

SD50 Parameter Data Function Block

February 10th, 2025

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 SD50 and allows the user to easily change SD50 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 blocks.

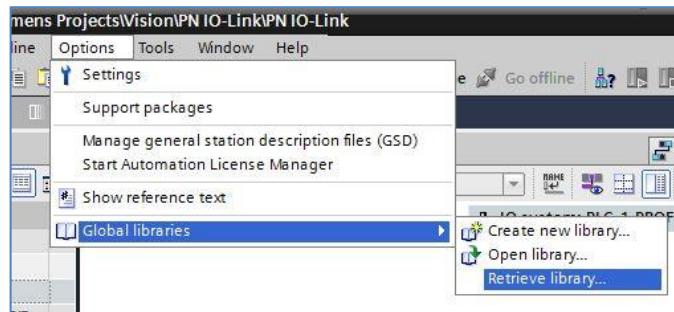
Components

Banner SD50 Library.zal15

There are two methods for parameter 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 manufacturers' IO-Link masters.

Installation Instructions

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



3. Select the Banner SD50 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 9 for all other IO-Link Masters.

Setup of SD50 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.

Banner IO-Link Master Info_1	0	1	1...9	Banner IO-Link Master Info
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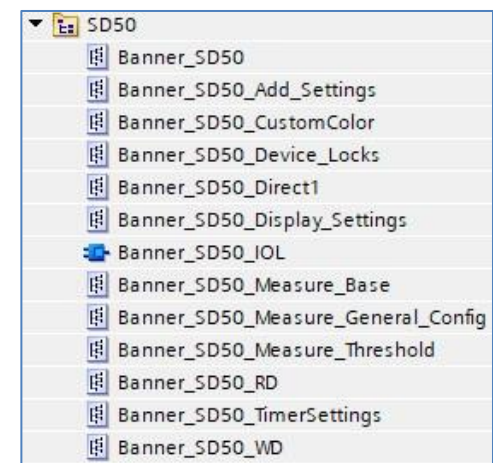
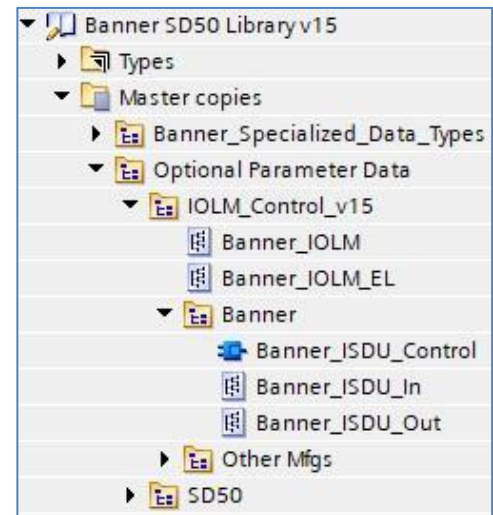
3. Open the IO-Link Generic Devices and select the proper module. The IO-Link ISDU 190/190 Byte_1 is required for this Function Block. Make note of the I address for Slot 10. The inputs data starts at I185 while the outputs data starts at Q185 for this example.

IO-Link ISDU 190/190 Byte_1	0	10	185...380	185...380	IO-Link ISDU 190/190 Byte
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















4. Drag the Banner_IOLM and Banner_IOLM_EL to the PLC Data Types area under your PLC. These are found in IOLM_Control.
5. Open the Banner folder and drag the Banner_ISDU_Control to the Program blocks area.
6. Move the Banner_ISDU_In and Banner_ISDU_Out to the PLC Data Types.
7. Now open the SD50 folder under the Optional Parameter Data folder.
8. Move the Banner_SD50_IOL to the Program blocks area.
9. Finally move the Banner_SD50, Banner_SD50_Add_Settings, Banner_SD50_CustomColor, Banner_SD50_Device_Locks, Banner_SD50_Direct1, Banner_SD50_Display_Settings, Banner_SD50_Measure_Base, Banner_SD50_Measure_General_Config, Banner_SD50_Measure_Threshold, Banner_SD50_RD, Banner_SD50_TimerSettings, and Banner_SD50_WD to the PLC Data Types.
10. Go to PLC Tags. Create two tags. The first tag "IOLM1 ISDU In" and the second tag is "IOLM1 ISDU Out". Use the %I and %Q values from step 3.

IOLM1 ISDU In	"Banner_ISDU_In"	%I185.0
IOLM1 ISDU Out	"Banner_ISDU_Out"	%Q185.0

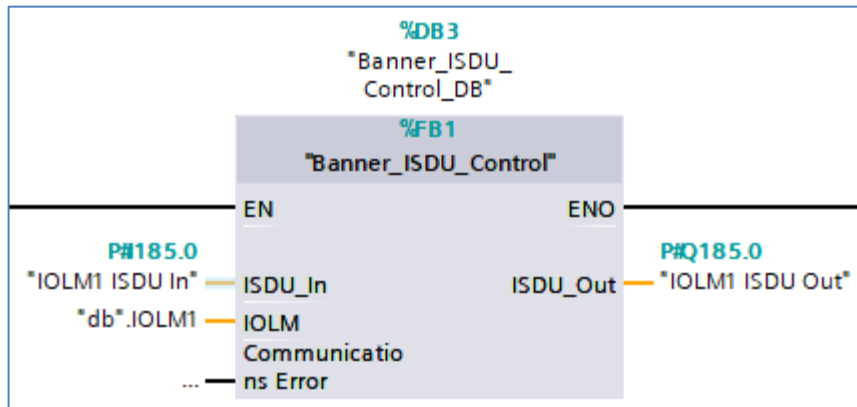
11. Go to Program blocks. Add a new Data block if necessary. In this example the new data block is named "db".
12. Create a tag with the type of "Banner_IOLM". This example uses IOLM1.



13. Expand the IOLM1 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.

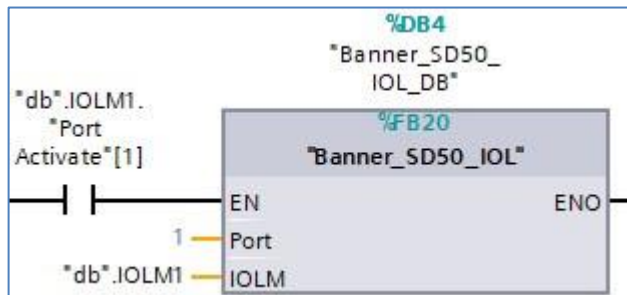
db			
	Name	Data type	Start value
	■ ▼ IOLM1	"Banner_IOLM"	
	■ ▼ Port Controlled	Array[1..8] of Bool	
	■ Port Controlled[1]	Bool	true
	■ Port Controlled[2]	Bool	true
	■ Port Controlled[3]	Bool	true
	■ Port Controlled[4]	Bool	false
	■ Port Controlled[5]	Bool	false
	■ Port Controlled[6]	Bool	false
	■ Port Controlled[7]	Bool	false
	■ Port Controlled[8]	Bool	false
	■ ▶ Port Activate	Array[1..8] of Bool	
	■ ▶ Port Read Request	Array[1..8] of Bool	
	■ ▶ Port Write Request	Array[1..8] of Bool	
	■ ▶ Port RW Complete	Array[1..8] of Bool	
	■ ▶ Port Device Read	Array[1..8] of Bool	
	■ ▶ Transfer Data	Array[0..231] of B...	
	■ Wr_Length	UInt	0
	■ Rd_Length	UInt	0
	■ IO-Index	Int	0
	■ Reset	Bool	false

14. Next add the “Banner_ISDU_Control” function block to an OB ladder. You will be prompted to make a new data block. You now must define three input variables for this function block: ISDU_In, ISDU_Out, and IOLM.



15. Link the IOLM variable to the database IOLM tag created in step 12. While ISDU_In are linked to variables created in step 10.
16. Now add the “Banner_SD50_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 12.

As a final step, the Port Activate bit is added on the same rung as the SD50 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.



17. The SD50 Parameter Data function block is now set up. Compile the project and download it to the PLC. Go online, then open the SD50 data block. When the function block starts out, it does an initial global read of all SD50 information. The Read Data section of the data block shows this information.

Name	Data type	Start value	Monitor value
■ ▼ SD50 Data	"Banner_SD50"		
■ Initial Global Read	Bool	false	TRUE
■ Command	Int	0	0
■ ▼ Read	"Banner_SD50_RD"		
■ ▼ Direct Parameters	"Banner_SD50_Direct1"		
■ Master Cycle Time	USInt	0	98
■ Min Cycle Time	USInt	0	98
■ M-Sequence Capability	USInt	0	9
■ IO-Link Version ID	USInt	0	17
■ Process Data Input Length	USInt	0	0
■ Process Data Output Len...	USInt	0	159
■ Vendor ID Combined	UDInt	0	451
■ Vendor ID 1	USInt	0	1
■ Vendor ID 2	USInt	0	195
■ Device ID Combined	UDInt	0	393235
■ Device ID 1	USInt	0	6
■ Device ID 2	USInt	0	0
■ Device ID 3	USInt	0	19
■ Serial Number	String	"	'FSSSSSSSSPPPPDD'
■ ► Write	"Banner_SD50_WD"		

The Write Data section of the data block shows all the writeable parameter data for the SD50.

Name	Data type	Start value	Monitor value
■ ▼ SD50 Data	"Banner_SD50"		
■ Initial Global Read	Bool	false	TRUE
■ Command	Int	0	0
■ ▶ Read	"Banner_SD50_RD"		
■ ▼ Write	"Banner_SD50_WD"		
■ System Command	USInt	0	0
■ ▶ Device Locks	"Banner_SD50_Device_Locks"		
■ Operating Mode	USInt	0	0
■ ▶ Settings	"Banner_SD50_Add_Settings"		
■ ▶ Display Settings	"Banner_SD50_Display_Settings"		
■ ▶ Timer Settings	"Banner_SD50_TimerSettings"		
■ ▶ Measure General	"Banner_SD50_Measure_General_Config"		
■ ▶ Measure Base	"Banner_SD50_Measure_Base"		
■ ▶ Measure Threshold	Array[1..4] of "Banner_SD50_Measure_Threshold"		
■ ▶ Custom Color1	"Banner_SD50_CustomColor"		
■ ▶ Custom Color2	"Banner_SD50_CustomColor"		
■ ▶ Message	Array[1..13] of String		
■ Reset	Bool	false	FALSE

Most of the data is accessed by opening the tags. Measure General is shown as an example below.

■ ▼ Measure General	"Banner_SD50_Measure_General_Config"		
■ Filtering	USInt	0	0
■ Hysteresis	USInt	0	0
■ MTC Data Label	String	"	'time='
■ MTC Value	USInt	0	1
■ MTC Bar Graph	USInt	0	1
■ Output Scale Value Low	UInt	0	0
■ Output Scale Value High	UInt	0	10
■ Input Scale Value Low	UInt	0	0
■ Input Scale Value High	UInt	0	65535
■ MTC Value Label	String	"	's'
■ MTC Display Orientation	USInt	0	0
■ MTC Display Minimal Bar Graph	USInt	0	0
■ MTC Decimal Places	USInt	0	1
■ MTC Display as Time	USInt	0	0

Updating a tag involves first setting a new value to tag. After all the tags are updated, a numerical value is sent to the Command value. This initiates a write up date for an IO-Link Index. See table on next page for commands and which IO-Link Index is accessed by the Command.

Command Number

Rules	Read	Write	IO-Link Index	RO - 0	WO - 1	RW - 2
	1			Global Read All		
2	2		0	Direct Param 1		
3		43	2		Standard Command	
4	4	44	12			Device Access Locks
5	5		21	Serial Number		
6	6	46	80			Operating Mode Selection
7	7	47	81			Additional Settings
8	8	48	82			Display Settings
9	9	49	83			Timer Settings
10	10	50	84			Measure General Configuration
11	11	51	85			Measure Base Configuration
12	12	52	86			Measure Threshold 1 Configuration
13	13	53	87			Measure Threshold 2 Configuration
14	14	54	88			Measure Threshold 3 Configuration
15	15	55	89			Measure Threshold 4 Configuration
16	16	56	90			Custom Color 1
17	17	57	91			Custom Color 2
18	18	58	92.1			Message 1
19	19	59	92.2			Message 2
20	20	60	92.3			Message 3
21	21	61	92.4			Message 4
22	22	62	92.5			Message 5
23	23	63	92.6			Message 6
24	24	64	93.1			Message 7
25	25	65	93.2			Message 8
26	26	66	93.3			Message 9
27	27	67	93.4			Message 10
28	28	68	93.5			Message 11
29	29	69	93.6			Message 12
30	30	70	93.7			Message 13

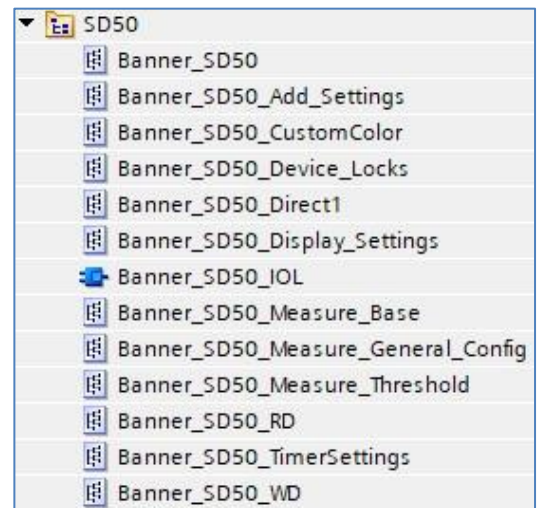
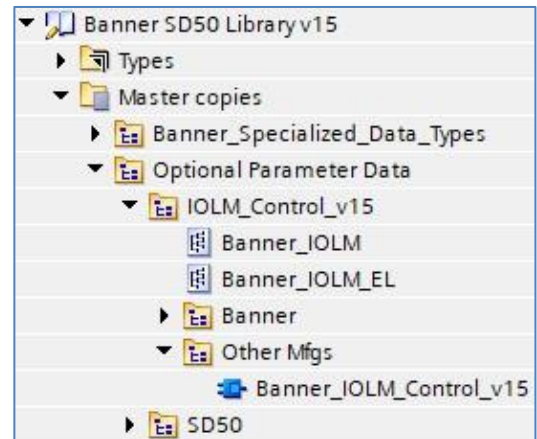
Setup of SD50 with other IO-Link Masters

Additional Component Needed

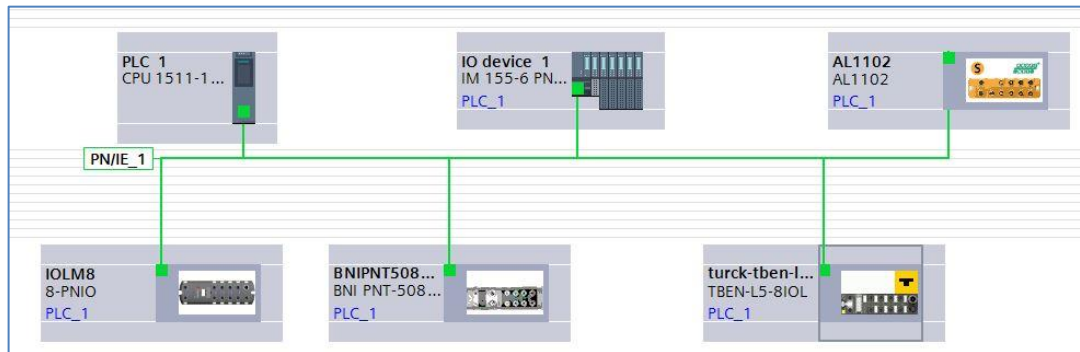
Siemens IO_LINK_DEVICE function block v5.2

Installation Instructions

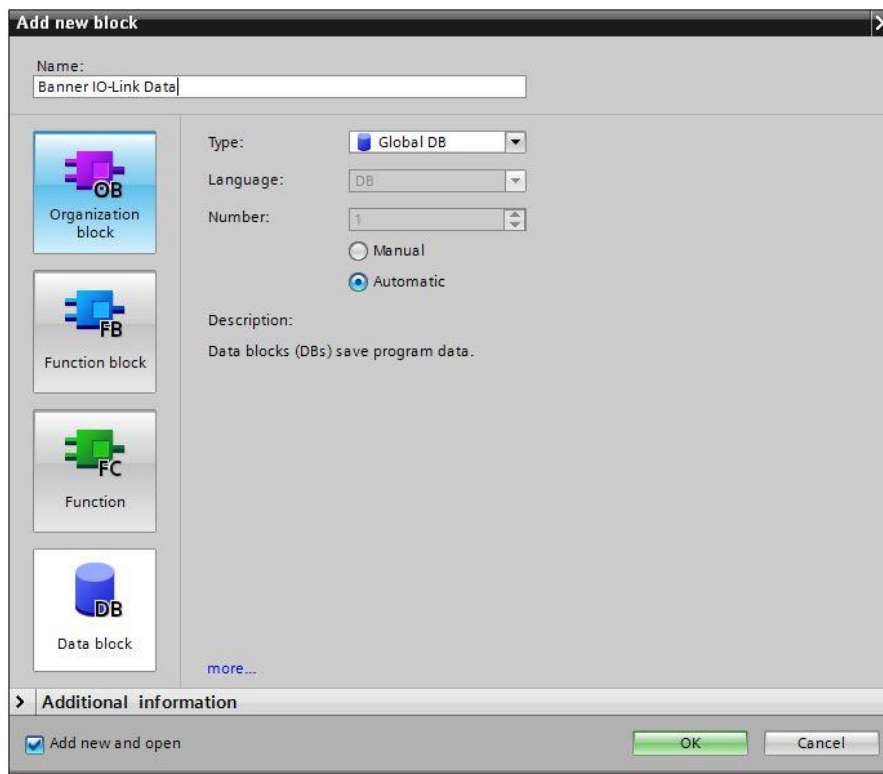
1. The Banner SD50 Library will now be in the Global Library List. Expand the Master copies section. Now open the Optional Parameter Data Folder along with the SD50 folders. Finally open the Other Mfgs folder.
2. Drag Banner_SD50_IOL to the Program Blocks area under your PLC.
3. Drag the Banner_SD50, Banner_SD50_Add_Settings, Banner_SD50_CustomColor, Banner_SD50_Device_Locks, Banner_SD50Direct1, Banner_SD50_Display_Settings, Banner_SD50_Measure_Base, Banner_SD50_Measure_General_Config, Banner_SD50_Measure_Threshold, Banner_SD50_RD, Banner_SD50_TimerSettings, and Banner_SD50_WD to the PLC Data Types area under your PLC.
4. We also must prepare for setting up the IO-Link Master. Go to the IOLM_Control section of the Banner IO-Link Library List.
5. Drag Banner_IOLM and Banner_IOLM_EL to the PLC Data Types area under your PLC.
6. Drag the Banner_IOLM_Control_v15 to the Program Blocks area under your PLC.
7. Finally, we must bring the Siemens-made IO_LINK_DEVICE (5.2 version used for this) 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.



8. 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.



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



10. 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 "IOLM1". A different IO-Link Master might be called IOLM2 or IOLM3, for instance.

11. Expand the IOLM1 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.

db			
	Name	Data type	Start value
db	IOLM1	"Banner_IOLM"	
db	Port Controlled	Array[1..8] of Bool	
db	Port Controlled[1]	Bool	true
db	Port Controlled[2]	Bool	true
db	Port Controlled[3]	Bool	true
db	Port Controlled[4]	Bool	false
db	Port Controlled[5]	Bool	false
db	Port Controlled[6]	Bool	false
db	Port Controlled[7]	Bool	false
db	Port Controlled[8]	Bool	false
db	Port Activate	Array[1..8] of Bool	
db	Port Read Request	Array[1..8] of Bool	
db	Port Write Request	Array[1..8] of Bool	
db	Port RW Complete	Array[1..8] of Bool	
db	Port Device Read	Array[1..8] of Bool	
db	Transfer Data	Array[0..231] of B...	
db	Wr_Length	UInt	0
db	Rd_Length	UInt	0
db	IO-Index	Int	0
db	Reset	Bool	false

- 12. Next add the “Banner_IOLM_Control” function block to an OB ladder. You will be prompted to make a new data block. You now must 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-508-105-2015)	255
Control (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 10.

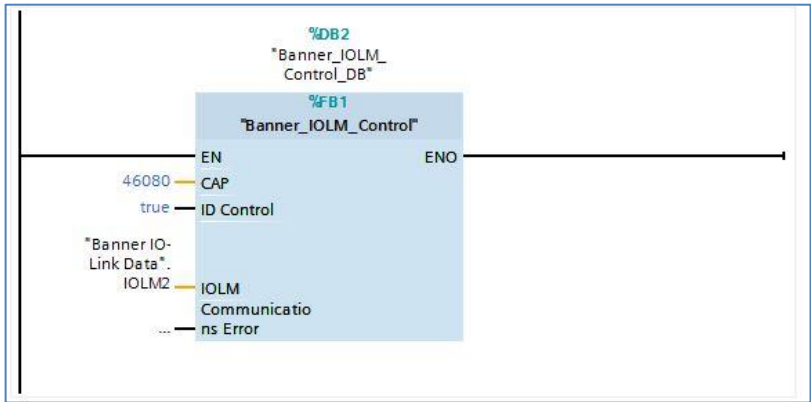


Figure 1: An example using an ifm IO-Link Master

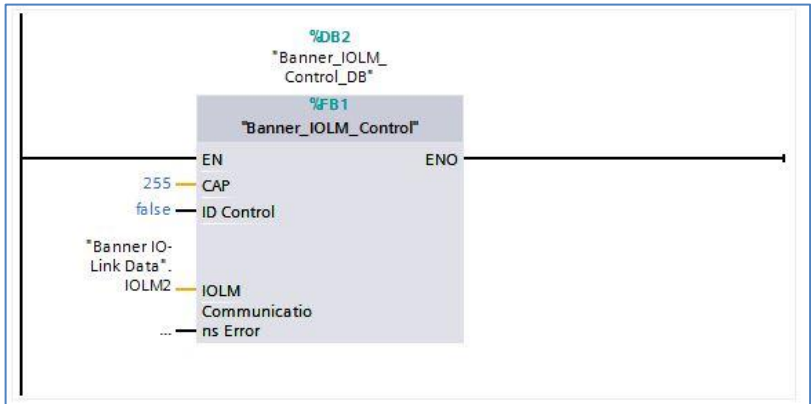


Figure 2: An example using a Balluff IO-Link Master

13. 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 in 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

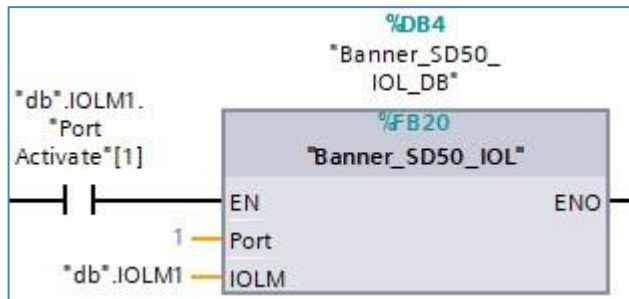
Figure 3: The ID_Array when using an ifm IO-Link Master; device attached to port 6

▼ 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)

14. Now add the “Banner_SD50_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 10.

As a final step, the Port Activate bit is added on the same rung as the SD50 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.



15. The SD50 Parameter Data function block is now set up. Compile the project and download it to the PLC. Go online, then open the SD50 data block. When the function block starts out, it does an initial global read of all SD50 information. The Read Data section of the data block shows this information.

Name	Data type	Start value	Monitor value
■ ▼ SD50 Data	"Banner_SD50"		
■ Initial Global Read	Bool	false	TRUE
■ Command	Int	0	0
■ ▼ Read	"Banner_SD50_RD"		
■ ▼ Direct Parameters	"Banner_SD50_Direct1"		
■ Master Cycle Time	USInt	0	98
■ Min Cycle Time	USInt	0	98
■ M-Sequence Capability	USInt	0	9
■ IO-Link Version ID	USInt	0	17
■ Process Data Input Length	USInt	0	0
■ Process Data Output Len...	USInt	0	159
■ Vendor ID Combined	UDInt	0	451
■ Vendor ID 1	USInt	0	1
■ Vendor ID 2	USInt	0	195
■ Device ID Combined	UDInt	0	393235
■ Device ID 1	USInt	0	6
■ Device ID 2	USInt	0	0
■ Device ID 3	USInt	0	19
■ Serial Number	String	"	'FSSSSSSSSPPPPDD'
■ ▶ Write	"Banner_SD50_WD"		

16. The Write Data section of the data block shows all the writeable parameter data for the SD50.

Name	Data type	Start value	Monitor value
■ ▼ SD50 Data	"Banner_SD50"		
■ Initial Global Read	Bool	false	TRUE
■ Command	Int	0	0
■ ▶ Read	"Banner_SD50_RD"		
■ ▼ Write	"Banner_SD50_WD"		
■ System Command	USInt	0	0
■ ▶ Device Locks	"Banner_SD50_Device_Locks"		
■ Operating Mode	USInt	0	0
■ ▶ Settings	"Banner_SD50_Add_Settings"		
■ ▶ Display Settings	"Banner_SD50_Display_Settings"		
■ ▶ Timer Settings	"Banner_SD50_TimerSettings"		
■ ▶ Measure General	"Banner_SD50_Measure_General_Config"		
■ ▶ Measure Base	"Banner_SD50_Measure_Base"		
■ ▶ Measure Threshold	Array[1..4] of "Banner_SD50_Measure_Threshold"		
■ ▶ Custom Color1	"Banner_SD50_CustomColor"		
■ ▶ Custom Color2	"Banner_SD50_CustomColor"		
■ ▶ Message	Array[1..13] of String		
■ Reset	Bool	false	FALSE

Most of the data is accessed by opening the tags. Measure General is shown as an example below.

■ ▼ Measure General	"Banner_SD50_Measure_General_Config"		
■ Filtering	USInt	0	0
■ Hysteresis	USInt	0	0
■ MTC Data Label	String	"	'time='
■ MTC Value	USInt	0	1
■ MTC Bar Graph	USInt	0	1
■ Output Scale Value Low	UInt	0	0
■ Output Scale Value High	UInt	0	10
■ Input Scale Value Low	UInt	0	0
■ Input Scale Value High	UInt	0	65535
■ MTC Value Label	String	"	's'
■ MTC Display Orientation	USInt	0	0
■ MTC Display Minimal Bar Graph	USInt	0	0
■ MTC Decimal Places	USInt	0	1
■ MTC Display as Time	USInt	0	0

Updating a tag involves first setting a new value to tag. After all the tags are updated, a numerical value is sent to the Command value. This initiates a write up date for an IO-Link Index. See table on next page for commands and which IO-Link Index is accessed by the Command.

Command Number						
Rules	Read	Write	IO-Link Index	RO - 0	WO - 1	RW - 2
	1			Global Read All		
2	2		0	Direct Param 1		
3		43	2		Standard Command	
4	4	44	12			Device Access Locks
5	5		21	Serial Number		
6	6	46	80			Operating Mode Selection
7	7	47	81			Additional Settings
8	8	48	82			Display Settings
9	9	49	83			Timer Settings
10	10	50	84			Measure General Configuration
11	11	51	85			Measure Base Configuration
12	12	52	86			Measure Threshold 1 Configuration
13	13	53	87			Measure Threshold 2 Configuration
14	14	54	88			Measure Threshold 3 Configuration
15	15	55	89			Measure Threshold 4 Configuration
16	16	56	90			Custom Color 1
17	17	57	91			Custom Color 2
18	18	58	92.1			Message 1
19	19	59	92.2			Message 2
20	20	60	92.3			Message 3
21	21	61	92.4			Message 4
22	22	62	92.5			Message 5
23	23	63	92.6			Message 6
24	24	64	93.1			Message 7
25	25	65	93.2			Message 8
26	26	66	93.3			Message 9
27	27	67	93.4			Message 10
28	28	68	93.5			Message 11
29	29	69	93.6			Message 12
30	30	70	93.7			Message 13

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 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.

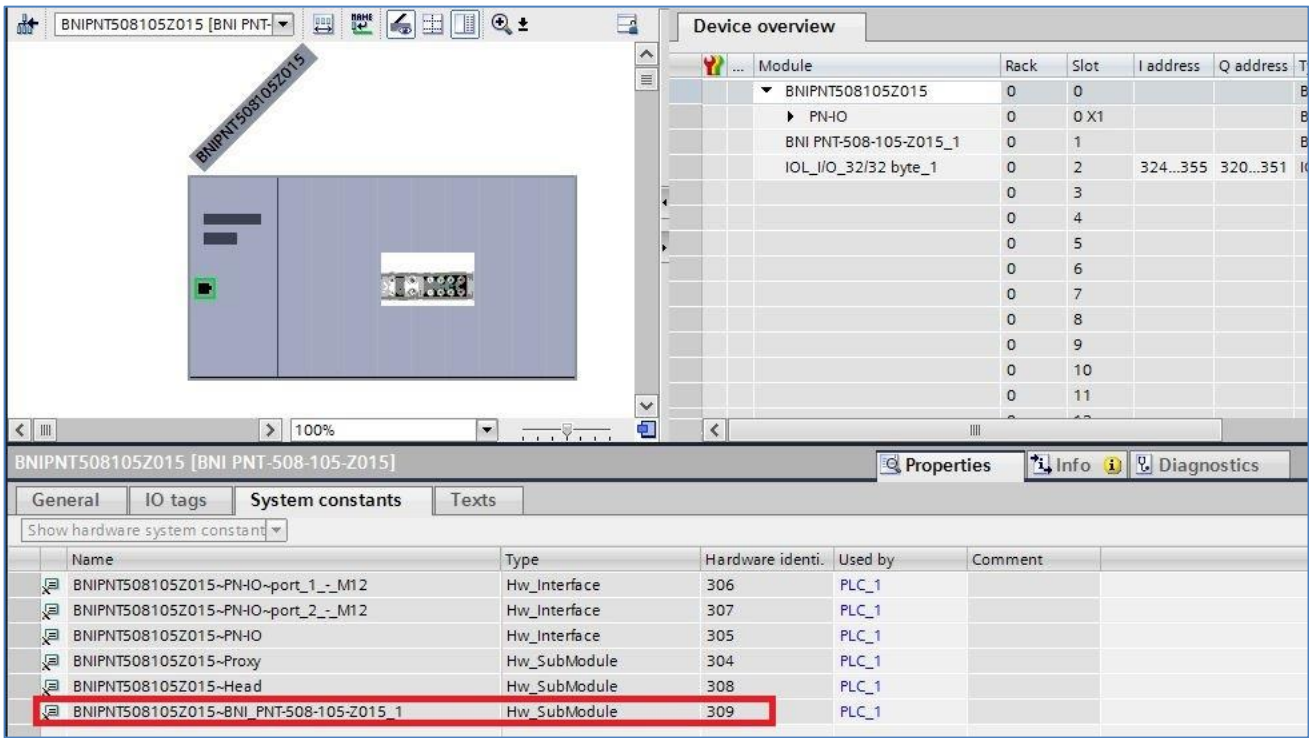


Figure 5: Balluff BNI005H. Type this value into the “ID_Array[1]” location.

Control

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.

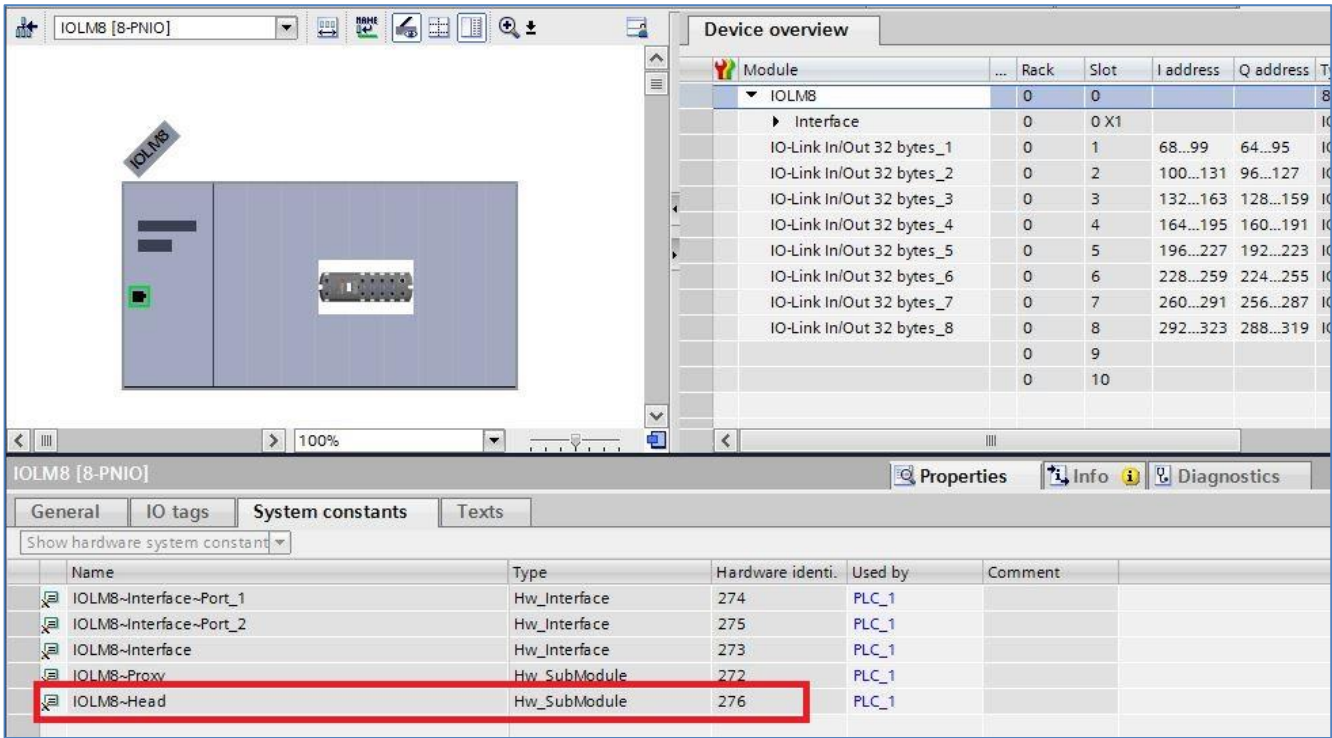


Figure 6: Control IOLM8 PNIO. Type this value into the “ID_Array[1]” location.

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.

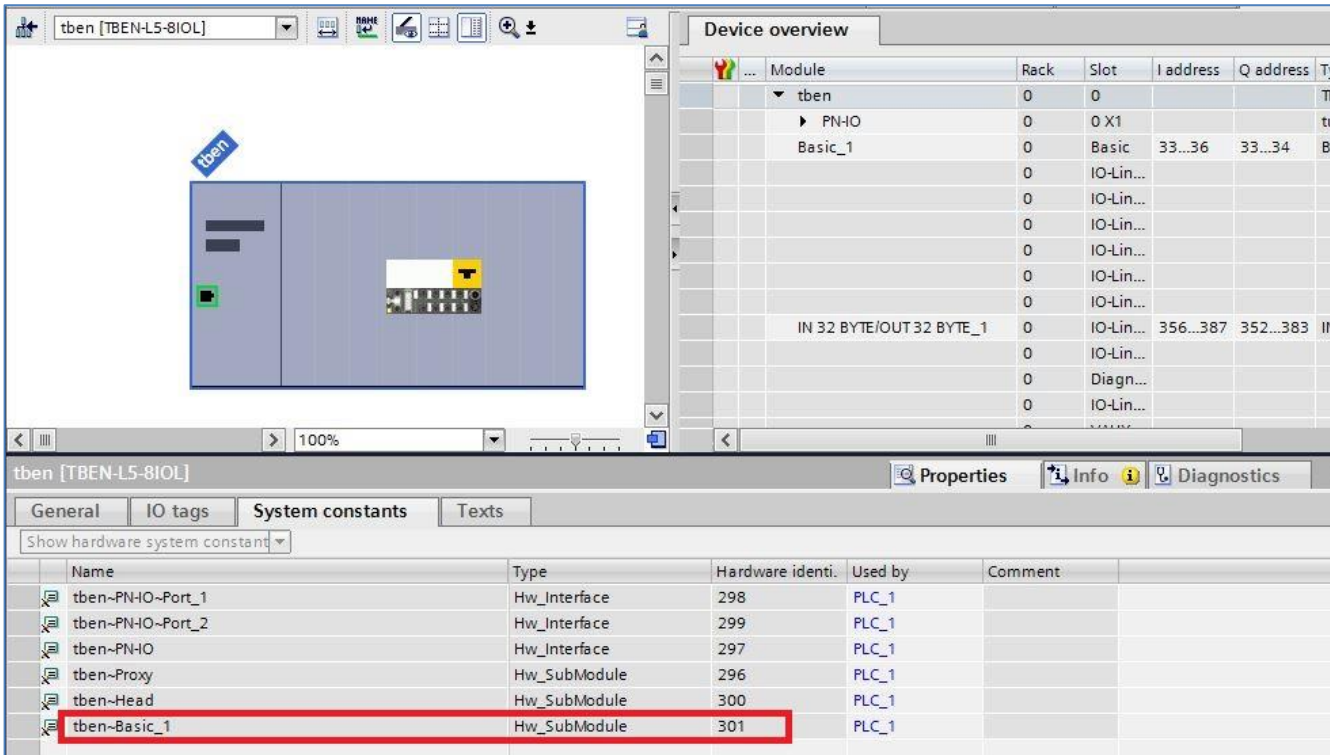


Figure 3: Turck TBEN-L5-8IOL. Type this value into the “ID_Array[1]” location.

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.

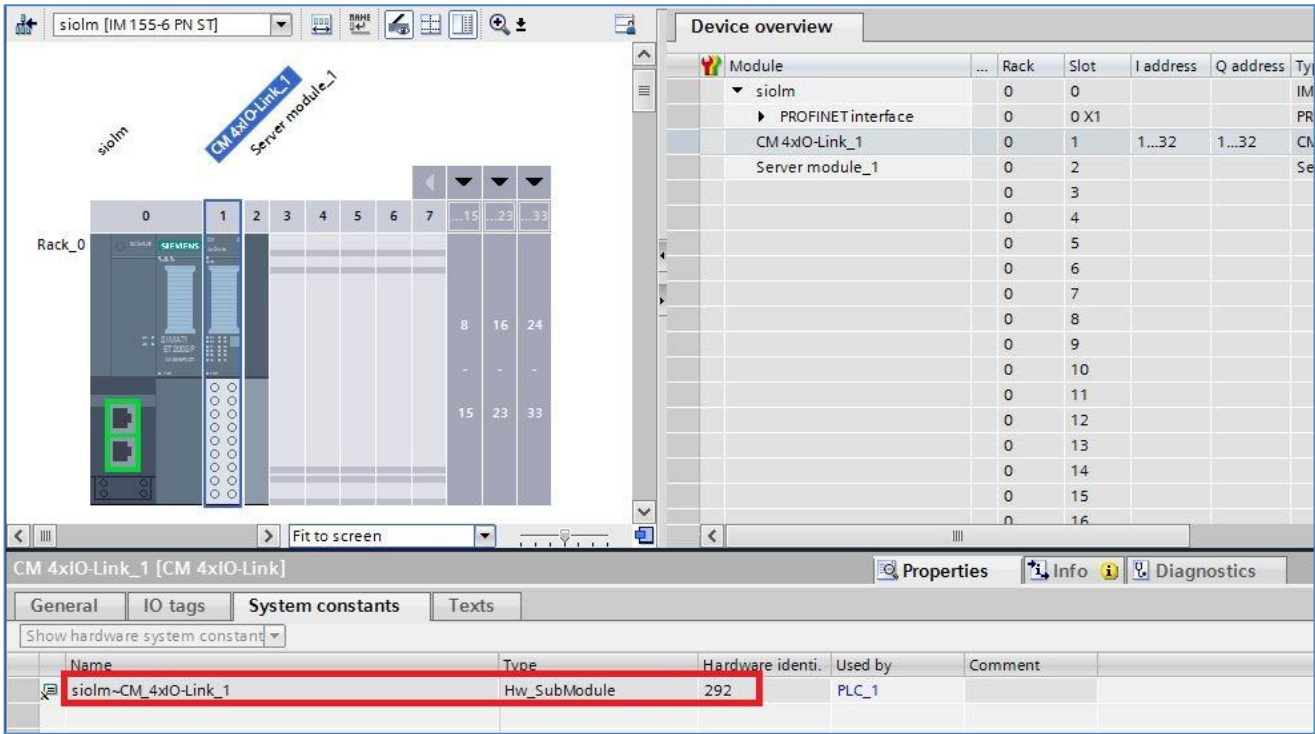


Figure 4: Siemens CM 4xIO-Link Master on ET-200SP. Type this value into the “ID_Array[1]” location.

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”.

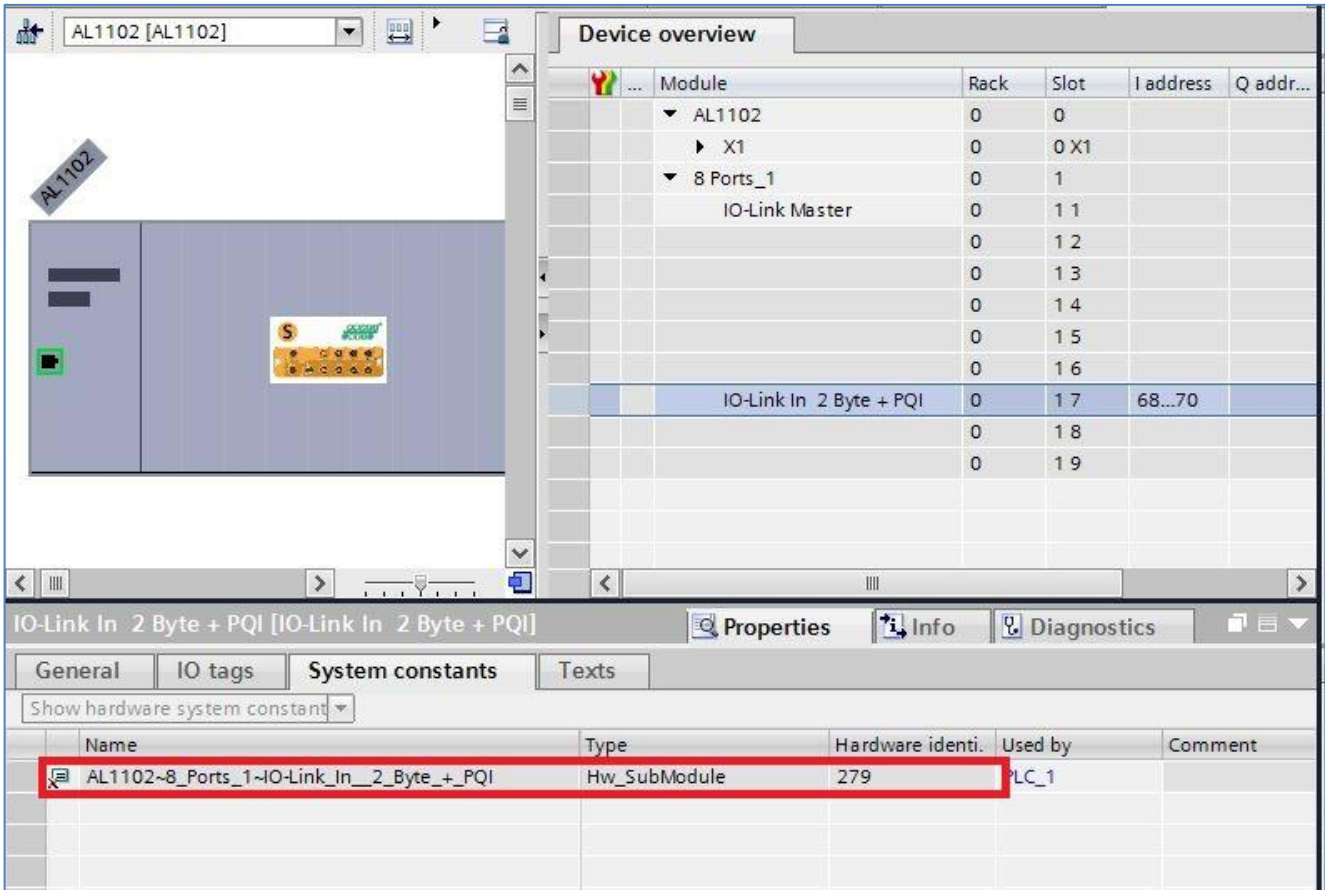


Figure 5: ifm AL1102: each port on the ifm IO-Link Master has its own Hardware ID. Type these values into the correct “ID_Array[x]” location, where ‘x’ is the port number in question ([6] here, as the ports are labeled 2 through 9).