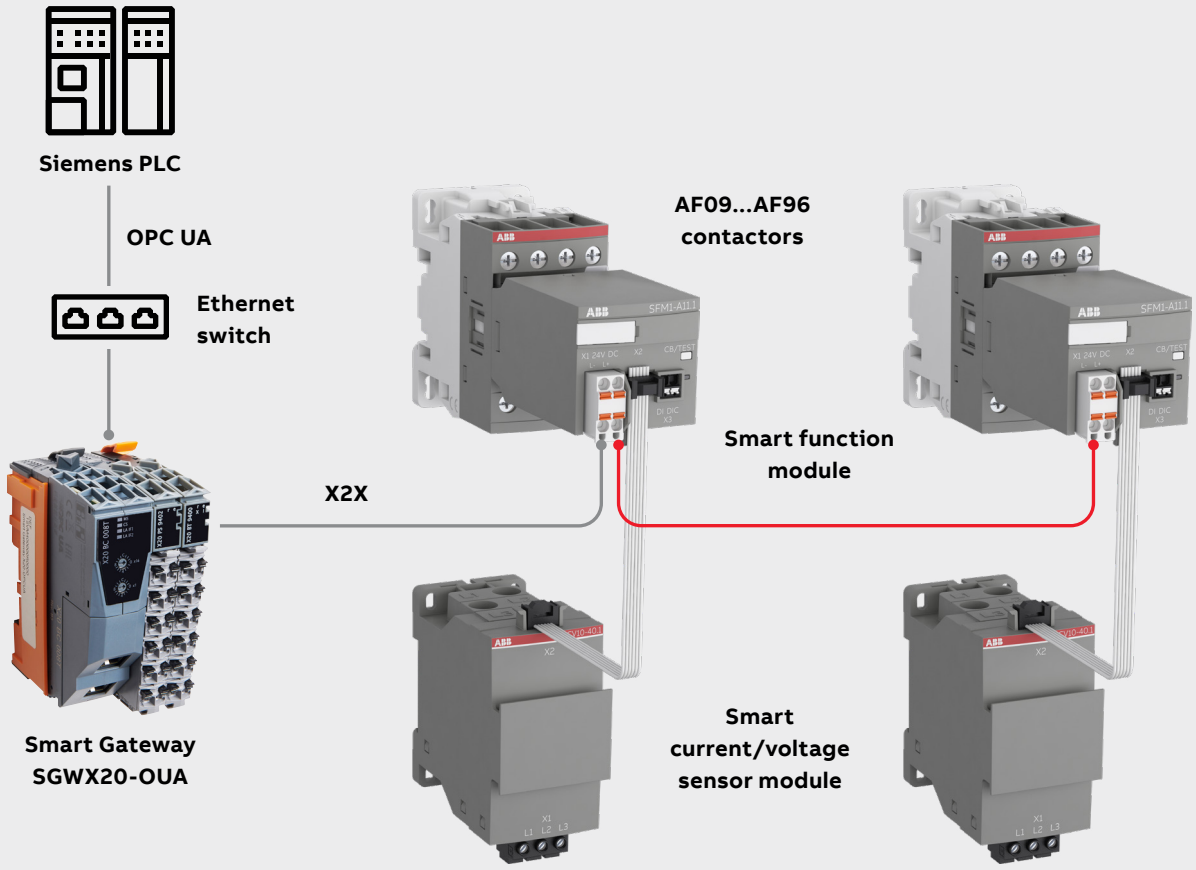
APPLICATION GUIDE

Novolink with Siemens PLC

Connecting Smart Gateway SGWX20-OUA to Siemens PLC using TIA Portal V17



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1. Purpose and basic description

This section describes the basic steps to set up the ABB Novolink modules with the Siemens PLC via Smart Gateway using OPC UA.

1.1. What is Novolink?

The ABB Novolink™ devices help digitalize motor starting solutions and gain insights into the connected loads. They‘re easy to design into existing wiring plans and connect to standard AF contactors. Installation is fast and simple, thanks to reduced wiring and fewer components, so engineering efforts are minimized. The Novolink devices enables predictive maintenance to reduce downtime, as well as increasing efficiencies and boosting cost savings. It’s fully integrated into the B&R automation system. And the possibilities open up even more as full remote access to your data creates new maintenance service and revenue opportunities.

2. Important disclaimers & recommendations

2.1. Cyber security legal disclaimer

The Smart Gateway and Novolink modules are designed to be connected in the ABB and 3rd party products and communicate information data via network interface. It is the user’s sole responsibility to provide and continuously ensure a secure connection between the product and the user’s network or any other. The user shall establish and maintain any appropriate measures (such as but not limited to the installation of firewalls, application of authentication measures, encryption of data, installation of anti-virus programs, etc.) to protect the product, the network, its system, and the interface against any kind of security breaches, unauthorized access, interference, intrusion, leakage and/or theft of data or information. ABB and its affiliates are not liable for damages and/or losses related to such security breaches, any unauthorized access, interference, intrusion, leakage and/or theft of data or information. The data, examples and diagrams in this manual are included solely for the concept or product description and are not to be deemed as a statement of guaranteed properties. All people responsible for applying the equipment addressed in this manual must satisfy themselves that each intended application is suitable and acceptable, including that any applicable safety or other operational requirements are complied with. Any risks in applications where a system failure and/or product failure would create a risk for harm to property or persons (including but not limited to personal injuries or death) shall be the sole responsibility of the person or entity applying the equipment, and those so responsible are hereby requested to ensure that all measures are taken to exclude or mitigate such risks. This document has been carefully checked by ABB, but deviations cannot be completely ruled out. In case any errors are detected, the reader is kindly requested to notify the manufacturer. Other than under explicit contractual commitments, in no event shall ABB be responsible or liable for any loss or damage resulting from the use of this manual or the application of the equipment.

2.2. UaExpert

UaExpert is software, provided by Unified Automation. We suggest using this software for monitoring the data as described in chapter “UaExpert”.
Important: This software does not belong to ABB, and we do not take any responsibility on its functionality.

2.3. Making your networks more secure

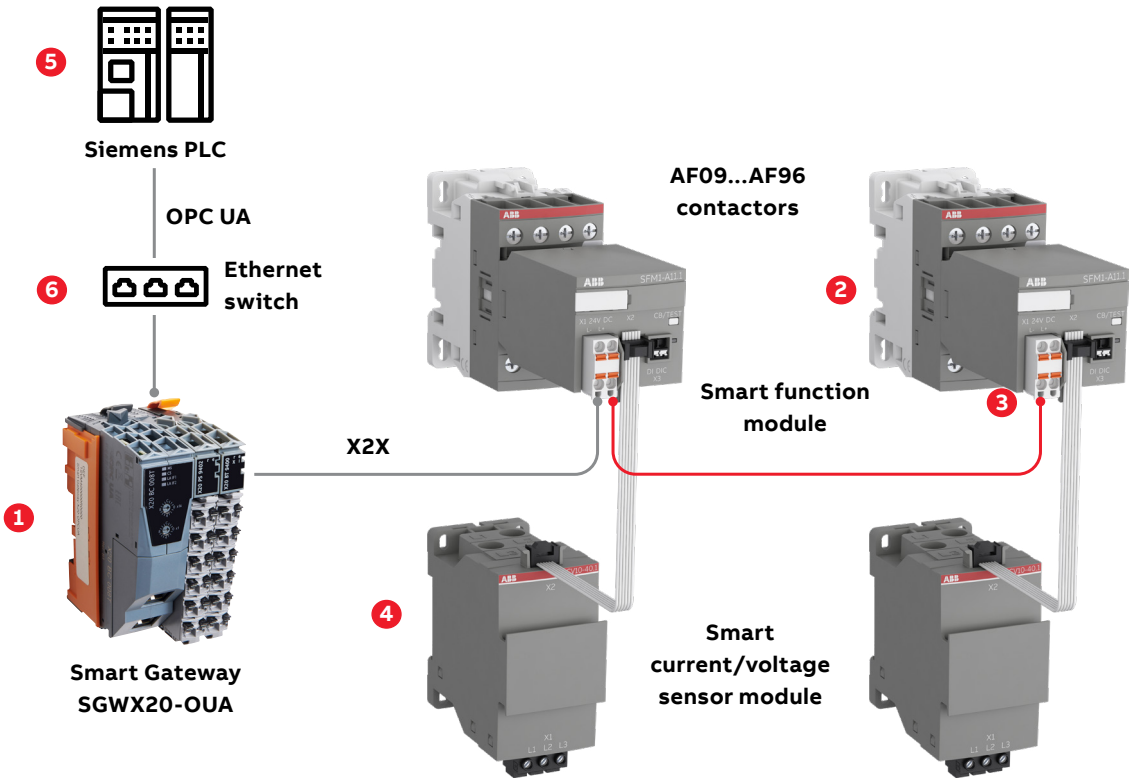
Following points are strongly recommended to make networks more secure:

- **Isolate your network** – separate the OT network (Operation Technology) from the IT network (Information Technology). This helps prevent any attack reaching the IT network from spreading to the OT network.
- **Use firewalls** – Implement firewalls to prevent unauthorized access to the OT network.
- **Use access control** – Implement access controls to restrict the human and device access to the OT/IT network and devices.
- **Keep software up to date** – Make sure all software/firmware of the devices are up to date to have the latest security updates installed.
- **Reduce attack surface on devices** – Disable device functions, services and ports not needed.
- **Replace default passwords** – Replace all default passwords of the devices to prevent attacker from getting access using default credentials.
- **Monitor network activity** – Monitor the OT network for any malicious activities that could be a sign of an attack. Example of network monitoring tool is intrusion detection system (IDS).
- **Train employees** – Train operators and service people on IT and OT security best practices.

3. Basic setup

This section describes basic steps required to set up the Smart Gateway SGWX20-OUA with Smart Function Module (SFM) and Smart Current/Voltage modules (SCM /SVM) connected to Siemens PLC over OPC UA.

The setup can be done as shown in the figure below:



The figure shows the main components and how they can be combined for complete motor starting solutions:

- Smart Gateway SGWX20-OUA (1) is connected to Siemens PLC (5) via ethernet switch (6).
- Smart Function Module SFM (3) should be mounted on AF contactors (2).
- SFM are connected to Smart Current/Voltage sensor module SCV (4) over X2X cable.
- All the SFMs are connected to Smart Gateway SGWX20-OUA (1) over X2X cable.

Note: Smart Gateway SGWX20-OUA can be an OPC UA server.

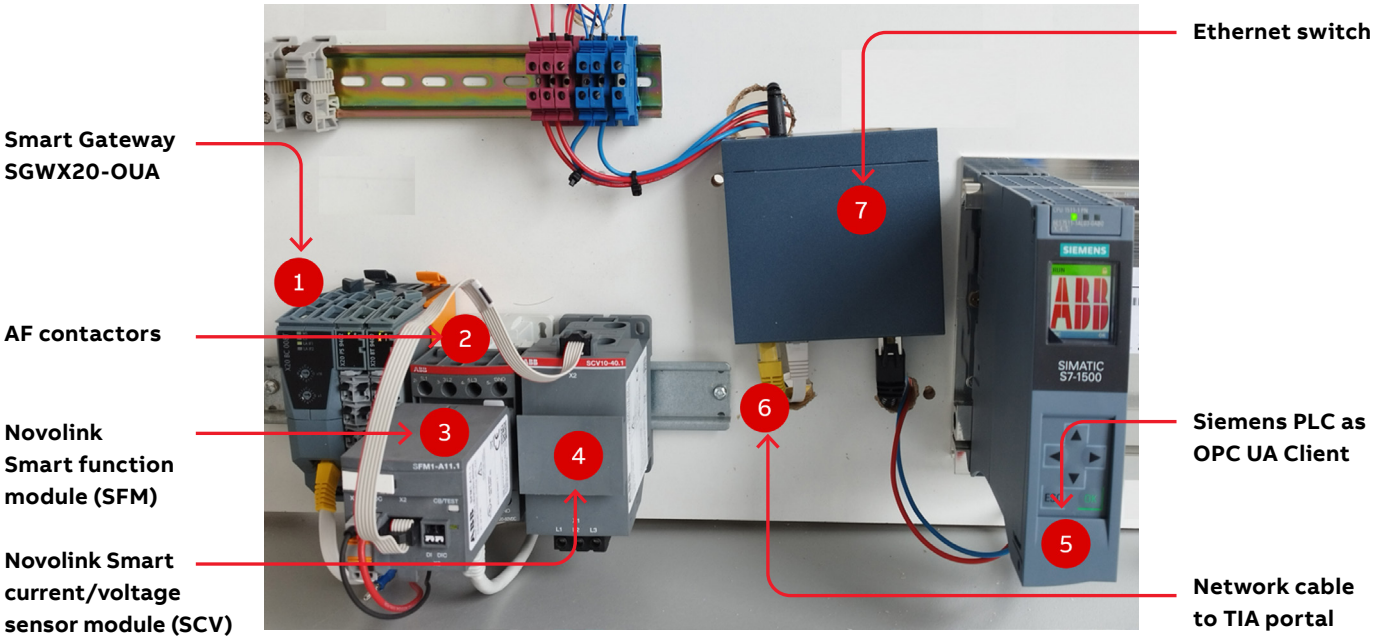
3.1. Hardware used

Following hardware are used.

	Device	Description	Part number	Quantity
Siemens	PLC	Siemens S7 1500 with firmware v2.6 or higher	1511-1PN - 6ES7 511-1AK02-0AB0 with firmware V2.9	1
Novolink	SFM-CAB-RJTB.1-500	Connection cable RJ45 - X20 Terminal block of X20BT9400	1SVM823000R0500	2
Novolink	SFM-CAB-S.1-50	Connection cable SFM to sensor 0.5 m	1SVM811000R0050	2
Novolink	SCV10-40.1	Smart current/voltage sensor	1SVM320010R0000	1
Novolink	SFM1-A11.1	Advanced function module with X2X	1SVM120012R0000	2
Contactor	AF09	Contactors	1SBL137001R1101 AF09-30-01-11	2
X2X OPC UA Gateway	X2X OPC UA Gateway	B&R controller	X20BT08T	1
X2X OPC UA Gateway	Power supply for the bus coupler	B&R controller	X20PS9400	1
X2X OPC UA Gateway	Power supply and interface of the X2X bus	B&R controller	X20BT9400	1
X2X OPC UA Gateway	Backplane module	B&R controller	X20BB80X	1

3.2. Architecture used

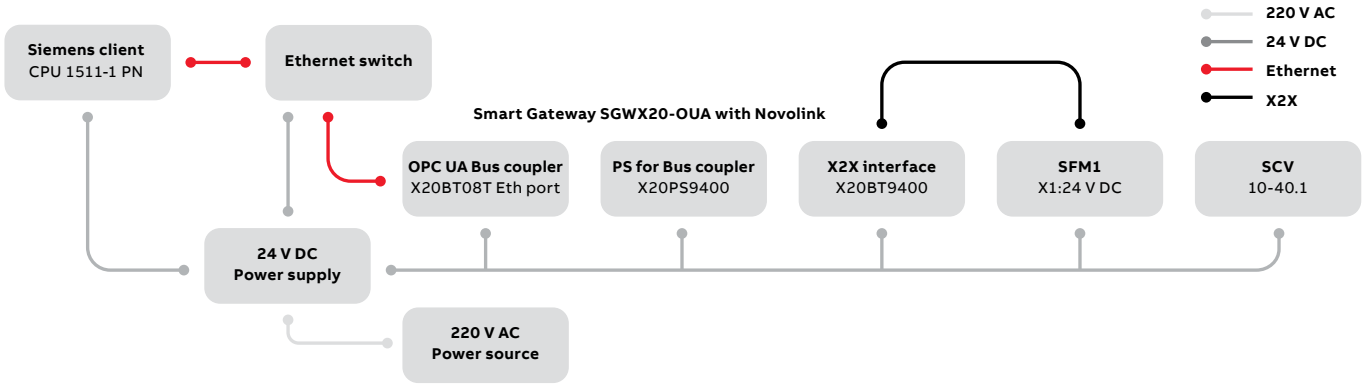
This section describes basic steps required to set up the Smart Gateway, Novolink modules with Siemens PLC.
The setup can be done as shown in the picture below:



Number	Description
1	Smart Gateway SGWX20-OUA
2	AF contactors
3	Novolink Smart function module (SFM)
4	Novolink Smart current/voltage sensor module (SCV)
5	Siemens PLC as OPC UA Client
6	Network cable to TIA Portal (install on a PC)
7	Ethernet switch

3.2.1. Wiring and power up

Refer to the architecture used, please ensure that all wiring is done, and devices are powered up using the schematic shown below.



24 V DC	24VDC is connected to the Smart Gateway, Novolink modules and PLCs
220 V AC	220 V AC is required for power supply. 220 VAC can also be used for power up contactors
OPC UA	For OPC UA: Connect the Smart Gateway and Siemens PLC to the ethernet switch
X2X	Connect Smart Gateway to SFM with cable “SFM-CAB-RJTB.1-500” Connect SFM to Sensors with cable “SFM-CAB-S.1-50”

3.2.2. Software configuration

Configuration of Siemens PLC	Following software are used to configure the Siemens PLC: • Siemens TIA Portal V17 or higher • Siemens OPC-UA license
Configuration of B&R Gateway	UaExpert
Reading/writing data from Novolink via B&R controller	UaExpert

4. Siemens client

4.1. Preparation and supplies

This section describes what you need to make the configuration in TIA V17.

- Novolink setup:
  see manual “SGWX20-OUA Smart Gateway X20 to OPC UA Connecting Novolink devices with OPC UA clients.”
- Siemens S7 1500 with firmware v2.6 or higher (example: 1511-1PN - 6ES7 511-1AK02-0AB0 with firmware V2.9)
- Siemens TIA Portal V17 or higher
- Siemens OPC-UA license
- The modules are wired to each other.
- IP-address of the server (example: 192.168.2.11)

This example will use the CPU 1511 with Firmware V2.9.

4.2. The properties of the CPU

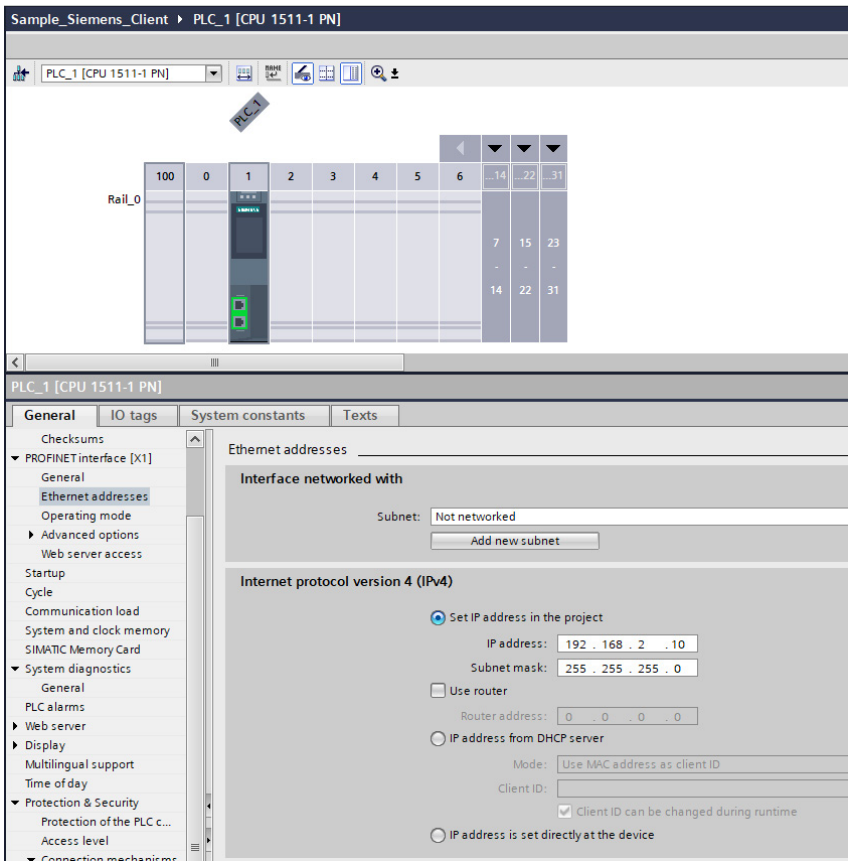


Figure 1: CPU_IP Address

- Make sure that the IP-address of the server and the client are in the same network

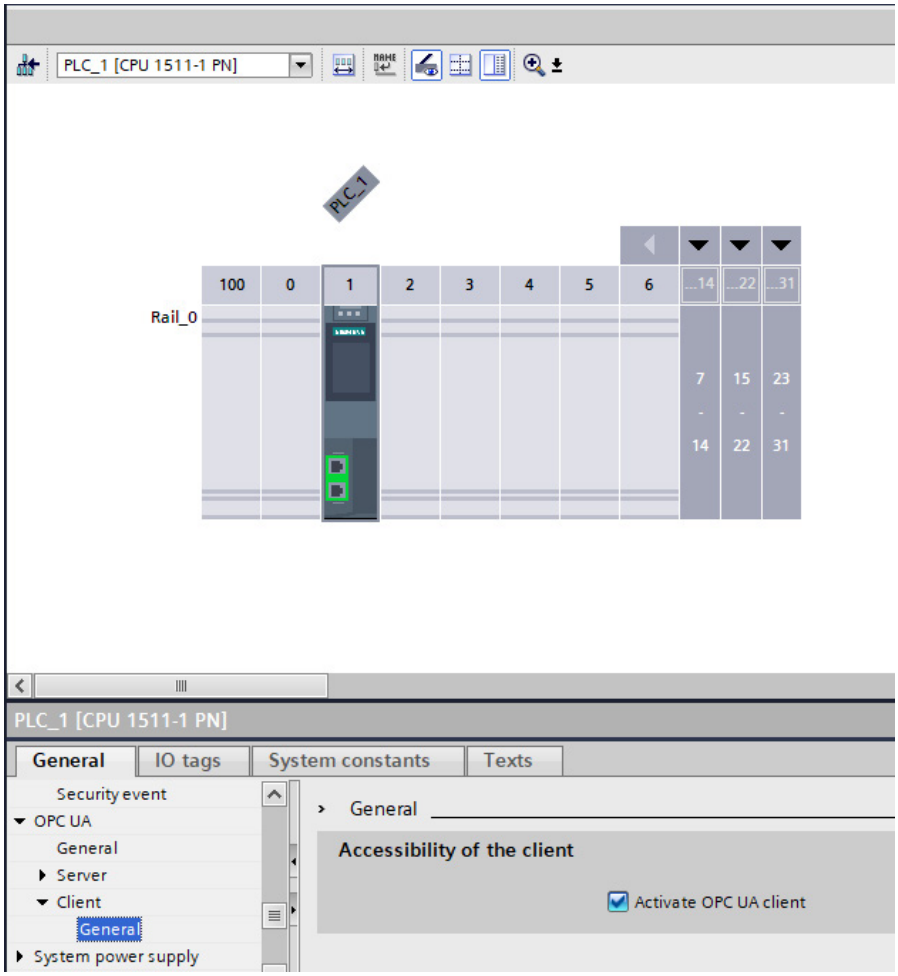


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Figure 2: CPU_OPCUA_Client

- Enable the checkbox “Activate OPC UA Client”

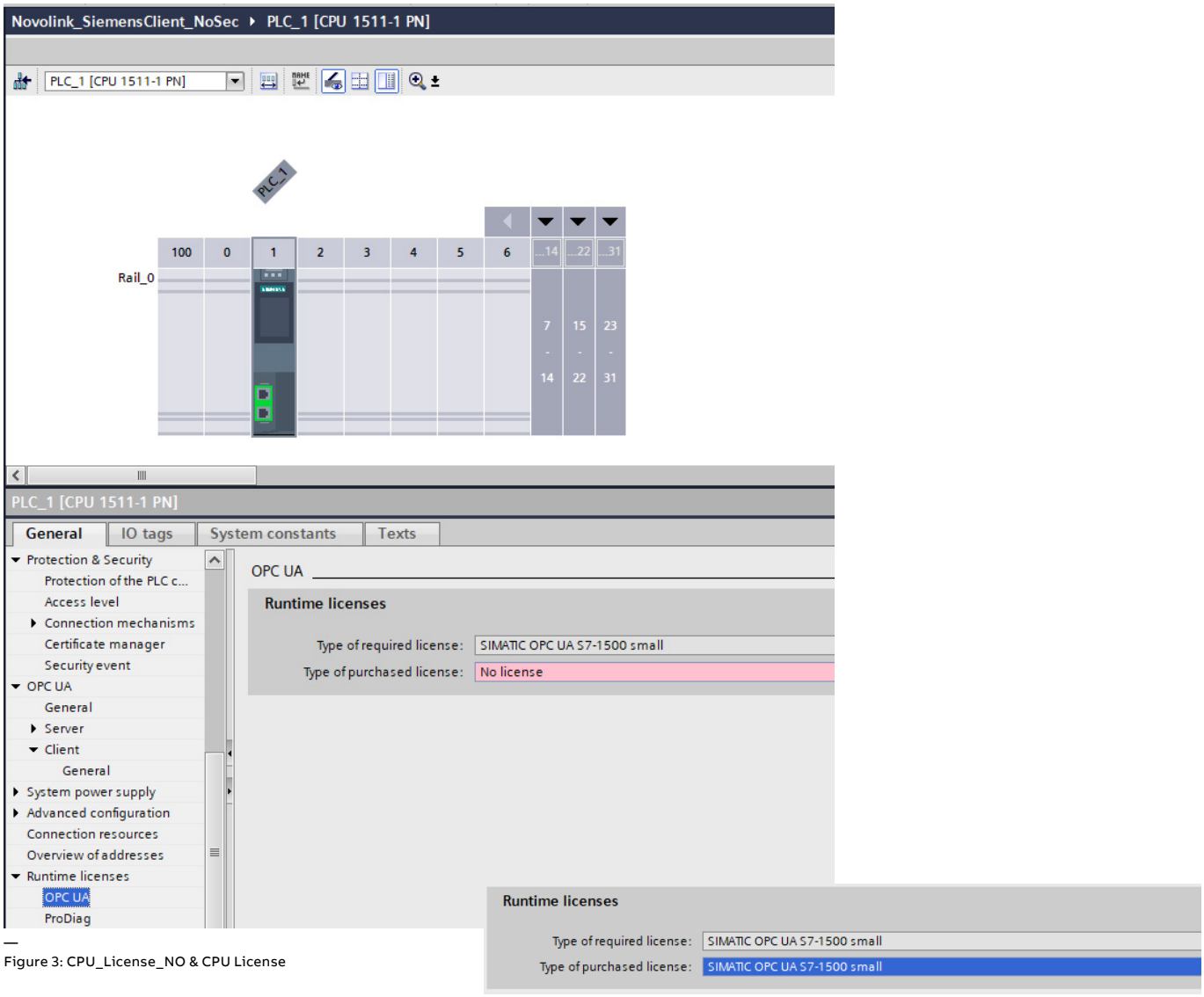


Figure 3: CPU_License_NO & CPU License

- Select the license, Siemens will inform what license you require

The license type is determined by the PLC that is used.

Licensing

An OPC UA Server or OPC UA Client is available on the target systems (CPUs) and is activated using runtime licenses. Runtime licenses are offered in three levels for different target systems:

Target system	OPC UA S7-1200 Basic	OPC UA S7-1500 Small	OPC UA S7-1500 Medium	OPC UA S7-1500 Large
S7-1200 CPUs	Yes	No	No	No
ET 200SP CPU 1510SP/1512SP/1515SP (Open Controller) S7-1500 CPU 1511/1513 CPU 1504D Drive Controller	No	Yes	Yes	Yes
ET 200pro CPU 1516pro S7-1500 CPU 1515/1516 PLC 1507S software	No	No	Yes	Yes
S7-1500 CPU 1517/1518/1508S CPU 1507D Drive Controller	No	No	No	Yes

The runtime license includes the certificate for OPC UA (Server and Client) and can be run on the respective target systems including F, C and T/TF as from firmware V2.0 (Client V2.6).

You can find more information on the Software Update Service, license types, Online Software Delivery and handling your SW licenses with the Automation License Manager under this link.

https://mall.industry.siemens.com/mall/en/WW/Catalog/Products/10315991

4.3. The client interface

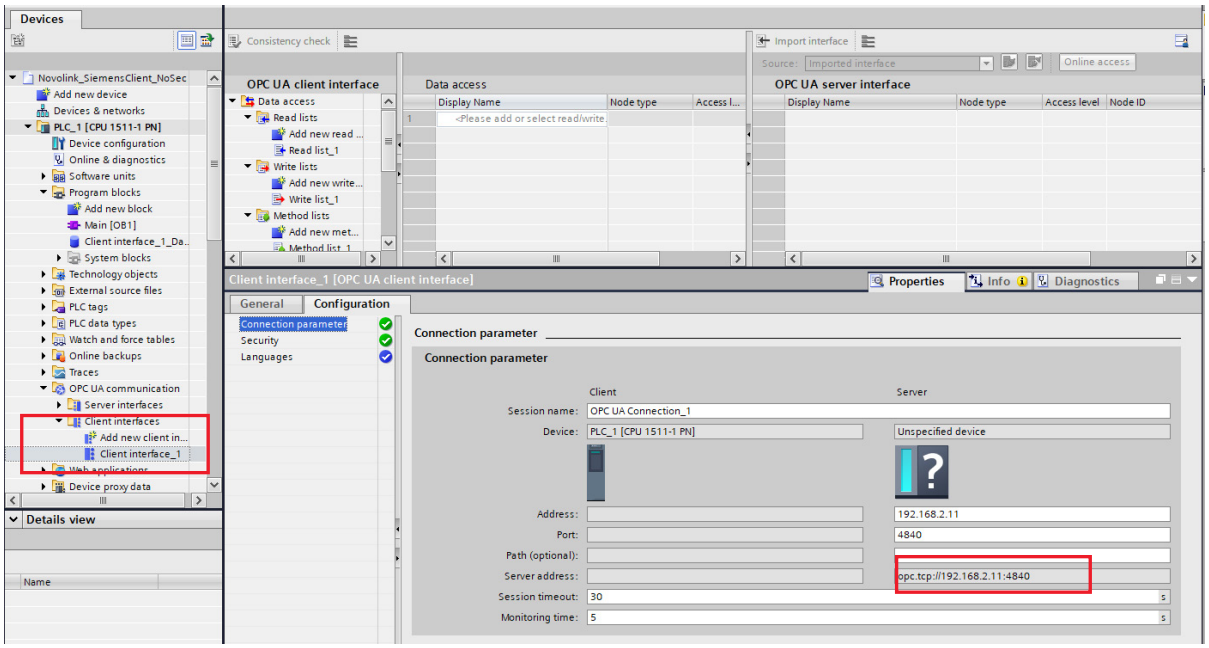


Figure 4: ClientInterface_ConnectParameter

- Add a new client interface
- Fill in the IP address of the server

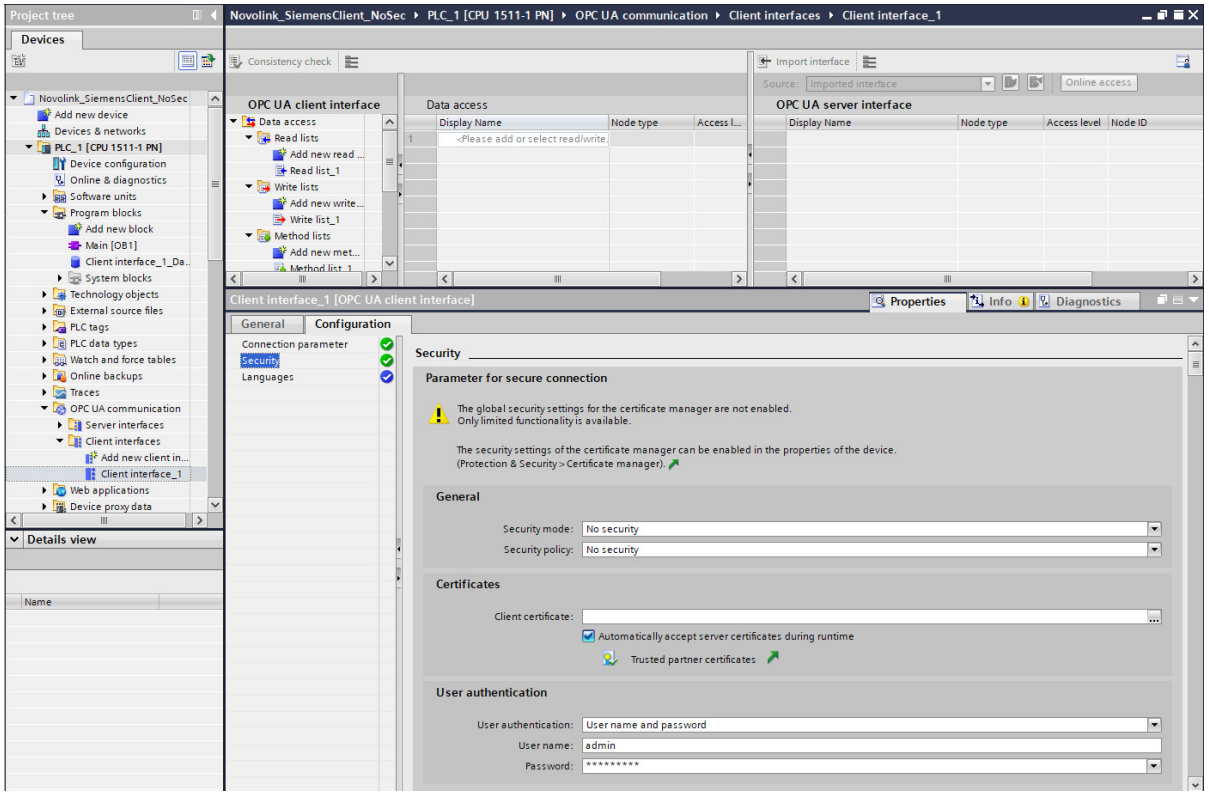


Figure 5: ClientInterface_Security

- Make sure “No security” is selected and that “automatically accept server certificates during runtime” is checked
- Fill in the username and the password of the server

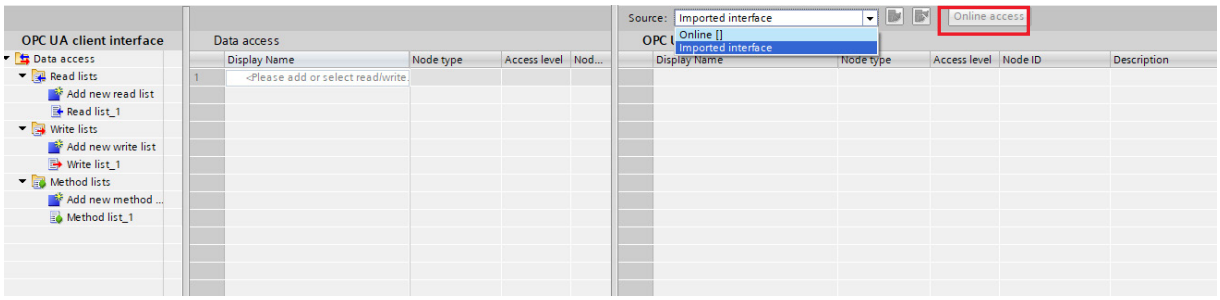


Figure 6: ClientInterface_OnlineAcces

On the topside of the client interface screen.

- Select “Online [ ]” behind source
- Click the “Online Access” button

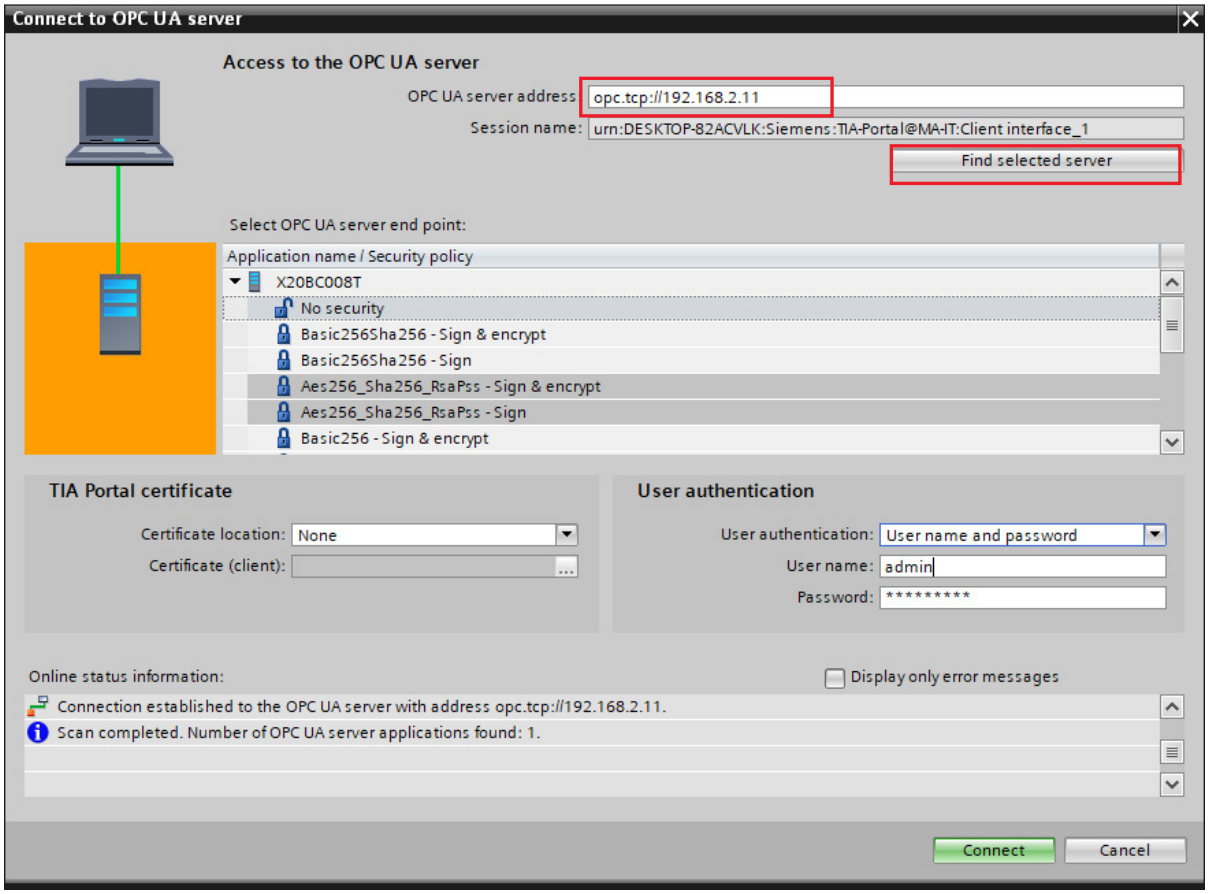


Figure 7: PopUp Online Access

The access pop-up popped up.

- Fill in the IP-address of the server
- Click the “Find Selected Server” button

Server with the security protocols will be shown

- Select “No Security”
- Select in User authorisation “User name and Password”
- Fill in the User name of the server
- Fill in the password of the server
- Click the button “Connect”

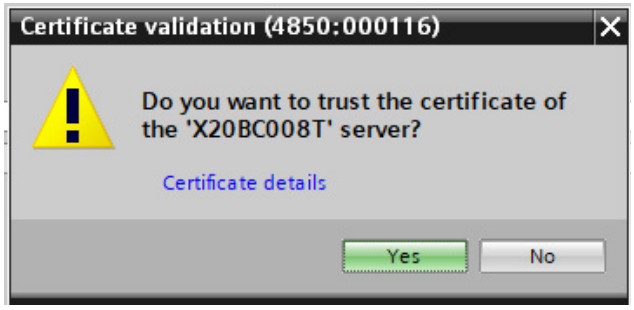


Figure 8: ClientInterface_ServerTrust

When asked if you trust the server certificate and you trust it.

- Click “yes”

On the right side of the screen, you will get the available objects of the server.

4.4. The Read list

4.4.1. Program read list

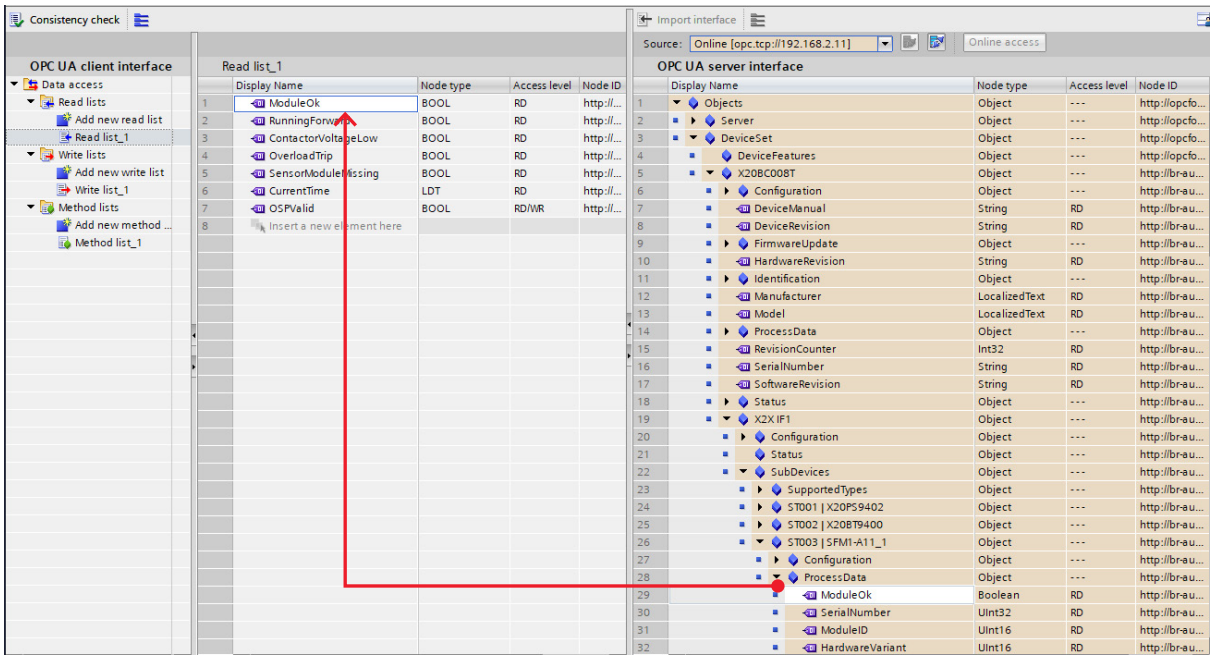


Figure 9: Read_list

- Add a new read-list.
- Select the variables you want to read and drag and drop the variables those you want to the left side into the read-list.
- Compile the software.

Note:
It is possible to add multiple read lists. For each read list you can use different reading intervals.

In this example we will use the next variables:

- ProcessData >> ModuleOk
- ProcessData >> RunningForward
- ProcessData >> ContactorVoltageLow
- ProcessData >> OverloadTrip
- ProcessData >> SensorModuleMissing
- ProcessData >> OSPValid

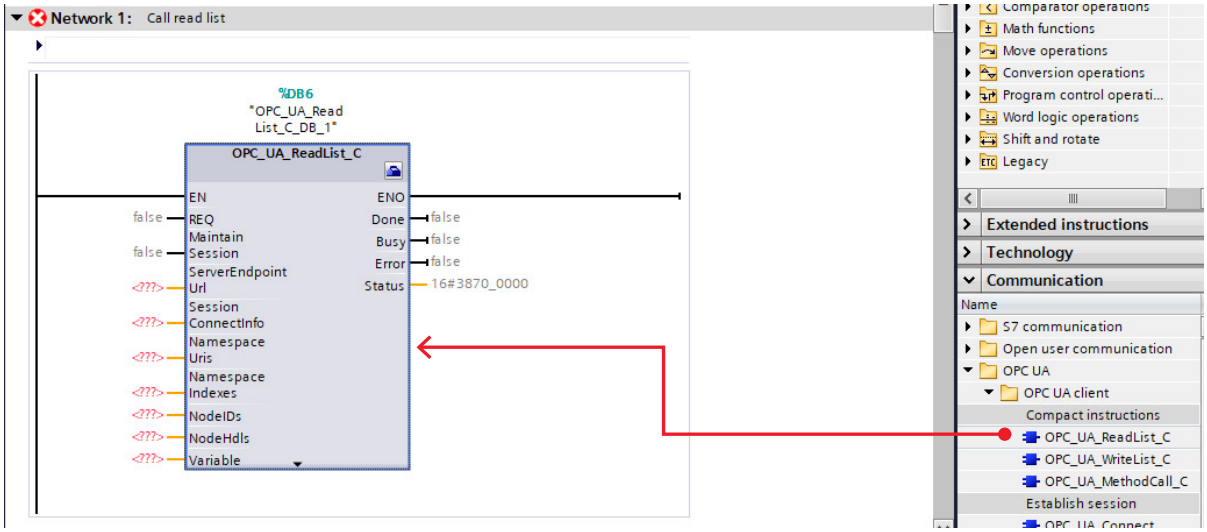


Figure 10: OB1_Readlist

- Drag and drop the OPC_UA_ReadList_C in OB1

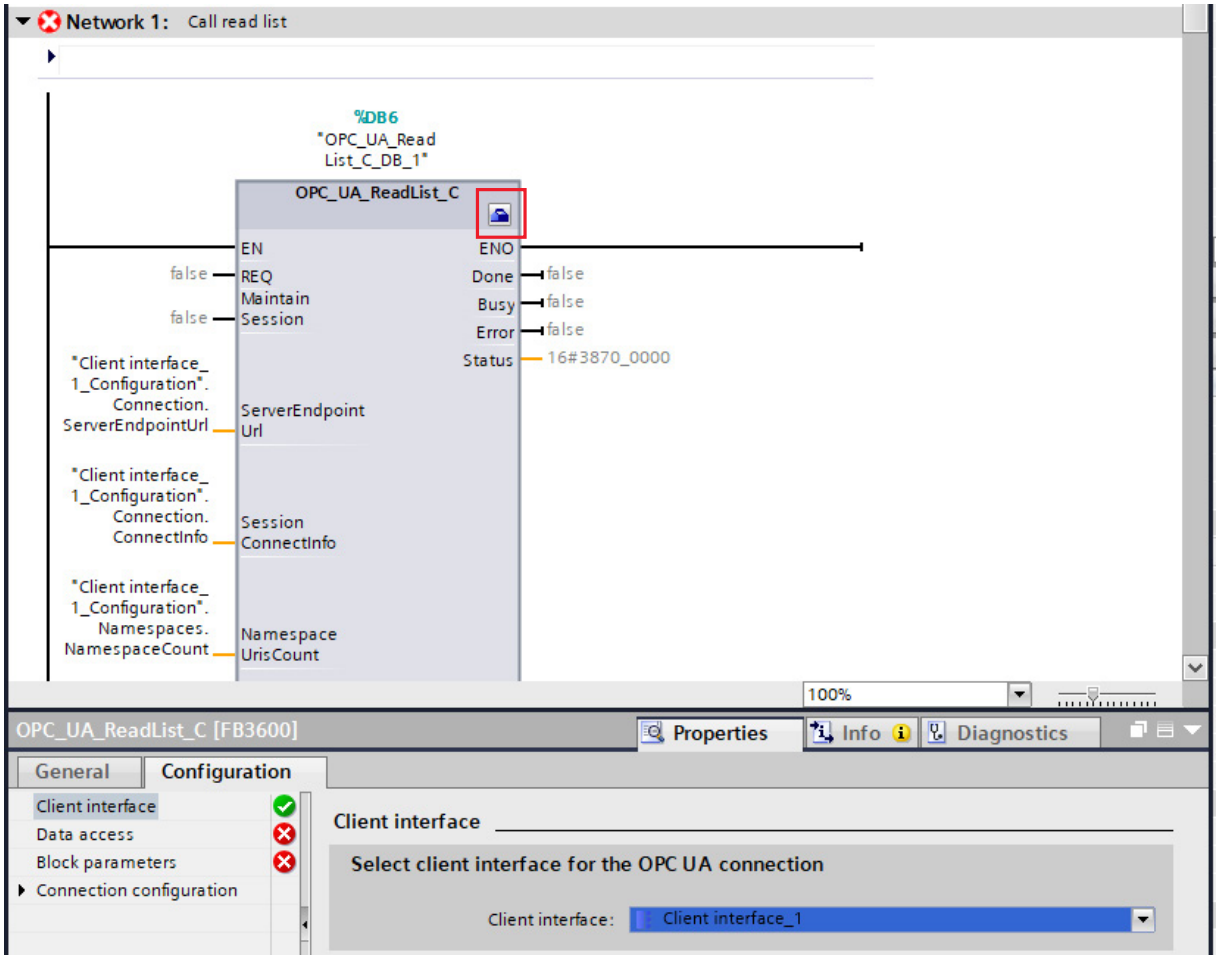


Figure 11: OB1_Readlist_ClientInterface

- Click on the toolbox icon in the upper right corner of the OPC_UA_ReadList_C block

The configuration of the OPC_UA_ReadList_C block will be shown below.

- Select the client interface that was made before.

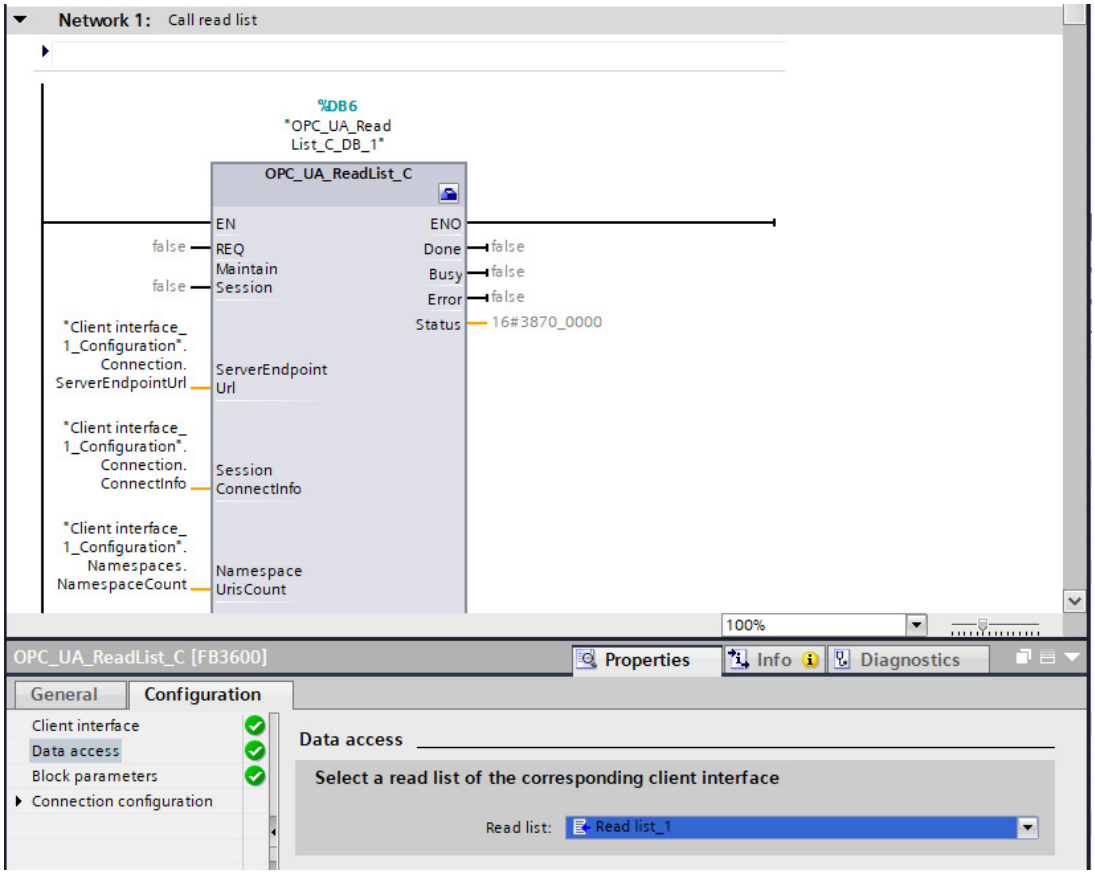


Figure 12: OB1_Readlist_DataAcces

- Select the read-list that was made before
- The rest of the parameters will be set automatically by Siemens

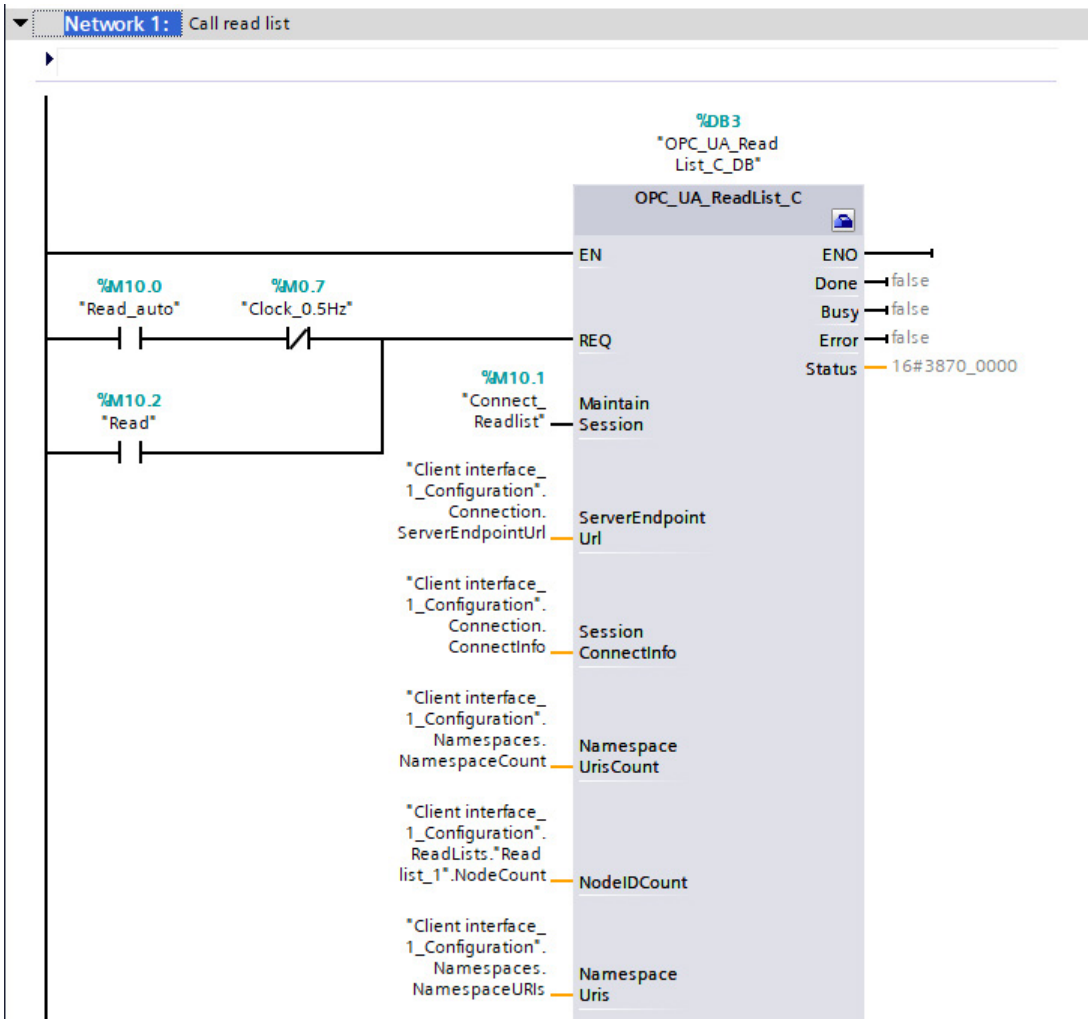


Figure 13: OB1_Readlist_Merkers

- Add a tag to the Request input (REQ). On every positive edge it will make connection with the server and the variables will read from the server
- Add a tag to the Maintain session
- Compile the project with a rebuild all for hardware and software
- Download “hardware configuration”
- Download “Software all”

Note:
The maintain session keeps the connection between server and client. It is not necessary to put this on true, but it will take less time to reconnect every time there is a positive edge on the REQ
When an error occurs it’s up to the user to disable the maintain and re-enable it to reconnect to the server.

4.4.2. Check read list

For reading the data from the server:

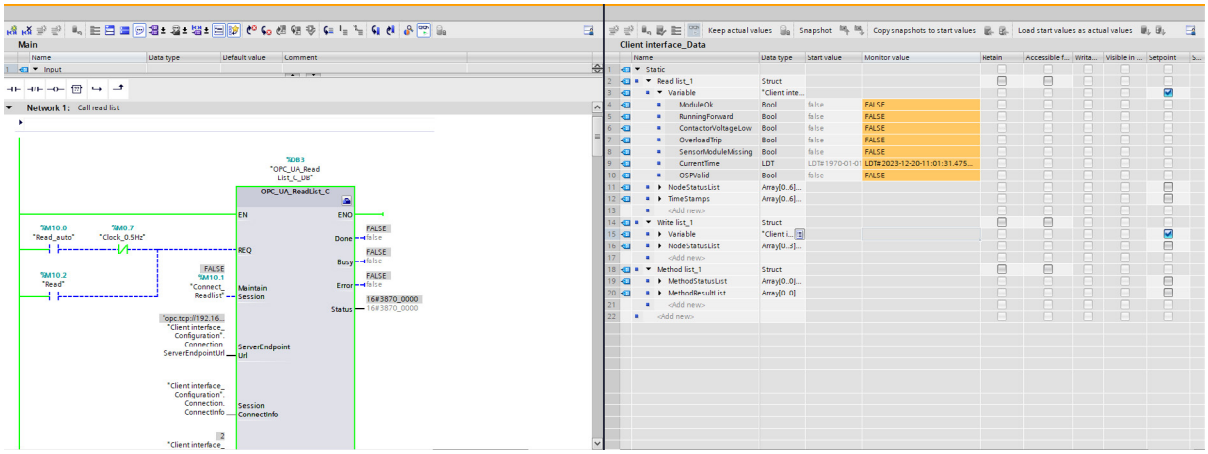


Figure 14: Online_setup_Reading

- Open “OB1” and “Client_Interface_Data” and put the screens next to each other
- Open the menu Readlist_1 >> Variable
- Monitor both screens

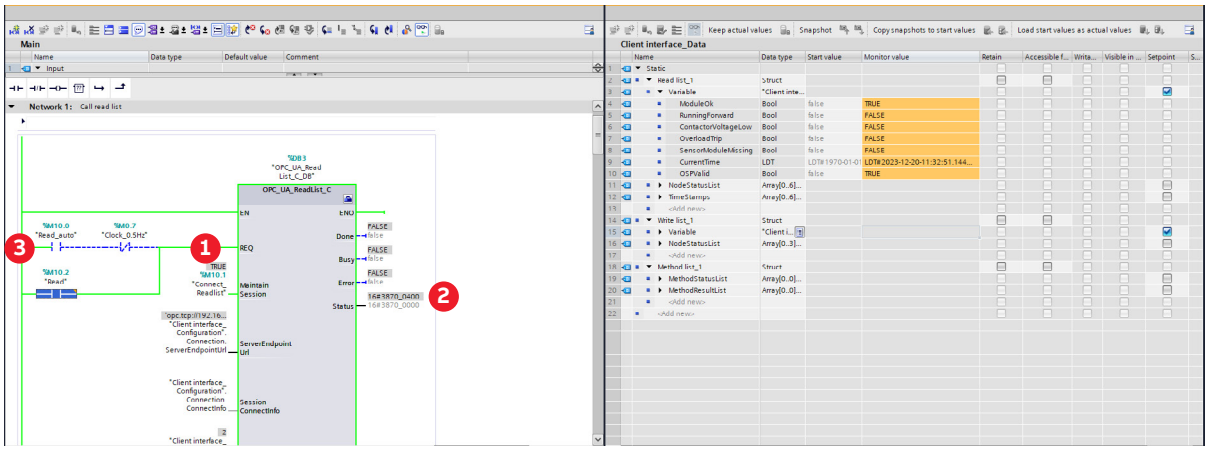


Figure 15: Online_Connect_Reading

- Connect to the server by set the tag “Connect_Readlist (Maintain Session)” on TRUE 1
- Check the status variable in OB1. The status should be return 16#3870_0400 2
- Read the values by setting the tag “Read”or “Read_auto” on TRUE. On Every positive edge of the REQ-signal the data will be reading from the server 3
- The variables on the “Client_Interface_Data” screen have now been read from the server

4.5. The write list

4.5.1. Program write list

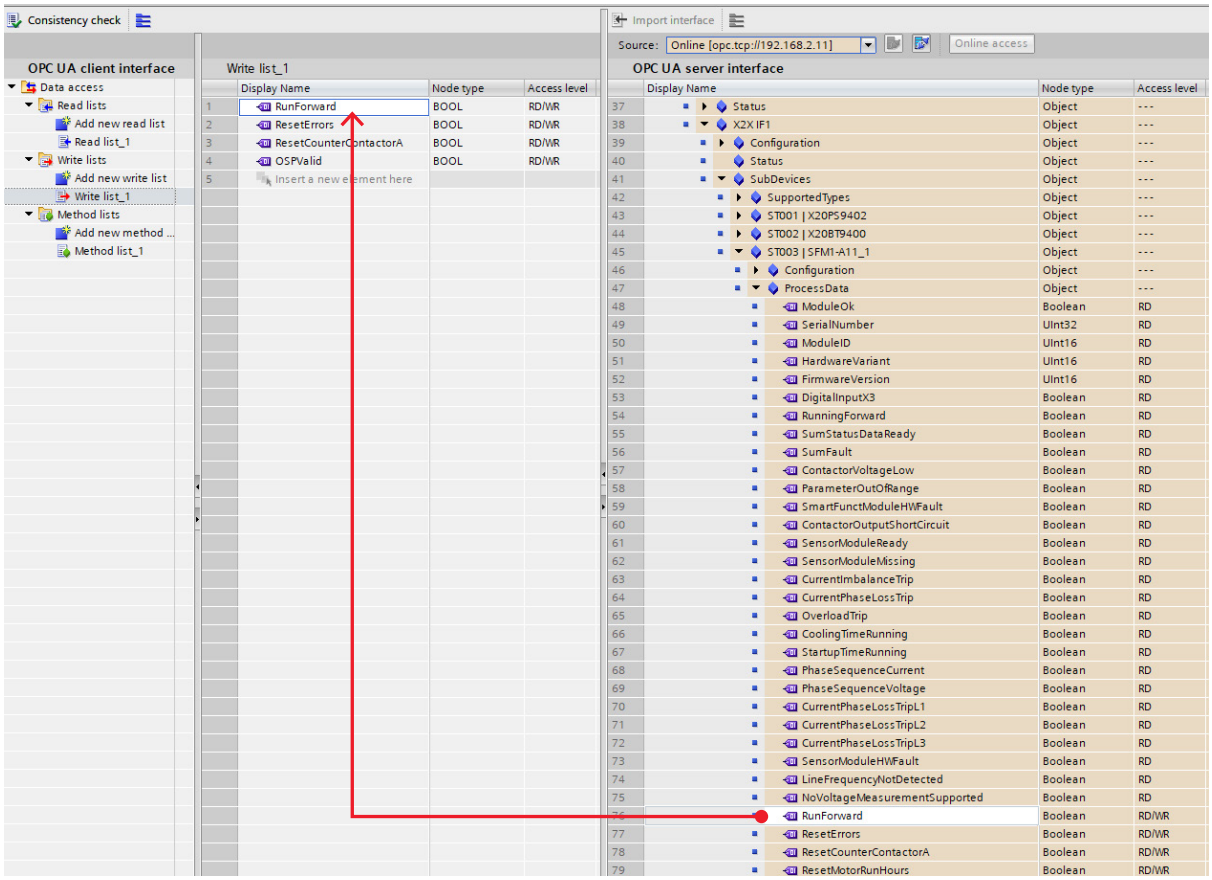


Figure 16: Write_list

- Add a new write-list
- Select the variables you want to write and drag and drop the variables those you want to the left side into the write-list
- Compile the software

Note: It is possible to add multiple write lists.

In this example we will use the next variables:

- ProcessData >> RunForward
- ProcessData >> ResetErrors
- ProcessData >> ResetCounterContactorA
- ProcessData >> OSPValid

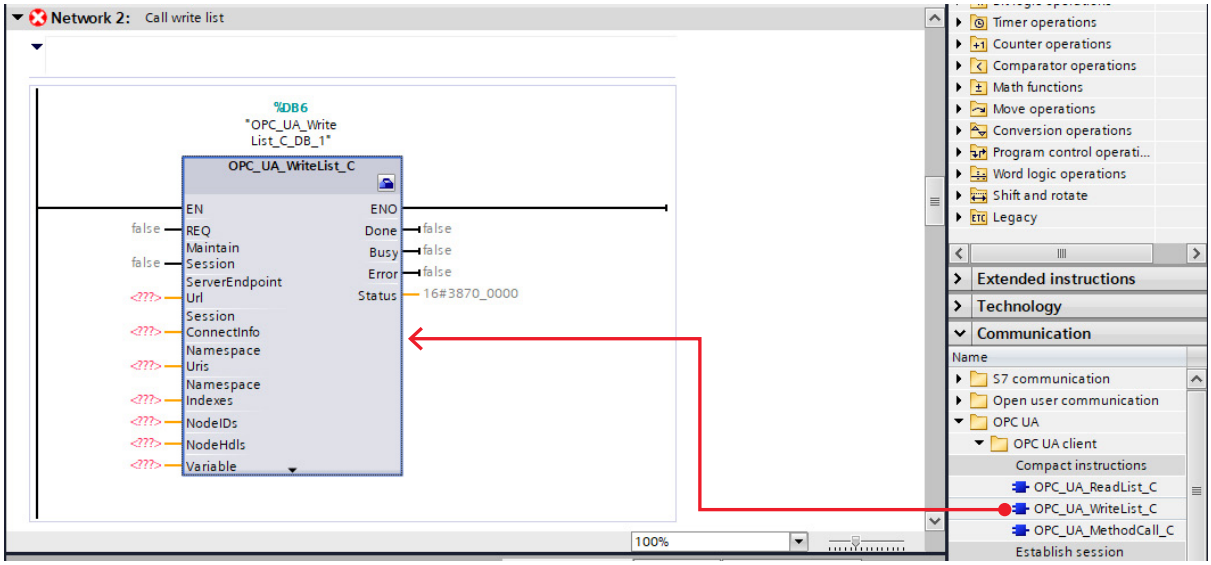


Figure 17: OB1_writelist

- Drag and drop the OPC_UA_WriteList_C in OB1

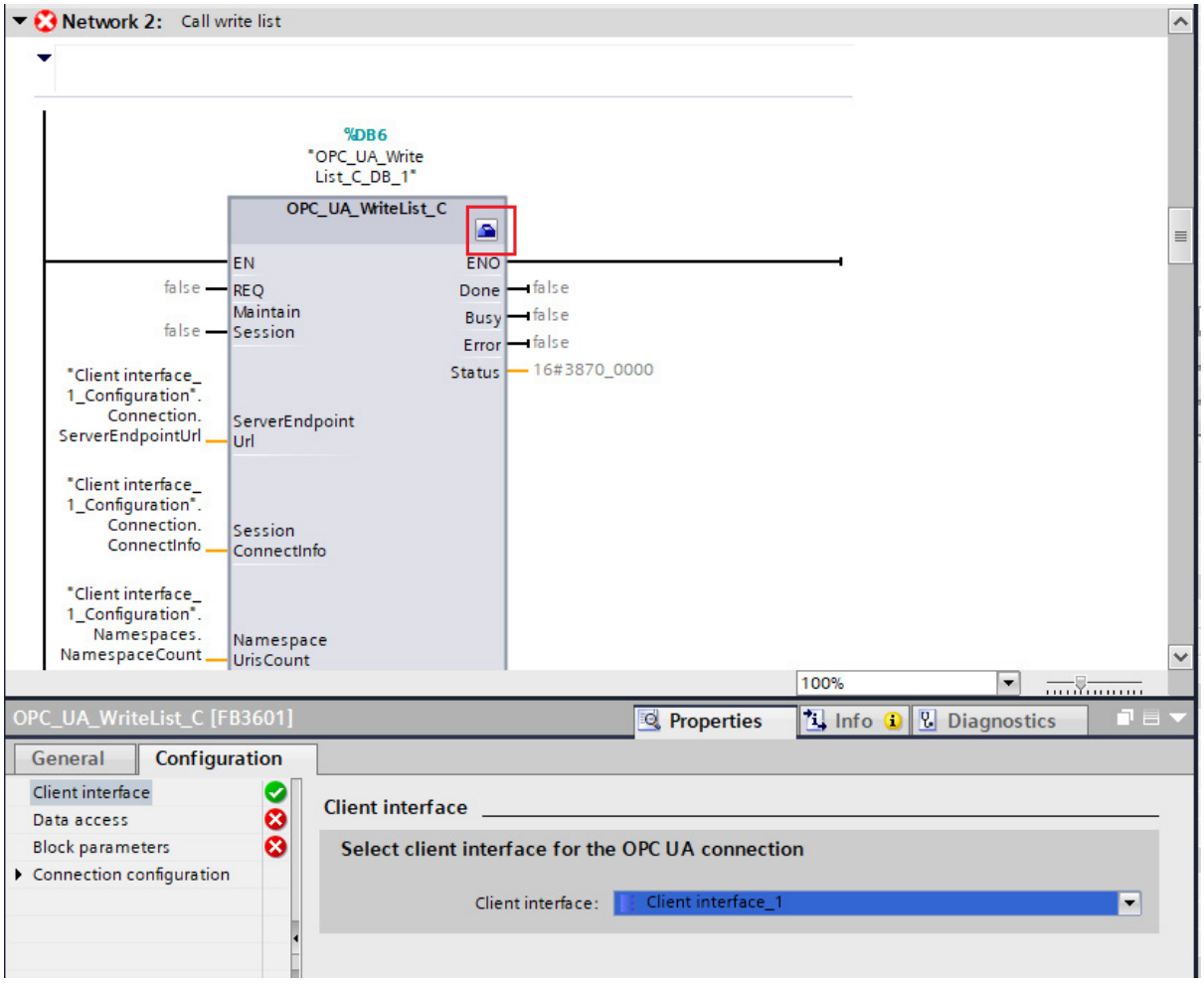


Figure 18: OB1_writelist_ClientInterface

- Click on the toolbox icon in the upper right corner of the OPC_UA_WriteList_C block

The configuration of the OPC_UA_WriteList_C block will be shown below.

- Select the client interface that was made before

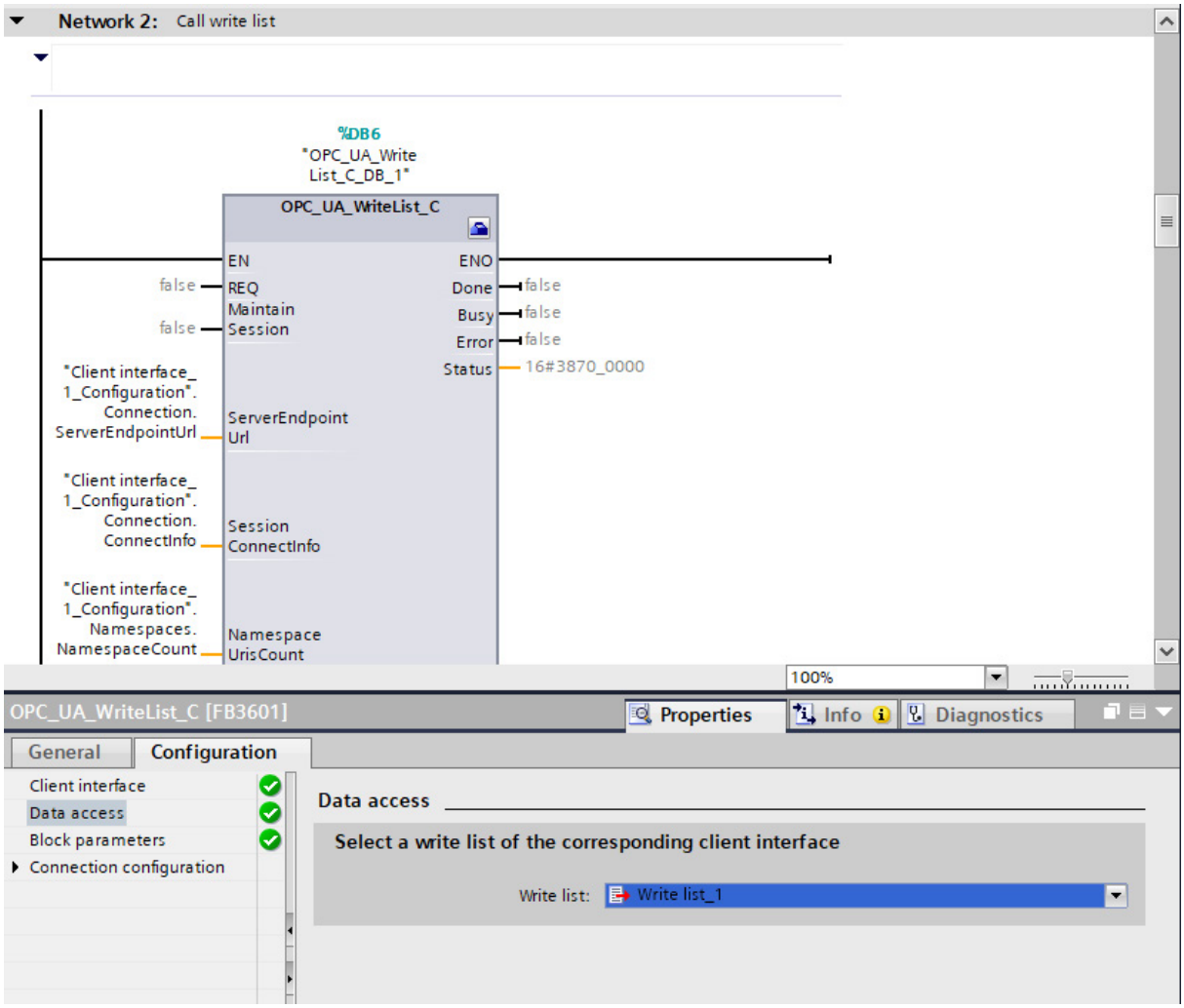


Figure 19: OB1_Writelist_DataAcces

- Select the write-list that was made before.
- The rest of the parameters will be set automatically by Siemens.

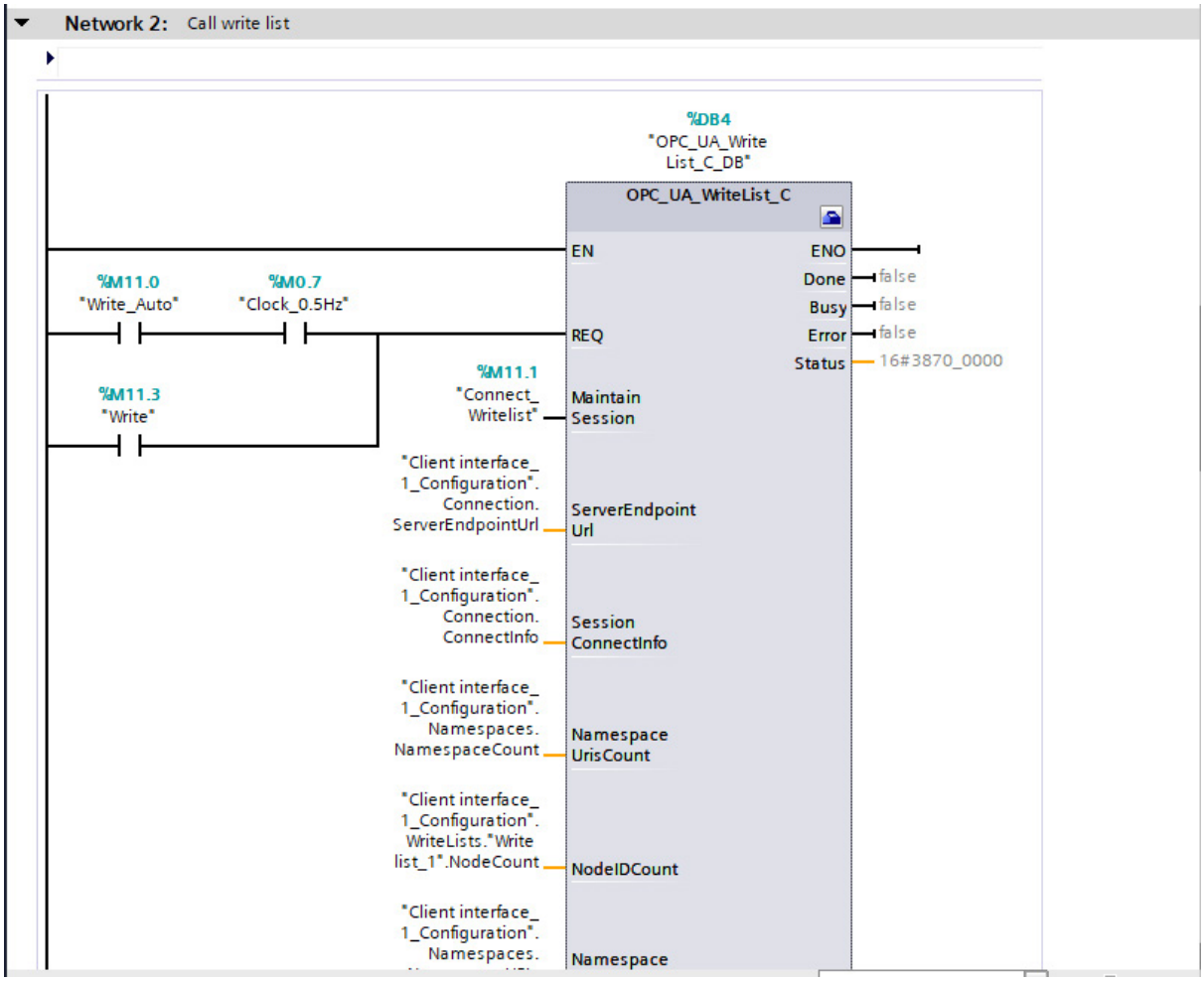


Figure 20: OB1_writelist_Merkers

- Add a tag to the Request input (REQ). On every positive edge it will make connection with the server and the variables will write to the server

Add a tag to the Maintain session.

- Compile the project with a rebuild all for hardware and software
- Download “hardware configuration”
- Download “Software all”

Note:
The maintain session keep the connection between server and client. It is not necessary to put this on true, but it will take less time to reconnect every time there is a positive edge on the REQ
When an error occurs it’s up to the user to disable the maintain and re-enable it to reconnect to the server.

4.5.2. Check write list

For writing the data in the server:

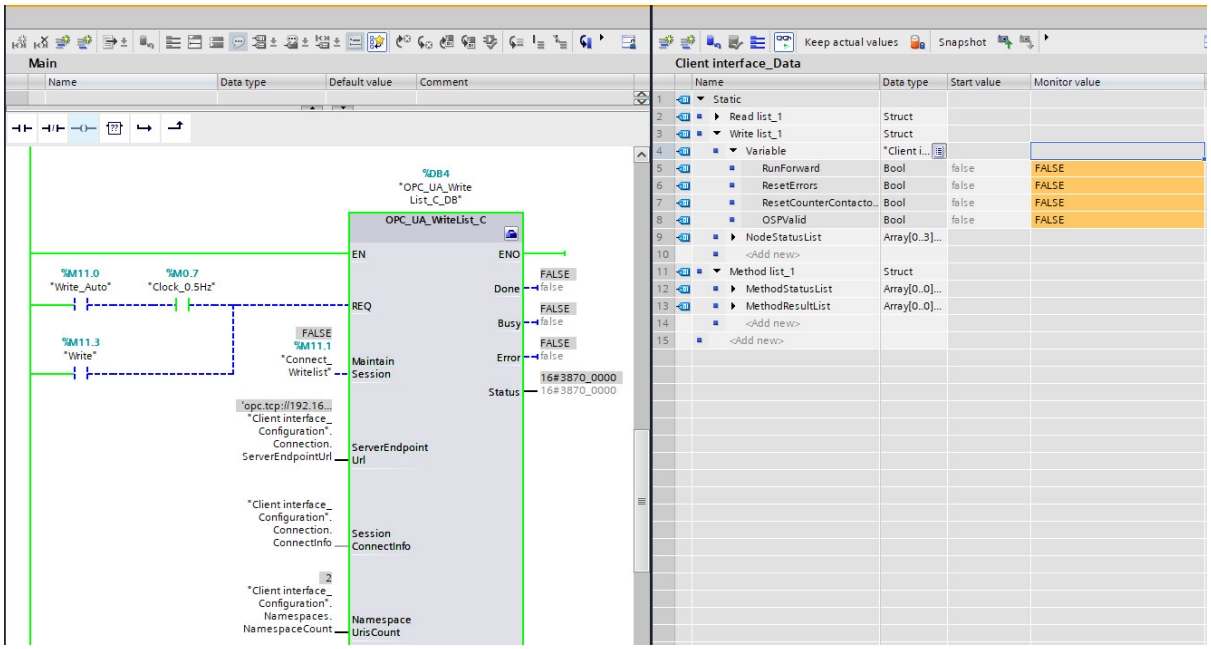


Figure 21: Online_setup_Writing

- Open “OB1” and “Client_Interface_Data” and put the screens next to each other
- Open the menu Writelist_1 >> Variable
- Monitor both screens.

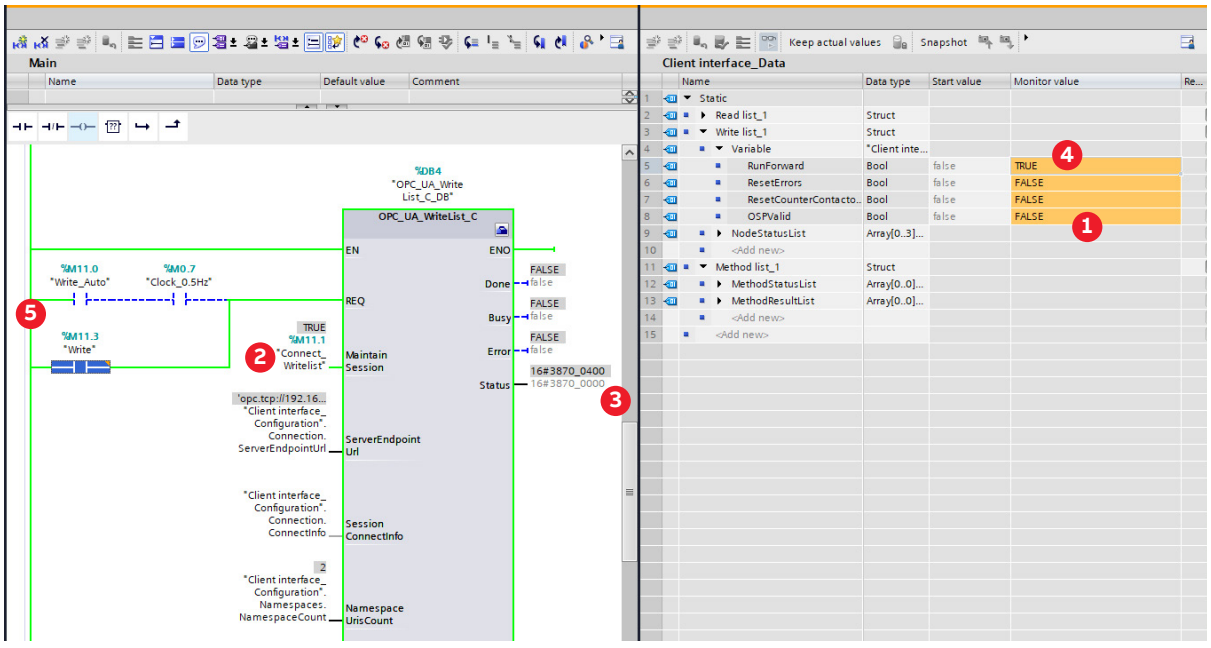


Figure 22: Online_Connect_Writing

- Check if “OSPValid” is True in the read variable else put the “OSPValid” variable on TRUE in the write list 1
- Connect to the server by set the tag “Connect_Writelist (Maintain Session)” on TRUE 2
- Check the status variable in OB1. The status should be return 16#3870_0400 3
- Change a value in the “Client_Interface_Data” screen, for example “RunForward” on TRUE 4
- Write the values by setting the tag “Write”or “Write_auto” on TRUE. On Every positive edge of the REQ-signal the data will be written to the server 5
- Check if the contactor makes a click sound

4.6. The method list

4.6.1. Program method list

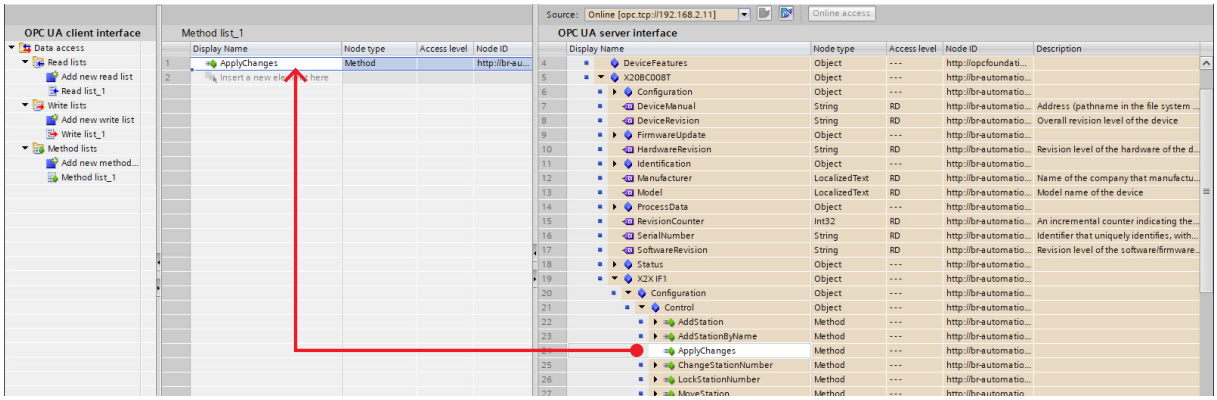


Figure 23: Method_list

- Add a new Method-list
- Select ApplyChanges and drag and drop the variable to the left side into the Method-list
- Compile the software

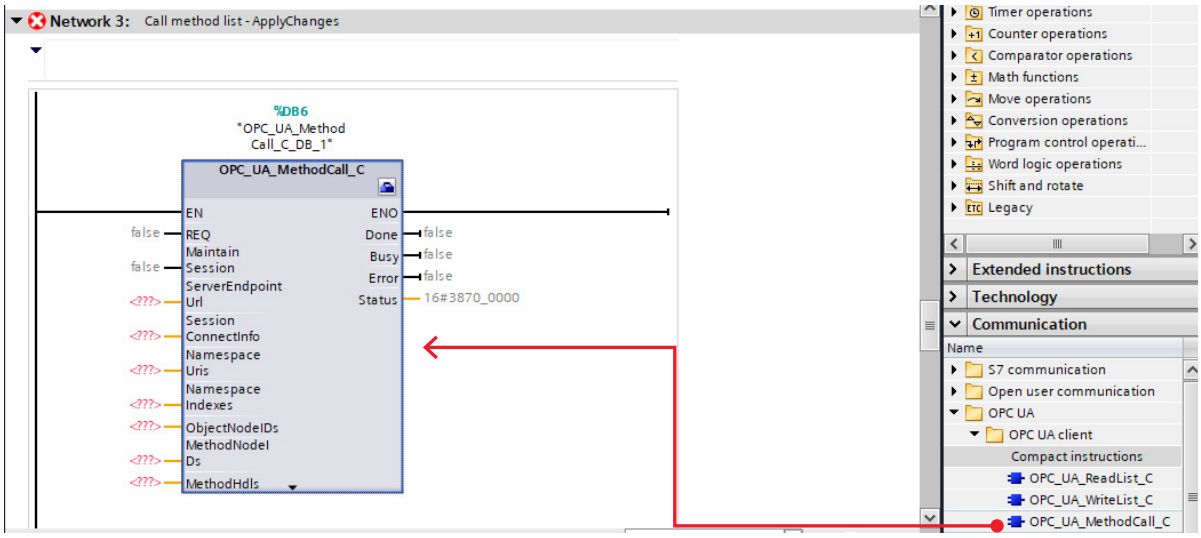


Figure 24: OB1_Methodlist

- Drag and drop the OPC_UA_MethodCall_C in OB1

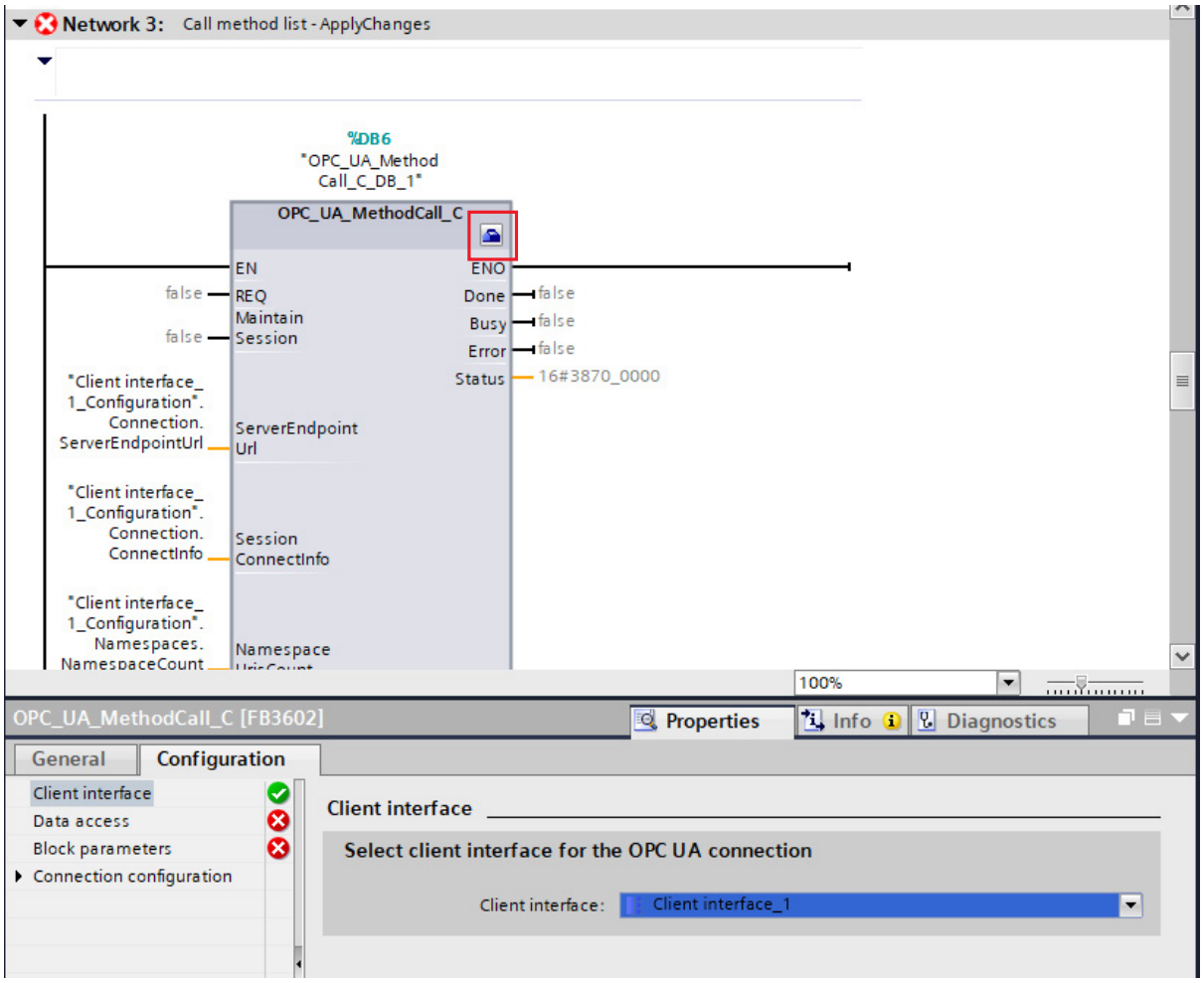
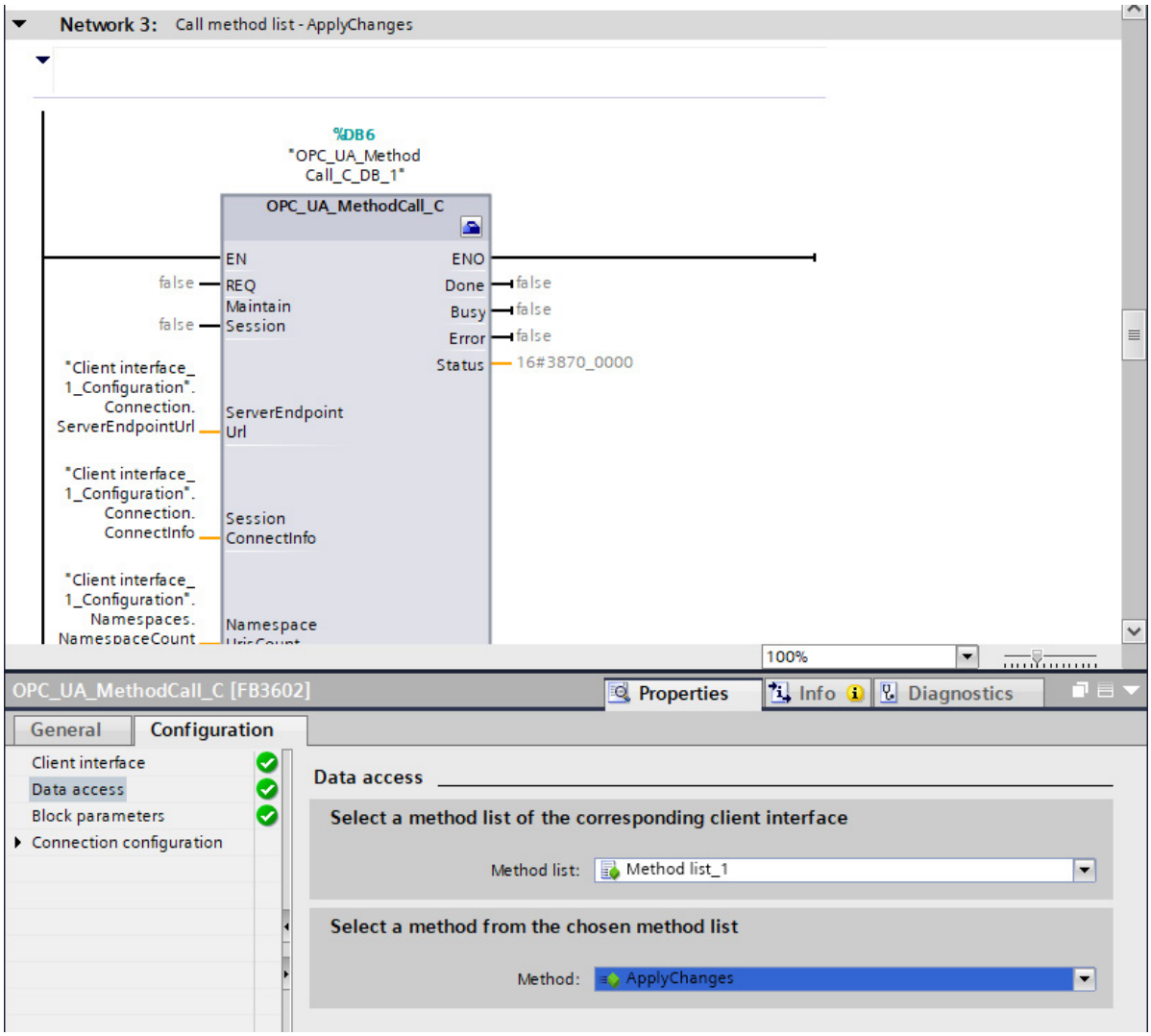


Figure 25: OB1_Methodlist_ClientInterface

- Click on the toolbox icon in the upper right corner of the OPC_UA_MethodCall_C block

The configuration of the OPC_UA_MethodCall_C block will be shown below.

- Select the client interface that was made before



—
Figure 26: OB1_Methodelist_DataAcces_AC

- Select the Method-list that was made before
- Select the method “ApplyChanges”
- The rest of the parameters will be set automatically by Siemens

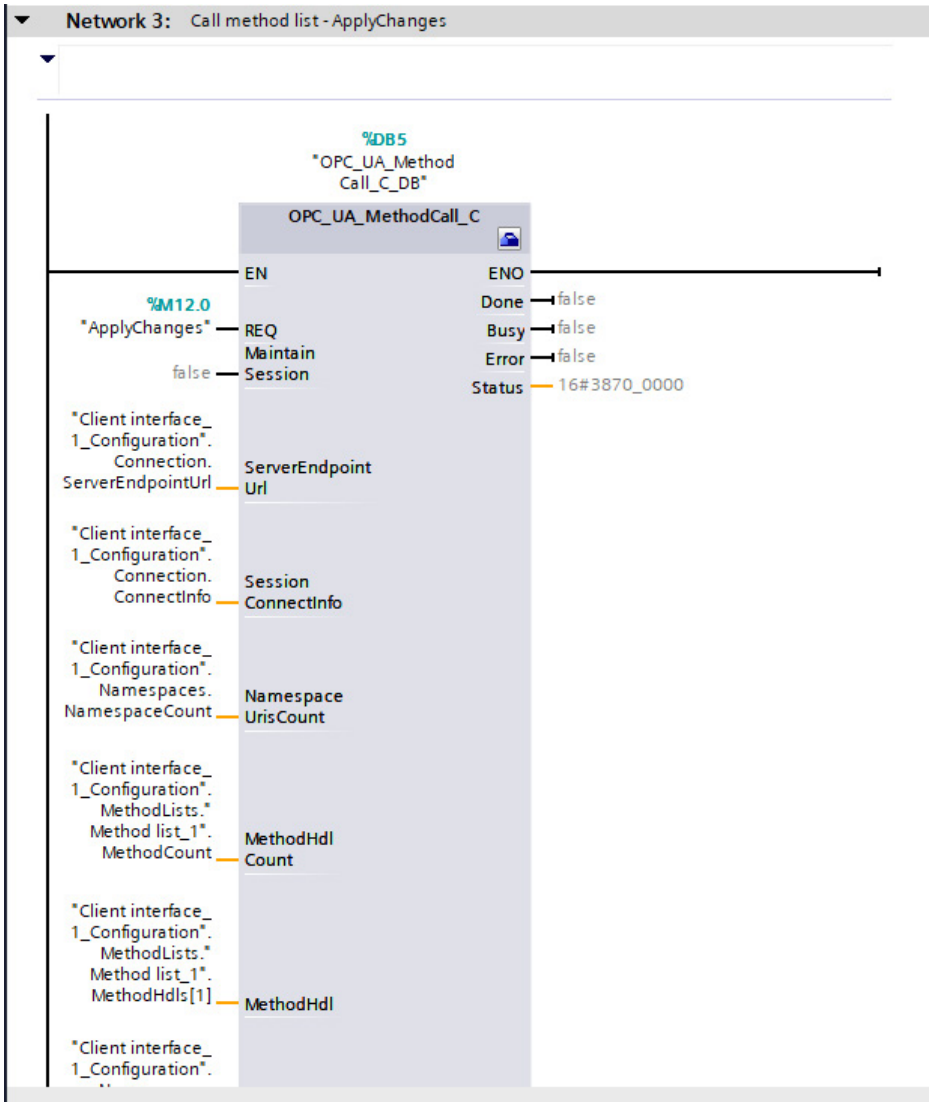


Figure 27: OB1_Methodlist_Merkers_AC

- Add a tag to the Request input (REQ). Every positive edge it will make connection with the server and apply the changes to the server
- Compile the project with a rebuild all for hardware and software
- Download “hardware configuration”
- Download “Software all”

4.7. Set parameters

To adjust the parameter value you must use the method-list.

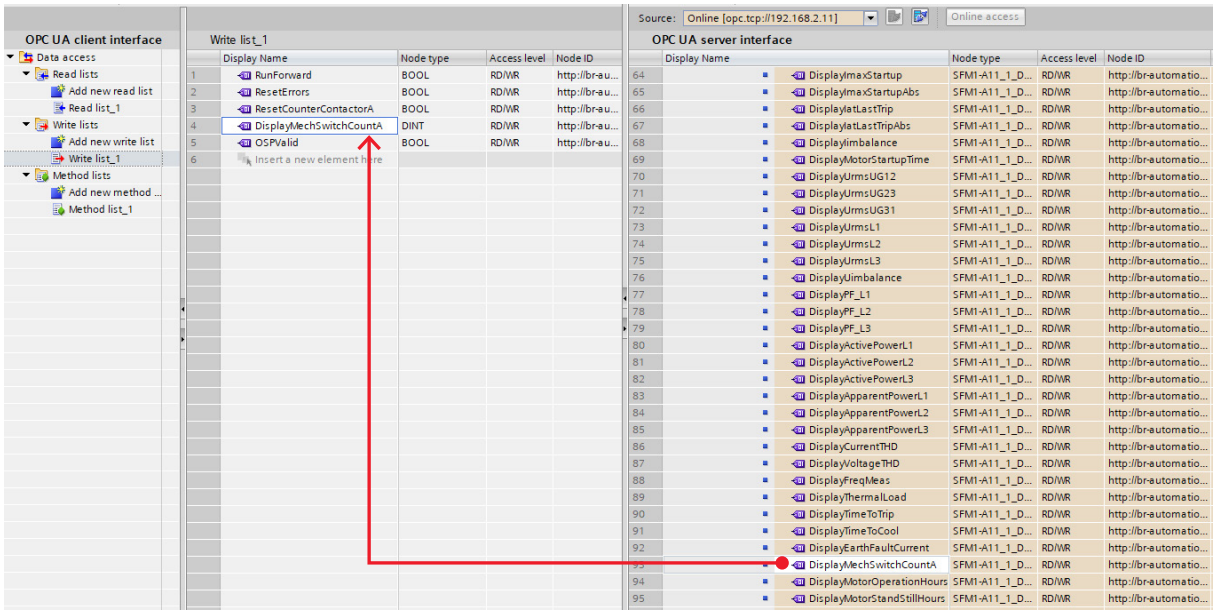


Figure 28:Online_Set_Parameter_Writelist

- Drag and drop the parameter in the write list
- Compile the software

In this example we want to know how many time the contactor switched.
To be able to do this, we have to perform the following steps:

- Set the parameter “DisplayMechSwitchCountA” to TRUE
- Write the parameter to the server
- Use the Method “Apply Changes”
- Read the variable in the readlist
- ParameterSet >> DisplayMechSwitchCountA

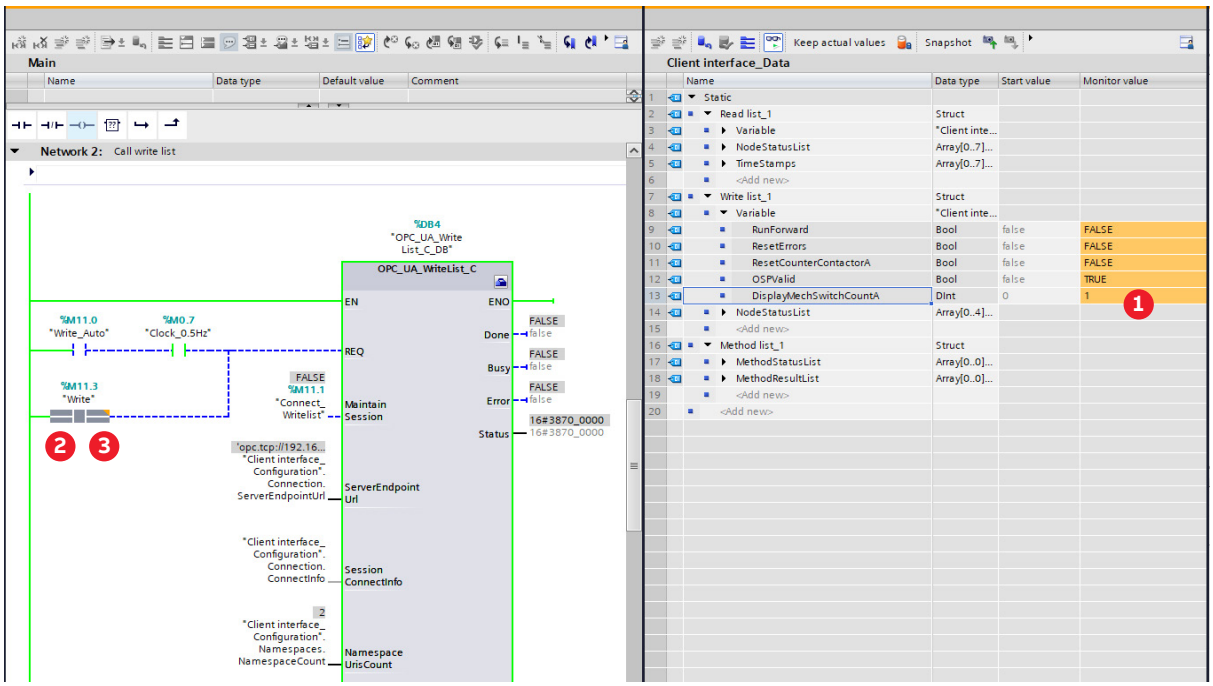


Figure 29: Online_Set_Parameter_Set

- Open “OB1” and “Client_Interface_Data” and put the screens next to each other
- Open the menu Writelist_1 >> Variable
- Monitor both screens
- Set “DisplayMechSwitchCountA” op 1 (1)
- Activate the write tag (2)
- Deactivate the write tag (3)

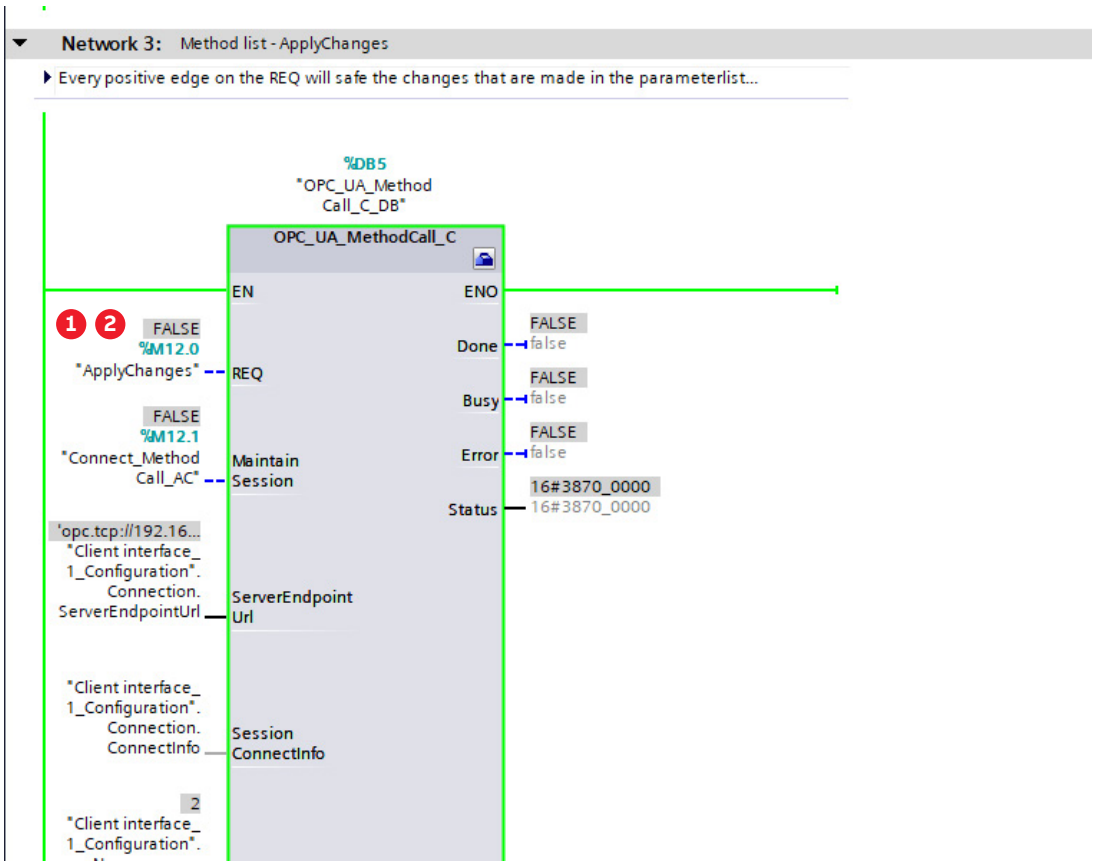


Figure 30: Online_Set_Parameter_ApplyChanges

- Activate the ApplyChanges (REQ) (1)
- Deactivate the Applychanges (REQ) (2)

After disconnecting and connect the server again, the variable should be available in the processData of the client interface.

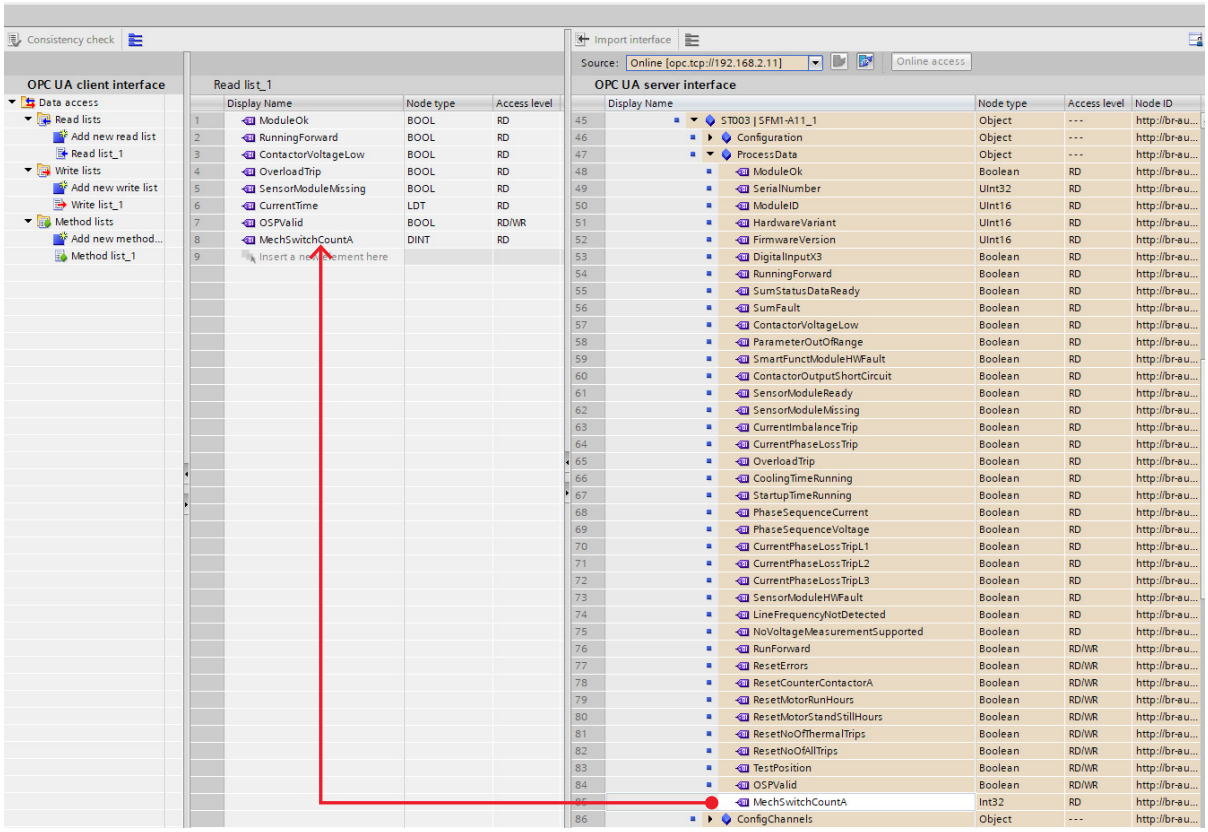


Figure 31: Online_Set_Parameter_Result

Example:

- ProcessData >> MechSwitchCountA

5. Configuring Novolink with Smart Gateway

Please use following documents to configure Novolink with Smart Gateway

Document type	Document number	Link
SFM1 Manual	2CDC100017M0201	link
User manual for Novolink	1SAC200230M0001	link

6. Troubleshooting

6.1. No OPC UA Sever application Found

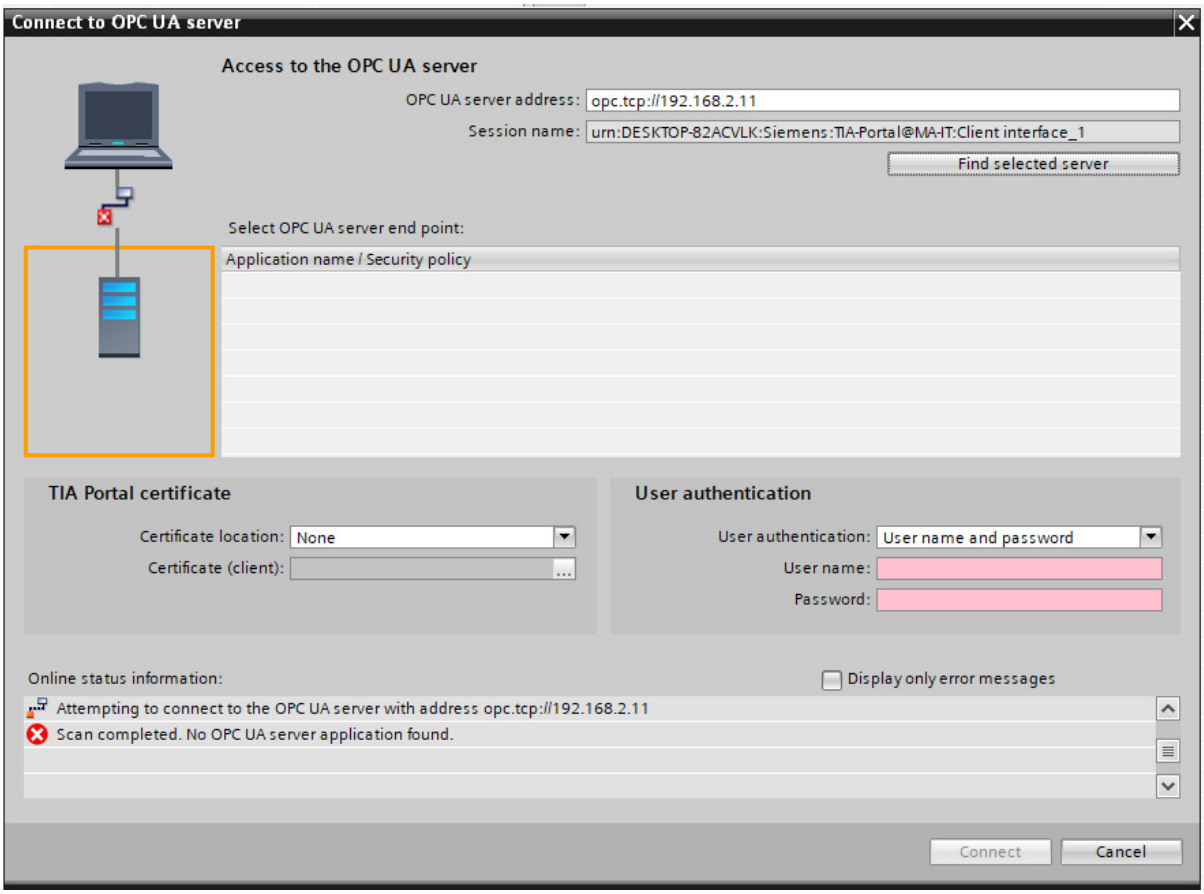


Figure 32: PopUp No_Online Access

- Verify TIA Portal is able to reach the smart-gateway
- Check the IP-address of the server
- Check the IP-address of your Client (TIA Portal)
- Check that you can reach the server using ping
- Reboot the server

6.2. Status 16#3870_0600

Activate the connection and the status is 3870_0600 check the next part:

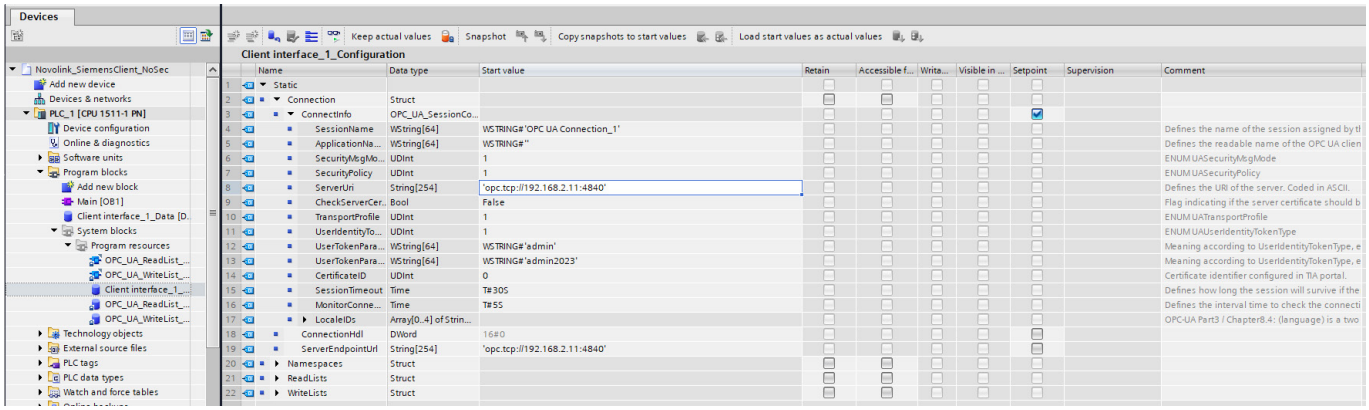


Figure 33: ClientInterface_Configuration

- Open the Client interface configuration data block
- Check if the ServerEndpointUrl" and "ServerUri" start values are the same
  - If this is not?

  Copy the "ServerEndpointUrl" to "ServerUri"
- Compile the project with a rebuild all for hardware and software
- Download "hardware configuration"
- Download "Software all"

7. List of related documents/links

Document type	Document number	Link
SFM1 Manual	2CDC100017M0201	link
User manual for Novolink	1SAC200230M0001	link
Siemens Licenses		link
Siemens PLCs		link

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ABB STOTZ-KONTAKT GmbH
Eppelheimer Strasse 82
69123 Heidelberg, Germany

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