



SI-RF IO-Link Device Parameter Data Add-On Instruction Guide, v2

9/24/2019

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 an SI-RF. 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_SIRF_Param_v2.L5X

AOIs Packaged with the AOI

IEEE754.L5X

UDT's Packaged with the AOI

Banner_IOL_Port_v2

Banner_SIRF_Basic_Data_v2

Banner_SIRF_RD_v2

Banner_SIRF_v2

NOTE:

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

It is intended to be linked to a v2 Banner IO-Link Master AOI to function.

Usage

Add and configure the relevant v2 Banner IO-Link Master AOI in your ladder logic program first; then add and configure v2 Banner IO-Link Device Parameter Data AOIs as desired, linking them to the Master AOI.

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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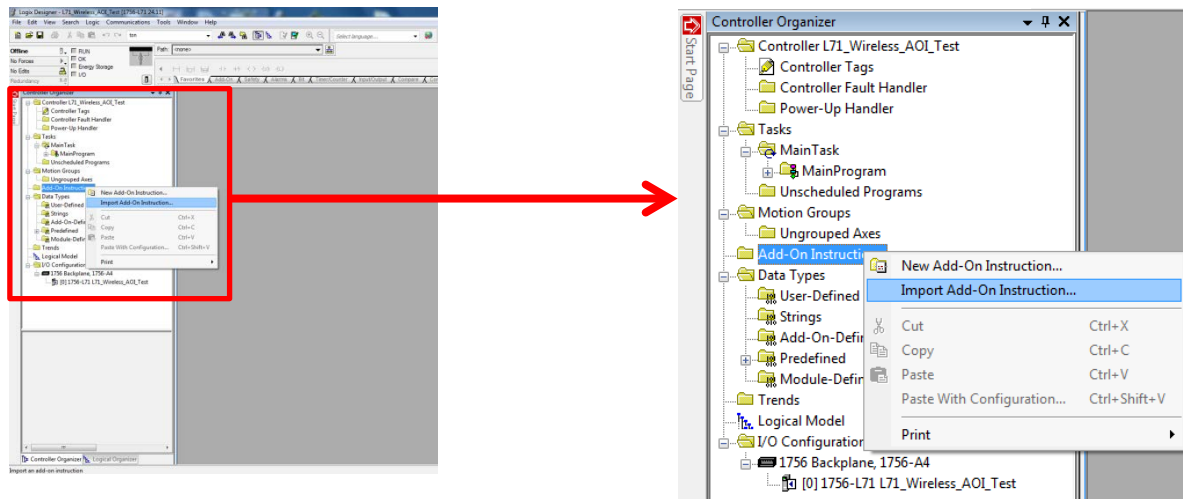
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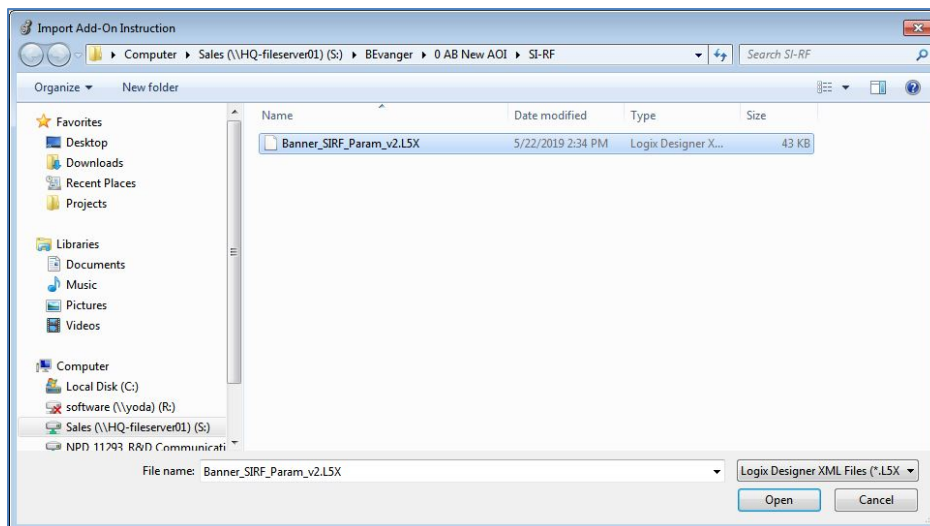
1. Installation Process

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

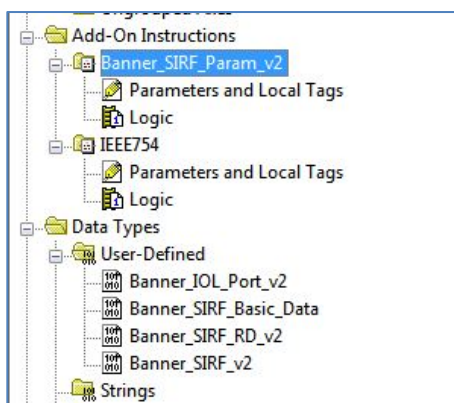
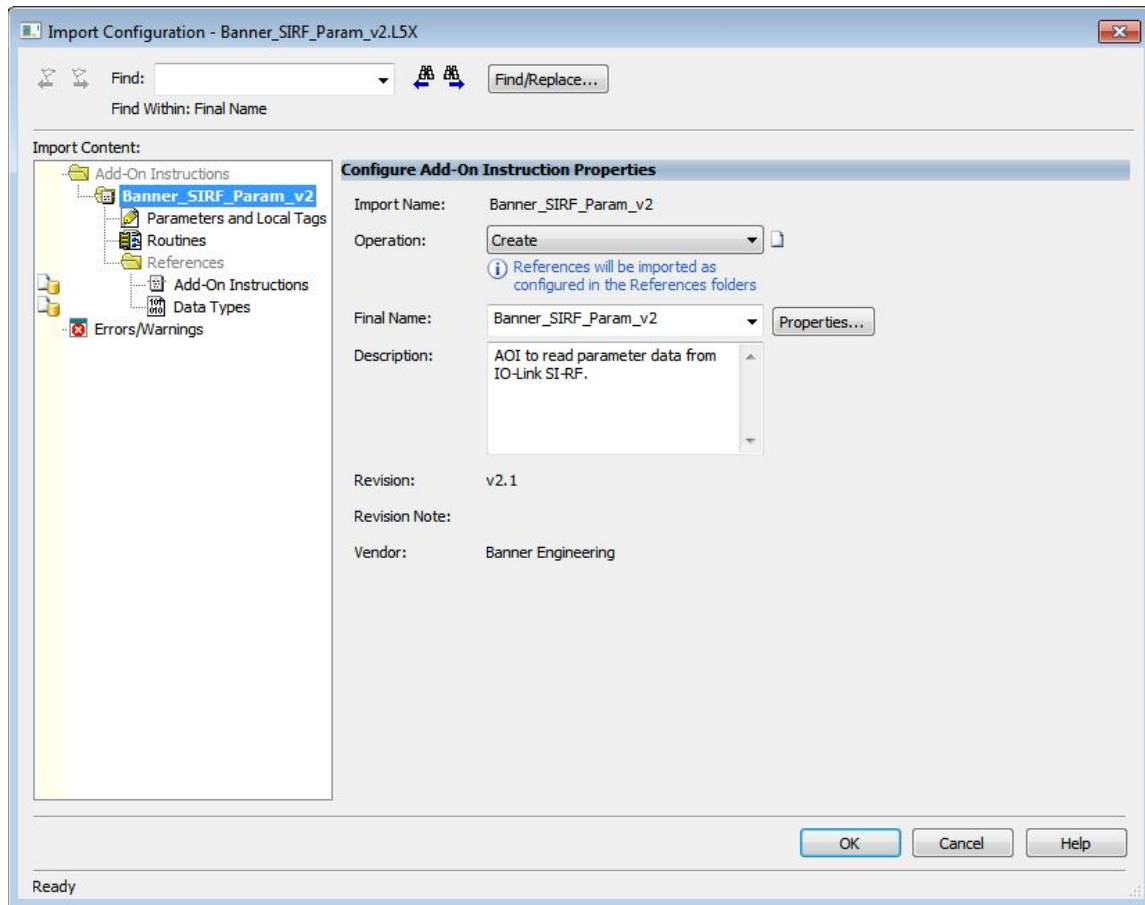
1. Open up a project.
2. In the Controller Organizer window, right-click on the Add-On Instruction folder. Select the Import Add-On Instruction option.



3. Navigate to the correct file location and select the AOI to be installed. In this example the "Banner_SIRF_Param_v2.L5X" file will be selected. Click the Open button.



4. The Import Configuration window will pop up. The default selection will create all of 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 similar to 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_SIRF_Param_v2” 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_SIRF_Param_v2”. Click New Tag. In this example, we’ll use the name “SIRF_IOLM2_8_Status”. The example naming convention accounts for this being a SI-RF device connected to IO-Link Master #2, port #8, in our program. More masters could be named IOLM1, IOLM3, and different sensors could be connected at other port numbers, etc.

New Tag

Name: SIRF_IOLM2_8_Status

Description:

Usage: <controller>

Type: Base

Alias For:

Data Type: Banner_SIRF_Param_v2

Parameter Connection:

Scope: Test

External Access: Read/Write

Style: Constant

Sequencing

Open Configuration

Open Parameter Connections

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

	{...}	{...}		Banner_SIRF_Param_v2
SIRF_IOLM2_8_Status				
SIRF_IOLM2_8_Status.EnableIn	1		Decimal	BOOL
SIRF_IOLM2_8_Status.EnableOut	0		Decimal	BOOL
SIRF_IOLM2_8_Status.Port	0		Decimal	DINT
SIRF_IOLM2_8_Status.Num_SIRF	0		Decimal	DINT

3. Now click on the question mark on the line labeled “SIRF”. Click New Tag. In this example, we’ll use the name “SIRF_IOLM2_8”. This array of tags includes the port number to which the SI-RF is connected and the Read data block, made up of the information from the SI-RF IO-Link Index and Subindex values.

New Tag

Name: SIRF_IOLM2_8

Description:

Usage: <controller>

Type: Base

Alias For:

Data Type: Banner_SIRF_v2

Parameter Connection:

Scope: Test

External Access: Read/Write

Style:

☐ Constant

☐ Sequencing

☐ Open Configuration

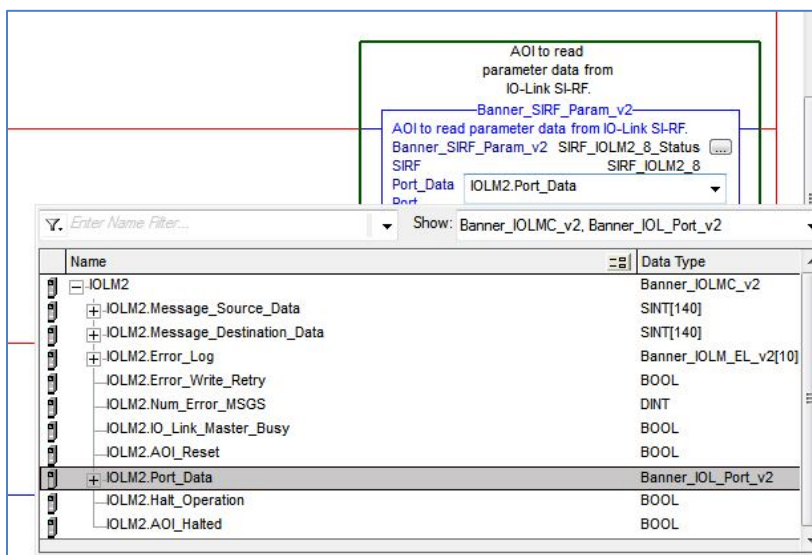
☐ Open Parameter Connections

SIRF_IOLM2_8	{...}	{...}		Banner_SIRF_v2
SIRF_IOLM2_8.Initial_Global_Read	0		Decimal	BOOL
+ SIRF_IOLM2_8.Command	0		Decimal	INT
+ SIRF_IOLM2_8.Read_Data	{...}	{...}		Banner_SIRF_RD_v2
SIRF_IOLM2_8.Reset	0		Decimal	BOOL

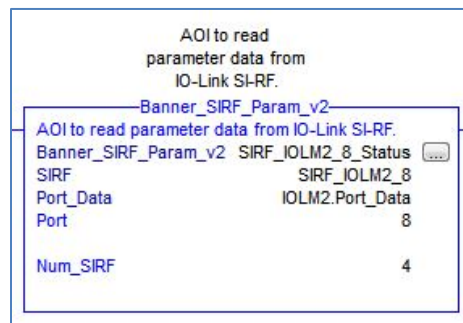
3. Linking the Device AOI to the Master AOI

The third tag in the SI-RF 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 “IOLM2.Port_Data”.

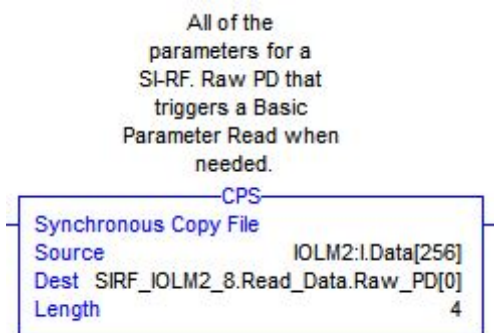


2. For the last two lines of the SI-RF AOI require two numbers. For “Port_Number”, type in a number equal to the IO-Link Master port number to which the SI-RF is connected. In this example, the device is on port 8. For “Num_SIRF”, type in the number of SI-RF devices connected in the chain (up to 32).

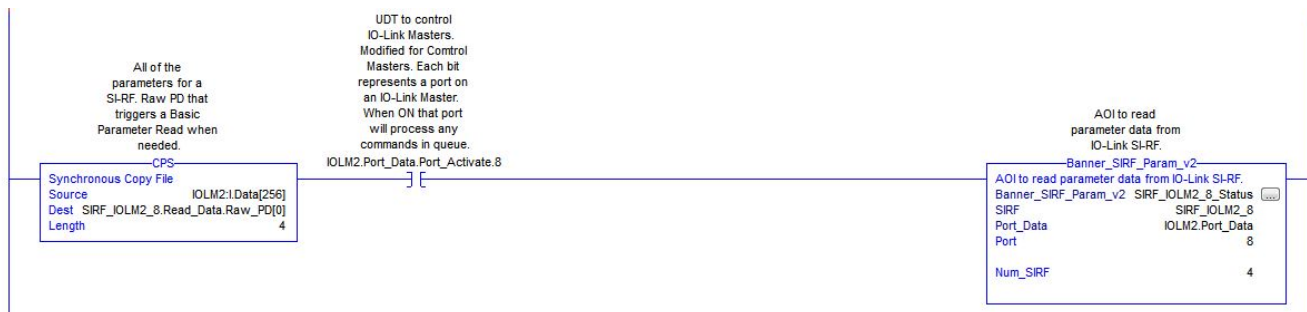


3. Add an Examine On instruction before the SI-RF AOI on the same ladder rung and tie it to the IO-Link Master AOI’s “Port_Activate” bit corresponding to the port number to which the SI-RF device is connected. In this example the SI-RF device is on port 8 of the IO-Link Master named IOLM2, so the bit “IOLM2.Port_Data.Port_Activate.8” is used.

4. The final step required before we download and run the SI-RF AOI involves a File Synchronous Copy (CPS) instruction. A CPS instruction is added to the AOI rung, before the Examine On bit from step 3 and before the AOI. This CPS instruction is used to copy Process Data In into the AOI into the raw Process Data Out registers used by the IO-Link Master. See Appendix C for more information. In this example, we will connect the starting byte location for port 8 in the Process Data In side to the AOI's "Raw_PD[0]" array. In this example, that is byte 96. The size to be copied is 4 bytes.



Here is what the entire rung looks like when completed.



5. The "Banner_SIRF_Param_v2" AOI is now ready for use.

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 the Banner SI-RF IO-Link device becomes as easy as watching 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 SI-RF device AOI. The AOI watches for any change in the Process Data In from the SI-RF. If a change is detected, the AOI automatically triggers the process of acyclic reading, using correctly-formatted CIP generic message commands. This Process Data triggered Parameter Data read is what collects the information from the SI-RF system.

There are three methods for acyclic reading of Banner SI-RF 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 toggling the "Port_Data.Device_Read" bits performs a one-time read of all values from a given Banner device AOI connected to a specific port on the IO-Link Master. To initiate this one-time read, toggle the bit (0-15) in the "Port_Data.Device_Read" variable corresponding to the port number in question. The AOI will read the device parameters from that port once, then turn the bit back to 0 automatically.
3. 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.

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. The write commands are most useful when an IO-Link device has been physically replaced with a new device of the same type—in this situation executing the “41” command will restore all the PLC saved settings to the new unit.

[-] S1RF_IOLM2_8	{...}	{...}		Banner_S1RF_v2
[-] S1RF_IOLM2_8.Initial_Global_Read	1		Decimal	BOOL
+ S1RF_IOLM2_8.Command	0		Decimal	INT
+ S1RF_IOLM2_8.Read_Data	{...}	{...}		Banner_S1RF_RD_v2
[-] S1RF_IOLM2_8.Reset	0		Decimal	BOOL

The table below shows the command numbers associated with the reading of specific pieces of data (the SI-RF does not have any writeable parameters). See the SI-RF IODD file or the SI-RF IO-Link Data Reference Guide for more information of the parameters.

Table 1: AOI Command Numbers

SI-RF Parameter (IO-Link Index #)	Read Command
Global Read (all)	1
Basic Information (64)	2
Device ID (256)	3
Supply Voltage (272)	4
Distance (288)	5
Temperature (204)	6
Vu Counter (320)	7
Q Counter (336)	8
BB Counter (352)	9
Remaining Teaches (448)	10

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.

[-] SIFR_IOLM2_8	{...}	{...}		Banner_SIFR_v2
SIFR_IOLM2_8.Initial_Global_Read	1	Decimal	BOOL	
[+] SIFR_IOLM2_8.Command	0	Decimal	INT	
SIFR_IOLM2_8.Read_Data	1	{...}		Banner_SIFR_RD_v2
SIFR_IOLM2_8.Reset	0	Decimal	BOOL	

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 C IO-Link Master Cheat Sheet

Different IO-Link Masters behave differently in a number of 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 2. First Register of Process Data "SINT0"

Port	Allen-Bradley*		Comtrol		Balluff		Turck		ifm	
	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
2	I.Ch1Data[0]	O.Ch1Data[0]	40	32	56	38	38	36	222	78
3	I.Ch2Data[0]	O.Ch2Data[0]	76	64	104	70	70	68	254	110
4	I.Ch3Data[0]	O.Ch3Data[0]	112	96	152	102	102	100	286	142
5	I.Ch4Data[0]	O.Ch4Data[0]	148	128	200	134	134	132	318	174
6	I.Ch5Data[0]	O.Ch5Data[0]	184	160	248	166	166	164	250	206
7	I.Ch6Data[0]	O.Ch6Data[0]	220	192	296	198	198	196	382	238
8	I.Ch7Data[0]	O.Ch7Data[0]	256	224	344	230	230	228	414	270

*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.

Table 3. Byte-Swap

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

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