Q5X 5000 Parameter Data Function Block

2/8/2022

This document covers the installation and use of a function block for Siemen's TIA Portal software package. This function block handles acyclic IO-Link commands to and from a Banner Q5X 5000 and allows the user to easily change Q5X 5000 Parameter Data.

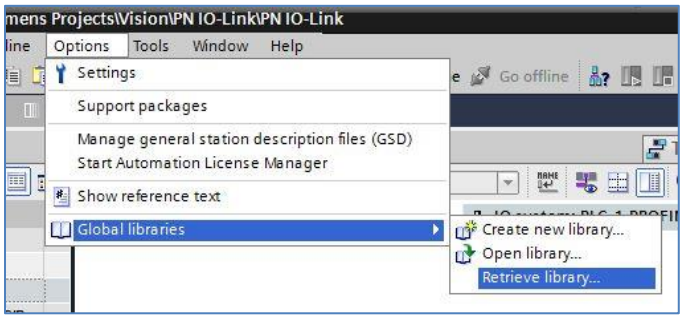
Each Banner IO-Link Device Parameter Data function block is meant to be used alongside a Banner IO-Link Device Master Control function block. This paper describes how to set up both of these blocks.

Components

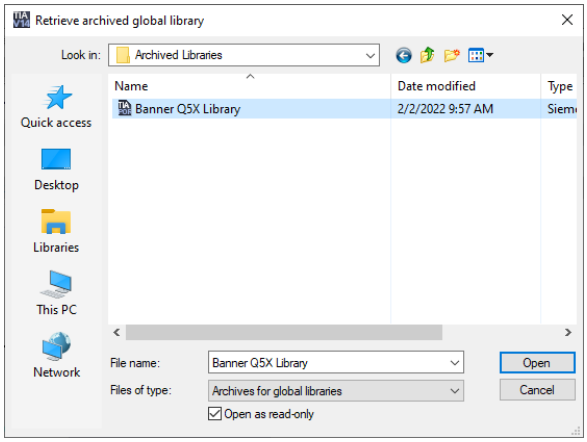
Banner Q5X Library.zal14
also requires Siemens IO_LINK_DEVICE function block

Installation Instructions

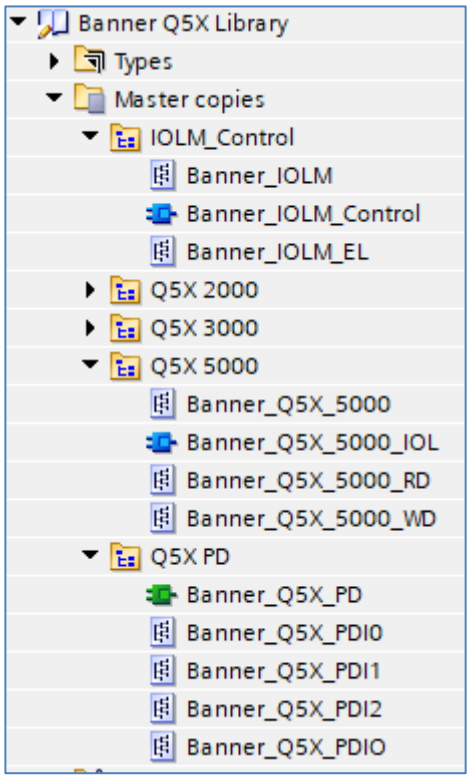
1. Open a project.
2. Go to Options > Global Libraries > Retrieve Library.



3. Select the Banner Q5X Library. Click Open.



4. The Banner Q5X Library will now be in the Global Library List. Expand the Master copies section. The Q5X 5000 folder contains elements for both Process Data and Parameter Data connections to a Q5X 5000 sensor. As Parameter Data is the focus of this paper, we will concern ourselves with these four items: Banner_Q5X_5000, Banner_Q5X_5000_IOL, Banner_Q5X_5000_RD, and Banner_Q5X_5000_WD.



5. Drag Banner_Q5X_5000_IOL to the Program Blocks area under your PLC.

6. Drag the Banner_Q5X_5000, Banner_Q5X_5000_RD, and Banner_Q5X_5000_WD to the PLC Data Types area under your PLC.

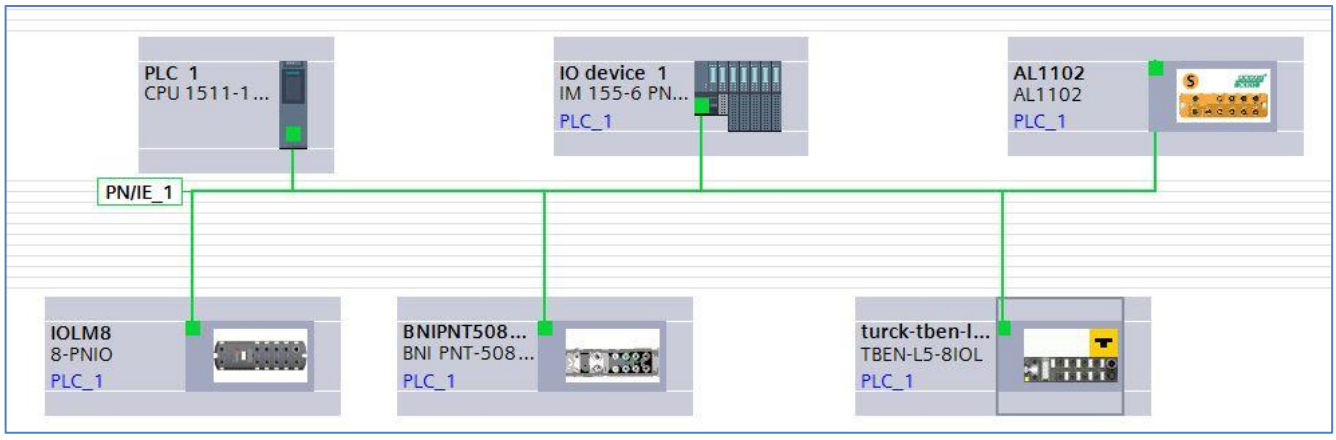
7. We also must prepare for setting up the IO-Link Master. Go to the IOLM_Control section of the Banner IO-Link Library List.

8. Drag Banner_IOLM and Banner_IOLM_EL to the PLC Data Types area under your PLC.

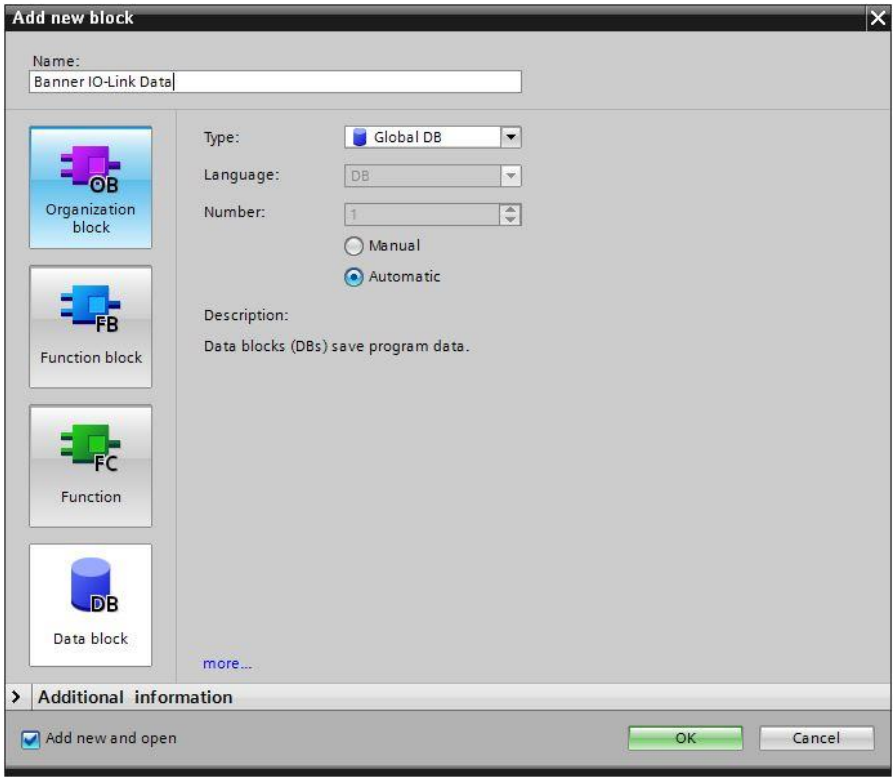
9. Drag the Banner_IOLM_Control to the Program Blocks area under your PLC.

10. Finally, we must bring the Siemens-made IO_LINK_DEVICE function block specific to your PLC into our project. This can be found in a Siemens IO-Link Library. See their website for more details. Once that library is retrieved and opened, drag IO_LINK_DEVICE to the Program Blocks area under your PLC.

11. 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.



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



13. In the new data block, create a new tag to represent the IO-Link Master, using the data type “Banner_IOLM”. This example uses the tag name “IOLM2”. A different IO-Link Master might be called IOLM1 or IOLM3, for instance.

14. Expand the IOLM2 tag, then expand the Port Controlled section. The Port Controlled tag array determines which of the ports has a function block-controlled Banner IO-Link device plugged into it. Each Port Controlled array tag with ***true*** as the start value is considered to have such a device connected. Correctly setting this array allows the Device and IO-Link Master function blocks to control the device on that port. Errors will occur if a port without an IO-Link device is set to true.

Banner IO-Link Data

	Name	Data type	Start value
1	Static		
2	IOLM2	"Banner_IOLM"	
3	Port Controlled	Array[1..8] of Bool	
4	Port Controlled[1]	Bool	false
5	Port Controlled[2]	Bool	false
6	Port Controlled[3]	Bool	false
7	Port Controlled[4]	Bool	false
8	Port Controlled[5]	Bool	false
9	Port Controlled[6]	Bool	false
10	Port Controlled[7]	Bool	true
11	Port Controlled[8]	Bool	false
12	Port Activate	Array[1..8] of Bool	
13	Port Read Request	Array[1..8] of Bool	
14	Port Write Request	Array[1..8] of Bool	
15	Port RW Complete	Array[1..8] of Bool	
16	Port Device Read	Array[1..8] of Bool	
17	Transfer Data	Array[0..231] of Byte	
18	Wr_Length	UInt	0
19	Rd_Length	UInt	0
20	IO-Index	Int	0
21	Reset	Bool	false

15. Next add the “Banner_IOLM_Control” function block to an OB ladder. You will be prompted to make a new data block. You now have to define three input variables for this function block: CAP, ID Control state, and IOLM.

    Defining an input variable for the fourth input, Communications Error, is optional.

    The Client Access Point (CAP) varies, depending on the specific IO-Link Master used.

IO-Link Master	CAP
Balluff (BNI PNT-508-105-Z015)	255
Comtrol (IOLMPN8P)	255
ifm (AL1102)	46080
Siemens (CM 4xIO-Link)	227
Turck (TBEN-L5-8IOL)	251

    The ID Control state variable should be “true” if using an IO-Link Master from ifm; otherwise it should be set to “false”.

    Link the “IOLM” input variable to the tag created in step 13.

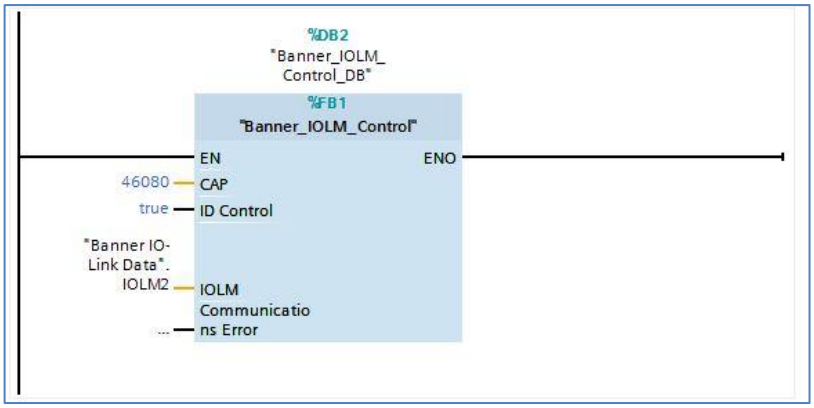


Figure 1: An example using an ifm IO-Link Master

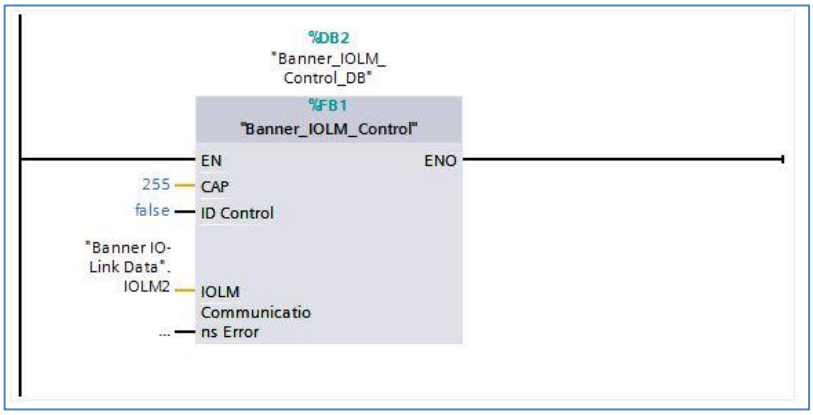


Figure 2: An example using a Balluff IO-Link Master

16. The ID Control true/false state is linked to an array called “ID_Array”, found in “Banner_IOLM_Control_DB”. This array contains the Hardware ID property of the PROFINET configuration.

    See Appendix A for more information on how to find the correct value for your specific IO-Link Master.

    In the case of an IO-Link Master from ifm, each port has a different Hardware ID and each number must be entered into the correct place. The example shown in Figure 3 is of an IO-Link device connected to port 6 of an ifm IO-Link Master. The ifm IO-Link Master’s port 6 Hardware ID is entered into the “ID_Array[6]” slot. This full array of different Hardware IDs, based on port used, is used when the “ID Control” variable is set to true (i.e. only when the IO-Link Master is from ifm).

    IO-Link Masters from other vendors use a single Hardware ID value for all ports. In this case, the Hardware ID is entered into the “ID_Array[1]” slot of the array, regardless of the port to which the device is connected. This array is ignored (but the [1] slot is still important) when the “ID Control” variable is set to false.

ID_Array	Array[1..8] of HW_IO	
ID_Array[1]	HW_IO	0
ID_Array[2]	HW_IO	0
ID_Array[3]	HW_IO	0
ID_Array[4]	HW_IO	0
ID_Array[5]	HW_IO	0
ID_Array[6]	HW_IO	279
ID_Array[7]	HW_IO	0
ID_Array[8]	HW_IO	0

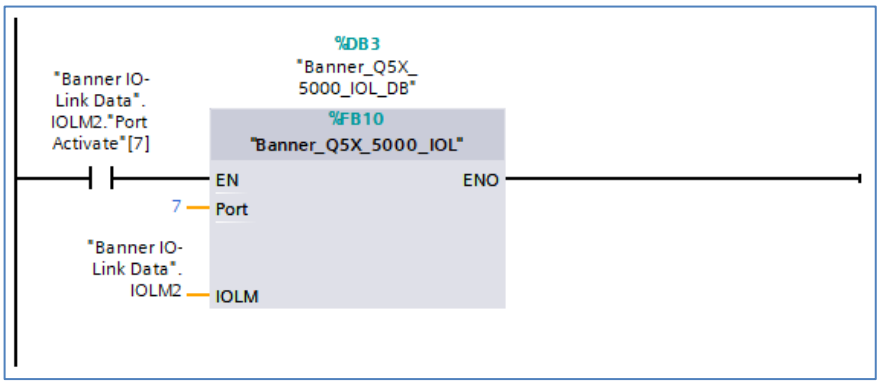
Figure 3: The ID_Array when using an ifm IO-Link Master; device attached to port 6

ID_Array	Array[1..8] of HW_IO	
ID_Array[1]	HW_IO	309
ID_Array[2]	HW_IO	0
ID_Array[3]	HW_IO	0
ID_Array[4]	HW_IO	0
ID_Array[5]	HW_IO	0
ID_Array[6]	HW_IO	0
ID_Array[7]	HW_IO	0
ID_Array[8]	HW_IO	0

Figure 4: The ID_Array when using a Balluff IO-Link Master; device attached to any port (only ID_Array[1] is used)

17. Now add the “Banner_Q5X_5000_IOL” function block to an OB ladder. You will be prompted to make a new data block. Type in the port number for the device, then link the “IOLM” variable to the IO-Link master variable created in step 13.

    As a final step, the Port Activate bit is added on the same rung as the Q5X 5000 function block to ensure orderly behavior. The IO-Link Master function block will cycle through all ports, giving each connected device function block a time to shine.



18. The Q5X 5000 Parameter Data function block is now set up. Compile the project and download it to the PLC. Go online, then open the Q5X 5000 data block. When the function block starts out, it does an initial global read of all Q5X 5000 information. The Read Data section of the data block shows this information.

Banner_Q5X_5000_IOL_DB

	Name	Data type	Start value	Monitor value
7	Q5X 5000 Data	"Banner_Q5X_5000"		
8	Initial Global Read	Bool	false	TRUE
9	Command	Int	0	0
10	Read Data	"Banner_Q5X_5000_RD"		
11	Master Cycle Time	USInt	0	40
12	Min Cycle Time	USInt	0	36
13	M-Sequence Capability	USInt	0	9
14	IO-Link Version ID	USInt	0	17
15	Process Data Input Length	USInt	0	195
16	Process Data Output Length	USInt	0	8
17	Vendor ID Combined	UDInt	0	451
18	Vendor ID 1	USInt	0	1
19	Vendor ID 2	USInt	0	195
20	Device ID Combined	UDInt	0	589826
21	Device ID 1	USInt	0	9
22	Device ID 2	USInt	0	0
23	Device ID 3	USInt	0	2
24	Serial Number	String	''	'FSSSSSSSSPPPPPDD'
25	Teach State	USInt	0	0
26	SP1 TP1	USInt	0	0
27	SP2 TP2	USInt	0	0

19. The Write Data section of the data block shows all the writeable parameter data for the Q5X 5000. Simply change a value here and it will be automatically written to the sensor via a one-time acyclic write through the IO-Link Master.

    It is almost like the Q5X 5000 is a PROFINET-speaking device!

Banner_Q5X_5000_IOL_DB

	Name	Data type	Start value	Monitor value
7	Q5X 5000 Data	"Banner_Q5X_5000"		
8	Initial Global Read	Bool	false	TRUE
9	Command	Int	0	0
10	Read Data	"Banner_Q5X_5000_RD"		
11	Write Data	"Banner_Q5X_5000_WD"		
12	System Command	USInt	0	0
13	Parameter Access Lock	Bool	false	FALSE
14	Data Storage Lock	Bool	false	FALSE
15	Local Parameterization Lock	Bool	false	FALSE
16	Local User Interface Lock	Bool	false	FALSE
17	Function Tag	String	''	'More Sensors. More Solutions.'
18	Location Tag	String	''	'More Sensors. More Solutions.'
19	Teach Channel	USInt	0	0
20	BDC1 Setpoint SP1	UDInt	0	4400
21	BDC1 Setpoint SP2	UDInt	0	0
22	BDC1 Switchpoint	USInt	0	0
23	BDC1 BDC Mode	USInt	0	128
24	BDC1 Hysteresis	UInt	0	0
25	BDC2 Setpoint SP1	UDInt	0	1500
26	BDC2 Setpoint SP2	UDInt	0	0
27	BDC2 Switchpoint	USInt	0	0

Appendix A IO-Link Master Hardware ID Numbers

The Hardware ID number used in “ID_Array” in the “Banner_IOLM_Control_DB” function block is not trivial to find. Each manufacturer uses the Hardware Identifier of a slightly different subcomponent as the value required for our purposes. Furthermore, the particular Hardware Identifier numbers will change based on the number of devices in your configuration. These pictures show which subcomponent’s Hardware ID is relevant to the function block.

In each case, click on the hardware device from the “Devices & Networks” view. Click on “Properties”, then click on “System Constants” to see the screen shots below.

Balluff

Use the Hardware Identifier from the “BNI_PNT-508-105-Z015_1” Hw_SubModule. Type this number into the [1] slot of the ID_Array found in the “Banner_IOLM_Control_DB” data block.

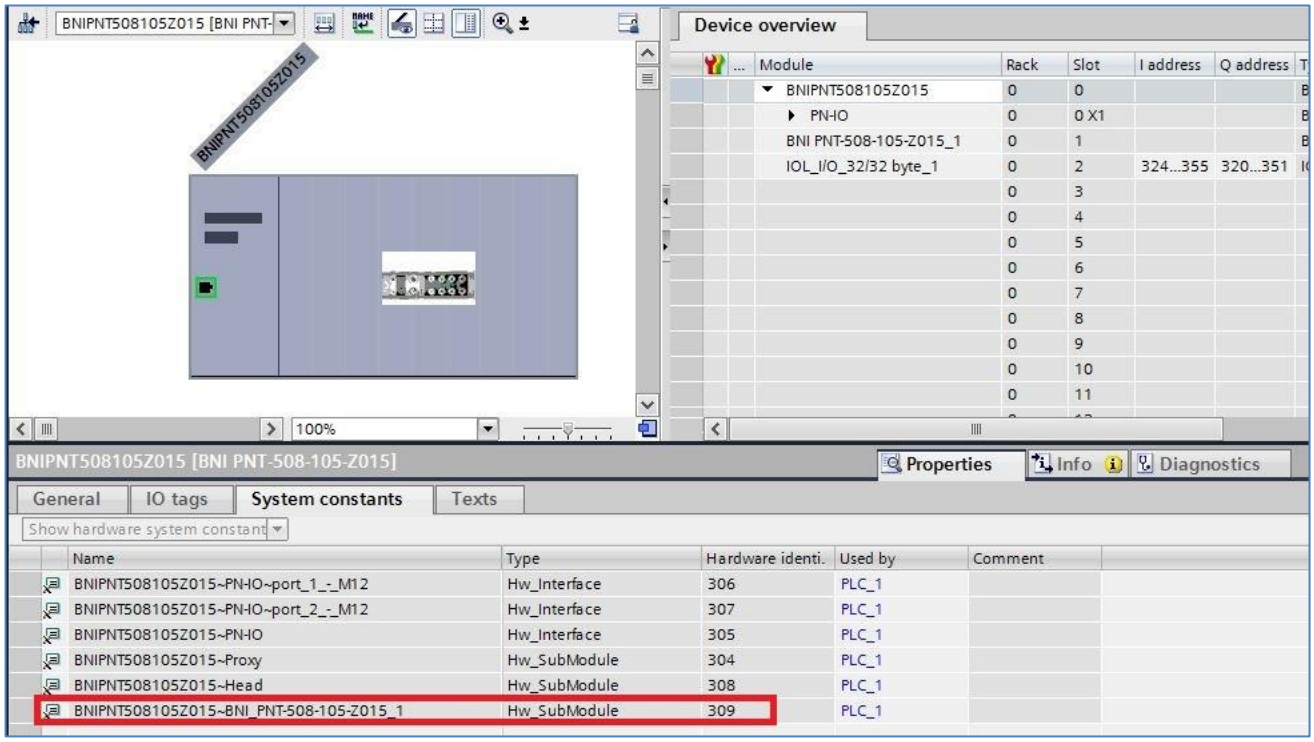


Figure 5: Balluff BNI005H. Type this value into the “ID_Array[1]” location.

Comtrol

Use the Hardware Identifier from the “Head” Hw_SubModule. Type this number into the [1] slot of the ID_Array found in the “Banner_IOLM_Control_DB” data block.

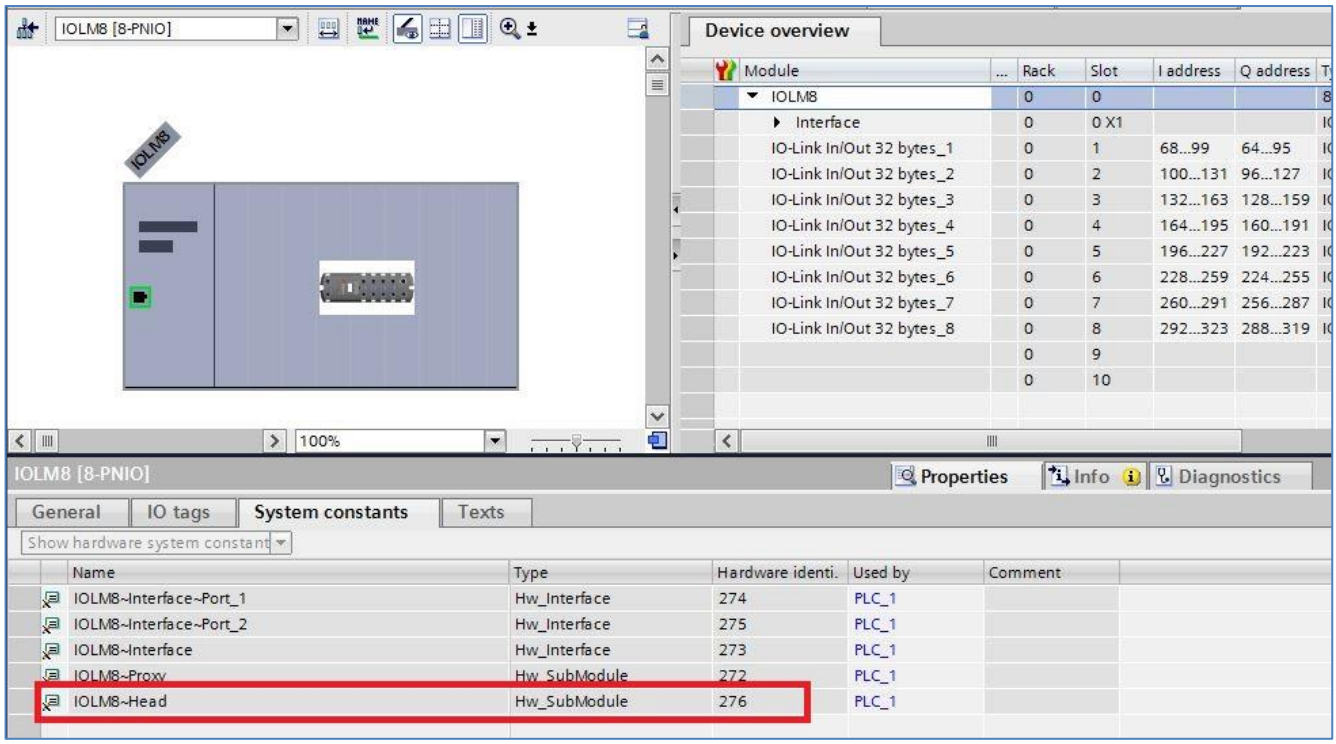


Figure 6: Comtrol IOLM8 PNIO. Type this value into the “ID_Array[1]” location.

Turck

Use the Hardware Identifier from the “Basic_1” Hw_SubModule. Type this number into the [1] slot of the ID_Array found in the “Banner_IOLM_Control_DB” data block.

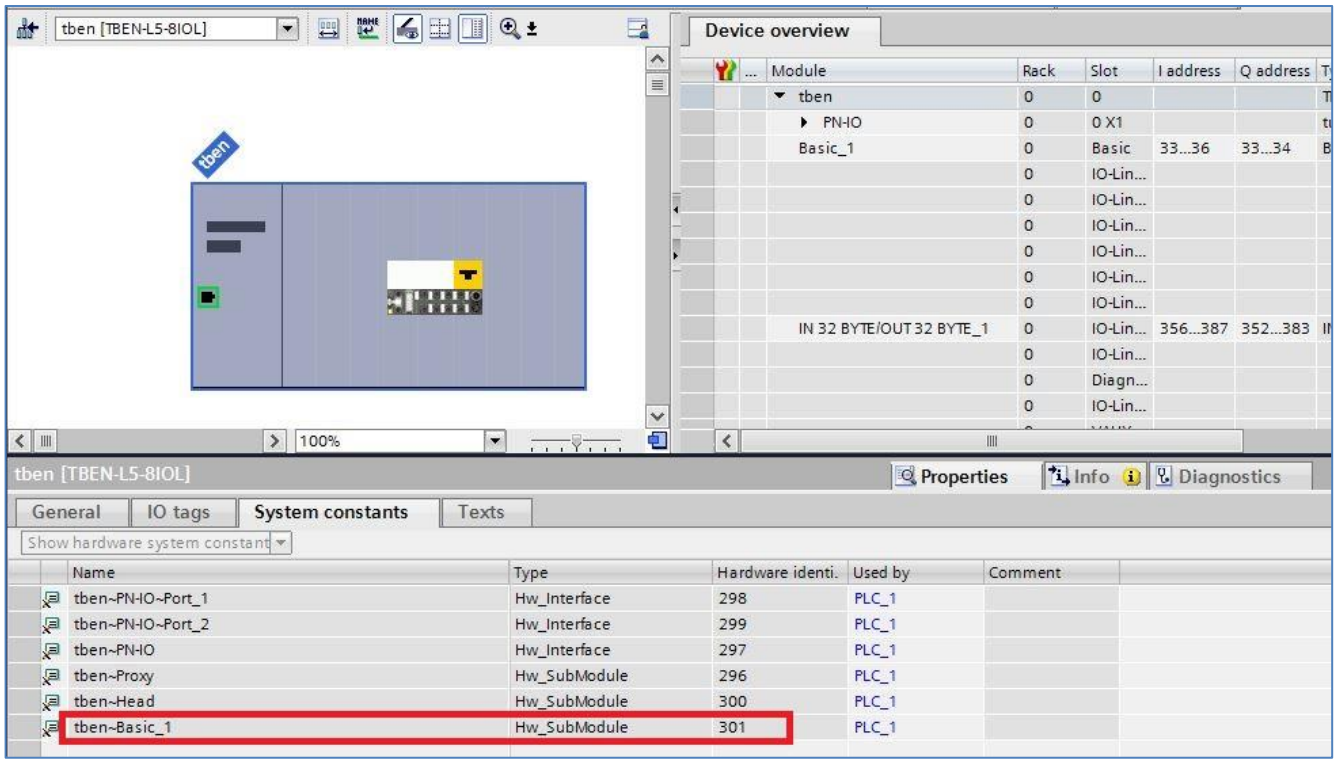


Figure 3: Turck TBEN-L5-8IOL. Type this value into the “ID_Array[1]” location.

Siemens

Use the Hardware Identifier from the “CM_4xIO-Link_1” Hw_SubModule. Type this number into the [1] slot of the ID_Array ID_Array found in the “Banner_IOLM_Control_DB” data block.

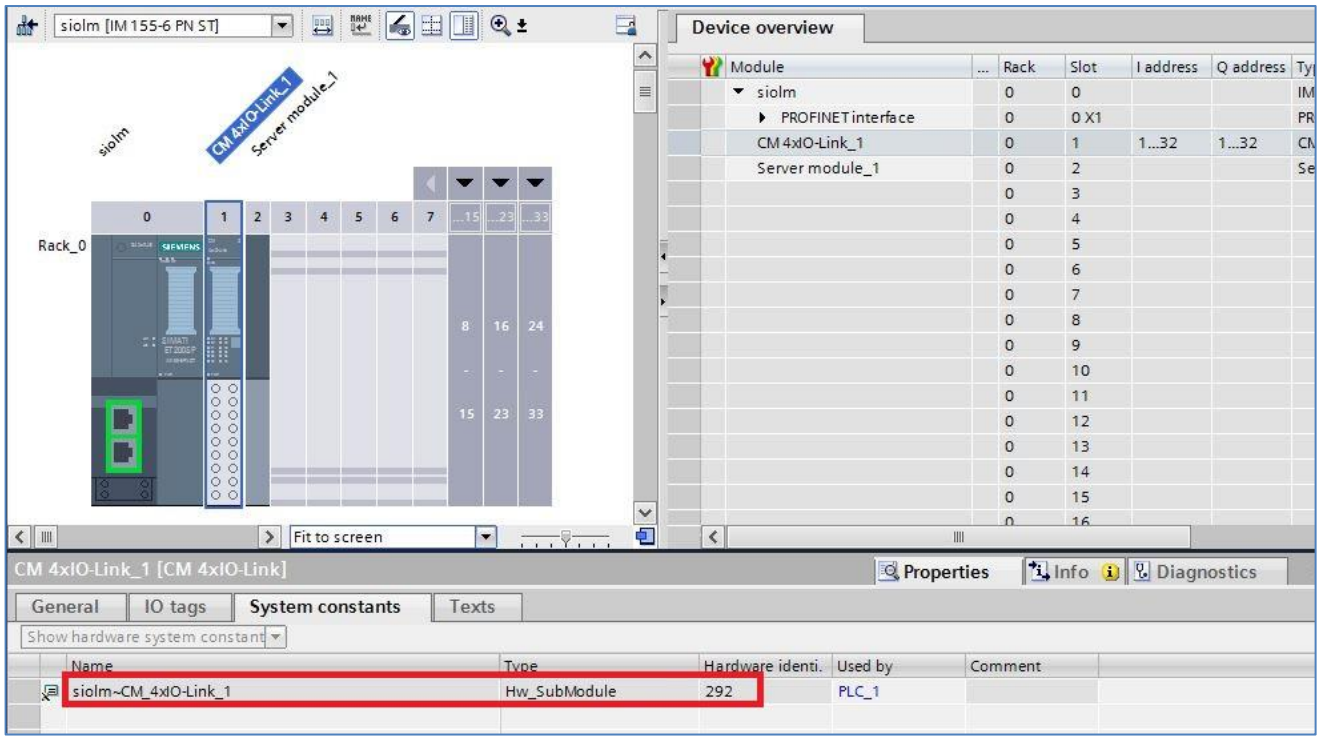


Figure 4: Siemens CM 4xIO-Link Master on ET-200SP. Type this value into the “ID_Array[1]” location.

ifm

Use the Hardware Identifier from the port to which the IO-Link Device you wish to control is connected Hw_SubModule. Each port is a different Hardware identifier. You will need to populate the ID_Array, found in the “Banner_IOLM_Control_DB” data block, with the correct values. In the example below, port 6 on the master has a Hardware ID of “279”. Thus, the [6] entry in the ID_Array variable should be set to “279”.

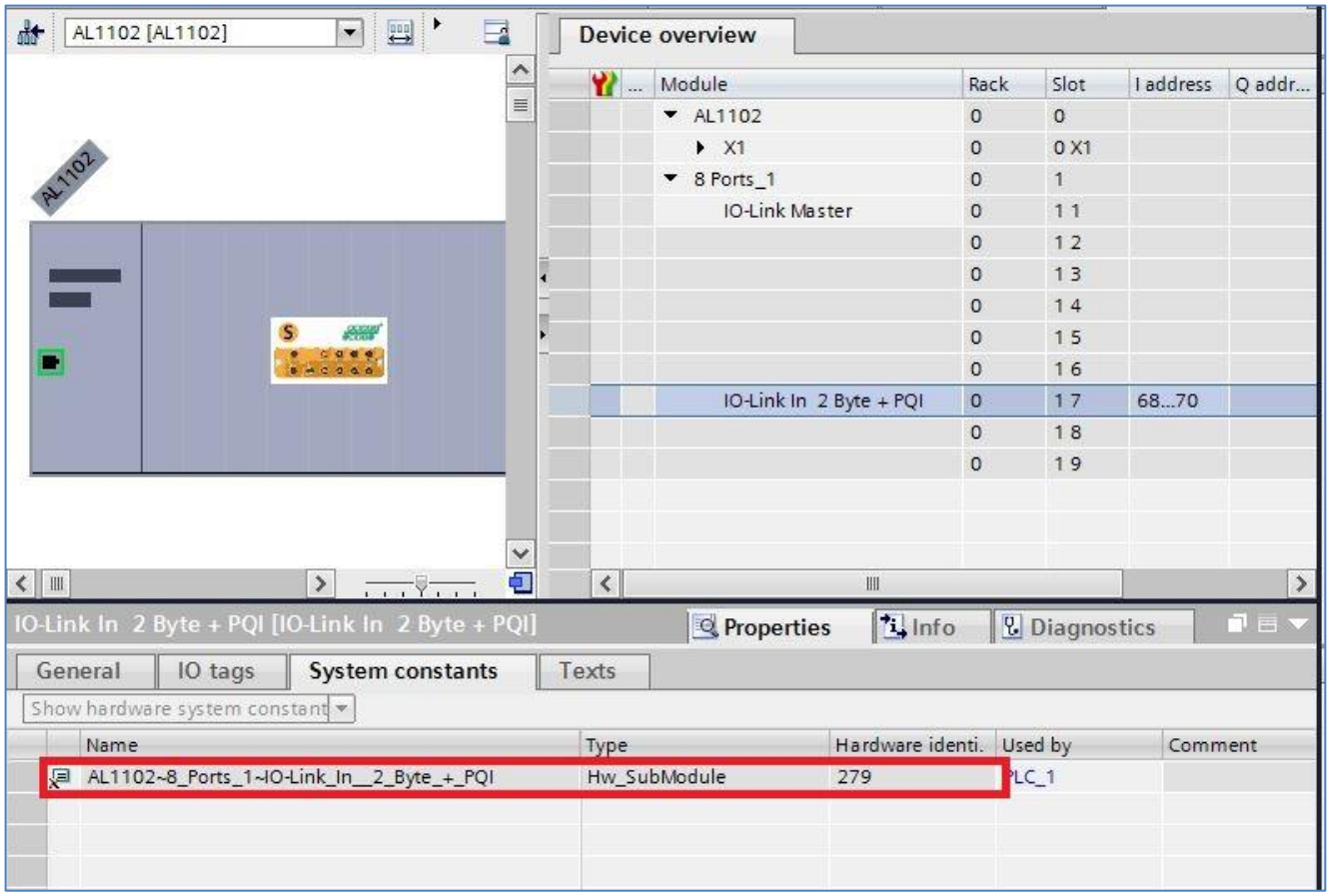
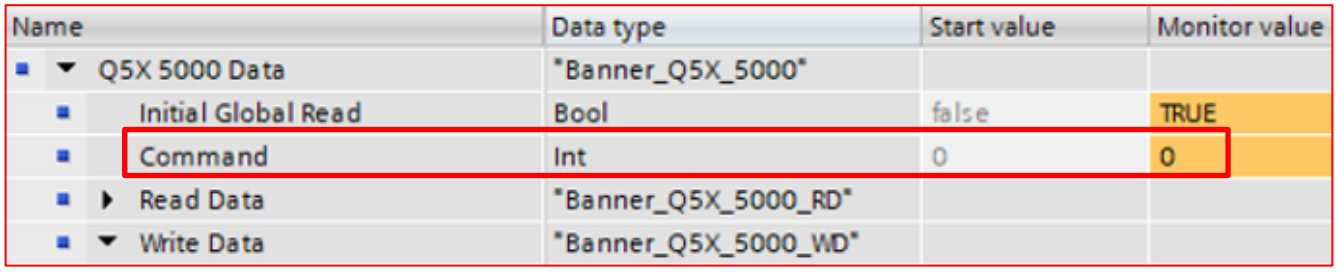


Figure 5: ifm AL1102: each port on the ifm IO-Link Master has its own Hardware ID. Type these values into the correct “ID_Array[x]” location, where ‘x’ is the port number in question ([6] here, as the ports are labeled 2 through 9).

Appendix B 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 Function Block achieves its automatic control.



The table below shows the command numbers associated with the reading and writing of specific pieces of data. See the Q5X 5000 IODD file or the Q5X 5000 IO-Link Data Reference Guide for more information of the parameters.

Table 1: Function Block Command Numbers

Q5X 5000 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
BDC2 Setpoints (62)	9	47
BDC2 Configuration (63)	10	48
Configuration (64)	11	49
BDC1 Vendor Specific Config (65)	12	50
BDC2 Vendor Specific Config (66)	13	51
Status (67)	14	
All Time Run Time (69)	15	
Resettable Run Time (70)	16	52
Pulse Frequency Configuration (71)	17	53
Display String (72)	18	
All Time Run Time Event (76)	19	54
Resettable Run Time Event (77)	20	55
MDC Descriptor (16512)	21	