



ThinkTopVx0_nPORT_IOL Add-On Instruction Guide for Allen Bradley Compact/ControlLogix PLC's

ThinkTop V20, V50, V55, V70





Version 1.0 2/2024



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1 Preliminary notes

This document demonstrates:

1. Ethernet/IP communication between an ifm AL1x2x IO-Link Master and an Allen Bradley controller.
2. Integrating the ThinkTop Add-On Instruction into a PLC project

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2 Intended Use

The ThinkTopVx0_nPORT_IOL Add-On Instruction provides a logical user interface to ThinkTop Valves.

The Add-On Instruction is to be integrated in a PLC program to:

1. Parse the valves Process Data Input
2. Allow the user to control the Process Data Output
3. Provide IO-Link port communication status
4. Feedback incorrect user input settings
5. Produce status of IO-Link Automatic Device Replacement

3 Prerequisites

The user has:

1. RS Logic 5000 or Studio 5000 software.
2. An ifm IO-Link master AL112x, AL122x, AL132x, AL142x, AL192x.
3. A ThinkTop Valve version 20, 50 or 70 is connected to a sensor port of the IO-Link master.

4 Set Network settings of ifm IO-Link master using ifm Netsetter

1. Download the ifm Netsetter executable from the [ifm website](#) and select your country.
2. Text search “netsetter”
3. Click [Show Downloads for this search term...](#)

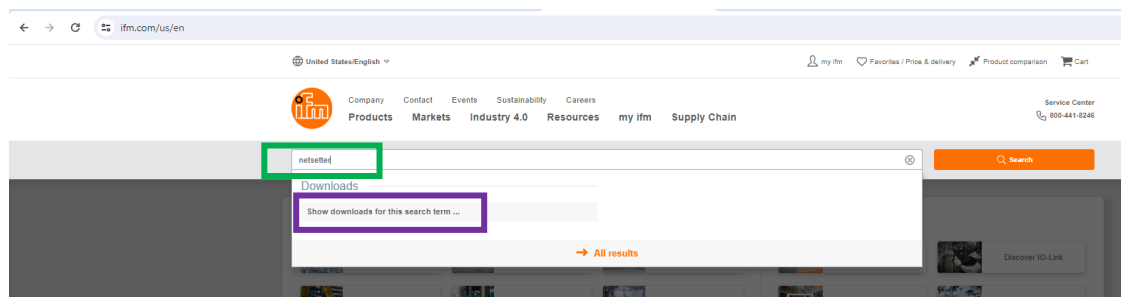


Figure 1

4. Click the [Download](#) button.

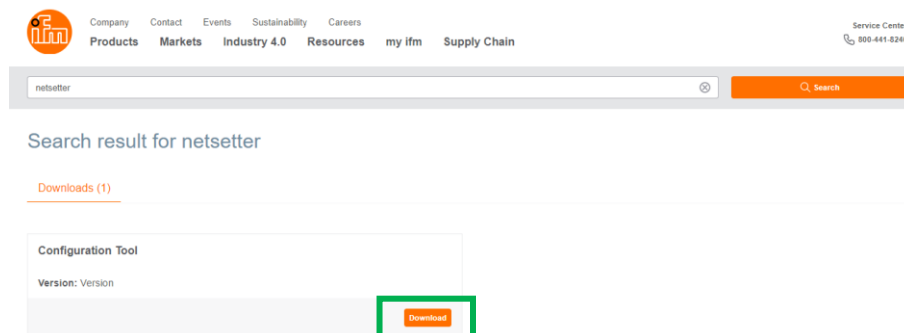


Figure 2

5. Click the [download](#) button for the Ethernet Configuration Tool (ifm netsetter)

Note: A “my ifm” account must be created and logged in before downloading. Follow the prompts to create a “my ifm” account.

Configuration Tool

AL1100 | AL1101 | AL1102 | AL1103 | AL1120 | AL1121 | AL1122 | AL1123 | AL1200 | AL1201 | AL1202 | AL1203 | AL1220 | AL1221 | AL1222 | AL1223 | AL1300 | AL1301 | AL1302 | AL1303 | AL1304 | AL1305 | AL1306 | AL1307 | AL1320 | AL1321 | AL1322 | AL1323 | AL1324 | AL1325 | AL1326 | AL1327 | AL1330 | AL1331 | AL1332 | AL1333 | AL1340 | AL1341 | AL1342 | AL1343 | AL1350 | AL1351 | AL1352 | AL1353 | AL1370 | AL1371 | AL1372 | AL1373 | AL1400 | AL1401 | AL1402 | AL1403 | AL1420 | AL1421 | AL1422 | AL1423 | AL1900 | AL1920 | AL1930 | AL1940 | AL1950 | AL1970 | AL4002 | AL4003 | AL4102 | AL4103 | AL4022 | AL4023 | AL4122 | AL4123 | AL4042 | AL4043 | AL4142 | AL4143 | ZZ1100 | ZZ1120 | ZZ1350

Show compatible products			
Version			
Name	Description	File info	
Ethernet configuration tool (ifm netsetter)	IP-Address setting of the Ethernet devices V1.0	zip(2.7 MB) SHA-256	Download
Ethernet configuration tool (Hilscher)	IP-Address setting of the Ethernet devices V1.9	zip(3.7 MB) SHA-256	Download
Ethernet configuration tool (Moxa/ODVA)	IP-Address setting of the Ethernet devices (EIP) V2.3	zip(1.8 MB) SHA-256	Download
IoT-Core Assistant (ifm)	IoT-Core JSON requests via POST or GET methods V1.2	zip(11.3 MB) SHA-256	Download

Figure 3

6. From the Ethernet Device Configuration software download as a zip file. Extract the zip file by right clicking on the file and select **Extract All**.

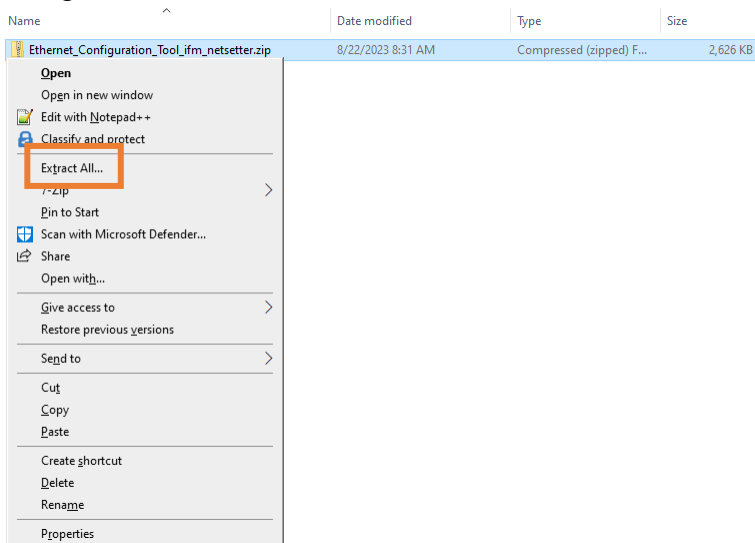


Figure 4

7. Open the extracted folder called **Ethernet_Configuration_Tool_ifm_netsetter**.

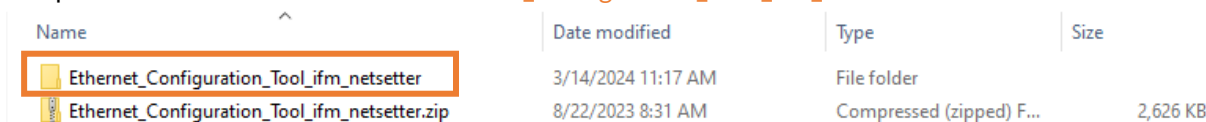


Figure 5

8. Double click **Ethernet_Configuration_Tool_ifm_netsetter_1.0.0.exe** to run the netsetter software (no installation required).

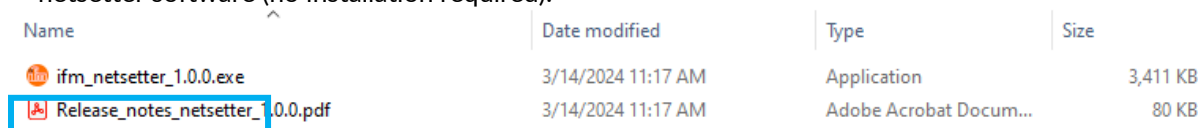


Figure 6

7. For DataLine IO-Link Modules (AL132x or AL192x) connect an Ethernet cable to the port labeled X23 (IoT) or X21 (Ethernet/IP)

For StandardLine, PowerLine and PerformanceLine IO-Link modules (AL11xx, AL12xx, AL14xx) connect an Ethernet cable to the port labeled X21.



5 PLC setup

5.1 EDS file

There are three methods to find the O2D5xx EDS file for integration into the PLC. Use one of the methods in section 5.1 to save the EDS file to a PC.

5.1.1 EDS file from the ThinkTop Startup Package

1. Find the appropriate EDS file in the folder named “1. EDS” in the ThinkTop Startup Package.

Name	Status	Date modified	Type	Size
1. EDS	✓	2/28/2024 3:42 PM	File folder	
2. Add_On Instruction	✓	2/29/2024 8:55 AM	File folder	
3. IO-Link Device Descriptions	✓	3/11/2024 3:32 PM	File folder	
4. Sample Project	✓	2/28/2024 3:40 PM	File folder	
Change Log.txt	✓	11/15/2023 11:47 AM	Text Document	1 KB

Figure 2

ifm_IOL_Master_AL1120.eds	✓	9/8/2023 1:54 PM	EDS File	62 KB
ifm_IOL_Master_AL1121.eds	✓	9/8/2023 1:54 PM	EDS File	62 KB
ifm_IOL_Master_AL1122.eds	✓	9/8/2023 1:55 PM	EDS File	101 KB
ifm_IOL_Master_AL1123.eds	✓	9/8/2023 1:55 PM	EDS File	101 KB
ifm_IOL_Master_AL1220.eds	✓	9/8/2023 1:55 PM	EDS File	62 KB
ifm_IOL_Master_AL1221.eds	✓	9/8/2023 1:55 PM	EDS File	62 KB
ifm_IOL_Master_AL1222.eds	✓	9/8/2023 1:55 PM	EDS File	101 KB
ifm_IOL_Master_AL1223.eds	✓	9/8/2023 1:55 PM	EDS File	101 KB
ifm_IOL_Master_AL1320.eds	✓	9/8/2023 1:55 PM	EDS File	63 KB
ifm_IOL_Master_AL1321.eds	✓	9/8/2023 1:55 PM	EDS File	63 KB
ifm_IOL_Master_AL1322.eds	✓	9/8/2023 1:56 PM	EDS File	102 KB
ifm_IOL_Master_AL1323.eds	✓	9/8/2023 1:56 PM	EDS File	102 KB
ifm_IOL_Master_AL1324.eds	✓	9/8/2023 1:56 PM	EDS File	62 KB
ifm_IOL_Master_AL1325.eds	✓	9/8/2023 1:56 PM	EDS File	62 KB
ifm_IOL_Master_AL1326.eds	✓	9/8/2023 1:56 PM	EDS File	101 KB
ifm_IOL_Master_AL1327.eds	✓	9/8/2023 1:56 PM	EDS File	101 KB
ifm_IOL_Master_AL1420.eds	✓	9/8/2023 1:57 PM	EDS File	74 KB
ifm_IOL_Master_AL1421.eds	✓	9/8/2023 1:57 PM	EDS File	74 KB
ifm_IOL_Master_AL1422.eds	✓	9/8/2023 1:57 PM	EDS File	117 KB
ifm_IOL_Master_AL1423.eds	✓	9/8/2023 1:57 PM	EDS File	117 KB
ifm_IOL_Master_AL1920.eds	✓	9/8/2023 1:56 PM	EDS File	102 KB
ifm_IOL_Master_AL1921.eds	✓	9/8/2023 1:56 PM	EDS File	101 KB

Figure 3

5.2 EDS File installation

1. Add the EDS file to RS Linx by navigating to Tools->EDS Hardware Installation Tool.
2. Follow the prompts to add the EDS.

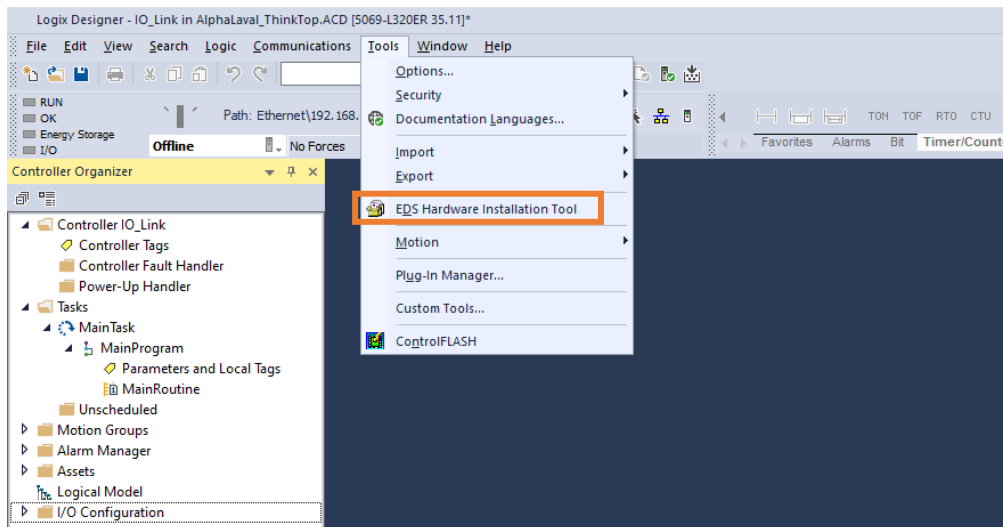


Figure 12

5.3 Add an ifm IO-Link master Ethernet module to the PLC project

1. Right click on Ethernet in the I/O configuration folder and choose **New module**.

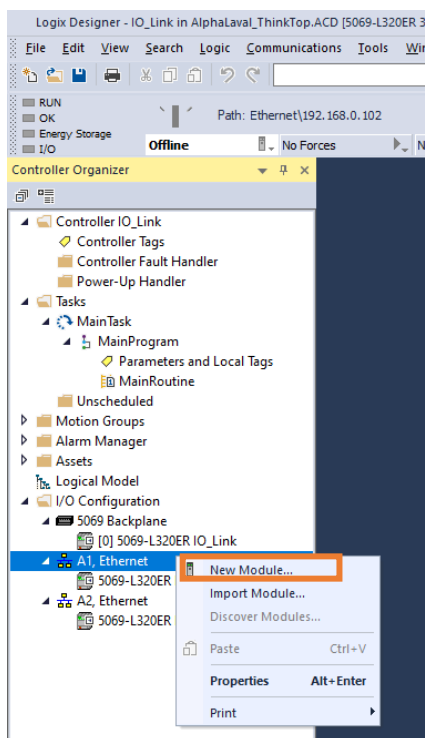
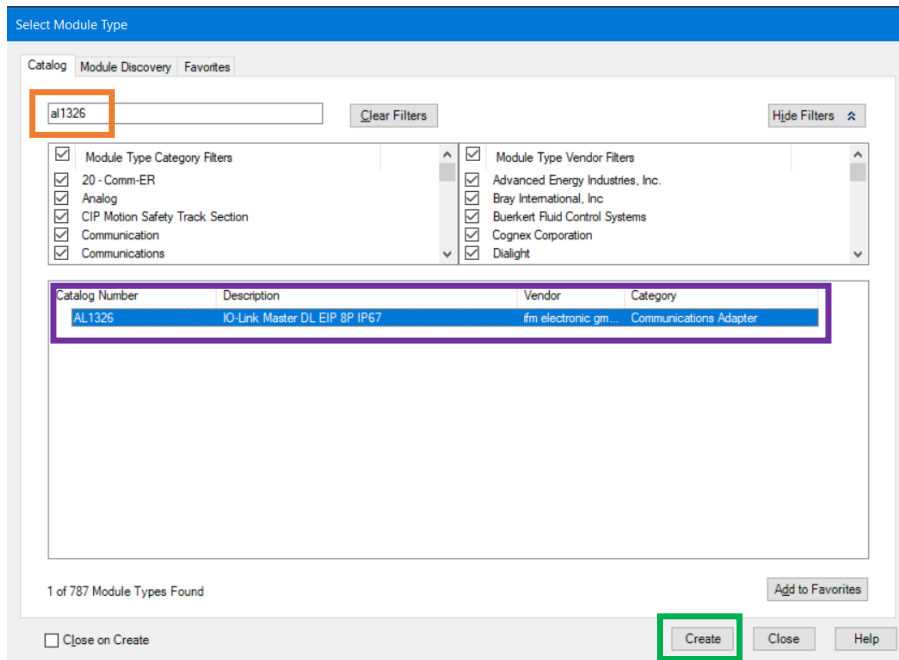


Figure 13

2. Search the article number for the IO-Link master, i.e., **AL1326**. Select the Catalog Number named **AL1x2x** and click **Create** button.



Select Module Type

al1326

Clear Filters

Hide Filters

Module Type Category Filters

- ☒ 20 - Comm-ER
- ☒ Analog
- ☒ CIP Motion Safety Track Section
- ☒ Communication
- ☒ Communications

Module Type Vendor Filters

- ☒ Advanced Energy Industries, Inc.
- ☒ Bray International, Inc.
- ☒ Burkert Fluid Control Systems
- ☒ Cognex Corporation
- ☒ Dialight

Catalog Number	Description	Vendor	Category
AL1326	IO-Link Master DL EIP 8P IP67	ifm electronic gm...	Communications Adapter

1 of 787 Module Types Found

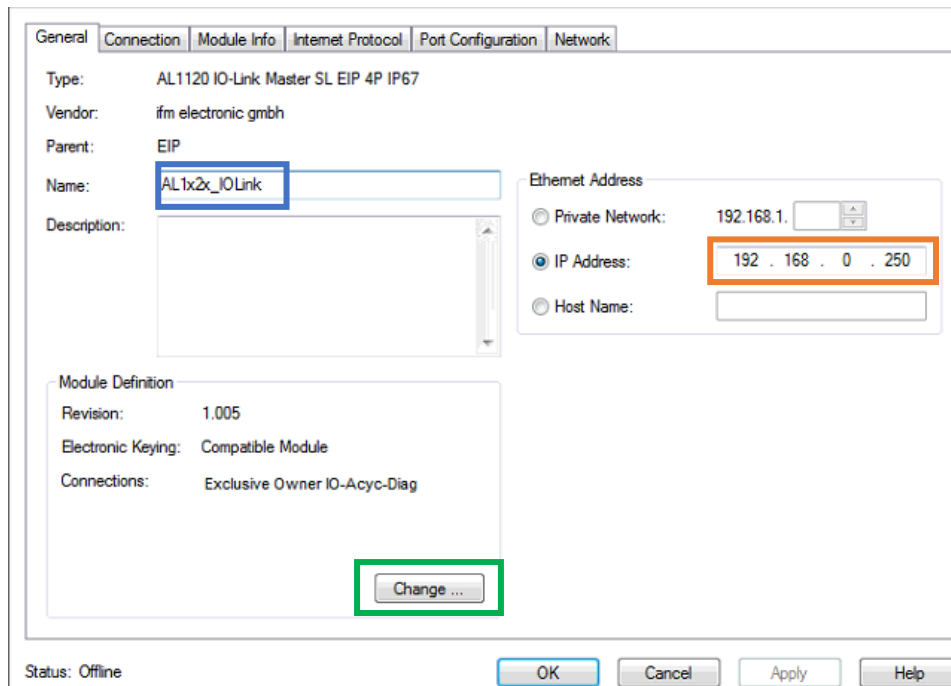
Add to Favorites

☐ Close on Create

Create Close Help

Figure 14

3. Provide a unique **Name** and **IP address** for the Ethernet module.
4. Click **Change** button to open the Module Definition Window.



General Connection Module Info Internet Protocol Port Configuration Network

Type: AL1120 IO-Link Master SL EIP 4P IP67

Vendor: ifm electronic gmbh

Parent: EIP

Name: AL1x2x_IOLink

Description:

Ethernet Address

Private Network: 192.168.1.

IP Address: 192.168.0.250

Host Name:

Module Definition

Revision: 1.005

Electronic Keying: Compatible Module

Connections: Exclusive Owner IO-Acyc-Diag

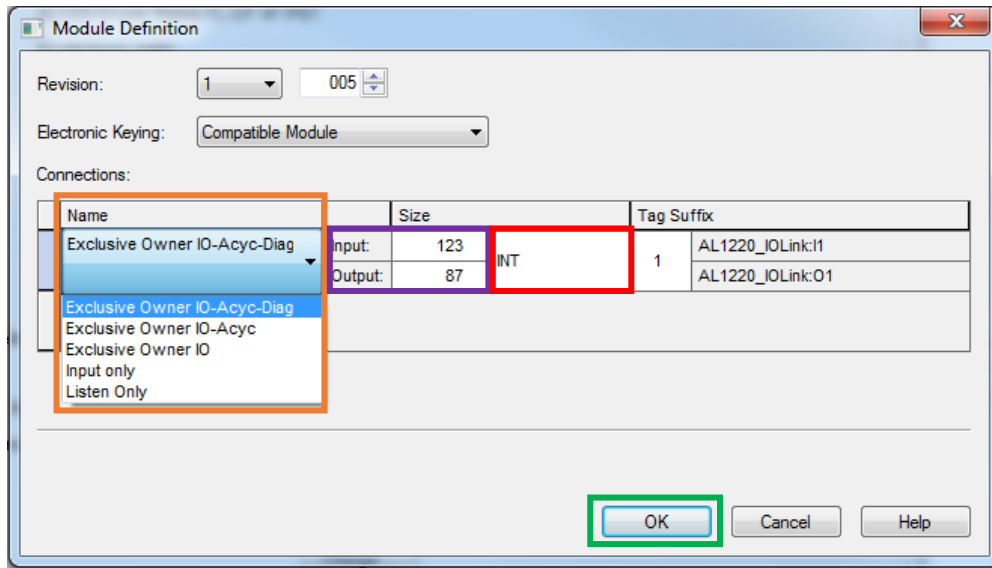
Change ...

Status: Offline

OK Cancel Apply Help

Figure 15

5. In the Module Definition window, select **Exclusive Owner IO-Acyc-Diag** in the name field.
6. Change the Size type from **SINT** to **INT**.
7. Verify the default size.
 - a. 4 port Modules **Input=123 Output=87**
 - b. 8 port Modules **Input=223 Output=151**
8. Click **OK** to complete the Module Setup

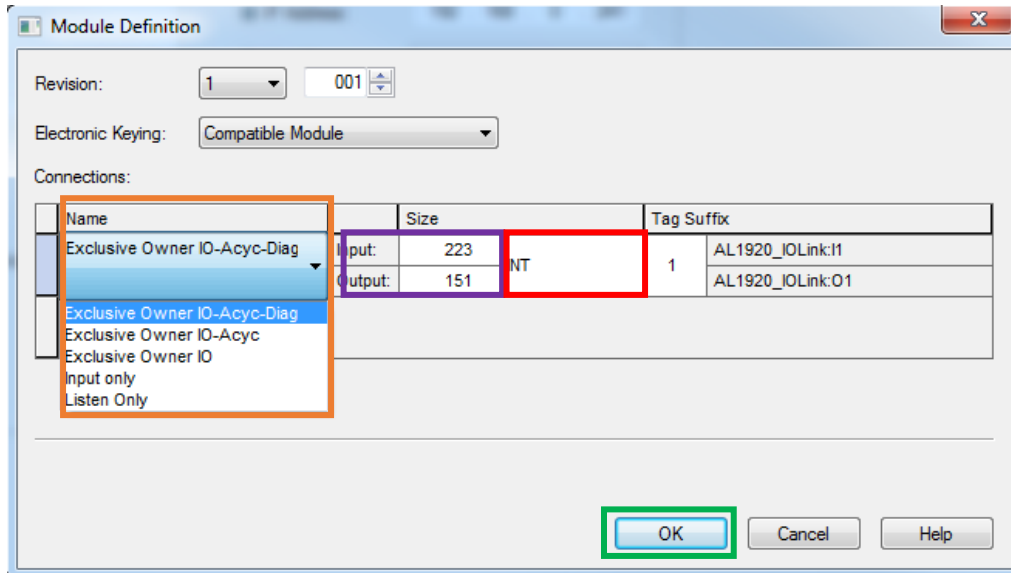


Module Definition window showing the configuration for a module. The Revision is 1, and the Electronic Keying is set to Compatible Module. The Connections table is as follows:

Name	Size	Tag Suffix
Exclusive Owner IO-Acyc-Diag	Input: 123	1
Exclusive Owner IO-Acyc-Diag	Output: 87	AL1220_IOLink:01

The Size column is highlighted in red, and the OK button is highlighted in green.

Figure 16



Module Definition window showing the configuration for a module. The Revision is 1, and the Electronic Keying is set to Compatible Module. The Connections table is as follows:

Name	Size	Tag Suffix
Exclusive Owner IO-Acyc-Diag	Input: 223	1
Exclusive Owner IO-Acyc-Diag	Output: 151	AL1920_IOLink:01

The Size column is highlighted in red, and the OK button is highlighted in green.

Figure 17



9. Verify the configuration of the AL1x2x IO-Link master in the PLC project by navigating to the Controller Organizer. Double click on **Controller Tags** to find the **Input Array** of size 223 INT (8 port) or 123 INT (4 port) and **Output Array** of size 151 INT (8 port) or 87 INT (4 port).
10. A **<IOLinkMasterName>:C** tag array is also assigned to the Controller tags. These are settings used to configure the IO-Link master. No changes to the settings are needed to send and receive process data to the ThinkTop valves.

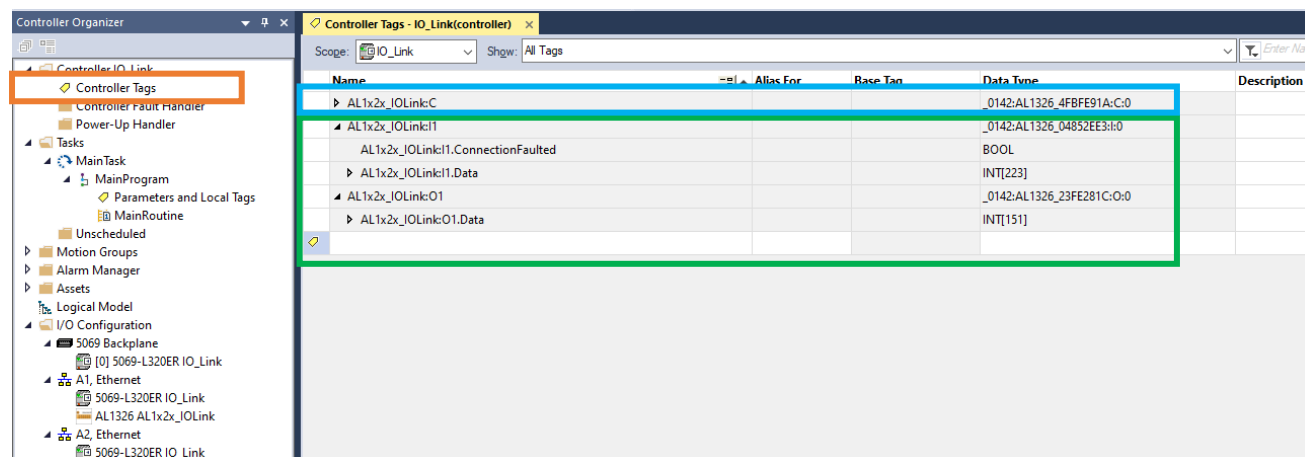


Figure 18

5.4 Requested Packet Interval (RPI) of the ifm IO-Link Ethernet module

The RPI time of the ifm IO-Link master Ethernet/IP module is the polling rate in which the PLC will update the input and output controller tags. The default setting is 10 ms. The possible setting range is 1.0-1000.0 ms.

1. To adjust the RPI time, right click on the **Ethernet/IP module** and select **Properties**.

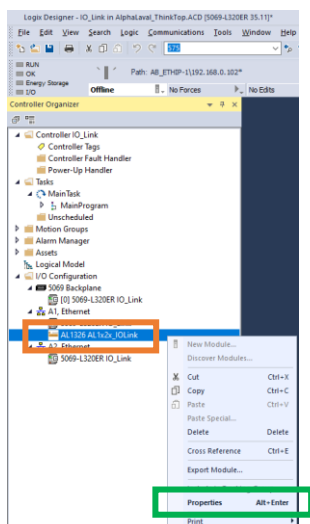


Figure 19

2. In the **Module Properties** window, select **Connection** and adjust the **RPI** field within the 10.0-9999.9 range. Click **OK** to accept the change.

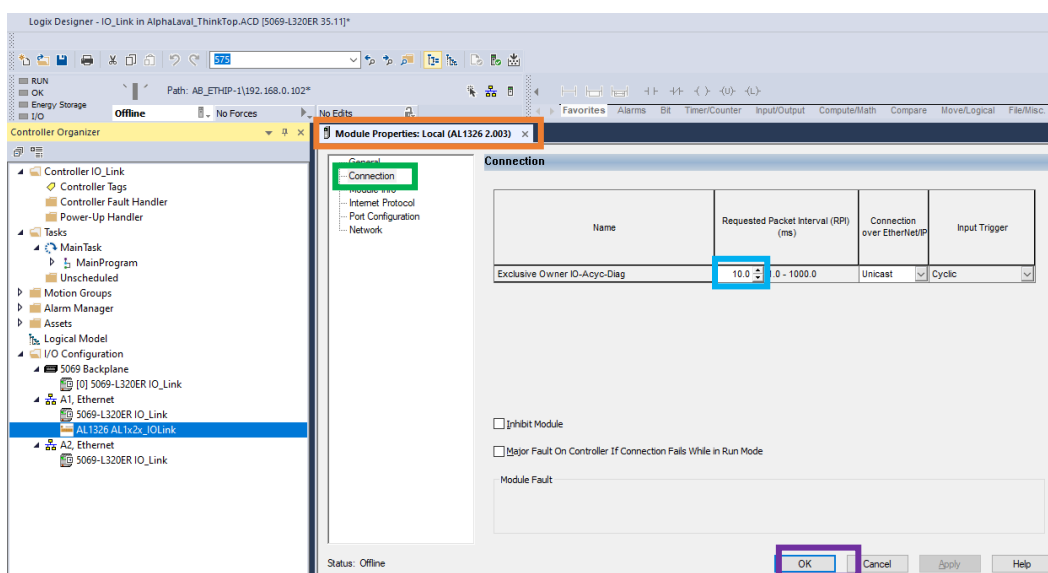


Figure 20

6 Integrate the ThinkTopVx0_nPORT_IOL to the PLC project's logic

Section 6.1 and 6.2 show instructions while offline with the PLC. It is also possible to perform the importing methods while online.

6.1 Import the Add-On Instruction

1. In the Controller Organizer, expand the **Assets** folder. Right click Add-On Instruction and select **Import Add-On Instruction...**

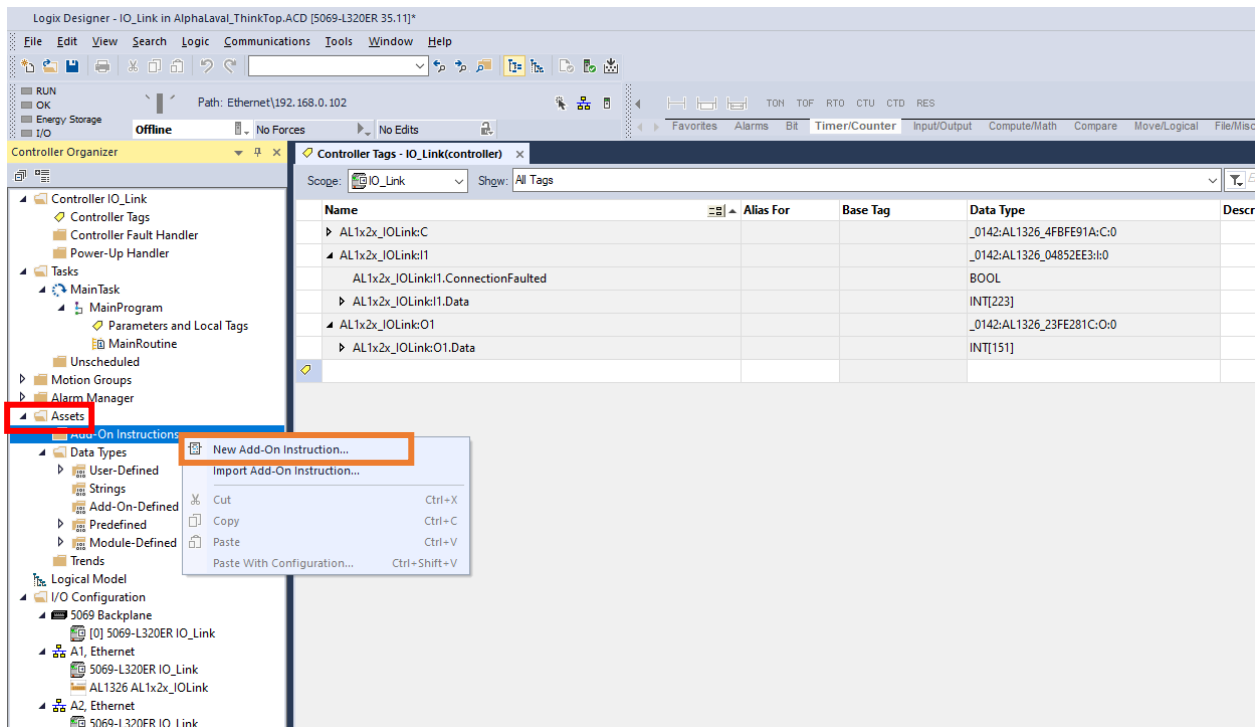


Figure 21

2. Select **ThinkTopVx0_nPort_IOL.L5X** from the folder named "2. Add_On Instruction" in the ThinkTop_EIP_AllenBradley_StartupPackage and click **Open**.

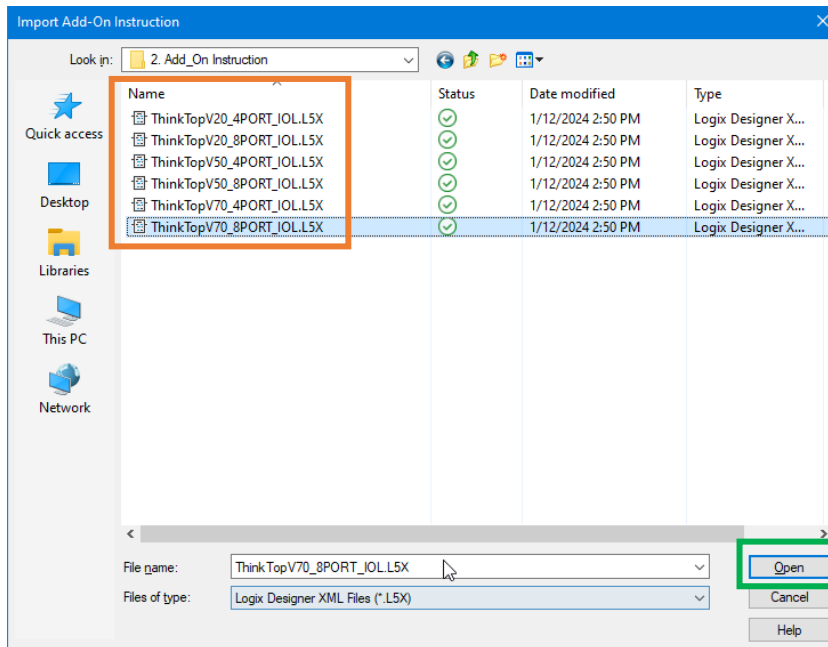


Figure 22

3. Click **Open** to Import.

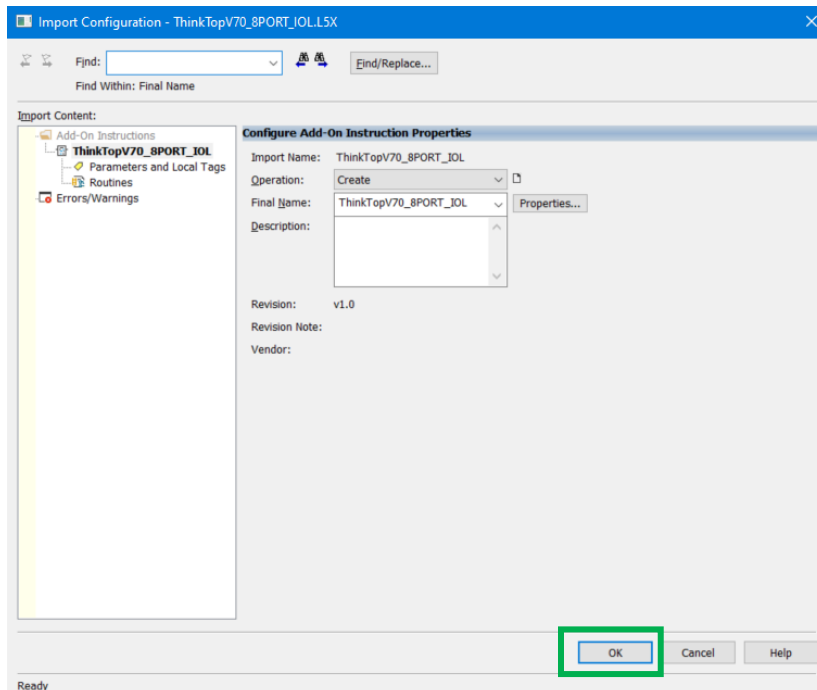


Figure 23

4. The **ThinkTopVx0_nPORT_IOL** Add-On Instruction is displayed in the Add-On Instructions folder.

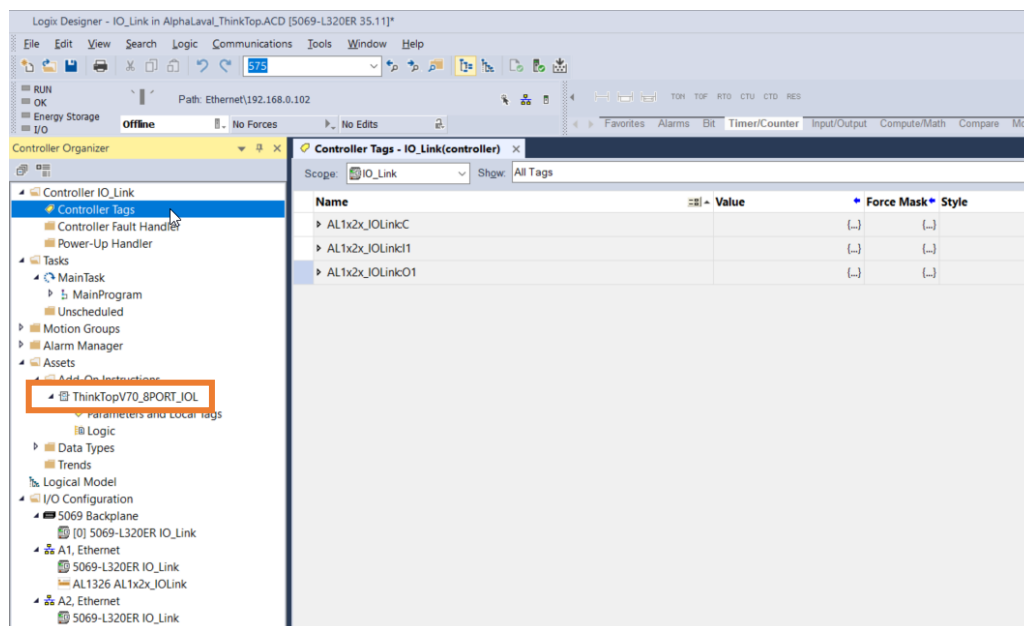


Figure 24

6.2 Integrate the ThinkTopVx0_nPORT_IOL Add-On Instruction in a routine

1. Click and drag the **ThinkTopVx0_nPORT_IOL** Add-On Instruction onto a rung of logic.

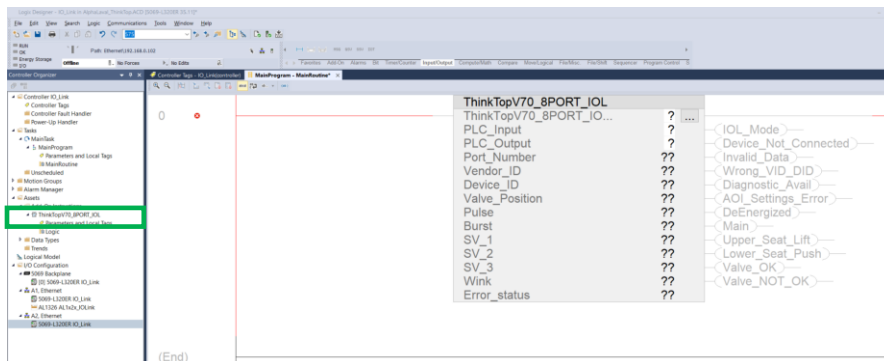


Figure 25

2. Define the Add-On Instruction tag name. Right click **?** and click **New Tag**.

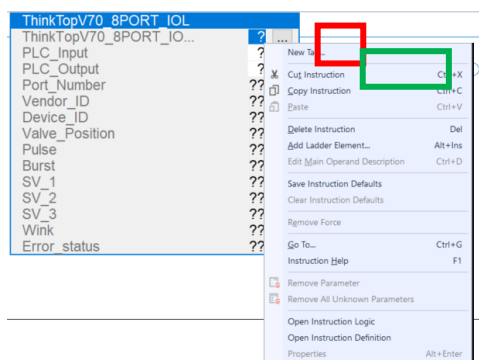


Figure 26

3. Create a **user defined name** and click **Create**.

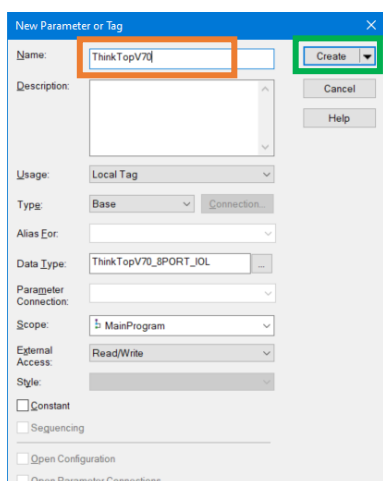


Figure 27

4. Assign the PLC_Input and PLC_Output tags using the ifm IO-Link master's producing **input data array** and consuming **output data array** from the Controller Tags.

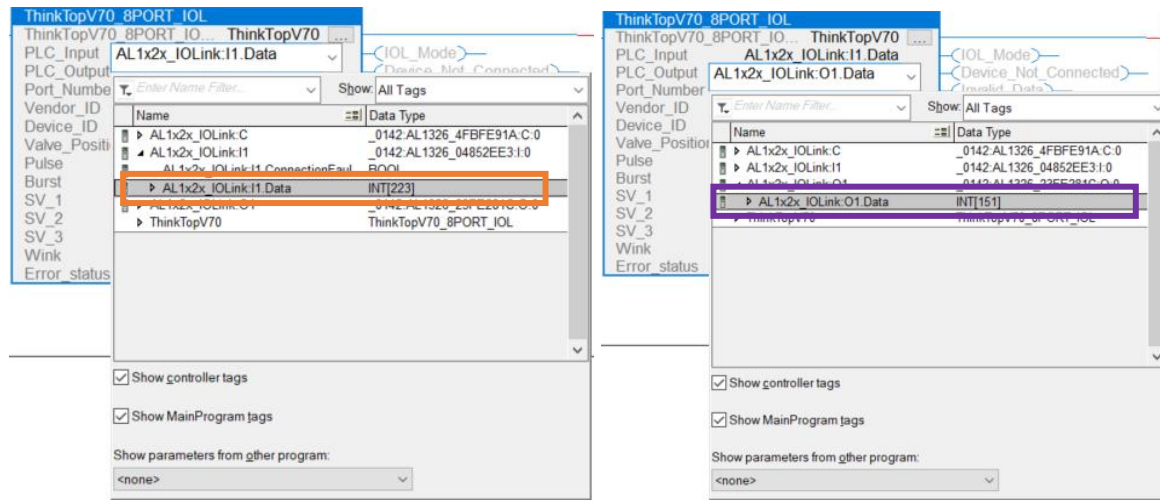


Figure 28

5. Enter the port number of the IO-Link master where the ThinkTop valve is connected.
Value = 1..4 (four port masters) or **Value = 1..8** (eight port masters)

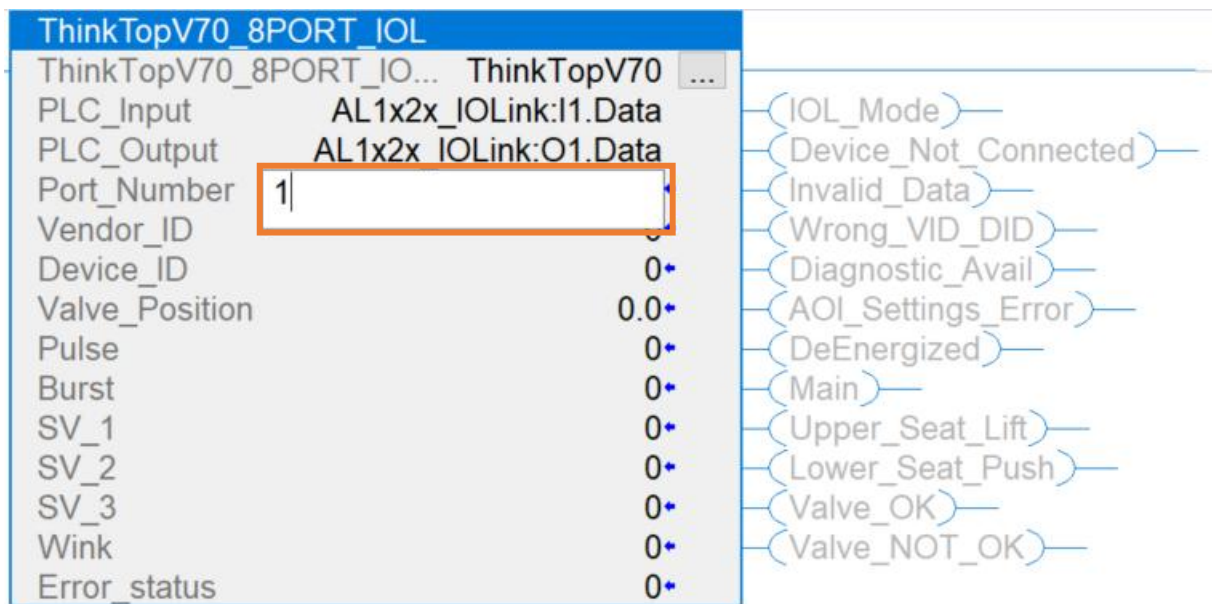


Figure 29

6. The rung is complete with no errors.

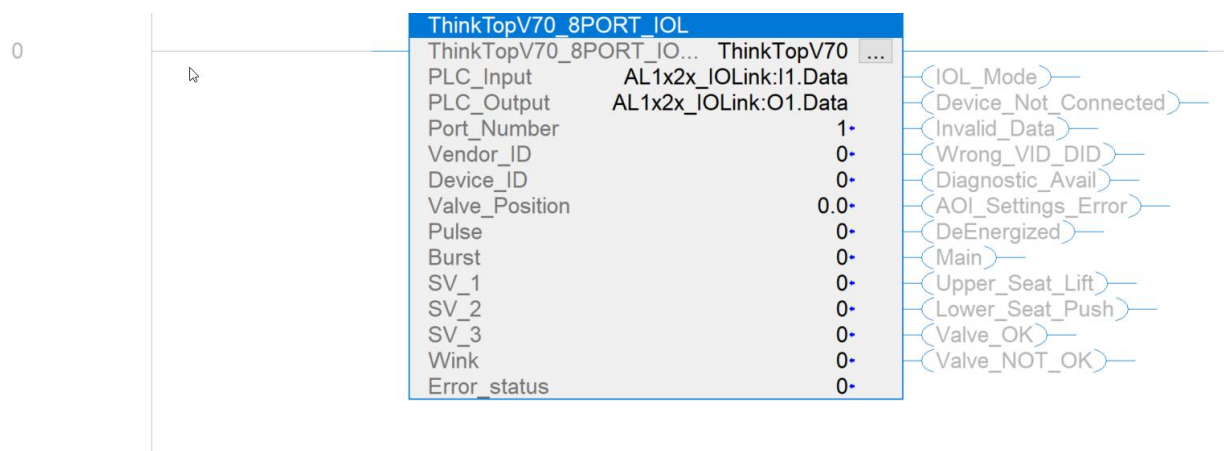


Figure 30

7. If the previous steps were made offline, the Add-On Instruction is ready to be downloaded to the PLC.
If the previous steps were made online, the pending edits are ready to be finalized.

7 ThinkTopVx0_nPORT_IOL Parameter Data Types and Descriptions

ThinkTopV70_8PORT_IOL			
ThinkTopV70_8PORT_IO...	ThinkTopV70	...	
PLC_Input	AL1x2x_IOLink:I1.Data		IOL_Mode
PLC_Output	AL1x2x_IOLink:O1.Data		Device_Not_Connected
Port_Number	1*		Invalid_Data
Vendor_ID	0*		Wrong_VID_DID
Device_ID	0*		Diagnostic_Avail
Valve_Position	0.0*		AOI_Settings_Error
Pulse	0*		DeEnergized
Burst	0*		Main
SV_1	0*		Upper_Seat_Lift
SV_2	0*		Lower_Seat_Push
SV_3	0*		Valve_OK
Wink	0*		
Error_status	0*		

Figure 31

7.1 Add-On Instruction Output Parameter tags: Values produced to the PLC

Vendor_ID:	Static integer (INT) value produced by when IO-Link device is connected to the IO-Link master. For Alfa Laval products value= 1292 decimal / 0x050C hex
Device_ID:	Static double integer (DINT) value produced by when IO-Link device is connected to the IO-Link master. Value will change depending on IO-Link device.
Valve_Position:	Current valve position of data type REAL. Represents the actual distance between the top of the valve actuator and the top of the valve stem. Value range will change depending on valve used. See IO-Link Device Description pdf. Units in millimeters. If not data value =3276.4
Error_Status:	Short description of the current error of data type integer (INT). Troubleshooting advice is available in the Instruction manual. Value range: 0: Everything is OK 16: Sensor target missing 17: Setup prerequisite issue 18: Pneumatic part issue 19: Seat lift sensor issue 20: Position not reached 21: Unexpected movement 22: Seat-lift sensor missing 23: Pilot valve 1 missing 24: Pilot valve 2 missing 25: Pilot valve 3 missing 26: Interlock active 27: Output short circuit 28: Setup aborted 29: Blocked button 30: Communication failure



31: Safety stop active

- IOL_Mode:** Binary (BOOL) indication of operating mode of the IO-Link master port.
Value range - TRUE (IO-Link mode) .. FALSE (port has been set to disabled, digital input or digital output mode)
Note: The eds file installation defaults all ports to IO-Link mode. The port mode is changed in the configuration controller tags.
- Device_Not_Connected:** Binary (BOOL) indication of the connection status to IO-Link device on the port
Value range – FALSE (an IO-Link device is connected) .. TRUE (an IO-Link device is not connected)
- Invalid_Data:** Binary (BOOL) indication of the IO-Link device's process data.
Value range - FALSE (valid) .. TRUE (invalid)
- Wrong_VID_DID:** Binary (BOOL) indication of the match between configured and recognized Vendor ID / Device ID
Value range - FALSE (both Vendor ID and Device ID match the configuration set in the Validation Data Storage settings in the configuration controller tag of the IO-Link master) .. TRUE (either the vendor ID and/or device ID does not match the Validation Data Storage settings)
- Diagnostic_Avail:** Binary (BOOL) indication of the presence of IO-Link Event data.
Value range - FALSE (no event data present) .. TRUE (event data present)
Note: Most commonly used to detect when automatic device replacement has taken place.
When an IO-Link device is detected and the Vendor ID and Device ID match the configured settings then the Diagnostic_Avail output will be true for 10 seconds and then goes false.

See Appendix A for instructions to set the validation data storage (automatic device replacement) settings.
- AOI_Settings_Error:** Binary (BOOL) indication of at least one, Add-On Instruction user input error.
Value Range – FALSE (No error present) .. TRUE (at least one error present)
- DeEnergized:** Valve position is in the De-energized state
Value Range – FALSE (inactive) .. TRUE (active)
- Main:** Valve position is in the main energized position.
Value Range – FALSE (inactive) .. TRUE (active)
- Upper_Seat_Lift:** Upper Seat Lift energized position
Value Range – FALSE (inactive) .. TRUE (active)
- Lower_Seat_Lift:** Lower seat lift energized position
Value Range – FALSE (inactive) .. TRUE (active)
- Valve_OK:** Current Valve state
Value Range – TRUE (Valve system is OK) .. FALSE (Valve system NOT OK)

7.2 Add-On Instruction Input Parameter tags: Values consumed by the PLC

- Pulse:** User controlled binary setting (BOOL) to trigger one clean pulse on SV 1.
The pulse stroke length can be customized via acyclic commands. See IO-Link Device Description pdf for the list of possible commands.
Value range - FALSE (Disable) .. TRUE (Enable)
- Burst:** User controlled binary setting (BOOL) to enable burst clean
Value range - FALSE (Disable) .. TRUE (Enable)
- SV1:** User controlled binary setting (BOOL) to trigger solenoid valve 1 for main valve activation
Value range - FALSE (Disable) .. TRUE (Enable)
- SV2:** User controlled binary setting (BOOL) to trigger solenoid valve 2 for upper seat lift activation
Value range - FALSE (Disable) .. TRUE (Enable)
- SV3:** User controlled binary setting (BOOL) to trigger solenoid valve 3 for lower seat push activation
Value range - FALSE (Disable) .. TRUE (Enable)
- Wink:** User controlled binary setting (BOOL) to trigger a Visual indication for locating the unit (Purple flashing as default)
Value range - FALSE (Disable) .. TRUE (Enable)

8. Data Storage of IO-Link device information (optional)

The Data Storage feature can be used to:

- Check Vendor ID and Device ID match was is currently connected.
- Quickly and easily replace an IO-Link device and its parameters.

- Configure the ThinkTop for the application as needed.
- In the Controller Organizer, double click **Controller Tags**.
- Expand the **Configuration Controller tag** of the IO-Link master's Ethernet Module

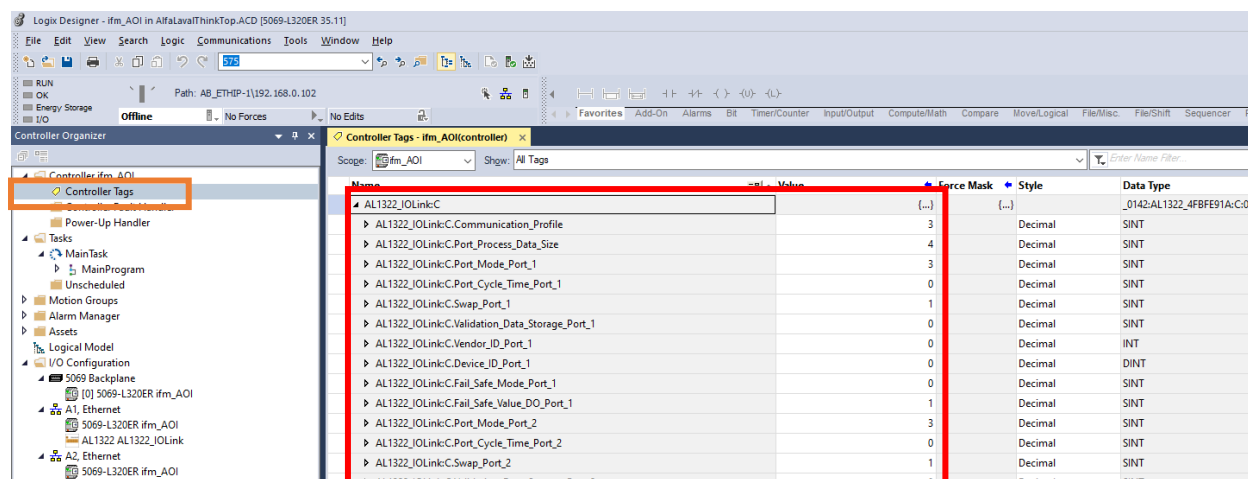


Figure 32

4. Find the Validation Data Storage setting for the port number to be configured and enter the a value to set the type of data storage needed for the application.
Value Range – 0: **No check and clear.** No parameter restoration is enabled and the IO-Link master memory area for the port's parameters is empty.
 - 2: **Verify Vendor ID and Device ID match only.** No restoration of parameters is enabled.
 - 3: **Verify Vendor ID and Device ID match and restore last set parameters.**
The IO-Link device's onboard methods (push buttons, displays, IO-Link software, etc...) for setup and configuration is allowed.
Any changes made are uploaded and stored in the IO-Link master.
If the IO-Link device is disconnected and reconnected the last parameters will be restored to the replaced device.
 - 4: **Verify Vendor ID and Device ID match and restore original parameters.**
The IO-Link device's parameters will be uploaded one time. No adjustments to the parameters (push buttons, displays, IO-Link software, etc...) are allowed.
If the IO-Link device is disconnected and reconnected the originally uploaded parameters will be downloaded to the currently connected IO-Link device.
Changes to the IO-Link device's parameters are only allowed by the PLC using acyclic commands. However, the changes are not saved in the IO-Link master and if the IO-Link device is disconnected and reconnected the original parameters set will be restored.

Controller Tags - ifm_AOI(controller)					
Scope: ifm_AOI		Show: All Tags		Enter Name Filter...	
Name	Value	Force Mask	Style	Data Type	
AL1322_IOLinkC		{...}	{...}	_0142:AL1322_4FBFE91A:C:0	
AL1322_IOLinkC.Communication_Profile		3	Decimal	SINT	
AL1322_IOLinkC.Port_Process_Data_Size		4	Decimal	SINT	
AL1322_IOLinkC.Port_Mode_Port_1		3	Decimal	SINT	
AL1322_IOLinkC.Port_Cycle_Time_Port_1		0	Decimal	SINT	
AL1322_IOLinkC.Swap_Port_1		1	Decimal	SINT	
AL1322_IOLinkC.Validation_Data_Storage_Port_1		4	Decimal	SINT	
AL1322_IOLinkC.Vendor_ID_Port_1		0	Decimal	INT	
AL1322_IOLinkC.Device_ID_Port_1		0	Decimal	DINT	
AL1322_IOLinkC.Fail_Safe_Mode_Port_1		0	Decimal	SINT	
AL1322_IOLinkC.Fail_Safe_Value_DO_Port_1		1	Decimal	SINT	
AL1322_IOLinkC.Port_Mode_Port_2		3	Decimal	SINT	
AL1322_IOLinkC.Port_Cycle_Time_Port_2		0	Decimal	SINT	
AL1322_IOLinkC.Swap_Port_2		1	Decimal	SINT	
AL1322_IOLinkC.Validation_Data_Storage_Port_2		0	Decimal	SINT	
AL1322_IOLinkC.Vendor_ID_Port_2		0	Decimal	INT	
AL1322_IOLinkC.Device_ID_Port_2		0	Decimal	DINT	
AL1322_IOLinkC.Fail_Safe_Mode_Port_2		0	Decimal	SINT	
AL1322_IOLinkC.Fail_Safe_Value_DO_Port_2		1	Decimal	SINT	
AL1322_IOLinkC.Port_Mode_Port_3		3	Decimal	SINT	
AL1322_IOLinkC.Port_Cycle_Time_Port_3		0	Decimal	SINT	
AL1322_IOLinkC.Swap_Port_3		1	Decimal	SINT	
AL1322_IOLinkC.Validation_Data_Storage_Port_3		0	Decimal	SINT	

Figure 32: port 1 is set to Verify Vendor ID and Device ID match

5. Enter the Vendor ID in the llllll setting.
6. Enter the Device ID in the iiiiii setting.
7. If the following adjustments were made online, then the settings will not take place until the Ethernet/IP communication is cycled. The following actions will cycle the Ethernet/IP communication:
 - a. Manually inhibit the Ethernet/IP module and uninhibit the Ethernet/Module



- b. Cycle power on the IO-Link master
- c. Use logic with SSV instruction.