Changes for the Better

MITSUBISHI ELECTRIC

How to use Mitsubishi AOI of MR-J4-TM EtherNet/IP on the RSLogix programming platform

Version 1.0

R72-181-SLSASG-011-*

Contents

CONTENTS ..... **I**

DISCLAIMER ..... **II**

FURTHER READING REFERENCE LIST ..... **III**

1 INTRODUCTION **1**

2 PREPARATION **2**

2.1 WIRING: 2

2.2 IP ADDRESS SETTING OF MR-J4-TM ETHERNET/IP DRIVE 3

2.3 REGISTER THE EDS FILE 3

2.4 CONTROLLOGIX PLC PROJECT CONFIGURATION 4

2.4.1 Adding the 1756 EN2TR EtherNet/IP Module *4*

2.4.2 Adding the MR-J4-TM EtherNet/IP Drive *6*

2.5 IMPORTING THE MITSUBISHI AOI IN THE RSLOGIX5000 PROJECT 9

3 CREATE A SAMPLE PROGRAM **12**

3.1 CONFIGURING COMMUNICATION AOI (MCOM) 12

3.2 CONFIGURE SERVO AXIS PROPERTIES AOI [MMCFG] 15

3.3 SERVO ENABLE 16

3.4 JOGGING THE AXIS USING THE MMAJ AND MMAS AOI 16

3.5 HOMING THE AXIS (MMAH) 17

3.6 MOTION MOVE MMAM: 17

4 TROUBLESHOOTING **19**

4.1 ACTION ON AN AOI ERROR 19

4.2 COMMON PROBLEMS AND SOLUTIONS 21

REVISIONS **1**

Disclaimer

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Further Reading Reference List

MELSERVO-J4 Servo MR-J4-TM Amplifier Instruction Manual (EtherNet/IP) SH(NA)030226

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

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

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

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

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

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

EMC Installation Guidelines IB(NA)67310

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

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

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

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

J4TM AOI User Manual [Links]

How to use the EDS file of MR-J4-TM in RSLogix 5000 platform [Links]

J4TM AOI Enhancement Guide for AOIs version 3

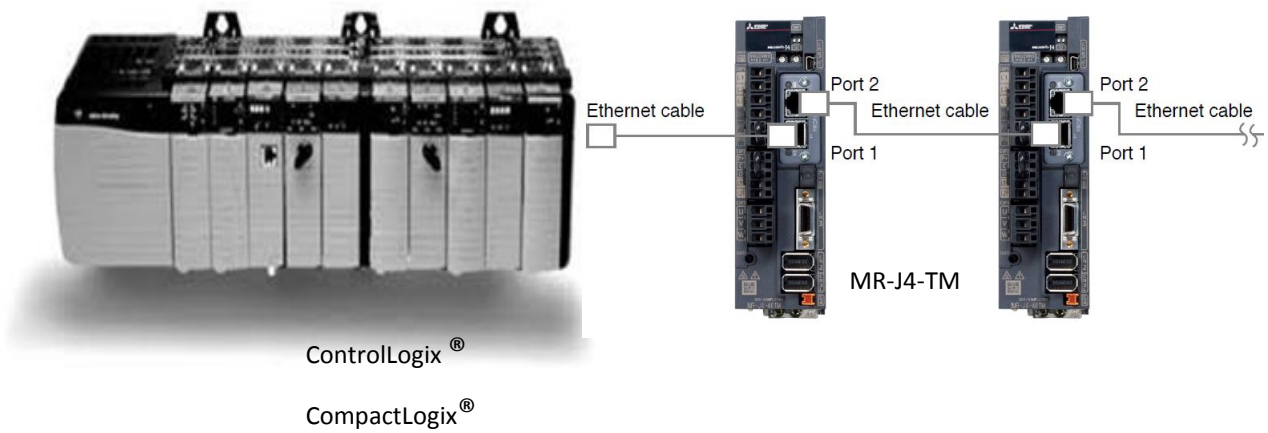
1 Introduction

This document describes the details setup procedure to run the MR-J4-TM EtherNet/IP Servo Amplifier by using AOI on the RXLogix platform.

The Mitsubishi Motion AOI commands are a set of Rockwell RSLogix5000 Add-On Instructions that can be used by users to command MR-J4-TM EtherNet/IP Servo Amplifier instead of Rockwell Automation motion instruction in an RSLogix5000 program. A user can replace the existing RA motion instruction with Mitsubishi motion control AOI without requiring major re-write of modifications to the existing RSLogix5000 programs. A user can substitute Rockwell Automation motion commands with equivalent Mitsubishi Motion AOI commands in an existing RSLogix5000 program with minimum program modifications.

This document provides examples of how to use the Mitsubishi Motion AOI Solution in a system consists of Rockwell ControlLogix PLC and MR-J4-TM EtherNet/IP Servo Amplifier.

An Example of the typical system architecture is shown in the figure below:



It is assumed that the user of this guide is familiar with the Rockwell RSLogix5000 environment and the operation of Mitsubishi MR-j4 series servo amplifier. It is critical for the users to refer to the servo amplifier instruction manuals when setting up the system parameters for EtherNet/IP and Mitsubishi Motion AOI applications.

The following hardware and software are used to create this quick start guide.

1756-L61 ControlLogix 5561 Controller Revisions 20.19
1756-EN2TR EtherNet/IP Module Revision 5.028
Ipconfig Tools (HMS)
Mitsubishi MR-J4-TM EtherNet/IP Amplifier F/W: B2 or later

2 Preparation

Assumed the user has a PC with installed RSLogix5000 version 20, Ipconfig tools and MR configurator2.

The following list contains high-level steps to establish proper EtherNet/IP communication of this example system. These steps will be further detailed in the subsequent section.

1) Connect the programming PC, Rockwell PLC, and Mitsubishi Servo amplifier to the Ethernet network:

   a. Configure all devices to have proper IP addresses and subnet masks;

   b. Ensure that RSLogix5000 (Ver. 20 or later), HMS IPconfig tools and Mitsubishi MR Configurator2 (Ver. 1.64 or later) software packages are installed on the programming PC.

2) Use the RSLogix5000 software to create a new project or modify an existing RSLogix5000 project to control the MR-J4-TM-EIP.

3) Then set an IP address using the “AnybusIPconfig" tool offered by HMS Industrial Networks and axis selection rotary switch (SW2/SW3) on the display of the servo amplifier, and controller.

   a. Set an IP address using the “AnybusIPconfig" tool offered by HMS Industrial Networks and axis selection rotary switch (SW2/SW3) on the display of the servo amplifier(Refer to section 2.2)

   b. Installed the EDS file (Refer to section 2.3)

   c. Add the EtherNet/IP module and MR-J4-TM drive in the RSLogix5000 project and configure it. (Refer to Section 2.4 of this document)

   d. Import the Mitsubishi Motion AOI commands to the project (Refer to Section 2.5 of this document)

   e. Create a sample project using Mitsubishi AOI

2.1 Wiring:

One MR-J4-10TM EIP drive with a servomotor and ControlLogix PLC are used to create the demo program. The wiring option shows below:

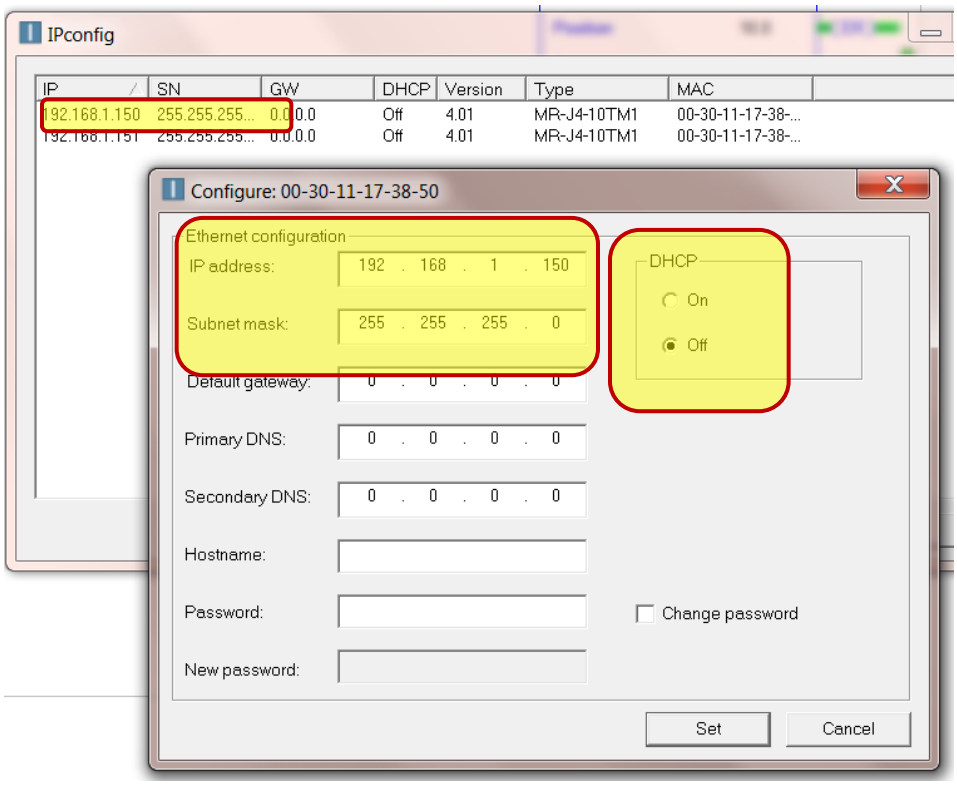
1) Wired three-phase AC power supply to L1, L2, L3 for main power and L11, L12 for control power.
2) U,V,W wiring between Motor and Amplifier
3) Connect the motor encoder cable between motor and CN2 of the MR-J4-TM Amplifier.
4) Connect Ethernet patch cable between PLC [port 1] and Ethernet switch.
5) Then connect the J4-TM Port 1 and personal computer to Ethernet switch
6) Install the PLC component in the chassis and wired AC power supply

2.2 IP address setting of MR-J4-TM EtherNet/IP Drive

IP Address can be set via BootP from the free IPConfig software provided by HMS Anybus. The download link is bellow:

https://www.anybus.com/docs/librariesprovider7/default-document-library/software/hms-IPConfig.zip?sfvrsn=1427add6_38

1) Install IPconfig tools and launch it.



2) Double click on [Scan Button] and double on the any drive.
3) Set the IP address and check the radio button to off of DHCP selection
4) Click the [Set] button.

2.3 Register the EDS file

Install the EDS before creating a project.

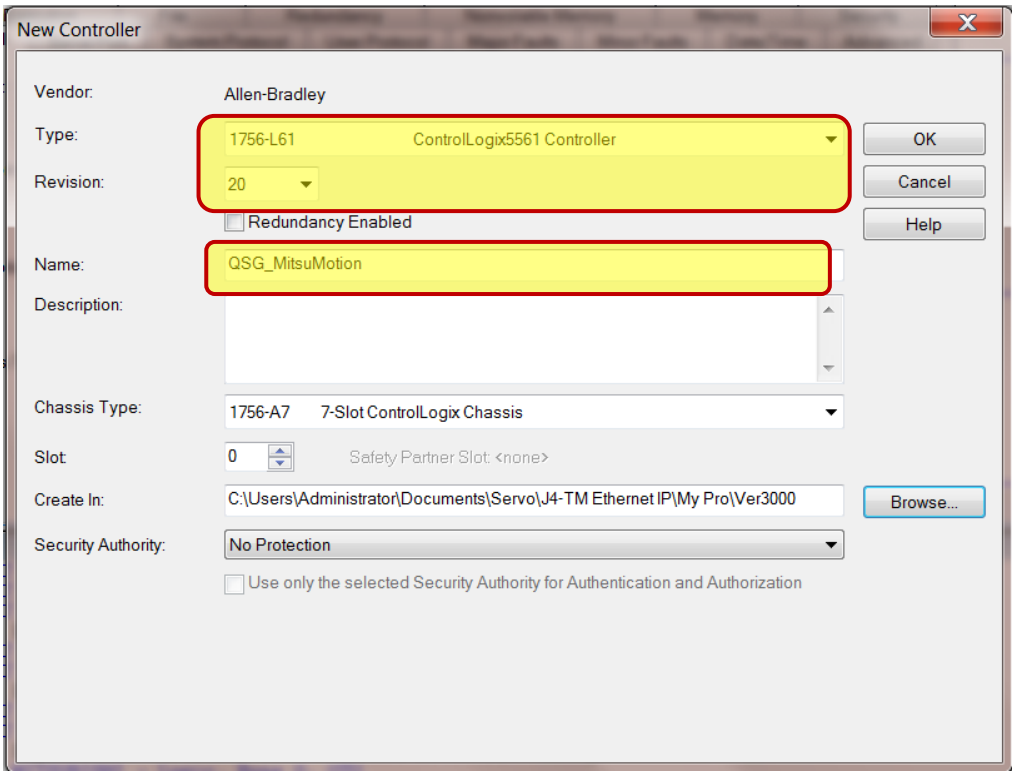
1) Download links for EDS file of MR-J4-TM EtherNet/IP servo amplifier in the Mitsubishis Website (links)
2) Technical bulletin for how to install EDS file (links)

2.4 ControlLogix PLC Project Configuration

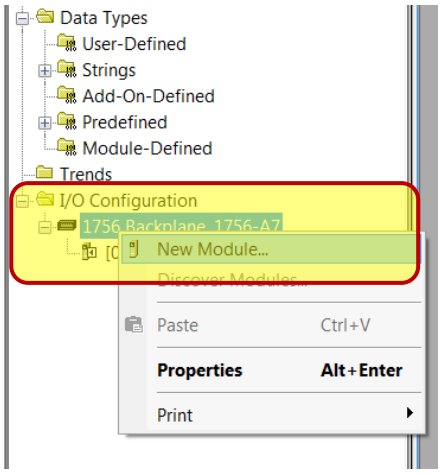
The configuration steps of a ControlLogix project have been described in this section.

2.4.1 Adding the 1756 EN2TR EtherNet/IP Module

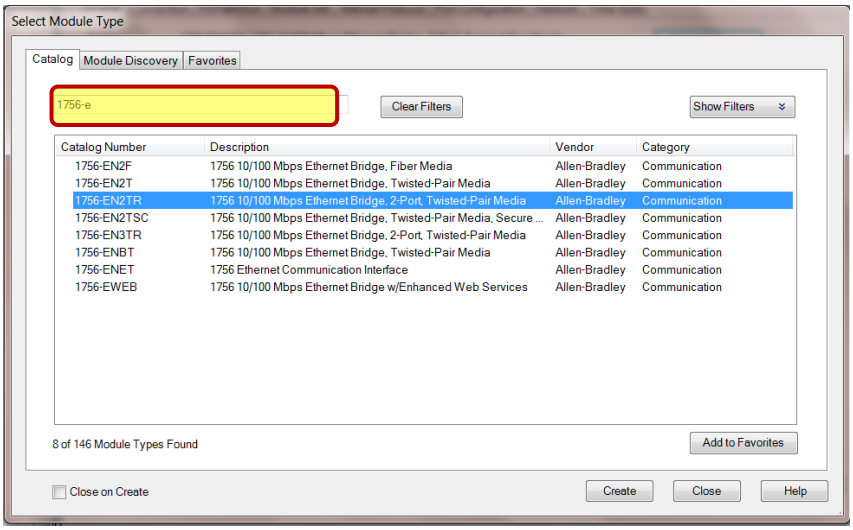
1) Create a new project in the RSLogix5000 using the proper revision level as the ControlLogix controller. In this example, the revision level is 20 and 1756- L61 PLS is used.



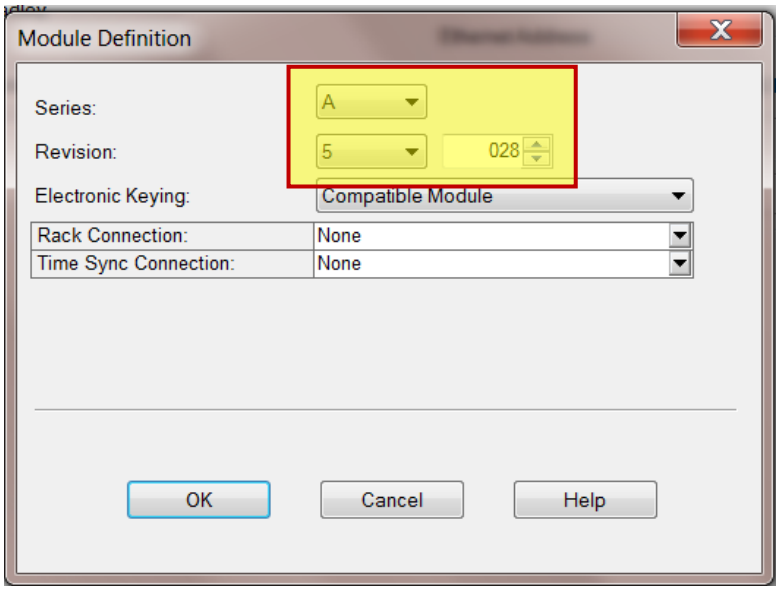
2) Right Click on the 1756 Backplane Selection and choose “New Module…



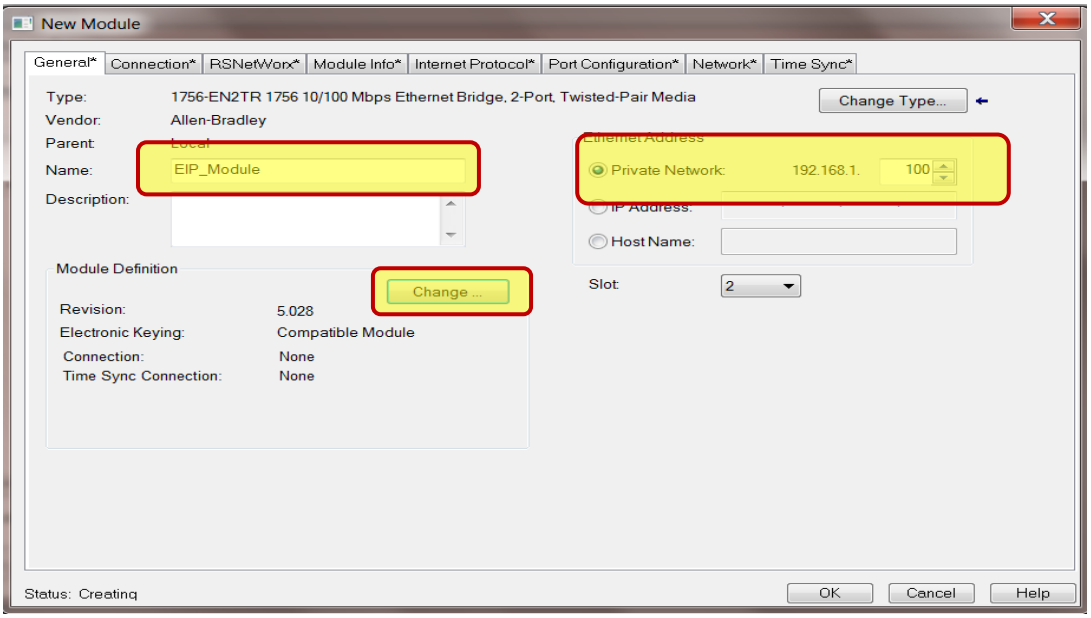
3) In the “Select Module” pop-up window, Enter “1756-E” search entry and then select the proper module 1756 EN2TR



4) Then click the [Change] button to select the Major Revision level of the EN2RT firmware. In the Verification System, the major revision level of the EN2RT module is 5 and 028.



5) Enter the proper Name, Slot Location, and IP Address of the EN2RT module. In the Verification System, the module name is set at EIP_Module, the module is in Slot 1 of the ControlLogix Chassis, and the IP address is set at 192.168.1.100, matching the previous configuration

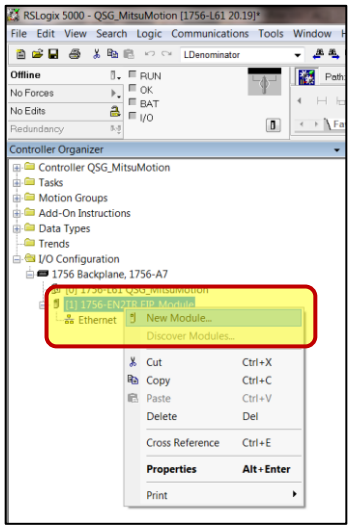


6) Click "OK" to accept the configuration and make no additional configuration changes to the "Connection" tab and simply click "OK" again to accept the configuration.

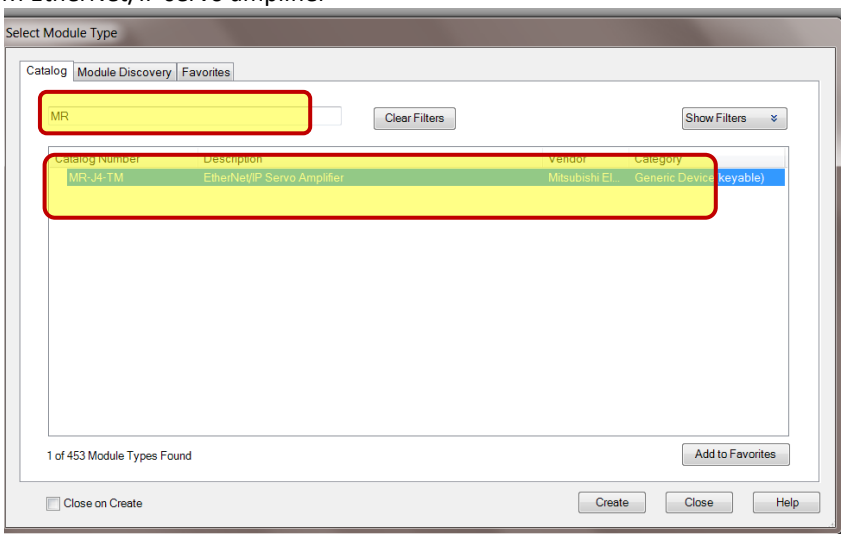
2.4.2 Adding the MR-J4-TM EtherNet/IP Drive

The following steps are used to add the MR-J4-TM Drive.

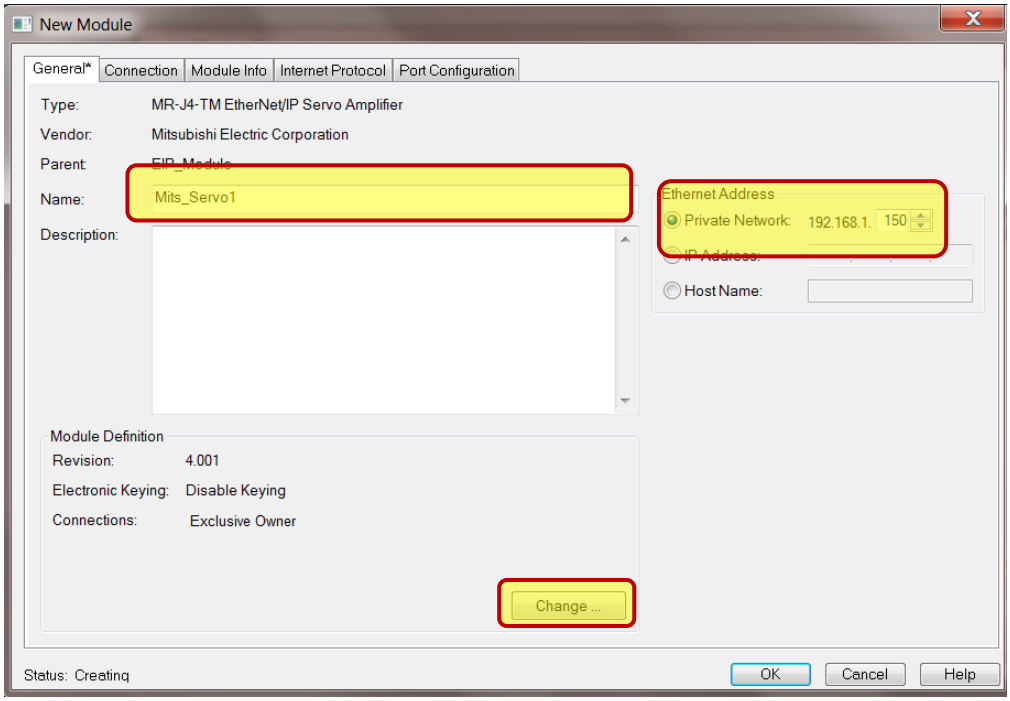
1) Right Click on the Ethernet icon and choose "New Module…"



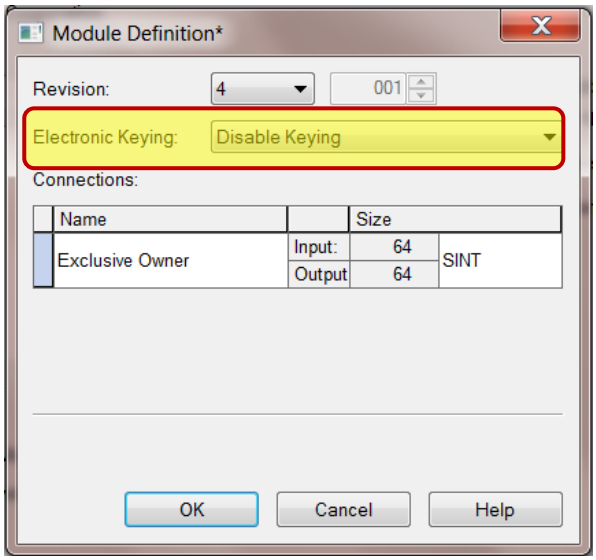
2) In the “Select Module” pop-up window, Click the “Catalog ” and write [MR] in the key search then select "MR-J4-TM EtherNet/IP servo amplifier



3) Enter the proper Name and set IP Address. In the Verification System, the module name is set at Mits_Servo1 and the IP address is set at 192.168.1.150 are as below

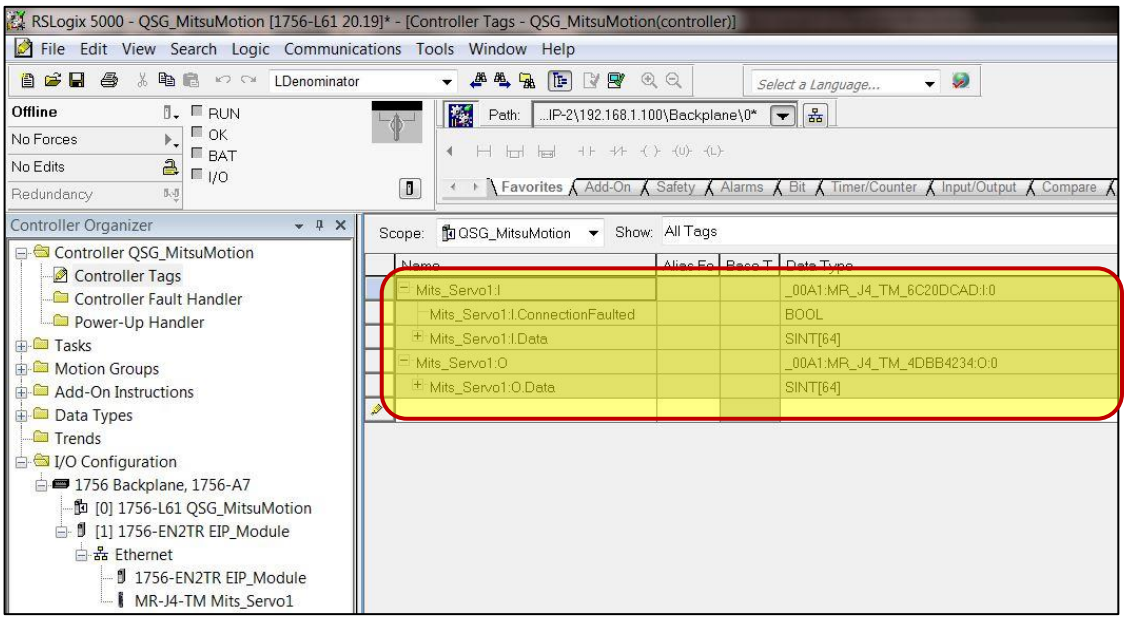


4) Then click [Change] button to choose the drive revision number, choose the Electronic Keying option [Disable Keying] if you are not sure the drive revision version.



5) Click [OK] and [OK] to accept the configuration and make no additional configuration changes to the “Connection” tab and simply click “OK” again to accept the configuration.

6) Double click on the "Controller Tags" selection and the following tags automatically created for the MR-J4-TM EtherNet/IP drive.

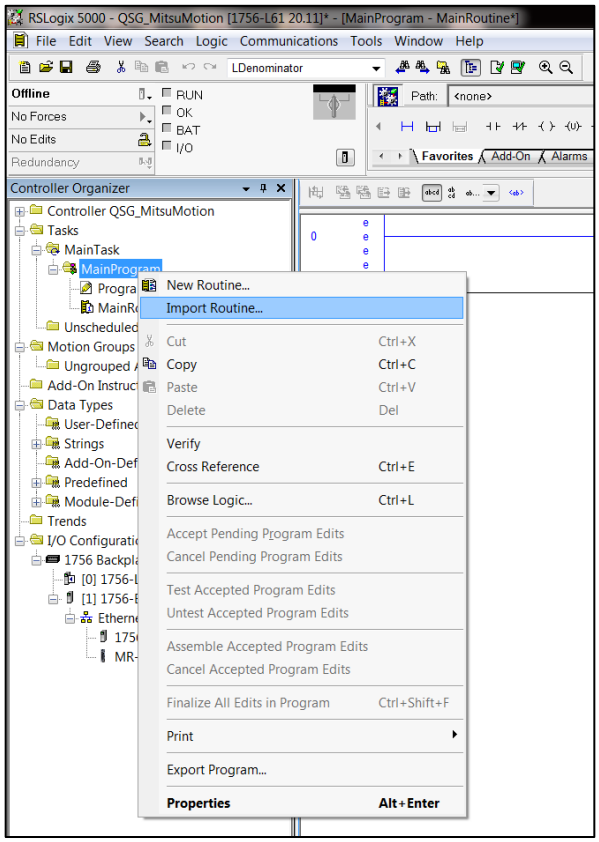


2.5 Importing the Mitsubishi AOI in the RSLogix5000 project

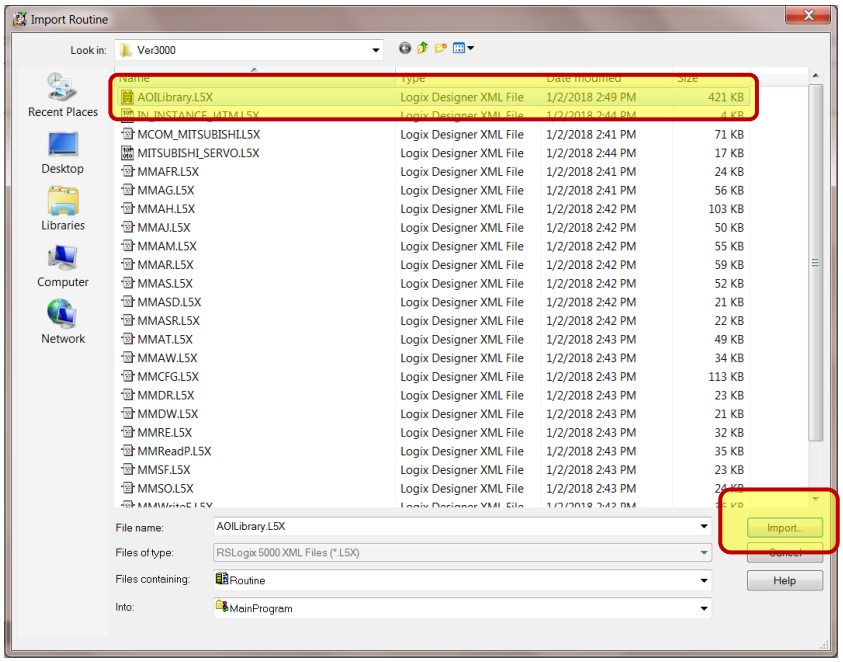
The following procedure shows to bring all AOI in the project file. Here are the Mitsubishi AOI download links:

https://us.mitsubishielectric.com/fa/en/support/technical-support/knowledge-base/getdocument/?docid=3E26SJWH3ZZR-37-915

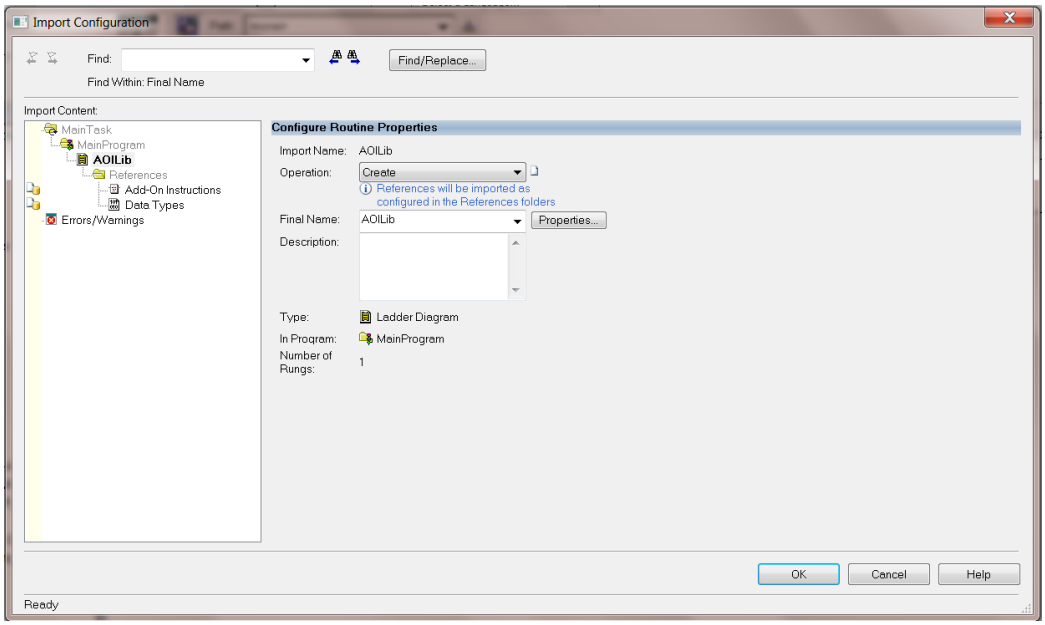
1) Right click on the MainProgram routine and choose Import Routine…



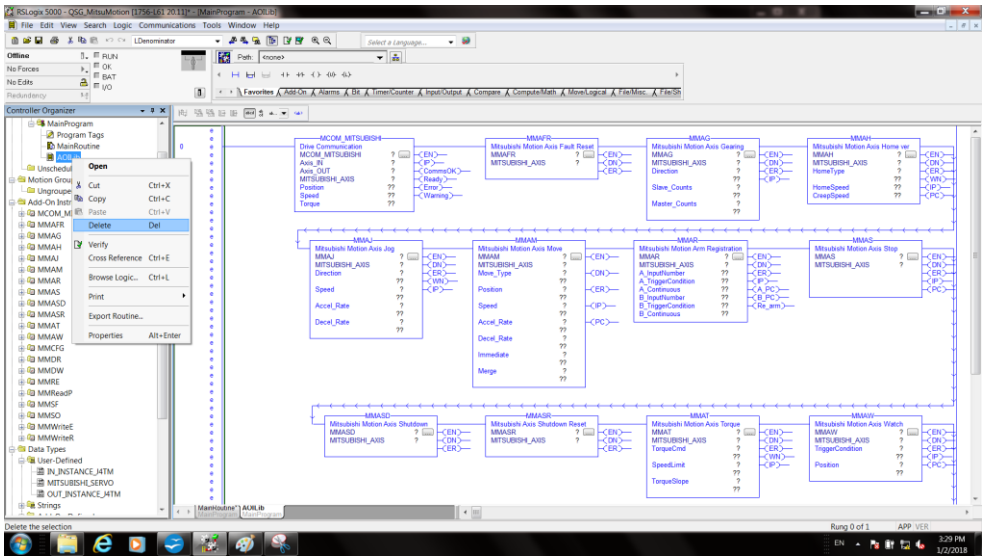
2) Browse to the AOILibrary.L5X under the download folder at under Ver3000 and select and then click [Import] button.



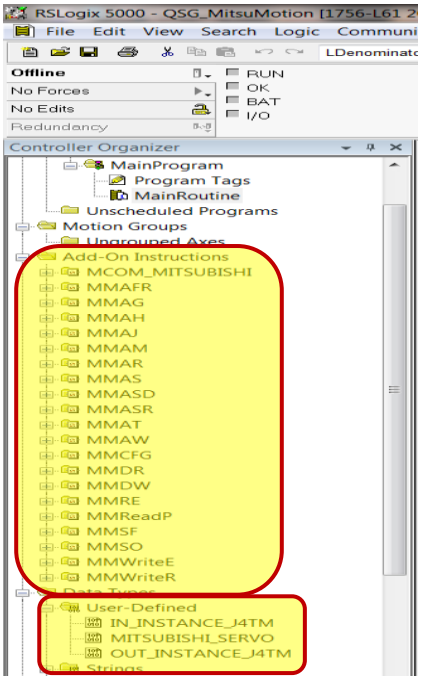
3) The AOI routine will be Read and then click OK on the pop-up window to load the routine.



4) Then Delete the routine from the project.



Now all the AOI in your project. The following picture shows the imported AOI and user defined UDT



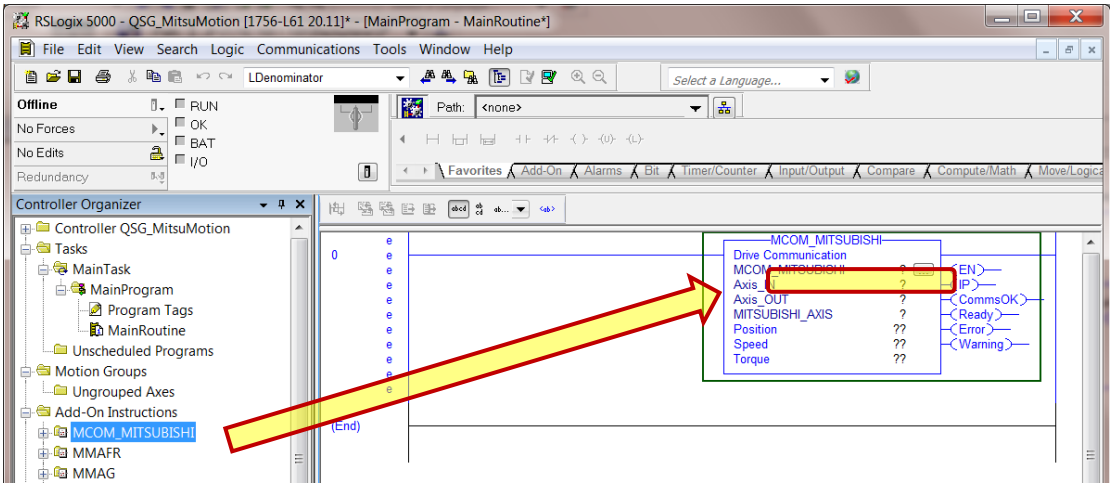
3 Create a Sample Program

This section shows an example to create sample program by using AOI.

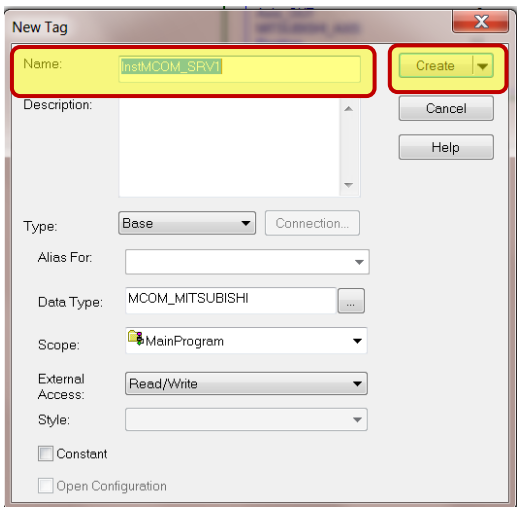
3.1 Configuring Communication AOI (MCOM)

The MCOM block sets up communication between the RSLogix5000 program file and MR-J4-TM EtherNet/IP servo drive using the control tags of MR-J4-TM EtherNet/IP servo drive. Each MCOM block will handle one axis of Servo drive. The block must continually execute every PLC SCAN or close to RPI setting to work correctly.

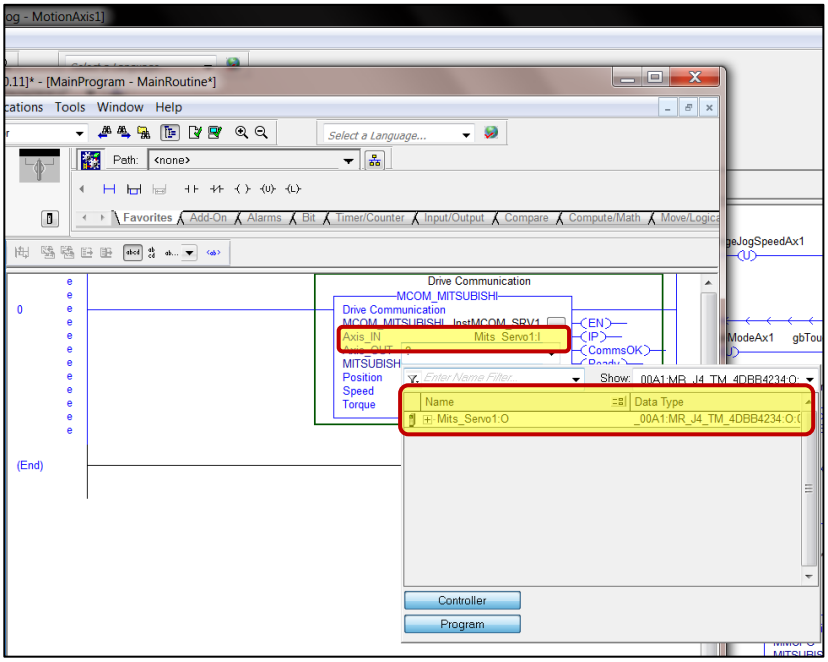
1) Add the MCOM AOI to a program routine [Drag and drop in the main routine]



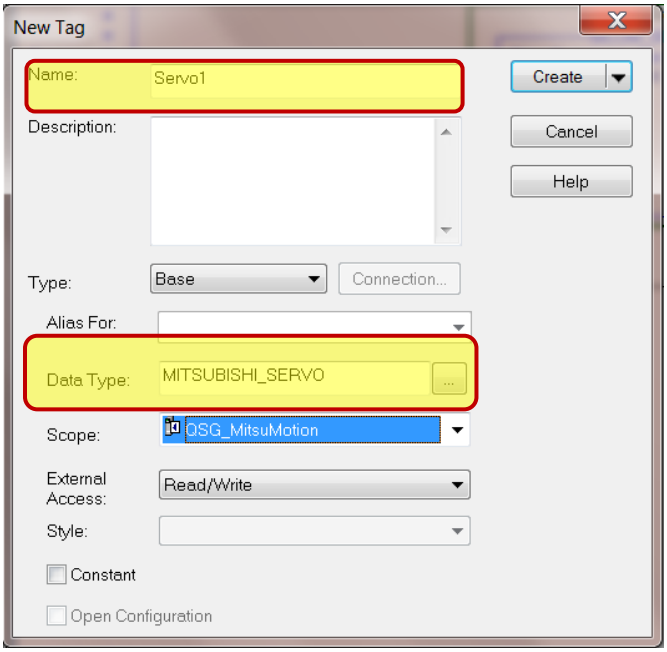
2) Create a New Tag for instance of MCOM_Mitsubishi AOI [Right click on [MCOM_Mitsubishi] and choose the New Tag and Enter the Tag name and click Create button



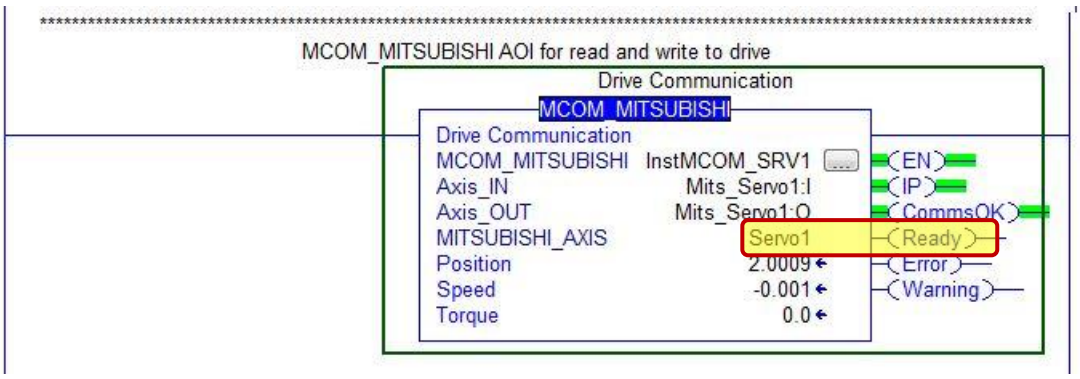
3) Assign the input tags Axis_IN and Axis_OUT of MCOM to Mits_Servo1:I and Mits_Servo1:O of the controller tags of MR-J4-TM EtherNet/IP drive that is created when MR-J4-TM EtherNet/IP drive is added in the project.



4) Create a Tags [Controller tags] Servo1 with UDT Data type [Mitsubishi_Servo] and assign to the output tag [Mitsubishi_Axis] of MCOM. This Tag will be used all others AOI.



5) The following picture is shown the configuration of MCOM AOI. In here Servo1 represent the reference UDT of MR-J4-TM EtherNet/IP servo drive and the user must need to use all others the AOI to work properly.

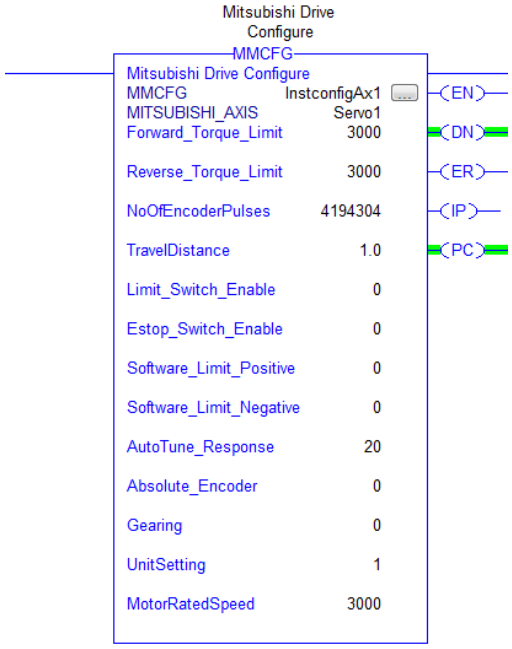


Note: User can access the following status from the servo amplifier.

Position (REAL)	Display actual servo position in user unit
Velocity (REAL)	Display actual speed in user unit
Torque(REAL)	Display actual servo torque in % of rated speed
CommsOK (BOOL)	True indicates the communication between controller and drive is OK
Ready(BOOL)	True indicates the servo ready states[Servo enabled]
Error(BOOL)	True indicates the servo experience an Error
Warning(BOOL)	True indicates the servo experience a warning

3.2 Configure Servo Axis properties AOI [MMCFG]

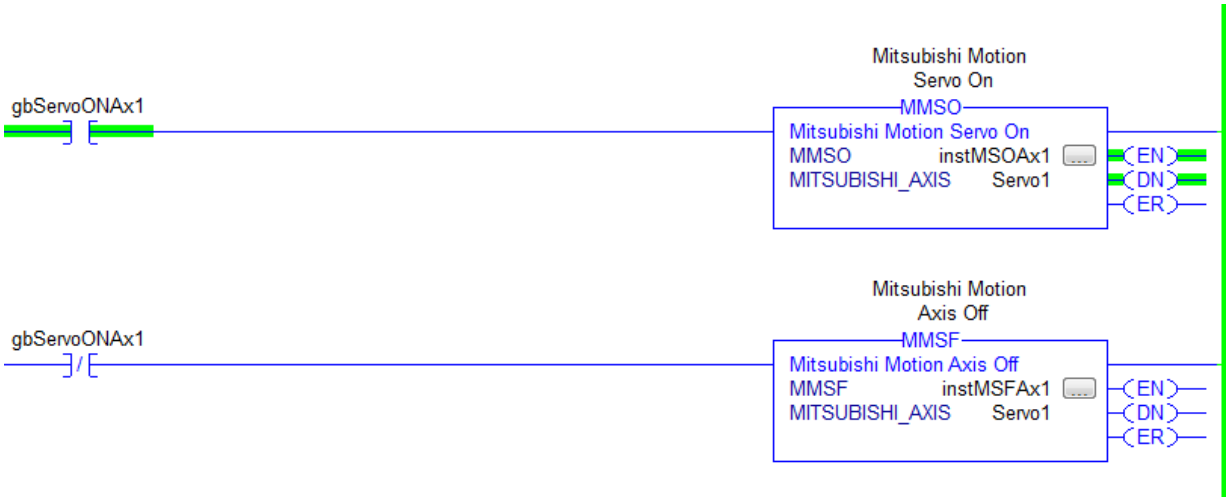
The MMCFG block sets up parameter values for the servo axis such as Electronic gear ratio, Hardware travel limits, Emergency Stop and other configuration parameters. In this example, we are setting torque limits to 300%, engineering unit to inches, travel distance 1 inches per revolution of motor [using a 22-bit encoder), disable the travel limits and Emergency stop signals. We are also setting the Auto-tune response setting to 20.



Note: Before using any AOI (except MCOM) , Execute the MMCFG AOI and recycle the power of the servo amplifier after PC is turn ON. This AOI write the servo parameters, user must has to recycle the power of the servo amplifier.

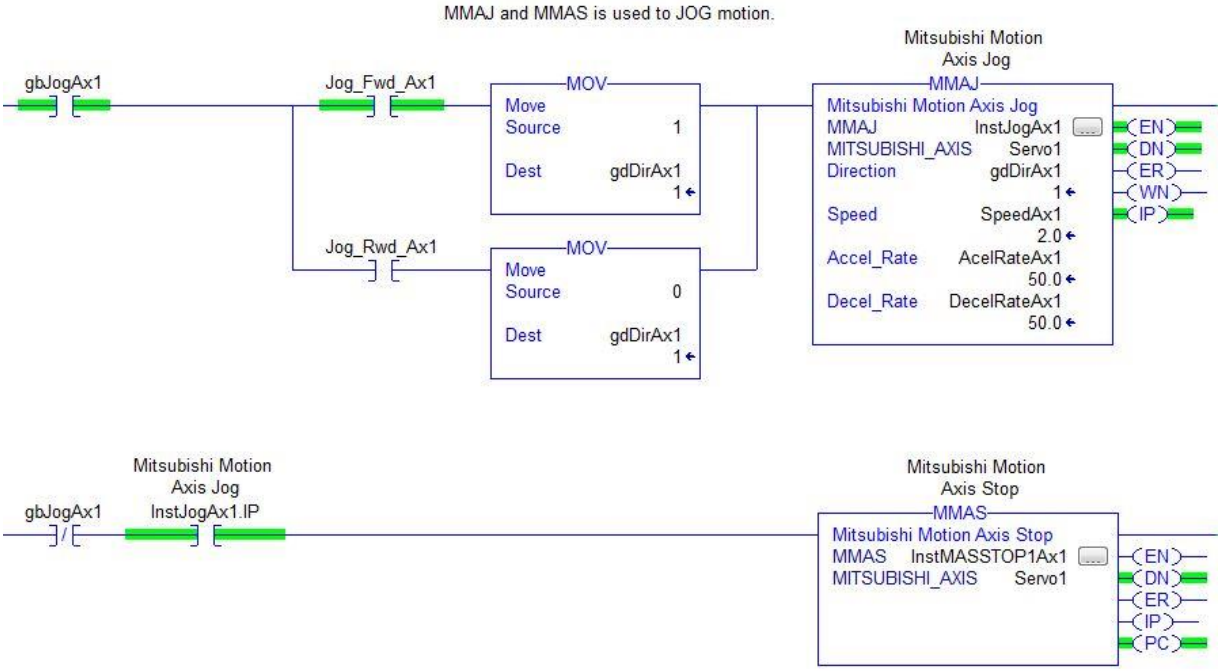
3.3 Servo enable

The enabling/ disabling the servo, add the MMSO and MMSF in the program routine. In this example, the Tag [gbServoONAx1] off to ON make servo enable and OFF to ON make servo disable.



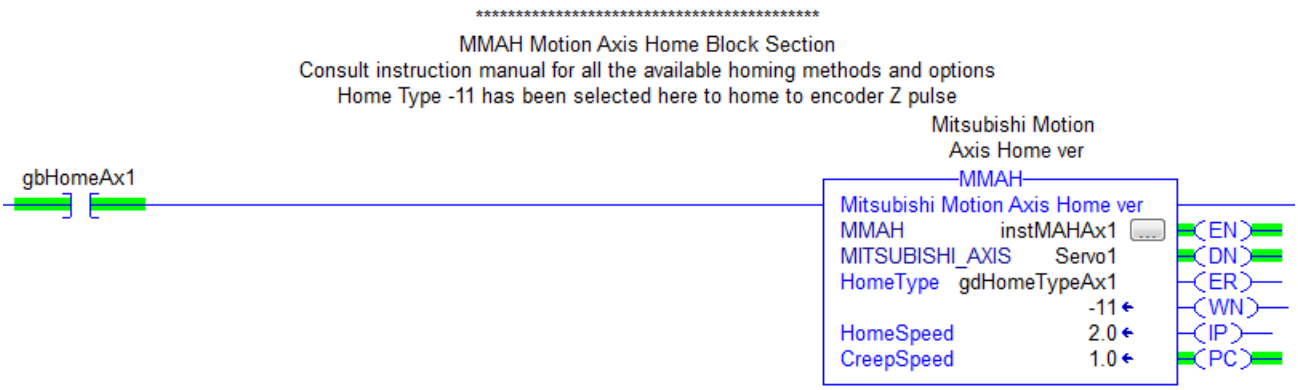
3.4 Jogging the axis using the MMAJ and MMAS AOI

The following example shows the Jog function using MMAJ and MMAS. In this example, axis starts to move forward direction with 2.0 inches/sec and 50.0 inches/Sec^2 acceleration when tags variable **gbJogAx1** turn OFF to ON and stop when **gbJogAx1** is turn ON to Off.



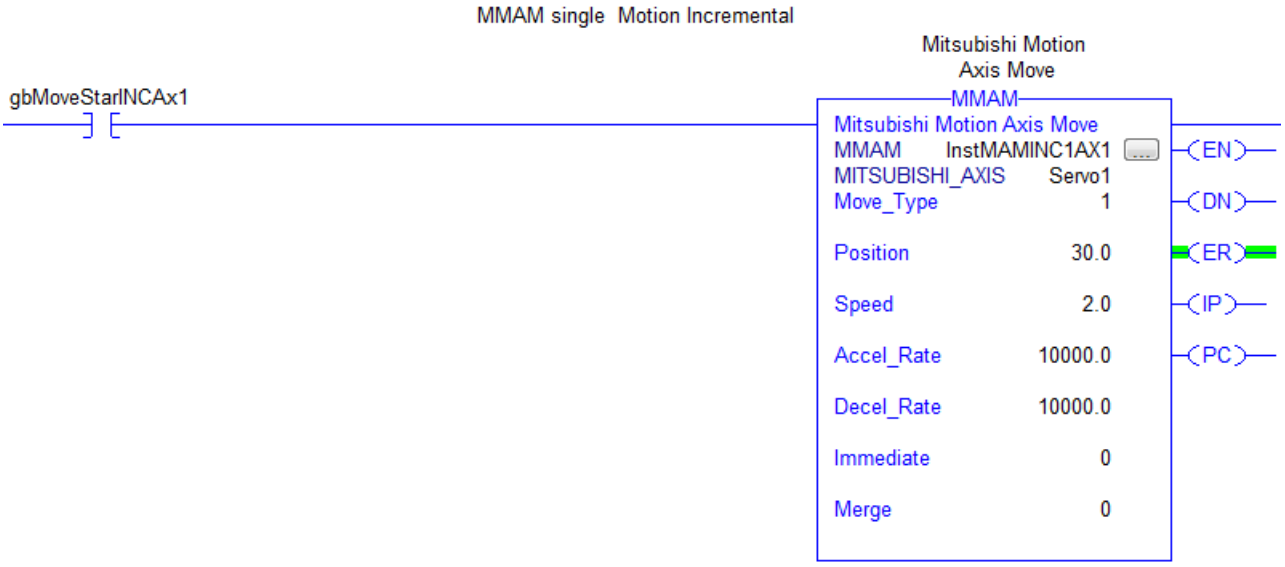
3.5 Homing the axis (MMAH)

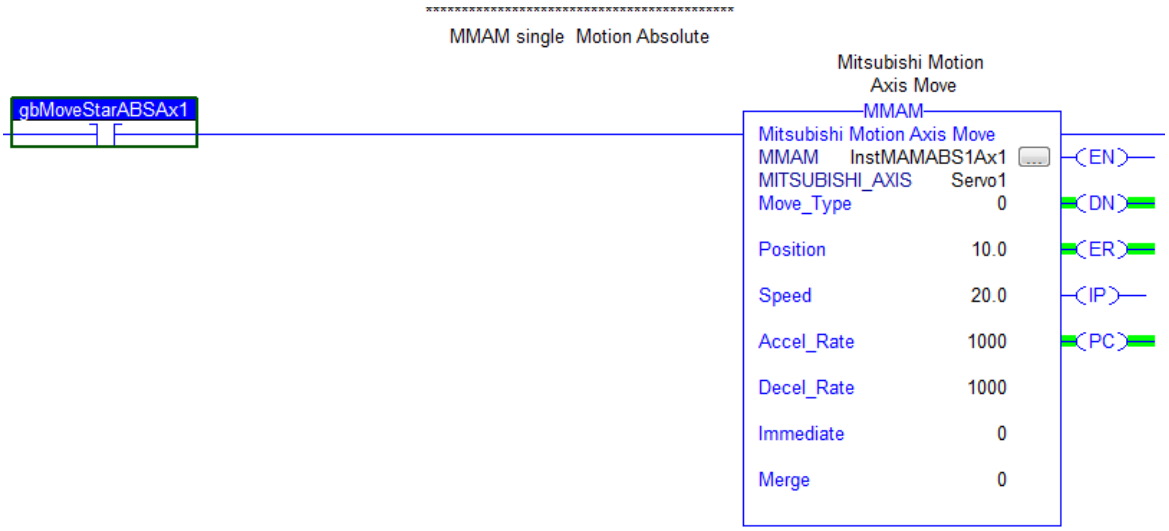
There are many ways to command the axis to home. The home type must be decided by the machine designer. In this example, we are performing the homing type -11[home to encoder Z pulse]. The Home speed set to 2.0 inches/sec and Creep speed is set to 1.0 inches/sec.



3.6 Motion Move MMAM:

The following example shows incremental move(Move_Type =1) and absolute move (Move_Type =0)



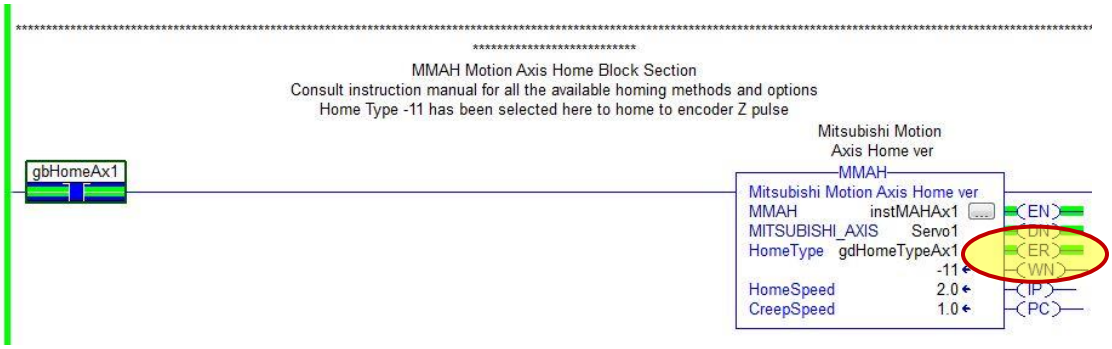

****
MMAM single Motion Absolute
Mitsubishi Motion
Axis Move
MMAM
gbMoveStarABSAx1
Mitsubishi Motion Axis Move
MMAM InstMAMABS1Ax1
MITSUBISHI_AXIS Servo1
Move_Type 0
Position 10.0
Speed 20.0
Accel_Rate 1000
Decel_Rate 1000
Immediate 0
Merge 0
EN
DN
ER
IP
PC

4 Troubleshooting

This chapter describes actions to be taken when AOI errors occur to identify the causes of the errors. Common problems and solutions are also documented next section.

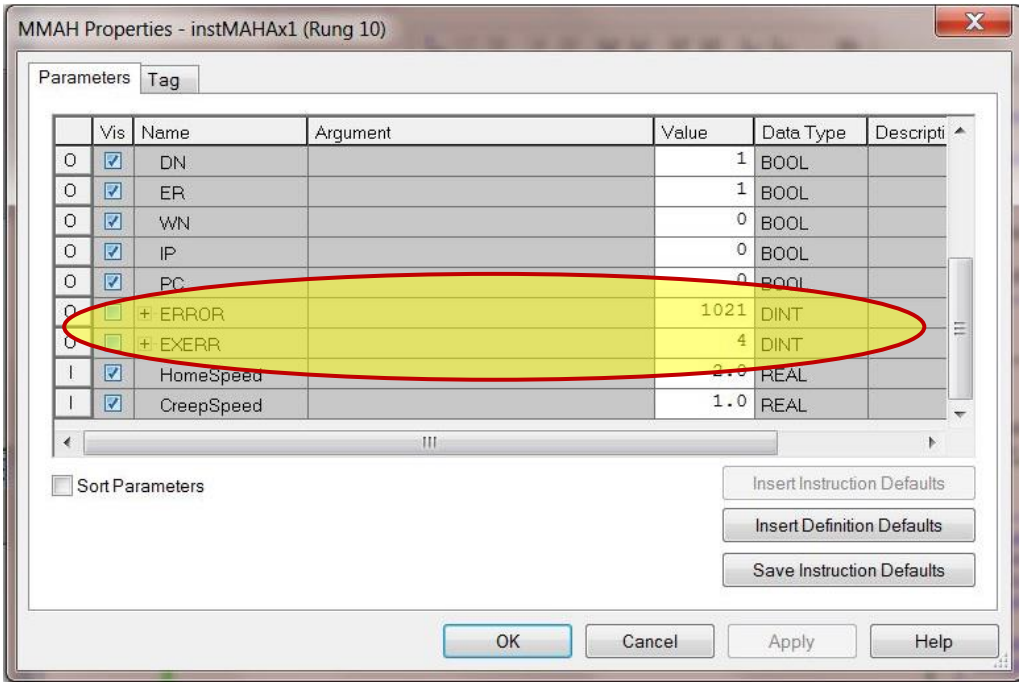
4.1 Action on an AOI Error

Each Mitsubishi AOI contains an error status bit and is shown as the "ER" output bit of AOI.



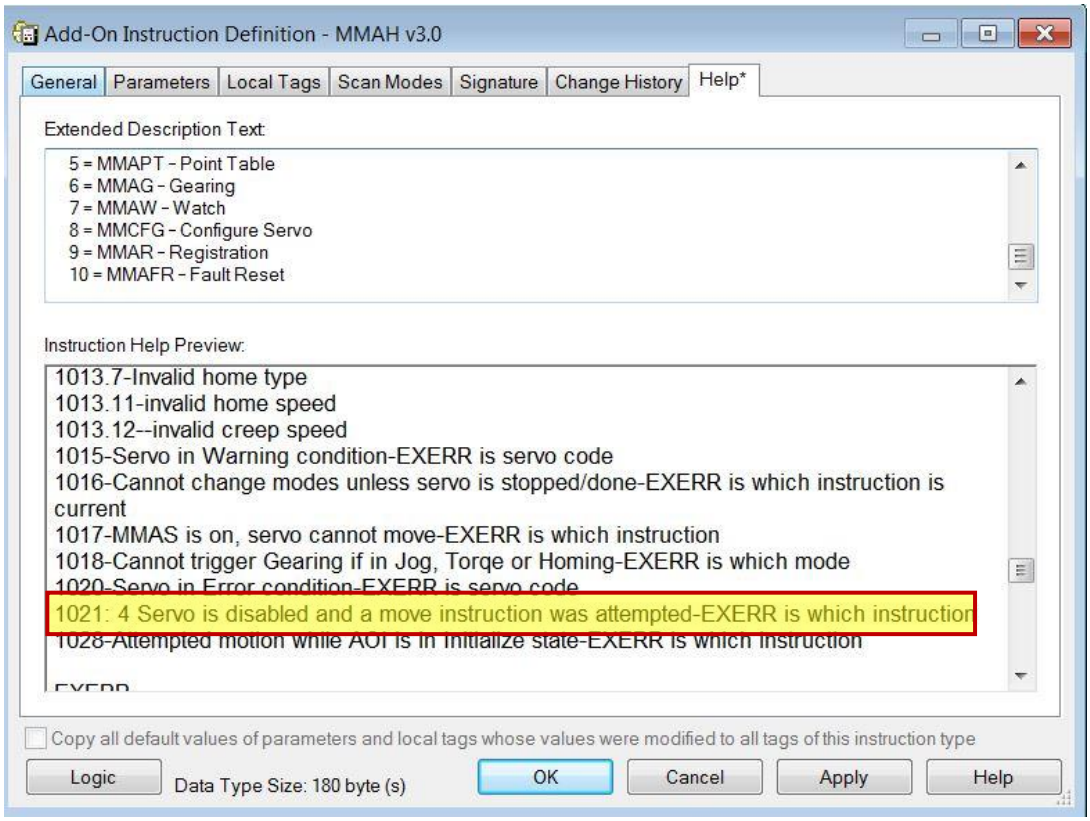
1) Right click on the AOI in the routine and select "Properties" in a pop-up window when the "ER" bit is on for the particular AOI.

2) Select the "Parameters" Tab and observe the Error Code and Extended Error Code that are stored in ERROR and EXERR tags (e.g.: In the below window, Error Code is 1021 and Extended Error Code is 4.)



3) Right click on the AOI again and select “Instruction Help” in a pop-up window.

4) Select “Help” tab and observe the “Instruction Help Preview” screen. Error Code, Error Name and Descriptions are described on this screen. In this example, Error Code 1021 and EXERR 4 is the “ Servo is disabled ” and the description of the error is stated as “attempted to execute with the axis in the disable state causes error”. Thus, Servo enable command has been executed before an attempt to execute this particular AOI.



4.2 Common problems and solutions

Although by no means exhaustive, the following table provides possible causes of some of the most common errors experienced when using the Mitsubishi Motion AOI

Problem	Cause	Solution
No communication between ControlLogix and MR-J4-TM EtherCAT/IP Drive	Power is off.	Power on ControlLogix, and the MR-J4-TM EtherCAT/IP Drive
	Ethernet cable is disconnected.	Connect Ethernet cable between switching hub and ControlLogix and the MR-J4-TM EtherCAT/IP Drive
	The IP address setting of the MR-J4-TM EtherCAT/IP Drive is incorrect.	Set a correct IP address
	Module Identify is mismatch	Use the right version of EDS file or disabling the electronic keying function.
Cannot Enable the servo	MR-J4-TM EtherCAT/IP Drive is not communicating.	Check the communication check above
	Controller is not run mode	Bring the controller in run mode.
	Servo amplifier is off.	Power on the servo amplifier.
Cannot reset Axis Fault	Servo amplifier power cycling is needed.	Cycle servo amplifier power. In some cases, it may be necessary to cycle the power twice.
	Servo amplifier is in particular error state.	Check the LED display on the servo amplifier monitor the error. (Refer to the servo amplifier troubleshooting manual described in FURTHER READING REFERENCE LIST)
AOI doesn't respond properly	Multiple AOIs are the scan in same tags name.	Make sure there are no duplicate tags names of same AOI

Problem	Cause	Solution
ERROR 1013: EXERR:1,5,6,10	Position, speed, Acceleration, or Deceleration command value is excessive large or excessive small.	Check the unit and set the appropriate value. Setting value range can be found under Mitsubishi_Servo UDT)
Servo Alarm 70.3	Encoder is not connect for Gearing	Check the encoder connection at CN2L or turn of the gearing function.
Servo Warning 90.1	Home position return is not performed	Please perform the home position
Servo Warning 99	Stroke limit warning	Check the wiring of hardware limit switch

Revisions

1) Version 1.0 Issued Date: 01/02/2018