MITSUBISHI ELECTRIC

FX5-40/80SSC-S Simple Motion Module PLCOpen Function Block

Version 1.001

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Disclaimer

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FURTHER READING REFERENCE LIST

Simple Motion User's manual

MELSEC iQ-F FX5 Simple Motion Module User's Manual (Startup) IB-0300251

MELSEC iQ-F FX5 Simple Motion Module User's Manual (Application) IB-0300253

MELSEC iQ-F FX5 Simple Motion Module User's Manual (Advanced Synchronous Control) IB-0300255

PLC user's manual:

MELSEC iQ-F FX5 User's Manual (Application) JY997D55401

MELSEC iQ-F FX5 Programming Manual (Program Design) JY997D55701

Operating Manual:
GX Works3 Operating Manual SH-081215ENG

Servo Amplifier User's Manual:

MELSERVO-J4-B Servo Amplifier Instruction Manual SH(NA)030106

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

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

MELSERVO Linear Encoder Instruction Manual SH(NA)030111

MELSERVO-JE-B Servo Amplifier Instruction Manual SH(NA)030152

MELSERVO-JE Servo Amplifier Instruction Manual (Troubleshooting) SH(NA)030166

1

Chapter 1 Introduction

In this document have been described how to use the Function blocks for PLCopen compliant positioning control

The system configuration for the project is shown in the picture below:

1.1 Supporting Hardware and software:

The following hardware and software are used to create this document.

Servo Amplifier:

- MR-J4-B or MR-J4-B-RJ (only rotary motor) or
- MR-JE-B

FX5-40SSC-S or FX5-80SSC-S simple motion Module:

- **OS version 1002 or later (manufacturing date September 2015 or later for command generation axis)**

Software:

- GX works3 version **1.020W or later**

PLCopen User Library:

- FX5SSC_PLCOpen_LD_GW3_V230.usl (support FX5-40SSC-S or FX5-80SSC-S simple motion)

Help File:

- FX5SSC_PLCOpen_LD_GW3_V230.chm

Sample Program:

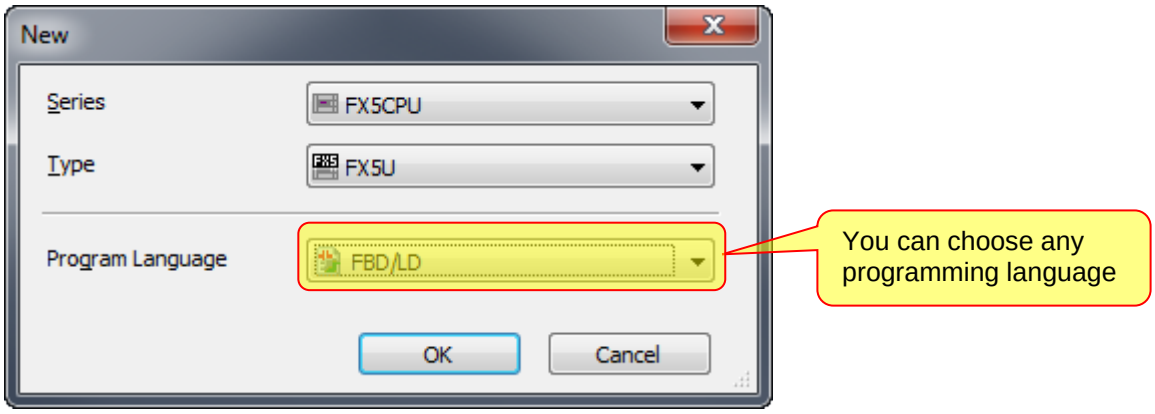
- FX5SSC_PLCOpenSampleV200.gx3

Chapter 2 Integration of the User Library

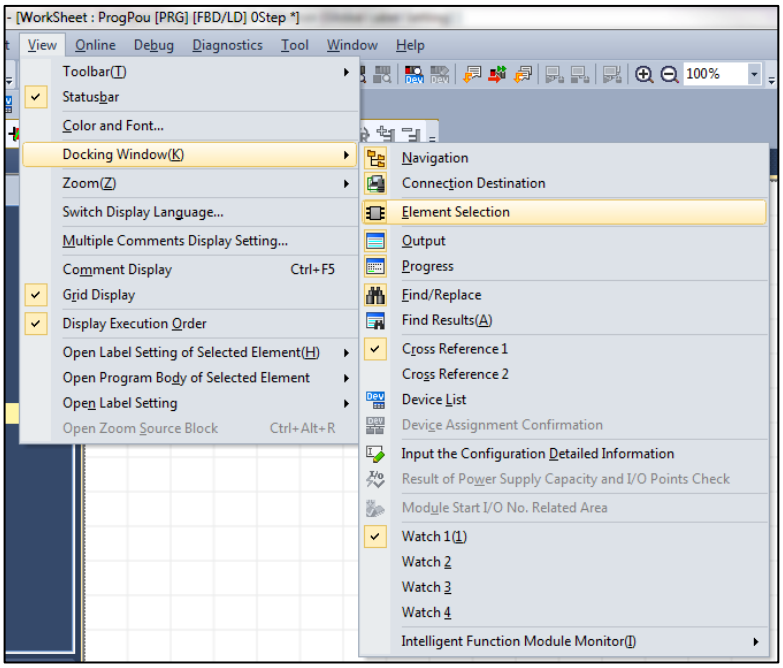
The library is created for the GX works3 programming software for FX5 PLC CPU. The following steps are required to make the GX Works3 project to link the FX5-40SSC-S or FX5-80SSC-S module to the library. Perform the steps in sequence which is listed in the following section.

2.1 Install a user Library in the GX Works3 project

1) Open/create a GX Works3 project with FX5 PLC CPU. The follow screen shot shows creating a new Project

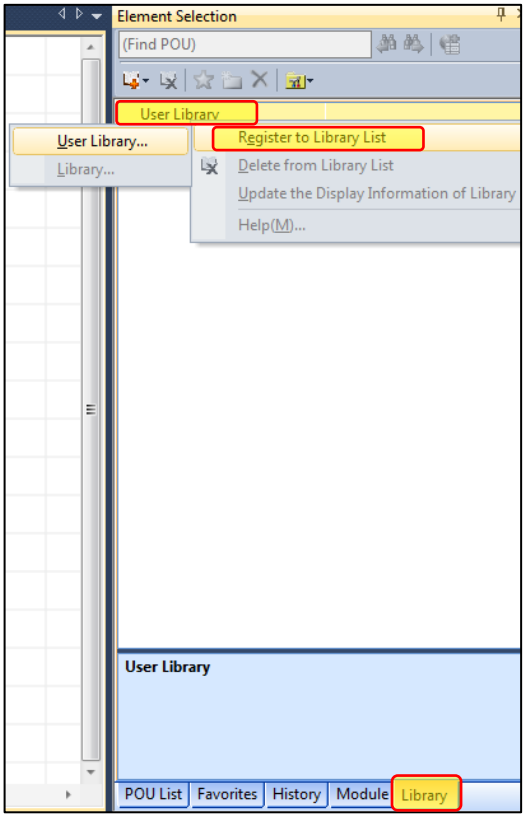


2) Open the [Element Selection] Window from Menu bar →View→Docking Window → Element

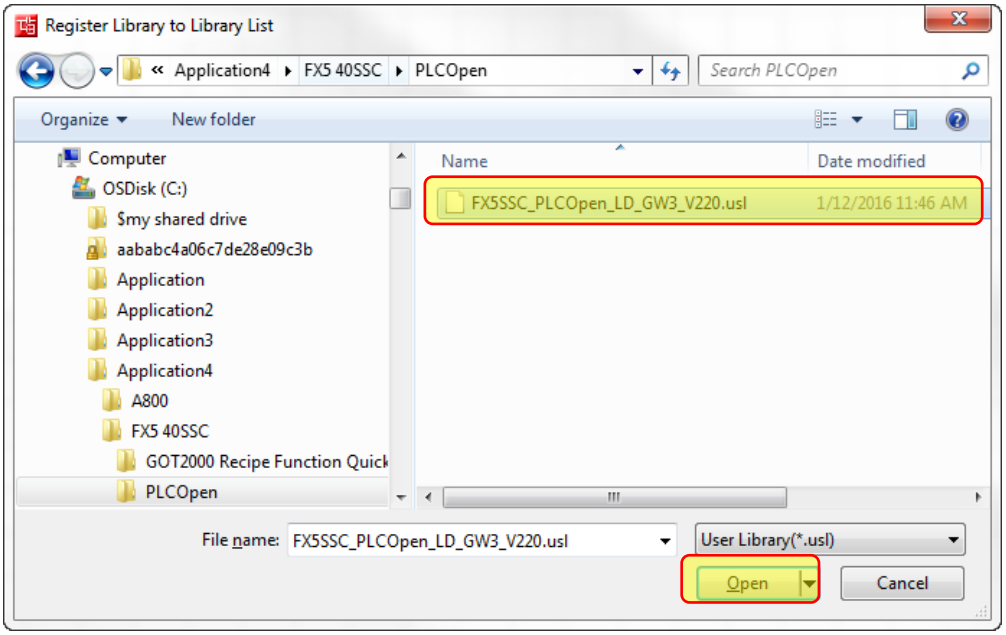


The Element section window will be appeared on the right side of the GX works3 Tools.

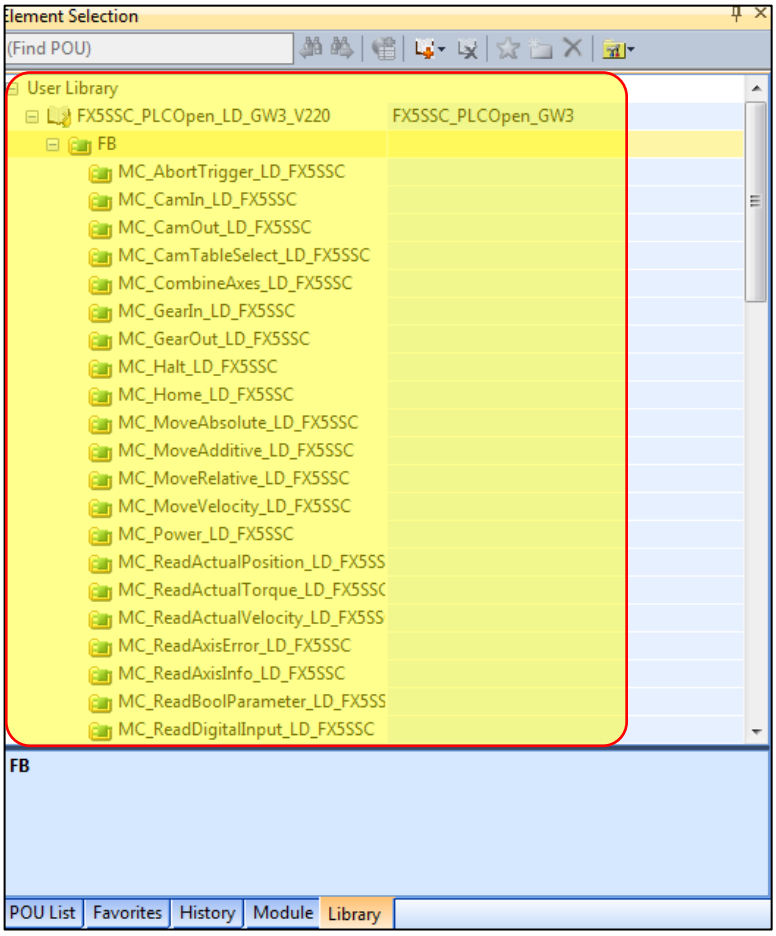
3) Then Click on the Library Tab and then



4) Right Click on the User Library then →Register to Library List →User Library and then choose the user library file [FX5SSC_PLCOpen_LD_GW3_V230.usl] from hard drive location and then click [Open] Tab to bring the GX Wroks3 tools.



5) Now the PLCopen library file is registered to GX works3 software tool. User can use this Function block any of their project.



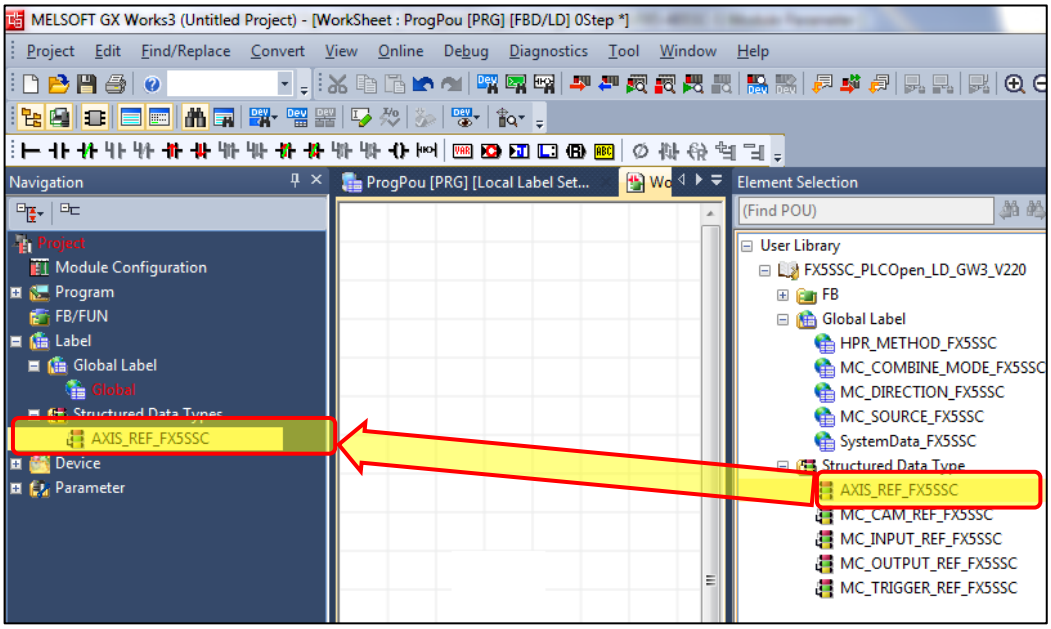
2.2 Example of creating Axis reference

Inside the library has a structured data type called [AXIS_REF_FX5SSC] which is used as an input and Output variable of the function blocks for linking between the function block and the simple motion module FX5-40/80SSC-S module. The user must need to declare [AXIS_REF_FX5SSC] data type as a label variable before using the function block in GX Work's project and the user must have to assign the appropriate value to elements of structure data type [AXIS_REF_FX5SSC]. The elements of Structured Data Types [AXIS_REF_FX5SSC] are needed to assign that are shown the following table.

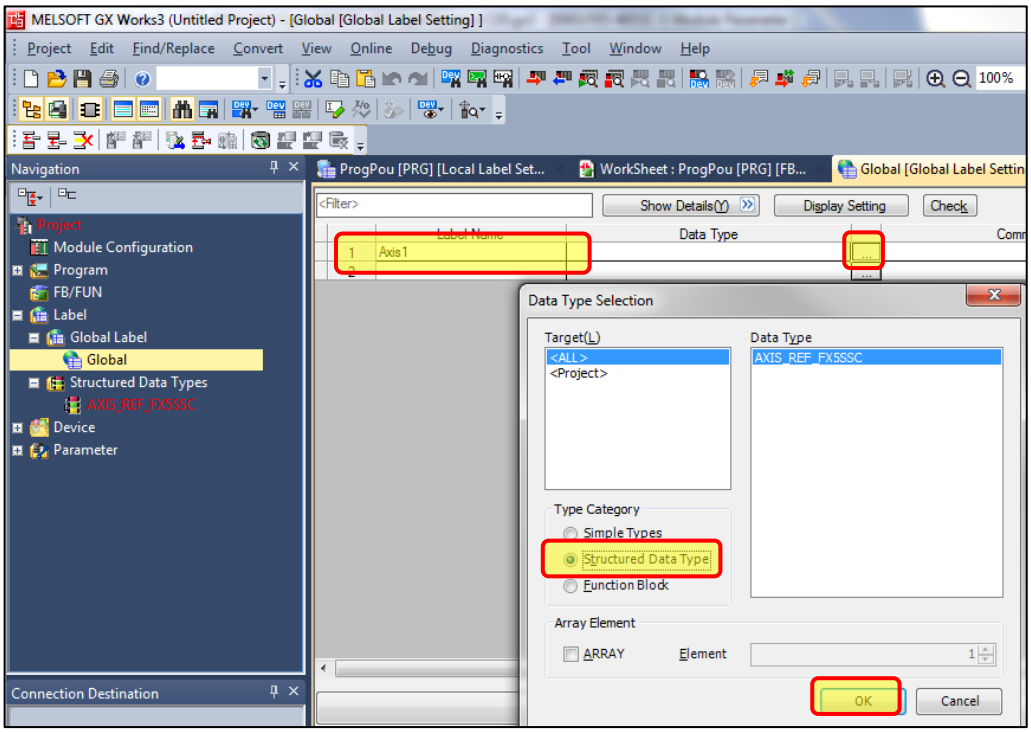
Name	Type	Description	Details
AxisNo	Word	Servo Axis number	Must be a range within 1-4 or 1-8 (FX5-80SSC-S)
HeadAddress	Word	Specify the module	Module number

The following example is shown to bring the structured data type in the project and declare for link to module.

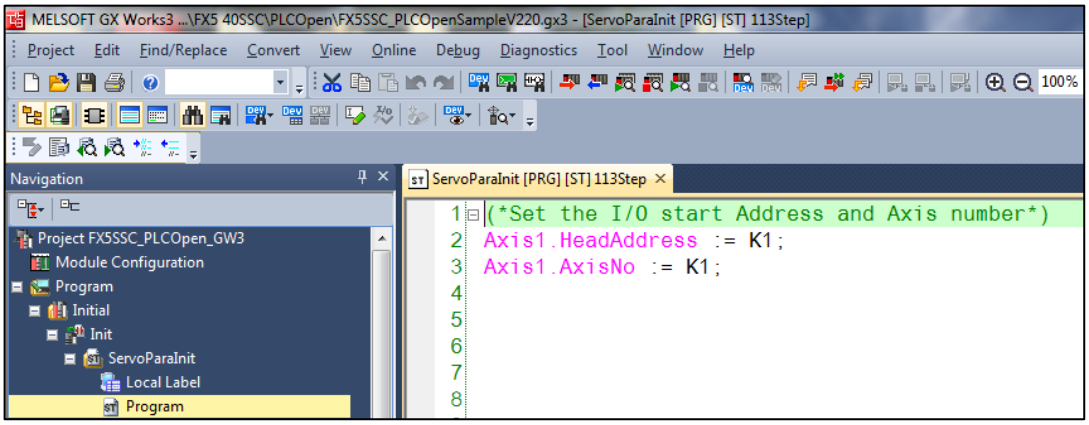
1) Drag and drop in your project a structure data [AXIS_REF_FX5SSC] from user library to the project under →Label→Structured Data Types



2) Then create an Axis name which is used in the function under Global label list and choose the data type [AXIS_REF_FX5SSC].



3) Now set axis number of servo amplifier and head address of the module to the structure label of [Axis1] at the first scan of the PLC. The example shows setting of the axis of servo in the Initial task.

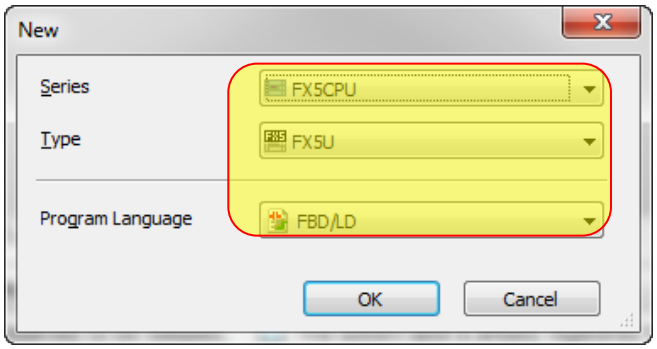


Chapter 3 Step by Step configuration and Programming examples for Jog

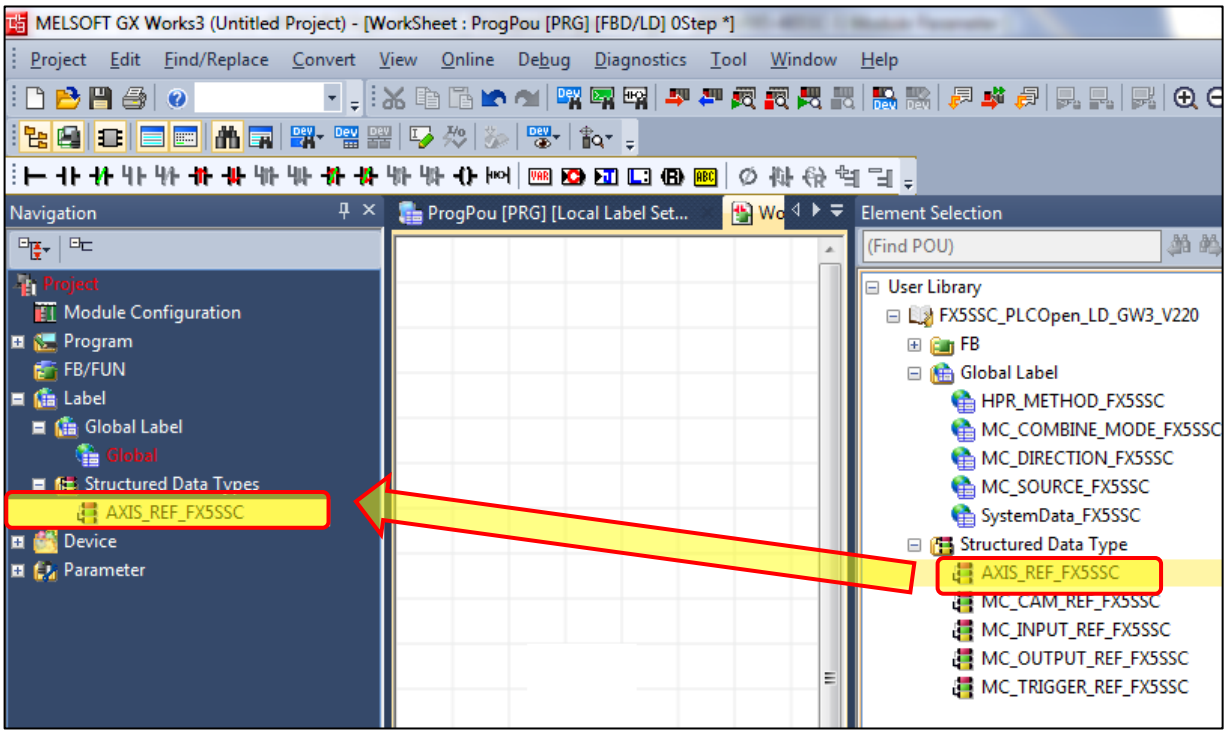
In this section shows the step by step procedure to create a sample program to perform a jog operation by using the PLCOpen Function block.

3.1 Create a sample program for JOG

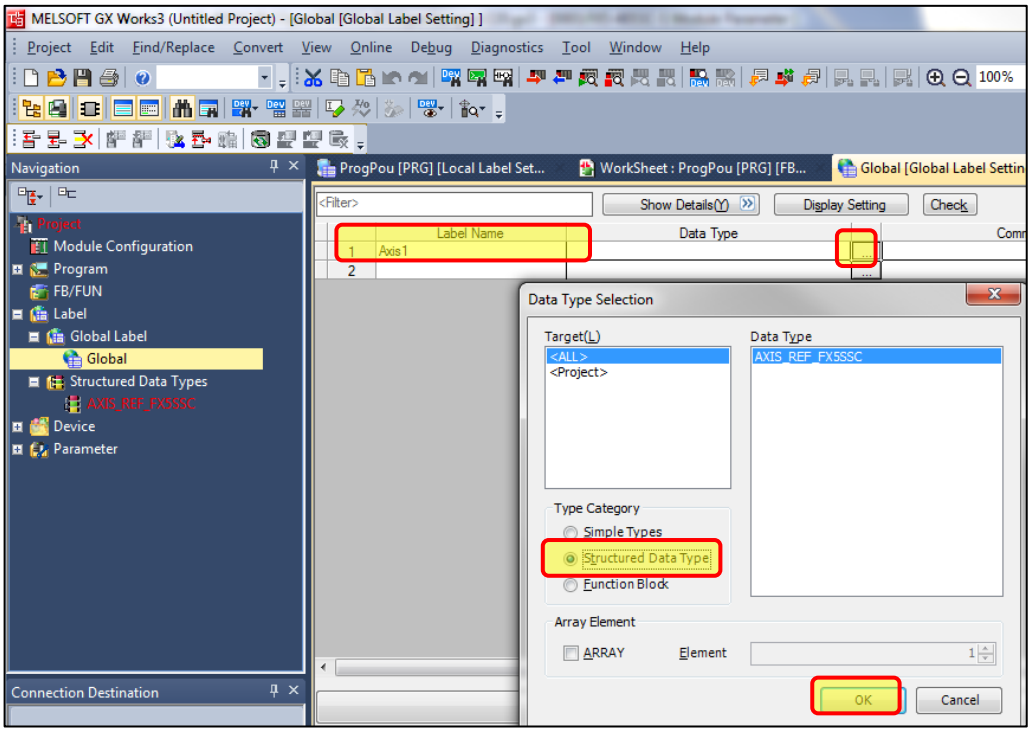
1) Create a new project with programming language selection [FBD/LD]



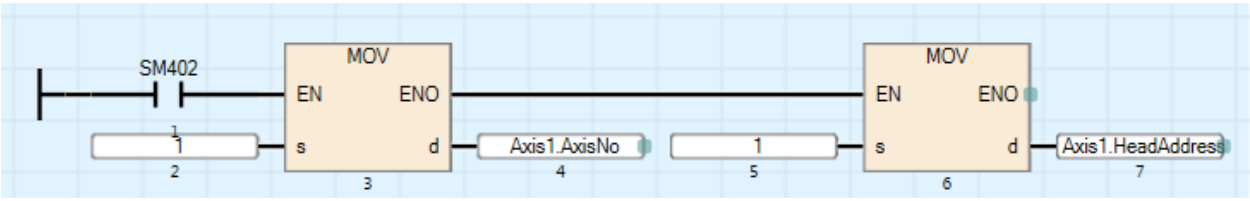
2) Drag and drop in your project a structure data [AXIS_REF_FX5SSC] from user library to under the project →Label→Structured Data Types



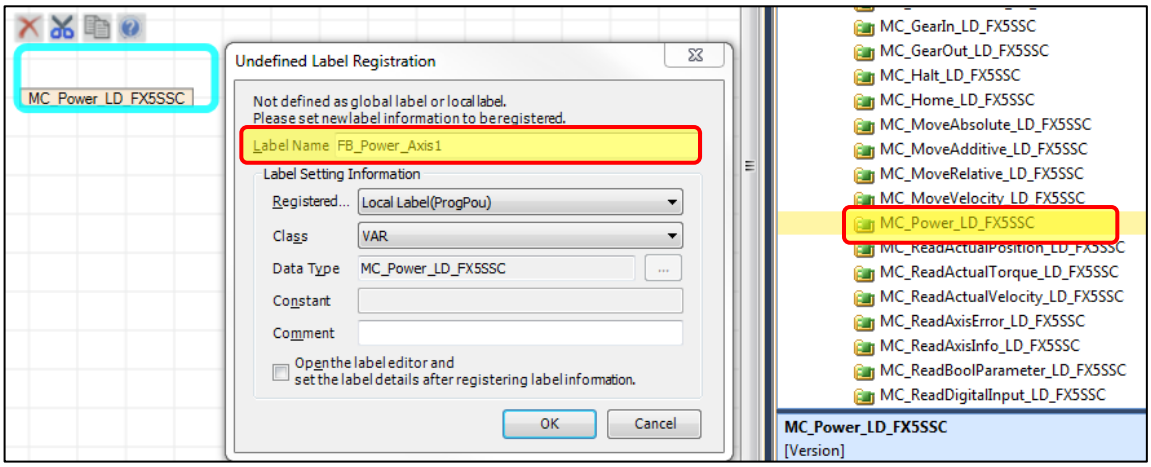
3) Create a Global label Name [Axis1] and choose the data type [AXIS_REF_FX5SSC].



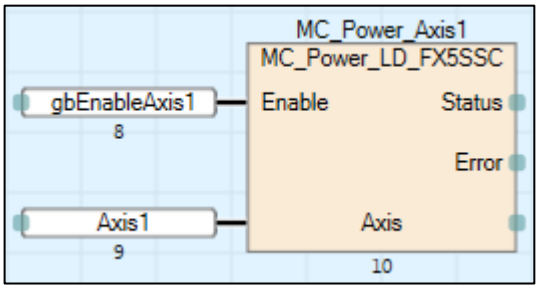
4) Initialize the element of axis1. In this example FX5-40SSC-S module is the first mounting position and axis1 is set the servo axis number 1.



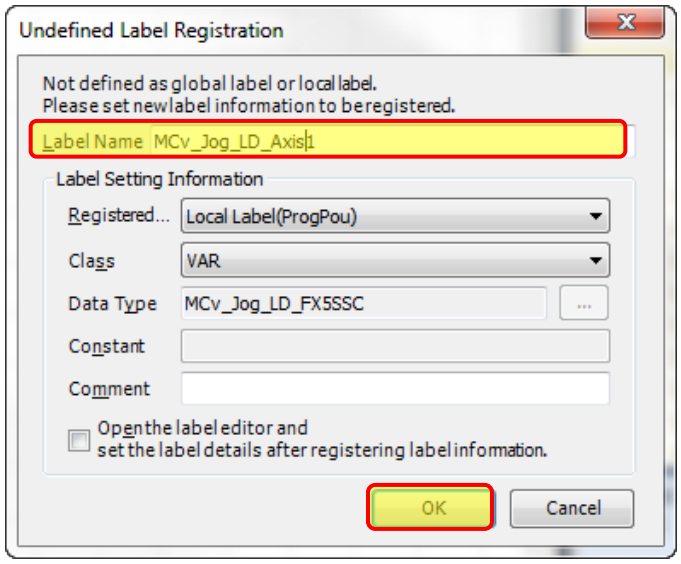
5) Drag and drop the [MC_Power_LD_FX5SSC] FBs into FBD editor and Enter the Function block Label name (Instance name) and click [OK]



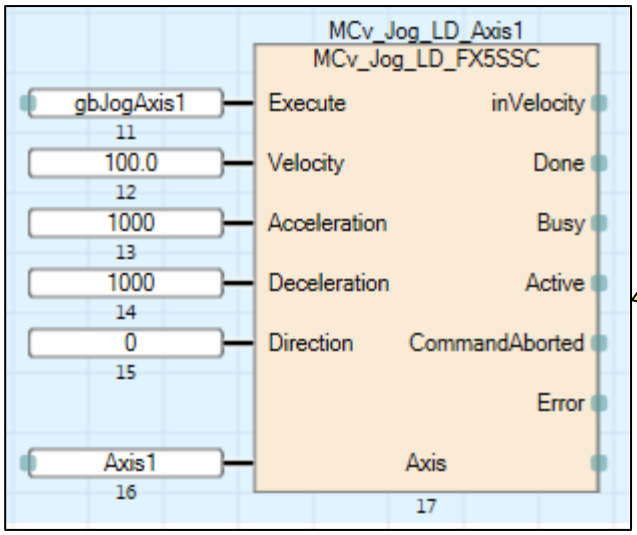
6) Then create a global variable [gbEnableAxis1] and Data type [Bit] for enabling the servo. See the screen shot for servo ON function blocks



7) Then Drag and drop the [MCv_Jog_LD_FX5SSC] FBs to FBD editor and Enter the Function block Label name (Instance name) and click [OK]



8) Then create a global variable [gbJogAxis1] and data type [Bit] for executing the servo Jog. See the screen shot for Jog Function blocks.

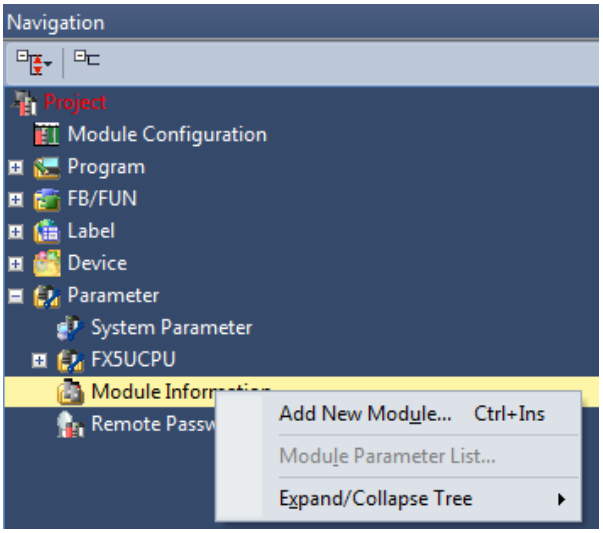


- Jog Speed set to 100.0 inches/min
- Acceleration set 1000 ms to reach the speed limit
- Deceleration set 1000 ms from speed limit to zero speed.
- Direction set to positive direction

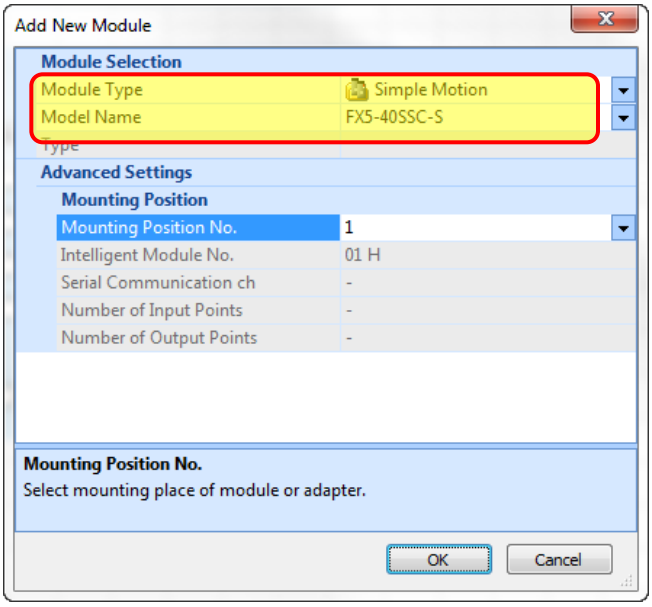
3.2 Add and configure FX5-40/80SSC-S simple motion module

In the section shows step by step procedure for FX5-40/80SSC-S simple motion Configuration

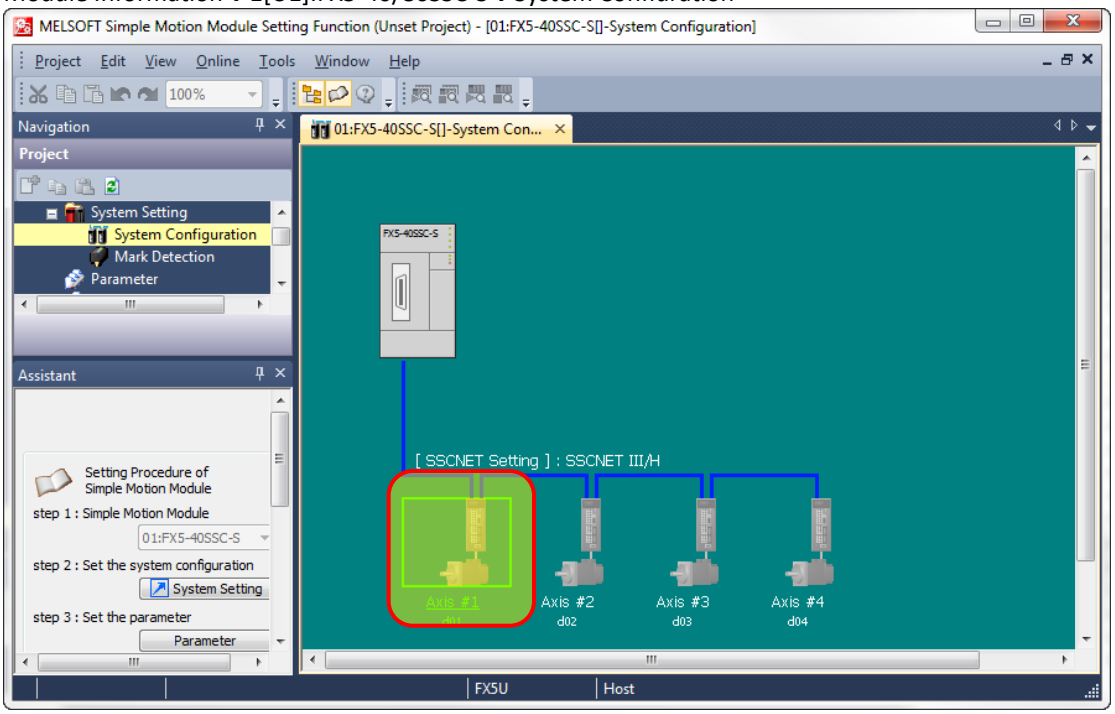
1) Add the FX5-40/80SSC-S simple module in the project by right clicking on the Module information from Navigation window→ Project→ Parameter→Module information→Add New Module



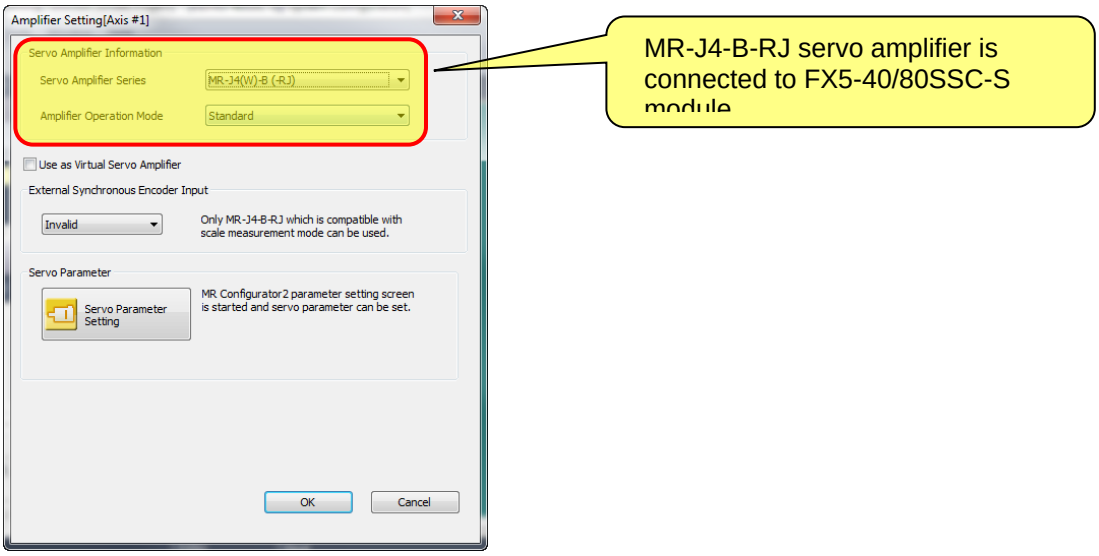
2) From [Add New Module] window choose Module Type Simple motion and click [OK] button.



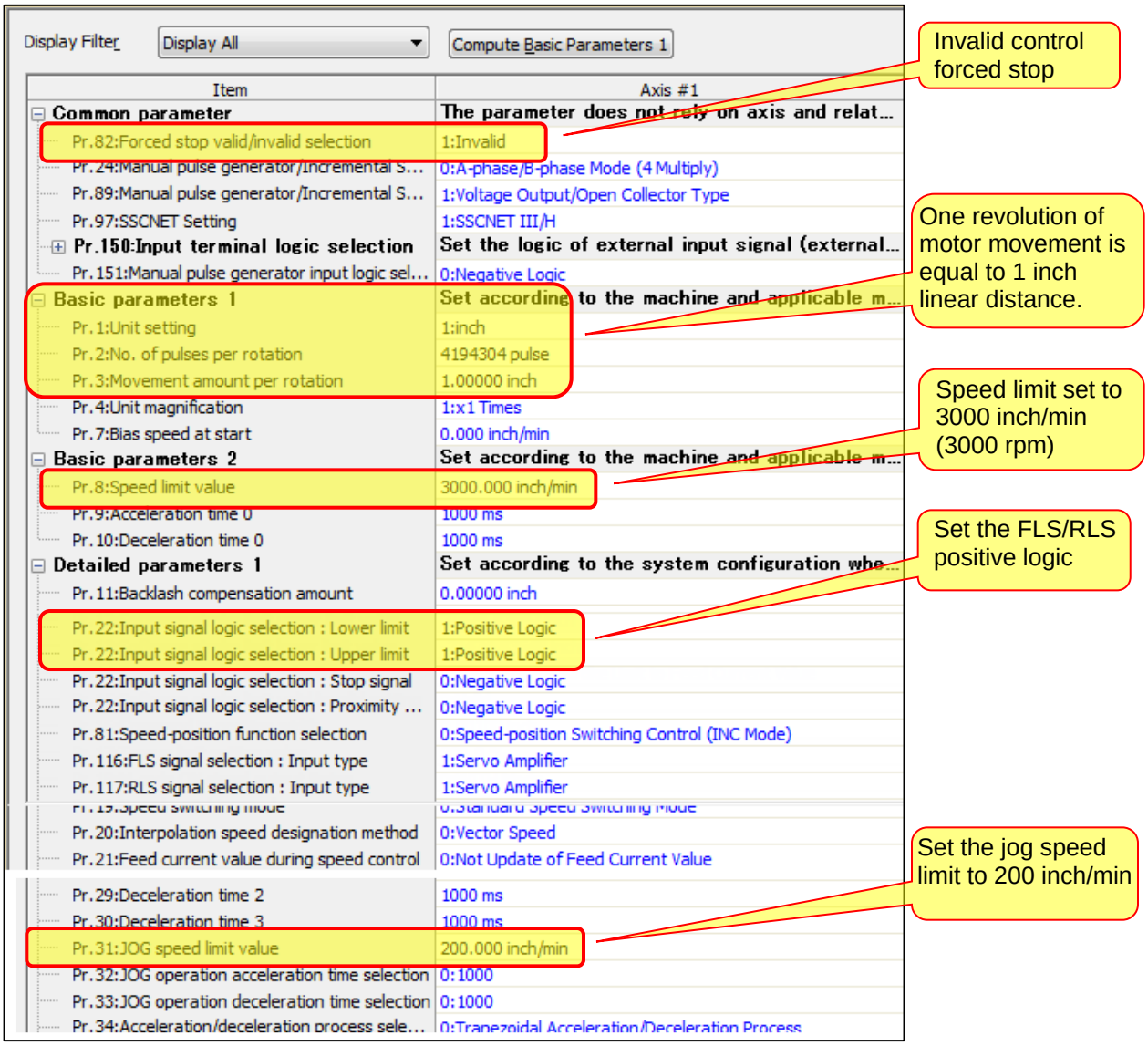
3) Double click On [**Simple motion Module Setting**] from Under Navigation window→ Project→ Parameter → Module Information→1[U1]:FX5-40/80SSC-S→System Confiuration



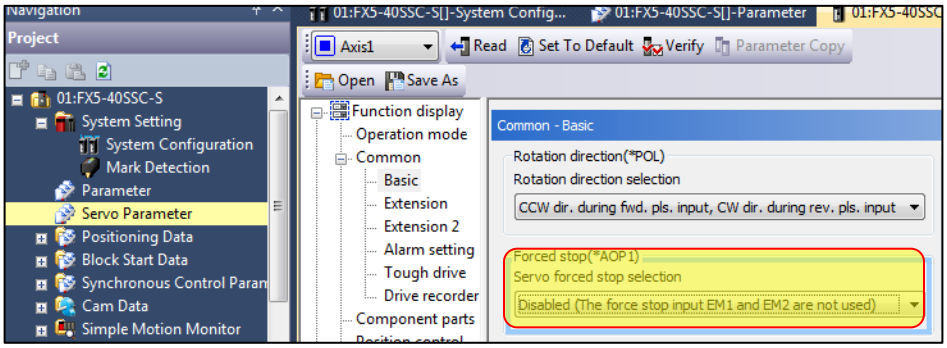
4) Double click Axis#1 and click OK button under System configuration and chose J4-B amplifier



5) Click on the Parameter tab and set following parameter.

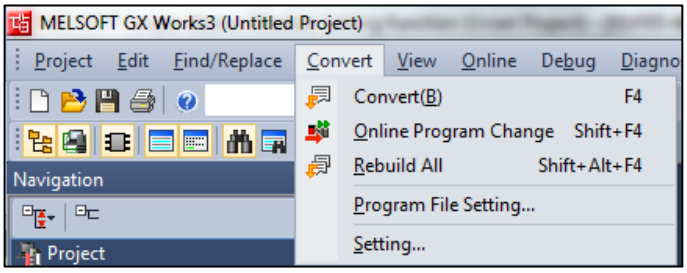


6) Click on the Servo Parameter and then disable the servo emergency input signal

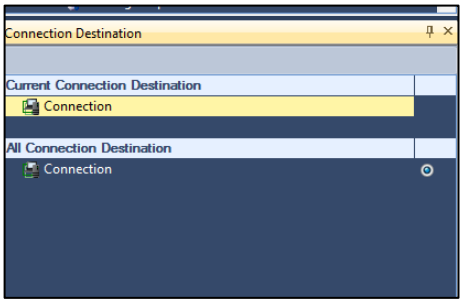


3.3 **Write the PLC program and simple motion module parameter**

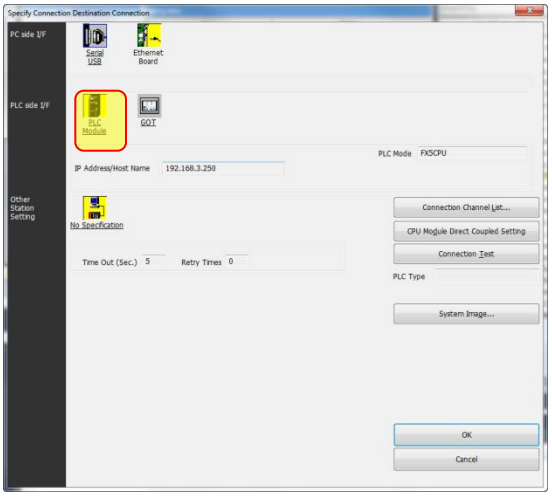
1) Rebuild the project from Convert→Rebuild All

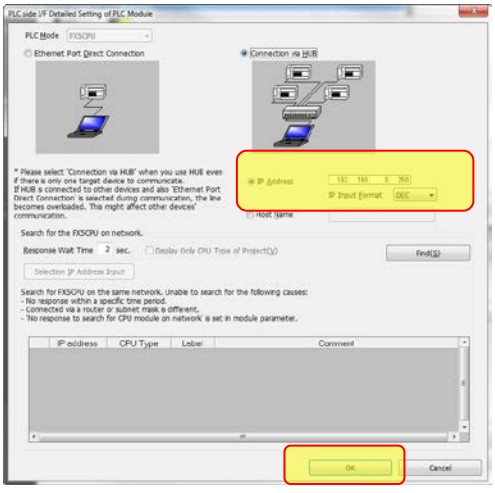


2) Double click the [Connection Destination] from Navigation window



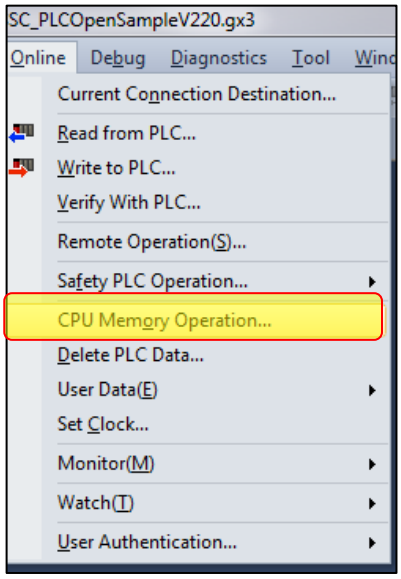
3) Click on PLC module and Set the IP Address[192.168.3.250]

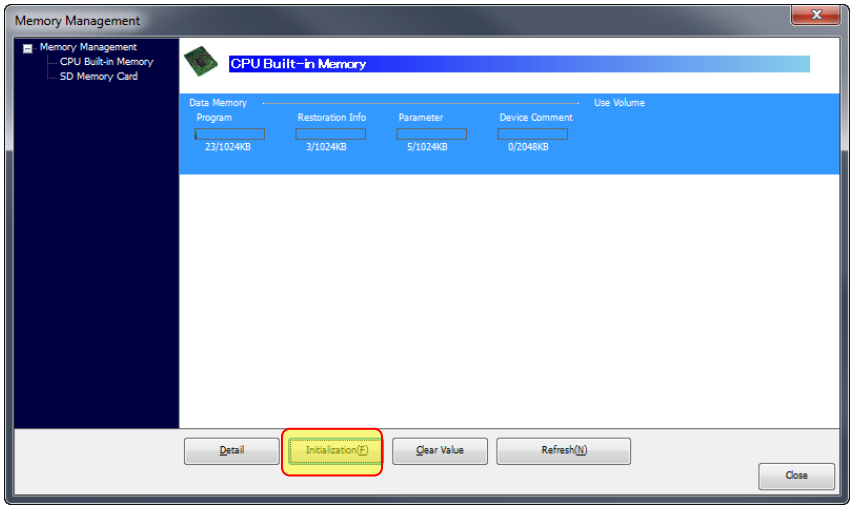




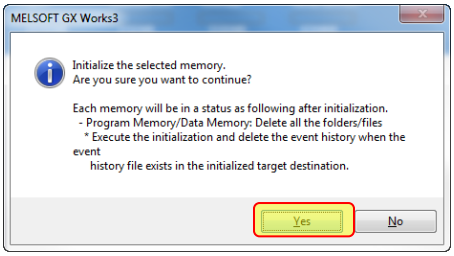
4) Put the PLC [RUN/STOP/RESET] switch to the STOP position

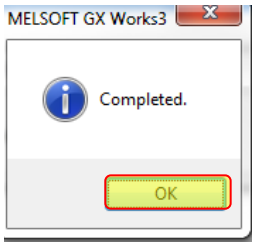
5) Then click Online →CPU Memory Operation





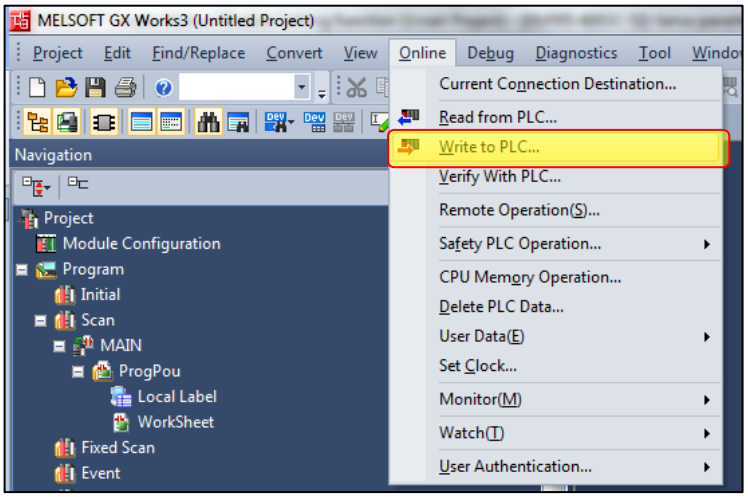
Then click Initialization and click [Yes] and after complete, close the Memory Management window.





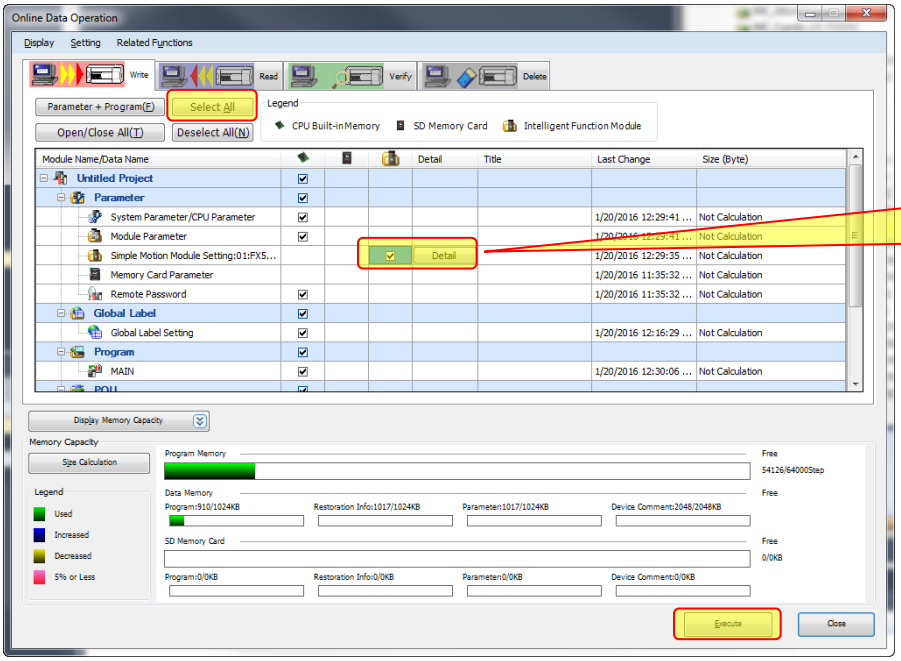
Note: This step is required to write the project file to PLC at the only first time.

6) Click Online → Write to PLC

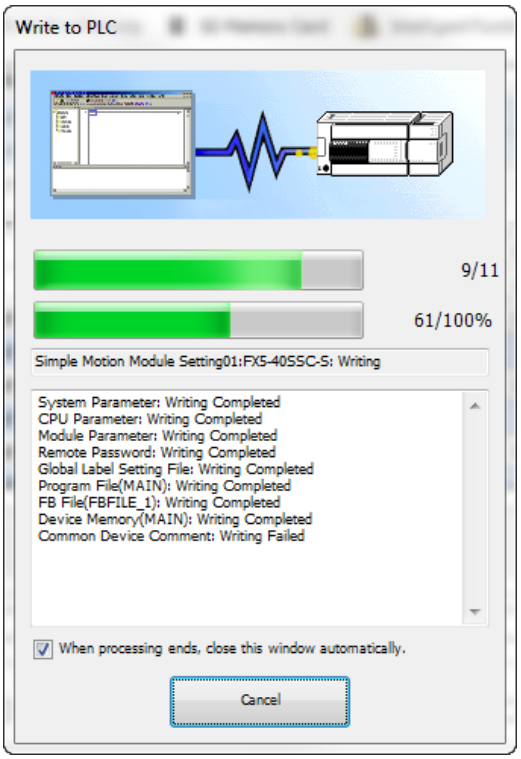


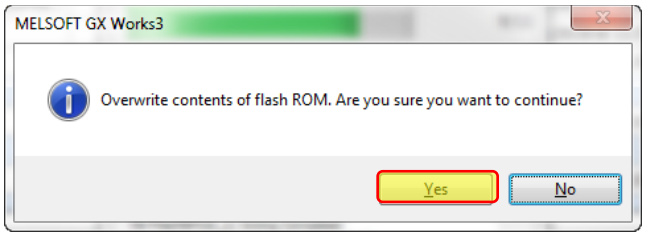
7) Then Click [Select All] tab and make sure simple motion Module setting check box is checked in the parameter.

Then click [Execute] button



[Select All] tab doesn't select the simple motion parameters. Make sure the box checked.





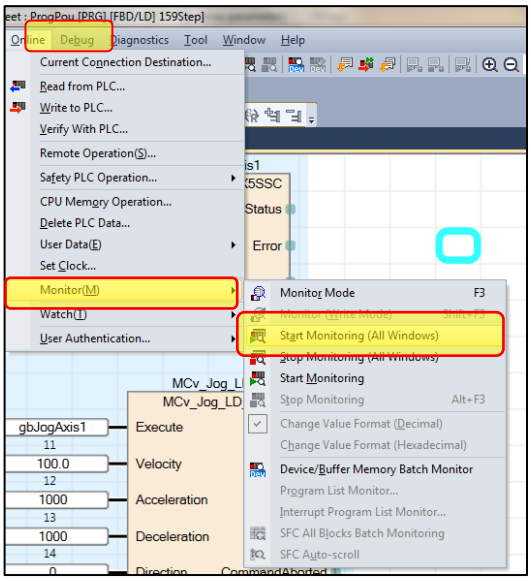
After completing the download the project, turn off the system power include servo amps and turn ON it again.

8) Bring the PLC [RUN/STOP/RESET] switch to the RUN position.

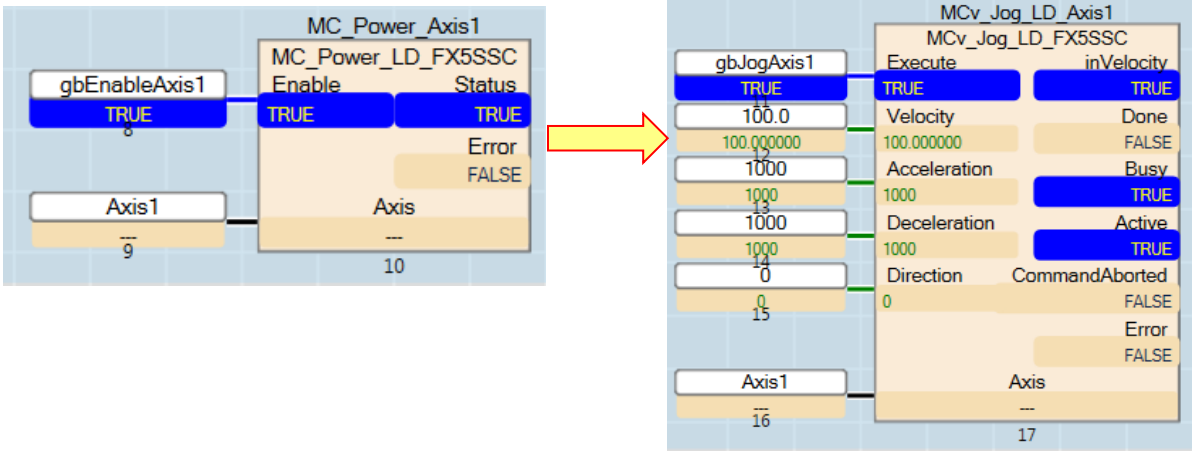
3.4 **Executing Jog Function**

1) Open the program Editor from Program→Scan→Main →ProgPou→WorkSheet

2) Then Start Monitor all Windows from Online→ Monitor→Start Monitor(All Windows)



3) Now Hold [Shift] key and then double click on [gbEnableAxis1] for enabling the servo. The status of MC_Power_LD_FX5SSC FBs should be true and servo should be enabled. If the status of MC-Power is true then Hold [Shift] key and then double click on [gbJogAxis1] for Start Jog function

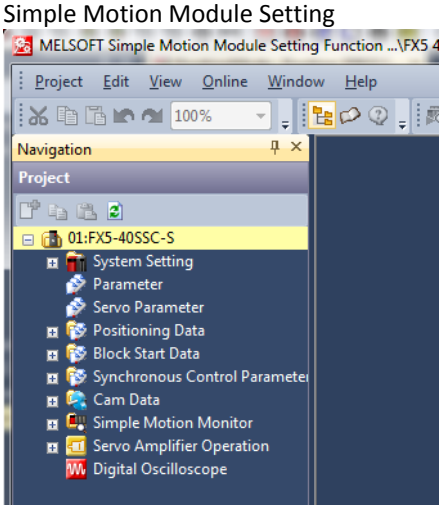


Chapter 4 Sample Programming with PLCOpen Function Blocks

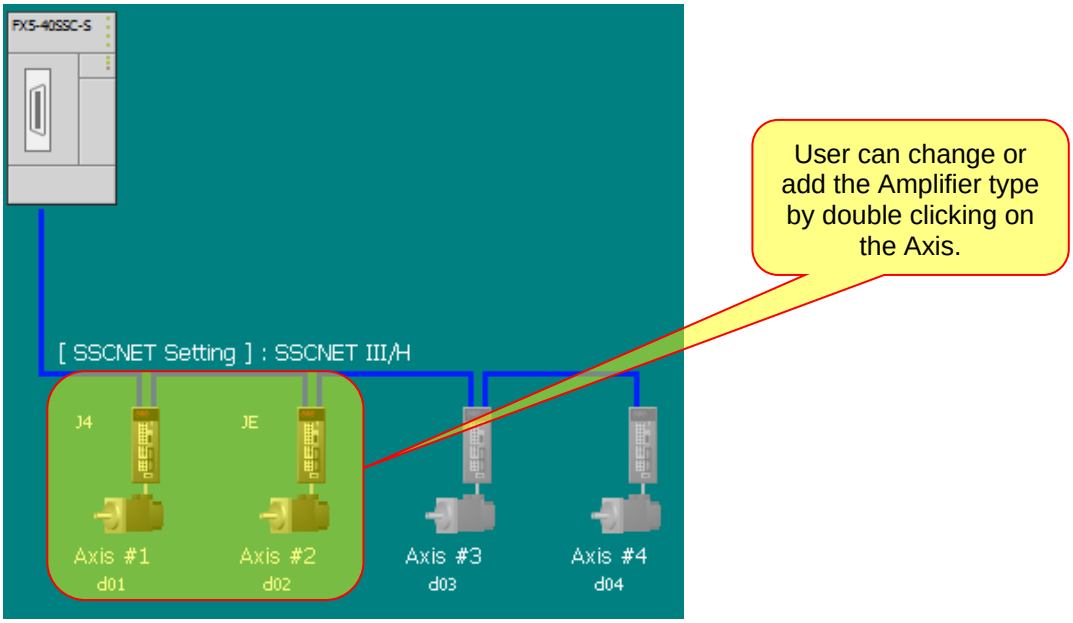
The sample program is provided with quick start guide along with GOT2000 project to execute basic motion by utilizing the PLCopen motion function block library. User can modify the project as their environment and use it. The following section shows some keys setting for this project.

4.1 Simple motion configuration file have configured the following item:

1) Open the Simple motion configuration file from Navigation Window→Parameter→Module Information→ Simple Motion Module Setting



2) System setting →One MR-J4-10B and MR-JE-B real servo amplifiers.



3) Common parameter: Pr.82 Forced stop setting invalid

Item	Axis #1	Axis #2
Common parameter	The parameter does not rely on axis and relate	to the whole system.
Pr.82:Forced stop valid/invalid selection	1:Invalid	
Pr.24:Manual pulse generator/Incremental Sync. ENC input selection	0:A-phase/B-phase Mode (4 Multiply)	
Pr.89:Manual pulse generator/Incremental Sync. ENC input type selection	1:Voltage Output/Open Collector Type	
Pr.97:SSCNET Setting	1:SSCNET III/H	

Axes are set one revolution of motor movement amount is equal to 1 inch linear distance. Axis1 is MR-J4 and Axis is MR-JE

4) Basic parameters 1 & 2:

Basic parameters 1	Set according to the machine and applicable motor when system is started up (It will be v...	
Pr.1:Unit setting	1:inch	1:inch
Pr.2:No. of pulses per rotation	4194304 pulse	131072 pulse
Pr.3:Movement amount per rotation	1.00000 inch	1.00000 inch
Pr.4:Unit magnification	1:x1 Times	1:x1 Times
Pr.7:Bias speed at start	0.000 inch/min	0.000 inch/min
Basic parameters 2	Set according to the machine and applicable motor when system is started up.	
Pr.8:Speed limit value	6000.000 inch/min	6000.000 inch/min
Pr.9:Acceleration time 0	2000 ms	2000 ms
Pr.10:Deceleration time 0	2000 ms	2000 ms

5) Detailed Parameters 1 setting:

Detailed parameters 1	Set according to the system configuration when...	
Pr.11:Backlash compensation amount	0.00000 inch	0.00000 inch
Pr.12:Software stroke limit upper limit value	0.00000 inch	0.00000 inch
Pr.13:Software stroke limit lower limit value	0.00000 inch	0.00000 inch
Pr.14:Software stroke limit selection	0:Set Software Stroke Limit to Feed Current Value	0:Set Software Stroke Limit to Feed Current V...
Pr.15:Software stroke limit valid/invalid setting	1:Invalid	1:Invalid
Pr.16:Command in-position width	0.00100 inch	0.00100 inch
Pr.17:Torque limit setting value	300.0 %	300.0 %
Pr.18:M-code ON signal output timing	0:WITH Mode	0:WITH Mode
Pr.19:Speed switching mode	0:Standard Speed Switching Mode	0:Standard Speed Swit...
Pr.20:Interpolation speed designation method	0:Vector Speed	0:Vector Speed
Pr.21:Feed current value during speed control	1:Update of Feed Current Value	1:Update of Feed Current Value
Pr.22:Input signal logic selection : Lower limit	1:Positive Logic	1:Positive Logic
Pr.22:Input signal logic selection : Upper limit	1:Positive Logic	1:Positive Logic
Pr.22:Input signal logic selection : Stop signal	0:Negative Logic	0:Negative Logic
Pr.22:Input signal logic selection : Proximity dog signal	0:Negative Logic	0:Negative Logic
Pr.81:Speed-position function selection	0:Speed-position Switching Control (INC Mode)	0:Speed-position Switching Control (INC ...
Pr.116:FLS signal selection : Input type	1:Servo Amplifier	2:Buffer Memory
Pr.117:RLS signal selection : Input type	1:Servo Amplifier	2:Buffer Memory
Pr.118:DOG signal selection : Input type	1:Servo Amplifier	2:Buffer Memory
Pr.119:STOP signal selection : Input type	2:Buffer Memory	2:Buffer Memory

Set the positive logic if don't have FLS and RLS signal wired to drive

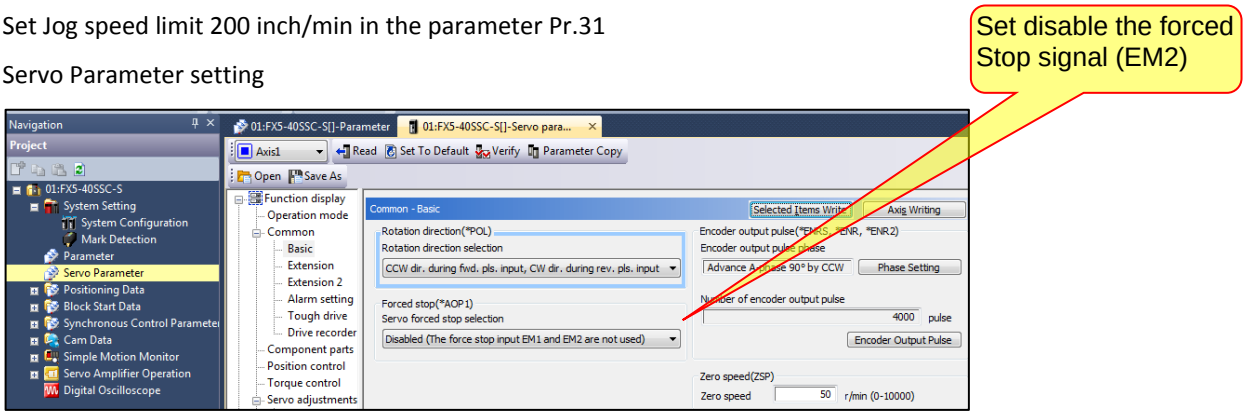
Only Buffer memory setting available for MR-JE

6) Homing return parameters

HPR basic parameters	Set the values required for carrying out HPR co...	
Pr.43:HPR method	6:Data Set Method	6:Data Set Method
Pr.44:HPR direction	0:Forward Direction (Address In...	0:Forward Direction (A...
Pr.45:HP address	0.00000 inch	0.00000 inch
Pr.46:HPR speed	50.000 inch/min	50.000 inch/min
Pr.47:Creep speed	0.001 inch/min	0.001 inch/min
Pr.48:HPR retry	0:Do Not Retry HPR with Limit S...	0:Do Not Retry HPR wit...

7) Set Jog speed limit 200 inch/min in the parameter Pr.31

8) Servo Parameter setting

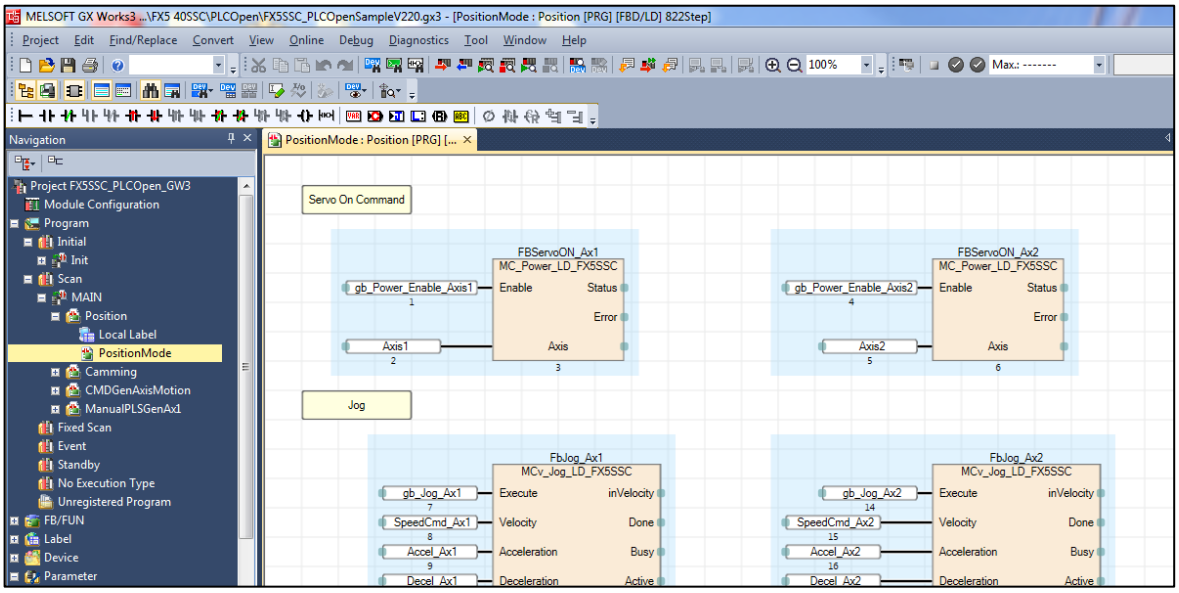


4.2 **Executing the sample program**

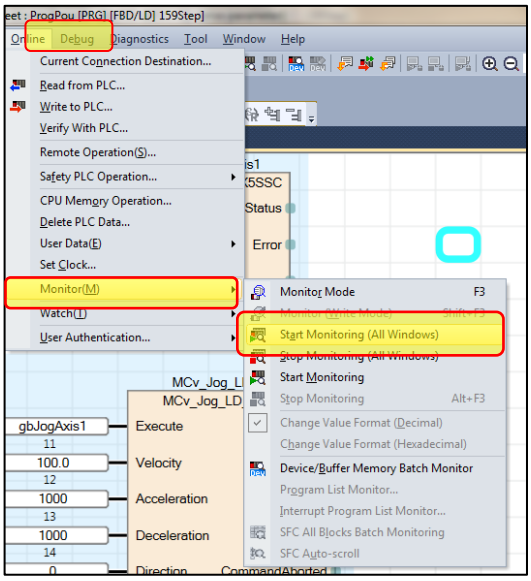
Lets download the project file to the controller. Assumed the FX5-40SSC-S and servo and GT27 are wired up properly. You may execute the turn ON /OFF the bit GX works3 monitoring mode or GOT screen.

The following step shows the procedure to execute the program.

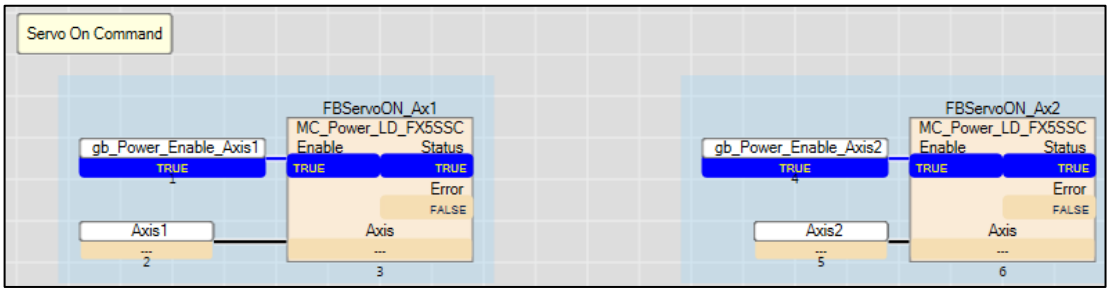
1) Open Program editor from Navigation Window →Program→Scan→Main→PositionMode



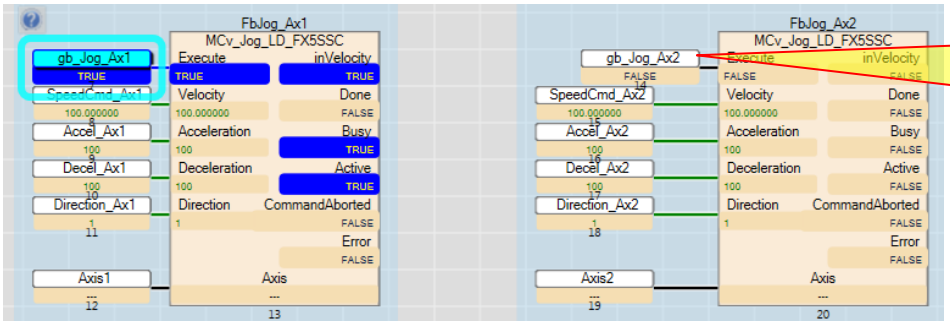
2) Then Start Monitor all Windows from Online→ Monitor→Start Monitor(All Windows)



3) For executing Servo On command ,Turn ON the [gb_Power_Enable_Axis1] by pressing Shift + double click on the Variable

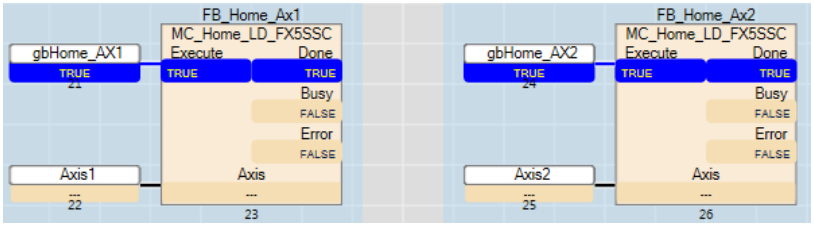


4) For executing jog command ,Turn ON the [gb_Jog_Ax1] by pressing Shift + double click on the Variable



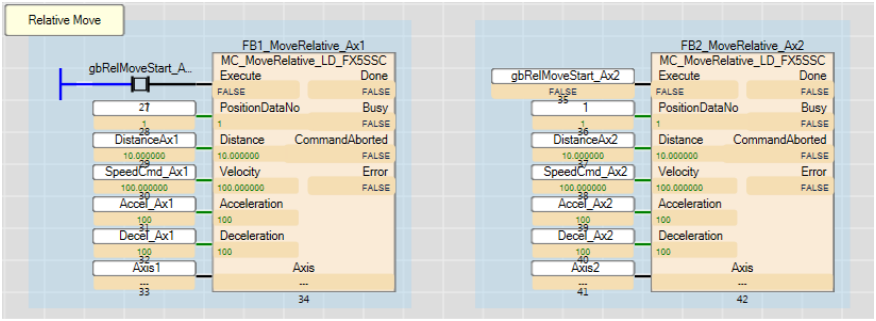
For jogging axis 2 pressing Shift + double click on gb_Jog_Ax1

5) For executing all axes Home routine, Turn On [bHOME_AX1]

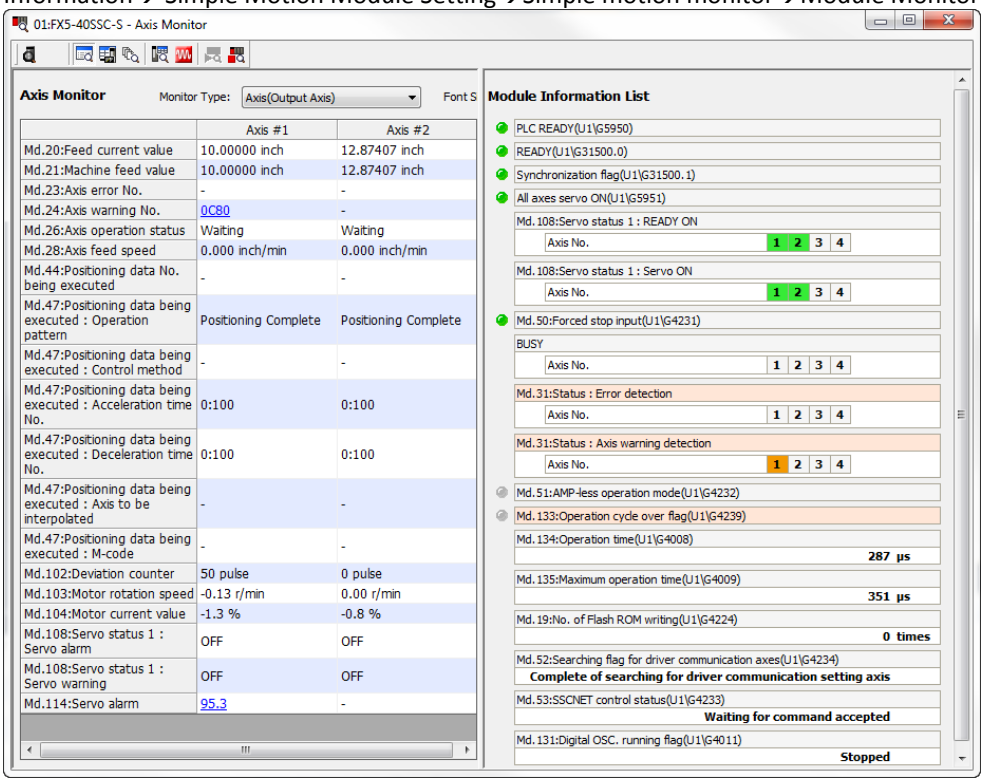


All servo axes will set the home position to Zero (user unit) according to Parameter setting

6) For below is shown the relative mode.



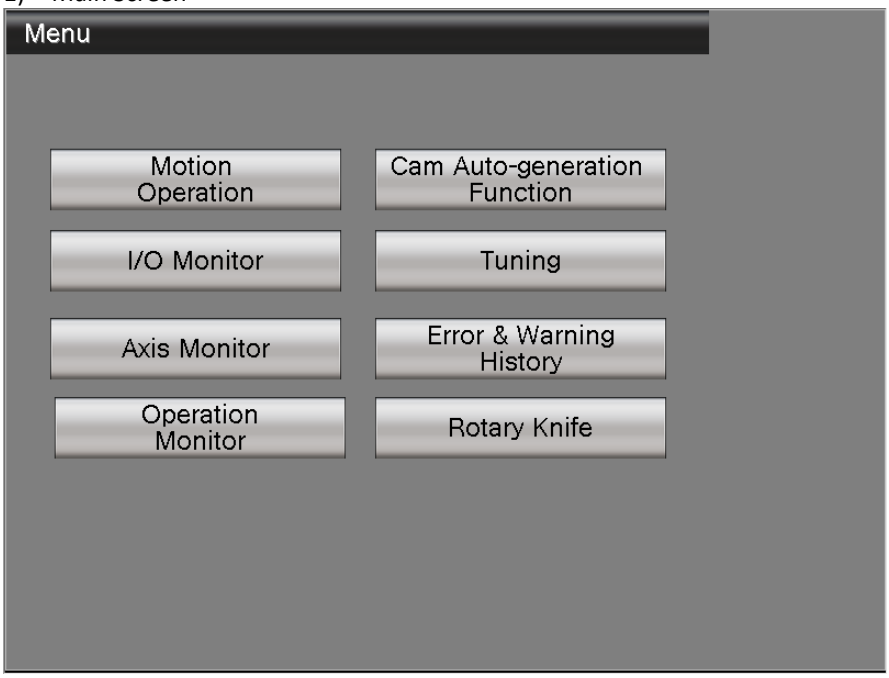
9) For monitoring the system status through the simple motion tools: Navigation Window→Parameter→Module Information→ Simple Motion Module Setting→Simple motion monitor→Module Monitor→ Axis Monitor.



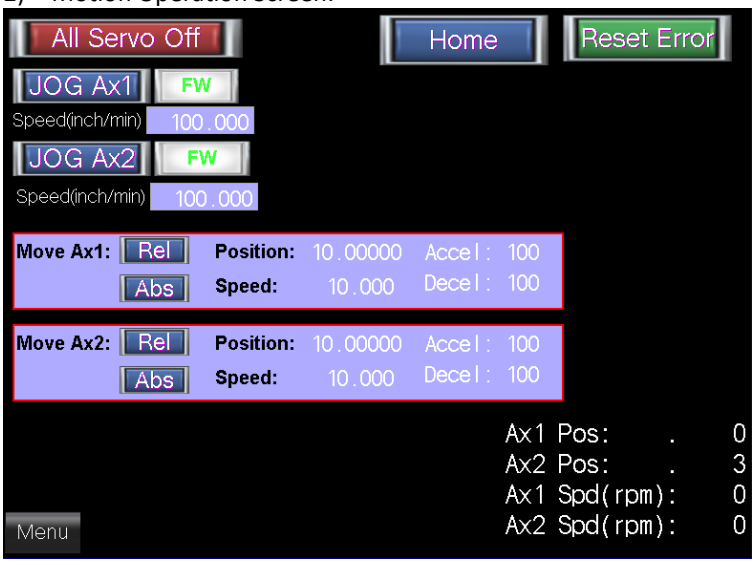
4.3 GOT project

A GOT project is included along this QSG for GT2710-STBA series. User may utilize the project to start up their application. Please find couple of the screen below:

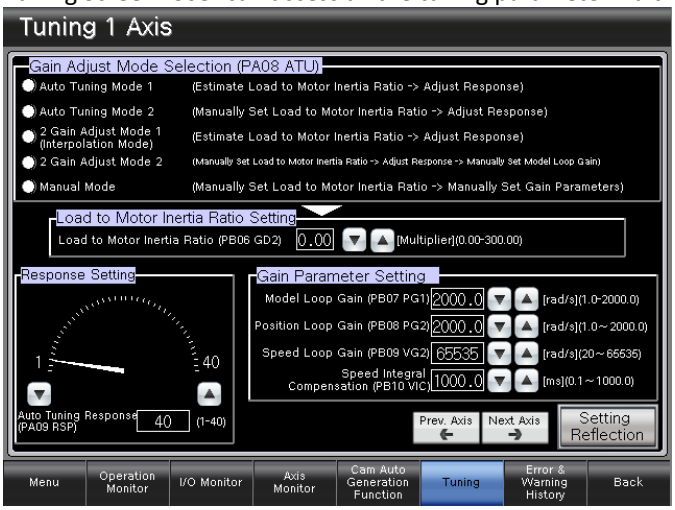
1) Main Screen



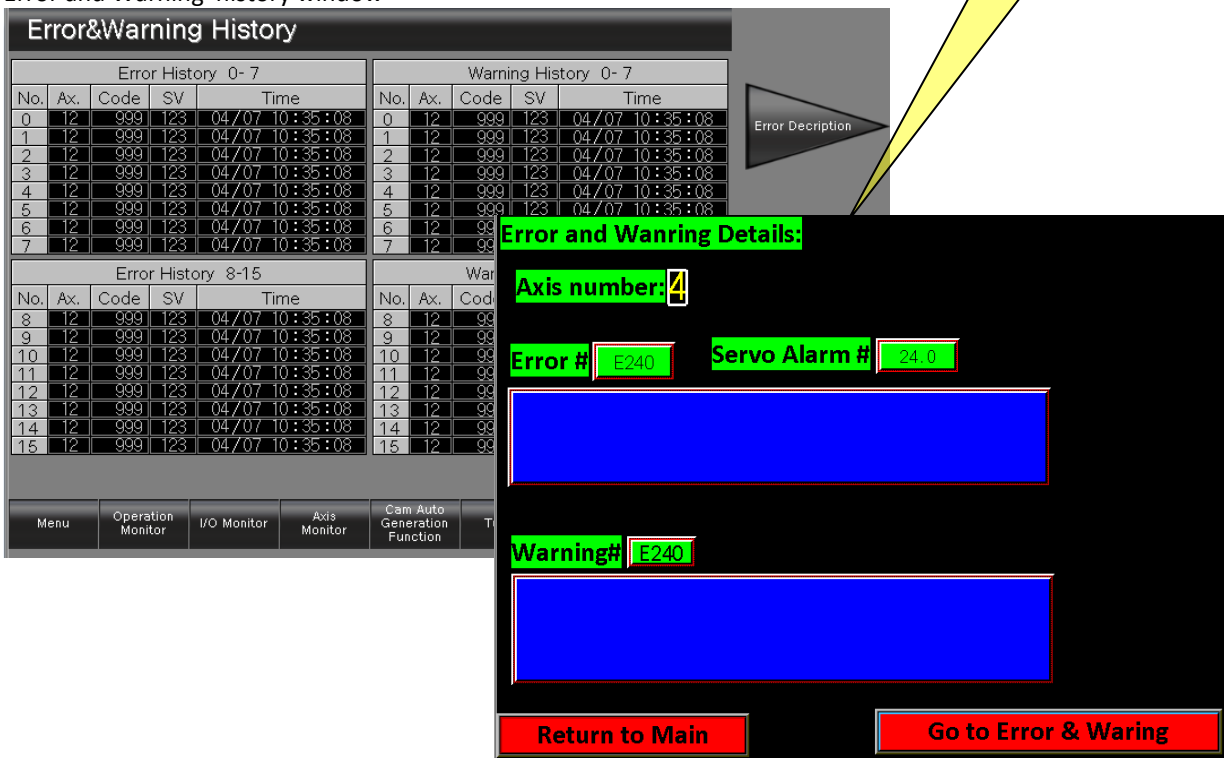
2) Motion Operation Screen:



3) Tuning Screen: User can access all the tuning parameter via the GOT screen.

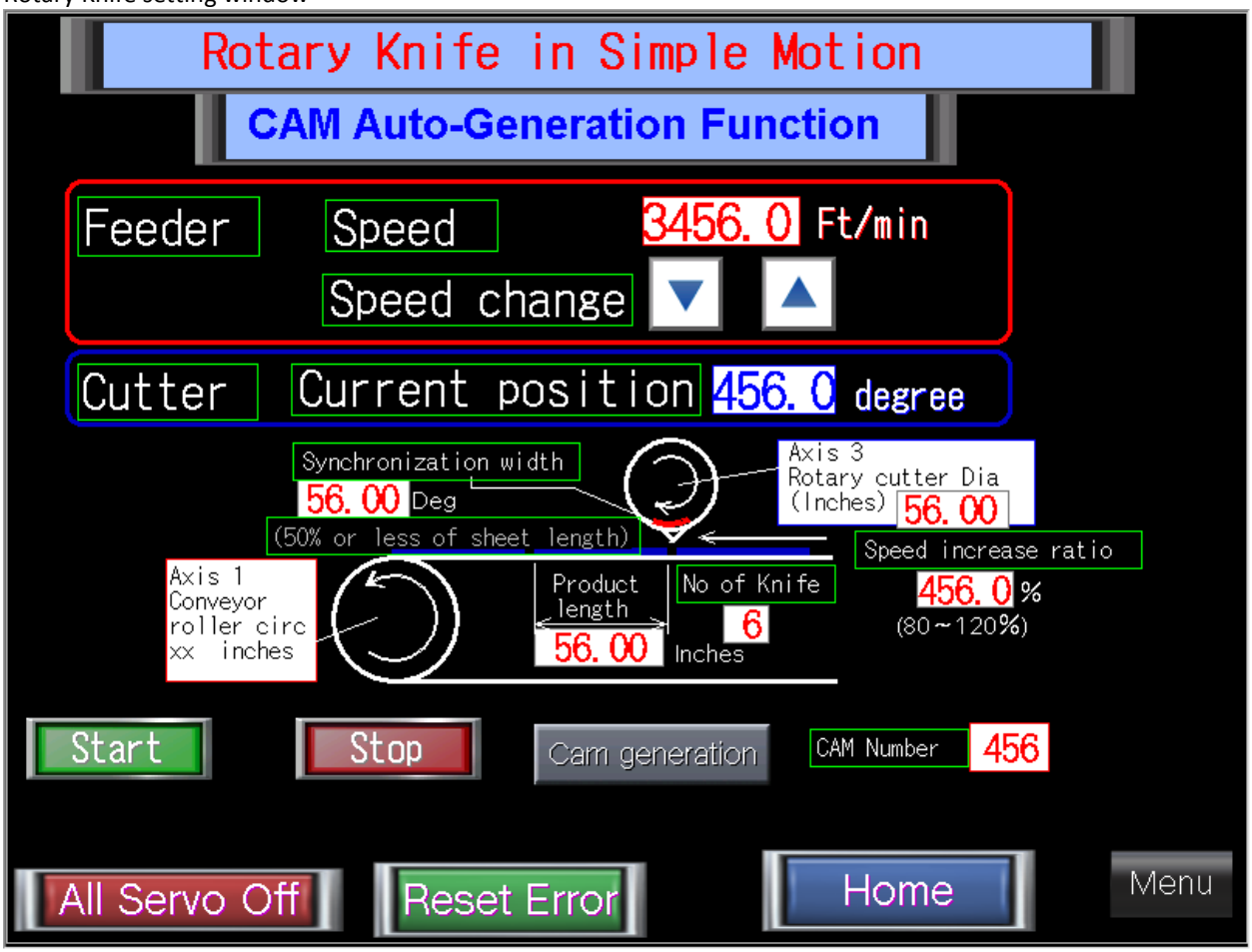


4) Error and Warning history window



User can monitor the description of error

5) Rotary Knife setting window

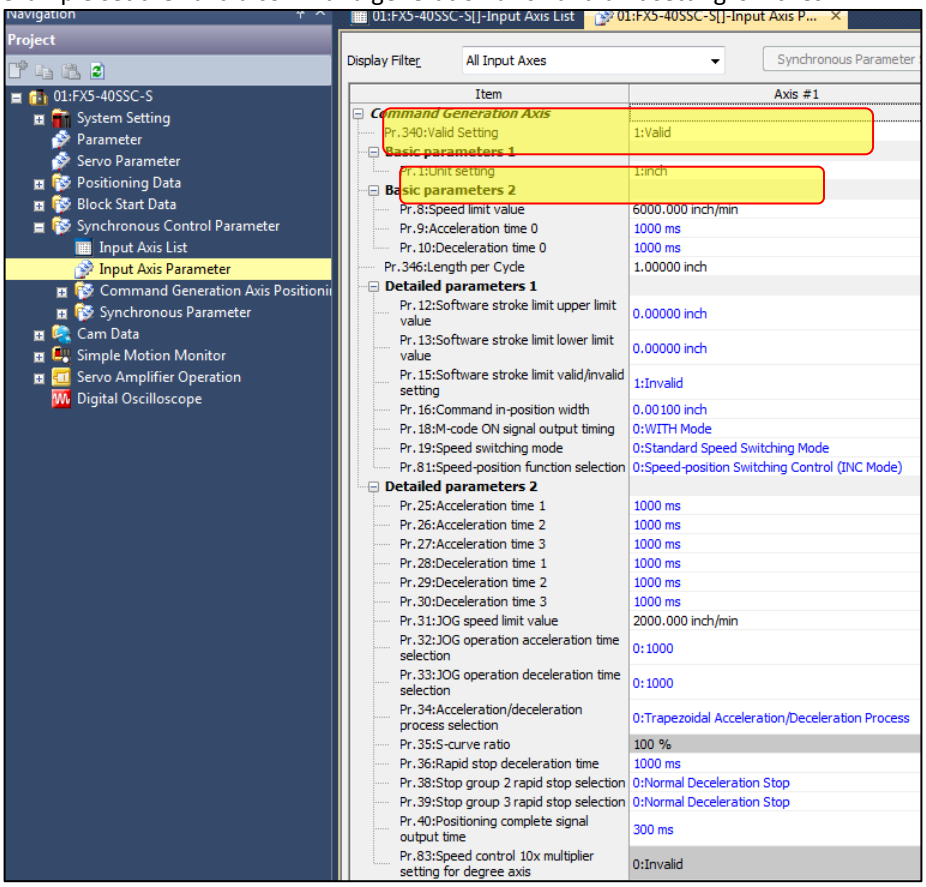


4.4 Command Generation Axis:

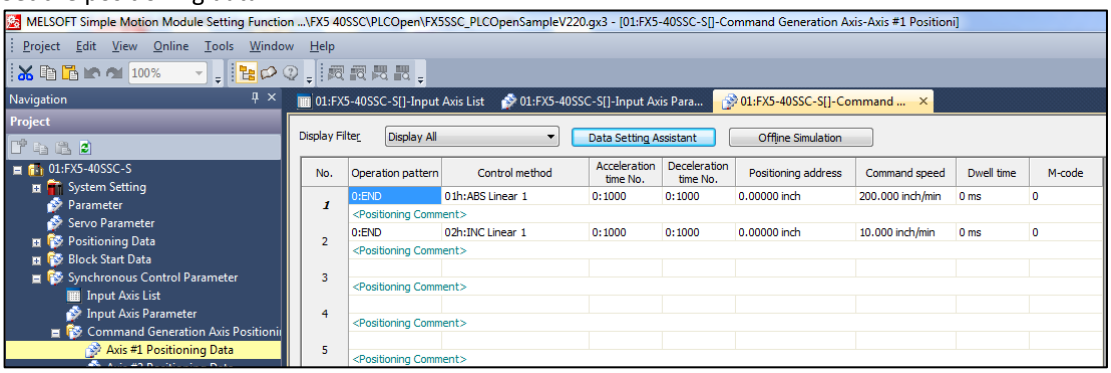
New FX5-40SSC-S module (manufactured September, 2015 or later) supports the command generation axes which can use in the synchronous control mode as master line shaft or auxiliary axis without utilizing a real axis. There is no function block for command generation axis to execute basic motion. In this sample program is included a program for command generation Axis.

4.4.1. Configuration of Command Generation

1) Open the simple motion tools from Navigation Window→Parameter→Module Information→ Simple Motion Module Setting and then Synchronous control parameter→Input Axis Parameter and set as below. In this example set the valid a command generation axis1 and unit setting is inches.



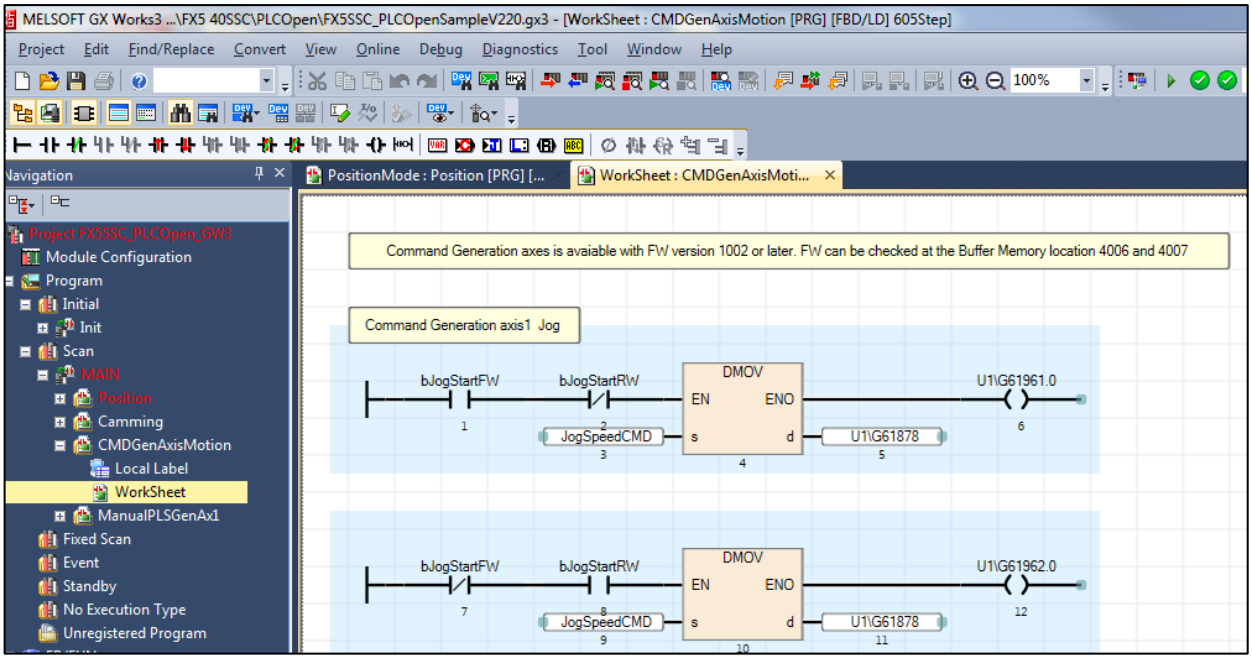
2) Set the positioning data



Note: there is no direct Buffer memory address to access this data. User can access the position data through the simple motion module setting tools or read/write command in the PLC program.

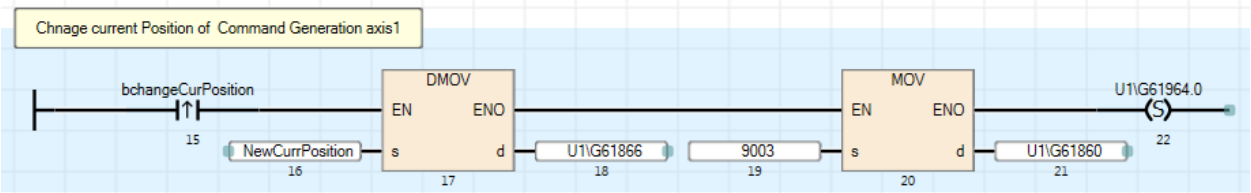
4.4.2. **Sample program for Command Generation axis:**

1) Open Program editor from Navigation Window →Program→Scan→Main→CMDGenAxisMotion→WorkSheet

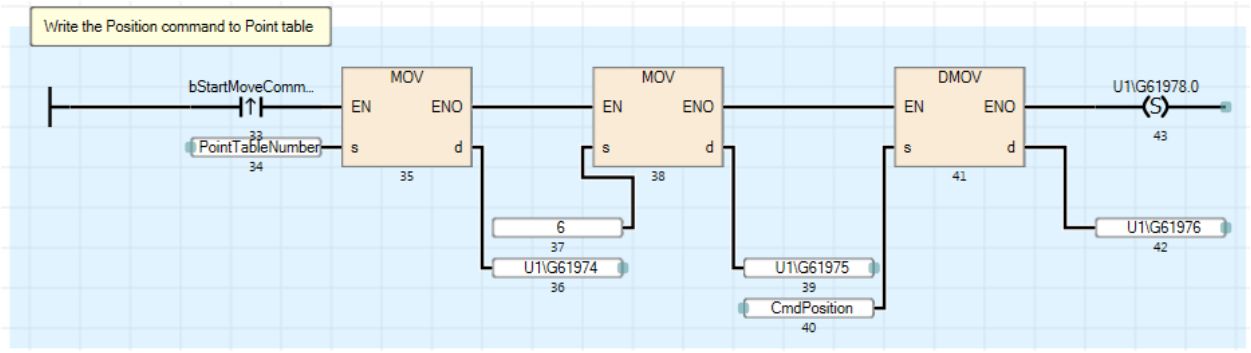


Above example shows a JOG forward and reverse movement for command generation axis1.

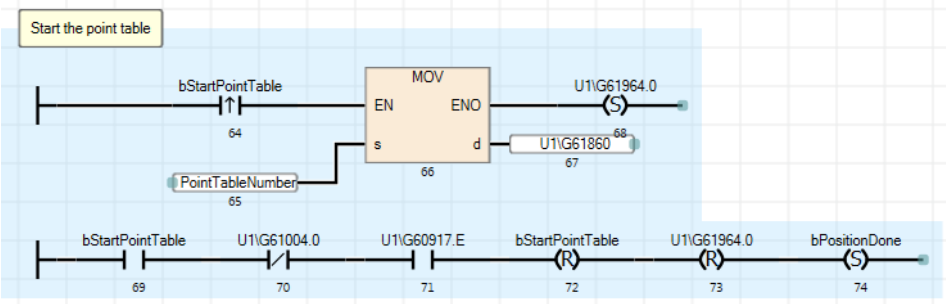
2) The example shows below for change the current position of Command generation axis 1



3) The example shows below for changing the Target position of the position table data table axis 1.



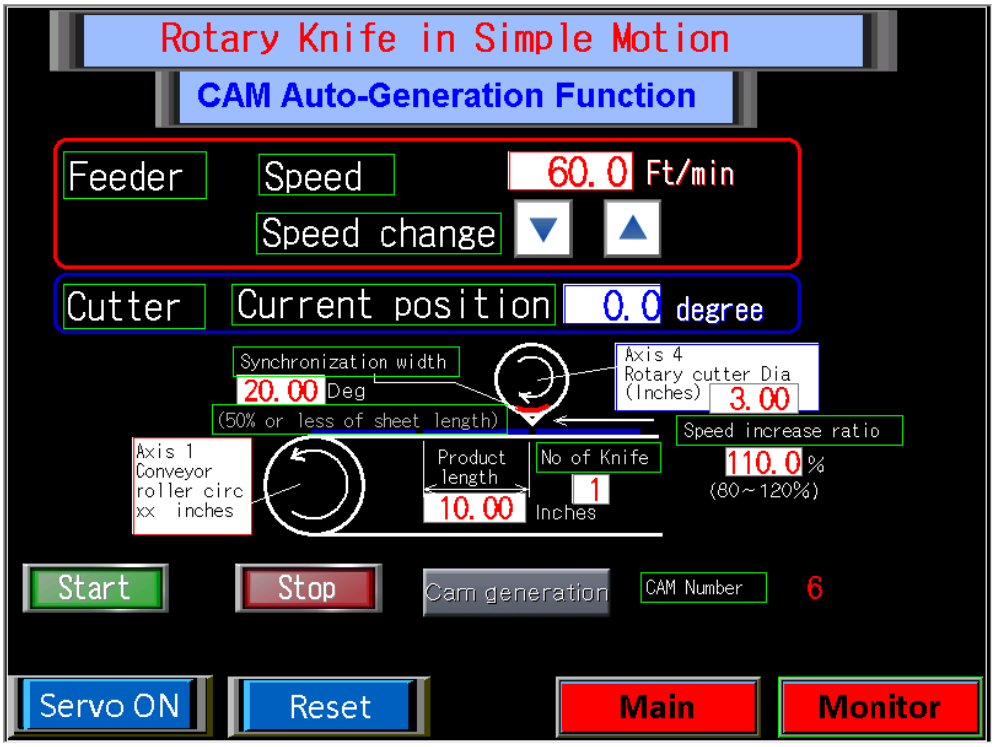
4) The example shows below for starting the position table data table axis 1 and completion the motion..



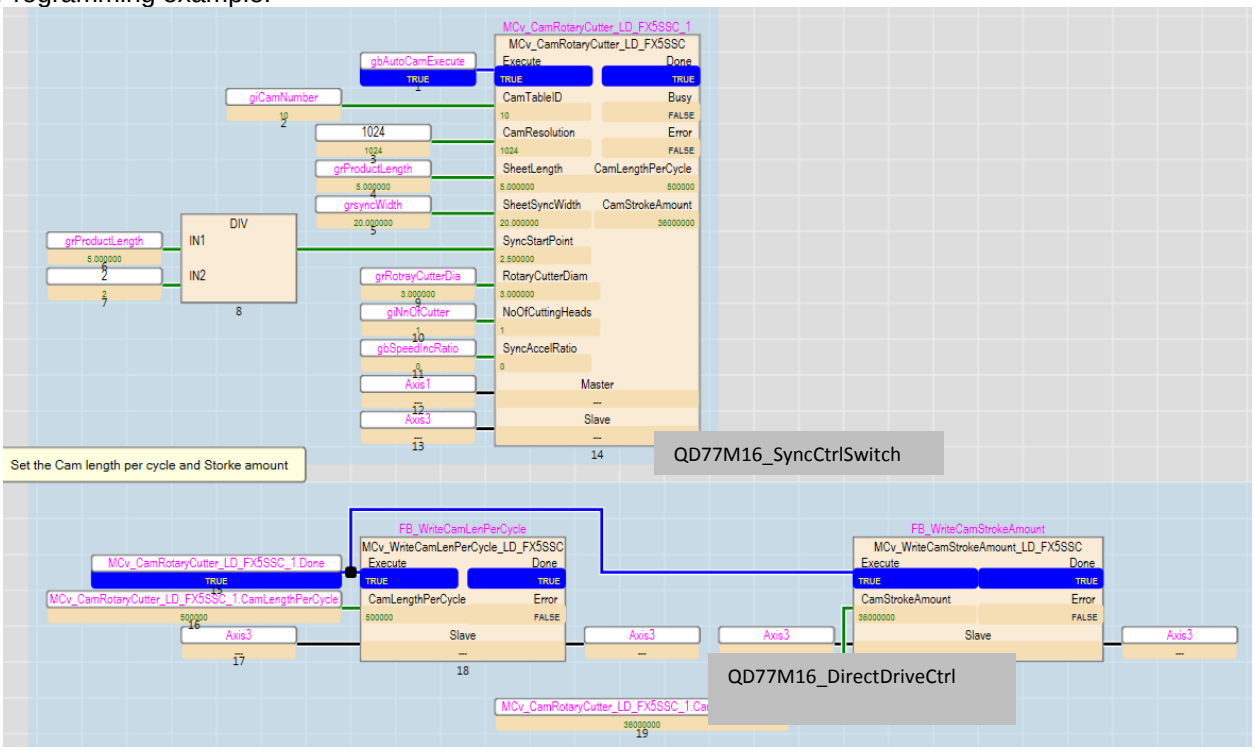
4.4.3. **Sample example of the rotary knife application:**

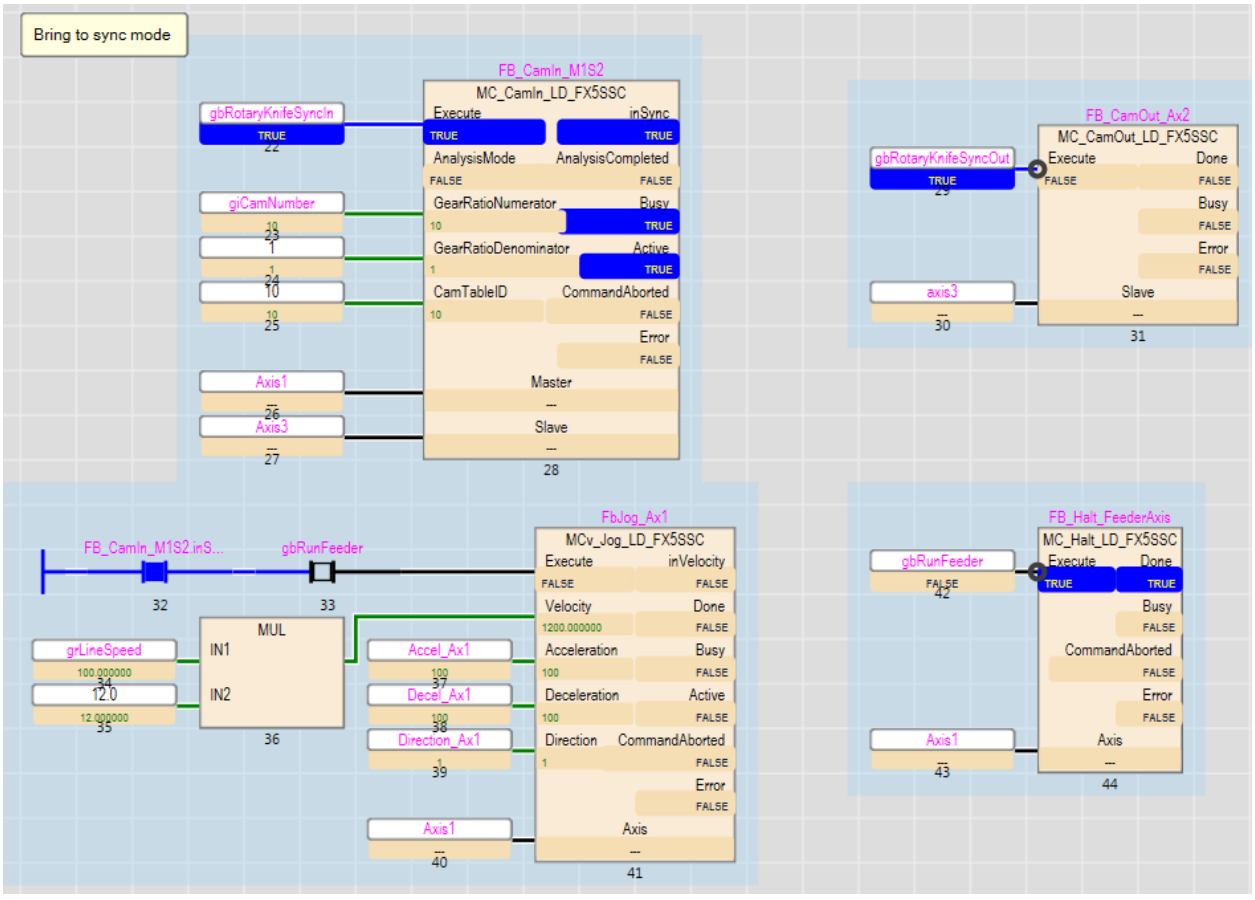
In this example consider the servo Axis1 is feeder axis with 2 inches diameter roller and the servo Axis 3 is rotary axis with 3 inches diameter include blade width. The user unit setting is inch and degree respect to feed and rotary axis. The basic parameters are set according to the mechanical information. The following HMI screen shows the rotary knife application setting for generates the cam profile and the synchronous control parameters.

HMI Screen:



Programming example:





Note: The above sample project files can be downloaded from
https://us.mitsubishielectric.com/fa/en/support/technical-support/knowledge-base/getdocument/?docid=3E26SJWH3ZZR-37-893

Executing example program:

1) Enter the inputs value of RotaryKnife function block on the HMI Screen.
2) Execute the RotaryKnifeFB by pushing CAM generation button on the HMI or turn ON the gbAutoCamExecute bit from the sample program
3) Push the Start button on the HMI screen or turn ON the bit gbRotaryKnifeSyncIn and gbRunFeeder in the from the sample program.

Revisions

1) Version 1.1 Issued Date: 02/09/2017