

IBH Link UA

Manual Part 2

PLC projects with TIA Portal

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	PLC example projects (PLC programs)	XII

PLC example projects (PLC programs)

CPU 416 TIA 16e	Project chapters 1 and 2 STEP® 7 TIA Portal V16; CPU 416-3 PN/DP.
WinAC RTX TIA 16e	Project chapter 3 STEP® 7 TIA Portal V16; CPU 416-3 PN/DP, IBH Link UA SoftPLC (Siemens WinAC RTX compatible.)
CPU300 TIA 16e	Project chapter 4 STEP® 7 TIA Portal V16; CPU 312, IBH Link S7++.
S5 CPU 103Ue STEP 5 and PLC Programs STEP® 7 TIA Portal V16 (File)	Project chapter 5 S5 CPU 103U. STEP® 7 TIA Portal V16 S5 PLC-Program: COUNT@ST.S5D S5W PLC-Program: Counter S5W.S5P
CPU 416 Alarms TIA 16e	Project chapter 6 STEP® 7 TIA Portal V16; CPU 416-3 PN/DP.
CPU 1500 TIA 16e	Project chapter 7 STEP® 7 TIA Portal V16; CPU 1511-1 PN.
CPU 1200 TIA 16e	Project chapter 8 STEP® 7 TIA Portal V16; CPU 1211 DC/DC/DC.
S5 CPUs and S7 CPUs TIA16e S5 multi CPUs Programs (File with STEP 5 / S5W PLC- Programs)	Project chapter 9 Data exchange between several S7 / S5 CPUs STEP® 7 TIA Portal V16 project with several CPUs.
2x CPU 300 TIA16e	Project chapter 10. STEP® 7 TIA Portal V16; 2x CPU 312, IBH Link S7++.
CPU 1500-CPU 1200 TIA16e	Project chapter 11 STEP® 7 TIA Portal V16; CPU 1511-1 PN connected to CPU 1211 DC/DC/DC.

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

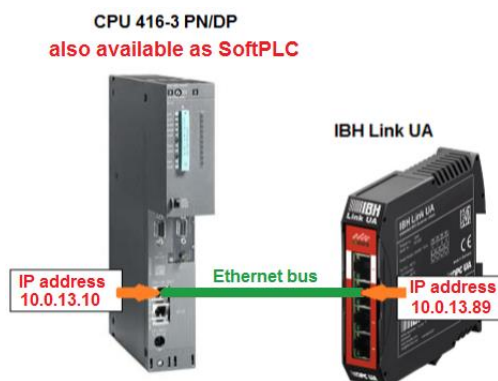
The following example shows the connection of a CPU 416 to the IBH Link UA with an Ethernet connection.

1.1 Project with TIA Portal V16

Creating a project with the TIA Portal, with the connection of a CPU 416 and the IBH Link UA using an Ethernet bus.



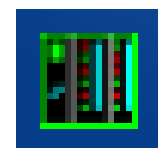
1.1.1 Hardware structure – (CPU 416-3 PN / DP – IBH Link UA)



1.1.2 Software PLC CPU 416-3 PN/DP

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

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

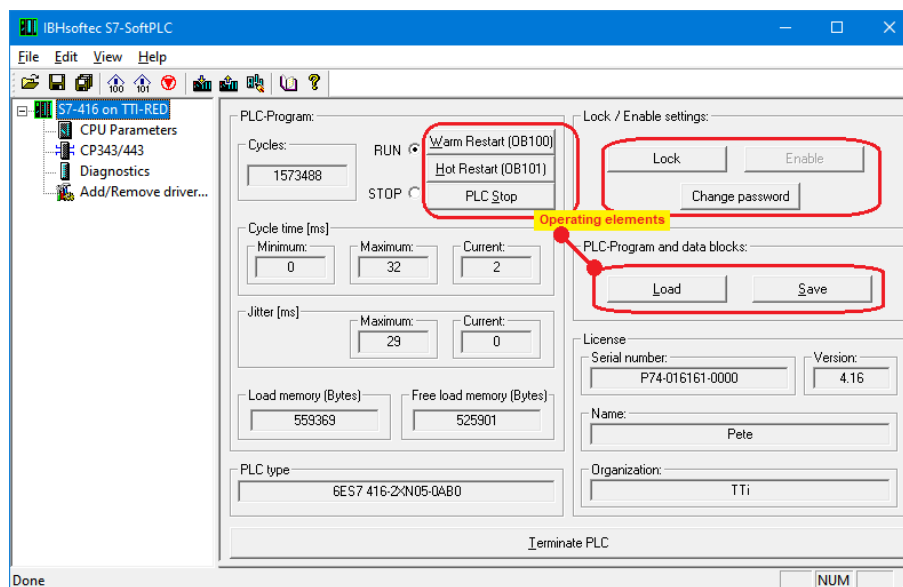


The SoftPLC CPU 416-3 PN/DP from IBHsoftec is installed on the PC and is already running. Right-clicking on the **SoftPLC** icon in the task bar opens the IBHsoftec S7-SoftPLC window for Configuring and Diagnosing the SoftPLC.

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.

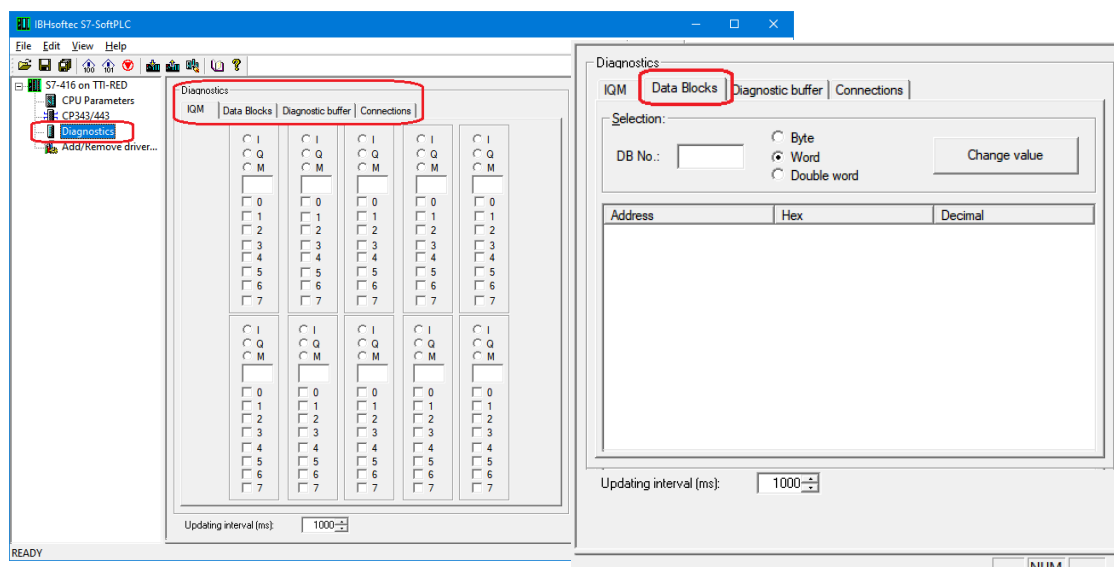
SoftPLC Operating and Status windows



SoftPLC Diagnostic window

The diagnosis provides four tabs.

- **IQM** Status display of individual bits of an operand. The status of freely selectable inputs (I n.), outputs (Q n.) 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.



1.1.3 PLC program of the CPU 416

The project **CPU 416 TIA 16e** 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.

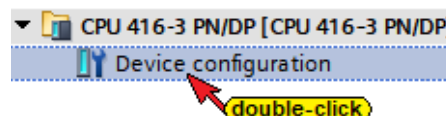
The up and down counting are controlled with the variables **Down** and **Up**. The counter **Value** variable is an integer (INT). The variables **Max** and **Min** are only used internally. The integer values of the minimum and maximum counter values are stored in data block DB2 (**CounterData**).

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 [DB2]** are forwarded to the OPC server IBH Link UA as OPC tags.

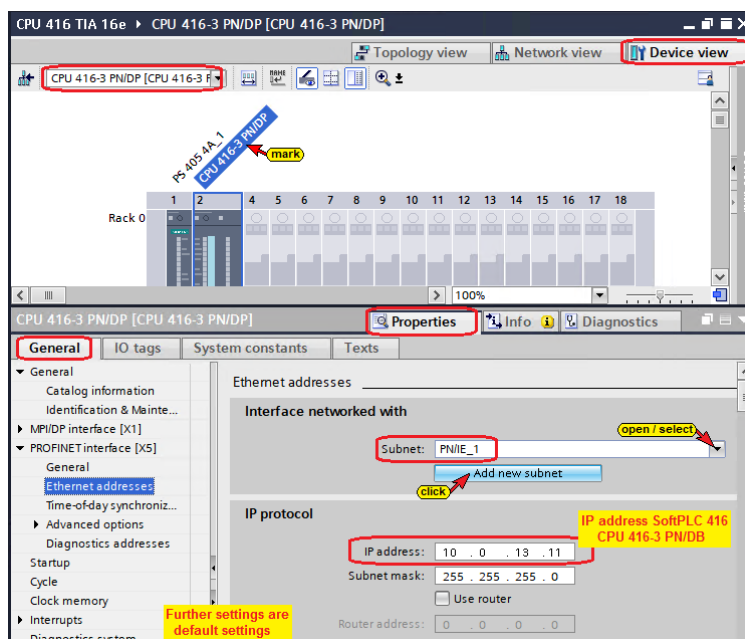
Loading the PLC Program into the CPU

Double-click **Device Configuration** to open the Device view window.



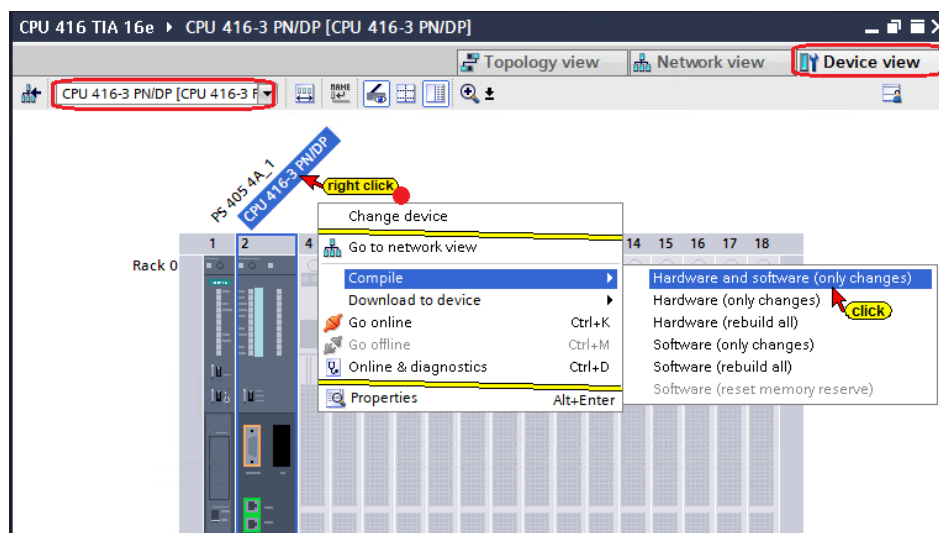
In the example, the CPU 416-3 PN/DP (6ES7 416-3ER05-0AB0) firmware version V5.1 is used, which is also available as a software PLC from IBHsoftec.

In the dialog box properties, the required IP address is set under IP protocol. In the example, the IP address of the PC is – 10.0.13.11. The Ethernet connection is direct without a router.

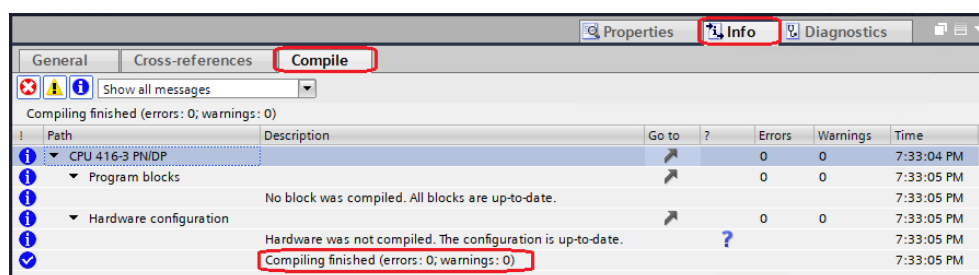


Hardware and software compilation

Use the command from the context menu to compile the software and the hardware.

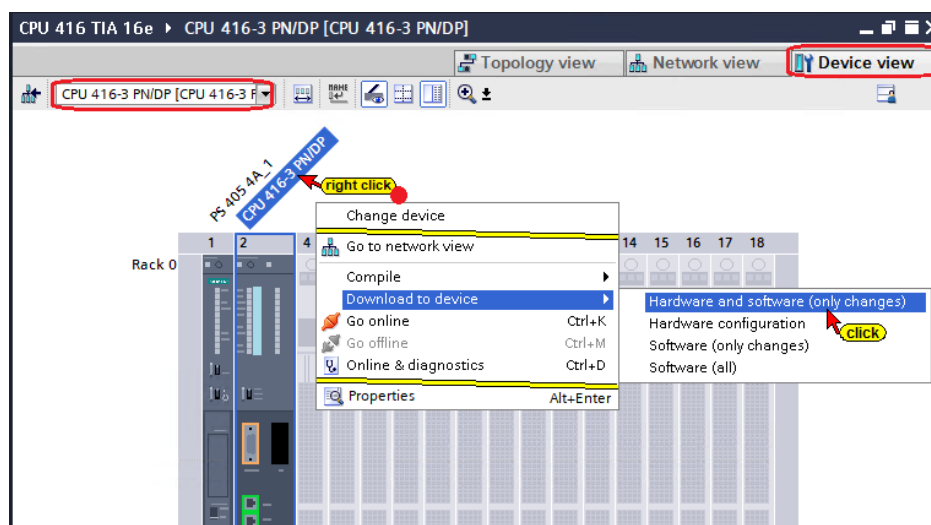


Hardware and software compilation

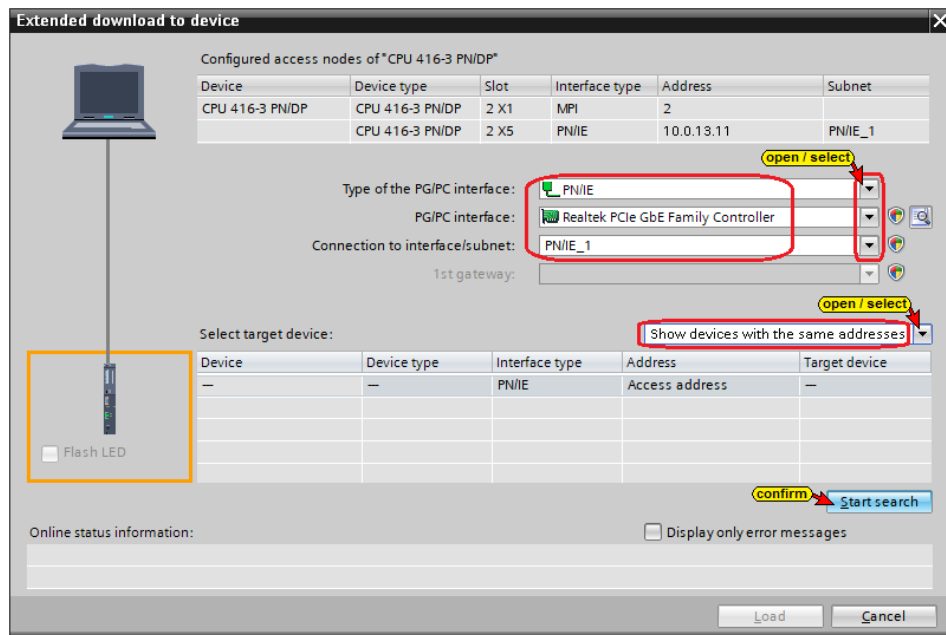


Download the hardware and software into the CPU

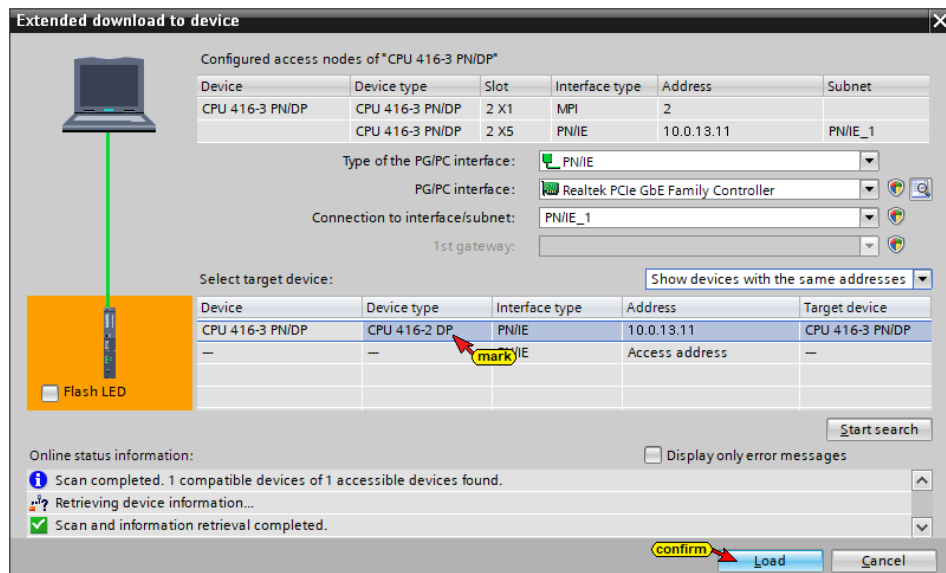
With the commands from the context menu, the software and the hardware configuration can be downloaded into the device.



The load command opens the dialog window to set the interface for the device. **Connection with interface / subnet PN/IE1**, and Show devices with the same addresses must be selected.

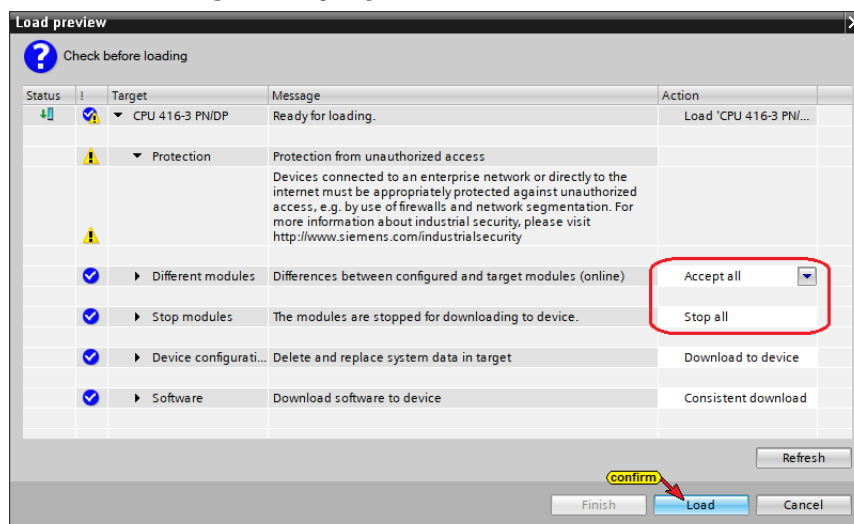


The successful search is displayed.

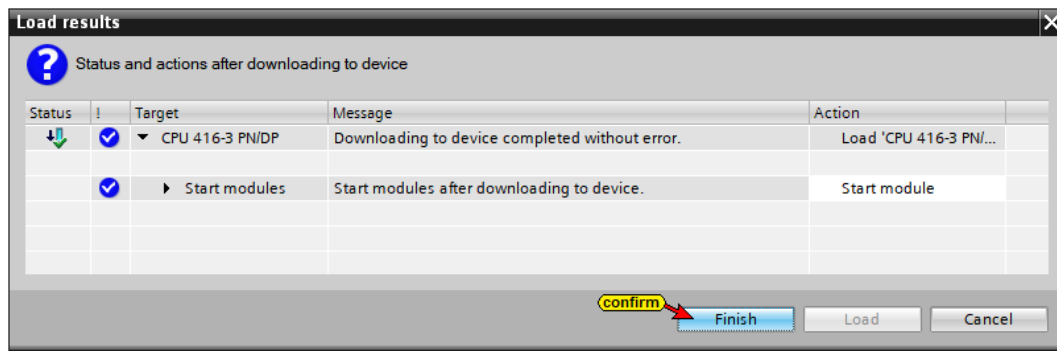


The loading process requires several confirmations of messages.

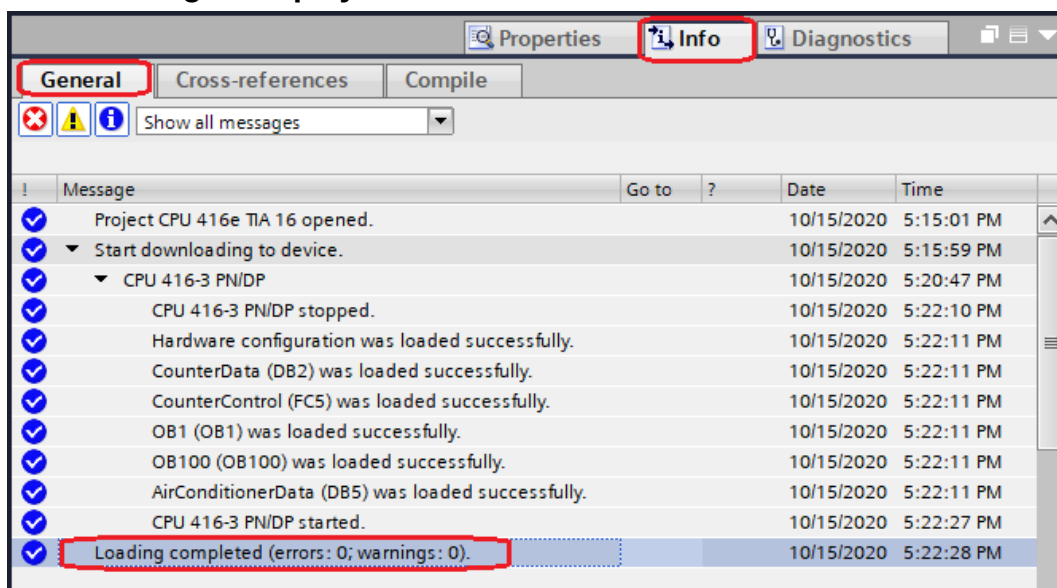
A preview of the loading is displayed.



Finish loading

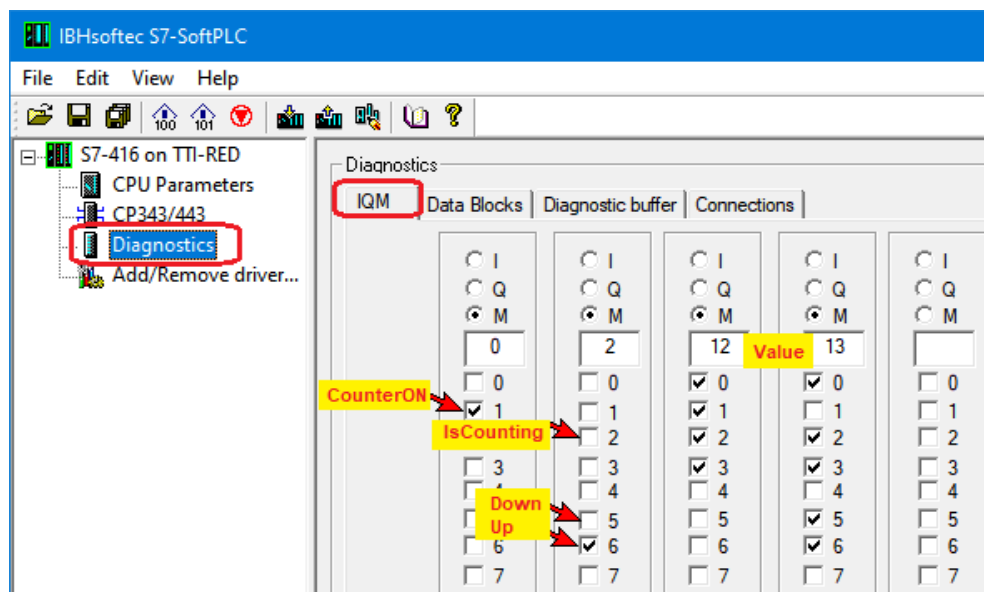


Error-free loading is displayed

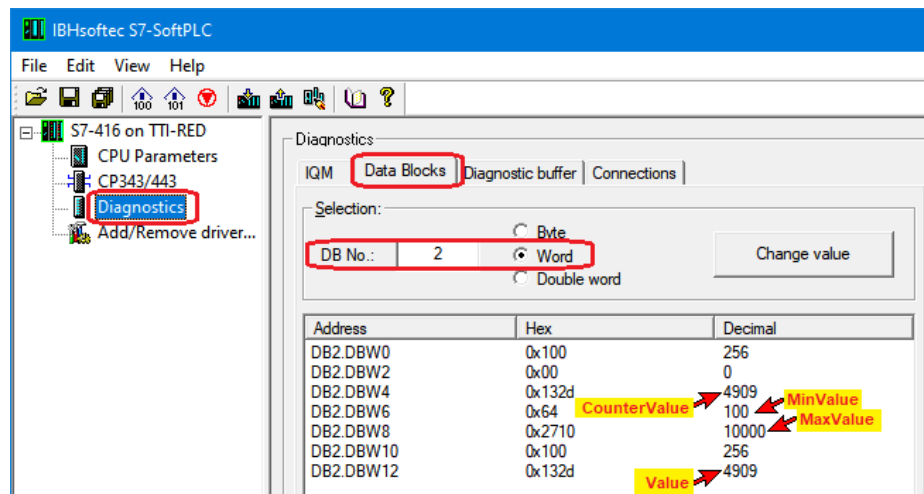


SoftPLC diagnosis window CPU 416-3 PN / DP

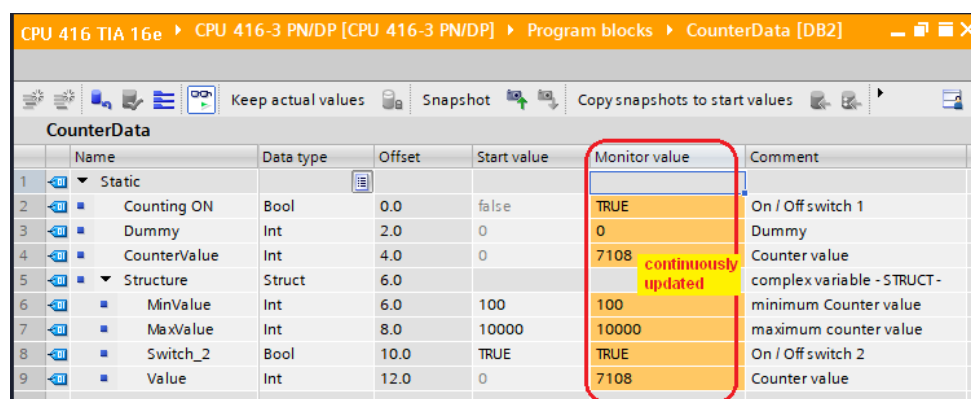
In the diagnosis window **IQM** of the SoftPLC 416 the Memory M0.1 **CounterON** were set. The Memory M2.5 **Down** and M2.6 **Up** are displayed. The **Value** of the counter is represented by **MW12** (**MB12** and **MB13**).



The Data Block **DB2 [CounterData]** holds variables used by the counter. The data words DW4 (**CounterValue**) and, DW9 (**Value**) shows the value of the counter. The data words DW6 / DW7 hold the counting limits **MinValue** / **MaxValue**.

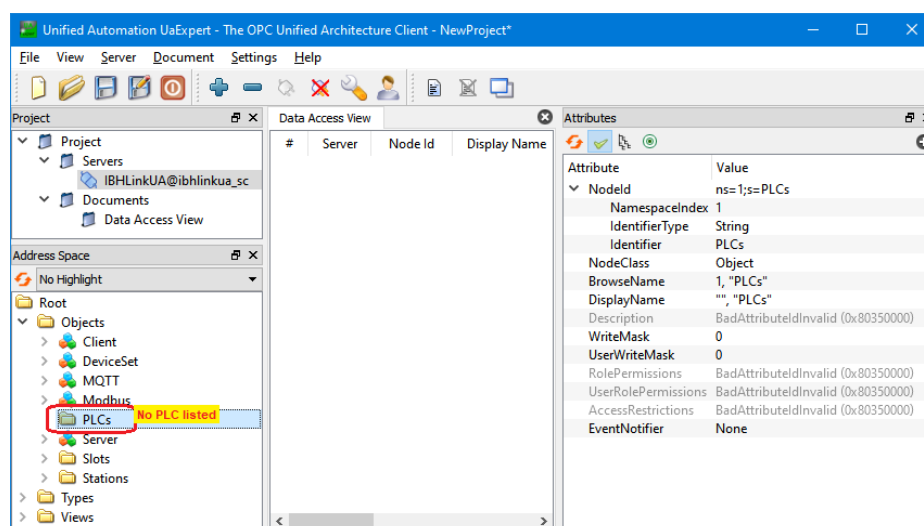


The up and down counting can be checked online.

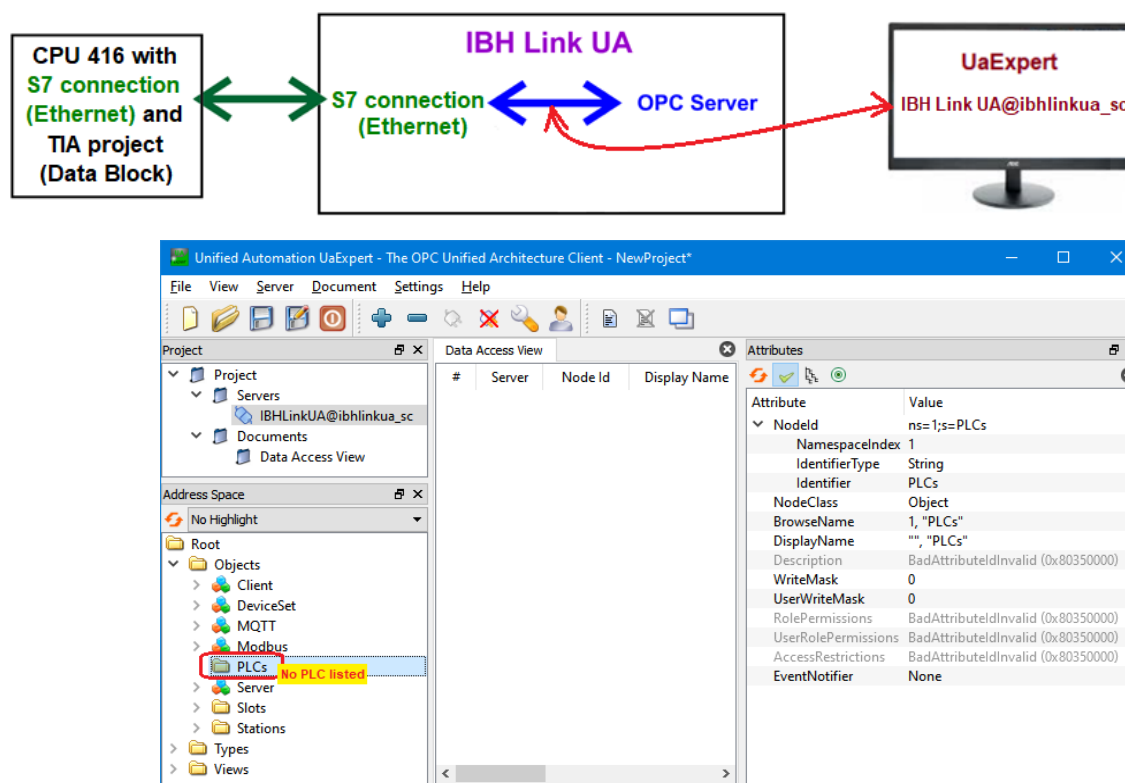


1.1.4 UaExpert - program window

The CPU 416 is not yet available in the **UaExpert program window** because the IBH Link UA has not yet been inserted into the program.

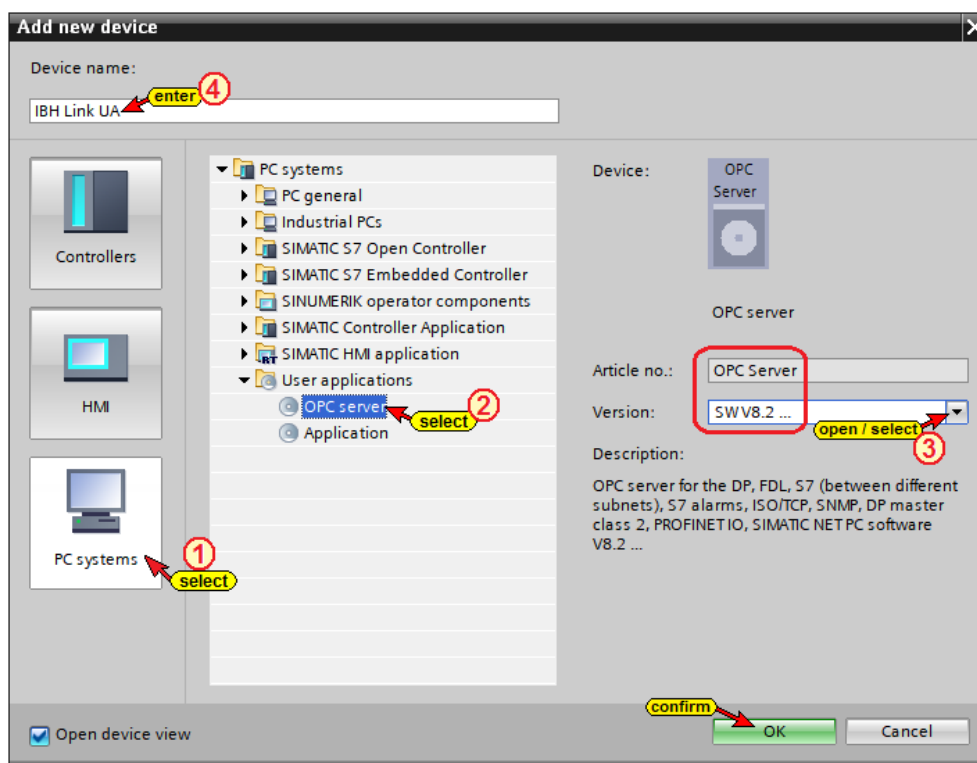
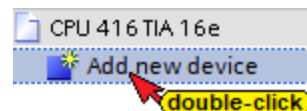


Display of the OPC tags in UaExpert

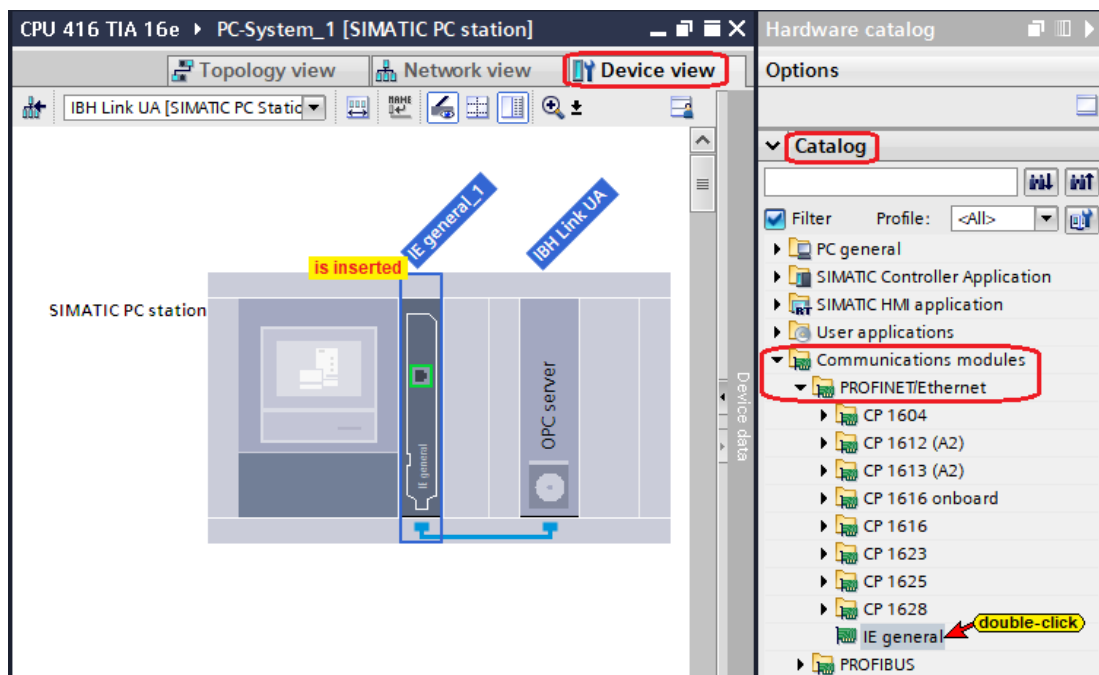


1.1.5 Insert IBH Link UA as a SIMATIC PC station

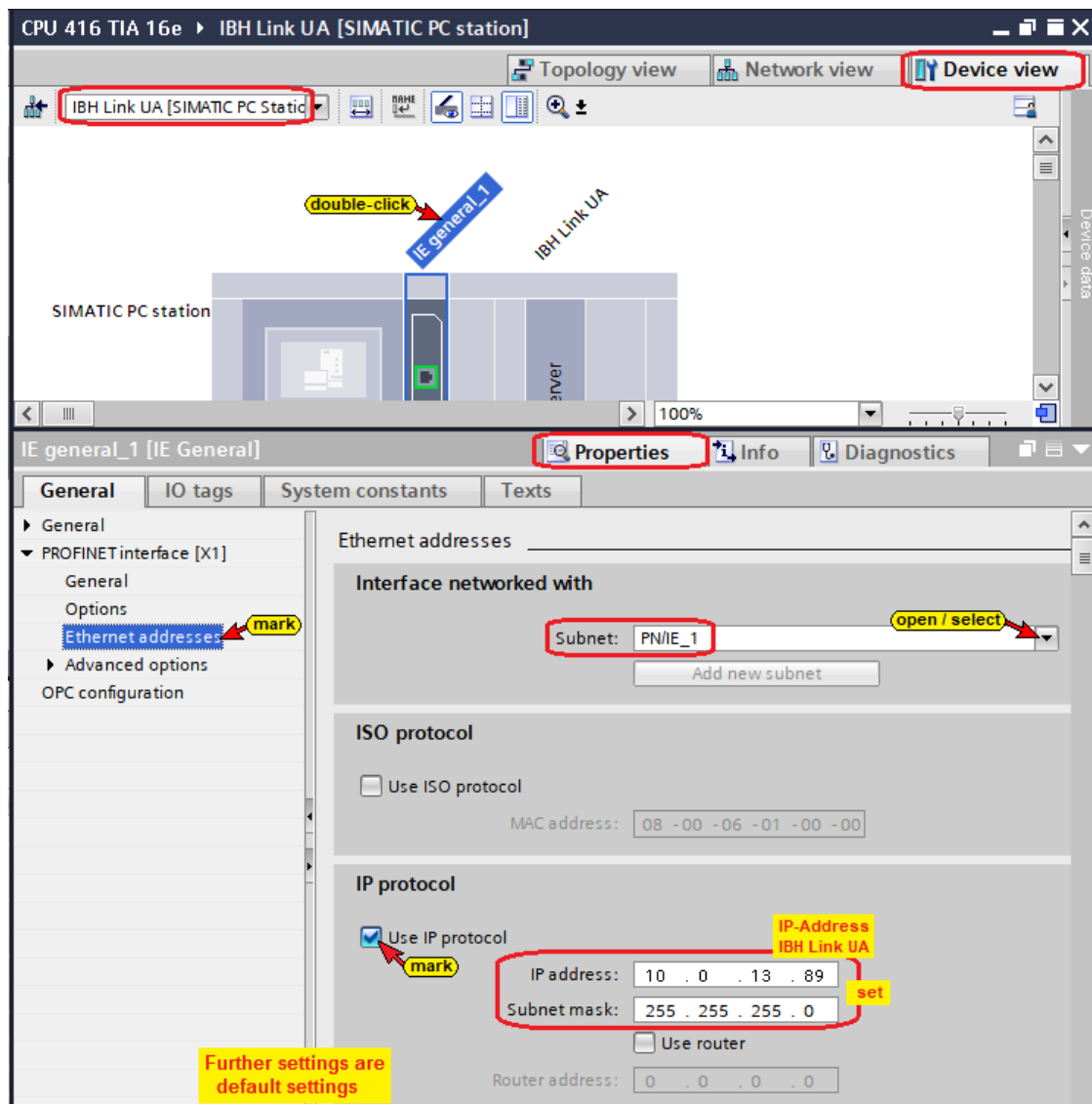
Double-clicking on **Add new device** opens the device selection dialog box. If an OPC server is added to the project, a **SIMATIC PC** station is automatically added.

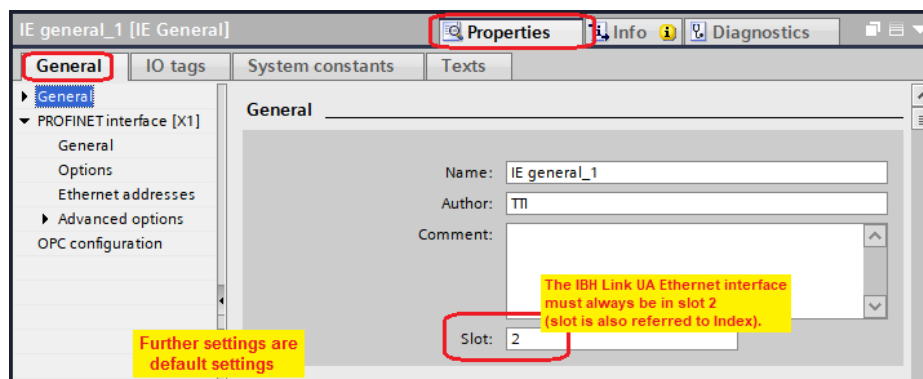


Insert communication module into the IBH Link UA



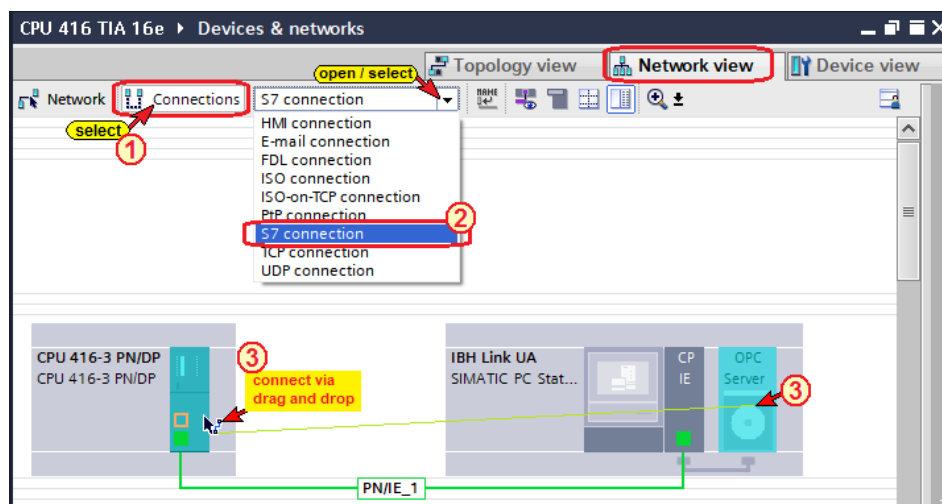
Define communication module properties



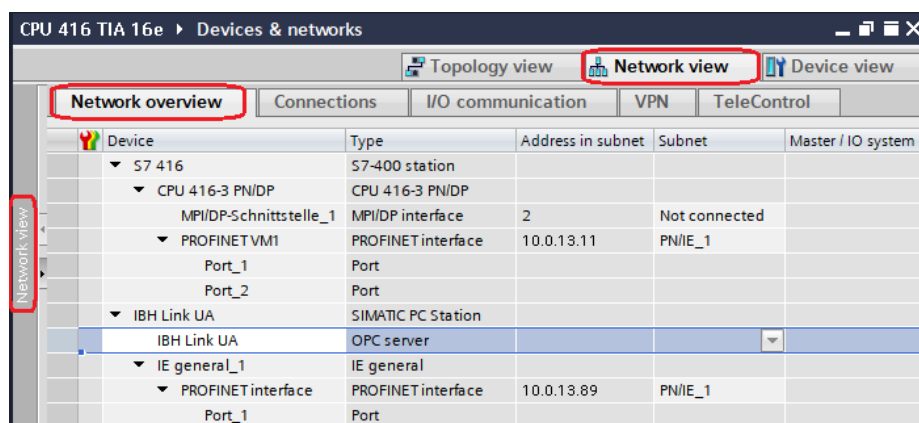
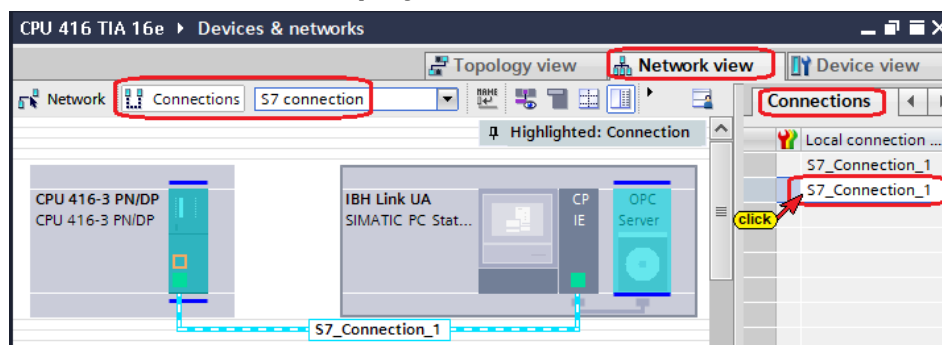


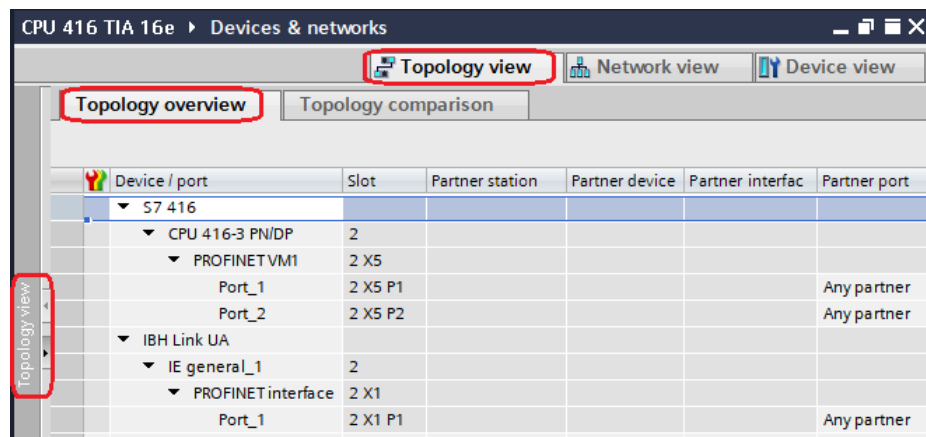
Create S7 connection IBH Link UA OPC Server - SoftPLC 416

Via **drag & drop**, from the OPC server to the PLC 416, the S7 connection established.

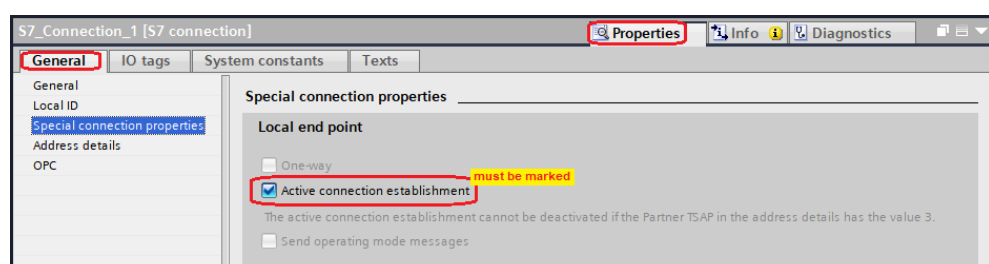
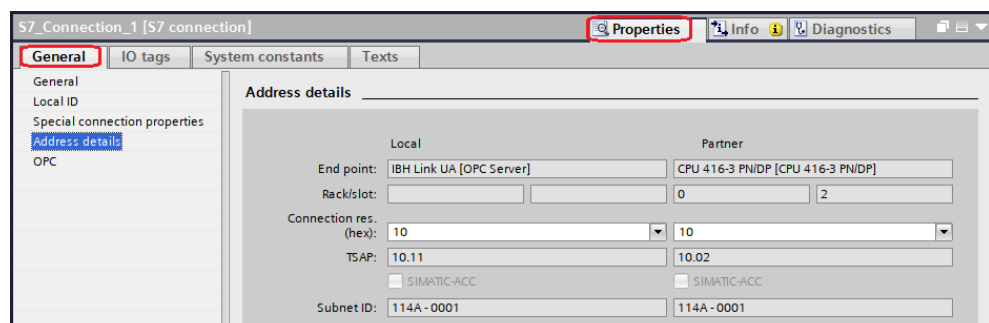
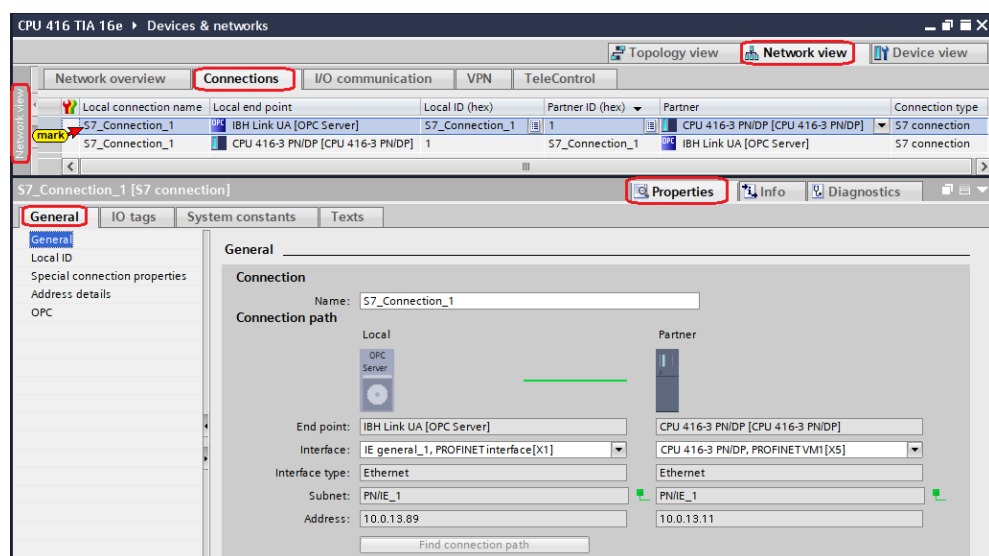


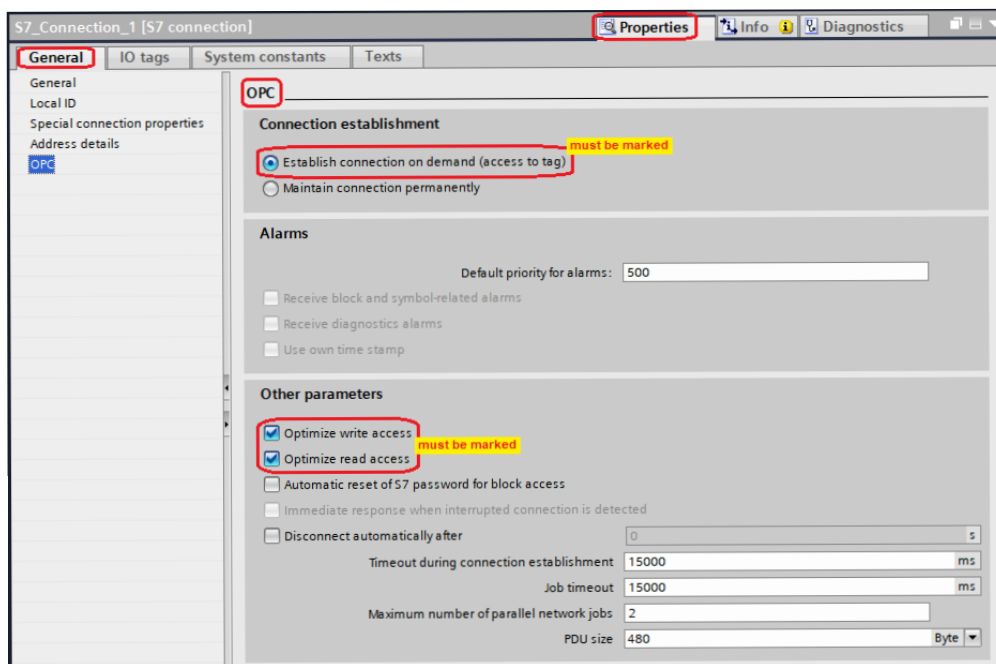
The created S7 connection is displayed.





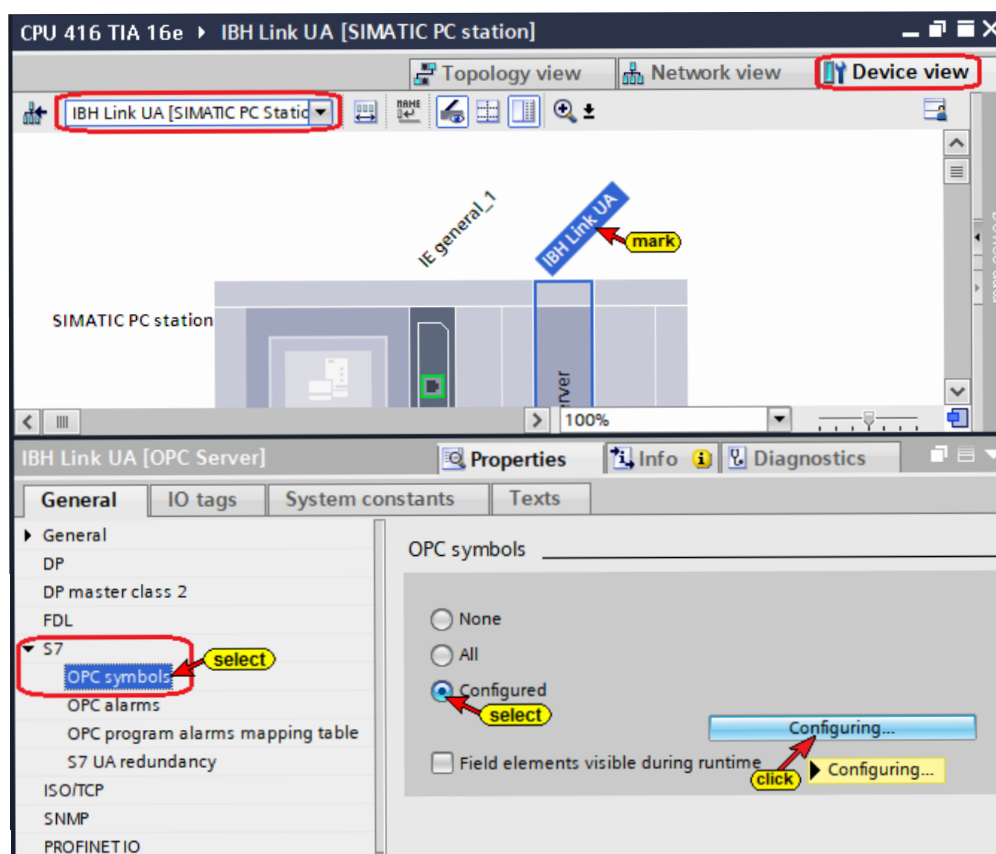
S7 connection - display / set connection properties.





Select OPC symbols (tags) in the OPC configuration

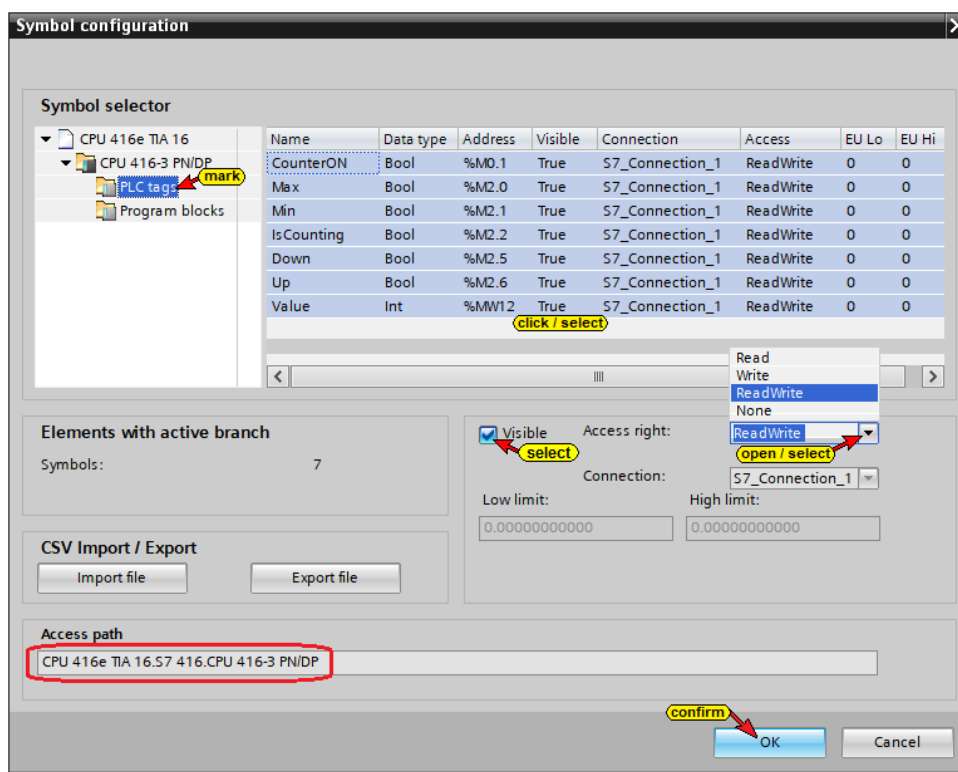
Open the configuration for the **OPC server / properties**.



The **Configure** button opens the Symbol configuration dialog box, in which the operands defined in the symbol table (PLC program Tank Level) can be selected as OPC tags.

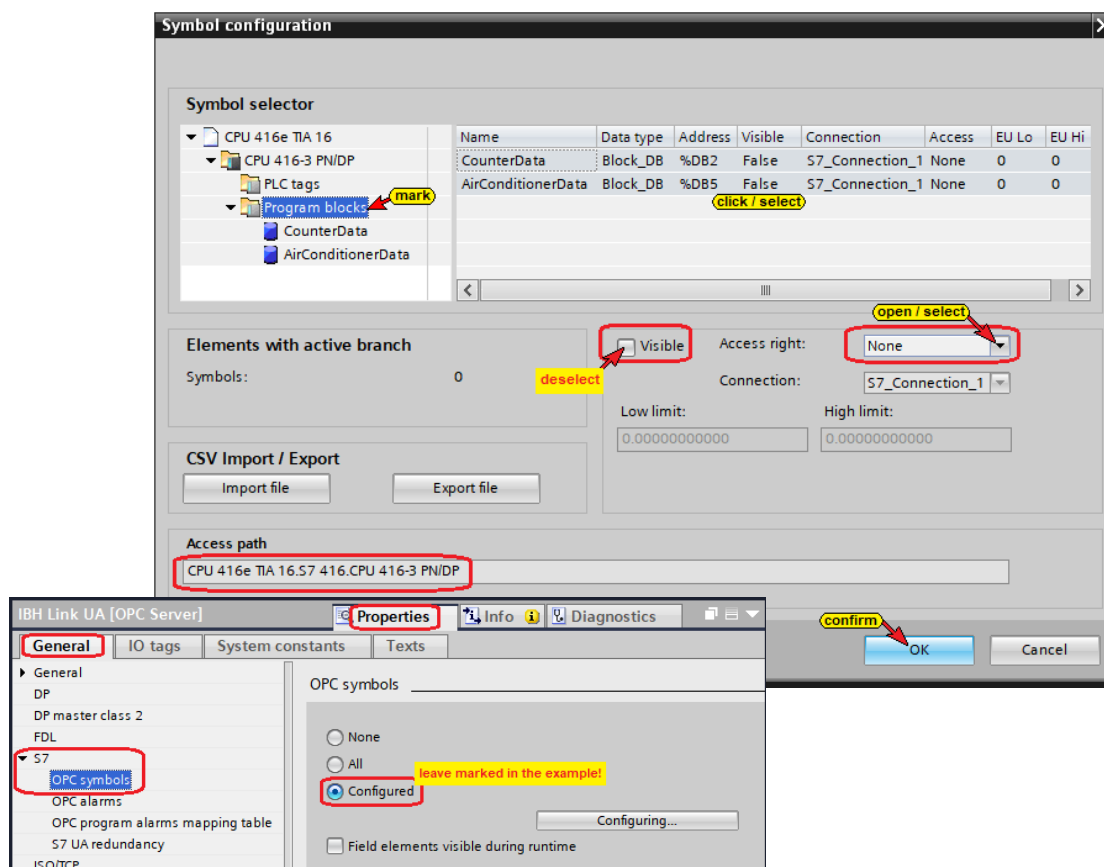
The **read / write, etc.** access rights can be assigned to the individual operands (OPC tags).

Configurable global symbolic operands



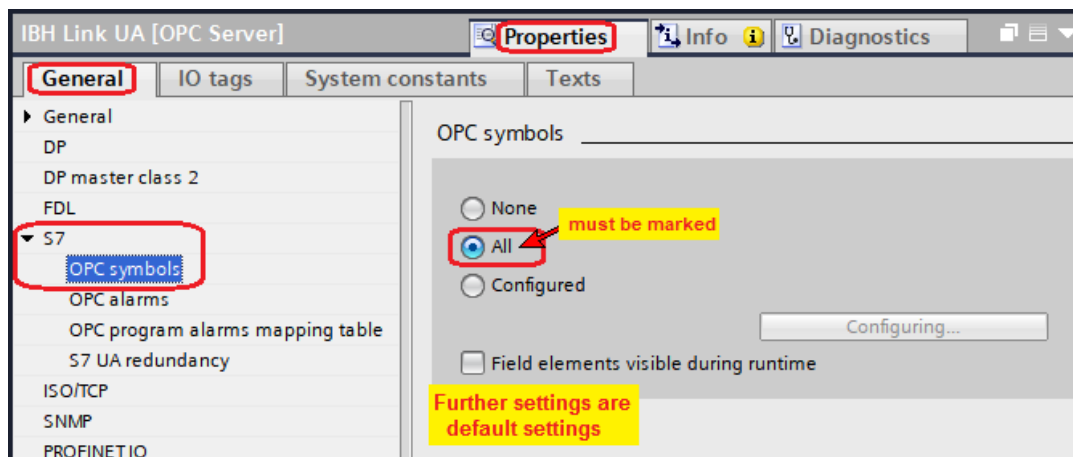
Data blocks CounterData [DB 2] / AirConditionerData [DB5]

The access rights of the data blocks DB2 and DB5 was set to None (no access) and defined as not visible. Only the PLC tags are visible, readable, and writable.

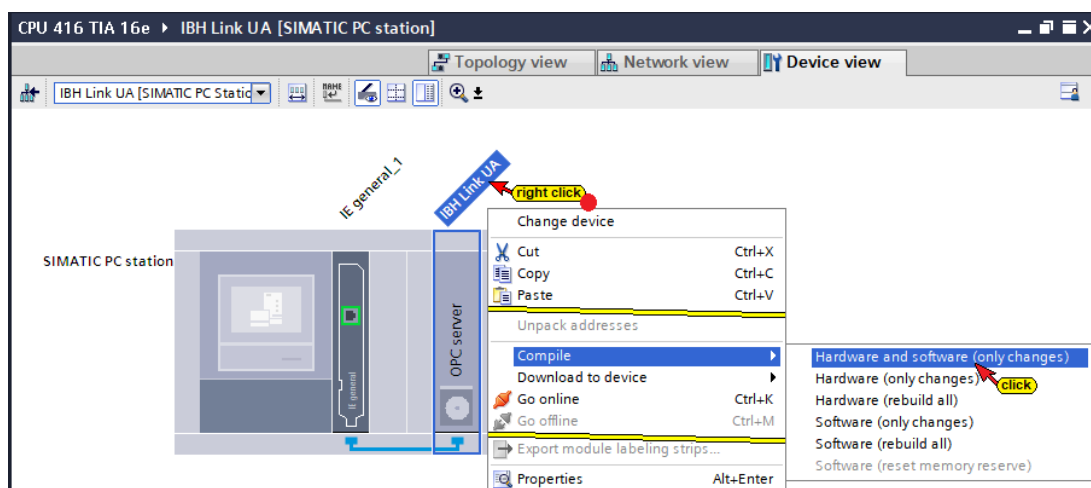


Selection of all OPC tags (symbols) in the OPC configuration

If all global symbolic operands and the data from all data blocks are to be used as OPC tags, **All** must be selected in the Properties - OPC Server dialog box.

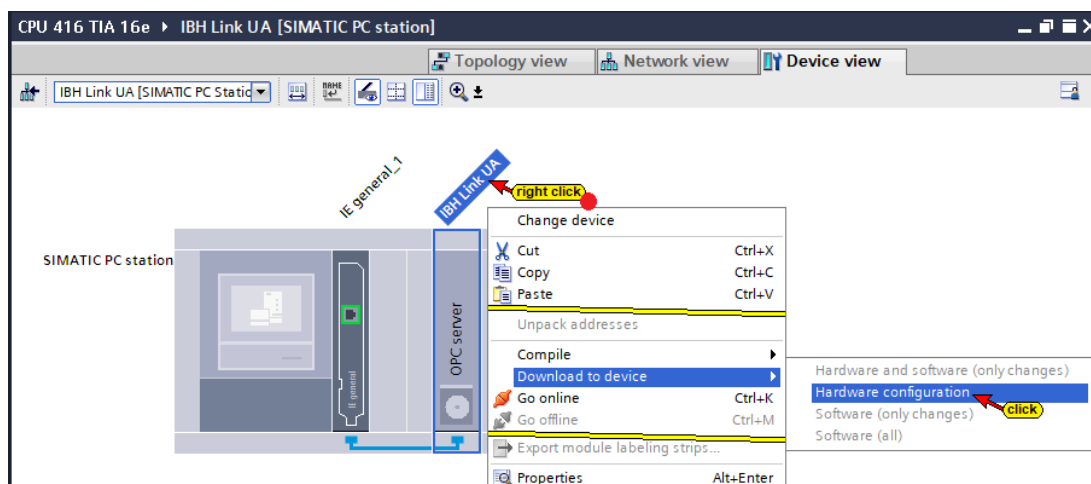


Compile the configuration of the OPC server

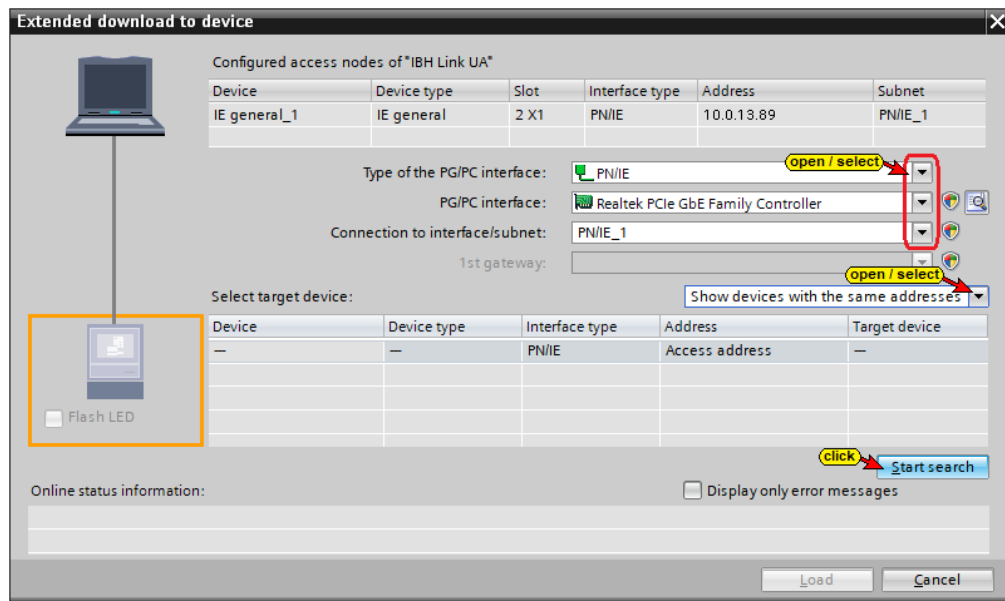


If no error is displayed when the hardware is compiled, the next step is to load the hardware into the IBH Link UA OPC server.

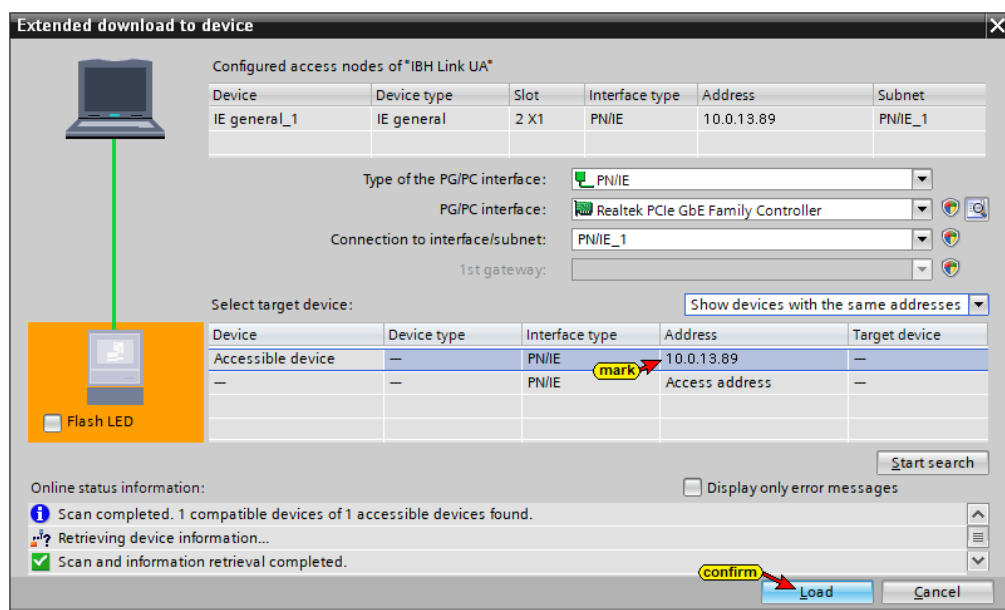
Load configuration of the OPC server into IBH Link UA



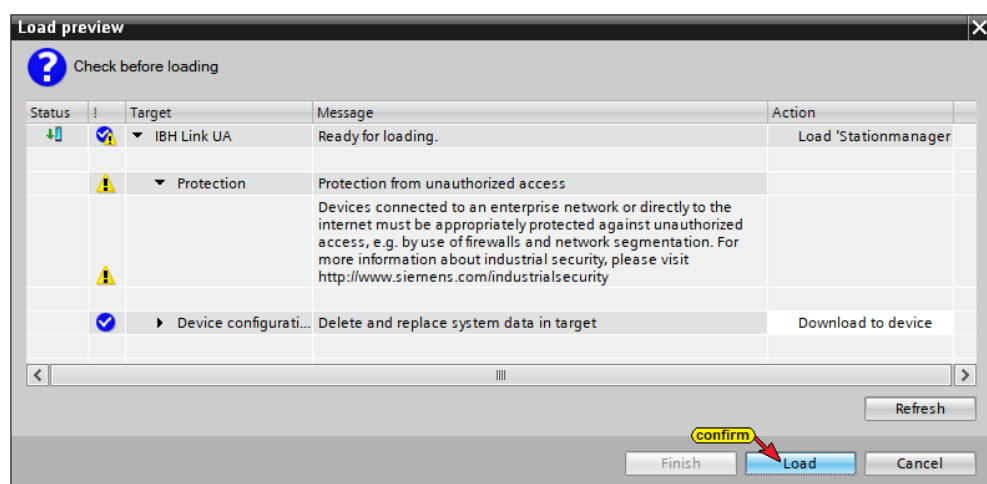
The selection of the interface is displayed.



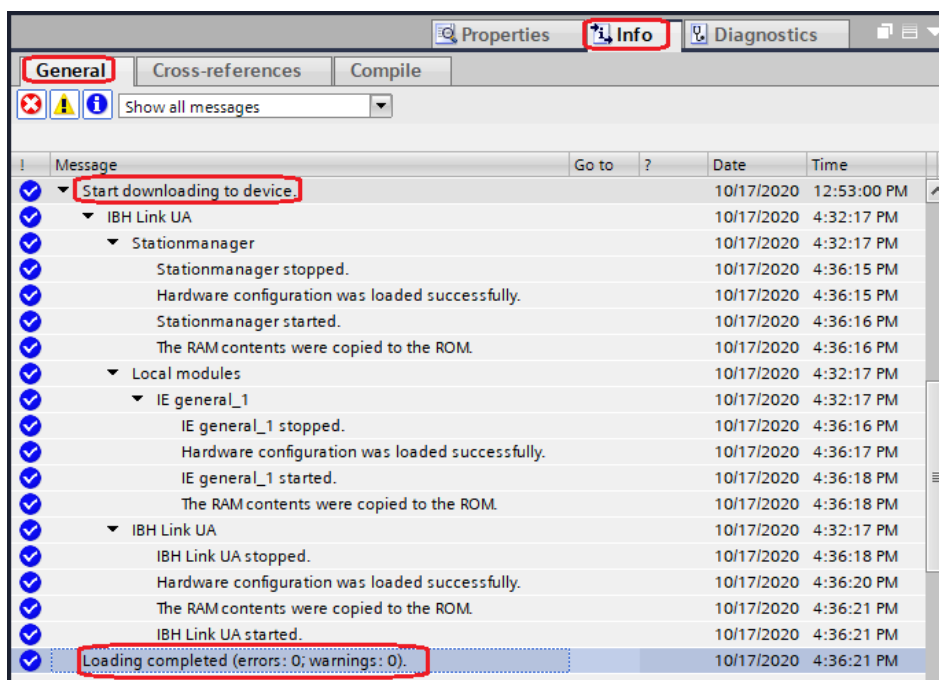
The interface was found



A check is made before loading

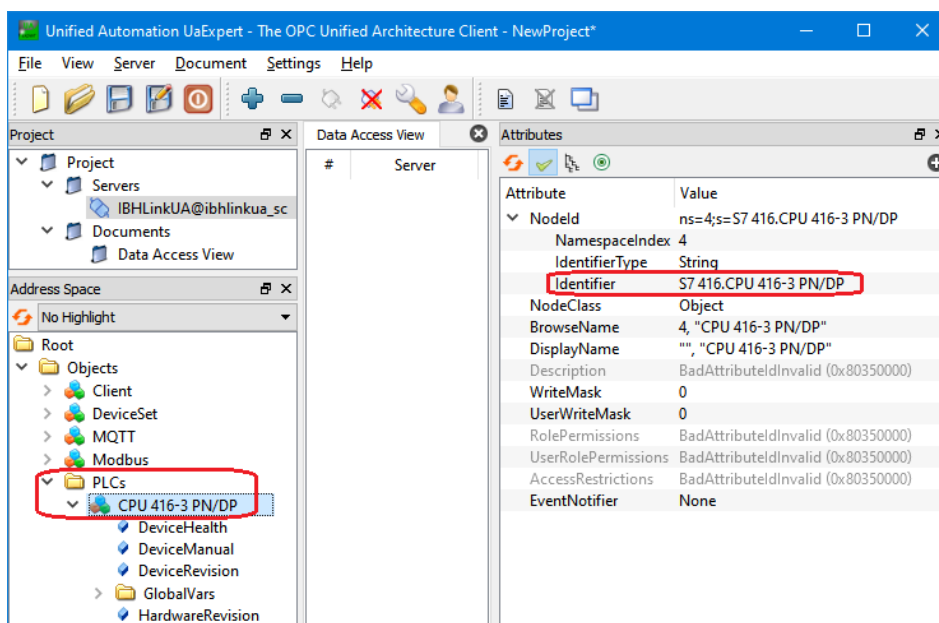


The progress of the loading day is displayed as information.

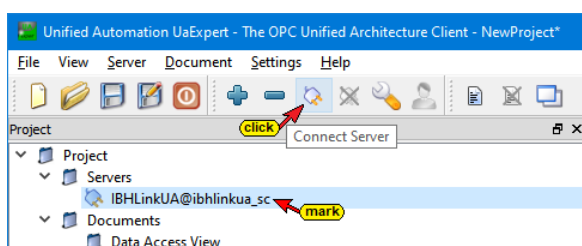


UaExpert – program window

The UaExpert program window displays the PLC CPU 416-3 PN/DP.



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.



UaExpert – program window at the CPU 416-3 PN/DP

The operands defined in the symbol table that were defined as OPC tags are listed under **GlobalVars**. Use **drag and drop** to display the OPC tags in the **Data Access View**.

The screenshot shows the UaExpert interface. On the left, the 'Project' tree shows 'IBHLinkUA@ibhlinkua_sc' and 'Data Access View'. The 'Address Space' tree shows 'CPU 416-3 PN/DP' and 'GlobalVars'. The 'GlobalVars' list includes 'CounterON', 'Down', 'IsCounting', 'Max', 'Min', 'Up', and 'Value'. The 'Data Access View' table lists the same variables with their values and datatypes. A red box highlights the 'CounterON' variable in the 'GlobalVars' list, and a red arrow points to the 'Data Access View' table. A yellow box highlights the 'CounterON' variable in the 'GlobalVars' list.

#	Server	Node Id	Display Name	Value	Datatype	Source Timestamp	Server Timestamp	Statuscode
1	IBHLinkUA...	NS4[String]S7 416.CPU 416-3 PN/DP.GlobalVars.CounterON	CounterON	true	Boolean	17:02:53.071	17:02:53.321	Good
2	IBHLinkUA...	NS4[String]S7 416.CPU 416-3 PN/DP.GlobalVars.Down	Down	false	Boolean	17:04:12.354	17:04:12.604	Good
3	IBHLinkUA...	NS4[String]S7 416.CPU 416-3 PN/DP.GlobalVars.IsCounting	IsCounting	true	Boolean	17:02:53.071	17:02:53.321	Good
4	IBHLinkUA...	NS4[String]S7 416.CPU 416-3 PN/DP.GlobalVars.Max	Max	false	Boolean	17:02:53.321	17:02:53.571	Good
5	IBHLinkUA...	NS4[String]S7 416.CPU 416-3 PN/DP.GlobalVars.Min	Min	false	Boolean	16:59:39.668	16:59:40.502	Good
6	IBHLinkUA...	NS4[String]S7 416.CPU 416-3 PN/DP.GlobalVars.Up	Up	true	Boolean	17:04:12.354	17:04:12.604	Good
7	IBHLinkUA...	NS4[String]S7 416.CPU 416-3 PN/DP.GlobalVars.Value	Value	6262	Int16	17:04:24.609	17:04:24.860	Good

The value of a variable can be changed. In the example, the OPC tag **CounterON** is set to true. The PLC program **CPU 416-3 PN/DP** is processed. Changes are displayed under **Data Access View / Value**.

The screenshot shows the 'Data Access View' table with the 'CounterON' variable highlighted. A red box highlights the 'CounterON' variable in the table, and a red arrow points to the 'Value' column. The table shows the following data:

#	Server	Node Id	Display Name	Value	Datatype
1	IBHLinkUA...	NS4[String]S7 416.CPU 416-3 ...	CounterON	true	Boolean
2	IBHLinkUA...	NS4[String]S7 416.CPU 416-3 ...	Down	false	Boolean
3	IBHLinkUA...	NS4[String]S7 416.CPU 416-3 ...	IsCounting	true	Boolean

1.1.6 Data blocks in the IBH Link OPC UA server.

Additional global data block.

The screenshot shows the 'CounterData' data block in the TIA 16e software. A red box highlights the 'CounterData' data block, and a red arrow points to the 'Counting ON' variable. The table shows the following data:

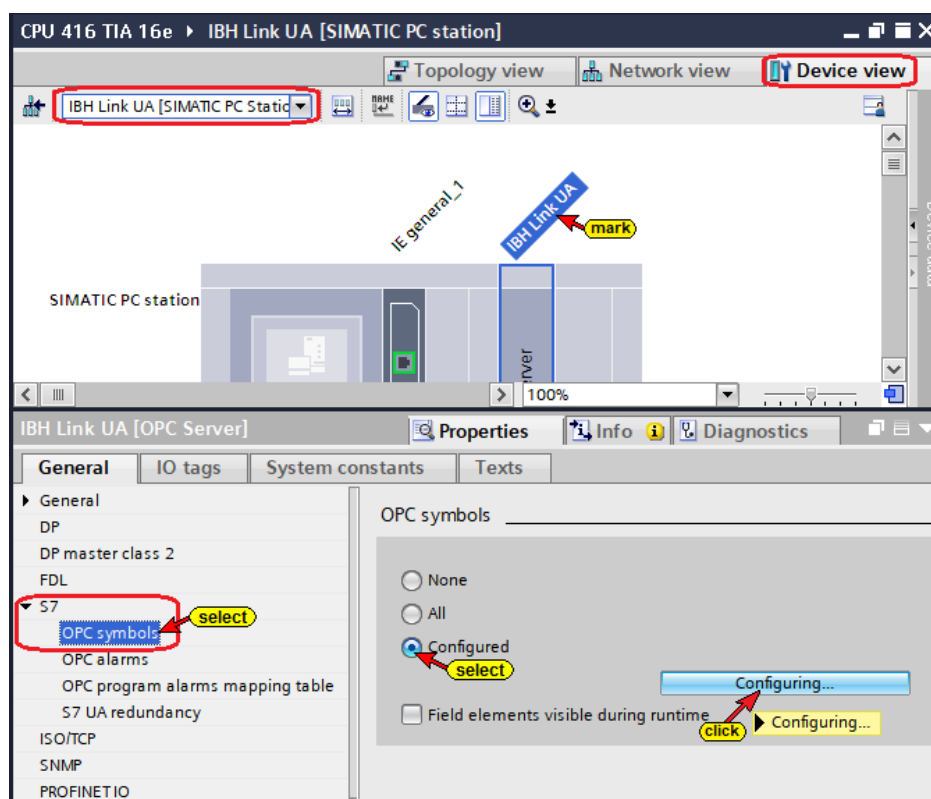
Name	Data type	Offset	Start value	Monitor value	Comment
Static					
Counting ON	Bool	0.0	false		On / Off switch 1
Dummy	Int	2.0	0		Dummy
CounterValue	Int	4.0	0		Counter value
Structure	Struct	6.0			complex variable - STRUCT -

The global data block **CounterData [DB 2]** is available in the **CPU 416-3 PN/DP** PLC program. The data should be transferred to the OPC server.

Reselect OPC tags

In the previous steps, the global variables of the Tank Level program were selected as OPC tags. Now the data at the tank level values block should be released as OPC tags (visible, readable, and writable).

Open the configuration for the **OPC server / properties**.

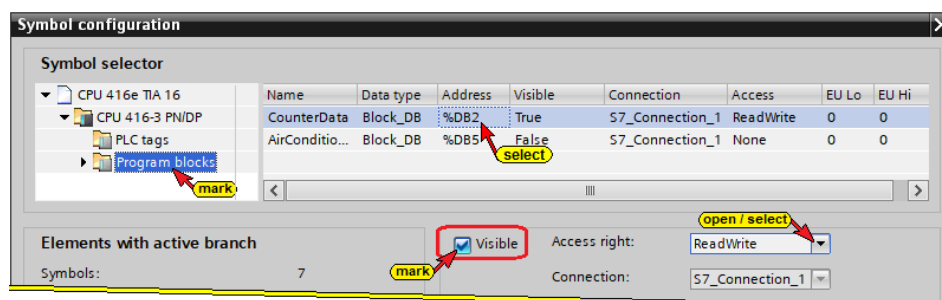


The **Configure** button opens the Symbol configuration dialog box.

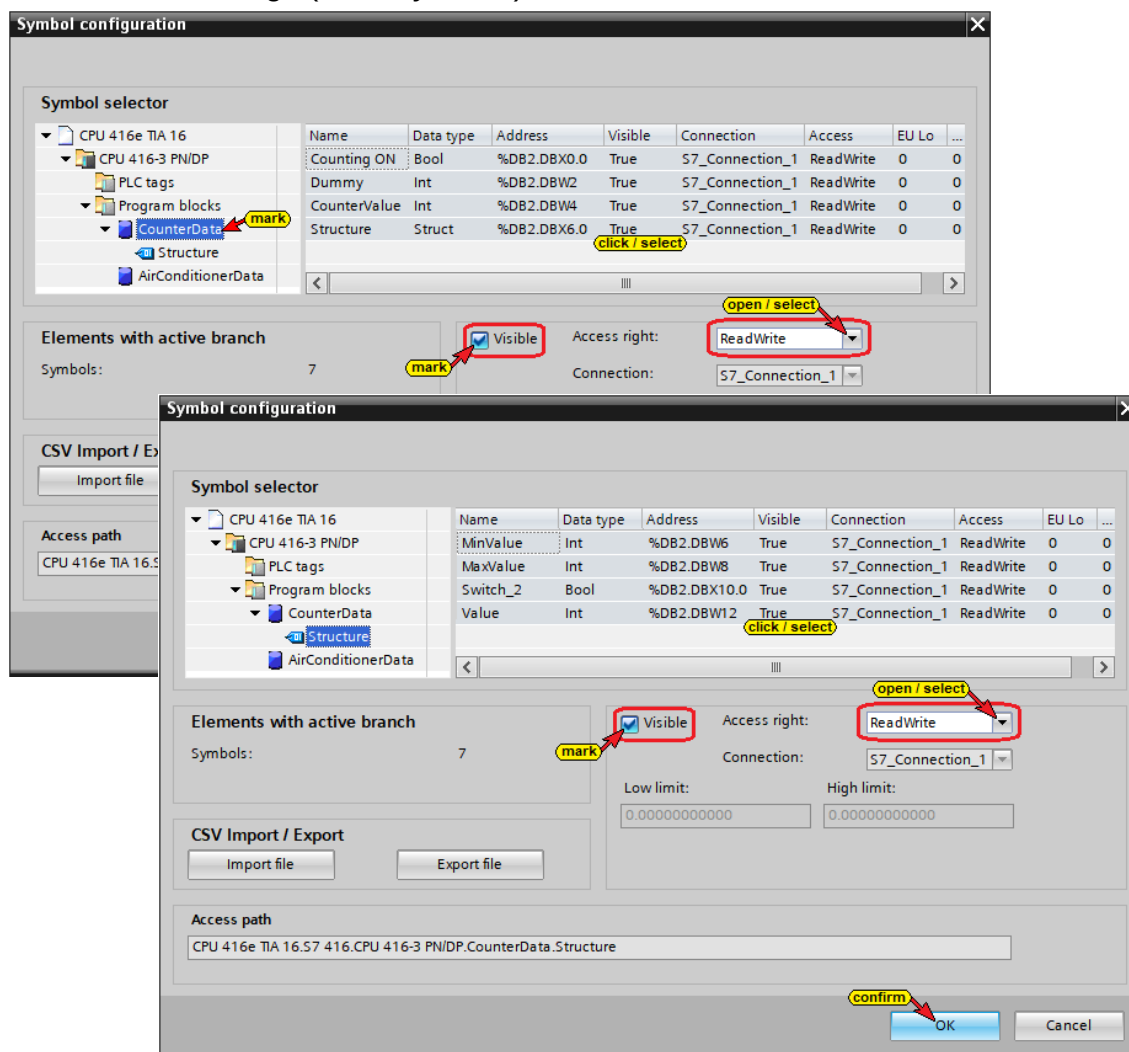
Data block Counter Data [DB 2]

The access rights of the PLC tags (global OPC tags) should not be changed in this example.

Set the access rights of the data block **Counter Data [DB2]** to visible, readable, and writable (RW).

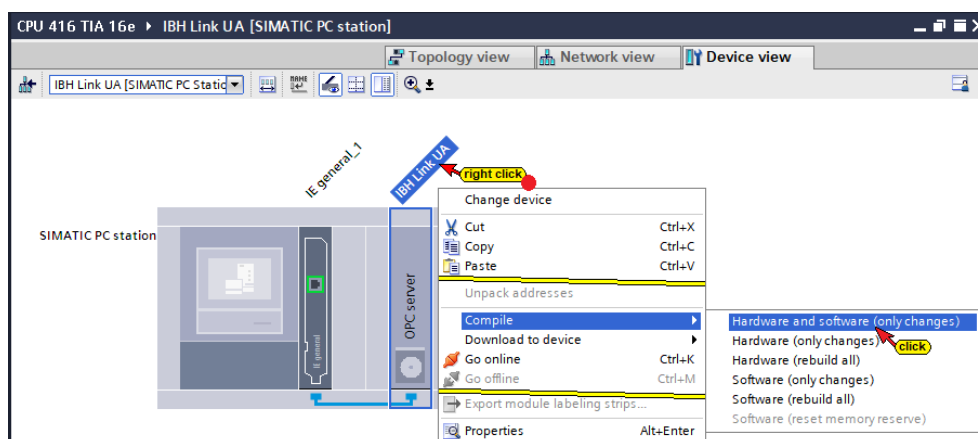


Select the data of the data block **Counter Data [DB2]** as OPC tags (OPC symbols). The data of the structure should also be selected as OPC tags (OPC symbols).



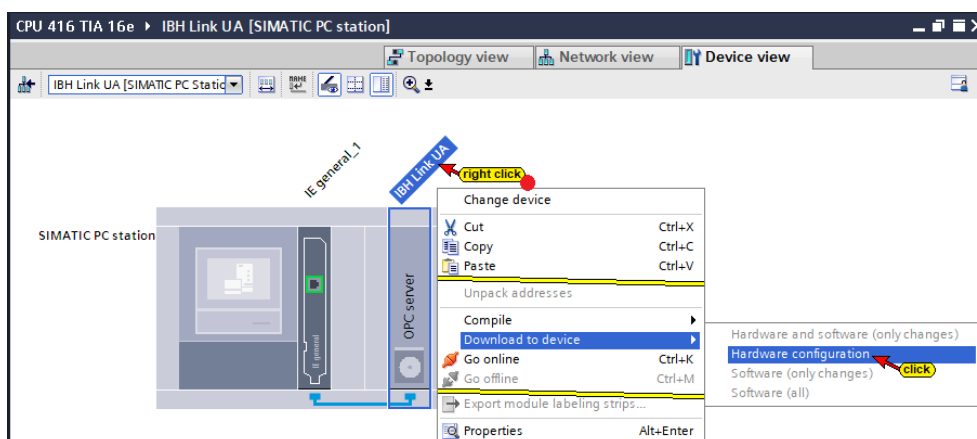
The data of the data block **AirConditioningData [DB22]** were not accepted as OPC tags.

Compile the configuration of the OPC server

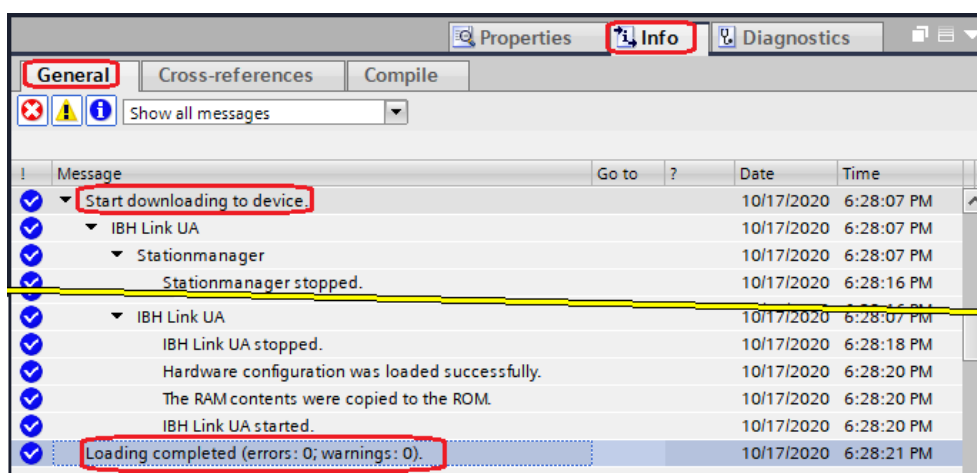


If no error is displayed when the hardware is compiled, the next step is to load the hardware into the IBH Link UA OPC server.

Load configuration of the OPC server into IBH Link UA

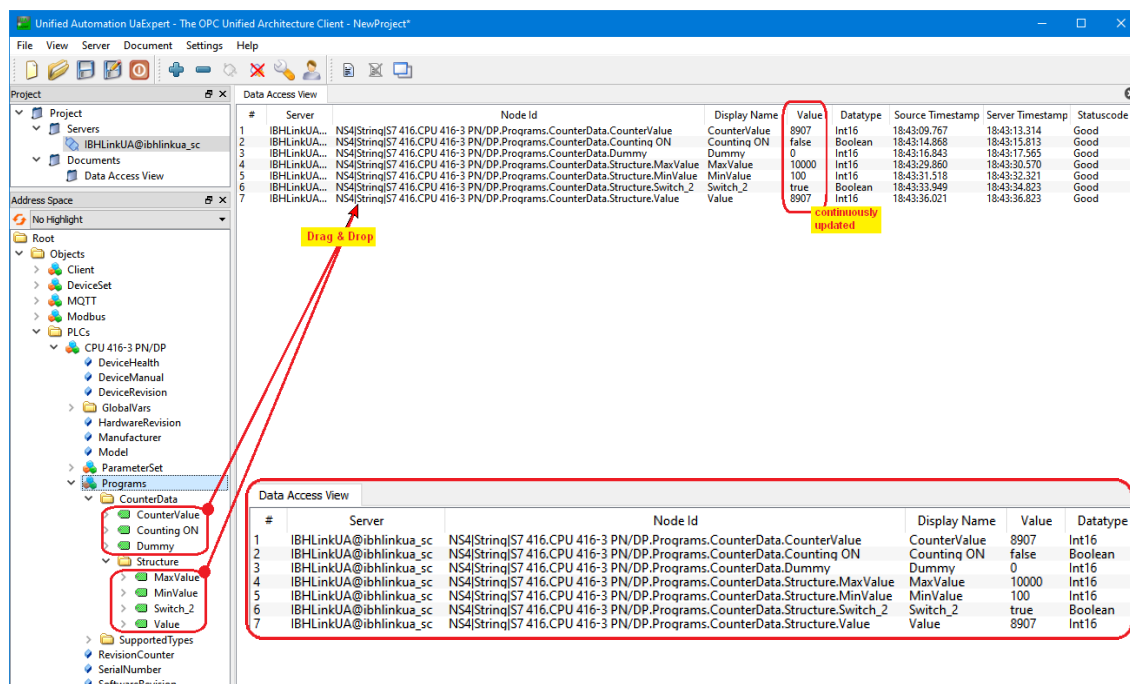


The progress of the loading day is displayed as information.



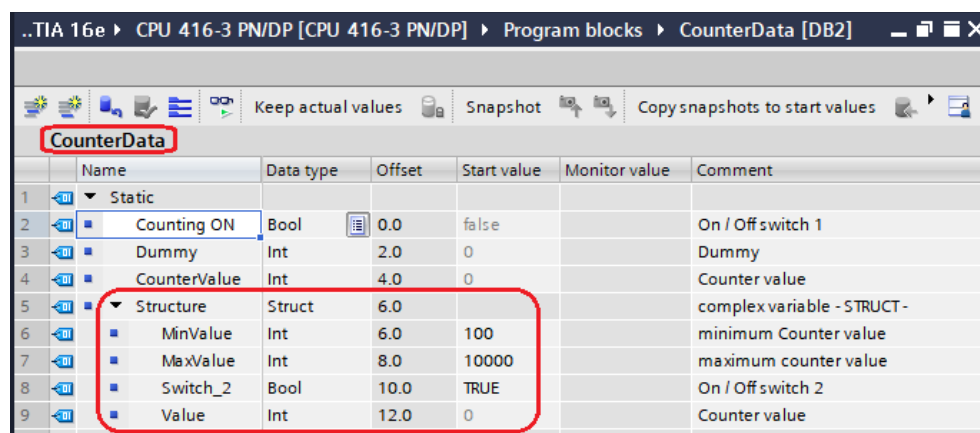
UaExpert - program window

The data block **Counter Data [DB2]** is listed in the *UaExpert* program window.



1.1.7 Complex variable - STRUCT -

A structure (STRUCT) with four values is available in the data block **Counter Data [DB2]**.

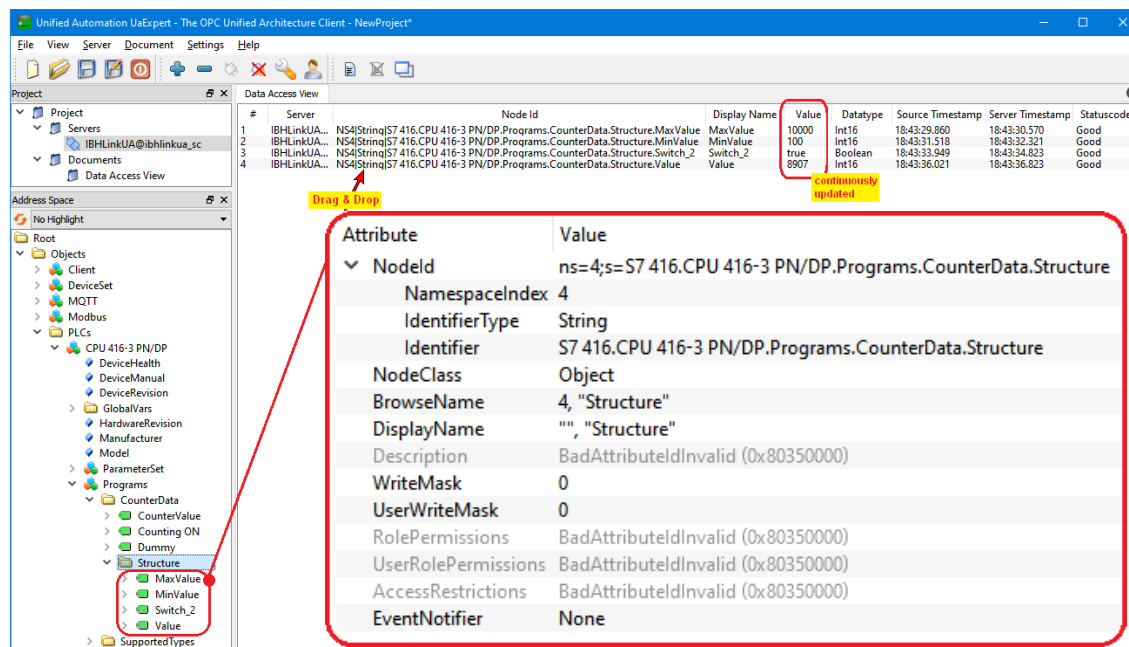


	Name	Data type	Offset	Start value	Monitor value	Comment
1	Static					
2	Counting ON	Bool	0.0	false		On / Off switch 1
3	Dummy	Int	2.0	0		Dummy
4	CounterValue	Int	4.0	0		Counter value
5	Structure	Struct	6.0			complex variable - STRUCT -
6	MinValue	Int	6.0	100		minimum Counter value
7	MaxValue	Int	8.0	10000		maximum counter value
8	Switch_2	Bool	10.0	TRUE		On / Off switch 2
9	Value	Int	12.0	0		Counter value

UaExpert - program window

Display in the UaExpert window before activating the structure variables

In the **UaExpert** - Program window Address Space, the structure with the variables **MinValue**, **MaxValue**, **Switch_2**, and **Value** are listed under Programs. No further information is displayed under Structure. The structure values can be displayed.



#	Server	Node Id	Display Name	Value	Datatype	Source Timestamp	Server Timestamp	Statuscode
1	IBHLinkUA...	NS4(String)S7 416.CPU 416-3 PN/DP.Programs.CounterData.Structure.MaxValue	MaxValue	10000	Int16	18:43:29.860	18:43:30.570	Good
2	IBHLinkUA...	NS4(String)S7 416.CPU 416-3 PN/DP.Programs.CounterData.Structure.MinValue	MinValue	100	Int16	18:43:31.518	18:43:32.321	Good
3	IBHLinkUA...	NS4(String)S7 416.CPU 416-3 PN/DP.Programs.CounterData.Structure.Switch_2	Switch_2	true	Boolean	18:43:33.949	18:43:34.823	Good
4	IBHLinkUA...	NS4(String)S7 416.CPU 416-3 PN/DP.Programs.CounterData.Structure.Value	Value	8907	Int16	18:43:36.021	18:43:36.823	Good

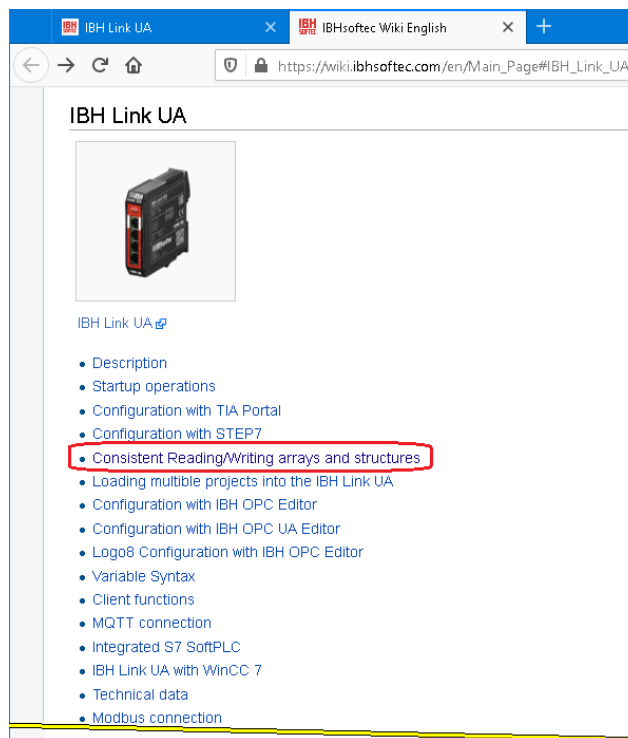
Attribute	Value
NodeId	ns=4;s=S7 416.CPU 416-3 PN/DP.Programs.CounterData.Structure
NamespaceIndex	4
IdentifierType	String
Identifier	S7 416.CPU 416-3 PN/DP.Programs.CounterData.Structure
NodeClass	Object
BrowseName	4, "Structure"
DisplayName	"" , "Structure"
Description	BadAttributeInvalid (0x80350000)
WriteMask	0
UserWriteMask	0
RolePermissions	BadAttributeInvalid (0x80350000)
UserRolePermissions	BadAttributeInvalid (0x80350000)
AccessRestrictions	BadAttributeInvalid (0x80350000)
EventNotifier	None

The identifier and the identifier type result in a unique name who avoids a name conflict.

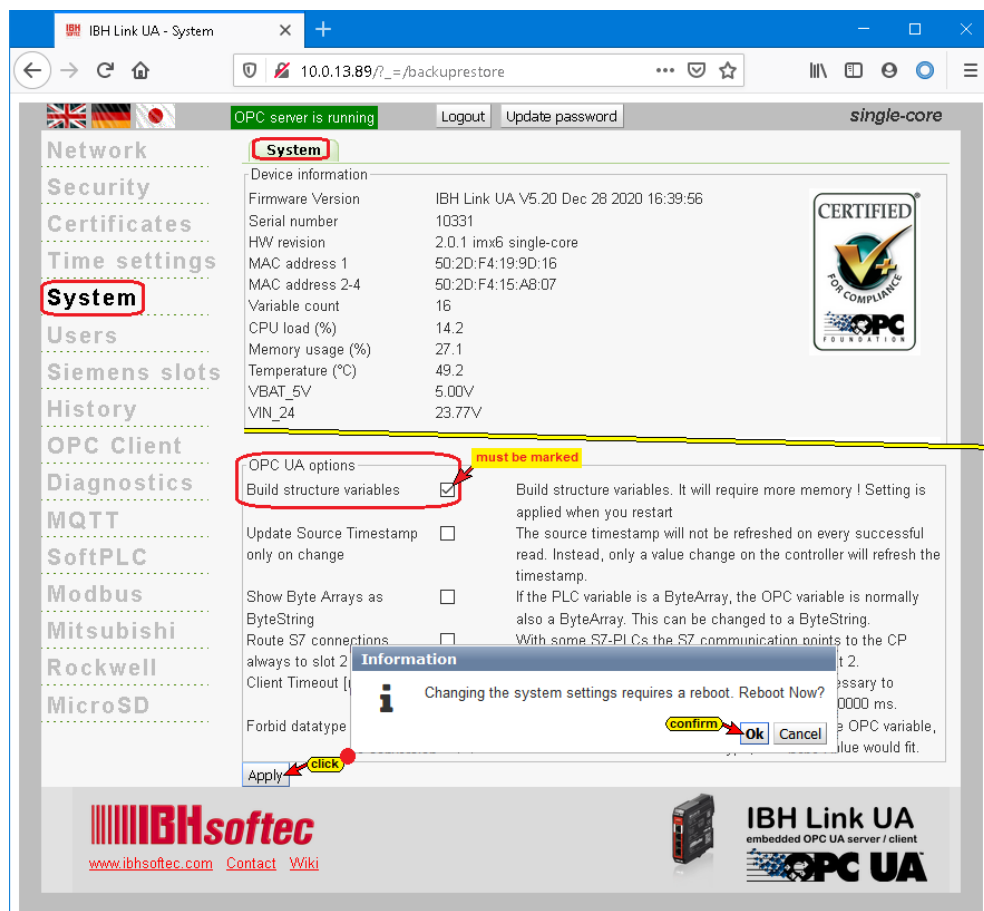
1.1.8 Use structure variables

The OPC UA option **Build structure variables** can be activated in the IBH Link UA **System** browser window.

The structure variables are described in detail in the **IBHsoftec WIKI** under the heading **Consistent reading / writing of arrays and structures**.



1.1.9 Browser window system – Build structure variables.



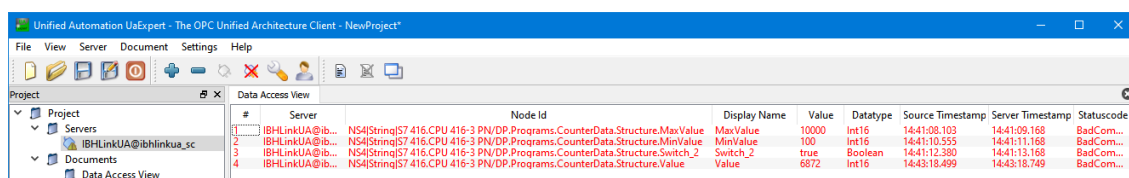
Build structure variable

The function is activated by marking the option **Build structure variables** and then clicking the **Apply** button, which must be confirmed. With the S7-300 / S7-400, 64-byte structures are consistently possible. Structure tags are created that require more memory.

UaExpert - program window – Build structure variables

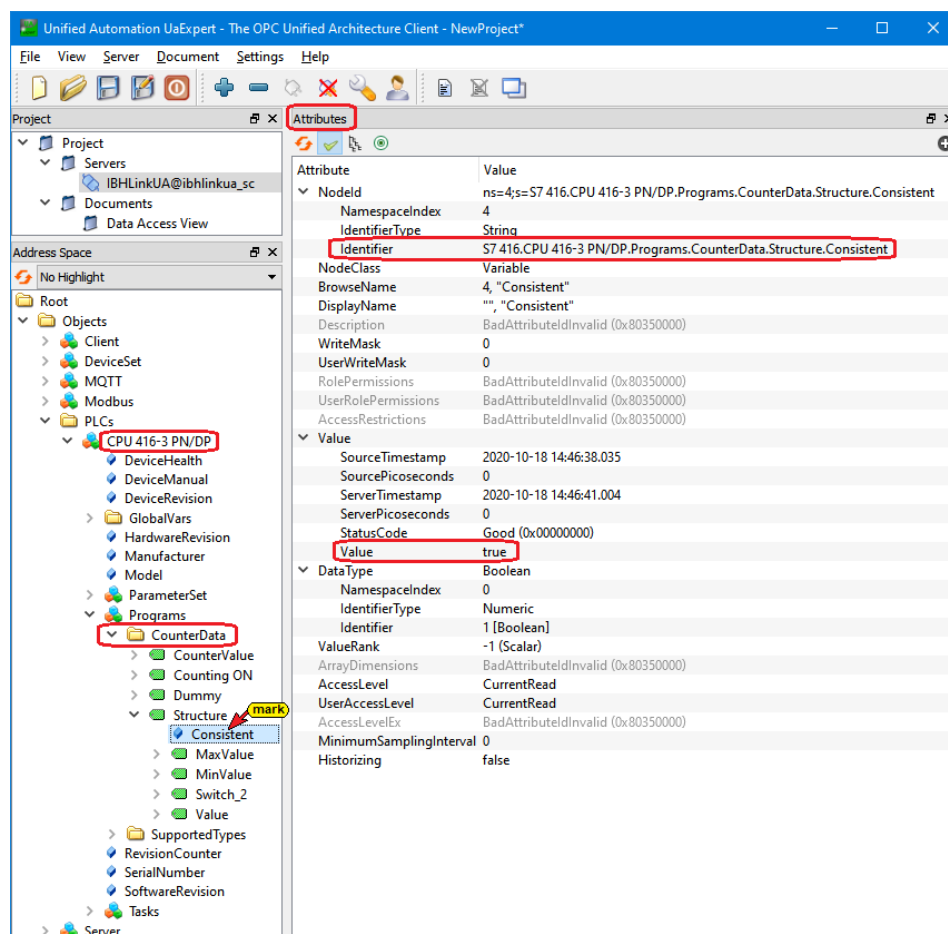
If the option **Build structure variables** is activated, the OPC server is restarted. While the OPC server is not running, the variables of the structure in the UaExpert window, Data Access View are displayed in red (the connection to the OPC server is interrupted).

UaExpert window connection interrupted.



#	Server	Node Id	Display Name	Value	Datatype	Source Timestamp	Server Timestamp	Statuscode
1	IBHLinkUA@ib...	NS4StringS7 416.CPU 416-3 PN/DP.Programs.CounterData.Structure.MaxValue	MaxValue	10000	Int16	14:41:08.103	14:41:09.168	BadCom...
2	IBHLinkUA@ib...	NS4StringS7 416.CPU 416-3 PN/DP.Programs.CounterData.Structure.MinValue	MinValue	100	Int16	14:41:10.555	14:41:11.168	BadCom...
3	IBHLinkUA@ib...	NS4StringS7 416.CPU 416-3 PN/DP.Programs.CounterData.Structure.Switch_2	Switch_2	true	Boolean	14:41:12.380	14:41:13.168	BadCom...
4	IBHLinkUA@ib...	NS4StringS7 416.CPU 416-3 PN/DP.Programs.CounterData.Structure.Value	Value	6872	Int16	14:43:18.499	14:43:18.749	BadCom...

After restarting the OPC server and restarting the connection of the UaExpert to the IBH Link UA, the system variable **Consistent** is displayed.



The screenshot shows the UaExpert interface with the 'Attributes' window open for the variable 'Consistent'. The variable is located under 'CPU 416-3 PN/DP' > 'CounterData' > 'Structure' > 'Consistent'. The 'Consistent' variable is highlighted with a yellow 'mark' icon. The 'Attributes' window displays the following details:

- Attribute:** NodeId, NamespaceIndex, IdentifierType, Identifier, NodeClass, BrowseName, DisplayName, Description, WriteMask, UserWriteMask, RolePermissions, UserRolePermissions, AccessRestrictions, Value, DataType, NameSpaceIndex, IdentifierType, Identifier, ValueRank, ArrayDimensions, AccessLevel, UserAccessLevel, AccessLevelEx, MinimumSamplingInterval, Historizing.
- Value:** ns=4;s=S7 416.CPU 416-3 PN/DP.Programs.CounterData.Structure.Consistent
- Identifier:** S7 416.CPU 416-3 PN/DP.Programs.CounterData.Structure.Consistent
- NodeClass:** Variable
- BrowseName:** 4, "Consistent"
- DisplayName:** "", "Consistent"
- Description:** BadAttributeInvalid (0x80350000)
- WriteMask:** 0
- UserWriteMask:** 0
- RolePermissions:** BadAttributeInvalid (0x80350000)
- UserRolePermissions:** BadAttributeInvalid (0x80350000)
- AccessRestrictions:** BadAttributeInvalid (0x80350000)
- Value:** SourceTimestamp: 2020-10-18 14:46:38.035, SourcePicoSeconds: 0, ServerTimestamp: 2020-10-18 14:46:41.004, ServerPicoSeconds: 0, StatusCode: Good (0x00000000), Value: true
- DataType:** Boolean
- NameSpaceIndex:** 0
- IdentifierType:** Numeric
- Identifier:** 1 [Boolean]
- ValueRank:** -1 (Scalar)
- ArrayDimensions:** BadAttributeInvalid (0x80350000)
- AccessLevel:** CurrentRead
- UserAccessLevel:** CurrentRead
- AccessLevelEx:** BadAttributeInvalid (0x80350000)
- MinimumSamplingInterval:** 0
- Historizing:** false

If this variable is **true**, consistent data can be **read** from the CPU and sent to the CPU (**write**). To do this, click **Consistent**.

Display or change structure variable

To do this, drag and drop the **structure** of the **Data Access View** field.

The screenshot shows the Unified Automation UaExpert interface. On the left, the 'Address Space' tree shows the 'Structure' variable under 'CounterData'. A red arrow labeled 'Drag & Drop' points from the 'Structure' variable to the 'Data Access View' table. The 'Data Access View' table lists variables: MaxValue (10000), MinValue (100), Switch_2 (true), and Value (6704). A red box highlights the 'Structure' variable. A red arrow labeled 'double-click' points to the 'Structure' variable in the table. The 'Edit Value' dialog box is open, showing the 'Structure' variable with its sub-variables: MinValue (100), MaxValue (12000), Switch_2 (true), and Value (1907). A red box highlights the 'MaxValue' field, and a red arrow labeled 'double click value for modification' points to it. A red arrow labeled 'confirm' points to the 'Write' button.

#	Server	Node Id	Display Name	Value	Datatype	Source Timestamp	Server Timestamp	Statuscode
1	IBHLinkUA@ib...	NS4 String S7 416...	MaxValue	10000	Int16	14:57:46.683	14:57:47.447	Good
2	IBHLinkUA@ib...	NS4 String S7 416...	MinValue	100	Int16	14:57:48.889	14:57:49.698	Good
3	IBHLinkUA@ib...	NS4 String S7 416...	Switch_2	true	Boolean	14:57:50.859	14:57:51.701	Good
4	IBHLinkUA@ib...	NS4 String S7 416...	Value	6704	Int16	15:02:11.381	15:02:11.631	Good
5	IBHLinkUA@ib...	NS4 String S7 416...	Structure	Double click to display value	Extension...			

Name	Value
MinValue	100
MaxValue	12000
Switch_2	true
Value	1907

Node Id	Display Name	Value	Datatype
NS4 String S7 416.CPU 416-3 PN/DP.Programs.CounterData.Structure.MaxValue	MaxValue	12000	Int16
NS4 String S7 416.CPU 416-3 PN/DP.Programs.CounterData.Structure.MinValue	MinValue	100	Int16
NS4 String S7 416.CPU 416-3 PN/DP.Programs.CounterData.Structure.Switch_2	Switch_2	true	Boolean
NS4 String S7 416.CPU 416-3 PN/DP.Programs.CounterData.Structure.Value	Value	9036	Int16
NS4 String S7 416.CPU 416-3 PN/DP.Programs.CounterData.Structure	Structure	(Double click to display value)	ExtensionObject

With a double-click on the text **Double click to display value**, in the line structure, a dialog box is opened in which the variables of the structure can be displayed and changed.

Display structure variable online

The changed variables can then be observed in data block **Counter Data [DB2]** of the CPU-416.

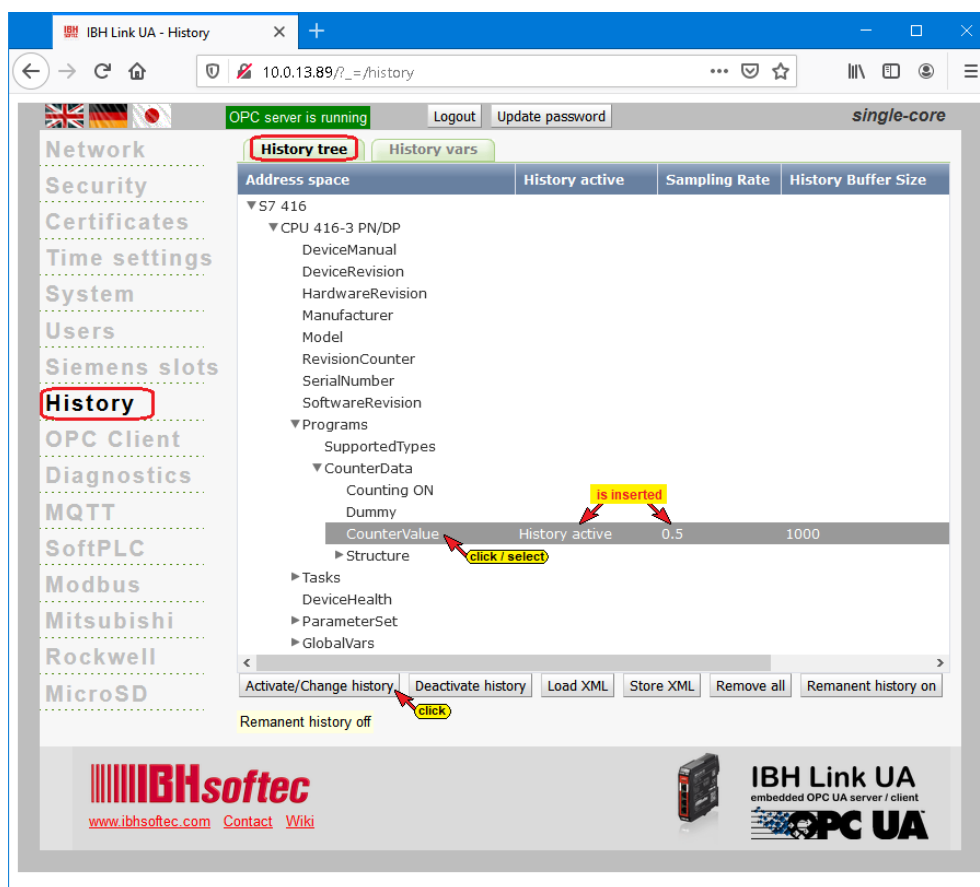
CPU 416 TIA 16e ▶ CPU 416-3 PN/DP [CPU 416-3 PN/DP] ▶ Program blocks ▶ CounterData [DB2]						
Keep actual values Snapshot Copy snapshots to start values						
CounterData						
	Name	Data type	Offset	Start value	Monitor value	Comment
1	Static					
2	Counting ON	Bool	0.0	false	TRUE	On / Off switch 1
3	Dummy	Int	2.0	0	0	Dummy
4	CounterValue	Int	4.0	0	7104	Counter value
5	Structure	Struct	6.0			complex variable - STRUCT -
6	MinValue	Int	6.0	100	100	minimum Counter value
7	MaxValue	Int	8.0	10000	12000	maximum counter value
8	Switch_2	Bool	10.0	TRUE	TRUE	On / Off switch 2
9	Value	Int	12.0	0	7104	Counter value

1.2 Historical data - IBH Link UA

While **OPC Data Access** enables access to data in real time, **OPC Historical Data Access**, also known as OPC HDA, supports access to data that has already been saved.

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

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



In the opened history parameter input field, the required values must be entered and confirmed.

History parameter

Enter the sampling rate [seconds]:

specify value

Enter the history buffer size [number of values]:

specify value

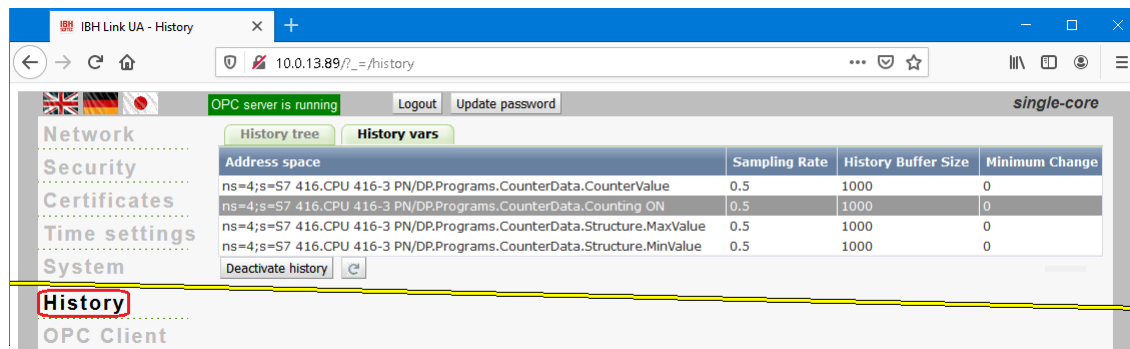
Store on minimum change:

specify value

confirm

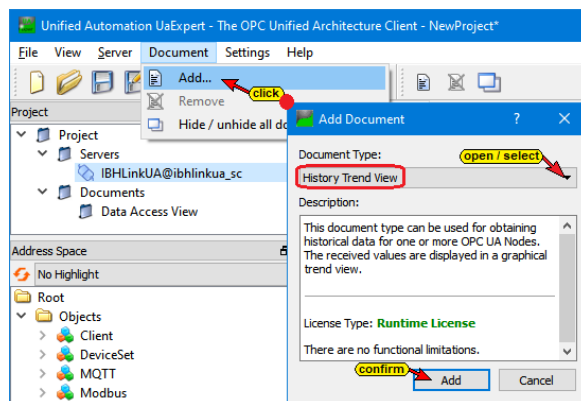
History variables

In the History / Variables window, all selected variables are displayed with their parameters.

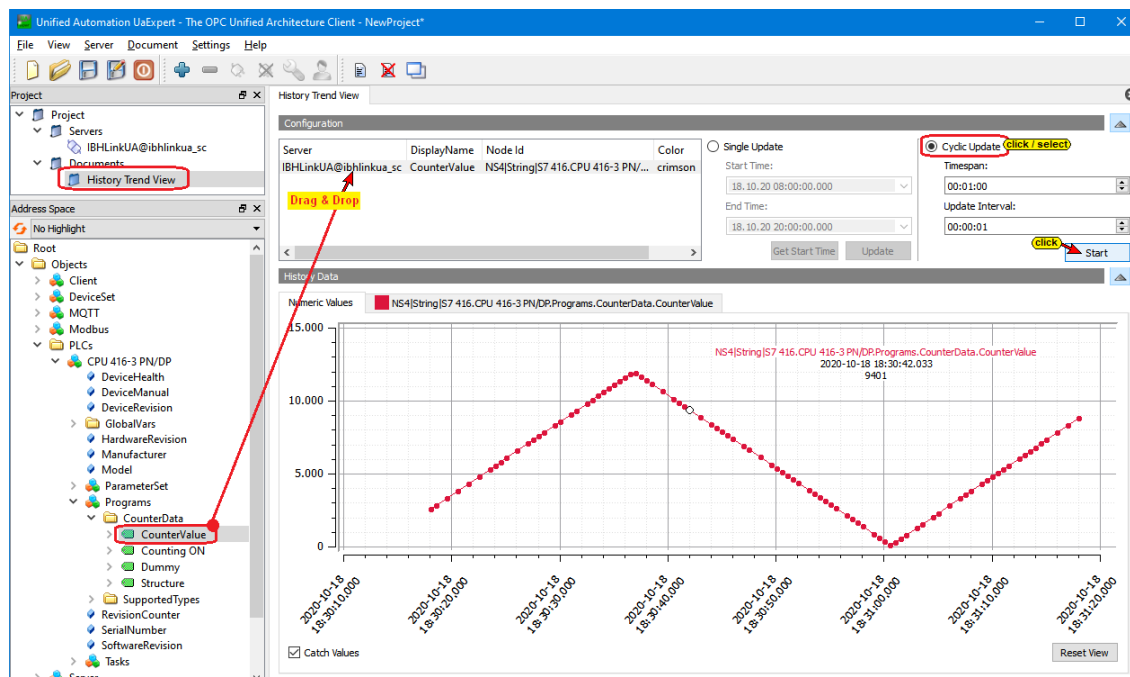


1.2.1 UaExpert - program window

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

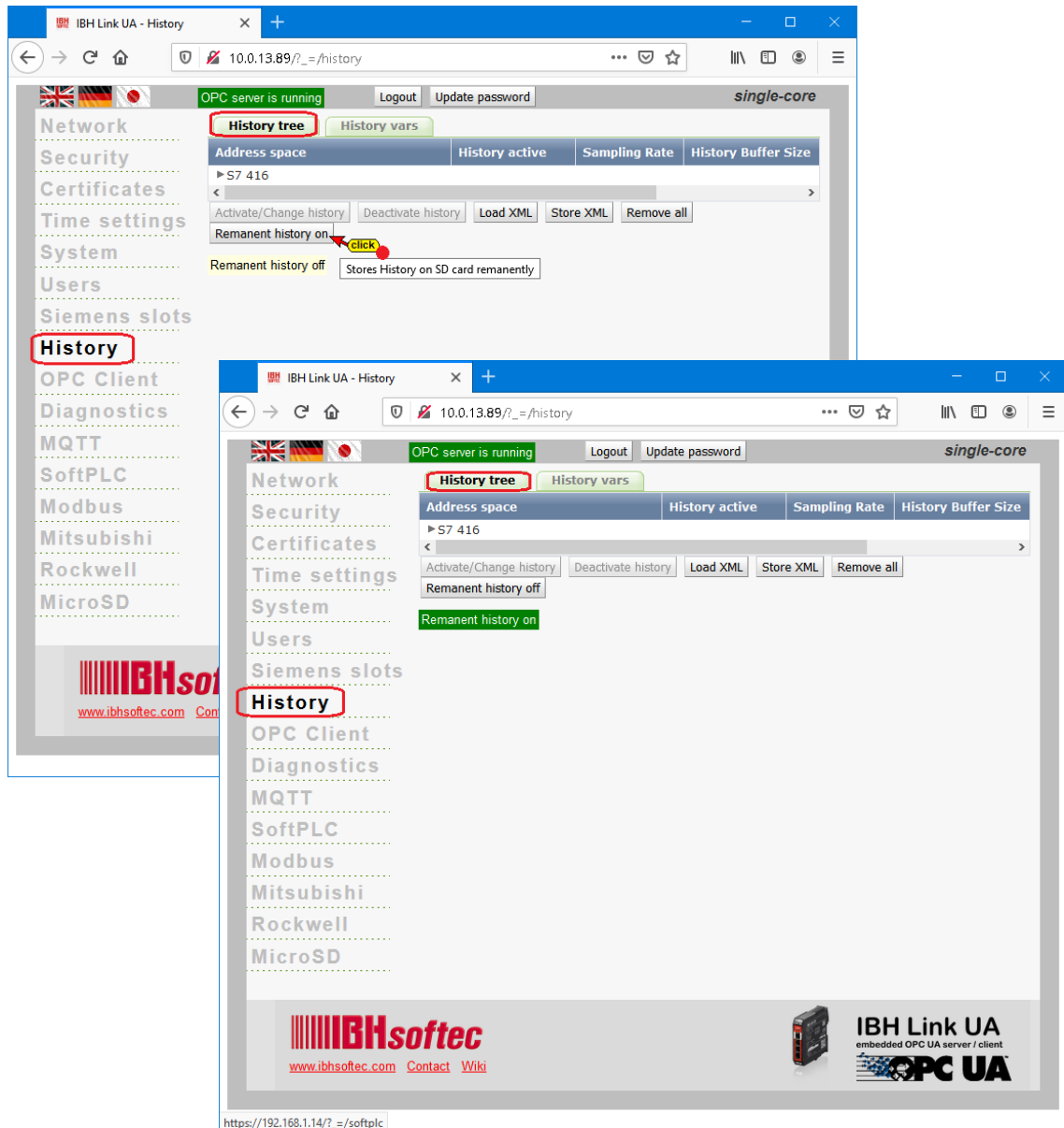


The historical data of values



Note:

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

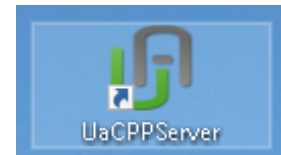


2 IBH Link UA - OPC UA client function

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 server. The **IBH Link UA** from IBHsoftec is a **server / client module**.

The OPC client function enables data to be exchanged between OPC servers.

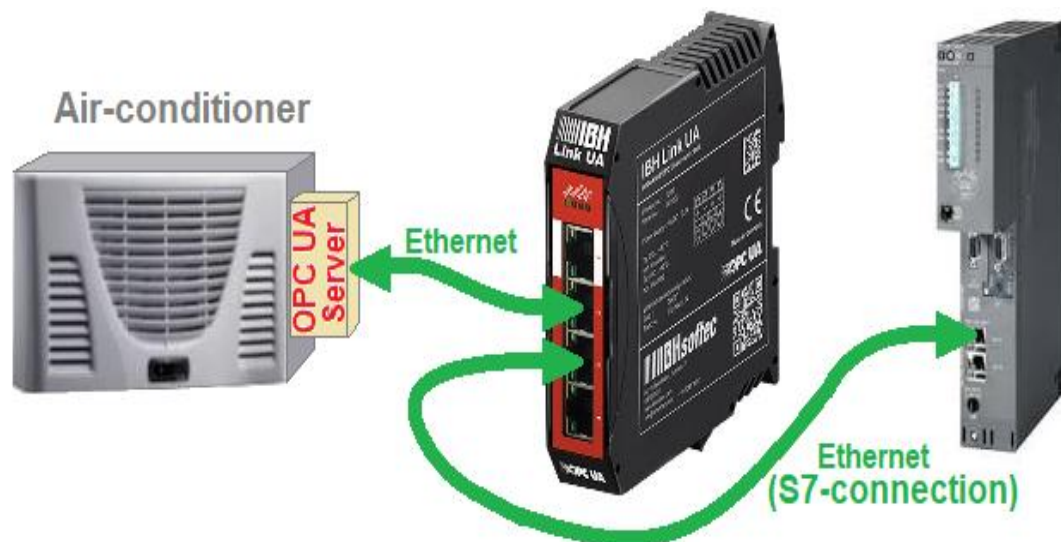
The **OPC Unified Architecture Demo Server** must be available one on the PC (see IBH Link UA Manual Part 1, chapter 2.4).



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

Device configuration example S7 project CPU 416e TIA 16.

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



2.1 Example project with TIA Portal

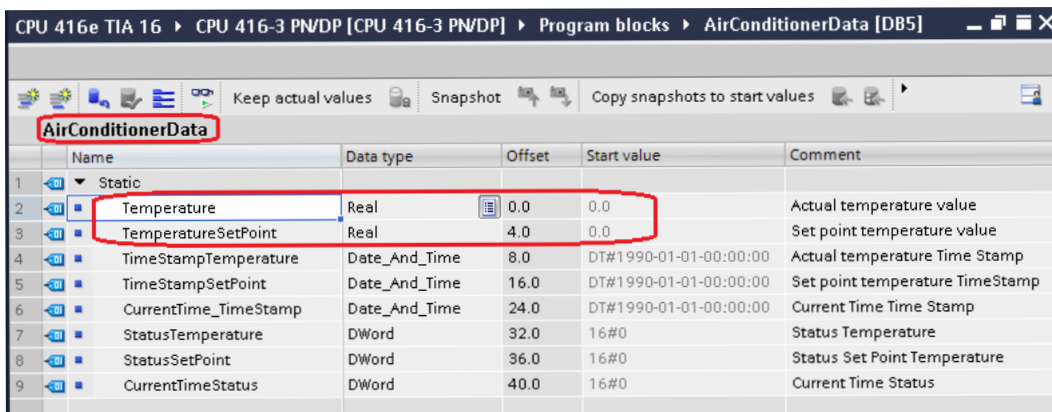
An air-conditioning system transfers its data to the data block **AirConditionerData [DB 2]** from the **CPU 416e TIA** project (Chapter 1).

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.



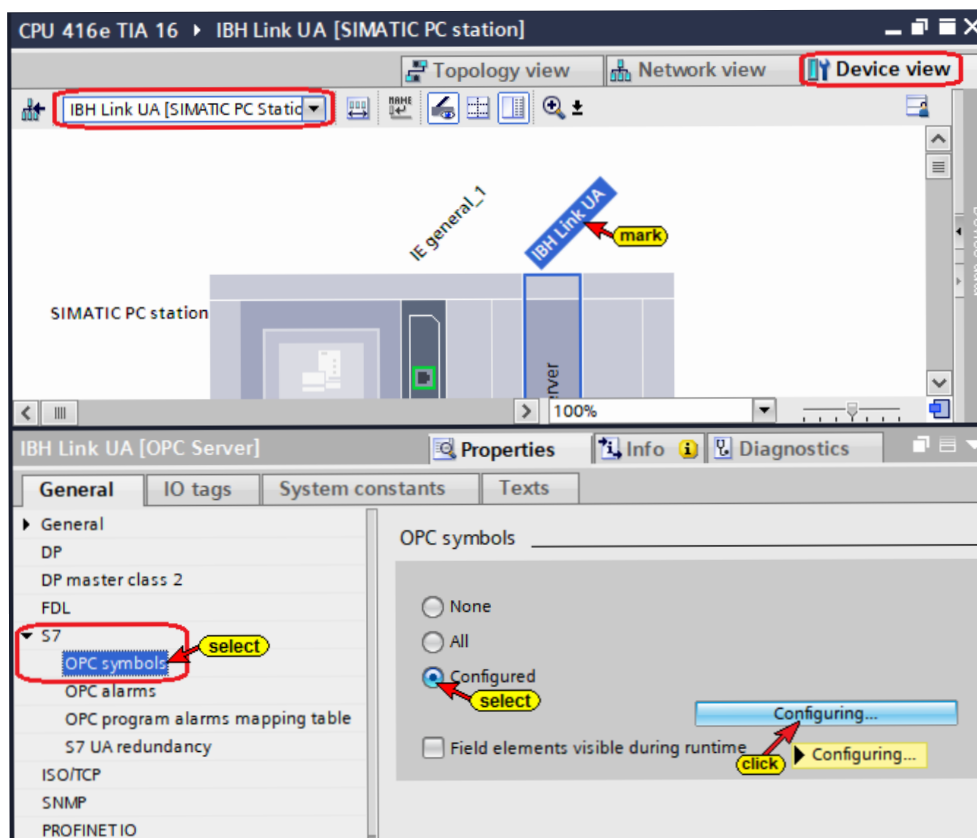
Data block *AirConditionerData* [DB 2]



	Name	Data type	Offset	Start value	Comment
1	Static				
2	Temperature	Real	0.0	0.0	Actual temperature value
3	TemperatureSetPoint	Real	4.0	0.0	Set point temperature value
4	TimeStampTemperature	Date_And_Time	8.0	DT#1990-01-01-00:00:00	Actual temperature Time Stamp
5	TimeStampSetPoint	Date_And_Time	16.0	DT#1990-01-01-00:00:00	Set point temperature TimeStamp
6	CurrentTime_TimeStamp	Date_And_Time	24.0	DT#1990-01-01-00:00:00	Current Time Time Stamp
7	StatusTemperature	DWord	32.0	16#0	Status Temperature
8	StatusSetPoint	DWord	36.0	16#0	Status Set Point Temperature
9	CurrentTimeStatus	DWord	40.0	16#0	Current Time Status

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

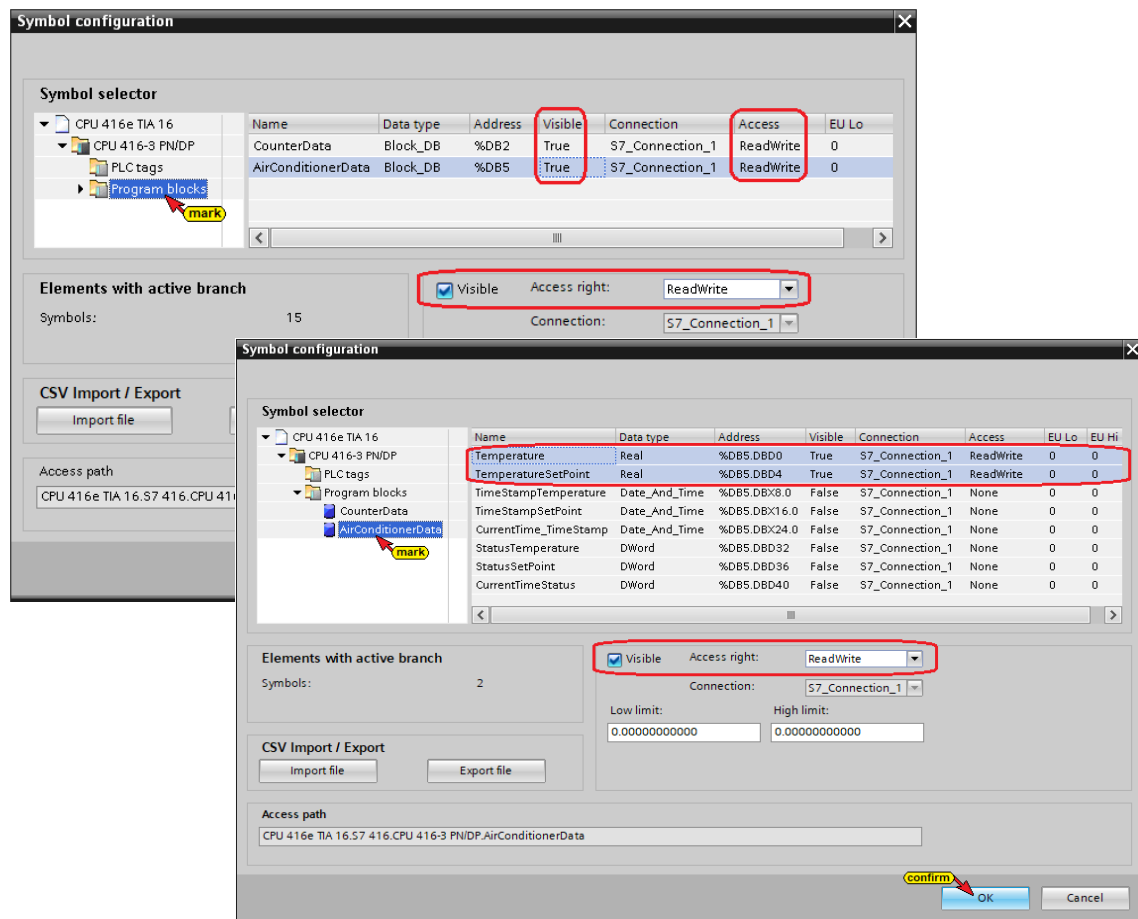
Open the configuration for the **OPC server / properties**.



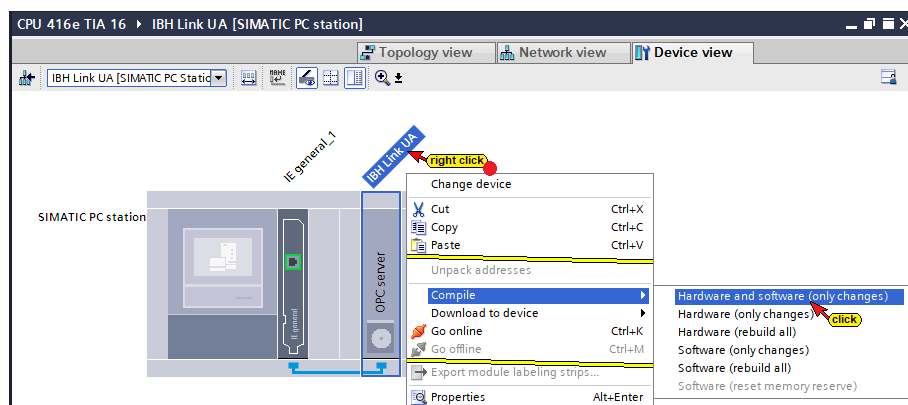
The **Configure** button opens the Symbol Configuration dialog box. Here data from the data block ***AirConditionerData* [DB 5]** are selected as OPC tags.

Configurable data from data block *AirConditionerData* [DB 2]

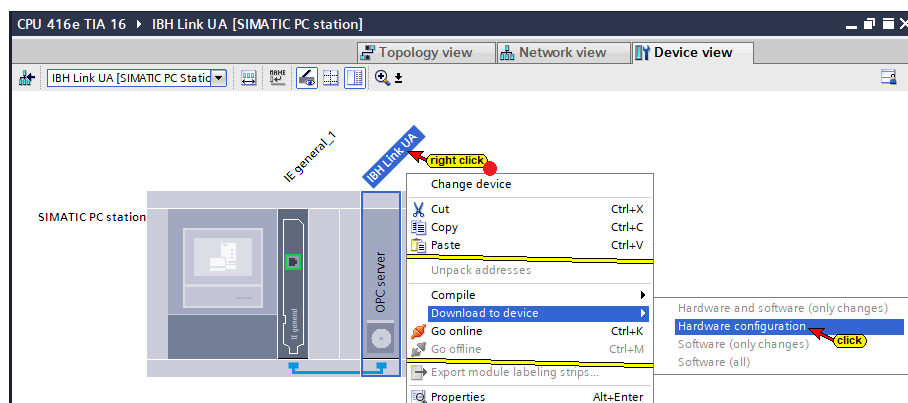
Select data of the data block ***AirConditionerData* [DB 2]** in addition to data block ***CounterData* [DB5]** as OPC tags (OPC symbols). The **read / write** access rights can be assigned to the individual operands (OPC tags).



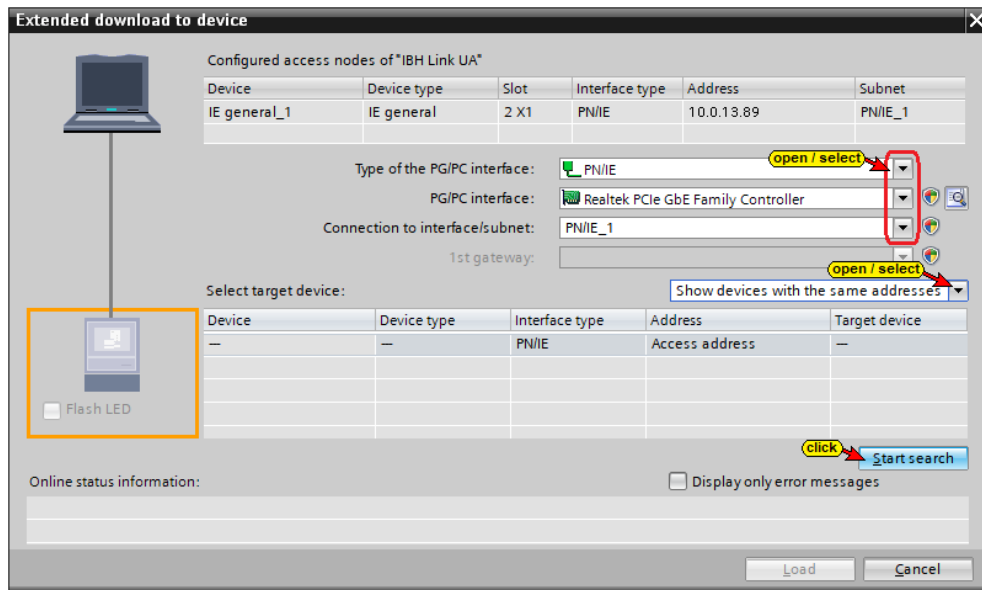
Compile the configuration of the OPC server



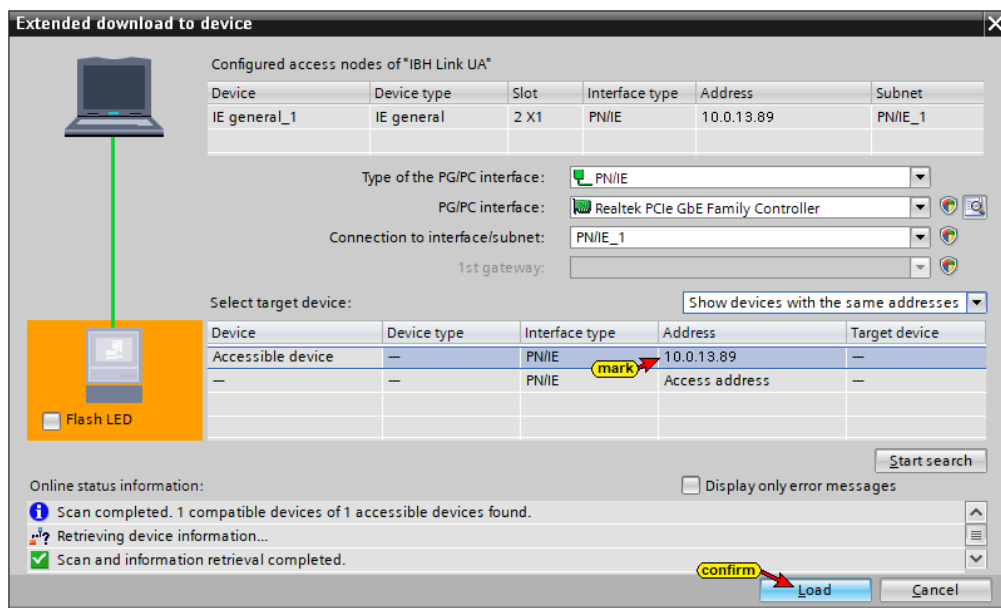
If no error is displayed when the hardware is compiled, the next step is to load the hardware into the IBH Link UA OPC server.



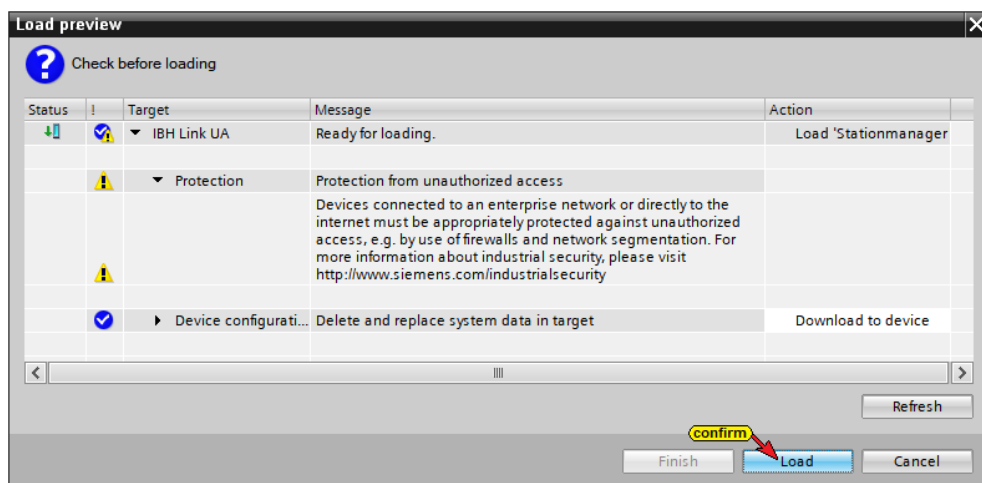
The selection of the interface is displayed.



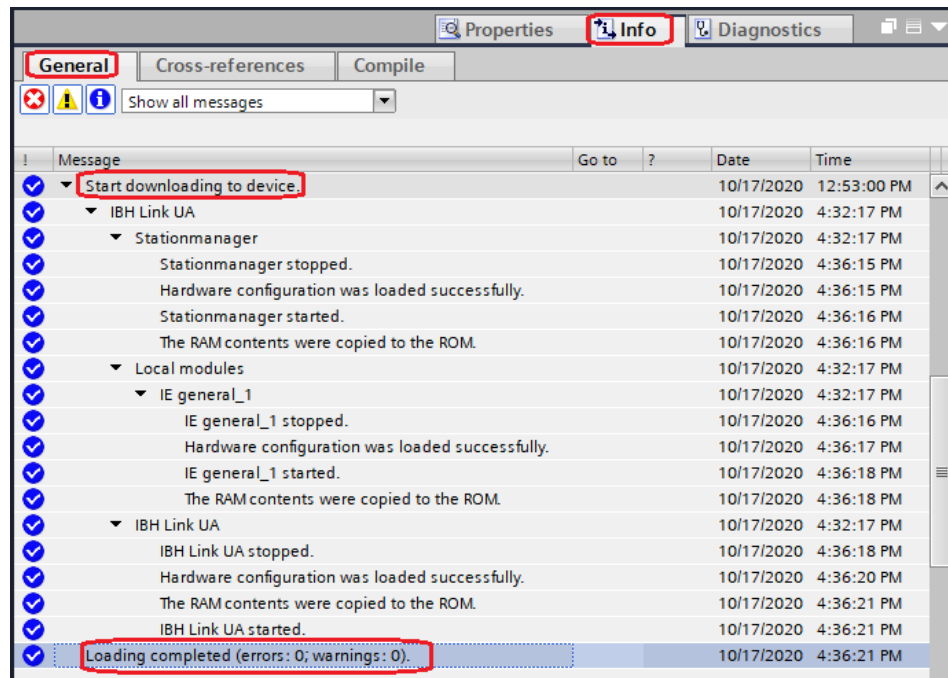
The interface was found



A check is made before loading.

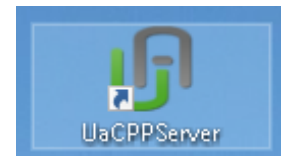


The progress of the loading day is displayed as information.

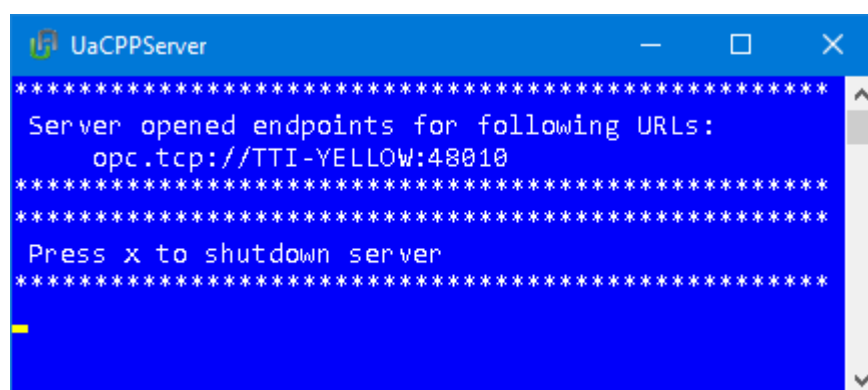


2.1.1 Start external OPC UA server

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 5]**) are in the **IBH Link UA** to register the two **OPC UA servers** who provide the data for exchange.

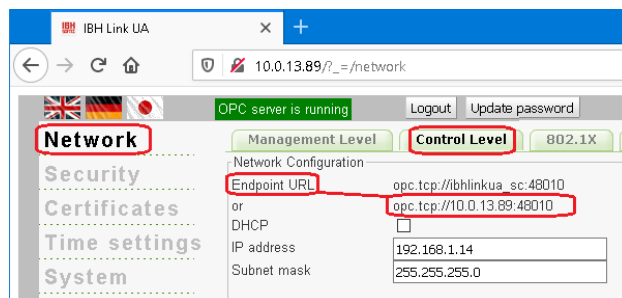
The server integrated in the **IBH Link UA** provides the OPC tags that are defined in the PLC-CPU.

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 5]** to the PLC CPU, should be specified.

The **security mode** for the data exchange must also be selected here. Enter **none**.

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:

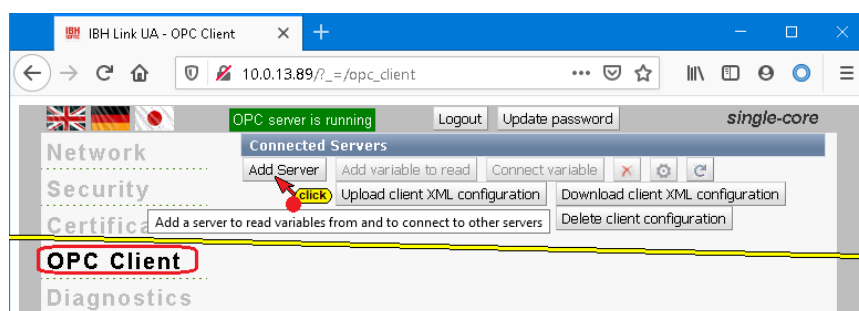
opc.tcp: // ibhlinkua_sc: 48010

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.

Discovery Servers

Url of a computer with discovery service running: Endpoint URL (from Network / Control Level) confirm

Publishing interval [ms]: Synchronous read: ☐ Username (leave empty for none): Password (leave empty for none):

Server Uri	Server Name	Endpoint Url	Security Policy	Security Mode
urn:ibhlinkua...	IBHLinkUA@ibhlinkua_sc	opc.tcp://ibhli...	http://opcfoundation.org/UA/SecurityPolicy#None	None
urn:ibhlinkua...	IBHLinkUA@ibhlinkua_sc	opc.tcp://ibhli...	http://opcfoundation.org/UA/SecurityPolicy#Basic256Sha256	Sign
urn:ibhlinkua...	IBHLinkUA@ibhlinkua_sc	opc.tcp://ibhli...	http://opcfoundation.org/UA/SecurityPolicy#Basic256Sha256	SignAndEncrypt
urn:ibhlinkua...	IBHLinkUA@ibhlinkua_sc	opc.tcp://ibhli...	http://opcfoundation.org/UA/SecurityPolicy#Aes128_Sha256...	Sign
urn:ibhlinkua...	IBHLinkUA@ibhlinkua_sc	opc.tcp://ibhli...	http://opcfoundation.org/UA/SecurityPolicy#Aes128_Sha256...	SignAndEncrypt
urn:ibhlinkua...	IBHLinkUA@ibhlinkua_sc	opc.tcp://ibhli...	http://opcfoundation.org/UA/SecurityPolicy#Aes256_Sha256...	Sign
urn:ibhlinkua...	IBHLinkUA@ibhlinkua_sc	opc.tcp://ibhli...	http://opcfoundation.org/UA/SecurityPolicy#Aes256_Sha256...	SignAndEncrypt

Remote server certificate details:

Common Name: IBHLinkUA@ibhlinkua_rescued
 Organization: Organization
 Organization Unit: Unit
 Locality: LocationName
 State: State
 Country: DE
 Valid from: 2020-08-31
 Valid to: 2025-08-30
 Application URI: urn:ibhlinkua_sc:IBHsoftec:IBHLinkUA
 Encryption strength: RSA-SHA256 - 2048 Bit
 The certificate is valid.

confirm OK Cancel

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

IBH Link UA - OPC Client

10.0.13.89/?_=opc_client

OPC server is running Logout Update password Status

Connected Servers

urn:ibhlinkua_sc:IBHsoftec:IBHLinkUA (opc.tcp://ibhlinkua_sc:48010) Good (0x00000000) SecurityPolicy#None

Add variable to read Connect variable Upload client XML configuration Download client XML configuration Delete client configuration

Add a server to read variables from and to connect to other servers

Discovery Servers

Url of a computer with discovery service running: URL external OPC UA server (UnitedAutomation - air conditioner) confirm

Publishing interval [ms]: Synchronous read: ☐ Username (leave empty for none): Password (leave empty for none):

Server Uri	Server Name	Endpoint Url	Security Policy	Security Mode
urn:TTI-YELLO...	UaServerCpp@TTI-YELLOW	opc.tcp://TTI-Y...	http://opcfoundation.org/UA/SecurityPolicy#None	None
urn:TTI-YELLO...	UaServerCpp@TTI-YELLOW	opc.tcp://TTI-Y...	http://opcfoundation.org/UA/SecurityPolicy#Basic256	Sign
urn:TTI-YELLO...	UaServerCpp@TTI-YELLOW	opc.tcp://TTI-Y...	http://opcfoundation.org/UA/SecurityPolicy#Basic256	SignAndEncrypt
urn:TTI-YELLO...	UaServerCpp@TTI-YELLOW	opc.tcp://TTI-Y...	http://opcfoundation.org/UA/SecurityPolicy#Basic256Sha256	Sign
urn:TTI-YELLO...	UaServerCpp@TTI-YELLOW	opc.tcp://TTI-Y...	http://opcfoundation.org/UA/SecurityPolicy#Basic256Sha256	SignAndEncrypt

Remote server certificate details:

Common Name: UaServerCpp@TTI-1
 Organization: Organization
 Organization Unit: Unit
 Locality: LocationName
 State: State
 Country: DE
 Valid from: 2016-04-01
 Valid to: 2021-03-31
 Application URI: urn:TTI-1:UnifiedAutomation:UaServerCpp
 Encryption strength: RSA-SHA256 - 2048 Bit
 The certificate is valid.

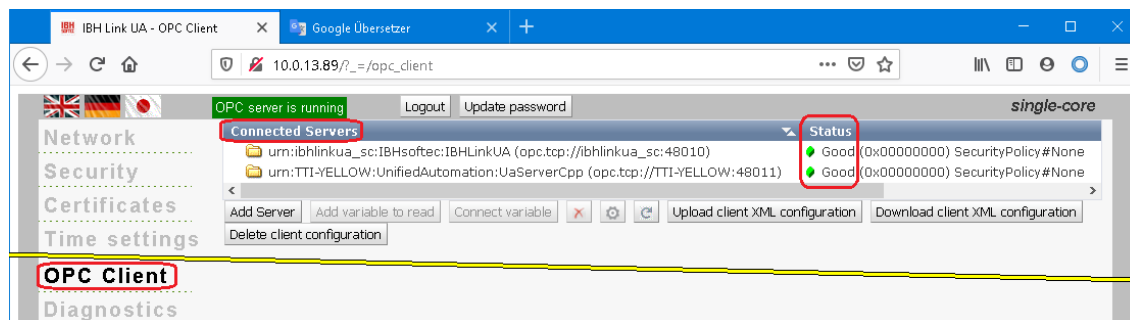
confirm OK Cancel

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***

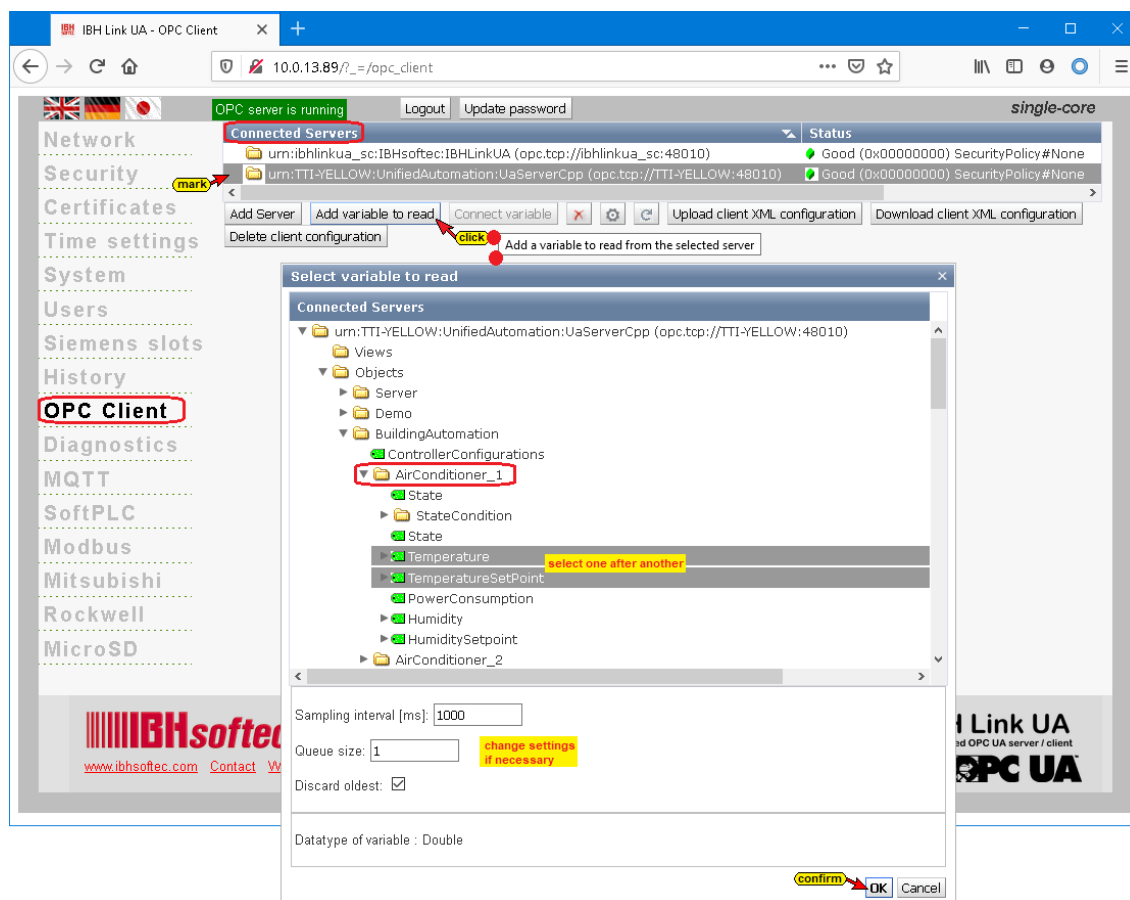
Security Policy None and ***Security Mode None*** were selected for data transmission.

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.

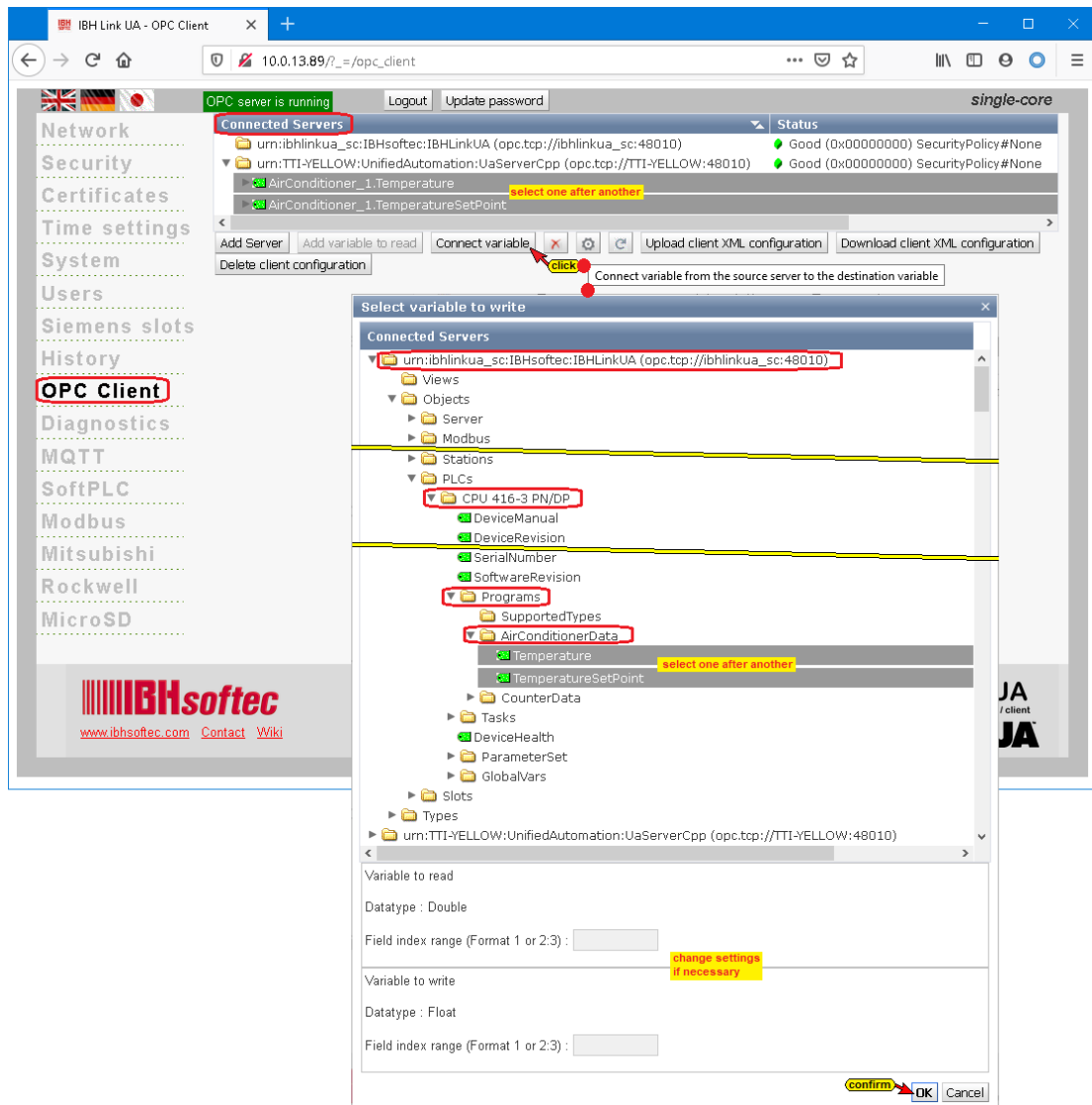


These variables are sent via the OPC server to the data block ***AirConditionerData [DB 5]***, in the CPU-416.

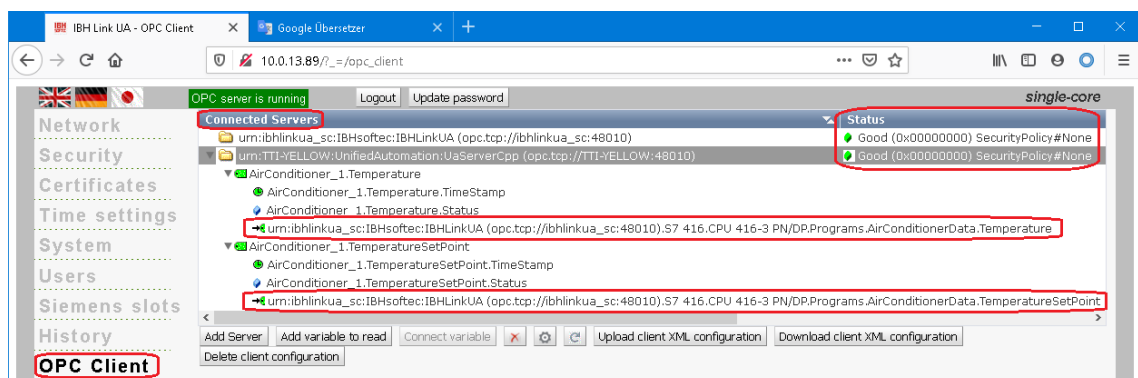
Connect with variables

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 PLC program (**CPU 416 TIA Portal**) in the CPU-416.

Variable (OPC tags) from the data block **AirConditionerData [DB 5]**.

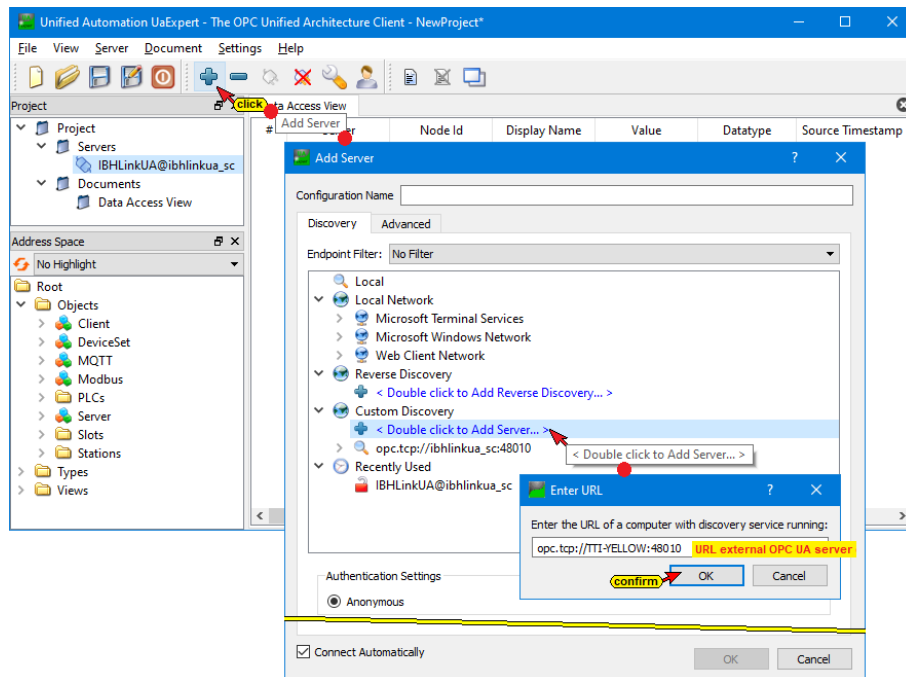


The connections are displayed in the IBH Link UA web browser window OPC Client.



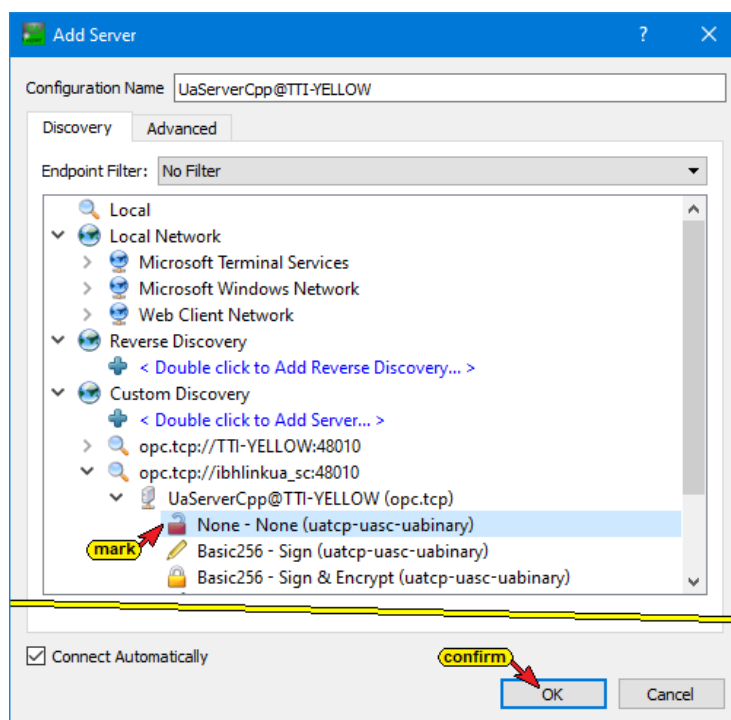
2.1.2 Establishing a connection to the external OPC server

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.

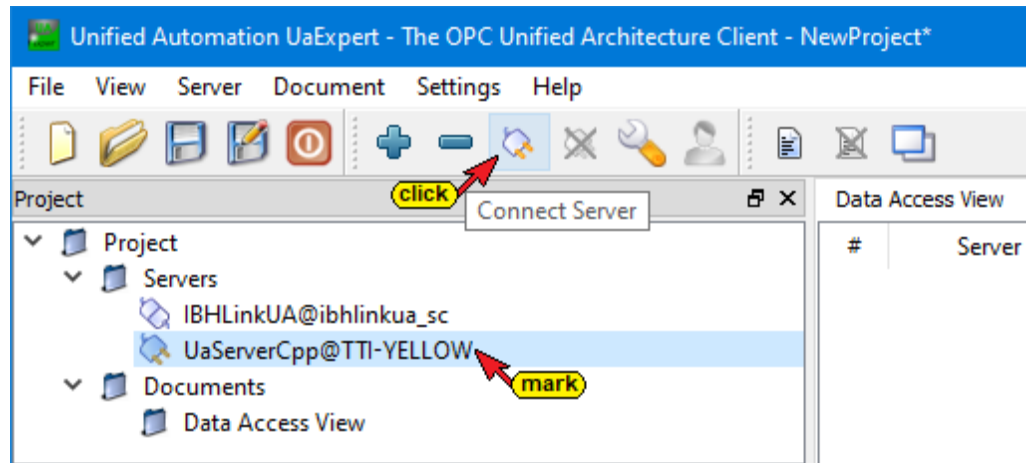
The **Endpoint URL** of  **< Double click to Add Server... >** the external **OPC server External OPC UA Server** (Air-Conditioner) must be entered here.



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

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

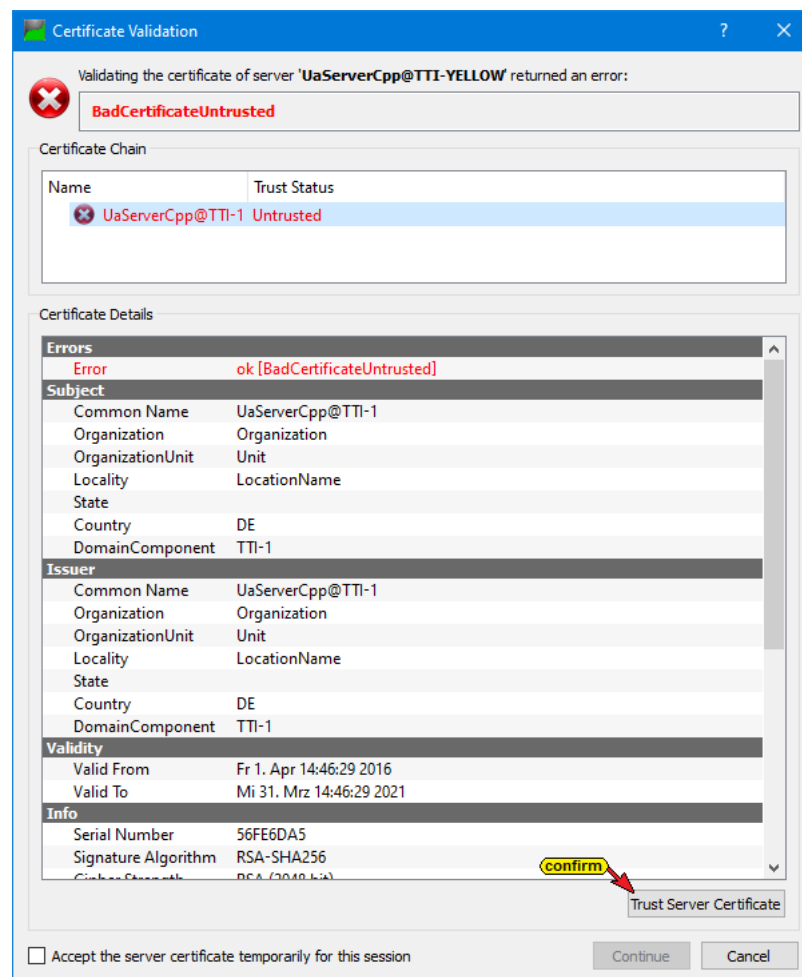
In the opened **UaExpert program window**, the connected servers are displayed.



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

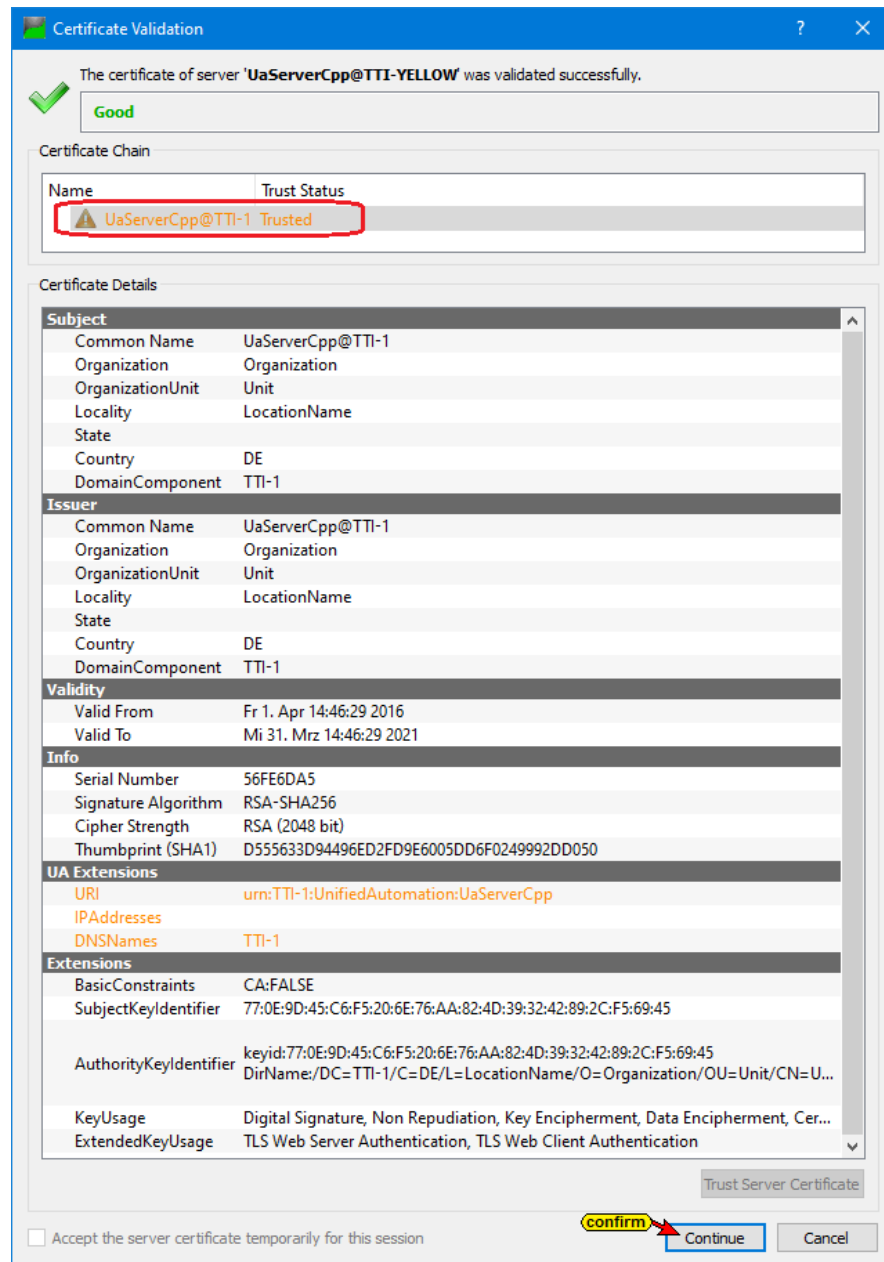


Since there is no certificate acceptance for the desired connection, the dialog box for accepting the OPC UA server certificate opens.



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

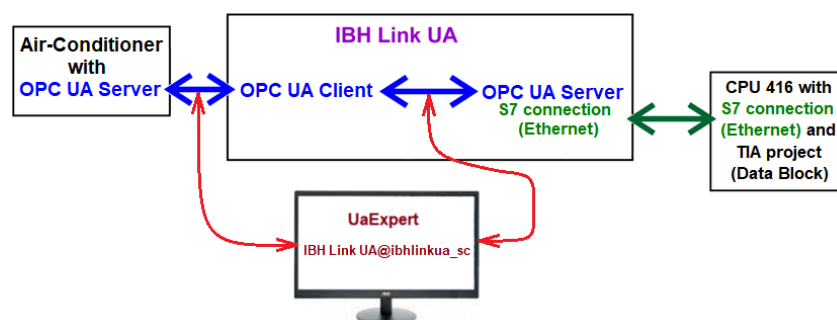
Trust Server Certificate



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

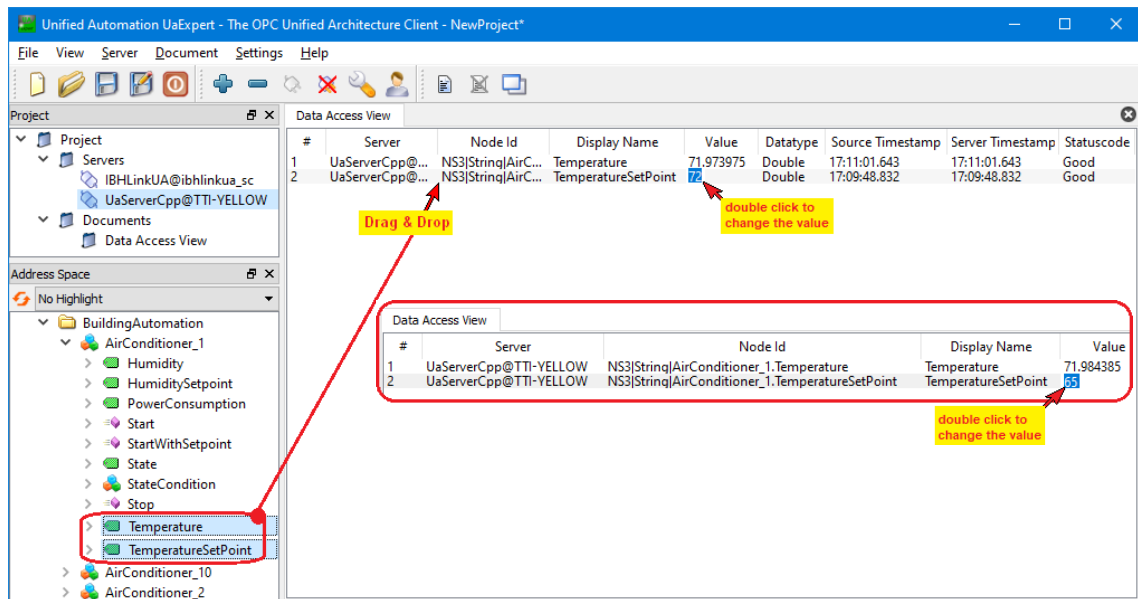
Continue

UaExpert – Displays



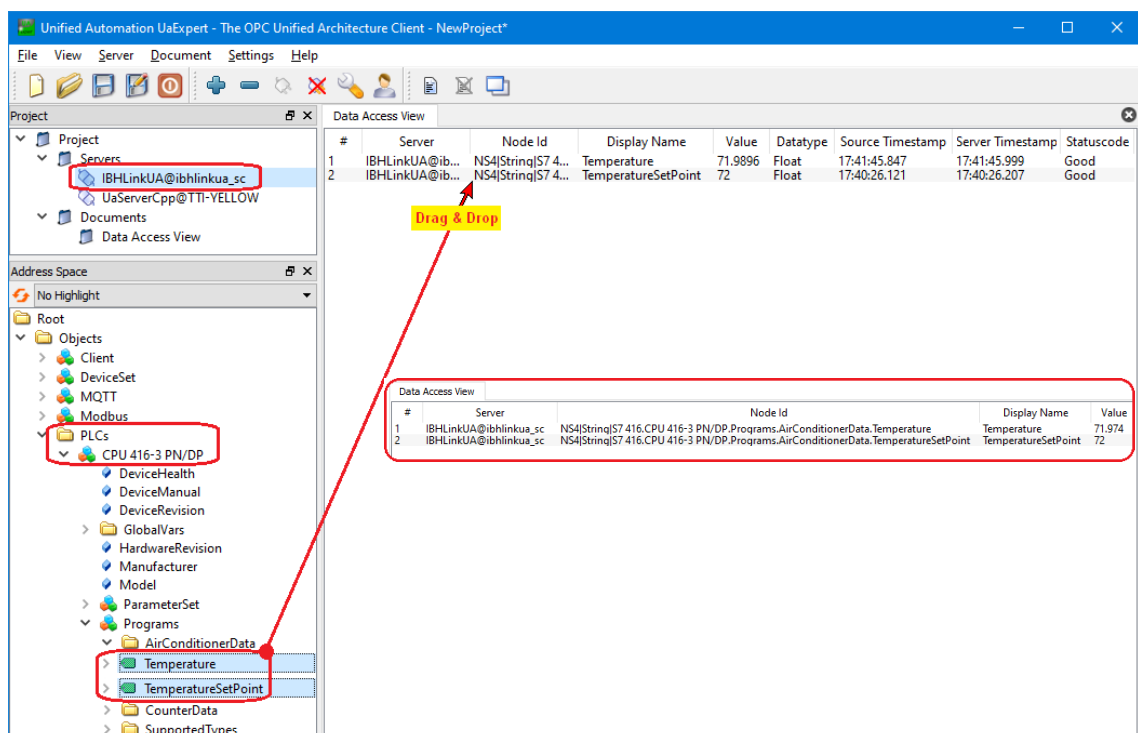
UaExpert - Program Window

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



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

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 5]** are displayed.



Status data block *AirConditionerData* [DB 5] - CPU 416e TIA 16

In the program of the CPU-416, the two values Temperature and TemperatureSetPoint are displayed in the data block *AirConditionerData* [DB 5].

	Name	Data type	Offset	Start value	Monitor value	Comment
1	Static					
2	Temperature	Real	0.0	0.0	64.99407	Actual temperature value
3	TemperatureSetPoint	Real	4.0	0.0	65.0	Set point temperature value
4	TimeStampTemperature	Date_And_Time	8.0	DT#1990-01-01-00:00:00	DT#1990-01-01-00:00:00	Actual temperature Time Stamp
5	TimeStampSetPoint	Date_And_Time	16.0	DT#1990-01-01-00:00:00	DT#1990-01-01-00:00:00	Set point temperature TimeStamp
6	CurrentTime_TimeStamp	Date_And_Time	24.0	DT#1990-01-01-00:00:00	DT#1990-01-01-00:00:00	Current Time Time Stamp
7	StatusTemperature	DWord	32.0	16#0	16#0000_0000	Status Temperature
8	StatusSetPoint	DWord	36.0	16#0	16#0000_0000	Status Set Point Temperature
9	CurrentTimeStatus	DWord	40.0	16#0	16#0000_0000	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 **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.

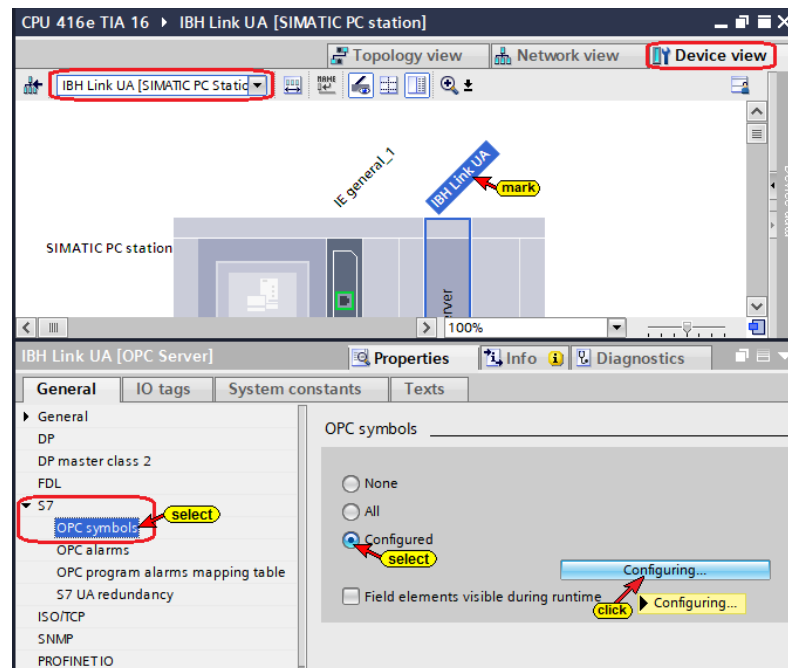
The data block *AirConditionerData* [DB 5] is provided for this purpose.

	Name	Data type	Offset	Start value	Comment
1	Static				
2	Temperature	Real	0.0	0.0	Actual temperature value
3	TemperatureSetPoint	Real	4.0	0.0	Set point temperature value
4	TimeStampTemperature	Date_And_Time	8.0	DT#1990-01-01-00:00:00	Actual temperature Time Stamp
5	TimeStampSetPoint	Date_And_Time	16.0	DT#1990-01-01-00:00:00	Set point temperature TimeStamp
6	CurrentTime_TimeStamp	Date_And_Time	24.0	DT#1990-01-01-00:00:00	Current Time Time Stamp
7	StatusTemperature	DWord	32.0	16#0	Status Temperature
8	StatusSetPoint	DWord	36.0	16#0	Status Set Point Temperature
9	CurrentTimeStatus	DWord	40.0	16#0	Current Time Status

Reselect OPC tags

The variables that the data block ***AirConditionerData [DB 5]*** should receive from the external OPC UA server are to be selected.

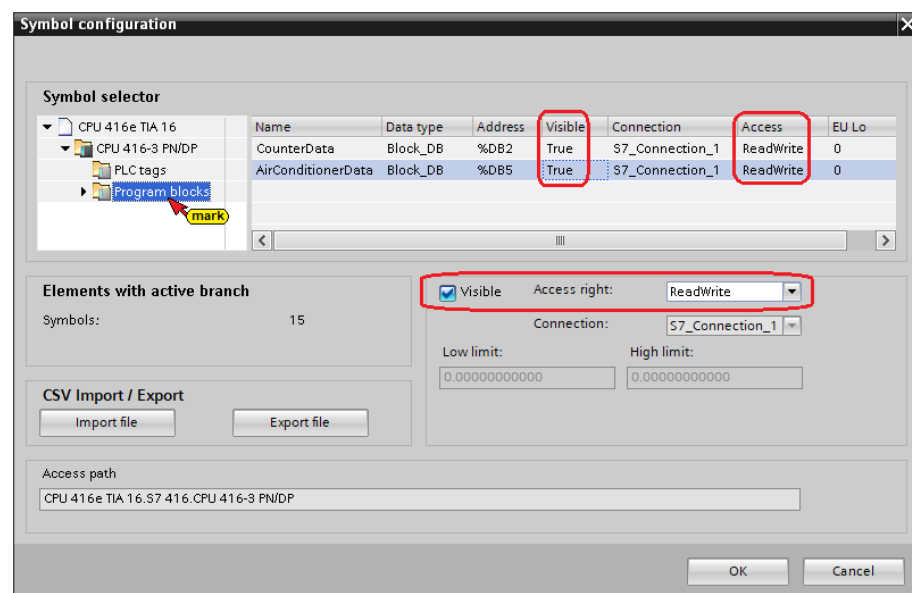
Open the configuration for the ***OPC server / properties***.

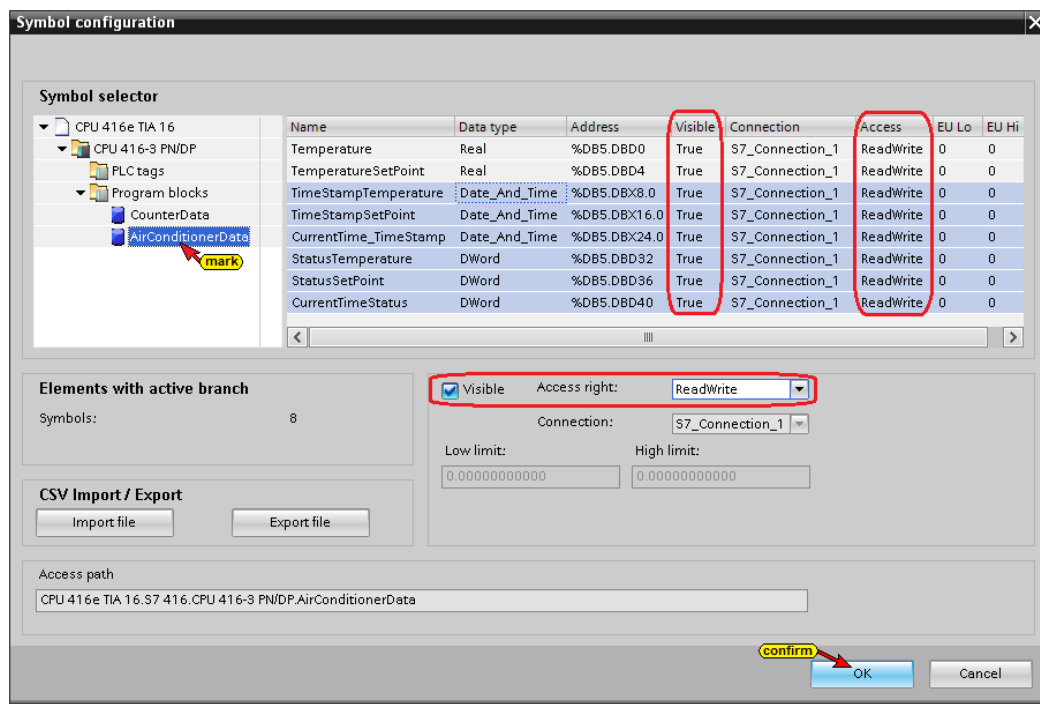


The ***Configure*** button opens the Symbol Configuration dialog box. Here data from the data block ***AirConditionerData [DB 5]*** are selected as OPC tags.

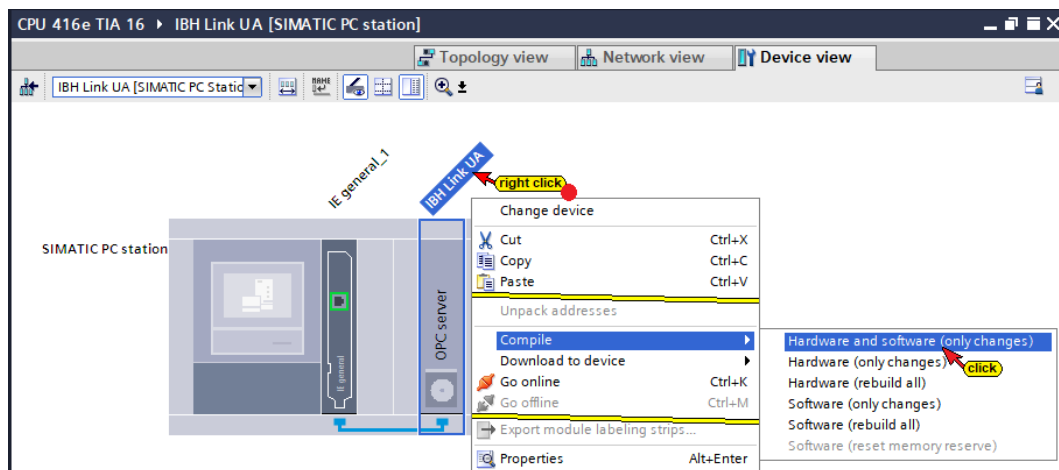
Configurable data from data block ***AirConditionerData [DB 5]***

Select data of the data block ***AirConditionerData [DB 5]*** in addition to data block ***CounterData [DB2]*** as OPC tags (OPC symbols). The ***read / write*** access rights can be assigned to the individual operands (OPC tags).



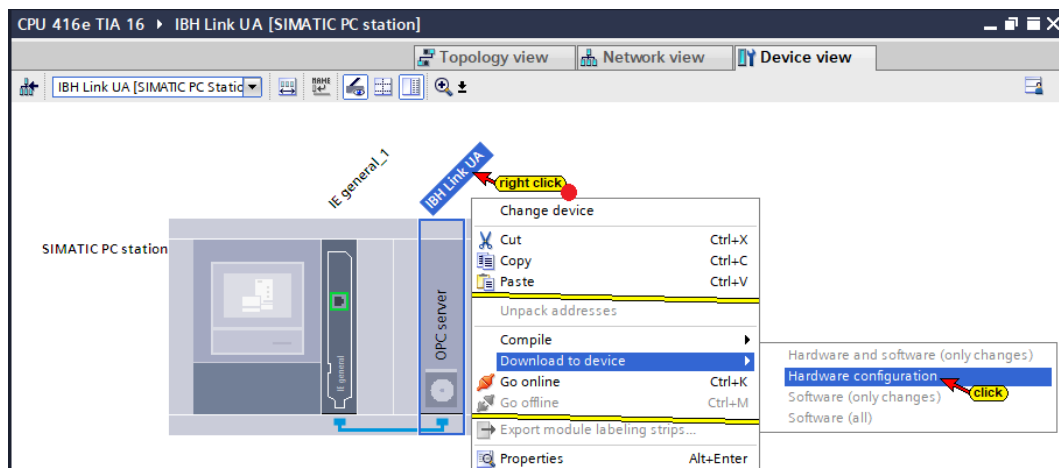


Compile the configuration of the OPC server

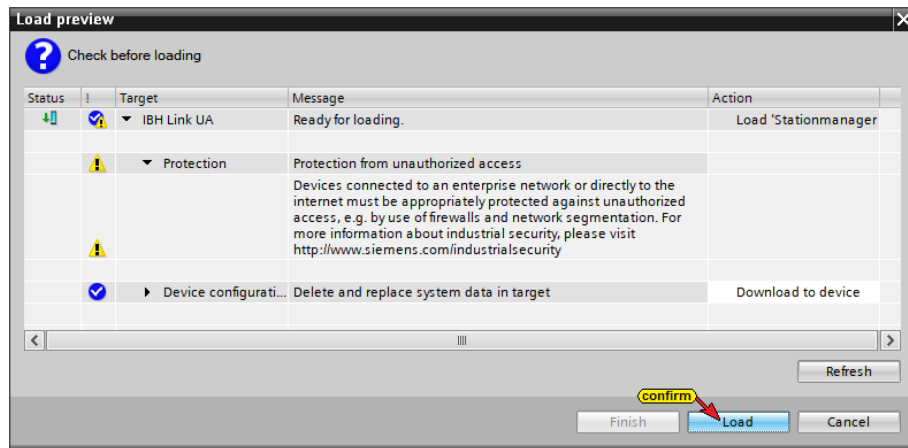


If no error is displayed when the hardware is compiled, the next step is to load the hardware into the IBH Link UA OPC server.

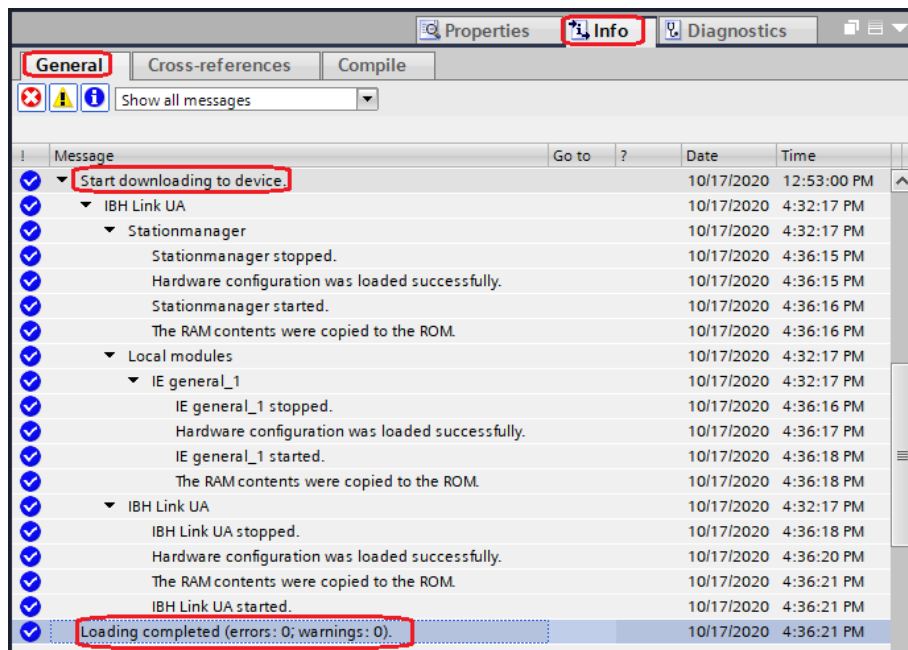
Load configuration of the OPC server into IBH Link UA



A check is made before loading.



The progress of the loading day is displayed as information.



2.2.2 Browser window IBH Link UA - OPC Client

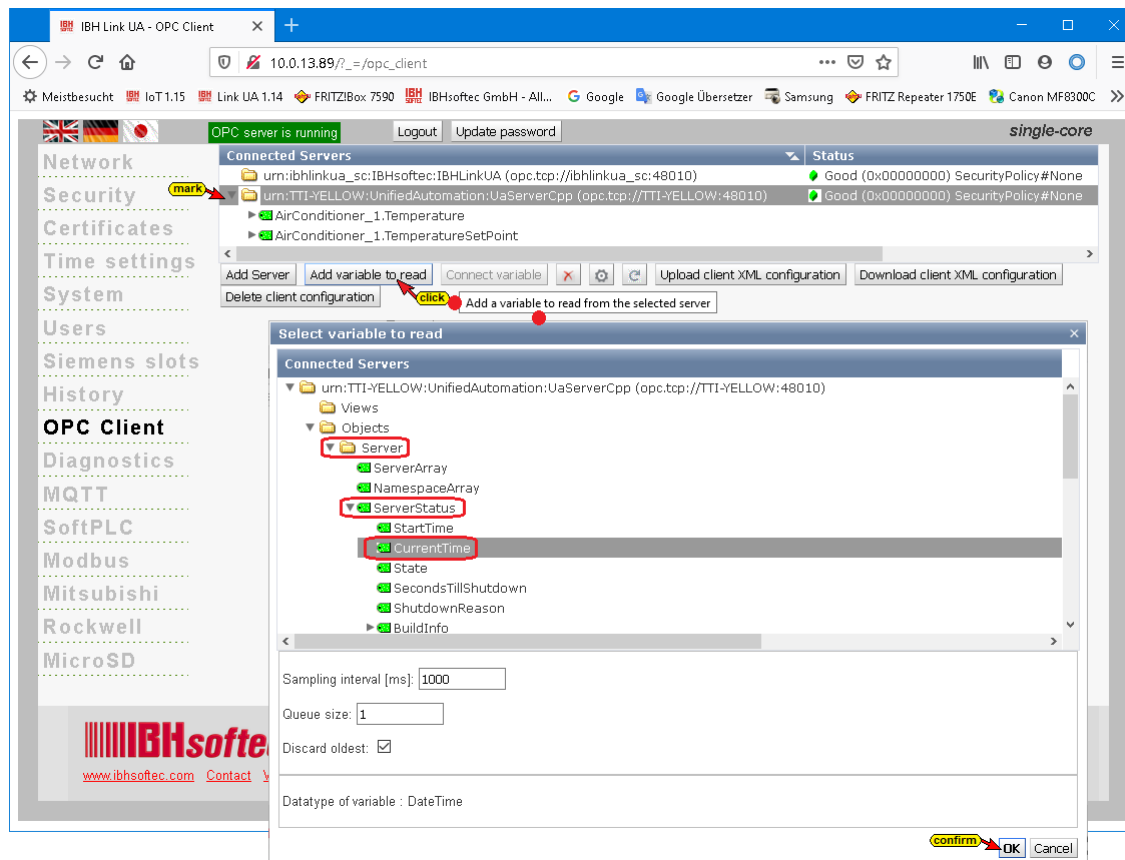
In the example, the read variables **Temperature** and **TemperatureSetPoint** of the external OPC UA server were linked with the variables of the data block **AirConditionerData [DB 5]** (**Temperature**, **TemperatureSetPoint**). This connection can remain.

In addition, the read variable **CurrentTime** of the external server is to be connected to the variable of the data block **AirConditionerData [DB 5]**.

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

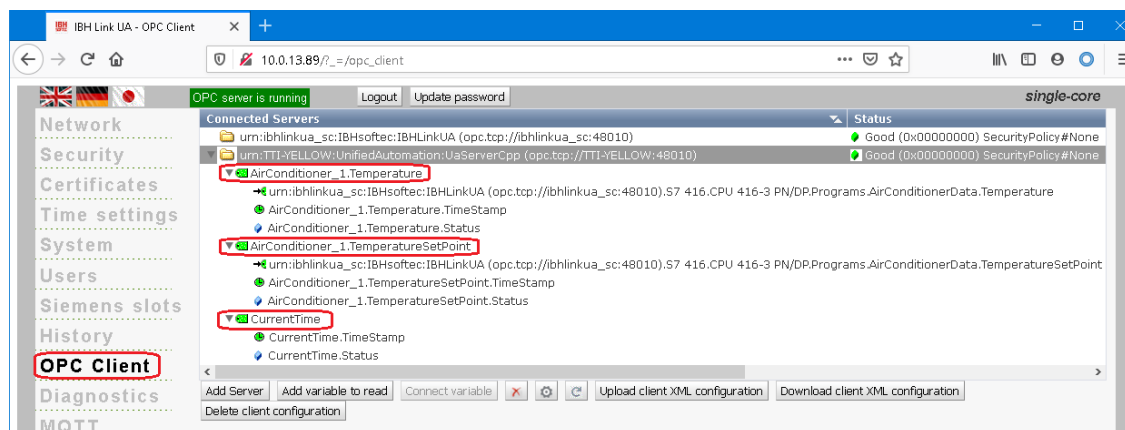
The **TemperatureSetPoint** variable also consists of the **Value**, the **TimeStamp**, and the **Status**.

The **ServerStatus** / **CurrentTime** variable must be selected as the read variable.



Selected read variable

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

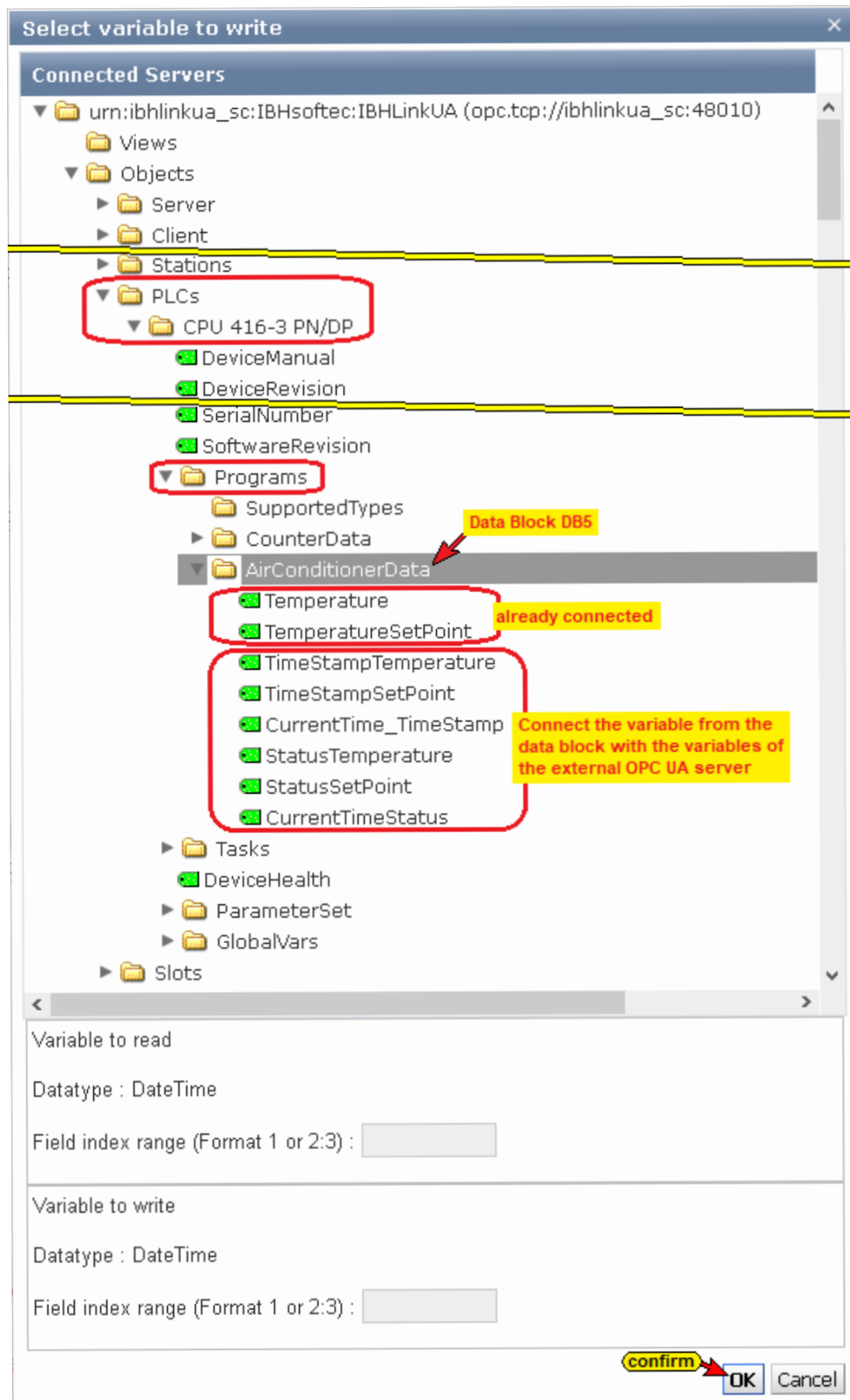


The following read variables are to be connected to the OPC tags of the data block **AirConditionerData** [DB 5]:

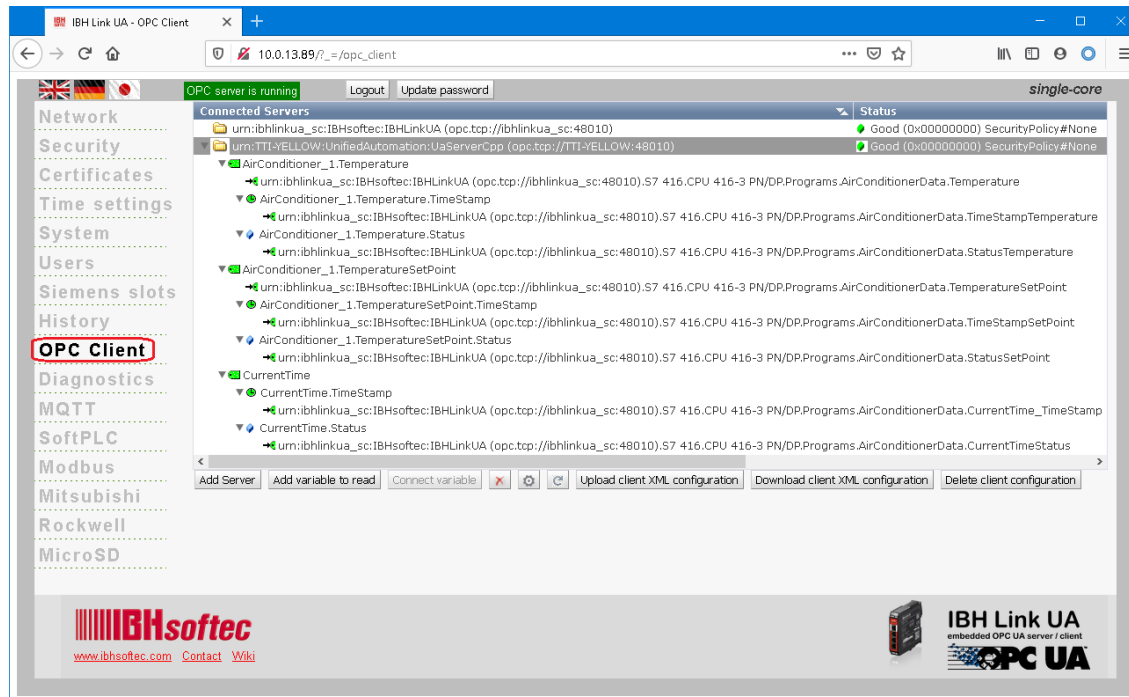
- **AirConditioner_1.Temperature.TimeStamp**
- **AirConditioner_1.Temperature.Status**
- **AirConditioner_1.TemperatureSetPoint.TimeStamp**

- ***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 5]***.



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

#	Server	Node Id	Display Name	Value	Datatype	Source Timestamp	Server Timestamp	Statuscode
1	IBHLinkUA@ib...	NS4:String\$7 4...	CurrentTimeStatus	0	UInt32	14:29:08.760	14:29:08.793	Good
2	IBHLinkUA@ib...	NS4:String\$7 4...	CurrentTime_TimeStamp	2020-10-25T13:34:43.747Z	DateTime	14:34:43.711	14:34:43.748	Good
3	IBHLinkUA@ib...	NS4:String\$7 4...	StatusSetPoint	0	UInt32	14:29:13.278	14:29:14.047	Good
4	IBHLinkUA@ib...	NS4:String\$7 4...	StatusTemperature	0	UInt32	14:29:15.391	14:29:16.047	Good
5	IBHLinkUA@ib...	NS4:String\$7 4...	Temperature	71.9944	Float	14:34:44.227	14:34:44.249	Good
6	IBHLinkUA@ib...	NS4:String\$7 4...	TemperatureSetPoint	72	Float	14:32:57.393	14:32:58.433	Good
7	IBHLinkUA@ib...	NS4:String\$7 4...	TimeStampSetPoint	2020-10-25T10:01:12.706Z	DateTime	14:33:08.399	14:33:09.187	Good
8	IBHLinkUA@ib...	NS4:String\$7 4...	TimeStampTemperature	2020-10-25T13:34:44.245Z	DateTime	14:34:44.227	14:34:44.249	Good

Greenwich Mean Time (GMT) zulu time (Z)

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

The variables **CurrentTime**, **Temperature** and **TemperatureSetPoint** can be dragged and dropped on the **Data Access Viewer** window.

External OPC UA server - air conditioner data

Double click to change the value

Drag & Drop

Drag & Drop

greenwich Mean Time (GMT) Zulu time (Z)

CET - Central European Time

#	Server	Node Id	Display Name	Value	Datatype	Source Timestamp	Server Timestamp	StatusCode
1	UaServerCpp@TTI-YELL...	NS3[String]AirConditioner_1.TemperatureSetPoint	TemperatureSetPoint	72	Double	11:01:12.706	17:58:58.846	Good
2	UaServerCpp@TTI-YELL...	NS3[String]AirConditioner_1.Temperature	Temperature	71.9791800001	Double	19:41:41.282	19:41:41.282	Good
3	UaServerCpp@TTI-YELL...	NS0[Numeric]2258	CurrentTime	2020-10-25T18:41:42.013Z	DateTime	19:41:42.013	19:41:42.013	Good
4	UaServerCpp@TTI-YELL...	NS0[Numeric]2259	State	0 (Running)	Int32	10:32:22.707	17:58:32.529	Good

#	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
4	UaServerCpp@TTI-YELLOW	NS0[Numeric]2259	State

Display Name	Value	Datatype
TemperatureSetPoint	72	Double
Temperature	71.9843850001	Double
CurrentTime	2020-10-25T18:49:36.941Z	DateTime
State	0 (Running)	Int32

With a double-click on the value of the target temperature (**TemperatureSetPoint Value**) this can be changed.

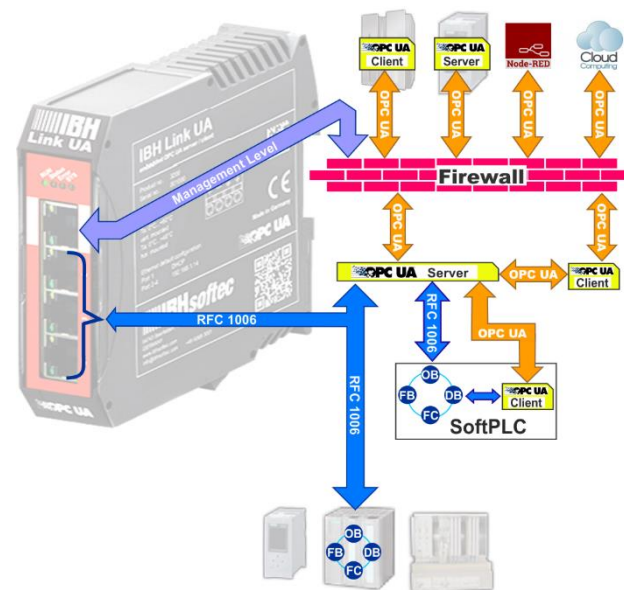
Online status – Data block AirConditionerData [DB5] CPU-416

CPU 416e TIA 16 ▶ CPU 416-3 PN/DP [CPU 416-3 PN/DP] ▶ Program blocks ▶ AirConditionerData [DB5]

Keep actual values Snapshot Copy snapshots to start values

Name	Data type	Offset	Start value	Monitor value	Comment
Static					
Temperature	Real	0.0	0.0	71.97398	Actual temperature value
TemperatureSetPoint	Real	4.0	0.0	72.0	Set point temperature value
TimeStampTemperature...	Date_And_Time	8.0	DT#1990-01-01-0	DT#2020-10-25-18:53:05.378	Actual temperature Time Stamp
TimeStampSetPoint	Date_And_Time	16.0	DT#1990-01-01-0	DT#2020-10-25-10:01:12.706	Set point temperature TimeStamp
CurrentTime_TimeSta...	Date_And_Time	24.0	DT#1990-01-01-0	DT#2020-10-25-18:53:06.140	Current Time Time Stamp
StatusTemperature	DWord	32.0	16#0	16#0000_0000	Status Temperature
StatusSetPoint	DWord	36.0	16#0	16#0000_0000	Status Set Point Temperature
CurrentTimeStatus	DWord	40.0	16#0	16#0000_0000	Current Time Status

3 IBH Link UA - integrated SoftPLC



The IBH Link UA also 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

3.1.1 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

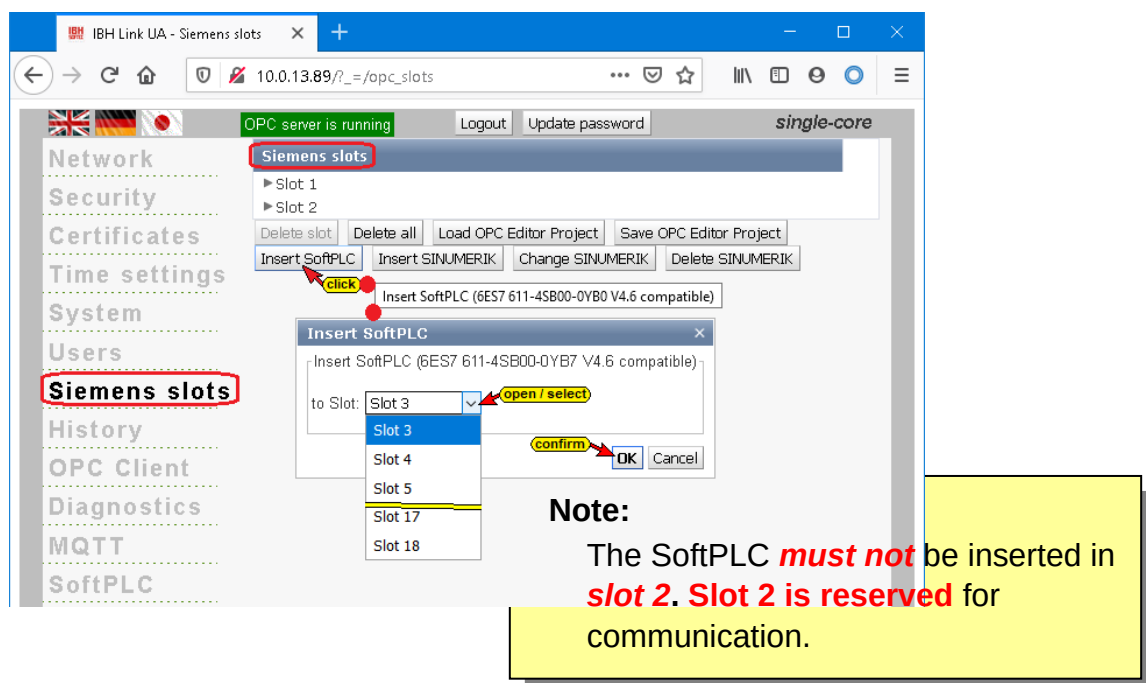
The **IBH Link UA – SoftPLC** can establish a configured connection. The **PUT (SFB 15)** and **GET (SFB 14)** blocks can be used to read data directly from an S7 controller with the SoftPLC integrated in the IBH Link UA.

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.

3.2 Activating the integrated SoftPLC

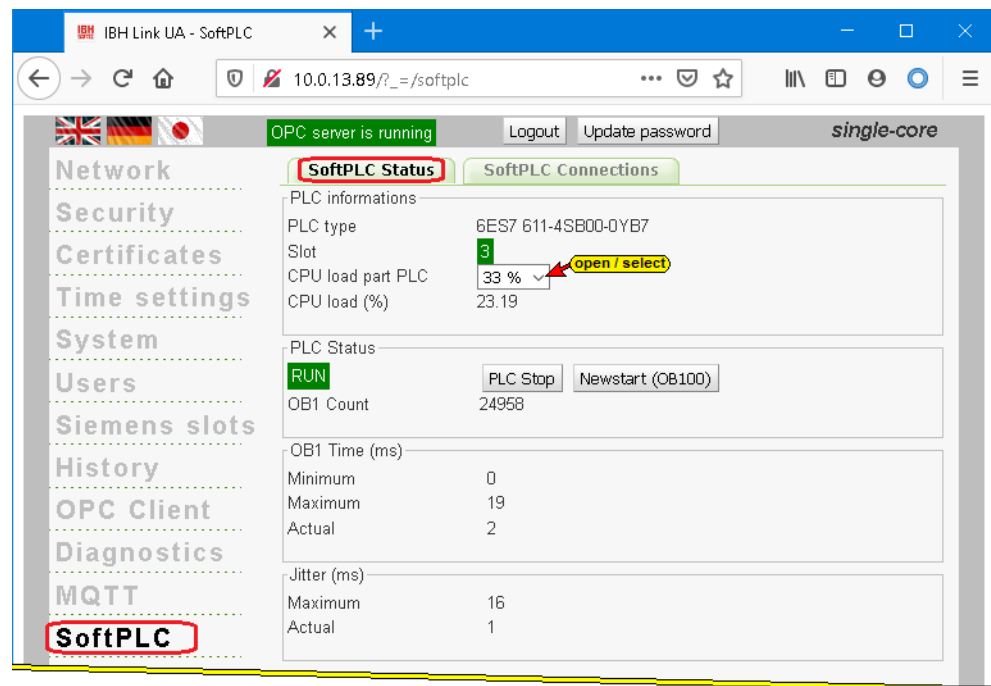
The SoftPLC must be activated via the WEB interface page Siemens Slots of the IBH Link UA.



The screenshot shows the 'Siemens slots' web interface. The left sidebar contains a menu with options: Network, Security, Certificates, Time settings, System, Users, **Siemens slots** (highlighted with a red box), History, OPC Client, Diagnostics, MQTT, and SoftPLC. The main content area shows the 'Siemens slots' configuration page. It includes a status bar at the top indicating 'OPC server is running' and buttons for 'Logout' and 'Update password'. Below this, there's a 'Siemens slots' section with a tree view showing 'Slot 1' and 'Slot 2'. A 'click' annotation points to the 'Insert SoftPLC' button. A dialog box titled 'Insert SoftPLC' is open, showing a list of slots: Slot 3, Slot 4, Slot 5, Slot 17, and Slot 18. An 'open / select' annotation points to the 'Slot 3' option. A 'confirm' annotation points to the 'OK' button. A yellow note box at the bottom right states: 'Note: The SoftPLC **must not** be inserted in **slot 2**. Slot 2 is reserved for communication.'

3.3 SoftPLC status and settings

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

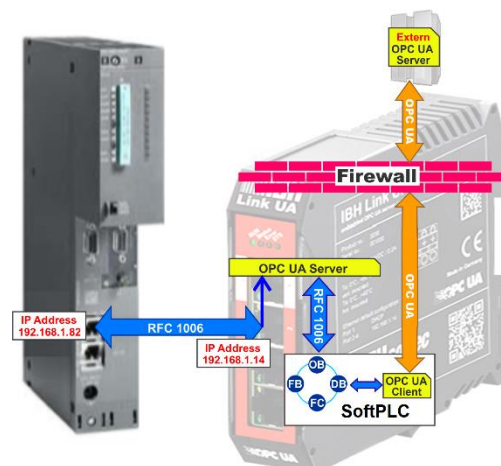


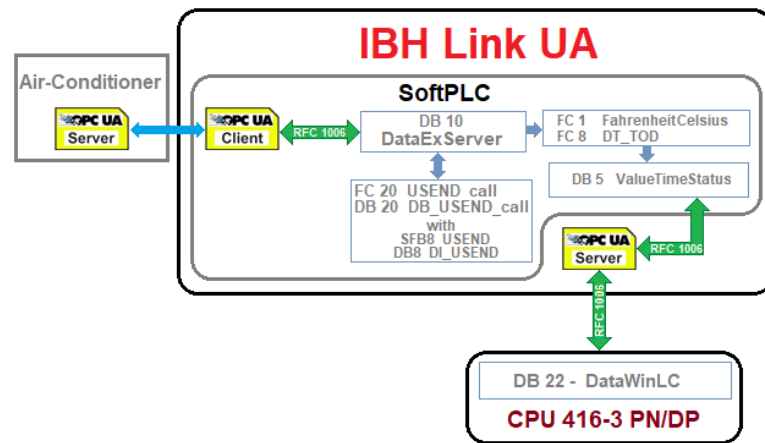
3.4 Configure SoftPLC in the IBH Link UA with TIA Portal

In the following example - **WinAC RTX TIA16e** – 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 **DataExServer [DB10]**.



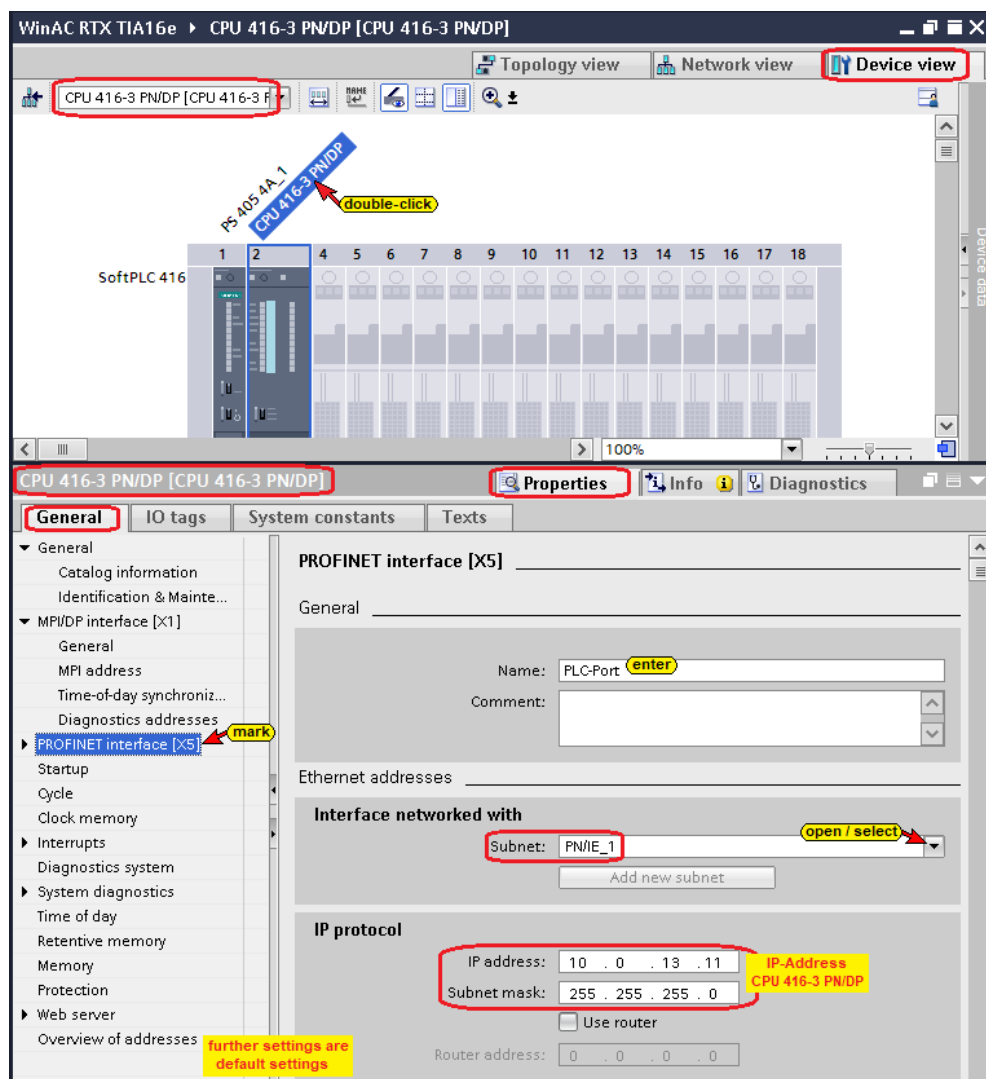
The temperature values and time stamps are converted. °Fahrenheit into °Celsius and Date and Time into Time of Day. These converted values along with the status are saved in the data block **ValueTimeStatus [DB5]** and sent to the **PLC CPU 416** (IBHsoftec SoftSPS) data block **DataWinAC [DB22]**.





3.4.1 PLC CPU 416 program (IBHsoftec SoftPLC 416)

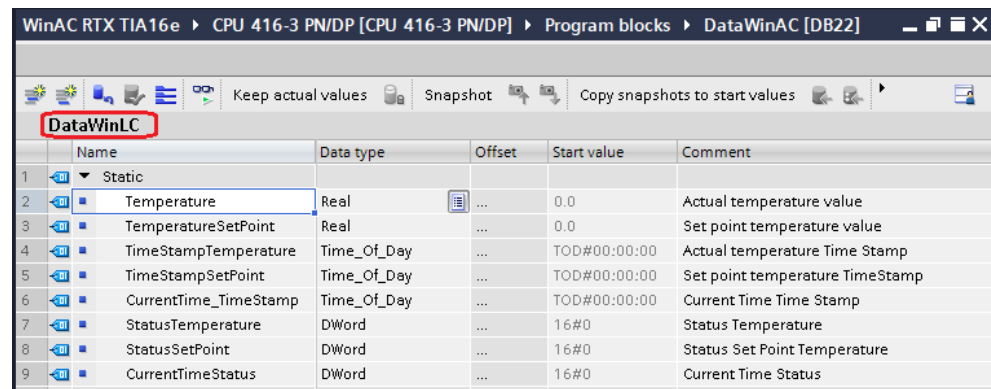
An S7 400 station with the CPU 416-3 PN / DP (6ES7 416-3ER05-0AB0) firmware version V5.1 and a PS 407 A4 power supply unit was created as hardware.



The Ethernet IP address was specified in the dialog box opened by double-clicking on CPU 416-3 PN/DP.

3.4.2 PLC CPU 416 program (IBHsoftec SoftSPS)

The data coming from the SoftPLC in the IBH Link UA is stored in the data block **DataWinAC [DB22]**.

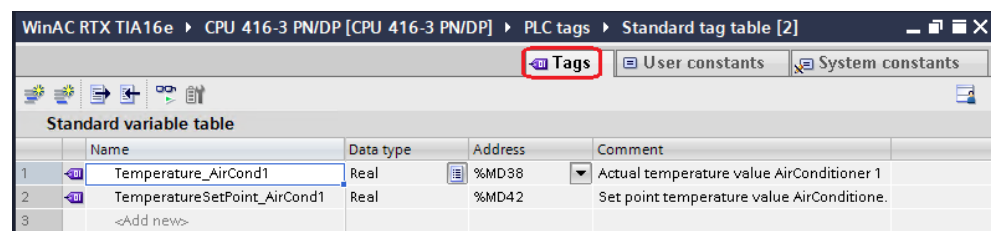


	Name	Data type	Offset	Start value	Comment
1	Static				
2	Temperature	Real	...	0.0	Actual temperature value
3	TemperatureSetPoint	Real	...	0.0	Set point temperature value
4	TimeStampTemperature	Time_Of_Day	...	TOD#00:00:00	Actual temperature Time Stamp
5	TimeStampSetPoint	Time_Of_Day	...	TOD#00:00:00	Set point temperature TimeStamp
6	CurrentTime_TimeStamp	Time_Of_Day	...	TOD#00:00:00	Current Time Time Stamp
7	StatusTemperature	DWord	...	16#0	Status Temperature
8	StatusSetPoint	DWord	...	16#0	Status Set Point Temperature
9	CurrentTimeStatus	DWord	...	16#0	Current Time Status

Organization block OB1

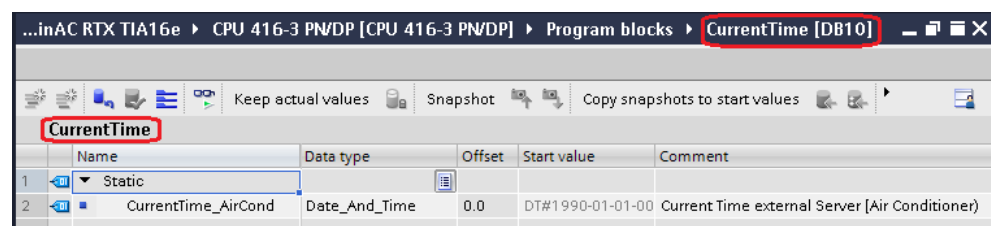
OB1 has no function in the example.

Standard variable table - CPU 416-3 PN / DP -



	Name	Data type	Address	Comment
1	Temperature_AirCond1	Real	%MD38	Actual temperature value AirConditioner 1
2	TemperatureSetPoint_AirCond1	Real	%MD42	Set point temperature value AirConditione.
3	<Add new>			

Data block CurrentTime [DB10]



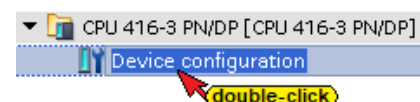
	Name	Data type	Offset	Start value	Comment
1	Static				
2	CurrentTime_AirCond	Date_And_Time	0.0	DT#1990-01-01-00	Current Time external Server (Air Conditioner)

Note:

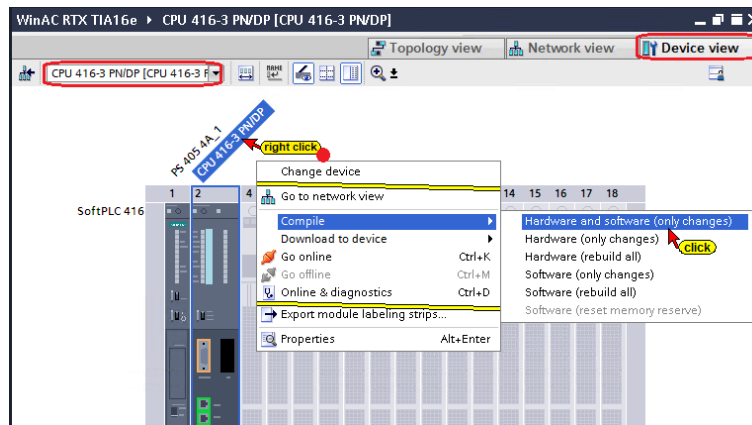
Temperature_AirCond1, TemperatureSetPoint_AirCond1, and CurrentTime_AirCond are only required for the definition of the OPC variables. **These variables) have no further function.**

Compile hardware and software

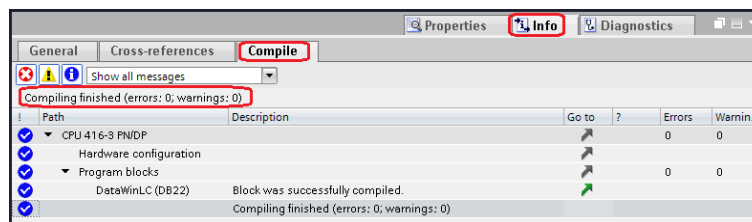
Double-click on Device configuration to open the Device view window.



A right click on CPU 416-3 PN/DP opens the context menu. Click Compile / Hardware and Software.

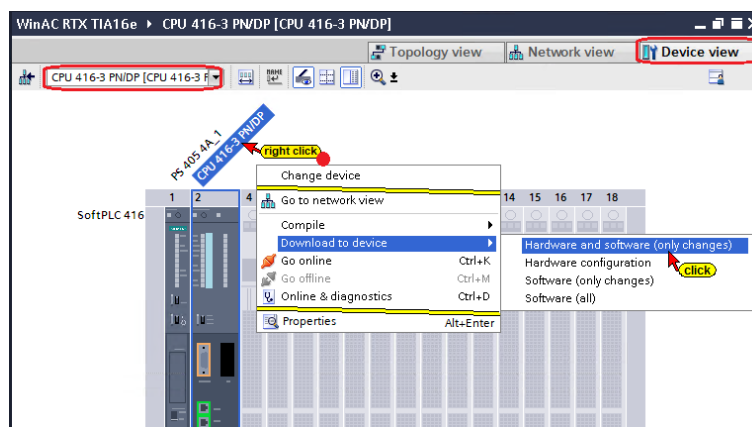


Compiling the hardware and software without errors

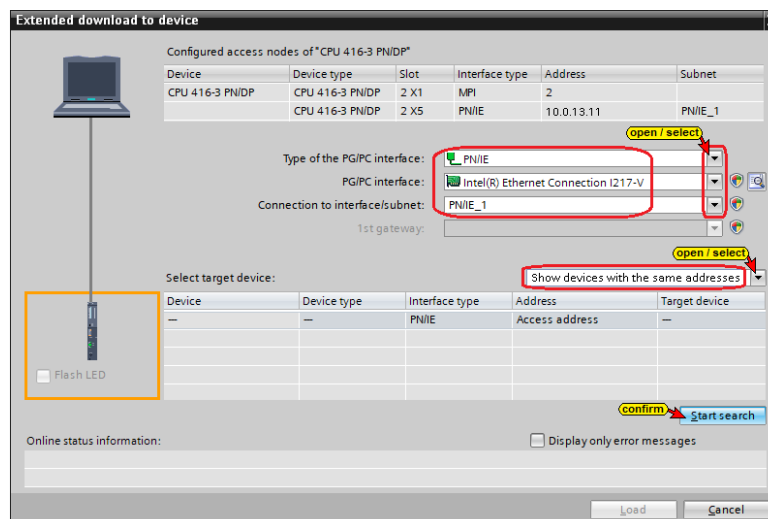


Loading the hardware and software into the CPU

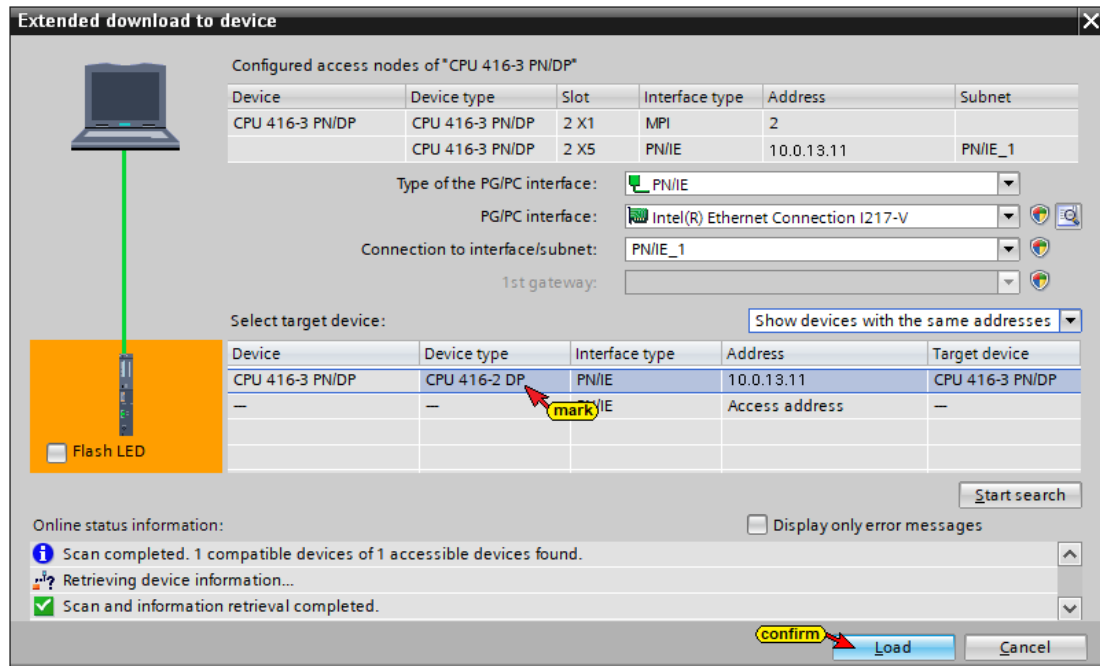
The software and hardware configuration can now be loaded into the device using the commands from the context menu.



The hardware configuration load command opens the dialog box.

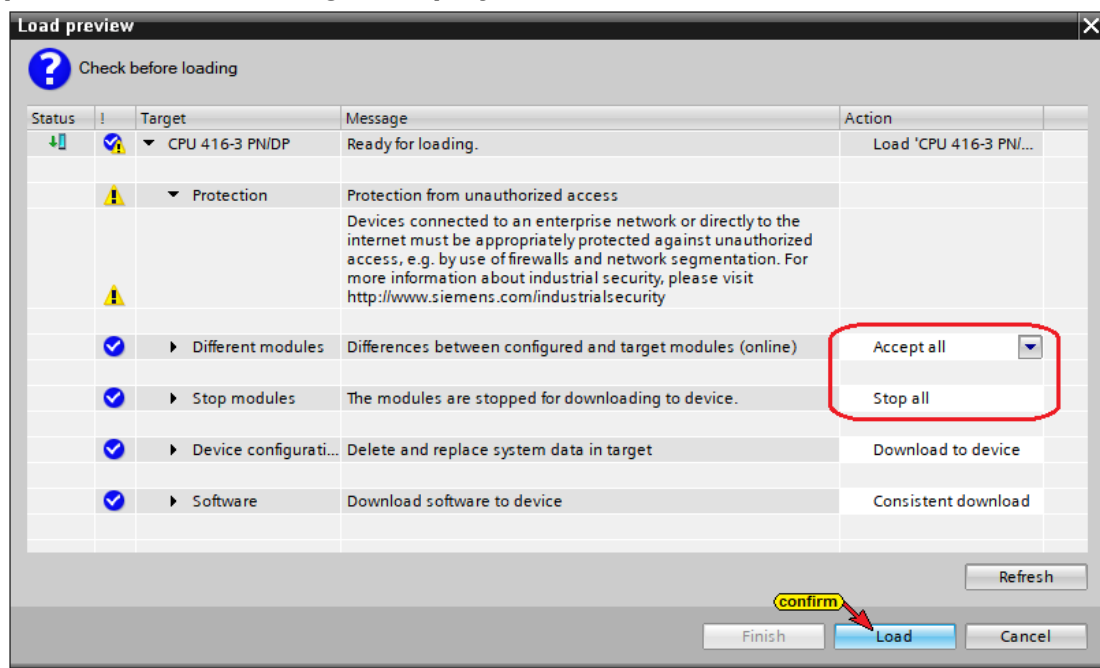


The successful search is displayed.

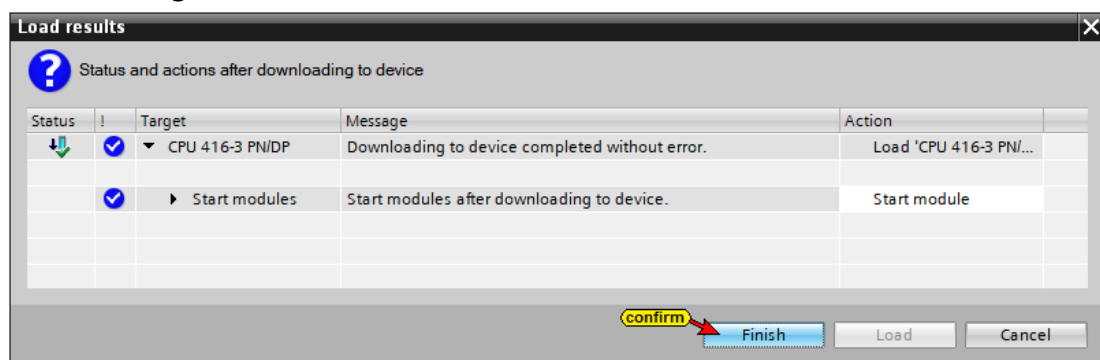


The loading process requires several confirmations of messages.

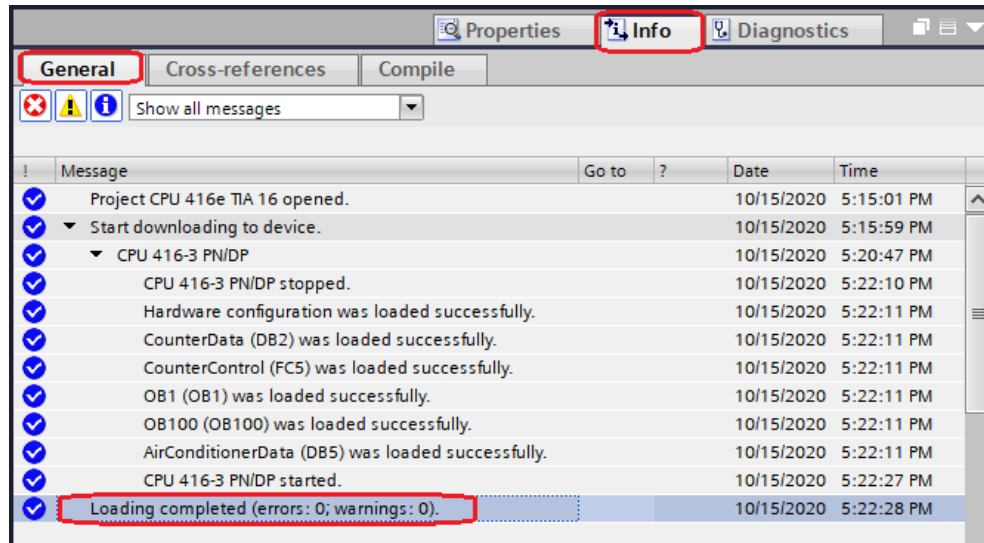
A preview of the loading is displayed.



Finish loading

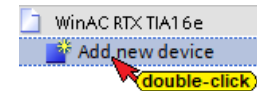


Error-free loading is displayed

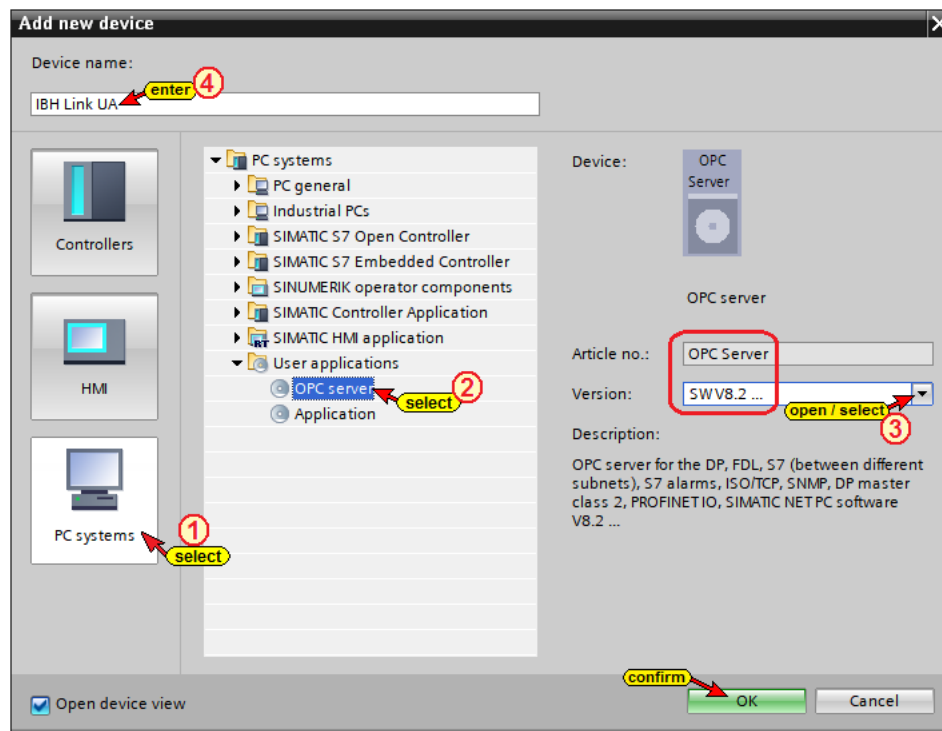


3.4.3 Insert IBH Link UA as an SIMATIC PC station

Double-clicking on Add new device opens the device selection dialog box.



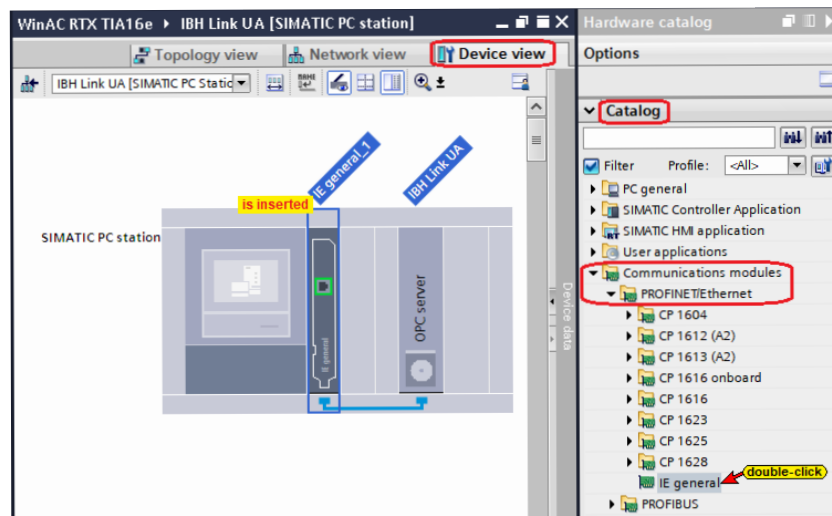
If an OPC server is added to the project, an SIMATIC PC station is automatically added.



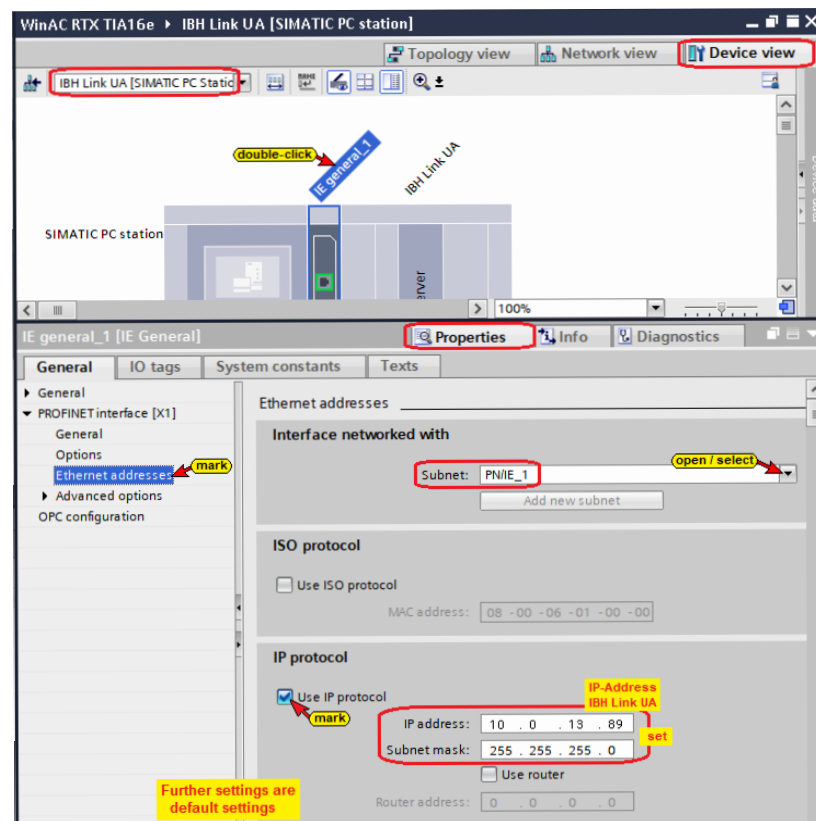
Note:

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, V14, V15** and **V16**.

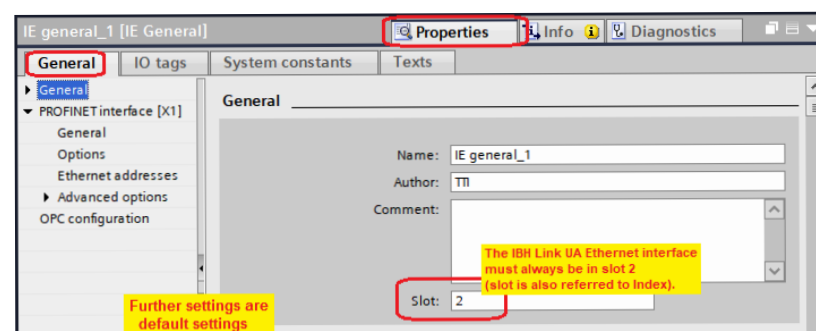
3.4.4 Insert communication module into the IBH Link UA



Define communication module properties

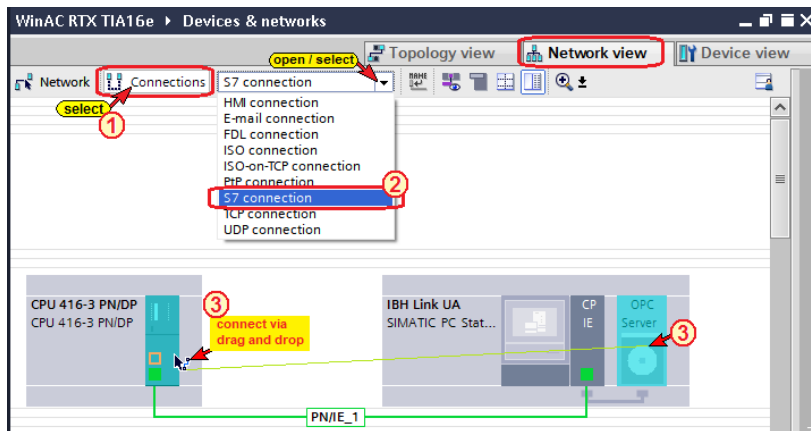


Check slot IE General_1

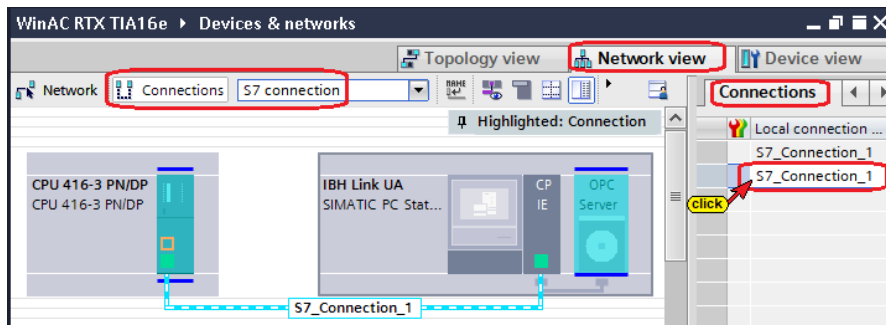


Create S7 connection IBH Link UA OPC Server – SoftPLC 416

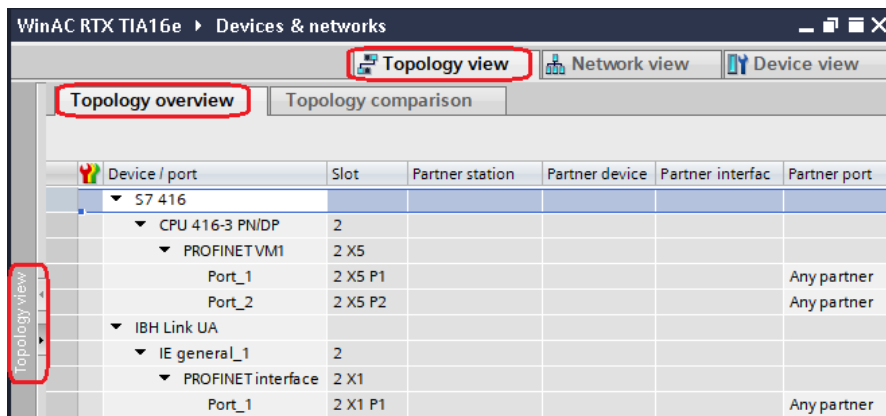
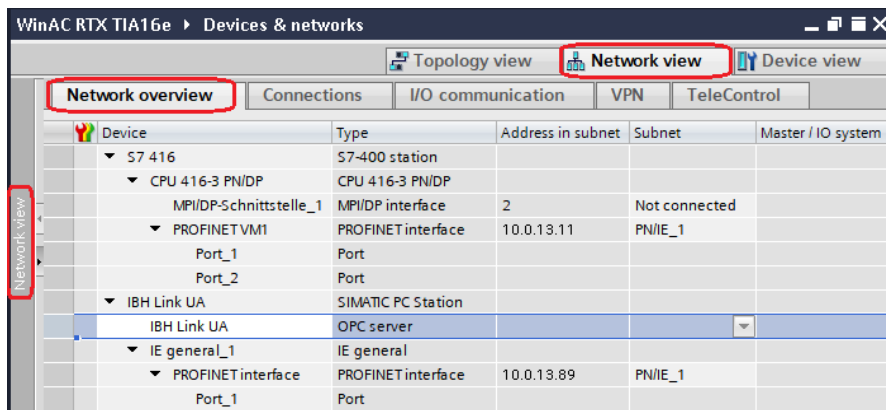
Via **drag & drop**, from the OPC server to the PLC 416, the S7 connection established.



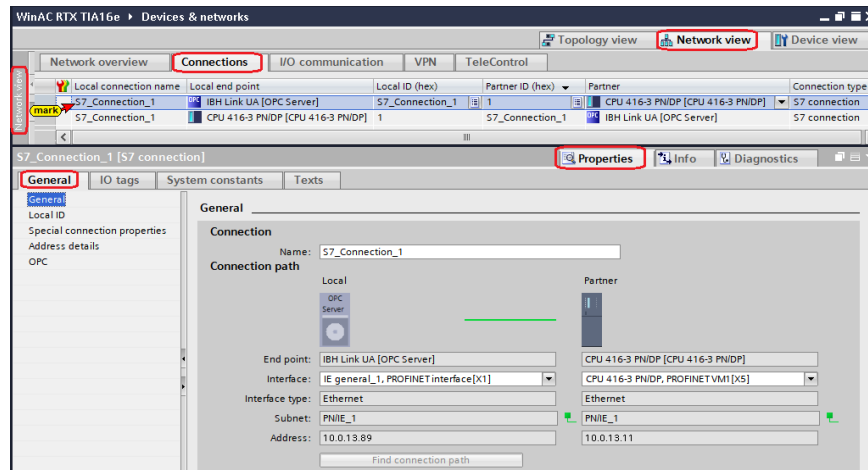
The created S7 connection is displayed.



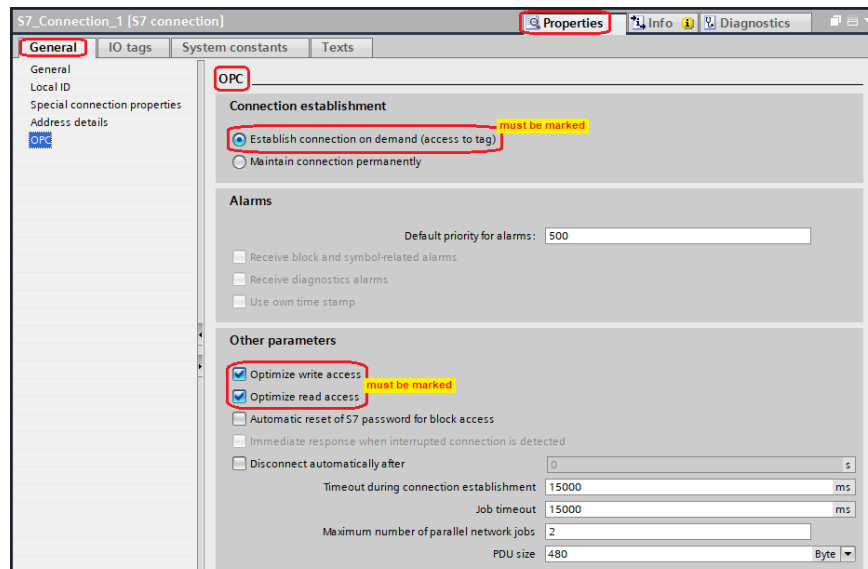
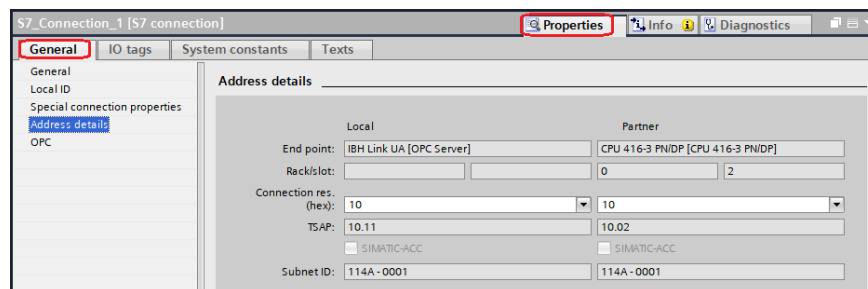
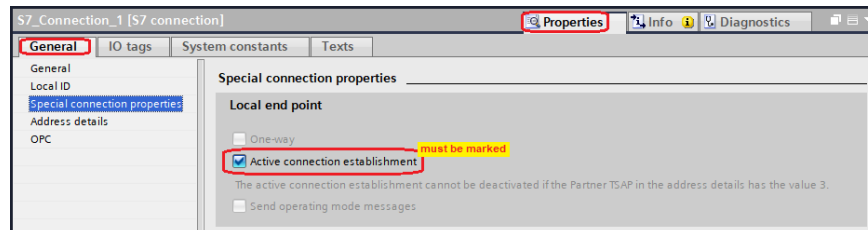
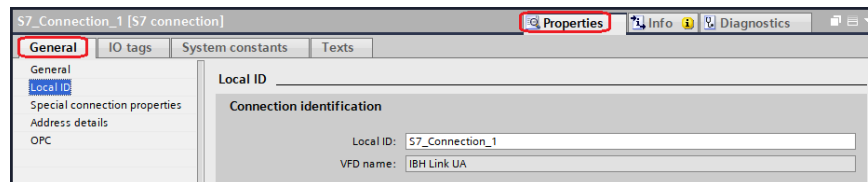
S7 connection - display connection properties



S7 connection - display / set connection properties.



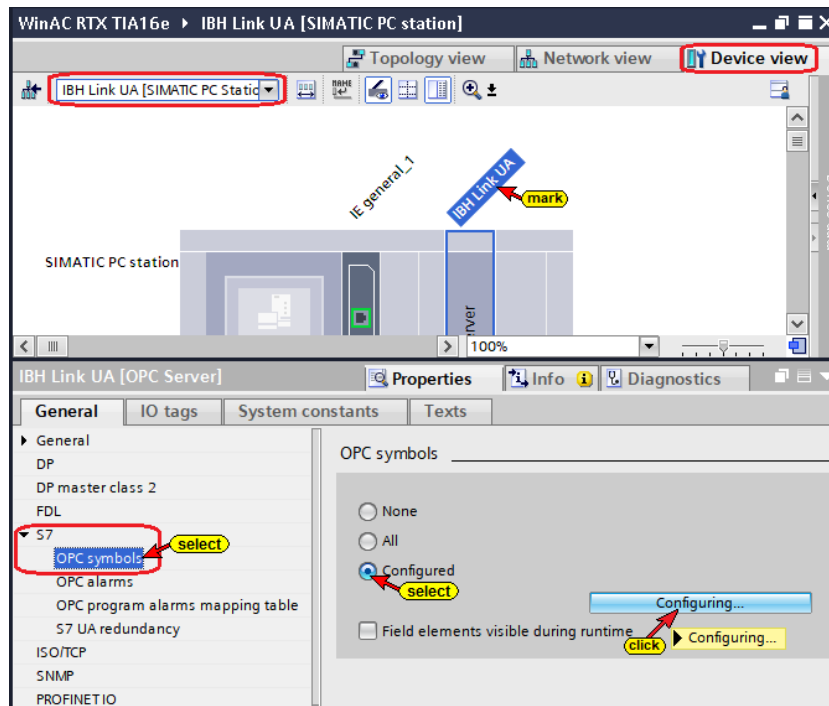
S7 connection - display connection properties



Select OPC symbols (tags) in the OPC configuration

Since the OPC UA identifiers of the variables, Temperature_AirCond1 and TemperatureSetPoint_AirCond1 are required as start values, these variables are defined as OPC symbols and transferred to the OPC server.

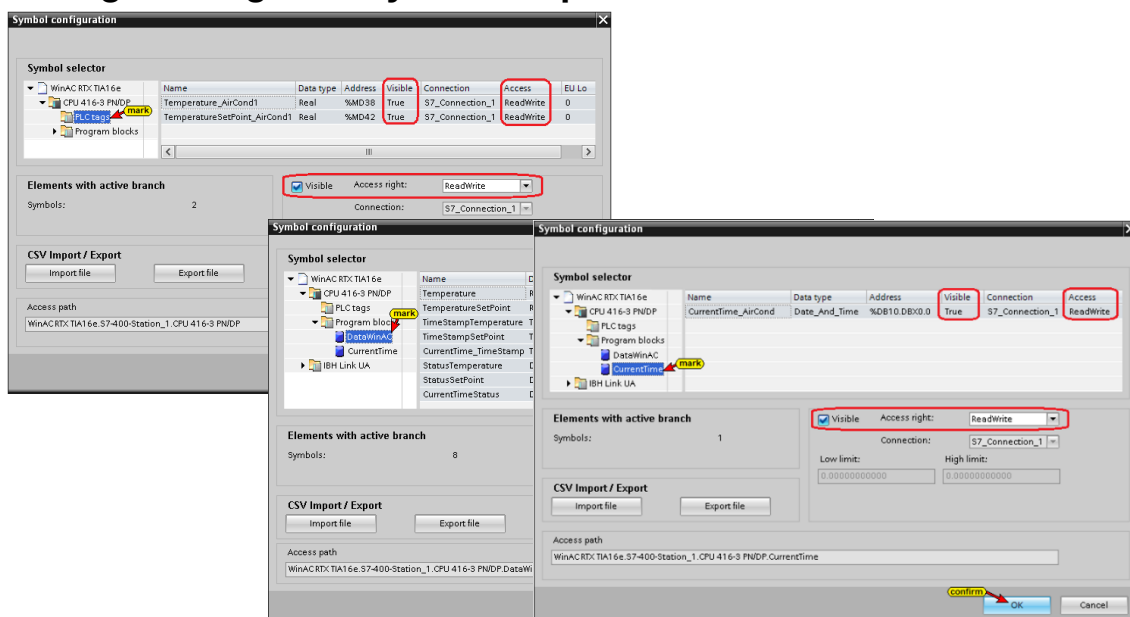
Open the configuration for the **OPC server / properties**.



The **Configure** button opens the Symbol configuration dialog box for OPC tag selection.

The **read / write, etc.** access rights can be assigned to the individual operands (OPC tags).

Configurable global symbolic operands



The PLC-block **USEND** is called in the PLC program of the **CPU WinAC RTX** (SoftPLC in IBH Link-UA). The PLC-block **USEND** requires pointers to OPC variables. These are stored in the data block **DB_USEND [DB20]**.

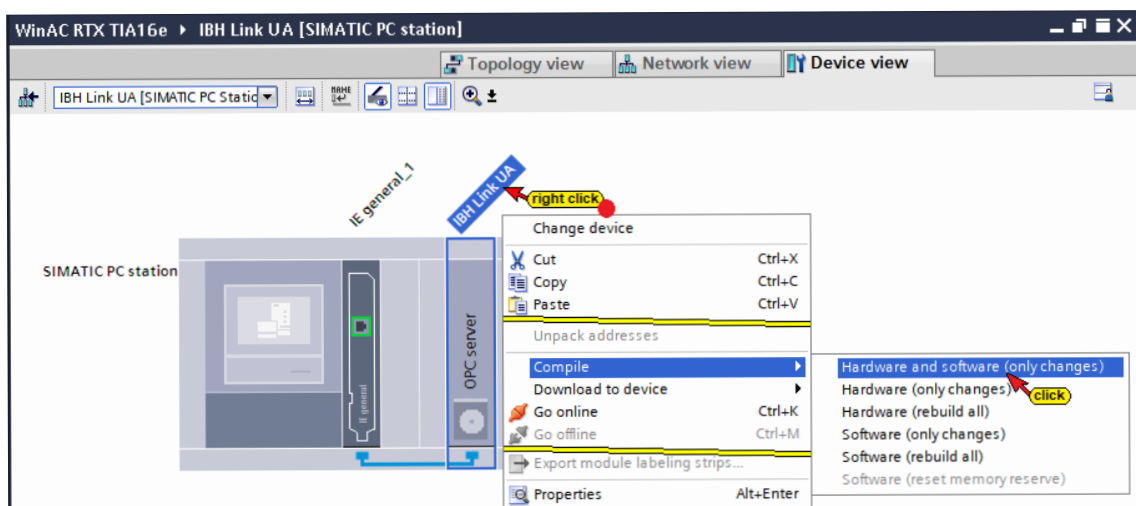
The pointers to OPC variables are generated by copying the identifier from the in the **Attributes** window of the **UAExpert** program. These are assigned to the **STAT** variables in the data block **DB_USEND [DB20]** as initial values.

Note:



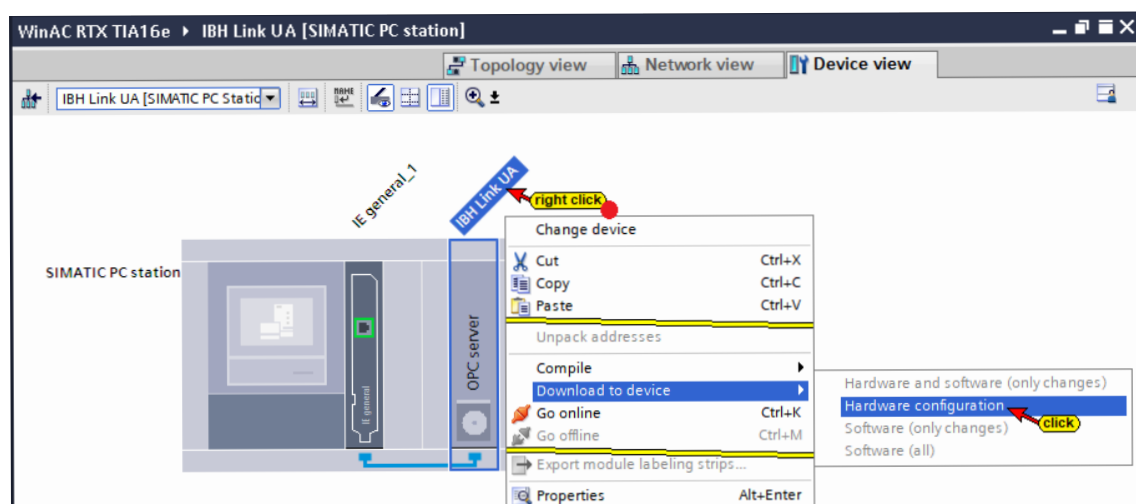
The **Attributes** can only be copied from the **UAExpert** program window after the OPC tags have been attached to the IBH Link UA (OPC UA Server) were transferred.

Compile the configuration of the OPC server

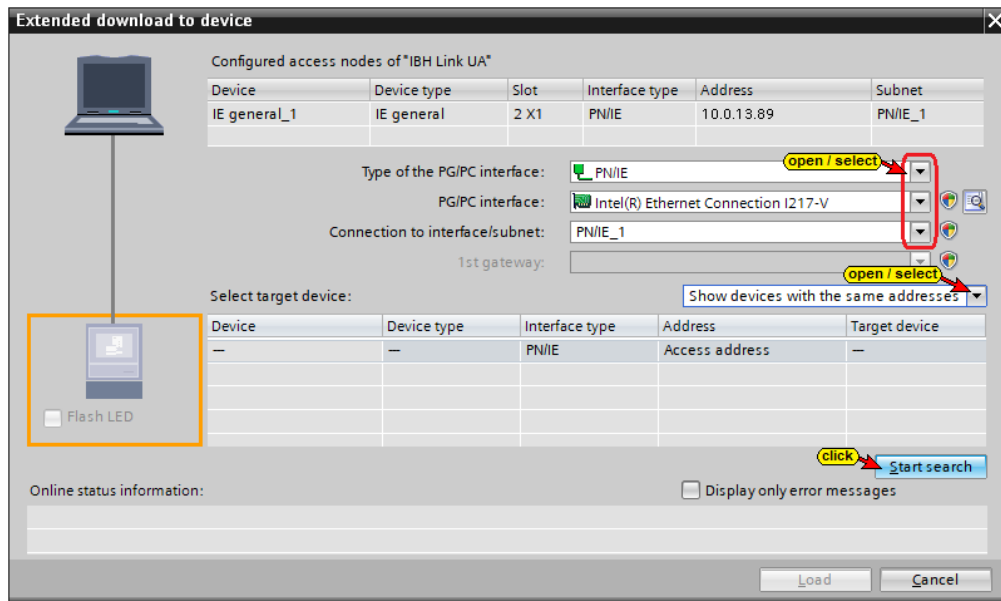


If no error is displayed when the hardware is compiled, the next step is to load the hardware into the IBH Link UA OPC server.

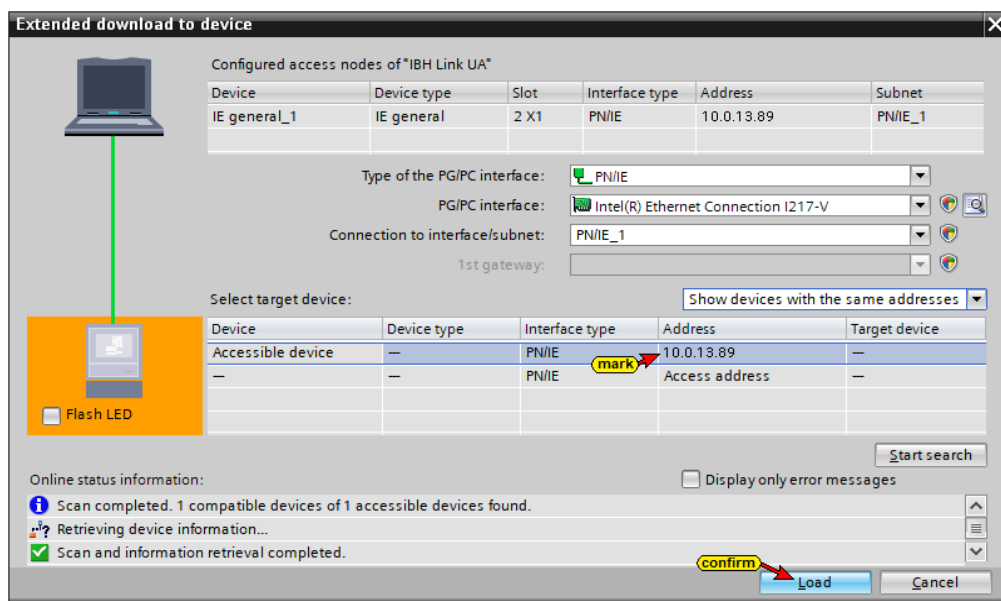
Load configuration of the OPC server into IBH Link UA



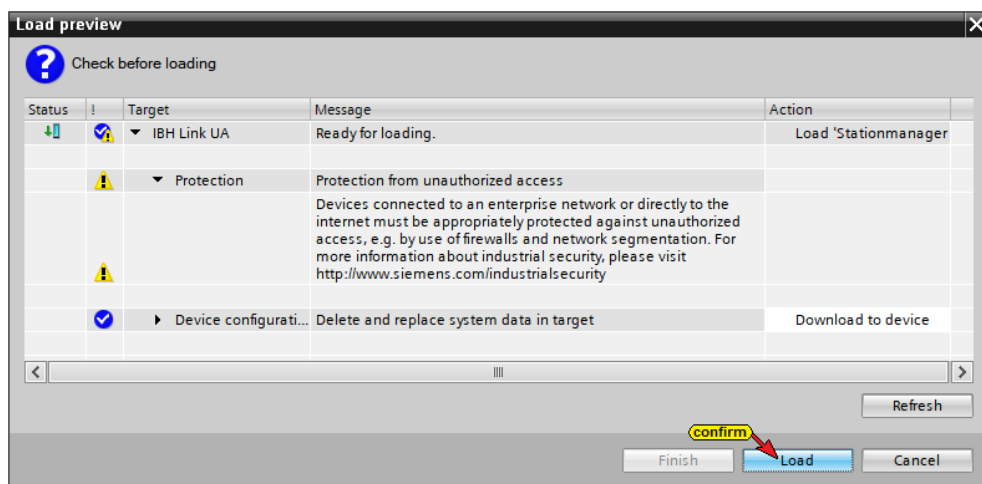
The selection of the interface is displayed.



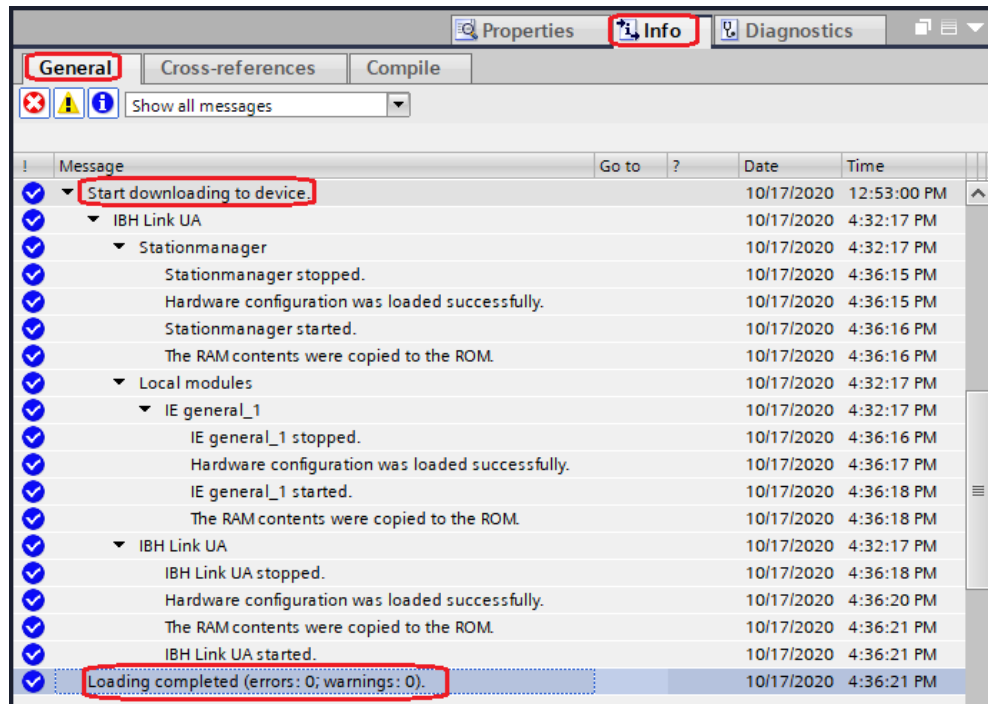
The interface was found



A check is made before loading

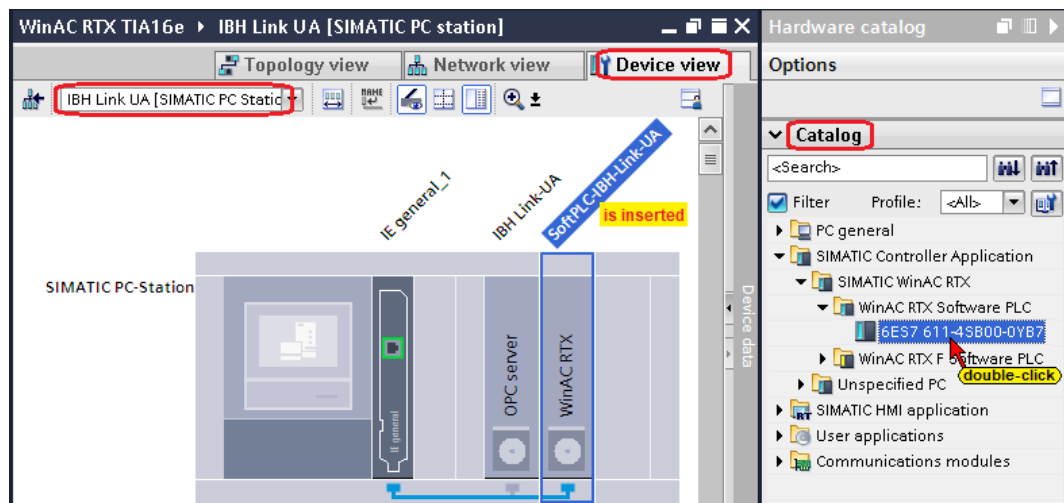


The progress of the loading day is displayed as information.



3.4.5 Insert SoftPLC as SIMATIC WinAC RTX

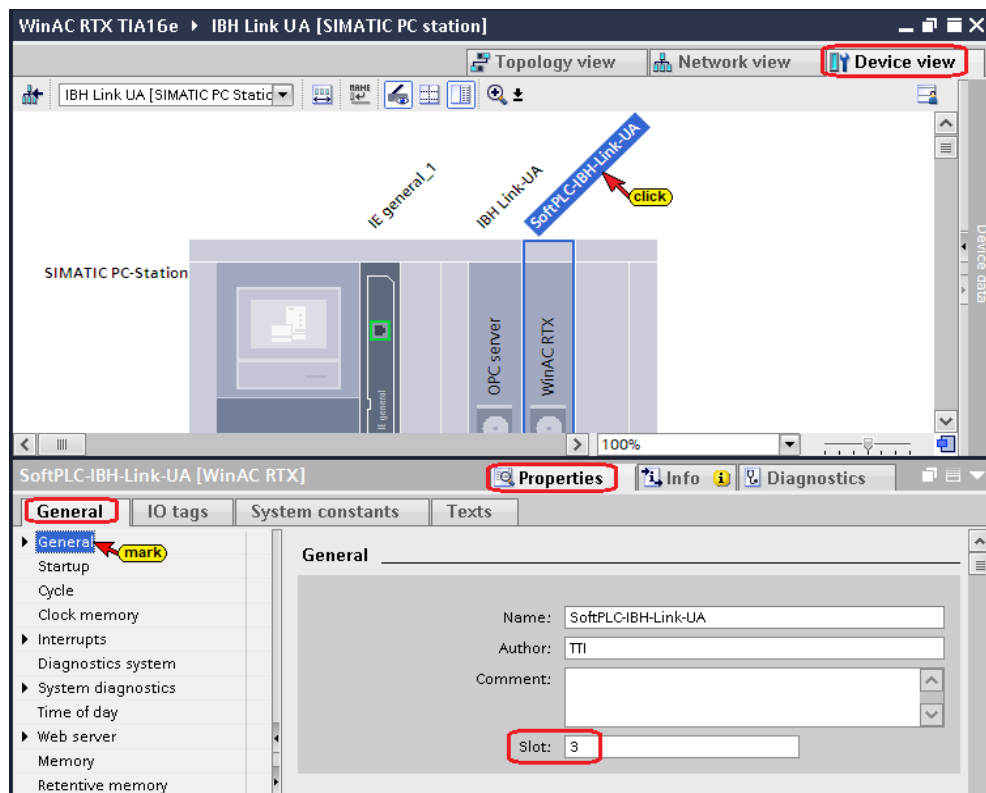
With a double-click on **WinAC RTX Software PLC / 6ES7 611-4SB00-0YB7**, under SIMATIC Controller Application in the right window **Catalog**, the software PLC is inserted.



The **WinAC RTX software PLC / 6ES7 611-4SB00-0YB7** must have firmware version **V4.6**. The **Software PLC_1** have been renamed in **Soft PLC -IBH-Link-UA**.

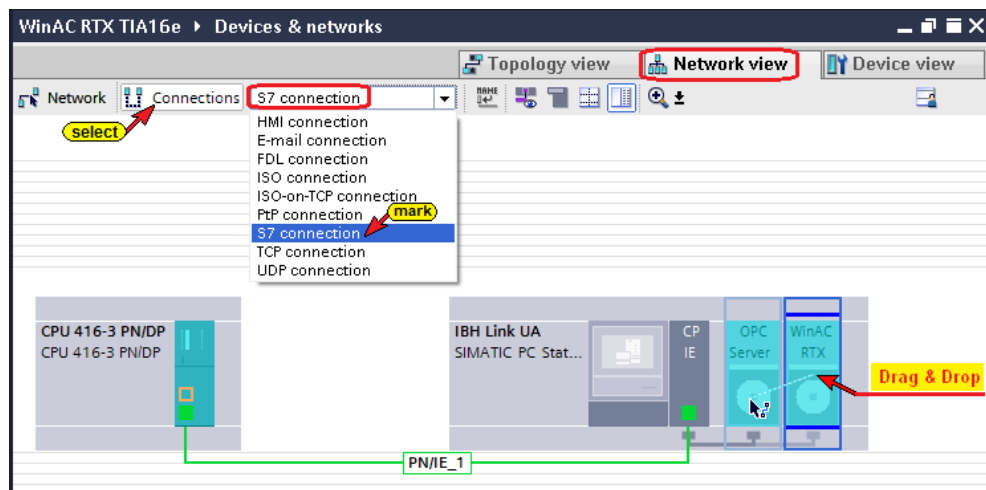
Check the WinAC RTX (Soft-PLC-Link-UA) slot

The soft PLC WinAC RTX was created in **Siemens slot 3** in the IBH Link UA. In the device view, the soft **PLC WinAC RTX (Soft PLC -IBH-Link-UA)** must therefore be in **slot 3**.



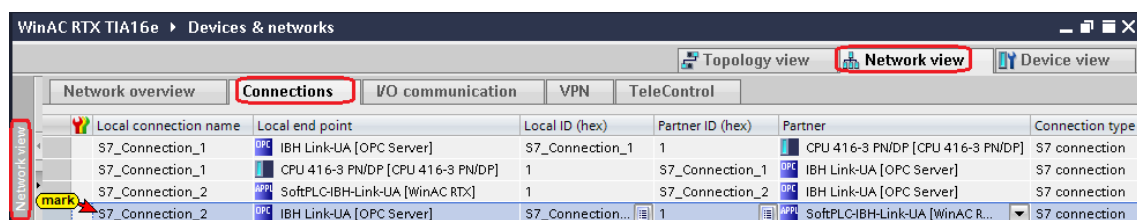
S7 connection - IBH Link UA OPC server - Soft-PLC-Link-UA

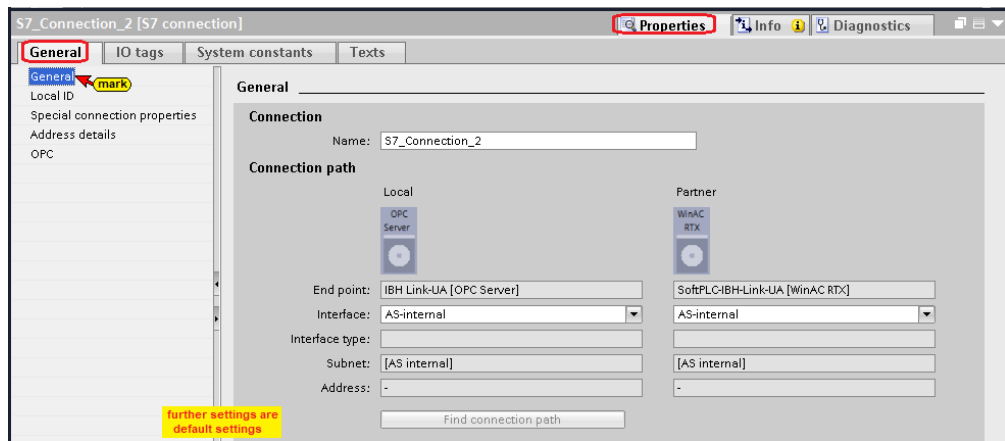
The S7 connection is created via drag and drop from the **Soft-PLC-Link-UA** to the **OPC server**.



The S7 connections between the OPC server and Soft-PLC-Link-UA are displayed as **S7_Connection_2**.

The **S7_Connection_1** is the connection between **CPU 416-3 PN/DP** and the **IBH Link UA (OPC server)**.





3.5 PLC program for the 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 - DataExServer

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

...X TIA16e ▸ IBH Link UA [SIMATIC PC station] ▸ SoftPLC-IBH-Link-UA [WinAC RTX] ▸ Program blocks ▸ DataExServer [DB10]					
DataExServer					
	Name	Data type	Offset	Start value	Comment
1	Static				
2	Temperature	Real	0.0	0.0	Temperature (Value) - from external OPC server
3	TemperatureSetPoint	Real	4.0	0.0	TemperatureSetPoint (Value) - from external OPC server
4	TimeStampTemperature	Date_And_Time	8.0	DT#1990-01-01-00:00:00	Temperature (Time Stamp) - from external OPC server
5	TimeStampSetPoint	Date_And_Time	16.0	DT#1990-01-01-00:00:00	Temperature Set Point (Time Stamp) - from external OPC server
6	TimeStampCurrentTime	Date_And_Time	24.0	DT#1990-01-01-00:00:00	Current Time (Time Stamp) - from external OPC server
7	StatusTemperature	DWord	32.0	16#0	Temperature (Status) - from external OPC server
8	StatusSetPoint	DWord	36.0	16#0	Temperature Set Point (Status) - from external OPC server
9	StatusCurrentTime	DWord	40.0	16#0	Current Time (Status) - from external OPC server

Data block DB 5 – ValueTimeStatus

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.

...H Link UA [SIMATIC PC station] ▸ SoftPLC-IBH-Link-UA [WinAC RTX] ▸ Program blocks ▸ ValueTimeStatus [DB5]					
ValueTimeStatus					
	Name	Data type	Offset	Start value	Comment
1	Static				
2	TemperatureTimeStamp	Time_Of_Day	0.0	TOD#00:00:00	Temperature Time Stamp (to CPU 416)
3	TemperatureSetPointTimeStamp	Time_Of_Day	4.0	TOD#00:00:00	Temperature Set Point Time Stamp (to CPU 416)
4	CurrentTime_TimeStamp	Time_Of_Day	8.0	TOD#00:00:00	Current Time Time Stamp (to CPU 416)
5	Temperature	Real	12.0	0.0	Temperature (to CPU 416)
6	TemperatureSetPoint	Real	16.0	0.0	Temperature Set Point (to CPU 416)
7	TemperatureStatus	DWord	20.0	16#0	Status Temperature (to CPU 416)
8	SetPointStatus	DWord	24.0	16#0	Status Temperature Set Point (to CPU 416)
9	CurrentTimeStatus	DWord	28.0	16#0	Status Current Time (to CPU 416)

Functions FC 8 - DT_TOD and FC 1 - FahrenheitCelsius

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. The **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.

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
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** are 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 in OB 100. Only those parameters are to be transferred to the PLC that has integrated the block (SFB 8 – USEND).

Function FC 20 – calling USEND

The screenshot shows the 'USEND_call [FC20]' block in the LAD editor. The block is titled 'Calling USEND'. It contains two networks:

Network 1: Temperature transfer

Line	Parameter	Value
1	CALL USEND , "DI_USEND"	%DB8
2	Any	
3	REQ	:=TRUE
4	ID	:=W#16#FF78
5	R_ID	:=DW#16#1F40002
6	DONE	:=
7	ERROR	:=
8	STATUS	:=
9	SD_1	:= "DB_USEND_call".OPC_Variable_Name_Temperature
10	SD_2	:= "DataExServer".Temperature
11	SD_3	:= "DataExServer".StatusTemperature
12	SD_4	:= "DataExServer".TimeStampTemperature

Network 2: Set Point temperature transfer

Line	Parameter	Value
1	CALL USEND , "DI_USEND"	%DB8
2	Any	
3	REQ	:=TRUE
4	ID	:=W#16#FF78
5	R_ID	:=DW#16#1F40002
6	DONE	:=
7	ERROR	:=
8	STATUS	:=
9	SD_1	:= "DB_USEND_call".OPC_Variable_Name_SetPoint
10	SD_2	:= "DataExServer".TemperatureSetPoint
11	SD_3	:= "DataExServer".StatusCurrentTime
12	SD_4	:= "DataExServer".TimeStampSetPoint

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.

Note:

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

Data block DB20 - (DB_USEND)

To complete the data block 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.

Identifier from the Attributes window of the UAExpert program

The screenshot displays the UAExpert software interface with the 'Attributes' window open for two variables. The top window shows the attributes for 'TemperatureSetPoint_AirCond1' and the bottom window shows the attributes for 'Temperature_AirCond1'. Both windows have a right-click context menu open with 'Copy Value' selected. Red boxes highlight the Identifier fields in both windows. A 'mark' label points to the 'TemperatureSetPoint_AirCond1' variable in the project tree.

Attribute	Value
NodeID	ns=4;s=S7-400-Station_1.CPU 416-3 PN/DP.GlobalVars.TemperatureSetPoint_AirCond1
NamespaceIndex	4
IdentifierType	String
Identifier	S7-400-Station_1.CPU 416-3 PN/DP.GlobalVars.TemperatureSetPoint_AirCond1
NodeClass	Variable
BrowseName	4, "TemperatureSetPoint_AirCond1"
DisplayName	"", "TemperatureSetPoint_AirCond1"
Description	
WriteMask	0
UserWriteMask	0
RolePermissions	BadAttributeInvalid (0x80350000)
UserRolePermissions	BadAttributeInvalid (0x80350000)
AccessRestrictions	BadAttributeInvalid (0x80350000)
Value	
SourceTimestamp	27.10.2020 17:43:13.564
SourcePicoSeconds	0
ServerTimestamp	27.10.2020 17:43:13.565
ServerPicoSeconds	0
StatusCode	Good (0x00000000)
Value	0
DataType	Float
NamespaceIndex	0
IdentifierType	Numeric
Identifier	10 [Float]
ValueRank	-1 (Scalar)
ArrayDimensions	BadAttributeInvalid (0x80350000)
AccessLevel	CurrentRead, CurrentWrite
UserAccessLevel	CurrentRead, CurrentWrite
AccessLevelEx	BadAttributeInvalid (0x80350000)
MinimumSamplingInterval	50
Historizing	false

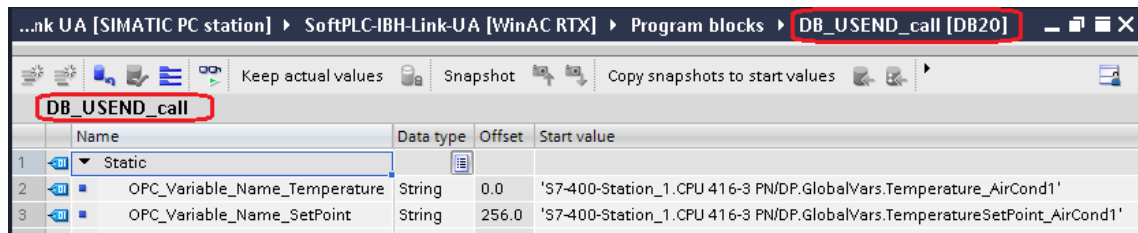
Attribute	Value
NodeID	ns=4;s=S7-400-Station_1.CPU 416-3 PN/DP.GlobalVars.Temperature_AirCond1
NamespaceIndex	4
IdentifierType	String
Identifier	S7-400-Station_1.CPU 416-3 PN/DP.GlobalVars.Temperature_AirCond1
NodeClass	Variable
BrowseName	4, "Temperature_AirCond1"
DisplayName	"", "Temperature_AirCond1"
Description	
WriteMask	0
UserWriteMask	0

TemperatureSetPoint_AirCond1

Attribute	Value
NamespaceIndex	4
IdentifierType	String
Identifier	S7-400-Station_1.CPU 416-3 PN/DP.GlobalVars.TemperatureSetPoint_AirCond1

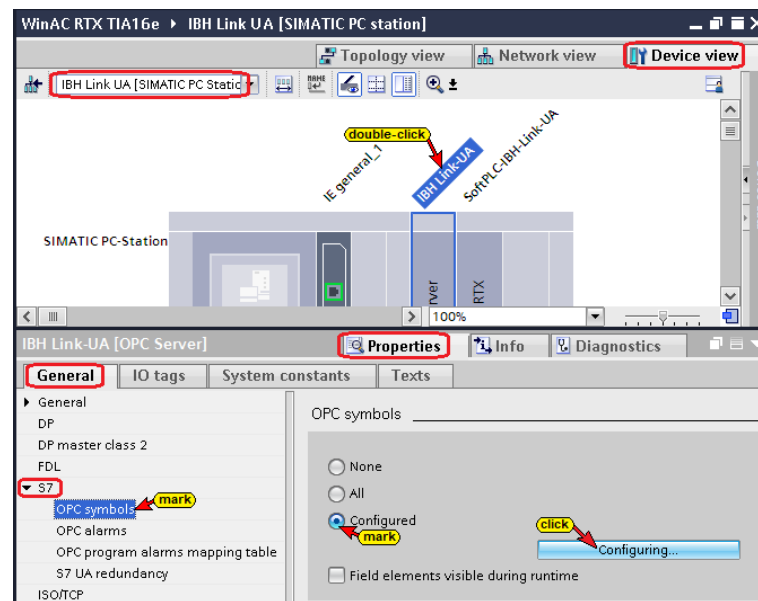
Temperature_AirCond1

Attribute	Value
NamespaceIndex	4
IdentifierType	String
Identifier	S7-400-Station_1.CPU 416-3 PN/DP.GlobalVars.Temperature_AirCond1



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

3.5.1 Configuring S7 OPC symbols

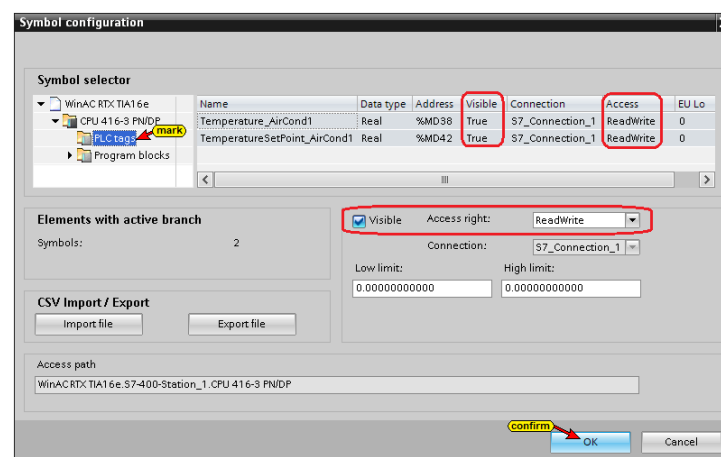


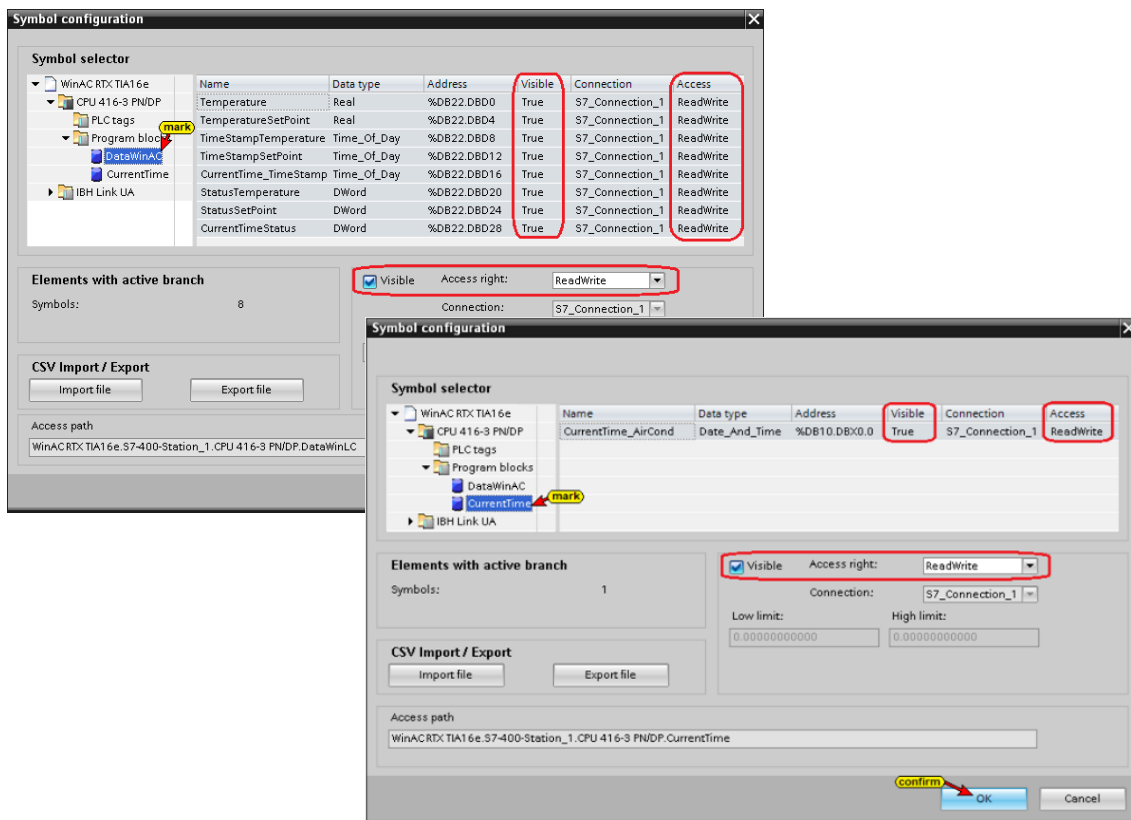
Configuring OPC tags - CPU 416-3 PN / DP

The **Configure** button opens a dialog box in which the defined operands can be selected as **OPC tags**. The tag management of the CPUs is known through the previously configured S7 connections.

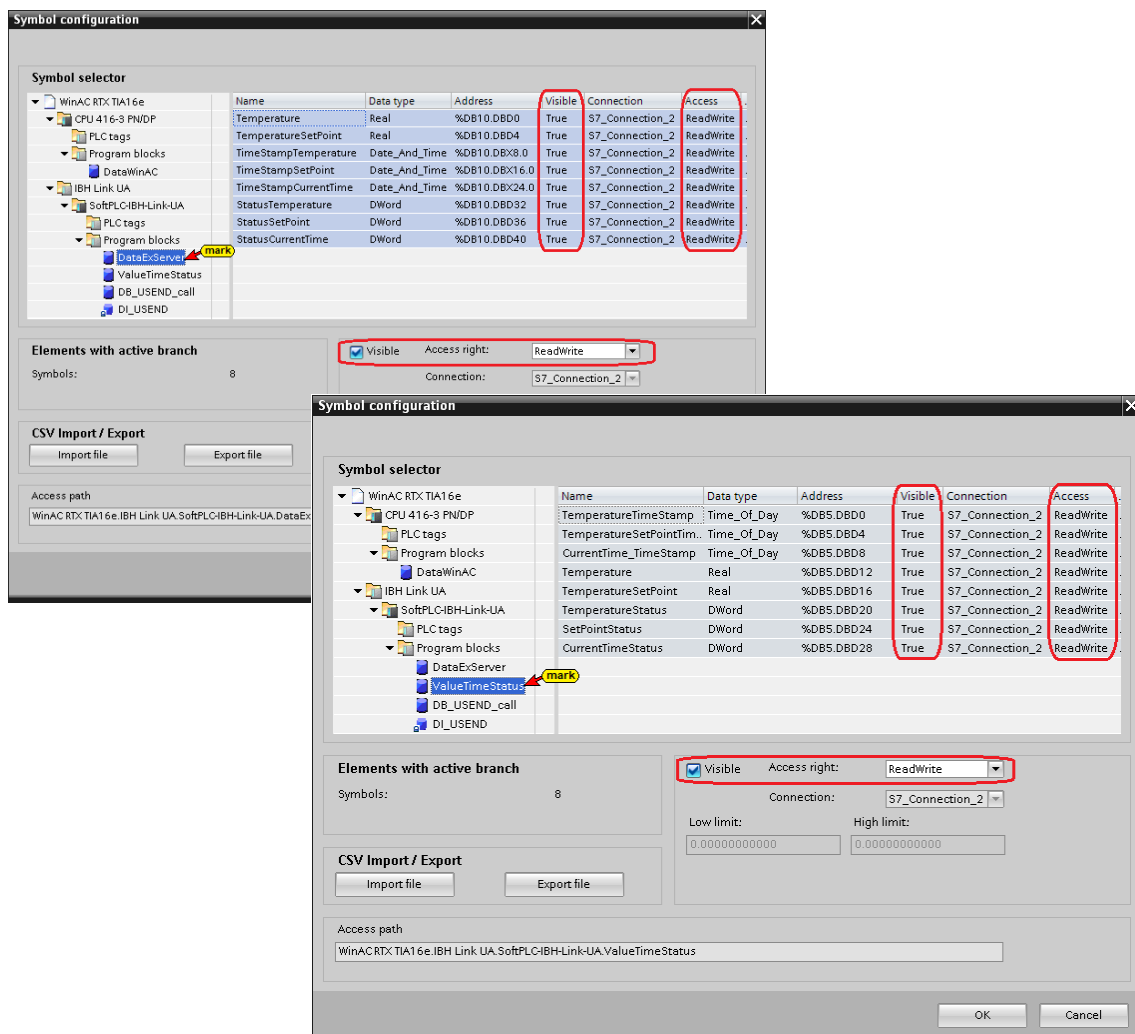
Only the OPC tags that are used for the transfer should be selected.

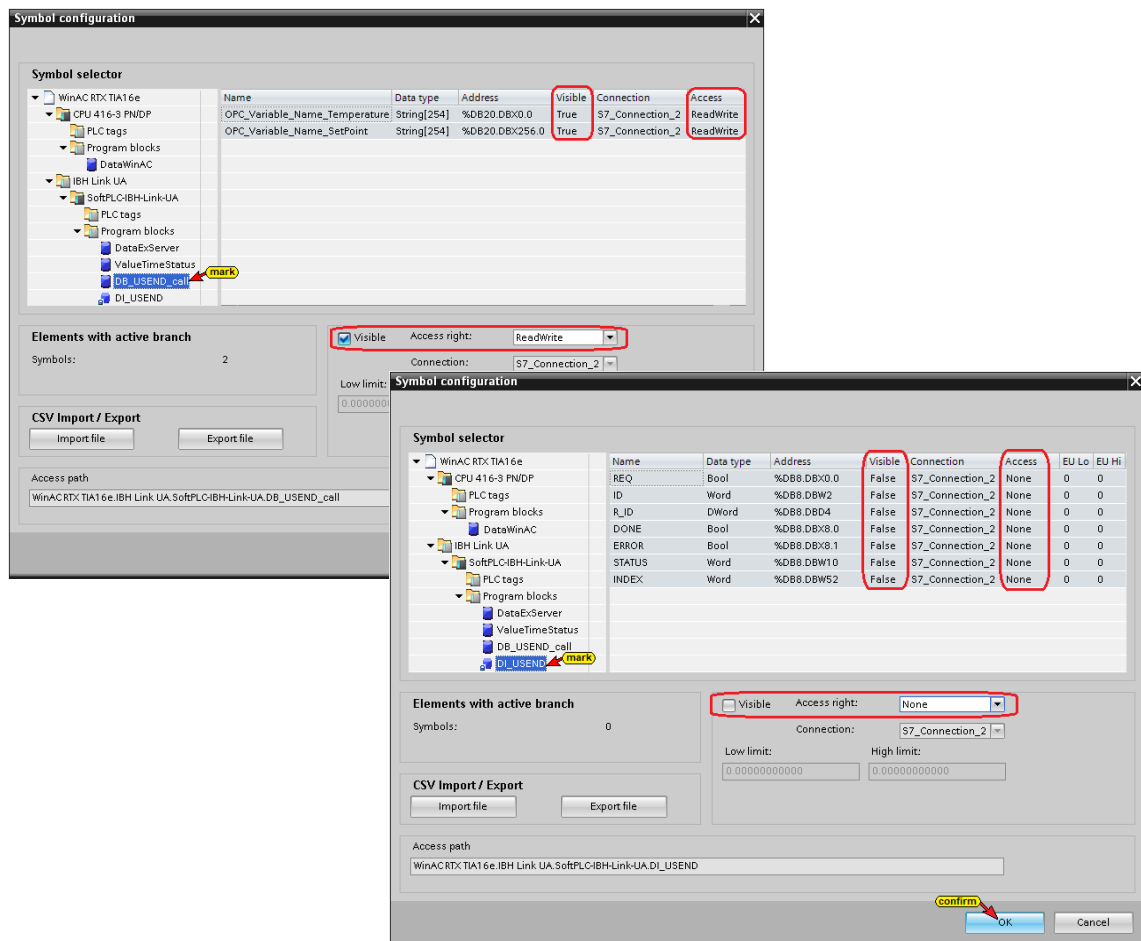
These OPC tags have already been selected for copying the identifiers from the **Attributes** window of the **UAExpert** program.





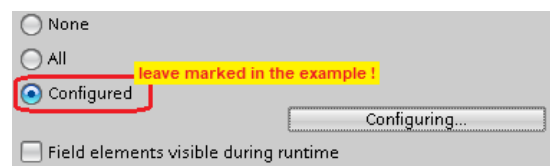
Configure OPC tags - Soft-PLC - IBH Link UA





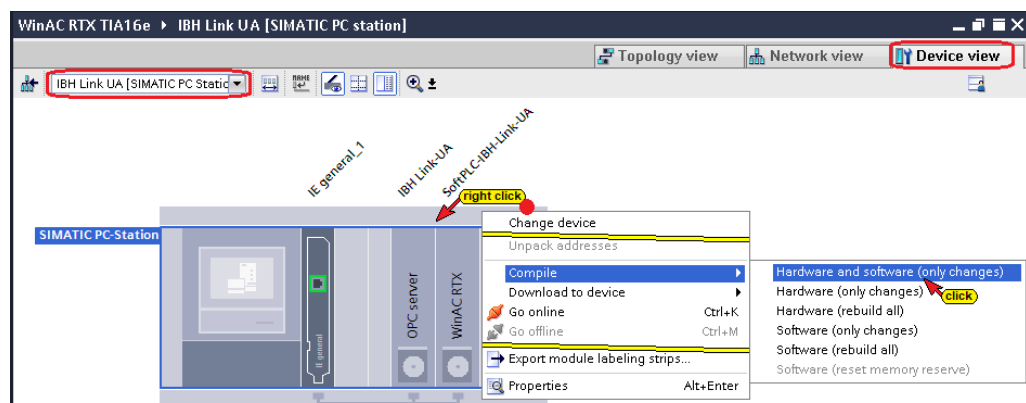
Selection of the OPC tags (symbols) in the OPC configuration

Since not all global symbolic operands or data from data blocks should be used as OPC tags, the configured items in the Properties - OPC server dialog box must remain selected.



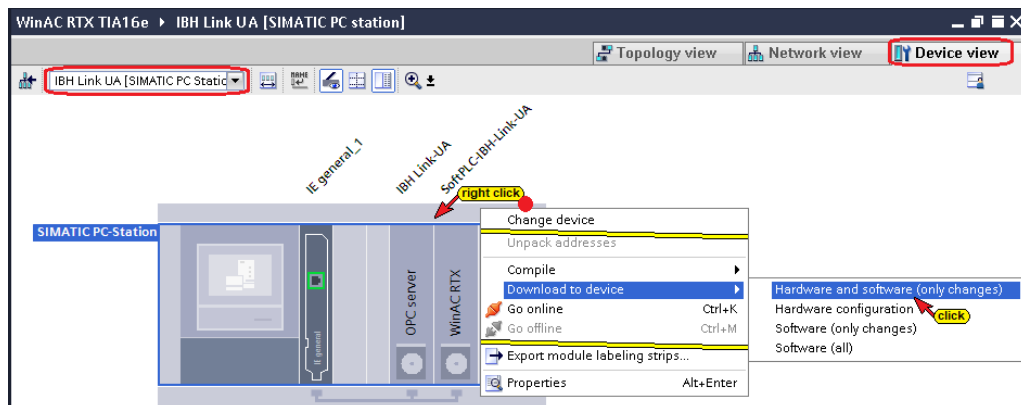
Compile hardware and software for the IBH Link UA

Compile hardware and software with the command from the context menu.

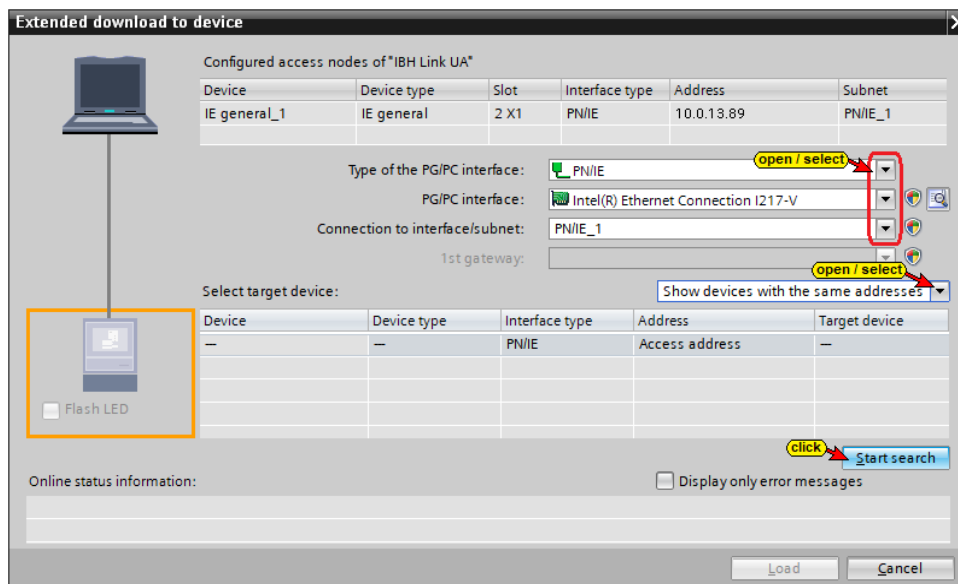


Load hardware and software into the IBH Link UA

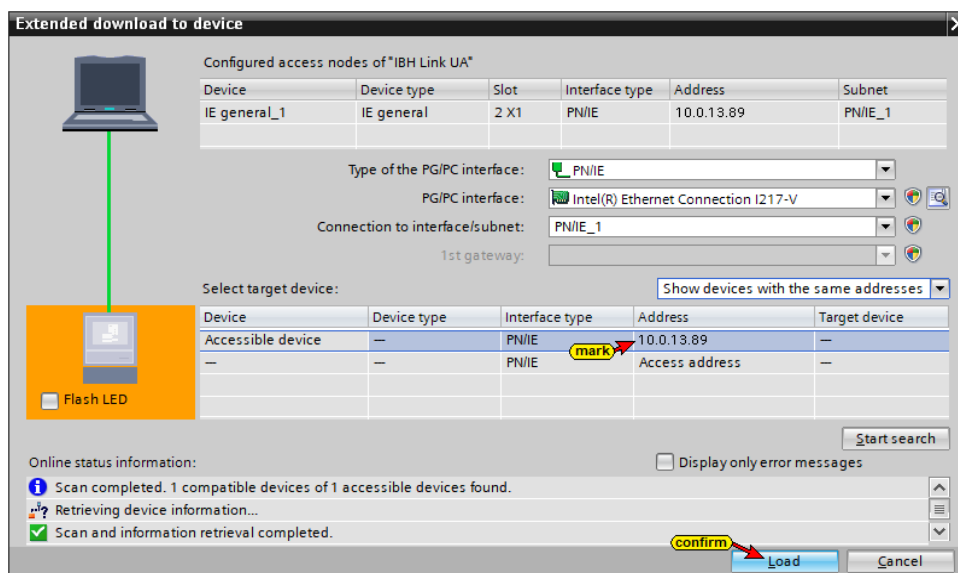
If no error was detected during compilation, the configuration can be loaded into the IBH Link UA.



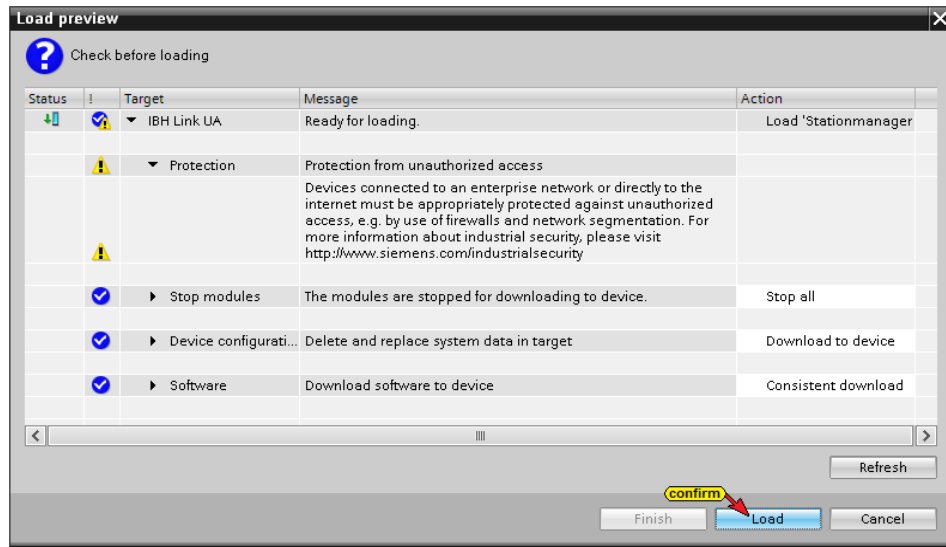
The hardware and software download command opens the **Extended download to device** dialog box.



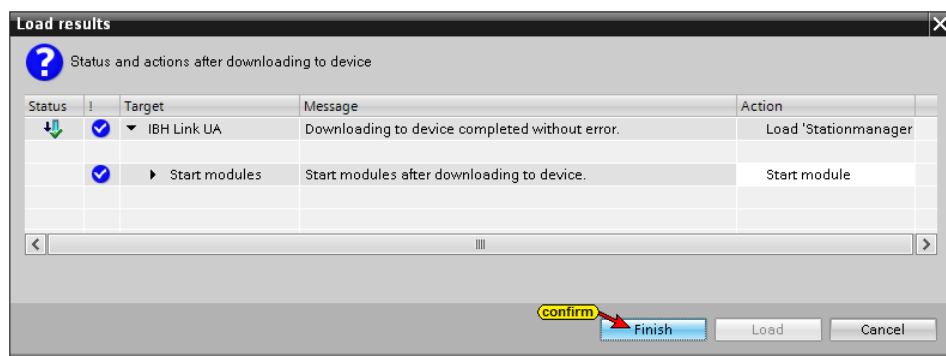
The successful search is displayed.



A preview of the loading is displayed.

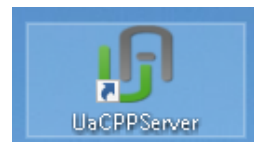


Finish loading

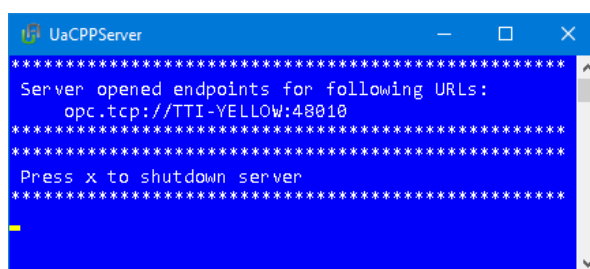


3.5.2 Start external OPC UA server

If the external OPC UA server is no longer active, it must be started. Double-click the **UA Server** icon to start the program (from **UnitedAutomation**) that simulates several air conditioning and heating systems and provides operating data (temperature, time stamp, etc.) as OPC UA tags (see IBH Link UA Manual Part 1 V5.18, chapter 2.4).



External OPC UA server (air conditioning and heating systems)



The OPC UA server for the data exchange must be specified (see chapter 2.1.1 - page 5).

3.5.3 Establishing a connection with the OPC server variables via the OPC UA client function

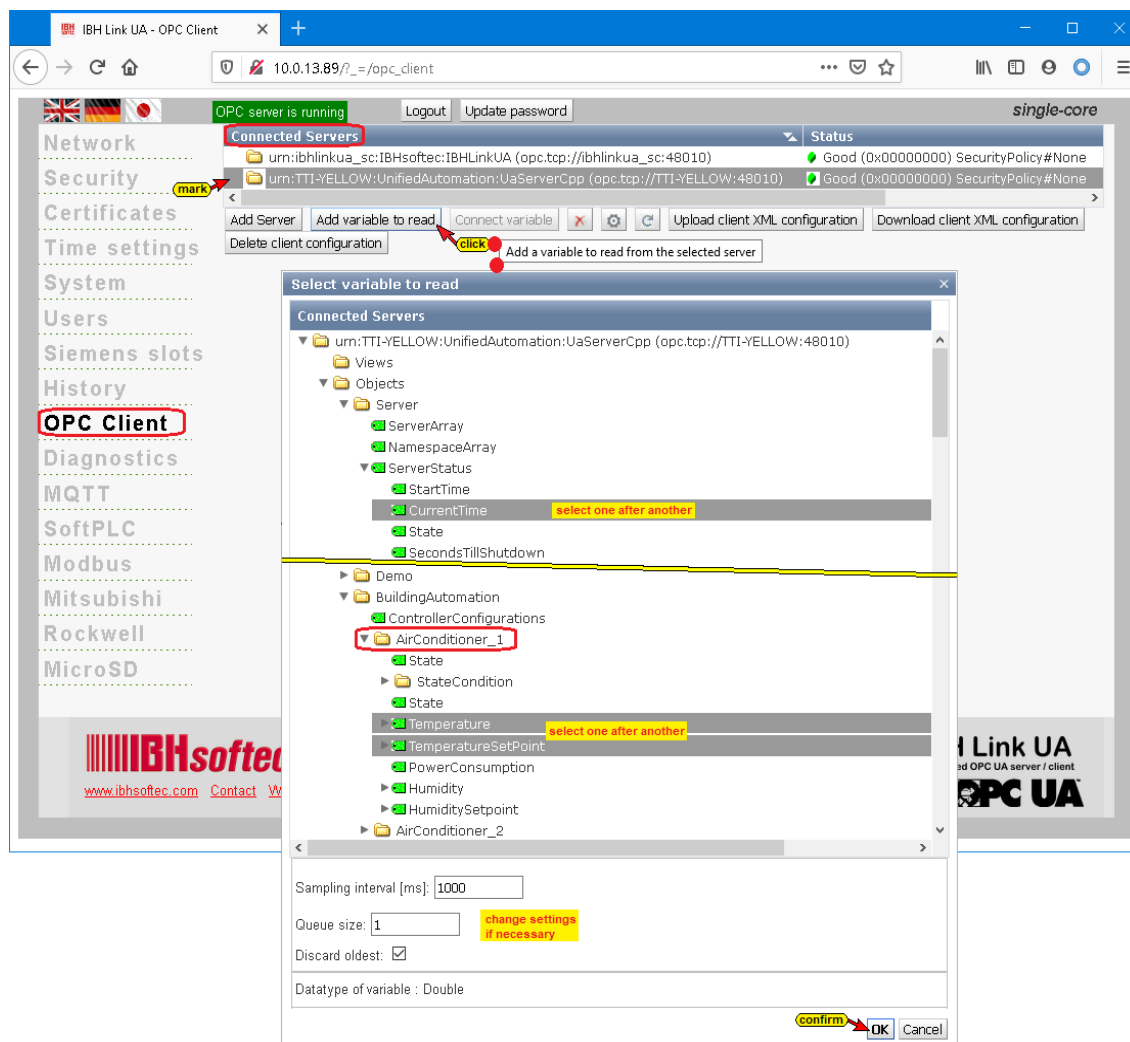
A connection with the OPC server variables is established via the OPC UA client function.

The OPC tags provided by the air conditioner (OPC server variable) are selected in the OPC client browser window.

AirConditioner_1 → Add read variable

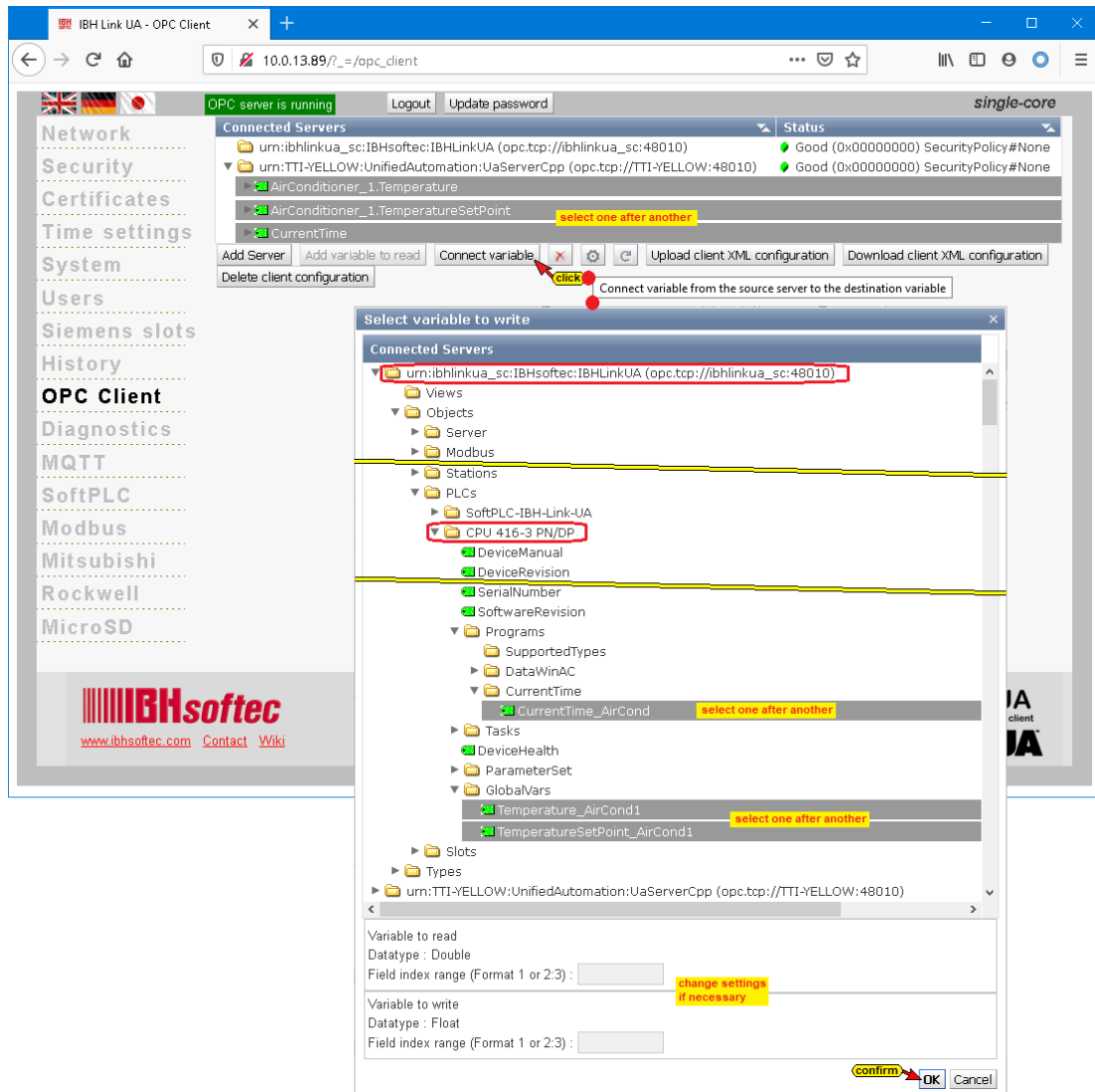
The two variables **Temperature**, **TemperatureSetPoint**, and **CurrentTime** that the external OPC UA server makes available are declared as read variables.

The **OPC UA client** in the **IBH Link UA** reads this data.

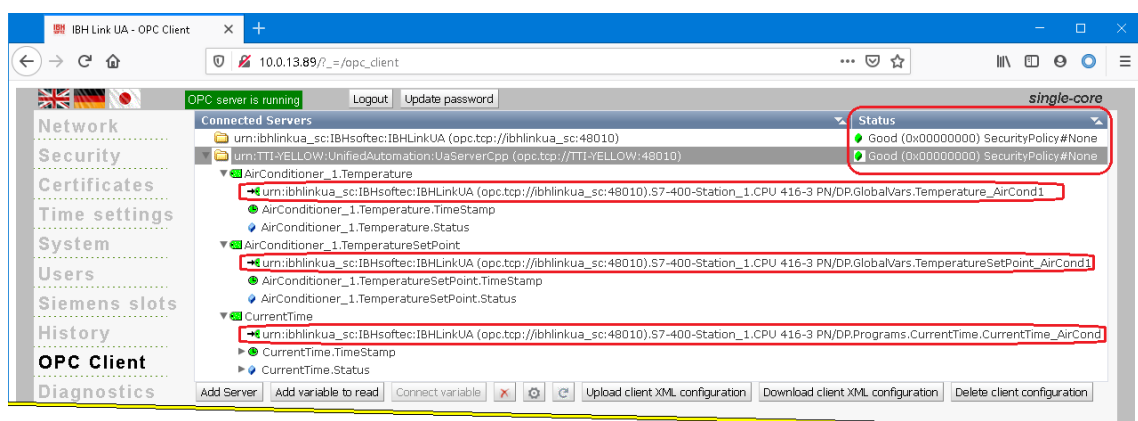


Connect with variables

The variables **Temperature**, **TemperatureSetPoint**, and **CurrentTime** which have been declared as read variables, are connected to the IBH Link UA OPC server, which then sends them to the PLC program of the CPU 416-3 PN/DP.

Variable (OPC Tags) **GlobalVars** and Data block **CurrentTime**.

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



UaExpert – Program Window –

In the UaExpert program window, the values of the OPC tags of the **SoftPLC-IBH-Link-UA [WinAC RTX]** are displayed under **Data Access View**.

Data Access View

#	Server	Node Id	Display Name	Value	Datatype	Source Timestamp	Server Timestamp	Statuscode
1	IBHLinkUA@...	NS4 String ...	StatusCurrentTime	0	UInt32	17:30:32.036	17:30:32.920	Good
2	IBHLinkUA@...	NS4 String ...	StatusSetPoint	0	UInt32	17:30:40.120	17:30:40.923	Good
3	IBHLinkUA@...	NS4 String ...	StatusTemperature	0	UInt32	17:30:42.890	17:30:43.674	Good
4	IBHLinkUA@...	NS4 String ...	Temperature	59.9869	Float	17:33:01.563	17:33:01.814	Good
5	IBHLinkUA@...	NS4 String ...	TemperatureSetPoint	60	Float	17:30:48.049	17:30:48.925	Good
6	IBHLinkUA@...	NS4 String ...	TimeStampCurrentTime	2020-10-28T16:33:01.371Z	DateTime	17:33:01.563	17:33:01.814	Good
7	IBHLinkUA@...	NS4 String ...	TimeStampSetPoint	2020-10-28T16:33:01.385Z	DateTime	17:33:01.563	17:33:01.814	Good
8	IBHLinkUA@...	NS4 String ...	TemperatureStatus	0	UInt32	17:31:25.871	17:31:26.477	Good
9	IBHLinkUA@...	NS4 String ...	CurrentTimeStatus	0	UInt32	17:33:01.563	17:33:01.814	Good
10	IBHLinkUA@...	NS4 String ...	CurrentTime_TimeStamp	59581555	UInt32	17:31:31.077	17:31:31.977	Good
11	IBHLinkUA@...	NS4 String ...	SetPointStatus	0	UInt32	17:33:01.563	17:33:01.814	Good
12	IBHLinkUA@...	NS4 String ...	Temperature	15.5483	Float	17:33:01.563	17:33:01.814	Good
13	IBHLinkUA@...	NS4 String ...	TemperatureSetPoint	15.5556	Float	17:31:35.415	17:31:35.980	Good
14	IBHLinkUA@...	NS4 String ...	TemperatureSetPointTime...	59581385	UInt32	17:33:01.563	17:33:01.814	Good
15	IBHLinkUA@...	NS4 String ...	TemperatureStatus	0	UInt32	17:31:38.825	17:31:39.482	Good
16	IBHLinkUA@...	NS4 String ...	TemperatureTimeStamp	59581385	UInt32	17:33:01.563	17:33:01.814	Good

Programs

- DB_USEND_call
- DI_USEND
- DataExServer
 - StatusCurrentTime
 - StatusSetPoint
 - StatusTemperature
 - Temperature
 - TemperatureSetPoint
 - TimeStampCurrentTime
 - TimeStampSetPoint
 - TimeStampTemperature
- SupportedTypes
- ValueTimeStatus
 - CurrentTimeStatus
 - CurrentTime_TimeStamp
 - SetPointStatus
 - Temperature
 - TemperatureSetPoint
 - TemperatureSetPointTimeStamp
 - TemperatureStatus
 - TemperatureTimeStamp

Display Name

Display Name	Value	Datatype
StatusCurrentTime	0	UInt32
StatusSetPoint	0	UInt32
StatusTemperature	0	UInt32
Temperature	59.9921	Float
TemperatureSetPoint	60	Float
TimeStampCurrentTime	2020-10-28T16:49:06.357Z	DateTime
TimeStampSetPoint	2020-10-28T16:49:06.782Z	DateTime
TimeStampTemperature	2020-10-28T16:49:06.782Z	DateTime
CurrentTimeStatus	0	UInt32
CurrentTime_TimeStamp	60547515	UInt32
SetPointStatus	0	UInt32
Temperature	15.5511	Float
TemperatureSetPoint	15.5556	Float
TemperatureSetPointTimeStamp	60546782	UInt32
TemperatureStatus	0	UInt32
TemperatureTimeStamp	60546782	UInt32

#

#	Server	Node Id	Display Name
1	IBHLinkUA@ibhlinkua_sc	NS4 String IBH Link UA.SoftPLC-IBH-Link-UA.Programs.DataExServer.StatusCurrentTime	StatusCurrentTime
2	IBHLinkUA@ibhlinkua_sc	NS4 String IBH Link UA.SoftPLC-IBH-Link-UA.Programs.DataExServer.StatusSetPoint	StatusSetPoint
3	IBHLinkUA@ibhlinkua_sc	NS4 String IBH Link UA.SoftPLC-IBH-Link-UA.Programs.DataExServer.StatusTemperature	StatusTemperature
4	IBHLinkUA@ibhlinkua_sc	NS4 String IBH Link UA.SoftPLC-IBH-Link-UA.Programs.DataExServer.Temperature	Temperature
5	IBHLinkUA@ibhlinkua_sc	NS4 String IBH Link UA.SoftPLC-IBH-Link-UA.Programs.DataExServer.TemperatureSetPoint	TemperatureSetPoint
6	IBHLinkUA@ibhlinkua_sc	NS4 String IBH Link UA.SoftPLC-IBH-Link-UA.Programs.DataExServer.TimeStampCurrentTime	TimeStampCurrentTime
7	IBHLinkUA@ibhlinkua_sc	NS4 String IBH Link UA.SoftPLC-IBH-Link-UA.Programs.DataExServer.TimeStampSetPoint	TimeStampSetPoint
8	IBHLinkUA@ibhlinkua_sc	NS4 String IBH Link UA.SoftPLC-IBH-Link-UA.Programs.DataExServer.TimeStampTemperature	TimeStampTemperature
9	IBHLinkUA@ibhlinkua_sc	NS4 String IBH Link UA.SoftPLC-IBH-Link-UA.Programs.ValueTimeStatus.CurrentTimeStatus	CurrentTimeStatus
10	IBHLinkUA@ibhlinkua_sc	NS4 String IBH Link UA.SoftPLC-IBH-Link-UA.Programs.ValueTimeStatus.CurrentTime_TimeStamp	CurrentTime_TimeStamp
11	IBHLinkUA@ibhlinkua_sc	NS4 String IBH Link UA.SoftPLC-IBH-Link-UA.Programs.ValueTimeStatus.SetPointStatus	SetPointStatus
12	IBHLinkUA@ibhlinkua_sc	NS4 String IBH Link UA.SoftPLC-IBH-Link-UA.Programs.ValueTimeStatus.Temperature	Temperature
13	IBHLinkUA@ibhlinkua_sc	NS4 String IBH Link UA.SoftPLC-IBH-Link-UA.Programs.ValueTimeStatus.TemperatureSetPoint	TemperatureSetPoint
14	IBHLinkUA@ibhlinkua_sc	NS4 String IBH Link UA.SoftPLC-IBH-Link-UA.Programs.ValueTimeStatus.TemperatureSetPointTimeStamp	TemperatureSetPointTimeStamp
15	IBHLinkUA@ibhlinkua_sc	NS4 String IBH Link UA.SoftPLC-IBH-Link-UA.Programs.ValueTimeStatus.TemperatureStatus	TemperatureStatus
16	IBHLinkUA@ibhlinkua_sc	NS4 String IBH Link UA.SoftPLC-IBH-Link-UA.Programs.ValueTimeStatus.TemperatureTimeStamp	TemperatureTimeStamp

IBH Link UA diagnosis and SoftPLC displays

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

Controller diagnostics

ID	Connection name	Address	Time	Source	Error number	Error Text
1-2	S7_Connection_2	127.0.0.1:102	28.10.2020 16:27:57	PLC	0	Connection established (6ES7 611-4SB00-0YB7)
1-1	S7_Connection_1	10.0.13.11:102	28.10.2020 16:27:57	PLC	0	Connection established (6ES7 416-3ER05-0AB0)

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

SoftPLC Connections

Status	Access	OPC Variable	PLC Variable	Sampling Interval
Good	Read	ns=4;s=S7-400-Station_1.CPU 416-3 PN/DP.GlobalVars.Temperature_AirCond1	P#DB10.DBX0.0 REAL 1	500
Good	Read	ns=4;s=S7-400-Station_1.CPU 416-3 PN/DP.GlobalVars.TemperatureSetPoint_AirCond1	P#DB10.DBX4.0 REAL 1	500
Good	Read	ns=4;s=S7-400-Station_1.CPU 416-3 PN/DP.Programs.CurrentTime.CurrentTime_AirCond	P#DB10.DBX24.0 BYTE 8	500

Online display SoftPLC-Link-UA [WinAC RTX] - Watch table_1

The transferred or converted values are displayed.

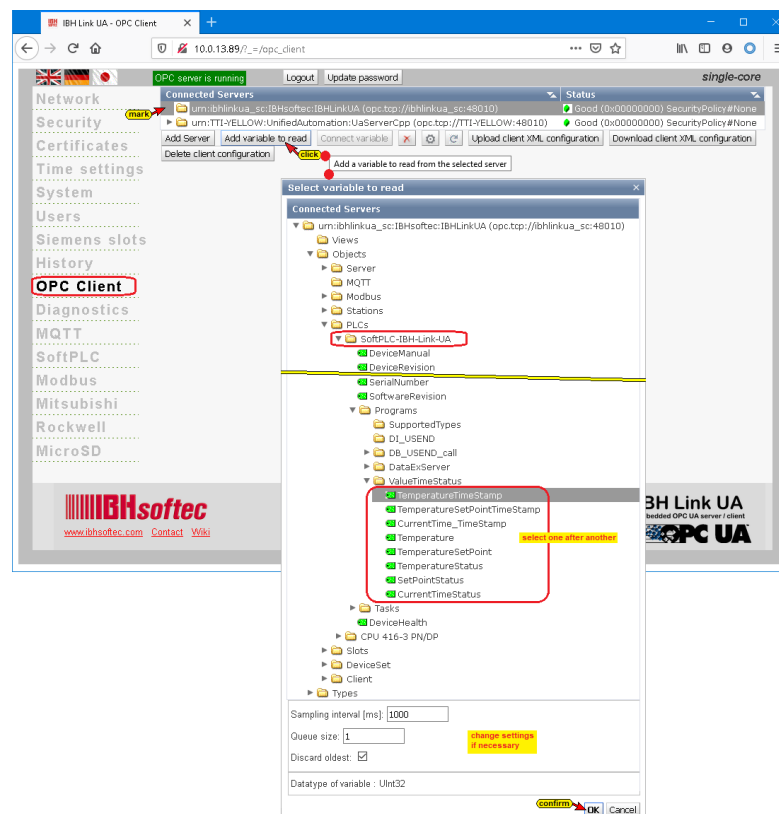
The values of DB10 (**DataExServer**) were transferred with the help of USEND. The values of DB5 (**ValueTimeStatus**) are converted values and will be made available to the CPU 416-3 PN / DP with the next steps.

	Name	Address	Display format	Monitor value
1	"ValueTimeStatus".TemperatureTimeStamp	%DB5.DBD0	TIME_OF_DAY	TOD#17:20:27.107
2	"ValueTimeStatus".TemperatureSetPointTimeStamp	%DB5.DBD4	TIME_OF_DAY	TOD#17:20:27.107
3	"ValueTimeStatus".CurrentTime_TimeStamp	%DB5.DBD8	TIME_OF_DAY	TOD#17:20:27.696
4	"ValueTimeStatus".Temperature	%DB5.DBD12	Floating-point number	15.55693
5	"ValueTimeStatus".TemperatureSetPoint	%DB5.DBD16	Floating-point number	15.55556
6	"ValueTimeStatus".TemperatureStatus	%DB5.DBD20	Hex	16#0000_0000
7	"ValueTimeStatus".SetPointStatus	%DB5.DBD24	Hex	16#0000_0000
8	"ValueTimeStatus".CurrentTimeStatus	%DB5.DBD28	Hex	16#0000_0000
9	"DataExServer".Temperature	%DB10.DBD0	Floating-point number	60.00248
10	"DataExServer".TemperatureSetPoint	%DB10.DBD4	Floating-point number	60.0
11	"DataExServer".TimeStampTemperature	F#DB10.DBX8.0	DATE_AND_TIME	DT#2020-10-28-17:20:27.107
12	"DataExServer".TimeStampSetPoint	F#DB10.DBX16.0	DATE_AND_TIME	DT#2020-10-28-17:20:27.107
13	"DataExServer".TimeStampCurrentTime	F#DB10.DBX24.0	DATE_AND_TIME	DT#2020-10-28-17:20:27.341
14	"DataExServer".StatusTemperature	%DB10.DBD32	Hex	16#0000_0000
15	"DataExServer".StatusTemperature	%DB10.DBD32	Hex	16#0000_0000
16	"DataExServer".StatusCurrentTime	%DB10.DBD40	Hex	16#0000_0000

3.5.4 Add read variable

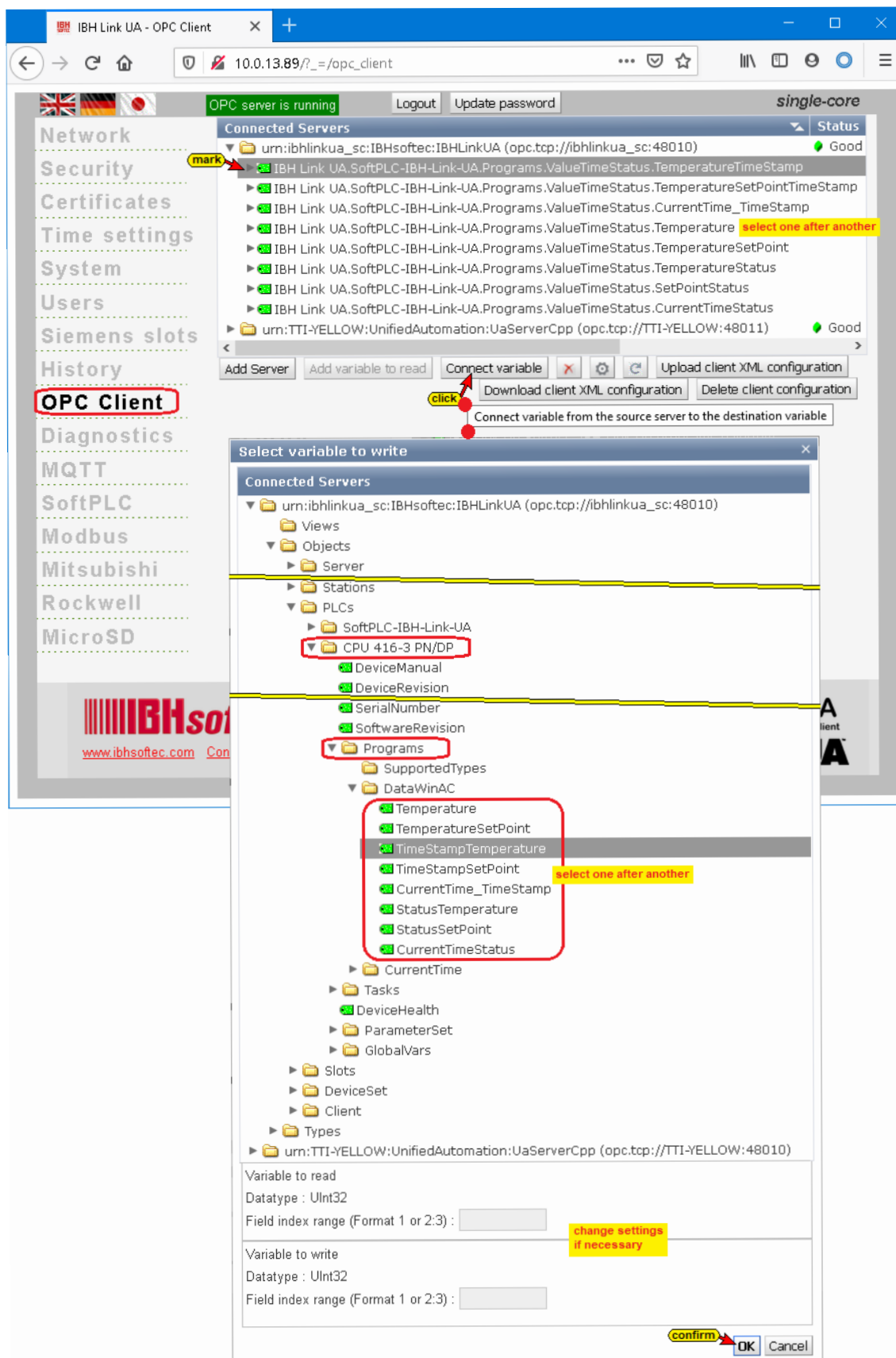
The variables provided in the SoftPLC (OPC server variable) of the data block **ValueTimeStatus** [DB 5] are selected as read variables.

SoftPLC-IBH-Link-UA [WinAC RTX]] → Add read variable

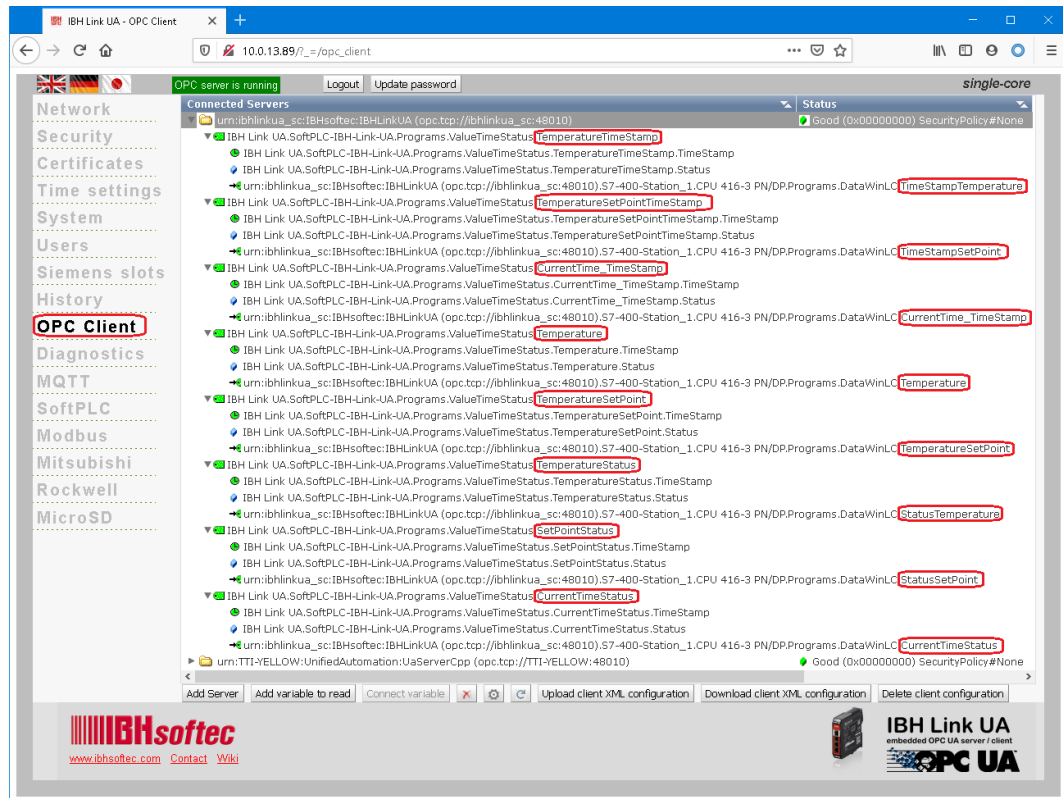


Inserted read variables / Connect to variables to be written to

The variables provided by the **SoftPLC (OPC server variable)** from the data block **ValueTimeStatus [DB 5]** are connected to the data of the data block **DataWinAC [DB22]** of the CPU 416-3 PN/DP.

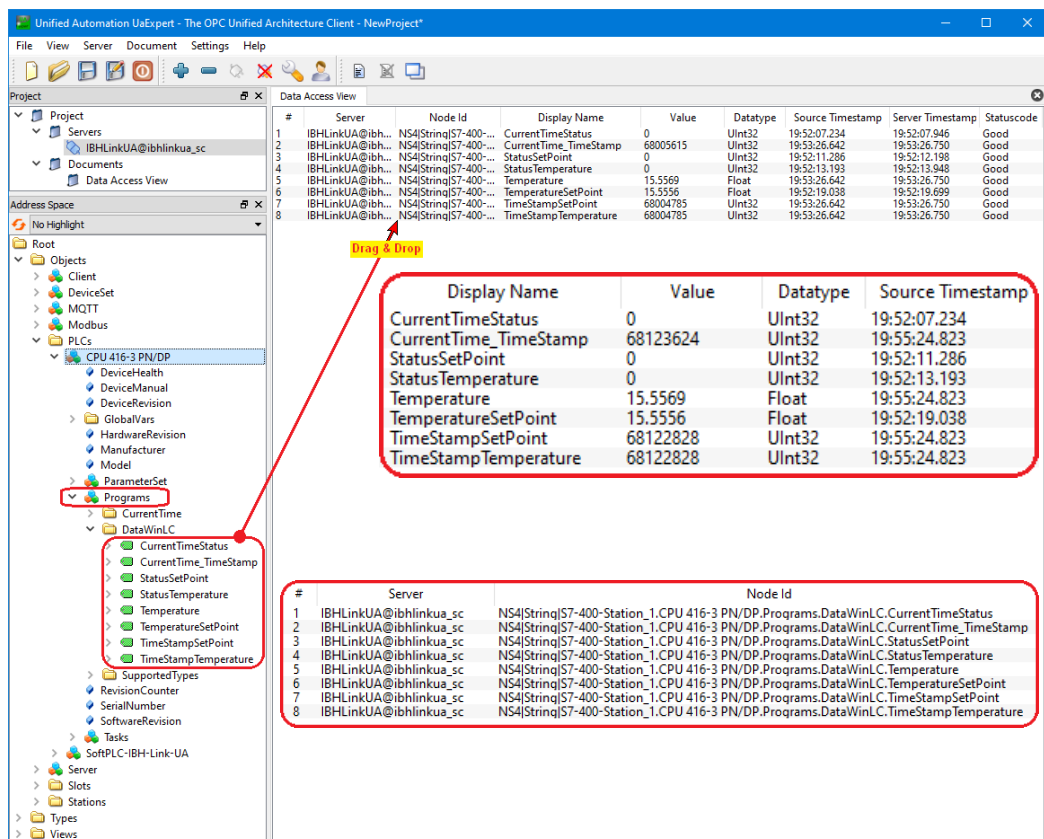


Inserted connection with variables



UaExpert – Program Window –

In the **UaExpert** program window, the values of the OPC tags (Daten_von_WinAC RTX [DB10] - the CPU 416-3 PN / DP) are displayed under Data Access View.



Online display CPU 416-3 PN / DP

The variables provided by the data block **ValueTimeStatus [DB 5]** of the **SoftPLC-Link-UA [WinAC RTX]** (OPC server variable) are displayed in the CPU 416-3 PN / DP.

CPU 416-3 PN / DP – data block **DataWinAC [DB22]**

WinLA RTX TIA16e > CPU 416-3 PN/DP [CPU 416-3 PN/DP] > Program blocks > **DataWinLA [DB22]**

Keep actual values Snapshot Copy snapshots to start values

DataWinLA

	Name	Data type	Offset	Start value	Monitor value	Comment
1	Static					
2	Temperature	Real	0.0	0.0	15.55404	Actual temperature value
3	TemperatureSetPoint	Real	4.0	0.0	15.55556	Set point temperature value
4	TimeStampTemperature	Time_Of_Day	8.0	TOD#00:00:00	TOD#18:57:06.873	Actual temperature Time Stamp
5	TimeStampSetPoint	Time_Of_Day	12.0	TOD#00:00:00	TOD#18:57:06.873	Set point temperature TimeStamp
6	CurrentTime_TimeStamp	Time_Of_Day	16.0	TOD#00:00:00	TOD#18:57:07.657	Current Time Time Stamp
7	StatusTemperature	DWord	20.0	16#0	16#0000_0000	Status Temperature
8	StatusSetPoint	DWord	24.0	16#0	16#0000_0000	Status Set Point Temperature
9	CurrentTimeStatus	DWord	28.0	16#0	16#0000_0000	Current Time Status

CPU 416-3 PN / DP – Watch table_1

...6e > CPU 416-3 PN/DP [CPU 416-3 PN/DP] > Watch and force tables > **Watch table_1**

	Name	Address	Display format	Monitor value
1	"DataWinLC".CurrentTime_TimeStamp	%DB22.DBD16	TIME_OF_DAY	TOD#19:03:21.726
2	"DataWinLC".TimeStampSetPoint	%DB22.DBD12	TIME_OF_DAY	TOD#19:03:21.235
3	"DataWinLC".TimeStampTemperature	%DB22.DBD8	TIME_OF_DAY	TOD#19:03:21.235
4	"DataWinLC".Temperature	%DB22.DBD0	Floating-point number	15.54247
5	"DataWinLC".TemperatureSetPoint	%DB22.DBD4	Floating-point number	15.55556
6	"DataWinLC".StatusSetPoint	%DB22.DBD24	Hex	16#0000_0000
7	"DataWinLC".Temperature	%DB22.DBD0	Floating-point number	15.54247
8	"DataWinLC".CurrentTimeStatus	%DB22.DBD28	Hex	16#0000_0000
9				

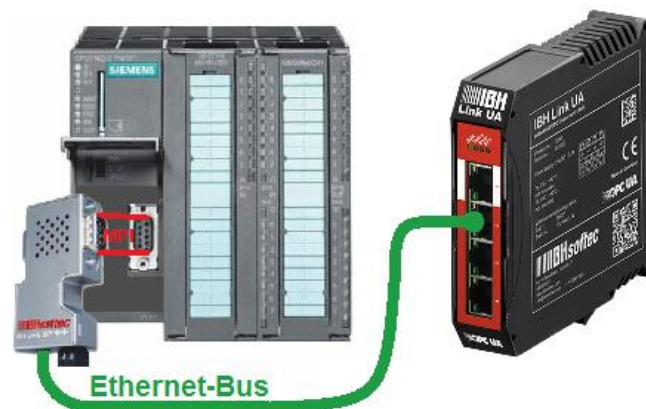
4 IBH Link UA – Connection of a CPU 312

The following example shows the creation of a project with the TIA Portal connecting a **CPU 312 (6ES7 312-1AE13-0AB0)** with the **IBH Link UA** using as an Ethernet connection the **IBH Link S7++**.

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.



4.1 Counter level – Configuration with the TIA Portal

Example: Counter level

The prepared example project **CPU 300 TIA16e** 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.

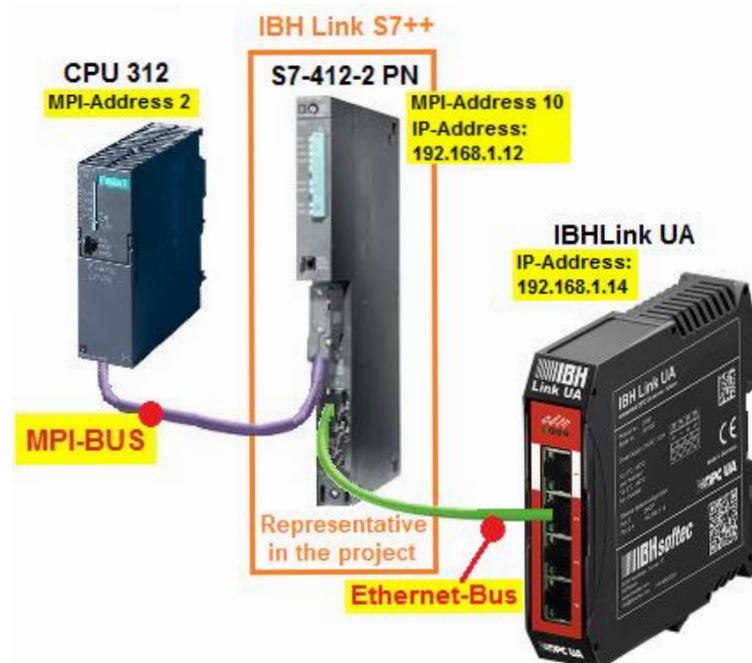


The SIEMENS PLC programming systems TIA Portal V16 is used to create the network configuration.

IBH Link UA - configuration with the TIA Portal

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)

4.1.1 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.

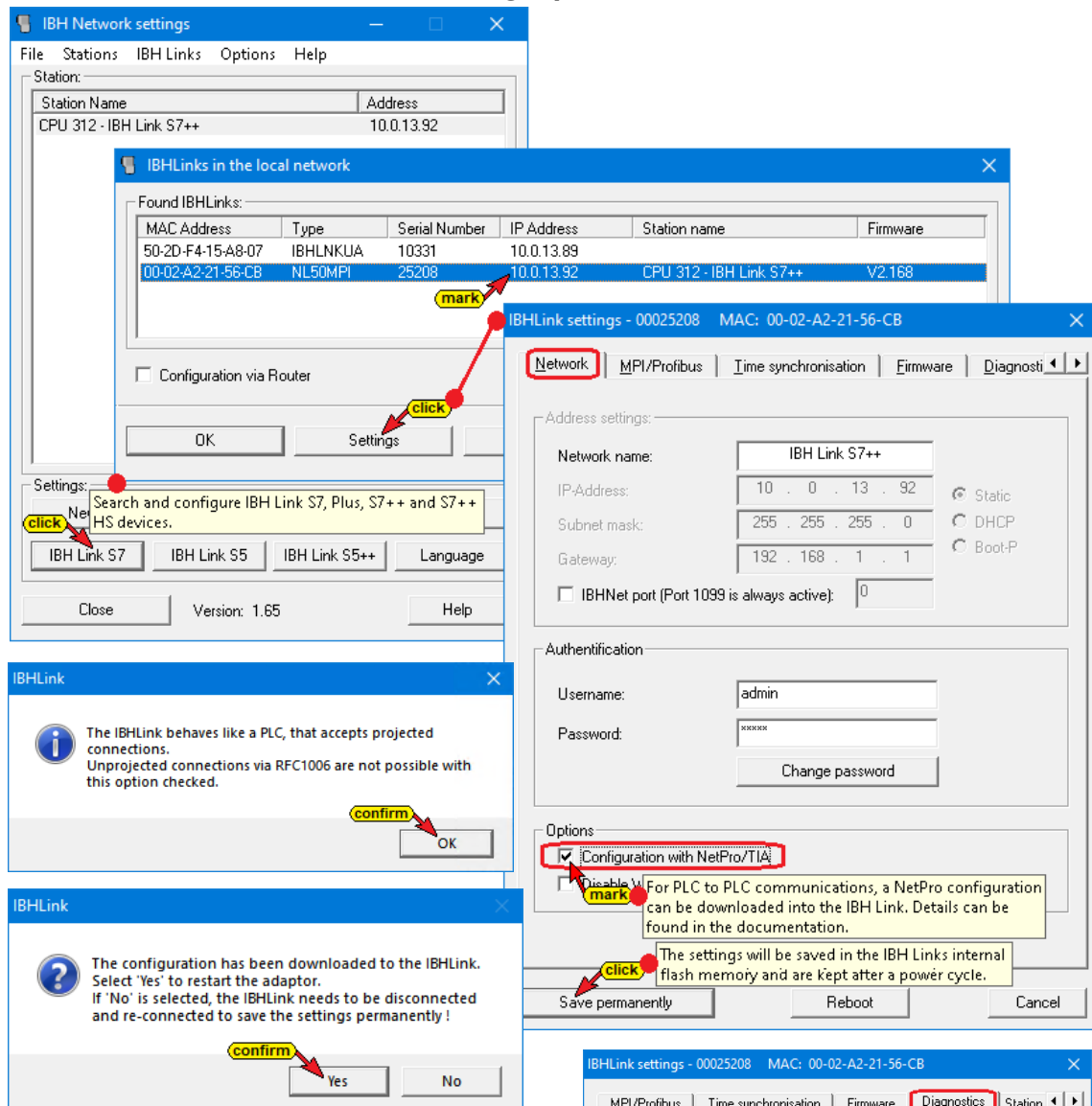
After starting **Manage IBHNet Stations**, the **IBH Network Settings** dialog box opens. Click the **IBH Link S7** button to open the IBH Links in the local network dialog box.



Configuration of the IBH Link S7++

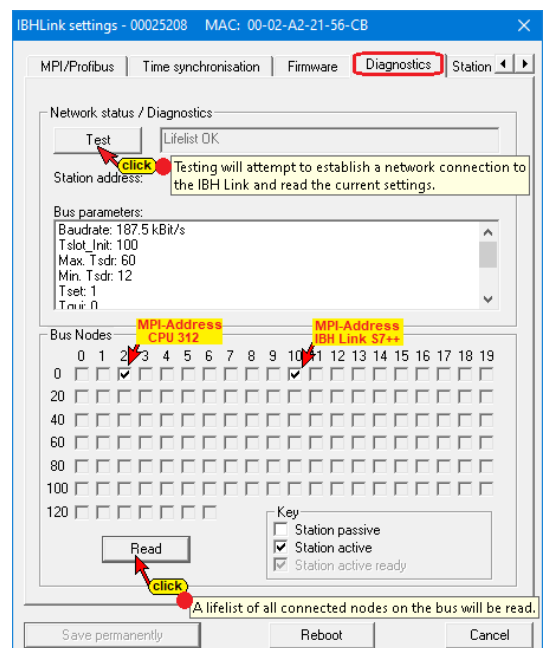
To set the properties of the **IBHNet station** follow the screen shots.

Activate **Configuration with NetPro** in the dialog box **Properties IBHLink/Network/Routing Options**.



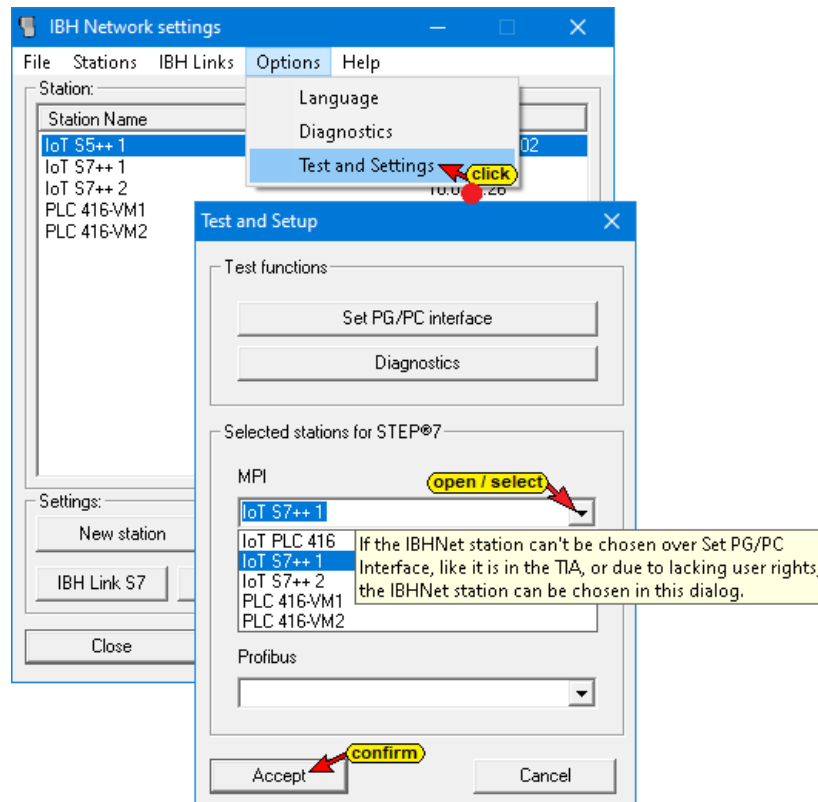
IBH Link S7++ MPI addresses

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



4.1.2 Selecting the IBH Link S7++

The TIA Portal programming environment does not have a dialog to select different IBH Link S7++. If two or more IBH Link S7++ are in the subnet, the selection must be performed using the **IBH Network Settings** dialog box.



By clicking the **Accept** button, the IBHNet driver is given the IP address. The TIA Portal, therefore, only has access to the assigned CPU via the **IBH Link S7++**.

4.2 TIA example: IBH Link UA - S7-312 routed via IBH Link S7 ++

PLC tags / Default tag table

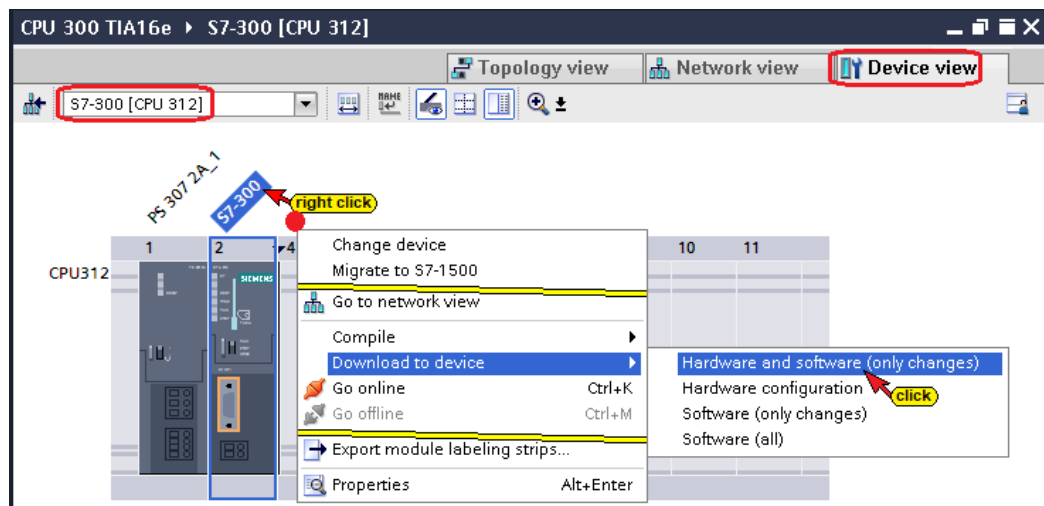
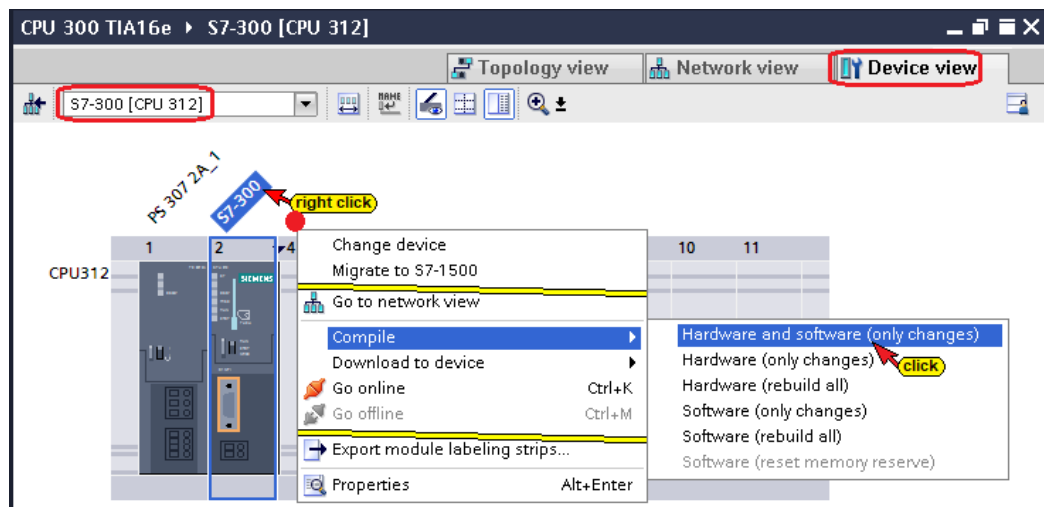
...TIA16e > S7-300 [CPU 312] > PLC tags > **Default tag table [7]**

Tags | User constants | System constants

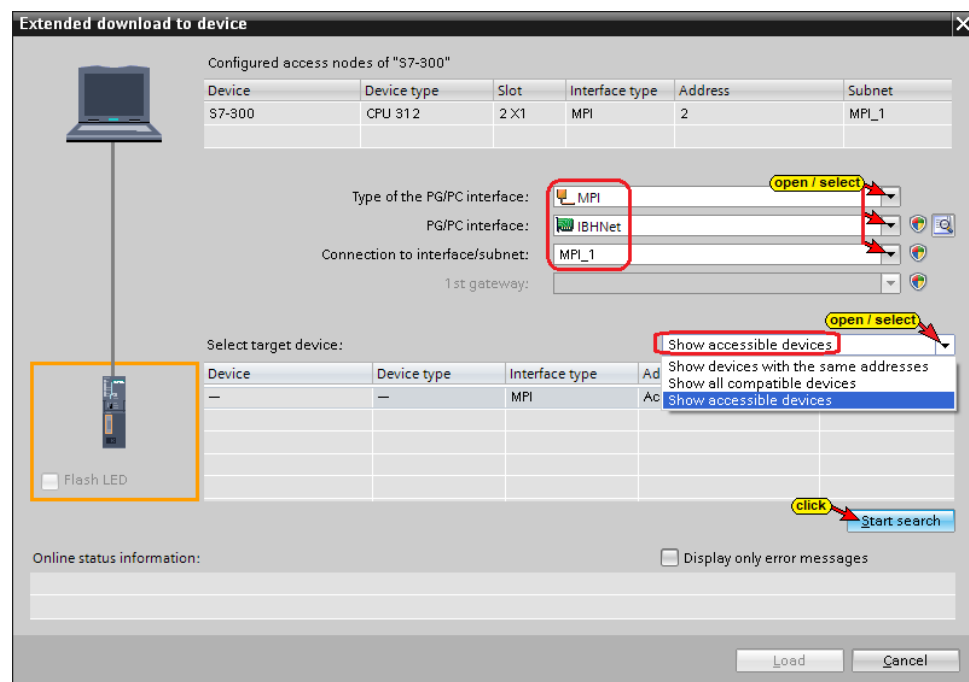
Default tag table

	Name	Data type	Address	Comment
1	CounterON	Bool	%M0.1	start counting
2	Max	Bool	%M2.0	Maximum reached
3	Min	Bool	%M2.1	Minimum reached
4	IsCounting	Bool	%M2.2	Counting control ON
5	Down	Bool	%M2.5	down counting
6	Up	Bool	%M2.6	up counting
7	Value	Int	%MW12	Counter value

4.2.1 Load program blocks and device configuration into the CPU (device)

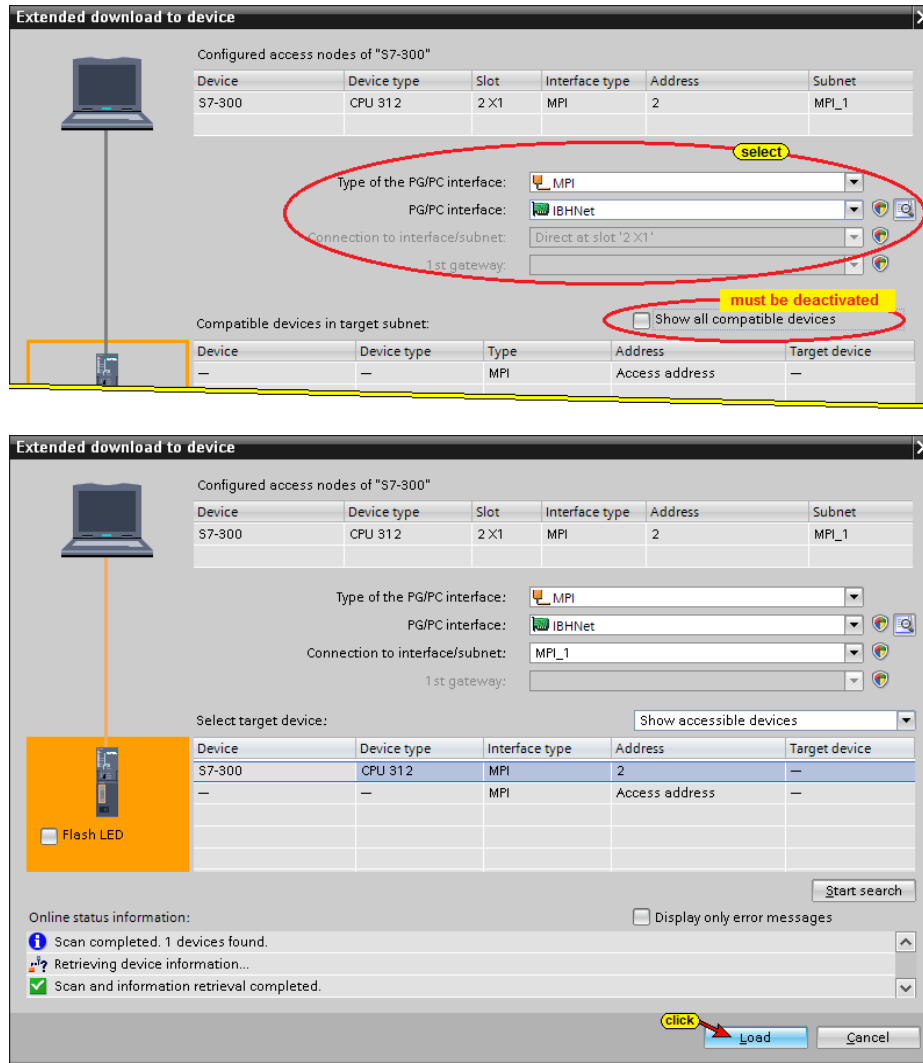


Extended Download Dialog Box

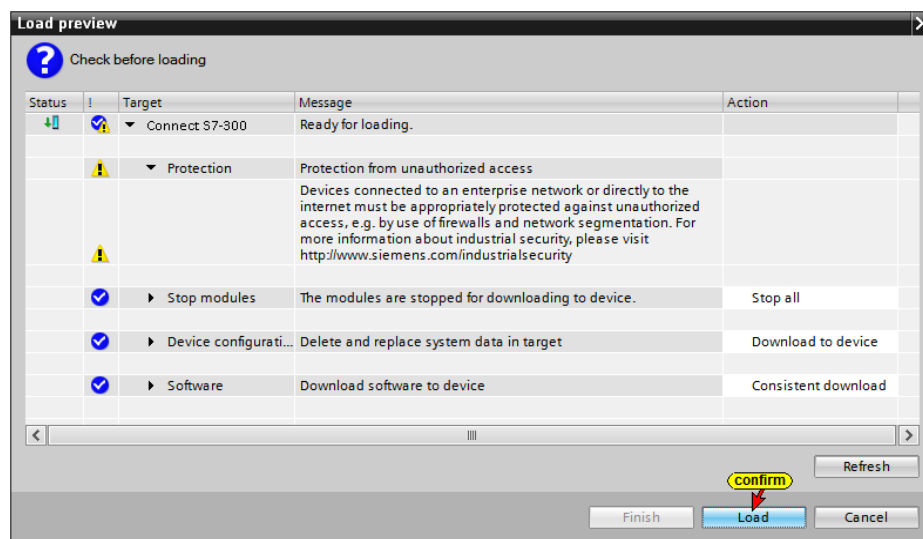


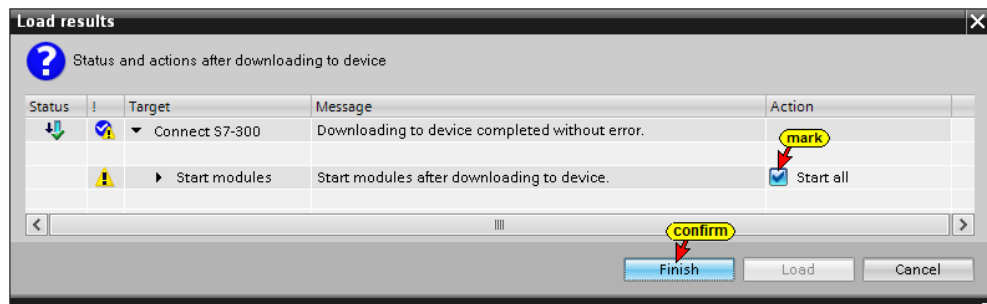
Note TIA 13

In the TIA 13 portal, in the Advanced Loading dialog box, the **Show all compatible devices** option must be deactivated. Otherwise the TIA Portal would search for devices via PROFINET DCP but could not find any PROFINET devices.



A preview of the loading is displayed.





The counting can be checked online.

The screenshot shows the 'CounterData [DB2]' table in the TIA Portal. The table has columns: Name, Data type, Offset, Start value, Monitor value, and Comment.

Name	Data type	Offset	Start value	Monitor value	Comment
Static					
Counting ON	Bool	0.0	false	TRUE	On / Off switch 1
CounterValue	Int	2.0	0	3616	Counter value
MinValue	Int	4.0	100	100	minimum Counter value
MaxValue	Int	6.0	10000	10000	maximum Counter value

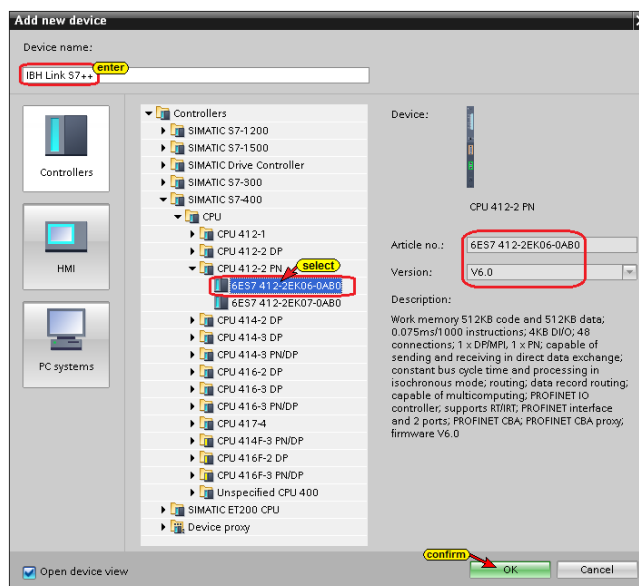
4.3 Insert IBHLink S7++ as CPU 412-2 PN into the project

The IBHLink S7++ is created in the TIA Portal as an S7-400 station and connected to the corresponding bus system (MPI or PROFIBUS).

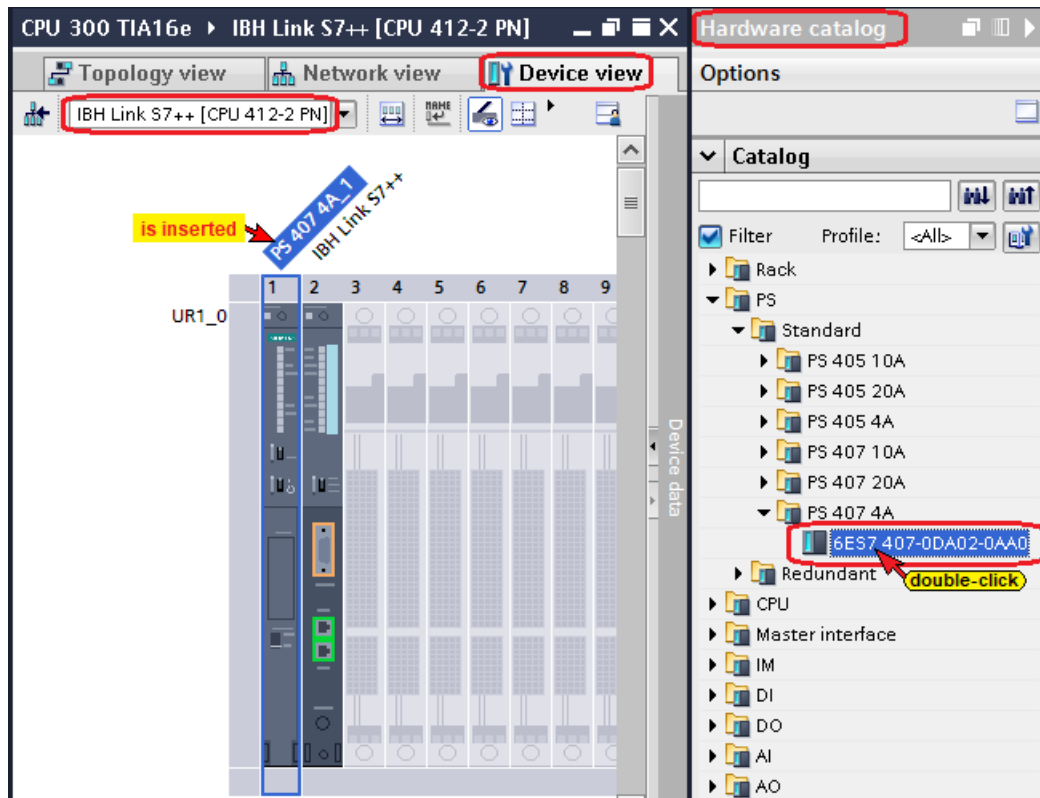
The following module must be used as a representative for the IBHLink S7 ++:

- **MLFB: 6ES7 412-2EK06-0AB0 V6.0 in rack 0, slot 2**

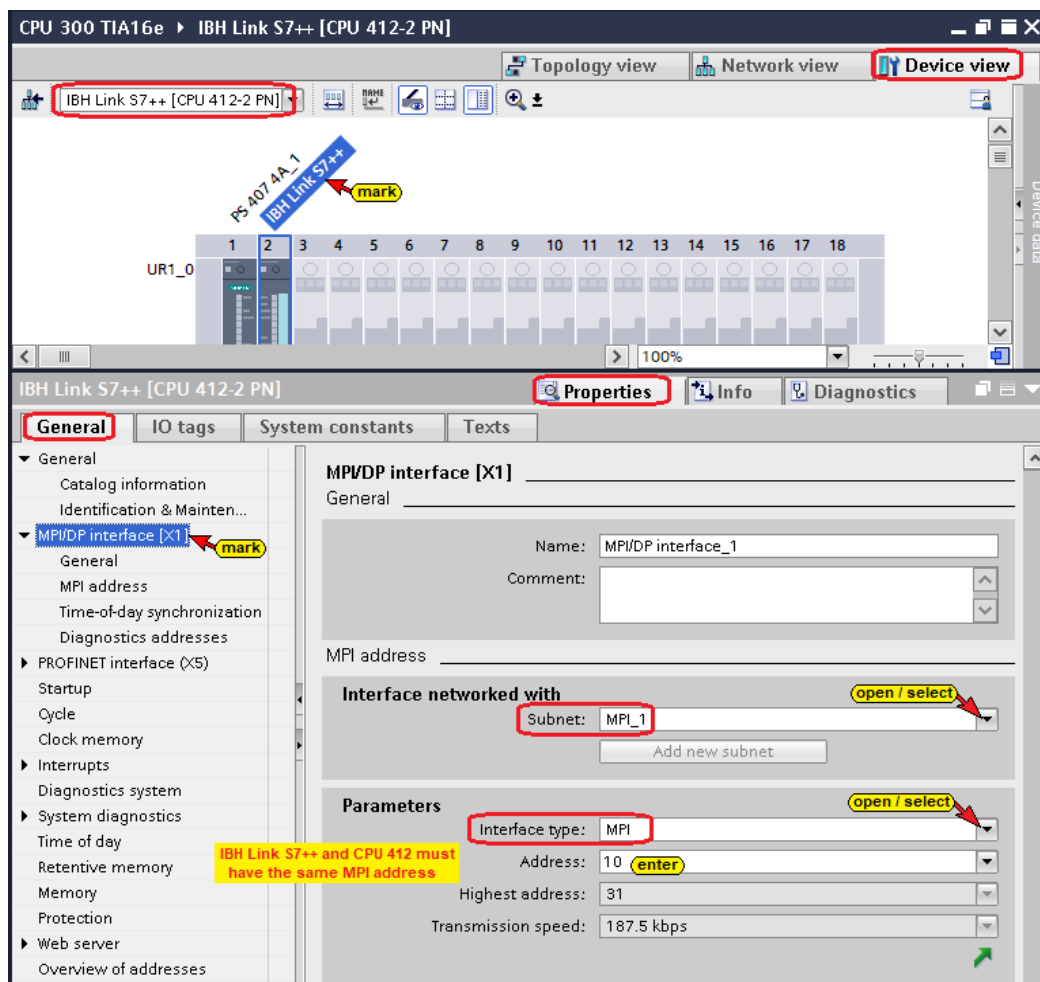
Double-click Add new device to select the CPU 412.



Insert power supply in IBHLink S7++

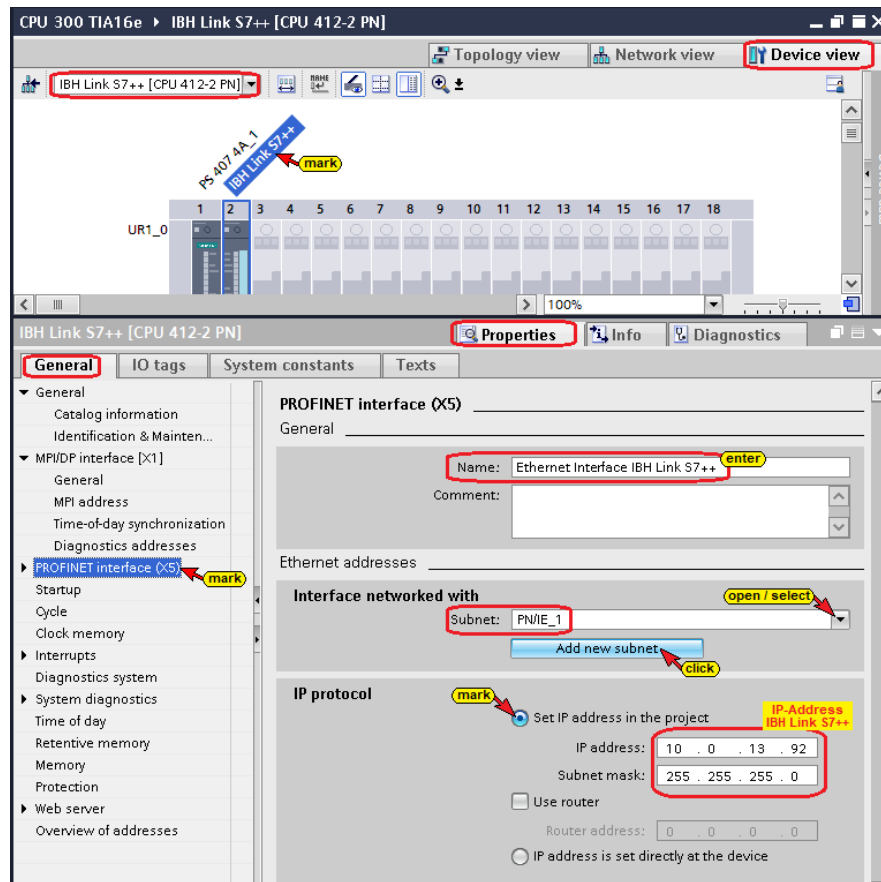


Define the MPI interface of the CPU 412 (MPI interface IBH Link S7 ++)



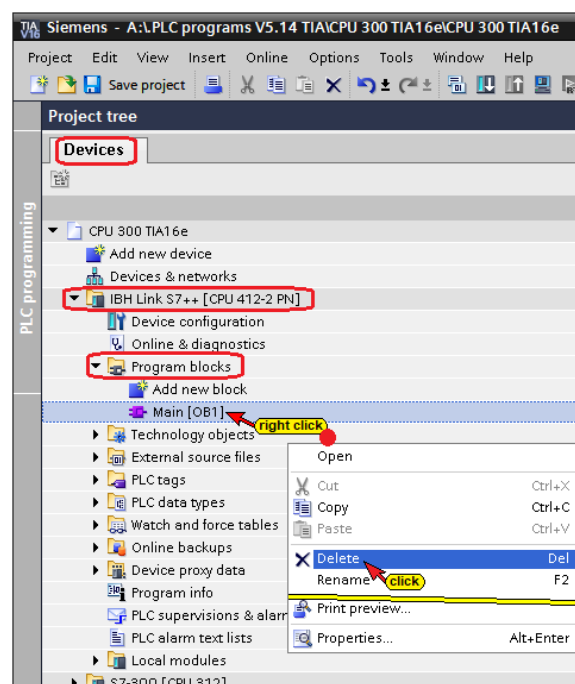
Define the Ethernet interface of the CPU 412

Ethernet connection IBH Link S7++ to IBH Link UA.



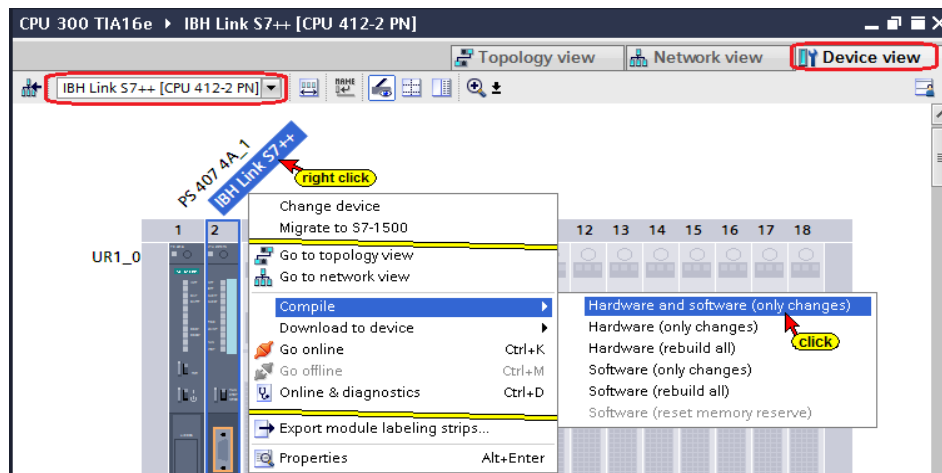
Delete blocks (IBH Link S7 ++ / CPU 412)

No blocks can be loaded into the **IBH Link S7++**. In the offline mode all PLC blocks of the **IBH Link S7++ / CPU 412** must be deleted.

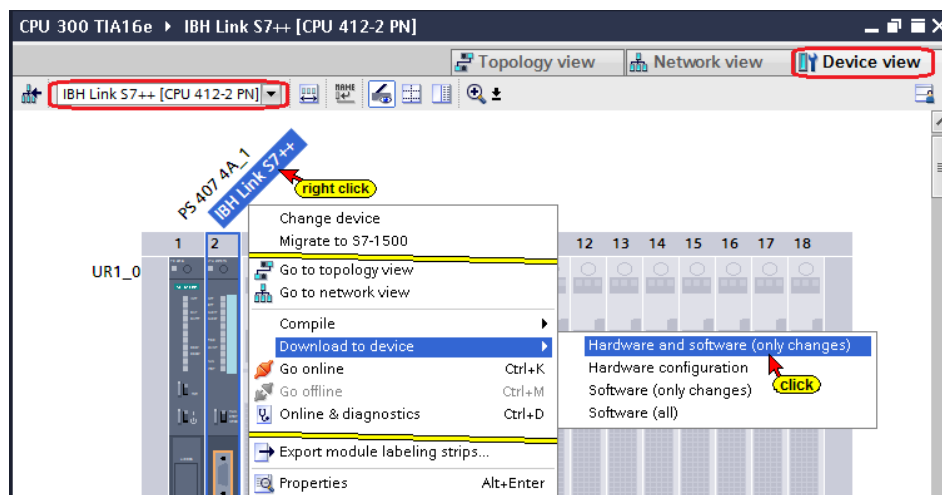


Compile hardware and software (IBH Link S7 ++ / CPU 412)

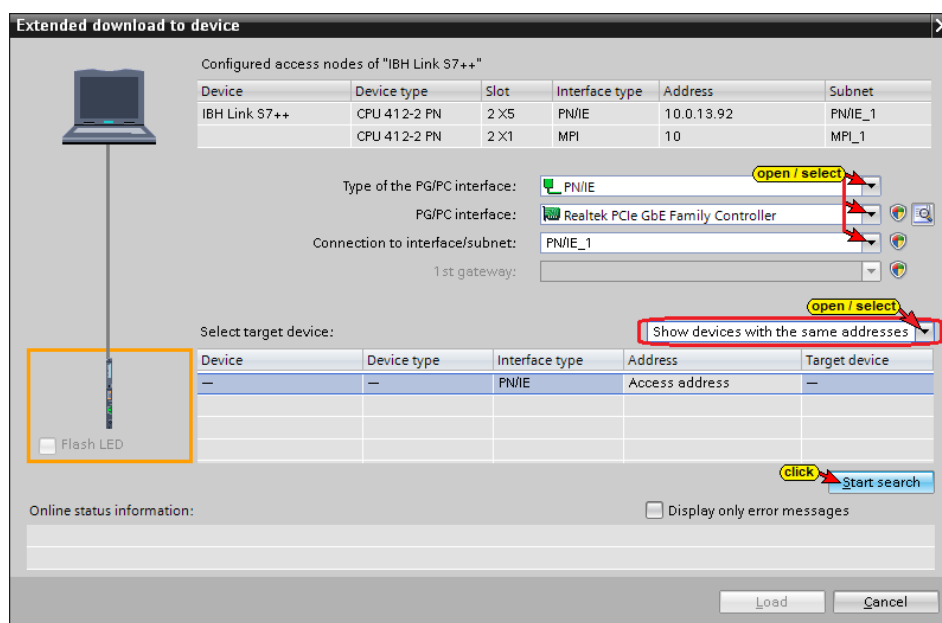
Before loading the hardware configuration and software into the device, these must be compiled.

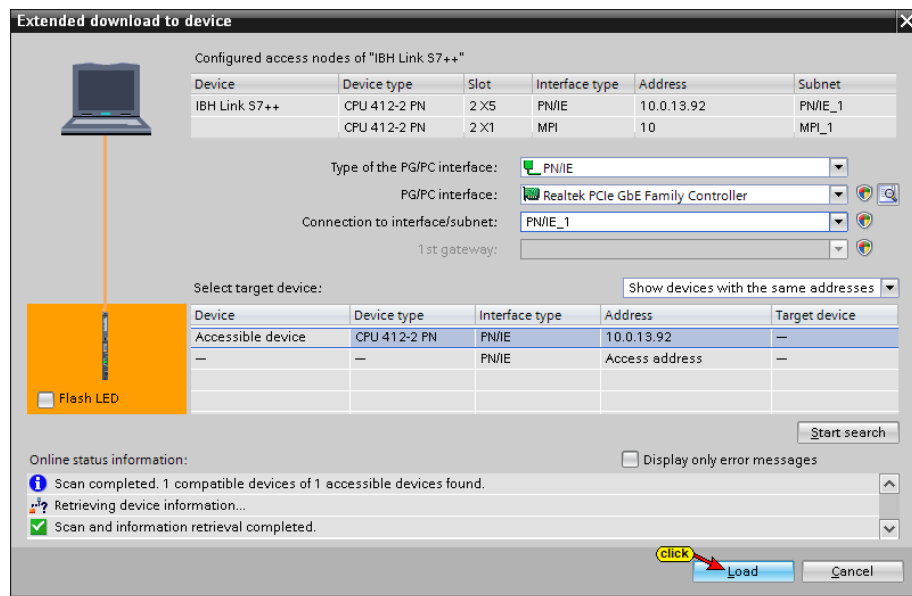


Load hardware into the device (IBH Link S7++ / CPU 412)

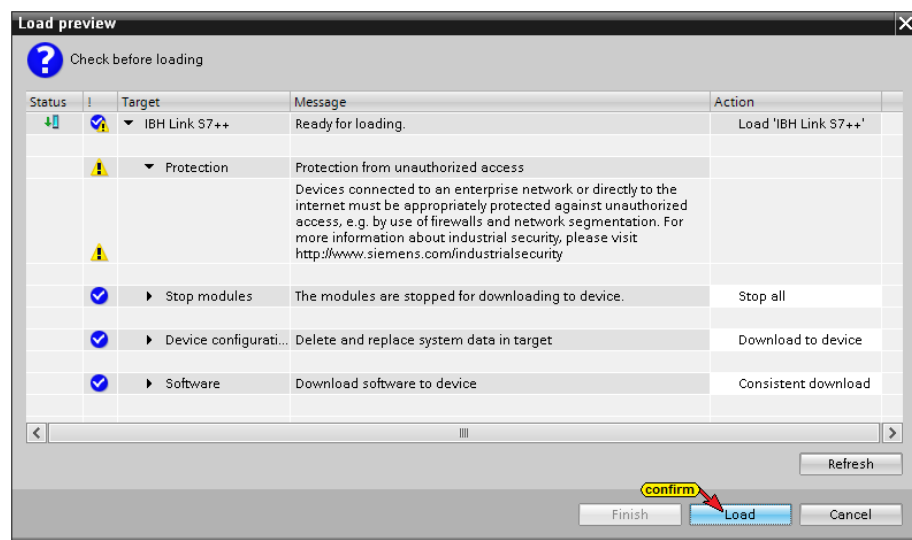


The loading process requires the following screen shots.

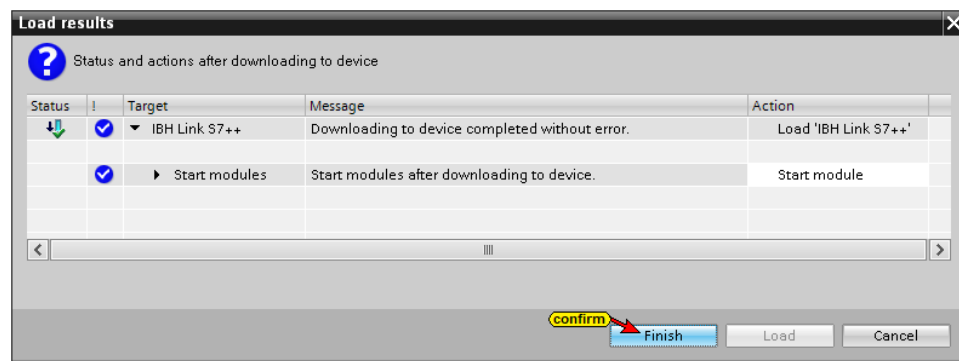




Several dialog boxes will open to indicate the following steps of loading.



The loading of the hardware configuration is completed.

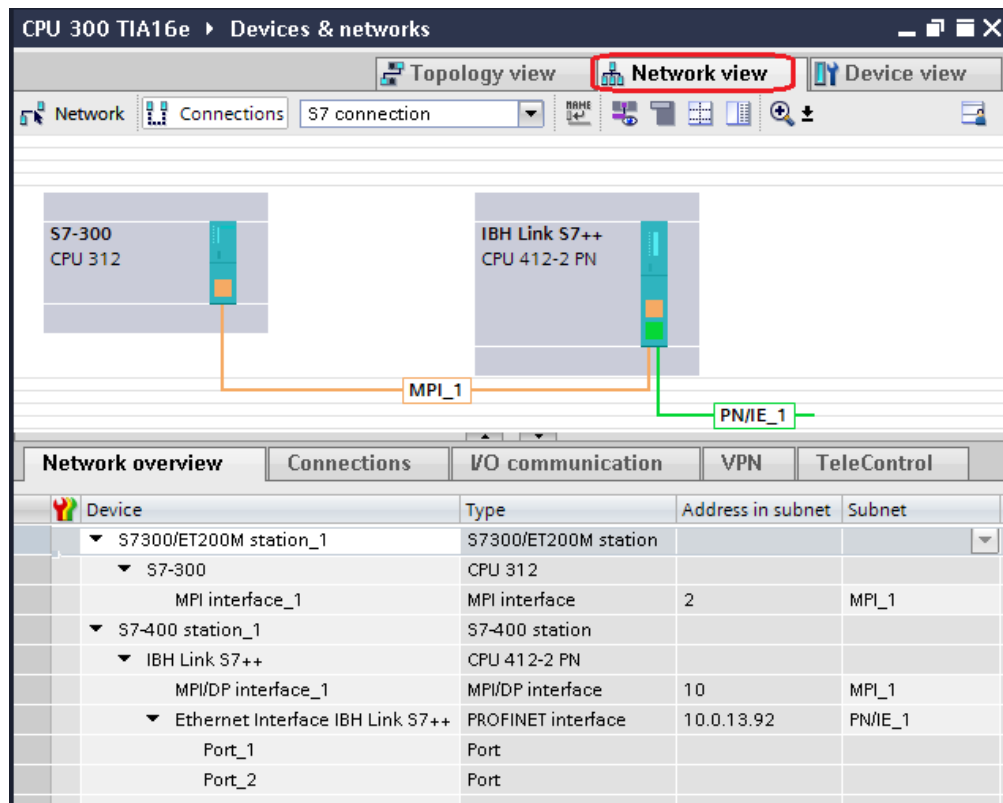


The stopped device (**IBH Link S7++**) is restarted after loading the hardware configuration.

The successful loading of the hardware configuration into the **IBH Link S7++ (CPU 412-2 PN)** is displayed.

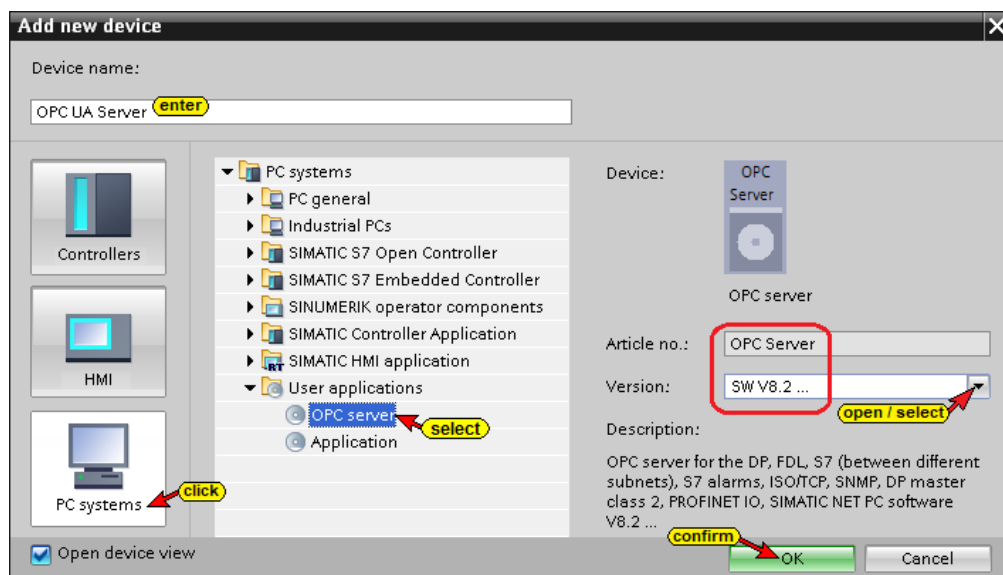
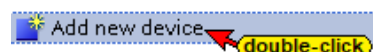
4.4 Create MPI connection between PC_1 (CPU 312) and IBH Link S7++ (CPU 412-2 PN)

The MPI connection is created automatically and displayed.

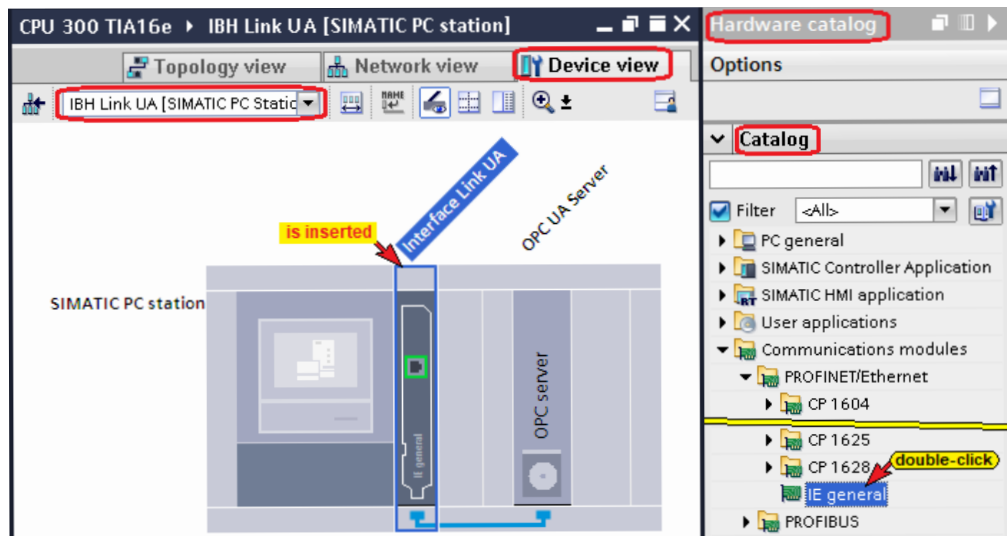


4.5 Insert IBH Link UA as an SIMATIC PC station

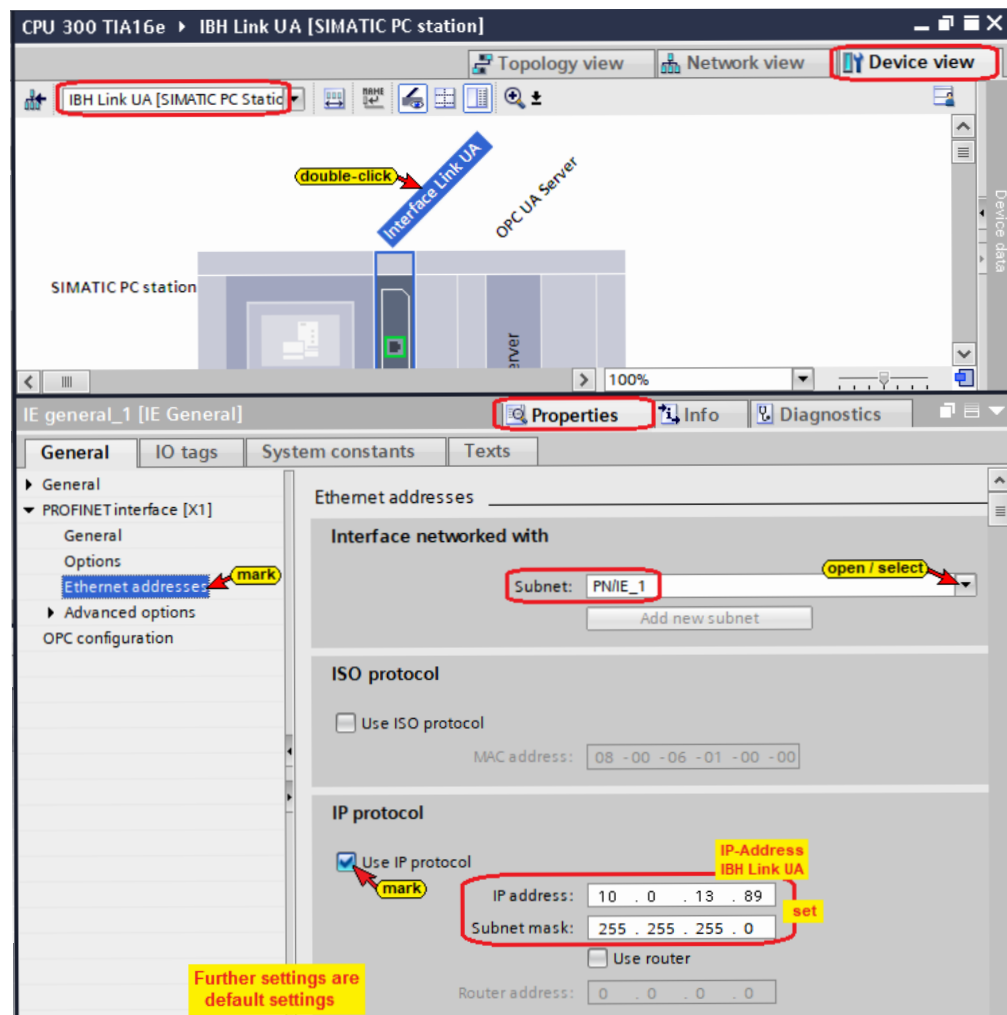
Double-click Add new device to select PC systems, User application, OPC server.



Insert communication module in the IBH Link UA



Define communication module properties

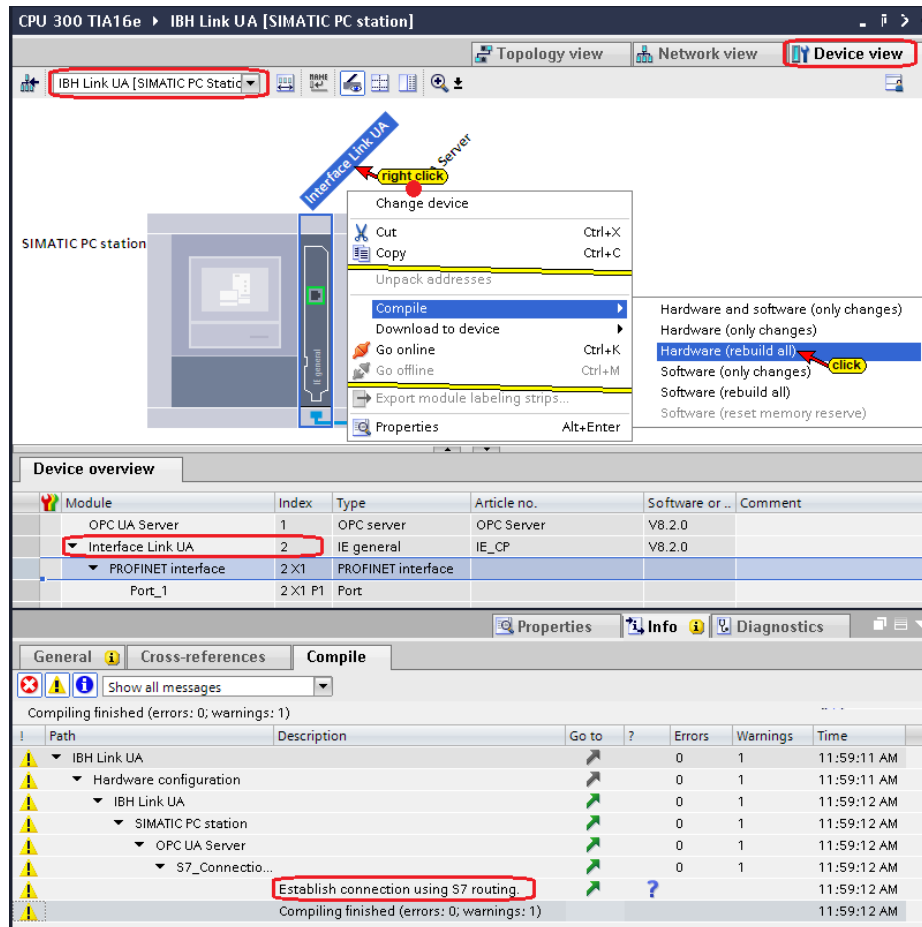


Note:



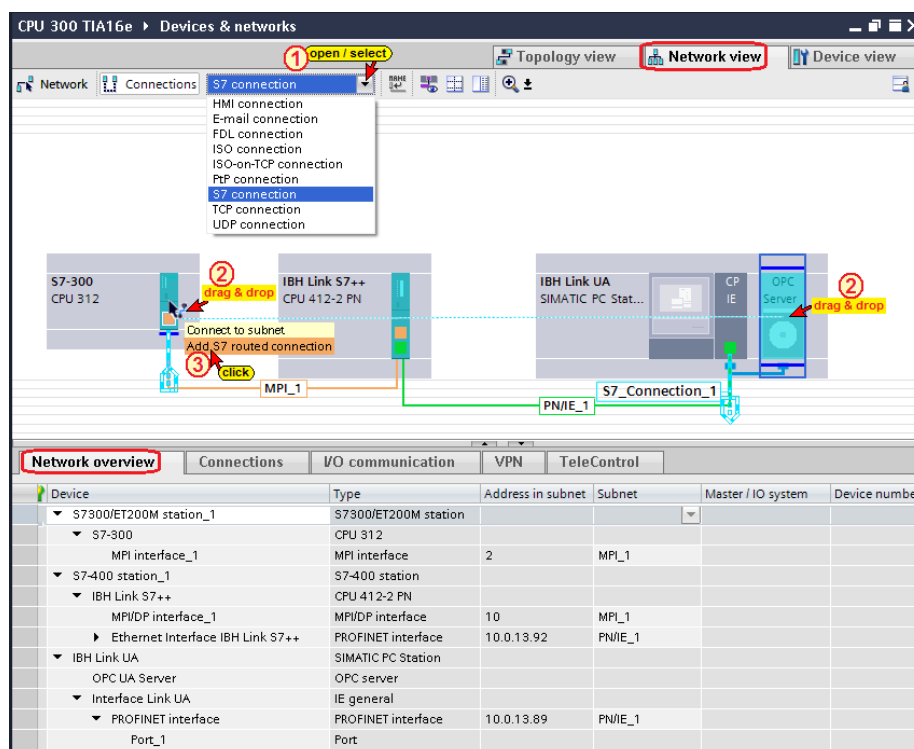
The communication module **must** be inserted in **Slot 2 / Index 2**.
The IBH Link UA expects the communication interface in **Slot 2 / Index 2**.

Compiling the hardware of the communication module

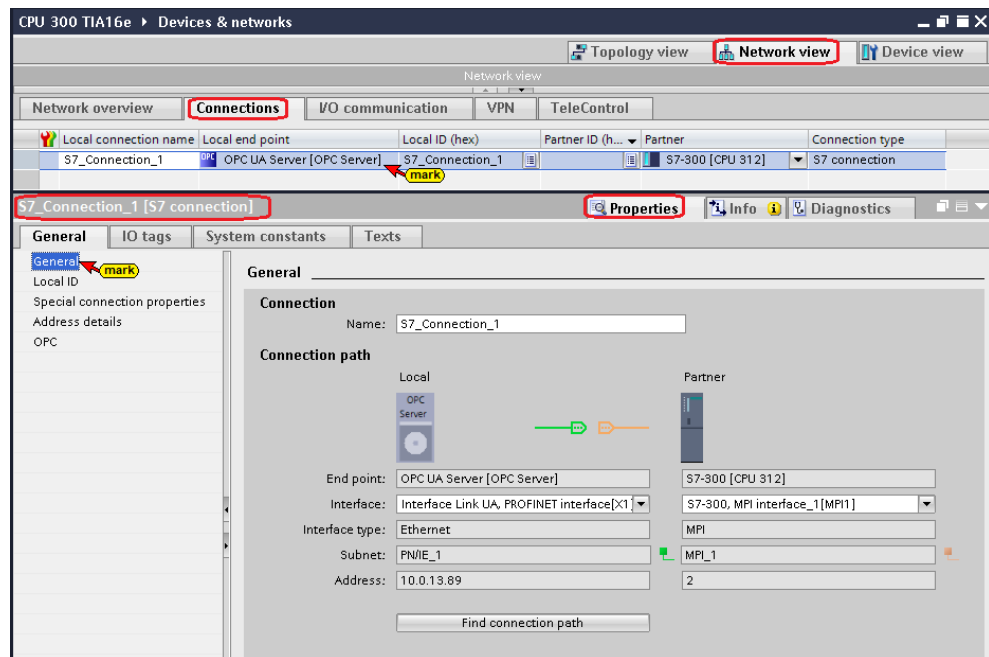


Establish an S7 connection from the OPC server to the CPU 312

The S7 connection is established via drag and drop from the OPC server to the CPU 312.

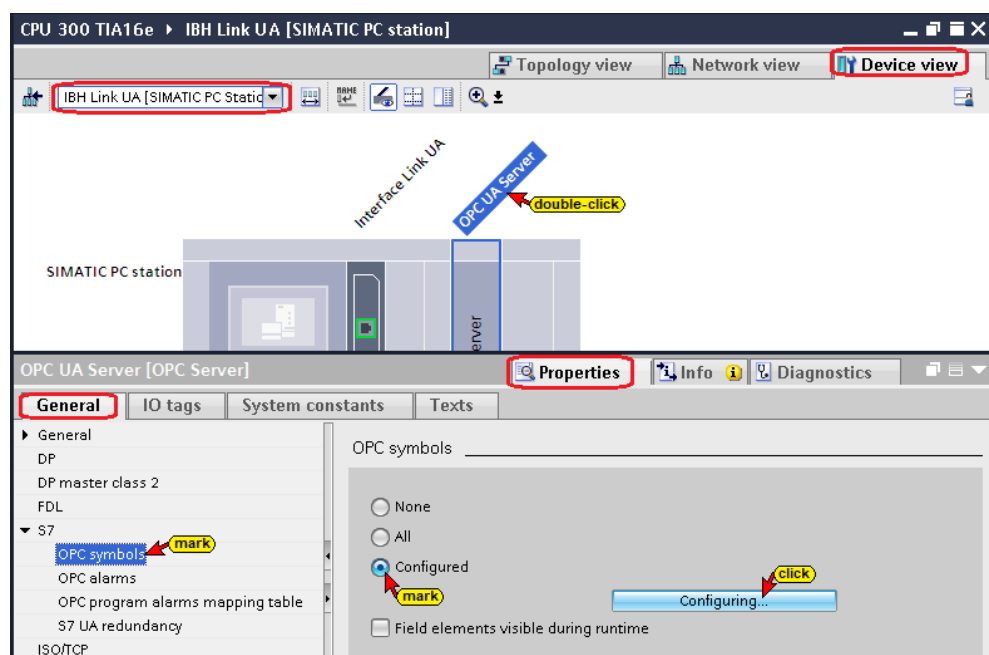


The created S7 connection is listed in the Network view window.

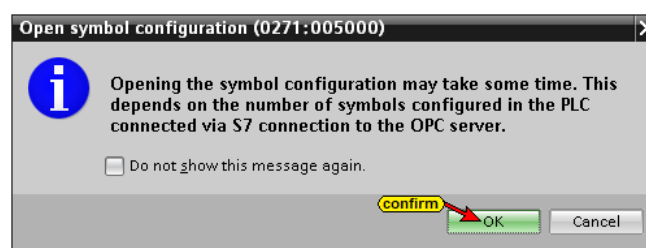


Select OPC symbols (tags) in the OPC configuration

Open the configuration on the OPC server / properties.

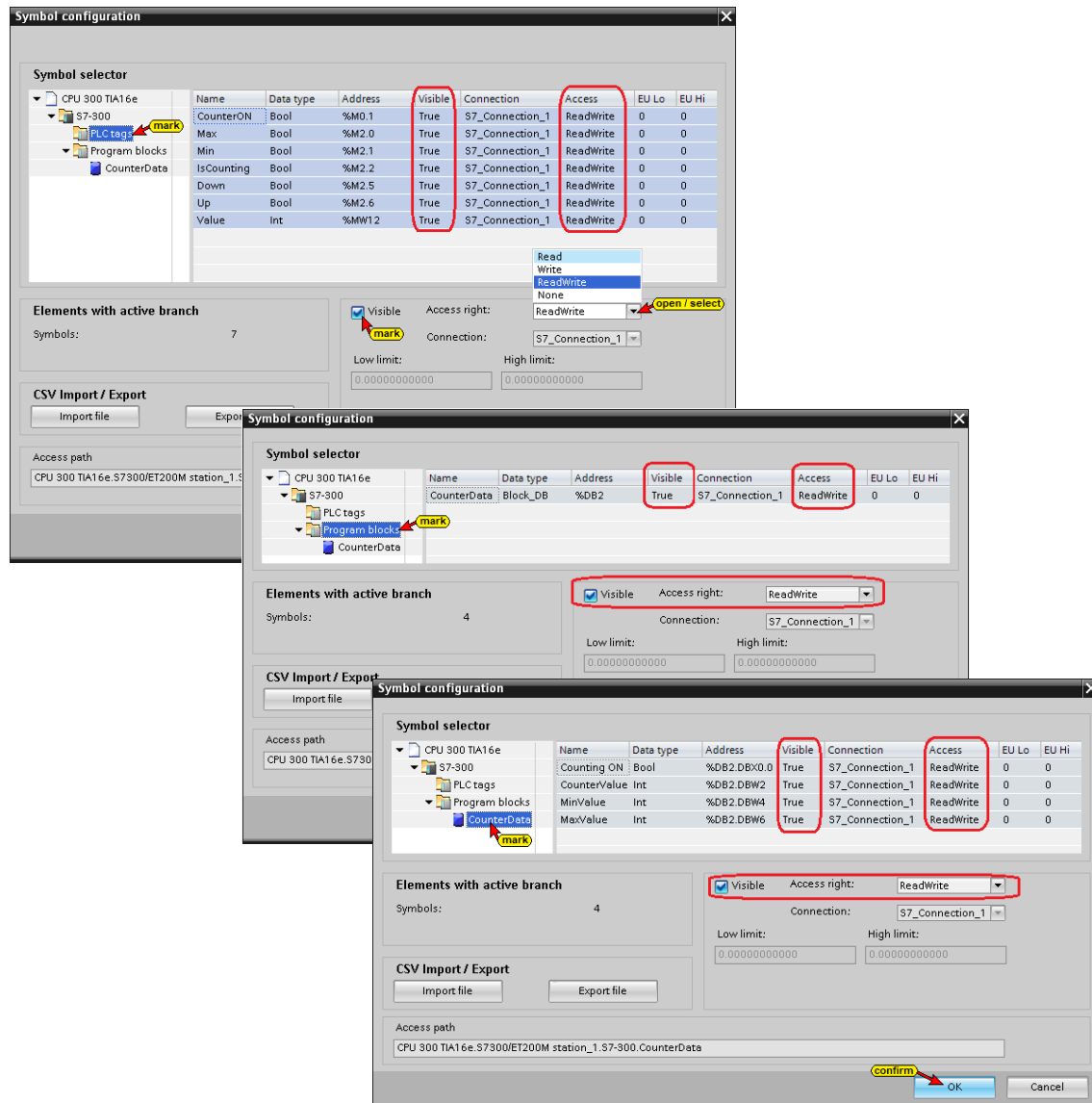


The TIA Portal issues a message because the information from the entire symbol table is adopted.

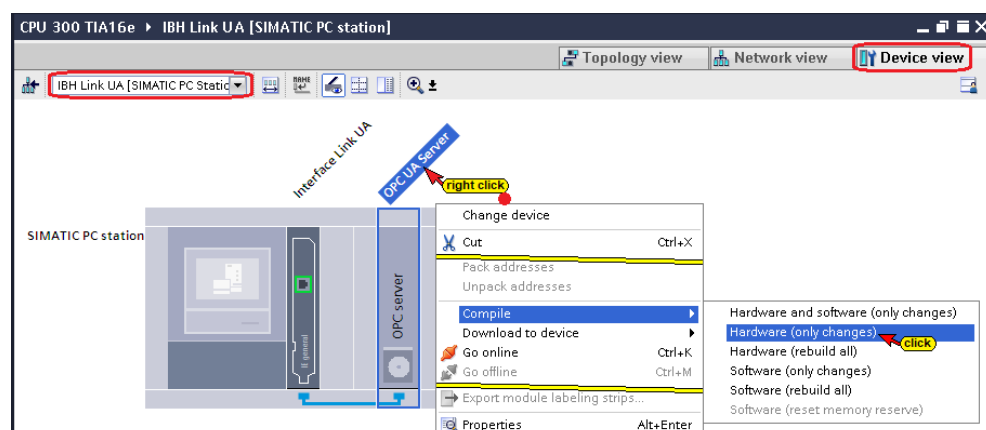


The Configure button opens the Symbol configuration dialog box, in which the operands defined in the symbol table (PLC program CPU 312) can be selected as OPC tags.

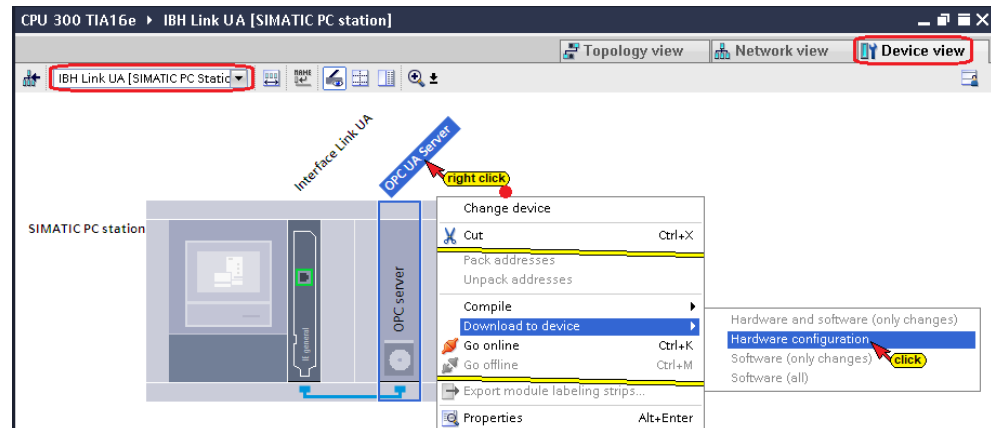
The read / write, etc. access rights can be assigned to the individual operands (OPC tags).



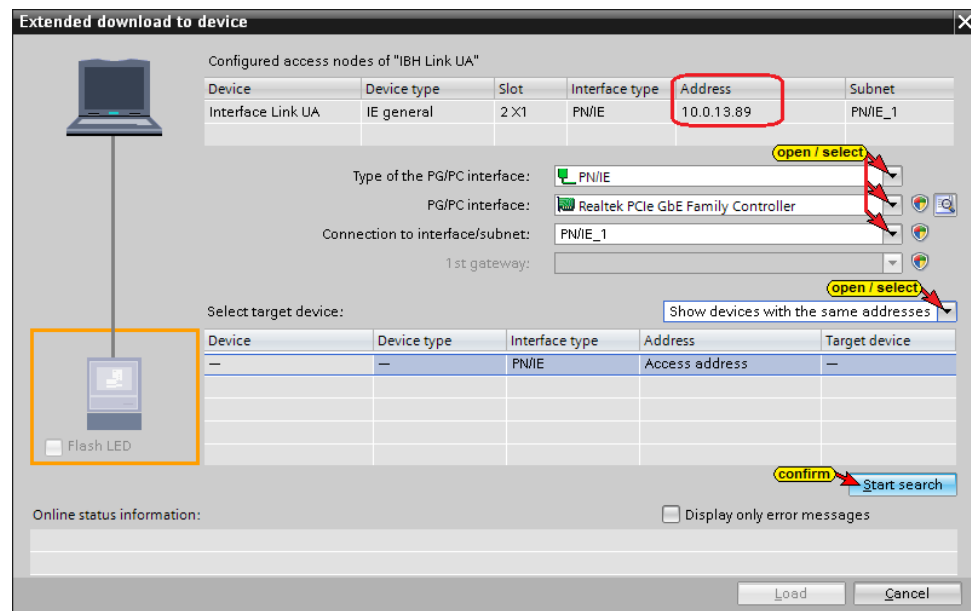
Compile the configuration of the OPC server



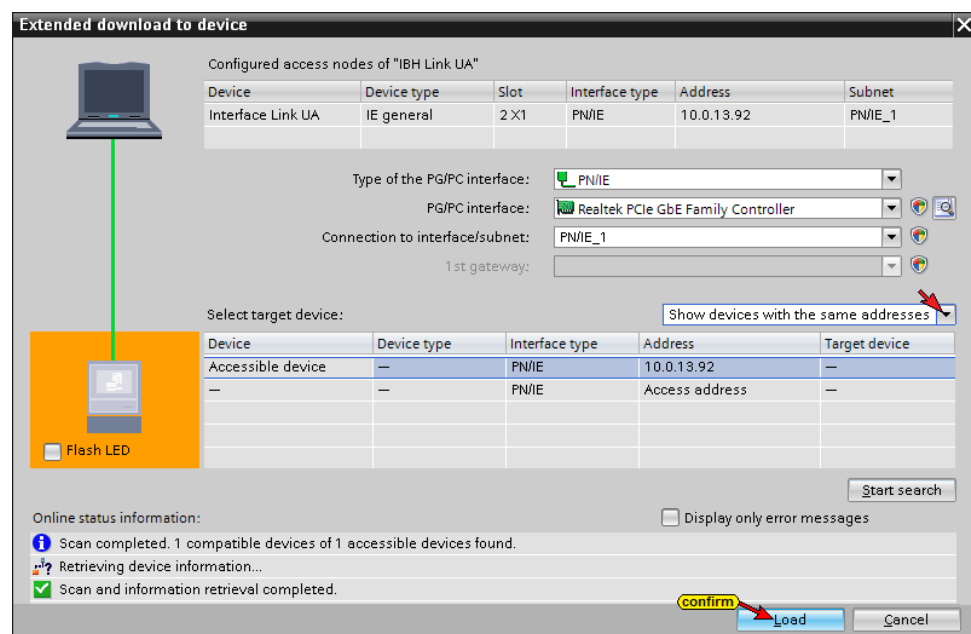
Load configuration of the OPC server into IBH Link UA



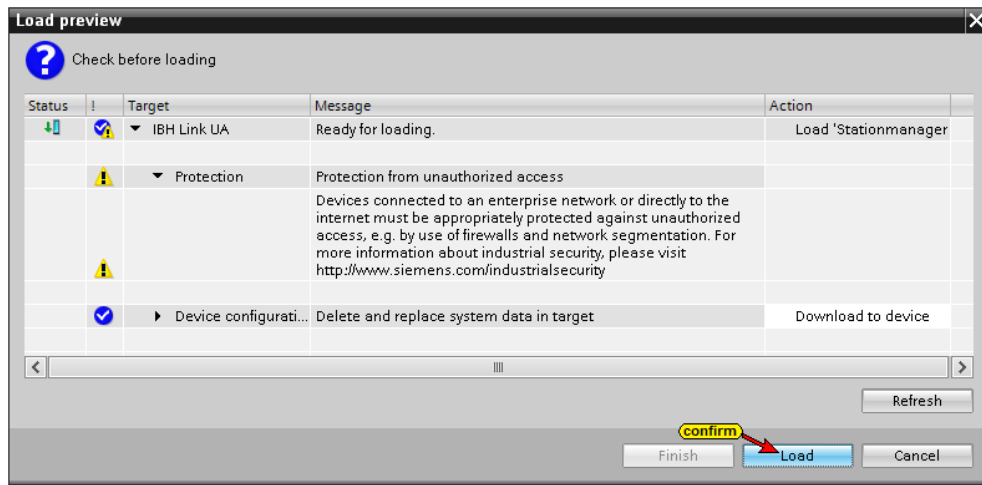
The settings are to be made according the screen shots in the **Extended download to device** dialog box.



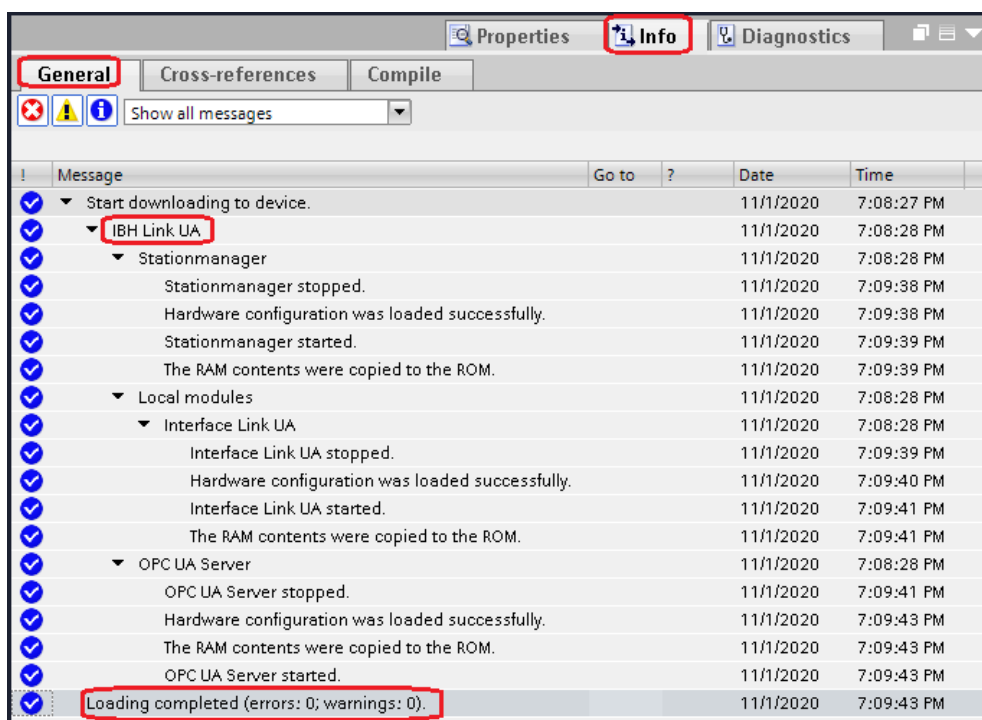
The interface search was successful.



A check is carried out prior loading.



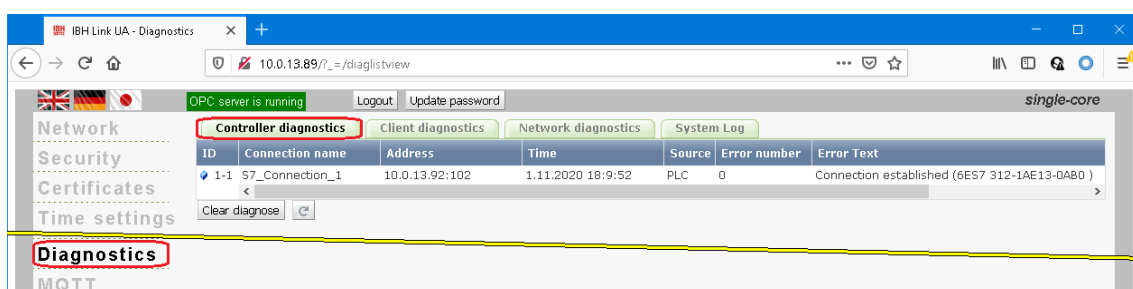
The steps of the successful loading process are displayed as info.



Successful loading is indicated in the **IBH Link UA**.

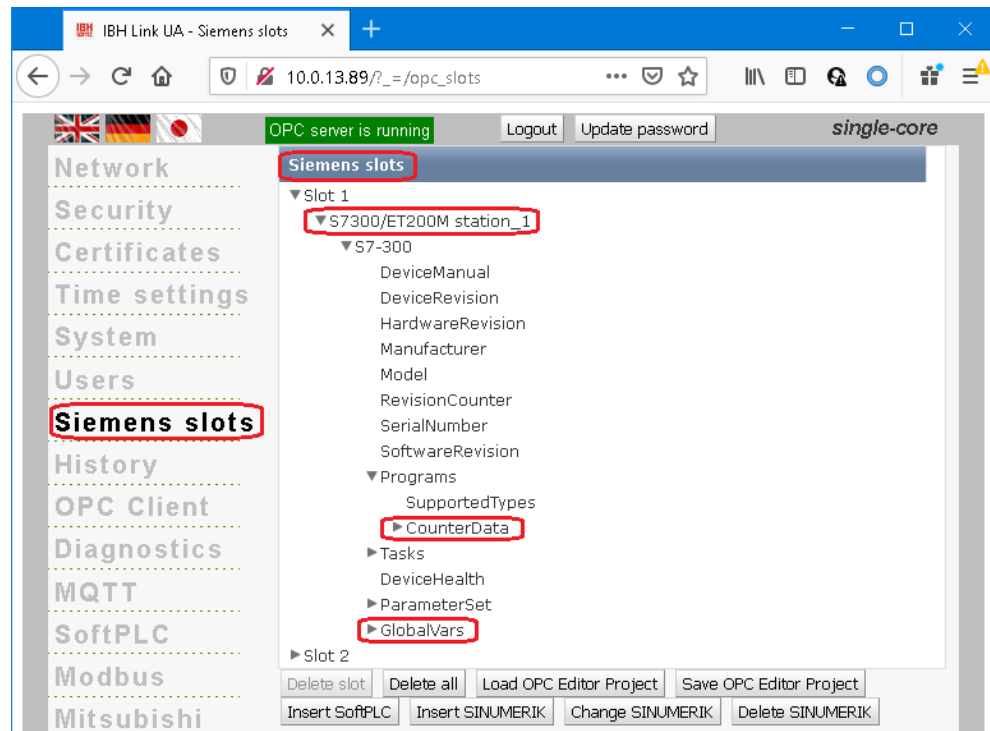
4.5.1 Browser window diagnosis / control diagnosis

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

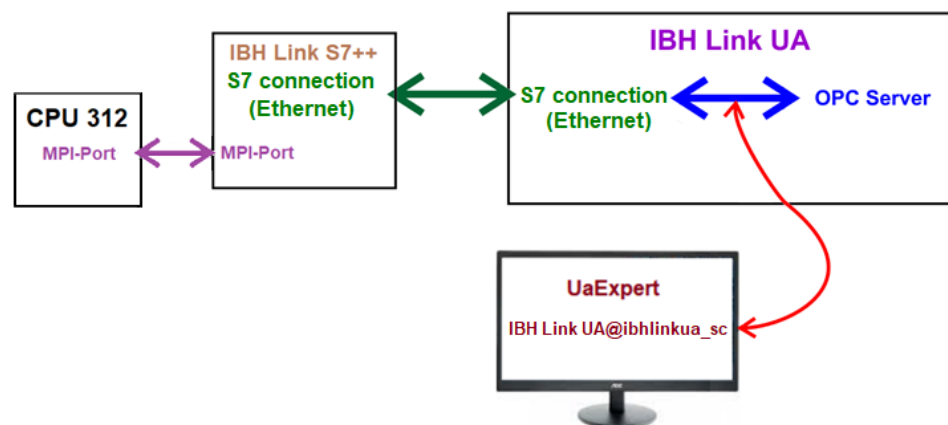


4.5.2 IBH Link UA browser window Siemens slots.

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

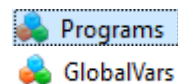


4.6 UaExpert - program window



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**. If 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.



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

File View Server Document Settings Help

Project: IBHLinkUA@ibhlinkua_sc

Address Space: No Highlight

Objects: Client, DeviceSet, MQTT, Modbus, PLCs, S7-300, DeviceHealth, DeviceManual, DeviceRevision, GlobalVars, CounterON, Down, IsCounting, Max, Min, Up, Value, HardwareRevision, Manufacturer, Model, ParameterSet, Programs, CounterData, CounterValue, Counting ON, MaxValue, MinValue, SupportedTypes, RevisionCounter, SerialNumber

Data Access View

#	Server	Node Id	Display Name	Value	Datatype	Source Timestamp	Server Timestamp	Statuscode
1	IBHLinkUA@ib...	NS4 String S7300/...	CounterON	true	Boolean	19:44:44.098	19:44:44.793	Good
2	IBHLinkUA@ib...	NS4 String S7300/...	Down	false	Boolean	19:46:30.358	19:46:30.608	Good
3	IBHLinkUA@ib...	NS4 String S7300/...	IsCounting	true	Boolean	19:44:48.147	19:44:48.795	Good
4	IBHLinkUA@ib...	NS4 String S7300/...	Max	false	Boolean	19:44:49.904	19:44:50.545	Good
5	IBHLinkUA@ib...	NS4 String S7300/...	Min	false	Boolean	19:44:51.545	19:44:52.295	Good
6	IBHLinkUA@ib...	NS4 String S7300/...	Up	true	Boolean	19:46:30.358	19:46:30.608	Good
7	IBHLinkUA@ib...	NS4 String S7300/...	Value	3588	Int16	19:46:33.108	19:46:33.358	Good
8	IBHLinkUA@ib...	NS4 String S7300/...	CounterValue	3589	Int16	19:46:33.108	19:46:33.358	Good
9	IBHLinkUA@ib...	NS4 String S7300/...	Counting ON	true	Boolean	19:44:57.992	19:44:58.553	Good
10	IBHLinkUA@ib...	NS4 String S7300/...	MaxValue	10000	Int16	19:44:59.501	19:45:00.054	Good
11	IBHLinkUA@ib...	NS4 String S7300/...	MinValue	100	Int16	19:45:00.833	19:45:01.555	Good

Drag & Drop

continuously updated

Display Name	Value	Datatype	Source Timestamp
CounterON	true	Boolean	11:38:53.558
Down	true	Boolean	11:51:51.170
IsCounting	true	Boolean	11:38:56.998
Max	false	Boolean	11:38:58.805
Min	false	Boolean	11:39:00.317
Up	false	Boolean	11:51:51.170
Value	964	Int16	11:51:58.674
CounterValue	967	Int16	11:51:58.674
Counting ON	true	Boolean	11:49:04.018
MaxValue	10000	Int16	11:49:05.858
MinValue	100	Int16	11:49:07.687

#	Server	Node Id
1	IBHLinkUA@ibhlinkua_sc	NS4 String S7300/ET200M station_1.S7-300.GlobalVars.CounterON
2	IBHLinkUA@ibhlinkua_sc	NS4 String S7300/ET200M station_1.S7-300.GlobalVars.Down
3	IBHLinkUA@ibhlinkua_sc	NS4 String S7300/ET200M station_1.S7-300.GlobalVars.IsCounting
4	IBHLinkUA@ibhlinkua_sc	NS4 String S7300/ET200M station_1.S7-300.GlobalVars.Max
5	IBHLinkUA@ibhlinkua_sc	NS4 String S7300/ET200M station_1.S7-300.GlobalVars.Min
6	IBHLinkUA@ibhlinkua_sc	NS4 String S7300/ET200M station_1.S7-300.GlobalVars.Up
7	IBHLinkUA@ibhlinkua_sc	NS4 String S7300/ET200M station_1.S7-300.GlobalVars.Value
8	IBHLinkUA@ibhlinkua_sc	NS4 String S7300/ET200M station_1.S7-300.Programs.CounterData.CounterValue
9	IBHLinkUA@ibhlinkua_sc	NS4 String S7300/ET200M station_1.S7-300.Programs.CounterData.Counting ON
10	IBHLinkUA@ibhlinkua_sc	NS4 String S7300/ET200M station_1.S7-300.Programs.CounterData.MaxValue
11	IBHLinkUA@ibhlinkua_sc	NS4 String S7300/ET200M station_1.S7-300.Programs.CounterData.MinValue

#	Display Name	Value	Datatype	Source Timestamp	Server Timestamp	Statuscode
1	CounterON	true	Boolean	11:38:53.558	11:38:54.105	Good
2	Down	false	Boolean	12:05:19.263	12:05:19.513	Good
3	IsCounting	true	Boolean	11:38:56.998	11:38:57.605	Good
4	Max	false	Boolean	11:38:58.805	11:38:59.606	Good
5	Min	false	Boolean	12:03:38.472	12:03:38.722	Good
6	Up	true	Boolean	12:05:19.263	12:05:19.513	Good
7	Value	9472	Int16	12:05:19.513	12:05:19.764	Good
8	CounterValue	9471	Int16	12:05:19.513	12:05:19.764	Good
9	Counting ON	true	Boolean	11:49:04.018	11:49:04.596	Good
10	MaxValue	10000	Int16	11:49:05.858	11:49:06.597	Good
11	MinValue	100	Int16	11:49:07.687	11:49:08.350	Good

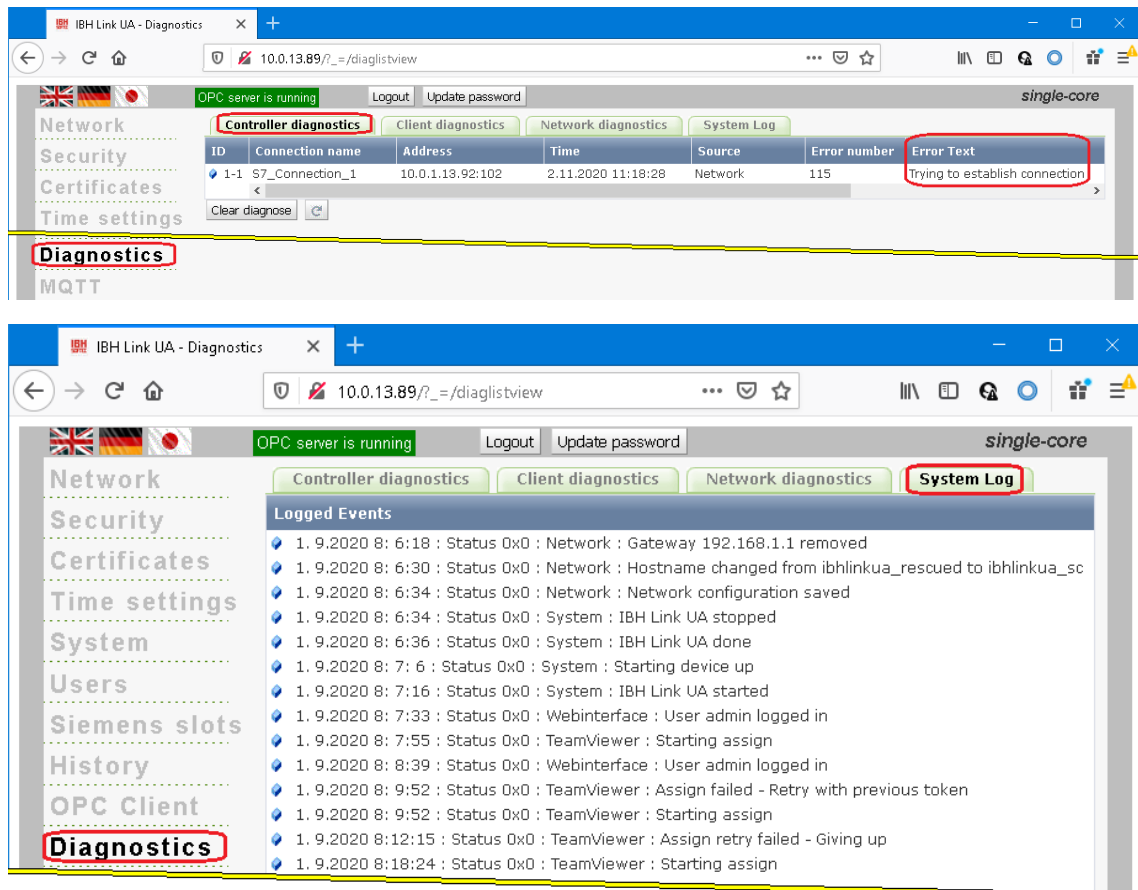
The **GlobalVars** and **Data block** variables / (OPC tags) can also be displayed online in the Watch table_1.

CPU 300 TIA16e ▶ S7-300 [CPU 312] ▶ Watch and force tables ▶ Watch table_1

	Name	Address	Display format	Monitor value	Tag comment
1	"CounterON"	%M0.1	Bool	☒ TRUE	start counting
2	"Down"	%M2.5	Bool	☒ TRUE	down counting
3	"IsCounting"	%M2.2	Bool	☒ TRUE	Counting control ON
4	"Max"	%M2.0	Bool	☐ FALSE	Maximum reached
5	"Min"	%M2.1	Bool	☐ FALSE	Minimum reached
6	"Up"	%M2.6	Bool	☐ FALSE	up counting
7	"Value"	%MW12	DEC+/-	9200	Counter value
8	"CounterData".CounterValue	%DB2.DBW2	DEC+/-	9199	Counter value
9	"CounterData"."Counting ON"	%DB2.DBX0.0	Bool	☒ TRUE	On / Off switch 1
10	"CounterData".MaxValue	%DB2.DBW6	DEC+/-	10000	maximum Counter value
11	"CounterData".MinValue	%DB2.DBW4	DEC+/-	100	minimum Counter value

4.7 Diagnostics

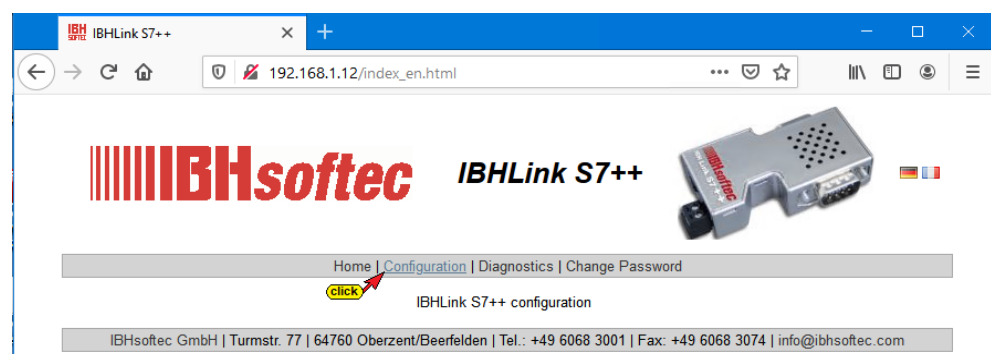
If no values are displayed in the UaExpert – Data Access View window or error messages are displayed, the IBH Link UA diagnosis window provides information as to whether the connection to the PLC exists.

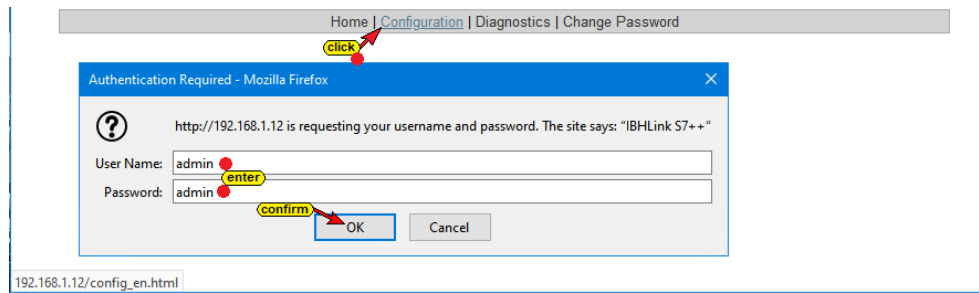


4.7.1 IBH Link S7 ++ web server

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

IBHsoftec IBHLink S7++

Home Configuration Diagnostics | Change Password

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

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IBH Link S7 ++ web server diagnosis page

IBHsoftec IBHLink S7++

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

Connected PROFIBUS Devices:

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

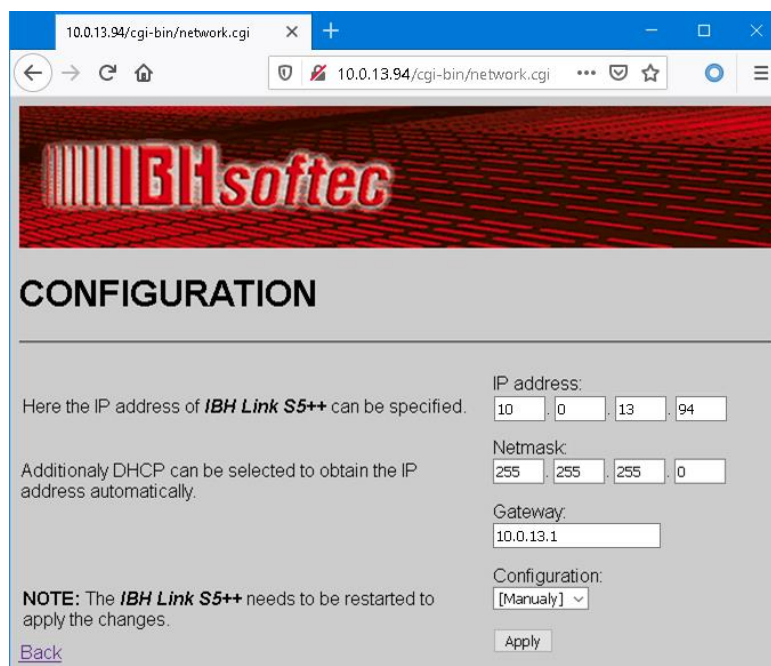
192.168.1.12/passwd_en.html

5 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.

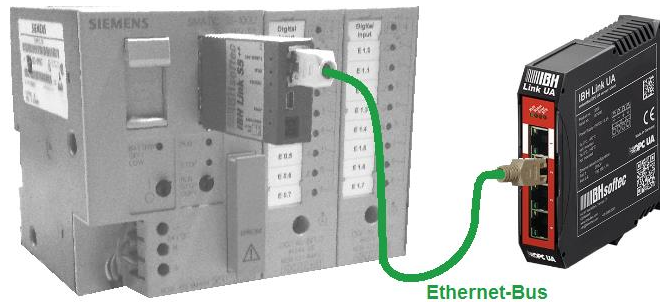
5.1 Counter level – Configuration with the TIA Portal

Example: Project CPU S5 TIA 16e

The SIEMENS PLC programming systems TIA Portal V16 is used to create the network configuration.



Connection IBH Link UA - S5 PLC with CPU 103U



5.1.1 IBH Link UA - configuration with the STEP7 TIA Portal

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.

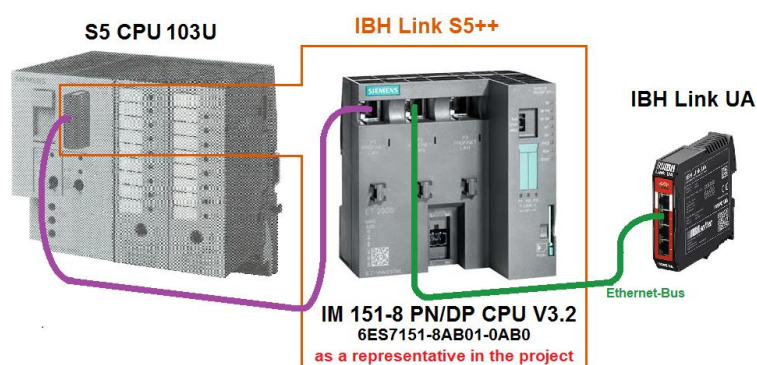
PG communication and S7 communication are possible via the PROFINET interface.

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



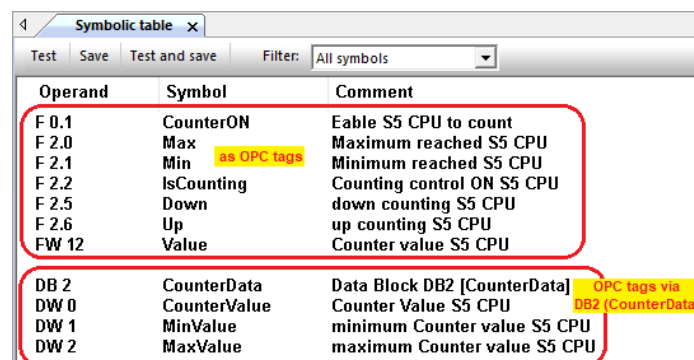
The symbol table for defining the OPC tags is available in the **CPU S5 TIA16e** project. The hardware components required for the communication between **S5 CPU** and **IBH Link UA** are specified in the project.

5.1.2 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.

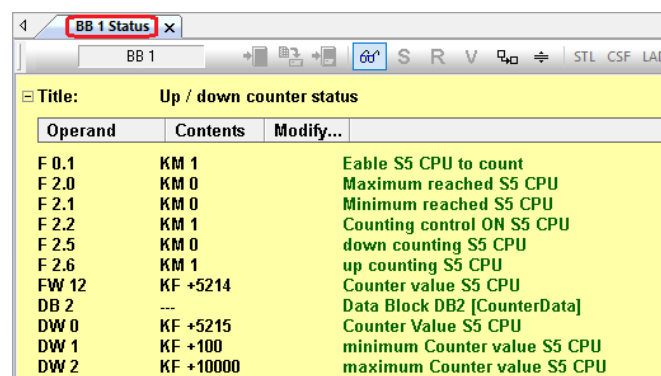
S5 symbol table

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 2	CounterData	Data Block DB2 [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 DB2



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 2	---	Data Block DB2 [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

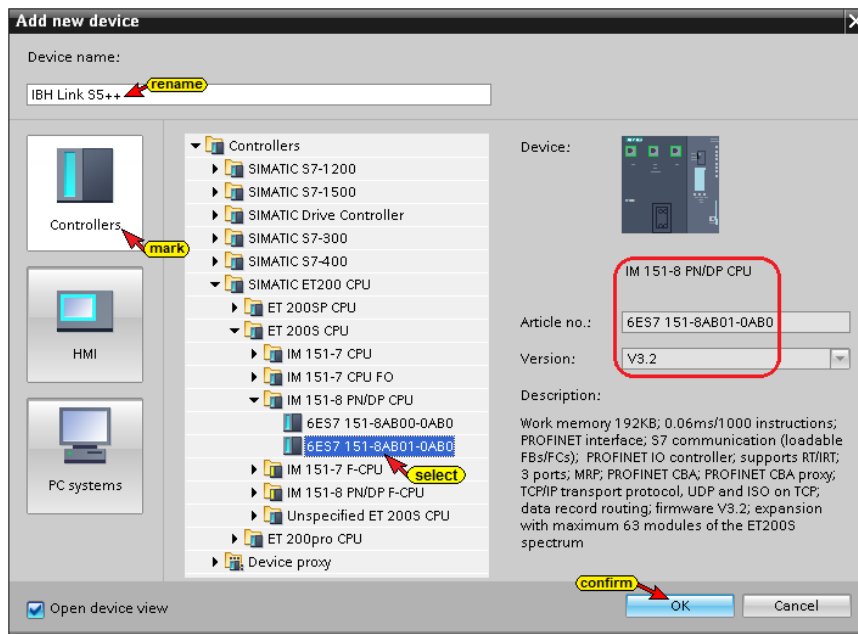
5.2 Create the CPU S5 TIA16e project in the TIA Portal

Create the new project CPU S5 TIA16e in the TIA V16 portal.

Insert device IM115-8 PN / DB CPU V3.2 into the project.

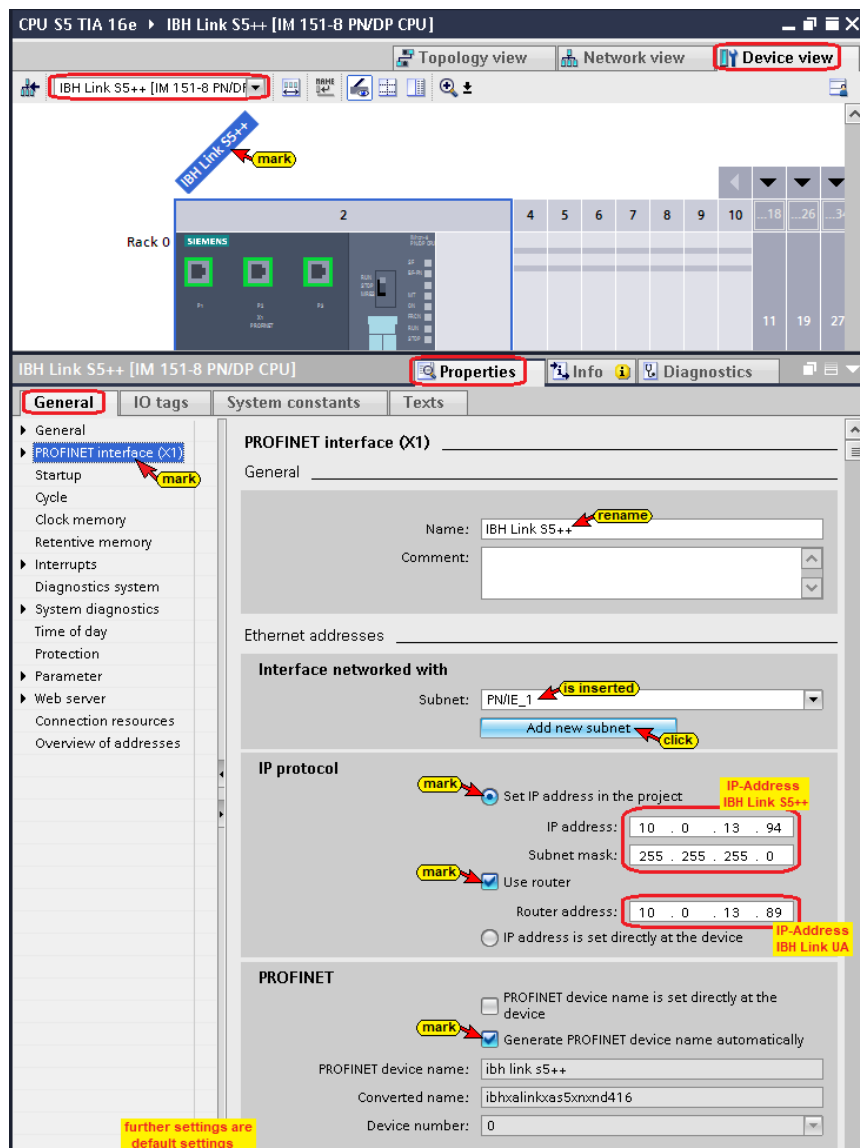
Double-click on **Add new device** to open the dialog box for selecting the modules.





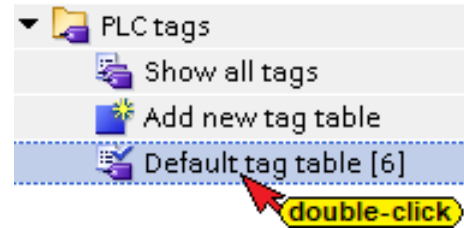
Define IBH Link S5 ++ (IM115-8 PN/DP CPU) properties

The IM115-8 is displayed in the device view.



Define OPC tags (symbols) as default tags

A double-click opens the default tag table. In this table, operands of the symbol table of the S5 program (**Counter.SEQ**) are entered, which are to be sent to the OPC server as OPC tags (OPC symbols).



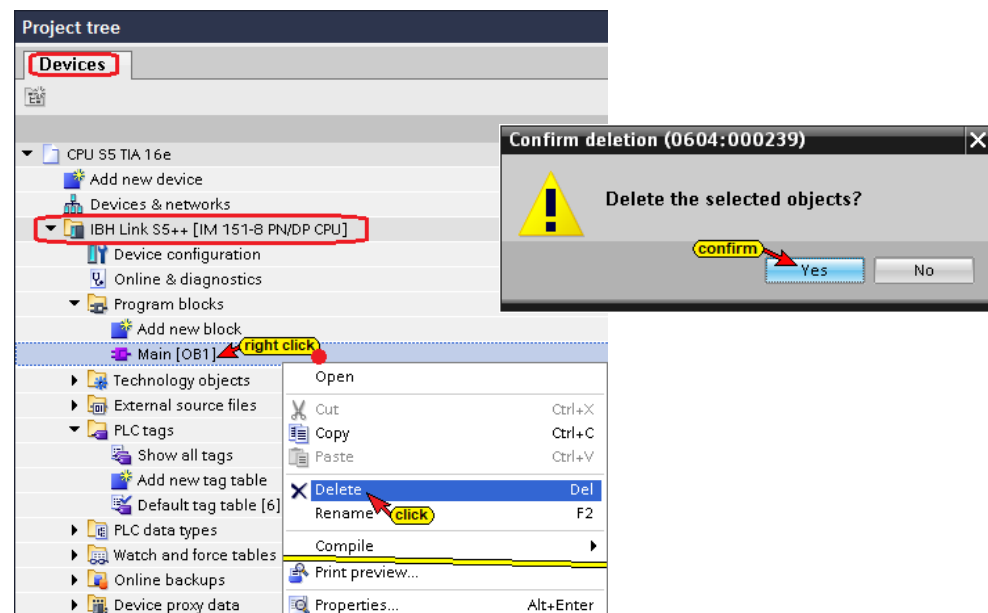
A direct import of the S5 program symbol table (**Counter.SEQ**) is impossible in the TIA Portal.

... IBH Link S5++ [IM 151-8 PN/DP CPU] > PLC tags > Default tag table [7]

Default tag table				
	Name	Data type	Address	Comment
1	CounterON	Bool	%M0.1	Enable S5 CPU to count
2	Down	Bool	%M2.5	down counting S5 CPU
3	IsCounting	Bool	%M2.2	Counting control ON S5 CPU
4	Max	Bool	%M2.0	Maximum reached S5 CPU
5	Min	Bool	%M2.1	Minimum reached S5 CPU
6	Up	Bool	%M2.6	up counting S5 CPU
7	Value	Int	%MW12	Counter value S5 CPU

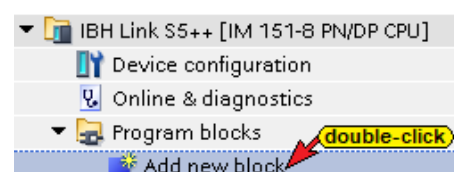
Delete block OB1

Only data can be transferred with the **IBH Link S5++**. Therefore, all program blocks, except for **data blocks**, must be deleted in the IM 151-8 CPU.

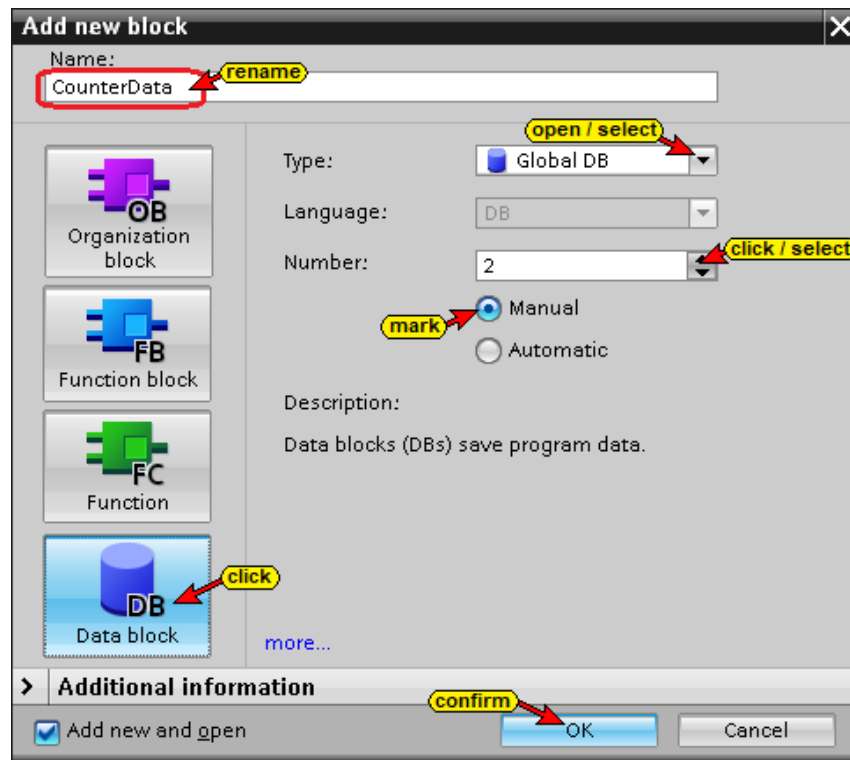


Create Data block

Double-click on **Add new block** to open the dialog box for creating the required block **CounterData [DB 2]**.



The data block must have a symbolic name so that the data can be sent to the OPC server as OPC tags (OPC symbols).



Data block CounterData [DB 2]

... IBH Link S5++ [IM 151-8 PN/DP CPU] ▶ Program blocks ▶ CounterData [DB2]

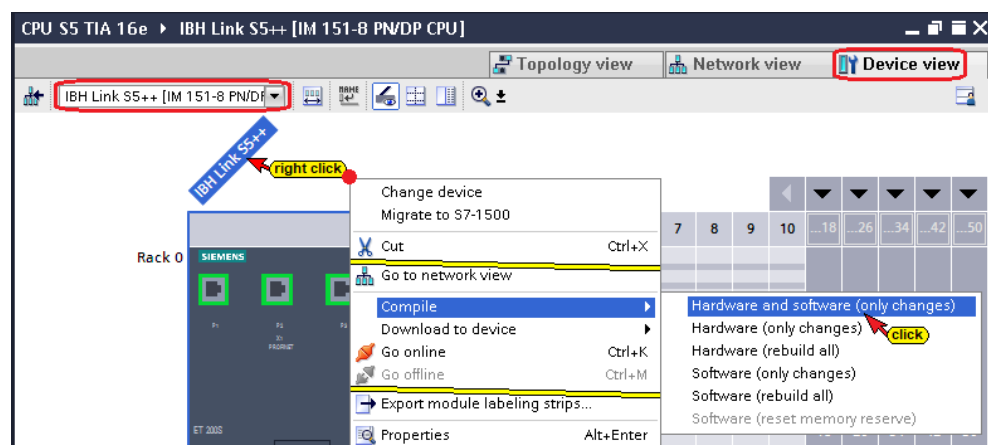
Keep actual values Snapshot

CounterData

	Name	Data type	Offset	Start value	Comment
1	Static				
2	CounterValue	Int	0.0	0	Counter value S5 CPU
3	MinValue	Int	2.0	0	minimum Counter value S5 CPU
4	MaxValue	Int	4.0	0	maximum Counter value S5 CPU

Compile hardware and software (IBH Link S5 ++)

The hardware configuration and software should be compiled so that errors can be recognized.



Note:

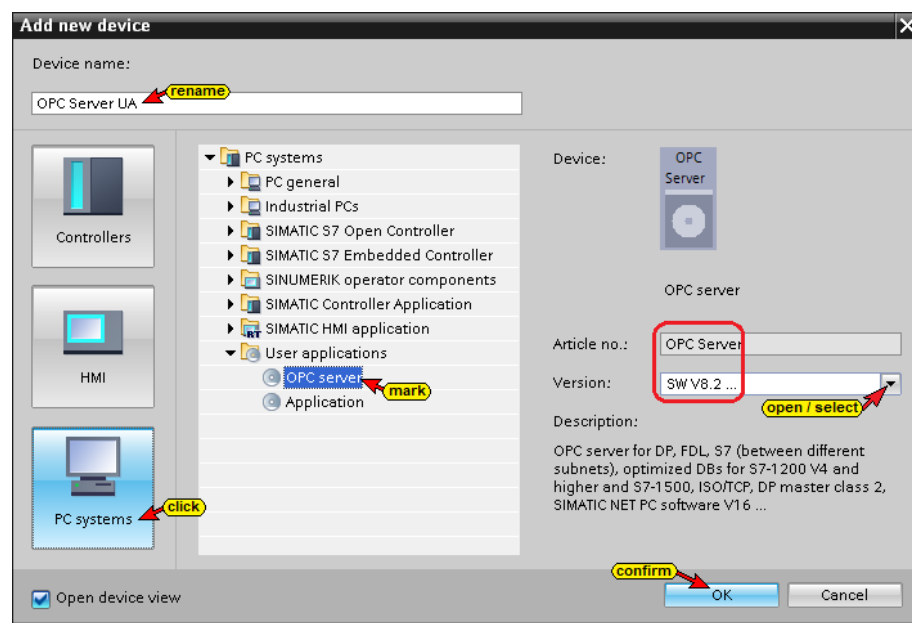
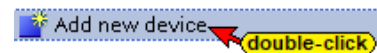
Only data can be transferred with the **IBH Link S5++**. Therefore, all program blocks in the Profinet I/O CPU must be deleted. Data blocks can be used.

The hardware configuration and the PLC blocks must not be loaded into the IBH Link S5++.

The use of the download command is not permitted !

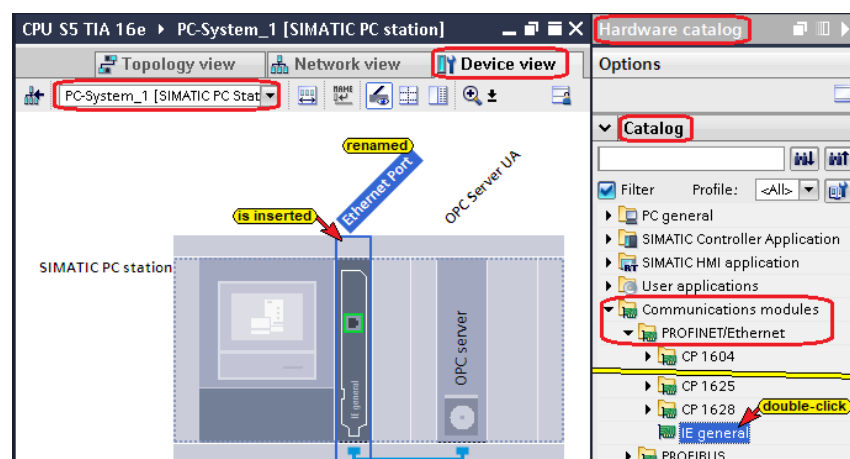
Insert IBH Link UA as an SIMATIC PC station

Double-click on **Add new device** to open the dialog box for selecting the modules.



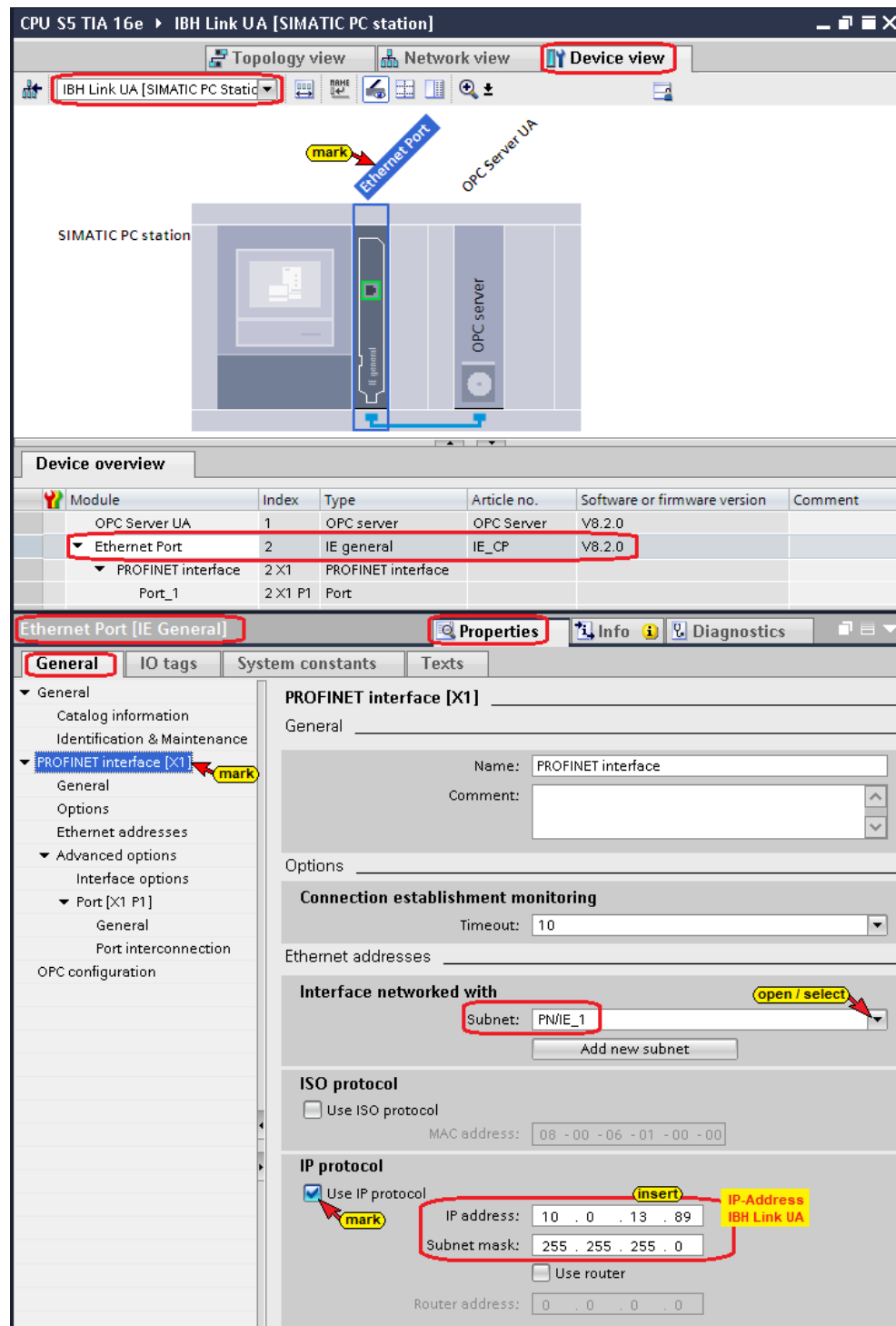
Insert communication module in the SIMATIC PC station (IBH Link UA)

Double-click on the device in the hardware catalog to insert the communication module IE general into the IBH Link UA (SIMATIC PC station).



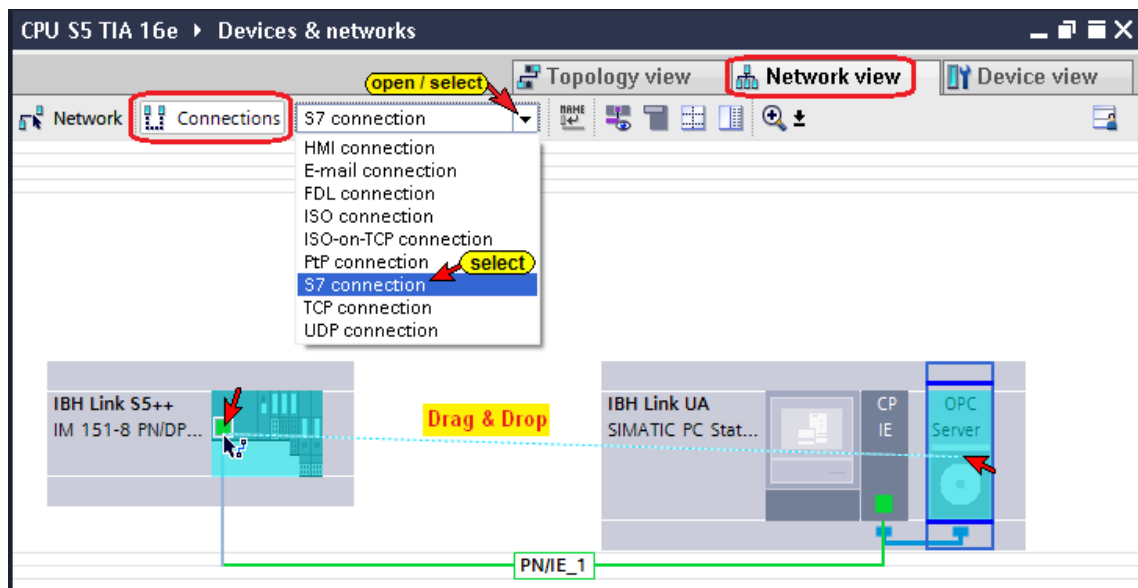
Define communication module properties

Clicking **Ethernet Port** in the **SIMATIC PC Station [IBH Link UA]** opens the properties of the **Ethernet Port [IE General]** dialog box. The **Ethernet address** of the IBH Link UA must be entered. The Networking is also defined.

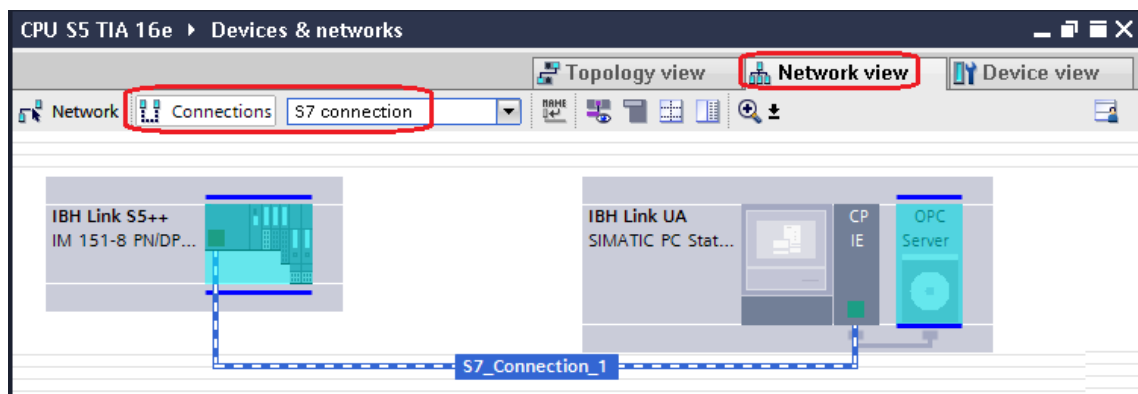


Creating an S7 connection from the OPC server to the IBH Link S5 ++ (IM 115-8 PN/DP CPU)

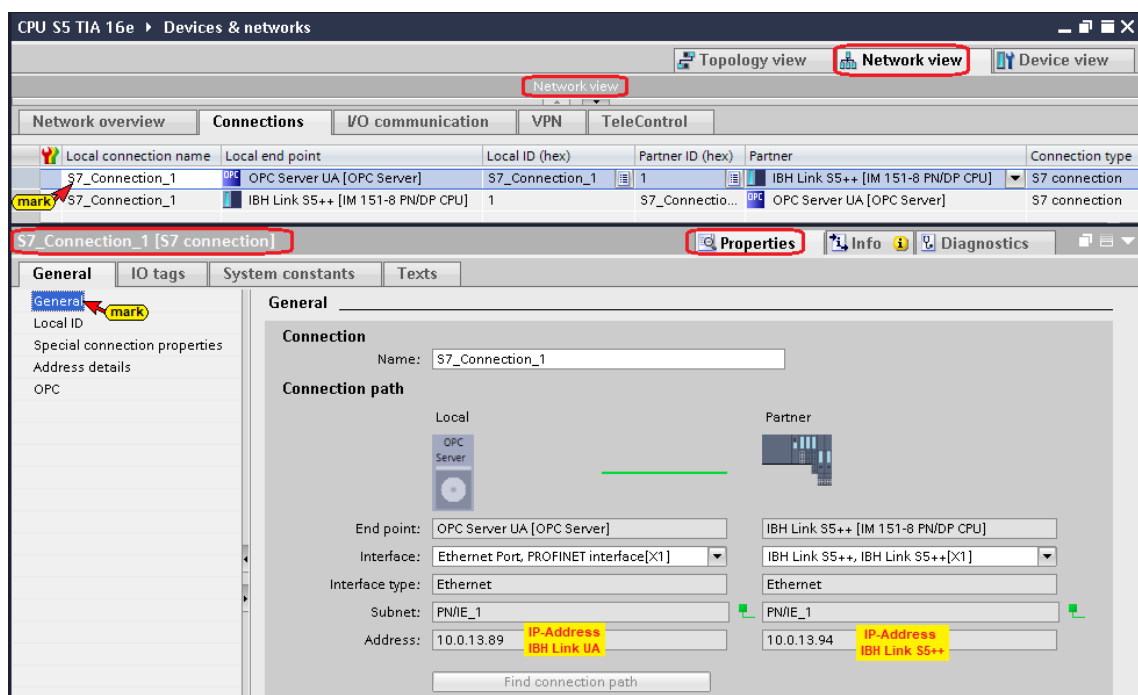
The S7 connection is established via drag and drop from the OPC server to the IBH Link S5++ (IM115-8 PN/DP CPU).



The S7 connection from the OPC server to the IBH Link S5++ (IM115-8 PN/DP CPU) is displayed.

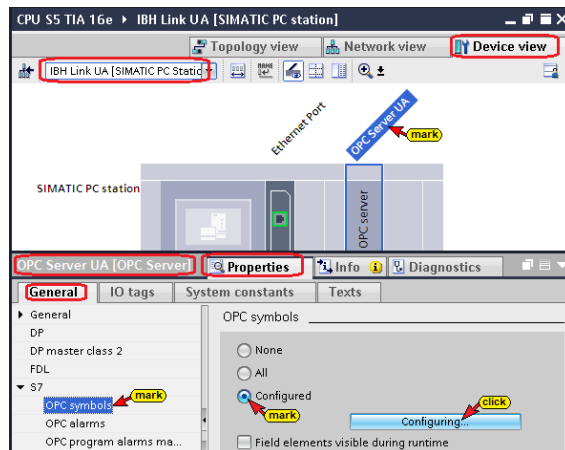


A click switches between the connection representations. The created S7 connection is listed in the Network view window.



Select OPC symbols (tags) in the OPC configuration

Open the configuration on the OPC server / properties.

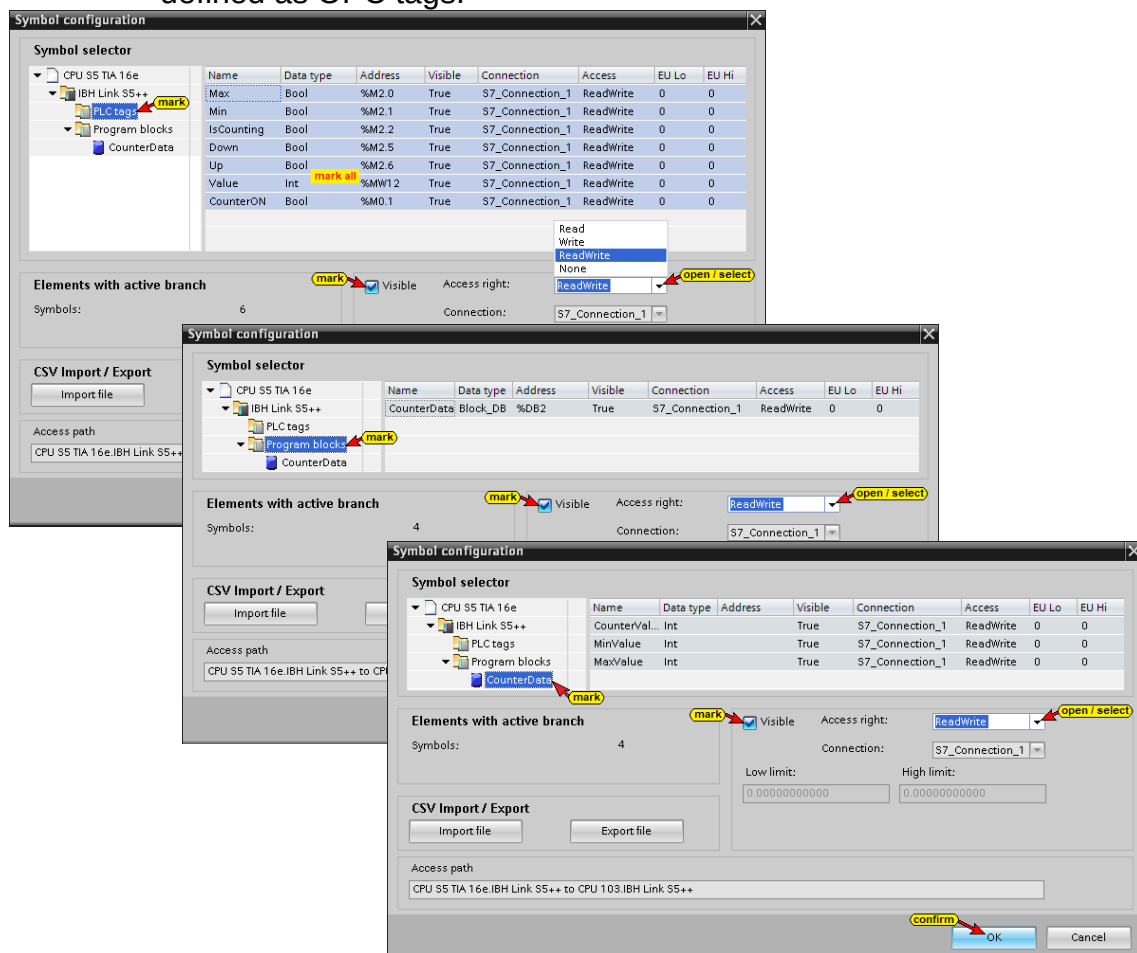


The **Configure** button opens the Symbol configuration dialog box, in which the operands defined in the default tag table (PLC program IM115-8 PN/DP CPU) can be selected as OPC tags.

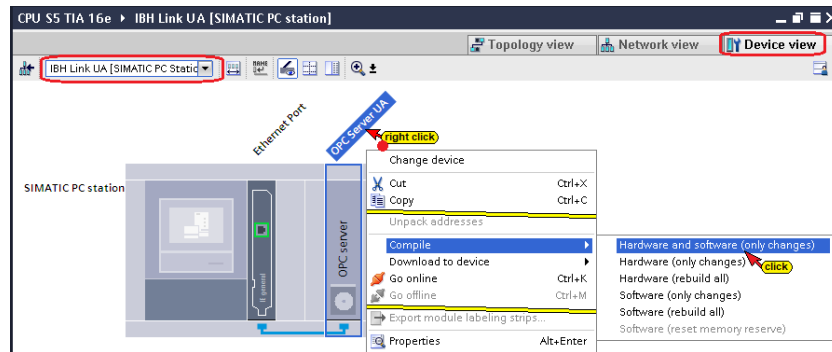
The read / write, etc. access rights can be assigned to the individual operands (OPC tags).

Select global variables as OPC tags

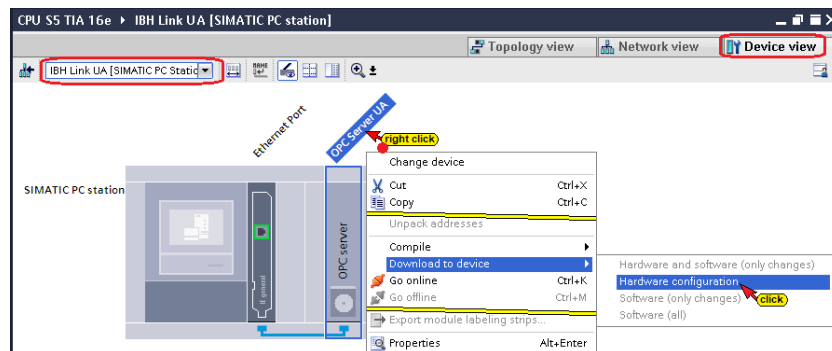
In addition to the global variables, the data from data blocks can be defined as OPC tags.



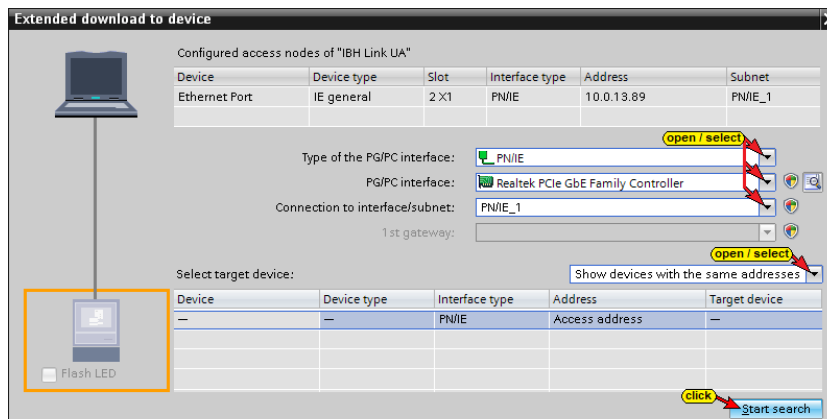
Compile the configuration of the OPC server



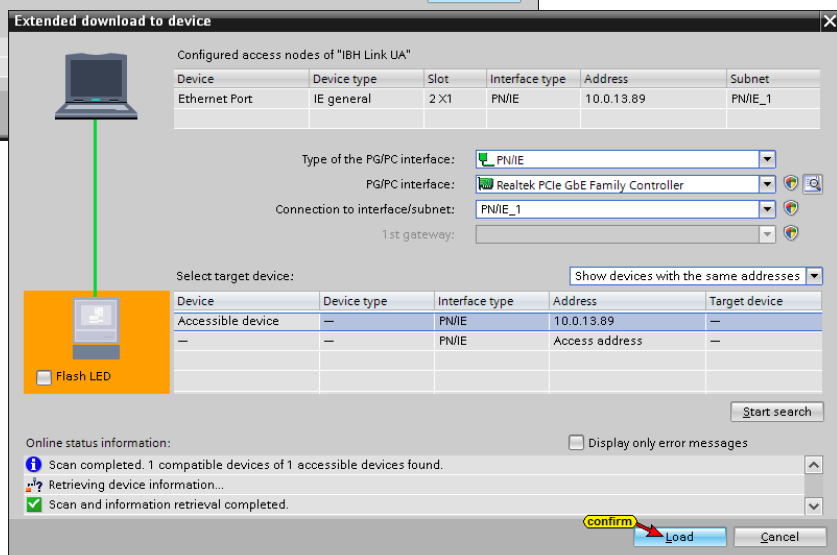
Load configuration of the OPC server into IBH Link UA



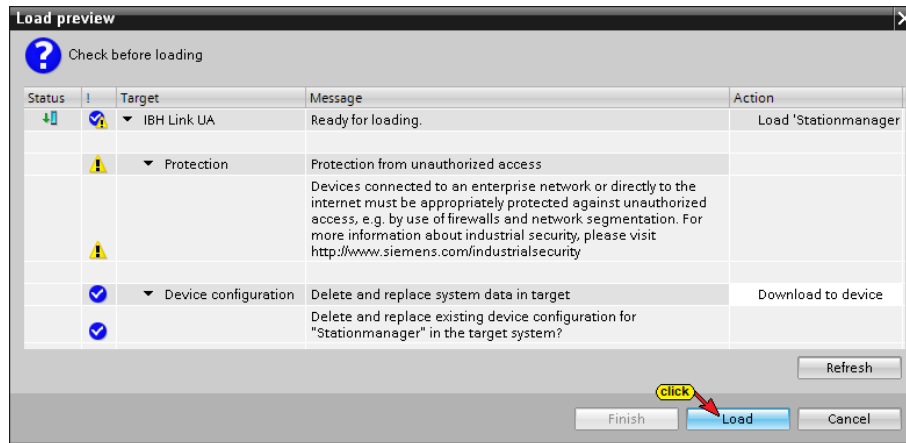
The settings must be made in the dialog box according to the screen shot.



The interface search was successful.

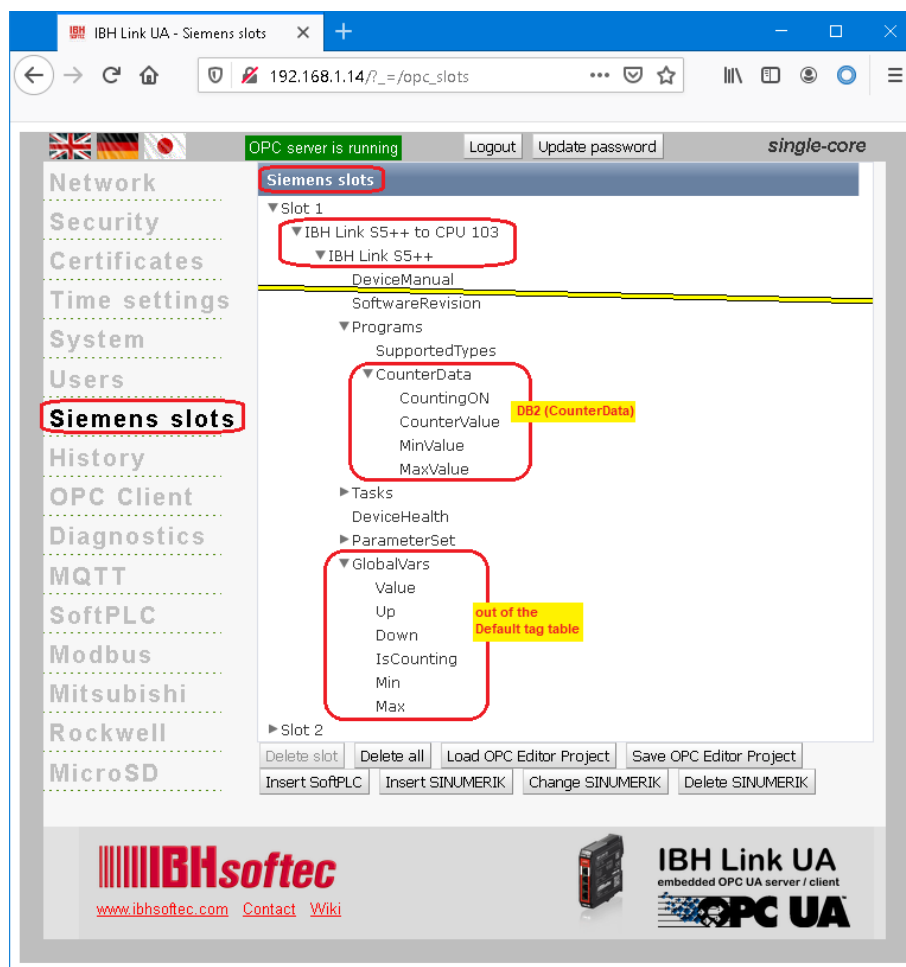


A check is made prior loading.



5.2.1 IBH Link UA browser window Siemens slots

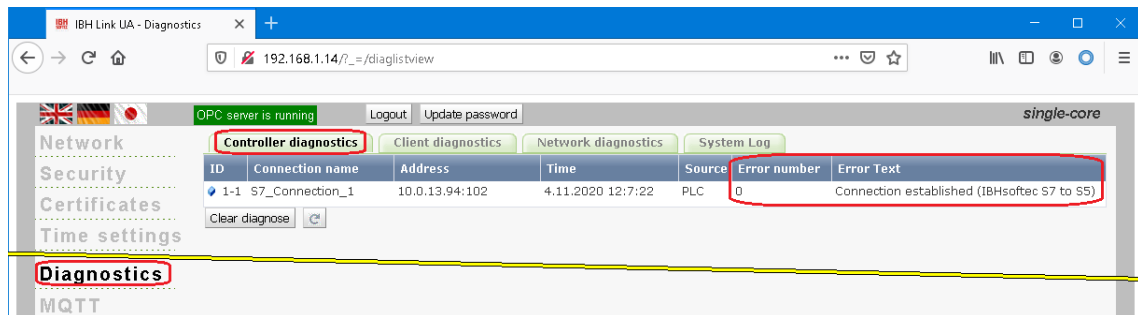
The CPU with the OPC tags is displayed in the Siemens Slots browser window.



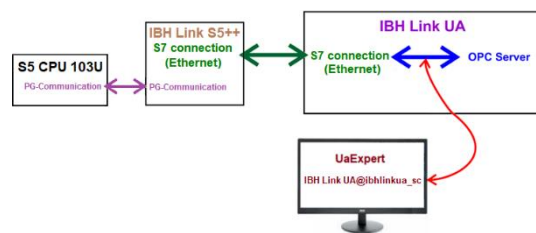
5.2.2 Browser window diagnostics

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

Controller diagnostics



5.3 OPC tags in the UaExpert window



In the UaExpert - program window the **global variables** of the PLC program **CPU S5 TIA16e** are displayed and under Programs, the variables of the data block **CounterData [DB 2]**.

#	Server	Node Id	Display Name	Value	Datatype	Source Timestamp	Server Timestamp	Statuscode
1	IBHLinkUA...	NS4[String]IBH ...	Down	false	Boolean	13:56:12.042	13:56:12.542	Good
2	IBHLinkUA...	NS4[String]IBH ...	IsCounting	true	Boolean	13:50:01.925	13:50:02.560	Good
3	IBHLinkUA...	NS4[String]IBH ...	Max	false	Boolean	13:50:03.367	13:50:04.060	Good
4	IBHLinkUA...	NS4[String]IBH ...	Min	false	Boolean	13:50:05.015	13:50:05.562	Good
5	IBHLinkUA...	NS4[String]IBH ...	Up	true	Boolean	13:56:12.042	13:56:12.542	Good
6	IBHLinkUA...	NS4[String]IBH ...	Value	2326	Int16	13:56:20.547	13:56:21.047	Good
7	IBHLinkUA...	NS4[String]IBH ...	CounterValue	2183	Int16	13:56:20.547	13:56:21.047	Good
8	IBHLinkUA...	NS4[String]IBH ...	CountingON	512	UInt16	13:50:12.046	13:50:12.821	Good
9	IBHLinkUA...	NS4[String]IBH ...	MaxValue	10000	Int16	13:50:15.343	13:50:16.073	Good
10	IBHLinkUA...	NS4[String]IBH ...	MinValue	100	Int16	13:50:17.174	13:50:17.824	Good

#	Display Name	Value	Datatype
1	Down	false	Boolean
2	IsCounting	true	Boolean
3	Max	false	Boolean
4	Min	false	Boolean
5	Up	true	Boolean
6	Value	5681	Int16
7	CounterValue	5539	Int16
8	CountingON	512	UInt16
9	MaxValue	10000	Int16
10	MinValue	100	Int16

Data Access View

#	Server	Node Id
1	IBHLinkUA@ibhlinkua_sc	NS4 String IBH Link S5++ to CPU 103.IBH Link S5++.GlobalVars.Down
2	IBHLinkUA@ibhlinkua_sc	NS4 String IBH Link S5++ to CPU 103.IBH Link S5++.GlobalVars.IsCounting
3	IBHLinkUA@ibhlinkua_sc	NS4 String IBH Link S5++ to CPU 103.IBH Link S5++.GlobalVars.Max
4	IBHLinkUA@ibhlinkua_sc	NS4 String IBH Link S5++ to CPU 103.IBH Link S5++.GlobalVars.Min
5	IBHLinkUA@ibhlinkua_sc	NS4 String IBH Link S5++ to CPU 103.IBH Link S5++.GlobalVars.Up
6	IBHLinkUA@ibhlinkua_sc	NS4 String IBH Link S5++ to CPU 103.IBH Link S5++.GlobalVars.Value
7	IBHLinkUA@ibhlinkua_sc	NS4 String IBH Link S5++ to CPU 103.IBH Link S5++.Programs.CounterData.CounterValue
8	IBHLinkUA@ibhlinkua_sc	NS4 String IBH Link S5++ to CPU 103.IBH Link S5++.Programs.CounterData.CountingON
9	IBHLinkUA@ibhlinkua_sc	NS4 String IBH Link S5++ to CPU 103.IBH Link S5++.Programs.CounterData.MaxValue
10	IBHLinkUA@ibhlinkua_sc	NS4 String IBH Link S5++ to CPU 103.IBH Link S5++.Programs.CounterData.MinValue

Data Access View

#	Display Name	Value	Datatype	Source Timestamp	Server Timestamp	Statuscode
1	Down	true	Boolean	14:29:19.021	14:29:19.522	Good
2	IsCounting	true	Boolean	13:50:01.925	13:50:02.560	Good
3	Max	false	Boolean	13:50:03.367	13:50:04.060	Good
4	Min	false	Boolean	13:50:05.015	13:50:05.562	Good
5	Up	false	Boolean	14:29:19.021	14:29:19.522	Good
6	Value	2258	Int16	14:29:21.523	14:29:22.023	Good
7	CounterValue	2401	Int16	14:29:21.523	14:29:22.023	Good
8	CountingON	512	UInt16	13:50:12.046	13:50:12.821	Good
9	MaxValue	10000	Int16	13:50:15.343	13:50:16.073	Good
10	MinValue	100	Int16	13:50:17.174	13:50:17.824	Good

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.

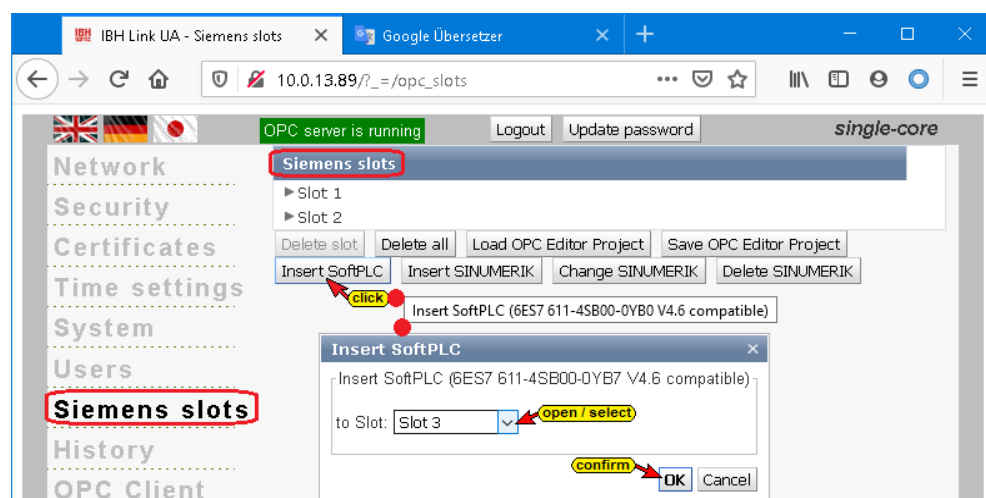
Control systems without Alarm system (SFB / SFC blocks) can also indirectly trigger **Alarms and Conditions** via the integrated SoftPLC.

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**.

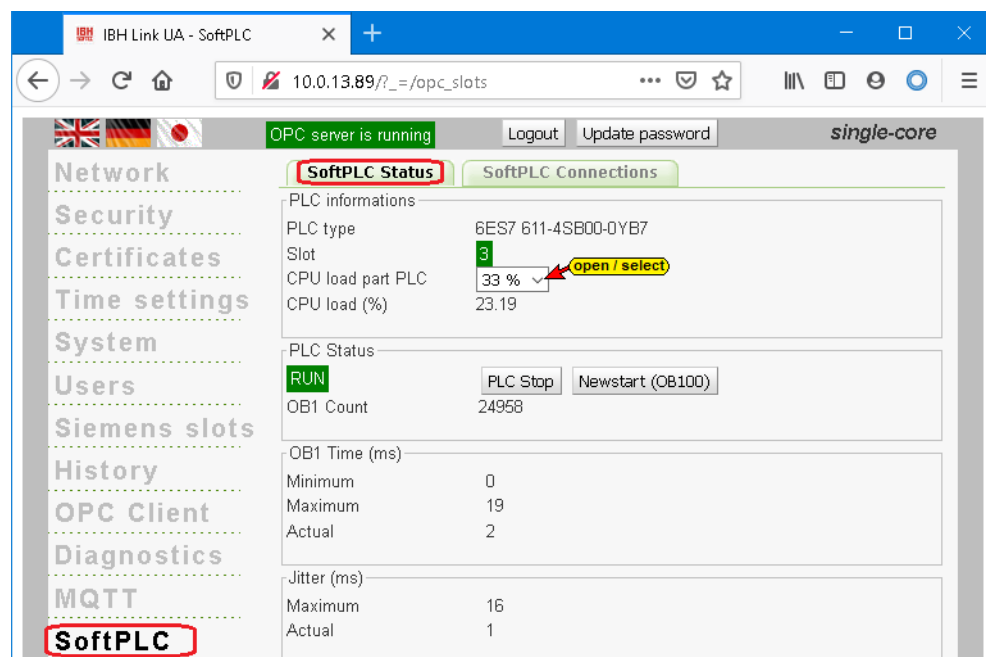
6.1 Activating the integrated SoftPLC

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 Example – OPC UA Alarms TIA Project

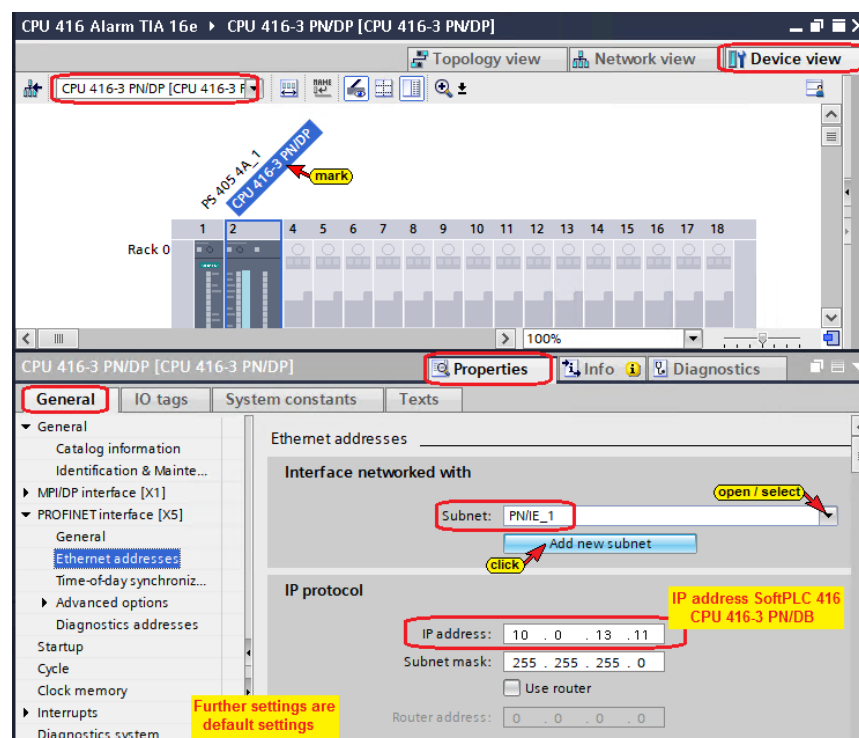
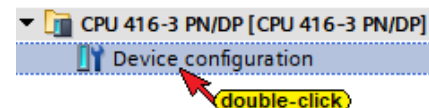
The prepared example project **CPU 416 Alarm TIA16e** is identical to the PLC program, as described in chapter 1. The counter counts until **MaxValue** is reached (up counting, indicated by the tag **Up**) and counts down until the **MinValue** is reached (down counting, indicated by the tag **Down**). The tag **Value** holds the counter reading of the counter. The SIEMENS PLC programming systems TIA Portal V16 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 CPU Hardware Configuration

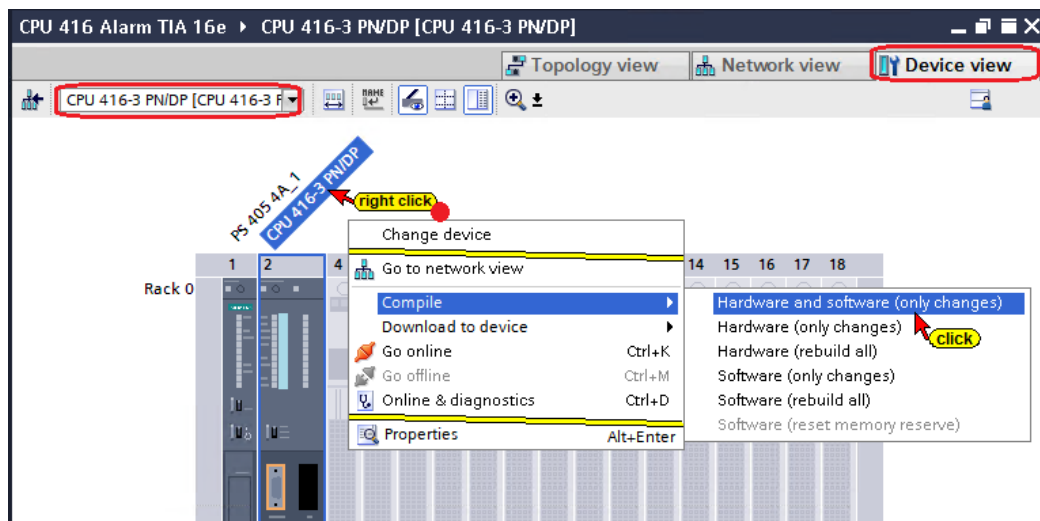
Double-click **Device Configuration** to open the Device view window. In the example, the CPU 416-3 PN/DP (6ES7 416-3ER05-0AB0) firmware version V5.1 is used, which is also available as a software PLC from IBHsoftec.



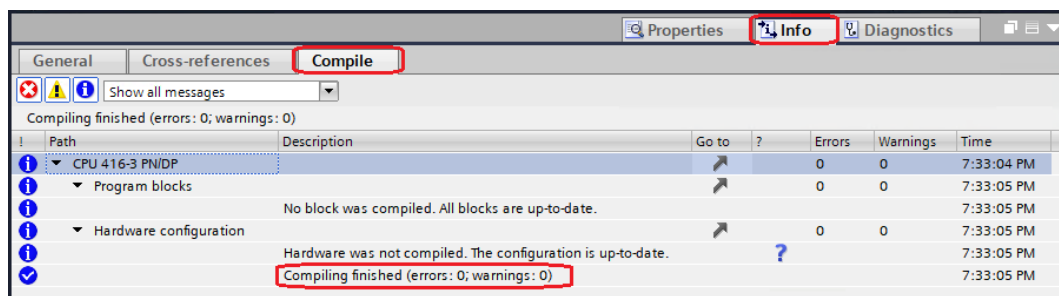
The required IP address is set under IP protocol. In the example, the IP address of the CPU is **10.0.13.11**. The Ethernet connection is direct without a router.

Hardware and software compilation

Use the command from the context menu to compile the software and the hardware.

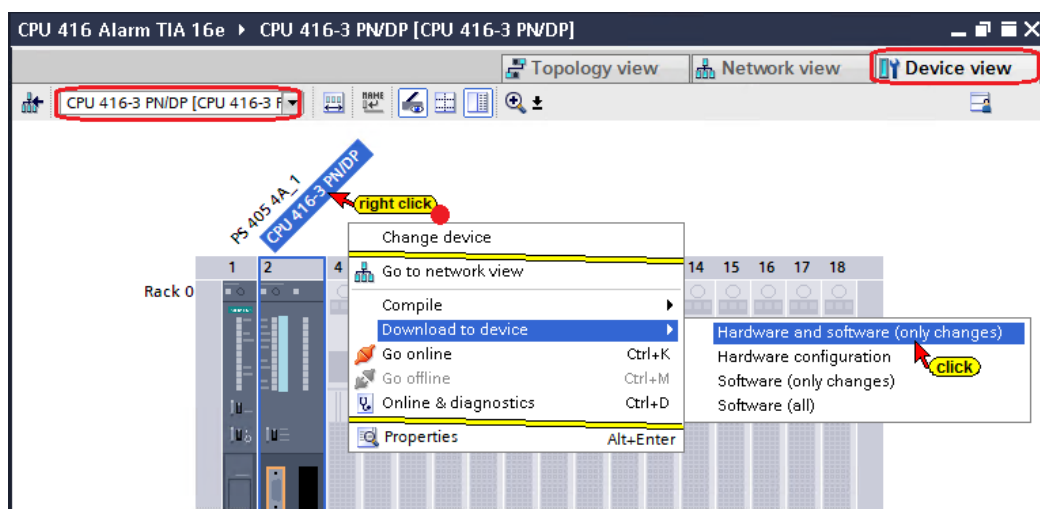


Hardware and software compilation

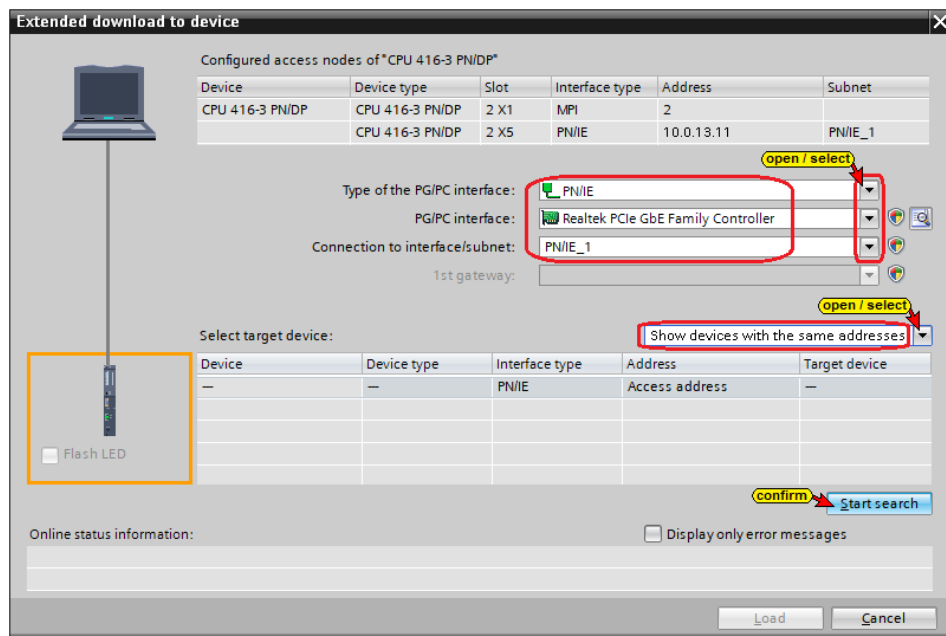


Download the hardware and software into the CPU

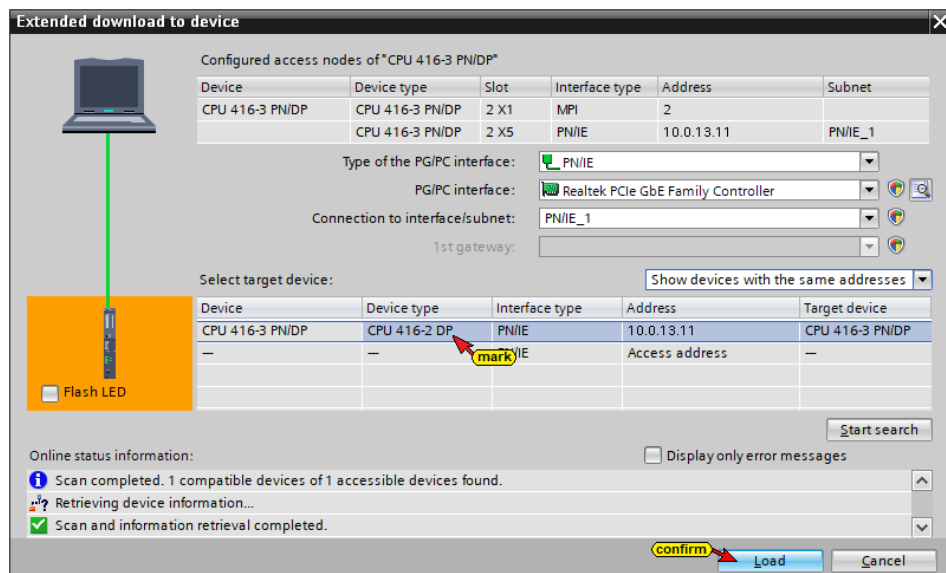
With the commands from the context menu, the software and the hardware configuration can be downloaded into the device.



The load command opens the dialog window to set the interface for the device. **Connection with interface / subnet PN/IE1**, and **Show devices with the same addresses** must be selected.

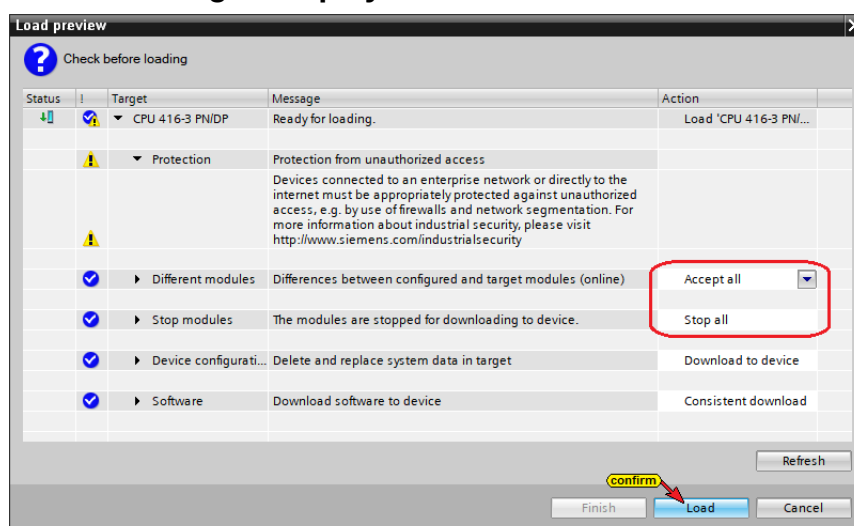


The successful search is displayed.

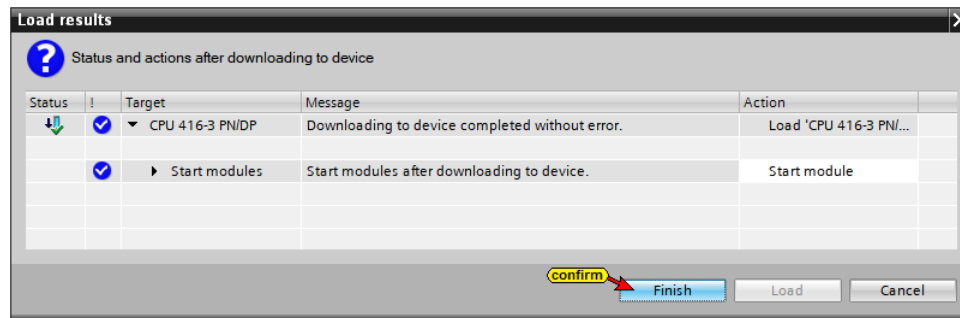


The loading process requires several confirmations of messages.

A preview of the loading is displayed.

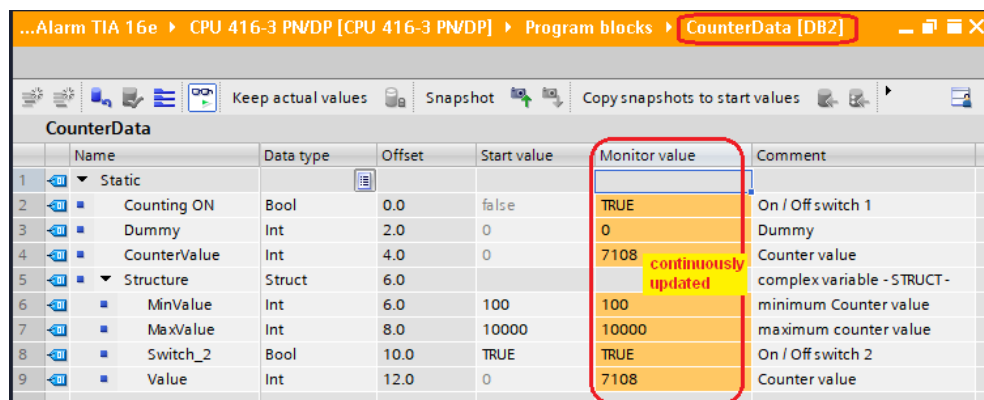


Finish loading



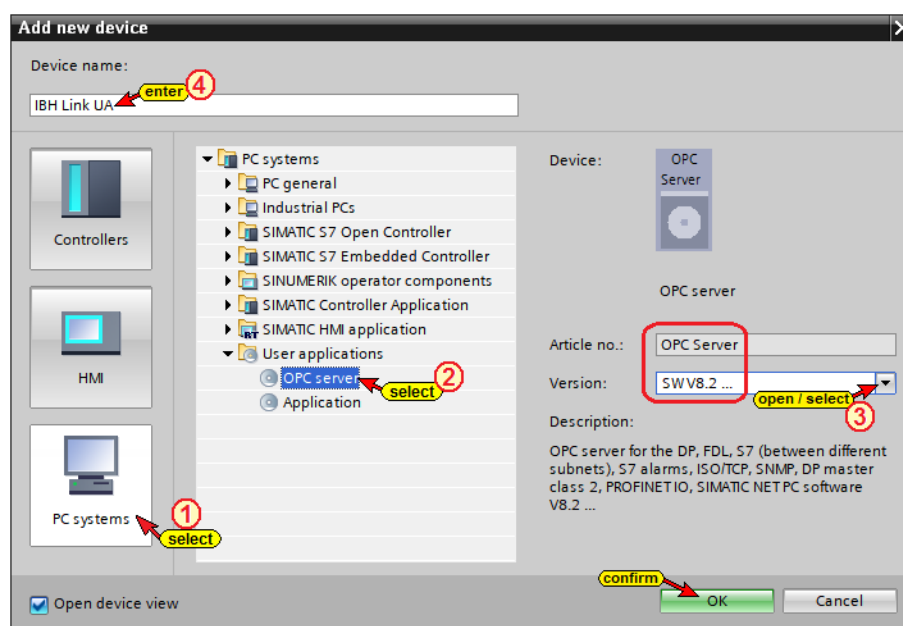
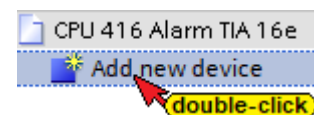
CPU 416-3 PN/DP online

The up and down counting can be checked online.

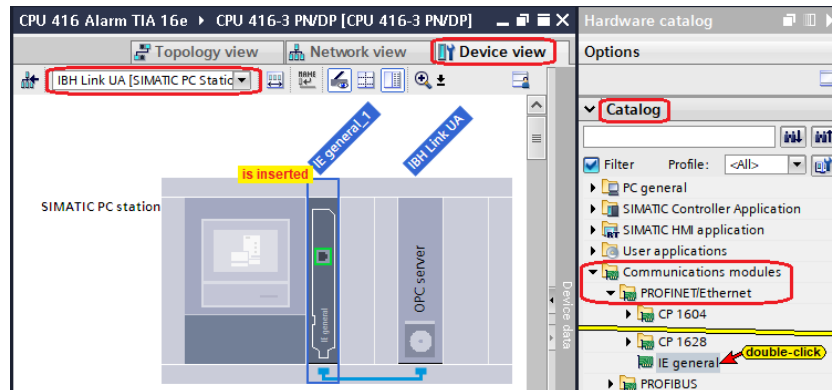


6.3 Insert IBH Link UA as an SIMATIC PC station

Double-clicking on **Add new device** opens the device selection dialog box. If an OPC server is added to the project, an **SIMATIC PC** station is automatically added.

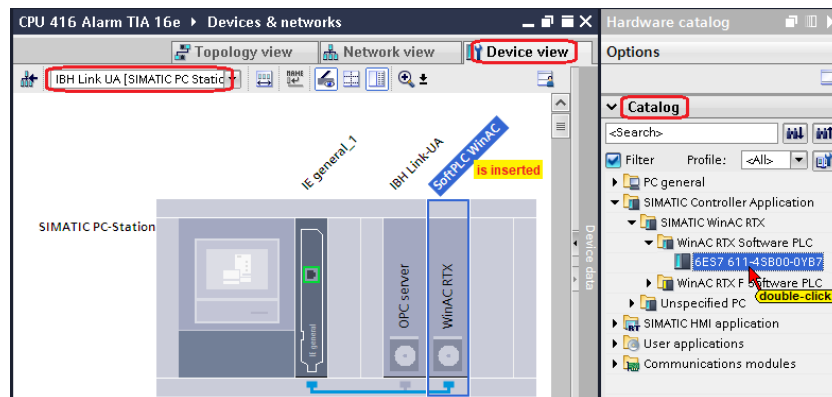


Insert communication module into the IBH Link UA



6.3.1 Insert SoftPLC as SIMATIC WinAC RTX

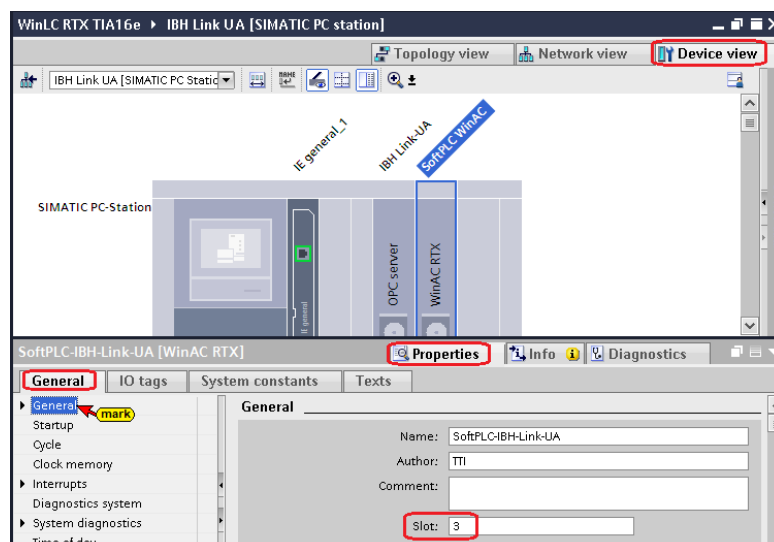
With a double-click on **WinAC RTX Software PLC / 6ES7 611-4SB00-0YB7**, the software PLC is inserted.



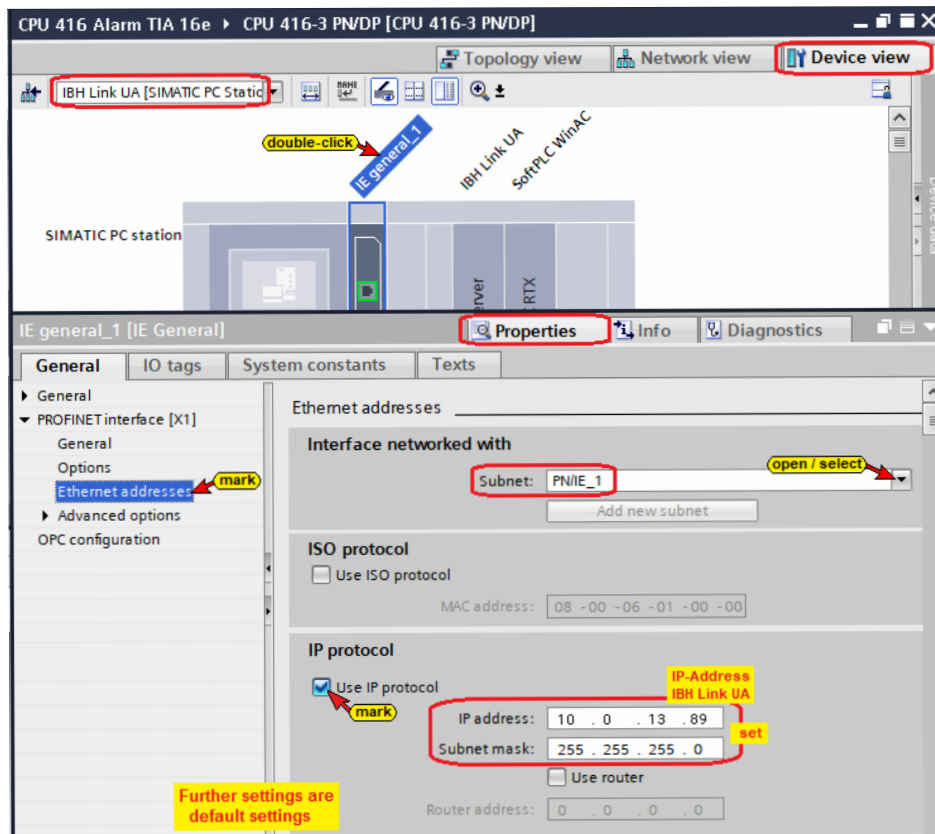
The firmware must have version **V4.6**. The **Software PLC_1** have been renamed in **Soft PLC WinAC**.

Check the WinAC RTX (Soft PLC WinAC) slot

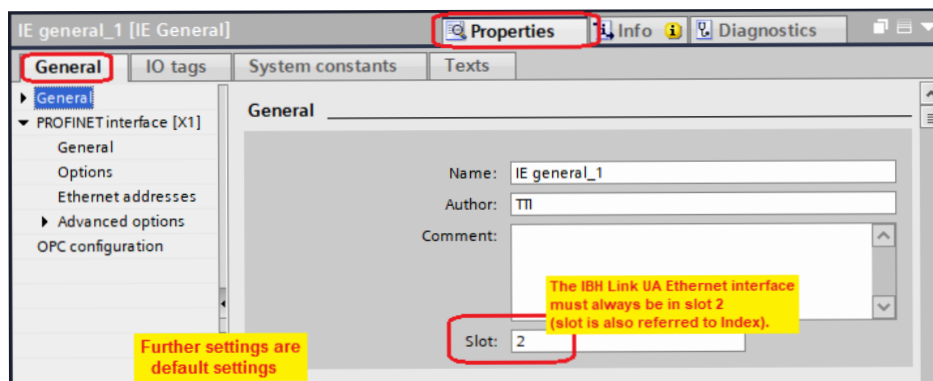
The soft PLC WinAC RTX was created in **Siemens slot 3** in the IBH Link UA. The soft **Soft PLC WinAC** must be in **slot 3**.



Define communication module properties



Check slot IE General_1



6.3.2 IBH Link UA SoftPLC WinAC – PLC Program

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

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

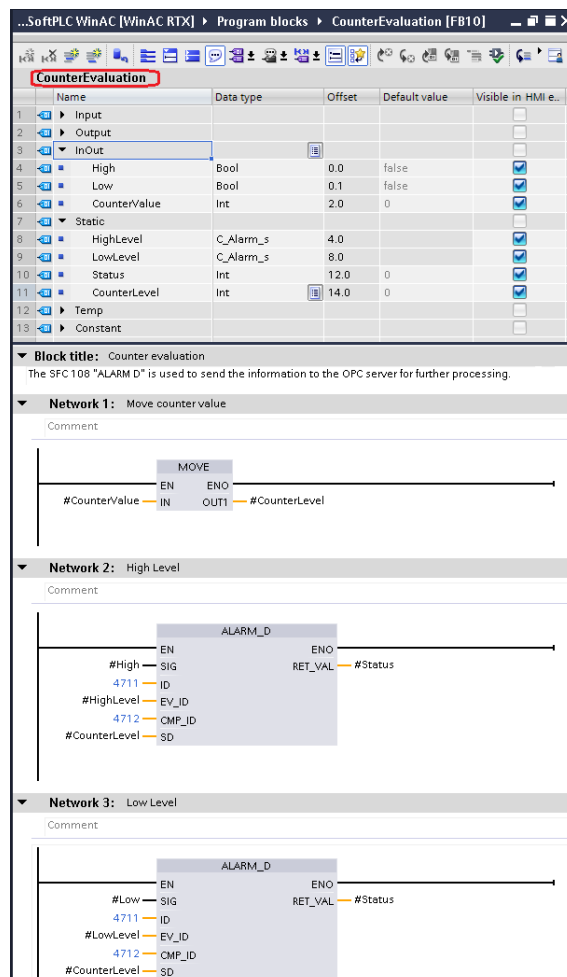
The signals **High** and **Low** are used to trigger the transfer of the messages.

ALARM D (SFC 108) Parameters

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

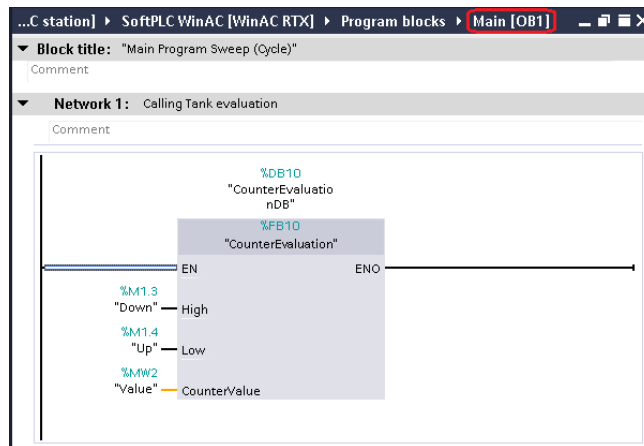
Parameter	Declaration	Data type	Memory area	Description
SIG	INPUT	BOOL	I, Q, M, D, L	The alarm triggering signal
ID	INPUT	WORD	I, Q, M, D, L or constant	Data channel for alarms: W#16#EEEE
EV_ID	INPUT	DWORD	I, Q, M, D, L	Alarm number (not allowed: 0)
CMP_ID	INPUT	DWORD	I, Q, M, D, L or constant	component 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 *CounterEvaluation* [FB 10]



Organization Block Main [OB1]

The function module **CounterEvaluation** [FB 10] should be called now because the instance data block **CounterEvaluationDB** must exist to define the values for the PLC messages of the **Data type C_Alarms_s**.

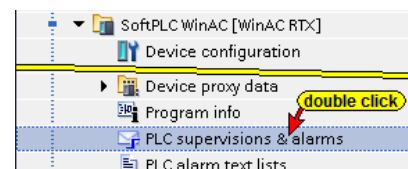


6.3.3 Configuring PLC messages

Values can be assigned to the messages being defined with the parameters SD. These values may have a maximum length of 12 bytes. The accompanying value is a block beginning and ending with the character @.

Opening the Program alarms window

Double-click to open the Program alarms window to set the associated values.



Alarm types						
Name	Range	Type	ID	Location	Alarm text	
HighLevel	1	Alarm_s		CounterEvaluation	Counter reading @1%3u@ Low	
LowLevel	1	Alarm_s		CounterEvaluation	Counter reading @1%3u@ High	

Alarm instances						
Name	Range	Type	ID	Location	Alarm text	
HighLevel	1	Alarm_s	1610612737	CounterEvaluationDB	Counter reading @1%3u@ Low	

Alarm instances						
Name	Range	Type	ID	Location	Alarm text	
LowLevel	1	Alarm_s	1610612738	CounterEvaluationDB	Counter reading @1%3u@ High	

Marking a line in the **Alarm types** field, lists the **ID** of the associated name in the **Alarm instances** field.

The **Alarm text** belonging to the individual names can be edited in the **Alarm types** list.

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:

Counter reading @1l%3u@ Low
Counter reading @1l%3u@ High

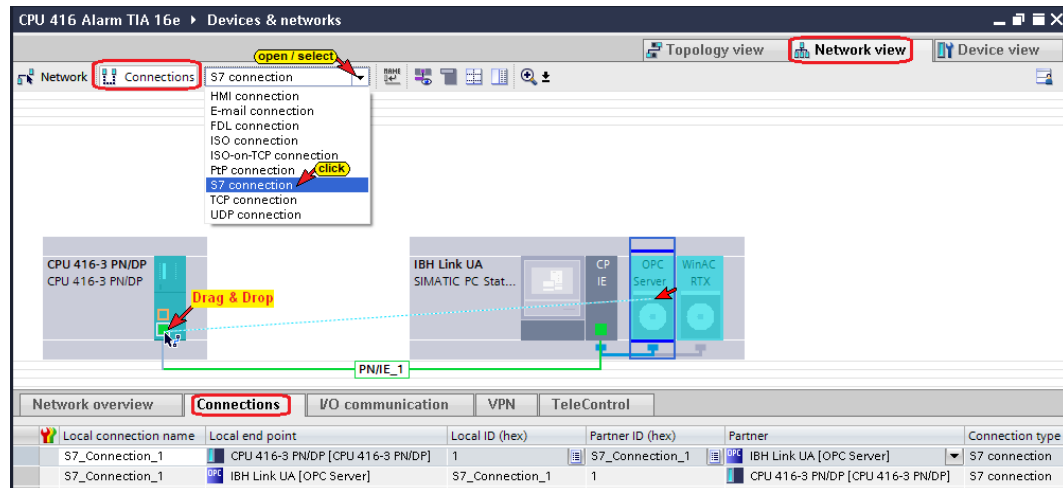
Output on the display:

Counter reading 385 Low
Counter reading 9846 High

6.3.4 S7 connection – OPC server with CPU 416 / OPC server with WinAC RTX

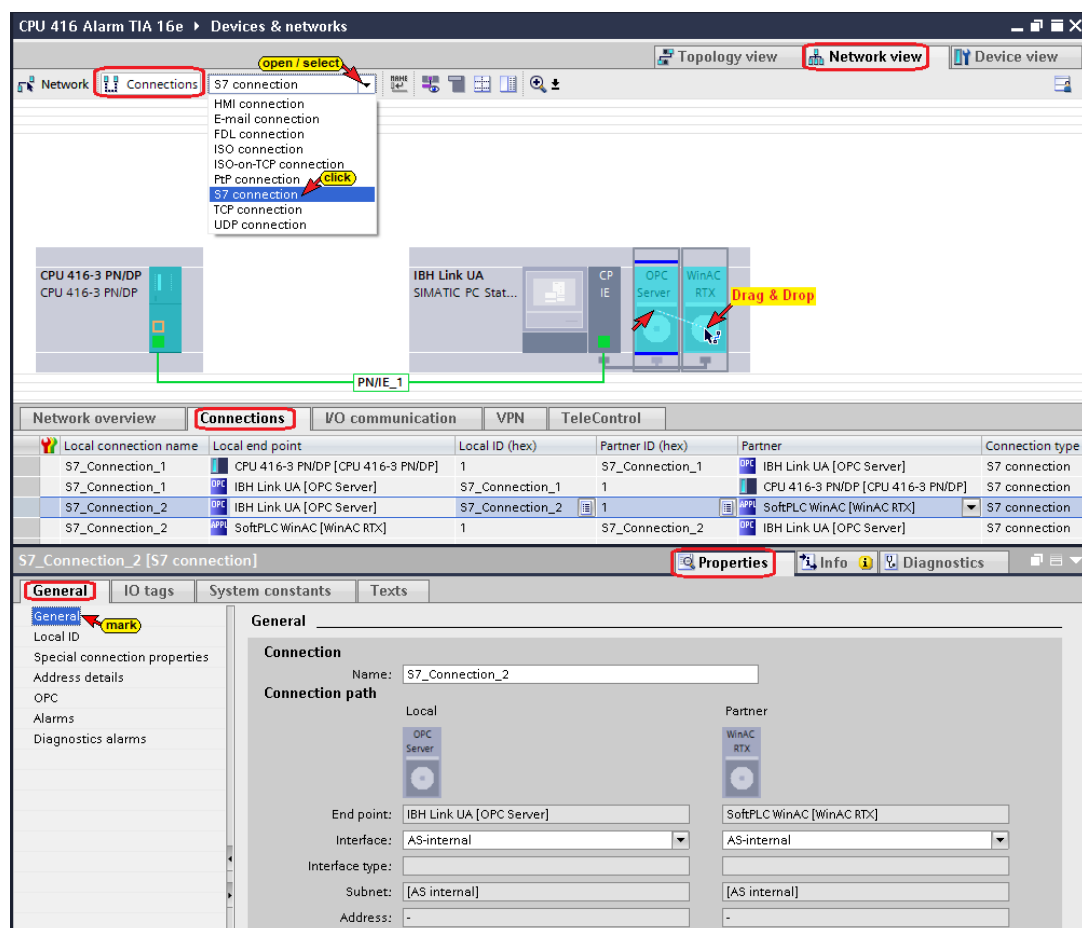
S7 connection – IBH Link UA-OPC server – CPU 416-3 PN/DP

Via **drag & drop**, from the **OPC server** to the **PLC 416-3 PN/DP**, the S7 connection established.

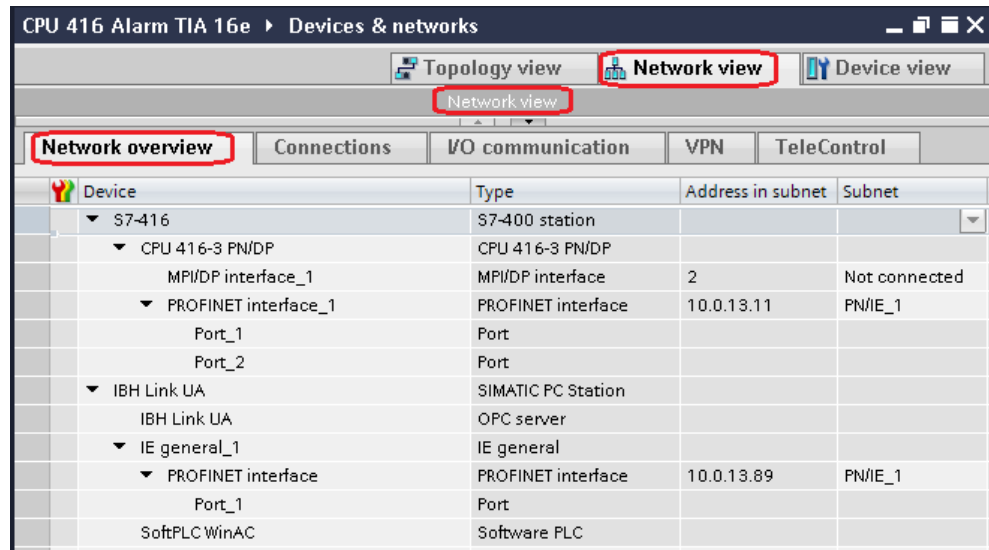


S7 connection – IBH Link UA-OPC server – WinAC RTX

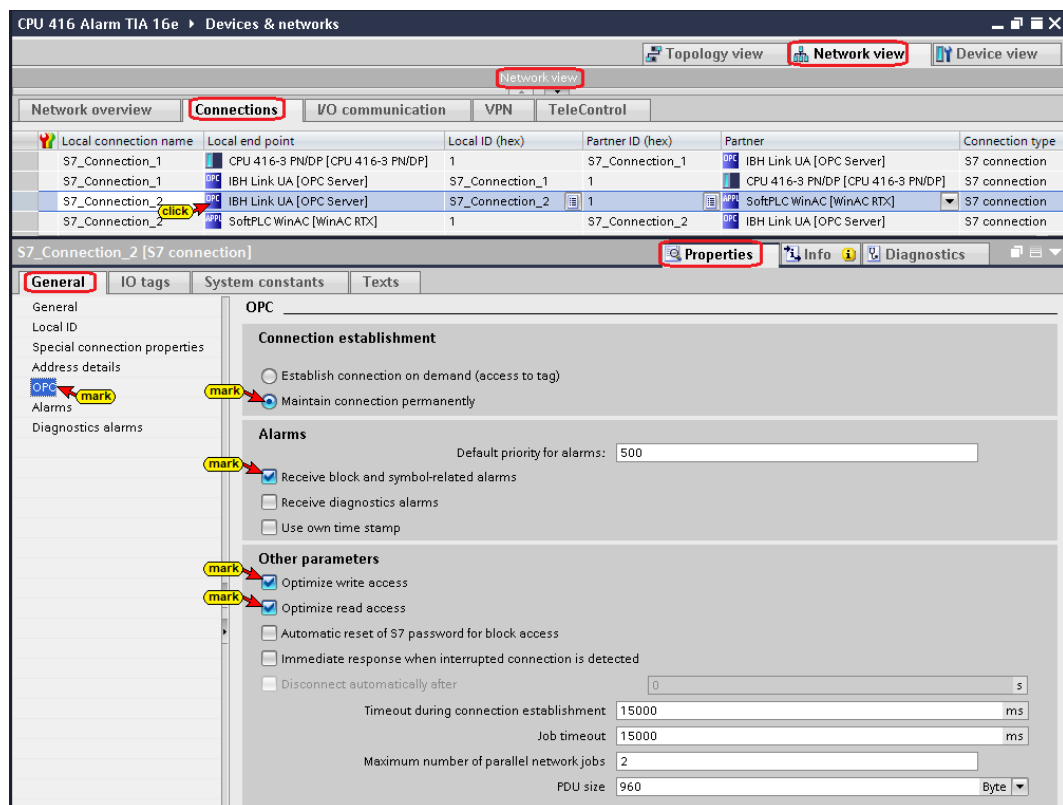
Via **drag & drop**, from the **OPC server** to the **WinAC RTX**, the S7 connection established.



The connections are displayed.



S7 connection - display / set OPC properties



With a click on the S7_Connection (**IBH Link UA OPC Server [OPC Server] with SoftPLC [WinAC RTX]**) the window S7_Connection_2 [S7 connection] / Properties is opened.

The specified settings must be made under OPC:

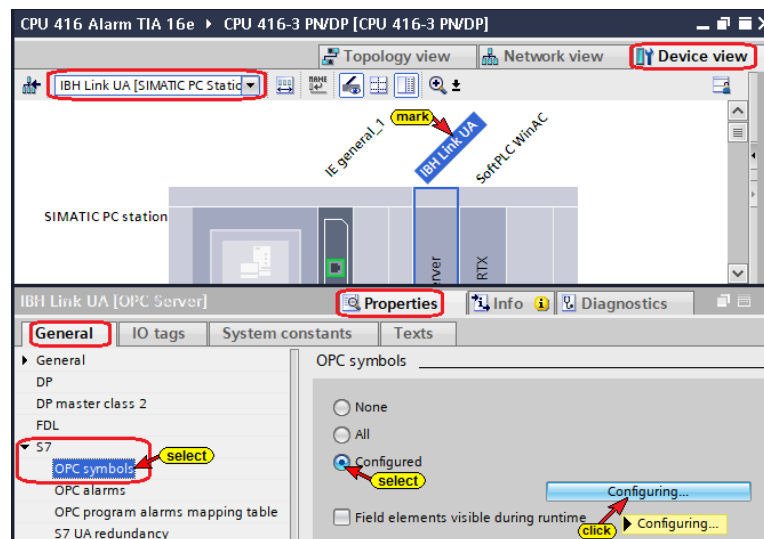
- Maintain connection permanently.
- Receive block and symbol-related alarms.
- Optimized write access
- Optimized read access

Select OPC symbols (tags) in the OPC configuration

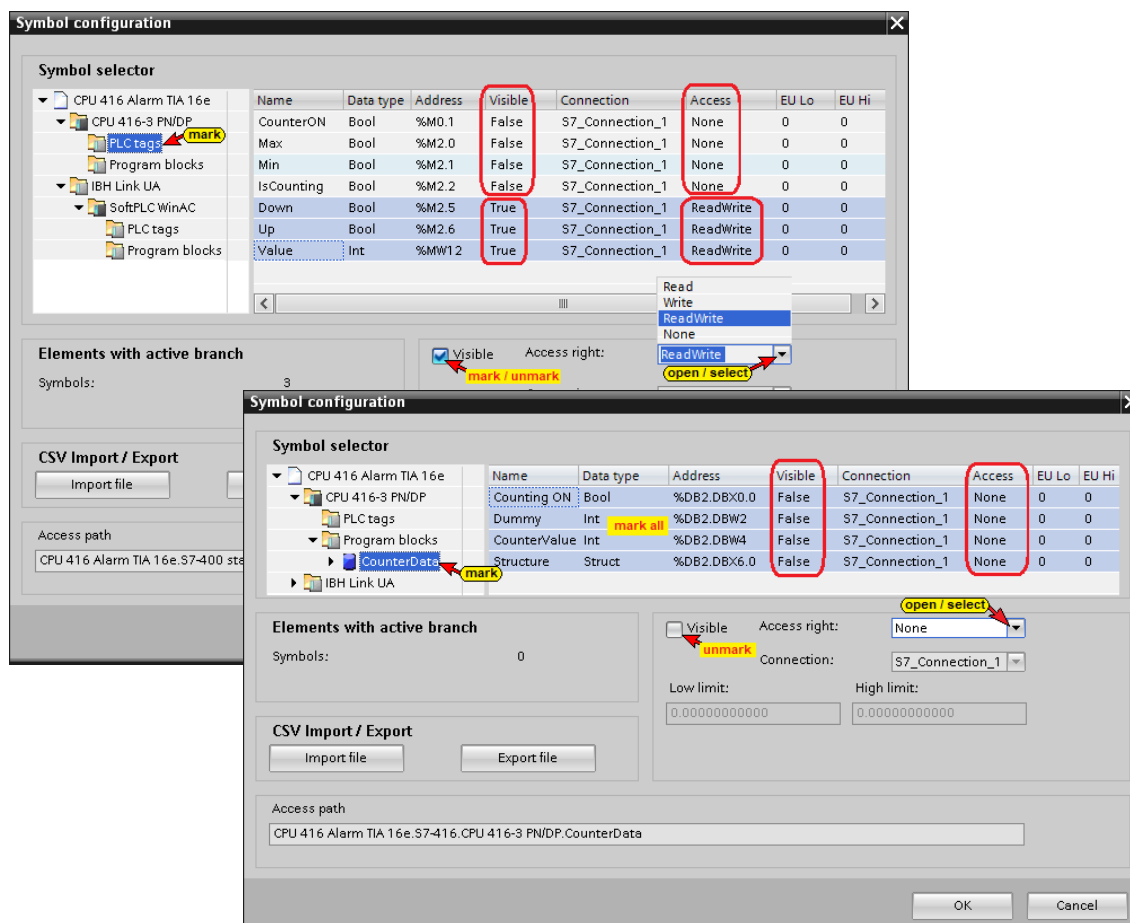
Open the configuration for the **OPC server / properties**.

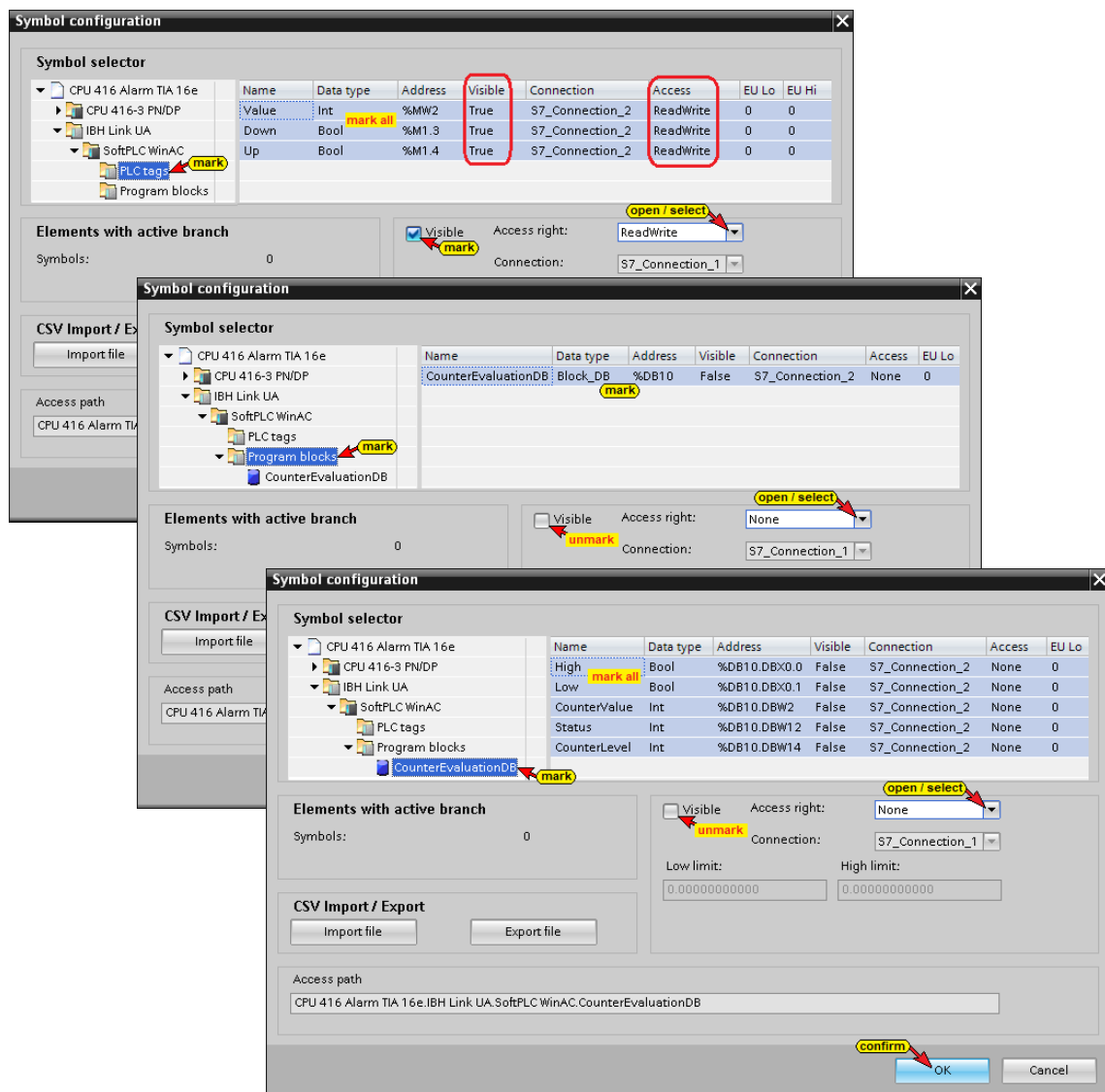
The **Configure** button opens the Symbol configuration dialog box, in which the operands defined in the symbol table (PLC program Tank Level) can be selected as OPC tags.

The **read / write, etc.** access rights can be assigned to the individual operands (OPC tags).

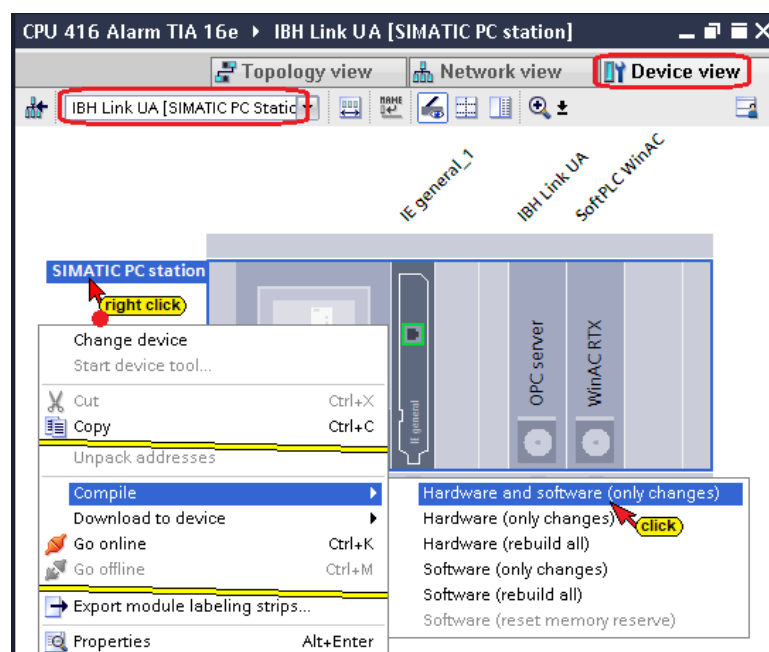


Configurable global PLC tags





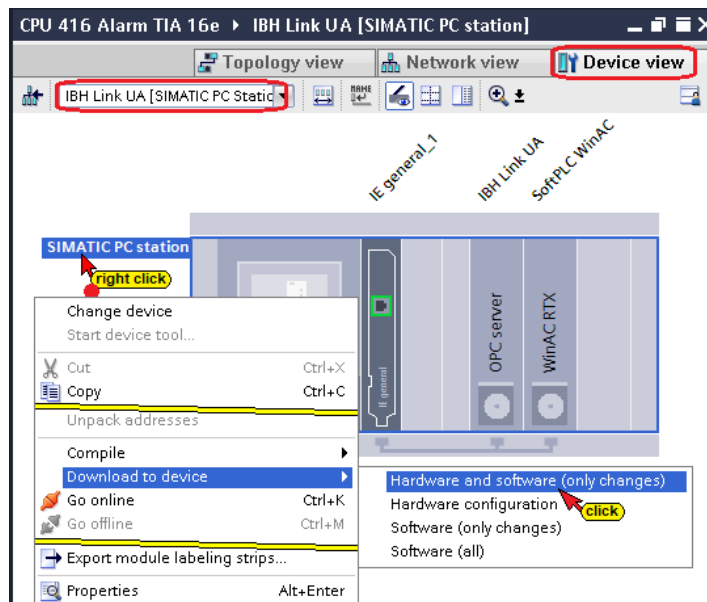
6.3.5 Compiling the SIMATIC PC station (IBH Link UA) Hardware and Software



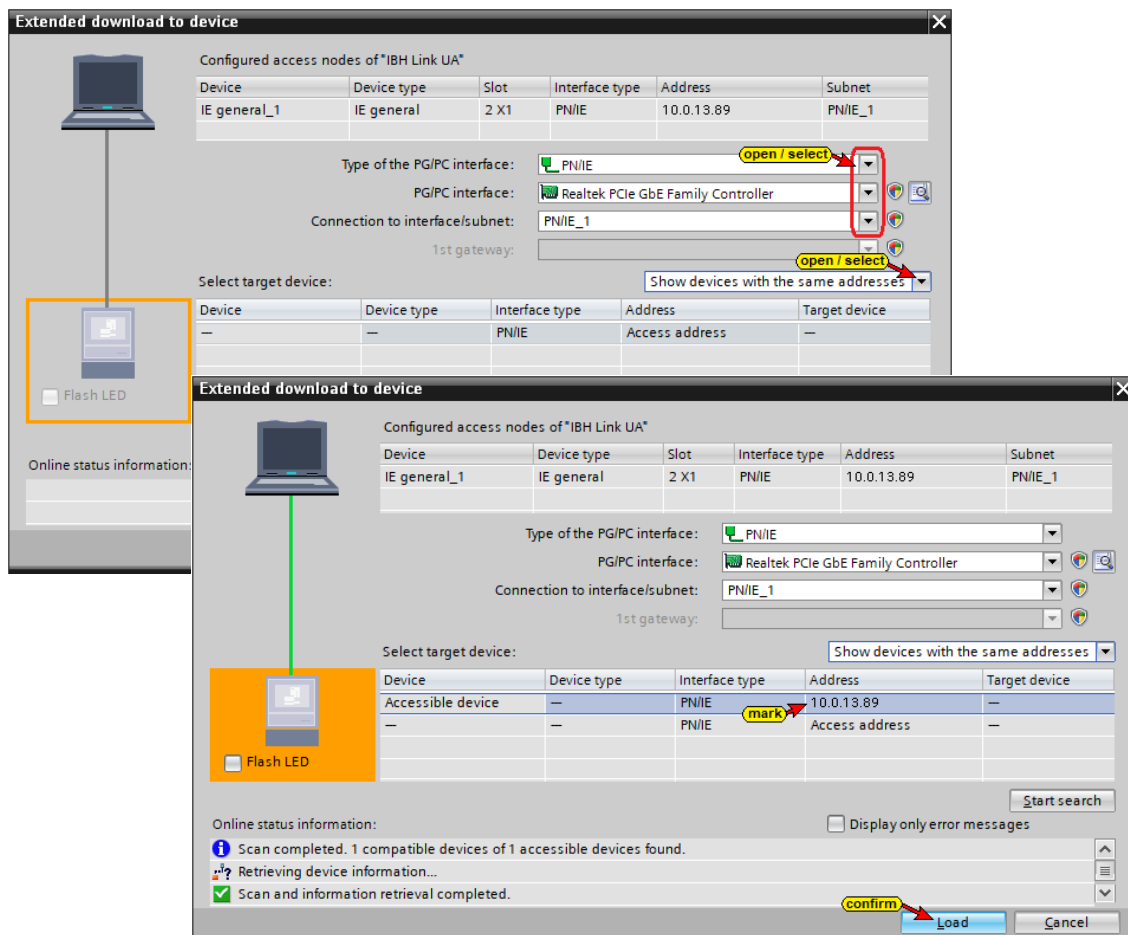
If no error occurs during the hardware and software compilation, they can be loaded into the **IBH Link UA [SIMATIC PC Station]**.

Load the Hardware and Software into the IBH Link UA

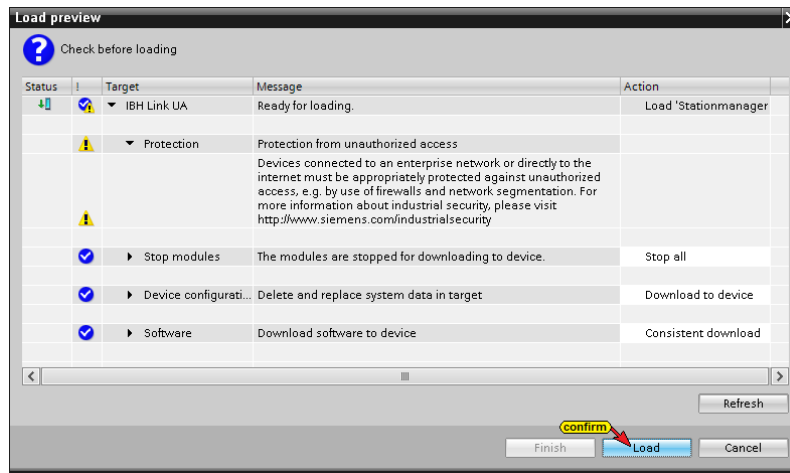
With the commands from the context menu the software and the hardware configuration are download into the device.



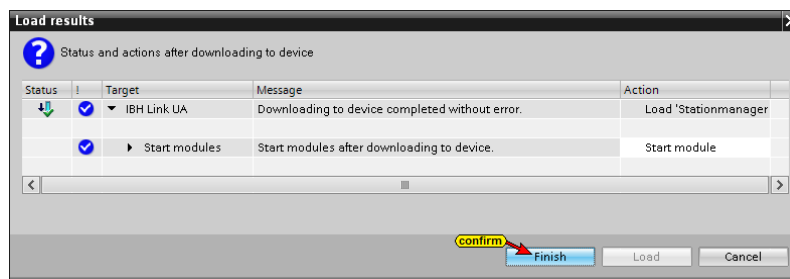
The **Download** command opens the dialog box to set the interface for the device.



A preview of the loading is displayed

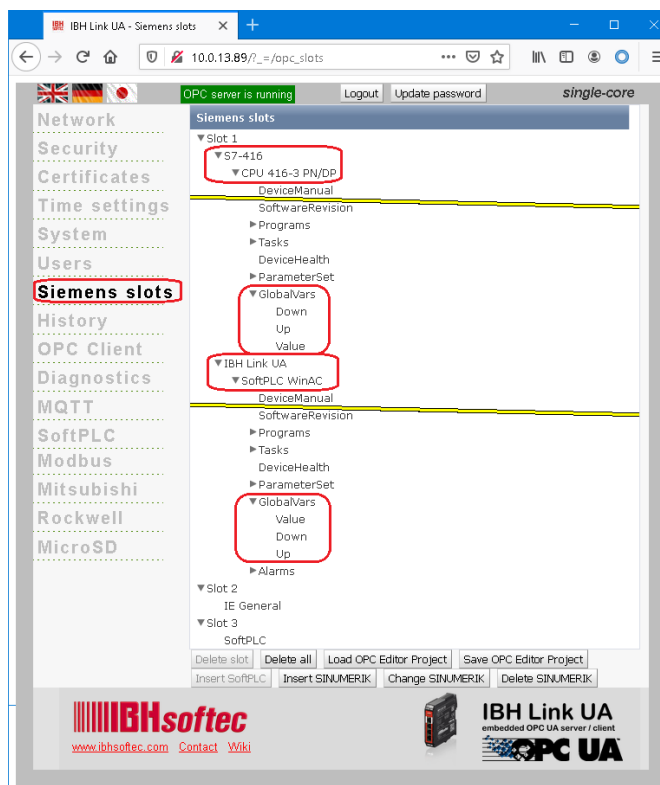


Finish loading



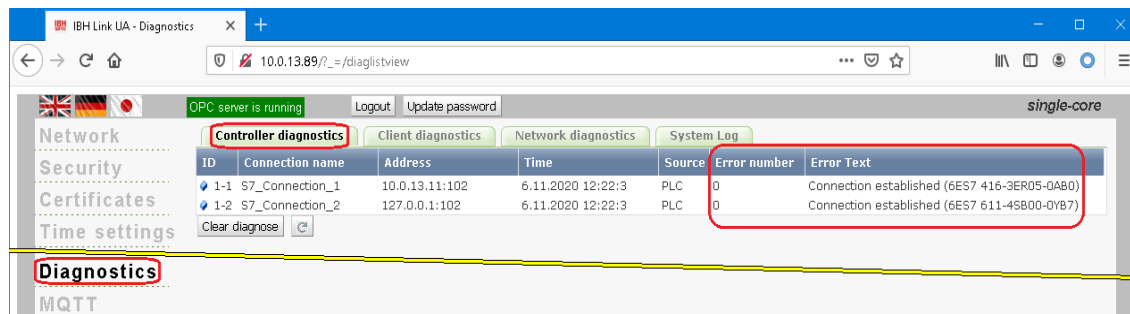
6.3.6 IBH Link UA browser window Siemens slots.

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



6.3.7 Browser window diagnosis / control diagnosis

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

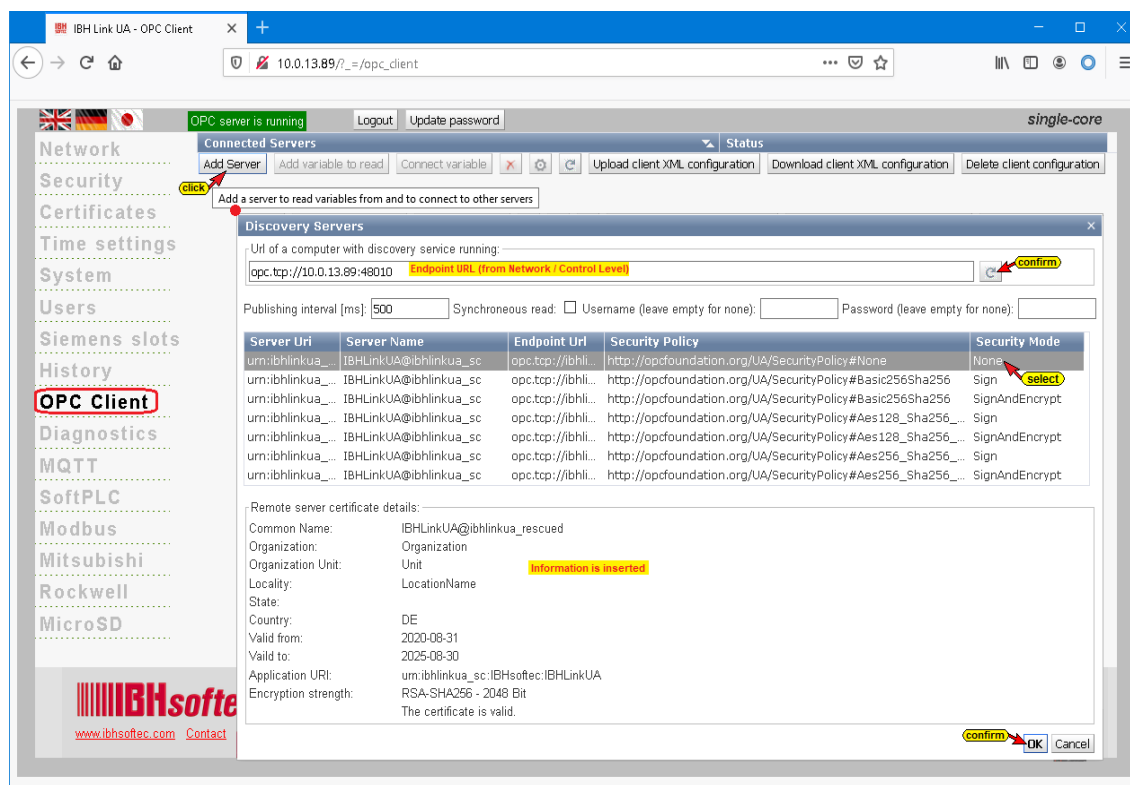


6.4 Create OPC clients in IBH Link UA

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. Enter the copied Endpoint URL **opc.tcp://10.0.13.89: 48010** in the open field in the IBH Link UA web browser window / OPC client for the OPC UA server.

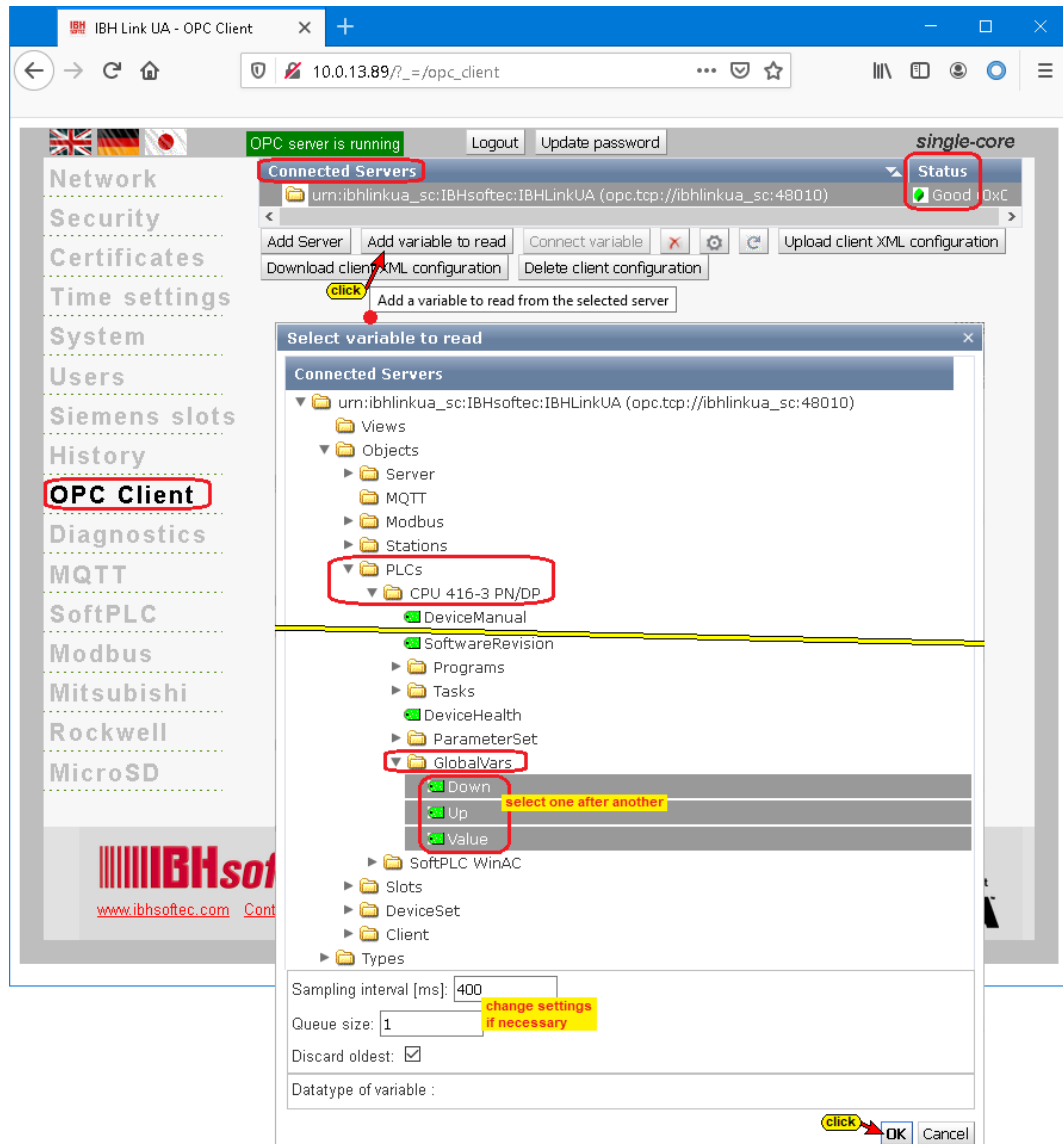


Security Policy **None** and Security Mode **None** were selected for data transmission.

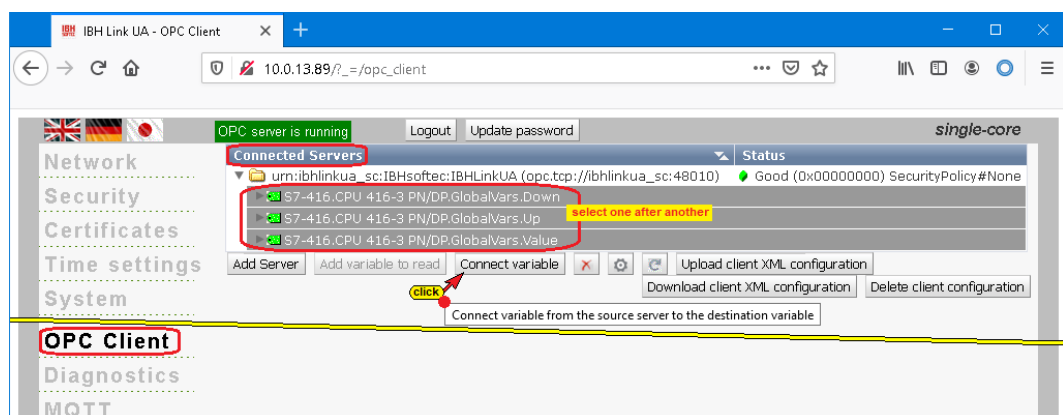
The IBH Link UA OPC UA server is connected. The status of the servers is good.

Add Variable to Read

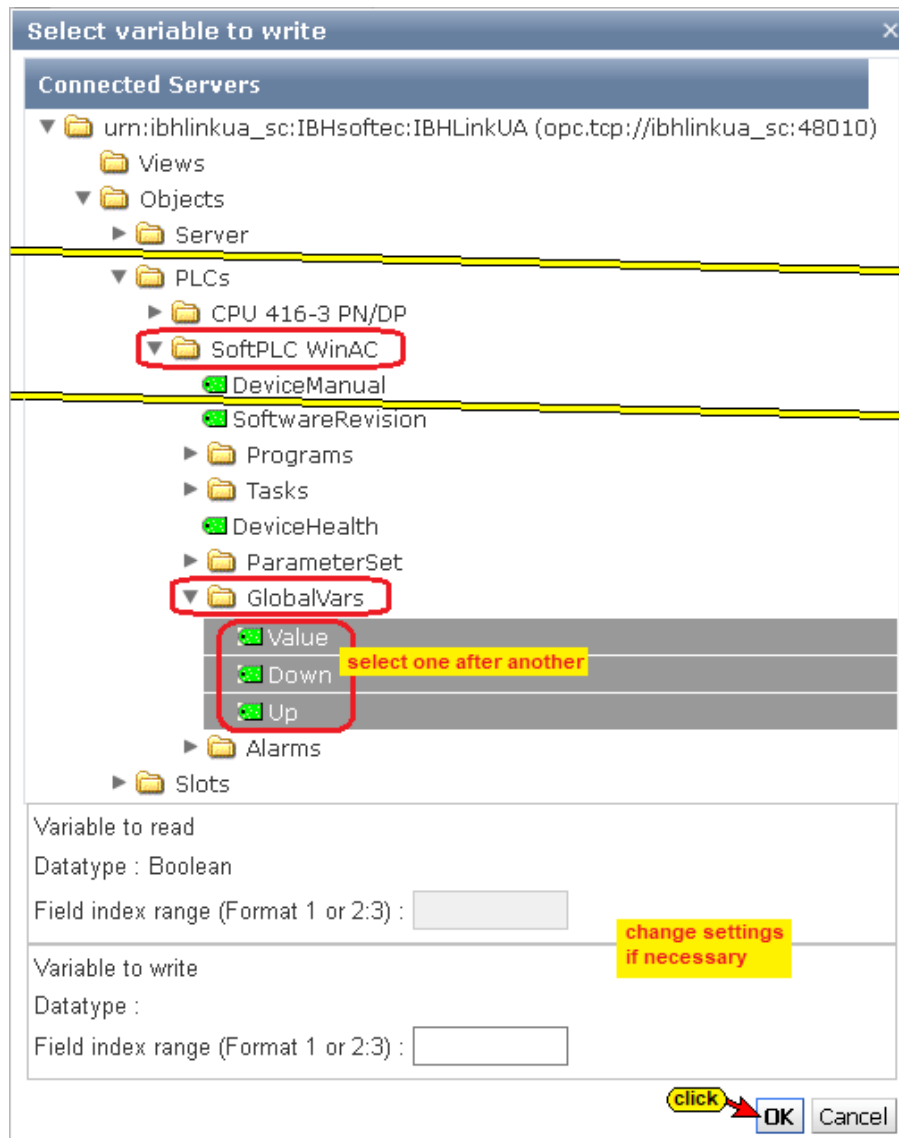
Select the **GlobalVars** (tags) **Down**, **Up**, and **Value** from the **CPU 416-3 PN/DP** to be read variables.



Connect Variables

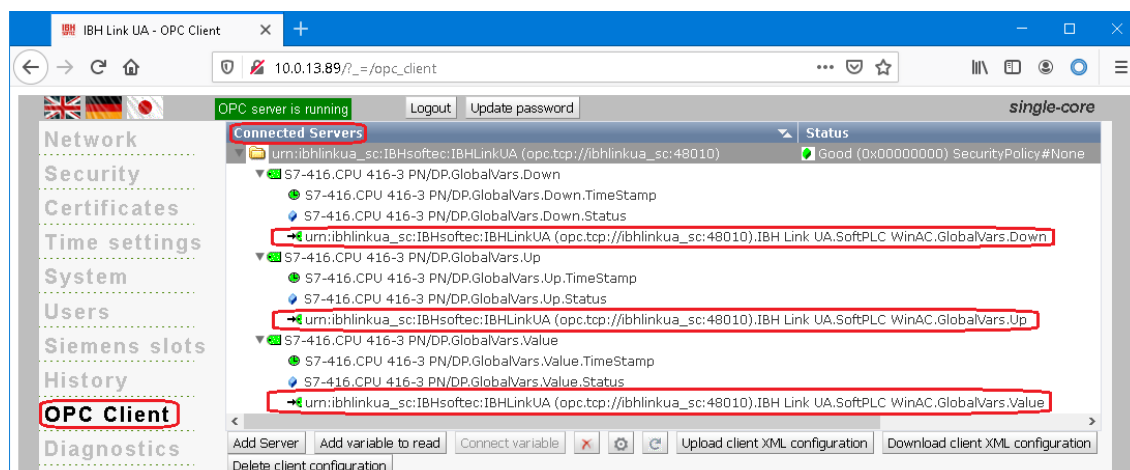


The three variables from the **CPU 416-3 PN/DP** (416-3 PN/DP) to be passed via the OPC Server to the integrated **SoftPLC WinAC** in the IBH Link UA.



In the IBH Link UA web browser window **OPC Client** the established connections are displayed.

CPU 416-3 PN/DP → SoftPLC WinAC



Note:

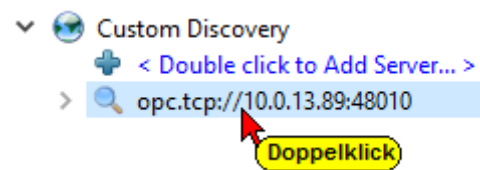
The messages from the **Alarm block** calls are sent immediately by the alarm-triggering PLC to the OPC UA server.

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**.

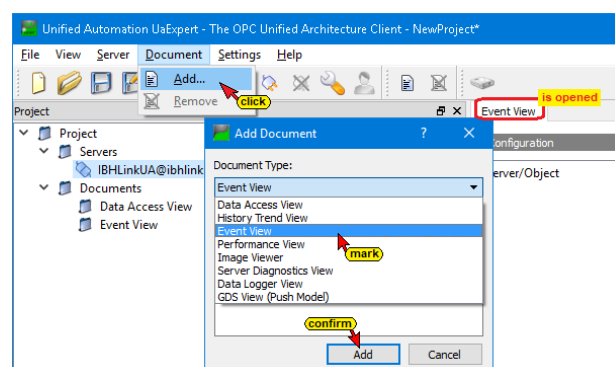
Double-clicking on the entry **None - None (uatcp-uasc-uabinary)** in the AddServer dialog box sets this security level and closes the dialog box.

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.

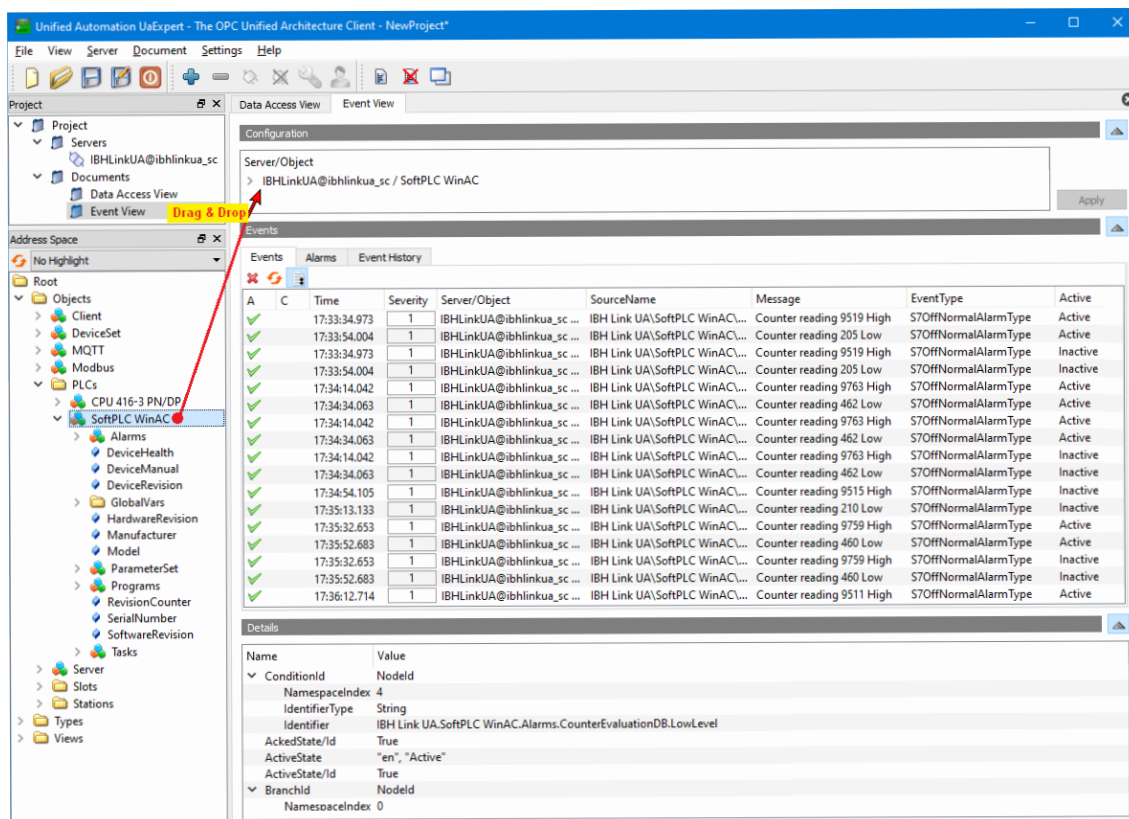
To display the messages from the alarm block calls, the Event View window must be opened.



6.5.1 UaExpert - program window

Drag & Drop the entire **PLC (SoftPLC WinAC)** 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
✓		17:48:03.873	1	IBHLinkUA@ibhlinkua_sc / SoftPLC WinAC	IBH Link UA\SoftPLC WinAC\CounterEvaluationDB
✓		17:48:23.934	1	IBHLinkUA@ibhlinkua_sc / SoftPLC WinAC	IBH Link UA\SoftPLC WinAC\CounterEvaluationDB

Message	EventType	Active
Counter reading 9660 High	S7OffNormalAlarmType	Active
Counter reading 577 Low	S7OffNormalAlarmType	Active

6.5.2 CPU 416 Watchtable – Status

... > CPU 416-3 PN/DP [CPU 416-3 PN/DP] > Watch and force tables > Watch table_1							
	Name	Address	Display format	Monitor value	Modify value		Comment
1	"Value"	%MW12	DEC+/-	6124		☐	Counter value
2	"Up"	%M2.6	Bool	FALSE		☐	up counting
3	"Down"	%M2.5	Bool	TRUE		☐	down counting

7 IBH Link UA - connection of a CPU 1500

In the following example, a project is made of the connection of a CPU1511-1 PN (6ES7 511-1AK00-0AB0) using the Ethernet bus.

Instead of the CPU1511-1 PN, any other S7 CPU 1500 with an unused Ethernet port could be used.

7.1 Assign an IP address to the CPU 1500 online

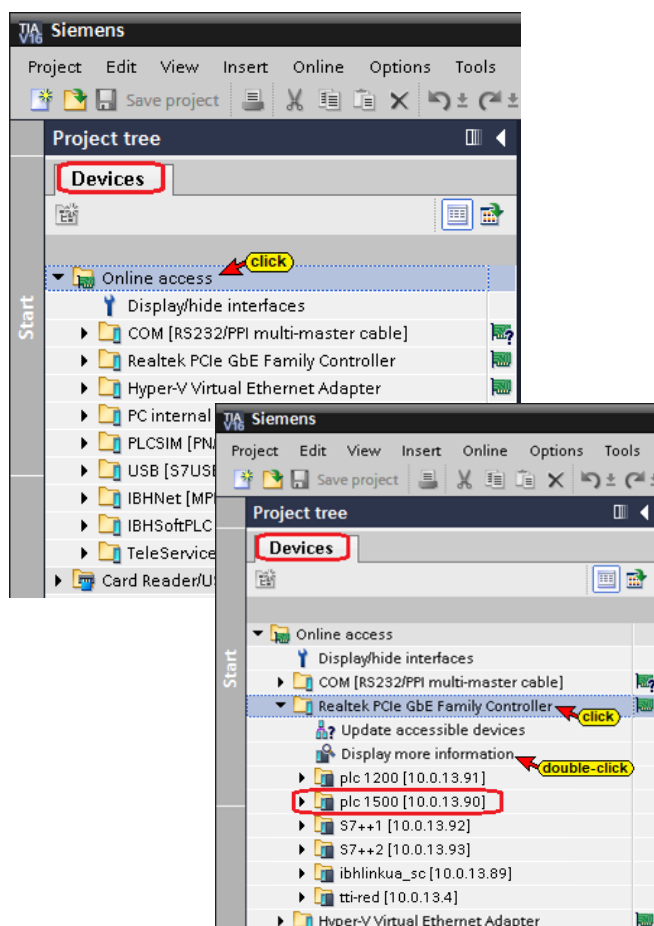
The MAC address (MAC ADD1) is printed on the housing above the LAN port (example: 00-1B-1B-13-23-CB)

Connect the Ethernet Port with the network of the PC. The network must have a server (router) that is set to DHCP.

No project needs to be available in the open TIA Portal.

Click on online access

Click on on-line access to display the list of possible on-line interfaces.



Select the Ethernet controller via which the CPU 1500 is connected to the DHCP network.

If the shown PLC 1500 has not the correct IP-Address, a new address must be assigned.

7.2 Project with TIA Portal V16

Creation of a project with the TIA Portal, with the connection of a CPU 1500 and the IBH Link UA via an Ethernet connection, is shown.



7.3 Hardware structure (CPU1511-1 PN – IBH Link UA)



Example: Counter level

The prepared example project **CPU 1500 TIA16e** 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. This process is repeated continuously. The up count is controlled by the variable **Up** and the counting down by the variable **Down**. The variables **Value** (Default tag table) and **CounterValue** (data block **CounterData [DB2]**) hold the counter reading.



The SIEMENS PLC programming systems TIA Portal V16 is used to create the PLC program.

Variables of the **Default tag table** and of the data block **CounterData [DB2]** are to be used by the OPC server IBH Link UA as **OPC tags**.

Note:



The data blocks **CounterData [DB2]** must not have **Optimized block access**.

The **IBH Link UA – OPC UA Server** cannot access data blocks [DB] variables in an optimized data block of an S7-1500 CPU.

Data block *CounterData* [DB2]

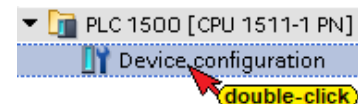
	Name	Data type	Offset	Start value	Comment
1	Static				
2	Counting ON	Bool	0.0	false	On / Off switch 1
3	CounterValue	Int	2.0	0	Counter value
4	MinValue	Int	4.0	100	minimum Counter value
5	MaxValue	Int	6.0	10000	maximum Counter value

Default tag table

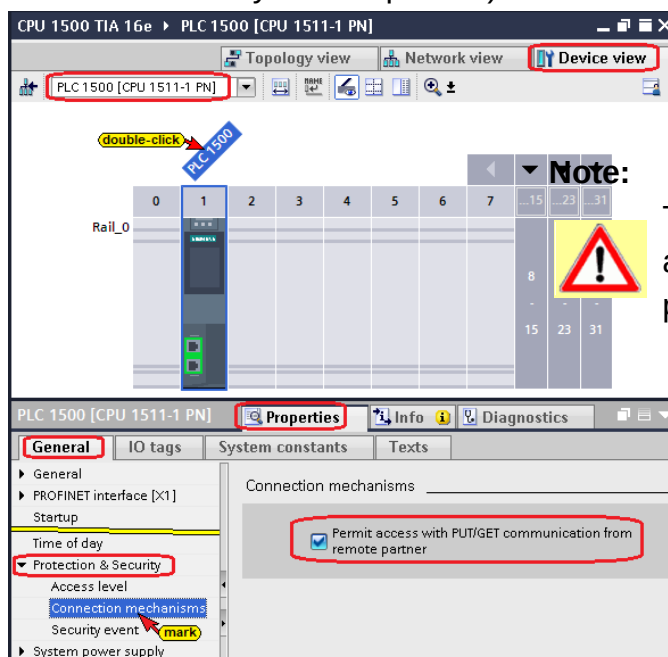
	Name	Data type	Address	Comment
1	CounterON	Bool	%M0.1	start counting
2	Max	Bool	%M2.0	Maximum reached
3	Min	Bool	%M2.1	Minimum reached
4	IsCounting	Bool	%M2.2	Counting control ON
5	Down	Bool	%M2.5	down counting
6	Up	Bool	%M2.6	up counting
7	Value	Int	%MW12	Counter value

7.4 Configuration of the CPU 1500

Double-clicking on **Device configuration** opens the Device view window.

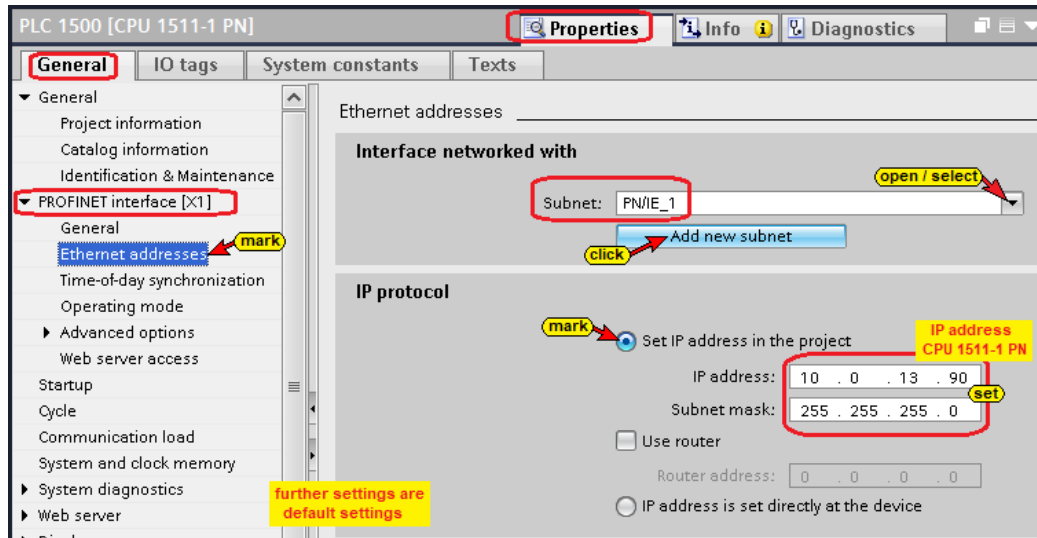


Activate S7 communication **GET and PUT** (allow access via PUT / GET by remote partner).



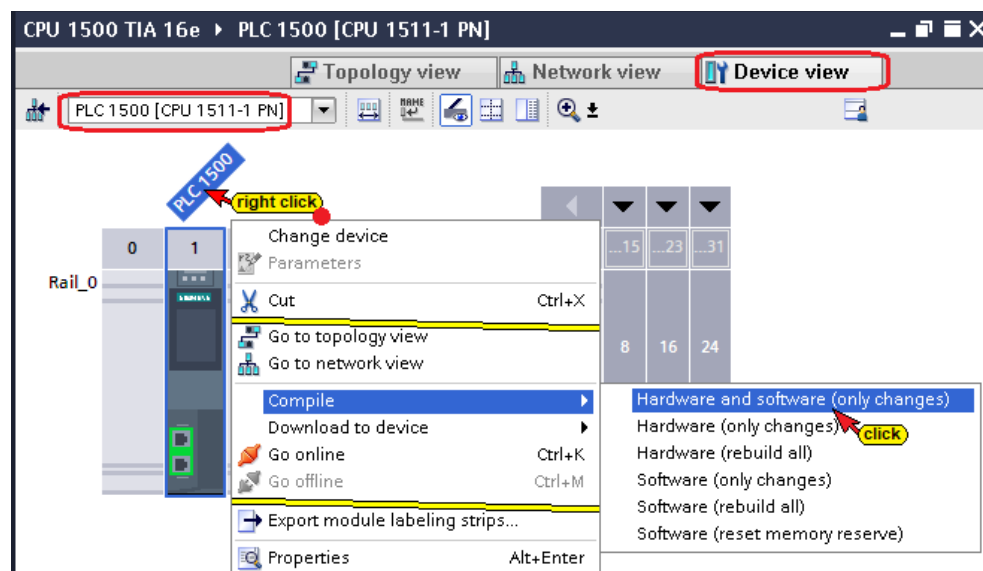
The **GET / PUT** function is not automatically activated in the program of a CPU1500.

The required IP address has been specified in the opened **Properties / PLC 1500 [CPU 1511-1 PN] / Ethernet addresses field**. In the example, the IP address of the CPU is **192.168.1.18** (other CPUs can have a different address). The Ethernet connection is direct without a router.



7.4.1 Compile the PLC program PLC 1500 and load it into the CPU

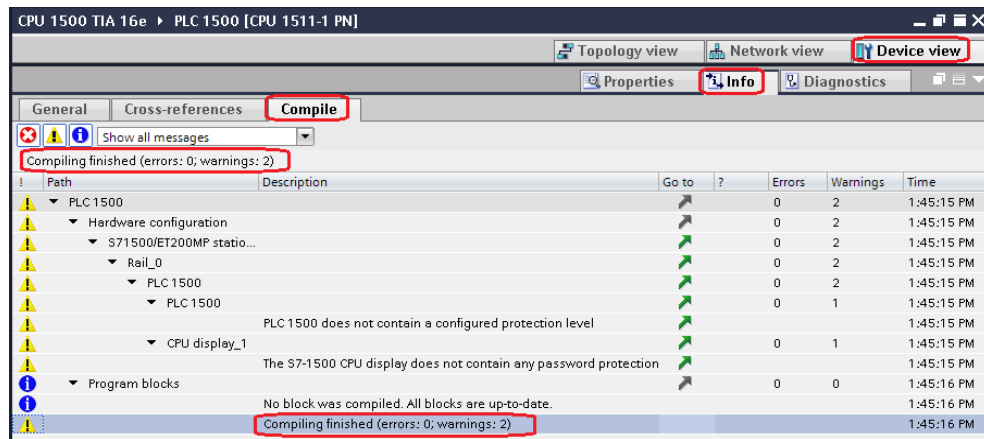
The software and hardware are compiled with the commands from the context menu.



Compiling the hardware and software with a warning

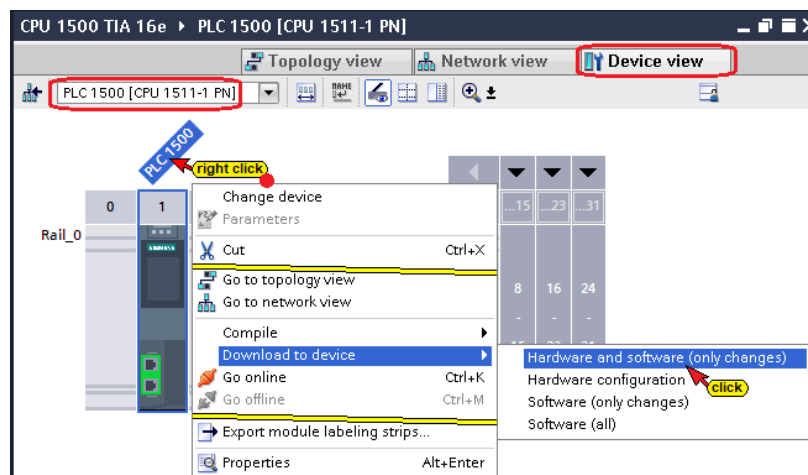
The user of the CPU 1511 has access to all functions (full access - no protection - read access / write access). A password has not been set. Since this is a sample PLC program, no hardware is required for the inputs and outputs.

The warnings can be ignored.



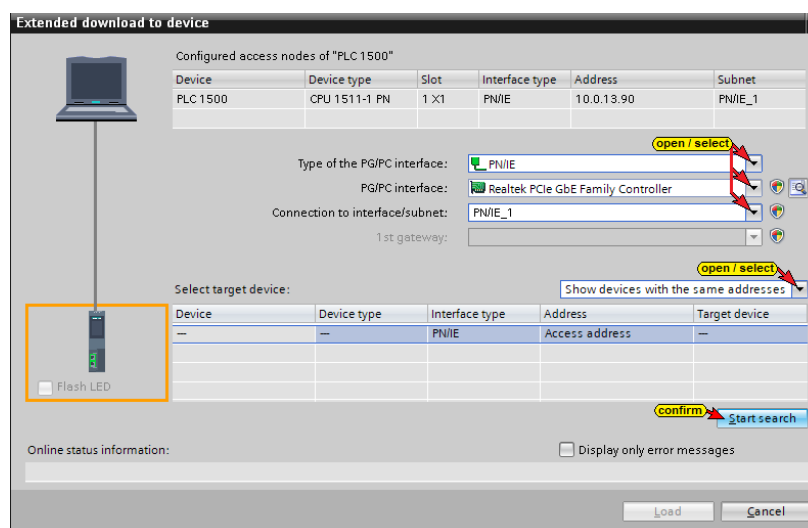
Load hardware and software into the CPU

With the command **Load in device / Hardware and software (only changes)** from the context menu, the software and the hardware configuration can now be loaded into the device.

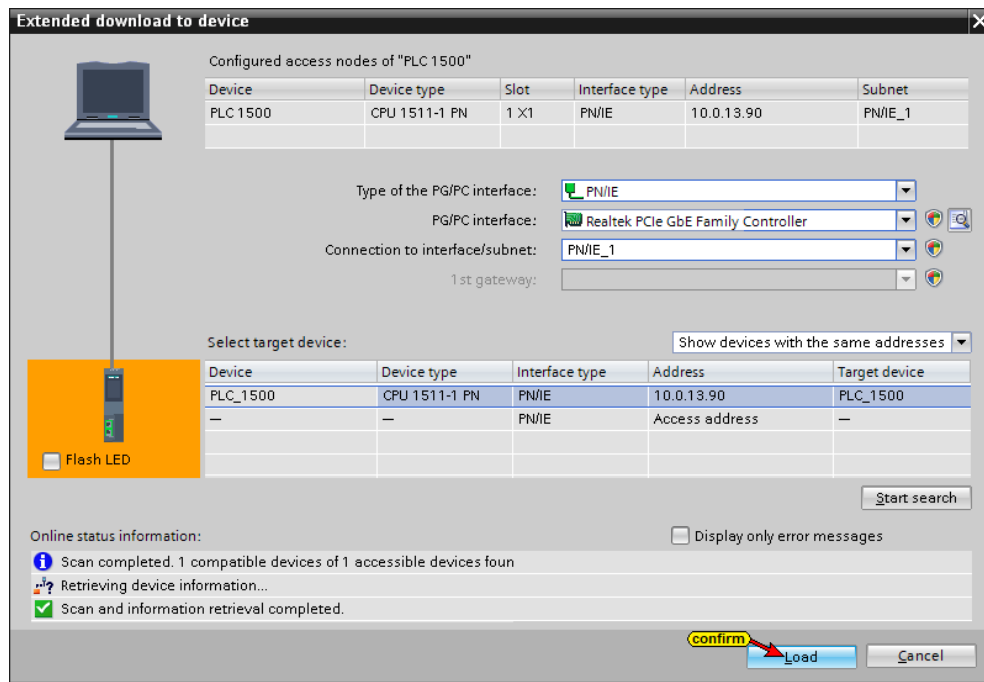


The load command opens the dialog window to set the interface for the device. Connection with interface / subnet PN/IE_1 must be selected.

Extended download to device

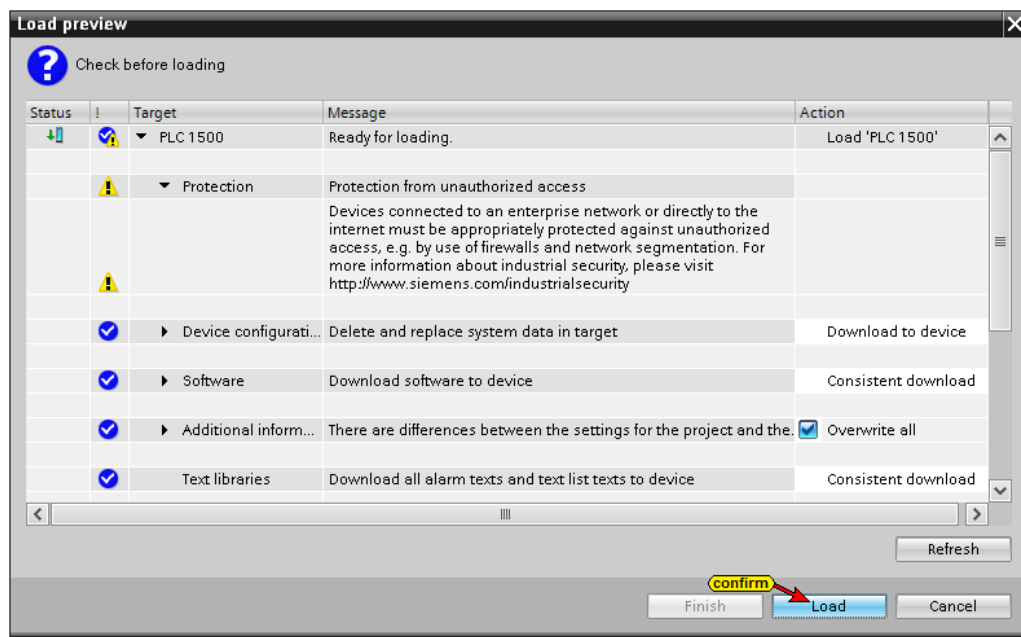


The successful search is displayed

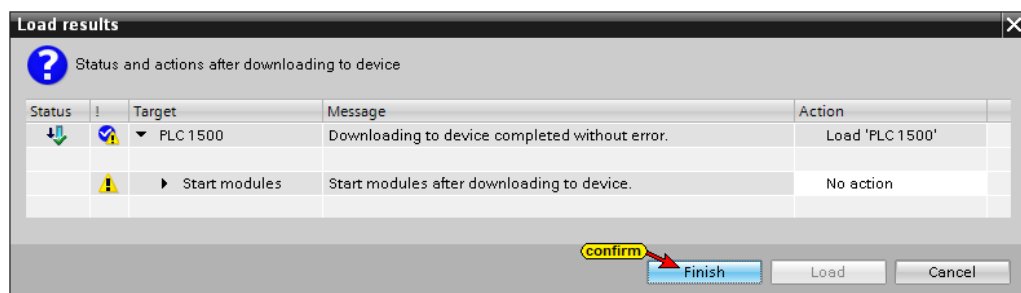


The download process requires several confirmations of messages.

A preview of the download is displayed.



Finish loading

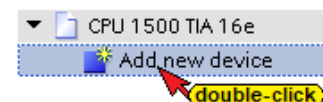


The up and down counting can be checked online data block **CounterData [DB2]**.

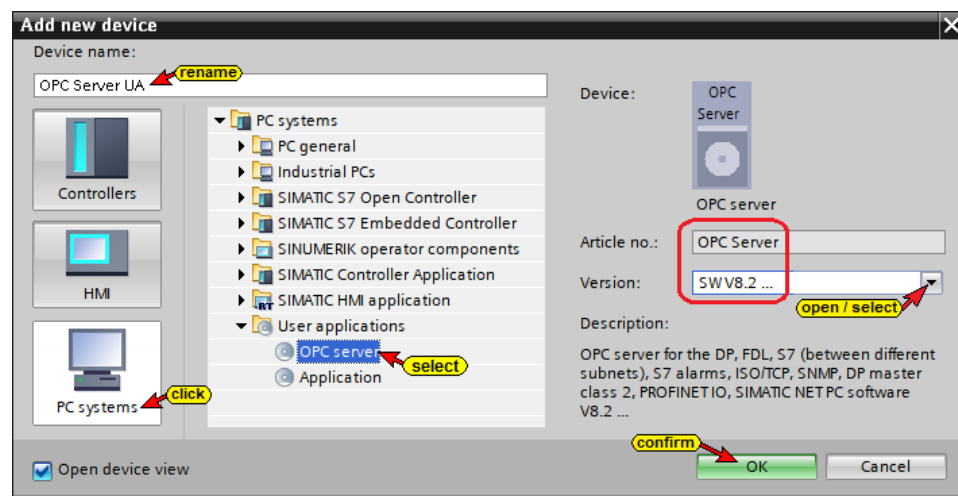
	Name	Data type	Offset	Start value	Monitor value	Comment
1	Static					
2	Counting ON	Bool	0.0	false	TRUE	On / Off switch 1
3	CounterValue	Int	2.0	0	9038	Counter value
4	MinValue	Int	4.0	100	100	minimum Counter value
5	MaxValue	Int	6.0	10000	10000	maximum Counter value

7.5 Add IBH Link UA as a SIMATIC PC station

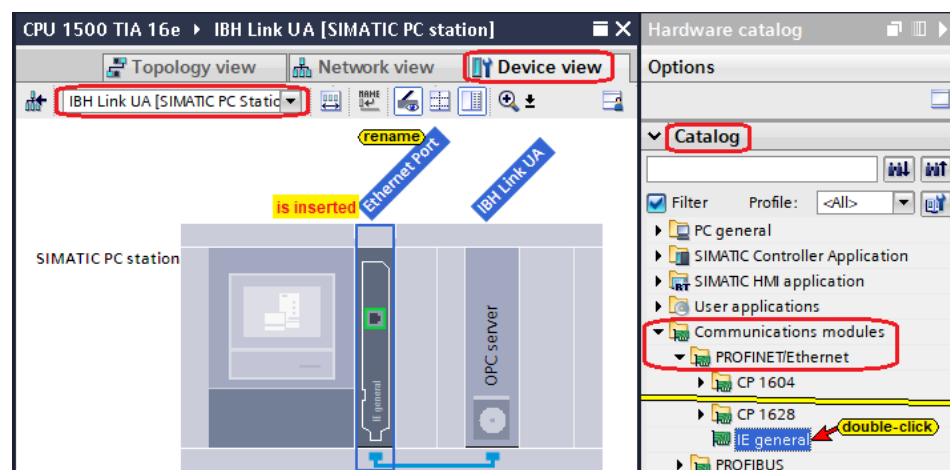
Double-clicking on Add new device opens the device selection dialog box.



If an OPC server is added to the project, a SIMATIC PC station is automatically added. The inserted OPC server must be version 8.2. The device name was changed to **IBH Link UA**.

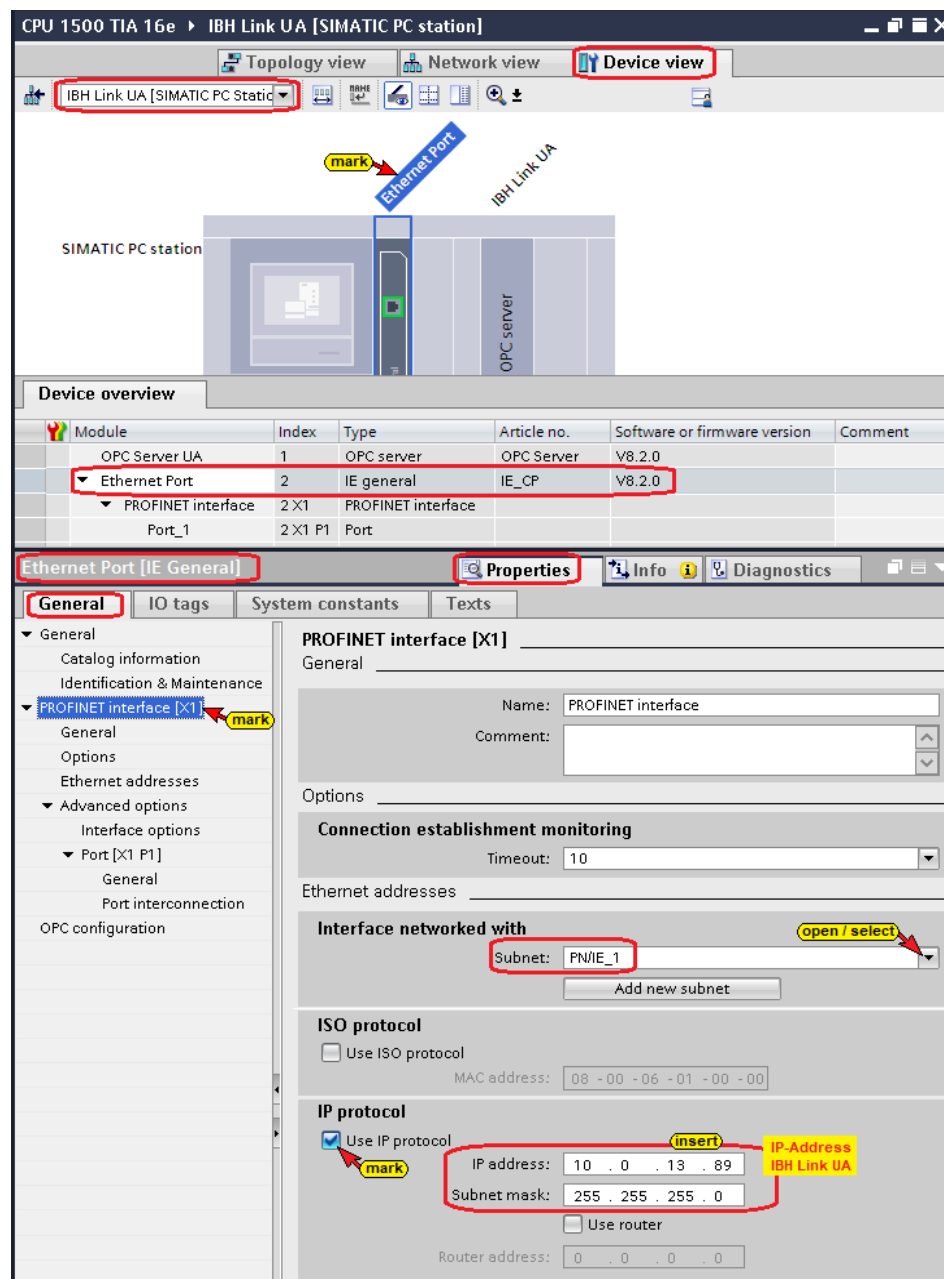


Insert communication module into the IBH Link UA



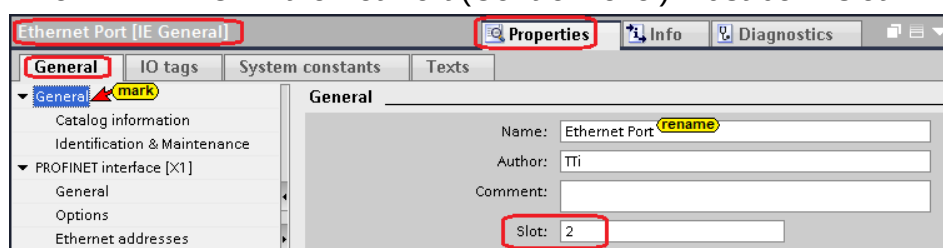
Define communication module properties

Clicking **Ethernet Port** in the **SIMATIC PC Station [IBH Link UA]** opens the properties of the **EE general_1 [IE General]** dialog box. The **Ethernet address** of the IBH Link UA must be entered. The Networking is also defined.



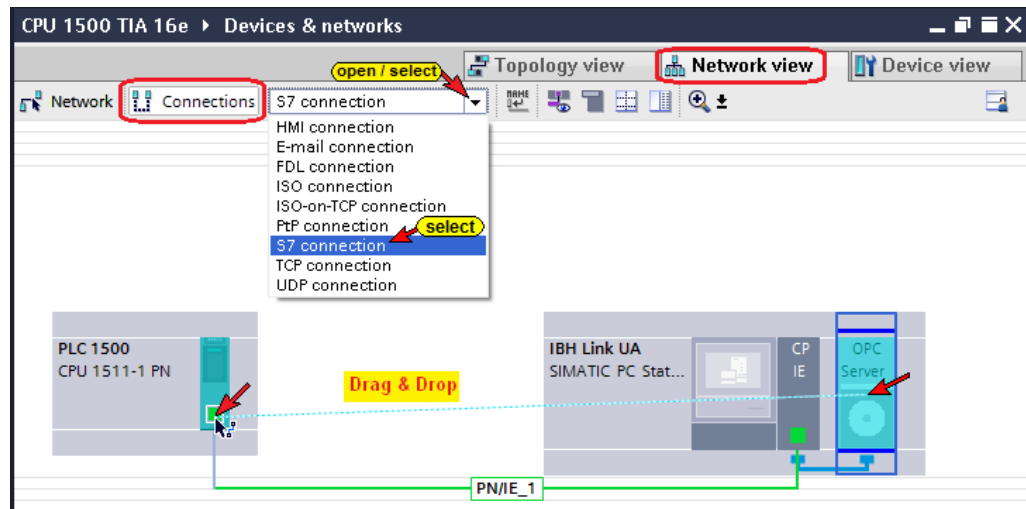
Communication module slot check

The IBH Link UA Ethernet Port (Control Level) must be in slot 2.

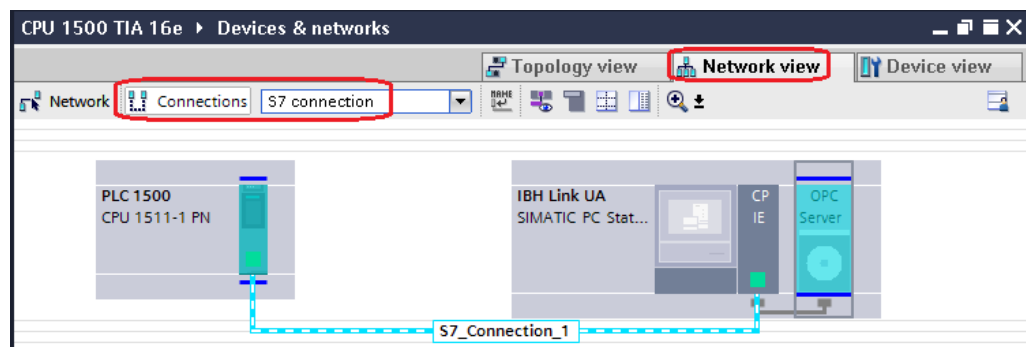


Create S7 connection IBH Link UA OPC Server - CPU 1500

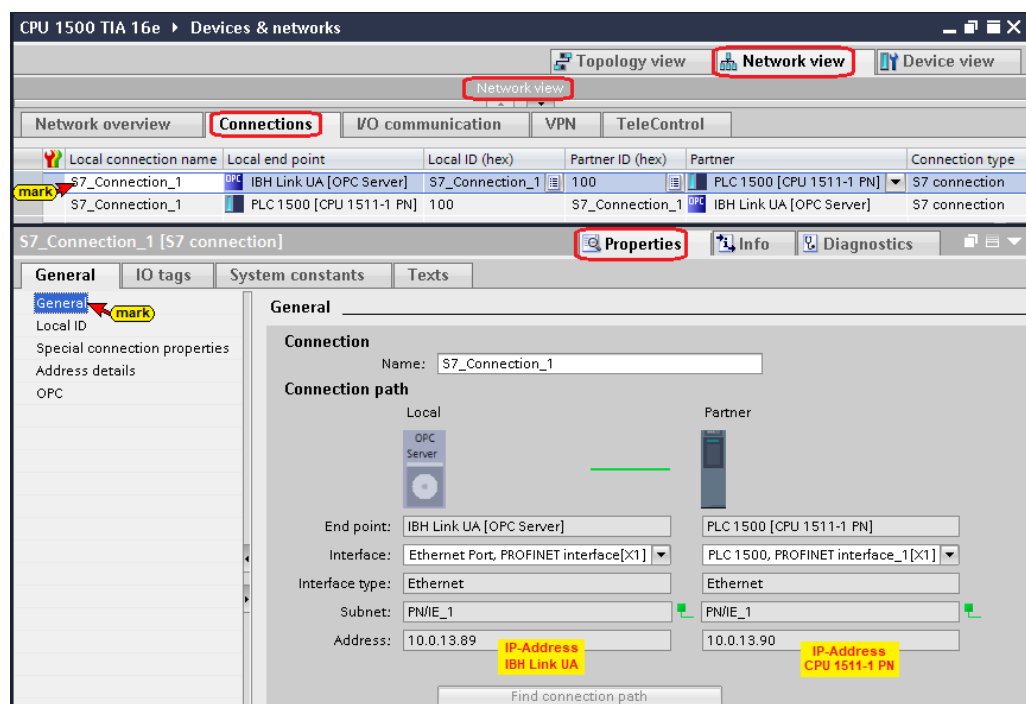
S7 connection OPC server - CPU 1500 created using drag & drop.



The S7 connection from the OPC server to the PLC 1500 [CPU 1511-1 PN] is displayed.

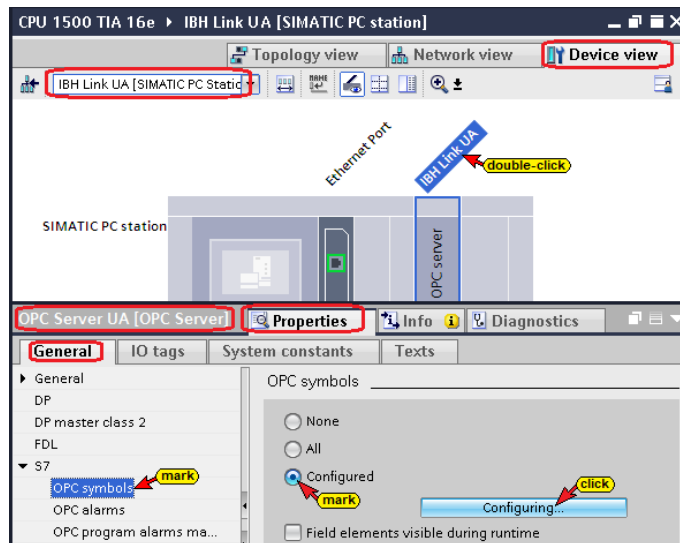


A click switches between the connection representations. The created S7 connection is listed in the Network view window.



Select OPC symbols (tags) in the OPC configuration

Open the configuration on the OPC server / properties.

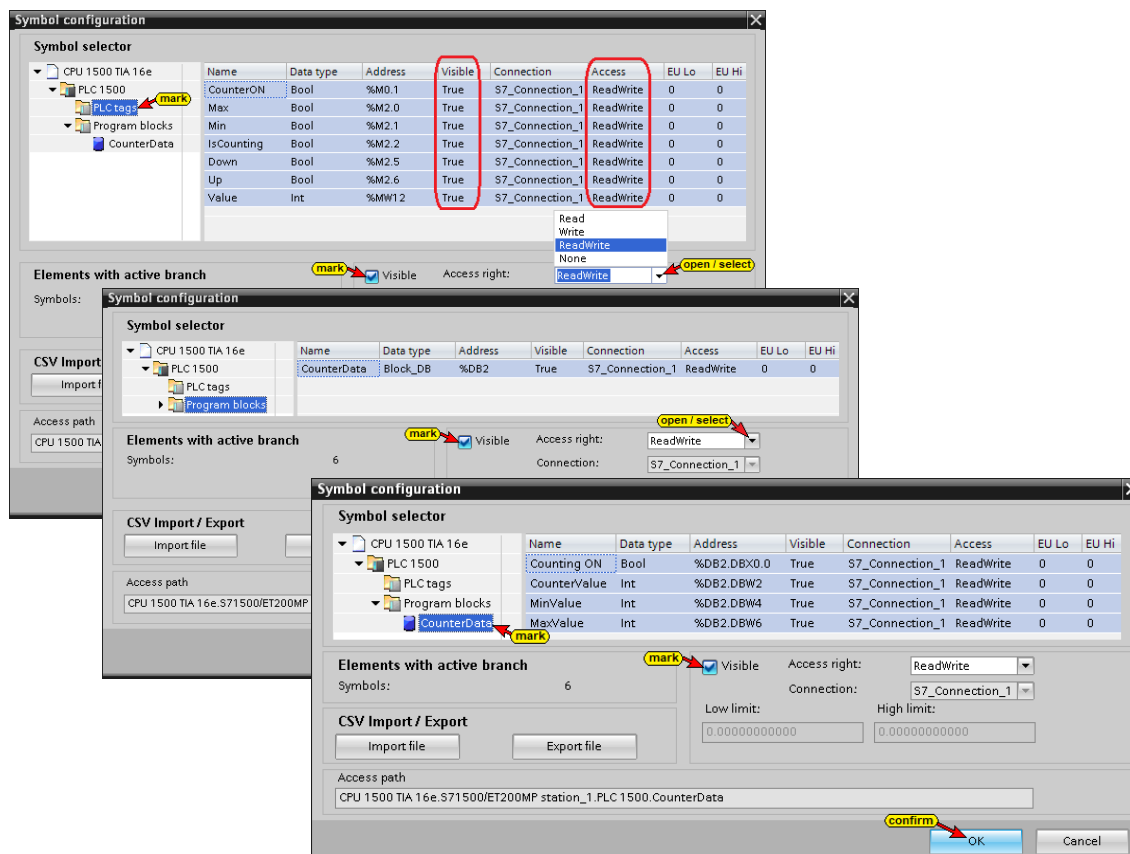


The **Configure** button opens the Symbol configuration dialog box, in which the operands defined in the default tag table (PLC 1500 [CPU1511-1 PN]) can be selected as OPC tags.

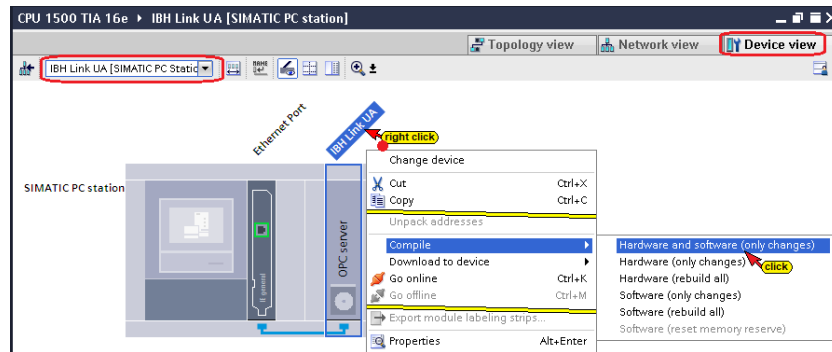
The read / write, etc. access rights can be assigned to the individual operands (OPC tags).

Select global variables as OPC tags

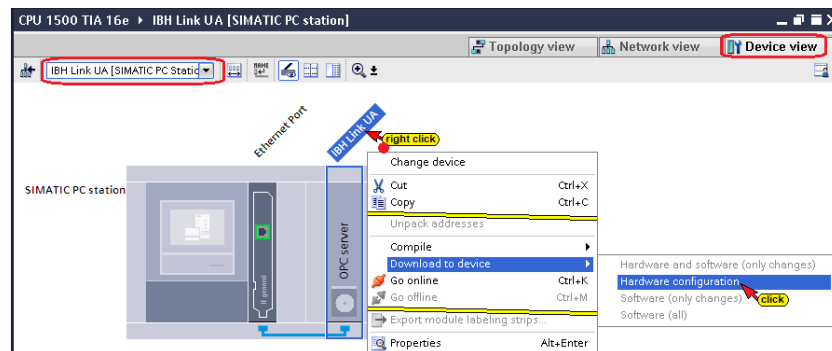
In addition to the global variables, the data from data blocks can be defined as OPC tags.



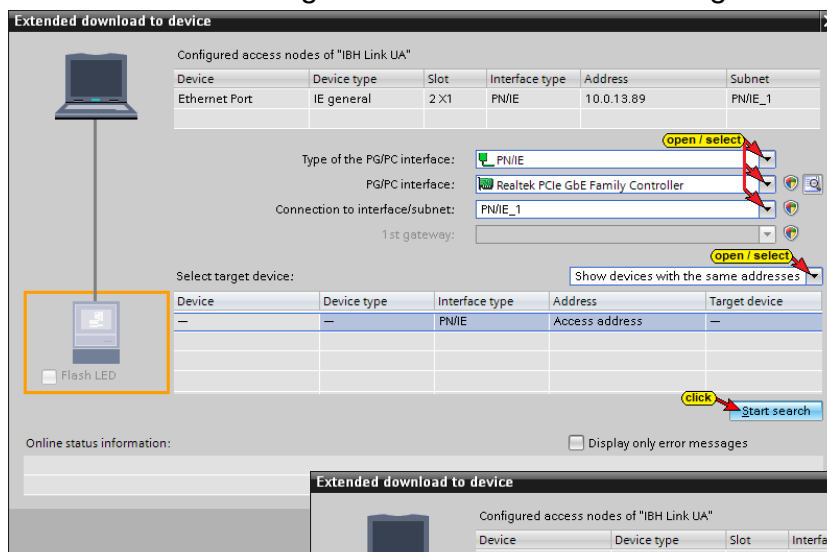
Compile the configuration of the OPC server



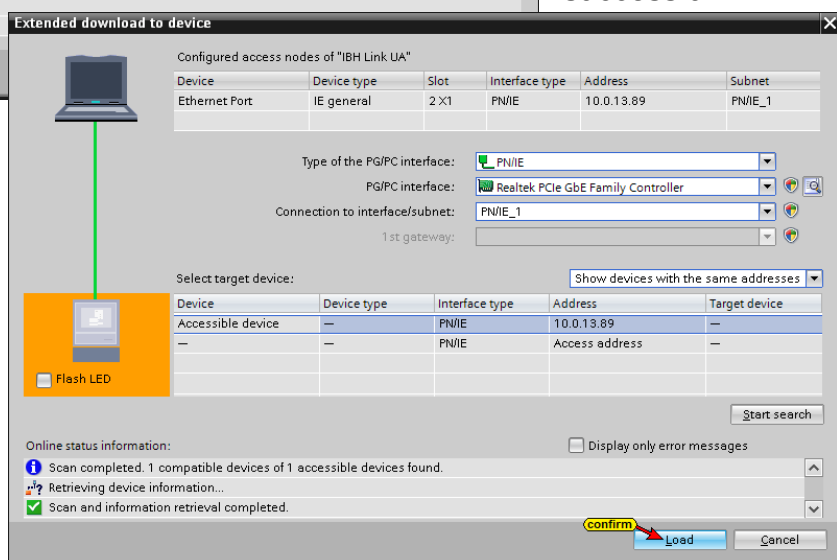
Load configuration of the OPC server into IBH Link UA



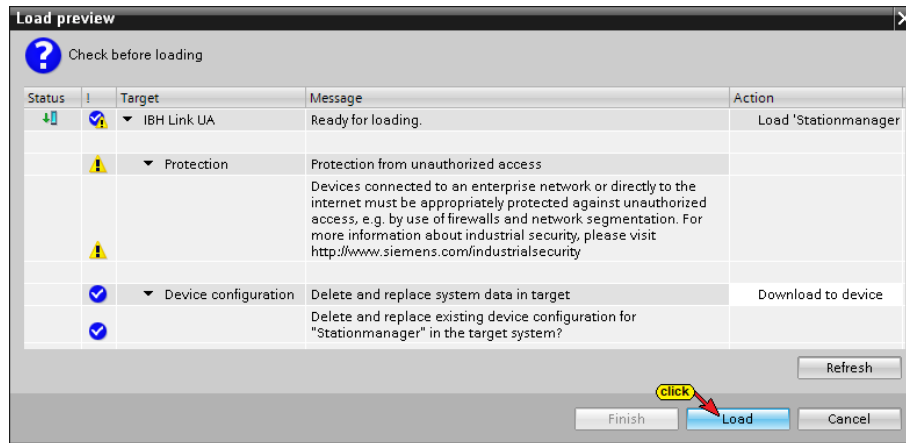
The settings must be made in the dialog box according to the screen



The interface search was successful.

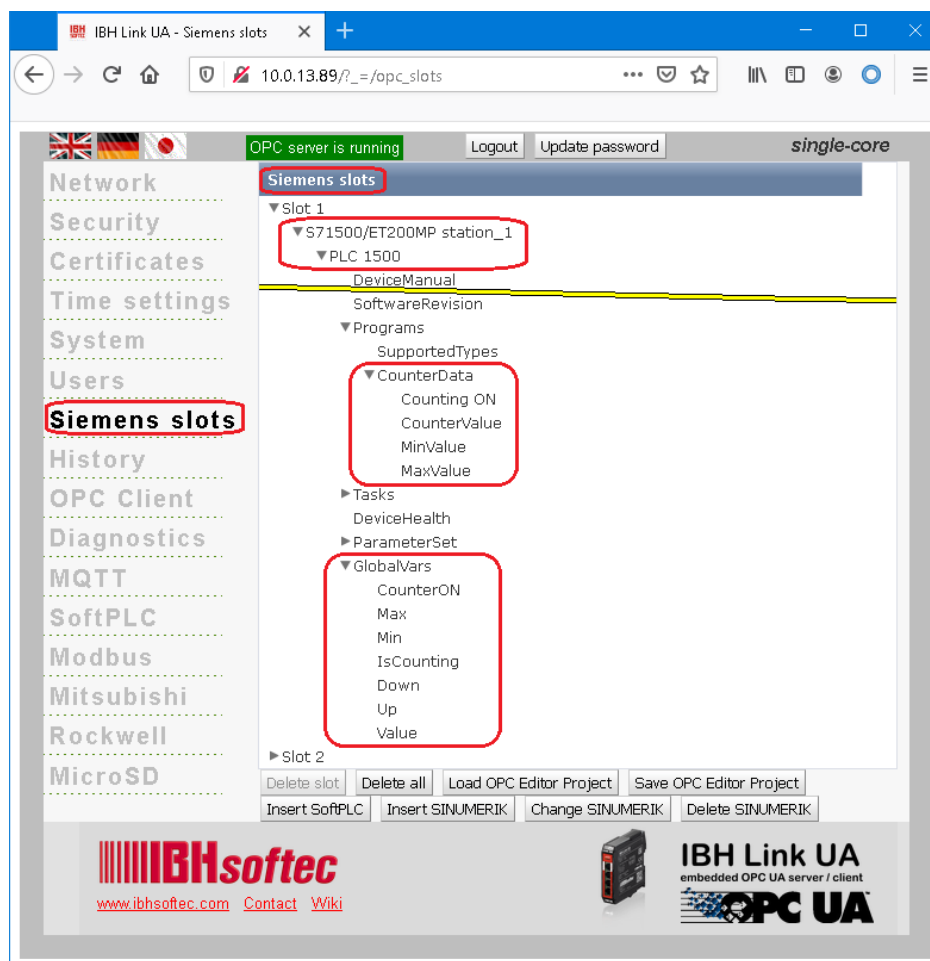


A check is made prior loading.



7.5.1 IBH Link UA browser window *Siemens slots*

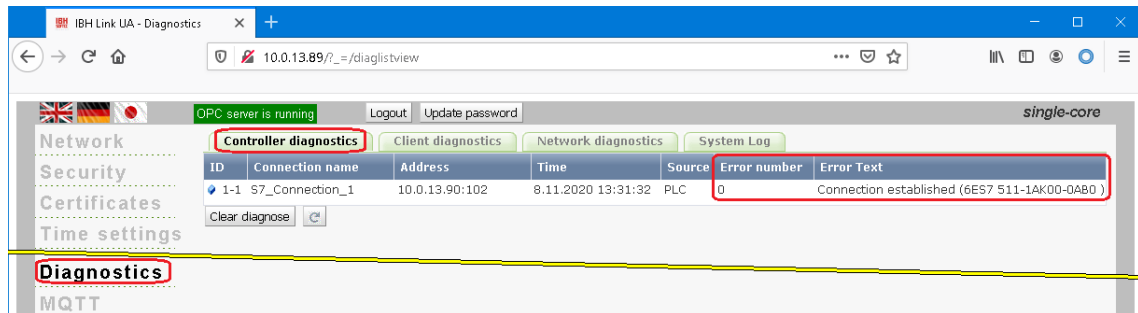
The CPU with the OPC tags is displayed in the Siemens Slots browser window.



7.5.2 Browser window diagnostics

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

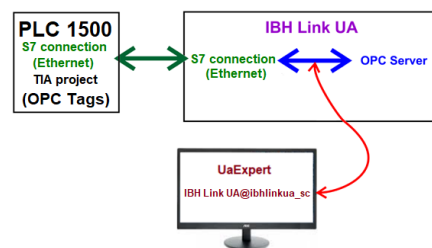
Controller diagnostics



7.6 UaExpert - program window

In the UaExpert program window, the OPC tags of the PLC 1500 are displayed. The handling of the UaExpert program is described in part 1 of the manual.

7.6.1 Display of the OPC tags in the UaExpert



UaExpert - program window at PLC 1500

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

File View Server Document Settings Help

Project Data Access View

Project

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

Address Space

- No Highlight
- Root
 - Objects
 - Client
 - DeviceSet
 - MQTT
 - Modbus
 - PLCs
 - PLC 1500
 - DeviceHealth
 - DeviceManual
 - DeviceRevision
 - GlobalVars
 - CounterON
 - Down
 - IsCounting
 - Max
 - Min
 - Up
 - Value
 - HardwareRevision
 - Manufacturer
 - Model
 - ParameterSet
 - Programs
 - CounterData
 - CounterValue
 - Counting ON
 - MaxValue
 - MinValue
 - SupportedTypes
 - RevisionCounter
 - SerialNumber
 - SoftwareRevision
 - Tasks

#	Server	Node Id	Display Name	Value	Datatype	Source Timestamp	Server Timestamp	Status
1	IBHLinkUA@ibh...	NS4(String)S71500/...	CounterON	true	Boolean	16:53:17.620	16:53:18.176	Good
2	IBHLinkUA@ibh...	NS4(String)S71500/...	Down	false	Boolean	16:54:57.239	16:54:57.490	Good
3	IBHLinkUA@ibh...	NS4(String)S71500/...	IsCounting	true	Boolean	16:53:20.994	16:53:21.688	Good
4	IBHLinkUA@ibh...	NS4(String)S71500/...	Max	true	Boolean	16:53:22.553	16:53:23.189	Good
5	IBHLinkUA@ibh...	NS4(String)S71500/...	Min	false	Boolean	16:53:24.787	16:53:25.689	Good
6	IBHLinkUA@ibh...	NS4(String)S71500/...	Up	true	Boolean	16:54:57.239	16:54:57.490	Good
7	IBHLinkUA@ibh...	NS4(String)S71500/...	Value	5634	Int16	16:55:01.491	16:55:01.741	Good
8	IBHLinkUA@ibh...	NS4(String)S71500/...	CounterValue	5635	Int16	16:55:01.491	16:55:01.741	Good
9	IBHLinkUA@ibh...	NS4(String)S71500/...	Counting ON	true	Boolean	16:53:56.273	16:53:56.955	Good
10	IBHLinkUA@ibh...	NS4(String)S71500/...	MaxValue	10000	Int16	16:53:57.427	16:53:58.206	Good
11	IBHLinkUA@ibh...	NS4(String)S71500/...	MinValue	100	Int16	16:53:58.882	16:53:59.707	Good

Drag & Drop

continuously updated

Display Name	Value	Datatype
CounterON	true	Boolean
Down	false	Boolean
IsCounting	true	Boolean
Max	false	Boolean
Min	false	Boolean
Up	true	Boolean
Value	8764	Int16
CounterValue	8765	Int16
Counting ON	true	Boolean
MaxValue	10000	Int16
MinValue	100	Int16

double-click to change value

The operands defined in the **Default tag table** that were defined as OPC tags are listed under GlobalVars. The data of the **CounterData [DB2]** are listed under Programs.

Data Access View					
#	Server	Node Id			
1	IBHLinkUA@ibhlinkua_sc	NS4 String S71500/ET200MP station_1.PLC 1500.CounterON			
2	IBHLinkUA@ibhlinkua_sc	NS4 String S71500/ET200MP station_1.PLC 1500.Down			
3	IBHLinkUA@ibhlinkua_sc	NS4 String S71500/ET200MP station_1.PLC 1500.IsCounting			
4	IBHLinkUA@ibhlinkua_sc	NS4 String S71500/ET200MP station_1.PLC 1500.Max			
5	IBHLinkUA@ibhlinkua_sc	NS4 String S71500/ET200MP station_1.PLC 1500.Min			
6	IBHLinkUA@ibhlinkua_sc	NS4 String S71500/ET200MP station_1.PLC 1500.Up			
7	IBHLinkUA@ibhlinkua_sc	NS4 String S71500/ET200MP station_1.PLC 1500.Value			
8	IBHLinkUA@ibhlinkua_sc	NS4 String S71500/ET200MP station_1.PLC 1500.CounterData.CounterValue			
9	IBHLinkUA@ibhlinkua_sc	NS4 String S71500/ET200MP station_1.PLC 1500.CounterData.Counting ON			
10	IBHLinkUA@ibhlinkua_sc	NS4 String S71500/ET200MP station_1.PLC 1500.CounterData.MaxValue			
11	IBHLinkUA@ibhlinkua_sc	NS4 String S71500/ET200MP station_1.PLC 1500.CounterData.MinValue			

Display Name	Value	Datatype	Source Timestamp	Server Timestamp	Statuscode
CounterON	true	Boolean	16:53:17.620	16:53:18.176	Good
Down	false	Boolean	17:15:20.973	17:15:21.224	Good
IsCounting	true	Boolean	16:53:20.994	16:53:21.688	Good
Max	false	Boolean	16:59:22.402	16:59:22.650	Good
Min	false	Boolean	16:53:24.787	16:53:25.689	Good
Up	true	Boolean	17:15:20.973	17:15:21.224	Good
Value	4498	Int16	17:15:26.480	17:15:26.730	Good
CounterValue	4499	Int16	17:15:26.480	17:15:26.730	Good
Counting ON	true	Boolean	16:53:56.273	16:53:56.955	Good
MaxValue	10000	Int16	16:53:57.427	16:53:58.206	Good
MinValue	100	Int16	16:53:58.882	16:53:59.707	Good

8 IBH Link UA – Connection of a CPU 1200

In the following example, a project is made of the connection of a CPU1211C DC/DC/DC (6ES7 211-1AE40-0XB0) using the Ethernet bus.

Instead of the CPU1211C, any other S7 CPU 1200 with an unused Ethernet port could be used.

8.1 Assign an IP address to the CPU 1200 online

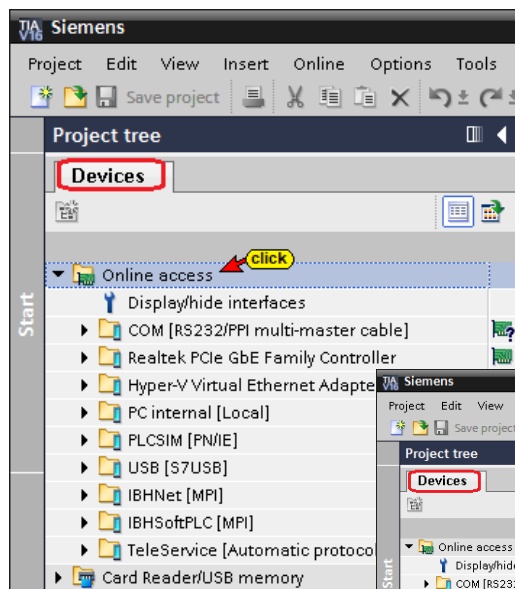
The MAC address (MAC ADD1) is printed on the housing above the LAN port (example: AC:64:17:1D:49:ED)

Connect the Ethernet Port with the network of the PC. The network must have a server (router) that is set to DHCP.

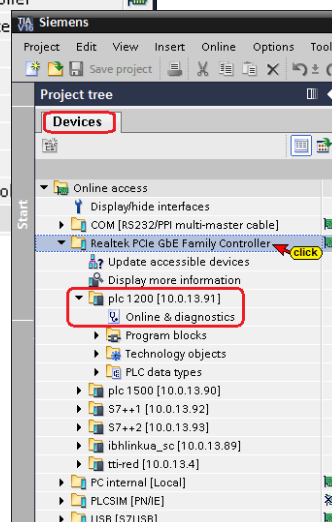
No project needs to be available in the open TIA Portal.

Click on online access

Click on on-line access to display the list of possible on-line



Select the Ethernet controller via which the CPU 1200 is connected to the DHCP network.

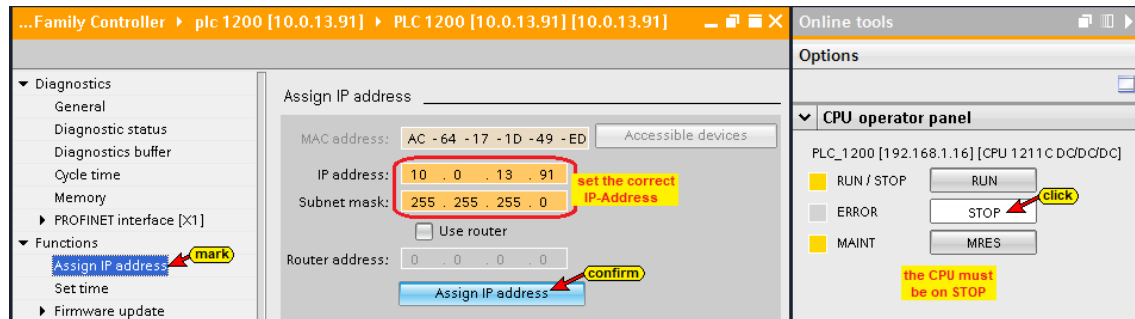
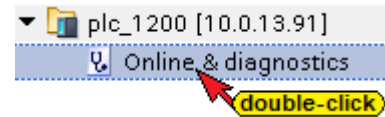


With a double-click on Update accessible devices, the TIA Portal software searches the selected network for participants.

If the PLC 1200 has not the correct IP-address or only the MAC address is shown a new IP-address must be assigned.

Assigning a new IP-address must

Double-click **Online & diagnostics** to open the on-line access window. Mark **Assign IP address**.

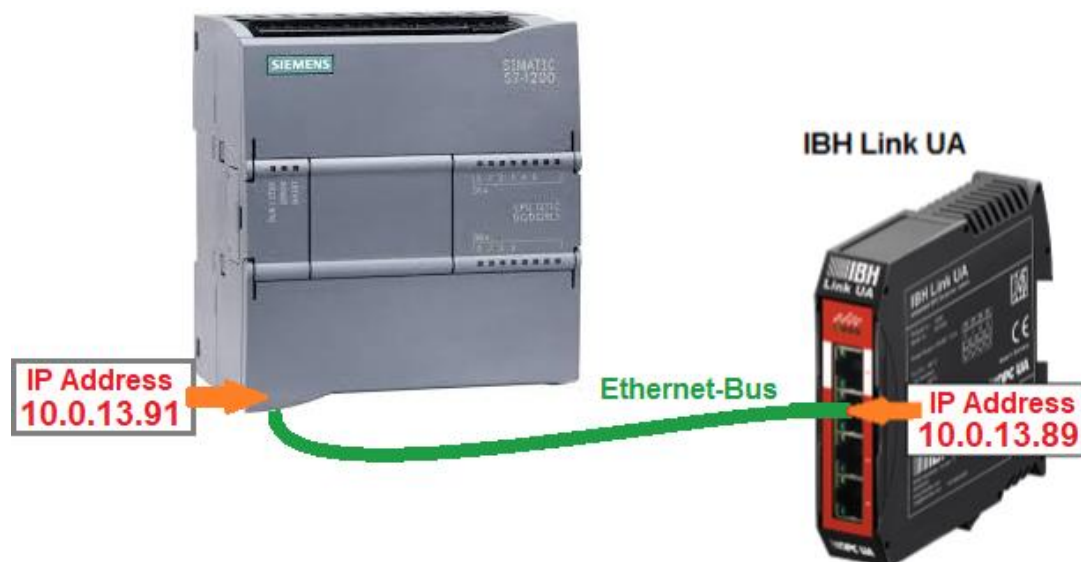


8.2 Project with TIA Portal V16

Creation of a project with the TIA Portal, with the connection of a CPU 1200 and the IBH Link UA via an Ethernet connection, is shown.



8.3 Hardware structure (CPU1211C – IBH Link UA)



Example: Counter level

The prepared example project **CPU 1200 TIA16e** 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. This process is repeated continuously.



The up count is controlled by the variable **Up** and the counting down by the variable **Down**. The variables **Value** (Default tag table) and **CounterValue** (data block **CounterData [DB2]**) hold the counter reading.

The SIEMENS PLC programming systems TIA Portal V16 is used to create the PLC program.

Variables of the **Default tag table** and of the data block **CounterData [DB2]** are to be used by the OPC server IBH Link UA as **OPC tags**.

Note:

The data block DB2 must not have been created as an optimized **Data Block [DB]**.

The OPC server cannot access DB variables in an optimized DB of an S7-1200 CPU.

Data block **CounterData [DB2]**

CPU 1200 TIA 16e ▶ PLC 1200 [CPU 1211C DC/DC/DC] ▶ Program blocks ▶ **CounterData [DB2]**

Keep actual values Snapshot Copy snapshots to start values

CounterData

	Name	Data type	Offset	Start value	Comment
1	Static				
2	Counting ON	Bool	0.0	false	On / Off switch 1
3	CounterValue	Int	2.0	0	Counter value
4	MinValue	Int	4.0	100	minimum Counter value
5	MaxValue	Int	6.0	10000	maximum Counter value

Default tag table

... 1200 [CPU 1211C DC/DC/DC] ▶ PLC tags ▶ Default tag table [37]

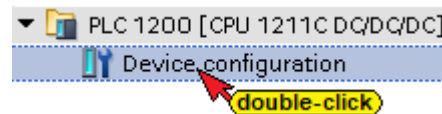
Tags User constants System constants

Default tag table

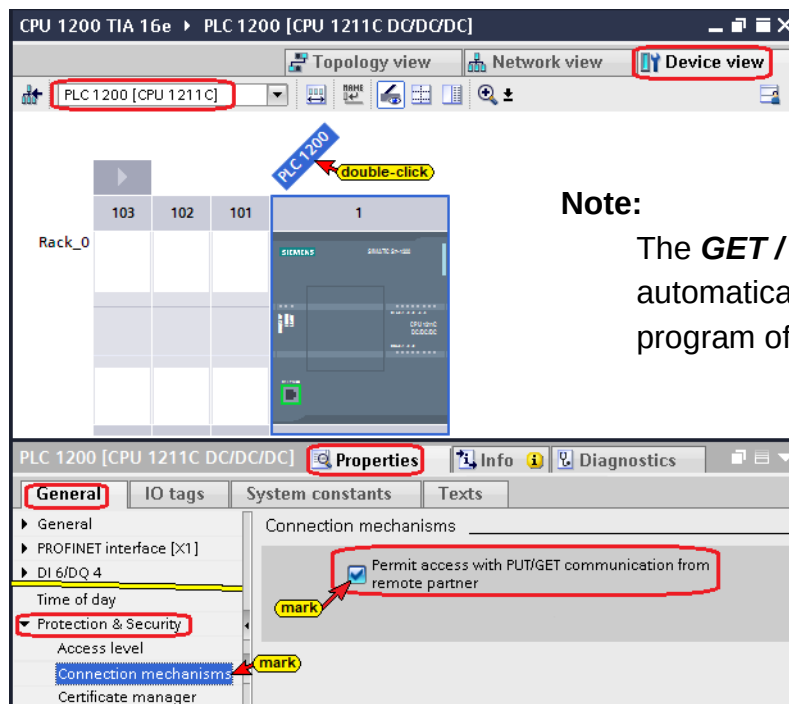
	Name	Data type	Address	Comment
1	CounterON	Bool	%M0.1	start counting
2	Max	Bool	%M2.0	Maximum reached
3	Min	Bool	%M2.1	Minimum reached
4	IsCounting	Bool	%M2.2	Counting control ON
5	Down	Bool	%M2.5	down counting
6	Up	Bool	%M2.6	up counting
7	Value	Int	%MW12	Counter value
8	RetBit	Bool	%M2.3	Return Bit

8.4 Configuration of the CPU 1200

Double-clicking on **Device configuration** opens the Device view window.



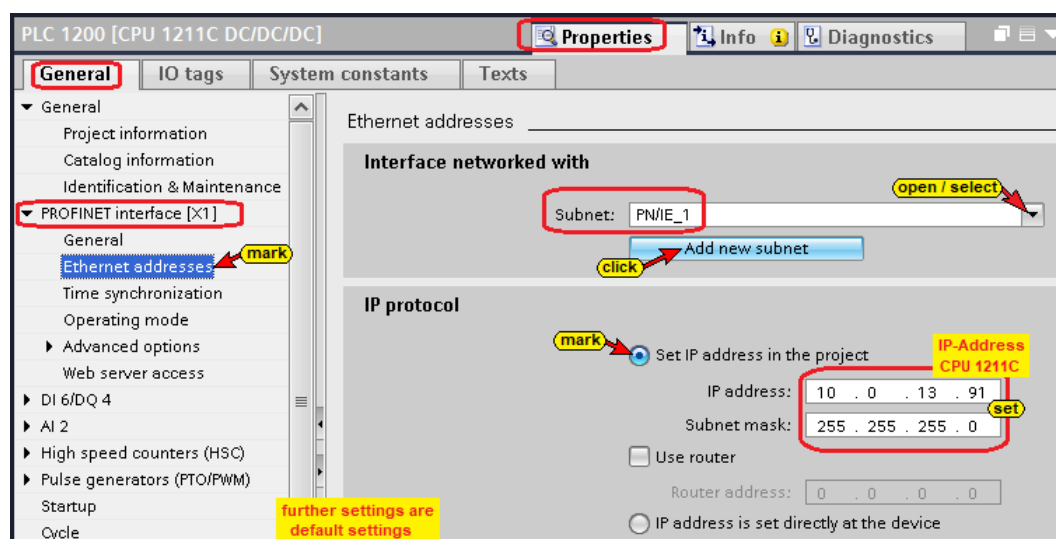
Activate S7 communication **GET and PUT** (allow access via PUT / GET by remote partner).



Note:

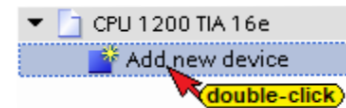
The **GET / PUT** function is not automatically activated in the program of a CPU1200.

The required IP address has been specified in the opened **Properties / PLC 1200 [CPU 1211C DC/DC/DC] / Ethernet addresses field**. In the example, the IP address of the CPU is **10.0.13.91** (other CPUs can have a different address). The Ethernet connection is direct without a router.

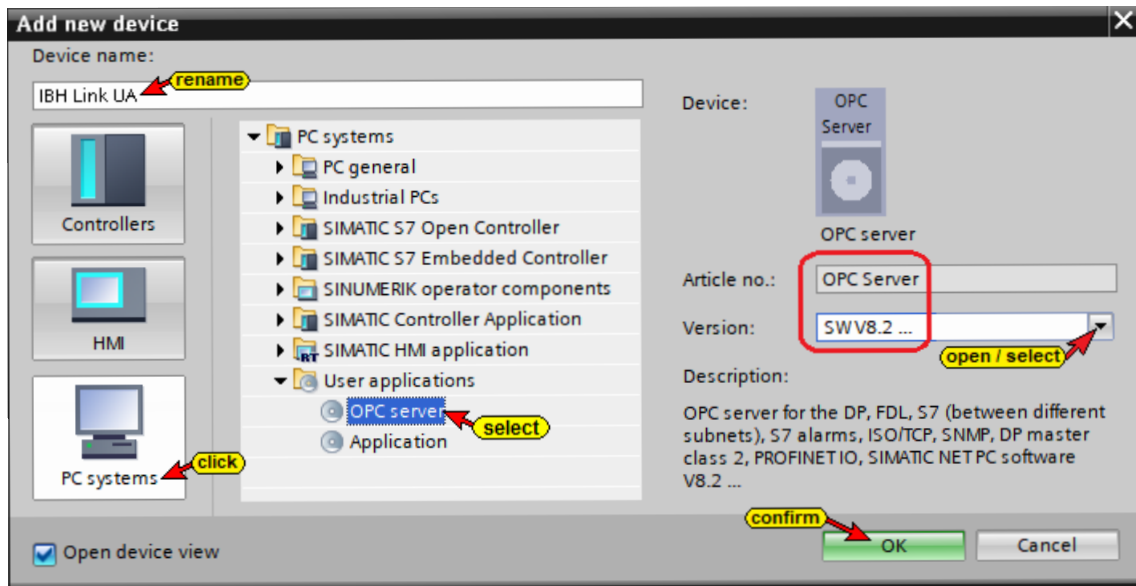


8.5 Add IBH Link UA as an SIMATIC PC station

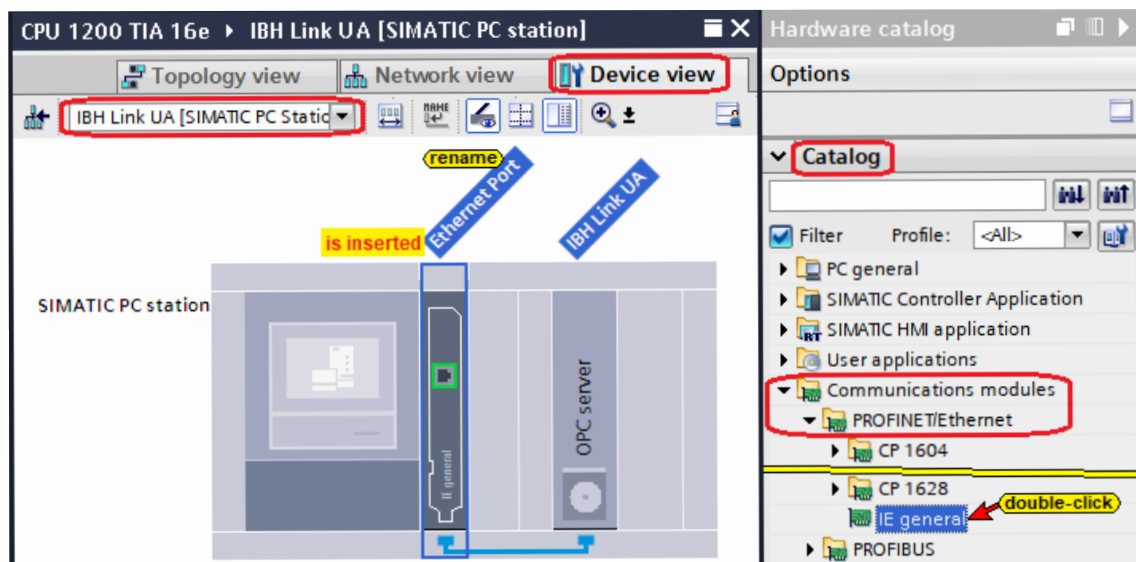
Double-clicking on Add new device opens the device selection dialog box.



If an OPC server is added to the project, an SIMATIC PC station is automatically added. The inserted OPC server must be version 8.2. The device name was changed to **IBH Link UA**.



Insert communication module into the IBH Link UA



Define communication module properties

Clicking **Ethernet Port** in the **SIMATIC PC Station [IBH Link UA]** opens the properties of the **Ethernet Port [IE General]** dialog box. The **Ethernet address** of the IBH Link UA must be entered. The Networking is also defined.

CPU 1200 TIA 16e ▶ IBH Link UA [SIMATIC PC station]

Topology view Network view **Device view**

IBH Link UA [SIMATIC PC Station]

mark Ethernet Port IBH Link UA

SIMATIC PC station

Device overview

Module	Index	Type	Article no.	Software or firmware version	Comment
OPC Server UA	1	OPC server	OPC Server	V8.2.0	
▼ Ethernet Port	2	IE general	IE_CP	V8.2.0	
▼ PROFINET interface	2 X1	PROFINET interface			
Port_1	2 X1 P1	Port			

Ethernet Port [IE General] Properties Info Diagnostics

General IO tags System constants Texts

General

Catalog information

Identification & Maintenance

▼ PROFINET interface [X1] mark

General

Options

Ethernet addresses

▼ Advanced options

Interface options

▼ Port [X1 P1]

General

Port interconnection

OPC configuration

PROFINET interface [X1]

General

Name: PROFINET interface

Comment:

Options

Connection establishment monitoring

Timeout: 10

Ethernet addresses

Interface networked with

Subnet: PN/IE_1 open / select

Add new subnet

ISO protocol

☐ Use ISO protocol

MAC address: 08 - 00 - 06 - 01 - 00 - 00

IP protocol

☒ Use IP protocol mark

IP address: 10 . 0 . 13 . 89 insert IP-Address IBH Link UA

Subnet mask: 255 . 255 . 255 . 0

☐ Use router

Router address: 0 . 0 . 0 . 0

Communication module slot check

The IBH Link UA Ethernet Port (Control Level) must be in slot 2.

Ethernet Port [IE General] Properties Info Diagnostics

General IO tags System constants Texts

General

Catalog information

Identification & Maintenance

▼ PROFINET interface [X1]

General

Options

Ethernet addresses

General

Name: Ethernet Port rename

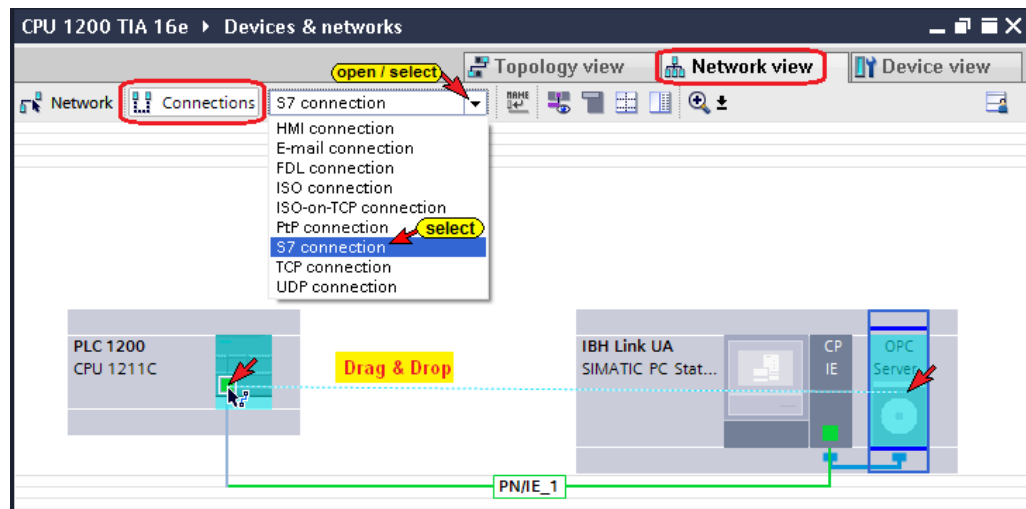
Author: TTi

Comment:

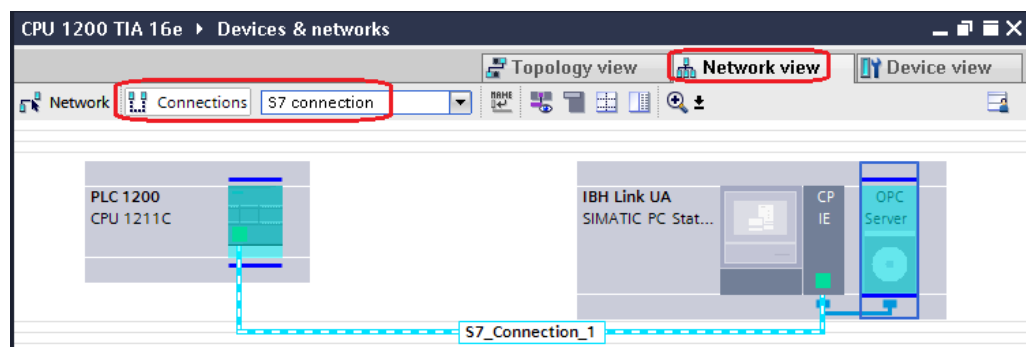
Slot: 2

Create S7 connection IBH Link UA OPC Server - CPU 1200

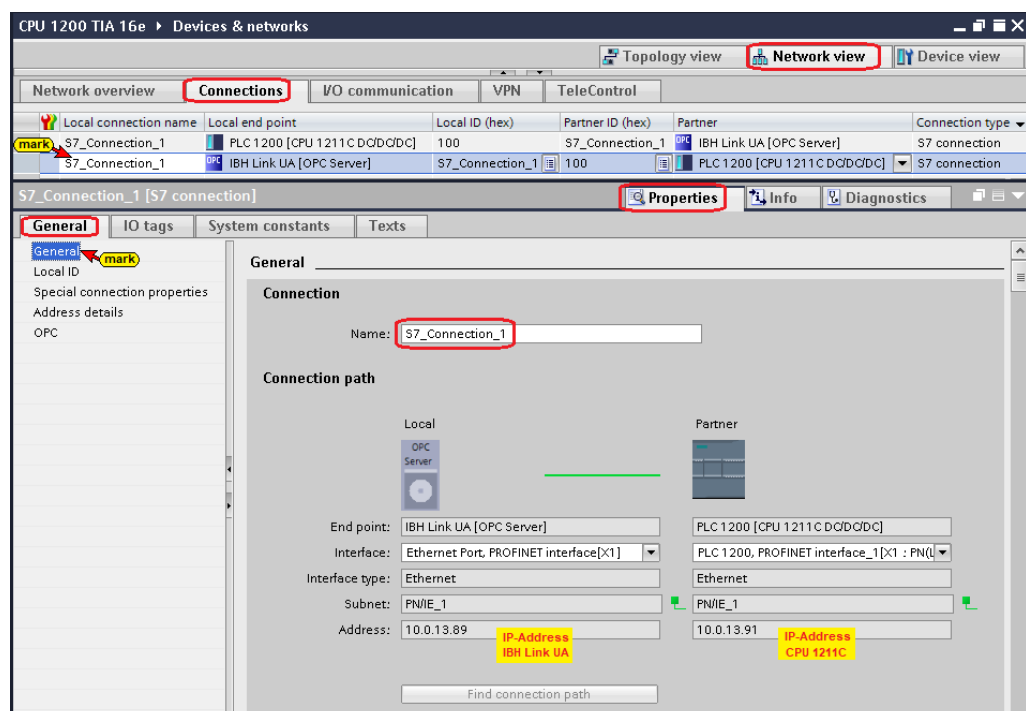
S7 connection OPC server - CPU 1200 created using drag & drop.



The S7 connection from the OPC server to the PLC 1200 [CPU 1211C DC/DC/DC] is displayed.

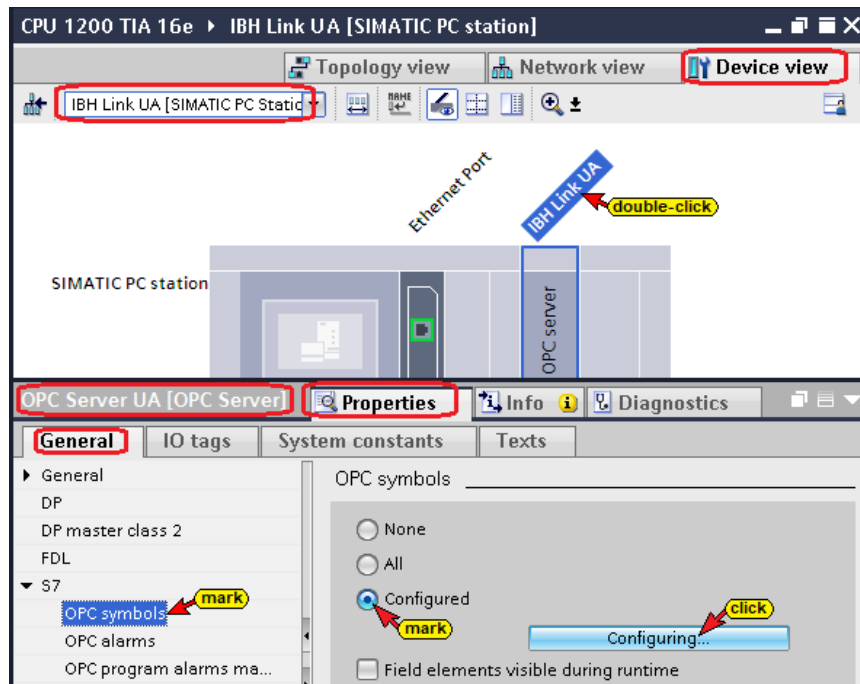


A click switches between the connection representations. The created S7 connection is listed in the Network view window.



Select OPC symbols (tags) in the OPC configuration

Open the configuration on the OPC server / properties.

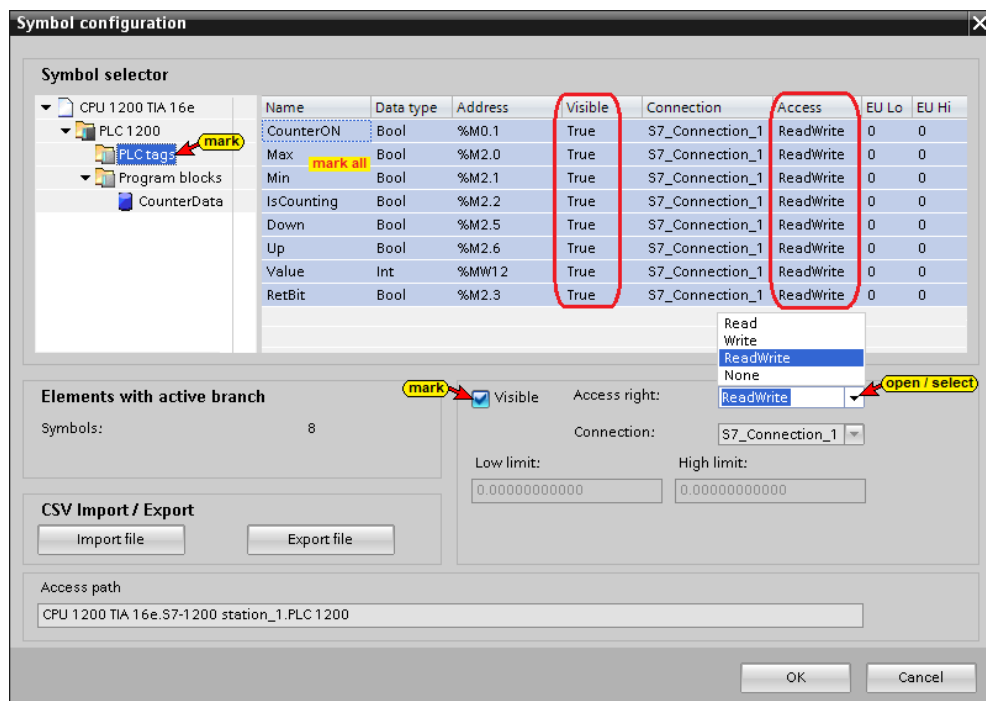


The **Configure** button opens the Symbol configuration dialog box, in which the operands defined in the default tag table (PLC 1200 [CPU1211C]) can be selected as OPC tags.

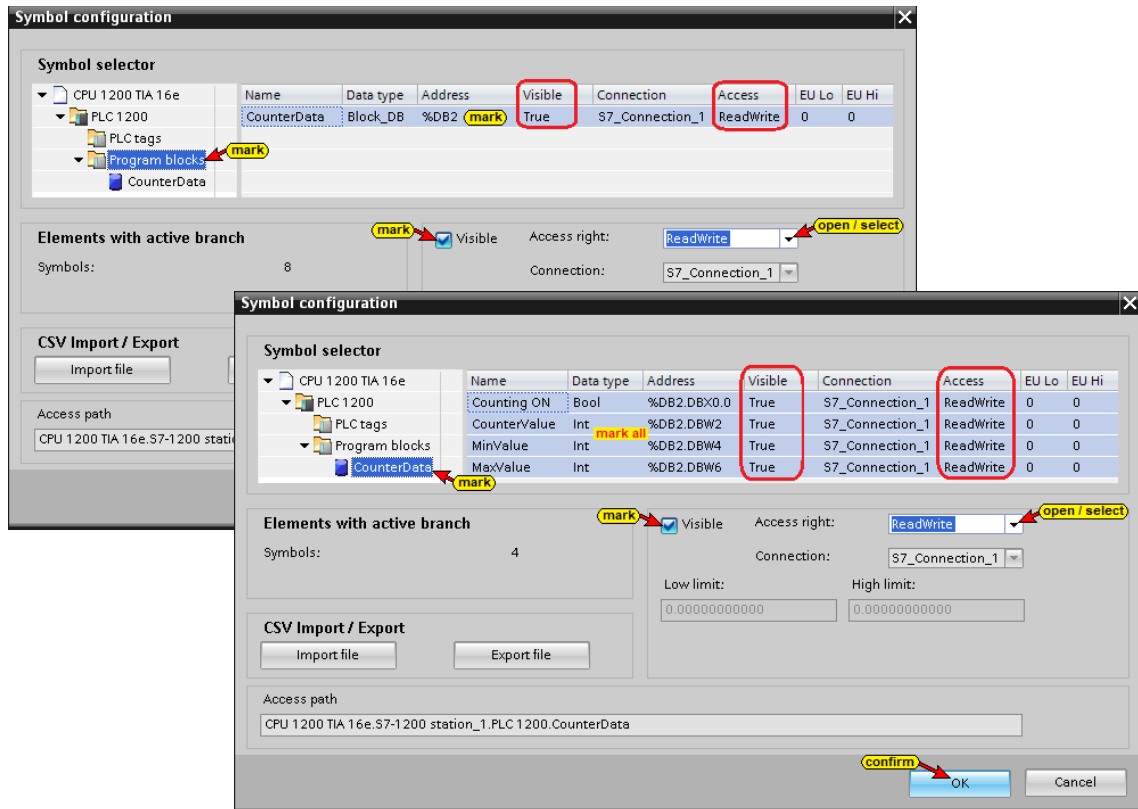
The read / write, etc. access rights can be assigned to the individual operands (OPC tags).

Select global variables as OPC tags

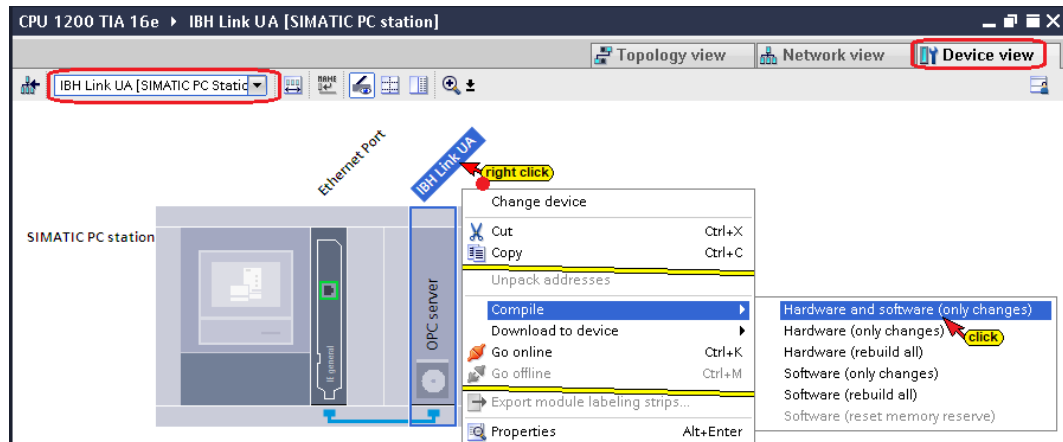
In addition to the global variables, the data from data blocks can be defined as OPC tags.



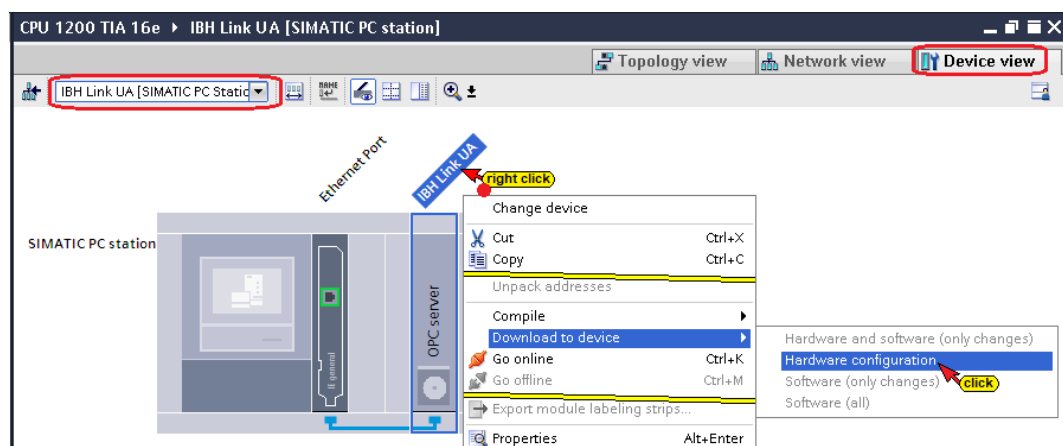
Select Data block variables as OPC tags



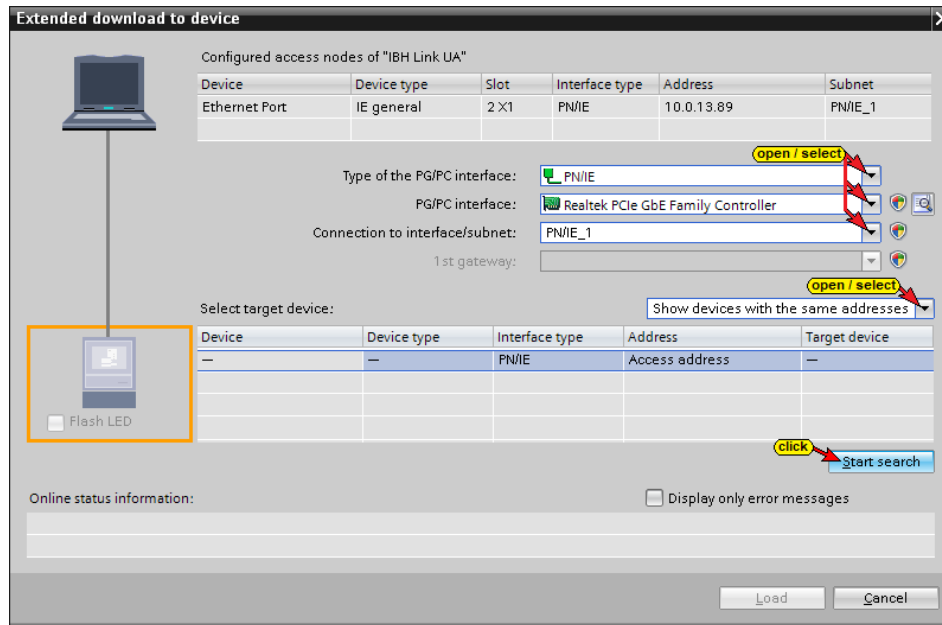
Compile the configuration of the OPC server



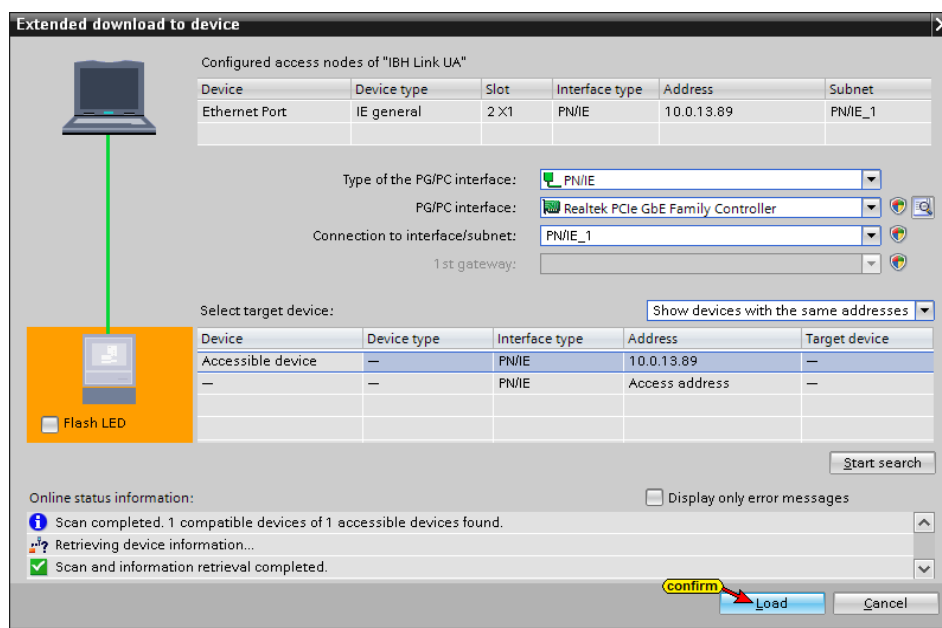
Load configuration of the OPC server into IBH Link UA



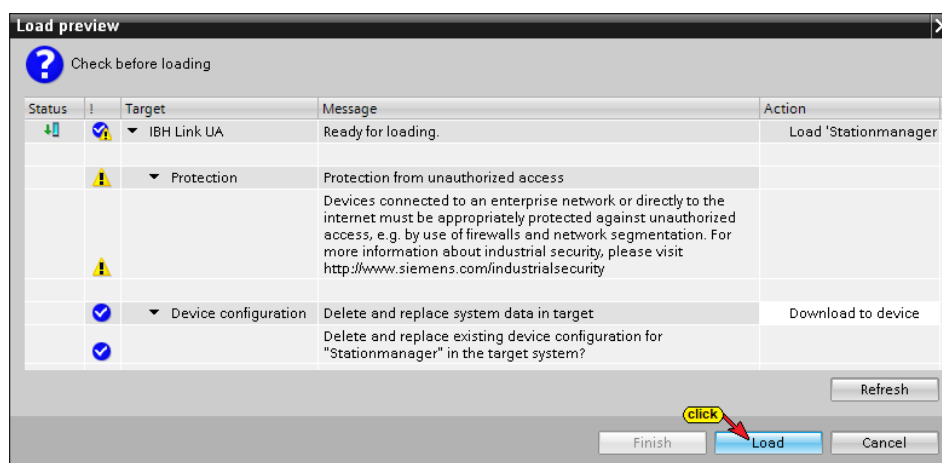
The settings must be made in the dialog box according to the screen



The interface search was successful.

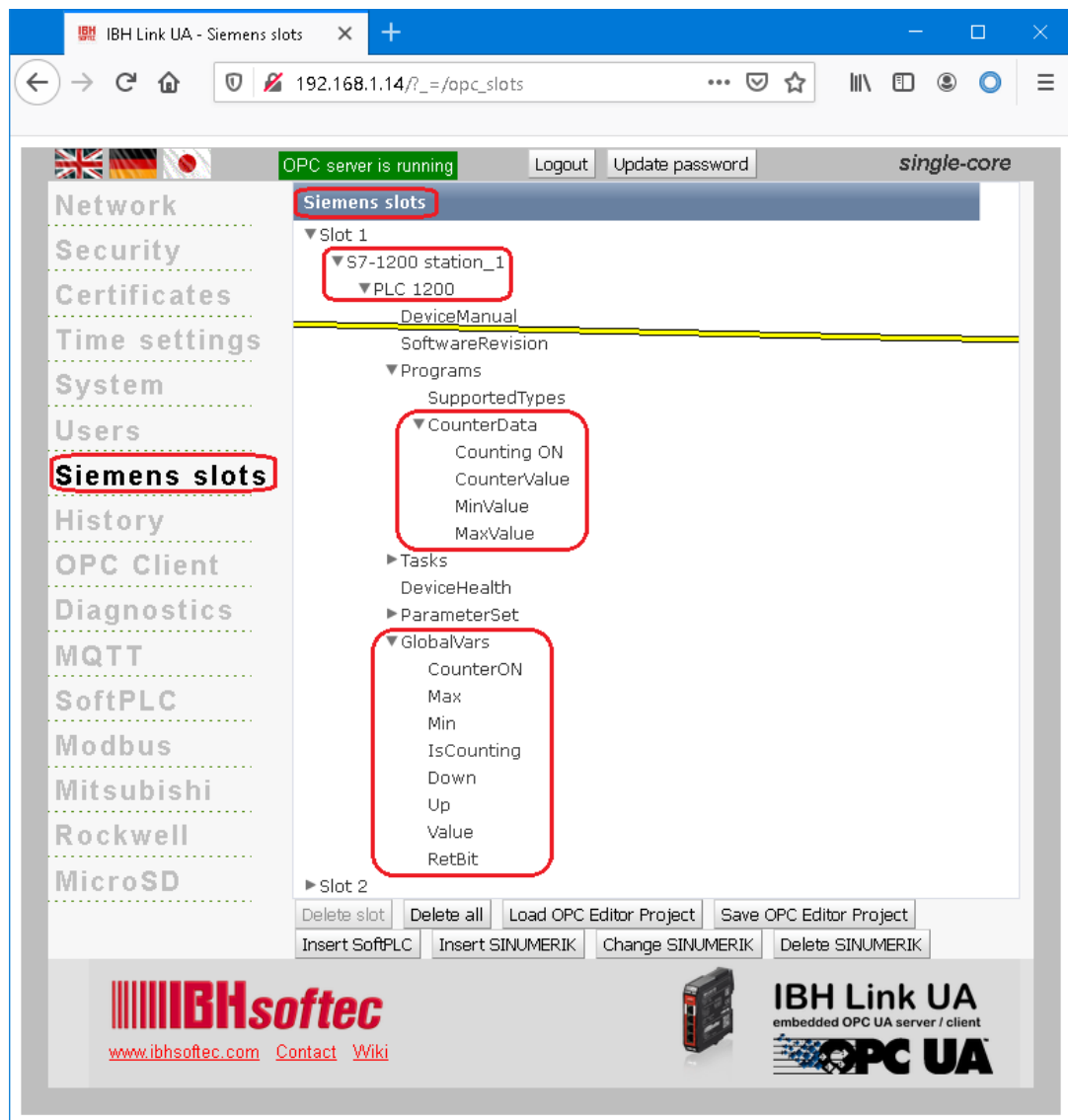


A check is made prior loading.



8.5.1 IBH Link UA browser window *Siemens slots*

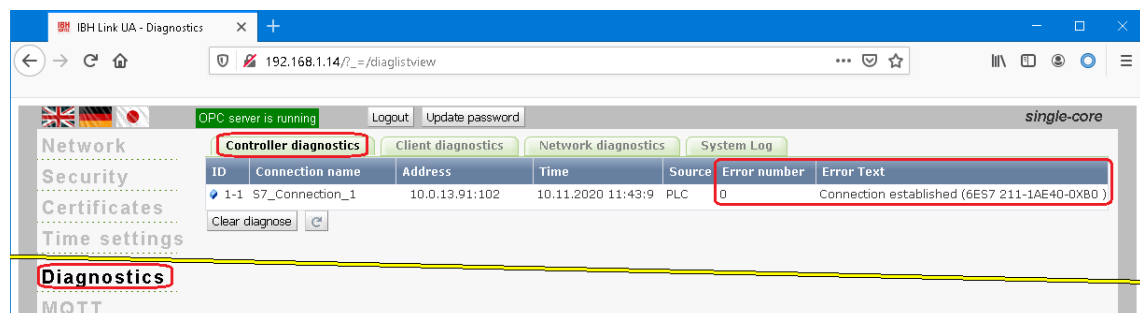
The CPU with the OPC tags is displayed in the Siemens Slots browser window.



8.5.2 Browser window diagnostics

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

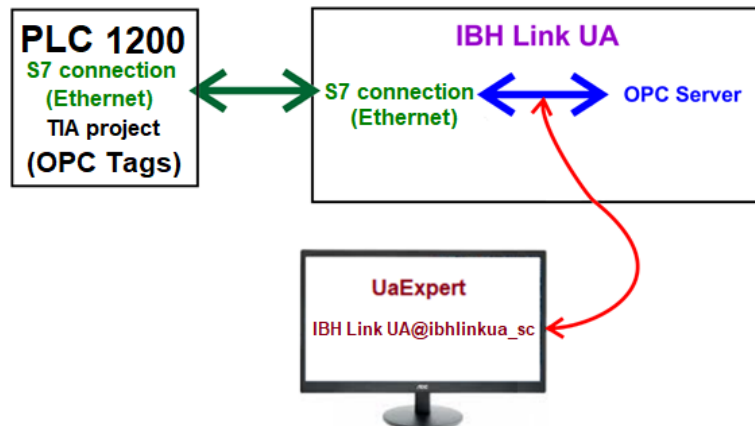
Controller diagnostics



8.6 UaExpert - program window

In the UaExpert program window, the OPC tags of the PLC 1200 are displayed. The handling of the UaExpert program is described in part 1 of the manual.

8.6.1 Display of the OPC tags in the UaExpert



UaExpert - program window at PLC 1200

The screenshot shows the UaExpert program window with the 'Data Access View' tab selected. The 'Data Access View' table displays the following data:

#	Server	Node Id	Display Name	Value	Datatype	Source Timestamp	Server Timestamp	Statuscode
1	IBHLinkUA@ibh...	NS4[String]S7-1200...	CounterON	true	Boolean	12:50:30.347	12:50:30.892	Good
2	IBHLinkUA@ibh...	NS4[String]S7-1200...	Down	false	Boolean	12:52:17.222	12:52:17.471	Good
3	IBHLinkUA@ibh...	NS4[String]S7-1200...	IsCounting	false	Boolean	12:50:34.011	12:50:34.645	Good
4	IBHLinkUA@ibh...	NS4[String]S7-1200...	Max	false	Boolean	12:50:35.647	12:50:36.397	Good
5	IBHLinkUA@ibh...	NS4[String]S7-1200...	Min	false	Boolean	12:50:37.247	12:50:37.898	Good
6	IBHLinkUA@ibh...	NS4[String]S7-1200...	RetBit	false	Boolean	12:50:39.150	12:50:39.648	Good
7	IBHLinkUA@ibh...	NS4[String]S7-1200...	Up	true	Boolean	12:52:17.222	12:52:17.471	Good
8	IBHLinkUA@ibh...	NS4[String]S7-1200...	Value	6390	Int16	12:52:18.221	12:52:18.471	Good
9	IBHLinkUA@ibh...	NS4[String]S7-1200...	CounterValue	6385	Int16	12:52:18.221	12:52:18.471	Good
10	IBHLinkUA@ibh...	NS4[String]S7-1200...	Counting ON	true	Boolean	12:51:09.827	12:51:10.667	Good
11	IBHLinkUA@ibh...	NS4[String]S7-1200...	MaxValue	10000	Int16	12:51:12.196	12:51:12.918	Good
12	IBHLinkUA@ibh...	NS4[String]S7-1200...	MinValue	100	Int16	12:51:13.602	12:51:14.170	Good

The 'PLC 1200' object tree on the left shows the following structure:

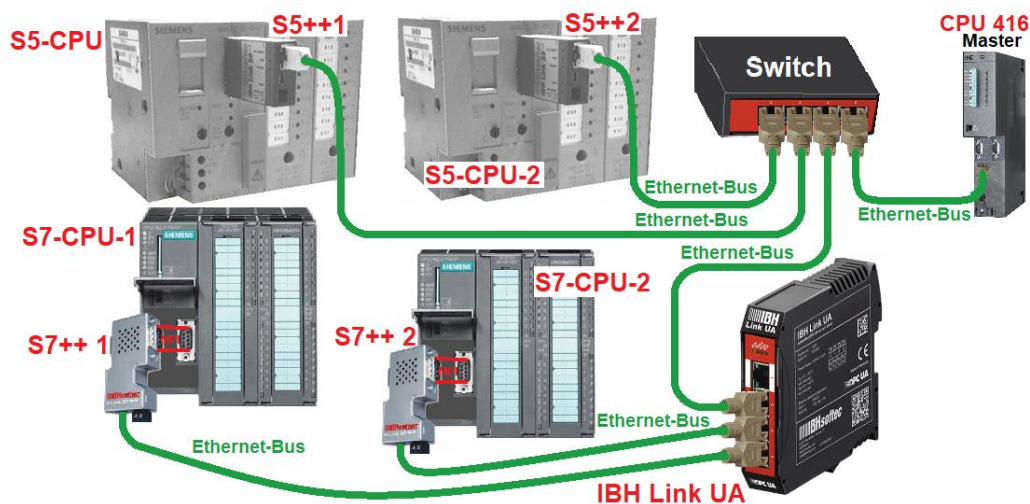
- PLC 1200
 - DeviceHealth
 - DeviceManual
 - DeviceRevision
 - GlobalVars
 - CounterON
 - Down
 - IsCounting
 - Max
 - Min
 - RetBit
 - Up
 - Value
 - HardwareRevision
 - Manufacturer
 - Model
 - ParameterSet
 - Programs
 - CounterData
 - CounterValue
 - Counting ON
 - MaxValue
 - MinValue
 - SupportedTypes
 - RevisionCounter
 - SerialNumber
 - SoftwareRevision
 - Tasks
 - Server

Annotations in the screenshot include:

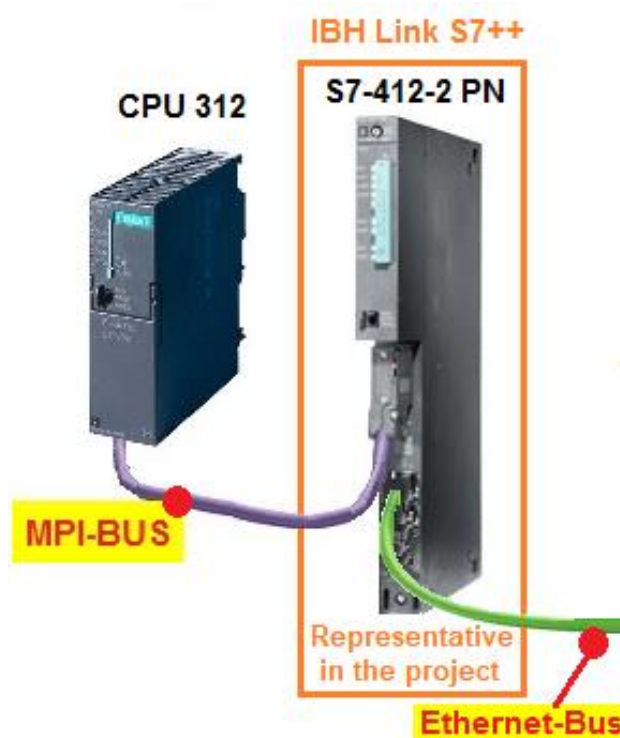
- 'Drag & Drop' pointing to the 'CounterON' object in the GlobalVars tree.
- 'continuously updated' pointing to the 'Value' column in the Data Access View table.
- 'double-click to change value' pointing to the 'MinValue' cell in the Data Access View table.

9 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.



9.1 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)

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

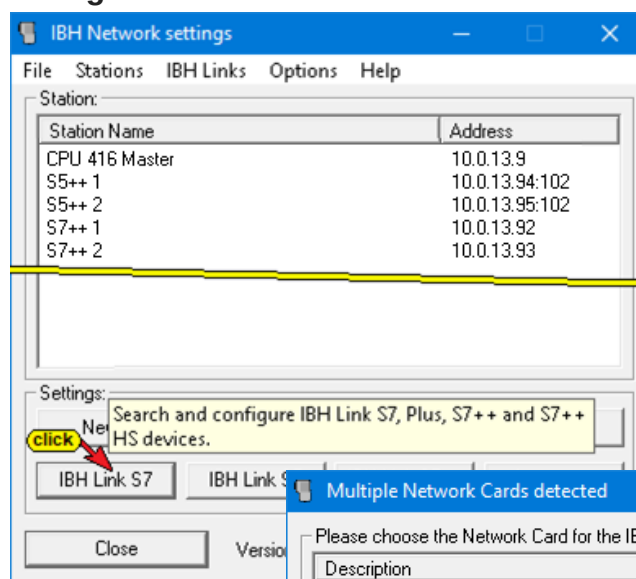
In the STEP 7 example, the S7 CPU 312 is to be routed via the IBH Link S7 ++ and connected to the IBH Link UA.

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

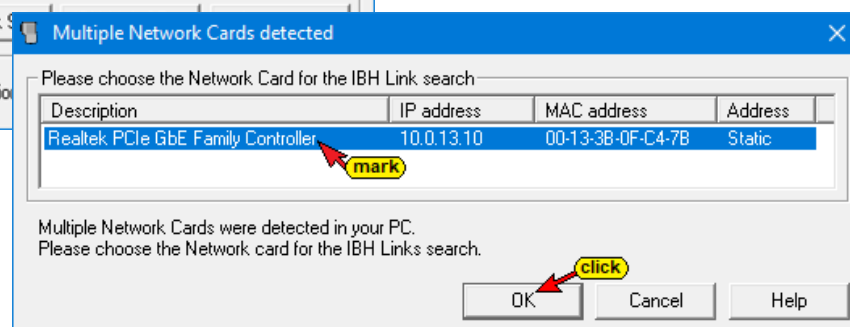
After starting **Manage IBHNet Stations**, the **IBH Network Settings** dialog box opens. Click the **IBH Link S7** button to open the IBH Links in the local network dialog box.



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

Below the table, there is a 'Settings' button with a red arrow pointing to it and a yellow 'click' label. A yellow note says 'select one after another'.

The second screenshot shows the 'IBHLink settings - 00025208' 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/DHCP/Boot-P radio buttons are present.

 The 'Authentication' section has fields for Username (admin) and Password (xxxxxx), with a 'Change password' button.

The 'Options' section has a checked box for 'Configuration with NetPro/TIA'. A yellow note explains: 'For PLC to PLC communications, a NetPro configuration can be downloaded into the IBH Link. Details can be found in the documentation.' Below this, another note says 'The settings will be saved in the IBH Links internal flash memory and are kept after a power cycle.' A red arrow points to the 'Save permanently' button with a yellow 'click' label.

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 red arrow points to the 'Yes' button with a yellow 'confirm' label.

The fourth screenshot shows another '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 red arrow points to the 'OK' button with a yellow 'confirm' label.

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 ++.

9.2 S5 CPU connection via IBH Link S5++

S5 controllers do not have an Ethernet connection as standard.

The screenshot shows a web browser window at the address 10.0.13.94/cgi-bin/network.cgi. The page has a red header with the 'IBHsoftec' logo. Below the header, the title 'CONFIGURATION' is displayed.

The main content area contains the following fields and text:

- Text: 'Here the IP address of **IBH Link S5++** can be specified.'
- IP address input: 10 . 0 . 13 . 94
- Text: 'Additionally DHCP can be selected to obtain the IP address automatically.'
- Netmask input: 255 . 255 . 255 . 0
- Gateway input: 10.0.13.1
- Configuration dropdown: [Manually] v
- Buttons: 'Apply' and 'Back'
- NOTE: 'The **IBH Link S5++** needs to be restarted to apply the changes.'

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:

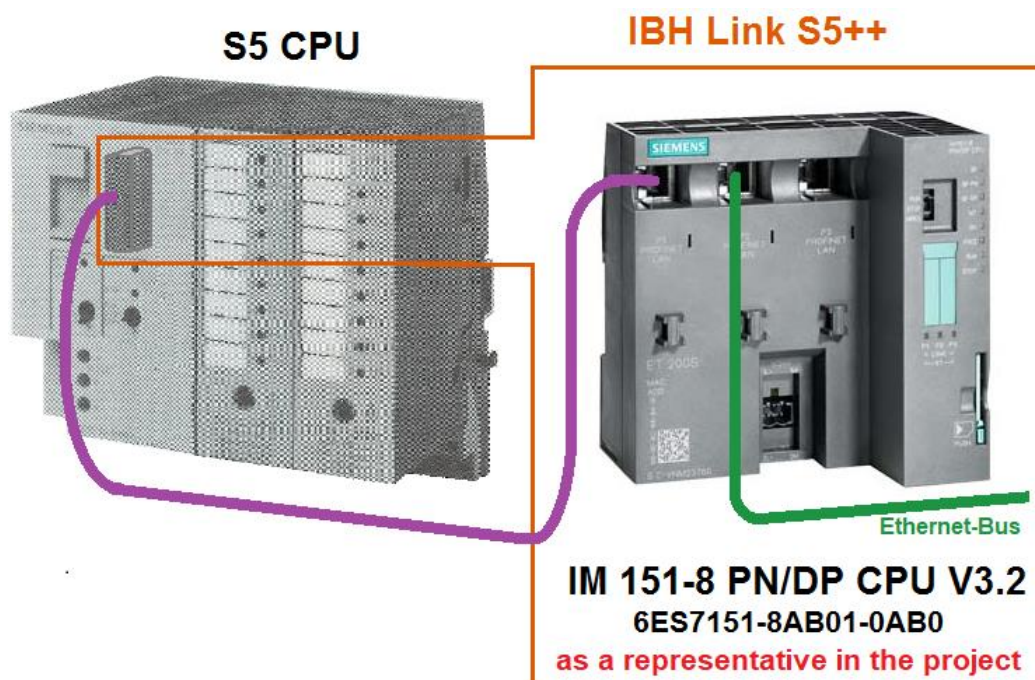
The interface module **IM 151-8 PN/DP CPU V3.2** provides a PROFINET interface with an integrated switch. PG communication and S7 communication are possible via the PROFINET interface.

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)

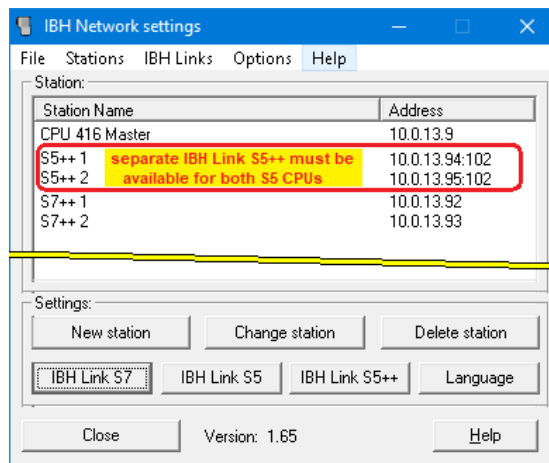
IM 151-8 PN/DP as a representative on the project



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.



9.3 Example with STEP 7 - TIA Portal

In the following example, the creation of a project with the STEP 7 - TIA Portal 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	10.0.13.9	
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

9.3.1 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.

Name	Data type	Offset	Start value	Comment
Static				
Control_ON	Bool	0.0	false	all CPUs start counting
MaxValue_1	Int	2.0	5500	maximum counter value S7 CPU 1
MaxValue_2	Int	4.0	5000	maximum counter value S7 CPU 2
MaxValue_3	Int	6.0	4500	maximum counter value S5 CPU 1
MaxValue_4	Int	8.0	4000	maximum counter value S5 CPU2
MinValue_1	Int	10.0	900	minimum counter value S7 CPU 1
MinValue_2	Int	12.0	800	minimum counter value S7 CPU 2
MinValue_3	Int	14.0	700	minimum counter value S5 CPU 1
MinValue_4	Int	16.0	600	minimum counter value S5 CPU 2

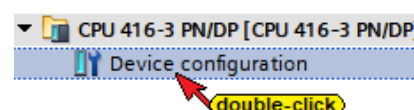
Variable from CPUs [DB5]

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

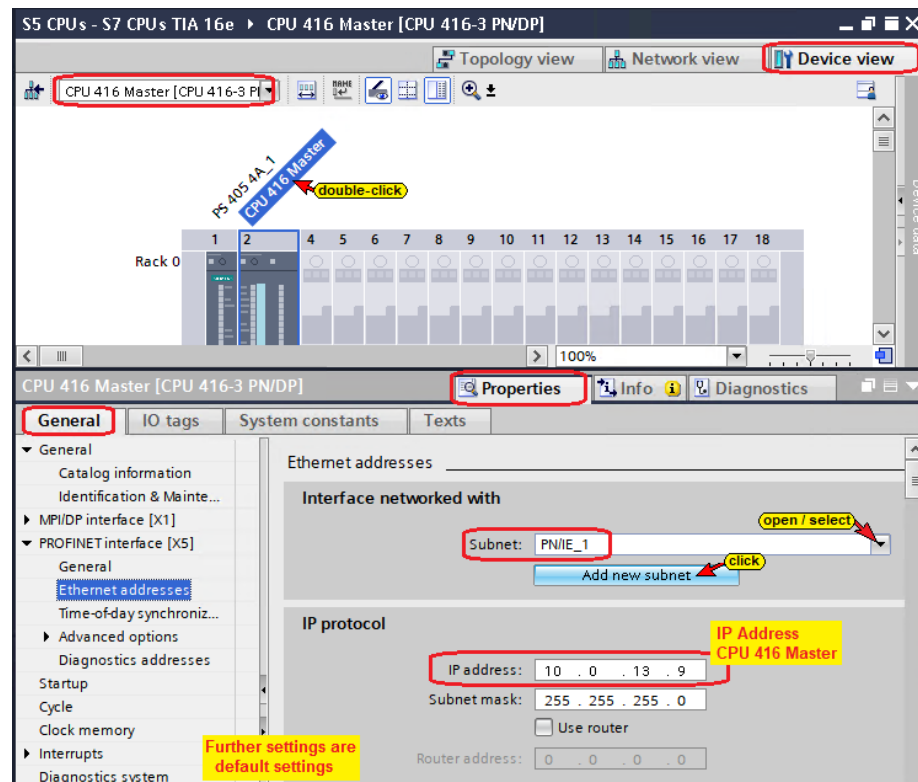
Name	Data type	Offset	Start value	Comment
Static				
Controlling_is_ON_1	Bool	0.0	false	S7 CPU 1 is counting
Controlling_is_ON_2	Bool	0.1	false	S7 CPU 2 is counting
Controlling_is_ON_3	Bool	0.2	false	S5 CPU 1 is counting
Controlling_is_ON_4	Bool	0.3	false	S5 CPU 2 is counting
Value_1	Int	2.0	0	Counter reading S7 CPU 1
Value_2	Int	4.0	0	Counter reading S7 CPU 2
Value_3	Int	6.0	0	Counter reading S5 CPU 1
Value_4	Int	8.0	0	Counter reading S5 CPU 2

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

Double-click **Device Configuration** to open the Device view window.

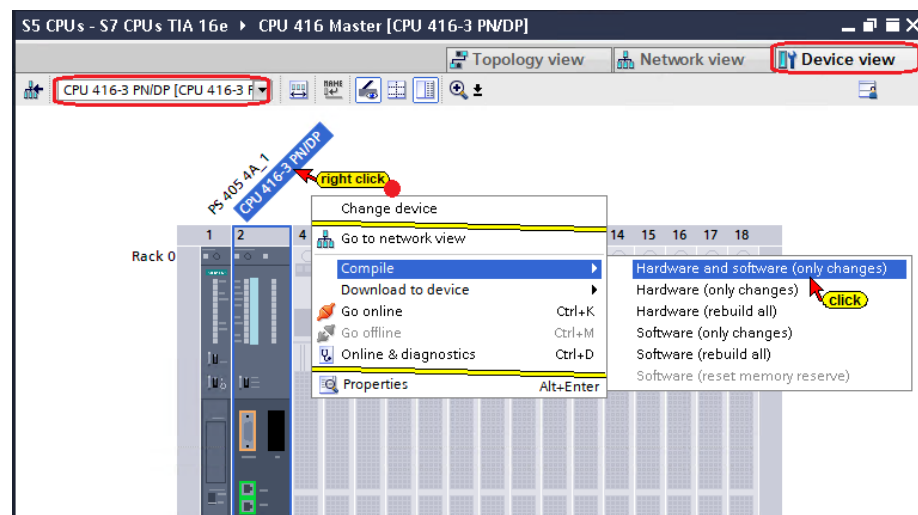


In the dialog box properties, the required IP address is set under IP protocol. In the example, the IP address of the PC is – 10.0.13.9. The Ethernet connection is direct without a router.

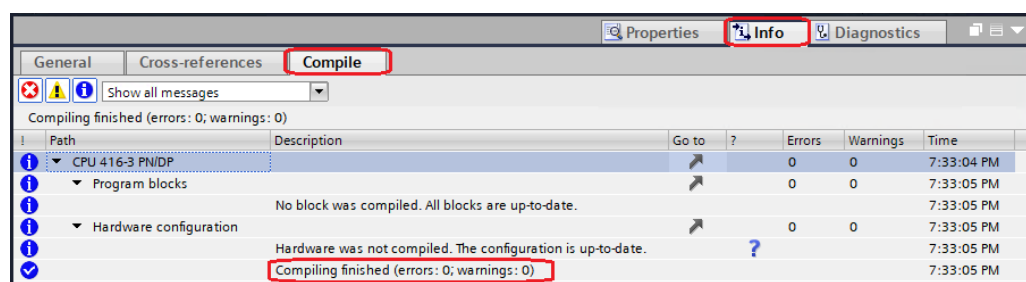


Hardware and software compilation

Use the command from the context menu to compile the software and the hardware.



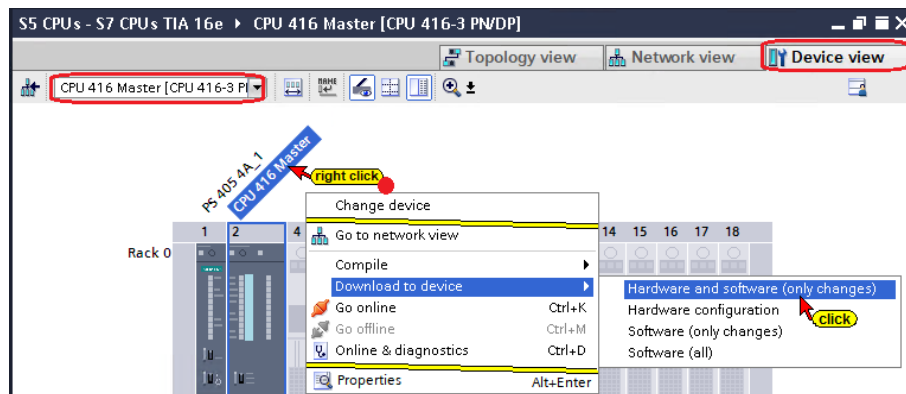
Hardware and software compilation



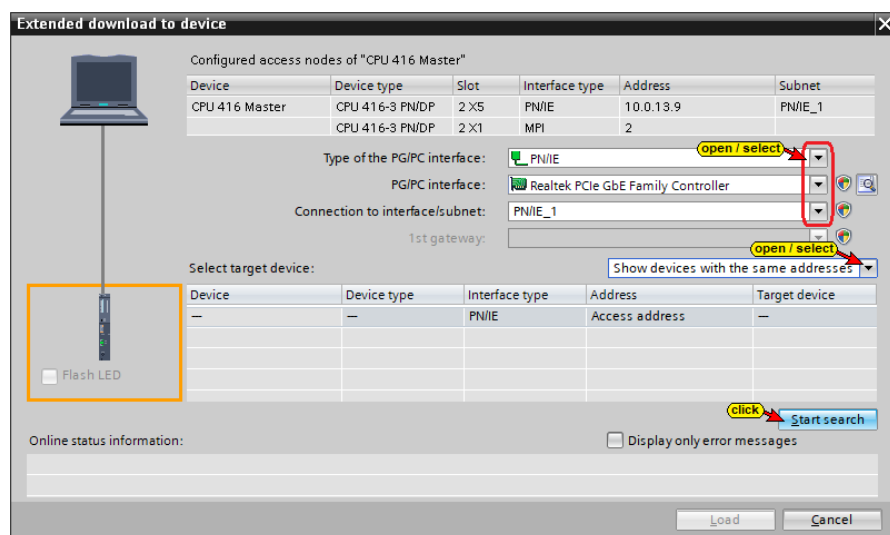
The configuration reports no errors. The download can be done.

Download the hardware and software into the CPU

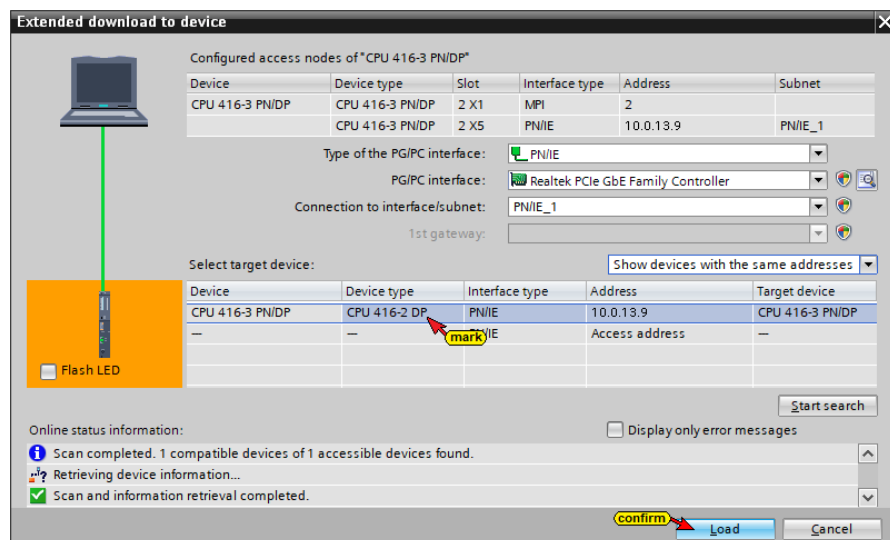
With the commands from the context menu, the software and the hardware configuration can be downloaded into the device.



The load command opens the dialog window to set the interface for the device. **Connection with interface / subnet PN/IE1**, and **Show devices with the same addresses** must be selected.

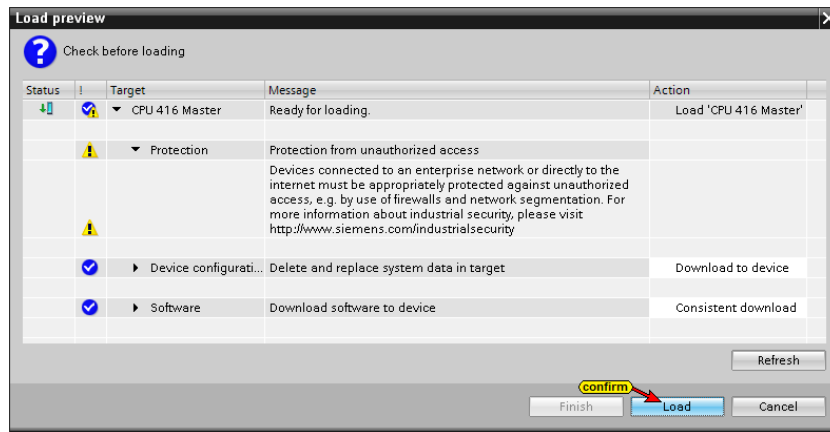


The successful search is displayed

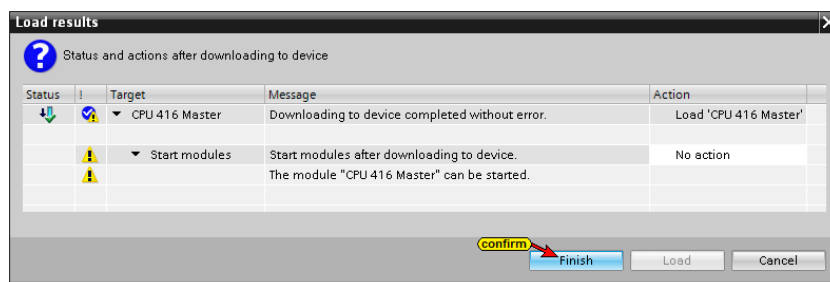


The loading process requires several confirmations of messages.

A preview of the loading is displayed



Finish loading



9.3.3 S5++ to S5 CPU 1 [IM 158-8 PN/DP CPU] – (IBH Link S5++)

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.

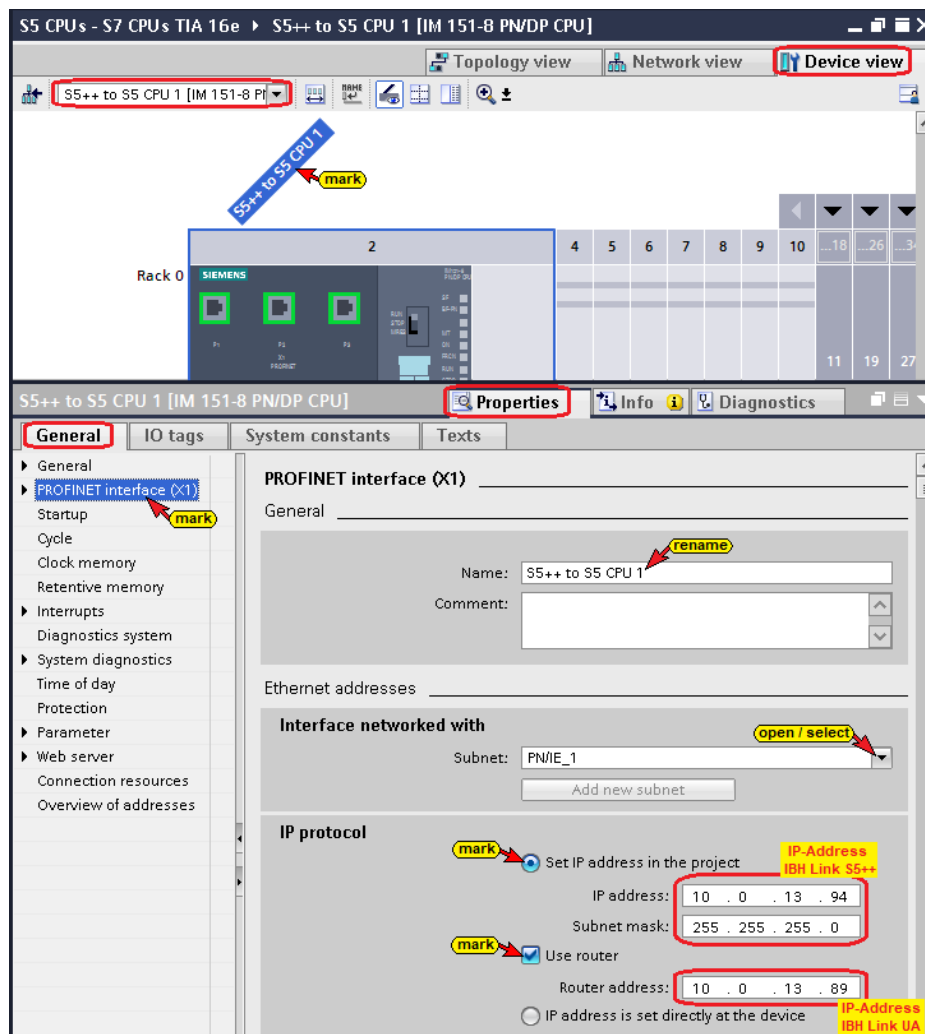
Symbol	Operand	Comment
CounterON_3	F 0.1	Eable S5 CPU 1 to count as OPC tag
Max_3	F 2.0	Maximum reached S5 CPU 1
Min_3	F 2.1	Minimum reached S5 CPU 1
IsCounting_3	F 2.2	Counting control ON S5 CPU 1 as OPC tag
Down_3	F 2.5	down counting S5 CPU 1
Up_3	F 2.6	up counting S5 CPU 1
Value_3	FW 12	Counter value S5 CPU 1
CounterData_3	DB 2	Data Block DB2 [CounterData] accept as OPC tags via DB2 (CounterData)
CounterValue_3	DW 0	Counter Value S5 CPU 1
MinValue_3	DW 1	minimum Counter value S5 CPU 1
MaxValue_3	DW 2	maximum Counter value S5 CPU 1

Picture Block S5-CPU 103U: Global variable / data from DB2

Operand	Contents	Modify value
F 0.1	KM 1	Eable 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 0	down counting S5 CPU 1
F 2.6	KM 1	up counting S5 CPU 1
FW 12	KF +4216	Counter value S5 CPU 1
DB 2	---	Data Block DB2 [CounterData]
DW 0	KF +4217	Counter Value S5 CPU 1
DW 1	KF +700	minimum Counter value S5 CPU 1
DW 2	KF +4500	maximum Counter value S5 CPU 1

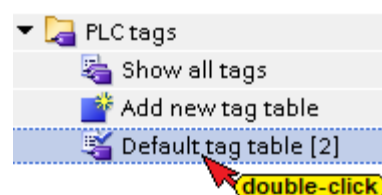
Define IBH Link S5 ++ [IM115-8 PN/DP CPU] properties

The IM115-8 is displayed in the device view.

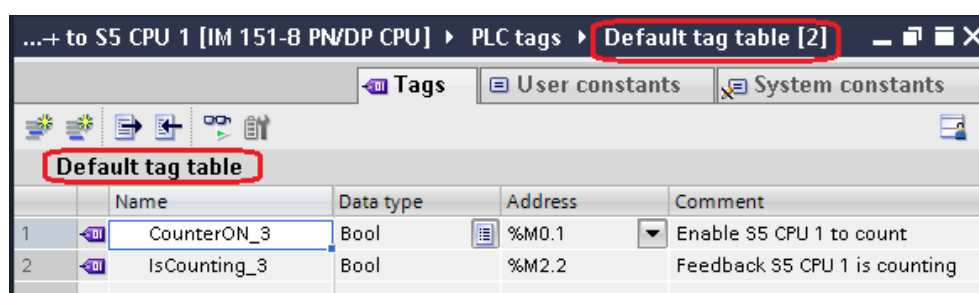


Define OPC tags (symbols) as default tags

A double-click opens the default tag table. In this table, operands of the symbol table of the S5 program (**Counter.SEQ**) are entered, which are to be sent to the OPC server as OPC tags (OPC symbols).



A direct import of the S5 program symbol table (**Counter.SEQ**) is impossible in the TIA Portal.



Data block CounterValues3 [DB2]

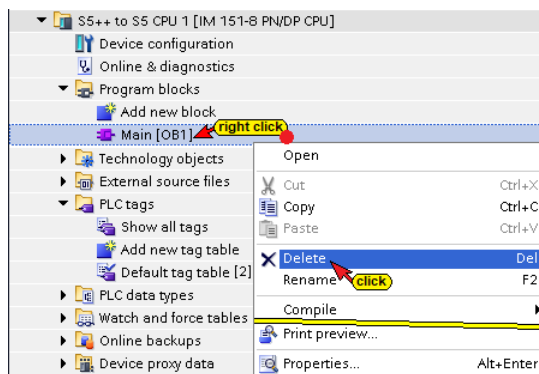
... S5 CPU 1 [IM 151-8 PN/DP CPU] ▶ Program blocks ▶ CounterValues3 [DB2]

Keep actual values Snapshot

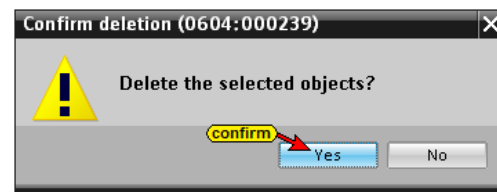
CounterValues3

	Name	Data type	Offset	Start value	Comment
1	Static				
2	Value_3	Int	0.0	0	Counter value S5 CPU 1
3	MinValue_3	Int	2.0	0	minimum Counter value S5 CPU 1
4	MaxValue_3	Int	4.0	0	maximum Counter value S5 CPU 1

Delete block OB1

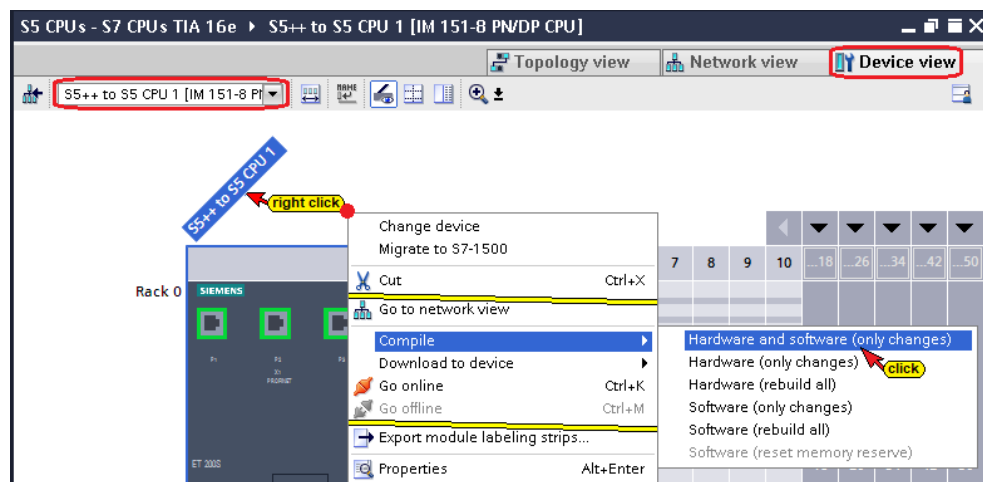


Only data can be transferred with the **IBH Link S5++**. Therefore, all program blocks, except for **data blocks**, must be deleted in the IM 151-8 CPU.



Compile hardware and software (IBH Link S5 ++)

The hardware configuration and software should be compiled so that errors can be recognized.



Note:



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

The hardware configuration and the PLC blocks must not be loaded into the IBH Link S5++.

The use of the download command is not permitted !

9.3.4 S5++ to S5 CPU 2 [IM 158-8 PN/DP CPU] – (IBH Link S5++)

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.

Symbol	Operand	Comment
CounterON_4	F 0.1	Enable S5 CPU 2 to count <i>as OPC tag</i>
Max_4	F 2.0	Maximum reached S5 CPU 2
Min_4	F 2.1	Minimum reached S5 CPU 2
IsCounting_4	F 2.2	Counting control ON S5 CPU 2 <i>as OPC tag</i>
Down_4	F 2.5	down counting S5 CPU 2
Up_4	F 2.6	up counting S5 CPU 2
Value_4	FW 12	Counter value S5 CPU 2
CounterData_4	DB 2	Data Block DB2 [CounterData] <i>accept as OPC tags via DB2 (CounterData)</i>
CounterValue_4	DW 0	Counter Value S5 CPU 2
MinValue_4	DW 1	minimum Counter value S5 CPU 2
MaxValue_4	DW 2	maximum Counter value S5 CPU 2

Picture Block S5-CPU 103U: Global variable / data from DB2

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 0	down counting S5 CPU 2
F 2.6	KM 1	up counting S5 CPU 2
FW 12	KF +2480	Counter value S5 CPU 2
DB 2	---	Data Block DB2 [CounterData]
DW 0	KF +2481	Counter Value S5 CPU 2
DW 1	KF +600	minimum Counter value S5 CPU 2
DW 2	KF +4000	maximum Counter value S5 CPU 2

Define IBH Link S5 ++ [IM115-8 PN/DP CPU] properties

The IM115-8 is displayed in the device view.

S5 CPUs - S7 CPUs TIA 16e ▶ S5++ to S5 CPU 2 [IM 151-8 PN/DP CPU]

Topology view Network view **Device view**

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

Properties

General IO tags System constants Texts

PROFINET interface (X1)

General

Name: S5++ to S5 CPU 2 *rename*

Comment:

Ethernet addresses

Interface networked with *open / select*

Subnet: PN/IE_1

Add new subnet

IP protocol

mark Set IP address in the project *IP-Address IBH Link S5++*

IP address: 10 . 0 . 13 . 95

Subnet mask: 255 . 255 . 255 . 0

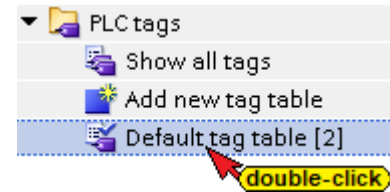
mark Use router

Router address: 10 . 0 . 13 . 89 *IP-Address IBH Link UA*

☐ IP address is set directly at the device

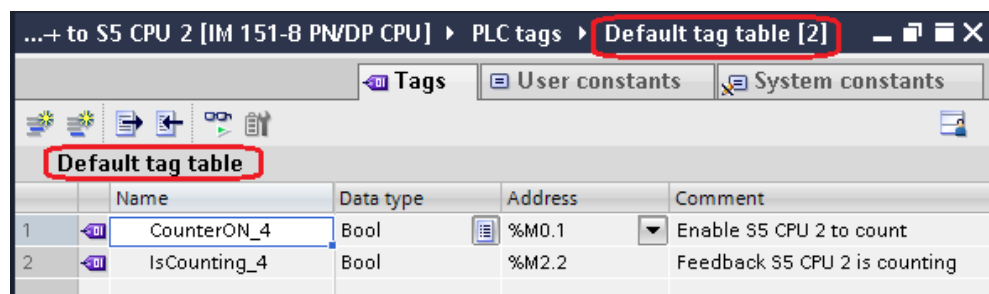
Define OPC tags (symbols) as default tags

A double-click opens the default tag table. In this table, operands of the symbol table of the S5 program (*Counter.SEQ*) are entered, which are to be sent to the OPC server as OPC tags (OPC symbols).



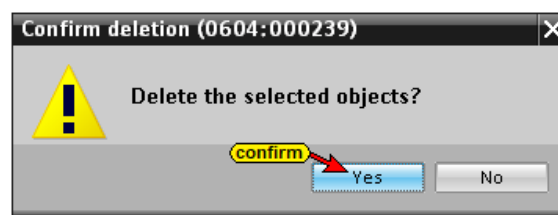
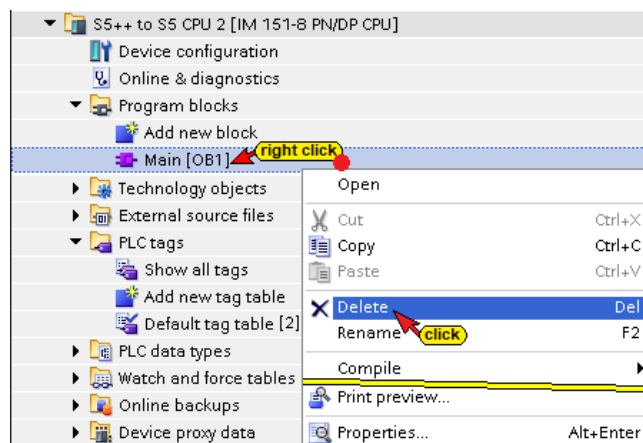
Data block CounterValues4 [DB2]

A direct import of the S5 program symbol table (*Counter.SEQ*) is impossible in the TIA Portal.



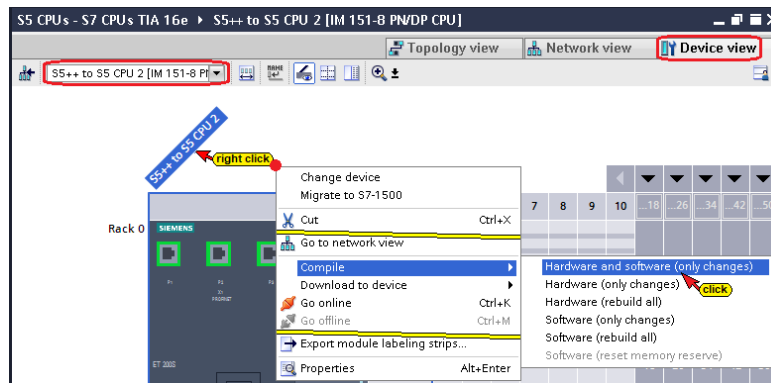
Delete block OB1

Only data can be transferred with the *IBH Link S5++*. Therefore, all program blocks, except for **data blocks**, must be deleted in the IM 151-8 CPU.



Compile hardware and software (IBH Link S5 ++)

The hardware configuration and software should be compiled so that errors can be recognized.

**Note:**

Only data can be transferred with the **IBH Link S5++**. Therefore, all program blocks in the Profinet I/O CPU must be deleted. Data blocks can be used. The hardware configuration and the PLC blocks must not be loaded into the IBH Link S5++.

The use of the download command is not permitted !

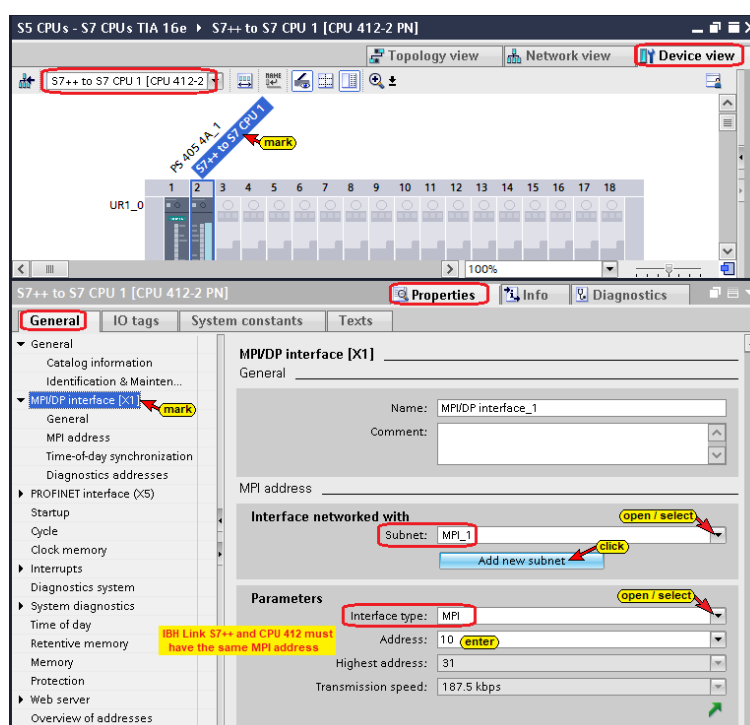
9.3.5 S7++ to CPU 1 [CPU 412-2 PN] – (IBH Link S7++)

The IBHLink S7++ is created in the TIA Portal as an S7-400 station and connected to the corresponding MPI/DP bus system.

The following module must be used as a representative for the IBHLink S7++: **6ES7 412-2EK06-0AB0 V6.0; Rack 0, Slot 2**

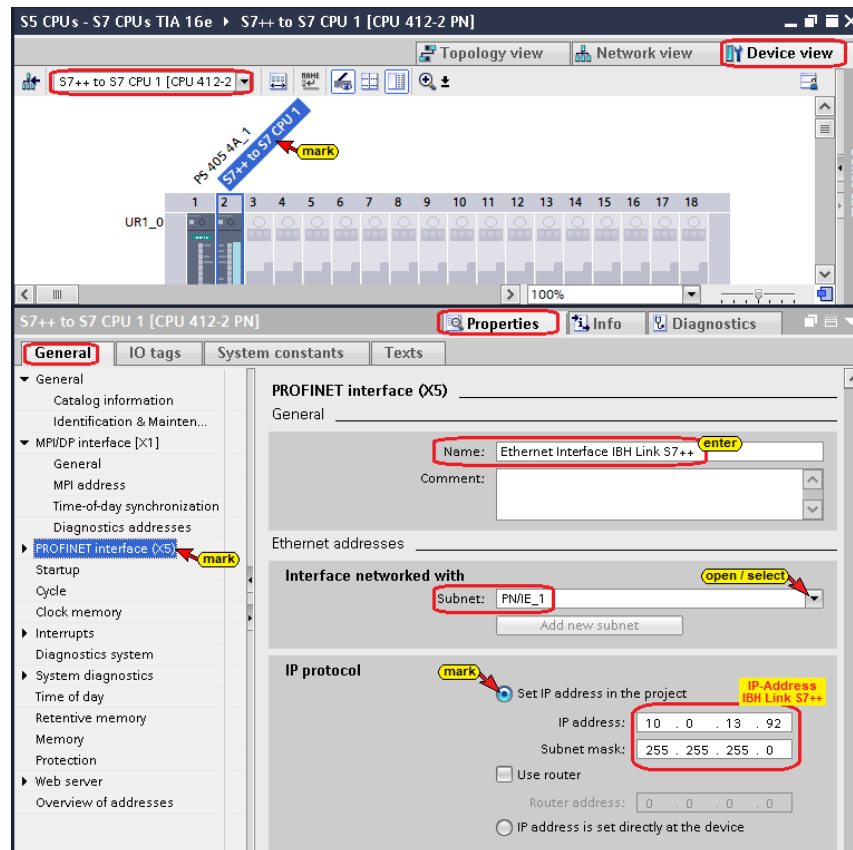
Define the MPI interface of the CPU 412 (MPI interface IBH Link S7++)

The MPI port (**address 10**) is connected via the **MPI_1** subnet with the S7 CPU 1 [CPU 312] MPI port (**address 2**).



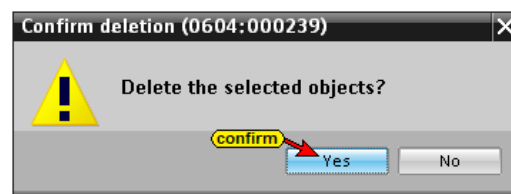
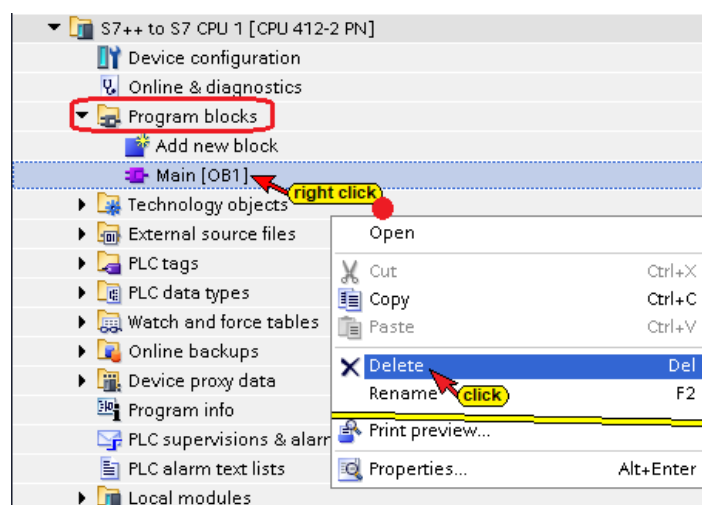
Define the Ethernet interface of the CPU 412

Ethernet connection S7++ to S7 CPU 1 [CPU 412-2 PN].



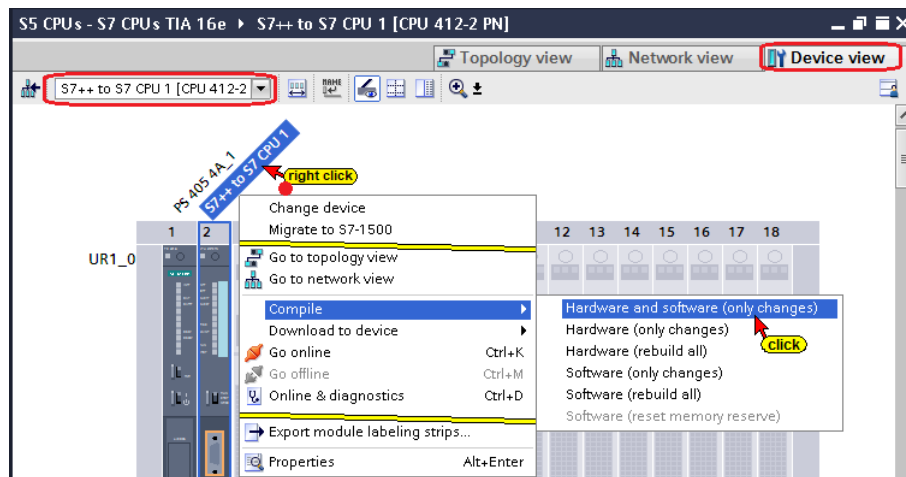
Delete blocks S7++ to S7 CPU 1 [CPU 412-2 PN]

No blocks can be loaded into the **IBH Link S7++**. In the offline mode all PLC blocks of the **S7++ to S7 CPU 1 [CPU 412-2 PN]** must be deleted.



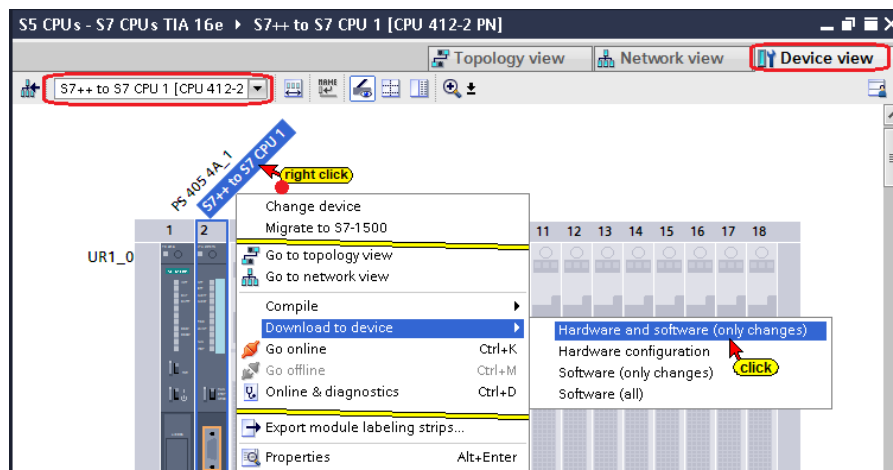
Compile hardware and software (IBH Link S7 ++ / CPU 412)

Use the command from the context menu to compile the software and the hardware.

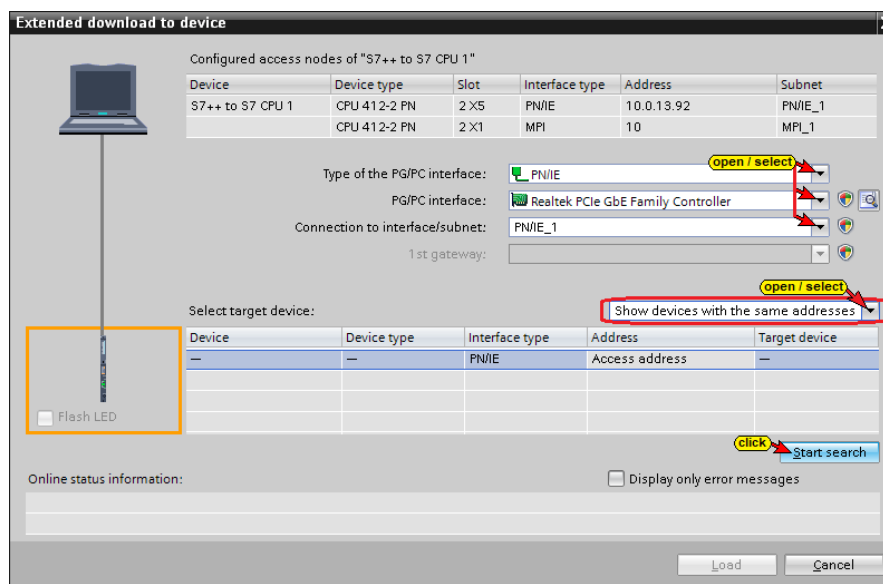


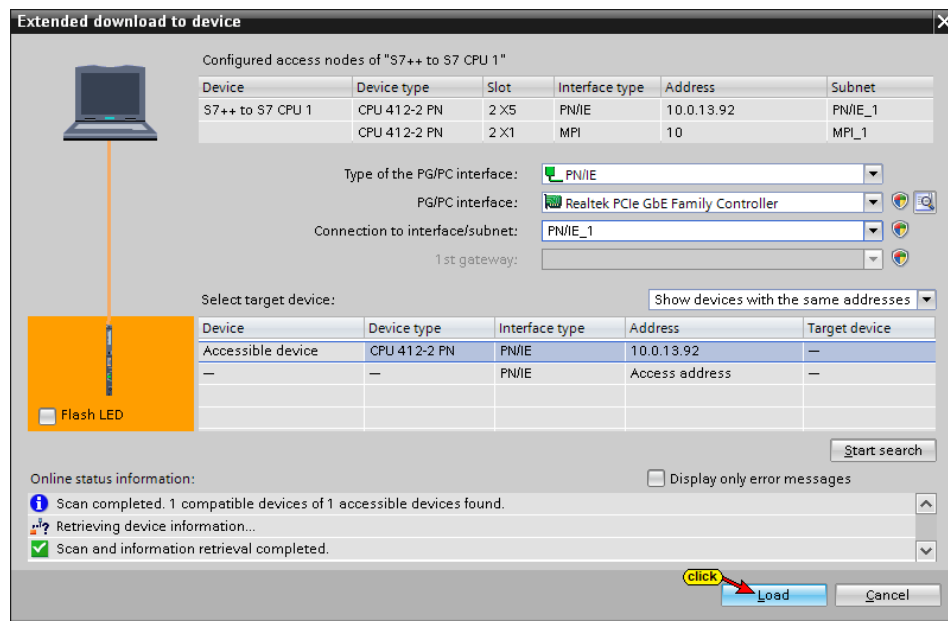
The configuration reports no errors. The download can be done.

Load hardware into the device S7++ to S7 CPU 1

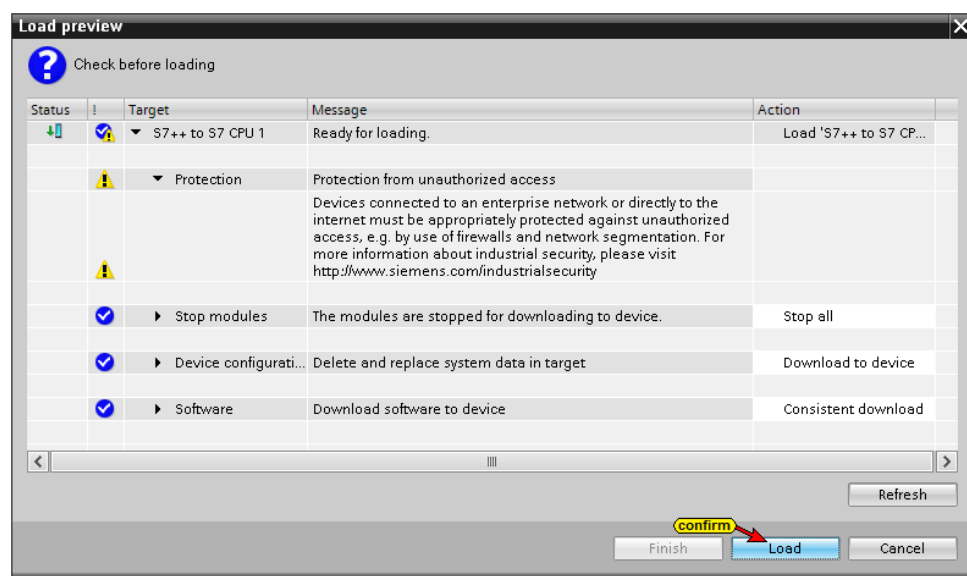


The loading process requires the following screen shots.

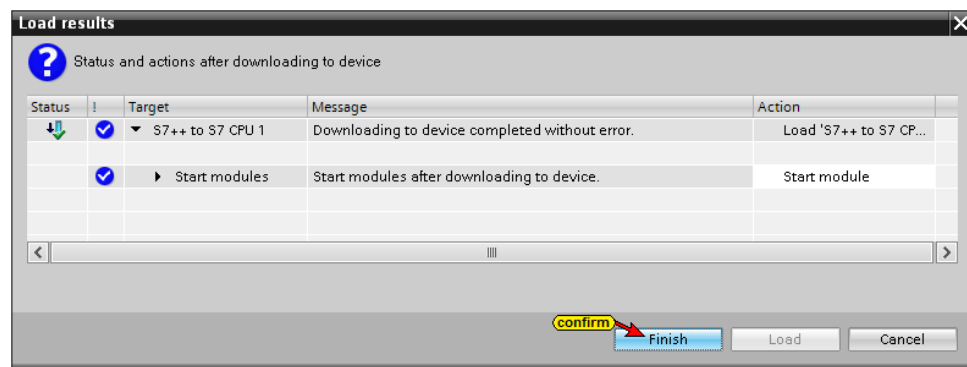




Several dialog boxes will open to indicate the following steps of loading.



The loading of the hardware configuration is completed.



The stopped device S7++ to S7 CPU 1 [**S7++ to S7 CPU 1 [CPU 412-2 PN]**] is restarted after loading the hardware configuration.

The S7 CPU 1 [CPU 312] can be downloaded via the **CPU 412-2 PN**.

9.3.6 S7 CPU 1 [CPU 312]

In the example **S7 CPU 1** a counter is counting until **MaxValue** is reached and counts down until the **MinValue** is reached.

The program contains the data block **CounterValues_1 [DB2]** and a global variable for the data exchange with the CPU 416 master [CPU 416-3 PN / DP].

Tag name	Direction	Location
MinValue_1	from CPU 416	CounterValues_1 [DB2]
MaxValue_1	from CPU 416	CounterValues_1 [DB2]
CounterON_1	from CPU 416	Default tag table
Value_1	from CPU 312	CounterValues_1 [DB2]
IsCounting_1	from CPU 312	CounterValues_1 [DB2]

Data block CounterValues_1 [DB2]

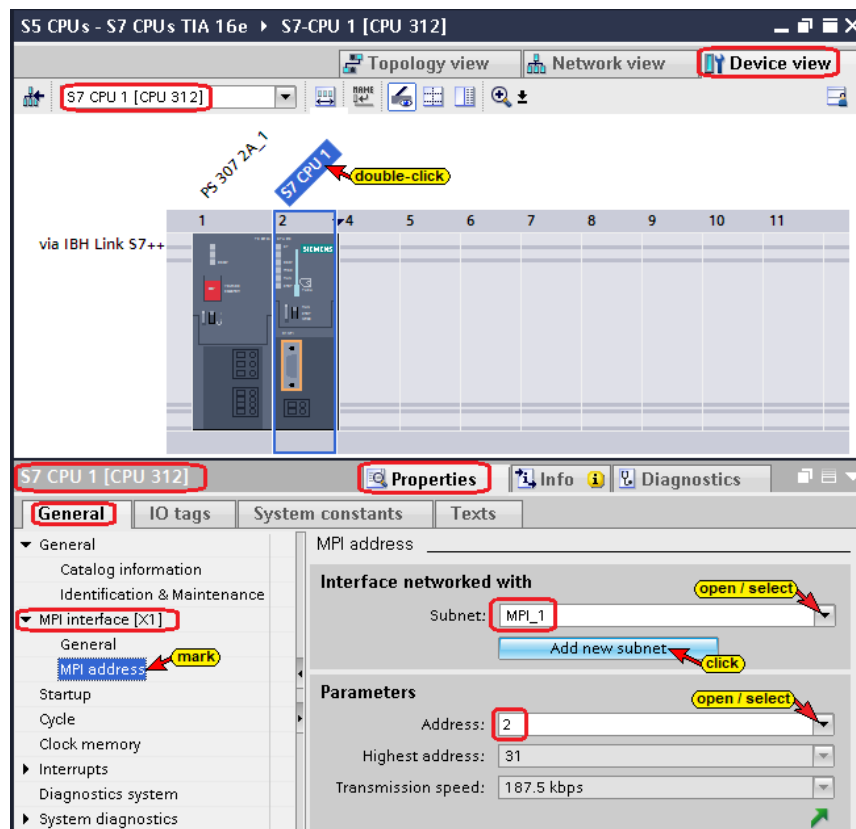
...CPUs TIA 16e > S7 CPU 1 [CPU 312] > Program blocks > CounterValues_1 [DB2]					
Keep actual values Snapshot					
CounterValues_1					
	Name	Data type	Offset	Start value	Comment
1	Static				
2	MinValue_1	Int	0.0	0	minimum Counter value S7 CPU1
3	MaxValue_1	Int	2.0	0	maximum Counter value S7 CPU1
4	Value_1	Int	4.0	0	Counter value S7 CPU1
5	IsCounting_1	Bool	6.0	false	Couter is counting S7 CPU1

Default tag table

...PUs - S7 CPUs TIA 16e > S7 CPU 1 [CPU 312] > PLC tags > Default tag table [6]				
Tags User constants System constants				
Default tag table				
	Name	Data type	Address	Comment
1	CounterON_1	Bool	%M0.1	Enable S7 CPU 1 to count as OPC tag
2	Max_1	Bool	%M2.0	Maximum reached S7 CPU 1
3	Min_1	Bool	%M2.1	Minimum reached S7 CPU 1
4	Down_1	Bool	%M2.5	down counting S7 CPU 1
5	Up_1	Bool	%M2.6	up counting S7 CPU 1
6	Value_1	Int	%MW12	Counter value S7 CPU 1

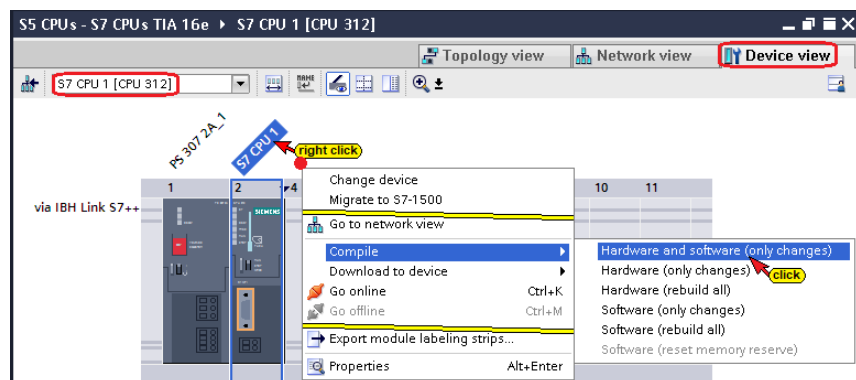
S7 CPU 1 [CPU 312] hardware configuration

The MPI port (**address 2**) is connected via the **MPI_1** subnet with the CPU 412-2 PN (IBH Link S7++ substitute)



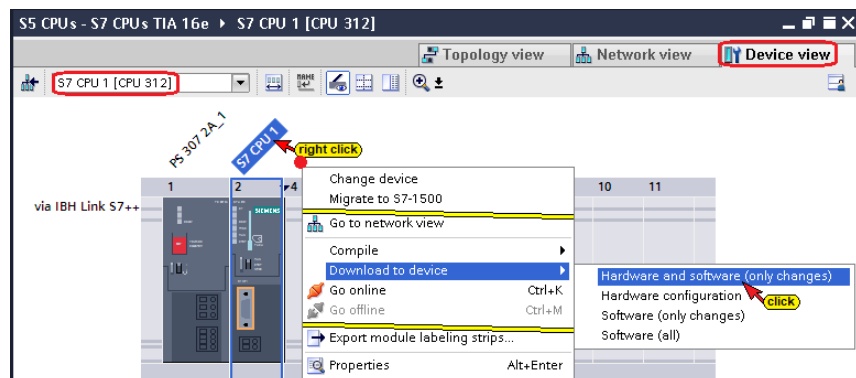
Compile hardware and software S7 CPU 1 [CPU 312]

Use the command from the context menu to compile the software and the hardware.



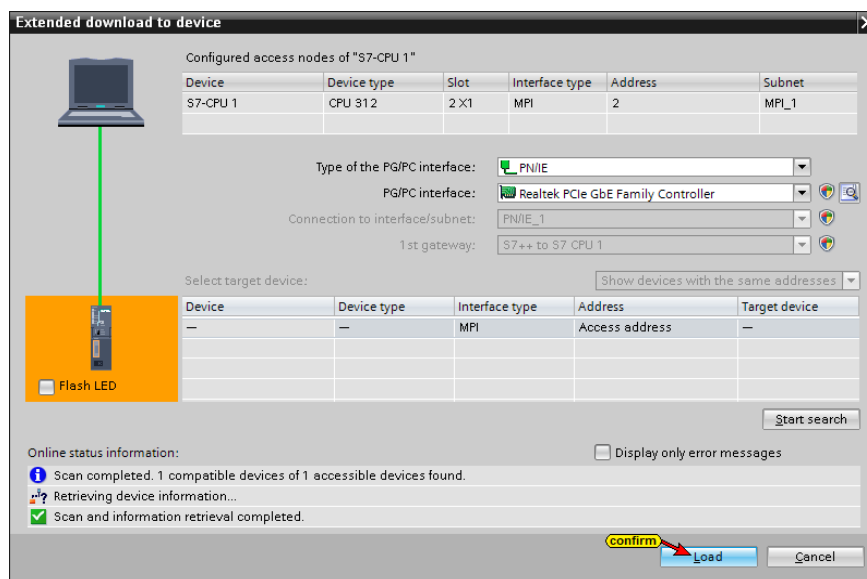
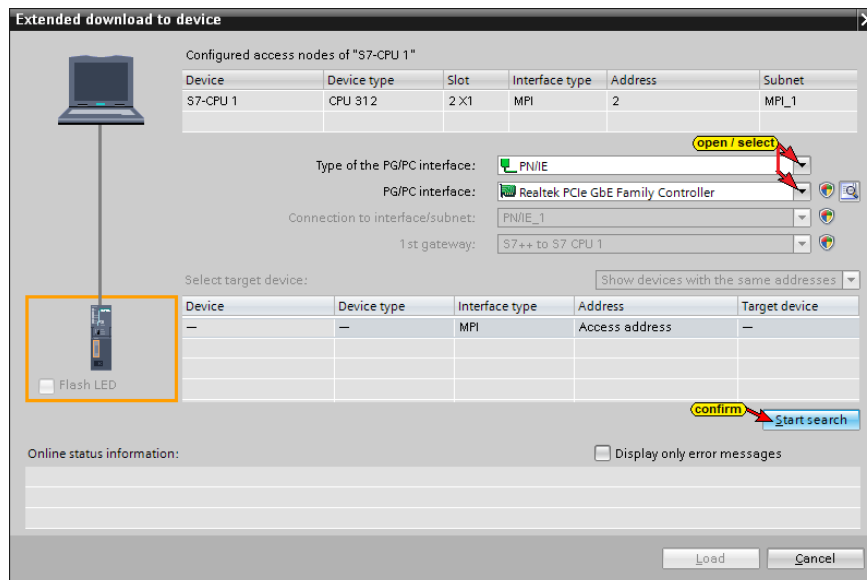
The configuration reports no errors. The download can be done.

Load hardware into the device S7 CPU 1

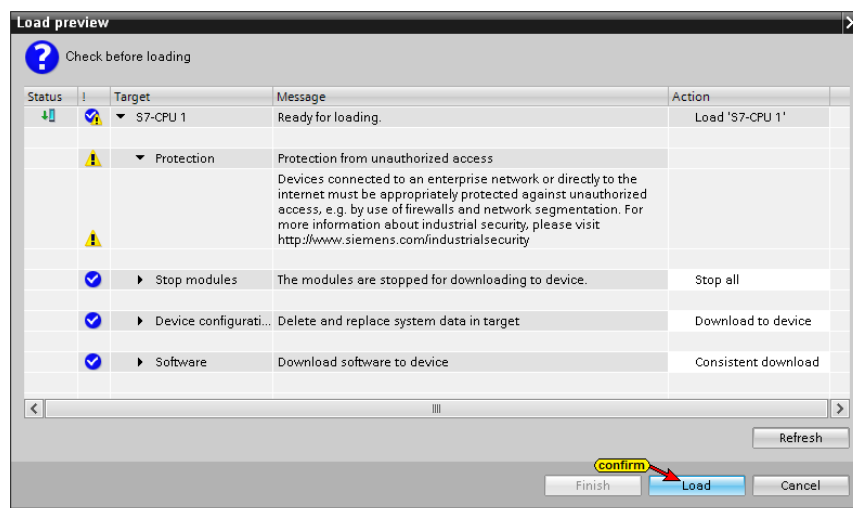


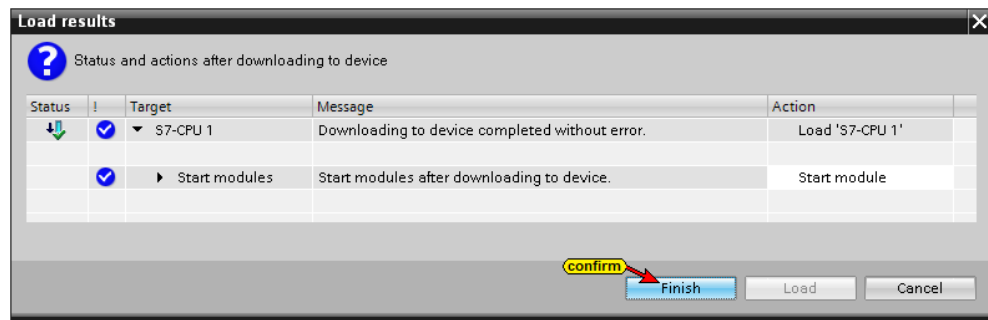
Extended Download Dialog Box

The S7 CPU 1 Hardware and Software download is routed via an IBH Link S7++.



A preview of the loading is displayed.





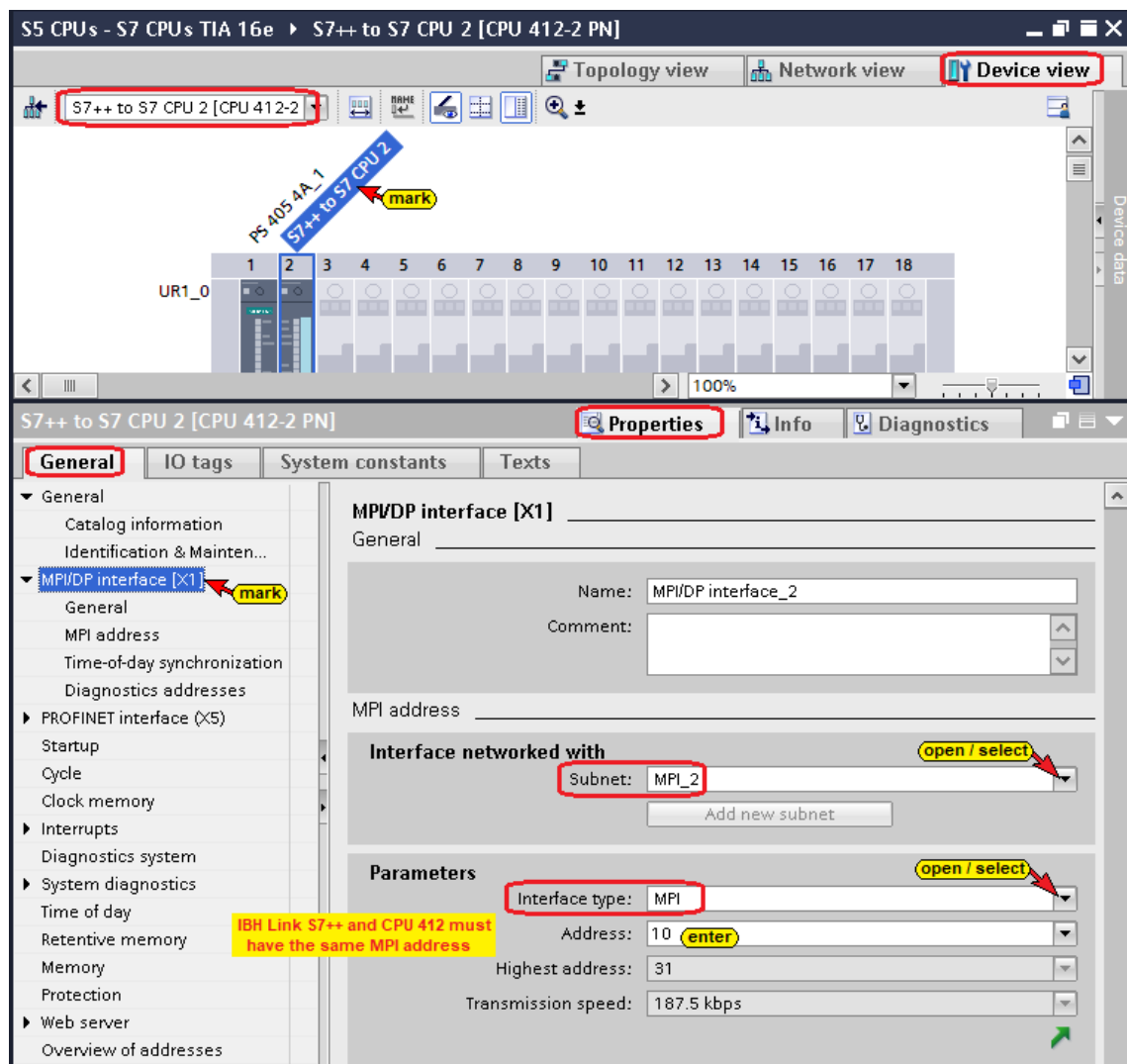
9.3.7 S7++ to CPU 2 [CPU 412-2 PN] – (IBH Link S7++)

The IBHLink S7++ is created in the TIA Portal as an S7-400 station and connected to the corresponding MPI/DP bus system.

The following module must be used as a representative for the IBHLink S7++: **6ES7 412-2EK06-0AB0 V6.0; Rack 0, Slot 2**

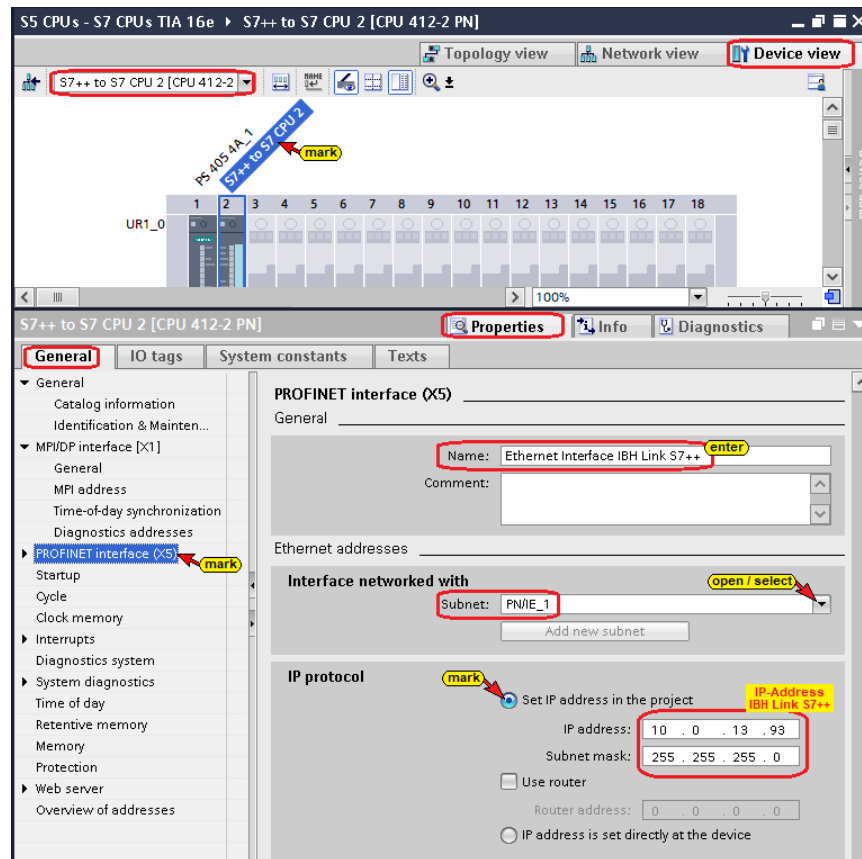
Define the MPI interface of the CPU 412 (MPI interface IBH Link S7++)

The MPI port (**address 10**) is connected via the **MPI_2** subnet with the S7 CPU 2 [CPU 312] MPI port (**address 2**).



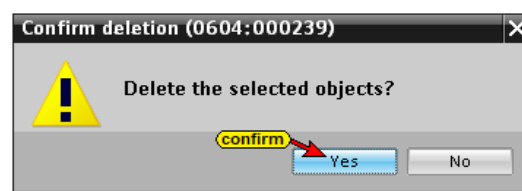
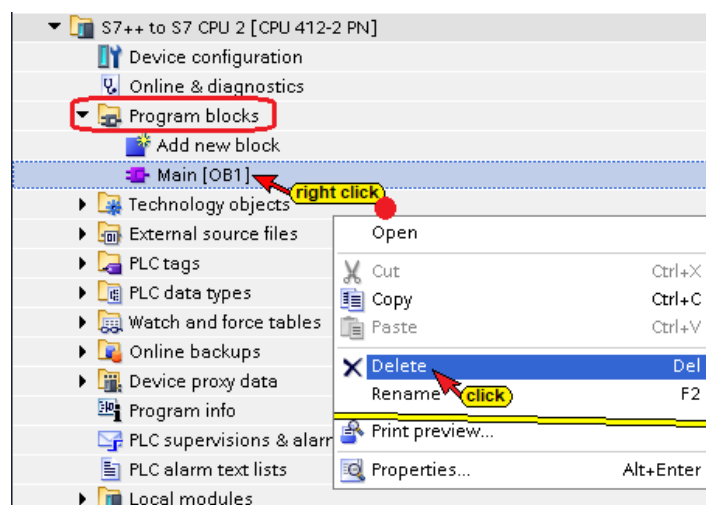
Define the Ethernet interface of the CPU 412

Ethernet connection S7++ to S7 CPU 2 [CPU 412-2 PN].



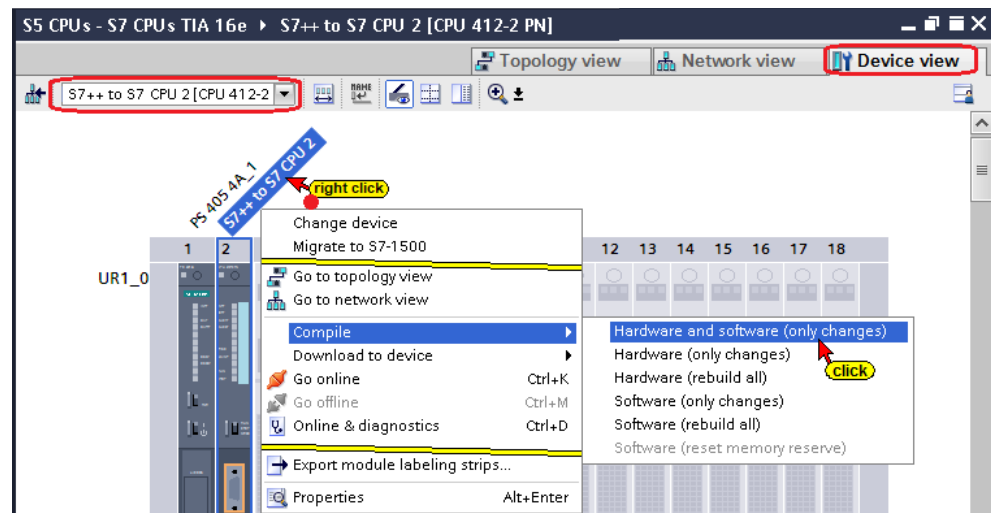
Delete blocks S7++ to S7 CPU 2 [CPU 412-2 PN]

No blocks can be loaded into the *IBH Link S7++*. In the offline mode all PLC blocks of the *S7++ to S7 CPU 2 [CPU 412-2 PN]* must be deleted.



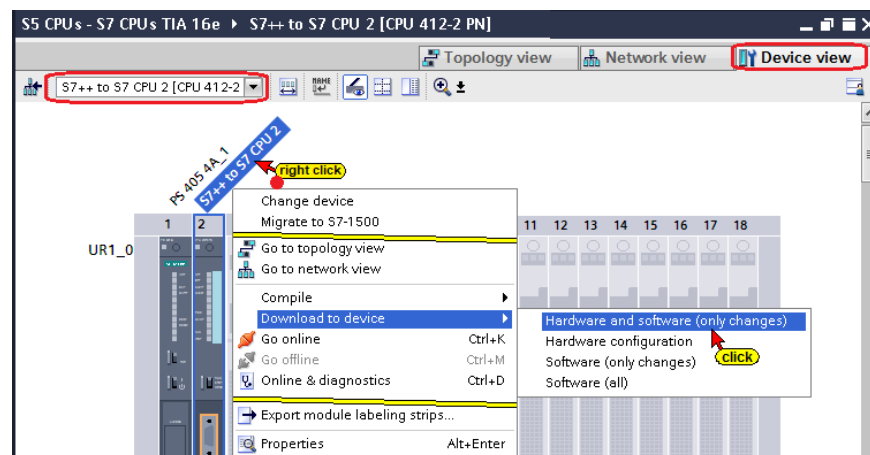
Compile hardware and software (IBH Link S7++ / CPU 412)

Use the command from the context menu to compile the software and the hardware.

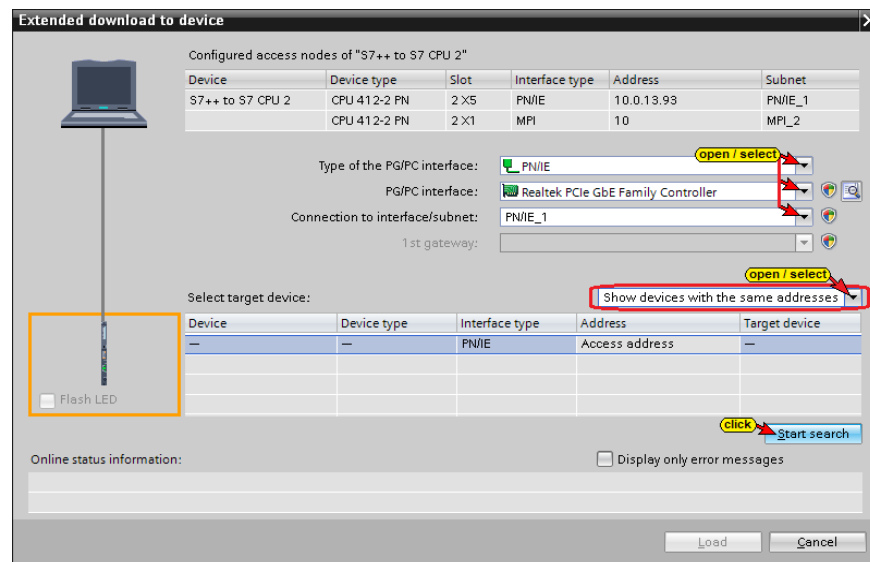


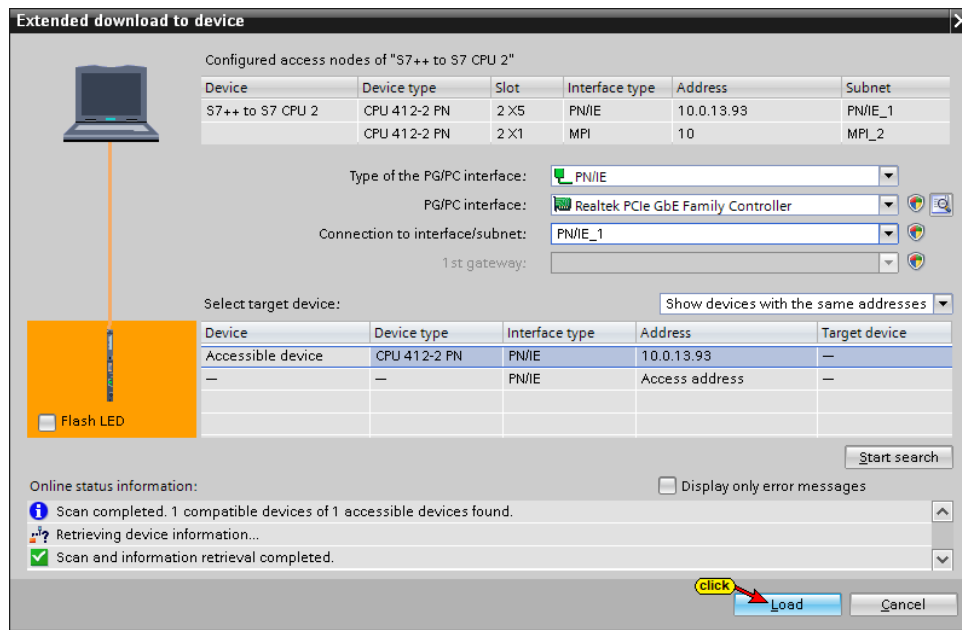
All devices must be configured and compiled prior to the download.

Load hardware into the device S7++ to S7 CPU 2

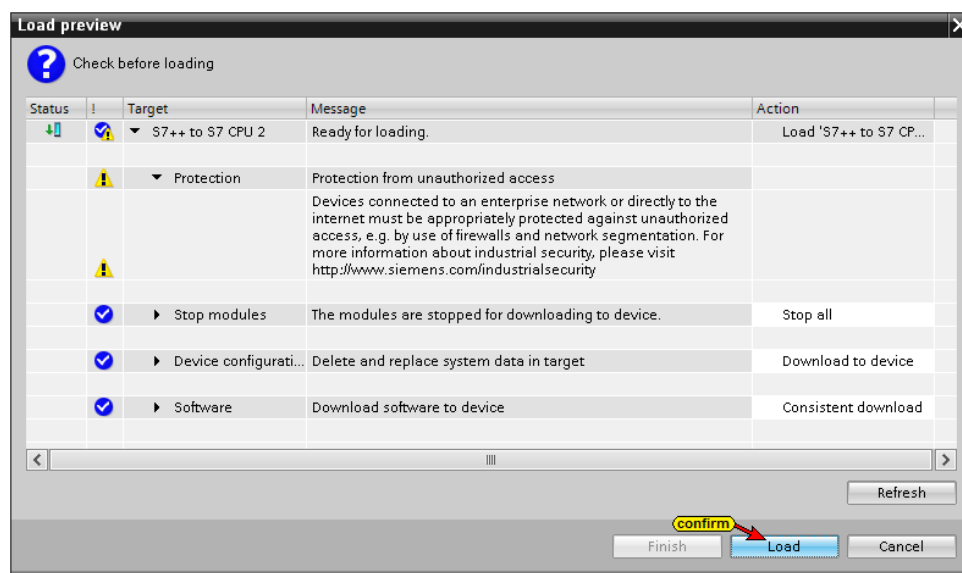


The loading process requires the following screen shots.

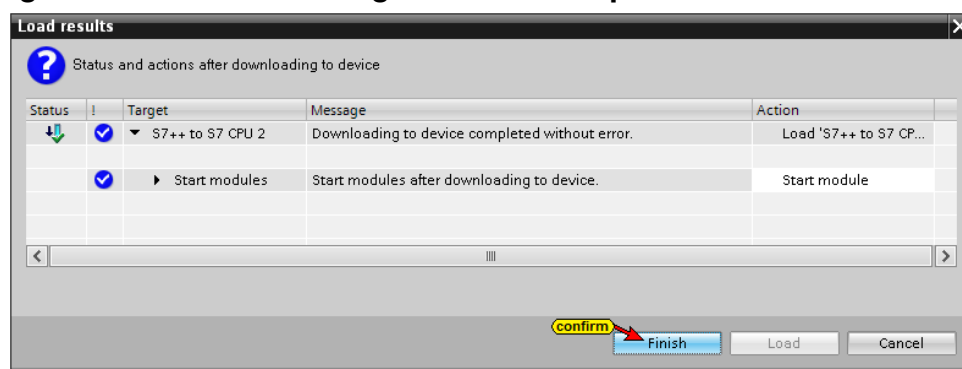




Several dialog boxes will open to indicate the following steps of loading.



The loading of the hardware configuration is completed.



The stopped device S7++ to S7 CPU 2 [**S7++ to S7 CPU 2 [CPU 412-2 PN]**] is restarted after loading the hardware configuration.

The S7 CPU 2 [CPU 312] can be downloaded via the **CPU 412-2 PN**.

9.3.8 S7 CPU 2 [CPU 312]

In the example **S7 CPU 2** a counter is counting until **MaxValue** is reached and counts down until the **MinValue** is reached. The program contains the data block **CounterValues_2 [DB2]** and a global variable for the data exchange with the CPU 416 master [CPU 416-3 PN / DP].

Tag name	Direction	Location
MinValue_2	from CPU 416	CounterValues_2 [DB2]
MaxValue_2	from CPU 416	CounterValues_2 [DB2]
CounterON_2	from CPU 416	Default tag table
Value_2	from CPU 312	CounterValues_2 [DB2]
IsCounting_2	from CPU 312	CounterValues_2 [DB2]

Default tag table

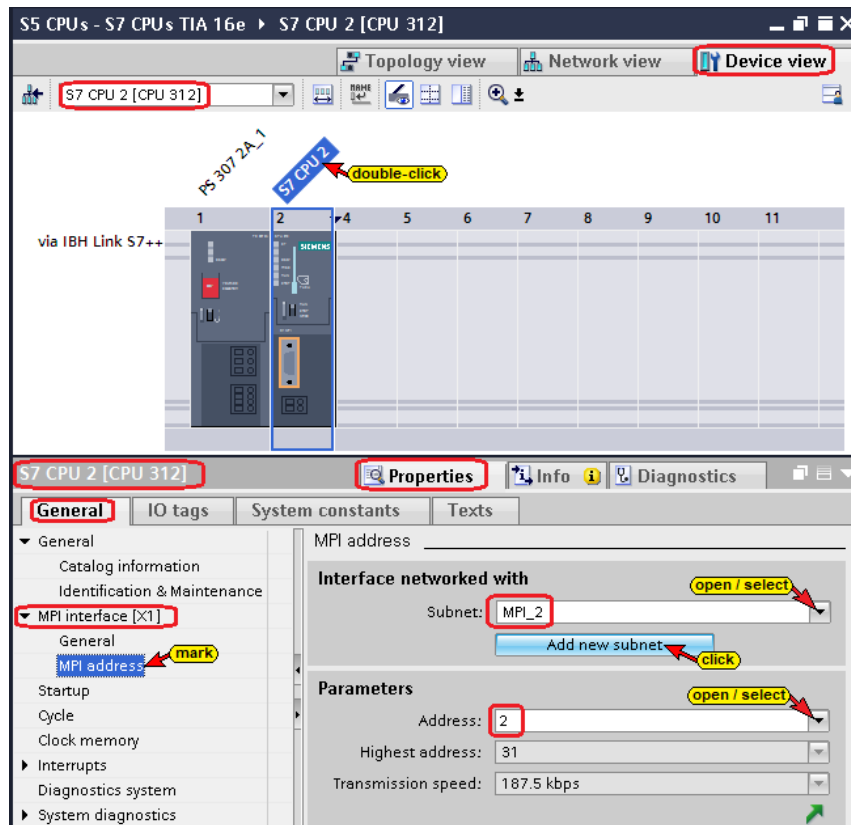
Name	Data type	Address	Comment
CounterON_2	Bool	%M0.1	Enable S7 CPU 2 to count as OPC tag
Max_2	Bool	%M2.0	Maximum reached S7 CPU 2
Min_2	Bool	%M2.1	Minimum reached S7 CPU 2
Down_2	Bool	%M2.5	down counting S7 CPU 2
Up_2	Bool	%M2.6	up counting S7 CPU 2
Value_2	Int	%MW12	Counter value S7 CPU 2
<Add new>			

Data block CounterValues_2 [DB2]

Name	Data type	Offset	Start value	Comment
Static				
MinValue_2	Int	0.0	0	minimum Counter value S7 CPU 2
MaxValue_2	Int	2.0	0	maximum Counter value S7 CPU 2
Value_2	Int	4.0	0	Counter value S7 CPU 2
IsCounting_2	Bool	6.0	false	Feedback S7 CPU 2 is counting

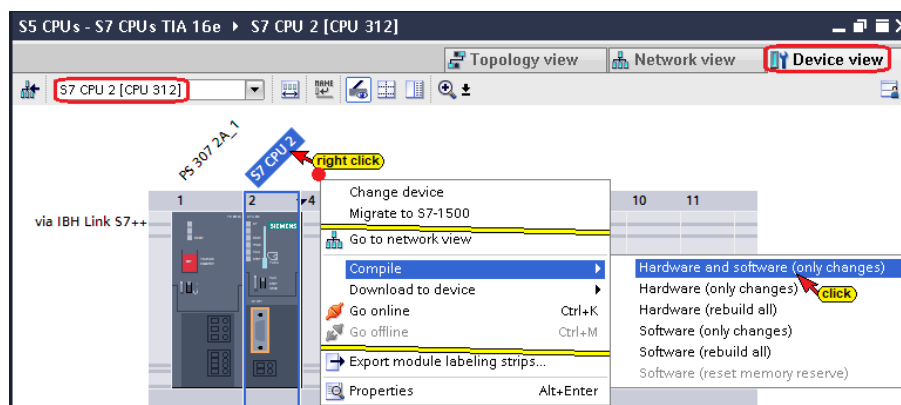
S7 CPU 2 [CPU 312] hardware configuration

The MPI port (**address 2**) is connected via the **MPI_2** subnet with the CPU 412-2 PN (IBH Link S7++ substitute)

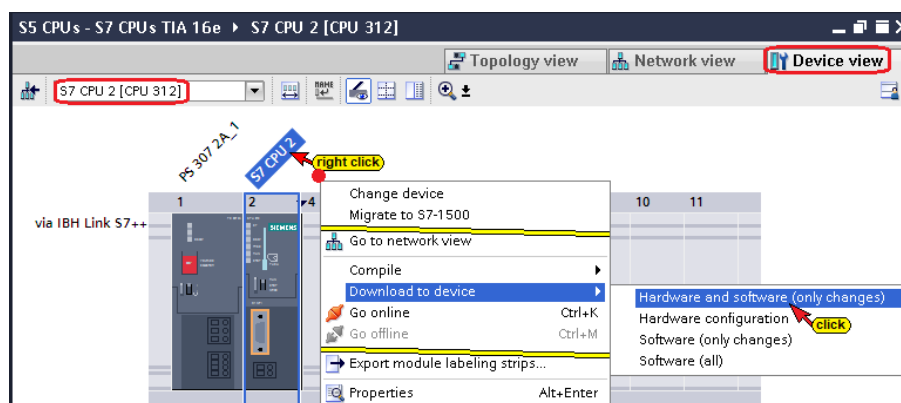


Compile hardware and software S7 CPU 2 [CPU 312]

Use the command from the context menu to compile the software and the hardware.

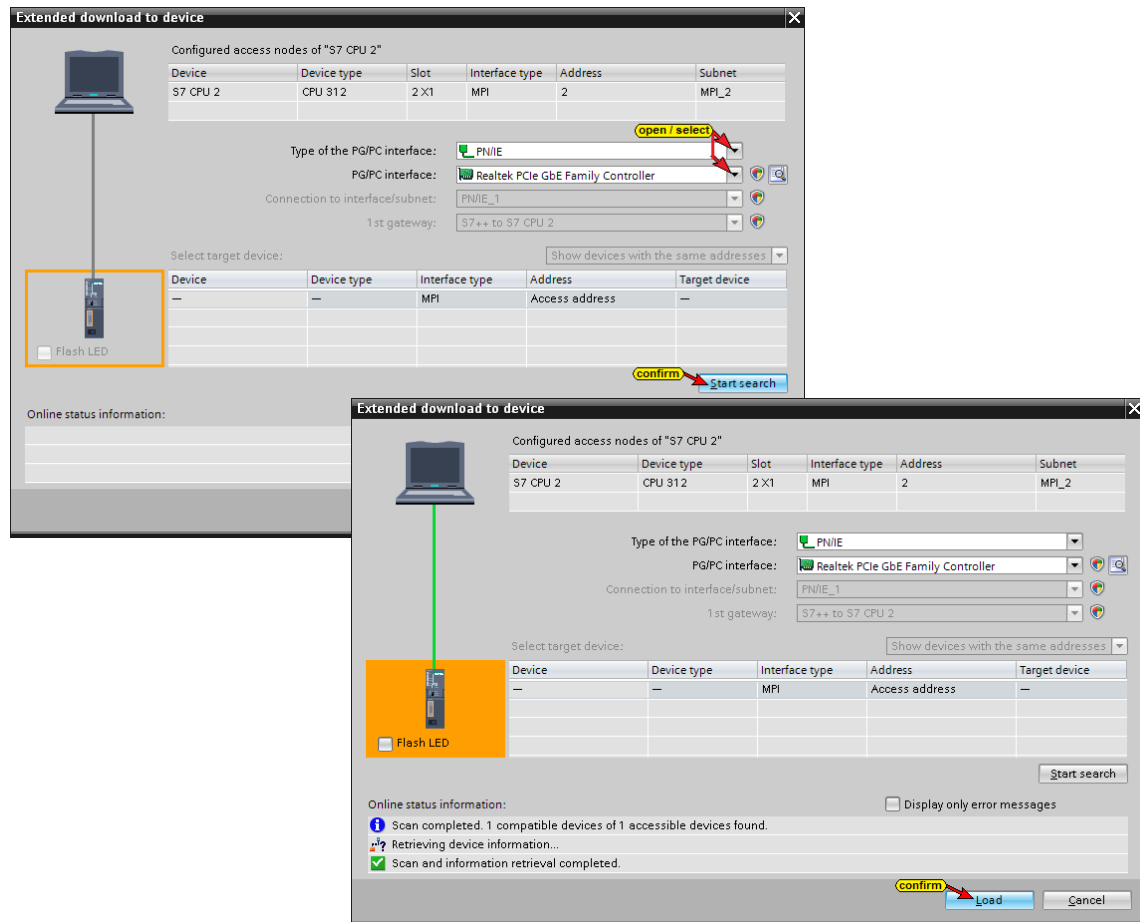


Load hardware into the device S7 CPU 2

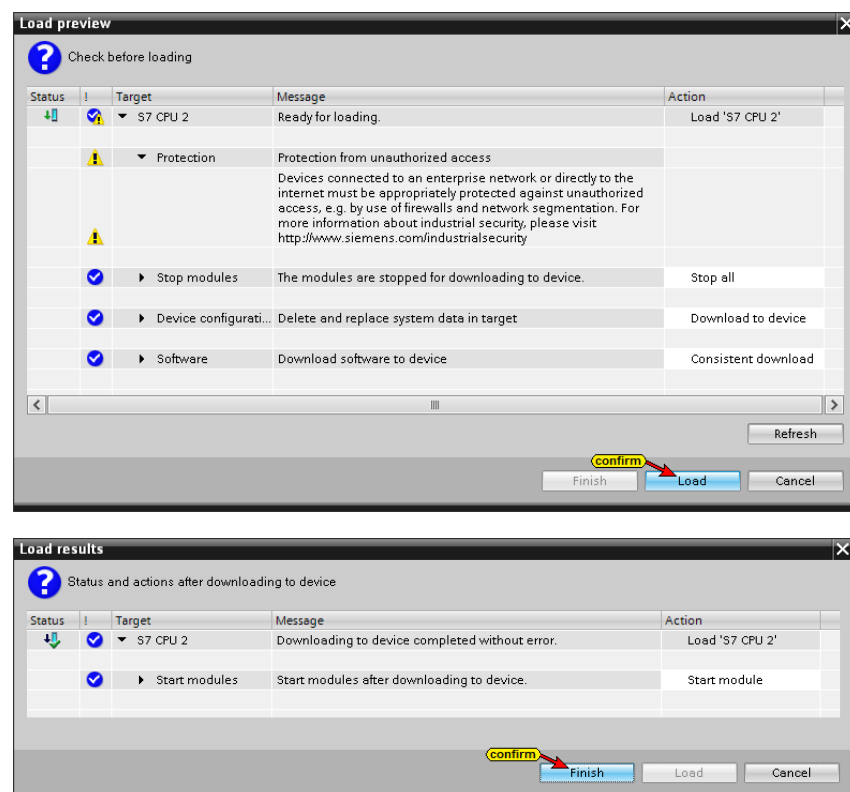


Extended Download Dialog Box

The S7 CPU 2 Hardware and Software download is routed via an IBH Link S7++.

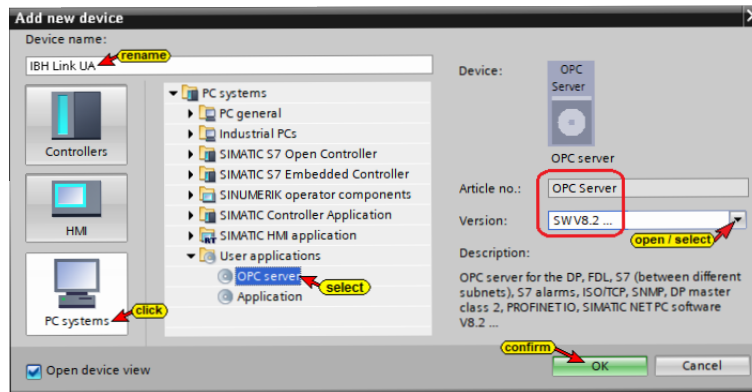
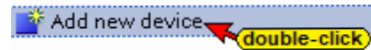


A preview of the loading is displayed.

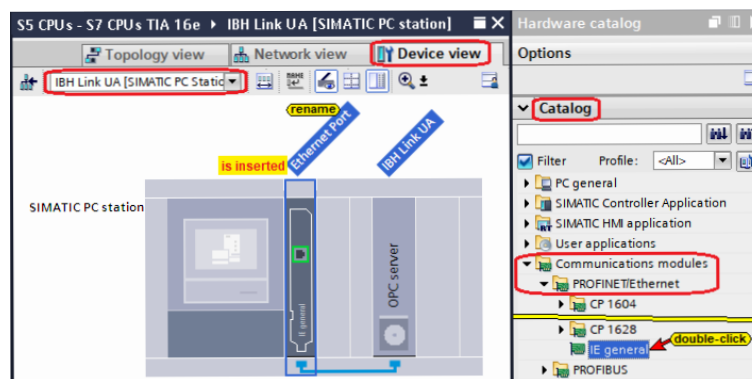


9.4 Insert IBH Link UA as an SIMATIC PC station

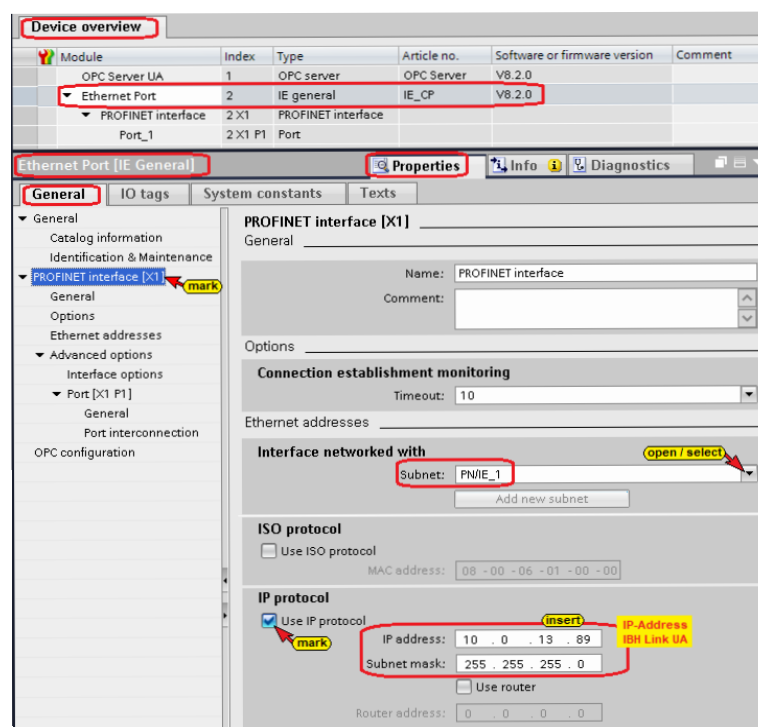
Double-click Add new device to select PC systems, User application, OPC server.



Insert communication module in the IBH Link UA



Define communication module properties

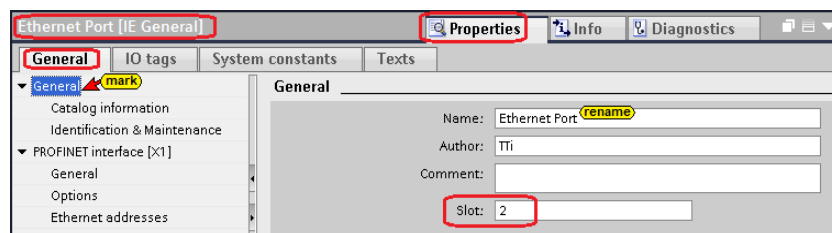


Note:

The communication module **must** be inserted in **Slot 2 / Index 2**.
The IBH Link UA expects the communication interface in **Slot 2 / Index 2**.

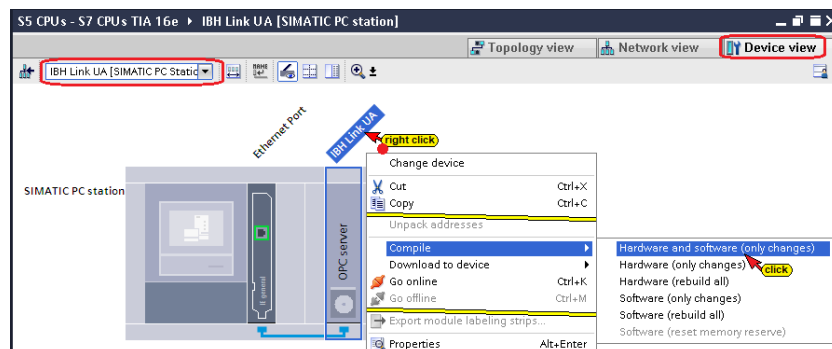
Communication module slot check

The IBH Link UA Ethernet Port (Control Level) must be in slot 2.



The selection of the OPC symbols (tags) will be done after the S7-Connection **IBH Link UA OPC Server** to the **S5 CPUs** and **S7 CPUs** is accomplished.

Compile the configuration of the OPC server



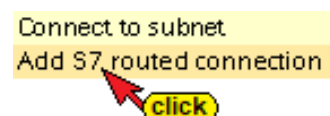
If the compiling of the configuration does not report any errors, the **S7 connection** can be established.

9.4.1 Establish an S7 connection from the OPC server to the CPUs

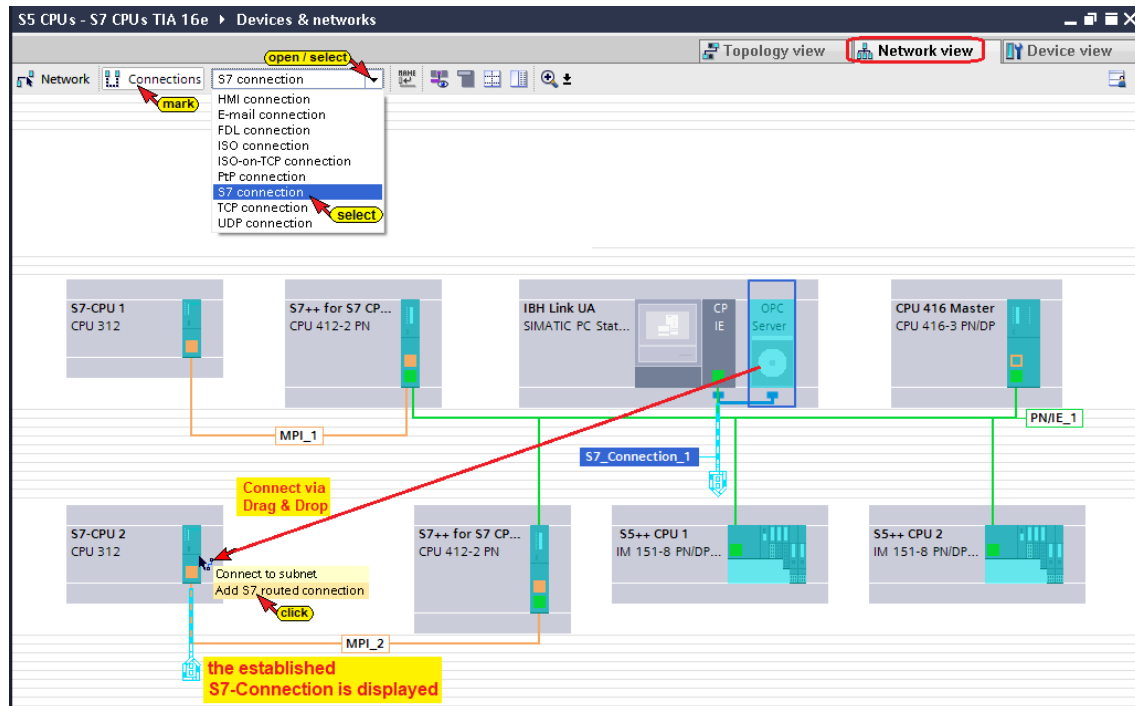
The S7 connection is established via drag and drop from the **OPC Server-IBH Link UA** to the CPUs **S7-CPU 1** [CPU 312], **S7-CPU 2** [CPU 312], **S5 CPU 1** [IM 151-8 PN/DP CPU], **S5 CPU 2** [IM 151-8 PN/DP CPU], and **CPU 416 Master** [CPU 416-3 PN/DP].

The S7 connections to the S7-CPU 1 [CPU 312] and S7-CPU 2 [CPU 312] are routed connections.

A note is displayed at the drag & drop target. S7-routed connection added must be clicked to establish the connection.



S7 Connections



The established S7 connections are displayed.

Local connection name	Local end point	Local ID (hex)	Partner ID (hex)	Partner	Connection type
S7_Connection_1	S5++ to S5 CPU 2 [IM 151-8 PN/DP CPU]	2	S7_Connection_1	IBH Link UA [OPC Server]	S7 connection
S7_Connection_1	IBH Link UA [OPC Server]	S7_Connection_1	2	S5++ to S5 CPU 2 [IM 151-8 PN/DP CPU]	S7 connection
S7_Connection_2	S5++ to S5 CPU 1 [IM 151-8 PN/DP CPU]	2	S7_Connection_2	IBH Link UA [OPC Server]	S7 connection
S7_Connection_2	IBH Link UA [OPC Server]	S7_Connection_2	2	S5++ to S5 CPU 1 [IM 151-8 PN/DP CPU]	S7 connection
S7_Connection_3	S7++ to S7 CPU 2 [CPU 412-2 PN]	1	S7_Connection_3	IBH Link UA [OPC Server]	S7 connection
S7_Connection_3	IBH Link UA [OPC Server]	S7_Connection_3	1	S7++ to S7 CPU 2 [CPU 412-2 PN]	S7 connection
S7_Connection_4	IBH Link UA [OPC Server]	S7_Connection_4		S7 CPU 2 [CPU 312]	S7 connection
S7_Connection_5	IBH Link UA [OPC Server]	S7_Connection_5		S7 CPU 1 [CPU 312]	S7 connection
S7_Connection_6	IBH Link UA [OPC Server]	S7_Connection_6	1	CPU 416 Master [CPU 416-3 PN/DP]	S7 connection
S7_Connection_6	CPU 416 Master [CPU 416-3 PN/DP]	1	S7_Connection_6	IBH Link UA [OPC Server]	S7 connection

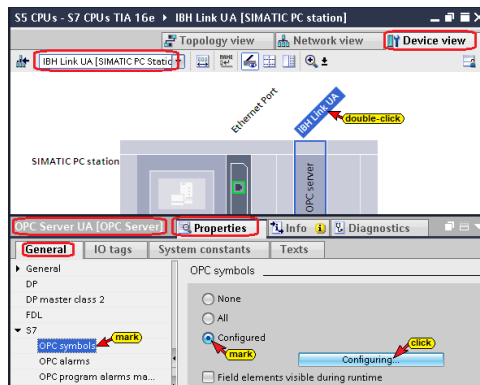
The created S7 connection is listed in the **Network view** window. A click switches between the connection representations.

The screenshot shows the 'Network view' with the 'Connections' tab selected. The 'S7_Connection_1' connection is highlighted. The 'Properties' window is open, showing the 'General' tab. The 'Connection path' section displays the local and partner endpoints, interfaces, and IP addresses.

Local	Partner
End point: IBH Link UA [OPC Server]	S5++ to S5 CPU 2 [IM 151-8 PN/DP CPU]
Interface: Ethernet Port, PROFINET interface[X1]	S5++ to S5 CPU 2, S5++ to S5 CPU 2[X1]
Interface type: Ethernet	Ethernet
Subnet: PN/IE_1	PN/IE_1
Address: 10.0.13.89 (IP-Address IBH Link UA)	10.0.13.95 (IP-Address IBH Link S5++)

Select OPC symbols (tags) in the OPC configuration

Open the configuration on the OPC server / properties.



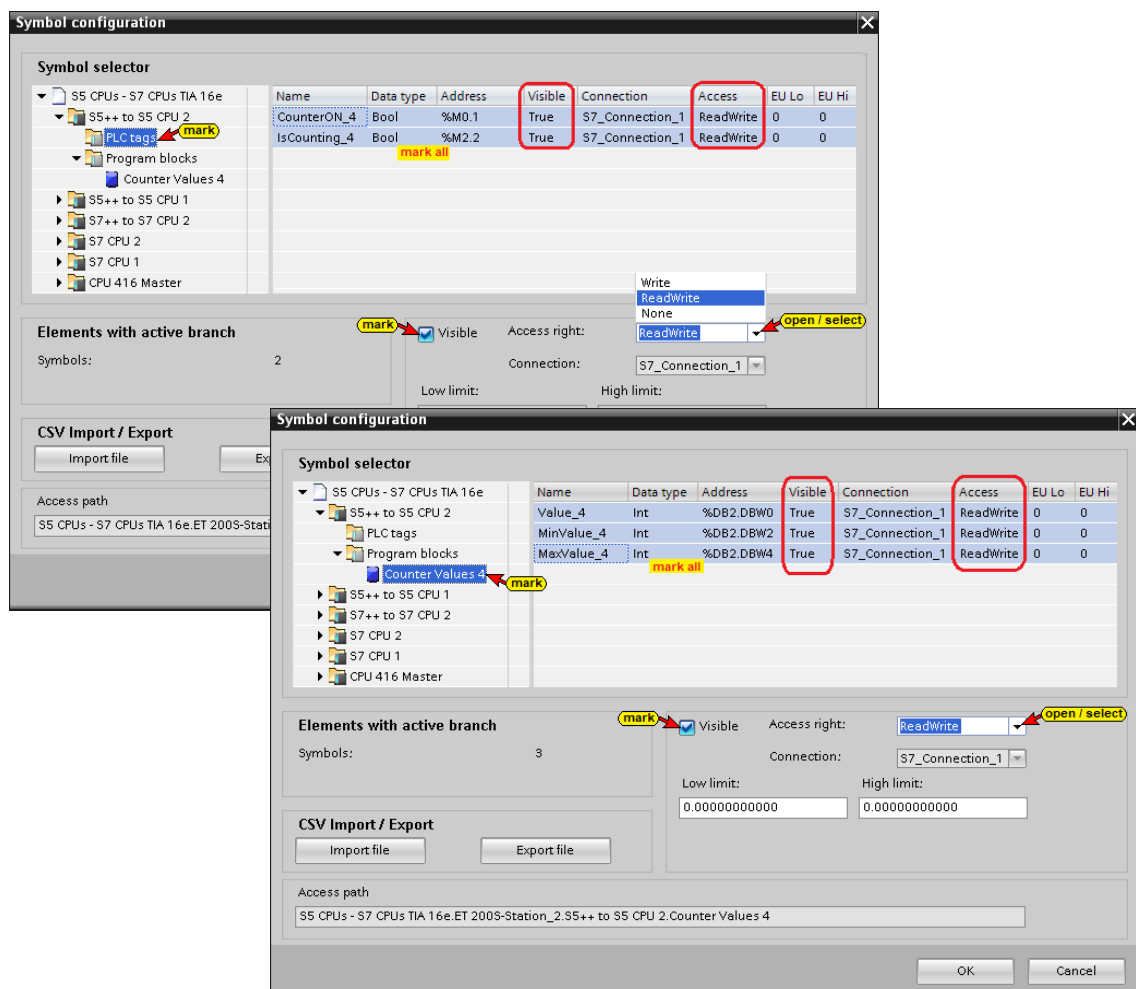
The **Configure** button opens the Symbol configuration dialog box to select the OPC tags.

The read / write, etc. access rights can be assigned to the individual operands (OPC tags).

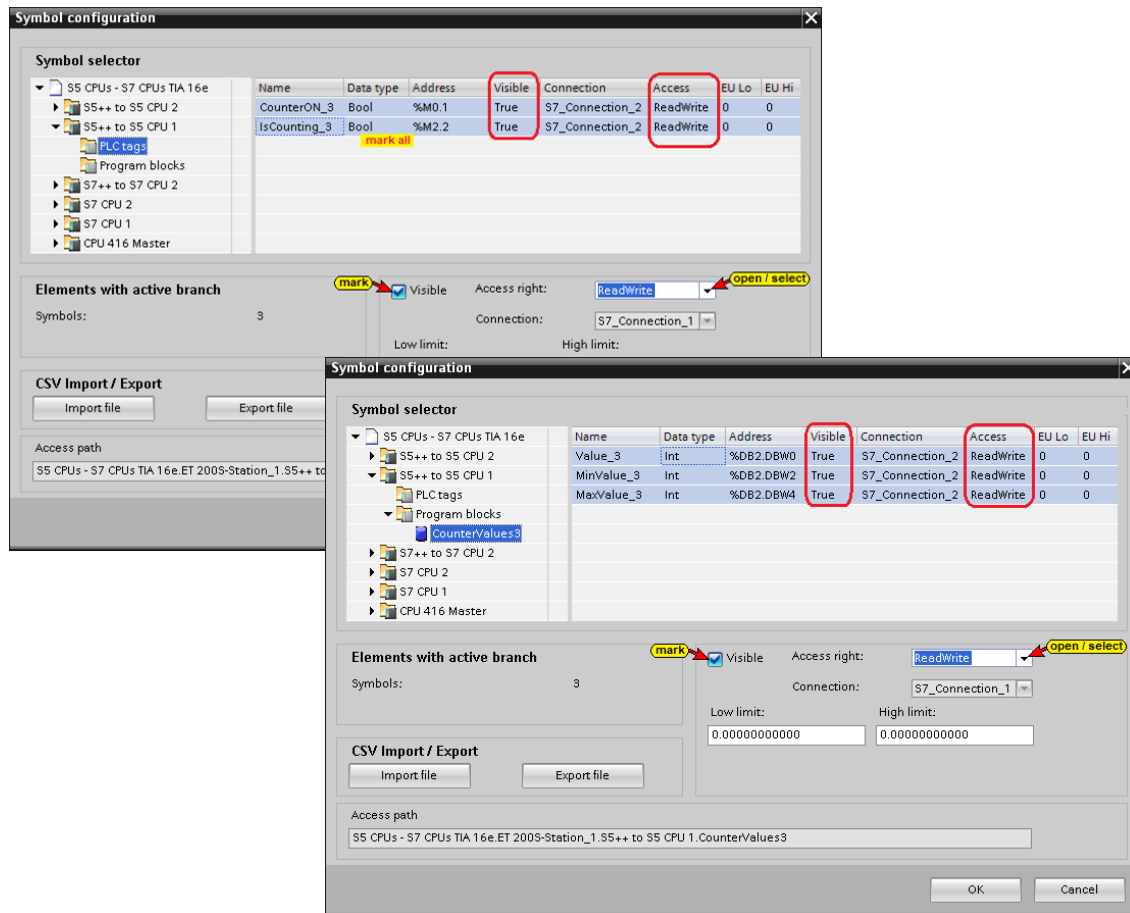
Select variables as OPC tags

In addition to the global variables, the data from data blocks can be defined as OPC tags.

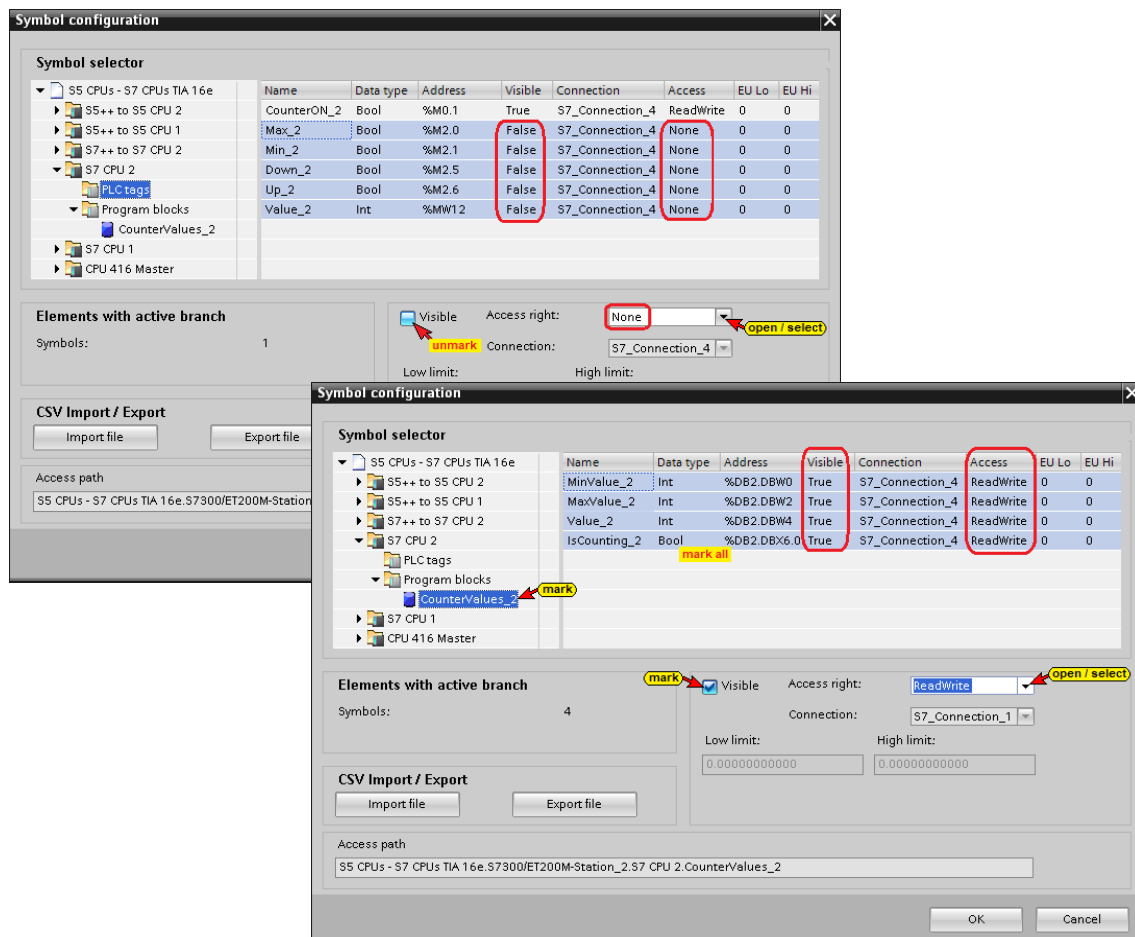
S5++ to S5 CPU 2



S5++ to S5 CPU 1



S7 CPU 2



S7 CPU 1

Symbol configuration

Symbol selector

Name	Data type	Address	Visible	Connection	Access	EU Lo	EU Hi
CounterON_1	Bool	%M0.1	True	S7_Connection_5	ReadWrite	0	0
Max_1	Bool	%M2.0	False	S7_Connection_5	None	0	0
Min_1	Bool	%M2.1	False	S7_Connection_5	None	0	0
Down_1	Bool	%M2.5	False	S7_Connection_5	None	0	0
Up_1	Bool	%M2.6	False	S7_Connection_5	None	0	0
Value_1	Int	%MW12	False	S7_Connection_5	None	0	0

Elements with active branch

Visible: ☒ Access right: None Connection: S7_Connection_4

CSV Import / Export

Import file: Export file

Access path: S5 CPUs - S7 CPUs TIA 16e.S7300/ET200M-Station

Symbol configuration

Symbol selector

Name	Data type	Address	Visible	Connection	Access	EU Lo	EU Hi
MinValue_1	Int	%DB2.DBW0	True	S7_Connection_5	ReadWrite	0	0
MaxValue_1	Int	%DB2.DBW2	True	S7_Connection_5	ReadWrite	0	0
Value_1	Int	%DB2.DBW4	True	S7_Connection_5	ReadWrite	0	0
IsCounting_1	Bool	%DB2.DBX6.0	True	S7_Connection_5	ReadWrite	0	0

Elements with active branch

Visible: ☒ Access right: ReadWrite Connection: S7_Connection_1

Low limit: 0.000000000000 High limit: 0.000000000000

CSV Import / Export

Import file: Export file

Access path: S5 CPUs - S7 CPUs TIA 16e.S7300/ET200M-Station_1.S7 CPU 1

OK Cancel

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

Symbol configuration

Symbol selector

Name	Data type	Address	Visible	Connection	Access	EU Lo	EU Hi
EnableCounters	Bool	%M0.1	True	S7_Connection_6	ReadWrite	0	0

Elements with active branch

Visible: ☒ Access right: ReadWrite Connection: S7_Connection_1

CSV Import / Export

Import file: Export file

Access path: S5 CPUs - S7 CPUs TIA 16e.S7-400-Station_3.CPU 416

Symbol configuration

Symbol selector

Name	Data type	Address	Visible	Connection	Access	EU Lo	EU Hi
Control_ON	Bool	%DB2.DBX0.0	True	S7_Connection_6	ReadWrite	0	0
MaxValue_1	Int	%DB2.DBW2	True	S7_Connection_6	ReadWrite	0	0
MaxValue_2	Int	%DB2.DBW4	True	S7_Connection_6	ReadWrite	0	0
MaxValue_3	Int	%DB2.DBW6	True	S7_Connection_6	ReadWrite	0	0
MaxValue_4	Int	%DB2.DBW8	True	S7_Connection_6	ReadWrite	0	0
MinValue_1	Int	%DB2.DBW10	True	S7_Connection_6	ReadWrite	0	0
MinValue_2	Int	%DB2.DBW12	True	S7_Connection_6	ReadWrite	0	0
MinValue_3	Int	%DB2.DBW14	True	S7_Connection_6	ReadWrite	0	0
MinValue_4	Int	%DB2.DBW16	True	S7_Connection_6	ReadWrite	0	0

Elements with active branch

Visible: ☒ Access right: ReadWrite Connection: S7_Connection_1

Low limit: 0.000000000000 High limit: 0.000000000000

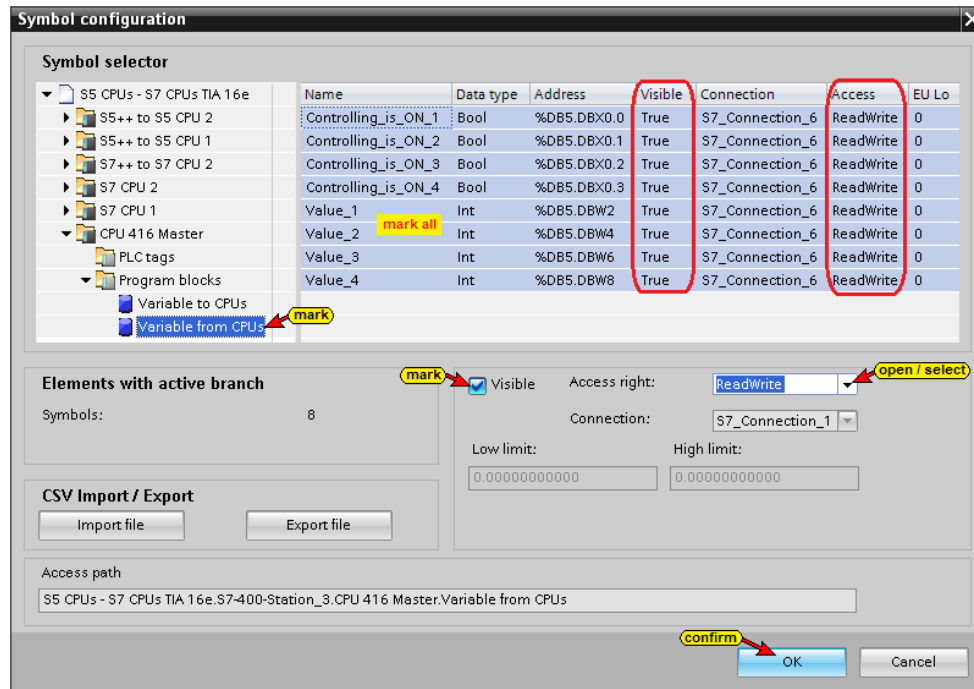
CSV Import / Export

Import file: Export file

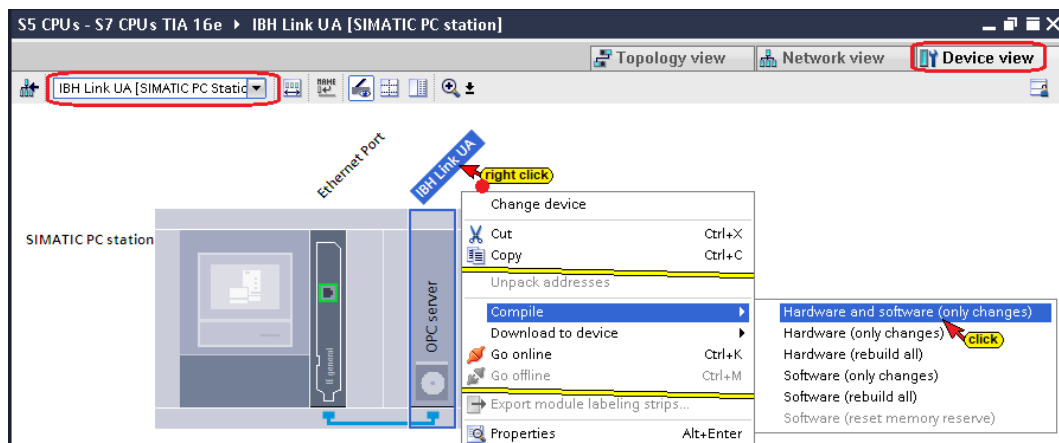
Access path: S5 CPUs - S7 CPUs TIA 16e.S7-400-Station_3.CPU 416 Master.Variable to CPUs

OK Cancel

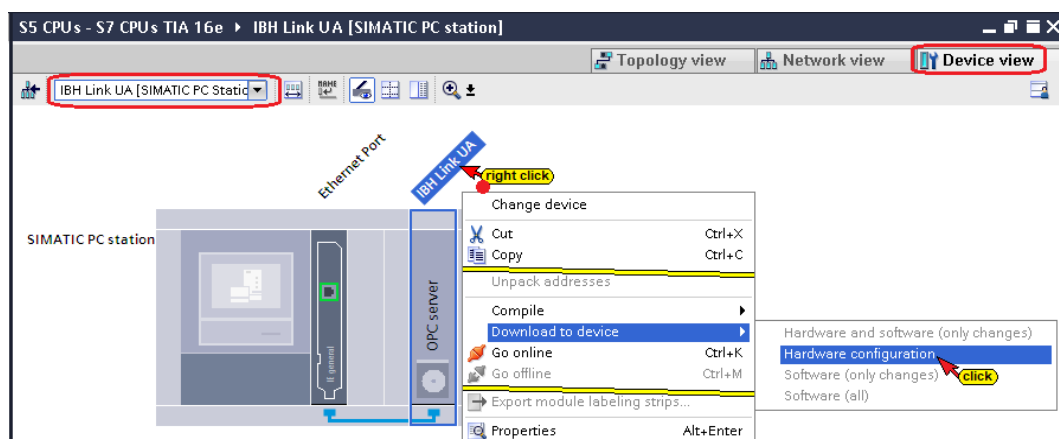
CPU 416 Master / Variables from CPUs



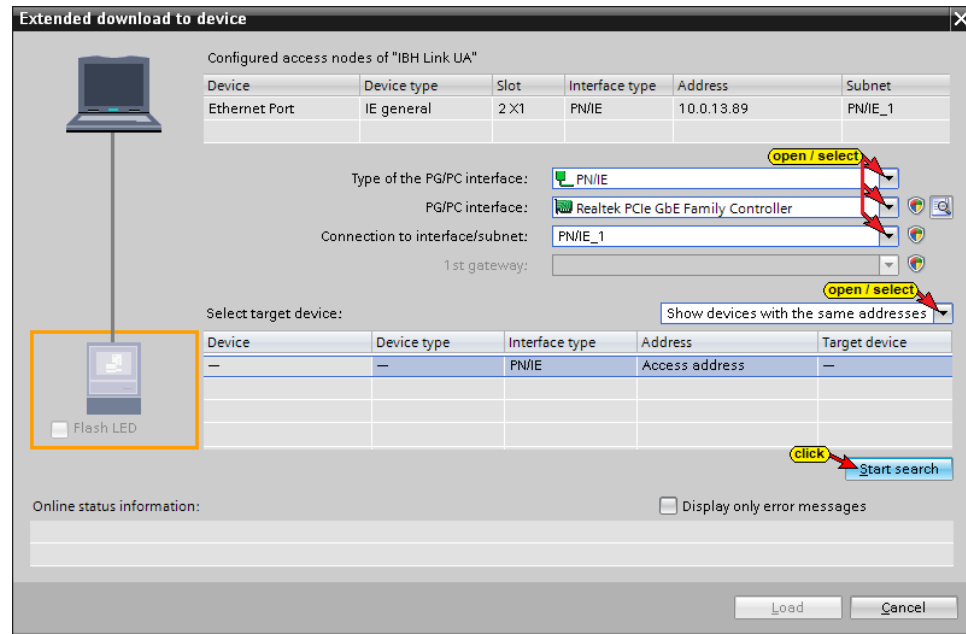
Compile the configuration of the OPC server



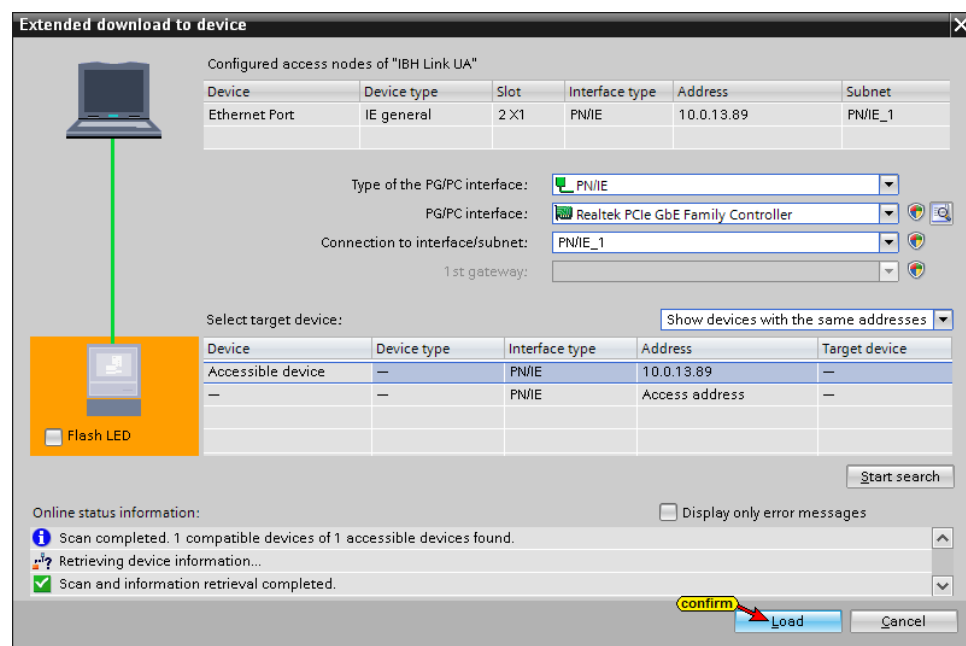
The compiling of the IBH Link UA shows two [2] warnings. The warnings have been established due to the S7 routing to the S7 CPUs 312. The warnings can be ignored because the routing has been selected.



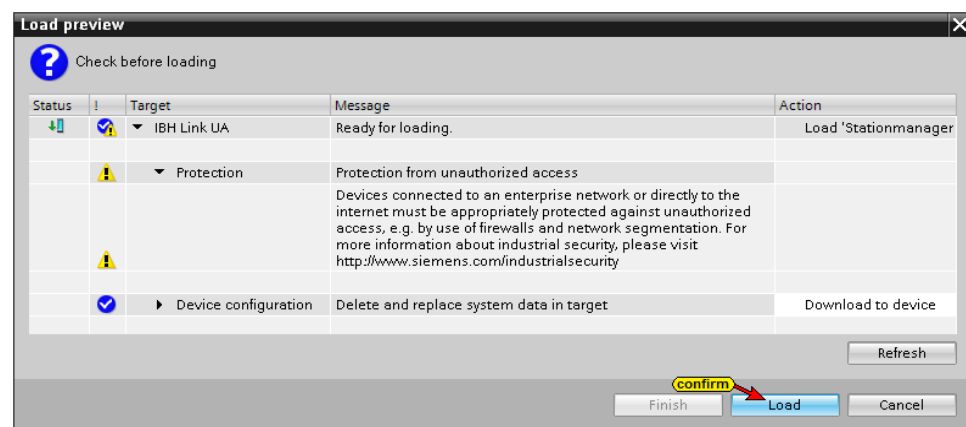
The settings must be made in the dialog box according to the screen



The interface search was successful.

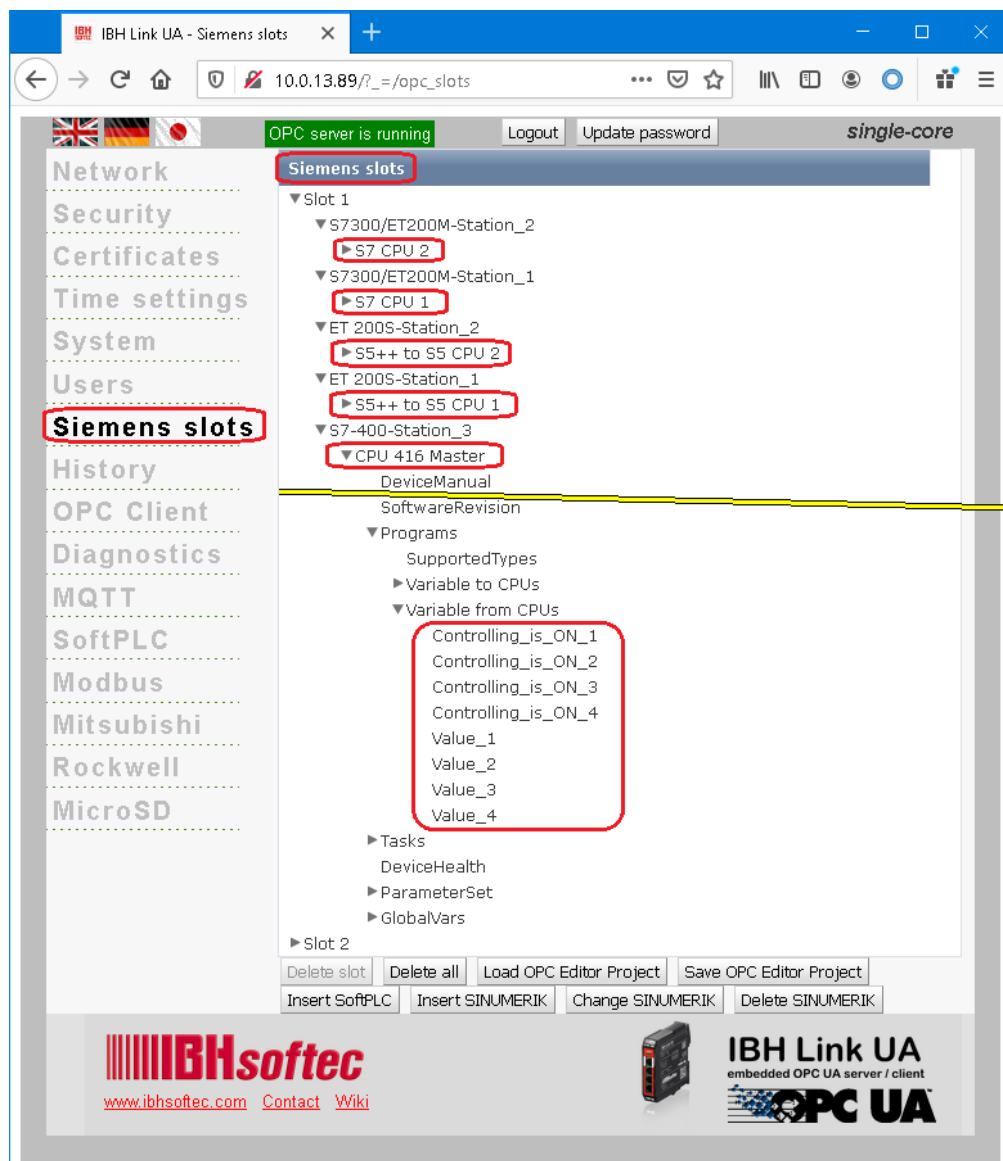


A check is made prior loading.



9.4.2 IBH Link UA browser window *Siemens slots*

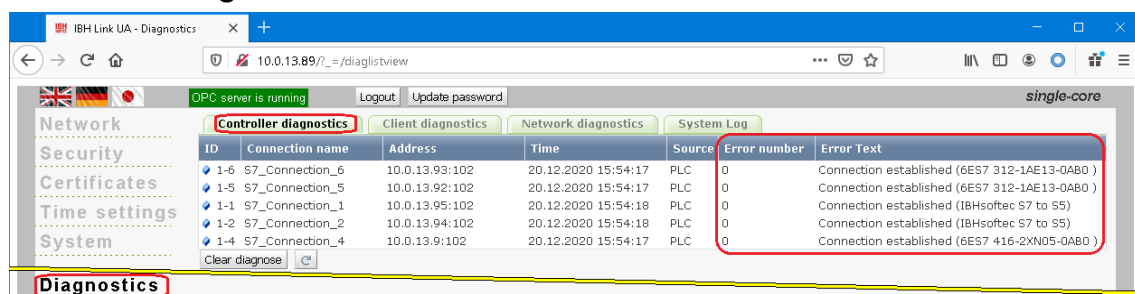
The CPU with the OPC tags is displayed in the Siemens Slots browser window.



9.4.3 Browser window diagnostics

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

Controller diagnostics



Define the OPC UA server for the data exchange

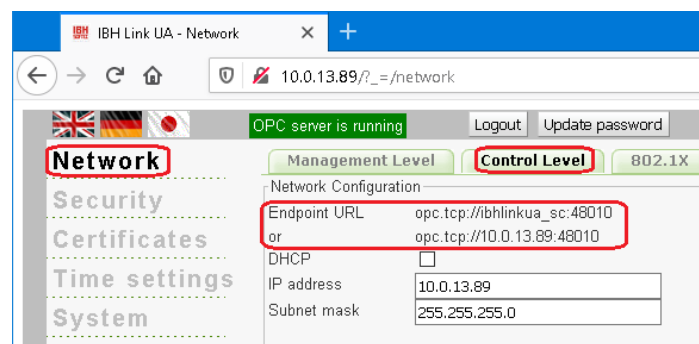
For data exchange the OPC UA servers, and OPC UA clients must be registered in the IBH Link (**CPU 416 master** [CPU 416 - 3 PN / DP], **S7 CPU 1** [CPU 312], **S7 CPU 2** [CPU 312], **S5 CPU 1** [IM 151-8 PN / DP CPU], **S5 CPU 2** [IM 151-8 PN / DP CPU]).

All the above-mentioned PLC controls are both **OPC UA servers** and **OPC UA clients**. 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 between all PLC CPUs is specified in the **OPC Client** web browser window.

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:

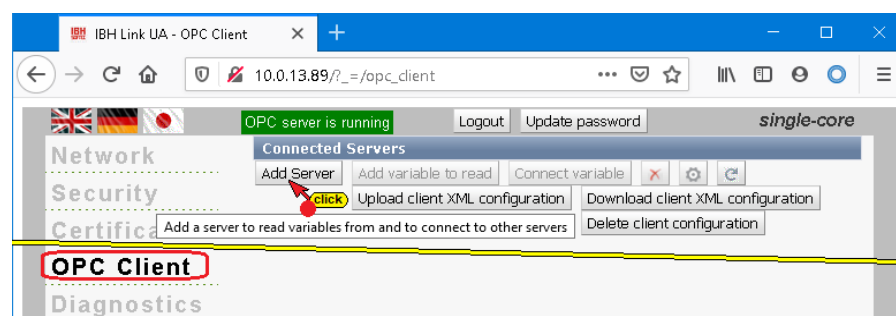
opc.tcp://ibhlinkua_sc: 48010

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

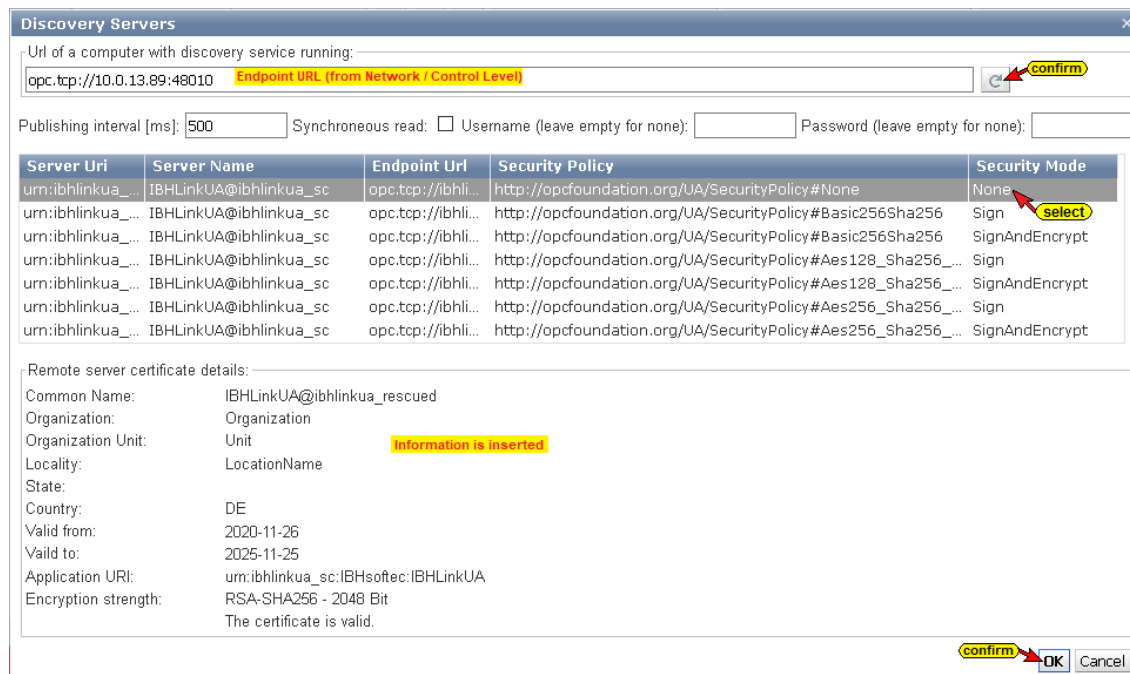
The endpoint URL can be copied into the IBH Link UA web browser window / network / control level.

Add server

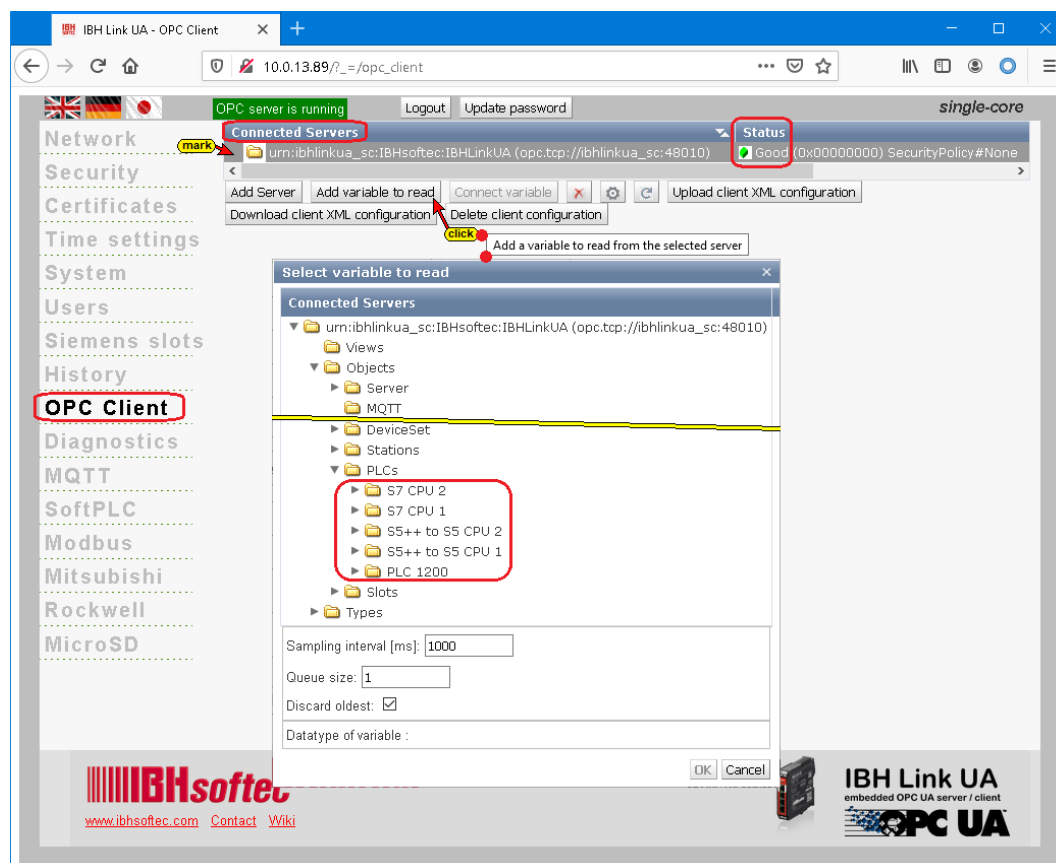


The copied endpoint URL **opc.tcp://ibhlinkua_sc: 48010** or **opc.tcp://10.0.13.89: 48010** is in the open field in the IBH Link UA web browser window / OPC client is to be added as a server.

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



The IBH Link UA OPC UA server is connected. The status of the server is good.

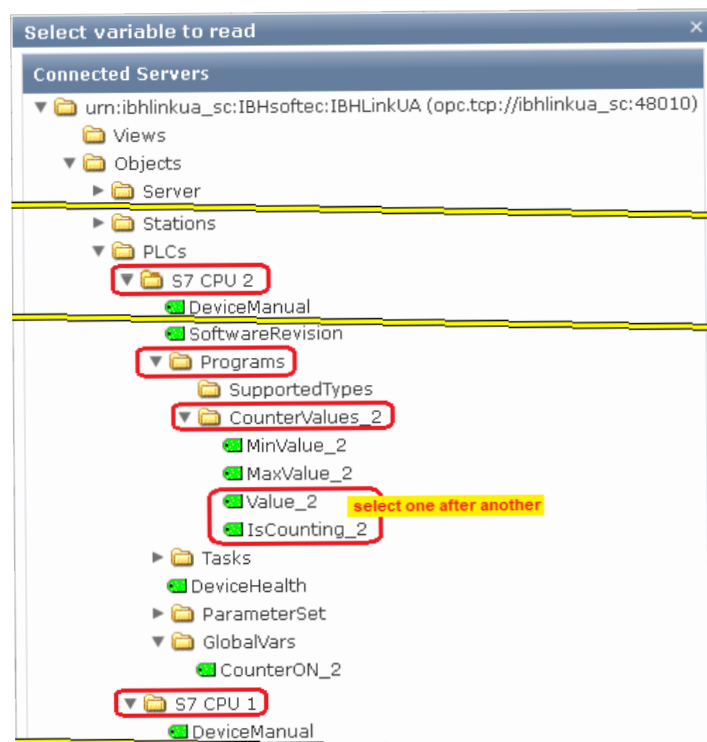


9.4.4 Add read variable

The following tags from the CPUs are declared as read variables.

CPU	Programs (Data block)	GlobalVars
S7 CPU 2	CounterValues_2 - Value_2 - IsCounting_2	
S7 CPU 1	CounterValues_1 - Value_1 - IsCounting_1	
S5++ S5 CPU 2	CounterValues_4 Value_4	CounterON_4
S5++ S5 CPU 1	CounterValues_3 Value_3	CounterON_3
CPU 416 Master	Variable to CPUs - Control_ON - MaxValue_1 - MaxValue_2 - MaxValue_3 - MaxValue_4 - MinValue_1 - MinValue_2 - MinValue_3 - MinValue 4	

Read variable: S7 CPU 2 Data block



Read variable: S7 CPU 1, S5++ CPU 2, S5++ CPU 1, CPU 416 Master

The screenshot displays a configuration window for reading variables from four different CPU types. Each CPU type is represented by a separate panel with a tree view of available variables.

- Panel 1 (S7 CPU 1):** The tree view shows folders like **Programs**, **CounterValues_1**, **GlobalVars**, and **S5++ to S5 CPU 2**. Red boxes highlight **CounterValues_1** and **GlobalVars**. Yellow callouts indicate "select one after another" for **MinValue_1** and **MaxValue_1**, and "select" for **CounterON_1**.
- Panel 2 (S5++ CPU 2):** The tree view shows folders like **Programs**, **Counter Values 4**, **GlobalVars**, and **S5++ to S5 CPU 1**. Red boxes highlight **Counter Values 4** and **GlobalVars**. Yellow callouts indicate "select one after another" for **MinValue_4** and **MaxValue_4**, and "select" for **CounterON_4**.
- Panel 3 (S5++ CPU 1):** The tree view shows folders like **Programs**, **CounterValues3**, **GlobalVars**, and **CPU 416 Master**. Red boxes highlight **CounterValues3** and **GlobalVars**. Yellow callouts indicate "select one after another" for **MinValue_3** and **MaxValue_3**, and "select" for **CounterON_3**.
- Panel 4 (CPU 416 Master):** The tree view shows folders like **Programs**, **Variable to CPUs**, **Variable from CPUs**, and **Types**. Red boxes highlight **Variable to CPUs** and **Variable from CPUs**. Yellow callouts indicate "select one after another" for **MaxValue_1** through **MaxValue_4** and **MinValue_1** through **MinValue_4**.

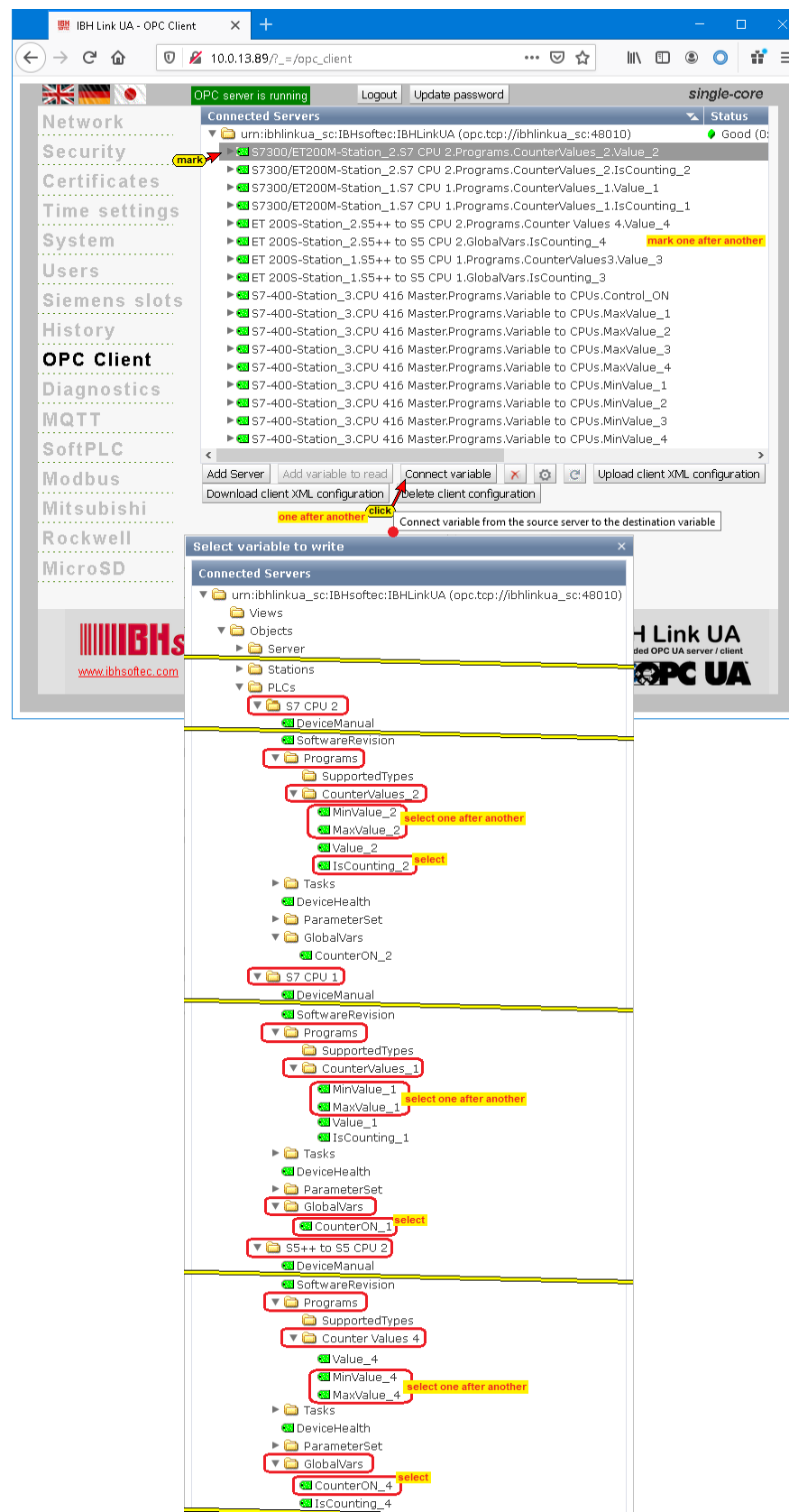
At the bottom of the window, there are settings for the data exchange:

- Sampling interval (ms): 1000
- Queue size: 1
- Discard oldest: ☒
- Datatype of variable :

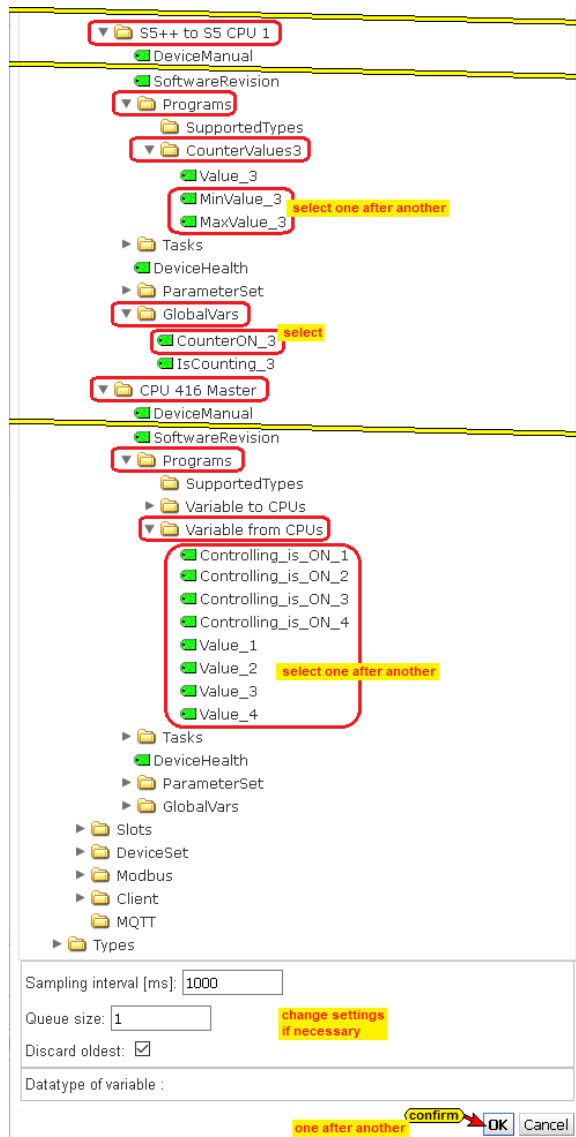
Buttons at the bottom include "confirm", "OK", and "Cancel". A yellow callout "one after another" points to the "confirm" button.

Connect with variables

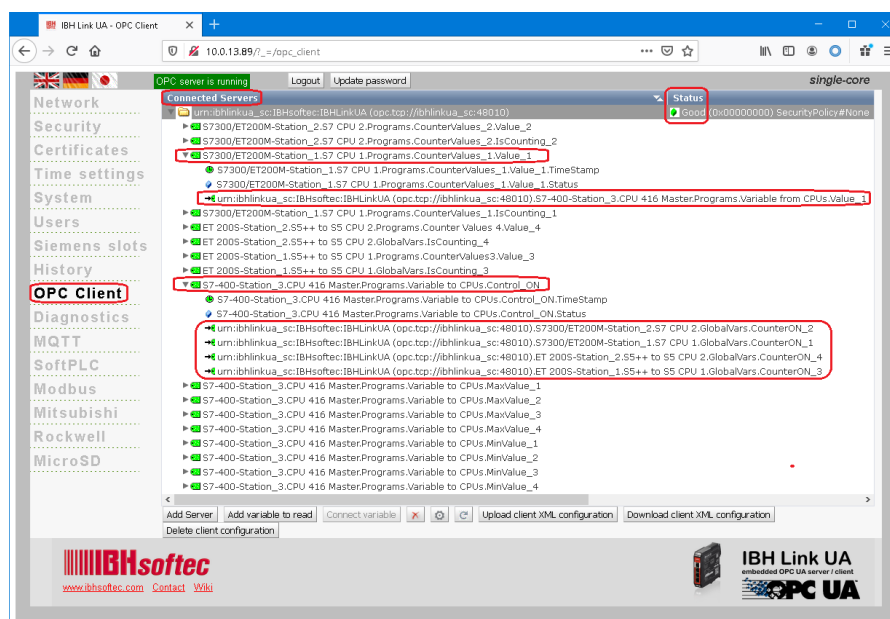
The tags, which have been declared as read variables, are connected to the IBH Link UA OPC server, selected to be connected. OPC tags from the data blocks ***FromPLC1500 [DB5]*** and ***FromPLC1200 [DB5]***.



Connect with variables



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



9.5 UaExpert - program window

In the UaExpert program window, the OPC tags of the CPUs are displayed. The handling of the UaExpert program is described in part 1 of the manual.

9.5.1 Display of the OPC tags in the UaExpert

#	Server	Node Id	Display Name	Value	Datatype	Source Timestamp	Server Timestamp	Statuscode
1	IBHLinkUA...	NS4[String]S7-400-Station_3.CPU 416 M...	Controlling_is_ON_1	true	Boolean	12:54:38.003	12:54:38.252	Good
2	IBHLinkUA...	NS4[String]S7-400-Station_3.CPU 416 M...	Controlling_is_ON_2	true	Boolean	12:54:38.003	12:54:38.252	Good
3	IBHLinkUA...	NS4[String]S7-400-Station_3.CPU 416 M...	Controlling_is_ON_3	true	Boolean	12:54:38.003	12:54:38.252	Good
4	IBHLinkUA...	NS4[String]S7-400-Station_3.CPU 416 M...	Controlling_is_ON_4	true	Boolean	12:54:38.003	12:54:38.252	Good
5	IBHLinkUA...	NS4[String]S7-400-Station_3.CPU 416 M...	Value_1	3129	Int16	13:10:54.413	13:10:54.580	Good
6	IBHLinkUA...	NS4[String]S7-400-Station_3.CPU 416 M...	Value_2	3531	Int16	13:10:54.413	13:10:54.580	Good
7	IBHLinkUA...	NS4[String]S7-400-Station_3.CPU 416 M...	Value_3	3031	Int16	13:10:54.413	13:10:54.580	Good
8	IBHLinkUA...	NS4[String]S7-400-Station_3.CPU 416 M...	Value_4	1553	Int16	13:10:54.413	13:10:54.580	Good
9	IBHLinkUA...	NS4[String]S7-400-Station_3.CPU 416 M...	Control_ON	true	Boolean	12:54:37.752	12:54:38.003	Good
10	IBHLinkUA...	NS4[String]S7-400-Station_3.CPU 416 M...	MaxValue_1	5500	Int16	12:54:37.752	12:54:38.003	Good
11	IBHLinkUA...	NS4[String]S7-400-Station_3.CPU 416 M...	MaxValue_2	5000	Int16	12:54:37.752	12:54:38.003	Good
12	IBHLinkUA...	NS4[String]S7-400-Station_3.CPU 416 M...	MaxValue_3	4500	Int16	12:54:37.752	12:54:38.003	Good
13	IBHLinkUA...	NS4[String]S7-400-Station_3.CPU 416 M...	MaxValue_4	4000	Int16	12:54:37.752	12:54:38.003	Good
14	IBHLinkUA...	NS4[String]S7-400-Station_3.CPU 416 M...	MinValue_1	900	Int16	12:54:37.752	12:54:38.003	Good
15	IBHLinkUA...	NS4[String]S7-400-Station_3.CPU 416 M...	MinValue_2	800	Int16	12:54:37.752	12:54:38.003	Good
16	IBHLinkUA...	NS4[String]S7-400-Station_3.CPU 416 M...	MinValue_3	700	Int16	12:54:37.752	12:54:38.003	Good
17	IBHLinkUA...	NS4[String]S7-400-Station_3.CPU 416 M...	MinValue_4	600	Int16	12:54:37.752	12:54:38.003	Good
18	IBHLinkUA...	NS4[String]ET 2005-Station_1.S5++ to S5...	CounterON_3	true	Boolean	12:55:31.070	12:55:31.813	Good
19	IBHLinkUA...	NS4[String]ET 2005-Station_1.S5++ to S5...	IsCounting_3	true	Boolean	12:55:33.037	12:55:33.814	Good
20	IBHLinkUA...	NS4[String]ET 2005-Station_1.S5++ to S5...	MaxValue_3	4500	Int16	12:55:40.761	12:55:41.570	Good
21	IBHLinkUA...	NS4[String]ET 2005-Station_1.S5++ to S5...	MinValue_3	700	Int16	12:55:42.157	12:55:42.821	Good
22	IBHLinkUA...	NS4[String]ET 2005-Station_1.S5++ to S5...	Value_3	3662	Int16	13:10:53.975	13:10:54.831	Good
23	IBHLinkUA...	NS4[String]ET 2005-Station_1.S5++ to S5...	CounterON_4	true	Boolean	12:55:52.732	12:55:53.326	Good
24	IBHLinkUA...	NS4[String]ET 2005-Station_1.S5++ to S5...	IsCounting_4	true	Boolean	12:55:54.180	12:55:55.077	Good
25	IBHLinkUA...	NS4[String]ET 2005-Station_1.S5++ to S5...	MaxValue_4	4000	Int16	12:56:02.861	12:56:03.581	Good
26	IBHLinkUA...	NS4[String]ET 2005-Station_1.S5++ to S5...	MinValue_4	600	Int16	12:56:04.588	12:56:05.581	Good
27	IBHLinkUA...	NS4[String]ET 2005-Station_1.S5++ to S5...	Value_4	1871	Int16	13:10:54.580	13:10:55.332	Good
28	IBHLinkUA...	NS4[String]S7300/ET200M-Station_1.S7...	CounterON_1	true	Boolean	12:56:13.740	12:56:16.588	Good
29	IBHLinkUA...	NS4[String]S7300/ET200M-Station_1.S7...	IsCounting_1	true	Boolean	12:56:21.798	12:56:22.626	Good
30	IBHLinkUA...	NS4[String]S7300/ET200M-Station_1.S7...	MaxValue_1	5500	Int16	12:56:24.315	12:56:25.130	Good
31	IBHLinkUA...	NS4[String]S7300/ET200M-Station_1.S7...	MinValue_1	900	Int16	12:56:25.806	12:56:26.631	Good
32	IBHLinkUA...	NS4[String]S7300/ET200M-Station_1.S7...	Value_1	5087	Int16	13:10:55.082	13:10:55.332	Good
33	IBHLinkUA...	NS4[String]S7300/ET200M-Station_2.S7...	CounterON_2	true	Boolean	12:56:43.668	12:56:44.387	Good
34	IBHLinkUA...	NS4[String]S7300/ET200M-Station_2.S7...	IsCounting_2	true	Boolean	12:56:54.802	12:56:55.393	Good
35	IBHLinkUA...	NS4[String]S7300/ET200M-Station_2.S7...	MaxValue_2	5000	Int16	12:56:53.862	12:56:56.646	Good
36	IBHLinkUA...	NS4[String]S7300/ET200M-Station_2.S7...	MinValue_2	800	Int16	12:56:57.151	12:56:57.899	Good
37	IBHLinkUA...	NS4[String]S7300/ET200M-Station_2.S7...	Value_2	866	Int16	13:10:55.082	13:10:55.332	Good

UaExpert - program window CPU 416 Master

Display Name	Value	Datatype	Source Timestamp
Controlling_is_ON_1	true	Boolean	13:13:28.092
Controlling_is_ON_2	true	Boolean	13:13:29.592
Controlling_is_ON_3	true	Boolean	13:13:31.037
Controlling_is_ON_4	true	Boolean	13:13:32.754
Value_1	5126	Int16	13:23:00.194
Value_2	2816	Int16	13:23:00.194
Value_3	1307	Int16	13:23:00.194
Value_4	1818	Int16	13:23:00.194
Control_ON	true	Boolean	13:13:43.006
MaxValue_1	5500	Int16	13:13:44.240
MaxValue_2	5000	Int16	13:13:46.007
MaxValue_3	4500	Int16	13:13:47.006
MaxValue_4	4000	Int16	13:13:49.006
MinValue_1	900	Int16	13:13:51.007
MinValue_2	800	Int16	13:13:52.006
MinValue_3	700	Int16	13:13:54.007
MinValue_4	600	Int16	13:13:56.008

9.6 Status – Watch tables CPUs

CPU 416 Master

S5 CPUs - S7 CPUs TIA 16e > CPU 416 Master [CPU 416-3 PN/DP] > Watch and force tables > Watch table_1						
	Name	Address	Display format	Monitor value		Tag comment
1	"Variable from CPUs".Controlling_is_ON_1	%DB5.DBX0.0	Bool	TRUE	☐	S7 CPU 1 is counting
2	"Variable from CPUs".Controlling_is_ON_2	%DB5.DBX0.1	Bool	TRUE	☐	S7 CPU 2 is counting
3	"Variable from CPUs".Controlling_is_ON_3	%DB5.DBX0.2	Bool	TRUE	☐	S5 CPU 1 is counting
4	"Variable from CPUs".Controlling_is_ON_4	%DB5.DBX0.3	Bool	TRUE	☐	S5 CPU 2 is counting
5	"Variable from CPUs".Value_1	%DB5.DBW2	DEC+/-	3405	☐	Counter reading S7 CPU 1
6	"Variable from CPUs".Value_2	%DB5.DBW4	DEC+/-	3963	☐	Counter reading S7 CPU 2
7	"Variable from CPUs".Value_3	%DB5.DBW6	DEC+/-	4269	☐	Counter reading S5 CPU 1
8	"Variable from CPUs".Value_4	%DB5.DBW8	DEC+/-	2564	☐	Counter reading S5 CPU 2
9	"Variable to CPUs".Control_ON	%DB2.DBX0.0	Bool	TRUE	☐	all CPUs start counting
10	"Variable to CPUs".MaxValue_1	%DB2.DBW2	DEC+/-	5500	☐	maximum counter value S7 CPU 1
11	"Variable to CPUs".MaxValue_2	%DB2.DBW4	DEC+/-	5000	☐	maximum counter value S7 CPU 2
12	"Variable to CPUs".MaxValue_3	%DB2.DBW6	DEC+/-	4500	☐	maximum counter value S5 CPU 1
13	"Variable to CPUs".MaxValue_4	%DB2.DBW8	DEC+/-	4000	☐	maximum counter value S5 CPU 2
14	"Variable to CPUs".MinValue_1	%DB2.DBW10	DEC+/-	900	☐	minimum counter value S7 CPU 1
15	"Variable to CPUs".MinValue_2	%DB2.DBW12	DEC+/-	800	☐	minimum counter value S7 CPU 2
16	"Variable to CPUs".MinValue_3	%DB2.DBW14	DEC+/-	700	☐	minimum counter value S5 CPU 1
17	"Variable to CPUs".MinValue_4	%DB2.DBW16	DEC+/-	600	☐	minimum counter value S5 CPU 2

S7 CPU 1 [CPU 312]

S5 CPUs - S7 CPUs TIA 16e > S7 CPU 1 [CPU 312] > Watch and force tables > Watch table 1						
	Name	Address	Display format	Monitor value		Tag comment
1	"CounterON_1"	%M0.1	Bool	TRUE	☐	Enable S7 CPU 1 to count
2	"CounterValues_1".IsCounting_1	%DB2.DBX6.0	Bool	TRUE	☐	Counter is counting S7 CPU1
3	"CounterValues_1".MaxValue_1	%DB2.DBW2	DEC+/-	5500	☐	maximum Counter value S7 CPU1
4	"CounterValues_1".MinValue_1	%DB2.DBW0	DEC+/-	900	☐	minimum Counter value S7 CPU1
5	"Value_1"	%MW12	DEC+/-	1831	☐	Counter value S7 CPU 1

S7 CPU 2 [CPU 312]

S5 CPUs - S7 CPUs TIA 16e > S7 CPU 2 [CPU 312] > Watch and force tables > Watch table_1						
	Name	Address	Display format	Monitor value		Tag comment
1	"CounterON_2"	%M0.1	Bool	TRUE	☐	Enable S7 CPU 2 to count
2	"CounterValues_2".IsCounting_2	%DB2.DBX6.0	Bool	TRUE	☐	Feedback S7 CPU 2 is counting
3	"CounterValues_2".MaxValue_2	%DB2.DBW2	DEC+/-	5000	☐	maximum Counter value S7 CPU 2
4	"CounterValues_2".MinValue_2	%DB2.DBW0	DEC+/-	800	☐	minimum Counter value S7 CPU 2
5	"CounterValues_2".Value_2	%DB2.DBW4	DEC+/-	4527	☐	Counter value S7 CPU 2

S5/S7 for Windows - S5 CPU 1 -- A:\S17\SS CPU 1e\S5 CPU 1.5SP

File PLC Block Edit InsertCtrl+V Presentation Find View Window Help

Online

Network

S5++ 1

PLC 90/95/100 U (CPU 103)

Used operands

Free operands

Program structure

Trace back

S5++ 2

CPU 416 Master

S7++ 1

S7++ 2

STEP7

BB 1 Status

Title: Status S5 CPU 1

Operand	Contents	Modify value
F 0.1	KM 1	Enable S5 CPU 1 to count
F 2.2	KM 1	Counting control ON S5 CPU 1
DB 2	...	Data Block DB2 [CounterData]
DW 0	KF +7220	Counter Value S5 CPU 1
DW 1	KF +100	minimum Counter value S5 CPU 1
DW 2	KF +10000	maximum Counter value S5 CPU 1

S5 CPU 1

S5/S7 for Windows - S5 CPU 2 -- A:\S17\SS CPU 2e\S5 CPU 2.5SP

File PLC Block Edit InsertCtrl+V Presentation Find View Window Help

Online

Network

S5++ 1

S5++ 2

PLC 115 U (CPU941)

Used operands

Free operands

Program structure

Trace back

S7++ 1

S7++ 2

STEP7

BB 1 Status

Title: Status S5 CPU 2

Operand	Contents	Modify value
F 0.1	KM 1	Enable S5 CPU 2 to count
F 2.2	KM 1	Counting control ON S5 CPU 2
DB 2	...	Data Block DB2 [CounterData]
DW 0	KF +2161	Counter Value S5 CPU 2
DW 1	KF +600	minimum Counter value S5 CPU 2
DW 2	KF +4000	maximum Counter value S5 CPU 2

S5 CPU 2

10 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.

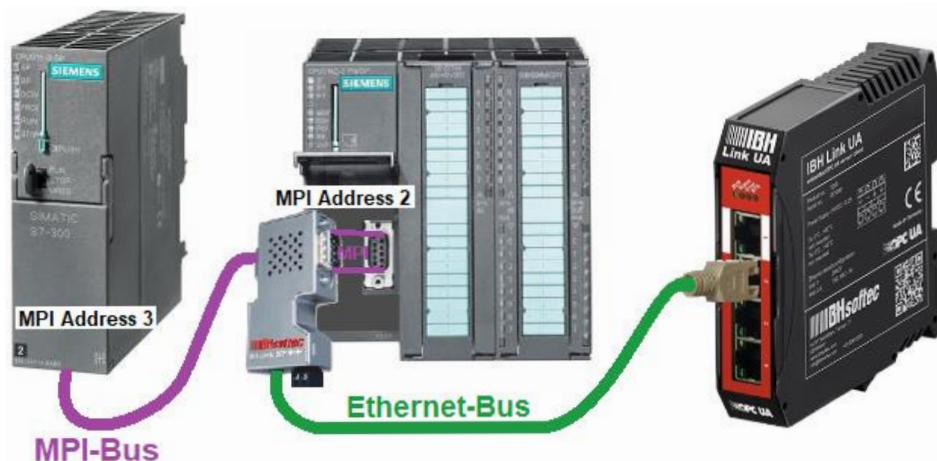
IBH Link S7++

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



10.1 Project with TIA Portal V16

The **CPU 312 2x TIA16e** project is identical to the Counter program, as described under 1.1.3.

The counter counts until **MaxValue** is reached and counts down until the **MinValue** is reached. The SIEMENS PLC programming system TIA Portal V16 is used to create the project.

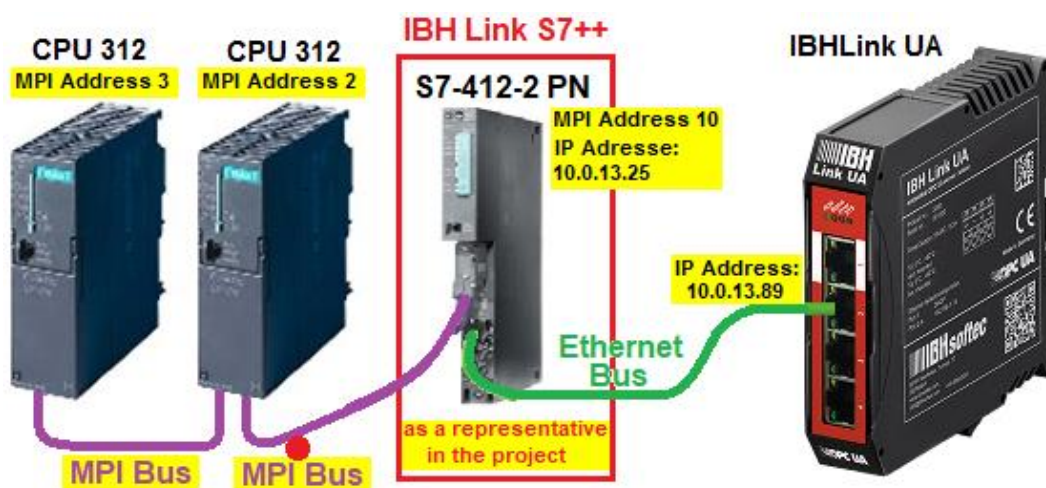


IBH Link UA - configuration with the TIA Portal

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

The routing mode must be activated in the **IBH Link S7++**. This mode is available from firmware version 2.142. In this mode, non-configured 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 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):

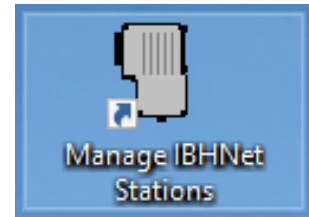
Interfaces / Bus type	Protocols
1x MPI / PROFIBUS DP	MPI / PROFIBUS
1x PROFINET (1 Port)	ISO-on-TCP (RFC1006)

IP / MPI addresses of the devices used

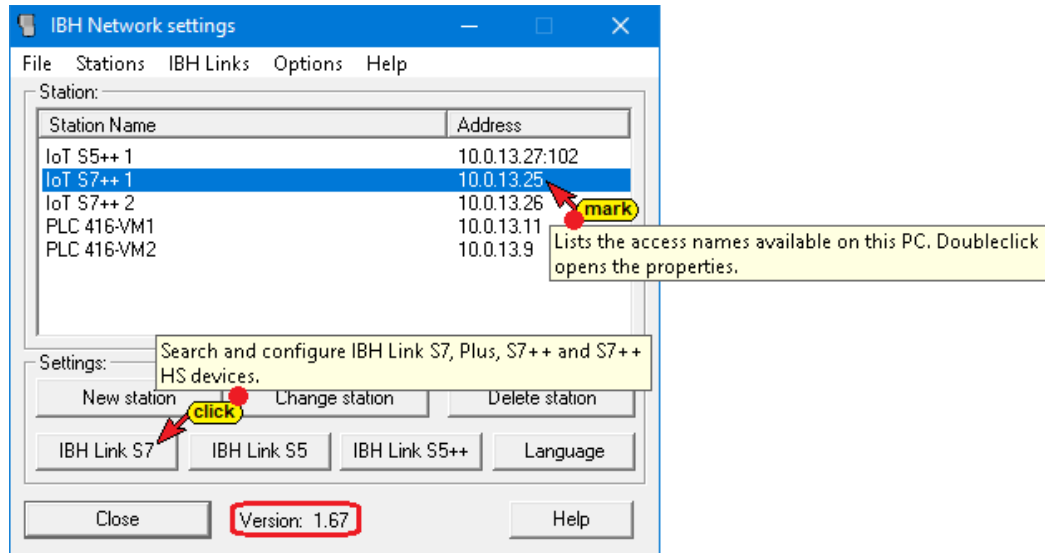
Device	IP address	MPI address
IBH Link UA [Control Level]	10.0.13.89	not applicable
IBH Link S7 ++ for S7 CPU 1 [CPU 412-2 PN] (for IBH Link S7++ and CPU)	10.0.13.25 routed	10
S7-CPU 1 [CPU 312]	not applicable	2
S7-CPU 2 [CPU 312]	not applicable	3

10.1.1 IBH Link S7++ settings

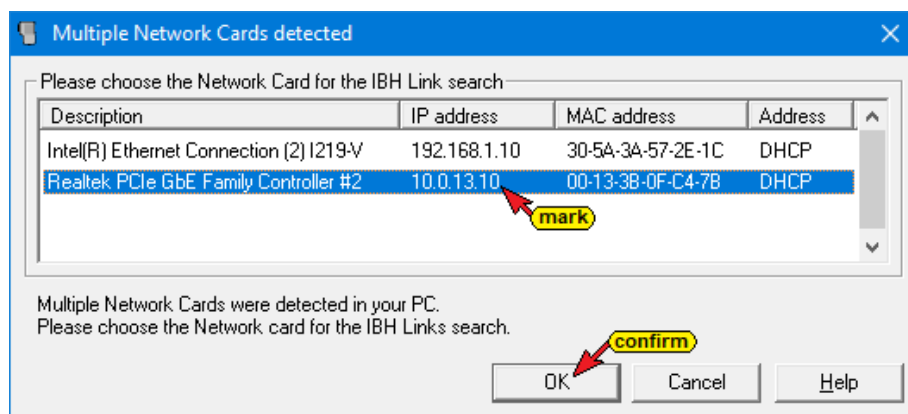
After starting **Manage IBHNet Stations**, the **IBH Network Settings** dialog box opens. Click the IBH Link S7 button to open the Detect multiple network cards dialog box.



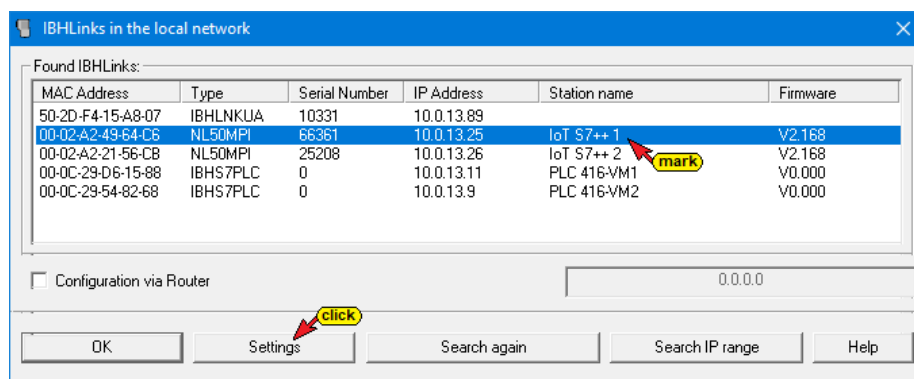
Dialog box IBH Network Settings



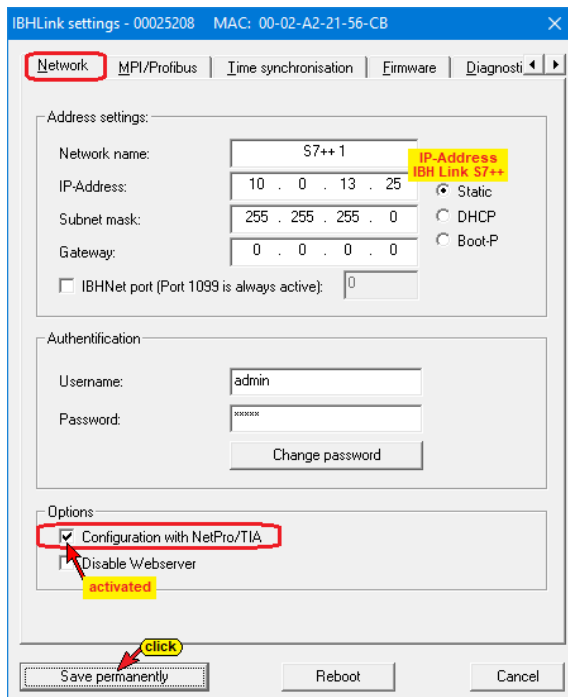
Mark the network card the **IBH Link S7++** is connected and confirm with **OK**.



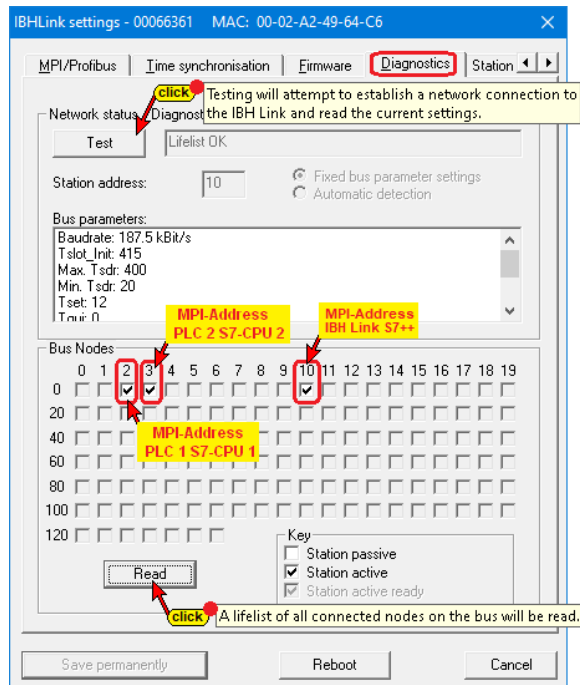
Mark the connected **IBH Link S7++** and click on **Settings** to open the IBHLink Settings dialog box.



In the **IBHLink Settings / Network** dialog box, activate the **Routing option Configuration with NetPro / TIA**.

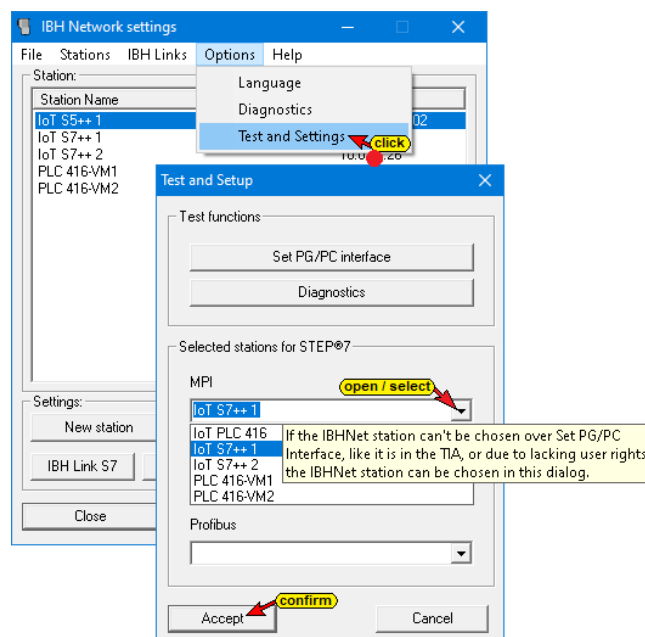


IBH Link S7++ MPI-Addresses



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

The TIA Portal programming environment does not have a dialog to select different IBH Link S7++. If two or more IBH Link S7++ are in the subnet, the selection must be performed using the **IBH Network Settings** dialog box.



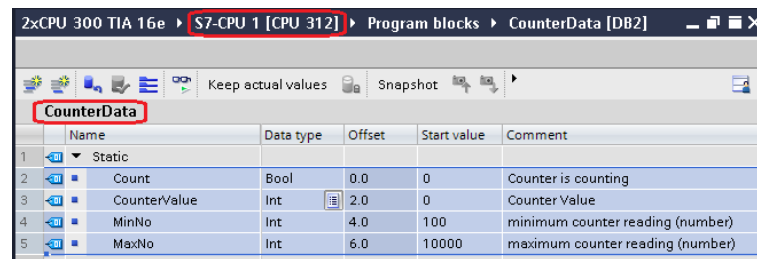
By clicking the **Accept** button, the IBHNet driver is given the IP address. The TIA Portal, therefore, only has access to the assigned CPU via the **IBH Link S7++**.

10.1.2 S7-CPU 1 [CPU 312]

In the program for the S7-CPU 1, the data blocks **CounterData [DB2]**, and **Data_from_CPU 2 [DB5]** are available for the data exchange with the S7-CPU 2. The variables of these blocks are defined as (OPC tags).

Data block CounterData CPU 1 [DB2]

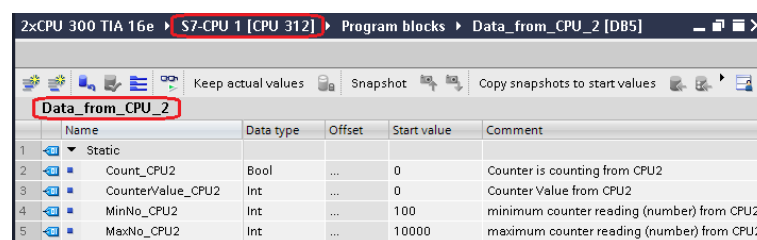
These variables are defined as OPC tags (read variables).



	Name	Data type	Offset	Start value	Comment
1	Static				
2	Count	Bool	0.0	0	Counter is counting
3	CounterValue	Int	2.0	0	Counter Value
4	MinNo	Int	4.0	100	minimum counter reading (number)
5	MaxNo	Int	6.0	10000	maximum counter reading (number)

Data block Data_from_CPU 2 [DB5]

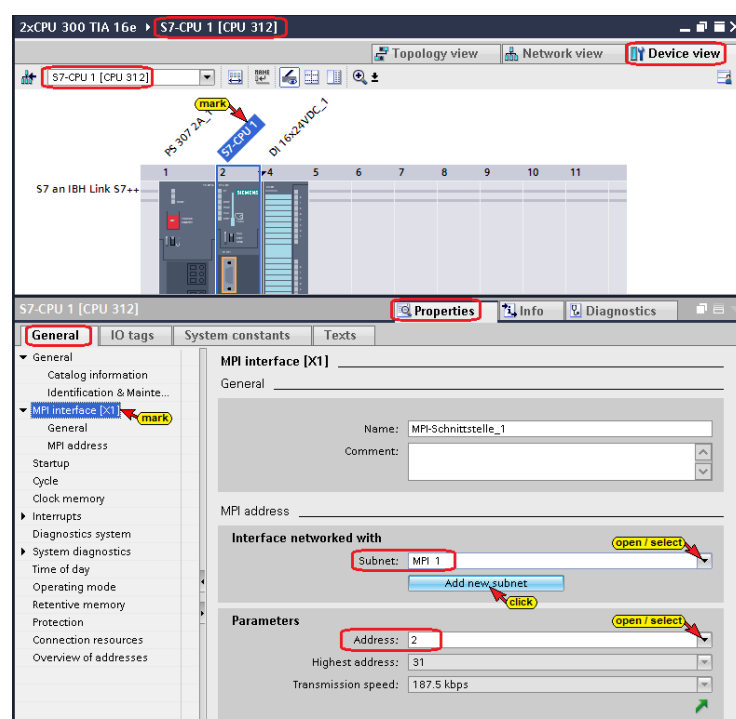
These variables are defined as OPC tags.



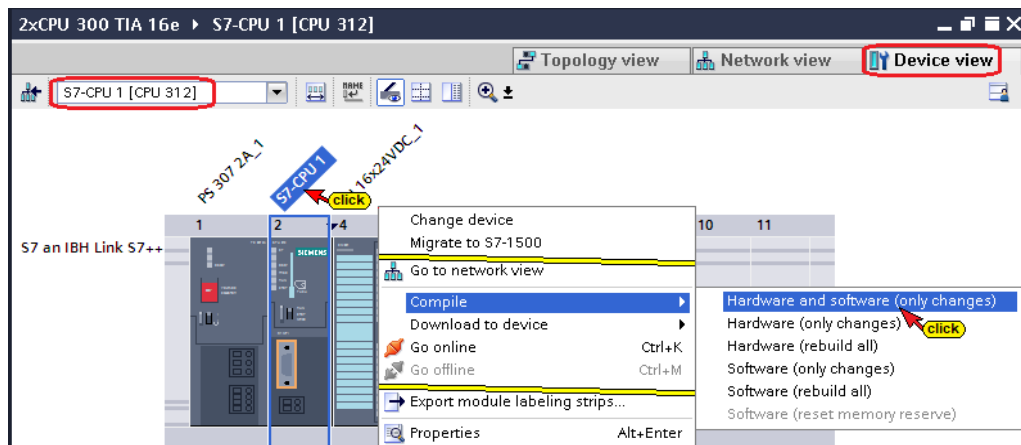
	Name	Data type	Offset	Start value	Comment
1	Static				
2	Count_CPU2	Bool	...	0	Counter is counting from CPU2
3	CounterValue_CPU2	Int	...	0	Counter Value from CPU2
4	MinNo_CPU2	Int	...	100	minimum counter reading (number) from CPU2
5	MaxNo_CPU2	Int	...	10000	maximum counter reading (number) from CPU2

Configurations of the S7-CPU 1 [CPU 312]

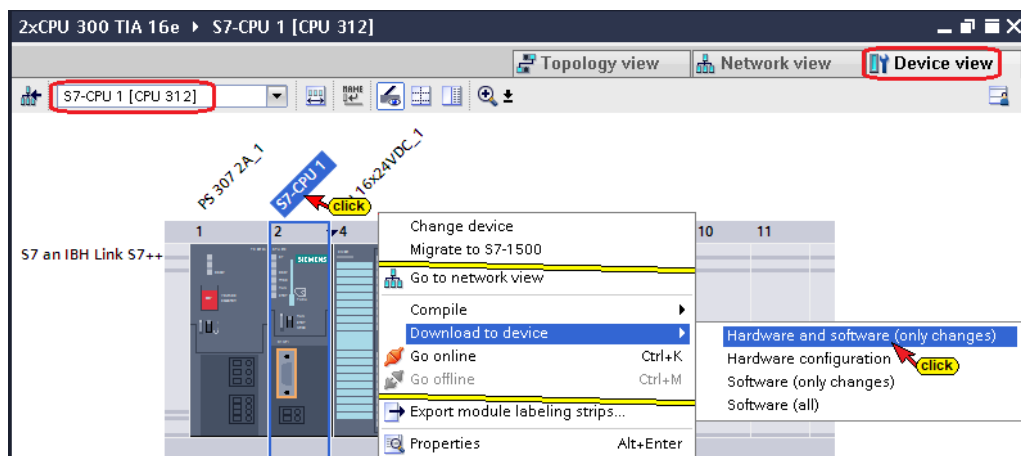
Only these settings are necessary for the project.



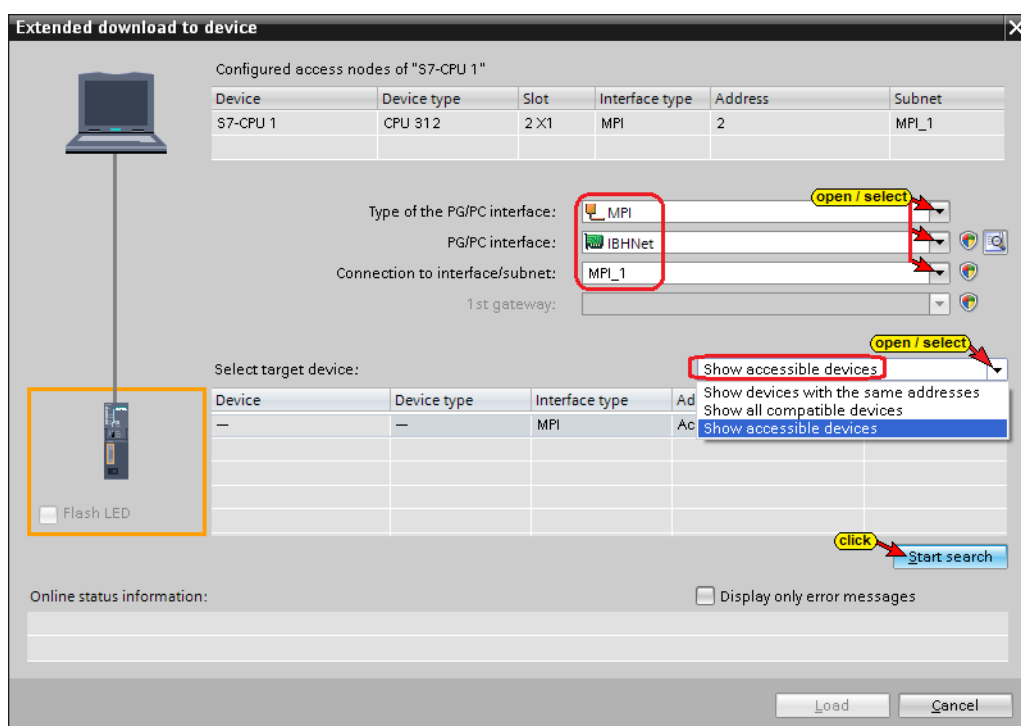
Compile program blocks and device configuration S7-CPU 1 [CPU 312] (device)



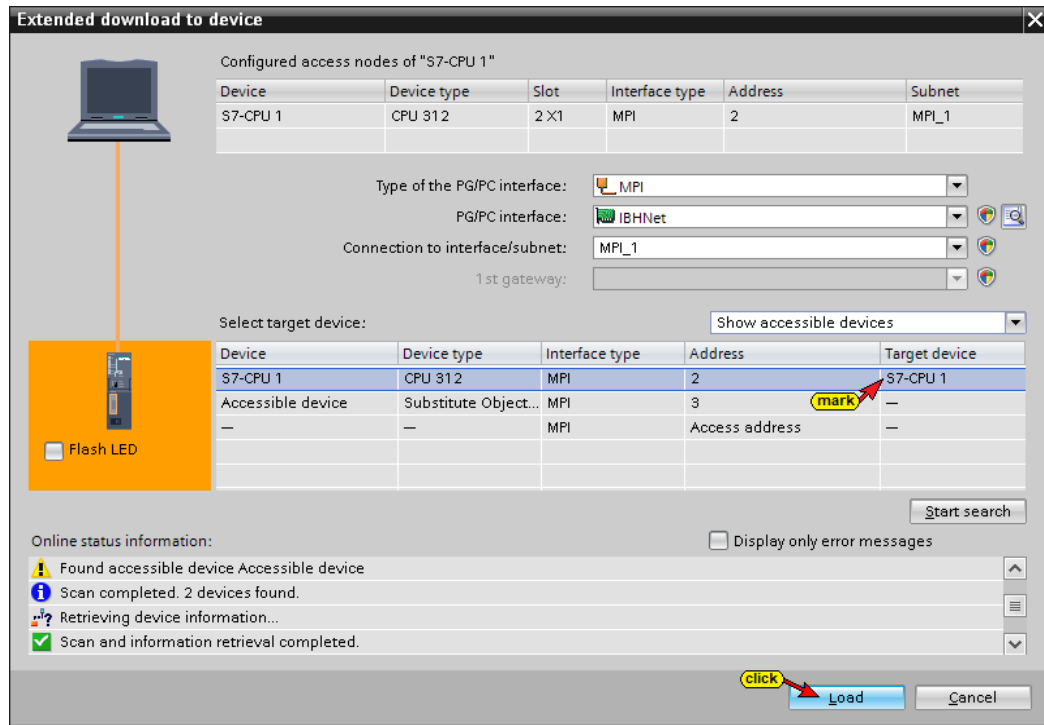
Load program blocks and device configuration into the S7-CPU 1 [CPU 312] (device)



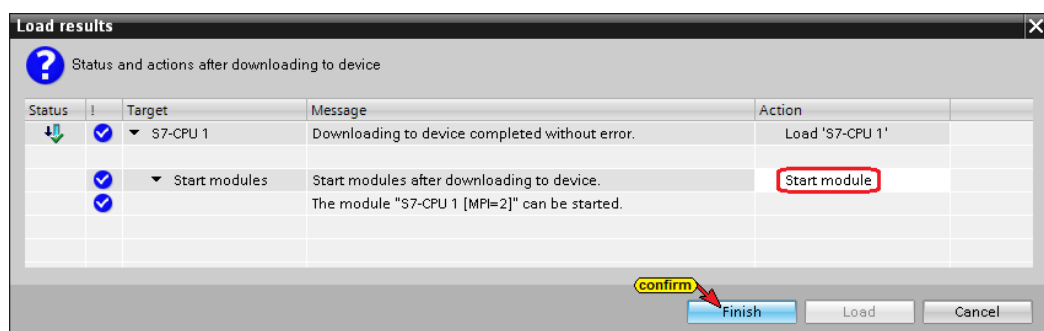
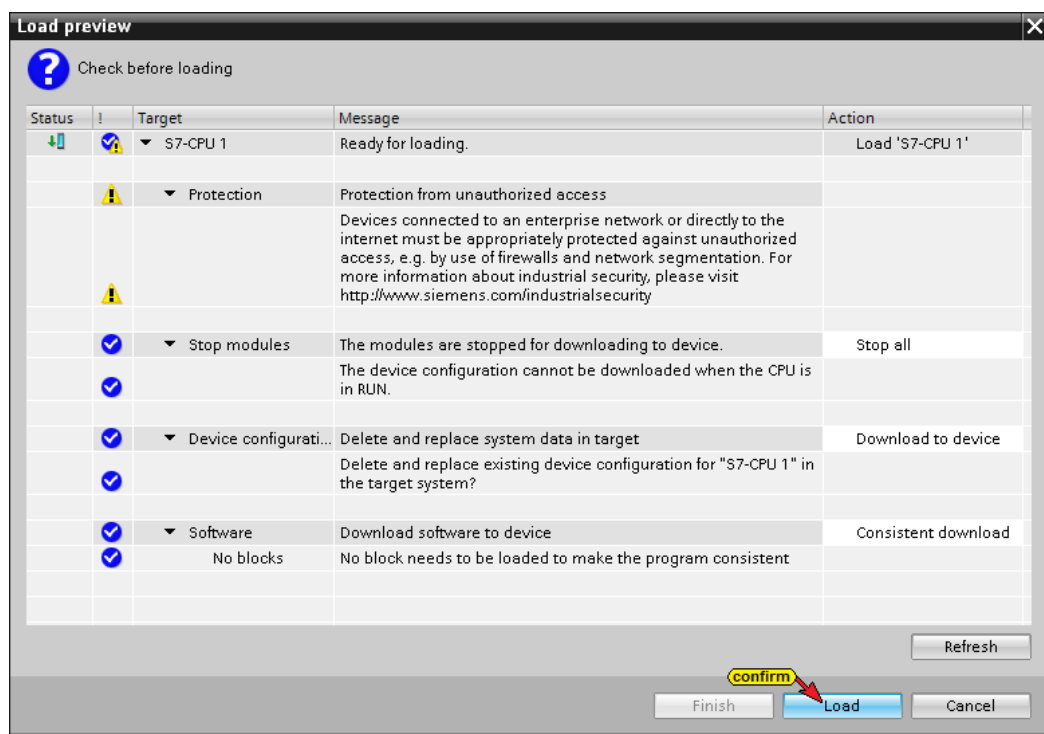
Extended download to device dialog box – Start search



Extended download to device dialog box – Load



A preview of the loading is displayed.

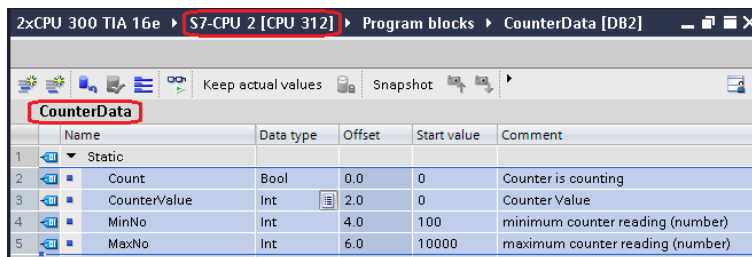


10.1.3 S7-CPU 2 [CPU 312]

In the program for the S7-CPU 2, the data blocks **CounterData** [DB2] CPU 1, and **Data_from_CPU 1** [DB5] are available for the data exchange with the S7-CPU 2. The variables of these blocks are defined as (OPC tags).

Data block CounterData [DB2] CPU 2

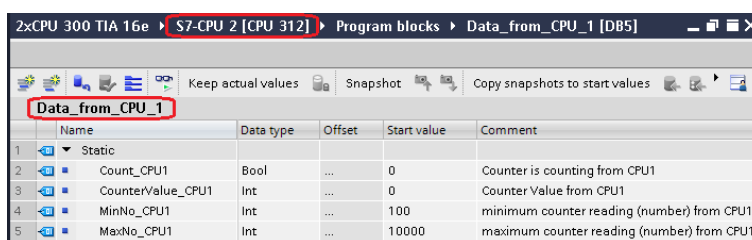
These variables are defined as OPC tags (read variables).



	Name	Data type	Offset	Start value	Comment
1	Static				
2	Count	Bool	0.0	0	Counter is counting
3	CounterValue	Int	2.0	0	Counter Value
4	MinNo	Int	4.0	100	minimum counter reading (number)
5	MaxNo	Int	6.0	10000	maximum counter reading (number)

Data block Data_from_CPU 1 [DB5]

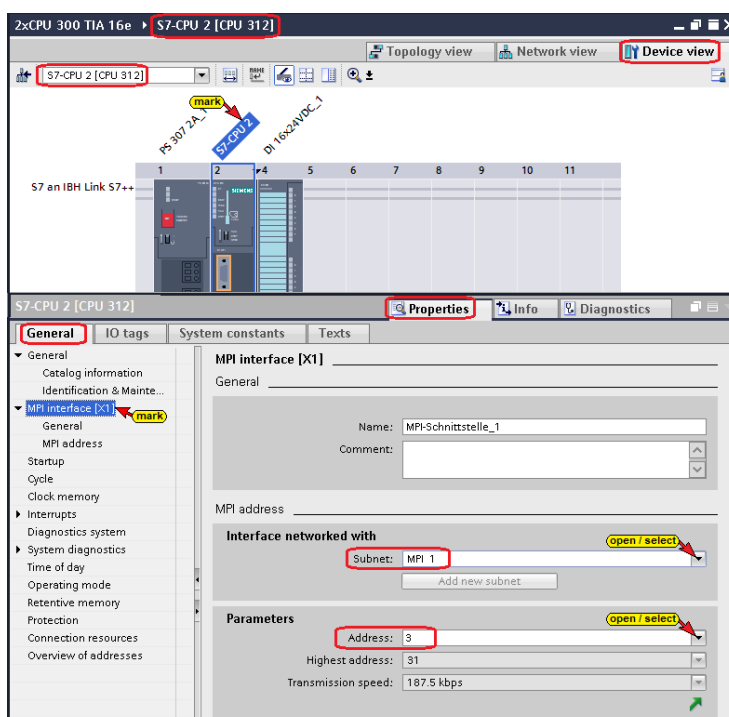
These variables are defined as OPC tags.



	Name	Data type	Offset	Start value	Comment
1	Static				
2	Count_CPU1	Bool	...	0	Counter is counting from CPU1
3	CounterValue_CPU1	Int	...	0	Counter Value from CPU1
4	MinNo_CPU1	Int	...	100	minimum counter reading (number) from CPU1
5	MaxNo_CPU1	Int	...	10000	maximum counter reading (number) from CPU1

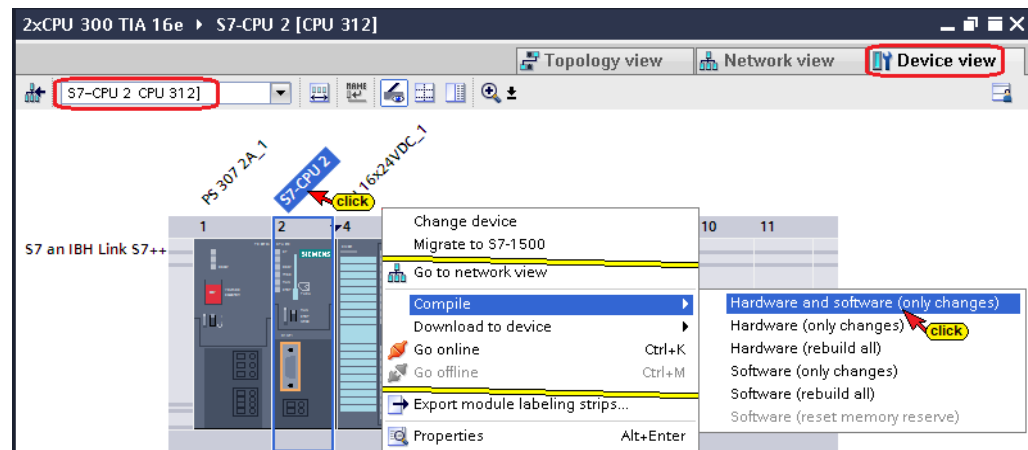
Configurations of the S7-CPU 2 [CPU 312]

Only these settings are necessary for the project.

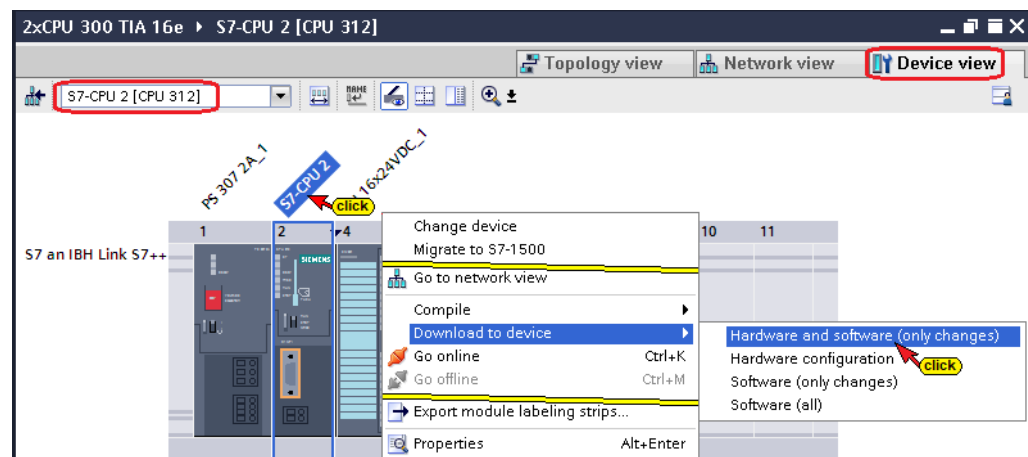


The screenshot shows the TIA Portal software interface. The 'Device view' tab is selected, displaying a rack configuration with S7-CPU 2 [CPU 312] at position 2. The 'Properties' window for S7-CPU 2 [CPU 312] is open, showing the 'General' tab. The 'MPI interface [X1]' section is expanded, showing the 'Subnet' set to 'MPI 1' and the 'Address' set to '3'. The 'Interface networked with' dropdown is set to 'open / select'.

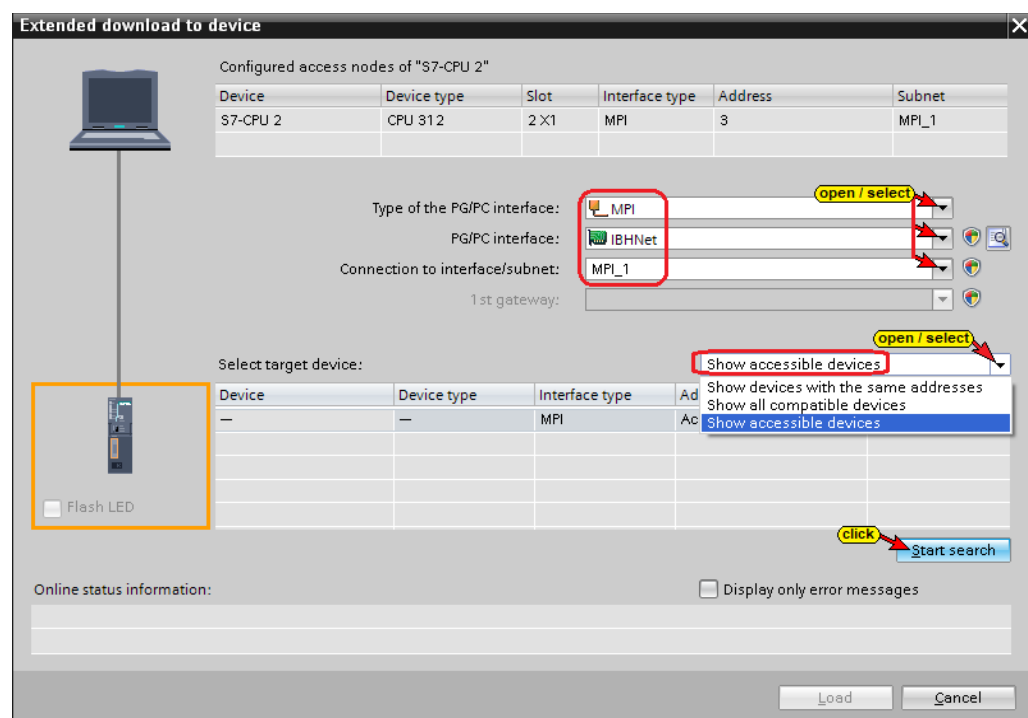
Compile program blocks and device configuration S7-CPU 2 [CPU 312] (device)



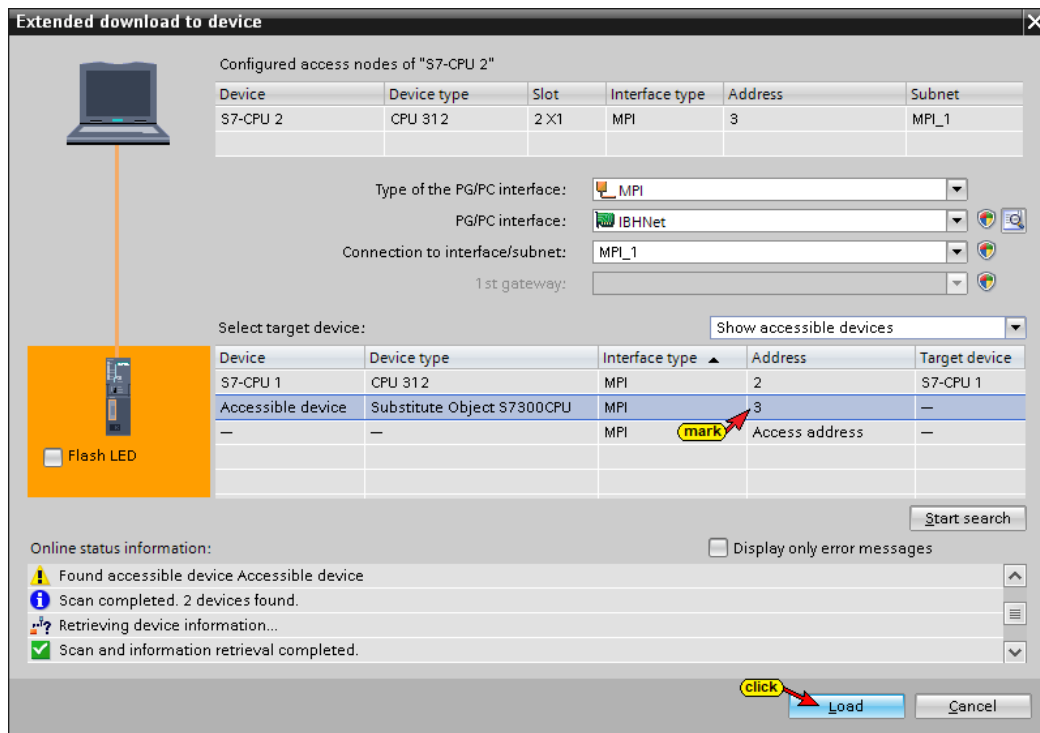
Load program blocks and device configuration into the S7-CPU 2 [CPU 312] (device)



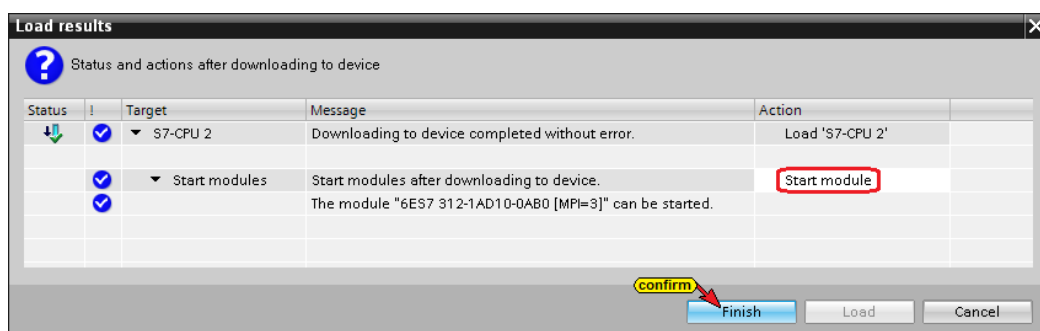
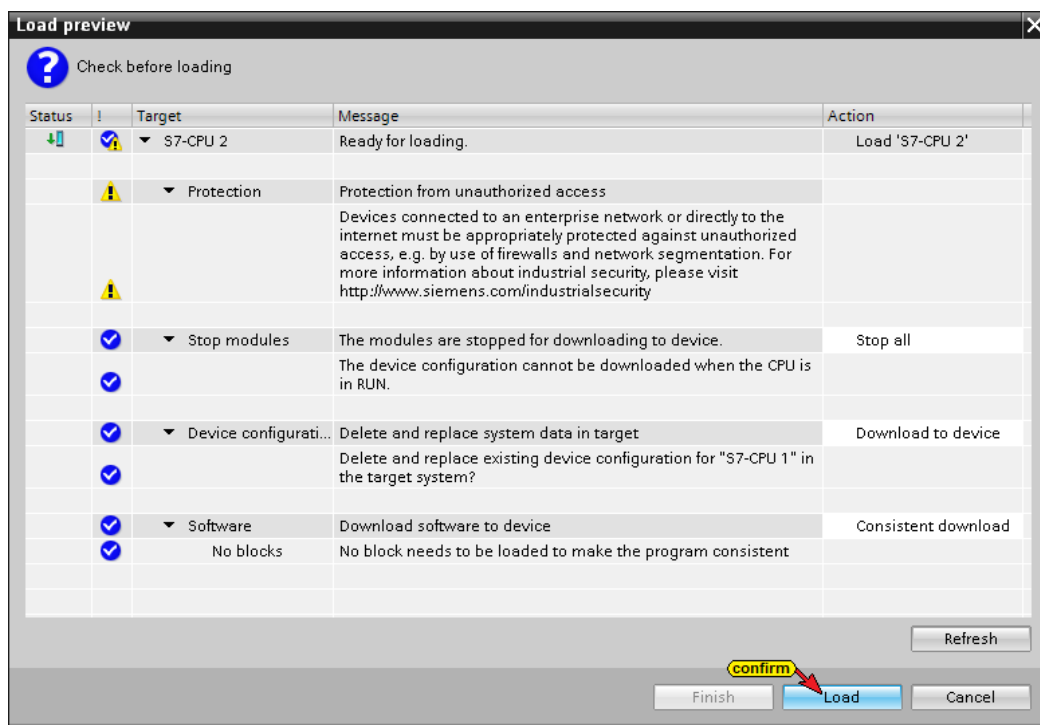
Extended download to device dialog box – Start search



Extended download to device dialog box – Load



A preview of the loading is displayed.



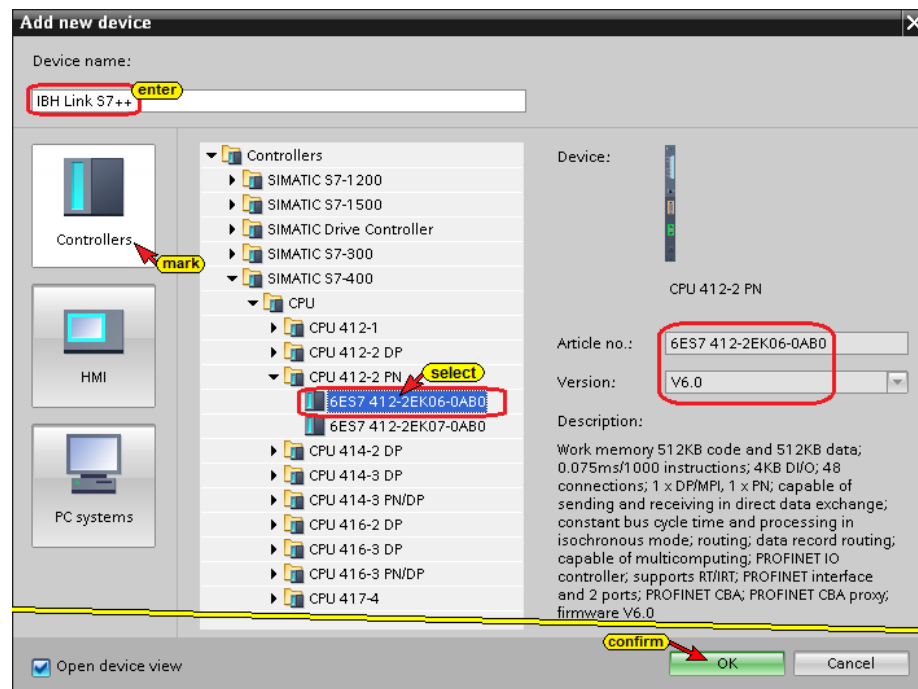
10.2 Insert IBHLink S7++ as CPU 412-2 PN into the project

The IBHLink S7++ is created in the TIA Portal as an S7-400 station and connected to the corresponding bus system (MPI or PROFIBUS).

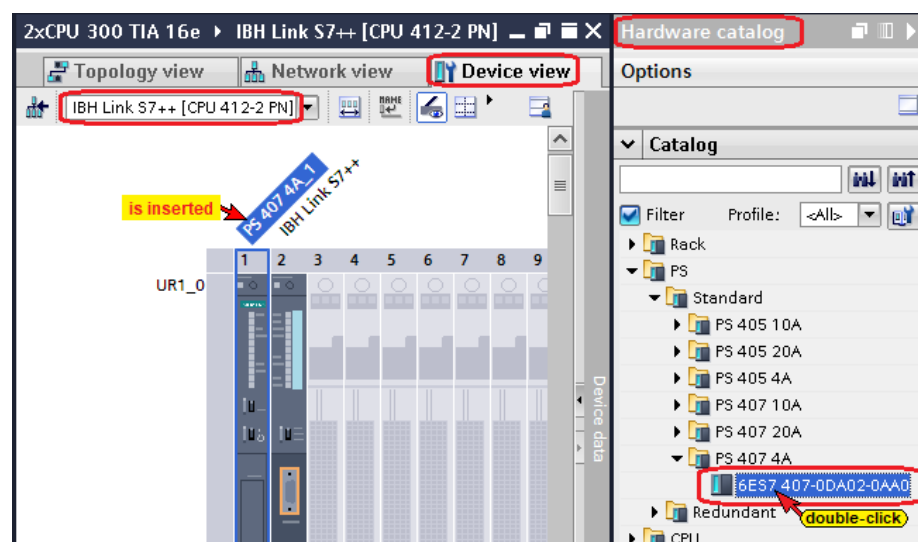
The following module must be used as a representative for the IBHLink S7 ++:

- **MLFB: 6ES7 412-2EK06-0AB0 V6.0 in rack 0, slot 2**

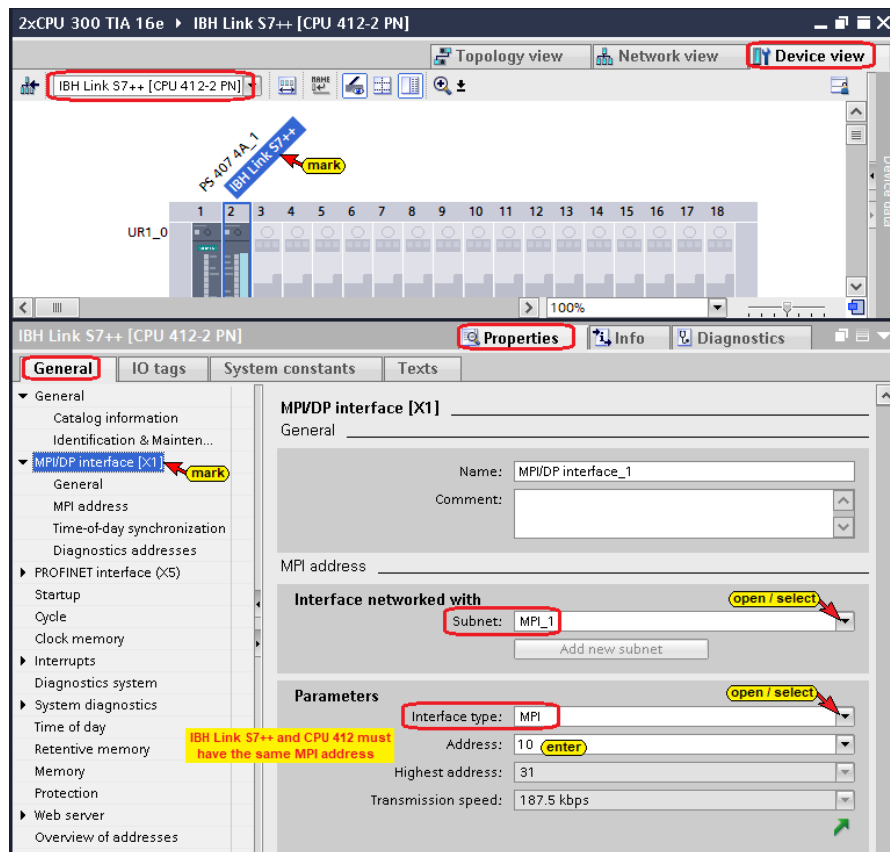
Double-click Add new device to select the CPU 412.



Insert power supply in IBHLink S7++

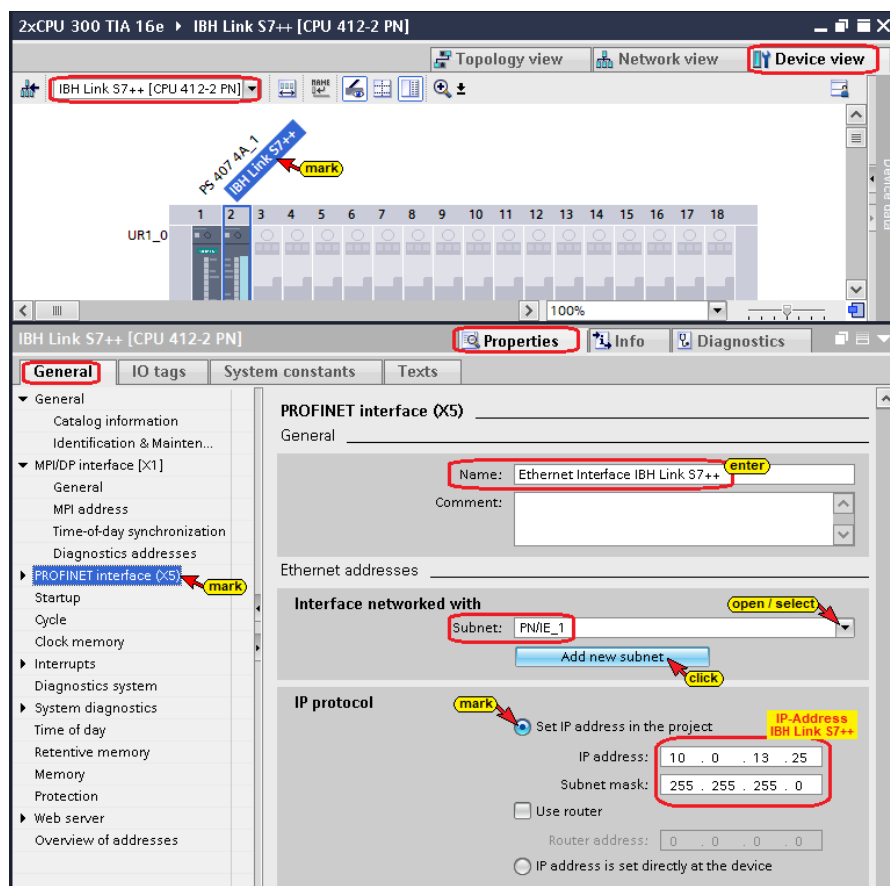


Define the MPI interface of the CPU 412 (MPI interface IBH Link S7 ++)

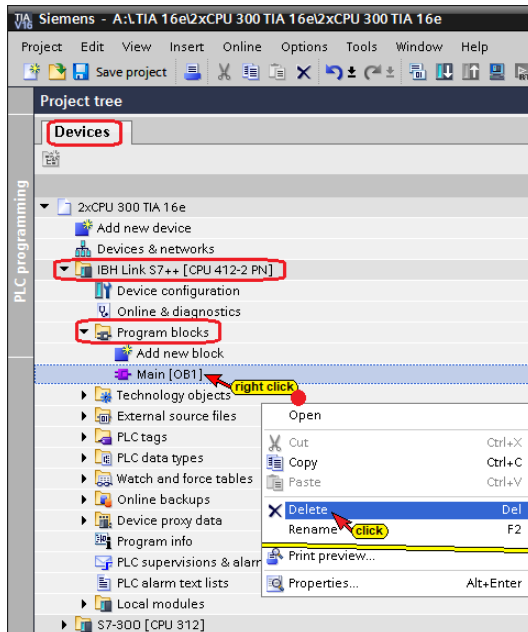


Define the Ethernet interface of the CPU 412

Ethernet connection IBH Link S7++ to IBH Link UA.



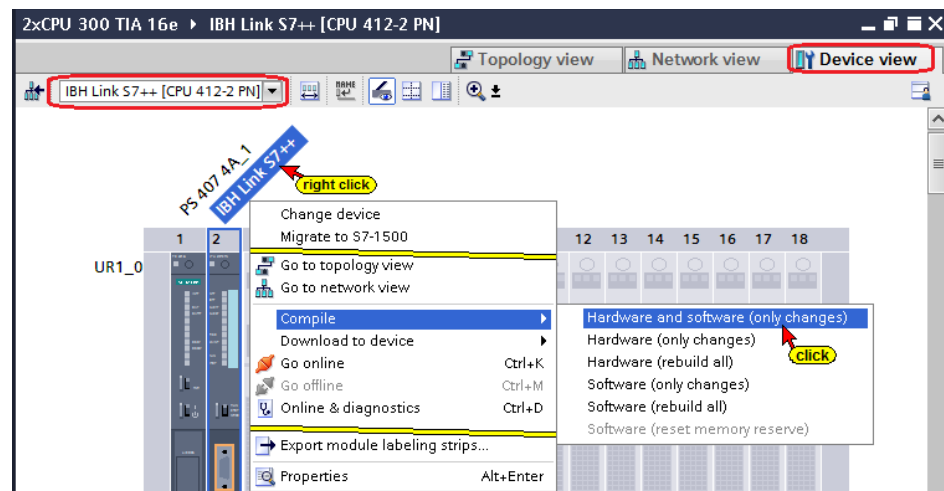
Delete blocks (IBH Link S7 ++ / CPU 412)



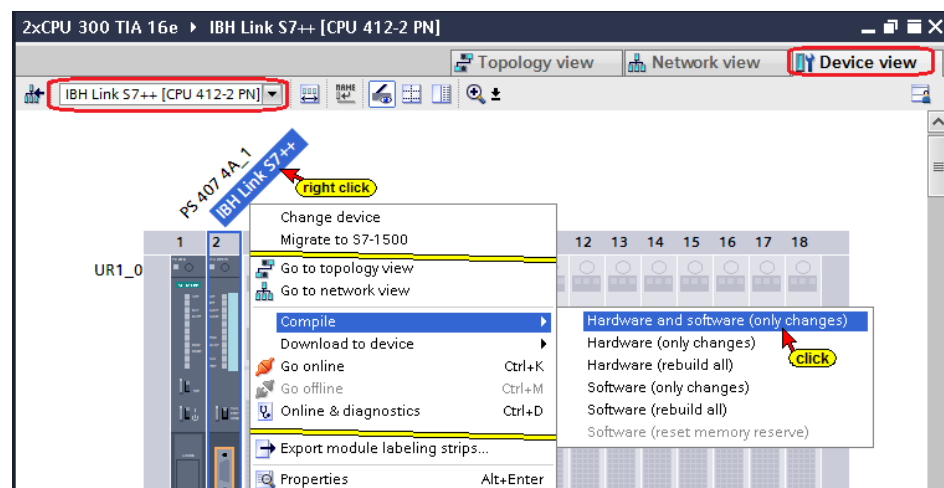
No blocks can be loaded into the **IBH Link S7++**. In the offline mode all PLC blocks of the **IBH Link S7++ / CPU 412** must be deleted.

Compile hardware and software (IBH Link S7 ++ / CPU 412)

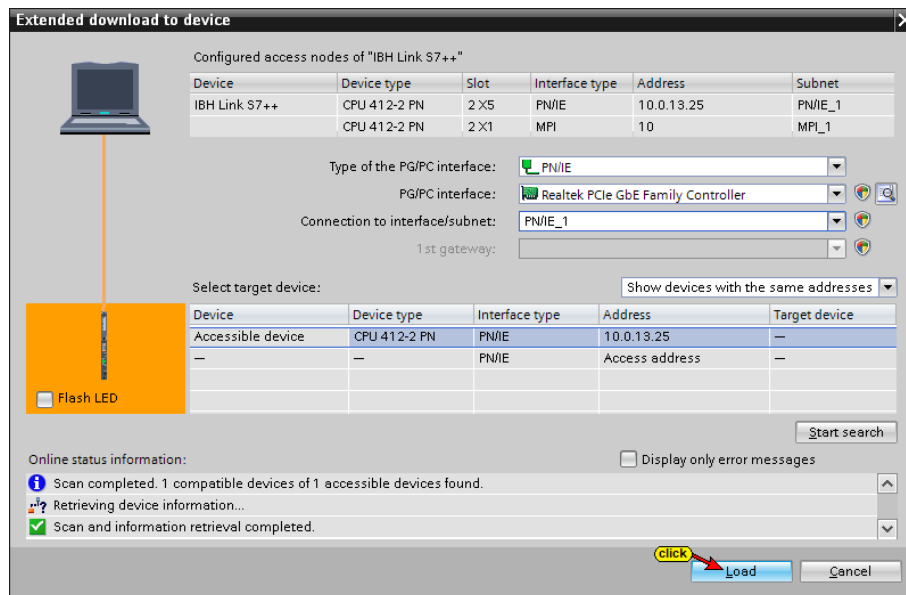
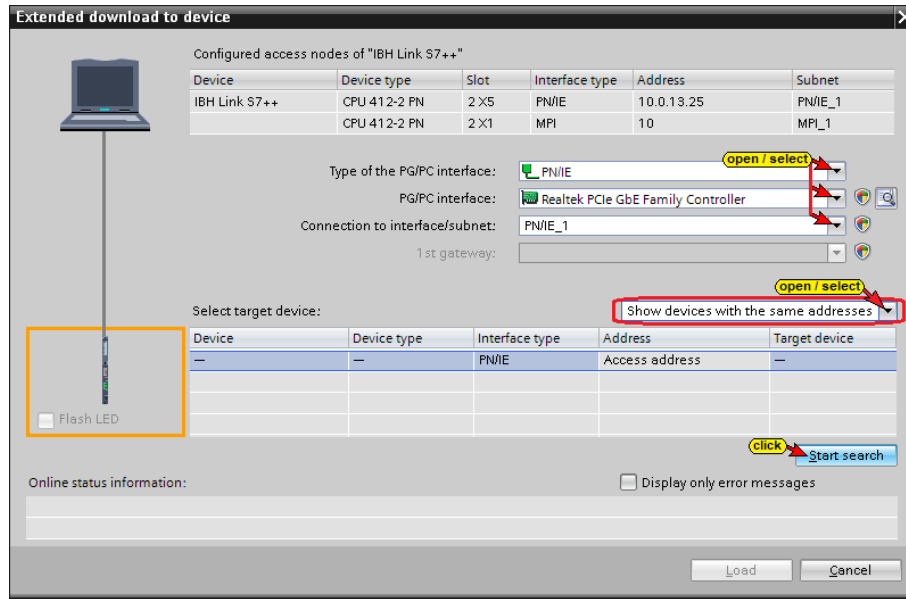
Before loading the hardware configuration and software into the device, these must be compiled.



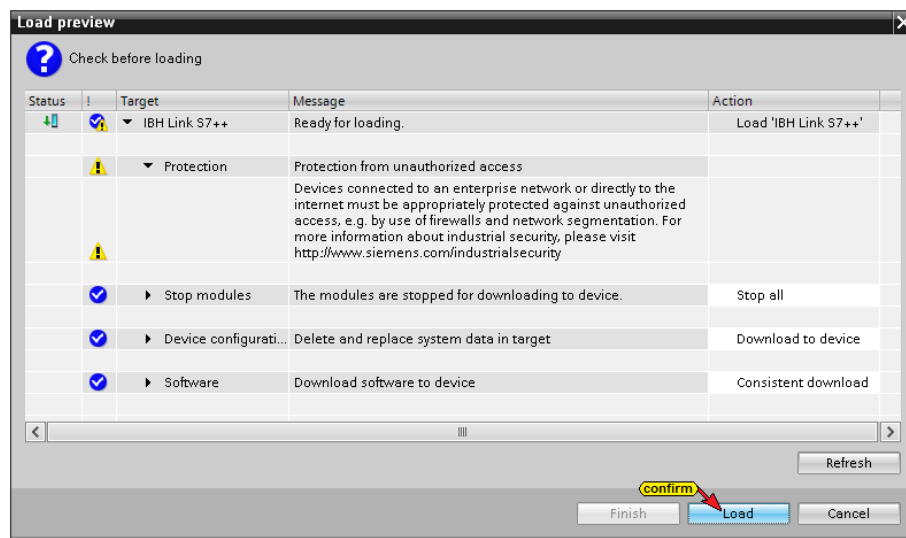
Load hardware into the device (IBH Link S7++ / CPU 412)



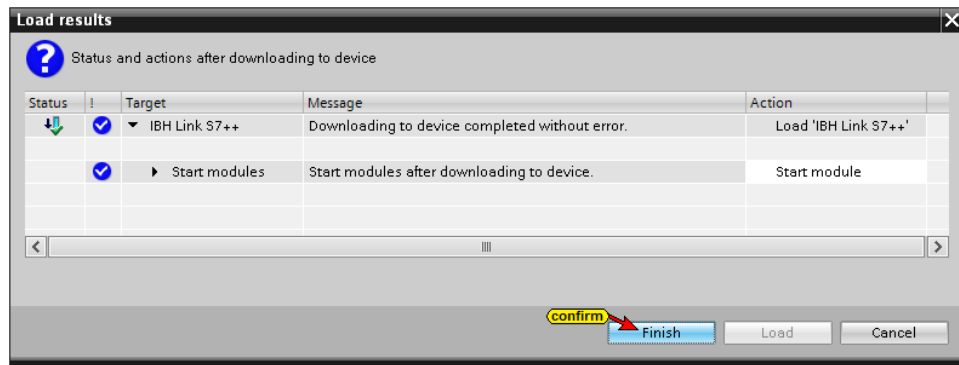
The loading process requires the following screen shots.



Several dialog boxes will open to indicate the following steps of loading.



The loading of the hardware configuration is completed.

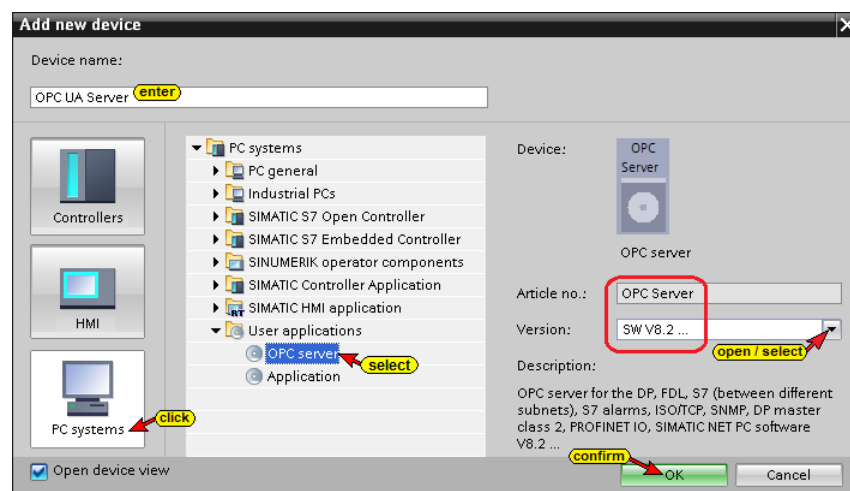


The stopped device (**IBH Link S7++**) is restarted after loading the hardware configuration.

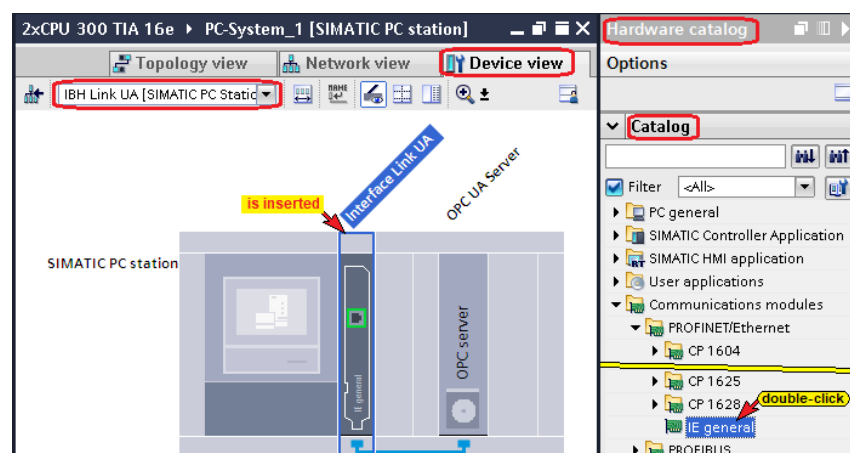
The successful loading of the hardware configuration into the **IBH Link S7++ (CPU 412-2 PN)** is displayed.

10.3 Insert IBH Link UA as an SIMATIC PC station

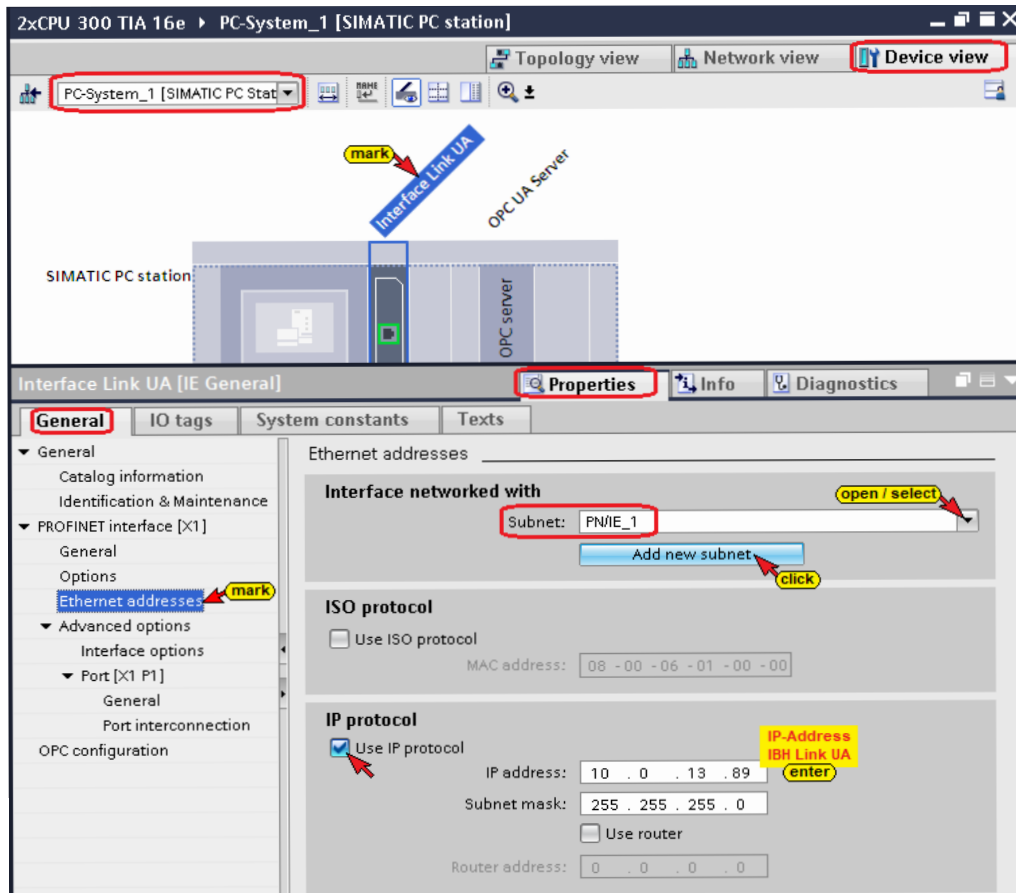
Double-click Add new device to select PC systems, User application, OPC server.



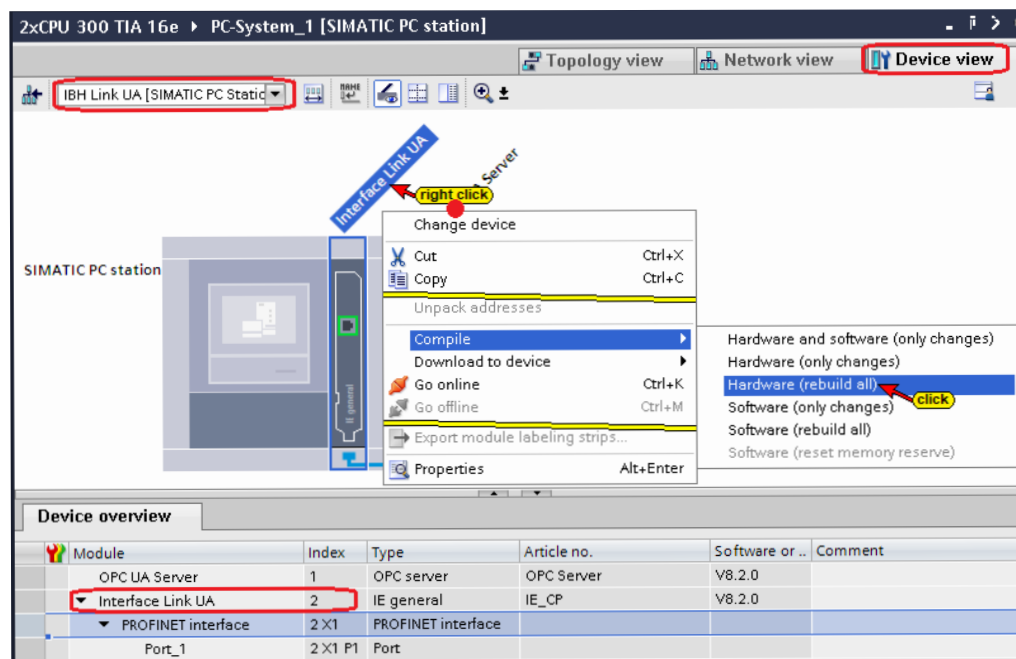
Insert communication module in the IBH Link UA



Define communication module properties



Compiling the hardware of the communication module



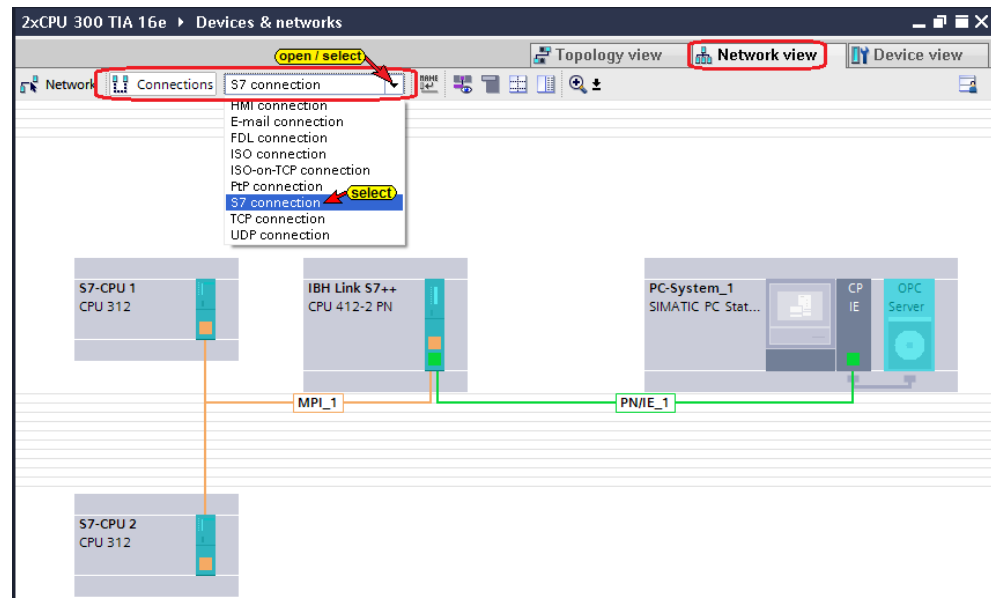
Note:



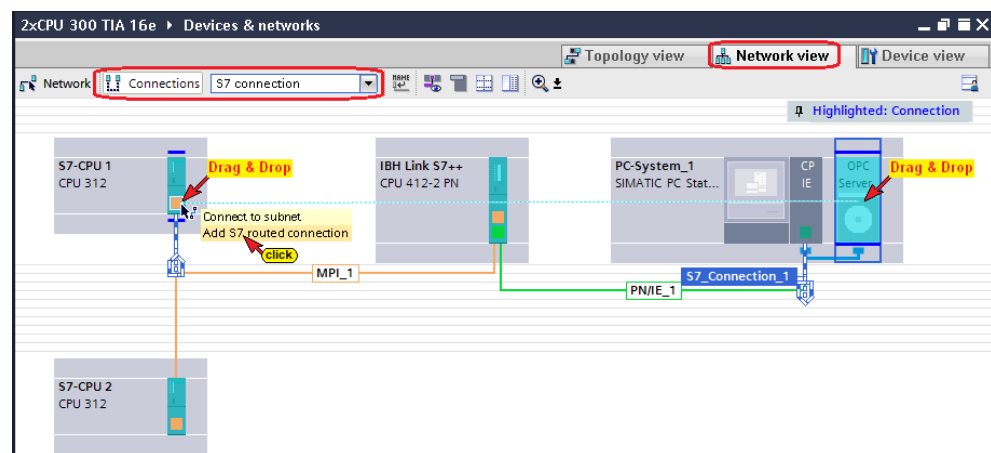
The communication module **must** be inserted in **Slot 2 / Index 2**.
The IBH Link UA expects the communication interface in **Slot 2 / Index 2**.

10.3.1 Establish an S7 connection from the OPC server to the S7-300 CPUs

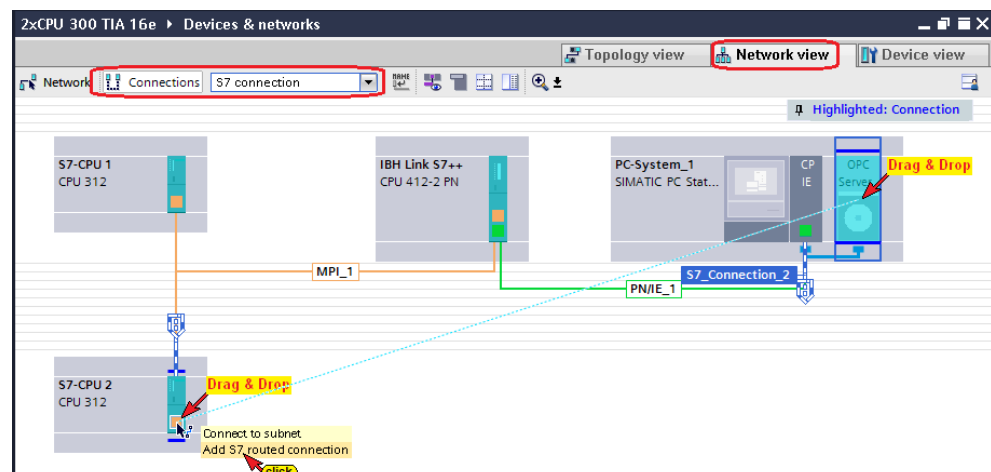
The S7 connection is established via the drag and drop from the OPC server to each of the CPUs 312.



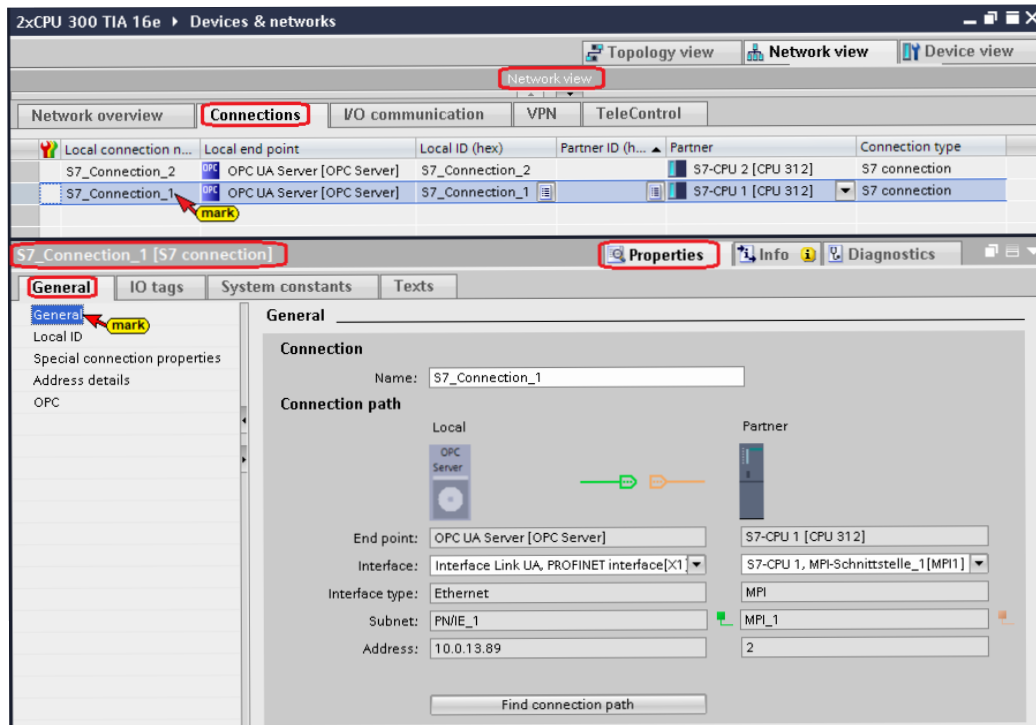
S7 connection S7-CPU 1



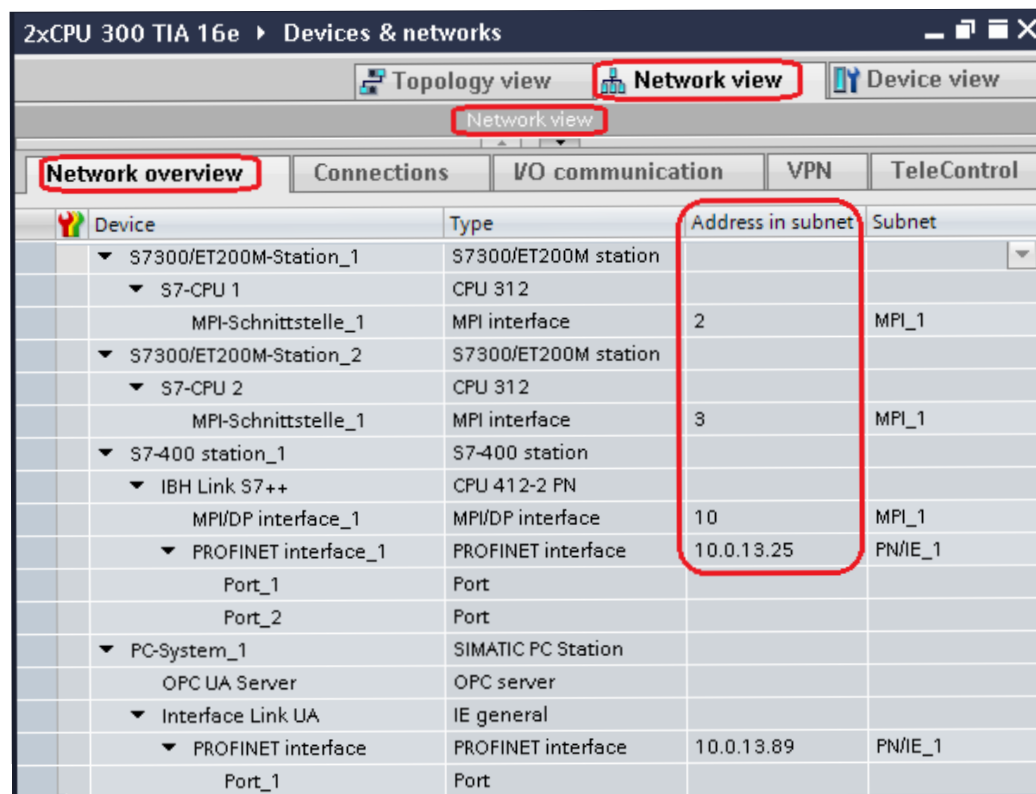
S7 connection S7-CPU 2



Network view – S7-CPU 1



Network overview



Select OPC symbols (tags) in the OPC configuration

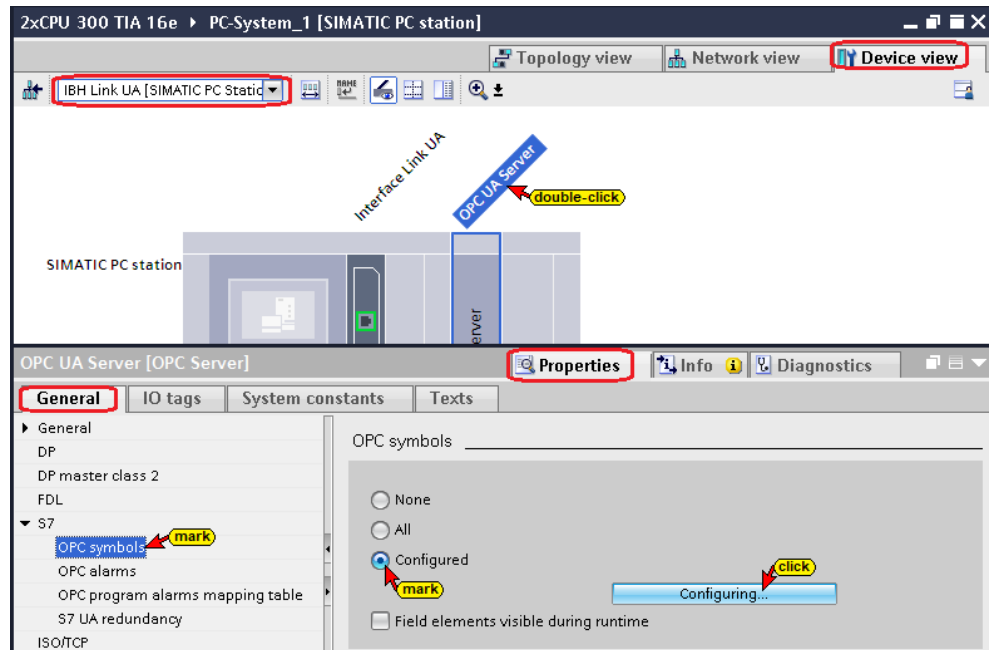
The **Configure** button opens the **Symbol configuration** dialog box.

Here the program block data can be defined as OPC tags:

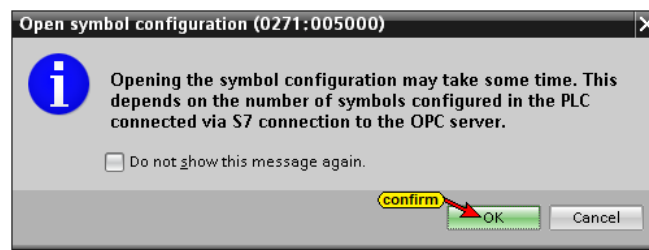
S7-CPU 1, CounterData [DB2], Data_from_CPU 2 [DB5]

S7-CPU 2, CounterData [DB2], Data_from_CPU 1 [DB5].

Open the configuration on the OPC server / properties.

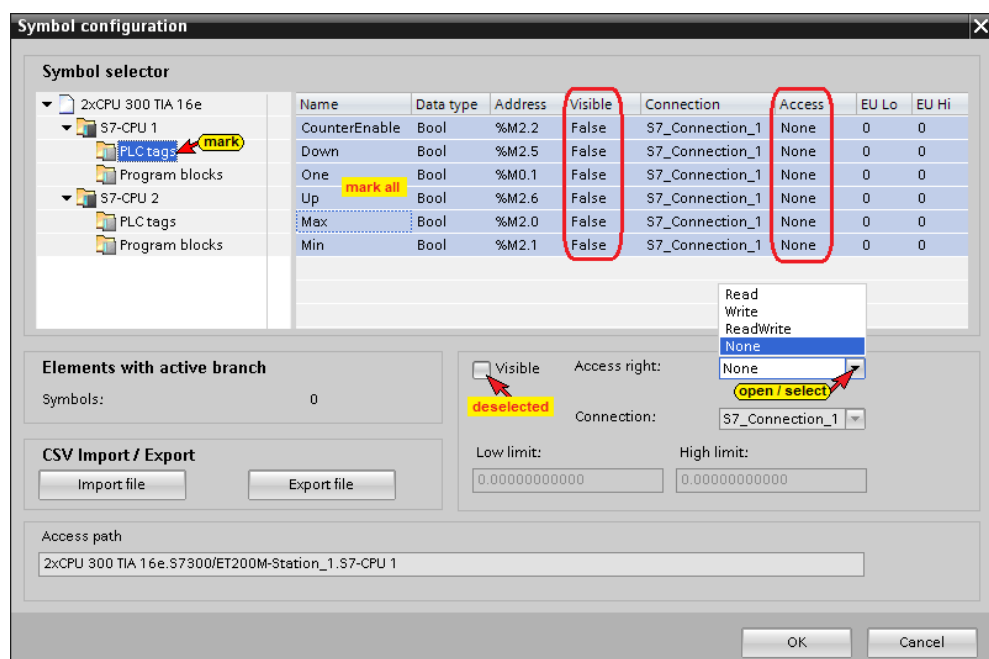


The TIA Portal issues a message because the information from the entire symbol table may be adopted.

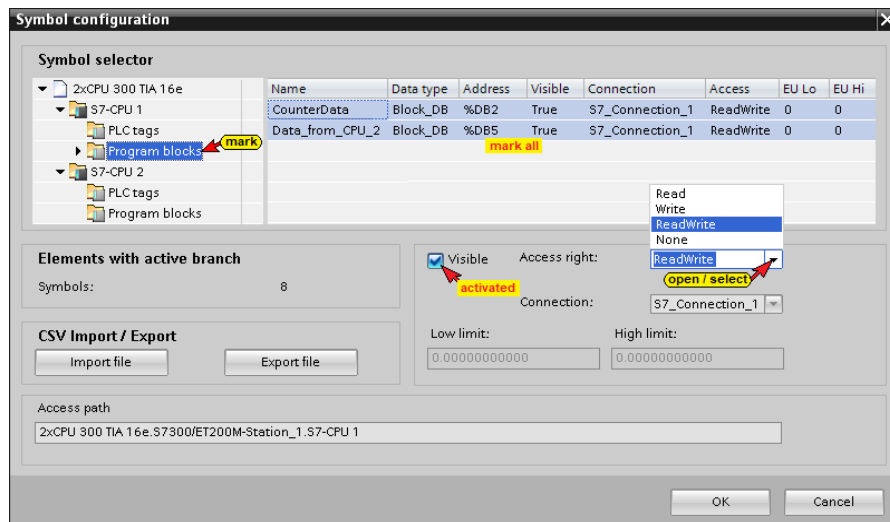


The read / write, etc. access rights can be assigned to the individual operands (OPC tags).

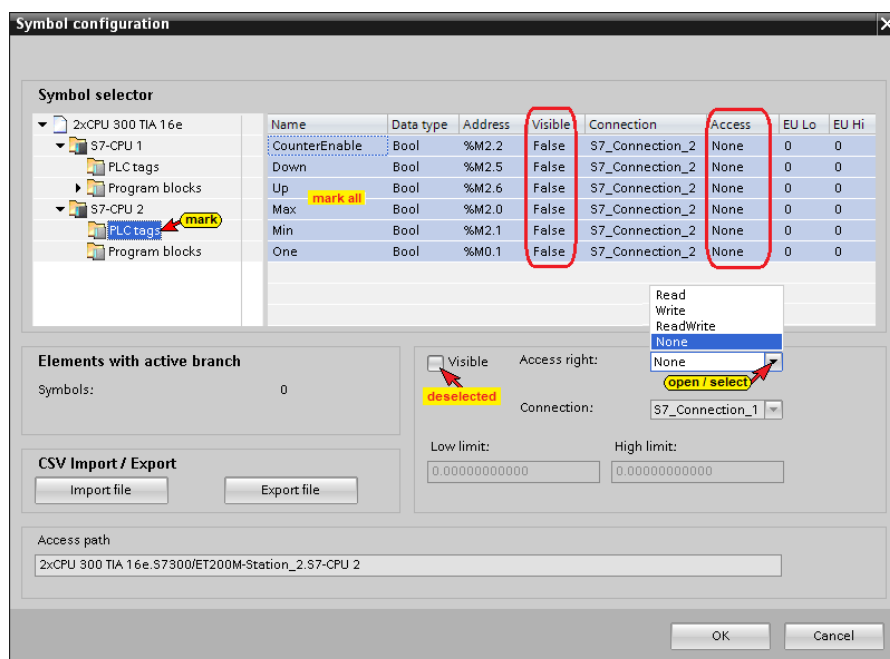
Deselcted tags – S7-CPU 1, Standard tag table



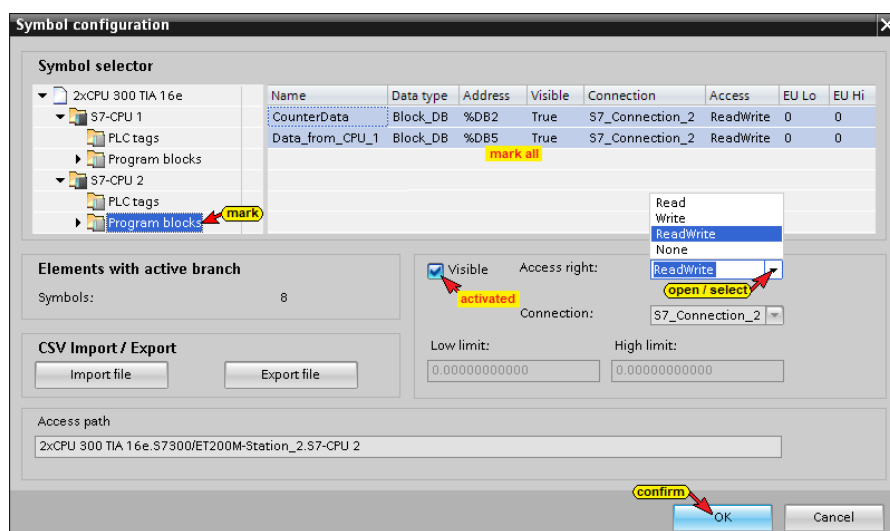
Selected tags – S7-CPU 1, Program blocks



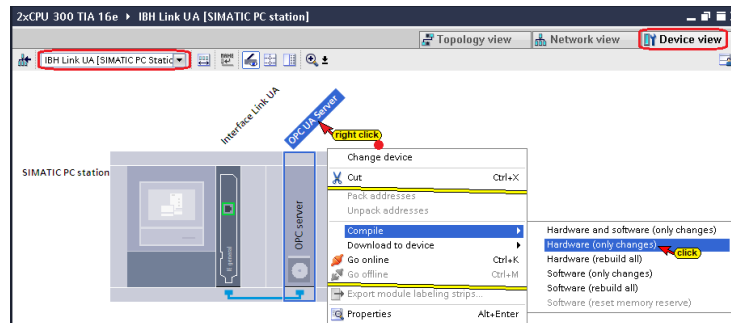
Deselected tags – S7-CPU 2, Standard tag table



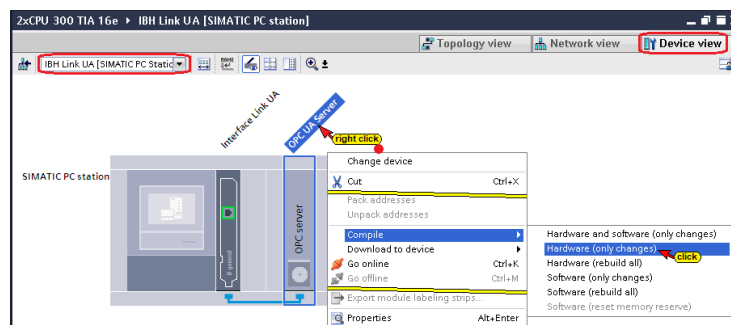
Selected tags – S7-CPU 2, Program blocks



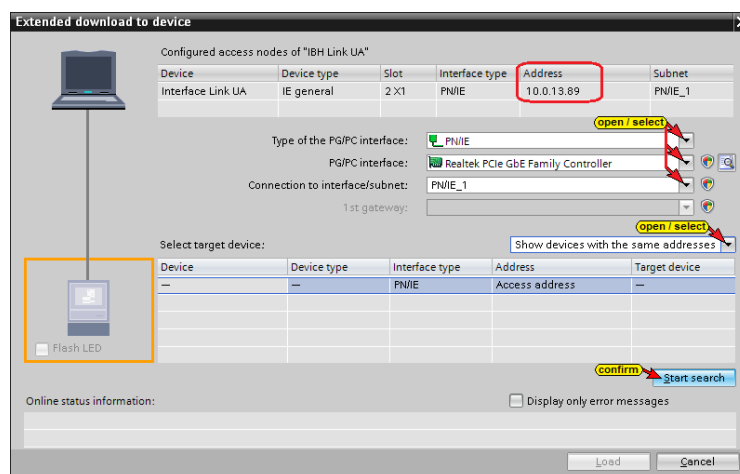
Compile the configuration of the OPC server



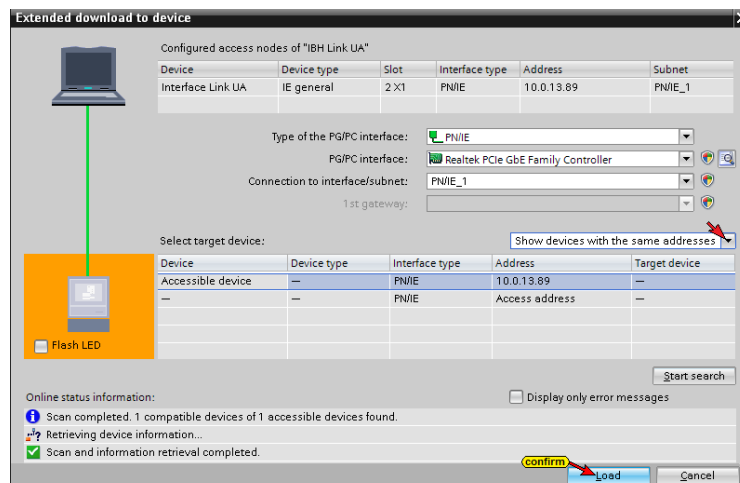
Load configuration of the OPC server into IBH Link UA



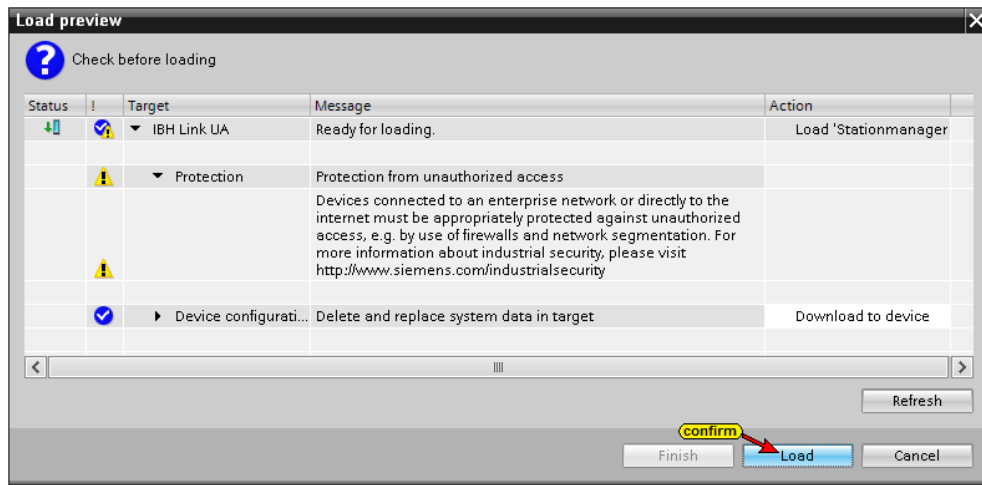
The settings are to be made according to the screen shots in the **Extended download to device** dialog box.



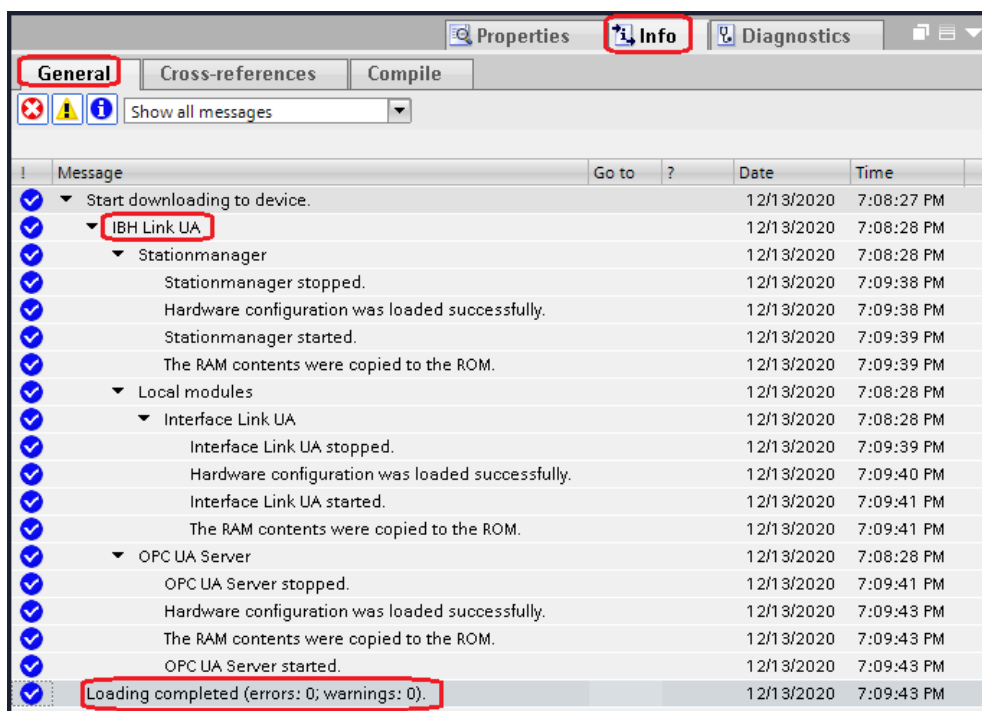
The interface search was successful.



A check is carried out prior loading.



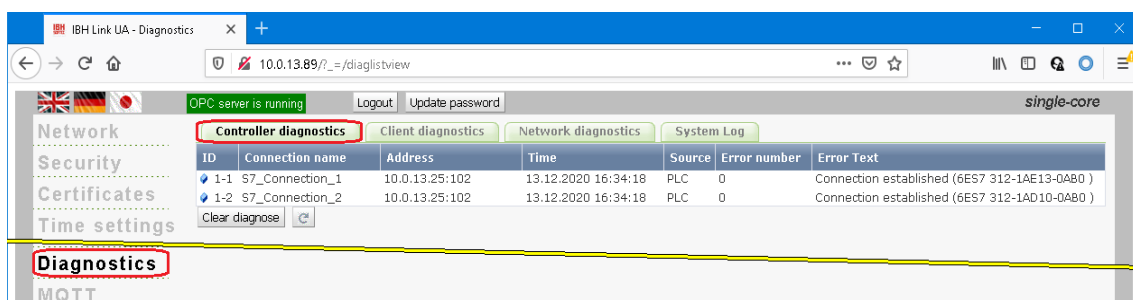
The steps of the successful loading process are displayed as info.



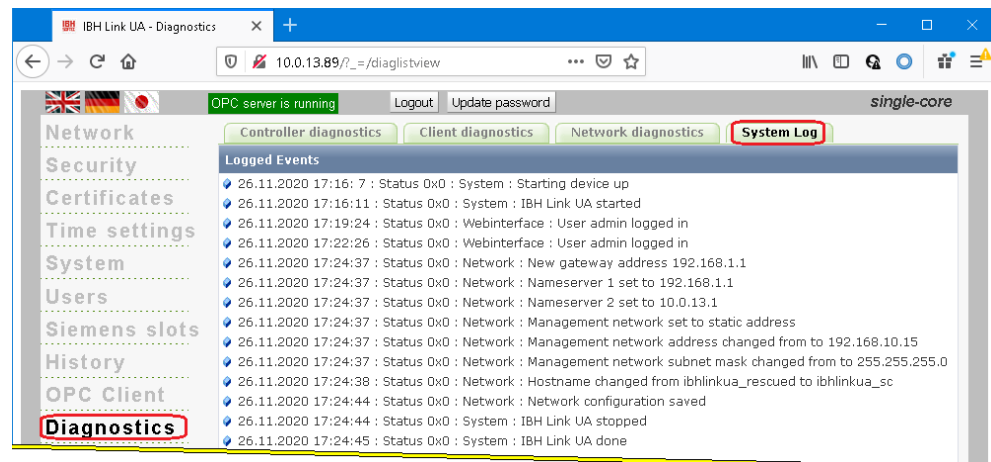
Successful loading is indicated in the **IBH Link UA**.

10.3.2 Browser window diagnosis / control diagnosis

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

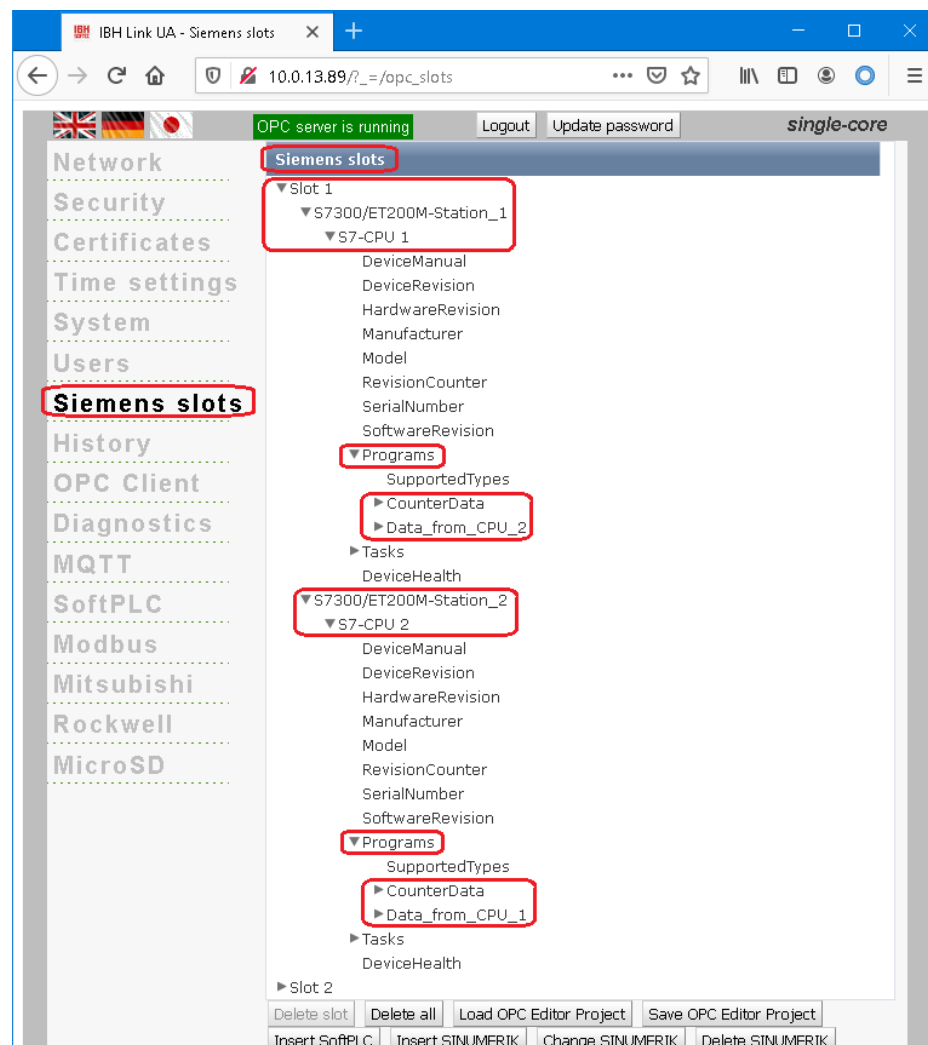


If no values are displayed in the **UaExpert – Data Access View** window or error messages are displayed, the IBH Link UA diagnosis window provides information as to whether the connection to the PLC exists.



10.3.3 IBH Link UA browser window Siemens slots.

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

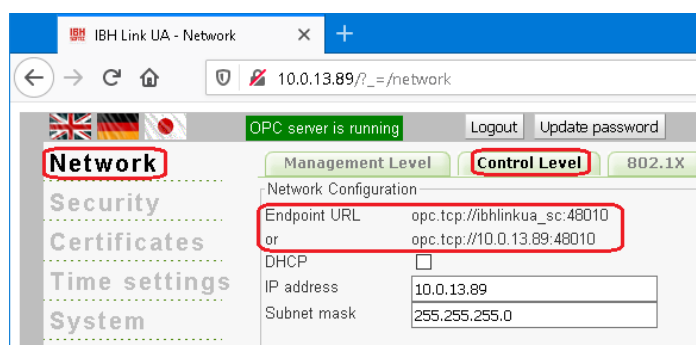


10.4 Define the OPC UA server for the data exchange

For data exchange between the PLC's (**S7-CPU 1** and **S7-CPU 2**) the **IBH Link UA** provides the **OPC UA server** for the data exchange. The OPC server lists the OPC tags that are defined in the PLC's (**S7-CPU 1** and **S7-CPU 2**).

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

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:

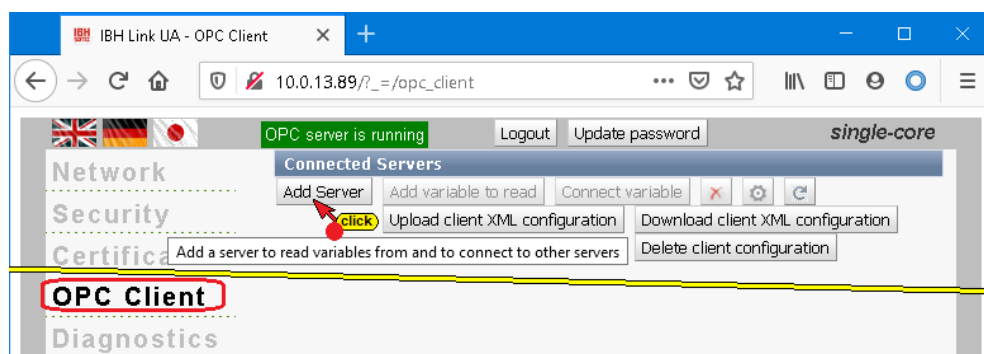
opc.tcp: // ibhlinkua_sc: 48010

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

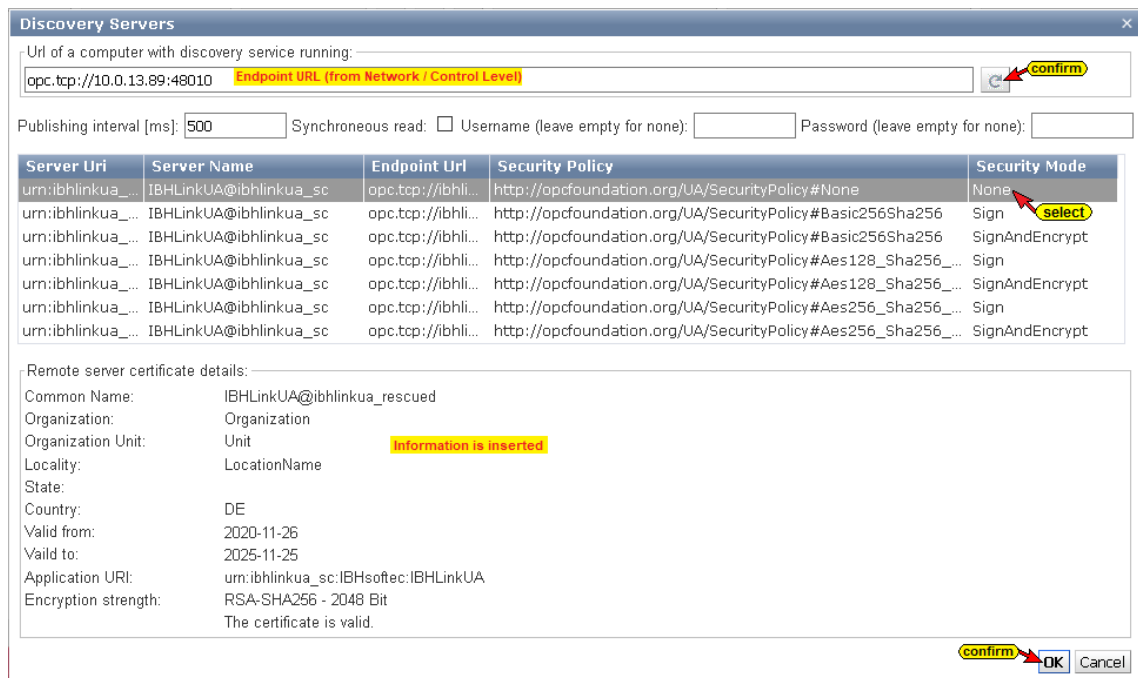
The endpoint URL can be copied into the IBH Link UA web browser window / network / control level.

Add server

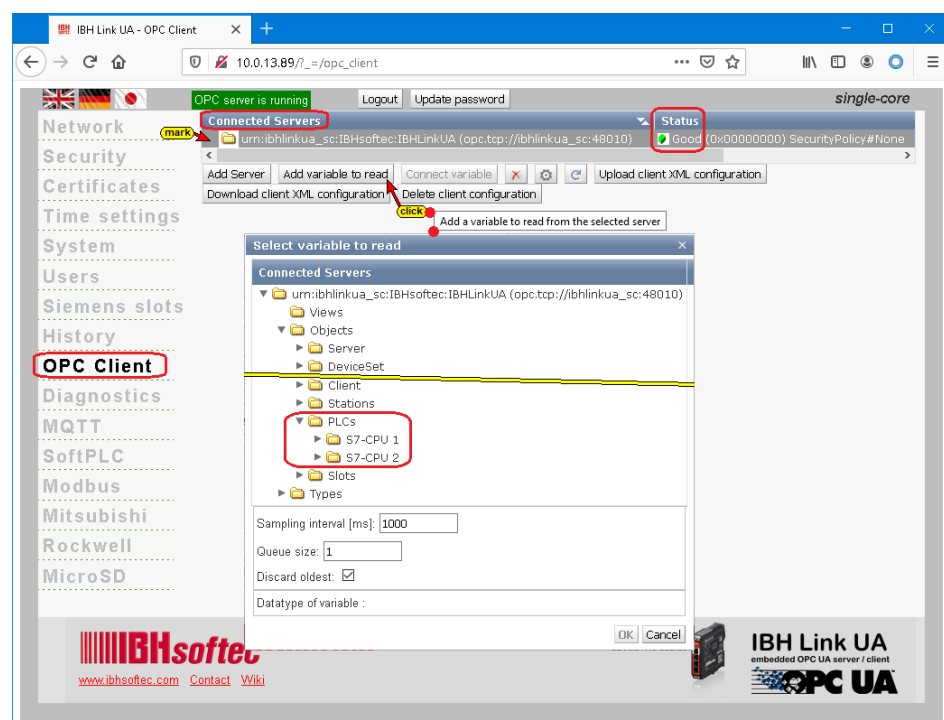


The copied endpoint URL **opc.tcp: // ibhlinkua_sc: 48010** or **opc.tcp: //10.0.13.89: 48010** is in the open field in the IBH Link UA web browser window / OPC client is to be added as a server.

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



The IBH Link UA OPC UA server is connected. The status of the server is good.



10.4.1 Add read variable

The tags from the **S7-CPU 1, CounterData [DB2]** and tags from the **S7-CPU 2, CounterData [DB2]** that the OPC UA server makes available are declared as read variables. The **OPC UA client** in the **IBH Link UA** reads this data.

S7-CPU 1 / S7-CPU 2, CounterData [DB2] tags

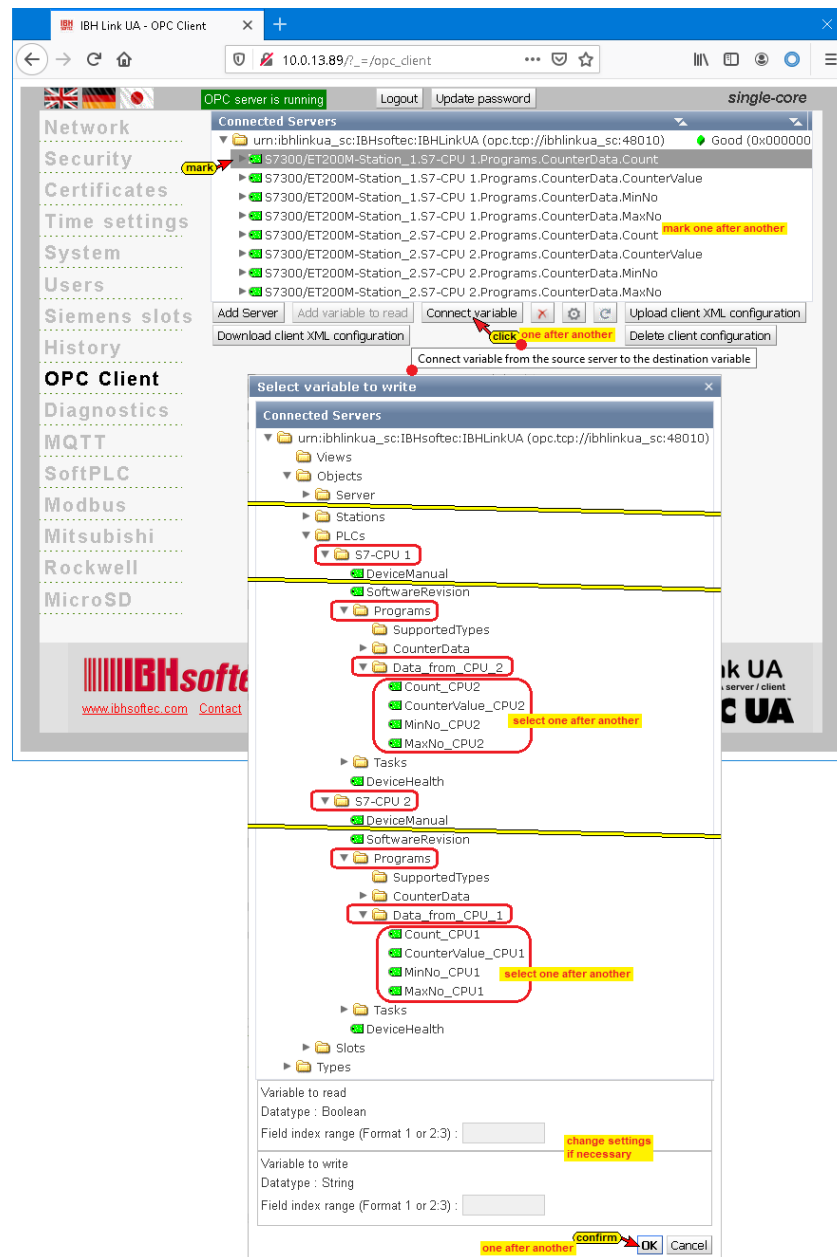


These tags are sent via the OPC server to the data blocks **Data_from_CPU 1 [DB5]** and **Data_from_CPU 2 [DB5]**, in the CPU's **S7-CPU 2** and **S7-CPU 1**.

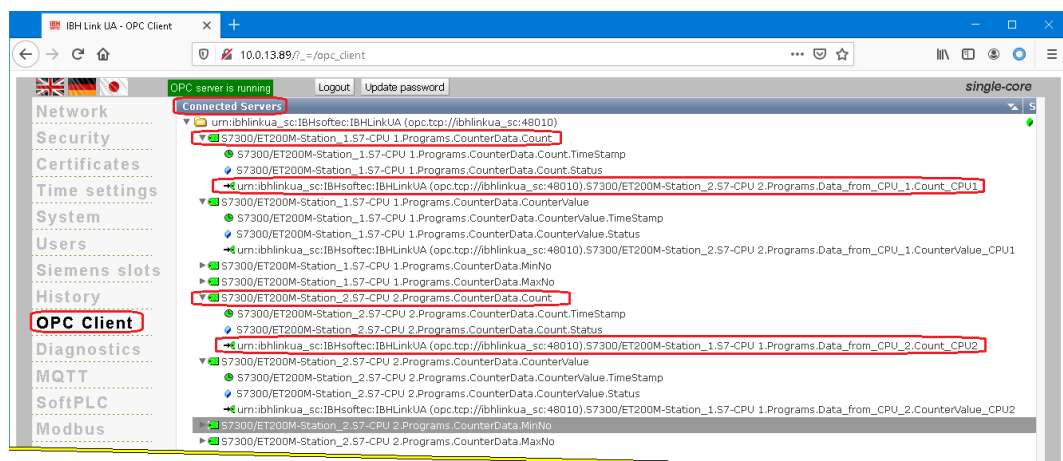
Connect with variables

The tags, which have been declared as read variables, are connected to the IBH Link UA OPC server, selected to be connected.

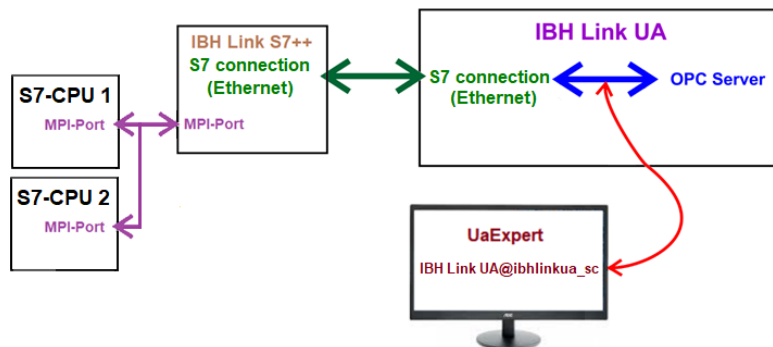
OPC tags from the data blocks **Data_from_CPU 1 [DB5]** and **Data_from_CPU 2 [DB5]**.



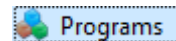
The connections are displayed in the IBH Link UA web browser window OPC Client.



10.5 UaExpert - program window



The **S7-CPU 1** and **S7-CPU 2** are displayed in the UaExpert program window. The variables of the data blocks **CounterData [DB2]** and **Data_from_CPU_2 [DB5] / Data_from_CPU_1 [DB5]** were defined as OPC tags are listed under **Programs**.



These can be dragged and dropped into the **Data Access View**.

#	Server	Node Id	Display Name	Value	Datatype	Source Timestamp	Server Timestamp	Statuscode
1	IBHLinkUA@ib...	NS4(String)S730...	Count	true	Boolean	16:33:39.574	16:33:39.673	Good
2	IBHLinkUA@ib...	NS4(String)S730...	CounterValue	4817	Int16	16:36:40.006	16:36:40.255	Good
3	IBHLinkUA@ib...	NS4(String)S730...	MaxNo	8000	Int16	16:33:43.575	16:33:43.927	Good
4	IBHLinkUA@ib...	NS4(String)S730...	MinNo	50	Int16	16:34:57.975	16:34:58.209	Good
5	IBHLinkUA@ib...	NS4(String)S730...	Count_CPU2	true	Boolean	16:33:48.016	16:33:50.930	Good
6	IBHLinkUA@ib...	NS4(String)S730...	CounterValue_CPU2	763	Int16	16:36:39.734	16:36:39.756	Good
7	IBHLinkUA@ib...	NS4(String)S730...	MaxNo_CPU2	9000	Int16	16:34:39.031	16:34:39.201	Good
8	IBHLinkUA@ib...	NS4(String)S730...	MinNo_CPU2	100	Int16	16:33:59.830	16:34:00.435	Good
9	IBHLinkUA@ib...	NS4(String)S730...	Count	true	Boolean	16:34:12.415	16:34:12.441	Good
10	IBHLinkUA@ib...	NS4(String)S730...	CounterValue	1871	Int16	16:36:40.006	16:36:40.255	Good
11	IBHLinkUA@ib...	NS4(String)S730...	MaxNo	9000	Int16	16:34:38.430	16:34:38.451	Good
12	IBHLinkUA@ib...	NS4(String)S730...	MinNo	100	Int16	16:34:17.874	16:34:17.942	Good
13	IBHLinkUA@ib...	NS4(String)S730...	Count_CPU1	true	Boolean	16:34:23.663	16:34:24.194	Good
14	IBHLinkUA@ib...	NS4(String)S730...	CounterValue_CPU1	3751	Int16	16:36:39.734	16:36:39.756	Good
15	IBHLinkUA@ib...	NS4(String)S730...	MaxNo_CPU1	8000	Int16	16:34:26.168	16:34:26.696	Good
16	IBHLinkUA@ib...	NS4(String)S730...	MinNo_CPU1	50	Int16	16:34:59.062	16:34:59.209	Good

Display Name	Value	Datatype	Source Timestamp
Count	true	Boolean	16:33:39.574
CounterValue	1201	Int16	16:55:30.810
MaxNo	8000	Int16	16:33:43.575
MinNo	50	Int16	16:34:57.975
Count_CPU2	true	Boolean	16:33:48.016
CounterValue_CPU2	1990	Int16	16:55:30.120
MaxNo_CPU2	9000	Int16	16:34:39.031
MinNo_CPU2	100	Int16	16:33:59.830
Count	true	Boolean	16:34:12.415
CounterValue	955	Int16	16:55:30.810
MaxNo	9000	Int16	16:34:38.430
MinNo	100	Int16	16:34:17.874
Count_CPU1	true	Boolean	16:34:23.663
CounterValue_CPU1	1574	Int16	16:55:30.120
MaxNo_CPU1	8000	Int16	16:34:26.168
MinNo_CPU1	50	Int16	16:34:59.062

If the PLC counting program is processed, the changes are displayed. With a double-click on the value of a variable its value can be modified.

Data Access View			
#	Server	Node Id	Display Name
1	IBHLinkUA@ibhlinkua_sc	NS4[String]S7300/ET200M-Station_1.S7-CPU 1.Programs.CounterData.Count	Count
2	IBHLinkUA@ibhlinkua_sc	NS4[String]S7300/ET200M-Station_1.S7-CPU 1.Programs.CounterData.CounterValue	CounterValue
3	IBHLinkUA@ibhlinkua_sc	NS4[String]S7300/ET200M-Station_1.S7-CPU 1.Programs.CounterData.MaxNo	MaxNo
4	IBHLinkUA@ibhlinkua_sc	NS4[String]S7300/ET200M-Station_1.S7-CPU 1.Programs.CounterData.MinNo	MinNo
5	IBHLinkUA@ibhlinkua_sc	NS4[String]S7300/ET200M-Station_1.S7-CPU 1.Programs.Data_from_CPU_2.Count_CPU2	Count_CPU2
6	IBHLinkUA@ibhlinkua_sc	NS4[String]S7300/ET200M-Station_1.S7-CPU 1.Programs.Data_from_CPU_2.CounterValue_CPU2	CounterValue_CPU2
7	IBHLinkUA@ibhlinkua_sc	NS4[String]S7300/ET200M-Station_1.S7-CPU 1.Programs.Data_from_CPU_2.MaxNo_CPU2	MaxNo_CPU2
8	IBHLinkUA@ibhlinkua_sc	NS4[String]S7300/ET200M-Station_1.S7-CPU 1.Programs.Data_from_CPU_2.MinNo_CPU2	MinNo_CPU2
9	IBHLinkUA@ibhlinkua_sc	NS4[String]S7300/ET200M-Station_2.S7-CPU 2.Programs.CounterData.Count	Count
10	IBHLinkUA@ibhlinkua_sc	NS4[String]S7300/ET200M-Station_2.S7-CPU 2.Programs.CounterData.CounterValue	CounterValue
11	IBHLinkUA@ibhlinkua_sc	NS4[String]S7300/ET200M-Station_2.S7-CPU 2.Programs.CounterData.MaxNo	MaxNo
12	IBHLinkUA@ibhlinkua_sc	NS4[String]S7300/ET200M-Station_2.S7-CPU 2.Programs.CounterData.MinNo	MinNo
13	IBHLinkUA@ibhlinkua_sc	NS4[String]S7300/ET200M-Station_2.S7-CPU 2.Programs.Data_from_CPU_1.Count_CPU1	Count_CPU1
14	IBHLinkUA@ibhlinkua_sc	NS4[String]S7300/ET200M-Station_2.S7-CPU 2.Programs.Data_from_CPU_1.CounterValue_CPU1	CounterValue_CPU1
15	IBHLinkUA@ibhlinkua_sc	NS4[String]S7300/ET200M-Station_2.S7-CPU 2.Programs.Data_from_CPU_1.MaxNo_CPU1	MaxNo_CPU1
16	IBHLinkUA@ibhlinkua_sc	NS4[String]S7300/ET200M-Station_2.S7-CPU 2.Programs.Data_from_CPU_1.MinNo_CPU1	MinNo_CPU1

Data Access View						
#	Display Name	Value	Datatype	Source Timestamp	Server Timestamp	Statuscode
1	Count	true	Boolean	16:33:39.574	16:33:39.673	Good
2	CounterValue	2584	Int16	17:43:52.650	17:43:52.899	Good
3	MaxNo	8000	Int16	16:33:43.575	16:33:43.927	Good
4	MinNo	50	Int16	16:34:57.975	16:34:58.209	Good
5	Count_CPU2	true	Boolean	16:33:48.016	16:33:50.930	Good
6	CounterValue_CPU2	2026	Int16	17:43:52.456	17:43:52.650	Good
7	MaxNo_CPU2	9000	Int16	16:34:39.031	16:34:39.201	Good
8	MinNo_CPU2	100	Int16	16:33:59.830	16:34:00.435	Good
9	Count	true	Boolean	16:34:12.415	16:34:12.441	Good
10	CounterValue	3129	Int16	17:43:52.650	17:43:52.899	Good
11	MaxNo	9000	Int16	16:34:38.430	16:34:38.451	Good
12	MinNo	100	Int16	16:34:17.874	16:34:17.942	Good
13	Count_CPU1	true	Boolean	16:34:23.663	16:34:24.194	Good
14	CounterValue_CPU1	4135	Int16	17:43:52.456	17:43:52.650	Good
15	MaxNo_CPU1	8000	Int16	16:34:26.168	16:34:26.696	Good
16	MinNo_CPU1	50	Int16	16:34:59.062	16:34:59.209	Good

10.5.1 Status data blocks S7-CPU 1 and S7-CPU 2

In the program of the CPUs, the OPC-tags are displayed in the data blocks.

S7-CPU 1 data block CounterData [DB2]

2xCPU 300 TIA 16e > S7-CPU 1 [CPU 312] > Program blocks > CounterData [DB2]						
CounterData						
	Name	Data type	Offset	Start value	Monitor value	Comment
1	Static					
2	Count		0.0	0	TRUE	Counter is counting
3	CounterValue		2.0	0	4956	Counter Value
4	MinNo		4.0	100	50	minimum counter reading (number)
5	MaxNo		6.0	10000	8000	maximum counter reading (number)

S7-CPU 1 data block Data_from_CPU_2 [DB5]

2xCPU 300 TIA 16e > S7-CPU 1 [CPU 312] > Program blocks > Data_from_CPU_2 [DB5]						
Data_from_CPU_2						
	Name	Data type	Offset	Start value	Monitor value	Comment
1	Static					
2	Count_CPU2	Bool	0.0	0	TRUE	Counter is counting from CPU2
3	CounterValue_CPU2	Int	2.0	0	8068	Counter Value from CPU2
4	MinNo_CPU2	Int	4.0	100	100	minimum counter reading (number) from CPU2
5	MaxNo_CPU2	Int	6.0	10000	9000	maximum counter reading (number) from CPU2

S7-CPU 2 data block CounterData [DB2]

2xCPU 300 TIA 16e ▶ S7-CPU 2 [CPU 312] ▶ Program blocks ▶ CounterData [DB2]

Keep actual values Snapshot Copy snapshots to start values

CounterData

Name	Data type	Offset	Start value	Monitor value	Comment
1 Static					
2 Count	Bool	0.0	0	TRUE	Counter is counting
3 CounterValue	Int	2.0	0	735	Counter Value
4 MinNo	Int	4.0	100	100	minimum counter reading (number)
5 MaxNo	Int	6.0	10000	9000	maximum counter reading (number)

S7-CPU 2 data block Data_from_CPU_1 [DB5]

2xCPU 300 TIA 16e ▶ S7-CPU 2 [CPU 312] ▶ Program blocks ▶ Data_from_CPU_1 [DB5]

Keep actual values Snapshot Copy snapshots to start values

Data_from_CPU_1

Name	Data type	Offset	Start value	Monitor value	Comment
1 Static					
2 Count_CPU1	Bool	0.0	0	TRUE	Counter is counting from CPU1
3 CounterValue_CPU1	Int	2.0	0	189	Counter Value from CPU1
4 MinNo_CPU1	Int	4.0	100	50	minimum counter reading (number) from CPU1
5 MaxNo_CPU1	Int	6.0	10000	8000	maximum counter reading (number) from CPU1

10.5.2 IBH Link S7 ++ web server

The IBH Link S7 ++ web server offers further diagnostic options.

The IP address (http://10.0.13.25) opens the web browser window.

IBHsoftec IBHLink S7++

Home | Configuration | Diagnostics | Change Password

IBHLink S7++ configuration

nt/Beerfelden | Tel.: +49 6068 3001 | Fax: +49 6068 3074 | info@ibhsoftec.com

Authentication Required - Mozilla Firefox

http://10.0.13.25 is requesting your username and password. The site says: "IBHLink S7++"

User Name: admin enter

Password: admin confirm

OK Cancel

The Configuration page is opened with **User Name** and **Password**.

IBH Link S7 ++ change Password

IBHsoftec IBHLink S7++

Home | Configuration | Diagnostics | Change Password

Username admin

Password ***** enter

Repeat password ***** enter

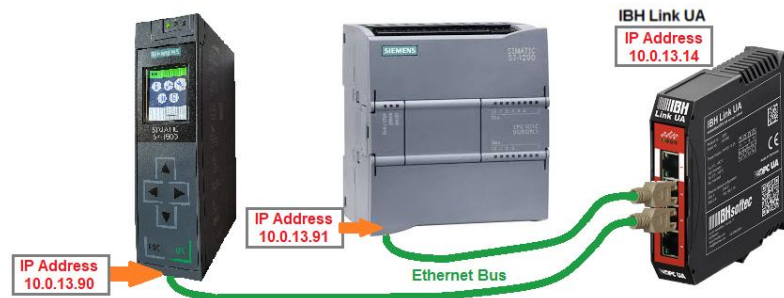
Save confirm

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

For more safety in the Network change the Password.

11 IBH Link UA – Data exchange between a CPU 1500 and a CPU 1200

The following example shows the creation of a project with the connection of a CPU 1500 to a CPU 1200 via **IBH Link UA**.



11.1 Example with STEP 7 - TIA Portal

The following example shows the creation of a project with the **STEP 7 – TIA Portal** with the connection of the CPU 1500, the CPU 1200 and the IBH Link UA using an Ethernet connection.

The CPU 1500 and the CPU 1200 contain programs that count to a value until **MaxValue** is reached. Then the value is counted down until **MinValue** is reached. This is repeated continuously. The numerical values for **MaxValue**, **MinValue**, the current Value and whether counting (**CounterON**) is exchanged by the two CPUs.

IP addresses of the devices used

Device	IP address
IBH Link UA [Control Level]	10.0.13.89
CPU 1511-1 PN	10.0.13.90
CPU 1211C DC/DC/DC	10.0.13.91

Based on the MAC address printed on the housing, the IP addresses were assigned to the CPU 1511-1 PN and the CPU 1211C DC/DC/DC.

11.1.1 PLC_1500 [CPU 1511-1 PN]

The program for the PLC_1500 contains the data block **CounterValues1500 [DB5]**. This data is sent to the PLC_1200.

The data block (**FromPLC1200 [DB10]**) holds the data coming from the PLC_1200. The variables of these data blocks are defined as **OPC tags**.

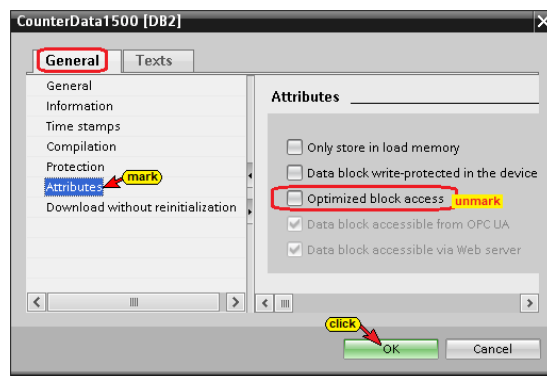
Note:



The data blocks **CounterValues1500 [DB5]**, and **FromPLC1200 [DB10]** must not have **Optimized block access**.

The **IBH Link UA – OPC UA Server** cannot access data blocks [DB] variables in an optimized data block of an S7-1500 CPU.

Data block properties dialog box

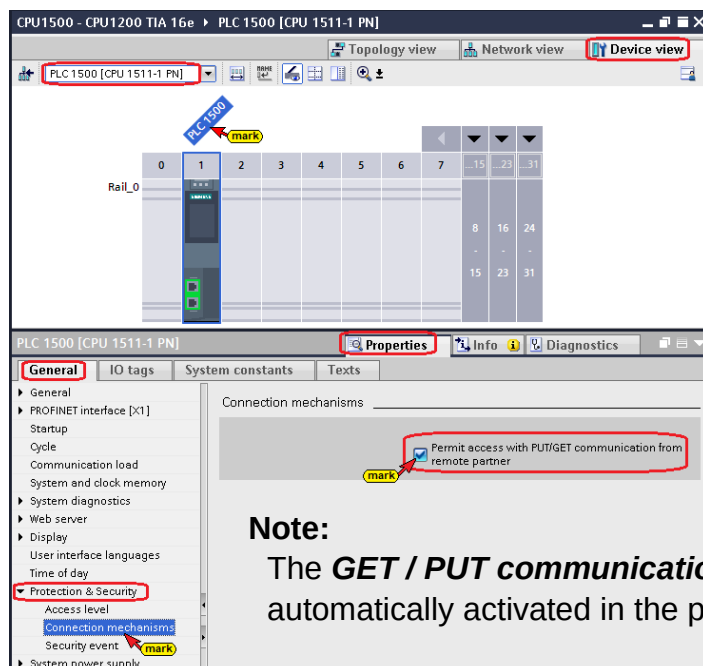


11.1.2 CPU 1500 Configuration

Double-clicking on **Device configuration** opens the **Device view** window.



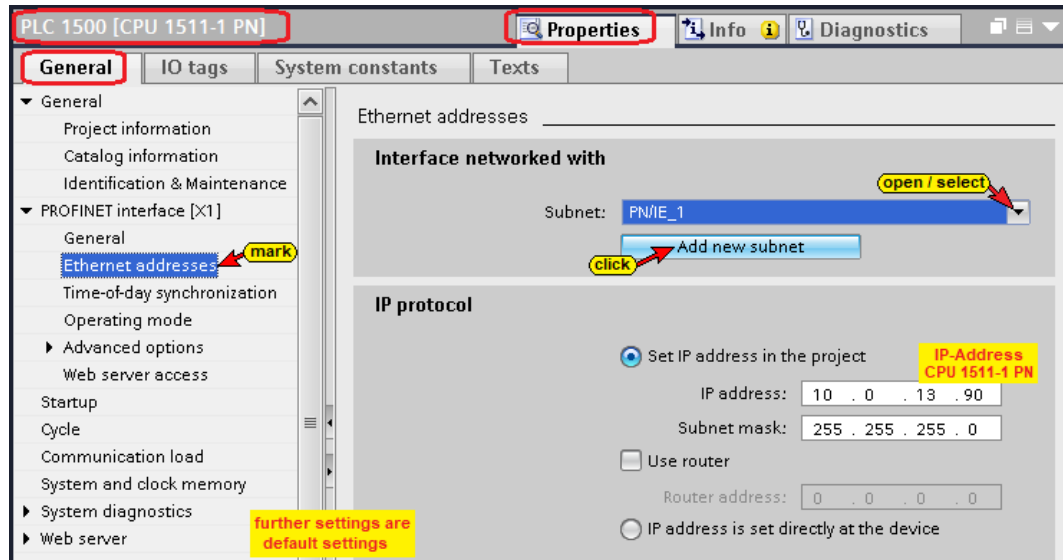
Activate S7 communication - GET and PUT (**Permit access via PUT / GET communication from remote partner**).



Note:

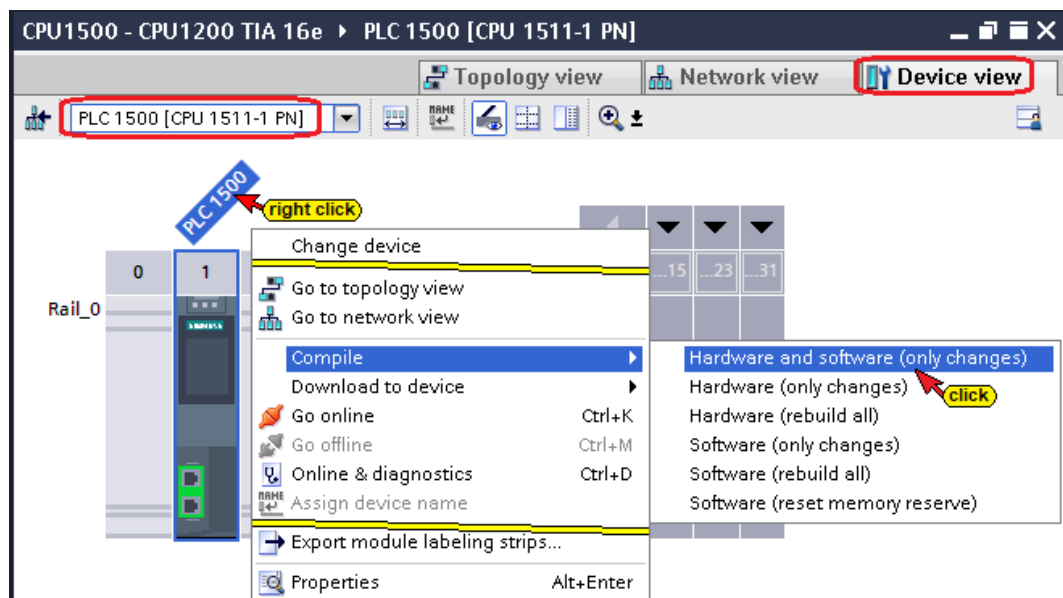
The **GET / PUT communication** function is not automatically activated in the program of a CPU1500 V4.0.

The required IP address has been specified in the opened field **Properties / PLC 1500 [CPU 1511-1 PN] / Ethernet addresses**. In the example, the IP address of the CPU is **10.0.13.90** (other CPUs can have a different address). The Ethernet connection is direct without a router.



11.1.3 Compile the PLC program and load it into the CPU

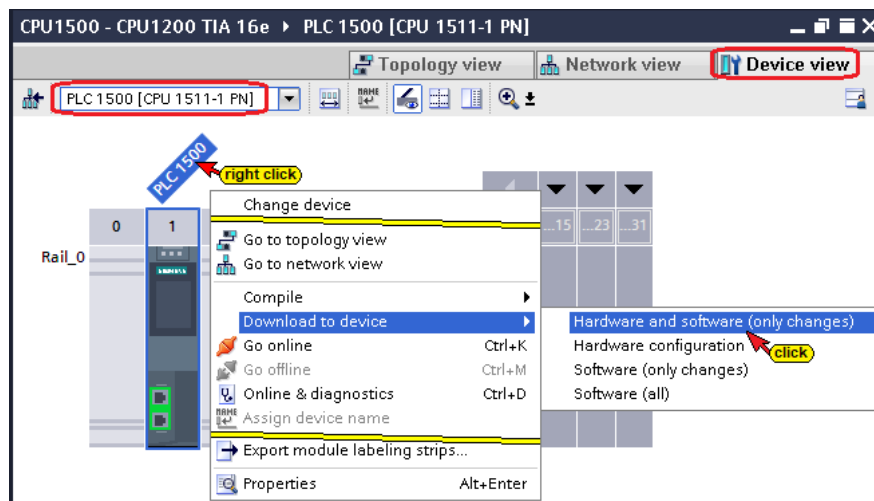
The software and hardware are compiled with the command from the context menu.



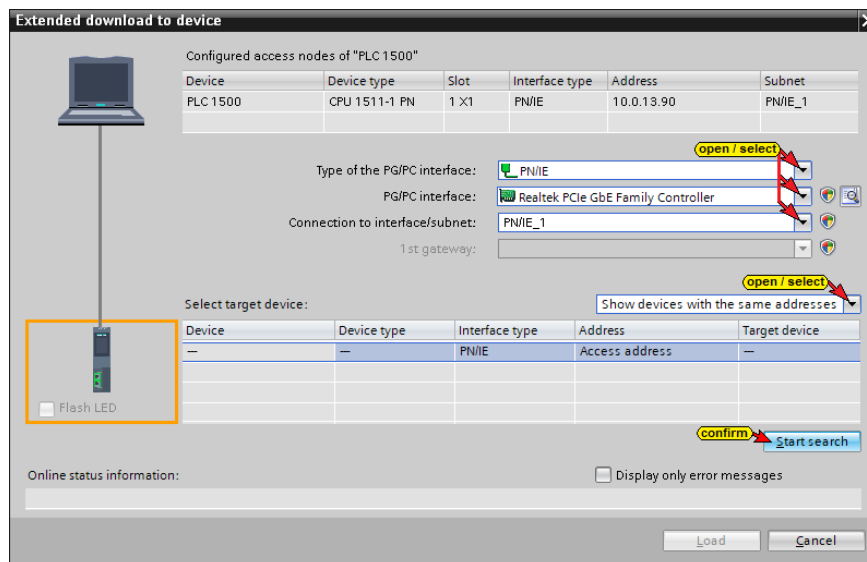
Warnings can be ignored.

Load hardware and software into the CPU

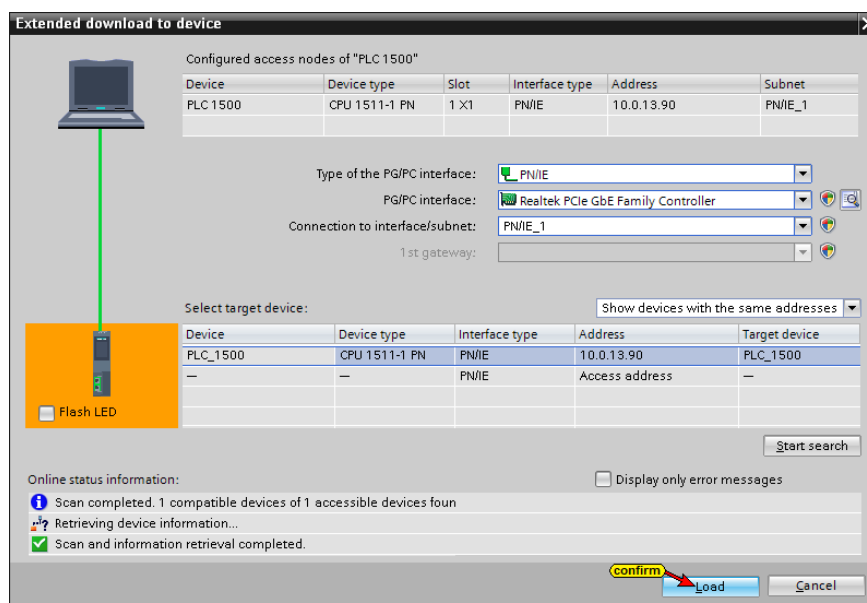
With the command **Download to device / Hardware and software (only changes)** from the context menu, the software and the hardware configuration are loaded into the device.



The load command opens the dialog window to set the interface for the device. **Connection to interface/subnet PN/IE1** must be selected.

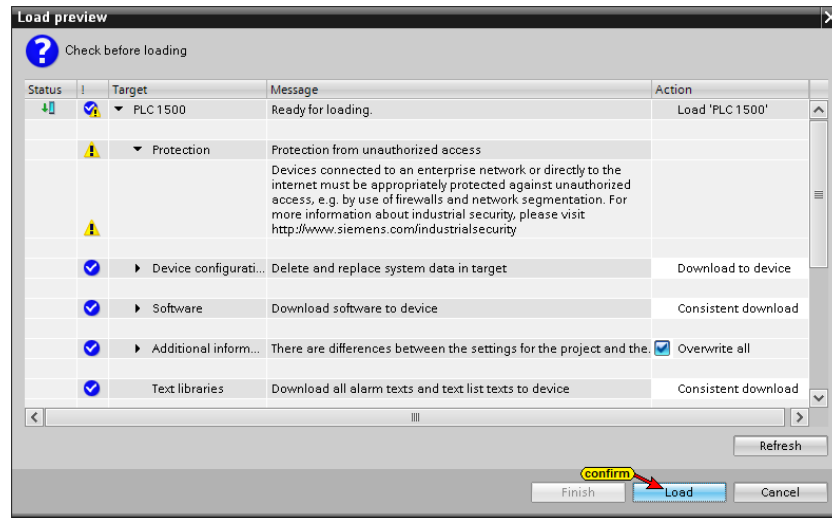


The successful search is displayed

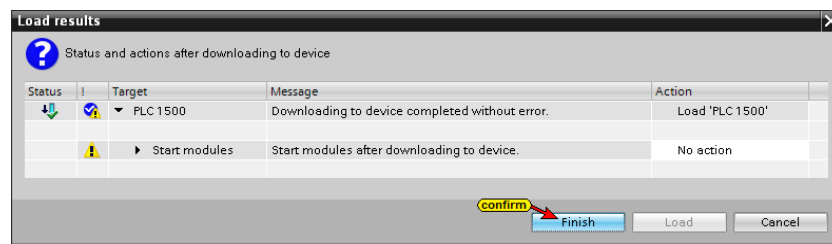


A preview of the download is displayed.

The download process requires several confirmations of messages.

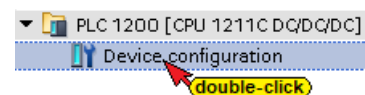


Finish loading

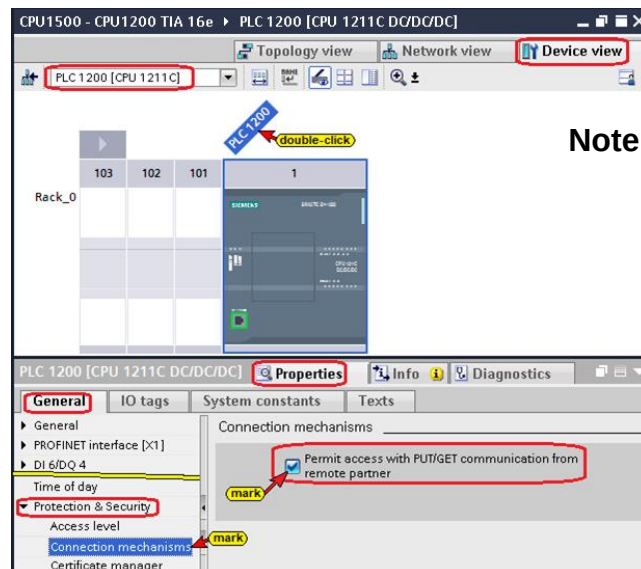


11.2 Configuration of the CPU 1200

Double-clicking on **Device configuration** opens the Device view window.



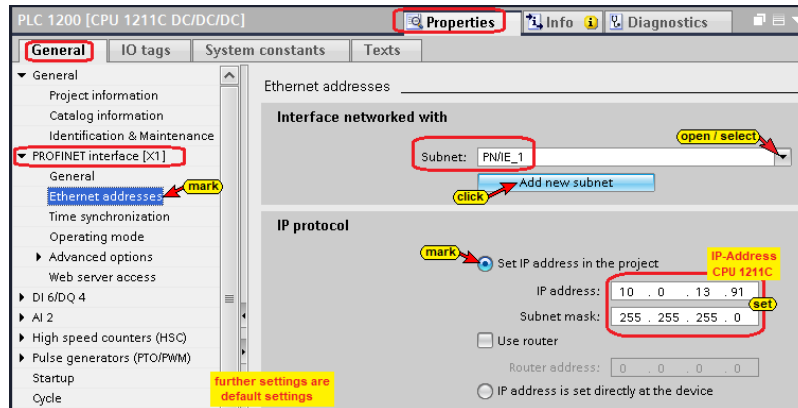
Activate S7 communication - GET and PUT (**Permit access via PUT / GET communication from remote partner**).



Note:

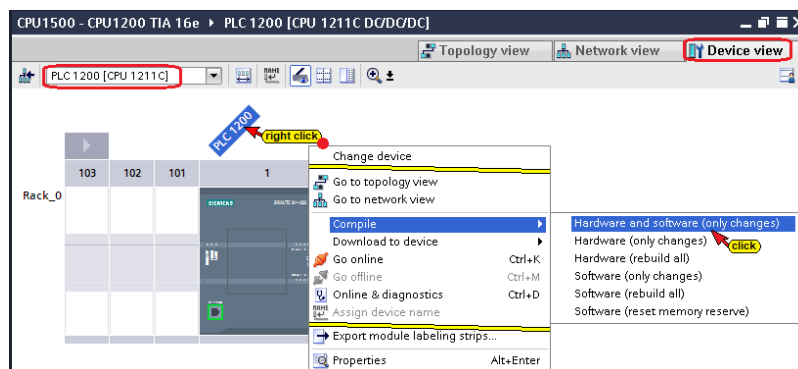
The **GET / PUT** function is not automatically activated in the program of a CPU1200.

The required IP address has been specified in the opened **Properties / PLC 1200 [CPU 1211C DC/DC/DC] / Ethernet addresses field**. In the example, the IP address of the CPU is **10.0.13.91** (other CPUs can have a different address). The Ethernet connection is direct without a router.



11.2.1 Compile the PLC program and load it into the CPU

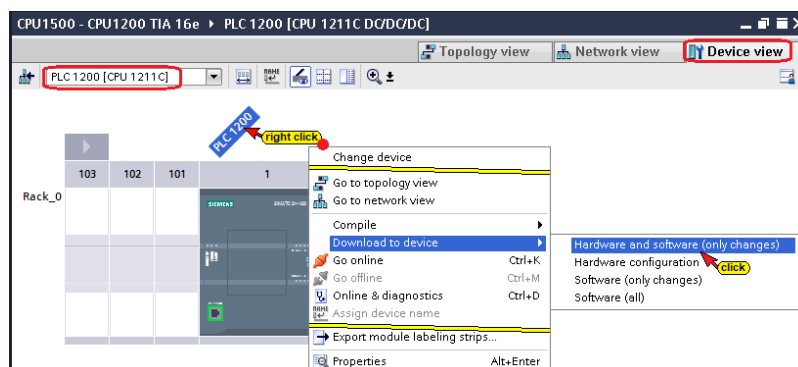
The software and hardware are compiled with the command from the context menu.



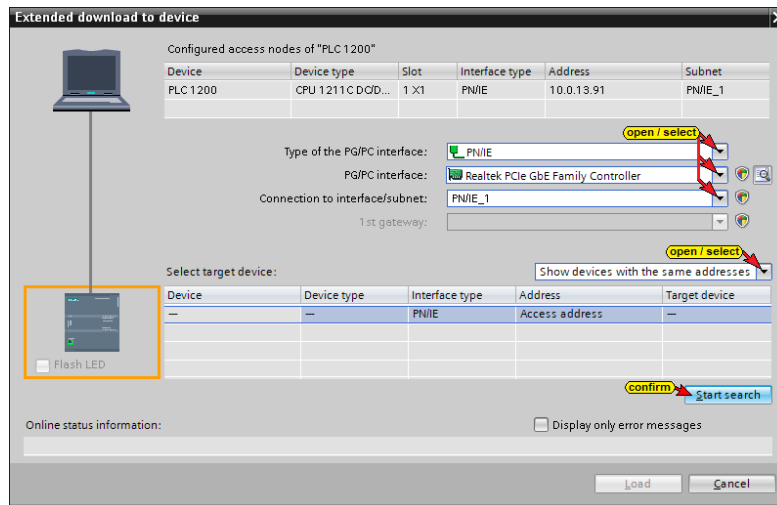
Warnings can be ignored.

Load hardware and software into the CPU

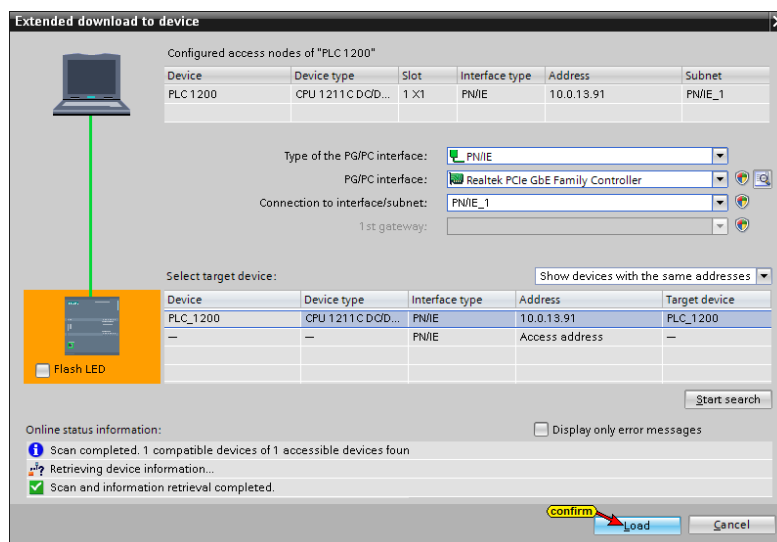
With the command **Download to device / Hardware and software (only changes)** from the context menu, the software and the hardware configuration are loaded into the device.



The download command opens the dialog window to set the interface for the device. **Connection to interface/subnet PN/IE1** must be selected.

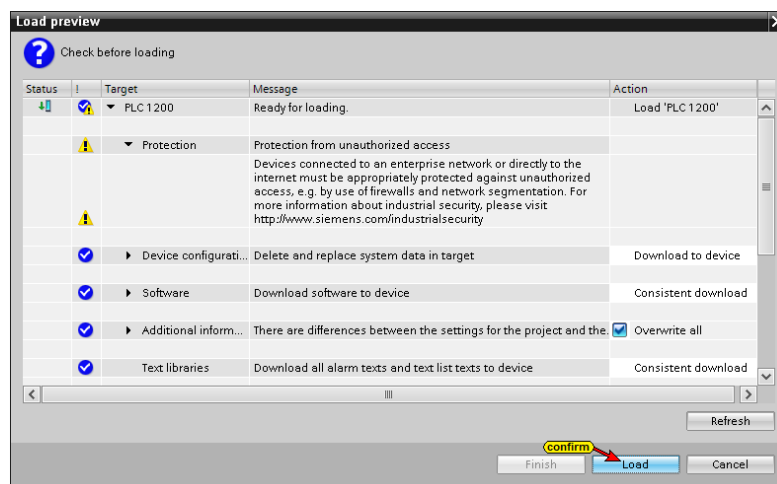


The successful search is displayed

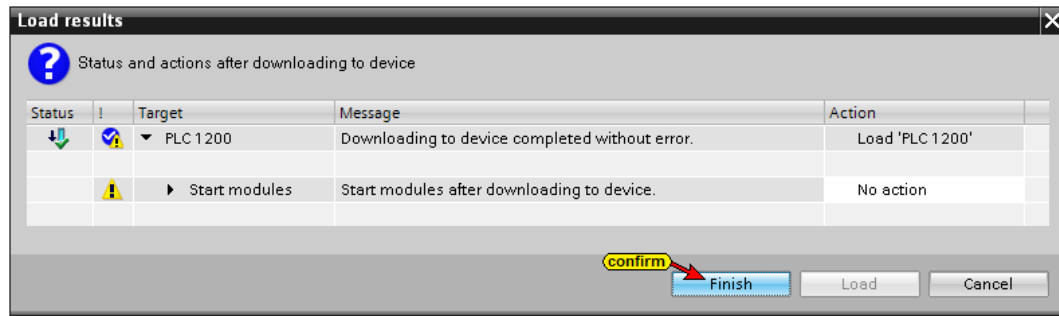


A preview of the download is displayed.

The download process requires several confirmations of messages.

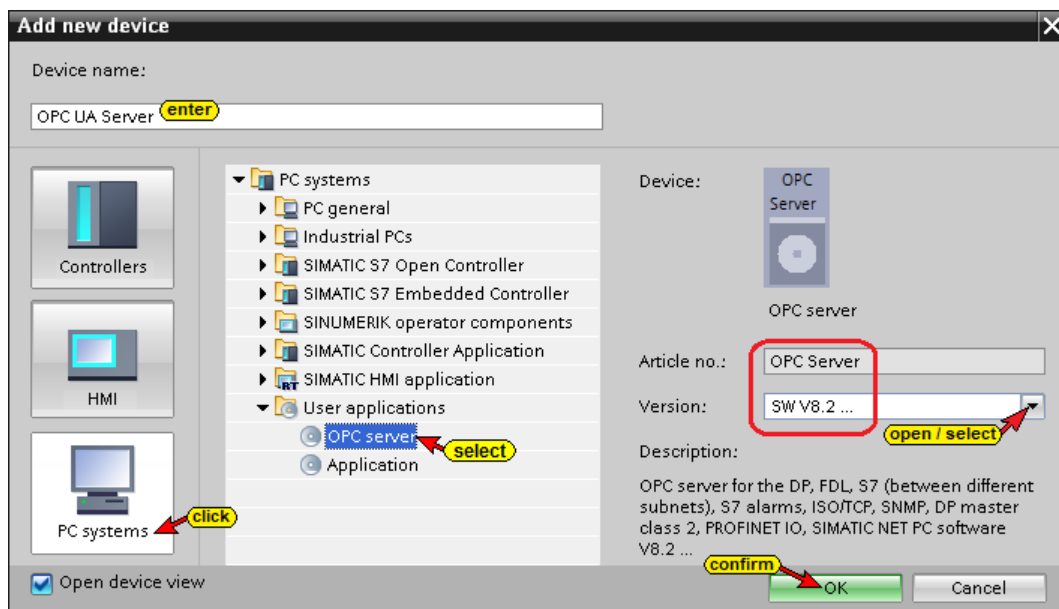


Finish loading

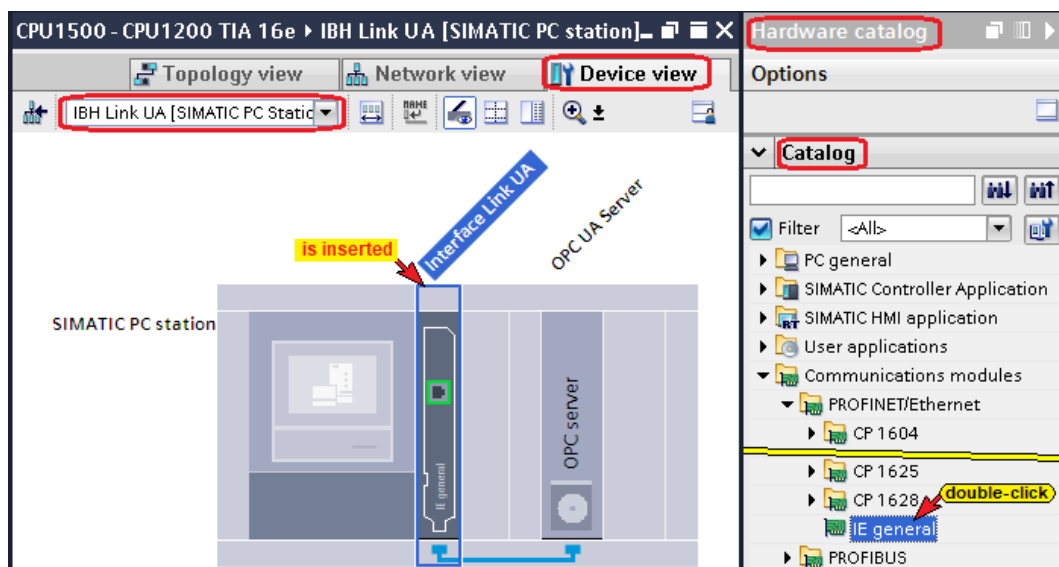


11.3 Insert IBH Link UA as an SIMATIC PC station

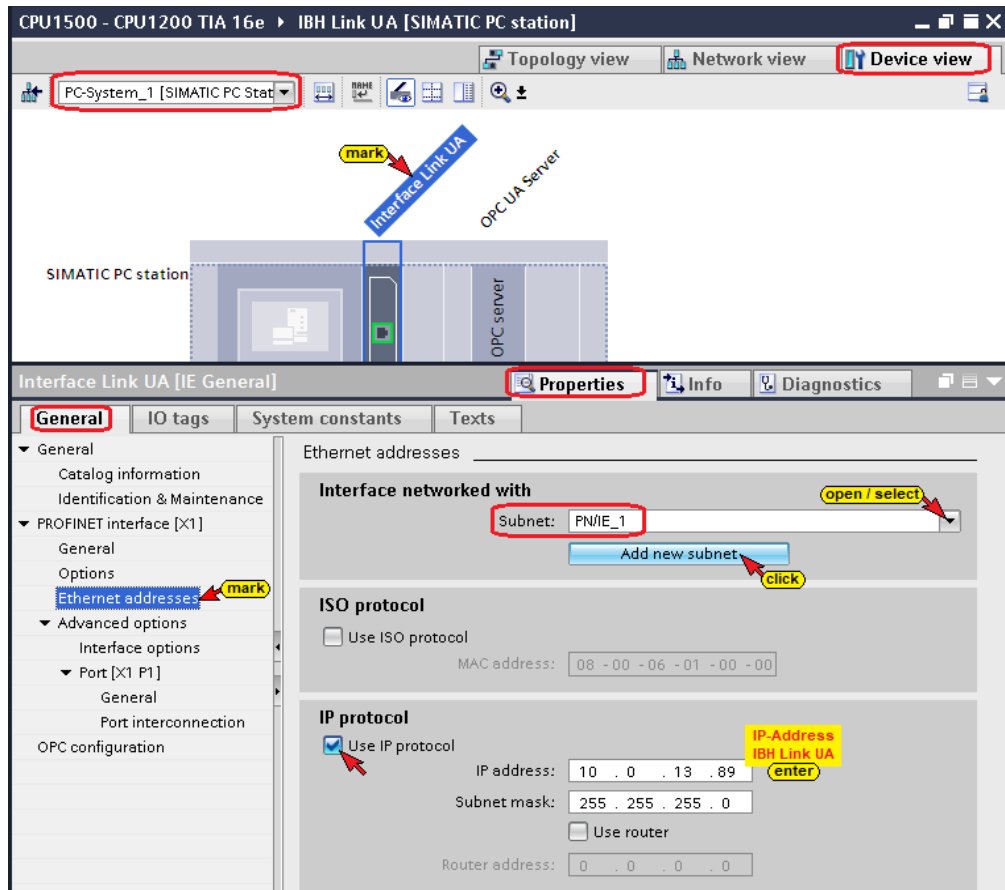
Double-click Add new device to select PC systems, User application, OPC server.



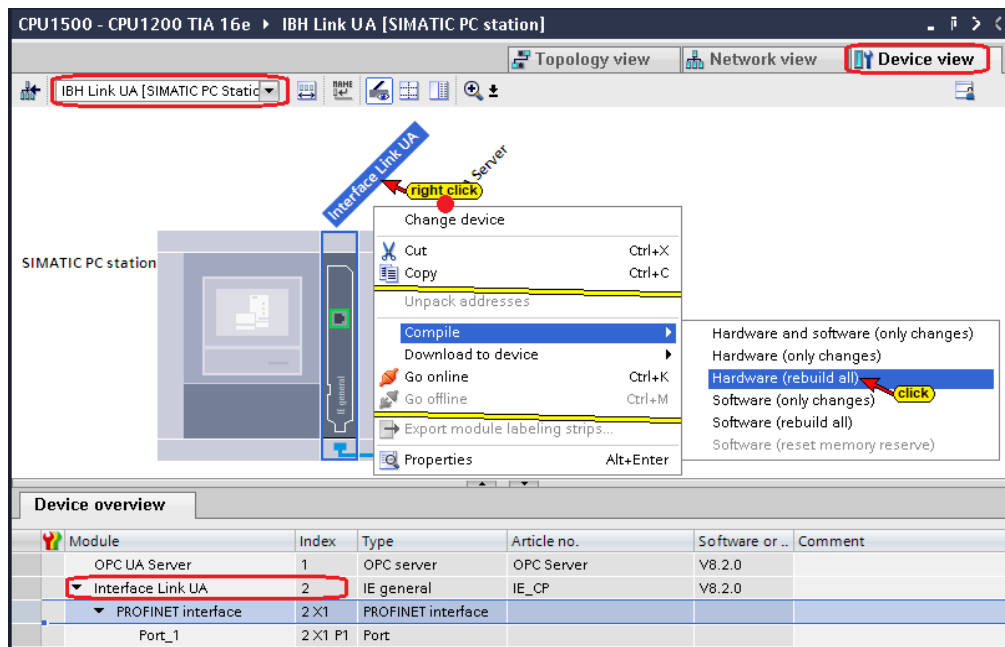
Insert communication module in the IBH Link UA



Define communication module properties



Compiling the hardware of the communication module



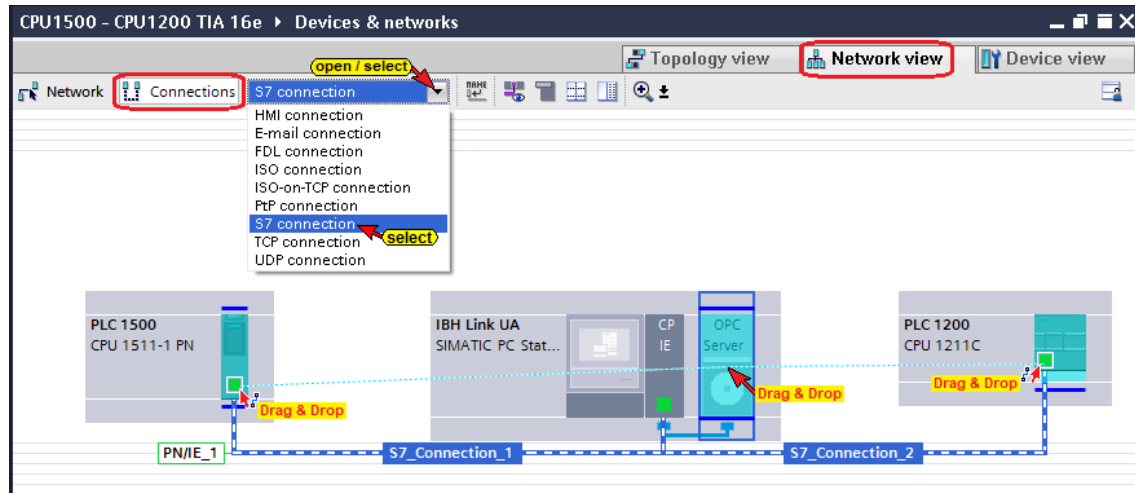
Note:



The communication module **must** be inserted in **Slot 2 / Index 2**. The IBH Link UA expects the communication interface in **Slot 2 / Index 2**.

11.3.1 Establish an S7 connection from the OPC server to the PLC 1200 and PLC 1500

The S7 connection is established via the drag and drop from the OPC server to the PLC 1200 and PLC 1500.



PLC 1500 – S7_Connection_1 is displayed

Local connection name	Local end point	Local ID (hex)	Partner ID (hex)	Partner	Connection type
S7_Connection_1	OPC UA Server [OPC Server]	S7_Connection_1	100	PLC 1500 [CPU 1511-1 PN]	S7 connection
S7_Connection_1	PLC 1500 [CPU 1511-1 PN]	100	S7_Connection_1	OPC UA Server [OPC Server]	S7 connection
S7_Connection_2	OPC UA Server [OPC Server]	S7_Connection_2	100	PLC 1200 [CPU 1211C DODC...]	S7 connection
S7_Connection_2	PLC 1200 [CPU 1211C DODC...]	100	S7_Connection_2	OPC UA Server [OPC Server]	S7 connection

PLC 1200 – S7_Connection_2 is displayed

The top screenshot shows the 'Connections' table in the TIA Portal. The table lists the following connections:

Local connection name	Local end point	Local ID (hex)	Partner ID (hex)	Partner	Connection type
S7_Connection_1	OPC UA Server [OPC Server]	S7_Connection_1	100	PLC 1500 [CPU 1511-1 PN]	S7 connection
S7_Connection_1	PLC 1500 [CPU 1511-1 PN]	100	S7_Connection_1	OPC UA Server [OPC Server]	S7 connection
S7_Connection_2	OPC UA Server [OPC Server]	S7_Connection_2	100	PLC 1200 [CPU 1211C DC]	S7 connection
S7_Connection_2	PLC 1200 [CPU 1211C DC]	100	S7_Connection_2	OPC UA Server [OPC Server]	S7 connection

The bottom screenshot shows the 'Properties' dialog for S7_Connection_2. The 'General' tab is selected. The 'Connection path' section shows the connection between the OPC UA Server and the PLC 1200. The 'IP-Address' field is set to 10.0.13.89. The 'Properties' dialog also shows the 'OPC' tab with 'Connection establishment' and 'Alarms' settings. A yellow box highlights 'All settings are preset'.

11.4 Select OPC tags in the OPC configuration

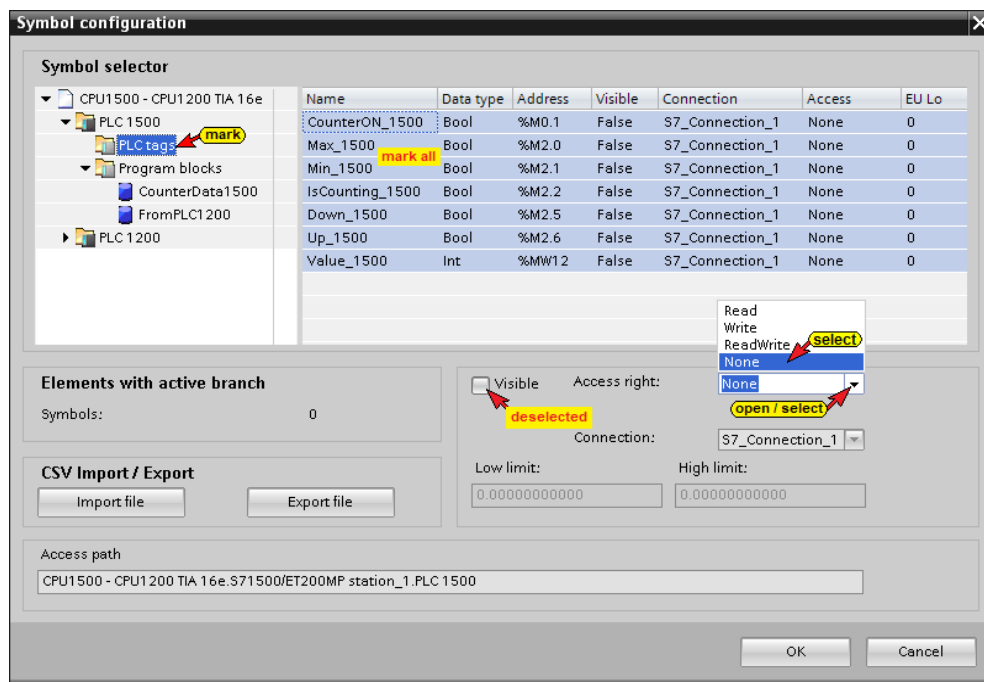
The screenshot shows the 'Device view' of the SIMATIC PC station. The 'IBH Link UA [SIMATIC PC Station]' is highlighted. The 'Properties' dialog is open, showing the 'General' tab. The 'OPC symbols' section is selected, and the 'Configured' radio button is chosen. A yellow box highlights 'Configuring...'.

The **Configure** button opens the Symbol configuration dialog box, in which the data defined in the data blocks can be selected as OPC tags.

The read / write, etc. access rights can be assigned to the individual OPC tags.

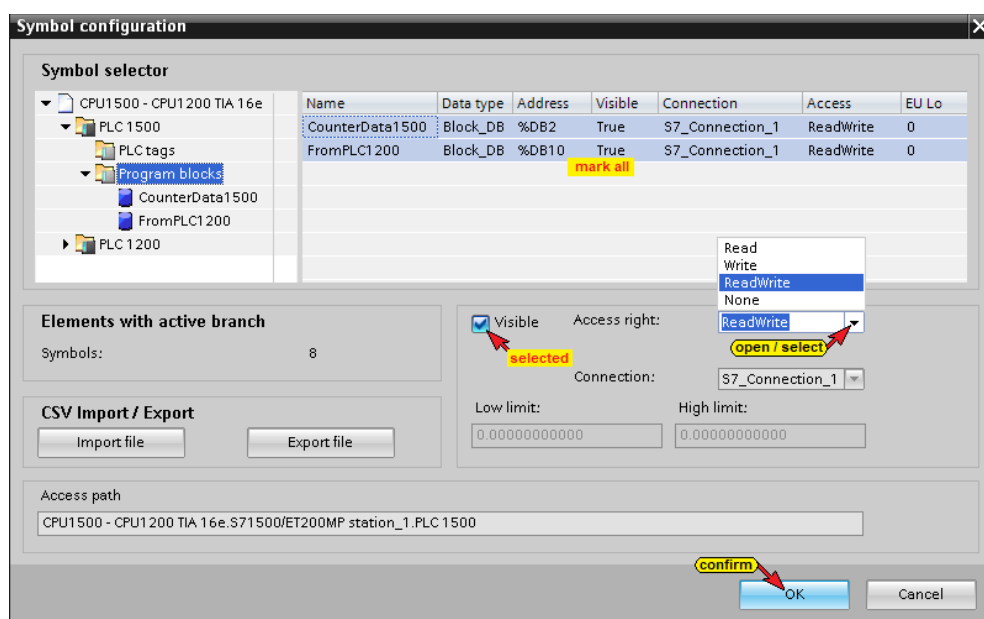
OPC-Tags PLC 1500

Deselected tags – PLC 1500, Standard tag table (Global variables). These tags are not used as OPC tags in the example.



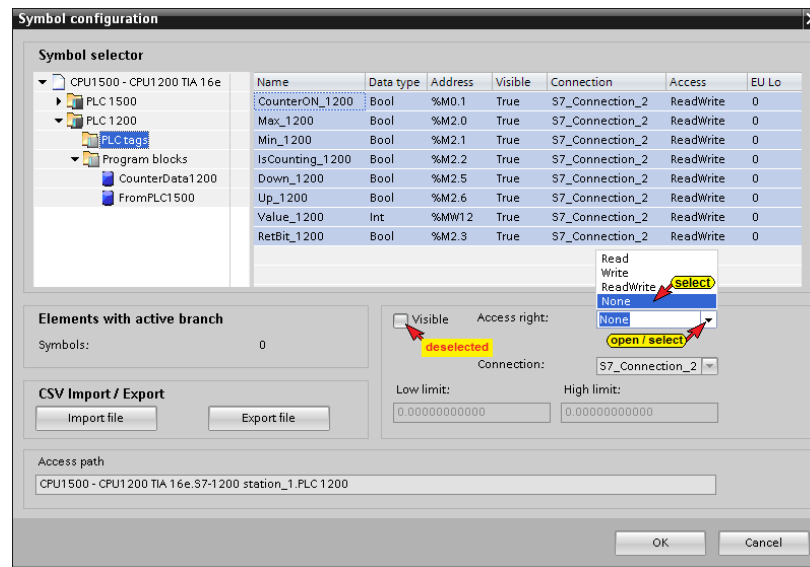
Selected tags – PLC 1500, Program blocks

The data of the program blocks **CounterValues1500 [DB5]**, and **FromPLC1200 [DB10]** is defined as OPC tags.



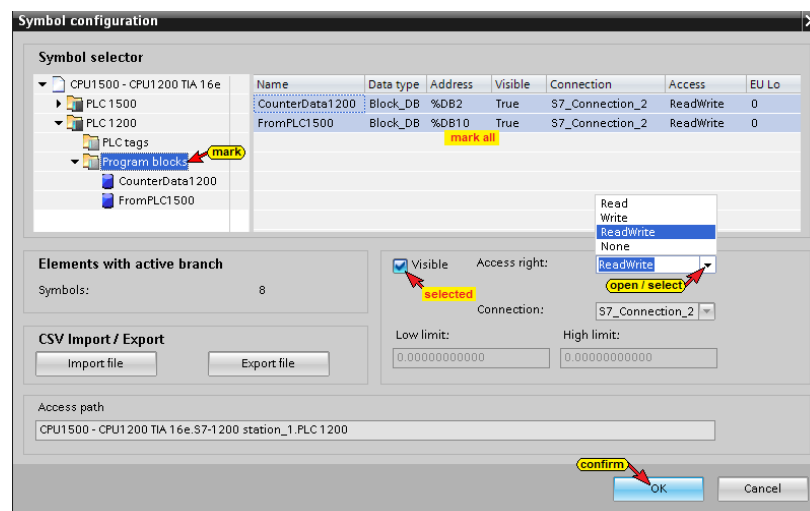
OPC-Tags PLC 1200

Deselected tags – PLC 1200, Standard tag table (Global variables).
These tags are not used as OPC tags in the example.

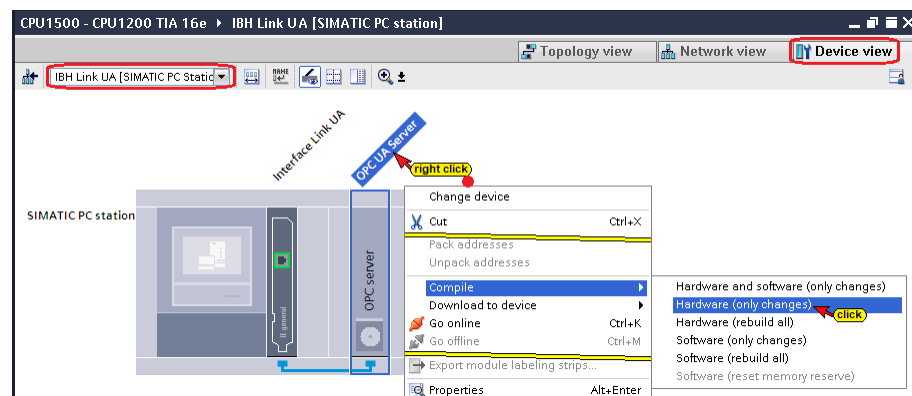


Selected tags – PLC 1200, Program blocks

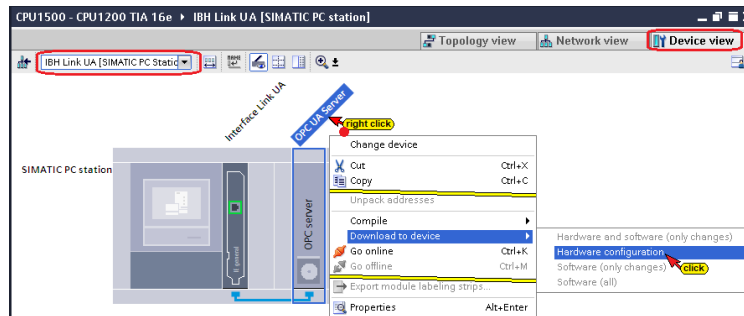
The data of the program blocks **CounterValues1200 [DB5]**, and **FromPLC1500 [DB10]** is defined as OPC tags.



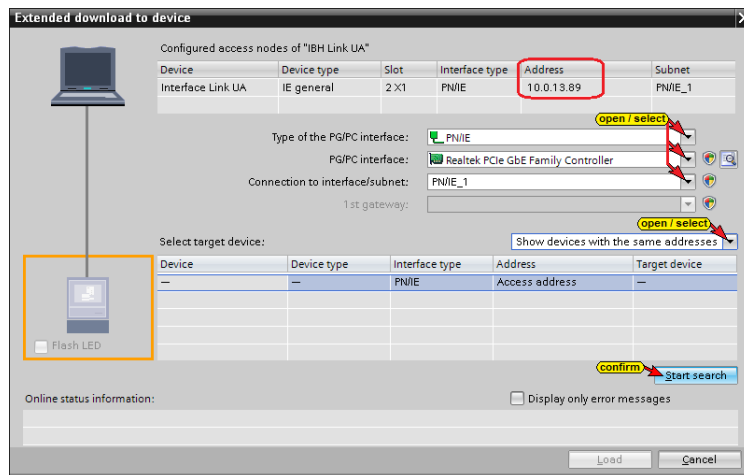
Compile the configuration of the OPC server



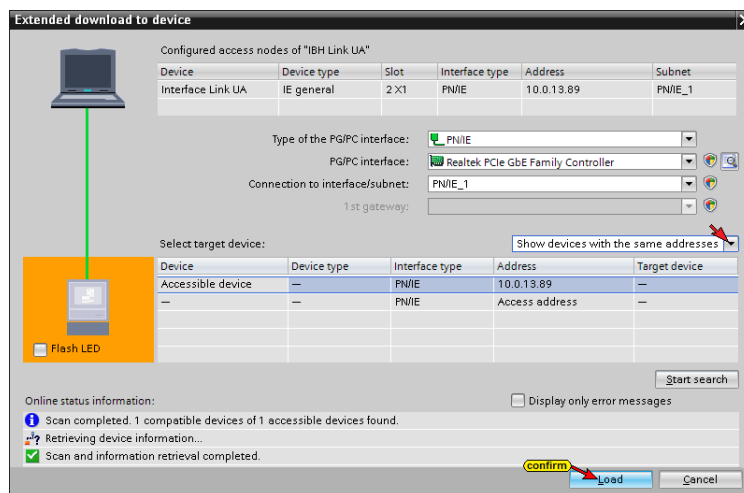
Load configuration of the OPC server into IBH Link UA



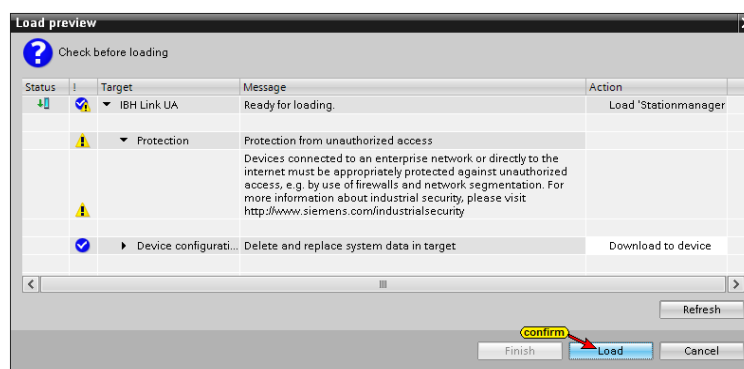
The settings are to be made according to the screen shots in the **Extended download to device** dialog box.



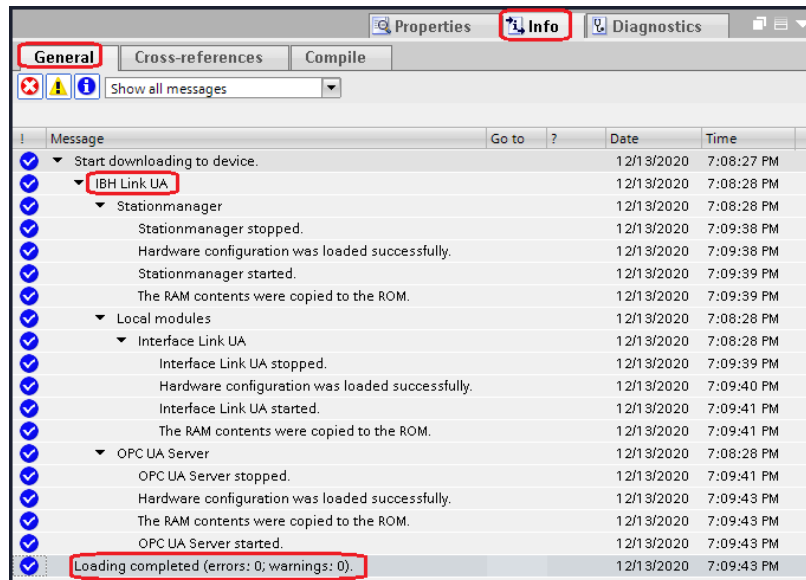
The interface search was successful.



A check is carried out prior loading.



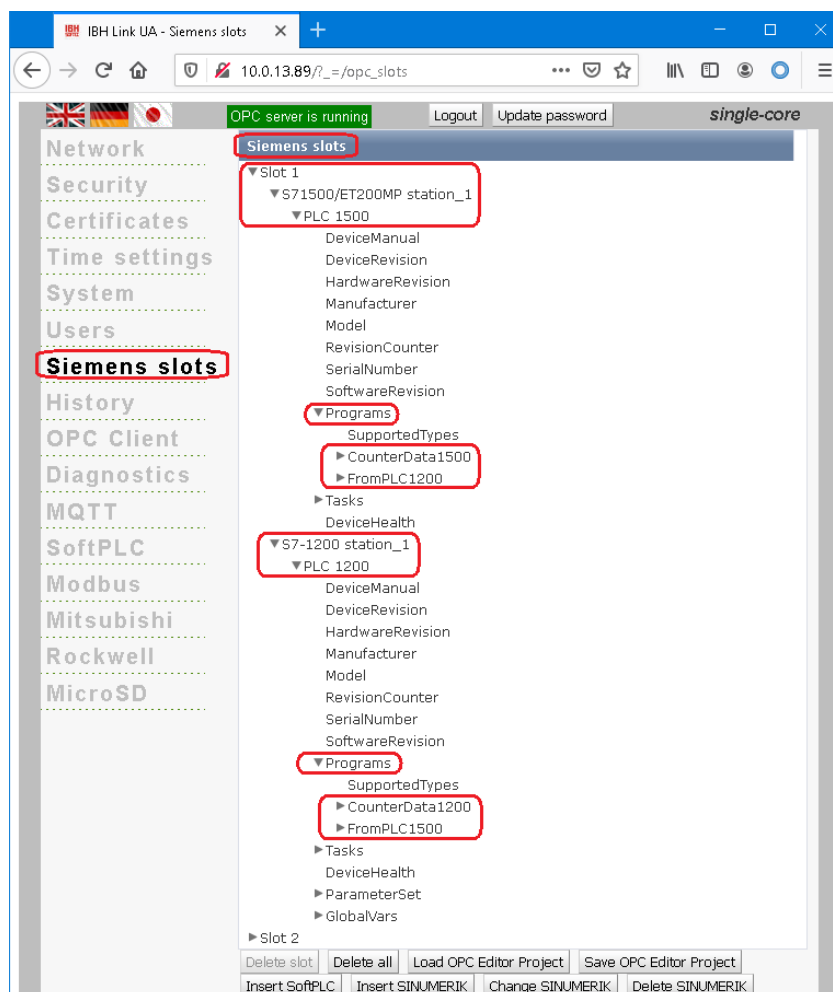
The steps of the successful loading process are displayed as info.



Successful loading is indicated in the **IBH Link UA**.

11.4.1 IBH Link UA browser window Siemens slots.

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

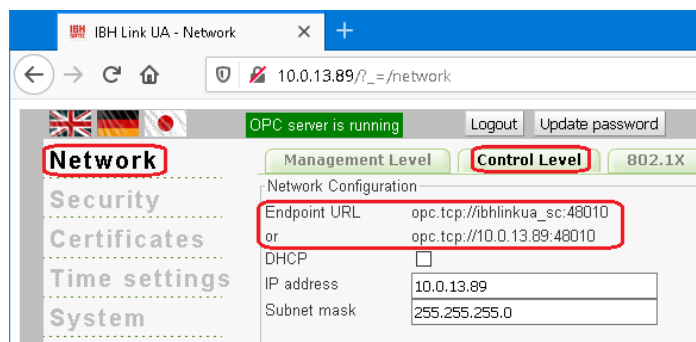


11.5 Define the OPC UA server for the data exchange

For data exchange between the PLCs (**PLC 1500** and **PLC 1200**) the **IBH Link UA** provides the **OPC UA server** for the data exchange. The OPC server lists the OPC tags that are defined in the PLC's (**PLC 1500** and **PLC 1200**).

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

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:

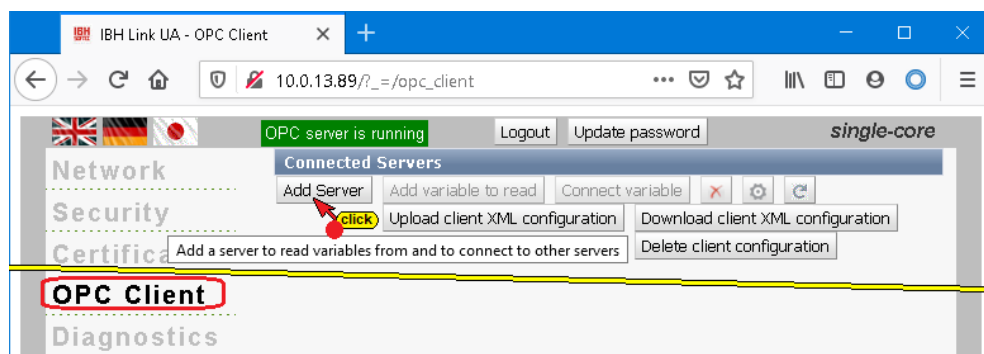
opc.tcp: // ibhlinkua_sc: 48010

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

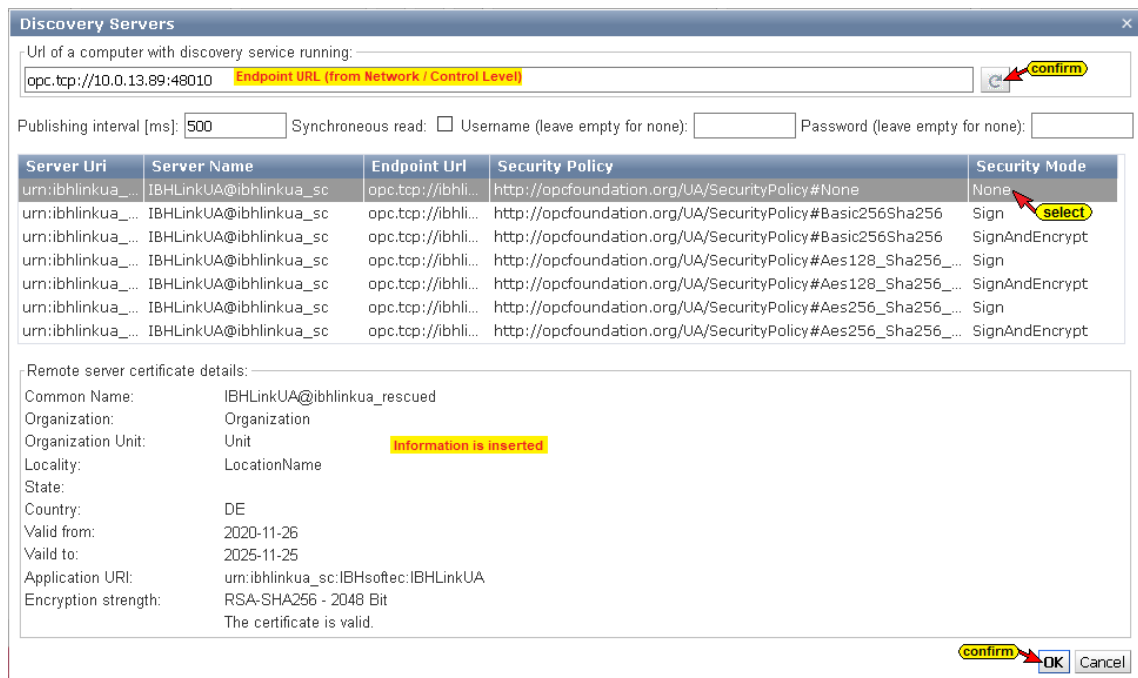
The endpoint URL can be copied into the IBH Link UA web browser window / network / control level.

Add server

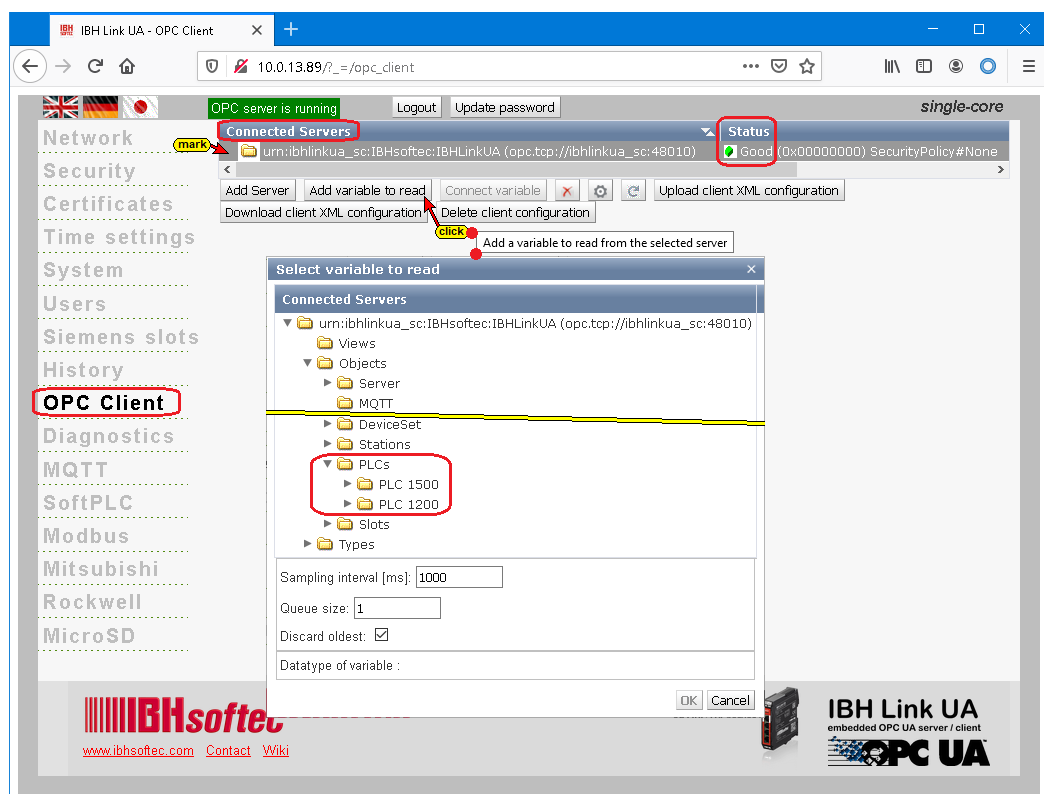


The copied endpoint URL **opc.tcp: // ibhlinkua_sc: 48010** or **opc.tcp: //10.0.13.89: 48010** is in the open field in the IBH Link UA web browser window / OPC client is to be added as a server.

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



The IBH Link UA OPC UA server is connected. The status of the server is good.

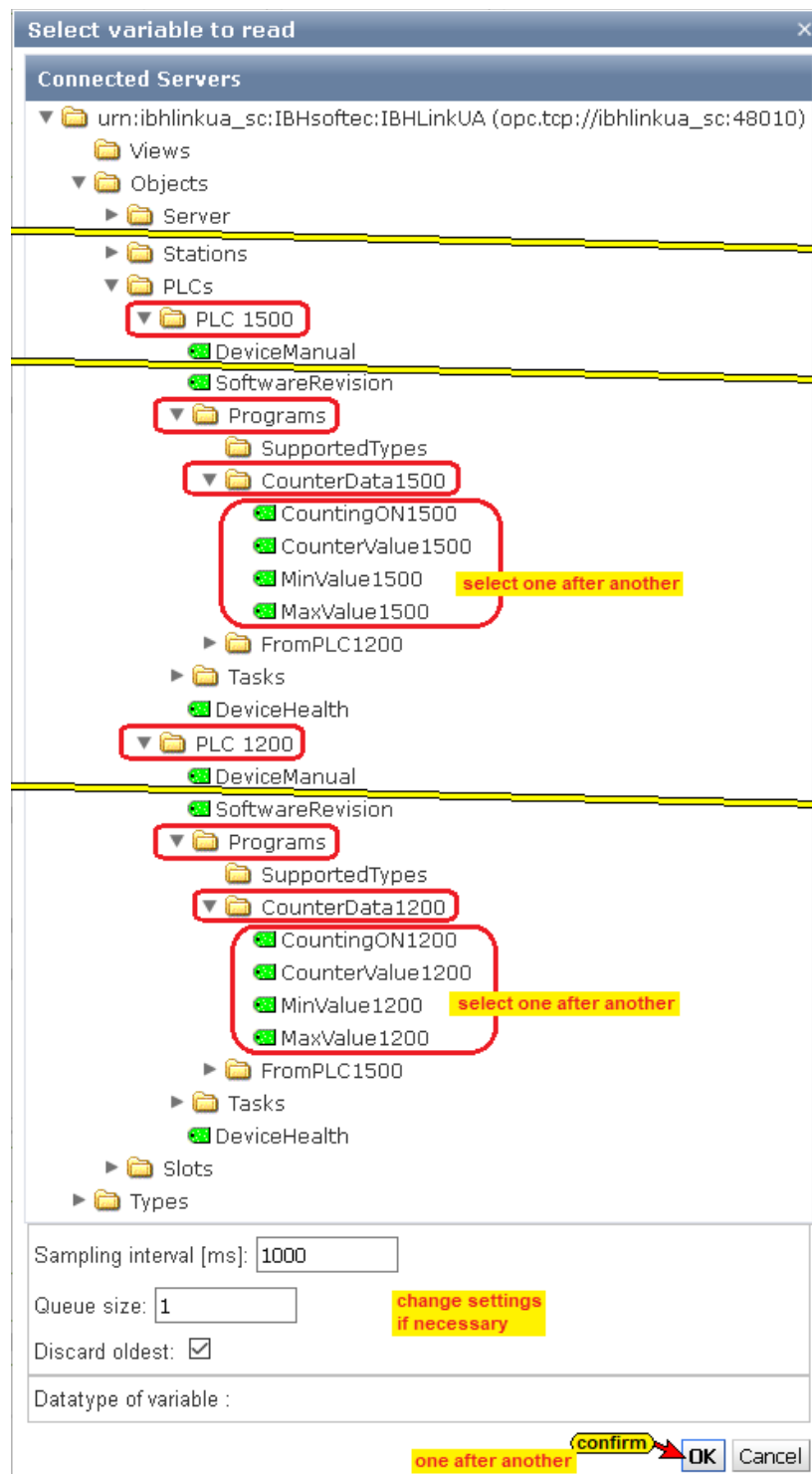


11.5.1 Add read variable

The tags from the **PLC 1500**, **CounterData1500 [DB2]** and tags from the **PLC 1200**, **CounterData1200 [DB2]** that the OPC UA

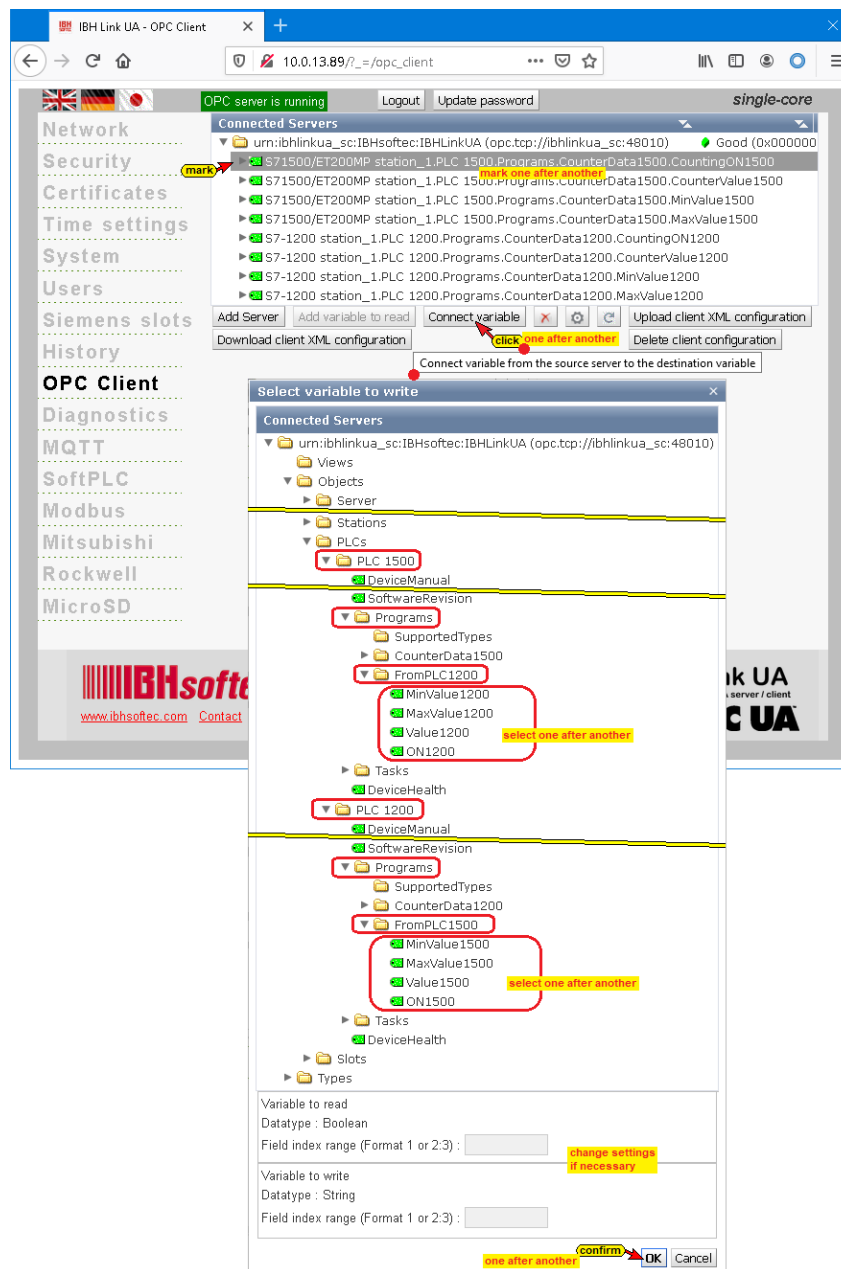
server makes available are declared as read variables. The **OPC UA client** in the **IBH Link UA** reads this data.

CounterData1500 [DB2] and CounterData1200 [DB2] tags

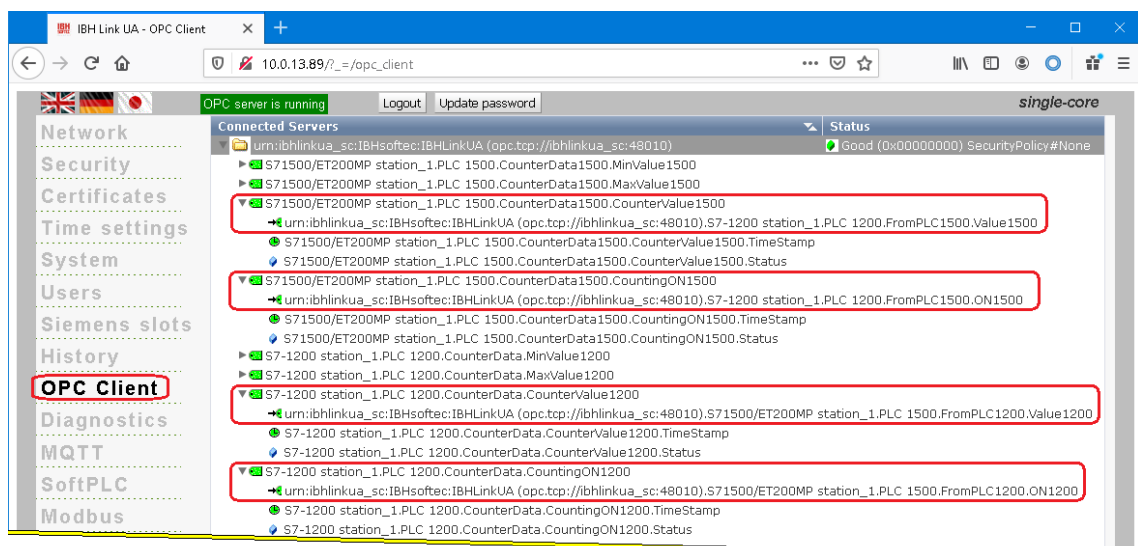


Connect with variables

The tags, which have been declared as read variables, are connected to the IBH Link UA OPC server, selected to be connected. OPC tags from the data blocks **FromPLC1500 [DB5]** and **FromPLC1200 [DB5]**.

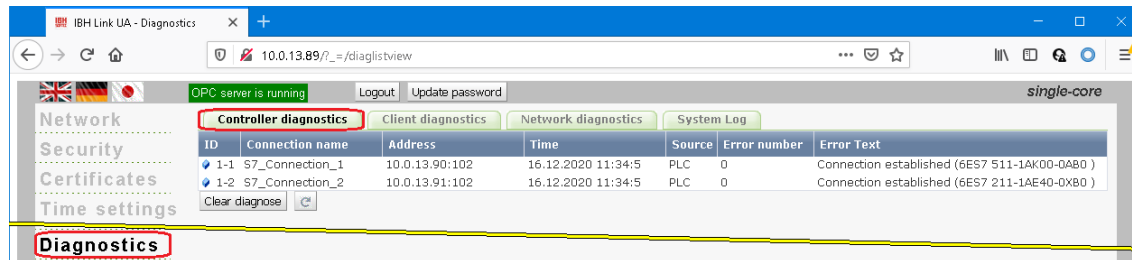


The connections are displayed in the IBH Link UA web browser window OPC Client.

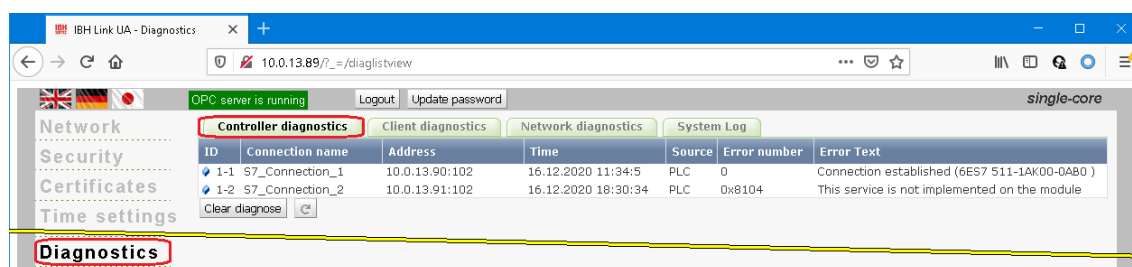


11.5.2 Browser window diagnostics / control diagnosis

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



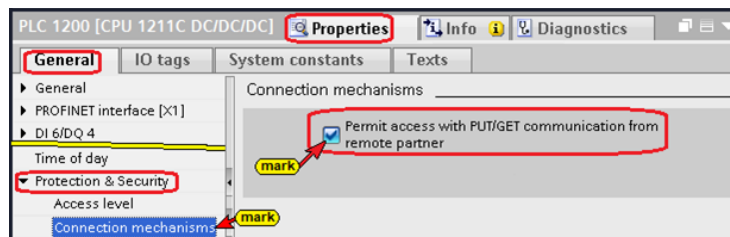
Control diagnostics – Error is displayed



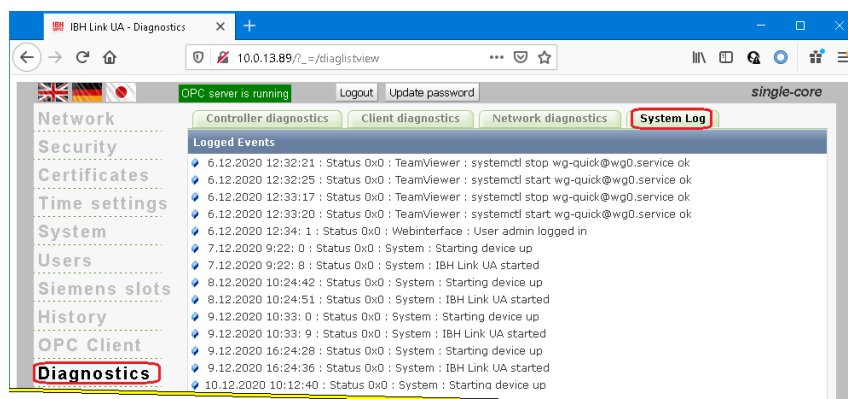
The OPC UA Server connected via the S7_Connection_2 with the PLC 1200 is not responding.

Explanation:

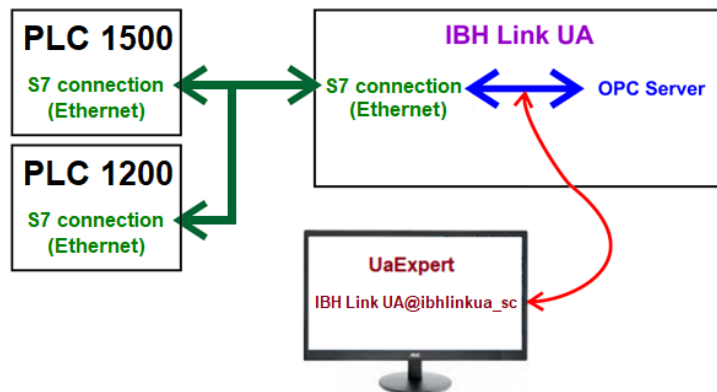
The **GET / PUT communication** function is not activated in the hardware configuration of the CPU1200.



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



11.6 UaExpert - program window



The **PLC 1500** and **PLC 1200** are displayed in the UaExpert program window. The variables of the data blocks **CounterData1500 [DB2]**, **CounterData1200 [DB2]**, **FromPLC1200 [DB5]** and **FromPLC1500 [DB5]** were defined as OPC tags are listed under **Programs**.

The variables are updated continuously.

#	Display Name	Value	Datatype	Source Timestamp
1	CounterValue1200	7283	Int16	13:56:45.080
2	CountingON1200	true	Int16	13:39:20.806
3	MaxValue1200	10000	Boolean	13:39:22.806
4	MinValue1200	100	Int16	13:39:24.807
5	MaxValue1500	10000	Int16	13:39:32.960
6	MinValue1500	100	Int16	13:39:35.409
7	ON1500	true	Boolean	13:39:37.184
8	Value1500	8085	Int16	13:56:44.448
9	CounterValue1500	7598	Int16	13:56:45.080
10	CountingON1500	true	Int16	13:40:06.945
11	MaxValue1500	10000	Boolean	13:40:08.138
12	MinValue1500	100	Int16	13:40:09.814
13	MaxValue1200	10000	Int16	13:40:14.821
14	MinValue1200	100	Int16	13:40:16.064
15	ON1200	true	Boolean	13:40:17.906
16	Value1200	5559	Int16	13:56:44.448

These can be dragged and dropped into the **Data Access View**.

OPC-Tags PLC 1200

Data Access View			
#	Node Id	Display Name	Value
1	NS4[String]S7-1200 station_1.PLC 1200.CounterData.CounterValue1200	CounterValue1200	5570
2	NS4[String]S7-1200 station_1.PLC 1200.CounterData.CountingON1200	CountingON1200	true
3	NS4[String]S7-1200 station_1.PLC 1200.CounterData.MaxValue1200	MaxValue1200	10000
4	NS4[String]S7-1200 station_1.PLC 1200.CounterData.MinValue1200	MinValue1200	100
5	NS4[String]S7-1200 station_1.PLC 1200.FromPLC1500.MaxValue1500	MaxValue1500	10000
6	NS4[String]S7-1200 station_1.PLC 1200.FromPLC1500.MinValue1500	MinValue1500	100
7	NS4[String]S7-1200 station_1.PLC 1200.FromPLC1500.ON1500	ON1500	true
8	NS4[String]S7-1200 station_1.PLC 1200.FromPLC1500.Value1500	Value1500	1533

OPC-Tags PLC 1500

Data Access View			
#	Node Id	Display Name	Value
9	NS4[String]S71500/ET200MP station_1.PLC 1500.CounterData1500.CounterValue1500	CounterValue1200	1567
10	NS4[String]S71500/ET200MP station_1.PLC 1500.CounterData1500.CountingON1500	CountingON1200	true
11	NS4[String]S71500/ET200MP station_1.PLC 1500.CounterData1500.MaxValue1500	CounterValue1500	7042
12	NS4[String]S71500/ET200MP station_1.PLC 1500.CounterData1500.MinValue1500	CountingON1500	true
13	NS4[String]S71500/ET200MP station_1.PLC 1500.FromPLC1200.MaxValue1200	MaxValue1500	10000
14	NS4[String]S71500/ET200MP station_1.PLC 1500.FromPLC1200.MinValue1200	MinValue1500	100
15	NS4[String]S71500/ET200MP station_1.PLC 1500.FromPLC1200.ON1200	MaxValue1200	10000
16	NS4[String]S71500/ET200MP station_1.PLC 1500.FromPLC1200.Value1200	MinValue1200	100

Status – PLC 1200 [CPU 1211C DC/DC/DC]

CounterData [DB2]

...I200 TIA 16e > PLC 1200 [CPU 1211C DC/DC/DC] > Program blocks > CounterData [DB2]						
CounterData						
Name	Data type	Offset	Start value	Monitor value	Comment	
1 Static						
2 MinValue1200	Int	0.0	100	100	minimum Counter value 1200	
3 MaxValue1200	Int	2.0	10000	10000	maximum Counter value 1200	
4 CounterValue1200	Int	4.0	0	763	Counter value 1200	
5 CountingON1200	Bool	6.0	false	TRUE	Counter is counting 1200	

FromPLC1500 [DB5]

...I200 TIA 16e > PLC 1200 [CPU 1211C DC/DC/DC] > Program blocks > FromPLC1500 [DB5]						
FromPLC1500						
Name	Data type	Offset	Start value	Monitor value	Comment	
1 Static						
2 MinValue1500	Int	0.0	0	100	minimum Counter value of PLC 1500	
3 MaxValue1500	Int	2.0	0	10000	maximum Counter value of PLC 1500	
4 Value1500	Int	4.0	0	8793	Counter value of PLC 1500	
5 ON1500	Bool	6.0	false	TRUE	PLC 1500 is counting	

Status – PLC 1500 [CPU 1511-1 PN]

CounterData1500 [DB2]

...I1200 TIA 16e > PLC 1500 [CPU 1511-1 PN] > Program blocks > CounterData1500 [DB2]						
CounterData1500						
Name	Data type	Offset	Start value	Monitor value	Comment	
1 Static						
2 MinValue1500	Int	0.0	100	100	minimum Counter value PLC 1500	
3 MaxValue1500	Int	2.0	10000	10000	maximum Counter value PLC 1500	
4 CounterValue1500	Int	4.0	0	2883	Counter value PLC 1500	
5 CountingON1500	Bool	6.0	false	TRUE	Counter is counting PLC 1500	

FromPLC1200 [DB5]

...I200 TIA 16e > PLC 1500 [CPU 1511-1 PN] > Program blocks > FromPLC1200 [DB5]						
FromPLC1200						
Name	Data type	Offset	Start value	Monitor value	Comment	
1 Static						
2 MinValue1200	Int	0.0	0	100	Minimum Value of PLC 1200	
3 MaxValue1200	Int	2.0	0	10000	Maximum Value of PLC 1200	
4 Value1200	Int	4.0	0	6791	Counter Value of PLC 1200	
5 ON1200	Bool	6.0	false	TRUE	PLC 1200 is counting	