Ezi-STEP CC-Link IE TSN 4X Connection Guide**

◆ Master station: MXR300-16 / MXR300-32 / MXR300-64 / MXR300-128 / MXR300-256 MXF100-8 / MXF100-16

PLCopen® Motion Control FB (Function Block)

- Control programs can be easily written using the PLCopen Motion Control FB library, an international standard specification.
- This program allows third parties to easily understand its contents, significantly reducing design and maintenance time.

◆ Engineering software

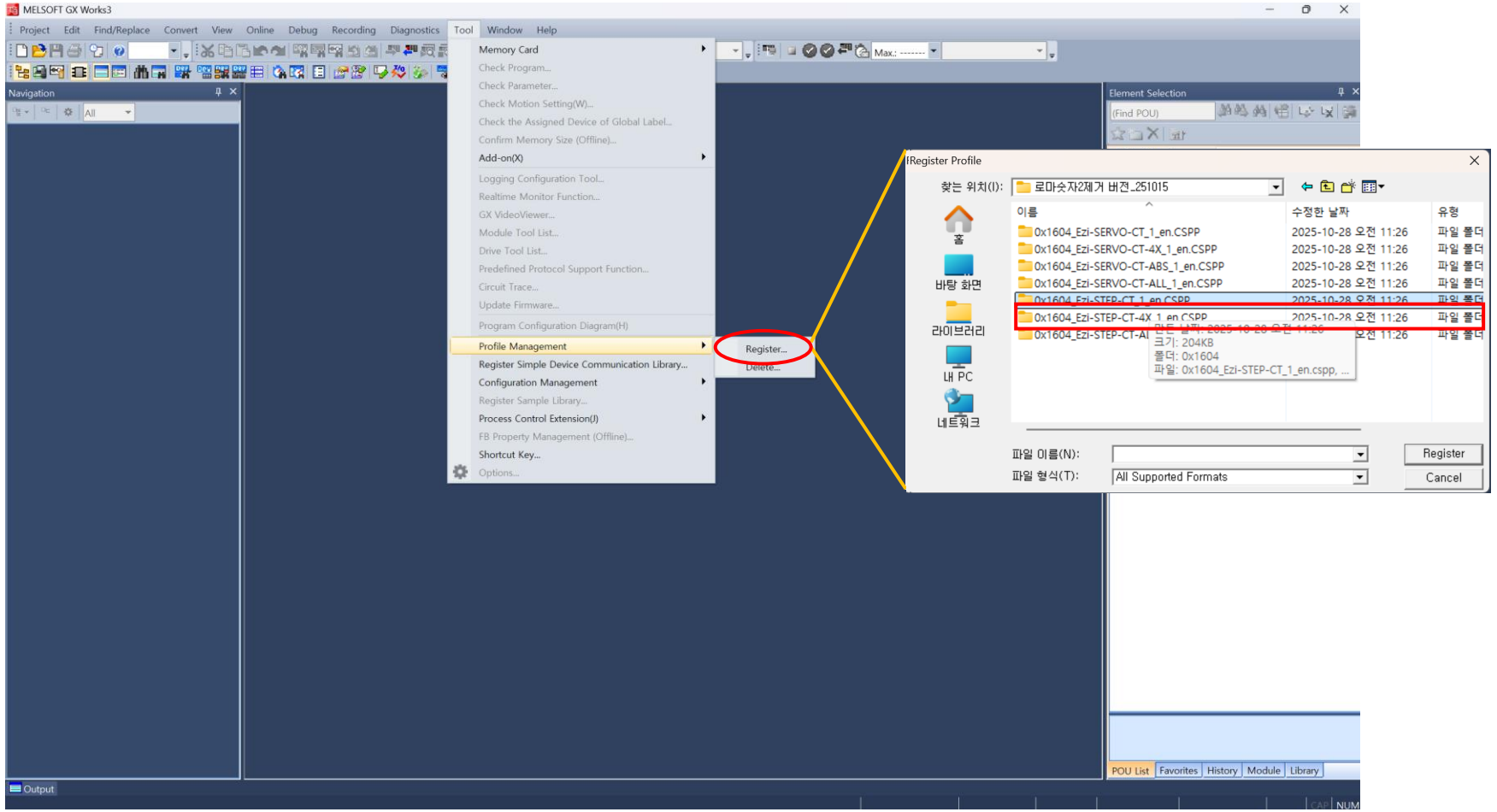
- GX Works3: Ver. 1.105K or higher
- For the latest files, please refer to the Mitsubishi Electric website. (https://www.mitsubishielectric.com/fa/download/index.html)

◆ Remote station: Ezi-STEP CC-Link IE TSN 4X

- CSP+ File Download address: https://cltsn.fastech-motions.com/en/download/quick
- File name: 0x1604_Ezi-STEP-CT_4X_1_en_CSPP

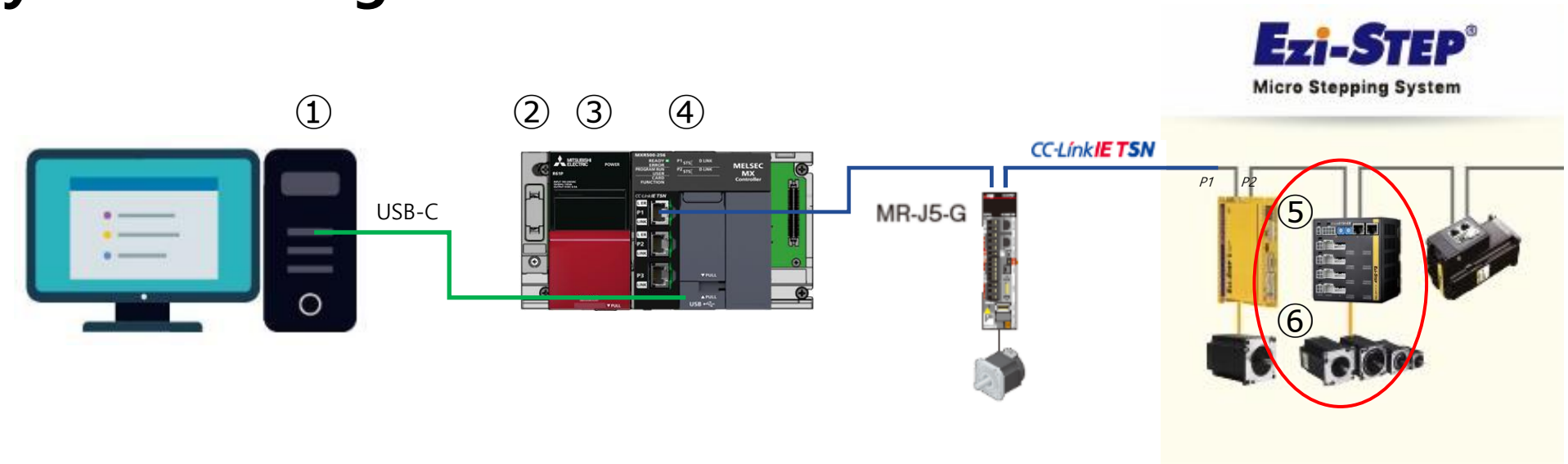
1-2. Ezi-STEP CC-Link IE TSN 4X CSP+ File Registration

- **CSP+ Registration**
  - [GX Works3] Tool / Profile Management / Register ※ Registration is only possible before opening a project.



1-3. CC-Link IE TSN Configuration

● System Configuration



Configuration		Product name	IP address
①	Engineering software	GX Works3	-
②	Main base	R33B	-
③	Power supply module	R61P	-
④	Controller	MXR300-16	192.168.3.253
⑤	Driver	EzT2-CT-4X	192.168.3.1
⑥	Motor	BM-42S	-

1-3. CC-Link IE TSN Configuration

- **Ezi-STEP Specifications**

Item		Specifications
Communication protocol		CC-Link IE TSN Class B
Communication speed		1Gbps / 100Mbps
Modes of operation		CiA402 drive profile: cyclic Synchronous position Mode (CSP) / Profile position mode (PP) / Homing mode (HM)
Synchronization method	Time synchronization method	IEEE1588 / IEEE802.1AS
	Communication cycle	Minimum 250 μs
	Network synchronization communication	Synchronous Communication (CSP, PP, HM) / Asynchronous Communication (PP, HM)
Encoder type		Incremental type

1-4. Setup Sequence

- **Ezi-STEP, MX Controller Parameter Settings**

No	Item	Description
1	Ezi-STEP Settings 	Configure parameters using the driver configuration program (Ezi-CT Manager). Please download the configuration program and its usage guide from the FASTECH Co., Ltd. website. ※ Address: https://cltsn.fastech-motions.com/en/download/quick
2	MX Controller Setup 	Create a project for the MX controller using GX-Works3, then configure the unit parameters (communication method, connection target) and axis parameters (for motion control).
3	MX Controller + Ezi-STEP Operation Verification 	Write a program to verify that the MX Controller and Ezi-STEP are configured correctly. Manipulate labels to verify the motor operates normally.

1-4. Setup Sequence

- **Ezi-STEP Setup Notes**

Item	Details
IP address setting	① Set using the driver's rotary switch ② Rotary Switch → Setting value: '00', IP address (Index: 2101h, Subindex: 01~04h)
Driver homing method setting	① Set the homing method (Index: 6098h, Subindex: 00h) - Set homing method: '0' (default) → '33' etc. ※ Refer to [Appendix] Homing Method ② Home offset (Index: 607Ch, Subindex:00h) → Set to '0' Caution) Setting a value other than 0 may cause rapid acceleration or deceleration when homing is complete.
Limit stop method setting	① Limit stop method (Index:2003h, Subindex:00h) setting - 0: PP, HM → Quick stop / CSP → No stop - 1: PP, HM → Deceleration stop / CSP → Does not stop ② Setting a value other than '0' or '1' may cause '1ED0H: Drive error' when detecting the hardware stroke limit.
In-position range	① In-position range (Index:2B21h, Subindex:00h, Data type:Unsigned32) setting - Register a value within the In-position range (5 to 20000 pulses) considering the operating environment ② If [Md.102: Deviation counter value] is less than the setting value, [Md.108: Servo status 1: In-position] turns ON. As a rule, this object should not be made public. Please configure it using the servo transient transmission function of the FX5 CPU module.

1-5. Restrictions

Motion Control Function Constraints (MX Controller and Ezi-STEP)

Item	Restriction
Torque limit function	The driver does not support the following object, so the Torque limit function cannot be used. • Positive torque limit value (Index:60E0h, Subindex:00h) • Negative torque limit value (Index:60E1h, Subindex:00h)
Absolute position system	The encoder is of the Incremental type, so the Absolute position system cannot be used.
Virtual servo amplifier function	Emulated by MR-J5-G.
Follow up function	This product must perform homing when the servo is turned ON. As this is an open-loop control system, the 'Position actual value (Index:6064h, Subindex: 00h)' is not updated when the servo is OFF. In the Follow-up function, the motor rotation amount is reflected in the controller command based on the 'Position actual value (Index:6064h, Subindex:00h)'. Therefore, the controller command and the motor position will be misaligned by the amount the motor rotated while the servo was OFF.
Mark detection function	The driver's TPR1 (Touch Probe 1) cannot be used for [Pr.800: Mark detection signal setting].
Optional data monitor function	When using the Optional data monitor function, set the objects to monitor in [Pr.91~94: Optional data monitor: Data type setting 1~4] and [Pr.591~594: Optional data monitor: Data type expansion setting 1~4]. The default value is "0: Not set". Therefore, [Md.109~112: Optional data monitor output 1~4] will be '0'.

1-5. Restrictions

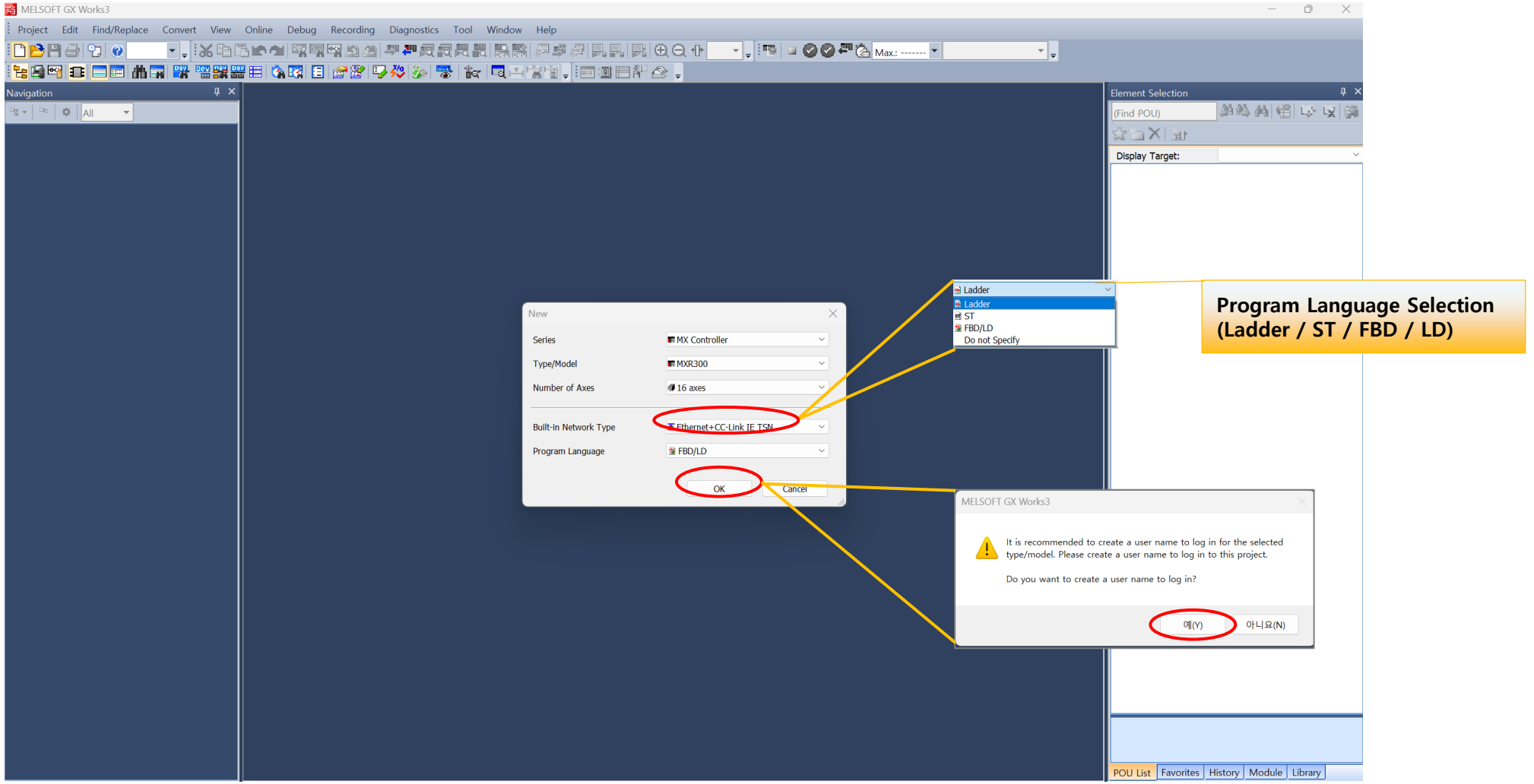
Motion Control Function Constraints (MX Controller and Ezi-STEP)

Item	Restriction
Md.103: Motor rotation speed	Since the driver does not support 'SI unit velocity (Index:60A9h, Subindex:00h)', it outputs the motor rotation speed in pulses per second.
Md.104: Motor current value	Since the driver does not support 'Torque actual value (Index:6077h, Subindex:00h)', it is always displayed as "0".
Md.108: Servo status 1	The following bits in the monitor data are always in the 'OFF' state. · Gain switching (b4) · Fully closed control switching (b5) · Torque limit active (b13) · Absolute position lost (b14) · Servo warning (b15)
Md.119: Servo status 2	The following bits in the monitor data are always in the 'OFF' state. · Zero point pass (b0) · Zero speed (b3) · Speed limit active (b4) · PID control active (b8)
Md.115: Servo alarm detail number	Not supported. This monitor data is always displayed as '0'.
Cd.108: Gain switching command flag	Not supported. Only MELSERVO responds to this data.
Cd.133: Semi/Fully closed loop switching request	Not supported. Only MELSERVO responds to this data.
Cd.136: PI-PID switching request	Not supported. Only MELSERVO supports this data.

2. MX Controller Settings

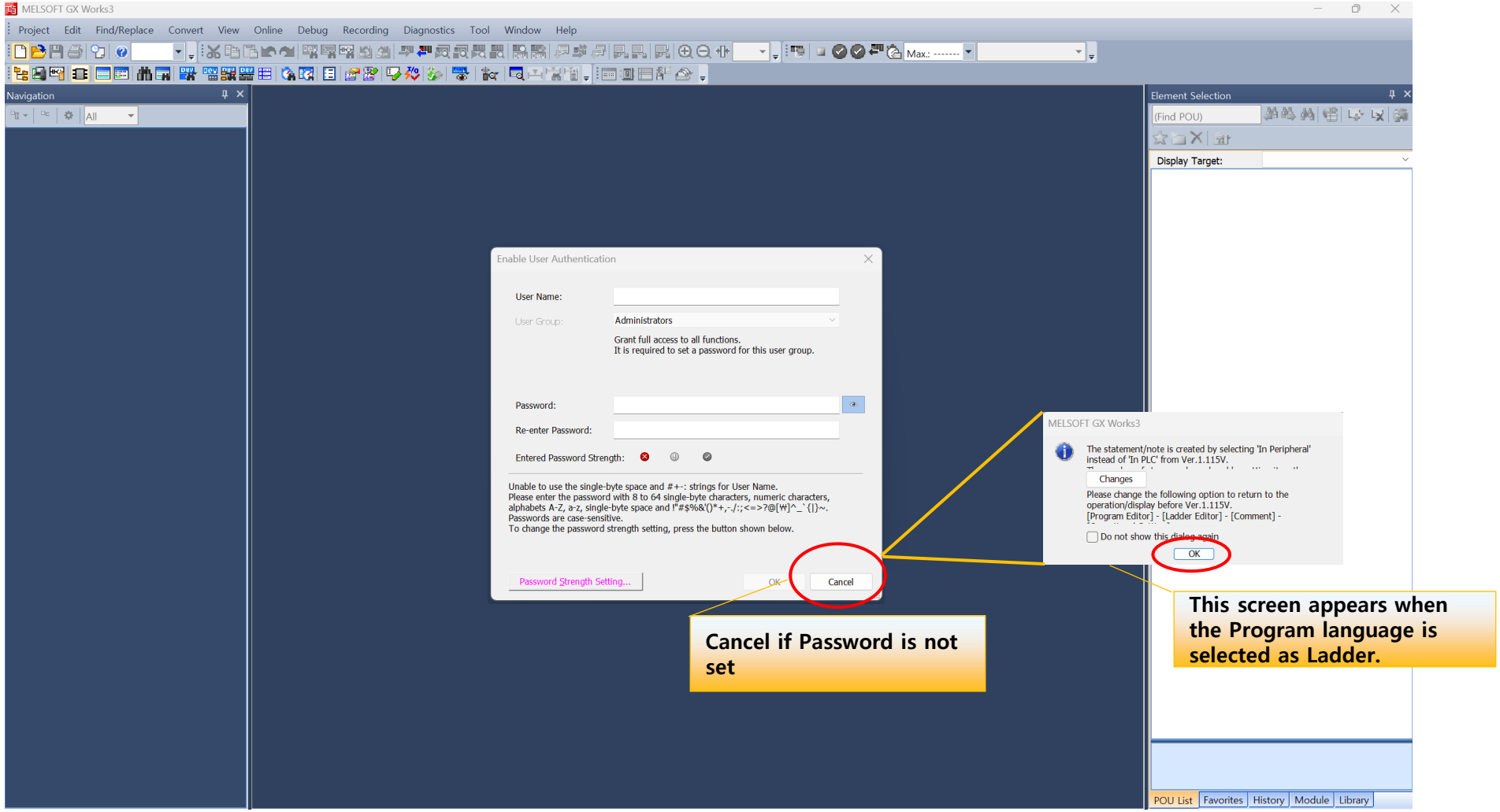
2-1. Project Creation

- **When creating a new project, select the MX Controller, model name, number of axes used, and programming language**



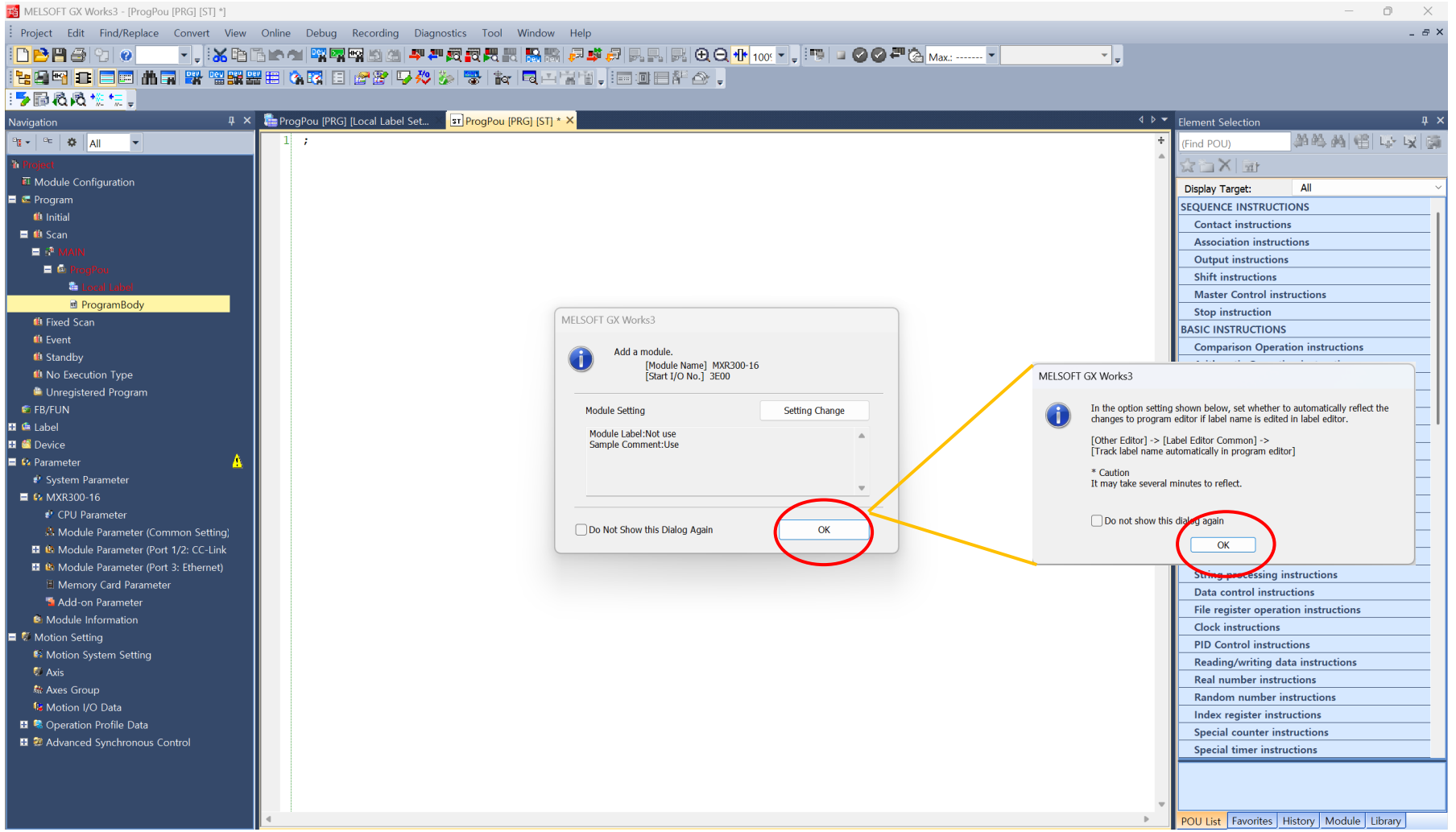
2-2. User Authentication Settings

- **Password Setting** ※ In this chapter, Cancel is selected when no password is set.



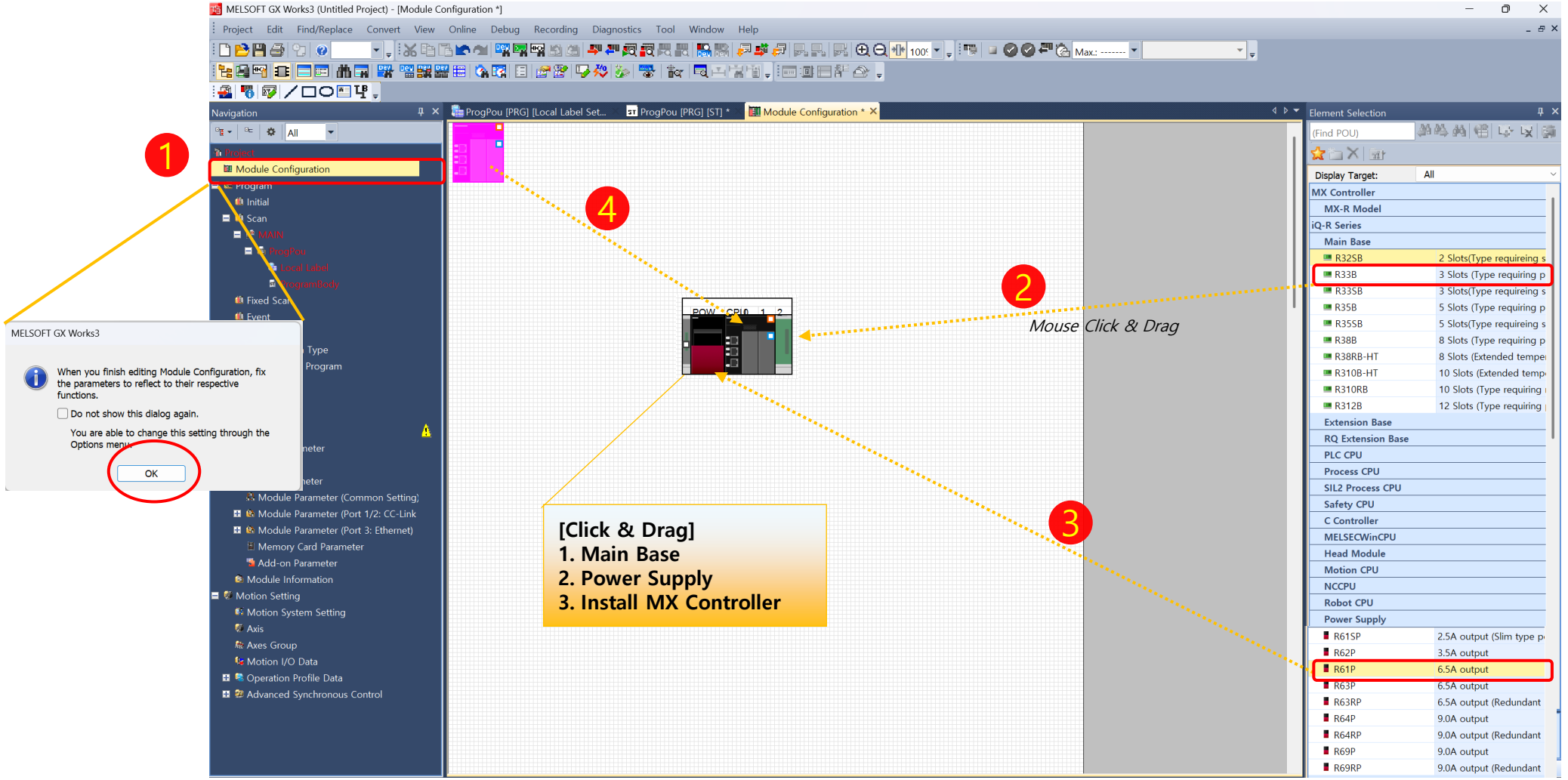
2-3. Module Registration

- **MXR300-xx Registration**



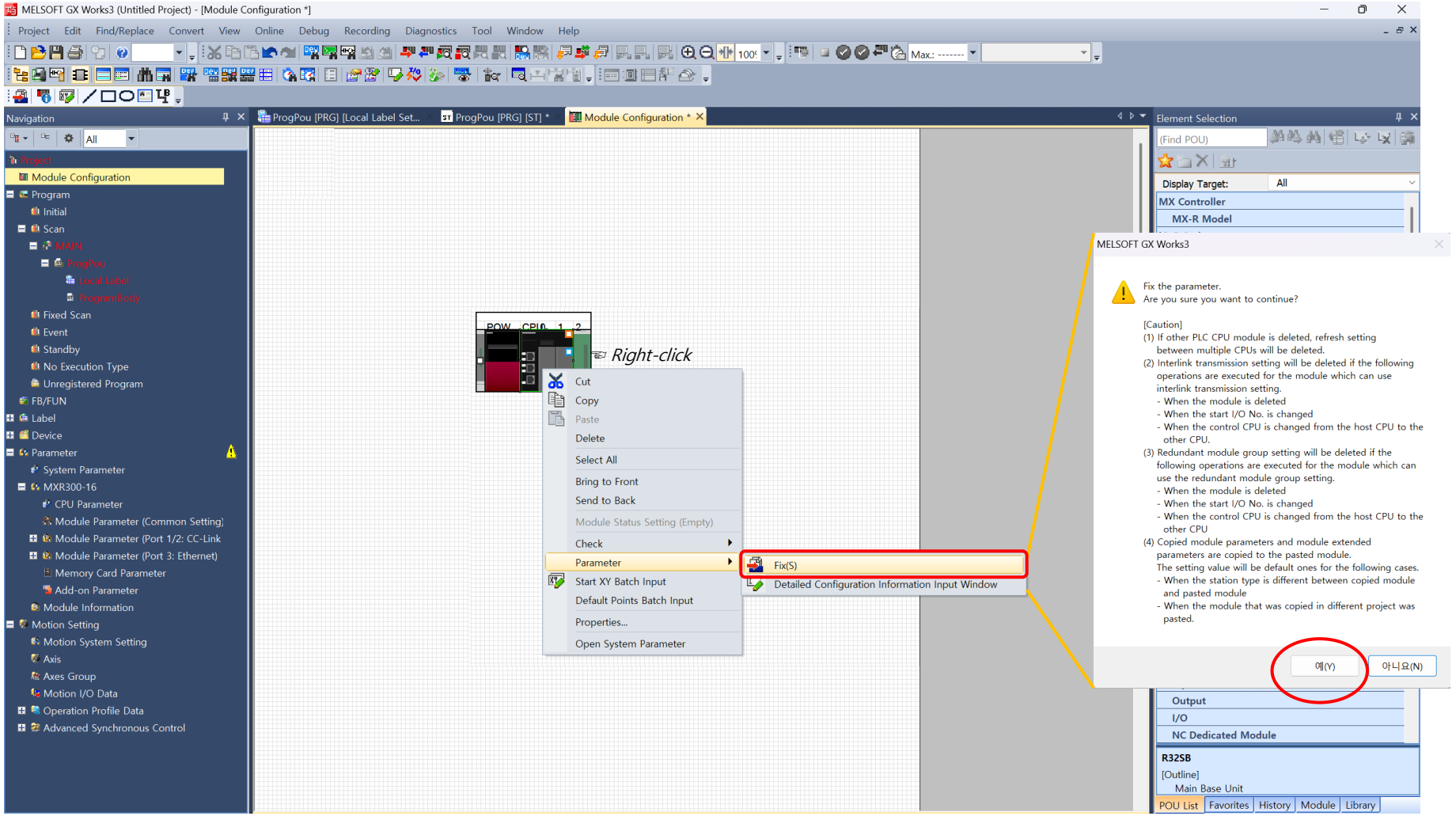
2-4. Module Configuration – H/W

- **Configure the Main Base, CPU Module, and Power Supply by clicking and dragging with the mouse**



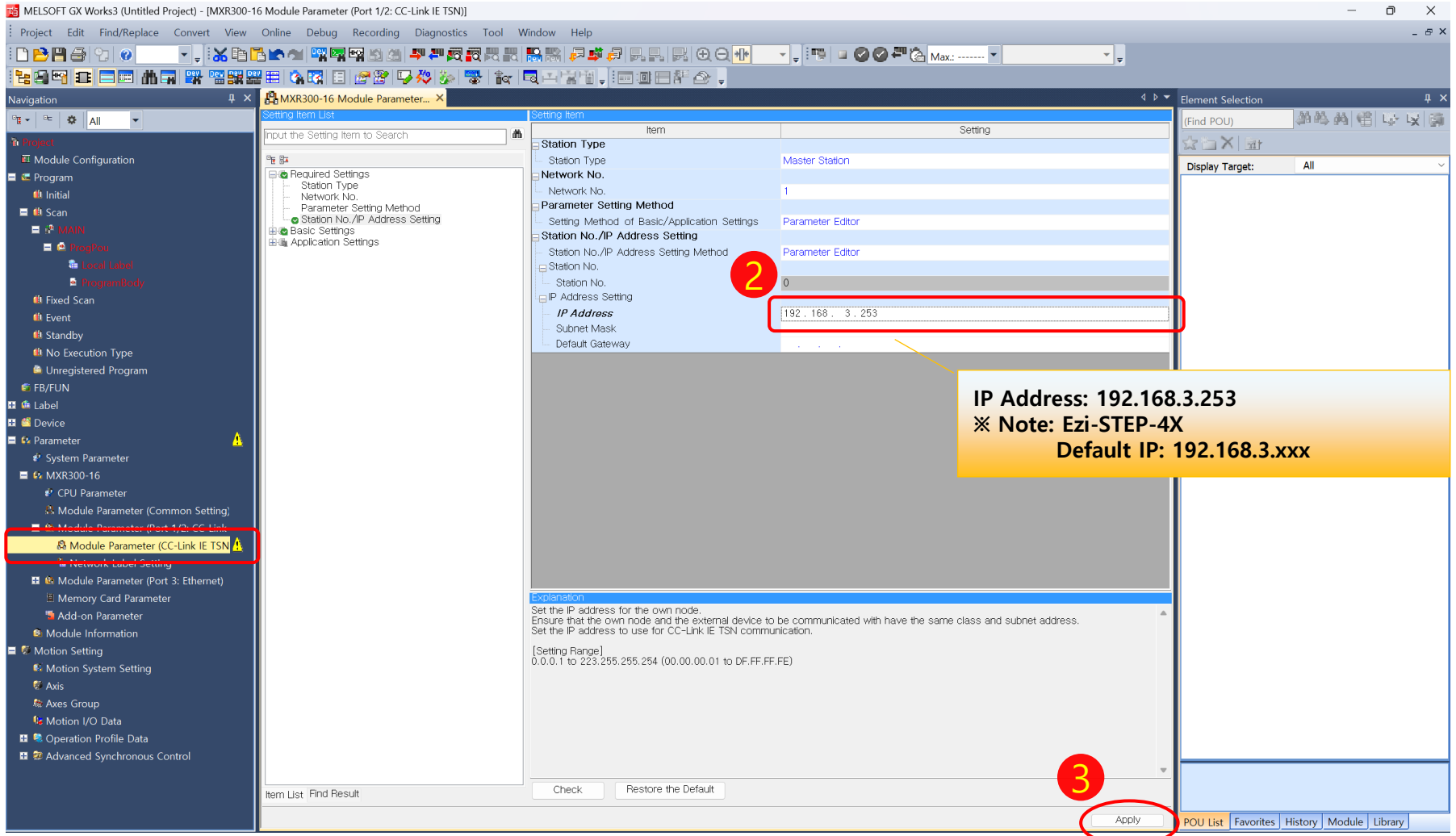
2-4. Module Configuration – H/W

- **Right-click the mouse and select Fix(S) to complete the module configuration**



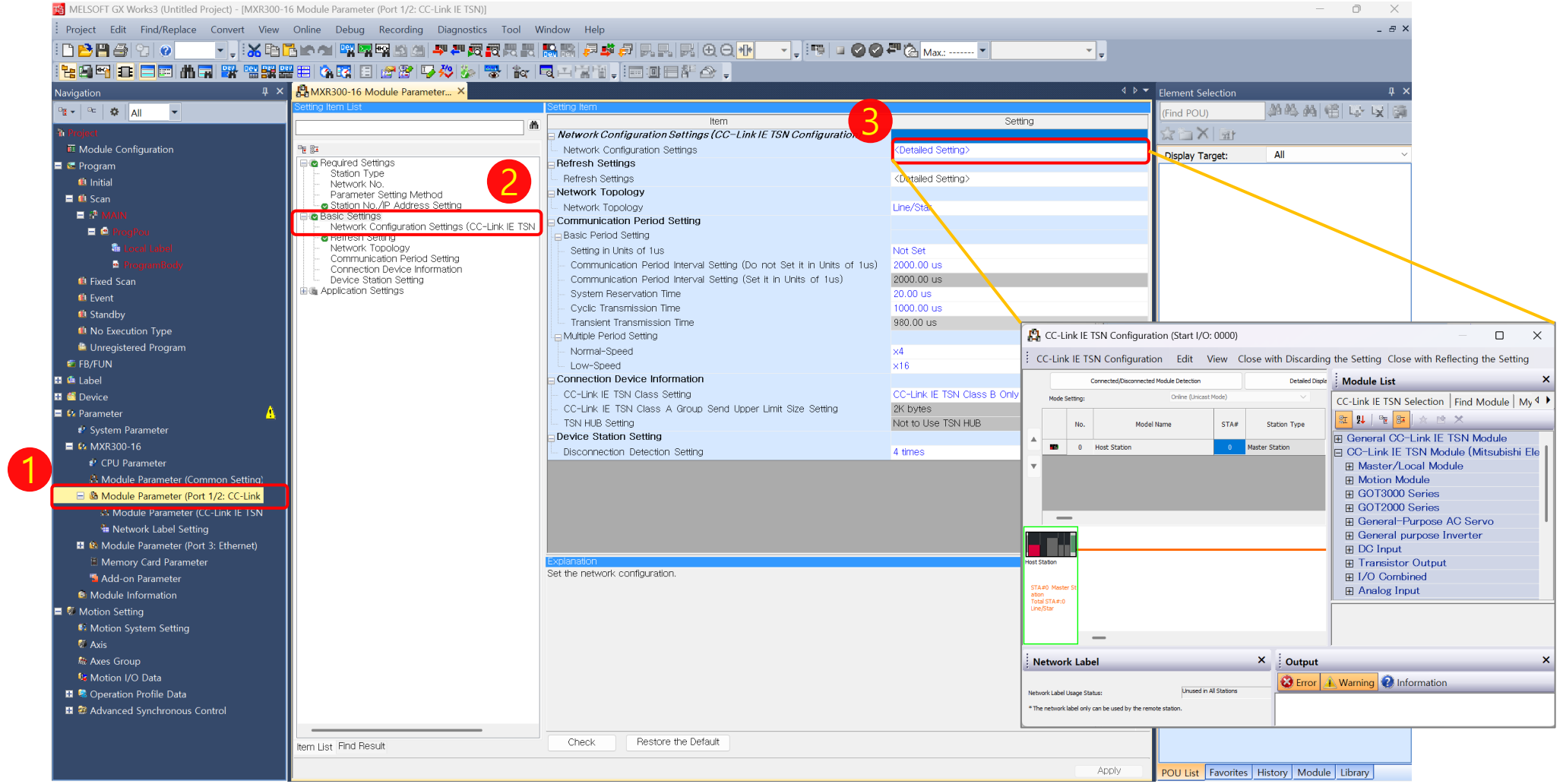
2-5. Parameter / Module Information / 0000:RD78G4

- **Station No./IP Address Setting : Example) IP Address → 192.168.3.253**



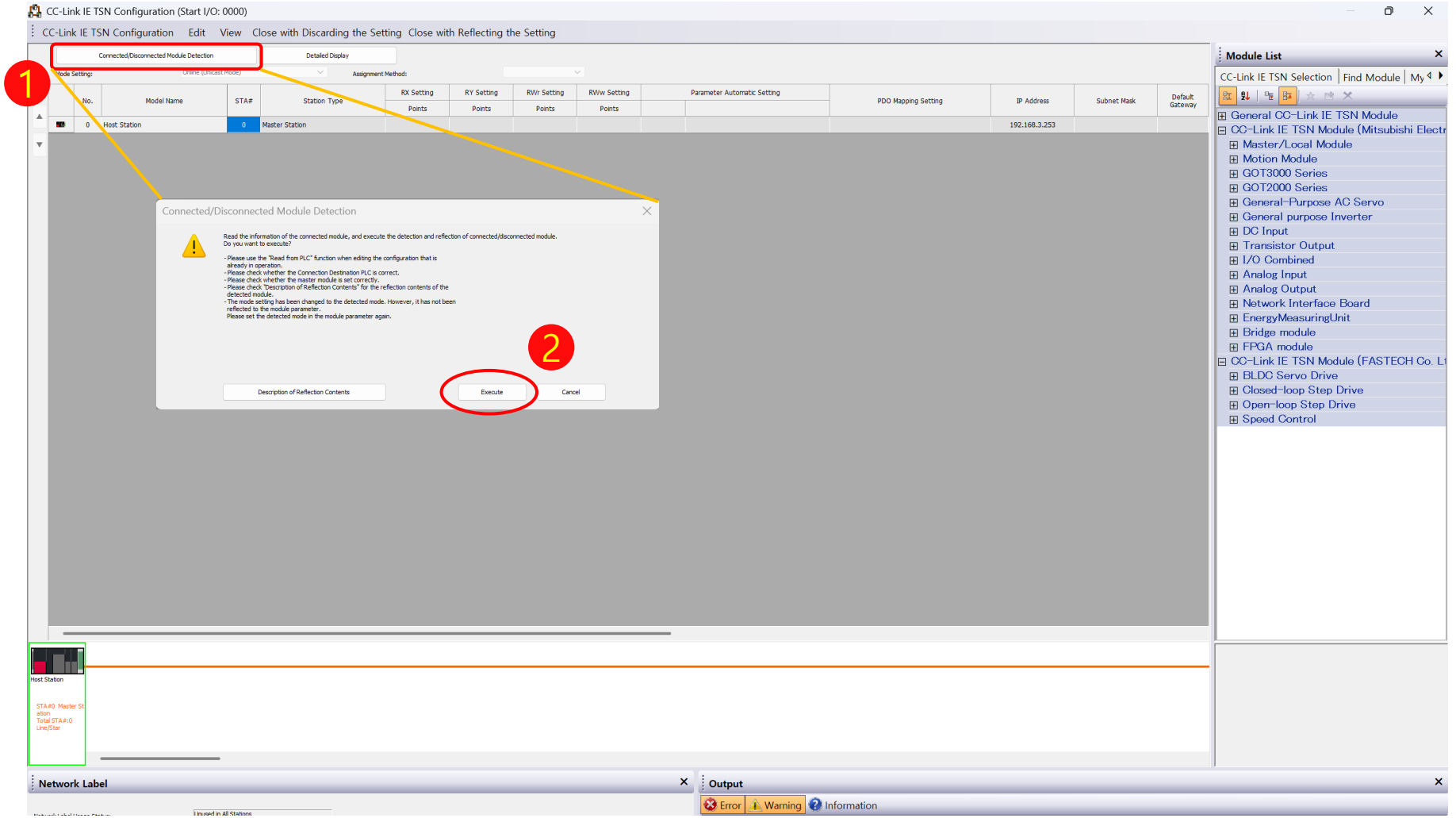
2-5. Module Parameter – Network Configuration

- **Network Configuration Settings**



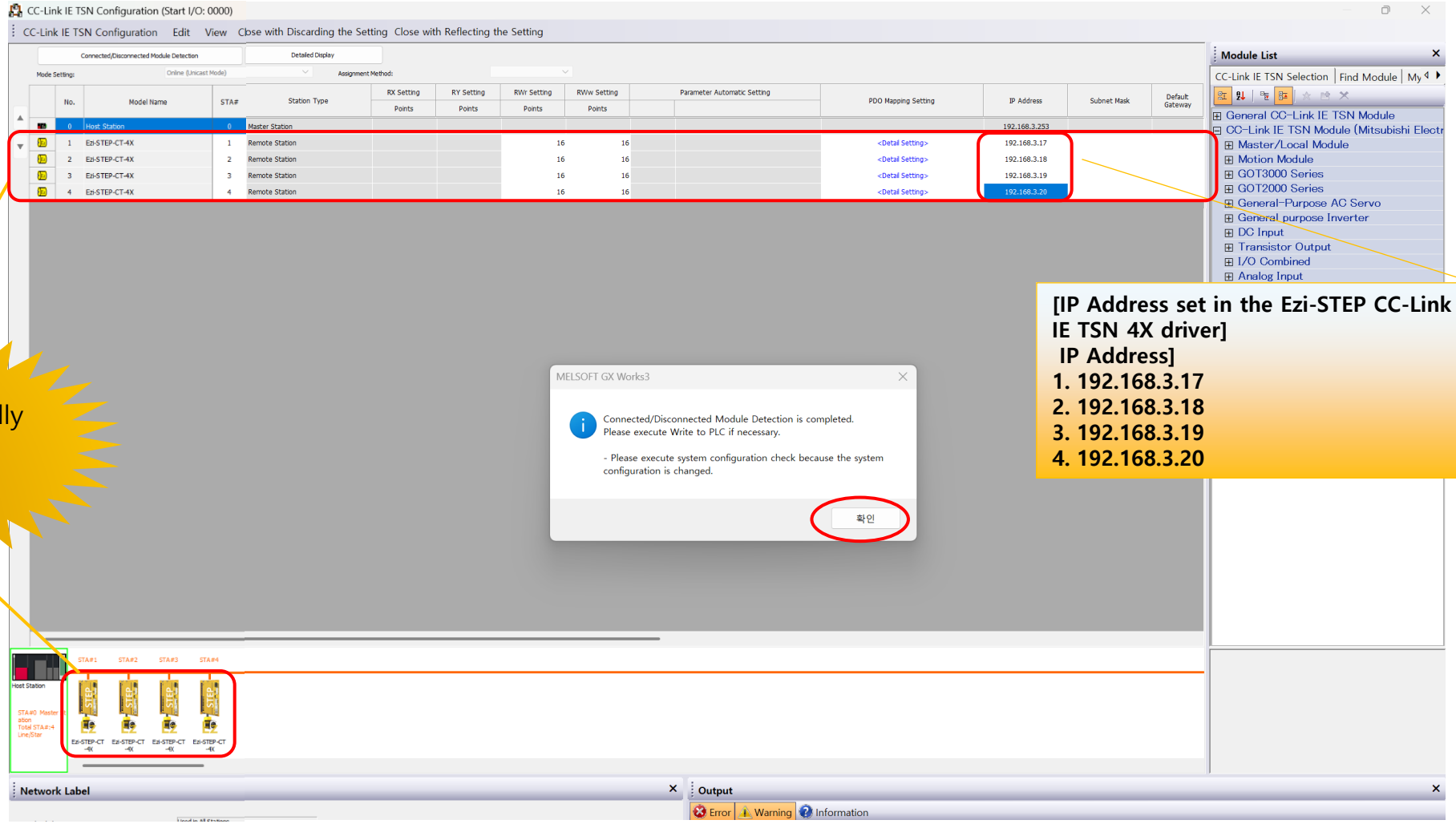
2-5. Module Parameter – CC-Link IE TSN Configuration

- **Network-connected state: Automatically detects and configures the CC-Link IE TSN Module**



2-5. Module Parameter – CC-Link IE TSN Configuration

- **Network-connected state: Automatically detects and configures the CC-Link IE TSN Module on the Ezi-STEP CC-Link IE TSN 4X**

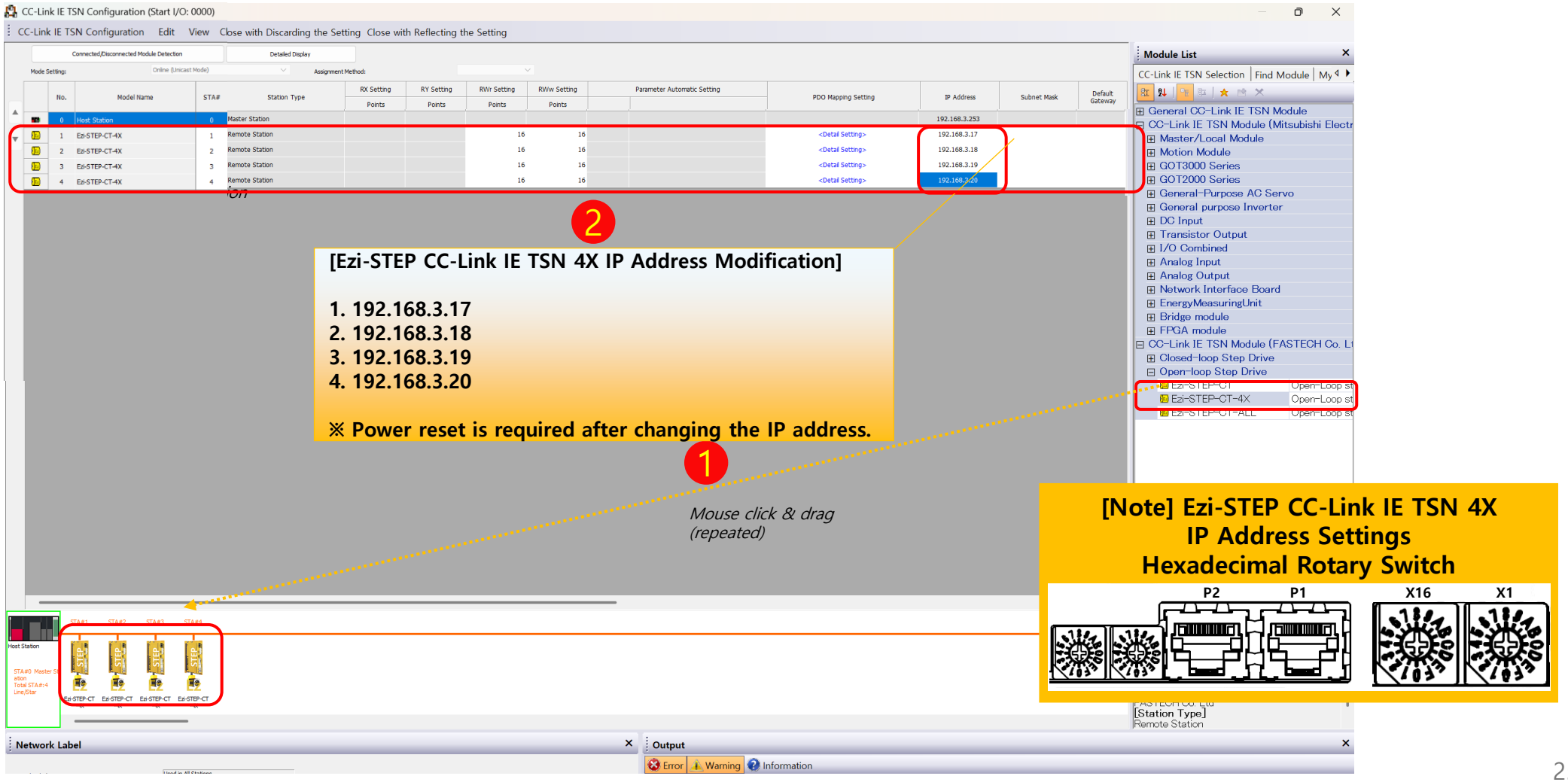


Automatically detected Module

[IP Address set in the Ezi-STEP CC-Link IE TSN 4X driver]
IP Address]
1. 192.168.3.17
2. 192.168.3.18
3. 192.168.3.19
4. 192.168.3.20

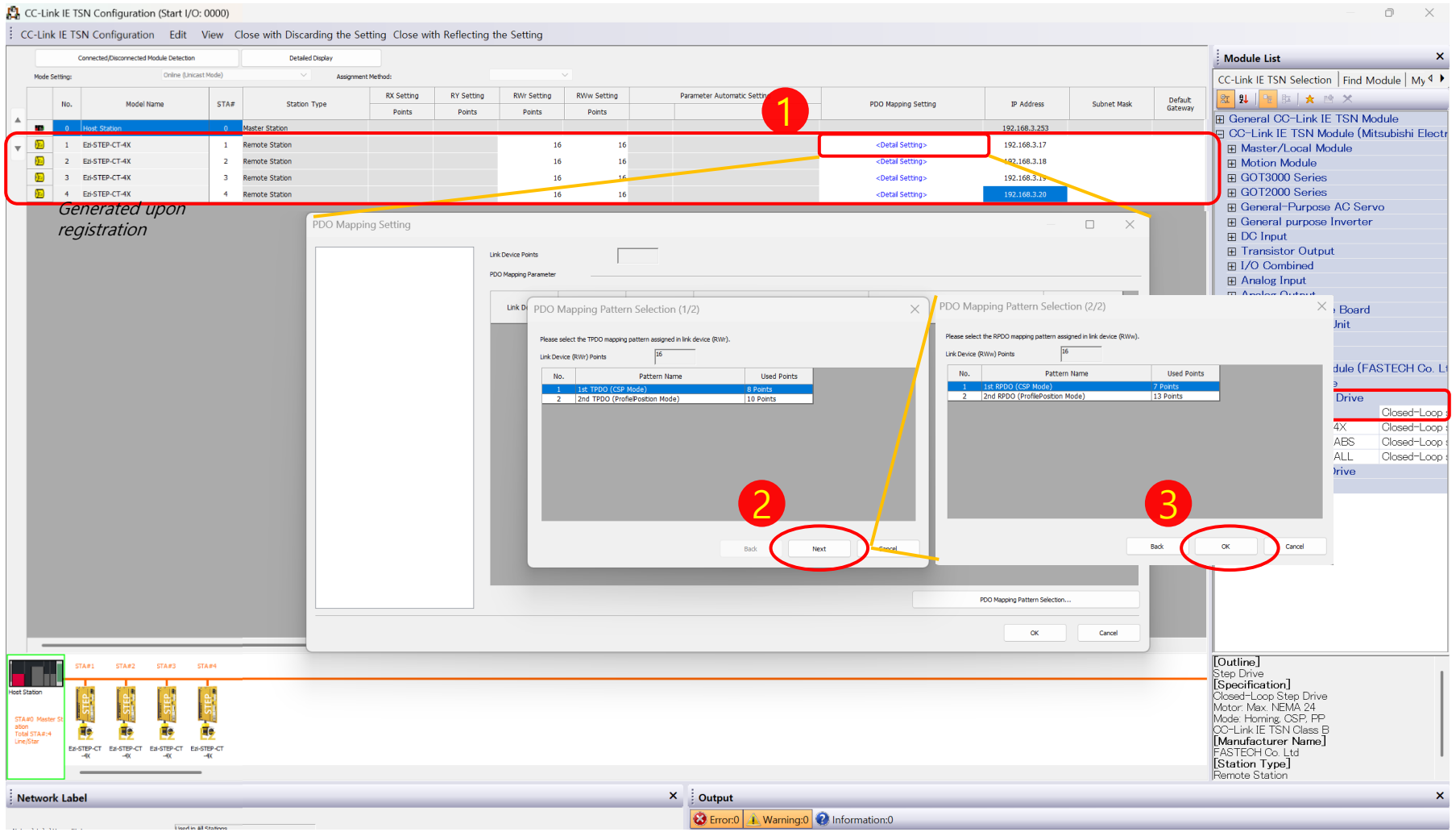
2-5. Module Parameter – CC-Link IE TSN Configuration

- **Network Unconnected State: Manually configure the CC-Link IE TSN Module (click & drag)**



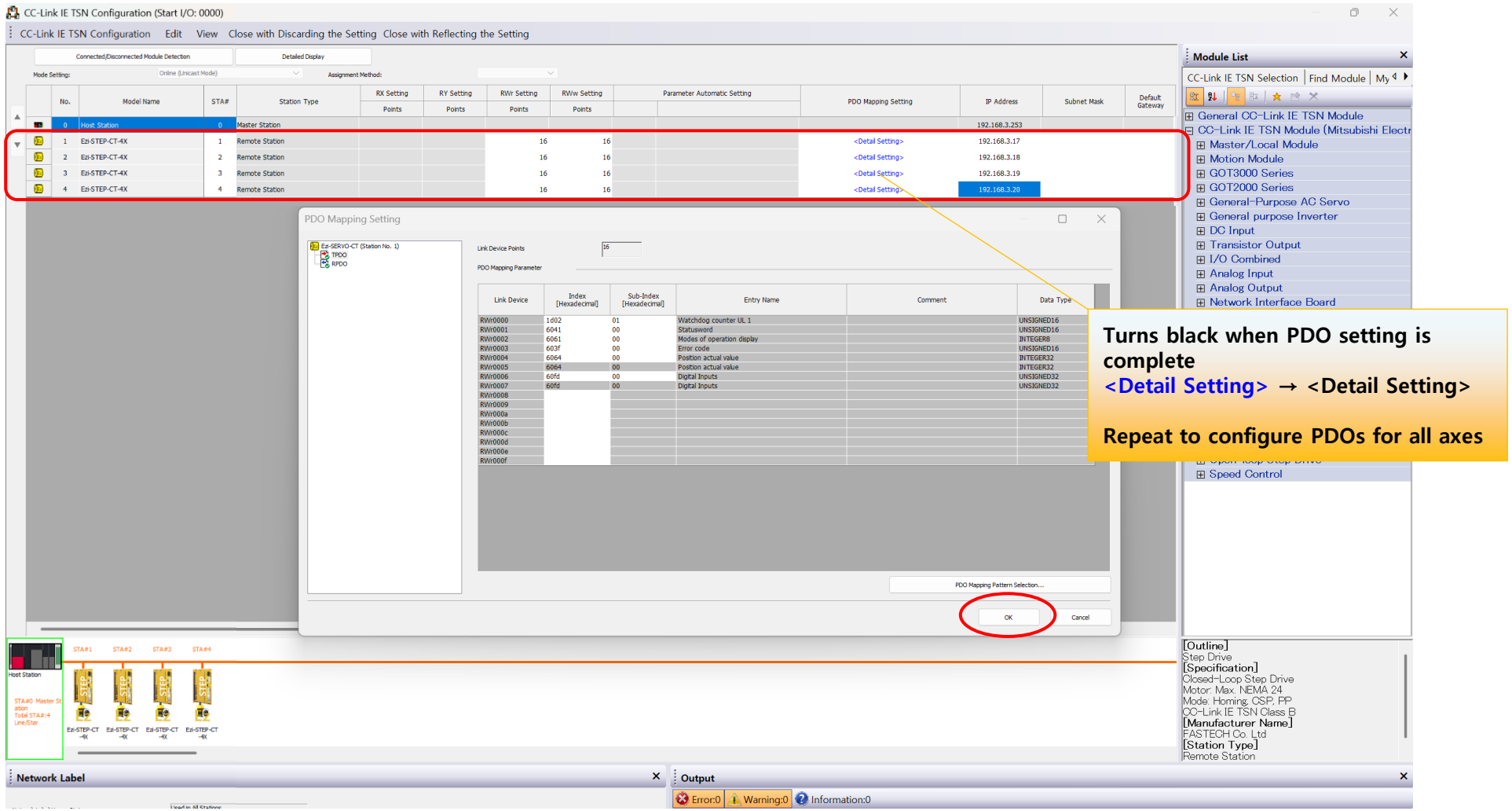
2-5. Module Parameter – CC-Link IE TSN Configuration

- **CC-Link IE TSN Module PDO Mapping Setting (Per-Axis Setting)**



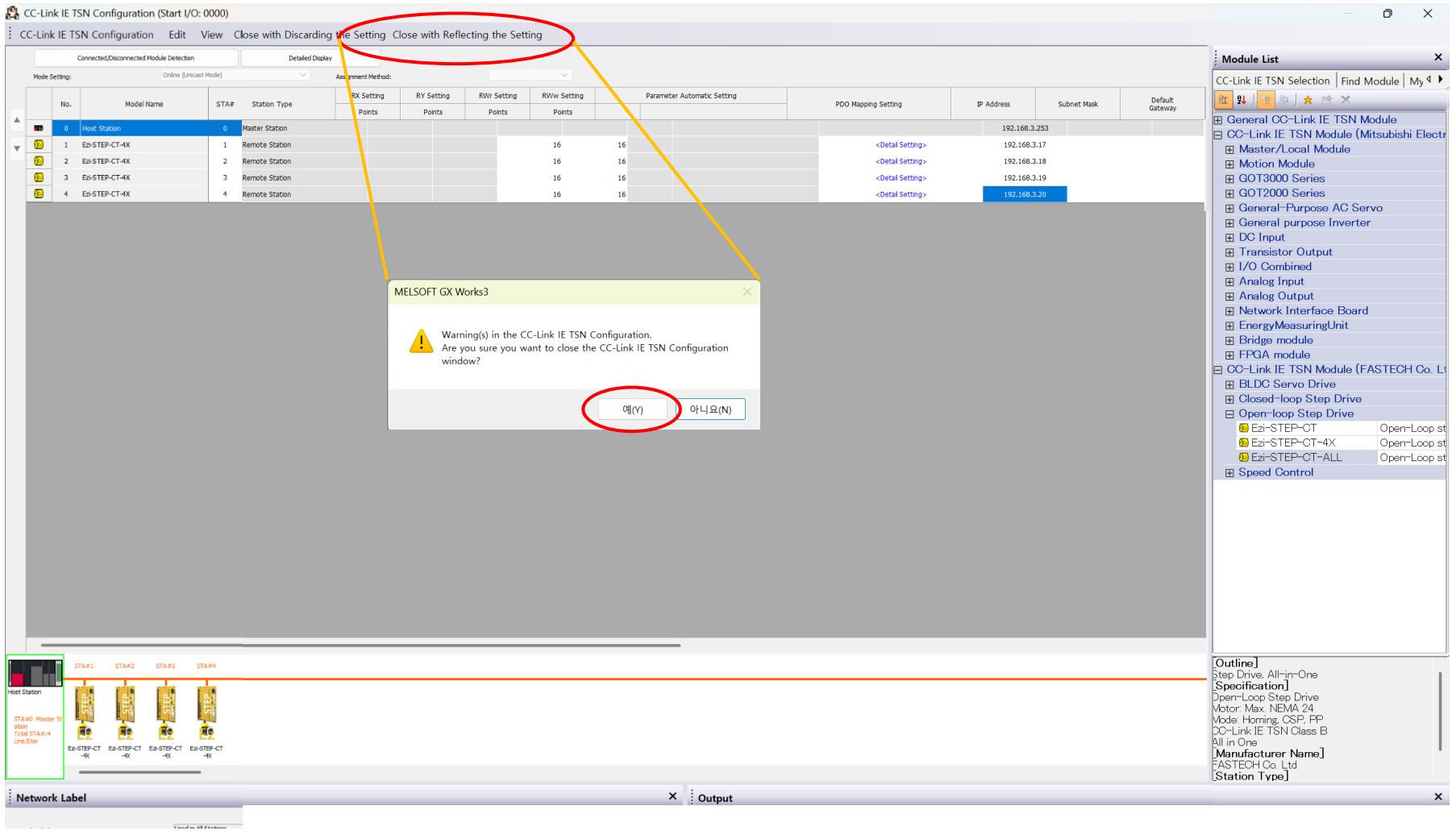
2-5. Module Parameter – CC-Link IE TSN Configuration

- **CC-Link IE TSN Module PDO Mapping Setting (Per-Axis Setting)**



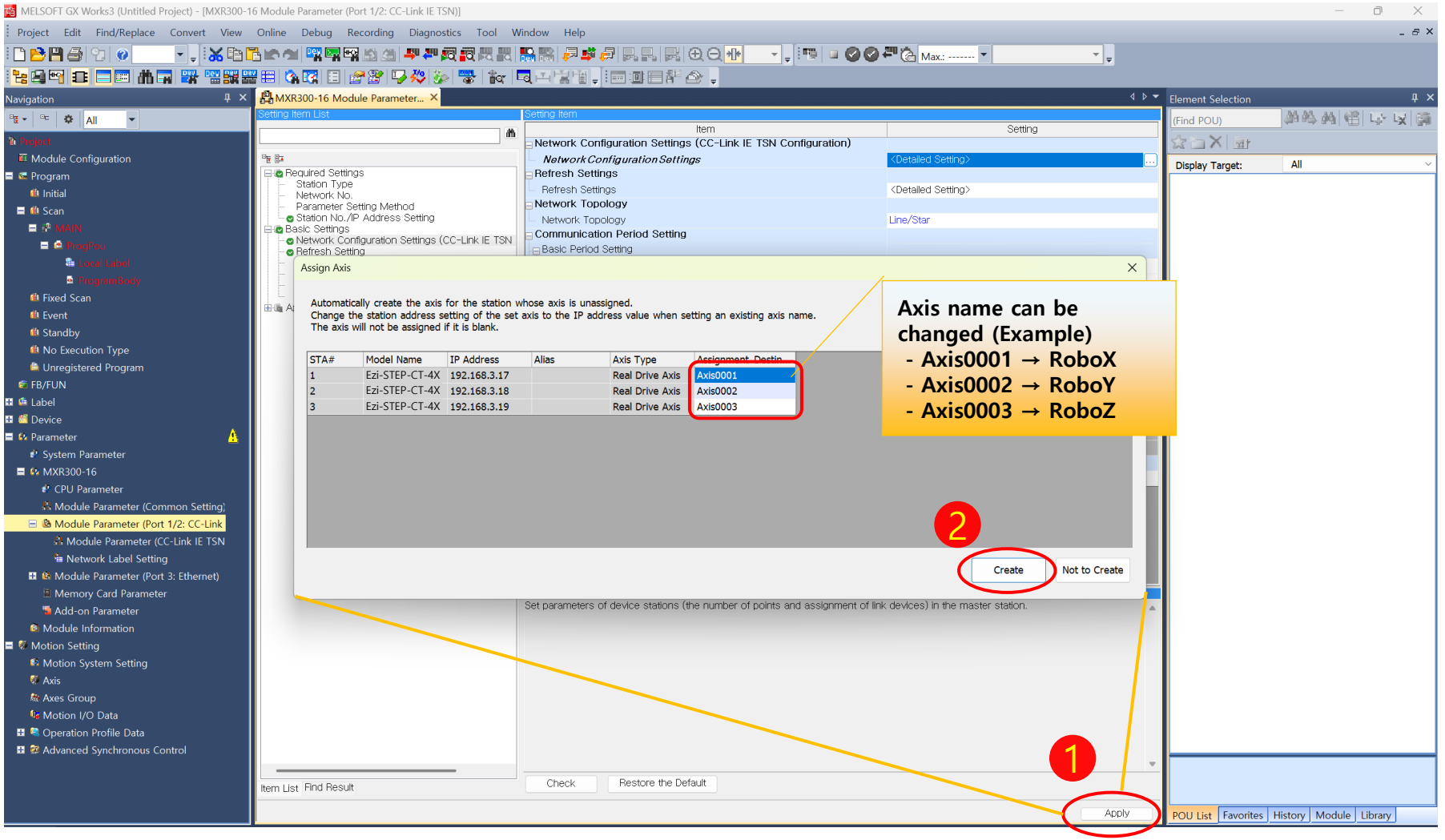
2-5. Module Parameter – CC-Link IE TSN Configuration

- **CC-Link IE TSN Module Setting Applied**



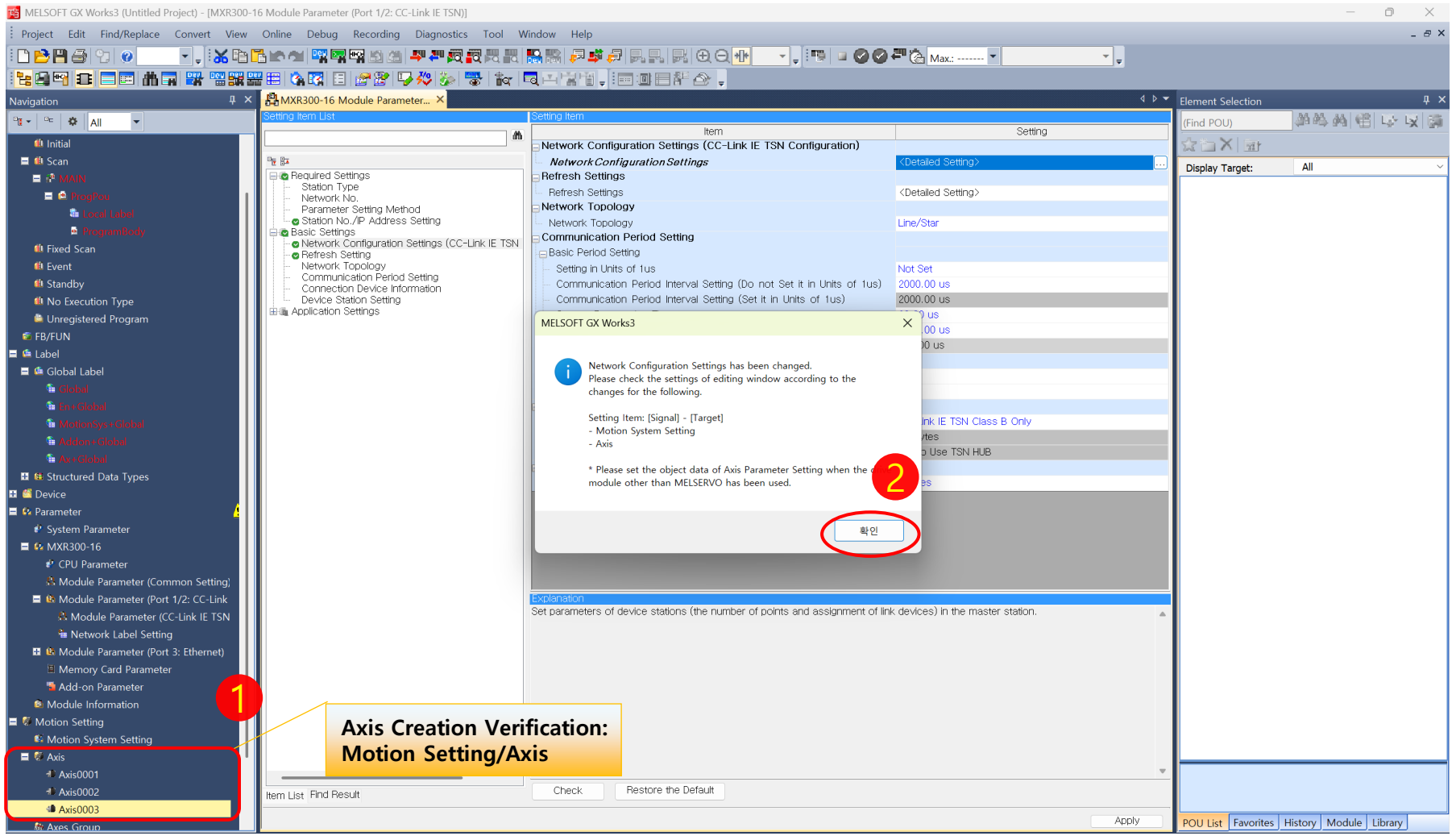
2-5. Module Parameter – CC-Link IE TSN Configuration

- **Axis Creation**



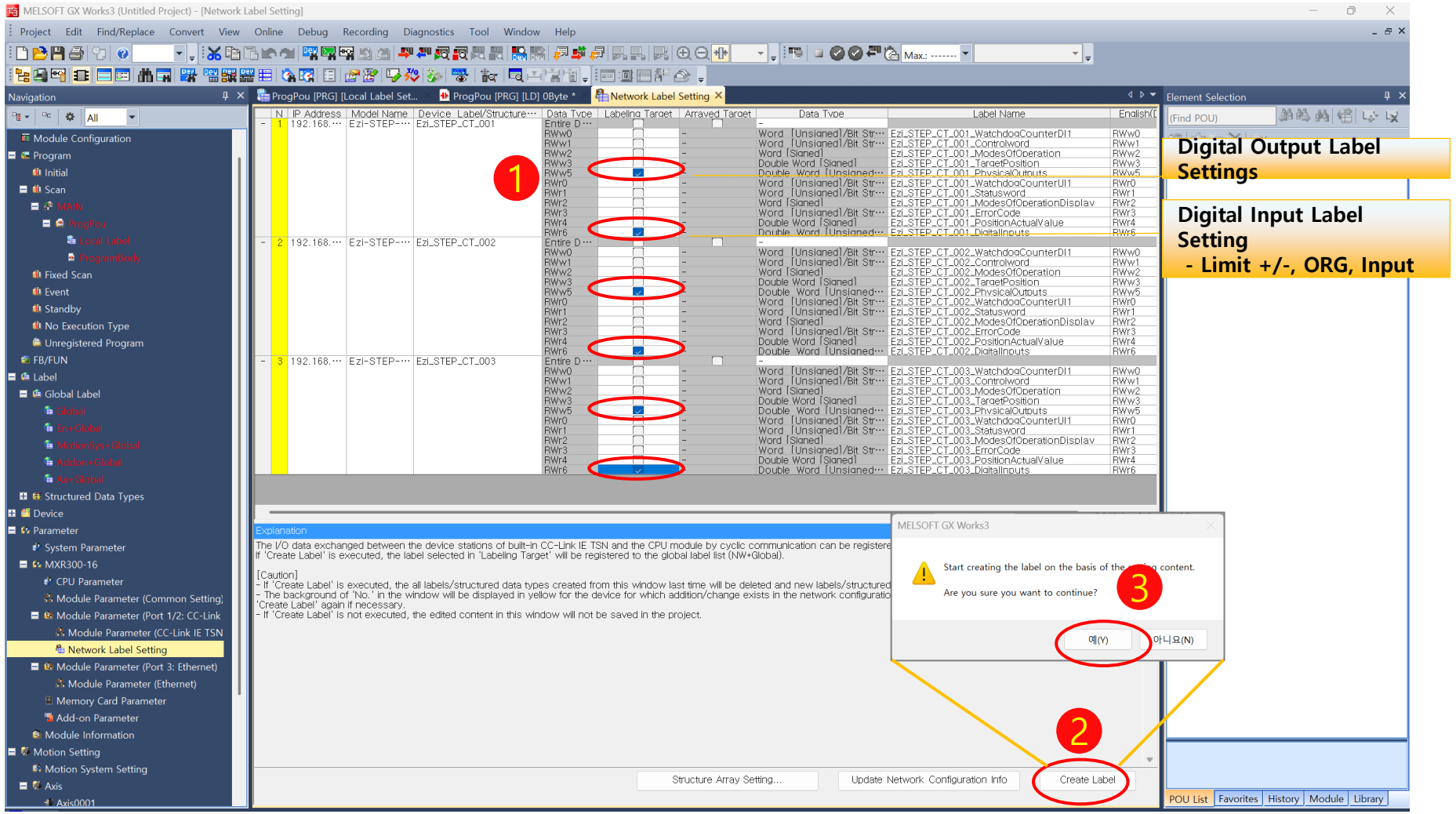
2-5. Module Parameter – CC-Link IE TSN Configuration

- **Confirming axis creation**



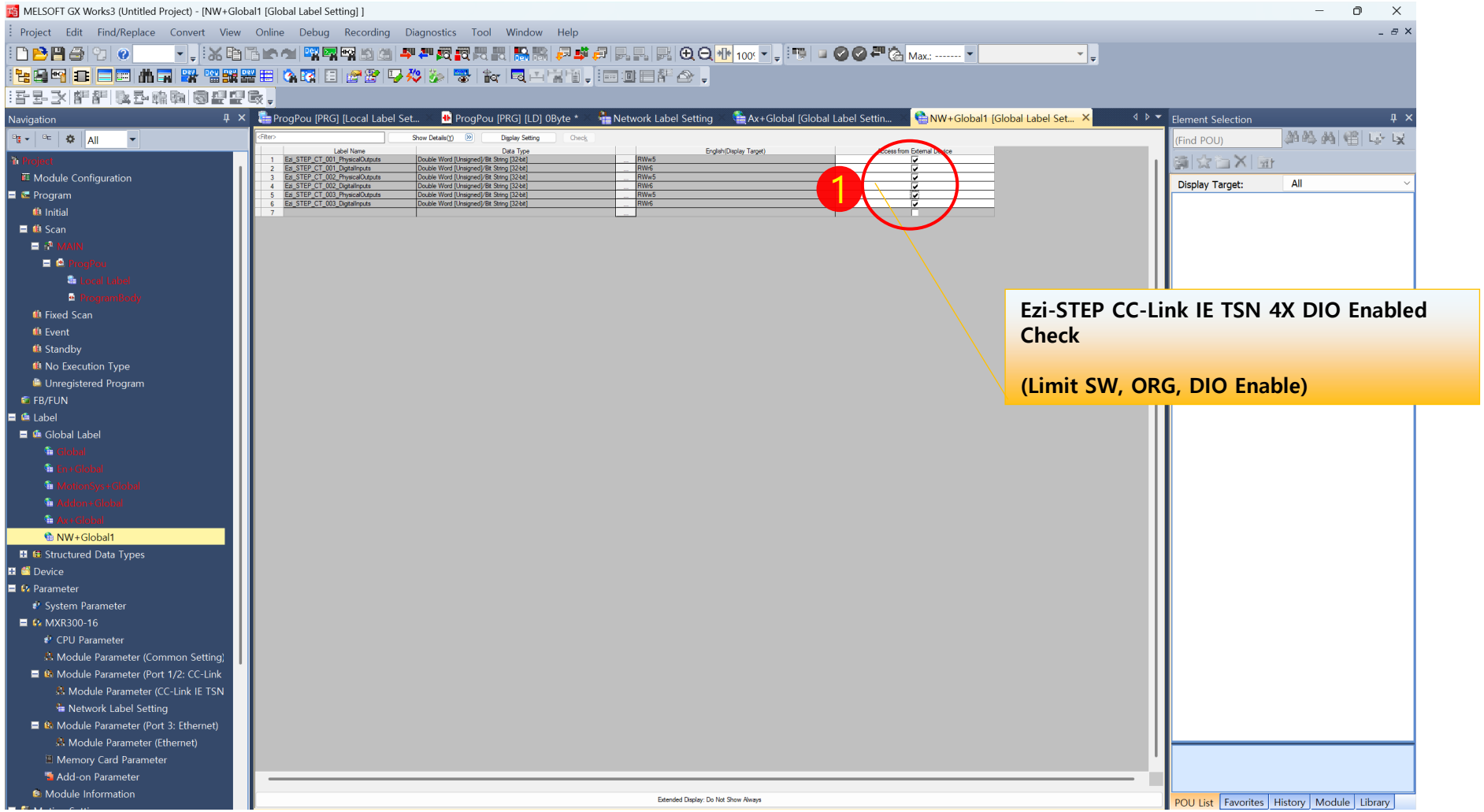
2-5. Module Parameter – CC-Link IE TSN Configuration

- **Network Label Setting – Channel-Specific Digital Input/Output Settings**



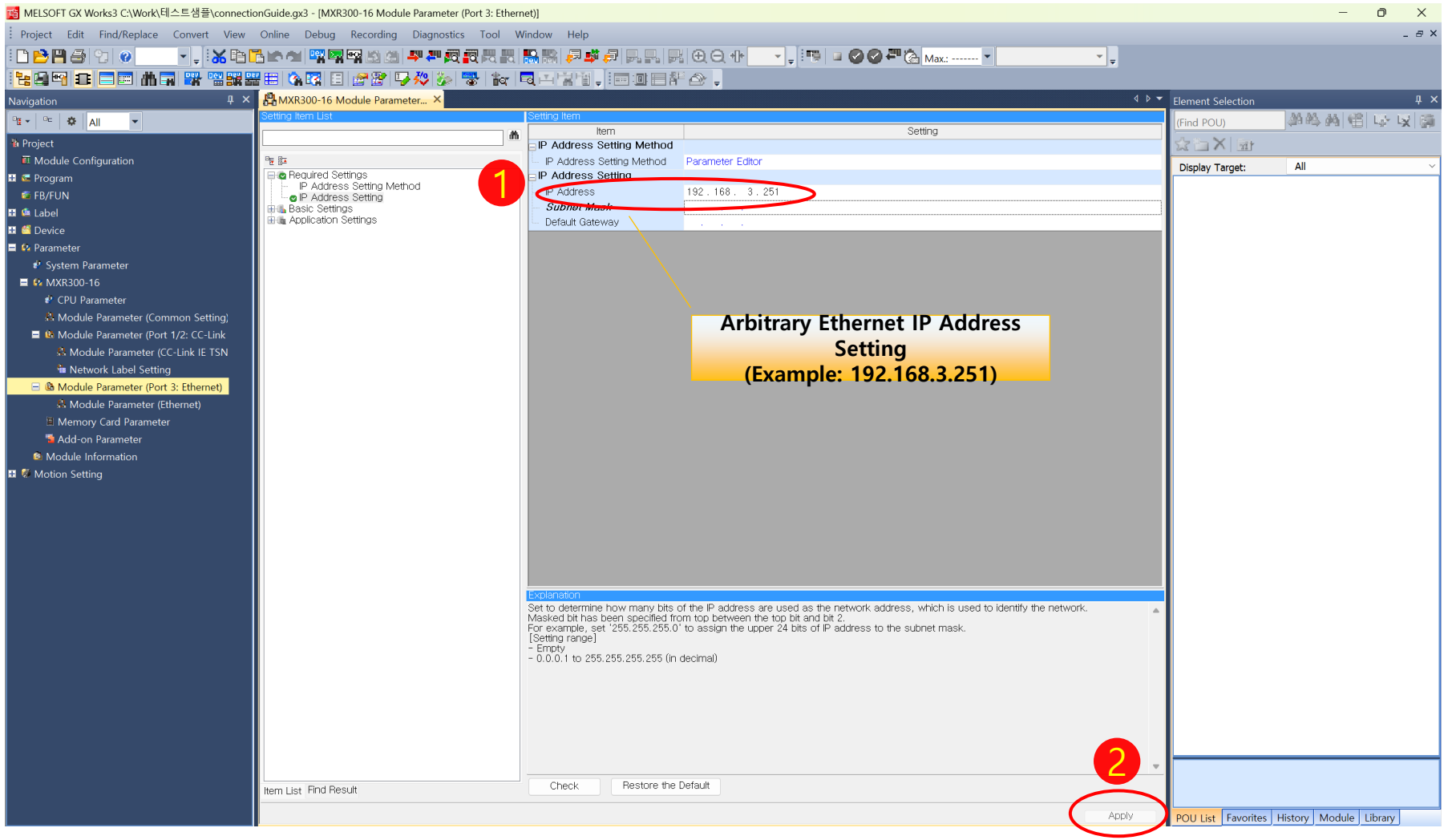
2-5. Module Parameter – CC-Link IE TSN Configuration

- **Network Label Setting – Digital Input/Output Enable per Channel *Limit SW, ORG SW, DIO Enable Settings**



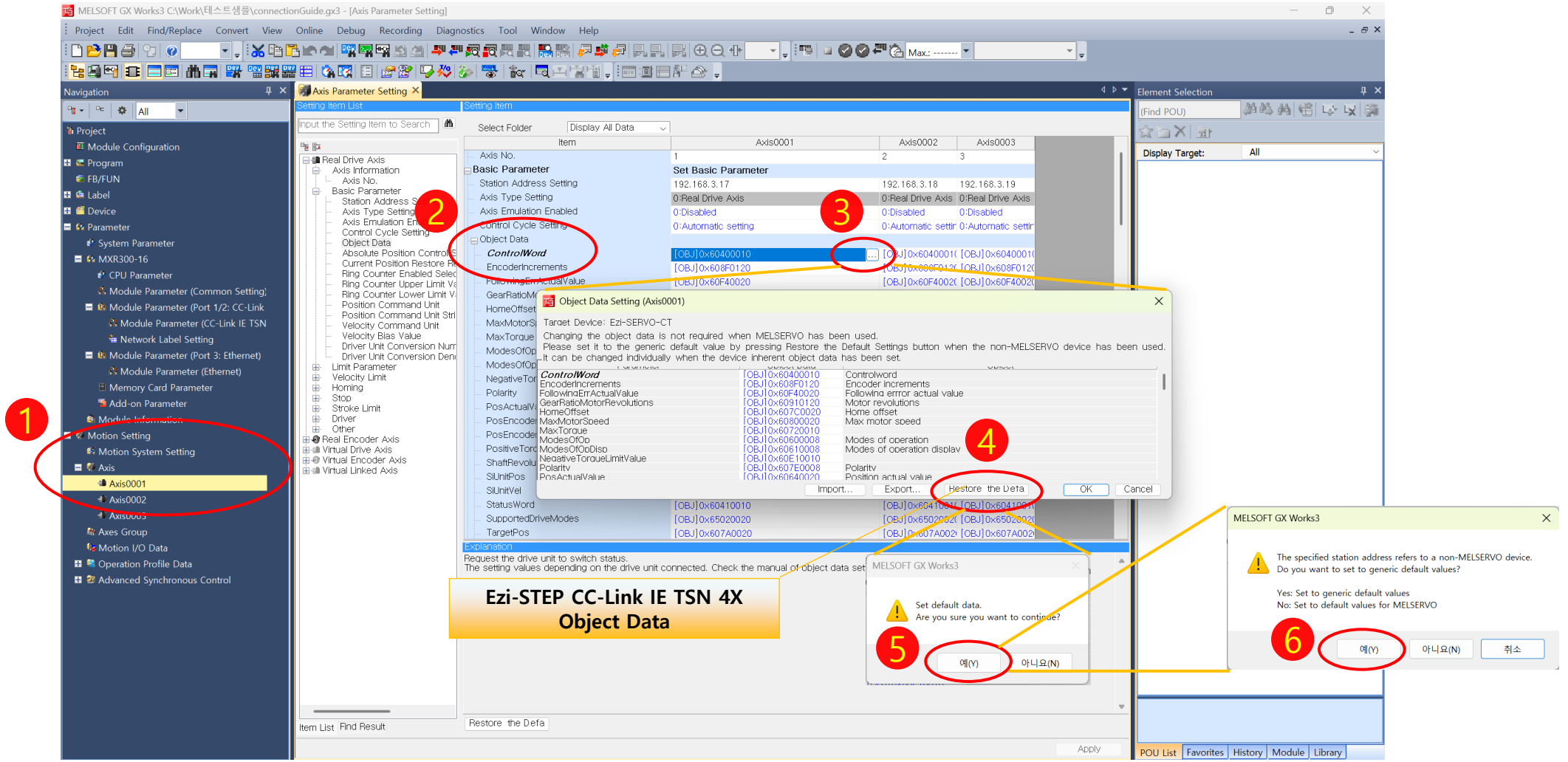
2-5. Module Parameter – Port 3: Ethernet

- **Ethernet IP Address Setting**



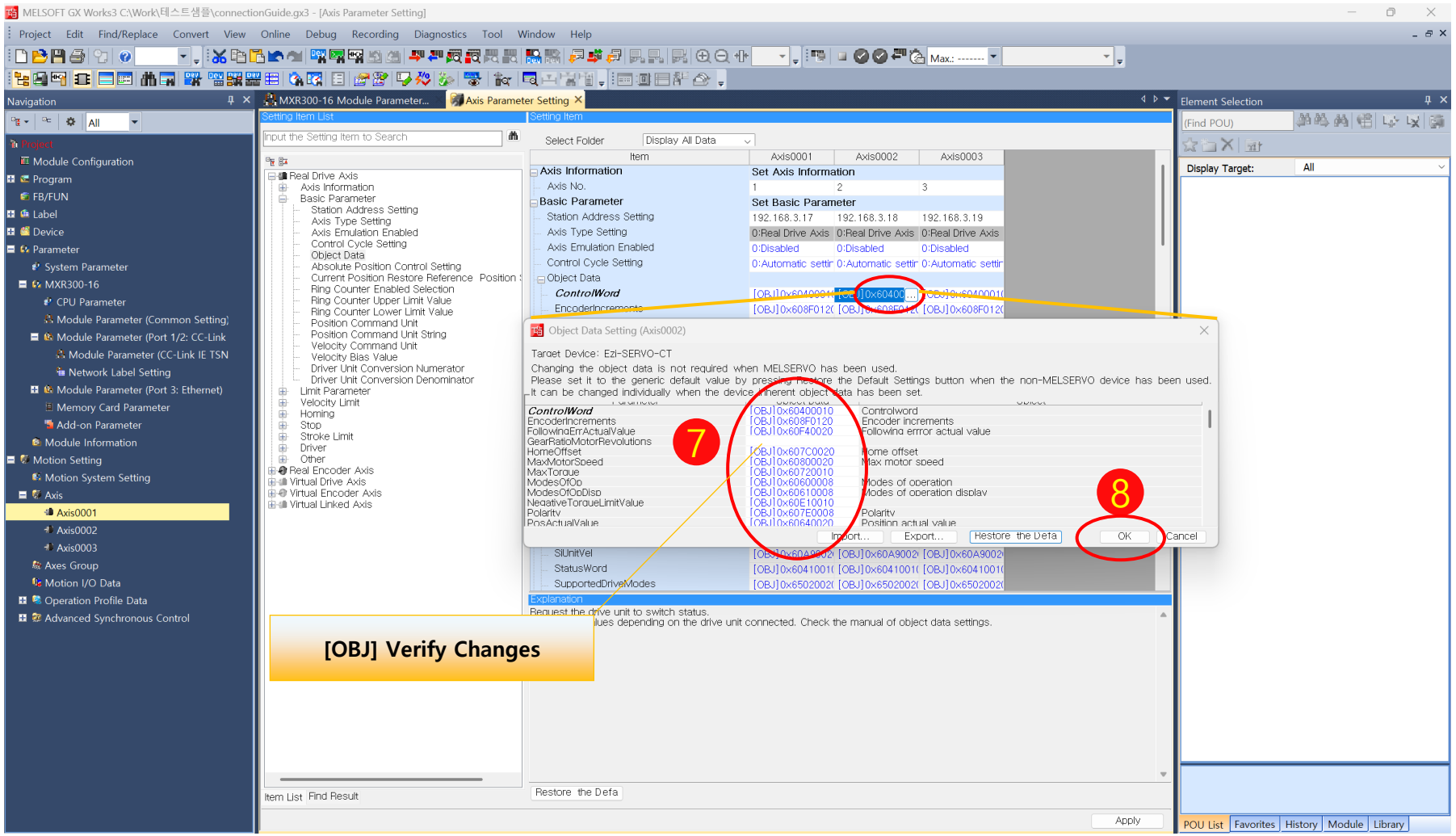
2-6. Motion Setting – Basic Parameter

- **Real Drive Axis / Basic Parameter / Object Data Settings (1/3)** ***Ezi-STEP CC-Link IE TSN 4X Object Data Registration**



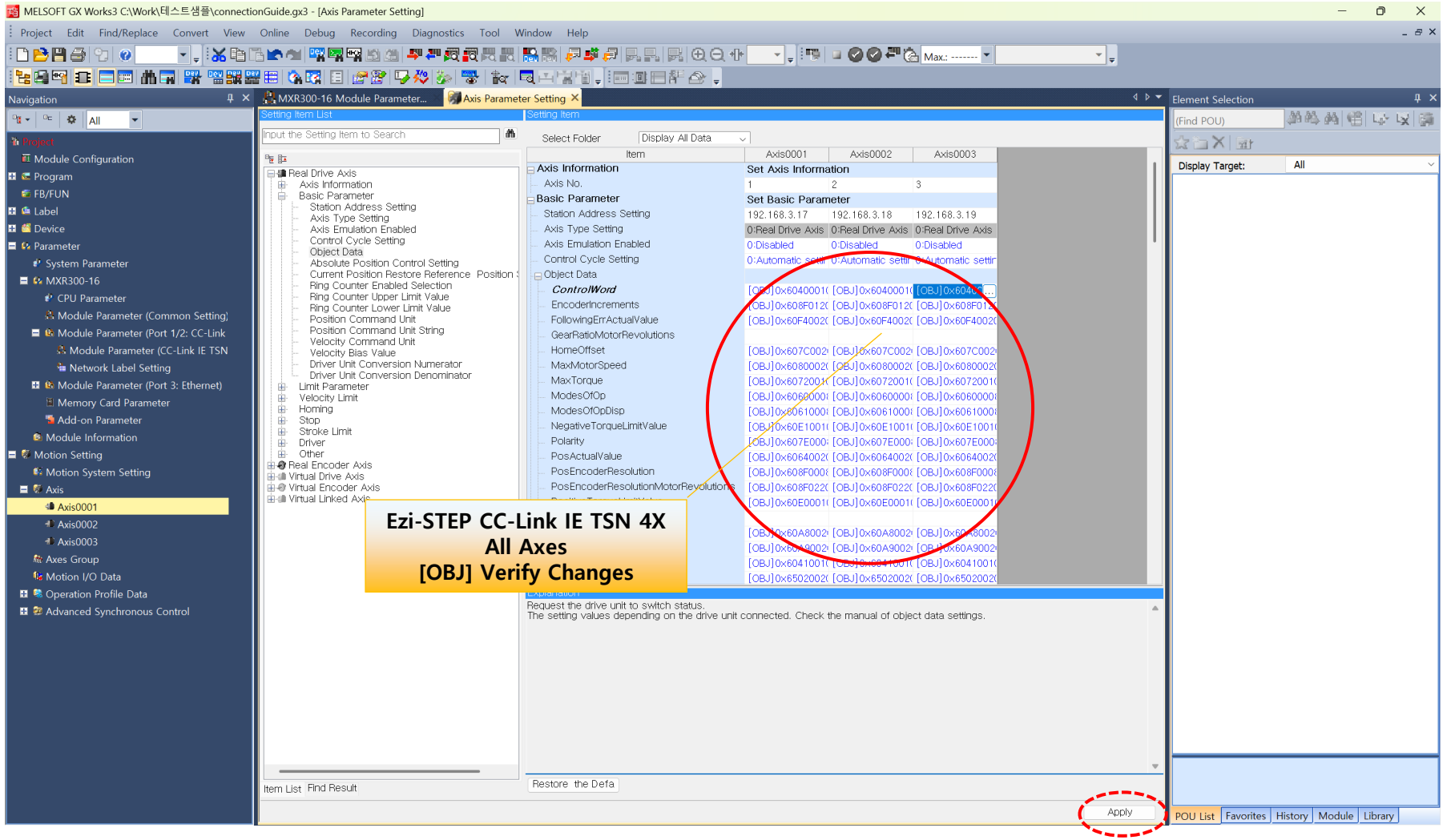
2-6. Motion Setting – Basic Parameter

- **Real Drive Axis / Basic Parameter / Object Data Settings (2/3)** ***Ezi-STEP CC-Link IE TSN 4X Object Data Registration**



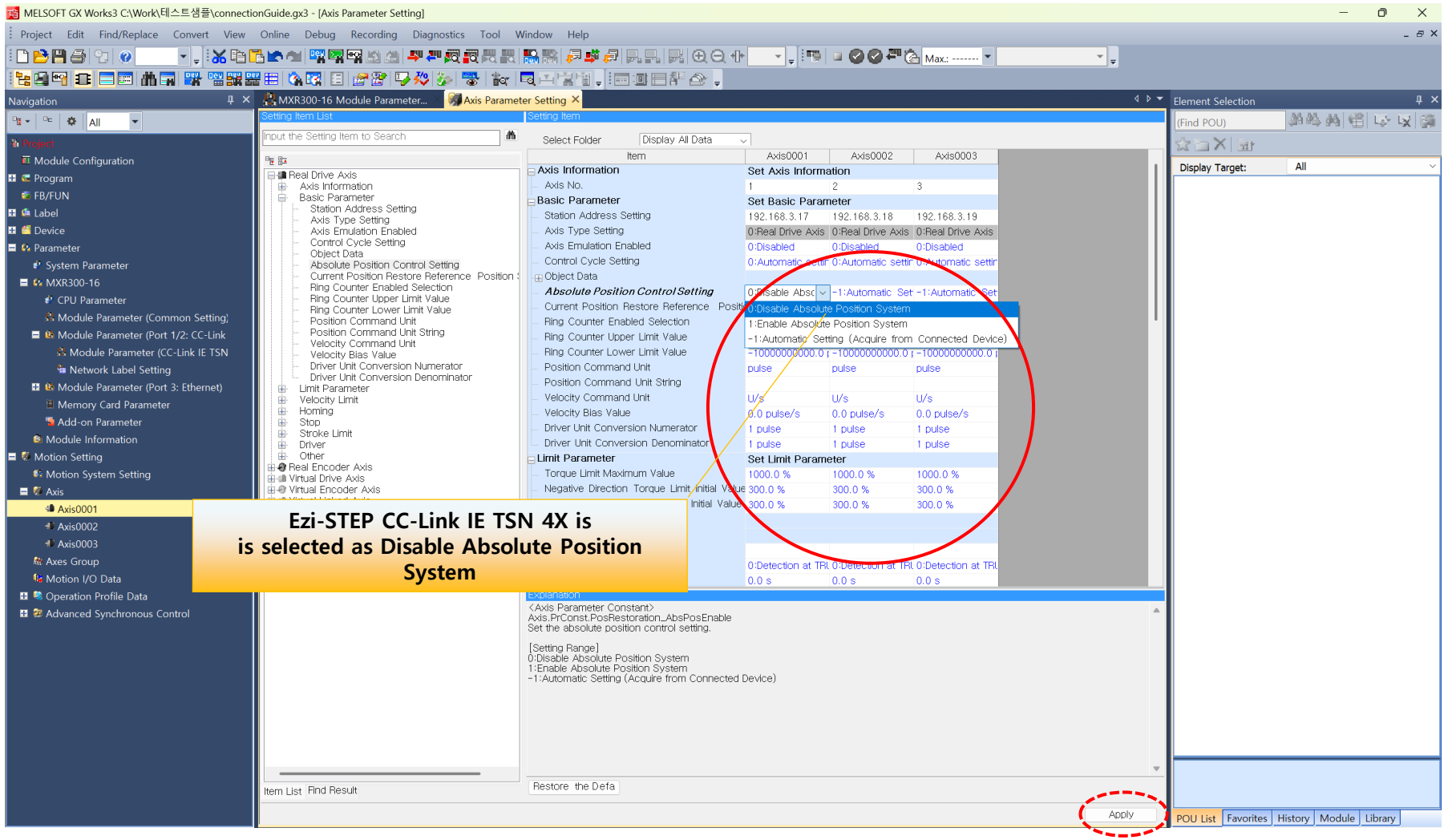
2-6. Motion Setting – Basic Parameter

- **Real Drive Axis / Basic Parameter / Object Data Settings (3/3)** ***Ezi-STEP CC-Link IE TSN 4X Object Data Registration**



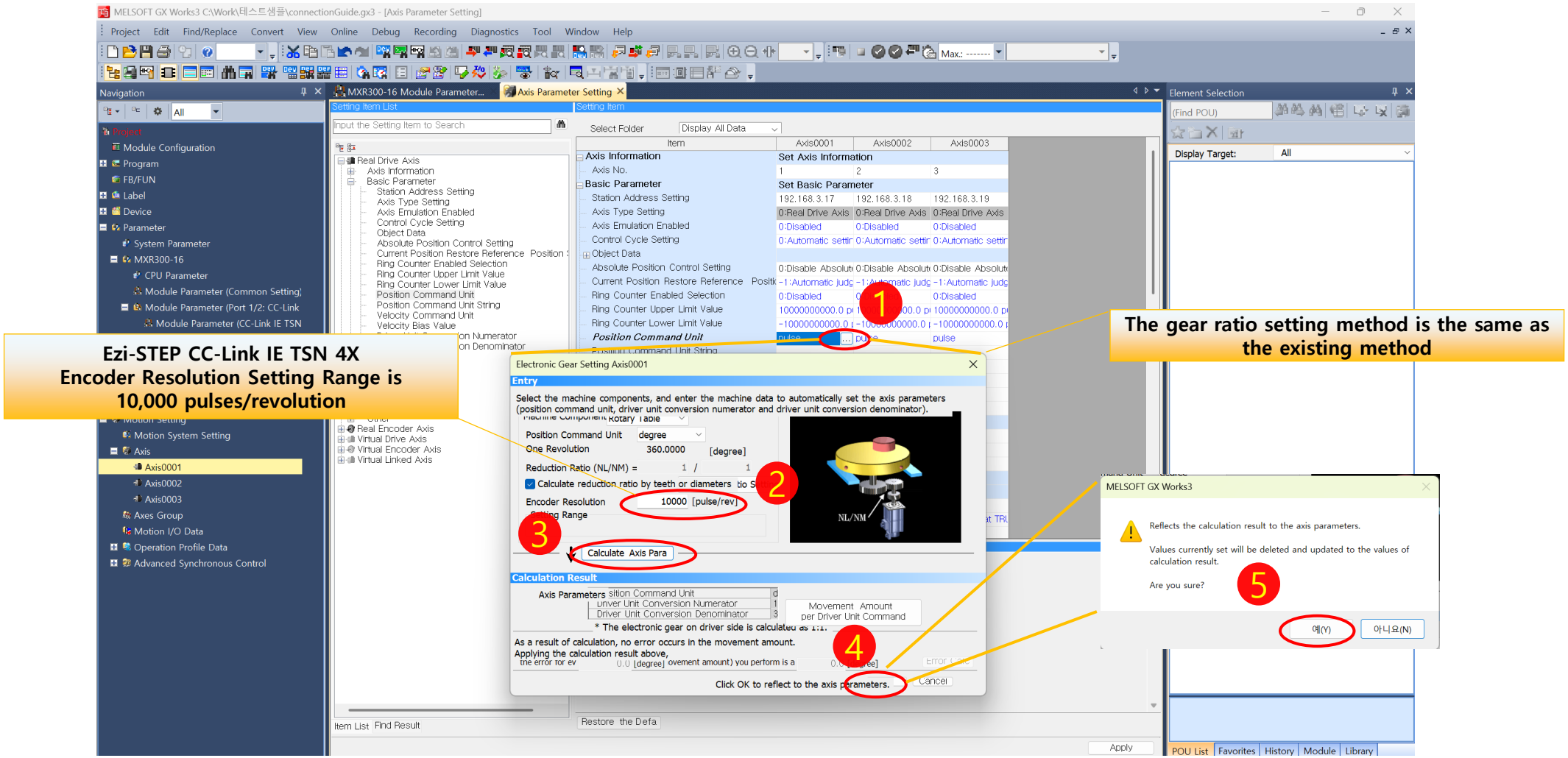
2-6. Motion Setting – Basic Parameter

- **Real Drive Axis / Basic Parameter / Absolute Position Control Setting - Disable selected**



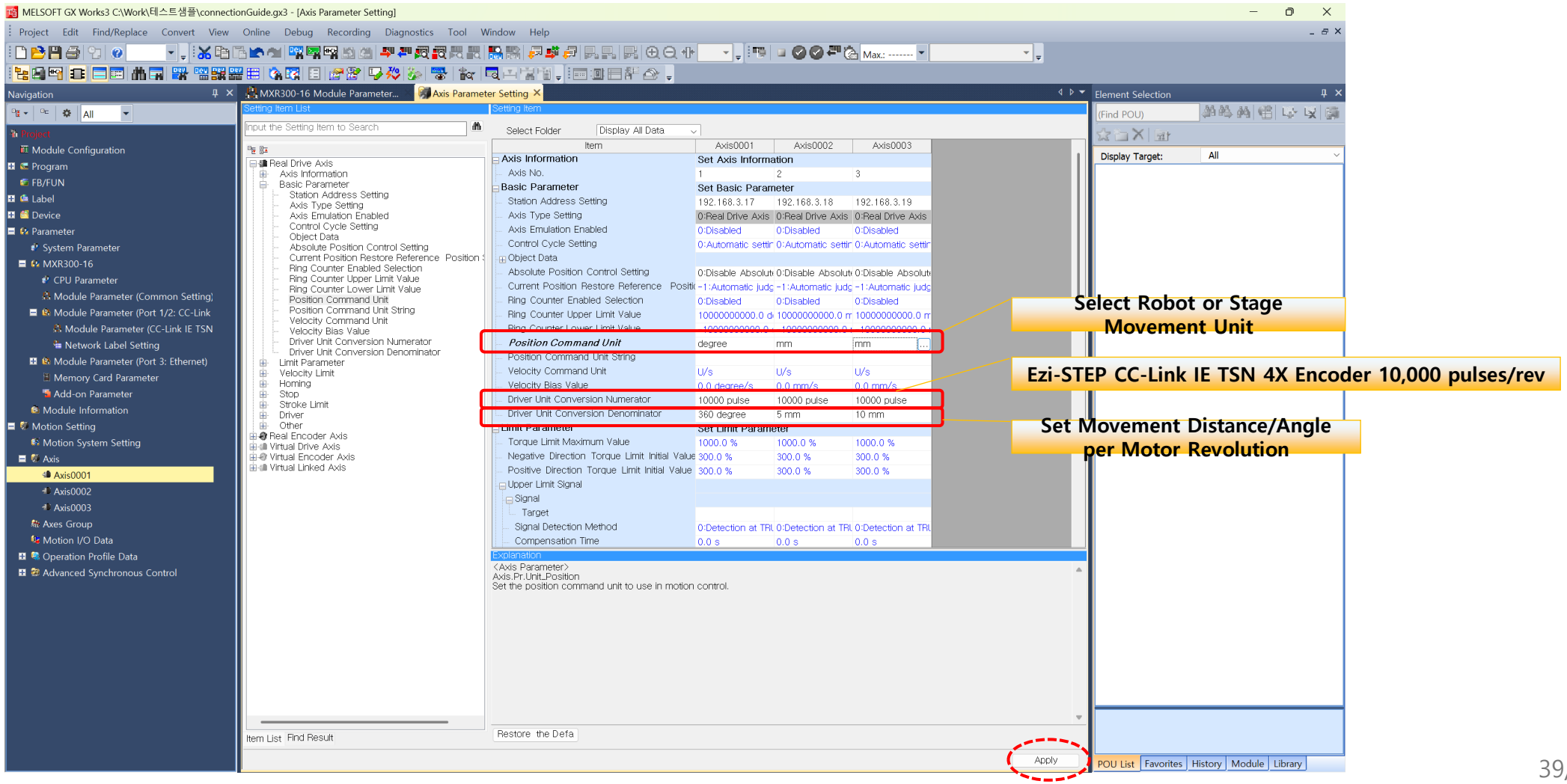
2-6. Motion Setting – Basic Parameter

- **Real Drive Axis / Basic Parameter / Position Command Unit Settings (Ezi-STEP 4X 10,000 ppr)**



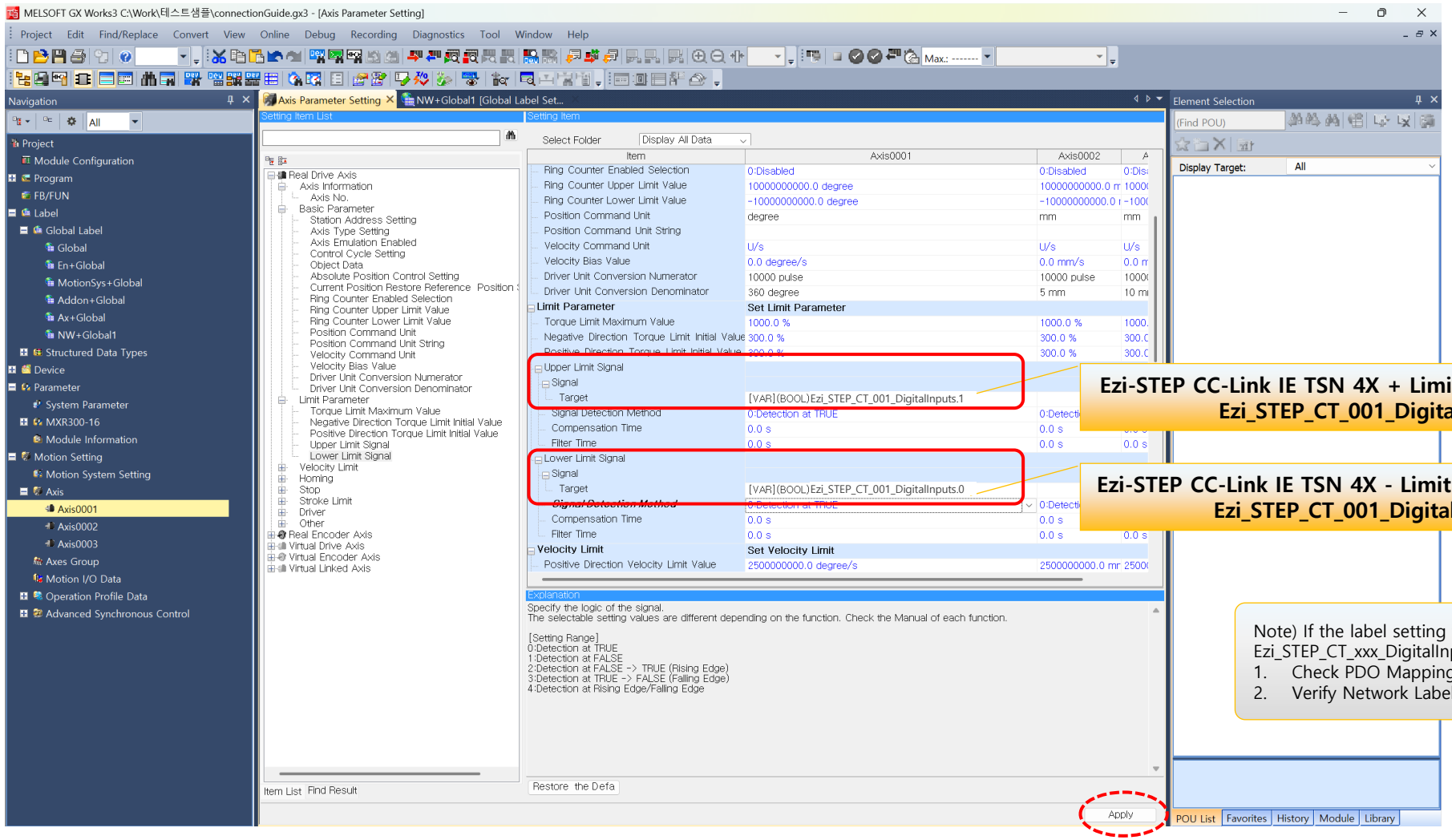
2-6. Motion Setting – Basic Parameter

- **Real Drive Axis / Basic Parameter / Position Command Unit Settings (Ezi-STEP 4X 10,000 ppr)**



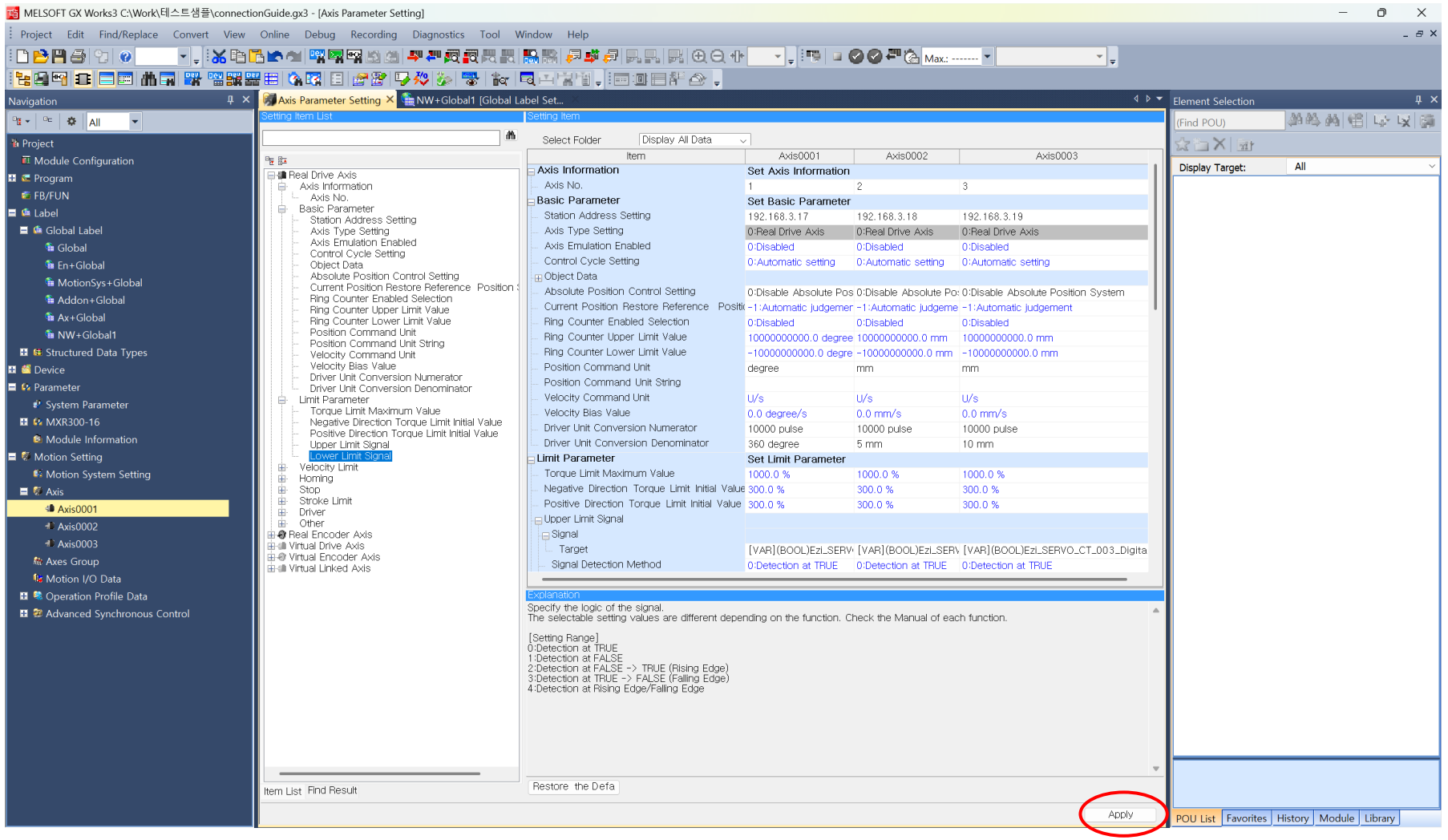
2-6. Motion Setting – Basic Parameter

- **Real Drive Axis / Basic Parameter / Limit Parameter**



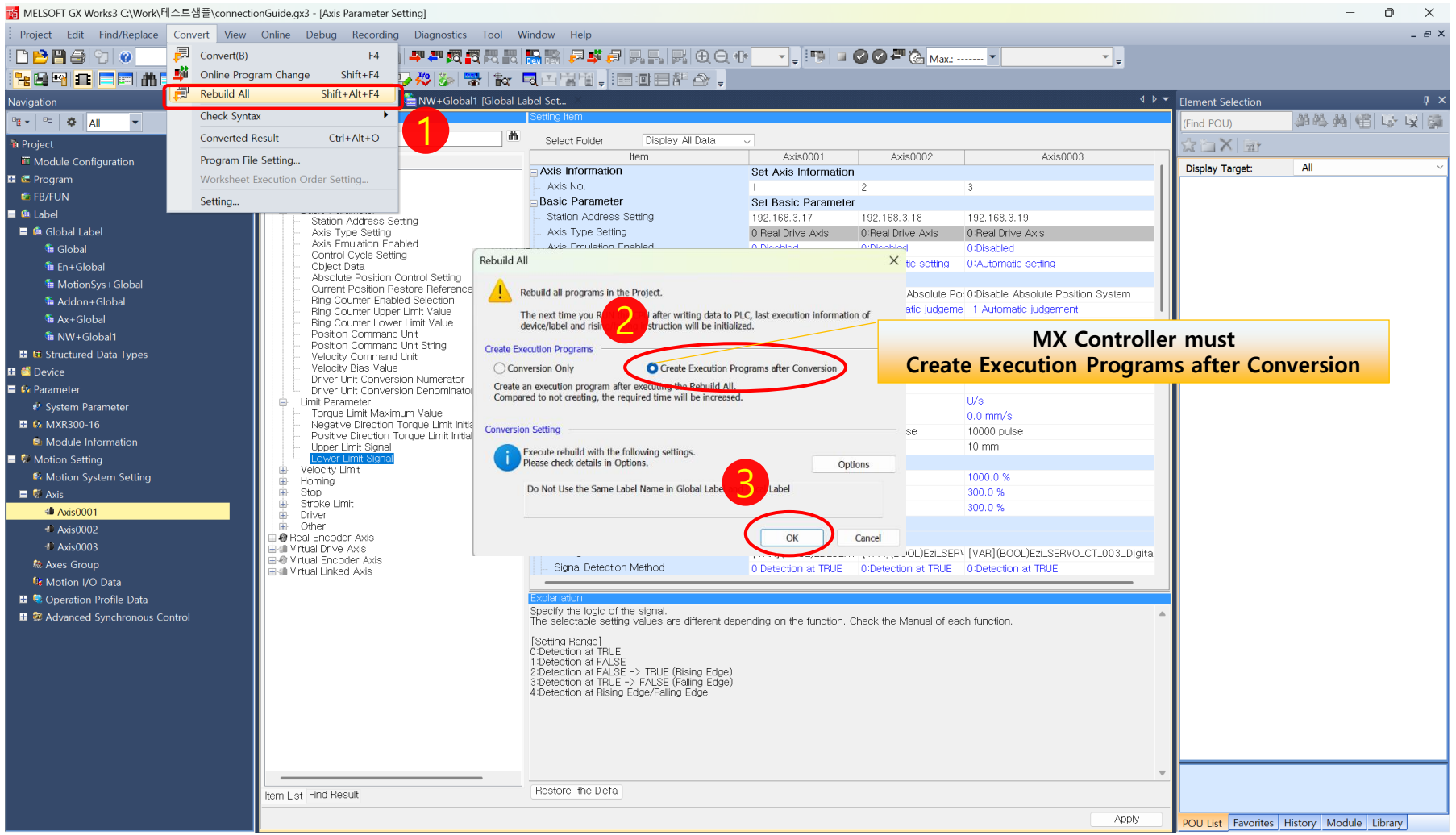
2-6. Motion Setting – Parameter Registration

- **Complete Motion Setting by registering parameters**



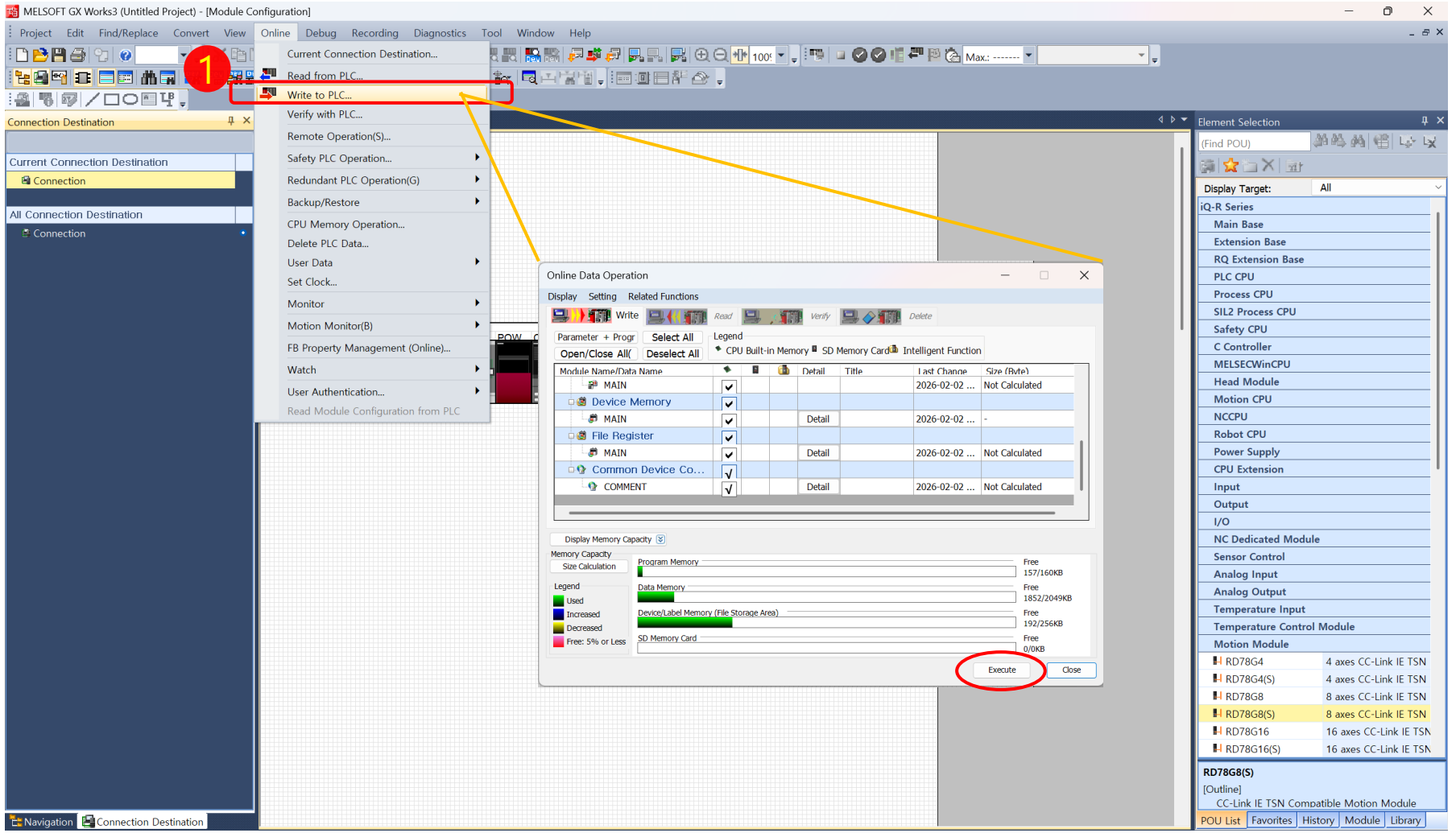
2-7. Convert

- **Regarding parameter settings, etc., "Create Execution Programs after Conversion"**



2-8. Write to PLC

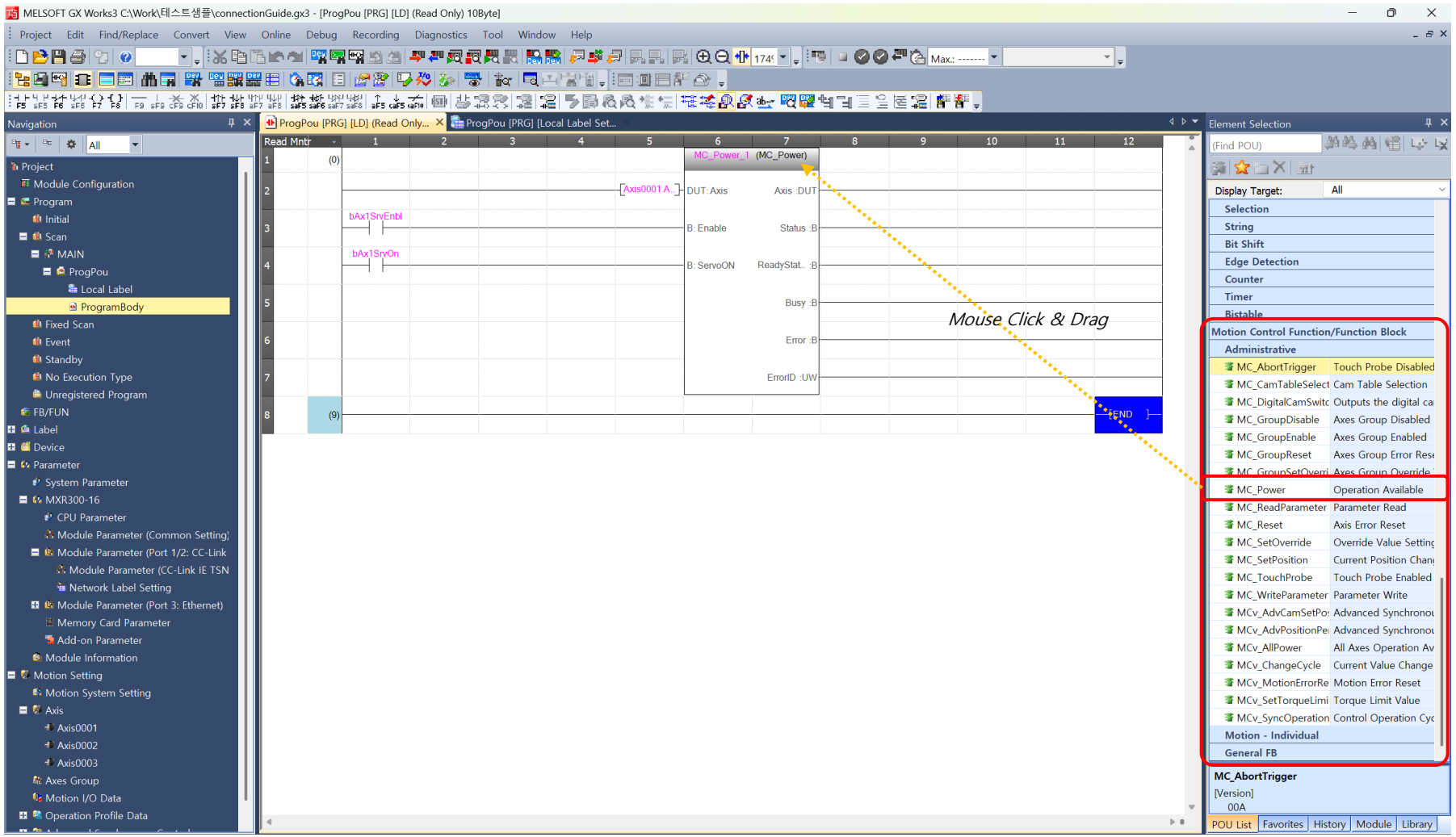
- **Online Data Operation**



3. Follow the Program

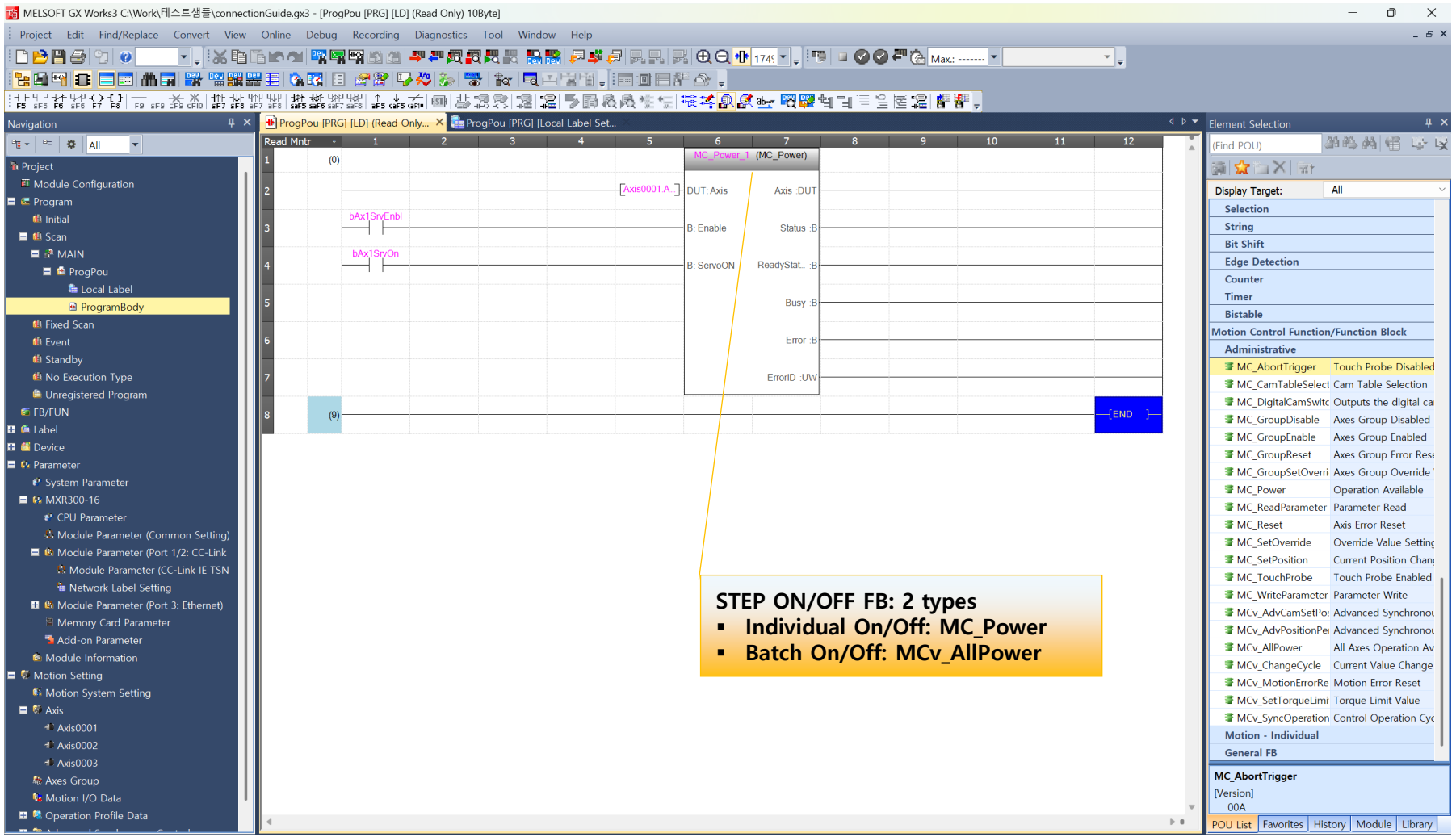
3-1. Exploring Motion Control Commands

- **Motion Control Function/Function Block Command – Element Selection (Left Menu)**



3-2. [Ladder] STEP Enable, STEP ON

- **Ezi-STEP CC-Link IE TSN 4X Enable/STEP ON Program**

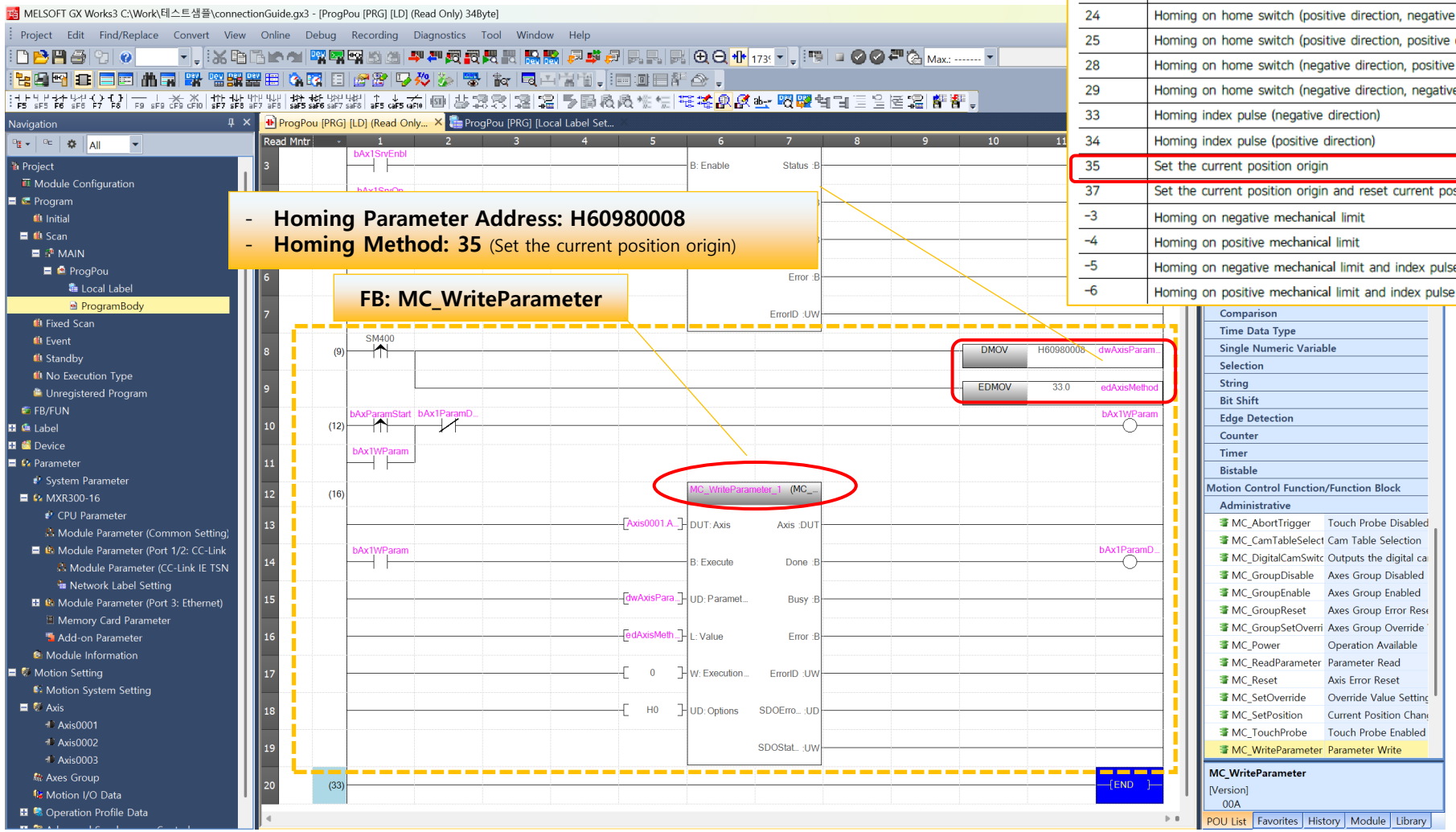


3-3. [Ladder] Specifying the homing method

- Specifying the homing method (MC_WriteParameter, 33: Homing in

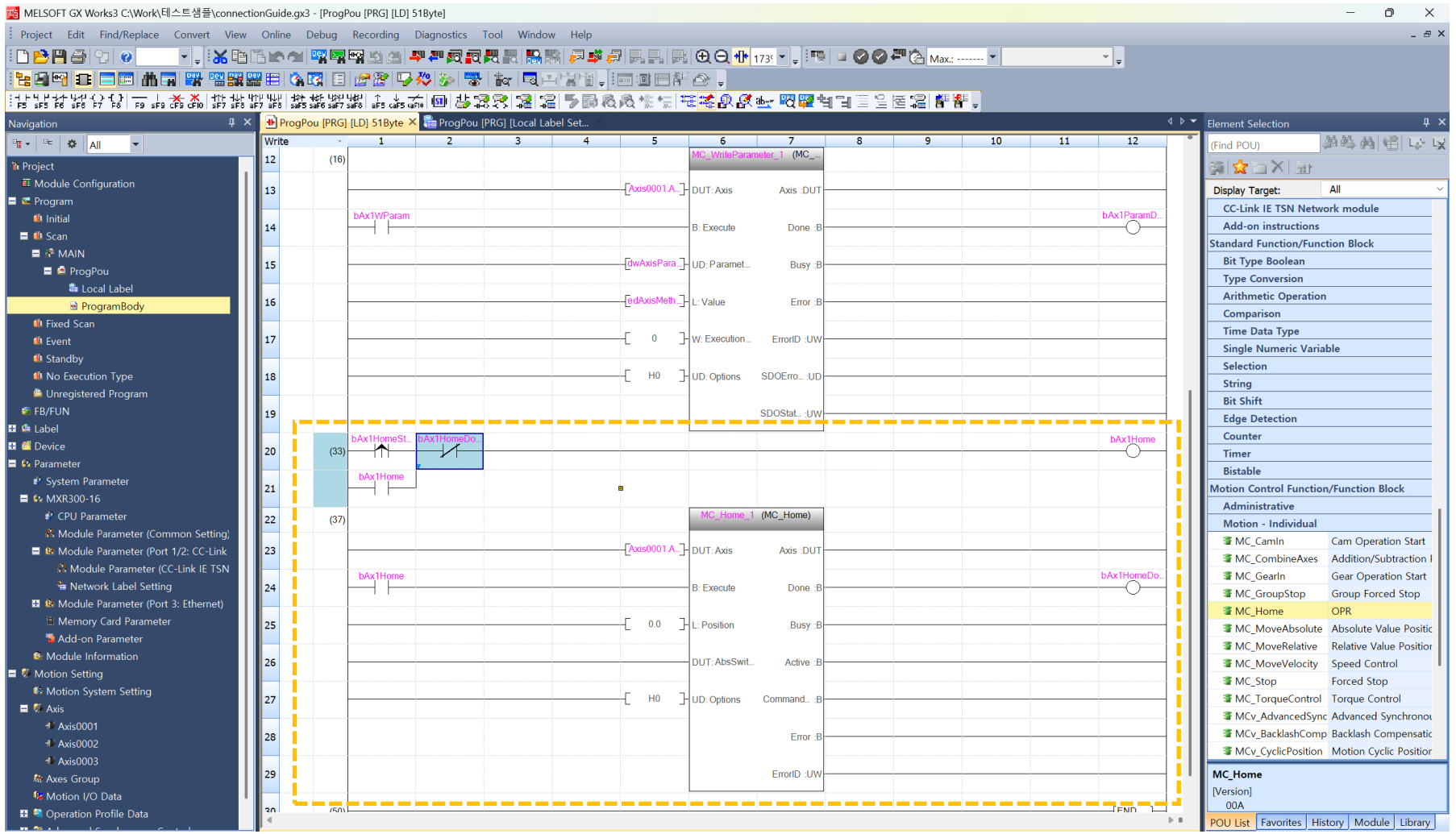
The homing method is classified as follows based on the setting value for Homing method (6098h):

설정값	내용
1	Homing on negative limit switch and index pulse
2	Homing on positive limit switch and index pulse
7	Homing on home switch (positive direction, negative edge) and index pulse
10	Homing on home switch (positive direction, positive edge) and index pulse
11	Homing on home switch (negative direction, positive edge) and index pulse
14	Homing on home switch (negative direction, negative edge) and index pulse
17	Homing on negative limit switch
18	Homing on positive limit switch
24	Homing on home switch (positive direction, negative edge)
25	Homing on home switch (positive direction, positive edge)
28	Homing on home switch (negative direction, positive edge)
29	Homing on home switch (negative direction, negative edge)
33	Homing index pulse (negative direction)
34	Homing index pulse (positive direction)
35	Set the current position origin
37	Set the current position origin and reset current position
-3	Homing on negative mechanical limit
-4	Homing on positive mechanical limit
-5	Homing on negative mechanical limit and index pulse
-6	Homing on positive mechanical limit and index pulse



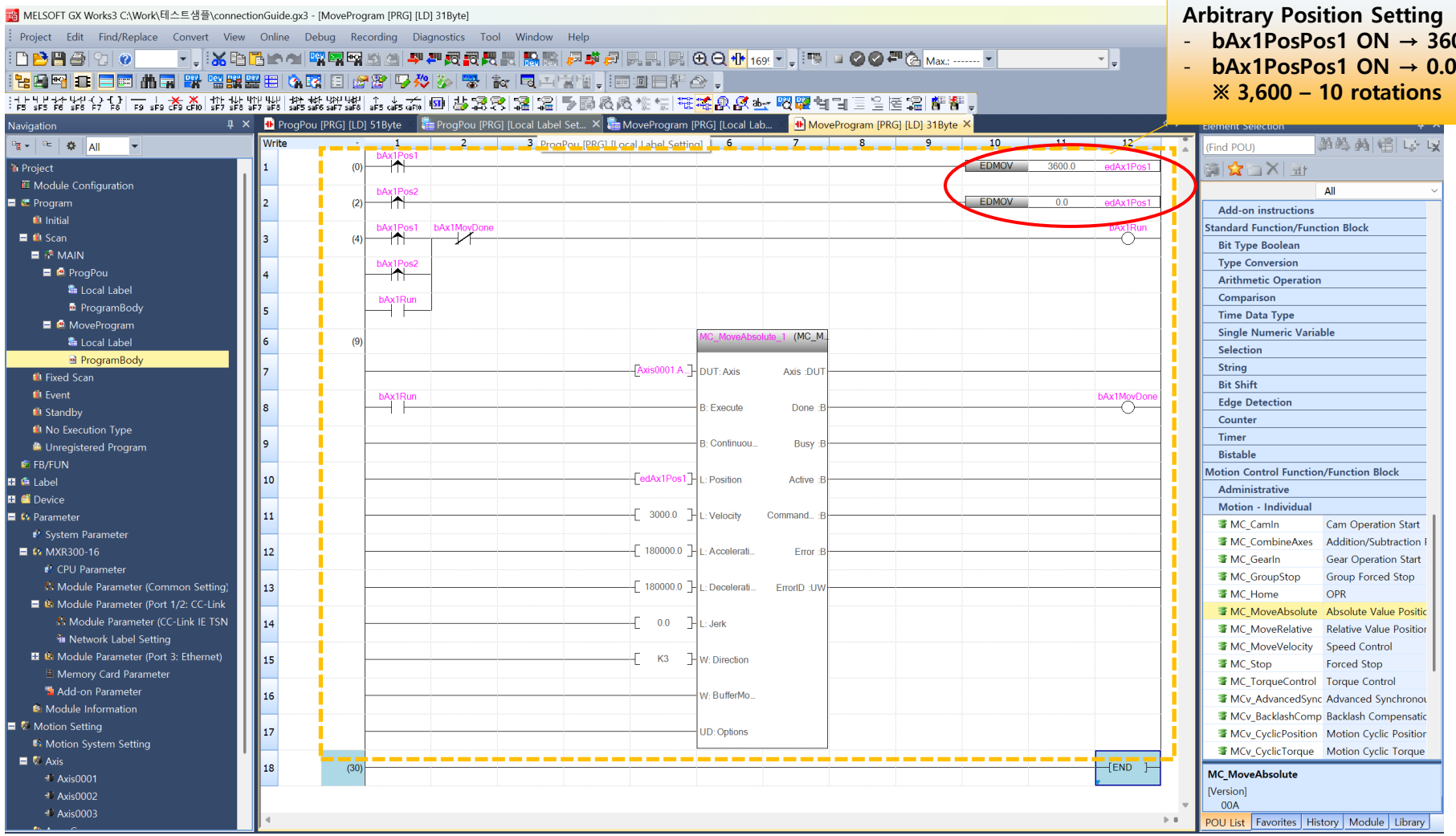
3-4. [Ladder] Execute Ezi-STEP homing

- Execute Homing (MC_Home)



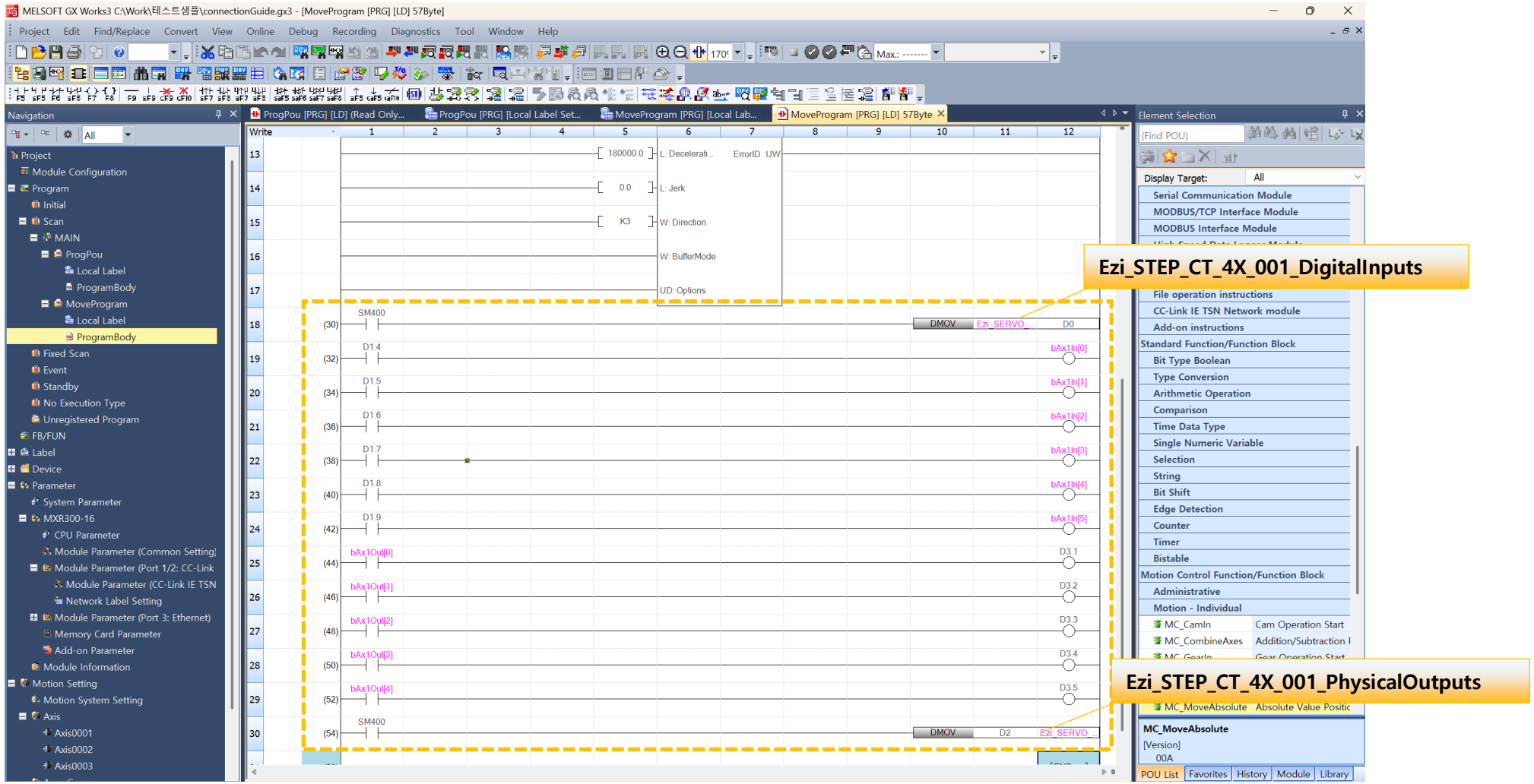
3-5. [Ladder] Execute Ezi-STEP Operation

- Execute Movement Action (MC_MoveAbsolute)



3-6. [Ladder] Ezi-STEP DIO Operation

- Digital Input, Output Operation Execution



3-6. [Ladder] Ezi-STEP DIO Map - Reference

- Digital Inputs

Bit 31	Bit 30	Bit 29	Bit 28	Bit 27	Bit 26	Bit 25	Bit 24
-	Motor Power	TQOFF2	TQOFF1	-	-	User input 6	User input 5
Bit 23	Bit 22	Bit 21	Bit 20	Bit 19	Bit 18	Bit 17	Bit 16
User input 4	User input 3	User input 2	User input 1	Reserved	Reserved	Reserved	
Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
-	-	-	-	-	-	-	-
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
-	-	-	-	-	Origin switch	Positive limit switch	Negative limit switch

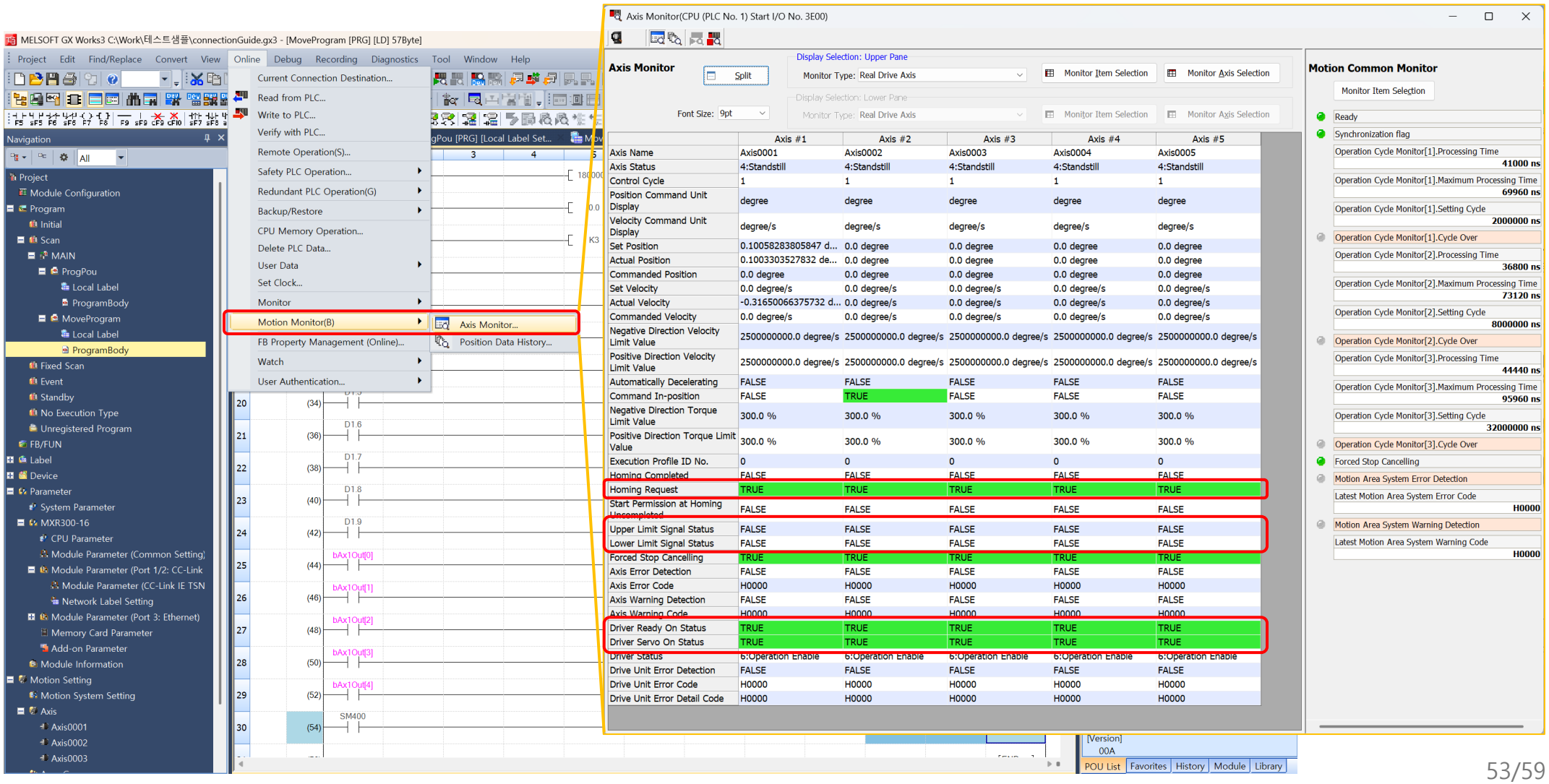
- Physical Outputs

Bit 31	Bit 30	Bit 29	Bit 28	Bit 27	Bit 26	Bit 25	Bit 24
-	-	-	-	-	-	-	-
Bit 23	Beat 22	Bit 21	Bit 20	Bit 19	Bit 18	Bit 17	Bit 16
-	-	-	User output 5	User output 4	User output 3	User output 2	User output 1
Bit 15	Bit 14	Bit 13	Beat 12	Bit 11	Bit 10	Bit 9	Bit 8
-	-	-	-	-	-	-	-
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
-	-	-	-	-	-	-	Set brake

Appendix

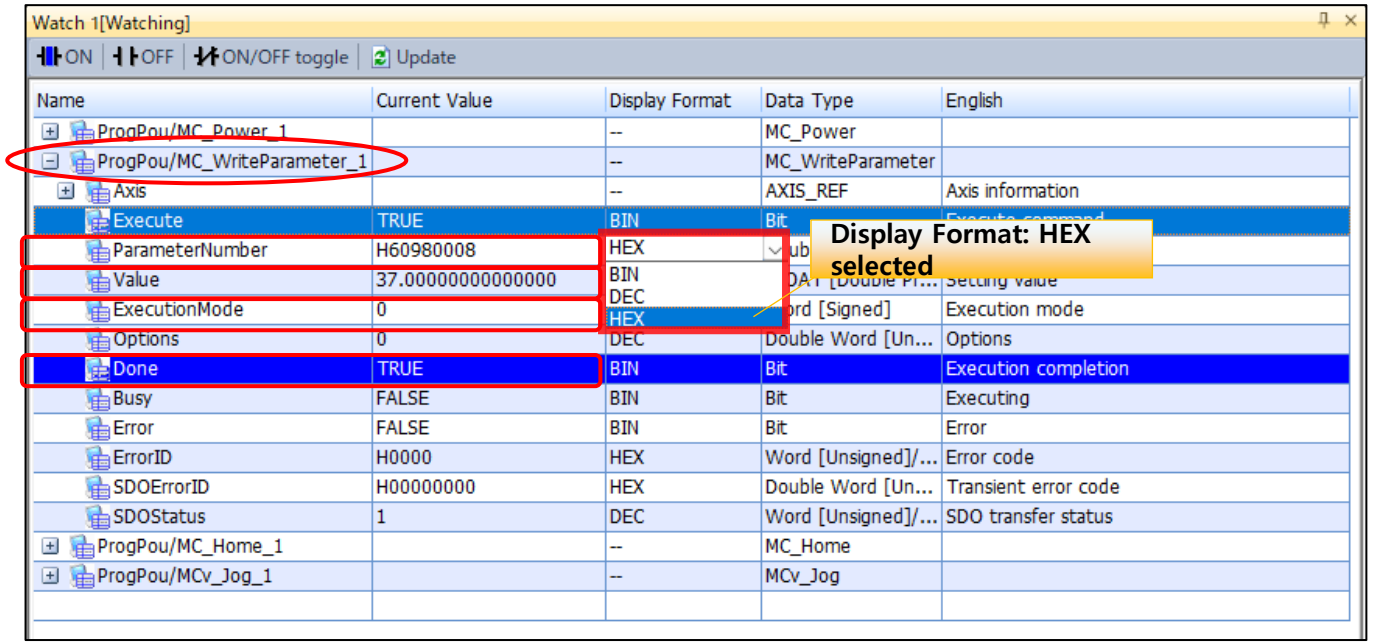
[Operation Verification] Axis Monitor

- Monitor the status, position, homing, and error of each axis.



[Operation Verification] Changing the Homing Method

- Change the homing method using Motion Control FB
  - ① Specify Parameter Number: H60980008
  - ② Value (Homing Method) Specified: 33.0
  - ③ ExecutionMode: TRUE (Write)
  - ④ Done: Becomes TRUE



The homing method is classified as follows based on the setting value for Homing method (6098h).

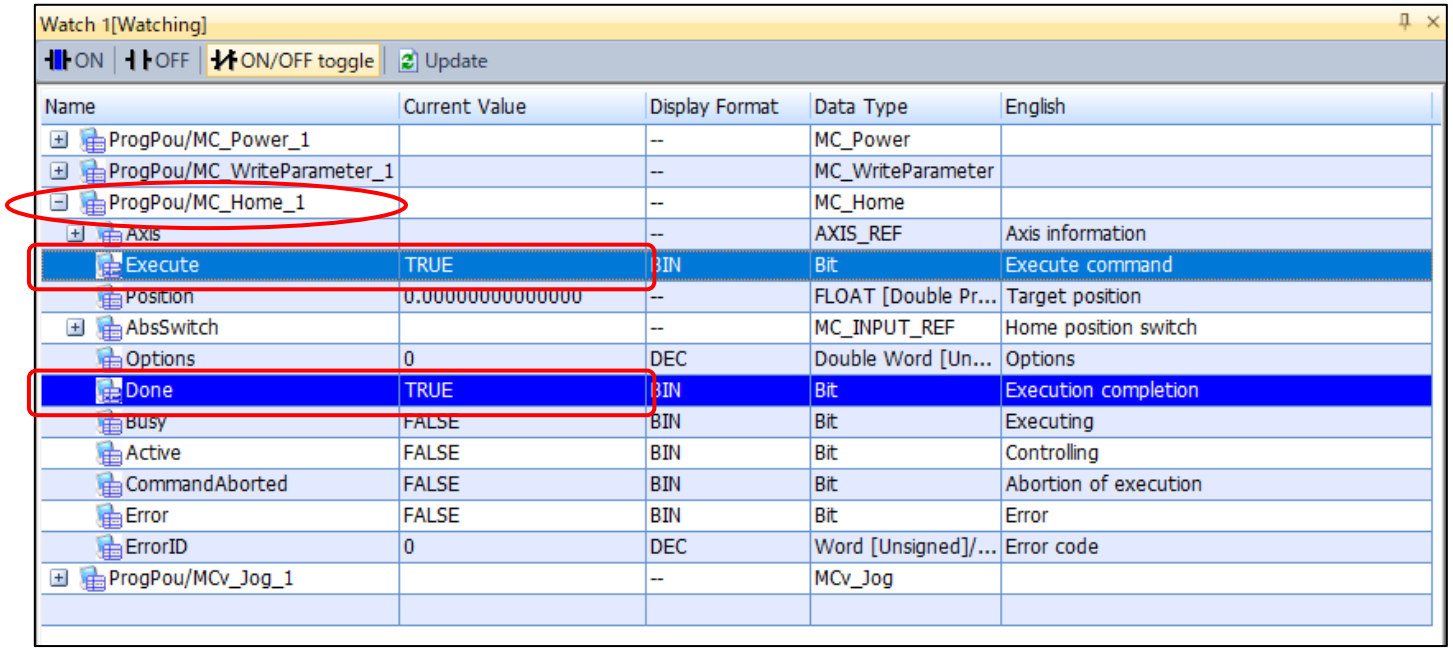
설정값	내용
1	Homing on negative limit switch and index pulse
2	Homing on positive limit switch and index pulse
7	Homing on home switch (positive direction, negative edge) and index pulse
10	Homing on home switch (positive direction, positive edge) and index pulse
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14	Homing on home switch (negative direction, negative edge) and index pulse
17	Homing on negative limit switch
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24	Homing on home switch (positive direction, negative edge)
25	Homing on home switch (positive direction, positive edge)
28	Homing on home switch (negative direction, positive edge)
29	Homing on home switch (negative direction, negative edge)
33	Homing index pulse (negative direction)
34	Homing index pulse (positive direction)
35	Set the current position origin
37	Set the current position origin and reset current position
-3	Homing on negative mechanical limit
-4	Homing on positive mechanical limit
-5	Homing on negative mechanical limit and index pulse
-6	Homing on positive mechanical limit and index pulse

[Operation Verification] Homing

- Execute homing using motion control FB

① Execute → TRUE (Write)

② Done → Becomes TRUE



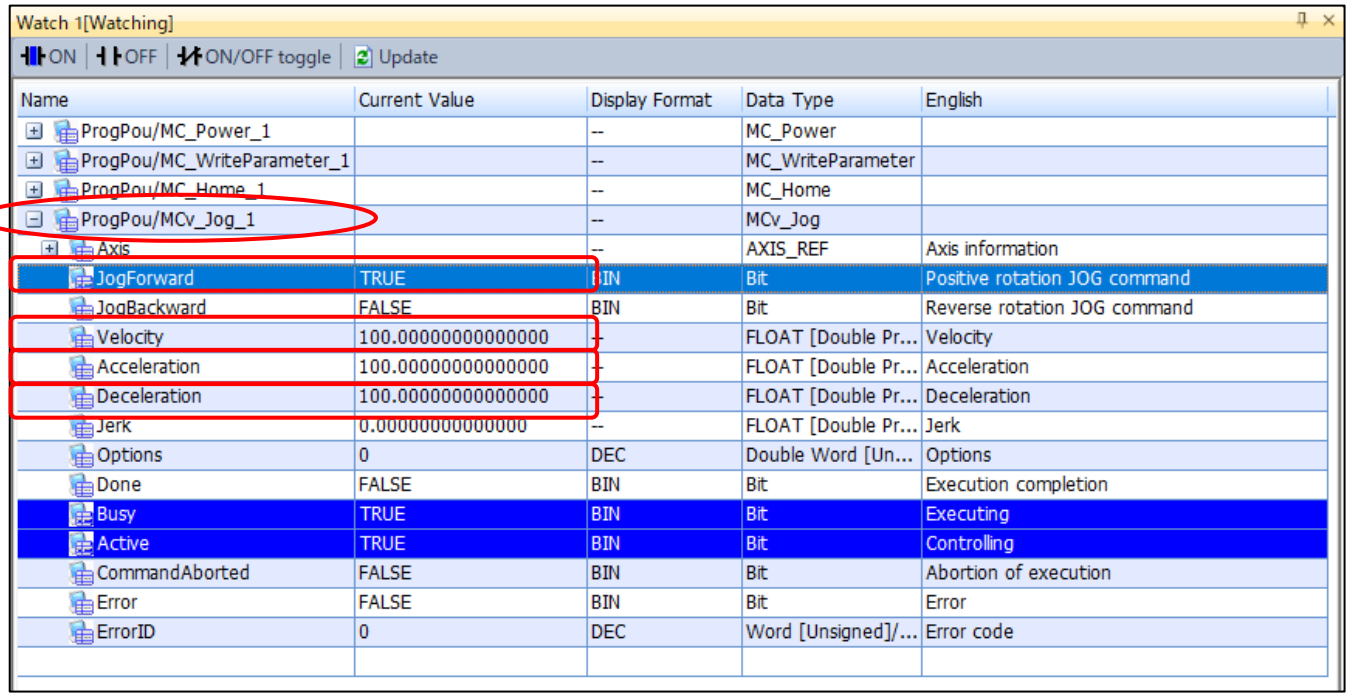
Name	Current Value	Display Format	Data Type	English
ProgPou/MC_Power_1		--	MC_Power	
ProgPou/MC_WriteParameter_1		--	MC_WriteParameter	
ProgPou/MC_Home_1		--	MC_Home	
Axis		--	AXIS_REF	Axis information
Execute	TRUE	BIN	Bit	Execute command
Position	0.0000000000000	--	FLOAT [Double Pr...	Target position
AbsSwitch		--	MC_INPUT_REF	Home position switch
Options	0	DEC	Double Word [Un...	Options
Done	TRUE	BIN	Bit	Execution completion
Busy	FALSE	BIN	Bit	Executing
Active	FALSE	BIN	Bit	Controlling
CommandAborted	FALSE	BIN	Bit	Abortion of execution
Error	FALSE	BIN	Bit	Error
ErrorID	0	DEC	Word [Unsigned]/...	Error code
ProgPou/MCv_Jog_1		--	MCv_Jog	

- When using the LIMIT+ / LIMIT− signals of the Ezi-STEP CC-Link IE TSN 4X as hardware stroke limits, set the following axis control data before startup (start).

[AxisName.Cd.HwStrokeLimit_Override] → 'DISABLE'

[Operation Verification] Jog Operation

- Execute Jog operation using Motion Control FB
  - ① Velocity → 100.0
  - ② Acceleration → 100.0
  - ③ Deceleration → 100.0
  - ④ JogForward → TRUE (Write)

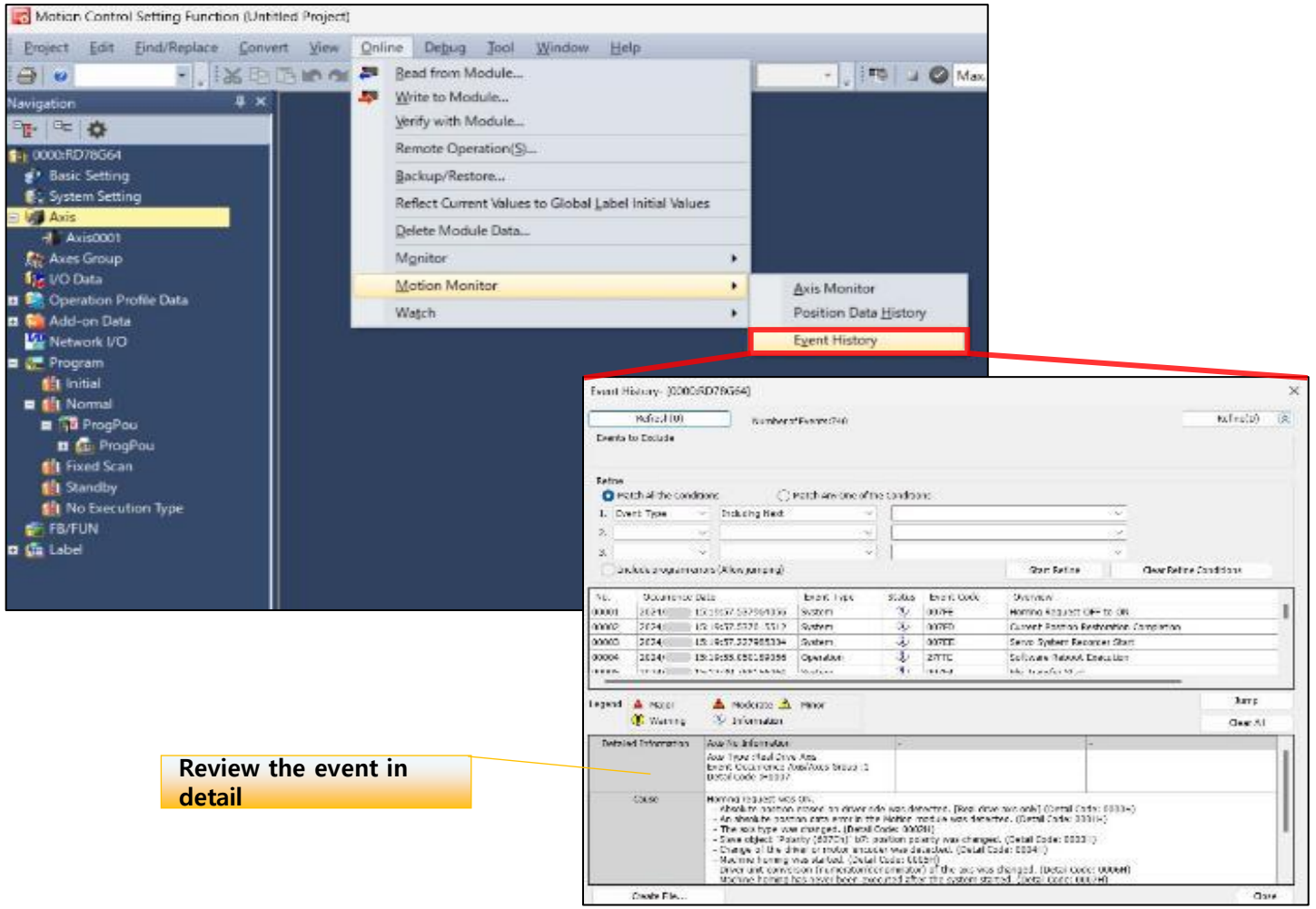


Name	Current Value	Display Format	Data Type	English
ProgPou/MC_Power_1		--	MC_Power	
ProgPou/MC_WriteParameter_1		--	MC_WriteParameter	
ProgPou/MC_Home_1		--	MC_Home	
ProgPou/MCv_Jog_1		--	MCv_Jog	
Axis		--	AXIS_REF	Axis information
JogForward	TRUE	BIN	Bit	Positive rotation JOG command
JogBackward	FALSE	BIN	Bit	Reverse rotation JOG command
Velocity	100.00000000000000	--	FLOAT [Double Pr...	Velocity
Acceleration	100.00000000000000	--	FLOAT [Double Pr...	Acceleration
Deceleration	100.00000000000000	--	FLOAT [Double Pr...	Deceleration
Jerk	0.00000000000000	--	FLOAT [Double Pr...	Jerk
Options	0	DEC	Double Word [Un...	Options
Done	FALSE	BIN	Bit	Execution completion
Busy	TRUE	BIN	Bit	Executing
Active	TRUE	BIN	Bit	Controlling
CommandAborted	FALSE	BIN	Bit	Abortion of execution
Error	FALSE	BIN	Bit	Error
ErrorID	0	DEC	Word [Unsigned]/...	Error code

[Operation Verification] Troubleshooting

- When an error occurs, check the cause in the event history (log)

  ① [Online] -> [Motion Monitor] -> [Event History]



[Operation Verification] Troubleshooting

- If **"SLMP Communication Error" (1C43h)** occurs

  → Please set the object data by referring to the axis parameters.

- If the **"Warning: Connection settings error for drive unit other than MELSERVO" (0D4Ch)** occurs

  → Refer to the axis parameters and disable the Absolute position system.

- If **"Control Mode Switching Error" (1A1Dh)** occurs when **starting MC_Home**

  → In the network configuration settings (add driver),

  Set Network Synchronous Communication to **"Synchronous"**.

- When starting MC_Home using the driver's **LIMIT+ / –** signals, it detects upper/lower limit signals and stops

  → Set [AxisName.Cd.HwStrokeLimit_Override] to 'DISABLE' and configure the axis control data in the program, etc.

[Parameter] Homing Parameter Settings

- Various settings related to homing are performed on the following object
  - Use MC_WriteParameter to write the setting values.
  - For detailed information on each object, refer to the Ezi-STEP CC-Link IE TSN 4X Manual.

Object Name	Index: Subindex	Setting Details
Home Offset	**Obj.607C: 00h**	**Difference between the zero position of the machine coordinate system and the homing position**
Homing method	**Obj.6098: 00h**	**Homing method**
Homing speeds	**Obj.6099: 01h**	**Homing speeds**
Homing speeds	**Obj.6099: 02h**	**Cliff speed during homing**
Homing acceleration	**Obj.609A: 00h**	**Acceleration during homing**

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