BANNER **IO-Link**

Murr IO-Link Master Add-On Instruction Guide, v4
September 18th, 2023

This document covers the installation and use of an Add-On Instruction (AOI) for the Logix Designer software package from Rockwell Automation. This AOI handles acyclic IO-Link commands from an Allen-Bradley PLC through an Murr IO-Link Master. This AOI has two User Defined Tag data types.

This IO-Link Master AOI is meant to be used alongside one or more v4 Banner IO-Link Device Parameter Data AOIs.

This document was written using an Murr Impact67 E DIO 12 DIO4/IOL4 4P (Art.-No. 55144). Other Murr IO-Link Masters may work as well.

Components
Banner _IOLM_M_v4.L5X

UDT's Packaged with the AOI
Banner_IOLM_v4
Banner_IOLM_EL_v4
Banner_IOL_Port_v4

NOTE:

This Banner IO-Link Master AOI is useless on its own.

It is intended to be linked to one or more v4 Banner Device Parameter AOIs to function.

Other AOIs Available Separately
Banner has AOI files for other brands of IO-Link Master and for controlling a variety of Banner IO-Link devices. Banner also has AOI files for easily handling Banner device Process Data.

Contents

1.   Installation Process

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

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.
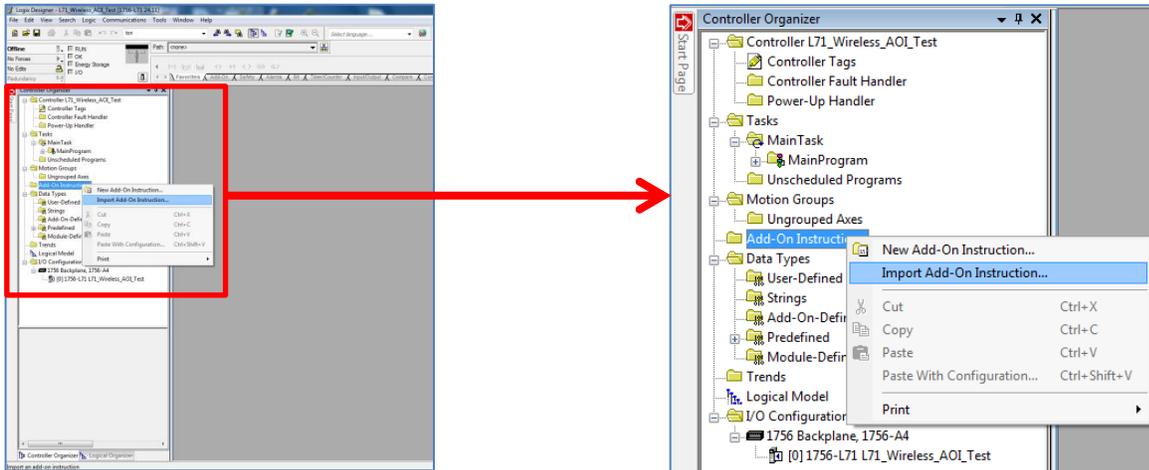
3. Navigate to the correct file location and select the AOI to be installed. In this example the "Banner_ IOLM_M_v4_AOI.L5X" file will be selected. Click the Open button.
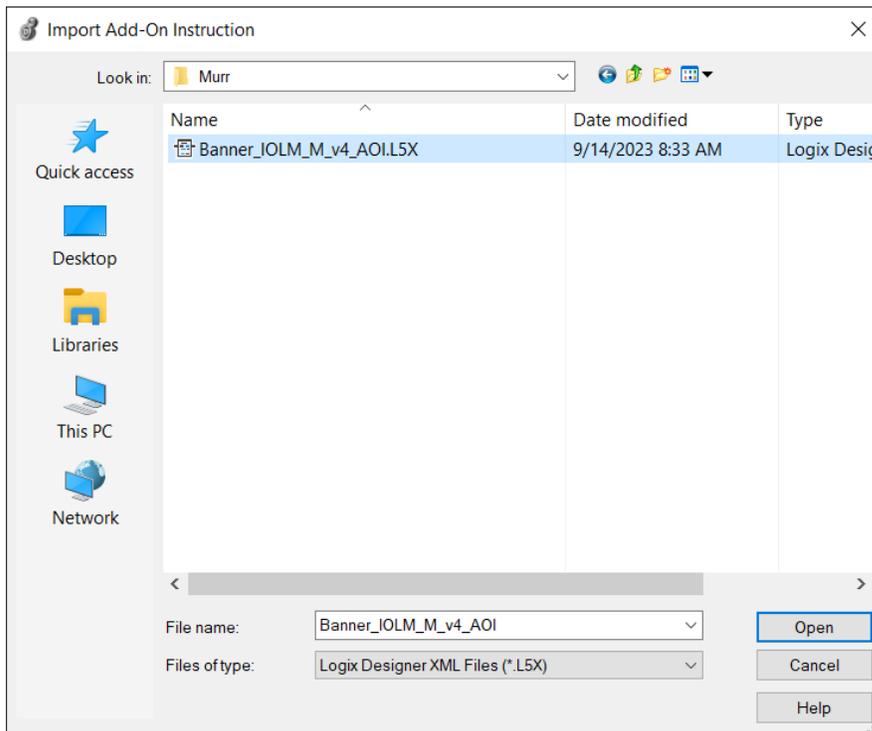
4. The Import Configuration window will pop up. The default selection will create all the necessary items for the AOI. Click the OK button to complete the import process.
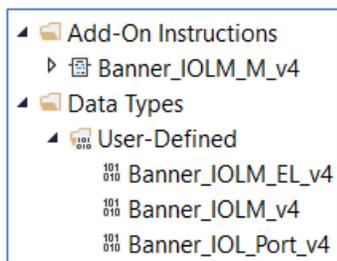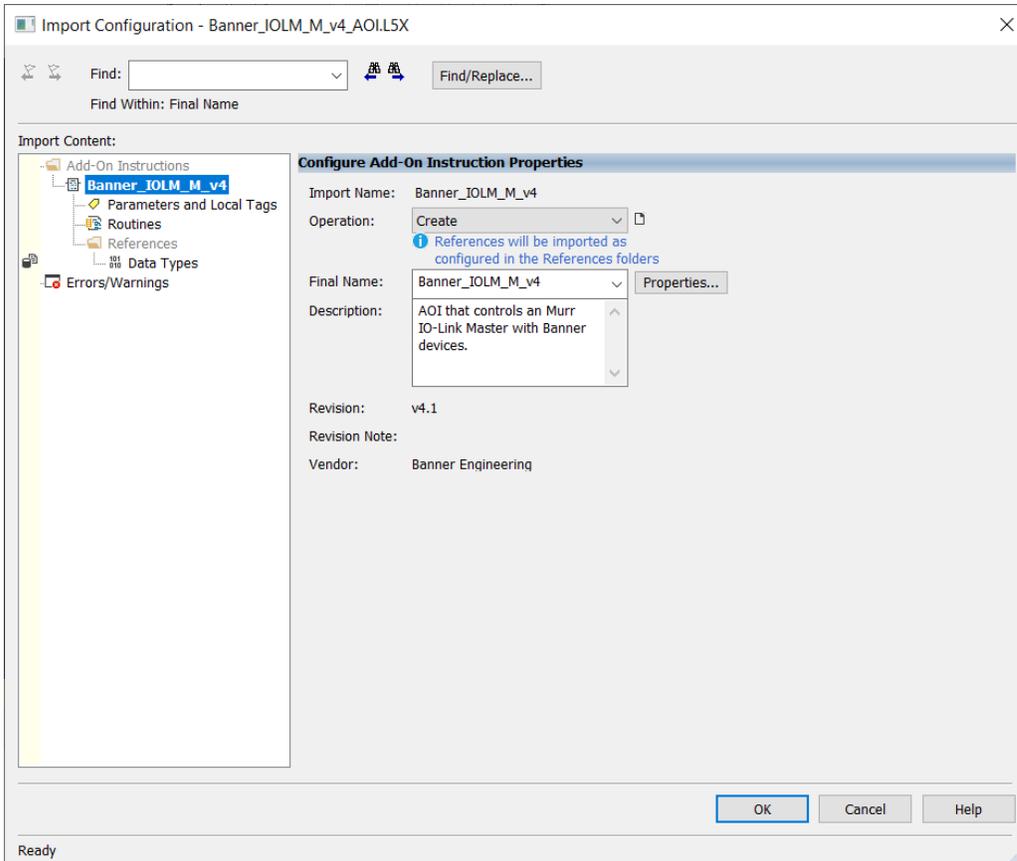
5. The AOI is added to the Controller Organizer window and should look like the picture at left.

6. AOI installation into the Logix Designer software complete.

2.   Configuring the Murr IO-Link Master

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

Create an Ethernet communications module for the Murr IO-Link Master device. In this example the EDS file was used, and the connection was named "IOLM1". The controller tags include Input (I) and Output (O) Assembly Instances. Each Assembly has a corresponding tag array. Creating this Class 1 EtherNet/IP implicit IO connection will provide the PLC access to the IO-Link sensor Process Data. Each port on the IO-Link Master is given a dedicated group of I and O registers. See the relevant Murr User's Guide for more information. This connection will also provide a communications pathway for the explicit messages used by the AOI to send IO-Link information to and from the Banner devices.

3.   Configuring the Banner IO-Link Master AOI

1.   Add the "Banner_IOLM_M_v4" 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.
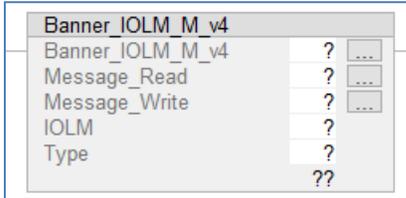
2.   In the AOI, right-click on the question mark on the line labeled "Banner_IOLM_M_v4". Click New Tag. In this example, we'll use the name "IOLM1_Status". The example naming convention accounts for this being the #1 IO-Link Master in our program. More masters could be named IOLM2, IOLM3, etc.
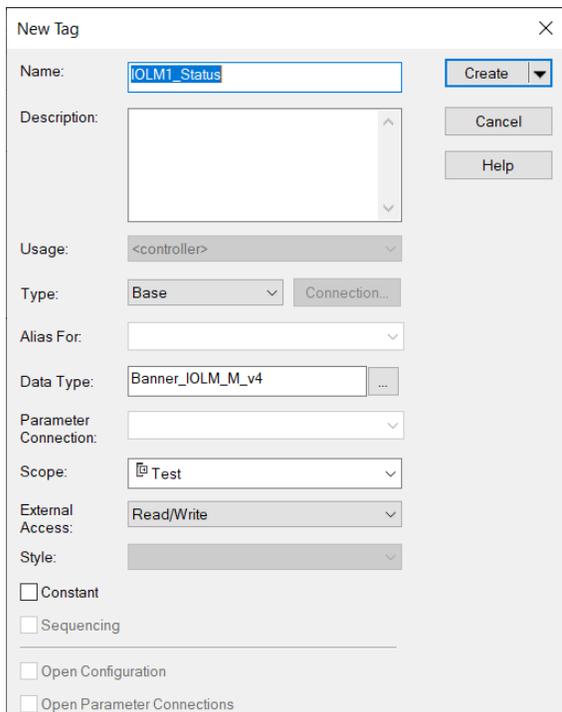
The "EnableIn" and "EnableOut" variables are ladder logic rung status bits automatically added to all AOIs.

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_Message_Read". Click Create.

    Do the same for the "Message_Write" line in the AOI.

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.

5. 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.
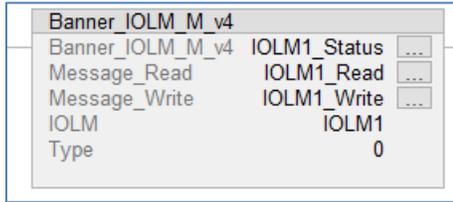
    b. Murr Impact67 Pro E DIO8 IOL8 M12L 5P (Art.-No. 54631) uses 16#83 for CIP_Class and port number for the CIP_Instance. A value of 1 in the Type parameter for the AOI configures the AOI for this data format.
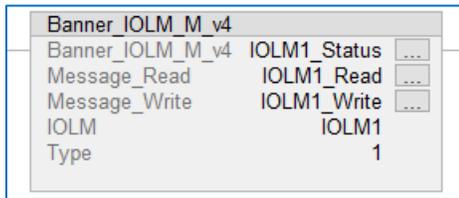
6. Now configure "Message_Read", setting up the Explicit Message that will handle half of the communications between the PLC and the IO-Link Master. Click on the "…" button at the far right of the "Message_Read" line.
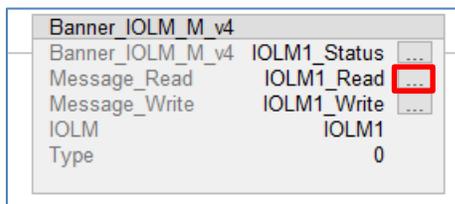
7. In the Message Configuration window, keep the Message Type "CIP Generic" and the Service Type "Custom". Enter a Service Code of 4b.
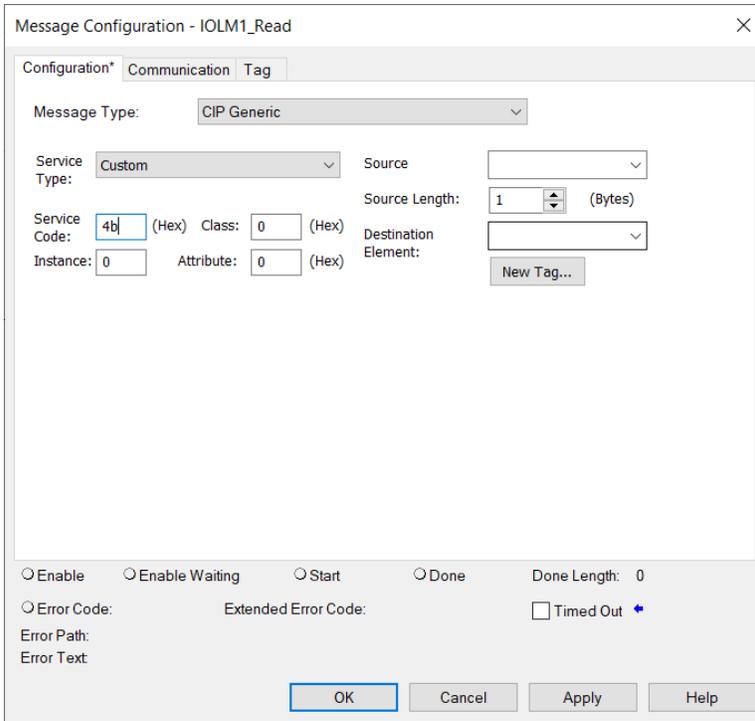
8. For the Source Element field, select "IOLM1.Message_Source_Data".
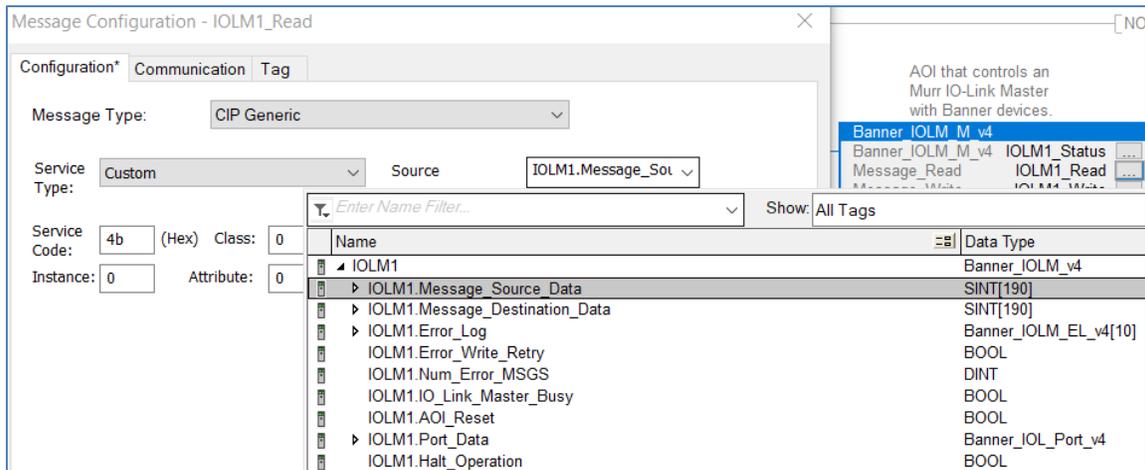
9. For Destination Element, select "IOLM1.Message_Destination_Data".
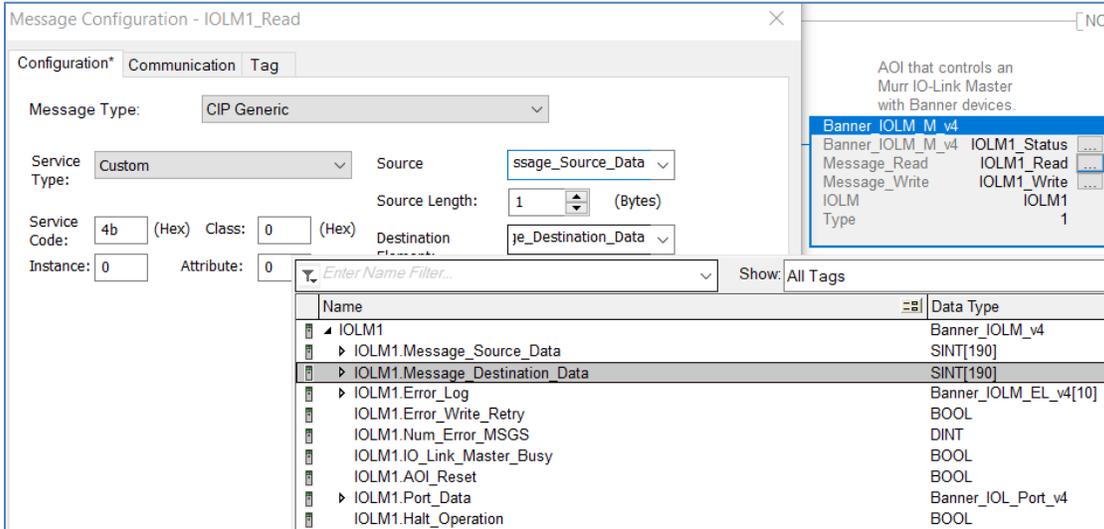
10. Now click on the Communication tab, then click the Browse button.
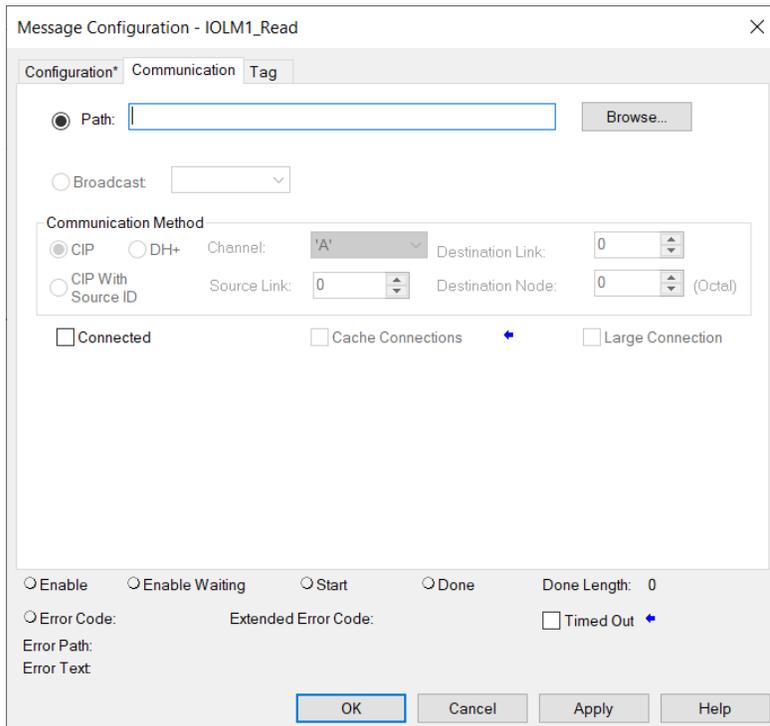
11. Select the IO-Link Master, then click OK to close the Message Path Browser window, then click OK again to close the Message Configuration window.
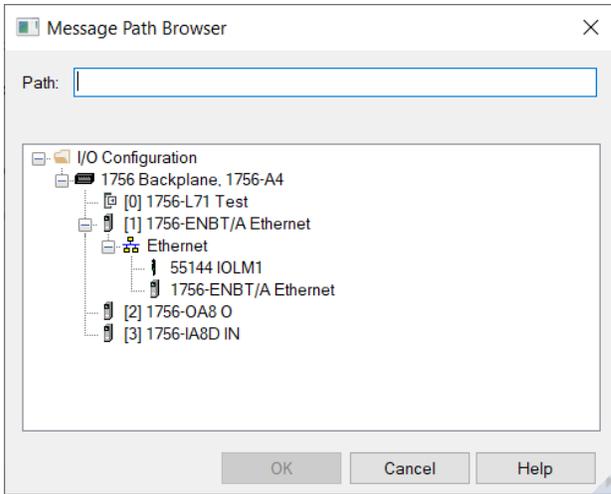
12. Now configure "Message_Write", setting up the Explicit Message that will handle the other half of the communications between the PLC and the IO-Link Master. Click on the "…" button at the far right of the "Message_Write" line.
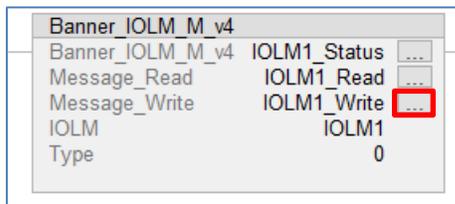
13. In the Message Configuration window, keep the Message Type "CIP Generic" and the Service Type "Custom". Enter a Service Code of 4c.
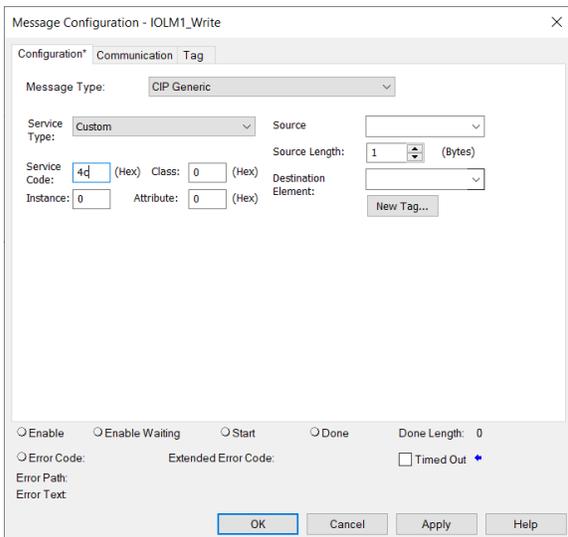
14. For the Source Element field, select "IOLM1.Message_Source_Data".
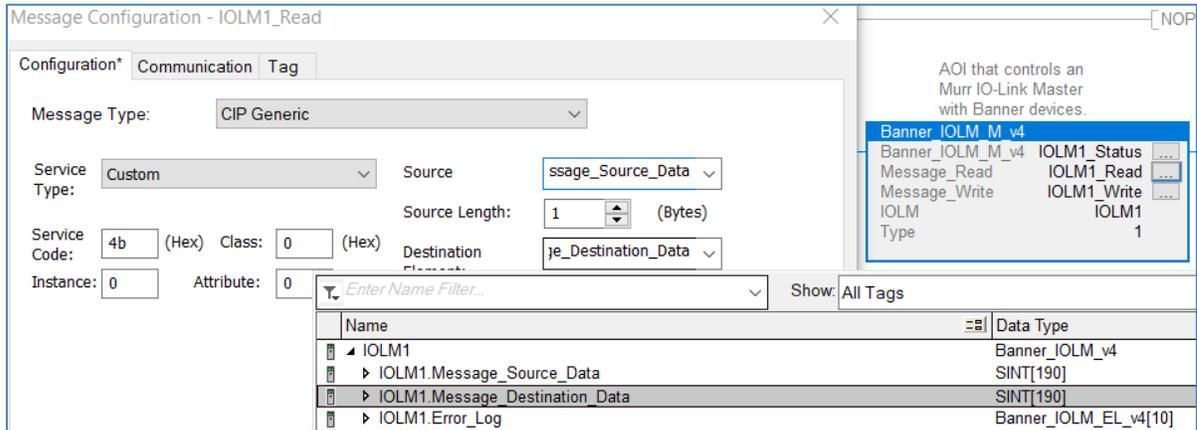
15. For Destination Element, select "IOLM1.Message_Destination_Data".
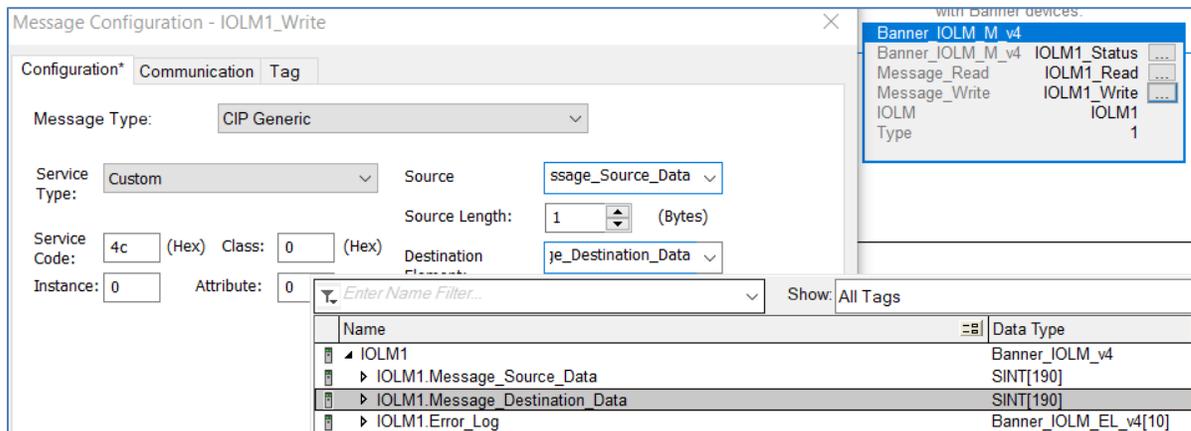
16. Now click on the Communication tab, then click the Browse button.
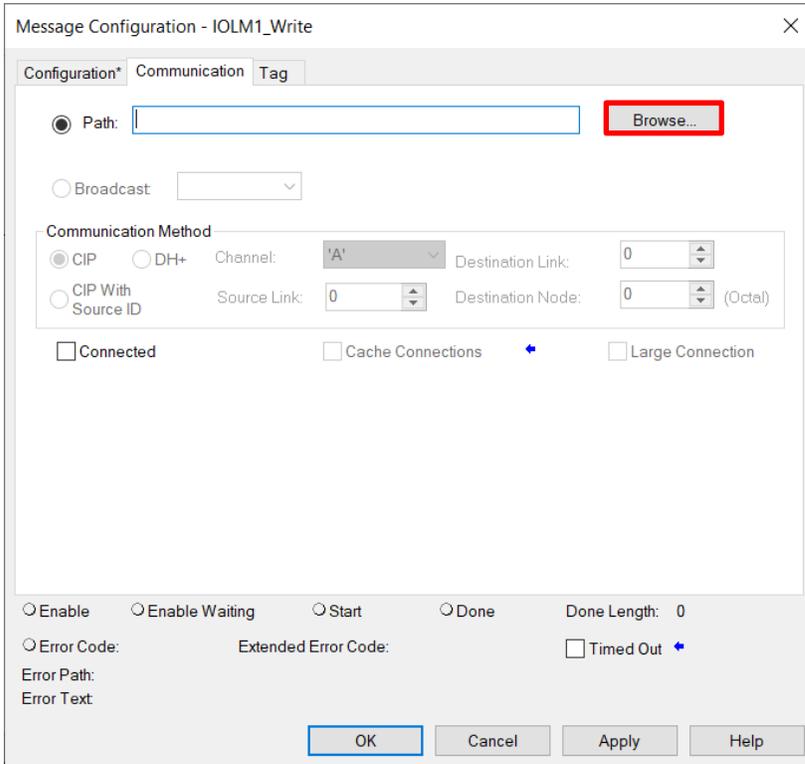

17. Select the IO-Link Master, then click OK to close the Message Path Browser window, then click OK again to close the Message Configuration window.
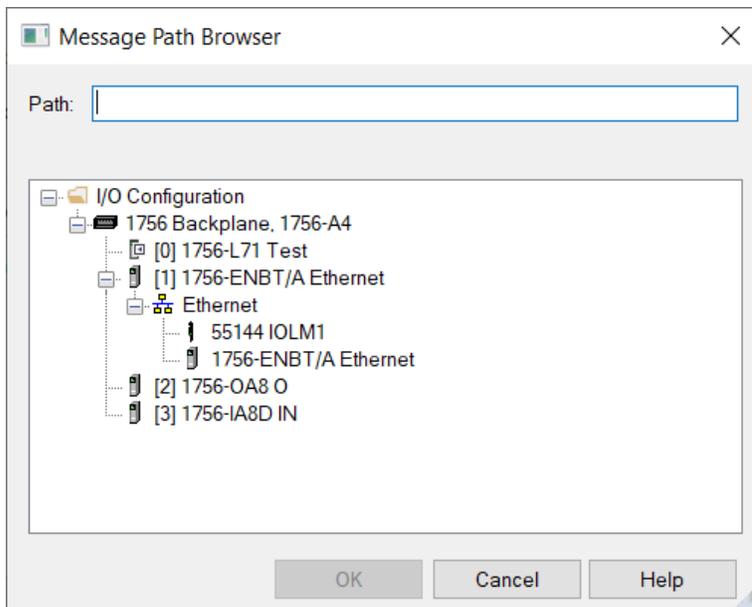
4.   Linking the Master AOI to Device AOIs

Select and install one or more Banner device AOIs. The device AOIs then need to be linked to this IO-Link Master AOI to provide control over IO-Link settings. See the relevant Banner IO-Link device AOI documents for more information.

Set "IOLM1.Port_Controlled" bits to 1 for every port on the IO-Link Master with a connected Banner device and its corresponding Device Parameter Data AOI. In the example below, a single Banner device is connected to port 1. The specific bit used here matches the port's label on the IO-Link Master. Some masters start with port 0, some start with port 1, depending on manufacturer. Save the program to store these changes in the database.

▲ IOLM1.Port_Data	{...}
▲ IOLM1.Port_Data.Port_Controlled	2
IOLM1.Port_Data.Port_Controlled.0	0
IOLM1.Port_Data.Port_Controlled.1	1
IOLM1.Port_Data.Port_Controlled.2	0
IOLM1.Port_Data.Port_Controlled.3	0
IOLM1.Port_Data.Port_Controlled.4	0
IOLM1.Port_Data.Port_Controlled.5	0
IOLM1.Port_Data.Port_Controlled.6	0
IOLM1.Port_Data.Port_Controlled.7	0
IOLM1.Port_Data.Port_Controlled.8	0

5.   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 writeable parameters for that device. This archive is used to determine whether one of the writeable 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 A of any Banner Device Parameter AOI guide.

Acyclic writes to the IO-Link device are handled by simply changing the relevant tag values in the device's "Write_Data" tag array.

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 IOLM1, and one connected Q4X having their respective AOIs being reset in this way.
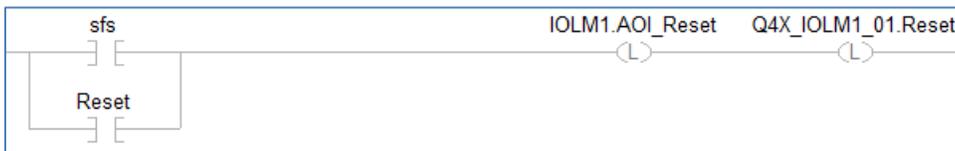
Appendix B   Halt AOI Operation

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