

Q76 Process Data Function

11/28/2022

This document covers the installation and use of a function for Siemens's TIA Portal software package. This function handles cyclic IO-Link Process Data In and Process Data Out from a Banner Q76 sensor via an IO-Link Master to a Siemens PLC. The function covers parsing and display of the Q76 sensor Process Data In and Process Data Out.

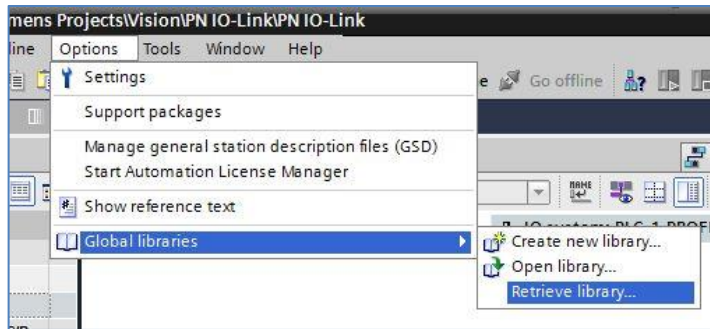
Components

Banner Q76 Library.zal14

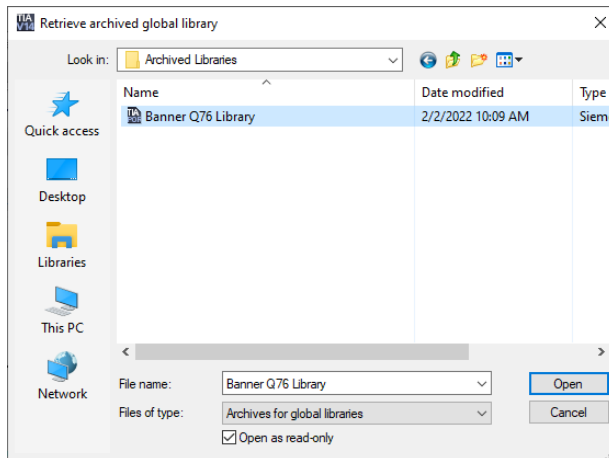
There are two methods for the process data. The first is used when creating a connection to Banner's IO-Link masters. The second set of instructions are for systems using other manufacturer's IO-Link masters.

Installation Instructions

1. Open a project.
2. Go to Options > Global Libraries > Retrieve Library.



3. Select the Banner Q76 Library. Click Open.



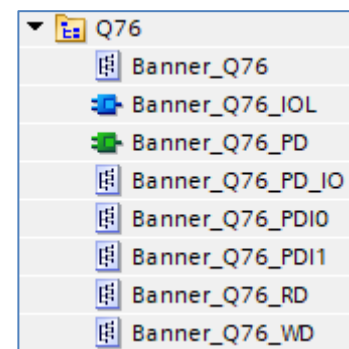
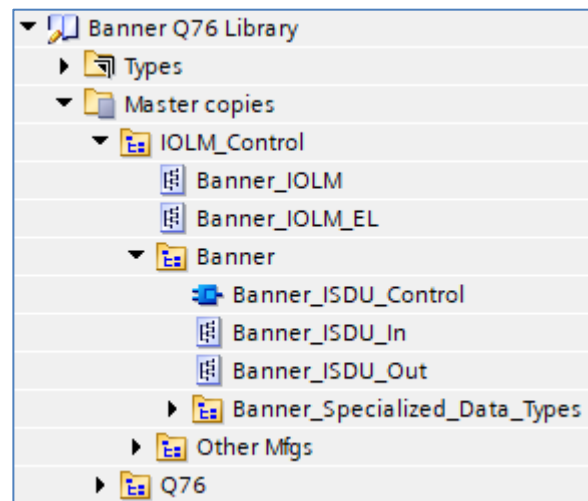
4. The library is now accessible in the Libraries tab.
5. Go to page 3 for Banner IO-Link Masters and to page 7 for all other IO-Link Masters.

Setup of Q76 with a Banner DXMR90-4K

1. Go to Device and Networks to configure the DXMR90-4K. Add the DXMR90-4K if it has yet to be added to the system.
2. Add Banner IO-Link Master Info to Slot 1. This sets the DXMR90-4K for IO-Link mode.
3. Open the IO-Link Generic Devices and select the proper module. The 1/1 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.

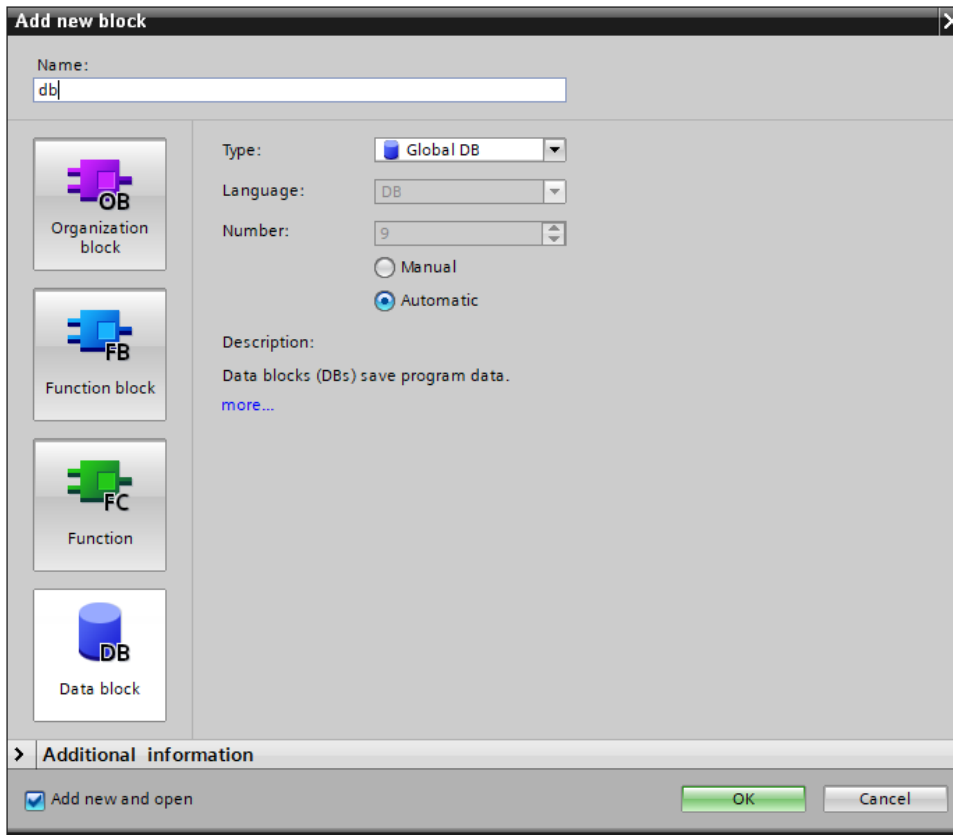
Module	Rack	Slot	I address	Q address	Type
▼ dxm	0	0			1-port Device
▶ Interface	0	0 X1			dxm
Banner IO-Link Master Info_1	0	1	1...9		Banner IO-Link Master Info
IO-Link In/Out 1/ 1 Byte + Status_1	0	2	10...14	1...15	IO-Link In/Out 1/ 1 Byte + Status

4. Drag the Banner_Q76_PD_IO, Banner_Q76_PDI0, and Banner_Q76_PDI1 to the PLC Data Types area under your PLC. Banner_Q20_PDI is found in the Q76 folder in the library. Drag the Banner_Q76_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_1in". 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 "Q76 IOLM1 01 PDI" was created using a Data Type of "Banner_1in". 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 "Q76 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
▶ Q76 IOLM1 01 PDI	"Banner_1In"	%I10.0
Q76 IOLM1 01 inRaw	USInt	%IB14
▶ Q76 IOLM1 01 PDO	"Banner_1Out"	%Q1.0
Q76 IOLM1 01 outRaw	USInt	%QB3

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 Q76. The tag name again calls out the type of sensor, the IO-Link Master, and the port number. Use the data type "Banner_Q76_PDI" for the new tag.

Name	Data type
▼ Static	
■ ▼ Q76 IOLM1 01 PD	"Banner_Q76_PD_IO"
■ ▶ PDI0	"Banner_Q76_PDI0"
■ ▶ PDI1	"Banner_Q76_PDI1"

9. Add the “Banner_Q76_PD” function to an OB ladder. Link the “Process Data In” and the “Process Data Out” to the raw process data variable from step 5. The tag name again calls out the type of device, IO-Link Master, and the port number. The “Q76PD” needs to be linked to the variable created in step 7. It was called “db.”LE IOLM1 01 PD” for this example.

The last variable, “DataSet”, allow the function to correctly interpret the Process Data.

There are two ways to achieve this goal. We can simply type in the correct number for entries (see Fig. 1), or we can link this Q76 Function to the Q76 Data Function Block Data (see Fig. 2). See Appendix A for more information about LM Process Data.

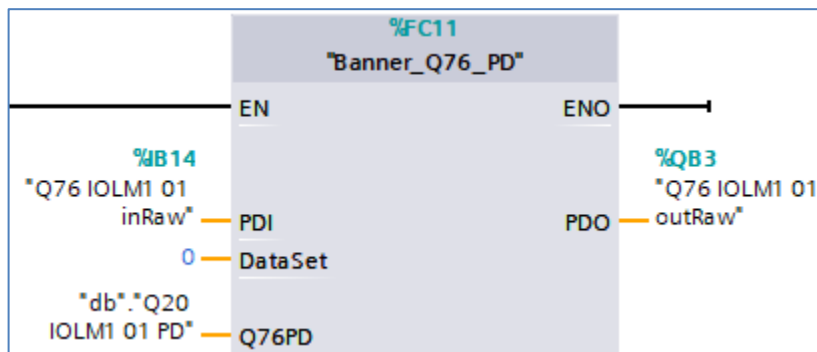


Figure 1: Hand typed correct numbers for Include Binary and Process Measurement 1

NOTE: if you type in the incorrect number, you will get incorrectly displayed Process Data information.

DataSet: the options here are “0” (Switching Signal and Status) and “1” (Analog ADC value and Switching Signal). The default is “0”.

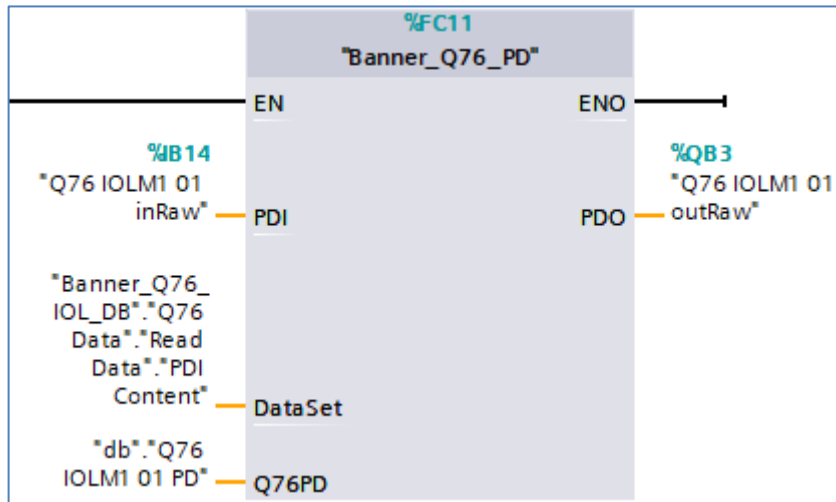
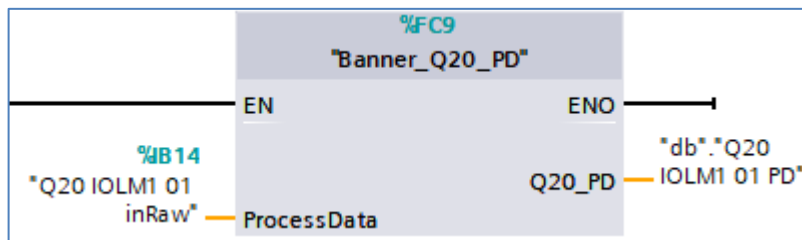


Figure 2: Linking DataSet variable to Q76 Parameter Data Function Block

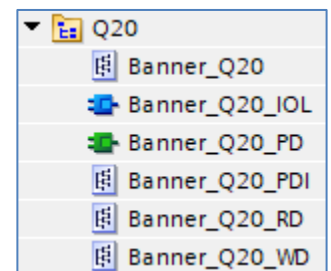
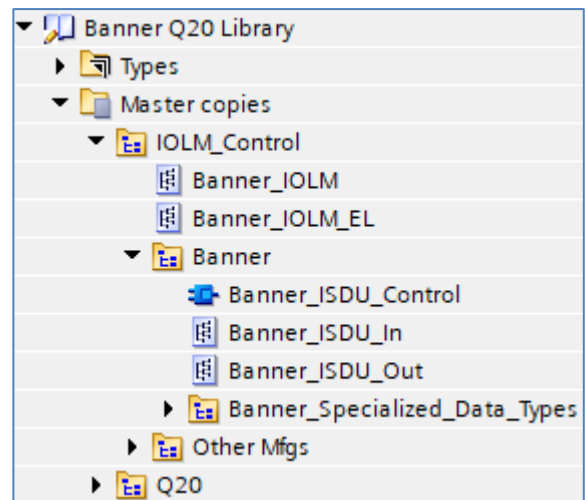
10. The "Banner_Q76_PD" function to an OB ladder. Link the "Process Data Word" to the raw Process Data variable from step 4. Link the "Q76 Process Data" to the parsed Process Data variable from step 6.

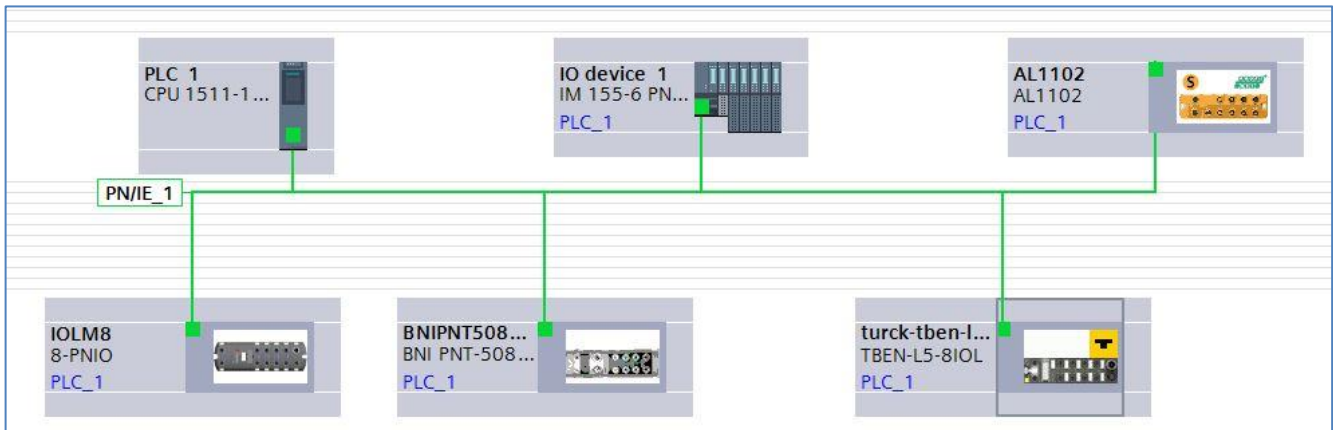


11. Process Data setup is complete.
 12. Compile and download the configuration to the PLC, then go online. Open the "db" data block and click Monitor all. You should see parsed Q76 Process Data In, like that shown below.

Setup of Q76 with other IO-Link Masters

1. The Banner Q76 Library will now be in the Global Library List. Expand the Master copies section. The Q76 folder contains elements for both Process Data and Parameter Data connections to a Q76 sensor. As Process Data is the focus of this paper, we will concern ourselves with these items: Banner_Q76_PD, Banner_Q76_PD_IO, Banner_Q76_PDI0, and Banner_Q76_PDI1.
2. Drag Banner_Q76_PD to the Program Blocks area under your PLC.
3. Drag Banner_Q76_PD_IO, Banner_Q5X76_PDI0, and Banner_Q76_PDI1 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.

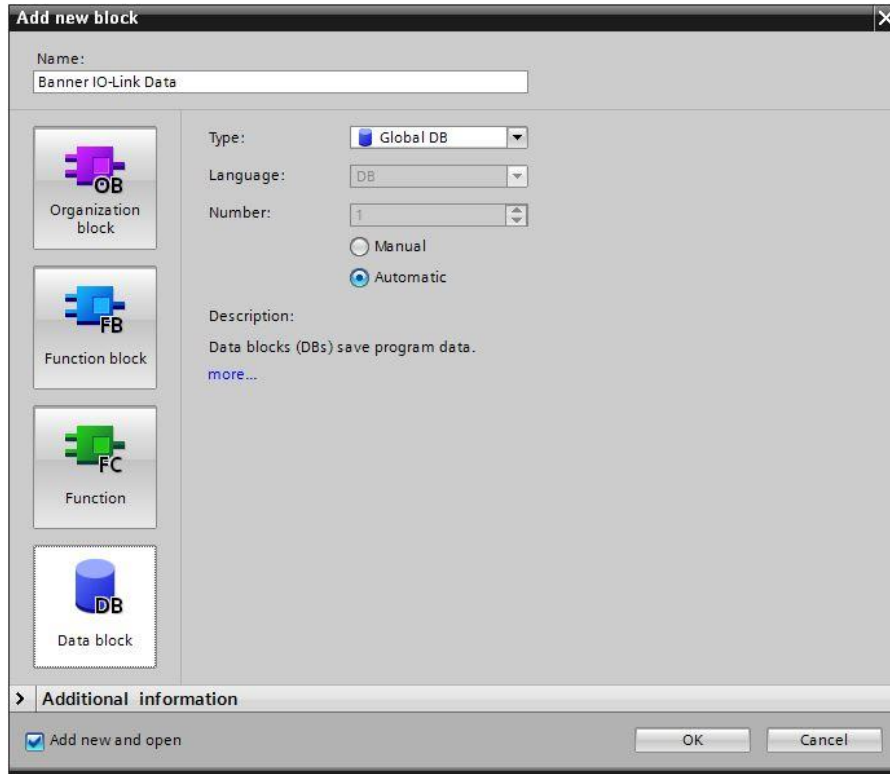




5. Click on the relevant device and configure the IO-Link Master as necessary. Refer to the documentation for the IO-Link Master. Recall that a Q76 requires 1 byte of space for the Process Data In and 1 byte for the Process Data Out.
6. Record the "I" address where this Q76 Process Data In is to be stored, as the address will be required in the next step. In this example, 1 byte of Process Data In for port 3 on the IO-Link Master will be stored in I68. The one byte of Process Data Out will be in Q64.
7. Go to PLC Tags. Add a new tag table, if desired, then create a new tag to represent the raw Process Data from the IO-Link Master. In this example the tag "Q76 IOLM2 03 PDI" was created using a Data Type of "Byte". 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 Q76 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		Q76 IOLM2 03 PDI	Byte	%IB68
2		Q76 IOLM2 03 PDO	Byte	%QB64

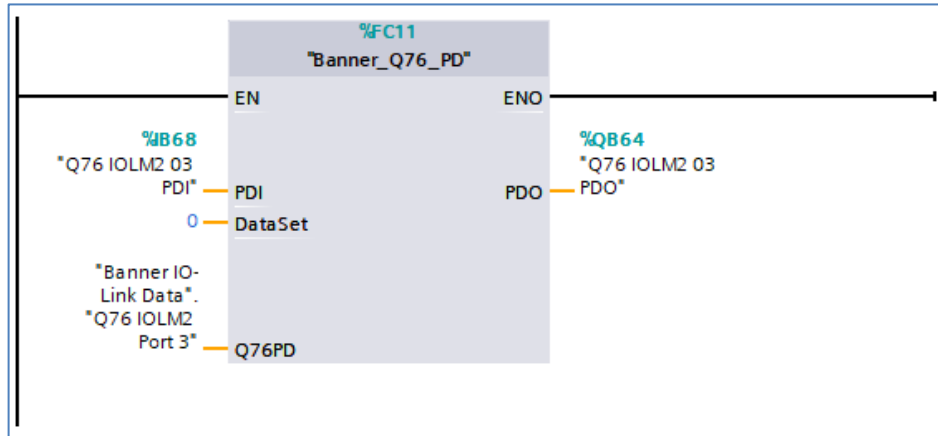
8. Go to Program blocks. Add a new Data block if necessary. In this example the new data block is named "Banner IO-Link Data".



9. In the new data block, create a new tag to represent the parsed Process Data for our Q76. The tag name again calls out the type of sensor, the IO-Link Master, and the port number. Use the data type "Banner_Q76_PD_IO" for the new tag.

Banner IO-Link Data		
	Name	Data type
1	Static	
2	Q76 IOLM2 Port 3	"Banner_Q76_PD_IO"

10. Add the "Banner_Q76_PD" function to an OB ladder. Link the "PDI" and "PDO" to the raw Process Data variables from step 10. Link "Q76PD" to the parsed Process Data variable from step 12. For the "DataSet" decision, see Appendix A.



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 Q76 Process Data In, like that shown below.

Banner IO-Link Data				
	Name	Data type	Start value	Monitor value
1	Static			
2	Q76 IOLM2 Port 3	"Banner_Q76_PD_IO"		
3	PDI0	"Banner_Q76_PDI0"		
4	Q	Bool	false	TRUE
5	Warning	Bool	false	FALSE
6	Status	Bool	false	TRUE
7	PDI1	"Banner_Q76_PDI1"		
8	PDO	USInt	0	0

Appendix A

Q76 Process Data

The Q76 has 1 byte of Process Data In and 1 bit of Process Data Out, as shown below. There are two modes for this Process Data, called Switching Signal and Status and Analog ADC Value and Switching Signal. The default mode, Switching Signal and Status, is shown first. In this mode, the Process Data In includes three bits: a 1-bit sensor output status, 1 1-bit sensor warning, and a 1-bit sensor active status. The Process Data Out includes control of the Q76 emitter.

Figure 3: PDI Mode 0, " Switching Signal and Status "

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.								

Figure 4: PDO, same for both modes

This Process Data is mapped to a specific group of PROFINET addresses. The 8-bits of Process Data In encode three separate pieces of information.

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

The "Analog ADC Value and Switching Signal" mode for the Q76 Process Data In is shown below (the Process Data Out remains unchanged from that shown above). In this mode, there are two pieces of information: a 1-bit sensor output status and a 7-bit ADC received signal value.

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	0	
element bit	6	5	4	3	2	1	0		

Figure 5: PDI Mode 1, "Analog ADC Value and Switching Signal "