AP10

Siemens S7-300®
PROFIBUS® Interface Module
for SIMATIC® Manager V5.5 + SP3
via HMS Anybus® Communicator™

Software Description

V1.0.0

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1 General Notes

1.1 Trademarks

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1.3 Limitations

The library and its function were tested with SIMATIC® S7-300 CPU 6ES7 313-6CE01-0AB0. The interface module was engineered in STL using SIMATIC® Manager V5.5 + SP3.

The configuration file and its function were tested on an Anybus® Communicator™ AB7000. The file was setup using Anybus® Configuration Manager - Communicator RS232/422/485 version v.4.4.1.3 (Win 2000/XP/Vista/7).

1.4 Requirements

- Basic knowledge of handling and programming Siemens systems.
- Familiarity with PROFIBUS®.
- Basic knowledge of setup and handling Anybus® Communicator™
- Familiarity with Anybus® Configuration Manager

1.5 Versions Overview

This manual is related to

- AP10 firmware version >= 1.05
- Library “SIKO_SN5-PBvABC_LIB_V501”
- Know-how protected function block FB310 “SIKO_DRV_AP10vPB”
- Anybus® configuration file “SIKO_PB_20-SN5_pattern”
- Anybus® Communicator™ file “HMSB1803.gsd”

1.6 List of Abbreviations

FPB	PROFIBUS®	ABC	Anybus® Communicator™
SN5	SIKONETZ-5	ACM	Anybus® Configuration Manager
SW	Status Word	FB	Function Block
CW	Control Word	DB	Data Block

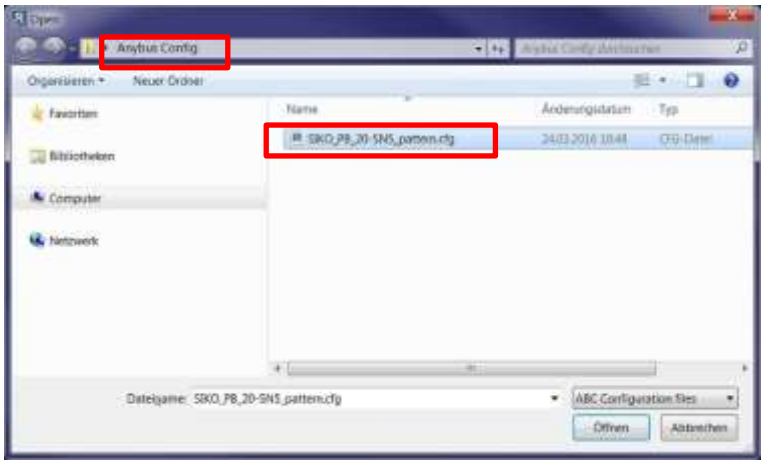
2 Hardware Configuration

2.1 Setup of Anybus® Communicator™

Please note, that the Anybus® configuration file is designed for a flexible SN5 participant numbers of minimum 1 to maximum 20. Later node address has to be modified according to your network requirements. Please consider a FPB address modification when reading further on.

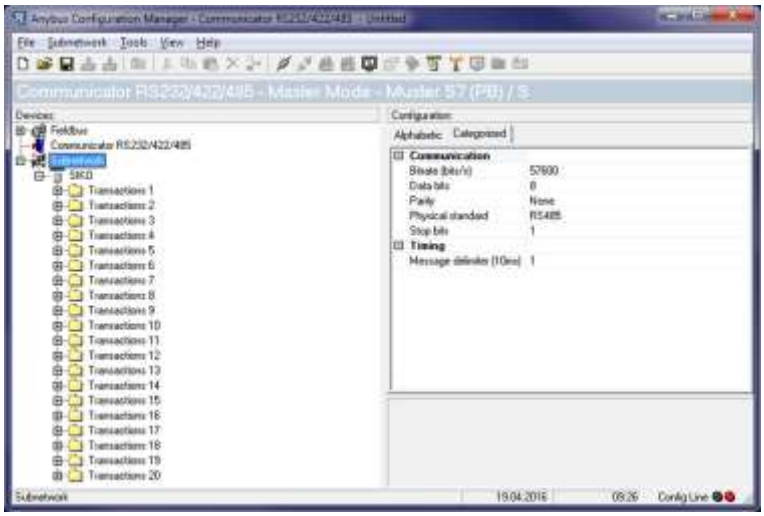
2.1.1 ABC Configuration File

Start ACM and select configuration file “SIKO_PB_20-SN5_pattern” from the folder “Anybus Config”.



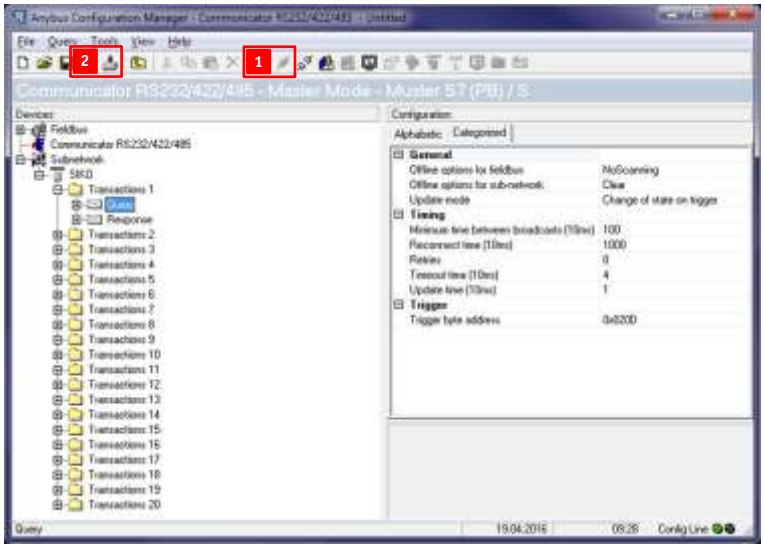
2.1.2 Transfer Configuration

Connect ABC with PC via “RS232 configuration cable” of Anybus accessories.



1. Press “Connect” to go online with the ABC.
2. Press “download to the ABC”.

You should have the following view:



2.1.3 ABC Cycle Time

Each transaction consists of “Query” and “Response”. The minimum time for a used transaction is about >= 10 ms. Each Subnetwork cycle has an overhand of about >= 100 ms.

Since the plc cycle time is asynchronous with ABC cycle time the FB integrates a trigger instead of checksum to the SN5 structure. When a master telegram is completed by the FB the trigger will be incremented. The corresponding transaction will be updated by change of state on trigger and exchanges the trigger with checksum byte before the SN5 telegram is send into subnetwork.
The subnetwork reply is checked and checksum byte is exchanged with incremented trigger byte before the telegram is send to plc by ABC. The FB will wait until a valid slave telegram is responded before sending a new telegram. Due to it the minimum time between update cycle amounts to >= 110 ms minimum. Please consider this for time critical applications!

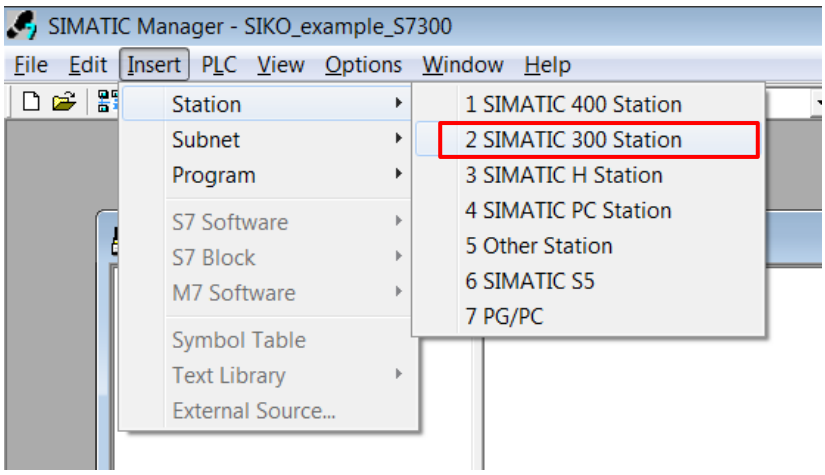
2.2 Setup of PLC, PROFIBUS® and ABC

Create New SIMATIC® Manager Project

1. Start the SIMATIC® Manger and create a new project: "File" > "New".
2. Enter the project name “SIKO_example_S7300”.
3. Choose a project path.
4. Execute the command “OK”.

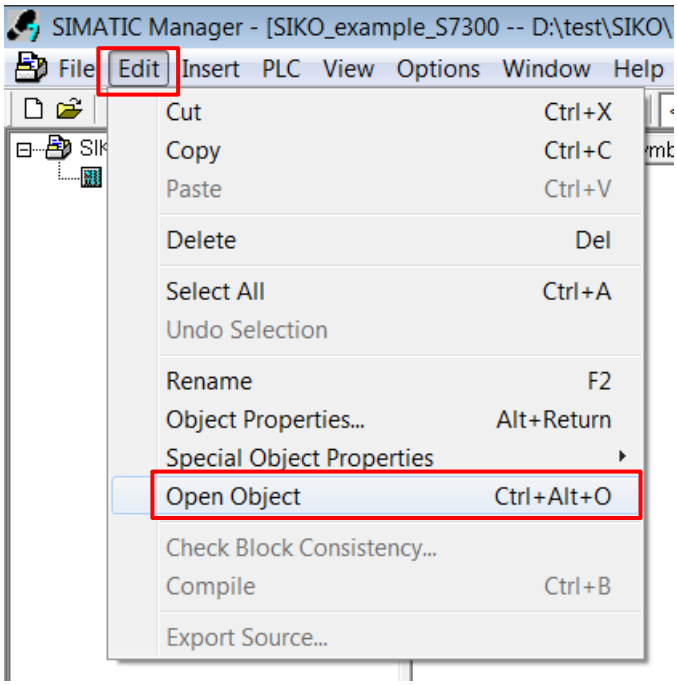
2.2.1 Add Your PLC to the Project

1. Insert a new S7-300 station by using the command
   "Insert" > "Station" > "SIMATIC 300 Station"



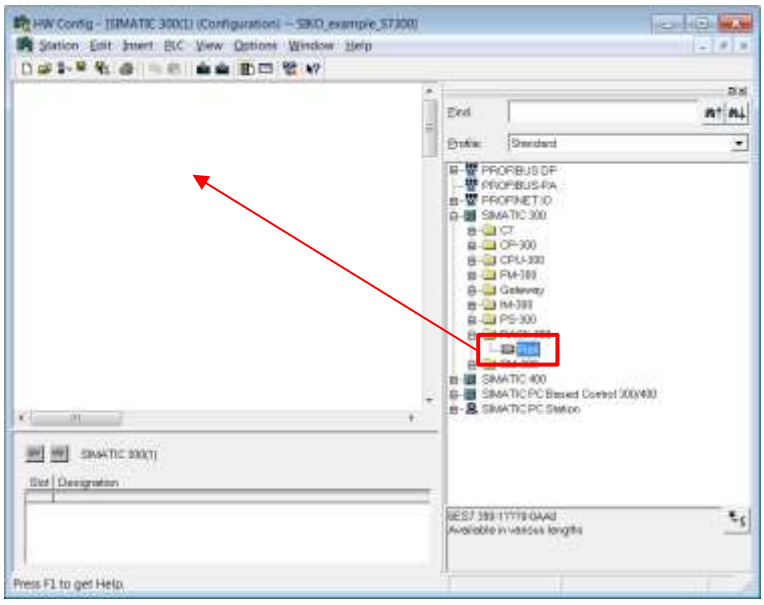
The new station appears below the project name.

2. Open the hardware configuration tool with command "Edit" > "Open Object"

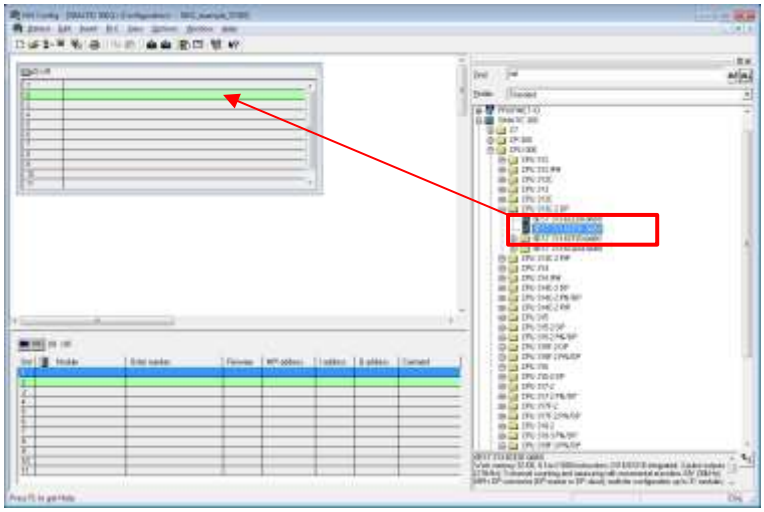


Now an empty hardware configuration window is opened.

3. Choose "Rail" from the folder "RACK-300" of the hardware catalog on the right side. Use drag and drop to move the "Rail" to the hardware configuration.



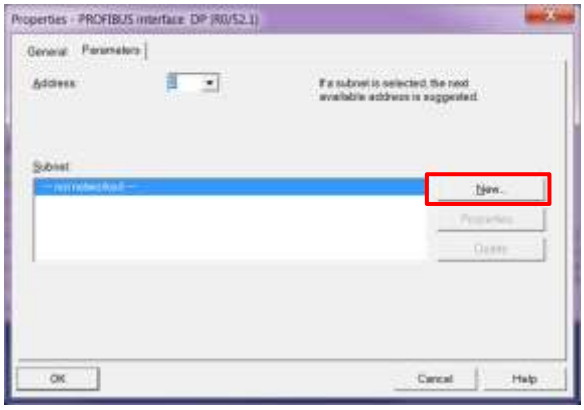
4. Choose the CPU from the hardware catalog and plug it into slot 2 of the rail.



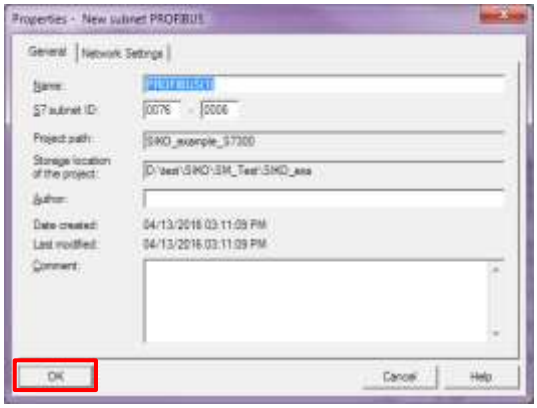
The Properties – PROFIBUS interface DP will open.

NOTICE	The Profibus Address in this example can cause problems under certain circumstances.

5. Create a new Subnet "New..."



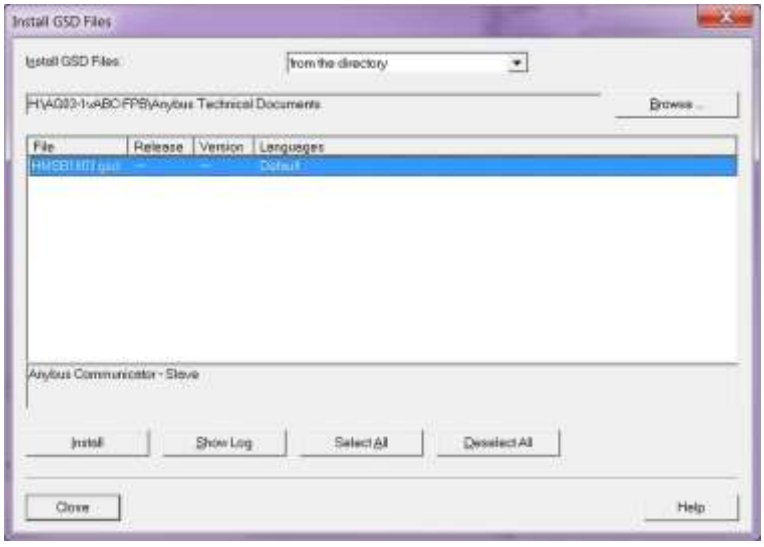
6. Confirm the settings with "OK".



7. Close the "Properties – PROFIBUS interface DP" window.

2.2.2 Register the GSD Device Description File for ABC

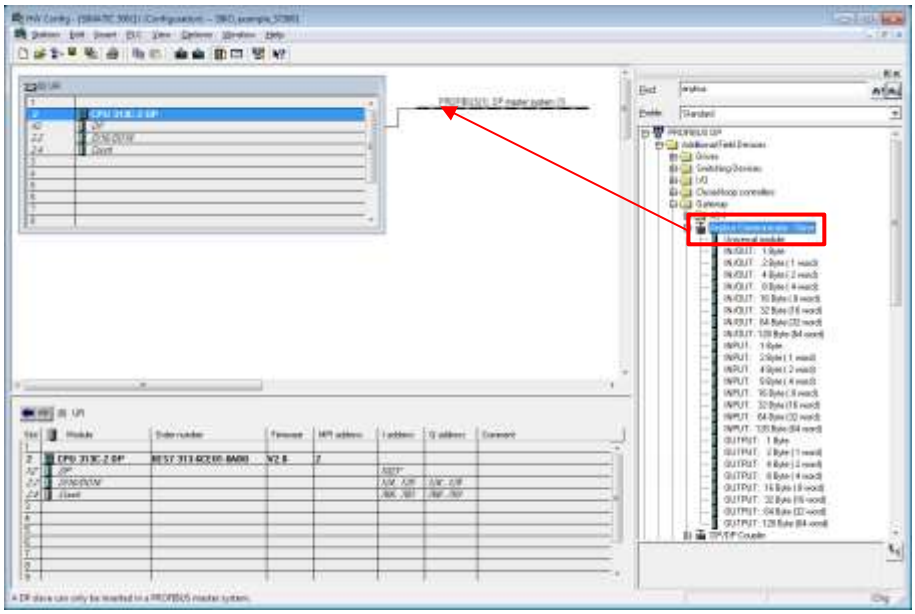
1. Install GSD for ABC via command "Options" > "Install GSD File..."
2. Browse to the storage location of the GSD file and choose the actual version.
3. Install the selected file.



After installation the ABC is available in the hardware catalog.

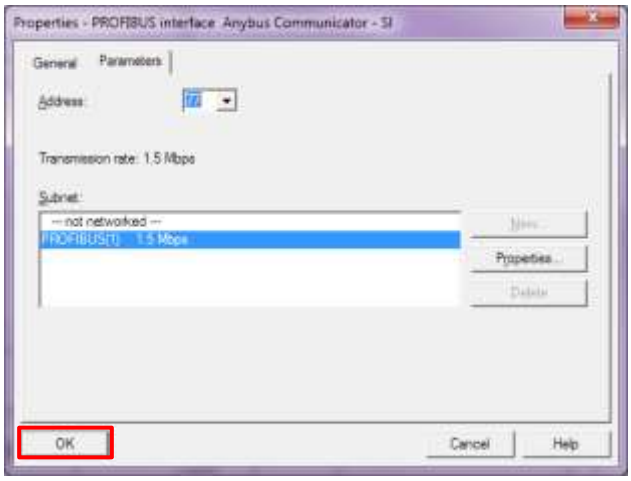
2.2.3 Add New Module to Your Hardware Configuration

1. Choose "Anybus Communicator Slave" within the folder "Gateway" from the hardware catalog and attach it to the PROFIBUS subnet using drag and drop.



The Properties – PROFIBUS interface Anybus Communicator SI will open.

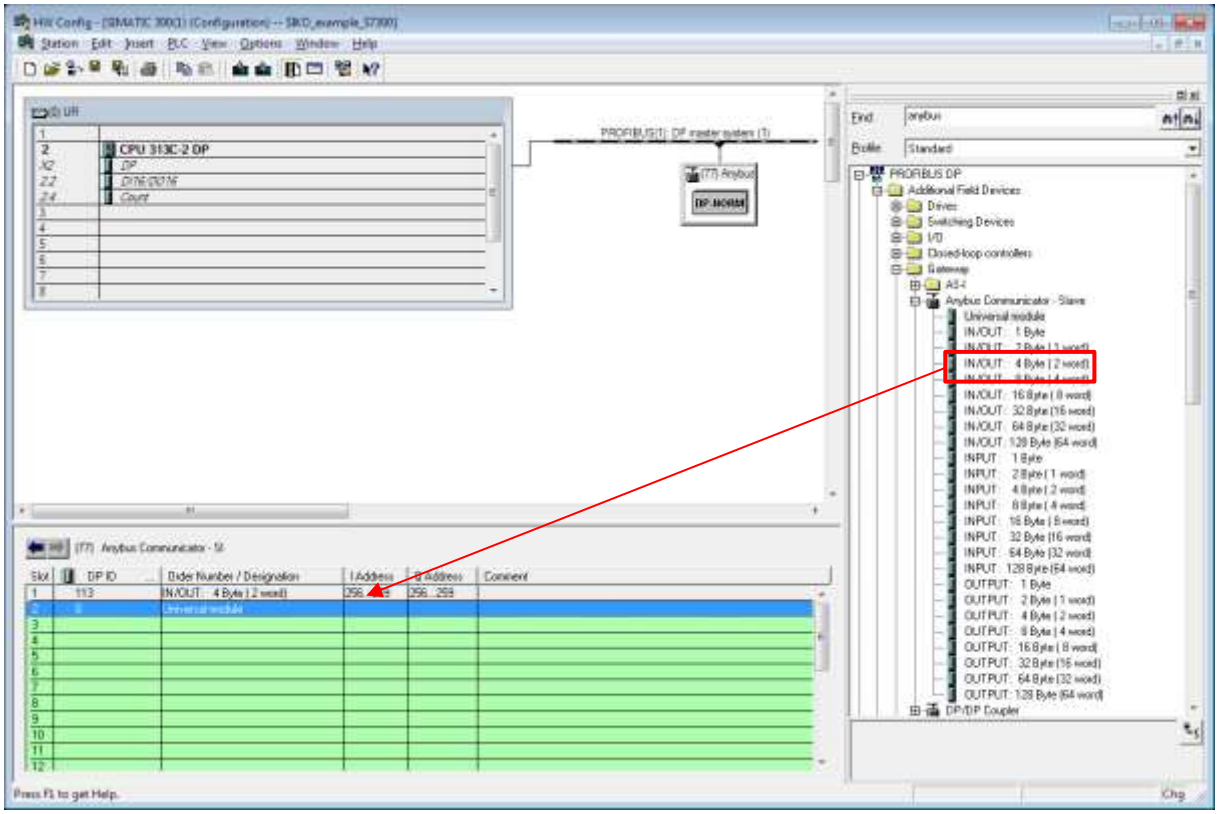
NOTICE	The Profibus Address in this example can cause problems under certain circumstances.



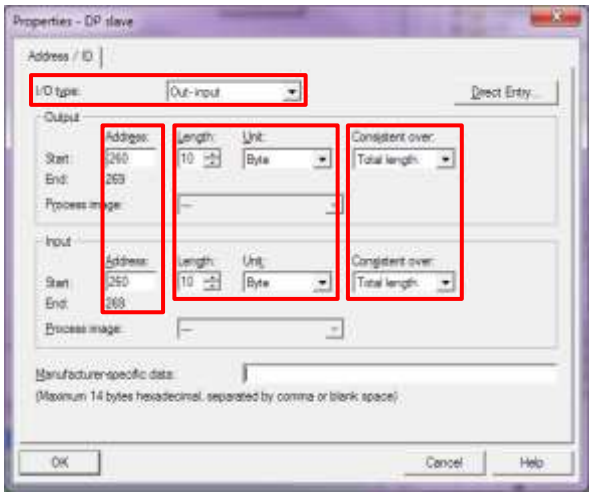
2. Enter a valid PROFIBUS® Address, “77” for example.
3. Confirm the settings with "OK".

2.2.4 Configure the Data Input / Output of ABC

1. Add "IN/OUT 4 Bytes (2 word)" from device “Anybus Communicator Slave” of the hardware catalog to the “Devices overview”.
2. Add "Universal module" from device “Anybus Communicator Slave” of the hardware catalog to the “Devices overview”.



3. Double click on “Universal module” to open “Properties DP slave”.



Setup the “I/O type” to “Out – input”.

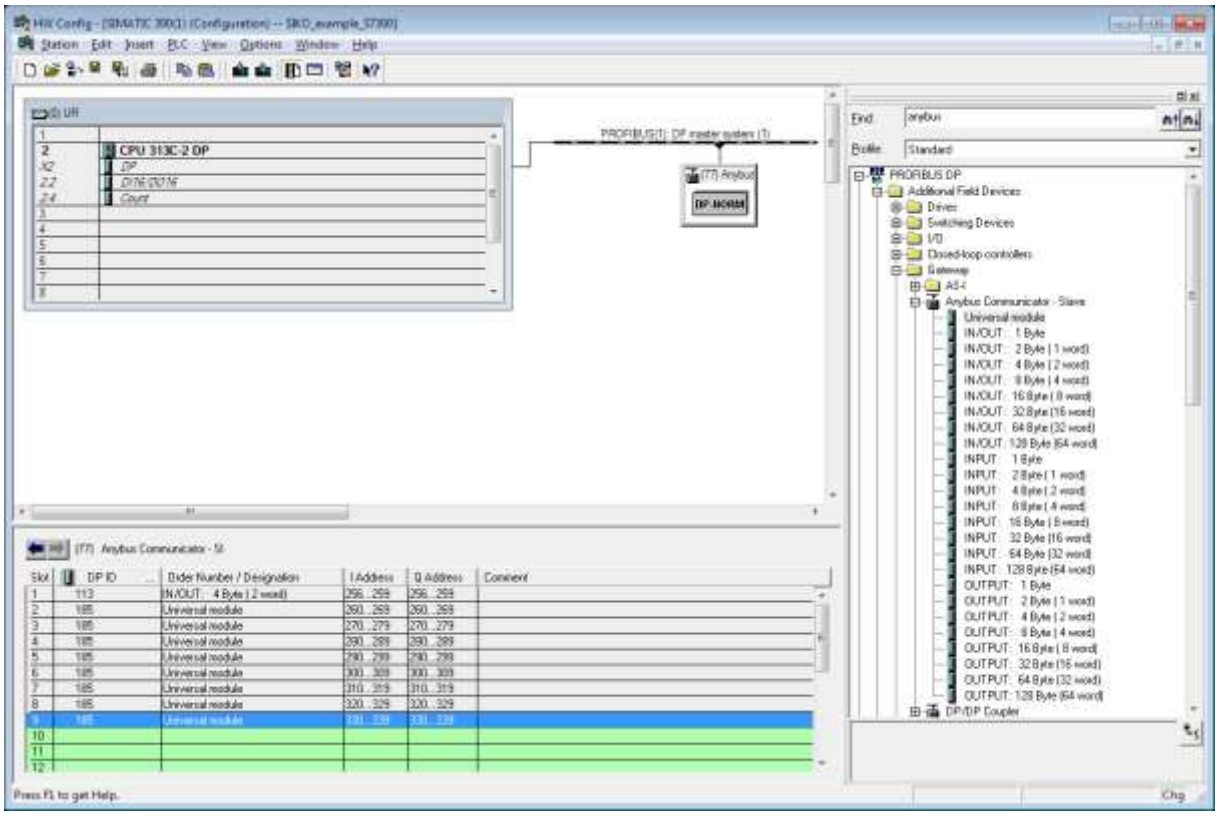
Choose the next “Address” after "IN/OUT 4 Bytes (2 word)".

Modify the “Length” to “10” of “Unit” “Byte”.

Select for “Consistent over” “Total length”.

4. Confirm the settings with "OK".

5. For each SN5 device a “Universal module” is required.
   Select the before modified “Universal Module”. Copy “Ctrl + C” and Paste “Ctrl + V” it to the required amount.



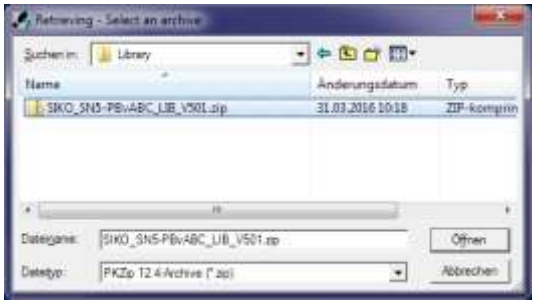
6. Save and compile the hardware configuration.
7. Close "HW Config".

The hardware configuration of the project is now complete.

3 Software Configuration

3.1 Import the SIKO-Library

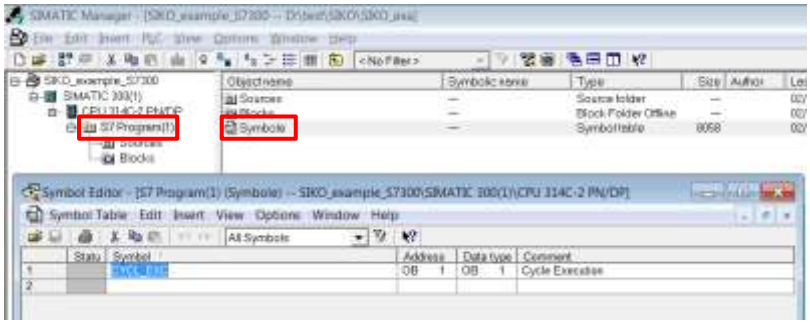
1. Execute command "File" > "Retrieve".
2. Browse to the storage location of the SIKO-library.
3. Select the archive SIKO_SN5-PBvABC_LIB_V501.zip.
4. Execute the command “Open”.



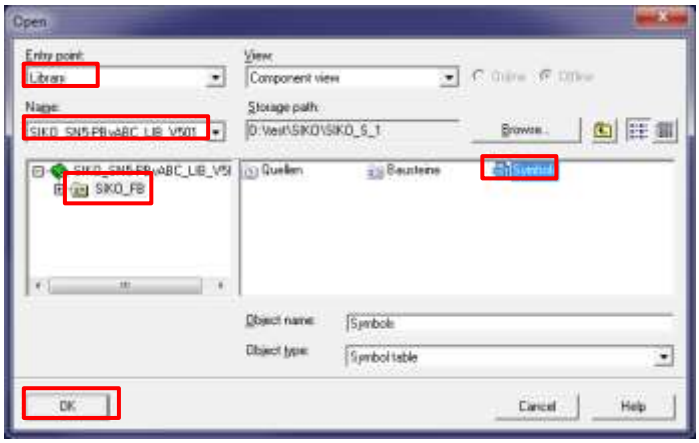
5. Select a destination directory accordingly and open it.

3.1.1 Integrate the Symbole from the Library to Project

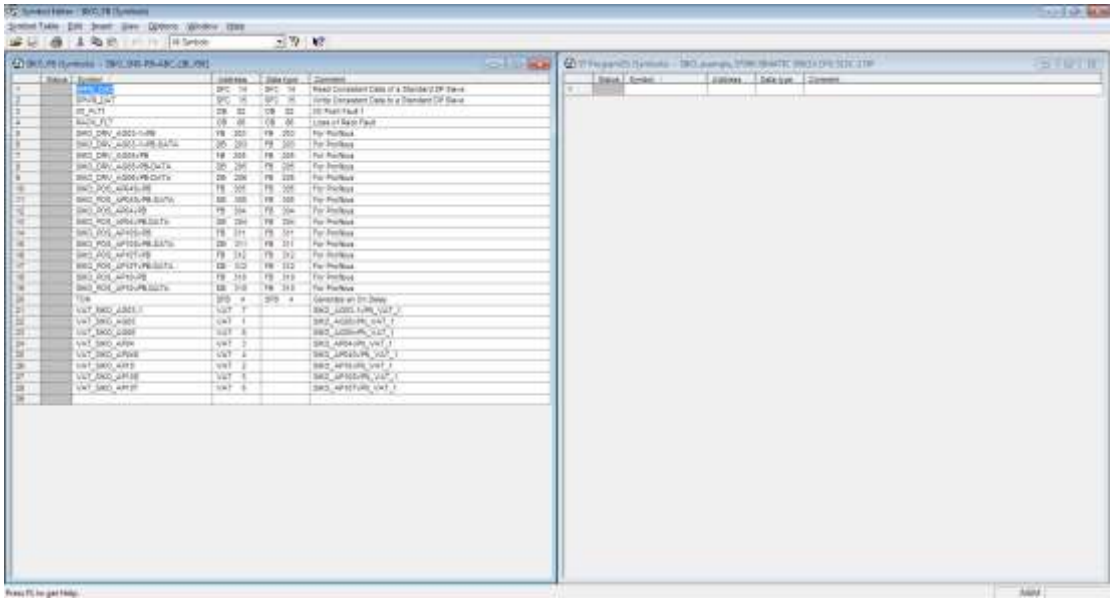
1. Navigate to the tab “S7 Program(1)” in the project tree
2. Double-click on the object “Symbole” in the right window



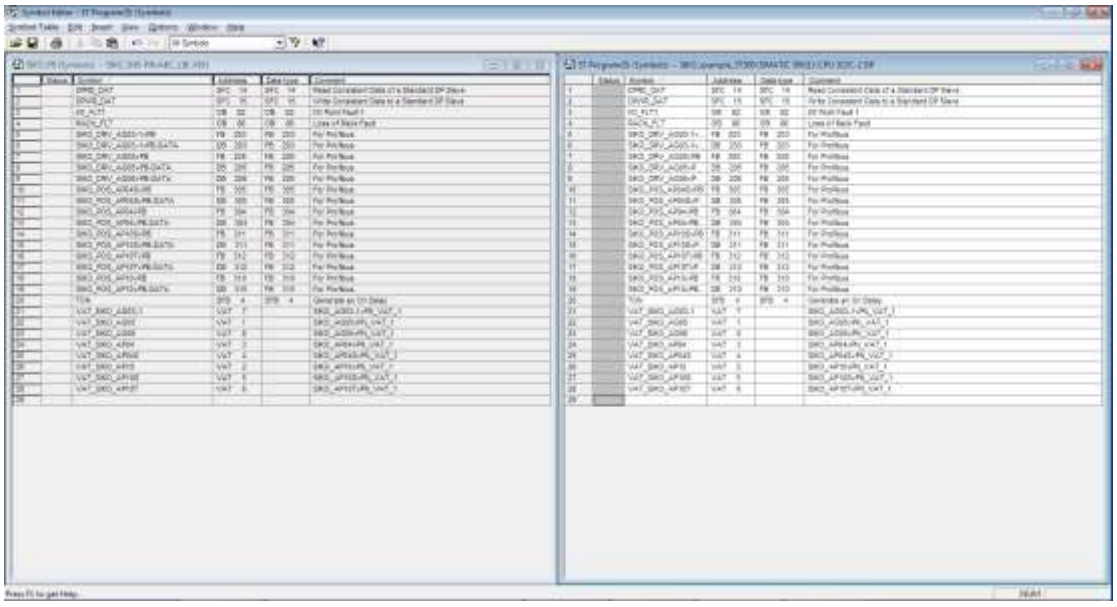
3. In the Symbole Editor execute command "Symbole" > "open".
4. Select the library SIKO_SN5-PBvABC_LIB_V501 and “SIKO_FB”.
5. Choose “Symbole” and confirm your selection with “OK”.



6. Execute command "Window" > "Arange" > “Vertically”.



7. Select ALL by the keystroke combination [**Ctrl**] + [**A**].
8. Copying it into the clipboard with the keystroke combination [**Ctrl**] + [**C**].
9. Click into line 2 (emty one) of your project symbole table and enter with the keystroke combination [**Ctrl**] + [**V**].
10. Delete the the red marked line.

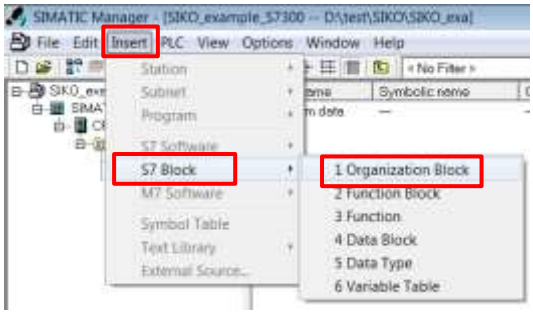


11. Close symbole table “SIKO_FB”.
12. Save and close your project symbole table.

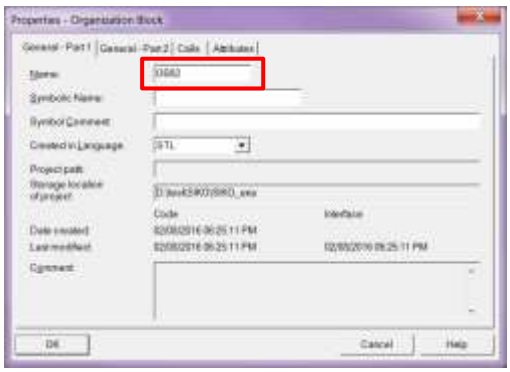
3.2 Add Required Function Blocks

Add OB82, OB86 and OB122 to the folder "Blocks".

1. Select folder "Blocks".
2. Execute command "Insert" > "S7 Block" > "1 Organization Block".



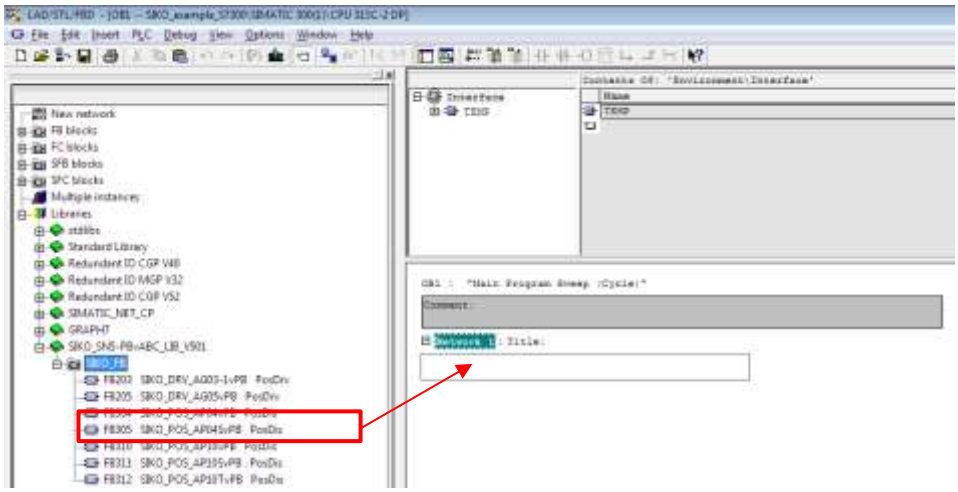
3. Enter organization block name "OB82".



4. Repeat steps 2 and 3 with block name "OB86" and "OB122".

3.3 Call SIKO Function Block Cyclically

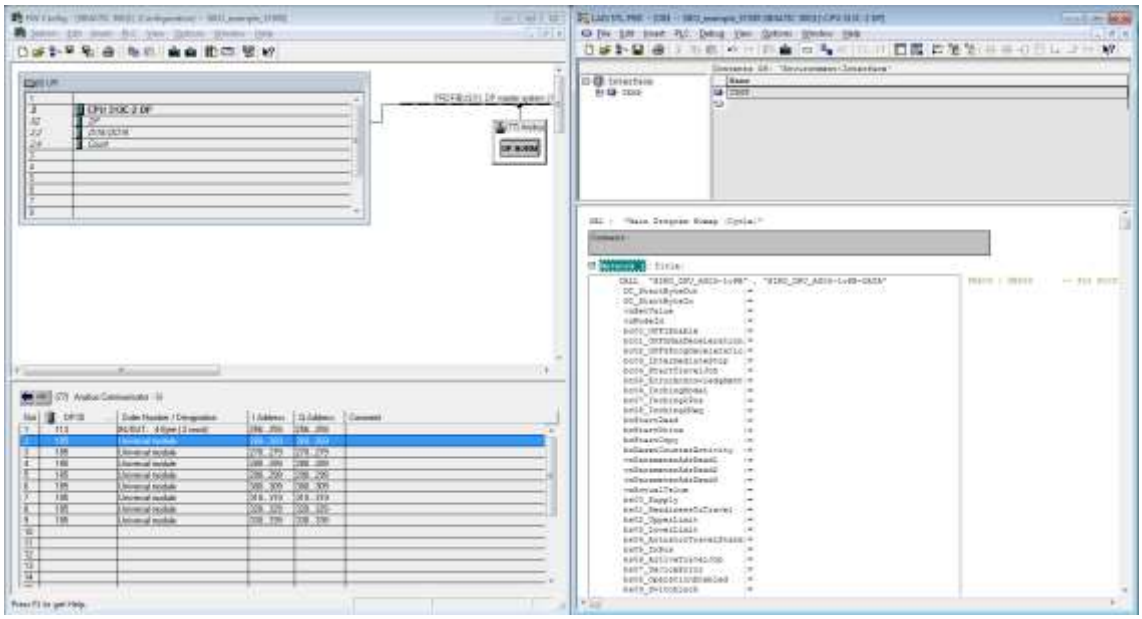
1. Double click on "OB1".
2. Add function block FB310 from library to main program.



3. Enter the name "DB310" for instance data block.
4. Confirm the message window / selection with "Yes", so the instance DB310 is generated.

3.3.1 Setup the Input and Output Addresses of the SIKO Function Block

To setup the input and output addresses of the function block the decimal address values from the hardware configuration have to be converted to hexadecimal values.



In this example the conversion table looks like this:

Slot 2 – Q address	260...269dec	DC_StartByteOut	W#16#104
Slot 2 – I address	260...269dec	DC_StartByteIn	W#16#104

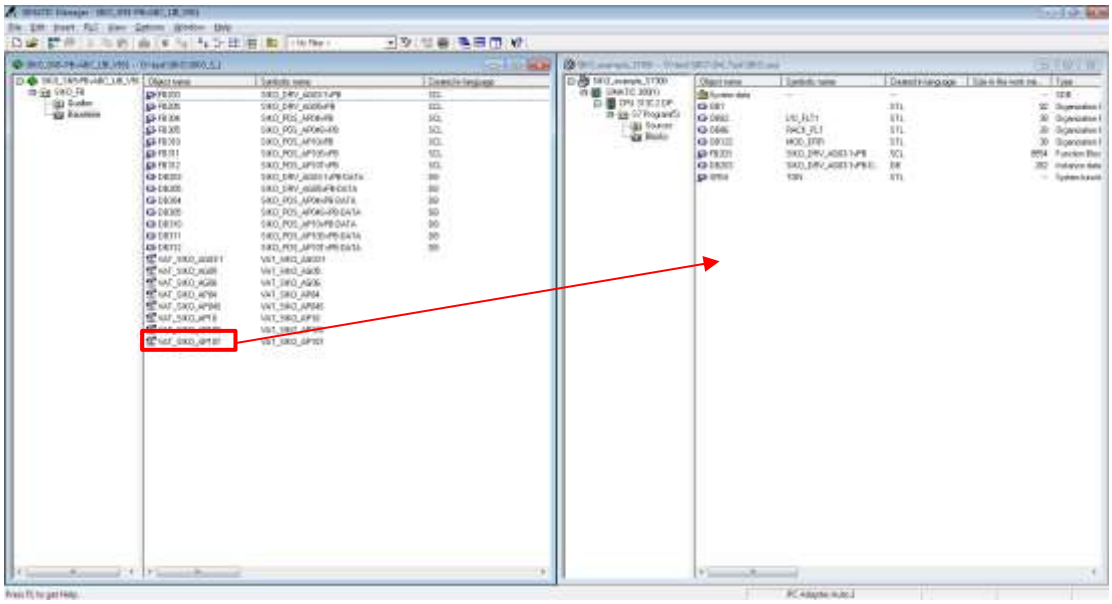
The input "nNodeId" of the function block must be connected with the set note address of the SN5 device.

In this example the address B#16#17 (23dec) is used.

After set up of the addresses save the settings and close the editior window and confirm "OK".

3.4 Insert Variable Table for Testing

1. While your project is still open execute command “File” > "open"
2. Select the library SIKO_SN5-PBvABC_LIB_V501
3. Execute command "Window" > "Arange" > “Vertically”.
4. Choose “VAT_SIKO_AP10” and copy it into your project using drag and drop.



5. Close library “SIKO_SN5-PBvABC_LIB_V501”.

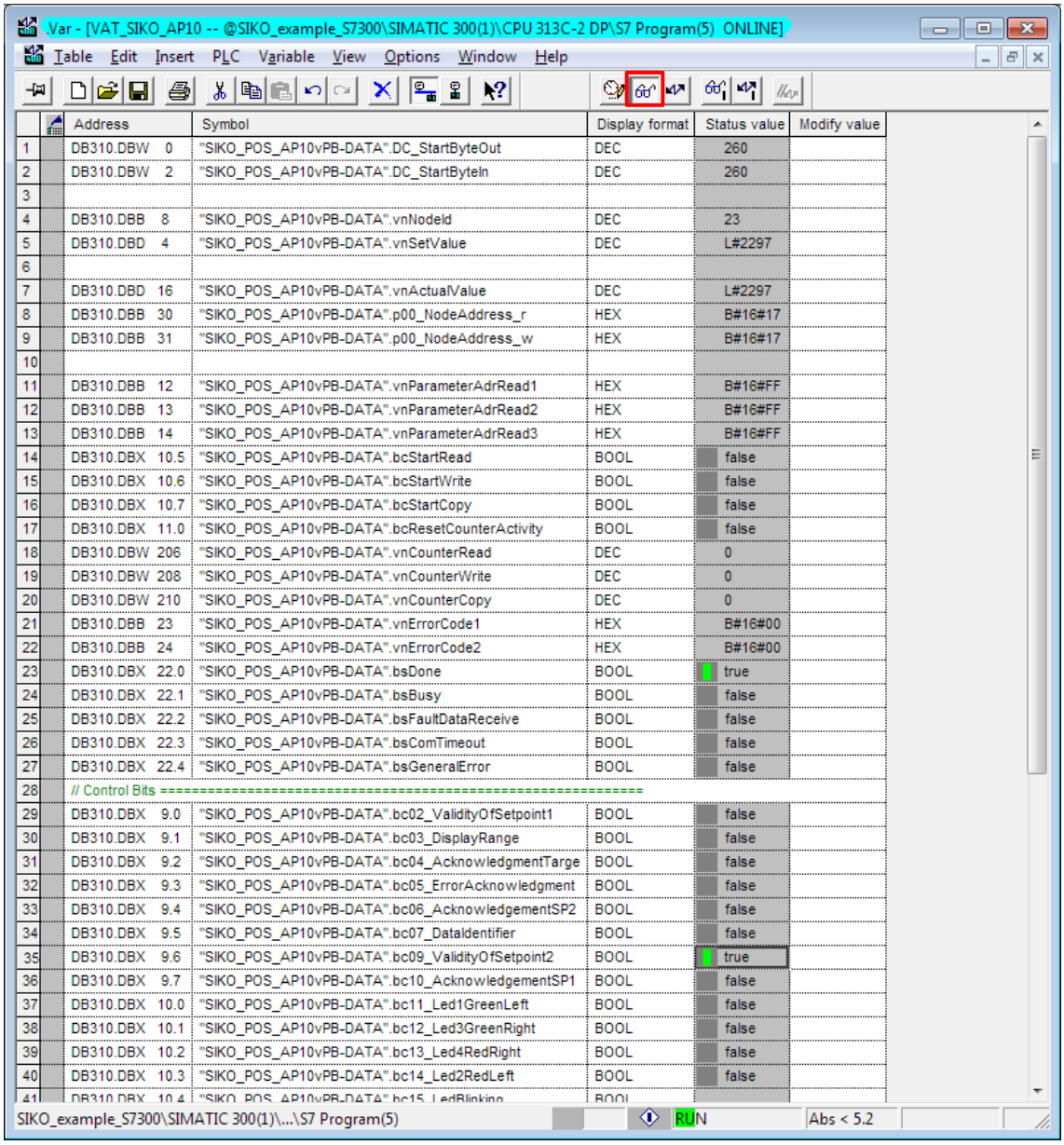
3.5 Complete the Project

1. Select folder "Blocks".
2. Click into the right window and select ALL by the keystroke combination [**Ctrl**] + [**A**].
3. Execute the command “Download”.

4. Confirm the following message boxes with “Yes” or “OK” respectively.

3.6 Work with the Project

1. Double-click on “VAT_SIKO_AP10”.
2. Enable the “Monitor” option in the VAT window.
3. Now you can control the SIKO-AP10 by setting the control bits.



	Address	Symbol	Display format	Status value	Modify value
1	DB310.DBW 0	"SIKO_POS_AP10vPB-DATA".DC_StartByteOut	DEC	260	
2	DB310.DBW 2	"SIKO_POS_AP10vPB-DATA".DC_StartByteIn	DEC	260	
3					
4	DB310.DBB 8	"SIKO_POS_AP10vPB-DATA".vnNodeId	DEC	23	
5	DB310.DBD 4	"SIKO_POS_AP10vPB-DATA".vnSetValue	DEC	L#2297	
6					
7	DB310.DBD 16	"SIKO_POS_AP10vPB-DATA".vnActualValue	DEC	L#2297	
8	DB310.DBB 30	"SIKO_POS_AP10vPB-DATA".p00_NodeAddress_r	HEX	B#16#17	
9	DB310.DBB 31	"SIKO_POS_AP10vPB-DATA".p00_NodeAddress_w	HEX	B#16#17	
10					
11	DB310.DBB 12	"SIKO_POS_AP10vPB-DATA".vnParameterAdrRead1	HEX	B#16#FF	
12	DB310.DBB 13	"SIKO_POS_AP10vPB-DATA".vnParameterAdrRead2	HEX	B#16#FF	
13	DB310.DBB 14	"SIKO_POS_AP10vPB-DATA".vnParameterAdrRead3	HEX	B#16#FF	
14	DB310.DBX 10.5	"SIKO_POS_AP10vPB-DATA".bcStartRead	BOOL	false	
15	DB310.DBX 10.6	"SIKO_POS_AP10vPB-DATA".bcStartWrite	BOOL	false	
16	DB310.DBX 10.7	"SIKO_POS_AP10vPB-DATA".bcStartCopy	BOOL	false	
17	DB310.DBX 11.0	"SIKO_POS_AP10vPB-DATA".bcResetCounterActivity	BOOL	false	
18	DB310.DBW 206	"SIKO_POS_AP10vPB-DATA".vnCounterRead	DEC	0	
19	DB310.DBW 208	"SIKO_POS_AP10vPB-DATA".vnCounterWrite	DEC	0	
20	DB310.DBW 210	"SIKO_POS_AP10vPB-DATA".vnCounterCopy	DEC	0	
21	DB310.DBB 23	"SIKO_POS_AP10vPB-DATA".vnErrorCode1	HEX	B#16#00	
22	DB310.DBB 24	"SIKO_POS_AP10vPB-DATA".vnErrorCode2	HEX	B#16#00	
23	DB310.DBX 22.0	"SIKO_POS_AP10vPB-DATA".bsDone	BOOL	true	
24	DB310.DBX 22.1	"SIKO_POS_AP10vPB-DATA".bsBusy	BOOL	false	
25	DB310.DBX 22.2	"SIKO_POS_AP10vPB-DATA".bsFaultDataReceive	BOOL	false	
26	DB310.DBX 22.3	"SIKO_POS_AP10vPB-DATA".bsComTimeout	BOOL	false	
27	DB310.DBX 22.4	"SIKO_POS_AP10vPB-DATA".bsGeneralError	BOOL	false	
28	// Control Bits ==========				
29	DB310.DBX 9.0	"SIKO_POS_AP10vPB-DATA".bc02_ValidityOfSetpoint1	BOOL	false	
30	DB310.DBX 9.1	"SIKO_POS_AP10vPB-DATA".bc03_DisplayRange	BOOL	false	
31	DB310.DBX 9.2	"SIKO_POS_AP10vPB-DATA".bc04_AcknowledgmentTarge	BOOL	false	
32	DB310.DBX 9.3	"SIKO_POS_AP10vPB-DATA".bc05_ErrorAcknowledgment	BOOL	false	
33	DB310.DBX 9.4	"SIKO_POS_AP10vPB-DATA".bc06_AcknowledgementSP2	BOOL	false	
34	DB310.DBX 9.5	"SIKO_POS_AP10vPB-DATA".bc07_DataIdentifier	BOOL	false	
35	DB310.DBX 9.6	"SIKO_POS_AP10vPB-DATA".bc09_ValidityOfSetpoint2	BOOL	true	
36	DB310.DBX 9.7	"SIKO_POS_AP10vPB-DATA".bc10_AcknowledgementSP1	BOOL	false	
37	DB310.DBX 10.0	"SIKO_POS_AP10vPB-DATA".bc11_Led1GreenLeft	BOOL	false	
38	DB310.DBX 10.1	"SIKO_POS_AP10vPB-DATA".bc12_Led3GreenRight	BOOL	false	
39	DB310.DBX 10.2	"SIKO_POS_AP10vPB-DATA".bc13_Led4RedRight	BOOL	false	
40	DB310.DBX 10.3	"SIKO_POS_AP10vPB-DATA".bc14_Led2RedLeft	BOOL	false	
41	DB310.DBX 10.4	"SIKO_POS_AP10vPB-DATA".bc15_LedBlinking	BOOL		

4 Communication Settings

4.1 Data Exchange

The FB is designed to send or receive in alternation the “nSetValue” (Write, Parameter: 0xFF “Set Point ”) or the “nActualValue” (Read, Parameter: 0xFE “Actual Position”) respectively, while no specific parameter access is active.

With the “nParameterAdrRead1”, “nParameterAdrRead2” and “nParameterAdrRead3” further parameter can be included in the data read cycle. With default value 0xFE the inclution is disabled.

NOTE: If “bsFaultDataReceive” is indicated the complete data exchange is stopped, while Control and Status Word are still updated! A missing or not responsing subnetwork participant is indicated by “bsComTimeout” (0,5sec. + time set in parameter 0x02 Bus Timeout).

4.2 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).

A rising edge must be applied either to the “bcStartRead” or to the “bcStartWrite” input on the module described here in order to enable a read or write process of one of the variables.

4.2.1 Read Parameters

If a rising edge is applied to the ”bcStartRead” input, then all parameters will be read and can be used for further programming. If counter read value is not reset to “0” the read cycle was interrupted by read failure. This indicates to a communication failure.

4.2.2 Write Parameters

If a rising edge is applied to the “bcStartWrite” input of the module, then all parameters will be transferred to the module. If counter write value is not reset to “0” the write cycle was interrupted by a write failure. This indicates to a communication failure or parameter value is beyond range of value accepted by AP10.

4.2.3 Copy Parameters from Read to Write

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

4.3 S-Commands

After executing a S-Command a read cycle is been triggered to refresh all actual values (_r).

4.4 Counter Value

Count read value	Count write value	Name	Value range (dec)	Default
	1	0xA8 Programming Mode On/Off	0 ... 1	0
1	2	0x00 Note address	0 ... 31	31
2	3	0x01 Baud rate	0 ... 2	1
3	4	0x02 Bus Timeout	0 ... 20	20
4	5	0x03 Response parameter to a setpoint write access	0 ... 2	0
5	6	0x04 Keys enable time: Configuration start delay	1 ... 60	5
6	7	0x05 Key function enable1: Calibration enable	0 ... 1	1
7	8	0x06 LED flashing	0 ... 1	0
8	9	0x07 LED3 (green right)	0 ... 1	1
9	10	0x08 LED2 (red left)	0 ... 1	1
10	11	0x09 LED1 (green left)	0 ... 1	1
11	12	0x0A Decimal places	0 ... 4	0
12	13	0x0B Display divisor (ADI)	0 ... 3	0
13	14	0x0C Direction indicators (CW, CCW)	0 ... 2	0
14	15	0x0D Display orientation	0 ... 1	0
15	16	0x0E Configuration programming mode	0 ... 1	0
16	17	0x1B Counting direction	0 ... 1	0
17	18	0x1C Resolution per revolution	1 ... 65535	880
18	19	0x1E Offset value	-9999 ... 9999	0
19	20	0x1F Calibration value	-999999 ... 999999	0
20	21	0x20 Target window1 (near field)	0 ... 9999	5
21	22	0x21 Positioning type (loop type)	0 ... 2	0
22	23	0x22 Loop length	0 ... 9999	0
23	24	0x28 Operating mode	0 ... 3	0
24	25	0x30 Display in the 2nd row	0 ... 1	0
25	26	0x31 Target window2 (extended)	0 ... 9999	0
26	27	0x32 Target window2 visualization	0 ... 1	0
27	28	0x33 Application of the display divisor (ADI application)	0 ... 1	0
28	29	0x34 Formation of the differential value	0 ... 1	0
29	30	0x35 Key function enable2: Incremental measurement enable	0 ... 1	1
30	31	0x39 LED4 (red right)	0 ... 1	1
31	32	0x3A LCD backlight flashing	0 ... 1	0
32	33	0x3B LCD backlight white	0 ... 1	1

Count read value	Count write value	Name	Value range (dec)	Default
33	34	0x3C LCD backlight red	0 ... 1	1
34	35	0x3D Key function enable3: Configuration enable via keyboard	0 ... 1	1
35	36	0x3E Acknowledgement settings	0 or 2	0
36	37	0x3F Indication factor	0 ... 8	0
37		0x63 Battery voltage		0
38		0x65 Device identification		0
39		0x67 Software version		0
40		0x80 Number of errors		0
41		0x81 Error 01		0
42		0x82 Error 02		0
43		0x83 Error 03		0
44		0x84 Error 04		0
45		0x85 Error 05		0
46		0x86 Error 06		0
47		0x87 Error 07		0
48		0x88 Error 08		0
49		0x89 Error 09		0
50		0x8A Error 10		0
51		0x96_00 Input Errors		0
52		0x96_01 Input Errors Index 1		0
53		0x96_02 Input Errors Index 2		0
54		0x96_03 Input Errors Index 3		0
55		0x96_04 Input Errors Index 4		0
56		0x96_05 Input Errors Index 5		0
57		0x96_06 Input Errors Index 6		0
58		0x96_07 Input Errors Index 7		0
59		0x96_08 Input Errors Index 8		0
60		0x96_09 Input Errors Index 9		0
61		0x96_10 Input Errors Index 10		0
	38	0xA7 Execute Calibration	0 ... 1	0
	39	0xAA FreezeAV	0 ... 1	0
62		0xC5 ADC values of the sensor		0
63		0xCF Period counter		0
64	40	0xD0 Response delay	0 ... 20	0
	41	0xD2 Auto Id Assignment	1 ... 31	0
65		0xFA System Status word		0
66	42	0xFB Setpoint1	–2.147.483.648 ... 2.147.483.647	0
67		0xFC Differential value		0

Count read value	Count write value	Name	Value range (dec)	Default
68		0xFE Position value		0
69		0xFF Setpoint2		0
	43	0xA0 System Command	1, 2, 5, 7 or 9	0

4.4.1 Error Codes

If a communication error occurs, there is an error code present at the outputs “nErrorCode1” and “nErrorCode2”. Please refer to the AP10 manual (keyword: error codes) for a complete description of these error codes.

5 Additional Information

5.1 Corresponding Node Address

Since the different SN5 devices can be commanded to change the actual used node address, make sure, that before a “bcStartWrite” is executed, “vnNodeId” (temporary address) and “p00_NodeAddress_w” (set address) are adjusted accordingly.
Otherwise a lost of communication after cold start or software reset is possible!

5.2 Priority of “bcStartRead”, “bcStartWrite”, “bcStartCopy” or “bcResetCounterActivity”

If one of “bcStartRead”, “bcStartWrite”, “bcStartCopy” is high/true the others are blocked, except “bcResetCounterActivity”. The priority is: “bcStartRead”, “bcStartWrite”, “bcStartCopy”.

There is no timing or device condition to execute either “bcStartRead” or “bcStartCopy”. For execute “bcStartWrite” the device must be without movement and “vnCounterRead” and “vnCounterCopy” are inactive.
Otherwise “bcStartWrite” is not executed or delayed!

If “bcResetCounterActivity” is high/true ALL counters are set to “0” as well as the internal status of “bcStartRead”, “bcStartWrite”, “bcStartCopy”.

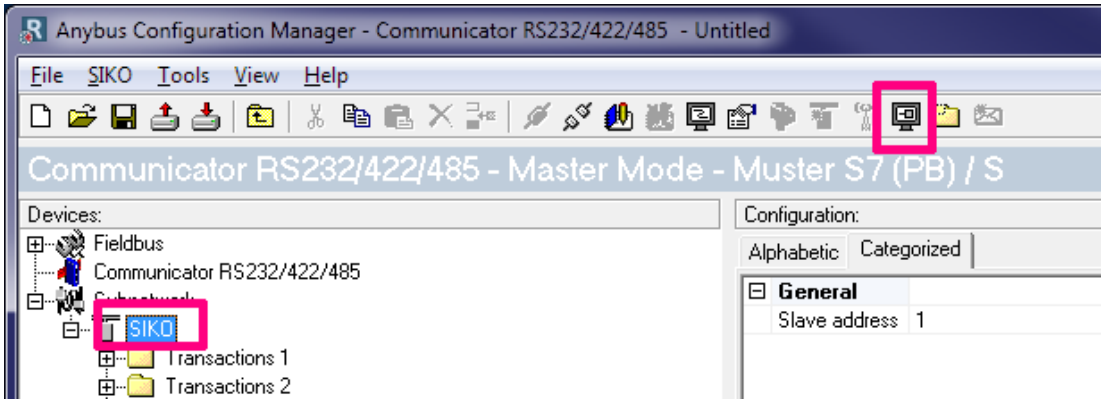
5.3 Difference in SN5 Protocol Between PLC <-> ABC and ABC <-> SN5 device

The FB is creating a protocol string according to the device manual but with one network required modification, which is a trigger byte instead of checksum byte at the protocol end.

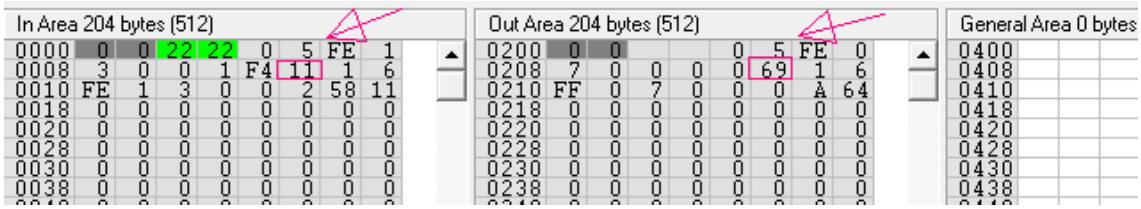
This is required since the plc cycle and update time is much higher than from the ABC. Every time the FB has completed the string, it increases the trigger value by one. The ABC configuration is designed to check this plc trigger. Every time the ABC application update cycle comes together with the plc trigger change, the ABC configuration exchanges the trigger byte with a checksum byte and sends the SN5 protocol into the subnet.

The addressed SN5 slave replies with a respectively protocol and the ABC performs the checksum test. If positively checked, the ABC exchanges the checksum byte with a trigger byte and transfers the protocol string to the master plc. This trigger is monitored (fix 500 ms) and used together with “p02_BusTimeout_r” to create “bsComTimeout”.

The protocol string with trigger byte recived from and transmitted to plc can be viewed in the ABC “Node Monitor”. Go online with ABC while application runs. Click the node underneath “Subnet”. Then start the “Node Monitor” which should be selectable now:



You should have similar few:



In the “Out Area …” you can see what is send from plc. In this example the ID5 is requested for current position.
In the “In Area …” you can see what comes from subnet. In this example the ID5 replies current position (1F4 (h) = 500 (d)).
To the ID 6 the target position (258 (h) = 600 (d)) is send and confirmed.

Please keep in mind, that the 10th Byte is not checksum but trigger value!