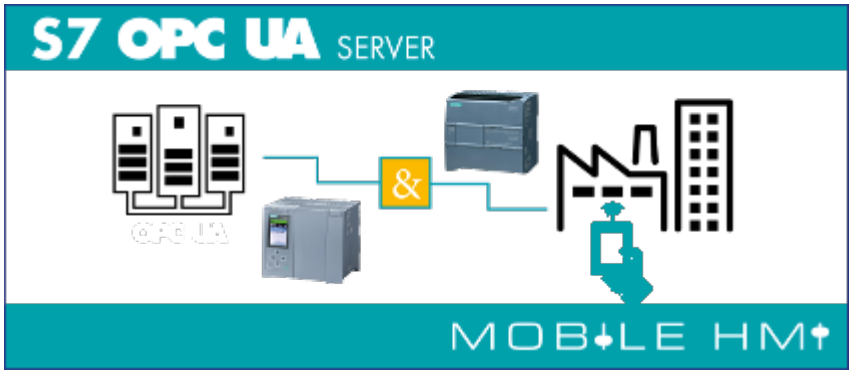
S7 OPC-UA Server

Version 1.36



SPS-Types

- S7-1500
- S7-1200
- S7-300/400 with TCP/IP on Board / PN or CP 343-x/443-x
- S7-300/400 MPI/Profibus with S7-LAN
- Win AC RTX
- S7-200 with CP 243-1
- S7-Soft-PLC
- SIMATIC-S5 over S5-LAN

Operating systems

Windows

- 10
- 8
- 7

Windows Server

- 2012 R2
- 2012
- 2008 R2
- 2008

Functions overview

- Visualization / control via web browser / mobile device (optional)
- OPC-UA-Server possible
- User account control
- Automatically generating the display
- To define your own scaling

Areas of application

- Visualisation
- Control
- Data transfer via OPC-UA

Installation

Start “S7 OPC UA & Mobile HMI Setup 1.0.36.0.exe”. The installation checks whether you have installed the required software packages.

Deinstallation

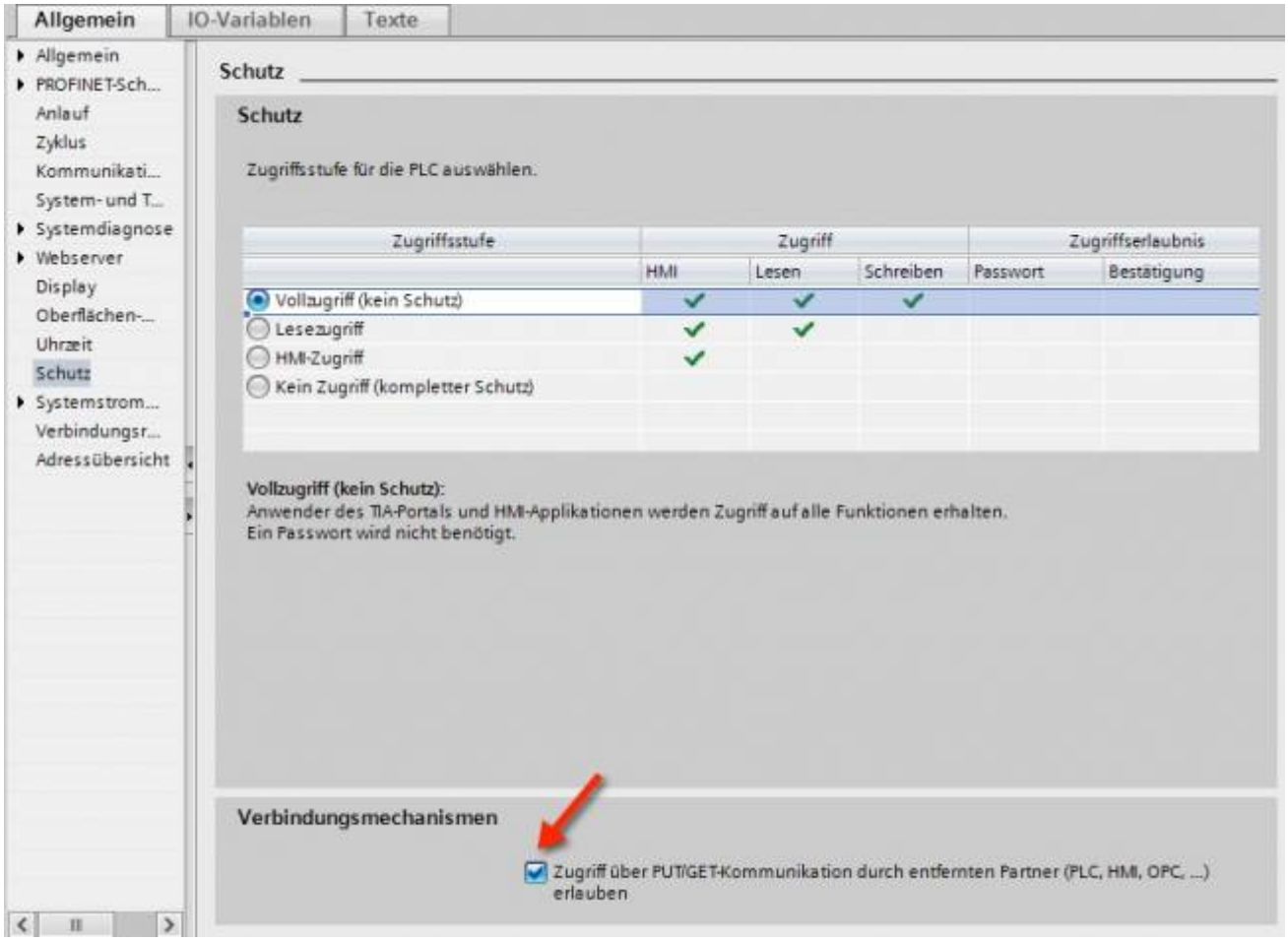
- System Control → Programs and Features → S7 OPC UA & Mobile HMI → Uninstall
- Remove the folder where the configuration data is stored

PLC - Settings

Settings for S7 1200/1500

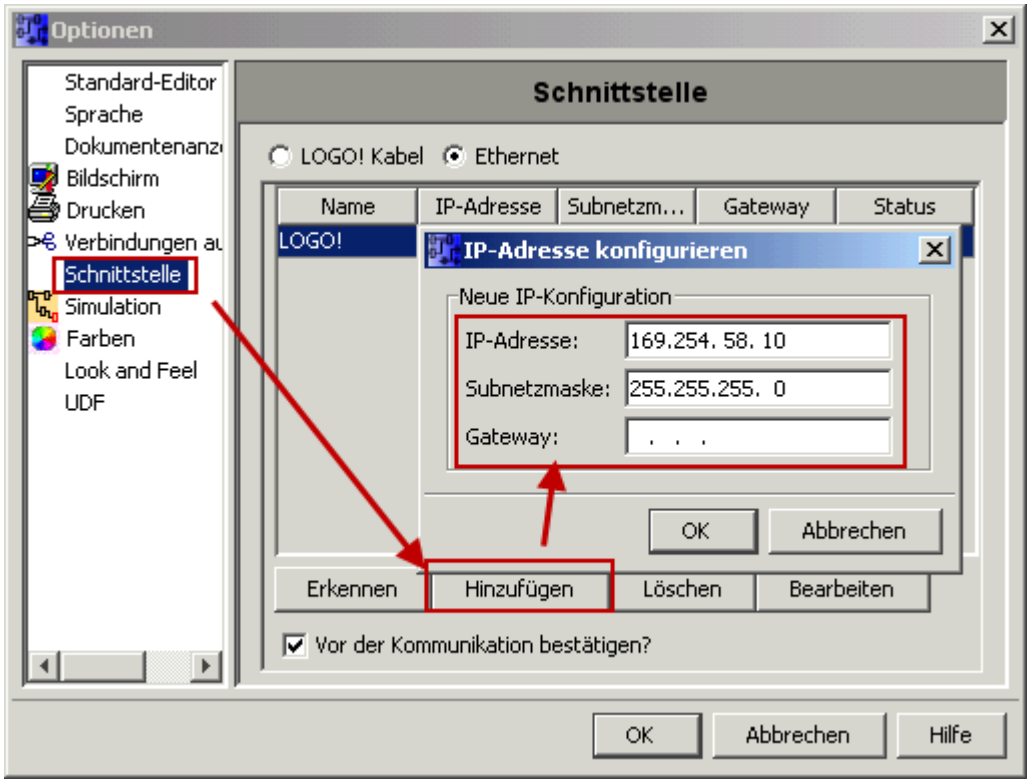
The optimized block access needs to be deactivated in the data block attributes for access to the S7-1500 and S7-1200.

In the S7-1500 must be enabled in the communication setting in addition to the PUT / GET access . How this works you see here (snapshot from TIA Portal) .

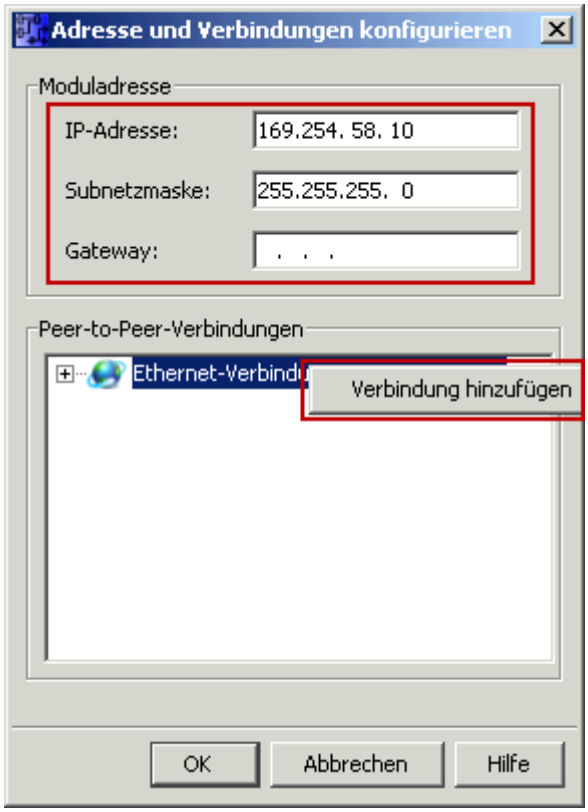


Settings Logo

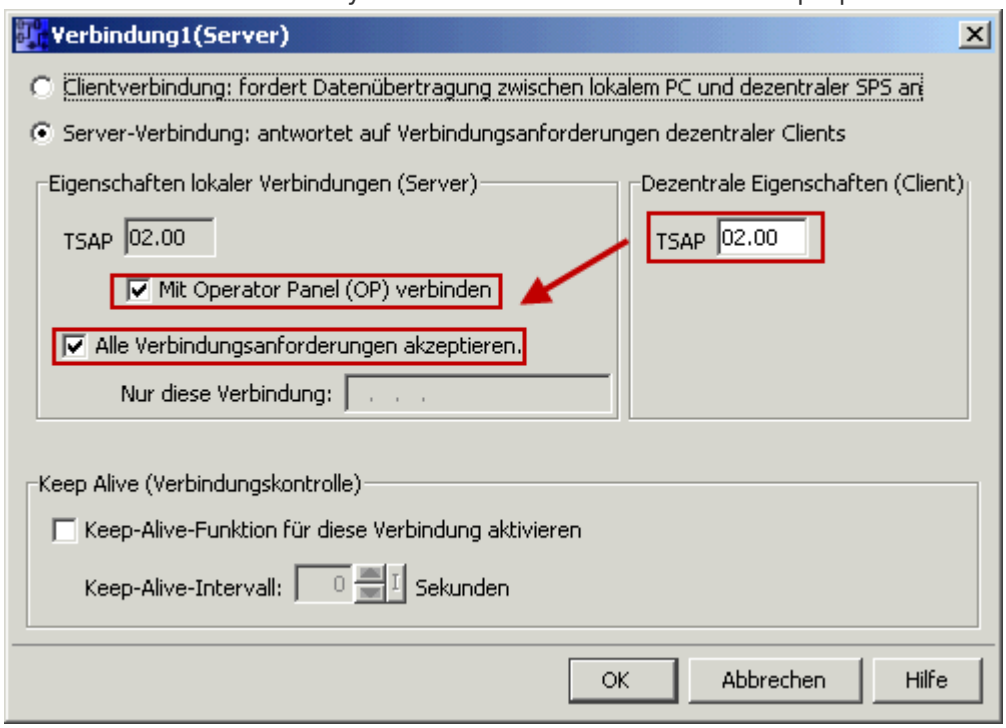
1. Use the Logo Soft Comfort the IP address of a logo! PLCs:



2. Configure PLCs so that connections from an HMI device accepted the Logo!. To do so, go to “Tools- > Ethernet Connections” and then add a new connection.



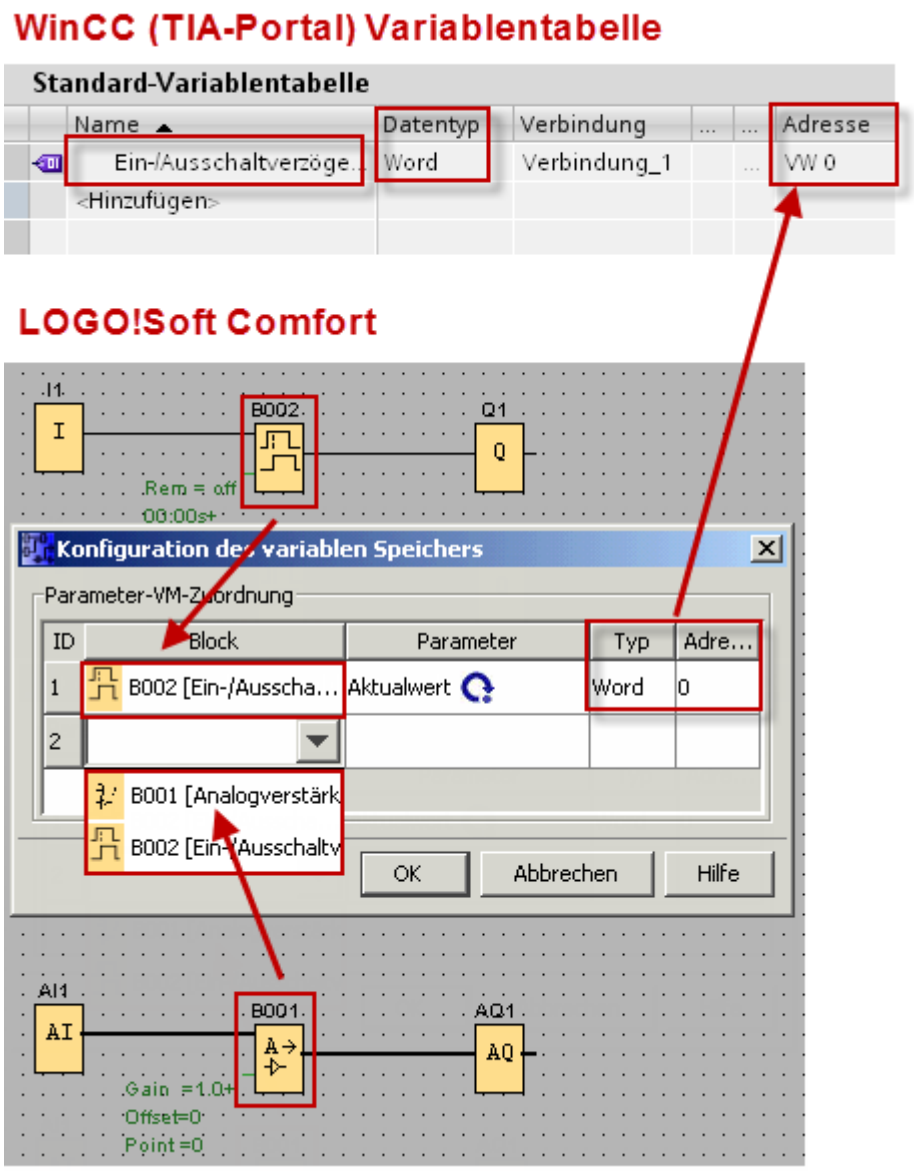
3. Double-click on the newly created connection to access the properties.



Select:

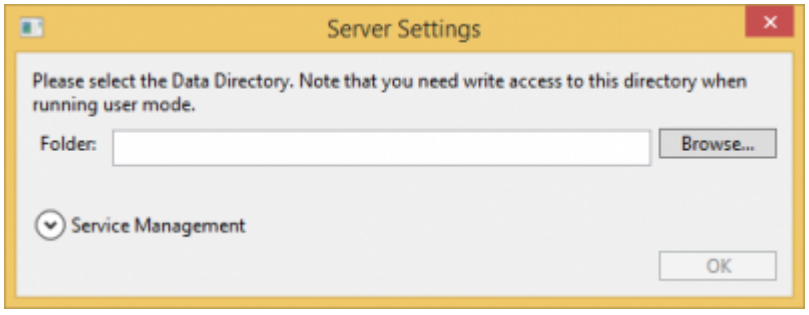
1. Server Connection
2. Local TSAP: 02:00 - 02:00 decentralized TSAP
3. accept all connections.

You can access DB1, inputs , outputs, flags , counters and timers with IP -S7 -LINK . Now put on “ Tools- > VM parameter map ” the variables that are to be transferred to the DB1.



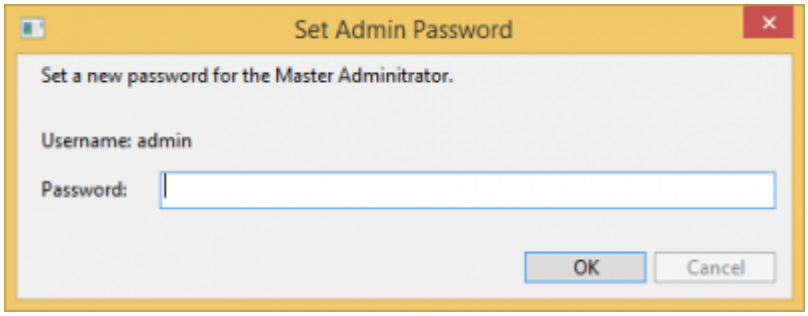
First Start

After the start, you receive the following message:



Select the location for the server data and click OK.

You are then prompted to set the admin password:

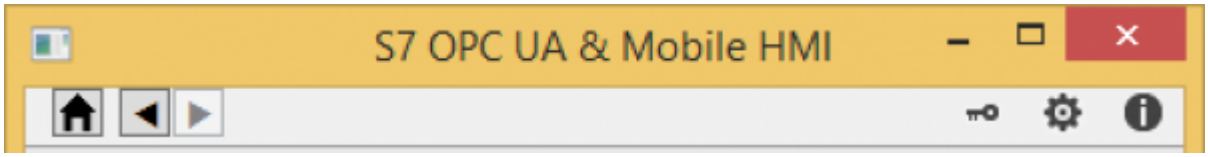


In the following start window, log in as admin and your chosen password:

The application

The application is divided into the menu and display area.

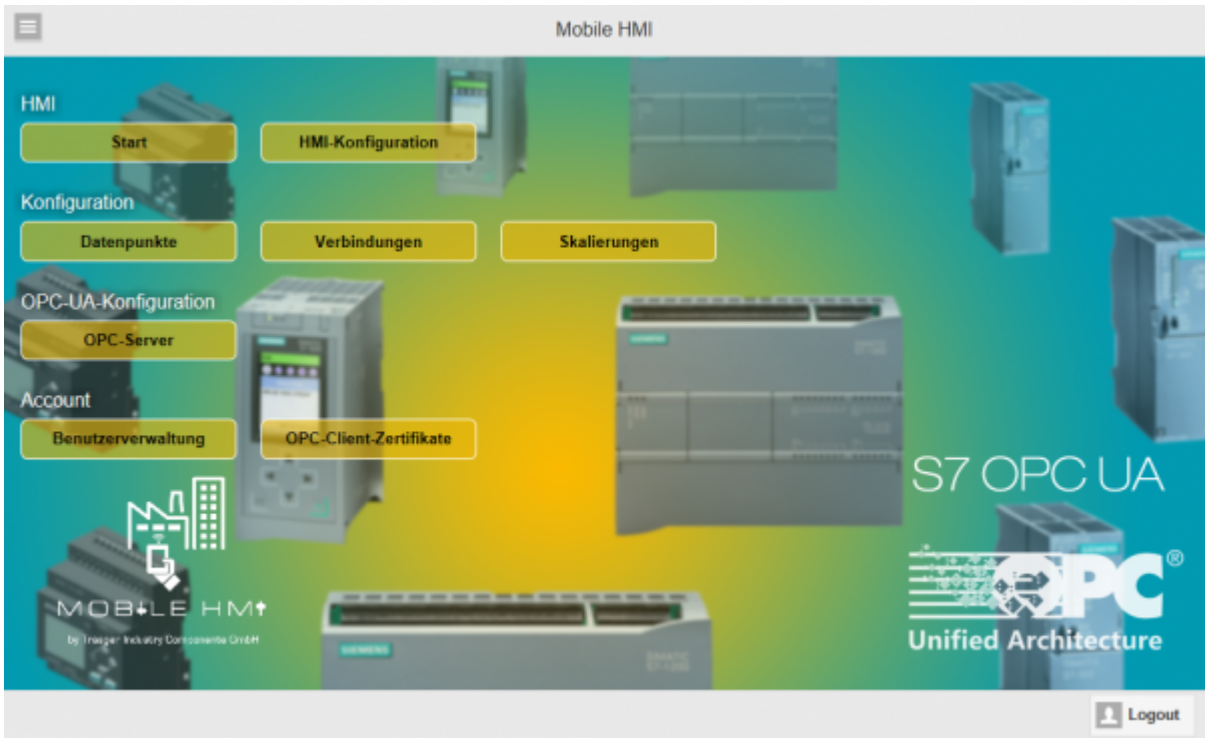
Area of the menu



Name	Description
	call Start page
◄	one page backward
►	one page forward
	Generate Machine Code, enter license key
	Call the server settings

Name	Description
	Information about the product and licensing

Display area

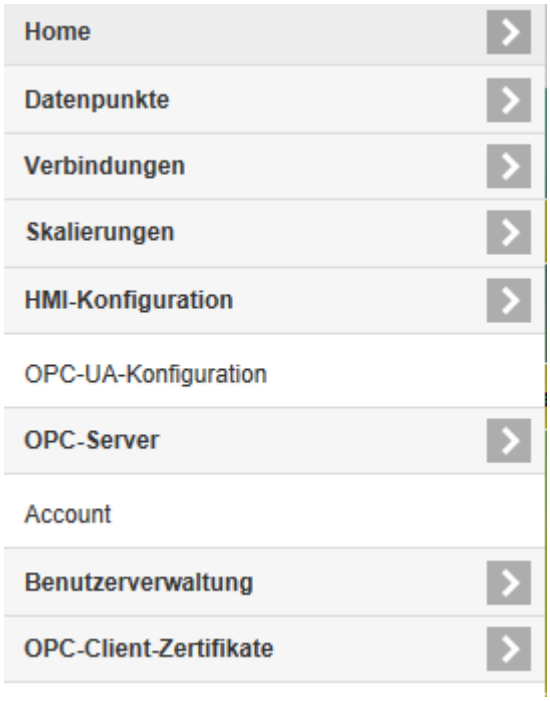


Displays the currently selected page with the available data and options.
Im obigen Bild sehen Sie z.B. die Startseite.

Fields marked with * are required.

Configuration menu

You can access all available pages by clicking on  . The following menu items are available:

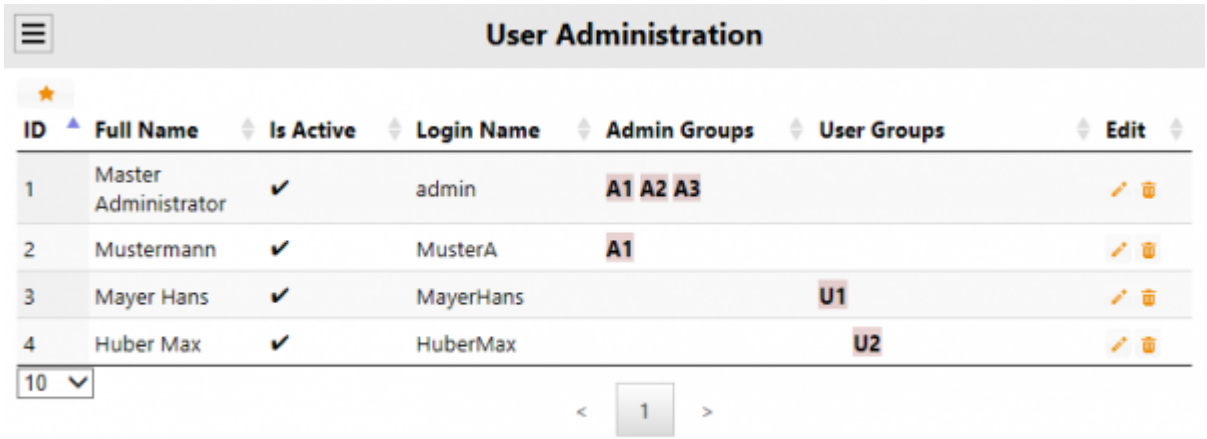


Menu	Description / task
Home	Call start page
Benutzerverwaltung	Manage your users and set permissible access to the data
Verbindungen	Establish the connections to your Siemens PLCs
Datenpunkte	Link the connections with the desired data addresses in the PLC. The tree structure allows you to pre-sort your data immediately
Skalierungen	Here you have the possibility to define various control and input elements for the view
HMI-Config	Design the desired view with main and sub-pages and add the desired data points to the respective data groups
OPC-Konfiguration	Sammelmenü für OPC-Einstellungen
OPC-Server	Create and manage OPC UA Server
OPC-Client Zertifikate	Certificates from OPC UA clients for the authenticated connection to the OPC UA server. You also assign the rights granted to the user

Standard functions in the menu item:

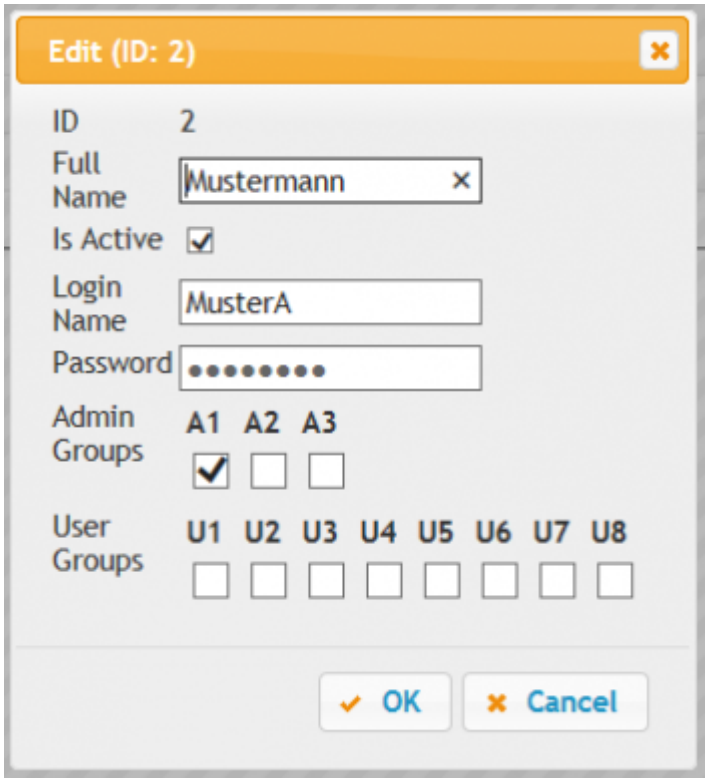
Funktion	Task
★	Add new settings
	Edit settings
	Delete settings

User administration



Overview of existing users.

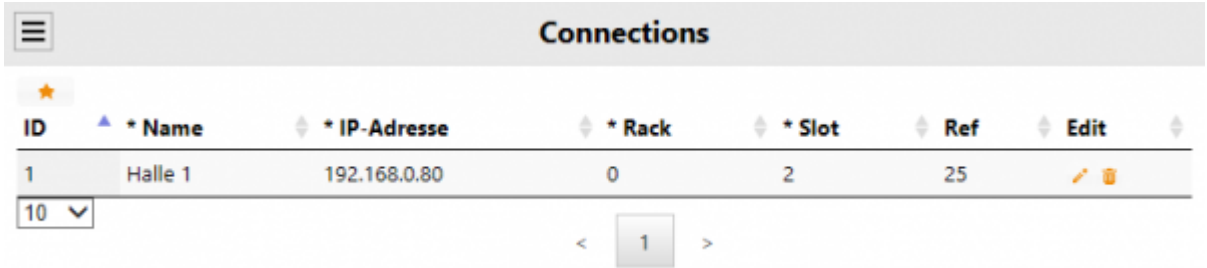
By clicking on ★ a new user will be added and you get the following dialog:



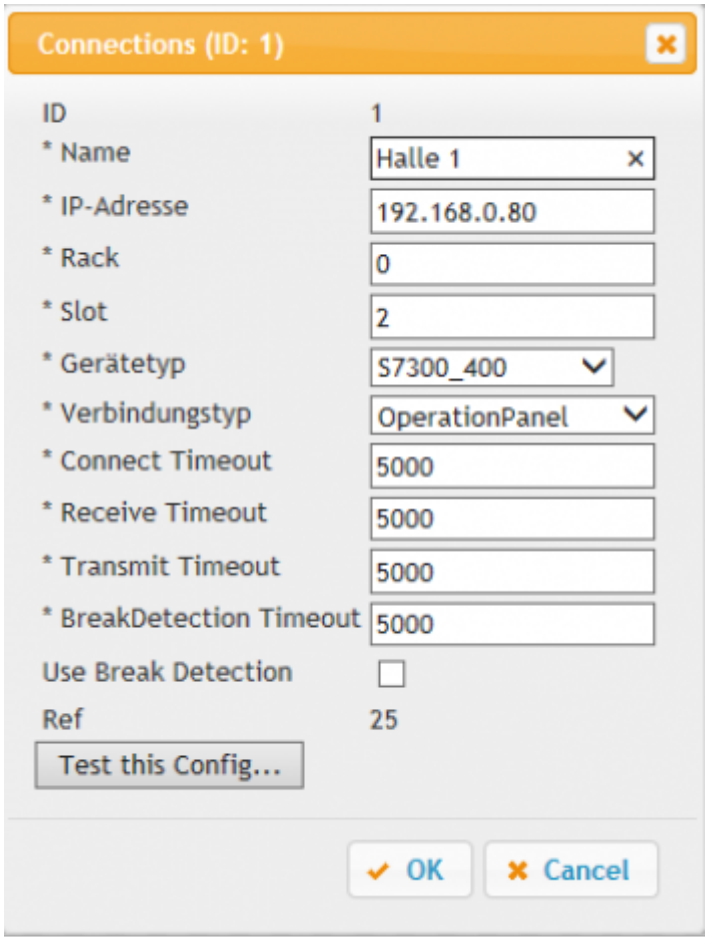
Name	Function
ID	User-assigned ID
Full Name	Username is displayed
Is Active	User can log on
Login Name	Name zur Identifikation des Benutzers
Password	Password for login
Admin Groups	Assign to the desired admin group (s). See user group table
User Groups	Assignment to the desired user group (s). See user group table

User group	Function
A1	Admin without restriction
A2	OPC-Admin, Data points and OPC relevant data
A3	HMI-Admin, Manage data points and HMI pages
U1 - U8	User groups 1 to 8. User groups can be used to group multiple users. You can then assign different data points to this group, adapted to your requirements. For example: user group U1 = all layer leaders (sees all machines and can control them), U2 = machine operator H2 (only sees the machines in its task area)

PLC-Connections

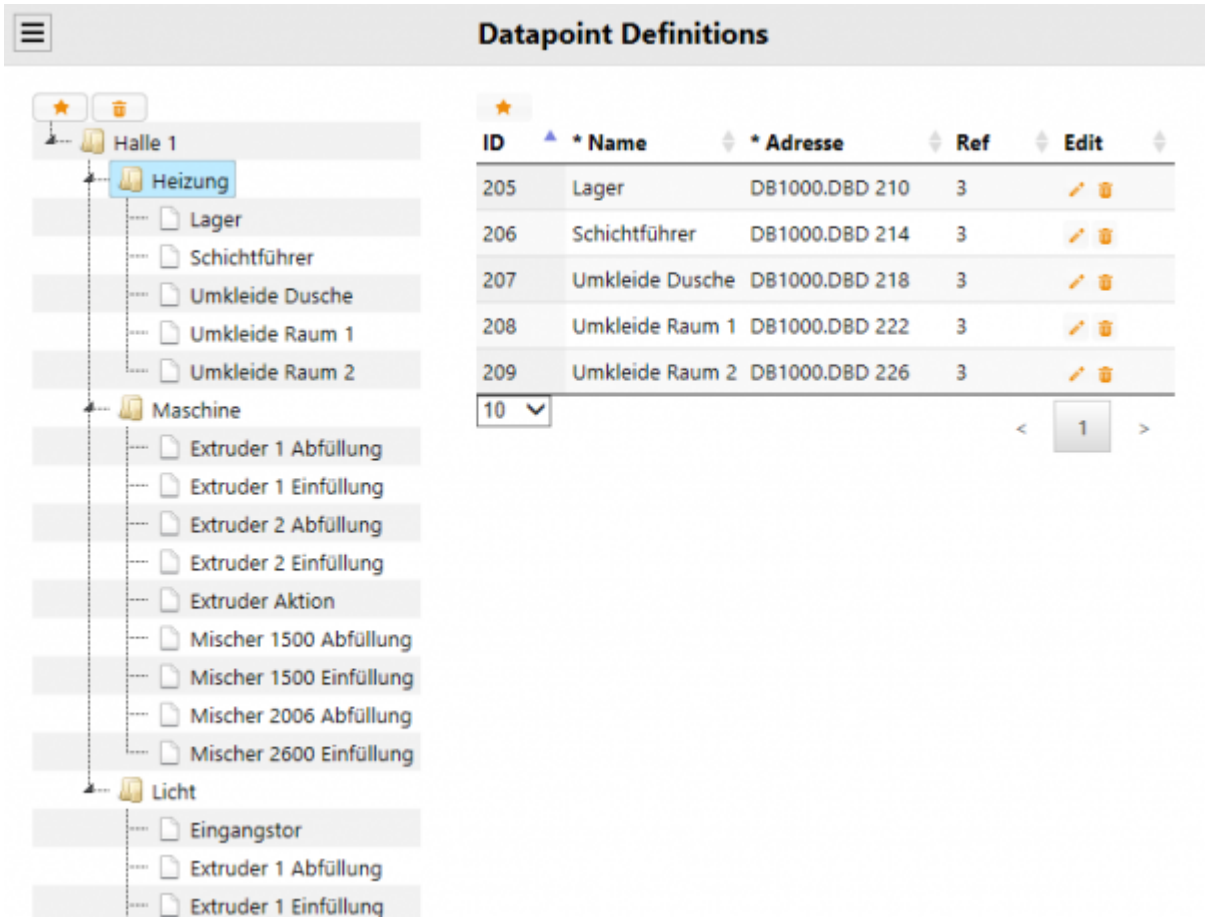


Overview of configured Siemens PLC connections.



Name	Function
ID	System-assigned ID
Name	Name of the connection in the display
IP-Adresse	IP address under which the PLC can be reached
Rack	Rack number of the CPU
Slot	Slot of the CPU
Gerätetyp	Type designation of the PLC. Available types: Logo S7200 S7300_400 S71200 S71500
Connection type	Default: Standard connection to the PLC (OperationPanel) OperationPanel: Connection via the OP channel ProgrammerDevice: Connection via the PG channel Other: Connection via the Other channel
Connect Timeout	Timeout in ms for connection setup
Recieve Timeout	Timeout in ms for receiving the data from the PLC
Transmit Timeout	Timeout in ms for sending to the PLC
BreakDetection Timeout	Keep Alive-Time for monitoring the TCP / IP connection (interesting at large intervals)
User Break Detection	Set Break Detection Timeout is used
Ref	Number of data points that point to this connection

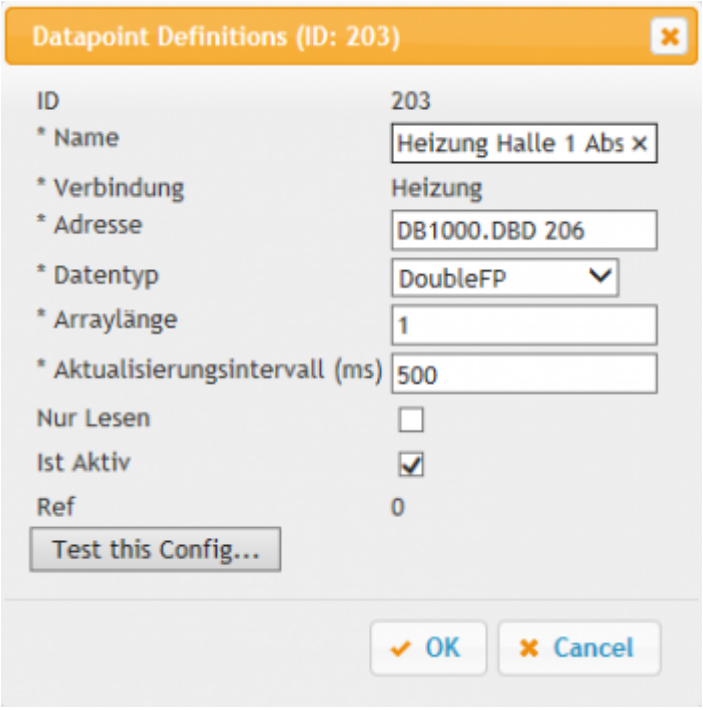
Data point definition



The addresses of the data points, which serve as data sources, are defined here.
The first node is always the connection. One connection can be added one

- New node
- New datapoint

Name	Description
Left	Adds a new node under the selected node
Right	Add a datapoint
	Rename the selected point
	Delete the selected point



Name	Description
ID	System-assigned ID
Name	Display name of the data point. If empty, the Data address (without spaces) is used as name.
Verbindung	Is added to this connection (the connection must already have been created)
Adresse	Data address to be processed in the PLC. DB1.DBB 0 for data block 1, data byte 0
Datentyp	Specifies the data type that the software driver reads from the PLC Please select... Bool Byte UInt16 Int16 UInt32 Int32 UInt64 Int64 SingleFP DoubleFP String
Arraylänge	Length of the array to be read
Anzahl der zu erstellenden, konsekutive DPs	Several consecutive data points can be created automatically. If the number is greater than 1, the end address of a data point is calculated and the address is entered as the next data point. Example: Name: Temperature, Address: **DBW100.DBD10** , Type: **Int16** , Number: **3** Generated: Name: Temperature_1 Address: DBW100.DBD10 Name: Temperature_2 Address: DBW100.DBD12 Name: Temperature_3 Address: DBW100.DBD14
Aktualisierungsintervall (ms)	Time grid of data updating
Nur lesen	Data can only be read. Even if this is entered as a setpoint in the GUI, this DP can not be written anymore

Name	Description
Ist Aktiv	Data point can be used
Ref	Number of references used

Move sample data points:
beispiel_datenpunkt_verschieben.mp4

PLC address variables:

Operand

Name	Abbreviation (Siemens, DE)	Abbreviation(IEC)
Input	E	I
Output	A	Q
Flag	M	M
Peripherals	P	P
Counter	Z	C
Data Block	DB	DB
Timer	T	16

Data types

Name	Abbreviation	Bit size	Range	Description	Array
BOOL	X	1	0 to 1	single bit representing true (1) or false (0)	x
BYTE	B	8	0 to 255	unsigned 8-bit	x
WORD	W	16	0 to 65.535	unsigned 16-bit (Word)	x
DWORD	D	32	0 to 2^{32} -1	unsigned 32-bit (Double Word)	x
CHAR	B	8	A+00 to A+ff	ASCII-Code unsigned 8-bit character	x
INT	W	16	-32.768 to 32.767	signed 16-bit integer	x
DINT	D	32	-2^{31} to 2^{31}-1	signed 32-bit integer (Double Word)	x
REAL	D	32	+-1.5e-45 to +-3.4e38	IEEE754 32-bit single precision floating point number	x
S5TIME	W	16	00.00:00:00.100 to 00.02:46:30.000	binary coded decimal (BCD) number representing a time span	
TIME	D	32	00.00:00:00.000 to 24.20:31:23.647	signed 16-bit integer representing a time span in milliseconds	
TIME_OF_DAY	D	32	00.00:00:00.000 to 00.23:59:59.999	unsigned 16-bit integer representing a time span in milliseconds	
DATE	W	16	01.01.1990 to 31.12.2168	unsigned 16-bit integer representing a date in days	
DATE_AND_TIME	D	64	00:00:00.000 01.01.1990 to 23:59:59.999 31.12.2089	binary coded decimal (BCD) number representing a date and time	
S7String	B	any	A+00 to A+ff	ASCII-Code, max. 254 Bytes	

The variables are composed of operand and data type. Examples:

Examples	Data type	Example Siemens	Example IEC
Input Byte 1, Bit 0	BOOL	E 1.0	I 1.0
Output Byte 1, Bit 7	BOOL	A 1.7	Q 1.7
Flag Byte 10, Bit 1	BOOL	M 10.1	M 10.1
Data Block 1, Byte 1, Bit 0	BOOL	DB1.DBX 1.0	DB1.DBX 1.0
Input Byte 1	BYTE	EB 1	IB 1
Output Byte 10	BYTE	AB 10	QB 10
Flag Byte 100	BYTE	MB 100	MB 100
Peripherals Input Byte 0	BYTE	PEB 0	PIB 0
Peripherals Output Byte 1	BYTE	PAB 1	PQB 1
Data Block 1, Byte 1	BYTE	DB1.DBB 1	DB1.DBB 1

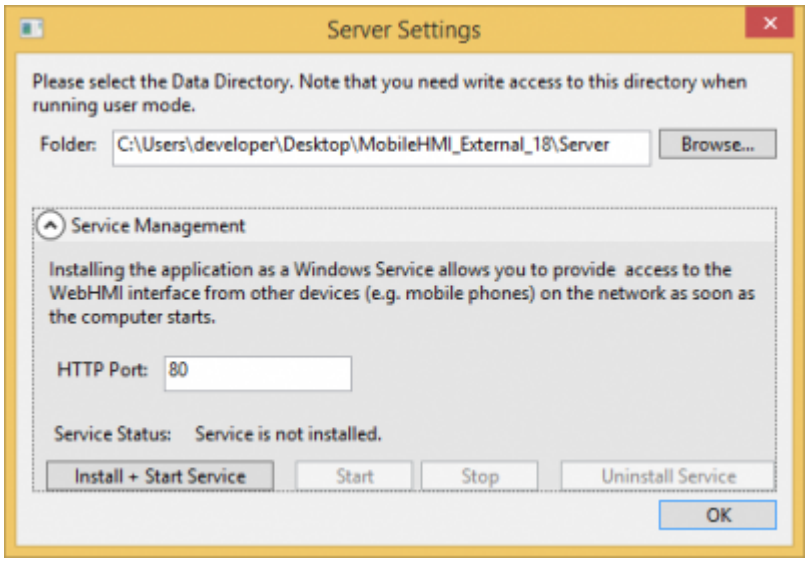
Data Block 1, Data Block 1 Typ bool, Address 1.0 → DB1.DBX 1.0
Data Block 1, Data Block Typ Byte, Address 1 → DB1.DBB 1
Peripherals Input, Typ DWORD, Address 0 → PED 0

Help:
DB#.DBB # = Data Block#.Data Block Byte #
DB#.DBW # = Data Block#.Data Block Word #
DB#.DBD # = Data Block#.Data Block Doubleword #
= Address

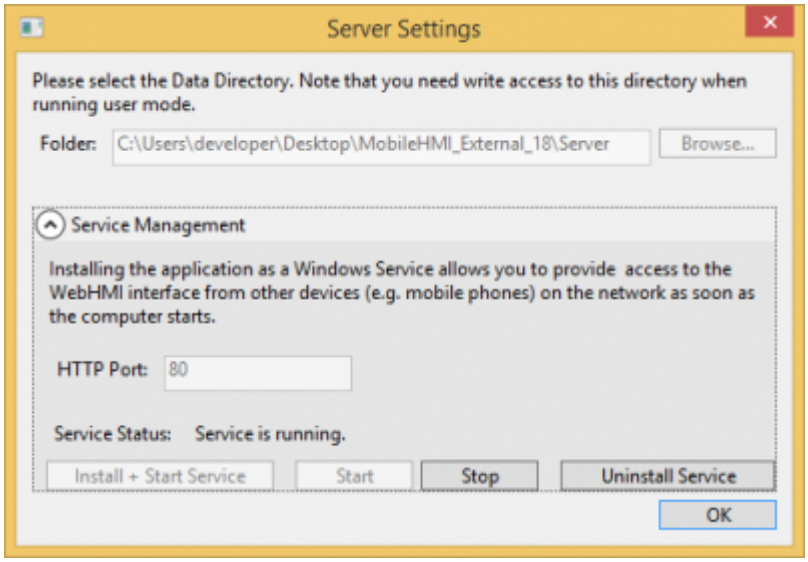
Service settings

- Among  You will find the settings for the service.

Service not installed:



Service installed:



Name	Description
HTTP Port	Port for the web interface of the configuration / display
Install + Start Service	Installs the application as a service and starts it automatically
Start	manual start teh service
Stop	Stop the service, e.g. for changes
Uninstall Service	Remove the installed service

If you want to change the port, stop the service and make the desired change and restart it.

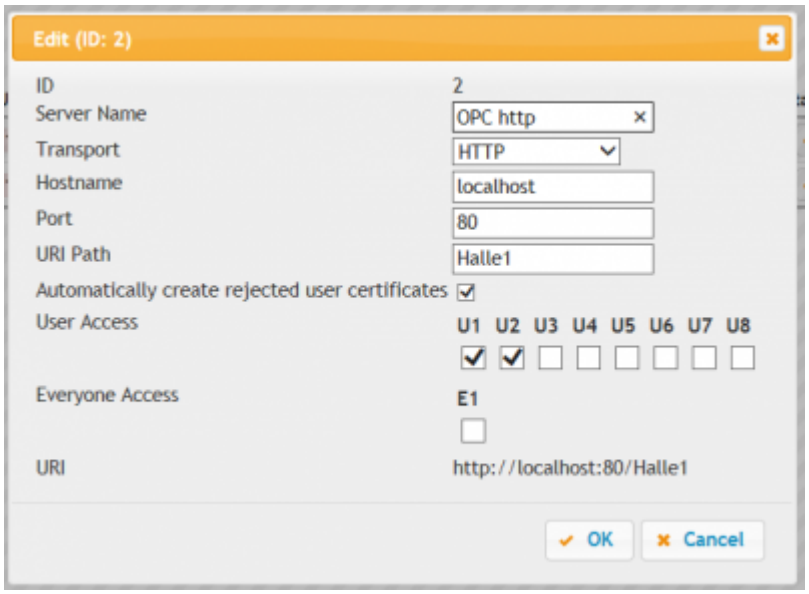
For external users to access the application, the following firewall rules must be added:

- Under Service set port
- If necessary, set OPC Server Ports

OPC Server configuration

Function	Description	
Restart all Servers	Restarts all OPC servers	
Server Name	Display name for internal administration	
User Access	Authorized user groups are displayed. General and OPC administrators generally have access to each server	
Everyone Access	E1 = Anonymous login enabled no display = only user groups assigned have access	
URI	Address for the connection setup	
OPC-Status	Status of the OPC server with the possibility of controlling the server	
	When you move the mouse over the status image, a tooltip appears for the current status	
	Status	**Description**
		Server has not started yet
		Server is started / stopped
		Server is active
		An error has occurred
	Action	**Description**
		Start OPC-Server
		Restart OPC-Server
		Stop OPC-Server

Create new server ():



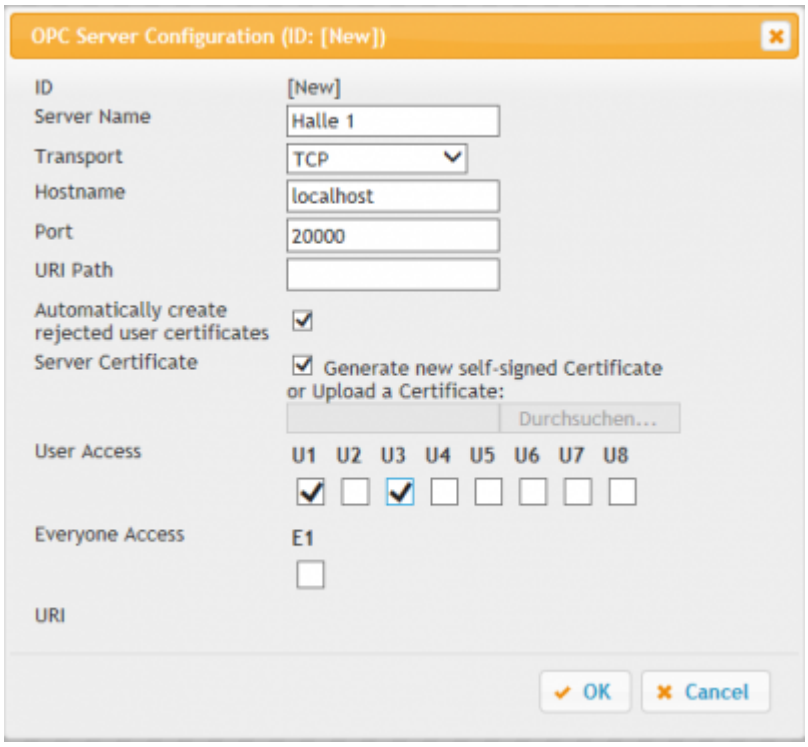
Name	Description	TCP	HTTP
Server Name	Display name		
Transport	Type of data transmission	Binary Protocol, is more efficient than HTTP	Uses HTTP web services, higher compatibility with firewalls

Name	Description	TCP	HTTP
Hostname	Server name or IP address for access	Only relevant for the creation of the certificate	Relevant for the creation of the certificate, and specifies the host HTTP header via which the HTTP request is assigned to the OPC server
Port	OPC server target port	A separate port must be used for each OPC server, since each socket is used for each OPC connection	The same port as for the configuration (eg: 80) and for other (HTTP) OPC server because an HTTP handler is registered for the port, hostname, and URI path
URI Path	Destination address of the OPC server	Not relevant, since the OPC server is identified by the port	Specifies the URL path under which HTTP requests are assigned to this OPC server
Automatically create rejected user certificates	Rejected certificate is automatically saved and can then be processed under client certificates		
User Access	Allowed user groups		
Everyone Access	Permission, the non-defined user can also connect to the server		

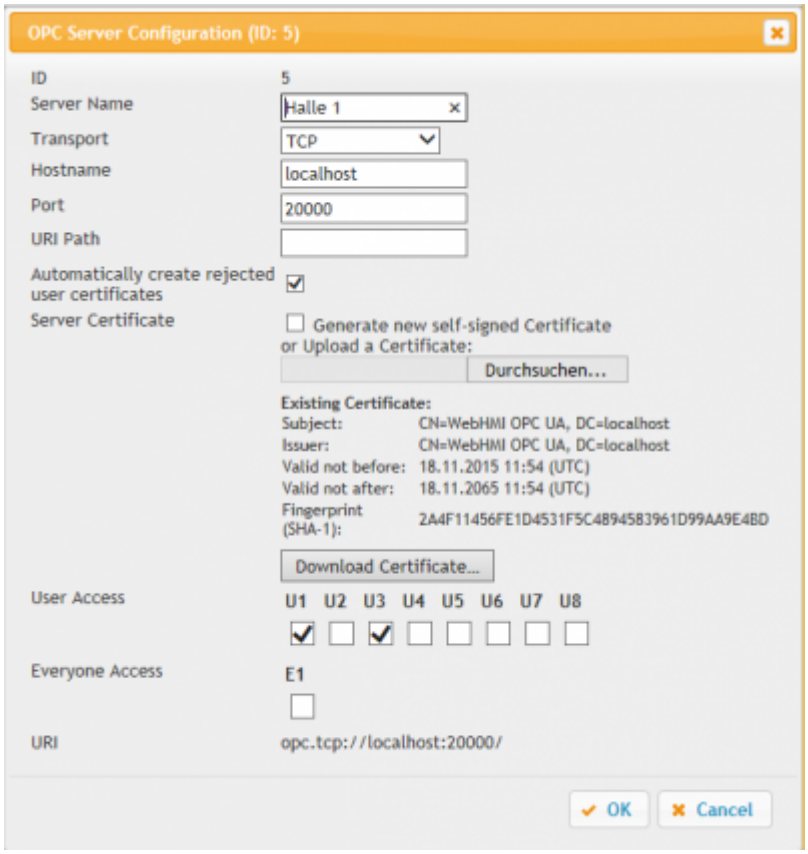
When creating the OPC-UA server, you have the option to upload a certificate or to automatically create a certificate. The stored data is displayed automatically.

Example OPC server via TCP

- Server Name: Halle 1
- Transport: TCP
- Hostname: localhost
- Port: 20000
- Automatically create rejected user certificates: ☑
- Generate new self-signed Certificate: ☑
- Erlaubte Benutzergruppen: U1 and U3



After save:

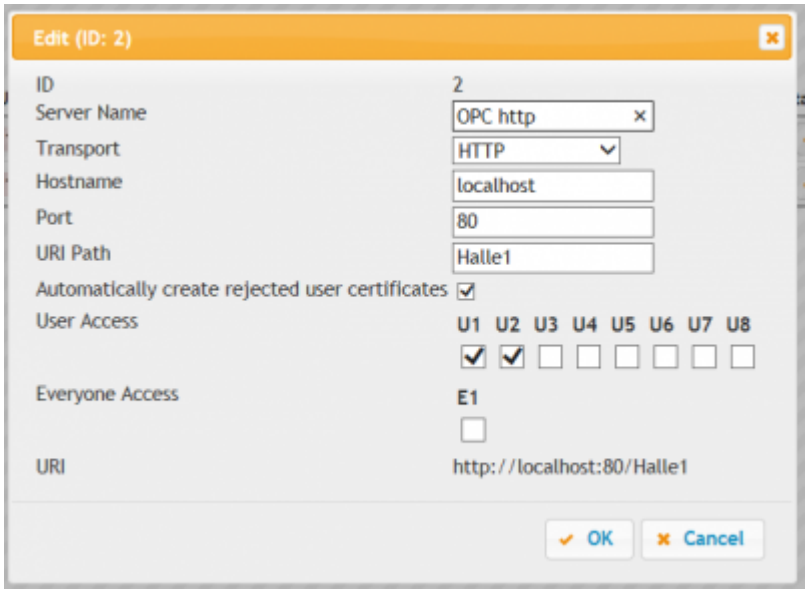


The following entry appears in the overview:

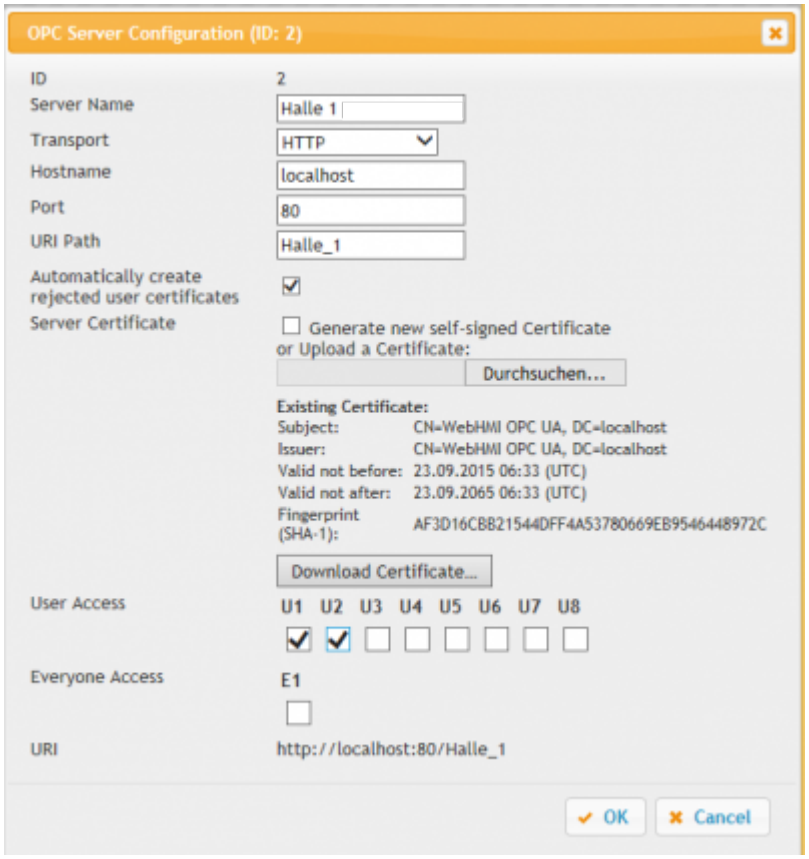
After saving, you can start the server by clicking on .

Example OPC server via HTTP

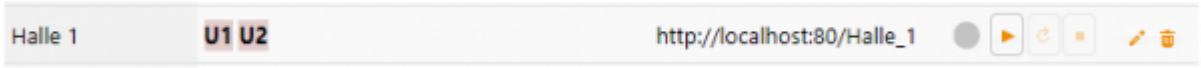
- Server Name: Halle 1
- Transport: HTTP
- Hostname: localhost
- Port: 80
- URI Path: Halle1
- Benutzergruppen: U1 and U2



After save:

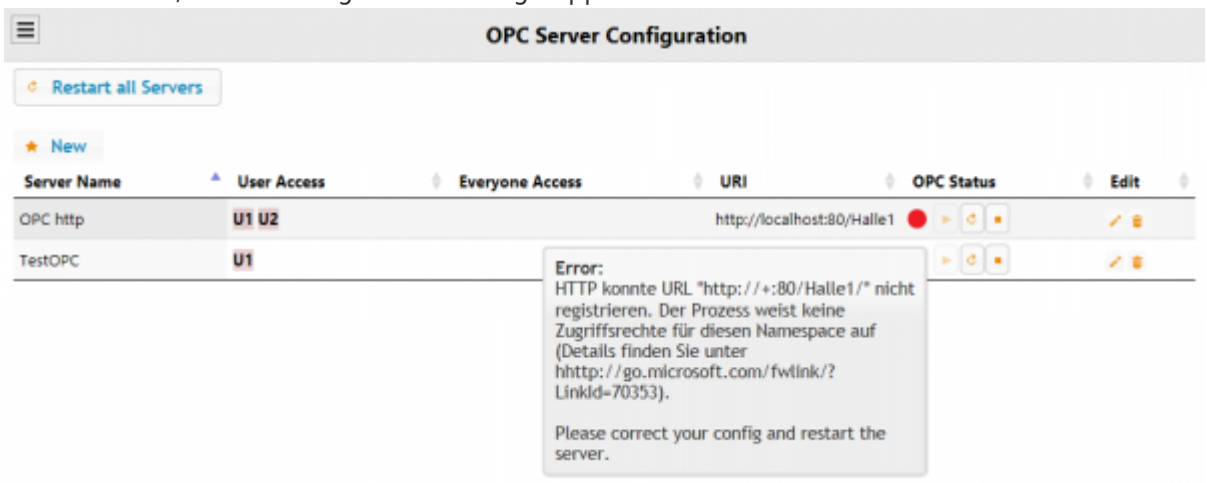


The following entry appears in the overview:



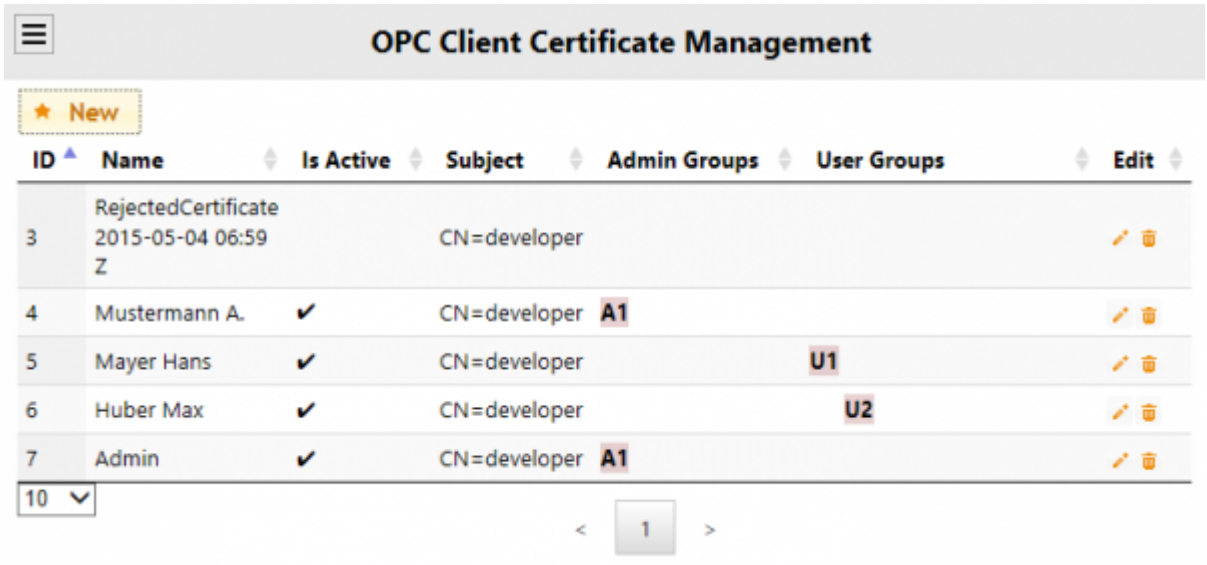
After saving, you can start the server by clicking on .

TIP:
If you have not already created the application as a service, or you are not running the application as an administrator, the following error message appears:

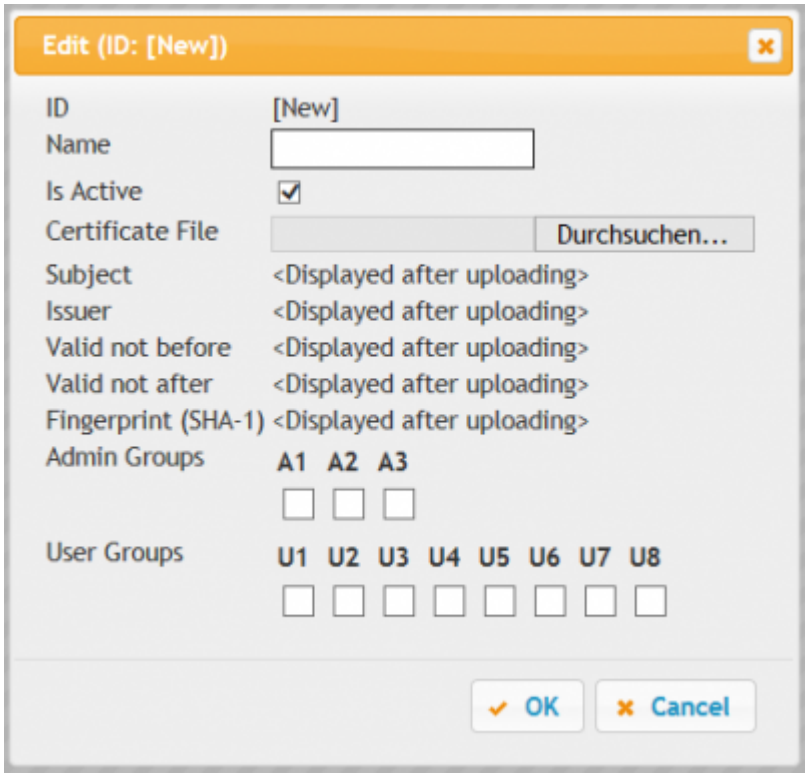


Since http connections run via a web service, you need administrative rights.

OPC Client Certificate



Add OPC user (*):



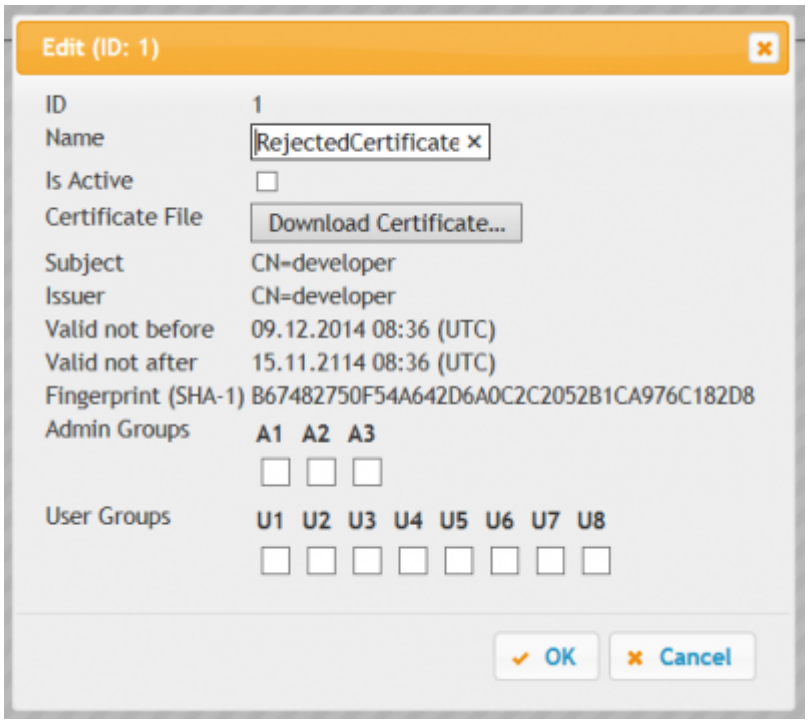
Field	Description
Name	Free
Is Active	☑ User can access the OPC servers
Certificate File	Upload certificate file
Zertifikatsdaten	
Subject	Certificate number CN: common name DC =
Issuer	Certificate Issuer
Valid not before	valid from
Valid not after	Expiration date certificate
Fingerprint (SHA-1)	Fingerprint of the certificate

- Enter a name

- Download the certificate
- Set the desired authorization(s)
- Restart all OPC servers

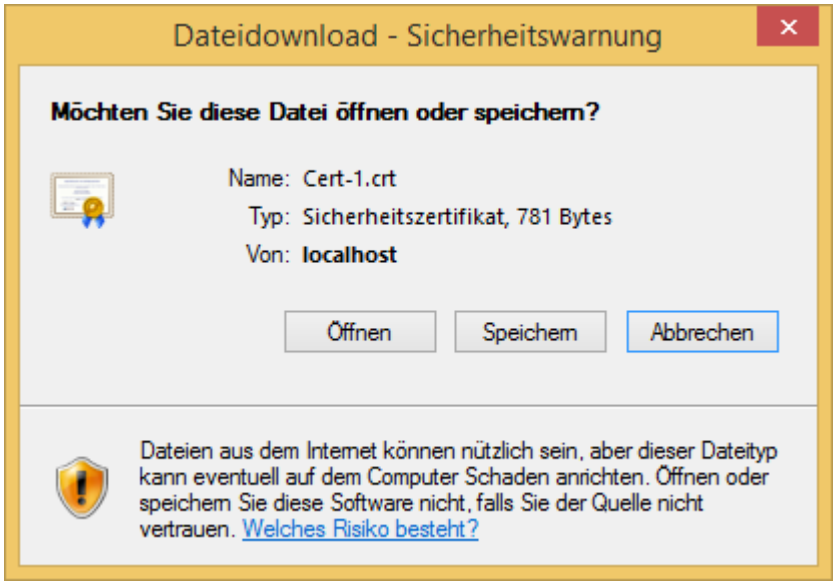
If you have set the rejected certificates in the OPC server, you will see a connection attempt after a connection attempt. Following entry in your administration:

- Click the Edit icon



If you click on Download Certificate, you can get the certificate

- Open
- Save



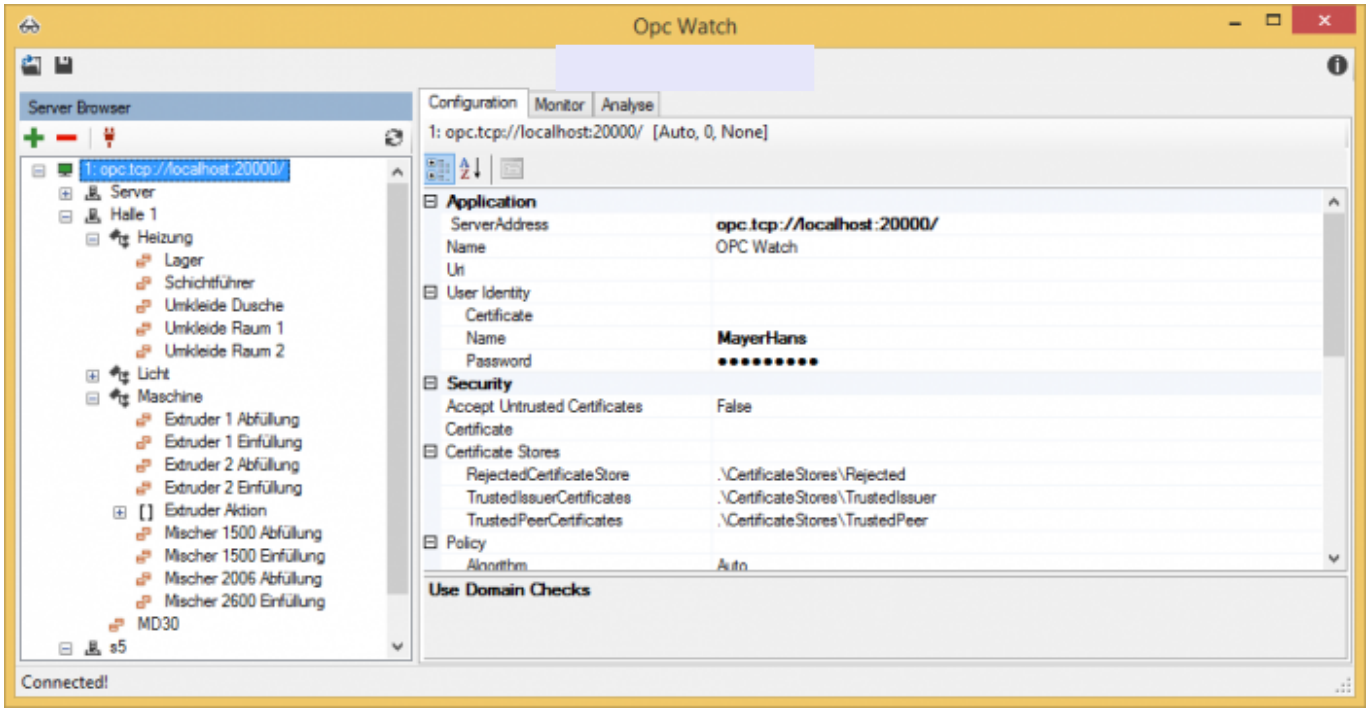
- Check the box “Is active”
- Set the desired permission(s)

- Restart all OPC servers

Testing the OPC UA server

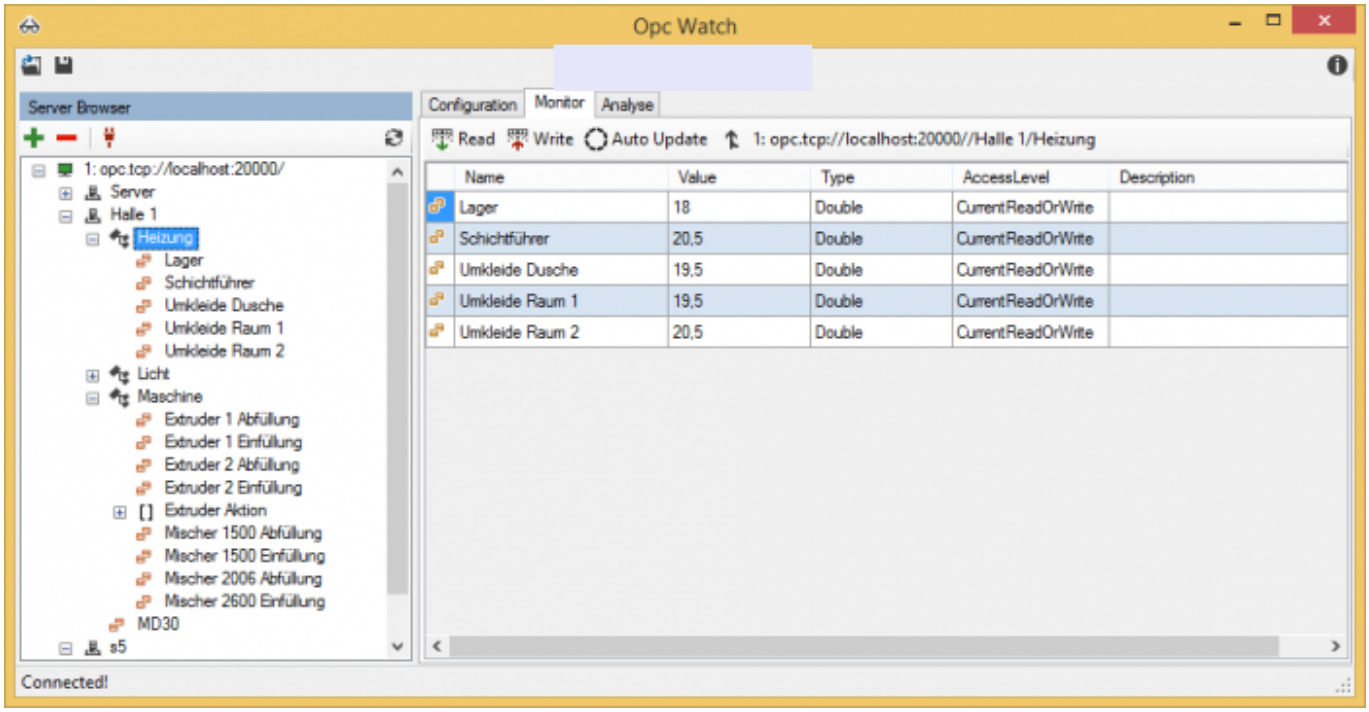
With OPC-Watch (OPC UA Client)

With our free “OPC-Watch” tool, you can connect to OPC servers, which are standard OPC servers. This allows them to access prepared data and view and test settings from the OPC server.

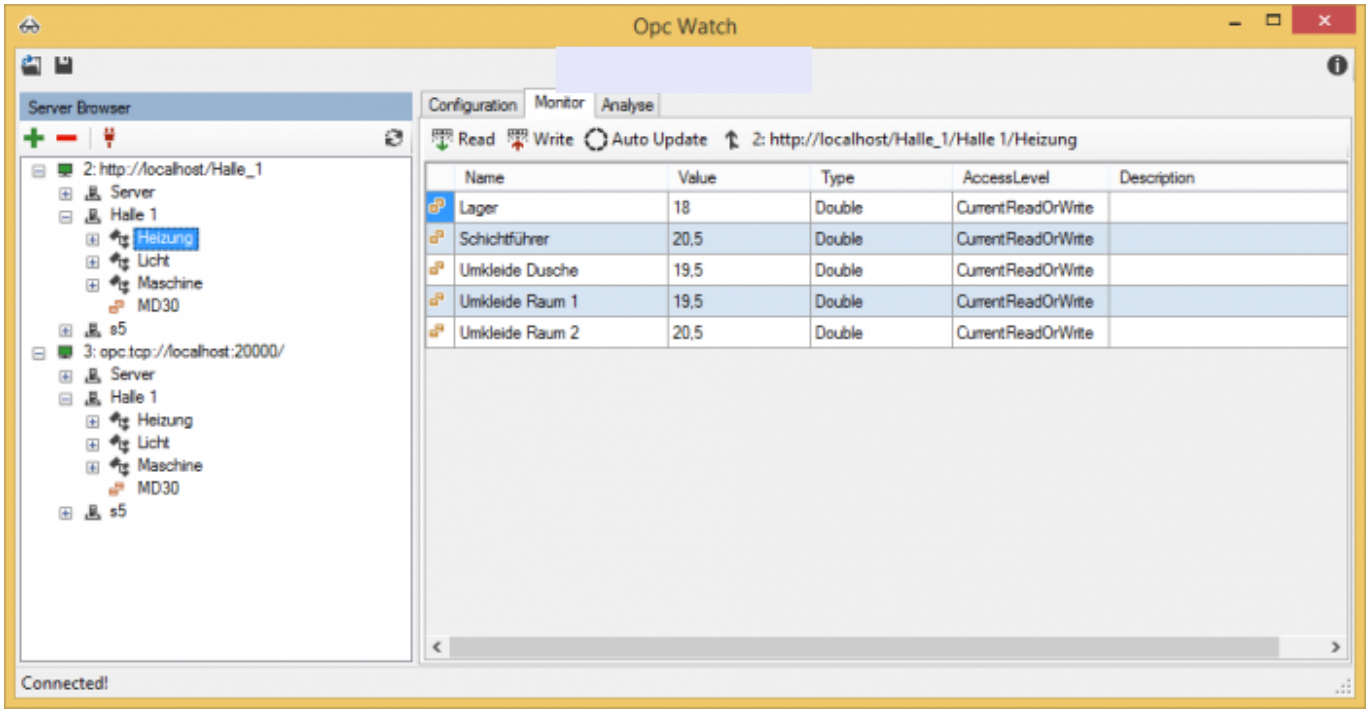


All entries are automatically displayed as shown in “Data points”.

Connection via TCP:



Connection via HTTP:



With OPC UA framework (C # example)

```
    OpcCertificateManager.AutoCreateCertificate = true;

    OpcClient client = new OpcClient("opc.tcp://localhost:20000/");
    client.UserIdentity = new UserIdentity("MayerHans", "MayerHans");
    client.UseDomainChecks = false;

    //Zertifikat automatisch akzeptieren
    client.Configuration.SecurityConfiguration.AutoAcceptUntrustedCertificates = true;

    OpcNodeId nodeId = new OpcNodeId("Halle_1/Heizung/Lager", 2);

    client.Connect();

    Console.WriteLine("ReadNode: {0}", client.ReadNode(nodeId));

    try
    {
       client.WriteNode(nodeId, 14);
    }
    catch (Exception ex)
    {
       Console.WriteLine(ex.Message);
    }

    Console.WriteLine("ReadNode: {0}", client.ReadNode(nodeId));

    client.Disconnect();
    Console.ReadKey(true);
```

Overview Menu structure

S7 OPC UA & MobileHMI

- Home
    - Visualisierung start
- Benutzerverwaltung
    - Name
    - Login Name
    - Passwort
    - Benutzergruppe
        - Admingruppen A1-A3
        - Benutzergruppen U1-U8
- Verbindungen
    - Name
    - IP-Adresse
    - Rack
    - Slot
    - Gerätetyp
        - Logo
        - S7200
        - S7300_400
        - S71200
        - S71500
    - Verbindungstyp
        - Default
        - Operation Panel
        - Programmer Device
        - Other
    - Timeouts
        - Connect
        - Recieve
        - Transmit
        - BreakDetection
- Datenpunkte
    - Verbindung(en)
        - Datenpunkt(e)
        - Knoten
            - Datenpunkt(e)
            - Unterknoten
                - Datenpunkt(e)
    - Name
    - Adresse
    - Datentyp
        - Bool
        - Byte
        - UInt16
        - Int16
        - UInt32
        - Int32

        - UInt64
        - Int64
        - SingleFP (23 bit Mantisse, 8 bit Exponent, 1 bit Vorzeichen)
        - DoubleFP (52 bit Mantisse, 11 bit Exponent, 1 bit Vorzeichen)
        - String
    - Arraylänge
    - Anzahl der zu erstellenden, konsekutiven Datenpunkte
    - Aktualisierungsintervall
    - Nur lesen
- Skalierungen
    - Name
    - Skalierung
        - Text/String
        - Stufentext
        - Linear
    - Eingabeart
        - Textfeld
        - Numerisches Textfeld
        - Schieberegler
        - Auswahlfeld oder Schalter/Taster
- HMI-Config
    - Seite(n)
        - Datenpunktgruppe(n)
            - Datenpunkt(e)
        - Unterseite
            - Datenpunktgruppe(n)
                - Datenpunkt(e)
    - Seite anlegen
        - Titel
    - Datenpunktgruppe anlegen
        - Titel
    - Datenpunkt zuweisen
        - Titel
        - Istwert-DP
        - Istwert-Skalierung
        - Sollwert-DP
        - Sollwert-Skalierung
        - Taster-Anzeigewert
        - Taster-Skalierung
        - Numerischer Istwert-Min
        - Numerischer Istwert-Max
- OPC Server
    - Alle Server neustarten
    - Neuen Server anlegen
        - Server Name
        - Transport
            - TCP
            - HTTP
        - Hostname
        - Port

        - URI Path
        - Automatically create rejected user certificates
        - Server Certificate
        - User Access
        - Everyone Acces
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    - Server starten
    - Server stoppen
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- OPC Client Zertifikate
    - Name
    - Is active
    - Certificate File
    - Admingruppe festlegen
    - Benutzergruppe festlegen
- Recipe Manager
    - Clear Selection
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