

MSE6-E2M-5000-FB36-AGD commissioning with ROCKWELL STUDIO5000 in ETHERNET/IP Network

This Application Note helps to integrate Allen-Bradly PLC with MSE6-E2M Energy Efficient Module through EtherNet-IP Network. Also Provide Detailed Description About Hardware & Software Configuration.

MSE6-E2M

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1 Introduction

This Application note will help you to integrate the Energy Efficient Module with Allen-Bradly CompactLogix PLC or Control Logix PLC over EtherNet-IP network. Also application note will provide step by step instruction for Control, Data Read, Data Write & Diagnostic Add-on Instructions of Energy Efficient Module. Add-On profile of Energy Efficient Module done with FMT .L5X export method.

1.1 Components/Software used

Type/Name	Version Software/Firmware	Date of manufacture
MSE6-E2M-5000-FB36-AGD	Nil	23/01/2019
CompactLogix PLC-L33ER	V31**	23/01/2019
Festo CPX-USB-Adapter - NEFC-M12G5-0.3-U1G5	V10.09	23/01/2019
USB Cable – 9300-USBCBL-ABHR2	Nil	23/01/2019
Ethernet Cable (NEBC-D12G4-ES-1-S-R3G4-ET)	Nil	23/01/2019
CPX FMT Tool	V4.21.203	23/01/2019
Festo Field Device Tool	V2.9.6.56066	23/01/2019
Rockwell Studio 5000	V31**	23/01/2019

** Please Refer Note

Table 1.1: 1 Hardware/Software Used

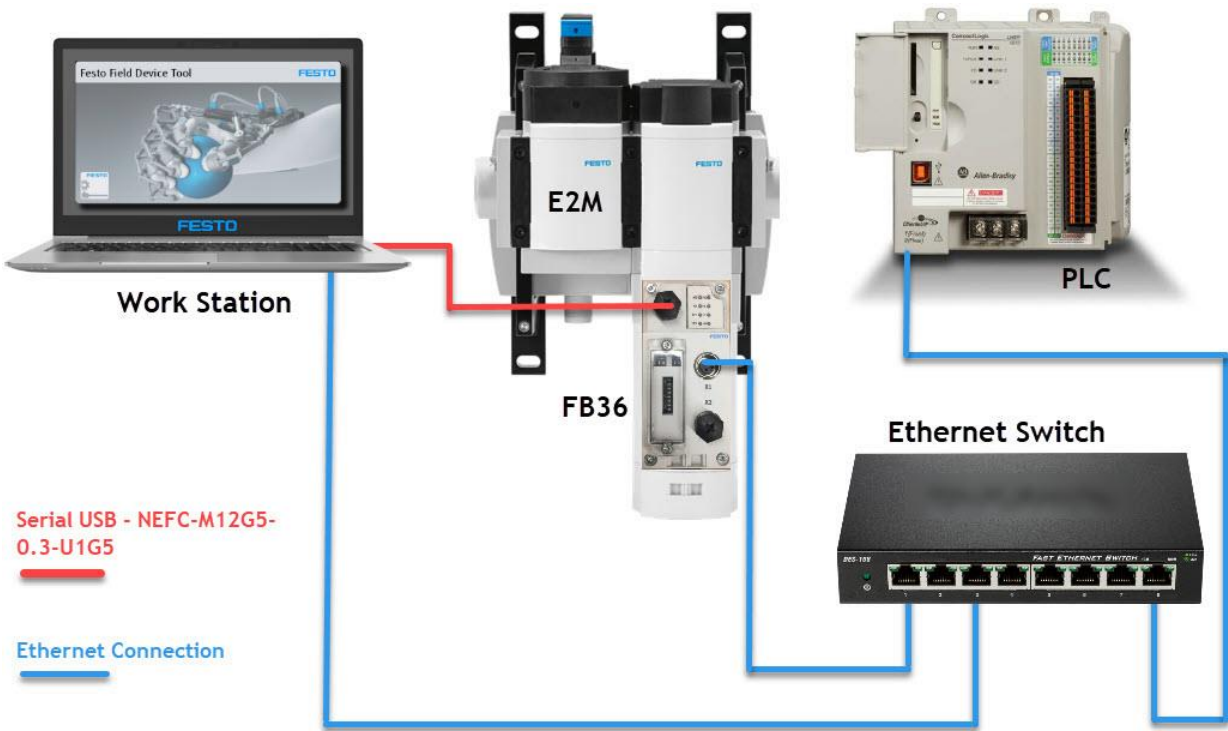
1.2 Basic Knowledge to Use This Application Note

User who are working with this application note mandatorily need basic knowledge about MSE6-E2M Module, Festo Software Tools & Allen-Bradly Software Tools.

1.3 Work Flow

- 1 - Introduction < (You are here now)
- 2 - Hardware configuration
- 3 - Software configuration
- 4 - PLC Programming

1.4 Communication Architecture



1.5 Energy Efficient Module Hardware Over View

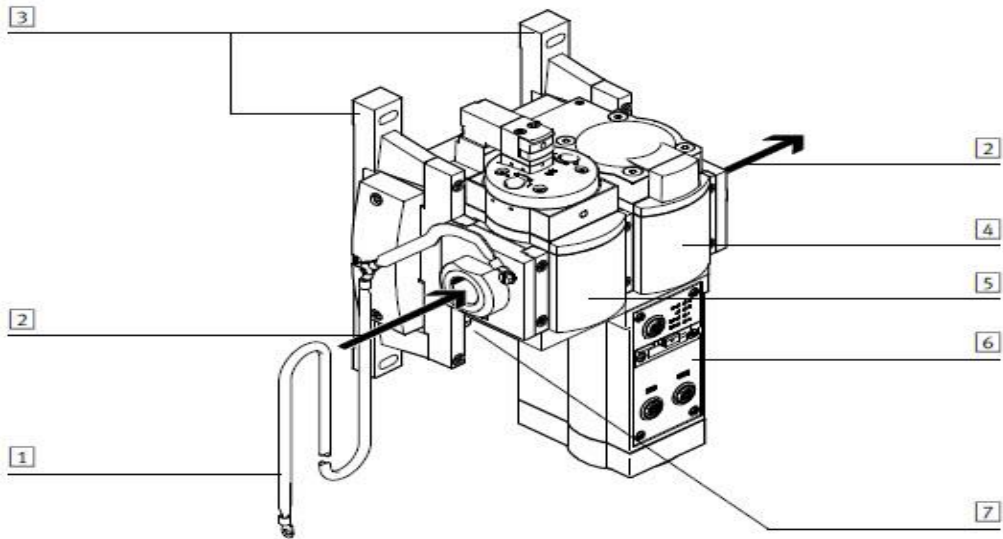


Fig. 2.1 Design (at the bus node as an example CPX-FB33)

MSE6-E2M		Brief description
1	Earth terminal	FE connection of the device
2	Pneumatic ports	– Pneumatic port 1: compressed air inlet – Pneumatic port 2: compressed air outlet
3	Wall bracket	Mounting of the device
4	Sensor module	Module for measuring pressure, flow and consumption as well as activation of the shut-off valve
5	Shut-off valve	Used to release and block the system supply air.
6	Bus node	Establishes a communicative connection to a higher-order controller via a network, transmits control signals to the integrated sensor module and monitors its functionality.
7	System supply	Electric power supply of the device

2 Hardware Configuration

This chapter will detail explanation about hardware configuration of energy efficient module MSE6-E2M-5000-FB36-AGD & Allen-Bradley CompactLogix L27ERM PLC.

2.1 PLC IP Address Configuration

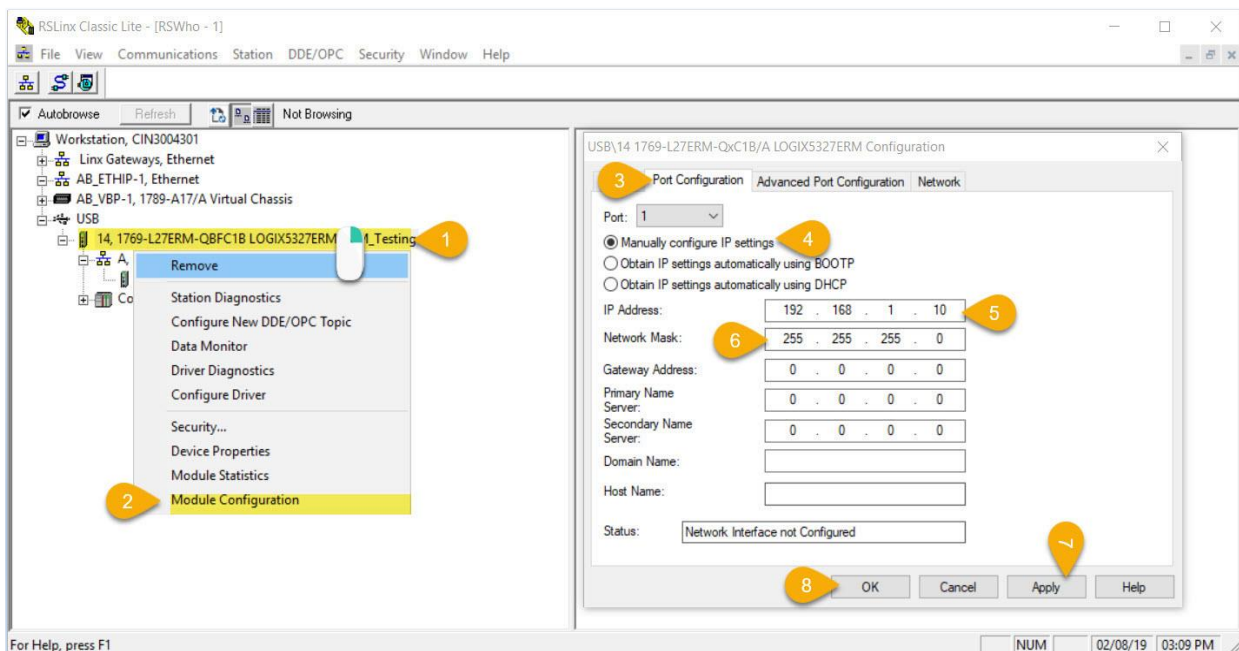
Connect the USB cable (9300-USBCBL-ABHR2) between PLC port & work station computer. Open RSLinx Software. Once USB connection communication is healthy user will see the “USB” symbol on RSLinx software.



Note

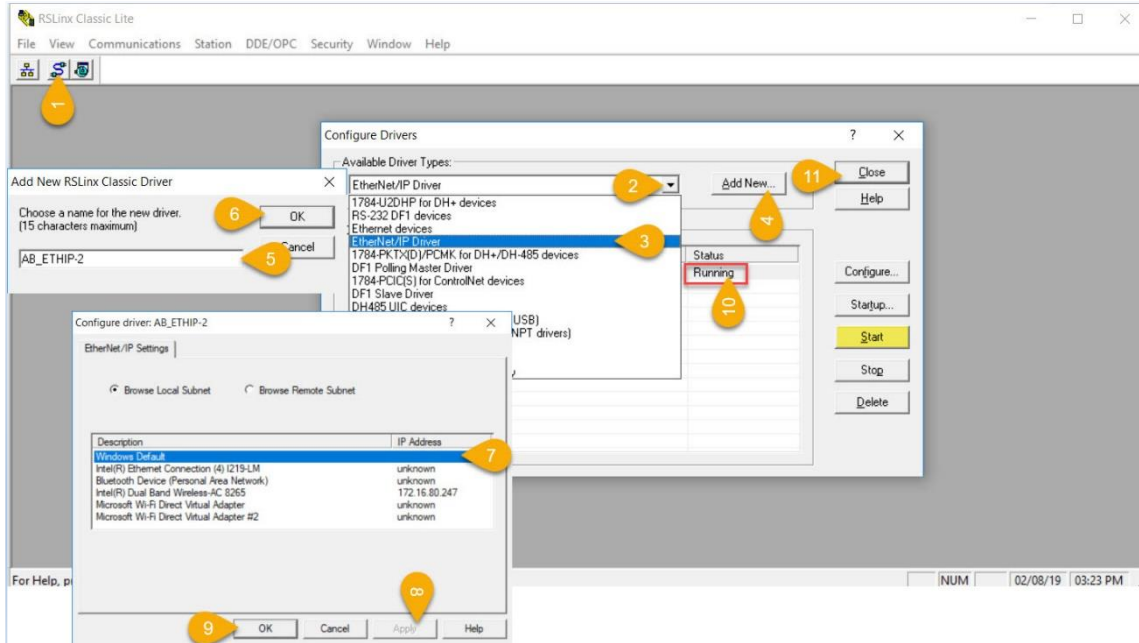
Ignore Chapter 2.1 in case integration of E2M module with existing running project file and jump to Chapter 2.2.

Step – 1



1. **Explore “USB” folder** on RSLinx software and **select controller** with right click on mouse. In this case controller is 1769-L27ERM.
2. From right click menu select **“Module Configuration”** option. At this stage new module configuration window will open.
3. Select **“Port Configuration”** tab.
4. Select **“Manual configuration IP setting”** option. Once Manual option selected IP Address & Network Mask field will be available for editing.
5. Enter the **IP Address** of the PLC.
6. Enter the **Network Mask** of PLC. Other addressing option depend upon users network configuration. IP Address & Network Mask are the minimum required configuration for establishing communication.
7. Click **“Apply”** button.
8. Click **“OK”** button.

Step – 2



1. Select **“Configure Drive”** Icon.
2. From configuration driver’s window select **dropdown menu**.
3. Select **“Ethernet/IP Driver”** from the driver list.
4. Select **“Add New”** Button.
5. **Enter the Name** of the driver. Its optional user can also go with default name.
6. Select **“OK”** Button.
7. Select **“Windows Default”** Ethernet driver from the list so it will take workstation inbuilt system configured IP address. If user using any type of converter like Ethernet to USB, user need to select correct driver name for that mode of interface.
8. Click **“Apply”** button to apply change.
9. Click **“OK”** button to ensure the configuration.
10. Check the created driver status is in **“Running”**. If not in running status select the driver and click the start button.
11. Select **“Close”** button once all above configurations are done.

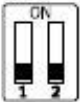
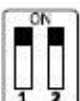
2.2 Energy Efficient DIL Switch Configuration

Step – 1 DIL Switch Group - 1

DIL switch1.1		Operating mode
	DIL 1.1: OFF (Factory setting)	Remote I/O All functions of the CPX terminal are controlled directly by the higher-order controller (PLC). A control block integrated into the CPX terminal (e.g. CPX-CEC or CPX-FEC) works as a passive function module without controller.
DIL switch1.2		Network protocol
	DIL 1.2: OFF (Factory setting)	EtherNet/IP The CPX terminal uses the Ethernet/IP network protocol.

Leave DIL 1.1 & DIL 1.2 should be in factory setting (OFF) to give the control to PLC & Enable Ethernet/IP network.

Step – 2 DIL Switch Group – 2

DIL switch2	Diagnostics mode (Remote I/O) ¹⁾	Data field size (Remote Controller) ²⁾
 2.1: OFF 2.2: OFF (Factory setting)	I/O diagnostics interface and status bits switched off	8 byte I/8 byte O for communication of the bus node with a control block (e.g. B. CPX-FEC)
 2.1: ON 2.2: OFF	I/O diagnostics interface is switched on	32 byte I/32 byte O for communication of the bus node with a control block (e.g. B. CPX-FEC) ³⁾
 2.1: OFF 2.2: ON	Status bits switched on	16 byte I/16 byte O for communication of the bus node with a control block (e.g. B. CPX-FEC)
 2.1: ON 2.2: ON	Reserved	64 byte I/64 byte O for communication of the bus node with a control block (e.g. B. CPX-FEC) ⁴⁾

1) Setting of the diagnostic mode is available only in the remote I/O operating mode.

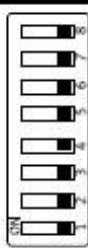
2) Setting of the data field size is available only in the remote controller operating mode.

3) From Revision 12

4) From Revision 13

Depend on diagnostic mode DIL 2.1 & DIL 2.2 need to be configure. Above table shows configuration details. For Diagnostic OFF (Standard Mode) both DIL 2.1 & DIL 2.2 should be in OFF state. For Diagnostic ON mode DIL 2.1- ON & DIL 2.2 – OFF. For Status bits ON mode DIL 2.1 – OFF & DIL 2.2 - ON.

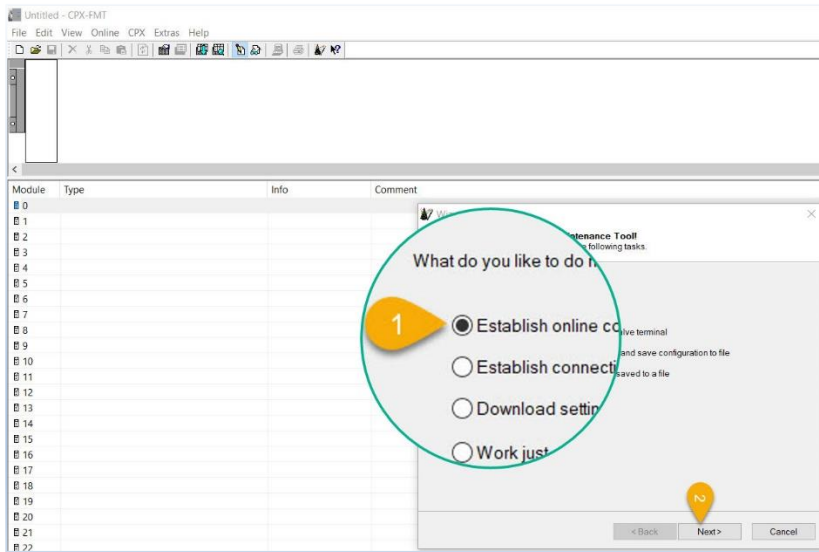
Step – 3 DIL Switch Group - 3

DIL switch3	IP addressing
 DIL 3.8: $2^7 = 128$ DIL 3.7: $2^6 = 64$ DIL 3.6: $2^5 = 32$ DIL 3.5: $2^4 = 16$ DIL 3.4: $2^3 = 8$ DIL 3.3: $2^2 = 4$ DIL 3.2: $2^1 = 2$ DIL 3.1: $2^0 = 1$	The type of addressing or the host ID of the IP address of the bus node is set via DIL switch elements 3.1 ... 3.8. Possible settings: 0 = Dynamic addressing via DHCP/BOOTP 1 ... 254 = Permissible address range 255 = Reset all IP parameters to factory setting Factory setting: 0

DIL switch group – 3 used to configure the IP address of E2M module. We will configure the IP address of E2M module using FMT tool so ensure all the DIL switches from DIL 3.1 to DIL 3.8 should be in OFF condition to avoid IP address configuration through DIL switch.

2.3 IP Address Configuration of E2M Module

Step – 1



Open the CPX Festo Maintenance Tool from Window Start › Festo Software.

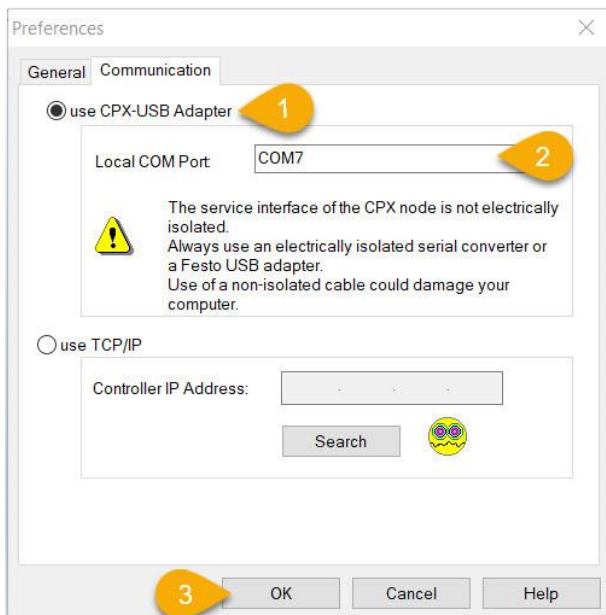


Note

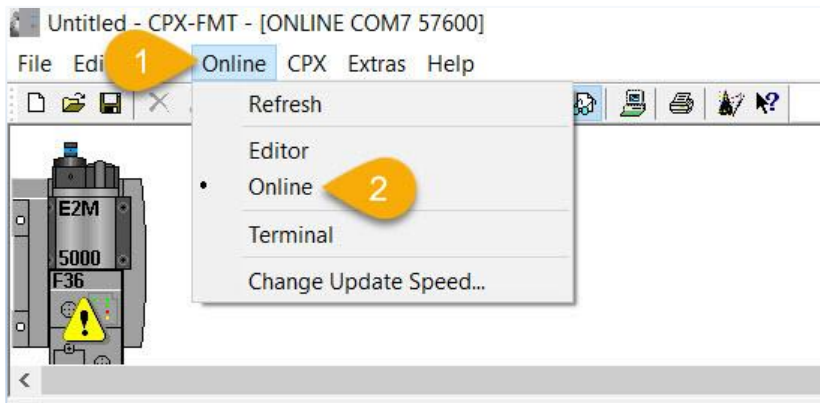
Ensure the USB serial communication connection has been established between work station & E2M module as shown in Architecture.

1. Once FMT software opens Welcome POP-UP window will appear automatically. From there select “**Establish online connection**” option. If welcome pop-up not appear got to tool bar Extras › Preference then jump to Step - 2.
2. Select “Next” button.

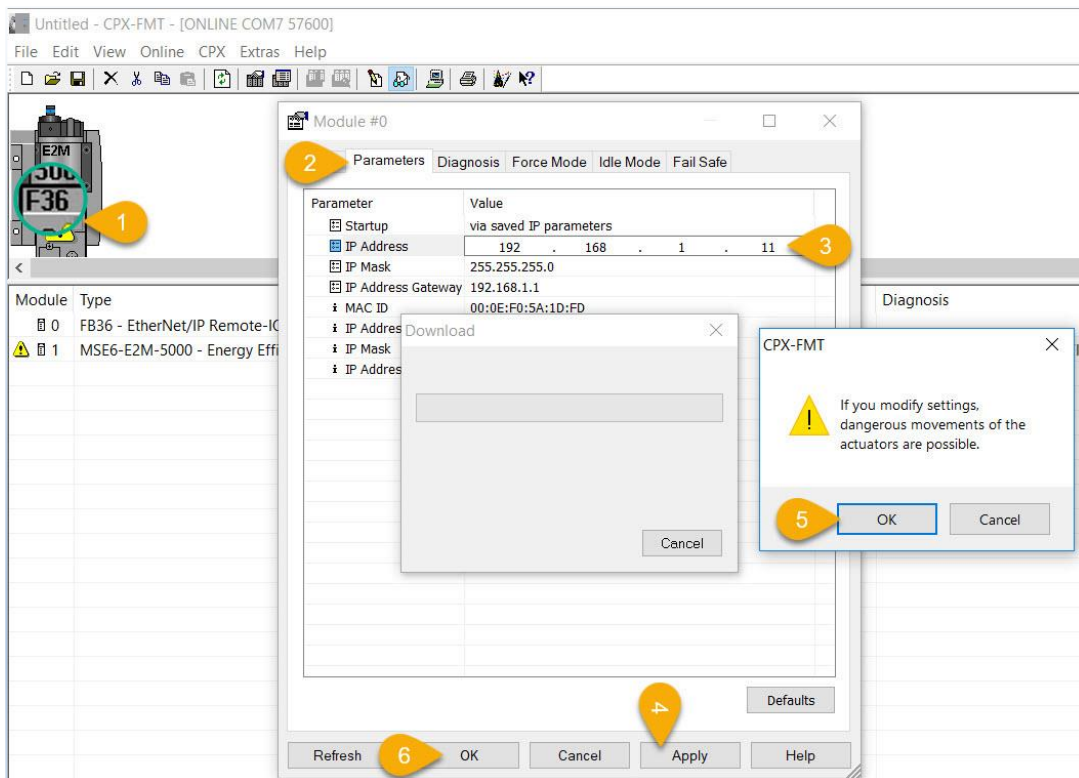
Step – 2



1. Select “**use CPX-USB Adapter**” option from preferences window.
2. Select **COM Port Number**. Before select COM Port number ensure correct COM port number in control panel device manager.
3. Click “**OK**” Button.

Step – 3

1. Select “**Online**” from tool bar.
2. Select “**Online**” from online menu.

Step – 4

1. Double click on “**FB36 Module**”.
2. Select “**Parameters**” tab.
3. Type the “**IP address**” & “**IP Mask**” of E2M module.
4. Click “**Apply**” Button.
5. Acknowledge the warning message by selecting “**OK**” button.
6. Finalize the configuration by clicking “**OK**” button.

**Note**

- In order to take effect new IP address, restarting the module is required.

3 Software Configuration

This chapter will detail step by step procedure for Function Block configuration & Function Block tag usage in Studio 5000 programming tool.



Note

Ignore Chapter 3.1 in case integration of E2M module with existing running project file and jump to Chapter 3.2.

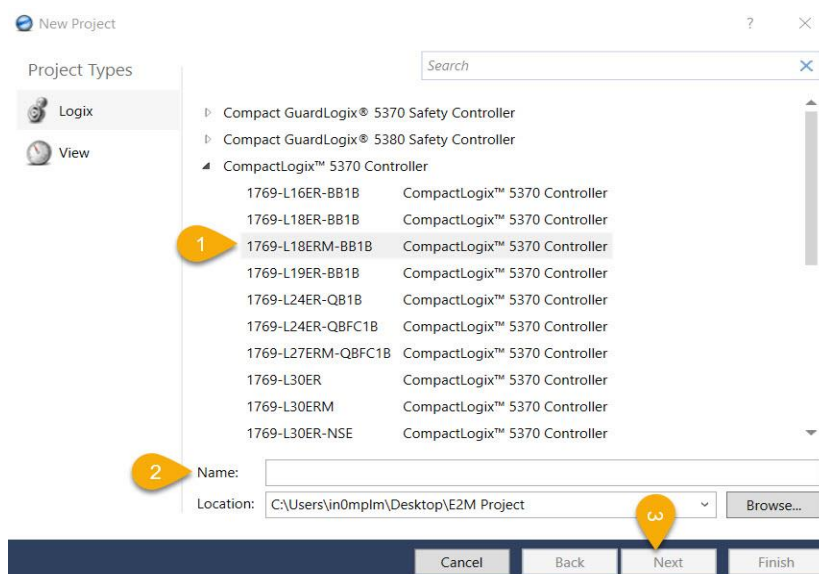
3.1 Create New Project File in Studio 5000

Step – 1



1. Double click the icon & wait until software start-up. If you not have desktop icon follow this navigation Start > Rockwell Software > Studio 5000.
2. After software gets ready Studio 5000 window will arise like pointer two. Select “New Project” under create menu.

Step-2



1. Select your PLC model number from different PLC category.
2. Enter the name of the project

- Click next button.

Step-3

1769-L18ERM-BB1B CompactLogix™ 5370 Controller
Sample_Demo

Revision: 31

Expansion I/O:

Danger: When online, if the modules present do not match the modules specified in the project, unexpected control may occur. The Expansion I/O setting must match the actual number of modules.

Security Authority: No Protection

☐ Use only the selected Security Authority for authentication and authorization

Secure With:

☐ Logical Name <Controller Name>

☐ Permission Set

Description:

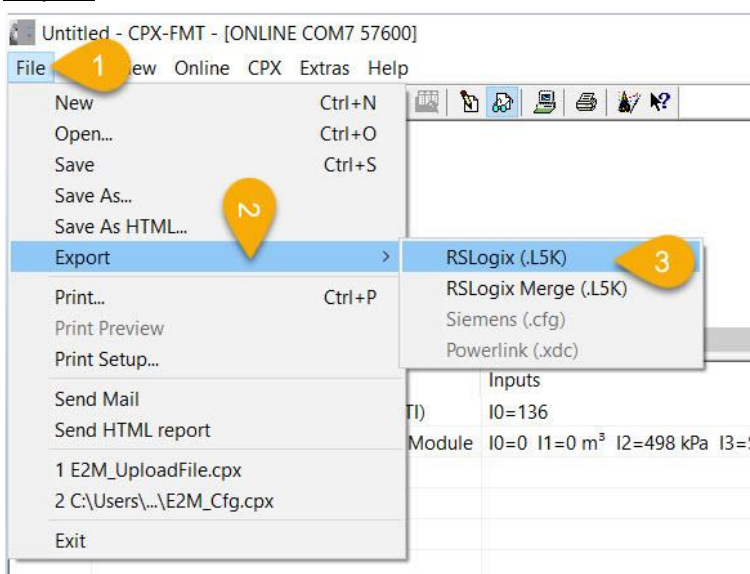
Cancel Back Next Finish

- Select firm revision number of your PLC.
- Select expansion module slot position of PLC. **“Module -0”** will be the default selection for Compact-Logix PLC & Slot position for the ControlLogix PLC is depend on PLC module mounted slot in backplane.
- Enter the details description of the project.
- Click the “Finish” Button to complete the initialization setup process.

3.2 Create E2M Module L5X Export File for Allen-Bradley PLC

Hardware configuration of Energy Efficiency Module has been done as seen in chapter 2.3. So now it's time to create the export file in .L5K format using FMT Software. Following simple two steps helps to create .L5K file.

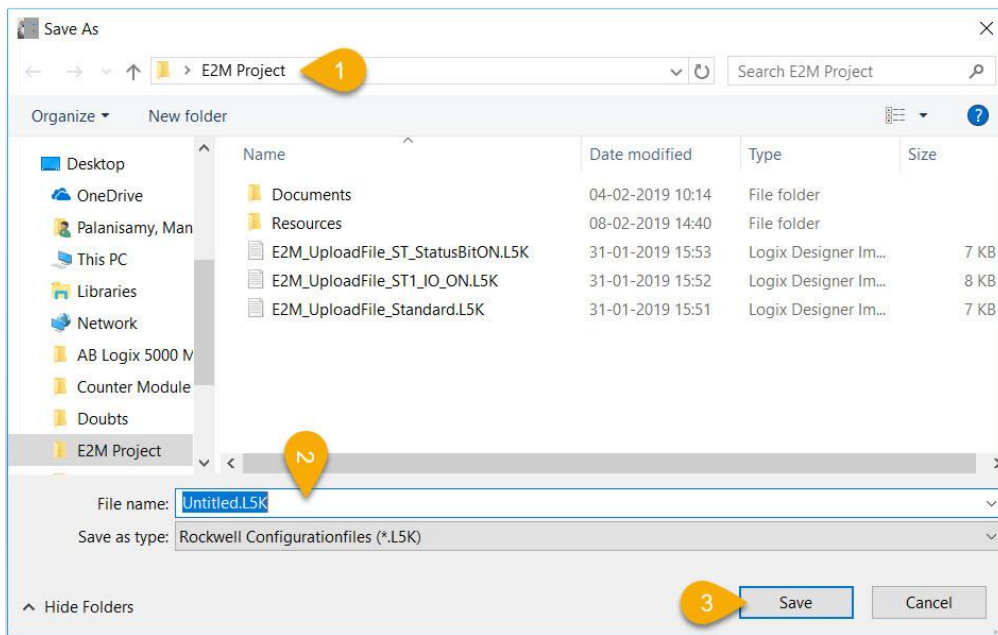
Step – 1



- Select “File” tab from tool bar.
- Select “Export” from File menu.

3. Select **“RSLogix(.L5K)”** from export menu.

Step – 2



1. Select preferred **“File Save Location”** of .L5K file.
2. Enter the preferred **“File Name”** of .L5K file.
3. Select **“Save”** to initialization the .L5K export.

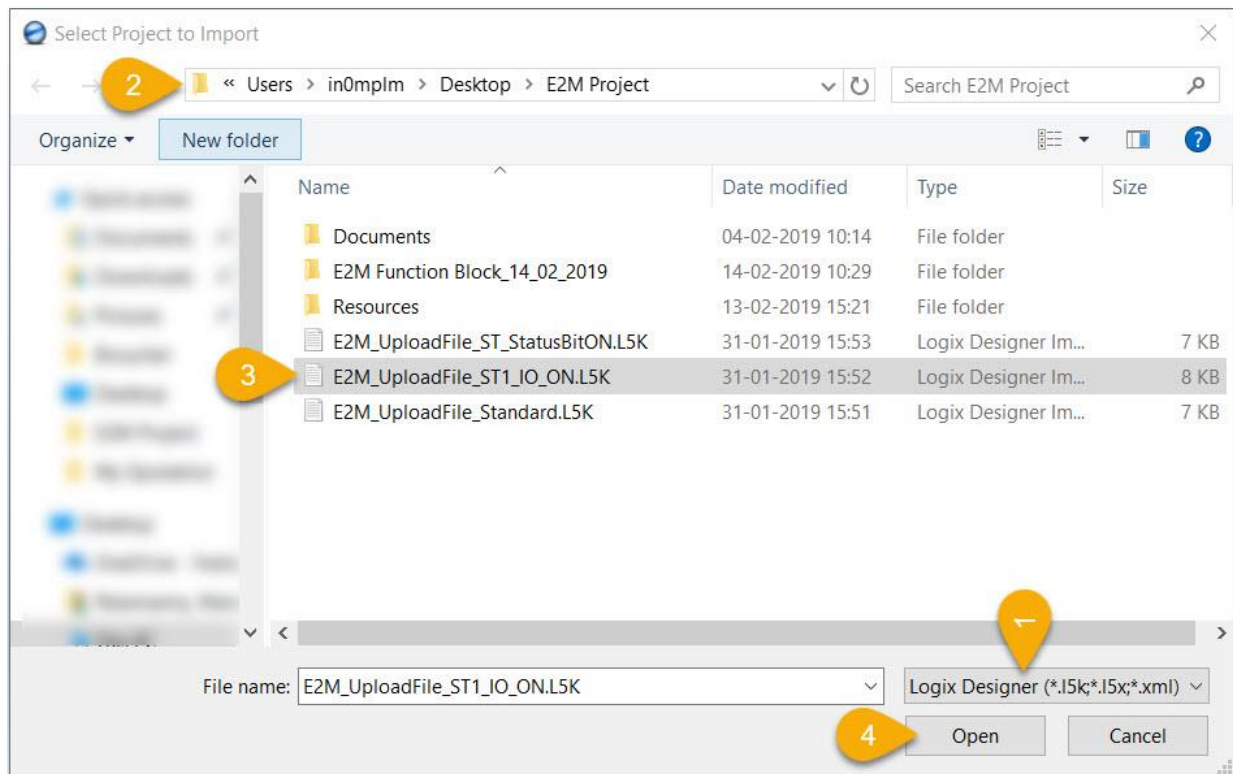
3.3 Import Resources in Studio 5000

3.3.1 Import CPX-FB36 Module (Add-On Profile)

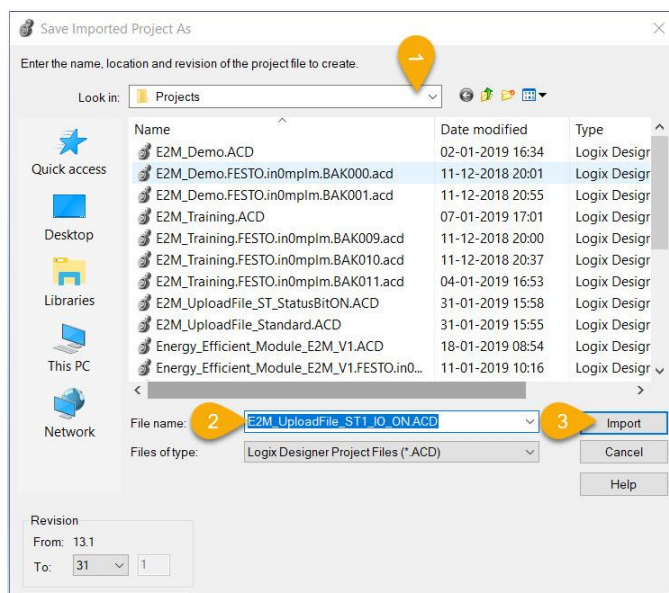
Step-1



1. Start Studio 5000 and select **“From Import”** in startup menu.

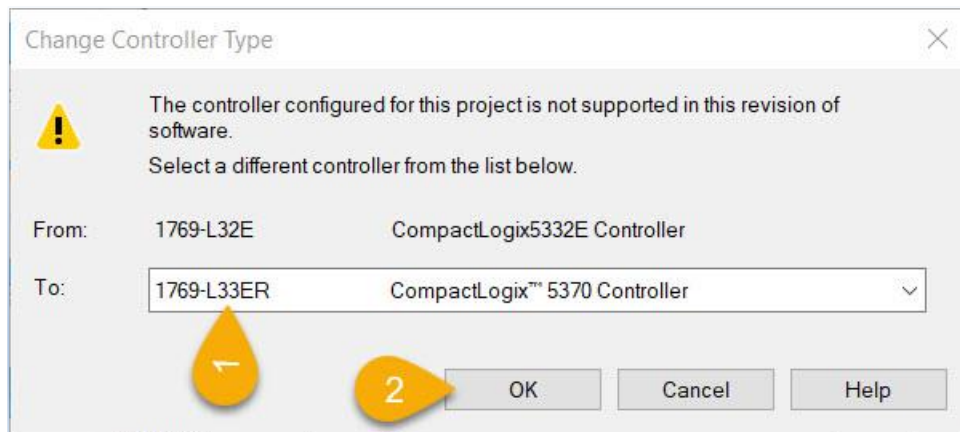
Step – 2

1. Select “**Logix Designer**” option from drop-down menu.
2. Go to folder where Exported file(**.L5K file**) is saved.
3. Select .L5K file which is exported as explain in **chapter 3.2**.
4. Click “**Open**” to import the module configuration in new project.

Step -3

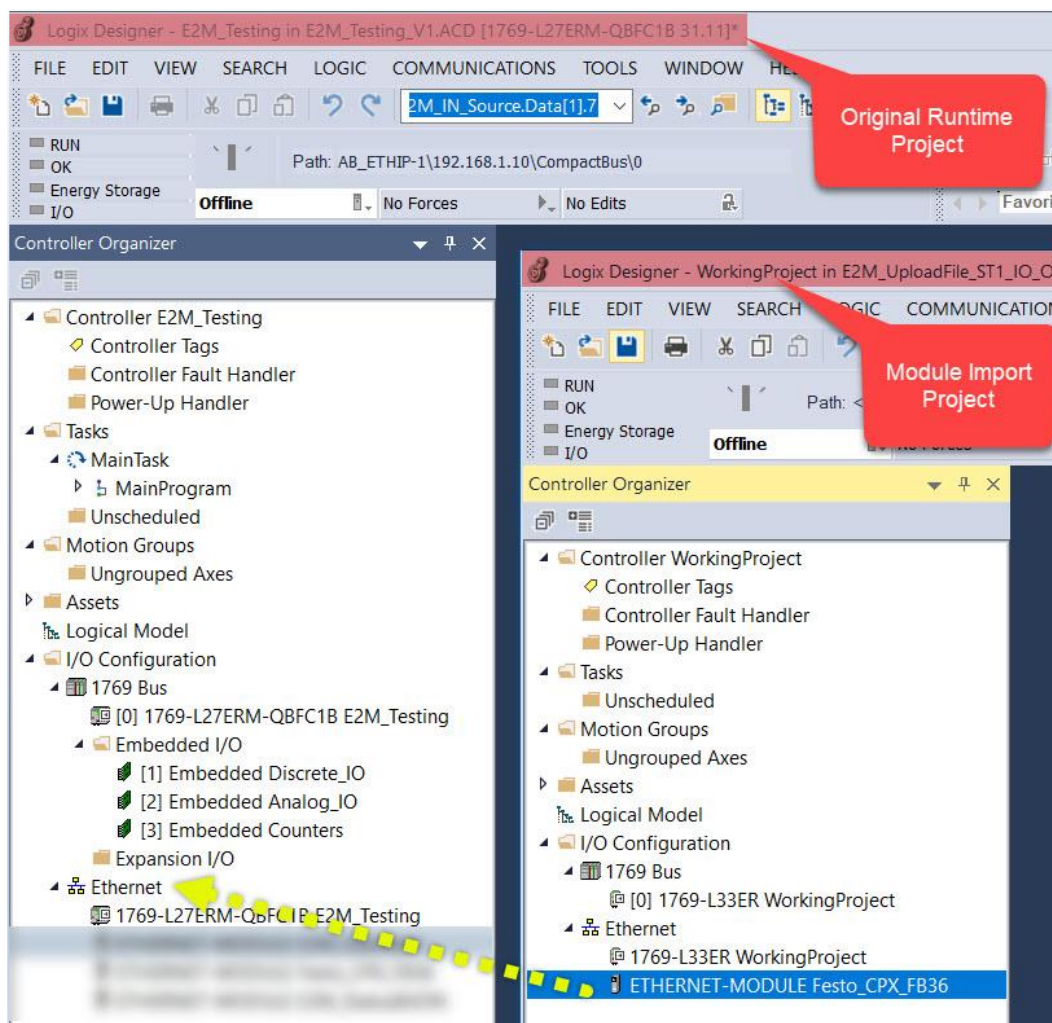
1. Browse the location where the project file has to be saved.
2. **Edit project name** based on user requirement.
3. Click “**Import**” option to initiate import process.

Step – 4

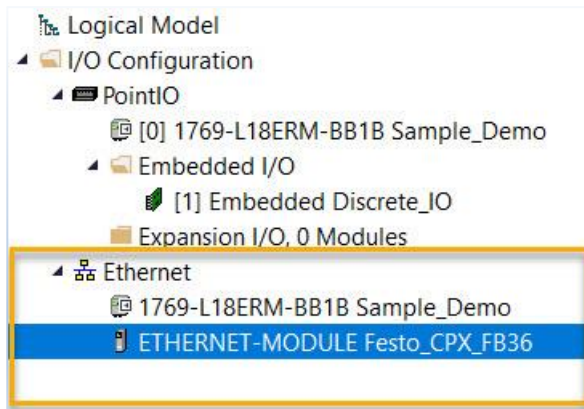


1. Select user preferred controller. In this case don't bother about controller type go to point-2.
2. Click "OK" button.

Step – 5



Drag and drop the newly imported module from “**Module Import Project**” to “**Original Runtime Project**” as shown in above image.

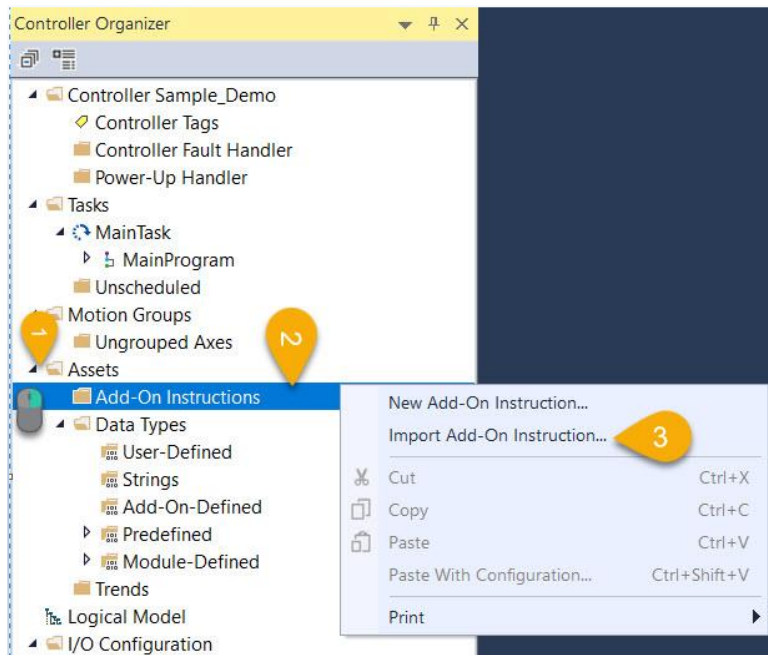
Step – 4

Controller Tags - Sample_Demo(controller)				
Scope:	Sample_Demo	Show:	All Tags	Enter Name Filter...
Name	Alias For	Base Tag	Data Type	
▸ Festo_CPX_FB36:C			AB:ETHERNET_MODULE:C:0	
▸ Festo_CPX_FB36:I			AB:ETHERNET_MODULE_SINT_14Bytes:I:0	
▸ Festo_CPX_FB36:O			AB:ETHERNET_MODULE_SINT_6Bytes:O:0	
▸ Local:1:C			AB:Embedded_DiscreteIO:C:0	
▸ Local:1:I			AB:Embedded_DiscreteIO:I:0	
▸ Local:1:O			AB:Embedded_DiscreteIO:O:0	

Now the “Festo_CPX_FB36” Module is available in project file as highlighted in yellow window. At this condition, system will automatically generate module Input tags, Output tags & Configuration tags in controller tag scope as highlighted in red box.

3.3.2 Importing Function Blocks (Add-on Instructions)**Step – 1**

Software Configuration



1. Under the “**Controller Organizer**” go to Assets and explore the folder.
2. Select “**Add-On Instructions**” Folder and right click on mouse.
3. Select “**Import Add-On Instructions**” from pop-up arise.

A pop-up window will arise once above points from 1 to 3 are done and Navigate to downloaded application note folder.

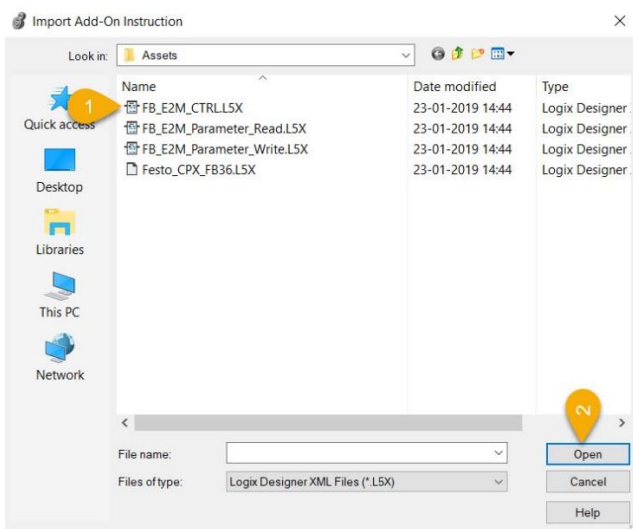


Note

Follow the below navigation to make “Controller Organizer” folder visible If it not available in Studio 5000 project.

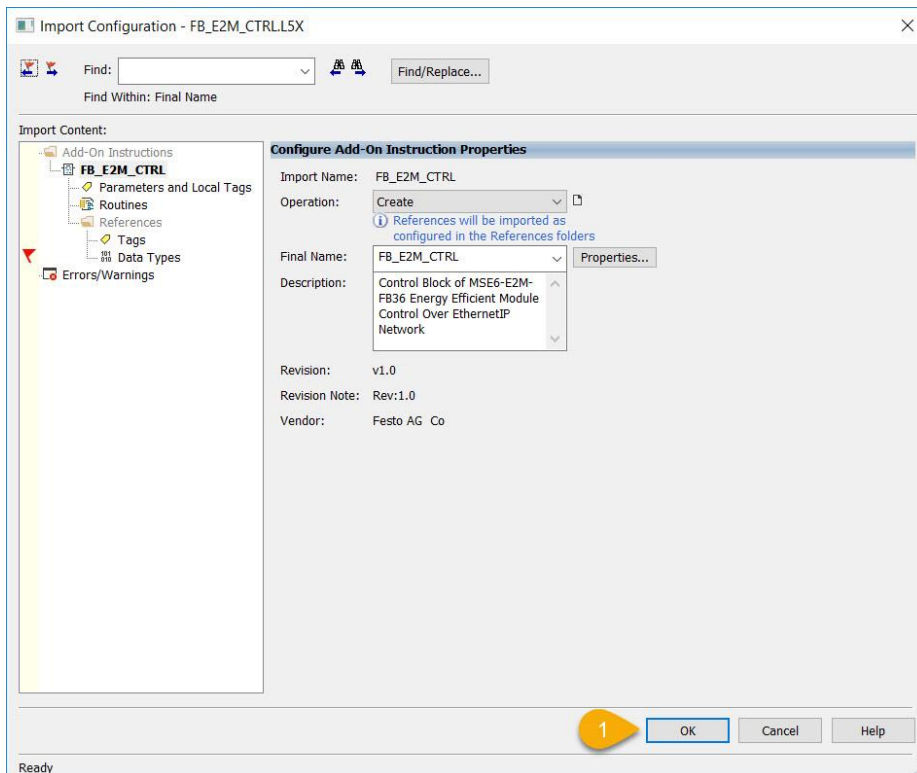
From Toolbar select View > Controller Organizer or Press keyboard shortcut key Alt+0.

Step - 2



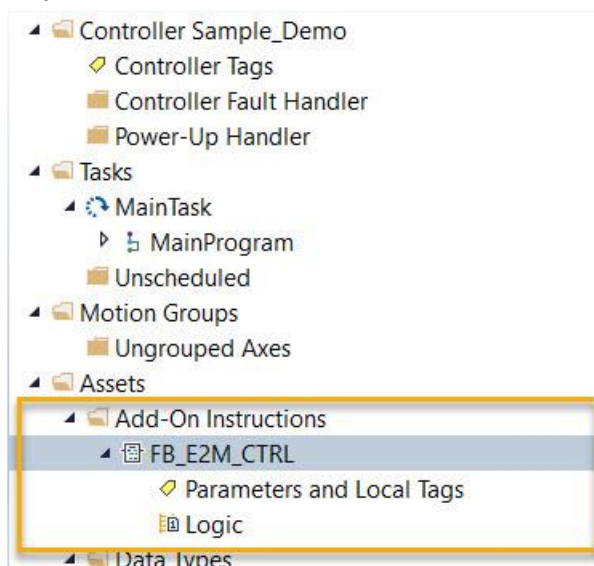
1. Select “FB_E2M_CTRL.LSX” file from window.
2. Click “Open” Button. Next it will take to Import Configuration Window.

Step – 3



1. No changes required in “Import Configuration” window just click **“OK”** button and move next step.

Step – 4

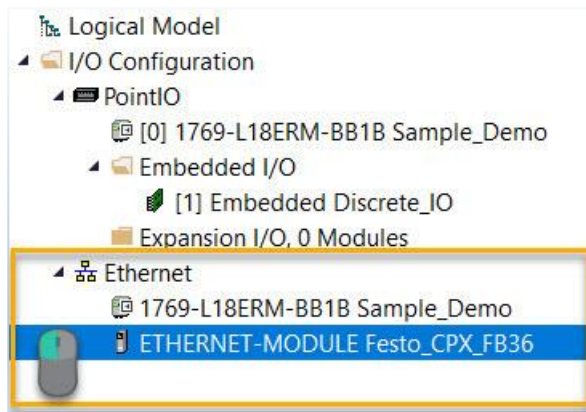


Now the “FB_E2M_CTRL” function block is available in project file as highlighted in yellow window. User can use this function block in program. **Repeat the Chapter 3.2 Step 1 to 4 for import other function blocks (FB_E2M_Parameter_Read & FB_E2M_Parameter_Write).**

3.4 EtherNet-IP Address Configuration of CPX-FB-36 Module in Studio 5000

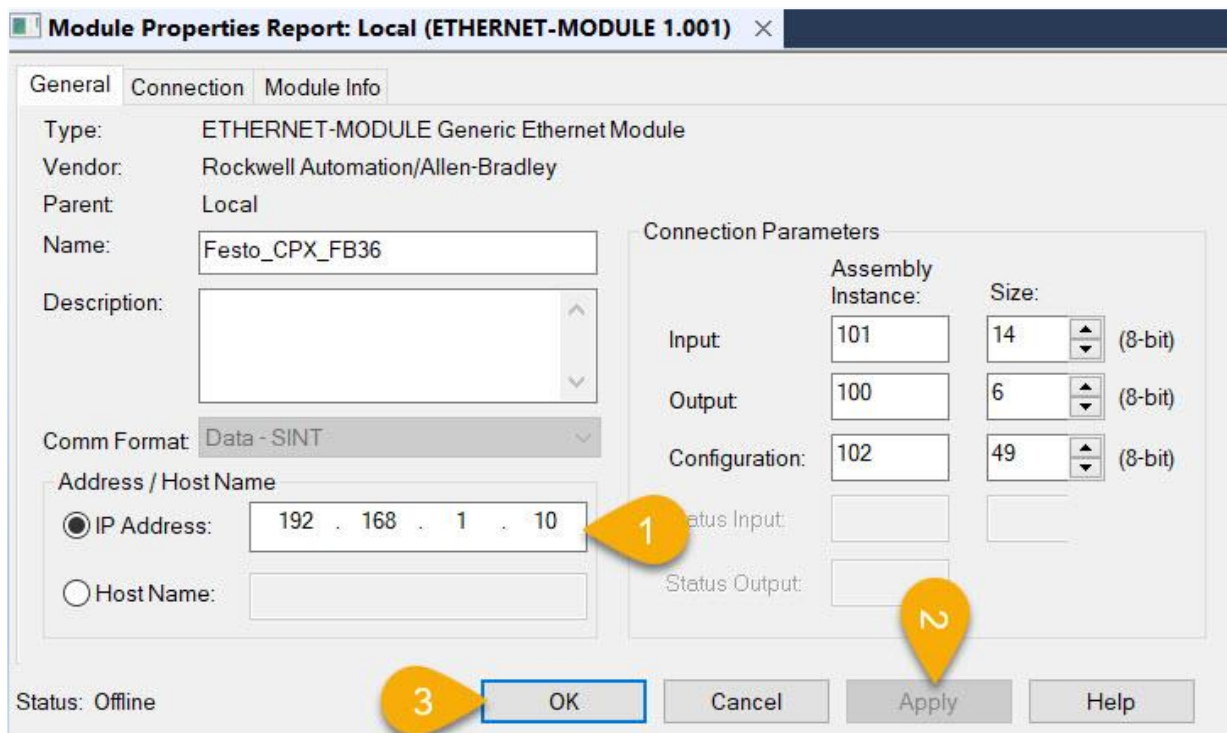
Step-1

Software Configuration



Select imported “Festo_CPX_FB36” module & Left double click on the mouse. Module property window will appear.

Step – 2



1. Enter the user preferred EtherNet-IP address in **“IP Address”** tab.
2. Click **“Apply”** button
3. Click **“OK”** button

**Note**

EtherNet-IP address of the “Festo_CPX_FB36” must meet same series of the PLC EtherNet-IP address. User can’t change “Festo_CPX_FB36” module IP address during Studio 5000 in online run mode. Festo CPX-FB36 module IP address details monitor & modify by “Festo Field Devices Tool” software.

4 PLC Programming

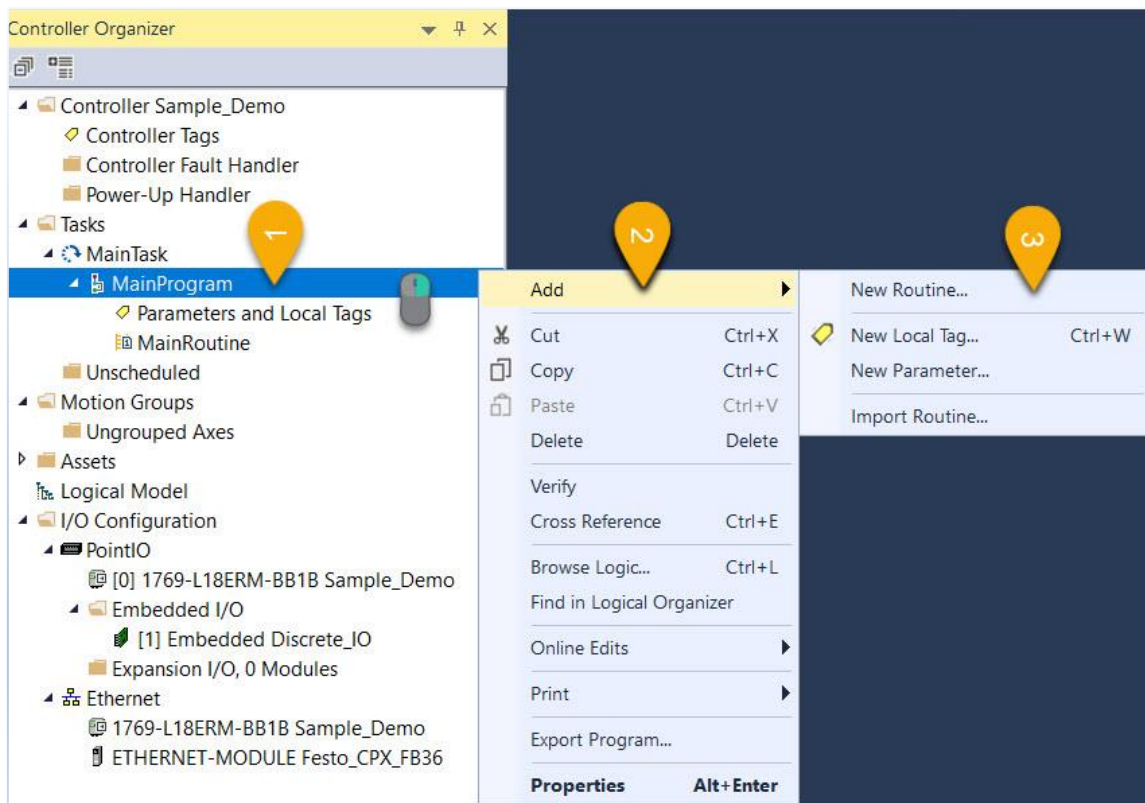
This chapter will explain implementation of Function Blocks (Add-On Instructions) in PLC program & Function Block tag define and tag usage. Function Block of MSE6-E2M developed as three different blocks. They are

- ✚ Control Function Block (FB_E2M_CTRL)
- ✚ Read Data Function Block (FB_E2M_Parameter_Read)
- ✚ Write Data Function Block (FB_E2M_Parameter_Write)

Upcoming chapters will describe detailed function & configuration of these blocks. All the programming for these blocks were done in ladder programming language.

4.1 Create New Ladder Routine for MSE6-E2M

Step-1



1. Navigate to following location “Controller Organizer > MainTask > MainProgram” **select MainProgram and right click on mouse.**
2. Select “**Add**” option from pop-up
3. Select “**New Routine**”. At this point “New Routine” window will open & go to next step.



Note

MainTask & MainProgram names are default continuous task in Studio 5000. Depending on user existing program select PLC continuous scan task and Add new routine.

Step-2

New Routine

Name: R100_MSE6_E2M_Program

Description: Energy Efficient Module Program

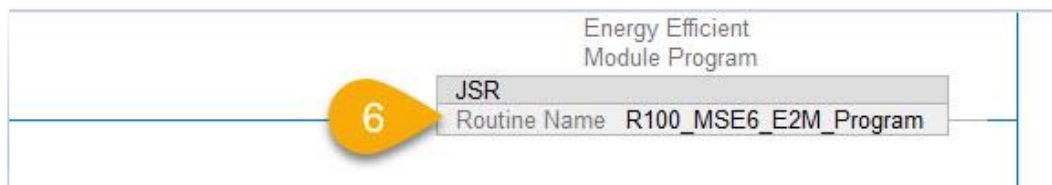
Type: Ladder Diagram

In Program or Phase: MainProgram

Assignment: <none>

Buttons: OK, Cancel, Help

☐ Open Routine



1. Enter the **Name of Routine**.
2. Enter the detail **Description of Routine**.
3. Select programming language type as “**Ladder Diagram**”.
4. Selection of program phase is user defined but continue scan task is recommended.
5. Click “**OK**” Button.
6. Add **JSR (Jump to Sub-Routine)** instruction in main routine of the task and make always rung true.

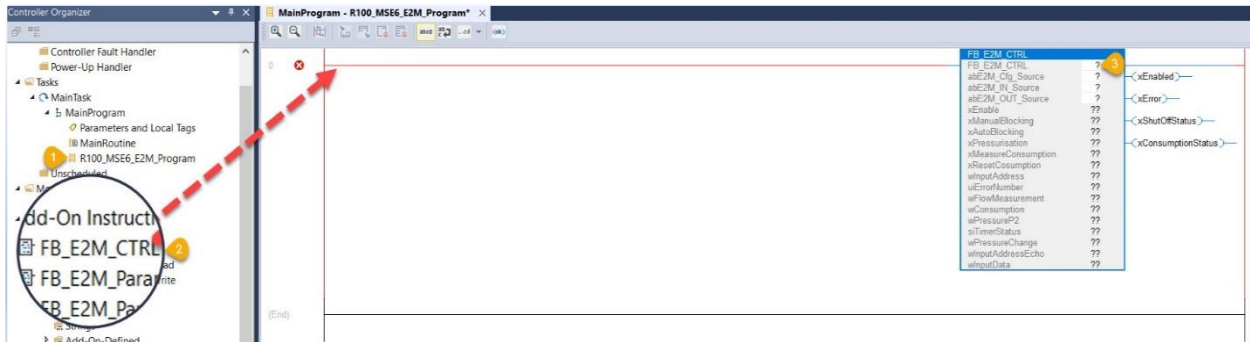
4.2 Control Function Block Programming & Configuration

Before start configure the control function block let we know some basic function of control function block. This function block used to do following operation in the MSE6-E2M module. They are

- Control of Enabling & Disabling Manual Blocking
- Control of Enabling & Disabling Auto Blocking
- Control of Enabling & Disabling Pressurization
- Control of Start & Stop Consumption Measurements
- Control of Reset Consumption Measurements Totalized Value

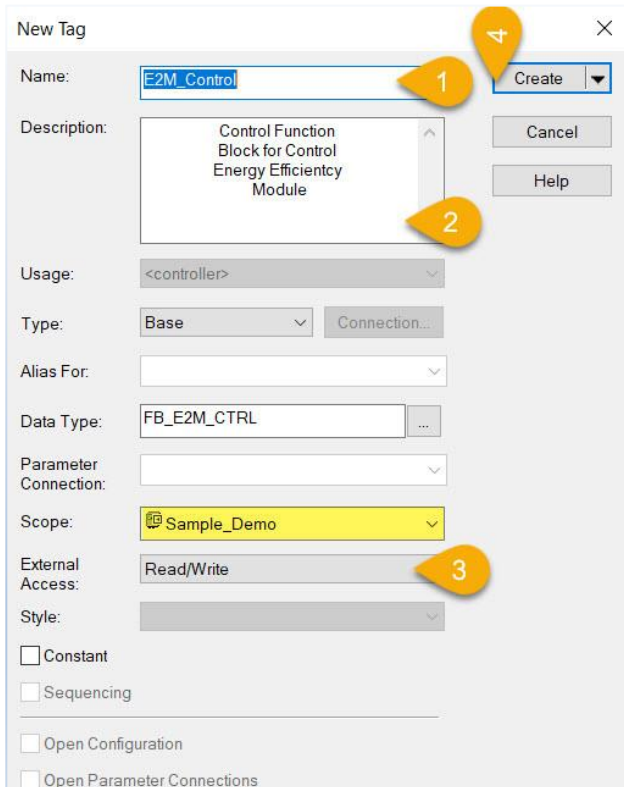
4.2.1 Add Control Function Block in PLC Program Routine

Step – 1



1. Double click & open “**R100_MSE6_E2M_Program**” routine which created in chapter 4.1.
2. Drag & drop Function Block “**FB_E2M_CTRL**” from Controller Organizer > Assets > Add-On Instructions.
3. Enter the tag name of function block in “**FB_E2M_CTRL**” field & press Enter key. After tag name entry select entered tag name and press keyboard shortcut **Ctrl+W** for open “New Tag” window.

Step – 2

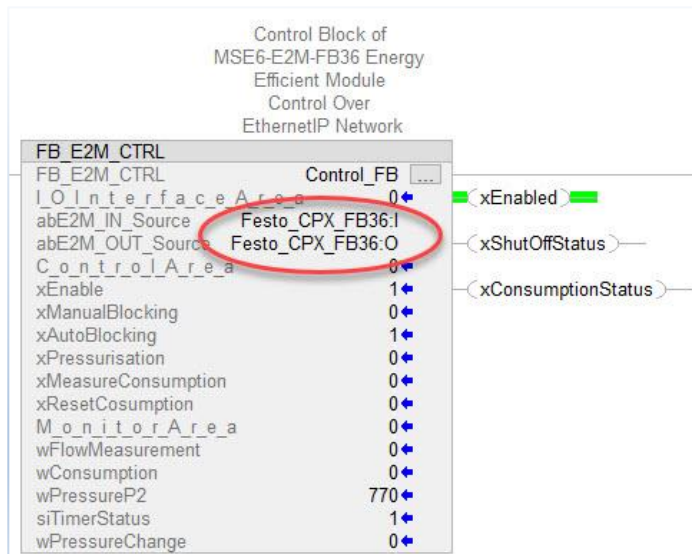


1. By default already entered tag name will be in “**Name**” field. If user wish to change the tag name its possible at this point.
2. Enter detailed description of the Function Block. It’s optional.
3. Check “**External Access**” must be “**Read/Write**”
4. Click “**Create**” button.



Note

Use same procedure as shown in Step 1 & 2 of this chapter 4.1.2 to create Read & Write function block. An important consideration for creating other function blocks is tag name should be unique. Its mandatory to assign the all Function Block’s (Control FB, Read FB, Write FB & Diagnose FB) tag in controller scope as shown in yellow highlights.

Step – 3

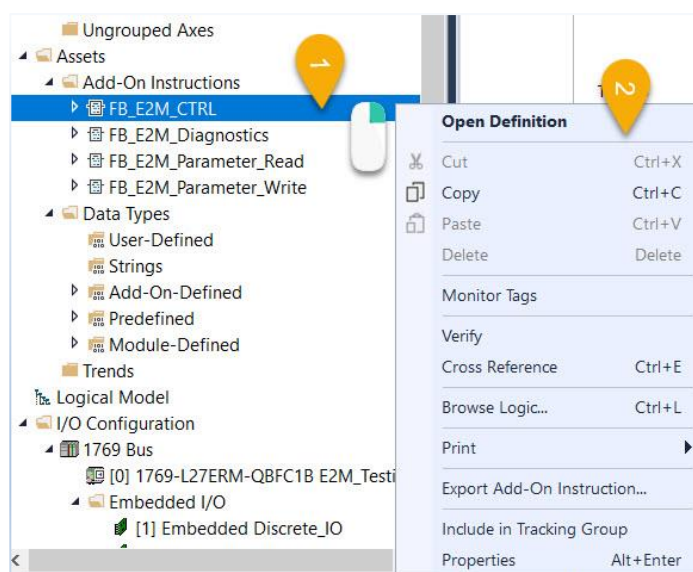
Assign tags for “abE2M_IN_Source” & “abE2M_OUT_Source” as shown in above picture.

**Note**

It's important to change the data type of tags “abE2M_IN_Source” & “abE2M_OUT_Source” depending on Diagnostic Mode.

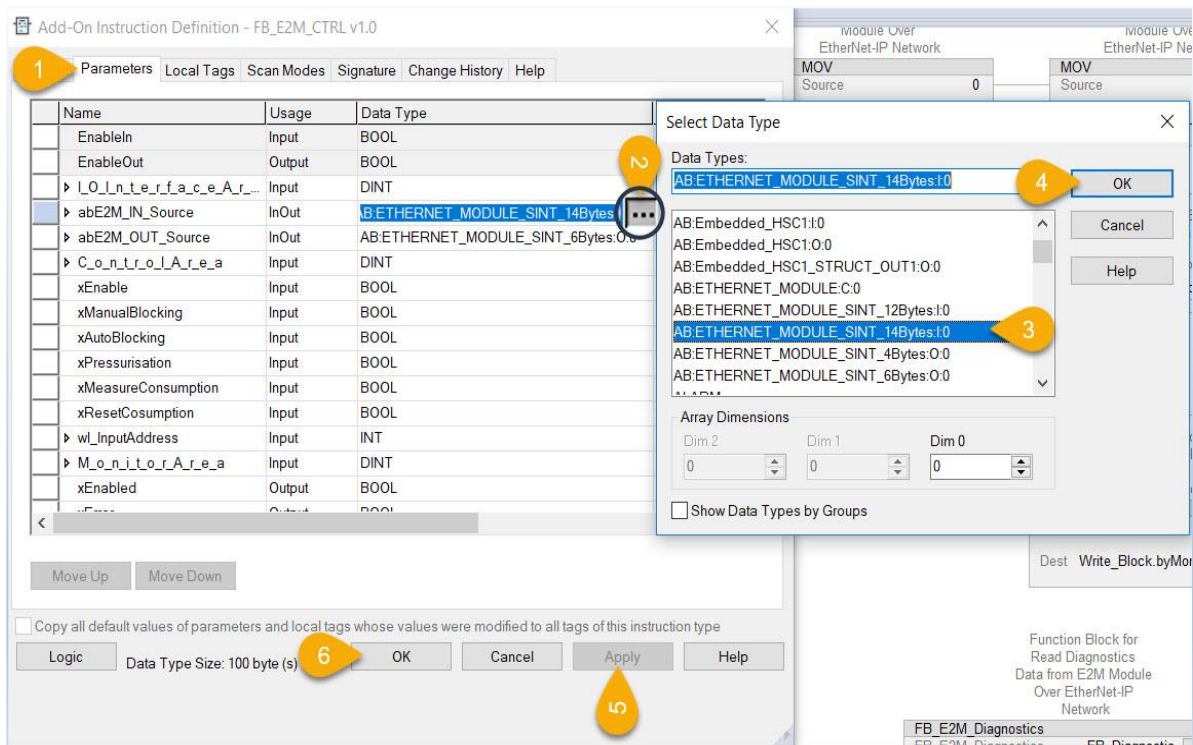
4.2.2 Data Type of Input & Output Hardware Interfacing Tags

Change the data type of tags “abE2M_IN_Source” & “abE2M_OUT_Source” depending on Diagnostic Mode. Following steps will give the explanation about data type changing of hardware Input & Output tags.

Step – 1

1. Navigate to following location “Controller Organizer > Assets > Add-On Instructions” > **Select FB_E2M_CTRL** & right click on mouse.
2. From right click menu select “**Open Definition**”

Step – 2



1. Select “**Parameters**” form Add-On Instruction Definition window.
2. Select “**Brows Button**” of Input parameter tag data type.
3. Select correct data type of Input parameter tag as shown in below table 4.1.
4. Click “**OK**” button.
5. Click “**Apply**” button.
6. Click “**OK**” button to close the configuration window.

Repeat same step – 1 to step – 6 for output tag.

Diagnostic Mode	DIL 2.1	DIL 2.2	abE2M_IN_Source Data Type	abE2M_OUT_Source Type
Standard	OFF	OFF	AB:ETHERNET_MODULE_SINT_12Bytes:I:0	AB:ETHERNET_MODULE_SINT_4Bytes:O:0
Diagnostic Input Enable	OFF	ON	AB:ETHERNET_MODULE_SINT_14Bytes:I:0	AB:ETHERNET_MODULE_SINT_4Bytes:O:0
STI Interface Enable	ON	ON	AB:ETHERNET_MODULE_SINT_14Bytes:I:0	AB:ETHERNET_MODULE_SINT_6Bytes:O:0

Table 4.1: DIL Switch Group – 2 Configuration & Its Data Type Compatibility

4.2.3 Control Function Block Tag Details

Input Tag Name	Data Type	Description
xEnable	BOOL	When bit true enables control FB functions
xManualBlocking	BOOL	When bit true enables control for manual blocking function.

Input Tag Name	Data Type	Description
xAutoBlocking	BOOL	When bit true enables control for auto blocking function.
xPressurisation	BOOL	Check in E2M Manual what is for pressurisation
xMeasureConsumption	BOOL	When bit true consumption measurement starts. When bit false consumption measurement stop.
xResetConsumption	BOOL	When bit true consumption measurement value will reset to zero.

Table 4.2: Control Function Block Input Tags

Output Tag Name	Data Type	Description
xEnabled	BOOL	Feedback signal of Function Block enabled
xError	BOOL	Feedback signal of FB error
uiErrorNumber	INT	Feedback signal of error number
wFlowMeasurement	INT	Feedback signal of Flow Rate Value
wConsumption	DINT	Feedback signal of Consumption Measurement Value
wPressureP2	INT	Feedback signal of PressureP2 Value
xShutOffStatus	BOOL	Feedback signal of Shut-Off valve status. When Bit True – Valve Open, False – Valve Close .
xConsumptionStatus	BOOL	Feedback signal of consumption measurement. When bit True – Consumption Measurement Active,

Table 4.3: Control Function Block Output Tags

InOut Tag Name	Data Type	Description
abE2M_IN_Source	AB:ETHERNET_MODULE_SINT_14Bytes:I:0	System generated input structure tag
abE2M_OUT_Source	AB:ETHERNET_MODULE_SINT_6Bytes:O:0	System generated output structure tag

Table 4.4: Control Function Block In/Out Tags

4.3 Read Function Block Programming & Configuration

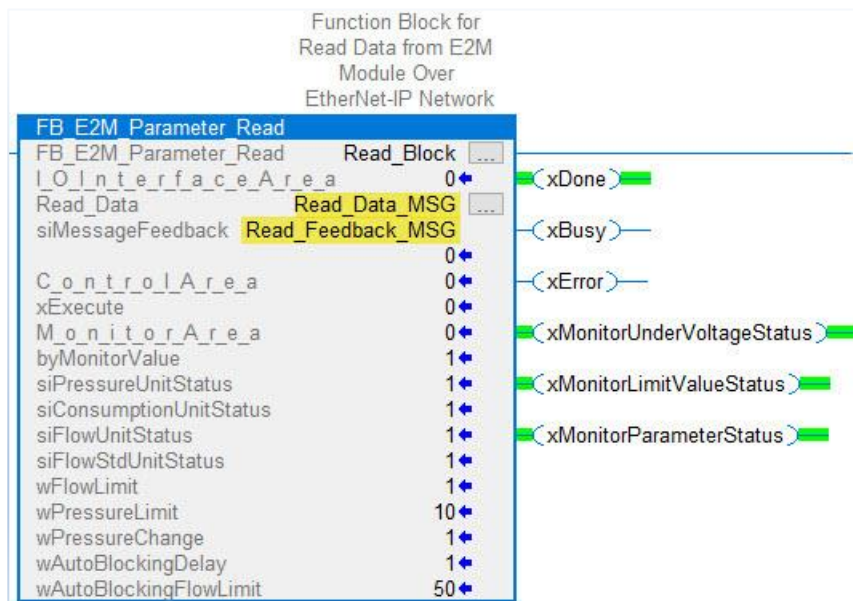
Read function block is used to read the parameter current set values from MSE6-E2M-5000-FB36 module. Following parameters are read from E2M module. The name of the function block is “FB_E2M_Parameter_Read”. Parameter read function block works based on event basis (When xExecute Bit get toggle from false to true)

- Under Voltage diagnose status enable or disable
- Limit Value diagnose status enable or disable
- Parameter error diagnose status enable or disable
- Monitor limit value start-up time value
- Actual set unit for Pressure, Flow, Consumption & Flow Standard
- Flow upper limit value
- Pressure upper limit value
- Pressure change value
- Auto blocking time delay value
- Auto Blocking low flow limit

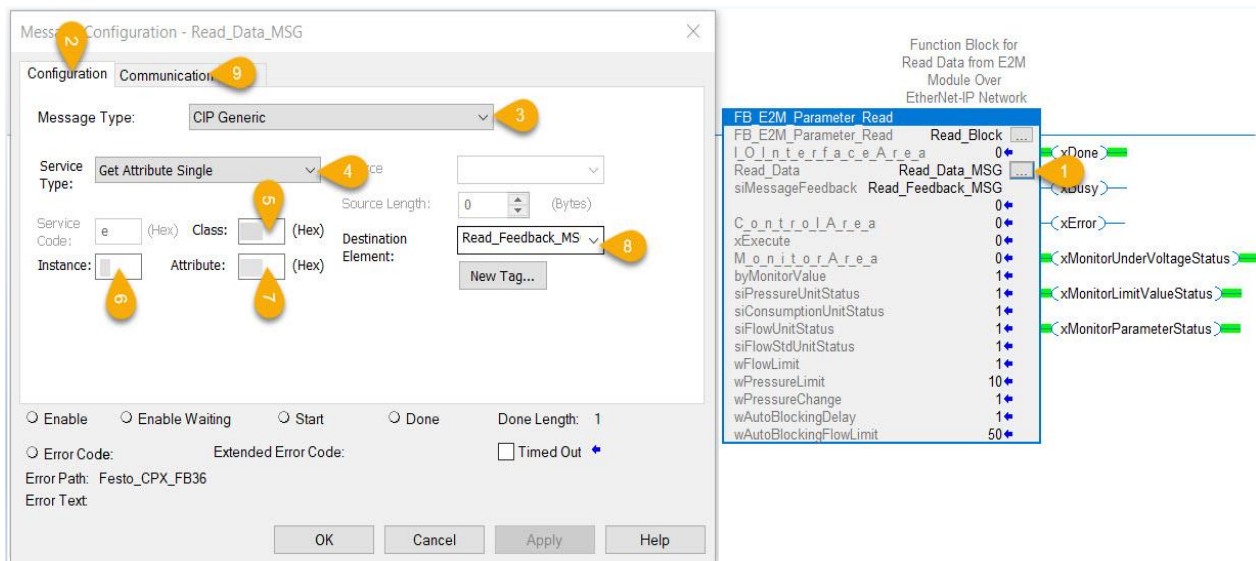
To add the Read Function Block in PLC program please refer the step – 1 to step -3 of chapter 4.1.

4.3.1 Configure Read Function Block Message Instruction

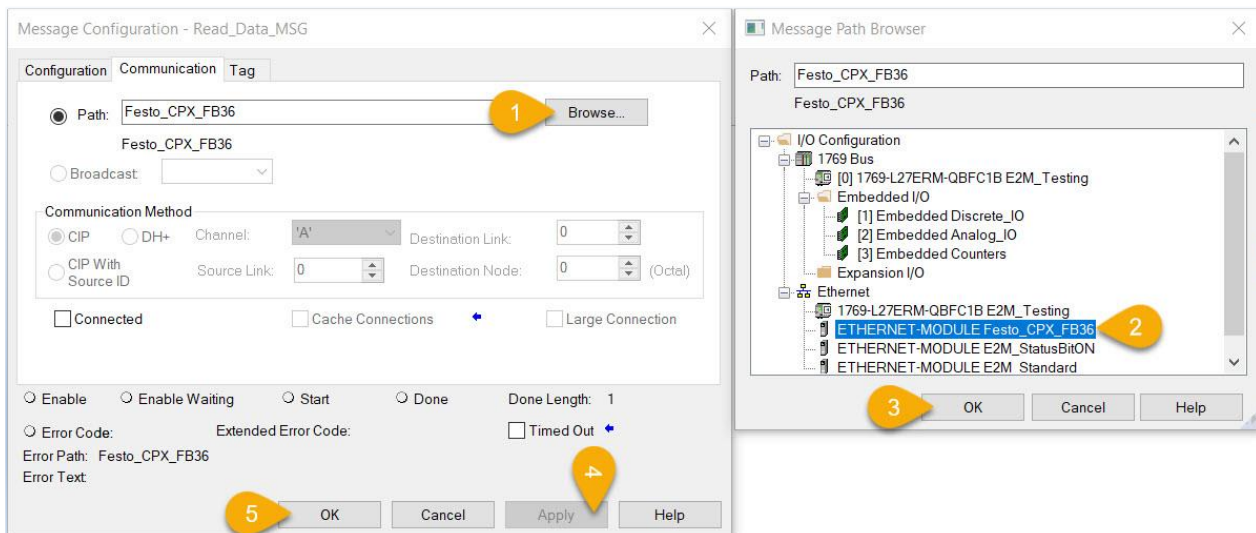
Step – 1



Assign tags for Function Block inputs **Read_Data** (MESSAGE – DATA TYPE) & **siMessageFeedback** (SINT – DATA TYPE) .

Step – 2

1. Click on the “**brows button**” of newly assigned Message Instruction tag.
2. Click “**Configuration tab**” on Message configuration window.
3. Select “**CIP Generic**” from message type menu.
4. Select “**Get Attribute Single**” form service type menu.
5. Fill “**Zero**” number in class field.
6. Fill “**Zero**” number in Instance field.
7. Fill “**Zero**” Number in Attribute field.
8. **Assign destination tag** same which assigned for “siMessageFeedback”.
9. Click the “**Communication**” tab.

Step – 3

1. Select “**Browse**” Button.
2. **Select configured E2M module** from Ethernet communication tree. Module which imported on Chapter 3.3.2.
3. Click “**OK**” Button. At this stage Message Path Browser window will automatically close after OK click.
4. Click “**Apply**” Button on Message Configuration window.
5. Click “**OK**” Button.

4.3.2 Read Function Block Tag Details

Input Tag Name	Data Type	Description
xExecute	Bool	When Bit true execute Read sequence of parameters from Energy Efficient Module.
siMessageFeedback	SINT	Assign Destination Tag used in Read Data Message Instruction.

Table 4.5: Read Function Block Input Tags

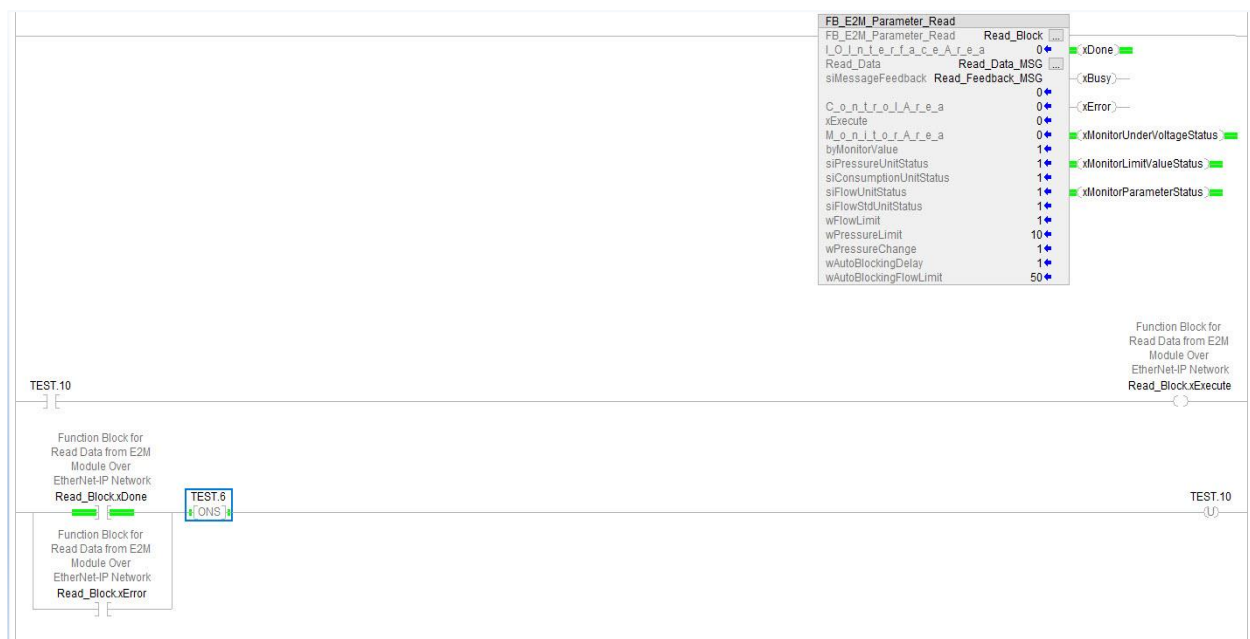
Output Tag Name	Data Type	Description
xMonitorUnderVoltageStatus	Bool	When bit True – Diagnose under voltage status enabled, False - Diagnose under voltage status disabled.
xMonitorLimitValueStatus	Bool	When bit True – Diagnose limit value status enabled, False - Diagnose limit value status disabled.
xMonitorParameterStatus	Bool	When bit True – Diagnose parameter error status enabled, False - Diagnose parameter error status disabled.
byMonitorValue	SINT	Specifies the time after the supply voltage has been switched on, During which limit monitoring is deactivated. When Value 0 = 0 Sec, 1 = 3 Sec, 2 = 5 Sec, 3 = 10 Sec, 4 = 30 Sec, 5 = 60 Sec, 6 = 120 Sec, 7 = 300 Sec, 8 to 250 not Permissible .
siUnitPressureStatus	SINT	Unit of Pressure. When value 0 – mbar, 1 – kPa, 2 – psi/10
siUnitConsumptionStatus	SINT	Unit of Consumption. When value 0 – l, 1 – m ³ , 2 – scf, 3 – Not permissible
siUnitFlowStatus	SINT	Unit of Flow. When value 0 – l/min, 1 – Not permissible, 2 - scfm/10
siUnitFlowStdStatus	SINT	Unit of Flow standard. When value 0 – DIN1343, 1 – ISO 2533, 2 – ISO6358.
wFlowLimit	INT	Upper Flow limit.
wPressureLimit	INT	Upper Pressure limit.
wPressureChange	INT	Upper Pressure limit for pressure change.
wAutoBlockingDelay	INT	Time taken to automatically blocking the value, When flow value below the Auto shut-off low flow limit parameter.
wAutoBlockingFlowLimit	INT	Low flow limit for auto-block the valve.
xBusy	Bool	Reading process active.
xDone	Bool	Reading process completed successfully.
xError	Bool	Reading process completed with error.

Table 4.6: Read Function Block Output Tags

InOut Tag Name	Data Type	Description
Read_Data	Message	Message instruction tag for read data from Energy Efficient Module.

Table 4.7: Read Function Block InOutput Tag

4.3.3 Sample Program of Read Block

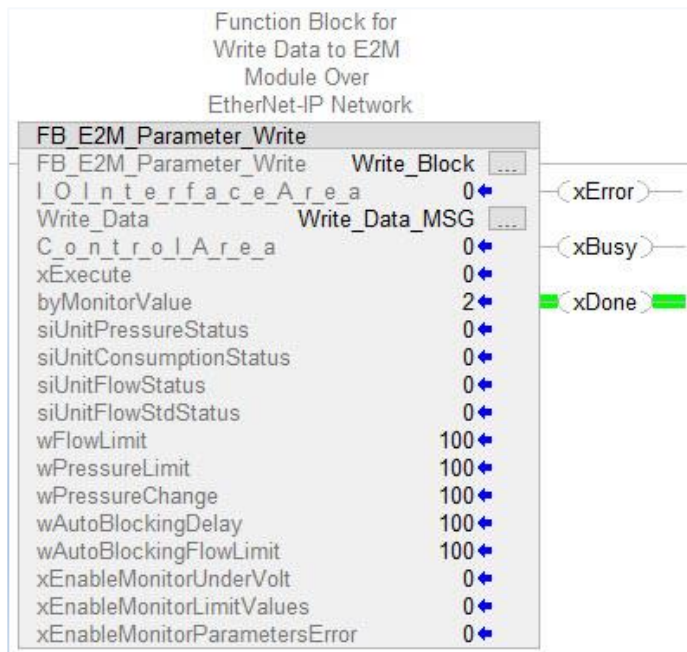


When tag “Read_Block.xExecute” is true Function Block starts to read data from Energy Efficient Module. Once “Read_Block.xExecute” is true “Read_Block.xDone” & “Read_Block.xError” tags will become false. After completion of reading process if reading all parameter done successfully “Read_Block.xDone” will be true & value of parameters will be updated in respective tags. If Reading process completed unsuccessfully “Read_Block.xError” will become true. If Error bit high please check the hardware communication connection between PLC & Energy Efficient Module.

4.4 Write Function Block Programming & Configuration

Write function block is used to write the parameter set values to MSE6-E2M-5000-FB36 module from PLC tags. Following parameters are writing to Energy Efficient Module from PLC. The name of the function block is “FB_E2M_Parameter_Write”. Parameter write function block works based on event basis (When xExecute Bit get toggle from false to true)

- Under Voltage diagnose status enable or disable
- Limit Value diagnose status enable or disable
- Parameter error diagnose status enable or disable
- Monitor limit value start-up time value
- Actual set unit for Pressure, Flow, Consumption & Flow Standard
- Flow upper limit value
- Pressure upper limit value
- Pressure change value
- Auto blocking time delay value
- Auto Blocking low flow limit



To add the Write Function Block in PLC program please refer the step – 1 to step -3 of chapter 4.2.1. Assign tags for Function Block inputs **Write_Data** (MESSAGE – DATA TYPE).

4.4.1 Write Function Block Tag Details

Input Tag Name	Data Type	Description
xExecute	Bool	When Bit true enable Writing sequence of parameters from PLC to Energy Efficient Module.
xEnableMonitorUnderVoltage	Bool	Set bit True – Diagnose under voltage status enabled, False - Diagnose under voltage status disabled.
xEnableMonitorLimitValue	Bool	Set bit True – Diagnose limit value status enabled, False - Diagnose limit value status disabled.
xEnableMonitorParameterError	Bool	Set bit True – Diagnose parameter error status enabled, False - Diagnose parameter error status disabled.
byMonitorValue	SINT	Specifies the time after the supply voltage has been switched on, During which limit monitoring is deactivated.
siUnitPressureStatus	SINT	Unit of Pressure. Set value 0 – mbar, 1 – kPa, 2 – psi/10, 3 – Not premissible
siUnitConsumptionStatus	SINT	Unit of Consumption. Set value 0 – l, 1 – m³, 2 – scf, 3 – Not premissible
siUnitFlowStatus	SINT	Unit of Flow. Set value 0 – l/min, 1 – Not permissible, scfm/10 – 2, 3 – Not permissible.
siUnitFlowStdStatus	SINT	Unit of Flow standard. Set value 0 – DIN1343, 1 – ISO 2533, 2 – ISO6358.
wFlowLimit	INT	Set Upper Flow limit.
wPressureLimit	INT	Set Upper Pressure limit.
wPressureChange	INT	Set Upper Pressure limit for pressure change.
wAutoBlockingDelay	INT	Set Time to automatically blocking the value, When flow value below the Auto shut-off low flow limit parameter.
wAutoBlockingFlowLimit	INT	Set Low flow limit for auto-block the valve.
xBusy	BOOL	Writing process active.
xDone	BOOL	Writing process completed successfully.

Input Tag Name	Data Type	Description
xError	BOOL	Writing process completed with error.

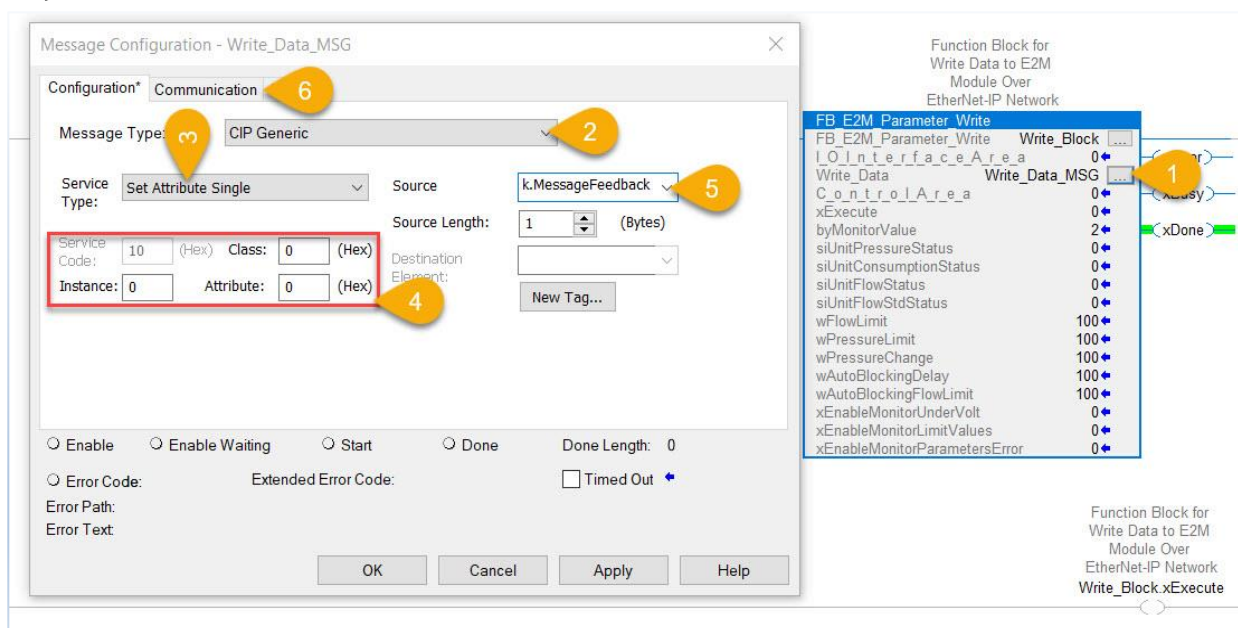
Table 4.8: Write Function Block Input Tags

Output Tag Name	Data Type	Description
Write_Data	Message	Message instruction tag for Write data to Energy Efficient Module.

Table 4.9: Write Function Block InOut Tags

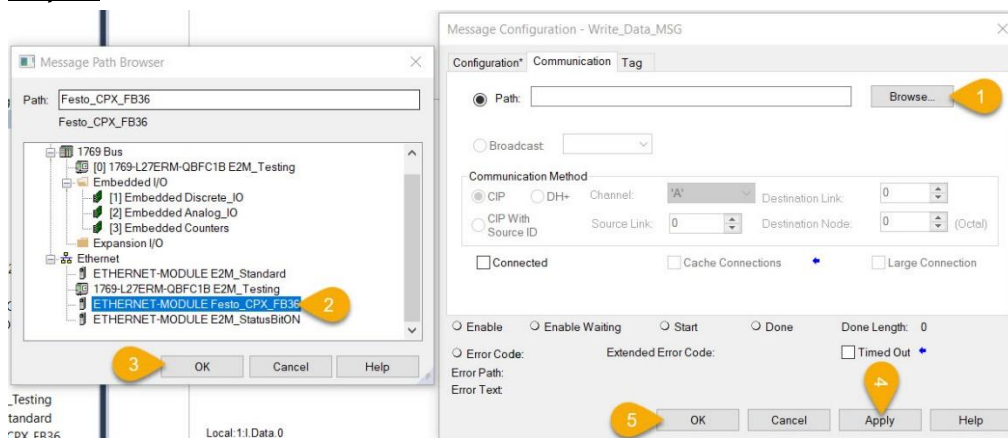
4.4.2 Configure Write Function Block Message Instruction

Step- 1



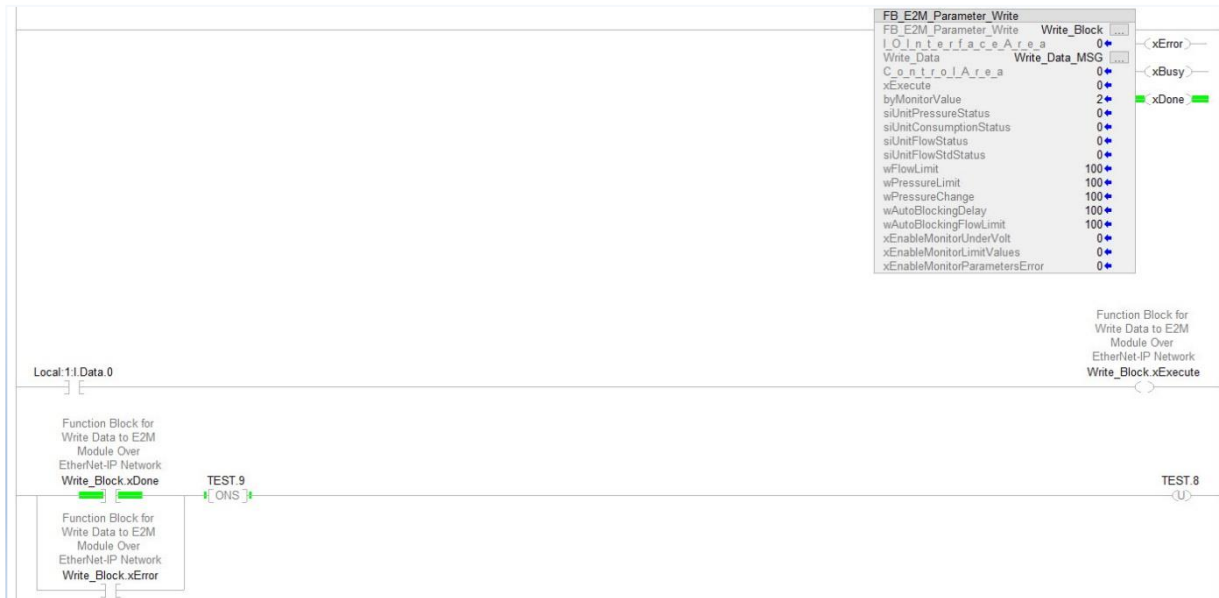
1. Select “**Browse**” button of Message instruction tag.
2. Select Message Type as “**CIP Generic**” from drop-down menu.
3. Select Service Type as “**set Attribute Signal**” from drop-down menu.
4. Fill zero to **Instance, Attribute & Class**.
5. Assign output tag “**MessageFeedback**” of Write_Block FB to “**Source**” field in message instruction.
6. Click “**Communication**” tab.

Step – 2

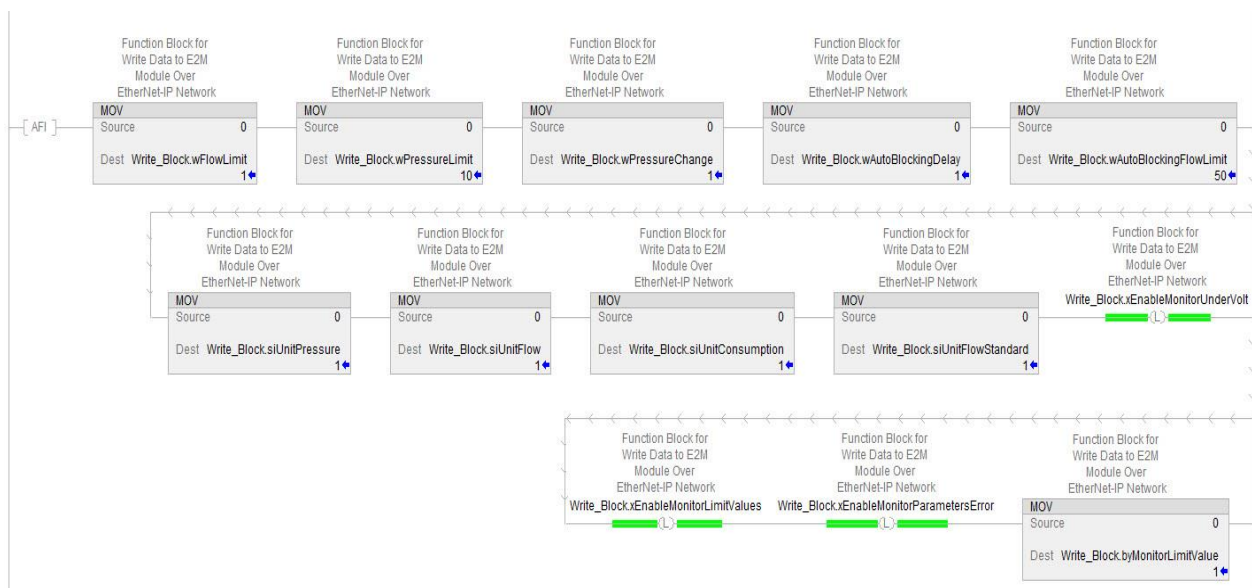


1. Select **“Browse”** button of communication path.
2. Select the **E2M module** from the Ethernet communication tree from Message Path Browser.
3. Click the **“OK”** button to ensure the selection.
4. Click **“Apply”** button to apply the changes.
5. Click **“OK”** button to complete the message instruction configuration.

4.4.3 Sample program of Write Block



When tag “Write_Block.xExecute” is true Function Block starts to write data to Energy Efficient Module. Once “Write_Block.xExecute” is true “Write_Block.xDone” & “Write_Block.xError” tags will become false. After completion of write process if all writing parameter done successfully “Write_Block.xDone” will be true & value of parameters will updated in respective module parameter. If Writing process completed unsuccessful “Write_Block.xError” will become true. If Error bit high please check the hardware communication connection between PLC & Energy Efficient Module. After result updating enable bit should be unlatch (TEST.8) .

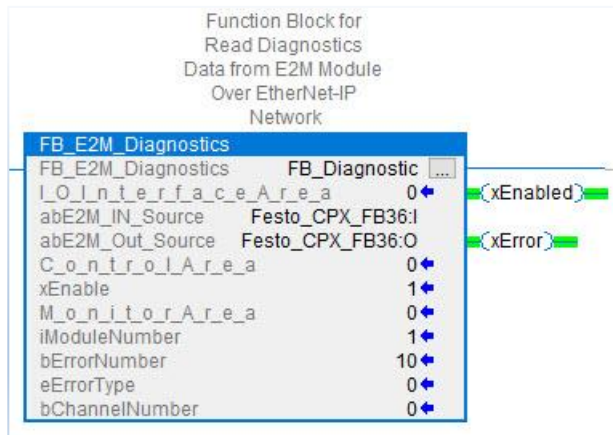


Above program shows mapping of all parameter to write in Energy Efficient Module.

4.5 Diagnostics Function Block Programming & Configuration

Diagnostics Block used to monitor the errors in Energy Efficient Module. The name of the function block is given as FB_E2M_Diagnostics. Its work as continues cycle mode & DIL switch group – 2 configuration must be in IO enable mode. This block is used to diagnose following errors.

- Error Module Number
- Error Channel Number
- Error Number
- Error Type



To add the Diagnostics Function Block in PLC program please refer the step – 1 to step -3 of chapter 4.2.1.



Note

It's must to enable IO enable mode in DIL switch group – 2 configuration for use Diagnostics Function Block. DIL – 2 position DIL 2.1 – ON & DIL 2.2 – OFF.

4.5.1 Diagnostics Block Tag Details

Input Tag Name	Data Type	Description
xEnable	BOOL	When Bit true enables diagnostics of Energy Efficient Module.

Table 4.10: Diagnostics Function Block Input Tags

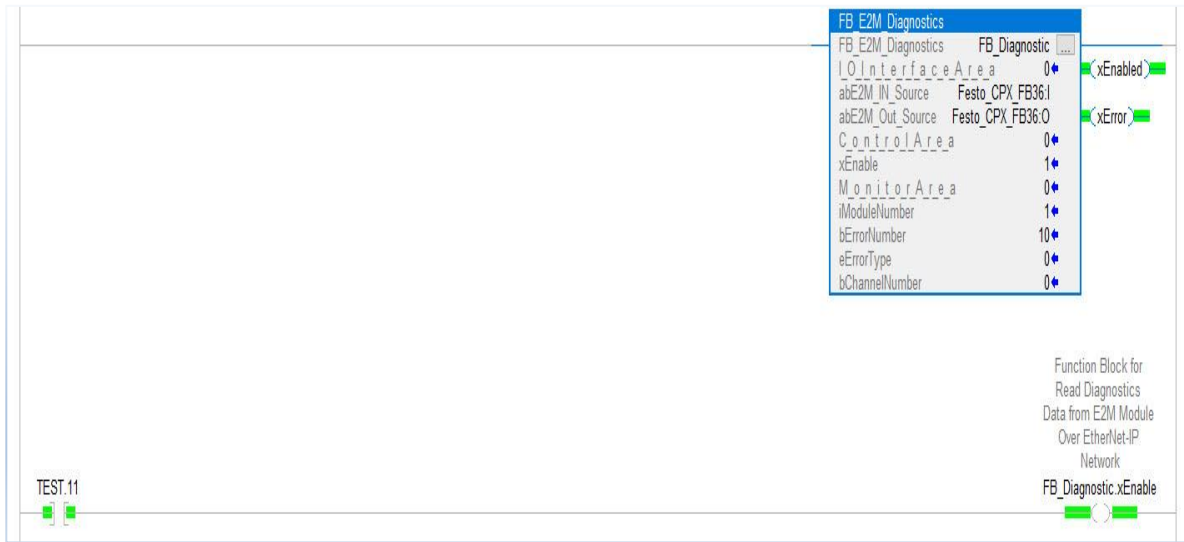
Output Tag Name	Data Type	Description
xEnabled	BOOL	Diagnostics monitor enabled feedback signal.
xError	BOOL	Energy Efficient Module in error feedback signal.
iModuleNumber	INT	Frist error module number.
bErrorNumber	SINT	Error number of module.
eErrorType	SINT	Type of Error. When value 0 – Input, 1 – Output, 2 – Module, 3 – No Error. Please refer chapter 5 Help links manual for more information.
bChannelNumber	SINT	Specifies number of the channel faulty Channel (0...65)

Table 4.11: Diagnostics Function Block Output Tags

Output Tag Name	Data Type	Description
abE2M_IN_Source	AB:ETHERNET_MODULE_SINT_14Bytes:I:0	System generated Input structure tag
abE2M_Out_Source	AB:ETHERNET_MODULE_SINT_6Bytes:O:0	System generated Output structure tag

Table 4.12: Diagnostics Function Block InOutput Tags

4.5.2 Sample Program of Diagnostics Block



When `FB_Diagnostic.xEnable` true Function Block starts monitor the Energy Efficient Module & Stopes monitor `xEnable` false. Diagnostic values will update in monitor tags when `xenable` bit true.

5 Help

This chapter will give additional documents details & web links to download it.

- Energy Efficient Module Over View
https://www.festo.com/cat/en-gb_gb/data/doc_ENGB/PDF/EN/MSE6_EN.PDF
- Energy Efficient Module Mounding Installation
https://www.festo.com/net/SupportPortal/Files/467531/MSE6-E2M_IN_2017-07c_8074161g1.pdf
- Energy Efficient Module Commissioning Parametrization & Error Description
https://www.festo.com/net/SupportPortal/Files/463109/MSE6-E2M_SY_2017-03d_8070284g1.pdf
- Terminal CPX Bus Node FB36 User Manual
https://www.festo.com/net/SupportPortal/Files/451228/CPX-FB36_2016-11a_8024075g1.pdf
- FESTO Maintenance Tool Software Download Link
https://www.festo.com/net/en-id_id/SupportPortal/default.aspx?q=1912451&tab=4&s=t#result
- Allen-Bradly Logix PLC General Instruction Reference Manual
https://literature.rockwellautomation.com/idc/groups/literature/documents/rm/1756-rm003_-en-p.pdf
- Allen-Bradly Logix PLC Add-On Instruction (Function Block's) Manual
https://literature.rockwellautomation.com/idc/groups/literature/documents/pm/1756-pm010_-en-p.pdf
- Allen-Bradly Logix PLC Message Instruction Manual
https://literature.rockwellautomation.com/idc/groups/literature/documents/pm/1756-pm012_-en-p.pdf
- Allen-Bradly Logix PLC EtherNet/IP Configuration Manual
https://literature.rockwellautomation.com/idc/groups/literature/documents/um/enet-um001_-en-p.pdf