

Machine Automation Controller NJ/NX-series

# Startup Guide for Motion Control

NX1P2-

Startup Guide







W514-E1-04

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# Introduction

Thank you for purchasing an NJ/NX-series CPU Unit and the Sysmac Studio.

This *NJ/NX-series Startup Guide for Motion Control* (hereafter referred to as "this Guide") describes the startup procedures that are required to use the NJ/NX-series Motion Control Function Module for the first time and provides operating instructions for the Sysmac Studio. You can follow the procedures that are given in this Guide to set axis parameters and perform simple one-axis positioning and two-axis linear interpolation. This Guide does not contain safety information and other details that are required for actual use of an NJ/NX-series Controller. Thoroughly read and understand the manuals for all of the devices that are used in this Guide to ensure that the system is used safely. Review the entire contents of these materials, including all safety precautions, precautions for safe use, and precautions for correct use.

For the startup and operating instructions for NJ/NX-series CPU Units, refer to the *NJ/NX-series Startup Guide for CPU Units* (Cat. No. W513).

### **Intended Audience**

This Guide is intended for the following personnel, who must also have knowledge of electrical systems (an electrical engineer or the equivalent).

- Personnel in charge of introducing FA systems.
- Personnel in charge of designing FA systems.
- Personnel in charge of installing and maintaining FA systems.

#### **Applicable Products**

This Guide covers the following products.

- CPU Units of NJ/NX-series Machine Automation Controllers
- Sysmac Studio Automation Software

#### **Special Information**

The icons that are used in this Guide are described below.

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Precautions on what to do and what not to do to ensure safe usage of the product.

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- When building a system, check the specifications for all devices and equipment that will make up the system and make sure that the OMRON products are used well within their rated specifications and performances. Safety measures, such as safety circuits, must be implemented in order to minimize the risks in the event of a malfunction.
- Thoroughly read and understand the manuals for all devices and equipment that will make up the system to ensure that the system is used safely. Review the entire contents of these materials, including all safety precautions, precautions for safe use, and precautions for correct use.
- Confirm all regulations, standards, and restrictions that the equipment and devices in the system must adhere to.

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# **Related Manuals**

The following manuals are related to the NJ/NX-series Controllers. Use these manuals for reference.
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Manual name	Cat. No.	Model	Application	Meaning
NX-series NX1P2 CPU Unit Hardware User's Manual	W578	NX1P2-000	Learning the basic specifications of the NX-series NX1P2 CPU Units, including introductory informa- tion, designing, instal- lation, and maintenance. Mainly hardware infor- mation is provided.	An introduction to the entire NX1P2 CPU Unit system is provided along with the following information on the NX1P2 CPU Unit. • Features and system configuration • Introduction • Part names and functions • General specifications • Installation and wiring • Maintenance and inspection
NX-series NX1P2 CPU Unit Built-in I/O and Option Board User's Manual	W579	NX1P2-000	Learning about the details of functions only for an NX-series NX1P2 CPU Unit and an introduction of functions for an NJ/NX-series CPU Unit.	Of the functions for an NX1P2 CPU Unit, the following information is provided. • Built-in I/O • Serial Communication Option Boards • Analog I/O Option Boards An introduction of following functions for an NJ/NX-series CPU Unit is also provided. • Motion control functions • EtherNet/IP communications functions • EtherCAT communications functions
NX-series CPU Unit Hardware User's Manual	W535	NX701-□□□	Learning the basic specifications of the NX701 CPU Units, including introductory information, designing, installation, and main- tenance. Mainly hardware infor- mation is provided.	<ul> <li>An introduction to the entire NX701 system is provided along with the following information on the CPU Unit.</li> <li>Features and system configuration</li> <li>Introduction</li> <li>Part names and functions</li> <li>General specifications</li> <li>Installation and wiring</li> <li>Maintenance and inspection</li> </ul>
NX-series NX502 CPU Unit Hardware User's Manual	W629	NX502-□□□	Learning the basic specifications of the NX502 CPU Units, including introductory information, designing, installation, and main- tenance. Mainly hardware infor- mation is provided.	<ul> <li>An introduction to the entire NX502 system is provided along with the following information on the CPU Unit.</li> <li>Features and system configuration</li> <li>Introduction</li> <li>Part names and functions</li> <li>General specifications</li> <li>Installation and wiring</li> <li>Maintenance and inspection</li> </ul>
NX-series NX102 CPU Unit Hardware User's Manual	W593	NX102-□□□	Learning the basic specifications of the NX102 CPU Units, including introductory information, designing, installation, and main- tenance. Mainly hardware infor- mation is provided.	<ul> <li>An introduction to the entire NX102 system is provided along with the following information on the CPU Unit.</li> <li>Features and system configuration</li> <li>Introduction</li> <li>Part names and functions</li> <li>General specifications</li> <li>Installation and wiring</li> <li>Maintenance and inspection</li> </ul>

Manual name	Cat. No.	Model	Application	Meaning
NJ-series CPU Unit Hardware User's Manual	W500	NJ501-□□□ NJ301-□□□ NJ101-□□□	Learning the basic specifications of the NJ-series CPU Units, including introduc- tory information, designing, installa- tion, and mainte- nance. Mainly hardware information is pro- vided.	<ul> <li>An introduction to the entire NJ-series system is provided along with the following information on a Controller built with an NJ-series CPU Unit.</li> <li>Features and system configuration</li> <li>Introduction</li> <li>Part names and functions</li> <li>General specifications</li> <li>Installation and wiring</li> <li>Maintenance and inspection</li> </ul>
NJ/NX-series CPU Unit Soft- ware User's Manual	W501	NX701-000 NX502-000 NX102-000 NX1P2-000 NJ501-000 NJ301-000 NJ101-000	Learning how to pro- gram and set up an NJ/NX-series CPU Unit. Mainly software infor- mation is provided.	<ul> <li>The following information is provided on a Controller built with an NJ/NX-series CPU Unit.</li> <li>CPU Unit operation</li> <li>CPU Unit features</li> <li>Initial settings</li> <li>Programming based on IEC 61131-3 language specifications</li> </ul>
NJ/NX-series CPU Unit Motion Control User's Manual	W507	NX701 NX502 NX102 NX1P2 NJ501 NJ301 NJ101	Learning about motion control set- tings and program- ming concepts.	The settings and operation of the CPU Unit and programming concepts for motion control are described.
NJ/NX-series Instructions Reference Manual	W502	NX701-000 NX502-000 NX102-000 NX1P2-000 NJ501-000 NJ301-000 NJ301-000	Learning detailed specifications on the basic instructions of an NJ/NX-series CPU Unit.	The instructions in the instruction set (IEC 61131-3 specifications) are described.
NJ/NX-series Motion Control Instructions Reference Manual	W508	NX701-000 NX502-000 NX102-000 NX1P2-000 NJ501-000 NJ301-000 NJ301-000	Learning about the specifications of the motion control instructions.	The motion control instructions are described.
NJ/NX-series CPU Unit Built- in EtherCAT® Port User's Manual	W505	NX701-000 NX502-000 NX102-000 NX1P2-000 NJ501-000 NJ301-000 NJ101-0000	Using the built-in EtherCAT port on an NJ/NX-series CPU Unit.	Information on the built-in EtherCAT port is pro- vided. This manual provides an introduction and pro- vides information on the configuration, features, and setup.
NJ/NX-series Troubleshoot- ing Manual	W503	NX701-000 NX502-000 NX102-000 NX1P2-000 NJ501-000 NJ301-000 NJ301-000	Learning about the errors that may be detected in an NJ/NX-series Con- troller.	Concepts on managing errors that may be detected in an NJ/NX-series Controller and information on individual errors are described.

Manual name	Cat. No.	Model	Application	Meaning
Sysmac Studio Version 1 Operation Manual	W504	SYSMAC-SE2	Learning about the operating proce- dures and functions of the Sysmac Studio.	The operating procedures of the Sysmac Stu- dio are described.
AC Servomotors/Servo Drives 1S-series with Built-in Ether- CAT® Communications User's Manual	1586	R88M-1□ R88D-1SN□-ECT	Learning how to use the Servomo- tors/Servo Drives with built-in EtherCAT Communications.	Describes the hardware, setup methods and functions of the Servomotors/Servo Drives with built-in EtherCAT Communications.
Servo System 1S-series Startup Guide	1823	R88M-1L□/-1M□ (AC Servomotors) R88D-1SN□-ECT (AC Servo Drives)	Gaining a basic understanding of a 1S-series AC Servo- motors/Servo Drives.	Describes the procedures for installation and setup of a 1S-series AC Servo Drive.

# **Revision History**

A manual revision code appears as a suffix to the catalog number on the front and back covers of the manual.



Revision code	Date	Revised content
01	November 2011	Original production
02	February 2017	Made changes accompanying the addition of NX1P2 CPU Units and 1S-series AC Servomotors / Servo Drivers
03	February 2019	Corrected mistakes.
04	April 2025	Corrected mistakes.

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# Features and System Configuration of NJ/NX-series Controllers and 1S-series AC Servo Systems

This section describes the configuration of the Servo system that is constructed in this Guide and the products that make up that system.

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# 1-1 Features of NJ/NX Series and 1S Series

The NX/NJ-series Machine Automation Controllers provide advanced motion control previously executed by dedicated controllers or Special Units.

The CPU Units have a built-in EtherCAT port for real-time machine control.

# **Easy Wiring**



# **Easy Motion Programming**



1

# **3D Simulation Makes Debugging Easy**



The actual equipment was required to check operation during debugging.



NX1P and 1S Series

You can check 3D operation at your desk, shortening on-site debugging time. While viewing the programmed Servomotor path, you can review operation with the machine engineers prior to system completion and fix problems in advance!



# Fast Recovery after Power Interruptions with the Standard-feature Absolute Encoder



# **1-2** System Configuration and Configuration Devices

## 1-2-1 Devices Used in This Guide

NX1P Machine Automation Controller	1S-series AC Servo Drive	1S-series AC Servomotor
NX1P2-1140DT	R88D-1SN01L-ECT	R88M-1M10030S
EtherCAT Communications Cable	Motor Power Cable	Encoder Cable
XS5W-T421-⊡MD-K	R88A-CA1A003S	R88A-CR1A003C
Sysmac Studio	ar O	
Sysmac Studio Automation Software Standard Edition Version 1.17 or higher	Ethernet Cable (100BASE-TX/10BASE-T)	24 VDC Power Supply
SYSMAC-SE200D (Media only) SYSMAC-SE201L (One license)		Example: S8VK-S

1

## **1-2-2** Configuration of the System Constructed in This Guide

This *NJ/NX-series Startup Guide for Motion Control* (hereafter referred to as "this Guide") builds the Servo system in the following two steps.



## Single-axis Servo System

This system performs single-axis positioning using a Servo Drive and Servomotor for one axis. The steps from device wiring to software design and debugging are described. Device connections are described in *Section 2 Before You Begin*, and software design and debugging are described in *Section 3 Setting Up a Single-axis Servo System*.





## **Two-axis Servo System**

This system performs linear interpolation using Servo Drives and Servomotors for two axes. The steps from device wiring to software design and debugging are described.

Device connections are described in *Section 2 Before You Begin*, and software design and debugging are described in *Section 4 Two-axis Linear Interpolation Program*.

The NX1P2-9024DT/-9024DT1 cannot be used in this linear interpolation example.

Use the NX1P2-1040DT/-1040DT1, NX1P2-1140DT/-1140DT1, NJ-series CPU Unit, or NX7 CPU Unit.



# 2

# **Before You Begin**

This section describes the installation of the Sysmac Studio and the process of assembling and wiring the hardware.

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#### Installing the Sysmac Studio 2-1

The Sysmac Studio is the Support Software that you use for an NJ/NX-series Controller. On it, you can create the Controller configuration and settings, you can write the programs, and you can debug and simulate operation.

Use the following procedure to install the Sysmac Studio.

1 Set the Sysmac Studio installation disk into the DVD-ROM drive.

The setup program is started automatically and the Select Setup Language Dialog Box is displayed.

**2** Select the language to use, and then click the **OK** Button.

The Sysmac Studio Setup Wizard is started.



- **3** Follow the instructions given by the Setup Wizard to complete the installation.
- 4 Restart the computer when the installation is completed.

#### **Additional Information**

• The system requirements for the Sysmac Studio are given in the following table.

OS		CPU	RAM	Display
Windows 7 (32-bit or 64-bit edition)	Minimum	IBM AT or compatible with Intel <sup>®</sup> Celeron <sup>®</sup> processor	2 GB	XGA 1,024 × 768, 16 million colors
Windows 8 (32-bit or 64-bit edition)		540 (1.8 GHz)		
Windows 8.1 (32-bit or 64-bit edition)	Recom- mended	IBM AT or compatible with Intel <sup>®</sup> Core <sup>TM</sup> i5 M520 pro-	4 GB min.	WXGA 1,280 × 800, 16 million colors
Windows 10 (32-bit or 64-bit edition)		cessor (2.4 GHz) or the equivalent		
Windows 11 (64-bit edition)				

Refer to the Sysmac Studio Version 1 Operation Manual (Cat. No. W504) if you are unable to install the Sysmac Studio with the above instructions.

#### **Precautions for Correct Use**

If CX-One version 4 or lower is installed, the installation is cancelled and the Sysmac Studio cannot be installed. In that case, uninstall the CX-One before you install the Sysmac Studio.

# 2-2 Wiring the Devices

This section describes how to wire the assembled the hardware devices.

This section gives an overview of the wiring procedures. Refer to the manuals for the devices that are used in the system for detailed wiring procedures and safety precautions.

## 2-2-1 Wiring the NX1P CPU Unit Power Supply

Wire the CPU Unit to the DC power supply.



## 2-2-2 Wiring the Servo Drive Power Supply

Wire the Servo Drives to the power supply as shown in the following figure.



## 2-2-3 Laying EtherCAT Communications Cables

Connect the EtherCAT slave communications cables between the built-in EtherCAT port on the CPU Unit and the EtherCAT slaves as shown in the following figure.

Connect the communications cable from the built-in EtherCAT port to the input port on the first slave, and then connect the communications cable to the next slave to the output port on the first slave. Do not connect anything to the output port of the slave at the end of the network.



# Setting the Node Addresses of the Servo Drives

Set the node addresses of the Servo Drives as shown below. Only the first Servo Drive is used in *Section 3 Setting Up a Single-axis Servo System*. The second Servo Drive is added in *Section 4 Two-axis Linear Interpolation Program*.



## 2-2-4 Wiring the Servo Drives and the Servomotors

Wire the Servo Drives and the Servomotors as shown in the following figure.



## 2-2-5 Wiring the Control Input Signals for the Servo Drives

Wire the control input signals for the Servo Drive using the R88A-CN101C Control I/O connector (CN1). For details on wiring, refer to the *AC Servomotors/Servo Drives 1S-series with Built-in EtherCAT Communications User's Manual* (Cat. No. 1586).



#### Additional Information

- If you use the default Servo parameters, you must wire the immediate stop input, negative drive prohibit input, and the positive drive prohibit input.
   If these inputs are not wired, the CPU Unit will remain in the drive prohibit signal and emergency stop signal detected state, and a minor fault level Controller error will occur. The minor fault level Controller errors that will occur are an Immediate Stop Input Error and a Drive Prohibition Input Error. (The event codes are 68220000 and 64E30000.)
- If the above signals are temporarily not wired while commissioning the system, you can temporarily change the Servo parameters to prevent these errors from occurring in the CPU Unit. Refer to *A-1 Settings When Control Input Signals Are Not Wired* for details on the settings that you must change in this case.

# 

# Setting Up a Single-axis Servo System

This section describes the procedures and operations required to set up a Servo system for one axis.

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# 3-1 Single-axis Servo System Operation

This section describes the operation of the single-axis Servo system that is set up in this Guide.



Axis 0 performs alternating single-axis positioning in the positive and negative directions.

The mechanical configuration of axis 0 is as shown in the following table.

Item	Axis 0 mechanical configuration
Motor rated speed	3,000 r/min
Ball screw pitch	10.000 mm
Encoder resolution	23 bits/rotation



# 3-2 System Setup Procedures

The basic design flow to follow to design a Servo system is shown below.

The startup operations in this Guide are described in the following steps.



# STEP 3. Start Programming (page 3-9)

Register an axis variable and create and check the POU program.

STEP 3-1 Set the axis (page 3-9).

STEP 3-2 Create the program (page 3-17) and check the program (page 3-27).

# STEP 4. Transfer the Project to the CPU Unit (page 3-28)

Transfer the project, which contains the user program, to the CPU Unit.

# STEP 5. Confirm System Operation (page 3-32)

Perform a check to test system operation. (Use online debugging.)

STEP 5-1 Check for Controller errors (page 3-32).

STEP 5-2 Reset the Absolute Encoder from the Sysmac Studio (page 3-35).

STEP 5-3 Check the Servo Drive wiring (page 3-38).

STEP 5-4 Check program operation (page 3-44).

STEP 5-5 Use data tracing to check operation (page 3-50).

# 3-3 Creating a Project

Start the Sysmac Studio and create a project.

## Starting the Sysmac Studio

Use one of the following methods to start the Sysmac Studio.

• Double-click the Sysmac Studio shortcut icon on your desktop.



• Select All Programs - OMRON - Sysmac Studio - Sysmac Studio from the Windows Start Menu.

All Programs	🕅 WinPcap	CX-Server     CX-Server     Sysmac Studio	•	Release Notes     Sysmac Studio	
Tour Windows XP	COMRON	Communications Middleware Utilities		O OMRON Automation Software AutoLipda	te.
Windows Update	<ul> <li>Windows Movie Maker</li> <li>Symantec Client Security</li> </ul>	As an all operations in the second seco		Manual Manual Network Configurator for EtherNetIP	
Wildows Messeliger	Windows Messenger			m Introduction Guide Library	
🔏 Windows Messenger	Windows Media Player	A CONTRACTOR OF A CONTRACTOR O		CX-Protocol	
Shortcut to Capture	💫 Remote Assistance	And and a second se		CX-Integrator	
-	🕼 Outlook Express	and the second second second second second		CX-Designer	
Nindows Media Play	MSN			CX-ConfiguratorFDT	
NSN 🦪	🥭 Internet Explorer	And State of the Party of State of State			

The Sysmac Studio starts and the following window is displayed.



# **Creating a Project**

Create a project in the Sysmac Studio.

**1** Click the **New Project** Button in the Project Window.



2 In the **Project Properties** Dialog Box, select *NXP12-1140DT* in the *Device Box* and the version to use in the *Version Box*, and then click the **Create** Button.



A project file is created and the following window is displayed.



This concludes the procedure to create a project file.

# Parts of the Window

This section gives the names and functions of the parts of the Sysmac Studio Window.



No.	Name		
(1)	Multiview Explorer	This pane is your access point for all Sysmac Studio data. It is separated into <i>Configurations and Setup</i> and <i>Programming</i> Layers.	
(2)	Filter Pane	The Filter Pane allows you to search for color codes and for items with an error icon. The results are displayed in a list.	
(3)	Edit Pane	The Edit Pane is used to display and edit the data for any of the items.	
		It is separated into Configurations and Setup and Programming Layers.	
(4)	Toolbox	The Toolbox shows the objects that you can use to edit the data that is displayed in the Edit Pane.	
(5)	Search and Replace Pane	In this pane, you can search for and replace strings in the data in the Pro- gramming Layer.	
(6)	Controller Status Pane	The Controller Status Pane shows the current operating status of the Controller. The Controller Status Pane is displayed only while the Sysmac Studio is online with the Controller.	
(7)	Simulation Pane	The Simulation Pane is used to set up, start, and stop the Simulator for the Controller.	
(8)	Cross Reference Tab Page	A Cross Reference Tab Page displays a list of where variables, data types, I/O ports, functions, and function blocks are used in the Sysmac Studio.	
(9)	Output Tab Page	The Output Tab Page shows the results of building.	
(10)	Watch Tab Page	The Watch Tab Page shows the monitor results of the Simulator or online Controller.	
(11)	Build Tab Page	The Build Tab Page shows the results of program checks and building.	
(12)	Search and Replace Results Tab Page	The Search and Replace Results Tab Page shows the results when <b>Search All</b> or <b>Replace All</b> is executed.	
(13)	Differential Monitor Tab Page	You can detect the number of times the specified BOOL variable or mem- ber changes to TRUE or FALSE and display the count in this tab page.	

Refer to the *Sysmac Studio Version 1 Operation Manual* (Cat. No. W504) for details on the Sysmac Studio panes and tab pages.

# 3-4 Creating the EtherCAT Network Configuration

A R88D-1SN01L-ECT Servo Drive is registered in the EtherCAT network configuration to operate as axis 0.

**1** Double-click **EtherCAT** under **Configurations and Setups** in the Multiview Explorer.



The EtherCAT Tab Page is displayed in the Edit Pane.





**2** Drag the R88D-1SN01L-ECT from the Toolbox to the master on the EtherCAT Tab Page.

The Servo Drive is added under the master with a node address of 1.

👬 EtherCAT 🗙		
Node Address Netw	ork configuration	I I
	Master Master	
1	E001 R88D-1SN01L-ECT Rev:1.0	

This concludes the creation of the EtherCAT network configuration.

#### Additional Information

If the physical EtherCAT network configuration is already connected, you can automatically create the virtual network configuration in the Sysmac Studio based on the physical network configuration.

Refer to the Sysmac Studio Version 1 Operation Manual (Cat. No. W504) for specific procedures.

# 3-5 Programming

In this section we will create the user program.

A Servo axis for axis 0 will be added and set up, and a program will be created to control the Servo Drive.

### 3-5-1 Setting the Axis

This section describes how to add the axis that is used to control the Servo Drive, assign it to the Servo Drive, and set the axis parameters. In this example, the Control Function of the axis to add is set to Single-axis Position Control Axis in order to perform single-axis position control.

# Adding the Axis Settings

Add the axis settings for axis 0.

**1** Right-click **Axis Settings** in the Multiview Explorer and select **Add** – **Single-axis Position Control Axis** from the menu.



3

Axis 0 is added to the Multiview Explorer. The axis is added as *MC\_Axis000*. This axis is called axis 0.



## Assigning a Servo Drive to the Axis

Next, assign the Servo Drive in the EtherCAT network configuration to the new axis 0 (MC\_Axis000).

**1** Right-click **MC\_Axis000** (axis 0) in the Multiview Explorer and select *Edit* from the menu.




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

**2** Select *Servo axis* in the *Axis type* Box.

🕵 Axis B	asic Settings		
Axis number Motion control Axis use Axis type Control function	0 MC1: Primary periodic task Used axis Servo axis Servo axis		
Feedback control Input device 1 Input device 2 Input device 3 Output device 2 Output device 3	Virtual servo axis Virtual encoder axis Nixola assumeda Rixola assumeda Rixola assigneda Rixola assigneda Rixola assigneda Virtual assigneda Virtual assigneda	Channel	

3 Select thne Servo Drive to use in the *Output device* Box (Node: 1, Device: R88D-1SN01L-ECT).

Axis number	0		
Motion control	MC1: Primary periodic task 🔍		
Axis use	Used axis 🔹		
Axis type	Servo axis 🔹		
Control function	Single-axis position control only 💌		
eedback control	No control loop		
Input device 1	<not assigned=""> 💌</not>	Channel	<b>T</b>
Input device 2	<not assigned=""></not>	Channel	<b>T</b>
Input device 3	<not assigned=""></not>	Channel	V
	🖢 <not assigned="" td="" 🔻<="" 🛛=""><td>Channel</td><td><b>T</b></td></not>	Channel	<b>T</b>
Output Node:1F	R88D-1SN01L-ECT(Ecc-,	Channel	
Output <not assi<="" td=""><td>gned&gt;</td><td>Channel</td><td><b>T</b></td></not>	gned>	Channel	<b>T</b>

This will assign node 1 and device R88D-1SN01L-ECT as the output device for axis 0.



Now, node 1 with device R88D-1SN01L-ECT can be used as an axis in the EtherCAT network configuration.

# **Setting the Axis Parameters**

Set the axis parameters for axis 0 based on the mechanical configuration of the system.

The input axis parameters are shown in the following table according to the mechanical configuration of axis 0.

lcon	on Settings Tab Page	Item	Set value
	Unit Conversion Settings	Unit of Display	mm
		Command Pulse Count Per Motor Rotation	8,388,608
		Work Travel Distance per Motor Rotation	10.000 mm
	Operation Settings	Maximum Velocity	500 mm/s
6		Maximum Jog Velocity	50 mm/s
153	Position Count Settings	Encoder type	Absolute encoder

**1** Set the parameters on the Axis Parameter Settings Tab Page.

Click an icon on the Axis Parameter Settings Tab Page to display the settings for that particular icon.

Set the axis parameters as indicated below.

Unit Conversion Settings



Operation Settings

🐼 MC_Axis00	00 (0,MC1) ×			*
ţ,	Operation Setting	gs		
	▼ Velocity/Acceleration/Decelerat	tion		<u>~</u>
₩₩₩ ₩ ₩	Maximum velocity	500 mm/s	Velocity warning value	0 %
	Maximum jog velocity	50 mm/s		
	Maximum acceleration	v 11111/5 2	Acceleration warning value	0 %
	Maximum deceleration	0 mm/s^2	Deceleration warning value	0 %
			ration (Blending is changed to Buffered) 🔻	
	Operation selection at Reversing D	eceleration stop 🔻		
	▼ Torque			
←	Positive torque warning value	0 %	Negative torque warning value	0 %
	▼ Monitor			
	In-position range	10 mm	In-position check time	0 ms
E • 7	Actual velocity filter time constant	0 ms	Zero position range	10 mm
щ				
177				
123				
ā				

Position Count Settings

💇 MC_Axis0	00 (0,MC1) ×
<b>ķ</b>	Position Count Settings
₩₩ +++	Count mode Count mode Linear mode Rotary mode Modulo maximum position setting value 2147483647 mm Modulo minimum position extrementer activation and activat
€	
+	
Ø	
<b>4</b>	
Ō	



#### Additional Information

You can also set the parameters for all axes on the same tab page.

Right-click **Axis Settings** in the Multiview Explorer and select **Axis Setting Table** from the menu to display the Axis Setting Table. The Axis Setting Table allows you to set the axis settings and axis parameters for all axes that have been added.



# Confirming That the Axis Variable Is Registered

A structure variable that is defined to hold information on an axis, such as physical quantities, status, and error information, is called an axis variable.

The axis variables are used in the user program to specify axes.

When an axis is added, an axis variable for that axis is automatically added to the global variable table. Use the following method to check the axis variables.

**1** Right-click **Global Variables** under **Programming - Data** in the Multiview Explorer and select *Edit* from the menu.



The global variable table is displayed in the Edit Pane.

You can confirm that the MC\_Axis000 axis variable for axis 0 has been added automatically.



## 3-5-2 Creating the Program

Create the instructions that control the Servo Drive in section 0 of program 0. Program 0 is automatically created when you create a project.

The following instructions are created. To do so, we will use an axis variable and motion control instructions.

Variable	es									
	ServoLock	100 C	Power1 Axis Axis Enable Status	– MC_Axis	\$000					
	11		Busy -	-Enter Va						
				– Enter Va – Enter Va						
L L					Move1			Move2		
	Start1	Complete1	MC_Axis000-		IC_MoveRelative Axis	—MC_Axis000	MC_Axis000-	Axis	Axis MC_Axis000	Complete1
				Execute	Done			Execute 0	Done	O
			20-	Distance	Busy	Enter Variable	-20	Distance	Busy — Enter Variable	
			10-	Velocity	Active	Enter Variable	10—	Velocity A	ctive - Enter Variable	
			200-	Accelerati	tion CommandAborted	Enter Variable	200—	Acceleration CommandAbo	orted -Enter Variable	
			200-	Decelerat	tion Error	Enter Variable	200—	Deceleration	Error — Enter Variable	
			Enter Variable	Jerk	ErrorID	Enter Variable	Enter Variable	Jerk En	rorID — Enter Variable	
			Enter Variable-	BufferMo	de		Enter Variable	BufferMode		

Refer to the *NJ/NX-series Startup Guide for CPU Units* (Cat. No. W513) for details on how to create ladder diagrams.

#### Precautions for Correct Use

Π

The sample programming that is provided in this Guide includes only the programming that is required to operate the Servomotors. When programming actual applications, also program EtherCAT communications, device interlocks, I/O with other devices, and other control procedures.

# **Opening the Ladder Editor**

To enter the program, you must start the Ladder Editor and open section 0 of program 0.

**1** Right-click **Section0** under **Programming** – **POUs** – **Programs** – **Program0** in the Multiview Explorer, and select *Edit* from the menu.

Multiview Explorer	, <del>1</del>
new_Controller_0 🔻	
Configurations and Setup	
Programming	
🌗 🔍 🛑 POUs	
🌗 🛛 🔻 🗐 Programs	
🌗 🛛 🔻 💀 Program0	
	Edit
L 🕄 Function	
L 😹 Function Blocks	
🕨 🖿 Data	<u>С</u> ору
Tasks	Paste
	Delete
	Rename
	Insert Above 🔸
	Move Up
	Move Down

The local variable table and Ladder Editor are displayed in the Edit Pane. From here, you can register local variables and create a ladder diagram.



# Creating the Instructions That Turn the Servo ON and OFF

You must turn ON the Servo in order to execute single-axis positioning from the Servo Drive. The MC\_Power (Power Servo) instruction is used to control turning the Servo ON and OFF.

#### **1** Enter an input for the *ServoLock* variable to control turning the Servo ON and OFF.



- How to enter an NO input Right-click the horizontal line in the Ladder Editor and select *Insert Input* from the menu. Or, press the C Key.
- How to display external variables and internal variables Select *Variable Table* from the View menu.
- 2 Drag MC\_Power from the Motion Area of the Toolbox to the right side of the ServoLock input.



An MC\_Power instruction is inserted to the right of the ServoLock input.

🔄 Section	n0 - Program0 🗙						•
Variab	les						•
Names	space - Using						
Internals	Name	I Data Type	Initial Value	AT	Retain	Constant	Comment I
Externals	ServoLock	BOOL					
0			unction Block				
		Enter Variable Axis	C_Power AxisEnte	er Variable			
	ServoLock	Enable	Status				
			Busy Ente	er Variable			
			Error Ente				
			ErrorID - Ente				
				er vurtuble			

# **3** Enter *Power1* as the instance name for the MC\_Power instruction.

Variables Namespace - Us	Defin Ladd	itions of any variables er Editor are automatio					<b>•</b>
Internals Externals Power1		Data Type BOOL MC_Power	Initial Value		Retain	Constant	Comment I
0 	ervoLock		Axis En Status Busy En	nter Power1 ter Variable ter Variable ter Variable		nstance na	ame.
			ErrorID	ter Variable			

**4** Enter the in-out variable for the Power1 instance.

Specify the axis variable of the axis to control for the *Axis* in-out variable of the Power1 instance. The axis variable for axis 0 is *MC\_Axis000*.



This concludes the creation of the instructions to control turning the Servo ON and OFF.

# Creating the Instructions That Perform Single-axis Positioning

Here, the MC\_MoveRelative (Relative Positioning) instruction is used to perform single-axis control. We will use two instances of this instruction to repeatedly perform round-trip operation with single-axis positioning.

1 Enter an input for the *Start1* variable to control the Relative Positioning instruction.

To add a rung, select the left bus bar and press the **R** Key.

🗧 Sec	tion0 - Program	n0 ×								+
Vari	iables									•
Nar	mespace - Using	)			_			_	_	A
Interna		Name	I Data Type	:	Initial Value	I	AT	Retain	Constant	Comment I
Externa	ls ServoLock		BOOL							
	Power1		MC_Power							
(	Start1	>	BOOL							
		Definitions of	of any variables	that ve						
0			er Editor are au							
			n the local varia			C Axis0	00			
	Serve	LOCK		1		C_P0030				
				Enable	Status					
					Busy En	ter Vari	able			
			put for the Star			ter Vari	able			
		control the	Relative Positi	oning i		ter Vari	nhle			
					Enond	cer vurt	ubic			
1	Sta	rt1								
	1	I								

2 Enter an NC input for the *Complete1* variable to control the repeated single-axis positioning. To enter an NC input, select the horizontal line in the Ladder Editor and press the *I* Key.

🚭 Section	n0 - Program0 🗙						-	
Variabl	Variables 🔹							
Names	space - Using						A	
Internals	Name	Data Type	Initial Value	I AT	Retain	Constant	Comment	
Externals	ServoLock	BOOL						
	Power1	MC_Power						
	Start1	BOOL						
	Complete1	BOOL						
0		Definitions of any variables Editor are automatically reg	jistered in the lo	ocal variable				
-	ServoLock	MIC_AXISOUU AXIS — Enable	Status					
	Enter an NC input for the <i>Complete1</i> variable, which is turned ON when the round-trip operation is completed.							
1	Start1	Complete1						



## **3** Insert an MC\_MoveRelative (Relative Positioning) instruction.





5

Enter the in-out variable for the Move1 instance.

Specify the axis variable of the axis to control for the *Axis* in-out variable of the Move1 instance. The axis variable for axis 0 is *MC\_Axis000*.



**6** Enter the values given in the following table for the input variables of the MC\_MoveRelative instruction.

Input variable	Meaning	Set value
Distance	Travel Distance (mm)	20
Velocity	Target Velocity (mm/s)	10
Acceleration	Acceleration Rate (mm/s <sup>2</sup> )	200
Deceleration	Deceleration Rate (mm/s <sup>2</sup> )	200



7 Insert the second MC\_MoveRelative (Relative Positioning) instruction.

Enter *Move2* as the instance name, enter the axis variable of axis 0 (*MC\_Axis000*) for the in-out variable, and enter the values in the following table for the input variables.

Input variable	Meaning	Set value
Distance	Travel Distance (mm)	-20
Velocity	Target Velocity (mm/s)	10
Acceleration	Acceleration Rate (mm/s <sup>2</sup> )	200
Deceleration	Deceleration Rate (mm/s <sup>2</sup> )	200



#### Additional Information

Cascade connections are possible for Ladder Diagram Instructions (e.g., LD (Load) and AND (AND)), for FB instructions (e.g., MC\_MoveRelative (Relative Positioning)), and for FUN instructions (e.g., MOVE (Move)). In this program, the Move2 instance is started after relative positioning for the Move1 instance is completed.

8 Enter an output for the *Complete1* variable to turn ON when the round-trip operation is completed.

	—MC_Axis000						
Enable Status Busy	– Enter Variable			ut fau tha C	) / -	to finania bia	. An Arrow .
Error	-Enter Variable		Enter an outpu ON when the r				
ErrorID	-Enter Variable						
	Move1	_		Move2			
MC_Axis000	Axis <u>MC_MoveRelative</u> Axi	s — MC_Axis000	MC_Axis000-	Axis — — — —		-MC_Axis000	Complete1
	Execute Don	e		Execute	Done		O
20-	– Distance Bus	Enter Variable	Enter Variable—	Distance	Busy	-Enter Variable	Ŭ
10-	- Velocity Activ	Enter Variable	Enter Variable-	Velocity	Active	-Enter Variable	
200-	Acceleration CommandAborter	–Enter Variable	Enter Variable-	Acceleration Comn	nandAborted	-Enter Variable	
200-	Deceleration Erro	r — Enter Variable	Enter Variable-	Deceleration	Error	-Enter Variable	
Enter Variable	– Jerk Errorii	Enter Variable	Enter Variable-	Jerk	ErrorID	-Enter Variable	
Enter Variable	– BufferMode		Enter Variable-	BufferMode			

This concludes the creation of the instructions to repeatedly execute single-axis positioning.

## 3-5-3 Checking the Program

Check the program that you created.

Check All Programs       F7       Image: Section Constant Cons	File Edit View Incort Project Control	ler Simul	ation Tools Help		_	_		
Childs Selected inguints Silleyring     Section0 - Program0 X       Build Controller     F8       Abort Build     Shift+F8       Memory Usage     Name pace - Using       International Controller     Name pace - Using       Memory Usage     Name pace - Using       International Controller     Name pace - Using       Memory Usage     Name pace - Using       International Controller     BOOL       Power1     MC Power       International Controller     International Controller       International Controller     International Controller       International Controller     BOOL       International Controller     International Controller       International Controller     International Controller       International Controller     BOOL       International Controller     International Controller       International Controller     International Controller       International Contr		<b>১</b> ৯৫	. # A 🖲 K	🔺 🔌 63 🚱 🖡	<u>କ ୦ ଅ</u> ଟ	o g e	<b>ર ૨</b> હ	
Variables       Variables       Memory Usage       Online Edit       Online Edit       Variables       Library       Variables       Variables       Variables       Memory Usage       Online Edit       Online Edit       Visite       Variables       Variables       Variables       Variables       Visite       Online Edit       Visite       V	Check beleased mograms brift+F7	_						
Name     Data Type     Initial Value     AT     Retain     Constant       Memory Usage     Online Edit     Itemati     Itemati     Itemati     Itemati       Online Edit     Itemati     Mare     Data Type     Initial Value     AT     Retain     Constant     Comment       Ubrary     Itemati     Itemati     Mare     Data Type     Initial Value     AT     Retain     Constant     Comment       Section0     Itemati     BOOL     Itemati     Itemati     Itemati     Itemati     Itemati       Life Function Blocks     Itemations     MC_MoveRelative     Itemation     Itemation     Itemation       Life Global Variables     Serviciock     MC_Misson0     Itemation     Itemation     Itemation	Build Controller F8	- 🔁 Sectio	on0 - Program0 🗙					
Memory Usage     Internals     Name     Data Type     Initial Value     AT     Retain     Constant     Comment       Online Edit	Rebuild Controller	Varia	oles					
Online Edit     •	Abort Build Shift+F8	Name	space - Using					
Online Edit     Servic.0ck     BOUL     Image: Constraint of the service of the se	Memory Usage				Initial Value	I AT	Retain   Consta	nt   Comment
Library     Start1     BOOL     Image: Complete 1       Limit Complete 1     BOOL     Image: Complete 1     BOOL       Limit Complete 1     BOOL     Image: Complete 1       Limit Complete 1     MC_MoveRelative     Image: Complete 1       Limit Complete 2     MC_MoveRelative     Image: Complete 1       Limit Complete 3     MC_MoveRelative     Image: Complete 3       Status 4     MC_MoveRelative 4     Image: Complete 3       ServeLock     MC_MoveRelative 4     Image: Complete 3       ServeLock     MC_MoveRelative 4     Image: Complete 3       ServeLock     MC_MoveRelative 4     Image: Complete 3       Finational ServeLock     MC_MoveRelative 4       Finatis     MC	Online Edit	Externais	Servolock					
V em registriu     Saft1     bOUL	Library			-				
L Section0 L Section0 L Section0 L Movel Movel Moveletative U Movel Movel Moveletative U Movel Moveletative U Movel Moveletative U Movel Moveletative U Mov								
L (#, Function Blocks ↓ (#) Function Blocks ↓ (#) Data L (#) Global Variables ▶ fit Tasks	Section0							
L (g) function blocks C L (g) bata Types L (m) Global Variables ► Fin Tasks Busy - Enter Variable Error - Enter Variable	L 😹 Functions		Movel	-				
L ter Global Variables Status Error – Enter Variable Error – Enter Variable		0		M	C_Power	C Aut+000		
Leer Global Variables  ► fit Tasks Busy — Enter Variable Error — Enter Variable	ㄴ 5명 Data Types		ServoLock	-		C_AXISOUU		
Error – Enter Variable	L test Global Variables			Enable	Status-			
	Tasks				Busy En	ter Variable		
ErrorD—Enter Variable					Error - En	ter Variable		
					ErrorID - En	ter Variable		
1 Movel						Mauri		
MC_MoveRelative		1				MC_MoveRe	lative	
Start1 Complete1 MC_Axis000 Axis — Axis MC_Axis000			Start1	Complete1	MC_Axis000-Axi	s	Axis MC_A	is000
Execute Done			i i		Exe	cute	Done	
20 Distance Busy Enter Variable					20- Dis	tance	Busy Enter 1	ariable
10-Velocity Active Enter Variable					10- Vel	ocity	Active Enter 1	ariable

**1** Select *Check All Programs* from the Project Menu.

The results of the program check are displayed on the Build Tab Page.

If there are any errors, correct them.

Warnings such as "A parameter is not entered for the output." may be displayed because variables and actual inputs are not assigned in the I/O map. In this case, ignore the warnings and continue the procedure.



3

3-27

# 3-6 Transferring the Project to the CPU Unit

The project, which contains the user program, is transferred to the CPU Unit. Turn ON the power supply to the Controller and to the Servo Drive.

#### Online Connection

**1** Use one of the following methods to go online.

Method 1: Select <i>Online</i> from the Controller Menu.	File       Edit       View       Insert       Project       Controller       Simulation       Tools       Help         Communications       Setup       S
Method 2: Click the A Button on the Toolbar.	
Method 3: Press the Ctrl + W W Keys.	

The CPU Unit name is written to the Controller, and the Sysmac Studio goes online with the Controller.

Startup motion_1202 - new_Controller_0 -		
Eile Edit View Insert Project Control	er Simulation Iools Help	
Comparison of Base     Second State     Second State	The Sysmac Studio goes online and the color of the bar at the top of the Edit Pane changes to yellow.	Landor

#### • Transferring the Project

You must transfer the project to the CPU Unit. The synchronize operation is used to transfer the project. Here, "synchronize" means to automatically compare the data for the Sysmac Studio on the computer with the data in the physical Controller and transfer the data in the direction that is specified by the user.

**1** Use one of the following methods to display the Synchronize Pane.



Comparison of the data on the computer and the data in the physical Controller is started.

The comparison results are displayed after the comparison is completed.





**3** Click the **Yes** Button.



The operating mode changes to PROGRAM mode, and the Sysmac Studio starts transferring the project to the CPU Unit. During the transfer, a progress bar appears in the Synchronize Pane.



**4** The following dialog box is displayed when the transfer is completed. Click the **No** Button. Do not change to RUN mode at this time (i.e., remain in PROGRAM mode).





The Synchronize Pane closes.

# 3-7 Confirming System Operation

Confirm that the system is operating correctly.

Place the CPU Unit online with the Sysmac Studio before you perform the procedures that are given in this section.

#### 3-7-1 Checking for Controller Errors

192.168

RUN mode

ONLINE

ERR/ALM

The color of the ERR/ALM indicator in the Controller Status Pane of the Sysmac Studio shows the presence of any errors. If ERR/ALM is red, an error has occurred. Follow the instructions that are given below to check the details of the error.



The Detailed View of the Controller Status Pane is displayed.

Partial or minor	Nerroral communications for a RUN mode fault level Controller error occurs
IP address	
Subnet mask	
Operation authority	Indicates a Controller error.
Primary periodic task execution time	0.000 us
Primary period	2000.000 us
EtherNet/IP Tag Data Link	
EtherCAT Process Data Communications	
Serial ID	
Variable in Forced Refreshing	None
Unit version	
Project unit version in the Controller	
Hardware revision	
List of Controllers Connected Online	
CPU Unit name IIP address new_Controller_0	slCommunicationslOperating model Controller error I User-defined err Normal comm. RUN mode Partial or minor fault level Cc No user-defined

**2** Use one of the following methods to open the Troubleshooting Window.



The Troubleshooting Window is displayed for the Edit Pane.

From there, you can check detailed information on any errors that have occurred and find out how to troubleshoot them.

Troubleshooting			
Controller Errors	× Controller Event Log	V User-defined Erro	ors × User-defined Event Log ×
	ource I Source Details I Event Nan AT Master Communications port Link OFF Er		
	A list of Controller errors is displayed.		
Details	A Link OFF state occurred.		ls on the errors and possible ons are displayed in this area.
Attached information 1	[Cause] (1) The Ethernet cable is broken between the (2) The Ethernet cable connector is disconnect (3) The Ethernet cable is not connected.		Click the <b>Display Switch</b> Button to switch between the detailed error information and possible solutions.
Attached information 2			
Attached information 3			
Attached information 4		Display 9	Witch Jump to Error Error Help Reset All

3 Refer to the error details and troubleshooting information to solve the problems and eliminate all errors.

**4** Click the **Reset All** Button in the Troubleshooting Window.

Click the Reset All Button.	Display Switch Jump to Error Error Help Reset All
The following confirmation dialog b <b>5</b> Click the <b>Yes</b> Button.	oox appears.
Click the Yes Button.	Troubleshooting When you reset observation or higher level Controller Errors in CJ-series Special I/O Units and CPU Bus Units, the applicable Units will be restarted after error reset. When you reset the Controller Errors in EtherCAT or EtherCAT slave terminals, the slaves not in the Operational state (i.e. output disabled) due to error will transition to the Operational state and their outputs will be enabled. Fully confirm the safety of connected devices before resetting the errors. Do you want to reset all errors? (Y/N)

All errors are reset.

If the cause of the error is not removed, the error will occur again.

#### Additional Information

- If an EtherCAT communications cable is not properly connected or if power is not supplied to a Remote I/O Unit, a minor fault level Controller error (a Link OFF Error or Network Configuration Verification Error) will occur. If you are sure that all EtherCAT communications cables are properly connected, first check to make sure that power is being supplied to the Remote I/O Units before you reset the errors.
- If you use the default Servo parameters, you must wire the immediate stop input, negative drive prohibit input, and the positive drive prohibit input.
   If these inputs are not wired, the CPU Unit will remain in the drive prohibit signal and emergency stop signal detected state, and a minor fault level Controller error will occur. The minor fault level Controller errors that will occur are an Immediate Stop Input Error and a Drive Prohibition Input Error. (The event codes are 68220000 and 64E30000.)
   If the above signals are temporarily not wired while commissioning the system, you can temporarily change the Servo parameters to prevent these errors from occurring in the CPU Unit. Refer to *A-1 Settings When Control Input Signals Are Not Wired* for details on the settings that you must change in this case.

### 3-7-2 Resetting the Absolute Encoder from the Sysmac Studio

Right-click the Servo Drive and select Setup and Tuning from the menu.

The absolute encoder must be set up the first time it is used, and when the rotation data is initialized to 0.



1

The Setup and Tuning Portal appears.

2 Click the Quick Parameter Setup and I/O Monitor Button.

Setup and Tuning Portal					
You can do Quick Parameter Setup, I/O Monitoring and Tuning easily.					
▼ Quick Parameter Setup and I/O Monitor					
Quick Parameter Setup and I/O Monitor         Setup basic parameters quickly and monitor I/O signals.         Tuning         Please choose the type of tuning you want to perform:					
Easy Tuning	Advanced Tuning	Manual Tuning			
Tune based on simple steps.	Tune based on simulating the system's response in frequency and time domains. Ensure that Inertia Ratio and Viscous Friction Coefficient are correctly set.	Tune based on setting the machine rigidity.			

The following dialog box appears. Click the Yes Button.



The Motor and Encoder setting Page appears.





The Encoder Properties Tab Page appears.

# 4 Click the Clear system Button.

Encoder Properties					
▼ Monitor					
Name	Value				
▼ Encoder Error					
Encoder - Encoder Communications Error C…	0				
▼ Encoder Status					
Encoder - Resolution per Rotation	8388608				
Encoder - One-rotation Data	718247 Encoder Unit				
Encoder - Multi-rotation Data	1352 Rotations				
Encoder - Electric Angle	154 degree				
Encoder - Mechanical Angle	30 degree				
Encoder - Encoder Temperature	40 °C				
▼ Operations					
Clear system Multiple rotation data will be cleared, and the machine system will change to a new position data system.					
Event Name Error Code					
Reset alarm					
Reset Communications Error Count Reset Motor Replacement Detection error					

An Absolute Value Clear Error (error display number: 2701) will occur, and a dialog box indicating "Restart the drive to complete the operation."

# **5** Click the **Yes** Button.

	Name		Value
r Enco	oder Error		
	Encoder - Encoder Communications Error Count		
F Enco	oder Status		
		8388608	Sysmac Studio
	Encoder - One-rotation Data	7427566 Encoder Unit	Sysmac Studio
	Encoder - Multi-rotation Data	81 Rotations	
	Encoder - Electric Angle	153 degree	Do you want to reset all errors? (Y/N)
	Encoder - Mechanical Angle	318 degree	
	Encoder - Encoder Temperature	39 °C	Yes No
perat	ions		
ear si	stem 🔥 Multiple rotation data will be cleared	l, and the machine system will cha	nge to a new position data system.
_			
	Alarm vent Name   Error Code		

The multiple rotation data of the absolute encoder is cleared.

- <b>_</b>	Encoder Properties		
▼ Monit	or		
1	Name		Value
T En	coder Error		
	Encoder - Encoder Communications Error C····		
▼ En	coder Status		
	Encoder - Resolution per Rotation	8388608	
_	Encoder One retation Data	570001 Encoder Linit	
	Encoder - Multi-rotation Data	0 Rotations	
►	Encoder - Electric Angle	124 degree	
	Encoder - Mechanical Angle	24 degree	
	Encoder - Encoder Temperature	40 °C	
<ul> <li>Opera</li> </ul>	ations		
Clear s		ared, and the machine system will change to a new position	data system.
Current	Event Name Error Code		
Reset a	alarm		
Res	et Communications Error Count		
Reset 1	Motor Replacement Detection error		

#### 3-7-3 Checking the Servo Drive Wiring

Use the MC Test Run operation in the Sysmac Studio to check the wiring of the Servo Drive.

The wiring is checked in PROGRAM mode to prevent a user program for which operation has not been verified from affecting the wiring confirmation results. In this Guide, the project is transferred in PRO-GRAM mode.

An MC Test Run allows you to perform tasks such as monitoring the control inputs of an OMRON Servo Drive that has been assigned to an axis or operating the Servomotor without any user programming. Use this to check the Servo Drive wiring and the operation of the Servomotor.

# Starting an MC Test Run

Start an MC Test Run from the Sysmac Studio.

**1** Right-click MC\_Axis000(0) under Configurations and Setup - Motion Control Setup - Axis Settings in the Multiview Explorer, and select *Start MC Test Run* from the menu.



**2** When the following caution dialog box appears, read the message carefully. After you confirm safety, click the **OK** Button.



The MC Test Run Tab Page is displayed in the Edit Pane.

MC Test Run 🗙	
Axis selection MC_Axis000(0)(Node : 1) V	
Status	
Axis ready-to-execute Axis disable	
Standstill Discrete moti	
Stopping Error stopping	ng Home defined In home position
Motion error list	Details
LevellSourcelEvent Namel	Details
	Countermeasure and remedy
	and remedy
	Reset errors
Test Run	
Stopping Servo ON	
Drive status	
Command current position 955.6303715705	7 mm Positive limit input OFF Home input OFF
Actual current position 955.6303715705	
Command current velocity 0.0005960464477539	06 mm/s Immediate stop input OFF Main power ON
Actual current velocity 0.0005960464477539	06 mm/s Home proximity input OFF Drive error input OFF
	Latch input 1 OFF Drive warning input OFF
	Latch input 2 OFF

# **Checking the Control Input Signal Wiring**

Use the control input signal status indicators on the MC Test Run Tab Page in the Sysmac Studio to check the wiring of the control input signals.



2 Check to see if the signals turn ON and OFF properly on the monitor screen by turning ON and OFF the sensor connected to each control input signal.



# **Checking the Servomotor Wiring**

Use the MC Test Run Tab Page in the Sysmac Studio to check the Servomotor wiring.

#### Precautions for Correct Use

• When one of the following operations is performed for a command from the Sysmac Studio, the Servomotor will operate at the set velocity: Servo ON, jogging, relative positioning, absolute positioning, or homing.

Always confirm that it is safe for the Servomotor to operate before executing any of these operations.

- When operating the Controller from the Sysmac Studio, always install external emergency circuits so that the Servomotor can be stopped safely whenever necessary. The Sysmac Studio may not be able to send commands under some circumstances, e.g., if an error occurs in the computer.
- Set the EtherCAT communications and establish communications before you attempt to perform operation from the Sysmac Studio.

#### Servo ON

You can use the Servo ON Button to turn the Servo ON and OFF.

**1** Select the axis to check on the MC Test Run Tab Page.

MC Test Run 🗙				*
Axis selectic MC_Axis000(0)(N	ode : 1) 🔻			
Status				
Axis ready-to-execute	Axis disabled			
Standstill	Discrete motion	Continuous motion	Homing	
Stopping	Error stopping	Home defined	In home position	

#### 2 Click the Servo ON Button.

Test Run Stopping	Servo ON		
Orive status			
Command current position	3124.19626116753 mm	Positive limit input OFF	Home input OFF
Actual current position	3124.19626116753 mm	Negative limit input OFF	Servo ready
Command current velocity	0.000596046447753906 mm/s	Immediate stop input OFF	Main power ON
Actual current velocity	0.000596046447753906 mm/s	Home proximity input OFF	Drive error input OFF
		Latch input 1 OFF	Drive warning input OFF
		Latch input 2 OFF	

The Servo is turned ON for the selected axis.

Click the Servo OFF Button in this state to turn the Servo OFF.

Test Run Stopping Drive status	Servo OFF		
Command current position	3124.19633150101 mm	Positive limit input OFF	Home input OFF
Actual current position	3124.19632911682 mm	Negative limit input OFF	Servo ready ON
Command current velocity	0 mm/s	Immediate stop input OFF	Main power ON
Actual current velocity	-0.00298023223876953 mm/s	Home proximity input OFF	Drive error input OFF
		Latch input 1 OFF	Drive warning input OFF
		Latch input 2 OFF	

#### Jogging

Jog the axis in the Servo ON state.

1 Click the Jogging Tab on the MC Test Run Tab Page.



2 Enter the target velocity, acceleration rate, and deceleration rate, and then click the **Apply** Button. For this example, set the target velocity to 50.



3 Click the 🖪 Button or the 🖪 Button.

The motor will operate in either the positive or negative direction while one of these buttons is clicked.

Check to see if the motor operates in the set direction.

# Ending the MC Test Run

After you have checked the wiring of the control input signals and the Servomotor, end the MC Test Run operation.

1 Right-click MC\_Axis000(0) under Configurations and Setup - Motion Control Setup - Axis Settings in the Multiview Explorer, and select *Stop MC Test Run* from the menu.

Multiview Explorer 🗸 🎍	MC Test Run ×
new_Controller_0         ▼         Configurations and Setup         > B EtherCAT         > St CPU/Expansion Racks         at 10 Map         ■ € Controller Setup         ♥ Motion Control Setup         ♥ Motion Control Setup         ♥ Motion Control Setup         ♥ Anst:         L @ Arest:         Ø' Cam Dat	Axis selection MC_Axis000(0)(Node : 1)  Status Axis ready-to-execute Axis disabled Standstil Discrete motion Continuous motion Homing Home defined In home position Motion error list Level/SourcelEvent Namel Details Countermeasure and remedy
Event Se Copy Task Seti	Reset errors
Pata Tra	Test Run
Programming     Rename	Stopping Servo OFF
Start MC Test Run	Drive status
Stop MC Test Run	nand current position 3228.48917961121 mm Positive limit input OFF Home input OFF
	Actual current position 3228.48918318748 mm Negative limit input OFF Servo ready ON

This ends the MC Test Run operation.

<u>File Edit View Insert Project Con</u>	ntroller s	Simulation	<u>T</u> ools <u>H</u>	elp	_		_	_	_	-	-	-	-	_	_	-	-	_
X 4 6 1 5 C 6	<b>। ८</b> क्षे	63 63 63	A 🖲	民	A X	63	ka 🖡	- <b>6</b>	0 ြ	: :P	Ľ	€,	ବ୍ "	iζ				
Multiview Explorer 🗸 🗸																		
new_Controller_0																		
Configurations and Setup																		
► I EtherCAT																		
CPU/Expansion Racks I/O Map																		
Controller Setup																		
▼ ∯ Motion Control Setup																		
▼ III Axis Settings																		
MC_Axis000 (0,MC1)																		
∟ li Axes Group Settings & Cam Data Settings																		
<ul> <li>Event Settings</li> </ul>																		
Task Settings																		
☑ Data Trace Settings																		
Programming																		

#### 3-7-4 Checking Program Operation

You will change the operating mode of the CPU Unit to RUN mode and then use monitoring, control BOOL variables (set/reset), and use the MC Monitor Table in the Ladder Editor to check the operation of the program that you created. Control (set/reset) the status of the inputs to control the motion control instructions, and use the MC Monitor Table to check the results of their execution.

**1** Double-click **Section0** under **Programming** – **POUs** – **Programs** – **Program0** in the Multiview Explorer.

Multiview Explorer 🚽 🕂	
new_Controller_0	
Configurations and Setup	
► 禤 EtherCAT	
CPU/Expansion Racks	
↓* I/O Map	
Controller Setup	
► ⊕ Motion Control Setup	
<ul> <li></li></ul>	
Task Settings	
► I Data Trace Settings	
▼ Programming	
V 🗐 POUs	
V 🗐 Programs	
L      Section0	
L 30 10	
L 🗊 Function Blocks	
▼ III Data ∟58 Data Types	
L 🖂 Global Variables	
✓ ► 🖿 Tasks	
🖬 Filter  🖈	

The ladder program is displayed in the monitored state in the Edit Pane.



**2** Use one of the following methods to change the operating mode to RUN mode.

Method 1: Select <i>Mode – RUN Mode</i> from the Controller Menu.	File X	Communicat Change Devi	ions Setup.		ller Simulation Tools Help X (고 삶 A 😟 🕅 🏹
	Mul	Online Offline Synchronize		Ctrl+W Ctrl+Shift+V Ctrl+M	N
		Transfer Mode			RUN Mode +3
		Monitor Stop Monitor	ing		PROGRAM Mode Ctrl+1
Method 2: Click the Button on the Toolbar.	Δ		6 <b>) (</b> 8	$\bigcirc$	0
Method 3: Press the Ctrl + 3 3 Keys.					

**3** The following dialog box is displayed. Confirm that no problem will occur even if you change the operating mode, and then click the **Yes** Button.

Sysmac Studio	0
	Make sure a Controller startup will cause no problem. Do you want to change to RUN Mode? (Y/N)
	Yes

4 Right-click *ServoLock* in the program in the Edit Pane, and then select *Set/Reset - Set* from the menu.



ServoLock changes to TRUE, and Power1 is executed.


5 Right-click Start in the program in the Edit Pane, and then select Set/Reset - Set from the menu.

🔤 Section0 - Program0 🗙		
Variables		-
0 Servolock M	C_Axis000 Axis MC_Power Axis Axis MC_Axis000 Enable Status Busy Enter Variable Error Enter Variable ErrorID Enter Variable ErrorID Enter Variable	
1 Start1 Completal Edit Data Type Go To Variable Table Edit Variable Value Insert Parallel Input Above Insert Parallel Input Below Invert Diff Up Diff Down Add to Differential Monitor Cut Copy Paste Delete Go To Breakpoints Frecked Refeshing Set V/Reset	More Avis MC_Avis000 MC_Avis000 Avis Avis Avis Avis MC_Avis000 Execute Done 20 Distance Busy Enter Variable 10 Velocity Active Enter Variable 200 Acceleration CommandAborted Enter Variable 200 Deceleration Error Enter Variable Enter Variable Jerk ErrortD Enter Variable Enter Variable BufferMode	

Start1 changes to TRUE.

Move1 is executed and positioning is started. When the positioning for Move1 is completed, Move1 execution stops and Move2 is executed. This operation is repeated.



6 Right-click Axis Settings under Configurations and Setup - Motion Control Setup in the Multiview Explorer, and select *MC Monitor Table* from the menu.



The MC Monitor Table Tab Page is displayed in the Edit Pane.

Multiview Explorer 🚽 🕂	MC Monitor Table	×	•
	Axis Name	1 MC_Axis000(0)	
new_Controller_0 🔽	▼ Cfg		<u>^</u>
✓ Configurations and Setup	AxNo	0	
	ExecID AxEnable		
► 跚 EtherCAT		Used axis Servo axis	
CPU/Expansion Racks	AxType NodeAddress		
4⇒ I/O Map	▼ Status	1	
Controller Setup	Ready	0	
▼ III Motion Control Setup	Disabled	0	
Axis Settings	Standstill	0	
Axes Group Settings	Discrete		
Cam Data Settings	Continuous	0	
	Synchronized	0	
Event Settings	Homing	0	
Task Settings	Stopping	0	
Data Trace Settings	ErrorStop	0	
V Programming	Coordinated ▼Details	0	
V 🗐 POUs	Idle	0	
▼ III Programs	InPosWaiting	0	
V 💀 Program0	Homed	1	
L 🖶 Section0	InHome	1	
_	VelLimit	0	
	▼ Dir		
∟ 😹 Function Blocks	Posi		
V 📰 Data	Nega	0	
∟ 🗄 Data Types	▼ DrvStatus		
L 🔤 Global Variables	ServoOn		
🗹 🕨 🖿 Tasks	Ready MainPower		
	P_OT	1	
	N OT		
	HomeSw		
	Home	0	
	ImdStop	0	

- **7** Use the MC Monitor Table to confirm that the axis is moving.
  - a and b in the following figure show the information that you need to check.
  - a: Check that the value of *Pos* under *Cmd* is either increasing or decreasing.
  - b: Check that the value of Pos under Act is either increasing or decreasing.

Multiview Explorer 🚽 🖡	MC Monitor Table	×	
	Axis Name	1 MC_Axis000(0)	
new_Controller_0	Synchronized		
✓ Configurations and Setup	Homing	0	
► TherCAT	Stopping ErrorStop	0	
CPU/Expansion Racks	Coordinated	0	
	▼ Details		
🖈 I/O Map	Idle	0	
Controller Setup	InPosWaiting	0	
🔲 🔻 🕸 Motion Control Setup	Homed	1	
📕 🕞 🍈 Axis Settings	InHome VelLimit	0	
► 🖏 Axes Group Settings	veiLimit ▼Dir	0	
🖋 Cam Data Settings	Posi	1	
Event Settings	Nega	ô	
🐚 Task Settings	▼ DrvStatus		
▶ 📨 Data Trace Settings	ServoOn	1	
V Programming	Ready	1	
V 📋 POUs	MainPower	1	
V III Programs	P_OT N_OT	0	
v  Program0	HomeSw	0	
L de Section0	Home	o	
	ImdStop	0	
	Latch1	0	
L 🕅 Function Blocks	Latch2	0	
▼ III Data	DrvAlarm	0	
∟ 🖫 Data Types	DrvWarning ILA	0	
∟ 🔤 Global Variables	CSP	1	
🗹 🕨 🖬 Tasks	CSV	ō	
	CST	0	
	▼Cmd		
	Pos	18.51 mm	
	Vel	9.99999999999979 mm/sec	l l
	Trq ▼Act	0	!
	Pos	18.4899997711182 mm	
	Vel	10.000467300415 mm/sec	• (b)
	Trq	0	
	TimeStamp	0	,
	▼ MFaultLvI		
	Active Code	0	
	Code	0	

#### 3-7-5 Using Data Tracing to Check Operation

Use data tracing to check the current operation.

**1** Right-click **Data Trace Settings** under **Configurations and Setup** in the Multiview Explorer and select **Add** – **Data Trace** from the menu.



DataTrace0 is added to the Multiview Explorer.





**2** Double-click the new **DataTrace0** item in the Multiview Explorer.

The DataTrace0 Tab Page is displayed in the Edit Pane.



**3** Select the *Enable trigger condition* Check Box on the DataTrace0 Tab Page and enter the variable to use as the trigger condition. For this example, use *Program0.Move1.Execute*.



#### **4** Click the **Add Target** Button.



A trace variable line is added to the list.



**5** Enter *MC\_Axis000.Cmd.Vel* for the name of the variable to trace on the new line.



#### 6 Click the Start Trace Button.



**7** Make sure that the status bar at the lower left changes as shown in the following figure.



**8** Make sure that the results of the data trace are displayed.



Make sure that the trace results show the same waveform as shown in *3-1 Single-axis Servo System Operation*.

# 4

# Two-axis Linear Interpolation Program

This section describes how to add an axis to the single-axis Servo system constructed in Section 3 to create a two-axis linear interpolation program.

4-1	Two-a	xis Servo System Operation 4-	-2
4-2	Syste	m Setup Procedures	-3
4-3	Chang	ging the Program	-4
	4-3-1	Setting Axis 0 to a Motion Control Axis 4	-4
	4-3-2	Adding a Servo Drive to the EtherCAT Network Configuration 4	-5
	4-3-3	Adding Axis 1 and Setting an Axes Group 4	-7
	4-3-4	Adding Instructions and Checking the Program 4-1	15
	4-3-5	Transferring the Project to the CPU Unit 4-2	21
4-4	Confir	ming System Operation 4-2	22
	4-4-1	Checking the New Axis 1 4-2	22
	4-4-2	Checking Program Operation 4-2	22
	4-4-3	Using Data Tracing to Check Operation	29

# 4-1 **Two-axis Servo System Operation**

This section describes the operation of the two-axis Servo system that is set up in this Guide.

In this system, axis 0 and axis 1, which are set up for an XY stage, will repeatedly travel between two points using linear interpolation.





The axis created in *Section 3 Setting Up a Single-axis Servo System* is axis 0. The axis added in this section is axis 1.

The mechanical configuration of axis 1 is the same as that of axis 0. Refer to 3-1 Single-axis Servo System Operation for the mechanical configuration of axis 0.

# 4-2 System Setup Procedures

The basic design flow to follow to design a Servo system is shown below.

This section describes how to add a new axis, continuing from the procedures performed in *Section 3 Setting Up a Single-axis Servo System.* 

Therefore, any procedures that were completed in 3-2 System Setup Procedures are not included in this section.

#### STEP **1**. Correct the Program (page 4-4)

Add an axis variable and an axes group variable, and then correct the POU program and check it.

STEP 1-1 Set axis 0 to a motion control axis (page 4-5).

STEP 1-2 Add a Servo Drive to the EtherCAT network configuration (page 4-5).

STEP 1-3 Add axis 1 and set axes group (page 4-7).

STEP 1-4 Add instructions and check the program (page 4-15).

STEP 1-5 Transfer the project to the CPU Unit (page 4-21).

### STEP 2. Confirm System Operation (page 4-22)

Perform a check to test system operation. (Use online debugging.)

STEP 2-1 Check program operation (page 4-22).

STEP 2-2 Use data tracing to check operation (page 4-29).

# 4-3 Changing the Program

Change the program to perform linear interpolation control between two axes.

Correct the program that was created in Section 3 Setting Up a Single-axis Servo System as follows:

- Set axis 0 to a motion control axis.
- Add the second Servo Drive to the EtherCAT network configuration.
- Add an axis for the second Servo Drive, and create an axes group that contains axis 0 and axis 1.
- Add programming to perform linear interpolation control.

#### 4-3-1 Setting Axis 0 to a Motion Control Axis

To perform linear interpolation control between two axes, change the setting of axis 0 that was created in *Section 3 Setting Up a Single-axis Servo System* from a single-axis position control axis to a motion control axis.



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





Selecting **All** enables the axis to be used for both single-axis position control and two-axis linear interpolation control.

#### 4-3-2 Adding a Servo Drive to the EtherCAT Network Configuration

A R88D-1SN01L-ECT Servo Drive is added as part of the EtherCAT network configuration that was created in *Section 3 Setting Up a Single-axis Servo System*. This Servo Drive will operate as axis 1.



#### **1** Double-click **EtherCAT** under **Configurations and Setups** in the Multiview Explorer.



The EtherCAT Tab Page is displayed in the Edit Pane.

**2** Right-click **R88D-1SN01L-ECT** in the Toolbox, and select **Insert** from the menu.

EtherCAT ×			Toolbox 🗸 🕂
Node AddressINetwork configuration			All vendors
1 Kaster RB8D-15N02L-ECT Rev1.0	Item name Device name Model name Product name Number of Saves DO Communications Cycle 1 PDO Communications Cycle 2 Reference Clock Total Cable Length Failasch Operations String Wait Time for Slave Startup PDO communications througe detection count Revision Check Method DC Synchronous Correction Device name Set a name for the master.	Value Master Master 2000 Gamma Content	Alignous     Terminal Coupler     Bervo Drives     Frequency Inverter     Training Vinetter     Training Vinetter     Training Vinetter     No-ECC201 Rev 1.2     No-ECC202 Stitle:Cr1 coupler v1.2     No-ECC203 Stitle:Cr1 coupler v1.2     No-ECC203 Rev 1.4     No-ECC203 Rev 1.4

The Servo Drive is added under *E001* with a node address of 2.



This concludes the creation of the EtherCAT network configuration.

#### 4-3-3 Adding Axis 1 and Setting an Axes Group

Add the axis settings for axis 1, and then set up the axes group to perform interpolation.

#### • Adding the Axis Settings for Axis 1

**1** Right-click **Axis Settings** in the Multiview Explorer and select **Add - Motion Control Axis** from the menu.



An axis is added to the Multiview Explorer.

The axis is added as *MC\_Axis001*. This axis is called axis 1.



#### • Assigning the Axis and Setting the Axis Parameters

Assign a Servo Drive to MC\_Axis001 (the new axis 1), and set its axis parameters.

You could use the same procedures as described in the *Assigning a Servo Drive to the Axis* on page 3-10 and *Setting the Axis Parameters* on page 3-13 in *3-5-1 Setting the Axis*.

For this example, we will use the Axis Setting Table to copy the settings from axis 0 to axis 1.

**1** Right-click **Axis Settings** under **Configurations and Setup - Motion Control Setup** in the Multiview Explorer, and select **Axis Setting Table** from the menu.



The Axis Setting Table is displayed in the Edit Pane.

The axis parameters for axis 0 (1 MC\_Axis000(0)) are already set, but the axis parameters for axis 1 (2 MC\_Axis001(1)) are still set to their default values.

🔯 Axis Setting Table 🗙		
Parameters to show All 🔻		
Axis Name	1 MC_Axis000	2 MC_Axis001
Axis Basic Settings		
Axis number	0	1
Motion control	MC1: Primary periodic task	MC1: Primary periodic task
Axis use	Used axis	Used axis
Axis type	Servo axis	Virtual servo axis
Control function	Single-axis position control only	All
Feedback control	No control loop	No control loop
Input device 1	-	-
Channel	-	-
Input device 2	-	-
Channel	-	-
Input device 3	-	-
Channel	-	
Output device 1	Node : 1	-
Channel	CH1	
Output device 2	-	-
Channel	-	-
Output device 3	-	
Channel	-	-

Axis Setting Table 🗙			
ameters to show All 🔻			
Axis Name	1 MC_Axis000	$\geq$	2 MC_Axis001
Axis Basic Settings	Select Axes to Show		
Axis number			
Motion control	Add New Arit		MC1: Primary periodic tas
Axis use	Сору	Ctrl+C	Used axi
Axis type	Paste	Curi÷ V	Virtual servo axi
Control function	Add New Axis and Pas	ste the Settings	А
Feedback control	No c	ontrol loop	No control loo
Input device 1		-	
Channel		-	
Input device 2		-	
Channel		-	
Input device 3		-	
Channel		-	
Output device 1		Node:1	
Channel		CH1	
Output device 2		-	
Channel		-	
Output device 3		-	

#### 2 Right-click 1 MC\_Axis000(0) and select Copy from the menu.



🔯 Axis Setting Table 🗙		
Parameters to show All 🔻		
Axis Name	1 MC_Axis000	2 MC_Axis001
Axis Basic Settings		
Axis number	0	1
Motion control	MC1: Primary periodic task	Select Axes to Show
Axis use	Used axis	Add New Axis
Axis type	Servo axis	Copy Ctrl+C
Control function	Single-axis position control only	Paste Ctrl+V
Feedback control	No control loop	Artenen
Input device 1	-	
Channel	-	-
Input device 2	-	-
Channel	-	-
Input device 3	-	-
Channel	-	-
Output device 1	Node : 1	· · · · · · · · · · · · · · · · · · ·
Channel	CH1	-
Output device 2	-	-
Channel	-	-
Output device 3	-	
Channel	-	

The settings of the axis parameters for axis 0 are copied to axis 1.

🔯 Axis Setting Table 🗙		
Parameters to show All 🔻		
Axis Name	1 MC_Axis000	2 MC_Axis001
Axis Basic Settings		
Axis number	0	0
Motion control	MC1: Primary periodic task	MC1: Primary periodic task
Axis use	Used axis	Used axis
Axis type	Servo axis	Servo axis
Control function	Single-axis position control only	Single-axis position control only
Feedback control	No control loop	No control loop
Input device 1	-	-

In this state, the input device for axis 1 still needs to be assigned to a Servo Drive.

4 Click the *Input device* Cell in the 2 MC\_Axis001(1) column, and select Node: 2, Device: R88D-1SN01L-ECT.

🔯 Axis Setting Table 🗙		
Parameters to show All 🔻		
Axis Name	1 MC_Axis000	2 MC_Axis001
Axis Basic Settings		
Axis number	0	1
Motion control	MC1: Primary periodic task	MC1: Primary periodic task
Axis use	Used axis	Used axis
Axis type	Servo axis	Servo axis
Control function	All	All
Feedback control	No control loop	No control loop
Input device 1	-	-
Channel	-	-
Input device 2	-	-
Channel	-	-
Input device 3	-	-
Channel	-	
Output device 1	Node : 1	<not assigned=""></not>
Channel		Node : 2 R88D-1SN02L-ECT(E002)
Output device 2	-	<nol assigned<="" td=""></nol>
Channel	-	-
Output device 3	-	-
Channel	-	-

This will assign node 2 and device R88D-1SN01L-ECT as the input device for axis 1.

🔯 Axis Setting Table 🗙				
Parameters to show All				
Axis Name	1 MC_Axis000	2 MC_Axis001		
Axis Basic Settings				
Axis number	0	1		
Motion control	MC1: Primary periodic task	MC1: Primary periodic task		
Axis use	Used axis	Used axis		
Axis type	Servo axis	Servo axis		
Control function	All	All		
Feedback control	No control loop	No control loop		
Input device 1	-	-		
Channel	-	-		
Input device 2	-	-		
Channel	-	-		
Input device 3	-	-		
Channel	-	-		
Output device 1	Node : 1	Noc : 2		
Channel	CH1	CHI		
Output device 2	-	-		
Channel	-	-		
Output device 3	-	-		
Channel	-	-		

Now, node 2 with device R88D-1SN01L-ECT can be used as an axis in the EtherCAT network configuration.

#### • Adding Axes Group Settings

**1** Right-click **Axes Group Settings** under **Configurations and Setup - Motion Control Setup** in the Multiview Explorer and select **Add - Axes Group Settings** from the menu.



An axes group is added to the Multiview Explorer.

The new axes group is displayed as *MC\_Group000*.





**2** Right-click the group that you added in the Multiview Explorer and select *Edit* from the menu.

The axes group settings are displayed on the Axes Group Basic Settings Display in the Edit Pane.





This concludes the axes group settings.

#### Confirming That the Axes Group Variable Is Registered

System-defined variables for axes groups are called Axes Group Variables.

You can use axes group variables in the user program to enable the execution of axes group motion control instructions or to access the status of the axes groups.

When axes group settings are added, an axes group variable is automatically added to the global variable table.

Use the following procedure to check axes group variables.

**1** Right-click **Global Variables** under **Programming - Data** in the Multiview Explorer and select *Edit* from the menu.



The global variable table where the *MC\_Group000* axes group variable was registered is displayed in the Edit Pane.

<u>File Edit View Insert Project Co</u> r	ntroller <u>S</u> imulation <u>T</u> ools <u>H</u> elp			
X 4 6 0 0 0 0 0	1 K M G # A 0 K .	A 🔉 68 🖗 🎙 🐂 O 🖫 🖓	<b>□ @ @ </b> ®	
Multiview Explorer 🗸 🖡	Mill Global Variables 🗙			•
	Name	Data Type   Initial Value	I AT	Retain   Constant   Network Publish
new_Controller_0	MC_Axis000	_sAXIS_REF	MC://_MC_AX[0]	Do not publish
Configurations and Setup	MC Avie001	_sAXIS_REF	MC://_MC_AX[1]	Do not publish
Programming	MC_Group000	_sGROUP_REF	MC://_MC_GRP[0]	Do not publish
V 🖞 POUs				
▼ II Programs				
V 💀 Program0				
∟ 🕾 Section0				
L 😹 Functions				
∟ 🕼 Function Blocks				
🖉 🐺 Data				
L 5명 Data Types				
📕 🗆 🖿 Global Variables				
🔻 🖽 Tasks				
PrimaryTask				

#### 4-3-4 Adding Instructions and Checking the Program

Instructions to perform linear interpolation of the Servo Drives for two axes is added to the program that was created in *Section 3 Setting Up a Single-axis Servo System*, and then the program is checked.

The following instructions are added. To do so, we will use axis variables, an axes group variable, and motion control instructions.



Refer to the *NJ/NX-series Startup Guide for CPU Units* (Cat. No. W513) for details on how to create ladder diagrams.

#### Precautions for Correct Use

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The sample programming that is provided in this Guide includes only the programming that is required to operate the Servomotors. When programming actual applications, also program EtherCAT communications, device interlocks, I/O with other devices, and other control procedures.

#### **Adding Instructions**

Add the instructions that control linear interpolation of the Servo Drives for two axes.

#### • Opening the Ladder Editor

To enter the program, you must start the Ladder Editor and open section 0 of program 0.

**1** Right-click **Section0** under **Programming** – **POUs** – **Programs** – **Program0** in the Multiview Explorer, and select *Edit* from the menu.



The local variable table and Ladder Editor are displayed in the Edit Pane. From here, you can register local variables and create a ladder diagram.

At this point, the program created in Section 3 Setting Up a Single-axis Servo System is displayed.



#### • Creating the Instructions That Turn the Servo ON and OFF

You must create the instructions that turn ON the Servo for the Servo Drive for axis 1 in the same way as you did for axis 0.

**1** Create the following instructions to control turning the Servo ON and OFF for axis 1 (the axis that you added in this section).

Section0 - Program0 ×										
Variables										
Name	space - Using									<b>_</b>
Internals Externals	Name Linear2	MC_MoveLinearRelative	Initial Value	AT	Retain	Constant	Comment			
	Power2	MC_Power								
	Group1	MC_GroupEnable								~
0	ServaLock	MC_Axis000-Axis	Error — En ErrorID — En	ter Variable ter Variable ter Variable						
1	Start1	b. Insert the MC_Po b. Insert an MC_F c. Enter <i>Power2</i> a d. Enter <i>MC_Axis</i>	Power (Pow is the instai 001 (the ax	ver Servo) nce name	) instru e. e of ax	ction. is 1) fo	r the in-out	variable.	Move2 Axis MC_MoveRe Execute 200 Distance 10 Velocity 200 Acceleration Comm	elative P Dc Bi Act
		the <i>ServoLock</i> vari Servo ON and OF	able	eleration	Error	—Enter Varia —Enter Varia	able	2 Enter Varia	200— Deceleration	Er Erro
2	a.		Status Busy — En	ter Variable ter Variable ter Variable ter Variable		]				

#### • Creating the Instructions That Enable the Axes Group

To perform linear interpolation for an axes group, the axis group must be enabled. Use the MC\_GroupEnable (Enable Axes Group) instruction to enable the axes group.



#### **1** Create the following instructions to enable the axes group.

#### Additional Information

# Cascade connections are possible for Ladder Diagram Instructions (e.g., LD (Load) and AND (AND)), for FB instructions (e.g., MC\_MoveRelative (Relative Positioning)), and for FUN instructions (e.g., MOVE (Move)).

#### • Creating the Instructions That Perform Linear Interpolation

Here, the MC\_MoveLinearRelative (Relative Linear Interpolation) instruction is used to perform linear interpolation. We will use two instances of this instruction to repeatedly perform linear interpolation.

**1** Create the following instructions to repeatedly perform round-trip operation with linear interpolation.

Enter the values that are given in the following table for the input variables for the two instances of the MC\_MoveLinearRelative (Relative Linear Interpolation) instruction. The values of the *Distance* input variables are set with the instructions that are entered in the next procedure.

Input variable	Meaning	Set value				
	Meaning	Linear1	Linear2			
Distance	Travel Distance (mm)	Distance1	Distance2			
Velocity	Velocity Target Velocity (mm/s)		200			
Acceleration	Acceleration Rate (mm/s <sup>2</sup> )	4000	4000			
Deceleration	Deceleration Rate (mm/s <sup>2</sup> )	4000	4000			



#### • Creating the Instructions to Set the Travel Distances

Values must be set for the *Distance* input variables to specify the travel distances for the MC\_Move-LinearRelative (Relative Linear Interpolation) instructions. A user-defined array variable is used to set the values for the *Distance* variables.

**1** Create the following instructions to set the travel distances for the linear interpolation operations.



#### • How to set for the *Distance* variables

Because the MC\_MoveLinearRelative (Relative Linear Interpolation) instruction performs linear interpolation for up to 4 axes, the data type of the *Distance* variable (Travel Distance) is ARRAY[0..3] OF LREAL.

This is an array that enables four real numbers to be set. The array is expressed by *Distance1[n]*, n = subscript.

As two axes are used for this program, the values shown below are set in *Distance 1* and *Distance 2* for axis 0 and axis 1.

			Distance1
Linear1	Axis 0	[0]	800
	Axis 1	[1]	600
	Not set	[2]	
	Not set	[3]	
			Distance2
Linear2	Axis 0	[0]	-800
	Axis 1	[1]	-600
	Not set	[2]	
	Not set	[3]	

#### **Checking the Program**

Check the program that you created.

If there are any errors, correct them.



The results of the program check are displayed on the Build Tab Page. If there are any errors, correct them.



#### 4-3-5 Transferring the Project to the CPU Unit

Use the procedure described in 3-6 Transferring the Project to the CPU Unit to transfer the corrected project to the CPU Unit.

Remain in PROGRAM mode at this time.

# 4-4 Confirming System Operation

Confirm that the system is operating correctly.

Place the CPU Unit online with the Sysmac Studio before you perform the procedures that are given in this section.

#### 4-4-1 Checking the New Axis 1

Before you check the operation of the program, you will check the new axis 1. Use the procedures in *3-7-1 Checking for Controller Errors* and *3-7-3 Checking the Servo Drive Wiring* to check the new axis 1. Axis 1 is checked in PROGRAM mode to prevent a user program for which operation has not been verified from affecting the confirmation results.

#### 4-4-2 Checking Program Operation

You will change the operating mode of the CPU Unit to RUN mode and then use monitoring, control BOOL variables (set/reset), and use the MC Monitor Table in the Ladder Editor to check the operation of the program that you created. Control (set/reset) the status of the inputs to control the motion control instructions, and use the MC Monitor Table to check the results of their execution.

**1** Double-click **Section0** under **Programming - POUs - Programs - Program0** in the Multiview Explorer.





The ladder program is displayed in the monitored state in the Edit Pane.

2 Use one of the following methods to change the operating mode to RUN mode.

Method 1: Select <i>Mode</i> – <i>RUN Mode</i> from the Controller Menu.	File X	Edit View Communio Change Di			Controller	Simulat র্ম্নার্ট্র	ion Tool	-
	Mul	Online Offline		Ctrl- Ctrl-	+₩ +Shift+W	<b>.</b>	+ #	
	۲I	Synchroni: Transfer	e	Ctrl	+M •			
		Mode Monitor Stop Moni	oring		(	PROGR	1ode RAM Mode	Ctrl+1
Method 2: Click the Button on the Toolbar.	4	*	63 🛓	$\bigcirc$		0		
Method 3: Press the Ctrl + 3 3 Keys.								

3 The following dialog box is displayed. Confirm that no problem will occur even if you change the operating mode, and then click the **Yes** Button.

Sysmac Studio	
A	Make sure a Controller stop will cause no problem. Do you want to change to PROGRAM Mode? (Y/N)





ServoLock changes to TRUE, and Power1 and Power2 are executed.







GroupEnable changes to TRUE, and Group1 is executed.



6 Right-click *Start2* in the program in the Edit Pane, and then select *Set/Reset - Set* from the menu.

Section0 - Program0 ×					
Variables					
	20-	Distance	Busy — Enter Variable	-20— Dist	tance Busy
	10-	Velocity	Active Enter Variable	10— Vel	ocity Active
	200-	Acceleration Cor	mmandAborted — Enter Variable	200— Acc	eleration CommandAborted
	200-	Deceleration	Error — Enter Variable	200-Dec	celeration Error
	Enter Variable <del>-</del>	lerk	ErrorID Enter Variable	Enter Variable	< ErrorID
Edit	Enter Variable			Enter Variable Buf	
	Enter variable	bullerwoode		Enter Variable	Termidde
Go To Variable Table	Power2				
Edit Variable Value	MC_Axis001 Axis Axis	MC_Axis001			
Insert Parallel Input Above	Enable Status				
	Busy	Enter Variable			
		Enter Variable			
Diff Up	ErrorID	Enter Variable			
	Group1				
Add to Differential Monitor	MC_Group000 AxesGroup	AxesGroup M	C Group000		
Cut	Execute	Done	1. C		
Сору			las Mariakia		
			ter Variable		
	Comr	handAborted = En	ter Variable		
Go To 🔹 🕨		Error En	ter Variable		
Breakpoints +		ErrorID = En	ter Variable		
Forced Refreshing		Li	near1		Linear2
Set/Reset	Set	MC_Move	LinearRelative	MC Group000-	MC_MoveLinearRela
Start2	Complete2		AxesGroup MC_Group000	MC_Group000-	
		Execute	Done		- Execute
	Distance1-	Distance	Busy Enter Variable	Distance2-	- Distance
	200-	Velocity	Active Enter Variable	200-	Velocity
	4000-	Acceleration	CommandAborted - Enter Variable	4000-	Acceleration Comma
	4000-	Deceleration	Error — Enter Variable	4000-	Deceleration

Start2 changes to TRUE.

*Linear1* is executed and positioning is started. When the positioning for *Linear1* is completed, *Linear1* execution stops and *Linear2* is executed. This operation is repeated.



7 Right-click Axis Settings under Configurations and Setup - Motion Control Setup in the Multiview Explorer, and select *MC Monitor Table* from the menu.



The MC Monitor Table is displayed in the Edit Pane.

MC Monitor Table 🗙			
Axis Name	1 MC_Axis000(0)	2 MC_Axis001(1)	
Disabled	0	0	
Standstill	0	0	
Discrete	0	0	
Continuous	0	0	
Synchronized	0	0	
Homing	0	0	
Stopping	0	0	
ErrorStop	0	0	
Coordinated	1	1	
▼ Details			
Idle	0	0	
InPosWaiting	0	0	
Homed	1	1	
InHome	0	0	
VelLimit	0	0	
▼ Dir			
Posi	1	1	
Nega	0	0	
▼ DrvStatus			
ServoOn	1	1	
Ready	1	1	
MainPower	1	1	
P_OT N_OT	0	0	
	0	0	
HomeSw	•		
Home	0	0	
ImdStop Latch1	0	0	
Latch2	0	0	
DrvAlarm	0	0	
DrvAlarm DrvWarning	0	0	
ILA	0	0	
CSP	0	1	
CSV	1	0	
CSV	0	0	
v Cmd	0	0	
Pos	259.04 mm	194.28 mm	
Vel	259.04 mm 159.99999999997 mm/sec	194.28 mm 120.0000000005 mm/sec	
Trq	123.393333333333333333333333333333333333	120.00000000000000000000000000000000000	
v Act	V		
Pos	258.719999790192 mm	194.039999246597 mm	
Vel	160.000324249268 mm/sec	119.999647140503 mm/sec	
Trq	100.000524249208 mm/sec	119,999047140505 mm/sec	
TimeStamp	0		
▼ MFaultLvl	· · · · · · · · · · · · · · · · · · ·	v	
Active	0	0	
Code	0	0	
▼ Obsr			
Active	0	0	
Code	0	0 0	
0000			

**8** Use the MC Monitor Table to confirm that the axis 0 and axis 1 are moving. *a* and *b* in the following figure show the information you need to check.

a: Check that the value of *Pos* under *Cmd* is either increasing or decreasing.

b: Check that the value of *Pos* under *Act* is either increasing or decreasing.



#### **Additional Information**

- In this program, positioning is performed without using the Home instruction because the 1Sseries AC Servo System is equipped standard with an absolute encoder.
- The *Linear1* and *Linear2* instances perform linear interpolation for relative positions from where execution of the *Linear1* instance starts.
   To start from 0 mm, execute the *MC\_Home* (Home) instruction to define home or execute the *MC\_MoveAbsolute* (Absolute Positioning) instruction to move to 0 mm, and then execute the *Linear1* instance.
### 4-4-3 Using Data Tracing to Check Operation

Use data tracing to check the current operation.

**1** Double-click **DataTrace0** under **Configurations and Setup** – **Data Trace Settings** in the Multiview Explorer.

Multiview Explorer 🗸 📮	MC Monitor Table	×	
	Axis Name	1 MC_Axis000(0)	2 MC_Axis001(1)
new_Controller_0	▼ Cfg		
Configurations and Setup	AxNo ExecID	0	1
► ₩ EtherCAT	AxEnable	L Used axis	Lused axis
CPU/Expansion Racks	AxType	Servo axis	Servo axis
J/O Map	NodeAddress	1	2
Controller Setup	▼ Status		
▼ ☆ Motion Control Setup	Ready	0	0
	Disabled	1	1
▼ III Axis Settings	Standstill	0	0
L 你 MC_Axis000 (0,MC1)	Discrete	0	0
L 你 MC_Axis001 (1,MC1)	Continuous	0	0
	Synchronized	0	0
Axes Group Settings	Homing	0	0
🖌 Cam Data Settings	Stopping	0	0
Event Settings	ErrorStop	0	0
Task Settings	Coordinated	0	0
	▼ Details		
V III Data Trace Settings	Idle	1	1
L EM DataTrace0	InPosWaiting	0	0
V Programming	Homed	1	1
V 🛾 POUs	InHome	1	1

The DataTrace0 Tab Page is displayed in the Edit Pane.



2 Select the *Enable trigger condition* Check Box on the DataTrace0 Tab Page and enter the variable to use as the trigger condition. For this example, use *Program0.Linear1.Execute*.



**3** Click the Add Target Button.



A trace variable line is added to the list.

DataTrace0 ×
Trace type Single 🔻 Sampling interval Every period of task 🔻 PrimaryTask 🔻 Trace No. 0 🔍
Number of samplings 10000
Post-trigger data ratio 100 % 0 10000
Start tracing at switching from PROGRAM mode to RUN mode
Visiblel   Name  X OffsetlY OffsetlY Axis Min. Y Axis Max.  Cursor   Minimum   Maximum   Average   Comment
0 0 0 0 0 119,9995 -120.0000 120.00000 1.110000
+0

**4** Enter *MC\_Axis001.Cmd.Vel* for the name of the variable to trace on the new line.

DataTrace0 ×		-
	📉 🔤 🖾 🖾 🖉 🎬 X Axis Time (ms) 🔽 🧭 🔔 🗰 🚺 🚺	
Trace type Single 🔻 Sampling interv	al Every period of task 🔻 PrimaryTask 🔻 Trace No. 0 🔍	
Number of samplings 10000		
Post-trigger data ratio 100% 0 10 Start tracing at switching from PROGRA	000 ■ Enable trigger condition Program0.Linear1.Execute TRUE (rising) ▼ M mode to RUN mode ■ Refresh charts during tracing	
Visible    Name	X Offset Y Offset Y Axis Min. Y Axis Max.  Cursor   Minimum   Maximum   Average   Comm	ent
MC Axis000.Cmd.Vel	0 0 0 0.48000 159.9999 -160.0000 160.00000 1.480000	
MC_Axis001.Cmd.Vel	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	
<b>十</b> 百		

#### **5** Click the **Start Trace** Button.



**6** Make sure that the status bar at the lower left changes as shown in the following figure.



4

**7** Make sure that the results of the data trace are displayed.



Make sure that the trace results show the same waveform as shown in 4-1 Two-axis Servo System Operation.

#### Additional Information

You can use the 3D Motion Trace Display Mode to check program operation. The 3D Motion Trace Display Mode displays the operation of an axes group based on a machine model that assumes an XY stage. This mode allows you to display the trace results in the same coordinate system as the graph that shows the positions of two axes in *4-1 Two-axis Servo System Operation*. Refer to *A-2 Using the 3D Motion Trace Display Mode to Check Operation* for the procedure.

# A

# **Appendices**

A-1	Settings When Control Input Signals Are Not Wired	A-2
A-2	Using the 3D Motion Trace Display Mode to Check Operation	A-7

# A-1 Settings When Control Input Signals Are Not Wired

An error will occur in the CPU Unit if the Servo parameters for the Servo Drive are left at their default values when the Servo Drive control input signals are not wired. This is because the CPU Unit stops operation when a drive prohibit or immediate stop signal is detected. The minor fault level Controller errors that occur are as follows:

- Error Stop Input (Event code: 68220000)
- Drive Prohibition Input Error (Event code: 64E30000)

This section describes how to temporarily change the Servo parameters to prevent these errors from occurring in the CPU Unit.

The procedure described here assume that a project with a Servo Drive registered to the EtherCAT network configuration has been transferred to the CPU Unit and that the CPU Unit is currently online.



#### **Precautions for Correct Use**

If the control input signals are not wired, it will not be possible to stop operation for limit inputs or immediate stop inputs in the event that unexpected motor operation occurs. Remove the coupling from the motor shaft or take other suitable measures to prevent a hazardous condition from occurring.

Perform the following before you perform the procedures that are given in this section.

- Place the Sysmac Studio online with the CPU Unit.
- Transfer to the CPU Unit the project that contains the EtherCAT network configuration in which the Servo Drives are registered.
  - **1** Right-click Node1: R88D-1SN01L-ECT (E001): Offline under Configurations and Setup EtherCAT in the Multiview Explorer, and select *Online* from the menu.



This places Node1:R88D-1SN01L-ECT(E001) online.

2 Right-click Node1: R88D-1SN01L-ECT (E001): RUN Mode under Configurations and Setup -EtherCAT in the Multiview Explorer, and select *Setup and Tuning* from the menu.

The Setup and Tuning Portal appears in the Edit Pane.

Multiview Explorer 🚽 🦊	Node1 : R88D-1SN02L ×
new_Controller_0  Configurations and Setup	Setup and Tuning Portal
EtherCAT Node1 : R88D-1SN02L-ECT (E001)	You can do Quick Parameter Setup, I/O Monitoring and Tuning easily.
▶	▼ Quick Parameter Setup and I/O Monitor
e* I/O Map	Quick Parameter Setup and I/O Monitor
► R Controller Setup     A Motion Control Setup     Cam Data Settings     Event Settings     Task Settings     Task Settings     Can Data Trace Settings	Setup basic parameters quickly and monitor I/O signals.
Programming	▼ Tuning
	Please choose the type of tuning you want to perform:
	Easy Tuning Advanced Tuning Manual Tuning
	Tune based on simple steps. Tune based on setting the machine rigidity. Tune based on setting the machine rigidity. Tune based on setting the machine rigidity.

**3** Click the Quick Parameter Setup and I/O Monitor Button.

Node1 : R88D-1SN02L··· ×		•
Se	etup and Tuning Port	al
You can do Quick Parameter Setup, I/O Monitoring	and Tuning easily.	
▼ Quick Parameter Setup and I/O Monitor		
Quick Parameter Setup and I/ Setup basic parameters quickly and monitor I/O		
<ul> <li>Funing</li> <li>Please choose the type of tuning you want to perform</li> </ul>	orm:	
Easy Tuning	Advanced Tuning	Manual Tuning
Tune based on simple steps.	Tune based on simulating the system's response in frequency and time domains. Ensure that Inertia Ratio and Viscous Friction Coefficient are correctly set.	Tune based on setting the machine rigidity.

The following dialog box appears. Click the Yes Button.



The Motor and Encoder setting Page appears.

## **4** Click the **Next** Button.



The Input Signals setting Page appears.

**5** Change the signal active conditions of the below listed input signals from High to Low, and then click the **Transfer to Drive** Button.

- Error Stop Input
- Positive Drive Prohibit Input
- Negative Drive Prohibit Input

Rode1 : R88D-1SN02L ×	•
1 > 2 Input Signals setting > 3	Test Run Function Status
_ Input Signals	Configuration
Signal active Physical condition signal status	Operation Direction
INI Error Stop Input - Port Selection (E Conception Con	Target Speed
IN2 Positive Drive Prohibition Input - F  High OFF 32  EDM+ SFL SFL SFL SFL	60 🛊 rpm
IN3         Negative Drive Prohibition Input: <ul> <li>High</li> <li>OFF</li> <li>13</li> <li>SF2</li> <li>SF2</li></ul>	Acceleration/Deceleration Time
IN4 Home Proximity Input - Port Selec V OFF 33 /ERR+ OUT1+ OUT1-	Step Distance ?
INS Monitor Input 1 - Port Selection () V High OFF 14 OUT3+ OUT3- Low NFF 14 DUT3- 102	0 🚖 Command Unit
IN6 Monitor Input 2 - Port Selection () V High OFF 34 INS 0 IN6 IN6 IN6 IN6	Number of Cycles
IN7 External Latch Input 1 - Port Select V High OFF 15 GND OF A- Low B-	0 🌲
IN7 External Latch Input 2 - Port Selec V Low Off 35 R5 Low 20 40	Dwell Time
	Motion
	Actual Current Position -1542785674 Command Unit
	Actual Current Speed
	Servo ON
Return to Factory Setting Transfer To Drive	K
Back to Portal < Back Next >	

The following dialog box appears. Click the Yes Button.



The drive restarts and you return to the Input Signals setting Page.

## 6 Click the Next Button.

The Output Signals setting Page appears.



Α

## **7** Click the **Finish** Button.



You return to Setup and Tuning Portal.

Servo parameter errors will no longer occur in the CPU Unit. Set Node2: R88D-1SN01L-ECT(E002) in the same way as Node1.

# A-2 Using the 3D Motion Trace Display Mode to Check Operation

In *4-4-3 Using Data Tracing to Check Operation*, we checked the traced data on a timeline to confirm that the system operation was correct. In this appendix, we will explain how to use the 3D Motion Trace Display Mode to check the current operation. The 3D Motion Trace Display Mode shows a 3D model that moves according to the movements of the axes to allow you to visually confirm the executed operations. It has the following features.

- The display can be linked to a data trace time chart graph.
- You can also display the path of a marker on the 3D Equipment Model at the same time.
- You can display the 2D paths of the markers for the projections in the 3D Equipment Model Display.
- You can simultaneously display the command values to the Servo Drives and the feedback (actual) values from the Servo Drives.

Refer to the *Sysmac Studio Version 1 Operation Manual* (Cat. No. W504) for details on the 3D Motion Trace Display Mode.

**1** Double-click **DataTrace0** under **Configurations and Setup** – **Data Trace Settings** in the Multiview Explorer.



The DataTrace0 Tab Page is displayed in the Edit Pane.



Α





**3** Click the **Settings** Button for 3D equipment model and select **Add** from the menu.

DataTrace0 x	
	X Axis Time (ms) 🗸 🞯 🔭 🙀 🚺 🚺 X1
3D equipment model No 3D equipment model is	Add Ref
Load only the command values.	Delete Replicate Vie
	Edit



**4** When the 3D Equipment Model Display appears, click the **OK** Button.

3D Equipment Model				
G 3D Machine Model List				
T. State	Type Orthogonal robot (XY)	▼ 2		
Displayl Name I	* Candidates will be listed by Ctrl + Space Keys	(excluding numerical types).		Local coordinate unit : mm
MC_Group000	Name	Data Type	Value *	Convert Value  unit II
	X Stage:Corresponding variable	_sAXIS_REF	MC_Axis000	
	X Stage:Length	LREAL	1000	
	Y Stage:Corresponding variable	_sAXIS_REF	MC_Axis001	
	Y Stage:Length	LREAL	1000	
Present position X 0 Y 0 Z 0 Orientation Ry[deg] 0 Rz[deg] 0		e 2000 Scale resolutio	n 100 unit mm	
<u> </u>	_ <del></del>	200 -100 100	) 200 300 (40	00 500 600 700
		100		
		- 200		
		-300		
		-200 -400		
		<b></b>		
				OK Cancel

The axis variables that are required for the 3D Motion Trace Display are added to the list of variables to trace.

DataTrace0 ×									
	Тससघ≝ 🎴			Axis Time (ms) 🔻 🔗	_ · · · · · · · · · · · · · · · · · · ·	▶ <b>   ■</b> ▶  x1.0 ▼			
Trace type Single	<ul> <li>Sampling interval</li> </ul>	Every period of	task 🔻 PrimaryTa	isk 🔻 Trace No. 🛛					
Number of samplings	10000								
Post-trigger data ratio	J	Enable t	rigger condition		TRUE (rising) 🔻				
100 %	1000								
Start tracing at swite				sh charts during tracing					
Visible		Offset Y Offset	Y Axis Min. Y Axis N		Minimum	Maximum	Average I	Comment	<u> </u>
MC_Axis0	00.Cmd.Vel 0		0 0	-159.999999999968	-160.00000000139	160.00000000139	1.48000000000114		
	ara 117 - Ia				400.00000000440				
MC_Axis0	00.Cmd.Pos 0		0 0	12.31999999999999	0	800	404.0237440000001		
MC_Axis0	00.Act.Pos 0		0 0	19.2698264122009	0.592743158340454	799.313875436783	403.9531710945368		
MC_Axis0	01.Cmd.Pos 0		0 0	9.2399999999999901	0	600	303.0178079999999		
MC_Axis0	01.Act.Pos 0		0 0	14.4535899162292	0.440235137939453	599.486562013626	302.9648781272173		

**5** Select the *Enable trigger condition* Check Box on the DataTrace0 Tab Page and enter the *Program0.Linear1.Execute* variable to use as the trigger condition.



6 Click the Start Trace Button.





**7** Make sure that the status bar at the lower left changes as shown in the following figure.

The following dialog box appears. Click the **Yes** Button.



The results of the data trace are displayed on the 3D Motion Trace Display.





8 Click the *View Mode* Box in the 3D Motion Trace Display and select *X*-*Y* from the list.

The results of the data trace are displayed in Cartesian coordinates with axis 0 as the X axis and axis 1 as the Y axis.



Make sure that the trace results show the same operation as shown in 4-1 Two-axis Servo System Operation.

Note: Do not use this document to operate the Unit.

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