

IBH Link UA

Manual Part 3

PLC projects with S7 –SIMATIC Manager

IBHsoftec GmbH
Turmstr. 77
64760 Oberzent / Beerfelden
Phone: +49 6068 3001
Fax: +49 6068 3074
info@ibhsoftec.com
www.ibhsoftec.com

TTi Ingenieurbüro für
Technologie Transfer
Dipl. Ing. B. Peter Schulz-Heise
Phone: +49 6061 3382
Fax: +49 6061 71162
tti@schulz-heise.com
www.schulz-heise.com

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	PLC example projects (PLC programs)	IIX

PLC example projects (PLC programs)

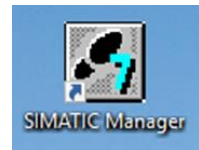
CPU 416 S7e	Project chapters 1 and 2 S7 SIMATIC Manager; CPU 416-3 PN/DP.
WinAC RTX TIA S7e	Project chapter 3 S7 SIMATIC Manager; CPU 416-3 PN/DP, IBH Link UA SoftPLC (Siemens WinAC RTX compatible.)
CPU300 S7e	Project chapter 4 S7 SIMATIC Manager; CPU 312, IBH Link S7++.
S5 CPU 103 S7e STEP 5 and PLC Programs 2xS5 CPUs (File)	Project chapter 5 S5 CPU 103U. S7 SIMATIC Manager S5W PLC-Program: Counter S5W.S5P S5 PLC-Program: COUNT2ST.S5D
Alarms S7e	Project chapter 6 S7 SIMATIC Manager; CPU 416-3 PN/DP.
2xS5_3xS7e S5 -S5We (File with STEP 5 / S5W PLC-Programs)	Project chapter 8 Data exchange between several S7 / S5 CPUs S7 SIMATIC Manager project with several CPUs.
2x CPU 300 S7e	Project chapter 9. S7 SIMATIC Manager; 2x CPU 312, IBH Link S7++.

1 Connection of a CPU 416 to the IBH Link UA – Historical data

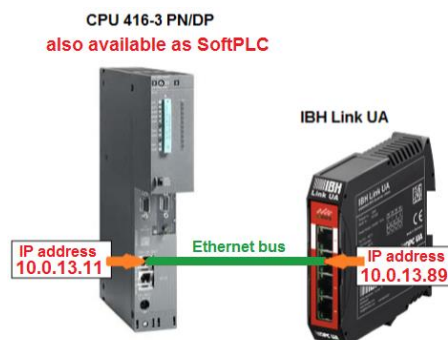
The following example shows the connection of a CPU 416 to the IBH Link UA with an Ethernet connection.

1.1 Project with STEP® 7 (SIMATIC Manager V5.6)

The following example shows a project with STEP® 7 (SIMATIC® Manager V5.5 / V5.6) connecting a CPU 416 and the IBH Link UA via Ethernet.



1.1.1 Hardware structure – (CPU 416-3 PN / DP – IBH Link UA)



1.2 Software PLC CPU 416-3 PN/DP

The example uses a CPU available as a software PLC from IBHsoftec (already installed on the PC).

The PG / PC interface (TCP IP) must be selected accordingly.

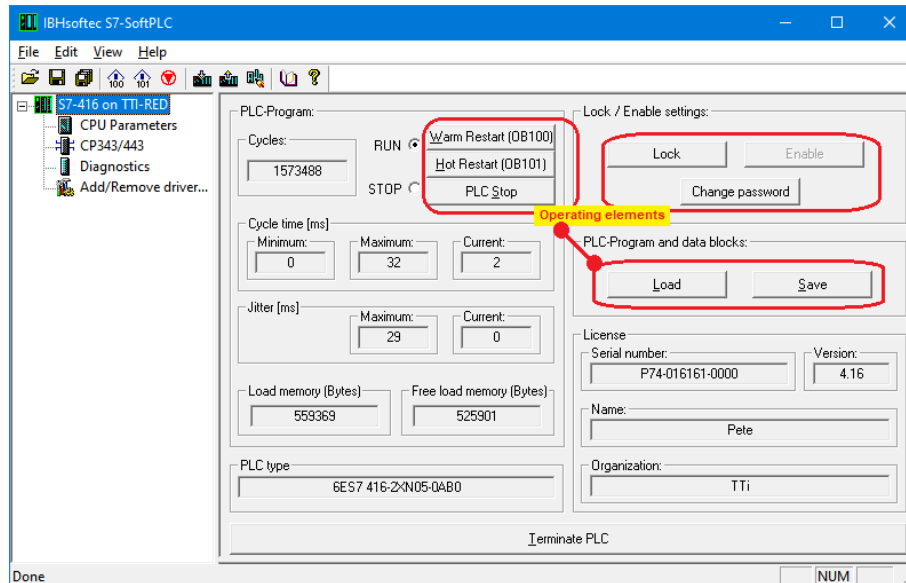


The SoftSPS CPU 416-3 PN/DP from IBHsoftec is installed on the PC and running. A right-clicking on the SoftSPS icon in the taskbar opens the IBHsoftec S7-SoftPLC window for configuring and diagnosing the SoftPLC.

SoftPLC Operating, Diagnostic and Configuration windows

In the status bar right-click the SoftPLC icon to open the window to configure and operate the SoftPLC. This window displays the status of the CPU and diagnostic elements are presented.

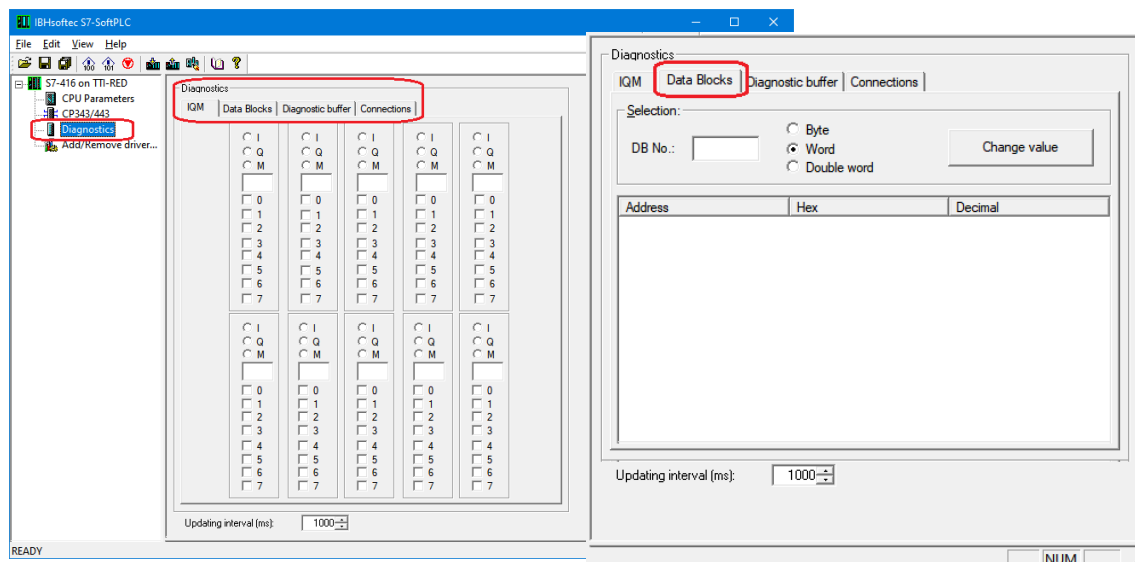
SoftPLC Operating and Status windows



SoftPLC Diagnostic window

The diagnosis provides four tabs.

- **IQM** Status display of individual bits of an operand. The status of freely selectable inputs (In._), outputs (Qn._) or flags (M n._) are displayed and changeable in these ten fields.
- **Data blocks** The status of existing, freely selectable data blocks can be displayed and its values can be changed as a byte, word or double word.
- **Diagnostic buffer** The diagnostics events of the CPU are listed in clear text with explanations in the order of their occurrence.
- **Connections** The connections of the CPU with ID, status, type etc. are displayed.



1.2.1 PLC program of the CPU 416

The project **CPU 416 S7e** with the SIMATIC 400 Station CPU 416 provides a program for up and down counting.

The counter counts until **MaxValue** is reached and counts down until the **MinValue** is reached.

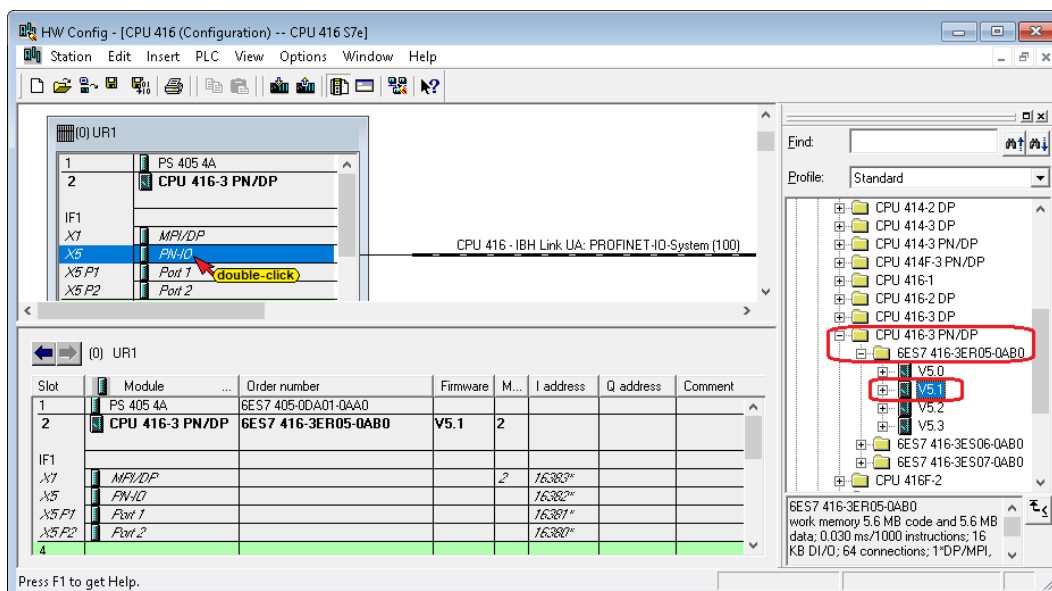
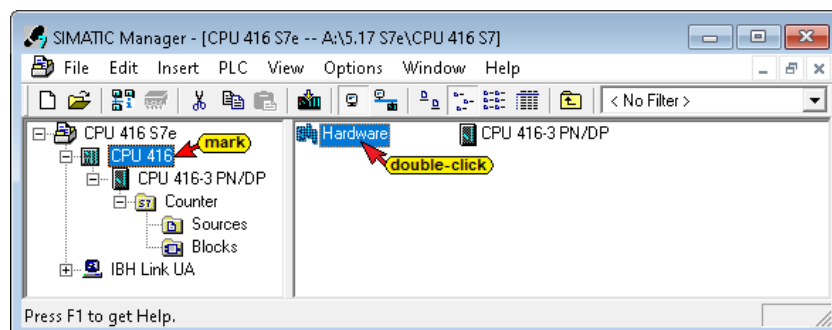
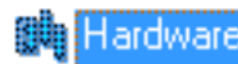
The up and down counting are controlled with the variables **Down** and **Up**. The counter **Value** variable is an integer (INT). The variables **Max** and **Min** are only used internally. The integer values of the minimum and maximum counter values are stored in data block DB5 (**CounterData**).

The PLC block FC5 (**CounterControl**) is used to control the up and down counting.

The PLC tags of the **Standard variable table** and the variables of the data block **CounterData [DB5]** are forwarded to the OPC server IBH Link UA as OPC tags.

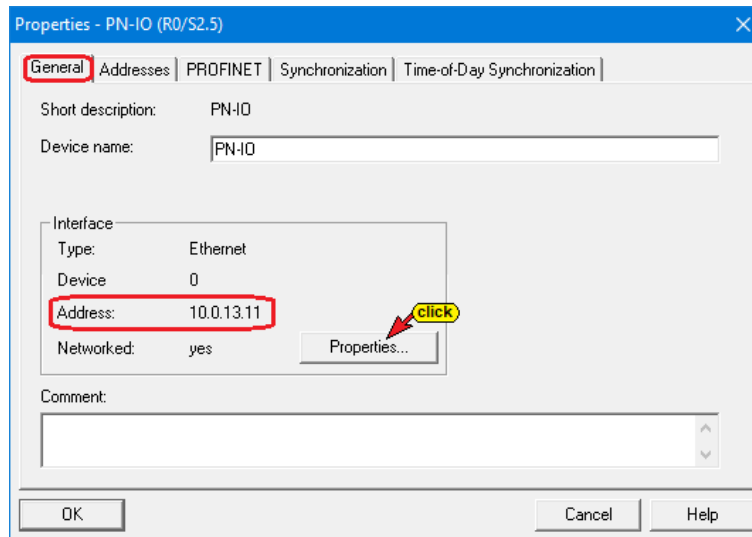
Loading the PLC Program into the CPU

Double-click **Hardware** to open the HW Configuration window.

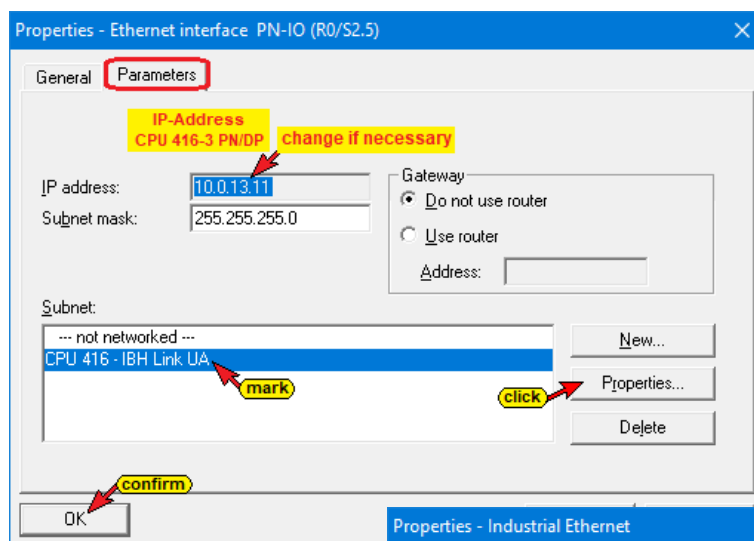


In the example, the CPU 416-3 PN/DP (6ES7 416-3ER05-0AB0) firmware version V5.1 is used, which is also available as a software PLC from IBHsoftec.

Double-click the line **X5 PN-IO** to open the **Properties - PN-IO (R0/S2.5)** dialog box.

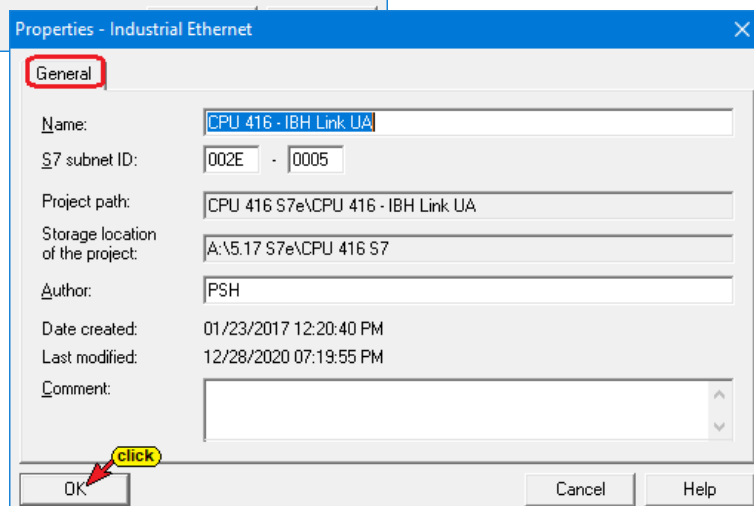


In the dialog box **Properties**, the IP address of the **CPU 416** is displayed. To change the IP address, click the **Properties** button.

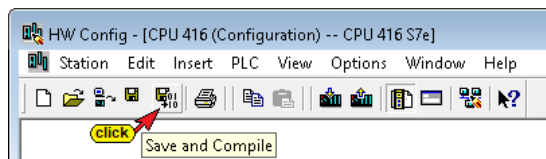


To display more details on the connection (Subnet) mark the subnet name and click the **Properties** button.

To close the dialog boxes, click the **OK** button.



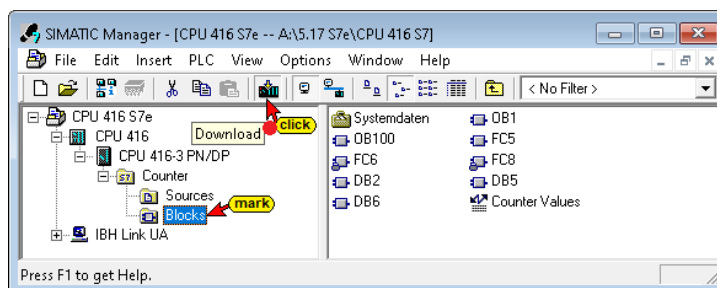
Clicking on the **Save and Compile** icon to save the configuration of the CPU 416.



1.2.2 Download, the PLC program and the System Data to the CPU

The connection from the PC to the CPU 416-3 PN/DP is made via the Ethernet interface of the PC. The PG/PC interface must be selected accordingly in SIMATIC Manager.

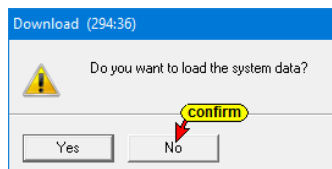
The name of the Ethernet connection may vary depending on the network card used in the PC.



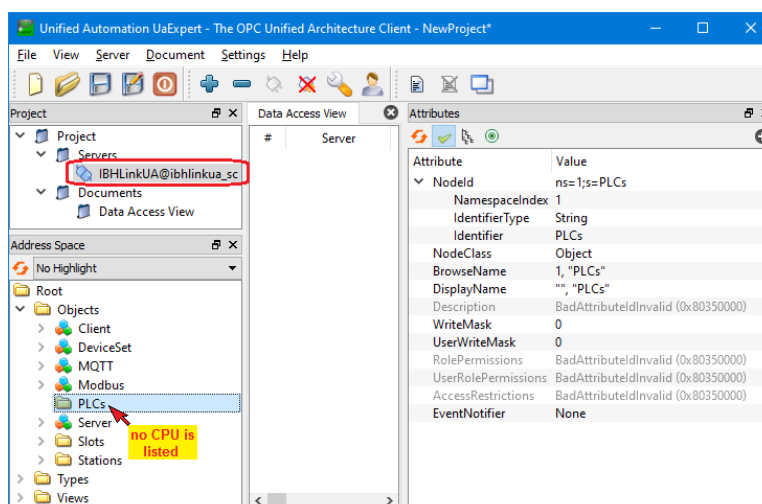
The PLC blocks FC6, FC8, DB2, and DB6 are not used in this example.

Download System Data.

The Hardware configuration of the CPU 416-3 PN/DP is downloaded.

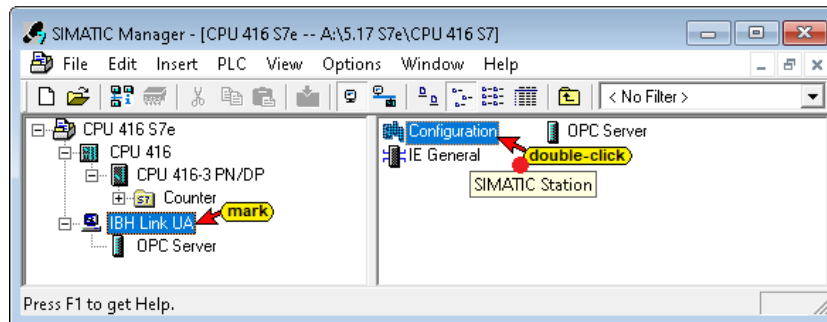


The CPU 416 is not yet available in the UaExpert program window, since an Ethernet connection (S7 connection) has not yet been established.



1.2.3 IBH Link UA as SIMATIC PC station.

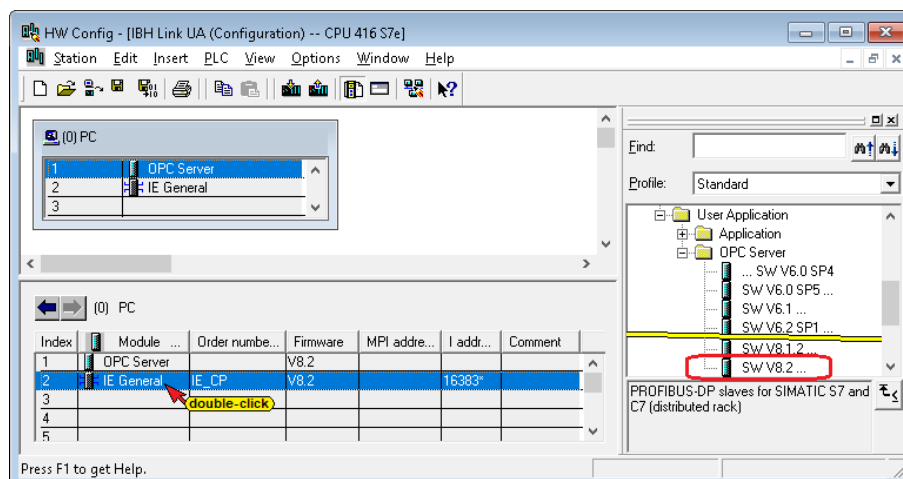
Mark the **IBH Link UA** station and double-click **Configuration** to open the hardware configuration window.



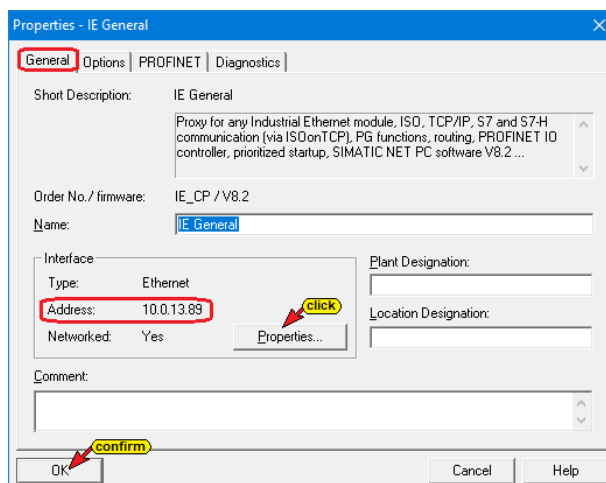
Configuration IBH Link UA (SIMATIC PC Station)

Note:

The Siemens **OPC Server SW V8.2...** and the CP Industrial Ethernet interface **IE General SW V8.2...** are available in the hardware catalogs of **STEP7 SIMATIC Manager, TIA V13, and newer.**

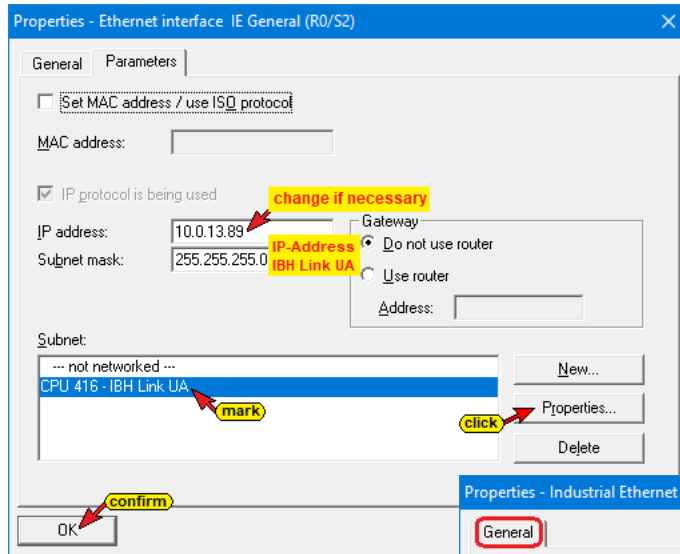


Double-click the name of the CP Industrial Ethernet interface **IE General IBH** to open the **Properties** dialog box.



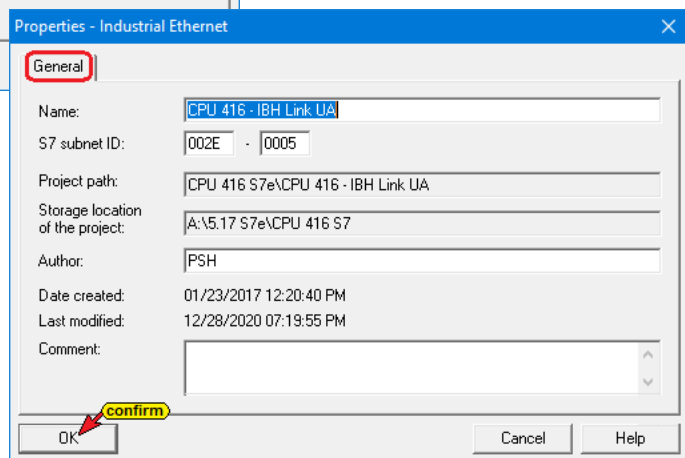
In the dialog box **Properties**, the IP address of the IBH Link UA is displayed. To change the IP address, click the **Properties** button.

Dialog box Properties - Ethernet interface IE General (R0/S2)

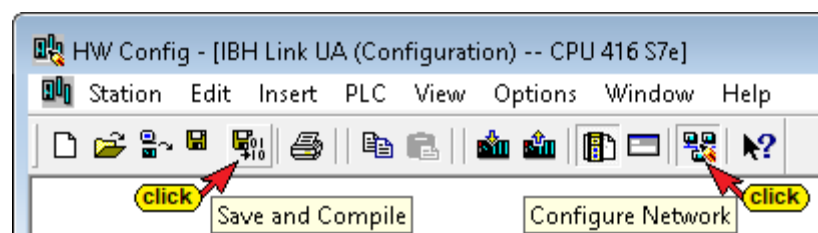


To display more details on the connection (Subnet) mark the subnet name and click the **Properties** button.

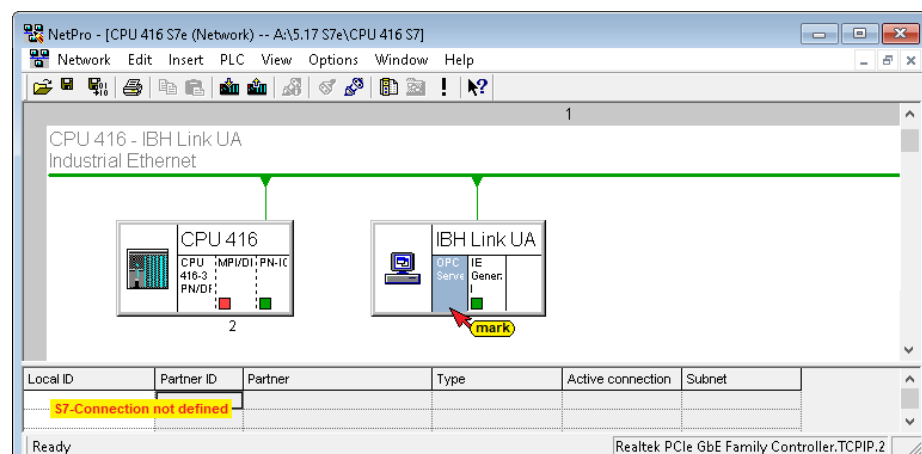
To close the dialog boxes, click the **OK** button.



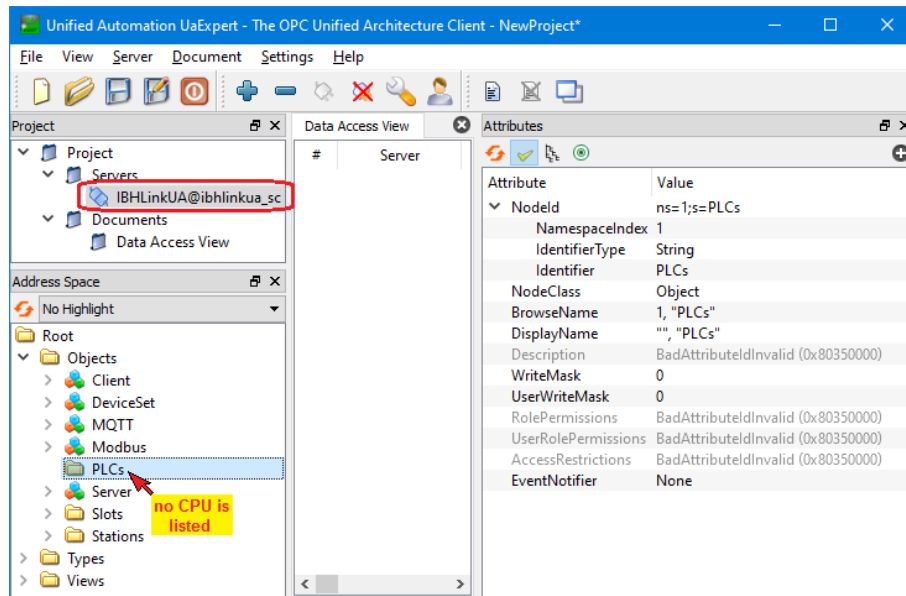
Clicking on the **Save and Compile** icon to save the configuration of the **IBH Link UA**.



Clicking on the **Configure network** icon displays the CPU-416 and IBH Link UA link graphically.

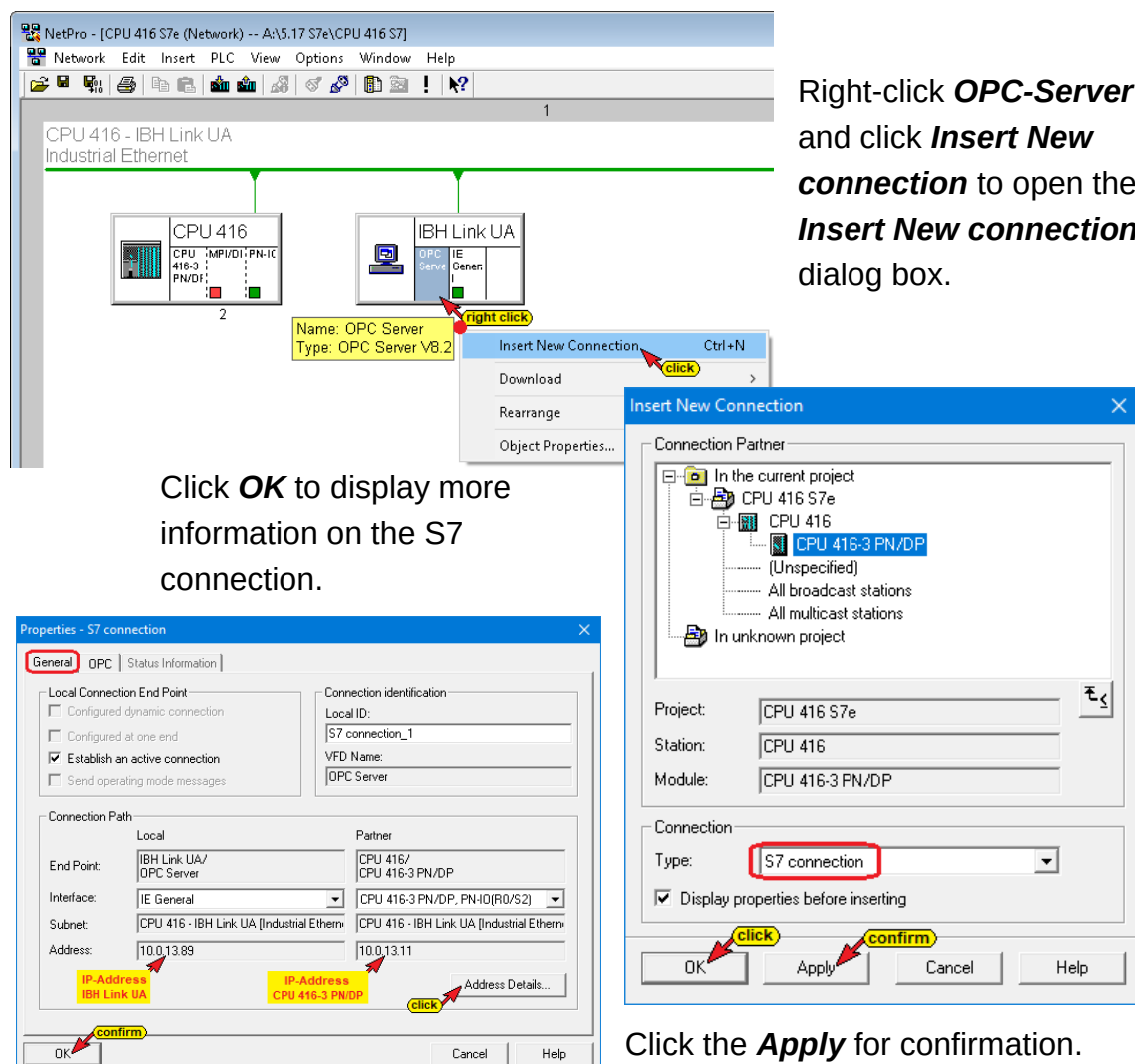


The CPU 416 is still not displayed in the **UaExpert** program window.

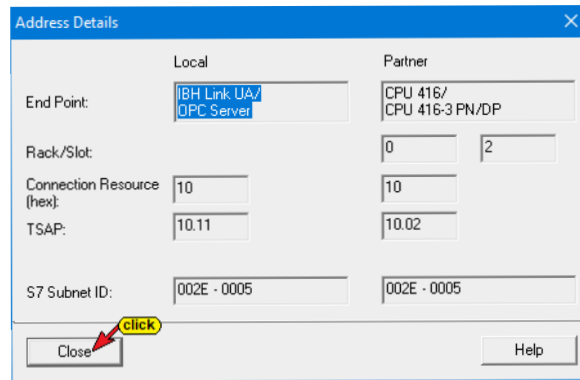


Connecting the CPU-416 with the IBH Link UA

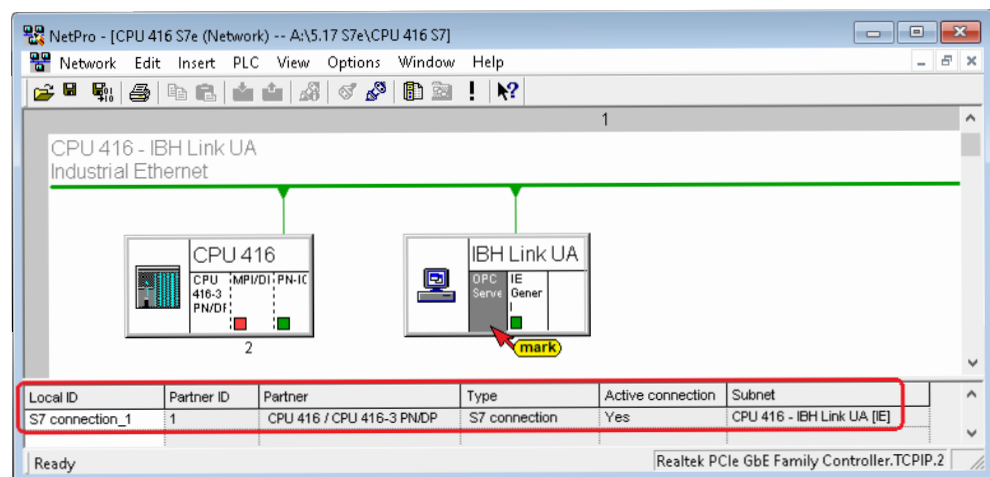
Using the following steps, an S7 connection is established between the CPU 416 and the IBH Link UA.



Address Details can be displayed by clicking the button.

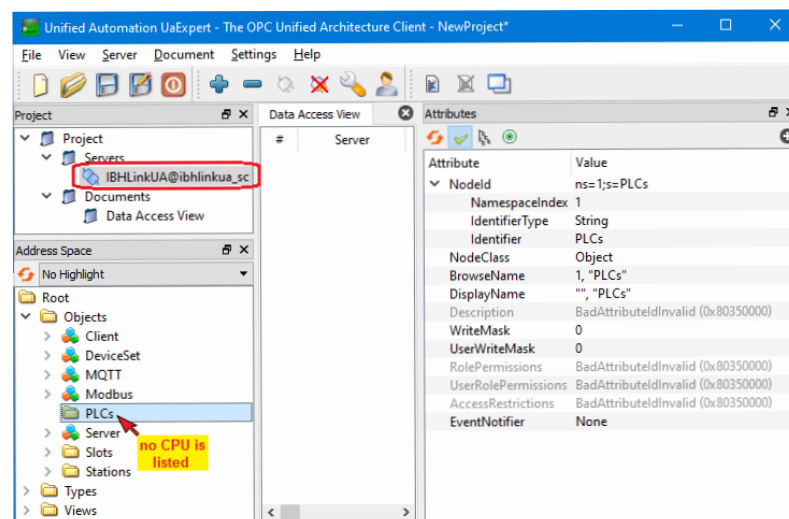


The established **S7 connection** between the **CPU 416** and the **IBH Link UA** is displayed.



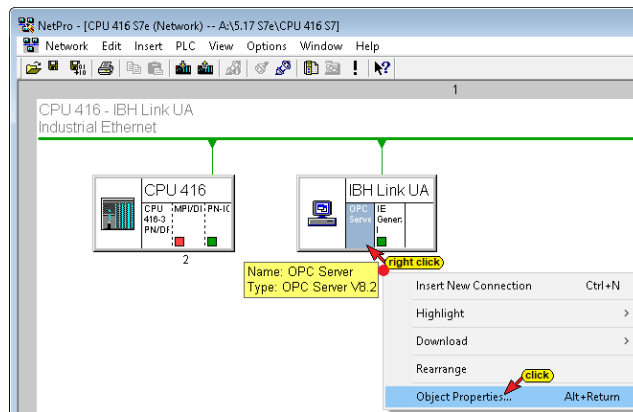
UaExpert Program Window

The CPU 416 is still not displayed in the **UaExpert** program window.

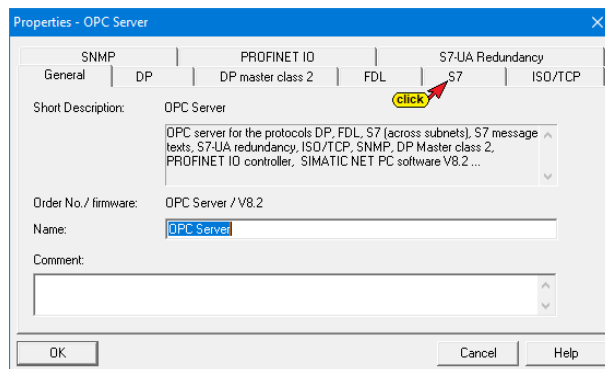


1.2.4 Select the symbols to be used (OPC tags)

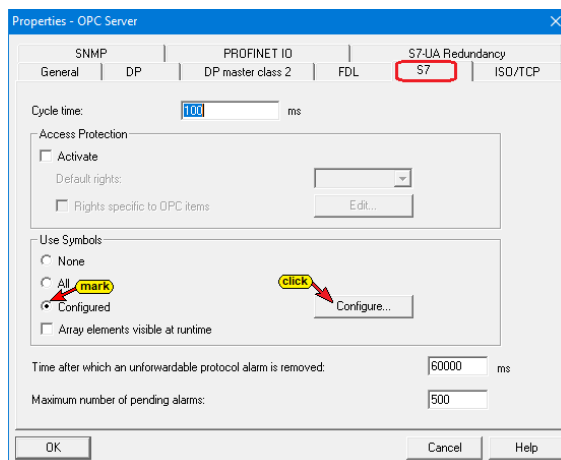
Right-click **OPC-Server** and click **Object Properties** to open the **Properties – OPC Server** dialog box.



Properties - OPC Server

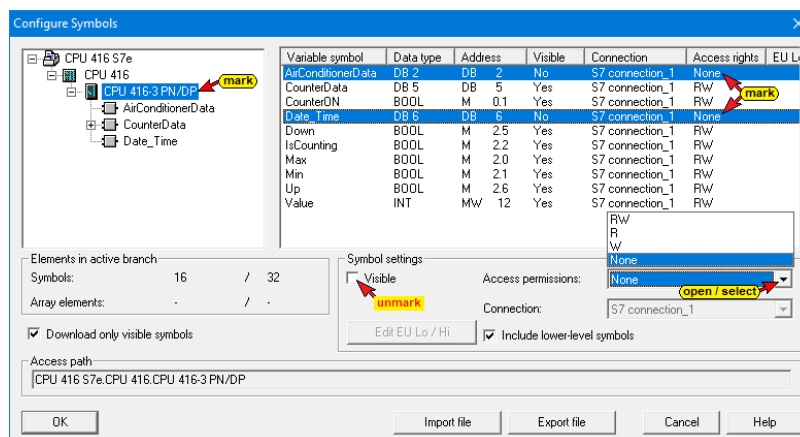


The **tab S7** defines the symbols (OPC tags) to be used.

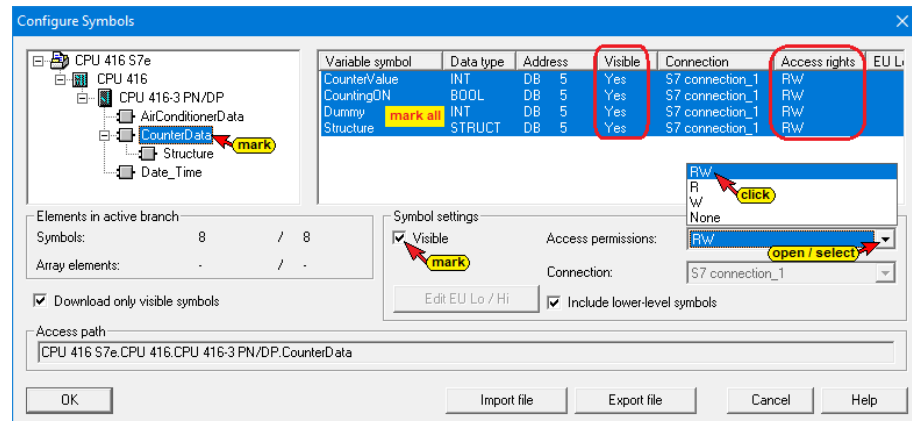


Mark **Configured** and click the **Configure...** button.

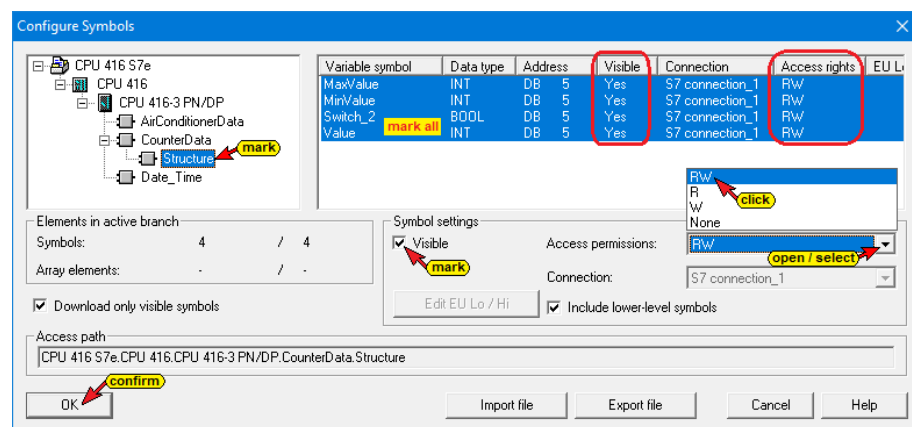
Global Variable (OPC tags) CPU 416-3 PN/DP



Data block CounterData [DB2] OPC tags



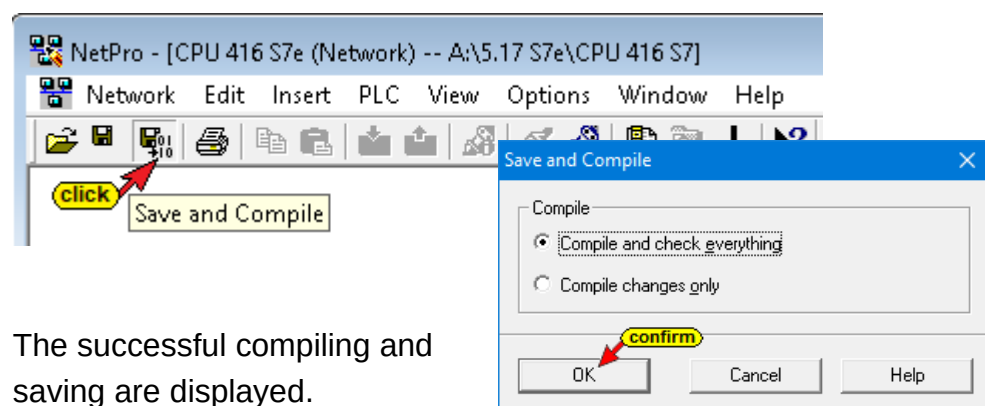
Structure Data block CounterData [DB2] OPC tags



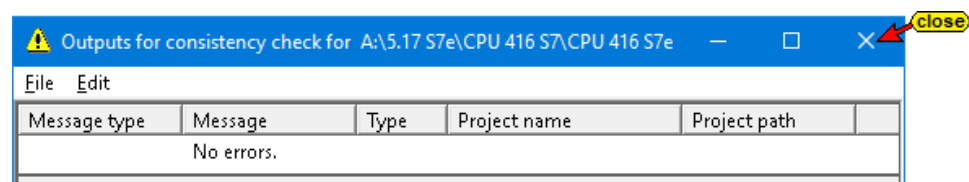
Click the **OK** buttons to close the **Configure Symbols** and the **Properties - OPC Server** dialog boxes.

NetPro - CPU 416 S7e (Network) window

Clicking on the **Save and Compile** icon to save the configuration of the **CPU 416** and **IBH Link UA**.

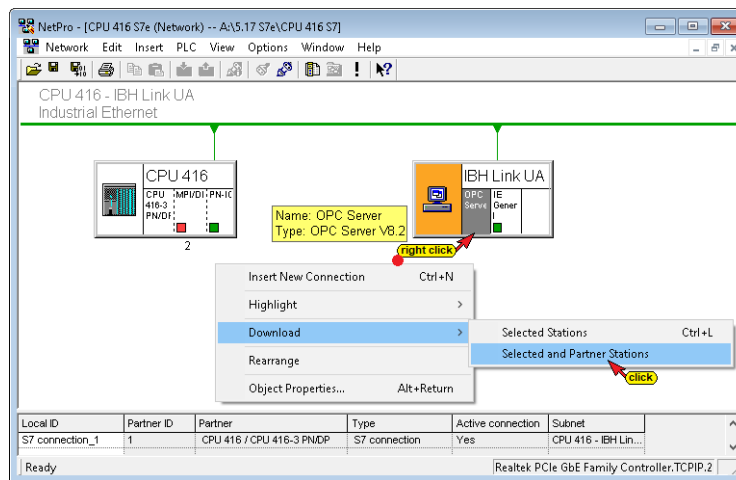


The successful compiling and saving are displayed.



Download the configuration of the CPU 416 and IBH Link UA.

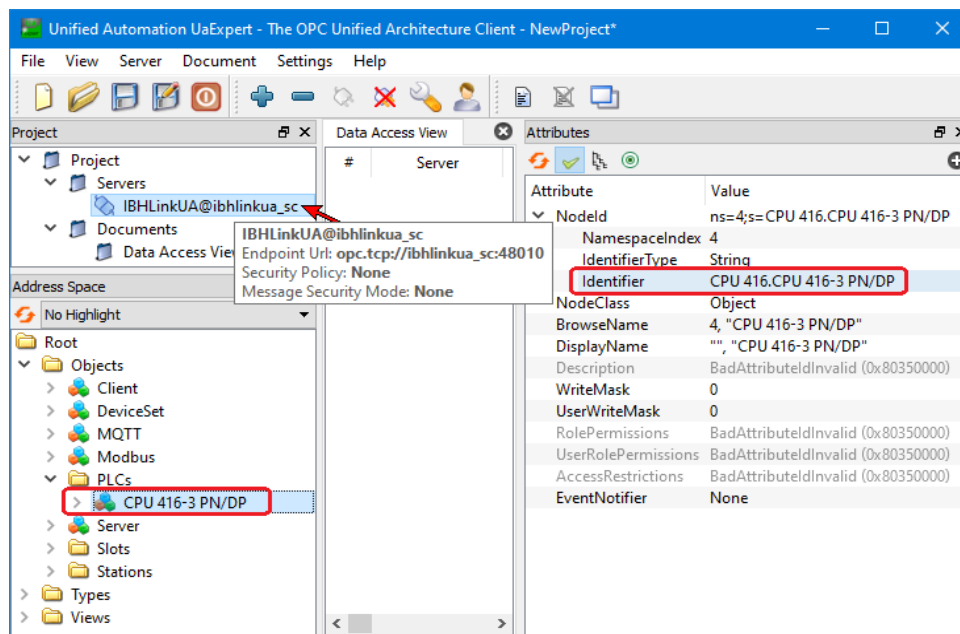
Right-click **OPC-Server** and click **Download / Selected and Partner Stations**.



Several information must be confirmed to complete the download.

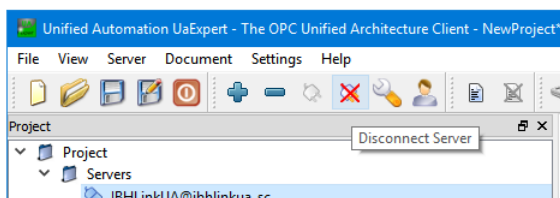
1.2.5 UaExpert – Program Window

The CPU 416 is now displayed in the **UaExpert** program window.

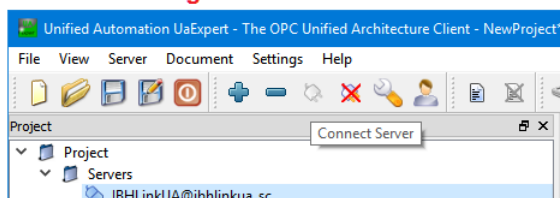


If the UaExpert program window was still active in the background of the PC, the connection to the IBH Link UA must be interrupted and restarted.

Disconnect the IBH Link UA Server



Connecting to the IBH Link UA Server



The operands defined in the symbol table, and the data from the **data block CounterData [DB2]**, which have been defined as OPC tags, are listed under **GlobalVars** and **Programs**. Using Drag&Drop the status of the tags can be displayed in the **Data Access View**.

The screenshot shows the Unified Automation UaExpert interface. The Project tree on the left has 'GlobalVars' and 'CounterData' expanded. The 'Data Access View' table in the center lists 14 tags with their values and datatypes. A red box highlights the 'Value' column, with a yellow callout 'continuously updated'. Another red box highlights the 'CounterData' structure in the Project tree, with a yellow callout 'Drag & Drop' pointing to the 'Data Access View' table. A third red box highlights the 'Data Access View' table, showing the 'Value' column with values like 'true', 'false', '4059', '4058', '0', '10000', '100', 'true', '1655'.

#	Server	Node Id	Display Name	Value	Datatype	Source Timestamp	Server Timestamp	Statuscode
1	IBHLinkUA...	NS4[String]CPU 416...	CounterON	true	Boolean	12:46:41.036	12:46:42.190	Good
2	IBHLinkUA...	NS4[String]CPU 416...	Down	false	Boolean	12:49:09.503	12:49:09.754	Good
3	IBHLinkUA...	NS4[String]CPU 416...	IsCounting	true	Boolean	12:47:27.948	12:47:28.955	Good
4	IBHLinkUA...	NS4[String]CPU 416...	Max	false	Boolean	12:47:29.498	12:47:30.207	Good
5	IBHLinkUA...	NS4[String]CPU 416...	Min	false	Boolean	12:47:31.020	12:47:31.708	Good
6	IBHLinkUA...	NS4[String]CPU 416...	Up	true	Boolean	12:49:09.503	12:49:09.754	Good
7	IBHLinkUA...	NS4[String]CPU 416...	Value	1654	Int16	12:49:37.513	12:49:37.763	Good
8	IBHLinkUA...	NS4[String]CPU 416...	CounterValue	1655	Int16	12:49:37.513	12:49:37.763	Good
9	IBHLinkUA...	NS4[String]CPU 416...	CountingON	true	Boolean	12:47:47.210	12:47:47.965	Good
10	IBHLinkUA...	NS4[String]CPU 416...	Dummy	0	Int16	12:47:49.220	12:47:49.966	Good
11	IBHLinkUA...	NS4[String]CPU 416...	MaxValue	10000	Int16	12:47:50.754	12:47:51.467	Good
12	IBHLinkUA...	NS4[String]CPU 416...	MinValue	100	Int16	12:47:53.060	12:47:53.721	Good
13	IBHLinkUA...	NS4[String]CPU 416...	Switch_2	true	Boolean	12:47:55.370	12:47:56.223	Good
14	IBHLinkUA...	NS4[String]CPU 416...	Value	1655	Int16	12:49:37.513	12:49:37.763	Good

The PLC program **Counter** – Project CPU 416 S7e – is processed, the changes are displayed in the **Data Access View / Value** window.

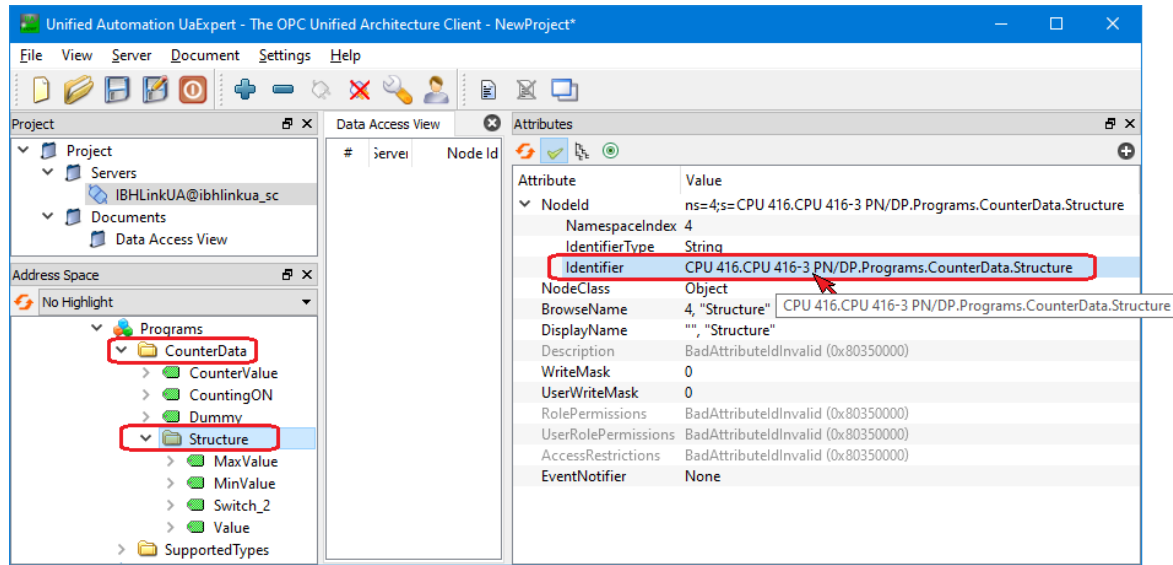
Online status CPU 416 – Counter Values

The screenshot shows the Var - [Counter Values -- @CPU 416 S7e\CPU 416\CPU 416-3 PN\DP\Counter ONLINE] window. The window displays a table with 11 rows of counter values. The 'Status value' column shows 'true' for CounterON, Down, IsCounting, and CountingON, and 'false' for Max, Min, and Up. The 'Modify value' column shows values like 579, 578, 100, 10000, and 578.

Address	Symbol	Display format	Status value	Modify value
M 0.1	"CounterON"	BOOL	true	true
M 2.5	"Down"	BOOL	true	
M 2.6	"Up"	BOOL	false	
M 2.0	"Max"	BOOL	false	
M 2.1	"Min"	BOOL	false	
MV 12	"Value"	DEC	579	
DB5.DBX 0.0	"CounterData".CountingON	BOOL	true	
DB5.DBW 4	"CounterData".CounterValue	DEC	578	
DB5.DBW 6	"CounterData".Structure.MinValue	DEC	100	
DB5.DBW 8	"CounterData".Structure.MaxValue	DEC	10000	
DB5.DBW 12	"CounterData".Structure.Value	DEC	578	

1.3 Complex Variable – STRUCT – in the IBH Link OPC UA Server

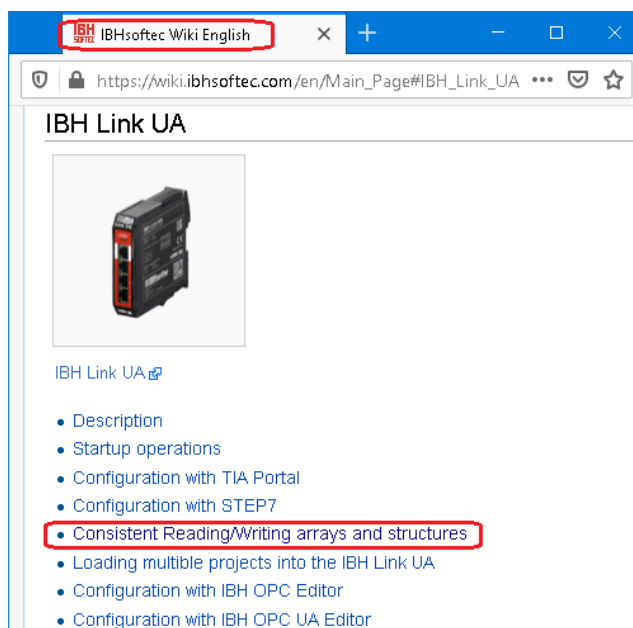
In the global data block **CounterData [DB2]** a **Structure** is present. The **structure** is displayed in the UaExpert program window. The identifier and the identifier type give a unique name that avoids a name conflict.



1.3.1 Using Structure Variables

Within the IBH Link browser window **System** the OPC UA option **Use Structure Variables** may be activated. With S7-300 / S7-400, 64-byte structures are consistently possible.

IBHsoftec WIKI

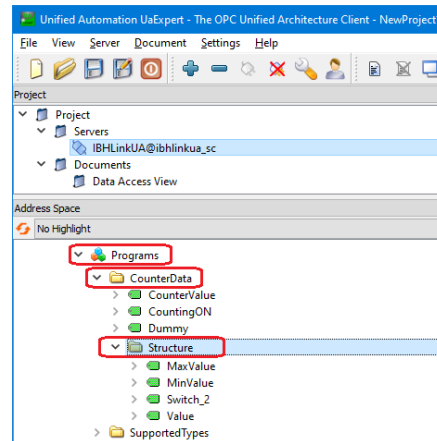


The structure variables are described in detail in IBHsoftec WIKI under the heading Consistent Reading/Writing arrays and structures.

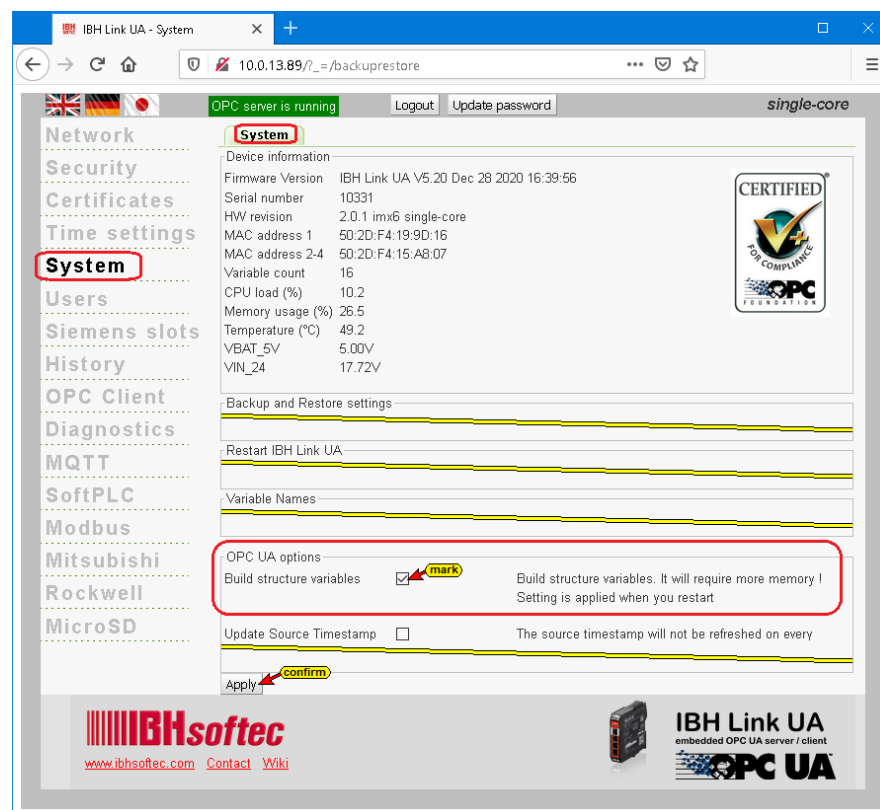
Programs in the UaExpert window prior activating the structure variables

In the **Address Space** window, below **Programs**, the structure is listed with the variable.

No additional information belonging to **Structure** is displayed.



System Browser window



Marking the check box **Build Structure Variables** and additionally clicking on the **Apply** button and confirming it the function will be activated.

Structure variables created require additional memory.

If the option **Use Structure Variables** is activated, the OPC server is restarted. In the **UaExpert** window **Data Access View** the variables

of the structure are displayed in red while the OPC server is not running (the connection to the OPC server is interrupted).

After restarting the OPC server and restarting the connection of the UaExpert to the IBH Link UA, the system variable **Consistent** is displayed. If this variable is **true**, consistent data can be read from the CPU (read) and written to the CPU (write).

Use Drag&Drop to pull **Consistent** and **Structure** into the **Data Access View** field.

The screenshot shows the UaExpert interface. On the left, the 'Address Space' tree is expanded to 'PLCs' > 'CPU 416-3 PN/DP' > 'CounterData' > 'Structure'. The 'Data Access View' table lists variables: MaxValue (10000), MinValue (100), Switch_2 (true), Value (7403), Consistent (true), and Structure (Double click to display value). A red box highlights the 'Structure' row. A red arrow points from the 'Structure' row to the 'Edit Value' dialog box. The dialog box shows the 'Name' as 'CPU 416.CPU 416-3 PN/DP.Types.Programs.CounterData.Structure' and lists variables: MinValue (100), MaxValue (10000), Switch_2 (true), and Value (5302). A red box highlights the 'MaxValue' field with the text 'can be changed'. A red arrow points from the 'confirm' button to the 'Write' button.

Data Access View

#	Server	Node Id	Display Name	Value	Datatype	Source Timestamp	Server Timestamp	Statuscode
1	IBHLinkUA@...	NS4StringCPU 416...	MaxValue	10000	Int16	14:53:06.311	14:53:07.184	Good
2	IBHLinkUA@...	NS4StringCPU 416...	MinValue	100	Int16	14:53:08.844	14:53:09.691	Good
3	IBHLinkUA@...	NS4StringCPU 416...	Switch_2	true	Boolean	14:53:11.225	14:53:12.192	Good
4	IBHLinkUA@...	NS4StringCPU 416...	Value	7403	Int16	14:56:41.305	14:56:41.356	Good
5	IBHLinkUA@...	NS4StringCPU 416...	Consistent	true	Boolean	14:55:27.505	14:55:40.855	Good
6	IBHLinkUA@...	NS4StringCPU 416...	Structure	Double click to display value	ExtensionObject	14:56:41.305	14:56:41.356	Good

Edit Value

Name	Value
MinValue	100
MaxValue	10000
Switch_2	true
Value	5302

The screenshot shows the 'Edit Value' dialog box. The 'Name' is 'CPU 416.CPU 416-3 PN/DP.Types.Programs.CounterData.Structure'. The variables listed are: MinValue (99), MaxValue (9990), Switch_2 (true), and Value (5302). A red box highlights the 'MaxValue' field with the text 'can be changed'. A red arrow points from the 'confirm' button to the 'Write' button.

Double-clicking on the icon in the **Double click to display value** **Structure** line opens a dialog box to display and modify the variables of the **Structure**.

Online Status Structure variables data block CounterData [DB5]

The screenshot shows the LAD editor for the 'CounterData' data block. The table lists variables: CountingON (BOOL, FALSE, TRUE, On / Off switch 1), Dummy (INT, 0, 0, Dummy), CounterValue (INT, 0, 8745, Counter value), Structure.MinValue (INT, 100, 99, minimum Counter value), Structure.MaxValue (INT, 10000, 9990, maximum Counter value), Structure.Switch_2 (BOOL, FALSE, TRUE, On / Off switch 2), and Structure.Value (INT, 0, 8745, Counter value). A red box highlights the 'Structure' variables.

Address	Name	Type	Initial value	Actual value	Comment
0.0	CountingON	BOOL	FALSE	TRUE	On / Off switch 1
2.0	Dummy	INT	0	0	Dummy
4.0	CounterValue	INT	0	8745	Counter value
6.0	Structure.MinValue	INT	100	99	minimum Counter value
8.0	Structure.MaxValue	INT	10000	9990	maximum Counter value
10.0	Structure.Switch_2	BOOL	FALSE	TRUE	On / Off switch 2
12.0	Structure.Value	INT	0	8745	Counter value

1.4 Historical Data – IBH Link UA

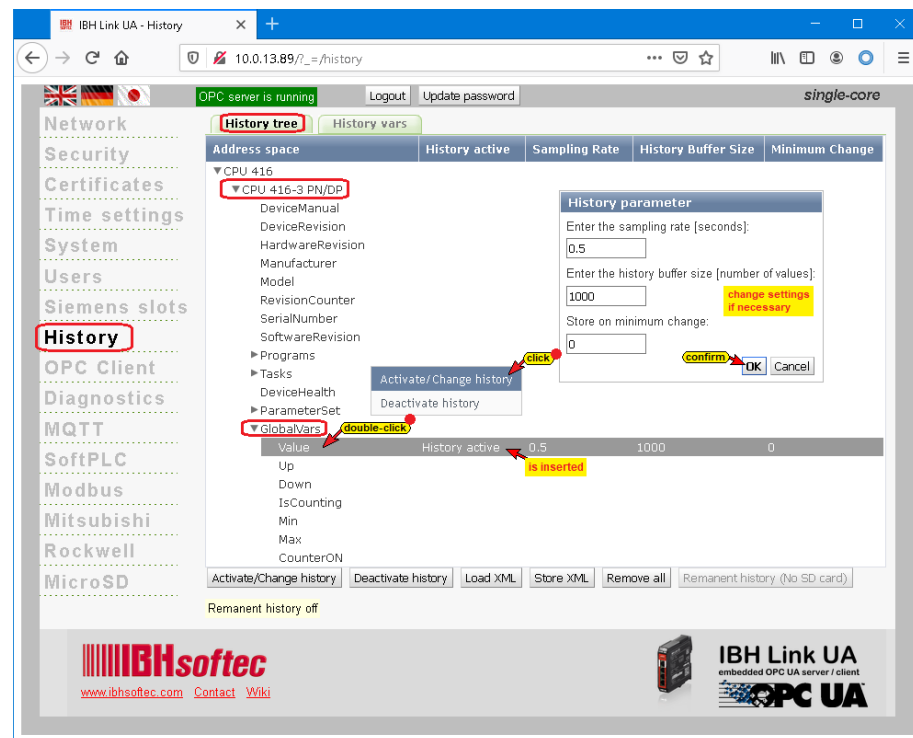
While **OPC Data Access** allows access to data in real-time, **OPC Historical Data Access**, also called **OPC HDA**, supports access to data already stored.

From simple data logging systems to complex SCADA systems, historical data can be queried in a standardized way.

The historical data are activated via the IBH Link UA **History** web interface. The historical data are organized in the IBH Link UA as a ring buffer in RAM.

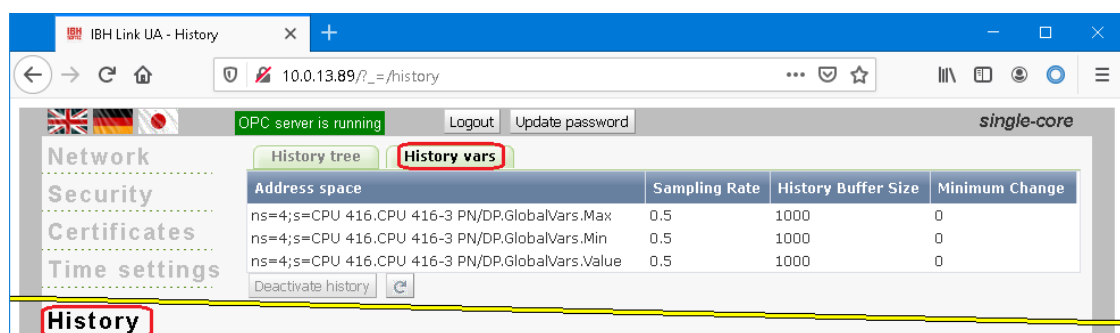
The project **CPU 416 S7e** with the SIMATIC 400 Stations provided the S7 program **Counter**.

The OPC tag (GlobalVars) **Value** is activated for historical access.



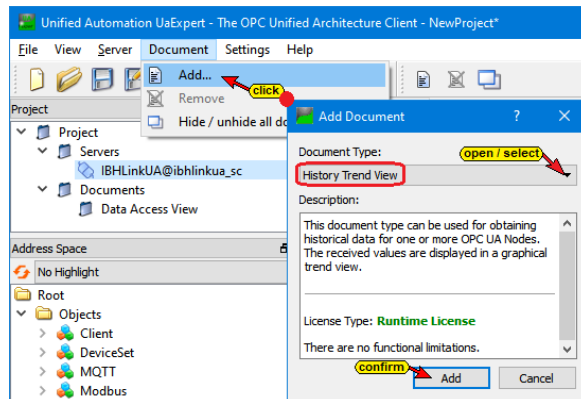
History variables

The **History vars** tab displays the variables with their parameters.

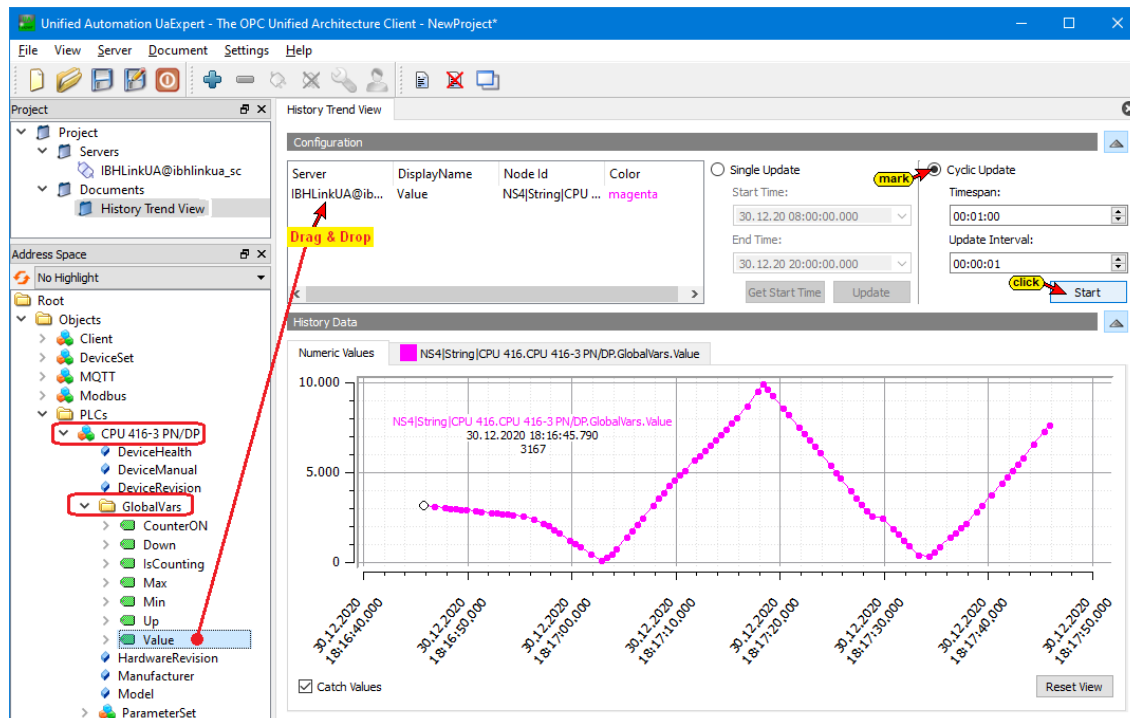


1.4.1 UaExpert - program window

Click in UaExpert Document / Add. In the opened dialog box, select History Trend View and confirm.

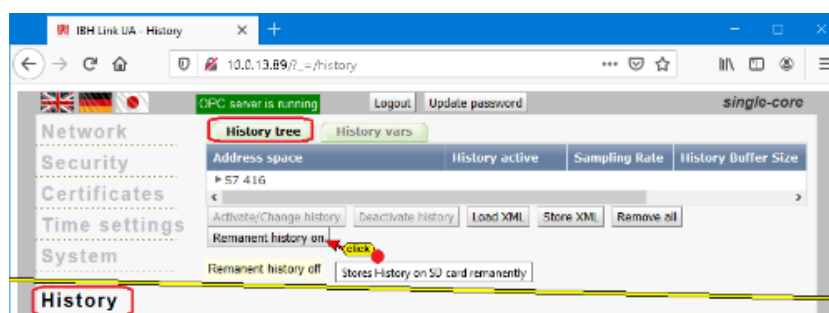


The historical data of values



Note:

If a formatted **SD-card** is available in the IBH Link UA, **history variables** can be stored remanent on the SD-card.



2 IBH Link UA – OPC UA client function

The **OPC client function** reads data from an OPC server and writes data to an OPC server. This does not have to be the same OPC client/server device. The **IBH Link UA** is a **Server / Client Module**. The OPC client function allows data exchange between OPC servers.

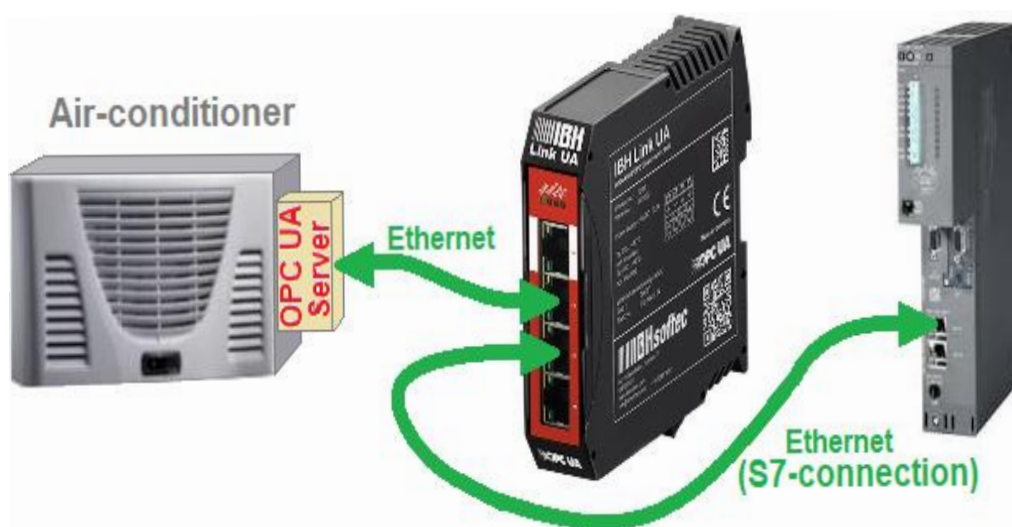
The **OPC Unified Architecture Demo Server** must be available one on the PC (see IBH Link UA Manual Part 1, chapter 2.4).



This external OPC UA server can be started by double-clicking the UA server icon.

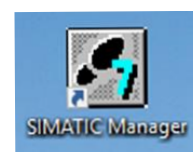
Device configuration example S7 project CPU 416

The data of an air-conditioning system should be given to the CPU-416.



2.1 Example project with STEP® 7 (SIMATIC Manager V5.6)

An air-conditioning system transfers its data to the data block **AirConditionerData [DB 5]** from the **CPU 416 S7e** project (Chapter 1).



Chapter 1 describes the connection of a CPU 416 to the IBH Link UA via an Ethernet connection.

The project from Chapter 1 must be loaded into the CPU416.

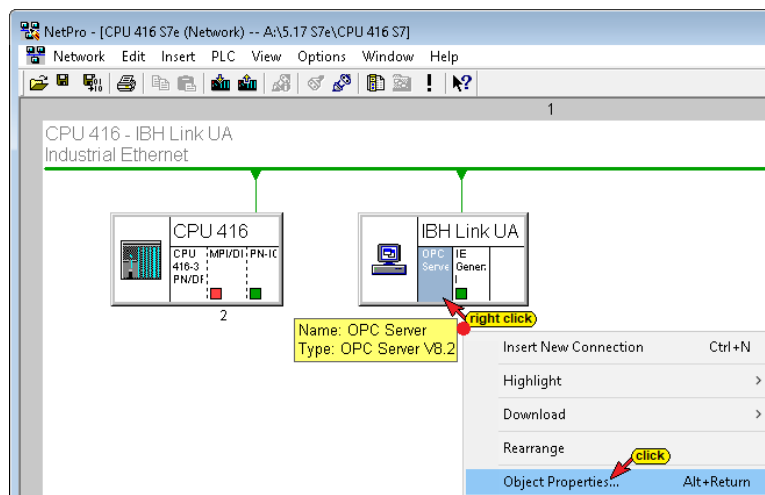
Data block *AirConditionerData* [DB 5]

Address	Name	Type	Initial value	Comment
0.0		STRUCT		
+0.0	Temperature	REAL	0.000000e+000	Actual temperature value
+4.0	TemperatureSetPoint	REAL	0.000000e+000	Set point temperature value
+8.0	TimeStampTemperature	DATE_AND_TIME	DT#90-1-1-0:0:0.000	Actual temperature Time Stamp
+16.0	TimeStampSetPoint	DATE_AND_TIME	DT#90-1-1-0:0:0.000	Set point temperature TimeStamp
+24.0	CurrentTime_TimeStamp	DATE_AND_TIME	DT#90-1-1-0:0:0.000	Current Time Time Stamp
+32.0	StatusTemperature	DWORD	DW#16#0	Status Temperature
+36.0	StatusSetPoint	DWORD	DW#16#0	Status Set Point Temperature
+40.0	CurrentTimeStatus	DWORD	DW#16#0	Current Time Status
+44.0		END_STRUCT		

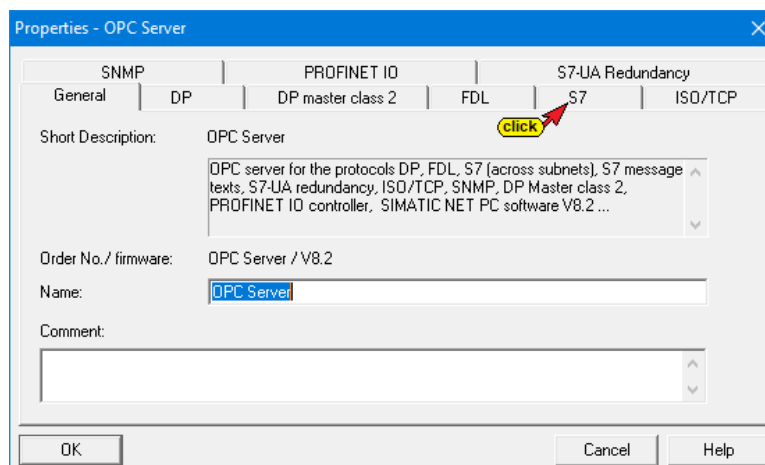
The actual **Temperature**, **set point Temperature**, and **Current Time** values are to be read from an air-conditioning system as OPC tags.

2.1.1 Select the symbols to be used (OPC tags)

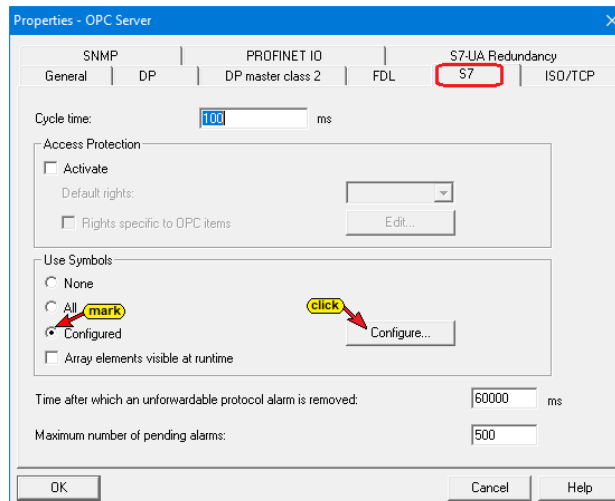
Right-click **OPC-Server** and click **Object Properties** to open the **Properties – OPC Server** dialog box.



Properties - OPC Server



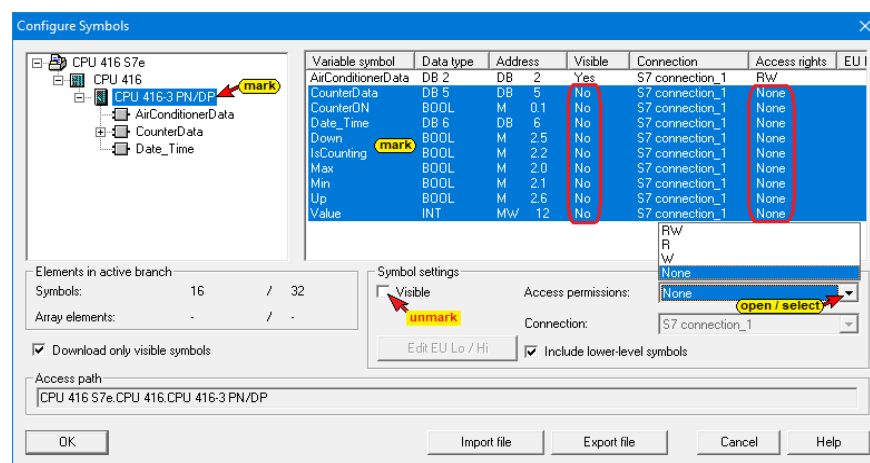
The **tab S7** defines the symbols (OPC tags) to be used.



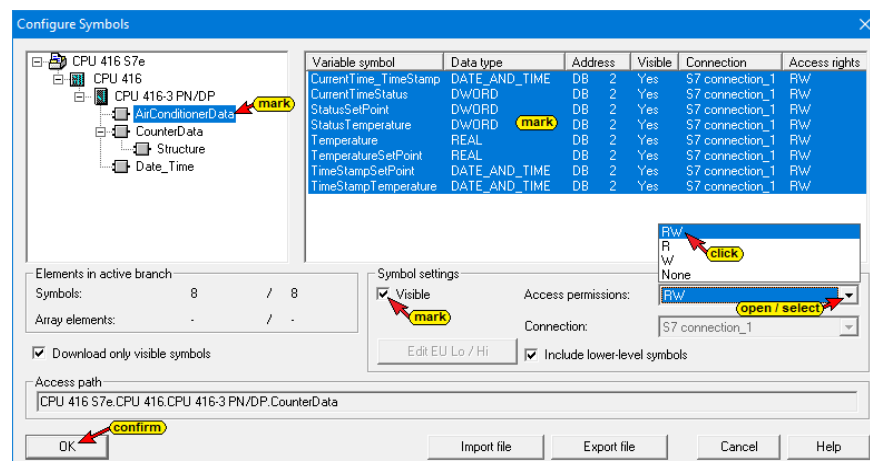
Mark **Configured** and click the **Configure...** button.

Global Variable (OPC tags) CPU 416-3 PN/DP

The data block **AirConditionerData [DB2]** is used as OPC tags. data block **Date_Time [DB6]** is used as OPC tags. The global variables OPC tags are not used in this example. They and data block **CounterData[DB5]** are used in the chapter 1 example. The variables of DB2 are used as OPC tags.



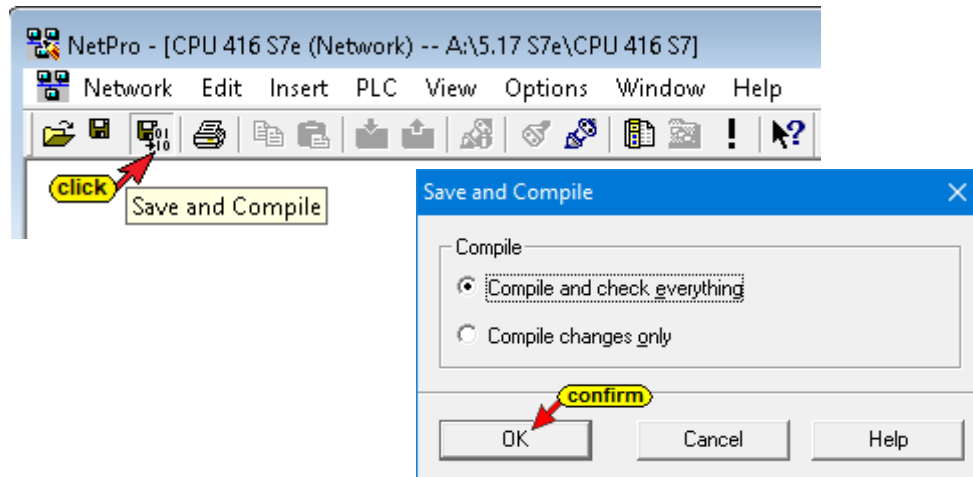
Data block AirConditionerData [DB2] OPC tags



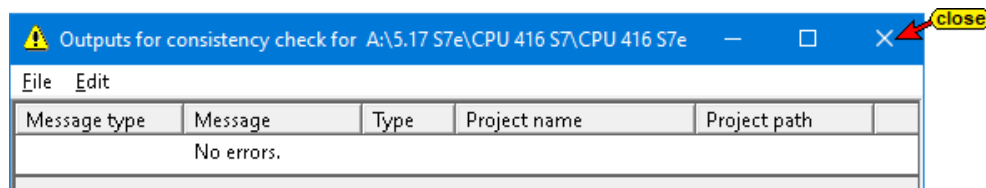
Click the **OK** buttons to close the **Configure Symbols** and the **Properties - OPC Server** dialog boxes.

NetPro - CPU 416 S7e (Network) window

Clicking on the **Save and Compile** icon to save the configuration of the **CPU 416** and **IBH Link UA**.

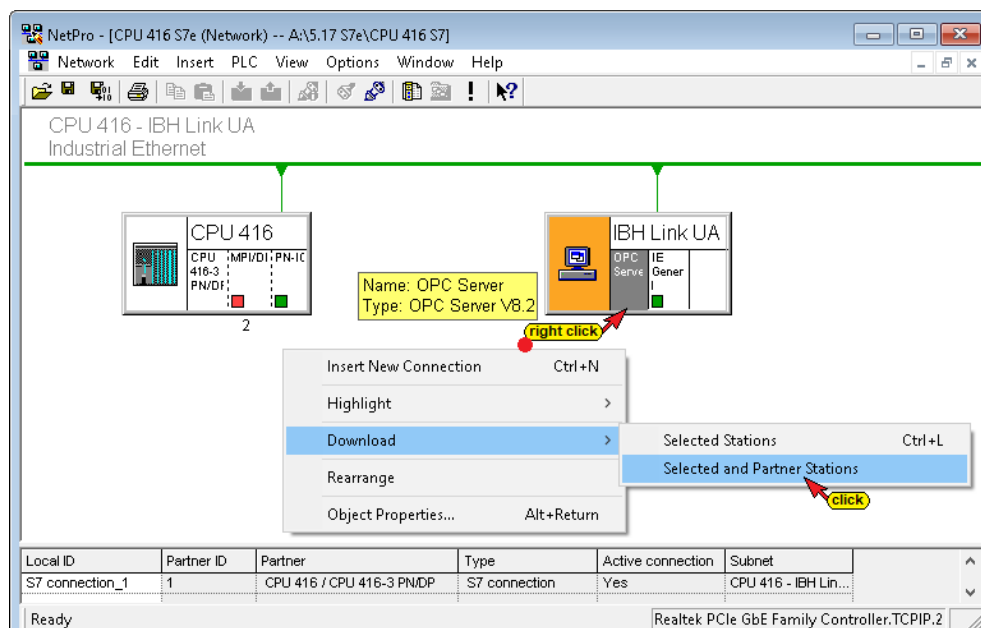


The successful compiling and saving are displayed.



Download the configuration of the CPU 416 and IBH Link UA.

Right-click **OPC-Server** and click **Download / Selected and Partner Stations**.



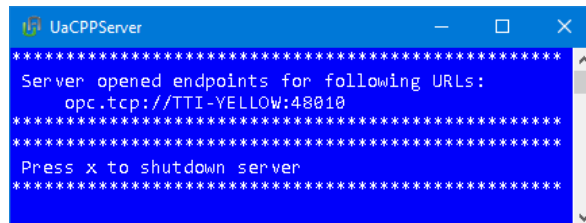
Several information must be confirmed to complete the download.

2.1.2 Start external OPC UA server

Double-click the UA Server icon to start a program (from **UnitedAutomation**) that simulates several air conditioning and heating systems (air conditioner, furnaces) and provides operating data (temperature, time value, etc.) as OPC UA tags.



External OPC UA server (air conditioning and heating systems)



The external OPC UA server has the endpoint URL:

opc.tcp: // TTI-YELLOW: 48010

If no **name server (DNS server)** is available, the PC name must be replaced with the absolute **IP address** of the **PC**.

The endpoint URL responsible for the connection could be, for example: **opc.tcp: //10.0.13.10: 48010**.

Define the OPC UA server for the data exchange

For data exchange between the air-conditioning system and PLC (**AirConditionerData [DB 2]**) are in the **IBH Link UA** to register the two **OPC UA servers** who provide the data for exchange.

The server integrated in the **IBH Link UA** provides the OPC tags that are defined in the PLC-CPU.

The servers for the data exchange are specified in the IBH Link UA web browser window OPC Client.

First, the OPC UA server, which provides the OPC tags from the data block **AirConditionerData [DB 2]** to the PLC CPU, should be specified.

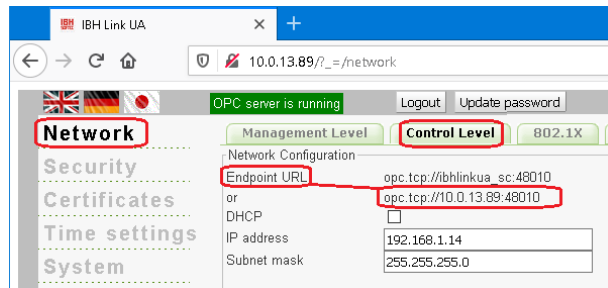
The required **endpoint URL** can be copied from the IBH Link UA web browser window network / control level.

The **IBH Link UA - OPC UA Server** has the Endpoint URL:

opc.tcp: // ibhlinkua_sc: 48010

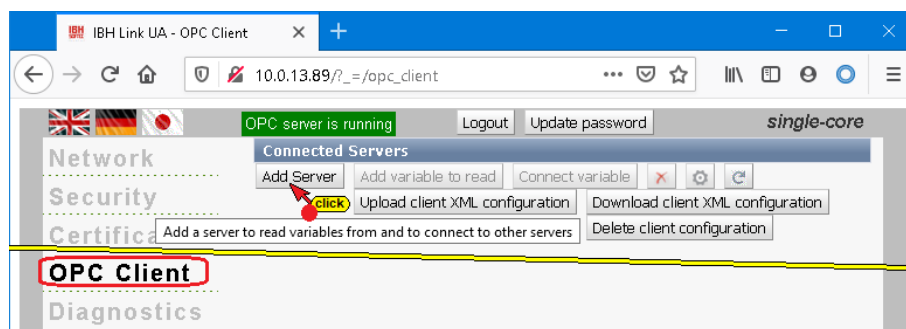
If no **name server (DNS server)** is available, the absolute IP address of the **IBH Link UA / control level** must be used as the endpoint URL. The absolute endpoint URL would then be:

opc.tcp: //10.0.13.89: 48010



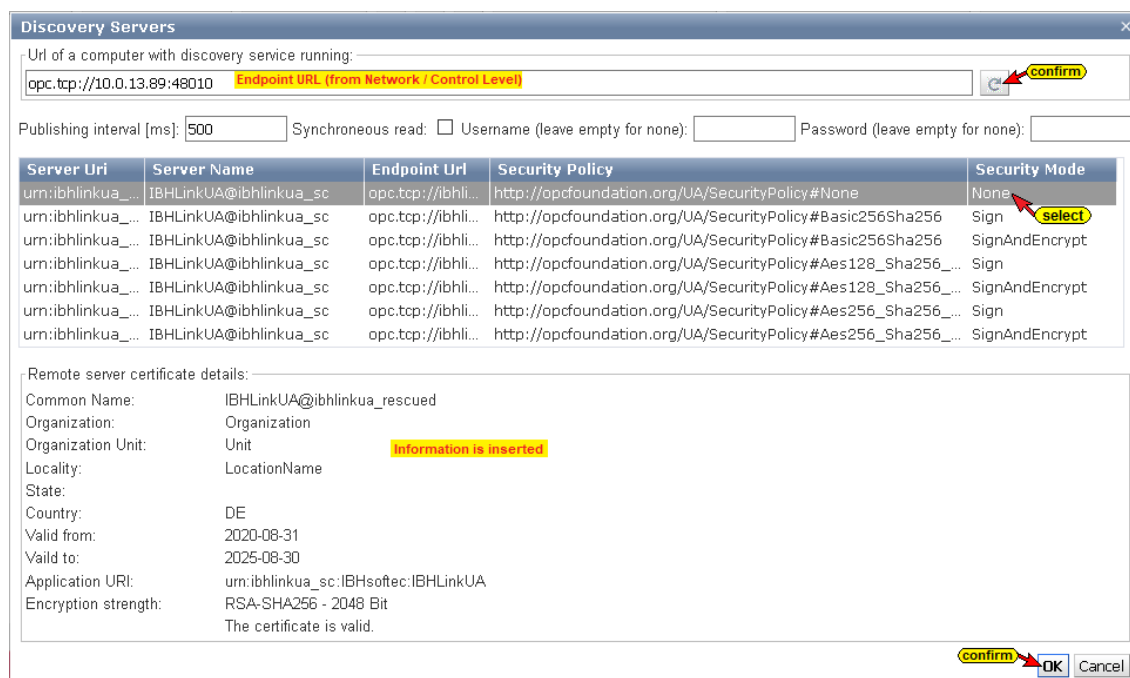
The endpoint URL can be copied into the IBH Link UA web browser window / network / control level.

Add server



The copied endpoint URL ***opc.tcp: // ibhlinkua_sc: 48010*** or ***opc.tcp: //10.0.13.89: 48010*** is in the open field in the IBH Link UA web browser window / OPC client is to be added as a server.

Security Policy None and ***Security Mode None*** were selected for data transmission.



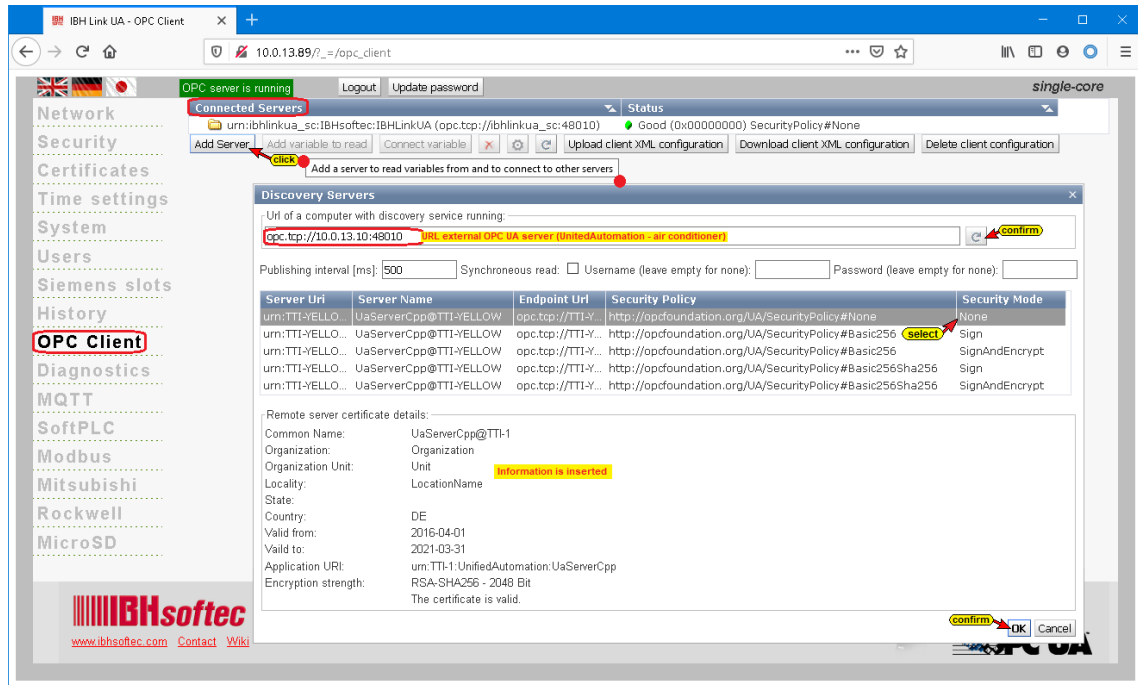
Next, the external ***OPC UA server (UnitedAutomation - air conditioner)*** is defined.

The external OPC UA server has the endpoint URL:

opc.tcp:// TTI-YELLOW: 48010

The absolute endpoint URL would then be:

opc.tcp://10.0.13.10: 48010

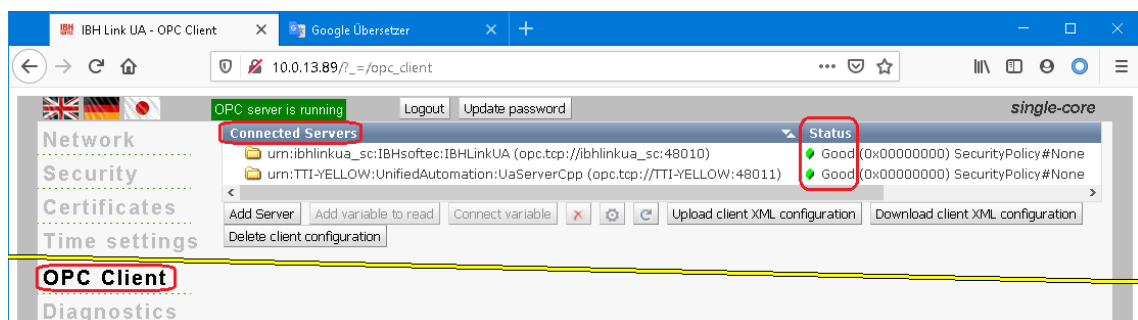


If no name server (DNS server) is available, the PC name must be replaced with the absolute IP address of the PC.

The endpoint URL responsible for the connection could be, for example: ***opc.tcp://10.0.13.10: 48010***

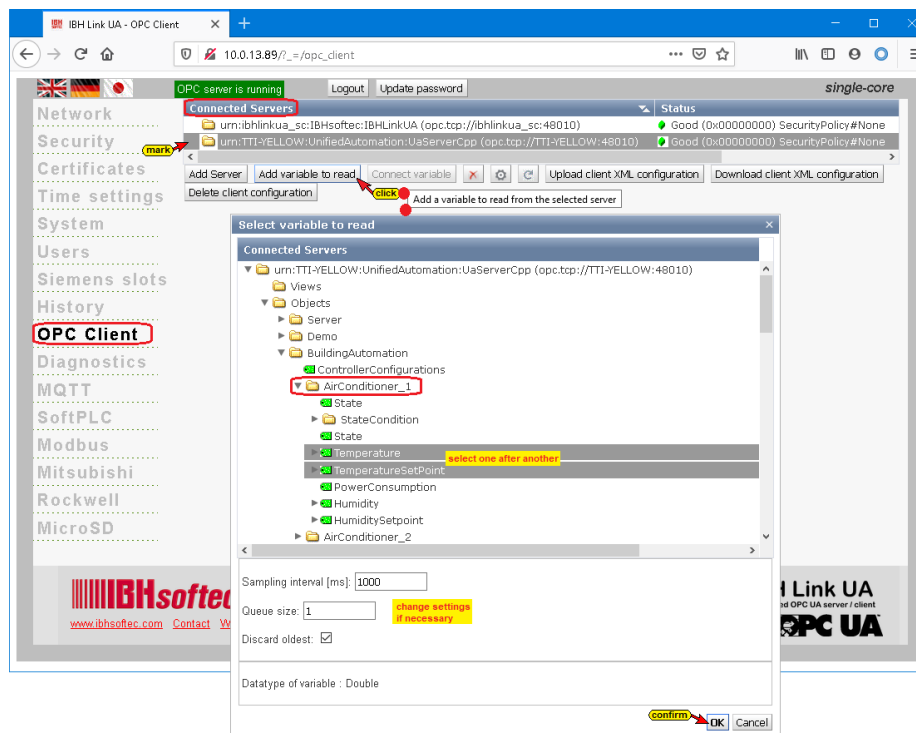
Security Policy None and ***Security Mode None*** were selected for data transmission.

The IBH Link UA and the external OPC UA server are connected. The status of both servers is good. None was selected as the security policy for both servers.



Add read variable

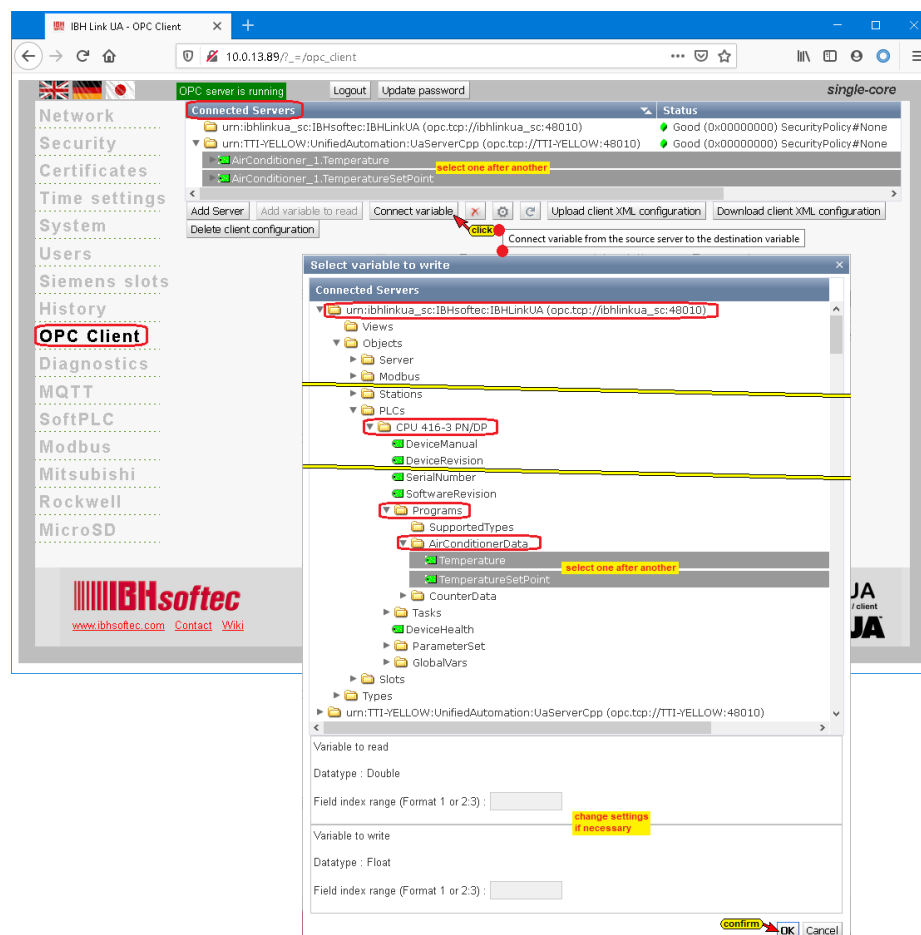
The two variables ***Temperature*** and ***TemperatureSetPoint*** that the external OPC UA server makes available are declared as read variables. The ***OPC UA client*** in the ***IBH Link UA*** reads this data.



These variables are sent via the OPC server to the data block ***AirConditionerData [DB2]***, in the CPU-416.

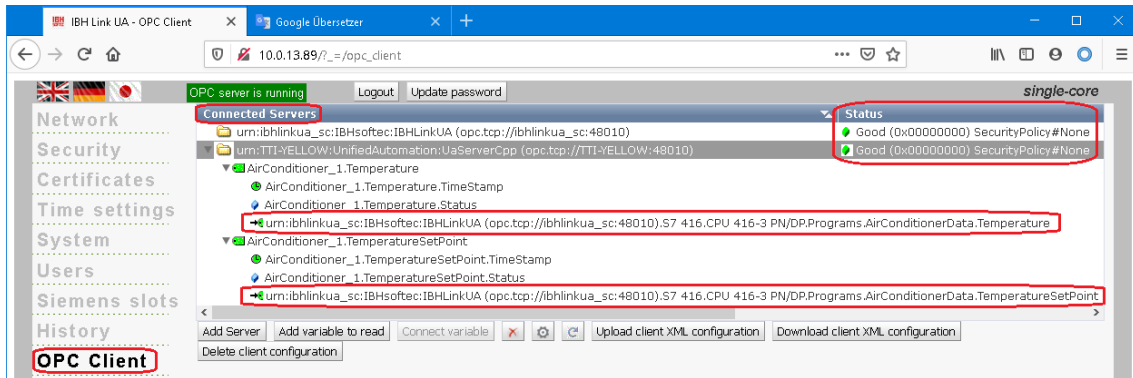
Connect with variables

Variable (OPC tags) from the data block ***AirConditionerData [DB 2]***.



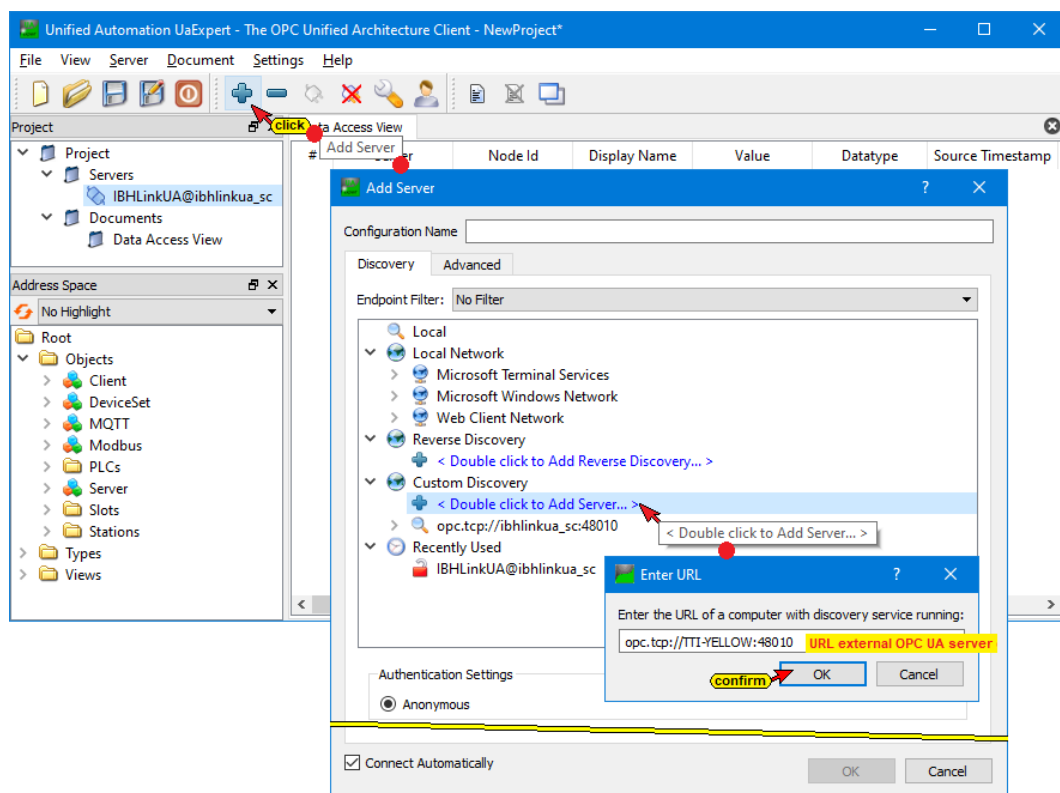
The two variables **Temperature** and **TemperatureSetPoint**, which have been declared as read variables, are connected to the IBH Link UA OPC server, which then sends them to the PLC program (**CPU 416 TIA Portal**) in the CPU-416.

The connections are displayed in the IBH Link UA web browser window OPC Client.

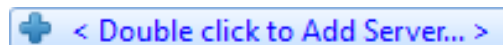


2.1.3 Establishing a connection to the external OPC server

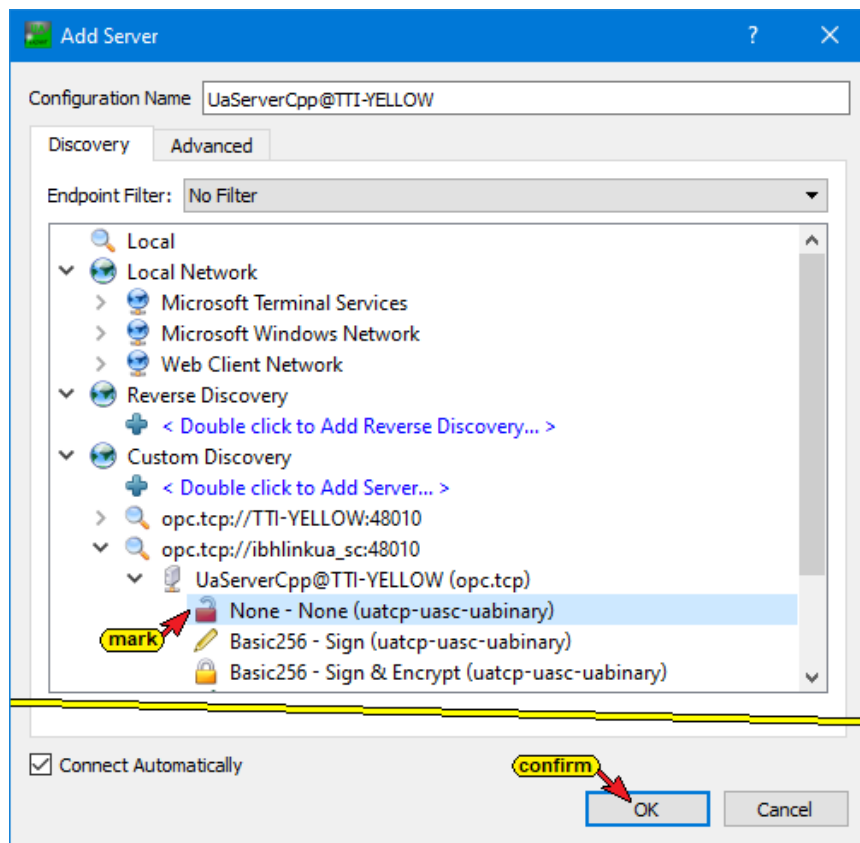
Clicking on the plus symbol in the **UaExpert window** opens the **AddServer** dialog box.



Double-click on **Add Server** to open the Enter URL dialog box.



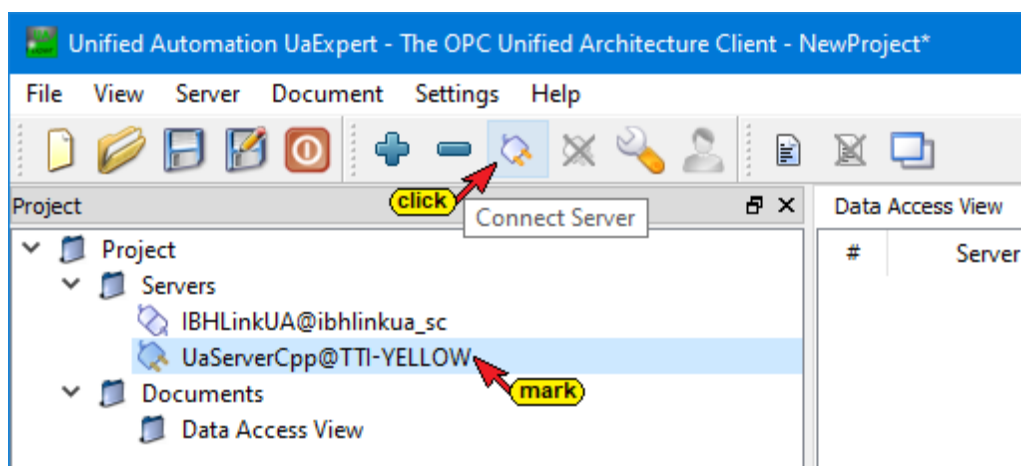
The **Endpoint URL** of the external **OPC server External OPC UA Server** (Air-Conditioner) must be entered here.



By opening **UaServerCpp@TTI-YELLOW- (opc.tcp)**, the possible security levels are listed.

Double-clicking the **None - None**  **None - None (uatcp-uasc-uabinary)** entry in the **AddServer** dialog box sets this security level and closes the **AddServer** dialog box.

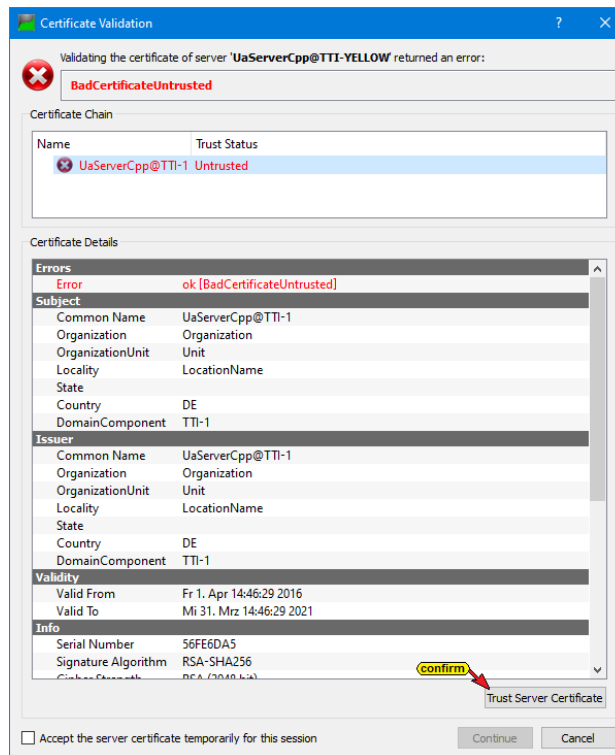
In the opened **UaExpert program window**, the connected servers are displayed.



With a click on **Connect Server** the connection to the OPC UA server is established.

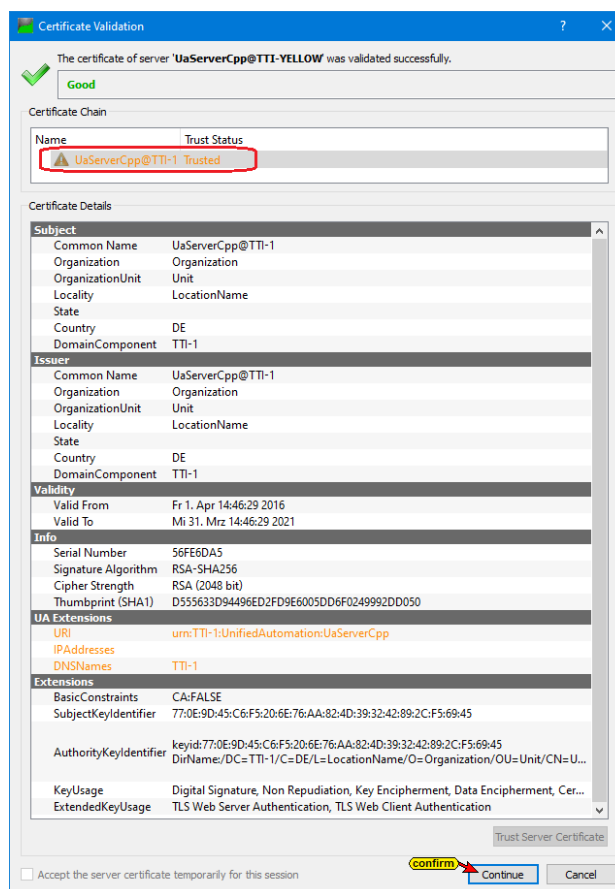


Since there is no certificate acceptance for the desired connection, the dialog box for accepting the OPC UA server certificate opens.



The selected certificate is confirmed by clicking the **Trust Server Certificate** button. The verified certificate is displayed.

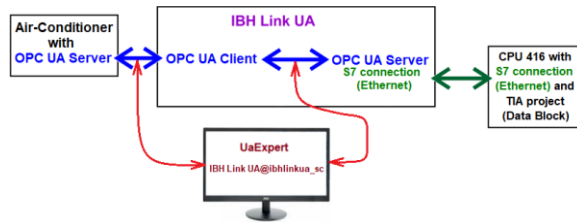
Trust Server Certificate



The dialog box is closed by clicking the Continue button. The connection to the selected OPC server is established.

Continue

UaExpert – Displays



UaExpert - Program Window

In the **UaExpert** program window, information about the connected external OPC server (**UAServCpp@TTI-Yellow**) is displayed under **Address Space**.

Data Access View

#	Server	Node Id	Display Name	Value	Datatype	Source Timestamp	Server Timestamp	Statuscode
1	UaServerCpp@...	NS3[String]AirC...	Temperature	71.973975	Double	17:11:01.643	17:11:01.643	Good
2	UaServerCpp@...	NS3[String]AirC...	TemperatureSetPoint	72	Double	17:09:48.832	17:09:48.832	Good

Address Space

- BuildingAutomation
 - AirConditioner_1
 - Humidity
 - HumiditySetpoint
 - PowerConsumption
 - Start
 - StartWithSetpoint
 - State
 - StateCondition
 - Stop
 - Temperature
 - TemperatureSetPoint
 - AirConditioner_10
 - AirConditioner_2

Data Access View (Detailed)

#	Server	Node Id	Display Name	Value
1	UaServerCpp@TTI-YELLOW	NS3[String]AirConditioner_1.Temperature	Temperature	71.984385
2	UaServerCpp@TTI-YELLOW	NS3[String]AirConditioner_1.TemperatureSetPoint	TemperatureSetPoint	55

The **Temperature** and **TemperatureSetPoint** OPC tags can be dragged from the external OPC UA server into the **Data Access Viewer** window using drag & drop.

Data Access View

#	Server	Node Id	Display Name	Value	Datatype	Source Timestamp	Server Timestamp	Statuscode
1	IBHLinkUA@ibhlinkua_sc	NS4[String]CPU 416...	Temperature	71.6118	Float	15:37:02.618	15:37:02.829	Good
2	IBHLinkUA@ibhlinkua_sc	NS4[String]CPU 416...	TemperatureSetPoint	72	Float	15:36:17.065	15:36:18.316	Good

Address Space

- Root
 - Objects
 - Client
 - Modbus
 - PLCs
 - CPU 416-3 PN/DP
 - DeviceHealth
 - ParameterSet
 - Programs
 - AirConditionerData
 - CurrentTimeStatus
 - CurrentTime_TimeStamp
 - StatusSetPoint
 - StatusTemperature
 - Temperature
 - TemperatureSetPoint
 - TimeStampSetPoint
 - TimeStampTemperature
 - CounterData
 - SupportedTypes
 - RevisionCounter

Data Access View (Detailed)

#	Display Name	Value	Datatype	Source Timestamp	Server Timestamp	Statuscode
1	Temperature	71.6118	Float	15:56:10.801	15:56:10.941	Good
2	TemperatureSetPoint	72	Float	15:56:02.187	15:56:04.437	Good

In the **UaExpert** program window, under **Address Space** information about the connected **IBH Link UA - OPC server**, the actual and set point temperatures that are given to the data block **AirConditionerData [DB 2]** are displayed.

Status data block **AirConditionerData [DB 2]** - CPU 416

In the program of the CPU-416, the two values Temperature and TemperatureSetPoint are displayed in the data block **AirConditionerData [DB 2]**.

Address	Name	Type	Initial value	Actual value	Comment
0.0	Temperature	REAL	0.000000e+000	71.353	Actual temperature value
4.0	TemperatureSetPoint	REAL	0.000000e+000	72.0	Set point temperature value
8.0	TimeStampTemperature	DATE_AND_TIME	DT#90-1-1-0:0:0.00	DT#90-1-1-0:0:0.00	Actual temperature Time Stamp
16.0	TimeStampSetPoint	DATE_AND_TIME	DT#90-1-1-0:0:0.00	DT#90-1-1-0:0:0.00	Set point temperature TimeStamp
24.0	CurrentTime_TimeStamp	DATE_AND_TIME	DT#90-1-1-0:0:0.00	DT#90-1-1-0:0:0.00	Current Time Time Stamp
32.0	StatusTemperature	DWORD	DW#16#0	DW#16#00000000	Status Temperature
36.0	StatusSetPoint	DWORD	DW#16#0	DW#16#00000000	Status Set Point Temperature
40.0	CurrentTimeStatus	DWORD	DW#16#0	DW#16#00000000	Current Time Status

2.2 In practice:

Each OPC UA value consists of:

- **Value – Status – TimeStamp**
- Not only the **Value**, but also the **Status Code** and the **Time Stamp** should be transferred from the source variable so that the quality and age of the variable can be evaluated.

Each OPC UA server also provides the actual time (variable **CurrentTime**) to carry out time comparisons.

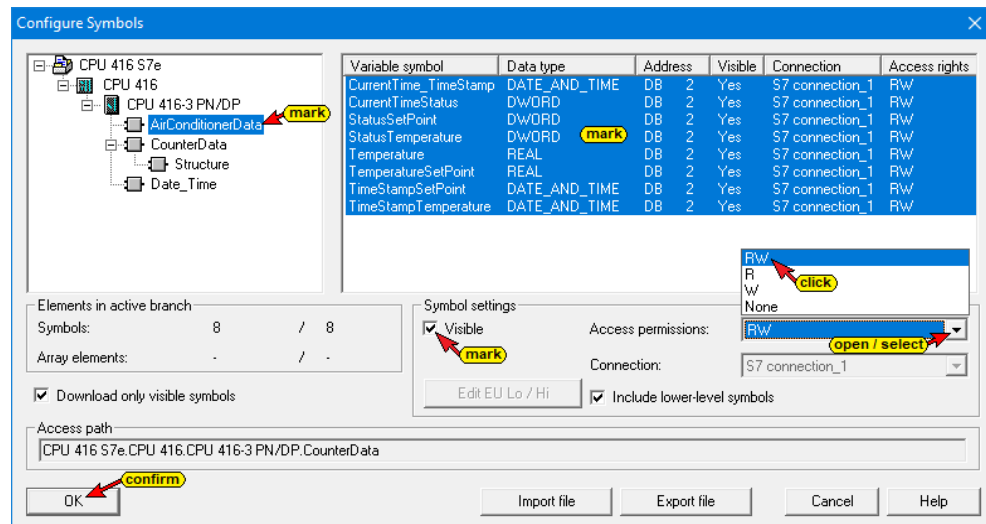
2.2.1 Example: TimeStamp and status code transmitted.

The data block **AirConditionerData [DB 2]** is provided for this purpose.

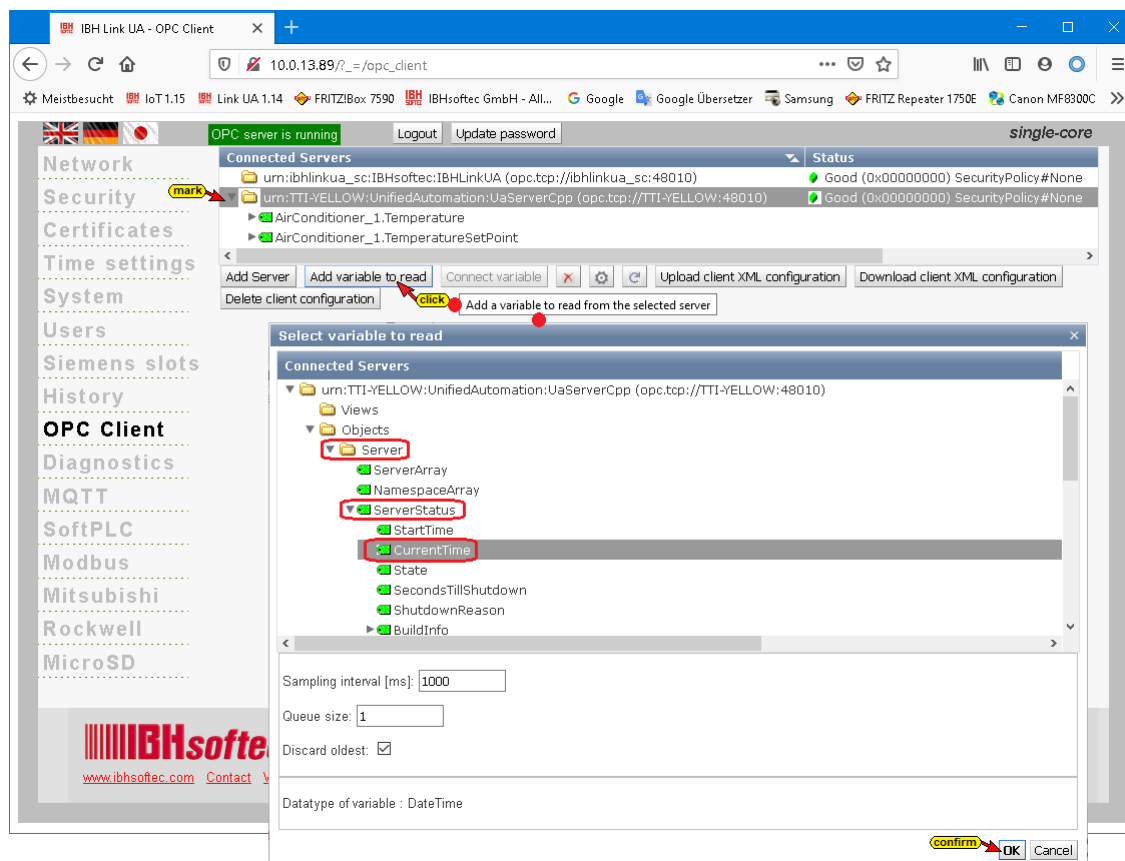
Address	Name	Type	Initial value	Comment
0.0		STRUCT		
+0.0	Temperature	REAL	0.000000e+000	Actual temperature value
+4.0	TemperatureSetPoint	REAL	0.000000e+000	Set point temperature value
+8.0	TimeStampTemperature	DATE_AND_TIME	DT#90-1-1-0:0:0.000	Actual temperature Time Stamp
+16.0	TimeStampSetPoint	DATE_AND_TIME	DT#90-1-1-0:0:0.000	Set point temperature TimeSta
+24.0	CurrentTime_TimeStamp	DATE_AND_TIME	DT#90-1-1-0:0:0.000	Current Time Time Stamp
+32.0	StatusTemperature	DWORD	DW#16#0	Status Temperature
+36.0	StatusSetPoint	DWORD	DW#16#0	Status Set Point Temperature
+40.0	CurrentTimeStatus	DWORD	DW#16#0	Current Time Status

The **Time Stamps** of variables and the actual time (variable **CurrentTime**) as well as the **Status Codes** of an external OPC UA server should be displayed or made available for further processing.

The OPC tags of the data block **AirConditionerData [DB 2]** receiving the data from the external OPC UA server is already selected.



2.2.2 Browser window IBH Link UA - OPC Client



In the example, the read variables Temperature and TemperatureSetPoint of the external OPC UA server are already

linked with the variables of the data block **AirConditionerData [DB 2]** (**Temperature**, **TemperatureSetPoint**). These connections remain.

In addition, the read variable **CurrentTime** of the external server is to be connected to the variable of the data block **AirConditionerData [DB 2]**.

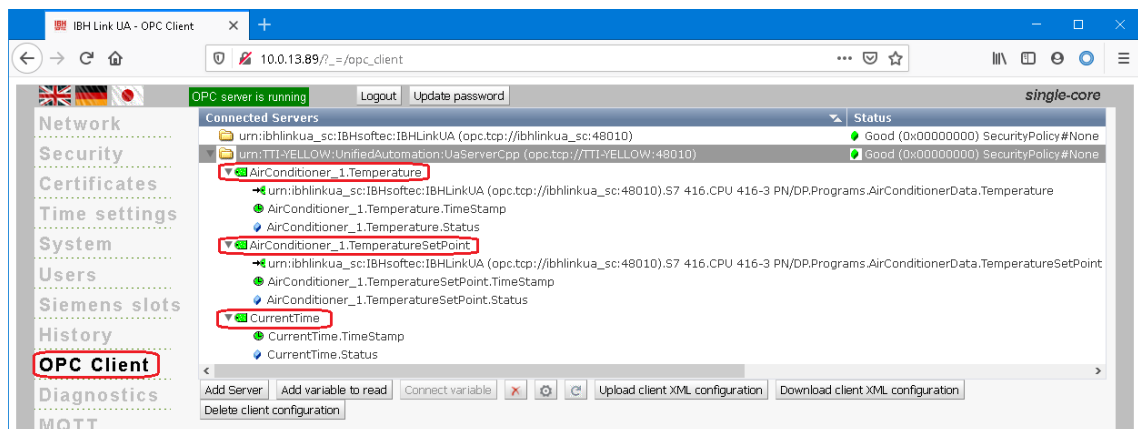
The **Temperature** variable consists of the **Value**, the **TimeStamp**, and the **Status**.

The **TemperatureSetPoint** variable also consists of the **Value**, the **TimeStamp**, and the **Status**.

The **ServerStatus / CurrentTime** variable must be selected as a read variable. It consists of its **Value**, the **TimeStamp**, and the **Status**. Since the Value (**CurrentTime**) and the **TimeStamp** is identical only **CurrentTime.TimeStamp** is selected.

Selected read variable

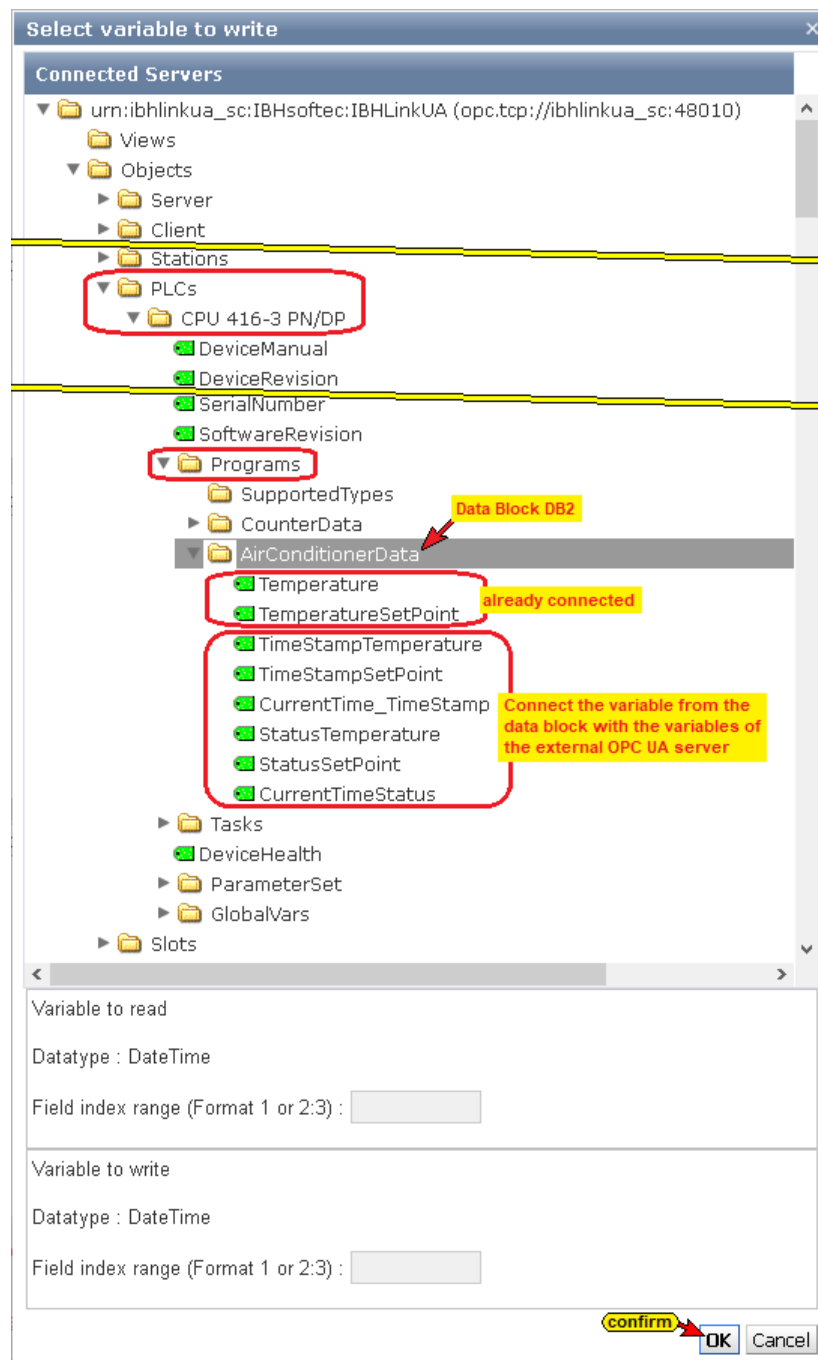
The selected **read tags** of the external OPC UA server are displayed.



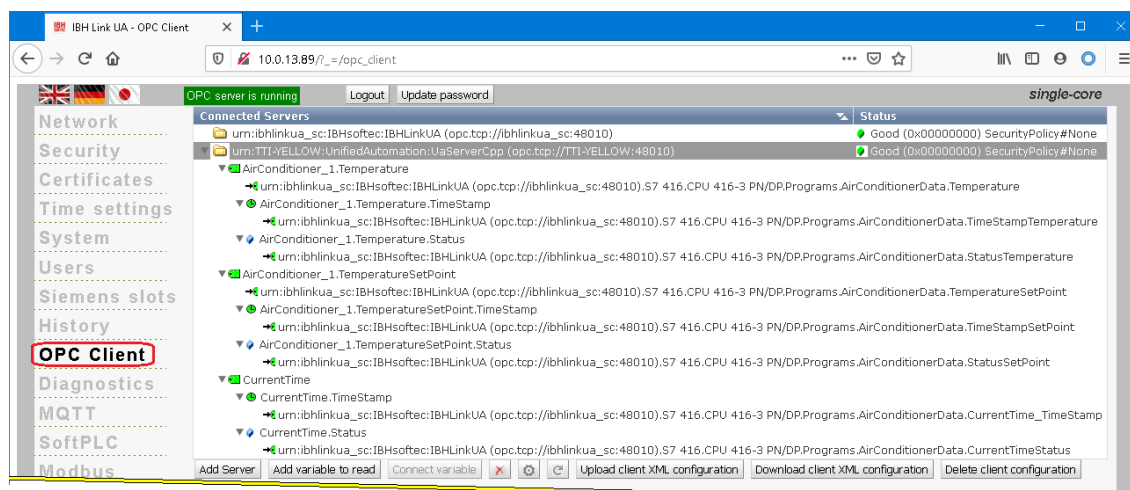
The following read variables are to be connected to the OPC tags of the data block **AirConditionerData [DB 2]**:

- **AirConditioner_1.Temperature.TimeStamp**
- **AirConditioner_1.Temperature.Status**
- **AirConditioner_1.TemperatureSetPoint.TimeStamp**
- **AirConditioner_1.TemperatureSetPoint.Status**
- **CurrentTime.TimeStamp**
- **CurrentTime.Status**

The variables **AirConditioner_1.Temperature** and **AirConditioner_1.TemperatureSetPoint** are already linked to the OPC tags of the data block **AirConditionerData [DB 2]**.



If the variables are linked, they are displayed.



Display the connection to the external OPC server

If the connection to the external OPC server exists, information about the connected external OPC server is displayed in the **UAExpert** program window under **Address Space**.

If the external OPC server is not displayed in the UAExpert program window, the connection must be established (see Chapter 2 - 4, **Add Server**).

UaExpert - Data Access View

Unified Automation UAExpert - The OPC Unified Architecture Client - New Project

File View Server Document Settings Help

Project

- Project
 - Servers
 - UaServerCpp@TTI-YELLOW
 - IBHLinkUA@ibhlinkua_sc**
 - Documents
 - Data Access View

Address Space

No Highlight

Root

- Objects
 - Client
 - DeviceSet
 - MQTT
 - Modbus
 - PLCs
 - CPU 416-3 PN/DP
 - DeviceHealth
 - DeviceManual
 - DeviceRevision
 - GlobalVars
 - HardwareRevision
 - Manufacturer
 - Model
 - ParameterSet **Data Block OBS**
 - Programs
 - AirConditionerData**
 - CurrentTimeStatus
 - CurrentTime_TimeStamp
 - StatusSetPoint
 - StatusTemperature
 - Temperature
 - TemperatureSetPoint
 - TimeStampSetPoint
 - TimeStampTemperature
 - CounterData
 - SupportedTypes
 - RevisionCounter

Data Access View

#	Server	Node Id	Display Name	Value	Datatype	Source Timestamp	Server Timestamp	Statuscode
1	IBHLinkUA@ib...	NS4 String S7 4...	CurrentTimeStatus	0	UInt32	14:29:08.760	14:29:08.793	Good
2	IBHLinkUA@ib...	NS4 String S7 4...	CurrentTime_TimeStamp	2020-10-25T13:34:43.747Z	Date/Time	14:34:43.711	14:34:43.748	Good
3	IBHLinkUA@ib...	NS4 String S7 4...	StatusSetPoint	0	UInt32	14:29:13.278	14:29:14.047	Good
4	IBHLinkUA@ib...	NS4 String S7 4...	StatusTemperature	0	UInt32	14:29:15.391	14:29:16.047	Good
5	IBHLinkUA@ib...	NS4 String S7 4...	Temperature	71.9844	Float	14:34:44.227	14:34:44.249	Good
6	IBHLinkUA@ib...	NS4 String S7 4...	TemperatureSetPoint	72	Float	14:32:57.393	14:32:58.433	Good
7	IBHLinkUA@ib...	NS4 String S7 4...	TimeStampSetPoint	2020-10-25T10:01:12.706Z	Date/Time	14:33:08.399	14:33:09.187	Good
8	IBHLinkUA@ib...	NS4 String S7 4...	TimeStampTemperature	2020-10-25T13:34:44.243Z	Date/Time	14:34:44.227	14:34:44.249	Good

Drag & Drop

Display Name	Value	Datatype
CurrentTimeStatus	0	UInt32
CurrentTime_TimeStamp	2020-10-25T13:44:13.334Z	Date/Time
StatusSetPoint	0	UInt32
StatusTemperature	0	UInt32
Temperature	71.9848	Float
TemperatureSetPoint	72	Float
TimeStampSetPoint	2020-10-25T10:01:12.706Z	Date/Time
TimeStampTemperature	2020-10-25T13:44:13.831Z	Date/Time

Greenwich Mean Time (GTM)
zulu time (Z)

Data Access View

#	Server	Node Id
1	IBHLinkUA@ibhlinkua_sc	NS4 String S7 416.CPU 416-3 PN/DP.Programs.AirConditionerData.CurrentTimeStatus
2	IBHLinkUA@ibhlinkua_sc	NS4 String S7 416.CPU 416-3 PN/DP.Programs.AirConditionerData.CurrentTime_TimeStamp
3	IBHLinkUA@ibhlinkua_sc	NS4 String S7 416.CPU 416-3 PN/DP.Programs.AirConditionerData.StatusSetPoint
4	IBHLinkUA@ibhlinkua_sc	NS4 String S7 416.CPU 416-3 PN/DP.Programs.AirConditionerData.StatusTemperature
5	IBHLinkUA@ibhlinkua_sc	NS4 String S7 416.CPU 416-3 PN/DP.Programs.AirConditionerData.Temperature
6	IBHLinkUA@ibhlinkua_sc	NS4 String S7 416.CPU 416-3 PN/DP.Programs.AirConditionerData.TemperatureSetPoint
7	IBHLinkUA@ibhlinkua_sc	NS4 String S7 416.CPU 416-3 PN/DP.Programs.AirConditionerData.TimeStampSetPoint
8	IBHLinkUA@ibhlinkua_sc	NS4 String S7 416.CPU 416-3 PN/DP.Programs.AirConditionerData.TimeStampTemperature

External OPC UA server - air conditioner data

Unified Automation UaExpert - The OPC Unified Architecture Client - NewProject*

File View Server Document Settings Help

Project Data Access View

Project

- Servers
 - UaServerCpp@TTI-YELLOW
 - IBHLinkKUA@ibhlinkkua_sc
 - Data Access View
- Documents
 - Data Access View

Address Space

- No Highlight
- Root
 - Objects
 - BuildingAutomation
 - AirConditioner_1
 - Humidity
 - HumiditySetPoint
 - StateCondition
 - Stop
 - Temperature
 - TemperatureSetPoint
 - AirConditioner_10
 - AirConditioner_2
 - StartLogging
 - StopLogging
 - Demo
 - Server
 - AlarmsNoNodes
 - AlarmsWithNodes
 - ServerRedundancy
 - ServerStatus
 - BuildInfo
 - CurrentTime
 - SecondsTillShutdown
 - ShutdownReason
 - StartTime
 - State
 - ServiceLevel
 - Trace
 - VendorServerInfo
 - Types
 - Vimes

Data Access View

#	Server	Node Id	Display Name	Value	Datatype	Source Timestamp	Server Timestamp	StatusCode
1	UaServerCpp@TTI-YELLOW	NS3[String]AirConditioner_1.TemperatureSetPoint	TemperatureSetPoint	72	Double	11:01:12.706	17:56:58.846	Good
2	UaServerCpp@TTI-YELLOW	NS3[String]AirConditioner_1.Temperature	Temperature	71.9791800001	Double	19:41:41.262	19:41:41.262	Good
3	UaServerCpp@TTI-YELLOW	NS0[Numeric]2258	CurrentTime	2020-10-25T18:42:01Z	DateTime	19:41:42.013	19:41:42.013	Good

Annotations:

- Drag & Drop (pointing to CurrentTime in the project tree)
- double-click to change the value (pointing to the Value column header and the 60 value in the TemperatureSetPoint row)
- Greenwich Mean Time (GMT) Zulu time (Z) (pointing to the 2020-10-25T18:42:01Z value)
- CET - Central European Time (pointing to the 19:41:42.013 value)

Display Name

TemperatureSetPoint

Temperature

CurrentTime

Value

60

71.9843850001

2020-10-25T18:49:36.941Z

Datatype

Double

Double

DateTime

Data Access View

#	Server	Node Id	Display Name
1	UaServerCpp@TTI-YELLOW	NS3[String]AirConditioner_1.TemperatureSetPoint	TemperatureSetPoint
2	UaServerCpp@TTI-YELLOW	NS3[String]AirConditioner_1.Temperature	Temperature
3	UaServerCpp@TTI-YELLOW	NS0[Numeric]2258	CurrentTime

Online status – Data block *AirConditionerData* [DB2] CPU-416

Address	Name	Type	Initial value	Actual value	Comment
0.0	Temperature	REAL	0.000000e+000	59.4482	Actual temperature value
4.0	TemperatureSetPoint	REAL	0.000000e+000	60.0	Set point temperature value
8.0	TimeStampTemperature	DATE_AND_TIME	DT#90-1-1-0:0:0.000	DT#90-1-1-0:0:0.000	Actual temperature Time Stamp
16.0	TimeStampSetPoint	DATE_AND_TIME	DT#90-1-1-0:0:0.000	DT#90-1-1-0:0:0.000	Set point temperature TimeStamp
24.0	CurrentTime_TimeStamp	DATE_AND_TIME	DT#90-1-1-0:0:0.000	DT#90-1-1-0:0:0.000	Current Time Time Stamp
32.0	StatusTemperature	DWORD	DW#16#0	DW#16#00000000	Status Temperature
36.0	StatusSetPoint	DWORD	DW#16#0	DW#16#00000000	Status Set Point Temperature
40.0	CurrentTimeStatus	DWORD	DW#16#0	DW#16#00000000	Current Time Status

Press F1 to get Help. RUN Abs < 5.2 Rd

The status of the data type DATE_AND_TIME is not displayed. The PLC program uses system functions to convert DATE_AND_TIME into the data types DATE and TIME_OF_DAY.

Online status – Data block *Data_Time* [DB6] CPU-416

Address	Name	Type	Initial value	Actual value	Comment
0.0	Temp_Date	DATE	D#1990-1-1	D#2021-01-04	Temperature Time Stamp Date
2.0	SetPoint_Date	DATE	D#1990-1-1	D#2021-01-04	SetPoint Time Stamp Date
4.0	CurrentTime_Date	DATE	D#1990-1-1	D#2021-01-04	CurrentTime Time Stamp Date
6.0	Temp_Time	TIME_OF_DAY	TOD#0:0:0.000	TOD#16:44:05.800	Temperature time of day
10.0	SetPoint_Time	TIME_OF_DAY	TOD#0:0:0.000	TOD#16:24:12.947	SetPoint time of day
14.0	CurrentTime_Time	TIME_OF_DAY	TOD#0:0:0.000	TOD#16:44:06.431	CurrentTime time of day

Press F1 to get Help. RUN Abs < 5.2 Rd

3 IBH Link UA – Connection of a CPU 300 / 400 via IBH Link S7++

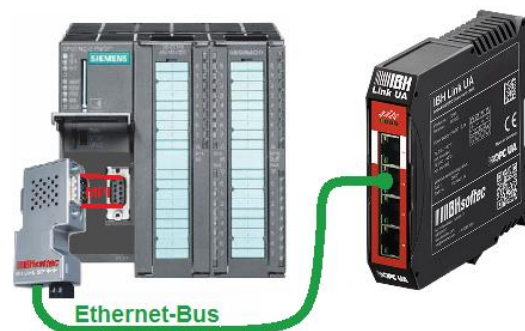
CPUs of the S7-300 and S7-400 series not having a free Ethernet port can be connected to the IBH Link UA via Ethernet (RFC 1006 protocol) using the programming port (MPI bus) of the CPU via an IBH Link S7++.

The following example shows a project with the connection of a **CPU 312 (6ES7 312-1AE13-0AB0)** to an **IBH Link UA** via an **IBH Link S7++**. Instead of the CPU 312, any other S7 CPU 300/400 could be used.

IBH Link S7++

The IBH Link S7++ is an Ethernet converter. The protocol used is the usual standard TCP/IP. All the advantages of Ethernet are thus without any problems to the user.

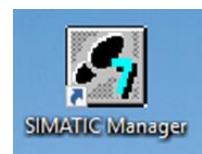
The use of **SimaticNet** as well as the use of CP communication processors are neither necessary on the PC nor on the PLC side.



3.1 Project with STEP® 7 (SIMATIC Manager V5.6)

Example: Up / down Counter

The example **CPU 300 S7e** is identical to the program **Counter**, as described in chapter 1. The counter counts until **MaxValue** is reached and counts down until the **MinValue** is reached.

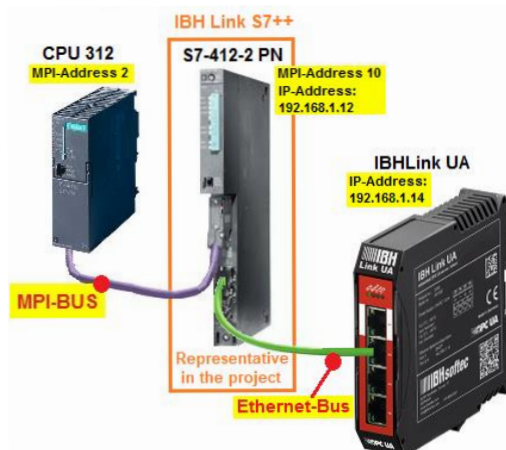


The SIEMENS PLC programming systems SIMATIC Manager V5.6 is used to create the network configuration.

IBH Link UA - configuration with the S7 (SIMATIC® Manager)

S7-300 and S7-400 controllers that do not have an Ethernet connection can be connected to the IBH Link UA via the **IBH Link S7 ++** or the **IBH Link S7 ++ HS**.

The routing mode must be activated in the **IBH Link S7 ++**. This mode is available from firmware version 2.142. In this mode, unconfigured connections via RFC1006 are no longer possible! Connections via the IBHNet driver continue to work.



Note:

The CPU S7-412-2 PN provides the **Routing Service** and is available in the hardware catalog of the TIA Portal and Step 7 (Simatic Manager).

The firmware of the IBH Link S7 ++ emulates the **Routing** capabilities of the CPU S7-412-2 PN (**6ES7 412-2EK06-0AB0 V6.0**).

The following properties are available (compatible with CPU S7-412-2 PN):

Interfaces / Bus type	Protocols
1x MPI/PROFIBUS DP	MPI/PROFIBUS
1x PROFINET (1 Port)	ISO-on-TCP (RFC1006)

3.1.1 Configuration of the IBH Link S7 ++ (Routing mode)

In the STEP 7 example, the S7 CPU 312 is to be routed via the IBH Link S7++ and connected to the IBH Link UA.

The **IBH Link S7++** must be configured to allow the **Routing mode**.

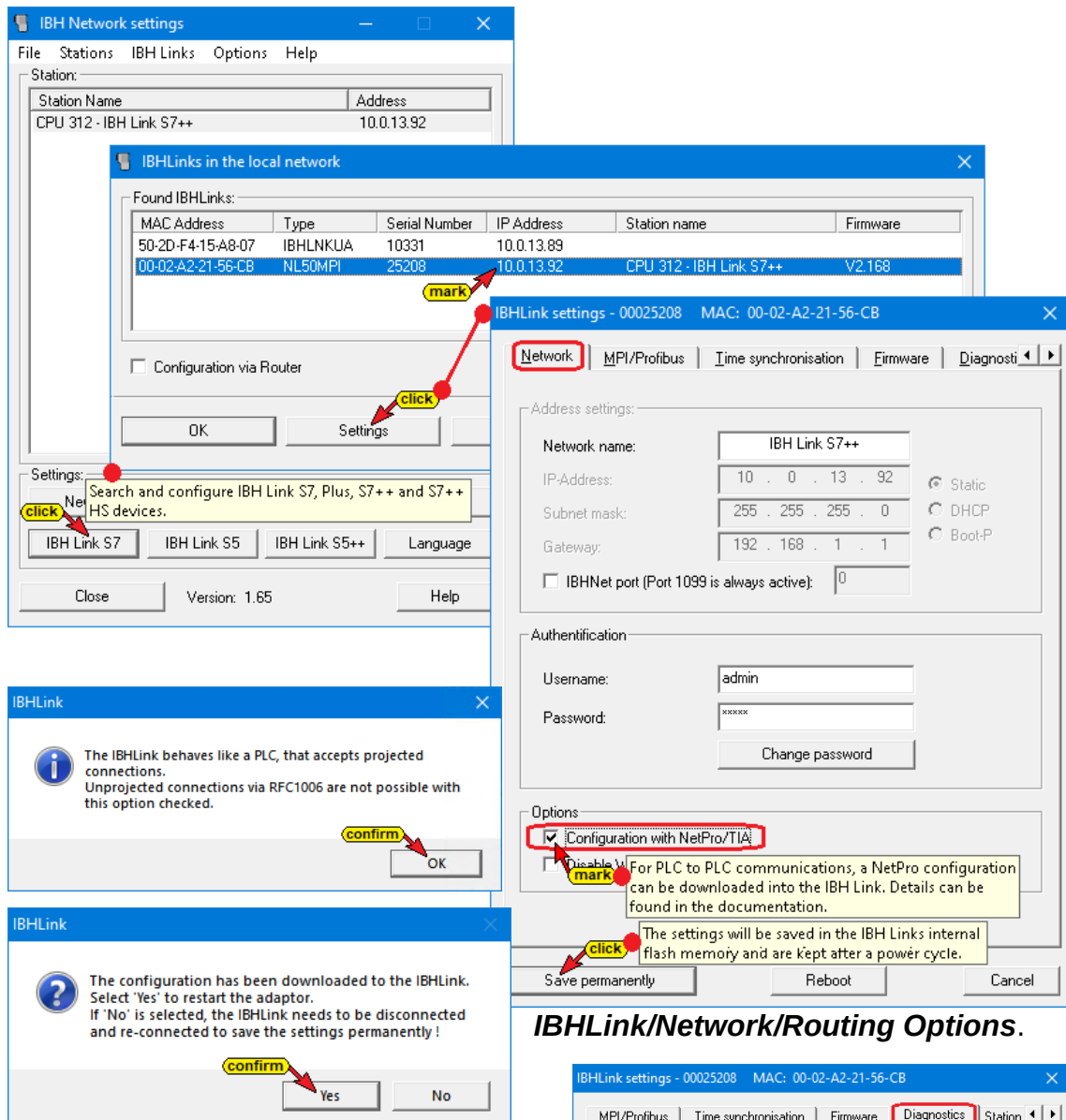
After starting **Manage IBHNet Stations**, the **IBH Network Settings** dialog box opens. Click the **IBH Link S7** button to open the IBH Links in the local network dialog box.



Configuration of the IBH Link S7++

To set the properties of the **IBHNet station** follow the screen shots.

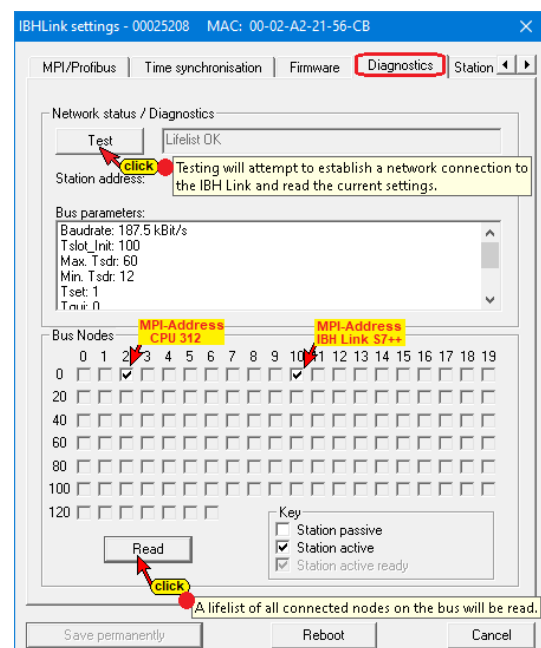
Activate **Configuration with NetPro** in the dialog box **Properties**



IBHLink/Network/Routing Options.

IBH Link S7++ MPI addresses

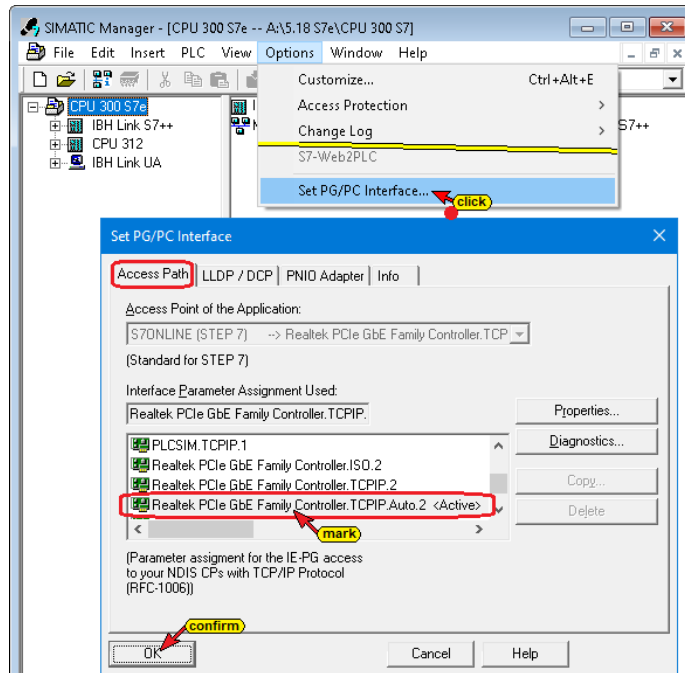
The setting made must be permanently adopted in the IBH Link S7 ++.



3.1.2 Set up the PG / PC interface as an Ethernet connection

To be able to establish a connection with the **IBH Link S7++** (CPU 412) and the **IBH Link UA** (OPC UA Server), the PG / PC interface must be set up as an Ethernet connection.

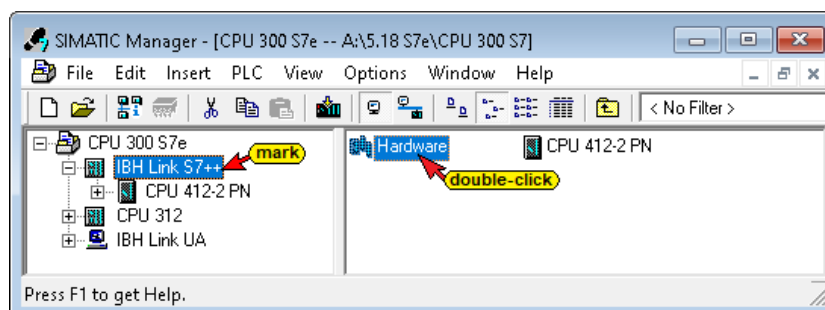
Set the PG / PC interface for Ethernet communication



3.2 IBHLink S7++ as CPU 412-2 PN in the project

The inserted SIMATIC 400 station (1) was renamed IBH Link S7++.

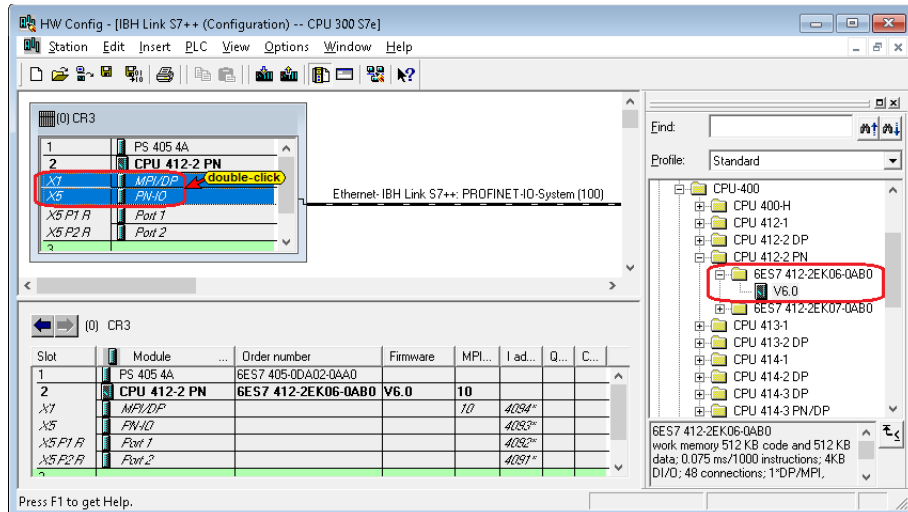
With a click on the **IBH Link S7++** (renamed SIMATIC 400 station) in the left window, and a double-click on **Hardware** in the right window the HW Config window is opened.



3.2.1 Configuration of IBH Link S7++ (SIMATIC 400 station)

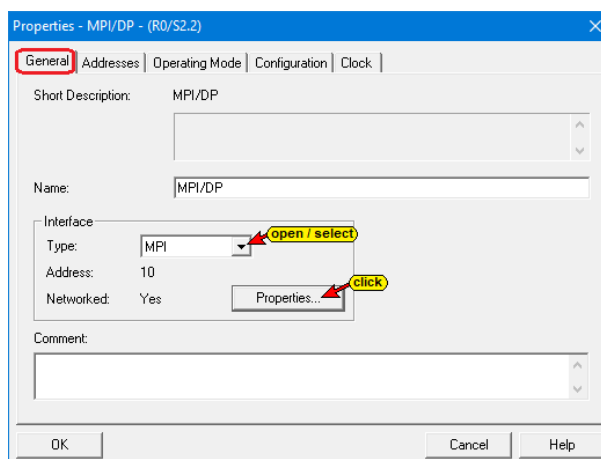
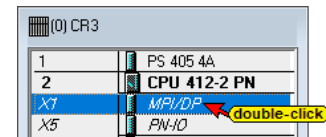
The following module must be used as a representative for the IBH Link S7 ++: **MLFB: 6ES7 412-2EK06-0AB0 V6.0** in rack 0, slot 2.

HW Config window IBH Link S7++ (SIMATIC 400 station)

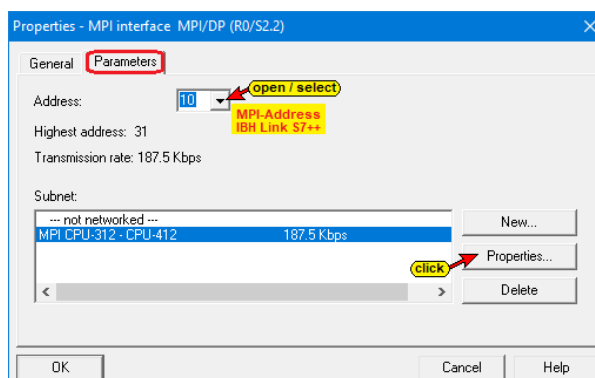


Define the MPI interface of the CPU 412 (MPI interface IBH Link S7++)

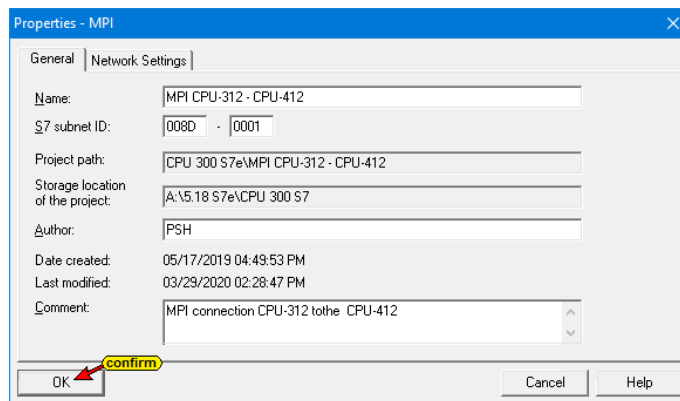
With a double-click on the line **X1 MPI/DP** the dialog box **Properties – MPI/DP - (R0 / S2.2)** is opened.



The Interface type **MPI** is selected. Click the button **Properties...** to open the dialog box **Properties – MPI interface - (R0 / S2.2)**. The tab **Parameters** show the selected MPI address (10) of the CPU 412. The subnet connection MPI CPU-312 – CPU-412 was established.



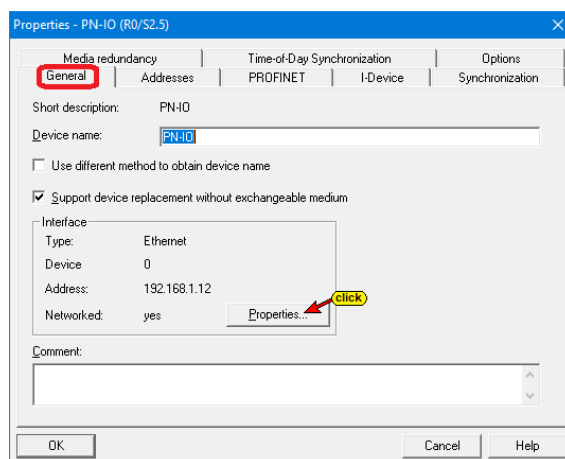
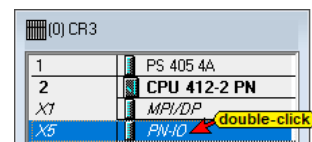
Click the button **Properties...** to open the dialog box **Properties – MPI** for more details on the connection.



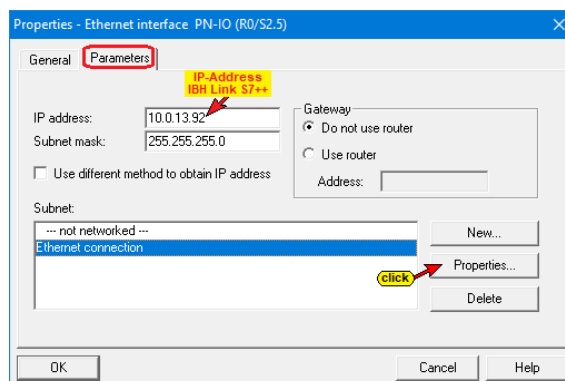
Click **OK** to close all dialog boxes.

Define the ethernet interface of the CPU 412

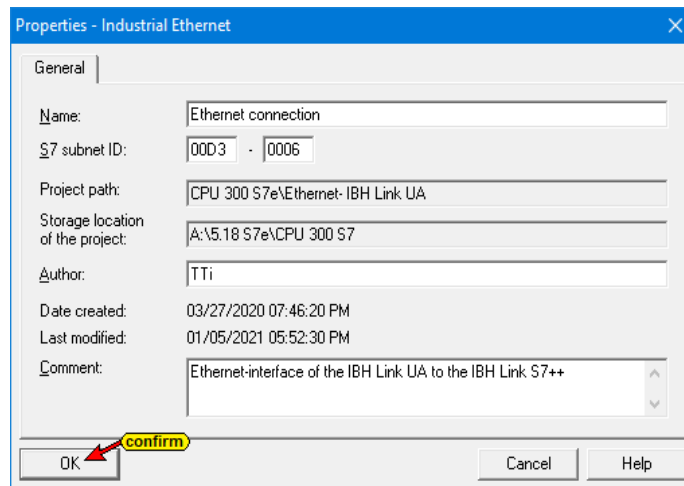
With a double-click on the line **X5 PN-IO** the dialog box **Properties – PN-IO - (R0 / S2.5)** is opened.



To set up the ethernet interface click the button **Properties...** button to open the dialog box **Properties – Ethernet interface PN - (R0 / S2.5)**.



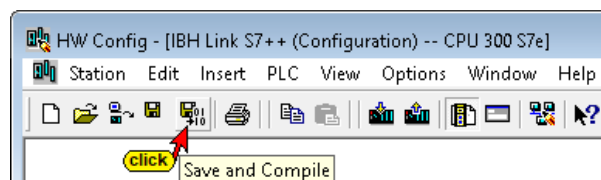
Click the button **Properties...** to open the dialog box **Properties – Industrial Ethernet** for more details on the connection.



Click **OK** to close all dialog boxes.

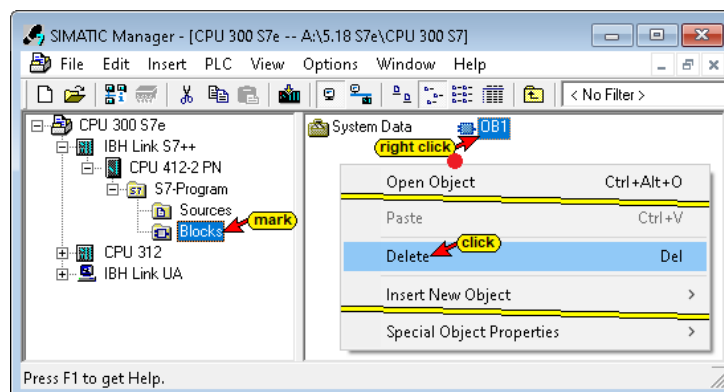
Configuration of CPU 412-2 PN (IBH Link S7++) Save and Compile

The configuration is accepted by clicking the Save and Compile icon.



Delete blocks (IBH Link S7++ / CPU 412-2 PN)

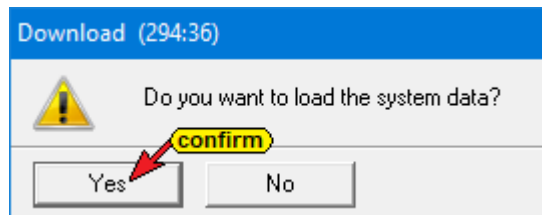
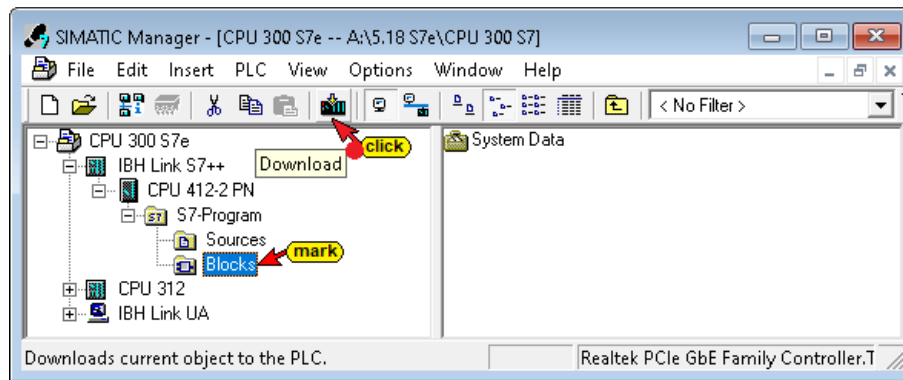
No blocks can be loaded into the IBH Link S7++. All blocks that are in offline mode from IBH Link S7++ / CPU 412-2 PN must be deleted.



Only data can be transferred with the **IBH Link S7++**. All program blocks in the **CPU 412-2 PN** must be deleted.
The configuration *must be loaded* into the IBH Link S7++!

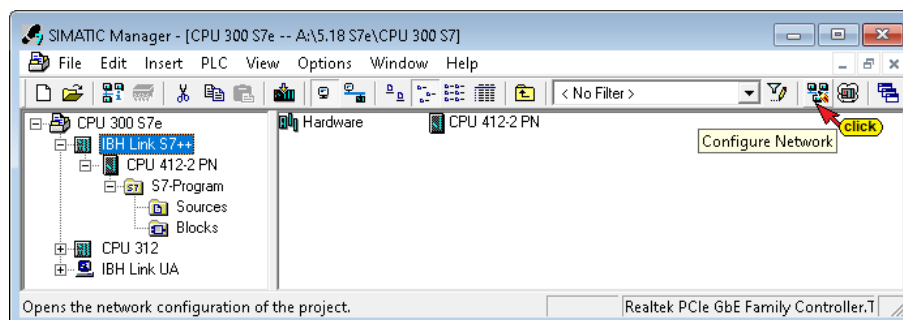
Load System configuration into the IBH Link S7++ / CPU 412

Loading into the CPU 412-2 PN (IBH Link S7 ++) requires several steps.



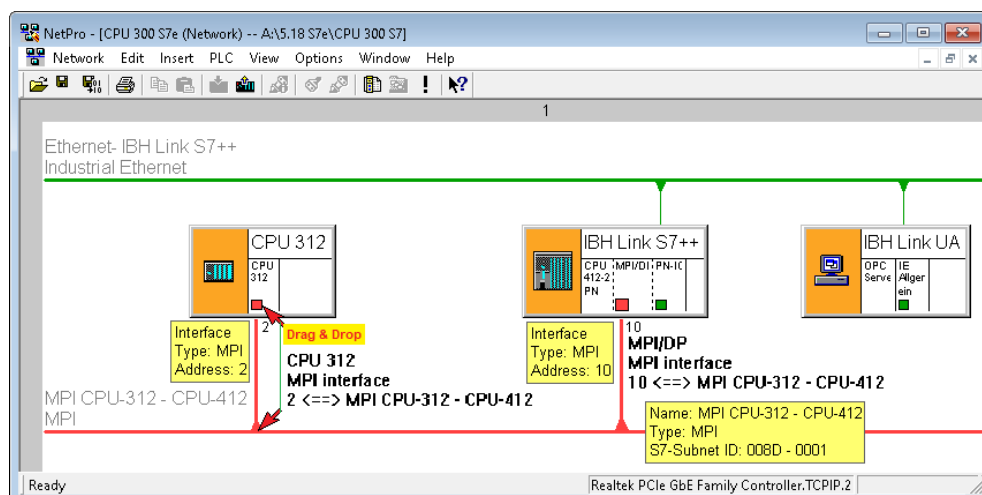
3.3 Create MPI connection between CPU 312 and CPU 412 / (IBH Link S7++)

Click the **Configure Network** icon to open the NetPro window.

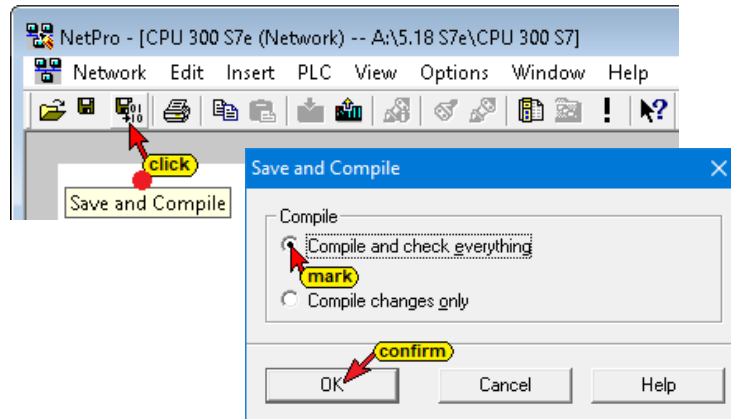


NetPro window

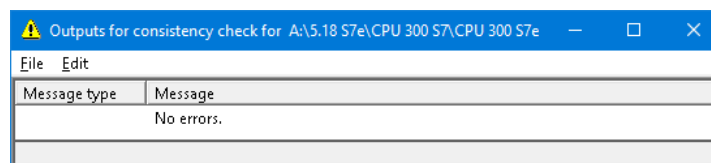
The MPI port of the CPU 312 is connected to the MPI bus with drag & drop.



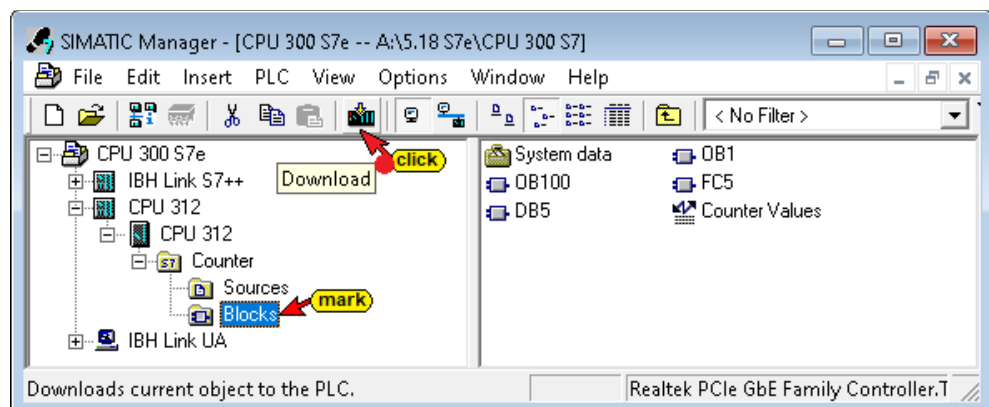
Save and Compile MPI connection



The procedure **Compile and check everything** shows no warning.



3.3.1 S7 PLC program (Counter) CPU 312



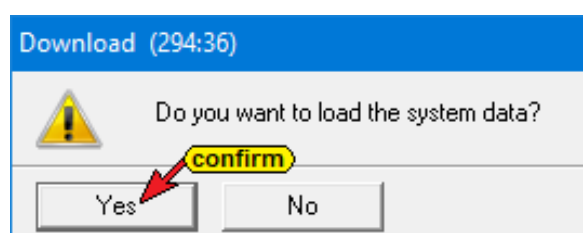
Load all PLC blocks and the System data into the S7 CPU 312

Note:

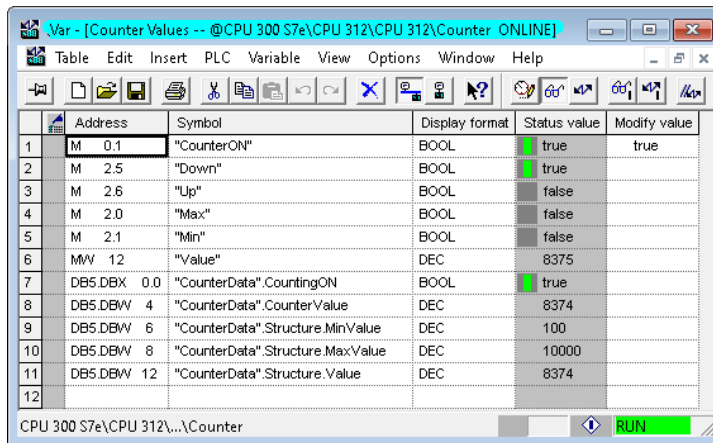


The S7-CPU [CPU 312] is connected to the CPU 412-2 PN [IBH Link S7++] via MPI, loading takes place via the Ethernet connection of the CPU 412-2 PN [IBH Link S7++].

Direct loading via MPI is only possible after changing the PG / PC interface to IBHNet.MPI.1. This is not recommended. This setting does not allow online access to the other devices.



The online status of the S7 PLC program is displayed.



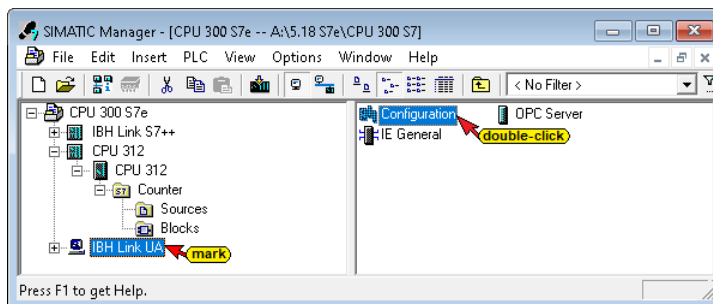
	Address	Symbol	Display format	Status value	Modify value
1	M 0.1	"CounterON"	BOOL	true	true
2	M 2.5	"Down"	BOOL	true	
3	M 2.6	"Up"	BOOL	false	
4	M 2.0	"Max"	BOOL	false	
5	M 2.1	"Min"	BOOL	false	
6	MV 12	"Value"	DEC	8375	
7	DB5.DBX 0.0	"CounterData".CountingON	BOOL	true	
8	DB5.DBW 4	"CounterData".CounterValue	DEC	8374	
9	DB5.DBW 6	"CounterData".Structure.MinValue	DEC	100	
10	DB5.DBW 8	"CounterData".Structure.MaxValue	DEC	10000	
11	DB5.DBW 12	"CounterData".Structure.Value	DEC	8374	
12					

CPU 300 S7e\CPU 312\...Counter

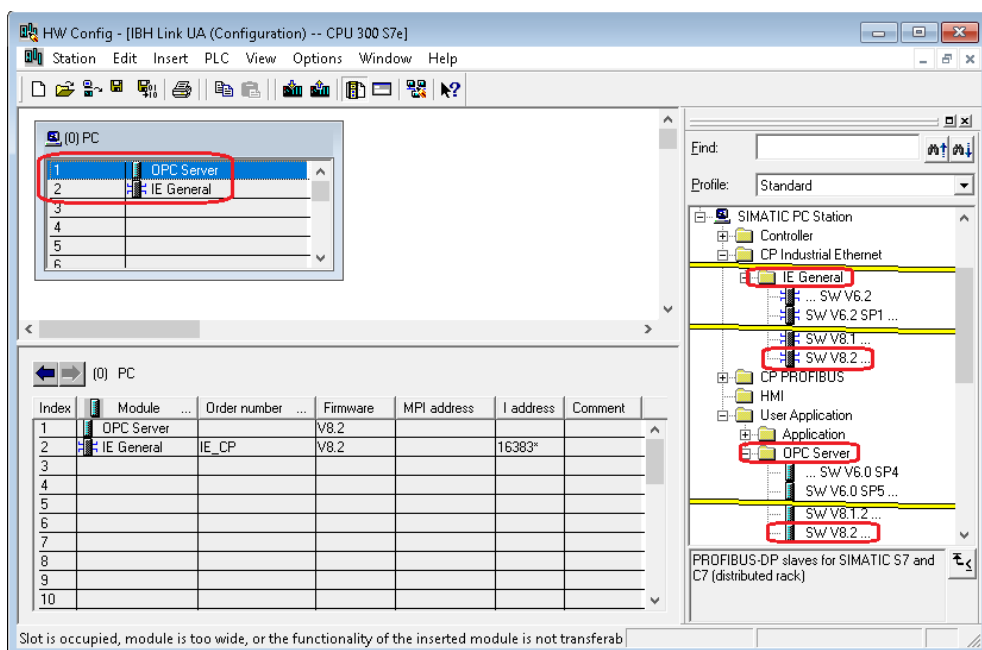
RUN

3.4 IBH Link UA as an SIMATIC PC station

A click on **IBH Link UA**, the renamed **SIMATIC PC station**, and a double-click on **Configuration** opens the window showing the configuration of the IBH Link UA.



3.4.1 Configuration of IBH Link UA (SIMATIC PC station)

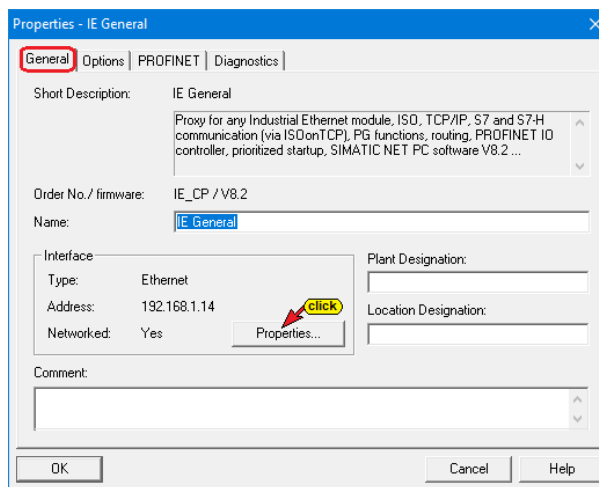
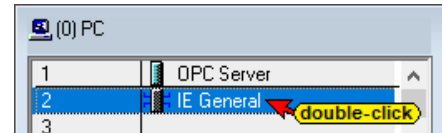


Note:

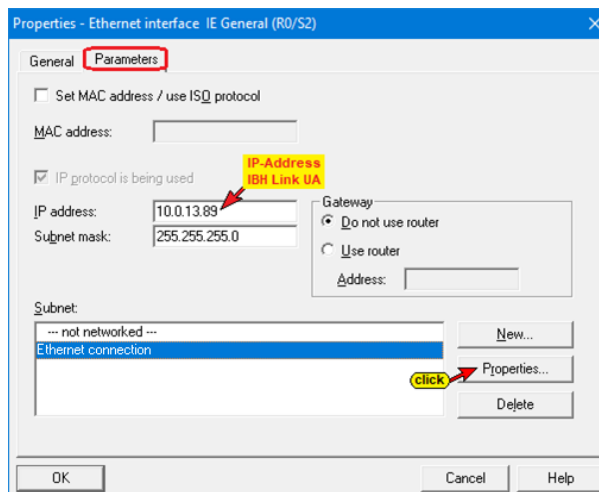
The Siemens **OPC server SW V8.2...** and the CP Industrial Ethernet interface **IE General SW V8.2...** are available in the hardware catalogs of STEP7-SIMATIC Manager and the TIA Portals.

Ethernet interface IE General (R0 / S2) set up

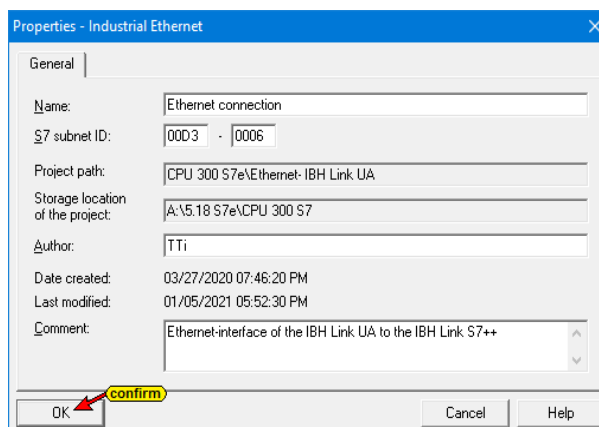
With a double-click on the line **1 IE General** the dialog box **Properties – IE General** is opened.



To set up the ethernet interface click the button **Properties...** to open the dialog box **Properties – Ethernet interface IE General (R0 / S2)**.



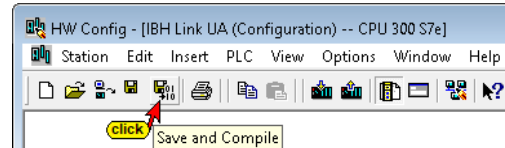
Click the button **Properties...** to open the dialog box **Properties – Industrial Ethernet** for more details on the connection.



Click **OK** to close all dialog boxes.

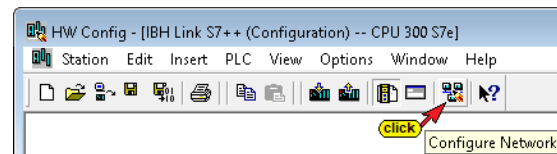
Configuration of the IBH Link UA Save and Compile

The configuration is accepted by clicking the Save and Compile icon.

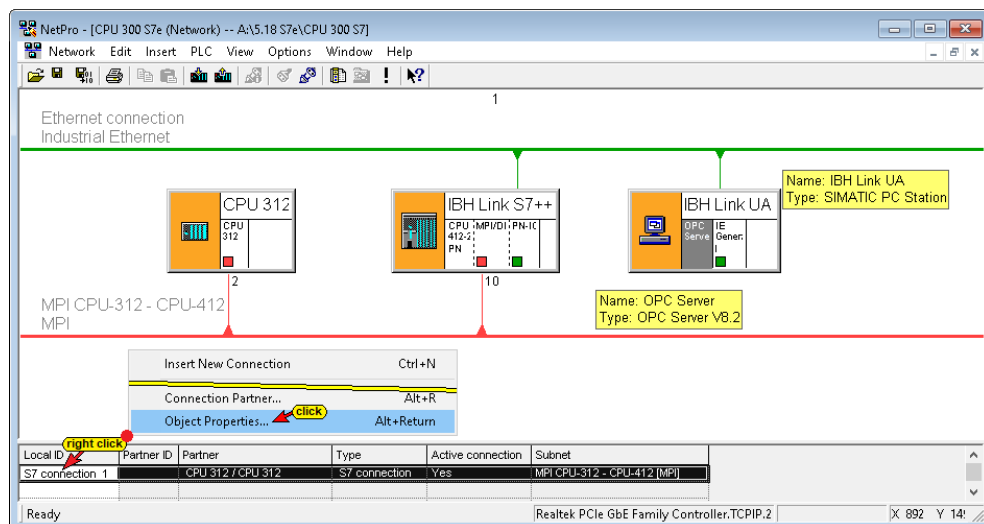


3.5 Create S7 connection between OPC Server and CPU 312

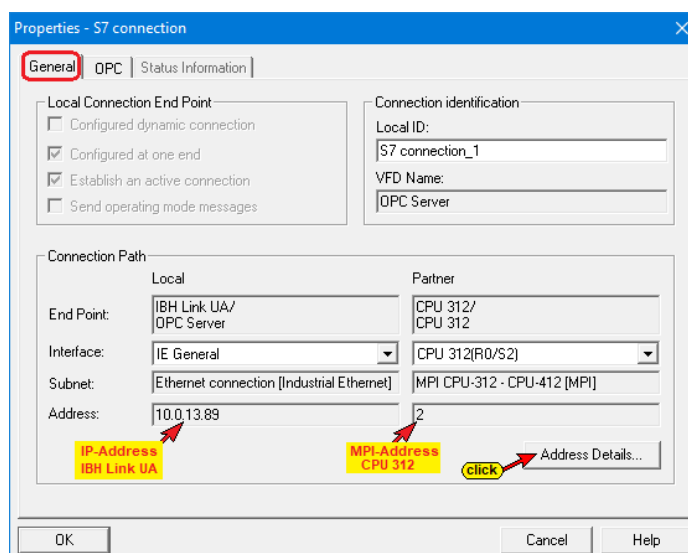
Click the **Configure Network** icon to open the **NetPro** window.



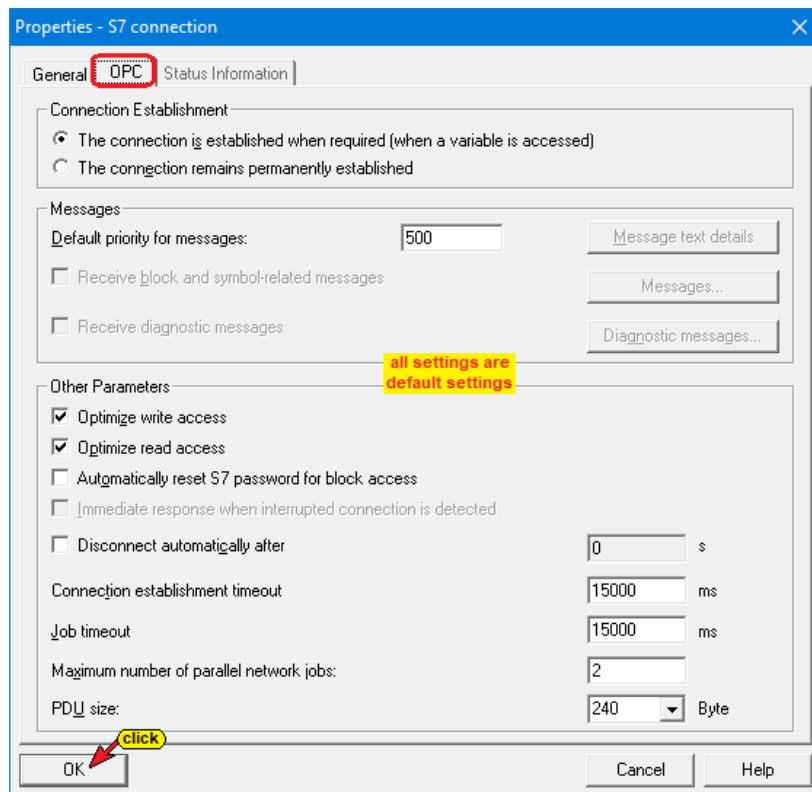
NetPro window



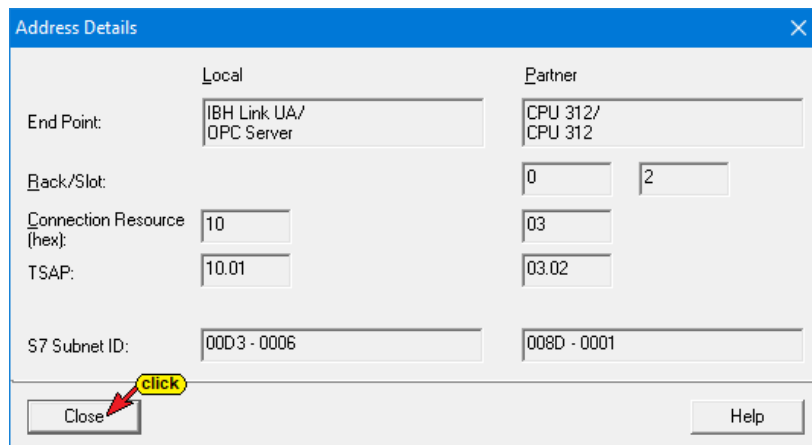
Right-click **S7_connection / Object Properties** to display details on the **S7 connection_1**.



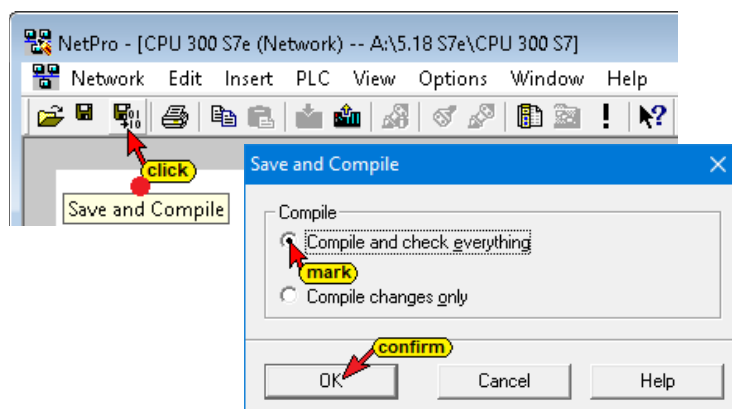
The tab OPC of the dialog box **Object Properties - S7 connection_1, tab OPC** displays further details on the connection.



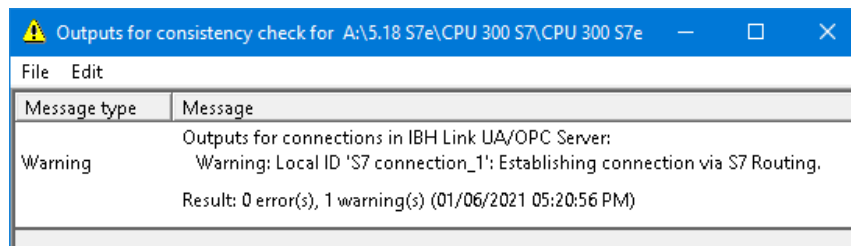
Details of the **S7 connection_1** addresses are displayed.



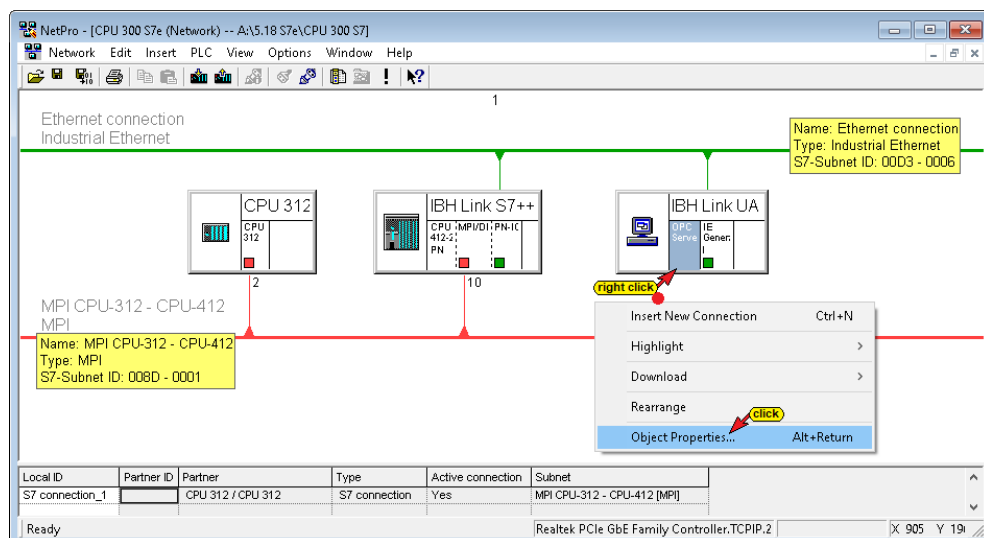
Save and Compile S7 connection_1



The procedure **Compile and check everything** shows a warning. Since routing is intentional, the warning does not apply.

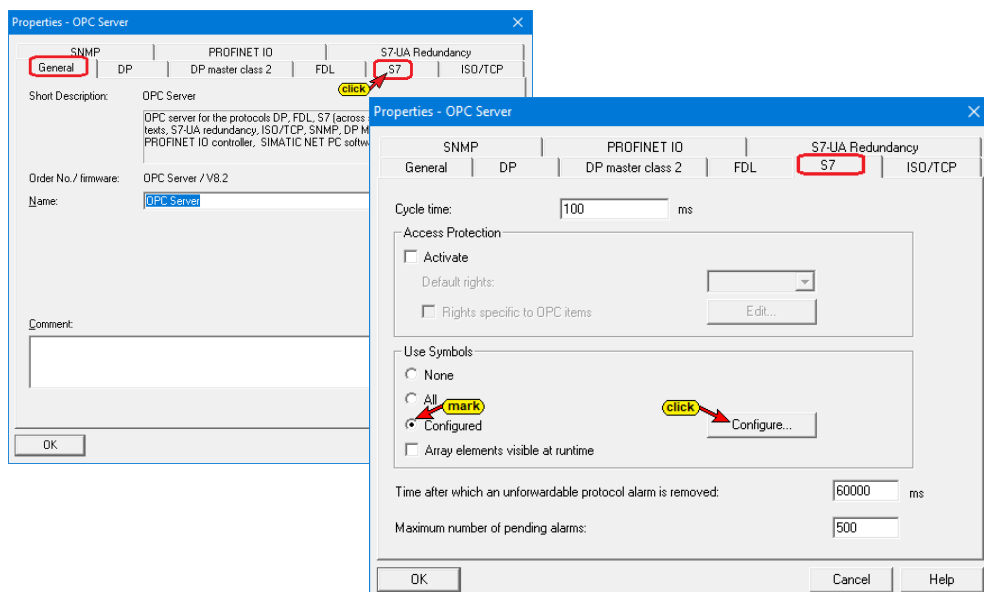


3.5.1 Select OPC tags

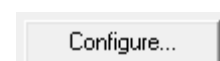


The command **Object properties...** from the context menu (right-click on **OPC server**) opens the **Properties - OPC server** dialog box.

The **S7 tab** defines whether symbols should be used and which ones.



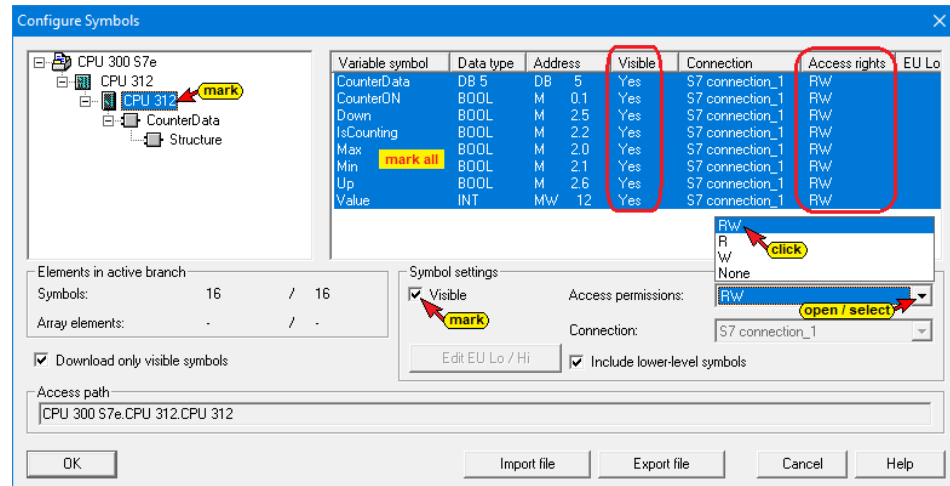
The **Configure...** button opens the **Properties - OPC Server** dialog box. The operands defined in



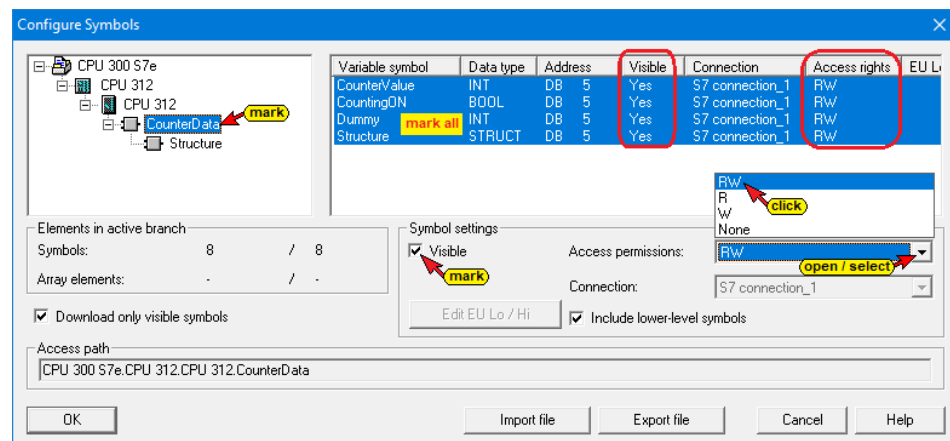
the symbol table, and the data of the data blocks can be selected as **OPC tags** (OPC symbols).

Due to the previously configured S7 connection, all tags are shown.

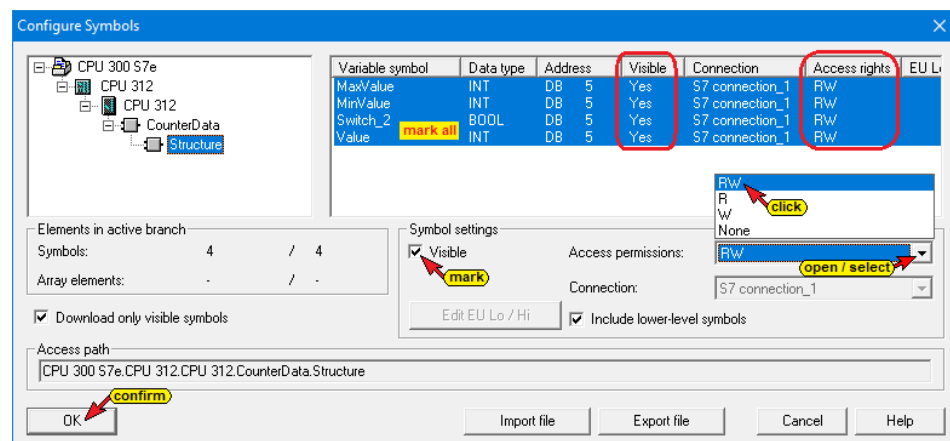
Global Variable (OPC tags) CPU 312



Data block CounterData [DB2] OPC tags



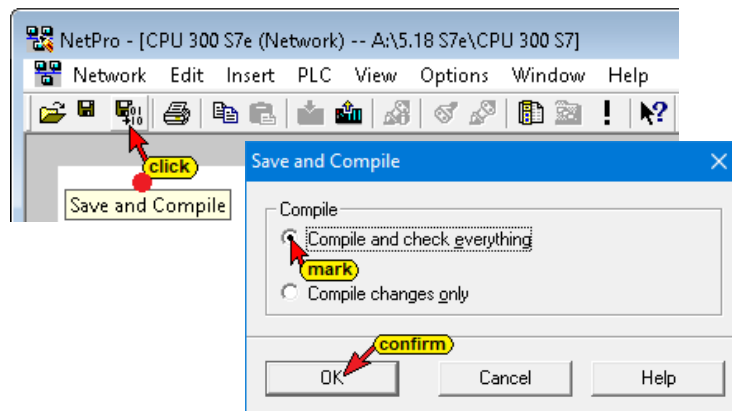
Structure Data block CounterData [DB2] OPC tags



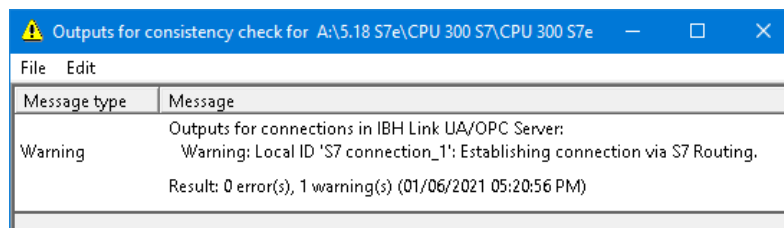
Click the **OK** buttons to close the **Configure Symbols** and the **Properties - OPC Server** dialog boxes.

NetPro - CPU 312 S7e (Network) window

Clicking on the **Save and Compile** icon to save the configuration of the **CPU312**, **CPU 412** and **IBH Link UA**.

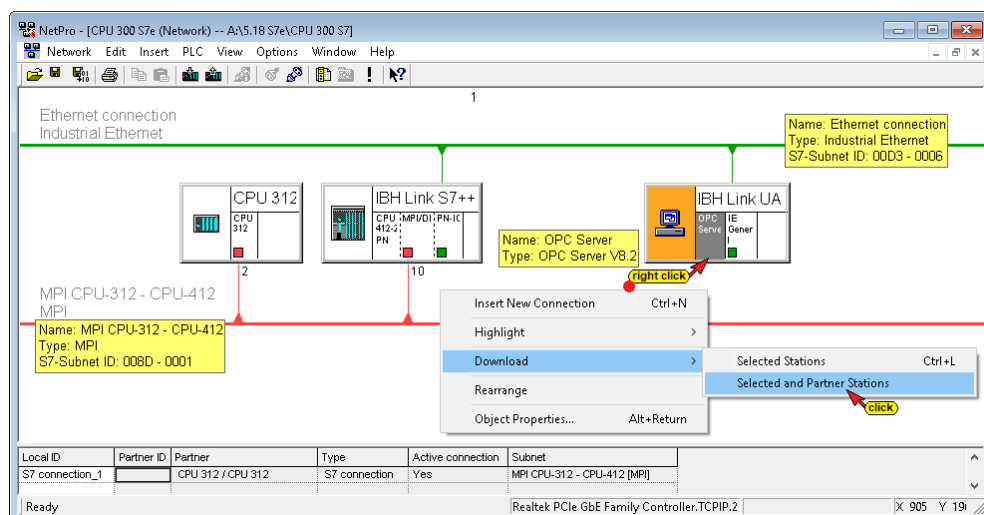


The procedure **Compile and check everything** shows a warning. Since routing is intentional, the warning does not apply.



Download the configuration of the CPU 416 and IBH Link UA.

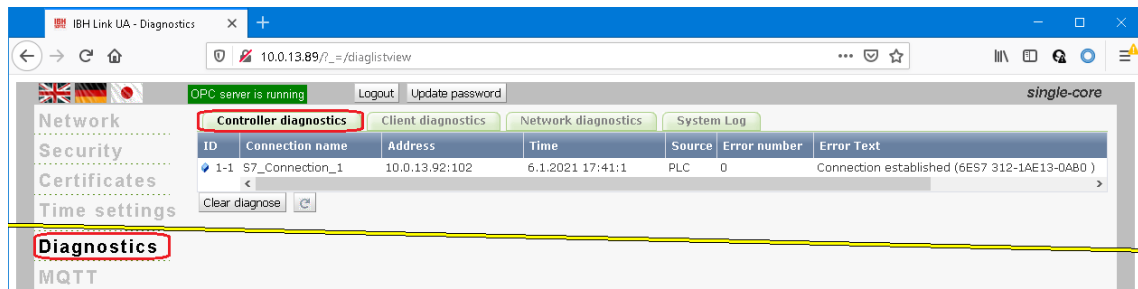
Right-click **OPC-Server** and click **Download / Selected and Partner Stations**.



Several information must be confirmed to complete the download.

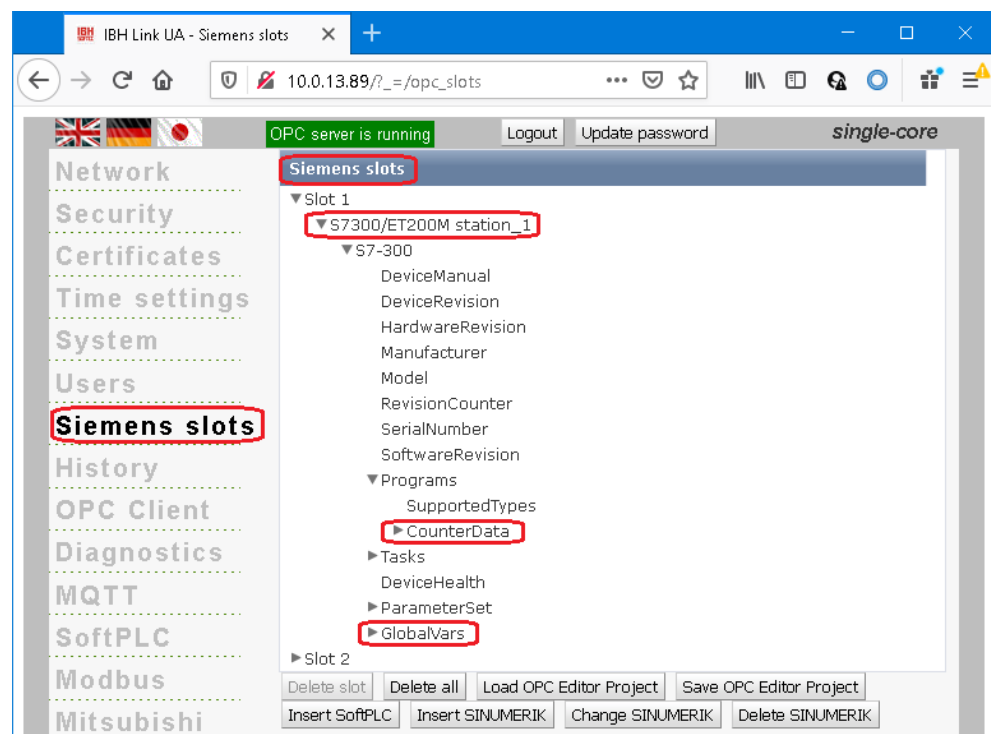
3.5.2 Browser window diagnosis / control diagnosis

The configured connection to the PLC control and its status (error-free / faulty) is displayed.

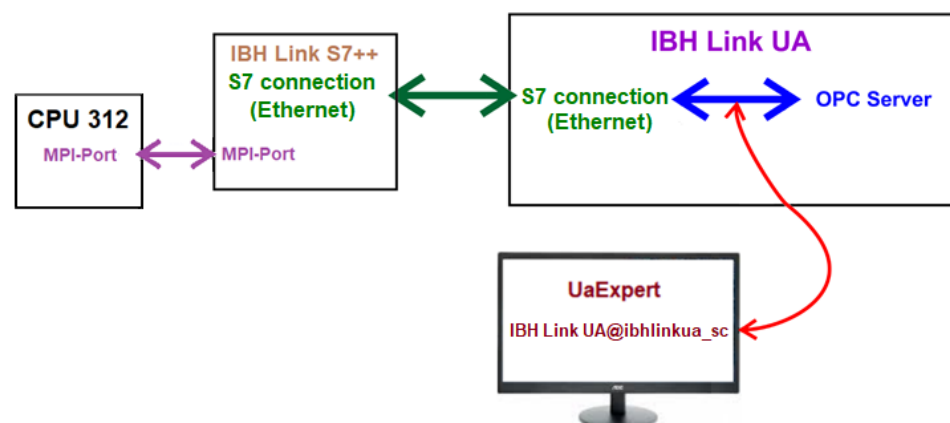


3.5.3 IBH Link UA browser window Siemens slots.

The CPU with the OPC tags is displayed in the Siemens Slots browser window.

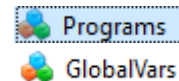


3.6 UaExpert - program window



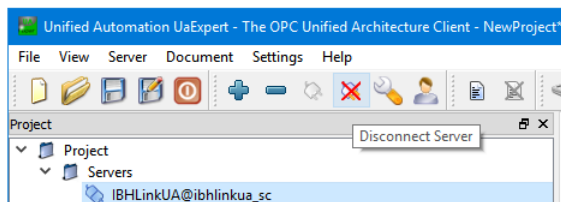
The **S7-CPU 312** is displayed in the UaExpert program window.

The variables of the data block **CounterData [DB2]** and the operands defined in the symbol table that were defined as OPC tags are listed under **Programs** and **GlobalVars**. These can be dragged and dropped into the **Data Access View**. The PLC counting program is processed, the changes are displayed. With a double-click on the value of a variable its value can be changed.

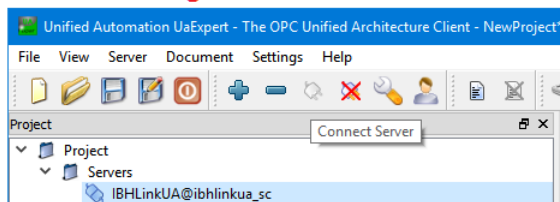


If the UaExpert program window was still active in the background of the PC, the connection to the IBH Link UA must be interrupted and restarted.

Disconnect the IBH Link UA Server



Connecting to the IBH Link UA Server



The Data Access View displays the following table:

#	Server	Node Id	Display Name	Value	Datatype	Source Timestamp	Server Timestamp	Statuscode
1	IBHLinkUA...	NS4[String]CPU 312...	CounterON	true	Boolean	18:52:17.795	18:52:18.514	Good
2	IBHLinkUA...	NS4[String]CPU 312...	Down	false	Boolean	18:53:40.324	18:53:40.575	Good
3	IBHLinkUA...	NS4[String]CPU 312...	IsCounting	true	Boolean	18:52:22.474	18:52:23.027	Good
4	IBHLinkUA...	NS4[String]CPU 312...	Max	false	Boolean	18:52:23.891	18:52:24.527	Good
5	IBHLinkUA...	NS4[String]CPU 312...	Min	false	Boolean	18:52:25.082	18:52:25.777	Good
6	IBHLinkUA...	NS4[String]CPU 312...	Up	true	Boolean	18:53:40.324	18:53:40.575	Good
7	IBHLinkUA...	NS4[String]CPU 312...	Value	6880	Int16	18:53:41.824	18:53:42.075	Good
8	IBHLinkUA...	NS4[String]CPU 312...	CounterValue	6880	Int16	18:53:41.824	18:53:42.075	Good
9	IBHLinkUA...	NS4[String]CPU 312...	CountingON	true	Boolean	18:52:31.513	18:52:32.282	Good
10	IBHLinkUA...	NS4[String]CPU 312...	Dummy	0	Int16	18:52:32.833	18:52:33.533	Good
11	IBHLinkUA...	NS4[String]CPU 312...	MaxValue	10000	Int16	18:52:34.366	18:52:35.036	Good
12	IBHLinkUA...	NS4[String]CPU 312...	MinValue	100	Int16	18:52:36.408	18:52:37.037	Good
13	IBHLinkUA...	NS4[String]CPU 312...	Switch_2	true	Boolean	18:52:37.852	18:52:38.537	Good
14	IBHLinkUA...	NS4[String]CPU 312...	Value	6880	Int16	18:53:41.824	18:53:42.075	Good

Annotations in the image:

- A red box highlights the 'Value' column, with a yellow note 'continuously updated' pointing to it.
- A red box highlights the 'CounterData' block in the Project tree, with a red arrow pointing to it from the 'Data Access View' table.
- A red box highlights the 'GlobalVars' block in the Project tree, with a red arrow pointing to it from the 'Data Access View' table.
- A red box highlights the 'CounterData' block in the Project tree, with a red arrow pointing to it from the 'Data Access View' table.
- A red box highlights the 'GlobalVars' block in the Project tree, with a red arrow pointing to it from the 'Data Access View' table.

The Data Access View table is also shown in a separate window below the main screenshot:

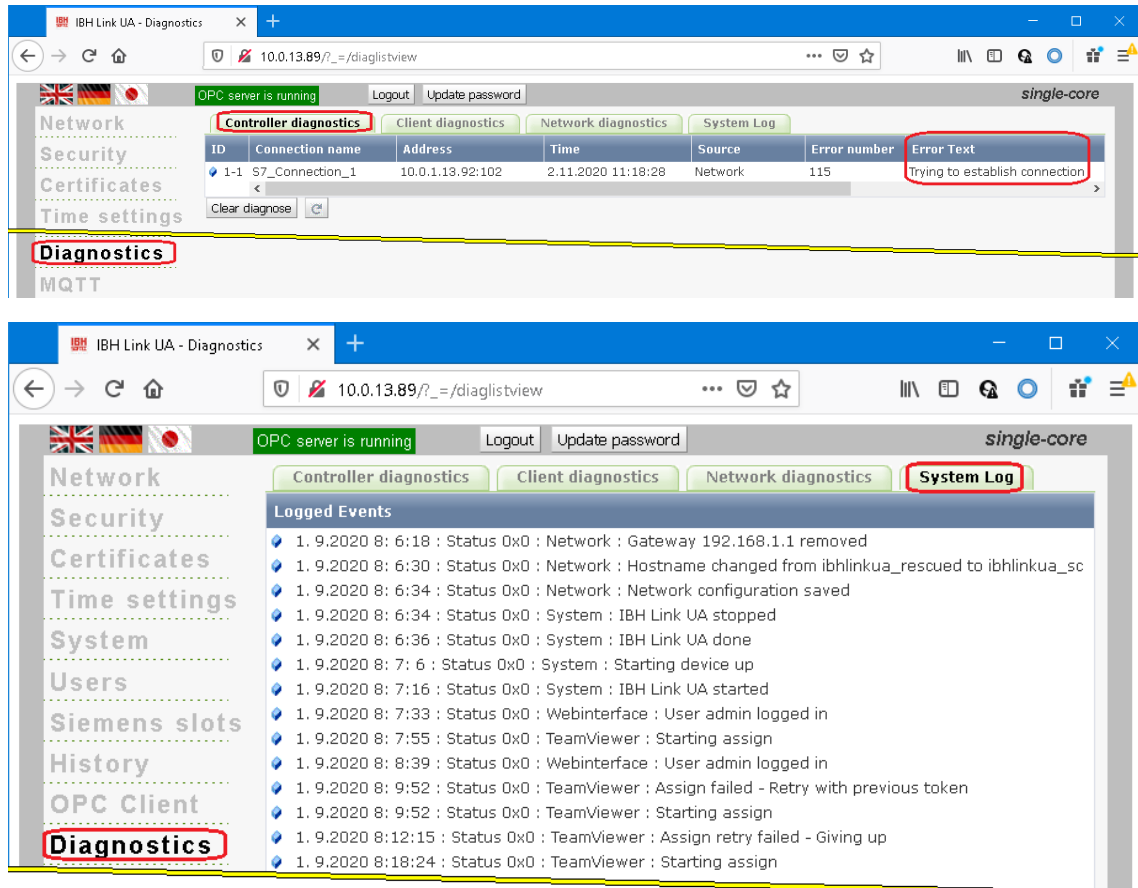
#	Display Name	Value	Datatype	Source Timestamp
1	CounterON	true	Boolean	18:52:17.795
2	Down	true	Boolean	18:59:55.779
3	IsCounting	true	Boolean	18:52:22.474
4	Max	false	Boolean	18:52:23.891
5	Min	false	Boolean	18:52:25.082
6	Up	false	Boolean	18:59:55.779
7	Value	1295	Int16	18:59:56.279
8	CounterValue	1295	Int16	18:59:56.279
9	CountingON	true	Boolean	18:52:31.513
10	Dummy	0	Int16	18:52:32.833
11	MaxValue	10000	Int16	18:52:34.366
12	MinValue	100	Int16	18:52:36.408
13	Switch_2	true	Boolean	18:52:37.852
14	Value	1295	Int16	18:59:56.279

The Data Access View table is also shown in a separate window below the main screenshot:

#	Server	Node Id
1	IBHLinkUA@ibhlinkua_sc	NS4[String]CPU 312.CPU 312.GlobalVars.CounterON
2	IBHLinkUA@ibhlinkua_sc	NS4[String]CPU 312.CPU 312.GlobalVars.Down
3	IBHLinkUA@ibhlinkua_sc	NS4[String]CPU 312.CPU 312.GlobalVars.IsCounting
4	IBHLinkUA@ibhlinkua_sc	NS4[String]CPU 312.CPU 312.GlobalVars.Max
5	IBHLinkUA@ibhlinkua_sc	NS4[String]CPU 312.CPU 312.GlobalVars.Min
6	IBHLinkUA@ibhlinkua_sc	NS4[String]CPU 312.CPU 312.GlobalVars.Up
7	IBHLinkUA@ibhlinkua_sc	NS4[String]CPU 312.CPU 312.GlobalVars.Value
8	IBHLinkUA@ibhlinkua_sc	NS4[String]CPU 312.CPU 312.Programs.CounterData.CounterValue
9	IBHLinkUA@ibhlinkua_sc	NS4[String]CPU 312.CPU 312.Programs.CounterData.CountingON
10	IBHLinkUA@ibhlinkua_sc	NS4[String]CPU 312.CPU 312.Programs.CounterData.Dummy
11	IBHLinkUA@ibhlinkua_sc	NS4[String]CPU 312.CPU 312.Programs.CounterData.Structure.MaxValue
12	IBHLinkUA@ibhlinkua_sc	NS4[String]CPU 312.CPU 312.Programs.CounterData.Structure.MinValue
13	IBHLinkUA@ibhlinkua_sc	NS4[String]CPU 312.CPU 312.Programs.CounterData.Structure.Switch_2
14	IBHLinkUA@ibhlinkua_sc	NS4[String]CPU 312.CPU 312.Programs.CounterData.Structure.Value

3.7 Diagnostics

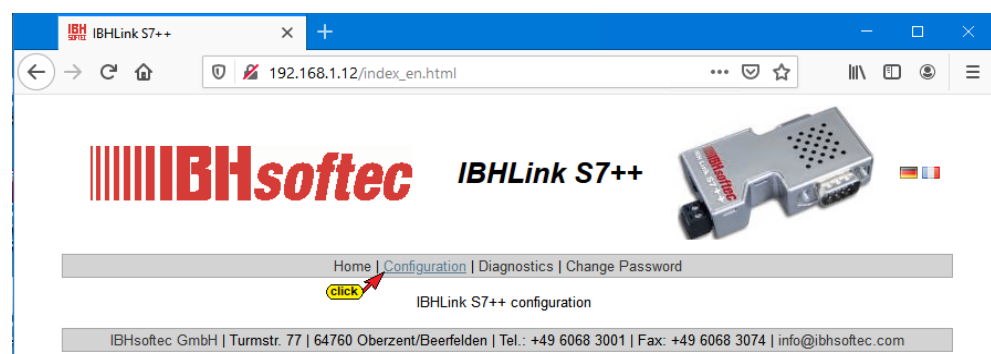
If no values are displayed in the UaExpert – Data Access View window or error messages are displayed, the IBH Link UA diagnosis window provides information as to whether the connection to the PLC exists.

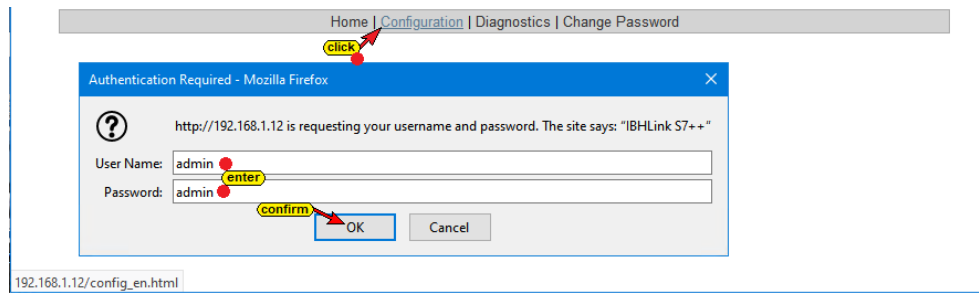


3.7.1 IBH Link S7 ++ web server

The IBH Link S7 ++ web server offers further diagnostic options. The web server side is created with the IBH Link S7 ++

IP address [example: <http://192.168.1.12>] opened with the web browser.





IBH Link S7 ++ web server Configuration page

Home **Configuration** Diagnostics | Change Password

IBHsoftec IBHLink S7++

Firmware version	NL50MPI V02.168 10.06.20 V1.55_release-30-gc132e9b
Serial number / MAC Address	25208 00:02:A2:21:56:CB
Network name	IBH Link S7++
IBHNet port (port 1099 is always active)	0
Configuration with NetPro	☒
DHCP	☐
IP address	192.168.1.12
Subnet mask	255.255.255.0
Default gateway	0.0.0.0
IPv6 (link-local)	[FE80::202:A2FF:FE21:56CB]
IPv6 (SLAAC)	[2A02:B98:F181:81FC:202:A2FF:FE21:56CB]
IPv6 (static)	[:]
Baudrate	187,5 kBit/s
Own station address	10
Highest station address	31
Set default bus parameters	MPI PROFIBUS
Tslot_Init	415
Max. TsdR	400
Min. TsdR	20
Tset	12
Tqui	0
Gap factor	5
Retry limit	2
Ttr	9984
Activate Time-of-Day Synchronization	☐
NTP update interval (10 - 86400 seconds)	60
NTP Server 1 (IP address)	0.0.0.0
NTP Server 2 (IP address)	0.0.0.0
NTP Server 3 (IP address)	0.0.0.0
NTP Server 4 (IP address)	0.0.0.0
MPI/DP update interval	

Save configuration

IBHsoftec GmbH | Turmstr. 77 | 64760 Oberzent/Beerfelden | Tel.: +49 6068 3001 | Fax: +49 6068 3074 | info@ibhsoftec.com

IBH Link S7 ++ web server diagnosis page

IBHsoftec IBHLink S7++

Home | Configuration | **Diagnostics** | Change Password

Address	Status	Type	Manufacturer
2	M	6ES7 312-1AE13-0AB0	Original Siemens Equipment

S7-300® / S7-400® Diagnostics:

Serial number	
Station name	S7300/ET200M station_1
Module name	S7-300
Plant designation	
Location designation	
Operating mode	RUN
Module time	9.2.2015, 00:57:39
Diagnostic buffer	Mode transition from STARTUP to RUN 8.2.2015, 22:41:41 Startup information: - Time for time stamp at the last non backed up power on - Single processor operation Current/last startup type: - Automatic warm restart after backed up power on Permissibility of certain startup types: - Manual warm restart permitted - Automatic warm restart permitted Last valid operation or setting of automatic startup type at power on: - Automatic warm restart after backed up power on Previous operating mode: No voltage Requested operating mode: No voltage (PK: 68) Event entering state

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IBH Link S7 ++ web server change Password page

IBHsoftec IBHLink S7++

Home | Configuration | Diagnostics | **Change Password**

Username	admin
Password	
Repeat password	

Save

IBHsoftec GmbH | Turmstr. 77 | 64760 Oberzent/Beerfelden | Tel.: +49 6068 3001 | Fax: +49 6068 3074 | info@ibhsoftec.com

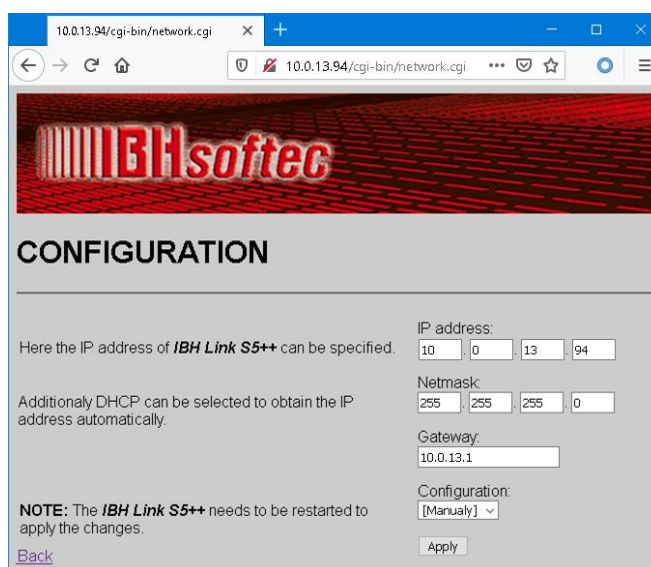
192.168.1.12/passwd_en.html

4 IBH Link UA – Connection of an S5 CPU 103U

The following example shows the programming of a project with the TIA Portal with a connection of an **S5 CPU 103U** and the **IBH Link UA** as an Ethernet connection the **IBH Link S5++**.

IBH Link S5 ++

The IBH Link S5++ is an Ethernet converter. The protocol used is the usual standard TCP/IP. The user can benefit from all the advantages of Ethernet-bus.



The use of **SimaticNet** and the use of a communication processor (**CP**) is not necessary on either the PC or the PLC side.

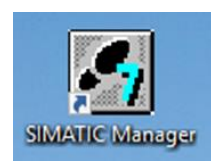
The sample program run in the **S5 CPU 103** is identical to the program **Counter**, as described in chapter 1. The counter counts until **MaxValue** is reached and counts down until the **MinValue** is reached. The S5 program **Counter.S5P** (or **COUNT_ST.S5D**) was transferred to the **CPU S5 103U** using the **STEP 5** programming system **S5 for Windows** by IBHsoftec.

4.1 Project with STEP® 7 (SIMATIC Manager V5.6)

Example: Project S5 CPU 103 S7e

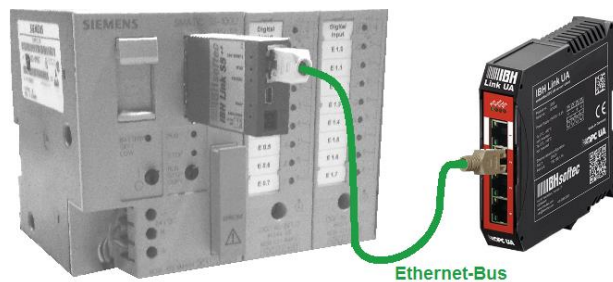
The example **S5 CPU 103 S7e** is identical to the program **Counter**, as described in chapter 1.

The counter counts until **MaxValue** is reached and counts down until the **MinValue** is reached.



The SIEMENS PLC programming systems SIMATIC Manager V5.6 is used to create the network configuration.

Connection IBH Link UA - S5 PLC with CPU 103U



4.1.1 IBH Link UA - configuration with the STEP 7

S5 controllers do not have an Ethernet connection as standard.

If no communication processor with an Ethernet Port available, the **IBH Link UA** can be connected via the **IBH Link S5++**.

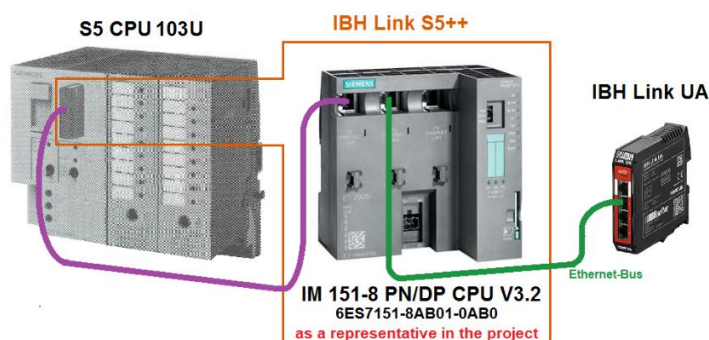
Note:

The interface module **IM 151-8 PN/DP CPU V3.2** provides a PROFINET interface with an integrated switch. PG communication and S7 communication are possible via the PROFINET interface.

The interface module IM 151-8 PN/DP CPU V3.2 is available in the hardware catalog of the TIA Portal and the STEP 7 (Simatic Manager). The firmware of the IBH Link S5++ emulates the PROFINET interfaces of the IM 151-8 PN/DP CPU V3.2 (**6ES7 151-8AB01-0AB0 V3.2**) as far as these are used for communication, S5 CPU PG interface - IBH Link UA Ethernet Port, are necessary. The following properties are available (compatible with IM 151-8 PN/DP CPU V3.2):

Interfaces / Bus Type	Protocols
1x PROFINET (1 Port)	PG-Communication
1x PROFINET (1 Port)	ISO-on-TCP (RFC1006)

IM 151-8 PN/DP as a representative on the project



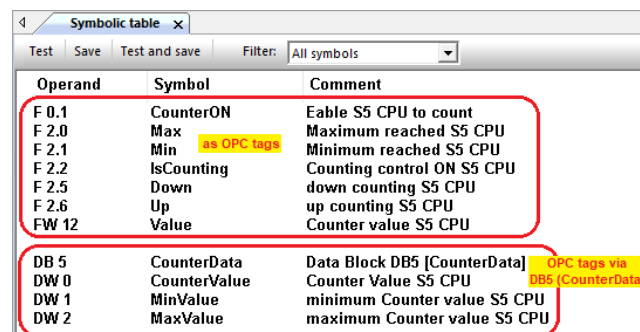
The symbol table for defining the OPC tags is available in the **S5 CPU 103 S7e** project. The hardware components required for the communication between **S5 CPU** and **IBH Link UA** are specified in the project.

4.1.2 S5 PLC Program

The PLC Program **Counter S5W.S5P (COUNT@ST.S5D** – SIMATIC S5 programming system) with the SIMATIC S5 CPU 103U provides a program for up and down counting.

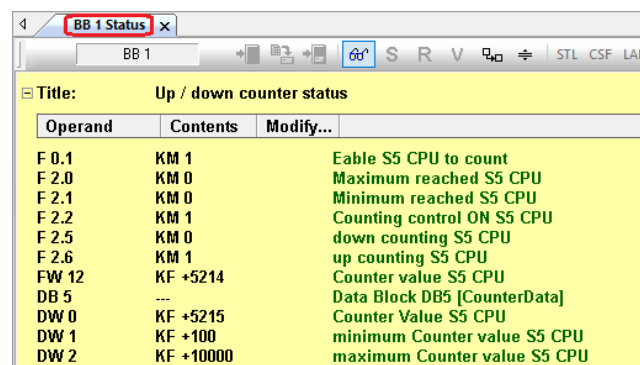
S5 symbol table

The following operands are used in the S5 program, are defined in the symbol table of the S5 program and should be available as OPC tags.



Operand	Symbol	Comment
F 0.1	CounterON	Eable S5 CPU to count
F 2.0	Max	Maximum reached S5 CPU
F 2.1	Min	Minimum reached S5 CPU
F 2.2	IsCounting	Counting control ON S5 CPU
F 2.5	Down	down counting S5 CPU
F 2.6	Up	up counting S5 CPU
FW 12	Value	Counter value S5 CPU
DB 5	CounterData	Data Block DB5 [CounterData]
DW 0	CounterValue	Counter Value S5 CPU
DW 1	MinValue	minimum Counter value S5 CPU
DW 2	MaxValue	maximum Counter value S5 CPU

Picture Block S5-CPU 103U: Global variable / data from DB5



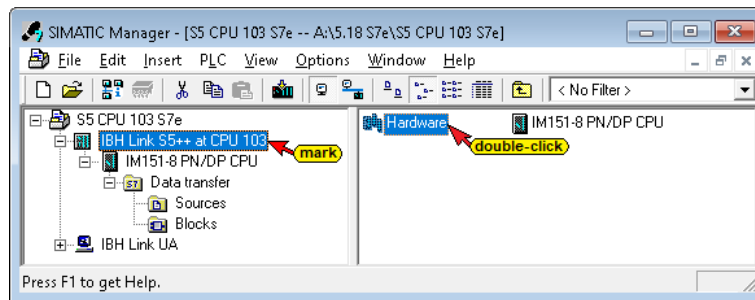
Operand	Contents	Modify...
F 0.1	KM 1	Eable S5 CPU to count
F 2.0	KM 0	Maximum reached S5 CPU
F 2.1	KM 0	Minimum reached S5 CPU
F 2.2	KM 1	Counting control ON S5 CPU
F 2.5	KM 0	down counting S5 CPU
F 2.6	KM 1	up counting S5 CPU
FW 12	KF +5214	Counter value S5 CPU
DB 5	---	Data Block DB5 [CounterData]
DW 0	KF +5215	Counter Value S5 CPU
DW 1	KF +100	minimum Counter value S5 CPU
DW 2	KF +10000	maximum Counter value S5 CPU

4.2 The example project in STEP 7 - Simatic Manager

Open the STEP 7 example project **S5 CPU 103 S7**.

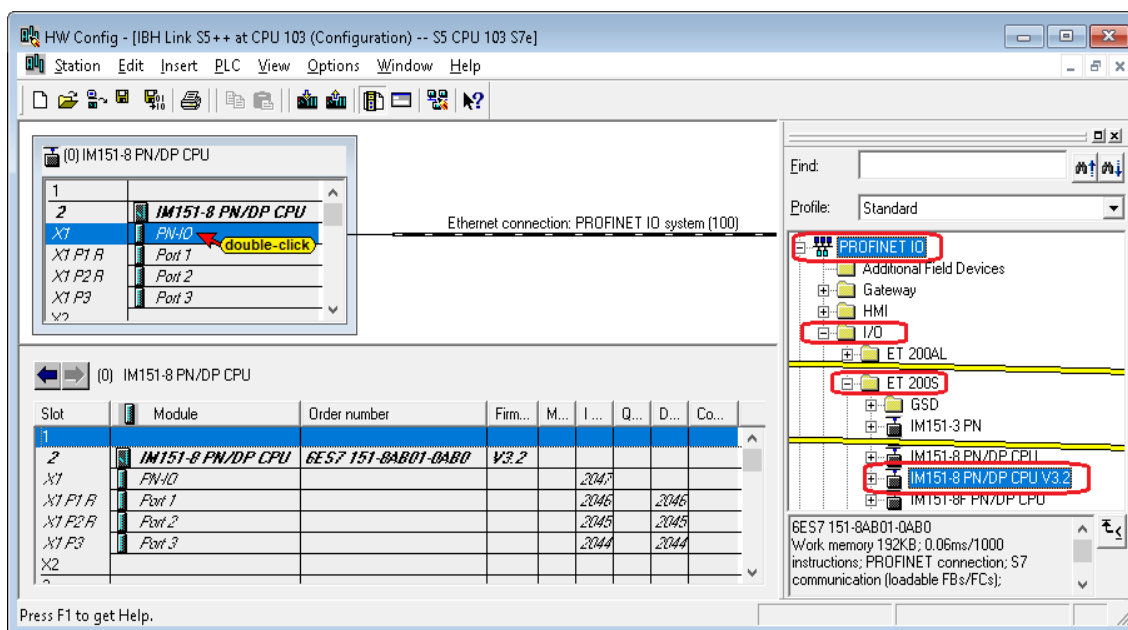
In the project the SIMATIC 300 station was rename in **IBH Link S5++ at CPU 103**.

To check the setting, double-click **Hardware** to open the configuration window.



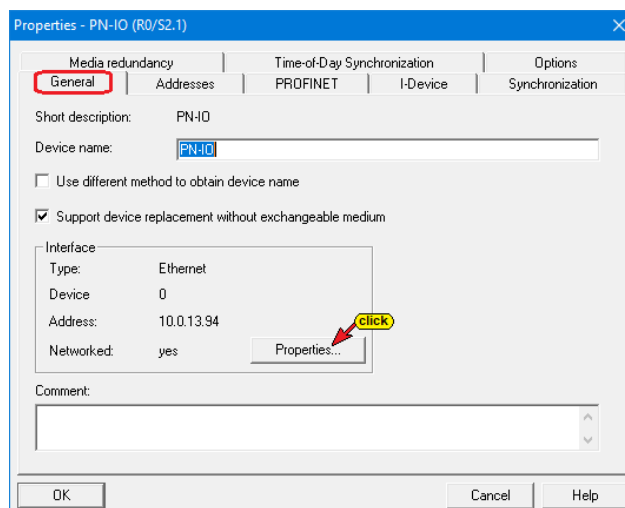
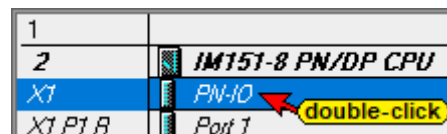
4.2.1 Configuration of IBH Link S5++ (SIMATIC 300 station)

The following module must be used as a representative for the IBH Link S5++: **Profinet-I/O-ET 200S-IM115-8 PN / DB CPU V3.2**.

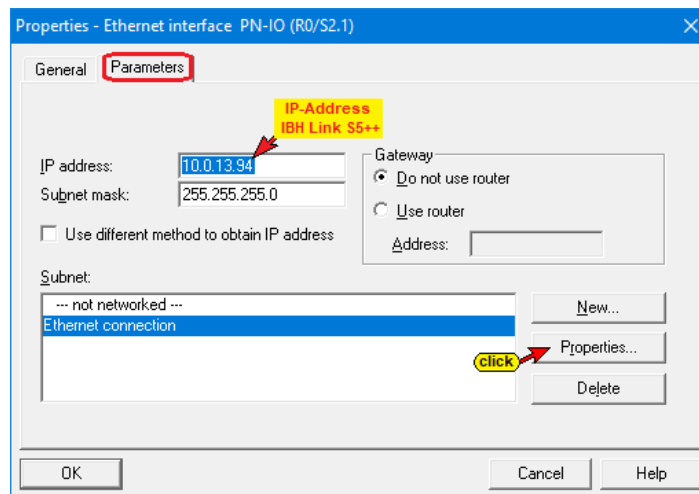


Define the ethernet interface of the IM115-8 PN / DB CPU

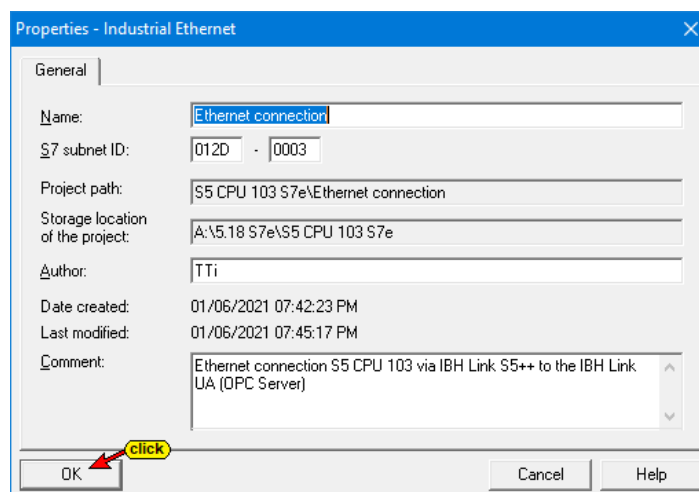
With a double-click on the line **X1** **PN-IO** the dialog box **Properties – PN-IO - (R0 / S2.1)** is opened.



To set up the ethernet interface click the button **Properties...** button to open the dialog box **Properties – Ethernet interface PN – IO (R0 / S2.1)**. The IP address of the **IBH Link S5++** was set.



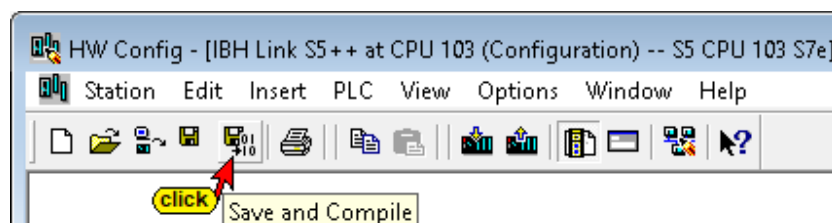
Click the button **Properties...** to open the dialog box **Properties – Industrial Ethernet** for more details on the connection.



Click **OK** to close all dialog boxes.

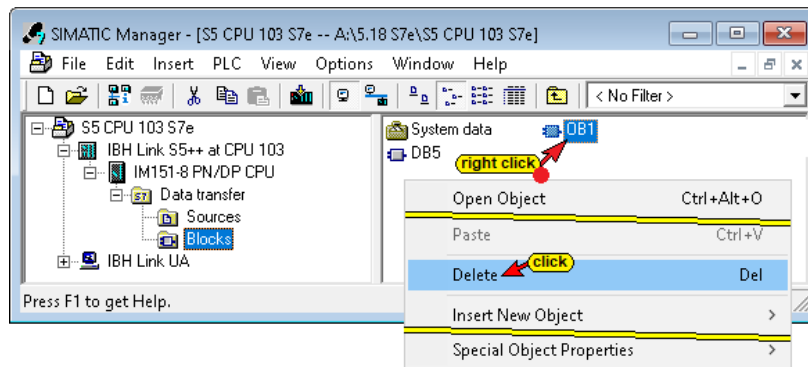
Configuration of the IM115-8 PN / DB CPU (IBH Link S5++) Save and Compile

The configuration is accepted by clicking the Save and Compile icon.



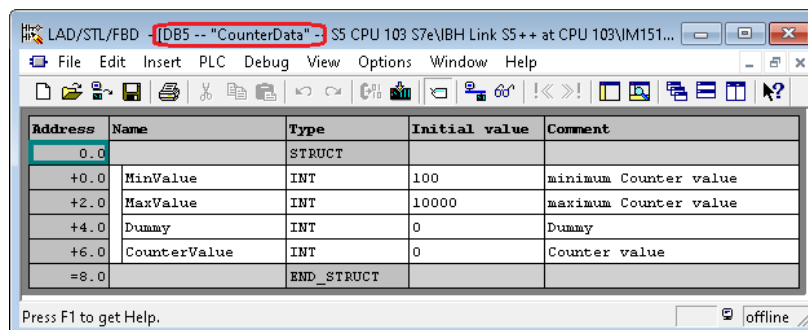
Delete PLC Block OB1 (IBH Link S5++ / IM115-8 PN / DB CPU)

No executable PLC blocks are allowed in the IBH Link S5++ / IM115-8 PN / DB CPU configuration.



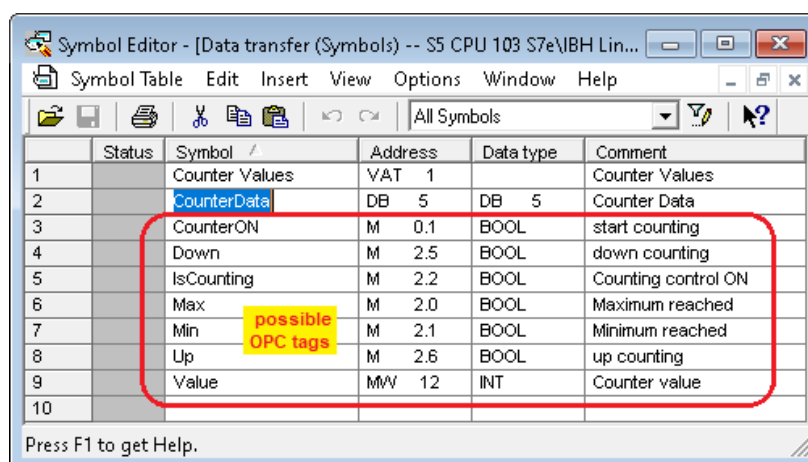
DB 5 of the IM115-8 PN/DB CPU V3.2 – IBH Link S5++

The PLC data block DB5 **CounterData** a symbolic name must be assigned to enable the possibility to use the variables defined in the DB5 to be OPC tags.



Symbolic Table IM115-8 PN/DB CPU V3.2 – IBH Link S5++

The symbol table (**Counter S5W.SEQ**) was imported from the S5 program with the command **Symbolic Table / Import**. These operands should be available as OPC tags.



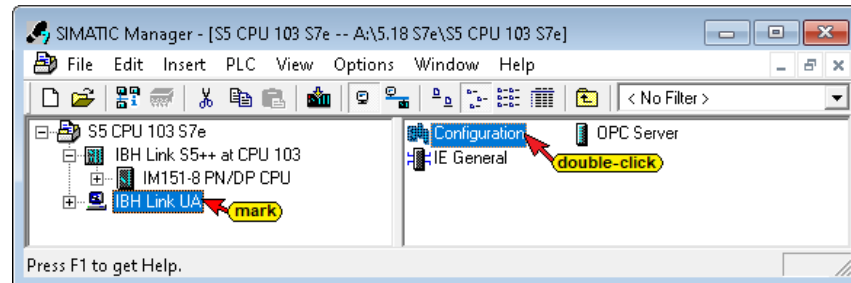
Note:



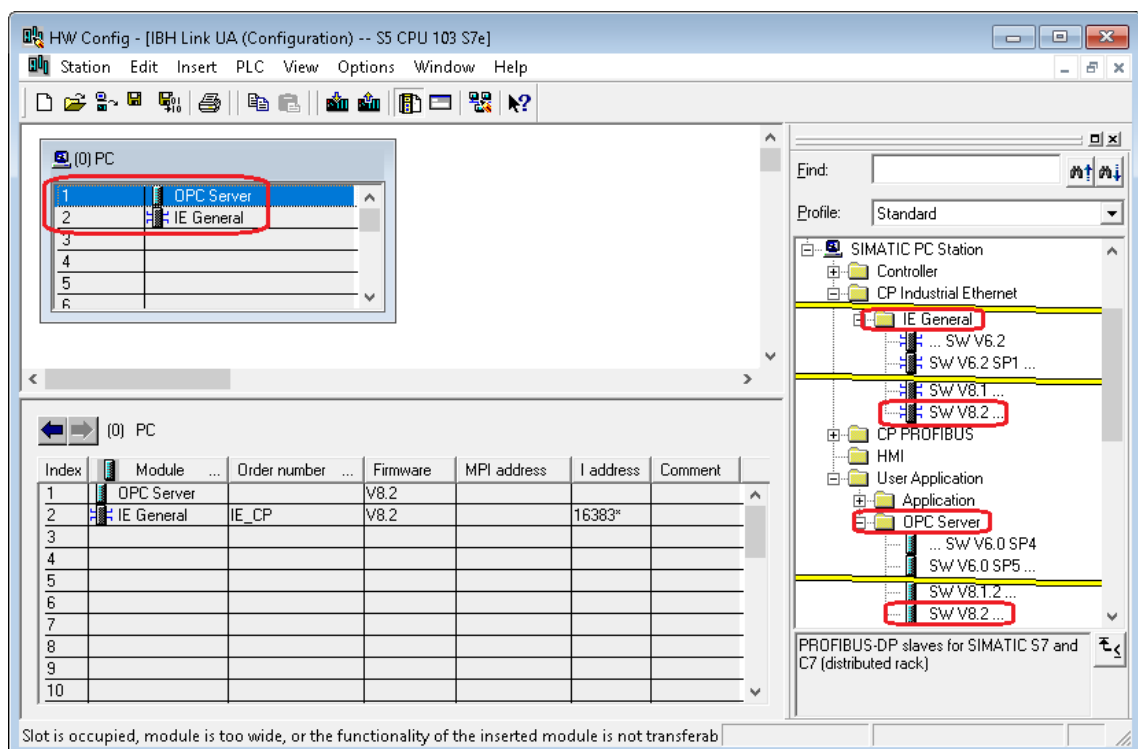
Neither PLC blocks nor system data may be loaded into the CPU. The variables of the symbol table and the data of data blocks are made available for selection via the S7 communication as OPC tags.

4.2.2 IBH Link UA as a SIMATIC PC station

A click on **IBH Link UA**, the renamed **SIMATIC PC station**, and a double-click on **Configuration** opens the window showing the configuration of the IBH Link UA.



4.2.3 Configuration of IBH Link UA (SIMATIC PC station)

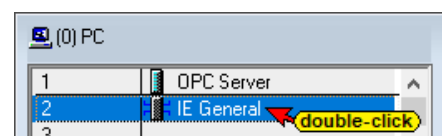


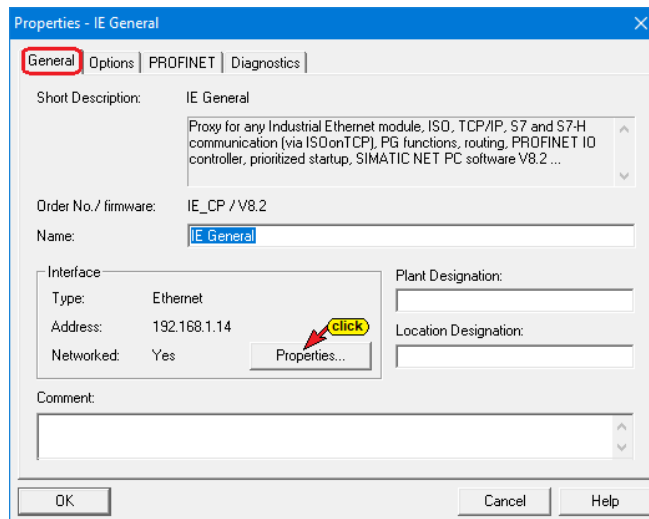
Note:

The Siemens **OPC server SW V8.2...** and the CP Industrial Ethernet interface **IE General SW V8.2...** are available in the hardware catalogs of STEP7-SIMATIC Manager and the TIA Portals.

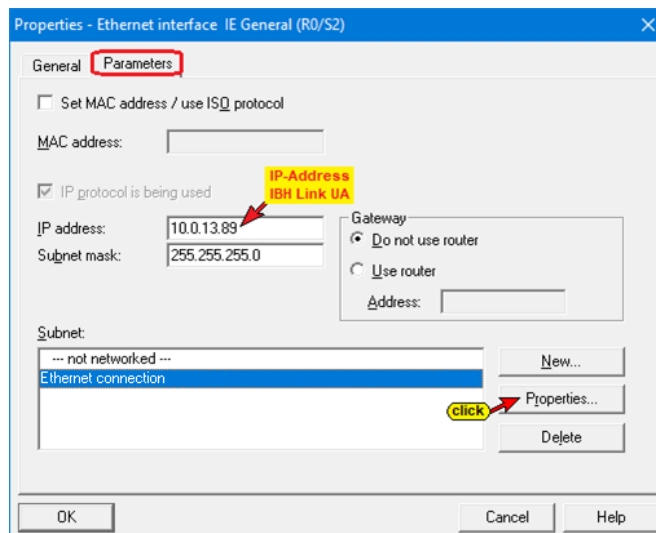
Ethernet interface IE General (R0 / S2) set up

With a double-click on the line **1 IE General** the dialog box **Properties – IE General** is opened.

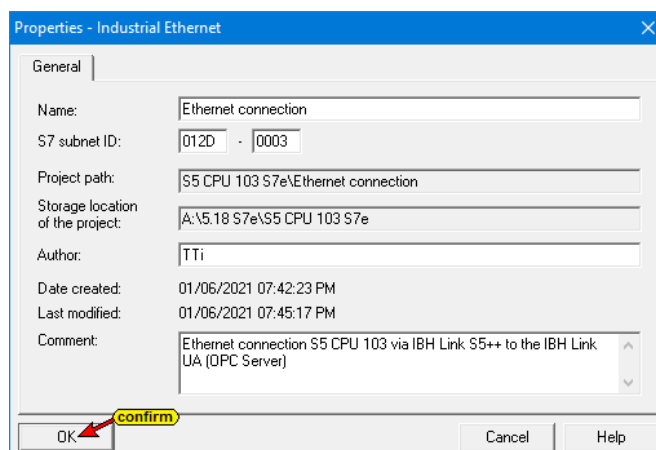




To set up the ethernet interface click the button **Properties...** button to open the dialog box **Properties – Ethernet interface IE General (R0 / S2)**.



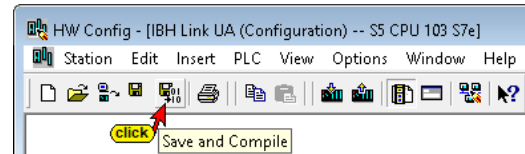
Click the button **Properties...** to open the dialog box **Properties – Industrial Ethernet** for more details on the connection.



Click **OK** to close all dialog boxes.

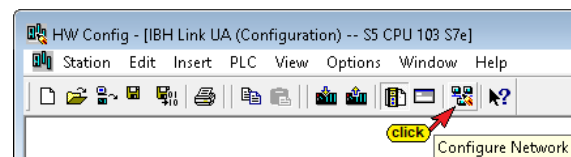
Configuration of the IBH Link UA Save and Compile

The configuration is accepted by clicking the Save and Compile icon.

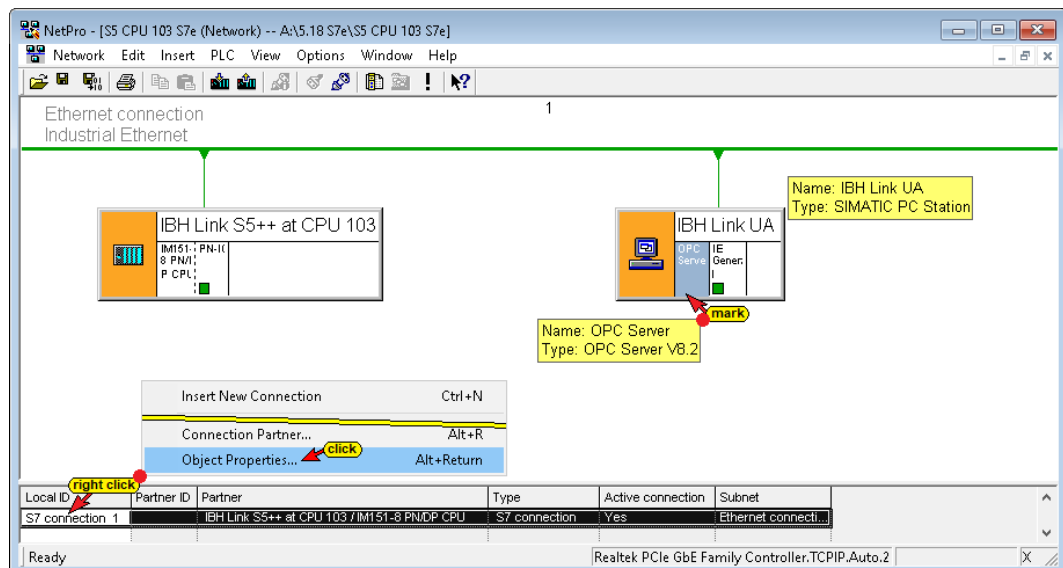


4.3 Create S7 connection between OPC Server and CPU 312

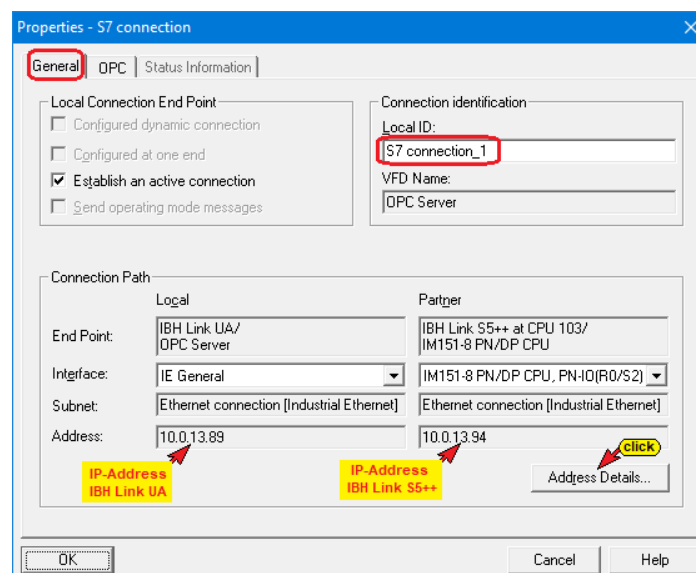
Click the **Configure Network** icon to open the **NetPro** window.



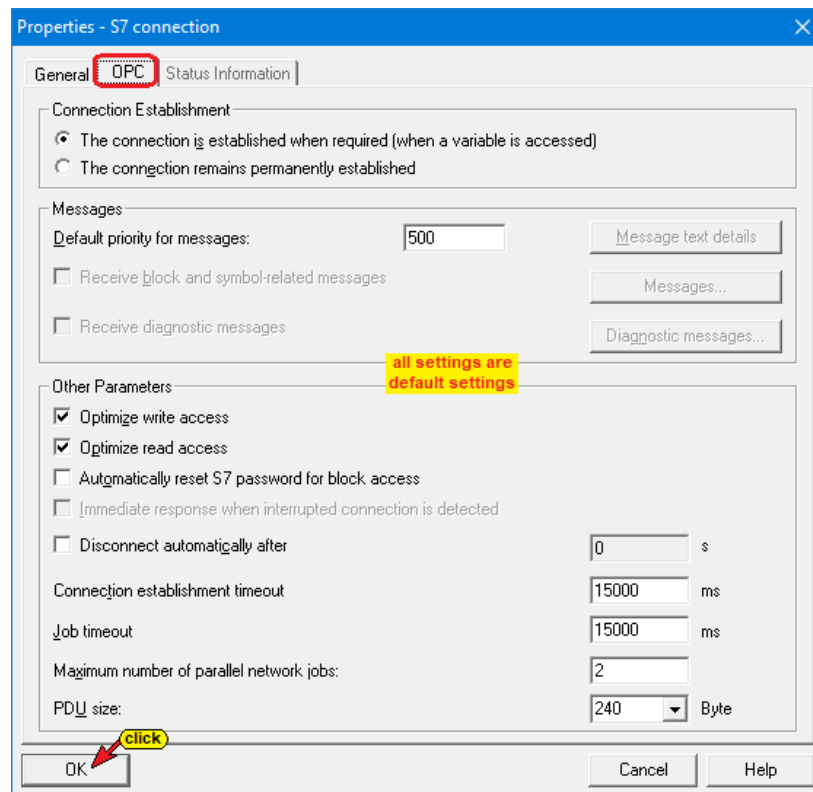
NetPro window



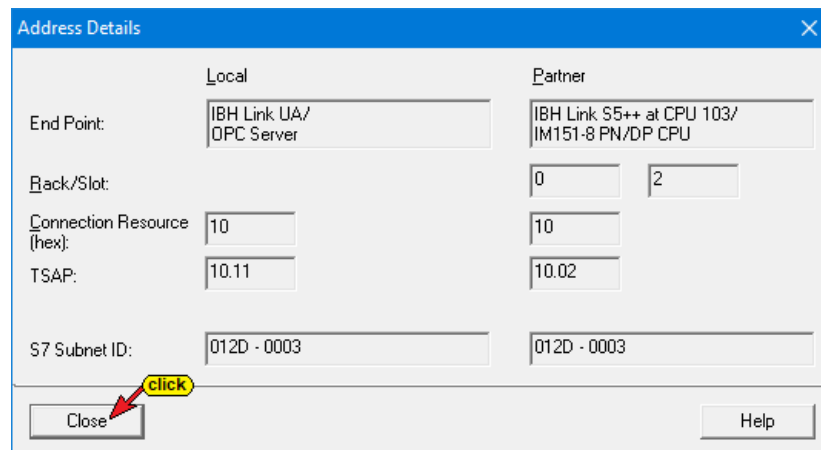
Right-click **S7_connection / Object Properties** to display details on the **S7 connection_1**.



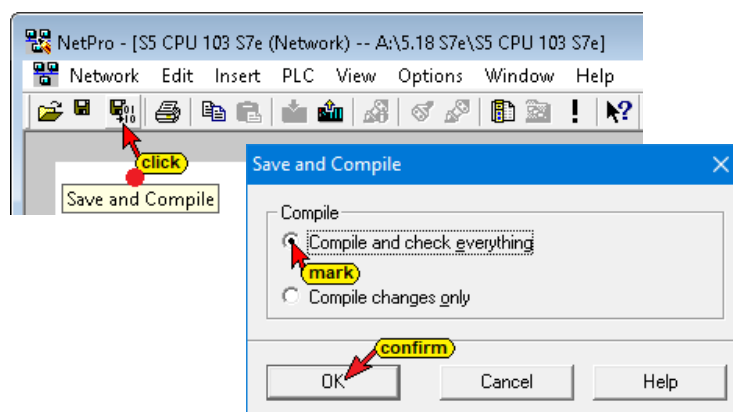
The **tab OPC** of the dialog box **Object Properties - S7 connection_1, tab OPC** displays further details on the connection.



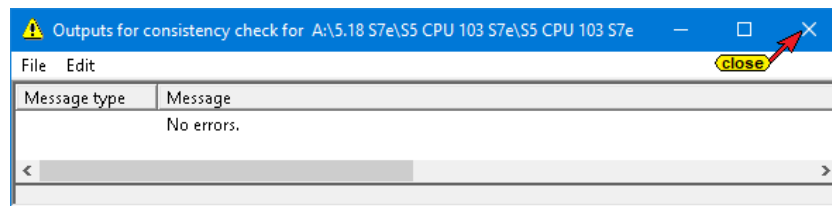
Details of the **S7 connection_1** addresses are displayed.



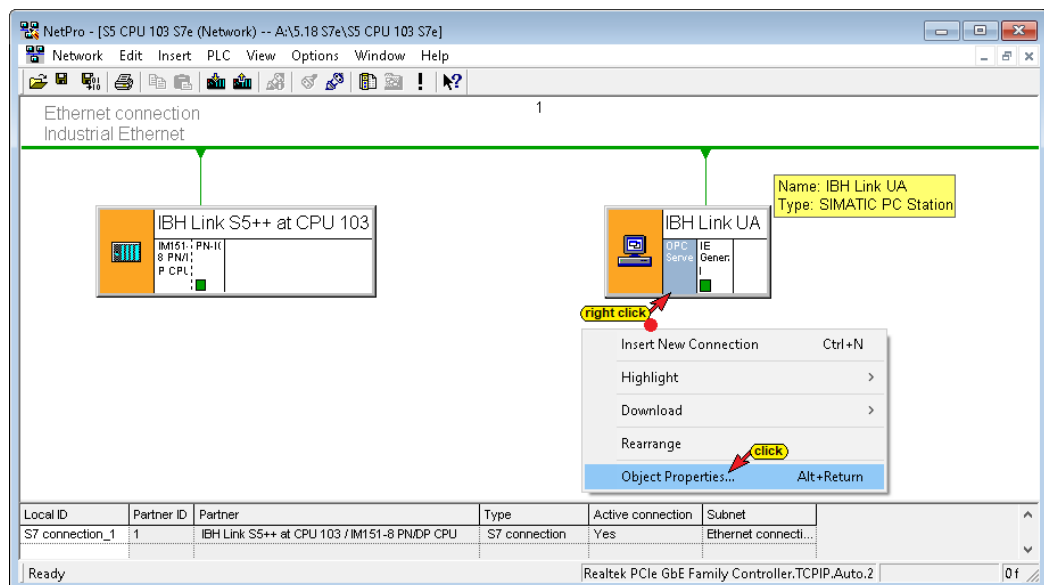
Save and Compile S7 connection_1



The procedure ***Compile and check everything*** shows no warning or error.

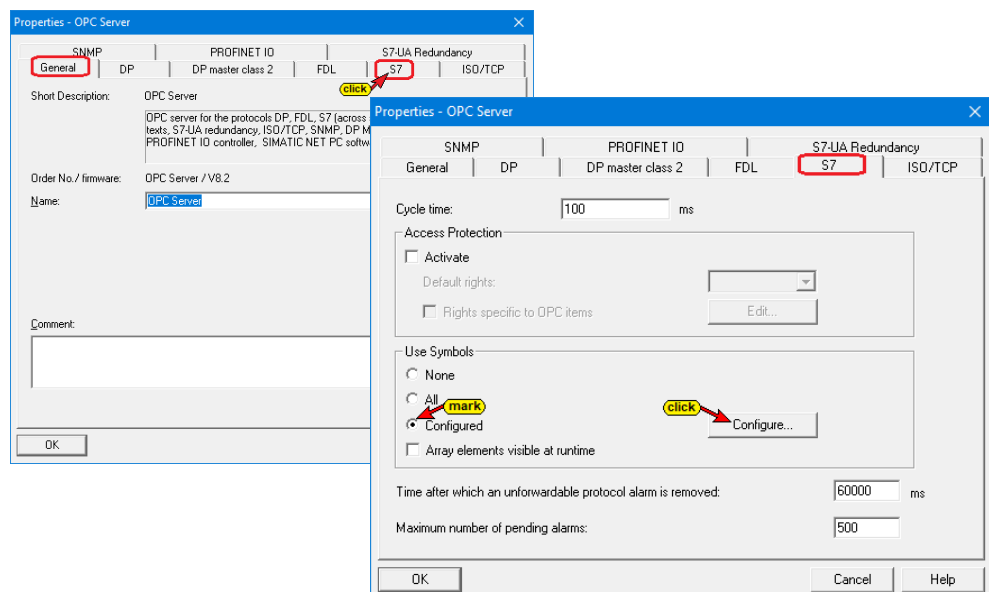


4.3.1 Select OPC tags



The command **Object properties...** from the context menu (right-click on **OPC server**) opens the **Properties - OPC server** dialog box.

The **S7 tab** defines whether symbols should be used and which ones.



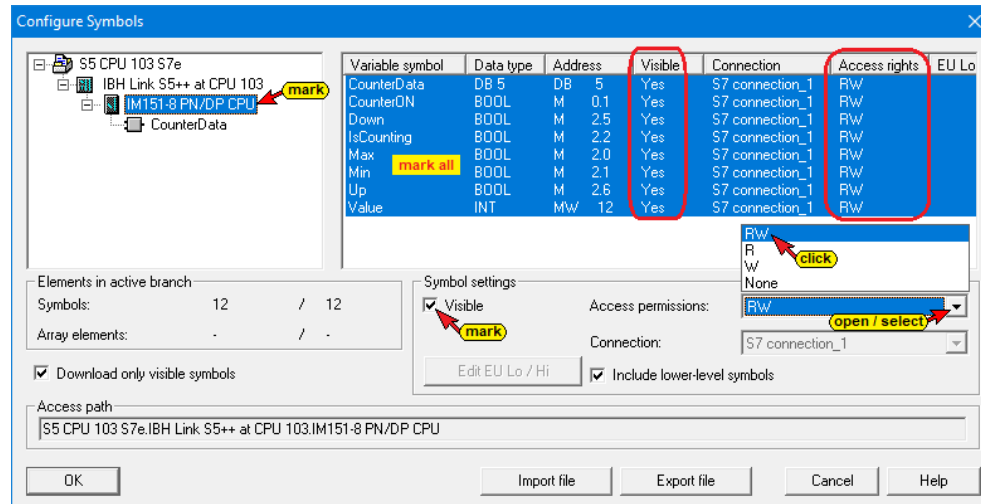
The **Configure...** button opens the **Properties - OPC Server** dialog box. The operands defined in

Configure...

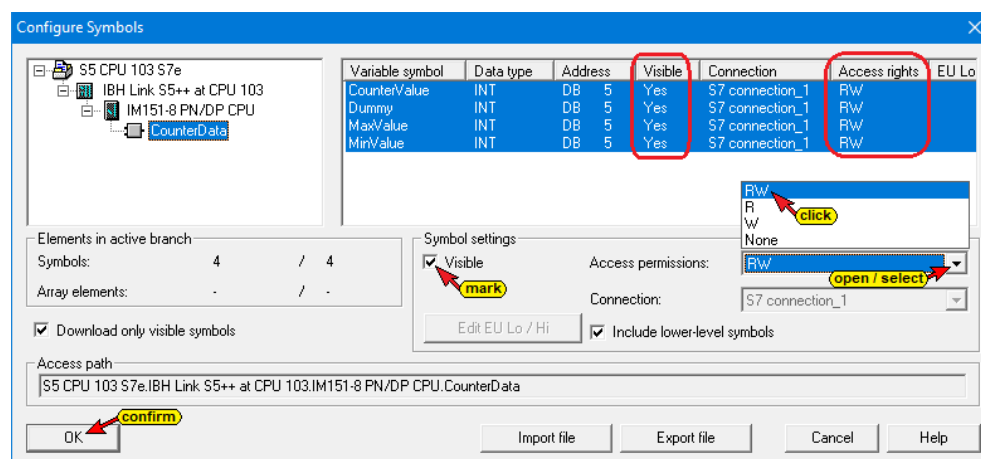
the symbol table, and the data of the data blocks can be selected as **OPC tags** (OPC symbols).

Due to the previously configured S7 connection, all tags are shown.

Global Variable (OPC tags) IM115-8 PN/DB CPU – IBH Link S5++



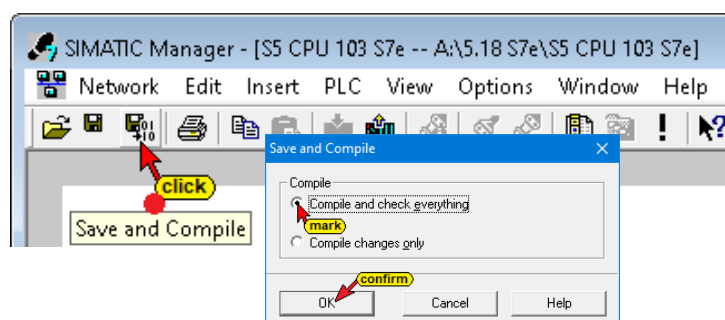
Data block CounterData [DB5] OPC tags



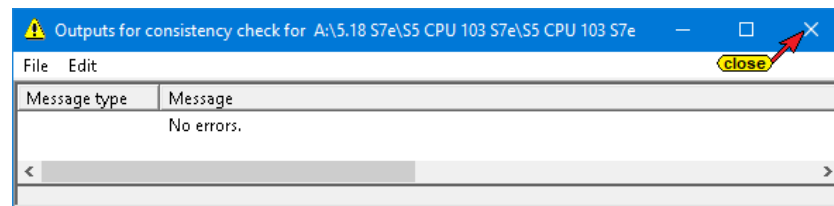
Click the **OK** buttons to close the **Configure Symbols** and the **Properties - OPC Server** dialog boxes.

NetPro – S5 CPU 103 S7e (Network) window

Clicking on the **Save and Compile** icon to save the configuration of the S5 **CPU103**, and the **IBH Link UA**.

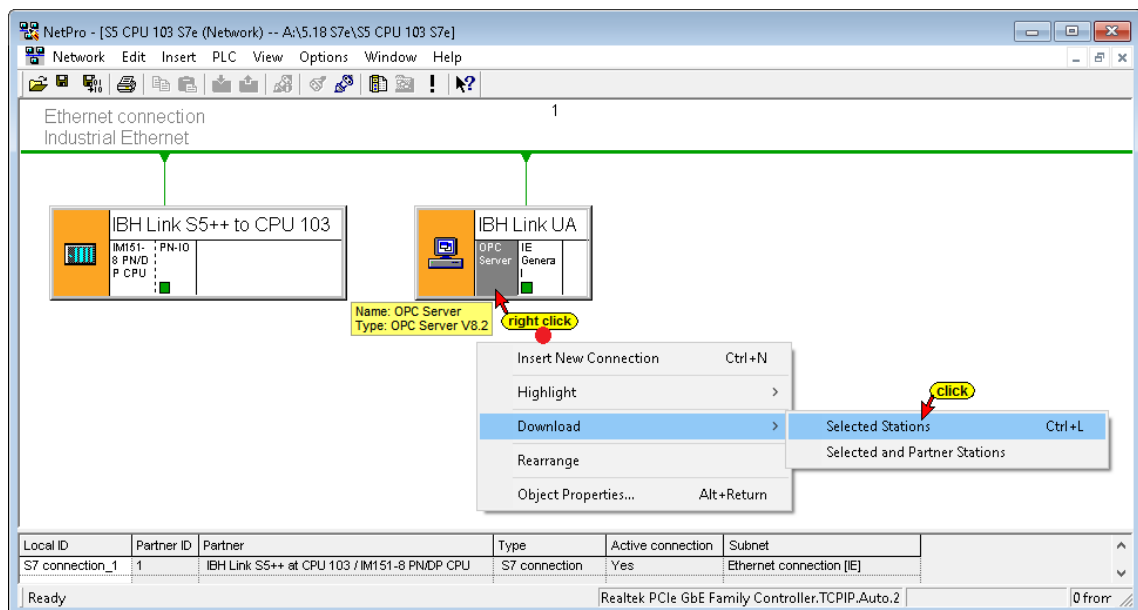


The procedure ***Compile and check everything*** shows no warning or error.



Download the configuration of the **IBH Link UA**.

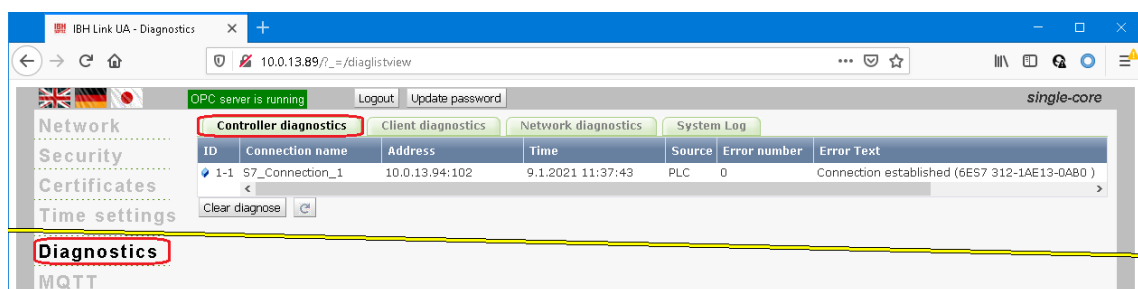
Right-click **OPC-Server** and click **Download / Selected Stations**.
No download is allowed into the **IM151-8 PN/DP (IBH Link S5++)**.



Several information must be confirmed to complete the download.

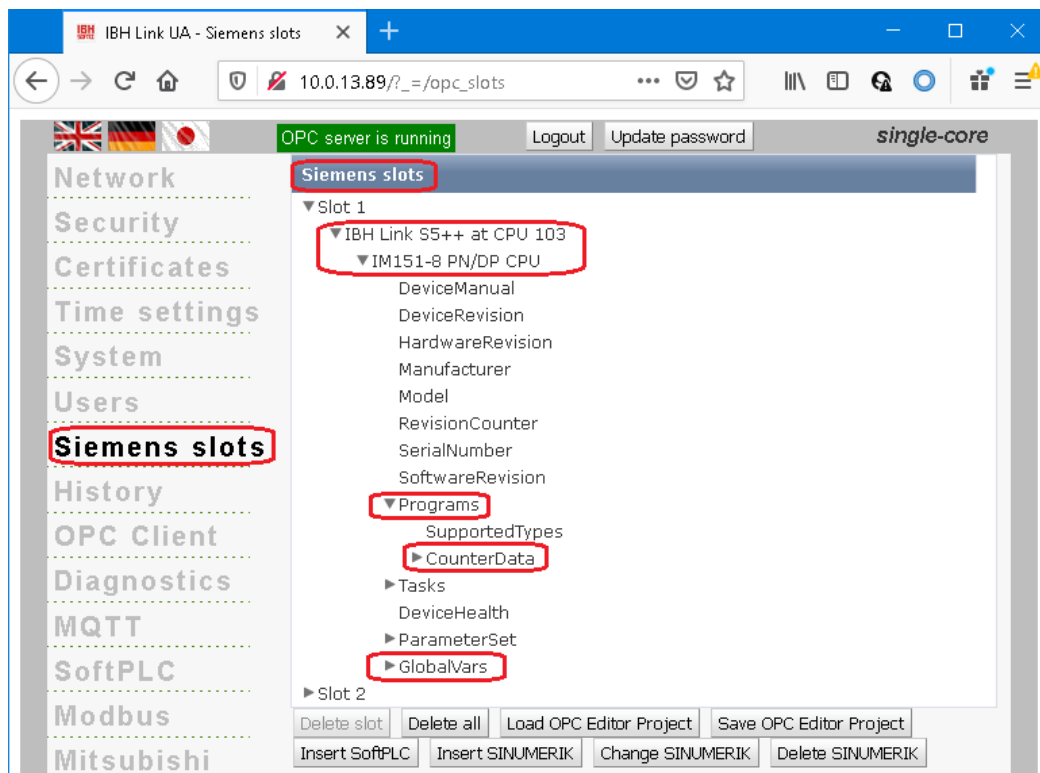
4.3.2 Browser window diagnosis / control diagnosis

The configured connection to the PLC control and its status (error-free / faulty) is displayed.

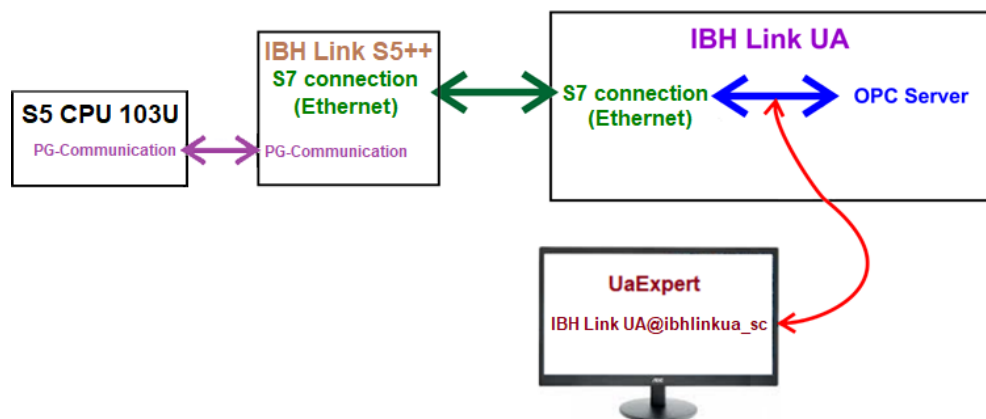


4.3.3 IBH Link UA browser window Siemens slots.

The CPU with the OPC tags is displayed in the Siemens Slots browser window.

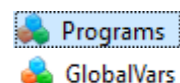


4.4 UaExpert - program window



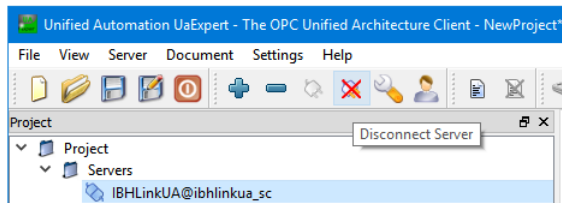
The **S5 CPU 103U** is displayed in the UaExpert program window.

The variables of the data block **CounterData [DB5]** and the operands defined in the symbol table that were defined as OPC tags are listed under **Programs** and **GlobalVars**. These can be dragged and dropped into the **Data Access View**. The PLC counting program is processed, the changes are displayed. With a double-click on the value of a variable its value can be changed.

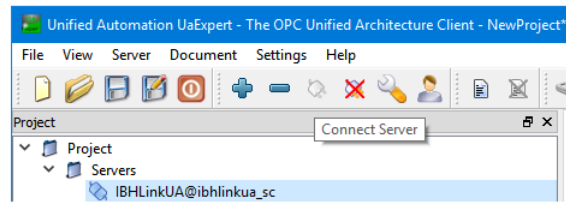


If the UaExpert program window was still active in the background of the PC, the connection to the IBH Link UA must be interrupted and restarted.

Disconnect the IBH Link UA Server



Connecting to the IBH Link UA Server



OPC tags in the UaExpert window

The screenshot shows the 'Unified Automation UaExpert - The OPC Unified Architecture Client - NewProject*' window. The 'Data Access View' is open, displaying a table of OPC tags. The 'Address Space' tree on the left shows the hierarchy of the device, with 'CounterData' expanded. A red box highlights the 'CounterData' folder, and a red arrow points to the 'Data Access View' table. A red box also highlights the 'Value' column in the table, with a yellow note indicating 'continuously updated'.

#	Server	Node Id	Display Name	Value	Datatype	Source Timestamp	Server Timestamp	Statuscode
1	IBHLinkUA...	NS4 String IBH Link S5++...	CounterON	true	Boolean	14:04:33.601	14:04:34.289	Good
2	IBHLinkUA...	NS4 String IBH Link S5++...	Down	false	Boolean	14:06:01.591	14:06:02.091	Good
3	IBHLinkUA...	NS4 String IBH Link S5++...	IsCounting	true	Boolean	14:04:37.204	14:04:37.789	Good
4	IBHLinkUA...	NS4 String IBH Link S5++...	Max	false	Boolean	14:04:38.922	14:04:39.791	Good
5	IBHLinkUA...	NS4 String IBH Link S5++...	Min	false	Boolean	14:04:40.508	14:04:41.292	Good
6	IBHLinkUA...	NS4 String IBH Link S5++...	Up	true	Boolean	14:06:01.591	14:06:02.091	Good
7	IBHLinkUA...	NS4 String IBH Link S5++...	Value	3669	Int16	14:06:08.394	14:06:09.095	Good
8	IBHLinkUA...	NS4 String IBH Link S5++...	CounterValue	3517	Int16	14:06:08.594	14:06:09.095	Good
9	IBHLinkUA...	NS4 String IBH Link S5++...	Dummy	0	Int16	14:05:07.478	14:05:08.307	Good
10	IBHLinkUA...	NS4 String IBH Link S5++...	MaxValue	10000	Int16	14:05:23.671	14:05:23.826	Good
11	IBHLinkUA...	NS4 String IBH Link S5++...	MinValue	100	Int16	14:05:28.076	14:05:28.078	Good

The 'Data Access View' table shows the following data:

#	Display Name	Value	Datatype	Source Timestamp
1	CounterON	true	Boolean	14:04:33.601
2	Down	true	Boolean	16:23:34.609
3	IsCounting	true	Boolean	14:04:37.204
4	Max	false	Boolean	16:05:44.380
5	Min	false	Boolean	14:04:40.508
6	Up	false	Boolean	16:23:34.609
7	Value	4612	Int16	16:23:39.612
8	CounterValue	4765	Int16	16:23:39.612
9	Dummy	0	Int16	14:05:07.478
10	MaxValue	10000	Int16	14:05:23.671
11	MinValue	100	Int16	14:05:28.076

The 'Address Space' tree shows the following structure:

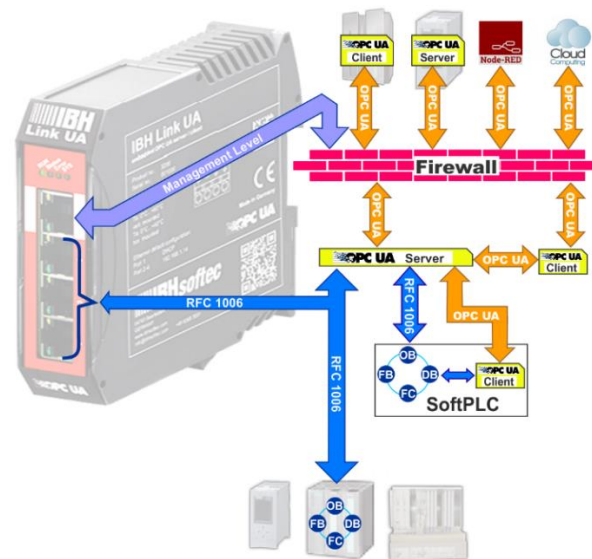
- Root
 - Client
 - DeviceSet
 - MQTT
 - Modbus
 - PLCs
 - IM151-8 PN/DP CPU
 - DeviceHealth
 - DeviceManual
 - DeviceRevision
 - GlobalVars
 - CounterON
 - Down
 - IsCounting
 - Max
 - Min
 - Up
 - Value
 - HardwareRevision
 - Manufacturer
 - Model
 - ParameterSet
 - Programs
 - CounterData
 - CounterValue
 - Dummy
 - MaxValue
 - MinValue
 - SupportedTypes
 - RevisionCounter
 - SerialNumber
 - SoftwareRevision
 - Tasks
 - Server
 - Slots
 - Stations
 - Types
 - Views

Online, the changes of the values in the S5 program are shown.

The screenshot shows the 'S5/S7 for Windows - Counter S5W' window. The 'Online' tab is active, displaying the 'Counter S5W' program. The 'Title' is 'Up / down counter status'. The 'Operand' column shows the program variables, and the 'Contents' column shows the program logic. The 'Modify value' column shows the current values of the variables.

Operand	Contents	Modify value
F 0.1	KM 1	Eable S5 CPU to count
F 2.0	KM 0	Maximum reached S5 CPU
F 2.1	KM 0	Minimum reached S5 CPU
F 2.2	KM 1	Counting control ON S5 CPU
F 2.5	KM 1	down counting S5 CPU
F 2.6	KM 0	up counting S5 CPU
FW 12	KF +157	Counter value S5 CPU
DB 5	---	Data Block DB5 [CounterData]
DW 0	KF +100	minimum Counter value S5 CPU
DW 1	KF +10000	maximum Counter value S5 CPU
DW 2	KF +0	Dummy
DW 3	KF +696	Counter Value S5 CPU

5 IBH Link UA – Integrated SoftPLC



The **IBH Link UA** contains a **SoftPLC**. The SoftPLC can read and write variables from the OPC UA server.

The integrated SoftPLC is used for data preprocessing and is programmed with STEP7® in LAD, FBD, STL, SCL or S7-GGRAPH.

Access (status, program transfer) to the integrated SoftPLC can take place via STEP® 7 (SIMATIC Manager) or the TIA portal.

The IBH Link UA - SoftPLC is compatible with **SIMATIC WinAC RTX** software PLC (**6ES7 611-4SB00-0YB7 V4.6**).

The performance of the SoftPLC can be set as follows:

PLC portion of CPU	Computing time 1000 mixed instructions
50%	about 360 µs
33%	about 550 µs
25%	about 720 µs
20%	about 900 µs
12%	about 1800 µs

5.1.1 IBH Link UA - SoftPLC as a client

The **IBH Link UA - SoftPLC** can be inserted as a client in a slot of the PC station of the OPC UA server. To do this, an S7 connection to the OPC UA server must be established. The status of the SoftPLC client connections can be queried in the browser window.

The SoftPLC can read and write the OPC variables cyclically. The configuration is carried out via SFB 8 (USEND) in the restart (called by OB100).

IBH Link UA - SoftPLC - PUT / GET functions

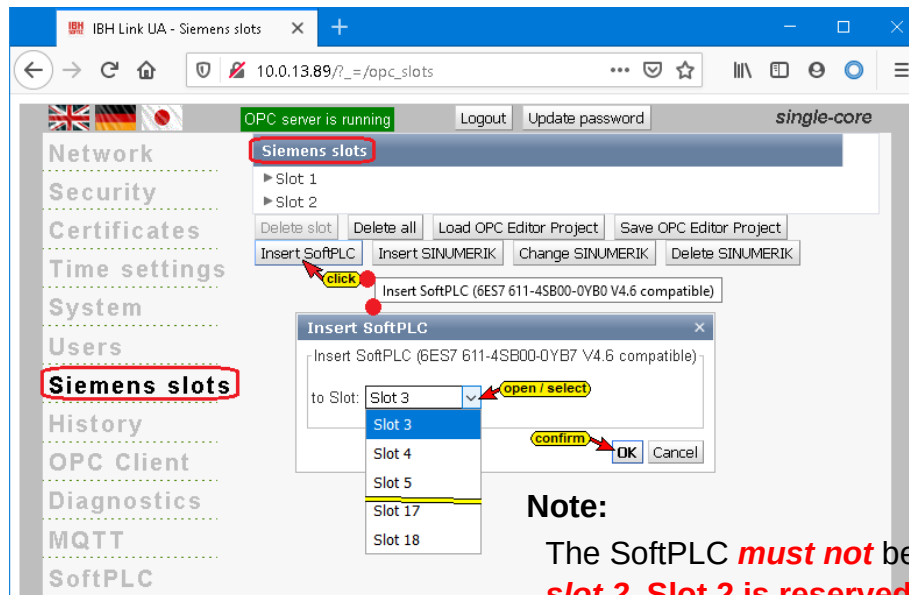
The **IBH Link UA – SoftPLC** can establish a configured connection. The **PUT (SFB 15)** and **GET (SFB 14)** blocks can be used to read data directly from an S7 controller with the SoftPLC integrated in the IBH Link UA.

This means that data can be read or written from freely addressable data areas of the partner controller.

For this purpose, an S7 connection from the IBH SoftPLC to the desired controller is created in the Simatic Manager or in the TIA Portal.

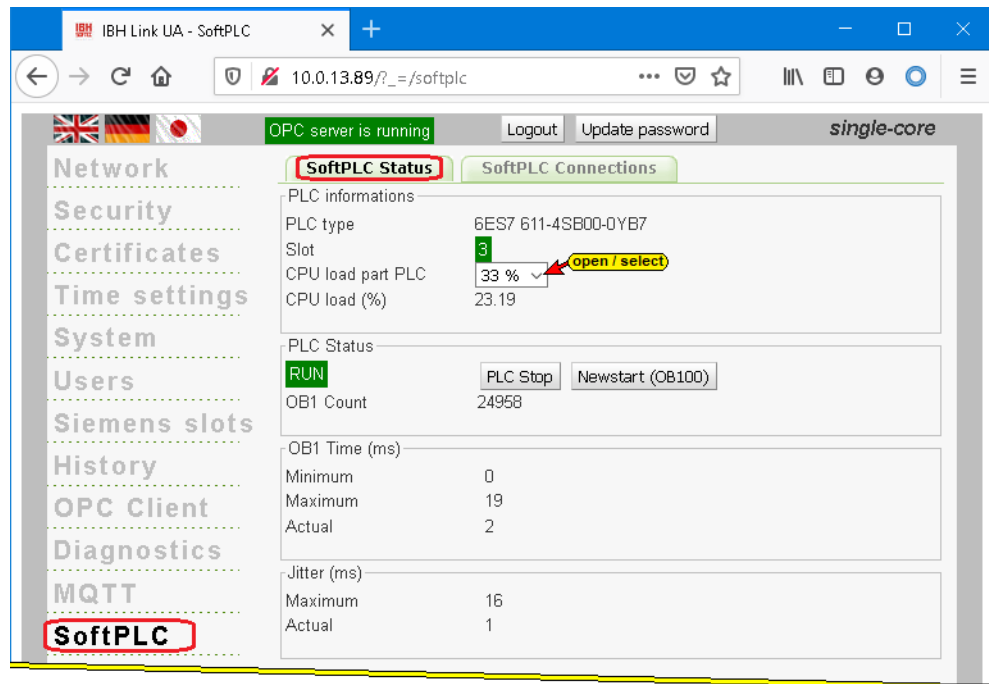
5.2 Activating the integrated SoftPLC

The SoftPLC must be activated via the WEB interface page Siemens Slots of the IBH Link UA.



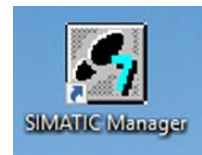
5.3 SoftPLC status and settings

The SoftPLC status is displayed on the WEB interface of the page **Soft PLC** of the IBH Link UA.

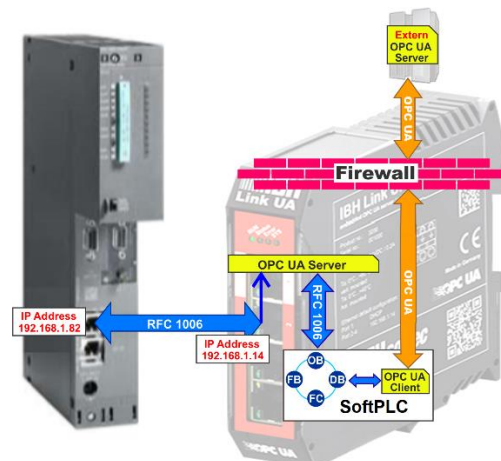


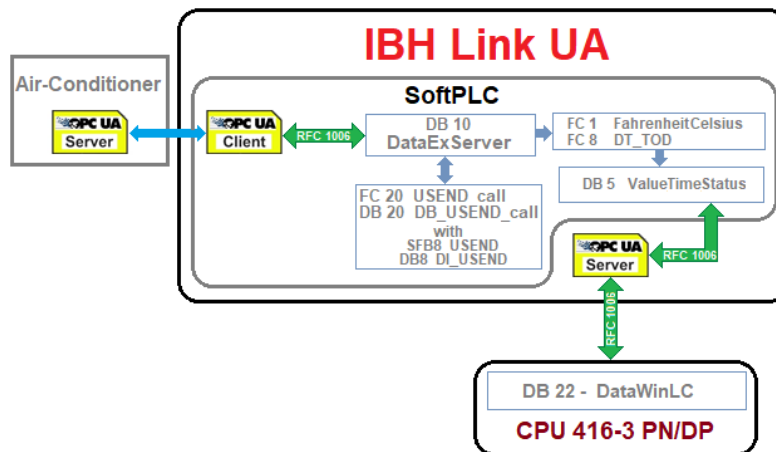
5.4 Configuring SoftPLC with STEP® 7 (SIMATIC Manager)

In the following example - **WinAC RTX S7e** – Data from an Air-Conditioner (external server) are sent to the **SoftPLC** integrated in the IBH Link UA. The PLC-Block **USEND [SFB8]** is used to transfer the **Temperature**, **TemperatureSetPoint** with the associated **TimeStamp** and **Status** to the data block **DataExServerF [DB10]**.



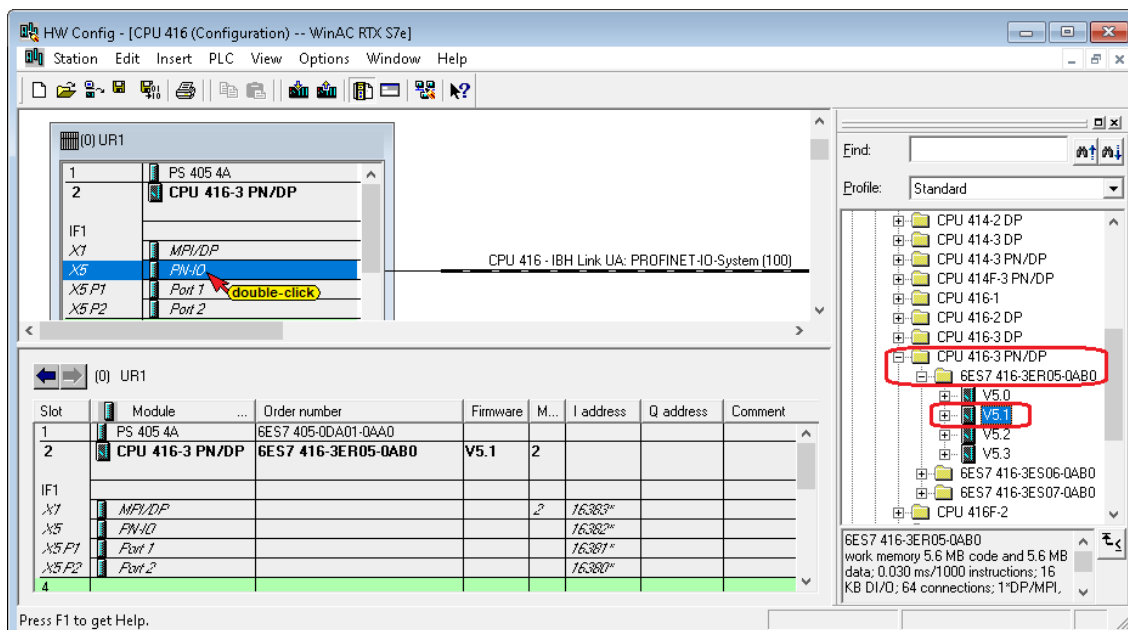
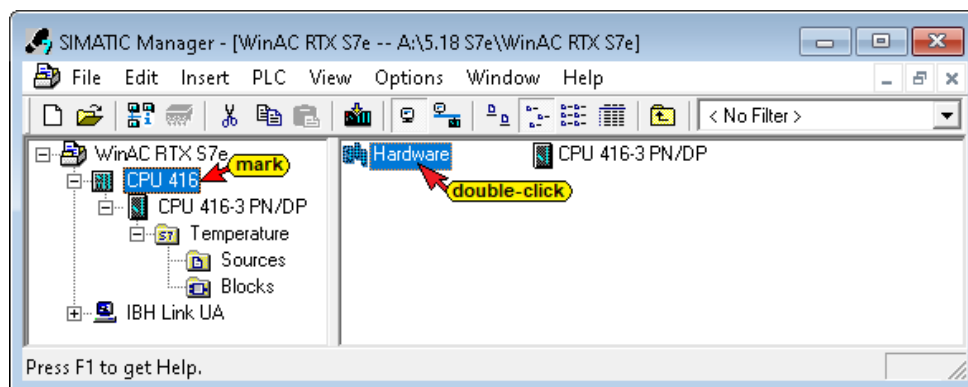
The temperature values and time stamps are converted. °Fahrenheit into °Celsius and Date and Time into Time of Day. These converted values along with the status are saved in the data block **TimeTempC_Status [DB5]** and sent to the **PLC CPU 416** (IBHsoftec SoftPLC) data block **WinAC_RTX_Data [DB22]**.





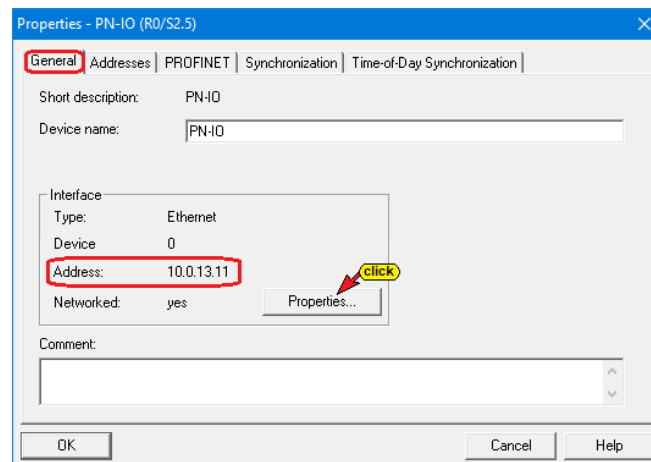
5.4.1 Loading the PLC Program into the CPU 416 program (IBHsoftec SoftPLC 416)

Double-click **Hardware** to open the HW Configuration window.

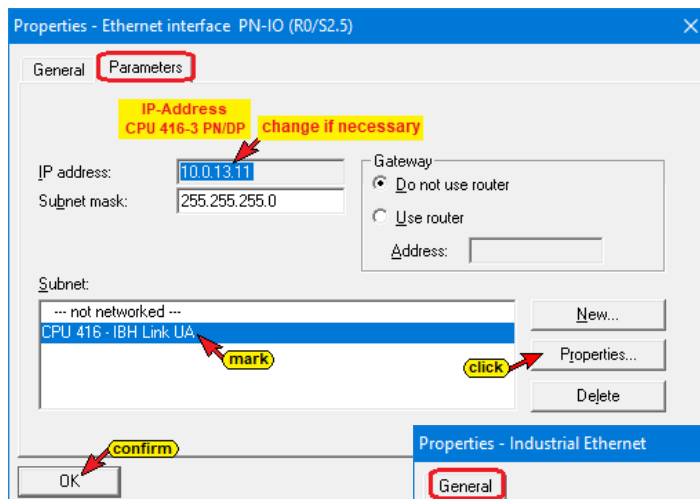


In the example, the **CPU 416-3 PN/DP (6ES7 416-3ER05-0AB0)** firmware version V5.1 is used, which is also available as a software PLC from IBHsoftec.

Double-click the line **X5 PN-IO** to open the **Properties - PN-IO (R0/S2.5)** dialog box.

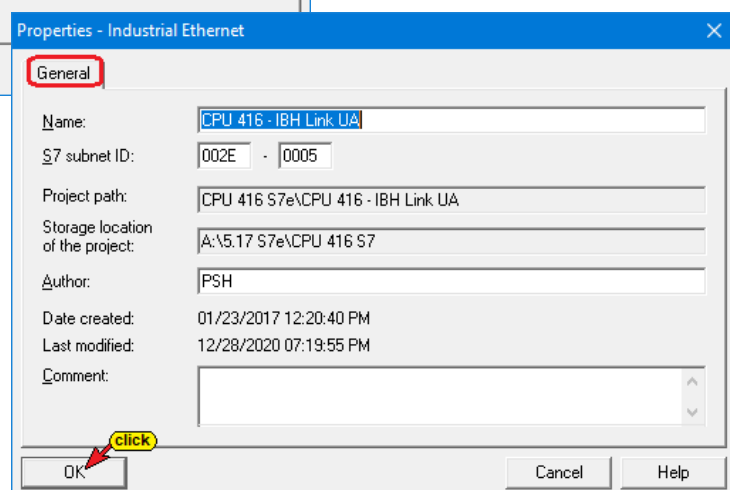


In the dialog box **Properties**, the IP address of the **CPU 416** is displayed. To change the IP address, click the **Properties** button.

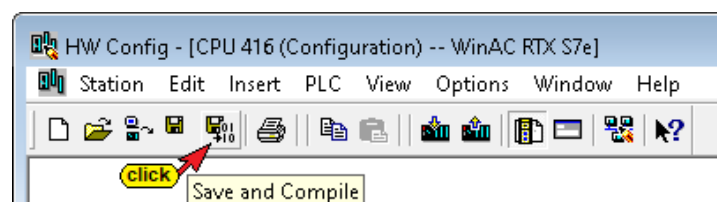


To display more details on the connection (Subnet) mark the subnet name and click the **Properties** button.

To close the dialog boxes, click the **OK** button.



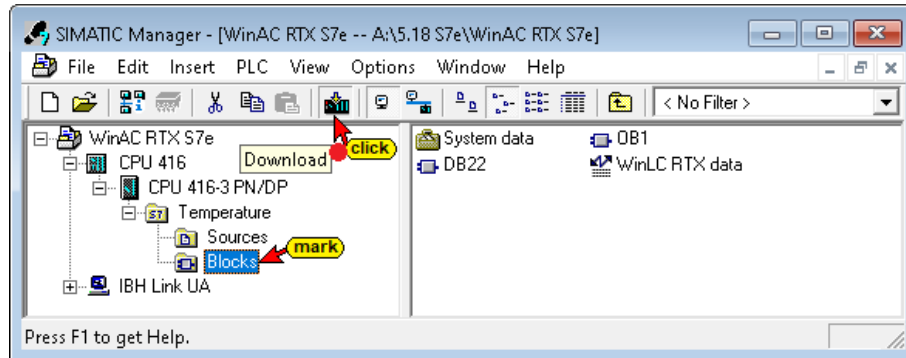
Clicking on the **Save and Compile** icon to save the configuration of the CPU 416.



5.4.2 Download, the PLC program and the System Data to the CPU 416

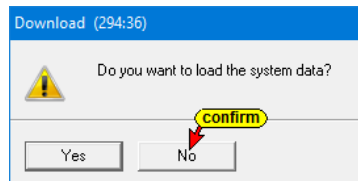
The connection from the PC to the CPU 416-3 PN/DP is made via the Ethernet interface of the PC. The PG/PC interface must be selected accordingly in SIMATIC Manager.

The name of the Ethernet connection may vary depending on the network card used in the PC.



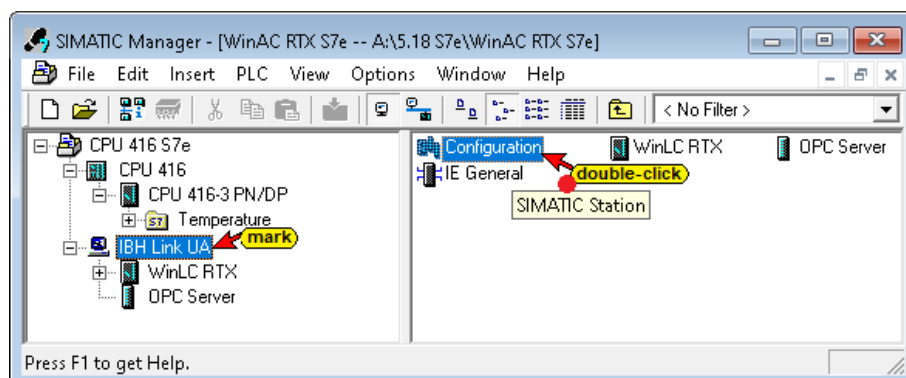
Download System Data

The Hardware configuration of the CPU 416-3 PN/DP is downloaded.



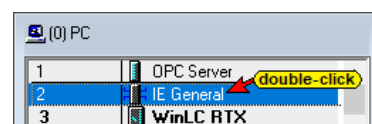
5.4.3 IBH Link UA as SIMATIC PC station

Mark the **IBH Link UA** station and double-click **Configuration** to open the hardware configuration window.

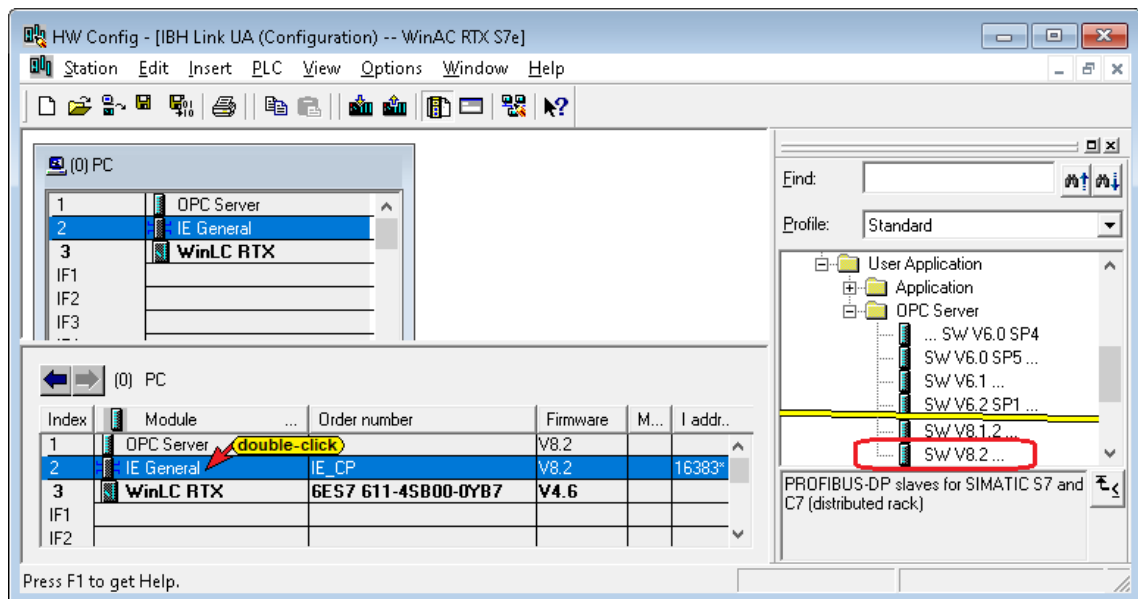


Configuration IBH Link UA (SIMATIC PC Station)

Double-click the name of the CP Industrial Ethernet interface **IE General** **IBH** to open the *Properties* dialog box.



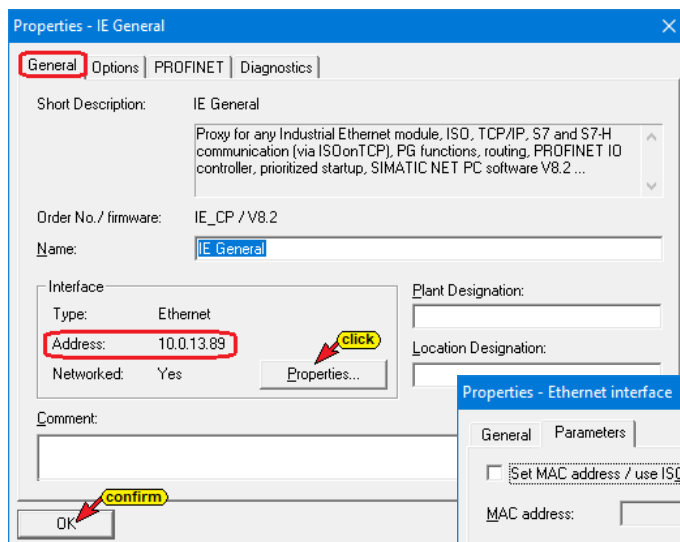
In the dialog box *Properties*, the IP address of the IBH Link UA is displayed. To change the IP address, click the **Properties** button.



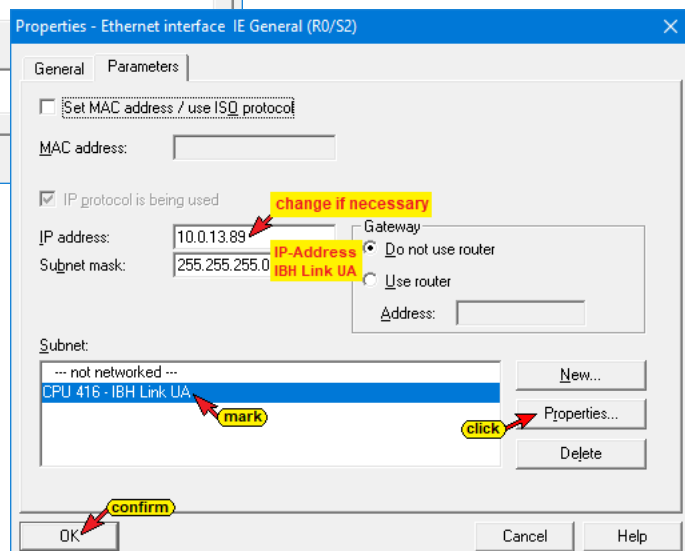
Note:

The Siemens **OPC Server SW V8.2...** and the CP Industrial Ethernet interface **IE General SW V8.2...** are available in the hardware catalogs of **STEP7 SIMATIC Manager** and the **TIA Portal**.

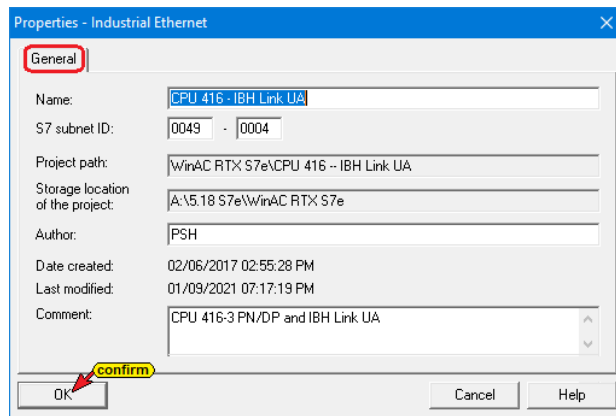
Dialog box Properties - Ethernet interface IE General (R0/S2)



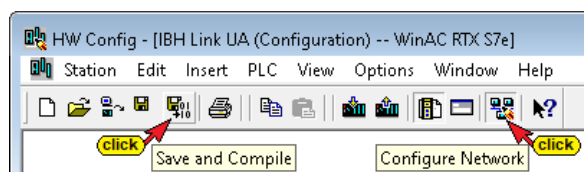
To display more details on the connection (Subnet) mark the subnet name and click the **Properties** button.



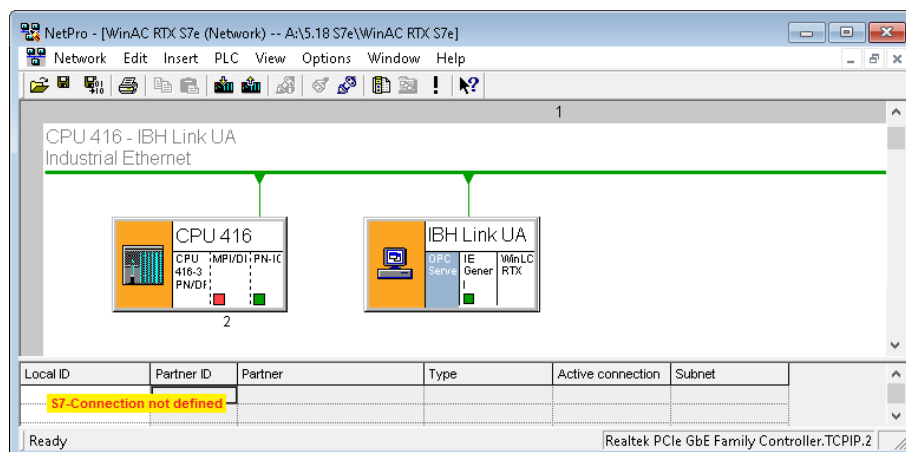
To close the dialog boxes, click the **OK** button.



Clicking on the **Save and Compile** icon to save the configuration of the **IBH Link UA**.

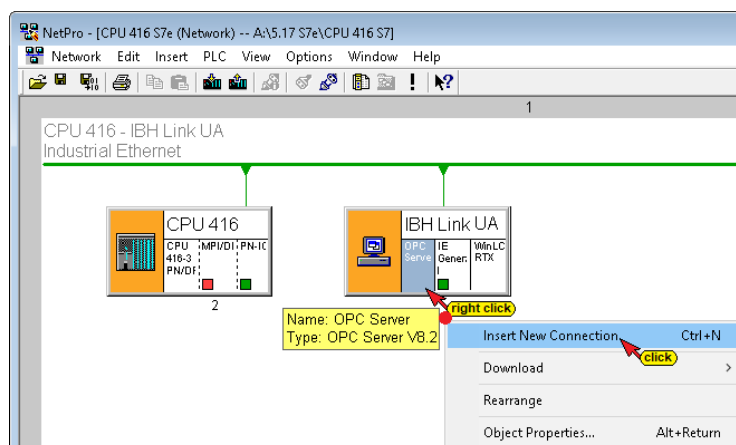


Clicking on the **Configure network** icon displays the CPU-416 and IBH Link UA link graphically.



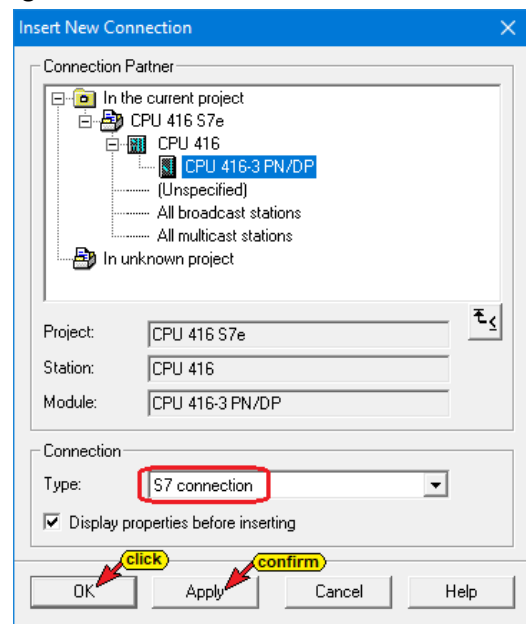
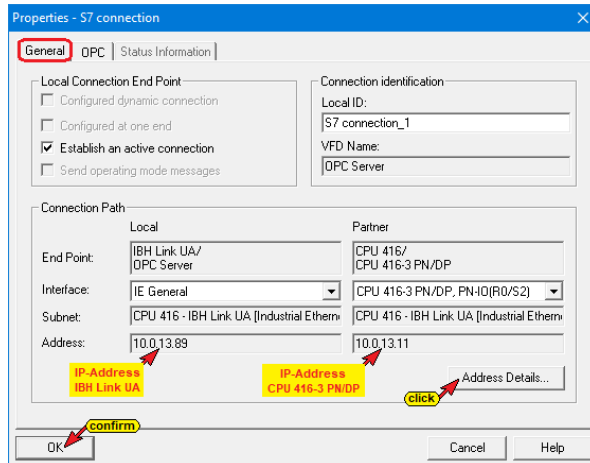
Connecting the CPU-416 with the OPC Server (IBH Link UA)

Using the following steps, an S7 connection is established between the CPU 416 and the IBH Link UA.



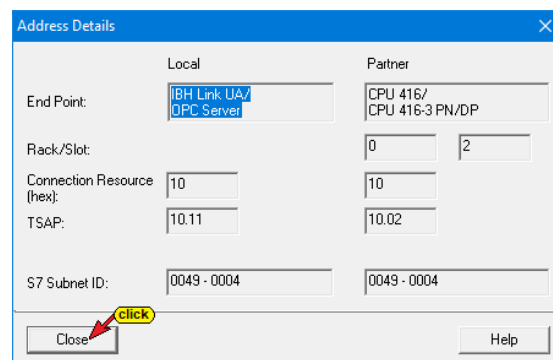
Right-click **OPC-Server** and click **Insert New connection** to open the **Insert New connection** dialog box.

Click **OK** to display more information on the S7 connection.

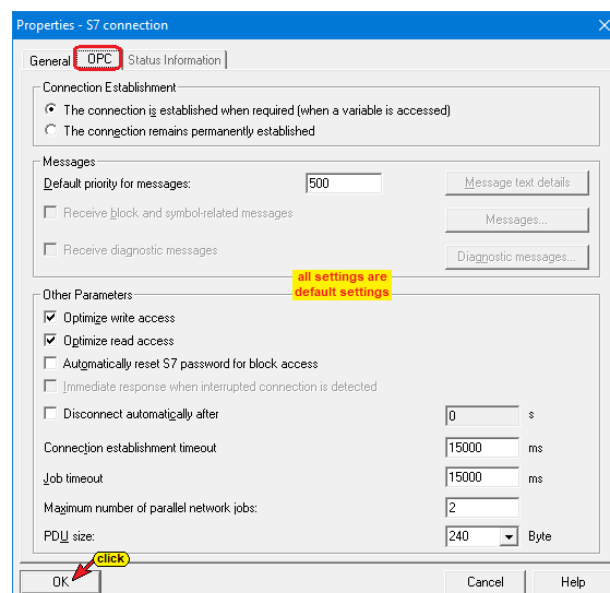


Click the **Apply** for confirmation.

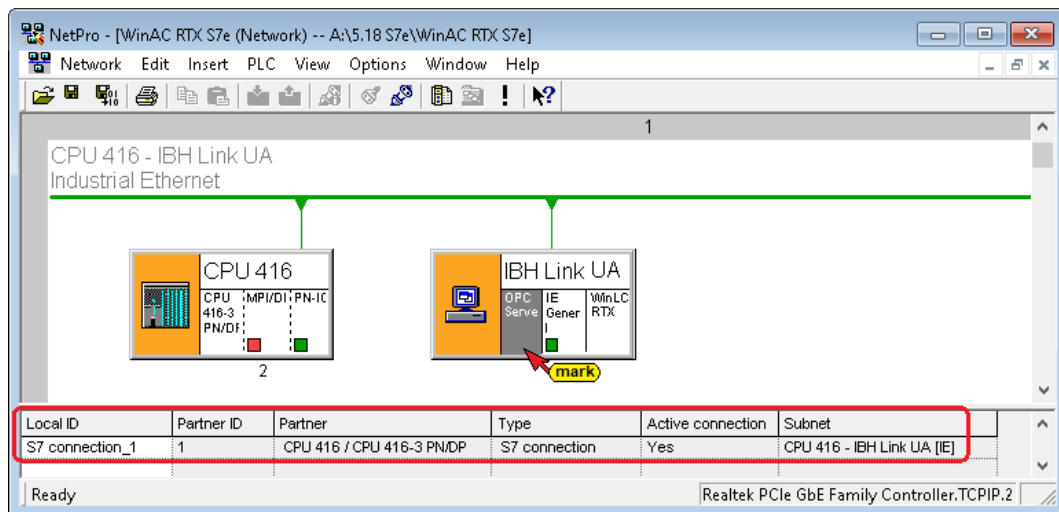
Address Details can be displayed by clicking the button.



The tab **OPC** of the dialog box **Object Properties - S7 connection_1**, **tab OPC** displays further details on the connection.

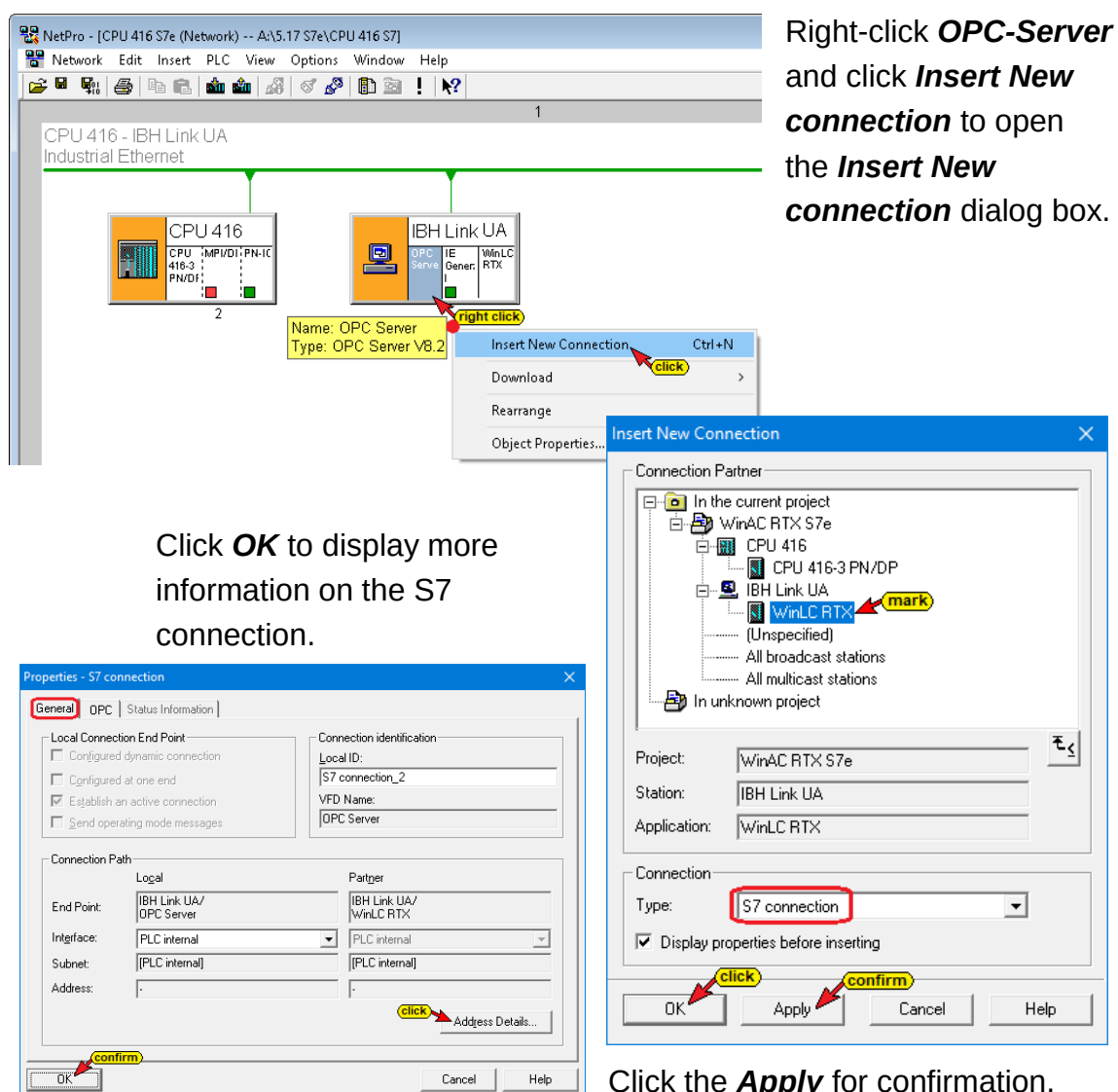


The established **S7 connection** between the **CPU 416** and the **IBH Link UA** is displayed.

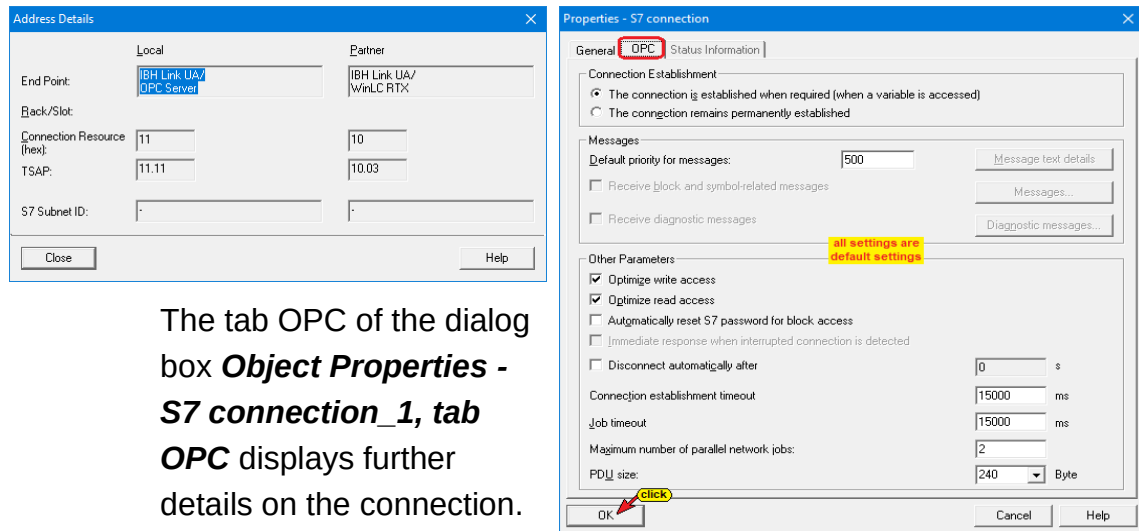


Connecting the WinLC RTX with the OPC Server (IBH Link UA)

Using the following steps, an S7 connection is established between the WinLC RTX and the OPC Server / IBH Link UA.

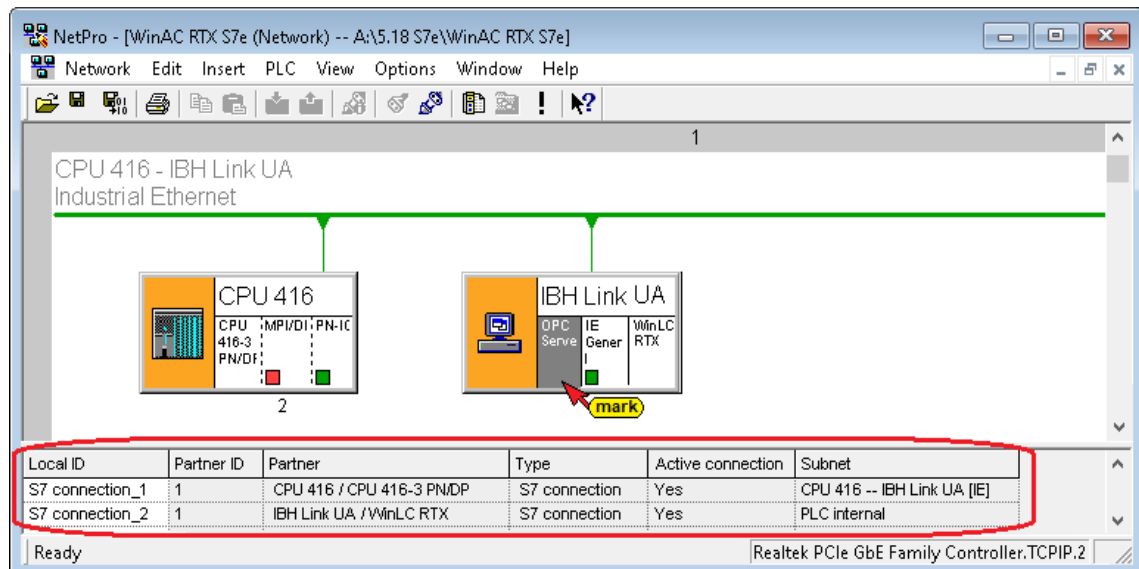


Address Details can be displayed by clicking the button.



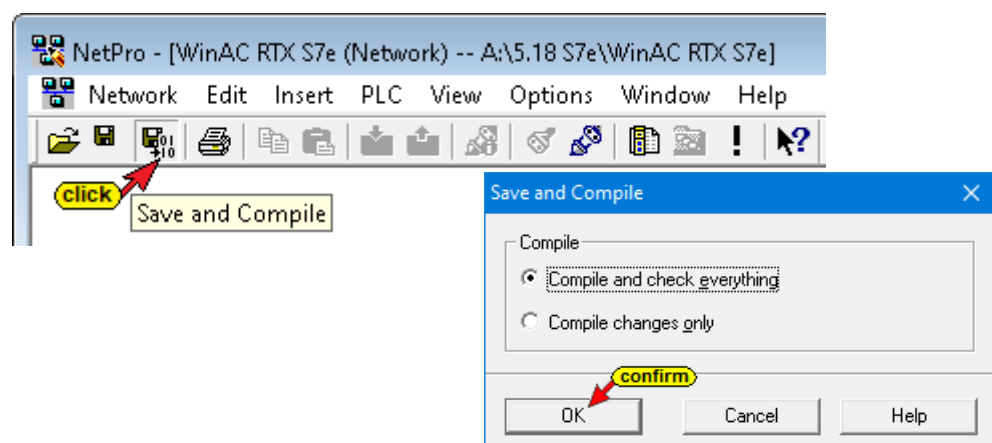
The tab **OPC** of the dialog box **Object Properties - S7 connection_1, tab OPC** displays further details on the connection.

The established **S7 connections** between the **CPU 416**, the **Soft PLC WinLC RTX**, and the **IBH Link UA** is displayed.

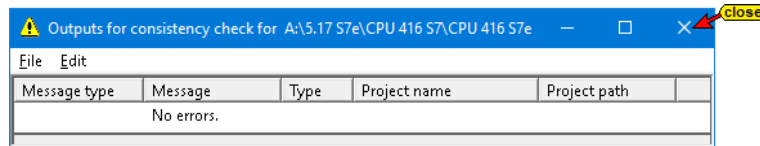


NetPro – WinAC RTX S7e (Network) window

Clicking on the **Save and Compile** icon to save the configuration of the **CPU 416**, the **Soft PLC WinLC RTX**, and **IBH Link UA**.

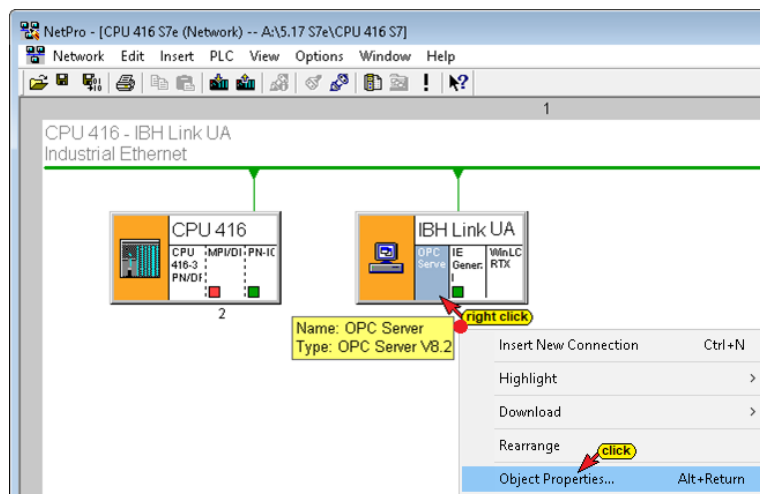


The successful compiling and saving are displayed.

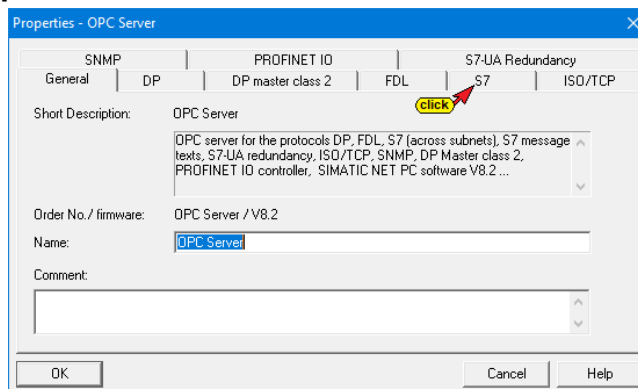


5.4.4 Select the symbols to be used (OPC tags)

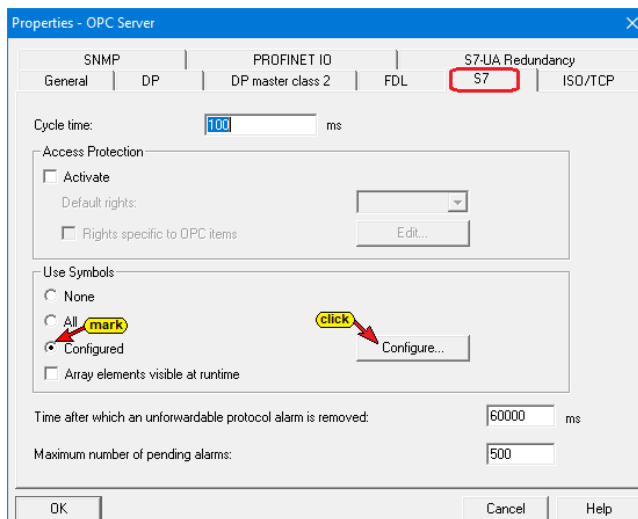
Right-click **OPC-Server** and click **Object Properties** to open the **Properties – OPC Server** dialog box.



Properties - OPC Server



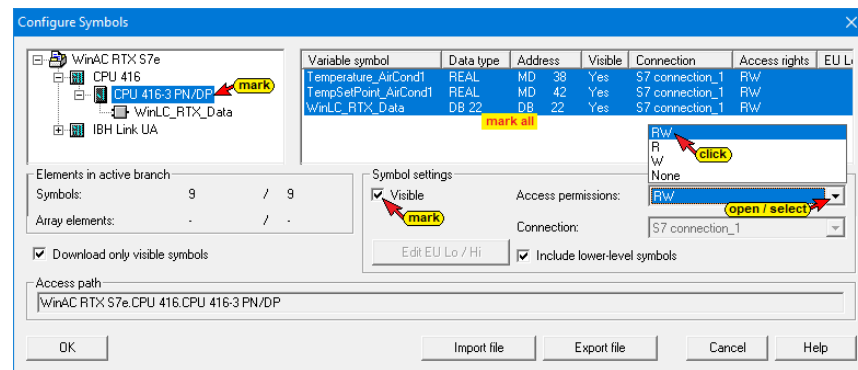
The **tab S7** defines the symbols (OPC tags) to be used.



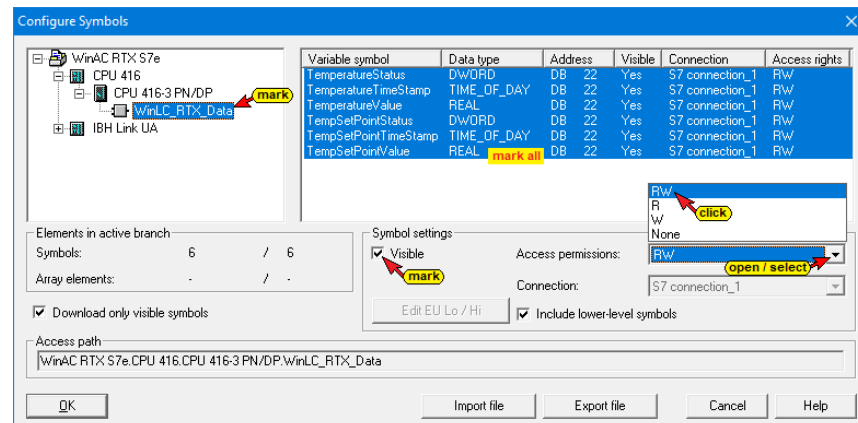
Mark **Configured** and click the **Configure...** button.

Global Variable (OPC tags) CPU 416-3 PN/DP

The global variables **Temperature_AirCond1** and **TempSetPoint_AirCond1** are used as OPC tags. They are needed to identify **Pointers** to OPC Variables in the **SoftPLC WinLC_RTX**. The identifiers of the variables are copied from the Attributes window of the Unified Automation UaExpert program. The data block **WinLC_RTX_Data [DB22]** is used as OPC tags.

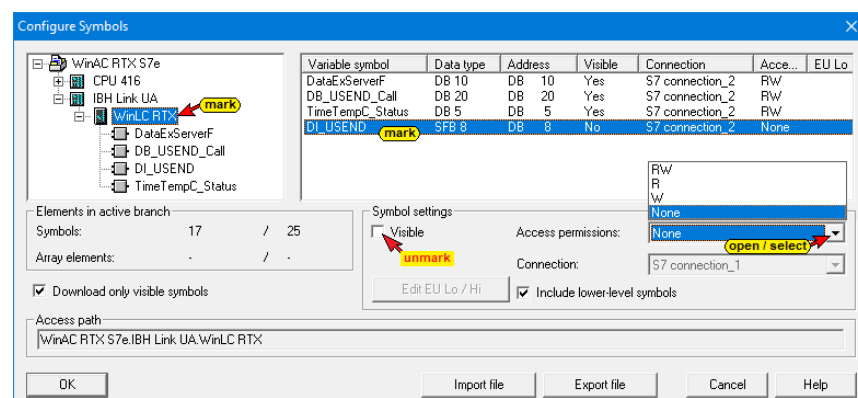


Data Block WinLC_RTX_Data [DB22] OPC tags, CPU 416

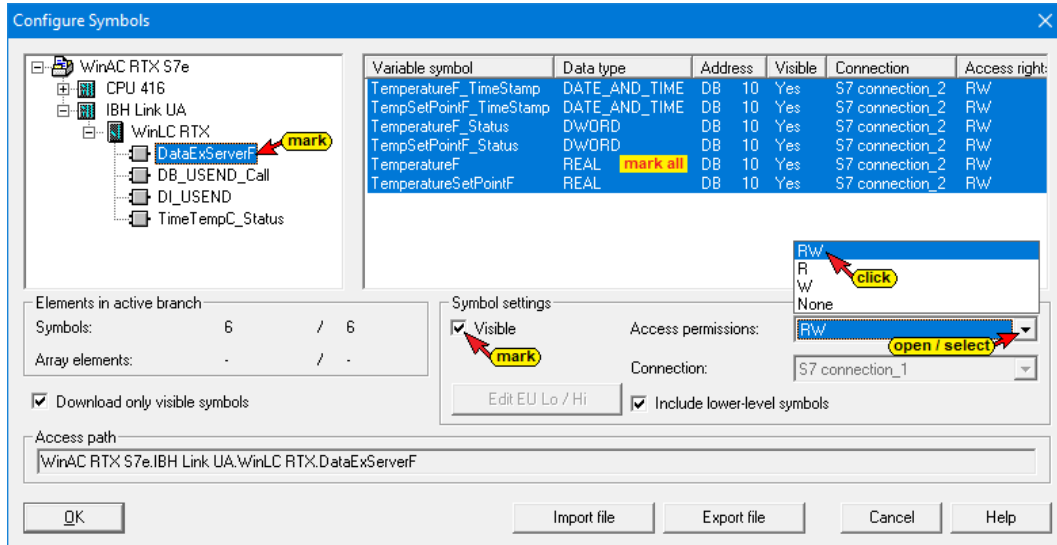


5.4.5 OPC tags SoftPLC WinLC RTX (IBH Link UA)

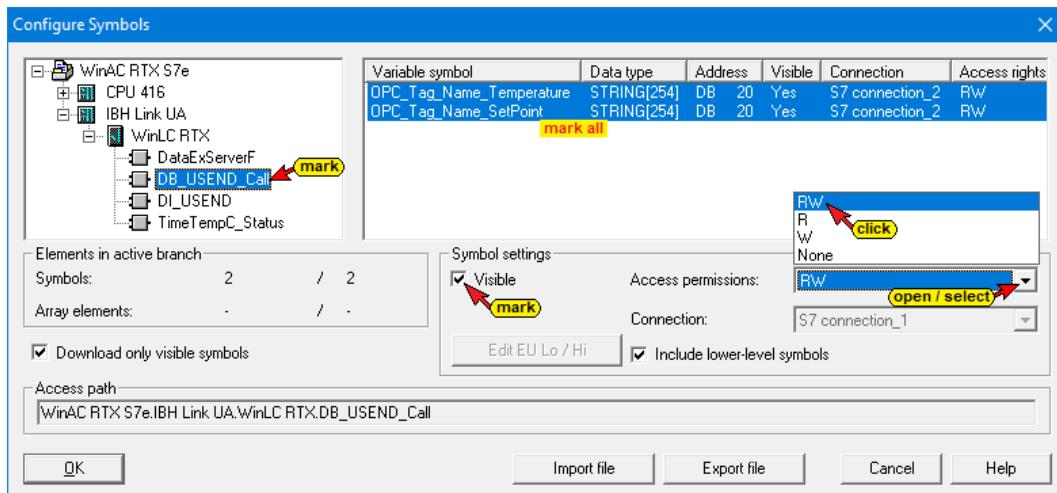
The data blocks **DateExServerF [DB10]**, **DB_USEND_Call [DB20]**, and **TimeTempC_Status [DB5]** are used as OPC tags. The data block **DI_USEND [DB8]** is not used as OPC tags.



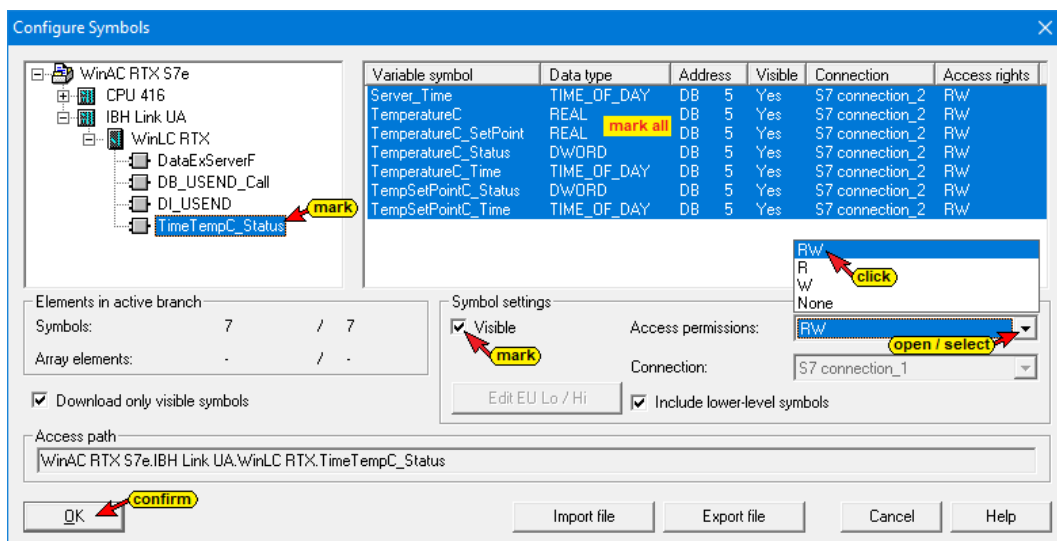
Data Block *DataExServerF* [DB10] OPC tags, WinLC RTX



Data Block *DB_USEND_Call* [DB20] OPC tags, WinLC RTX



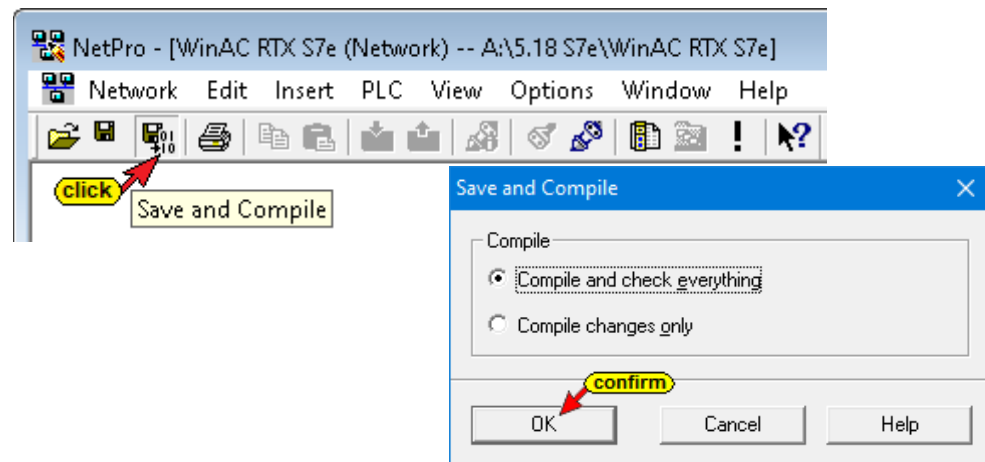
Data Block *TimeTempC_Status* [DB5] OPC tags, WinLC RTX



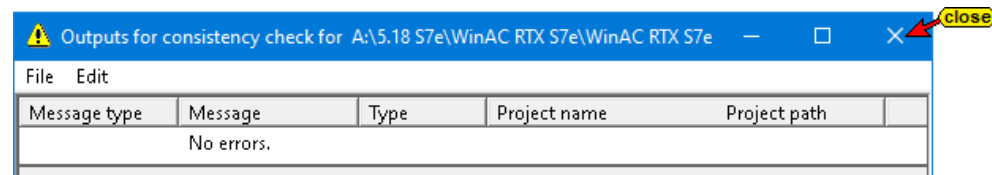
Click the **OK** buttons to close the **Configure Symbols** and the **Properties - OPC Server** dialog boxes.

NetPro – WinAC RTX S7e (Network) window

Clicking on the **Save and Compile** icon to save the configuration of the **CPU 416** and **IBH Link UA**.



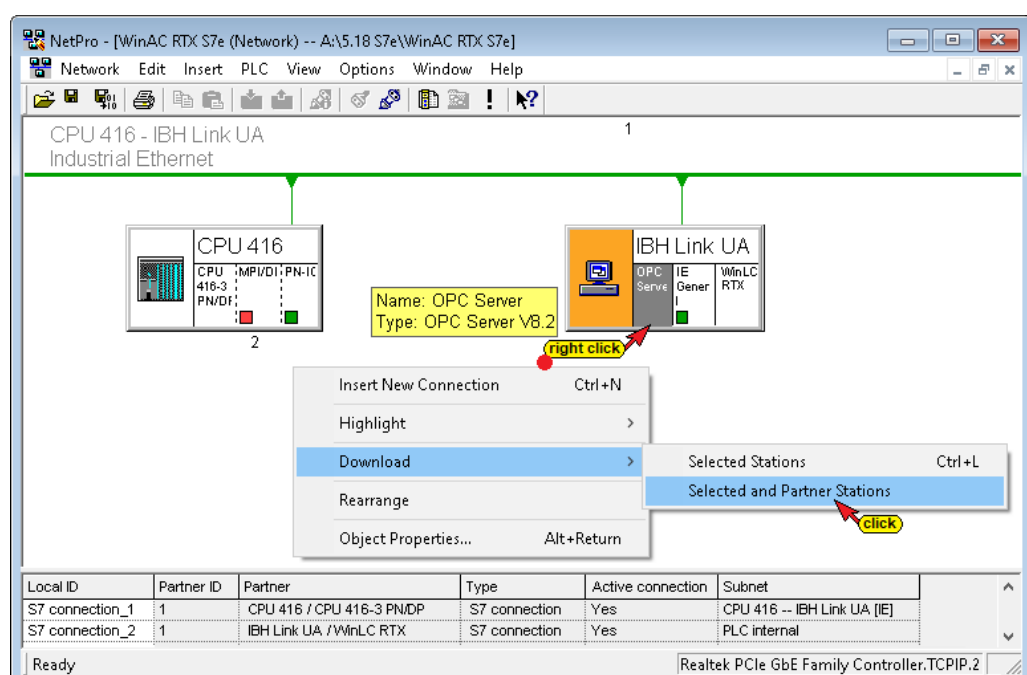
The successful compiling and saving are displayed.



Download the configuration of the **CPU 416** and **IBH Link UA**.

If no error was found with save and compile, the configuration can be loaded into the stations.

Right-click **OPC-Server** and click **Download / Selected and Partner Stations**.

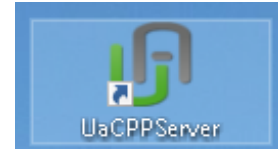


Several information must be confirmed to complete the download.

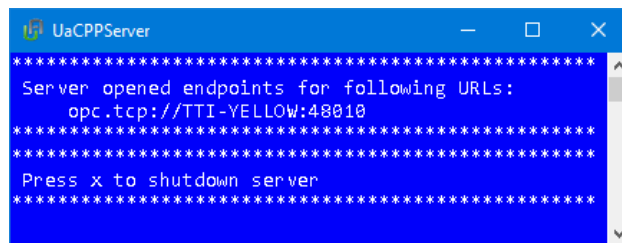
5.5 Start external OPC UA server

The **OPC client function** reads data from an OPC server and writes data to an OPC server. This does not have to be the same OPC client/server device. The **IBH Link UA** is a **Server / Client Module**. The OPC client function allows data exchange between OPC servers.

The **OPC Unified Architecture Demo Server** must be available one on the PC (see IBH Link UA Manual Part 1, chapter 2.4).



This external OPC UA server can be started by double-clicking the UA server icon.



External OPC UA server (air conditioning and heating systems)

The external OPC UA server has the endpoint URL:

opc.tcp: // TTI-YELLOW: 48010

If no **name server (DNS server)** is available, the PC name must be replaced with the absolute **IP address** of the **PC**. The endpoint URL responsible for the connection could be, for example:

opc.tcp: //10.0.13.10: 48010.

Define the OPC UA servers for the data exchange

For data exchange between the air-conditioning system and the PLCs, the two **OPC UA servers** who provide the data for exchange are to be registered in the **IBH Link UA**, web browser window **OPC Client**.

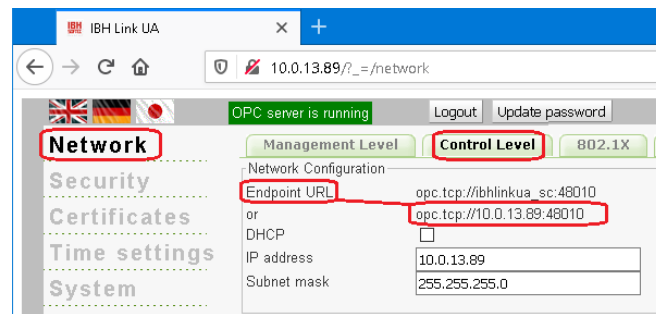
The **IBH Link UA - OPC UA Server** has the Endpoint URL:

opc.tcp: // ibhlinkua_sc: 48010

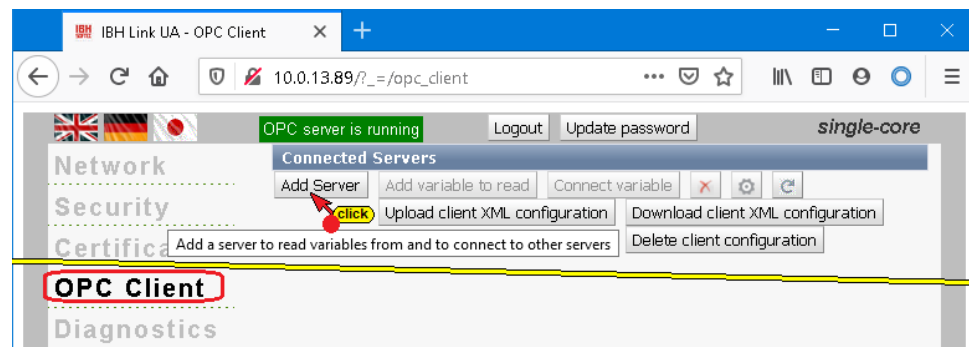
If no **name server (DNS server)** is available, the absolute IP address of the **Network / Control Level** must be used as the endpoint URL. The absolute endpoint URL would then be:

opc.tcp: //10.0.13.89: 48010

The required **endpoint URL** can be copied from the web browser window **Network / Control Level**.

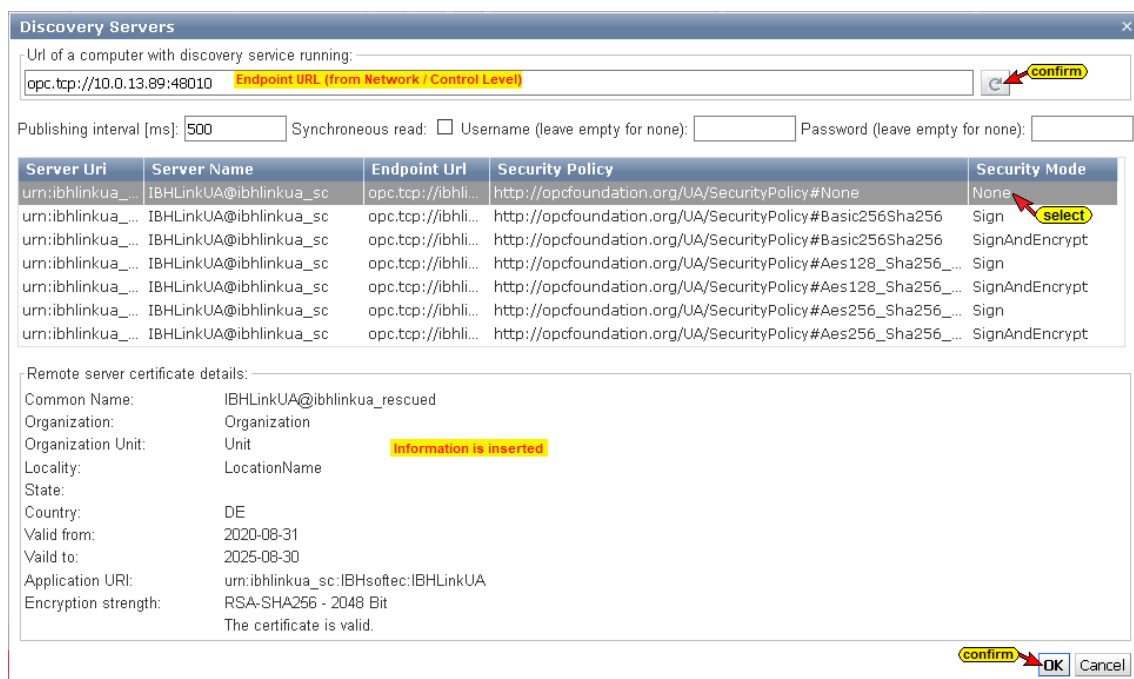


Add server



The copied endpoint URL **opc.tcp: // ibhlinkua_sc: 48010** or **opc.tcp: //10.0.13.89: 48010** is in the open field in the IBH Link UA web browser window / OPC client is to be added as a server.

Security Policy None and **Security Mode None** were selected for data transmission.



Next, the external **OPC UA server (UnitedAutomation - air conditioner)** is defined.

The external OPC UA server has the endpoint URL:

opc.tcp:// TTI-YELLOW: 48010

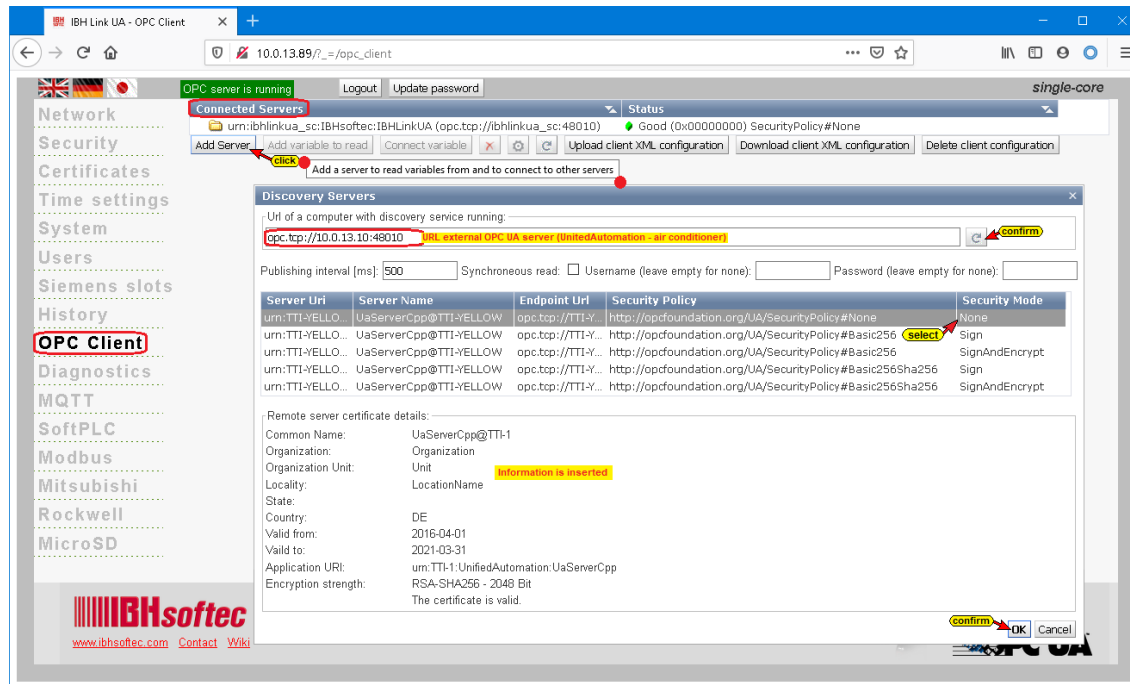
The absolute endpoint URL would then be:

opc.tcp://10.0.13.10: 48010

If no name server (DNS server) is available, the PC name must be replaced with the absolute IP address of the PC.

The endpoint URL responsible for the connection could be, for example:

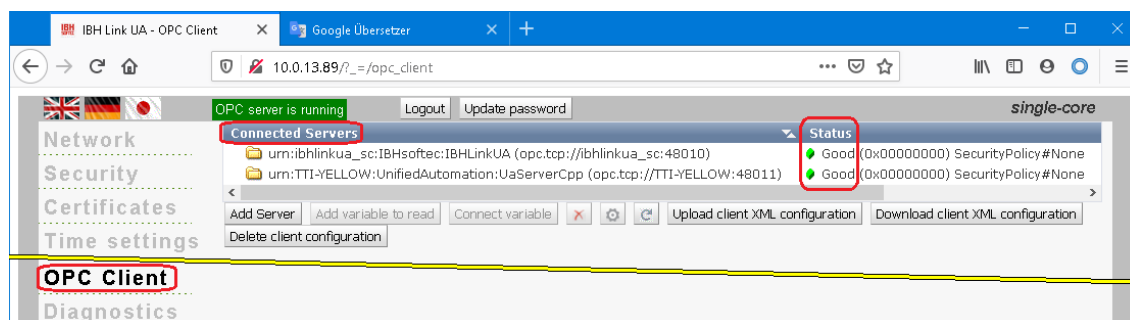
opc.tcp://10.0.13.10: 48010



Security Policy None and Security Mode None were selected for data transmission.

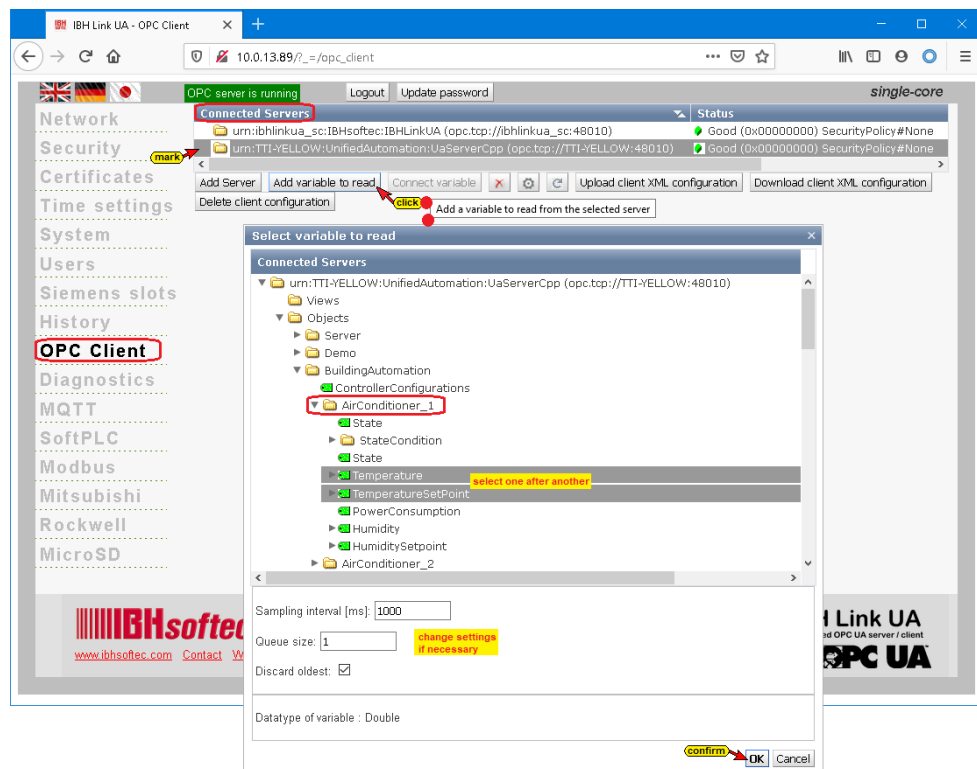
The IBH Link UA and the external OPC UA server are connected.

The status of both servers is good. None was selected as the security policy for both servers.



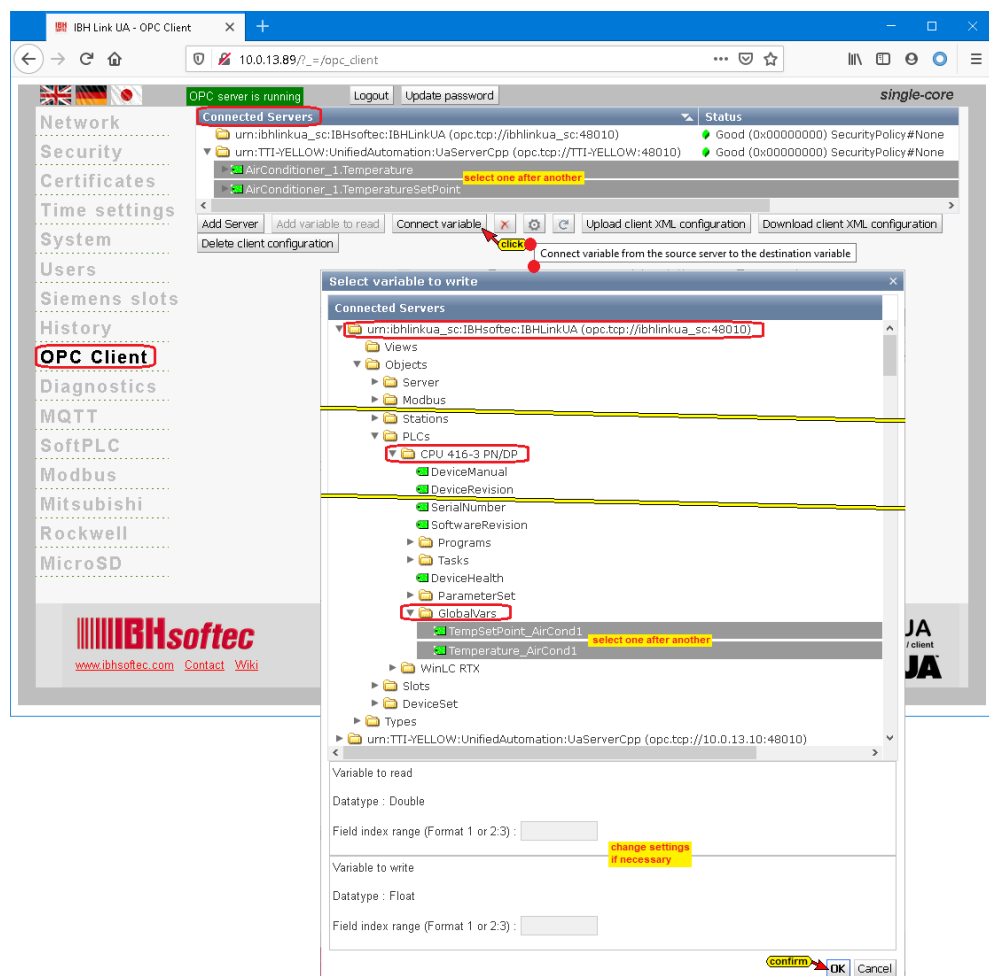
Add read variable Air Conditioner

The two variables ***Temperature*** and ***TemperatureSetPoint*** that the external OPC UA server makes available are declared as read variables. The ***OPC UA client in the IBH Link UA*** reads this data.



The Global Variables of the CPU-416 have access of these OPC tags.

Connect with CPU-416 Global Variables

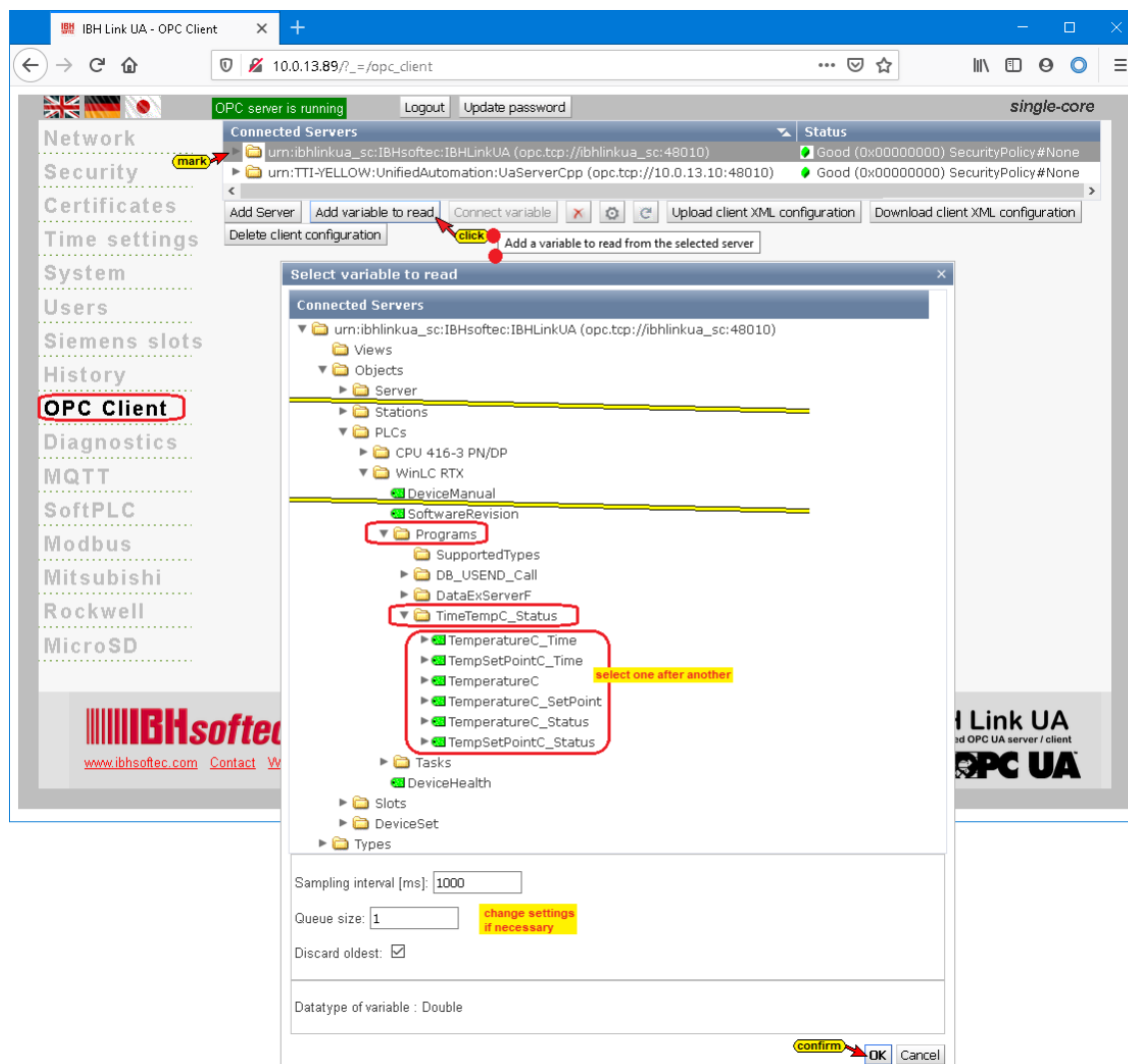


The two variables **Temperature** and **TemperatureSetPoint**, which have been declared as read variables, are connected to the IBH Link UA OPC server, which then sends them to the CPU-416.

The connections are displayed in the IBH Link UA web browser window OPC Client.

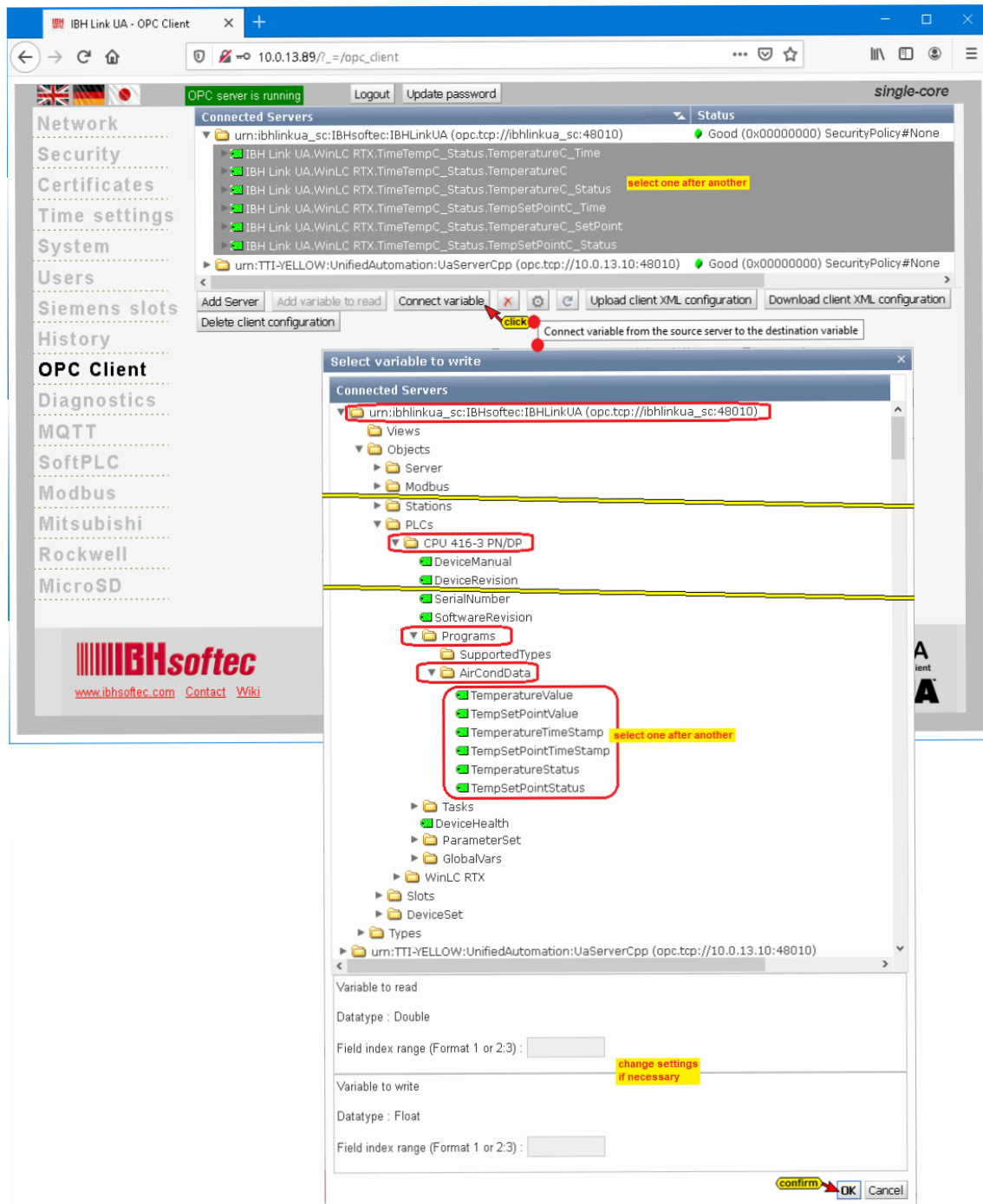
Add read variable WinAC RTX / SoftPLC IBH Link UA

The PLC Program in the WinAC RTX converts the variables **Temperature** and **TemperatureSetPoint** of the Air Conditioner. The time stamp variables originate with the data type **Date and Time** are converted in **Time of Day**. The temperature variables originate in **°Fahrenheit** are converted in **°Celsius**. The results are stored in the data block **TimeTempC_Status [DB5]**. These variables are declared to be read variables.



Connect with data block AirCondData [DB 10], CPU-416

The WinAC RTX read variable are connected with the variables of the data block **AirCondData [DB 10]** of the CPU-416.



5.6 PLC program for the WinAC RTX SoftPLC of the IBH Link UA

The data from the Air conditioner is send to the WinAC RTX SoftPLC of the IBH Link UA by using the System Block **USEND [SFB 8]**. The data from the WinAC RTX SoftPLC are send to the CPU 416.

Data block DB10 - DataExServerF

The variables of the external OPC server (OPC variable of the Air-Conditioner 1) are saved here.

Address	Name	Type	Initial value	Comment
0.0		STRUCT		
+0.0	TemperatureF	REAL	0.000000e+000	Temperature (Fahrenheit)
+4.0	TemperatureSetPointF	REAL	0.000000e+000	Temperature Set Point (Fahrenheit)
+8.0	TemperatureF_TimeStamp	DATE_AND_TIME	DT#90-1-1-0:0:0.000	Time Stamp Temperature (Fahrenheit)
+16.0	TempSetPointF_TimeStamp	DATE_AND_TIME	DT#90-1-1-0:0:0.000	Time Stamp Temperature Set Point (Fahrenheit)
+24.0	TemperatureF_Status	DWORD	DW#16#0	Status Temperature (Fahrenheit)
+28.0	TempSetPointF_Status	DWORD	DW#16#0	Status Temperature Set Point (Fahrenheit)
=32.0		END_STRUCT		

Data block DB 5 –TimeTempC_Status

The converted variables of the data block DB 10 are saved in this block. These variables can then be read as OPC variables by the CPU 416-3 PN / DP.

Address	Name	Type	Initial value	Comment
0.0		STRUCT		
+0.0	TemperatureC_Time	TIME_OF_DAY	TOD#0:0:0.000	Time Stamp Temperature (Celsius)
+4.0	TempSetPointC_Time	TIME_OF_DAY	TOD#0:0:0.000	Time Stamp Temperature Set Point (Celsius)
+8.0	TemperatureC	REAL	0.000000e+000	Temperature (Celsius)
+12.0	TemperatureC_SetPoint	REAL	0.000000e+000	Temperature Set Point (Celsius)
+16.0	TemperatureC_Status	DWORD	DW#16#0	Status Temperature (Celsius)
+20.0	TempSetPointC_Status	DWORD	DW#16#0	Status Temperature Set Point (Celsius)
=24.0		END_STRUCT		

Functions FC 8 - DT_TOD and FC 1 – Fahrenheit_to_Celsius

The FC 8 (DT_TOD) function converts the variables of the **DATE_AND_TIME** type into the **Time of Day** type. The FC 1 function converts °Fahrenheit into °Celsius.

System Block USEND [SFB 8]

The PLC Program of the **WinAC RTX** uses a standard System Block to access the variables of the Air Conditioner. **SFB 8 (USEND)** block in the Siemens libraries is suitable for transferring an OPC variable, which consists of the **Actual Value**, the associated **Time Stamp**, and the **Status**.

With this data, the PLC program can evaluate not only the value of a variable, but also its quality and age.

The SFB 8 (USEND) block has the necessary parameters for the simple registration of OPC variables.

With the special function code **65400 (Hex FF78)** the SFB 8 (USEND) used to register variables.

With the **4 ANY pointers** and the **R_ID parameter** of the block, all information for registering the variables can be transferred in one call.

The SoftPLC can read and write the OPC variables cyclically.
The configuration is carried out via SFB 8 (USEND) in the restart
(called in OB100).

Parameters of the SFB 8 (USEND) block - ID = 65400 (hex FF78)

```

REQ    := TRUE           // Not evaluated
ID     := W#16#FF78      // Fixed value: 65400
R_ID   := DW#16#1F40002 // Modus:
                        // Low Word; 2: Read(PLC Variable)
                        // High Word: Sampling in milliseconds
                        // 500 milliseconds

DONE   :=                // is not set
ERROR  :=                // No ERROR=0; ERROR=1
STATUS:=                // 0x0000 on success, 0x8090 on error
SD_1   :=                // Pointer to the OPC Variable.
SD_2   :=                // Pointer to the OPC Variable for the
                        // Value of the OPC Variable.
SD_3   :=                // Pointer to the PLC Variable for the
                        // Status of the Variable.
SD_4   :=                // Pointer to the PLC Variable for the
                        // Time Stamp.

```

Client function of the SFB 8 (USEND) block

Cyclic reading and writing.

The SoftPLC can read and write the OPC variables cyclically.

The configuration is carried out via SFB 8 (USEND) in the restart
(called by OB100).

Parameter	Declaration	Data type	Memory area	Description
REQ	INPUT	BOOL	I, Q, M, D, L	is not evaluated.
ID	INPUT	WORD	M, D, Const.	Fixed value: 65400 (hex: FF78)
R_ID	INPUT	DWORD	I, Q, M, D, L, Const.	0: Read (variable as XML string) 1: Write (variable as XML string) 2: Read (PLC variable) 3: Write (PLC variable) 4: Read (special variable) 5: Write (special variable) 6: Read (server variable) 7: Write (server variable) Bit 14 (low byte + 16348 [hex 4000]): The any pointer when writing points to DATE_AND_TIME Bit 15 (low byte + 32768 [hex 8000]): The any pointer when writing points to a STRING High Word: Sampling rate in milliseconds

Parameter	Declaration	Data type	Memory area	Description
DONE	OUTPUT	BOOL	I, Q, M, D, L	is not set
ERROR	OUTPUT	BOOL	I, Q, M, D, L	ERROR=0: The parameters were transferred correctly. ERROR = 1: The parameters were not transferred correctly.
STATUS	OUTPUT	WORD	I, Q, M, D, L	0x0000 If successful, 0x8090 on error.
SD_1	IN_OUT	ANY	D	Pointer to the OPC variable.
SD_2	IN_OUT	ANY	I, Q, M, D	Pointer to the PLC variable for the value of the OPC variable. Only the data types of BOOL, BYTE, CHAR, WORD, INT, DWORD, DINT, REAL, DATE, DATE_AND_TIME. Note: When the ANY pointer accesses a DB, the DB must always be specified (e.g.: P # DB10.DBX5.0 Byte 0).
SD_3	IN_OUT	ANY	I, Q, M, D	Pointer to the PLC variable for the variable status. The data type DWORD is permitted. Note: If the ANY pointer accesses a DB, the DB must always be specified (e.g.: P # DB10.DBX5.0 Byte 10).
SD_4	IN_OUT	ANY	D	Pointer to the PLC variable for the recording time (time stamp). The data type DATE_AND_TIME is permitted. Note: If the ANY pointer accesses a DB, the DB must always be specified (e.g.: P # DB10.DBX5.0 Byte 10).

OPC Variable Definitions

To uniquely identify the OPC variables, they are assigned a number (namespace), next to the actual name.

The OPC Variables are defined as follows:

Mode 0 and 1: 'ns=<Namespace>;s=<Identifier>'

or: ns=<Namespace>;i=<Numeric Identifier>'

All OPC Variables can be read using this mode.

The IBH Link UA knows the following Namespaces:

Namespace	Area
0	General OPC Server Variables
1, 2, 3, 5	No evaluable variables
4	All PLC specific OPC variables
6	IBH Link UA Special Variables

Mode 2 and 3: '<Identifier>'

The identifier is formed as follows:

**<Station name>.<PLC Name>.<GlobalVars>.<Variable name
from Variables table>**

or:

**<Station name>.<PLC Name>.<Programs>.<Variable name>.
<Data Block name>**

Mode 4 and 5: <Numeric Identifier>

Number of the Special Variable from Namespace 6.

Modus 6 and 7: <Numeric Identifier>

Number of the Server Variable from Namespace 0.

Function FC 20 – calls_USEND

The variables from **DB20 – DB_USEND_call** is transferred to the OPC_Variable as pointers when calling USEND as parameter **SD_1**. The parameters **REQ** and **ID** are according to the table on page 18 - 19 have been specified.

The **R_ID** parameter is made up as follows:

- Low Word: Value 2 (hex0002) – Read (PLC variable).
- High Word: 500 ms – hex 01F4 -

Parameter **R_ID** – doubleword: = 16 #1F40002

The parameters **DONE**, **ERROR** and **STATUS** are not evaluated in the example.

- SD_1: = pointer to the OPC variable.
- SD_2: = Pointer to the PLC variable for the value of the OPC variables.
- SD_3: = pointer to PLC variable for the value of the OPC variable status.
- SD_4: = pointer to PLC variable for the value of the OPC variable time stamp.

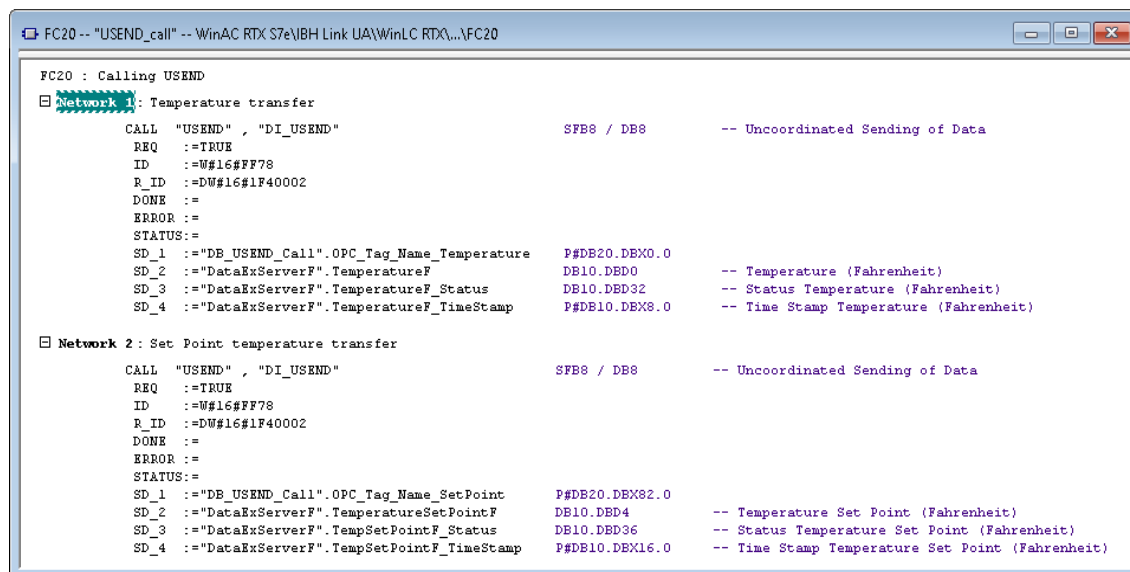
The FC 20 block is called once when the PLC is started and executing OB 100 once. Only those parameters are to be transferred to the PLC that has integrated the block (SFB 8 – USEND).

Note:

The same instance data block (**DB 8 - DI_USEND**) is used for both calls of **SFB 8 - USEND**. This instance data block is only necessary to satisfy the syntax.

Only the SoftPLC in IBH Link UA knows USEND in this form!

Function FC 20 –USEND_call



Instance data block DB8 - USEND_DB

The same instance data block (DB 8 – DI_USEND) is used for both calls of SFB 8 -USEND. This instance data block is only necessary to satisfy the syntax.

Data block DB20 - (DB_USEND_Call)

To complete the data block **DB_USEND_Call [DB20]**, the identifiers of the variables must be copied from the in the **Attributes** window of the **UAExpert** program and assigned to the **STAT** variables as initial values.

TempSetPoint_AirCond1	
Attribute	Value
Nodeid	ns=4;s=CPU 416.CPU 416-3 PN/DP.TempSetPoint_AirCond1
NamespaceIndex	4
IdentifierType	String
Identifier	CPU 416.CPU 416-3 PN/DP.TempSetPoint_AirCond1

Temperature_AirCond1	
Attribute	Value
Nodeid	ns=4;s=CPU 416.CPU 416-3 PN/DP.TempSetPoint_AirCond1
NamespaceIndex	4
IdentifierType	String
Identifier	CPU 416.CPU 416-3 PN/DP.TempSetPoint_AirCond1

Identifier from the Attributes window of the UAExpert program

The top screenshot shows the 'Attributes' window for the variable 'TempSetPoint_AirCond1'. The 'Identifier' field is highlighted in red, and a right-click context menu is open over it, with 'Copy Value' selected. The project tree on the left shows 'CPU 416-3 PN/DP' selected, and 'TempSetPoint_AirCond1' is marked with a red arrow.

The bottom screenshot shows the 'Attributes' window for the variable 'Temperature_AirCond1'. The 'Identifier' field is highlighted in red, and a right-click context menu is open over it, with 'Copy Value' selected. The project tree on the left shows 'Temperature_AirCond1' selected, and 'Temperature_AirCond1' is marked with a red arrow.

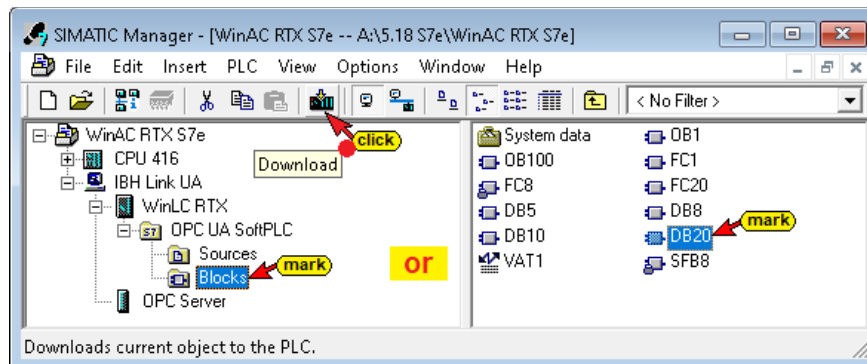
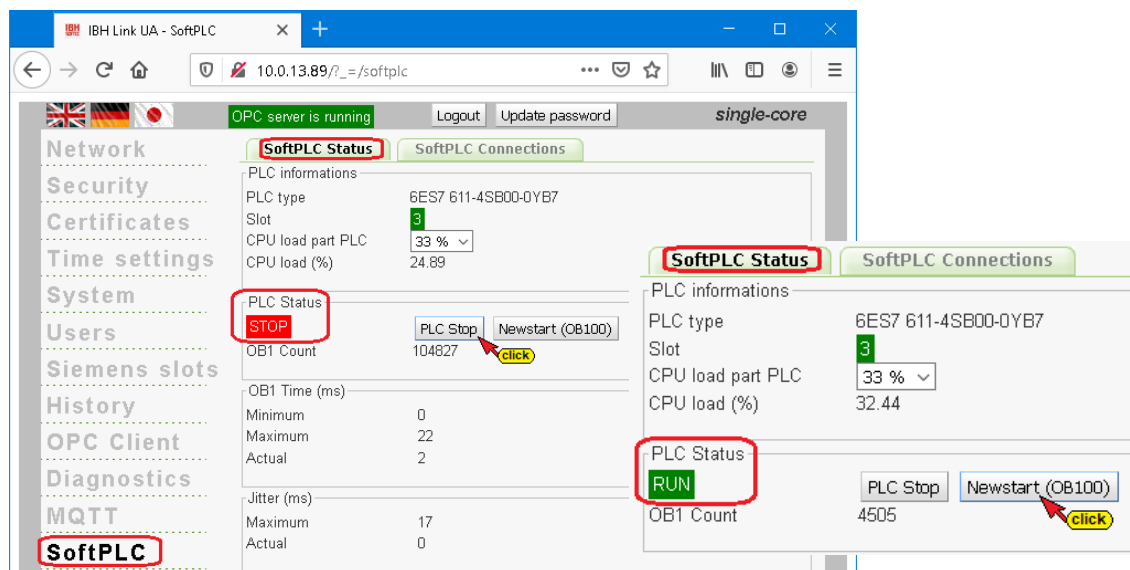
Data block DB20 - (DB_USEND_Call)

Address	Name	Type	Initial value	Comment
0.0		STRUCT		
+0.0	OPC_Tag_Name_Temperature	STRING[254]	'CPU 416.CPU 416-3 PN/DP.Temperature_AirCond1'	
+256.0	OPC_Tag_Name_SetPoint	STRING[254]	'CPU 416.CPU 416-3 PN/DP.TempSetPoint_AirCond1'	
=512.0		END_STRUCT		

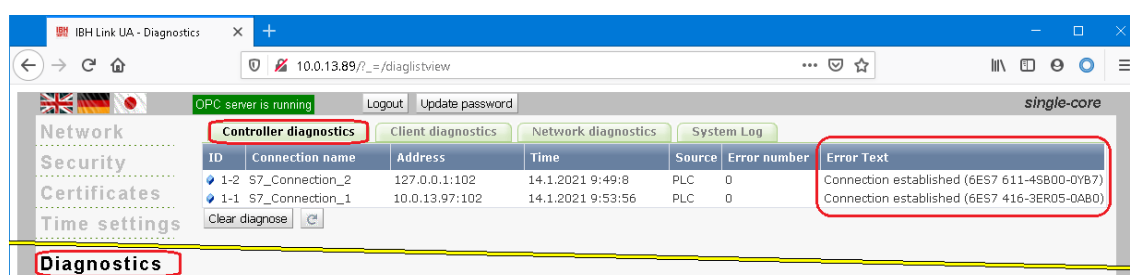
The start value of the pointer is a copy of the **Identifier** from the **Attributes** window of the **UAExpert** program.

ATTENTION!

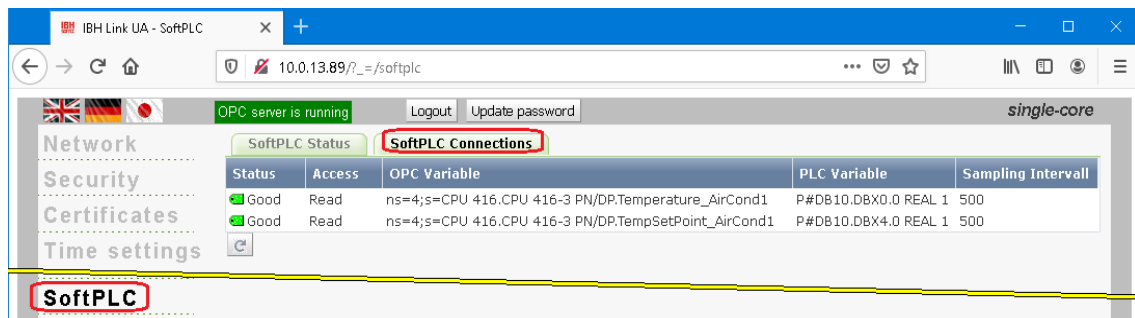
After copying the identifier into the DB20 data block, the block or the entire PLC program must be downloaded into the **WinLC RTX CPU**. After downloading, the operating state of the SoftPLC of the IBH Link UA must be set to **STOP**. Then the SoftPLC must be started again to execute **OB100** calling **FC 20** using the **DB20** data.

WinLC RTX CPU PLC program download**SoftPLC WinLC RTX STOP / START****IBH Link UA diagnosis and SoftPLC displays**

The established connections are displayed in the diagnosis browser window. In the example without errors.



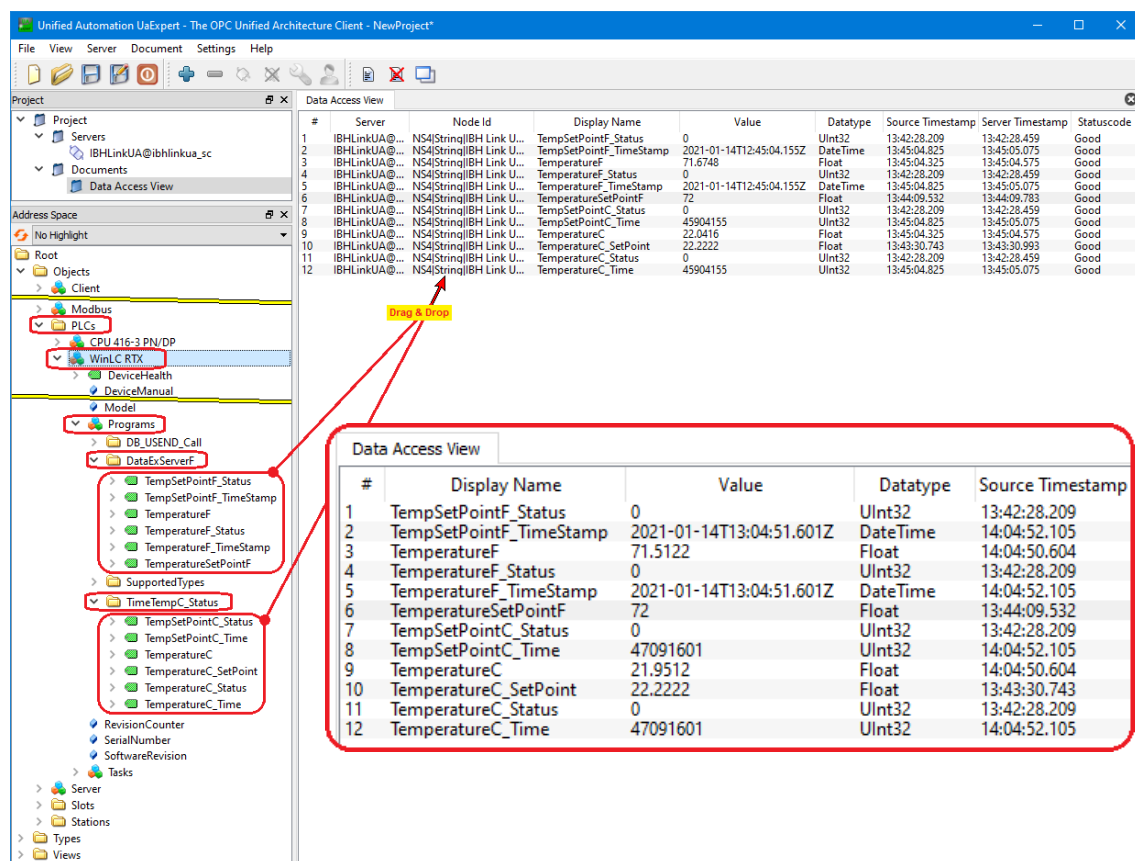
In the browser window SoftPLC / SoftPLC connections the established connections are displayed with additional information.



5.7 UaExpert – Program Window

In the UaExpert program window, the values of the OPC tags of the are displayed under **Data Access View**.

WinAC RTX – SoftPLC-IBH-Link-UA



#	Server	Node Id	Display Name	Value	Datatype
1	IBHLinkUA@ibhlinkua_sc	NS4:String IBH Link UA.WinLC RTX.DataExServerF.TempSetPointF_Status	TempSetPointF_Status	0	UInt32
2	IBHLinkUA@ibhlinkua_sc	NS4:String IBH Link UA.WinLC RTX.DataExServerF.TempSetPointF_TimeStamp	TempSetPointF_TimeStamp	2021-01-14T13:20:22.427Z	DateTime
3	IBHLinkUA@ibhlinkua_sc	NS4:String IBH Link UA.WinLC RTX.DataExServerF.TemperatureF	TemperatureF	71.6748	Float
4	IBHLinkUA@ibhlinkua_sc	NS4:String IBH Link UA.WinLC RTX.DataExServerF.TemperatureF_Status	TemperatureF_Status	0	UInt32
5	IBHLinkUA@ibhlinkua_sc	NS4:String IBH Link UA.WinLC RTX.DataExServerF.TemperatureF_TimeStamp	TemperatureF_TimeStamp	2021-01-14T13:20:22.886Z	DateTime
6	IBHLinkUA@ibhlinkua_sc	NS4:String IBH Link UA.WinLC RTX.DataExServerF.TemperatureSetPointF	TemperatureSetPointF	72	Float
7	IBHLinkUA@ibhlinkua_sc	NS4:String IBH Link UA.WinLC RTX.TimeTempC_Status.TempSetPointC_Status	TempSetPointC_Status	0	UInt32
8	IBHLinkUA@ibhlinkua_sc	NS4:String IBH Link UA.WinLC RTX.TimeTempC_Status.TempSetPointC_Time	TempSetPointC_Time	48022427	UInt32
9	IBHLinkUA@ibhlinkua_sc	NS4:String IBH Link UA.WinLC RTX.TimeTempC_Status.TemperatureC	TemperatureC	22.0416	Float
10	IBHLinkUA@ibhlinkua_sc	NS4:String IBH Link UA.WinLC RTX.TimeTempC_Status.TemperatureC_SetPoint	TemperatureC_SetPoint	22.2222	Float
11	IBHLinkUA@ibhlinkua_sc	NS4:String IBH Link UA.WinLC RTX.TimeTempC_Status.TemperatureC_Status	TemperatureC_Status	0	UInt32
12	IBHLinkUA@ibhlinkua_sc	NS4:String IBH Link UA.WinLC RTX.TimeTempC_Status.TemperatureC_Time	TemperatureC_Time	48022886	UInt32

CPU 416 – WinAC_RTX_Data [DB22]

Unified Automation UaExpert - The OPC Unified Architecture Client - NewProject*

Project Tree:

- Project
 - Servers
 - IBHLinkUA@ibhlinkua_sc
 - Documents
 - Data Access View

Address Space:

- No Highlight
- Root
 - Objects
 - Client
 - DeviceSet
 - MQTT
 - Modbus
 - PLCs
 - CPU 416-3 PN/DP
 - DeviceHealth
 - DeviceManual
 - DeviceRevision
 - GlobalVars
 - TempSetPoint_AirCond1
 - Temperature_AirCond1
 - HardwareRevision
 - Manufacturer
 - Model
 - ParameterSet
 - Programs
 - SupportedTypes
 - WinAC_RTX_Data
 - TempSetPointStatus
 - TempSetPointTimeStamp
 - TempSetPointValue
 - TemperatureStatus
 - TemperatureTimeStamp
 - TemperatureValue
 - RevisionCounter
 - SerialNumber
 - SoftwareRevision
 - Tasks
 - WinLC RTX

Data Access View Table:

#	Server	Node Id	Display Name	Value	Datatype	Source Timestamp	Server Timestamp	Statuscode
1	IBHLinkUA...	NS4[String]CPU 416...	TempSetPoint_AirCond1	72	Float	16:21:37.804	16:21:38.085	Good
2	IBHLinkUA...	NS4[String]CPU 416...	Temperature_AirCond1	72	Float	16:22:20.339	16:22:20.372	Good
3	IBHLinkUA...	NS4[String]CPU 416...	TempSetPointStatus	0	UInt32	16:21:42.373	16:21:43.088	Good
4	IBHLinkUA...	NS4[String]CPU 416...	TempSetPointTimeStamp	55087787	UInt32	16:21:43.663	16:21:44.345	Good
5	IBHLinkUA...	NS4[String]CPU 416...	TempSetPointValue	22.2222	Float	16:21:45.156	16:21:45.846	Good
6	IBHLinkUA...	NS4[String]CPU 416...	TemperatureStatus	0	UInt32	16:21:46.568	16:21:47.347	Good
7	IBHLinkUA...	NS4[String]CPU 416...	TemperatureTimeStamp	55087787	UInt32	16:21:48.442	16:21:49.098	Good
8	IBHLinkUA...	NS4[String]CPU 416...	TemperatureValue	21.8609	Float	16:21:49.800	16:21:50.600	Good

Online display WinAC RTX

The variables provided by the data block are displayed.

Data Block DataExServerF [DB 10]

LAD/STL/FBD - [DB10 -- "DataExServerF" -- WinAC RTX S7e\IBH Link UA\WinLC RTX\...DB10 ONLINE]

Address	Name	Type	Initial value	Actual value	Comment
0.0	TemperatureF	REAL	0.000000e+000	71.6748	Temperature (Fahrenheit)
4.0	TemperatureSetPointF	REAL	0.000000e+000	72.0	Temperature Set Point (Fahrenheit)
8.0	TemperatureF_TimeStamp	DATE_AND_TIME	DT#90-1-1-0:0:0.000	DT#90-1-1-0:0:0.000	Time Stamp Temperature (Fahrenheit)
16.0	TempSetPointF_TimeStamp	DATE_AND_TIME	DT#90-1-1-0:0:0.000	DT#90-1-1-0:0:0.000	Time Stamp Temperature Set Point (Fahrenheit)
24.0	TemperatureF_Status	DWORD	DW#16#0	DW#16#00000000	Status Temperature (Fahrenheit)
28.0	TempSetPointF_Status	DWORD	DW#16#0	DW#16#00000000	Status Temperature Set Point (Fahrenheit)

The data type **DATE_AND_TIME** is not online displayed.

Online display CPU 416

Data Block WinAC_RTX_Data [DB 22]

LAD/STL/FBD - [DB22 -- "WinAC_RTX_Data" -- WinAC RTX S7e\CPU 416\CPU 416-3 PN/DP\...DB22 ONLINE]

Address	Name	Type	Initial value	Actual value	Comment
0.0	TemperatureValue	REAL	0.000000e+000	21.86089	Temperature external OPC UA server
4.0	TempSetPointValue	REAL	0.000000e+000	22.22222	Temperature set point external OPC UA server
8.0	TemperatureTimeStamp	TIME_OF_DAY	TOD#0:0:0.000	TOD#15:18:07.787	Temperature Time Stamp
12.0	TempSetPointTimeStamp	TIME_OF_DAY	TOD#0:0:0.000	TOD#15:18:07.787	Temperature set point Time Stamp
16.0	TemperatureStatus	DWORD	DW#16#0	DW#16#00000000	Status Temperature external OPC UA server
20.0	TempSetPointStatus	DWORD	DW#16#0	DW#16#00000000	Status Temperature set point external OPC UA serve

6 IBH Link UA – Alarms and Conditions

OPC UA has defined the interface between **OPC Clients** and **OPC Servers** in the specification **Alarms and Conditions**.

Servers can report asynchronous alarms to clients registered with the server.

The alarms are triggered via the message blocks of the PLC controllers of the 300 and 400 series. These are the following blocks.

Event		Description	
ALARM_8	SFB34	8 channels, acknowledgeable, no associated values	S7-400
ALARM_8P	SFB35	8 channels, acknowledgeable, up to 10 associated values	S7-400
NOTIFY	SFB36	1 channel, non-acknowledgeable, up to 10 associated values	S7-400
ALARM	SFB33	1 channel, acknowledgeable, up to 10 associated values	S7-400
ALARM_S	SFC18	1 channel, non-acknowledgeable, 1 associated value	S7-400 and S7-300
ALARM_SQ	SFC17	1 channel, acknowledgeable, 1 associated value	S7-400 und S7-300
NOTIFY_8P	SFB31	8 channels, non-acknowledgeable, up to 10 associated values	S7-400
ALARM_DQ	SFC107	1 channel, acknowledgeable, 1 associated value	S7-400 and S7-300
ALARM_D	SFC108	1 channel, non-acknowledgeable, 1 associated value	S7-400 and S7-300

(Source: Programming a Message System for OPC UA Alarms & Conditions with .NET C# for the SIMATIC NET OPC UA Server, Entry ID: 26548467, December 2011)

The programming and parameterization of the Alarms and Conditions is carried out with the Simatic Manager or the TIA portal. The two programming systems manage the message texts and transmit them to the IBH Link UA.

The **SoftPLC** integrated in the **IBH Link UA** also has the alarm-triggering blocks as it is compatible with the S7-400.

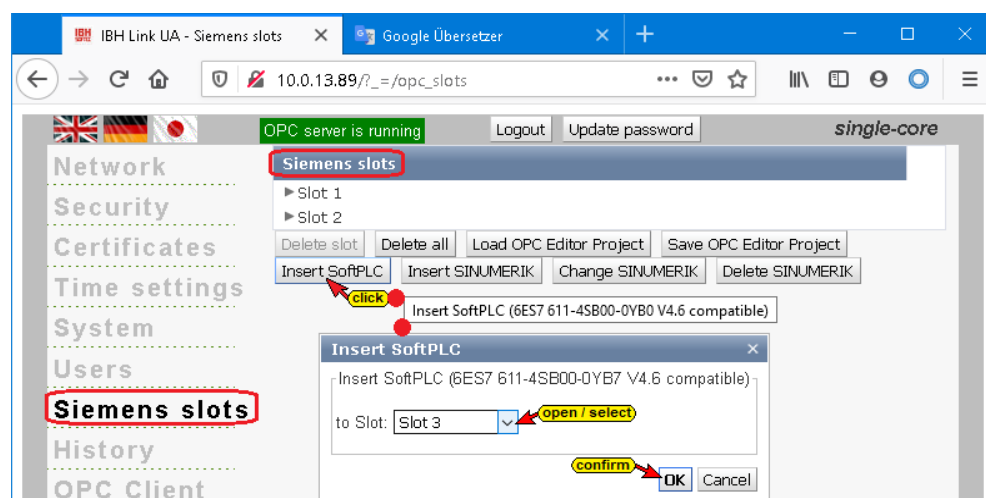
Control systems without Alarm system (SFB / SFC blocks) can also indirectly trigger **Alarms and Conditions** via the integrated SoftPLC.

The SoftPLC reads cyclically the values to be monitored from the connected PLC and triggers **Alarms and Conditions** depending on the programming of the SoftPLC.

Even an existing plant with e.g. an old S5 control system can be upgraded for **Alarms and Conditions**.

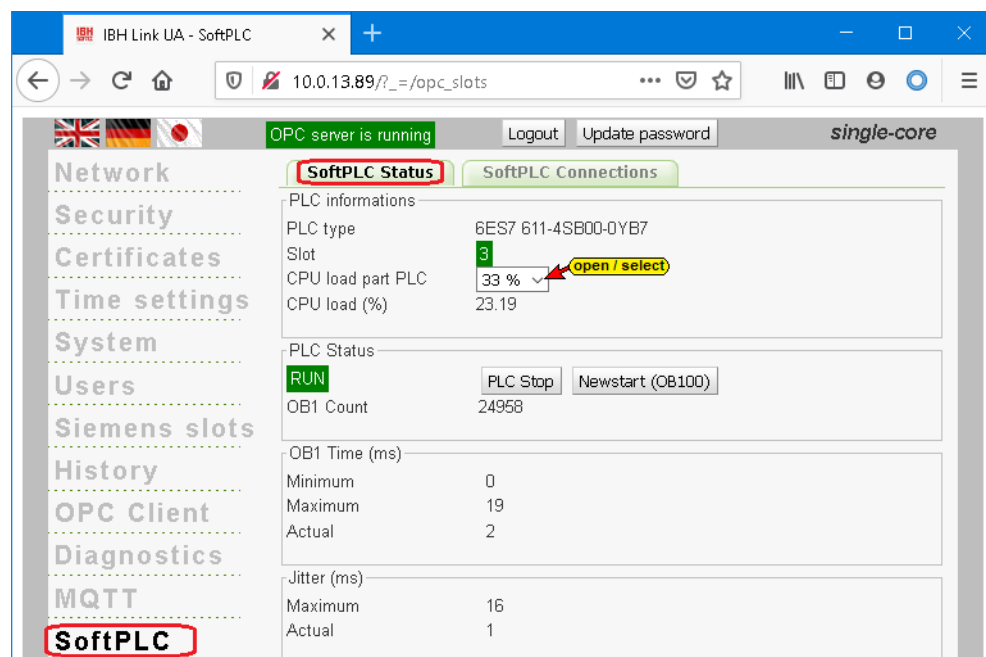
6.1 Activating the integrated SoftPLC

The SoftPLC must be activated via the WEB interface page Siemens Slots of the IBH Link UA.



6.1.1 SoftPLC status and settings

The SoftPLC status is displayed on the WEB interface of the page **Soft PLC** of the IBH Link UA.



6.2 Project with STEP® 7 (SIMATIC Manager V5.6)

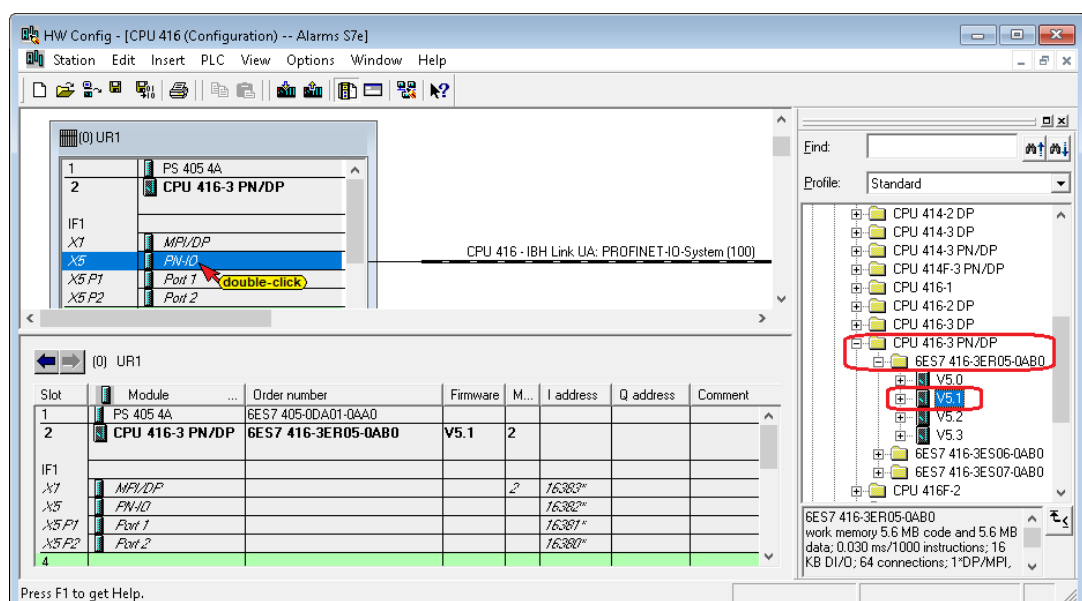
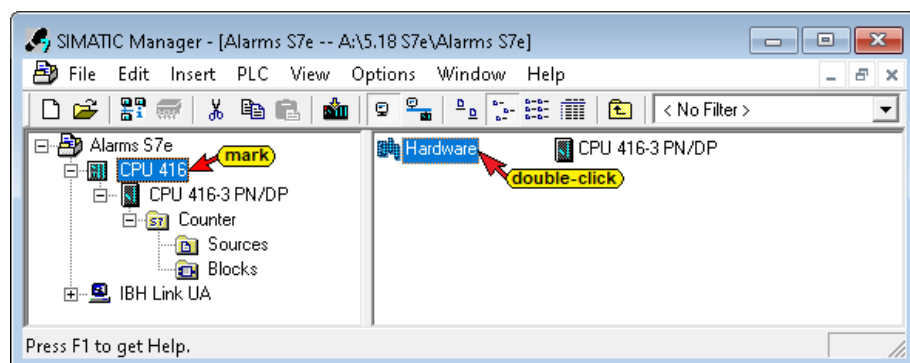
The prepared example project **Alarms S7e** is identical to the PLC program, as described in chapter 1. The counter counts until **MaxValue** is reached (up counting, indicated by the tag **Up**) and counts down until the **MinValue** is reached (down counting, indicated by the tag **Down**). The tag **Value** holds the counter reading of the counter. The SIEMENS PLC programming systems STEP® 7 (SIMATIC Manager V5.6) is used to create the network configuration.



The **SFC 108 "ALARM D"** is used to send the information about the up and down counting to the OPC server for further processing (e.g., visualization).

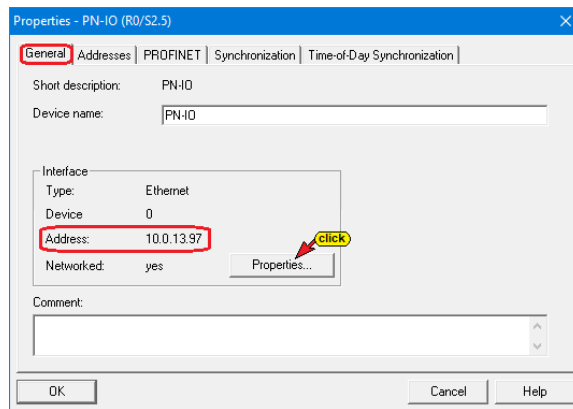
6.2.1 Loading the PLC Program into the CPU 416 program (IBHsoftec SoftPLC 416)

Double-click **Hardware** to open the HW Configuration window.

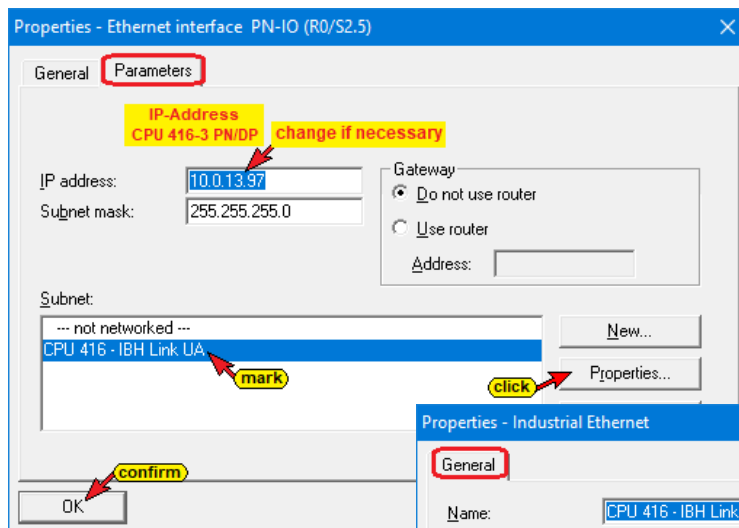


In the example, the **CPU 416-3 PN/DP (6ES7 416-3ER05-0AB0)** firmware version V5.1 is used, which is also available as a software PLC from IBHsofttec.

(R0/S2.5) dialog box

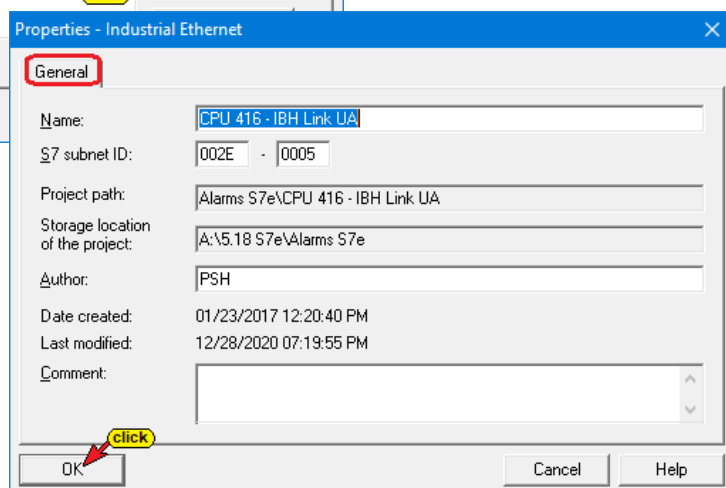


In the dialog box **Properties**, the IP address of the **CPU 416** is displayed. To change the IP address, click the **Properties** button.

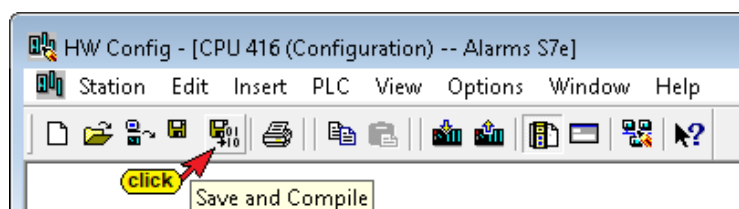


To display more details on the connection (Subnet) mark the subnet name and click the **Properties** button.

To close the dialog boxes, click the **OK** button.



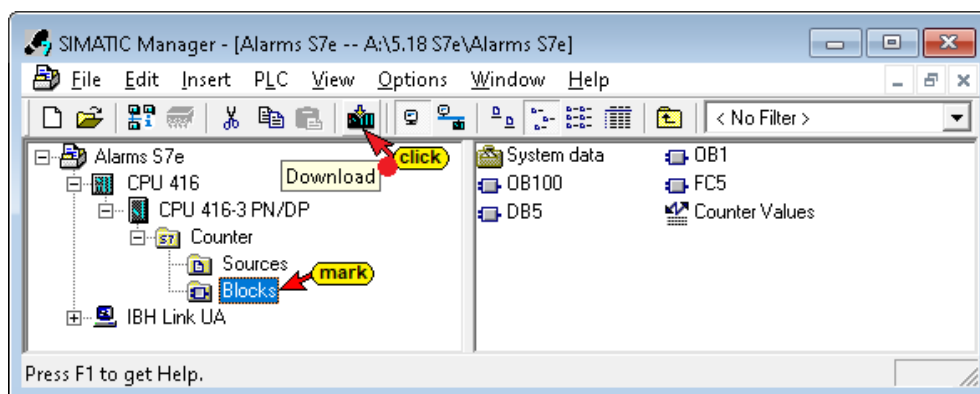
Clicking on the **Save and Compile** icon to save the configuration of the CPU 416.



6.2.2 Download, the PLC program and the System Data to the CPU 416

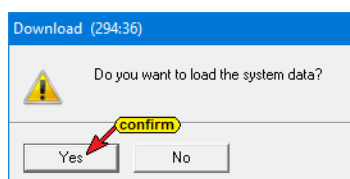
The connection from the PC to the CPU 416-3 PN/DP is made via the Ethernet interface of the PC. The PG/PC interface must be selected accordingly in SIMATIC Manager.

The name of the Ethernet connection may vary depending on the network card used in the PC.



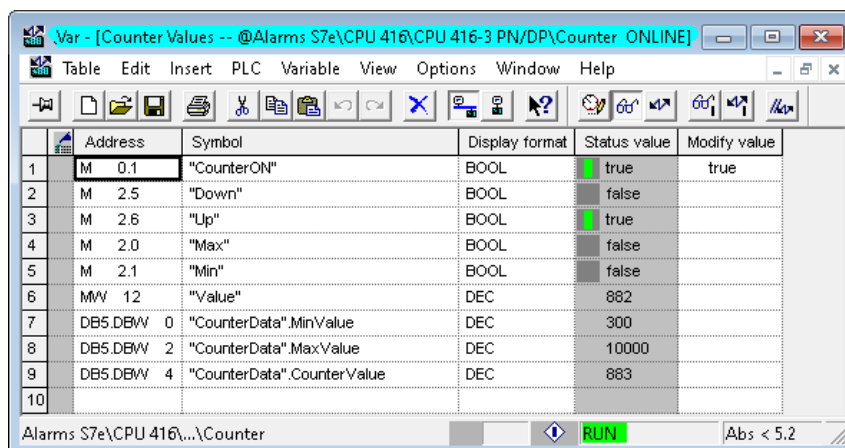
Download System Data

The Hardware configuration of the CPU 416-3 PN/DP is downloaded.



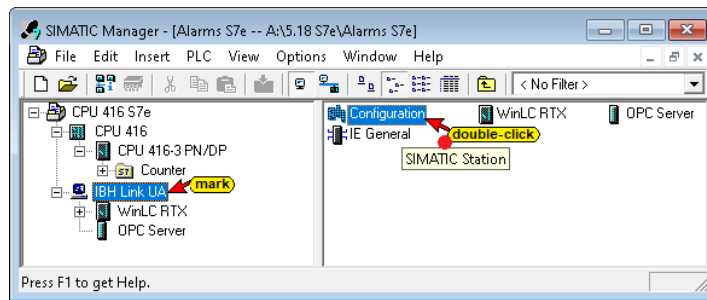
CPU 416-3 PN/DP online

The up and down counting can be checked online.



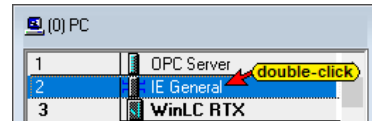
6.2.3 IBH Link UA as SIMATIC PC station

Mark the **IBH Link UA** station and double-click **Configuration** to open the hardware configuration window.

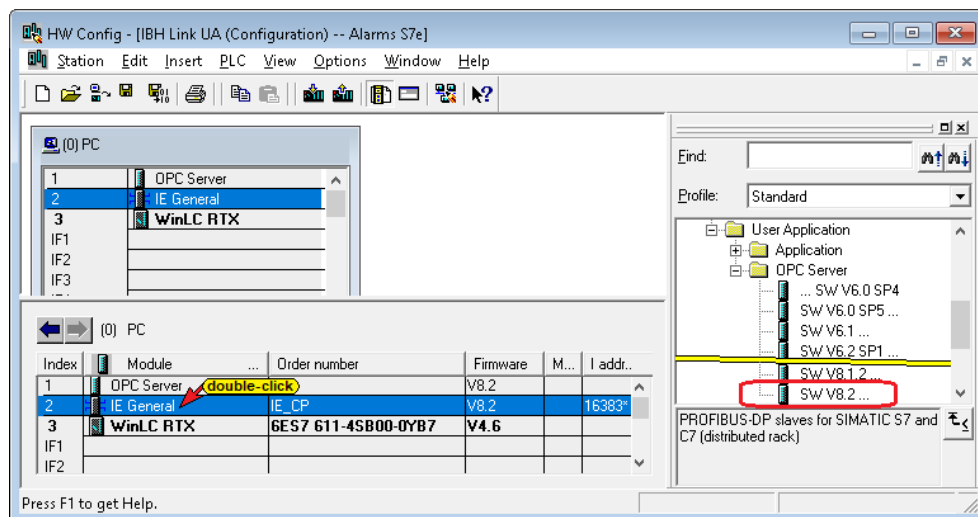


Configuration IBH Link UA (SIMATIC PC Station)

Double-click the name of the CP Industrial Ethernet interface **IE General** **IBH** to open the **Properties** dialog box.



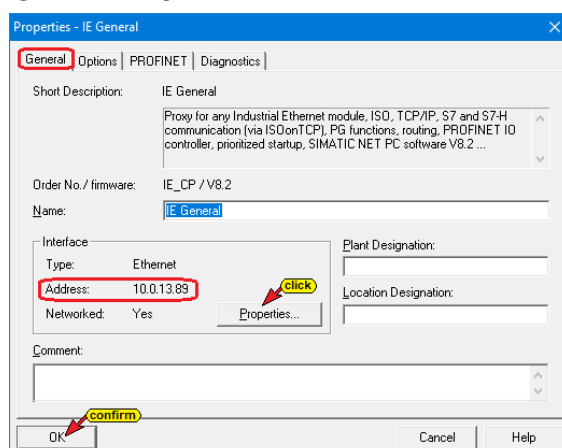
In the dialog box **Properties**, the IP address of the IBH Link UA is displayed. To change the IP address, click the **Properties** button.



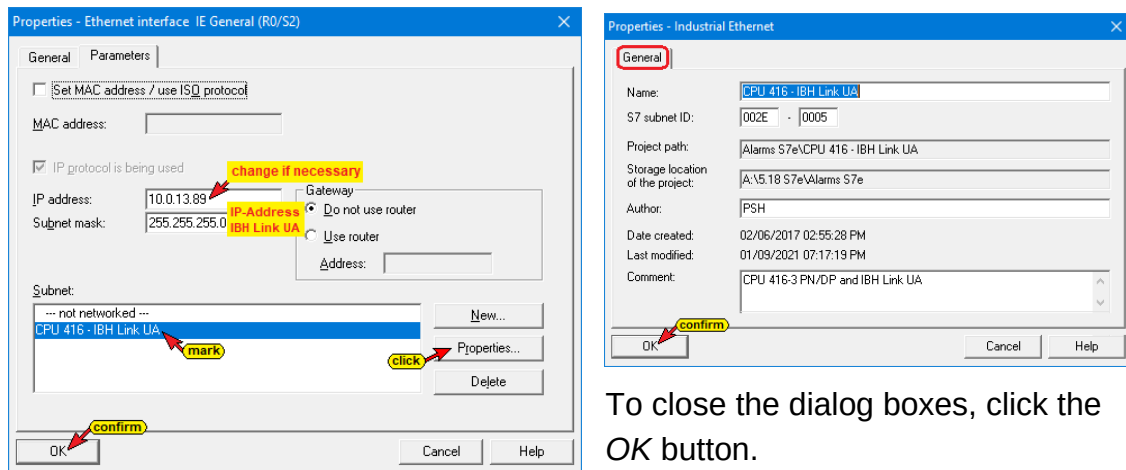
Note:

The Siemens **OPC Server SW V8.2...** and the CP Industrial Ethernet interface **IE General SW V8.2...** are available in the hardware catalogs of **STEP7 SIMATIC Manager** and the **TIA Portal**.

Dialog box Properties - Ethernet interface IE General (R0/S2)

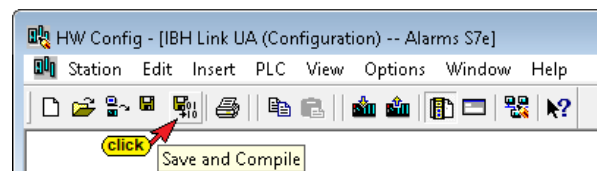


To display more details on the connection (Subnet) mark the subnet name and click the **Properties** button.



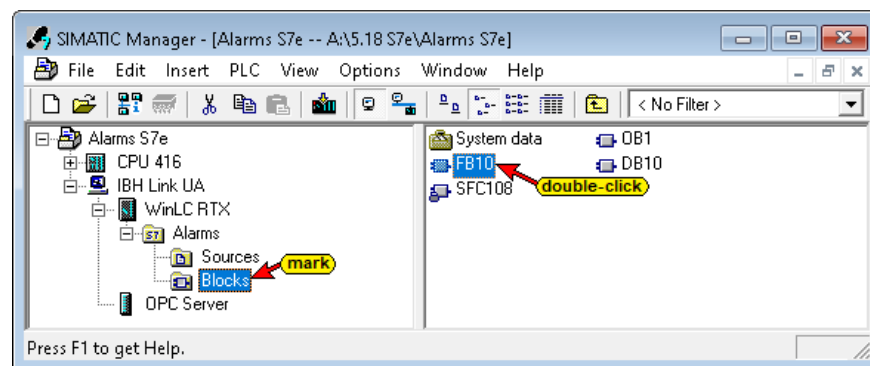
To close the dialog boxes, click the **OK** button.

Clicking on the **Save and Compile** icon to save the configuration of the **IBH Link UA**.



6.2.4 IBH Link UA SoftPLC WinAC – PLC Program

Double-click to open the PLC block **FB 10 [CounterEvaluation]**.



In this block, the block **ALARM D** (SFC 108) is called twice for transferring messages.

The signals **High** and **Low** are used to trigger the transfer of the messages.

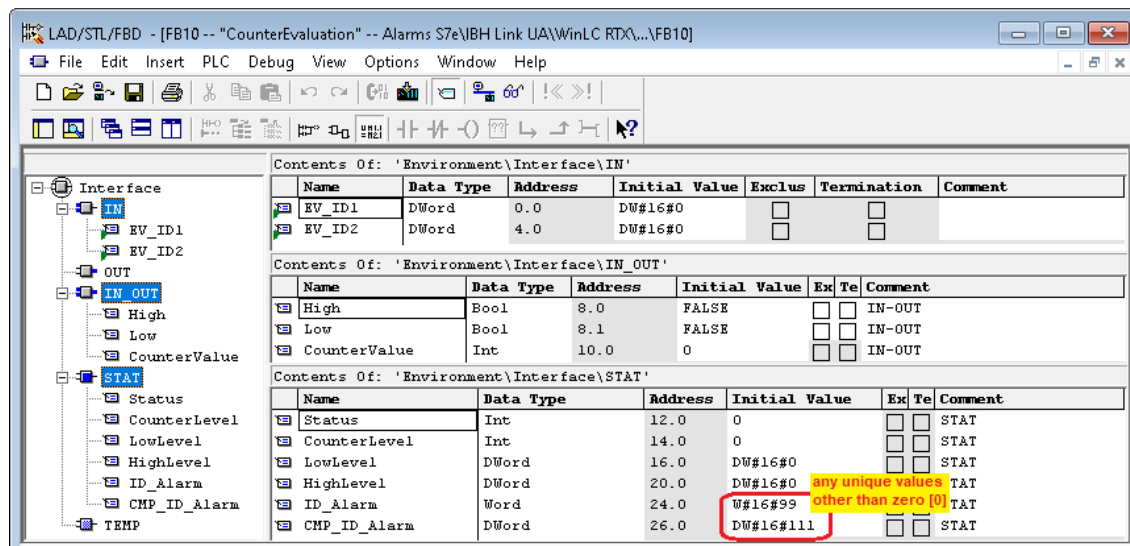
ALARM D (SFC 108) Parameters

The following table shows the parameters of the instruction "ALARM_D":

Parameter	Declaration	Data type	Memory area	Description
SIG	INPUT	BOOL	I, Q, M, D, L	The alarm triggering signal
ID	INPUT	WORD	I, Q, M, D, L or constant	Data channel for alarms: W#16#EEEE

Parameter	Declaration	Data type	Memory area	Description
EV_ID	INPUT	DWORD	I, Q, M, D, L	Alarm number (not allowed: 0)
CMP_ID	INPUT	DWORD	I, Q, M, D, L or constant	component identifier (not permitted: 0) ID for the subsystem to which the corresponding alarm is assigned Recommended values: - Low word: 1 to 65535 - High word: 0 You will not have any problems with the SIEMENS program package if you comply with these recommendations.
SD	INPUT	ANY	I, Q, M, D, T, C	Associated value Maximum length: 12 bytes Only the BOOL data types are permitted (not permitted: bit array), BYTE, CHAR, WORD, INT, DWORD, DINT, REAL, DATE, TOD, TIME, S5TIME, DATE AND TIME
RET_VAL	OUTPUT	INT	I, Q, M, D, L	Error Information

PLC block FB 10 [CounterEvaluation]

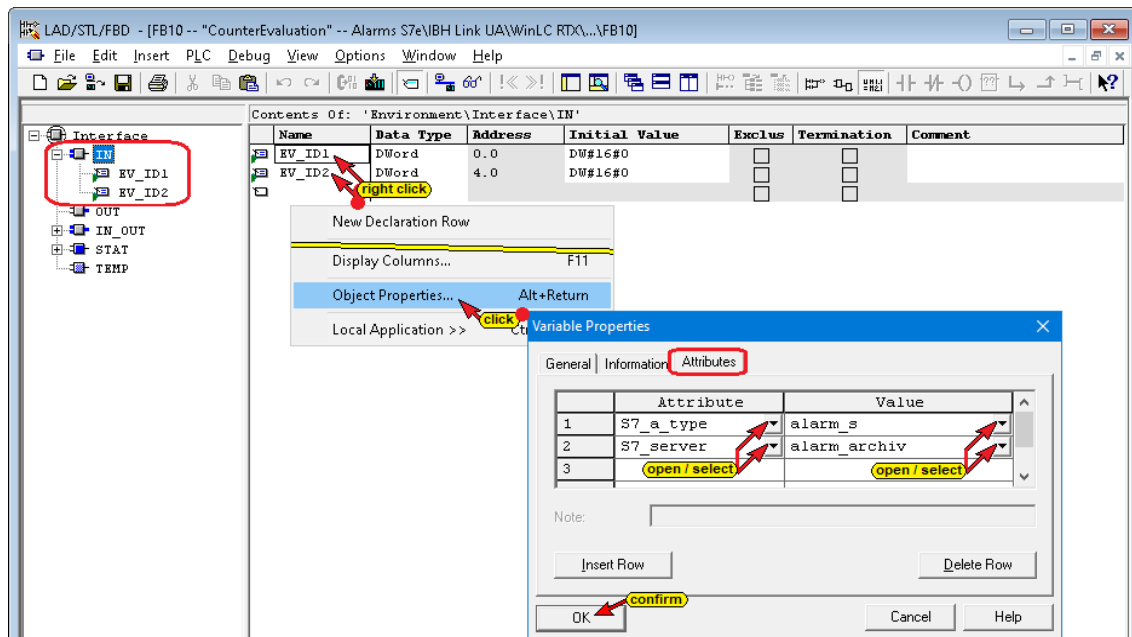


Define the object properties of the IN parameters for alarms

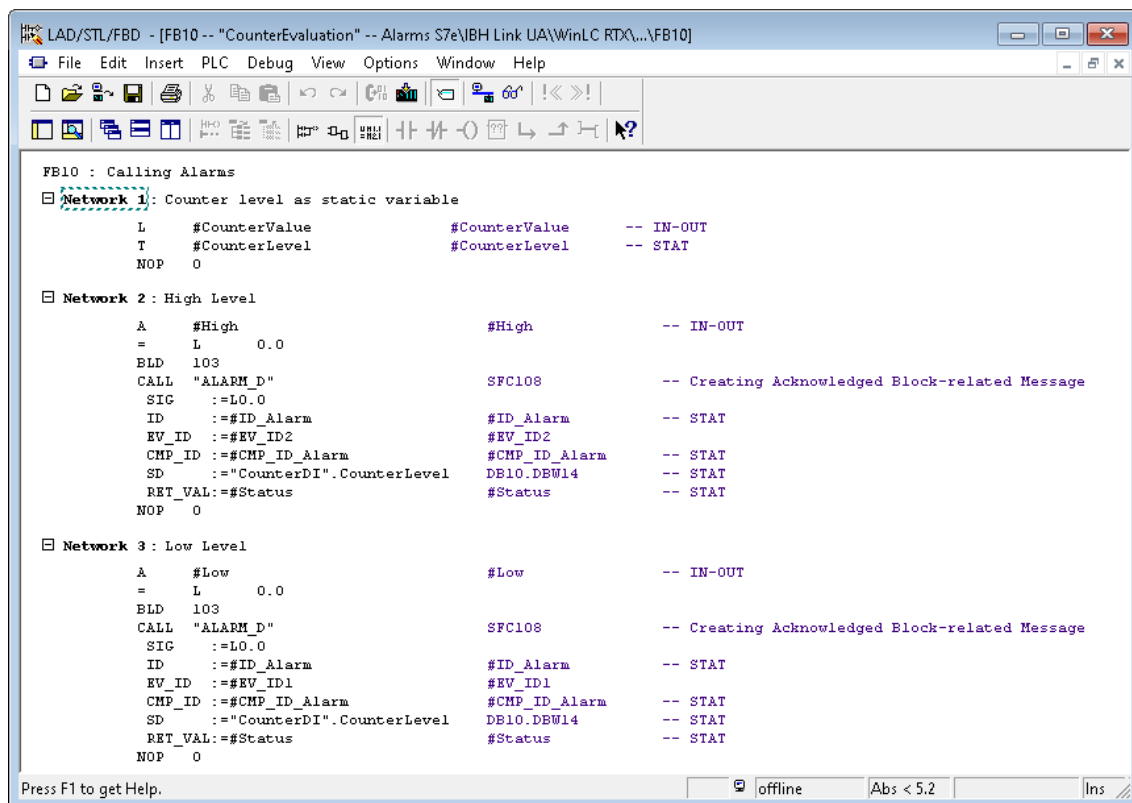
The IN parameters of the Function block **FB 10 [CounterEvaluation]** must be inserted as an attribute:

- S7_a_type = alarm_s
- S7_server = alarm_archive

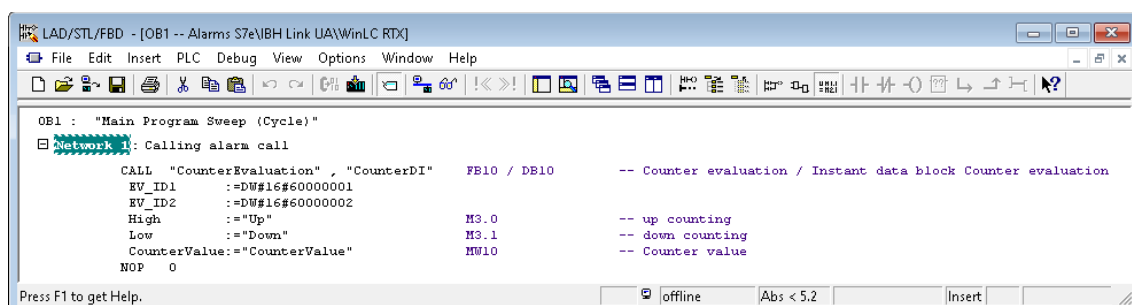
The attributes must be assigned so that messages can be assigned to the IN parameters.



Function block FB 10 [CounterEvaluation] – Networks



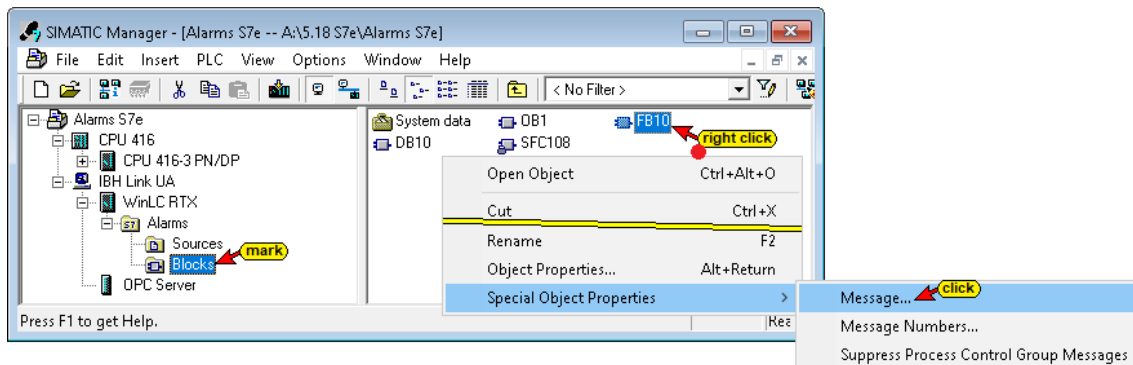
Organization Block Main [OB1]



The function block **FB 10 [CounterEvaluation]** with the instance data block **DB10 [CounterDI]** is called with the PLC messages of the **Data type C_Alarms_s** in the organization block OB 1.

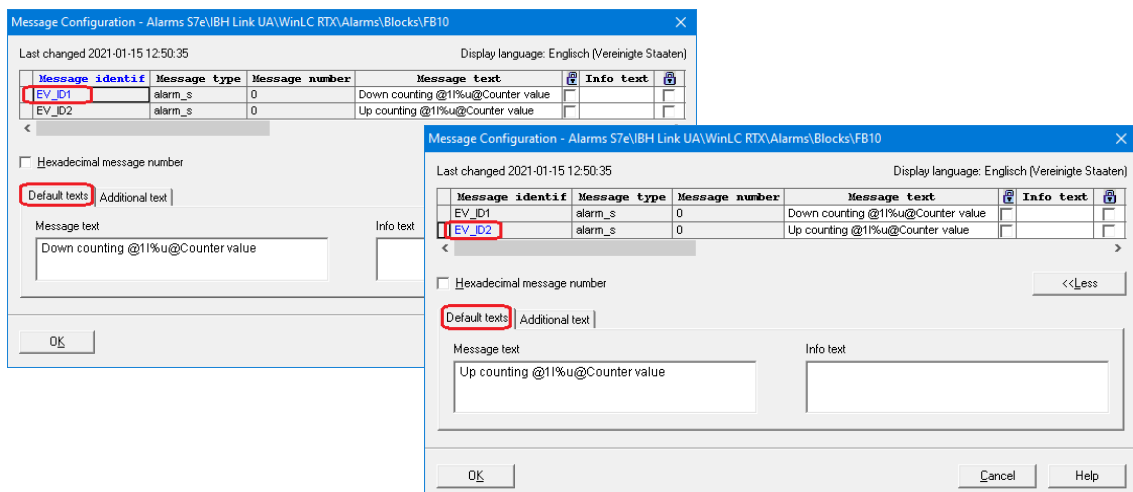
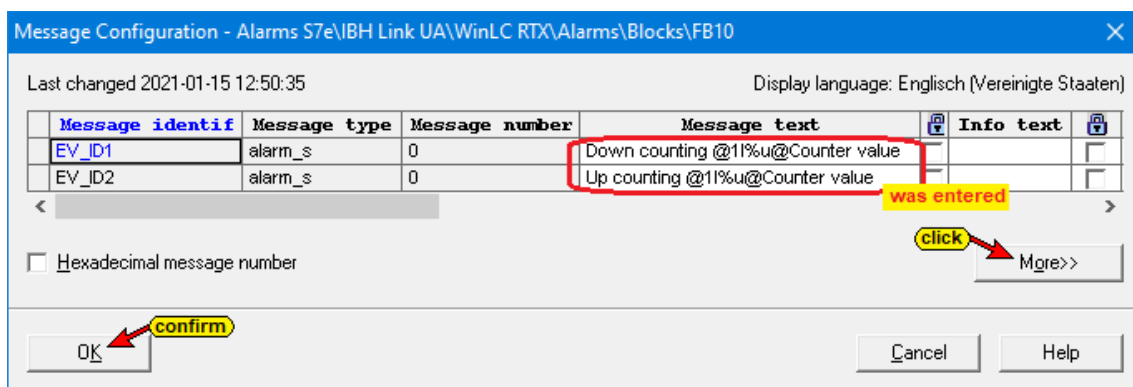
6.2.5 PLC message text configuration

Right-click on **FB10** to open the context menu. To open the Message configuration dialog box, activate the **Special Object Properties / Message ...** command.



Structure of associated values (message text)

Only the message text for the message identifiers **EV_ID1** and **EV_ID2** were entered in the message configuration. Everything else is preset automatically



Structure of associated values in alarms

Format specification

The format starts with the character "%". The alarm texts have the following fixed formats:

Format	Description
%[i]X	Hexadecimal number with i digits
%[i]u	Decimal number without sign with i digits
%[i]d	Decimal number with sign with i digits
%[i]b	Binary number with i digits
%[i][y]f	Floating-point number with sign with y digits after the decimal point and total number of digits i
%[i]s	String (ANSI string) with i digits Characters are printed up to the first 0 Byte (00Hex).
%t#<Name of the text list>	Access to text list

- If the number of digits [i] is too small, the value is still output in full length.
- If the number of digits [i] is too large, an appropriate number of fill characters is output before the value.

Element type

This uniquely configures the data type of the associated value:

Elements type	Data type
Y	BYTE
W	WORD
X	DWORD
I	Integer
D	DINT
B	BOOL
C	CHAR
R	REAL

Example:

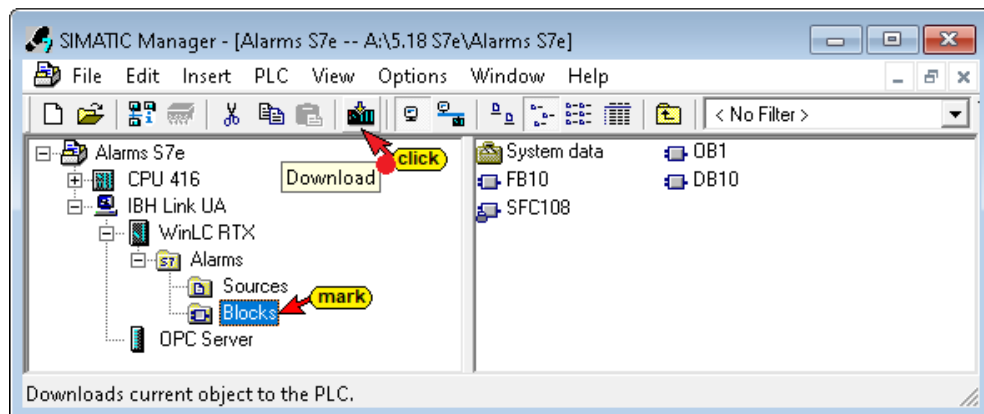
Alarm text:

Message text
Down counting @11%u@Counter value
Up counting @11%u@Counter value

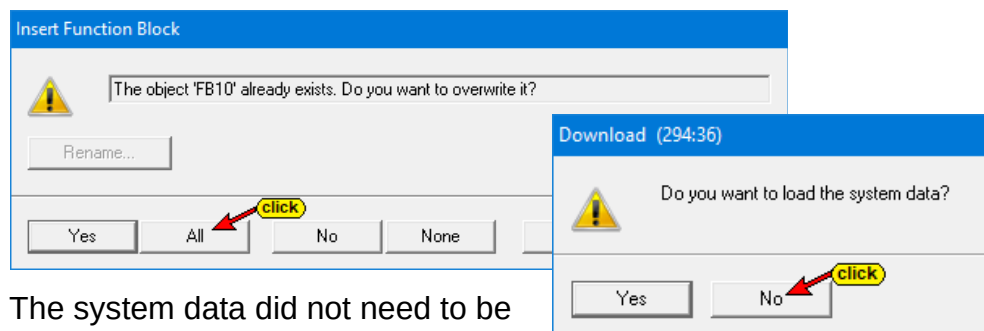
Output on the display:

Message
Up counting 421 Counter value
Down counting 2994 Counter value

6.2.6 Load PLC blocks into the SoftPLC of the IBH Link UA (WinLC RTX)



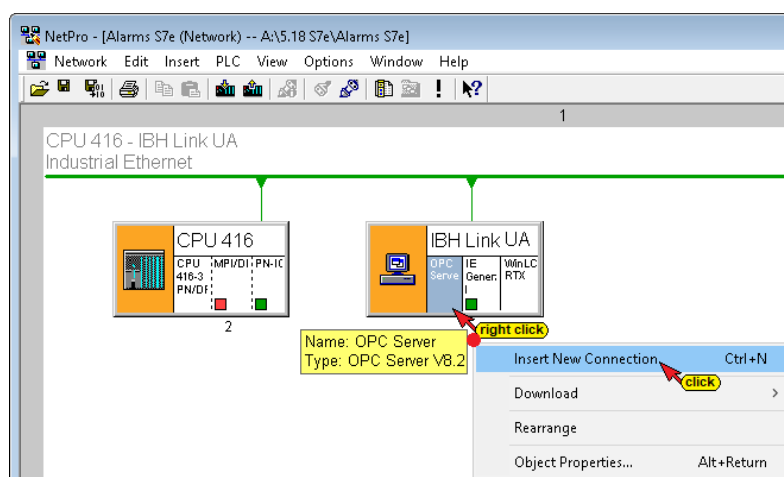
All blocks were transferred, existing blocks were overwritten.



The system data did not need to be transferred.

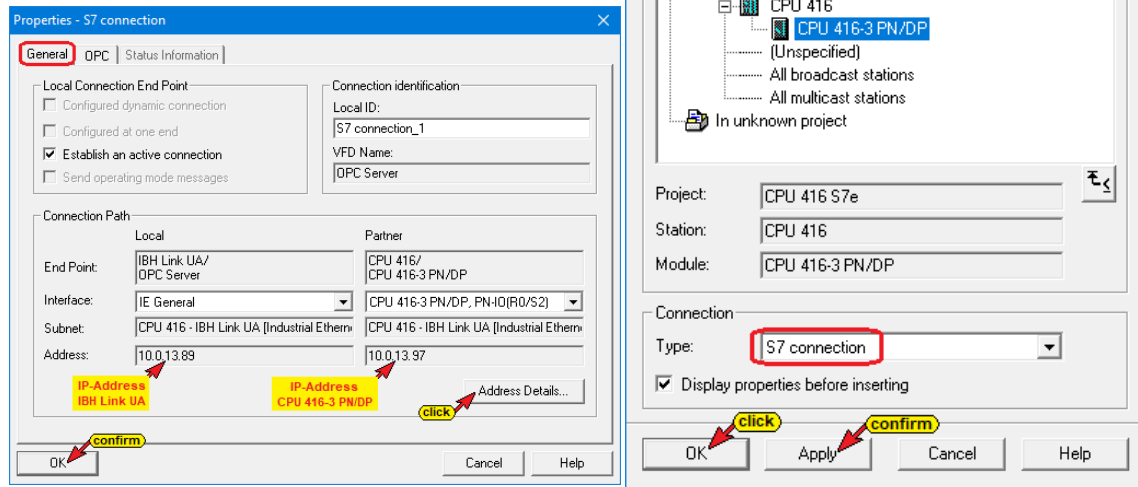
6.3 Connection CPU-416 – OPC Server (IBH Link UA)

The following steps were used to establish an S7 connection between the CPU 416 and the IBH Link UA.



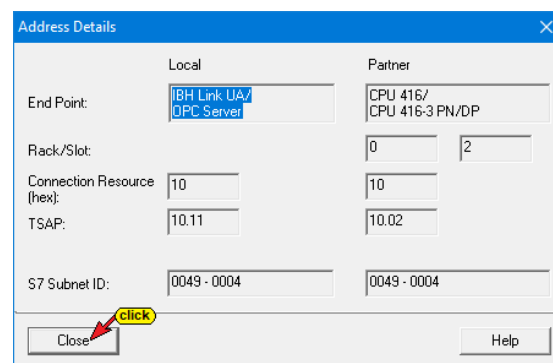
Right-click **OPC-Server** and click **Insert New connection** to open the **Insert New connection** dialog box.

Click **OK** to display more information on the S7 connection.

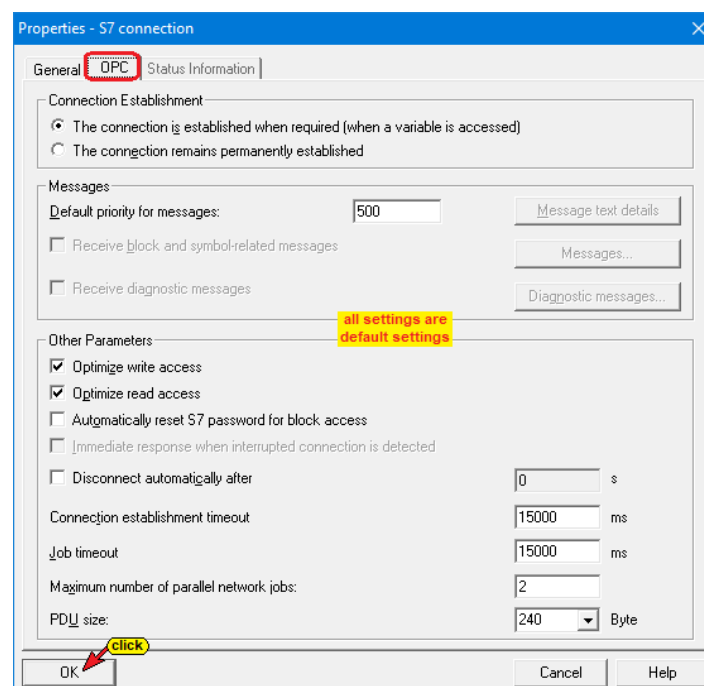


Click the **Apply** for confirmation.

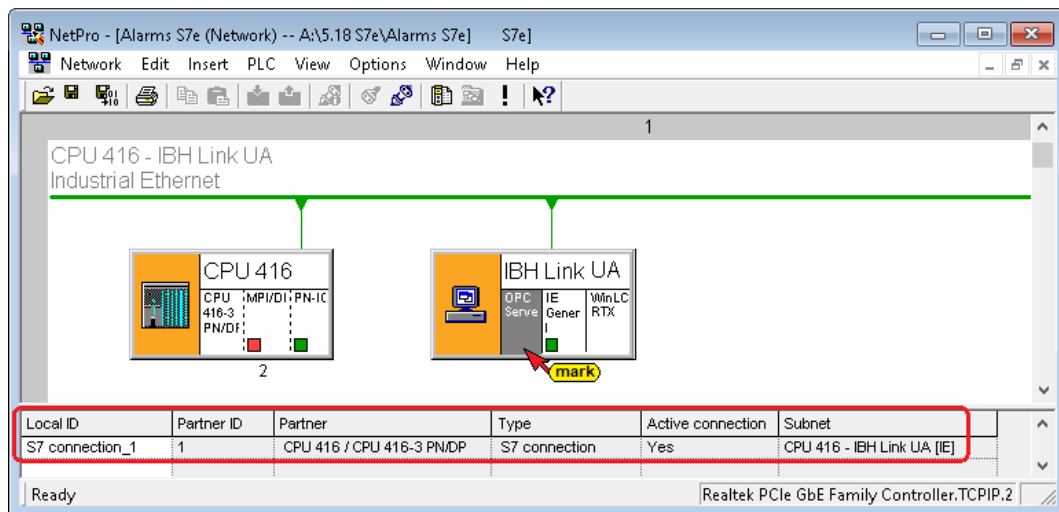
Address Details can be displayed by clicking the button.



The tab **OPC** of the dialog box **Object Properties - S7 connection_1**, tab **OPC** displays further details on the connection.

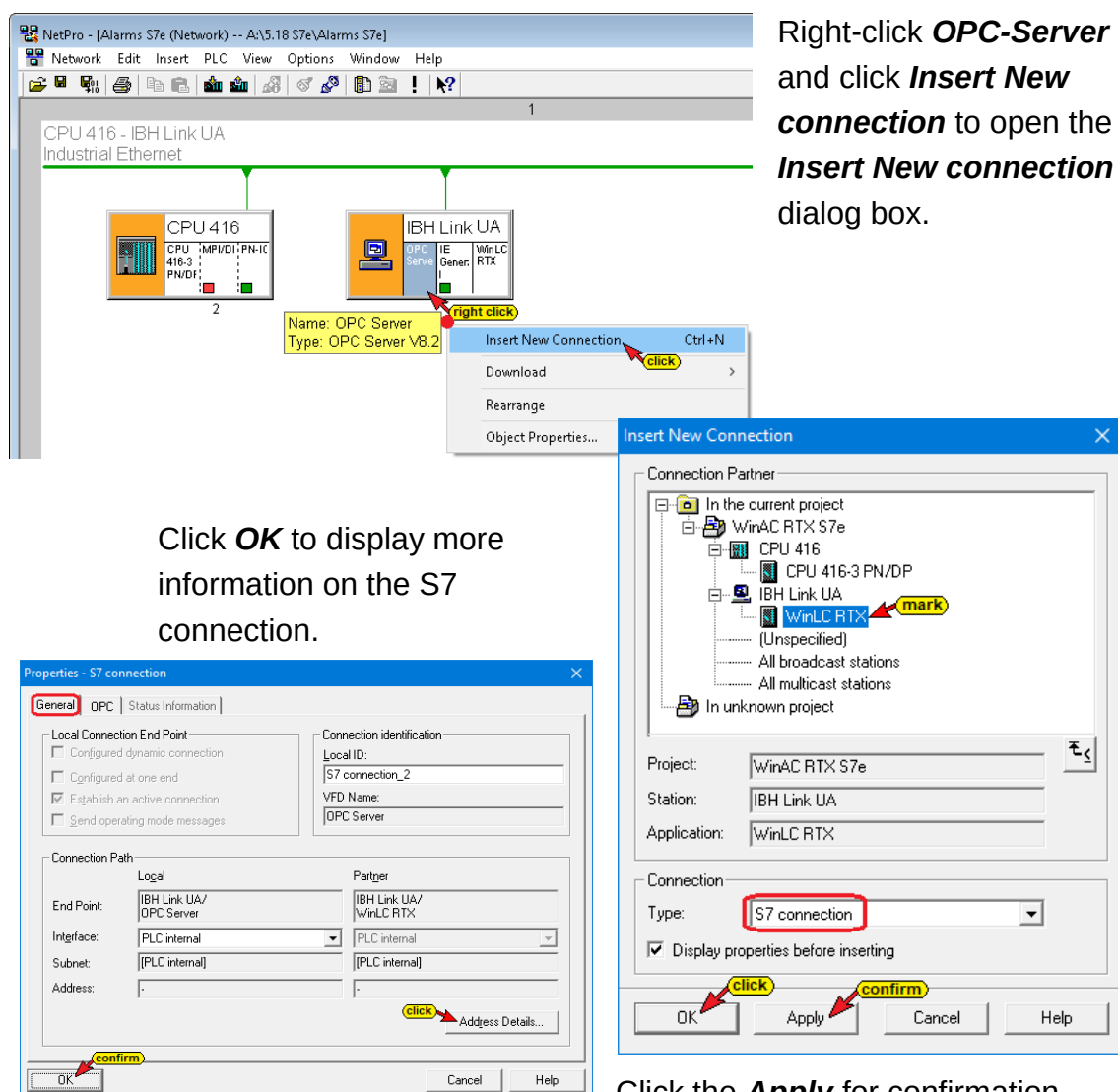


The established **S7 connection** between the **CPU 416** and the **IBH Link UA** is displayed.

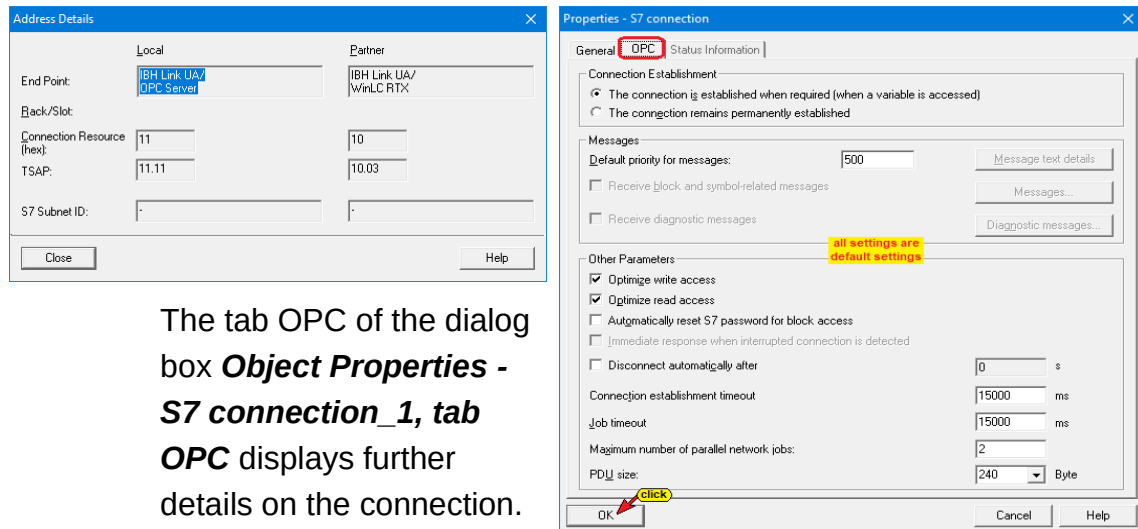


Connecting the WinLC RTX with the OPC Server (IBH Link UA)

Using the following steps, an S7 connection is established between the WinLC RTX and the OPC Server / IBH Link UA.

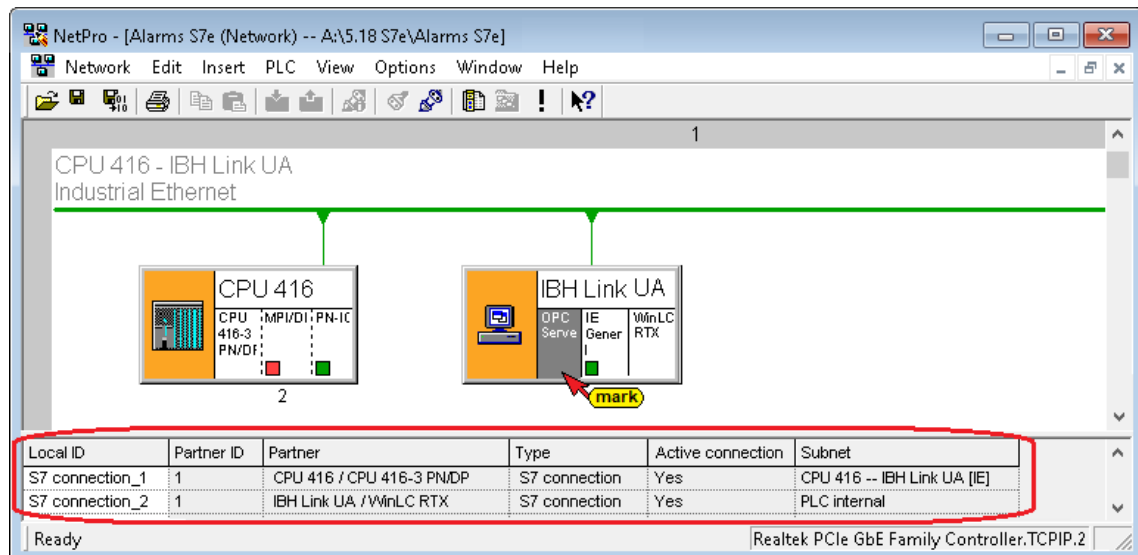


Address Details can be displayed by clicking the button.



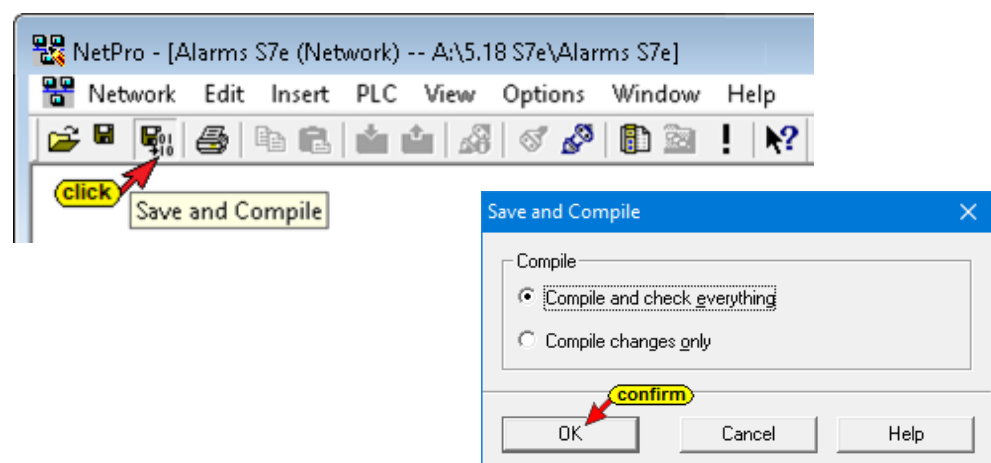
The tab **OPC** of the dialog box **Object Properties - S7 connection_1, tab OPC** displays further details on the connection.

The established **S7 connections** between the **CPU 416**, the **Soft PLC WinLC RTX**, and the **IBH Link UA** is displayed.

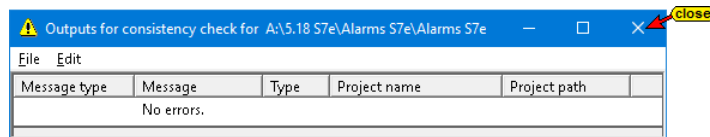


NetPro – Alarms S7e (Network) window

Clicking on the **Save and Compile** icon to save the configuration of the **CPU 416**, the **Soft PLC WinLC RTX**, and **IBH Link UA**.

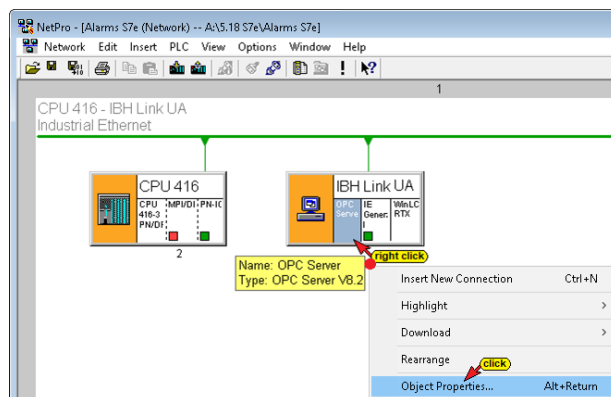


The successful compiling and saving are displayed.

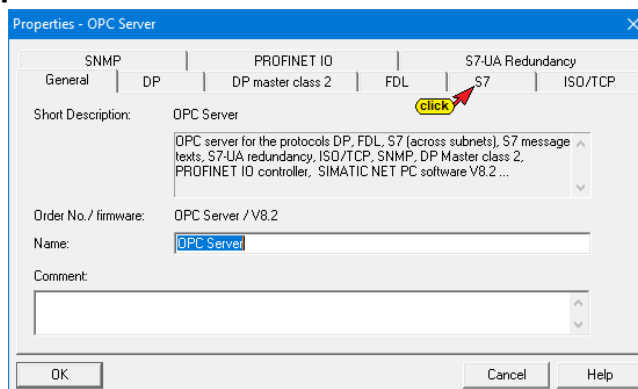


6.3.1 Select the symbols to be used (OPC tags)

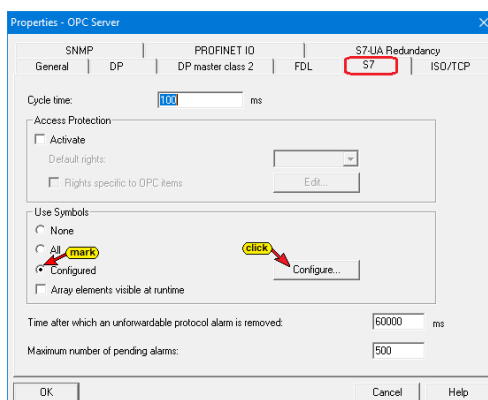
Right-click **OPC-Server** and click **Object Properties** to open the **Properties – OPC Server** dialog box.



Properties - OPC Server



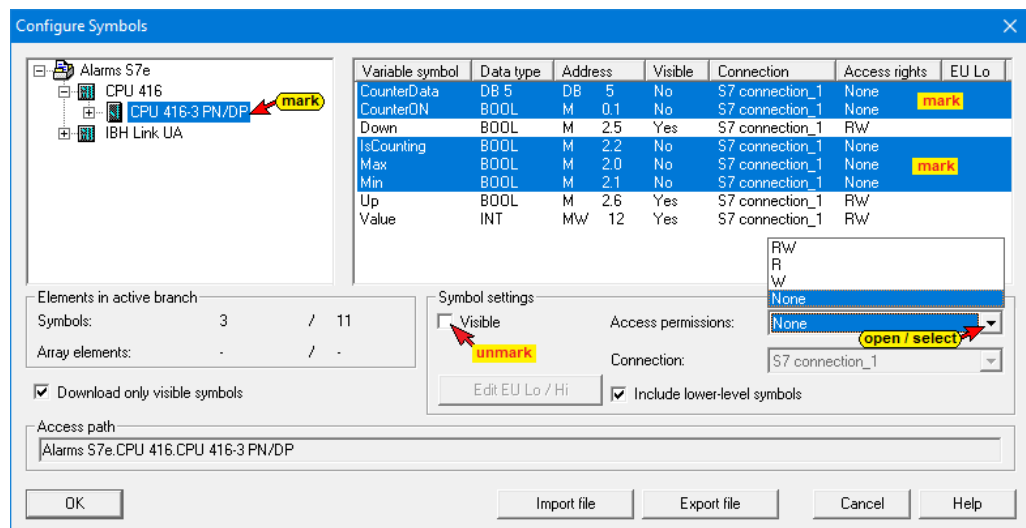
The **tab S7** defines the symbols (OPC tags) to be used.



Mark **Configured** and click the **Configure...** button.

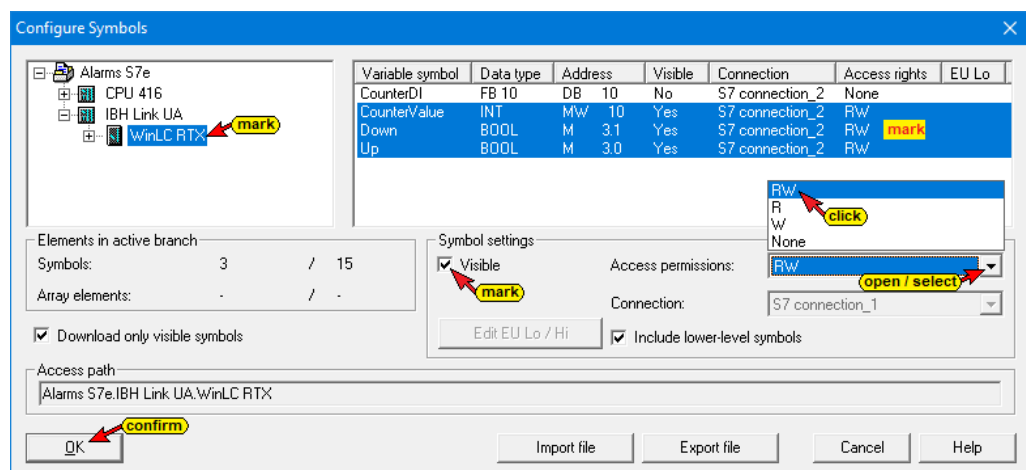
Global Variable (OPC tags) CPU 416-3 PN/DP

The global variables **Down**, **Up** and **Value** are used as OPC tags. The other global variables and the data block **CounterData [DB5]** are not used as OPC tags.



Global Variable (OPC tags) WinLC RTX (IBH Link UA SoftPLC)

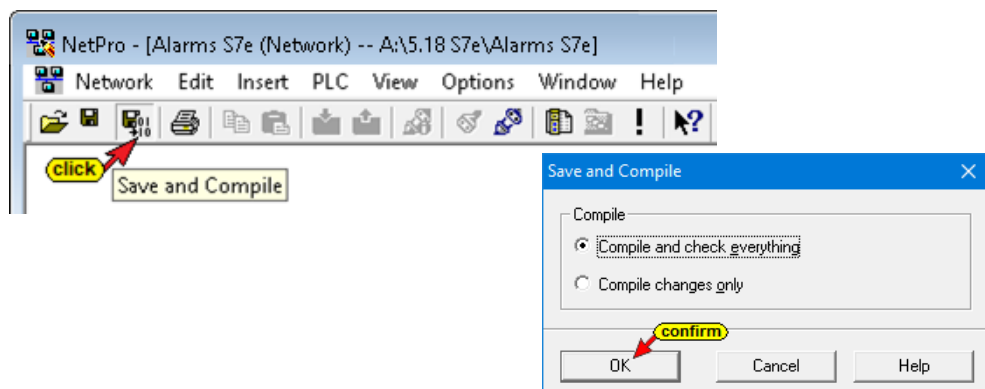
The global variables **CounterValue**, **Down**, and **Up** are used as OPC tags. The data block **CounterDI [DB10]** is not used as OPC tags.



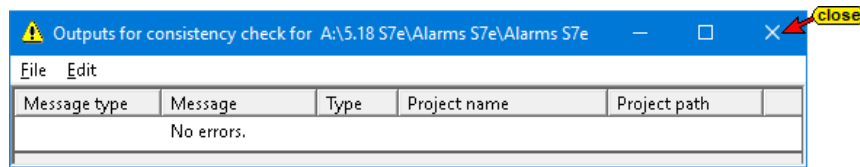
Click the **OK** buttons to close the **Configure Symbols** and the **Properties - OPC Server** dialog boxes.

NetPro – Alarms S7e (Network) window

Clicking on the **Save and Compile** icon to save the configuration of the **CPU 416** and **IBH Link UA**.



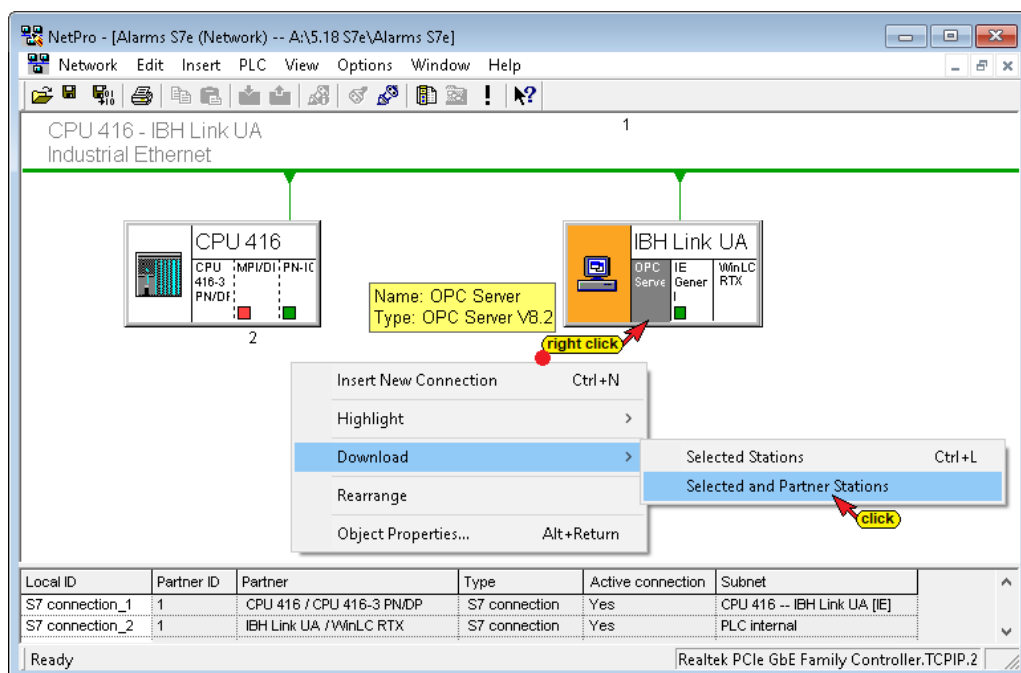
The successful compiling and saving are displayed.



Download the configuration of the **CPU 416** and **IBH Link UA**.

If no error was found with save and compile, the configuration can be loaded into the stations.

Right-click **OPC-Server** and click **Download / Selected and Partner Stations**.



Several information must be confirmed to complete the download.

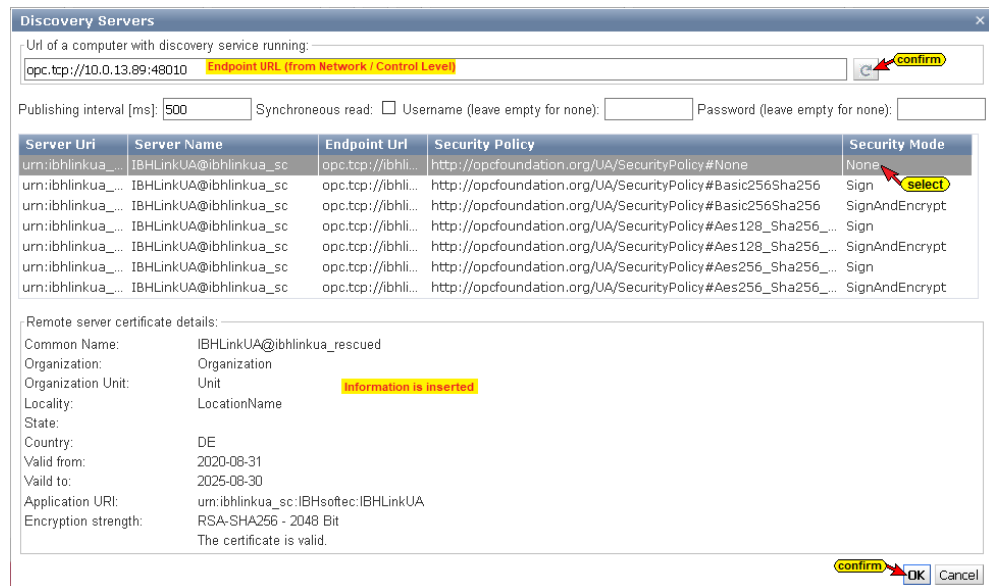
6.4 Create OPC clients in IBH Link UA

In the IBH Link UA web browser window / OPC client, enter the IBH Link UA as OPC client with the **security mode None**.

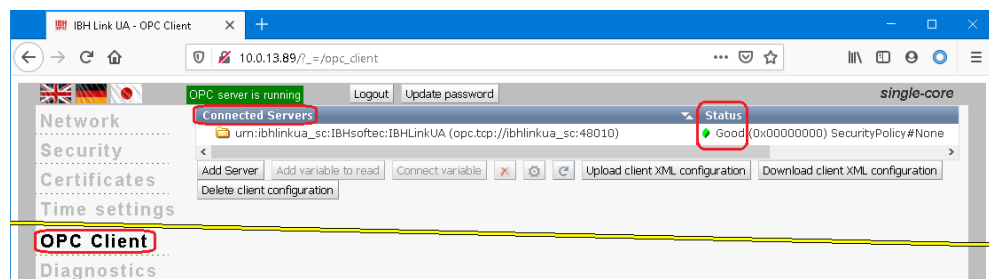
Add server

The **IBH Link UA** is set as the server. The copied Network/Control Level Endpoint URL **opc.tcp: //10.0.13.89: 48010** were entered in the open field in the IBH Link UA web browser window OPC client Connected Servers.

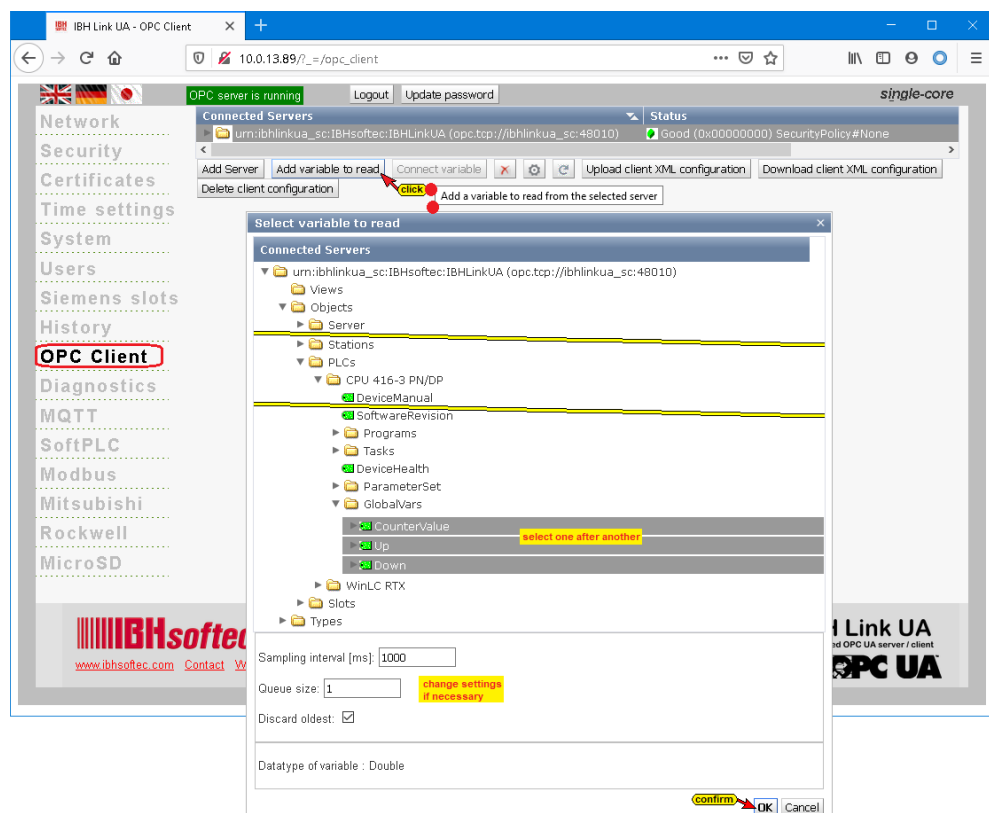
Security Policy None and **Security Mode None** were selected for data transmission.



The IBH Link UA OPC UA server is connected. The status of the server is good. None was selected as the security policy for the server.

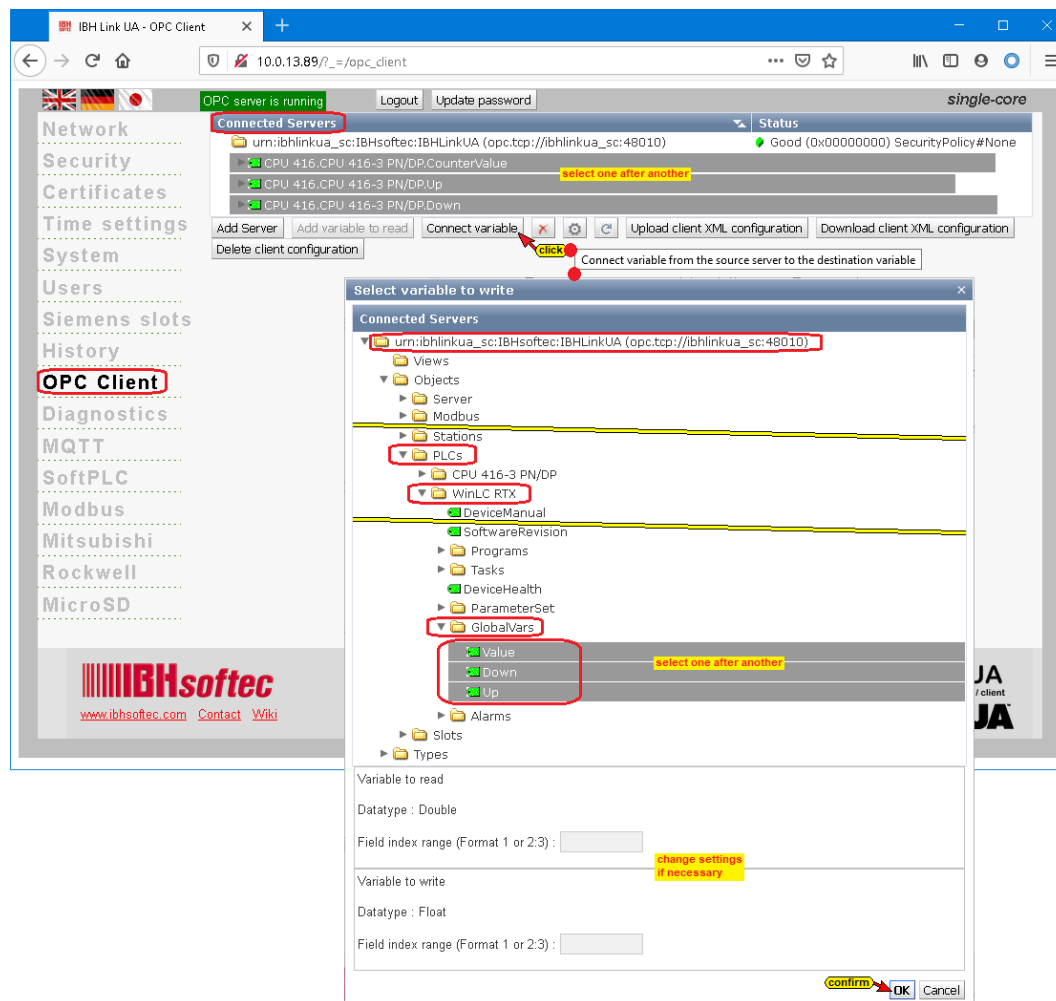


Add variable to read – CPU 416



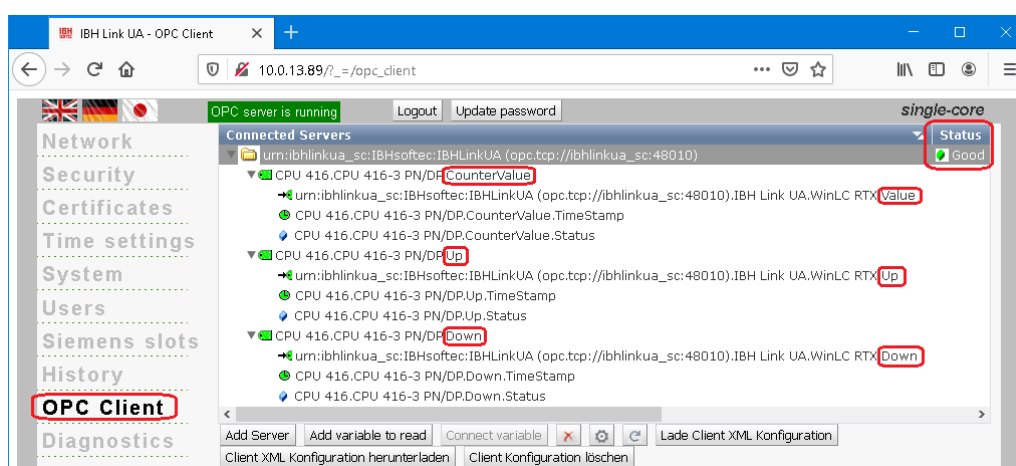
The variables **CounterValue**, **Up** and **Down** are declared as read variables. The **OPC UA client** in the **IBH Link UA** reads this data.

Connect Global Variable – WinLC RTX (IBH Link UA SoftPLC)



The variables **CounterValue**, **Up** and **Down** are, which have been declared as read variables, are connected to the IBH Link UA OPC server, which then sends them to the **WinLC RTX** (IBH Link UA SoftPLC) **Value**, **Down** and **Up**.

Inserted connection with variables



Note:

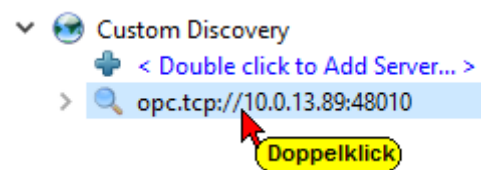
The messages from the **Alarm Block** calls are sent immediately by the alarm-triggering PLC to the OPC UA server.

6.5 UaExpert - program window - connection to Set up IBH Link UA OPC server

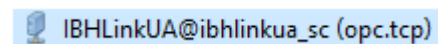
Clicking on the Plus icon opens the **AddServer** dialog box in **UaExpert**.



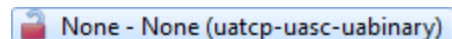
With a double-click on the **Endpoint URL** the name of the OPC server (host name) is displayed with its **Endpoint URL**.



A double-click on the **Endpoint URL** lists the security levels from the IBH Link UA browser window **Security / Server Security**.



Double-clicking on the entry **None - None (uatcp-uasc-uabinary)** in the **AddServer** dialog box sets this security level and closes the dialog box.

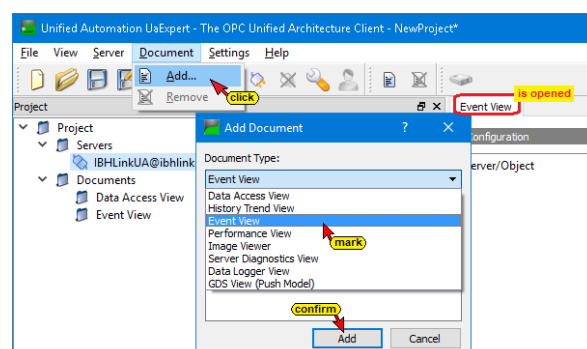


In the opened **UaExpert program window**, the connected server is displayed with the specified security level.



With a click on Connect Server the connection to the OPC UA server is established.

To display the messages from the alarm block calls, the Event View window must be opened.



6.5.1 UaExpert - program window

Drag & Drop the entire **PLC (WinLC RTX)** into the **EventView** window. All alarms coming from the PLC are displayed. It is not possible to select individual alarms.

Messages transmitted to the OPC UA server by the alarm block calls are listed with its **TimeStamp**.

A	C	Time	Severity	Server/Object	SourceName	Message	EventType	Active
✓		17:44:05.811	1	IBHLinkUA@ibhlinkua_sc / WinLC RTX	IBH Link UA\WinLC RTX\Alarms\Countere_DB	Up counting 585 Counter value	S7ExclusiveLevelAlarmType	Active HighHigh
✓		17:44:09.822	1	IBHLinkUA@ibhlinkua_sc / WinLC RTX	IBH Link UA\WinLC RTX\Alarms\Countere_DB	Down counting 2307 Counter value	S7ExclusiveLevelAlarmType	Active HighHigh
✓		17:44:05.811	1	IBHLinkUA@ibhlinkua_sc / WinLC RTX	IBH Link UA\WinLC RTX\Alarms\Countere_DB	Up counting 585 Counter value	S7ExclusiveLevelAlarmType	Inactive
✓		17:44:12.822	1	IBHLinkUA@ibhlinkua_sc / WinLC RTX	IBH Link UA\WinLC RTX\Alarms\Countere_DB	Down counting 2307 Counter value	S7ExclusiveLevelAlarmType	Inactive
✓		17:44:16.832	1	IBHLinkUA@ibhlinkua_sc / WinLC RTX	IBH Link UA\WinLC RTX\Alarms\Countere_DB	Up counting 2599 Counter value	S7ExclusiveLevelAlarmType	Active HighHigh
✓		17:44:12.822	1	IBHLinkUA@ibhlinkua_sc / WinLC RTX	IBH Link UA\WinLC RTX\Alarms\Countere_DB	Up counting 641 Counter value	S7ExclusiveLevelAlarmType	Inactive
✓		17:44:16.832	1	IBHLinkUA@ibhlinkua_sc / WinLC RTX	IBH Link UA\WinLC RTX\Alarms\Countere_DB	Down counting 2599 Counter value	S7ExclusiveLevelAlarmType	Inactive
✓		17:44:20.842	1	IBHLinkUA@ibhlinkua_sc / WinLC RTX	IBH Link UA\WinLC RTX\Alarms\Countere_DB	Up counting 809 Counter value	S7ExclusiveLevelAlarmType	Active HighHigh
✓		17:44:24.841	1	IBHLinkUA@ibhlinkua_sc / WinLC RTX	IBH Link UA\WinLC RTX\Alarms\Countere_DB	Down counting 2458 Counter value	S7ExclusiveLevelAlarmType	Active HighHigh
✓		17:44:20.842	1	IBHLinkUA@ibhlinkua_sc / WinLC RTX	IBH Link UA\WinLC RTX\Alarms\Countere_DB	Up counting 809 Counter value	S7ExclusiveLevelAlarmType	Inactive
✓		17:44:24.841	1	IBHLinkUA@ibhlinkua_sc / WinLC RTX	IBH Link UA\WinLC RTX\Alarms\Countere_DB	Down counting 2458 Counter value	S7ExclusiveLevelAlarmType	Inactive
✓		17:44:49.882	1	IBHLinkUA@ibhlinkua_sc / WinLC RTX	IBH Link UA\WinLC RTX\Alarms\Countere_DB	Up counting 515 Counter value	S7ExclusiveLevelAlarmType	Active HighHigh
✓		17:45:07.902	1	IBHLinkUA@ibhlinkua_sc / WinLC RTX	IBH Link UA\WinLC RTX\Alarms\Countere_DB	Down counting 2984 Counter value	S7ExclusiveLevelAlarmType	Active HighHigh
✓		17:44:49.882	1	IBHLinkUA@ibhlinkua_sc / WinLC RTX	IBH Link UA\WinLC RTX\Alarms\Countere_DB	Up counting 515 Counter value	S7ExclusiveLevelAlarmType	Inactive
✓		17:45:07.902	1	IBHLinkUA@ibhlinkua_sc / WinLC RTX	IBH Link UA\WinLC RTX\Alarms\Countere_DB	Down counting 2984 Counter value	S7ExclusiveLevelAlarmType	Inactive
✓		17:45:51.982	1	IBHLinkUA@ibhlinkua_sc / WinLC RTX	IBH Link UA\WinLC RTX\Alarms\Countere_DB	Up counting 302 Counter value	S7ExclusiveLevelAlarmType	Active HighHigh

Name	Value
EventId	len=16, 0x2ab1e772ee0e98a939fc3026716e13e
Eventtype	ModelId
NamespacesIndex	0
IdentifierType	Numeric
Identifier	2787 [RefreshStartEventType]
Message	...
Severity	500
SourceName	Server
Time	17:42:32.966

A	C	Time	Severity	Server/Object	SourceName
✓		17:59:07.241	1	IBHLinkUA@ibhlinkua_sc / WinLC RTX	IBH Link UA\WinLC RTX\Alarms\Countere_DB
✓		17:59:11.251	1	IBHLinkUA@ibhlinkua_sc / WinLC RTX	IBH Link UA\WinLC RTX\Alarms\Countere_DB

Message	EventType	Active
Up counting 421 Counter value	S7ExclusiveLevelAlarmType	Active HighHigh
Down counting 2994 Counter value	S7ExclusiveLevelAlarmType	Active HighHigh

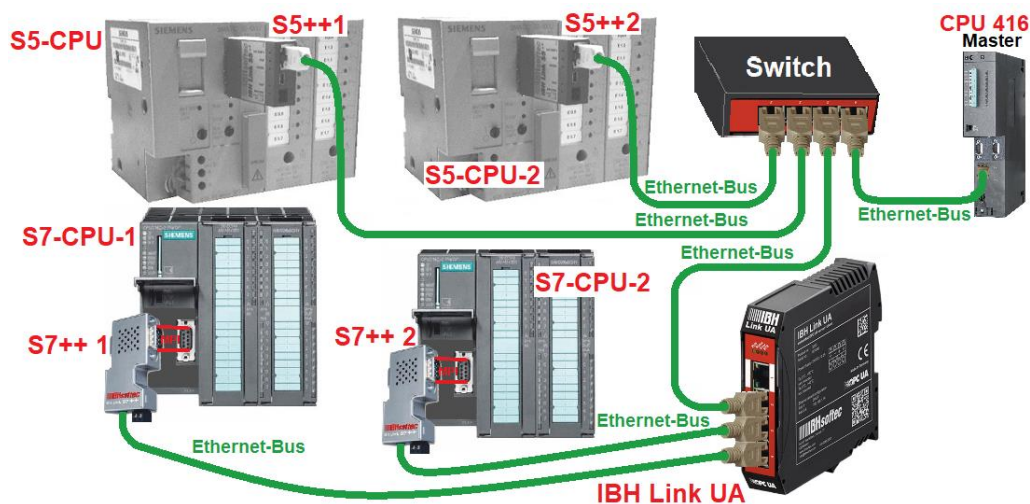
6.5.2 CPU WinLC RTX Variable Table – Online Status

	Address	Symbol	Display format	Status value	Modify value
1	M 3.0	"Up"	BOOL	false	
2	M 3.1	"Down"	BOOL	true	
3	M/W 10	"CounterValue"	DEC	1292	
4					

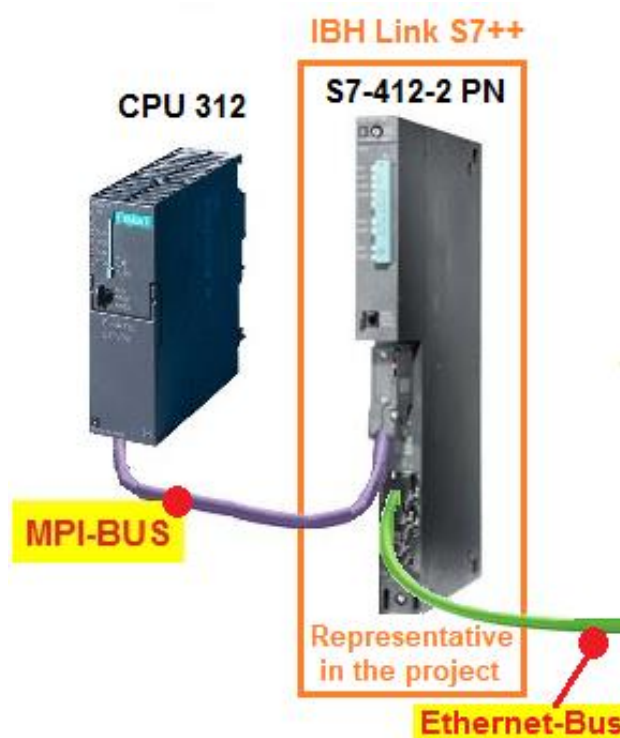
Alarms S7e\IBH Link UA\...Alarms

7 Data exchange between several S7 / S5 CPUs

On a system with three (3) S7 CPUs and two (2) S5 CPUs, data should be exchanged with one another. An S7 CPU with an Ethernet connection act as a master and is connected to the IBH Link UA via a switch. The other CPUs have no Ethernet interfaces and are connected to the IBH Link UA via IBH Link S7++ or IBH Link S5++, via a switch. The master makes data available for all CPUs; these give information back to the master.



7.1 CPU 312 connection via IBH Link S7++



The IBH Link S7++ is an Ethernet converter. The protocol used is the usual standard TCP/IP. All the advantages of Ethernet are thus without any problems to the user.

The use of **SimaticNet** as well as the use of CP communication processors are neither necessary on the PC nor on the PLC side.



Note:

The CPU S7-412-2 PN provides the **Routing Service** and is available in the hardware catalog of the TIA Portal and Step 7 (Simatic Manager).

The firmware of the IBH Link S7 ++ emulates the **Routing** capabilities of the CPU S7-412-2 PN (**6ES7 412-2EK06-0AB0 V6.0**).

The following properties are available (compatible with CPU S7-412-2 PN):

Interfaces / Bus type	Protocols
1x MPI/PROFIBUS DP	MPI/PROFIBUS
1x PROFINET (1 Port)	ISO-on-TCP (RFC1006)

7.1.1 Configuration of the IBH Link S7 ++ (Routing mode)

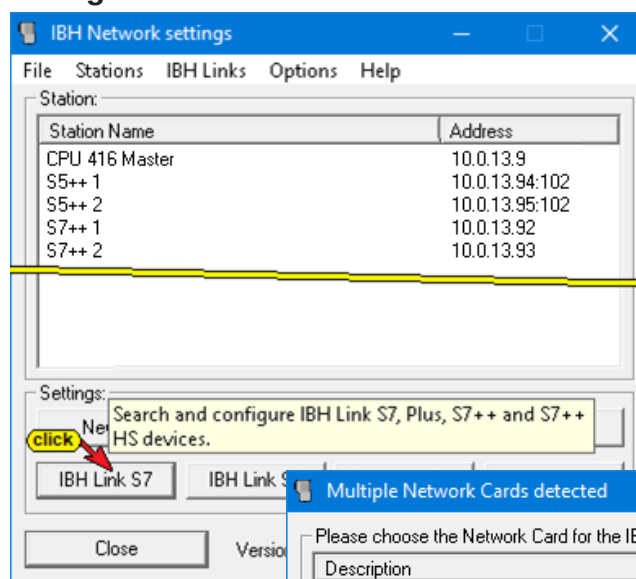
In the STEP 7 example, the S7 CPU 312 is to be routed via the IBH Link S7 ++ and connected to the IBH Link UA.

The IBH Link S7 ++ must be configured for this.

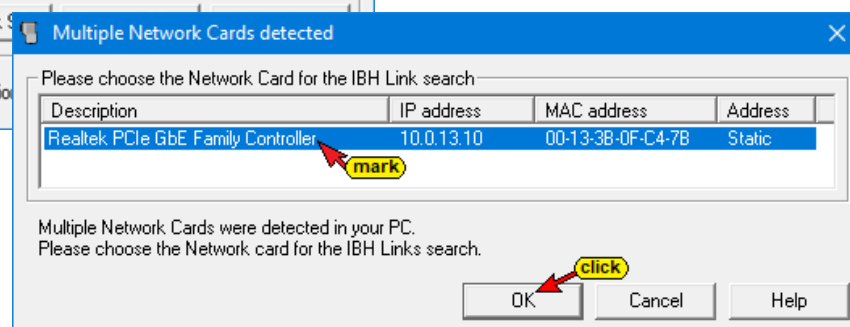
After starting **Manage IBHNet Stations**, the **IBH Network Settings** dialog box opens. Click the **IBH Link S7** button to open the IBH Links in the local network dialog box.



Configuration of the IBH Link S7++



To set the properties of the **IBHNet station** follow the screen shots.



IBH Link S7++ IP addresses

The first screenshot shows the 'IBHLinks in the local network' window. It contains a table of found IBHLinks:

MAC Address	Type	Serial Number	IP Address	Station name	Firmware
50-2D-F4-15-A8-07	IBHLNKUA	10331	10.0.13.89		
00-02-A2-21-56-C8	NL50MPI	25208	10.0.13.92	S7++ 1	V2.168
00-02-A2-49-64-C6	NL50MPI	66361	10.0.13.93	S7++ 2	V2.168

A yellow arrow points to the 'Settings' button with the text 'click'. A yellow box highlights the 'S7++ 1' station name with the text 'select one after another'.

The second screenshot shows the 'IBHLink settings - 00025208 MAC: 00-02-A2-21-56-C8' window. The 'Network' tab is selected. The 'Address settings' section shows:

- Network name: S7++ 1
- IP Address: 192 . 168 . 1 . 92
- Subnet mask: 255 . 255 . 255 . 0
- Gateway: 192 . 168 . 1 . 1
- Static IP selected, DHCP and Boot-P are unselected.

 The 'Authentication' section shows Username: admin and Password: (masked). The 'Options' section has 'Configuration with NetPro/TIA' checked. A yellow arrow points to this checkbox with the text 'mark'. A yellow box contains the text: 'For PLC to PLC communications, a NetPro configuration can be downloaded into the IBH Link. Details can be found in the documentation.' Another yellow arrow points to the 'Save permanently' button with the text 'click'.

The third screenshot shows an 'IBHLink' dialog box with a question mark icon. The text says: 'The configuration has been downloaded to the IBHLink. Select 'Yes' to restart the adaptor. If 'No' is selected, the IBHLink needs to be disconnected and re-connected to save the settings permanently!'. A yellow arrow points to the 'Yes' button with the text 'confirm'.

The fourth screenshot shows an 'IBHLink' dialog box with an information icon. The text says: 'The IBHLink behaves like a PLC, that accepts projected connections. Unprojected connections via RFC1006 are not possible with this option checked.' A yellow arrow points to the 'OK' button with the text 'confirm'.

Activate *Configuration with NetPro* in the dialog box *Properties*

IBHLink/Network/Routing Options.

The setting made must be permanently adopted in the IBH Link S7 ++.

7.2 S5 CPU connection via IBH Link S5++

S5 controllers do not have an Ethernet connection as standard.

The screenshot shows the 'CONFIGURATION' page of the IBHsoftec web interface. It includes fields for:

- IP address: 10 . 0 . 13 . 94
- Netmask: 255 . 255 . 255 . 0
- Gateway: 10.0.13.1
- Configuration: [Manually] (dropdown menu)

 There is an 'Apply' button at the bottom right. A 'NOTE' states: 'The IBH Link S5++ needs to be restarted to apply the changes.' A 'Back' link is at the bottom left.

If no communication processor with an Ethernet interface is available, the **IBH Link UA** can be connected via the **IBH Link S5++** (via switch).



Note:

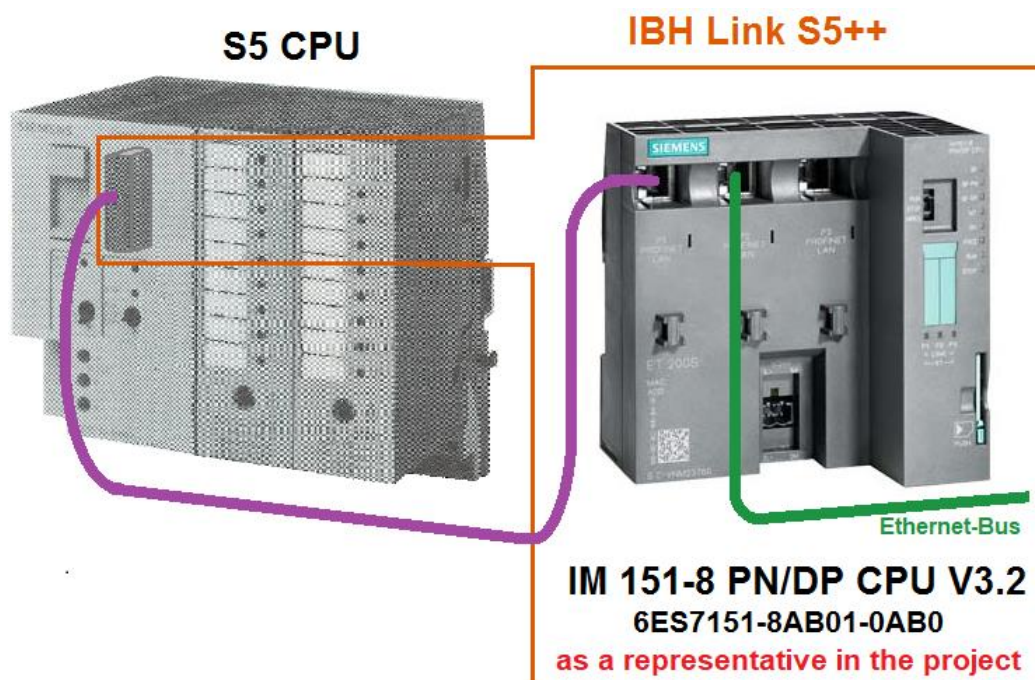
The interface module **IM 151-8 PN/DP CPU V3.2** provides a PROFINET interface with an integrated switch. PG communication and S7 communication are possible via the PROFINET interface.

The interface module IM 151-8 PN/DP CPU V3.2 is available in the hardware catalog of the TIA Portal and the STEP 7 (Simatic Manager). The firmware of the IBH Link S5++ emulates the PROFINET interfaces of the IM 151-8 PN/DP CPU V3.2 (**6ES7 151-8AB01-0AB0 V3.2**) as far as these are used for communication, S5 CPU PG interface - IBH Link UA Ethernet Port, are necessary.

The following properties are available (compatible with IM 151-8 PN/DP CPU V3.2):

Interfaces / Bus type	Protocols
1x PROFINET (1 Port)	PG-Communication
1x PROFINET (1 Port)	ISO-on-TCP (RFC1006)

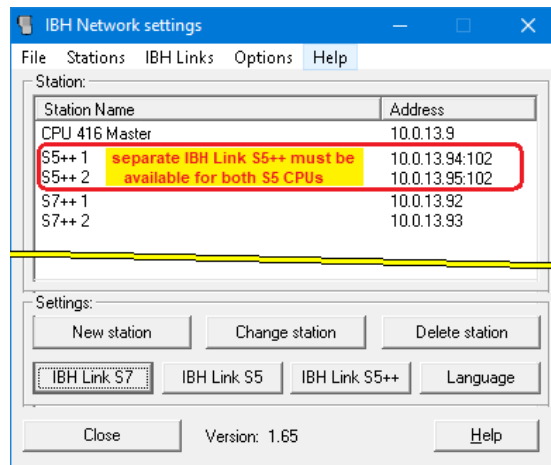
IM 151-8 PN/DP as a representative on the project



Configuration of the IBH Link S5++

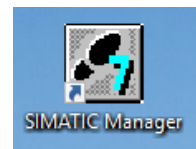
The **IBH Link S5++** is an Ethernet converter. The protocol used is the usual standard TCP / IP. The user can benefit from all the advantages of Ethernet without any problems. The IBH Link S5++ used must have different IP addresses.

The use of **SimaticNet** and the use of a CP communication processor is not necessary on either the PC or the PLC side.



7.3 Example with STEP 7 – SIMATIC Manager

In the following example, the creation of a project with the STEP 7 – SIMATIC Manager connecting **S5 CPUs 103U**, **S7 CPUs 312**, and **S7 CPU 416** are shown.



The **S7 CPU 416** is used as a master. The CPUs and the IBH Link UA is using Ethernet connections.

In the S5 / S7 CPUs, there are programs that count the value up to *MaxValue*. Then the value is counted down until *MinValue* is reached. This is repeated continuously. The counting is only possible if the master PLC has given **ControlON**. The numerical values for **MaxValue** and **MinValue** are specified for each CPU by the master PLC. Each CPU reports the current count **Value** to the master PLC.

IP / MPI addresses of the devices

Device	IP address	MPI address
IBH Link UA [SIMATIC PC Station]	10.0.13.89	not applicable
S7-CPU 416	10.0.13.97	
IBH Link S7++ for S7 CPU 1 [CPU 412-2 PN] (for IBH Link S7++ and CPU)	10.0.13.92 routed	10
S7-CPU 1 [CPU 312]	not applicable	2
IBH Link S7++ for S7 CPU 2 [CPU 412-2 PN] (for IBH Link S7++ and CPU)	10.0.13.93 routed	10
S7-CPU 2 [CPU 312]	not applicable	2
IBH Link S5++ for S5 CPU 1 [IM 151-8 PN / DP CPU] (for IBH Link S5++ and IM)	10.0.13.94	not applicable
IBH Link S5++ for S5 CPU 2 [IM 151-8 PN / DP CPU] (for IBH Link S5++ and IM)	10.0.13.95	not applicable

7.4 Project 2xS5 3x S7e

In the SIMATIC Manager project **2xS5 3x S7e** all programs with the configurations of the project devices are available.

7.4.1 CPU 416 Master [CPU 416 - 3 PN / DP]

The PLC program for the CPU 416-3 PN / DP (6ES7 416-3ER05-0AB0 / V5.1) has two data blocks to exchange data with the S5 / S7 CPUs. The variables of these blocks are defined as (OPC tags).

The organization blocks OB100 and OB1 are required for the controlled start of the OPC data transmission to the individual CPUs.

Variable to CPUs [DB2]

The variables (OPC tags) that are to be sent to the S5 CPUs and S7 CPUs are specified in this data block.

Address	Name	Type	Initial value	Comment
0.0		STRUCT		
+0.0	Control_ON	BOOL	TRUE	Enable counting all CPUs
+2.0	MaxValue_1	INT	5500	maximum value S7 CPU 1
+4.0	MaxValue_2	INT	5000	maximum value S7 CPU 2
+6.0	MaxValue_3	INT	4500	maximum value S5 CPU 1
+8.0	MaxValue_4	INT	4000	maximum value S5 CPU 2
+10.0	MinValue_1	INT	900	minimum value S7 CPU 1
+12.0	MinValue_2	INT	800	minimum value S7 CPU 2
+14.0	MinValue_3	INT	700	minimum value S5 CPU 1
+16.0	MinValue_4	INT	600	minimum value S5 CPU 2
=18.0		END_STRUCT		

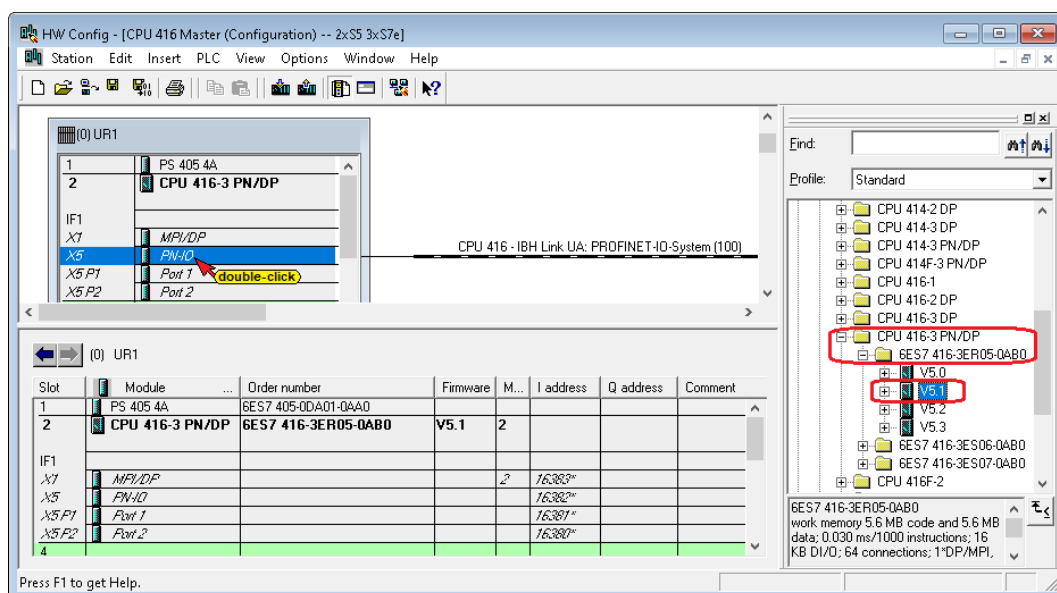
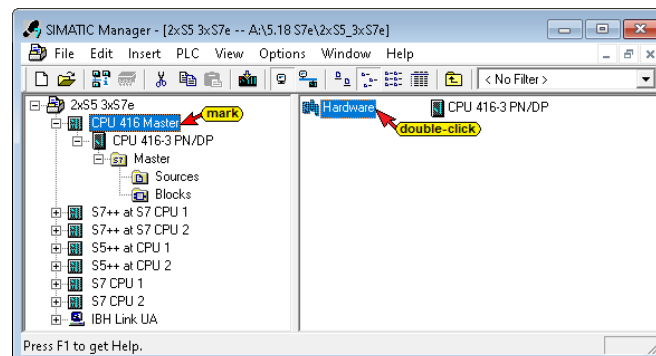
Variable from CPUs [DB5]

The variables (OPC tags) to be sent from the S5 CPUs and S7 CPUs to the CPU 416 master are specified in this block.

Address	Name	Type	Initial value	Comment
0.0		STRUCT		
+0.0	Counting_is_ON_1	BOOL	FALSE	S7 CPU 1 counting
+0.1	Counting_is_ON_2	BOOL	FALSE	S7 CPU 2 counting
+0.2	Counting_is_ON_3	BOOL	FALSE	S5 CPU 1 counting
+0.3	Counting_is_ON_4	BOOL	FALSE	S5 CPU 2 counting
+2.0	Value_1	INT	0	S7 CPU 1 counter value
+4.0	Value_2	INT	0	S7 CPU 2 counter value
+6.0	Value_3	INT	0	S5 CPU 1 counter value
+8.0	Value_4	INT	0	S5 CPU 2 counter value
=10.0		END_STRUCT		

7.4.2 CPU 416 Master [CPU 416 - 3 PN / DP] Configuration

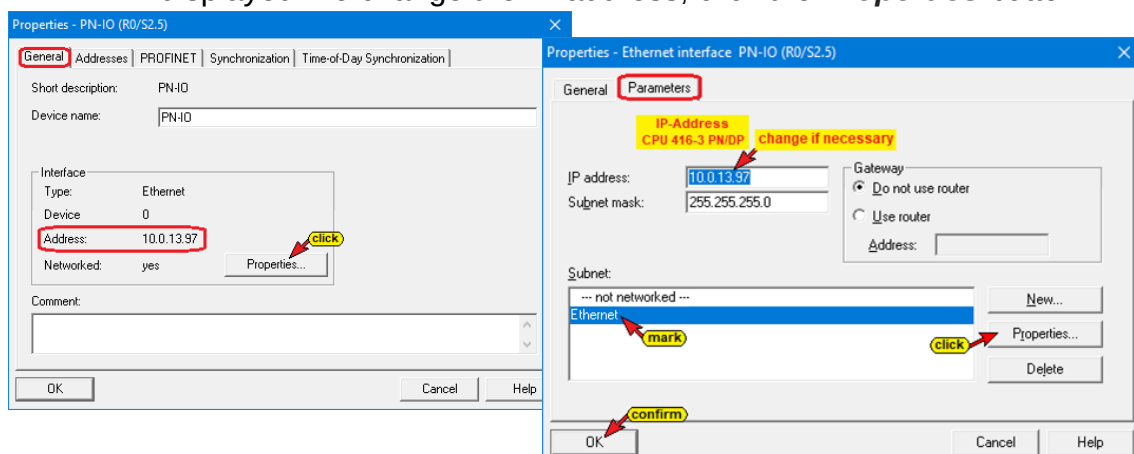
Double-click **Hardware** to open the HW Configuration window.



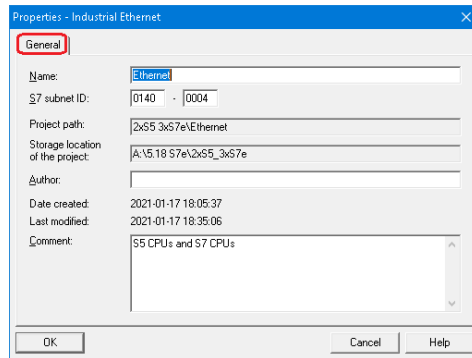
In the example, the **CPU 416-3 PN/DP (6ES7 416-3ER05-0AB0)** firmware version V5.1 is used, which is also available as a software PLC from IBHsoftec.

(R0/S2.5) dialog box.

In the dialog box **Properties**, the IP address of the **CPU 416** is displayed. To change the IP address, click the **Properties** button.

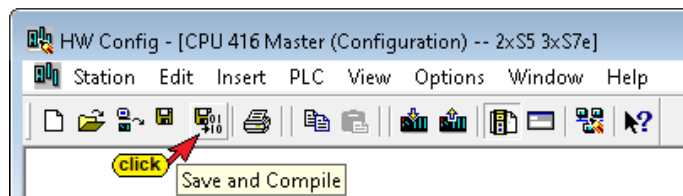


To display more details on the connection (Subnet) mark the subnet name and click the **Properties** button.



To close the dialog boxes, click the **OK** button.

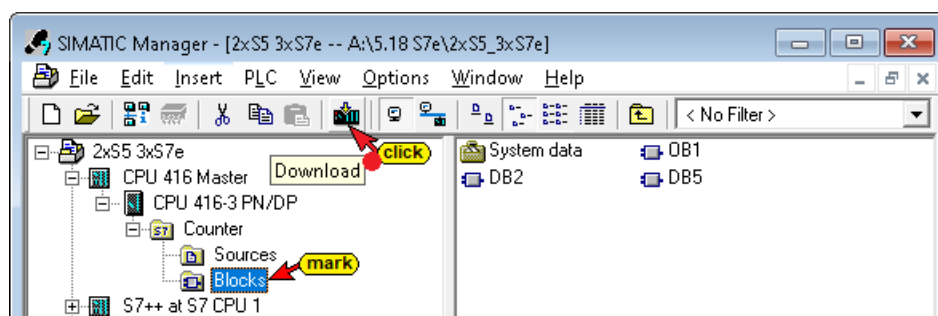
Clicking on the **Save and Compile** icon to save the configuration of the CPU 416.



7.4.3 Download, the PLC program and the System Data to the CPU 416

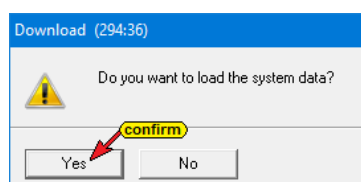
The connection from the PC to the CPU 416-3 PN/DP is made via the Ethernet interface of the PC. The PG/PC interface must be selected accordingly in SIMATIC Manager.

The name of the Ethernet connection may vary depending on the network card used in the PC.



Download System Data.

The Hardware configuration of the CPU 416-3 PN/DP is downloaded.



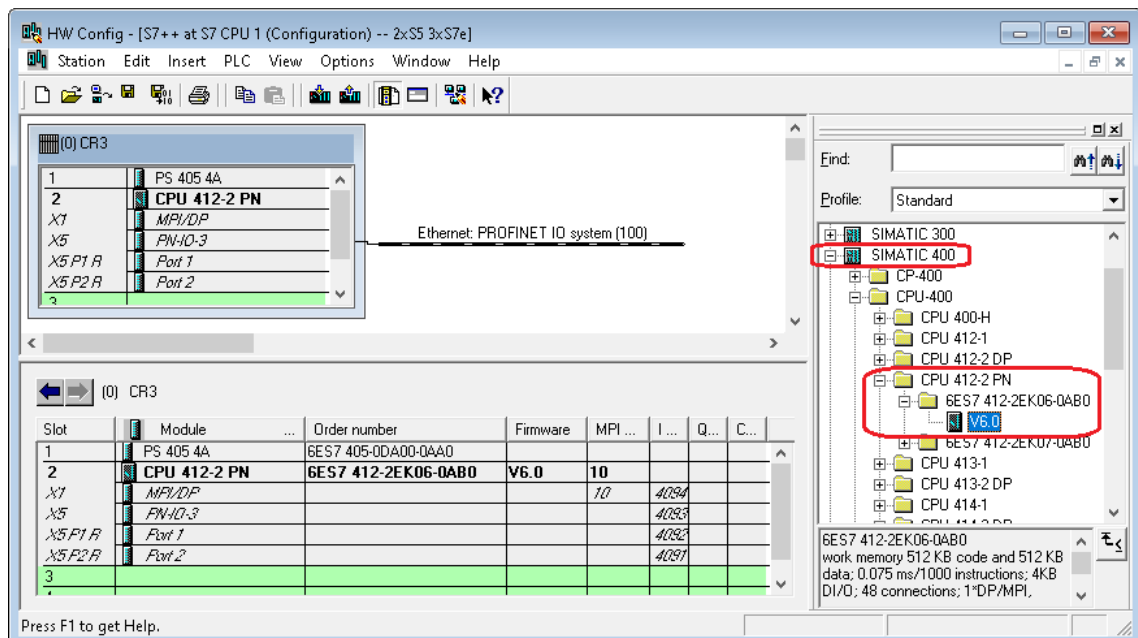
7.4.4 S7++ to CPU 1 [CPU 412-2 PN] – (IBH Link S7++)

The CPU **6ES7 412-2EK06-0AB0 V6.0** is the representative for the **IBH Link S7++**, which is plugged into the **S7 CPU 1**. This CPU is used for the routing connection between the S7-CPU 1 [CPU 312] and the IBH Link UA.

Since no blocks can be loaded into the IBH Link S7++, all blocks that are in offline mode of **IBH Link S7++ / CPU 412** must be deleted.

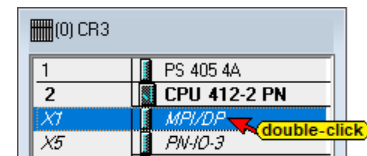
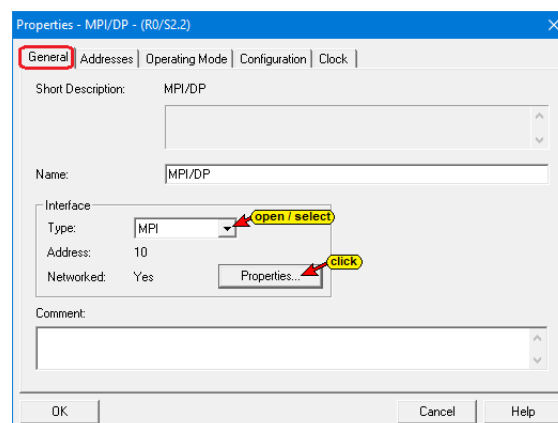
Configurations of the CPU 412-2 PN

The MPI interface (connection to the CPU 312) and the Ethernet interface (connection to the OPC server [IBH Link UA]) must be specified in the CPU.

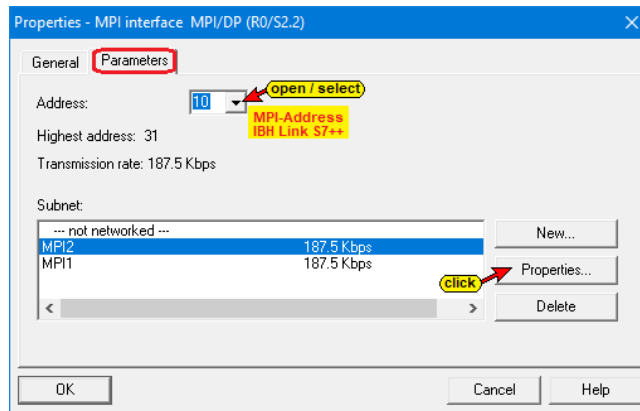


Define the MPI interface of the CPU 412 (MPI interface IBH Link S7++)

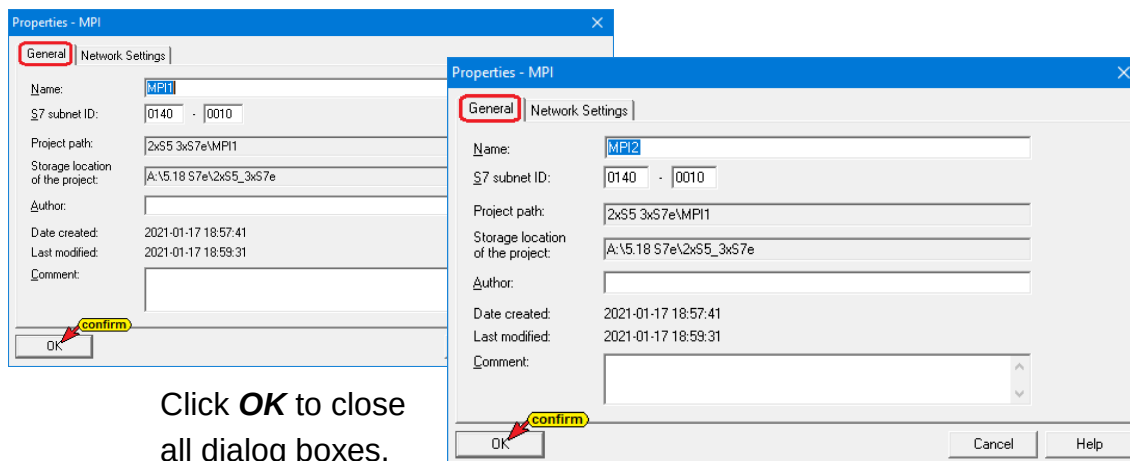
With a double-click on the line **X1 MPI/DP** the dialog box **Properties – MPI/DP - (R0 / S2.2)** is opened.



The Interface type **MPI** is selected. Click the button **Properties...** to open the dialog box **Properties – MPI interface - (R0 / S2.2)**. The tab **Parameters** show the selected MPI address (10) of the CPU 412. The subnet connections MPI1 and MPI2 were established.



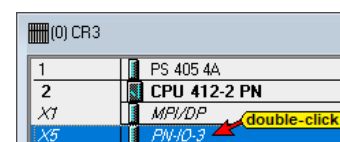
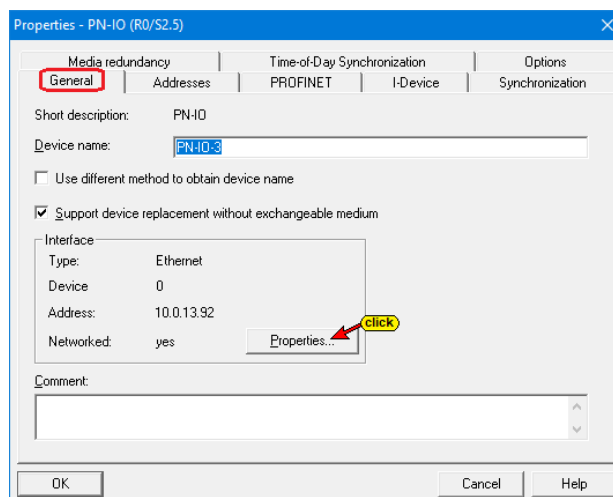
Mark subnet connections MPI1 and MPI2 one after another and click the button **Properties...** to open the dialog box **Properties – MPI1 / MPI2** for more details on the connection.



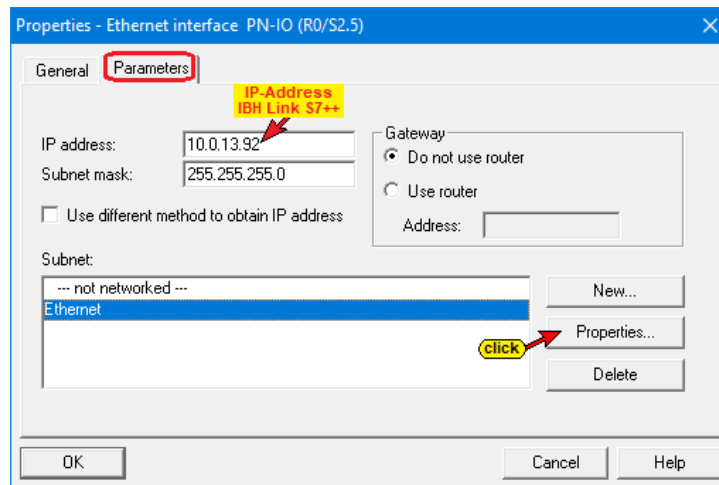
Click **OK** to close all dialog boxes.

Define the ethernet interface of the CPU 412

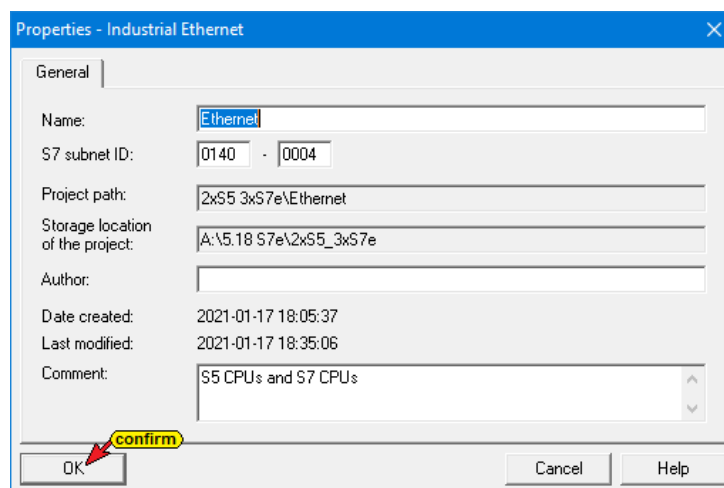
With a double-click on the line **X5 PN-IO** the dialog box **Properties – PN-IO - (R0 / S2.5)** is opened.



To set up the ethernet interface click the button **Properties...** button to open the dialog box **Properties – Ethernet interface PN - (R0 / S2.5)**.



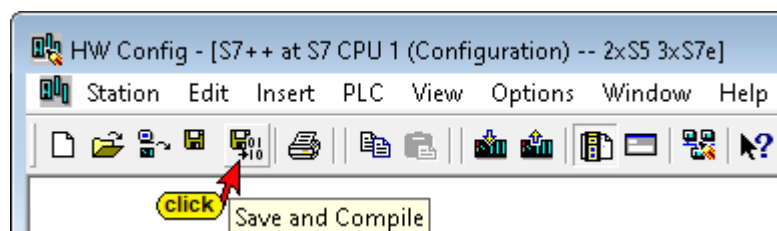
Click the button **Properties...** to open the dialog box **Properties – Industrial Ethernet** for more details on the connection.



Click **OK** to close all dialog boxes.

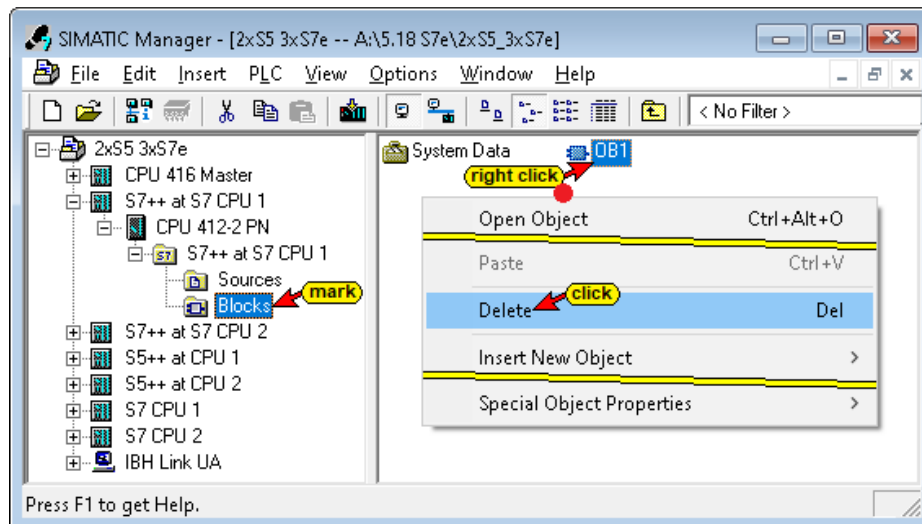
Configuration of CPU 412-2 PN (IBH Link S7++) Save and Compile

The configuration is accepted by clicking the Save and Compile icon.



Delete blocks (IBH Link S7++ / CPU 412-2 PN)

No blocks can be loaded into the IBH Link S7++. All blocks that are in offline mode from IBH Link S7++ / CPU 412-2 PN must be deleted.

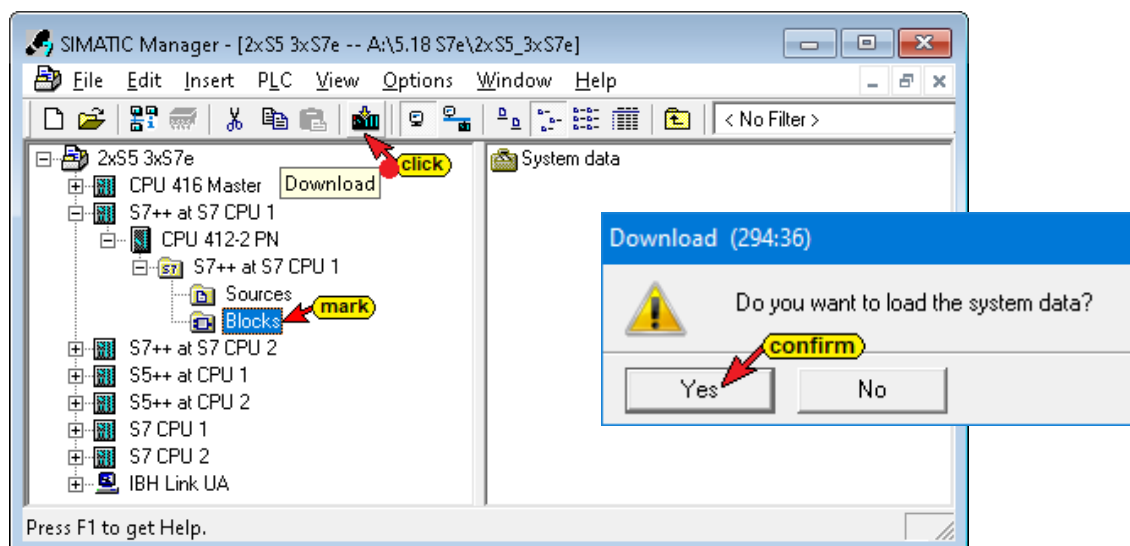
**Note:**

Only data can be transferred with the **IBH Link S7++**. All program blocks in the **CPU 412-2 PN** must be deleted.

The configuration **must be loaded** into the IBH Link S7++!

Load System configuration into the IBH Link S7++ / CPU 412

Loading into the CPU 412-2 PN (IBH Link S7 ++) requires several steps.



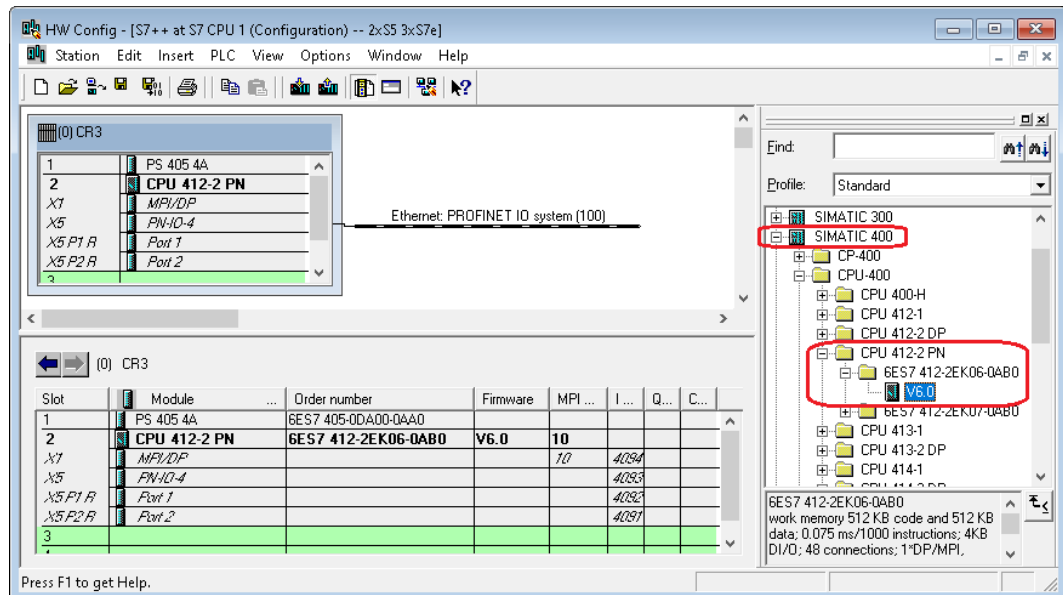
7.4.5 S7++ to CPU 2 [CPU 412-2 PN] – (IBH Link S7++)

The CPU **6ES7 412-2EK06-0AB0 V6.0** is the representative for the **IBH Link S7++**, which is plugged into the **S7 CPU 1**. This CPU is used for the routing connection between the S7-CPU 2 [CPU 312] and the IBH Link UA.

Since no blocks can be loaded into the IBH Link S7++, all blocks that are in offline mode of **IBH Link S7++ / CPU 412** must be deleted.

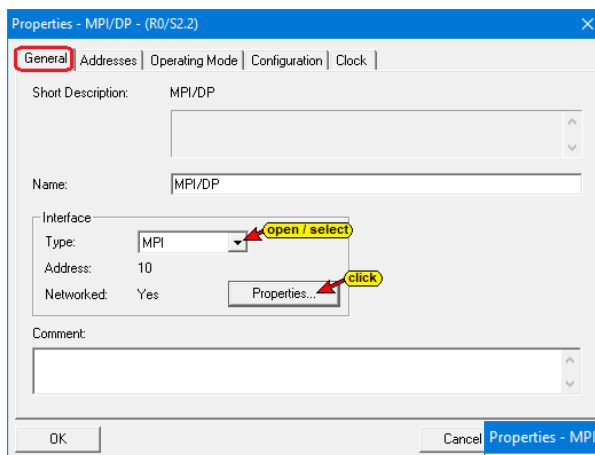
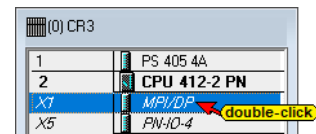
Configurations of the CPU 412-2 PN

The MPI interface (connection to the CPU 312) and the Ethernet interface (connection to the OPC server [IBH Link UA]) must be specified in the CPU.



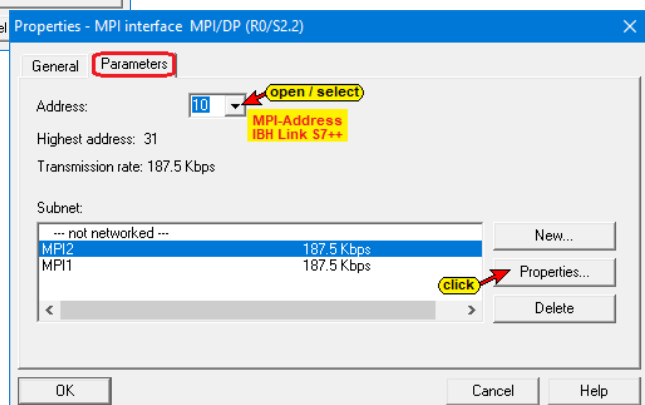
Define the MPI interface of the CPU 412 (MPI interface IBH Link S7++)

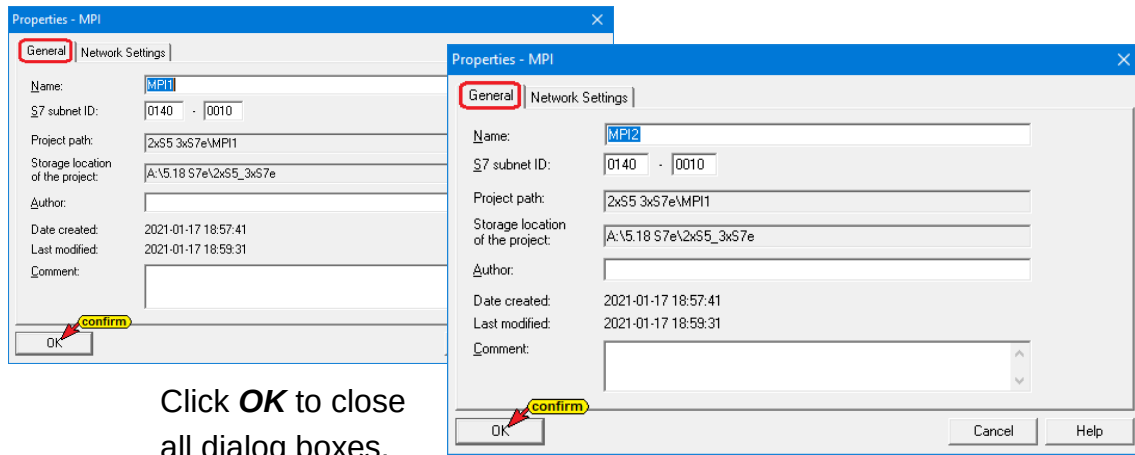
With a double-click on the line **X1 MPI/DP** the dialog box **Properties – MPI/DP - (R0 / S2.2)** is opened.



The Interface type **MPI** is selected. Click the button **Properties...** to open the dialog box **Properties – MPI interface - (R0 / S2.2)**. The tab **Parameters** show the selected MPI address (10) of the CPU 412. The subnet connections MPI1 and MPI2 were established.

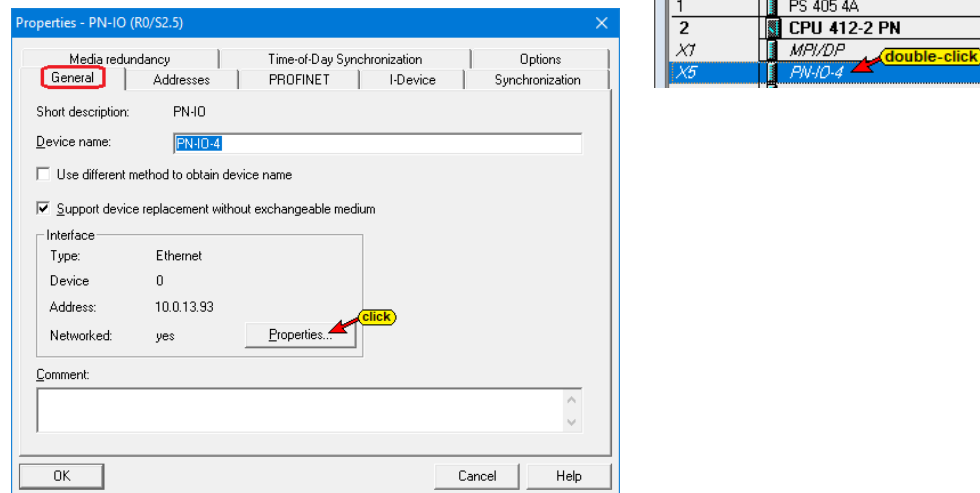
Mark subnet connections MPI1 and MPI2 one after another and click the button **Properties...** to open the dialog box **Properties – MPI1 / MPI2** for more details on the connection.



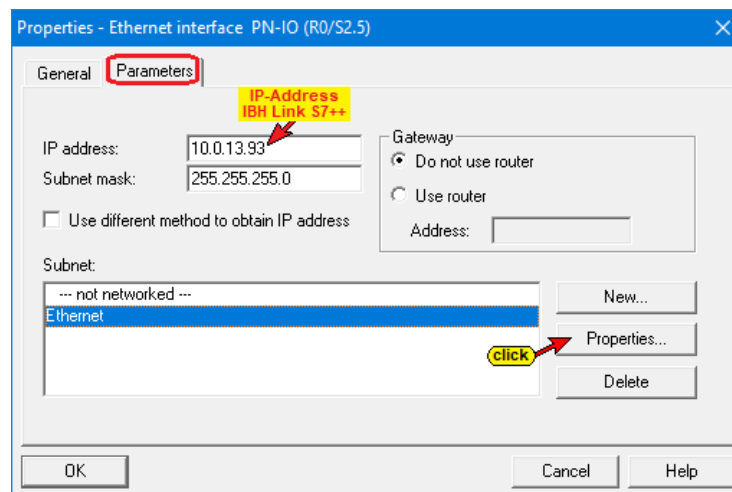


Define the ethernet interface of the CPU 412

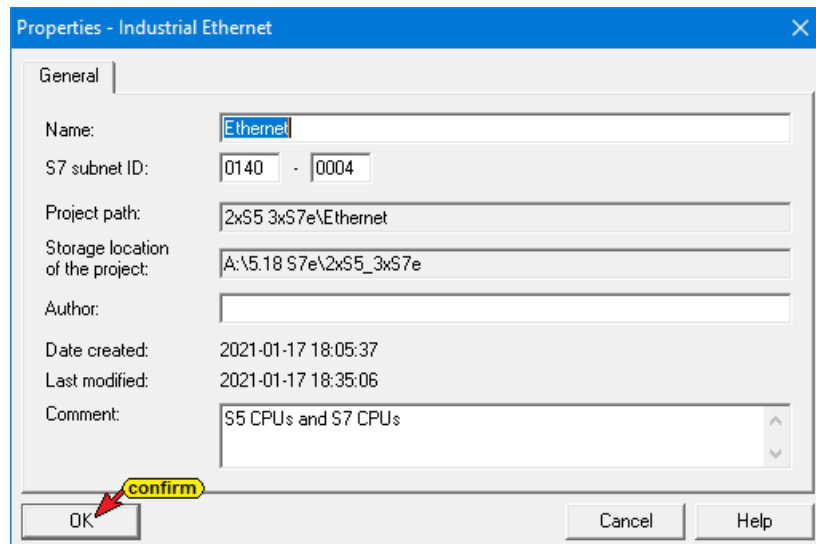
With a double-click on the line **X5 PN-IO** the dialog box **Properties – PN-IO - (R0 / S2.5)** is opened.



To set up the ethernet interface click the button **Properties...** button to open the dialog box **Properties – Ethernet interface PN - (R0 / S2.5)**.



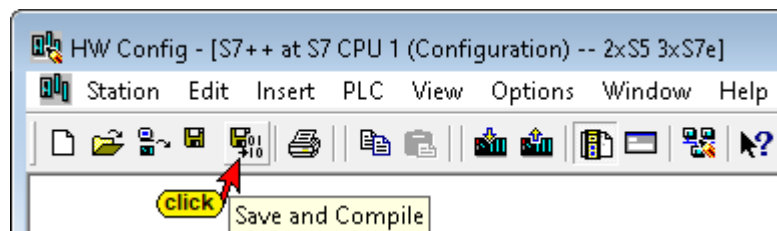
Click the button **Properties...** to open the dialog box **Properties – Industrial Ethernet** for more details on the connection.



Click OK to close all dialog boxes.

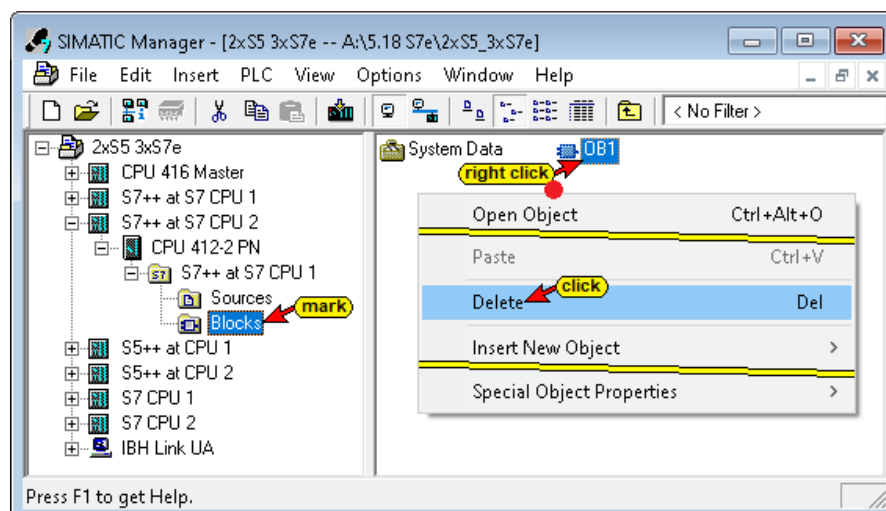
Configuration of CPU 412-2 PN (IBH Link S7++) Save and Compile

The configuration is accepted by clicking the Save and Compile icon.



Delete blocks (IBH Link S7++ / CPU 412-2 PN)

No blocks can be loaded into the IBH Link S7++. All blocks that are in offline mode from IBH Link S7++ / CPU 412-2 PN must be deleted.



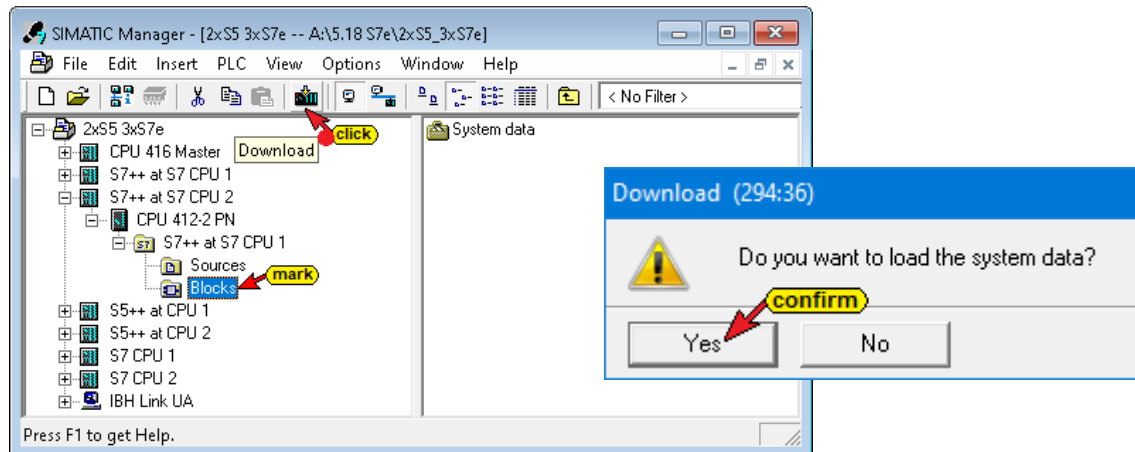
Load System configuration into the IBH Link S7++ / CPU 412

Loading into the CPU 412-2 PN (IBH Link S7 ++) requires several steps.

Note:

Only data can be transferred with the **IBH Link S7++**. All program blocks in the **CPU 412-2 PN** must be deleted.

The configuration **must be loaded** into the IBH Link S7++!

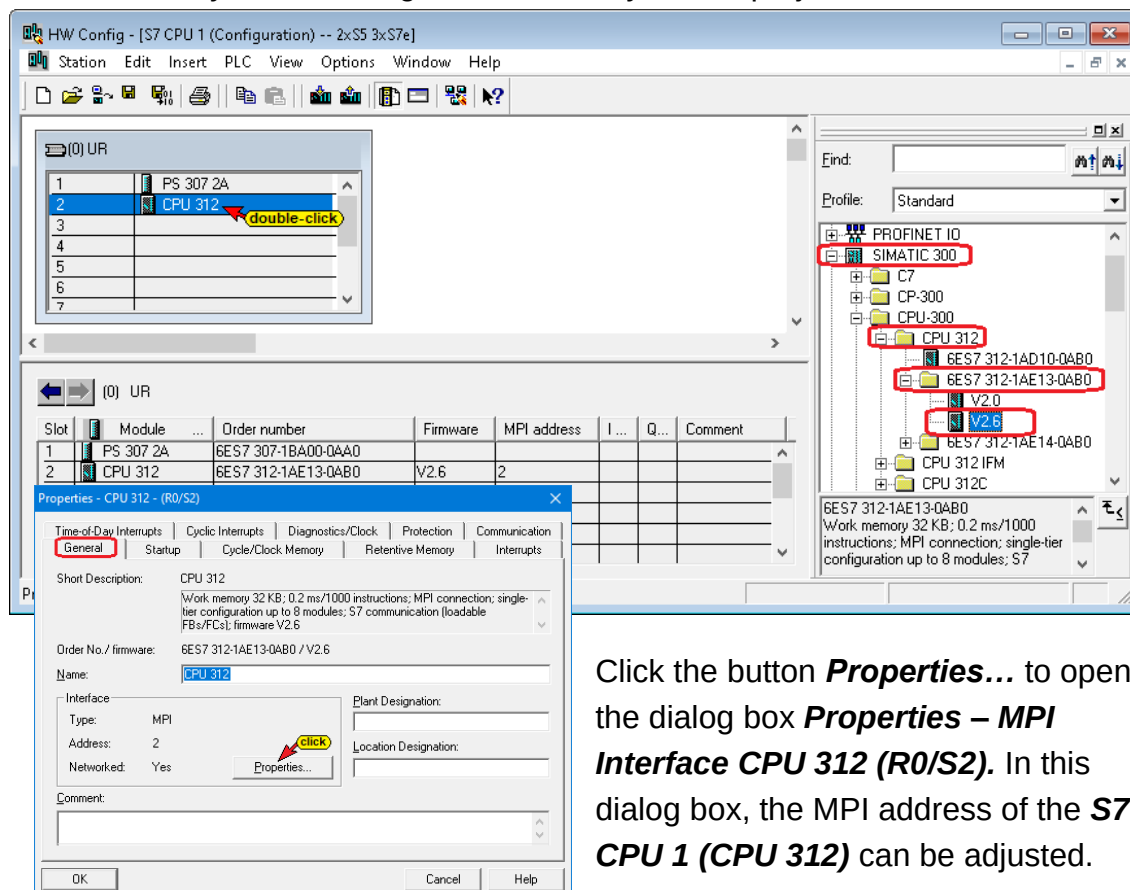


7.4.6 S7-CPU 1 [CPU 312]

Double-click Hardware to open the HW Config window.

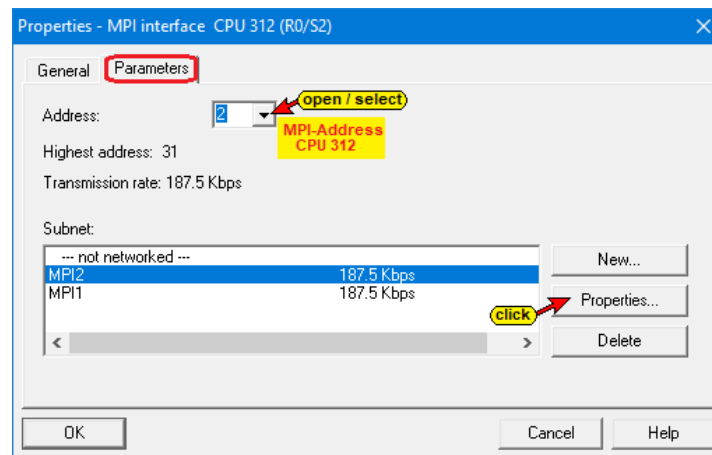
Configurations of the S7-CPU 1 [CPU 312]

Only these settings are necessary for the project.

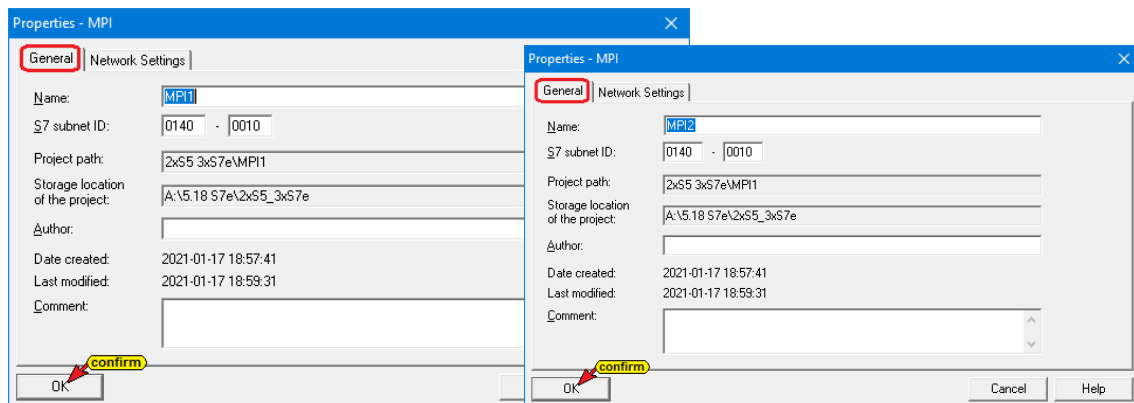


Click the button **Properties...** to open the dialog box **Properties – MPI Interface CPU 312 (R0/S2)**. In this dialog box, the MPI address of the **S7 CPU 1 (CPU 312)** can be adjusted.

The tab **Parameters** show the selected MPI address (2) of the CPU 312. The subnet connections MPI1 and MPI2 were established.



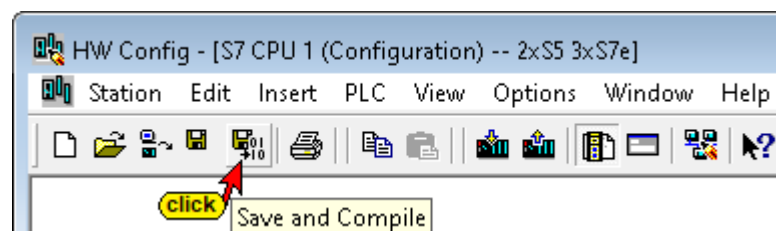
Mark subnet connections MPI1 and MPI2 one after another and click the button **Properties...** to open the dialog box **Properties – MPI1 / MPI2** for more details on the connection.



Click **OK** to close all dialog boxes.

Save and compile the S7 CPU1 (CPU 312) configuration

With one click the configuration is saved and compiled.



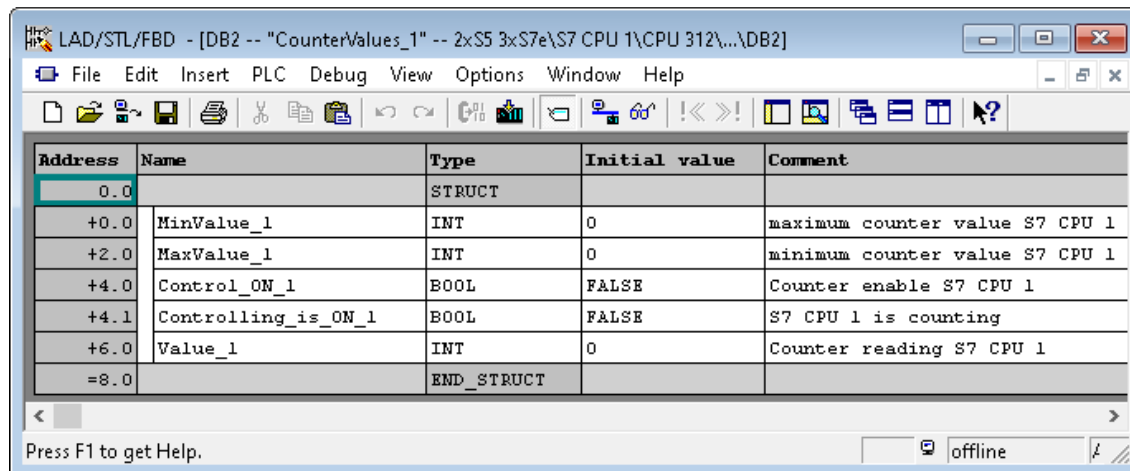
The hardware configuration and the PLC program can be transferred to the PLC.

PLC program S7 CPU 1 (CPU 312)

The program for the CPU 312 contains the data block Counter Values [DB2] for the data exchange with the CPU 416 master [CPU 416-3 PN / DP]. Only the variables of this block are defined as (OPC tags).

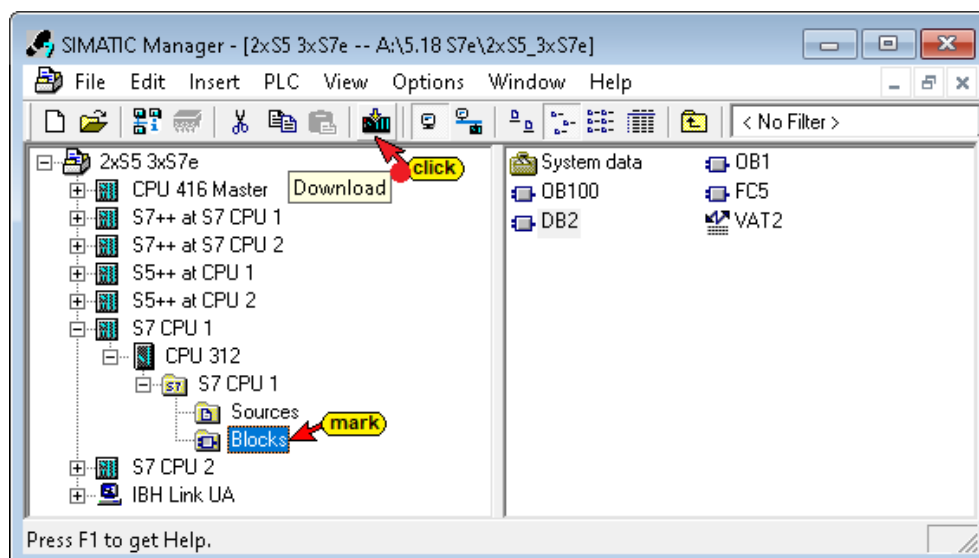
S7 CPU 1 (CPU 312) data block Counter Values_1 [DB2]

These variables are defined as OPC tags



Address	Name	Type	Initial value	Comment
0.0		STRUCT		
+0.0	MinValue_1	INT	0	maximum counter value S7 CPU 1
+2.0	MaxValue_1	INT	0	minimum counter value S7 CPU 1
+4.0	Control_ON_1	BOOL	FALSE	Counter enable S7 CPU 1
+4.1	Controlling_is_ON_1	BOOL	FALSE	S7 CPU 1 is counting
+6.0	Value_1	INT	0	Counter reading S7 CPU 1
=8.0		END_STRUCT		

Load program and hardware configuration into the S7 CPU 1



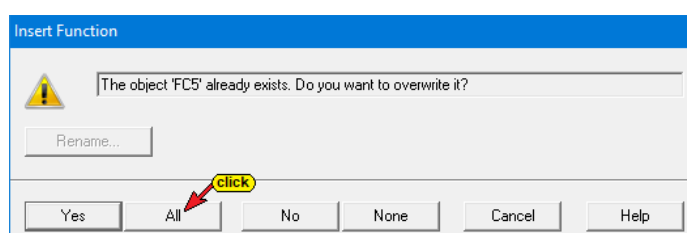
Note:



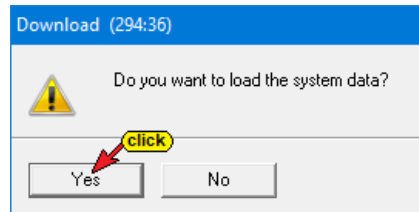
The S7-CPU 1 [CPU 312] is connected to the S7 ++ for S7 CPU 1 [CPU 412-2 PN] via MPI. The loading must take place via the Ethernet connection.

Direct loading via MPI is only possible after changing the PG/PC interface, it does not make sense because then there is no access to other devices.

Transfer all blocks, overwrite existing blocks.



S7-CPU 1 [CPU 312] transfer system data.

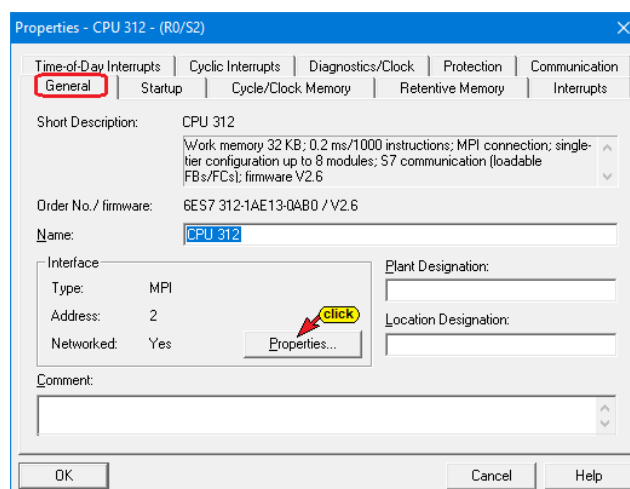
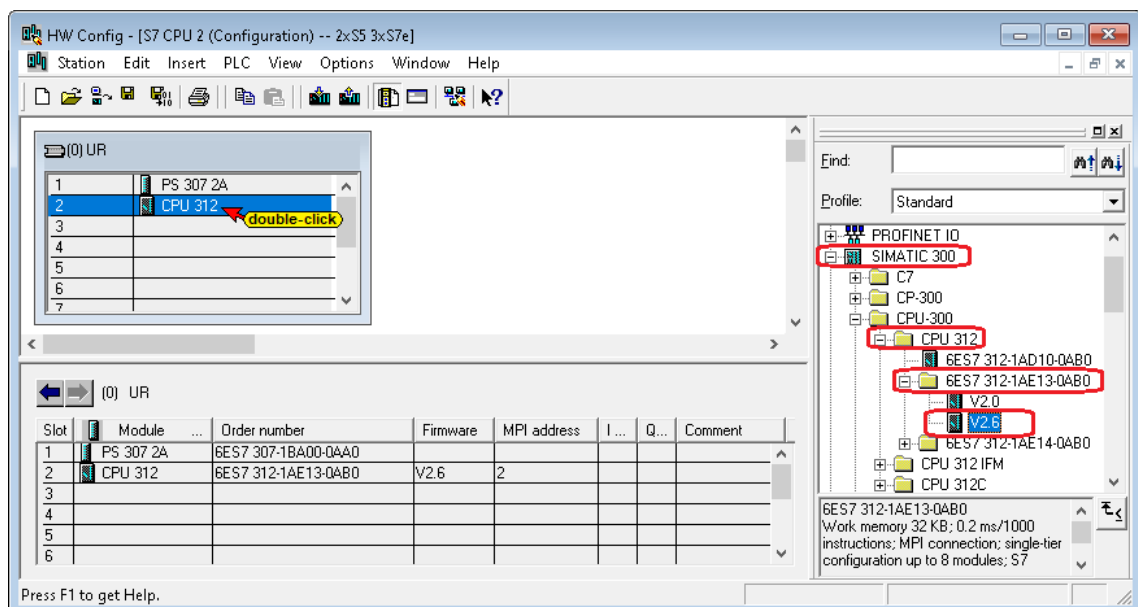


7.4.7 S7-CPU 2 [CPU 312]

Double-click Hardware to open the HW Config window.

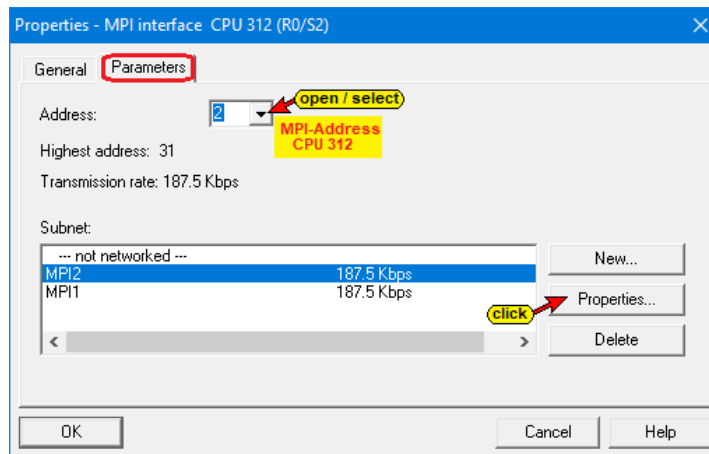
Configurations of the S7-CPU 2 [CPU 312]

Only these settings are necessary for the project.

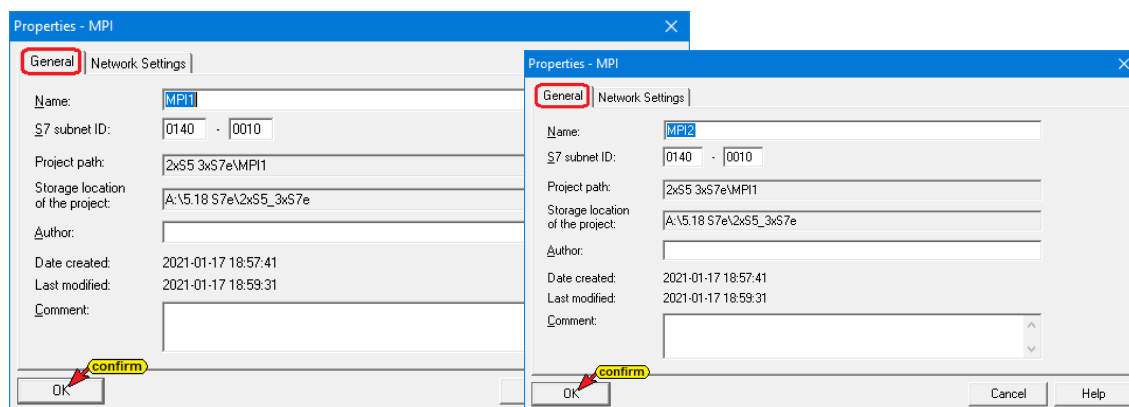


Click the button **Properties...** to open the dialog box **Properties – MPI Interface CPU 312 (R0/S2)**. In this dialog box, the MPI address of the **S7 CPU 2 (CPU 312)** can be adjusted.

The tab **Parameters** show the selected MPI address (2) of the **S7 CPU 2 (CPU 312)**. The subnet connections MPI1 and MPI2 were established.



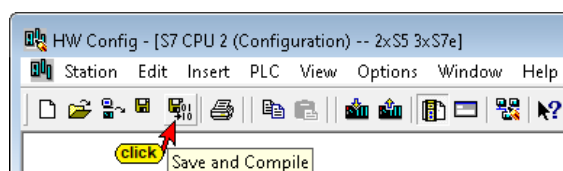
Mark subnet connections MPI1 and MPI2 one after another and click the button **Properties...** to open the dialog box **Properties – MPI1 / MPI2** for more details on the connection.



Click **OK** to close all dialog boxes.

Save and compile the S7 CPU1 (CPU 312) configuration

With one click the configuration is saved and compiled.



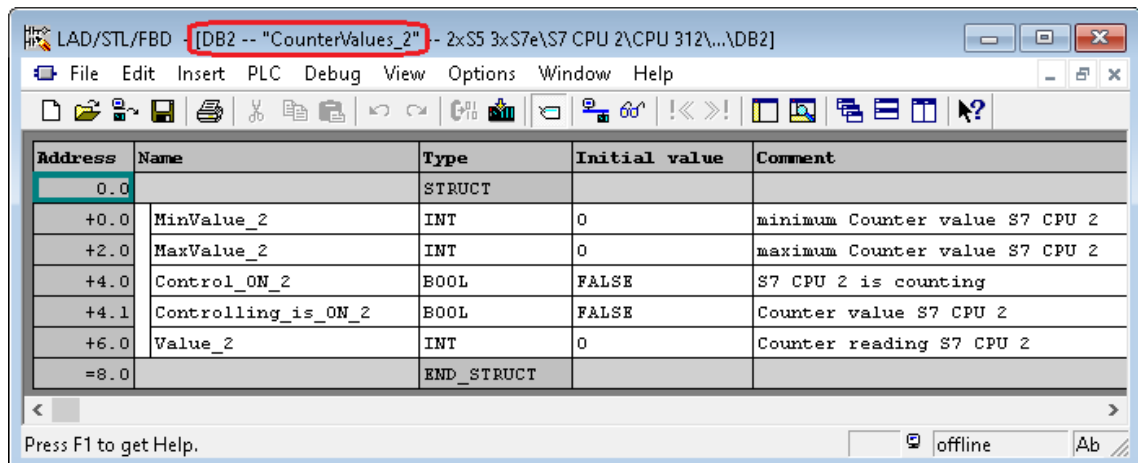
The hardware configuration and the PLC program can be transferred to the PLC.

PLC program S7 CPU 2 (CPU 312)

The program for the CPU 312 contains the data block Counter Values [DB2] for the data exchange with the CPU 416 master [CPU 416-3 PN / DP]. Only the variables of this block are defined as (OPC tags).

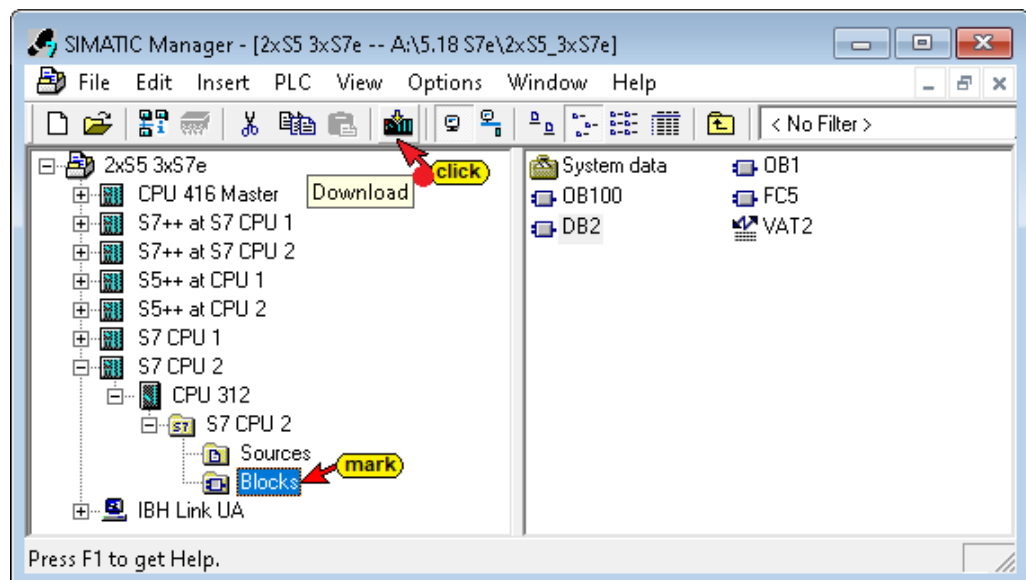
S7 CPU 2 (CPU 312) data block Counter Values_2 [DB2]

These variables are defined as OPC tags



Address	Name	Type	Initial value	Comment
0.0		STRUCT		
+0.0	MinValue_2	INT	0	minimum Counter value S7 CPU 2
+2.0	MaxValue_2	INT	0	maximum Counter value S7 CPU 2
+4.0	Control_ON_2	BOOL	FALSE	S7 CPU 2 is counting
+4.1	Controlling_is_ON_2	BOOL	FALSE	Counter value S7 CPU 2
+6.0	Value_2	INT	0	Counter reading S7 CPU 2
=8.0		END_STRUCT		

Load program and hardware configuration into the S7 CPU 2



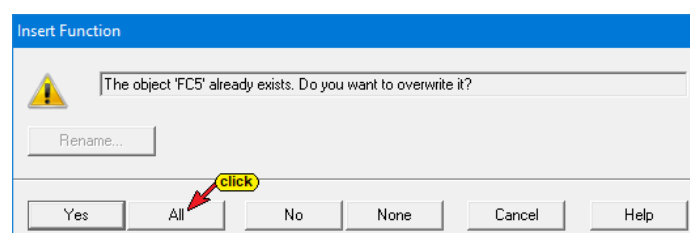
Transfer all blocks, overwrite existing blocks.

Note:

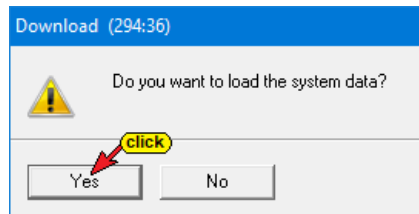


The S7-CPU 1 [CPU 312] is connected to the S7 ++ for S7 CPU 1 [CPU 412-2 PN] via MPI. The loading must take place via the Ethernet connection.

Direct loading via MPI is only possible after changing the PG/PC interface, it does not make sense because then there is no access to other devices.



S7-CPU 2 [CPU 312] transfer system data.

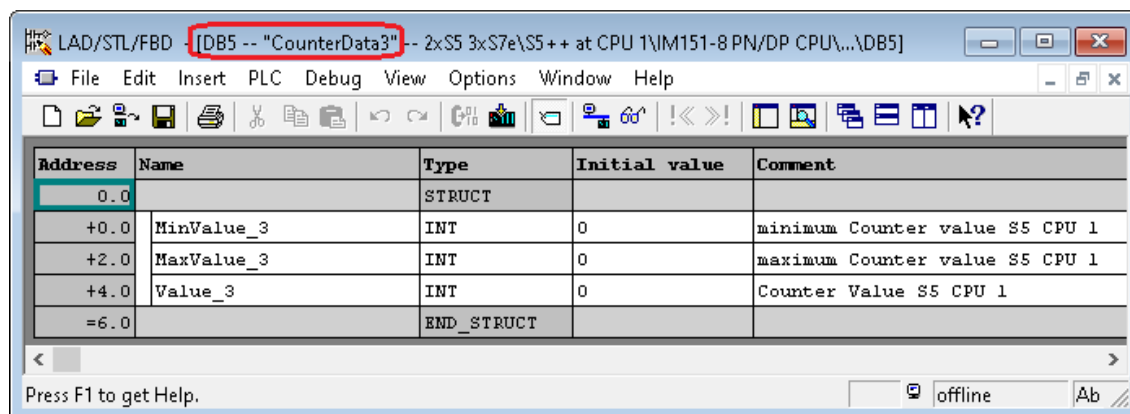


7.4.8 S5 ++ CPU 1 [IM 151 - 8 PN / DP CPU]

This CPU is the representative for the **IBH Link S5++**. It is plugged into the **S5 CPU 1**. The symbols and data block data words in the **S5 CPU 1** are to be used as OPC tags for data exchange with the CPU 416 master.

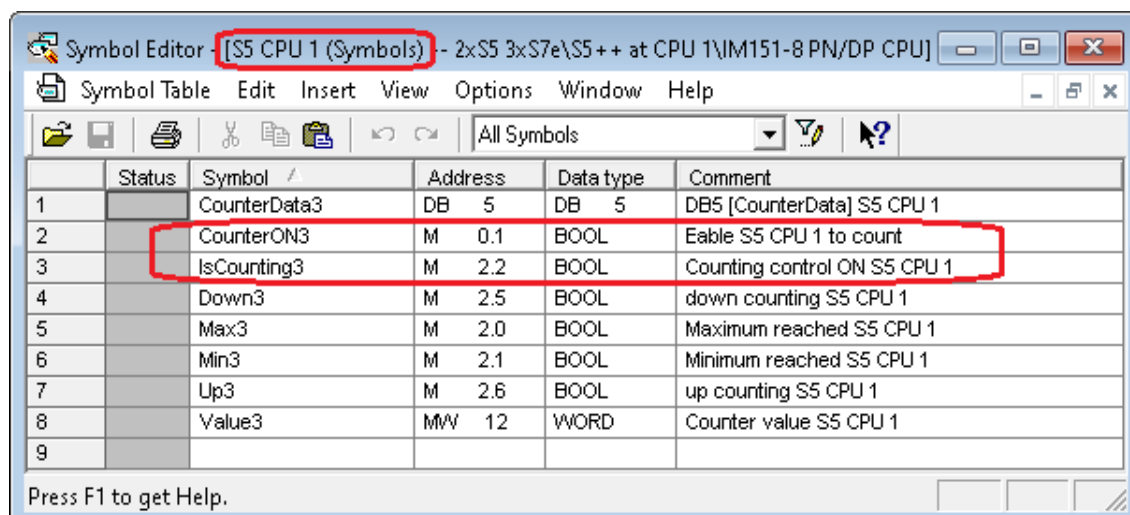
Data block CounterValues3 [DB5]

These variables are defined as OPC tags.

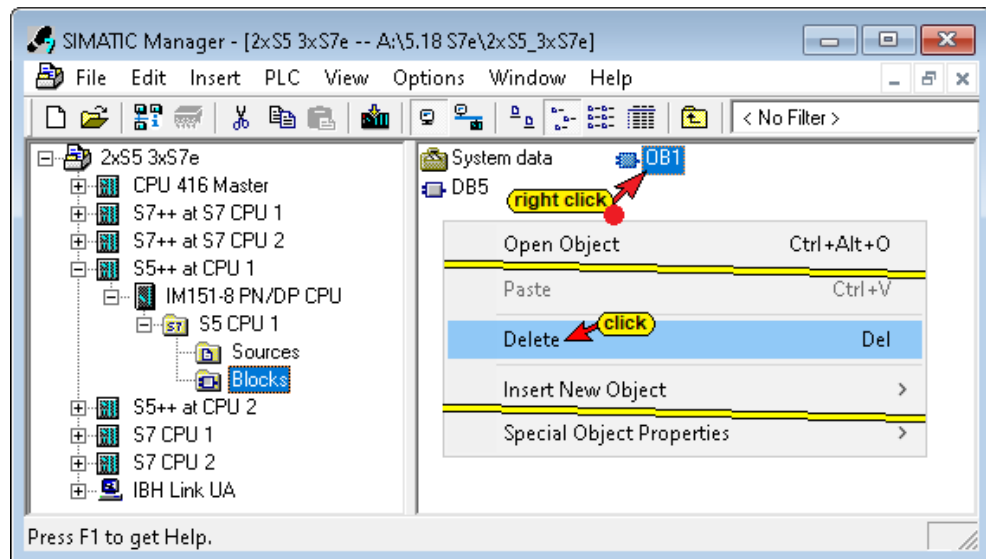


OPC tags from symbol table

Since the S5 CPUs used in the project do not know any bit variables (BOOL) in data blocks, individual bit flags from the symbol table are used as OPC tags.



Delete PLC Block OB1



Note:

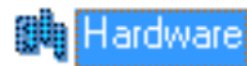


With the **IBH Link S5++** only data from **Data Blocks** can be transferred. Therefore, all program blocks in the Profinet I/O CPU must be deleted. Data blocks can be used.

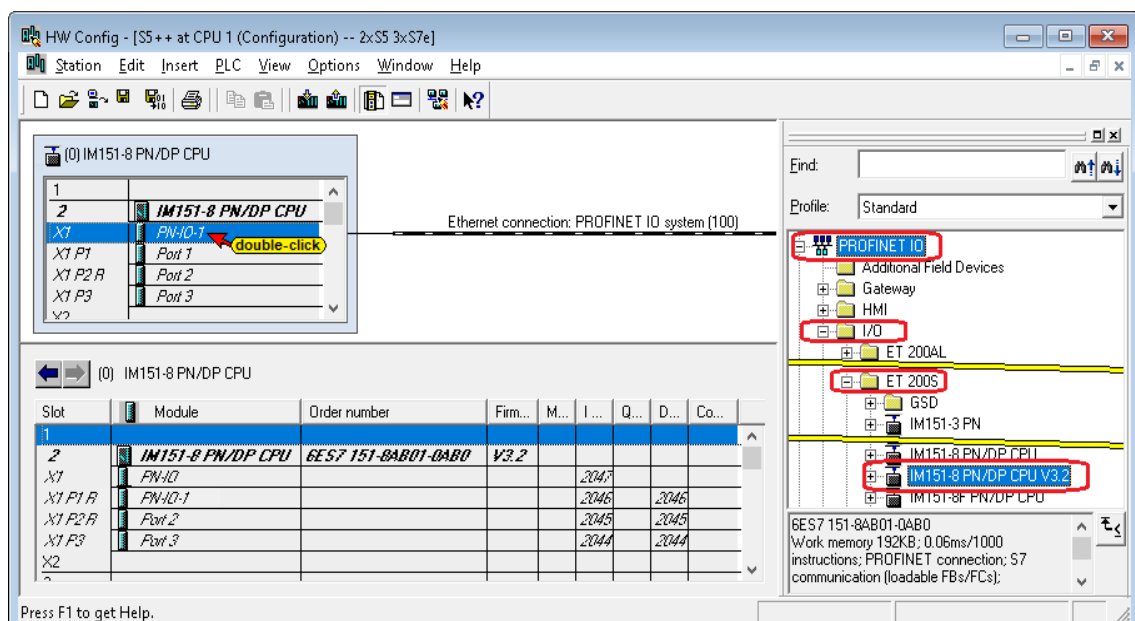
Configuration and blocks **must not be loaded** into the IBH Link S5 ++.
The load command is not permitted !

Configuration of IBH Link S5++ (SIMATIC 300 station)

Double-click **Hardware** to open the HW Configuration window.

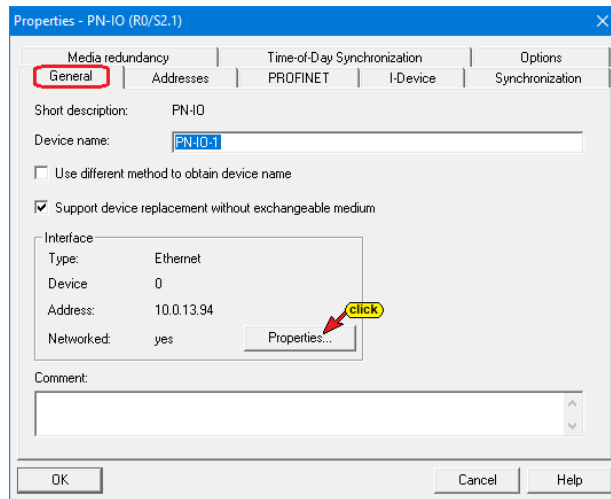
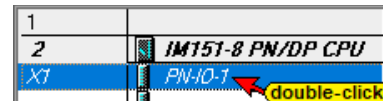


The following module must be used as a representative for the **IBH Link S5++: Profinet-I/O-ET 200S-IM15-8 PN / DB CPU V3.2.**

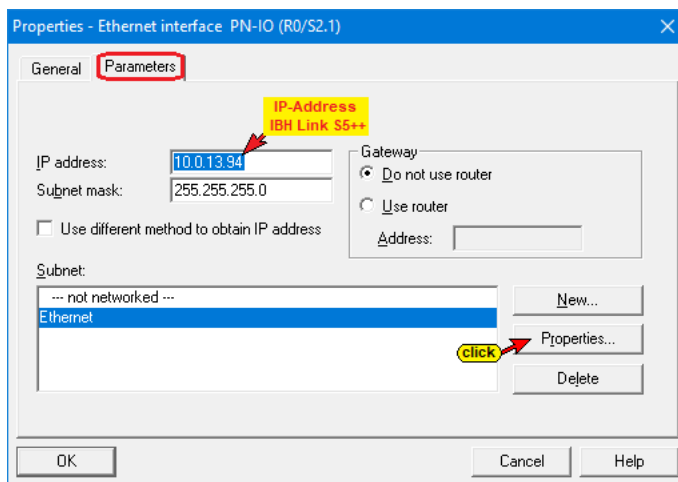


Define the ethernet interface of the *IM115-8 PN / DB CPU*

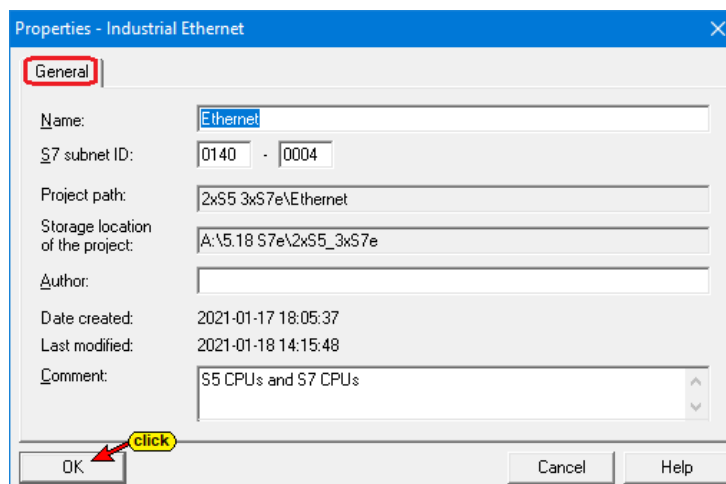
With a double-click on the line **X1 PN-IO-1** the dialog box *Properties – PN-IO – (R0 / S2.1)* is opened.



To set up the ethernet interface click the button **Properties...** button to open the dialog box *Properties – Ethernet interface PN-IO (R0 / S2.1)*. The IP address of the **IBH Link S5++** was set.



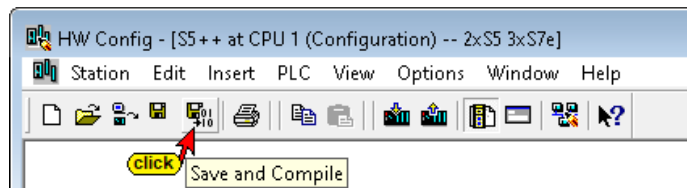
Click the button **Properties...** to open the dialog box *Properties – Industrial Ethernet* for more details on the connection.



Click **OK** to close all dialog boxes.

Configuration of the IM115-8 PN / DB CPU (IBH Link S5++) Save and Compile

The configuration is accepted by clicking the **Save and Compile** icon.



7.4.9 S5 ++ CPU 2 [IM 151 - 8 PN / DP CPU]

This CPU is the representative for the **IBH Link S5++**. It is plugged into the **S5 CPU 2**. The symbols and data block data words in the **S5 CPU 2** are to be used as OPC tags for data exchange with the CPU 416 master.

Data block CounterValues4 [DB5]

These variables are defined as OPC tags.

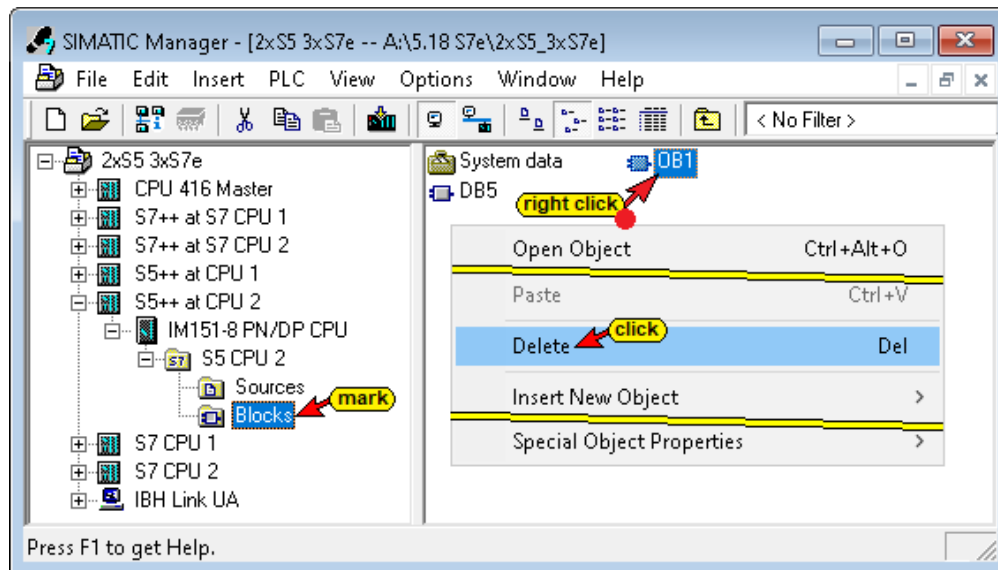
Address	Name	Type	Initial value	Comment
0.0		STRUCT		
+0.0	MinValue_4	INT	0	minimum Counter value S5 CPU 2
+2.0	MaxValue_4	INT	0	maximum Counter value S5 CPU 2
+4.0	Value_4	INT	0	Counter Value S5 CPU 2
+6.0		END_STRUCT		

OPC tags from symbol table

Since the S5 CPUs used in the project do not know any bit variables (BOOL) in data blocks, individual bit flags from the symbol table are used as OPC tags.

Status	Symbol	Address	Data type	Comment
1	CounterData4	DB 5	DB 5	DB5 [CounterData] S7 CPU 2
2	CounterON4	M 0.1	BOOL	Enable S5 CPU 2 to count
3	IsCounting4	M 2.2	BOOL	Counting control ON S5 CPU 2
4	Down4	M 2.5	BOOL	down counting S5 CPU 2
5	Max4	M 2.0	BOOL	Maximum reached S5 CPU 2
6	Min4	M 2.1	BOOL	Minimum reached S5 CPU 2
7	Up4	M 2.6	BOOL	up counting S5 CPU 2
8	Value4	MW 12	WORD	Counter value S5 CPU 2

Delete PLC Block OB1



Note:

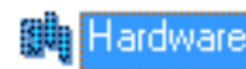


With the **IBH Link S5++** only data from **Data Blocks** can be transferred. Therefore, all program blocks in the Profinet **I/O CPU** must be deleted. Data blocks can be used.

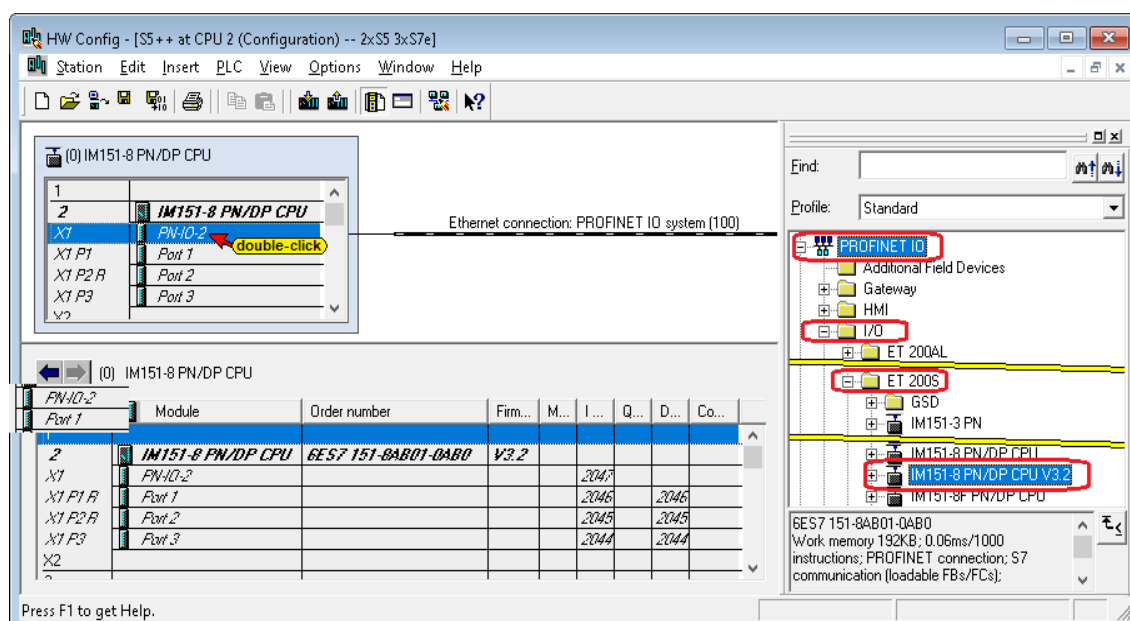
Configuration and blocks *must not be loaded* into the IBH Link S5 ++.
The load command is not permitted !

Configuration of IBH Link S5++ (SIMATIC 300 station)

Double-click **Hardware** to open the HW Configuration window.

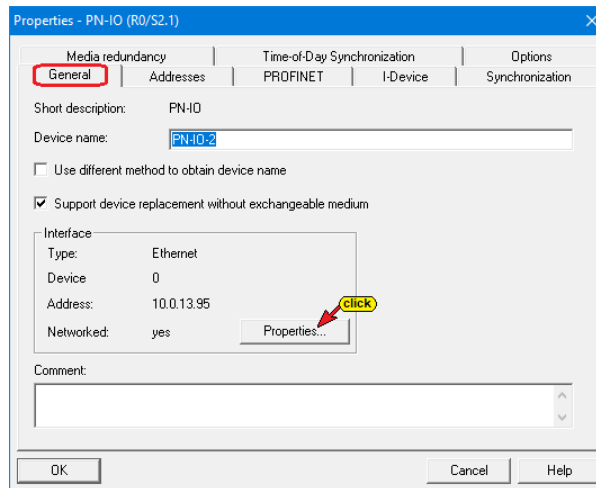
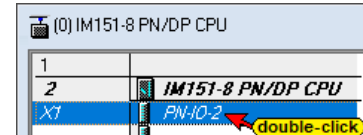


The following module must be used as a representative for the **IBH Link S5++: Profinet-I/O-ET 200S-IM115-8 PN / DB CPU V3.2.**

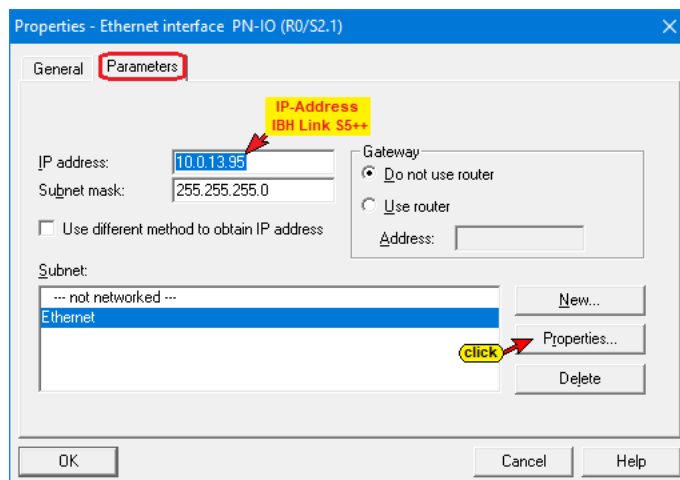


Define the ethernet interface of the *IM115-8 PN / DB CPU*

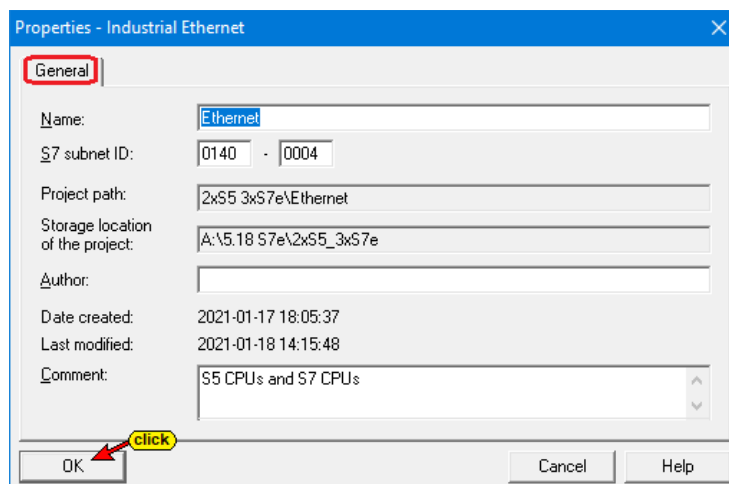
With a double-click on the line **X1 PN-IO-2** the dialog box *Properties – PN-IO - (R0 / S2.1)* is opened.



To set up the ethernet interface click the button **Properties...** button to open the dialog box **Properties – Ethernet interface PN-IO (R0 / S2.1)**. The IP address of the **IBH Link S5++** was set.



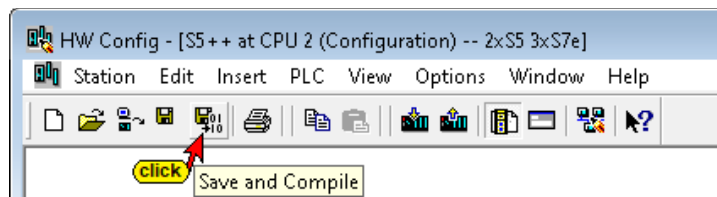
Click the button **Properties...** to open the dialog box **Properties – Industrial Ethernet** for more details on the connection.



Click **OK** to close all dialog boxes.

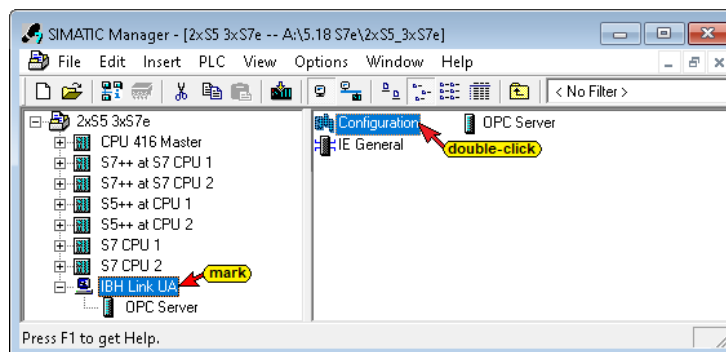
Configuration of the IM115-8 PN / DB CPU (IBH Link S5++) Save and Compile

The configuration is accepted by clicking the **Save and Compile** icon.

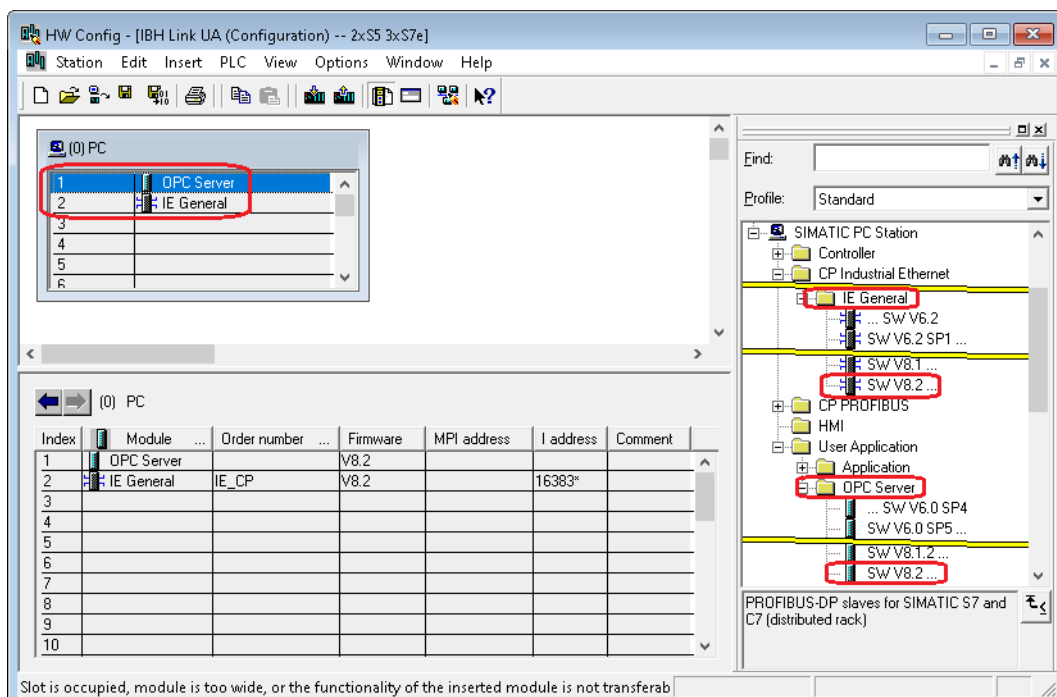


7.5 IBH Link UA as a SIMATIC PC station

A click on **IBH Link UA**, the renamed **SIMATIC PC station**, and a double-click on **Configuration** opens the window showing the configuration of the IBH Link UA.



7.5.1 Configuration of IBH Link UA (SIMATIC PC station)

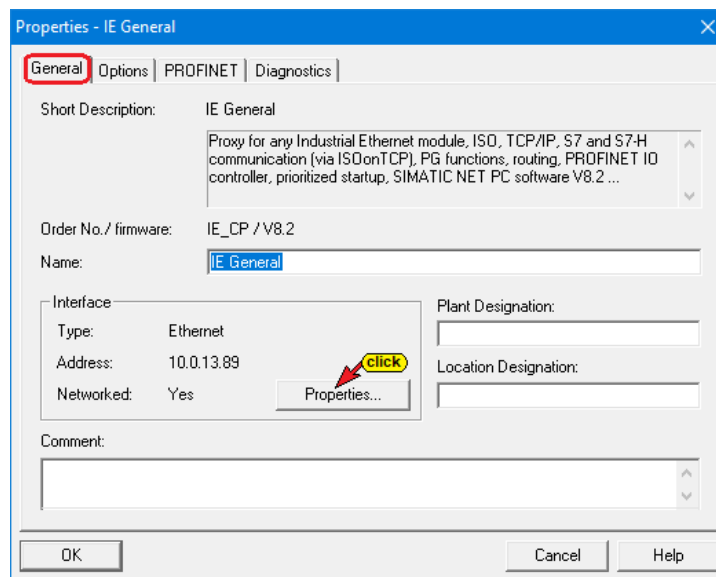
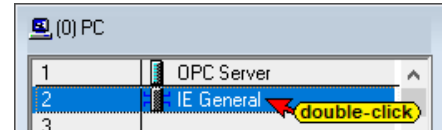


Note:

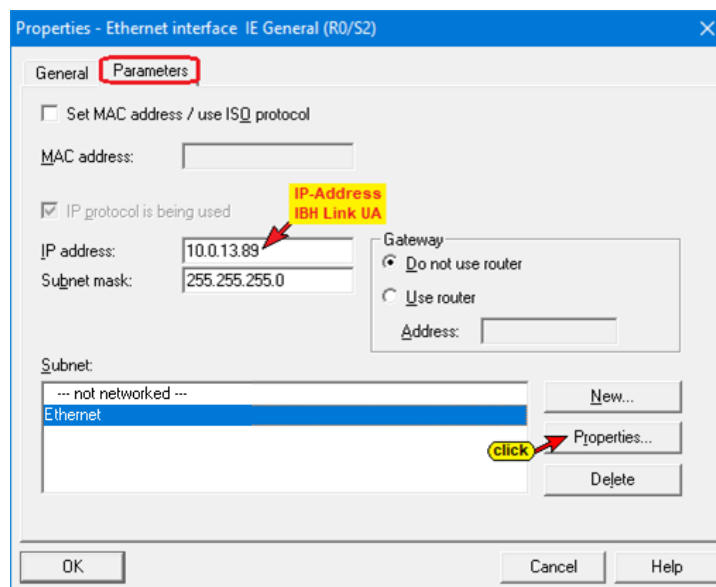
The Siemens **OPC server SW V8.2...** and the CP Industrial Ethernet interface **IE General SW V8.2...** are available in the hardware catalogs of STEP7-SIMATIC Manager and the TIA Portals.

Ethernet interface IE General (R0 / S2) set up

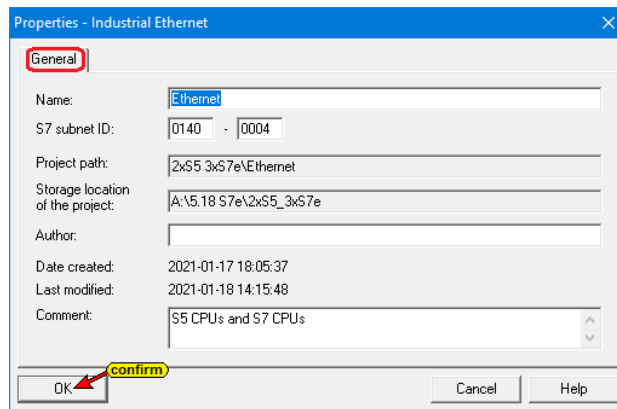
With a double-click on the line **1 IE General** the dialog box **Properties – IE General** is opened.



To set up the ethernet interface click the button **Properties...** button to open the dialog box **Properties – Ethernet interface IE General (R0 / S2)**.



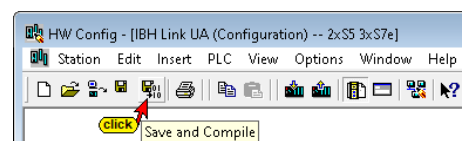
Click the button **Properties...** to open the dialog box **Properties – Industrial Ethernet** for more details on the connection.



Click OK to close all dialog boxes.

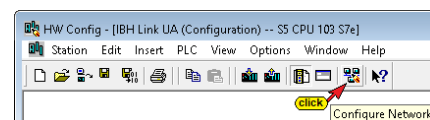
Configuration of the IBH Link UA Save and Compile

The configuration is accepted by clicking the Save and Compile icon.



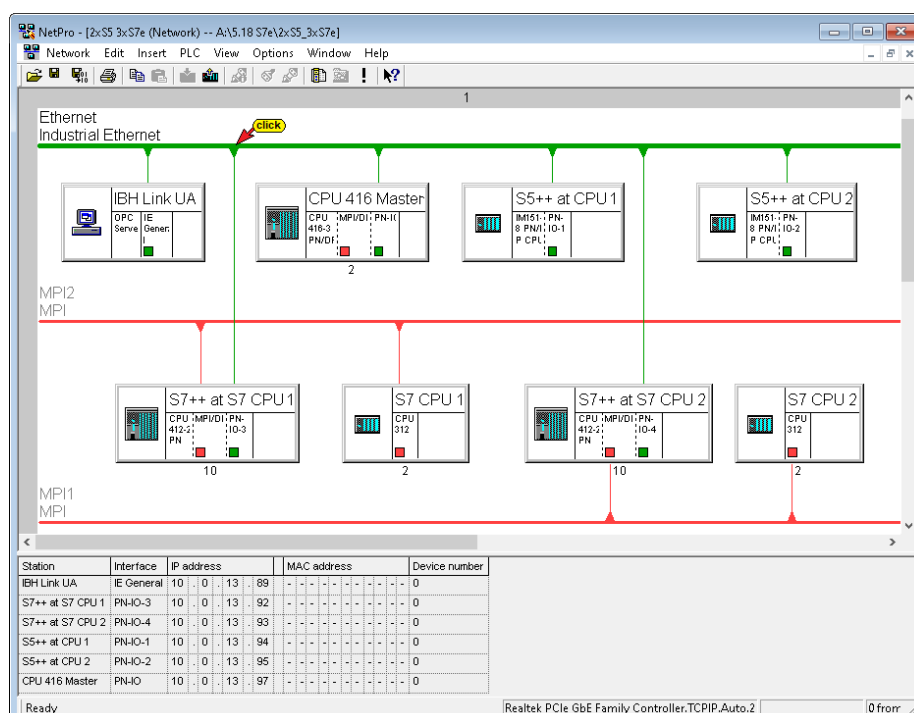
7.6 Create S7 connection between OPC Server and CPU 312

Click the **Configure Network** icon to open the **NetPro** window.



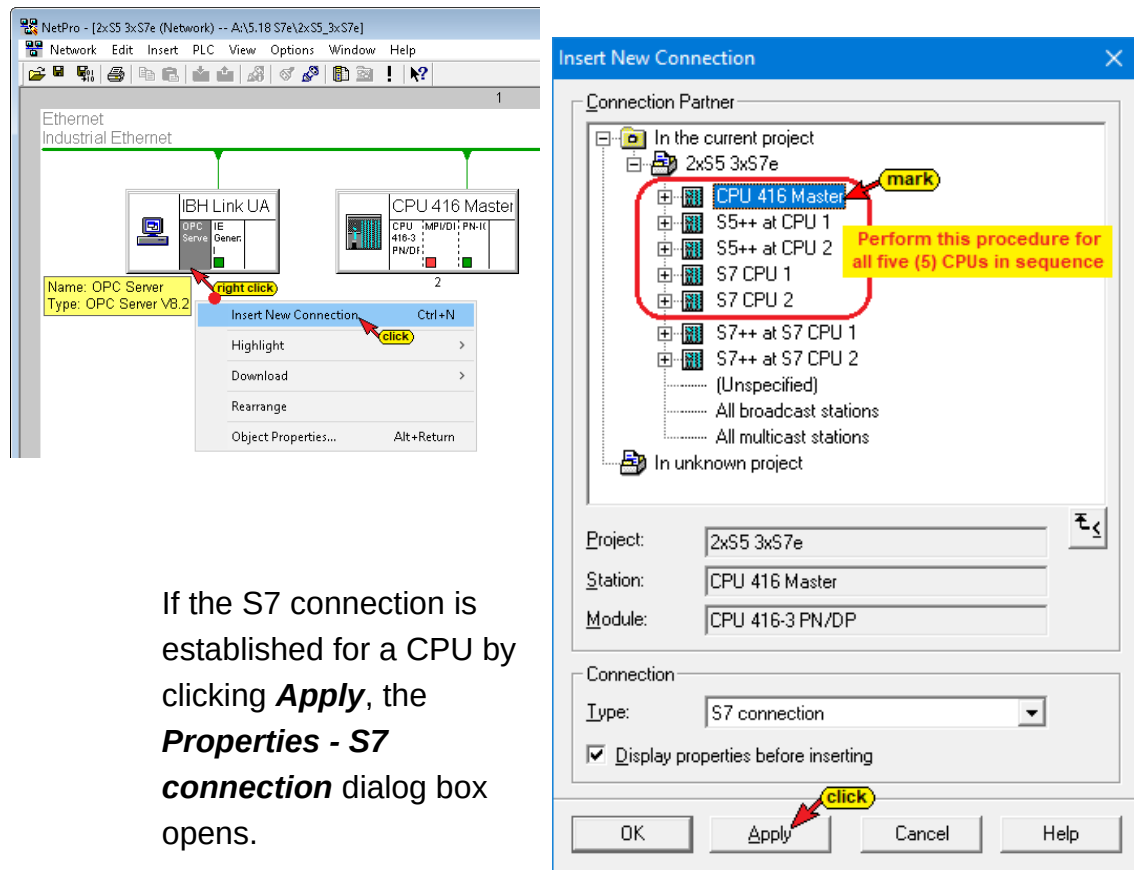
S7 connection from the **OPC Server-IBH Link UA** [OPC Server V8.2.0] to the devices are established.

NetPro window

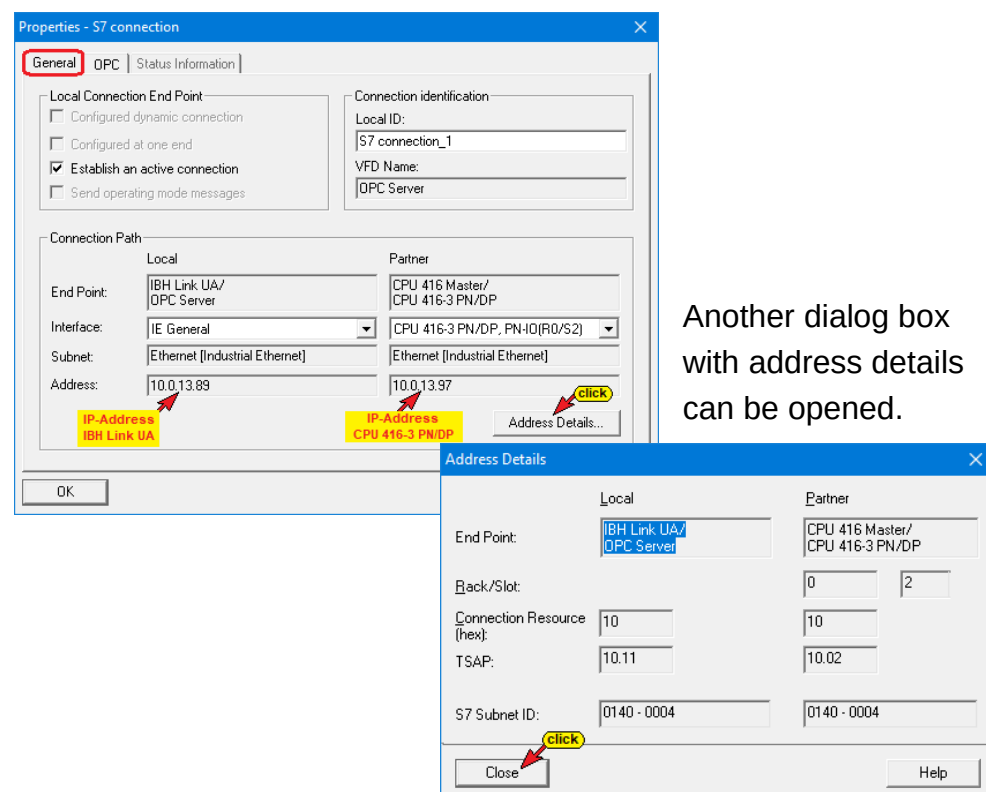


The S7 CPU 1 (CPU 312) and the S7 CPU 2 (CPU 312) do not have an Ethernet connection. They are connected via MPI with the corresponding IBH Link S7++ (CPU 412-2 PN).

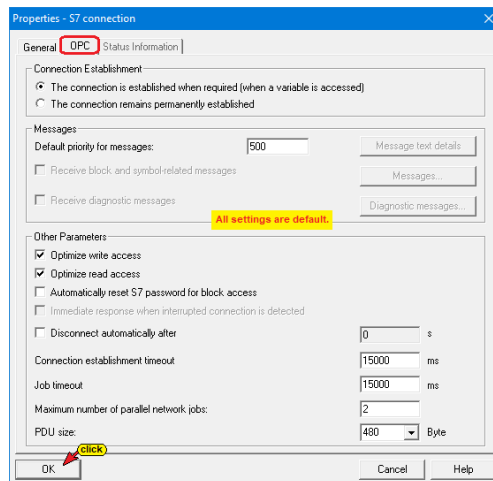
The S7 connections between the CPUs and the IBH Link UA was created with the following steps.



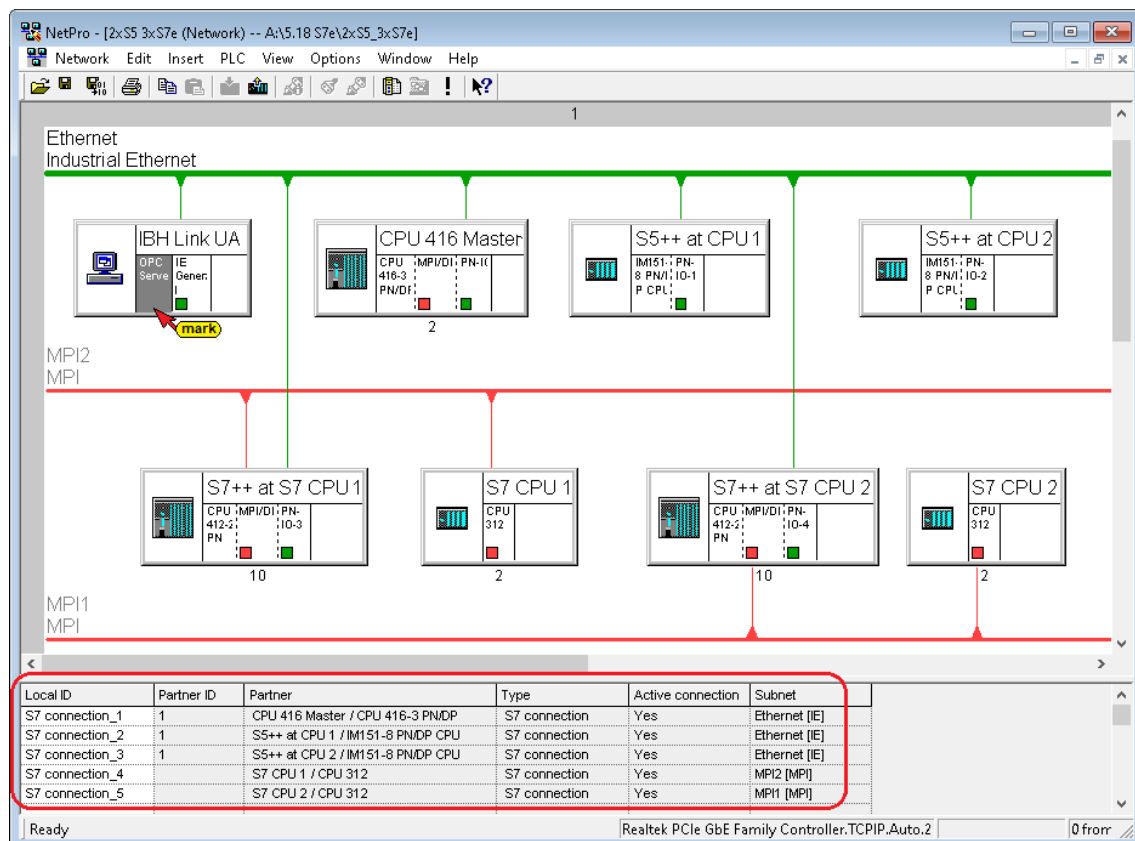
If the S7 connection is established for a CPU by clicking **Apply**, the **Properties - S7 connection** dialog box opens.



Another dialog box with address details can be opened.

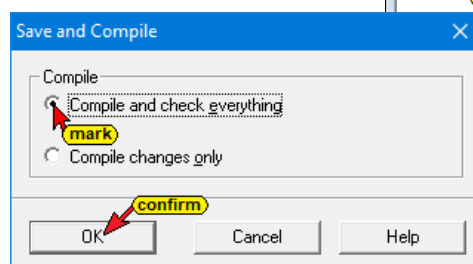
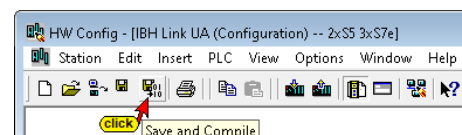


The five (5) established S7 connections are displayed in the NetPro window.



Configuration of the IBH Link UA Save and Compile

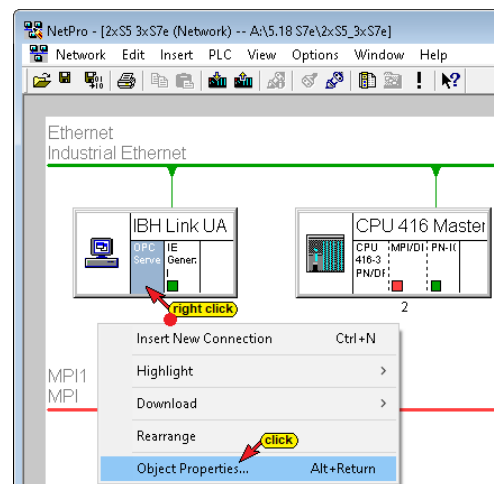
The configuration is accepted by clicking the **Save and Compile** icon.



The option compiles, and check shows warnings.
Routing was intended, the warning does not apply.

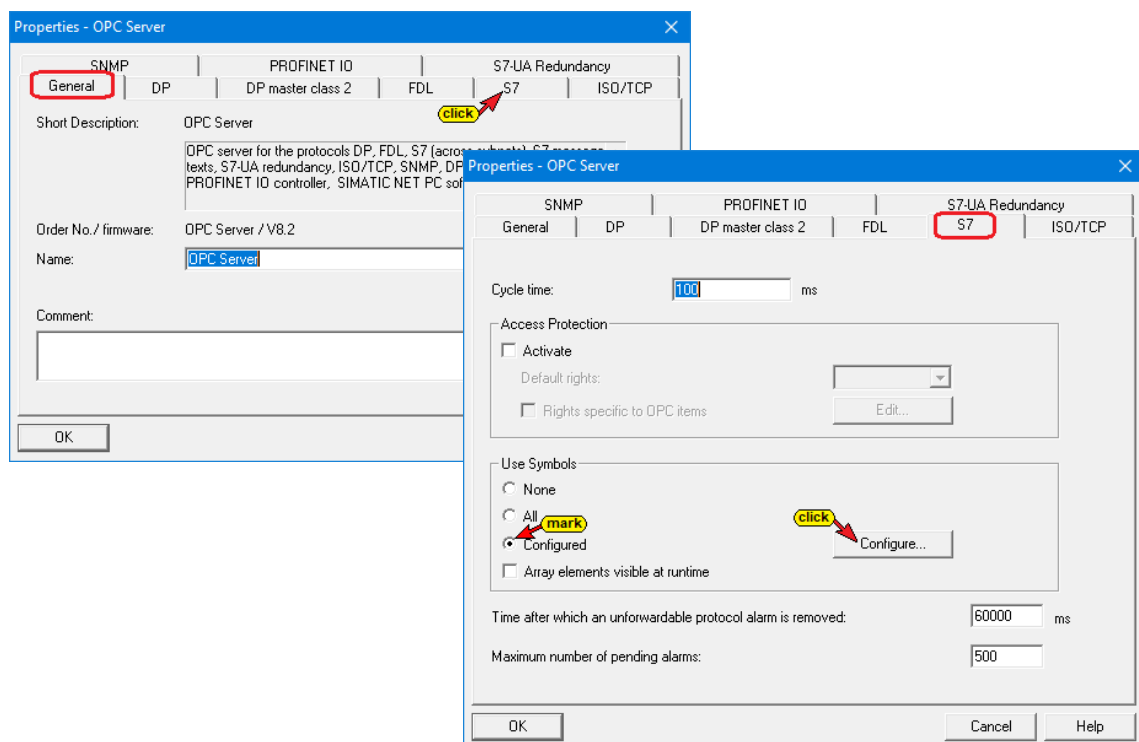
Outputs for consistency check for A:\5.18 S7e\2xS5_3xS7e\2xS5_3xS7e				
Message type	Message	Type	Project name	Project path
Warning	Outputs for connections in IBH Link UA/OPC Server:	OPC Server V8.2	2xS5_3xS7e	A:\5.18 S7e\2xS5_3xS7e
Warning	Warning: Local ID 'S7 connection_5': Establishing connection via S7 Routing.	S7 connection	2xS5_3xS7e	A:\5.18 S7e\2xS5_3xS7e
Warning	Warning: Local ID 'S7 connection_4': Establishing connection via S7 Routing.	S7 connection	2xS5_3xS7e	A:\5.18 S7e\2xS5_3xS7e
Result: 0 error(s), 2 warning(s) (2021-01-19 12:13:09)				

7.6.1 Select OPC tags



The command **Object Properties...** from the context menu (right-click) opens the **Properties - OPC server** dialog box.

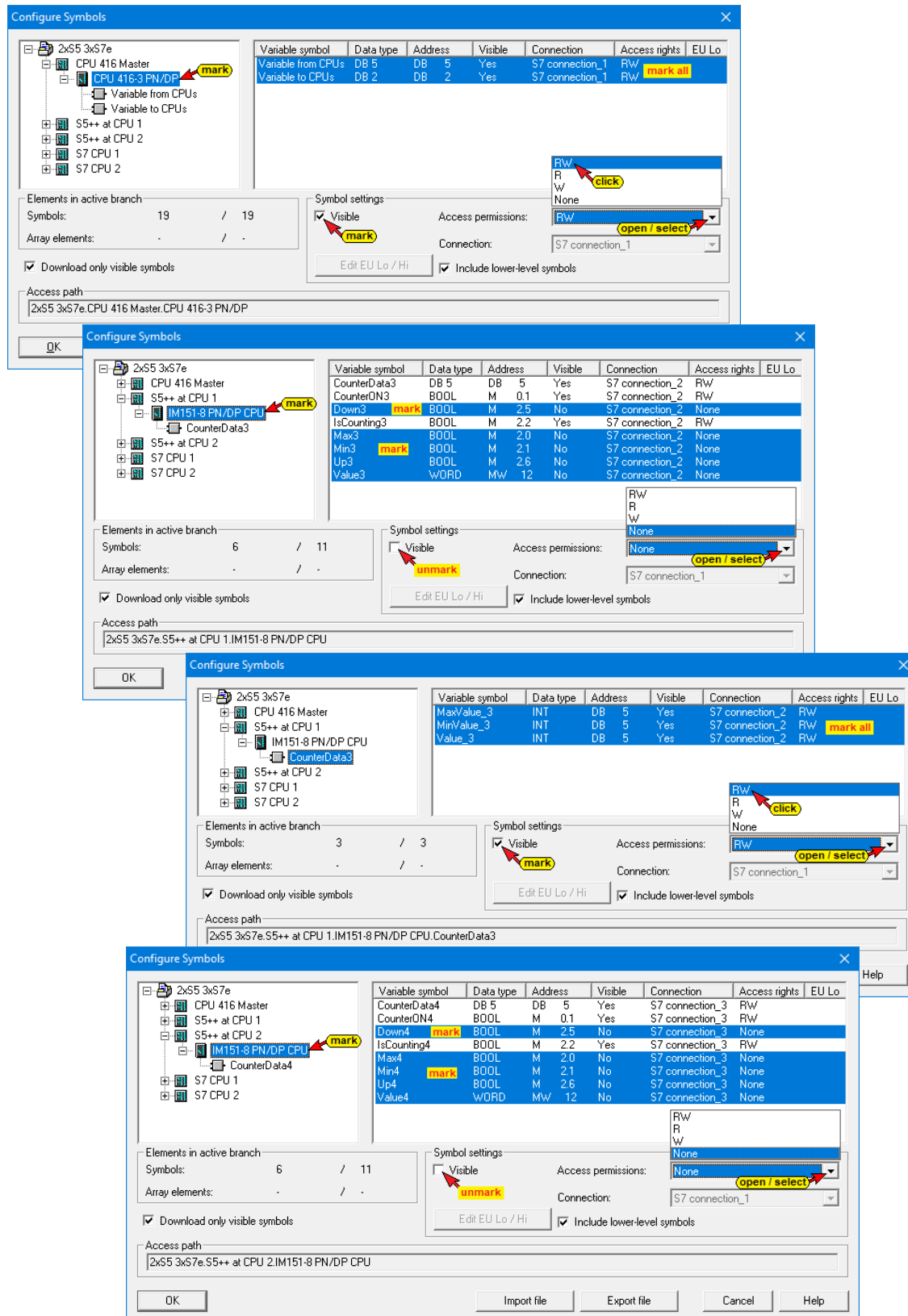
The S7 tab defines whether symbols should be used and which ones.

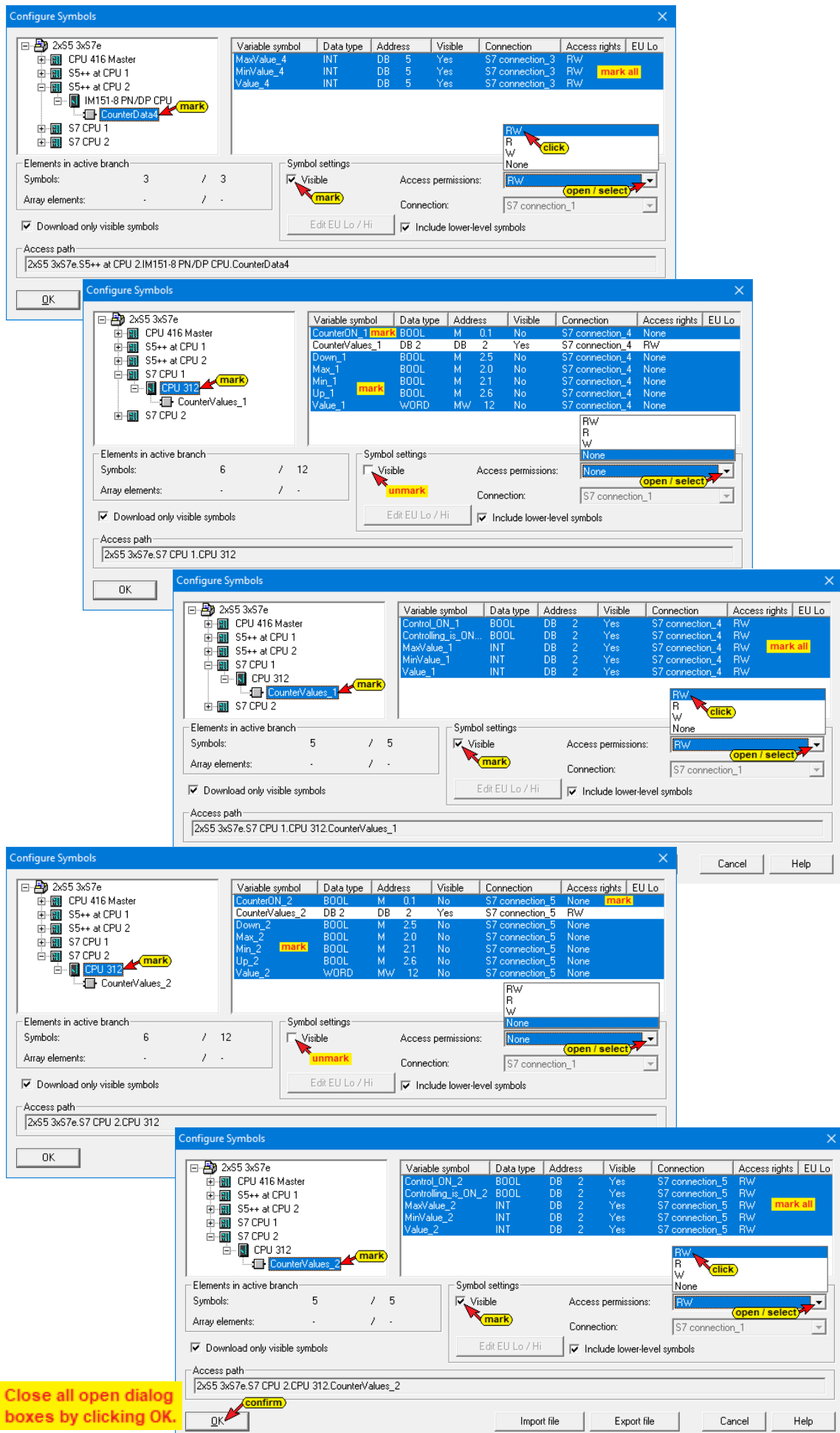


The **Configure** button opens the Configure Symbols dialog box. The operands defined in the symbol table, and the data of the data blocks can be selected here as **OPC tags** (OPC symbols).



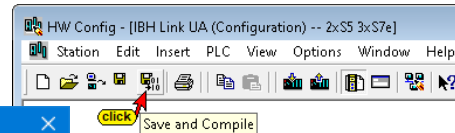
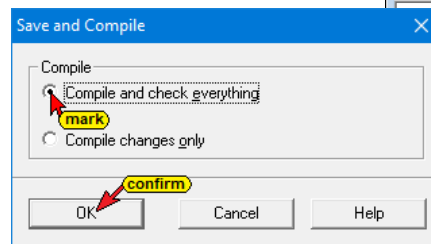
The tag management of the controller is known through the previously configured S7 connection.



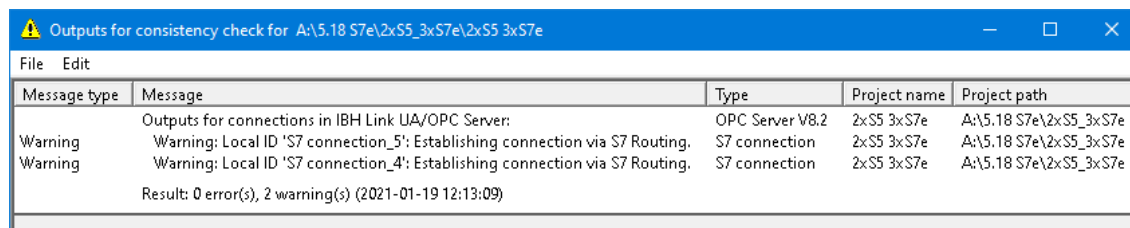


Configuration of the IBH Link UA Save and Compile

The configuration is accepted by clicking the **Save and Compile** icon.



The option compiles, and check shows warnings.
Routing was intended, the warning does not apply.



Note:



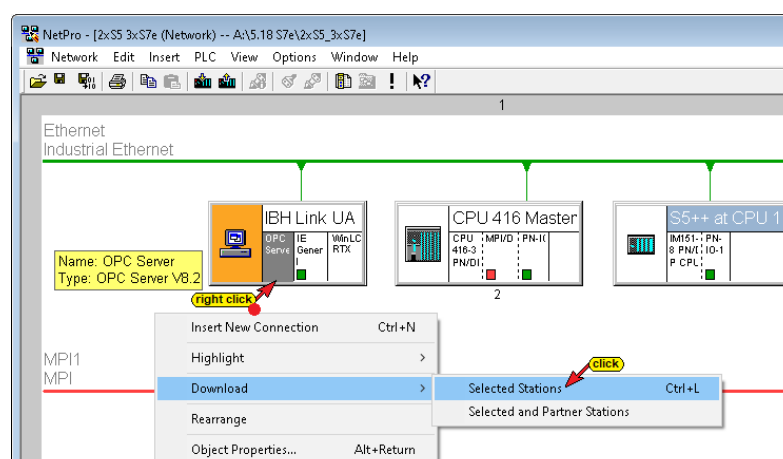
The firmware of the **IBH Link S7++** emulates the routing capabilities of the **CPU S7-412-2 PN** (6ES7 412-2EK06-0AB0 V6.0).

The hardware configuration must be loaded into the **S7++ for S7 CPU 1** [CPU 412-2 PN] and into the **S7++ for S7 CPU 2** [CPU 412-2 PN]. PLC Blocks cannot be loaded into the **IBH Link S7++**.

Only data can be transferred with the **IBH Link S5++**. All program blocks in the Profinet I/O CPU must be deleted. Data blocks can be used.

Configuration and PLC Blocks are not allowed to be loaded into the IBH Link S5++. The load command is not permitted !

Download the configuration of the IBH Link UA.

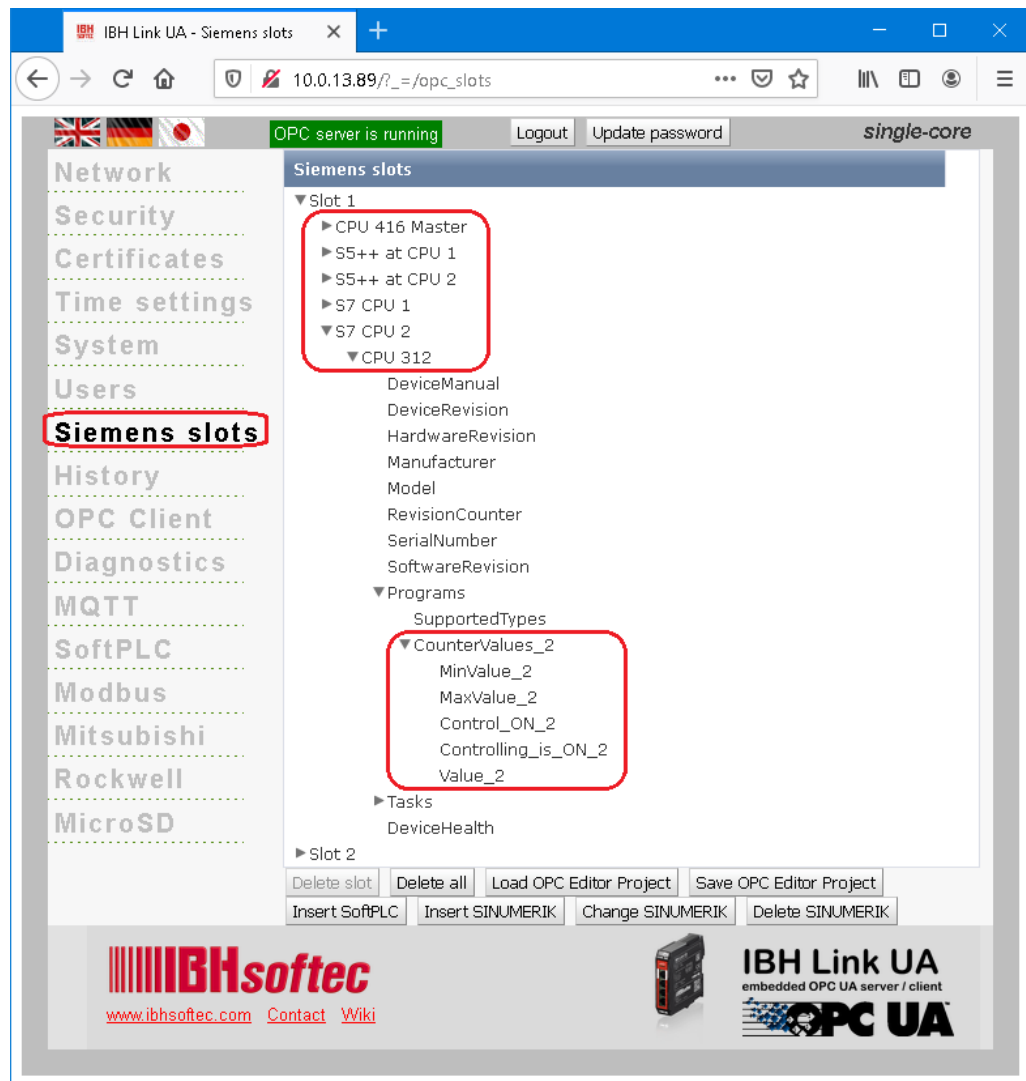


The configuration of the **IBH Link UA** can be loaded into the station.

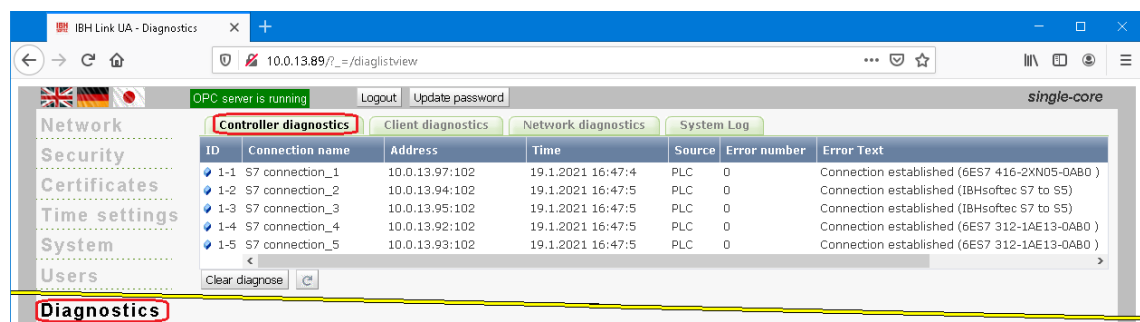
Right-click **OPC-Server** and click **Download / Selected Station**.

7.7 IBH Link UA browser window Siemens slots

The transferred devices are displayed with the OPC tags in the **Siemens Slots** browser window.



7.7.1 Browser window Diagnostics / Controller diagnostics



Define the OPC UA server for the data exchange

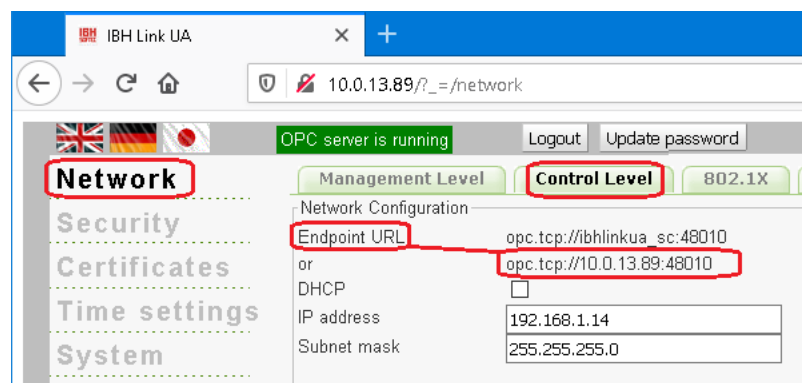
For data exchange between the **CPU 416 Master** [CPU 416 – 3 PN/DP], and the other PLC controls (**S7-CPU 1** [CPU 312], **S7-CPU 2** [CPU 312], **S5 CPU 1** [IM 151-8 PN/DP CPU] **S5 CPU 2** [IM 151-8 PN/DP CPU]) the **OPC UA servers**, and **OPC UA clients** are registered in the **IBH Link UA**.

All the above PLC controls are both **OPC UA server** and **OPC UA client**. The server integrated in the **IBH Link UA** provides the **OPC tags** that are defined in the PLC-CPU.

The **IBH Link UA** offers the **OPC UA server** as well as the **OPC UA client function** for all PLC CPUs.

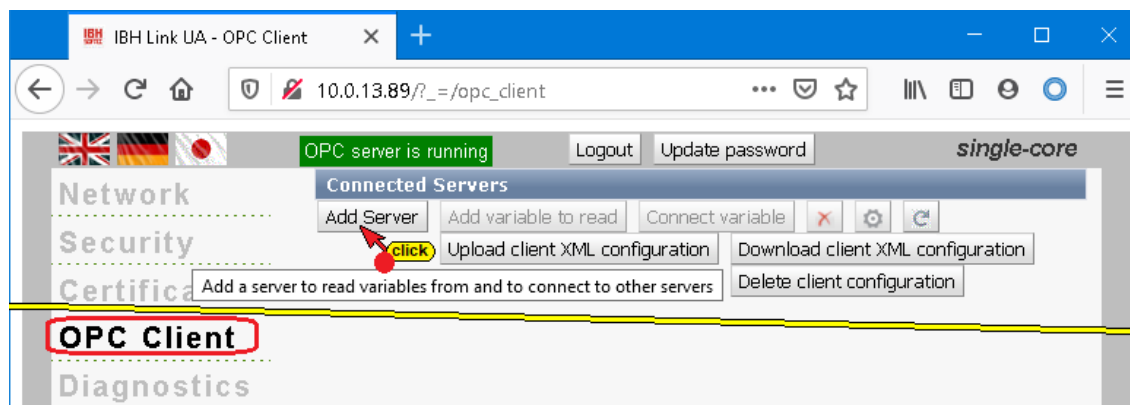
The server for the data exchange of all PLC CPUs is specified in the web browser window **OPC Client**.

The required endpoint URL can be copied from the IBH Link UA web browser window network / control level.



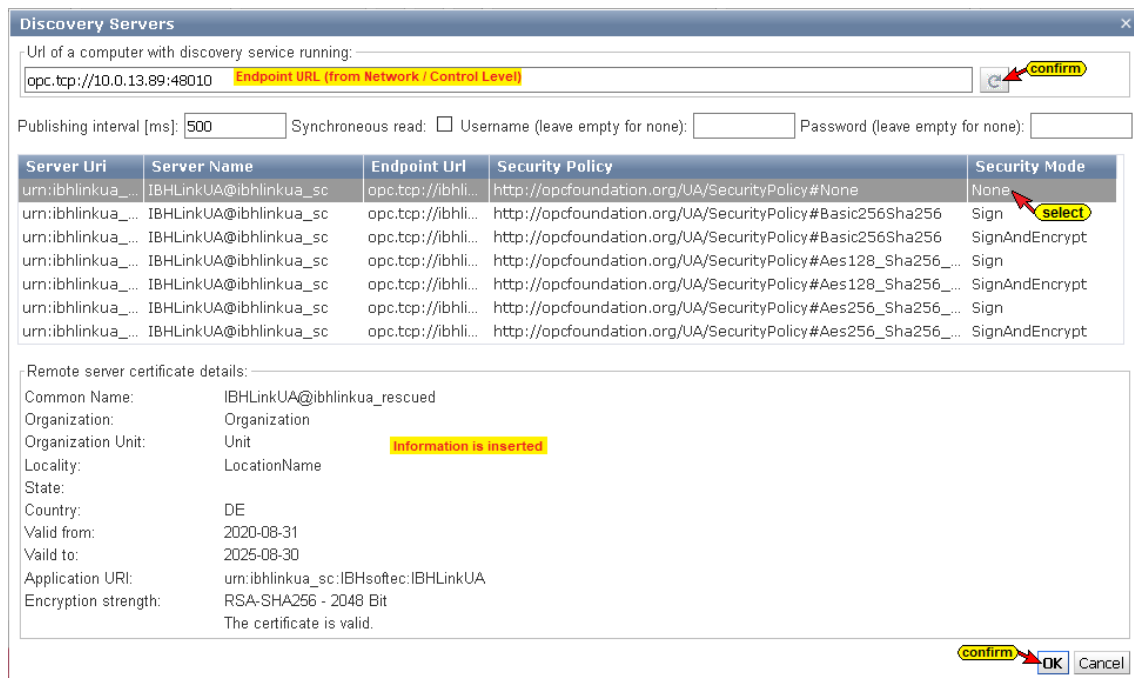
The endpoint URL can be copied into the IBH Link UA web browser window / network / control level.

Add server



The copied endpoint URL **opc.tcp: // ibhlinkua_sc: 48010** or **opc.tcp: //10.0.13.89: 48010** is in the open field in the IBH Link UA web browser window / OPC client is to be added as a server.

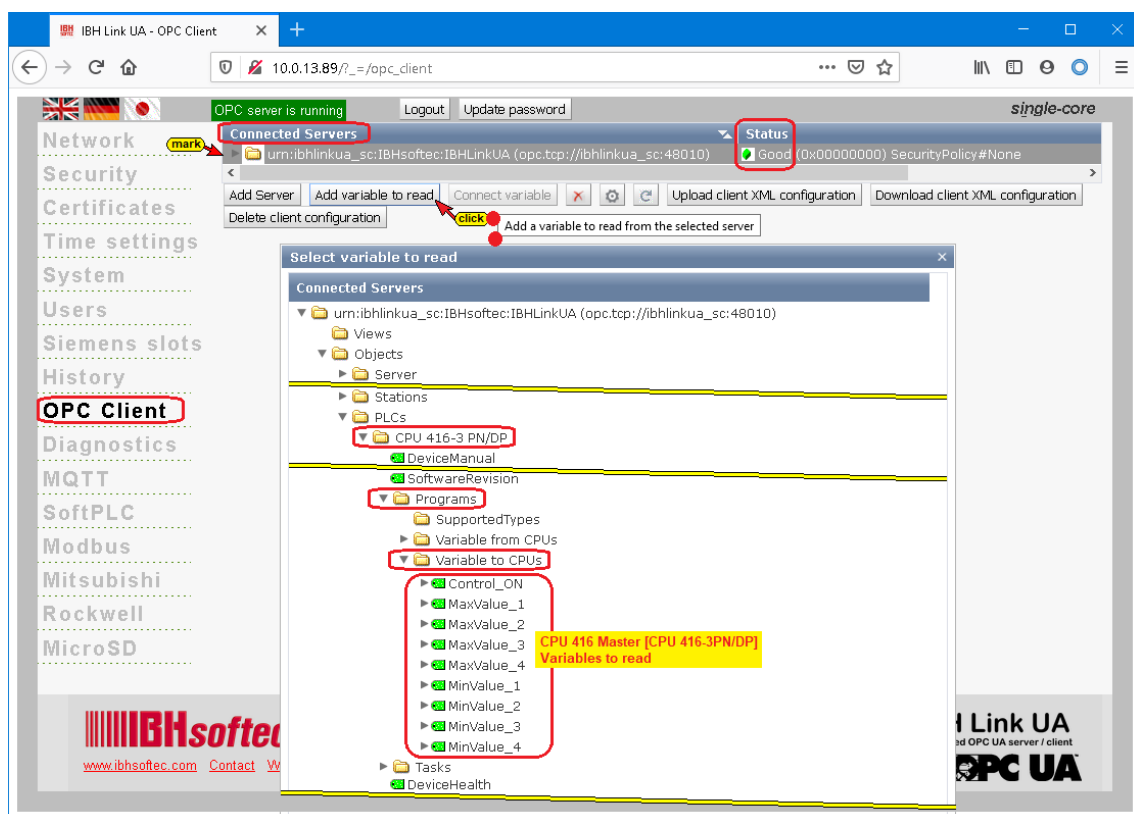
Security Policy None and Security Mode None were selected for data transmission.



The IBH Link UA OPC UA server is connected. The status of the server is good. None was selected as the security policy for the server.

Add read variable CPU 416 Master

OPC tags defined as read tags have the functions of an OPC UA server. These OPC tags are available to all OPC UA clients.



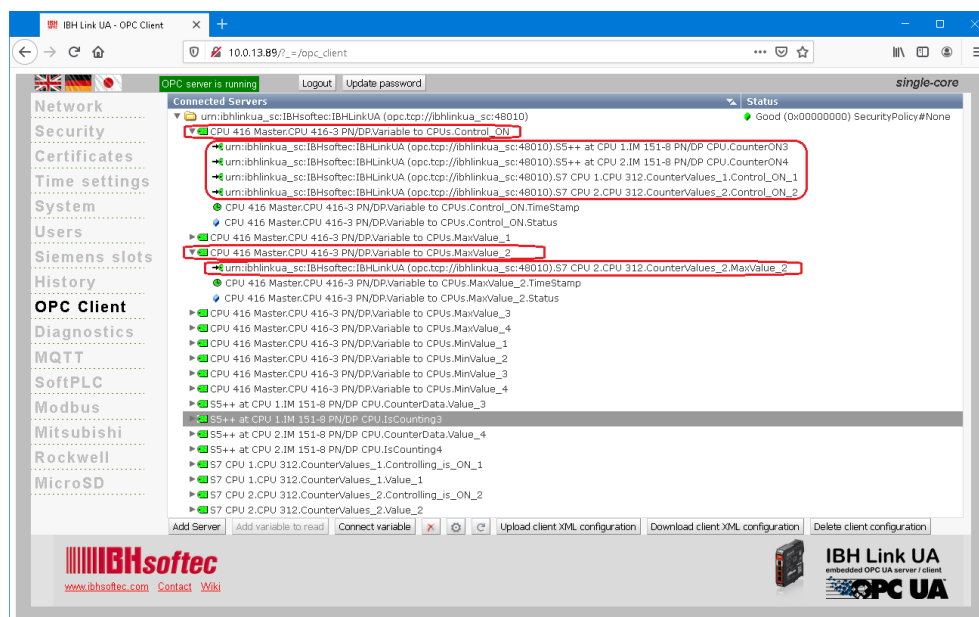
Add read variable S5 CPUs and S7 312 CPUs



Added read variables: S7 312 CPUs

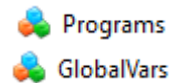


The connections are displayed in the IBH Link UA web browser window OPC Client.



7.8 UaExpert - program window

The PLC controls used in the example are listed in the **UaExpert** program window under PLC.



The variables defined as OPC tags in the data blocks (under **Programs**), and in the symbol table (under **GlobalVars**) can be dragged and dropped into the **Data Access View**. The variables are updated continuously.

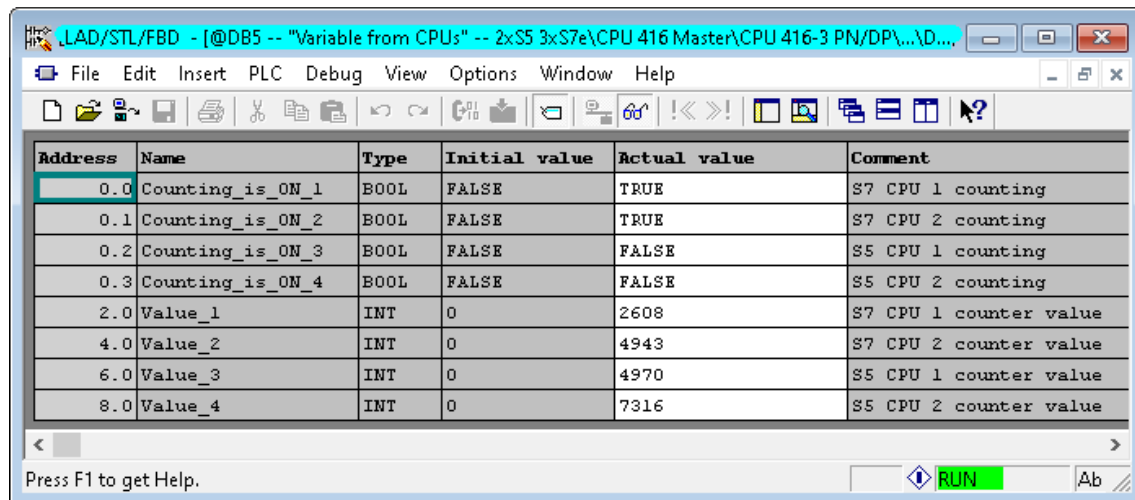
#	Server	Node Id	Display Name	Value	Datatype	Source Timestamp	Server Timestamp	Statuscode
1	IBHLinkUA...	NS4 String CPU 416 Master.C...	Control_ON	true	Boolean	12:46:05.506	12:46:05.756	Good
2	IBHLinkUA...	NS4 String CPU 416 Master.C...	MaxValue_1	5500	Int16	12:46:05.506	12:46:05.756	Good
3	IBHLinkUA...	NS4 String CPU 416 Master.C...	MaxValue_2	5000	Int16	12:46:05.506	12:46:05.756	Good
4	IBHLinkUA...	NS4 String CPU 416 Master.C...	MaxValue_3	4500	Int16	12:46:05.506	12:46:05.756	Good
5	IBHLinkUA...	NS4 String CPU 416 Master.C...	MaxValue_4	4000	Int16	12:46:05.506	12:46:05.756	Good
6	IBHLinkUA...	NS4 String CPU 416 Master.C...	MinValue_1	900	Int16	12:46:05.506	12:46:05.756	Good
7	IBHLinkUA...	NS4 String CPU 416 Master.C...	MinValue_2	800	Int16	12:46:05.506	12:46:05.756	Good
8	IBHLinkUA...	NS4 String CPU 416 Master.C...	MinValue_3	700	Int16	12:46:05.506	12:46:05.756	Good
9	IBHLinkUA...	NS4 String CPU 416 Master.C...	MinValue_4	600	Int16	12:46:05.506	12:46:05.756	Good
10	IBHLinkUA...	NS4 String S7 CPU 2.CPU 312...	Control_ON_2	true	Boolean	12:46:05.756	12:46:06.006	Good
11	IBHLinkUA...	NS4 String S7 CPU 2.CPU 312...	Counting_is_ON_2	true	Boolean	12:46:05.506	12:46:05.756	Good
12	IBHLinkUA...	NS4 String S7 CPU 2.CPU 312...	MaxValue_2	5000	Int16	12:46:05.756	12:46:06.006	Good
13	IBHLinkUA...	NS4 String S7 CPU 2.CPU 312...	MinValue_2	800	Int16	12:46:05.756	12:46:06.006	Good
14	IBHLinkUA...	NS4 String S7 CPU 2.CPU 312...	Value_2	3887	Int16	12:52:08.817	12:52:09.067	Good
15	IBHLinkUA...	NS4 String S7 CPU 1.CPU 312...	Control_ON_1	true	Boolean	12:46:05.756	12:46:06.006	Good
16	IBHLinkUA...	NS4 String S7 CPU 1.CPU 312...	Counting_is_ON_1	true	Boolean	12:46:05.506	12:46:05.756	Good
17	IBHLinkUA...	NS4 String S7 CPU 1.CPU 312...	MaxValue_1	5500	Int16	12:46:05.756	12:46:06.006	Good
18	IBHLinkUA...	NS4 String S7 CPU 1.CPU 312...	MinValue_1	900	Int16	12:46:05.756	12:46:06.006	Good
19	IBHLinkUA...	NS4 String S7 CPU 1.CPU 312...	Value_1	4233	Int16	12:52:08.817	12:52:09.067	Good
20	IBHLinkUA...	NS4 String CPU 416 Master.C...	Counting_is_ON_1	true	Boolean	12:46:05.756	12:46:06.006	Good
21	IBHLinkUA...	NS4 String CPU 416 Master.C...	Counting_is_ON_2	true	Boolean	12:46:05.756	12:46:06.006	Good
22	IBHLinkUA...	NS4 String CPU 416 Master.C...	Counting_is_ON_3	false	Boolean	12:46:05.756	12:46:06.006	Good
23	IBHLinkUA...	NS4 String CPU 416 Master.C...	Counting_is_ON_4	false	Boolean	12:46:05.756	12:46:06.006	Good
24	IBHLinkUA...	NS4 String CPU 416 Master.C...	Value_1	5355	Int16	12:52:08.873	12:52:09.067	Good
25	IBHLinkUA...	NS4 String CPU 416 Master.C...	Value_2	4986	Int16	12:52:08.873	12:52:09.067	Good
26	IBHLinkUA...	NS4 String CPU 416 Master.C...	Value_3	941	Int16	12:52:08.873	12:52:09.067	Good
27	IBHLinkUA...	NS4 String CPU 416 Master.C...	Value_4	5927	Int16	12:52:08.873	12:52:09.067	Good

Data of the data block *Variable from CPUs* [DB5] as OPC tags

Data Access View								
#	Server	Node Id		Display Name				
20	IBHLinkUA@ibhlinkua_sc	NS4 String CPU 416 Master.CPU 416-3 PN/DP.Variable from CPUs.Counting_is_ON_1		Counting_is_ON_1				
21	IBHLinkUA@ibhlinkua_sc	NS4 String CPU 416 Master.CPU 416-3 PN/DP.Variable from CPUs.Counting_is_ON_2		Counting_is_ON_2				
22	IBHLinkUA@ibhlinkua_sc	NS4 String CPU 416 Master.CPU 416-3 PN/DP.Variable from CPUs.Counting_is_ON_3		Counting_is_ON_3				
23	IBHLinkUA@ibhlinkua_sc	NS4 String CPU 416 Master.CPU 416-3 PN/DP.Variable from CPUs.Counting_is_ON_4		Counting_is_ON_4				
24	IBHLinkUA@ibhlinkua_sc	NS4 String CPU 416 Master.CPU 416-3 PN/DP.Variable from CPUs.Value_1		Value_1				
25	IBHLinkUA@ibhlinkua_sc	NS4 String CPU 416 Master.CPU 416-3 PN/DP.Variable from CPUs.Value_2		Value_2				
26	IBHLinkUA@ibhlinkua_sc	NS4 String CPU 416 Master.CPU 416-3 PN/DP.Variable from CPUs.Value_3		Value_3				
27	IBHLinkUA@ibhlinkua_sc	NS4 String CPU 416 Master.CPU 416-3 PN/DP.Variable from CPUs.Value_4		Value_4				

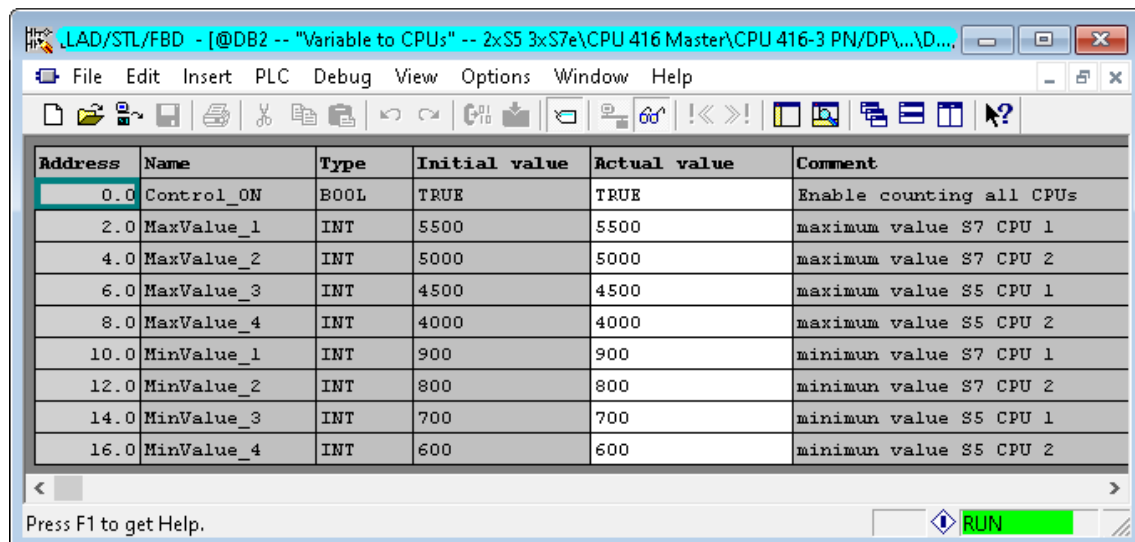
Data Access View						
#	Display Name	Value	Datatype	Source Timestamp	Server Timestamp	Statuscode
20	Counting_is_ON_1	true	Boolean	12:46:05.756	12:46:06.006	Good
21	Counting_is_ON_2	true	Boolean	12:46:05.756	12:46:06.006	Good
22	Counting_is_ON_3	false	Boolean	12:46:05.756	12:46:06.006	Good
23	Counting_is_ON_4	false	Boolean	12:46:05.756	12:46:06.006	Good
24	Value_1	3362	Int16	13:04:04.179	13:04:04.387	Good
25	Value_2	1095	Int16	13:04:04.179	13:04:04.387	Good
26	Value_3	9629	Int16	13:04:04.179	13:04:04.387	Good
27	Value_4	8334	Int16	13:04:04.179	13:04:04.387	Good

Data block status - CPU 416 master [CPU 416-3 PN / DP] Variable from CPUs [DB5]



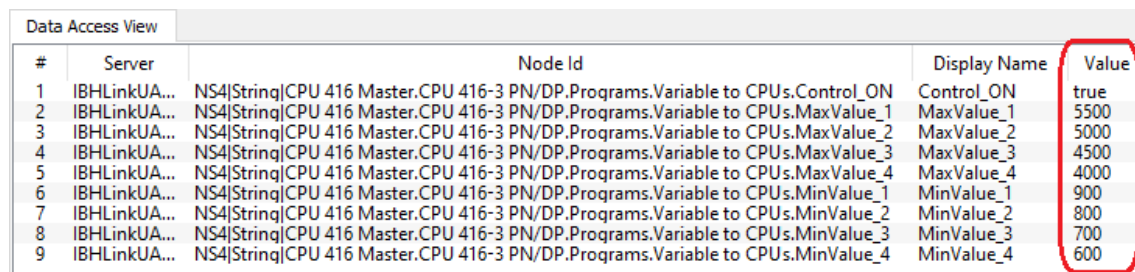
Address	Name	Type	Initial value	Actual value	Comment
0.0	Counting_is_ON_1	BOOL	FALSE	TRUE	S7 CPU 1 counting
0.1	Counting_is_ON_2	BOOL	FALSE	TRUE	S7 CPU 2 counting
0.2	Counting_is_ON_3	BOOL	FALSE	FALSE	S5 CPU 1 counting
0.3	Counting_is_ON_4	BOOL	FALSE	FALSE	S5 CPU 2 counting
2.0	Value_1	INT	0	2608	S7 CPU 1 counter value
4.0	Value_2	INT	0	4943	S7 CPU 2 counter value
6.0	Value_3	INT	0	4970	S5 CPU 1 counter value
8.0	Value_4	INT	0	7316	S5 CPU 2 counter value

Data block status - Variable to CPUs [DB2]



Address	Name	Type	Initial value	Actual value	Comment
0.0	Control_ON	BOOL	TRUE	TRUE	Enable counting all CPUs
2.0	MaxValue_1	INT	5500	5500	maximum value S7 CPU 1
4.0	MaxValue_2	INT	5000	5000	maximum value S7 CPU 2
6.0	MaxValue_3	INT	4500	4500	maximum value S5 CPU 1
8.0	MaxValue_4	INT	4000	4000	maximum value S5 CPU 2
10.0	MinValue_1	INT	900	900	minimum value S7 CPU 1
12.0	MinValue_2	INT	800	800	minimum value S7 CPU 2
14.0	MinValue_3	INT	700	700	minimum value S5 CPU 1
16.0	MinValue_4	INT	600	600	minimum value S5 CPU 2

Data of the data block Variable to CPUs [DB2] as OPC tags



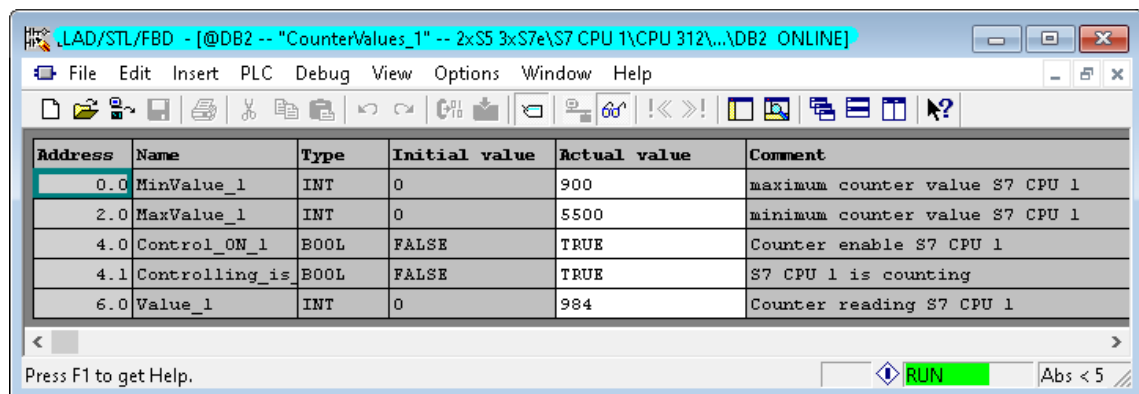
#	Server	Node Id	Display Name	Value
1	IBHLinkUA...	NS4[String]CPU 416 Master.CPU 416-3 PN/DP.Programs.Variable to CPUs.Control_ON	Control_ON	true
2	IBHLinkUA...	NS4[String]CPU 416 Master.CPU 416-3 PN/DP.Programs.Variable to CPUs.MaxValue_1	MaxValue_1	5500
3	IBHLinkUA...	NS4[String]CPU 416 Master.CPU 416-3 PN/DP.Programs.Variable to CPUs.MaxValue_2	MaxValue_2	5000
4	IBHLinkUA...	NS4[String]CPU 416 Master.CPU 416-3 PN/DP.Programs.Variable to CPUs.MaxValue_3	MaxValue_3	4500
5	IBHLinkUA...	NS4[String]CPU 416 Master.CPU 416-3 PN/DP.Programs.Variable to CPUs.MaxValue_4	MaxValue_4	4000
6	IBHLinkUA...	NS4[String]CPU 416 Master.CPU 416-3 PN/DP.Programs.Variable to CPUs.MinValue_1	MinValue_1	900
7	IBHLinkUA...	NS4[String]CPU 416 Master.CPU 416-3 PN/DP.Programs.Variable to CPUs.MinValue_2	MinValue_2	800
8	IBHLinkUA...	NS4[String]CPU 416 Master.CPU 416-3 PN/DP.Programs.Variable to CPUs.MinValue_3	MinValue_3	700
9	IBHLinkUA...	NS4[String]CPU 416 Master.CPU 416-3 PN/DP.Programs.Variable to CPUs.MinValue_4	MinValue_4	600

Display Name	Value	Datatype	Source Timestamp	Server Timestamp	Statuscode
Control_ON	true	Boolean	15:58:55.370	15:58:56.041	Good
MaxValue_1	5500	Int16	15:58:58.042	15:58:58.795	Good
MaxValue_2	5000	Int16	15:59:00.363	15:59:01.046	Good
MaxValue_3	4500	Int16	15:59:02.434	15:59:03.297	Good
MaxValue_4	4000	Int16	15:59:04.274	15:59:05.047	Good
MinValue_1	900	Int16	15:59:05.937	15:59:06.547	Good
MinValue_2	800	Int16	15:59:07.810	15:59:08.548	Good
MinValue_3	700	Int16	15:59:09.657	15:59:10.549	Good
MinValue_4	600	Int16	15:59:12.066	15:59:12.800	Good

Data of the data blocks Counter Values [DB2] of the S7 CPU 1 and the S7 CPU 2 as OPC tags.

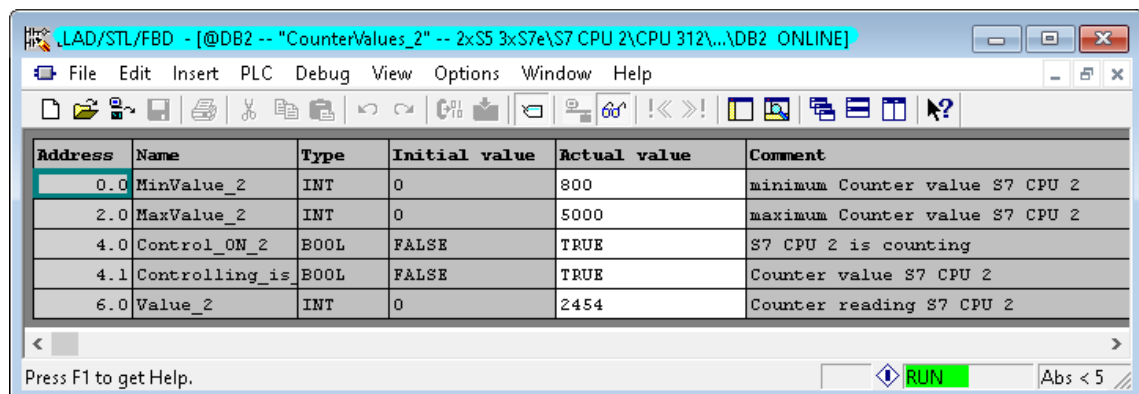
#	Server	Node Id	Display Name	Value	Datatype
10	IBHLinkUA@ibhlinkua-SC-14	NS4[String]S7 CPU 1.CPU 312.Programs.Counter Values.Control_ON_1	Control_ON_1	true	Boolean
11	IBHLinkUA@ibhlinkua-SC-14	NS4[String]S7 CPU 1.CPU 312.Programs.Counter Values.Controlling_is_ON_1	Controlling_is_ON_1	true	Boolean
12	IBHLinkUA@ibhlinkua-SC-14	NS4[String]S7 CPU 1.CPU 312.Programs.Counter Values.MaxValue_1	MaxValue_1	5500	Int16
13	IBHLinkUA@ibhlinkua-SC-14	NS4[String]S7 CPU 1.CPU 312.Programs.Counter Values.MinValue_1	MinValue_1	900	Int16
14	IBHLinkUA@ibhlinkua-SC-14	NS4[String]S7 CPU 1.CPU 312.Programs.Counter Values.Value_1	Value_1	5237	Int16
15	IBHLinkUA@ibhlinkua-SC-14	NS4[String]S7 CPU 2.CPU 312.Programs.Counter Values.Control_ON_2	Control_ON_2	true	Boolean
16	IBHLinkUA@ibhlinkua-SC-14	NS4[String]S7 CPU 2.CPU 312.Programs.Counter Values.Controlling_is_ON_2	Controlling_is_ON_2	true	Boolean
17	IBHLinkUA@ibhlinkua-SC-14	NS4[String]S7 CPU 2.CPU 312.Programs.Counter Values.MaxValue_2	MaxValue_2	4500	Int16
18	IBHLinkUA@ibhlinkua-SC-14	NS4[String]S7 CPU 2.CPU 312.Programs.Counter Values.Value_2	Value_2	1894	Int16

Data block status - Counter Values_1 [DB2] of the S7 CPU 1 [CPU 312]



Address	Name	Type	Initial value	Actual value	Comment
0.0	MinValue_1	INT	0	900	maximum counter value S7 CPU 1
2.0	MaxValue_1	INT	0	5500	minimum counter value S7 CPU 1
4.0	Control_ON_1	BOOL	FALSE	TRUE	Counter enable S7 CPU 1
4.1	Controlling_is	BOOL	FALSE	TRUE	S7 CPU 1 is counting
6.0	Value_1	INT	0	984	Counter reading S7 CPU 1

Data block status - Counter Values_2 [DB2] of the S7 CPU 2 [CPU 312]



Address	Name	Type	Initial value	Actual value	Comment
0.0	MinValue_2	INT	0	800	minimum Counter value S7 CPU 2
2.0	MaxValue_2	INT	0	5000	maximum Counter value S7 CPU 2
4.0	Control_ON_2	BOOL	FALSE	TRUE	S7 CPU 2 is counting
4.1	Controlling_is	BOOL	FALSE	TRUE	Counter value S7 CPU 2
6.0	Value_2	INT	0	2454	Counter reading S7 CPU 2

OPC tag of the S5 CPU 1 (S5 ++ to CPU1 - IM 151 - 8 PN / DP CPU) and S5 CPU 2 (S5 ++ to CPU1 - IM 151 - 8 PN / DP CPU) as OPC tags.

Display Name	Value	Datatype	Source Timestamp	Server Timestamp	Statuscode
Control_ON_3	true	Boolean	16:15:44.154	16:15:45.445	Good
Control_is_ON_3	true	Boolean	16:15:46.219	16:15:46.946	Good
MaxValue_3	4500	Int16	16:15:55.628	16:15:56.450	Good
MinValue_3	700	Int16	16:15:57.379	16:15:57.951	Good
Value_3	2545	Int16	16:21:22.080	16:21:22.581	Good
Control_ON_4	true	Boolean	16:16:07.467	16:16:08.706	Good
Control_is_ON_4	true	Boolean	16:16:09.174	16:16:09.957	Good
MaxValue_4	4000	Int16	16:16:14.547	16:16:15.459	Good
MinValue_4	600	Int16	16:16:16.307	16:16:17.210	Good
Value_4	1823	Int16	16:21:22.080	16:21:22.581	Good

#	Server	Node Id	Display Name	Value
20	IBHLinkUA...	NS4[String]S5++ an CPU 1.IM 151-8 PN/DP CPU.GlobalVars.Control_ON_3	Control_ON_3	true
21	IBHLinkUA...	NS4[String]S5++ an CPU 1.IM 151-8 PN/DP CPU.GlobalVars.Control_is_ON_3	Control_is_ON_3	true
22	IBHLinkUA...	NS4[String]S5++ an CPU 1.IM 151-8 PN/DP CPU.Programs.Counter Values.MaxValue_3	MaxValue_3	4500
23	IBHLinkUA...	NS4[String]S5++ an CPU 1.IM 151-8 PN/DP CPU.Programs.Counter Values.MinValue_3	MinValue_3	700
24	IBHLinkUA...	NS4[String]S5++ an CPU 1.IM 151-8 PN/DP CPU.Programs.Counter Values.Value_3	Value_3	2545
25	IBHLinkUA...	NS4[String]S5++ an CPU 2.IM 151-8 PN/DP CPU.GlobalVars.Control_ON_4	Control_ON_4	true
26	IBHLinkUA...	NS4[String]S5++ an CPU 2.IM 151-8 PN/DP CPU.GlobalVars.Control_is_ON_4	Control_is_ON_4	true
27	IBHLinkUA...	NS4[String]S5++ an CPU 2.IM 151-8 PN/DP CPU.Programs.Counter Values.MaxValue_4	MaxValue_4	4000
28	IBHLinkUA...	NS4[String]S5++ an CPU 2.IM 151-8 PN/DP CPU.Programs.Counter Values.MinValue_4	MinValue_4	600
29	IBHLinkUA...	NS4[String]S5++ an CPU 2.IM 151-8 PN/DP CPU.Programs.Counter Values.Value_4	Value_4	1823

Status S5 CPU 1

BB 1 Status

Operand	Contents	Modify value
F 0.1	KM 1	Enable S5 CPU 1 to count
F 2.0	KM 0	Maximum reached S5 CPU 1
F 2.1	KM 0	Minimum reached S5 CPU 1
F 2.2	KM 1	Counting control ON S5 CPU 1
F 2.5	KM 1	down counting S5 CPU 1
F 2.6	KM 0	up counting S5 CPU 1
FW 12	KF +3327	Counter value S5 CPU 1
DB 5	---	Data Block DB5 [CounterData]
DW 0	KF +100	minimum Counter value S5 CPU 1
DW 1	KF +10000	maximum Counter value S5 CPU 1
DW 2	KF +3840	Counter Value S5 CPU 1

PC block list

Block	Symbol	Length	Last Modification	Description
OB 1		22	23.12.2020 16:05:56	Call Counter Control
OB 21		36	09.01.2021 12:33:20	Preset DB / Counter Start
OB 22		36	09.01.2021 12:33:44	Preset DB / Counter Start
FB 5		88	17.01.2021 15:24:16	Counter control
DB 5	CounterData	16	17.01.2021 15:23:53	Data Block DB5 [CounterData]
BB 1		120	17.01.2021 15:30:29	Up / down counter status

Status S5 CPU 2

BB 1 Status

Operand	Contents	Modify value
F 0.1	KM 1	Enable S5 CPU 2 to count
F 2.0	KM 0	Maximum reached S5 CPU 2
F 2.1	KM 0	Minimum reached S5 CPU 2
F 2.2	KM 1	Counting control ON S5 CPU 2
F 2.5	KM 1	down counting S5 CPU 2
F 2.6	KM 0	up counting S5 CPU 2
FW 12	KF +9956	Counter value S5 CPU 2
DB 5	---	Data Block DB5 [CounterData]
DW 0	KF +100	minimum Counter value S5 CPU 2
DW 1	KF +10000	maximum Counter value S5 CPU 2
DW 2	KF +9955	Counter Value S5 CPU 2

PC block list

Block	Symbol	Length	Last Modification	Description
OB 1		22	17.01.2021 15:29:16	Call Counter Control
OB 21		36	17.01.2021 15:29:16	Preset DB / Counter Start
OB 22		36	17.01.2021 15:29:16	Preset DB / Counter Start
FB 5		88	17.01.2021 15:29:16	Counter control
DB 5	CounterData	16	17.01.2021 15:29:16	Data Block DB5 [CounterData]
BB 1		110	20.01.2021 13:30:22	Up / down counter status

8 IBH Link UA – connection of two S7 CPU 300 via an IBH Link S7++

CPUs of the **S7-300** series not having an unused Ethernet port can be connected to the **IBH Link UA** via an **IBH Link S7++**. The IBH Link S7++ converts the **MPI bus** to **Ethernet** (RFC 1006 protocol).

The following example shows a project with the connection of two (2) CPU 312 to one (1) IBH Link UA via IBH Link S7++. Instead of the CPU 312, any other S7 CPU 300/400 not having an unused Ethernet port could be used.

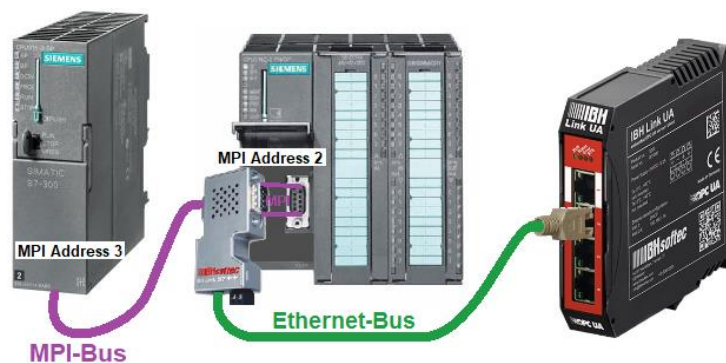
IBH Link S7++

The IBH Link S7++ is an Ethernet converter. The protocol used is the usual standard TCP / IP. The user can benefit from all the advantages of Ethernet without any problems.

The use of **SimaticNet** and the use of a CP communication processor is not necessary on either the PC or the PLC side.



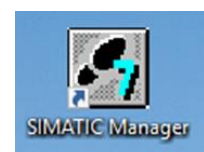
Connection IBH Link UA - 2x S7 PLC with CPU 312



8.1 Project with STEP® 7 (SIMATIC Manager V5.6)

Example: Up / down Counter

The example **2x CPU 300 S7e** is identical to the program **Counter**, as described in chapter 1. The counter counts until **MaxValue** is reached and counts down until the **MinValue** is reached.

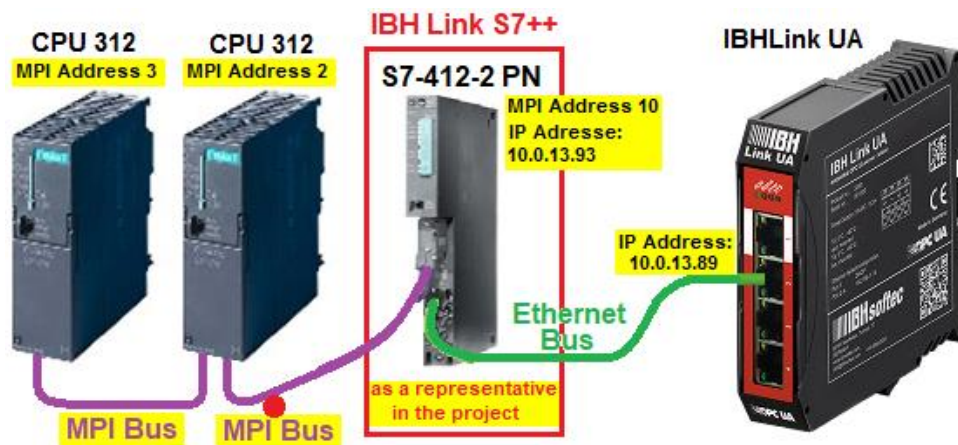


The SIEMENS PLC programming systems SIMATIC Manager V5.6 is used to create the network configuration.

IBH Link UA - configuration with the S7 (SIMATIC® Manager)

S7-300 and S7-400 controllers that do not have an Ethernet connection can be connected to the IBH Link UA via the **IBH Link S7 ++** or the **IBH Link S7 ++ HS**.

The routing mode must be activated in the **IBH Link S7 ++**. This mode is available from firmware version 2.142. In this mode, unconfigured connections via RFC1006 are no longer possible! Connections via the IBHNet driver continue to work. Connections via the IBHNet driver continue to work.



Note:

The **CPU S7-412-2 PN** provides the **Routing mode** and is available in the hardware catalog of the TIA Portal and STEP 7 (Simatic Manager).

The firmware of the IBH Link S7++ emulates the routing capabilities of the CPU S7-412-2 PN (**6ES7 412-2EK06-0AB0 V6.0**).

The following properties are available (compatible with CPU S7-412-2 PN):

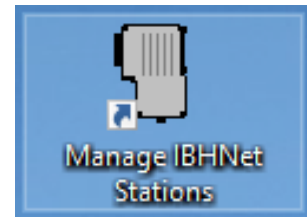
Interfaces / Bus type	Protocols
1x MPI / PROFIBUS DP	MPI / PROFIBUS
1x PROFINET (1 Port)	ISO-on-TCP (RFC1006)

IP / MPI addresses of the devices used

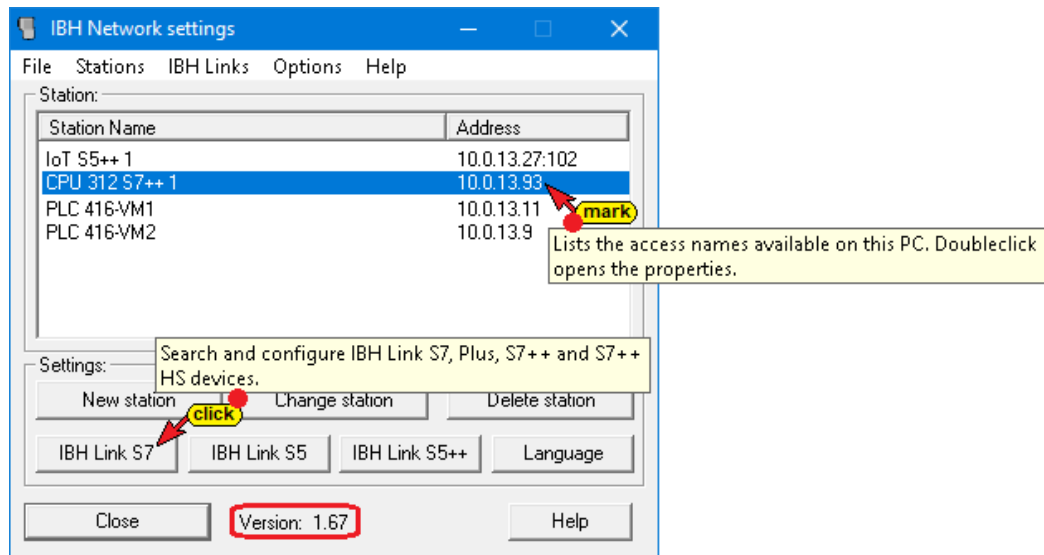
Device	IP address	MPI address
IBH Link UA [Control Level]	10.0.13.89	not applicable
IBH Link S7 ++ for S7 CPU 1 [CPU 412-2 PN] (for IBH Link S7++ and CPU)	10.0.13.93 routed	10
S7-CPU 1 [CPU 312]	not applicable	2
S7-CPU 2 [CPU 312]	not applicable	3

8.1.1 IBH Link S7++ settings

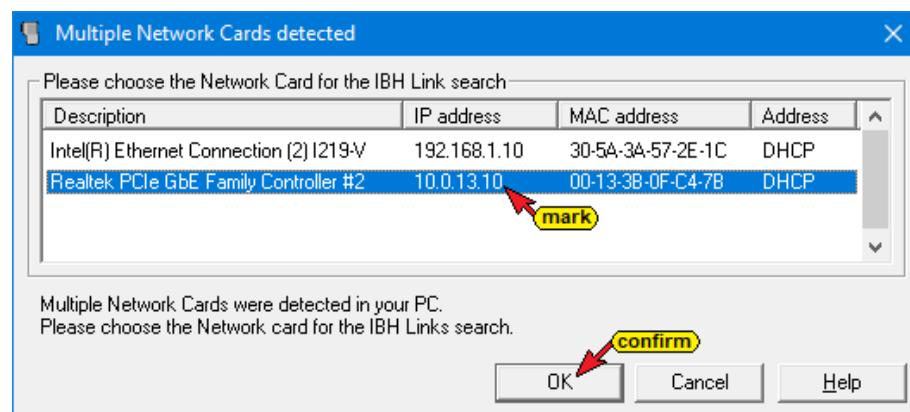
After starting **Manage IBHNet Stations**, the **IBH Network Settings** dialog box opens. Click the IBH Link S7 button to open the Detect multiple network cards dialog box.



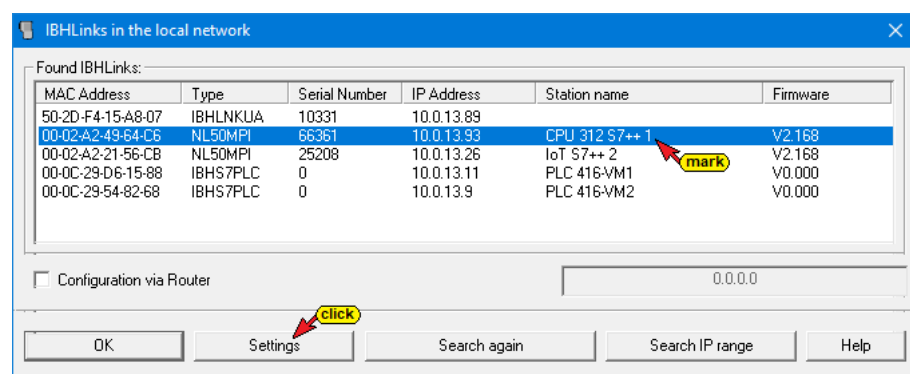
Dialog box IBH Network Settings



Mark the network card the **IBH Link S7++** is connected and confirm with **OK**.



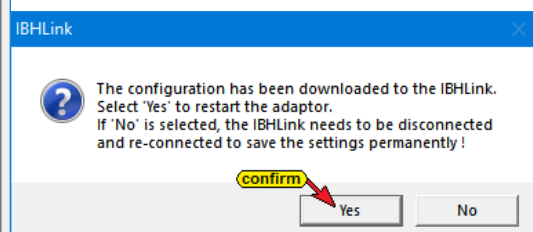
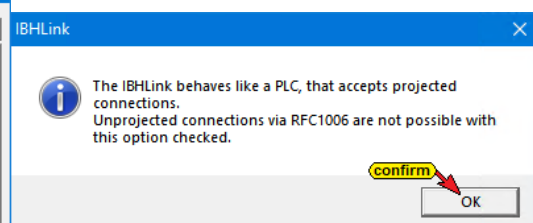
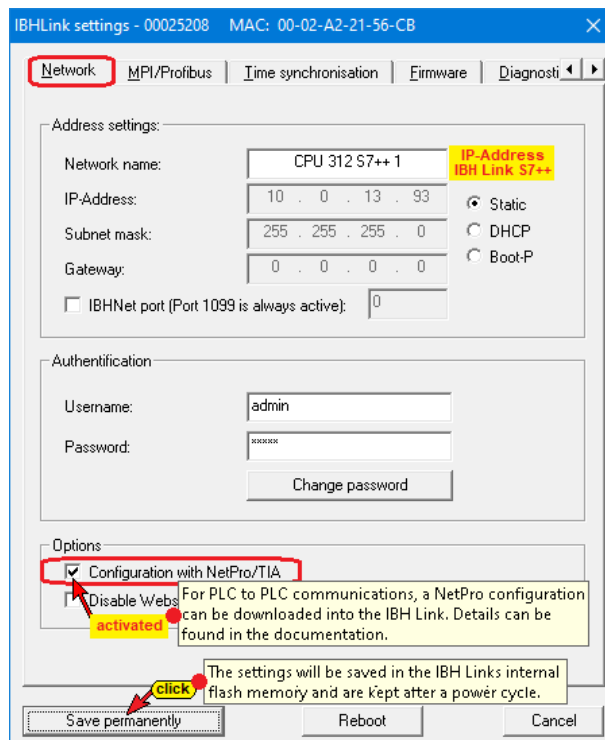
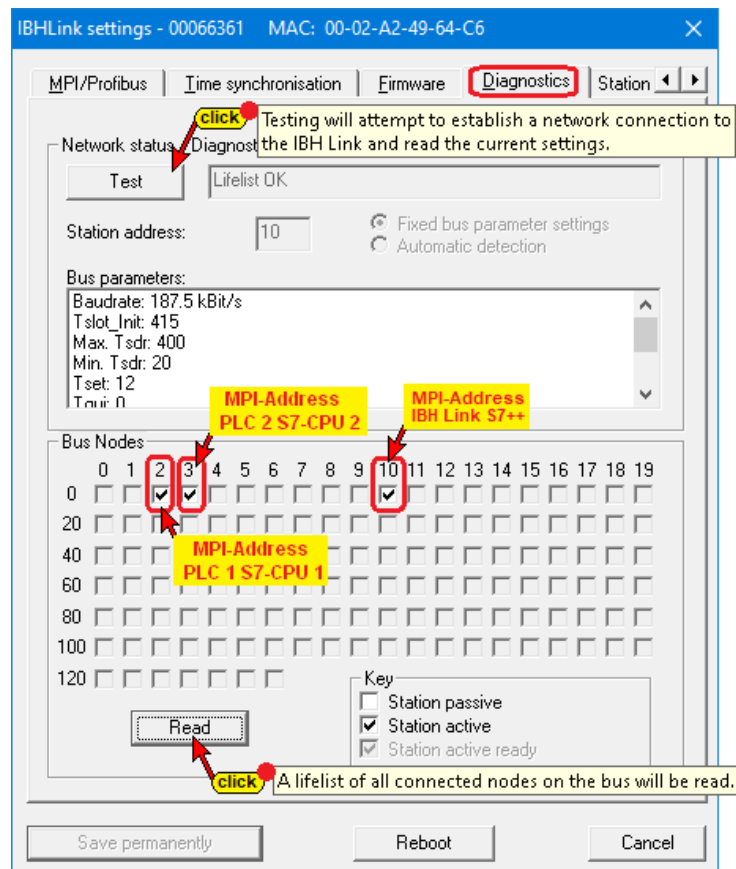
Mark the connected **IBH Link S7++** and click on **Settings** to open the IBHLink Settings dialog box.



In the **IBHLink Settings / Network** dialog box, activate the **Routing option Configuration with NetPro / TIA**.

IBH Link S7++ MPI-Addresses

The setting made must be permanently adopted in the **IBH Link S7++**.



IBH Link S7++ MPI addresses

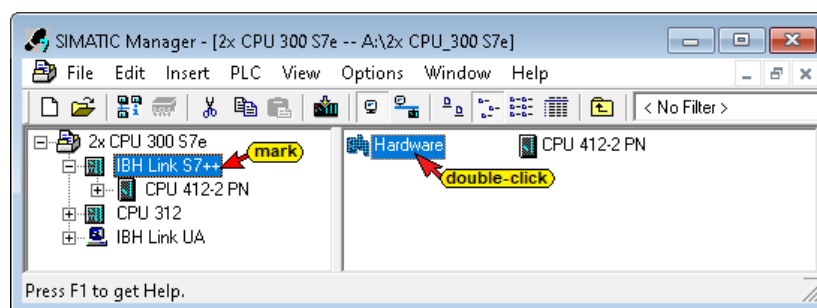
The setting made must be permanently adopted in the **IBH Link S7++**.

8.1.2 Set up the PG / PC interface as an Ethernet connection

To be able to establish a connection with the **IBH Link S7++** (CPU 412) and the **IBH Link UA** (OPC UA Server), the PG / PC interface must be set up as an Ethernet connection.

8.2 IBHLink S7++ as CPU 412-2 PN in the project

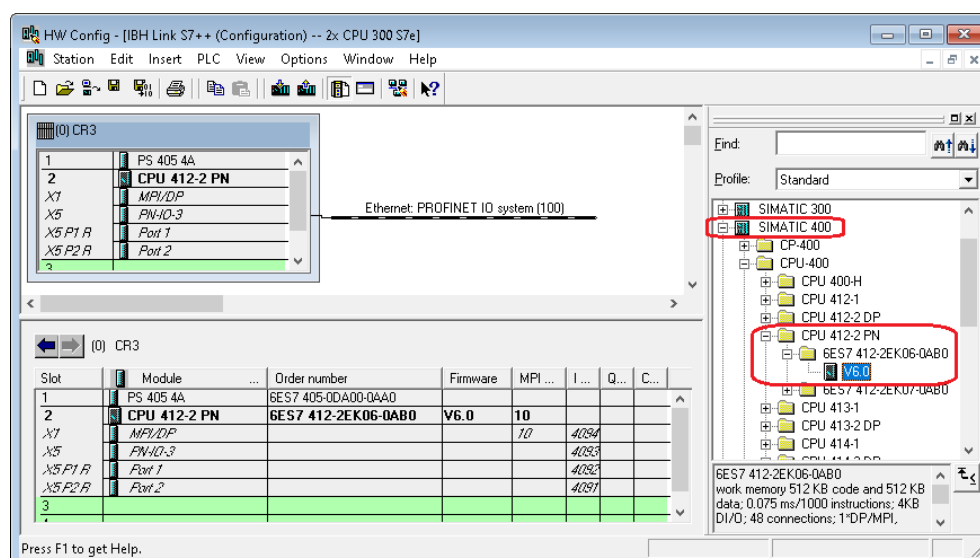
With a click on the **IBH Link S7++** (renamed SIMATIC 400 station) in the left window, and a double-click on **Hardware** in the right window the HW Config window is opened.



8.2.1 IBH Link S7++ [CPU 412-2 PN] to S7 CPU 1

The CPU **6ES7 412-2EK06-0AB0 V6.0** is the representative for the **IBH Link S7++**, which is plugged into the **S7 CPU 1**. This CPU is used for the routing connection between the S7-CPU 1 [CPU 312] and the IBH Link UA. Since no blocks can be loaded into the IBH Link S7++, all blocks that are in offline mode of **IBH Link S7++ / CPU 412** must be deleted.

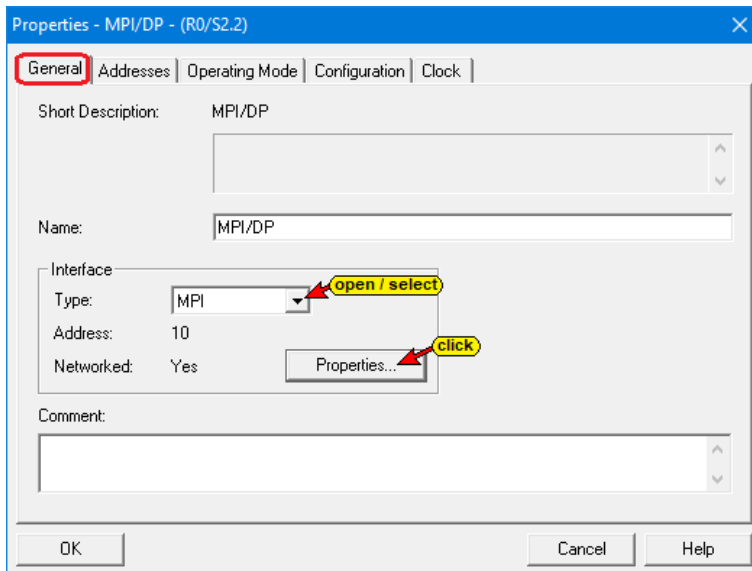
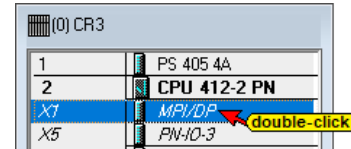
Configurations of the CPU 412-2 PN



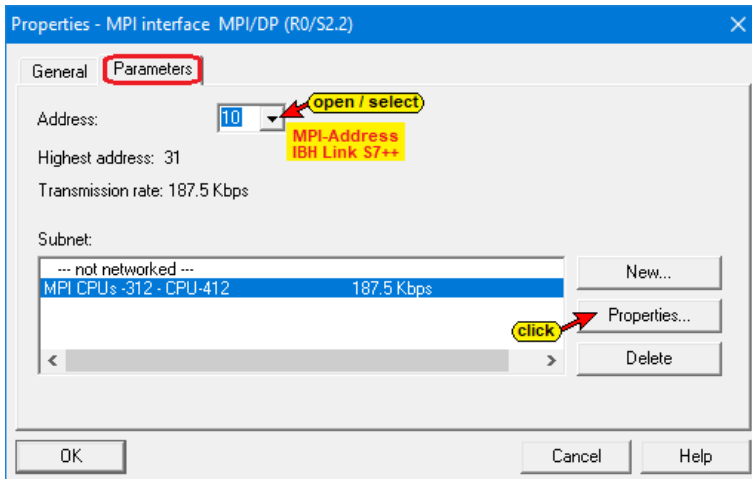
The MPI interface (connection to the CPU 312) and the Ethernet interface (connection to the OPC server [IBH Link UA]) must be specified in the CPU.

Define the MPI interface of the CPU 412 (MPI interface IBH Link S7++)

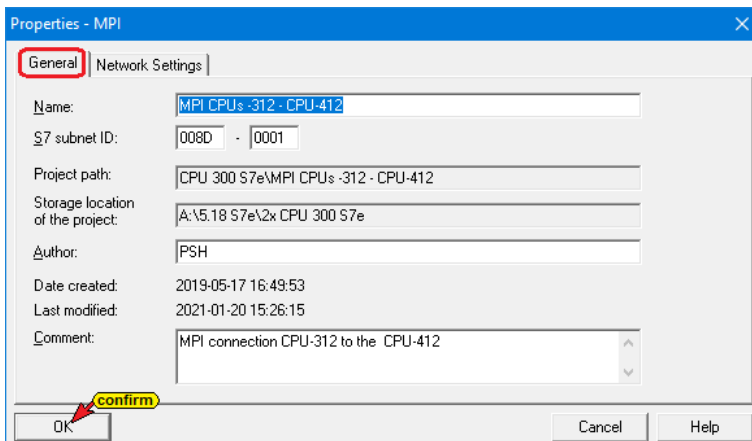
With a double-click on the line **X1 MPI/DP** the dialog box **Properties – MPI/DP - (R0 / S2.2)** is opened.



The Interface type **MPI** is selected. Click the button **Properties...** to open the dialog box **Properties – MPI interface - (R0 / S2.2)**.



The tab **Parameters** show the selected MPI address (10) of the CPU 412. The subnet connections MPI1 and MPI2 were established.

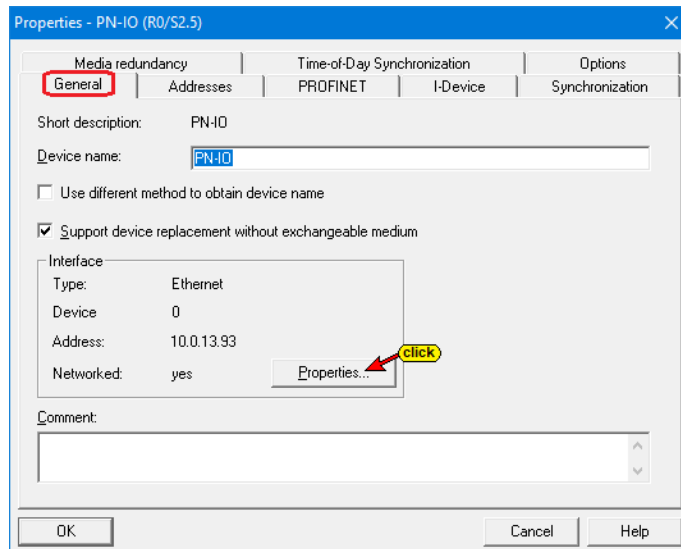
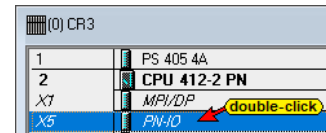


Mark subnet connections **MPI CPUs - 312 - CPU - 412** and click the button **Properties...** to open the dialog box **Properties – MPI1** for more details on the connection.

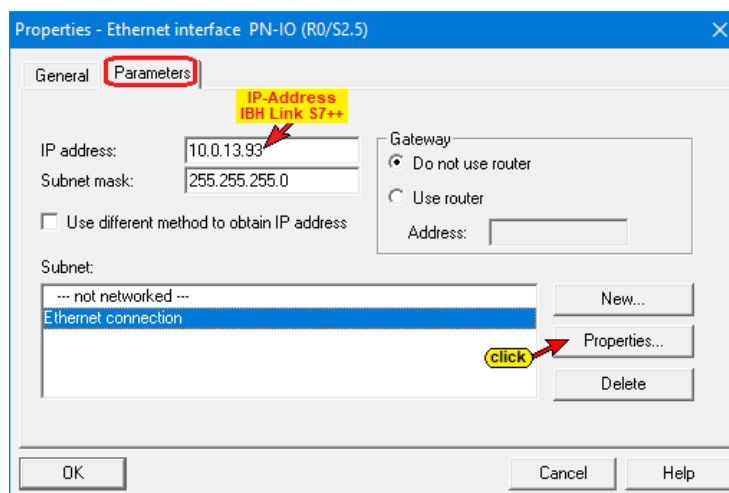
Click **OK** to close all dialog boxes.

Define the Ethernet interface of the CPU 412

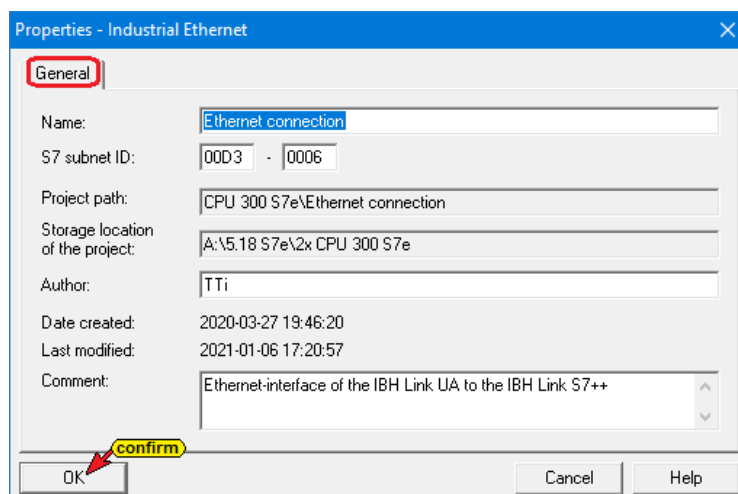
With a double-click on the line **X5 PN-IO** the dialog box **Properties – PN-IO - (R0 / S2.5)** is opened.



To set up the ethernet interface click the button **Properties...** to open the dialog box **Properties – Ethernet interface PN - (R0 / S2.5)**.



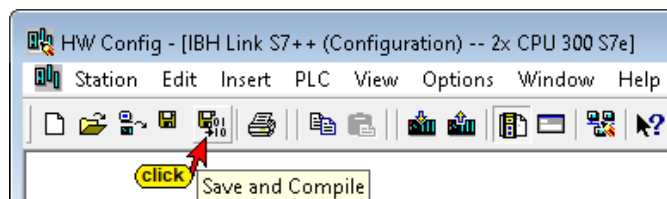
Click the button **Properties...** to open the dialog box **Properties – Industrial Ethernet** for more details on the connection.



Click **OK** to close all dialog boxes.

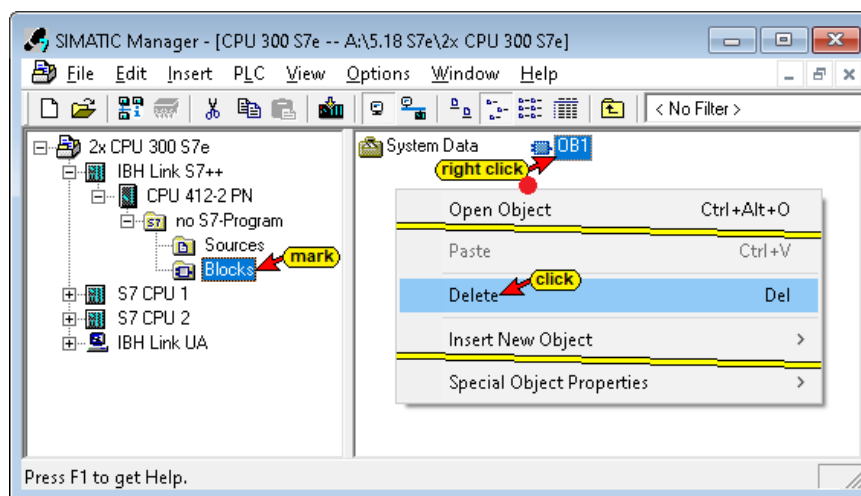
Configuration of CPU 412-2 PN (IBH Link S7++) Save and Compile

The configuration is accepted by clicking the Save and Compile icon.



Delete blocks (IBH Link S7++ / CPU 412-2 PN)

No blocks can be loaded into the IBH Link S7++. All blocks that are in offline mode from IBH Link S7++ / CPU 412-2 PN must be deleted.



Load System configuration into the IBH Link S7++ / CPU 412

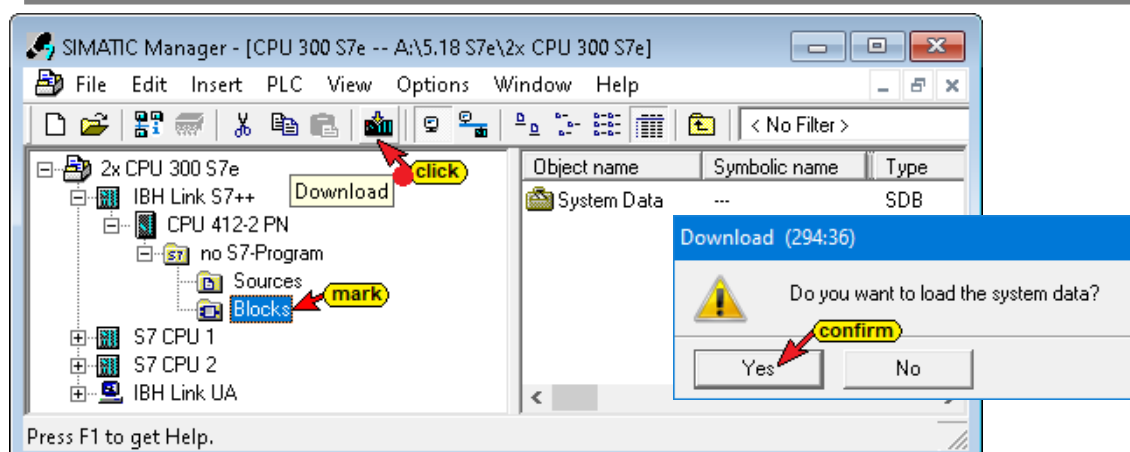
Loading into the CPU 412-2 PN (IBH Link S7 ++) requires several steps.

Note:



Only data can be transferred with the **IBH Link S7++**. All program blocks in the **CPU 412-2 PN** must be deleted.

The configuration **must be loaded** into the IBH Link S7++!

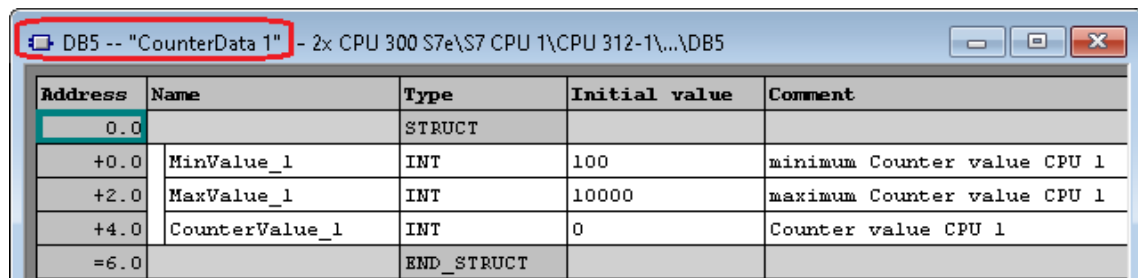


8.3 S7-CPU 1 [CPU 312]

In the program for the **S7-CPU 1**, the data blocks **CounterData 1 [DB5]**, and **Data from CPU 2 [DB20]** are available for the data exchange with the **S7 CPU 2**. The variables of these blocks are defined as (OPC tags).

Data block CounterData 1 CPU 1 [DB5]

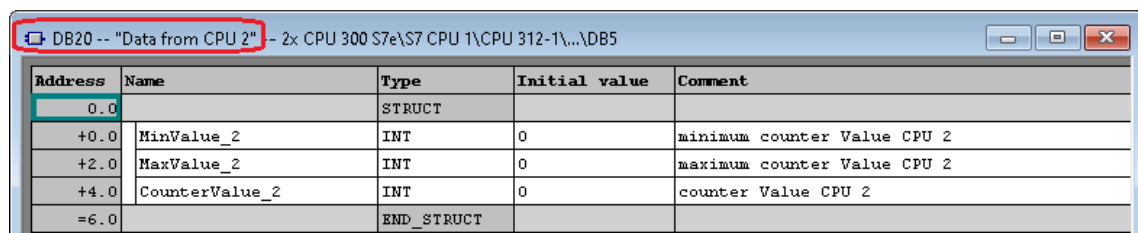
These variables are defined as OPC tags (read variables).



Address	Name	Type	Initial value	Comment
0.0		STRUCT		
+0.0	MinValue_1	INT	100	minimum Counter value CPU 1
+2.0	MaxValue_1	INT	10000	maximum Counter value CPU 1
+4.0	CounterValue_1	INT	0	Counter value CPU 1
=6.0		END_STRUCT		

Data block Data from CPU 2 [DB20]

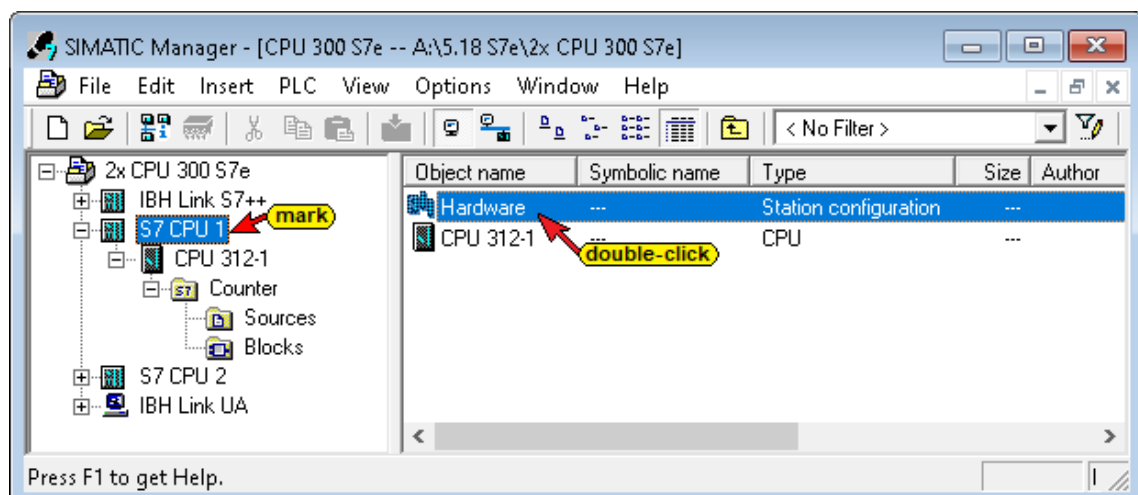
These variables are defined as OPC tags.



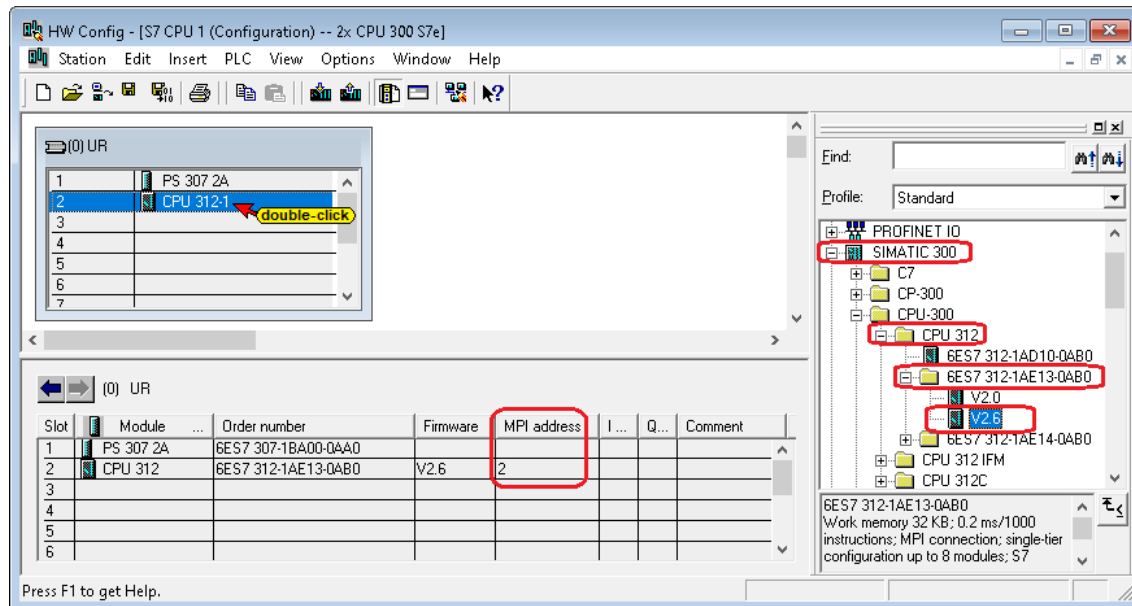
Address	Name	Type	Initial value	Comment
0.0		STRUCT		
+0.0	MinValue_2	INT	0	minimum counter Value CPU 2
+2.0	MaxValue_2	INT	0	maximum counter Value CPU 2
+4.0	CounterValue_2	INT	0	counter Value CPU 2
=6.0		END_STRUCT		

8.3.1 S7-CPU 1 [CPU 312]

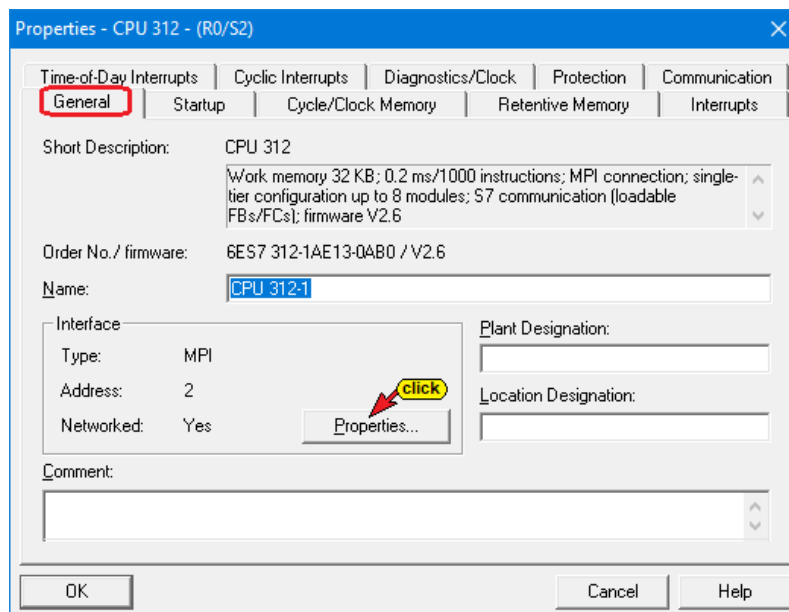
Double-click **Hardware** to open the HW Config window.



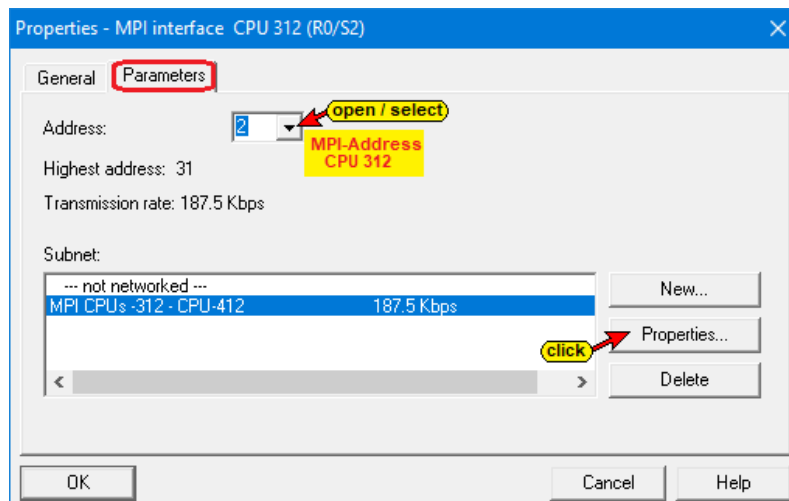
Configurations of the S7-CPU 1 [CPU 312]



Only these settings are necessary for the project. Double-click **CPU 312-1** to open the dialog box **Properties – CPU 312 (R0/S2)**.

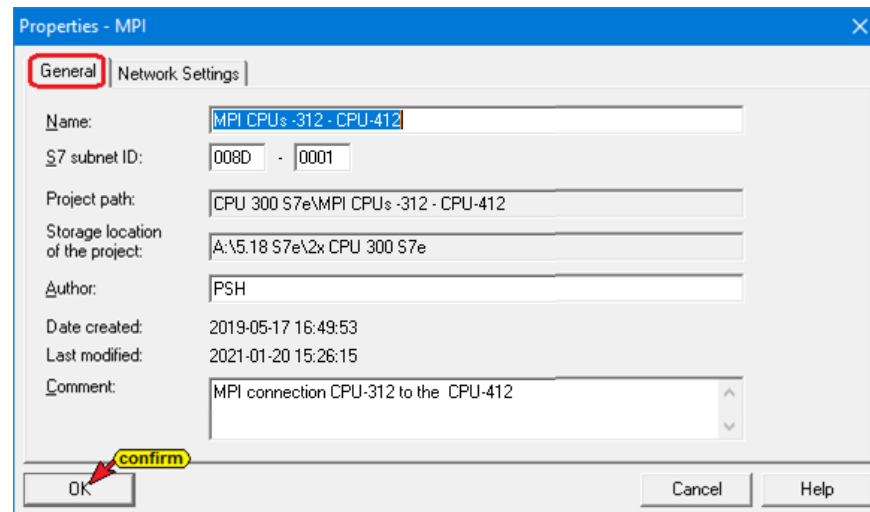


Click the button **Properties...** to open the dialog box **Properties – MPI Interface CPU 312 (R0/S2)**. In this dialog box, the MPI address of the **S7 CPU 1 (CPU 312)** can be adjusted.



The tab **Parameters** show the selected MPI address (2) of the CPU 312. The subnet connections MPI CPUs - 312 - CPU - 412 is established.

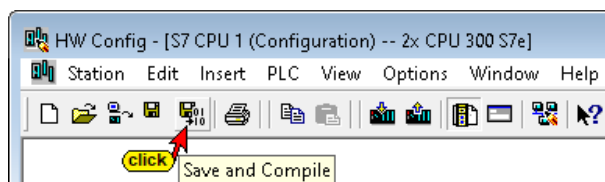
Mark subnet connections **MPI CPUs - 312 - CPU - 412** and click the button **Properties...** to open the dialog box **Properties – MPI** for more details on the connection.



Click **OK** to close all dialog boxes.

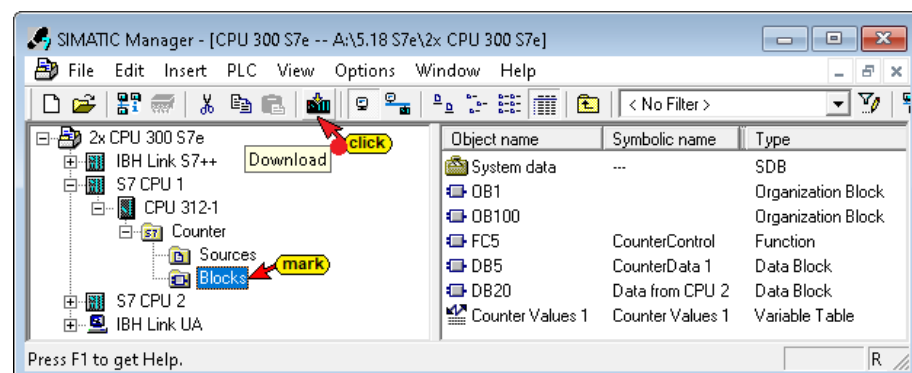
Save and compile the S7 CPU1 (CPU 312) configuration

With one click the configuration is saved and compiled.

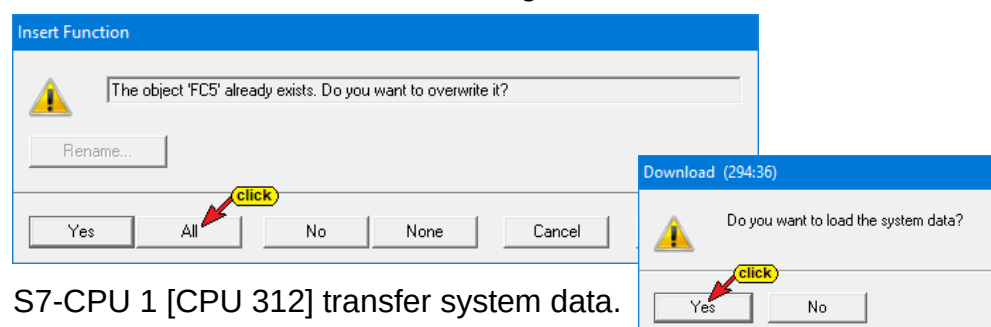


The hardware configuration and the PLC program can be transferred to the PLC.

Load program and hardware configuration into the S7 CPU 1



Transfer all blocks, overwrite existing blocks.



S7-CPU 1 [CPU 312] transfer system data.

S7-CPU 2 [CPU 312]

In the program for the **S7-CPU 2**, the data blocks **CounterData 2 [DB5]**, and **Data from CPU 1 [DB20]** are available for the data exchange with the **S7 CPU 1**. The variables of these blocks are defined as (OPC tags).

Note:



The S7-CPU 1 [CPU 312] is connected to the IBH Link S7++ [CPU 412-2 PN] via MPI. The loading must take place via the Ethernet connection.

Direct loading via MPI is only possible after changing the PG/PC interface, it does not make sense because then there is no access to other devices.

Data block CounterData 2 CPU 2 [DB5]

These variables are defined as OPC tags (read variables).

DB5 -- "CounterData 2" -- 2x CPU 300 S7e\S7 CPU 2\CPU 312-2\...\DB5				
Address	Name	Type	Initial value	Comment
0.0		STRUCT		
+0.0	MinValue_2	INT	100	minimum Counter value CPU 2
+2.0	MaxValue_2	INT	10000	maximum Counter value CPU 2
+4.0	CounterValue_2	INT	0	Counter value CPU 2
=6.0		END_STRUCT		

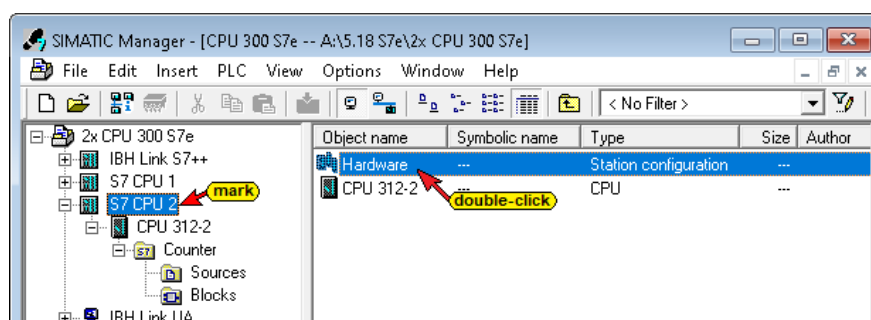
Data block Data from CPU 1 [DB10]

These variables are defined as OPC tags.

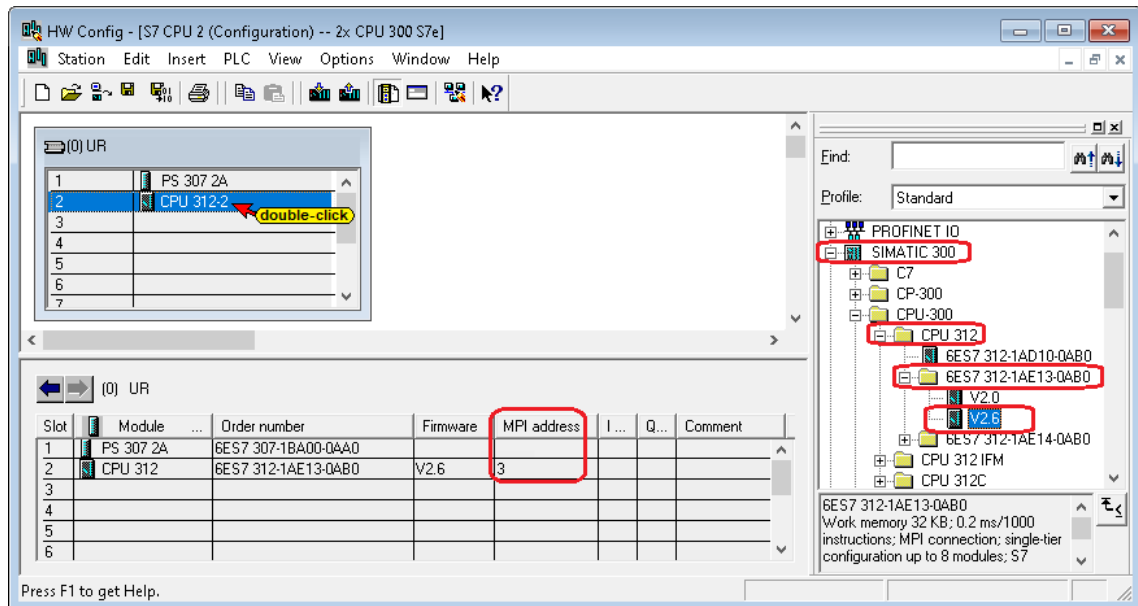
DB10 -- "Data from CPU 1" -- 2x CPU 300 S7e\S7 CPU 2\CPU 312-2\...\DB10				
Address	Name	Type	Initial value	Comment
0.0		STRUCT		
+0.0	MinValue_1	INT	0	minimum counter Value CPU 1
+2.0	MaxValue_1	INT	0	maximum counter Value CPU 1
+4.0	CounterValue_1	INT	0	counter Value CPU 1
=6.0		END_STRUCT		

8.3.2 S7-CPU 2 [CPU 312]

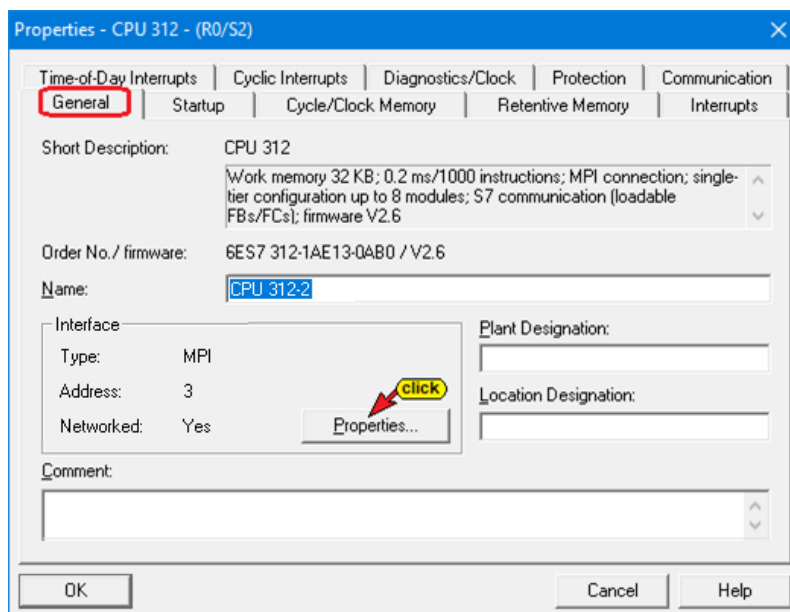
Double-click **Hardware** to open the HW Config window.



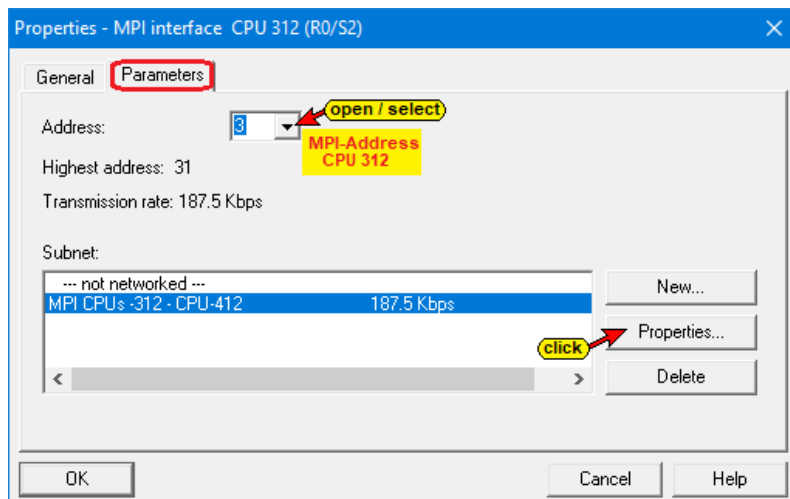
Configurations of the S7-CPU 2 [CPU 312]



Only these settings are necessary for the project. Double-click **CPU 312-2** to open the dialog box **Properties – CPU 312 (R0/S2)**.

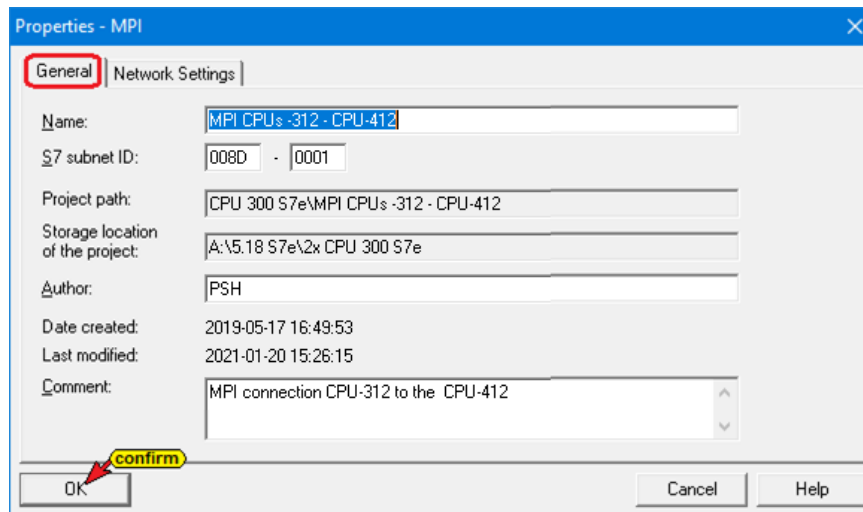


Click the button **Properties...** to open the dialog box **Properties – MPI Interface CPU 312 (R0/S2)**. In this dialog box, the MPI address of the **S7 CPU 2 (CPU 312)** can be adjusted.



The tab **Parameters** show the selected MPI address (2) of the CPU 312. The subnet connections MPI CPUs - 312 – CPU - 412 is established.

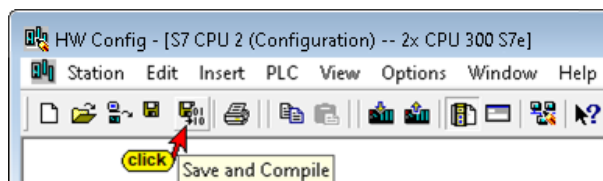
Mark subnet connections **MPI CPUs - 312 - CPU - 412** and click the button **Properties...** to open the dialog box **Properties – MPI** for more details on the connection.



Click **OK** to close all dialog boxes.

Save and compile the S7 CPU2 (CPU 312) configuration

With one click the configuration is saved and compiled.



The hardware configuration and the PLC program can be transferred to the PLC.

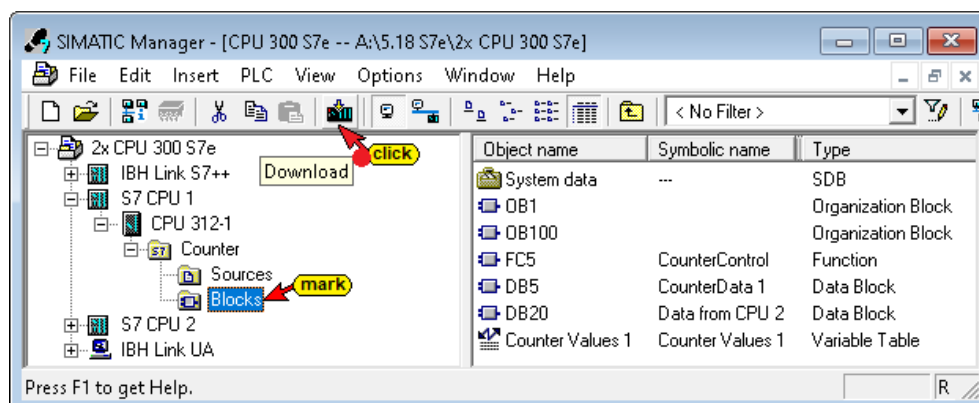
Load program and hardware configuration into the S7 CPU 2

Note:

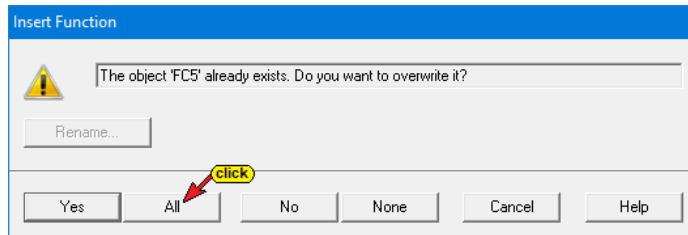


The S7-CPU 2 [CPU 312] is connected to the IBH Link S7++ [CPU 412-2 PN] via MPI. The loading must take place via the Ethernet connection.

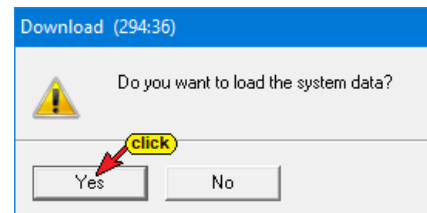
Direct loading via MPI is only possible after changing the PG/PC interface, it does not make sense because then there is no access to other devices.



Transfer all blocks, overwrite existing blocks.

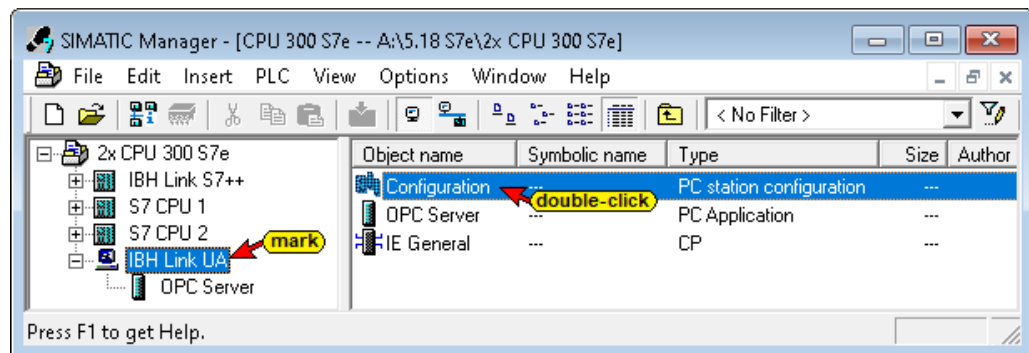


S7-CPU 2 [CPU 312] transfer system data.

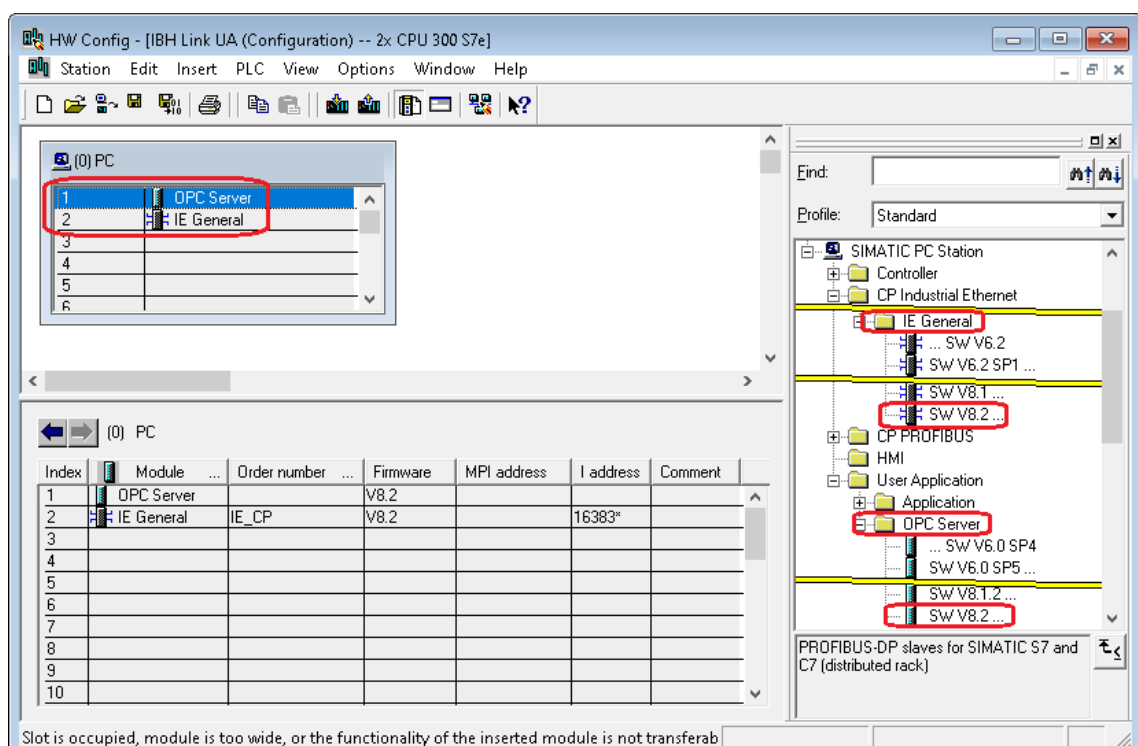


8.3.3 IBH Link UA as a SIMATIC PC station

A click on **IBH Link UA**, the renamed **SIMATIC PC station**, and a double-click on **Configuration** opens the window showing the configuration of the IBH Link UA.



8.4 Configuration of IBH Link UA (SIMATIC PC station)

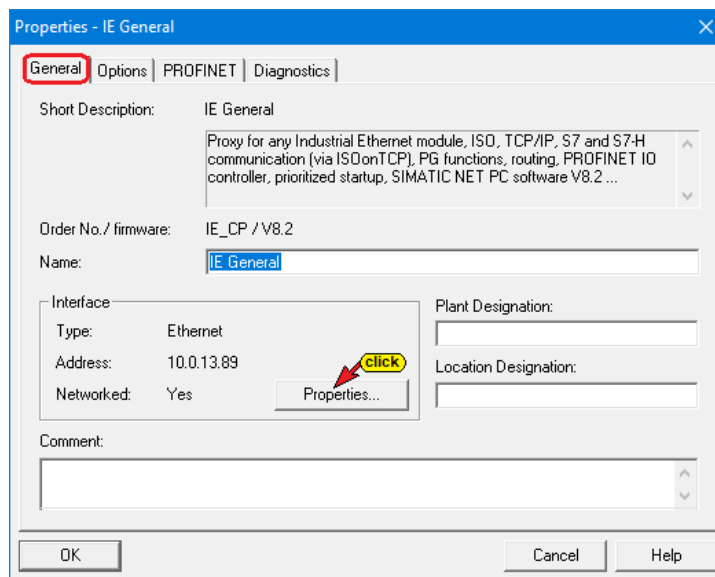
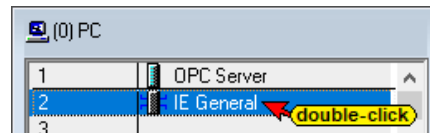


Note:

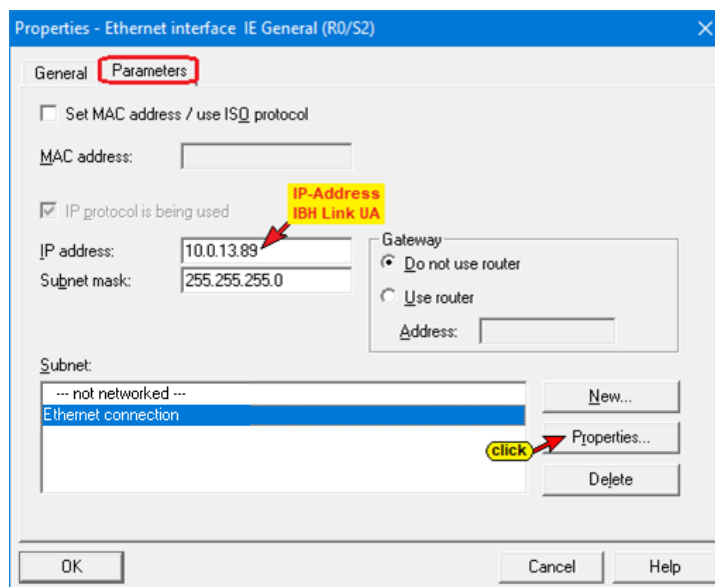
The Siemens **OPC server SW V8.2...** and the CP Industrial Ethernet interface **IE General SW V8.2...** are available in the hardware catalogs of STEP7-SIMATIC Manager and the TIA Portals.

Ethernet interface IE General (R0 / S2) set up

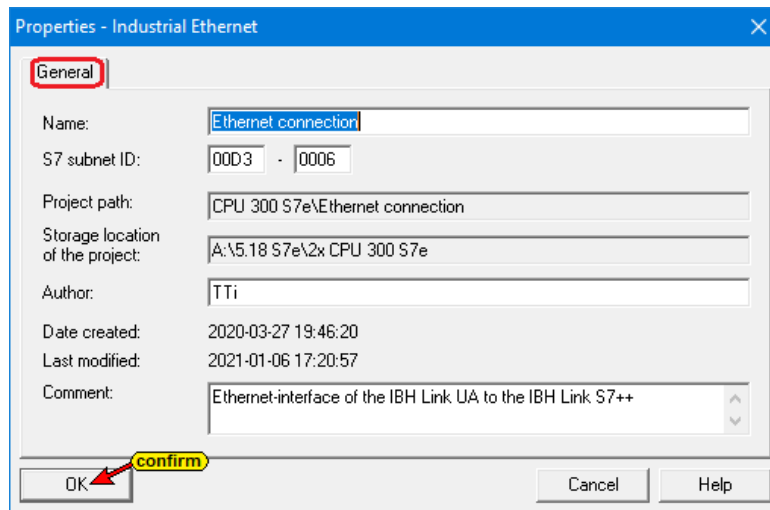
With a double-click on the line 1 *IE General* the dialog box **Properties – IE General** is opened.



To set up the ethernet interface click the button **Properties...** button to open the dialog box **Properties – Ethernet interface IE General (R0 / S2)**.

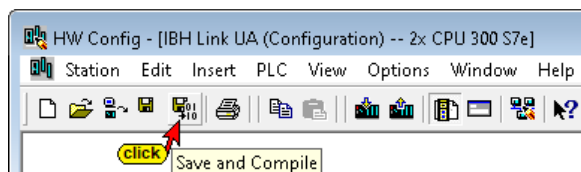


Click the button **Properties...** to open the dialog box **Properties – Industrial Ethernet** for more details on the connection.



Click **OK** to close all dialog boxes.

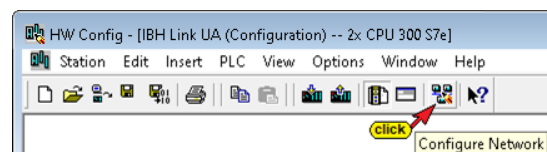
Configuration of the IBH Link UA Save and Compile



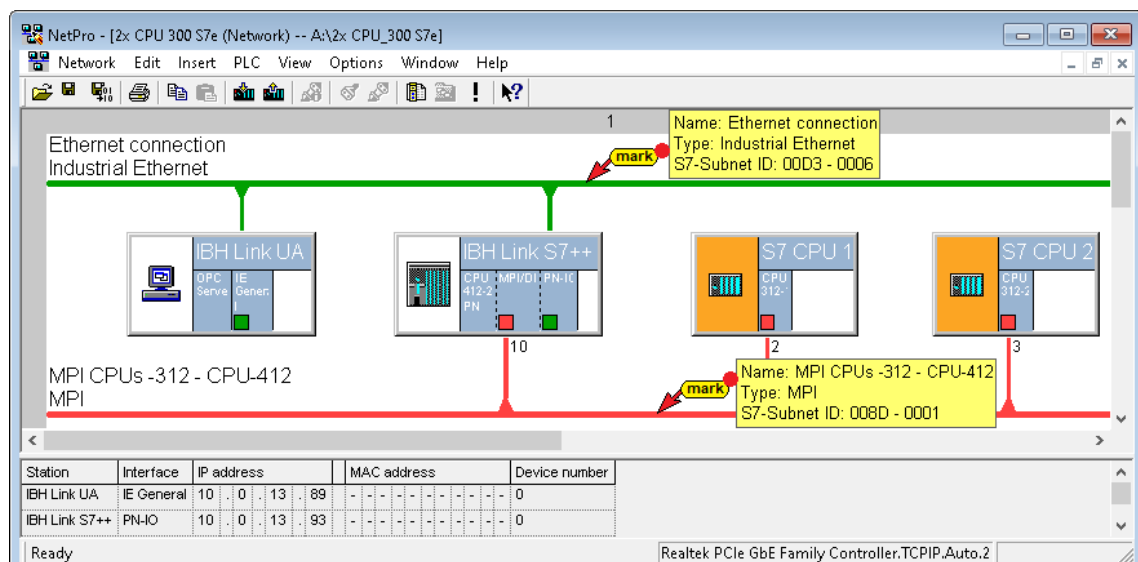
The configuration is accepted by clicking the Save and Compile icon.

8.5 Create S7 connection between OPC Server and CPU 312

Click the **Configure Network** icon to open the **NetPro** window. S7 connection from the **OPC Server-IBH Link UA** [OPC Server V8.2.0] to the devices are established.

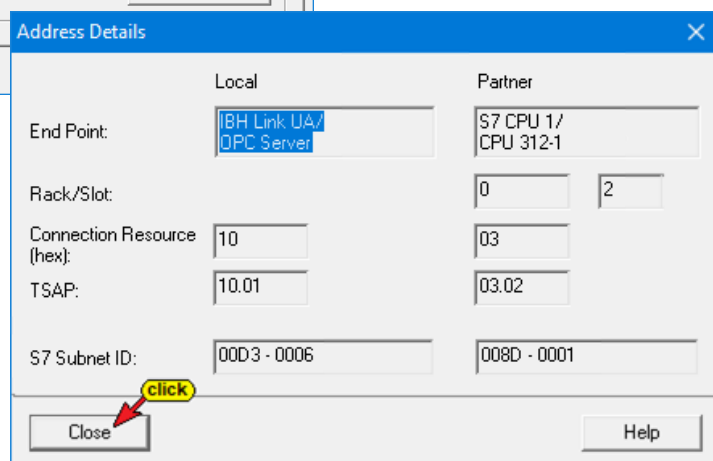
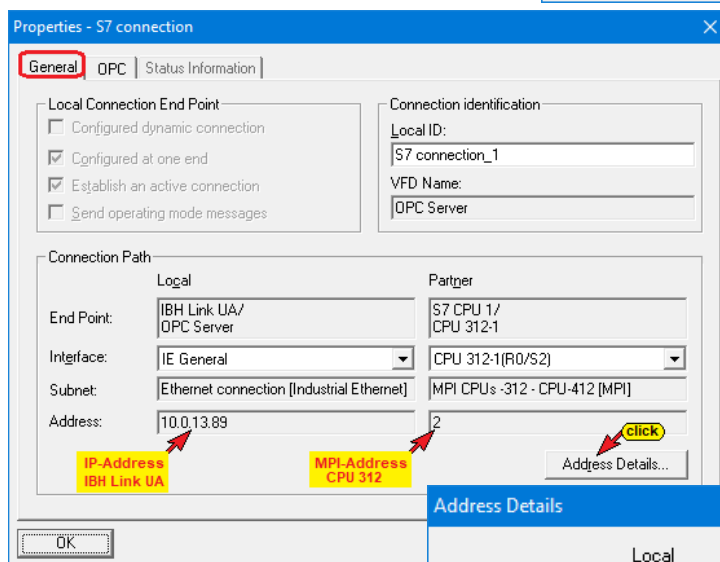
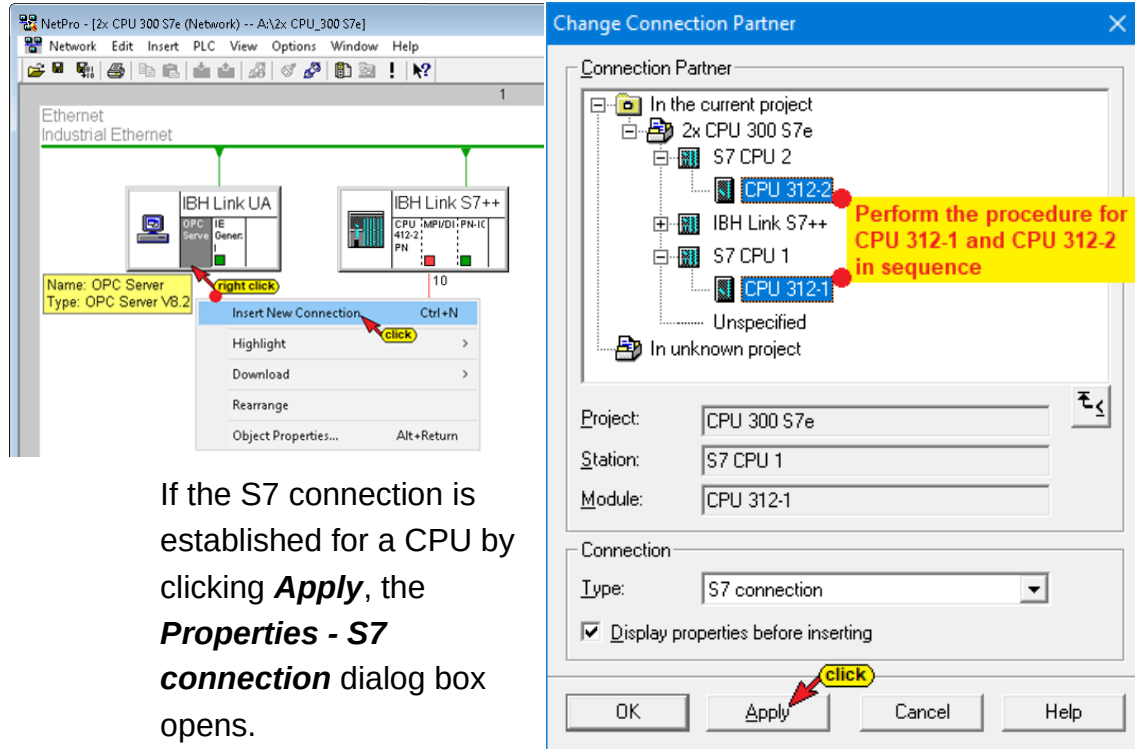


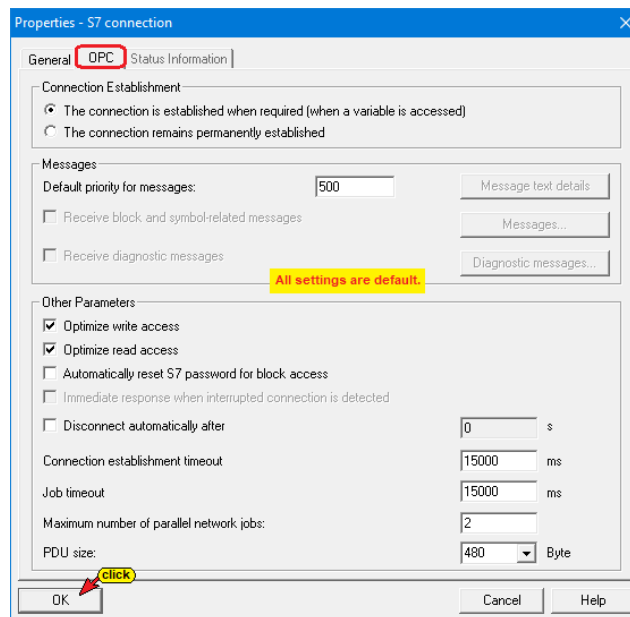
NetPro window



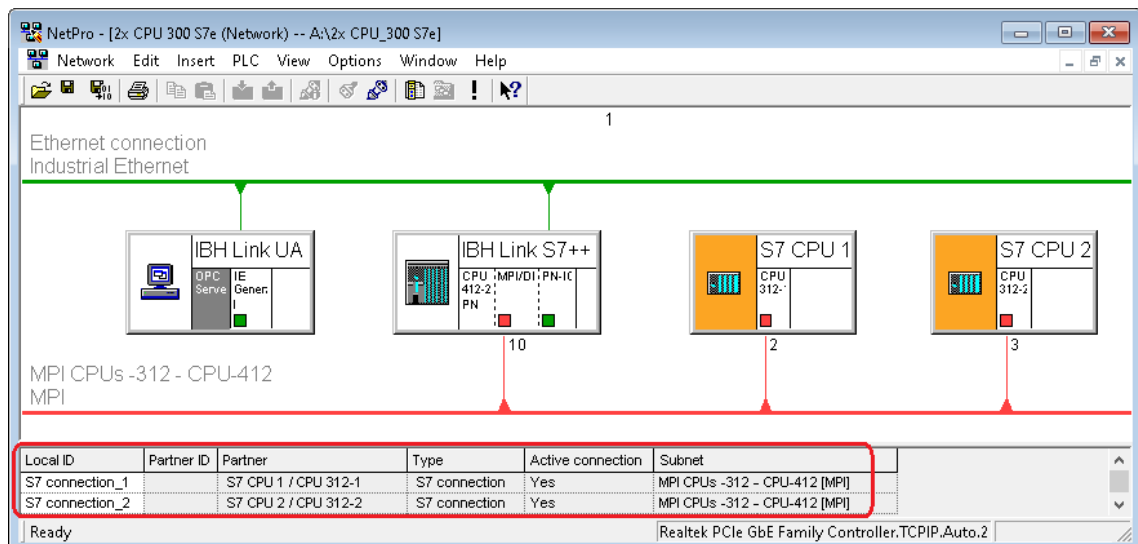
The S7 CPU 1 (CPU 312) and the S7 CPU 2 (CPU 312) do not have an Ethernet connection. They are connected via MPI with the IBH Link S7++ (CPU 412-2 PN).

The S7 connections between the CPUs and the IBH Link UA was created with the following steps.

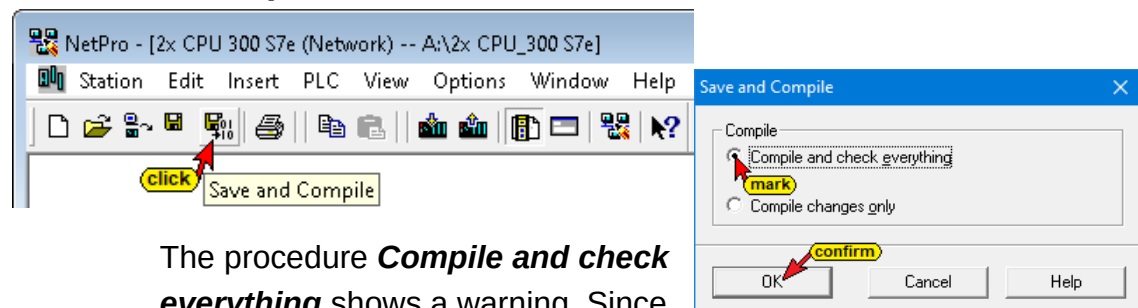




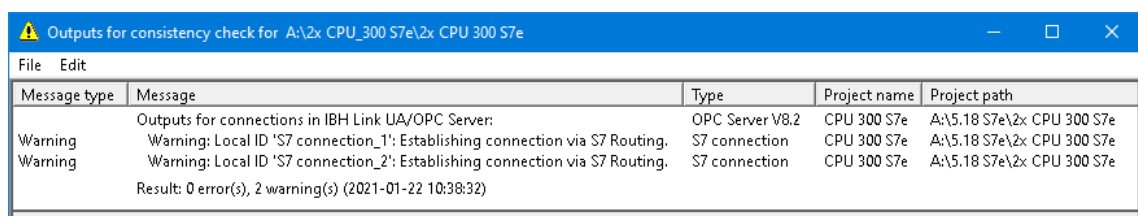
The established S7 connections are displayed in the NetPro window.



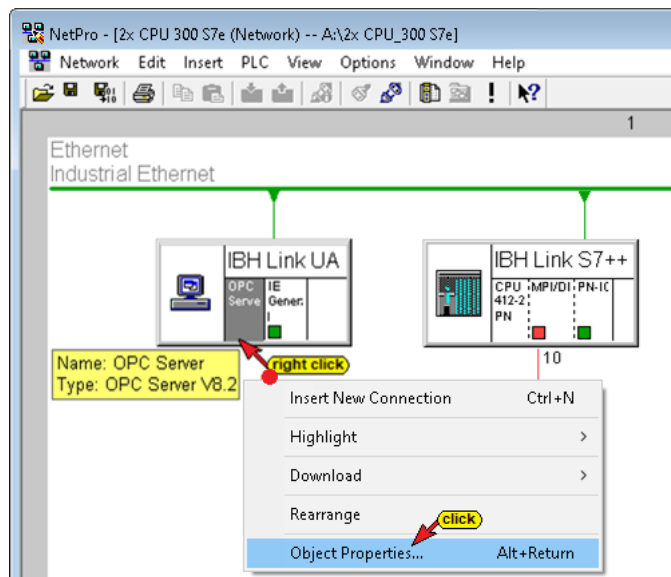
Save and Compile MPI connection



The procedure **Compile and check everything** shows a warning. Since routing is intentional, the warning does not apply.

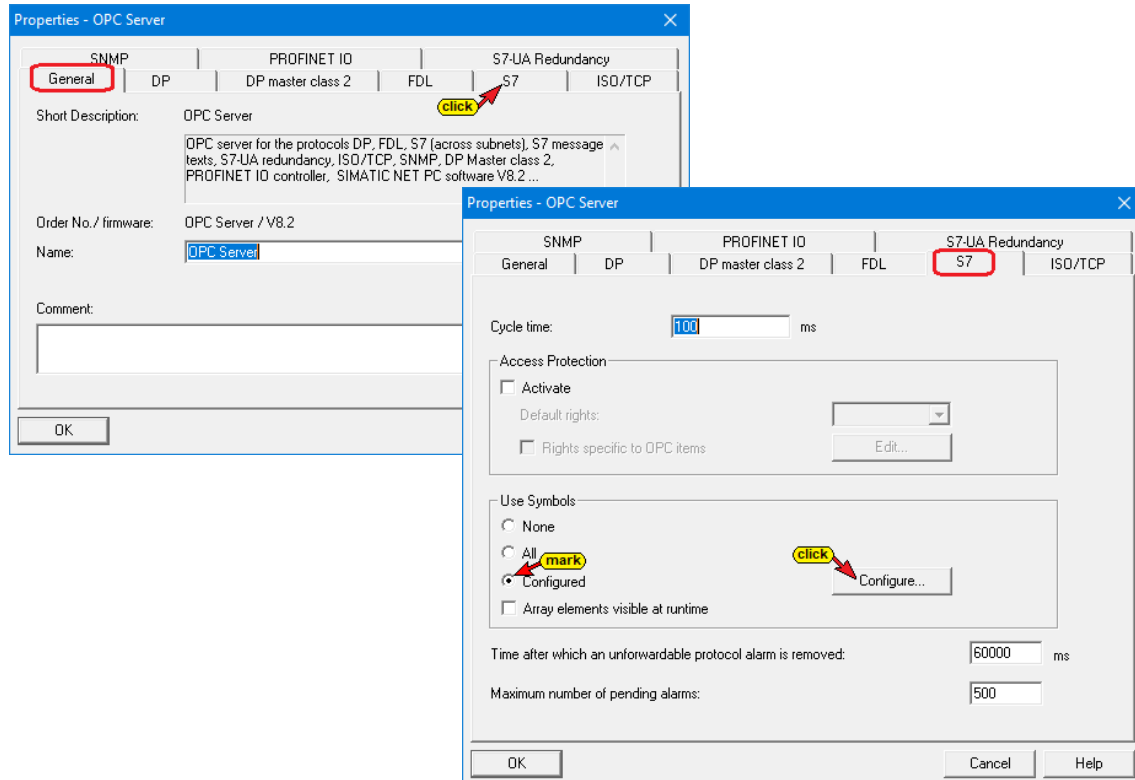


8.6 Select OPC tags

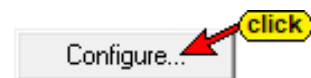


The command **Object Properties...** from the context menu (right-click) opens the **Properties - OPC server** dialog box.

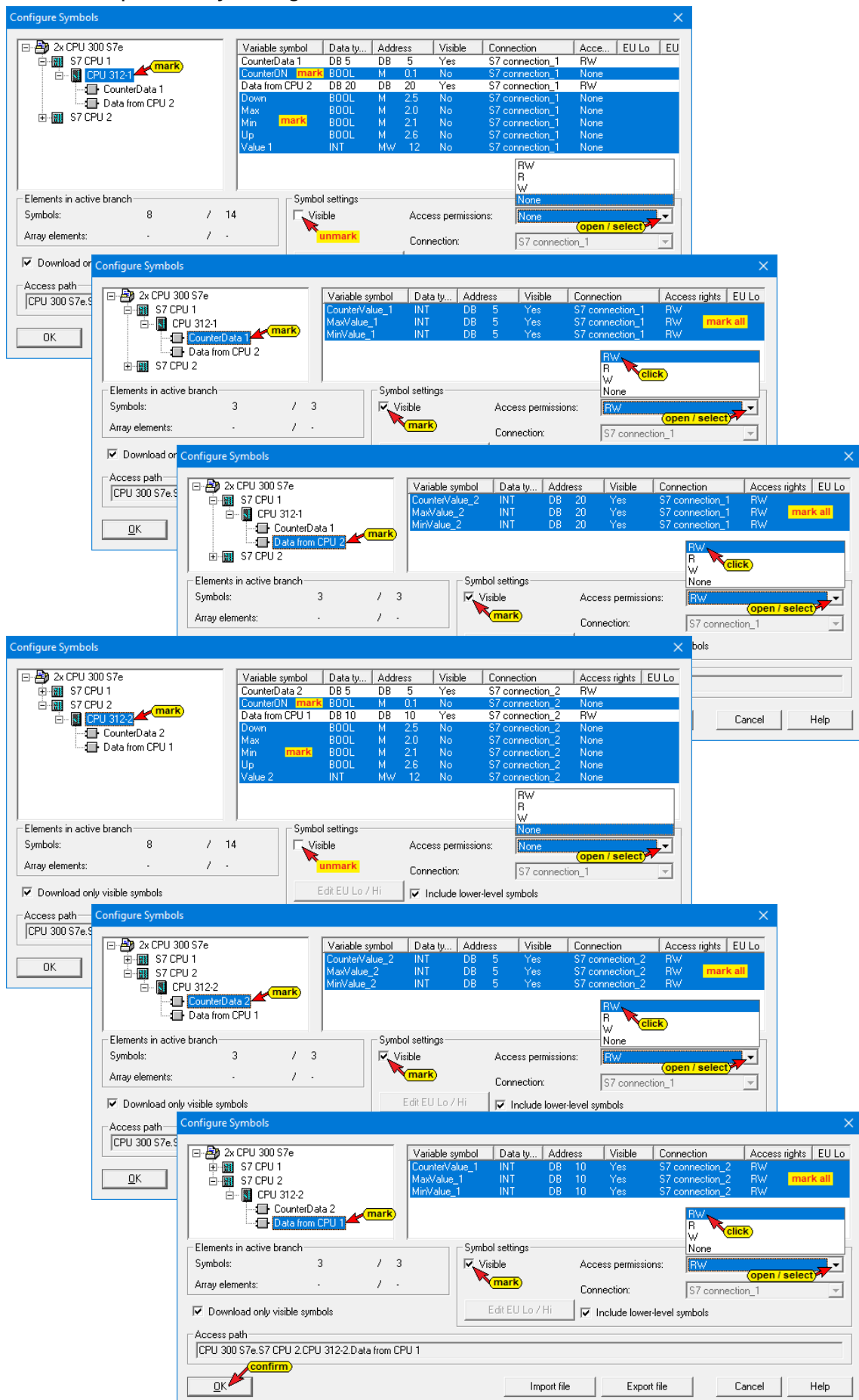
The S7 tab defines whether symbols should be used and which ones.



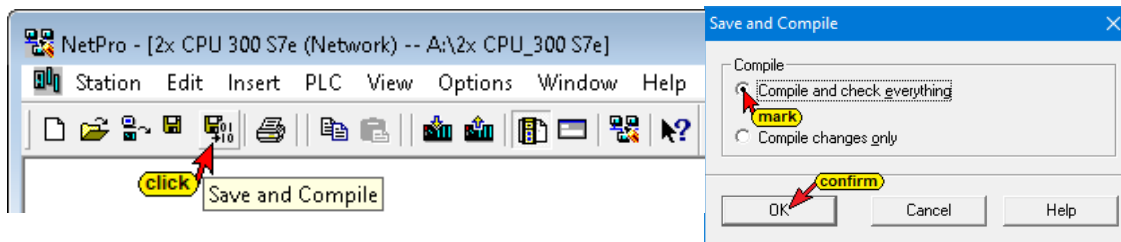
The **Configure** button opens the Configure Symbols dialog box. The operands defined in the symbol table, and the data of the data blocks can be selected here as **OPC tags** (OPC symbols).



The tag management of the controller is known through the previously configured S7 connection.



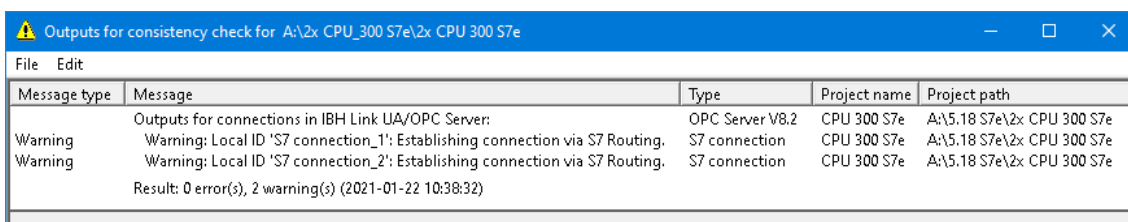
Configuration of the IBH Link UA Save and Compile



The configuration is accepted by clicking the **Save and Compile** icon.

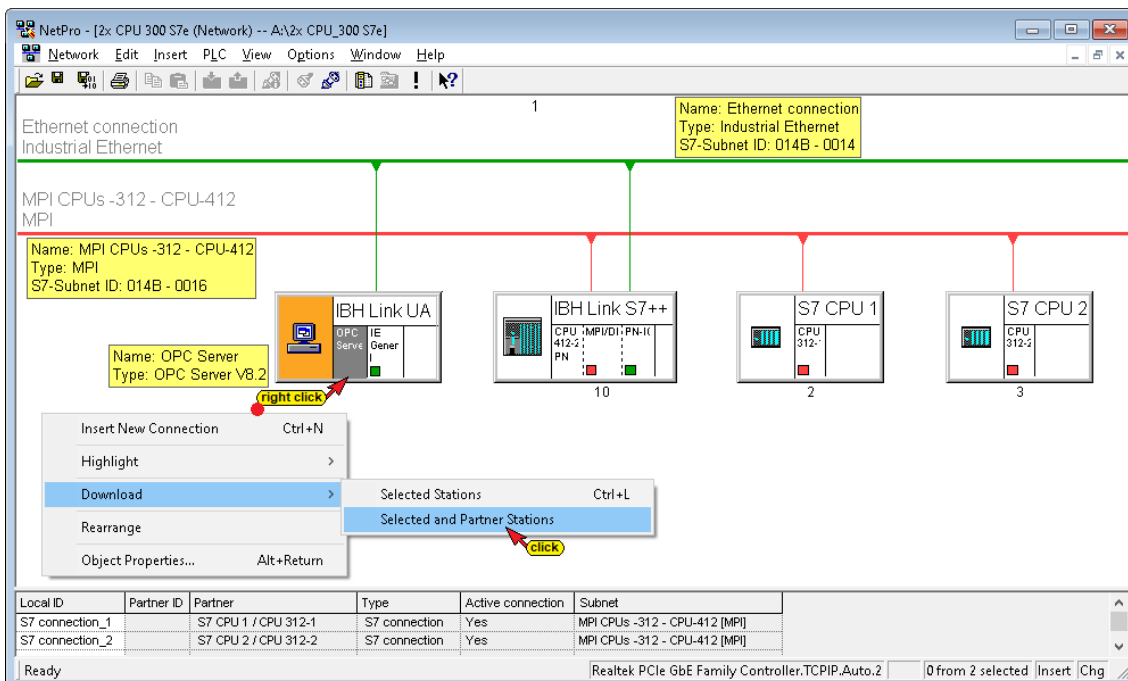
The option compiles, and check shows warnings.

Routing was intended, the warning does not apply.



Download the configuration of the IBH Link UA and CPUs 312.

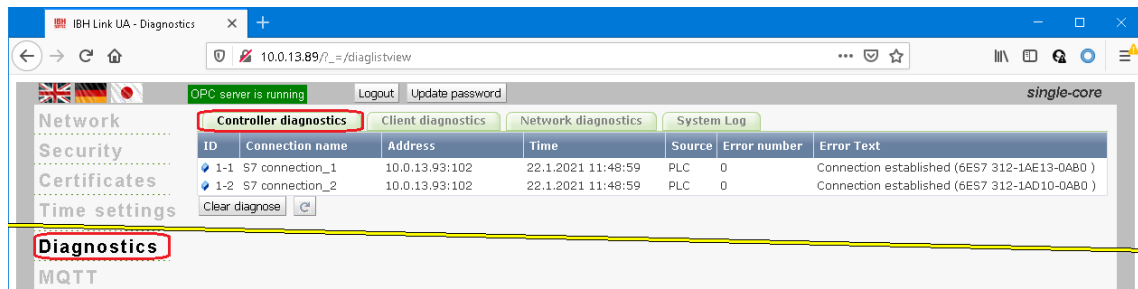
Right-click **OPC-Server** and click **Download / Selected and Partner Stations**.



Several information must be confirmed to complete the download.

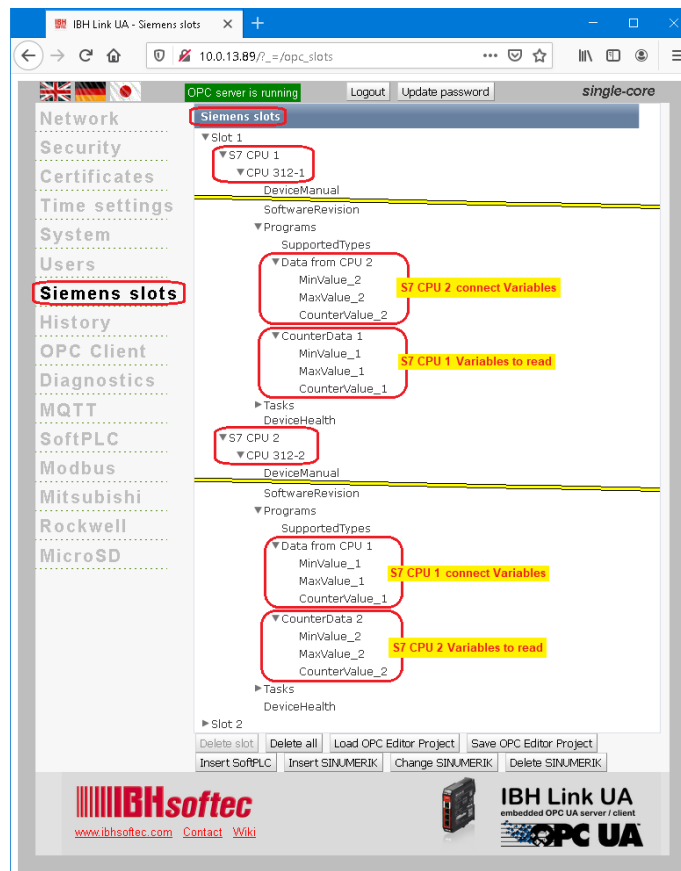
8.6.1 Browser window diagnosis / control diagnosis

The configured connection to the PLC control and its status (error-free / faulty) is displayed.



8.6.2 IBH Link UA browser window Siemens slots.

The CPU with the OPC tags is displayed in the Siemens Slots browser window.



8.6.3 Define the OPC UA server for the data exchange

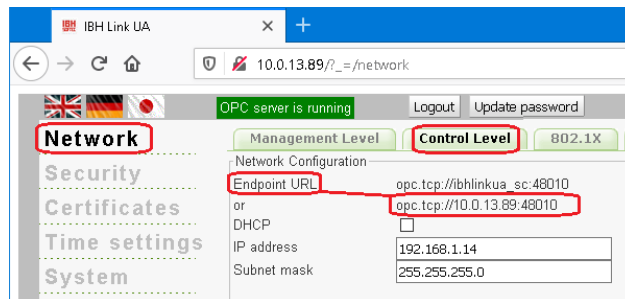
For data exchange between the PLC **S7-CPU 1** [CPU 312], and the **S7-CPU 2** [CPU 312] the **OPC UA servers**, and **OPC UA clients** are registered in the **IBH Link UA**.

All the PLC controls are both **OPC UA server** and **OPC UA client**. The server integrated in the **IBH Link UA** provides the **OPC tags** that are defined in the PLC-CPU.

The **IBH Link UA** offers the **OPC UA server** as well as the **OPC UA client function** for all PLC CPUs.

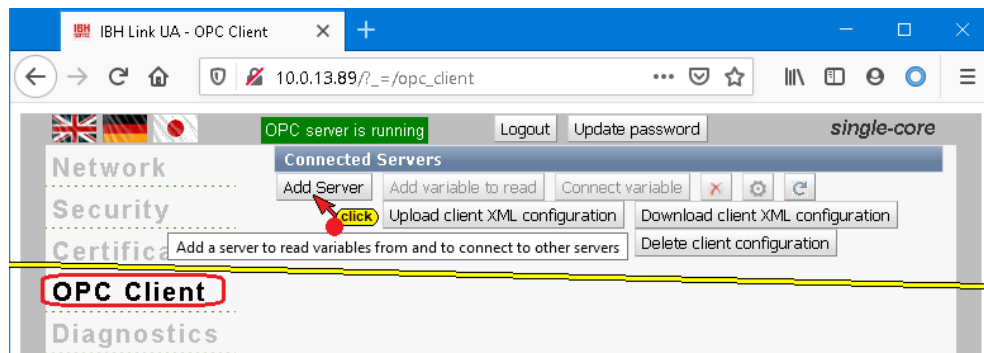
The server for the data exchange of all PLC CPUs is specified in the web browser window **OPC Client**.

The required endpoint URL can be copied from the IBH Link UA web browser window network / control level.



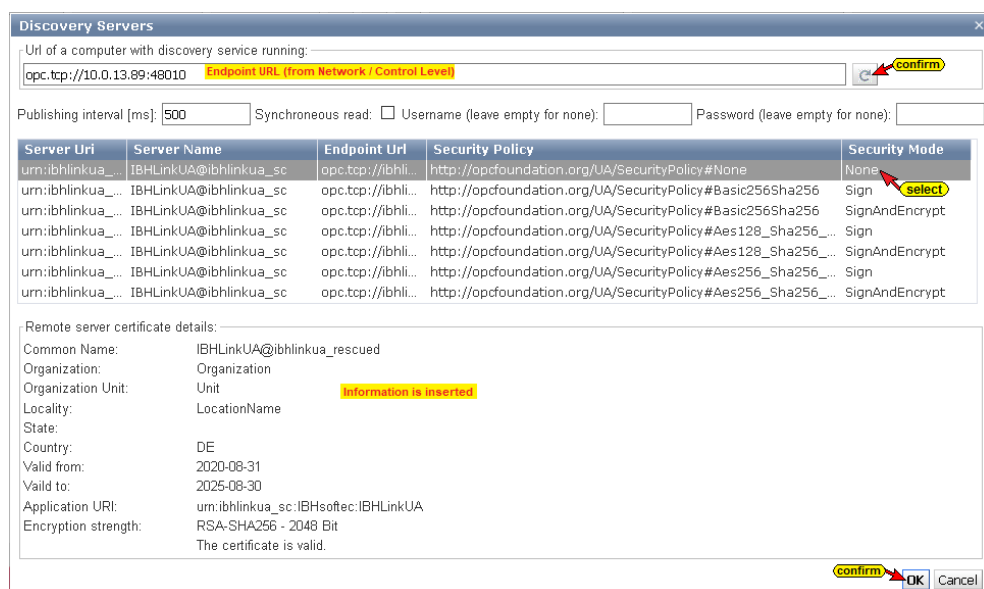
The endpoint URL can be copied into the IBH Link UA web browser window / network / control level.

Add server



The copied endpoint URL **opc.tcp: // ibhlinkua_sc: 48010** or **opc.tcp: //10.0.13.89: 48010** is in the open field in the IBH Link UA web browser window / OPC client is to be added as a server.

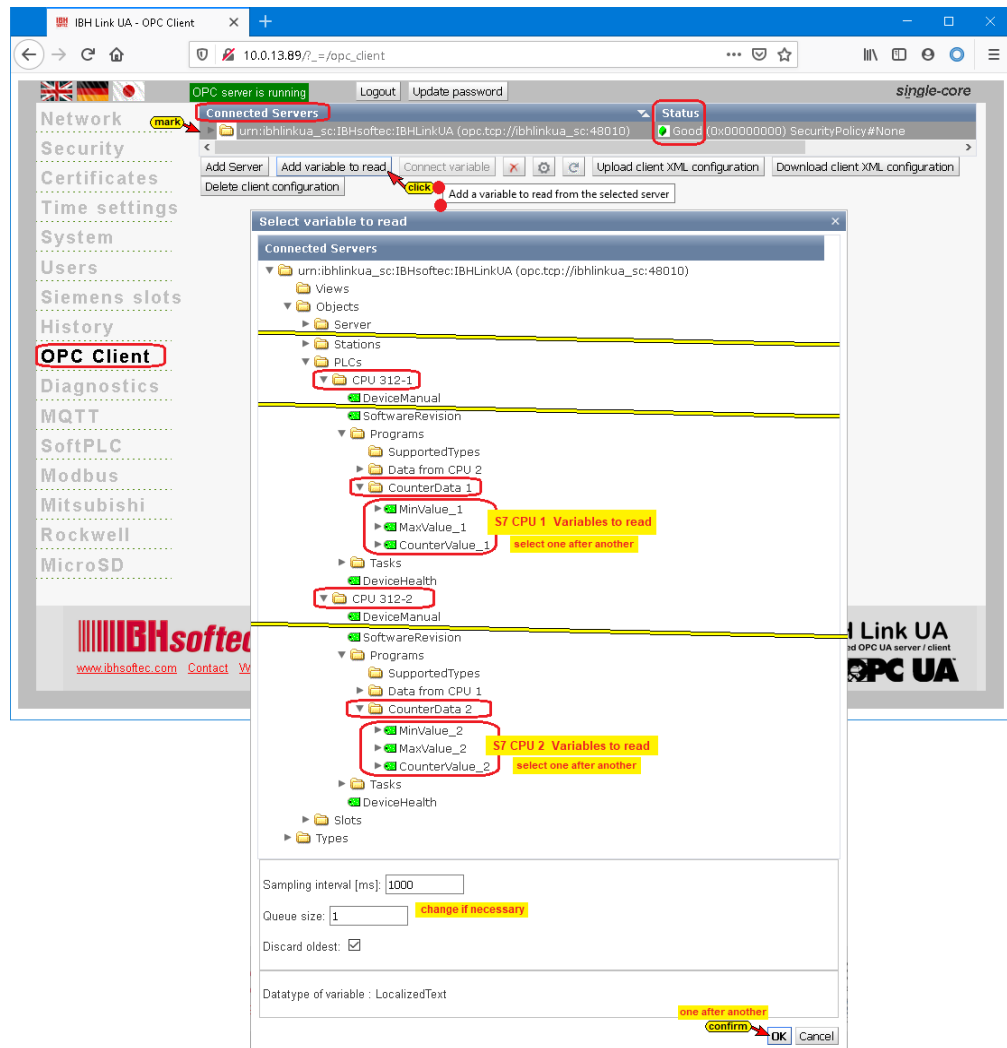
Security Policy None and **Security Mode None** were selected for data transmission.



The IBH Link UA OPC UA server is connected. The status of the server is good. None was selected as the security policy for the server.

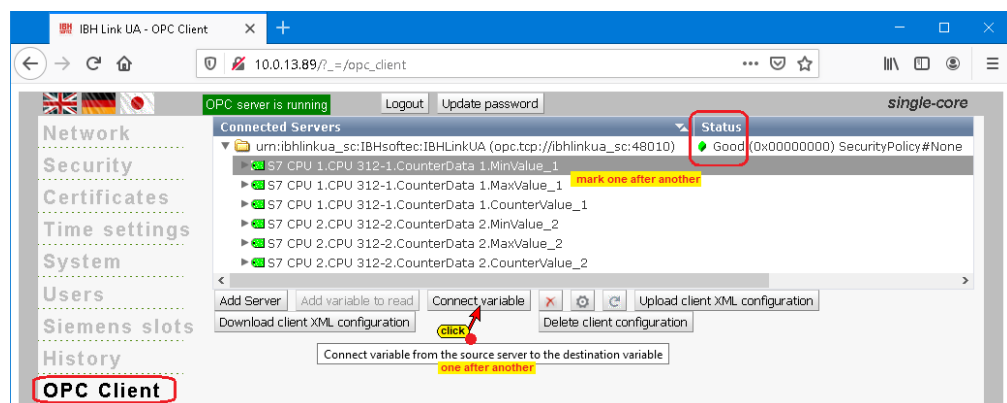
Add read variable S7 CPU 1, and S7 CPU

OPC tags defined as read tags have the functions of an OPC UA server. These OPC tags are available to all OPC UA clients.



Added read variables: S7 CPU 1, S7 CPU 2

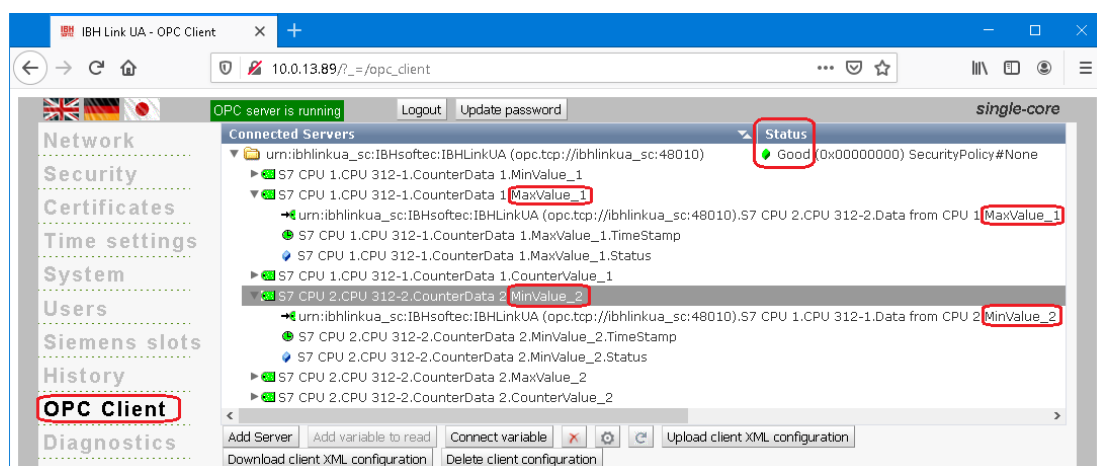
These variables can be linked to the variables of the OPC UA clients.



Added read variables: S7 CPU 1, S7 CPU 2

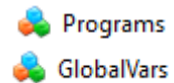


The connections are displayed in the IBH Link UA web browser window OPC Client.



8.7 UaExpert - program window

The PLC controls used in the example are listed in the **UaExpert** program window under PLC.



The variables defined as OPC tags in the data blocks (under **Programs**), and in the symbol table (under **GlobalVars**) can be dragged and dropped into the **Data Access View**. The variables are updated continuously.

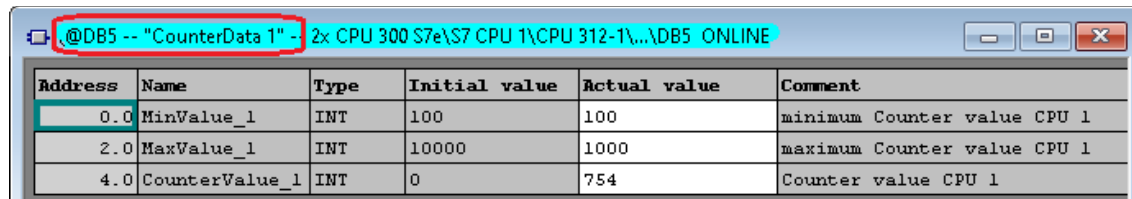
Data Access View

#	Server	Node Id	Display Name	Value	Datatype	Source Timestamp	Server Timestamp	Statuscode
1	IBHLinkUA...	NS4 String S7 CPU 1...	CounterValue_1	782	Int16	15:59:50.106	15:59:50.356	Good
2	IBHLinkUA...	NS4 String S7 CPU 1...	MaxValue_1	1000	Int16	15:57:35.973	15:57:36.778	Good
3	IBHLinkUA...	NS4 String S7 CPU 1...	MinValue_1	100	Int16	15:57:37.899	15:57:38.278	Good
4	IBHLinkUA...	NS4 String S7 CPU 1...	CounterValue_2	395	Int16	15:59:49.978	15:59:50.106	Good
5	IBHLinkUA...	NS4 String S7 CPU 1...	MaxValue_2	2000	Int16	15:57:44.315	15:57:45.031	Good
6	IBHLinkUA...	NS4 String S7 CPU 1...	MinValue_2	200	Int16	15:57:45.787	15:57:46.531	Good
7	IBHLinkUA...	NS4 String S7 CPU 2...	CounterValue_2	1019	Int16	15:59:50.106	15:59:50.356	Good
8	IBHLinkUA...	NS4 String S7 CPU 2...	MaxValue_2	2000	Int16	15:58:21.903	15:58:22.308	Good
9	IBHLinkUA...	NS4 String S7 CPU 2...	MinValue_2	200	Int16	15:58:23.904	15:58:24.309	Good
10	IBHLinkUA...	NS4 String S7 CPU 2...	CounterValue_1	691	Int16	15:59:49.978	15:59:50.106	Good
11	IBHLinkUA...	NS4 String S7 CPU 2...	MaxValue_1	1000	Int16	15:58:29.469	15:58:30.310	Good
12	IBHLinkUA...	NS4 String S7 CPU 2...	MinValue_1	100	Int16	15:58:31.732	15:58:32.561	Good

Data Access View

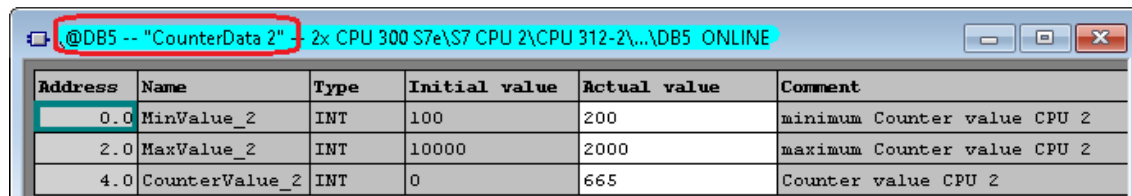
#	Server	Node Id
1	IBHLinkUA@ibhlinkua_sc	NS4 String S7 CPU 1.CPU 312-1.CounterData 1.CounterValue_1
2	IBHLinkUA@ibhlinkua_sc	NS4 String S7 CPU 1.CPU 312-1.CounterData 1.MaxValue_1
3	IBHLinkUA@ibhlinkua_sc	NS4 String S7 CPU 1.CPU 312-1.CounterData 1.MinValue_1
4	IBHLinkUA@ibhlinkua_sc	NS4 String S7 CPU 1.CPU 312-1.Data from CPU 2.CounterValue_2
5	IBHLinkUA@ibhlinkua_sc	NS4 String S7 CPU 1.CPU 312-1.Data from CPU 2.MaxValue_2
6	IBHLinkUA@ibhlinkua_sc	NS4 String S7 CPU 1.CPU 312-1.Data from CPU 2.MinValue_2
7	IBHLinkUA@ibhlinkua_sc	NS4 String S7 CPU 2.CPU 312-2.CounterData 2.CounterValue_2
8	IBHLinkUA@ibhlinkua_sc	NS4 String S7 CPU 2.CPU 312-2.CounterData 2.MaxValue_2
9	IBHLinkUA@ibhlinkua_sc	NS4 String S7 CPU 2.CPU 312-2.CounterData 2.MinValue_2
10	IBHLinkUA@ibhlinkua_sc	NS4 String S7 CPU 2.CPU 312-2.Data from CPU 1.CounterValue_1
11	IBHLinkUA@ibhlinkua_sc	NS4 String S7 CPU 2.CPU 312-2.Data from CPU 1.MaxValue_1
12	IBHLinkUA@ibhlinkua_sc	NS4 String S7 CPU 2.CPU 312-2.Data from CPU 1.MinValue_1

Data of the data block CounterData 1 [DB5] of the S7 CPU 1



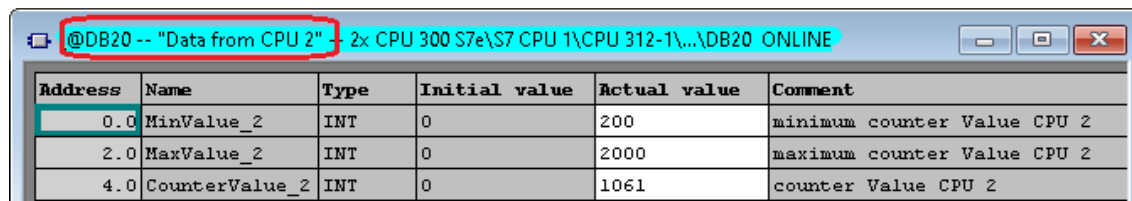
Address	Name	Type	Initial value	Actual value	Comment
0.0	MinValue_1	INT	100	100	minimum Counter value CPU 1
2.0	MaxValue_1	INT	10000	1000	maximum Counter value CPU 1
4.0	CounterValue_1	INT	0	754	Counter value CPU 1

Data of the data block CounterData 2 [DB5] of the S7 CPU 2



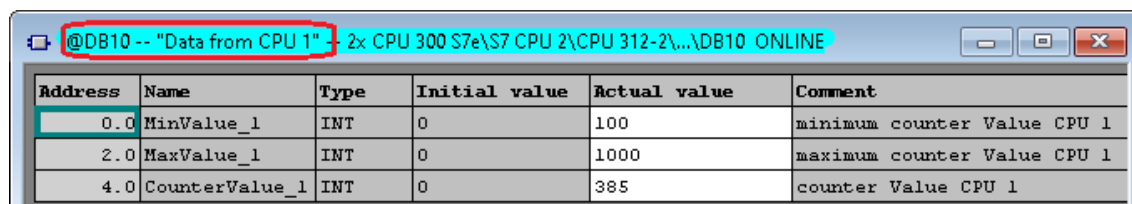
Address	Name	Type	Initial value	Actual value	Comment
0.0	MinValue_2	INT	100	200	minimum Counter value CPU 2
2.0	MaxValue_2	INT	10000	2000	maximum Counter value CPU 2
4.0	CounterValue_2	INT	0	665	Counter value CPU 2

Data of the data block Data from CPU 2 [DB20] of the S7 CPU 2



Address	Name	Type	Initial value	Actual value	Comment
0.0	MinValue_2	INT	0	200	minimum counter Value CPU 2
2.0	MaxValue_2	INT	0	2000	maximum counter Value CPU 2
4.0	CounterValue_2	INT	0	1061	counter Value CPU 2

Data of the data block Data from CPU 1 [DB10] of the S7 CPU 1



Address	Name	Type	Initial value	Actual value	Comment
0.0	MinValue_1	INT	0	100	minimum counter Value CPU 1
2.0	MaxValue_1	INT	0	1000	maximum counter Value CPU 1
4.0	CounterValue_1	INT	0	385	counter Value CPU 1