

Q5X Process Data Function

September 2nd, 2025

This document covers the installation and use of a function for Siemens' TIA Portal software package. This function handles cyclic IO-Link Process Data In and Process Data Out from a Banner Q5X (2000, 3000, 5000, or Jam) sensor via an IO-Link Master to a Siemens PLC. The function covers parsing and display of the Q5X sensor Process Data In and Process Data Out.

Components

Banner Q5X Library v16.zal16

There are two methods for the process data. The first is used when creating a connection to Banner's IO-Link masters. The second set of instructions are for systems using other manufacturer's IO-Link masters.

Installation Instructions

1. Open a project.
2. Go to the Open Global Library option in the Libraries tab in TIA Portal v16 or greater.



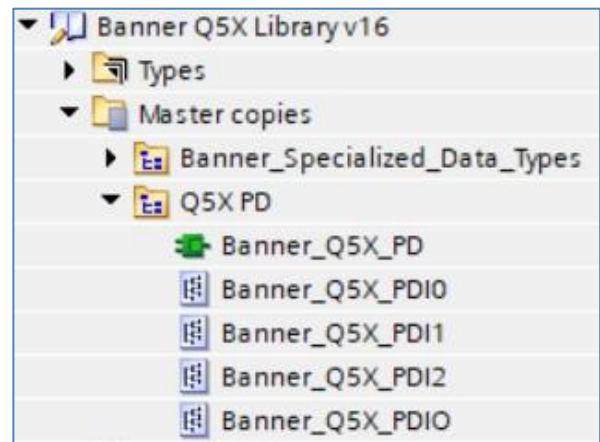
3. Switch the “Files of type” to Compressed libraries. Go to the location of the compressed library.
4. Press the Open button and the library will be uncompressed and opened.
5. The library is now accessible in the Libraries tab in v16 or greater.

Setup of Q5X with a Banner DXMR

1. Go to Device and Networks to configure the DXMR. Add the DXMR if it has yet to be added to the system.
2. Add Banner IO-Link Master Info to Slot 1. This sets the DXMR for IO-Link mode.
3. Open the IO-Link Generic Devices and select the proper module. The 4/4 byte option has been selected for port 1. Make note of the I address for the Slot 2 which represents Port 1. Slot 2 starts are 10. The other number needed is I14. The data for the port start at that point (I14). The previous four bytes represents Port Status, Process Data In Size, and Process Data Out Size.

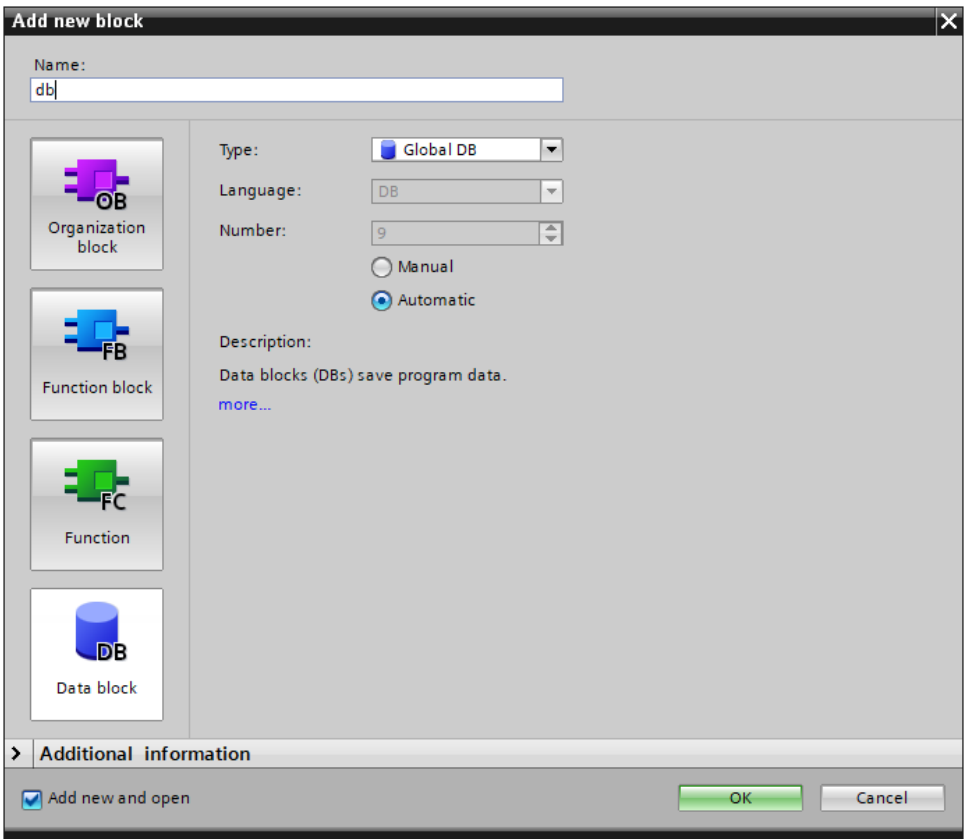
| Module | Rack | Slot | I address | Q address | Type |
|-------------------------------------|------|------|-----------|-----------|-----------------------------------|
| ▼ dxm | 0 | 0 | | | 1-port Device |
| ▶ Interface | 0 | 0 X1 | | | dxm |
| Banner IO-Link Master Info_1 | 0 | 1 | 1...9 | | Banner IO-Link Master Info |
| IO-Link In/Out 4/ 4 Byte + Status_1 | 0 | 2 | 10...17 | 1...18 | IO-Link In/Out 4/ 4 Byte + Status |

4. Drag the Banner_Q5X_PDI to the PLC Data Types area under your PLC. Banner_Q5X_PDI is found in the Q5X folder in the library. Drag the Banner_Q5X_PD to the Program Blocks area.
5. Drag the necessary tag from IOLM_Control > Banner > Banner_Specialized_Data_Types. The tag used in this example is "Banner_4in". This tag represents the full raw process data along with port status information.
6. Go to PLC Tags. Create four tags. One tag is for the full data structure while the second creates a tag to represent the raw Process Data from the IO-Link Master. In this example, Tag table_1 was created, then the tag "Q5X IOLM1 01 PDI" was created using a Data Type of "Banner_8In". This naming convention calls out the type of sensor in question as well as the specific IO-Link Master and port number where the sensor is connected. A different IO-Link Master might be named IOLM2 or IOLM3, for instance, and other specific sensors may be connected to different port numbers. The "I" address found in step 2 is tied to this new tag. The second is "Q5X IOLM1 01 inRaw". This is the tag that will be used in the Function block. That covers the inputs. Outputs are also needed. Outputs follow a similar format.



| Name | Data type | Address |
|-----------------------|---------------|---------|
| ▶ Q5X IOLM1 01 inRaw | "Banner_4In" | %I102.0 |
| ▶ Q5X IOLM1 01 outRaw | "Banner_4Out" | %Q102.0 |
| Q5X IOLM1 01 PDI | DWord | %ID106 |
| Q5X IOLM1 01 PDO | Byte | %QB104 |

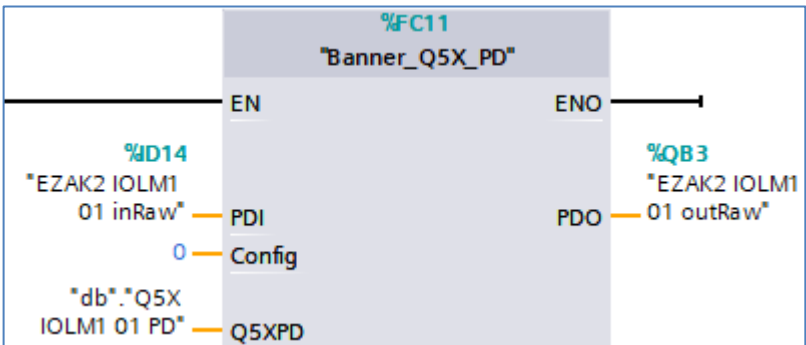
7. Go to Program blocks. Add a new Data block if necessary. In this example the new data block is named “db”.



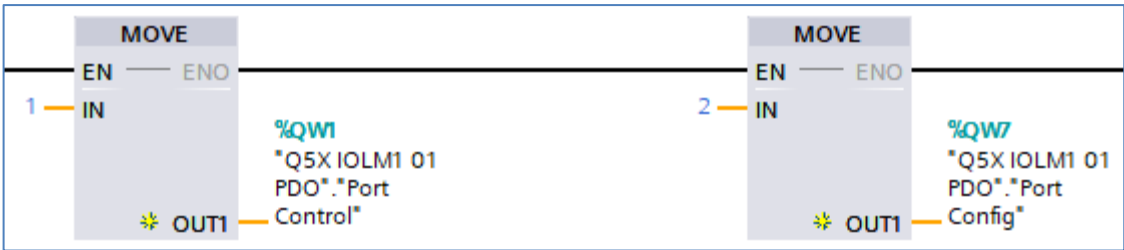
8. In the new data block, create a new tag to represent the parsed Process Data In for our Q5X. The tag name again calls out the type of sensor, the IO-Link Master, and the port number. Use the data type “Banner_Q5X_PDI” for the new tag.

| Name | Data type |
|----------------------|-------------------|
| ▼ Static | |
| ■ ▼ Q5X IOLM1 01 PD | "Banner_Q5X_PDIO" |
| ■ ▶ PDI 0 | "Banner_Q5X_PDIO" |
| ■ ▶ PDI 1 | "Banner_Q5X_PDI1" |
| ■ ▶ PDI 2 | "Banner_Q5X_PDI2" |
| ■ Transducer Disable | USInt |

9. Add the “Banner_Q5X_PD” function to an OB ladder. Link the “Process Data Word” to the raw Process Data variable from step 5. Link the “Q5X Process Data” to the parsed Process Data variable from step 7.



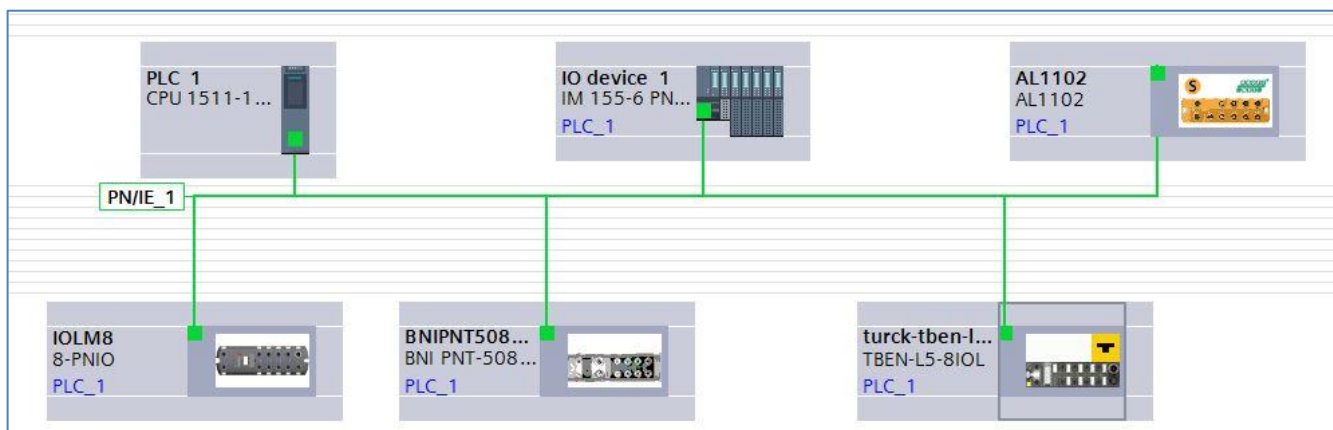
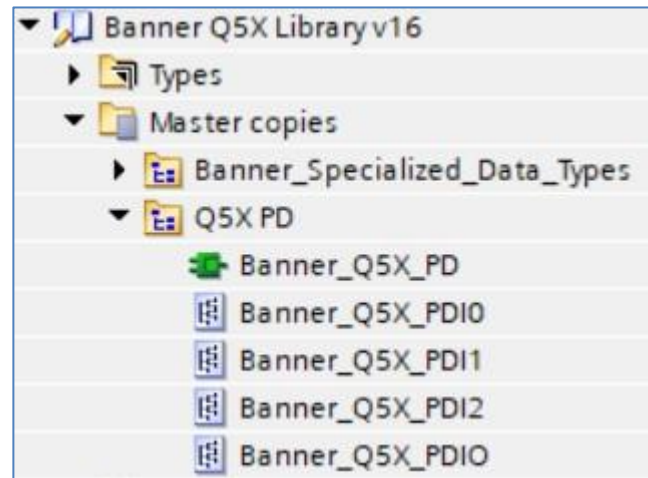
10. The final step is to configure the IO-Link output control. This is done by sending a 1 to Port Control and a 2 to Port Config. Both parameters are part of the tag created in step 6 “Q5X IOLM1 01 PDO”.



11. Process Data setup is complete.
12. Compile and download the configuration to the PLC, then go online. Open the “db” data block and click Monitor all. You should see parsed Q5X Process Data In.



Setup of Q5X with other IO-Link Masters

1. The Banner Q5X Library will now be in the Global Library List. Expand the Master copies section. Any of the Q5X folders contains the elements for both Process Data. Move the Process Data items:
Banner_Q5X_PD, Banner_Q5X_PDI0, Banner_Q5X_PDI1, Banner_Q5X_PDI2, and Banner_Q5X_PDI0.
2. Drag Banner_Q5X_PD to the Program Blocks area under your PLC.
3. Drag the other items to the PLC Data Types area under your PLC.
4. Go to Devices and networks to configure the system as necessary. Below is an example of what a configuration might look like. This example shows 5 different IO-Link Masters connected to the same PLC.

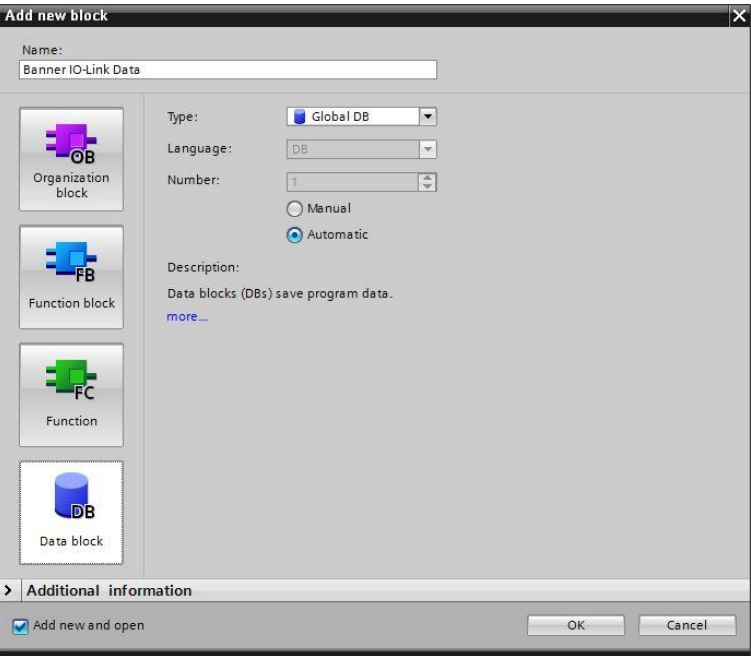


5. Click on the relevant device and configure the IO-Link Master as necessary. Refer to the documentation for the IO-Link Master. Recall that a Q5X requires 4 bytes of space for the Process Data In and 1 byte for the Process Data Out.
6. Record the "I" address where this Q5X Process Data In is to be stored, as the address will be required in the next step. In this example, 4 bytes of Process Data In for port 5 on the IO-Link Master will be stored in I66 through I69. The one byte of Process Data Out will be in Q66.



7. Go to PLC Tags. Add a new tag table, then create a new tag to represent the raw Process Data from the IO-Link Master. In this example, Tag table_1 was created, then the tag “Q5X 2000 IOLM2 05 PDI” was created using a Data Type of “DWord”. This naming convention calls out the type of sensor in question as well as the specific IO-Link Master and port number where the sensor is connected. A different IO-Link Master might be named IOLM1 or IOLM3, for instance, and other specific sensors may be connected to different port numbers. The “I” address found in step 9 is tied to this new tag. Another tag is created for the Q5X Process Data Out. This one is a Byte data type and is linked to the memory address found in step 9.

| Default tag table | | | |
|-------------------|---|-----------|---------|
| | Name | Data type | Address |
| 1 |  Q5X 2000 IOLM2 05 PDI | DWord | %ID68 |
| 2 |  Q5X 2000 IOLM2 05 PDO | Byte | %QB64 |

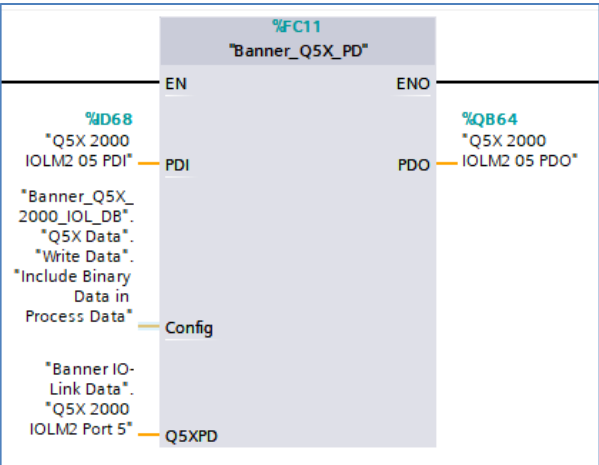
8. Go to Program blocks. Add a new Data block if necessary. In this example the new data block is named “Banner IO-Link Data”.



9. In the new data block, create a new tag to represent the parsed Process Data for our Q5X. The tag name again calls out the type of sensor, the IO-Link Master, and the port number. Use the data type “Banner_Q5X_PDIO” for the new tag.

| Banner IO-Link Data | | |
|---------------------|---|-------------------|
| | Name | Data type |
| 1 |  Static | |
| 2 |  Q5X 2000 IOLM2 Port 5 | "Banner_Q5X_PDIO" |

10. Add the “Banner_Q5X_PD” function to an OB ladder. Link the “Process Data In” and “Process Data Out” to the raw Process Data variables from step 10. Link the “Q5XPD” to the parsed Process Data variable from step 12. For “Config” link it uses the parameter data tag if using that Function Block, otherwise see Appendix A to enter a 0,1, or 2 manually.



11. Process Data setup is complete.
12. Compile and download the configuration to the PLC, then go online. Open the “Banner IO-Link Data” data block and click Monitor all. You should see parsed Q5X Process Data In, like that shown below.

| Banner IO-Link Data | | | | |
|---------------------|------------------------|--------------------|-------------|---------------|
| | Name | Data type | Start value | Monitor value |
| 1 | Static | | | |
| 2 | Q5X 2000 IOLM2 Port 5 | "Banner_Q5X_PDIO" | | |
| 3 | PDI 0 | "Banner_Q5X_PDIO" | | |
| 4 | Channel 1 Output State | Bool | false | TRUE |
| 5 | Channel 2 Output State | Bool | false | FALSE |
| 6 | Stability | Bool | false | TRUE |
| 7 | Measurement 1 Value | UInt | 0 | 3120 |
| 8 | Measurement 2 Value | UInt | 0 | 115 |
| 9 | PDI 1 | "Banner_Q5X_PDIO1" | | |
| 10 | PDI 2 | "Banner_Q5X_PDIO2" | | |
| 11 | Transducer Disable | USInt | 0 | 0 |

Appendix A

Q5X Process Data

The Q5X has 4 bytes of Process Data In and 1 byte of Process Data Out, as shown below. There are three modes for this Process Data, called Include, Don't Include, and Measurement Device. The default mode, Include, is shown first. In this mode, the Process Data In includes the binary states of channel 1, channel 2, and the stability indicator alongside the Measurement 1 and Measurement 2 values. The Process Data Out includes control of the Q5X laser transducer.

| ProcessDataIn "Process Data In" id=PD_ProcessDataIn | | | | | | | | | |
|--|------------|-----------------|--|---------------|-------------|-----------------|---------------|------------------------|----------------------------------|
| bit length: 32 data type: 32-bit Record (subindex access not supported) | | | | | | | | | |
| subindex | bit offset | data type | allowed values | default value | acc. restr. | mod. other var. | excl. from DS | name | description |
| 1 | 0 | Boolean | false = Inactive, true = Active | | | | | Channel 1 Output State | Channel 1 Output State |
| 2 | 1 | Boolean | false = Inactive, true = Active | | | | | Channel 2 Output State | Channel 2 Output State |
| 3 | 2 | Boolean | false = No target or Marginal, true = Stable | | | | | Stability | Stability state |
| 4 | 3 | 13-bit UInteger | | | | | | Measurement 1 Value | The selected measurement 1 value |
| 5 | 16 | 16-bit Integer | | | | | | Measurement 2 Value | The selected measurement 2 value |

| ProcessDataOut "Process Data Out" id=PD_ProcessDataOut | | | | | | | | | |
|--|------------|-----------|---------------------------------|---------------|-------------|-----------------|---------------|--------------------|-------------|
| bit length: 8 data type: 8-bit Record (subindex access not supported) | | | | | | | | | |
| subindex | bit offset | data type | allowed values | default value | acc. restr. | mod. other var. | excl. from DS | name | description |
| 1 | 0 | Boolean | false = Active, true = Inactive | | | | | Transducer Disable | |

This Process Data is mapped to a specific group of PROFINET addresses. The 32-bits of Process Data In encode five separate pieces of information. Bit 0 is the state of BDC1 (Binary Data Channel 1, also known simply as Output Channel 1). Bit 1 is BDC2 (Channel 2). Bit 2 is the stability indicator. The remaining 29 bits are used to communicate the Q5X measurement values, Measurement 1 and Measurement 2.

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

The Don't Include mode for the Q5X Process Data In is shown below (the Process Data Out remains unchanged from that shown above). In this mode, the binary components of the Process Data In are removed, simply leaving Measurement 1 and Measurement 2.

| ProcessDataIn "Process Data In" id=PD_ProcessDataInWithoutBinary | | | | | | | | | |
|--|------------|-----------------|----------------|---------------|-------------|-----------------|---------------|---------------------|----------------------------------|
| bit length: 32 data type: 32-bit Record (subindex access not supported) | | | | | | | | | |
| subindex | bit offset | data type | allowed values | default value | acc. restr. | mod. other var. | excl. from DS | name | description |
| 1 | 0 | 16-bit UInteger | | | | | | Measurement 1 Value | The selected measurement 1 value |
| 2 | 16 | 16-bit Integer | | | | | | Measurement 2 Value | The selected measurement 2 value |

The Measurement Device mode for the Q5X Process Data In is shown below. This mode is like the Include mode. It has an added parameter called Measurement Scale. This tells how the Measurement Value is scaled.

| ProcessDataIn "Process Data In" id=PD_ProcessDataInMeasurement | | | | | | | | | |
|--|------------|----------------|--|---------------|-------------|-----------------|---------------|------------------------|------------------------------|
| bit length: 32 | | | | | | | | | |
| data type: 32-bit Record (subindex access not supported) | | | | | | | | | |
| subindex | bit offset | data type | allowed values | default value | acc. restr. | mod. other var. | excl. from DS | name | description |
| 1 | 16 | 16-bit Integer | | | | | | Measurement Value | The measurement device value |
| 2 | 8 | 8-bit Integer | | | | | | Measurement Scale | The measurement device scale |
| 3 | 2 | Boolean | false = No target or Marginal, true = Stable | | | | | Stability | Stability state |
| 4 | 1 | Boolean | false = Inactive, true = Active | | | | | Channel 2 Output State | Channel 2 Output State |
| 5 | 0 | Boolean | false = Inactive, true = Active | | | | | Channel 1 Output State | Channel 1 Output State |