AG25, AG26

Siemens S7-1500®

PROFINET® Interface Module

for TIA Portal® V13 SP1 in SCL.

Software Description

V1.2

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1 General Notes

1.1 Trademarks

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1.2 Liability

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1.3 Limitations

The library and its function were tested with a Siemens S7-1500 1511-1PN. The module was programmed in SCL using Siemens TIA Portal® V13 SP1 Update 3.
There is also a library available for Siemens S7-1200 systems.
The method described in this document is the same for S7-1200 systems.

1.4 Requirements

- Basic knowledge of handling and programming Siemens systems.
- Familiarity with PROFINET® IO.

1.5 Versions Overview

This manual is related to the library “SIKO_AG2X_TIA_S71500_LIB_V101”.

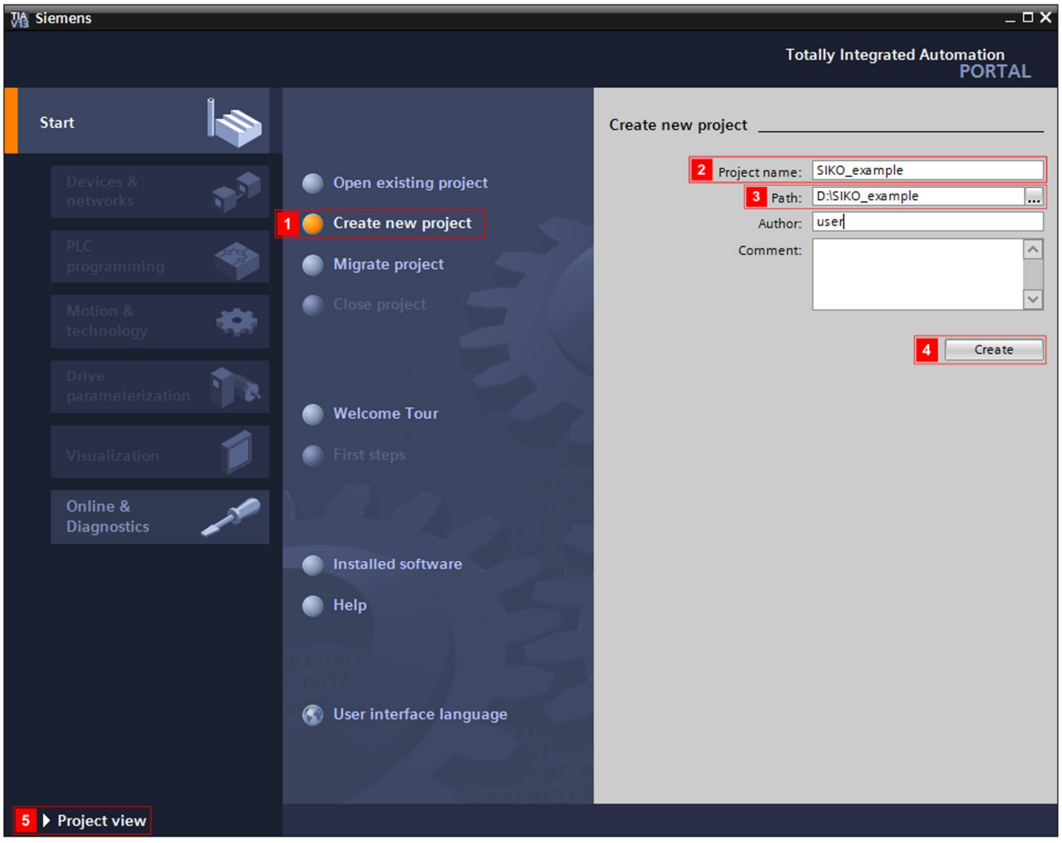
1.6 List of Abbreviations

EPN	PROFINET®
SW	Status Word
CW	Control Word

2 Hardware Configuration

2.1 Create New TIA Portal® Project

1. Execute the command “Create new project”.
2. Enter the project name “SIKO_example”.
3. Choose a project path.
4. Execute the command “Create”.
5. Change to “Project view”.



2.2 Add Your PLC to the Project

1. Navigate to the project tree in the project view and double-click on “Add new device”.

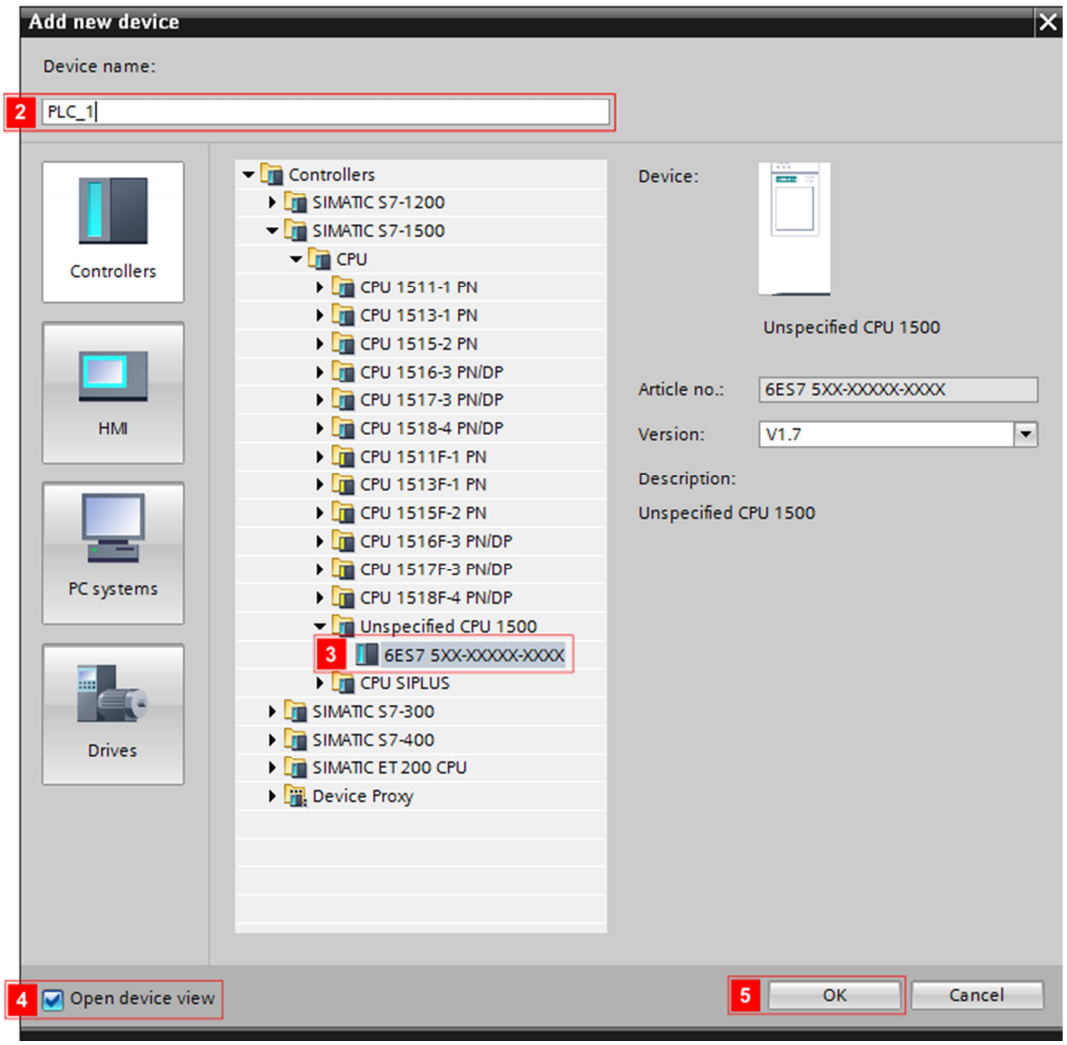
In this case we determine the device configuration by using “Unspecified CPU 1500”.

2. Assign a device name, for example “PLC_1”.

3. Select “Controllers” > “SIMATIC S7-1500” > “CPU” > “Unspecified CPU 1500” > “6ES7 5XX-XXXXX-XXXX”.

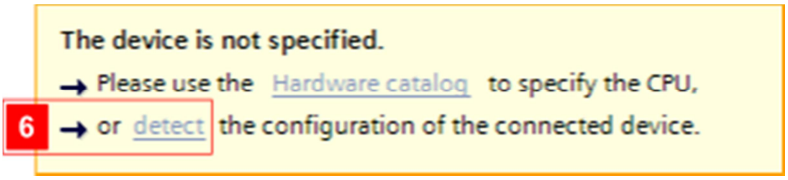
4. Select “Open device view”.

5. Confirm with “OK”.



Now the device configuration window opens.

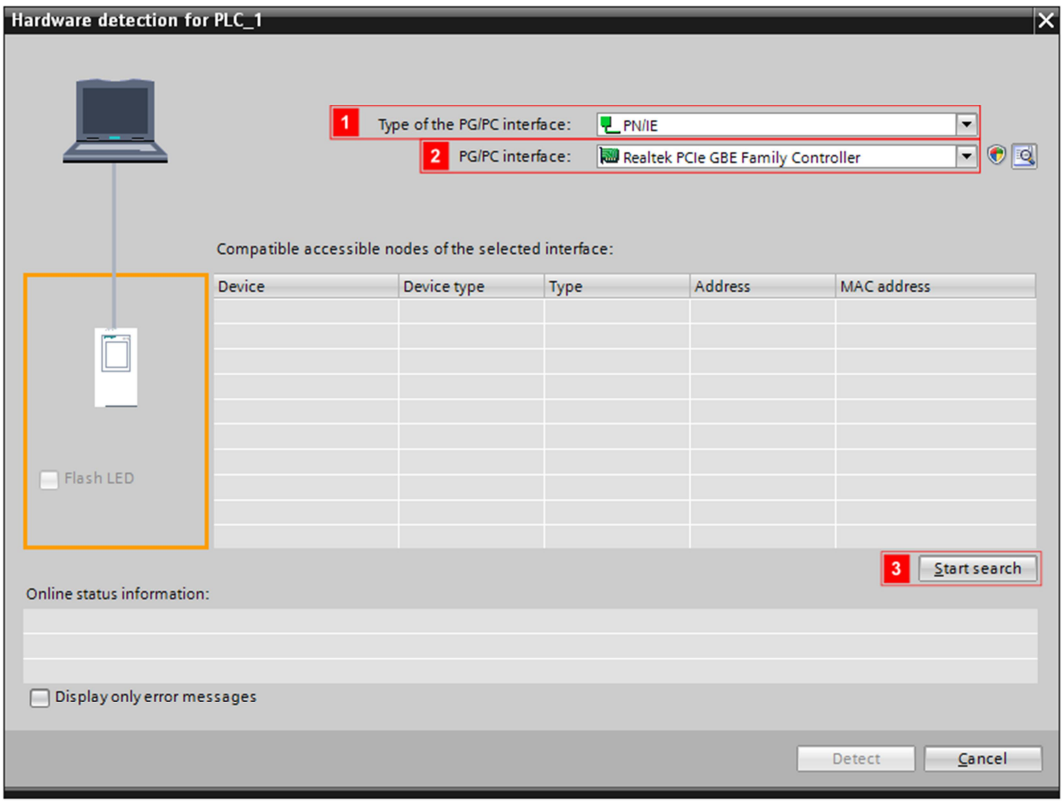
6. Use the dialog box to detect the configuration of the connected device.



2.2.1 Search for Compatible Accessible Nodes

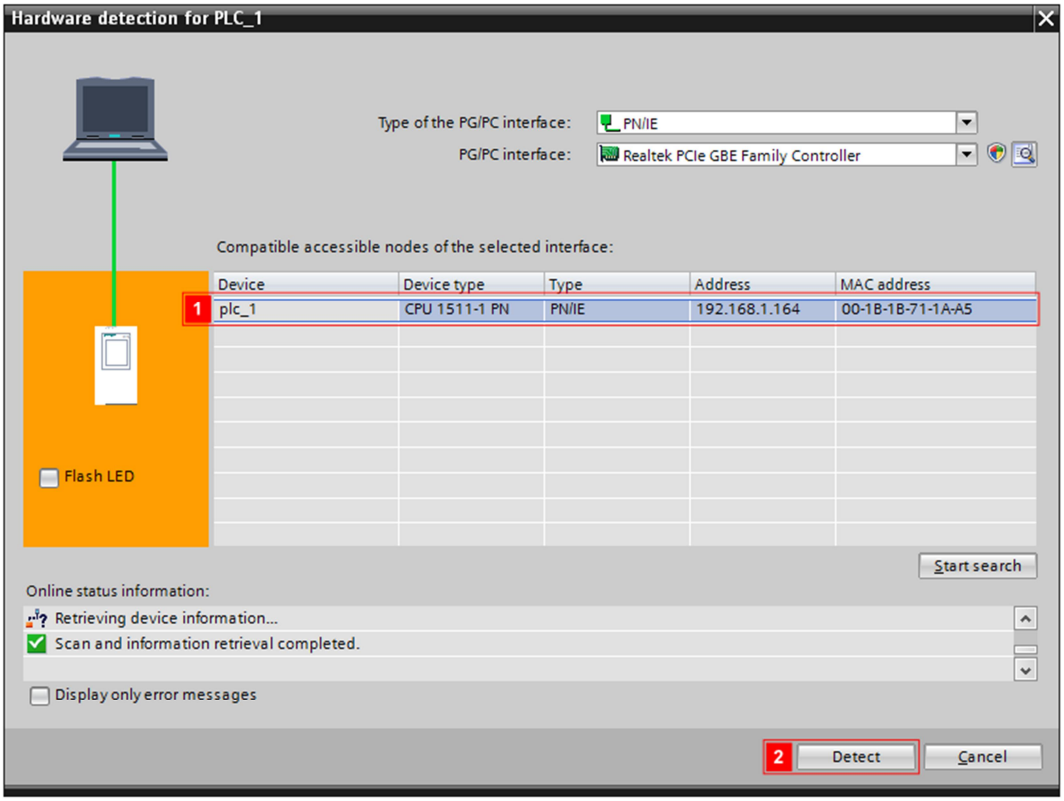
NOTICE	This example assumes that the IP address of the PLC is already configured.

1. Choose type of the PG/PC interface.
2. Choose PG/PC interface.
3. Execute the command “Start search”.



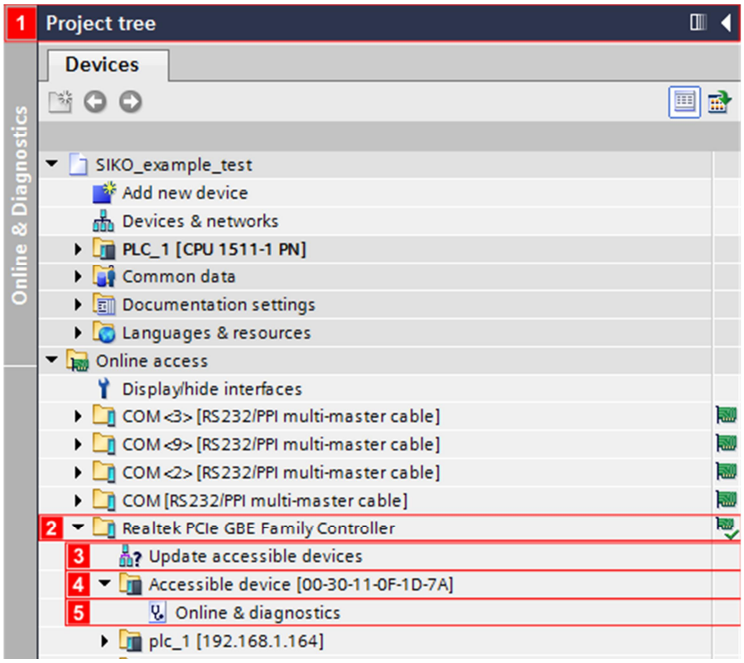
2.2.2 Detect Configuration

1. Select your PLC.
2. Execute the command “Detect”.



2.3 Open the Window “Online & diagnostics” of the SIKO-AG2X

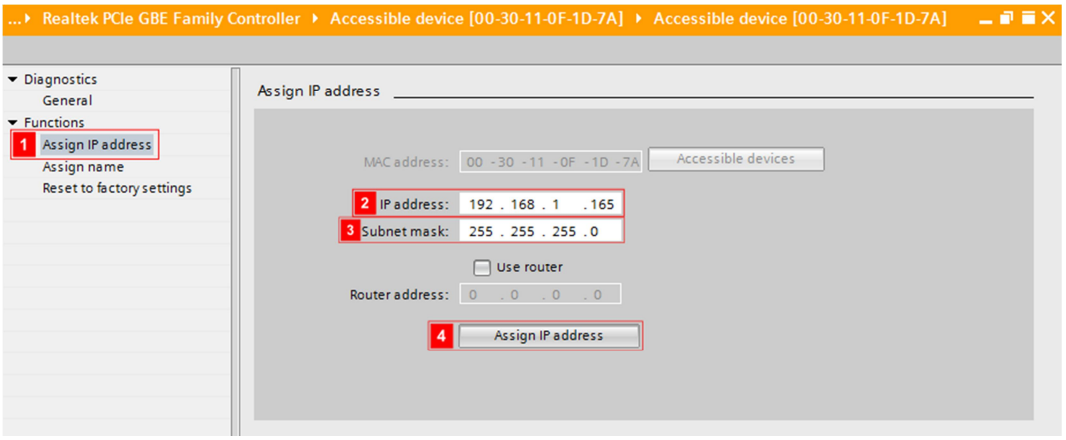
1. Navigate to the project tree in the project view.
2. Choose your network interface.
3. Double-click on “Update accessible devices”.
4. Identify the SIKO-AG2X by its MAC-ID.
5. Double-click on “Online & diagnostics”.



2.4 Enter the IP Address of the SIKO-AG2X

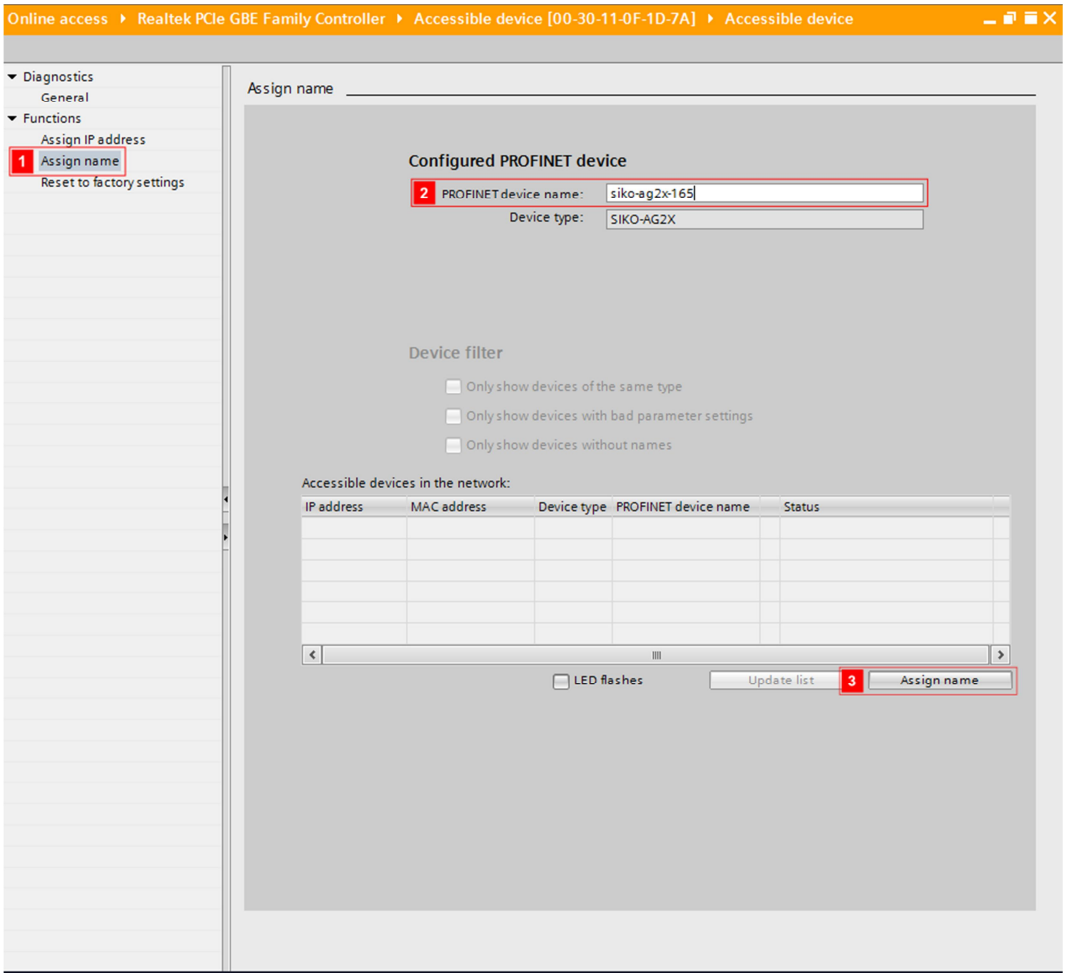
NOTICE	The IP settings in this example can cause serious network problems under certain circumstances. If you are in doubt about the correct IP settings for your network, ask your system administrator for assistance.

1. Navigate to folder “Assign IP address” in the “Online & diagnostics” window.
2. Enter a valid IP address, “192.168.1.165” for example.
3. Enter a valid subnet mask, “255.255.255.0” for example.
4. Execute the command “Assign IP address”.



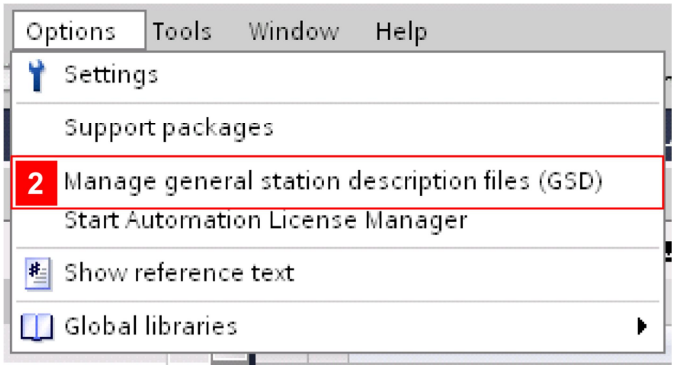
2.5 Enter the PROFINET® Device Name of the SIKO-AG2X

1. Navigate to the folder “Assign name” in the “Online & diagnostics” window.
2. Enter a valid PROFINET® device name, “siko-ag2x-165” for example.
3. Execute the command “Assign name”.

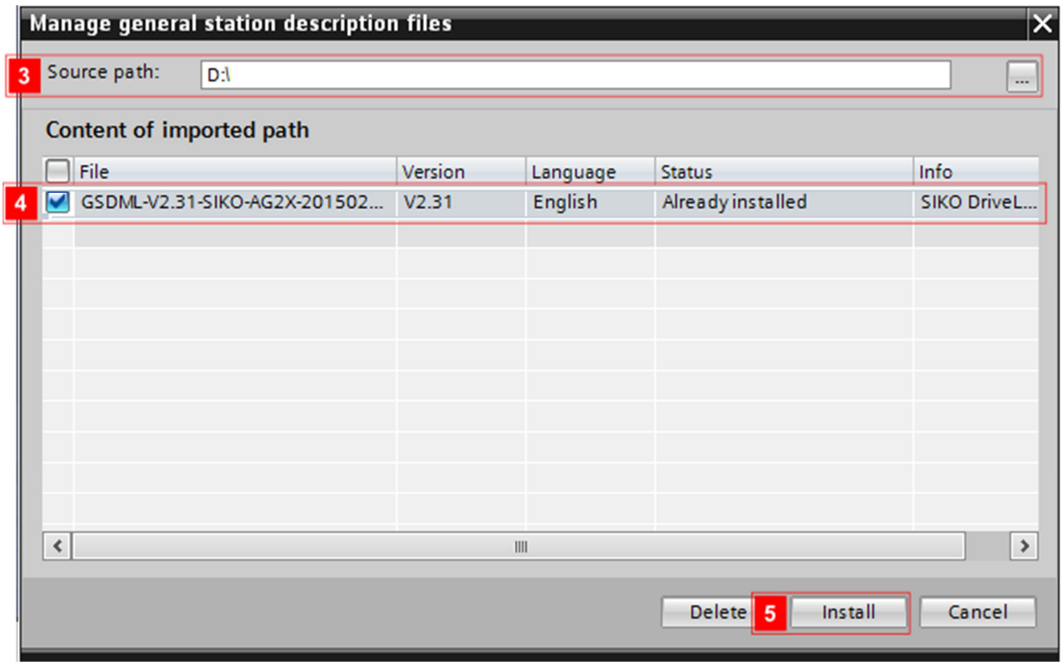


2.6 Register the GSDML Device Description File for AG2X

1. Go to the TIA Portal® “Project view”.
2. Execute the command: “Options” > “Manage general station description files (GSD)”.



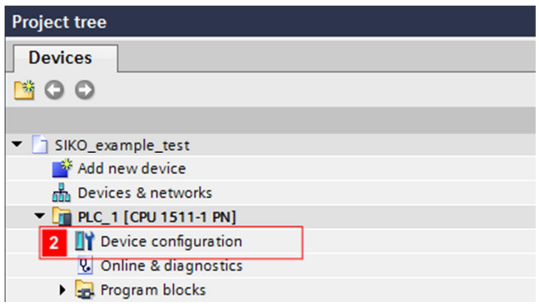
3. Browse to the storage location of the GSDML file.
4. Select the GSDML file for SIKO-AG2X.
5. Execute the command “Install”.



2.7 Add New Module to Your Hardware Configuration

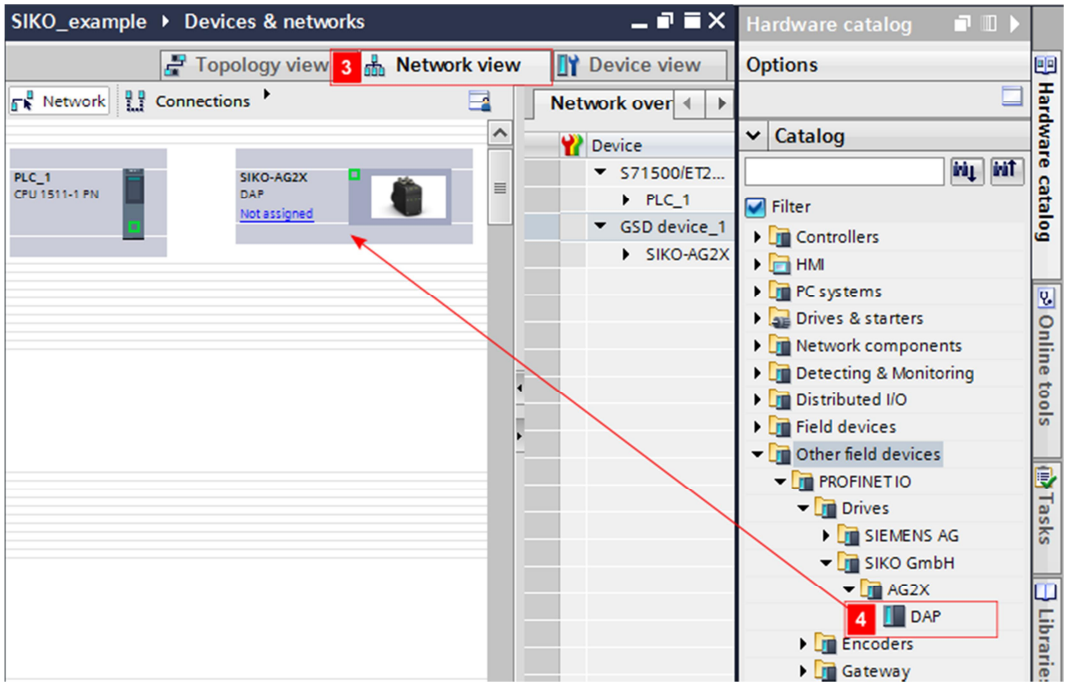
1. Go to the TIA Portal® “Project view”.

2. Double-click on “Device configuration” of your PLC.



3. Navigate to the tab “Network view”.

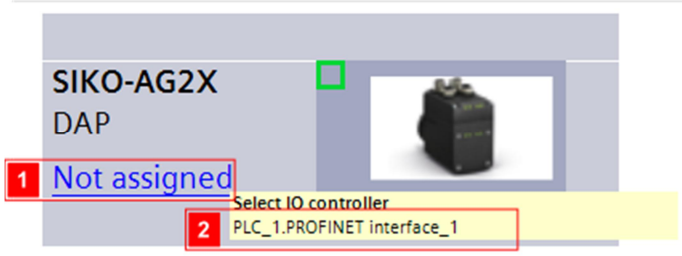
4. Add “DAP” from device “AG2X” of the hardware catalog to the “Devices & networks” window.



2.8 Select the PROFINET® IO Controller

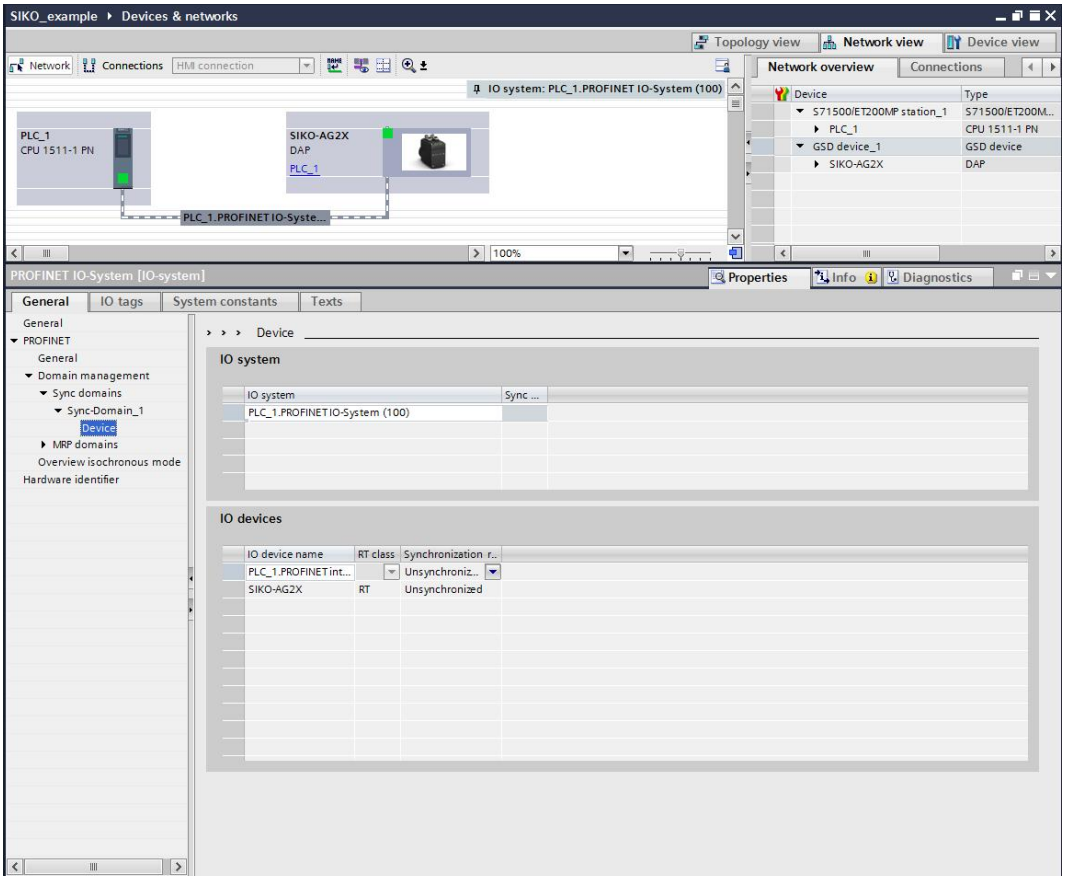
1. Left-click “Not assigned” inside the SIKO-AG2X symbol.

2. Select IO Controller.



2.9 Configure the Sync Domain

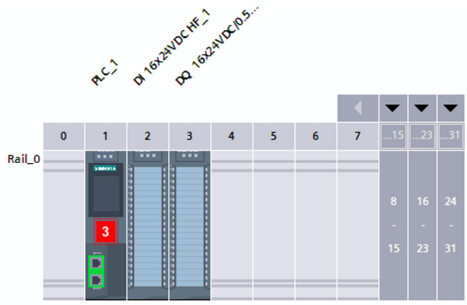
1. Double-click on the PROFINET® IO-System.
2. Make the settings.



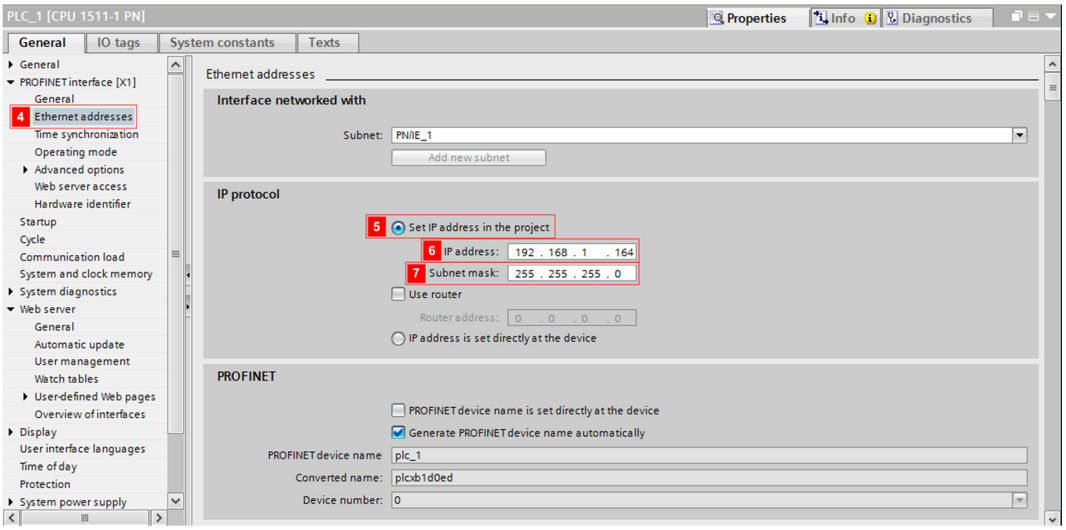
2.10 Configure the IP Address of the PLC in the Project

NOTICE	The IP settings in this example can cause serious network problems under certain circumstances. If you are in doubt about the correct IP settings for your network, ask your system administrator for assistance.

1. Navigate to the tab “Device view”.
2. Choose ”PLC_1”.
3. Double-click on slot 1.



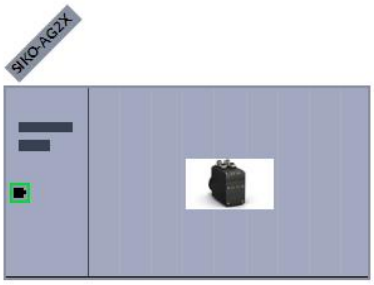
4. Left-click on “Ethernet addresses” from folder “PROFINET interface [X1]”.
5. Select “Set IP address in the project”.
6. Enter a valid IP address.
7. Enter a valid subnet mask.



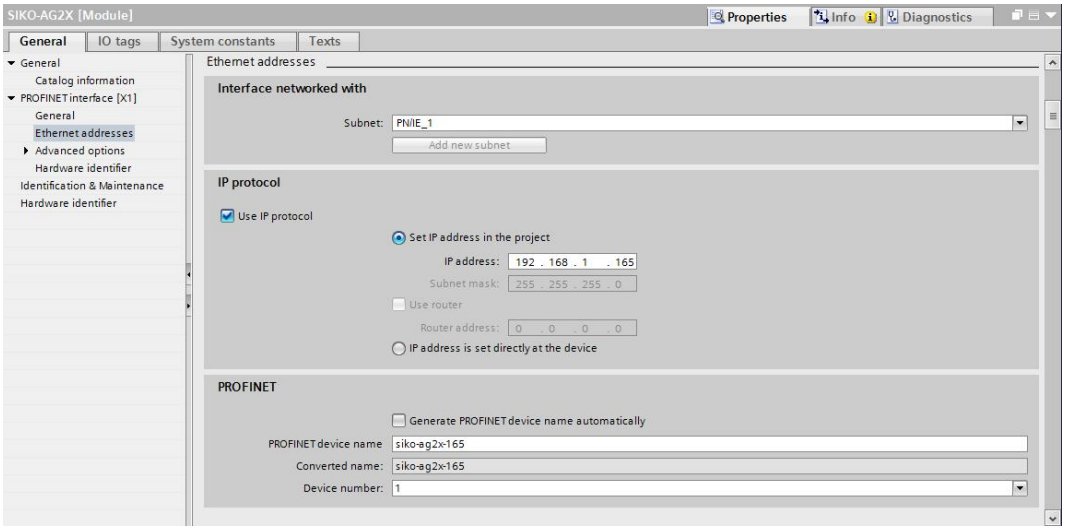
2.11 Configure the IP Address of the SIKO-AG2X in the Project

NOTICE	The IP settings in this example can cause serious network problems under certain circumstances. If you are in doubt about the correct IP settings for your network, ask your system administrator for assistance.

1. Navigate to the tab “Network view”.
2. Double-click on the SIKO-AG2X symbol.
3. Left-click on module.



4. Navigate to the “Ethernet addresses” folder.

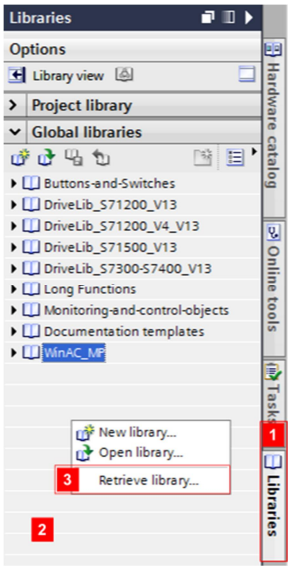


5. Choose “Set IP address in the project”.
6. Enter the IP address used in chapter 2.4: “192.168.1.165”.
7. Enter the PROFINET® device name used in chapter 2.5: “siko-ag2x-165”.

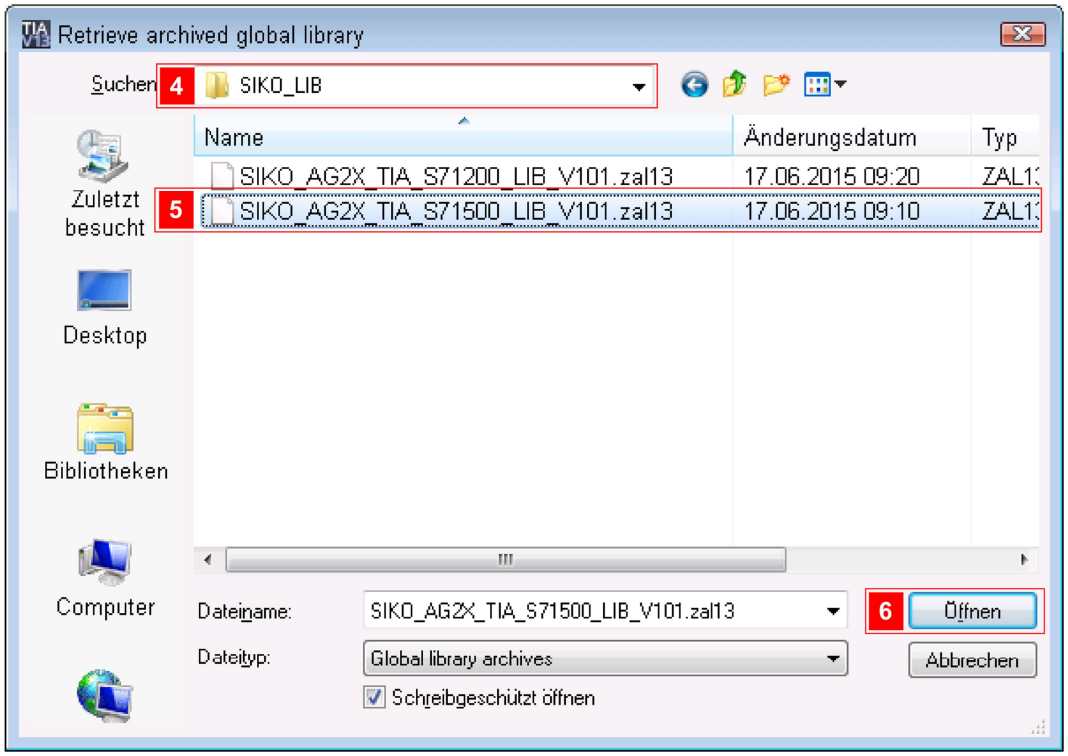
3 Software Configuration

3.1 Import the SIKO-library

1. Navigate to the tab “Libraries”.
2. Right-click in emty space inside the tab “Libraries”.
3. Execute the command “Retrieve library...”.

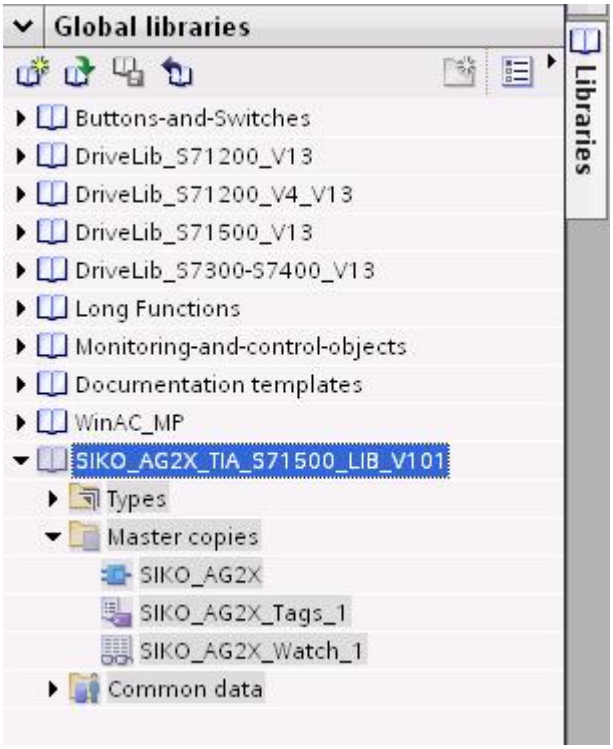


4. Browse to the storage location of the SIKO-library.
5. Select the archive SIKO_AG2X_TIA_S71500_LIB_VXXX.zal13.
6. Execute the command “Open”.



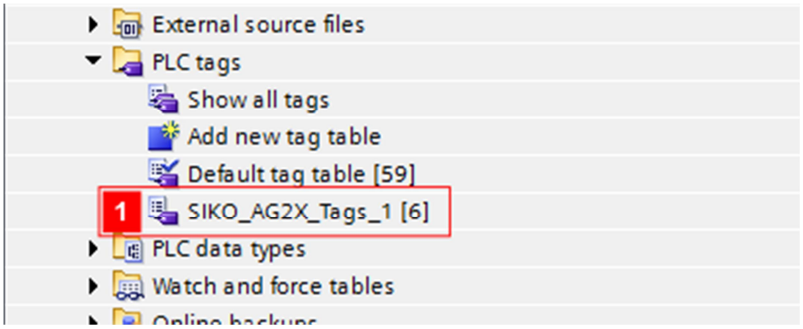
7. Choose a target directory to store the library.

8. The library appears in the “Global libraries” window.

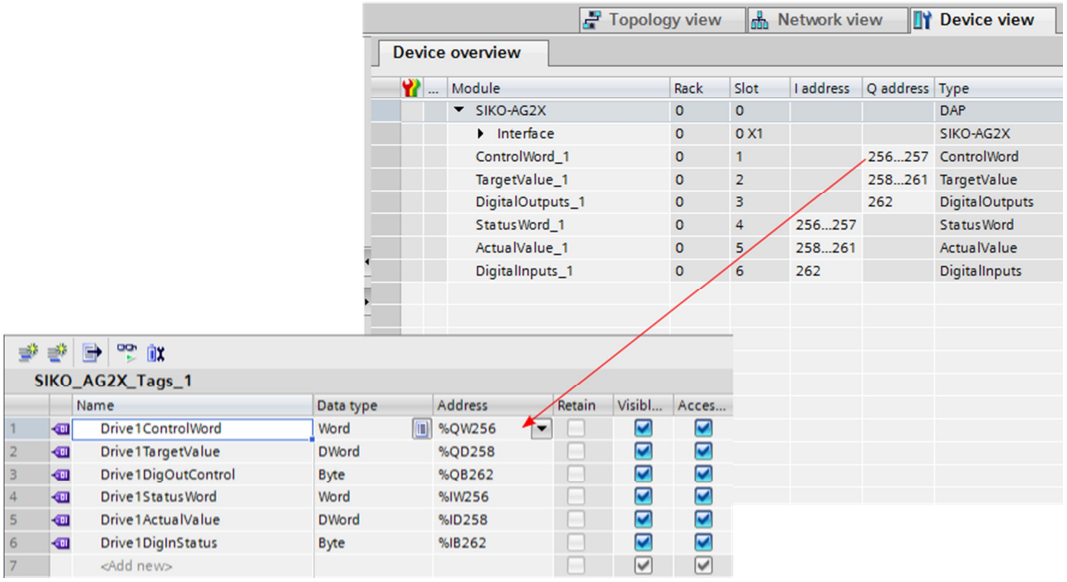


3.2 Add the Tag Table from the Library to the Project

1. Use drag and drop to move the tag table “SIKO_AG2X_Tags_1” from the library to the folder PLC tags.

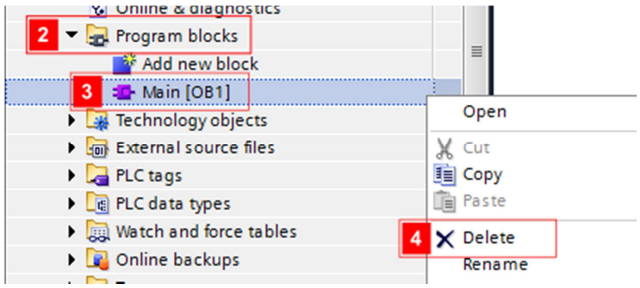


2. Compare the address settings and adjust them in the tag table “SIKO_AG2X_Tags_1” if neccessary.



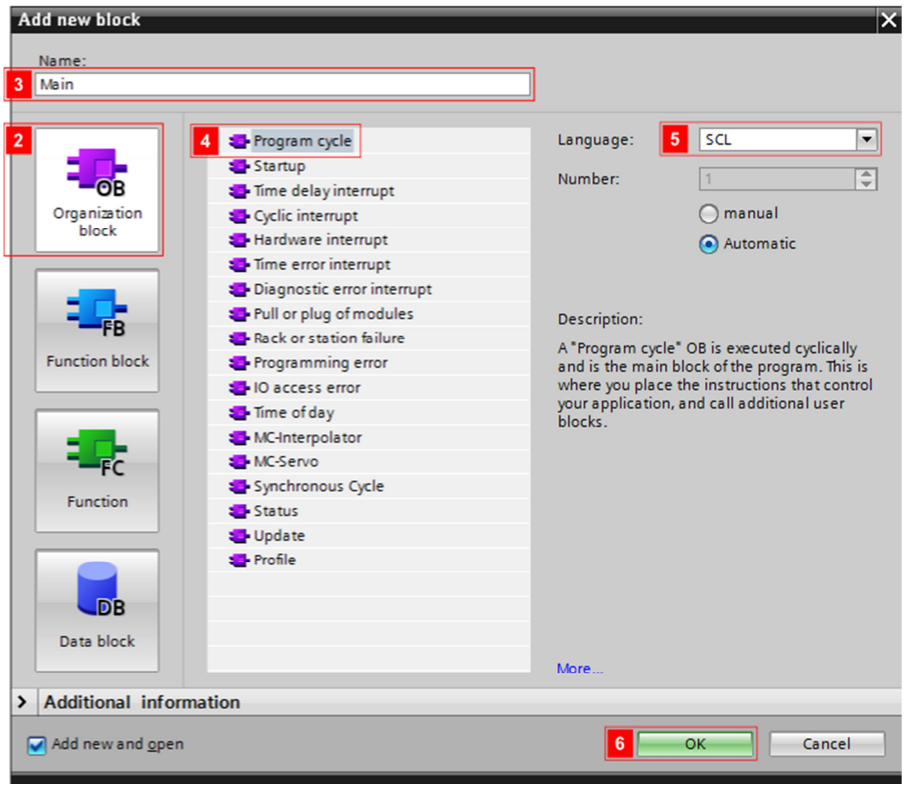
3.3 Delete OB1

1. Navigate to the project tree.
2. Go to the Program blocks folder.
3. Right-click on “Main [OB1]”.
4. Delete OB1.



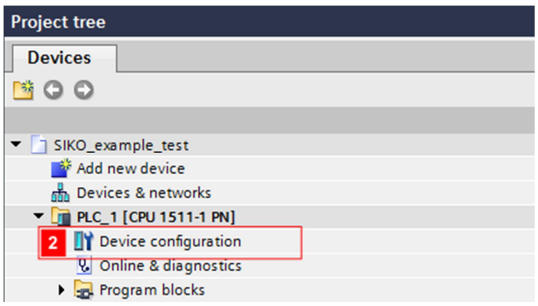
3.4 Create New OB1 in Language SCL

1. Create a new OB1 via the command “Program block” > “Add new block”.
2. Choose “Organization block”.
3. Enter “Main” as name.
4. Choose “Program cycle”.
5. Choose language “SCL”.
6. Confirm the settings with “OK”.

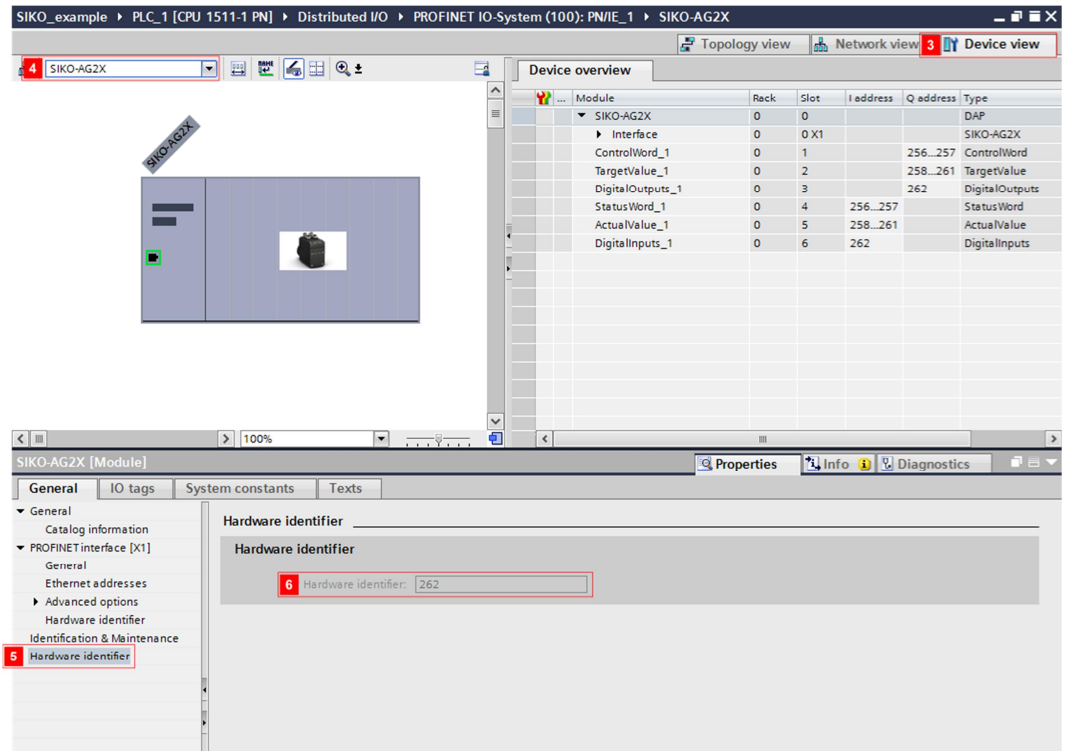


3.5 Determine the “Hardware identifier” of the SIKO-AG2X

1. Go to the TIA Portal® “Project view”.
2. Double-click on “Device configuration” of your PLC.

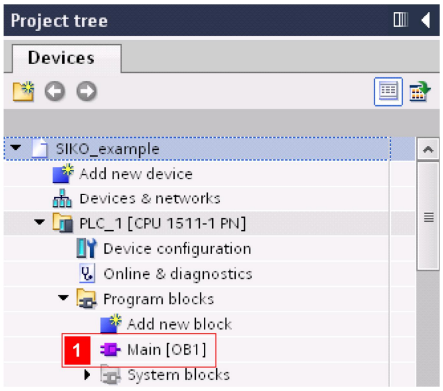


3. Left-click on the tab “Device view”.
4. Choose the SIKO-AG2X from the drop down list.
5. Open the window “Hardware identifier”.
6. Read out the “Hardware identifier” and remember the value for chapter 3.6.

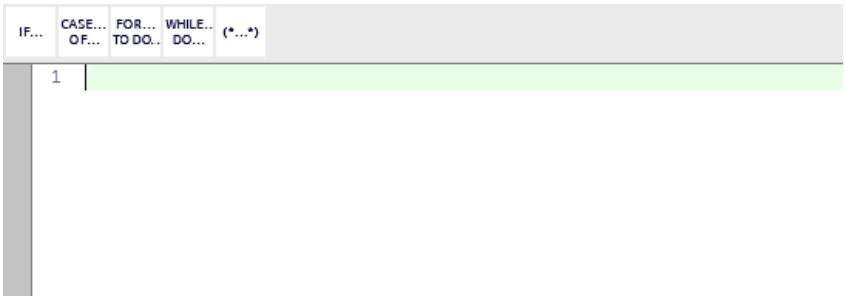


3.6 Function Block Call

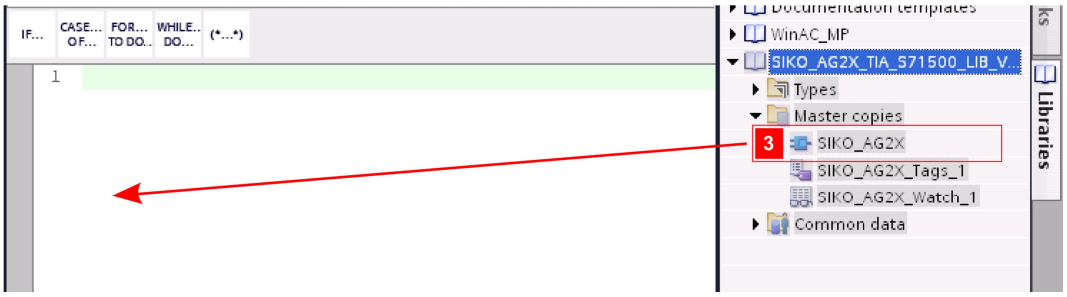
1. Double-click on “OB1”.



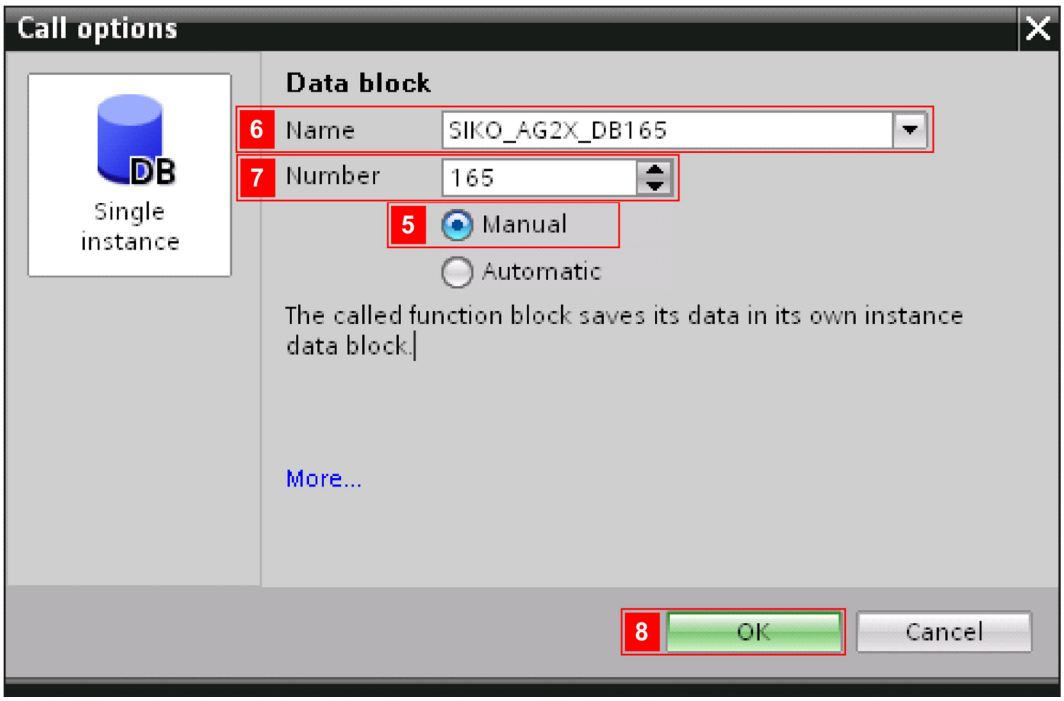
2. The SCL editor window is opened.



3. Use drag and drop to move the function block “SIKO_AG2X” from the SIKO-library to the OB1 SCL editor window.



4. Now the window “Call options” appears.
5. Select “Manual”.
6. Enter “SIKO_AG2X_DB165” as name for the instance data block.
7. Enter Number “165”.
8. Confirm with “OK”.



9. Enter the function block call:

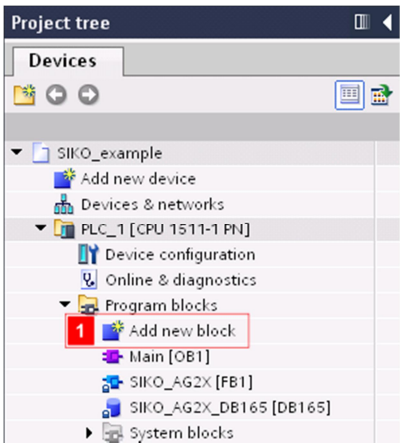
```
"SIKO_AG2X_DB165"(StatusWord:="Drive1StatusWord",
                  ActValIn:="Drive1ActualValue",
                  DigitalInputsStatus:="Drive1DigInStatus",
                  HwId:=262,
                  ControlWord=>"Drive1ControlWord",
                  TarValOut=>"Drive1TargetValue",
                  DigitalOutputControl=>"Drive1DigOutControl");
```

10. Enter the “Hardware Identifier” from chapter 3.5 to the input “HwId”.

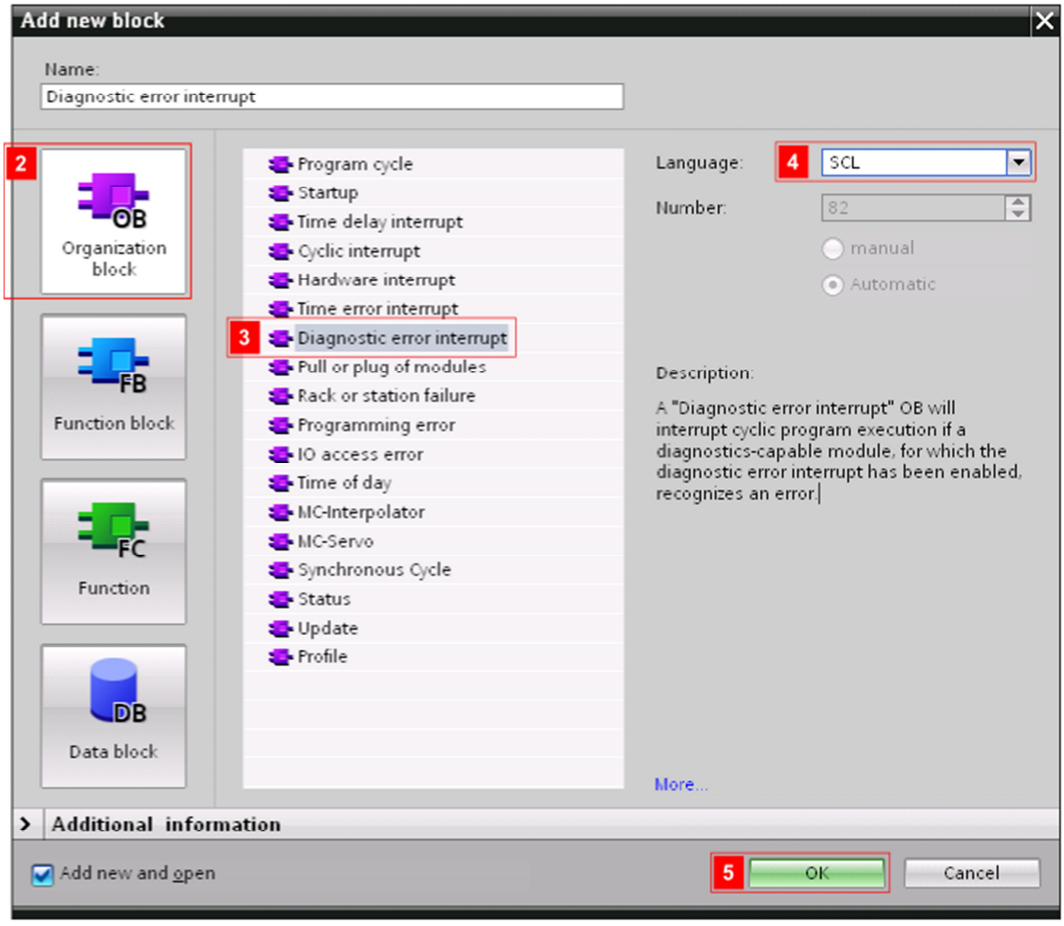
3.7 Add Required Function Blocks

Add OB82, OB86 and OB122 to the folder “Program blocks”.

1. Double-click on “Add new block” from folder “Program blocks”.



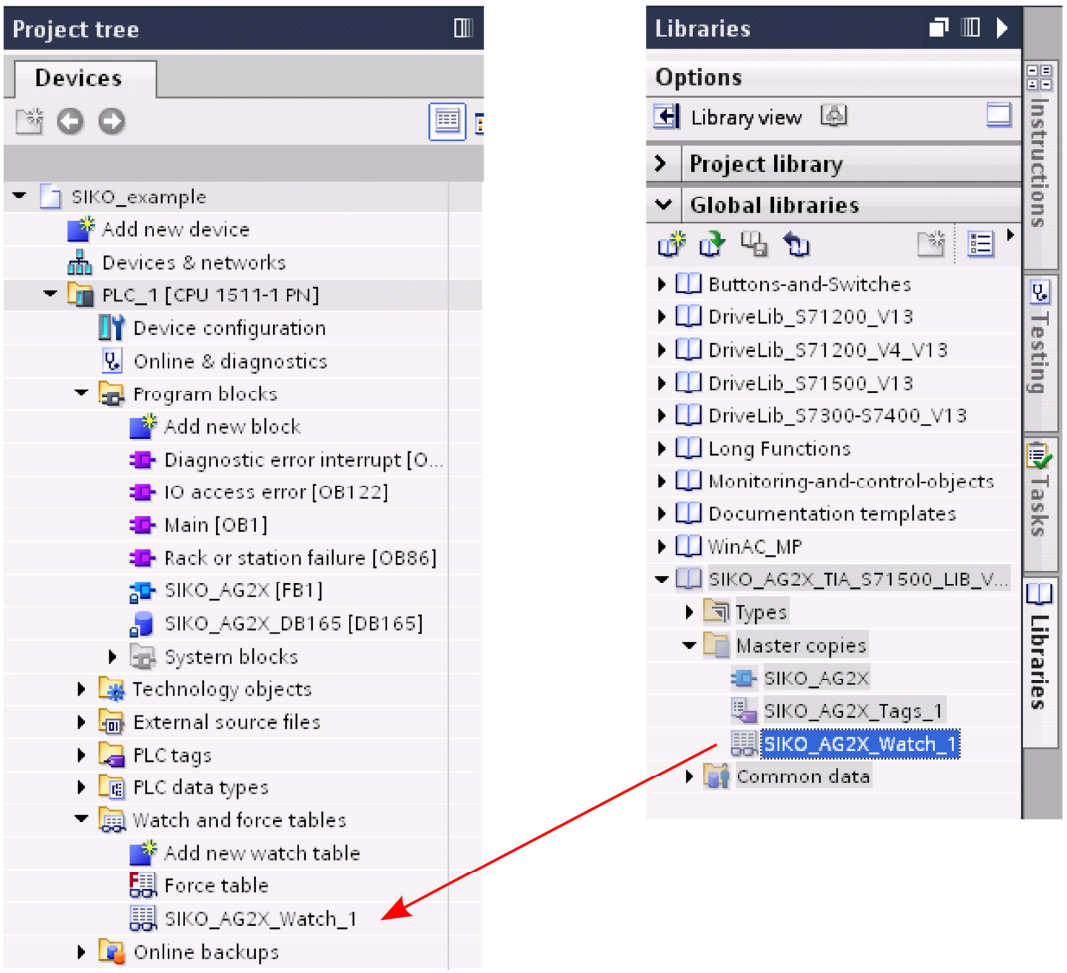
2. Choose “Organization block”.
3. Choose “Diagnostic error interrupt”.
4. Choose language “SCL”.
5. Confirm the settings with “OK”.



6. Repeat steps 1 to 5 for “Rack or station failure” and “IO access error”.

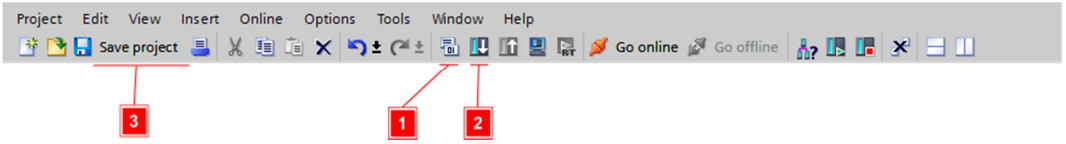
3.8 Add the Watch Table “SIKO_AG2X_Watch_1” from the SIKO-library

1. Use drag and drop to move the watch table from the SIKO-library to the project folder “Watch and force tables”.



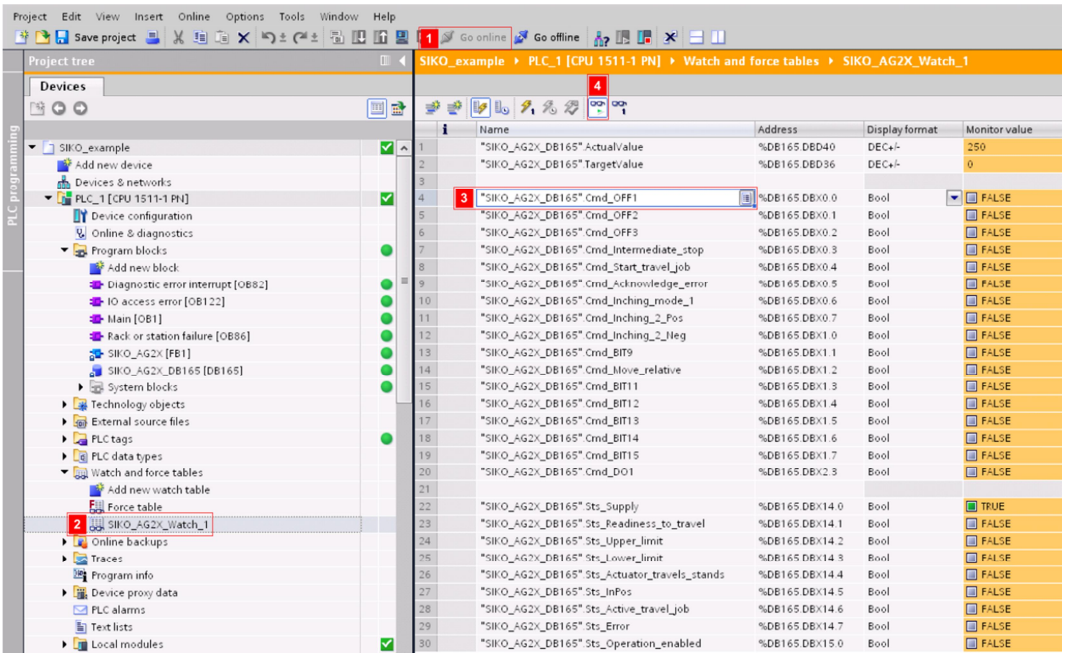
3.9 Complete the Project

1. Execute the command “Compile”.
2. Execute the command “Download to device”.
3. Execute the command “Save project”.



3.10 Work with the Project

1. Go online with your PLC.
2. Double-click on “SIKO_AG2X_Watch_1”.
3. Left-click inside the watch table window.
4. Enable the “Monitor all” option in the watch table window.
5. Now you can control the SIKO-AG2X by setting the control bits.



3.11 Software Example

3.11.1 Parameter Access

The present module contains the parameter data in addition to the process data (CW/SW). Parameters that can be changed (read/write) exist in programming as actual value (_r) and as target value (_w) as well. Furthermore, it is differentiated between pure read parameters (only indicated as actual value) and pure write parameters (only indicated as target value).

3.11.2 Read Parameters

If a rising edge is applied to the “Cmd_Start_read” input, then all parameters will be read and can be used for further programming.

3.11.3 Diagnosis Reading “counter_read”

If counter value is not reset to “0” the read cycle was interrupted by read failure. This indicates to a communication failure. For detailed information about the cause of failure there is an error code available at the output “status”.

3.11.4 Write Parameters

If a rising edge is applied to the “Cmd_Start_write” input of the module, then all actual values (_r) and their corresponding target values (_w) are compared. If they are different the target value will be transferred to the drive.

3.11.5 Diagnosis Reading “counter_write”

If counter value is not reset to “0” the write cycle was interrupted by write failure. This indicates to a communication failure or a parameter value is beyond range of value accepted by drive. For detailed information about the cause of failure there is an error code available at the output “status”.

3.11.6 Copy Parameters from Read to Write

If a rising edge is applied to the “Cmd_Start_copy” input of the module, then all actual values (_r) are copied to their corresponding target values (_w).

3.11.7 Counter Value

counter Read	counter Write	Name	Value range (dec)	Default
1	1	LED Functionality	0 ... 1	0
2	2	Service Interface Baud Rate	0 ... 3	1
3	3	Digital Output 1 Functionality	0 ... 3	0
4		Digital Output Functionalities State		-
5	4	Digital Outputs Polarity	0 ... 15	0
6	5	Digital Input 1 Functionality	0 ... 11	0
7	6	Digital Input 2 Functionality	0 ... 11	0
8	7	Digital Input 3 Functionality	0 ... 11	0
9	8	Digital Input 4 Functionality	0 ... 11	0
10		Digital Input Functionalities State		-
11	9	Digital Inputs Polarity	0 ... 15	0
12	10	Controller Parameter P	1 ... 500	300
13	11	Controller Parameter I	0 ... 500	2
14	12	Controller Parameter D	0 ... 500	0
15	13	A-Pos	1 ... 100	50
16	14	V-Pos	Gear 66:1 ⇒ 1 ... 75 rpm 98:1 ⇒ 1 ... 50 rpm 188:1 ⇒ 1 ... 30 rpm 368:1 ⇒ 1 ... 15 rpm	10
17	15	D-Pos	1 ... 101	101
18	16	A-Rot	1 ... 100	50
19	17	A-Inch	1 ... 100	50
20	18	V-Inch	Gear 66:1 ⇒ 1 ... 75 rpm 98:1 ⇒ 1 ... 50 rpm 188:1 ⇒ 1 ... 30 rpm 368:1 ⇒ 1 ... 15 rpm	10
21	19	Pos Window	0 ... 1000	10
22	20	Gear Ratio Numerator	1 ... 10000	1
23	21	Gear Ratio Denominator	1 ... 10000	1
24	22	Spindle Pitch	0 ... 1000000	0
25	23	Calibration Value	-999999 ... 999999	0
26	24	Software Limit 1	-9999999 ... 9999999	99999
27	25	Software Limit 2	-9999999 ... 9999999	-19999
28	26	Delta Inch	-1000000 ... 1000000	720
29	27	Sense of Rotation	0 ... 1	0
30	28	Pos Type	0 ... 2	0
31	29	Operating Mode	0 ... 1	0
32	30	Inching 2 Stop Mode	0 ... 1	0

counter Read	counter Write	Name	Value range (dec)	Default
33	31	Inpos Mode	0 ... 2	0
34	32	Loop Length	0 ... 30000	360
35	33	Contouring Error Limit	1 ... 30000	400
36	34	Current Limiting	25 ... 110	110
37	35	Inching 2 Offset	10 ... 100	100
38	36	Inching 2 Acceleration Type	0 ... 1	0
39	37	Offset Value	-999999 ... 999999	0
40	38	PCM Position 1	DINT	0
41	39	PCM Position 2	DINT	0
42	40	PCM Position 3	DINT	0
43	41	PCM Position 4	DINT	0
44	42	PCM Position 5	DINT	0
45	43	PCM Position 6	DINT	0
46	44	PCM Position 7	DINT	0
47	45	PCM Acceleration 1	1 ... 100	50
48	46	PCM Acceleration 2	1 ... 100	50
49	47	PCM Acceleration 3	1 ... 100	50
50	48	PCM Acceleration 4	1 ... 100	50
51	49	PCM Acceleration 5	1 ... 100	50
52	50	PCM Acceleration 6	1 ... 100	50
53	51	PCM Acceleration 7	1 ... 100	50
54	52	PCM Velocity 1	Gear 66:1 ⇒ 1 ... 75 rpm 98:1 ⇒ 1 ... 50 rpm 188:1 ⇒ 1 ... 30 rpm 368:1 ⇒ 1 ... 15 rpm	10
55	53	PCM Velocity 2	see PCM Velocity 1	10
56	54	PCM Velocity 3	see PCM Velocity 1	10
57	55	PCM Velocity 4	see PCM Velocity 1	10
58	56	PCM Velocity 5	see PCM Velocity 1	10
59	57	PCM Velocity 6	see PCM Velocity 1	10
60	58	PCM Velocity 7	see PCM Velocity 1	10
61	59	PCM Deceleration 1	1 ... 101	101
62	60	PCM Deceleration 2	1 ... 101	101
63	61	PCM Deceleration 3	1 ... 101	101
64	62	PCM Deceleration 4	1 ... 101	101
65	63	PCM Deceleration 5	1 ... 101	101
66	64	PCM Deceleration 6	1 ... 101	101
67	65	PCM Deceleration 7	1 ... 101	101
68		Output Stage Temperature		-
69		Voltage of Control		-

counter Read	counter Write	Name	Value range (dec)	Default
70		Voltage of Output Stage		-
71		Voltage of Battery		-
72		Motor Current		-
73		Actual Position		-
74		Actual Rotational Speed		-
75		Serial Number		-
76		Production Date		-
77		SW Motor Controller		-
78		Gear Reduction		-
79		System Status Word		-
80		Encoder Resolution		-
81		Device ID		-
82		Number of Errors		-
83		Error Number 1		-
84		Error Number 2		-
85		Error Number 3		-
86		Error Number 4		-
87		Error Number 5		-
88		Error Number 6		-
89		Error Number 7		-
90		Error Number 8		-
91		Error Number 9		-
92		Error Number 10		-
93	66	Configuration	0 ... 63	15
	67	S Command	0 ... 8	0

3.11.8 Error Codes

The “status” output parameter contains error information. If it is interpreted as ARRAY[1...4] OF BYTE , the error information has the following structure:

Field element	Name	Meaning
status[1]	Function_Num	B#16#00, if no error Function ID from DPV1-PDU: If an error occurs, B#16#80 will be output (for read data record: B#16#DE, for write data record: B#16#DF). If no DPV1 protocol element is used: B#16#C0
status[2]	Error_Decode	Location of the error ID
status[3]	Error_Code_1	Error ID
status[4]	Error_Code_2	Manufacturer-specific error ID extension

3.11.8.1 Field Element Status[2]

status[2] can have the following values:

Error_Decode (B#16#...)	Source	Meaning
00 to 7F	CPU	No error or no warning
80	DPV1	Error according to IEC 61158-6
81 to 8F	CPU	B#16#8x shows an error in the xth call parameter of the instruction
FE, FF	DP profile	Profile-specific error

3.11.8.2 Field Element Status [3]

Error_Decode (B#16#...)	Error_Code_1 (B#16#...)	Explanation according to DPV1	Meaning
0	00		No error, no warning
70	00	reserved, reject	Initial call; no active data record transfer
70	01	reserved, reject	Initial call; data record transfer has started
70	02	reserved, reject	Intermediate call; data record transfer already active
80	90	reserved, pass	Invalid logical start address
80	92	reserved, pass	Illegal type for ANY pointer
80	93	reserved, pass	The DP component addressed via ID or F_ID is not configured
80	95		Error when reading additional interrupt information (when reading out additional interrupt information for central or distributed I/O via an external DP interface, this error will be output as a “group error”.) Note: During link-up and update, the additional interrupt information may not be available temporarily.
80	96		The master CPU is in STOP mode. At that time, an OB was being processed. The instruction “RALRM” cannot supply the OB start information, the management information, the header information, or the additional interrupt information. The OB start information can be read with the “RD_SINFO” instruction. In addition, you can use the “DPNRM_DG” instruction to asynchronously read the current diagnostics frame of the affected DP slave for OBs 4x, 55, 56, 57, 82, and 83 (address information from the OB start information).
80	A0	read error	Negative acknowledgment while reading the module.
80	A1	write error	Negative acknowledgement when writing to the module
80	A2	module failure	DP protocol error at layer 2 (e.g., slave failure or bus problems)
80	A3	reserved, pass	PROFIBUS® DP: DP protocol error with Direct-Data-Link-Mapper or User-Interface/User PROFINET® IO: General CM error

Error_Decode (B#16#...)	Error_Code_1 (B#16#...)	Explanation according to DPV1	Meaning
80	A4	reserved, pass	Communication on the communication bus disrupted
80	A5	reserved, pass	-
80	A7	reserved, pass	DP slave or module is occupied (temporary error)
80	A8	version conflict	DP slave or module reports non-compatible versions
80	A9	feature not supported	Function is not supported by DP slave or module
80	AA to AF	user specific	DP slave or module reports a manufacturer-specific error in its application. Please check the documentation from the manufacturer of the DP slave or module.
80	B0	invalid index	Data record not known in module Illegal data record number ≥ 256
80	B1	write length error	The length specified in the RECORD parameter is incorrect; With “RALRM”: length error in AINFO, With “RDREC” and “WRREC”: length error in MLEN
80	B2	invalid slot	The configured slot is not occupied.
80	B3	type conflict	Actual module type does not match specified module type
80	B4	invalid area	DP slave or module reports access to an invalid area
80	B5	state conflict	DP slave or module not ready
80	B6	access denied	DP slave or module denies access
80	B7	invalid range	DP slave or module reports an invalid range for a parameter or value
80	B8	invalid parameter	DP slave or module reports an invalid parameter
80	B9	invalid type	DP slave or module reports an invalid type With “RDREC”: buffer too small (subsets cannot be read) With “WRREC”: buffer too small (subsets cannot be written)

Error_Decode (B#16#...)	Error_Code_1 (B#16#...)	Explanation according to DPV1	Meaning
80	BA to BF	user specific	DP slave or module reports a manufacturer-specific error when accessing. Please check the documentation from the manufacturer of the DP slave or module. Note on value B#16#BA: The following applies for PROFINET® in the H system: If a data record job with the return value W#16#80BA is rejected, the job must be repeated.
80	C0	read constrain conflict	With “WRREC”: the data can only be written when the CPU is in STOP mode. Note: this means that writing by the user program is not possible. You can only write the data online with PG/PC. With “RDREC”: the module routes the data record, but either no data is present or the data can only be read when the CPU is in STOP mode. Note: if data can only be read when the CPU is in STOP mode, then an evaluation by the user program is not possible. In this case, you can only read the data online with PG/PC.
80	C1	write constrain conflict	The data of the previous write job on the module for the same data record have not yet been processed by the module.
80	C2	resource busy	The module is currently processing the maximum possible number of jobs for a CPU.
80	C3	resource unavailible	The required operating resources are currently occupied.
80	C4		Internal temporary error. Job could not be carried out. Repeat the job. If this error occurs often, check your installation for sources of electrical interference.
80	C5		DP slave or module not available.
80	C6		Data record transfer was canceled due to priority class cancellation
80	C7		Job aborted due to warm or cold restart on the DP master

Error_Decode (B#16#...)	Error_Code_1 (B#16#...)	Explanation according to DPV1	Meaning
80	C8 to CF		DP slave or module reports a manufacturer-specific resource error. Please check the documentation from the manufacturer of the DP slave or module.
80	Dx	user specific	DP slave specific. Refer to the description of the DP slave.
8x (x=1, ... 9,A,B,C,D,E,F)	00 to FF		Error in y-th call parameter (y = 1, ...15) Error_Code_1 = 00: Illegal operating mode For all other values of Error_Code_1 refer also to: Evaluating errors with output parameter RET_VAL
FE, FF	00 to FF		Profile-specific error

3.11.8.3 Field Element Status [4]

In PROFINET® IO, status[4] has the value 0