CTL50 Process Data AOI Guide, v5
June 8th, 2026

This document covers the installation and use of Add-On Instruction (AOI) for the Logix Designer software package from Rockwell Automation. This AOI handles cyclic IO-Link Process Data Out to and from a Banner CTL50 device via an IO-Link Master connected to an Allen-Bradley PLC. The AOI covers parsing and display of the CTL50 Process Data Out. The AOI has nine User Defined Tag data types.

NOTE: AB 5032 IO-Link Masters do not use this Process Data AOI. The 5032 already breaks out the process data automatically. Use those tags.

Components
Banner_CTL50_PD_v5_AOI.L5X

Packaged AOI
Banner_CTL50_PD_Segment_Adv_v5

UDT Packaged with the AOI
Banner_CTL50_Advanced_v5
Banner_CTL50_GaugeMode_v5
Banner_CTL50_LED_v5
Banner_CTL50_Level_v5
Banner_CTL50_PDO_v5
Banner_CTL50_Run_v5
Banner_CTL50_SegmentControl_v5
Banner_CTL50_SegmentOverride_v5
Banner_CTL50_SegmentOverride_v5

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.

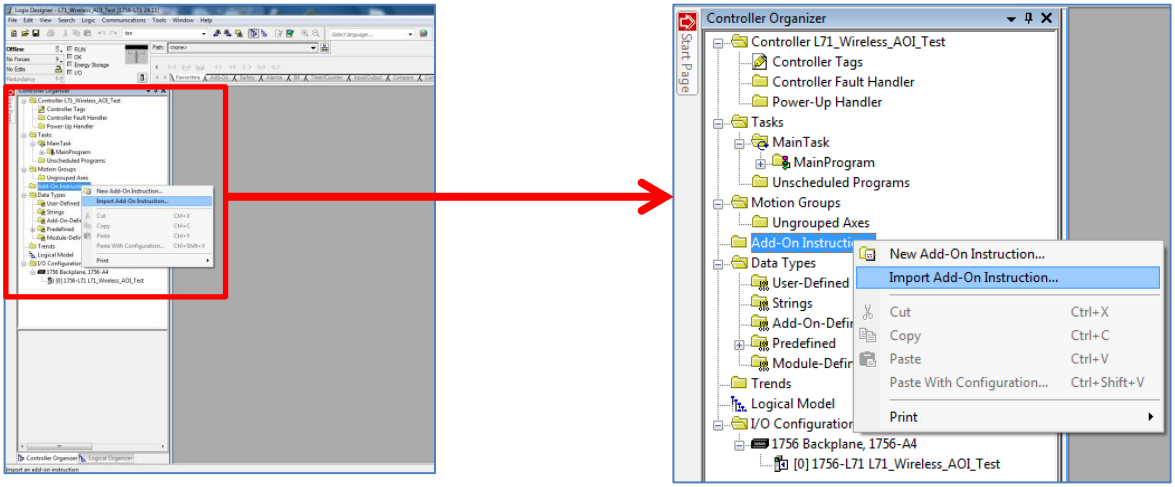
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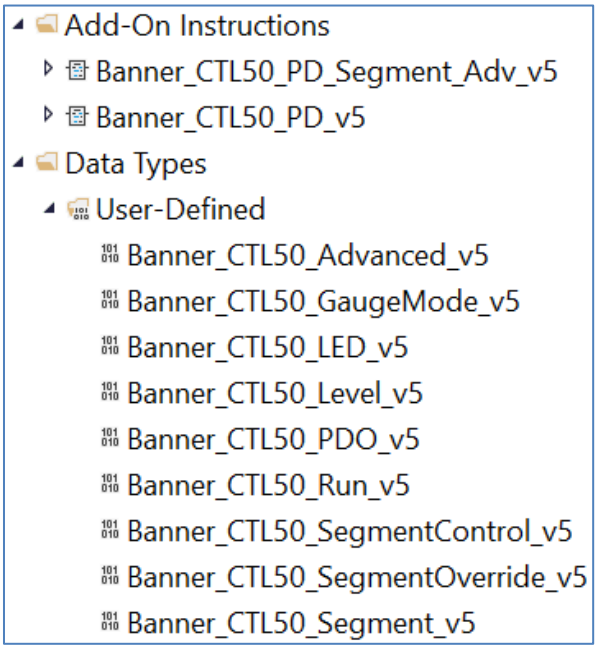
1. Installation Process

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_CTL50_PD_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 picture at the right.
6. AOI installation into the Logix Designer software is complete.



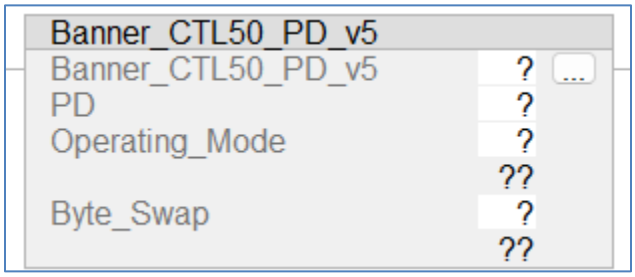
2. Configuring the IO-Link Master

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 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_CTL50_PD_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 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_CTL50_PD_v5”. Click New Tag. Name the new tag. This example uses the name “CTL50_IOLM1_01_PD_Status”. The example naming convention accounts for this being an CTL50 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.

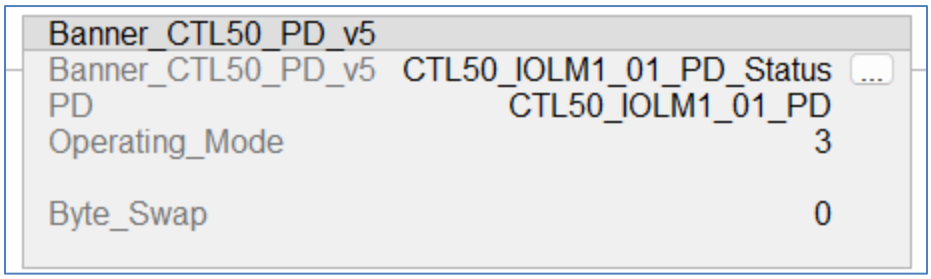
   Note that the Data Type is the User-Defined Data Type (UDT) entitled “Banner_CTL50_PD_v5”. This custom-made array of registers is specially built to handle the memory needs of this AOI. Click Create to make the tag array.

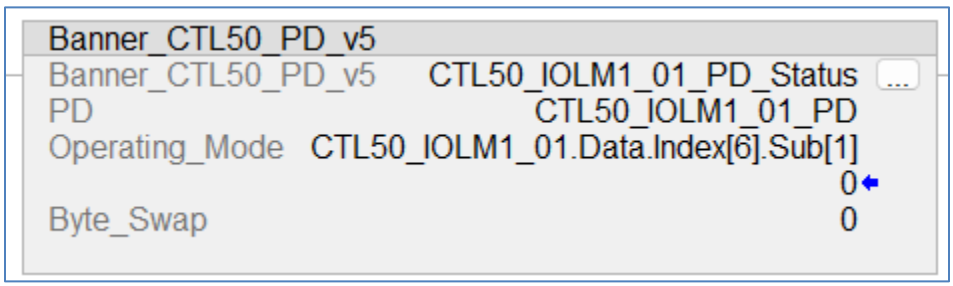
3. Now we will right-click on the question mark on the line labeled “PD” in the AOI. Click on “New Tag”. Give the tag a name. This example uses the name “CTL50_IOLM1_01_PD”. Notice that the Data Type is “Banner_CTL50_PDIO_v5”. Click Create.

   This array will handle the displaying of the parsed Process Data Out for the CTL50 device.

4. The line labeled “Operating_Mode” allows the AOI to know which of four possible Process Data Out definitions is currently in use. The choices for this setting are “0” (Run mode), “1” (Segment mode), “2” (Segment Override mode), “3” (Advanced Segement mode), “4” (Level mode), “5” (Gauge Mode), and “6” (LED mode). The default setting is “e”. This AOI needs to know which mode selection has been made in the device.

   There are two ways to achieve this goal. We can simply type in the correct number as a constant, or we can link this CTL50 Process Data AOI to the CTL50 Parameter Data AOI.



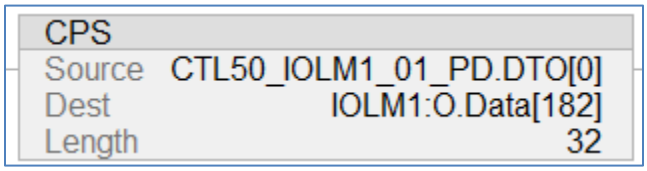


   NOTE: if you type in the incorrect number (i.e. it does not match the device’s current configuration) you will get incorrectly displayed Process Data Out information.

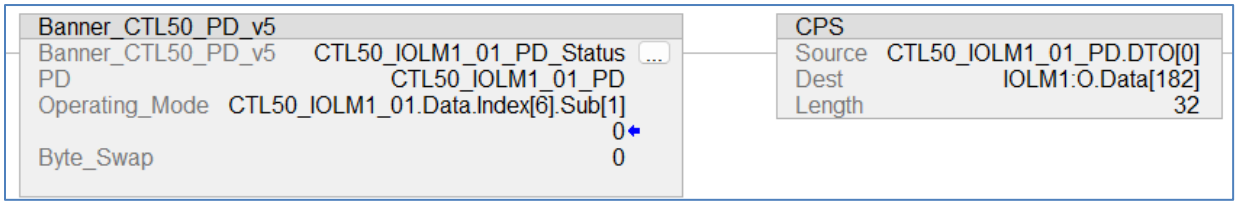
5. The last line in the AOI is a setting to account for byte swapping. In the case of the CTL50, the Process Data Out is 32 bytes long. IO-Link Masters may read each pair of bytes in either order, so this AOI must be ready to perform a byte swap. Enter a “0” or a “1” to toggle this setting. See Appendix A for more information.

6. The final two steps required before we download and run the CTL50 Process Data AOI involve a File Synchronous Copy (CPS) instruction. These instructions allow the AOI to write to the raw Process Data values found in the register tags of the IO-Link Master.

   A CPS instruction is added to the AOI rung. This CPS instruction is used to copy Process Data Out from the AOI into the raw Process Data Out registers used by the IO-Link Master. See Appendix A for more information. In this example, we will connect the AOI's "PDO_DTO[0]" to the starting byte location for port 1 in the Process Data Outside. The size to be copied is 32 bytes.

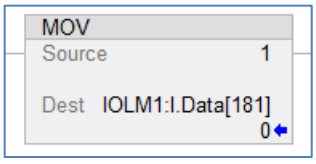


   Here is what the entire rung looks like when completed.



   If a Banner IO-Link Master is being used, set up 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.

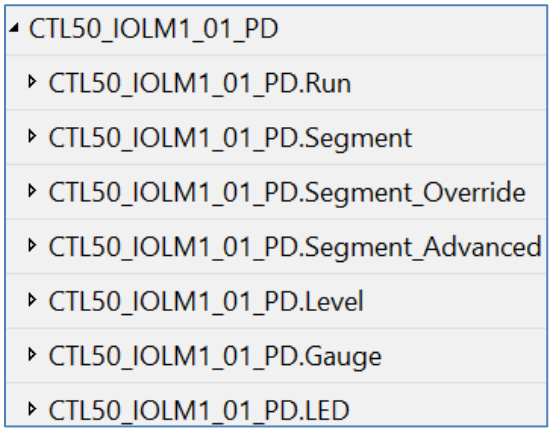
IO-Link Master Port	Activate Outputs
1	181
2	215
3	249
4	283
5	317
6	351
7	385
8	419



   The "Banner_CTL50_PD_v5" AOI is now ready for use.

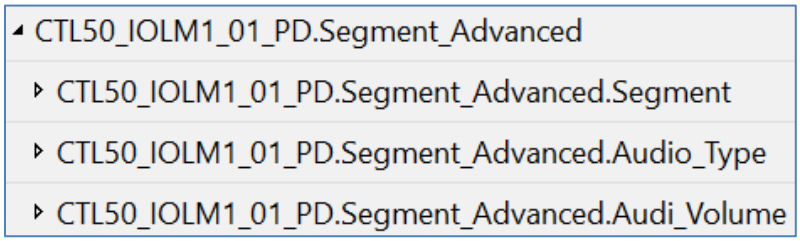
4. Using the AOI

The “Banner_CTL50_PD_v5” Add-On Instruction has created a group of tags representing the CTL50 Process Data, broken out into its component parts.



Look in the Controller Tags to find the name you used above. This example used the name “CTL50_IOLM1_01_PD”. The tag array, seen below, has individual pieces of information instead of unlabeled bits.

Each operating mode for the Process Data Out has its own tag array. If the CTL50 device is in operating mode “0” (Run mode), use the tags found under the “Run” array. If the operating mode is “3” (Advanced Segment mode, as seen below), use the corresponding tags in the “Segment Advanced” array instead.



CTL50_IOLM1_01_PD.Segment_Advanced.Segment[1]	{...}	0=Off, 1=On, 2=Flash, 3=Animation
CTL50_IOLM1_01_PD.Segment_Advanced.Segment[1].Animation	0	0=Off, 1=Steady, 2=Flash, 3=2 Color Flash, 4=2 Color Shift, 5=50/50 Rotate, 6=Chase, 7=Intensity Sw
CTL50_IOLM1_01_PD.Segment_Advanced.Segment[1].Speed	0	0=Medium, 1=Fast, 2=Slow, 3=Custom Flash Rate
CTL50_IOLM1_01_PD.Segment_Advanced.Segment[1].Pulse_Pattern	0	0=Normal, 1=Strobe, 2=3 Pulse, 3=SOS
CTL50_IOLM1_01_PD.Segment_Advanced.Segment[1].Color_1	0	0=Green, 1=Red, 2=Orange, 3=Amber, 4=Yellow, 5=Lime Green, 6=Spring Green, 7=Cyan, 8=Sky Blue,
CTL50_IOLM1_01_PD.Segment_Advanced.Segment[1].Color_1_Intensity	0	0=High, 1=Low, 2=Medium, 3=Off, 4=Custom
CTL50_IOLM1_01_PD.Segment_Advanced.Segment[1].Color_2	0	0=Green, 1=Red, 2=Orange, 3=Amber, 4=Yellow, 5=Lime Green, 6=Spring Green, 7=Cyan, 8=Sky Blue,
CTL50_IOLM1_01_PD.Segment_Advanced.Segment[1].Color_2_Intensity	0	0=High, 1=Low, 2=Medium, 3=Off, 4=Custom
CTL50_IOLM1_01_PD.Segment_Advanced.Segment[1].Direction	0	0=Up, 1=Down

Appendix A 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"

	Allen-Bradley*		Lumberg		Balluff		Turck		ifm		Banner	
Port	PDI	PDO	PDI	PDO	PDI	PDO	PDI	PDO	PDI	PDO	PDI	PDO
1	I.Ch0Data[0]	O.Ch0Data[0]	14	4	8	6	6	4	190	46	184	182
2	I.Ch1Data[0]	O.Ch1Data[0]	68	36	56	38	38	36	222	78	218	216
3	I.Ch2Data[0]	O.Ch2Data[0]	122	68	104	70	70	68	254	110	252	250
4	I.Ch3Data[0]	O.Ch3Data[0]	176	100	152	102	102	100	286	142	286	284
5	I.Ch4Data[0]	O.Ch4Data[0]	230	132	200	134	134	132	318	174	320	318
6	I.Ch5Data[0]	O.Ch5Data[0]	284	164	248	166	166	164	350	206	354	352
7	I.Ch6Data[0]	O.Ch6Data[0]	338	196	296	198	198	196	382	238	388	386
8	I.Ch7Data[0]	O.Ch7Data[0]	392	228	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)
- Lumberg 0980 XSL 3912-121-007D-00F
- 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