



Q76 Process Data AOI Guide, v4

October 31st, 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 cyclic IO-Link Process Data In from a Banner Q76 sensor via an IO-Link Master to an Allen-Bradley PLC. The AOI covers parsing and display of the Q76 sensor Process Data In. The AOI has one User Defined Tag data type.

Components

Banner_Q76_PD_v4_AOI.L5X

UDT Packaged with the AOI

Banner_Q76_PDIO_v4

Banner_Q76_Set0_v4

Banner_Q76_Set1_v4

Other AOIs Available Separately

Banner has AOI files for controlling other Banner IO-Link devices and for a variety of IO-Link Masters. Banner also has AOI files for easily handling Banner device Parameter Data.

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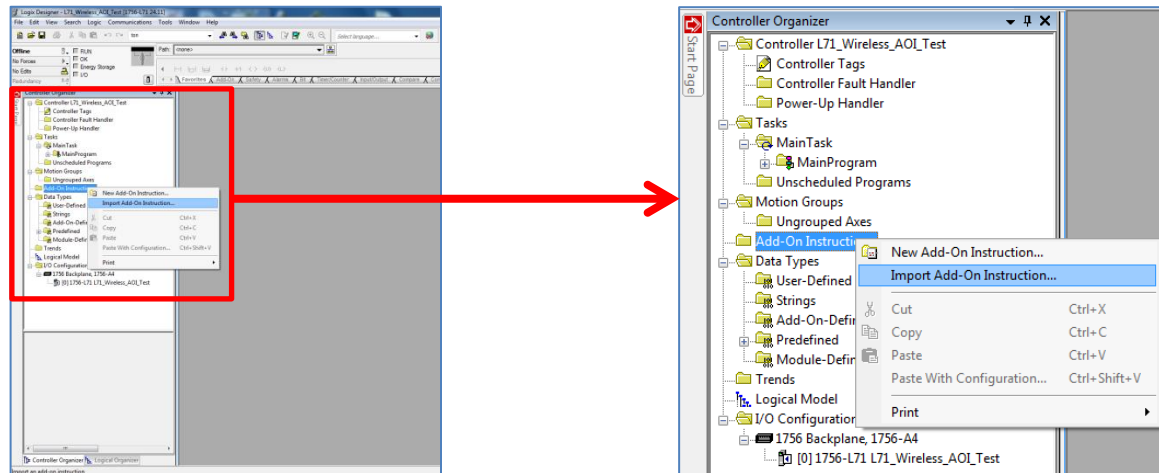
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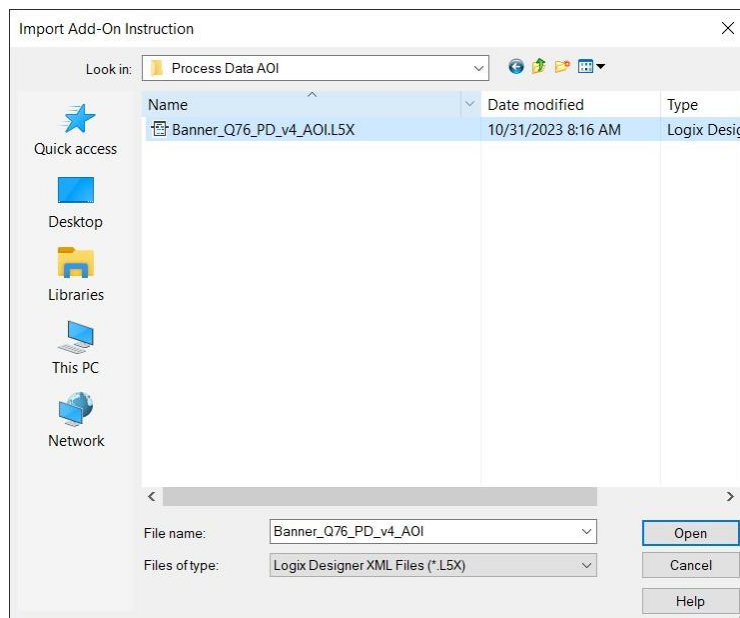
1. Installation Process

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

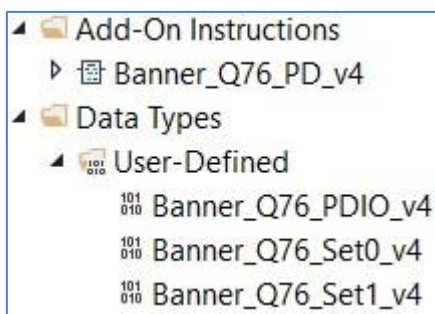
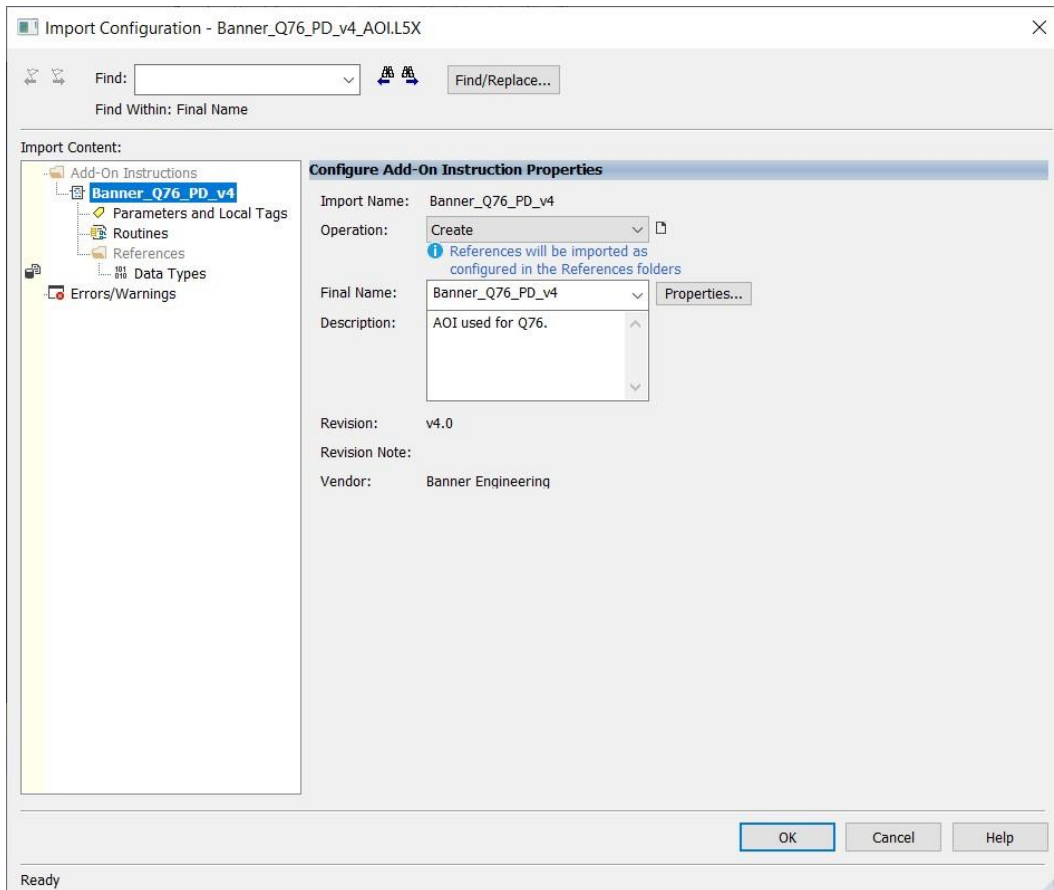
1. Open a project.
2. In the Controller Organizer window, right-click on the Add-On Instruction folder. Select the Import Add-On Instruction option.



3. Navigate to the correct file location and select the AOI to be installed. In this example the "Banner_Q76_PD_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.

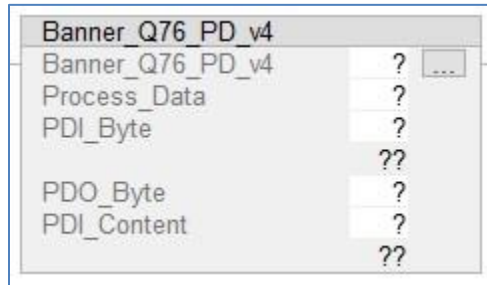
2. Configuring the IO-Link Master

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

Create an Ethernet communications module for the IO-Link Master device. The controller tags generated 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 device Process Data. Each port on the IO-Link Master is given a dedicated group of I and O registers. See the relevant IO-Link Master User's Guide for more information.

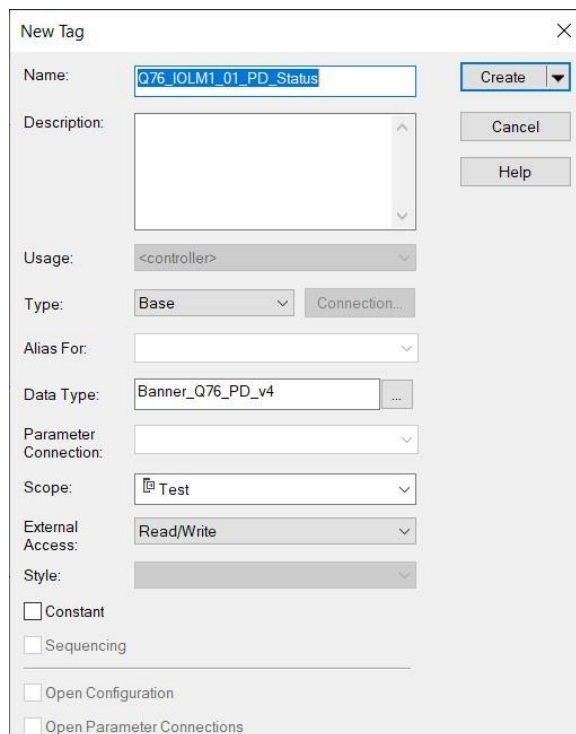
3. Configuring the AOI

1. Add the “Banner_Q76_PD_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 Tags (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_Q76_PD_v4”. Click New Tag. Name the new tag. This example uses the name “Q76_IOLM1_01_PD_Status”. The example naming convention accounts for this being a Q4X sensor 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.

Note that the Data Type is the User-Defined Data Type (UDT) entitled “Banner_Q76_PD_v4”. This custom-made array of registers is specially built to handle the memory needs of this AOI. Click Create to make the tag array.



New Tag

Name: Q76_IOLM1_01_PD_Status

Description:

Usage: <controller>

Type: Base

Alias For:

Data Type: Banner_Q76_PD_v4

Parameter Connection:

Scope: Test

External Access: Read/Write

Style:

☐ Constant

☐ Sequencing

☐ Open Configuration

☐ Open Parameter Connections

Create

Cancel

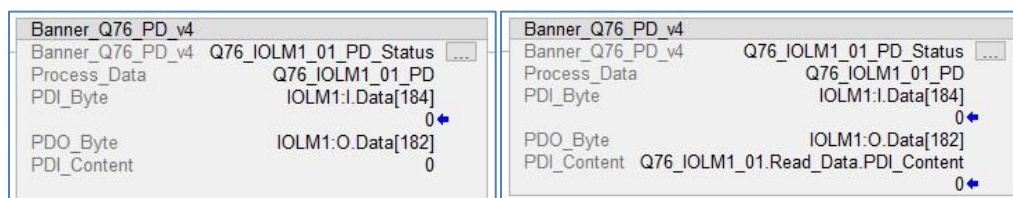
Help

- Now we will right-click on the question mark on the line labeled “Process_Data” in the AOI. Click on “New Tag”. Give the tag a name. This example uses the name “Q76_IOLM1_01_PD”. Notice that the Data Type is “Banner_Q76_PDIO_v4”. Click Create.

- Next, we will link the lines in the AOI labeled “PDI_Byte” and “PDO_Byte” with the group of registers the IO-Link Master has reserved for the Q76 in question. These registers are the raw Process Data that this AOI will separate out into component pieces. An IFM IO-Link Master is used for this example. See the relevant IO-Link Master documentation or Table 1 in Appendix B for more information on which registers contain the raw Process Data you need. Since Port 1 is being used the input byte is 184, while the output byte is 182. Add 1 to the byte listed for an IO-Link Master that requires a Byte Swap. See Table 2 in Appendix B for a list of masters. Since this IFM master is a bit swap device, this example uses bytes 185 and 183 instead of the 184 and 182 from the table.

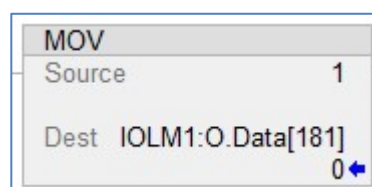
Banner_Q76_PD_v4		
Banner_Q76_PD_v4	Q76_IOLM1_01_PD_Status	...
Process_Data	Q76_IOLM1_01_PD	
PDI_Byte	IOLM1:I.Data[184]	
	0	←
PDO_Byte	IOLM1:O.Data[182]	
PDI_Content	0	

5. The last line that needs to be set is the “PDI_Content”. This can either be manually set or setting can be linked from the parameter data AOI.



If a Banner IO-Link Master is being used, setup a Move block. Send a 1 to the Activate Outputs array value (see table for each port's value). As an example, if port 1 needs the process data outputs active then send a 1 to 181.

IO-Link Master Port	Activate Outputs
1	181
2	215
3	249
4	283
5	317
6	351
7	385
8	419



The “Banner_Q76_PD_v4” AOI is now ready for use.

4. Using the AOI

The “Banner_Q76_PD_v4” Add-On Instruction has created a group of tags representing the Q4X Process Data, broken out into its component parts.

Look in the Controller Tags to find the name you used in Step 4 above. This example used the name “Q76_IOLM1_01_PD”. The tag array, seen below, has individual pieces of information.

▲ Q76_IOLM1_01_PD	{...}
▲ Q76_IOLM1_01_PD.Set0	{...}
▶ Q76_IOLM1_01_PD.Set0.Q	0
▶ Q76_IOLM1_01_PD.Set0.Warning	0
▶ Q76_IOLM1_01_PD.Set0.Status	0
▲ Q76_IOLM1_01_PD.Set1	{...}
▶ Q76_IOLM1_01_PD.Set1.Q	0
▶ Q76_IOLM1_01_PD.Set1.Signal	0
▶ Q76_IOLM1_01_PD.PDO	0

Appendix A Q76 Process Data

The Q76 has 1 byte of both Process Data In and Out, as shown below.

ProcessData id=PD_ProcessData (condition V_DirectParameters.26 == 0)

ProcessDataIn "Sensor Switching Signals (PDI)" id=PD_ProcessDataIn

bit length: 8

data type: 8-bit Record

subindex	bit offset	data type	allowed values	default value	acc. restr.	mod. other var.	excl. from DS	name	description
1	0	Boolean						Q	
2	1	Boolean						Warning	
3	2	Boolean						Status	

Octet 0

bit offset	7	6	5	4	3	2	1	0
subindex	//////	//////	//////	//////	//////	3	2	1

ProcessDataOut "PDO Function" id=PD_ProcessDataOut

bit length: 1

data type: Boolean

Octet 0

bit offset	7	6	5	4	3	2	1	0
element bit	sign ext.							

ProcessData id=PD_ProcessDataAdc (condition V_DirectParameters.26 == 1)

ProcessDataIn "Sensor Switching Signals (PDI)" id=PD_ProcessDataInAdc

bit length: 8

data type: 8-bit Record

subindex	bit offset	data type	allowed values	default value	acc. restr.	mod. other var.	excl. from DS	name	description
1	0	Boolean						Q	
2	1	7-bit UInteger						Received Signal	

Octet 0

bit offset	7	6	5	4	3	2	1	0
subindex	2							1
element bit	6	5	4	3	2	1	0	

ProcessDataOut "PDO Function" id=PD_ProcessDataOutAdc

bit length: 1

data type: Boolean

Octet 0

bit offset	7	6	5	4	3	2	1	0
element bit	sign ext.							

This AOI intelligently parses this Process Data into its component pieces.

Appendix B IO-Link Master Cheat Sheet

Different IO-Link Masters behave differently in several ways. For one, the register locations where Process Data is stored varies. For another, some IO-Link Masters require byte-swapping and/or word-swapping. The tables below aim to define some of these differences. Note that these numbers are when using all default settings. IO-Link Masters can change the register locations to which Process Data is mapped in response to non-default, optional settings. See relevant IO-Link Master documentation for more information.

PDI (Process Data In) is found in the IO-Link Master's T->O (PLC "Input") Assembly Instance.

PDO (Process Data Out) is found in the IO-Link Master's O->T (PLC "Output") Assembly Instance.

Table 1. First Register of Process Data "SINT0"

Port	Allen-Bradley*		Comtrol		Balluff		Turck		ifm		Banner	
	PDI	PDO	PDI	PDO	PDI	PDO	PDI	PDO	PDI	PDO	PDI	PDO
1	I.Ch0Data[0]	O.Ch0Data[0]	4	0	8	6	6	4	190	46	184	182
2	I.Ch1Data[0]	O.Ch1Data[0]	40	32	56	38	38	36	222	78	218	216
3	I.Ch2Data[0]	O.Ch2Data[0]	76	64	104	70	70	68	254	110	252	250
4	I.Ch3Data[0]	O.Ch3Data[0]	112	96	152	102	102	100	286	142	286	284
5	I.Ch4Data[0]	O.Ch4Data[0]	148	128	200	134	134	132	318	174	320	318
6	I.Ch5Data[0]	O.Ch5Data[0]	184	160	248	166	166	164	350	206	354	352
7	I.Ch6Data[0]	O.Ch6Data[0]	220	192	296	198	198	196	382	238	388	386
8	I.Ch7Data[0]	O.Ch7Data[0]	256	224	344	230	230	228	414	270	422	420

*see relevant Banner Allen-Bradley IO-Link Master AOI Guide and Allen-Bradley User Guides for more information on using device IODD files to aid in integration.

Note: Murr IO-Link Masters have configurable process data. Refer to the Murr IO-Link Master Instruction Manual for Process Data mappings.

Table 2. Byte-Swap

IO-Link Master	Byte Swap
Allen-Bradley	0
Comtrol	1
Balluff	0
Turck	1
ifm	1
Murr	0
Banner	0

Specific hardware used in both tables (all default settings):

- Allen-Bradley Armor Block I/O IO-Link Master (1732E-8IOLM12R)
- Comtrol 8-EIP IO-Link Master (99608-8)
- Balluff BNI006A (BNI EIP-508-105-Z015)
- Turck TBEN-L5-8IOL
- ifm AL1122
- Murr Impact67 E DIO 12 DIO4/IOL4 4P (Art.-No. 55144)

Banner IO-Link Masters (DXMR90-4K) have a port status register. The register gives the status of the port. It gives information on if the port has an IO-Link device connected and if Process Data is valid. This is optional information but is useful for troubleshooting. The data comes into the PLC as bytes while the literature shows the value as a word. The table below gives the upper- and lower-byte data location in the PLC. The upper byte includes bits 15 through 8, while the lower byte has bits 7 through 0.

IO-Link Master Port	Upper Bits 15 - 8	Lower Bits 7 - 0
1	182	183
2	216	217
3	250	251
4	284	285
5	318	319
6	352	353
7	386	387
8	420	421

Port Status:

Bit0 = Connected?

Bit1 = Process Data Valid?

Bit2 = Event Pending?

Bit3 = Ready for ISDU?

Bit4 = Pin4 SIO State

Bit5 = Pin2 SIO State

Bit6-7 = Pin4 Mode:

SDCI Mode = 0

SIO Input Mode = 1

SIO Output Mode = 2

Bit8-10 = Pin2 Mode:

Disabled = 0

Input Normal = 1

Output = 2

Diagnostic Input = 3

Inverted Input = 4