

EHMD with Mitsubishi Q-Series PLC using CMMT-ST through Modbus TCP Predefined Protocol

This Application Note explains how to integrate & control the Festo Rotary Gripper Module EHMD using CMMT-ST with Mitsubishi Q-Series PLC through Modbus TCP Predefined Protocol in GX Works2 Programming environment.

The user will be able to control the Festo Rotary Gripper Module EHMD in point-to-point mode using the sample code provided.

EHMD-40-RE-GE
EHMD-40-RE-GP
EHMD-RE-GE-16

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1 Introduction

The main use of this application note is to describe the communication between Festo Rotary Gripper Module EHMD and Mitsubishi Q-Series PLC through Modbus TCP predefined protocol.

The sample code provided in this application note allows the user to control the EHMD device in the following options:

1. EHMD Gripper Axis Commands
 - a. Axis Enable
 - b. Set Homing Reference
 - c. Jogging & Incremental Jogging
 - d. Open Close Command through Position & Force Control
2. EHMD Rotary Axis Commands
 - a. Axis Enable
 - b. Set Homing Reference
 - c. Jogging & Incremental Jogging
 - d. Open Close Command through Revolution, Velocity & Torque Control

The application note has the description for the following:

1. Festo Automation Suite
 - a. Field bus communication settings between CMMT-ST and Mitsubishi Q PLC
 - b. EHMD Rotary Axis Configuration
 - c. EHMD Gripper Axis Configuration
2. PLC (Mitsubishi)
 - a. How to set up a PLC program
 - b. Modbus TCP Predefined Protocol communication settings in GX Works2
 - c. Configuration of CMMT-ST as Modbus TCP devices
 - d. Configuration of Predefined Protocol Settings for CMMT-ST Process Data

1.1 Software Used

Software Name	Software Version
Mitsubishi GX Works2	V1.631H
Festo Automation Suite	V2.11.0.657
CMMT-ST Plug-in	V2.11.0.663

Table 1.1: Software used

1.2 Hardware Used

Device Name	Device Type	Version / Firmware
Festo PLC	Q03UDVCPU	Version Free
Rotary-Gripper Module	EHMD-40-RE-GE	Version Free
Motor Controller for Rotary	CMMT-ST-C8-1C-MP-S0	V36.11.0.3372
Motor Controller for Gripper	CMMT-ST-C8-1C-MP-S0	V36.11.0.3372
Motor Cable	NEBM-SF1W31-EH-2.6-Q15N-LE-28	-
Flat Flex Cable	NEBM-F1W31-EC-0.3-F1N-DF1W31	-
Ethernet Cable	-	Version Free

Table 1.2: Hardware used



Note

The EHMD sample code has been created and tested with the Q03UDVCPU.

- The user can use any Q-Series CPU that supports the Predefined Protocol function..

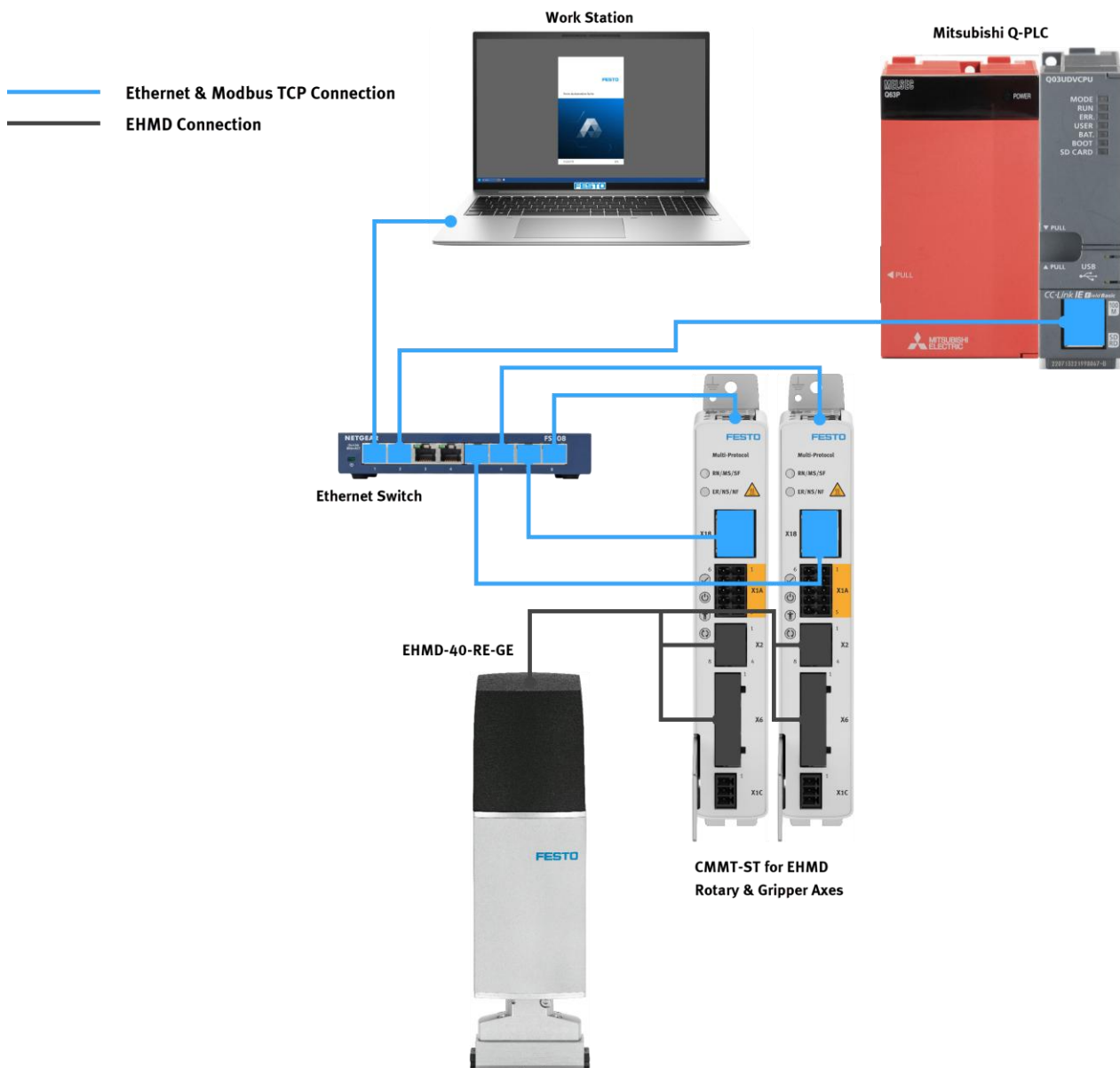
1.3 Topology Overview



Note

This application note entirely based on the following Topology Overview configuration as described.

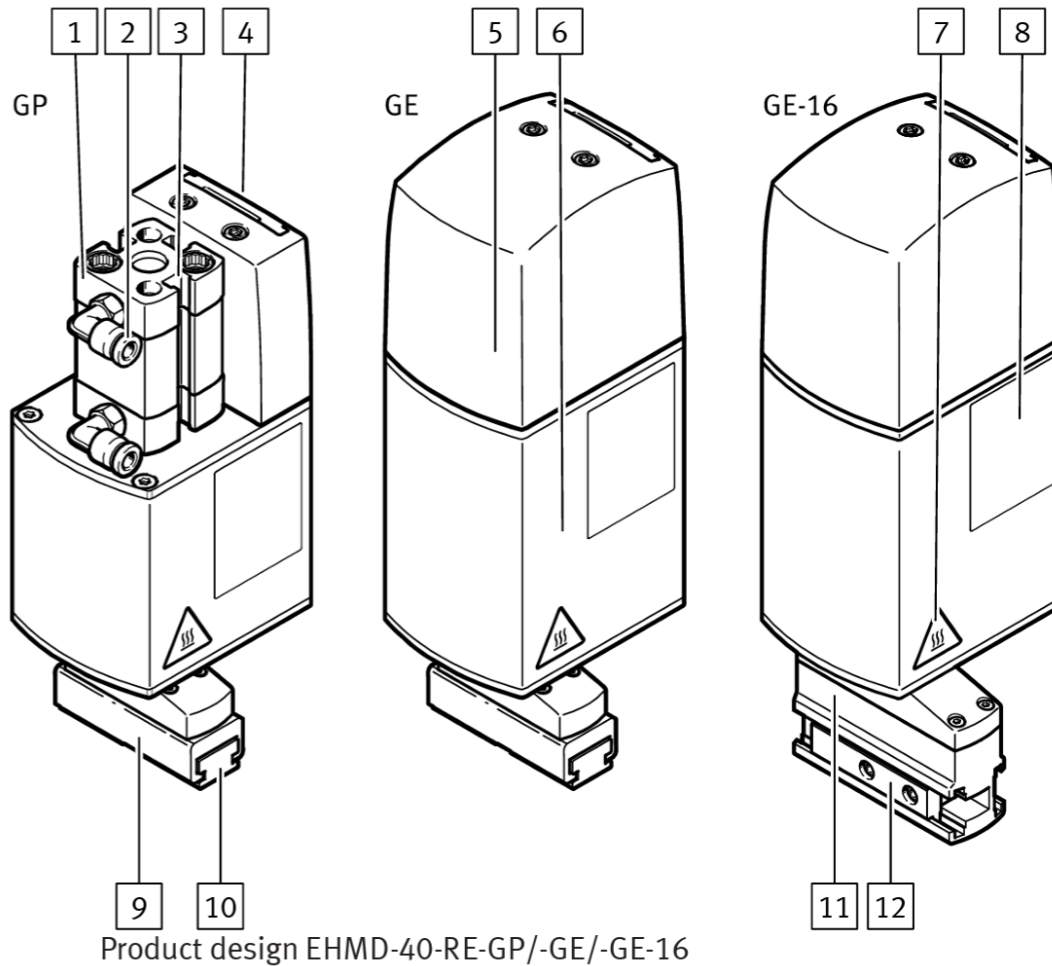
- The following Topology Overviews are only for an example to this application note. It may vary depending on actual user network configuration.



2 Hardware Configuration

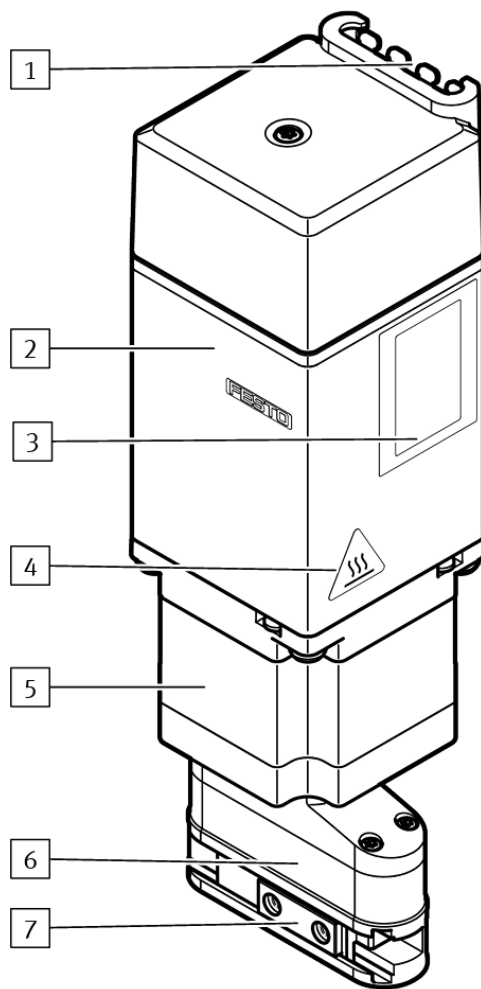
2.1 Product Overview

2.1.1 EHMD-40-RE-...



- | | |
|--|-----------------------------------|
| 1 Pneumatic gripper drive | 7 Warning: hot surface |
| 2 Pneumatic port | 8 Product labelling |
| 3 Slot for sensor | 9 Rotating short-stroke gripper |
| 4 Electrical connection: motor and encoder | 10 Gripper jaw with bottom guide |
| 5 Electric gripper drive with encoder | 11 Rotating long-stroke gripper |
| 6 Electric rotary drive with encoder | 12 Gripper jaw with lateral guide |

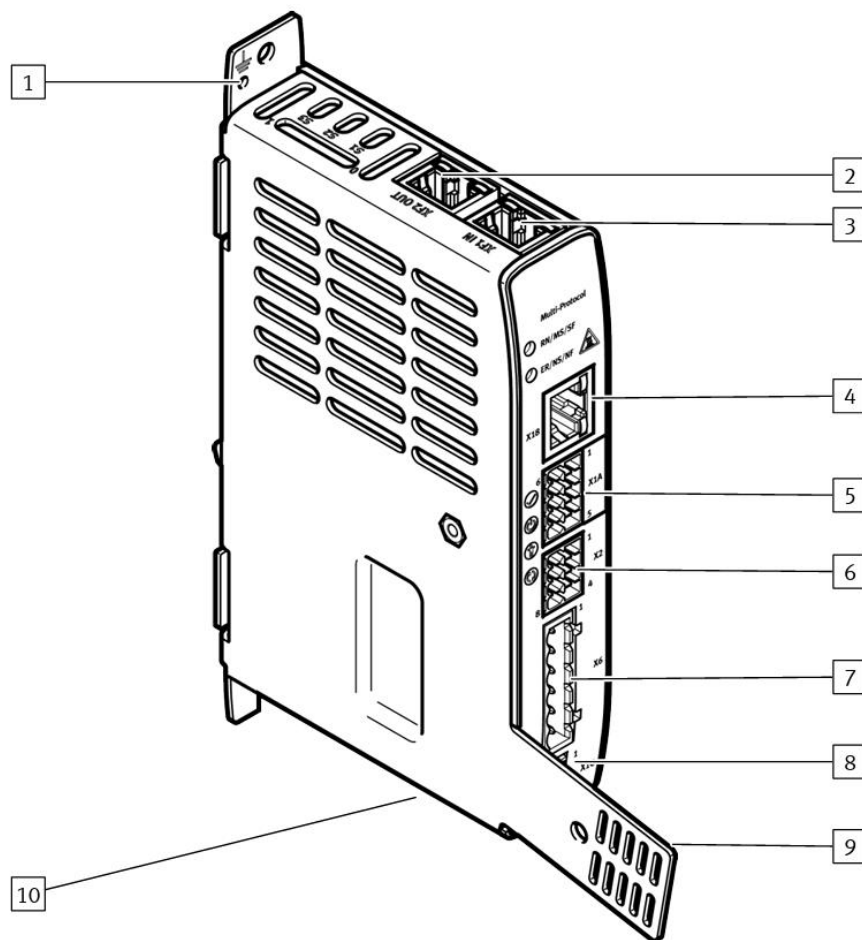
2.1.2 EHMD-50-RE-GE



- 1 Through-hole for motor cable and encoder cable
- 2 Electric gripper drive with encoder
- 3 Product labelling
- 4 Warning: hot surface
- 5 Electric rotary drive with encoder
- 6 Rotating long stroke gripper
- 7 Gripper jaw with lateral guide

Product design EHMD-50-RE-GE

2.1.3 CMMT-ST-...-MP-S0



Connections of the CMMT-ST-C8-1C-MP-S0

- | | |
|---|---|
| <p>1 Functional earth connection with label</p> <p>2 [XF2 OUT] RTE interface port 2</p> <p>3 [XF1 IN] RTE interface port 1</p> <p>4 [X18] standard Ethernet</p> <p>5 [X1A] I/O interface</p> <p>6 [X2] encoder connection</p> | <p>7 [X6] motor connection</p> <p>8 [X1C] connection for the reference switch or limit switch</p> <p>9 Sheet metal for connecting the cable shield and strain relief</p> <p>10 [X9] load and logic voltage (underneath)</p> |
|---|---|

2.2 EHMD Module Configuration

2.2.1 CMMT-ST-...-MP-S0 IP Address Configuration



Note

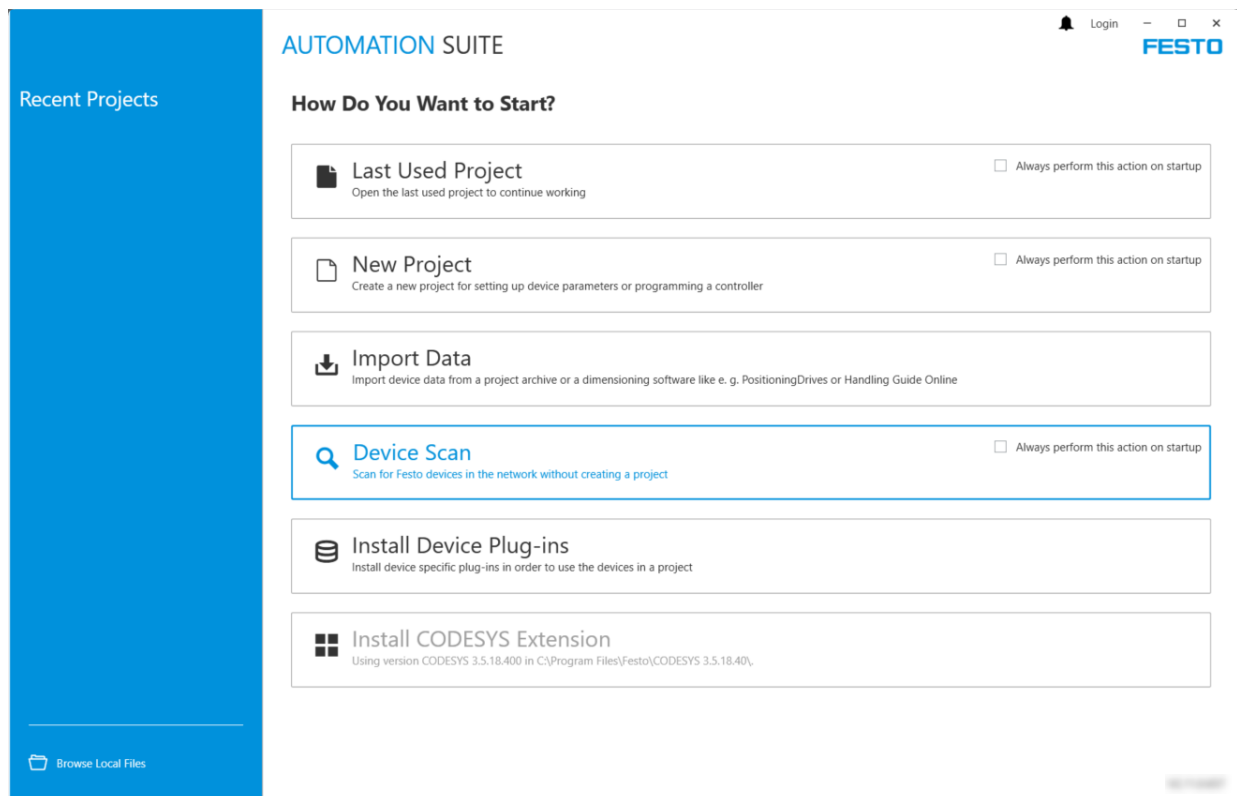
- Before starting the IP address configuration of the CMMT-ST, ensure that the hardware connection is established as shown in the Topology Overview ([Refer Chapter 1.3](#)).

Step 1



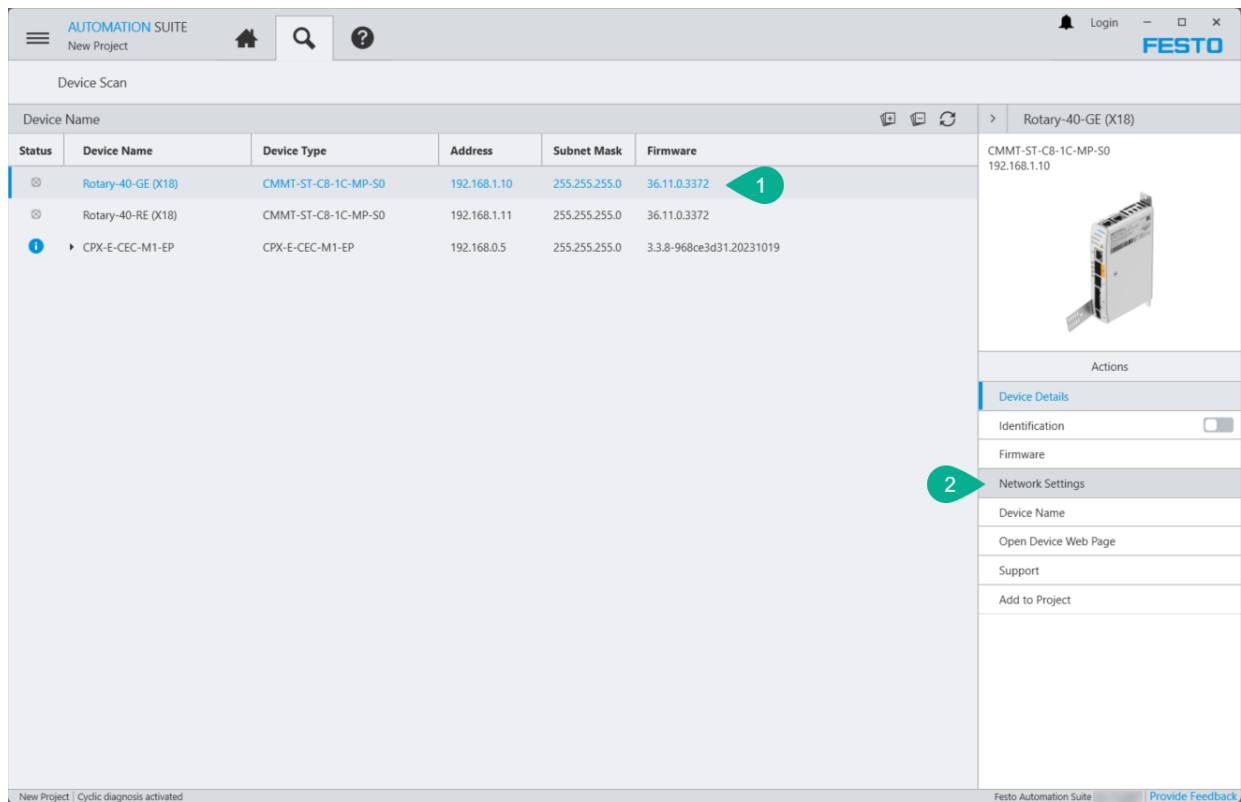
Open the **Festo Automation Suite** software (**Windows Start >> Festo Software >> Festo Automation Suite**).

Step 2



Click on **Device Scan** button from start screen.

Step 3



The screenshot shows the Festo Automation Suite interface. At the top, there's a header with 'AUTOMATION SUITE', 'New Project', a home icon, a search icon, a help icon, and a 'Login' button. Below the header, the main area is titled 'Device Scan'. It contains a table with the following columns: Status, Device Name, Device Type, Address, Subnet Mask, and Firmware. The table lists three devices: 'Rotary-40-GE (X18)', 'Rotary-40-RE (X18)', and 'CPX-E-CEC-M1-EP'. The first row is highlighted, and a green circle with the number 1 points to it. To the right of the table, there's a panel for the selected device, 'Rotary-40-GE (X18)'. It shows the device type 'CMMT-ST-C8-1C-MP-S0', the address '192.168.1.10', and a firmware version '36.11.0.3372'. Below this, there's a section titled 'Actions' with a 'Device Details' tab. Under 'Device Details', there are several options: 'Identification' (with a toggle switch), 'Firmware', 'Network Settings' (highlighted with a green circle and the number 2), 'Device Name', 'Open Device Web Page', 'Support', and 'Add to Project'. At the bottom of the interface, there's a status bar with 'New Project | Cyclic diagnosis activated', 'Festo Automation Suite', and a 'Provide Feedback' link.

Status	Device Name	Device Type	Address	Subnet Mask	Firmware
⊗	Rotary-40-GE (X18)	CMMT-ST-C8-1C-MP-S0	192.168.1.10	255.255.255.0	36.11.0.3372
⊗	Rotary-40-RE (X18)	CMMT-ST-C8-1C-MP-S0	192.168.1.11	255.255.255.0	36.11.0.3372
ⓘ	CPX-E-CEC-M1-EP	CPX-E-CEC-M1-EP	192.168.0.5	255.255.255.0	3.3.8-968ce3d31.20231019

Device Name: Rotary-40-GE (X18)

Device Type: CMMT-ST-C8-1C-MP-S0

Address: 192.168.1.10

Firmware: 36.11.0.3372

Actions

Device Details

Identification ☐

Firmware

Network Settings

Device Name

Open Device Web Page

Support

Add to Project

New Project | Cyclic diagnosis activated

Festo Automation Suite

[Provide Feedback](#)

1. Select any **CMMT-ST** from the **List View** in the Festo Automation Suite. For this application note, CMMT-ST for EHMD Gripper module is selected.
2. Click **Network Settings** in the action window.

Step 4

The screenshot displays the configuration interface for a Rotary-40-GE (X18) module. The left pane shows the module's details and network settings. The right pane shows two sequential confirmation windows.

Left Pane (Rotary-40-GE (X18)):

- Device: CMMT-ST-C8-1C-MP-S0
- IP Address: 192.168.1.21
- Network Settings:**
 - DHCP: ☐ Enable
 - Address: 192 . 168 . 0 . 10 (highlighted with a green box and a green circle with '1')
 - Subnet Mask: 255 . 255 . 255 . 0
 - Gateway: 0 . 0 . 0 . 0
- Activate New Settings** button (highlighted with a green circle with '2')

Right Pane (Network Settings Confirmation):

- Network Settings**
 - The device might reboot automatically when the new settings are activated!
 - 3** (green circle) **Ok** button

Right Pane (Network settings updated successfully):

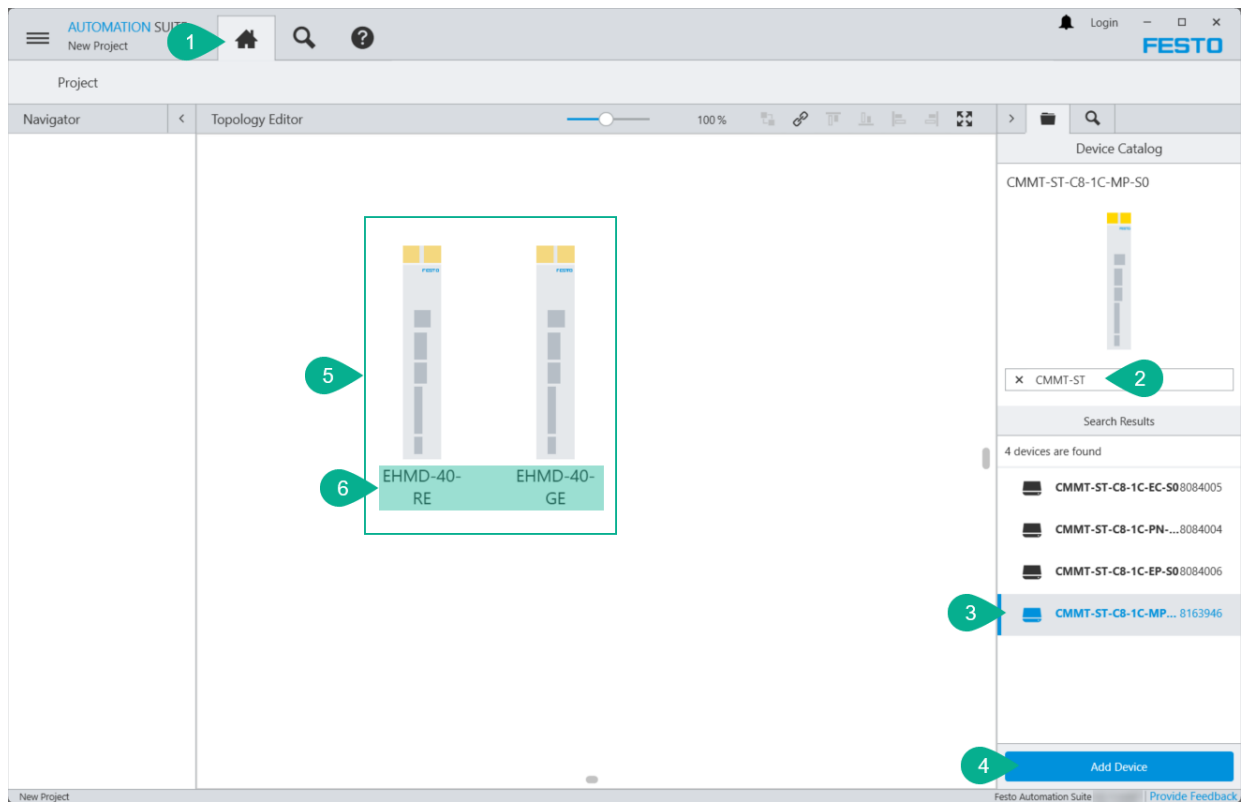
- Network settings updated successfully**
 - Updating the device was successful. The device reboots automatically if necessary and changes will take effect immediately.
 - 4** (green circle) **Ok** button

1. Enter the **IP Address & Subnet Mask** value for the CMMT-ST as per requirement.
2. Click on **Active New Settings** button to assign the entered values to the module.
3. Click on **OK** button to reboot the device.
4. Click on **OK** button to close the confirmation window.

**Note**

- Ensure that the CMMT-ST device IP address is within the same subnet as the PLC and workstation IP addresses. The above network configuration supports up to 255 devices.
- Repeat the above steps for configuring IP address of the CMMT-ST for EHMD Rotary module.

2.2.2 Creating a New Project with Motor Controller



1. Click the **Project Section** button.
2. Search for **CMMT-ST** device.
3. Select the **CMMT-ST-C8-1C-MP-S0** device from the available search results.
4. Click the **Add Device** button to add the selected device to the **Topology Editor** window.
5. EHMD requires one CMMT-ST per axis, so the user must add an additional CMMT-ST.
6. Rename the CMMT-ST drives as required to distinguish the each axis controller.

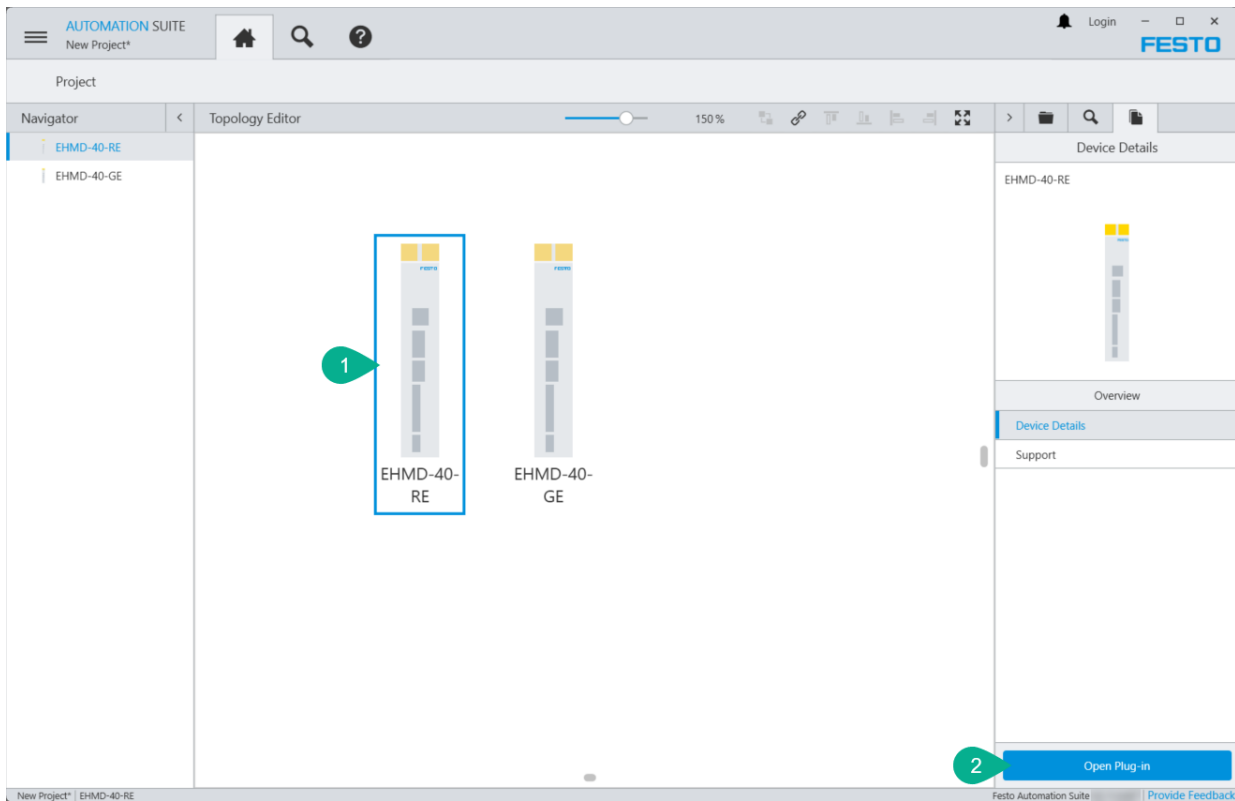
2.2.3 EHMD Rotary Axis Configuration



Note

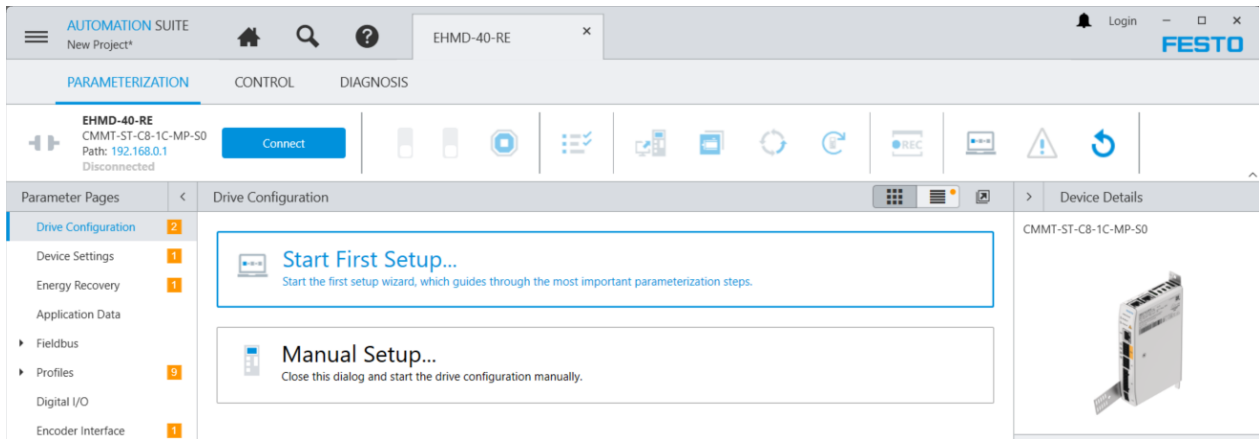
- Rotary and Gripper Axes must be configured separately with two independent motor controllers.
- EHMD Gripper Axis Configuration is shown on [Chapter 2.2.4](#).

Step 1



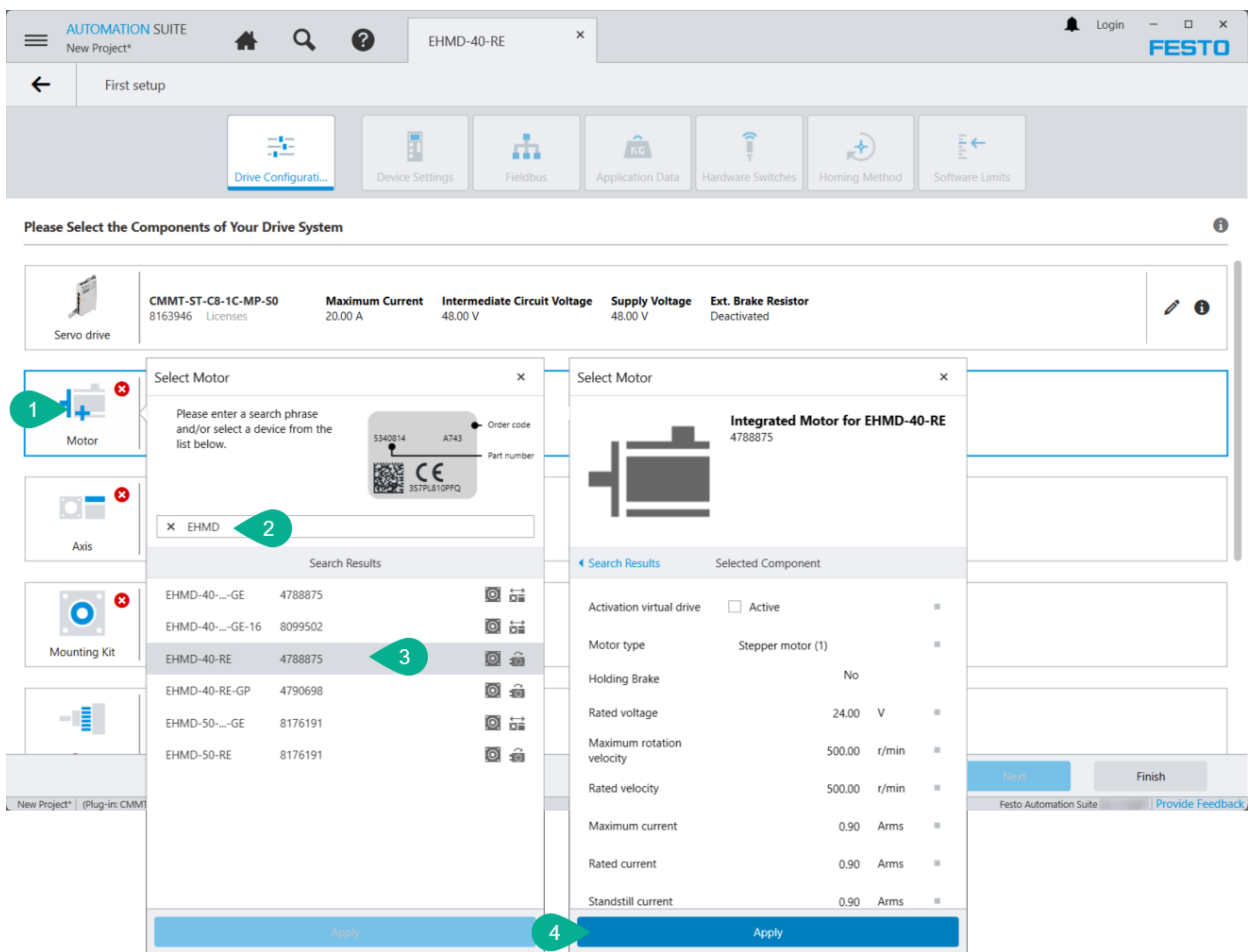
1. Select the **Motor Controller** for EHMD Rotary Module from **Topology Editor** window.
2. Click the **Open Plug-in** button to open the configuration.

Step 2



Click the **Start First Setup...** option from **Drive Configuration** window.

Step 3



1. Click the **Motor** or **Axis** option to add the axis component.
2. Search for **EHMD** motor component.
3. Select **EHMD-40-RE** motor from the available search results.
4. After selecting the motor click the **Apply** button to add the motor to the project.

Step 4

Automation Suite
New Project*

EHMD-40-RE

First setup

Drive Configurati... | Device Settings | Fieldbus | Application Data | Hardware Switches | Homing Method | Software Limits

Please Select the Components of Your Drive System

	CMMT-ST-C8-1C-MP-50 8163946 Licenses	Maximum Current 20.00 A	Intermediate Circuit Voltage 48.00 V	Supply Voltage 24.00 V	Ext. Brake Resistor Deactivated				
	Integrated Motor for EHMD-40-RE	Type Stepper motor (1)	Holding Brake No	Encoder Protocol Incremental (4)	Encoder Type Single turn (1)	Voltage 24.00 V	Virtual Mode Deactivated		
	EHMD-40-RE 4788875	Axis Size 40	Position Range 1.00 r						
	Axis Integrated Mounting Kit	Type Axial	Gear Ratio 1:1						
	No gear configured								

Back | **Next** | Finish

New Project* | (Plug-in: CMMT-ST Plug-in V2.10.0.103) | Operator (30) | Festo Automation Suite | [Provide Feedback](#)

The added **EHMD Rotary Axis** will be displayed as shown above image. Click the **Next** button for next level of configuration.

Step 5

1. Select the required **Enable Servo Drive** method from **Activation via** drop-down list. For this application note, **I/O and Fieldbus** method has been selected.
2. Select the appropriate **Supply Voltage** for the motor controller via **Mains voltage** drop-down list. Refer to the note below.
3. Click the **Next** button for next level of configuration.

**Note**

Possible supply voltages for Rotary-Gripper EHMD module:

- 24 V for EHMD-40 Rotary-Gripper unit.
- 24 V or 48 V for EHMD-50 Rotary-Gripper unit.

Step 6

Fieldbus Configuration

RTE Configuration (user defined) 1 EtherNet/IP - ModbusTCP (3)

EtherNet/IP - ModbusTCP configuration

Telegram selection 2 Telegram (111)

Activate DHCP ☐ Active

IP address 3 192 . 168 . 0 . 21

Subnet mask 255 . 255 . 255 . 0

Gateway address 0 . 0 . 0 . 0

1. Select **EtherNet/IP - ModbusTCP** as a **Fieldbus Configuration** via **RTE Configuration (user defined)** drop-down list.
2. Select **Telegram (111)** as a **Telegram Selection** via **Telegram selection** drop-down list.
3. Enter the required **IP Address & Subnet Mask** for **EtherNet/IP – ModbusTCP configuration** settings.
4. Click the **Homing Method** menu option to define the **Homing Method** of the rotary axis.

Step 7

Homing Method

Method 1 Actual position with zero pulse in negative direction (33)

Nominal current limit value scaling factor 0.20

Move to axis zero point after homing 2 ☒ Active

Activation Save zero point offset ☐ Active

Back 3 Next Finish

1. Select **Actual position with zero pulse in negative direction (33)** as a **Homing Method** via **Method** drop-down list.
2. Select the **Move to axis zero point after homing** checkbox.
3. click the **Next** button for next level of configuration.

Step 8

Software Limits

Axis zero point offset r

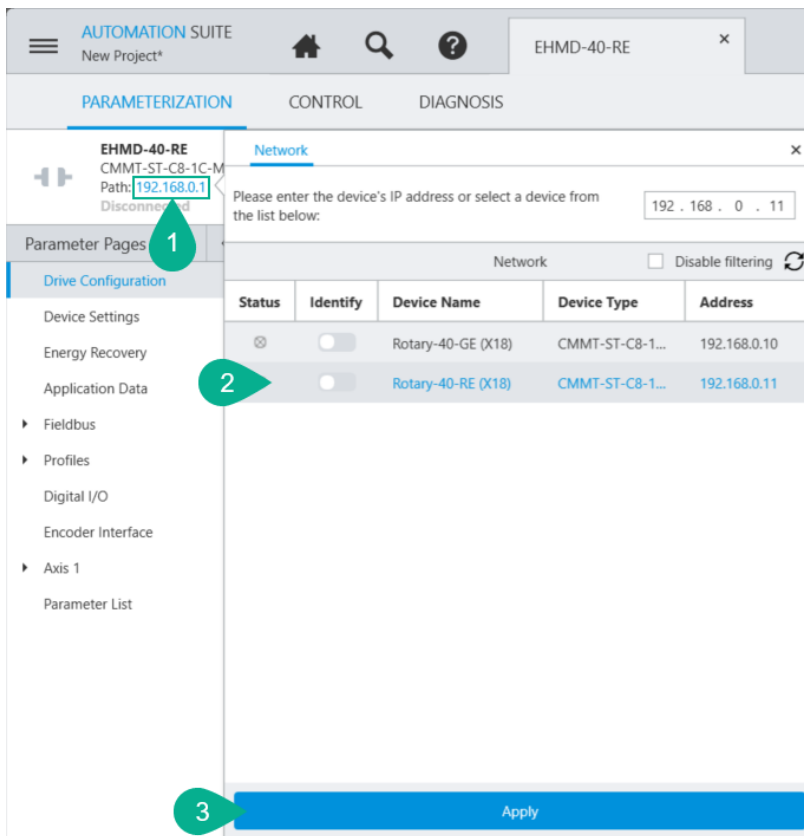
Software limit positions active ☐ Active

☐ Negative software limit position -0.03 r

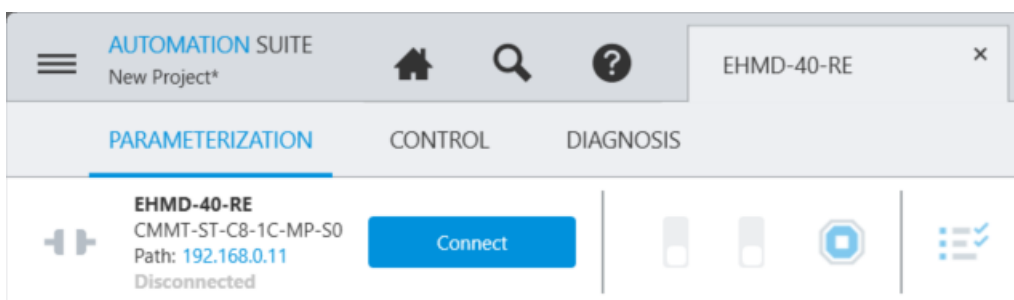
☐ Positive software limit position 0.97 r

Back Next Finish

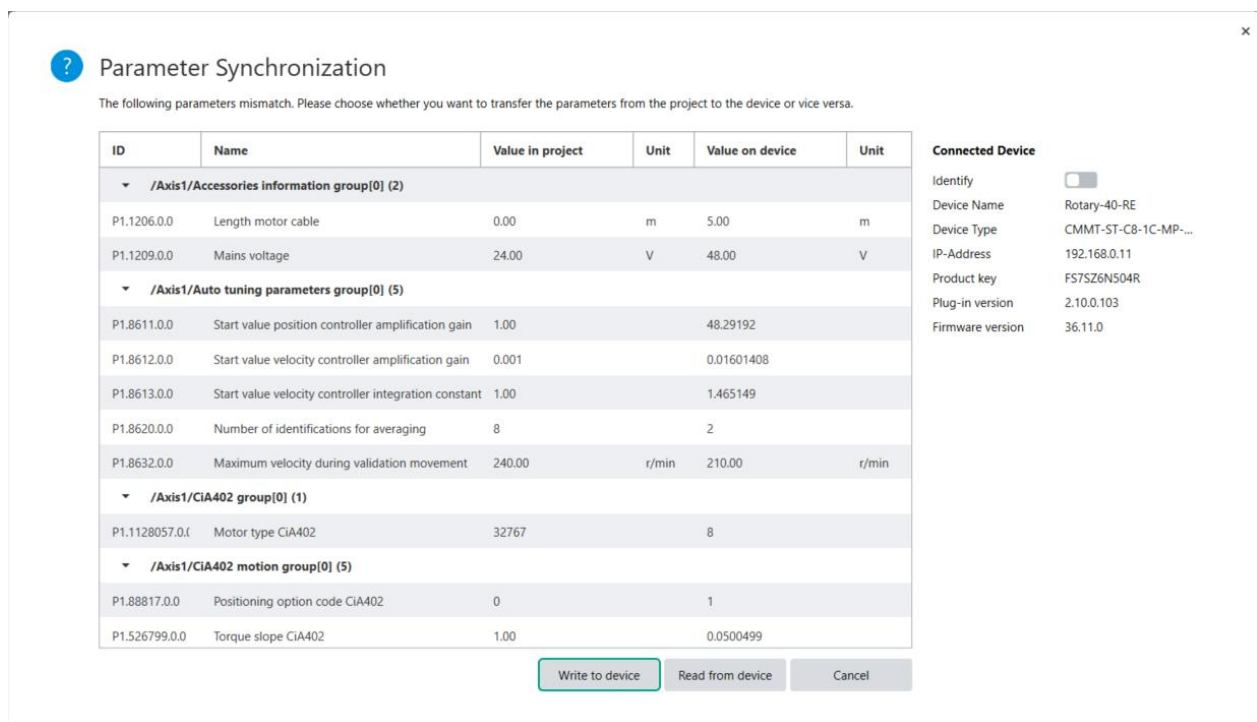
1. Enter the **Axis zero point offset** value as **Zero** for the EHMD Rotary Axis.
2. Ensure that **Software limit position active** checkbox is unselected.
3. Click the **Finish** button to complete the configuration.

Step 9

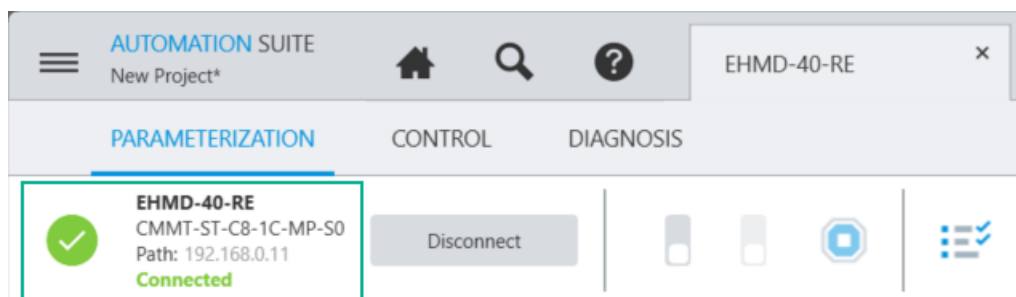
1. Click the Ip address **Path** option from tool bar.
2. Select the correct motor controller for the EHMD Rotary axis.
3. Click the **Apply** button to assign the **Path** address.

Step 10

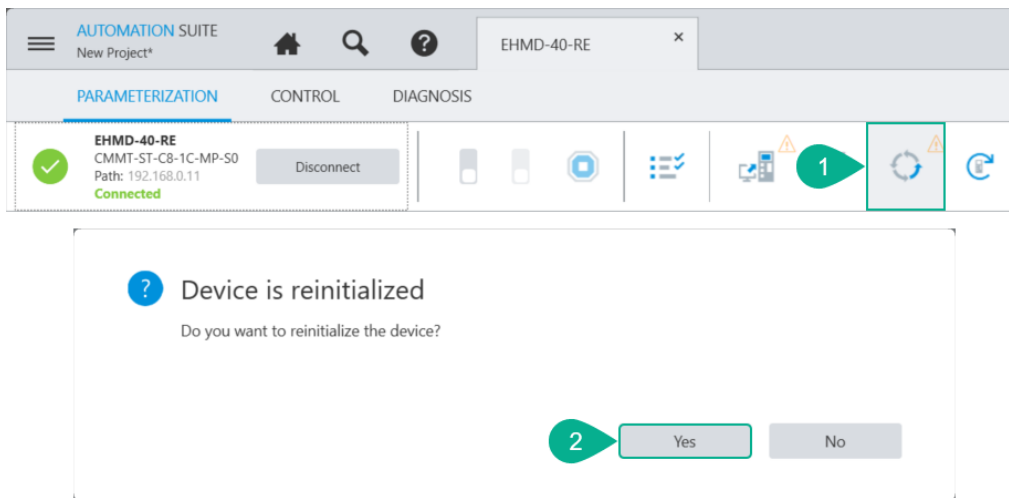
Click the **Connect** button to establish the communication.

Step 11

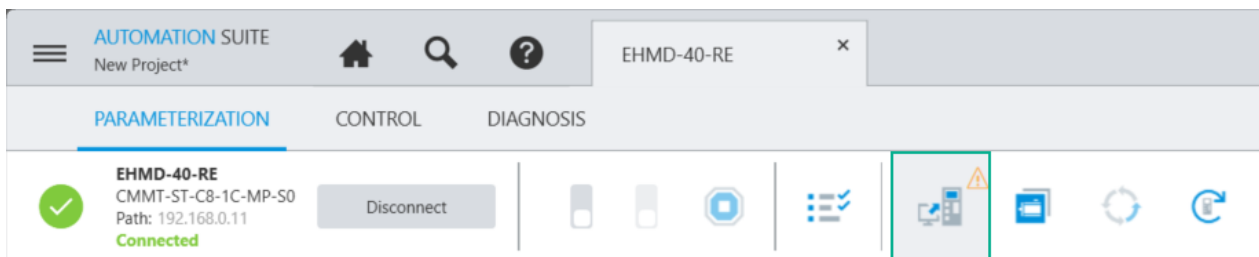
Click the **Write to device** button in the **Parameter Synchronization** window.

Step 12

The status of the motor controller changes from Disconnected to Connected.

Step 13

1. Click the **Reinitialize** button to reinitialize the motor controller.
2. Click the **Yes** button to confirm the reinitialization of the motor controller.

Step 14

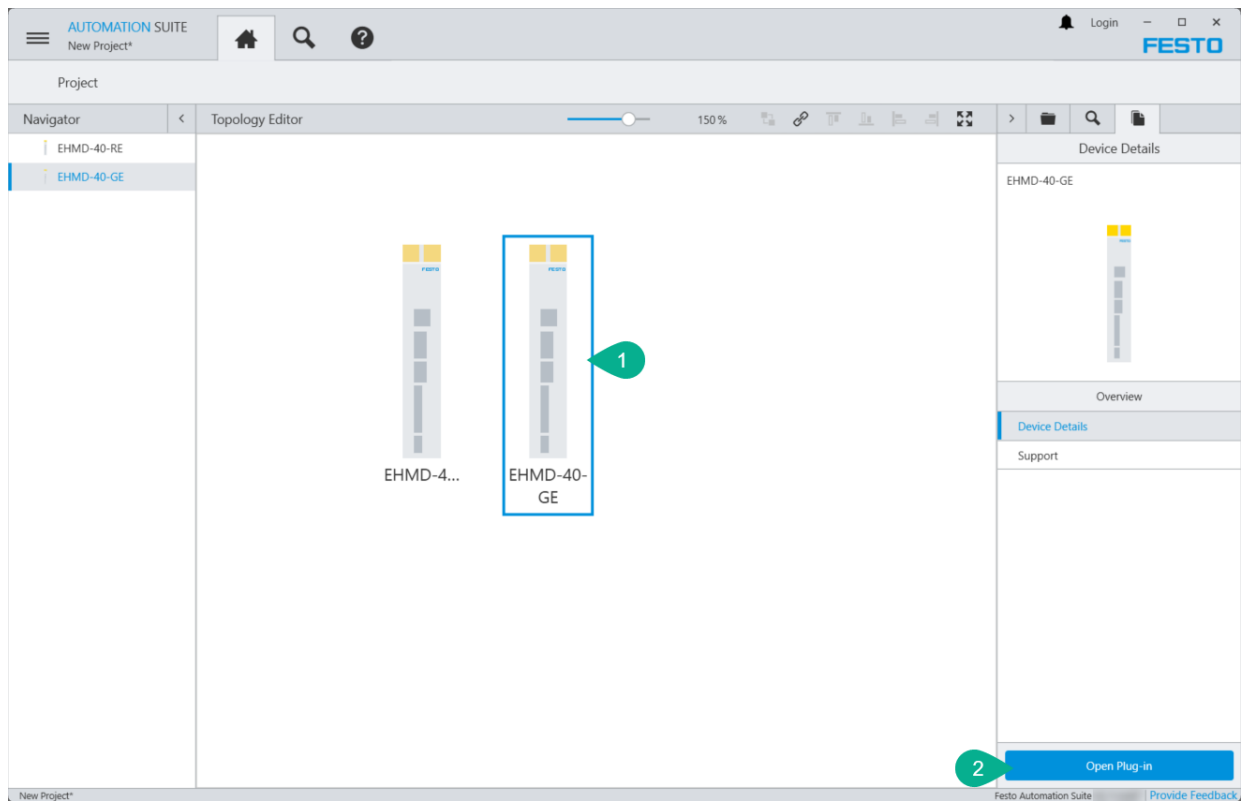
Click the **Store on Device** button to store all the parameters in the motor controller memory.

**Note**

- The triangle warning symbol on the buttons indicates action required.
- All the modified parameters will automatically erase from the motor controller during power re-start if the modified parameters are not stored in the motor controller.
- It's mandatory to reinitialize the motor controller for some parameter modification. If the motor controller is not reinitialized, then the motor controller performance remains the same as the previous configuration.

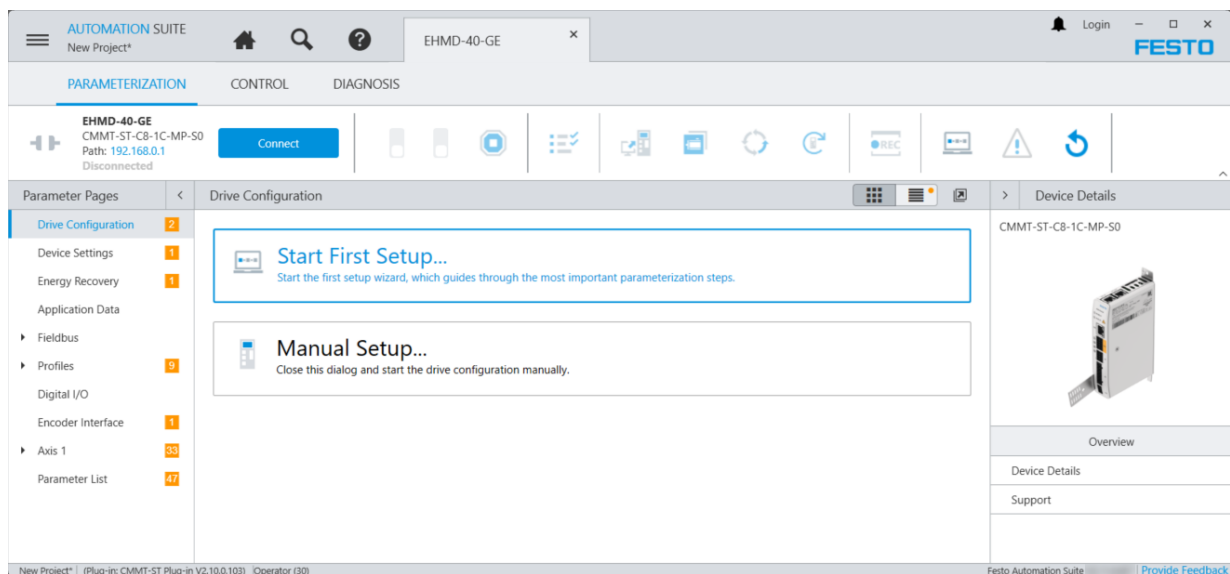
2.2.4 EHMD Gripper Axis Configuration

Step 1



1. Select the **Motor Controller** for EHMD Gripper Module from **Topology Editor** window.
2. Click the **Open Plug-in** button to open the configuration.

Step 2



Click the **Start First Setup...** option from **Drive Configuration** window.

Step 3

Automation Suite
New Project*
EHMD-40-GE

First setup

Drive Configurati...
Device Settings
Fieldbus
Application Data
Hardware Switches
Homing Method
Software Limits

Please Select the Components of Your Drive System

Servo drive
CMMT-ST-C8-1C-MP-S0
8163946 Licenses
Maximum Current
20.00 A
Intermediate Circuit Voltage
48.00 V
Supply Voltage
48.00 V
Ext. Brake Resistor
Deactivated

Select Motor

Please enter a search phrase and/or select a device from the list below.

5340814 A743 Order code
357PLB12PFQ Part number

EHMD

Search Results

Motor	Part number
EHMD-40-...-GE	4788875
EHMD-40-...-GE-16	8099502
EHMD-40-RE	4788875
EHMD-40-RE-GP	4790698
EHMD-50-...-GE	8176191
EHMD-50-RE	8176191

Select Motor

Integrated Motor for EHMD-40-...-GE
4788875

Search Results Selected Component

Activation virtual drive	☐ Active
Motor type	Stepper motor (1)
Holding Brake	No
Rated voltage	24.00 V
Maximum rotation velocity	1500.00 r/min
Rated velocity	1000.00 r/min
Maximum current	0.50 Arms
Rated current	0.50 Arms
Standstill current	0.50 Arms

Next Finish
Festo Automation Suite Provide Feedback

1. Click the **Motor** or **Axis** option to add the axis component.
2. Search for **EHMD** motor component.
3. Select **EHMD-40-...-GE** motor from the available search results.
4. After selecting the motor click the **Apply** button to add the motor to the project.

Step 4

AUTOMATION SUITE

New Project*

Step 5

1. Select the required **Enable Servo Drive** method from **Activation via** drop-down list. For this application note, **I/O and Fieldbus** method has been selected.
2. Select the appropriate **Supply Voltage** for the motor controller via **Mains voltage** drop-down list. Refer below note.
3. Click the **Next** button for next level configuration.

**Note**

Possible supply voltages for Rotary-Gripper EHMD module:

- 24 V for EHMD-40 Rotary-Gripper unit.
- 24 V or 48 V for EHMD-50 Rotary-Gripper unit.

Step 6

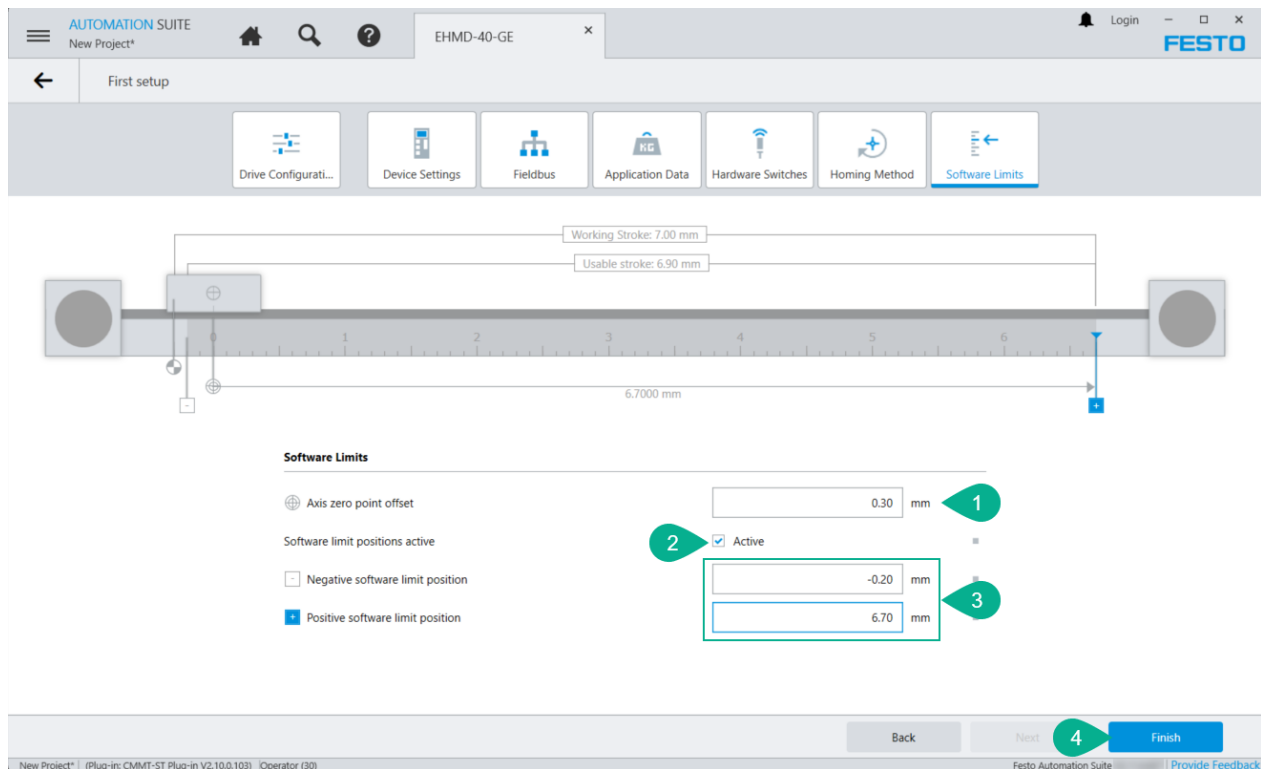
The screenshot shows the 'Fieldbus Configuration' window in the FESTO AUTOMATION SUITE. The 'RTE Configuration (user defined)' dropdown is set to 'EtherNet/IP - ModbusTCP (3)'. The 'EtherNet/IP - ModbusTCP configuration' section shows 'Telegram selection' set to 'Telegram (111)', 'Activate DHCP' unchecked, and IP address '192.168.0.22' and Subnet mask '255.255.255.0' entered. A 'Homing Method' button is highlighted with a green circle 4. Navigation buttons 'Back', 'Next', and 'Finish' are at the bottom.

1. Select **EtherNet/IP - ModbusTCP** as a **Fieldbus Configuration** via **RTE Configuration (user defined)** drop-down list.
2. Select **Telegram (111)** as a **Telegram Selection** via **Telegram selection** drop-down list.
3. Enter the required **IP Address & Subnet Mask** for **EtherNet/IP – ModbusTCP configuration** settings.
4. Click the **Homing Method** menu option to define the **Homing Method** of the rotary axis.

Step 7

The screenshot shows the 'Homing Method' window in the FESTO AUTOMATION SUITE. The 'Method' dropdown is set to 'Negative stop (-17)'. The 'Nominal current limit value scaling factor' is set to '0.20'. The 'Move to axis zero point after homing' checkbox is checked, and 'Activation Save zero point offset' is unchecked. A 'Next' button is highlighted with a green circle 3. Navigation buttons 'Back', 'Next', and 'Finish' are at the bottom.

1. Select **Negative stop (-17)** as a **Homing Method** via **Method** drop-down list.
2. Select the **Move to axis zero point after homing** checkbox.
3. click the **Next** button for next level configuration.

Step 8

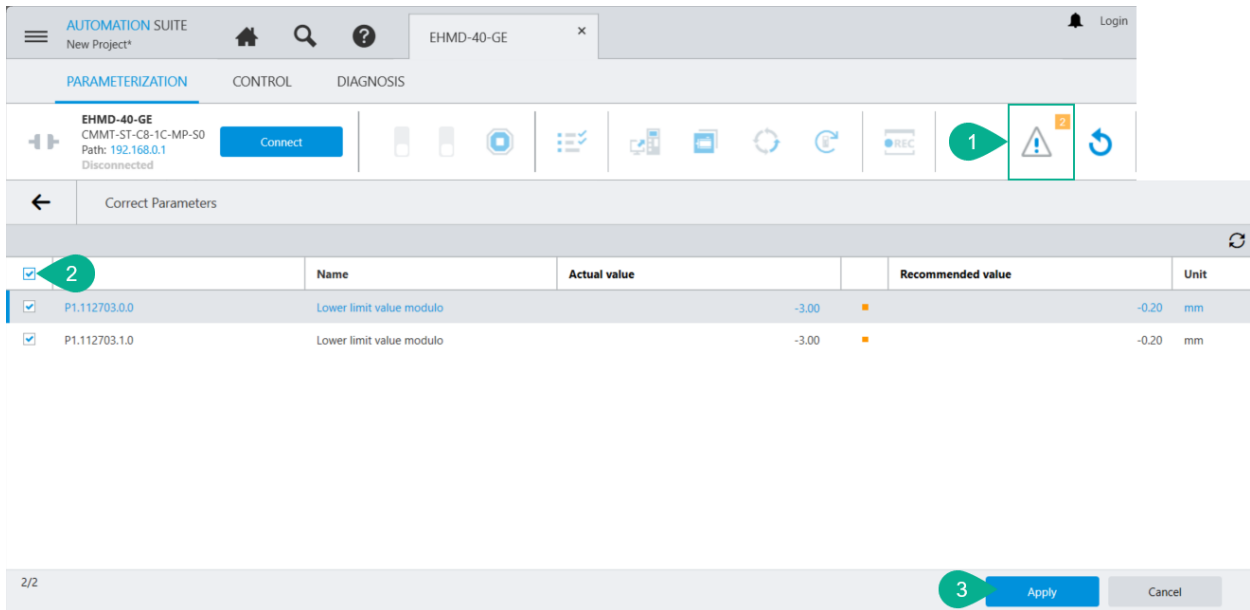
1. Enter the required **Axis zero point offset** value as per EHMD Gripper Module requirement. Refer below note.
2. Ensure that **Software limit position active** checkbox is selected.
3. Enter the required **Negative & Positive software limit position** values as per EHMD Gripper Module requirement. Refer below note.
4. Click the **Finish** button to complete the configuration.

**Note**

Software Limits for EHMD Gripper Module:

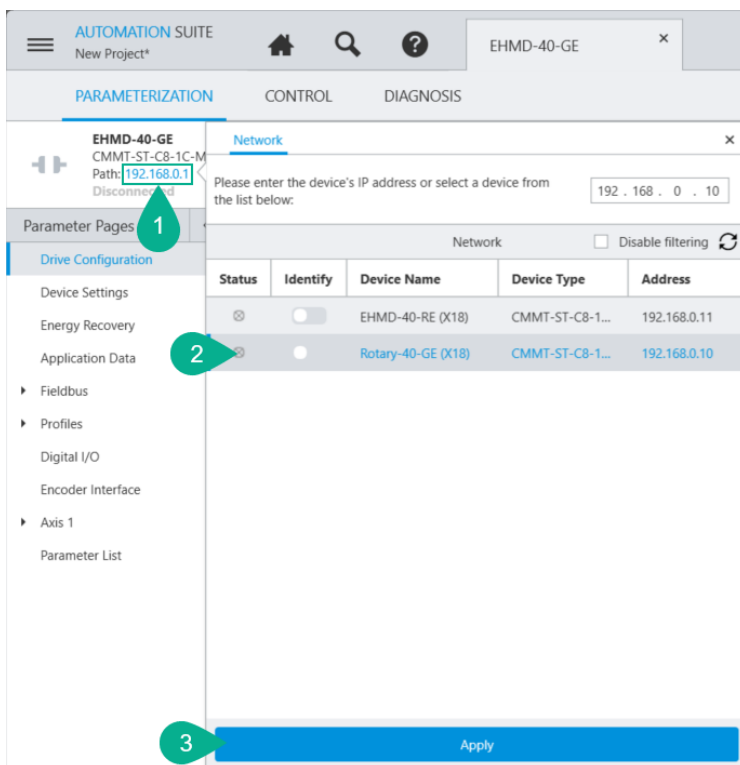
- EHMD-40-...-GE Gripper
 - Axis zero point offset ---> 0.3 mm
 - Negative Software Limit Position ---> -0.2 mm
 - Positive Software Limit Position ---> 6.7 mm
- EHMD-40-...-GE-16 Gripper
 - Axis zero point offset ---> 0.5 mm
 - Negative Software Limit Position ---> -0.3 mm
 - Positive Software Limit Position ---> 18 mm
- EHMD-50-...-GE-15 Gripper
 - Axis zero point offset ---> 0.5 mm
 - Negative Software Limit Position ---> -0.3 mm
 - Positive Software Limit Position ---> 15.3 mm

Step 9

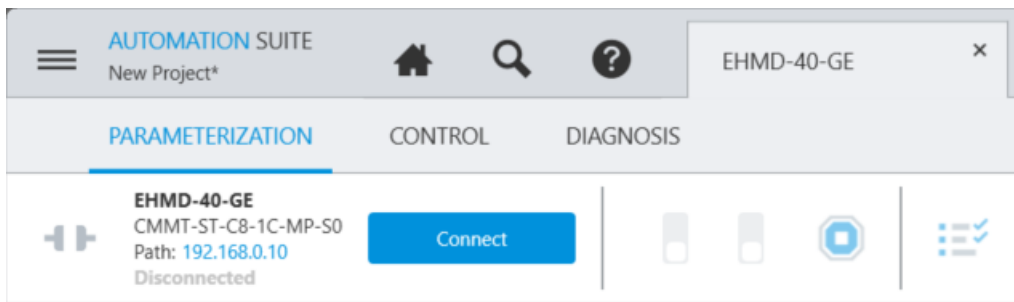


1. Click the **Correct Parameters** button to correct the modified parameters.
2. Click the checkbox to correct all the parameters at once.
3. Click the **Apply** button to apply the system generated recommended values.

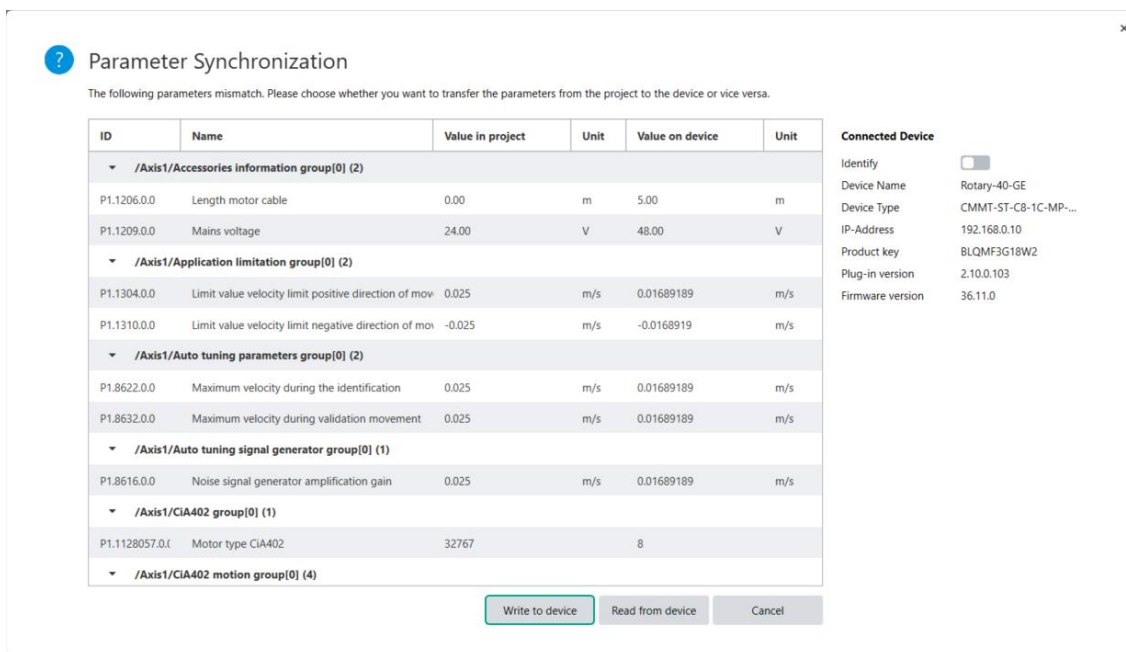
Step 10



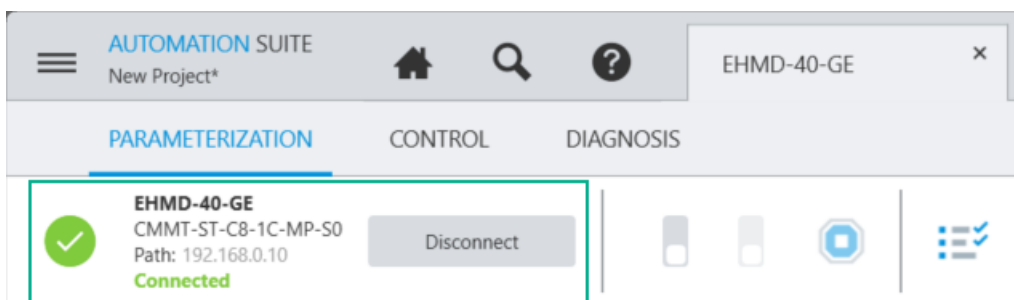
1. Click the Ip address **Path** option from tool bar.
2. Select the correct motor controller for the EHMD Gripper axis.
3. Click the **Apply** button to assign the **Path** address.

Step 11

Click the **Connect** button to establish the communication.

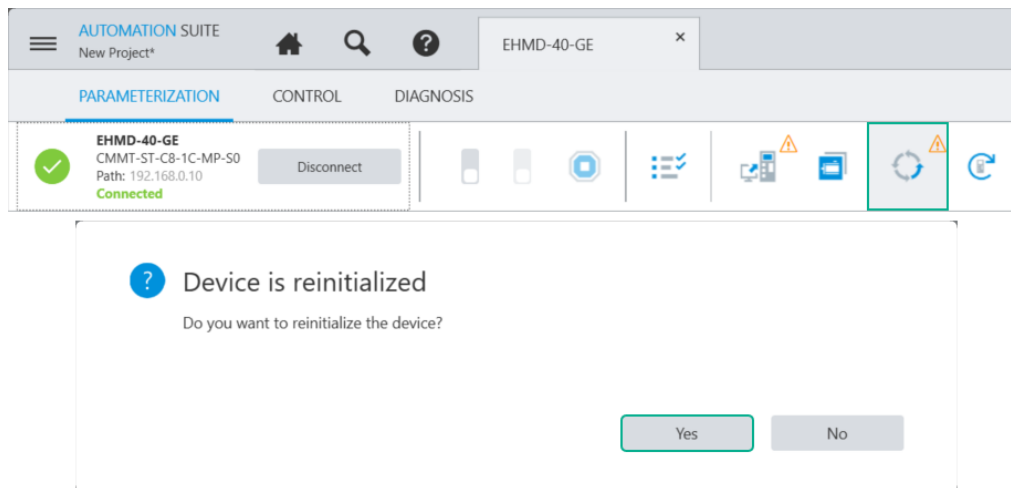
Step 12

Click the **Write to device** button in the **Parameter Synchronization** window.

Step 13

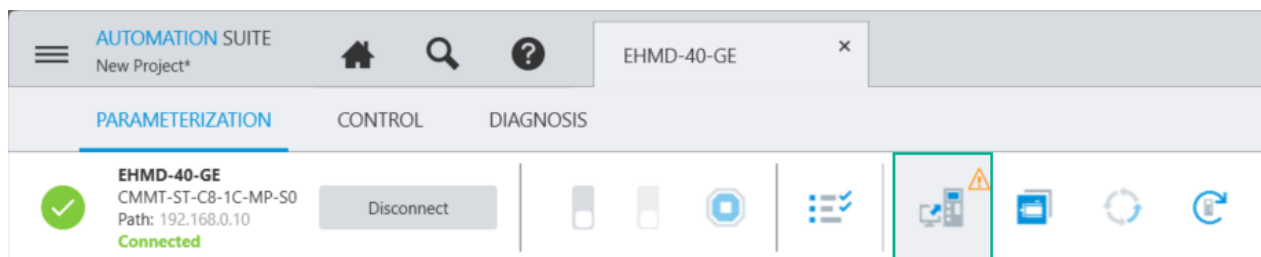
The status of the motor controller changes from Disconnected to Connected.

Step 14



1. Click the **Reinitialize** button to reinitialize the motor controller.
2. Click the **Yes** button to confirm the reinitialization of the motor controller.

Step 15



Click the **Store on Device** button to store all the parameters in the motor controller memory.



Note

- The triangle warning symbol on the buttons indicates action required.
- All the modified parameters will automatically erase from the motor controller during power re-start if the modified parameters are not stored in the motor controller.
- It's mandatory to reinitialize the motor controller for some parameter modification. If the motor controller is not reinitialized, then the motor controller performance remains the same as the previous configuration.

3 Software Configuration

This chapter describes about software configurations of Mitsubishi GX Works2 software, such as creating a new project, adding the controller to the project, adding and configuring CMMT-ST-...-MP-S0 as Modbus TCP slaves, and configuring the predefined protocol settings for CMMT-ST-...-MP-S0 drives' process data.

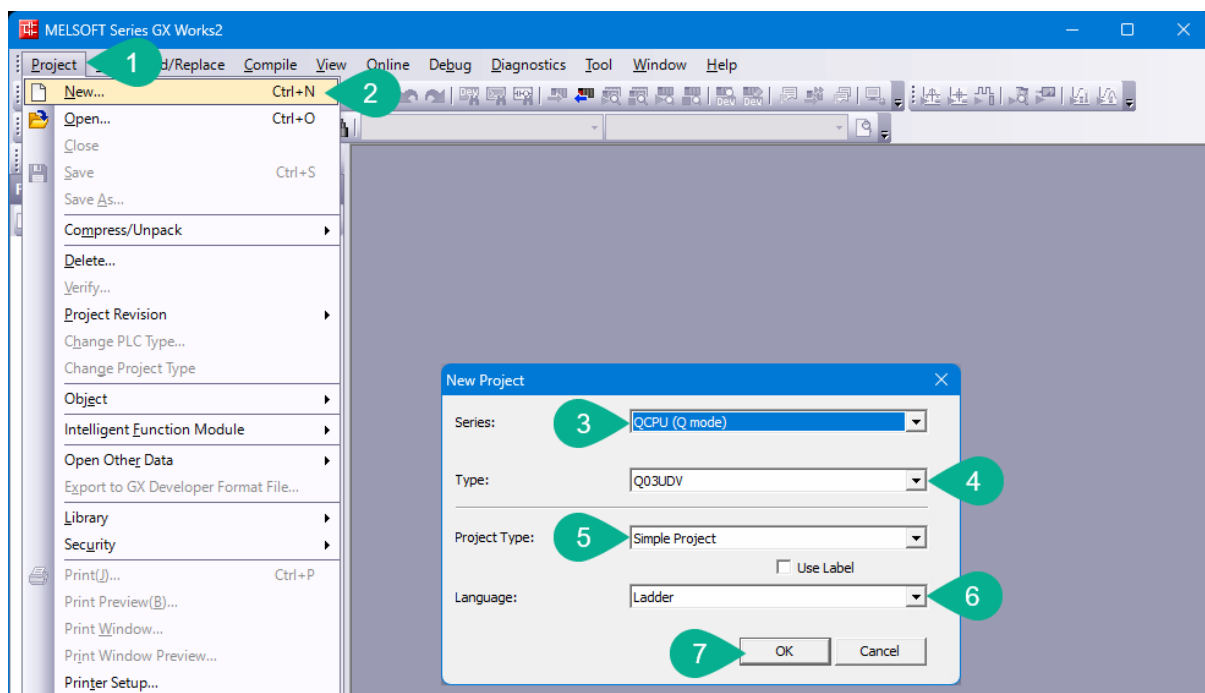
3.1 Creating a New Project and Adding the Controller in GX Works2

Step 1

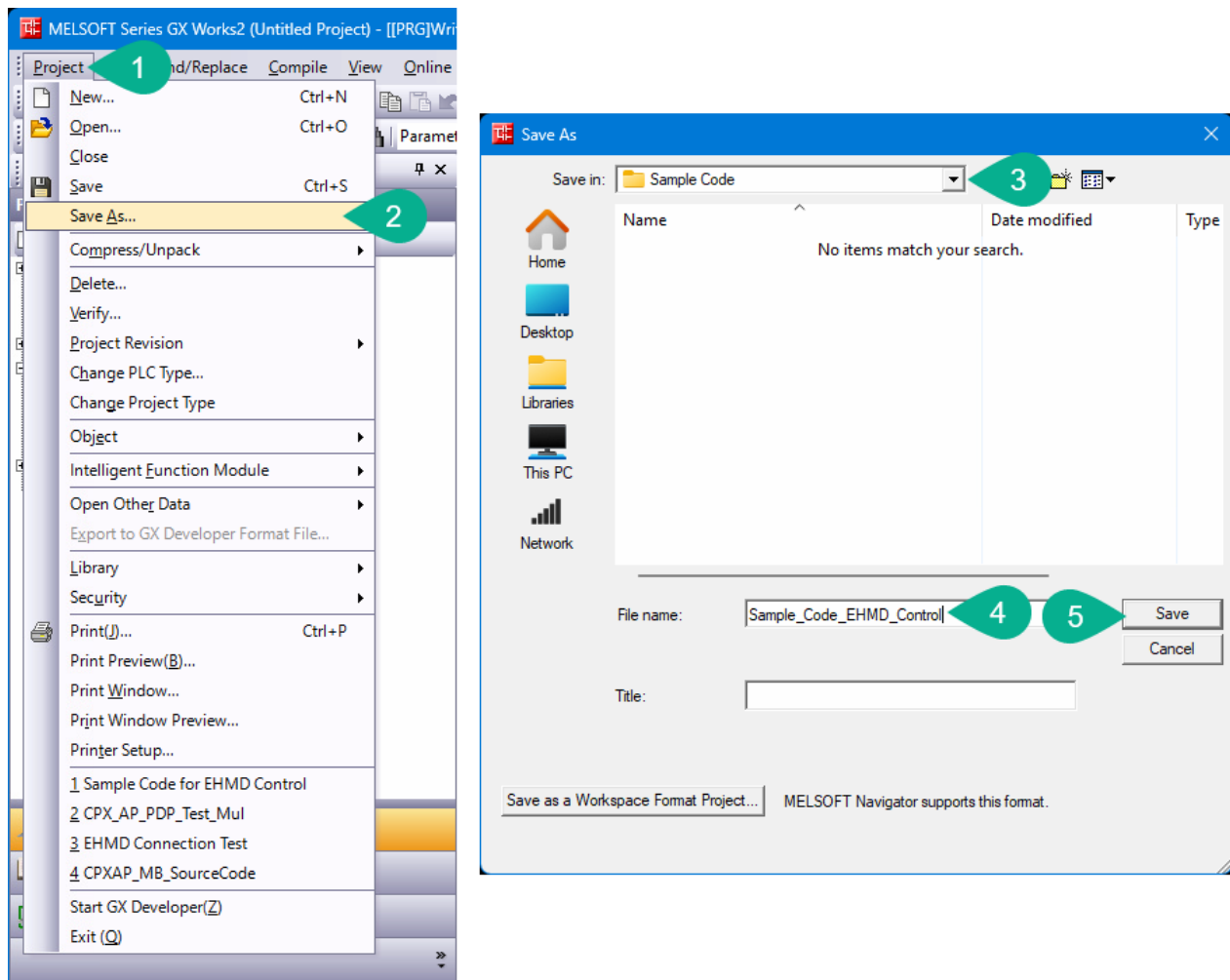


Open the **GX Works2** software (**Windows Start >> MELSOFT >> GX Works2**).

Step 2



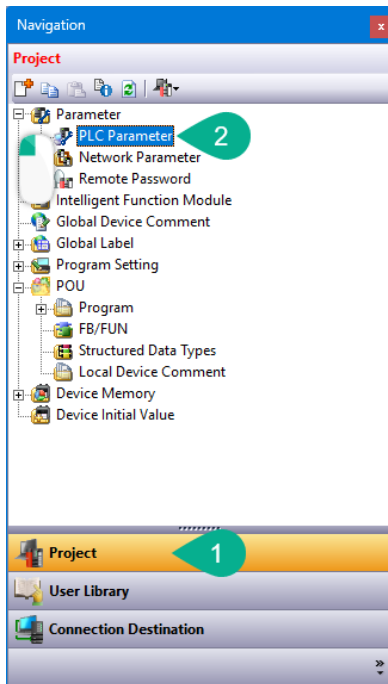
1. Click on **Project** menu option from toolbar.
2. Click on **New..** option or use shortcut key **Ctrl + N** to create a new project.
3. Select the **QCPU (Q mode)** option from **Series** drop-down option.
4. Select the **Q03UDV** as a CPU from **Type** drop-down option. The user can select the CPU as per their requirements
5. Select the **Simple Project** option from **Project Type** drop-down option.
6. Select the **Ladder** option from **Language** drop-down option as programming language.
7. Click **OK** button to create the project.

Step 3

1. Click on **Project** menu option from toolbar.
2. Click on **Save As..** or **Save** option or use shortcut key **Ctrl + S** to save the project.
3. Select the destination to save the project from **Save in** drop-down option.
4. Enter the project name in **File name** box as per requirement.
5. Click on **Save** button to save the project.

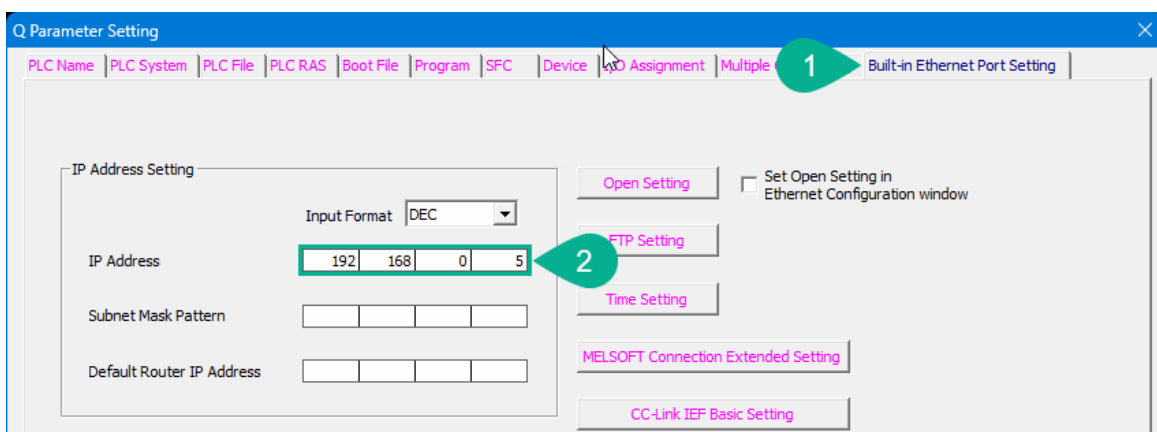
3.2 Built-in Ethernet Port Parameter Setting

Step 1



1. Select the **Project** option from **Navigation** window.
2. Double click on the **PLC Parameter** option under **Parameter** menu to open the **Q Parameter Setting** window.

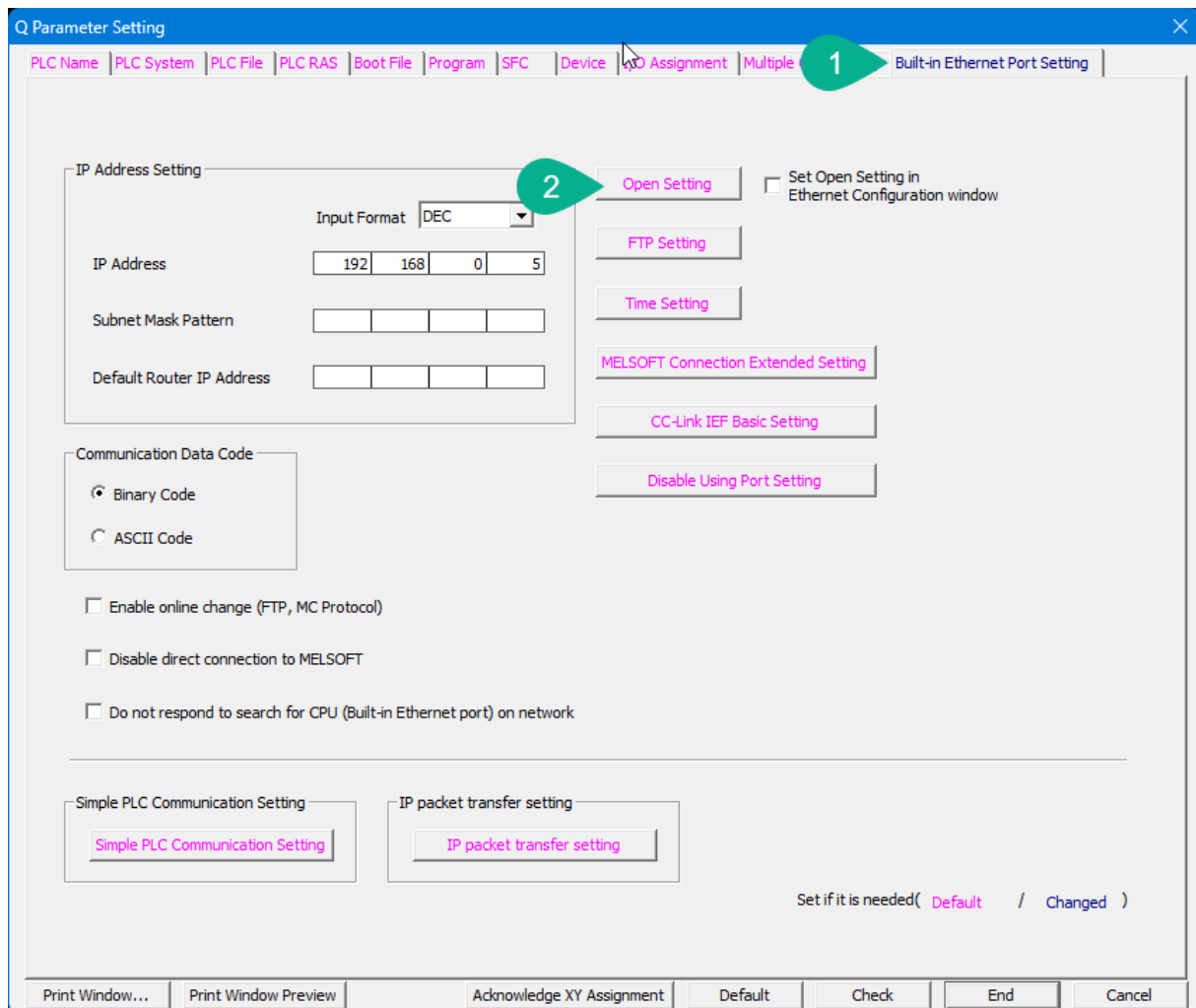
Step 2



1. Click on **Built-in Ethernet Port Setting** tab in the **Q Parameter Setting** window.
2. Enter the required **IP Address** for the PLC.

3.3 Modbus Slave Configuration in GX Works2

Step 1



1. Click on **Built-in Ethernet Port Setting** tab in the **Q Parameter Setting** window.
2. Click on **Open Setting** button to open the **Built-in Ethernet Port Open Setting** window.

Step 2

Built-in Ethernet Port Open Setting

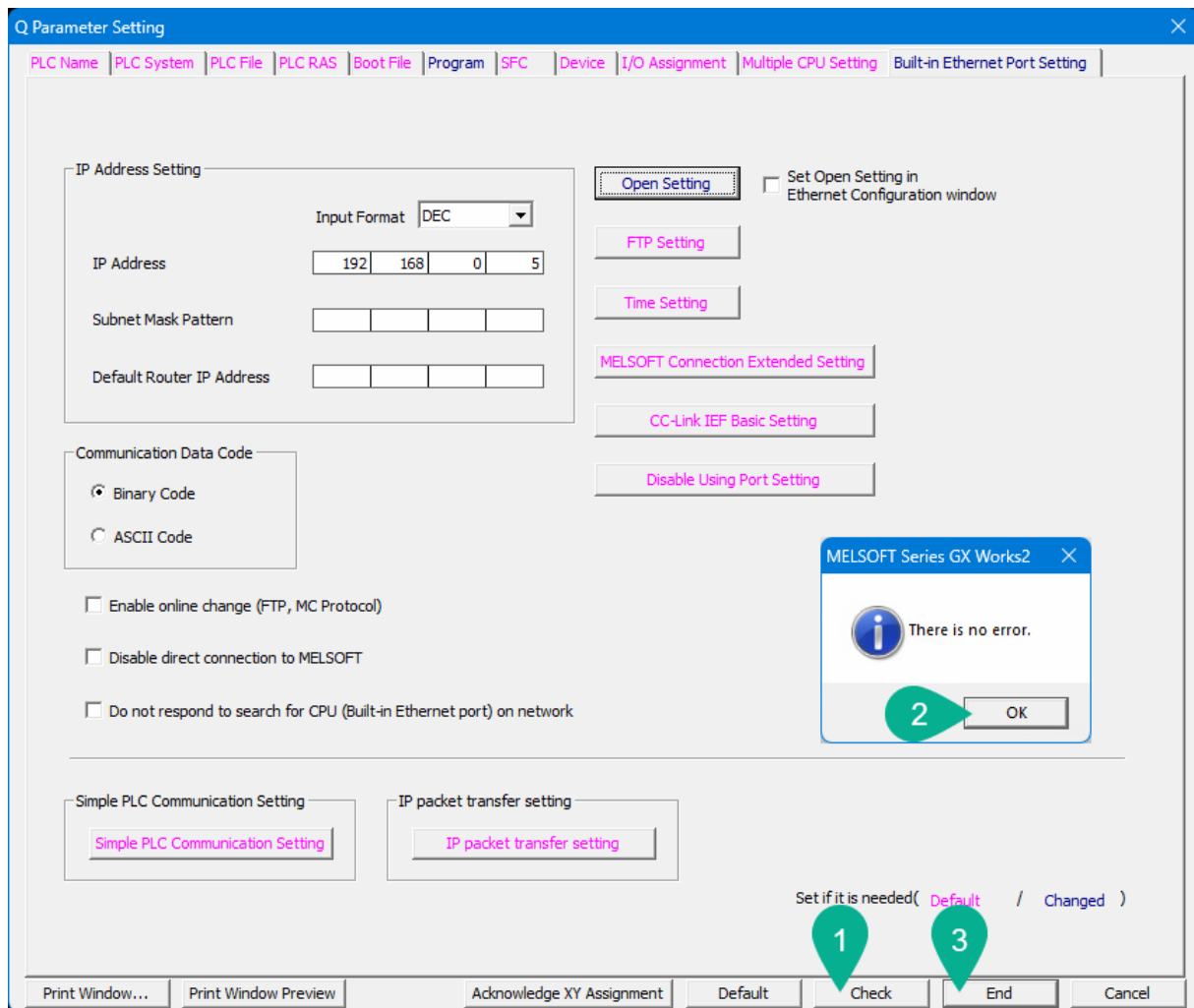
IP Address/Port No. Input Format: DEC

	Protocol	Open System	TCP Connection	Host Station Port No.	Destination IP Address	Destination Port No.	Start Device to Store Predefined Protocol Operation Status
1	TCP	Predefined Protocol	Active	2000	192.168. 0. 20	502	W0
2	TCP	Predefined Protocol	Active	2001	192.168. 0. 21	502	W100
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							

(*) IP Address and Port No. will be displayed by the selected format.
Please enter the value according to the selected number.

End Cancel

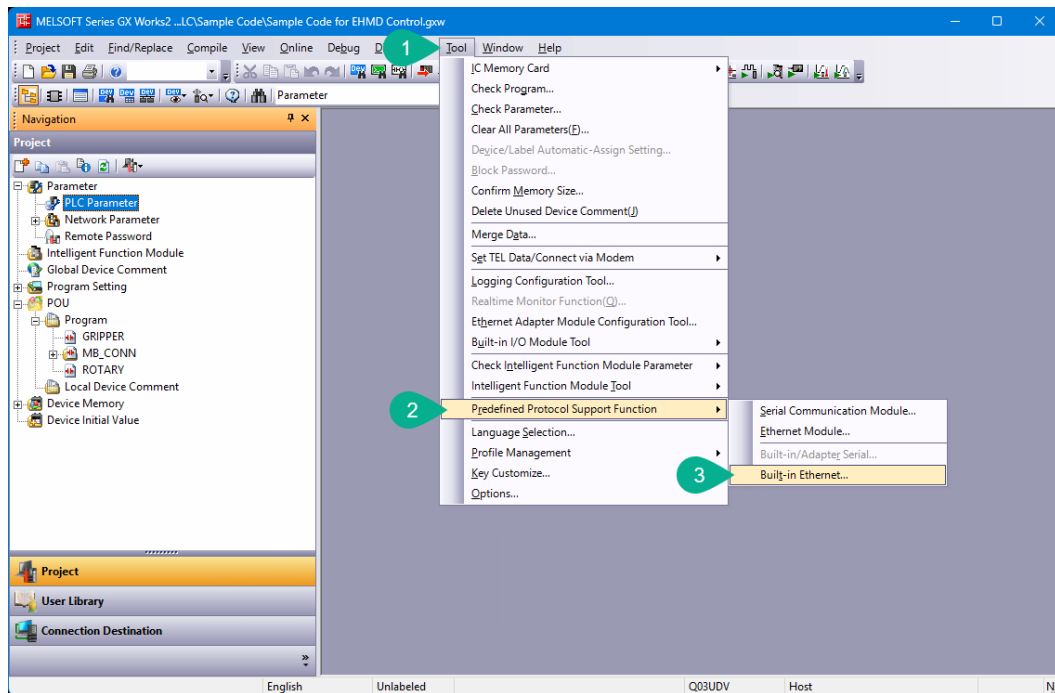
1. Select the **Connection Number** which is not used for configuring the Modbus Slave. For this Application Note, **Connection Number 1 & 2** is used.
2. Select the **TCP** option in **Protocol** column.
3. Select the **Predefined Protocol** option as **Protocol** in **Open System** column.
4. Select the **Active** option in **TCP Connection** column.
5. Enter the free **Port Number** of the PLC in **Host Station Port No.** column. For multiple slave devices, it is recommended to use different **Host Station Port Numbers** as shown.
6. Enter the CMMT-ST drives **IP Address** in **Destination IP Address** column.
7. Enter the Modbus TCP **Port Number 502** in **Destination Port No.** column.
8. Enter the free **Register** in **Start Device to Store Predefined Protocol Operation Status** column.
9. Click on **End** button to close the window.

Step 3

1. Click on **Check** button for error check.
2. Click on **OK** button in pop-up window as shown.
3. Click on **End** button to close the window.

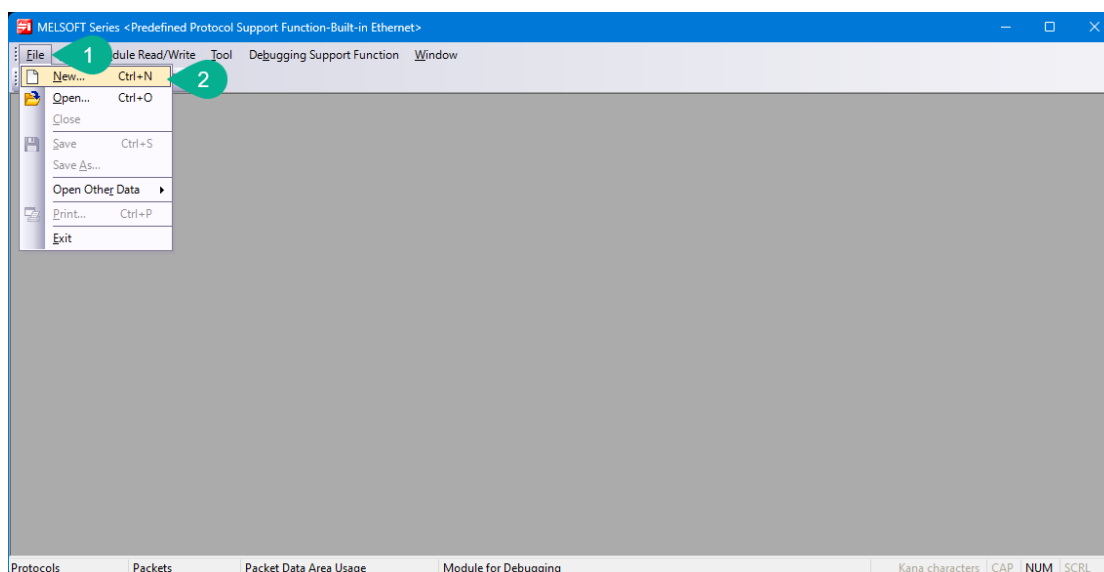
3.4 Predefined Protocol Support Function Settings

Step 1

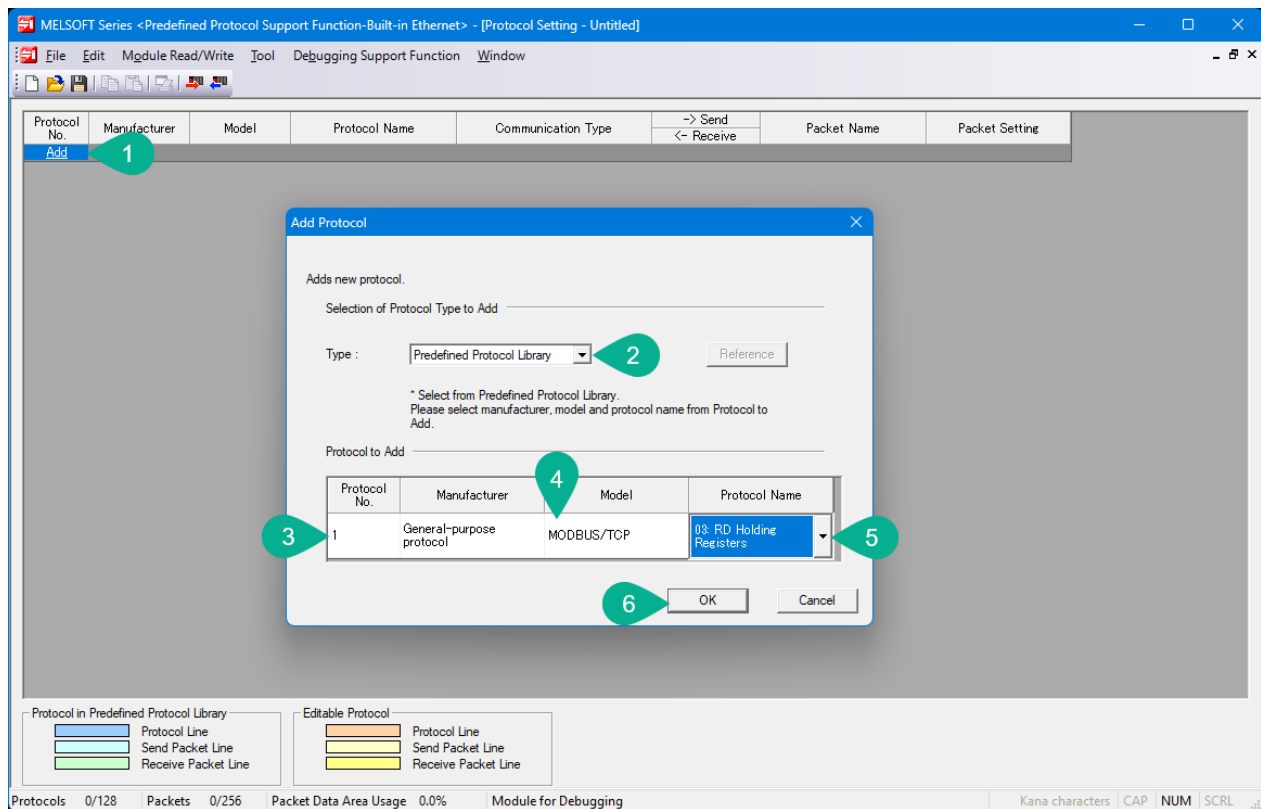


1. Click on **Tool** menu option from toolbar.
2. Select the **Predefined Protocol Support Function** option.
3. Click on **Built-in Ethernet...** option to open the **Predefined Protocol Support Function - Built-in Ethernet Protocol Setting** window.

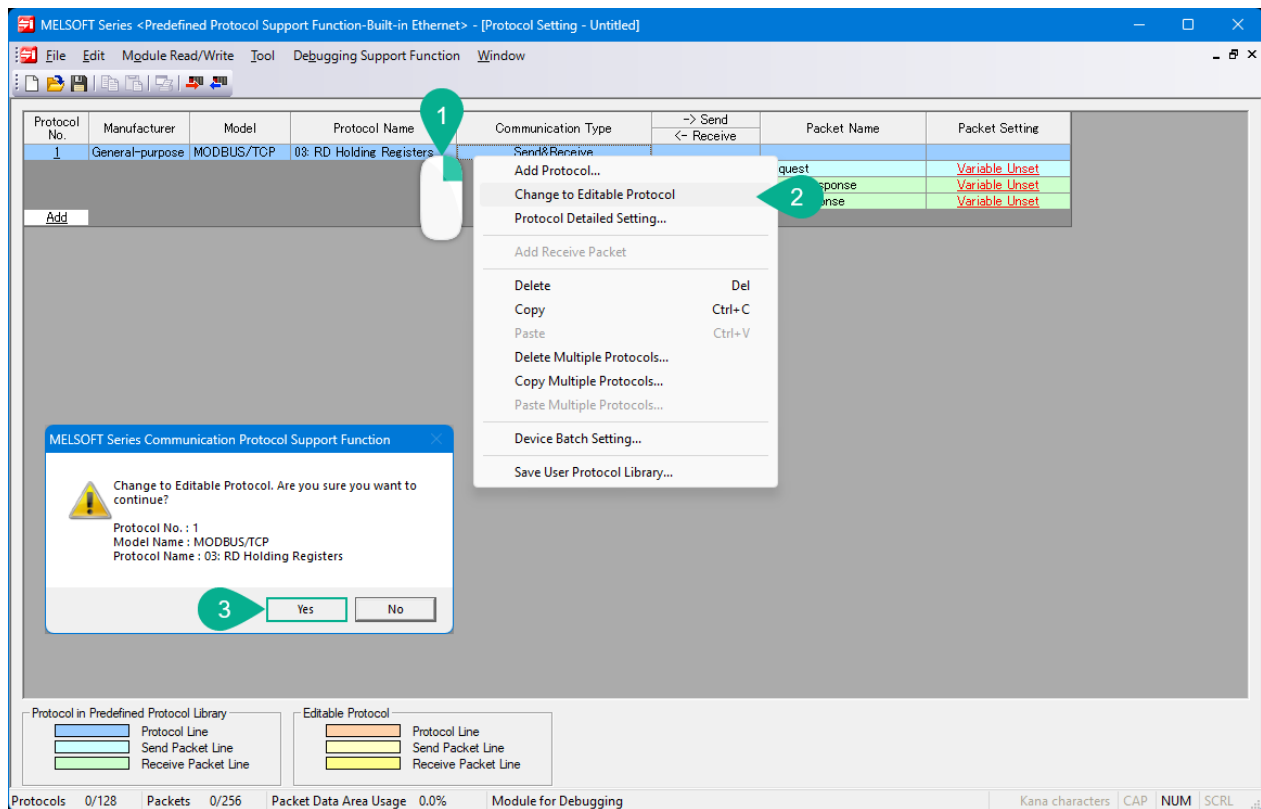
Step 2



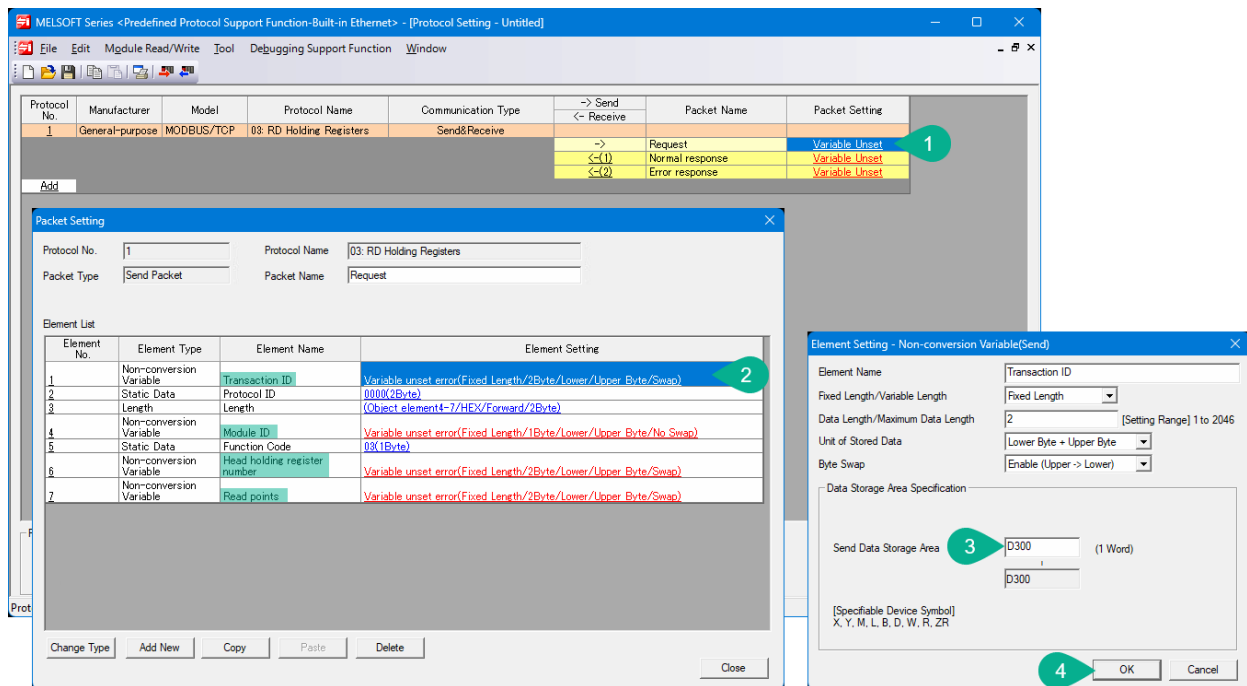
1. Click on **File** menu option from toolbar.
2. Click on **New...** option or use shortcut key **Ctrl + N** to create a new protocol file.

Step 3

1. Click on **Add** button to open the **Add Protocol** window.
2. Select the **Predefined Protocol Library** option from **Type** drop-down option under **Selection of Protocol Type to Add** setting.
3. Select the **Protocol Number** from **Protocol No.** drop-down option under **Protocol to Add** setting.
4. Select the **MODBUS/TCP** option from **Model** drop-down option.
5. Select the **03: RD Holding Registers** option from **Protocol Name** drop-down option.
6. Click on **OK** button to add the **Protocol** to the file.

Step 4

1. Select the added **Protocol** and right click on it.
2. Click on the **Change to Editable Protocol** option.
3. Click on the **Yes** button, so that the selected **Protocol** color changes from **Blue** to **Orange**, indicating that the **Protocol** is editable.

Step 5

1. Click on **Variable Unset** link in **Packet Setting** of the **Packet Name** Request option.
2. Click on the **Variable unset error** link in **Element Setting** of the **Transaction ID** Element Name.
3. Enter the **Register** address for **Send Data Storage Area** field.
4. Click on **OK** button.

Repeat the same procedure from 2nd point for assigning **Module ID**, **Head Holding register number** and **Read Points** elements highlighted in **Green** color box.

Step 6

Packet Setting

Protocol No. Protocol Name

Packet Type Packet Name

Element List

Element No.	Element Type	Element Name	Element Setting
1	Non-conversion Variable	Transaction ID	[D300-D300](Fixed Length/2Byte/Lower/Upper Byte/Swap)
2	Static Data	Protocol ID	0000(2Byte)
3	Length	Length	(Object element4-7/HEX/Forward/2Byte)
4	Non-conversion Variable	Module ID	[D301-D301](Fixed Length/1Byte/Lower/Upper Byte/No Swap)
5	Static Data	Function Code	03(1Byte)
6	Non-conversion Variable	Head holding register number	[D302-D302](Fixed Length/2Byte/Lower/Upper Byte/Swap)
7	Non-conversion Variable	Read points	[D303-D303](Fixed Length/2Byte/Lower/Upper Byte/Swap)

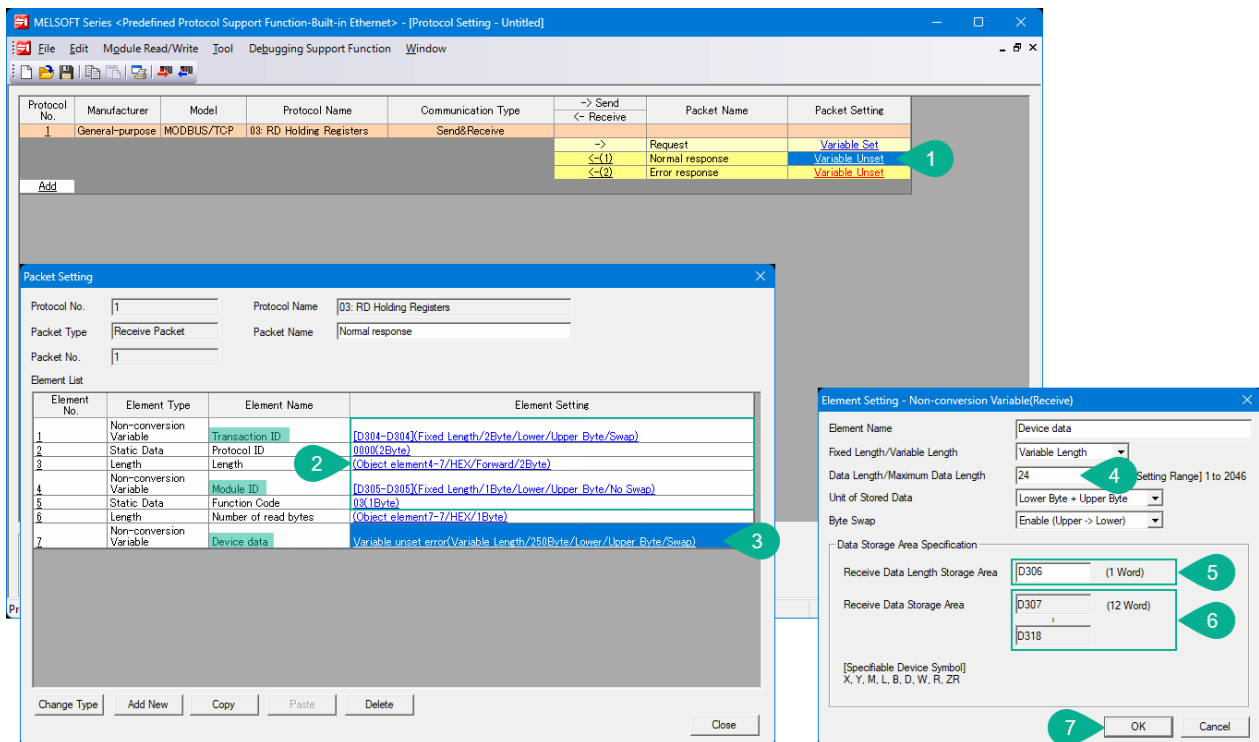
Change Type Add New Copy Paste Delete

Close

Once the **Packet Settings** of the **Request** are completed, it will appear as shown above, and click on **Close** button to close the window.

**Note**

- The user should allocate continuous register addresses, such as D300, D301, D302, and so forth, and not random register addresses, such as D300, D105, D205, etc.

Step 7

1. Click on **Variable Unset** link in **Packet Setting** of the **Packet Name** Normal Response option.
2. Assign the **Register** addresses for **Transaction ID** and **Module ID** elements highlighted in **Green** color box by following **Step 5** Point 2 to Point 4.
3. Click on the **Variable Unset Error** link in **Element Setting** of the **Device data** Element Name.
4. Enter the **Data Length** value of the **Protocol** in **Bytes (24 Bytes)** data in **Data Length/Maximum Data Length** field.
5. Enter the **Register** address for **Receive Data Length Storage Area** field.
6. The **Receive Data Storage Area** is assigned automatically, based on the **Data Length** (in **Word**) specified in **Point 4**. This is where the CMMT-ST status is received
7. Click on **OK** button.

**Note**

- The user should allocate immediate next register address from **Packet Settings** of the **Request** to the **Packet Settings** of the **Normal Response**.

Step 8

Packet Setting

Protocol No. Protocol Name

Packet Type Packet Name

Packet No.

Element List

Element No.	Element Type	Element Name	Element Setting
1	Non-conversion Variable	Transaction ID	[D304-D304](Fixed Length/2Byte/Lower/Upper Byte/Swap)
2	Static Data	Protocol ID	0000(2Byte)
3	Length	Length	(Object element4-7/HEX/Forward/2Byte)
4	Non-conversion Variable	Module ID	[D305-D305](Fixed Length/1Byte/Lower/Upper Byte/No Swap)
5	Static Data	Function Code	03(1Byte)
6	Length	Number of read bytes	(Object element7-7/HEX/1Byte)
7	Non-conversion Variable	Device data	[D306][D307-D318](Variable Length/24Byte/Lower/Upper Byte/Swap)

Change Type Add New Copy Paste Delete

Close

Once the **Packet Settings** of the **Normal Response** are completed, it will appear as shown above, and click on **Close** button to close the window.

Repeat above **Steps** to configure the **Packet Settings** of the **Error Response** Packet Name.

Step 9

The Packet Setting dialog box is shown with the following configuration:

- Protocol No.: 1
- Protocol Name: 03: RD Holding Registers
- Packet Type: Receive Packet
- Packet Name: Error response
- Packet No.: 2

The Element List table contains the following data:

Element No.	Element Type	Element Name	Element Setting
1	Non-conversion Variable	Transaction ID	[D319-D319](Fixed Length/2Byte/Lower/Upper Byte/Swap)
2	Static Data	Protocol ID	0000(2Byte)
3	Length	Length	(Object element4-6/HEX/Forward/2Byte)
4	Non-conversion Variable	Module ID	[D320-D320](Fixed Length/1Byte/Lower/Upper Byte/No Swap)
5	Static Data	Function Code	83(1Byte)
6	Non-conversion Variable	Exception Code	[D321-D321](Fixed Length/1Byte/Lower/Upper Byte/No Swap)

Buttons at the bottom: Change Type, Add New, Copy, Paste, Delete, and a Close button.

Once the **Packet Settings** of the **Error Response** are completed, it will appear as shown above, and click on **Close** button to close the window.

**Note**

- The user should allocate immediate next register address from **Packet Settings** of the **Normal Response** to the **Packet Settings** of the **Error Response**.

Step 10

The MELSOFT Series - [Protocol Setting - Untitled] window displays the following configuration:

Protocol No.	Manufacturer	Model	Protocol Name	Communication Type	→ Send ← Receive	Packet Name	Packet Setting
1	General-purpose	MODBUS/TCP	03: RD Holding Registers	Send&Receive	→ ←	Request	Variable Set
					←(1)	Normal response	Variable Set
					←(2)	Error response	Variable Set

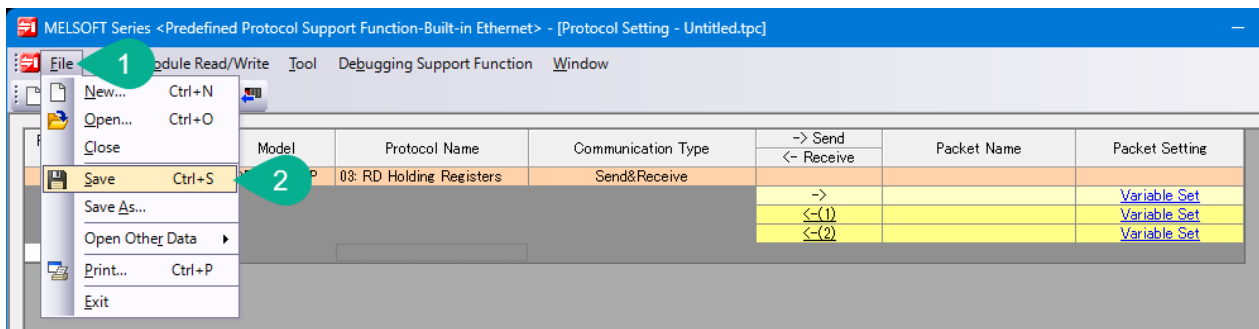
Buttons: Add

Legend:

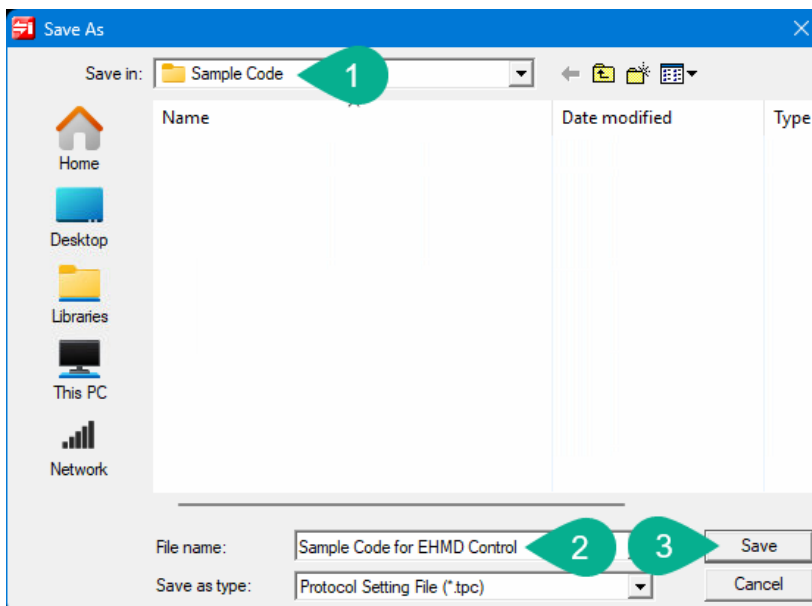
- Protocol in Predefined Protocol Library:
 - Protocol Line (Blue)
 - Send Packet Line (Green)
 - Receive Packet Line (Red)
- Editable Protocol:
 - Protocol Line (Orange)
 - Send Packet Line (Yellow)
 - Receive Packet Line (Yellow)

Status bar: Protocols 1/128, Packets 3/256, Packet Data Area Usage 1.0%, Module for Debugging, Kana characters, CAP, NUM, SCRL.

Once the configurations of **Protocol Settings** for the **Read EHMD Gripper Module Status Data** are completed, it will appear as shown above.

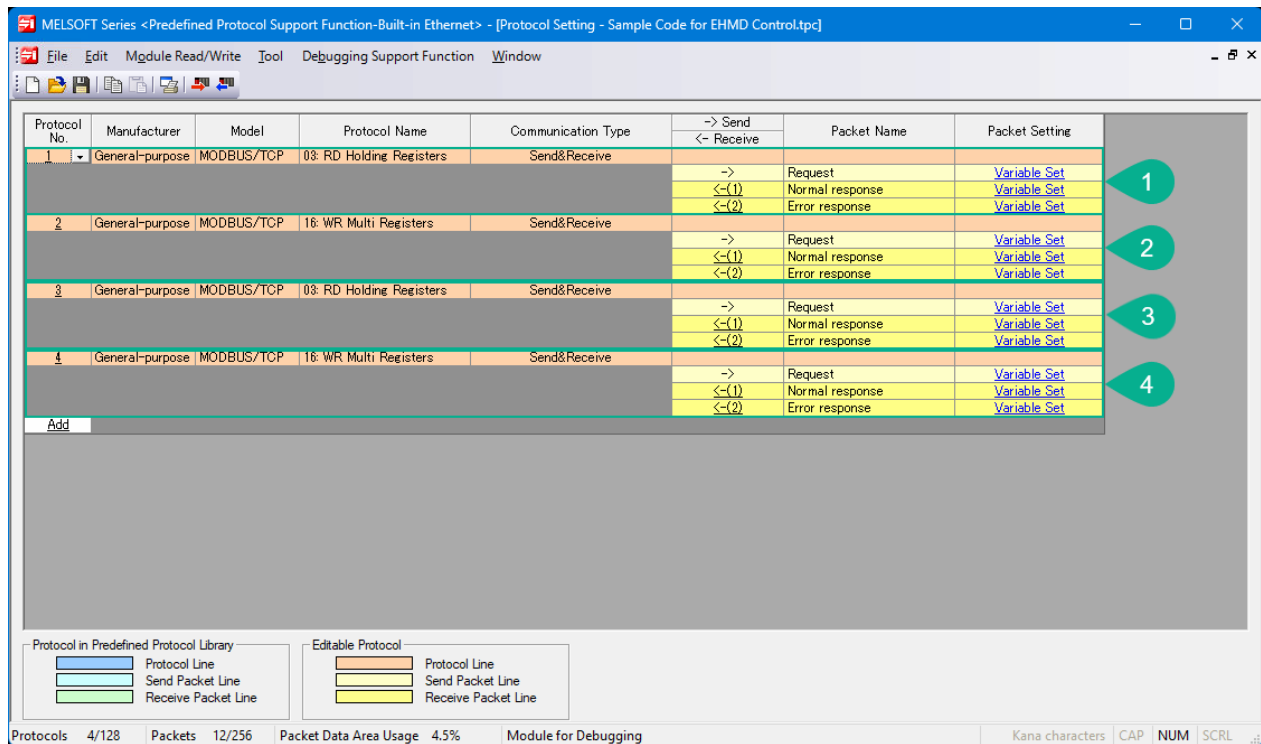
Step 11

1. Click on **Project** menu option from toolbar.
2. Click on **Save** option or use shortcut key **Ctrl + S** to save the protocol file.

Step 12

1. Select the destination to save the project from **Save in** drop-down option.
2. Enter the project name in **File name** box as per requirement.
3. Click on **Save** button to save the project.

Repeat the above Process for configuring the Protocol Settings of the **Write EHMD Gripper Module Control Data, Read EHMD Rotary Module Status** and **Write EHMD Rotary Module Control Data** as shown below.



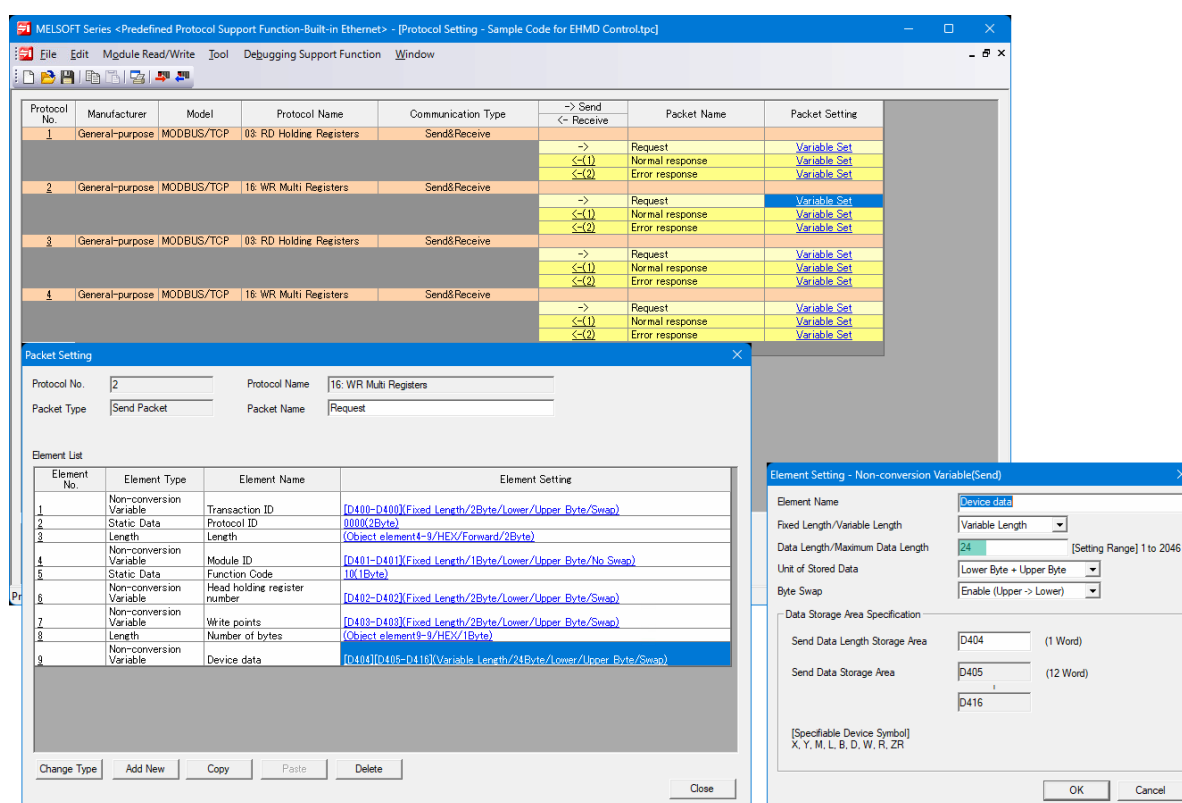
1. The **Protocol Number 1** is for **EHMD Gripper Module Drive Status** read.
2. The **Protocol Number 2** is for **EHMD Gripper Module Drive Control** write.
3. The **Protocol Number 3** is for **EHMD Rotary Module Drive Status** read.
4. The **Protocol Number 4** is for **EHMD Rotary Module Drive Control** write.



Note

- Select the **16: WR Multi Registers** as the **Protocol Name** for writing the data.
- Always configure **Consecutive Protocols** for EHMD Module Drives Status Read & Control Write.
- The above **Protocol Numbers** are configured only for this Application Note and may vary based on the user requirements.

Step 13



Enter the **Data Length** value of the **Protocol** in **Bytes (24 Bytes)** data in **Data Length/Maximum Data Length** field.

Configure **EHMD Gripper Module CMMT-ST** for **Read & Write** as shown. Repeat the same communication settings and protocol parameters for the **EHMD Rotary Module CMMT-ST**.



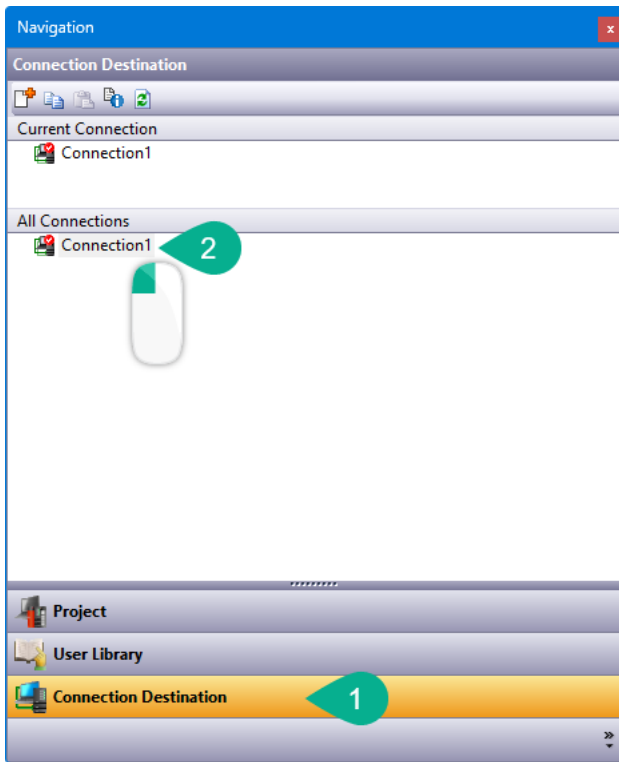
Note

Register mappings differ – the user must assign four distinct sets of D registers (one set per protocol) so that each CMMT-ST uses its own D-register ranges.

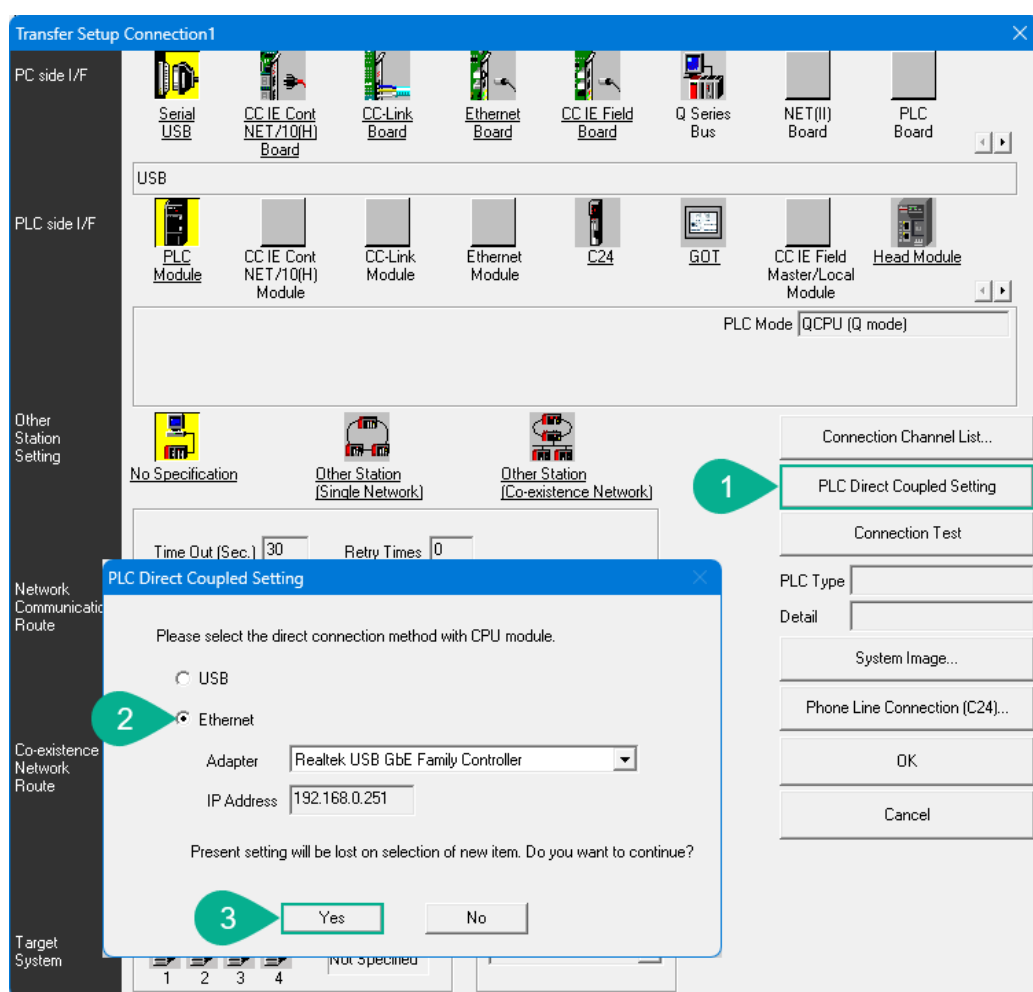
- EHMD Gripper Module CMMT-ST: **D300 – D321** (Read Status Data), **D400 – D423** (Write Control Data).
- EHMD Rotary Module CMMT-ST: **D500 – D521** (Read Status Data), **D600 – D623** (Write Control Data).

3.5 PLC Communication Setup

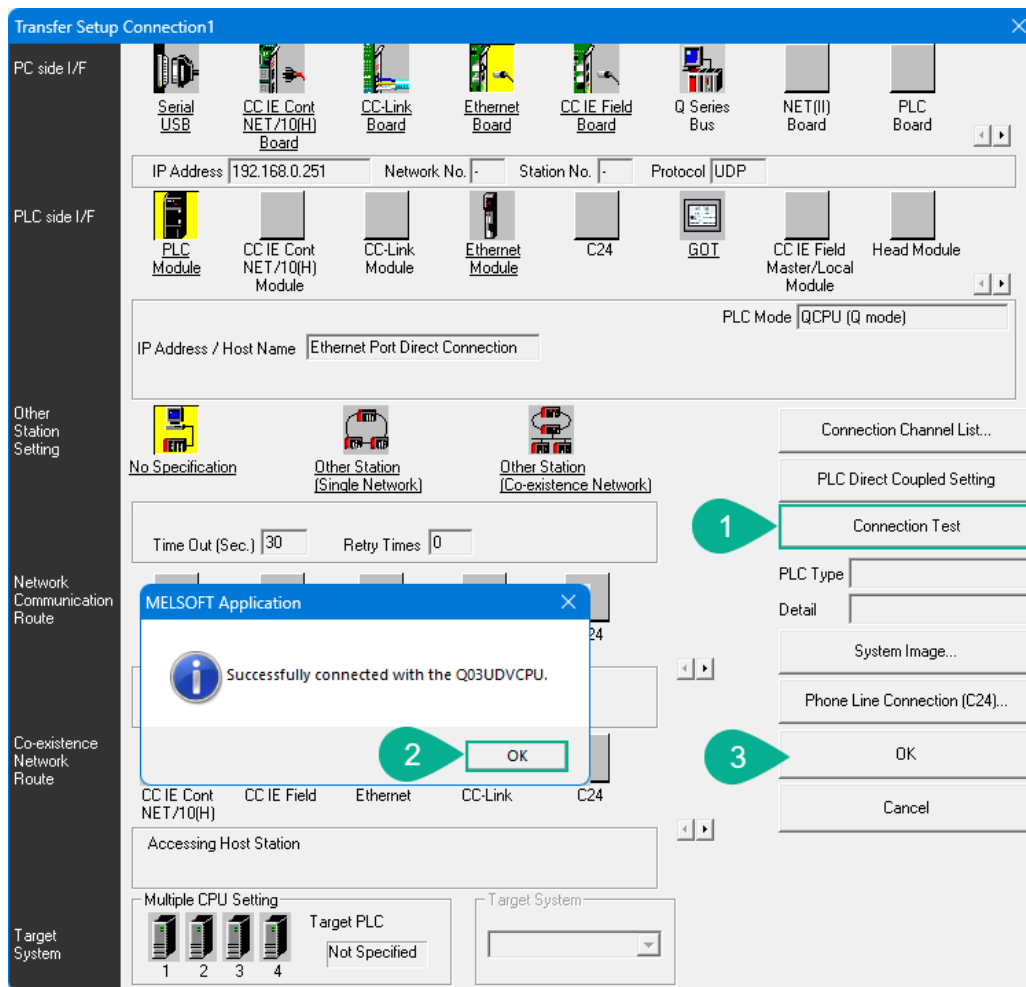
Step 1



1. Click on **Connection Destination** option from **Navigation** window.
2. Double click on **Connection1** option from **All Connections** tab.

Step 2

1. Click on **PLC Direct Coupled Setting** button on **Transfer Setup Connection 1** window.
2. Select **Ethernet** option as the **Direct Connection with CPU module** method.
3. Select the required **Work Station Adapter** from drop-down option.
4. Ensure the **Work Station IP Address** range is same as PLC.
5. Click on **Yes** button.

Step 3

1. Click on **Connection Test** button to test the connection with PLC.
2. Click on **OK** button once the communication is established successfully with PLC.
3. Click on **OK** button to **Save** and **Close** the **Transfer Setup Connection** window.

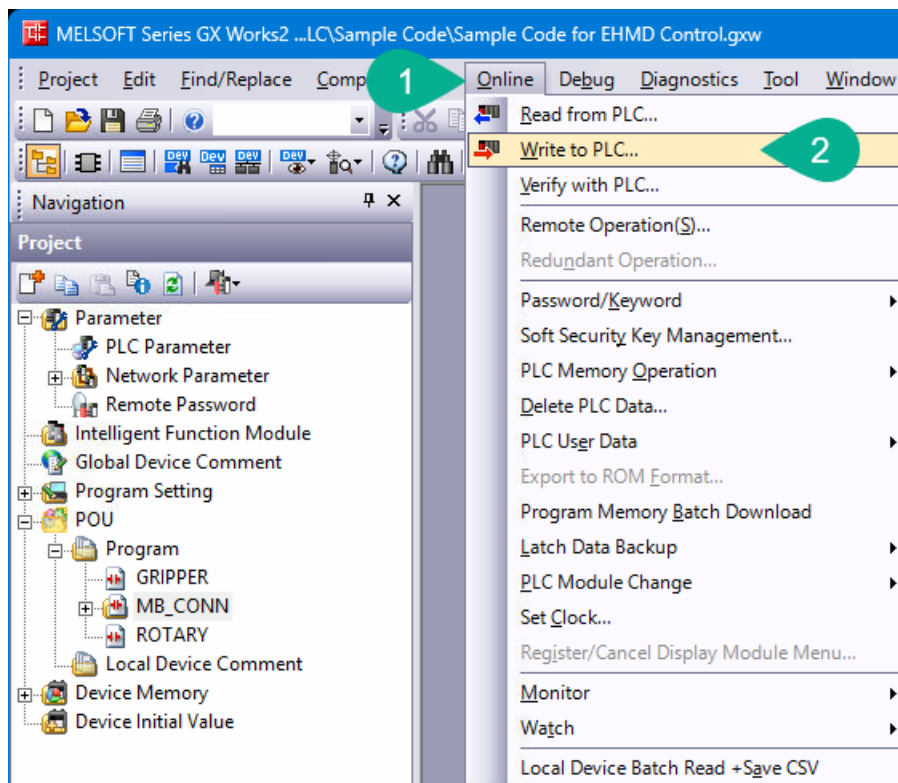
4 Program and Predefined Protocol Support Function Transfer

4.1 Downloading the Project to the PLC

Step 1

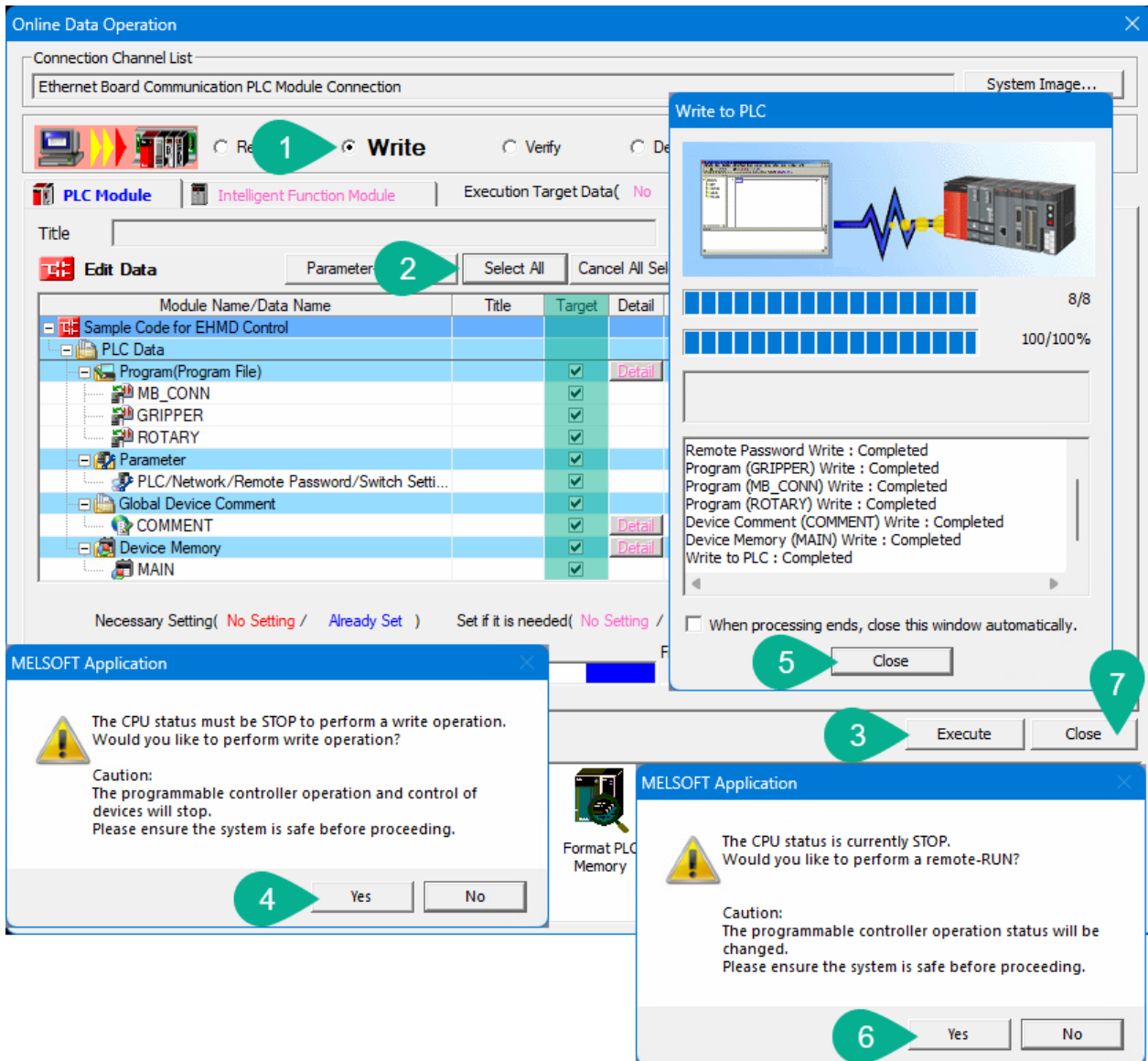
Rebuild the project after all configuration and programming has been completed.

Step 2



1. Click on **Online** option from toolbar.
2. Click on **Write to PLC...** option to download the project to PLC.

Step 3



1. Select **Write** option in **Online Data Operation** window.
2. Click on **Select All** button to select all data to download to PLC as highlighted in green color box. Select the download parameters as per user requirement.
3. Click on **Execute** button to start the **Write to PLC** process.
4. Click on **Yes** button to **Stop** the PLC operation status.
5. Click on **Close** button on **Write to PLC** window once the process is completed.
6. Click on **Yes** button to **Start** the PLC operation status.
7. Click on **Close** button to close the **Online Data Operation** window.

4.2 Download – Predefined Protocol Support Function – Built-in Ethernet Setting

Step 1

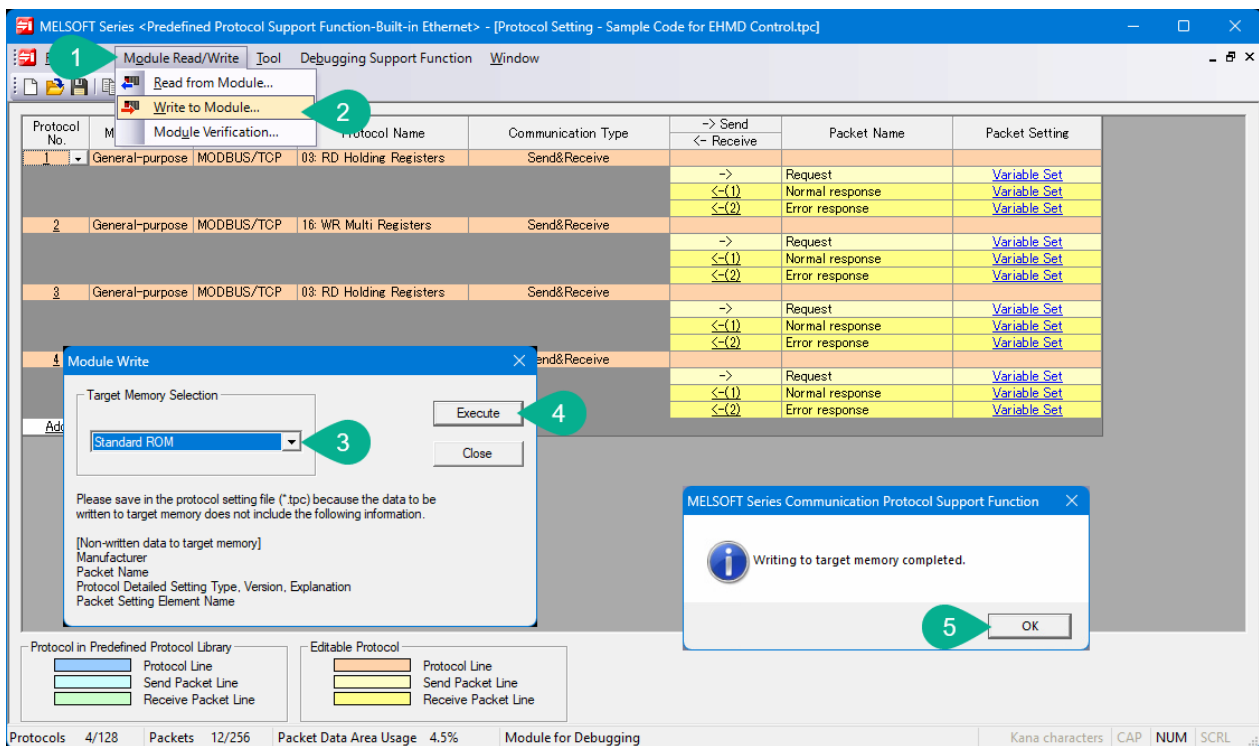
Switch the PLC to **Stop Mode** before downloading the Predefined Protocol Settings.

Step 2

Go to **Predefined Protocol Support Function - Built-in Ethernet Protocol Setting** window. [Refer Chapter 3.4](#)

Step 1.

Step 3



1. Click on **Module Read/Write** option from toolbar.
2. Click on **Write to Module...** option to download the Predefined Protocol Settings.
3. Select the **Target Memory Selection** as per user requirement. For this sample code, **Standard ROM** is selected.
4. Click on **Execute** button to start the process.
5. Click on **OK** button.

Step 4

Once the Predefined Protocol Settings downloaded, switch the PLC back to **Run Mode**.

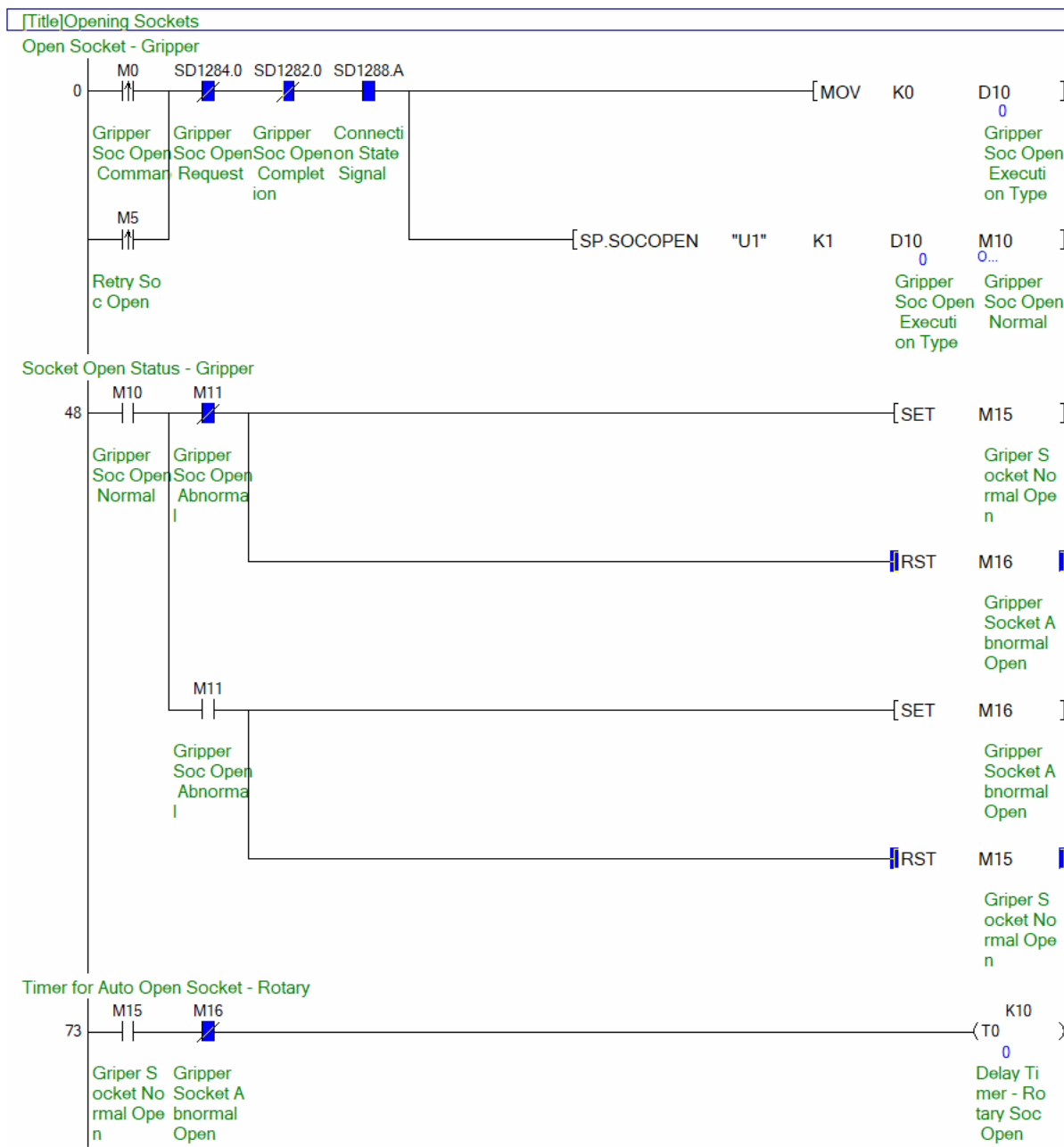
5 Sample Code for EHMD Control

This chapter describes about establishing the Modbus TCP connection for EHMD Rotary Gripper Module CMMT-ST drives connected with Mitsubishi Q-Series PLC in network and controlling through Modbus TCP process data.

5.1 Establishing the Modbus TCP Connection

5.1.1 Socket Open Operation

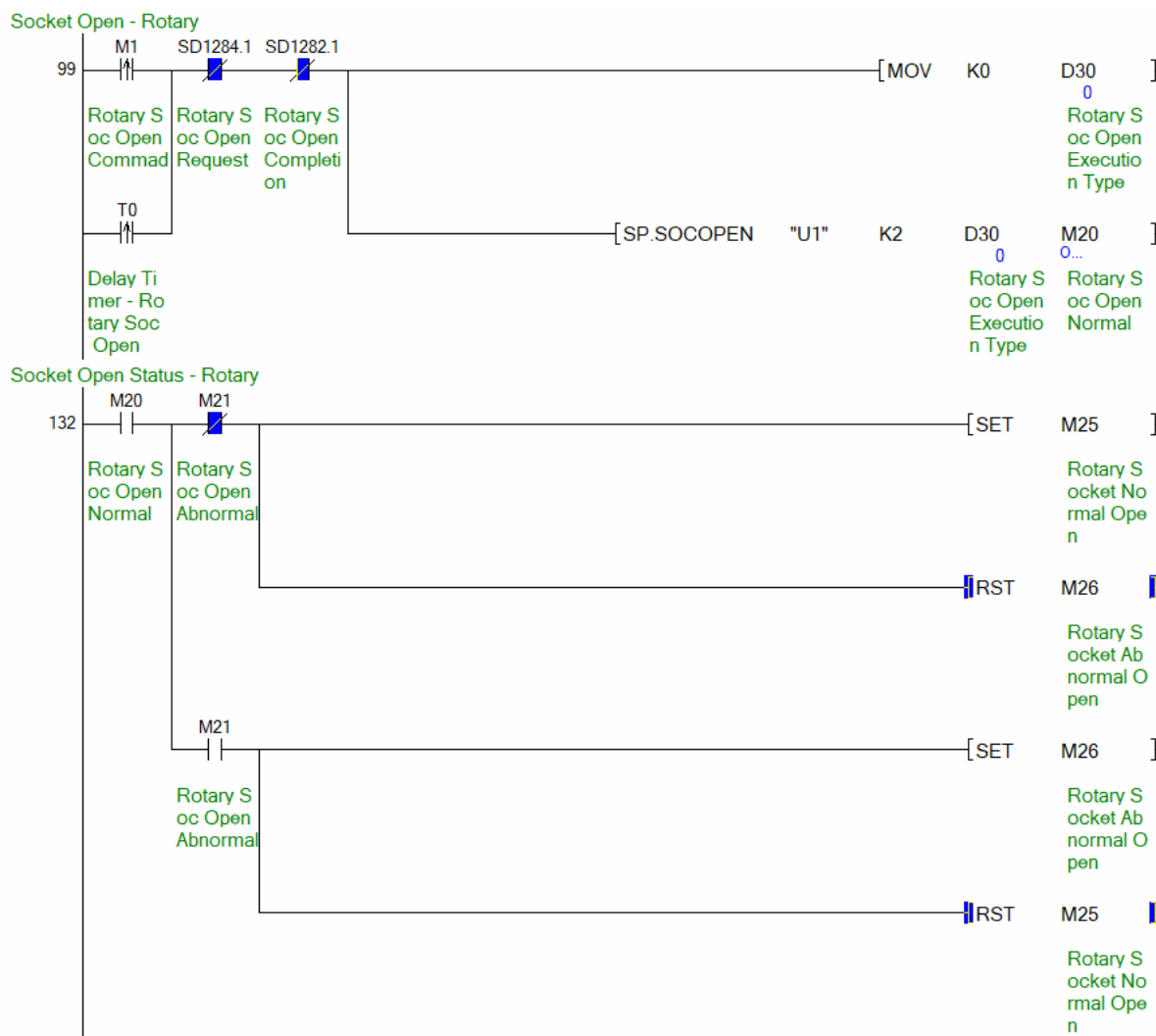
Step 1



1. Setting **Execution/Completion Type** for the **EHMD Gripper CMMT-ST** to **0** (Connection is opened according to the settings set in **Open Settings** of the **PLC Parameter**. [Refer Chapter 3.3](#)).
2. The instruction **SP.SOCOPEN** used to open the **Connection Number 1**.

- When **M0** is turned on, **Connection Number 1** is opened using the parameters set in **Open settings of PLC Parameter**. [Refer Chapter 3.3.](#)
- The **Gripper Socket Open Status** will monitor the **Normal** or **Abnormal** Socket Open Execution as shown.
- Once the **Gripper Socket Open** completed successfully, the delay timer will be activated to execute the **Rotary Socket Open** command.

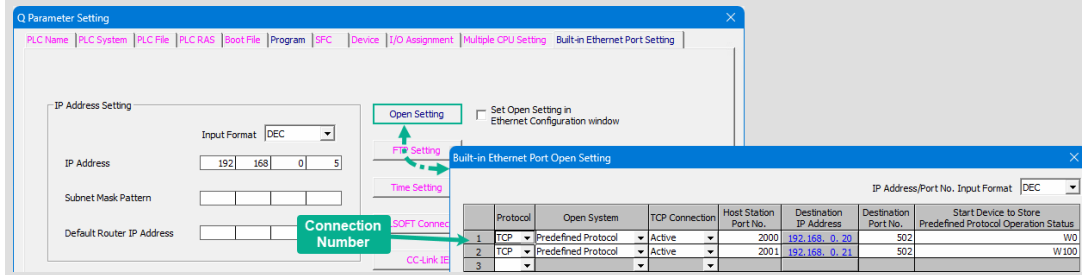
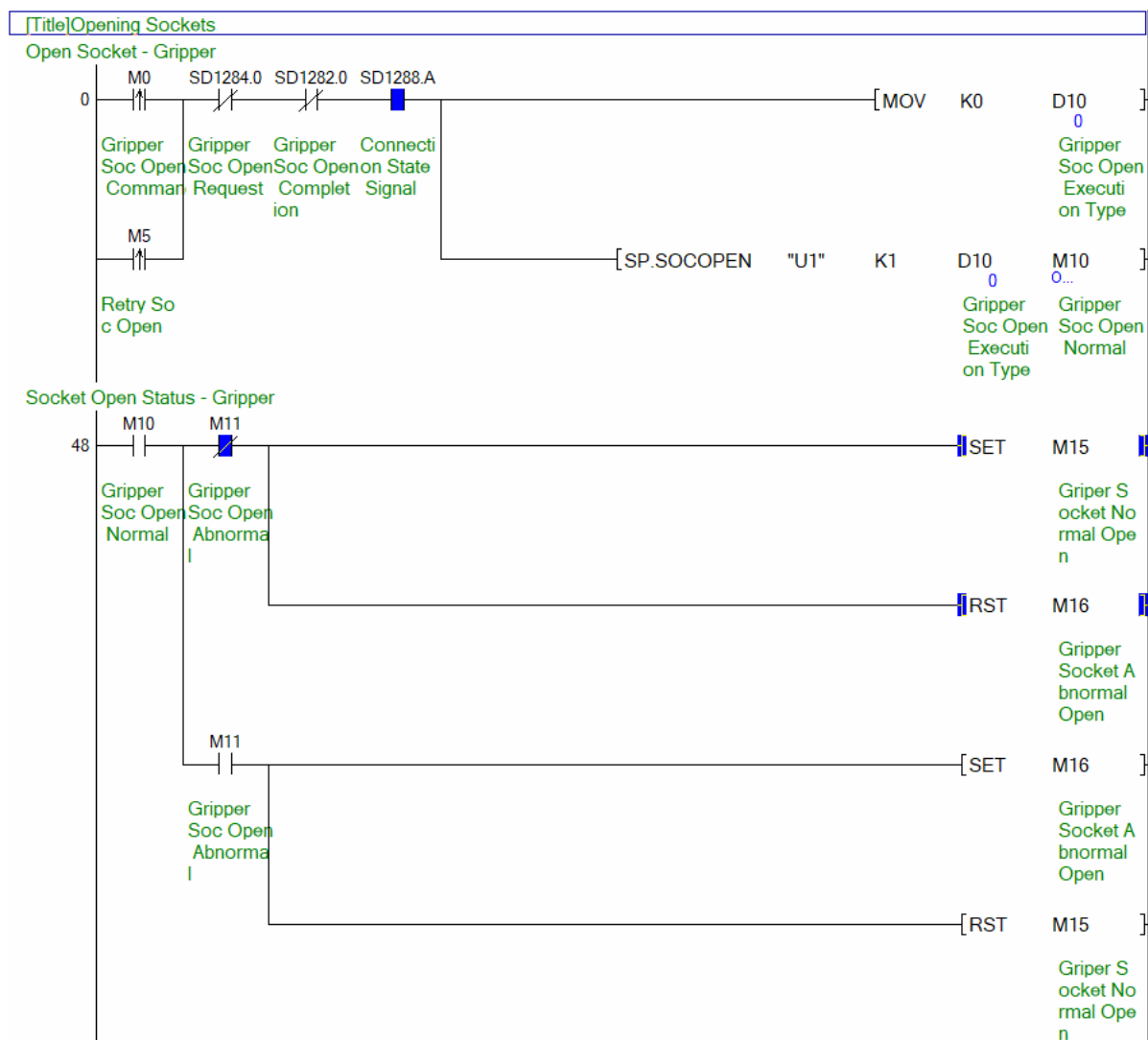
Step 2

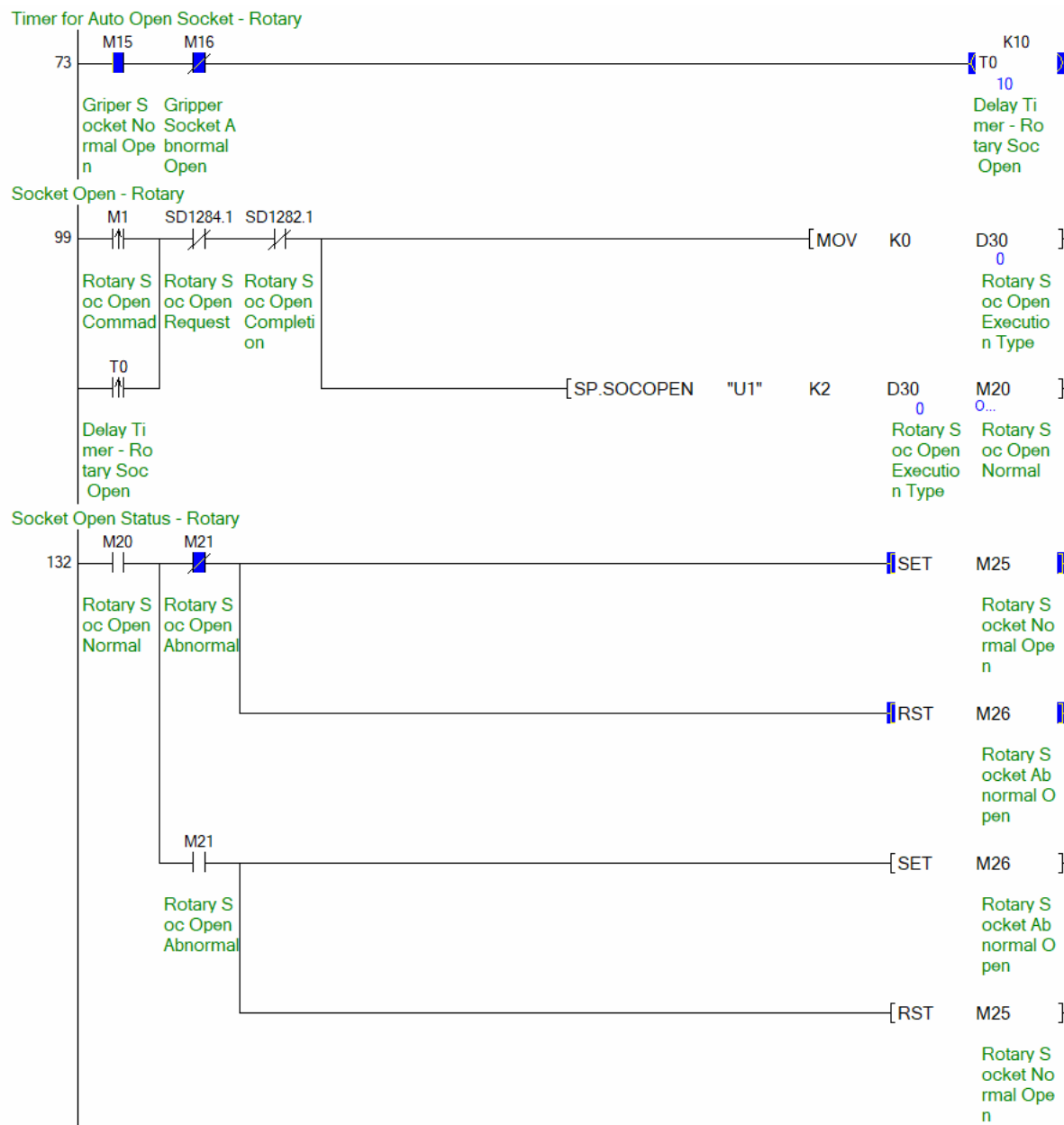


- Setting **Execution/Completion Type** for the **EHMD Gripper CMMT-ST** to **0** (Connection is opened according to the settings set in **Open Settings** of the **PLC Parameter**. [Refer Chapter 3.3.](#))
- The instruction **SP.SOCOPEN** used to open the **Connection Number 2**.
- When **M1** or **T0** is turned on, **Connection Number 2** is opened using the parameters set in **Open settings of PLC Parameter**. [Refer Chapter 3.3.](#)
- The **Rotary Socket Open Status** will monitor the **Normal** or **Abnormal** Socket Open Execution as shown.

**Note**

- The user has to take care of **Open Request Signal** (SD1284.0 & 1) and Open Completion Signal (SD1282.0 & 1), which varies depends on **Connection Number**. Example: For **Connection Number 3** it will be SD1284.2 and SD1282.2 respectively.
- Error in execution can be monitored in **D+1** Register (D11 & D31 in above examples).
- In **SP.SOCOPEN** instruction **K1** & **K2** is Connection Number, where the Connection Number or Module ID is associated with the built-in port setting number where the configuration is specified. [Refer Chapter 3.3](#).

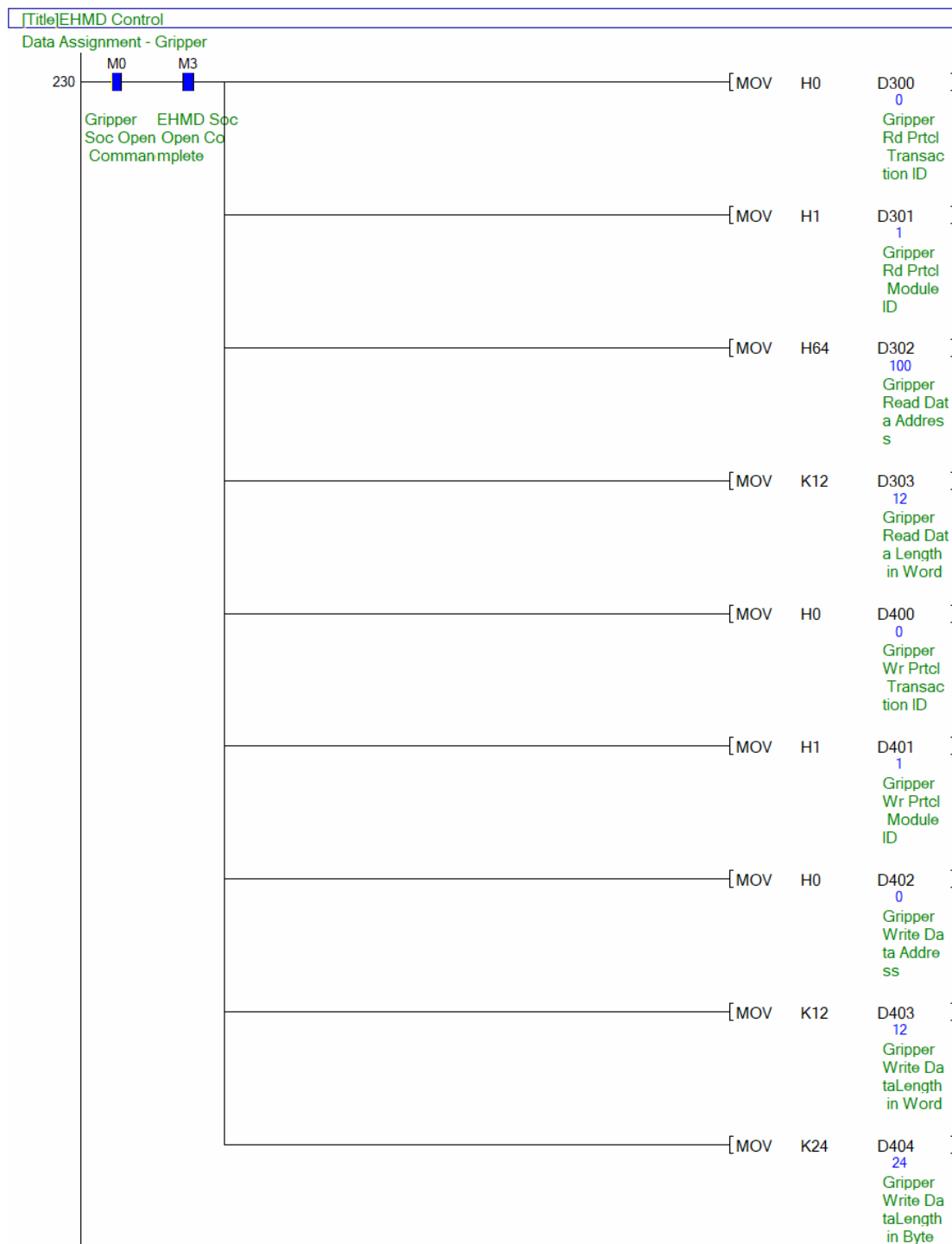
**Step 3**



The above image shows the successful **Socket Open Status** for the **EHMD Rotary Gripper Module CMMT-ST** drives.

5.1.2 ECPRTCL Operation – Gripper CMMT-ST

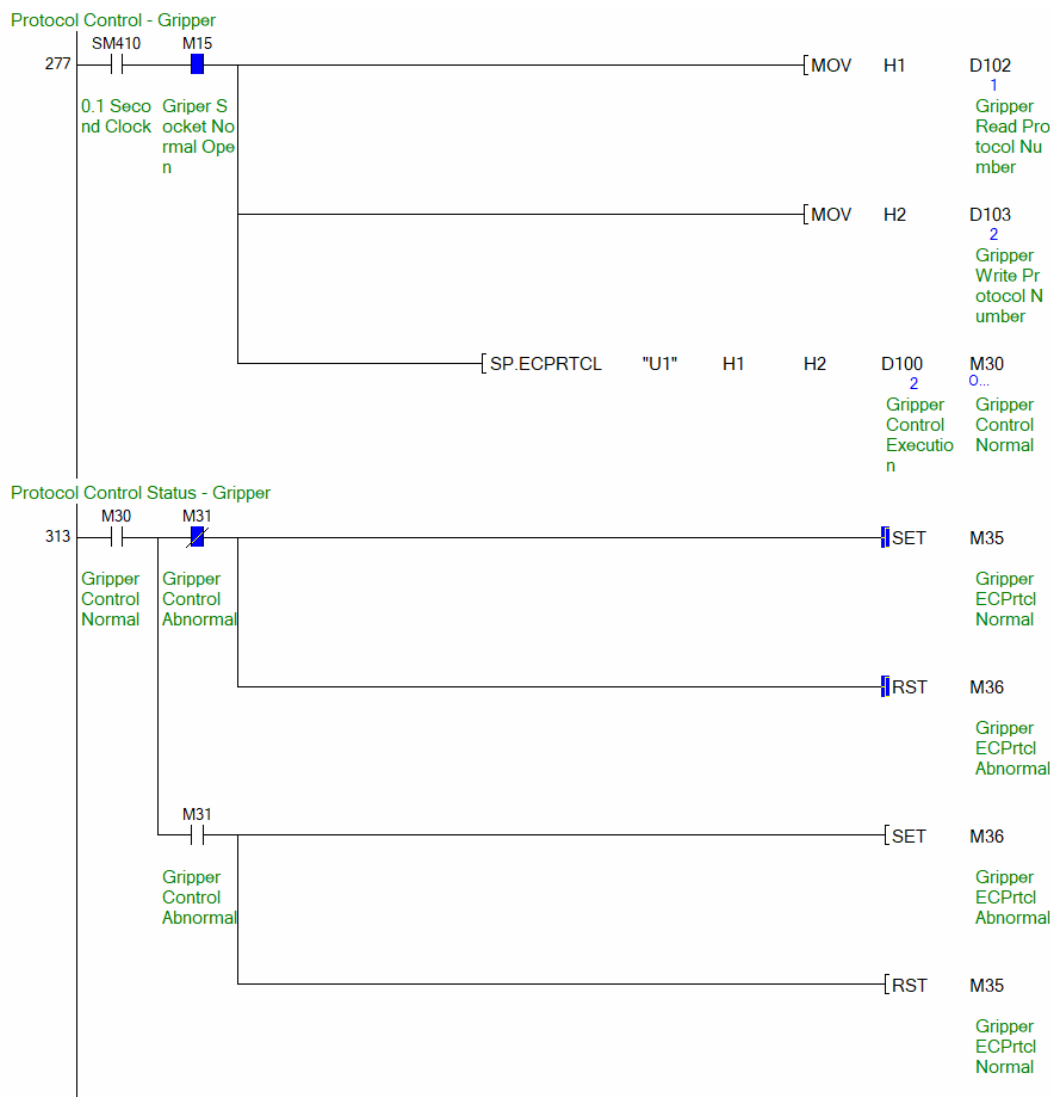
Step 1 – Data Assignment



1. Setting **Transaction ID** for the **EHMD Gripper CMMT-ST Read Status** protocol to **0**.
2. Setting **Module ID** or **Connection Number** for the **EHMD Gripper CMMT-ST Read Status** protocol to **1** which is associated with the **Built-in Port Setting** where configuration is specified. [Refer Chapter 3.2.](#)
3. Setting **Read Data Address** for the **EHMD Gripper CMMT-ST Read Status** protocol to **16#64** or **100**.
4. Setting **Read Data Length** in **WORD** for the **EHMD Gripper CMMT-ST Read Status** protocol to **12**.
5. Setting **Transaction ID** for the **EHMD Gripper CMMT-ST Write Control** protocol to **0**.

6. Setting **Module ID** or **Connection Number** for the **EHMD Gripper CMMT-ST Write Control** protocol to **1** which is associated with the **Built-in Port Setting** where configuration is specified. [Refer Chapter 3.2.](#)
7. Setting **Write Data Address** for the **EHMD Gripper CMMT-ST Write Control** protocol to **0**.
8. Setting **Write Data Length** in **WORD** for the **EHMD Gripper CMMT-ST Write Control** protocol to **12**.
9. Setting **Write Data Length** in **BYTE** for the **EHMD Gripper CMMT-ST Write Control** protocol to **24**.

Step 2 – Protocol Execution



1. Setting **EHMD Gripper CMMT-ST Read Status Protocol Number** to **D+2** Register (D102 in above example). [Refer Chapter 3.4 Step 12.](#)
2. Setting **EHMD Gripper CMMT-ST Write Control Protocol Number** to **D+3** Register (D103 in above example). [Refer Chapter 3.4 Step 12.](#)
3. The instruction **SP.ECPRTCL** used to executes the protocols registered in the flash ROM of the CPU using the predefined protocol function of GX Works2 for the **Connection Number 1**.
4. Setting the **Number of Consecutive Protocol Executions** using the instruction **SP.ECPRTCL** for the **Connection Number 1** to **2**.
5. When **SM410** is turned on, **Protocols 1 & 2** are executed for **Connection Number 1**.
6. The **Gripper Protocol Control Status** will monitor the **Normal** or **Abnormal** Protocol Execution as shown.

5.1.3 ECPRTCL Operation – Rotary CMMT-ST

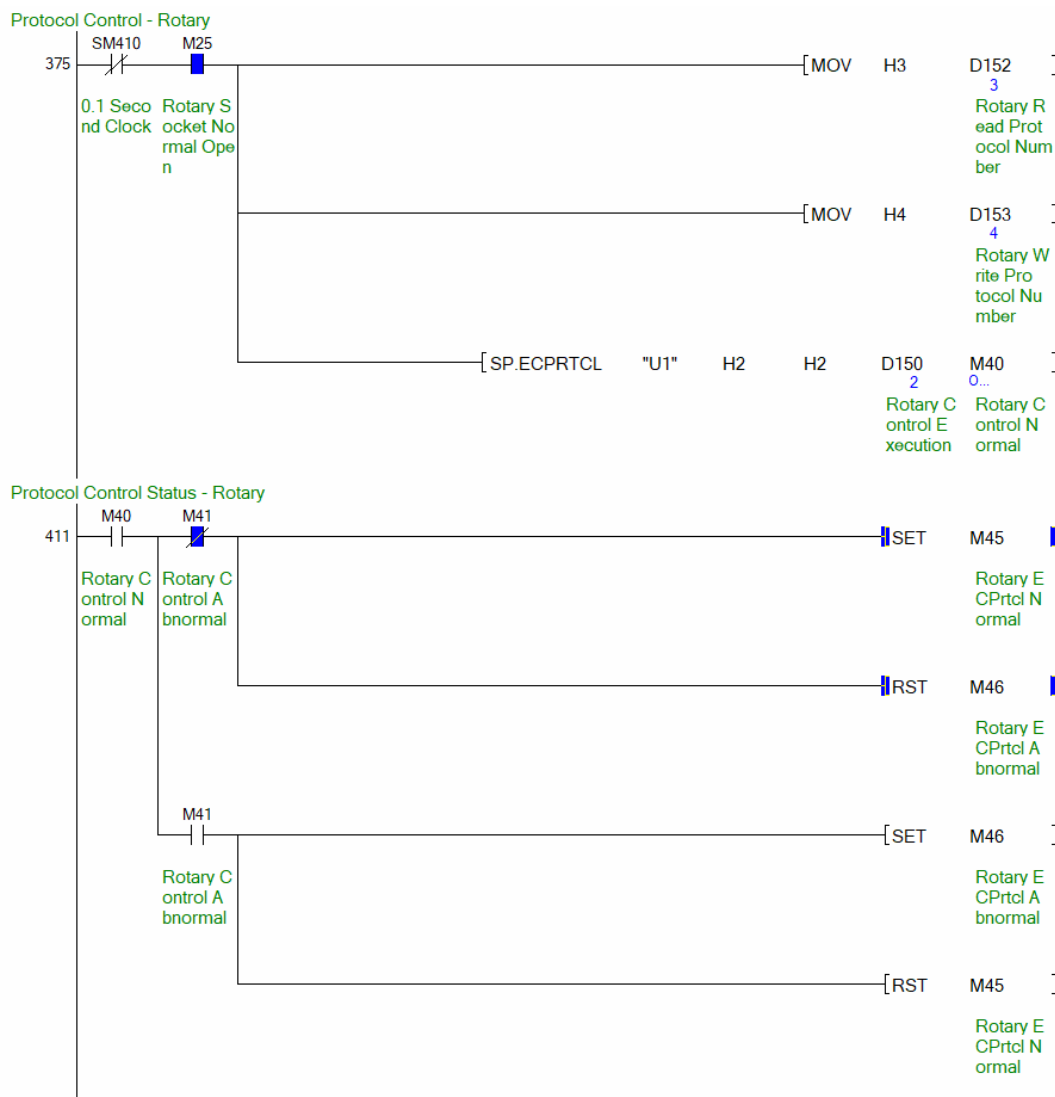
Step 1 – Data Assignment



1. Setting **Transaction ID** for the **EHMD Rotary CMMT-ST Read Status** protocol to **0**.
2. Setting **Module ID** or **Connection Number** for the **EHMD Rotary CMMT-ST Read Status** protocol to **2** which is associated with the **Built-in Port Setting** where configuration is specified. [Refer Chapter 3.2.](#)
3. Setting **Read Data Address** for the **EHMD Rotary CMMT-ST Read Status** protocol to **16#64** or **100**.
4. Setting **Read Data Length** in **WORD** for the **EHMD Rotary CMMT-ST Read Status** protocol to **12**.
5. Setting **Transaction ID** for the **EHMD Rotary CMMT-ST Write Control** protocol to **0**.

6. Setting **Module ID** or **Connection Number** for the **EHMD Rotary CMMT-ST Write Control** protocol to **2** which is associated with the **Built-in Port Setting** where configuration is specified. [Refer Chapter 3.2.](#)
7. Setting **Write Data Address** for the **EHMD Rotary CMMT-ST Write Control** protocol to **0**.
8. Setting **Write Data Length** in **WORD** for the **EHMD Rotary CMMT-ST Write Control** protocol to **12**.
9. Setting **Write Data Length** in **BYTE** for the **EHMD Rotary CMMT-ST Write Control** protocol to **24**.

Step 2 – Protocol Execution



1. Setting **EHMD Rotary CMMT-ST Read Status Protocol Number** to **D+2** Register (D152 in above example). [Refer Chapter 3.4 Step 12.](#)
2. Setting **EHMD Rotary CMMT-ST Write Control Protocol Number** to **D+3** Register (D153 in above example). [Refer Chapter 3.4 Step 12.](#)
3. The instruction **SP.ECPRTCL** used to executes the protocols registered in the flash ROM of the CPU using the predefined protocol function of GX Works2 for the **Connection Number 2**.
4. Setting the **Number of Consecutive Protocol Executions** using the instruction **SP.ECPRTCL** for the **Connection Number 2** to **2**.
5. When **SM410** is turned on, **Protocols 3 & 4** are executed for **Connection Number 2**.
6. The **Rotary Protocol Control Status** will monitor the **Normal** or **Abnormal** Protocol Execution as shown.

**Note**

- Data Registers **D300, D400, D500 and D600 Series** are used based on **Predefined Protocol Setting**. [Refer Chapter 3.4.](#)
- Protocol Number

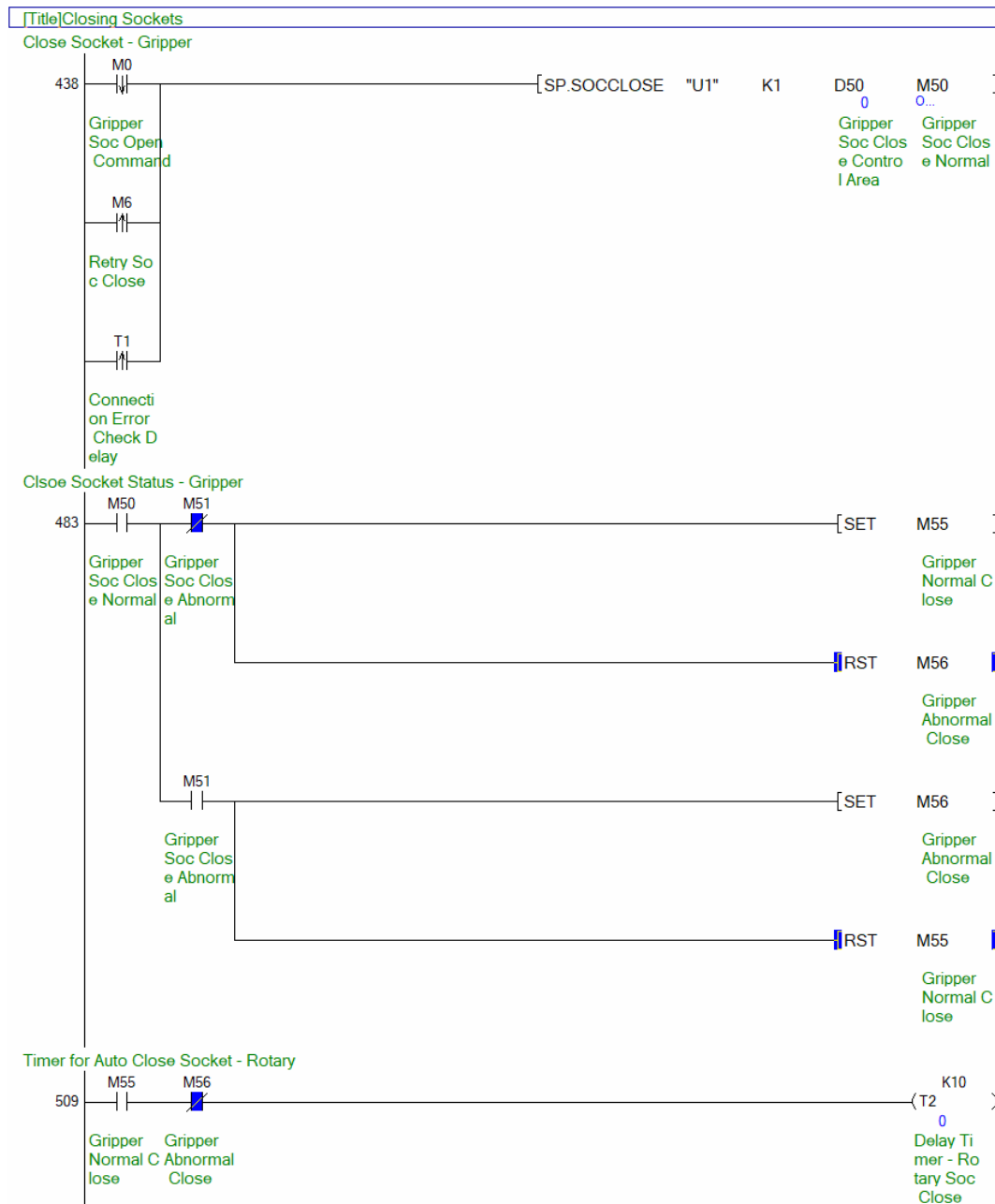
MELSOFT Series <Predefined Protocol Support Function-Built-in Ethernet> - [Protocol Setting - Sample Code for EHMD Control.tpc]

Protocol No.	Manufacturer	Model	Protocol Name	Communication Type	-> Send -< Receive	Packet Name	Packet Setting
1	General-purpose	MODBUS/TCP	03: RD Holding Registers	Send&Receive	->	Request	Variable Set
					<-(1)	Normal response	Variable Set
					<-(2)	Error response	Variable Set
2	General-purpose	MODBUS/TCP	16: WR Multi Registers	Send&Receive	->	Request	Variable Set
					<-(1)	Normal response	Variable Set
					<-(2)	Error response	Variable Set
3	General-purpose	MODBUS/TCP	03: RD Holding Registers	Send&Receive	->	Request	Variable Set
					<-(1)	Normal response	Variable Set
					<-(2)	Error response	Variable Set
4	General-purpose	MODBUS/TCP	16: WR Multi Registers	Send&Receive	->	Request	Variable Set
					<-(1)	Normal response	Variable Set
					<-(2)	Error response	Variable Set
Add							

- Error in execution can be monitored in **D+1** Register (D101 and D151 in above examples).
- While multiple instances of **SP.ECPRTCL** can exist in the program, they typically **operate in a sequential**, so it is **best to manage** the device queries **sequentially** by **alternating the trigger signal** to ensure data from one device is **fully received** before **requesting another**.

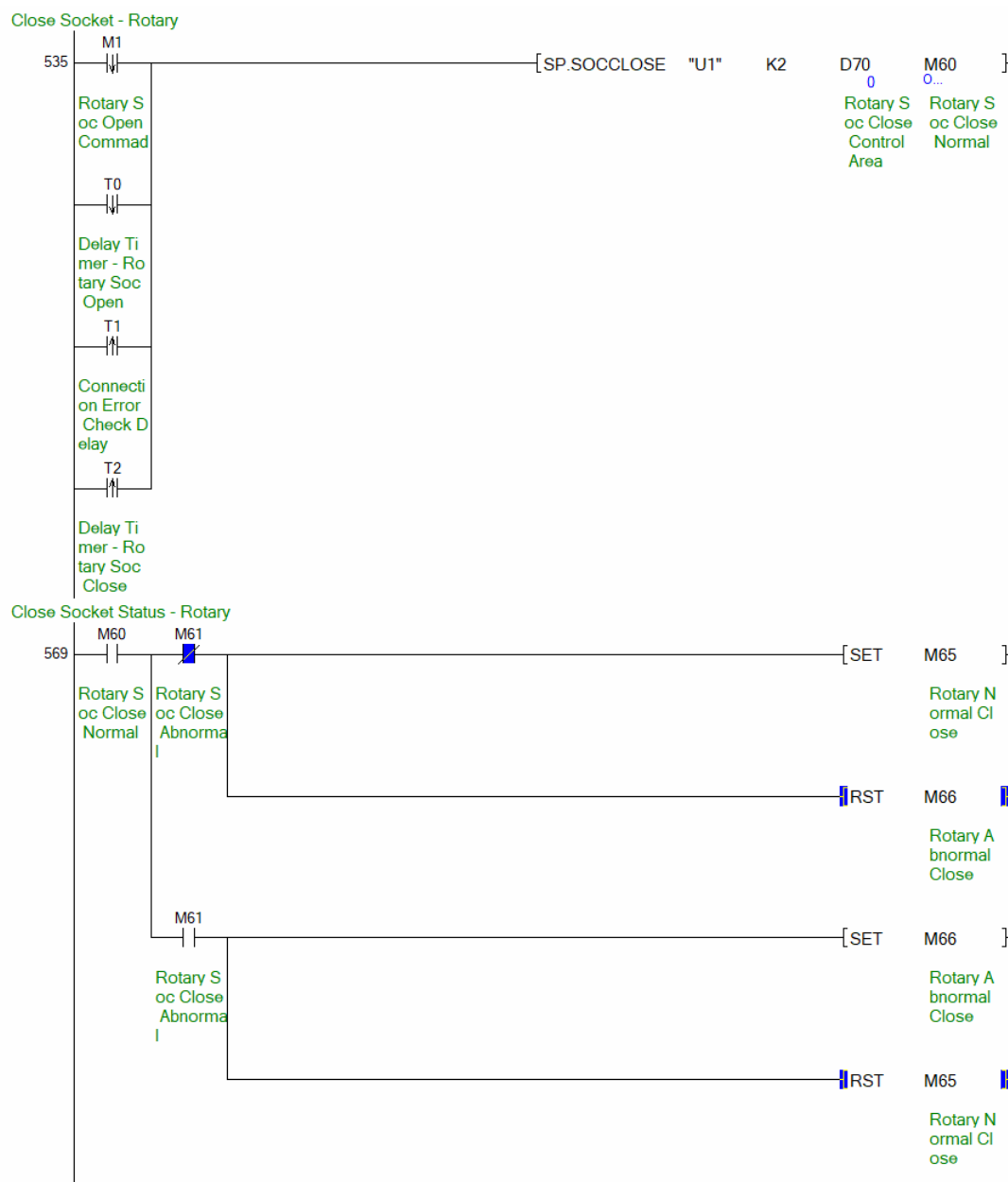
5.1.4 Socket Close Operation

Step 1



1. The instruction **SP.SOCCLOSE** used to close the **Connection Number 1**.
2. When **M0** is turned off or when the connected device disconnects connection number 1, **Connection Number 1** is disconnected by the above program.
3. The **Gripper Socket Close Status** will monitor the **Normal** or **Abnormal** Socket Close Execution as shown.
4. Once the **Gripper Socket Close** completed successfully, the delay timer will be activated to execute the **Rotary Socket Close** command.

Step 2

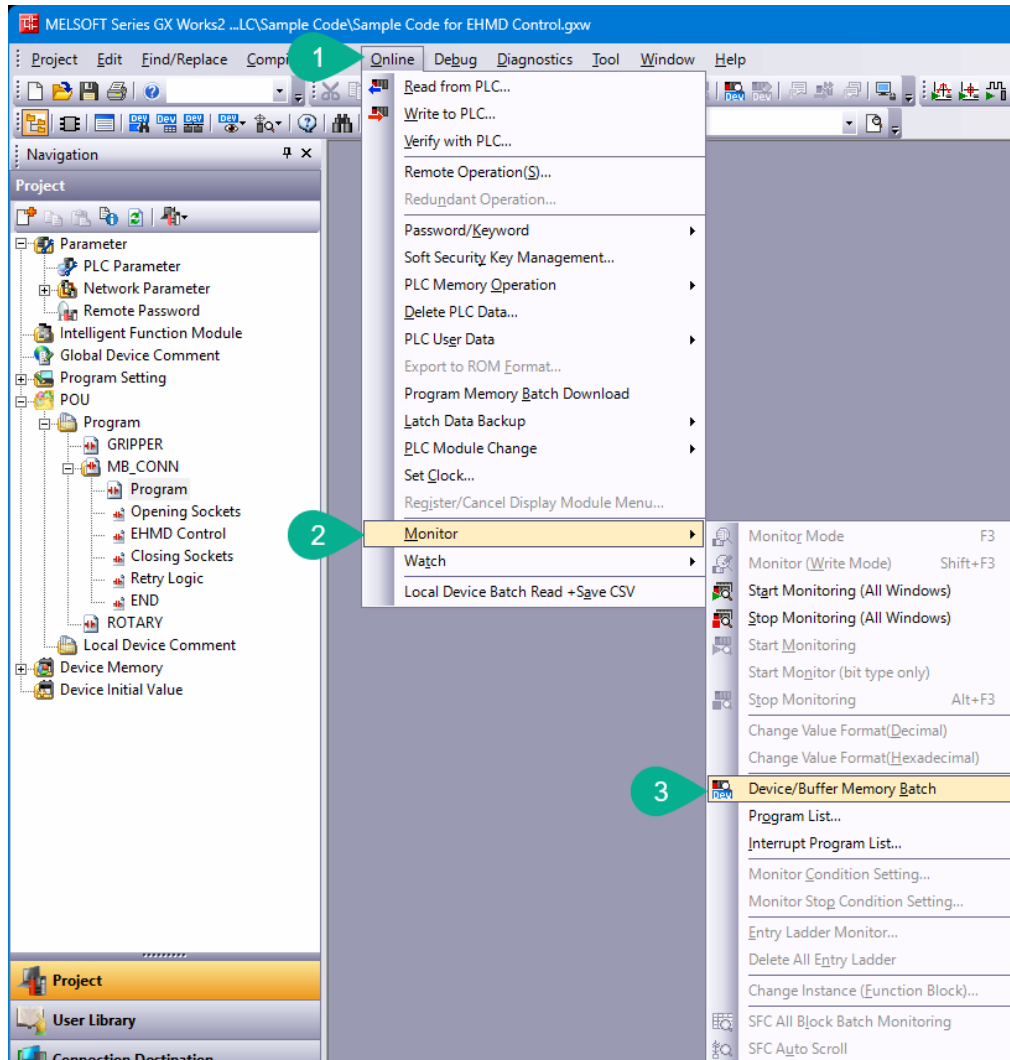


1. The instruction **SP.SOCCLOSE** used to close the **Connection Number 2**.
2. When **M1** or **T0** is turned off or when **T2** is turned on or when the connected device disconnects connection number 2, **Connection Number 2** is disconnected by the above program.
3. The **Rotary Socket Close Status** will monitor the **Normal** or **Abnormal** Socket Close Execution as shown.

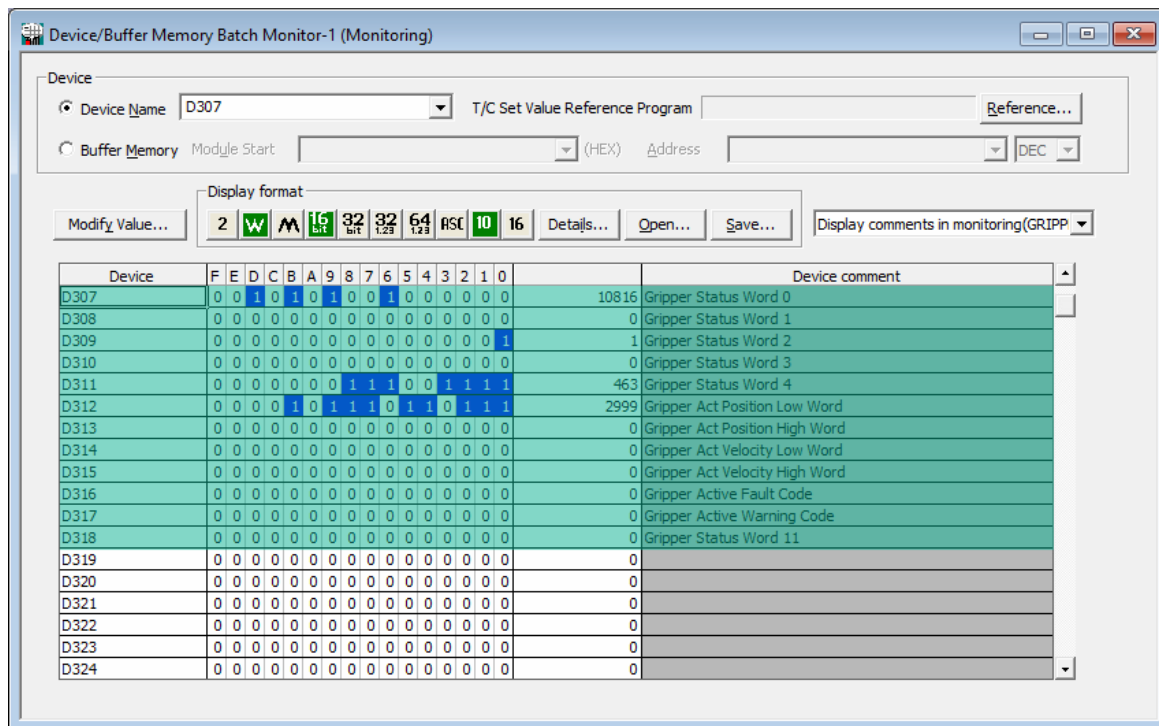
5.2 EHMD Module Status Word

5.2.1 EHMD Gripper Module Status Word

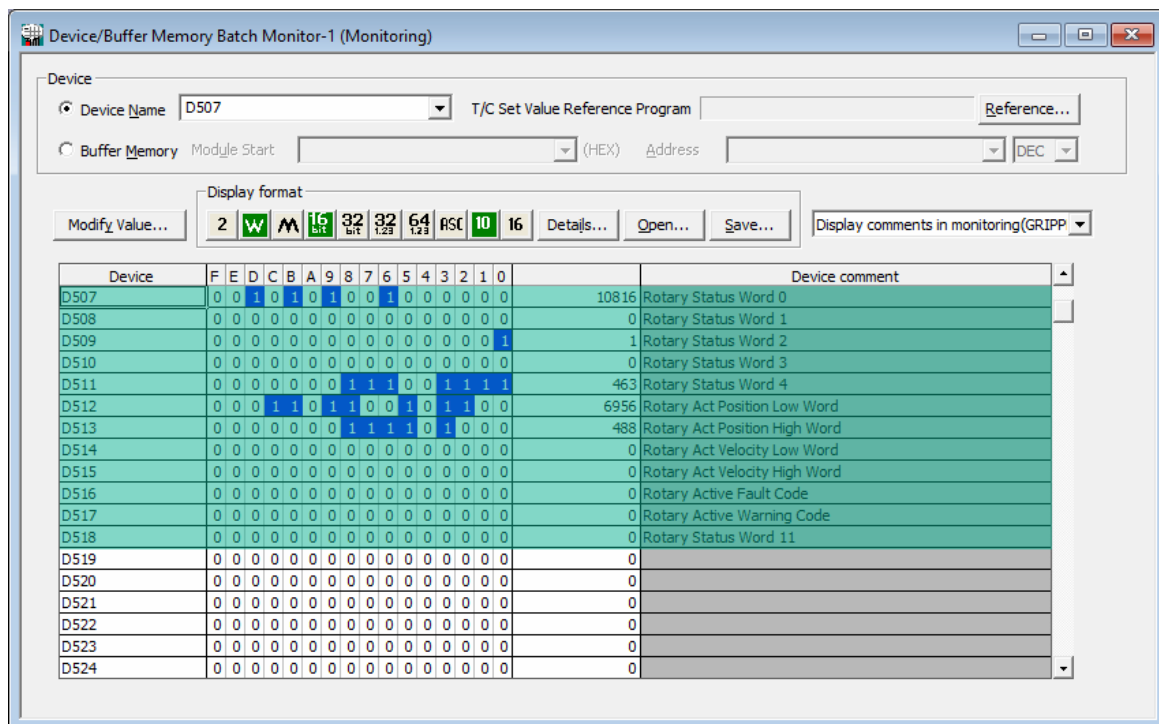
Step 1



1. Click on **Online** option from toolbar.
2. Click on **Monitor** option.
3. Click on **Device/Buffer Memory Batch** option to start the monitoring the status word of EHMD Gripper CMMT-ST drive.

Step 2

Check if the feedback signal of the EHMD Gripper CMMT-ST drive is properly received at input address D307 ([Refer Chapter 3.4](#)).

5.2.2 EHMD Rotary Module Status Word

Check if the feedback signal of the EHMD Rotary CMMT-ST drive is properly received at input address D507 ([Refer Chapter 3.4](#)).

5.3 EHMD Module Control Word

5.3.1 EHMD Gripper Module Control Word

Device/Buffer Memory Batch Monitor-1 (Monitoring)

Device: Device Name: D405 T/C Set Value Reference Program: Reference...

Buffer Memory: Module Start: (HEX) Address: DEC

Display format: Modify Value... 2 W M 16 32 32 64 RSC 10 16 Details... Open... Save... Display comments in monitoring(GRIPP)

Device	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0		Device comment
D405	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Gripper Control Word 0
D406	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-32768	Gripper Control Word 1
D407	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Gripper Control Word 2
D408	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Gripper Control Word 3
D409	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Gripper Velocity Override
D410	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Gripper Set Position Low Word
D411	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Gripper Set Position High Word
D412	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Gripper Set Velocity Low Word
D413	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Gripper Set Velocity High Word
D414	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Gripper MDI Acceleration
D415	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Gripper MDI Deceleration
D416	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Gripper Control Word 11
D417	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
D418	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	
D419	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
D420	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	12	
D421	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
D422	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

Check if the control signal of the EHMD Gripper CMMT-ST drive is properly send at input address D405 ([Refer Chapter 3.4](#)).

5.3.2 EHMD Rotary Module Status Word

Device/Buffer Memory Batch Monitor-1 (Monitoring)

Device: Device Name: D605 T/C Set Value Reference Program: Reference...

Buffer Memory: Module Start: (HEX) Address: DEC

Display format: Modify Value... 2 W M 16 32 32 64 RSC 10 16 Details... Open... Save... Display comments in monitoring(GRIPP)

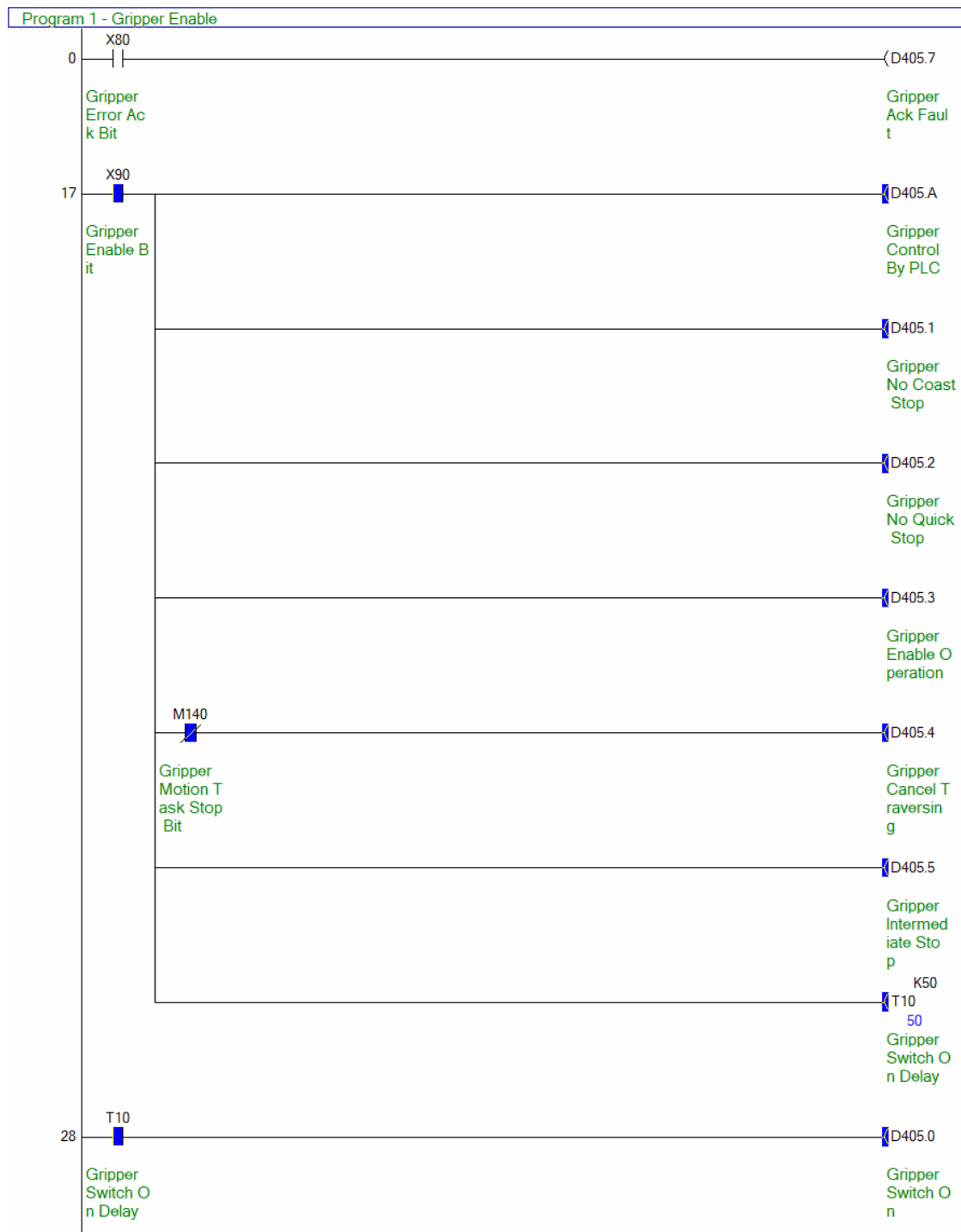
Device	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0		Device comment
D605	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Rotary Control Word 0
D606	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-32768	Rotary Control Word 1
D607	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Rotary Control Word 2
D608	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Rotary Control Word 3
D609	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Rotary Velocity Override
D610	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Rotary Set Position Low Word
D611	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Rotary Set Position High Word
D612	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Rotary Set Velocity Low Word
D613	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Rotary Set Velocity High Word
D614	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Rotary MDI Acceleration
D615	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Rotary MDI Deceleration
D616	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Rotary Control Word 11
D617	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
D618	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	
D619	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
D620	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	12	
D621	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
D622	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

Check if the control signal of the EHMD Rotary CMMT-ST drive is properly send at input address D605 ([Refer Chapter 3.4](#)).

The following chapters will explain the procedure to bitwise control of the EHMD Rotary Gripper Module through Process Data one by one.

5.4 Sample Code for EHMD Gripper Drive Control

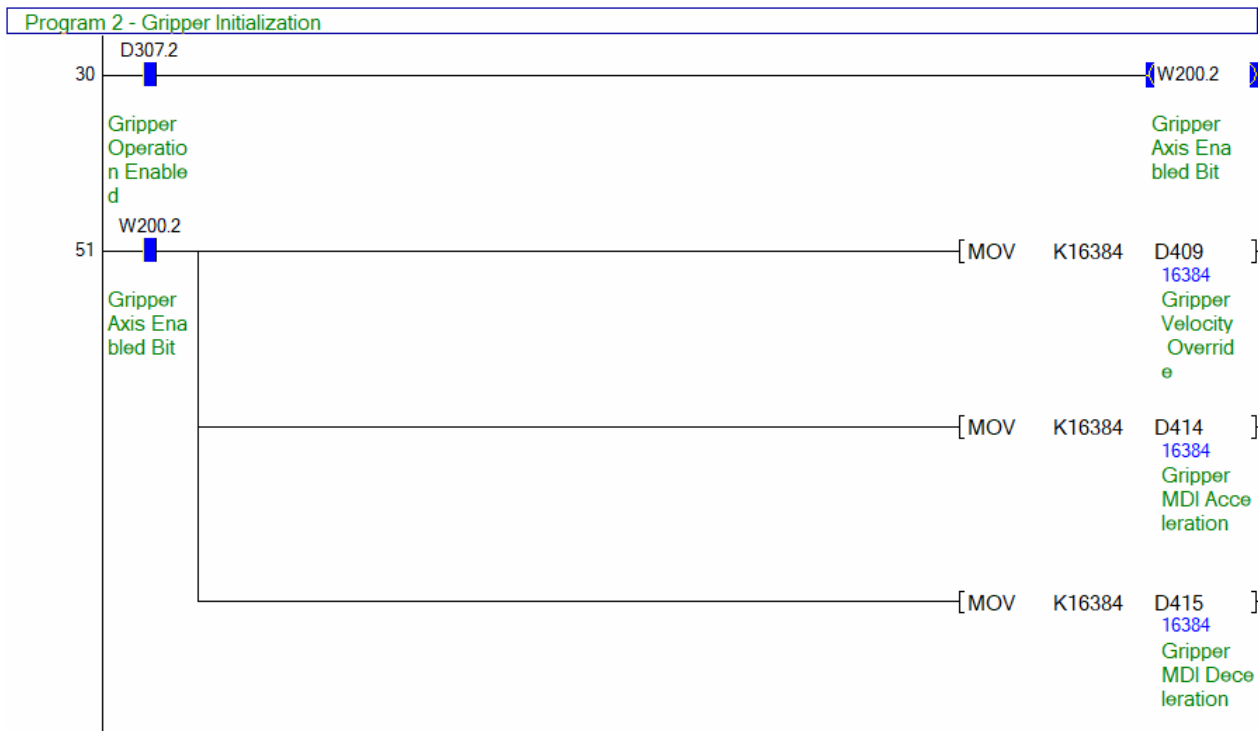
5.4.1 EHMD Gripper Axis Enable



1. Alarm Reset : D405.7 (1 : Active, 0 : Inactive).

2. Acquire control authority through PLC : D405.A.
3. Change Coast Stop : D405.1 to **1** (No coasting).
4. Change Fast Stop : D405.2 to **1** (No fast stop).
5. Change Enable Operation : D405.3 to **1** (Enabled).
6. Change Reject Positioning Task : D405.4 to **1** (Inactive).
7. Change Intermediate Stop D405.5 to **1** (Inactive).
8. If all conditions above are met, change Output Stage Enable : D405.0 to **1** (Gripper Axis On).

5.4.2 Gripper Axis Initialization



Initial Parameter Settings :-

After performing output stage enabling and completing the enabling operation, the D307.2 (Operation Enabled) signal is activated.

1. Override (Position, Velocity) : D409 = **16384 (4000H)**: Override at 100%
2. MDI ACC : D414 = **16384 (4000H)**: FAS setting at 100%
3. MDI DEC : D415 = **16384 (4000H)**: FAS setting at 100%.



Note

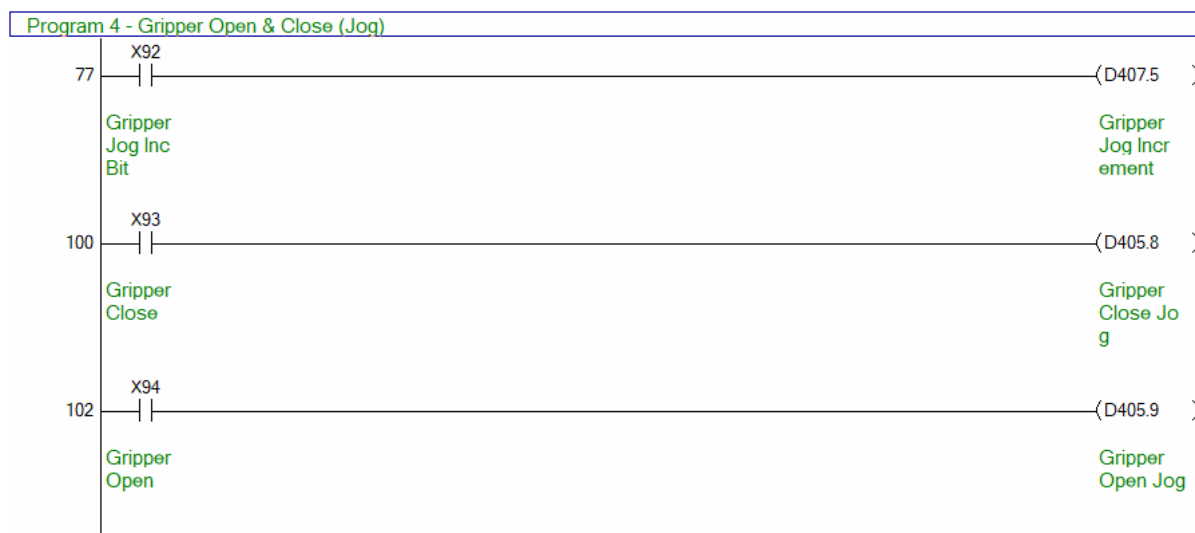
- For this sample code, the parameters above are **fixed at 100%**. To make the value **adjustable**, replace the **K16384** constant with the desired **Register Address**.

5.4.3 Gripper Axis Homing



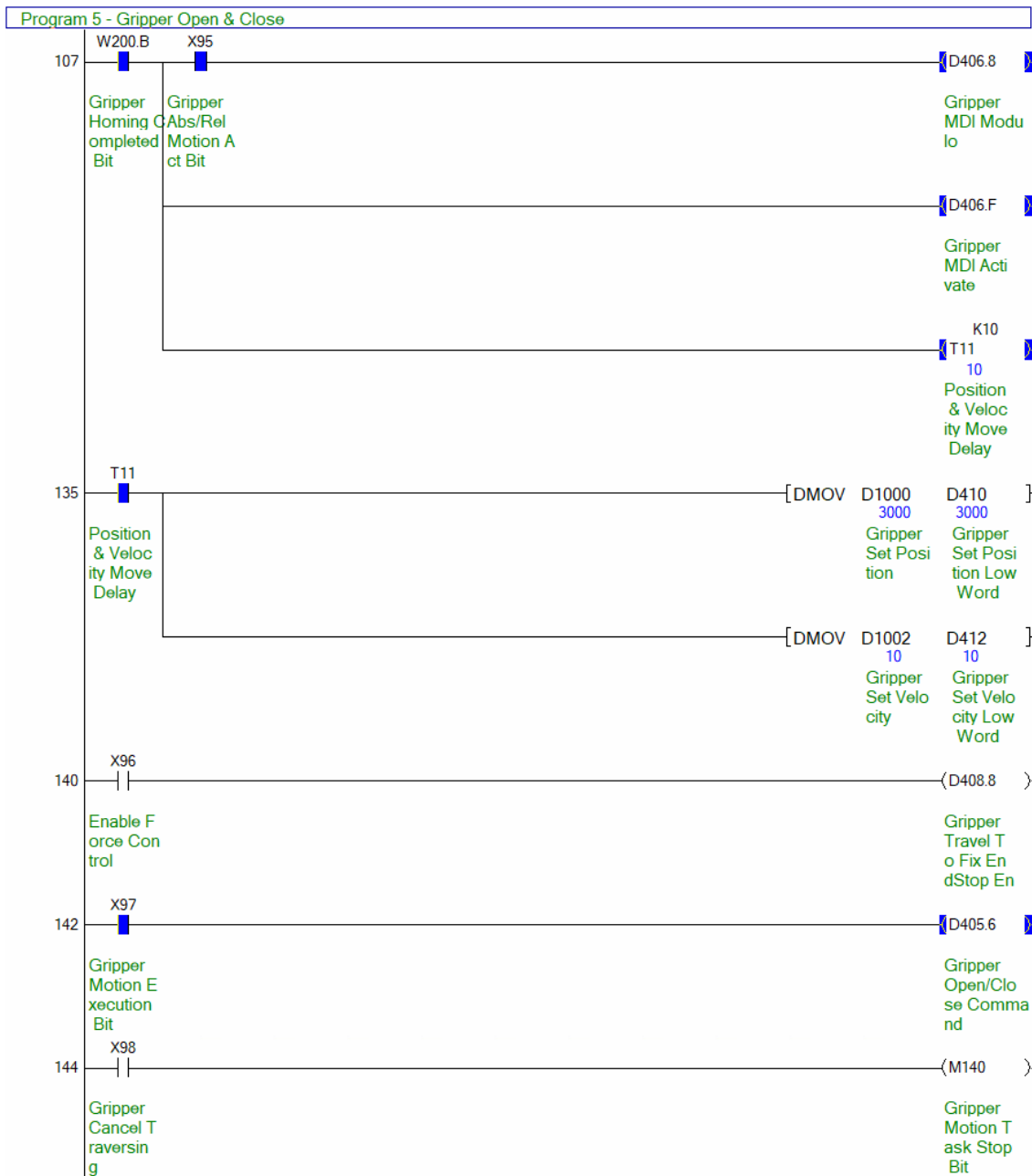
1. Start Homing (FAS Configuration) : D405.B (1 : Active, 0 : Inactive).
2. After performing homing and completing the origin operation, the D307.B (Homing Point Set) signal is activated.

5.4.4 Gripper Axis Jog Movement



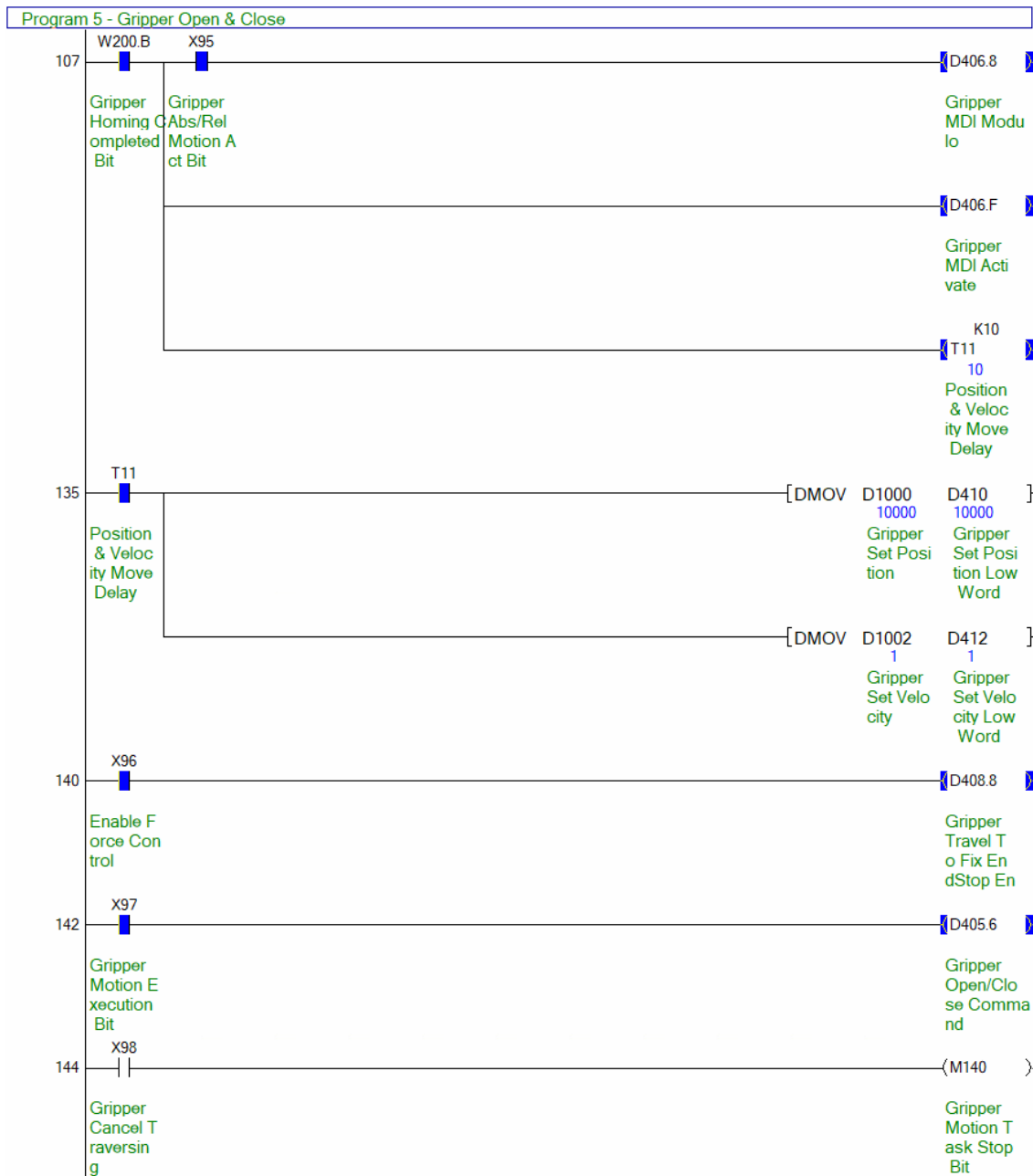
1. Inching/Incremental Jog : D407.5 (1 : Active, 0 : Inactive).
 - The incremental distance of positive & negative direction will be based on values set in parameters Relative Position Jog1 (P1.214530.0.0) & Relative Position Jog2 (P1.214538.0.0) respectively.
2. Jog Positive (Close) Direction : D405.8 (1 : Active, 0 : Inactive).
3. Jog Negative (Open) Direction : D405.9 (1 : Active, 0 : Inactive).

5.4.5 Gripper Axis Open-Close with Absolute or Relative Control



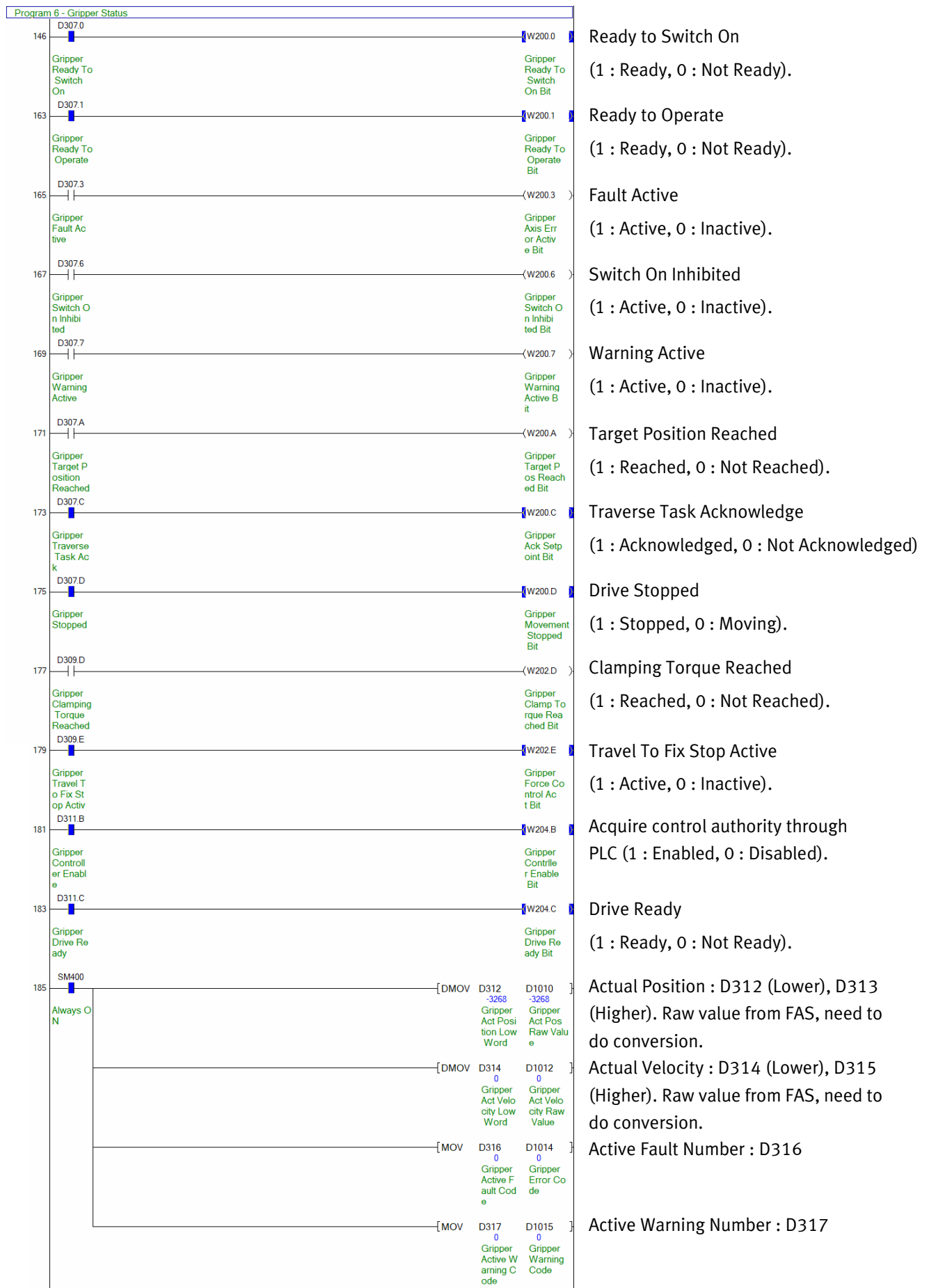
1. Set Positioning Method to **1** (Absolute Mode). Positioning Method : D406.8 (1 : Absolute, 0 : Relative).
2. Set MDI Selection to **1** (Activate MDI Mode). MDI Selection : D406.F (1 : Activate, 0 : Deactivate).
3. Position Control Parameter Settings
 - MDI Target Position : D410 (Lower), D411 (Higher).
 - MDI Velocity : D412 (Lower), D413 (Higher).
4. Activate Positioning task : D405.6 (0 -> 1 Rising Edge).

5.4.6 Gripper Axis Open-Close with Force Control



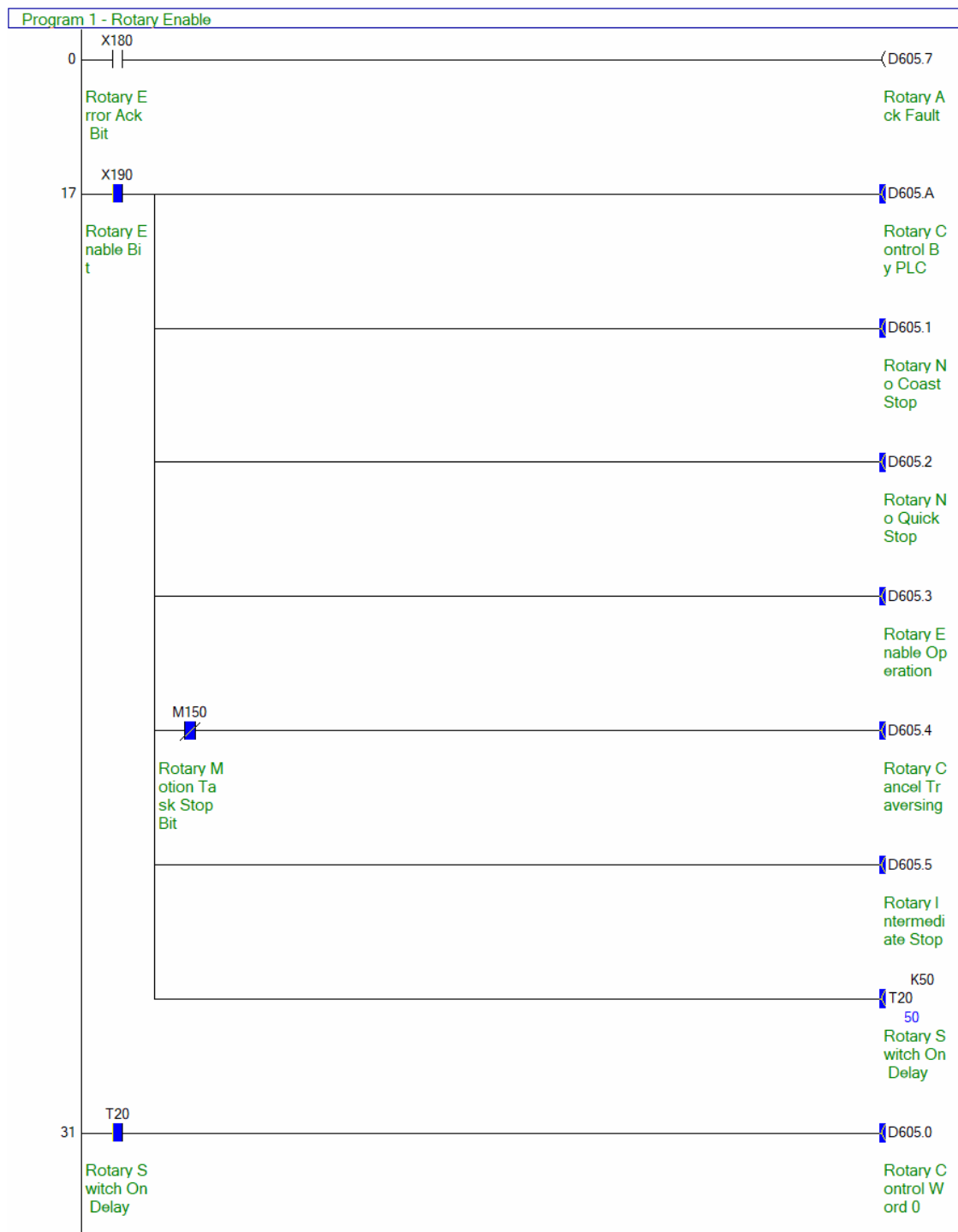
- Set Travel to Fix End Stop to **1** (Force Control). Travel to Fix End Stop : D408.8 (1 : Activate, 0 : Deactivate).
 - The clamping torque will be based on value set in parameters Clamping Torque (P1.526801.0.0).
- Set MDI Selection to **1** (Activate MDI Mode). MDI Selection : D406.F (1 : Activate, 0 : Deactivate).
- Position Control Parameter Settings
 - MDI Target Position : D410 (Lower), D411 (Higher).
 - MDI Velocity : D412 (Lower), D413 (Higher).
- Activate Positioning task : D405.6 (0 -> 1 Rising Edge).

5.4.7 Gripper Axis Status Word



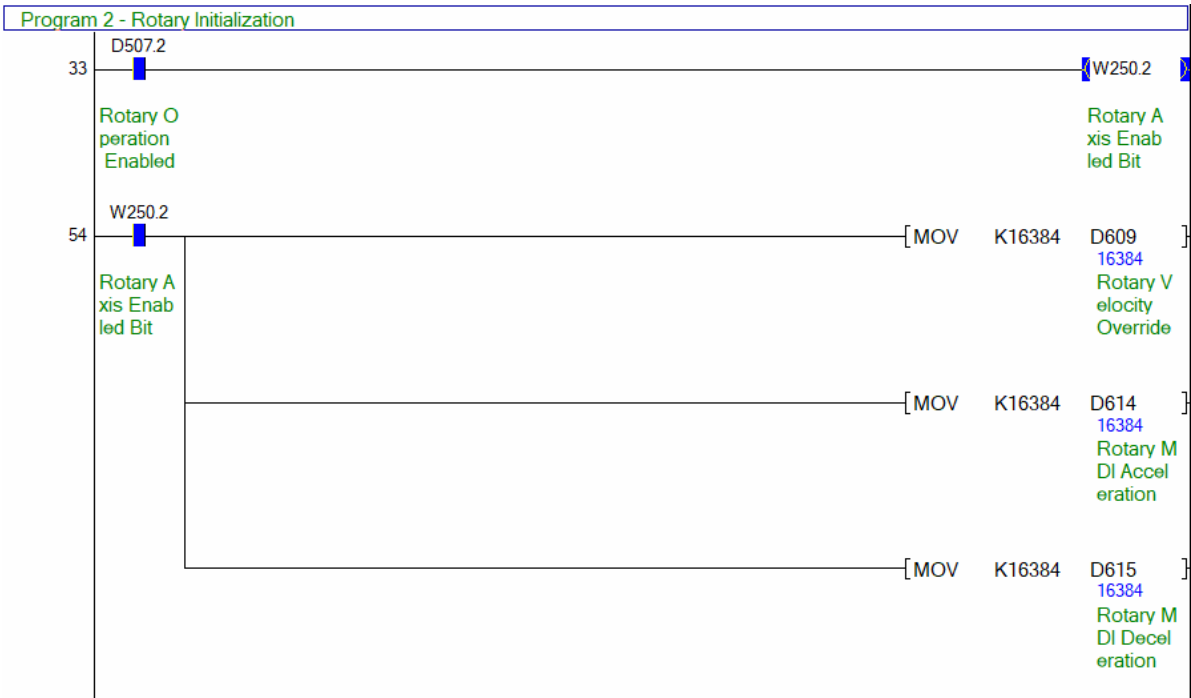
5.5 Sample Code for EHMD Rotary Drive Control

5.5.1 EHMD Rotary Axis Enable



1. Alarm Reset : D605.7 (1 : Active, 0 : Inactive).
2. Acquire control authority through PLC : D605.A.
3. Change Coast Stop : D605.1 to **1** (No coasting).
4. Change Fast Stop : D605.2 to **1** (No fast stop).
5. Change Enable Operation : D605.3 to **1** (Enabled).
6. Change Reject Positioning Task : D605.4 to **1** (Inactive).
7. Change Intermediate Stop : D605.5 to **1** (Inactive).
8. If all conditions above are met, change Output Stage Enable : D605.0 to **1** (Rotary Axis On).

5.5.2 Rotary Axis Initialization



Initial Parameter Settings :-

After performing output stage enabling and completing the enabling operation, the D507.2 (Operation Enabled) signal is activated.

- | | | |
|----------------------------------|---|--|
| 1. Override (Position, Velocity) | : | D609 = 16384 (4000H) : Override at 100% |
| 2. MDI ACC | : | D614 = 16384 (4000H) : FAS setting at 100% |
| 3. MDI DEC | : | D615 = 16384 (4000H) : FAS setting at 100%. |



Note

- For this sample code, the parameters above are **fixed at 100%**. To make the value **adjustable**, replace the **K16384** constant with the desired **Register Address**.

5.5.3 Rotary Axis Homing



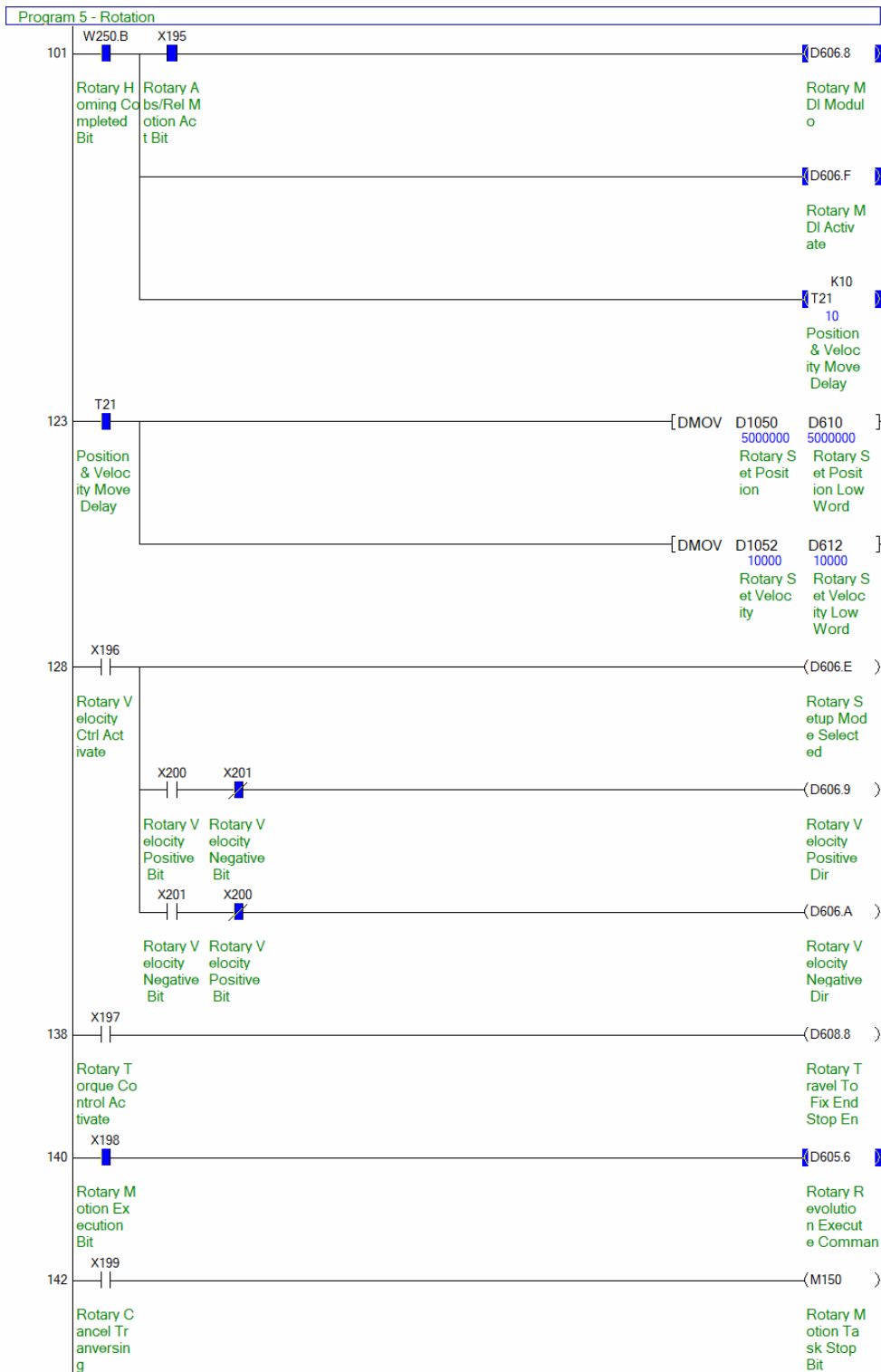
- Start Homing (FAS Configuration) : D605.B (1 : Active, 0 : Inactive).
- After performing homing and completing the origin operation, the D507.B (Homing Point Set) signal is activated.

5.5.4 Rotary Axis Jog Movement



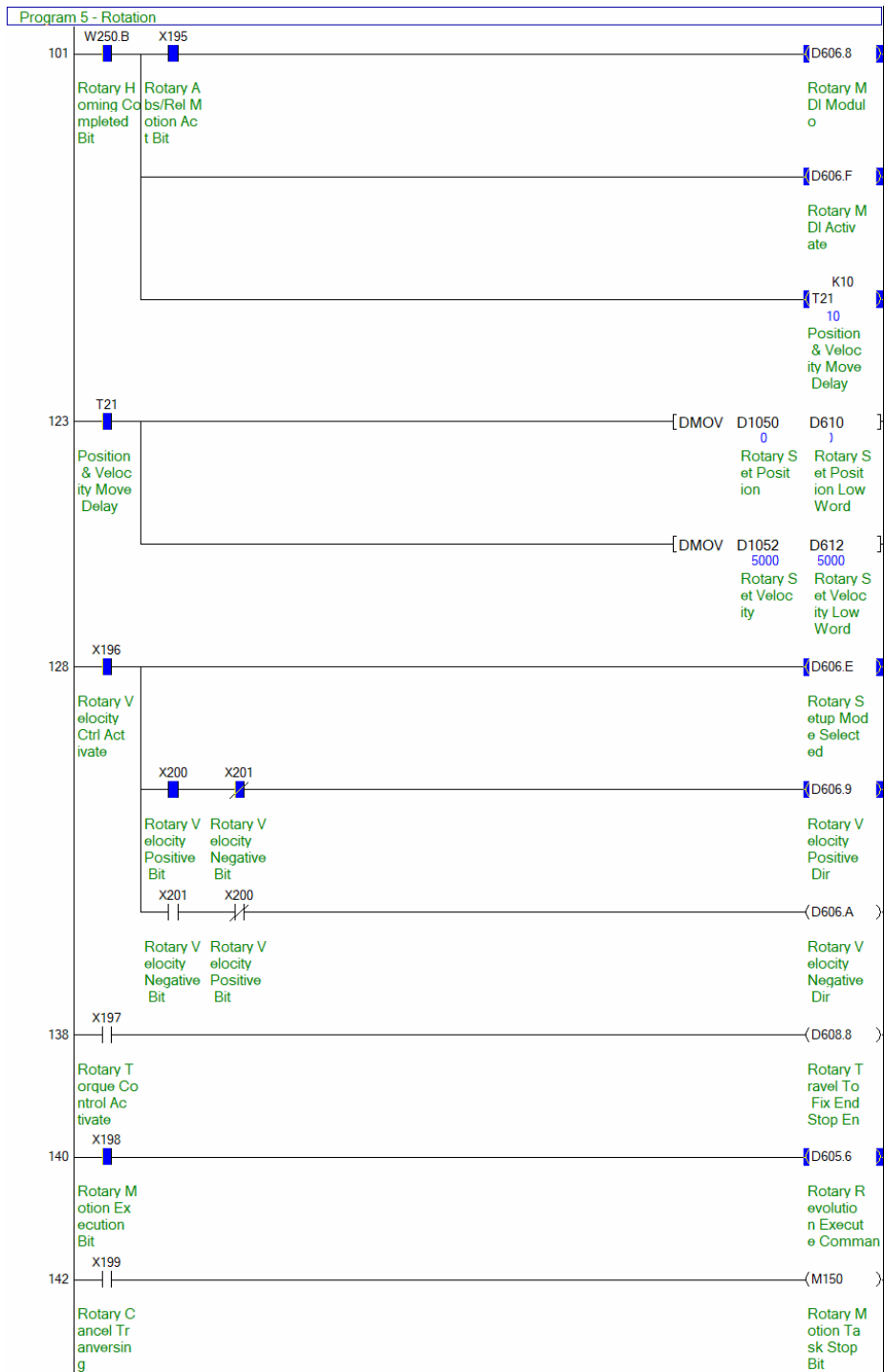
1. Inching/Incremental Jog : D607.5 (1 : Active, 0 : Inactive).
 - The incremental distance of positive & negative direction will be based on values set in parameters Relative Position Jog1 (P1.214530.0.0) & Relative Position Jog2 (P1.214538.0.0) respectively.
2. Jog Positive (Close) Direction : D605.8 (1 : Active, 0 : Inactive).
3. Jog Negative (Open) Direction : D605.9 (1 : Active, 0 : Inactive).

5.5.5 Rotary Axis Revolution with Absolute or Relative Control



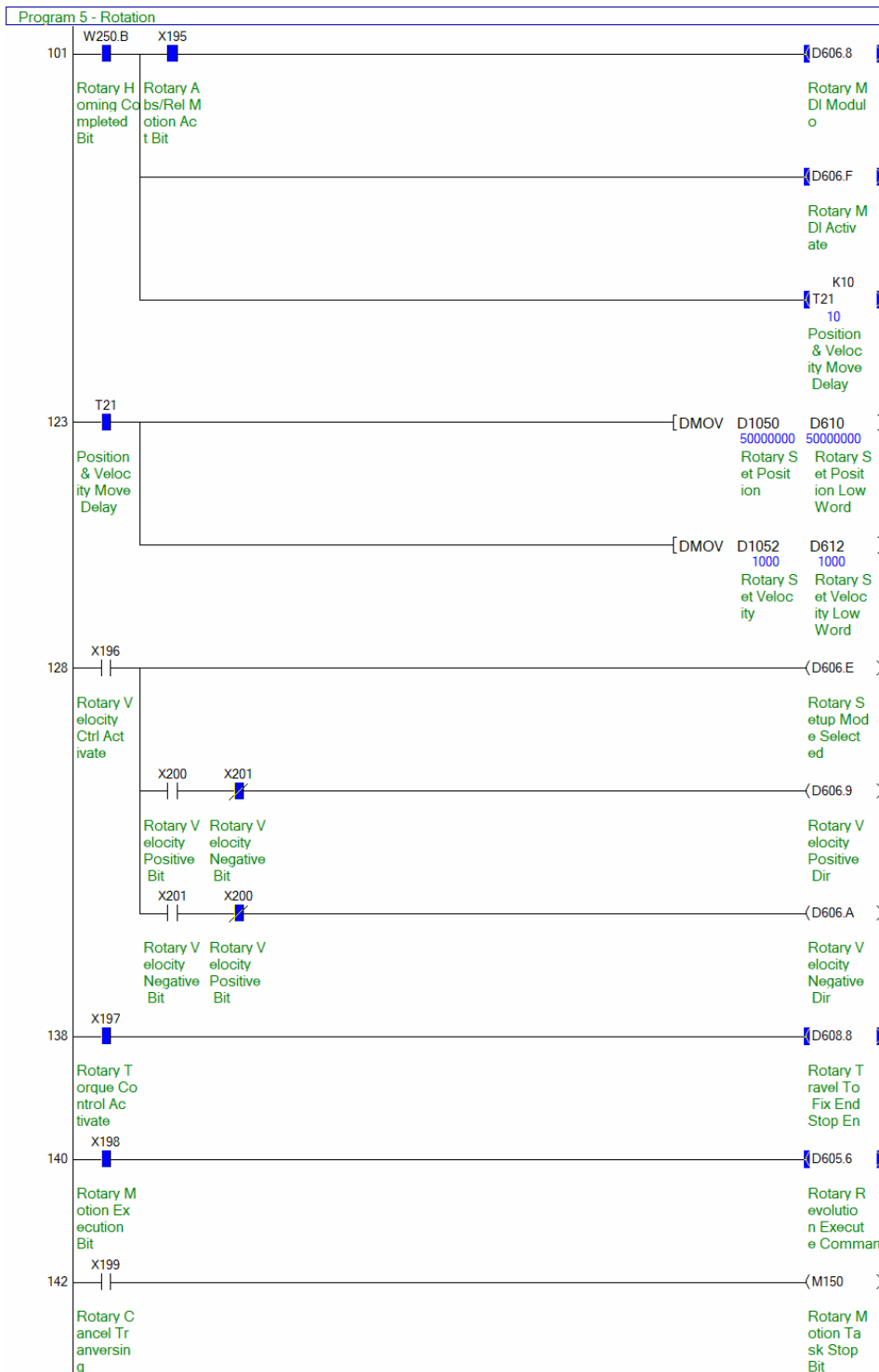
1. Set Positioning Method to **1** (Absolute Mode). Positioning Method : D606.8 (1 : Absolute, 0 : Relative).
2. Set MDI Selection to **1** (Activate MDI Mode). MDI Selection : D606.F (1 : Activate, 0 : Deactivate).
3. Position Control Parameter Settings
 - MDI Target Position : D610 (Lower), D611 (Higher).
 - MDI Velocity : D612 (Lower), D613 (Higher).
4. Activate Positioning task : D605.6 (0 -> 1 Rising Edge).

5.5.6 Rotary Axis Revolution with Velocity Control



1. Set Setup Mode Selected to **1** (Velocity Control). Setup Mode Selected : D606.E (1 : Activate, 0 : Deactivate).
2. Set Positioning Method to **1** (Absolute Mode). Positioning Method : D606.8 (1 : Absolute, 0 : Relative).
3. Direction Control Settings
 - Rotate Positive Direction : D606.9 (1 : Activate, 0 : Deactivate).
 - Rotate Negative Direction : D606.A (1 : Activate, 0 : Deactivate).
4. Set MDI Selection to **1** (Activate MDI Mode). MDI Selection : D606.F (1 : Activate, 0 : Deactivate).
5. Position Control Parameter Settings
 - MDI Target Position : D610 (Lower), D611 (Higher).
 - MDI Velocity : D612 (Lower), D613 (Higher).
6. Activate Positioning task : D605.6 (0 -> 1 Rising Edge).

5.5.7 Rotary Axis Revolution with Torque Control



- Set Travel to Fix End Stop to **1** (Force Control). Travel to Fix End Stop : D608.8 (1 : Activate, 0 : Deactivate).
 - The clamping torque will be based on value set in parameters Clamping Torque (P1.526801.0.0).
- Set MDI Selection to **1** (Activate MDI Mode). MDI Selection : D606.F (1 : Activate, 0 : Deactivate).
- Position Control Parameter Settings
 - MDI Target Position : D610 (Lower), D611 (Higher).
 - MDI Velocity : D612 (Lower), D613 (Higher).
- Activate Positioning task : D605.6 (0 -> 1 Rising Edge).

5.5.8 Rotary Axis Status Word

