



## **Q5X 3000 IO-Link Device Parameter Data Add-On Instruction Guide, v4** **October 17<sup>th</sup>, 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 to and from a Q5X POF (Phase of Flight) sensor. This AOI has four User Defined Tag data types.

**This IO-Link Device Parameter Data AOI is meant to be used alongside a v2 Banner IO-Link Master AOI.**

### **Components**

Banner\_Q5X\_3000\_Param\_v4\_AOI.L5X

### **UDT's Packaged with the AOI**

Banner\_IOL\_Port\_v4

Banner\_Q5X\_3000\_v4

Banner\_Q5X\_3000\_RD\_v4

Banner\_Q5X\_3000\_WD\_v4

### **NOTE:**

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

It is intended to be linked to a v4 Banner IO-Link Master AOI to function.

### **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 Process Data.

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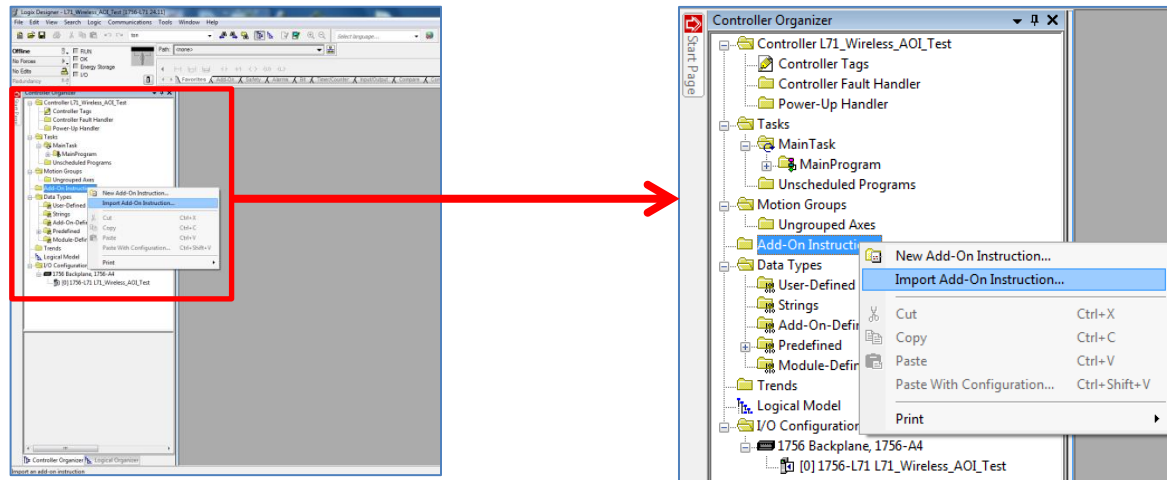
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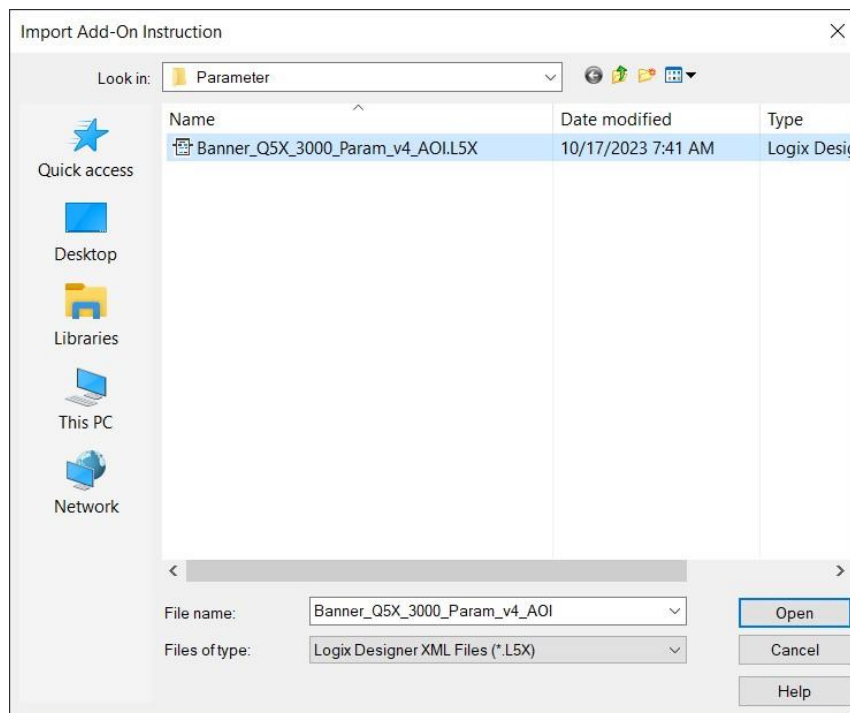
## 1. Installation Process

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

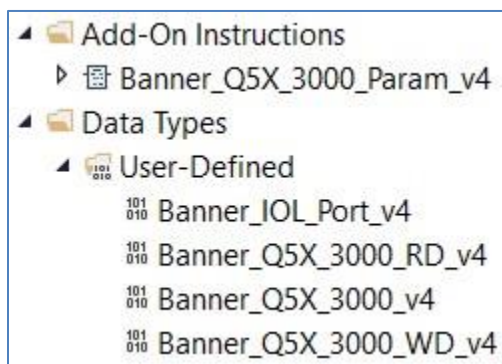
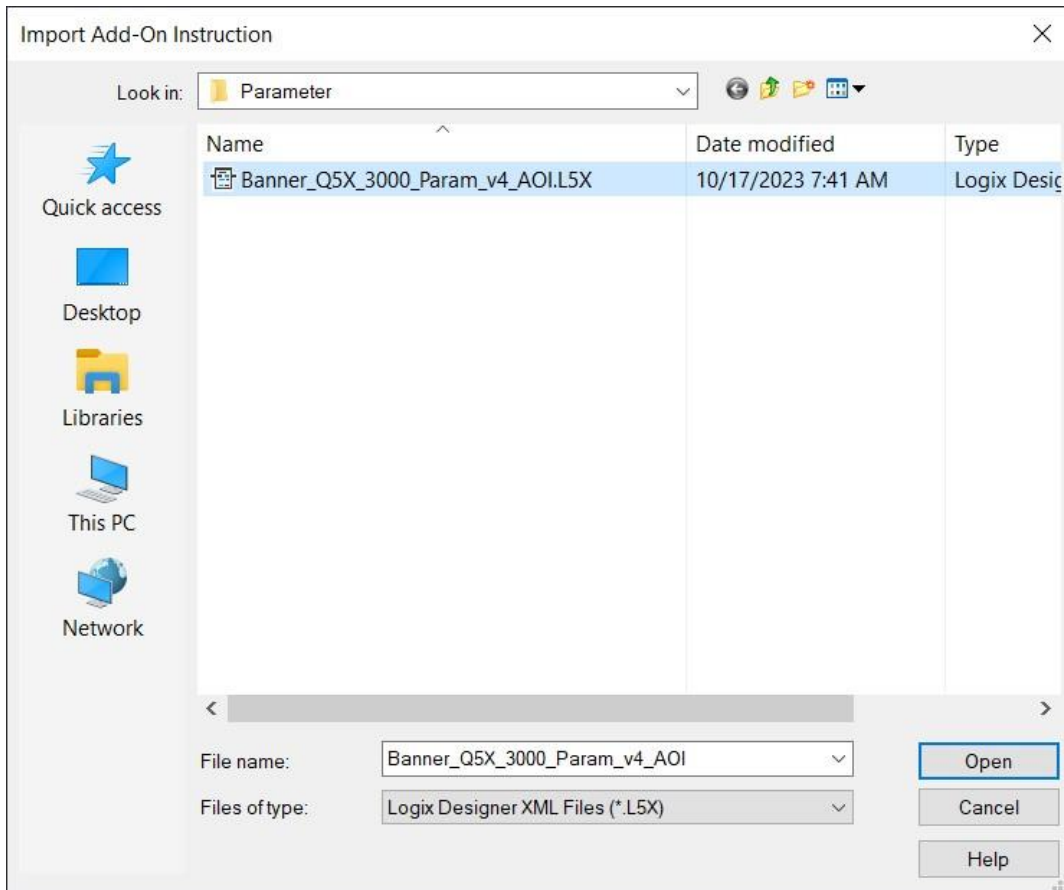
1. Open a project.
2. In the Controller Organizer window, right-click on the Add-On Instruction folder. Select the Import Add-On Instruction option.



3. Navigate to the correct file location and select the AOI to be installed. In this example the "Banner\_Q5X\_3000\_Param\_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.

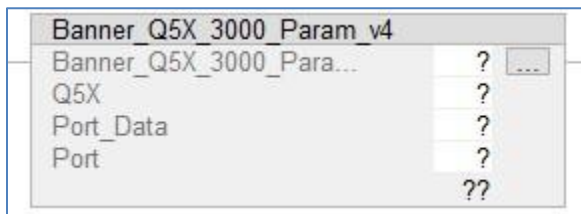


5. The AOI is added to the Controller Organizer window and should look like the picture at left.
6. AOI installation into the Logix Designer software complete.

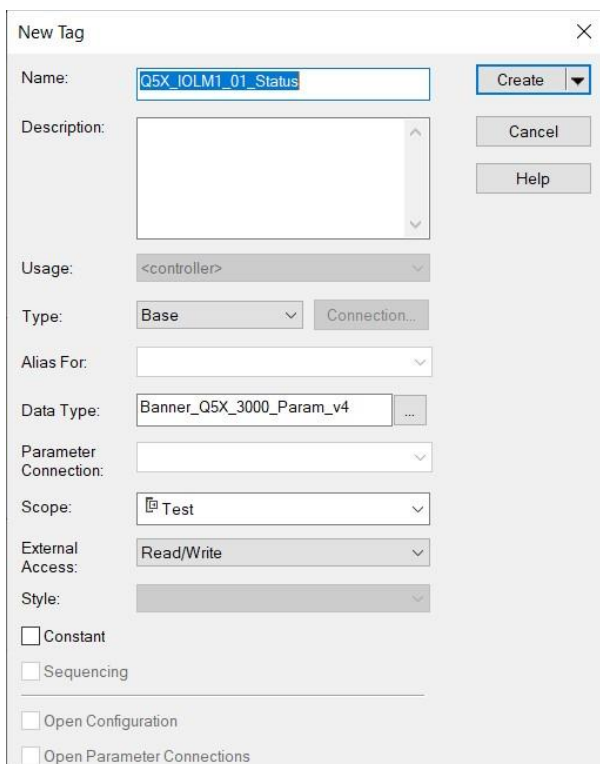
## 2. Configuring the AOI

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\_Q5X\_3000\_Param\_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 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\_Q5X\_3000\_Param\_v4”. Click New Tag. In this example, we’ll use the name “Q5X\_IOLM1\_01\_Status”. The example naming convention accounts for this being a Q5X 3000 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.



The “EnableIn” and “EnableOut” variables are ladder logic rung status bits automatically added to all AOIs.

- Now click on the question mark on the line labeled “Q5X\_3000”. Click New Tag. In this example, we’ll use the name “Q5X\_IOLM1\_01”. This array of tags includes the port number to which the Q5X 3000 is connected and the Read and Write data blocks, made up of the information from the Q5X 3000 IO-Link Index and Subindex values.

**New Tag** [X]

Name:  Create ▼

Description: Cancel

Usage: <controller> ▼

Type: Base ▼ Connection...

Alias For:

Data Type: Banner\_Q5X\_3000\_v4 ...

Parameter Connection:

Scope: Test ▼

External Access: Read/Write ▼

Style:  ▼

☐ Constant

☐ Sequencing

☐ Open Configuration

☐ Open Parameter Connections

Q5X_IOLM1_01	{...}
Q5X_IOLM1_01.Initial_Global_Read	0
▶ Q5X_IOLM1_01.Command	0
▶ Q5X_IOLM1_01.Read_Data	{...}
▶ Q5X_IOLM1_01.Write_Data	{...}
▶ Q5X_IOLM1_01.Archive	{...}
Q5X_IOLM1_01.Reset	0

### 3. Linking the Device AOI to the Master AOI

The third tag in the Q5X 3000 AOI is meant to be tied into the IO-Link Master AOI.

1. For the “Port\_Data” line, choose the relevant IO-Link Master AOI’s “Port\_Data” variable. In this example, we choose “IOLM1.Port\_Data”.

Banner_Q5X_3000_Param_v4	
Banner_Q5X_3000_Para...	Q5X_IOLM1_01_Status ...
Q5X	Q5X_IOLM1_01
Port_Data	IOLM1.Port_Data
Port	
Enter Name Filter...	
Show: All Tags	
Name	Data Type
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

2. For the last line of the Q5X 3000 AOI, “Port\_Number”, type in a number equal to the IO-Link Master port number to which the Q5X 3000 is connected. In this example, the Q5X 3000 is on port 1.

Banner_Q5X_3000_Param_v4	
Banner_Q5X_3000_Para...	Q5X_IOLM1_01_Status ...
Q5X	Q5X_IOLM1_01
Port_Data	IOLM1.Port_Data
Port	1

3. The Q5X 3000 AOI is now linked to the IO-Link Master AOI. Add an Examine On instruction to the beginning of the ladder rung and tie it to the IO-Link Master AOI’s “Port Activate” bit corresponding to the port number to which the Q5X 3000 is connected. In this example the Q5X 3000 is on port 4 of the IO-Link Master named IOLM1, so the bit “IOLM1.Port\_Data.Port\_Activate.1” is used.

IOLM1.Port_Data.Port_Activate.1	Banner_Q5X_3000_Param_v4
	Banner_Q5X_3000_Para... Q5X_IOLM1_01_Status ...
	Q5X Q5X_IOLM1_01
	Port_Data IOLM1.Port_Data
	Port 1

## 4. 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 as 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 Command Register

The “Command” register can be used to control the connected IO-Link device ‘by hand’. Placing the correct command numbers into this register is how the AOI achieves its automatic control.

Q5X_IOLM1_01	{...}
Q5X_IOLM1_01.Initial_Global_Read	0
▸ Q5X_IOLM1_01.Command	0
▸ Q5X_IOLM1_01.Read_Data	{...}
▸ Q5X_IOLM1_01.Write_Data	{...}
▸ Q5X_IOLM1_01.Archive	{...}
Q5X_IOLM1_01.Reset	0

The table below shows the command numbers associated with the reading and writing of specific pieces of data. See the Q5X 3000 IODD file or the Q5X 3000 IO-Link Data Reference Guide for more information of the parameters.

**Table 1: AOI Command Numbers**

Q5X 3000 Parameter (IO-Link Index #)	Read Command	Write Command
Global Read (all)	1	
Direct Parameters (0)	2	
System Command (2)		42
Device Access Locks (12)	3	43
Serial Number (21)	4	
Teach in Channel (58)	5	44
Teach Status (59)	6	
BDC1 Setpoints (60)	7	45
BDC1 Configuration (61)	8	46
Configuration (64)	9	47
BDC1 Vendor Specific Config (65)	10	48
Status (67)	11	
All Time Run Time (69)	12	
Resettable Run Time (70)	13	49
Display (72)	14	
AO1 Setpoints	15	50
AO1 Configuration	16	51
All Time Run Time Event (76)	17	52
Resettable Run Time Event (77)	18	53
MDC Descriptor (16512)	19	

## Appendix B                      AOI Resets

From time to time, a reset may be needed for an AOI, particularly if one of the read/write processes the AOI undertakes is interrupted. To this end, each Device Parameter Data AOI and IO-Link Master AOI has a reset bit.

Toggling this bit to a “1” causes the AOI to start over and try again.

▲ Q5X_IOLM1_01	{...}
Q5X_IOLM1_01.Initial_Global_Read	0
▶ Q5X_IOLM1_01.Command	0
▶ Q5X_IOLM1_01.Read_Data	{...}
▶ Q5X_IOLM1_01.Write_Data	{...}
▶ Q5X_IOLM1_01.Archive	{...}
Q5X_IOLM1_01.Reset	0

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.

