



ThinkTopVx0 Programming Guide for Siemens TIA Portal

ThinkTop V20, V50, V55, V70





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1. Preliminary notes

This document demonstrates:

1. Profinet communication between an ifm AL1x0x IO-Link Master and a Siemens controller.
2. Integrating the ThinkTop function block into a PLC project

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2. Intended Use

The ThinkTopVx0 function block provides a logical user interface to ThinkTop Valves.

The function block 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. TIA Portal V15.1 or higher software.
2. An ifm IO-Link master AL110x, AL120x, AL130x, AL140x, AL190x.
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...**

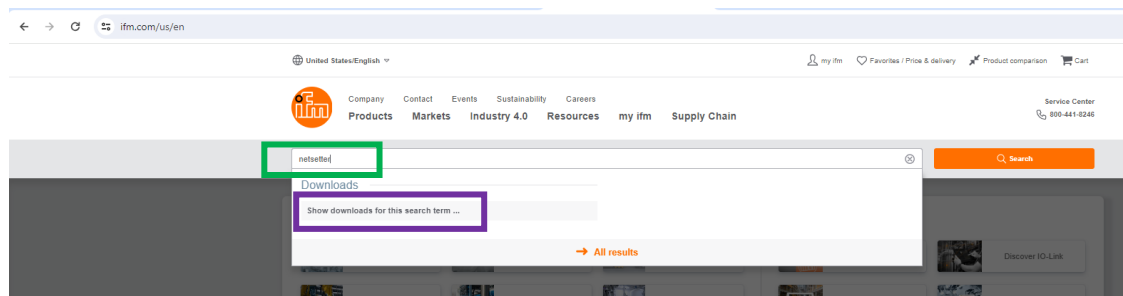


Figure 1



4. Click the **Download** button.

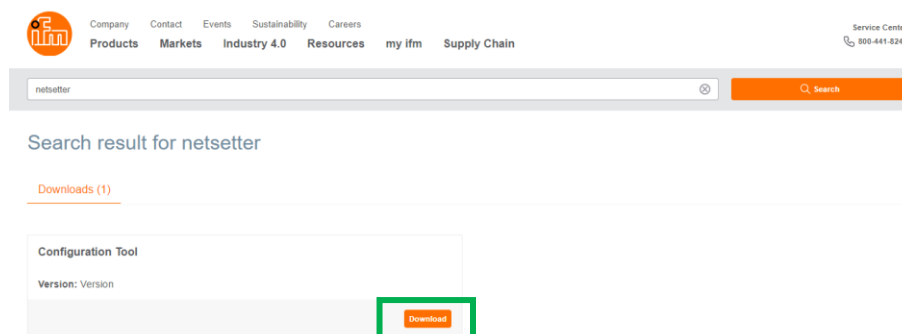


Figure 2

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.



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**.

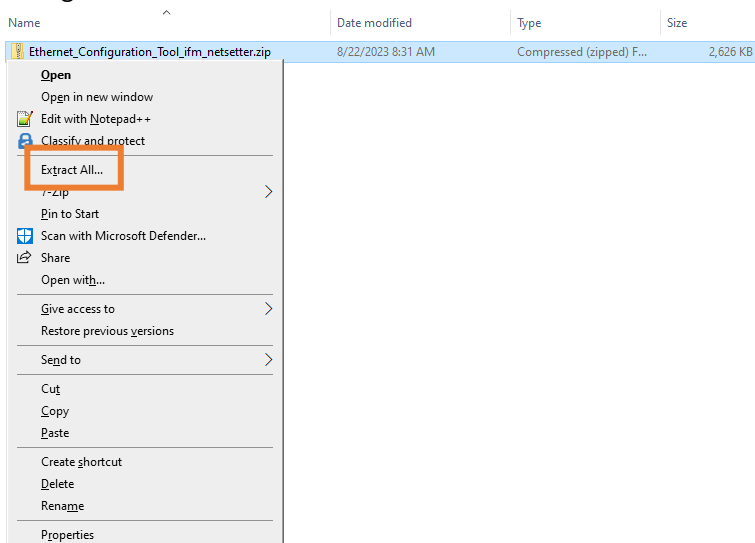


Figure 4

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

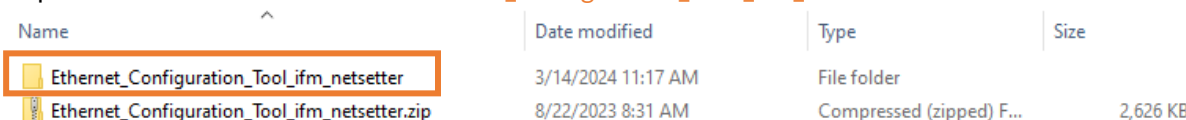


Figure 5

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

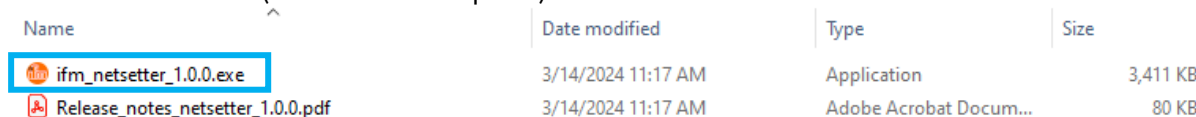


Figure 6

9. Connect an Ethernet cable to the port labeled X21 (Profinet) and scan this port. Here you are able to change the IP Settings of the Profinet Port.

For Dataline IO-Link Modules (AL130x or AL190x) you can also connect an Ethernet cable to the port labeled X23 (IoT) and scan this port. Here you are able to change the IP Settings of the IoT Port.

5. Integrate the ThinkTopVx0 TIA Solution 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.

5.1. Import the Global library

1. Open "Options, Global libraries, Open Library."

Please select file type "Compressed library", and the library is converted to the higher version.

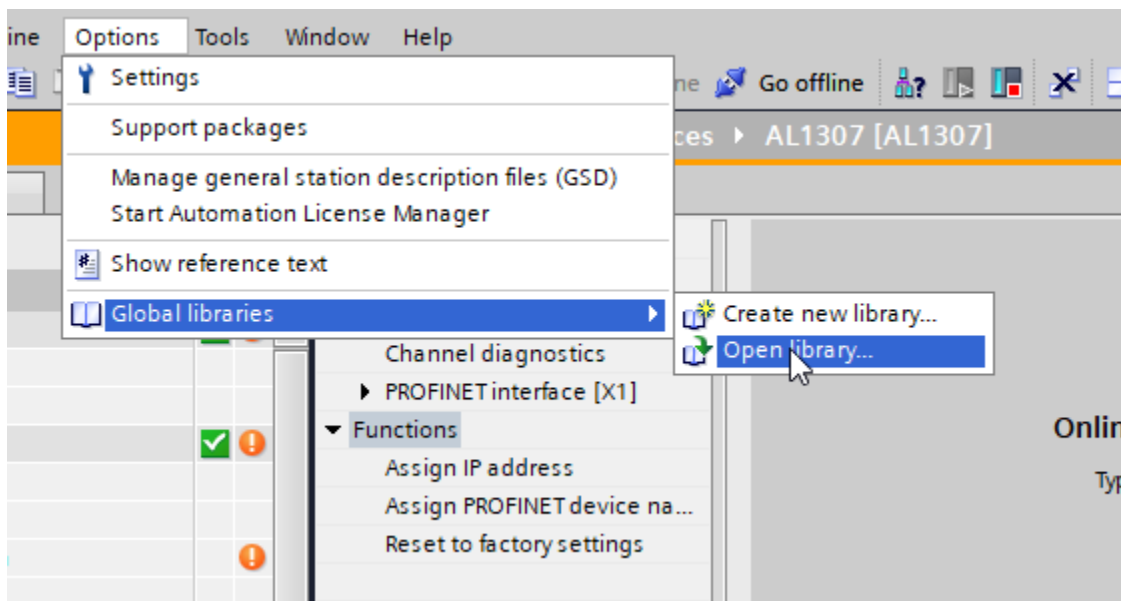


Figure 7

2. In the Libraries section, click on “Open global library”. Here you find Data types & Program blocks.

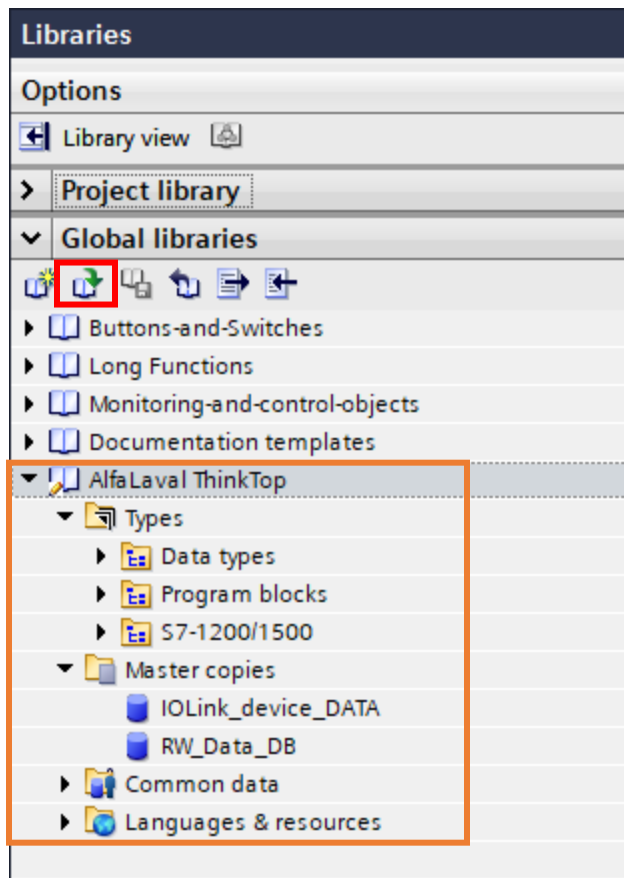


Figure 8

3. Import the datatypes with Drag & Drop to your “PLC data types”.

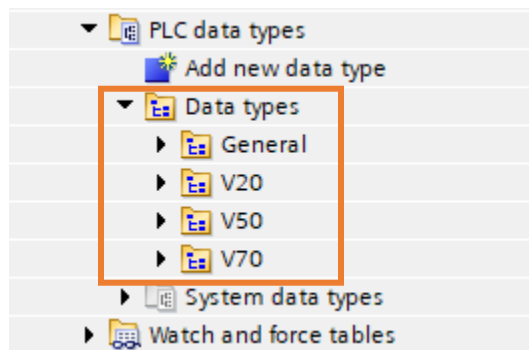


Figure 9

4. Import the “Program blocks”.

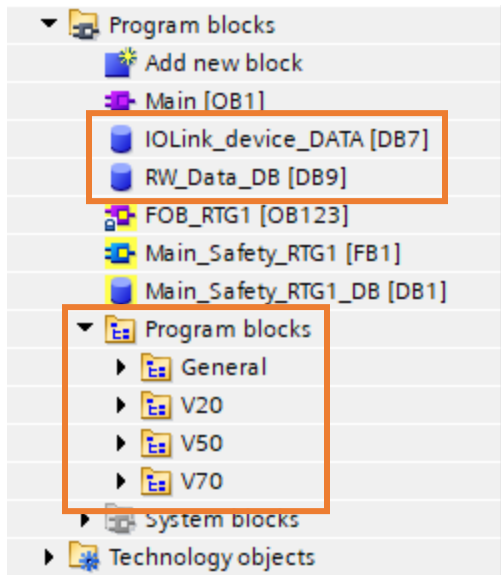


Figure 10

5.2. Integrate the ThinkTopVx0 function block in a program block

1. Click and drag the **V20** function block onto a rung of logic.

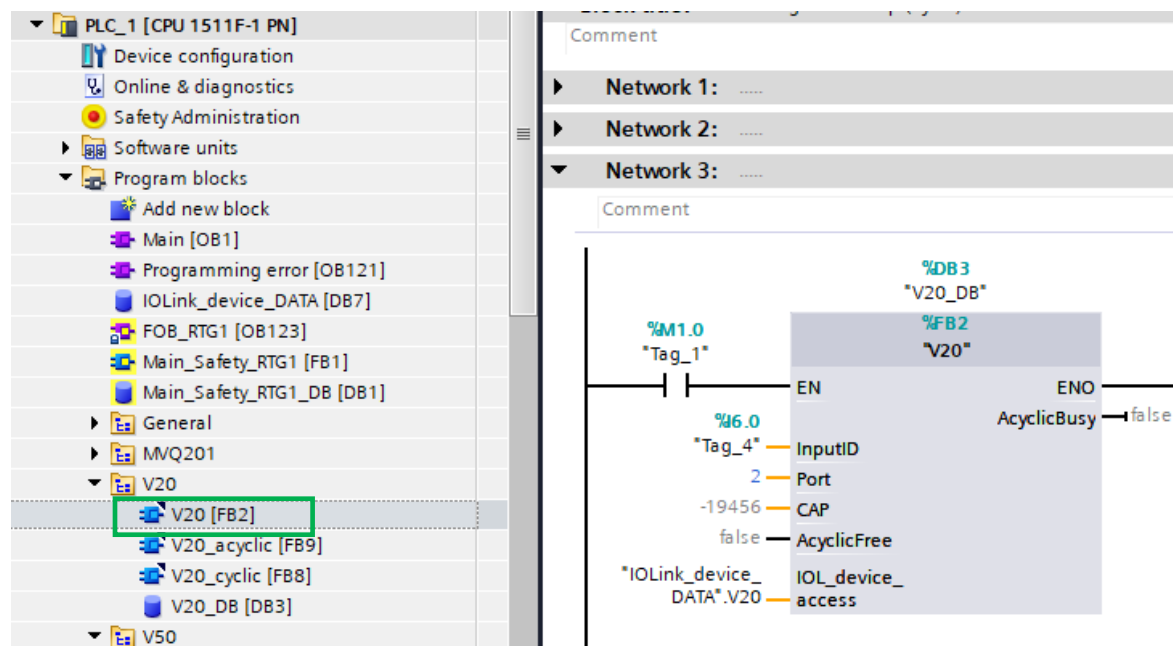


Figure 11

2. Take the input address of the connected slot **Input address** and the Port.

The screenshot shows the 'Device overview' table for the AL1306 module. The table has columns for Module, Rack, Slot, I address, Q address, Type, and Article no. The 'IOLink Master Proxy' module is highlighted, and its 'IOLink 4 I_1 O Byte + PQI' module is also highlighted. The 'I address' for this module is '6...10', which is circled in green.

Module	Rack	Slot	I address	Q address	Type	Article no.
AL1306	0	0			AL1306	AL1306
PNHO	0	0	X1		AL1306	
8 Ports_1	0	1			8 Ports	
IO-Link Master Proxy	0	1	IOL...	0	IO-Link Master Proxy	
IO-Link 4 I_1 O Byte + PQI	0	1	X01	0	IO-Link 4 I_1 O ...	
IO-Link 4 I_1 O Byte + PQI_1	0	1	X02	1	IO-Link 4 I_1 O ...	
	0	1	X03			
	0	1	X04			
	0	1	X05			
	0	1	X06			
	0	1	X07			
	0	1	X08			

Figure 12

3. Assign the data structure **V20** to the input “IOL_device_access”. When you have more devices, just define a new variable with this data type.

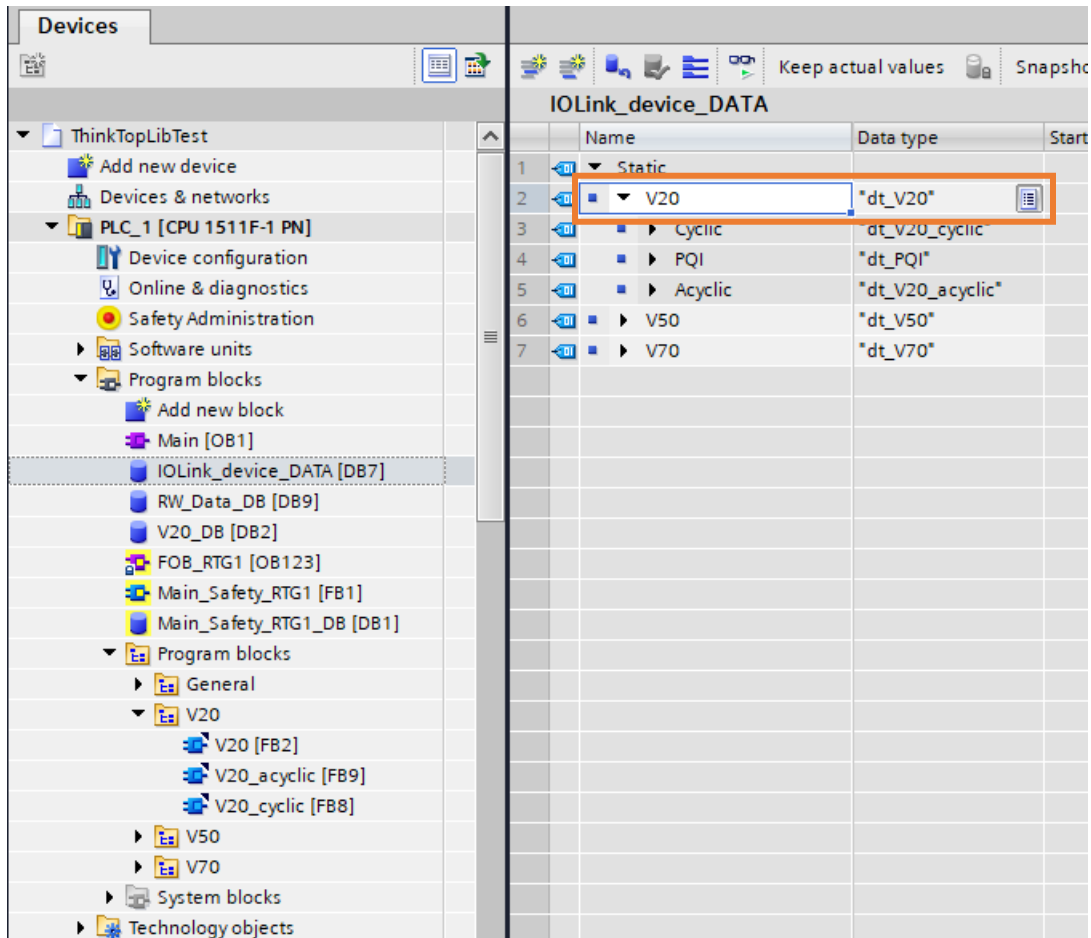


Figure 13

6. ThinkTopVx0 Types and Descriptions

6.1. Vx0 structure

dt_V70								
	Name	Data type	Default value	Accessible f...	Writa...	Visible in ...	Setpoint	Comment
1	▼ Cyclic	"dt_V70_cyclic"		☒	☒	☒	☐	
2	Valve_position	Real	0.0	☒	☒	☒	☐	Input: Valve position
3	DE_EN	Bool	false	☒	☒	☒	☐	Input: De-Energized
4	MAIN	Bool	false	☒	☒	☒	☐	Input: Main energised Position
5	USL	Bool	false	☒	☒	☒	☐	Input: Upper seat lift energised position
6	LSP	Bool	false	☒	☒	☒	☐	Input: Lower seat push energised position
7	Valve_State	Bool	false	☒	☒	☒	☐	Input: Current valve state
8	Error_status	UInt	0	☒	☒	☒	☐	Input: Error status
9	Pulse	Bool	false	☒	☒	☒	☐	Output: Pulse
10	Burst	Bool	false	☒	☒	☒	☐	Output: Burst
11	SV_1	Bool	false	☒	☒	☒	☐	Output: SV1
12	SV_2	Bool	false	☒	☒	☒	☐	Output: SV2
13	SV_3	Bool	false	☒	☒	☒	☐	Output: SV3
14	Wink	Bool	false	☒	☒	☒	☐	Output: Wink
15	▼ PQI	"dt_PQI"		☒	☒	☒	☒	
16	DI4	Bool	false	☒	☒	☒	☐	Digital input pin 4
17	DI2	Bool	false	☒	☒	☒	☐	Digital input pin 2
18	DA	Bool	false	☒	☒	☒	☐	Device available
19	DE	Bool	false	☒	☒	☒	☐	Device error
20	PQ	Bool	false	☒	☒	☒	☐	Port qualifier
21	▼ Acyclic	"dt_V70_acyclic"		☒	☒	☒	☐	TITLE: MVQAUTHOR : hchFAMILY : MVDEVICEI
22	► Identification	Struct		☒	☒	☒	☐	
23	► Application	Struct		☒	☒	☒	☐	
24	► Parameter	Struct		☒	☒	☒	☐	
25	► Command	Struct		☒	☒	☒	☐	

Figure 14

6.2. Vx0 cyclic

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

De_En: 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)

USL: Upper Seat Lift energized position
Value Range – FALSE (inactive) .. TRUE (active)

LSP: Lower seat lift energized position
Value Range – FALSE (inactive) .. TRUE (active)

Valve_State: Current valve state



- 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
- 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)

6.3. Vx0 PQI

- DI4: Digital input pin 4
DI2: Digital input pin 2
DA: Device available
DE: Device error
PQ: Port qualifier

6.4. Vx0 acyclic

6.4.1. Vx0 General handling

You have one array element for each datapoint.

e.g. Product name in element [3], you start the request sequence with Start_Read[3]

And get the response in IstText[3] as a String.

For the diagnosis you get a feedback in each struct and element.

IOLink_device_DATA			
	Name	Data type	Start value
1	Static		
2	MVQ201	"dt_MVQ201"	
3	V20	"dt_V20"	
4	Cyclic	"dt_V20_cyclic"	
5	PQI	"dt_PQI"	
6	Acyclic	"dt_V20_acyclic"	
7	Identification	Struct	
8	IstText	Array[1..9] of String	
9	Start_Read	Array[1..9] of Bool	
10	Start_Read[1]	Bool	false
11	Start_Read[2]	Bool	false
12	Start_Read[3]	Bool	false
13	Start_Read[4]	Bool	false
14	Start_Read[5]	Bool	false
15	Start_Read[6]	Bool	false
16	Start_Read[7]	Bool	false
17	Start_Read[8]	Bool	false
18	Start_Read[9]	Bool	false
19	Diagnosis	Array[1..9] of "dt_Diag"	
20	Application	Struct	
21	Parameter	Struct	
22	Command	Struct	
23	V50	"dt_V50"	
24	V70	"dt_V70"	

Figure 15

The same way you handle writing data.

e.g. RGB-Colour error in element [3], you start the writing sequence with Start_Write[3]

And the data from SollText[3] will be written to the device.

IOLink_device_DATA			
	Name	Data type	Start value
1	▼ Static		
2	▢ ▸ MVQ201	"dt_MVQ201"	
3	▢ ▼ V20	"dt_V20"	
4	▢ ▸ Cyclic	"dt_V20_cyclic"	
5	▢ ▸ PQI	"dt_PQI"	
6	▢ ▼ Acyclic	"dt_V20_acyclic"	
7	▢ ▸ Identification	Struct	
8	▢ ▸ Application	Struct	
9	▢ ▼ Parameter	Struct	
10	▢ ▸ IstDword	Array[1..15] of String	
11	▢ ▸ SollDword	Array[1..15] of String	
12	▢ ▸ Start_Read	Array[1..15] of Bool	
13	▢ ▼ Start_Write	Array[1..15] of Bool	
14	▢ Start_Write[1]	Bool	false
15	▢ Start_Write[2]	Bool	false
16	▢ Start_Write[3]	Bool	false
17	▢ Start_Write[4]	Bool	false
18	▢ Start_Write[5]	Bool	false
19	▢ Start_Write[6]	Bool	false
20	▢ Start_Write[7]	Bool	false
21	▢ Start_Write[8]	Bool	false
22	▢ Start_Write[9]	Bool	false
23	▢ Start_Write[10]	Bool	false
24	▢ Start_Write[11]	Bool	false
25	▢ Start_Write[12]	Bool	false
26	▢ Start_Write[13]	Bool	false
27	▢ Start_Write[14]	Bool	false
28	▢ Start_Write[15]	Bool	false
29	▢ ▸ Diagnosis	Array[1..15] of "dt_Diag"	
30	▢ ▸ Command	Struct	
31	▢ ▸ V50	"dt_V50"	

Figure 16

Please use the variable “AcyclicBusy” of each function block as you can see in network 2.

We only have one acyclic channel in each IO-Link master and also the Profinet acyclic communication on the Siemens PLC’s are limited.

You have to be sure that only one acyclic communication is active at the same time.

Use the first input address at “InputID”. The hardware identifier which is necessary for the acyclic communication will be found internally. The port information is nevertheless a must have.

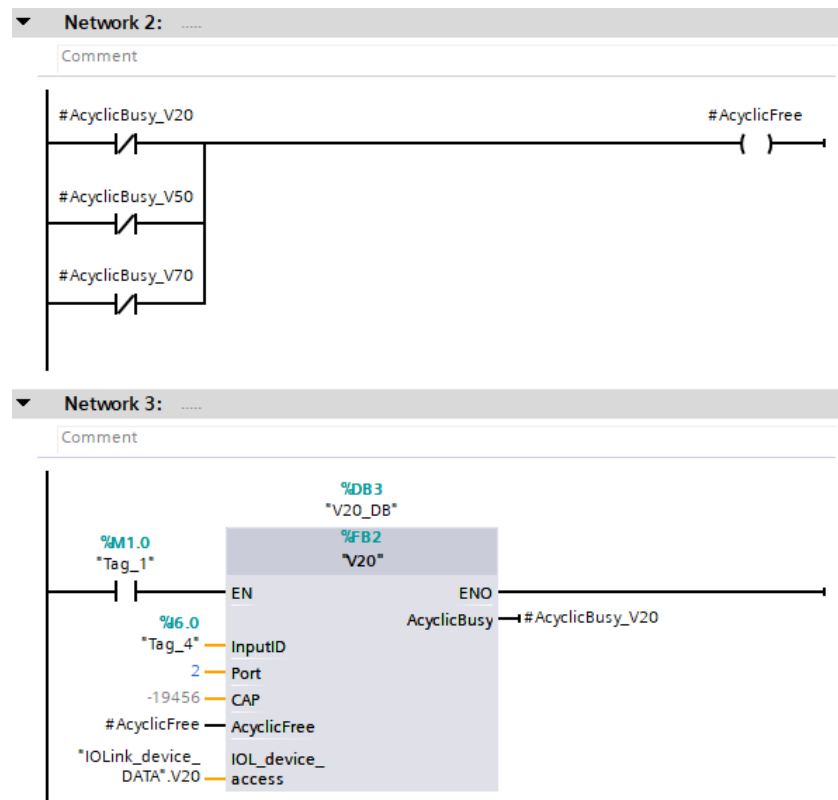


Figure 17



6.4.2. Vx0 Identification

Vendor name:	The vendor name that is assigned to a Vendor ID
Vendor text:	Additional information about the vendor
Product name:	Complete product name
Product ID:	Vendor-specific product or type identification (e.g., item number or model number)
Product text:	Additional product information for the device
Serial number:	Unique, vendor-specific identifier of the individual device
Hardware revision:	Unique, vendor-specific identifier of the hardware revision
Firmware revision:	Unique, vendor-specific identifier of the firmware revision
Production date:	Device production date

6.4.3. Vx0 Application

Application-specific tag:	Possibility to mark a device with user- or application-specific information
Function tag:	Description of the device function
Location tag:	Description of the physical device location

6.4.4. Parameter

6.4.4.1. V20

Index	Subindex		
36		Device Access Locks:	The access to the device parameters can be restricted by setting appropriate flags within this parameter.
37		Device status:	Device status
74	2	RGB-colour error:	RGB colour for error feedback
74	3	RGB-colour out:	RGB colour for Moving (out of any position)
74	4	RGB-colour De-En:	RGB colour for De-Energized position
74	5	RGB-colour Main:	RGB colour for Main position
74	8	RGB-colour Wink:	RGB colour for Wink position
80	1	Log PowerUps:	Logging information - Number of power-cycles
80	2	Log RunTime:	Logging information - Number of operating hours
81	1	Temperature current:	Temperature monitoring - Current core temperature
81	2	Temperature min:	Temperature monitoring - Minimum core temperature to date
81	3	Temperature max:	Temperature monitoring - Maximum core temperature to date
88		Active events:	Active events Bit mask for current
110	1	Setup Pos De-En:	Data for position in current setup - Target switchpoint (De-Energize)
111	1	Setup Pos Main:	Data for position in current setup - Target switchpoint (Main)



6.4.4.2. V50

Index	Subindex		
12		Device Access Locks:	The access to the device parameters can be restricted by setting appropriate flags within this parameter.
36		Device status:	Device status
37		Detailed device status:	Detailed device status
49		BLOB ID	BLOB ID The durations of the latest strokes and the latest events can be exported as data files
66		Valve type:	Detected or configured valve type
67		Setup type:	Type of current setup
70		Error modifier:	The 'position not reached' timeout of the surveillance mode feature is calculated by [stroke duration + error modifier], the error modifier can be modified
73		Power save:	Power save mode will turn off the visual indication when the unit is idle
74	1	RGB-colour button press:	RGB colour for Button press
74	2	RGB-colour error:	RGB colour for error feedback
74	3	RGB-colour out:	RGB colour for Moving (out of any position)
74	4	RGB-colour De-En:	RGB colour for De-Energized position
74	5	RGB-colour Main:	RGB colour for Main position
74	8	RGB-colour Wink:	RGB colour for Wink position
76		Key lock:	Locks the SELECT key on the local user interface to prevent unintentional changes, [Key Lock] is reset-table at the device.
78	1	Seat valve pulse De-En:	Pulse clean. Sets the travel distance of the seat during a pulse from De-En position.
78	2	Seat valve pulse Main:	Pulse clean. Sets the travel distance of the seat during a pulse from Main-En position.
79	1	Rotary valve pulse De-En:	Pulse clean. Sets the travel distance of the stem during a pulse from De-En position. Note: The relation between the stem movement and disc angle is not linear in a LKLA.
79	2	Rotary valve pulse Main:	Pulse clean. Sets the travel distance of the stem during a pulse from Main-En position. Note: The relation between the stem movement
80	1	Log PowerUps:	Logging information - Number of power-cycles
80	2	Log RunTime:	Logging information - Number of operating hours
80	3	Log LastCustomisation	Logging information - LastCustomisation
81	1	Temperature current:	Temperature monitoring - Current core temperature
81	2	Temperature min:	Temperature monitoring - Minimum core temperature to date
81	3	Temperature max:	Temperature monitoring - Maximum core temperature to date
82		Pressure shock counter:	Small unexpected valve movements (0,2 - 0,4mm movement within 0,5s, Event #32)
83	1	SV-activations SV1	Number of solenoid valve activations
84	1	SV-ON time SV1	Total ON time of solenoid valves
85	1	Setup En-stroke	The stroke durations per solenoid valve (energizing direction)
86	1	Setup DeEn-stroke	The setup stroke durations pr solenoid valve (de-energizing direction)
88		Active events:	Active events Bit mask for current
110	1	Setup Pos De-En:	Data for position in current setup - Target switchpoint (De-Energize)



110	1	Switchpoint logic :	Data for position in current setup - Target switchpoint logic (De-Energize)
110	3	Switchpoint hysteresis:	Data for position in current setup - Target switchpoint hysteresis (De-Energize)
111	1	Setup Pos Main:	Data for position in current setup - Target switchpoint (Main)
111	2	Switchpoint logic :	Data for position in current setup - Target switchpoint logic (Main)
111	3	Switchpoint hysteresis:	Data for position in current setup - Target switchpoint hysteresis (Main)



6.4.4.3. V70

Index	Subindex		
12		Device Access Locks:	The access to the device parameters can be restricted by setting appropriate flags within this parameter.
36		Device status:	Device status
37		Detailed device status:	Detailed device status
49		BLOB ID	BLOB ID The durations of the latest strokes and the latest events can be exported as data files
66		Valve type:	Detected or configured valve type
67		Setup type:	Type of current setup
70		Error modifier:	The 'position not reached' timeout of the surveillance mode feature is calculated by [stroke duration + error modifier], the error modifier can be modified
73		Power save:	Power save mode will turn off the visual indication when the unit is idle
74	1	RGB-colour button press:	RGB colour for Button press
74	2	RGB-colour error:	RGB colour for error feedback
74	3	RGB-colour out:	RGB colour for Moving (out of any position)
74	4	RGB-colour De-En:	RGB colour for De-Energized position
74	5	RGB-colour Main:	RGB colour for Main position
74	6	RGB-colour Usl:	RGB colour for Upper Seat Lift position
74	7	RGB-colour Lsp:	RGB colour for Lower Seat Push position
74	8	RGB-colour Wink:	RGB colour for Wink position
75		USA Bit mapping:	With this setting the seat-lift signals will represent seat closed position
76		Key lock:	Locks the SELECT key on the local user interface to prevent unintentional changes, [Key Lock] is reset-table at the device.
78	1	Seat valve pulse De-En:	Pulse clean. Sets the travel distance of the seat during a pulse from De-En position.
78	2	Seat valve pulse Main:	Pulse clean. Sets the travel distance of the seat during a pulse from Main-En position.
79	1	Rotary valve pulse De-En:	Pulse clean. Sets the travel distance of the stem during a pulse from De-En position. Note: The relation between the stem movement and disc angle is not linear in a LKLA.
79	2	Rotary valve pulse Main:	Pulse clean. Sets the travel distance of the stem during a pulse from Main-En position. Note: The relation between the stem movement
80	1	Log PowerUps:	Logging information - Number of power-cycles
80	2	Log RunTime:	Logging information - Number of operating hours
80	3	Log LastCustomisation	Logging information - LastCustomisation
81	1	Temperature current:	Temperature monitoring - Current core temperature
81	2	Temperature min:	Temperature monitoring - Minimum core temperature to date
81	3	Temperature max:	Temperature monitoring - Maximum core temperature to date
82		Pressure shock counter:	Small unexpected valve movements (0,2 - 0,4mm movement within 0,5s, Event #32)
83	1	SV-activations SV1	Number of solenoid valve activations
83	2	SV-activations SV2	Number of solenoid valve activations



83	3	SV-activations SV3	Number of solenoid valve activations
84	1	SV-ON time SV1	Total ON time of solenoid valves – SV1
84	2	SV-ON time SV2	Total ON time of solenoid valves – SV2
84	3	SV-ON time SV3	Total ON time of solenoid valves – SV3
85	1	Setup En-stroke SV1	The stroke durations per solenoid valve (energizing direction) – main
85	2	Setup En-stroke SV2	The stroke durations per solenoid valve (energizing direction) – USL
85	3	Setup En-stroke SV3	The stroke durations per solenoid valve (energizing direction) – LSP
86	1	Setup DeEn-stroke – SV1	The setup stroke durations pr solenoid valve (de-energizing direction) – SV1
86	2	Setup DeEn-stroke – SV2	The setup stroke durations pr solenoid valve (de-energizing direction) – SV2
86	3	Setup DeEn-stroke – SV3	The setup stroke durations pr solenoid valve (de-energizing direction) – SV3
88		Active events:	Active events Bit mask for current
110	1	Setup Pos De-En:	Data for position in current setup - Target switchpoint (De-Energize)
110	2	Switchpoint logic :	Data for position in current setup - Target switchpoint logic (De-Energize)
110	3	Switchpoint hysteresis:	Data for position in current setup - Target switchpoint hysteresis (De-Energize)
111	1	Setup Pos Main:	Data for position in current setup - Target switchpoint (Main)
111	2	Switchpoint logic :	Data for position in current setup - Target switchpoint logic (Main)
111	3	Switchpoint hysteresis:	Data for position in current setup - Target switchpoint hysteresis (Main)
112	1	Setup Pos LSP:	Data for position in current setup - Target switchpoint (LSP)
112	2	Switchpoint logic :	Data for position in current setup - Target switchpoint logic (LSP)
112	3	Switchpoint hysteresis:	Data for position in current setup - Target switchpoint hysteresis (LSP)
113	1	Setup Pos USL:	Data for position in current setup - Target switchpoint (USL)
113	2	Switchpoint logic :	Data for position in current setup - Target switchpoint logic (USL)
113	3	Switchpoint hysteresis:	Data for position in current setup - Target switchpoint hysteresis (USL)
114	1	Setup Pos Ext USL:	Data for position in current setup - Target switchpoint (external USL)
114	2	Switchpoint logic :	Data for position in current setup - Target switchpoint logic (external USL)
114	3	Switchpoint hysteresis:	Data for position in current setup - Target switchpoint hysteresis (external USL)

6.4.5. Vx0 Command

Upload Start	Start block parameter upload
Upload End	End block parameter upload
Download Start	Start block parameter download
Download End	Stop block parameter download
Store	Finalize block parameterization and start Data Storage
Break	Cancel block parameterization
Restore Factory Settings	
Start Auto Setup	
Setup Reset	
Parameter Reset	
Diagnostic Reset	
IO-Link 1.1 system test command	240 - Event 8DFE appears
IO-Link 1.1 system test command	241 - Event 8DFE disappears
IO-Link 1.1 system test command	242 - Event 8DFF appears
IO-Link 1.1 system test command	243 - Event 8DFF disappears