Servo System 1S-series

Startup Guide

R88M-1L[/-1M/] (AC Servomotors)
R88D-1SN[]-ECT (AC Servo Drives)
Introduction

The Servo System 1S-Series Startup Guide (hereinafter, may be referred to as "this Guide") describes the procedures for installation and setup of a 1S Servo Drive, where an NJ/NX-series CPU Unit is used in combination with 1S-series AC Servomotors/Servo Drives and NX-series Safety Unit, by using the Sysmac Studio. A simple installation model is used for the discussion. You can perform the procedures that are presented in this Guide to quickly gain a basic understanding of a 1S-series AC Servomotors/Servo Drives.

This Guide does not contain safety information and other details that are required for actual use. 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.

Intended Audience

This Guide is intended for the following personnel.

- Personnel in charge of introducing FA systems
- Personnel in charge of designing FA systems

The personnel must also have the following knowledge.

- Knowledge of electrical systems (an electrical engineer or the equivalent)
- Knowledge of NJ/NX-series CPU Units
- Knowledge of NX-series Safety Units
- Knowledge of Servomotors/Drives
- Knowledge of operation procedure of Sysmac Studio

Applicable Products

This Guide covers the following products.

- CPU Units of NJ/NX-series Machine Automation Controllers
- Automation Software Sysmac Studio
- 1S-series Servomotors/Servo Drives
- NX-series EtherCAT Coupler unit
- NX-series Safety controller

Special Information

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

Precautions for Correct Use

Precautions on what to do and what not to do to ensure proper operation and performance.

Additional Information

Additional information to read as required.

This information is provided to increase understanding or make operation easier.
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Product specifications and accessories may be changed at any time based on improvements and other reasons. It is our practice to change part numbers when published ratings or features are changed, or when significant construction changes are made. However, some specifications of the Product may be changed without any notice. When in doubt, special part numbers may be assigned to fix or establish key specifications for your application. Please consult with your Omron’s representative at any time to confirm actual specifications of purchased Product.

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Information presented by Omron Companies has been checked and is believed to be accurate; however, no responsibility is assumed for clerical, typographical or proofreading errors or omissions.
Precautions

- 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 manuals, including all safety precautions, precautions for safe use, and precautions for correct use.
- Confirm all regulations, standards, and restrictions that the system must adhere to.
- Check the user program for proper execution before you use it for actual operation.

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Software Licenses and Copyrights

The NJ-series CPU Units and Sysmac Studio incorporate certain third party software. The license and copyright information associated with this software is available at http://www.fa.omron.co.jp/nj_info_e/.
## Related Manuals

The following manuals are related. Use these manuals for reference.

<table>
<thead>
<tr>
<th>Manual name</th>
<th>Cat. No.</th>
<th>Model</th>
<th>Application</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sysmac Studio Version 1 Operation Manual</td>
<td>W504</td>
<td>SYSMAC-SE2□□□</td>
<td>Learning about the operating procedures and functions of the Sysmac Studio.</td>
<td>Describes the operating procedures of the Sysmac Studio.</td>
</tr>
<tr>
<td>Sysmac Studio Drive Functions Operation Manual</td>
<td>I589-E1</td>
<td>SYSMAC-SE2□□□</td>
<td>Learning about the operating procedures and functions of the Sysmac Studio for Drives.</td>
<td>Describes the operating procedures of the Sysmac Studio to setup Drives</td>
</tr>
</tbody>
</table>
| NJ-series CPU Unit Hardware User’s Manual       | W500     | NJ501-□□□□          | Learning the basic specifications of the NJ-series CPU Units, including introductory information, designing, installation, and maintenance. Mainly hardware information is provided. | Provides an introduction to the entire NJ-series system along with the following information on the CPU Unit.  
  - Features and system configuration  
  - Overview  
  - Part names and functions  
  - General specifications  
  - Installation and wiring  
  - Maintenance and inspection  
| NJ/NX-series CPU Unit Software User’s Manual    | W501     | NJ501-□□□□          | Learning how to program and set up an NJ/NX-series CPU Unit. Mainly software information is provided. | Provides the following information on a Controller built with an NJ/NX-series CPU Unit.  
  - CPU Unit operation  
  - CPU Unit features  
  - Initial settings  
  - Language specifications and programming based on IEC 61131-3  
  Use this manual together with the NJ-series CPU Unit Hardware User’s Manual (Cat. No. W500). |
| NJ/NX-series CPU Unit Motion Control User’s Manual | W507     | NJ501-□□□□          | Learning about motion control settings and programming concepts. | Describes the settings and operation of the CPU Unit and programming concepts for motion control.  
<table>
<thead>
<tr>
<th>Manual name</th>
<th>Cat. No.</th>
<th>Model</th>
<th>Application</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NJ/NX-series Motion Control Instructions</td>
<td>W508</td>
<td>NJ501-□□□□</td>
<td>Learning about the specifications of the motion control instructions that are provided by OMRON.</td>
<td>Describes the motion control instructions. When programming, use this manual together with the NJ-series CPU Unit Hardware User's Manual (Cat. No. W500), NJ/NX-series CPU Unit Software User's Manual (Cat. No. W501), and NJ/NX-series CPU Unit Motion Control User's Manual (Cat. No. W507).</td>
</tr>
<tr>
<td>Troubleshooting Manual</td>
<td>W503</td>
<td>NJ501-□□□□</td>
<td>Learning about the errors that may be detected in an NJ/NX-series Controller.</td>
<td>Describes concepts on managing errors that may be detected in an NJ/NX-series Controller and information on individual errors. Use this manual together with the NJ-series CPU Unit Hardware User's Manual (Cat. No. W500) and NJ/NX-series CPU Unit Software User's Manual (Cat. No. W501).</td>
</tr>
<tr>
<td>NX-series Safety Control Units User's Manual</td>
<td>Z930</td>
<td>NX-SL□□□□</td>
<td>Learning how to use the NX-series Safety Control Units.</td>
<td>Describe the hardware, setup methods and functions of the NX-series Safety Control Units.</td>
</tr>
<tr>
<td>1S-series AC Servomotors/Servo Drives with Built-in EtherCAT Communications User's Manual</td>
<td>I586</td>
<td>R88D-1S-ECT R88M-1□</td>
<td>Learning detailed specifications of a 1S-series Servo Drive.</td>
<td>Describes how to install and wire the Servo Drive, set parameters needed to operate the Servo Drive, and remedies to be taken and inspection methods to be used in case that problems occur.</td>
</tr>
</tbody>
</table>
Revision History

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

<table>
<thead>
<tr>
<th>Revision code</th>
<th>Date</th>
<th>Revised content</th>
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<tbody>
<tr>
<td>01</td>
<td>July 2016</td>
<td>Original production</td>
</tr>
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</table>

Cat. No.  I823-E1-01

Revision code
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1. Servo system configuration and peripheral products

1.1. Outline

The 1S-series AC Servo Drives with Built-in EtherCAT communications support 100-Mbps EtherCAT. When you use the 1S-series Servo Drive with a Machine Automation Controller NJ/NX-series CPU Unit or CJ1W-NC-8x: EtherCAT-compatible Position Control Unit, you can construct a high-speed and sophisticated positioning control system.

Also, you need only one communications cable to connect the Servo Drive and the Controller. Therefore, you can realize a position control system easily with reduced wiring effort.

With auto tuning, adaptive filter, notch filter, and damping control, you can set up a system that provides stable operation by suppressing vibration in low-rigidity machines.

The FSoE protocol, the technology for a safe communication layer supported by the 1S-series Servo Drives, allows you to build the safety system that uses the STO function from the safety controller on the EtherCAT network.

Additional Information

For additional information about 1S servo drive, please refer to 1S-series AC Servomotors and Servo Drives User’s Manual (with Built-in EtherCAT Communications) (Cat. No. I586)
1.2. Servo System constructed in this guide

This 1S-series Sysmac AC Servo Drives Startup Guide (hereafter referred to as “this Guide”) contains instructions from assembling the hardware that makes up the Servo system to performing debugging on the system. This Guide builds the Servo system in the following steps:

1. Installation and wiring
2. System Configuration with NJ and NX safety controller
3. Sysmac Studio project creation and sizing file import
4. Motor, ABS encoder, I/O Setup
5. Easy tuning for gain adjustment
6. FSoE STO Activation

Additional Information

For additional information on how to setup the motion, please refer to the start-up guide for motion control (W514-E1-01).
1.3. System configuration

The following figure shows the system configuration and devices that are used in this Guide. The system configuration is shown in the following figure.

- Configuration devices

The models of the devices that are described in this Guide are given in the following table. When selecting devices for an actual application, refer to the device manuals.

<table>
<thead>
<tr>
<th>Device name</th>
<th>Model</th>
<th>Manual name</th>
</tr>
</thead>
<tbody>
<tr>
<td>NJ-series CPU Unit</td>
<td>NJ501-[]</td>
<td>NJ-series CPU Unit Hardware User’s Manual (Cat. No. W500)</td>
</tr>
<tr>
<td>NJ-series Power Supply</td>
<td>NJ-P[3001</td>
<td></td>
</tr>
<tr>
<td>NX-series EtherCAT Coupler</td>
<td>NX-ECC[]</td>
<td>NX-series EtherCAT Coupler Unit User’s Manual (Cat. No. W519)</td>
</tr>
<tr>
<td>NX-series Safety control unit</td>
<td>NX-SL3300</td>
<td>NX safety CPU unit Hardware User’s Manual (Cat. No. Z930)</td>
</tr>
<tr>
<td>NX I/O Series</td>
<td>NX-SID[]</td>
<td></td>
</tr>
<tr>
<td></td>
<td>NX-SOD[]</td>
<td></td>
</tr>
<tr>
<td>Ethernet/EtherCAT communications cables</td>
<td>XS5W-T[]</td>
<td></td>
</tr>
<tr>
<td>AC Servo Drives</td>
<td>R88D-1SN[]</td>
<td>1S-series AC Servomotors and Servo Drives User’s Manual (with Built-in EtherCAT Communications) (Cat. No. I586)</td>
</tr>
<tr>
<td>AC Servo Motors</td>
<td>R88M-1[]</td>
<td></td>
</tr>
<tr>
<td>Power cables</td>
<td>R88A-CA[]</td>
<td></td>
</tr>
<tr>
<td>Encoder Cables</td>
<td>R88A-CR[]</td>
<td></td>
</tr>
</tbody>
</table>
### Automation software

<table>
<thead>
<tr>
<th>Product</th>
<th>Number of license</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sysmac Studio Standard Edition Version 1.16</td>
<td>None (DVD only)</td>
<td>SYSMAC-SE200D</td>
</tr>
<tr>
<td></td>
<td>From 1 license to site license</td>
<td>SYSMAC-SE[]</td>
</tr>
</tbody>
</table>
2. Before You Begin

■ Unpack Drive/Motor

1. **Unpack motor package.** The package includes only motor and instruction sheet. Cables are provided separately.

2. **Unpack drive package.** This product comes with the following accessories.
   - INSTRUCTION MANUAL × 1 copy
   - Warning label × 1 sheet
   - General Compliance Information and instructions for EU × 1 copy
   - Attached connectors

■ Install the Sysmac Studio Standard Edition

Refer to the *Sysmac Studio Version 1 Operation Manual* (Cat. No. W504) for how to install.

Additional Information

For further details on how to handle drive and motor package, please refer to 1S-series AC Servomotors and Servo Drives User’s Manual (with Built-in EtherCAT Communications) (Cat. No. I586)
3. Performing setup

3.1. Installation & Wiring

■ Drive installation

Install the Servo Drive according to the following.

**Single-unit Installation**

![Diagram of Single-unit Installation]

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>T</td>
<td>100 mm min.</td>
</tr>
<tr>
<td>B</td>
<td>100 mm min.</td>
</tr>
<tr>
<td>S1</td>
<td>40 mm min.</td>
</tr>
<tr>
<td>S2</td>
<td>10 mm min.</td>
</tr>
</tbody>
</table>

**Side-by-side Installation**

![Diagram of Side-by-side Installation]

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>45 mm min.</td>
</tr>
<tr>
<td></td>
<td>80 mm min.</td>
</tr>
<tr>
<td>C2</td>
<td>50 mm min.</td>
</tr>
<tr>
<td>C3</td>
<td>70 mm min.</td>
</tr>
</tbody>
</table>

When installing side-by-side, S2 can be reduced to 0mm under some conditions: temperature inside cabinet should be lower than 45°C and install a fan for air circulation to prevent uneven temperatures inside the cabinet/panel.

1. **In case of using the shield clamp, please fixe it in advance with the existing screw**
|   | Approach the drive from top to down.  
|---|---|
|   | ![Diagram](image1.png) Gravity direction  
|   | Bottom of Servo Drive  

| 3. | Tight the upper part.  
|---|---|
|   | ![Diagram](image2.png) Gravity direction  
|   | Bottom of Servo Drive  

| 4. | Tight the down part.  
|---|---|
|   | ![Diagram](image3.png) Gravity direction  
|   | Bottom of Servo Drive  

**Motor installation** (step 2, 3 order depends on your mechanical implementation)

1. Please handle the motor carefully & do not apply heavy impacts or loads during transport, installation, or removal of the motor.

2. Please fixe and connect the motor to the mechanical system

   Note: At first, please check motor operation without any load.

3. Please attached the power and encoder cable

   Here is an example with 200W motor

   Please tight screws in several times in this order :1>4>3>2

---

**Wiring**

1. **Overview**

   **Wiring Diagram**

   For further details please refer to section 4-2 wiring of 1S AC servo drive user’s manual (Cat. No. I586)

---

**Additional Information**

For further details about coupling method, please refer to 1S-series AC Servomotors and Servo Drives User’s Manual (with Built-in EtherCAT Communications) (Cat. No. I586)
2. Remove power connector(s) (CNA) or (CNA)/(CND) from the drive depending on the model:

100V/200V (up to 1kW)  
200V (1.5kW-3kW) 400V (0.6kW-3kW)

3. Please wire the 24V control power supply (stripped wires or ferrules can be used)

Connect wires with the spring opener

Please refer to the corresponding connector depending on your drive and power supply:
CNA for 100V/200V (up to 1kW)  CND for 200V (1.5kW-3kW) 400V (0.6kW-3kW)

4. Please wire the AC power supply

Please refer to the corresponding connector depending on your drive and AC power supply type
1-Phase

100V/200V (up to 1kW)  200V (1.5kW)

3-Phase

200V (up to 1kW)  200V (1.5kW-3kW) 400V (0.6kW-3kW)

Example: CNA for 100V/200V (up to 1kW)
5. Please remove the motor connector (CNC) from the drive:

6. Please wire U, V, W of the motor (stripped wires)

<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>U</td>
</tr>
<tr>
<td>2</td>
<td>V</td>
</tr>
<tr>
<td>3</td>
<td>W</td>
</tr>
</tbody>
</table>

7. Please screw the PE wire of the main power to the drive.

8. Please plug back above connectors to the drive. (Power and Motor)

9. Please fixe the FG wire from the motor cable to the drive

Or
In case of using the shield clamp, please attach the cable to the clamp in order to connect the shielded section.

10. Please plug the encoder cable to the drive (CN2)

Additional Information
For further details about wiring method, please refer to 1S-series AC Servomotors and Servo Drives User’s Manual (with Built-in EtherCAT Communications) (Cat. No. I586)
1. By default, STO function is inhibited and bypassed with jumpers.

2. In case of using STO by hardwire, Please make the proper wiring between the safety controller and the drive.

Wire SF1 and SF2 to different safety outputs.
3. In case of using STO by hardwire for multiple servo drives, please make the proper wiring between the safety controller and drives.

Note: When G9SP-series safety controller is used, you can connect up to four 1S-series Servo Drives.
4. When general I/Os are required, please make the proper wiring.

Here is an example of latch input 1:

Servo Drive connector view:

Additional Information

For further details about wiring method, please refer to 1S-series AC Servomotors and Servo Drives User’s Manual (with Built-in EtherCAT Communications) (Cat. No. I586)
3.2. System configuration with NJ and NX safety controller

- Ethercat node address configuration

1. Please configure the Ethercat node address of the drive to 1.

Note: You can configure the node address depending on your application

2. In case of using NX safety, please configure the node address of the NX coupler to 2.

Note: You can configure the node address depending on your application

3. Please connect EtherCAT cables to devices

CN10 Ethercat IN: Ethercat cable from NJ EtherCAT Master
CN11 Ethercat OUT: Ethercat cable to NX coupler unit

EtherCAT Master

NX coupler unit
NX safety CPU unit
NX Safety I/O unit

1S-series Servo Drives

Additional Information

For further details about safety controller, please refer to the NX-series safety control units user manual Z930
3.3 Sysmac Studio project creation

■ New project

1. Create new project
Select NJ501-1500 from the list.

2. Import the sizing file
Please select your sizing tool results

   ![Image](image1.png)

   Note 1: Please refer to the “motor sizing tool startup guide” for learning how to create the sizing result (I820-E1-01).

   Note 2: If you do not use the sizing file import please refer to the annex “Add drive and axis OFFLINE”

3. Device was imported successfully

4. Ethercat configuration was updated
5. Drive parameters were updated

6. Axis setting were created and updated

If you do not use NX Safety, please jump to step 10

7. Add a terminal coupler in EtherCAT editor
   Double click on Ethercat

   Drag and drop the terminal coupler
8. **Add NX Safety unit**
Double click on NX Coupler

![Image of Multiview Explorer showing NX Coupler]

Drag and drop NX safety controller

9. **Add NX safety I/O units**
Drag and drop Safety I/O

![Image of Toolbox with Safety I/O units]

10. **Please turn on the power supply of all devices.**
11. **Connect to NJ**

Please setup the method of connection

Enter the IP address and test the connection

Push connect button

12. **Send Program to NJ**

Push synchronize button

Uncheck the below box in order to send drive parameters and push transfer to controller
3.4 Motor, ABS Encoder and I/O Setup

- Quick setup wizard

1. Please right click to the drive and select “setup and tuning”

2. Select quick setup

3. This setting is related with Encoder usage and I/O pre-configuration

   Recommended settings [ ] Use [ ] Do not use

   When using I/O features of the drive in the motion control (MC) function module of Sysmac Controller, recommended settings should be used. (Related inputs: IN2: POT, IN3: NOT, IN4: DEC, IN7: EXT1, IN8: EXT2, Absolute encoder usage: "Use as absolute encoder but ignore multi-rotation counter overflow").

4. Absolute encoder usage

   1S motor has an absolute encoder for all models. But it can be used as incremental if needed. When using Sysmac Controller, it is recommended to keep the default value. (as described in previous step 3)
5. **Setup of the absolute encoder**

This function can be used for resetting the multi turn data or when replacing a motor in actual machine.

**Reset multi-turn data:**

Please push “clear system”

This setting required the drive to be restarted; Sysmac Studio can do it by pressing yes.

Encoder multi rotation data has been cleared
6. **Adjust the motor direction and transfer to the drive**

   - Motor Rotation
     - CW (Clockwise)
     - CCW (Counterclockwise)
     - Transfer To Drive

   NOTE: This changes 30200.01 bit ‘Motor Rotation Direction Setting’.

7. **Validate the motor operation**

   Apply the test run configuration, activate the Servo ON and initiate the movement

   ![Test Run Configuration Screen]

   Note: In case of Error 87.00 ESTP input, please check your wiring connection or disable the error stop input (IN1) as explained in the next step.

   ![Motion Screen]

   Click next
8. Adjust Input settings, transfer to the drive and validate with test run
By default, ESTOP Input is activated, please deactivated if necessary (as following). When ESTP is activated, Error 87.00 is present on the drive.

9. If necessary, Adjust Output settings, transfer to the drive and validate with test run

10. Please click finish
3.5. Easy tuning for gain adjustment

**Easy tuning**

Use the following procedure to perform adjustment. At first, it is recommended to perform easy tuning.

- **Start adjustment.**
  - Automatic adjustment?
    - Yes: Easy tuning
    - No: Manual tuning
  - Operation OK?
    - Yes: Use simulation to adjust?
      - Yes: Advanced tuning
      - No: Use the parameter table to adjust each gain.
    - No: Consult OMRON.
  - Write to non-volatile memory.
  - Adjustment completed.
1. Please right click to the drive and select “setup and tuning”

2. Please select Easy tuning

3. Please select simple mode and click next

4. Please adjust the motion profile
5. **Please adjust criteria and click next**

- If you choose the manual setting of settling time, gain will be increased gradually until achieving the specified settling time. The positioning window, specify the position deviation to determine that the positioning is completed. If it detects a vibration above the vibration detection level during tuning, an adjustment failure will occur.
- If you select the best effort mode, gain will be increased gradually until the system does not exceed the vibration detection level.

6. **Please click start, be careful the motor will move**

Criteria achieved

Click next
7. Please click the record button, the motor will move and data will be traced and auto scaled

Click next

8. Confirm new gain parameters and save to EEPROM

Click Finish
3.6. FSoE STO activation

If you do not use NX Safety and STO via FSoE, please ignore this part (3.6)

Manipulation to activate FSoE STO

1. Please double click on Ethercat

2. Please select the drive and Edit PDO map settings of the drive

3. Select safety input and output (273th)

   It is necessary for setting the information in the safety telegram.

4. Select the new safety CPU

5. Please confirm the FSoE slave addresses

   Safety signals from the servo are shown as Safety I/O
6. **Add the Emergency stop button**

![Image of emergency stop button configuration]

7. **Add the Reset button**

![Image of reset button configuration]

8. **Edit I/O Map variables**

![Image of I/O Map variable editing]
9. Create safety program

10. Transfer to the controller
    Please select the controller area
    Connect to the controller
    Synchronize with the controller
    Transfer to the controller
11. **Download the safety application**

Please select the new safety CPU

Switch to program mode

Activate and run the debug mode

Click on safety validation

The safety application is now ready to run

Please click on run
12. **The FSoE communication is now established**

FS LED is green and fixed ON.

STO is activated when Emergency stop button is pushed

<table>
<thead>
<tr>
<th>Color</th>
<th>STO Status</th>
<th>FSoE Communication Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green</td>
<td>ON</td>
<td>FSoE slave connection established in progress</td>
</tr>
<tr>
<td>Red</td>
<td>Flashing</td>
<td>Safety Parameter Error, Safety Communications Timeout, or other errors</td>
</tr>
<tr>
<td>---</td>
<td>OFF</td>
<td>STO via FSoE is disabled, the power is not supplied, or a fatal error including Self-diagnosis Error</td>
</tr>
</tbody>
</table>

STO is released when Emergency stop button was released and RESET button activated.
ANNEX

Add a drive and axis OFFLINE

Creating the EtherCAT Network Configuration

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 Drive 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.

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.
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.

1. Right-click MC_Axis000 (axis 0) in the Multiview Explorer and select Edit from the menu.

   Axis 0 is added to the Multiview Explorer. The axis is added as MC_Axis000.

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

4. Select the Servo Drive to use in the Input device Box

This will assign node 1 and the drive to the input device for axis 0.

5. Set the parameters on the Axis Parameter Settings Tab Page

The following figure shows the axis parameters for the unit conversion settings.

**Unit of Display:** degree

**Command Pulse Count Per Motor rotation:** 8388608 (23 bit)

**Work travel distance per motor rotation:** 360°
6. **Operation settings**
- **Maximum Velocity**: 18 000 degree/s
- **Maximum Jog Velocity**: 360 degree/s

7. **Position count settings**
- **Count mode**: Rotary mode
- **Modulo max**: 360
- **Modulo min**: 0
## Test run and data trace

1. **Please right click to the drive and select “test run”**

   ![Test Run](image1.png)

2. **Please click “step” tab, adjust motion profile and apply**

   ![Motion Profile](image2.png)

3. **Activate the servo ON**

   ![Servo ON](image3.png)

4. **Please right click to the “data trace settings” and add a new trace**

   ![Data Trace Settings](image4.png)

5. **Chose cyclic mode**

   ![Cyclic Mode](image5.png)

6. **Adjust the sampling interval**

   ![Sampling Interval](image6.png)
7. **Adjust the trigger condition**

8. **Push record button**

Sysmac Studio is now waiting for the trigger

9. **Place the Test run and Data trace windows side-by-side with docking window feature**

Push start in test run, data traces will appear cyclically
Manual tuning

- Manual tuning guide

1. Please right click to the drive and select “setup and tuning”

2. Please select Manual Tuning

   Manual tuning window is displayed

   It includes rigidity settings, gain parameters and drive test run
3. In order to check the behavior of the motor, please right click to the “data trace settings” and add a new trace.

- ![Image](image1.png)

4. Chose cyclic mode

- ![Image](image2.png)

5. Adjust the sampling interval

- ![Image](image3.png)

6. Adjust the trigger condition

- ![Image](image4.png)

7. Disable parameters reading

- ![Image](image5.png)

Push record button

- ![Image](image6.png)

 Sysmac Studio is now waiting for the trigger.

- ![Image](image7.png)

8. Place the Test run and Manual tuning windows side-by-side with docking window feature

- ![Image](image8.png)
9. Configure the motion profile and click Apply

10. Activate the Servo ON and Push Start

Be careful, the motor will move in the forward and reverse direction

11. The data trace is now triggered and result displayed

Each time the motor will move, traces will appear cyclically.
12. **It is possible to increase gain values by changing the rigidity settings**

![Machine Rigidity Settings](image)

Push transfer to send the gain parameters to the drive.

13. **Please repeat step 10, 11 and 12 until achieving the desired performance**

   If vibrations appear, please reduce the rigidity settings.

   If required, it is possible to increase responsiveness by applying notch filters in advanced tuning mode and adjusting gains. Please refer to Annex "Advanced tuning".
Advanced tuning

- Advanced tuning guide

Overview

Below example explain the way to tune a 1S servo drive and motor with advanced tuning. This method of tuning decrease dramatically the number of tests and trial with actual machine.

1. Please right click to the drive and select “setup and tuning”

2. Please select Advanced Tuning
3. **Configuration (Wizard Step 1)**

Please select your control mode

![Configuration settings](image)

Please estimate the load characteristics by pushing start (the motor will move)
If easy tuning has been performed already, please select “use present setting”

![Load characteristics](image)

Load characteristics have been updated

![Load characteristics updated](image)

Click Next

![Next button](image)

4. **Frequency response simulation (Wizard Step 2)**

Please start the trace (FFT measurement will be performed, the motor will move slightly)

![Frequency response simulation](image)

FFT measurement and simulated values are displayed (Gain and Phase)

![FFT measurement and simulated values](image)
5. **Adjust gain and simulate**

Please select Maps feature:

Adjust the gain to a proper value and push “refresh simulation”

- Pink curve is the measured value
- Red curve is the simulated value
6. **Adjust notch filters and simulate**

After increasing gains, the gain simulation shows a peak near 0dB. This peak shows a resonance frequency:

Activate the cursor to measure the frequency

Activate the 1\textsuperscript{st} notch filter to remove this resonance frequency at 2411 Hz:
7. **Increase gain with Maps and simulate**

After activating the notch filter, gain can be increased and performance improved.

![Gain Comparison](image)

8. **Time response simulation (Wizard step 3)**

In time response simulation, the motion profile can be simulated.

**Please push “Simulate Motion Profile”**

The chart is updated and shows:
- The speed command, speed detection simulation and following error simulation.

**If necessary, please adjust gains:**
If your application required a small tracking error, here is an example of position following gain adjustment:

Following error has been reduced.

9. When satisfied with the simulation result, please transfer parameters to the drive

Click Next

10. Check behavior (Wizard step 4)

Push start trace (the motor will move following the previous configuration in Wizard step 3)

The chart is updated and shows:
- The speed command, speed detection, following error and torque.

If satisfied, please click next
11. Results (Wizard step 5)

![Parameter Adjustments Table]

Save to EEPROM

![EEPROM Save Confirmation]

Finish

![Wizard Step 5 Completion]

Finish