



IO-Link Master Add-On Instruction Guide, v5
January 7th, 2026

This document covers the installation and use of optional Add-On Instructions (AOIs) for the Logix Designer software package from Rockwell Automation. This AOI handles acyclic (Parameter Data) IO-Link commands from various IO-Link Masters.

All the IO-Link Master AOIs are meant to be used in conjunction with the Banner_IOL_Parmaeter_AOI.

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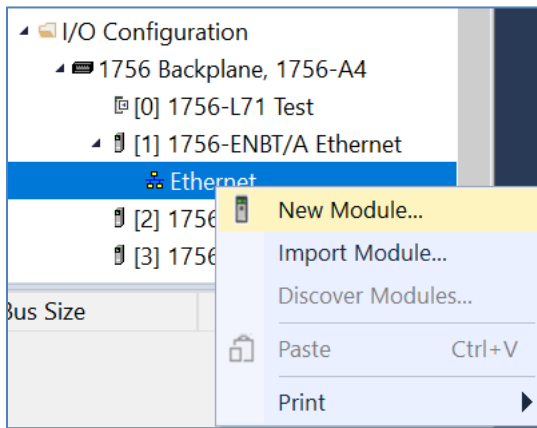
1. DXMR IO-Link Setup

This section describes how to install the DXMR into Studio 5000 and configure the AOI used Studio 5000.

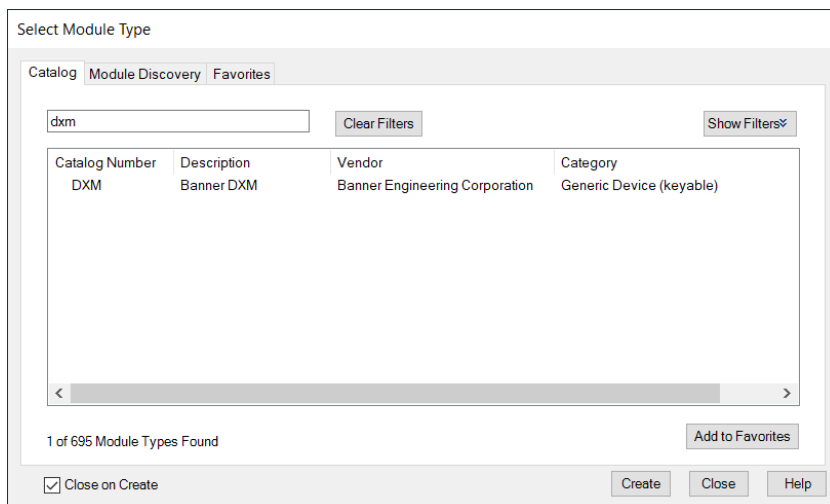
Create DXMR Connection

Make an EtherNet/IP connection to the Banner IO-Link Master.

1. There are two ways to create a connection to the DXMR.
 - a. If an EDS will be used go to Step 2.
 - b. If a generic connection will be used go to Step 3.
2. EDS setup instructions.
 - a. Create an Ethernet communications module for the Banner DXMR IO-Link Master device.

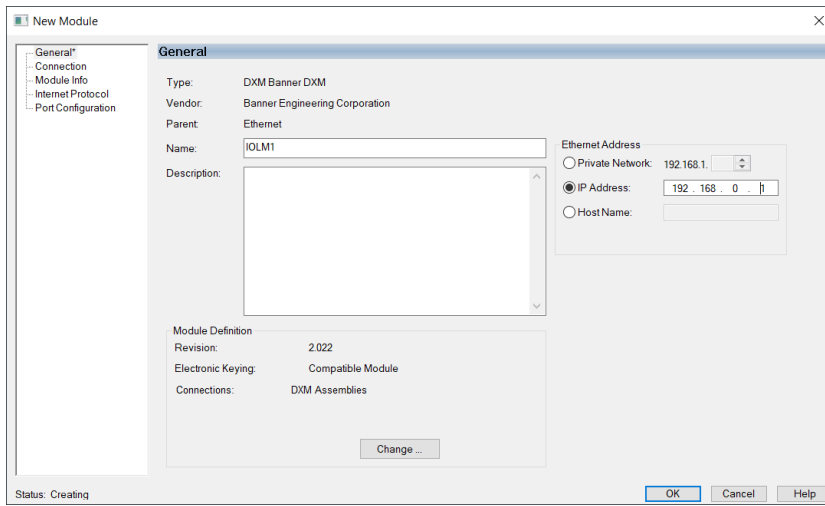


- b. The "Select Module Type" window will pop-up.
 - i. Search DXM.



- c. Select "DXM" option.

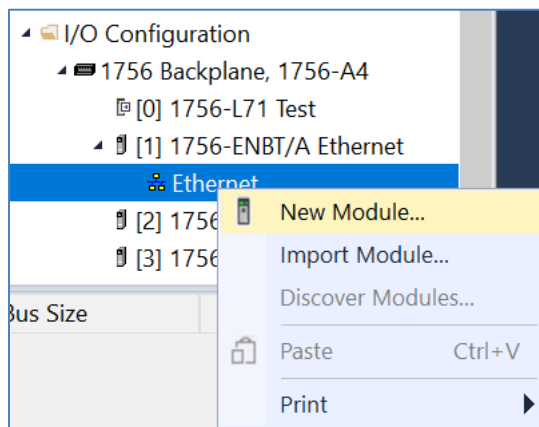
d. The “New Module” window will open.



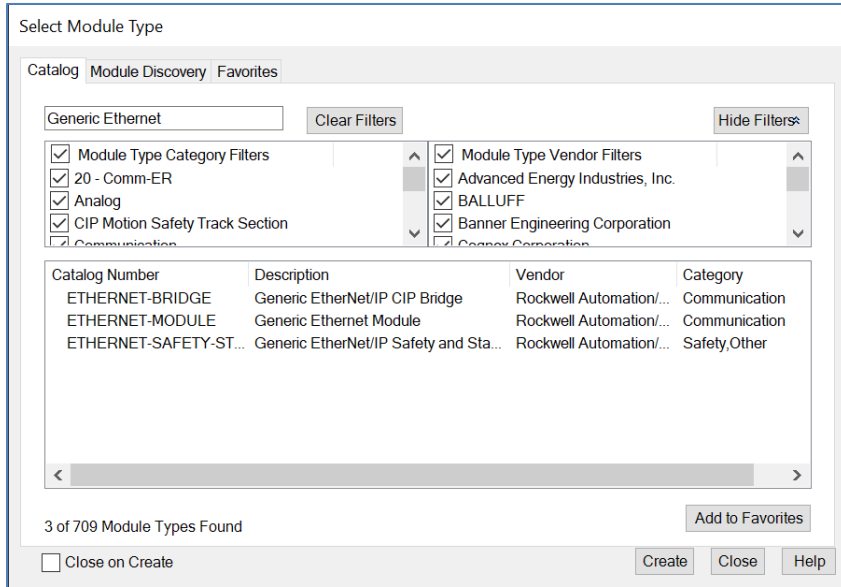
- e. Enter the Name of the unit and an IP Address.
- f. The data is defaulted as SINT. This is the data type that is used for a DXMR IO-Link models.
- g. EDS setup is complete.

3. Generic Ethernet Module Setup.

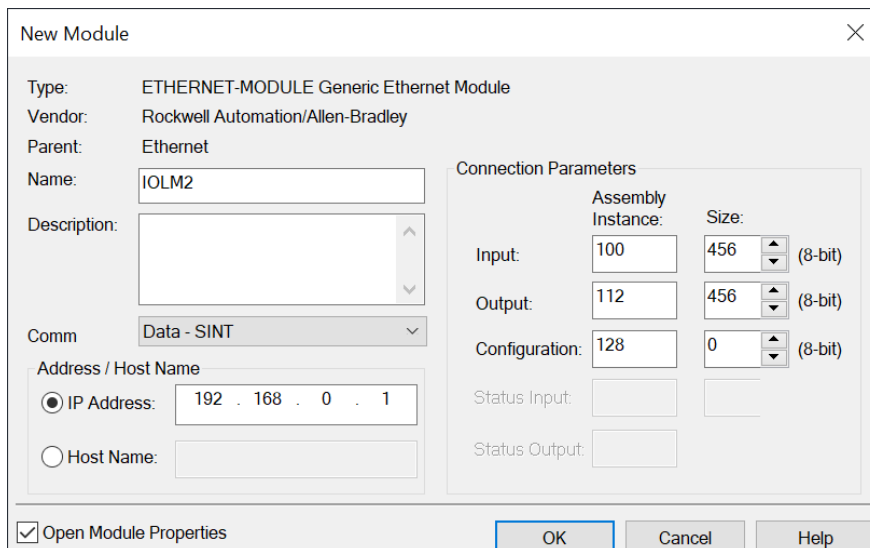
- a. Create an Ethernet communications module for the Banner DXMR90 IO-Link Master.



- b. The “Select Module Type” window will pop-up. Search for Generic Ethernet.

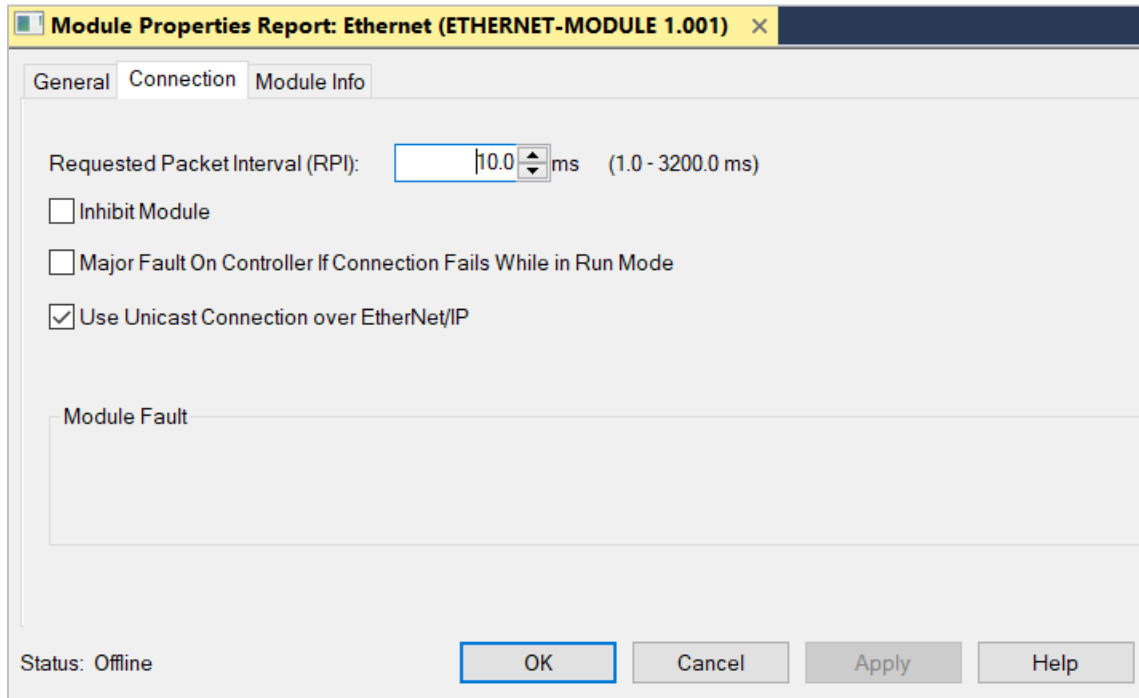


- c. Select the “Ethernet-Module” option.
- d. The “New Module” window will open.
- e. Make the following changes.
 - i. Change the Comm type from Data – DINT to Data – SINT.
 - ii. Name the unit. (The example uses IOLM2).
 - iii. Connection Parameters are Input 100 and Size 456, Output 112 and Size of 456, and Configuration 128 and Size 0.
 - iv. Enter the IP Address of the DXMR90-4K (192.168.0.1 was used in this example).
 - v. Press the OK button to finalize the changes.



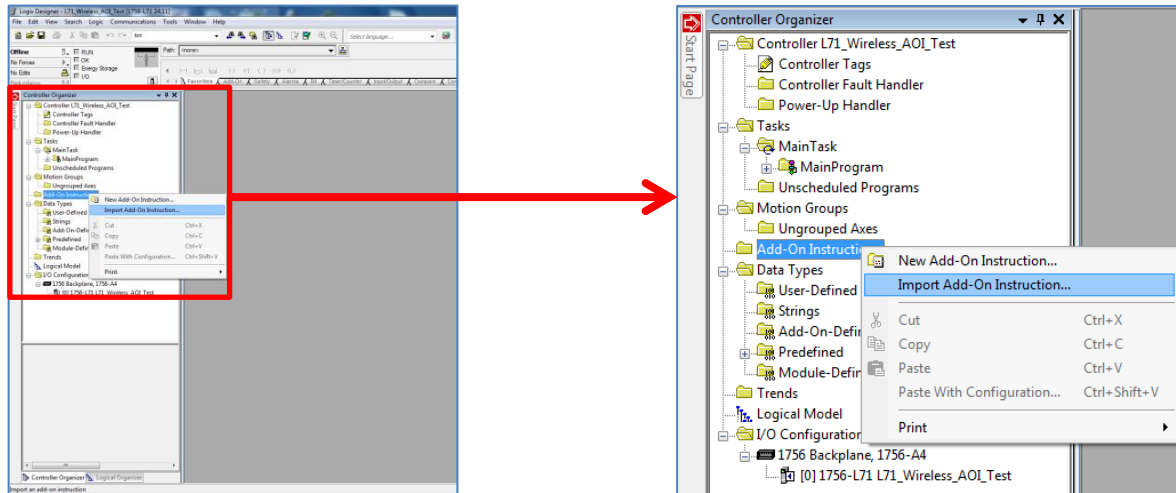
- f. The “Module Properties Report” window will pop-up.
- g. If the Connection tab is not active, press it to activate it.

- h. The RPI (Requested Packet Interval) should be set to 20. This number may need to be increased depending on the unit's operation in the system.
- i. Press OK to finalize the settings.

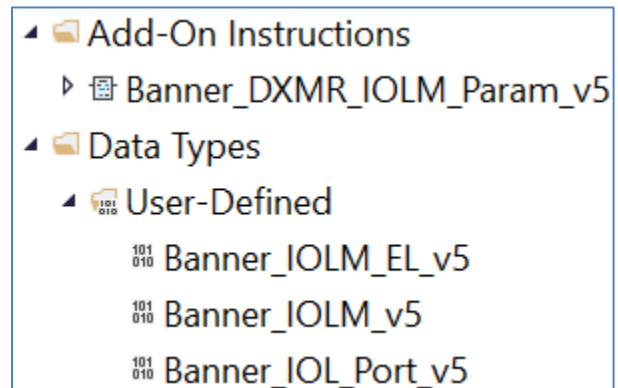


DXMR AOI Installation

1. Open a project.
2. In the Controller Organizer window, right-click on the Add-On Instruction folder. Select the Import Add-On Instruction option.

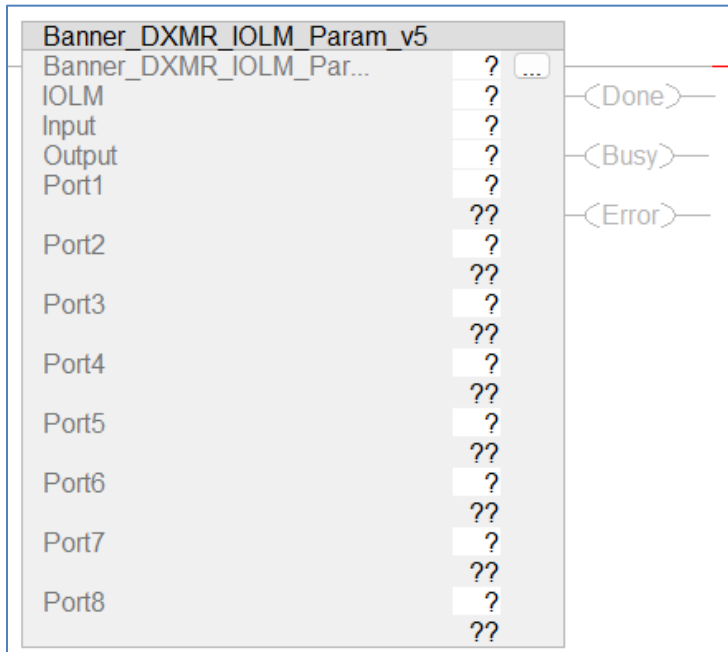


3. Navigate to the correct file location and select the AOI to be installed. In this example the “Banner_DXMR_IOLM_v5_AOI.L5X” file will be selected. Click the Open button.
4. The Import Configuration window will pop up. The default selection will create all the necessary items for the AOI. Click the OK button to complete the import process.
5. The AOI is added to the Controller Organizer window and should look like the image shown.
6. AOI installation into the Logix Designer software complete.



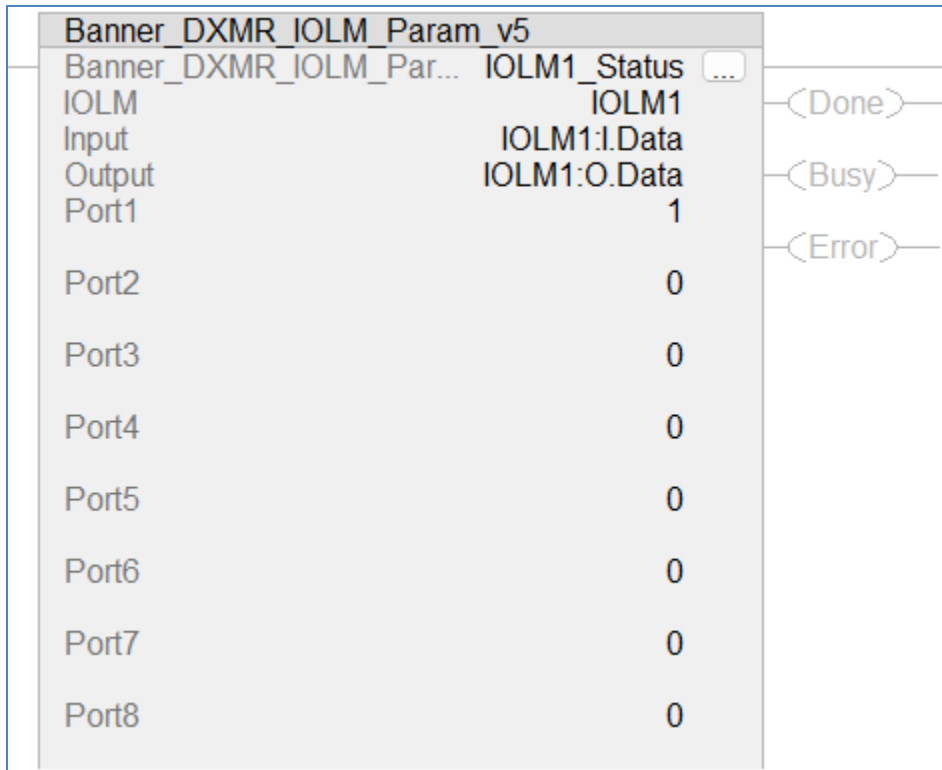
DXMR AOI Configuration

1. Add the “Banner_DXMR_IOLM_Param_v5” AOI to your ladder logic program. For each of the question marks shown in the instruction we need to create and link a new tag array. The AOI includes a new type of User Defined Tag (UDT): a custom array of tags meant specifically for this AOI.



2. In the AOI, right-click on the question mark on the line labeled “Banner_DXMR_IOLM_Param_v5”. Click New Tag. In this example, we’ll use the name “IOLM1_Status”. The example naming convention accounts for this being the #1 IO-Link Master in our program. More masters could be named IOLM2, IOLM3, etc.
3. Now create a new tag array for the “IOLM” line in the AOI. Here we used the name “IOLM1”. The tags created here will serve as linkages between the IO-Link Master AOI and the connected Banner device AOI(s). This group of tags also controls the flow of information to and from the master, ensuring that all sensors get a chance to read and write in an orderly fashion.
4. Link the Input line to the Input data from DXMR. Here the DXMR was called IOLM1, so the tag needed is IOLM1:I.Data.
5. Link the Output line to the Output data from DXMR. The tag needed is IOLM1:O.Data.
6. Port 1 Through 8 tells the AOI which ports are controlled. Set the Port value to 1 if controlled and 0 if not controlled.

7. The completed AOI should look like the below image.



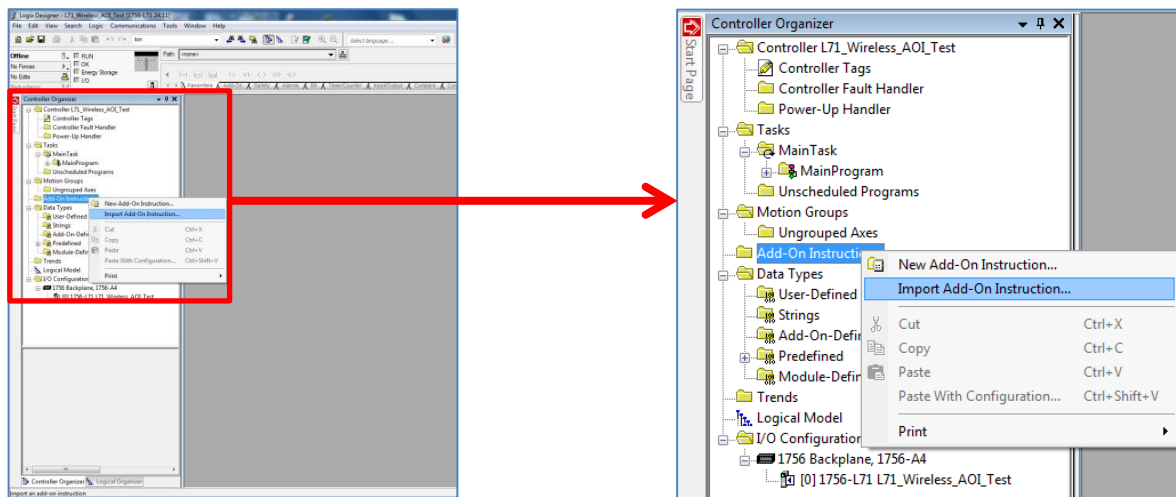
- 8. AOI configuration complete.
- 9. Go to the Import Device Data and Rule Set for Banner IOL Parameter AOI section to complete setup.

2. Allen Bradley 1732 & 1734 IO-Link Master Setup

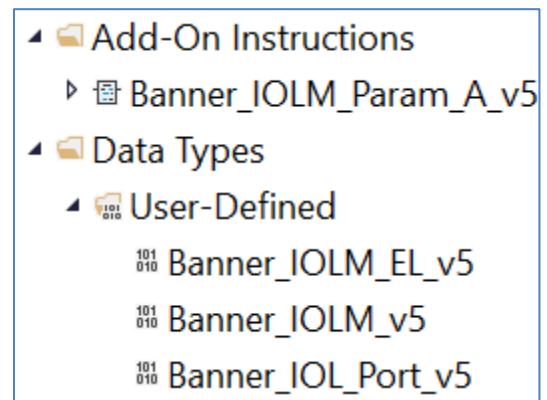
Ensure that the Allen Bradley IO-Link Master connection has been created in Studio 5000 before proceeding.

AB AOI Installation

1. Open a project.
2. In the Controller Organizer window, right-click on the Add-On Instruction folder. Select the Import Add-On Instruction option.

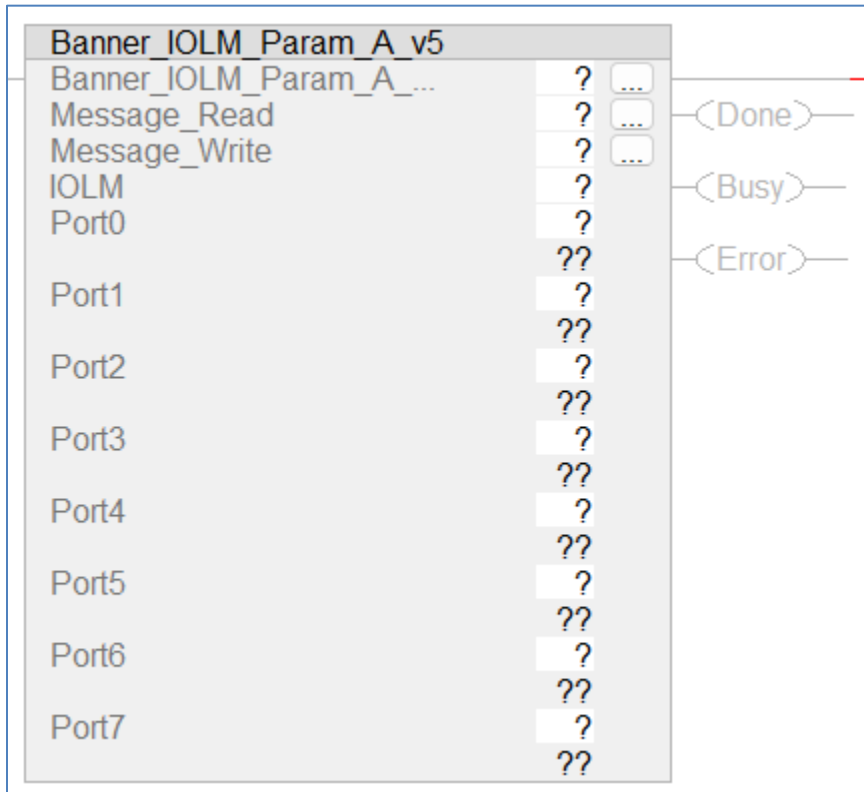


3. Navigate to the correct file location and select the AOI to be installed. In this example the “Banner_IOLM_Param_A_v5_AOI.L5X” file will be selected. Click the Open button.
4. The Import Configuration window will pop-up. The default selection will create all the necessary items for the AOI. Click the OK button to complete the import process.
5. The AOI is added to the Controller Organizer window and should look like the image shown.
6. AOI installation into the Logix Designer software complete.



AB AOI Configuration

1. Add the “Banner_IOLM_Param_A_v5” AOI to your ladder logic program. For each of the question marks shown in the instruction we need to create and link a new tag array. The AOI includes a new type of User Defined Tag (UDT): a custom array of tags meant specifically for this AOI.



2. In the AOI, right-click on the question mark on the line labeled “Banner_IOLM_Param_A_v5”. Click New Tag. In this example, we’ll use the name “IOLM1_Status”. The example naming convention accounts for this being the #1 IO-Link Master in our program. More masters could be named IOLM2, IOLM3, etc.
3. Now set up the Messages used to read and write to devices connected to this IO-Link Master. Right-click on the question mark for Message_Read line in the AOI and choose New Tag. In this example we’ll use the tag name IOLM1_Read. Click Create.
4. Do the same for the Message_Write line in the AOI.

5. Now create a new tag array for the “IOLM” line in the AOI. Here we used the name “IOLM1”. The tags created here will serve as linkages between the IO-Link Master AOI and the connected Banner device AOI(s). This group of tags also controls the flow of information to and from the master, ensuring that all sensors get a chance to read and write in an orderly fashion.

New Tag

Name: IOLM1

Description:

Usage: <controller>

Type: Base Connection...

Alias For:

Data Type: Banner_IOLM_v5

Parameter Connection:

Scope: Test

External Access: Read/Write

Style:

Constant

Sequencing

Open Configuration

Open Parameter Connections

Create

Cancel

Help

6. Now configure “Message_Read”, setting up the Explicit Message that will handle half of the communications between the PLC and the IO-Link Master. Click on the “...” button at the far right of the “Message_Read” line.

7. In the Message Configuration window, keep the Message Type “CIP Generic” and the Service Type “Custom”. Enter a Service Code of 4d.

Message Configuration - IOLM1_Read

Configuration* Communication Tag

Message Type: CIP Generic

Service Type: Custom Source: [Empty]

Service Code: 4d (Hex) Class: 0 (Hex) Source Length: 1 (Bytes)

Instance: 0 Attribute: 0 (Hex) Destination Element: [Empty]

New Tag...

Enable Enable Waiting Start Done Done Length: 0

Error Code: Extended Error Code: Timed Out

Error Path:
Error Text:

OK Cancel Apply Help

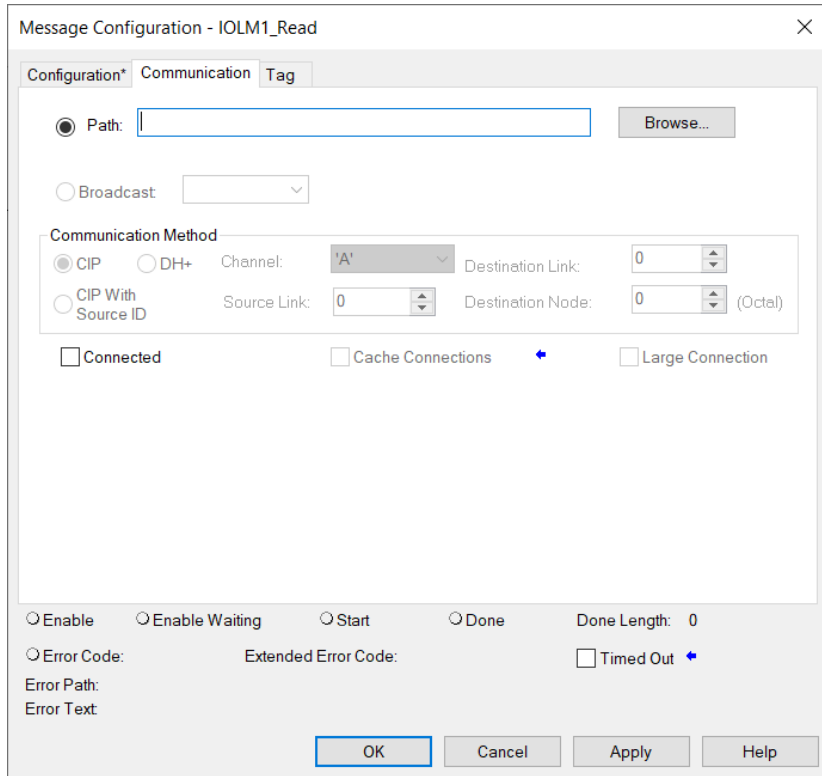
- For the Source Element field, select "IOLM1.Message_Source_Data".

Enter Name Filter...		Show: All Tags
Name	Data Type	
▲ IOLM1	Banner_IOLM_v4	
▶ IOLM1.Message_Source_Data	SINT[190]	
▶ IOLM1.Message_Destination_Data	SINT[190]	
▶ IOLM1.Error_Log	Banner_IOLM_EL_v4[10]	
IOLM1.Error_Write_Retry	BOOL	
IOLM1.Num_Error_MSGS	DINT	
IOLM1.IO_Link_Master_Busy	BOOL	
IOLM1.AOI_Reset	BOOL	
▶ IOLM1.Port_Data	Banner_IOL_Port_v4	
IOLM1.Halt_Operation	BOOL	

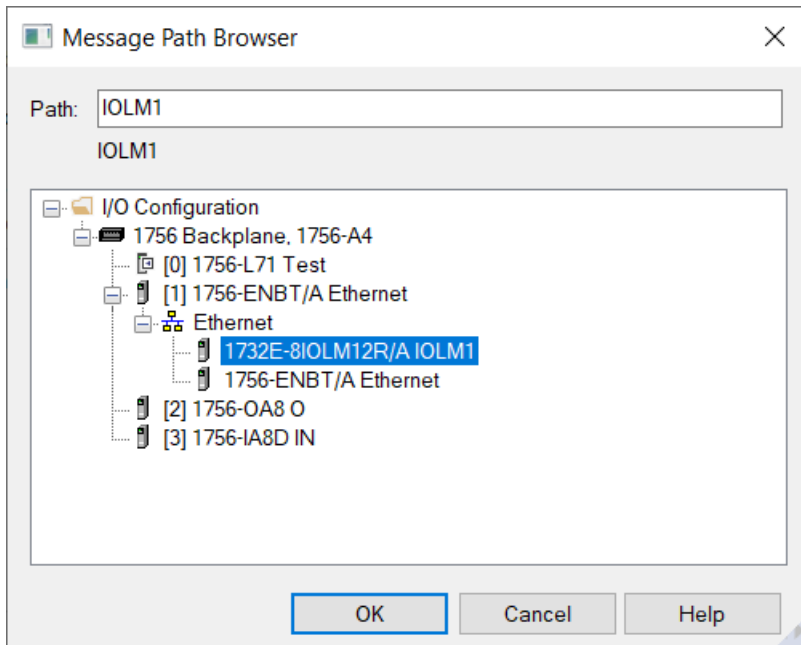
- For Destination Element, select "IOLM1.Message_Destination_Data".

Enter Name Filter...		Show: All Tags
Name	Data Type	
▲ IOLM1	Banner_IOLM_v4	
▶ IOLM1.Message_Source_Data	SINT[190]	
▶ IOLM1.Message_Destination_Data	SINT[190]	
▶ IOLM1.Error_Log	Banner_IOLM_EL_v4[10]	
IOLM1.Error_Write_Retry	BOOL	
IOLM1.Num_Error_MSGS	DINT	
IOLM1.IO_Link_Master_Busy	BOOL	
IOLM1.AOI_Reset	BOOL	
▶ IOLM1.Port_Data	Banner_IOL_Port_v4	
IOLM1.Halt_Operation	BOOL	

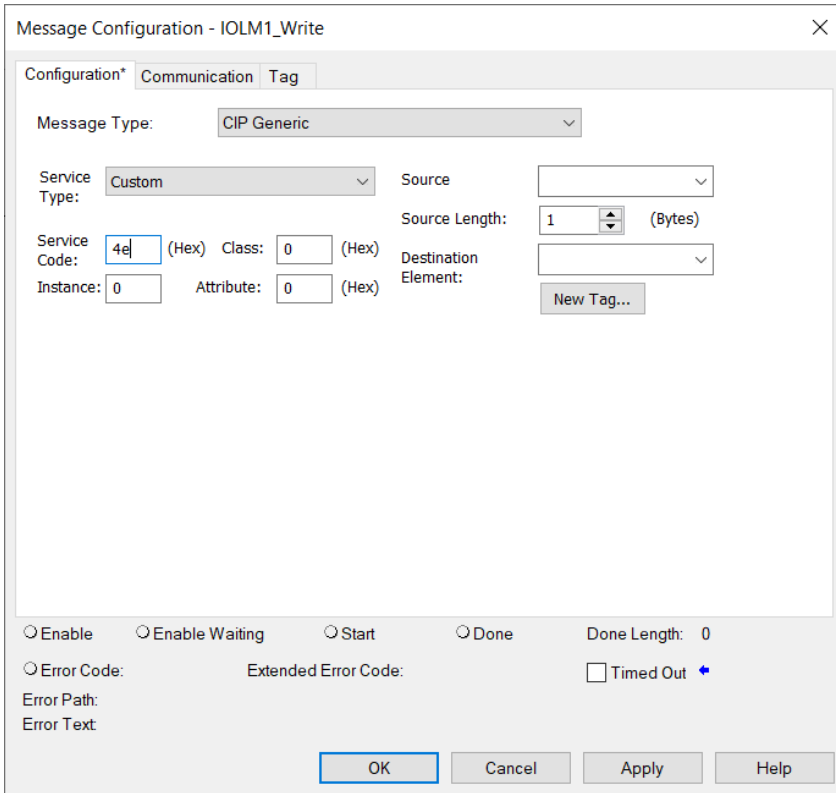
10. Now click on the Communication tab, then click the Browse button.



11. Select the IO-Link Master, then click OK to close the Message Path Browser window, then click OK again to close the Message Configuration window.



12. Now configure “Message_Write”, setting up the Explicit Message that will handle the other half of the communications between the PLC and the IO-Link Master. Click on the “...” button at the far right of the “Message_Write” line.
13. In the Message Configuration window, keep the Message Type “CIP Generic” and the Service Type “Custom”. Enter a Service Code of 4e. In the Message Configuration window, keep the Message Type “CIP Generic” and the Service Type “Custom”. Enter a Service Code of 4e.



14. For the Source Element field, select “IOLM1.Message_Source_Data”.

Enter Name Filter...		Show:	All Tags
Name			Data Type
▲ IOLM1			Banner_IOLM_v4
▶ IOLM1.Message_Source_Data			SINT[190]
▶ IOLM1.Message_Destination_Data			SINT[190]
▶ IOLM1.Error_Log			Banner_IOLM_EL_v4[10]
▶ IOLM1.Error_Write_Retry			BOOL
▶ IOLM1.Num_Error_MSGS			DINT
▶ IOLM1.IO_Link_Master_Busy			BOOL
▶ IOLM1.AOI_Reset			BOOL
▶ IOLM1.Port_Data			Banner_IOL_Port_v4
▶ IOLM1.Halt_Operation			BOOL

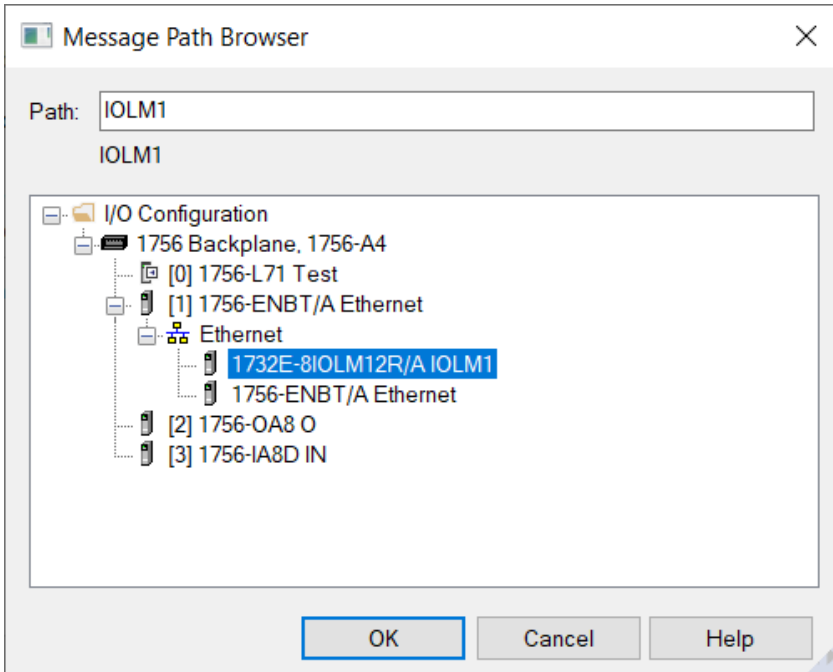
15. For Destination Element, select “IOLM1.Message_Destination_Data”.

Enter Name Filter...		Show: All Tags
Name	Data Type	
▲ IOLM1	Banner_IOLM_v4	
▶ IOLM1.Message_Source_Data	SINT[190]	
▶ IOLM1.Message_Destination_Data	SINT[190]	
▶ IOLM1.Error_Log	Banner_IOLM_EL_v4[10]	
▶ IOLM1.Error_Write_Retry	BOOL	
▶ IOLM1.Num_Error_MSGS	DINT	
▶ IOLM1.IO_Link_Master_Busy	BOOL	
▶ IOLM1.AOI_Reset	BOOL	
▶ IOLM1.Port_Data	Banner_IOL_Port_v4	
▶ IOLM1.Halt Operation	BOOL	

16. Now click on the Communication tab, then click the Browse button.

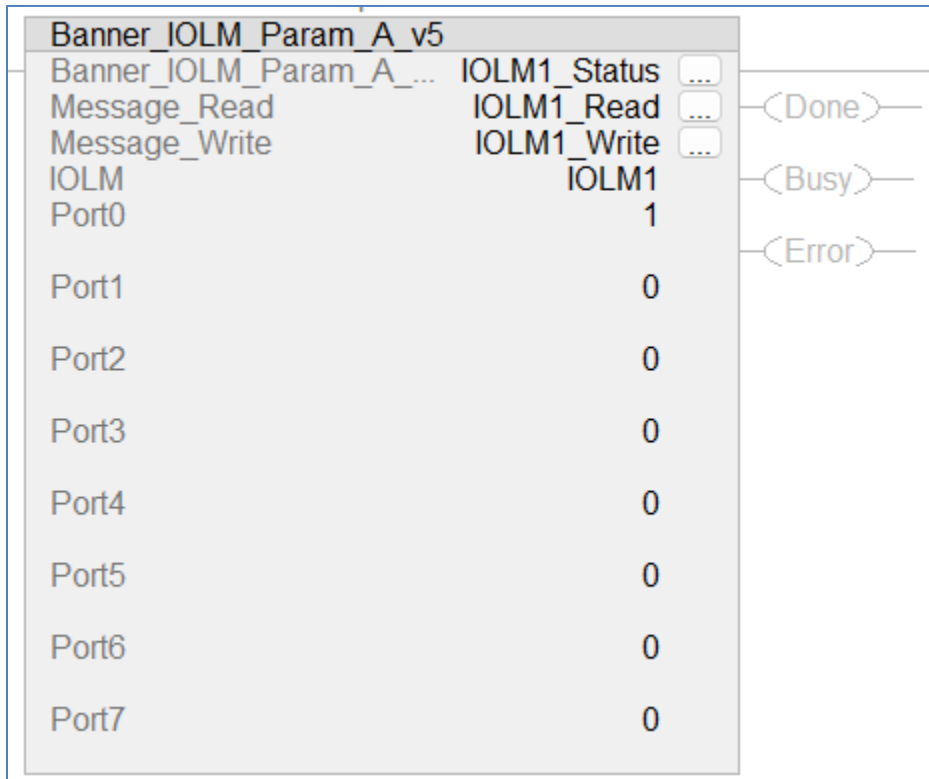
The screenshot shows the 'Message Configuration - IOLM1_Write' dialog box with the 'Communication' tab selected. The 'Path' field is empty, and the 'Browse...' button is highlighted with a red box. Below the 'Path' field, there are radio buttons for 'Broadcast' and 'Communication Method'. Under 'Communication Method', 'CIP' is selected, with 'Channel' set to 'A', 'Destination Link' set to 0, 'Source Link' set to 0, and 'Destination Node' set to 0 (Octal). There are also checkboxes for 'Connected', 'Cache Connections', and 'Large Connection'. At the bottom, there are radio buttons for 'Enable', 'Enable Waiting', 'Start', and 'Done', with 'Done Length' set to 0. There are also radio buttons for 'Error Code', 'Extended Error Code', and 'Timed Out'. The 'Error Path' and 'Error Text' fields are empty. At the bottom of the dialog are 'OK', 'Cancel', 'Apply', and 'Help' buttons.

17. Select the IO-Link Master, then click OK to close the Message Path Browser window, then click OK again to close the Message Configuration window.



18. Port 1 Through 8 tells the AOI which ports are controlled. Set the Port value to 1 if controlled and 0 if not controlled. In this example, port 1 will be the only port controlled.

19. The completed AOI should look like the below image.



20. AOI configuration complete.

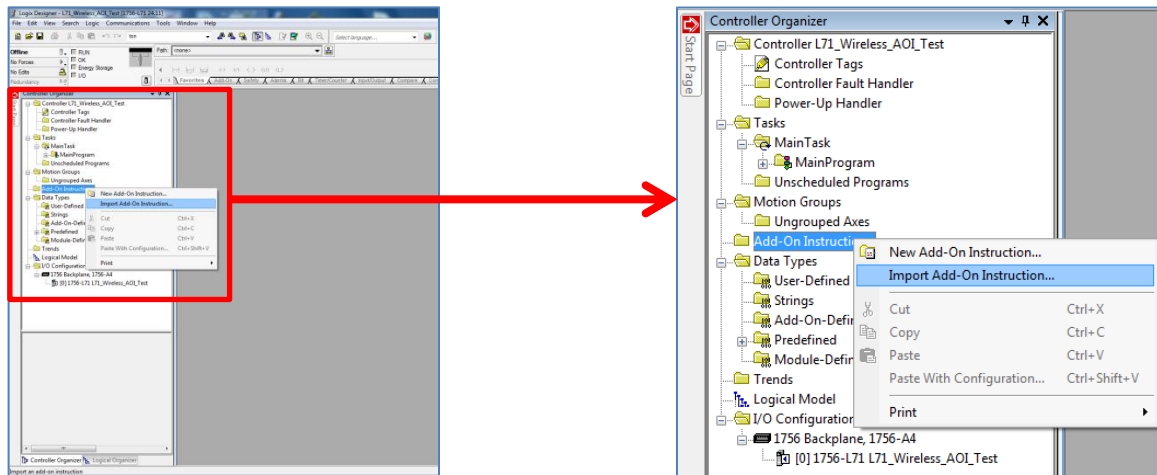
21. Go to the Import Device Data and Rule Set for Banner IOL Parameter AOI section to complete setup.

3. Allen Bradley 5032 IO-Link Master Setup

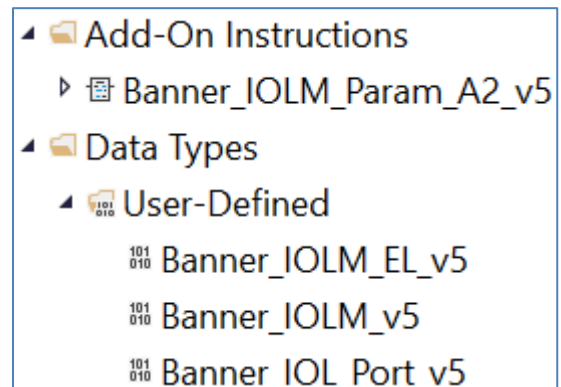
Ensure that the AB 5032 IO-Link Master connection has been created in Studio 5000 before proceeding.

5032 AOI Installation

1. Open a project.
2. In the Controller Organizer window, right-click on the Add-On Instruction folder. Select the Import Add-On Instruction option.

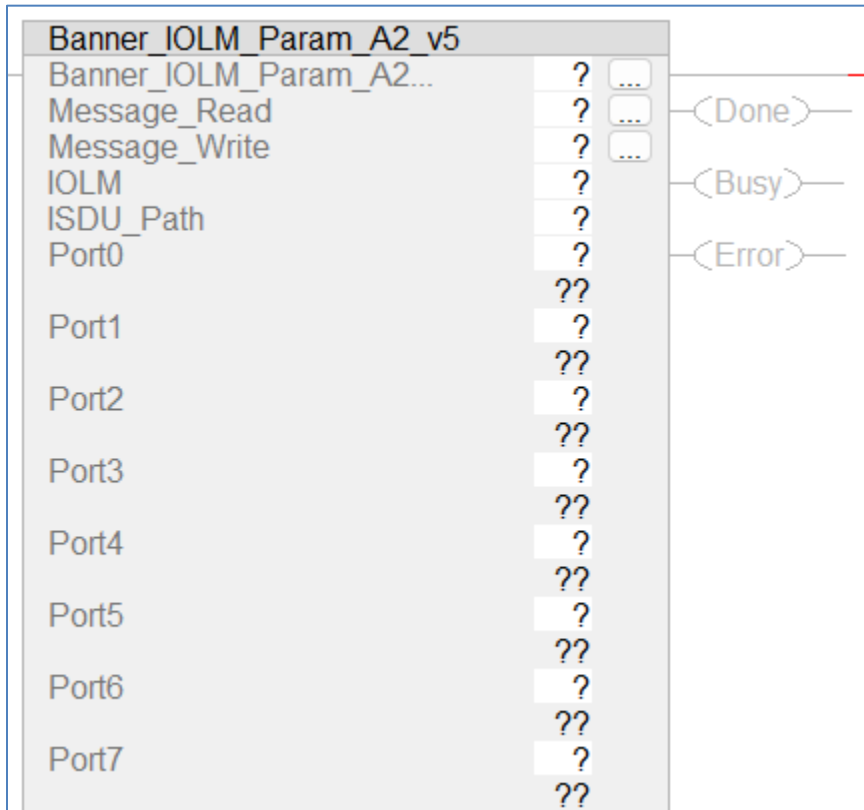


3. Navigate to the correct file location and select the AOI to be installed. In this example the “Banner_IOLM_Param_A5_v4_AOI.L5X” file will be selected. Click the Open button.
4. The Import Configuration window will pop-up. The default selection will create all the necessary items for the AOI. Click the OK button to complete the import process.
5. The AOI is added to the Controller Organizer window and should look like the image to the right.
6. AOI Installation into the Logix Designer software complete.



5032 AOI Configuration

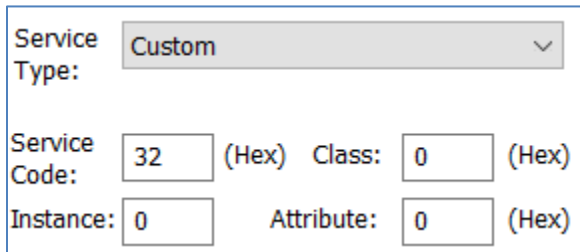
1. Add the “Banner_IOLM_Param_A2_v5” AOI to your ladder logic program. For each of the question marks shown in the instructions we need to create and link a new tag. The AOI includes a new type of User Defined Tag (UDT): a custom array of tags meant specifically for this AOI.



2. In the AOI, right-click on the question mark on the line labeled “Banner_IOLM_Param_A2_v5”. Click New Tag. In this example, we’ll use the name “IOLM1_Status”. The example naming convention accounts for this being the #1 IO-Link Master in our program. More masters could be named IOLM2, IOLM3, etc.
3. Now we set up the Messages used to read and write to devices connected to this IO-Link Master. Right click on the question mark for the “Message_Read” line in the AOI and choose New Tag. In this example we’ll use the tag name “IOLM1_Read”. Click Create.

Do the same for the “Message_Write” line in the AOI. In this example “IOLM1_Write” is used.

4. Now create a new tag array for the "IOLink" line in the AOI. Here we used the name "IOLM1". The tags created here will serve as linkages between the IO-Link Master AOI and the connected Banner device AOI(s). This group of tags also controls the flow of information to and from the master, ensuring that all sensors get a chance to read and write in an orderly fashion.
5. Create a new tag for the "ISDU_Path" line. This creates an array which stores the path for the controller to take to access the ISDU operation for the 5032 IO-Link Master. Can also import the tag via a rung import.
6. Enter either a 0 or 1 into Port0 to Port7. If the port has a Banner IO-Link Device connected to the Port then use a 1; otherwise, set it to a 0.
7. Now configure "Message_Read", setting up the Explicit Message that will handle half of the communications between the PLC and the IO-Link Master. Click on the "..." button at the far right of the "Message_Read" line.
8. In the Message Configuration window, keep the Message Type "CIP Generic" and the Service Type "Custom". Enter a Service Code of 32.

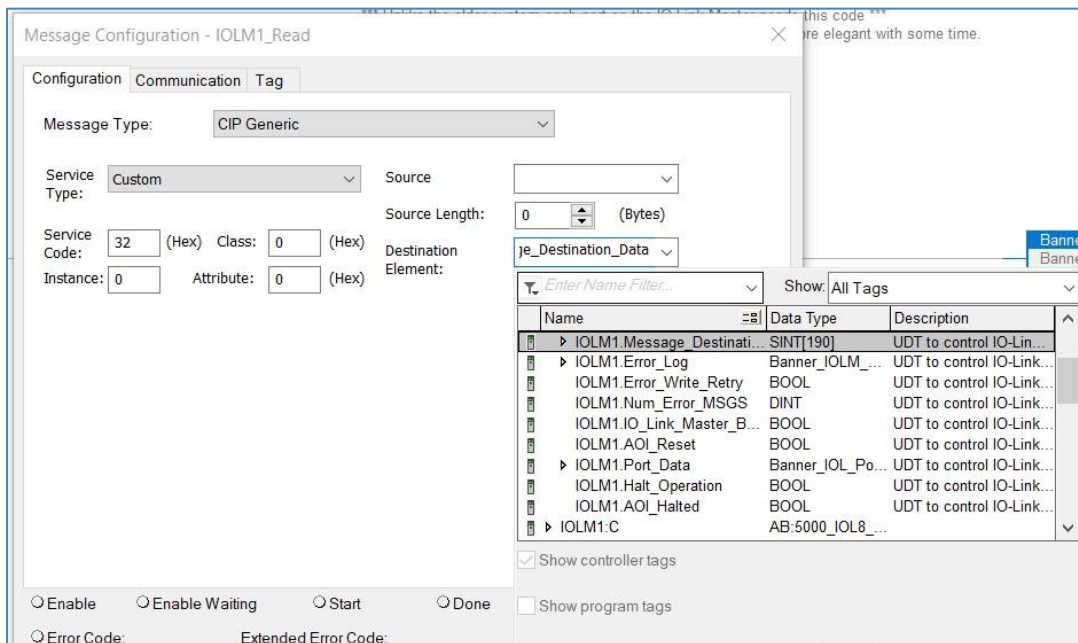


Service Type: Custom

Service Code: 32 (Hex) Class: 0 (Hex)

Instance: 0 Attribute: 0 (Hex)

9. Set the Source Length to 0.
10. For Destination Element, select "IOLM1.Message_Destination_Data".



Message Configuration - IOLM1_Read

Configuration Communication Tag

Message Type: CIP Generic

Service Type: Custom Source: [] Source Length: 0 (Bytes)

Service Code: 32 (Hex) Class: 0 (Hex) Destination Element: je_Destination_Data

Instance: 0 Attribute: 0 (Hex)

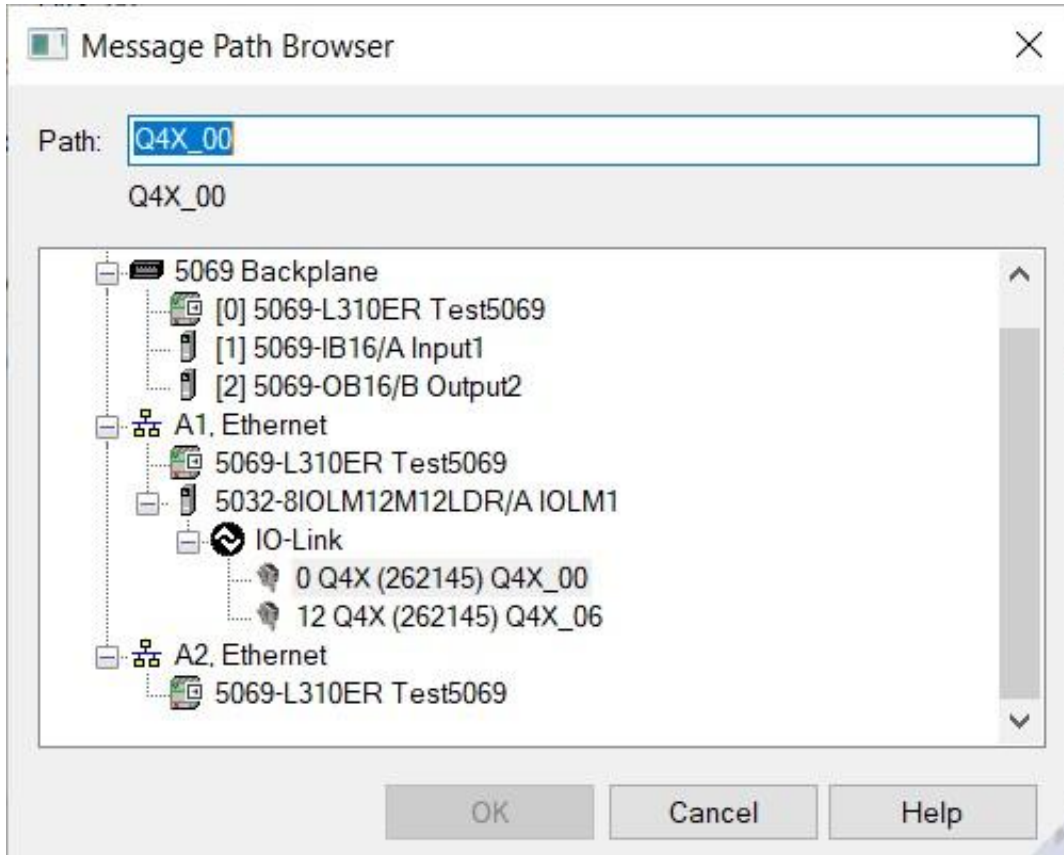
Name	Data Type	Description
IOLM1.Message_Destination...	SINT[190]	UDT to control IO-Lin...
IOLM1.Error_Log	Banner_IOLM_...	UDT to control IO-Lin...
IOLM1.Error_Write_Retry	BOOL	UDT to control IO-Lin...
IOLM1.Num_Error_MSGS	DINT	UDT to control IO-Lin...
IOLM1.IO_Link_Master_B...	BOOL	UDT to control IO-Lin...
IOLM1.AOI_Reset	BOOL	UDT to control IO-Lin...
IOLM1.Port_Data	Banner_IOL_Po...	UDT to control IO-Lin...
IOLM1.Halt_Operation	BOOL	UDT to control IO-Lin...
IOLM1.AOI_Halted	BOOL	UDT to control IO-Lin...
IOLM1.C	AB:5000_IOL8_...	

Show controller tags Show program tags

Enable Enable Waiting Start Done

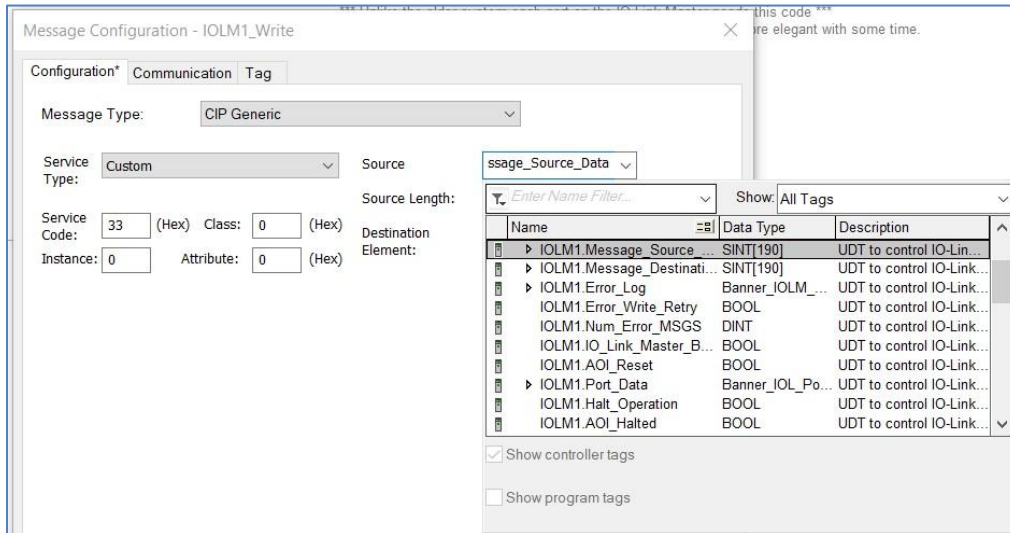
Error Code: Extended Error Code:

11. Now click on the Communication tab, then click the Browse button.
12. Select the IO-Link Master and then one of the IO-Link Devices attached to the unit, then click OK again to close the Message Configuration window.

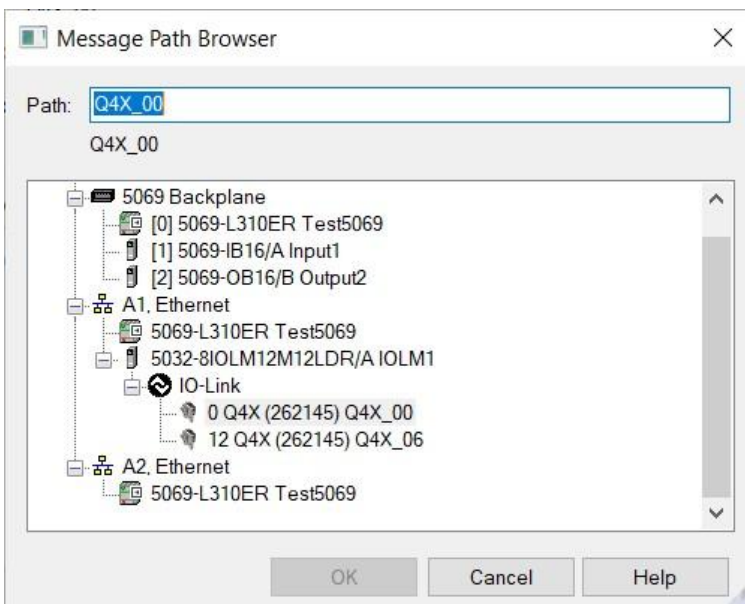


13. Now configure "Message_Write", setting up the Explicit Message that will handle the other half of the communications between the PLC and the IO-Link Master. Click on the "..." button at the far right of the "Message_Write" line.

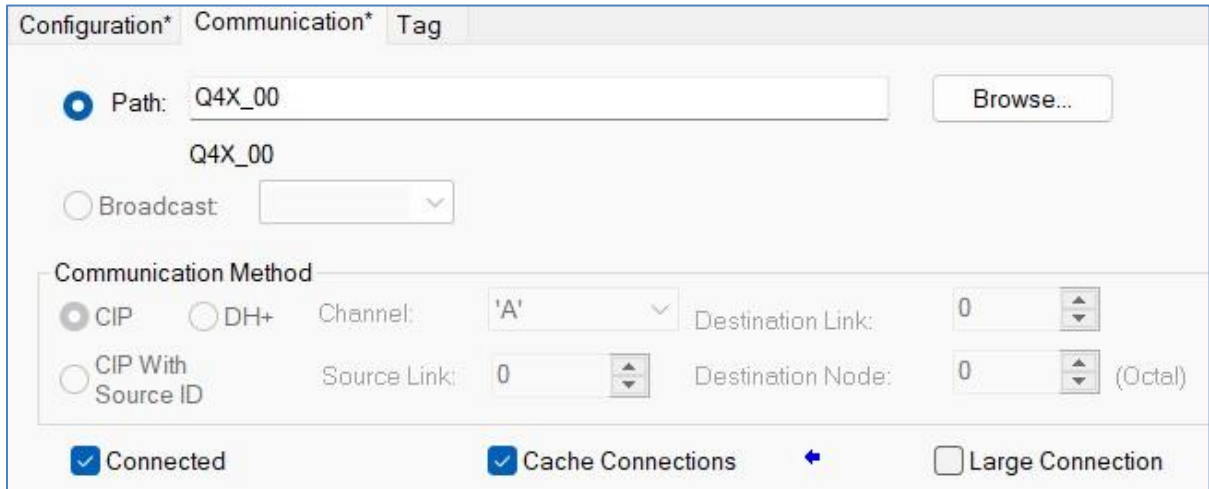
14. In the Message Configuration window, keep the Message Type “CIP Generic” and the Service Type “Custom”. Enter a Service Code of 33.
15. For the Source Element field, select “IOLM1.Message_Source_Data”.



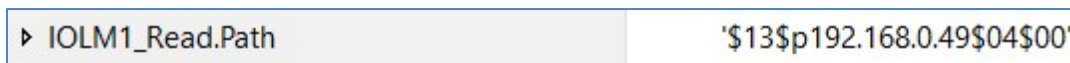
16. Now click on the Communication tab, then click the Browse button.
17. Select the IO-Link Master and then a device attached to the master. Then click OK again to close the Message Configuration window.



18. The last step is to select the Connected option. A check mark will appear for both Connected and Cache Connections. These are necessary to ensure the write commands work correctly to the 5032. If these are not selected if a Write operation is done an error will occur.



19. Press OK to finalize the changes.
20. Now it is necessary to generate the ISDU IP Paths the PLC needs for the read and write commands. The 5032 requires this information to correctly navigate to the various ports on the 5032. When the communication path was selected in step 17 that was to link to one port of the IO-Link. Since accessing all the ports is important for most applications these paths need to be figured out.
21. Got to the Controller Tags and look for the IOLM1_Read tags (or the tag you created for Step 6).
22. Expand the tag and look for the Path tag. The path shown here is the path that the PLC needs to use to access the port and channel on the IO-Link Master. In this example a 5069 PLC was being used. The 192.168.0.49 is the ip address for the IO-Link Master. The \$00 at the end is the channel address (Port 0 Channel 0 in this case) to be accessed. Everything else is based on the PLC being used. It is best to copy this string.



23. After copying the string go to the ISDU_Path tag created in Step 5.
24. If more than 1 port is going to be used copy that string into the required sections of the array. The modify the array numbers that represent the port/channel that has an IO-Link Device plug into it. The example will show all 8 ports being used.
 - a. Port 0 Channel 0 uses \$00
 - b. Port 1 Channel 2 uses \$02
 - c. Port 2 Channel 4 uses \$04
 - d. Port 3 Channel 6 uses \$06
 - e. Port 4 Channel 8 uses \$08
 - f. Port 5 Channel 10 uses \$I (lower case L).
 - g. Port 6 Channel 12 uses \$p
 - h. Port 7 Channel 14 uses \$OE

25. The completed array should look like the image below. Remember only the ports that have IO-Link devices plugged into them need the path.

Path1	{...}
Path1[0]	'\$13\$p192.168.0.49\$04\$00'
Path1[1]	'\$13\$p192.168.0.49\$04\$02'
Path1[2]	'\$13\$p192.168.0.49\$04\$04'
Path1[3]	'\$13\$p192.168.0.49\$04\$06'
Path1[4]	'\$13\$p192.168.0.49\$04\$08'
Path1[5]	'\$13\$p192.168.0.49\$04\$I'
Path1[6]	'\$13\$p192.168.0.49\$04\$p'
Path1[7]	'\$13\$p192.168.0.49\$04\$0E'

26. Setup of the IO-Link 5032 AOI is complete at this point. It will need a Banner IO-Link Device AOI to work properly, however.

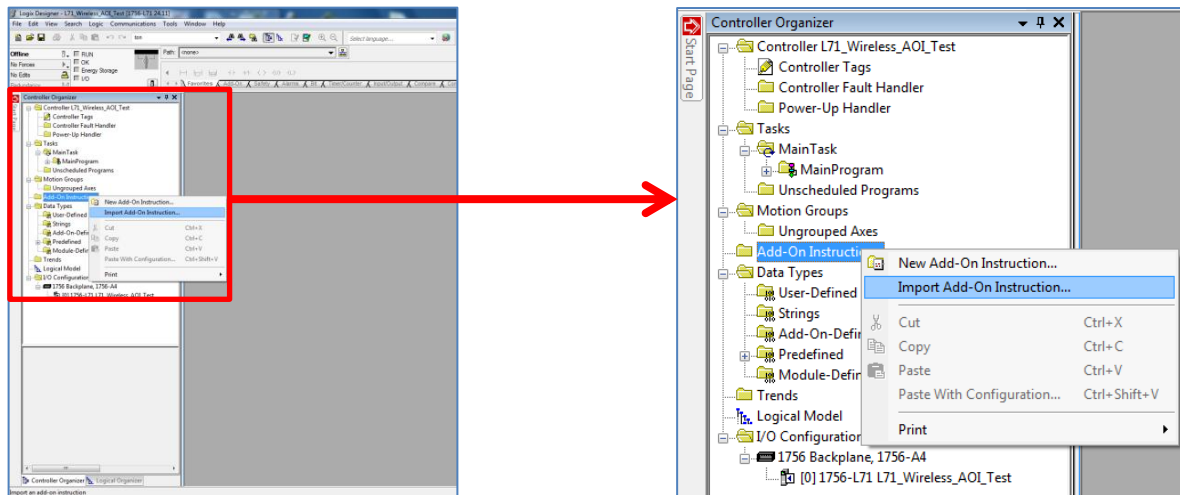
Banner_IOLM_Param_A2_v5		
Banner_IOLM_Param_A2...	IOLM1_Status	...
Message_Read	IOLM1_Read	...
Message_Write	IOLM1_Write	...
IOLM	IOLM1	(Done)
ISDU_Path	ISDU_Path	(Busy)
Port0	1	(Error)
Port1	0	
Port2	0	
Port3	0	
Port4	0	
Port5	0	
Port6	0	
Port7	0	

4. Balluff IO-Link Master Setup

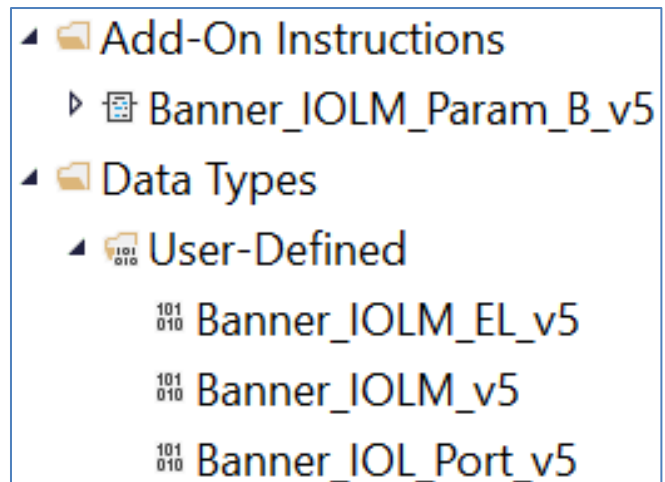
Ensure that the Balluff IO-Link Master connection has been created in Studio 5000 before proceeding.

Balluff AOI Installation

1. Open a project.
2. In the Controller Organizer window, right-click on the Add-On Instruction folder. Select the Import Add-On Instruction option.

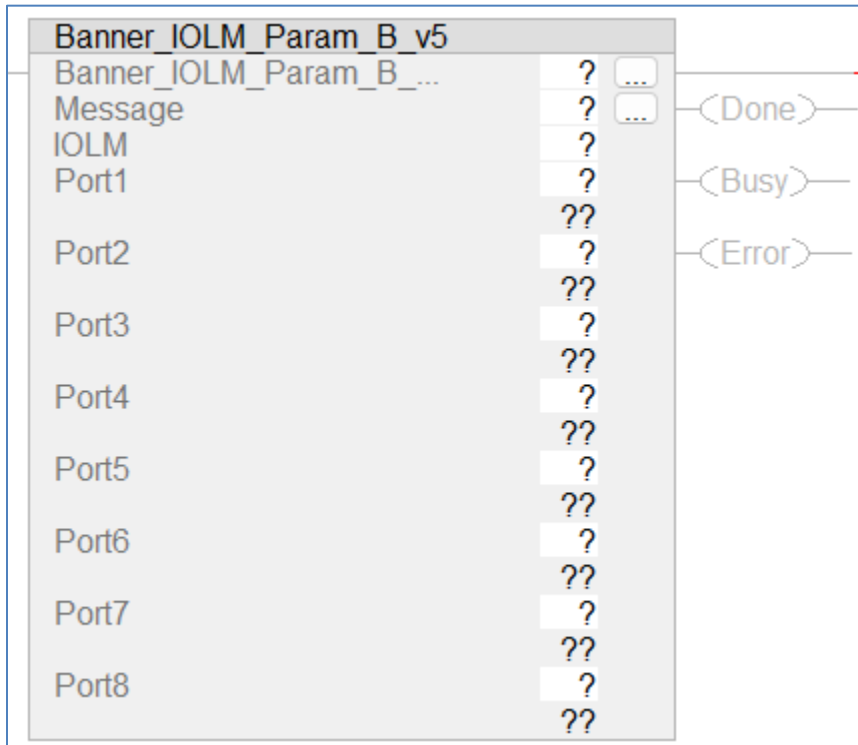


3. Navigate to the correct file location and select the AOI to be installed. In this example the “Banner_IOLM_Param_B_v5_AOI.L5X” file will be selected. Click the Open button.
4. The Import Configuration window will pop up. The default selection will create all the necessary items for the AOI. Click the OK button to complete the import process.
5. The AOI is added to the Controller Organizer window and should look like the image shown.
6. AOI installation into the Logix Designer software complete.



Balluff AOI Configuration

1. Add the “Banner_IOLM_Param_B_v5” AOI to your ladder logic program. For each of the question marks shown in the instruction we need to create and link a new tag array. The AOI includes a new type of User Defined Tag (UDT): a custom array of tags meant specifically for this AOI.



2. In the AOI, right-click on the question mark on the line labeled “Banner_IOLM_Param_B_v5”. Click New Tag. In this example, we’ll use the name “IOLM1_Status”. The example naming convention accounts for this being the #1 IO-Link Master in our program. More masters could be named IOLM2, IOLM3, etc.
3. Now set up the Message command used to read and write to devices connected to this IO-Link Master. Right click on the question mark for Message line in the AOI and choose New Tag. In this example we’ll use the tag name IOLM1_Message. Click Create.

4. Now create a new tag array for the “IOLM” line in the AOI. Here we used the name “IOLM1”. The tags created here will serve as linkages between the IO-Link Master AOI and the connected Banner device AOI(s). This group of tags also controls the flow of information to and from the master, ensuring that all sensors get a chance to read and write in an orderly fashion.

New Tag

Name: IOLM1

Description:

Usage: <controller>

Type: Base Connection...

Alias For:

Data Type: Banner_IOLM_v5

Parameter Connection:

Scope: Test

External Access: Read/Write

Style:

Constant

Sequencing

Open Configuration

Open Parameter Connections

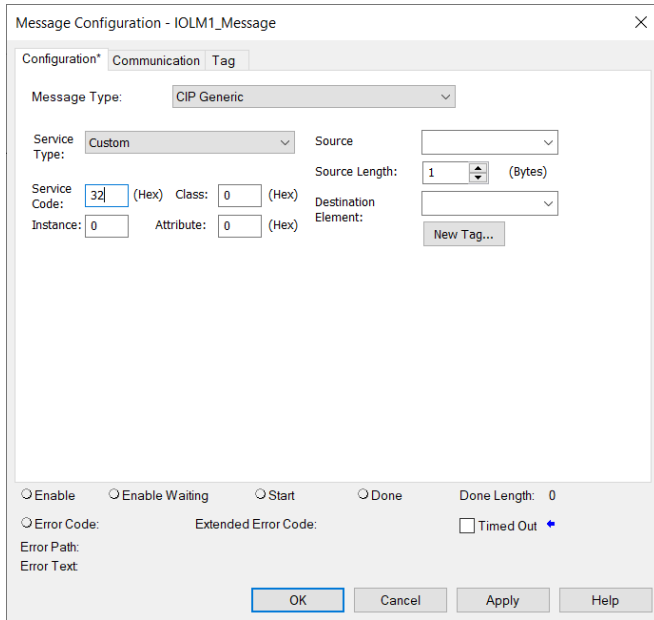
Create

Cancel

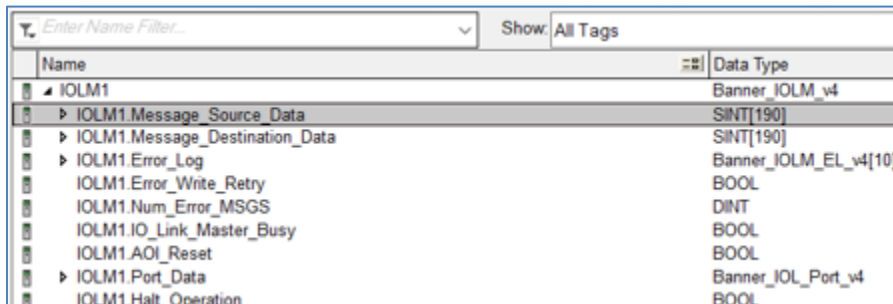
Help

5. Now configure “IOLM1_Message”, setting up the Explicit Message that will handle half of the communications between the PLC and the IO-Link Master. Click on the “...” button at the far right of the “Message” line.

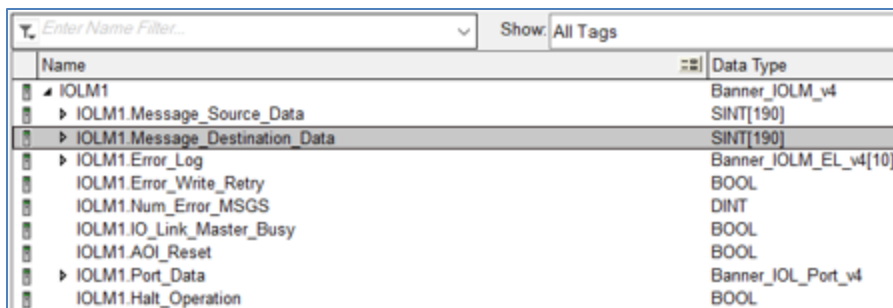
- In the Message Configuration window, keep the Message Type “CIP Generic” and the Service Type “Custom”. Enter Service Code 32.



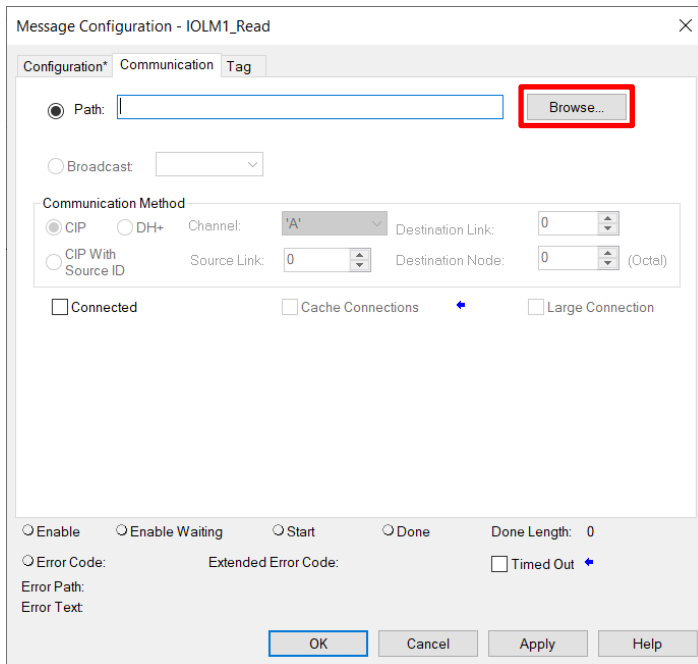
- For the Source Element field, select “IOLM1.Message_Source_Data”.



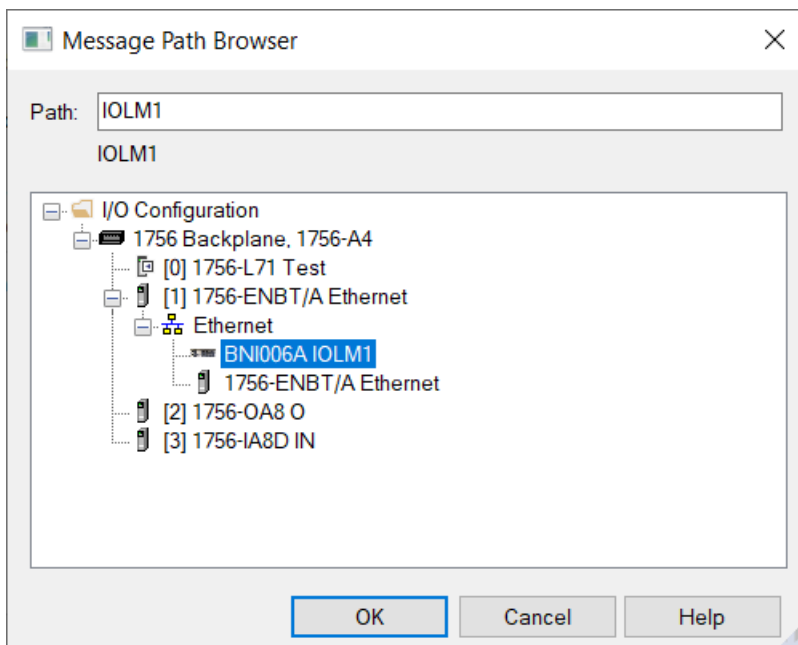
- For Destination Element, select “IOLM1.Message_Destination_Data”.



9. Now click on the Communication tab, then click the Browse button.



10. Select the IO-Link Master, then click OK to close the Message Path Browser window, then click OK again to close the Message Configuration window.



- 11. Port 1 Through 8 tells the AOI which ports are controlled. Set the Port value to 1 if controlled and 0 if not controlled. In this example, port 1 will be the only port controlled.
- 12. The completed AOI should look like the below image.

Banner_IOLM_Param_B_v5		
Banner_IOLM_Param_B_...	IOLM1_Status	...
Message	IOLM1_MSG	...
IOLM	IOLM1	
Port1	1	(Busy)
Port2	0	(Error)
Port3	0	
Port4	0	
Port5	0	
Port6	0	
Port7	0	
Port8	0	

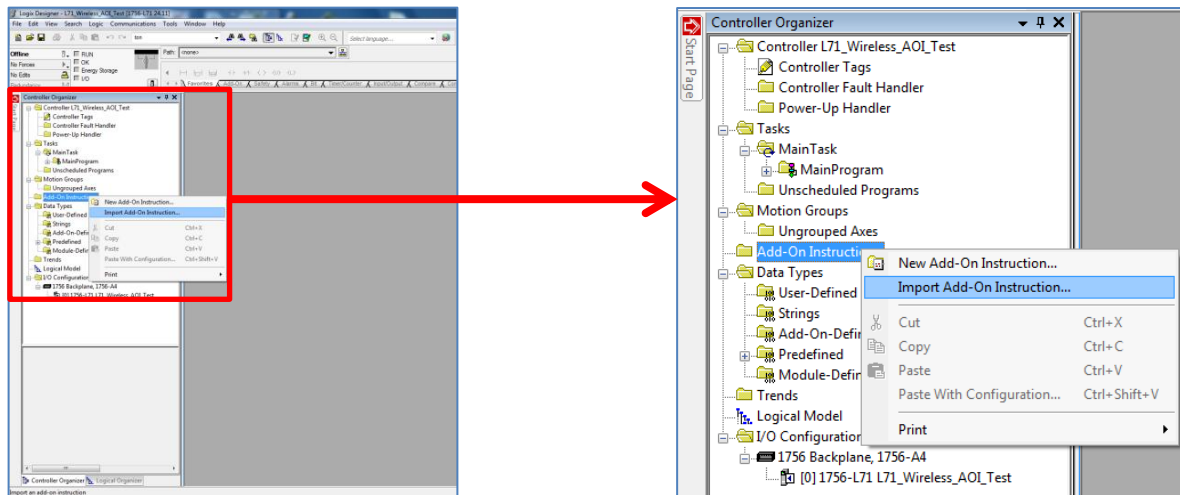
- 13. AOI configuration complete.
- 14. Go to the Import Device Data and Rule Set for Banner IOL Parameter AOI section to complete setup.

5. IFM IO-Link Master Setup

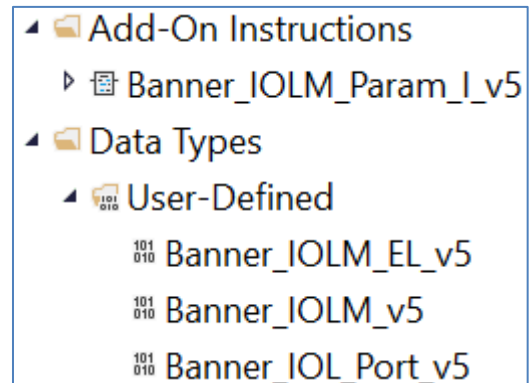
Ensure that the IFM IO-Link Master connection has been created in Studio 5000 before proceeding.

IFM AOI Installation

1. Open a project.
2. In the Controller Organizer window, right-click on the Add-On Instruction folder. Select the Import Add-On Instruction option.

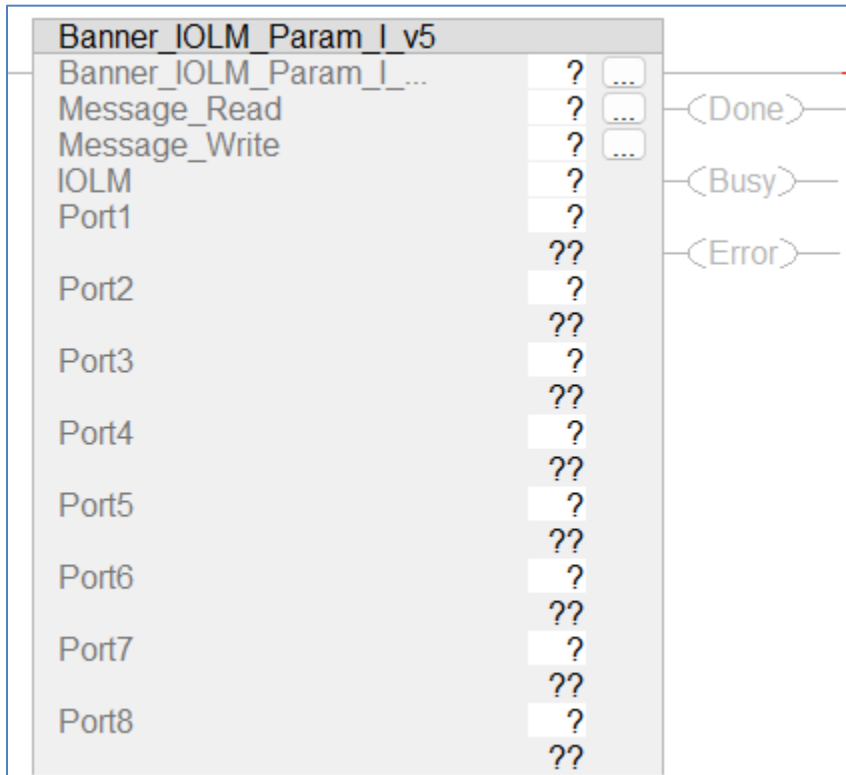


3. Navigate to the correct file location and select the AOI to be installed. In this example the “Banner_IOLM_Param_I_v5_AOI.L5X” file will be selected. Click the Open button.
4. The Import Configuration window will pop up. The default selection will create all the necessary items for the AOI. Click the OK button to complete the import process.
5. The AOI is added to the Controller Organizer window and should look like the image shown.
6. AOI installation into the Logix Designer software complete.



IFM AOI Configuration

1. Add the “Banner_IOLM_Param_I_v5” AOI to your ladder logic program. For each of the question marks shown in the instruction we need to create and link a new tag array. The AOI includes a new type of User Defined Tag (UDT): a custom array of tags meant specifically for this AOI.



2. In the AOI, right-click on the question mark on the line labeled “Banner_IOLM_Param_I_v5”. Click New Tag. In this example, we’ll use the name “IOLM1_Status”. The example naming convention accounts for this being the #1 IO-Link Master in our program. More masters could be named IOLM2, IOLM3, etc.
3. Now set up the Messages used to read and write to devices connected to this IO-Link Master. Right click on the question mark for Message_Read line in the AOI and choose New Tag. In this example we’ll use the tag name IOLM1_Read. Click Create.
4. Do the same for the Message_Write line in the AOI.

5. Now create a new tag array for the “IOLM” line in the AOI. Here we used the name “IOLM1”. The tags created here will serve as linkages between the IO-Link Master AOI and the connected Banner device AOI(s). This group of tags also controls the flow of information to and from the master, ensuring that all sensors get a chance to read and write in an orderly fashion.

New Tag

Name: IOLM1

Description:

Usage: <controller>

Type: Base Connection...

Alias For:

Data Type: Banner_IOLM_v5

Parameter Connection:

Scope: Test

External Access: Read/Write

Style:

Constant

Sequencing

Open Configuration

Open Parameter Connections

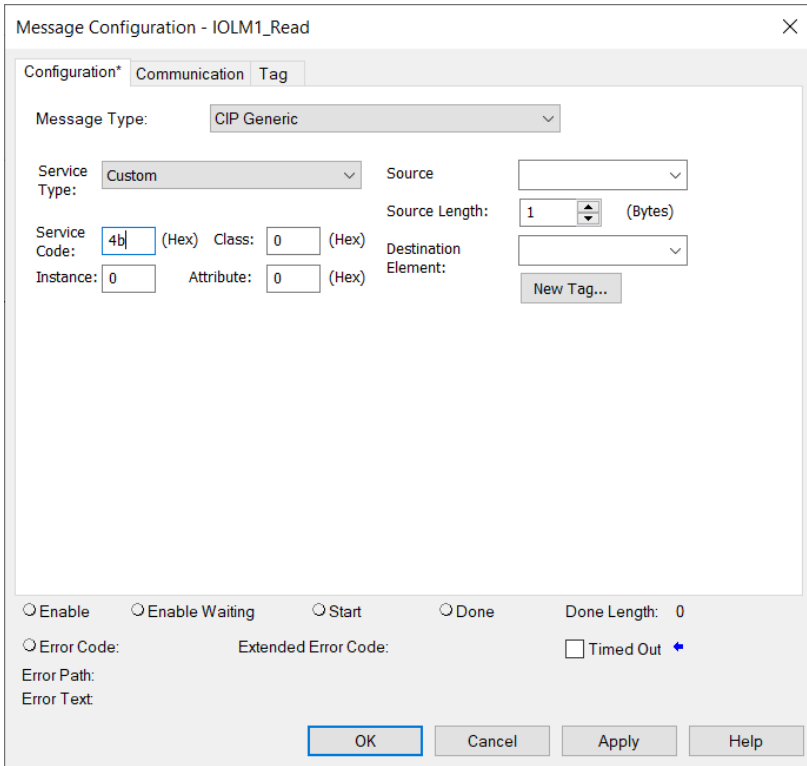
Create

Cancel

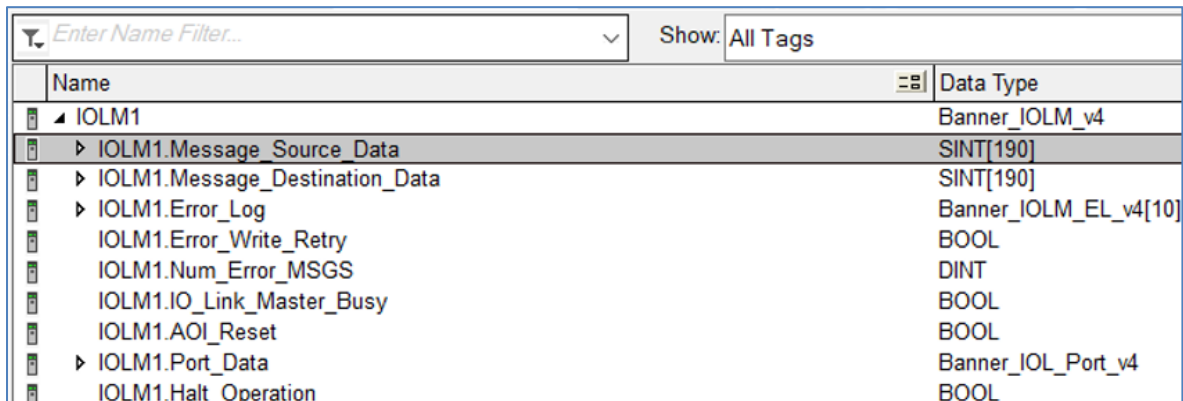
Help

6. Now configure “IOLM1_Read”, setting up the Explicit Message that will handle half of the communications between the PLC and the IO-Link Master. Click on the “...” button at the far right of the “Message_Read” line.

- In the Message Configuration window, keep the Message Type “CIP Generic” and the Service Type “Custom”. Enter Service Code 4b.



- For the Source Element field, select “IOLM1.Message_Source_Data”.



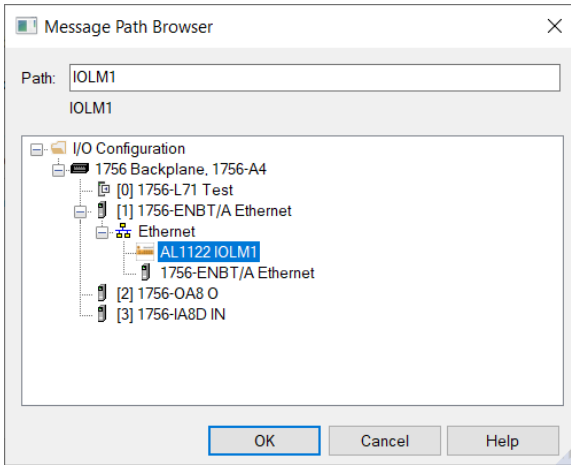
- For Destination Element, select "IOLM1.Message_Destination_Data".

Enter Name Filter...		Show: All Tags
Name		Data Type
▲ IOLM1		Banner_IOLM_v4
▶ IOLM1.Message_Source_Data		SINT[190]
▶ IOLM1.Message_Destination_Data		SINT[190]
▶ IOLM1.Error_Log		Banner_IOLM_EL_v4[10]
IOLM1.Error_Write_Retry		BOOL
IOLM1.Num_Error_MSGS		DINT
IOLM1.IO_Link_Master_Busy		BOOL
IOLM1.AOI_Reset		BOOL
▶ IOLM1.Port_Data		Banner_IOL_Port_v4
IOLM1.Halt Operation		BOOL

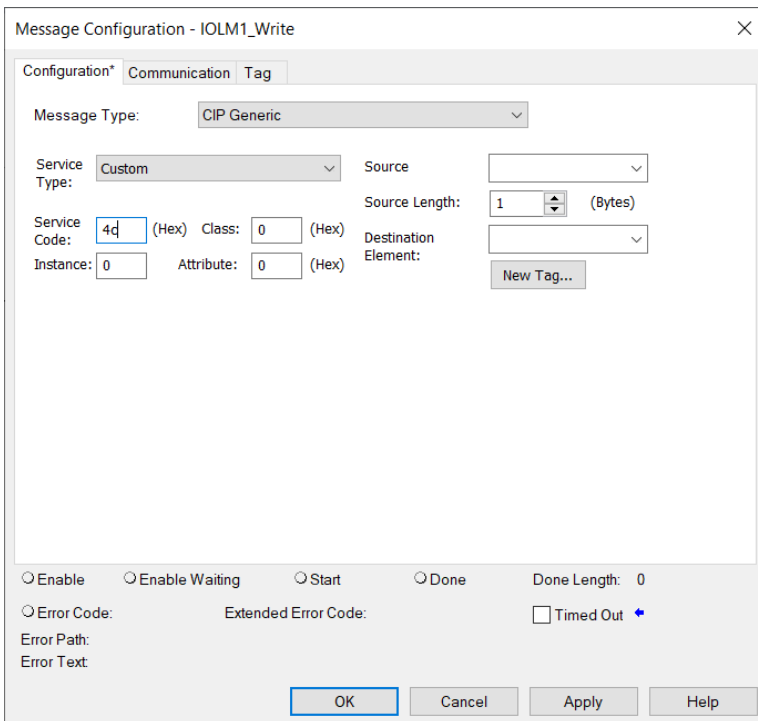
- Now click on the Communication tab, then click the Browse button.

The screenshot shows the 'Message Configuration - IOLM1_Read' dialog box with the 'Communication' tab selected. The 'Path' field is empty, and the 'Browse...' button is highlighted with a red box. Below the path field, there are radio buttons for 'Broadcast' and 'Communication Method'. Under 'Communication Method', 'CIP' is selected, with 'Channel' set to 'A', 'Destination Link' set to 0, and 'Destination Node' set to 0 (Octal). There are also checkboxes for 'CIP With Source ID', 'Connected', 'Cache Connections', and 'Large Connection'. At the bottom, there are radio buttons for 'Enable', 'Enable Waiting', 'Start', and 'Done', along with 'Done Length: 0'. There are also fields for 'Error Code', 'Extended Error Code', 'Error Path', and 'Error Text'. The 'OK', 'Cancel', 'Apply', and 'Help' buttons are at the bottom.

11. Select the IO-Link Master, then click OK to close the Message Path Browser window, then click OK again to close the Message Configuration window.



12. Now configure “Message_Write”, setting up the Explicit Message that will handle the other half of the communications between the PLC and the IO-Link Master. Click on the “...” button at the far right of the “Message_Write” line.
13. In the Message Configuration window, keep the Message Type “CIP Generic” and the Service Type “Custom”. Enter a Service Code of 4c.



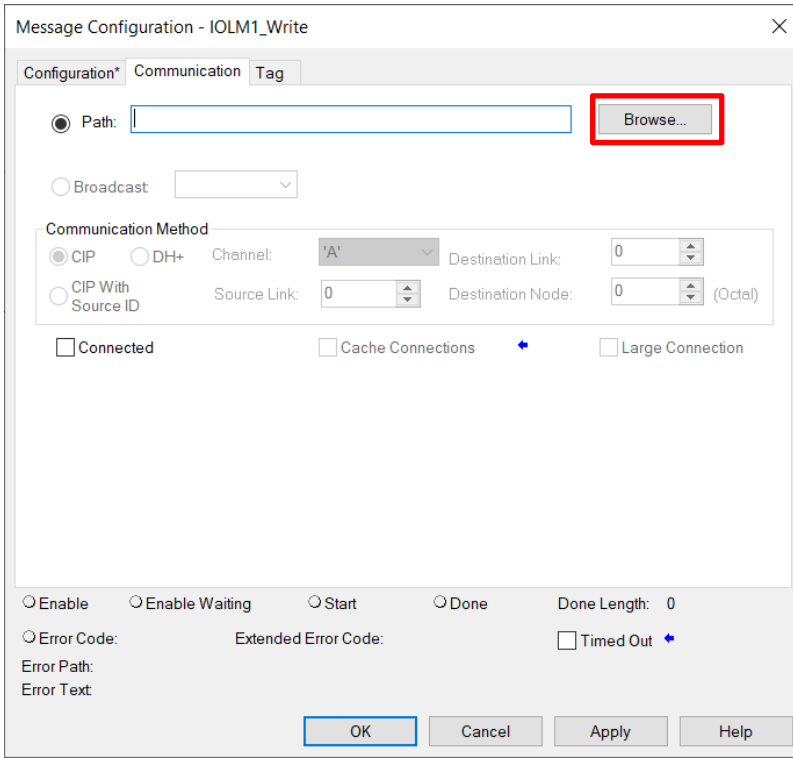
14. For the Source Element field, select “IOLM1.Message_Source_Data”.

Enter Name Filter...		Show: All Tags
Name		Data Type
▲ IOLM1		Banner_IOLM_v4
▶ IOLM1.Message_Source_Data		SINT[190]
▶ IOLM1.Message_Destination_Data		SINT[190]
▶ IOLM1.Error_Log		Banner_IOLM_EL_v4[10]
IOLM1.Error_Write_Retry		BOOL
IOLM1.Num_Error_MSGS		DINT
IOLM1.IO_Link_Master_Busy		BOOL
IOLM1.AOI_Reset		BOOL
▶ IOLM1.Port_Data		Banner_IOL_Port_v4
IOLM1.Halt_Operation		BOOL

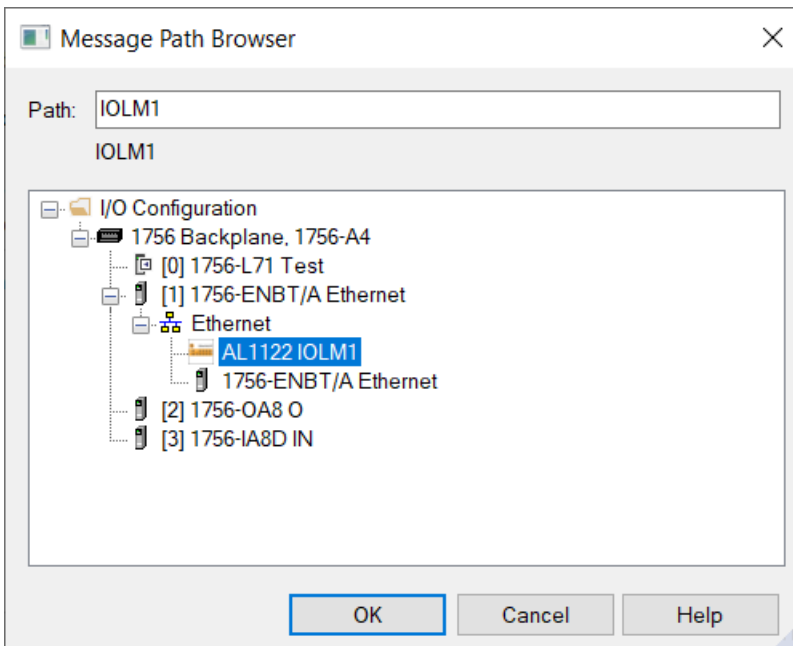
15. For Destination Element, select “IOLM1.Message_Destination_Data”.

Enter Name Filter...		Show: All Tags
Name		Data Type
▲ IOLM1		Banner_IOLM_v4
▶ IOLM1.Message_Source_Data		SINT[190]
▶ IOLM1.Message_Destination_Data		SINT[190]
▶ IOLM1.Error_Log		Banner_IOLM_EL_v4[10]
IOLM1.Error_Write_Retry		BOOL
IOLM1.Num_Error_MSGS		DINT
IOLM1.IO_Link_Master_Busy		BOOL
IOLM1.AOI_Reset		BOOL
▶ IOLM1.Port_Data		Banner_IOL_Port_v4
IOLM1.Halt_Operation		BOOL

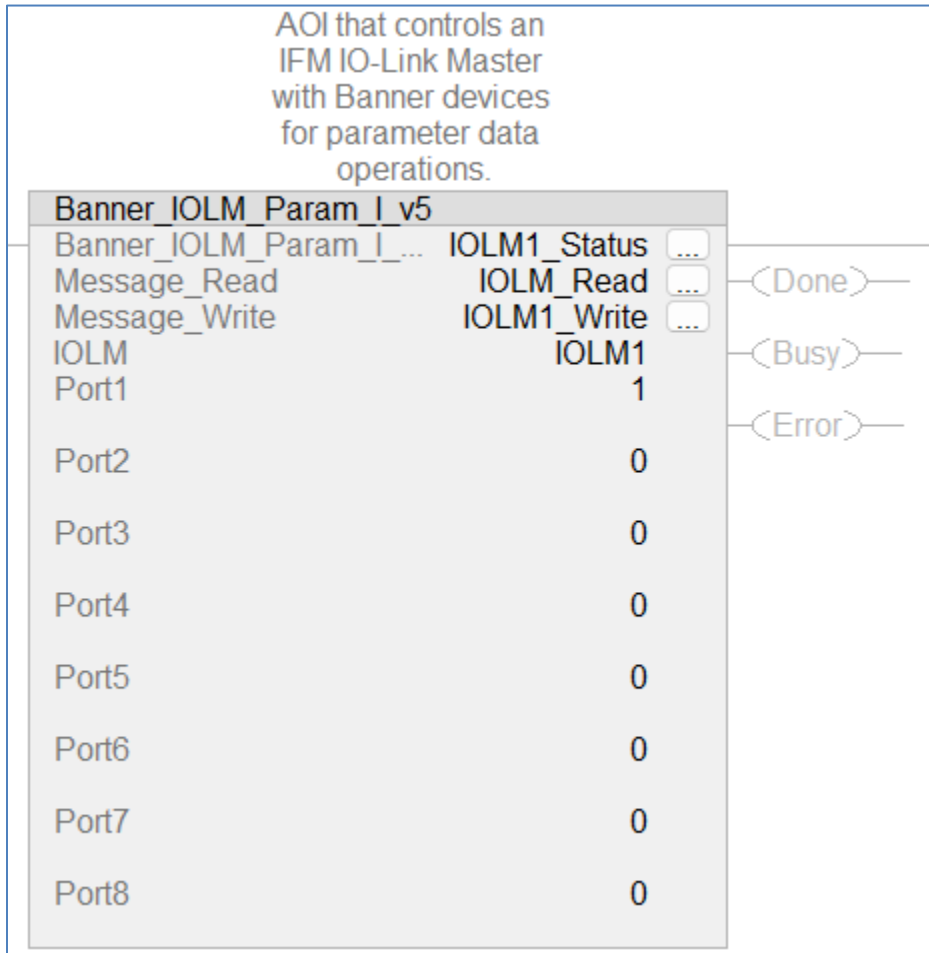
16. Now click on the Communication tab, then click the Browse button.



17. Select the IO-Link Master, then click OK to close the Message Path Browser window, then click OK again to close the Message Configuration window.



- 18. Port 1 Through 8 tells the AOI which ports are controlled. Set the Port value to 1 if controlled and 0 if not controlled. In this example, port 1 will be the only port controlled.
- 19. The completed AOI should look like the below image.



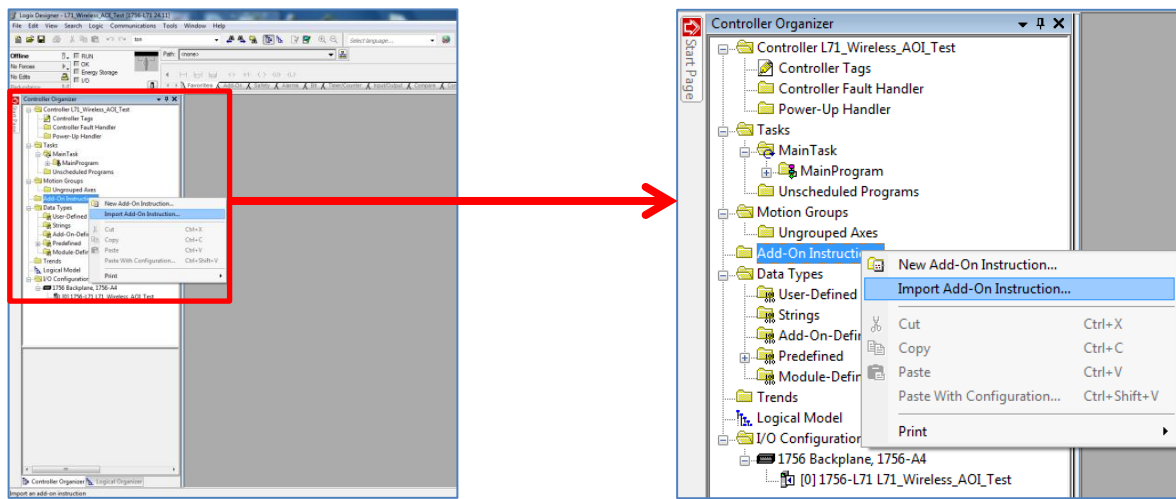
- 20. AOI configuration complete.
- 21. Go to the Import Device Data and Rule Set for Banner IOL Parameter AOI section to complete setup.

6. Murr IO-Link Master Setup

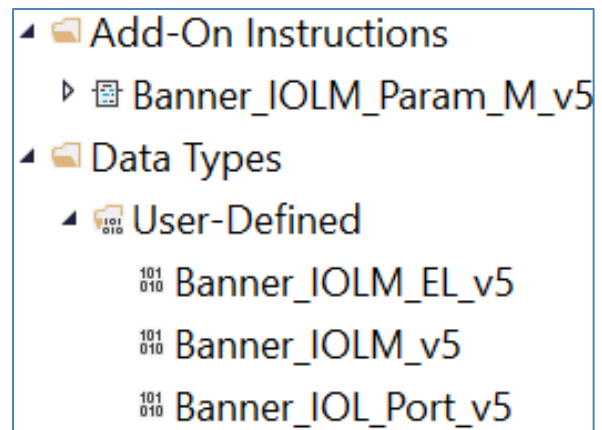
Ensure that the Murr IO-Link Master connection has been created in Studio 5000 before proceeding.

Murr AOI Installation

1. Open a project.
2. In the Controller Organizer window, right-click on the Add-On Instruction folder. Select the Import Add-On Instruction option.

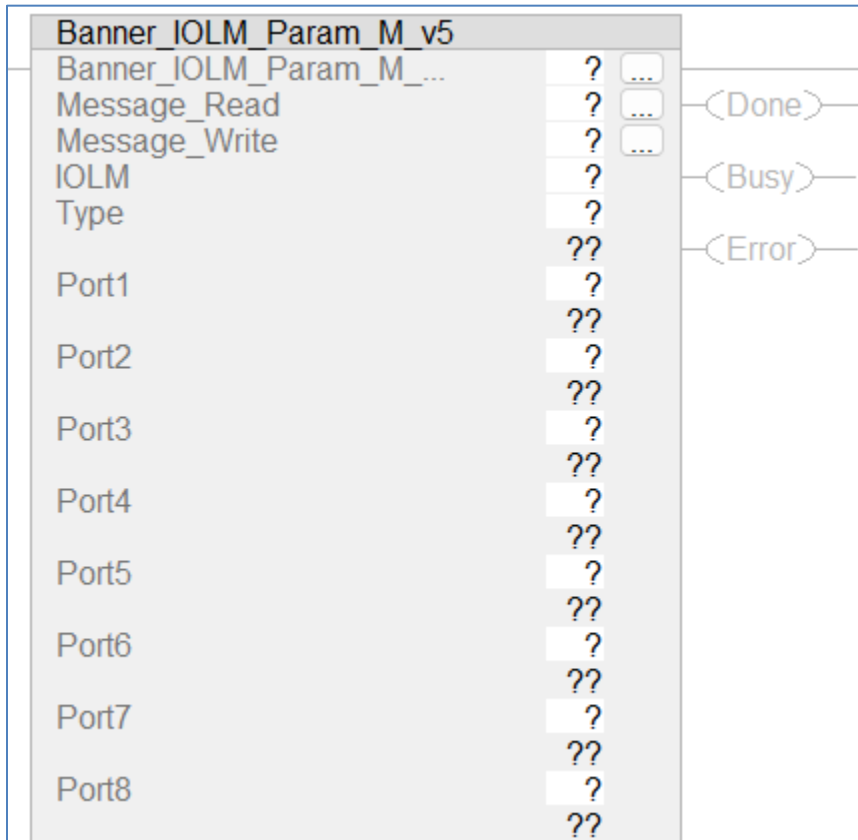


3. Navigate to the correct file location and select the AOI to be installed. In this example the “Banner_IOLM_Param_M_v5_AOI.L5X” file will be selected. Click the Open button.
4. The Import Configuration window will pop up. The default selection will create all the necessary items for the AOI. Click the OK button to complete the import process.
5. The AOI is added to the Controller Organizer window and should look like the image shown.
6. AOI installation into the Logix Designer software complete.



Murr AOI Configuration

1. Add the “Banner_IOLM_Param_M_v5” AOI to your ladder logic program. For each of the question marks shown in the instruction we need to create and link a new tag array. The AOI includes a new type of User Defined Tag (UDT): a custom array of tags meant specifically for this AOI.

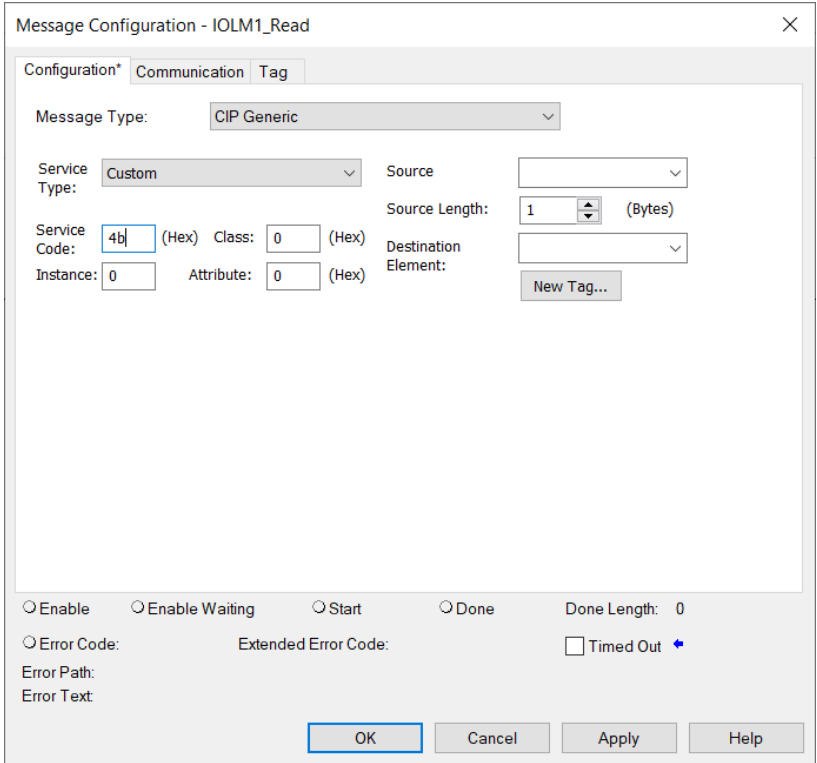


2. In the AOI, right-click on the question mark on the line labeled “Banner_IOLM_Param_M_v5”. Click New Tag. In this example, we’ll use the name “IOLM1_Status”. The example naming convention accounts for this being the #1 IO-Link Master in our program. More masters could be named IOLM2, IOLM3, etc.
3. Now set up the Messages used to read and write to devices connected to this IO-Link Master. Right click on the question mark for Message_Read line in the AOI and choose New Tag. In this example we’ll use the tag name IOLM1_Read. Click Create.
4. Do the same for the Message_Write line in the AOI.

5. Now create a new tag array for the “IOLM” line in the AOI. Here we used the name “IOLM1”. The tags created here will serve as linkages between the IO-Link Master AOI and the connected Banner device AOI(s). This group of tags also controls the flow of information to and from the master, ensuring that all sensors get a chance to read and write in an orderly fashion.

6. The Murr IO-Link Masters follow two separate IO-Link ISUD formats.
 - a. Murr Impact67 E DIO 12 DIO4/IOL4 4P (Art.-No. 55144) uses 16#80 for CIP_Class, a value of 1 for CIP_Instance, and port number for the CIP_Attribute. A value of 0 in the Type parameter for the AOI configures the AOI for this data format.
 - b. Murr Impact67 Pro E DIO8 IOL8 M12L 5P (Art.-No. 54631) uses 16#83 for CIP_Class and port number for the CIP_Instance. A value of 1 in the Type parameter for the AOI configures the AOI for this data format.

7. Now configure "IOLM1_Read", setting up the Explicit Message that will handle half of the communications between the PLC and the IO-Link Master. Click on the "..." button at the far right of the "Message_Read" line.
8. In the Message Configuration window, keep the Message Type "CIP Generic" and the Service Type "Custom". Enter Service Code 4b. In the Message Configuration window, keep the Message Type "CIP Generic" and the Service Type "Custom". Enter Service Code 4b.



9. For the Source Element field, select "IOLM1.Message_Source_Data".

Enter Name Filter...		Show: All Tags
Name		Data Type
▲ IOLM1		Banner_IOLM_v4
▶ IOLM1.Message_Source_Data		SINT[190]
▶ IOLM1.Message_Destination_Data		SINT[190]
▶ IOLM1.Error_Log		Banner_IOLM_EL_v4[10]
IOLM1.Error_Write_Retry		BOOL
IOLM1.Num_Error_MSGS		DINT
IOLM1.IO_Link_Master_Busy		BOOL
IOLM1.AOI_Reset		BOOL
▶ IOLM1.Port_Data		Banner_IOL_Port_v4
IOLM1.Halt Operation		BOOL

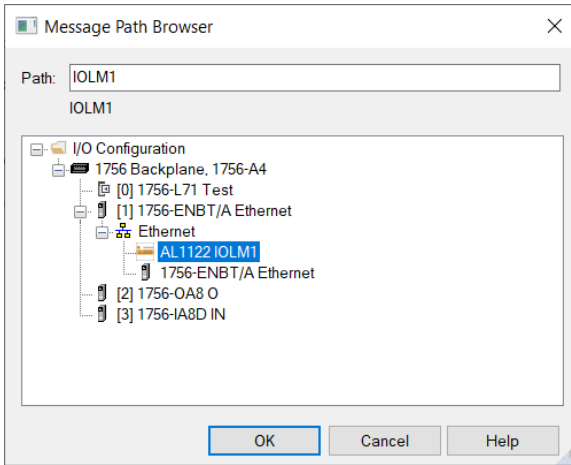
10. For Destination Element, select "IOLM1.Message_Destination_Data".

Enter Name Filter...		Show: All Tags
Name	Data Type	
▲ IOLM1	Banner_IOLM_v4	
▶ IOLM1.Message_Source_Data	SINT[190]	
▶ IOLM1.Message_Destination_Data	SINT[190]	
▶ IOLM1.Error_Log	Banner_IOLM_EL_v4[10]	
IOLM1.Error_Write_Retry	BOOL	
IOLM1.Num_Error_MSGS	DINT	
IOLM1.IO_Link_Master_Busy	BOOL	
IOLM1.AOI_Reset	BOOL	
▶ IOLM1.Port_Data	Banner_IOL_Port_v4	
IOLM1.Halt Operation	BOOL	

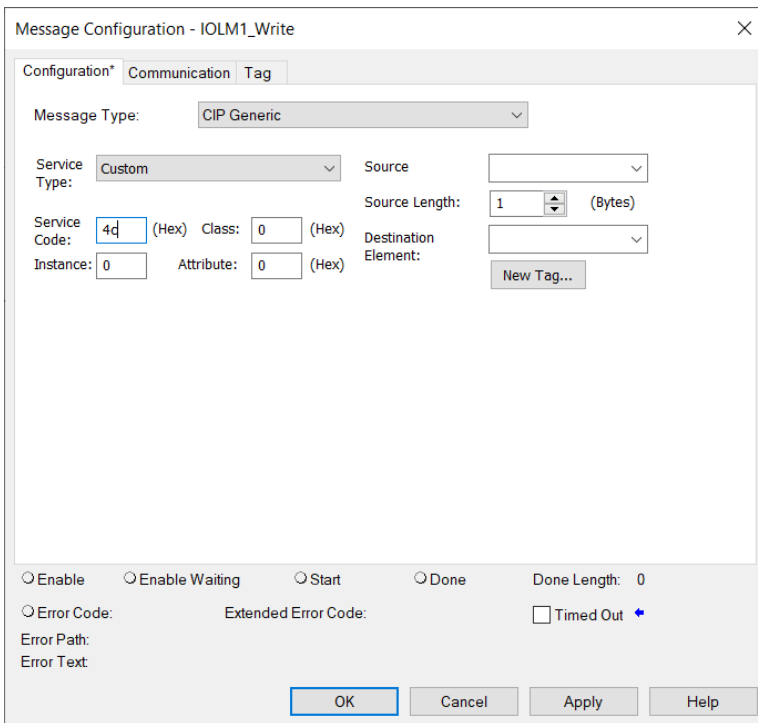
11. Now click on the Communication tab, then click the Browse button.

The screenshot shows the "Message Configuration - IOLM1_Read" dialog box. It has three tabs: "Configuration*", "Communication", and "Tag". The "Communication" tab is selected. In this tab, there is a "Path:" label followed by an empty text input field and a "Browse..." button, which is highlighted with a red rectangle. Below the path field is a "Broadcast:" dropdown menu. Under the "Communication Method" section, there are radio buttons for "CIP" (selected), "DH+", and "CIP With Source ID". The "CIP" method has sub-fields for "Channel:" (set to 'A'), "Destination Link:" (set to 0), "Source Link:" (set to 0), and "Destination Node:" (set to 0, with "(Octal)" next to it). There are also checkboxes for "Connected", "Cache Connections", and "Large Connection". At the bottom of the dialog, there are radio buttons for "Enable", "Enable Waiting", "Start", and "Done", along with a "Done Length:" field set to 0. There are also radio buttons for "Error Code:", "Extended Error Code:", and "Timed Out". At the very bottom are "OK", "Cancel", "Apply", and "Help" buttons.

12. Select the IO-Link Master, then click OK to close the Message Path Browser window, then click OK again to close the Message Configuration window.



13. Now configure “Message_Write”, setting up the Explicit Message that will handle the other half of the communications between the PLC and the IO-Link Master. Click on the “...” button at the far right of the “Message_Write” line.
14. In the Message Configuration window, keep the Message Type “CIP Generic” and the Service Type “Custom”. Enter a Service Code of 4c.



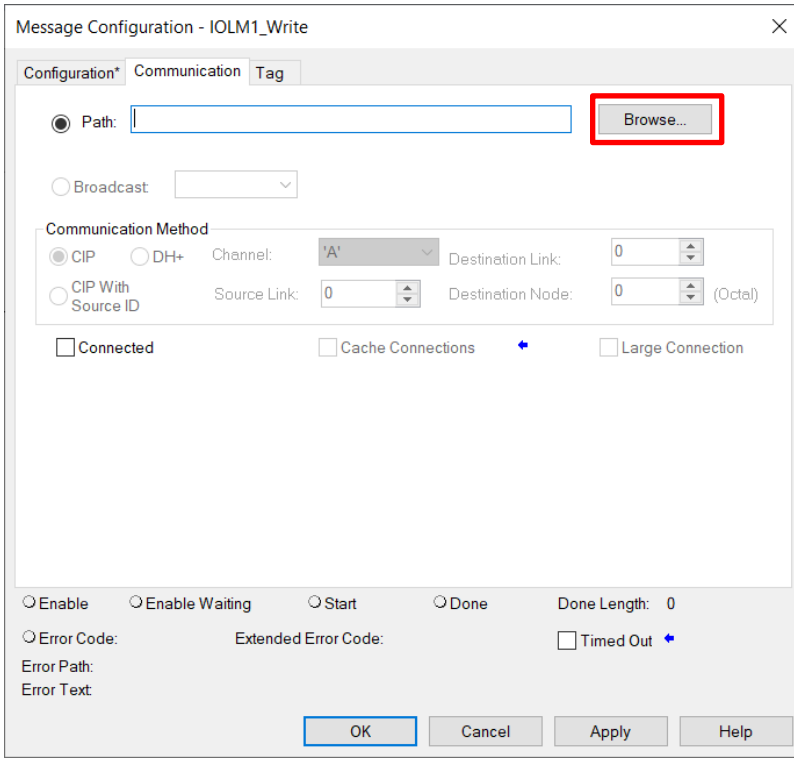
15. For the Source Element field, select “IOLM1.Message_Source_Data”.

Enter Name Filter...		Show:	All Tags
Name			Data Type
▲ IOLM1			Banner_IOLM_v4
▶ IOLM1.Message_Source_Data			SINT[190]
▶ IOLM1.Message_Destination_Data			SINT[190]
▶ IOLM1.Error_Log			Banner_IOLM_EL_v4[10]
▶ IOLM1.Error_Write_Retry			BOOL
▶ IOLM1.Num_Error_MSGS			DINT
▶ IOLM1.IO_Link_Master_Busy			BOOL
▶ IOLM1.AOI_Reset			BOOL
▶ IOLM1.Port_Data			Banner_IOL_Port_v4
▶ IOLM1.Halt_Operation			BOOL

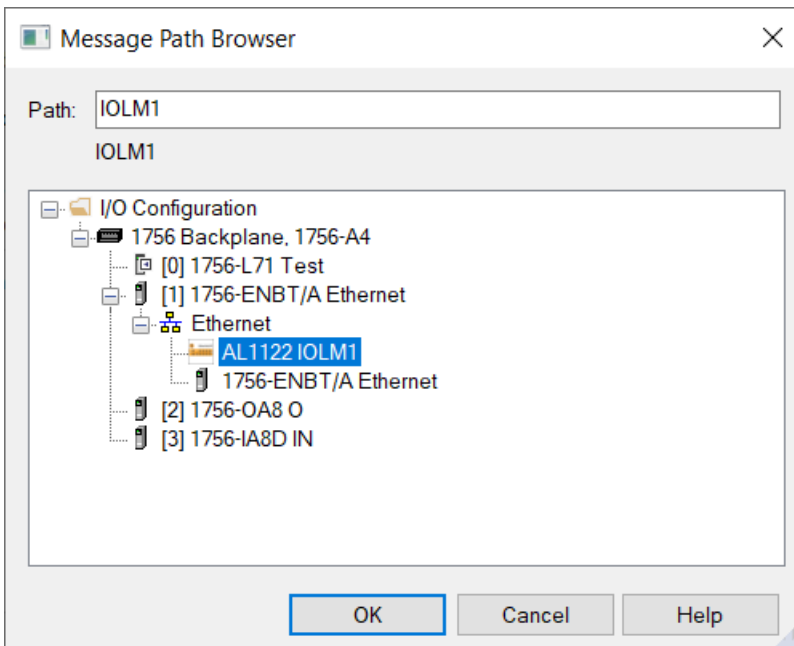
16. For Destination Element, select “IOLM1.Message_Destination_Data”.

Enter Name Filter...		Show:	All Tags
Name			Data Type
▲ IOLM1			Banner_IOLM_v4
▶ IOLM1.Message_Source_Data			SINT[190]
▶ IOLM1.Message_Destination_Data			SINT[190]
▶ IOLM1.Error_Log			Banner_IOLM_EL_v4[10]
▶ IOLM1.Error_Write_Retry			BOOL
▶ IOLM1.Num_Error_MSGS			DINT
▶ IOLM1.IO_Link_Master_Busy			BOOL
▶ IOLM1.AOI_Reset			BOOL
▶ IOLM1.Port_Data			Banner_IOL_Port_v4
▶ IOLM1.Halt_Operation			BOOL

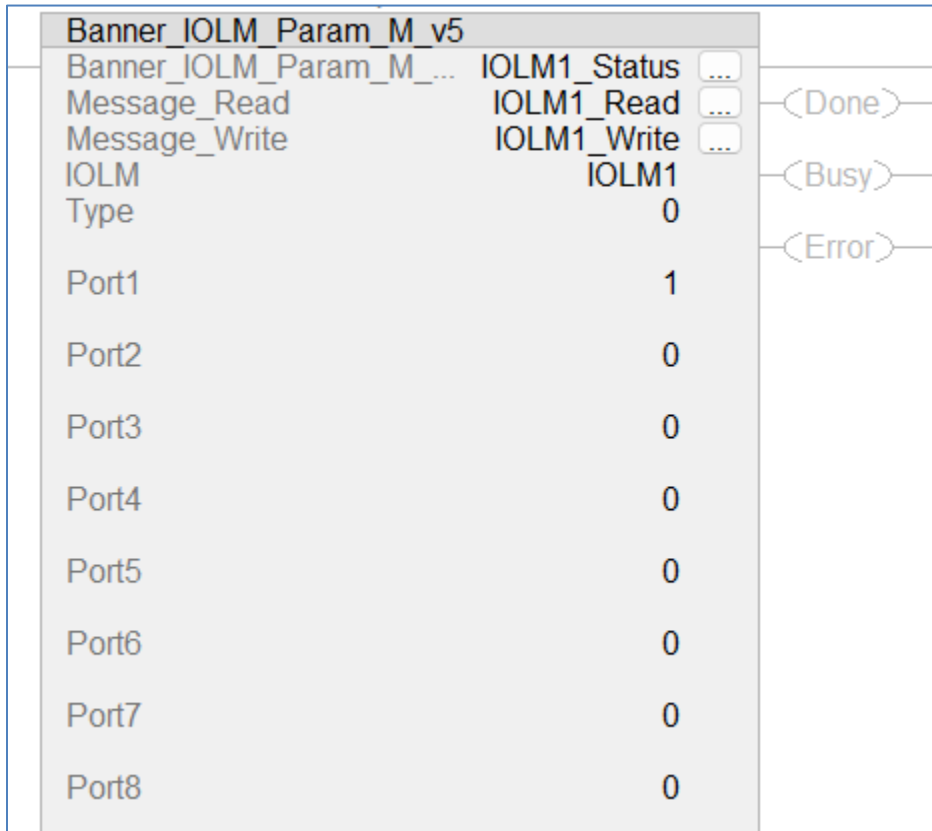
17. Now click on the Communication tab, then click the Browse button.



18. Select the IO-Link Master, then click OK to close the Message Path Browser window, then click OK again to close the Message Configuration window.



- 19. Port 1 Through 8 tells the AOI which ports are controlled. Set the Port value to 1 if controlled and 0 if not controlled. In this example, port 1 will be the only port controlled.
- 20. The completed AOI should look like the below image.



The image shows a configuration window titled "Banner_IOLM_Param_M_v5". It contains a table with columns for parameter names and values. To the right of the table are three status indicators: "Done", "Busy", and "Error", each with a left-pointing arrow. The "Done" indicator is connected to the "IOLM1_Read" parameter, "Busy" to "IOLM1_Write", and "Error" to "IOLM1".

Banner_IOLM_Param_M_v5	
Banner_IOLM_Param_M_...	IOLM1_Status ...
Message_Read	IOLM1_Read ...
Message_Write	IOLM1_Write ...
IOLM	IOLM1
Type	0
Port1	1
Port2	0
Port3	0
Port4	0
Port5	0
Port6	0
Port7	0
Port8	0

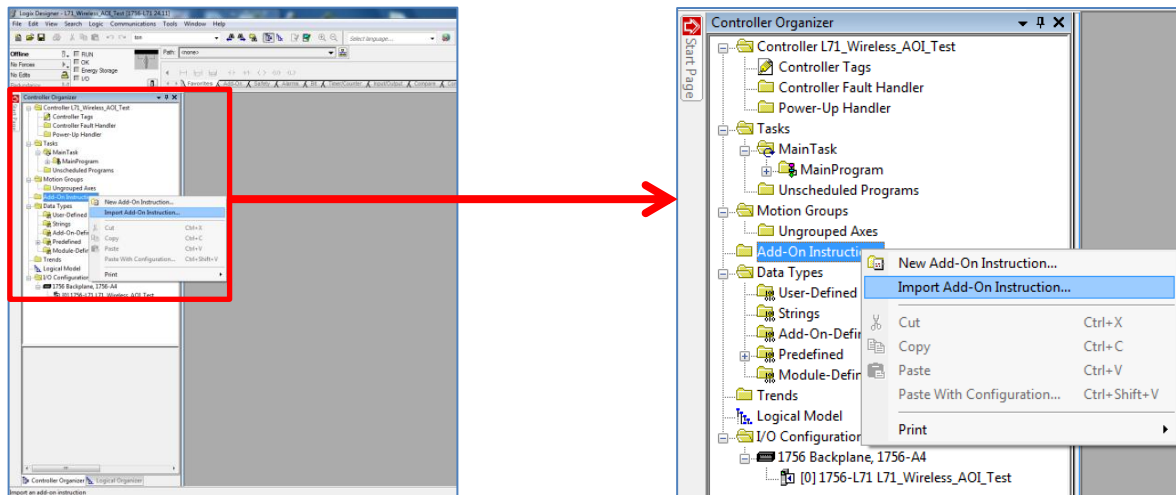
- 21. AOI configuration complete.
- 22. Go to the Import Device Data and Rule Set for Banner IOL Parameter AOI section to complete setup.

7. Turck IO-Link Master Setup

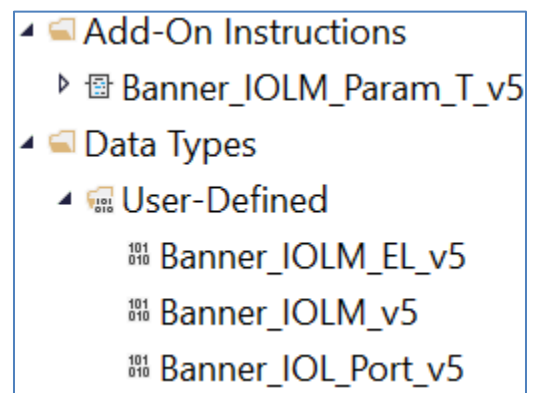
Ensure that the Turck IO-Link Master connection has been created in Studio 5000 before proceeding.

Turck AOI Installation

1. Open a project.
2. In the Controller Organizer window, right-click on the Add-On Instruction folder. Select the Import Add-On Instruction option.

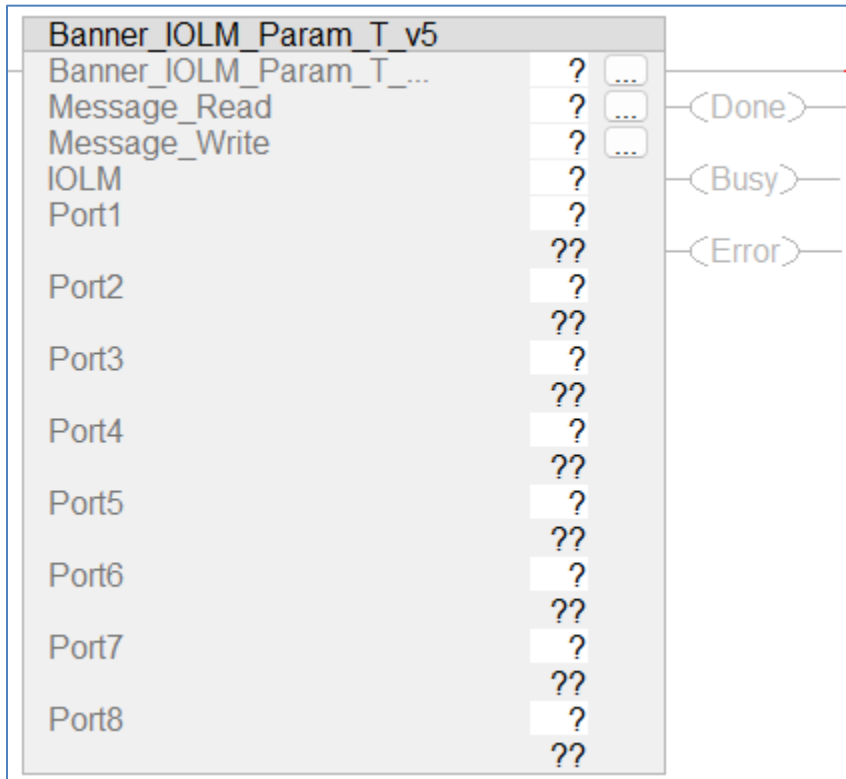


3. Navigate to the correct file location and select the AOI to be installed. In this example the “Banner_IOLM_Param_T_v5_AOI.L5X” file will be selected. Click the Open button.
4. The Import Configuration window will pop up. The default selection will create all the necessary items for the AOI. Click the OK button to complete the import process.
5. The AOI is added to the Controller Organizer window and should look like the image shown.
6. AOI installation into the Logix Designer software complete.



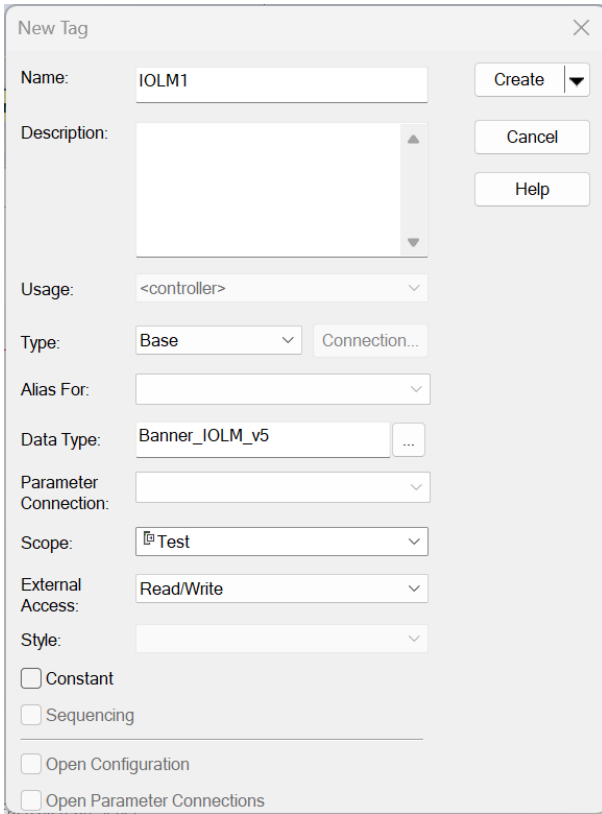
Turck AOI Configuration

1. Add the “Banner_IOLM_Param_T_v5” AOI to your ladder logic program. For each of the question marks shown in the instruction we need to create and link a new tag array. The AOI includes a new type of User Defined Tag (UDT): a custom array of tags meant specifically for this AOI.



2. In the AOI, right-click on the question mark on the line labeled “Banner_IOLM_Param_T_v5”. Click New Tag. In this example, we’ll use the name “IOLM1_Status”. The example naming convention accounts for this being the #1 IO-Link Master in our program. More masters could be named IOLM2, IOLM3, etc.
3. Now set up the Messages used to read and write to devices connected to this IO-Link Master. Right click on the question mark for Message_Read line in the AOI and choose New Tag. In this example we’ll use the tag name IOLM1_Read. Click Create.
4. Do the same for the Message_Write line in the AOI.

5. Now create a new tag array for the “IOLM” line in the AOI. Here we used the name “IOLM1”. The tags created here will serve as linkages between the IO-Link Master AOI and the connected Banner device AOI(s). This group of tags also controls the flow of information to and from the master, ensuring that all sensors get a chance to read and write in an orderly fashion.



6. Now configure “Message_Read”, setting up the Explicit Message that will handle half of the communications between the PLC and the IO-Link Master. Click on the “...” button at the far right of the “Message_Read” line.

7. In the Message Configuration window, keep the Message Type “CIP Generic” and the Service Type “Custom”. Enter a Service Code of 4b.

Message Configuration - IOLM1_Read

Configuration* Communication Tag

Message Type: CIP Generic

Service Type: Custom

Service Code: 4b (Hex) Class: 0 (Hex)

Instance: 0 Attribute: 0 (Hex)

Source Element:

Source Length: 1 (Bytes)

Destination Element:

New Tag...

Enable Enable Waiting Start Done Done Length: 0

Error Code: Extended Error Code: Timed Out

Error Path:

Error Text:

OK Cancel Apply Help

- 8. For the Source Element field, select "IOLM1.Message_Source_Data".

Enter Name Filter...		Show: All Tags
Name		Data Type
└ IOLM1		Banner_IOLM_v4
└ IOLM1.Message_Source_Data		SINT[190]
└ IOLM1.Message_Destination_Data		SINT[190]

- 9. For Destination Element, select "IOLM1.Message_Destination_Data".

Enter Name Filter...		Show: All Tags
Name		Data Type
└ IOLM1		Banner_IOLM_v4
└ IOLM1.Message_Source_Data		SINT[190]
└ IOLM1.Message_Destination_Data		SINT[190]
└ IOLM1.Error_Log		Banner_IOLM_EL_v4[10]

- 10. Now click on the Communication tab, then click the Browse button.

Message Configuration - IOLM1_Read

Configuration* Communication Tag

Path: Browse...

Broadcast:

Communication Method

CIP DH+ Channel: 'A' Destination Link: 0

CIP With Source ID Source Link: 0 Destination Node: 0 (Octal)

Connected Cache Connections Large Connection

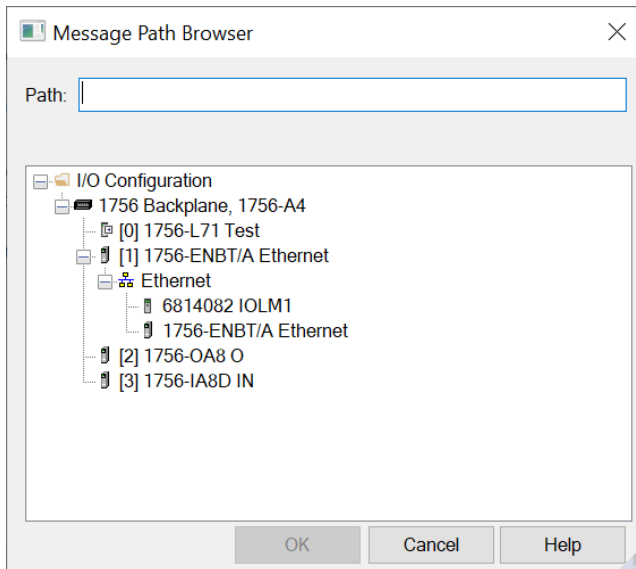
Enable Enable Waiting Start Done Done Length: 0

Error Code: Extended Error Code: Timed Out

Error Path:
Error Text:

OK Cancel Apply Help

11. Select the IO-Link Master, then click OK to close the Message Path Browser window, then click OK again to close the Message Configuration window.



12. Now configure "Message_Write", setting up the Explicit Message that will handle the other half of the communications between the PLC and the IO-Link Master. Click on the "..." button at the far right of the "Message_Write" line.

13. In the Message Configuration window, keep the Message Type “CIP Generic” and the Service Type “Custom”. Enter a Service Code of 4c.

Message Configuration - IOLM1_Write

Configuration* Communication Tag

Message Type: CIP Generic

Service Type: Custom

Service Code: 4c (Hex) Class: 0 (Hex)

Instance: 0 Attribute: 0 (Hex)

Source Element: [Empty]

Source Length: 1 (Bytes)

Destination Element: [Empty]

New Tag...

Enable Enable Waiting Start Done Done Length: 0

Error Code: Extended Error Code: Timed Out

Error Path:

Error Text:

OK Cancel Apply Help

14. For the Source Element field, select “IOLM2.Message_Source_Data”.

Enter Name Filter...		Show: All Tags
Name		Data Type
[-] IOLM1		Banner_IOLM_v4
[+] IOLM1.Message_Source_Data		SINT[190]
[+] IOLM1.Message_Destination_Data		SINT[190]
[+] IOLM1.Error_Log		Banner_IOLM_EL_v4[10]

15. For Destination Element, select “IOLM2.Message_Destination_Data”.

Enter Name Filter...		Show: All Tags
Name		Data Type
[-] IOLM1		Banner_IOLM_v4
[+] IOLM1.Message_Source_Data		SINT[190]
[+] IOLM1.Message_Destination_Data		SINT[190]
[+] IOLM1.Error_Log		Banner_IOLM_EL_v4[10]

16. Now click on the Communication tab, then click the Browse button.

Message Configuration - IOLM1_Write

Configuration* Communication Tag

Path:

Broadcast:

Communication Method

CIP DH+ Channel: Destination Link:

CIP With Source ID Source Link: Destination Node: (Octal)

Connected Cache Connections Large Connection

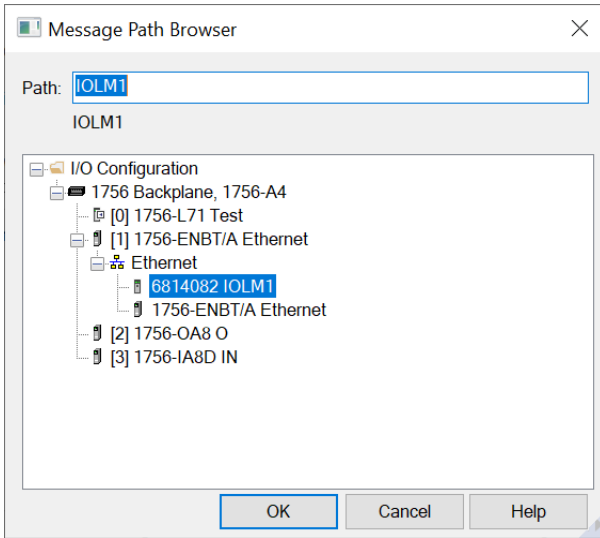
Enable Enable Waiting Start Done Done Length: 0

Error Code: Extended Error Code: Timed Out

Error Path:

Error Text:

17. Select the IO-Link Master, then click OK to close the Message Path Browser window, then click OK again to close the Message Configuration window.



18. Port 1 Through 8 tells the AOI which ports are controlled. Set the Port value to 1 if controlled and 0 if not controlled. In this example, port 1 will be the only port controlled.
19. The completed AOI should look like the below image.

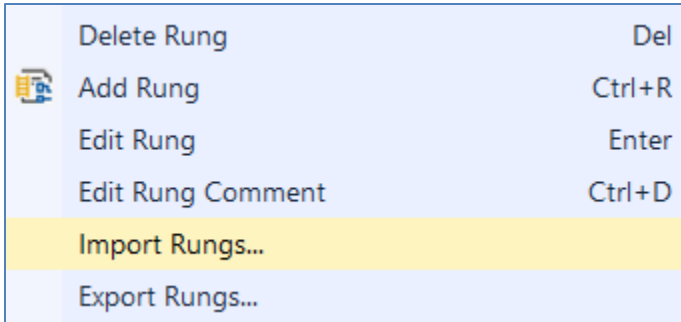
Banner_IOLM_Param_T_v5		
Banner_IOLM_Param_T_...	IOLM1_Status	...
Message_Read	IOLM1_Read	...
Message_Write	IOLM1_Write	...
IOLM	IOLM1	(Busy)
Port1	1	(Error)
Port2	0	
Port3	0	
Port4	0	
Port5	0	
Port6	0	
Port7	0	
Port8	0	

20. AOI configuration complete.
21. Go to the Import Device Data and Rule Set for Banner IOL Parameter AOI section to complete setup.

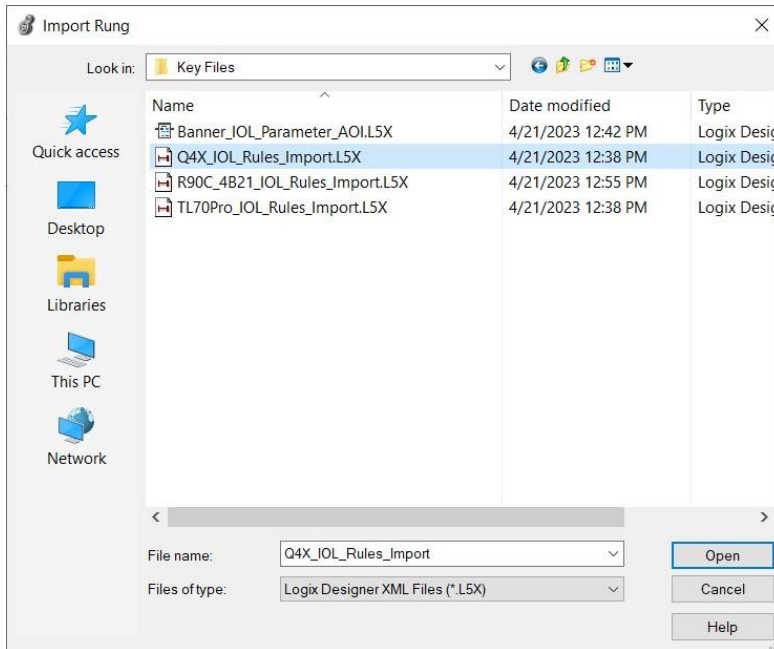
8. Import Device Data and Rule Set for Banner IOL Parameter AOI

This section describes how to import the User Defined Data Types in Logix Designer software.

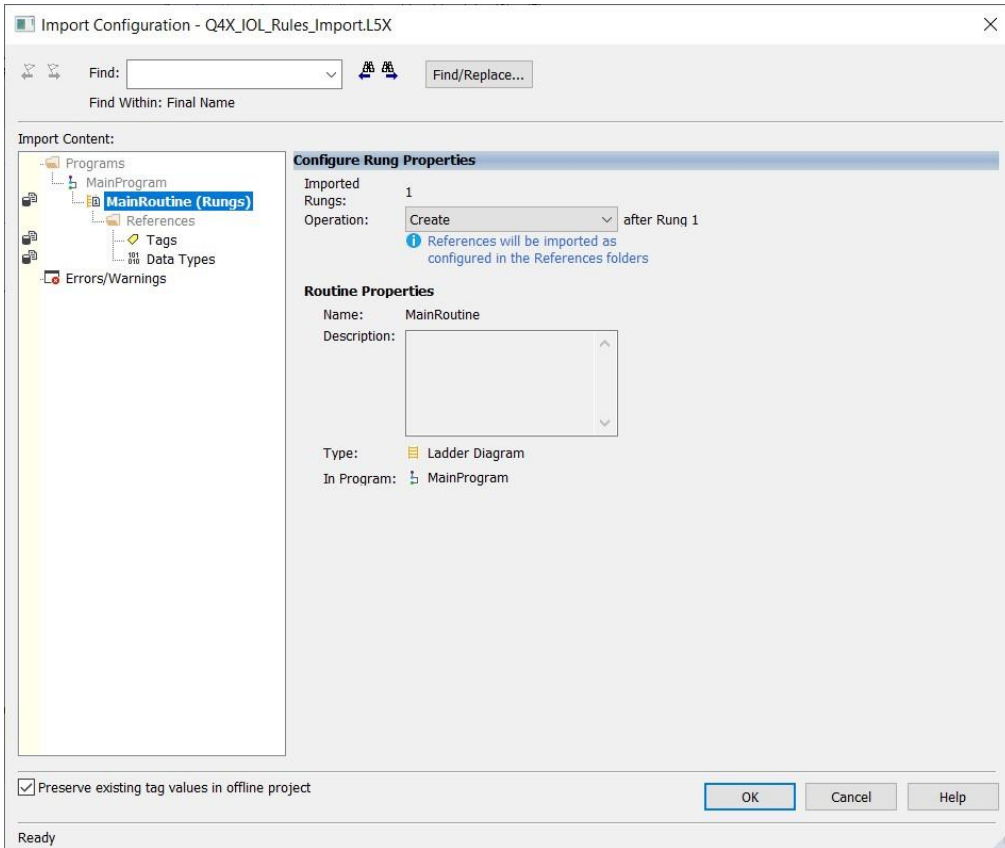
1. Go to an open ladder rung. Right click and select “Import Rungs...”. The Import rung window will appear.



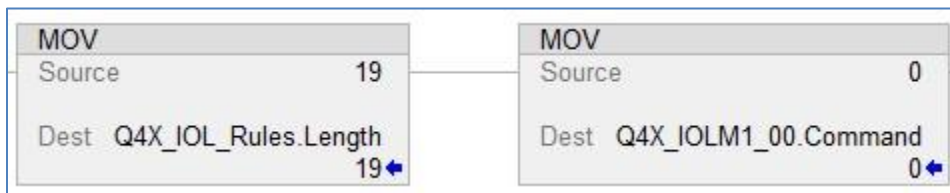
2. Navigate to the correct file location and select the IO-Link Rules to be installed. Select the Banner device required for your system. In this example the “Q4X_IOL_Rules_Import_v5.L5X” file will be selected. Click the Open button.



- The Import Configuration window will pop up. The default selection will create all the necessary items for the AOI. Click the OK button to complete the import process.

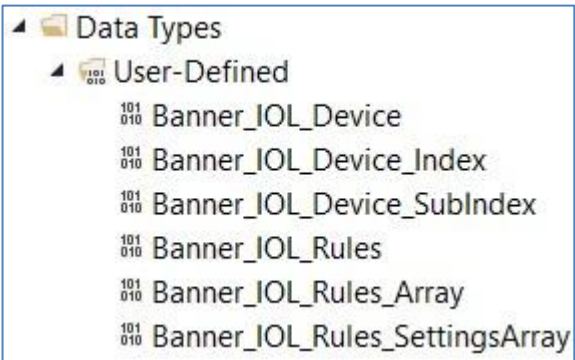


- Two Move blocks will now be added to the rung. This step imports the proper data for gathering the Q4X Parameter data. Delete these two blocks. The import is only done to get the tags populated into the system.



- Controller Tags will now have two new entries. These tags will be required after the AOI has been imported. Rename the tags for the system as needed.

▶ Q4X_IOL_Rules	{...}	Banner_IOL_Rules_Array
▶ Q4X_IOLM1_01	{...}	Banner_IOL_Device

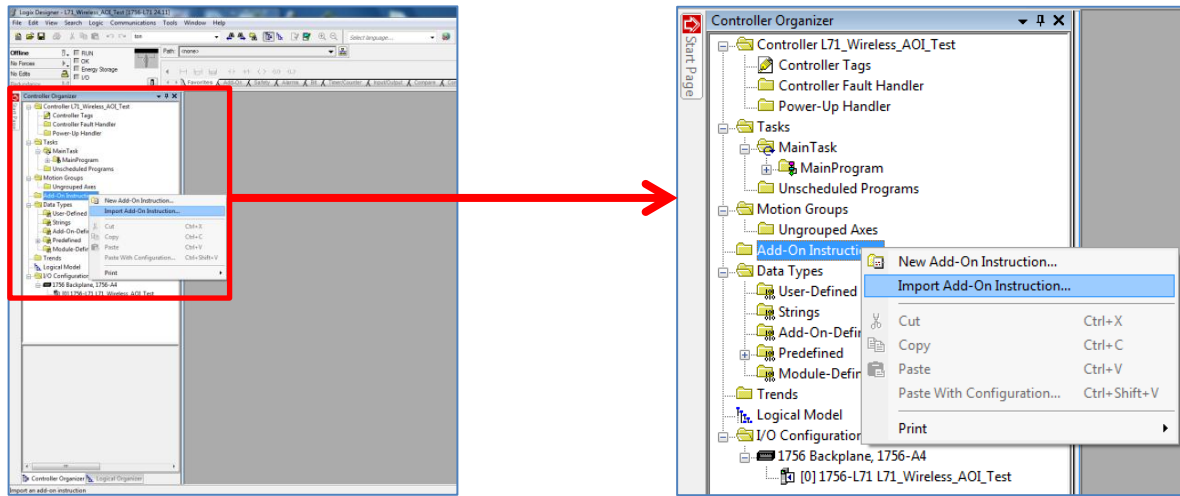


6. The import added several User-Defined Data Types to the system.
7. Import operation into the Logix Designer software complete.

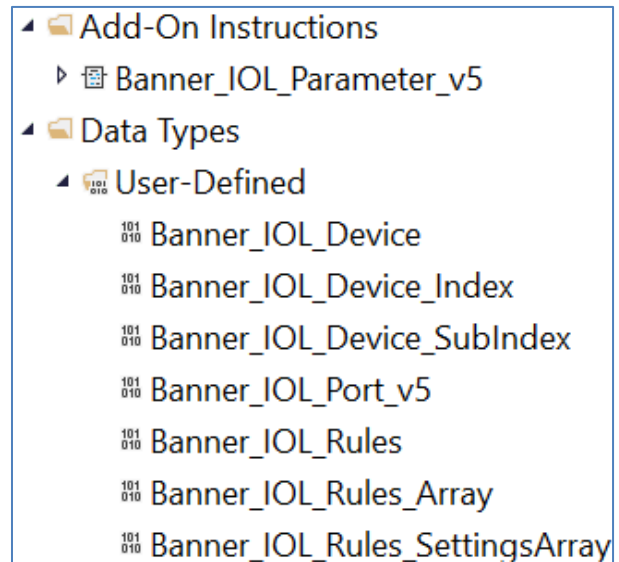
9. Install Banner IOL Parameter AOI

This section describes how to install the AOI in Logix Designer software.

1. In the Controller Organizer window, right-click on the Add-On Instruction folder. Select the Import Add-On Instruction option.



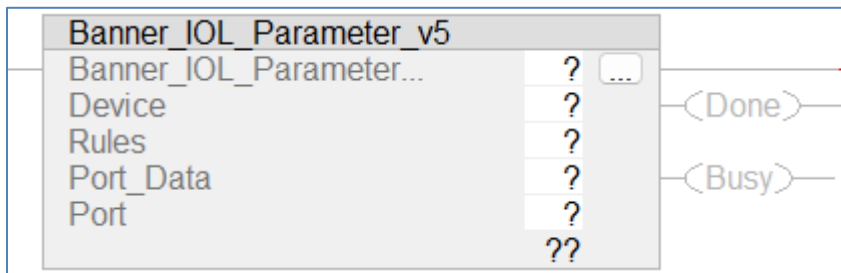
2. Navigate to the correct file location and select the AOI to be installed. In this example the “Banner_IOL_Parameter_v5_AOI.L5X” file will be selected. Click the Open button.
3. The Import Configuration window will pop up. The default selection will create all the necessary items for the AOI. Click the OK button to complete the import process.
4. The AOI is added to the Controller Organizer window and should look like the shown image.
5. AOI Installation into the Logix Designer software complete.



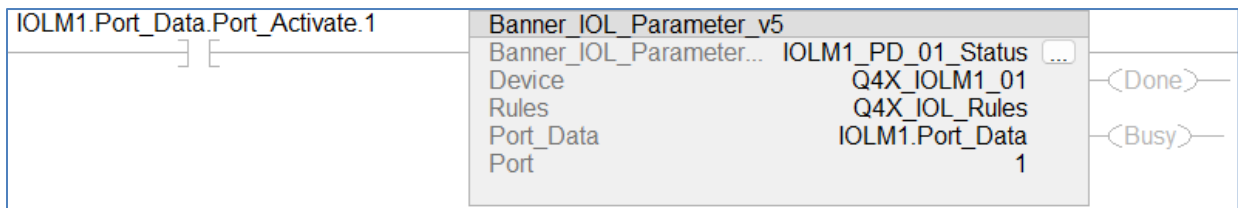
10. Configuring the Banner IO-Link Parameter AOI

Make sure to add and configure a Banner IO-Link Master AOI to your program before adding a Banner IO-Link Device AOI.

1. Add the “Banner_IOL_Parameter_v5” AOI to your ladder logic program. For each of the question marks shown in the instruction we need to create and link a new tag array. The AOI includes new types of User Defined Tag (UDT): custom arrays of tags meant specifically for this AOI.



2. In the AOI, right-click on the question mark on the line labeled “Banner_IOL_Parameter_v5”. Click New Tag. In this example, we’ll use the name “IOLM1_PD_01_Status”. The example naming convention accounts for this being an IO-Link device connected to IO-Link Master #1, port #1, in our program. More masters could be named IOLM2, IOLM3, and different sensors could be connected at other port numbers, etc.
3. Now link the tag imported in the previous section called “Q4X_IOLM1_01” to the Device line. This array of tags includes the Read and Write data blocks, made up of the information from the Q4X IO-Link Index and Subindex values.
4. Now link the tag imported in the previous section called “Q4X_IOL_Rules” to the Rules line. This tag array tells the Banner_IOL_Parameter AOI how to communicate with a Q4X device through the Banner DXMR90-4K or DXMR110-8K.
5. For the “Port_Data” line, choose the relevant IO-Link Master AOI’s “Port_Data” variable. In this example, we choose “IOLM1.Port_Data”.
6. The last line of the Q4X AOI, “Port”, type in a number equal to the IO-Link Master port number to which the Q4X is connected. In this example, the Q4X is on port 1.



7. Configuration of AOI complete.

11. Using the Paired IO-Link Master and Device Parameter Data AOIs

The goal is to make the Banner device’s IO-Link Index and Subindex values appear in PLC tag arrays as if it were an EtherNet/IP-speaking device. Reading from and writing to the Banner IO-Link device becomes as easy a changing tag values in the PLC. All the complicated work of translating from EtherNet/IP to IO-Link is handled automatically, behind the scenes.

When the program is downloaded to the PLC and the PLC goes into run mode, the IO-Link Master AOI performs a global read for each connected Banner device AOI. The Banner device AOI then creates an archive copy of all writable parameters for that device. This archive is used to determine whether one of the writable data tags has been changed. If so, the AOI automatically triggers the process of acyclic writing, using correctly formatted CIP generic message commands.

There are two methods for acyclic reading of Banner device Index and Subindex values.

1. The initial global read, as requested by the IO-Link Master AOI after the PLC program is downloaded and run.
2. Manually via the “Command” variable found in every Device Parameter Data AOI. The “Command” register can be used to force one-time read or write actions, as described in Appendix C of any Banner Device Parameter AOI guide.

Read rules can just be activated by entering the correct number into Command. A global read can be activated by entering a 1 into Command. Open the Data section and go to the Index of the data you are interested in. The updated data is now available.

Q4X_IOLM1_01	{...}
Q4X_IOLM1_01.Initial_Global_Read	0
Q4X_IOLM1_01.Command	0
Q4X_IOLM1_01.Data	{...}
Q4X_IOLM1_01.Reset	0

Write rules require first opening the Data section and going to the Index and Sub-Index that need to be adjusted. Enter the new value that will be written to the IO-Link Device. Set the Command line to the value (40 + Index number) to activate the write for the Index being updated.

Appendix A Error Handling & AOI Resets

Whenever an error related to the read or write Message Commands buried inside the AOI occurs, the “Num_Error_MSGS” variable will increment by 1.

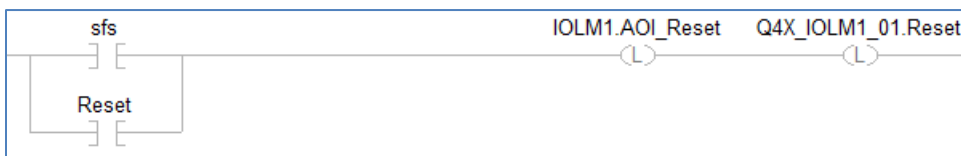
The specific error information will be stored in the “Error_Log” array. This array includes space for 10 errors. Each entry records whether the error occurred on a read (0) or write (1) attempt and which port on the IO-Link Master and Index on the IO-Link Device were involved. Once the error is logged, the AOI moves on to the next task. An example of an Error_Log entry is shown below, where an IO-Link Master AOI failed to write to Index 60 on the IO-Link device connected to port 1.

▲ IOLM1.Error_Log	{...}
▲ IOLM1.Error_Log[0]	{...}
▶ IOLM1.Error_Log[0].RW	1
▶ IOLM1.Error_Log[0].Port	1
▶ IOLM1.Error_Log[0].Index	60

Potential causes for errors include incorrect setup of the Device or Master AOI (wrong port number for device, wrong Port_Controlled array for master, or incorrect settings for the Master message commands), having the sensor physically connected to the incorrect port on the Master, or having no power to the IO-Link Master.

The “AOI_Reset” variable is used to restart the AOI from scratch. To initiate this reset, write a “1” to this register. The reset will occur, then turn the variable back to “0” automatically.

Best practices suggest adding a rung to your ladder logic program that resets all IO-Link Master and Device Parameter AOIs on the first scan. The example below shows one IO-Link Master, called IOLM4, and one connected Q5X having their respective AOIs being reset in this way.



Appendix B

Halt AOI Operation

At times it may be desirable to halt the IO-Link Master AOI. This is especially true if you are using AOIs made by other manufacturers, particularly those made by the manufacturer of the IO-Link Master itself. The “Halt_Operation” variable can be used to stop the action of the Banner IO-Link Master AOI, allowing other AOIs to function correctly. When the other AOIs are done, the Banner IO-Link Master AOI can be reactivated.

▾ IOLM1	{...}
▸ IOLM1.Message_Source_Data	{...}
▸ IOLM1.Message_Destination_Data	{...}
▸ IOLM1.Error_Log	{...}
IOLM1.Error_Write_Retry	0
▸ IOLM1.Num_Error_MSGS	0
IOLM1.IO_Link_Master_Busy	0
IOLM1.AOI_Reset	0
▸ IOLM1.Port_Data	{...}
IOLM1.Halt_Operation	0
IOLM1.AOI_Halted	0

Appendix C Command Register

The “Command” register is used to control the reading and writing of data to an IO-Link device.

Q4X_IOLM1_01	{...}
Q4X_IOLM1_01.Initial_Global_Read	0
Q4X_IOLM1_01.Command	0
Q4X_IOLM1_01.Data	{...}
Q4X_IOLM1_01.Reset	0

The table below shows the command numbers associated with the reading and writing of specific pieces of data. See the Q4X IODD file or the IO-Link Data Reference Guide for more information of the parameters.

Table 1: AOI Command Numbers

Rules	Read	Write	IOL Index	RO - 0	WO - 1	RW - 2
1	1			Global Read All		
2	2	42	0	Direct Parameters 1		
3		43	2		Standard Command	
4	4	44	12			Device Access Locks
5	5		21	Serial Number		
6	6	46	58			Teach-in Channel
7	7		59	Teach-in Status		
8	8	48	60			BDC1 Setpoints
9	9	49	61			BDC1 Configuration
10	10	50	62			BDC2 Setpoints
11	11	51	63			BDC2 Configuration
12	12	52	64			Configuration
13	13	53	65			BDC1 Vendor Specific Configuration
14	14	54	66			BDC2 Vendor Specific Configuration
15	15		67	Status		
16	16		69	All Time Run Time		
17	17	57	70			Resettable Run Time
18	18	58	71			Pulse Frequency Configuration
19	19		72	Display String		