



# EtherCAT communication for MR-J4-TM Servo drive using Omron NJ PLC

Version 1.0

# Quick Start Guide

A stylized illustration of a person in a running pose, moving from left to right. A dotted line follows the person's path, ending in an arrow that points to a button labeled "START". A mouse cursor icon is positioned over the "START" button.

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## Disclaimer

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## Further Reading Reference List

MELSERVO-J4 Servo MR-J4-A-TM Amplifier Instruction Manual (EtherCAT) SH(NA)030208

MELSERVO-J4 Servo MR-J4-A-TM Amplifier Instruction Manual SH(NA)030193

MR-J4 Servo Amplifier Instruction Manual (Troubleshooting) SH(NA)030109

MELSERVO Servo Motor Instruction Manual (Vol. 3) (Note 1) SH(NA)030113

MELSERVO Linear Servo Motor Instruction Manual (Note 2) SH(NA)030110

MELSERVO Direct Drive Motor Instruction Manual (Note 3) SH(NA)030112

MELSERVO Linear Encoder Instruction Manual (Note 2, 4) SH(NA)030111

EMC Installation Guidelines IB(NA)67310

Note 1. It is necessary for using a rotary servo motor.

2. It is necessary for using a linear servo motor.

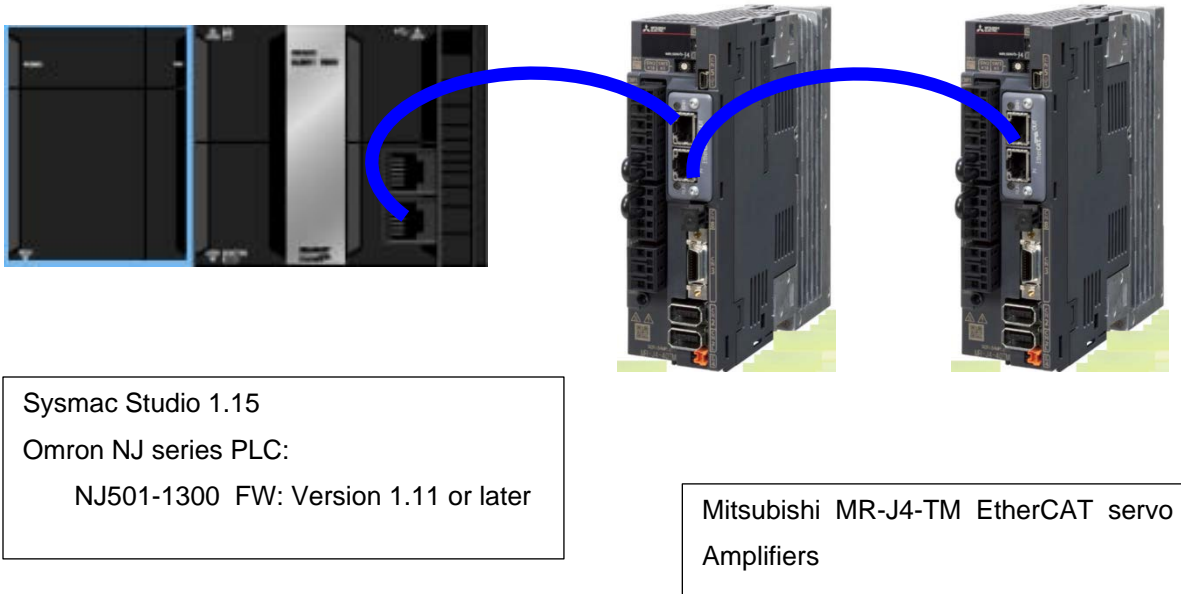
3. It is necessary for using a direct drive motor.

4. It is necessary for using a fully closed loop system.

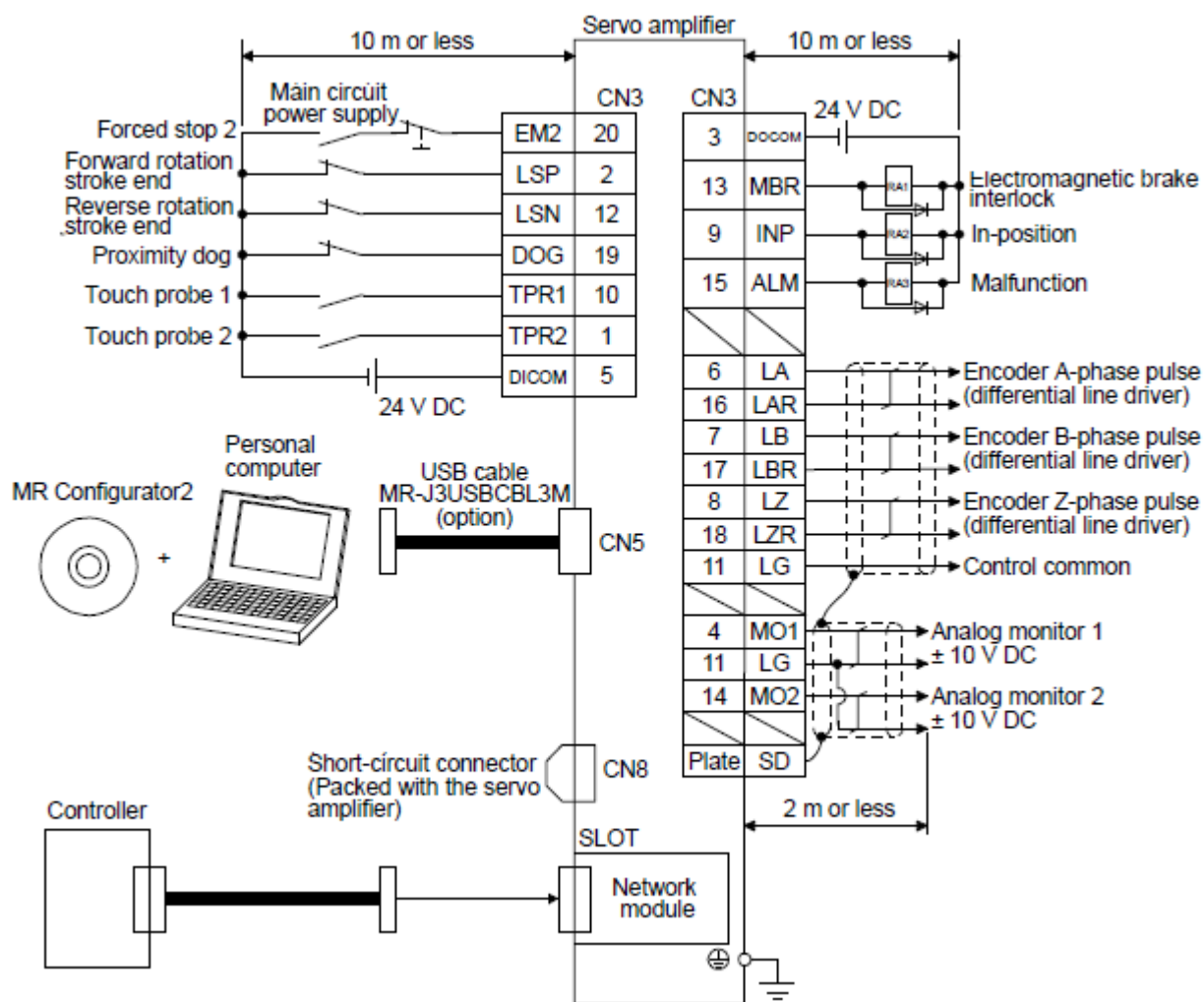
## Chapter 1 Introduction

This document describes the details setup procedure to run a MR-J4-TM EtherCAT (CoE) Servo Amplifier using Omron NJ series PLC. The MR-J4-TM servo amplifier supports as a slave station compliant with CANOpen application protocol over EtherCAT (CoE) standards and supported various control mode which is compatible with the CiA 402 drive profile. MR-J4-TM servo amplifier can operate rotary servo motors, linear servo motors, and direct drive motors as well as third party motor.

An example of the typical system connection is shown in the Figure below:

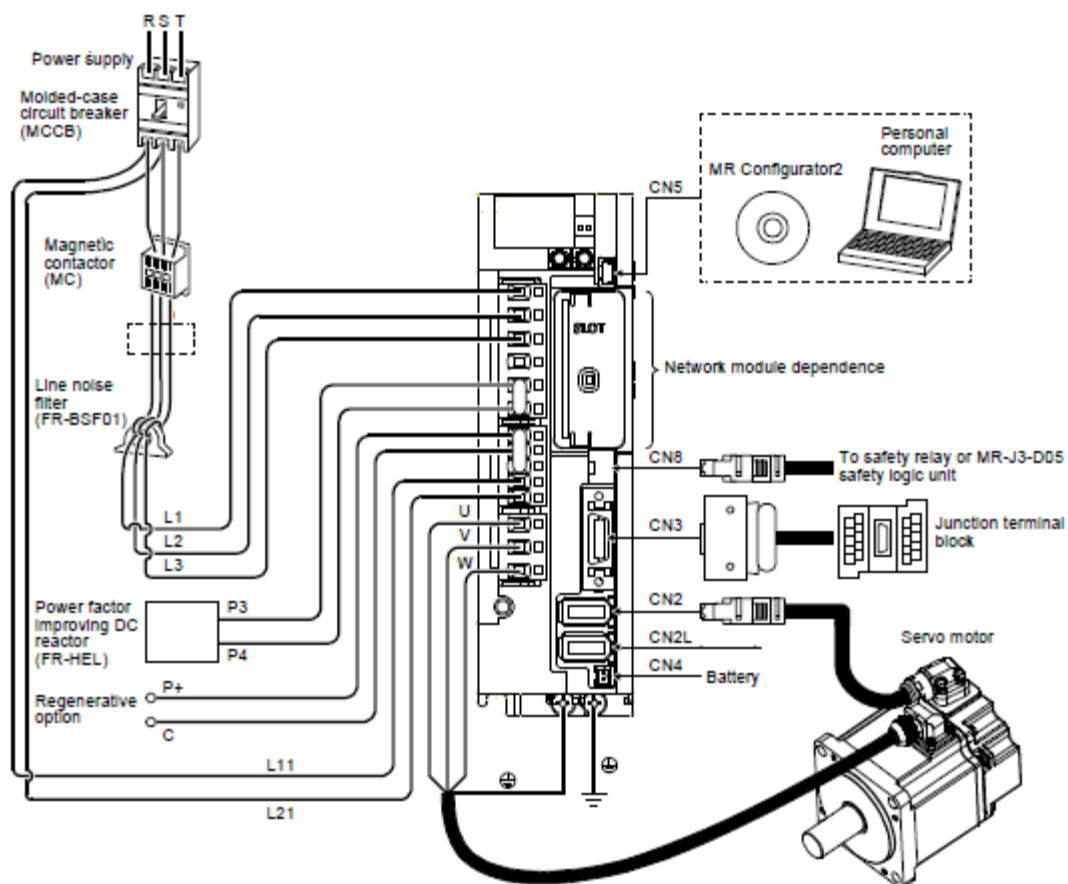


The below picture is shown an example of sink I/O signal connection of MR-J4-TM



Note: user can omit the I/O wiring by using servo parameter setting

The following system configuration shows an example using MR-J4-200TM or less



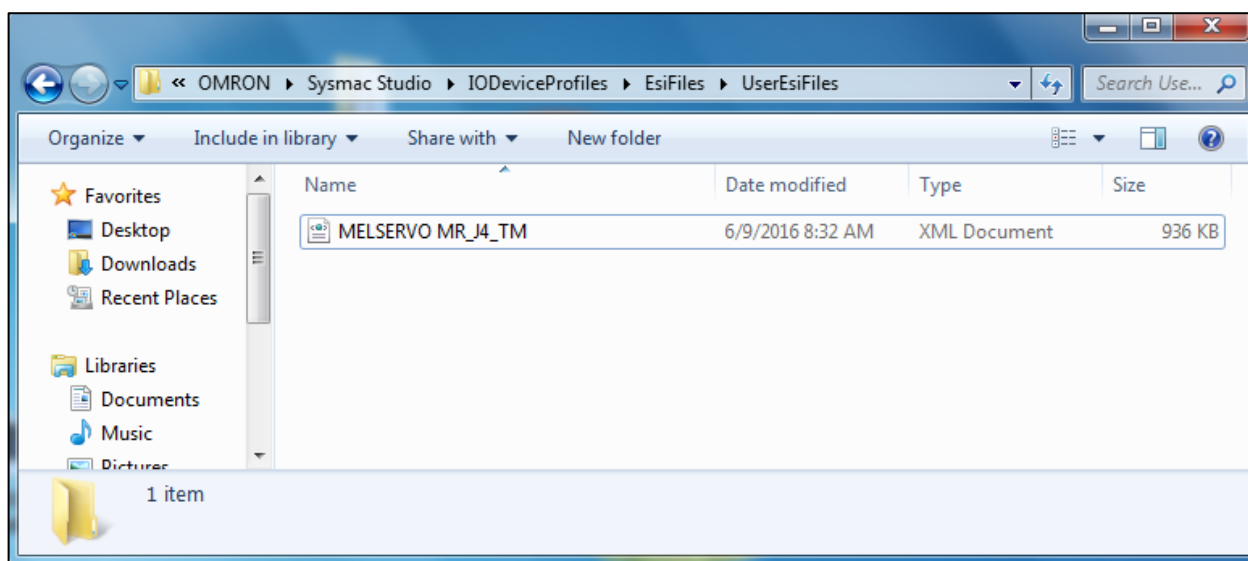
## Chapter 2 Preparation

Assumed user has a PC with installed Sysmac Studio version 1.15. Use the Sysmac Studio to set the EtherCAT slave node address for MR-J4-TM servo amplifier. By default the station alias address of MR-J4-TM is zero. Before establish the communication need to be set the slave node address by Sysmac Studio.

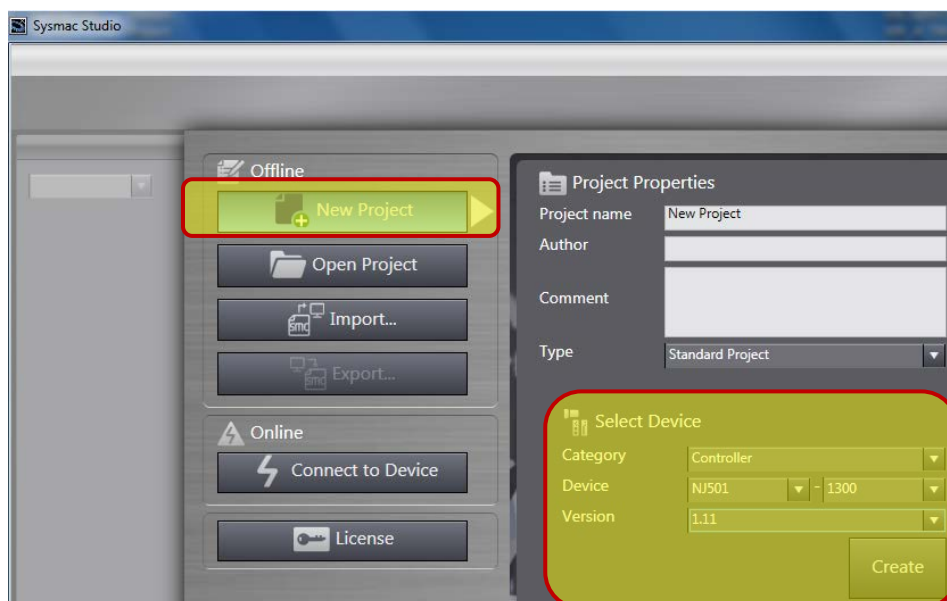
### 2.1 Slave address setting

Assumed Servo amplifier and motor wired properly, Servo amplifier power is ON and Ethernet cable is connected between the servo amps and built-in EtherCAT port on NJ Series PLC. Please see the following step.

- 1) Copy the ESI file in XML format file into the folder directory→ [C:\Program Files\OMRON\Sysmac Studio\IODeviceProfiles\EsiFiles\UserEsiFiles See image below for reference.

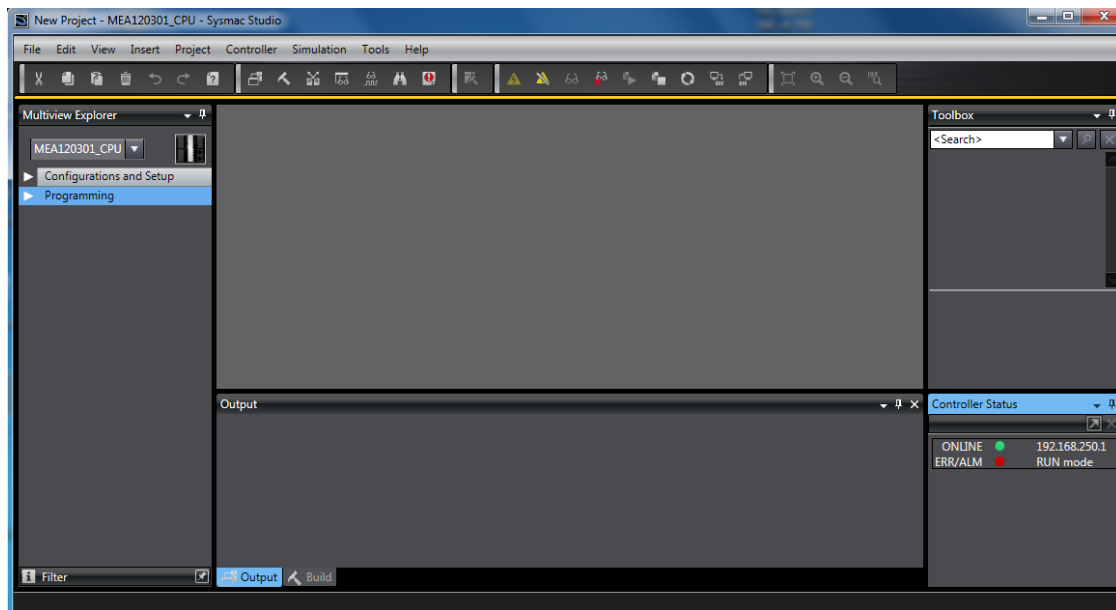


- 2) Start the Sysmac Studio and create a new project with controller and firmware version setting

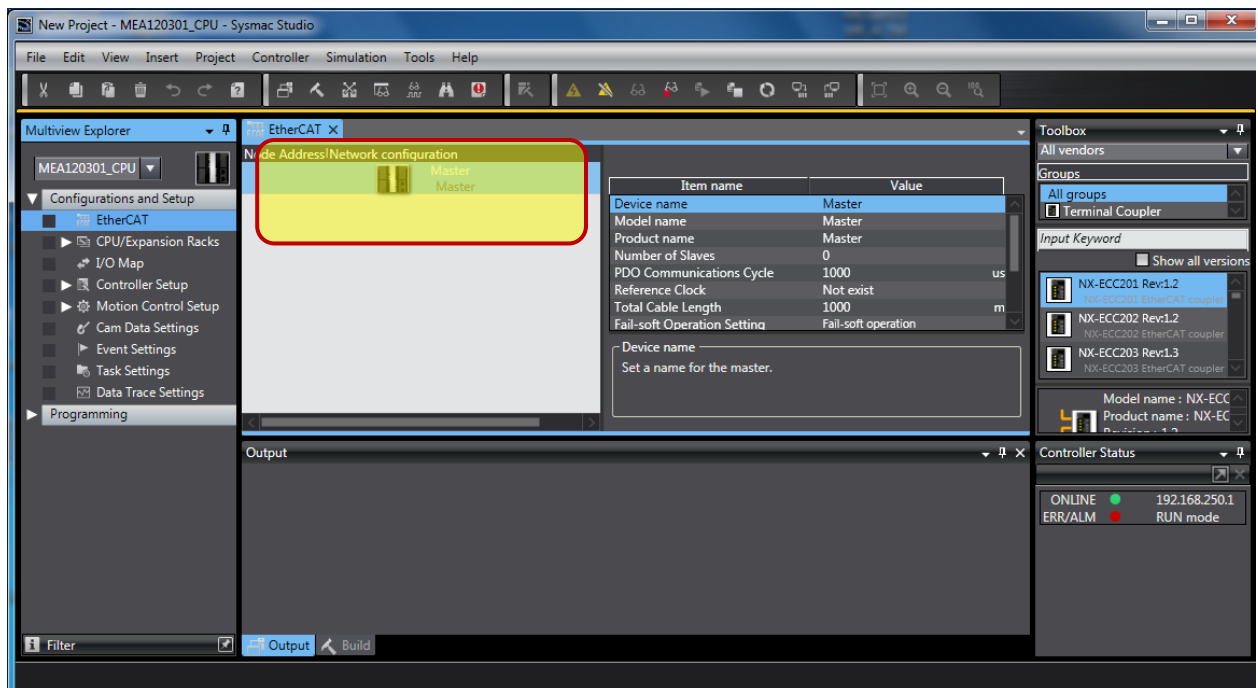




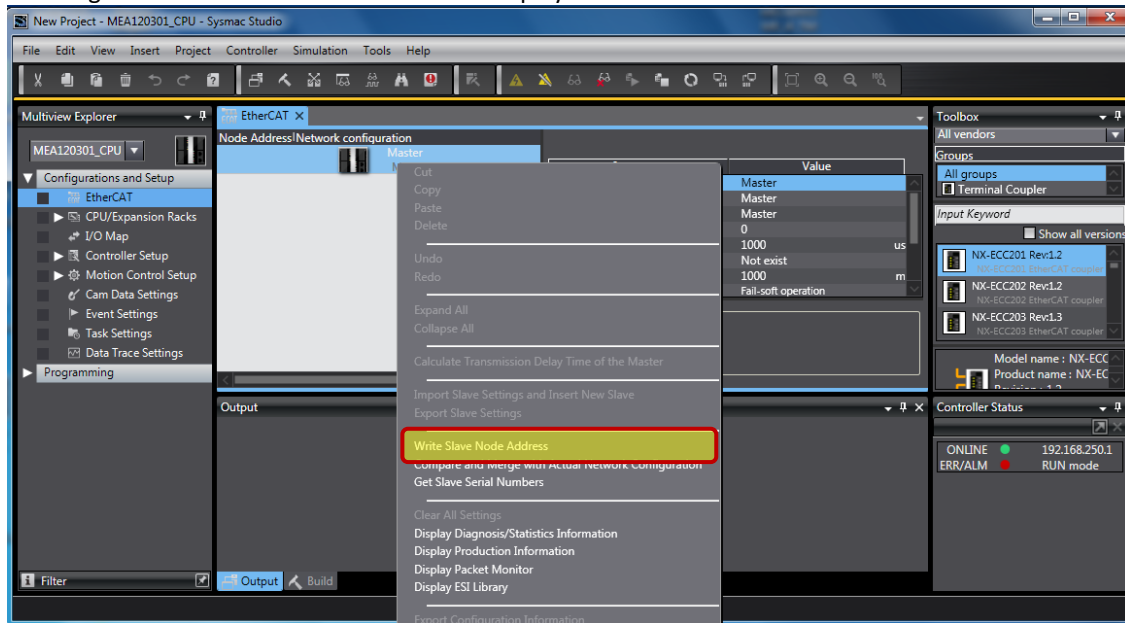
3) go online with the Controller



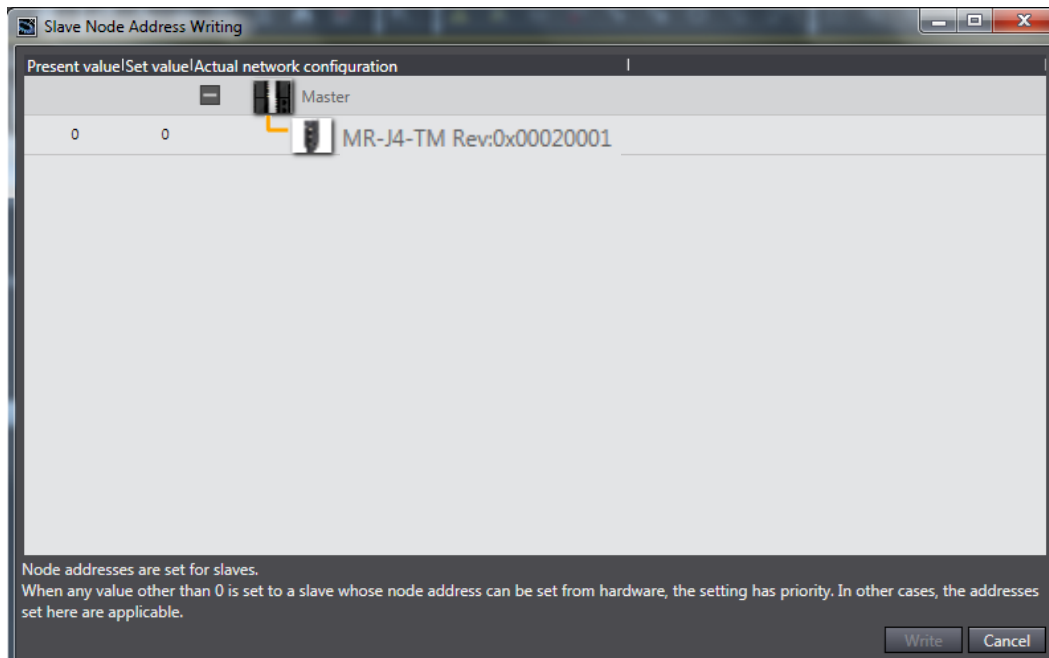
4) Double-click on [EtherCAT] under Configurations and Setups on the Multiview Explorer



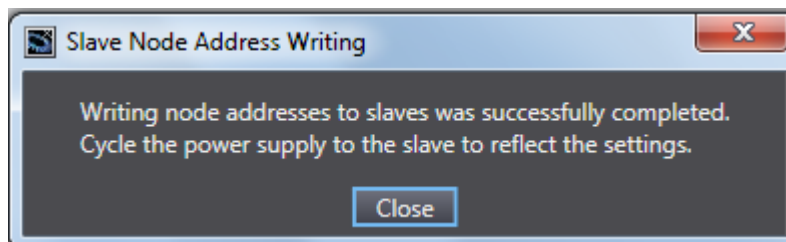
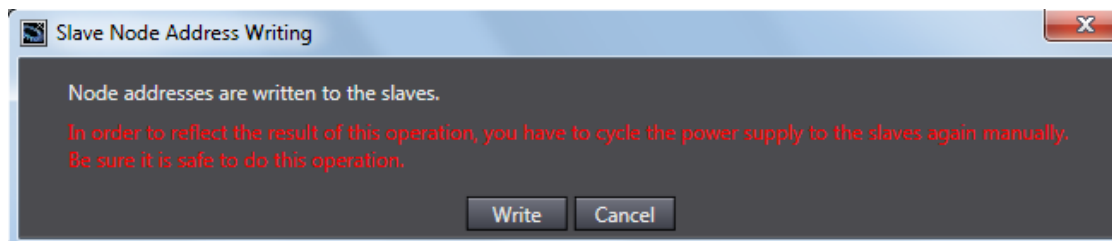
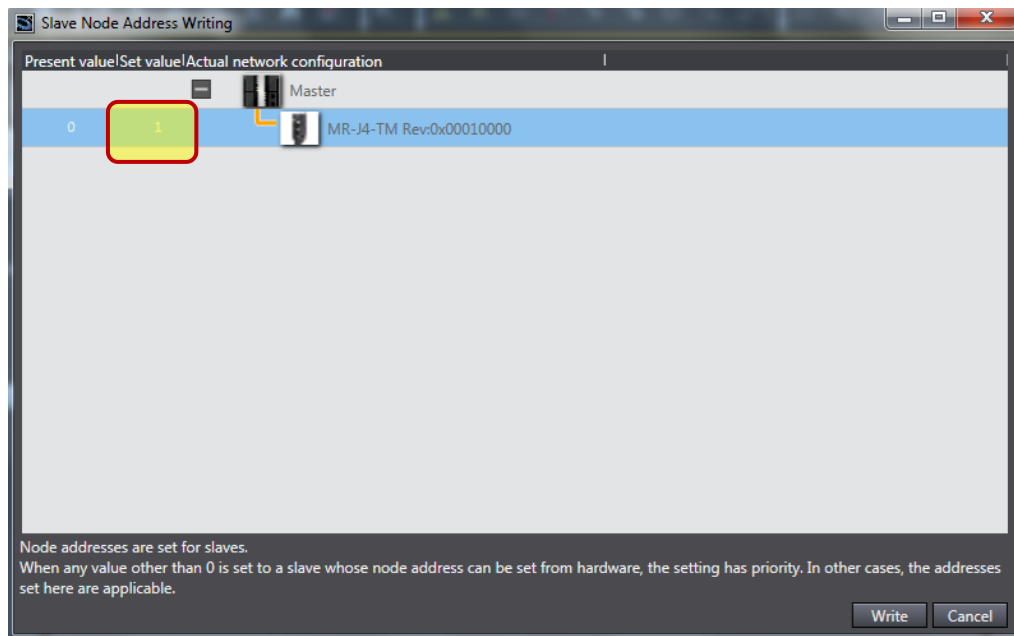
- 5) Then Right-click the EtherCAT master that is displayed in the Edit Pane and select **Write Slave Node Address**.



- 6) The Slave Node Address Writing Dialog Box is displayed. If there are slaves for which the node address is not set (i.e., for which the present value is 0) or if there is more than one slave with the same node address (indicated by “!”), change the set values of the slave addresses.



- 7) Change the slave address and then click the **Write Button**

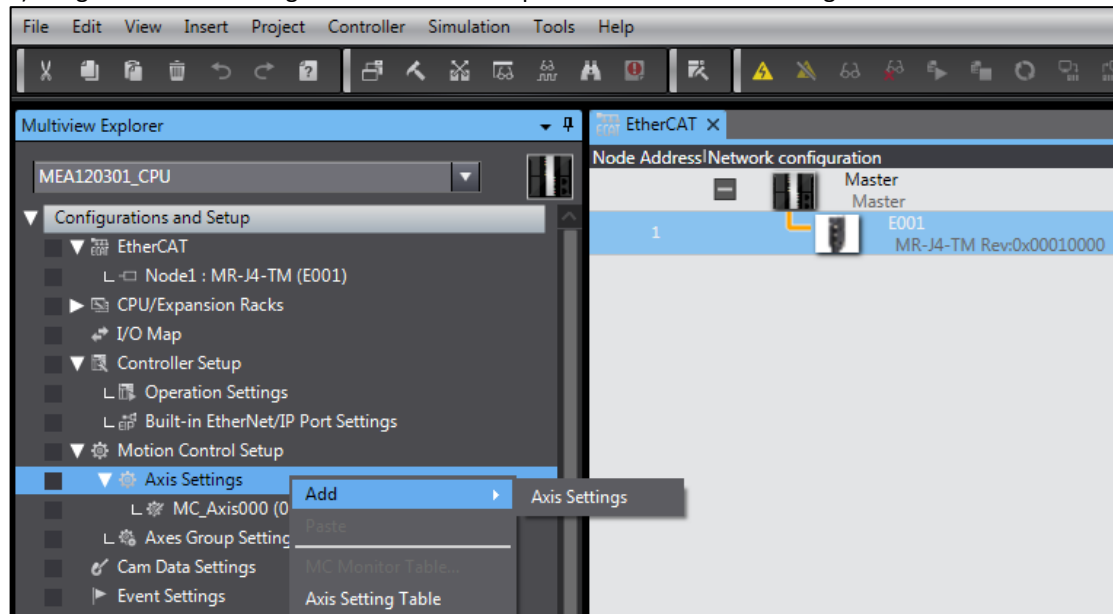


- 8) Then click Close. You may need to connect one amplifier at a time to change the slave node address.

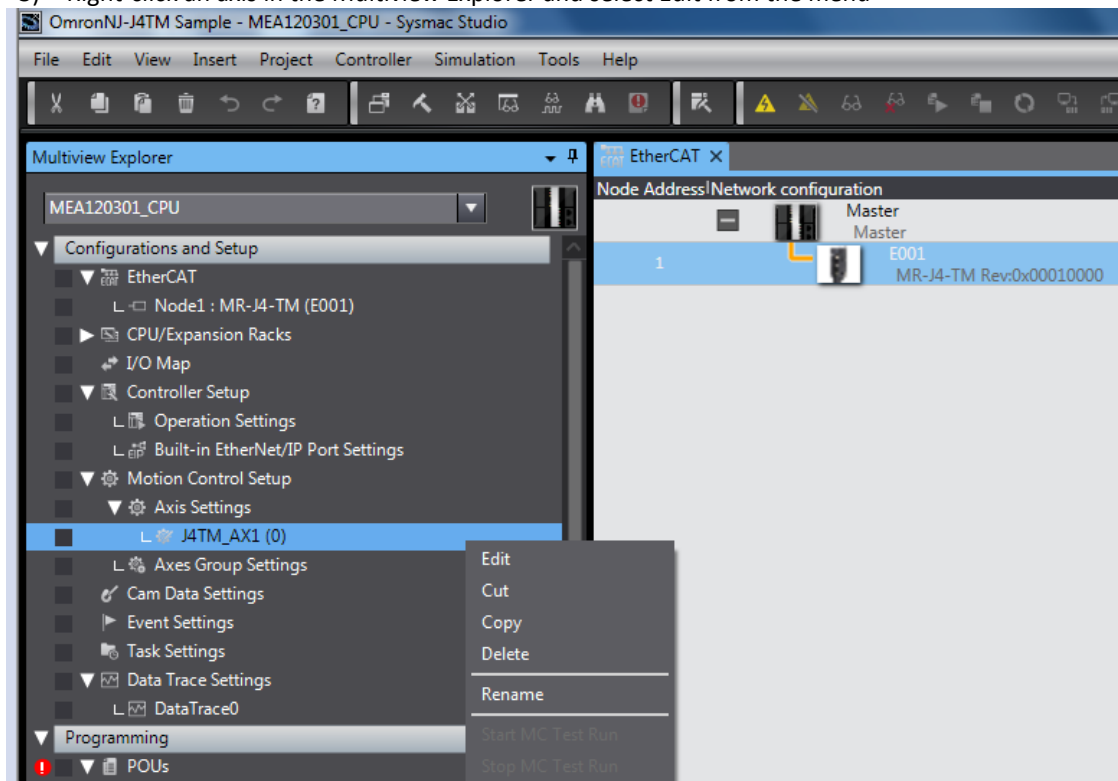
## 2.2 Configuring Axes

In this section shows how to add MR-J4-TM servo and configure as motion control axis.

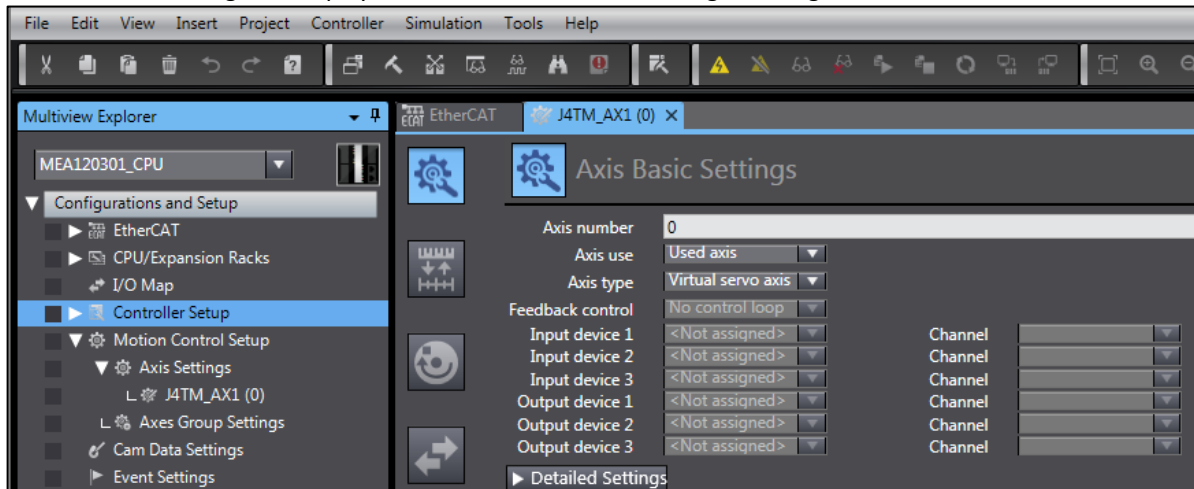
- 1) Right-click Axis Settings in the Multiview Explorer and select Axis Settings from the Add Menu.



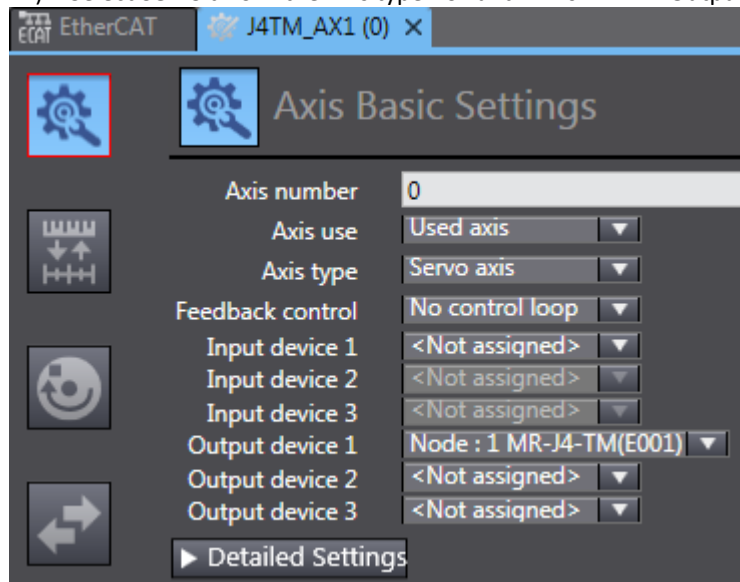
- 2) Rename the Axis to J4TM\_AX1 which will be use in the program.
- 3) Right-click an axis in the Multiview Explorer and select Edit from the menu



The Axis Basic Settings are displayed in the Axis Parameter Settings Tab Page.



4) Select **Servo axis** in the Axis type Box and **MR-J4-TM** in Output Device1



5) Click on [ Detailed setting] and choose the PDO Input and output mapping

The following picture shows output PDO mapping from controller to MR-J4-TM

▼ Detailed Settings			
Reset to Default			
	Function Name	Device	Process Data
-	Output (Controller to Device)		
★ 1.	Controlword	Node : 1 MR-J4-TM(E001)	6040h-00.0(Receive PDO Mapping_Controlword_6040_00)
★ 3.	Target position	Node : 1 MR-J4-TM(E001)	607Ah-00.0(Receive PDO Mapping_Target position_607A_00)
5.	Target velocity	Node : 1 MR-J4-TM(E001)	60FFh-00.0(Receive PDO Mapping_Target velocity_60FF_00)
7.	Target torque	Node : 1 MR-J4-TM(E001)	6071h-00.0(Receive PDO Mapping_Target torque_6071_00)
9.	Max profile Velocity	Node : 1 MR-J4-TM(E001)	2D20h-00.0(Receive PDO Mapping_Velocity limit value_2D20_00)
11.	Modes of operation	Node : 1 MR-J4-TM(E001)	6060h-00.0(Receive PDO Mapping_Modes of operation_6060_00)
15.	Positive torque limit value	Node : 1 MR-J4-TM(E001)	60E0h-00.0(Receive PDO Mapping_Positive torque limit value_60E0_00)
16.	Negative torque limit value	Node : 1 MR-J4-TM(E001)	60E1h-00.0(Receive PDO Mapping_Negative torque limit value_60E1_00)
21.	Touch probe function	Node : 1 MR-J4-TM(E001)	60B8h-00.0(Receive PDO Mapping_Touch probe function_60B8_00)
44.	Software Switch of Encoder's	<Not assigned>	<Not assigned>


The following picture shows Input PDO mapping from MR-J4-TM to controller

- Input (Device to Controller)			
★ 22. Statusword	Node : 1 MR-J4-TM(E001)	6041h-00.0(Transmit PDO mapping_Statusword_6041_00)	
★ 23. Position actual value	Node : 1 MR-J4-TM(E001)	6064h-00.0(Transmit PDO mapping_Position actual value_6064_00)	
24. Velocity actual value	Node : 1 MR-J4-TM(E001)	606Ch-00.0(Transmit PDO mapping_Velocity actual value_606C_00)	
25. Torque actual value	Node : 1 MR-J4-TM(E001)	6077h-00.0(Transmit PDO mapping_Torque actual value_6077_00)	
27. Modes of operation display	Node : 1 MR-J4-TM(E001)	6061h-00.0(Transmit PDO mapping_Modes of operation display_6061_00)	
40. Touch probe status	Node : 1 MR-J4-TM(E001)	6089h-00.0(Transmit PDO mapping_Touch probe status_6089_00)	
41. Touch probe pos1 pos value	Node : 1 MR-J4-TM(E001)	608Ah-00.0(Transmit PDO mapping_Touch probe pos1 pos value_608A_00)	
42. Touch probe pos2 pos value	Node : 1 MR-J4-TM(E001)	608Ch-00.0(Transmit PDO mapping_Touch probe pos2 pos value_608C_00)	
43. Error code	<Not assigned>	<Not assigned>	
45. Status of Encoder's Input Slave	<Not assigned>	<Not assigned>	
46. Reference Position for csp	<Not assigned>	<Not assigned>	

Click each of the icons in the Axis Parameter Settings Tab Page.

The settings for each icon are displayed on the Axis Parameter Settings Tab Page

Unit Setting:



## Unit Conversion Settings

▼ Unit

Unit of display ☐ pulse ☐ mm ☐ um ☐ nm ☐ degree ☒ inch

▼ Travel Distance

Command pulse count per motor rotation  pulse/rev ---- (1)

☒ Do not use reducers

Work travel distance per motor rotation  inch/rev ---- (2)

Reference: Unit conversion formula

Number of pulses [pulse] =  $\frac{(1) \text{ Command pulse count per motor rotation [UDINT]} \times \text{Travel distance [Unit of display]}}{(2) \text{ Work travel distance per motor rotation [LREAL]}}$

☐ Use reducers


Work travel distance per work rotation  inch/rev ---- (3)

(Calculated from the Modulo maximum/minimum positions in Position Count Settings if the count mode is Rotary)

Work gear ratio (Numerator of the reduction ratio)  ---- (4)

In this example is set one rev of motor equal to 1 inch.

Operation setting



## Operation Settings

▼ Velocity/Acceleration/Deceleration

Maximum velocity	<input type="text" value="100"/>	inch/s	Velocity warning value	<input type="text"/>
Start velocity	<input type="text" value="0"/>	inch/s		
Maximum jog velocity	<input type="text" value="50"/>	inch/s		
Maximum acceleration	<input type="text" value="512"/>	inch/s^2	Acceleration warning value	<input type="text"/>
Maximum deceleration	<input type="text" value="512"/>	inch/s^2	Deceleration warning value	<input type="text"/>

Acceleration/deceleration over  ▼

Operation selection at Reversing  ▼

▼ Torque

Positive torque warning value  %

Negative torque warning value

▼ Monitor

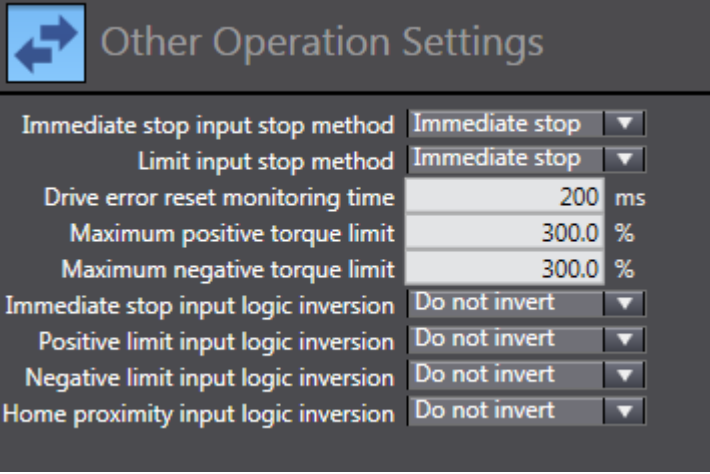
In-position range  inch

Actual velocity filter time constant  ms

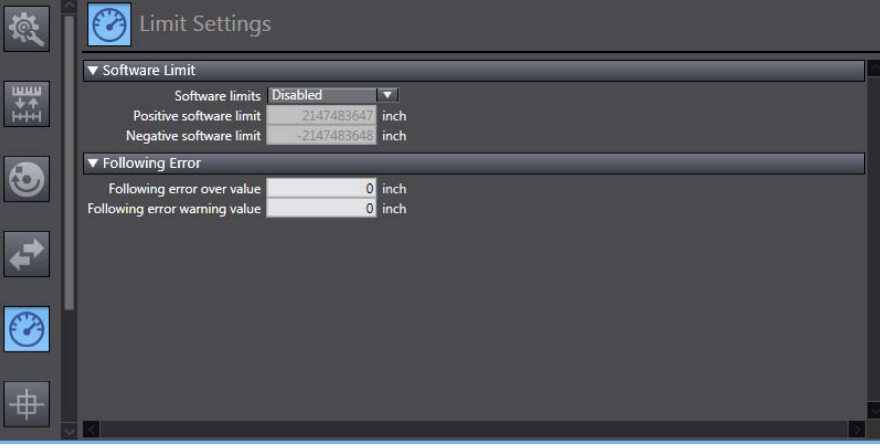
In-position check time

Zero position range

Other Operation setting:



Other Operation Settings	
Immediate stop input stop method	Immediate stop ▼
Limit input stop method	Immediate stop ▼
Drive error reset monitoring time	200 ms
Maximum positive torque limit	300.0 %
Maximum negative torque limit	300.0 %
Immediate stop input logic inversion	Do not invert ▼
Positive limit input logic inversion	Do not invert ▼
Negative limit input logic inversion	Do not invert ▼
Home proximity input logic inversion	Do not invert ▼



Limit Settings	
▼ Software Limit	
Software limits	Disabled ▼
Positive software limit	2147483647 inch
Negative software limit	-2147483648 inch
▼ Following Error	
Following error over value	0 inch
Following error warning value	0 inch

### 2.3 Servo Parameter setting:

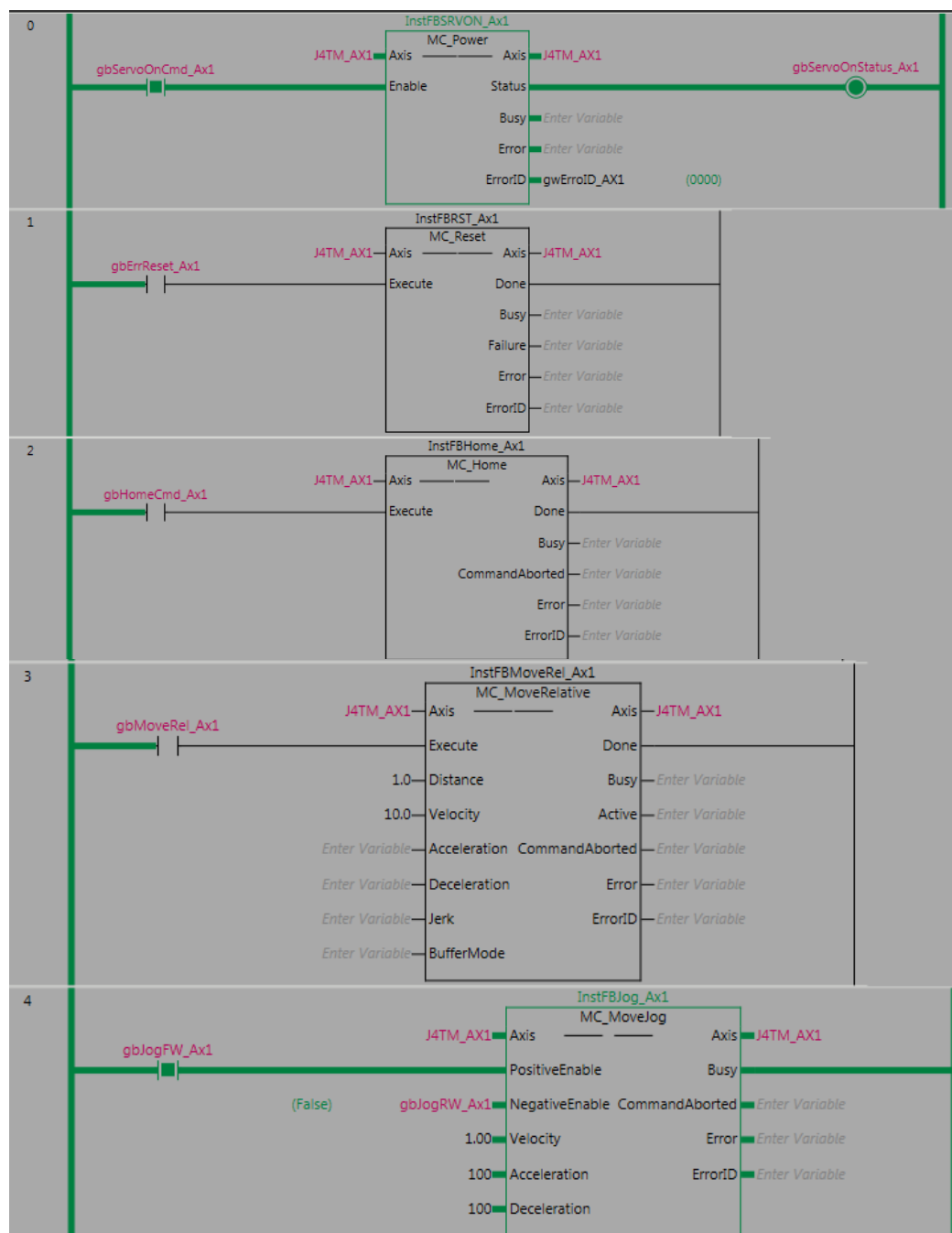
Set the following servo parameter to run the demo program.

- 1) PA01 to 1000 automatic selection for each network
- 2) PA04 to 2100 for disable forced stop input
- 3) PD01 to 0C00 for disable the external limit switches.
- 4) Then Turn Off and ON the servo amplifier after write these two parameters

**Note:** Servo parameter can be set via SDO communication or by using MR Configurator2

## Chapter 3 Sample Program

Create a sample program under programming section using PLCopen Library MC\_Power, MC\_Reset, MC\_Home, MC\_MoveRelative and MC\_MoveJog.



Transfer project to controller and perform the simple motion by turn ON/OFF the bit device of the Function blocks.



## Revisions

1) Version 1.0

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