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SIMATIC HMI and OPC UA Part 4: Comfort Panel Server, and OPC Scout Client

WinCC Comfort V14, Comfort Panel, OPC Scout

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Table of Contents

Warranty and Liability	2
1 Task.....	4
2 Solution.....	5
2.1 Hardware and software components	6
2.1.1 Validity	6
2.1.2 Components used	6
3 Configuration and Project Engineering.....	7
3.1 TP900 Comfort Panel configuration – server	8
3.1.1 OPC UA configuration	8
3.1.2 Creating tags	9
3.1.3 Creating the connection	9
3.1.4 Plant screen	10
3.2 TP700 Comfort Panel configuration – client.....	11
3.2.1 Creating the OPC UA connection	11
3.2.2 Online browsing to the TP900 Comfort Panel tags.....	12
3.2.3 TP700 Comfort Panel plant screen	13
3.3 OPC Scout V10 configuration	14
3.4 Handling the certificates	18
3.4.1 Comfort Panel (server) ↔ Comfort Panel (client)	18
3.4.2 Comfort Panel (server) ↔ OPC Scout (client)	21
4 Installation and Startup.....	23
4.1 Installation	23
4.2 Startup of the application example	23
5 Operation of the Application Example	24
6 Appendix	27
6.1 Service and Support.....	27
6.2 Related literature	28
6.3 History	28

1 Task

Introduction

The application example describes the configuration steps for creating a secure OPC UA connection (UA Security)¹ between two SIMATIC Comfort Panels and for testing the connection with SIMATIC OPC Scout.

Overview of the automation task

A production plant consists of several plant areas. In each plant area, an HMI operator panel is used to control a machine.

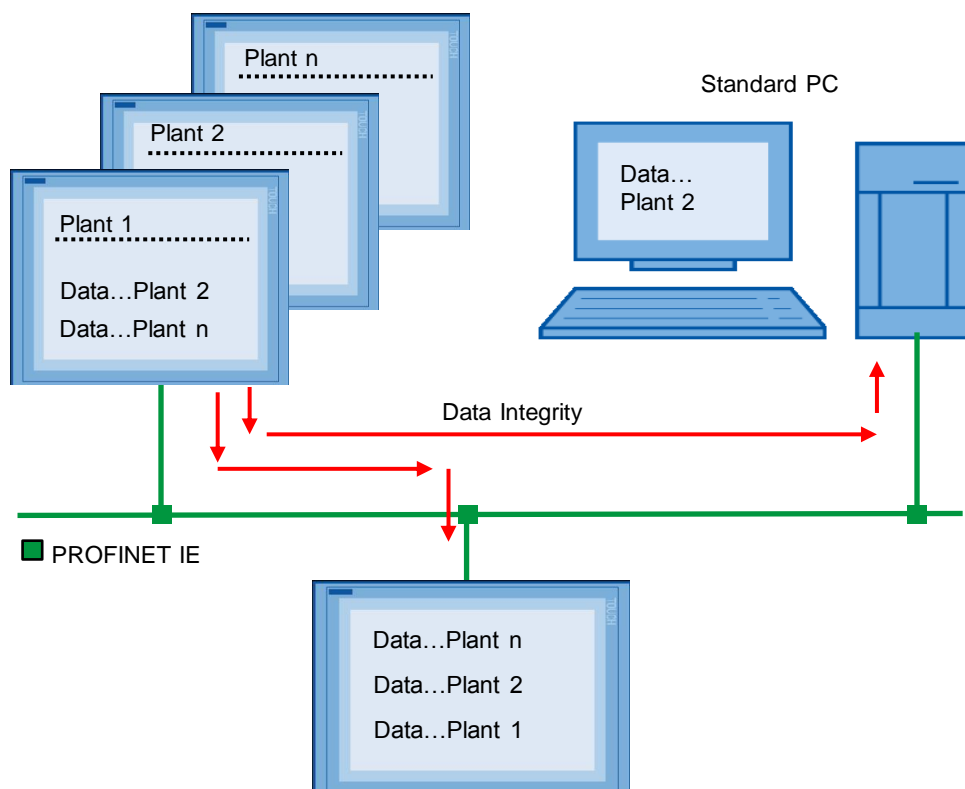
An additional HMI operator panel outputs selected information about the individual plant areas. This HMI operator panel directly accesses the tags of the individual HMI operator panels.

A standard PC with SIMATIC OPC Scout installed on it also outputs selected data of the HMI operator panels.

In both cases, data exchange is encrypted for security reasons.

The following figure provides an overview of the automation task.

Figure 1-1



¹ UA Security consists of authentication and authorization, encryption and data integrity via signatures.

2 Solution

Overview

SIMATIC Comfort Panels are used to control the plant areas and centrally output the data.

A standard PC with "SIMATIC OPC Scout" installed on it accesses the data of the Comfort Panels from the plant areas via the OPC UA interface.

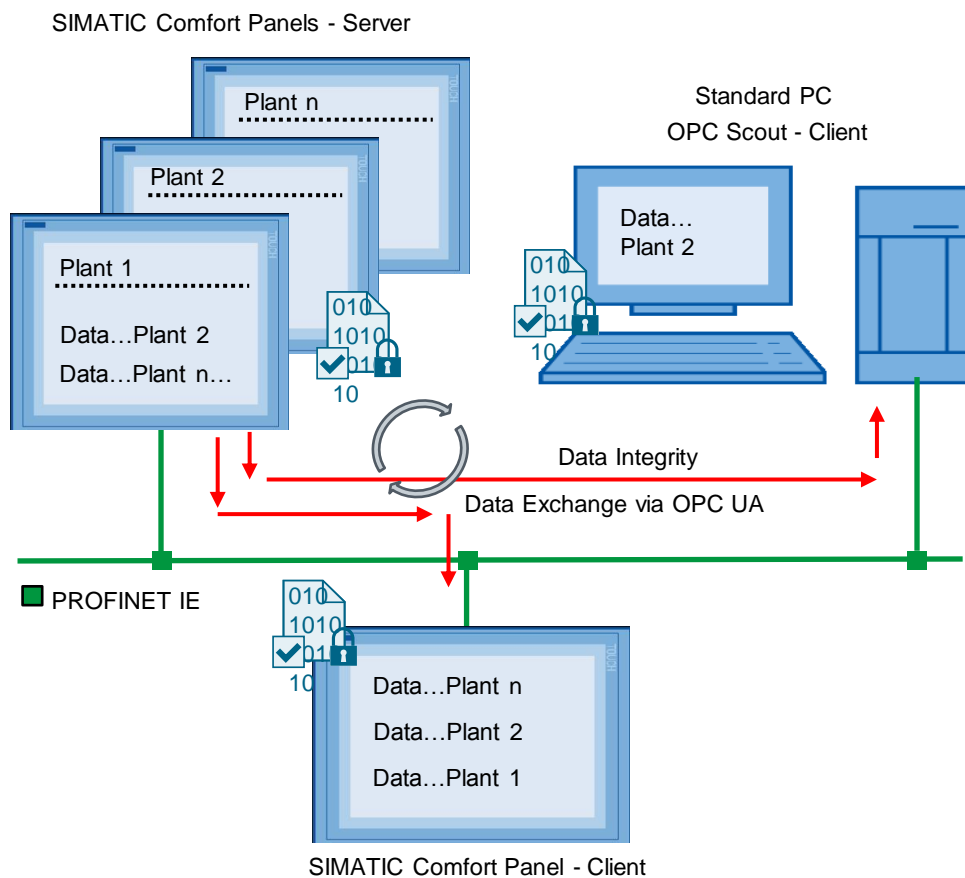
The devices are parameterized as follows:

- The Comfort Panels from the plant areas are parameterized as an OPC UA server.
- The Comfort Panel for central output of the data from the plant areas is parameterized as an OPC UA client.
- The PC station for central output of the data from the plant areas is parameterized as an OPC UA client.
- All devices communicate via an OPC UA connection. Data integrity through encryption and digital signatures is supported by the OPC UA interface.

Diagrammatic representation

The diagrammatic representation below shows the most important components of the solution:

Figure 2-1



Configuration

All nodes are integrated into a PROFINET network. The nodes communicate via the OPC UA interface.

The following devices are used as hardware:

- SIMATIC HMI Comfort Panels
- Standard PC with SIMATIC OPC Scout V10

2.1 Hardware and software components

2.1.1 Validity

The application example is valid for

- WinCC Advanced V14 or higher
- All Comfort Panels

2.1.2 Components used

The application example was created with the following components:

Hardware components

Table 2-1

Component	No.	Article number	Note
SIMATIC HMI TP900 COMFORT	1	6AV2124-0JC01-0AX0	
SIMATIC HMI TP700 COMFORT	1	6AV2124-0GC01-0AX0	
Standard PC	1	---	
S7-1500 CPU 1516-3 PN/DP	1	6AG1516-3AN01-7AB0	

Software components

Table 2-2

Component	No.	Article number	Note
SIMATIC WinCC Advanced V14	1	6AV2102-0AA04-0AA5	
SIMATIC STEP 7 Professional V14	1	6ES7822-1AA04-0YA5	
SIMATIC OPC Scout V10	1		*)

*) SIMATIC Net V8.0 or higher allows separate installation of SIMATIC OPC Scout. For more information, please refer to Chapter [4](#).

Sample files and projects

The following table contains the names of the sample files that are used in this application example.

Table 2-3

Component	Note
63481236_Part4_CODE_Panel Server und OPC-Scout Client.zip	Contains the WinCC Advanced V14 project.
63481236_Part4_Panel Server und OPC-Scout Client_de.pdf	This document.

3 Configuration and Project Engineering

General

This chapter describes all the settings that are required for data exchange via the OPC UA interface.

The supplied configuration includes the hardware devices and program settings listed in this chapter.

STEP 7 configuration

The application example additionally includes a SIMATIC S7-1516 3PN/DP.

The controller is optional and shows that all HMI tags (with and without a PLC connection) can be accessed via the OPC UA interface.

This application example does not provide a detailed description of how to create a connection to the controller.

Comfort Panel

The starting point is an existing WinCC (TIA Portal) project with the following components:

- SIMATIC TP900 Comfort Panel.
- SIMATIC TP700 Comfort Panel.

IP addresses

Define the IP addresses for the individual hardware components. The following table shows the IP addresses used in the sample project:

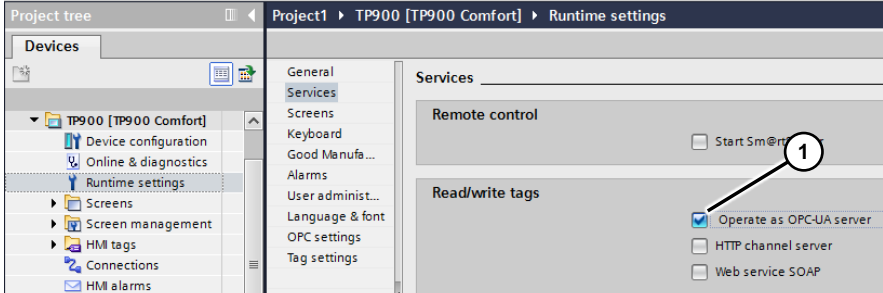
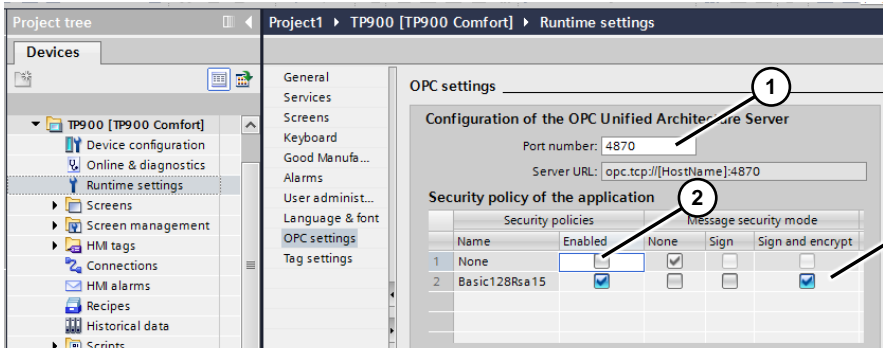
Table 3-1

Hardware	IP address	Subnet
SIMATIC HMI TP900 Comfort Panel	172.16.34.210	255.255.0.0
SIMATIC HMI TP700 Comfort Panel	172.16.34.220	255.255.0.0
CPU 1516-3PN/DP	172.16.34.34	255.255.0.0

3.1 TP900 Comfort Panel configuration – server

3.1.1 OPC UA configuration

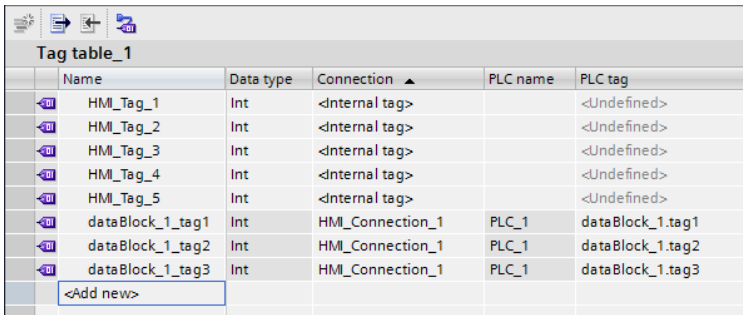
Table 3-2

No.	Action
1.	<p>Enabling OPC UA</p> <ul style="list-style-type: none"> In the project tree, select the TP900 Comfort Panel and open "Runtime settings". Select the "Services" menu item. "Project tree > Runtime settings > Services". In the "Read/write tags" section, check the "Operate as OPC-UA server" check box (1). 
2.	<p>OPC settings</p> <ul style="list-style-type: none"> In "Runtime settings", click the "OPC settings" menu ("Project tree > Runtime settings > OPC settings"). Specify the port number. You can specify a value between 1024 and 49151. The application example uses the default address, "4870", (1). In "Security policy of the application", uncheck the "None" check box in the "Security policies" table column (2). In the second row, specify the encryption. The application example uses the default setting, "Basic128Rsa15" and "Sign and encrypt", (3). 

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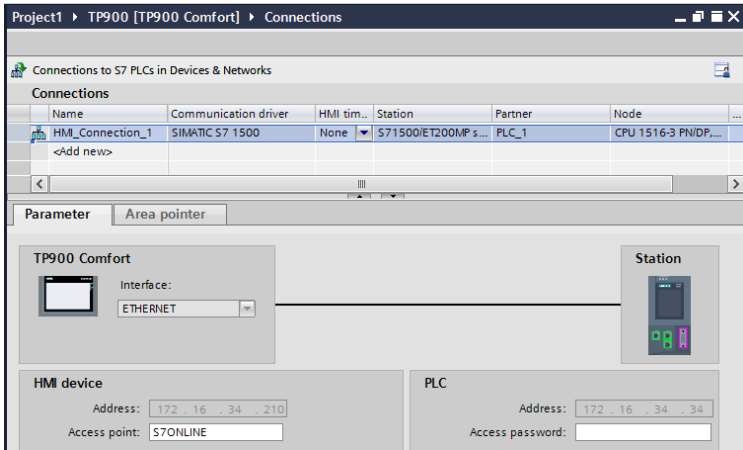
3.1.2 Creating tags

Table 3-3

No.	Action																																													
1.	<p>Insert all required tags. You can use internal HMI tags and tags with a PLC connection.</p> <p>Five internal tags and three tags with a PLC connection have been created for the application example.</p> <p>The application example does not provide a detailed description of how to create a tag.</p>  <table border="1"> <caption>Tag table_1</caption> <thead> <tr> <th>Name</th> <th>Data type</th> <th>Connection</th> <th>PLC name</th> <th>PLC tag</th> </tr> </thead> <tbody> <tr> <td>HMI_Tag_1</td> <td>Int</td> <td><Internal tag></td> <td></td> <td><Undefined></td> </tr> <tr> <td>HMI_Tag_2</td> <td>Int</td> <td><Internal tag></td> <td></td> <td><Undefined></td> </tr> <tr> <td>HMI_Tag_3</td> <td>Int</td> <td><Internal tag></td> <td></td> <td><Undefined></td> </tr> <tr> <td>HMI_Tag_4</td> <td>Int</td> <td><Internal tag></td> <td></td> <td><Undefined></td> </tr> <tr> <td>HMI_Tag_5</td> <td>Int</td> <td><Internal tag></td> <td></td> <td><Undefined></td> </tr> <tr> <td>dataBlock_1_tag1</td> <td>Int</td> <td>HMI_Connection_1</td> <td>PLC_1</td> <td>dataBlock_1_tag1</td> </tr> <tr> <td>dataBlock_1_tag2</td> <td>Int</td> <td>HMI_Connection_1</td> <td>PLC_1</td> <td>dataBlock_1_tag2</td> </tr> <tr> <td>dataBlock_1_tag3</td> <td>Int</td> <td>HMI_Connection_1</td> <td>PLC_1</td> <td>dataBlock_1_tag3</td> </tr> </tbody> </table>	Name	Data type	Connection	PLC name	PLC tag	HMI_Tag_1	Int	<Internal tag>		<Undefined>	HMI_Tag_2	Int	<Internal tag>		<Undefined>	HMI_Tag_3	Int	<Internal tag>		<Undefined>	HMI_Tag_4	Int	<Internal tag>		<Undefined>	HMI_Tag_5	Int	<Internal tag>		<Undefined>	dataBlock_1_tag1	Int	HMI_Connection_1	PLC_1	dataBlock_1_tag1	dataBlock_1_tag2	Int	HMI_Connection_1	PLC_1	dataBlock_1_tag2	dataBlock_1_tag3	Int	HMI_Connection_1	PLC_1	dataBlock_1_tag3
Name	Data type	Connection	PLC name	PLC tag																																										
HMI_Tag_1	Int	<Internal tag>		<Undefined>																																										
HMI_Tag_2	Int	<Internal tag>		<Undefined>																																										
HMI_Tag_3	Int	<Internal tag>		<Undefined>																																										
HMI_Tag_4	Int	<Internal tag>		<Undefined>																																										
HMI_Tag_5	Int	<Internal tag>		<Undefined>																																										
dataBlock_1_tag1	Int	HMI_Connection_1	PLC_1	dataBlock_1_tag1																																										
dataBlock_1_tag2	Int	HMI_Connection_1	PLC_1	dataBlock_1_tag2																																										
dataBlock_1_tag3	Int	HMI_Connection_1	PLC_1	dataBlock_1_tag3																																										

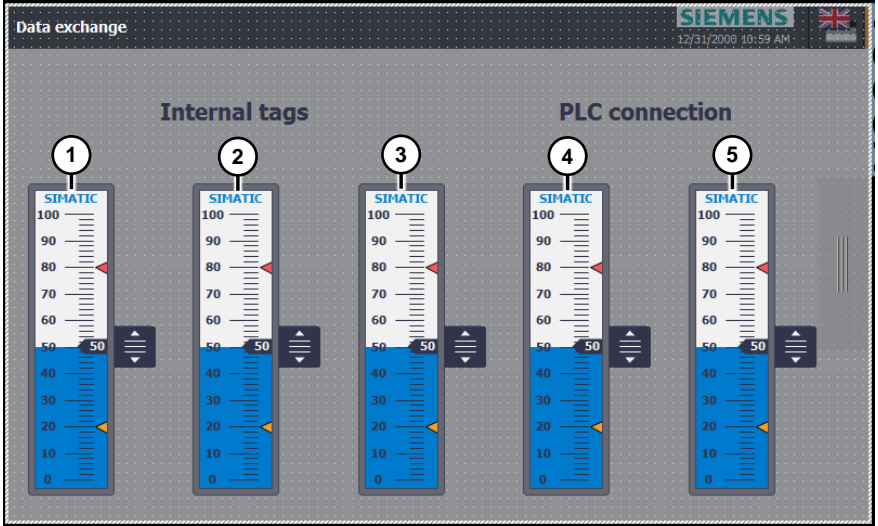
3.1.3 Creating the connection

Table 3-4

No.	Action
1.	<p>For OPC UA communication of the TP900 Comfort Panel, no settings need to be made in the "Connections" menu.</p> <p>The required communication settings are made when configuring the TP700 Comfort Panel ("client") (see Chapter 3.2.1 "Creating the OPC UA connection").</p> 

3.1.4 Plant screen

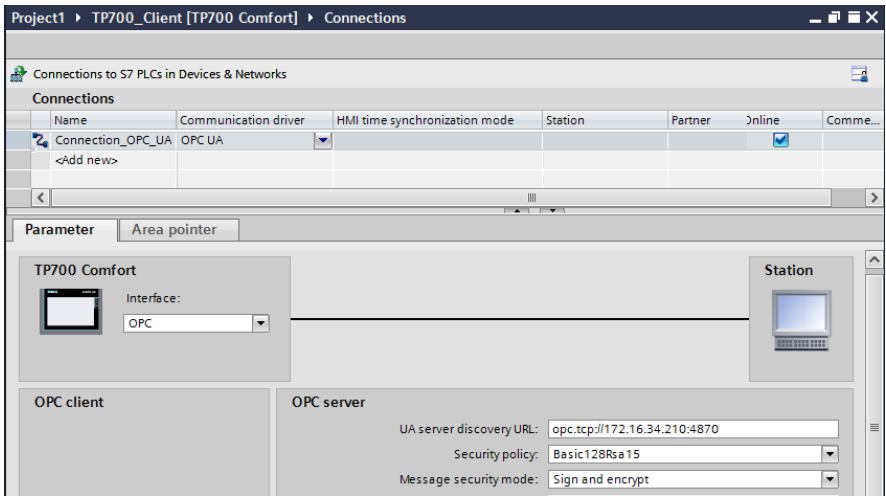
Table 3-5

No.	Action
1.	<p>A screen provides five sliders to test data exchange between the TP900 Comfort Panel and the TP700 Comfort Panel. The sliders allow you to simulate "process values".</p> <p>The first three sliders each use an internal tag.</p> <p>Sliders 4 and 5 each use a tag with a PLC connection.</p> 

3.2 TP700 Comfort Panel configuration – client

3.2.1 Creating the OPC UA connection

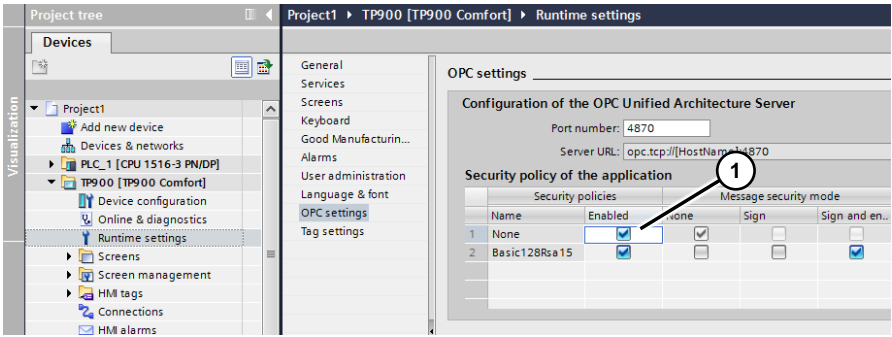
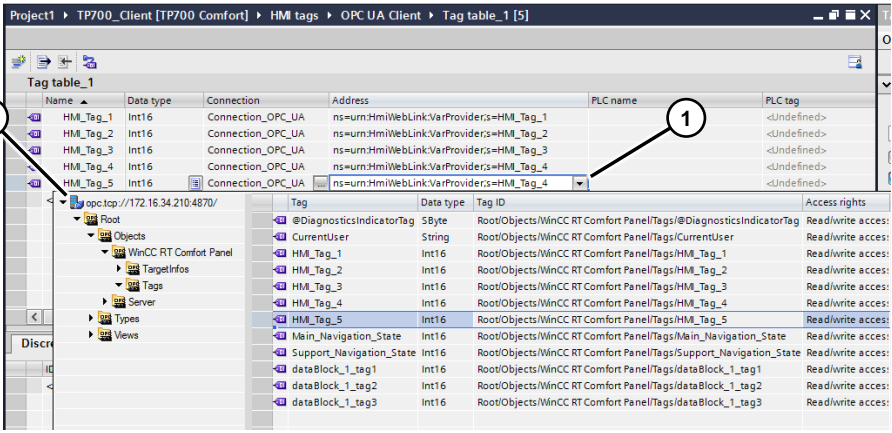
Table 3-6

No.	Action
1.	<p>Creating the OPC UA connection</p> <ul style="list-style-type: none"> • In the project tree, open the "Connections" folder. • Create a new connection. • In "Communication driver", select "OPC UA". <p>- "OPC server" settings (Specify the server's IP address. In this case: the TP900 Comfort Panel's IP address)</p> <p>UA server discovery URL: opc.tcp://172.16.34.210:4870 Security policy: Basic128Rsa15 Message security mode: Sign and encrypt.</p> <p>Note: The "security policy" used must match the "security policy" selected in the TP900 Comfort (server) configuration (see 3.1.1 "OPC UA configuration").</p> 

3.2.2 Online browsing to the TP900 Comfort Panel tags

From the TP700 Comfort Panel's (client) tag editor, you can browse (online) to the tags of the TP900 Comfort Panel (server).

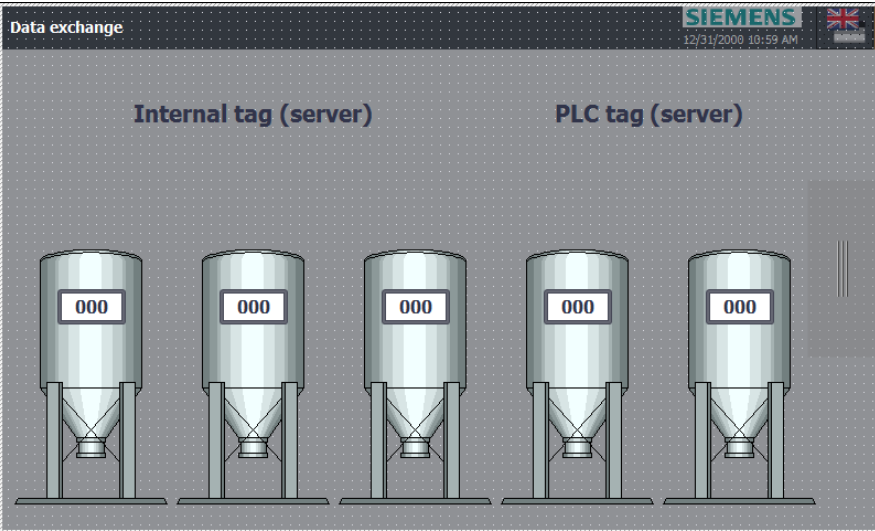
Table 3-7

No.	Action
1.	<p>Preparations in the TP900 Comfort Panel configuration</p> <p>To browse to the TP900 Comfort Panel tags online, edit the "security policies" in the TP900 Comfort Panel configuration.</p> <ul style="list-style-type: none"> In the TP900 Comfort Panel project tree, open the OPC settings. "Project tree > Runtime settings > OPC settings". For the period during which you browse to the TP900 Comfort Panel tags, check the "None" check box (1). Then transfer the configuration to the TP900 Comfort Panel. 
2.	<p>Adding tags</p> <ul style="list-style-type: none"> Open the TP700 Comfort Panel's tag editor. Insert a new tag and in the "Address" column, open the drop-down list (1). A dialog opens (2). In the dialog, click the arrow next to the "server object". Navigate to the "Root > WinCC RT Comfort Panel > Tags" folder. The folder displays the Comfort Panel's tags. <p>Note: The path may differ depending on the project.</p> <ul style="list-style-type: none"> Double-clicking a tag applies the tag to the HMI project. 

No.	Action
	<p>Note: If you apply a tag of the "String" type, you must enter the "string's" "length" in the tag properties. For the "length", refer to the "original application".</p>
3.	To add more tags, repeat the step from table section 2.
4.	<p>Enabling "security policies" on the TP900 Comfort Panel</p> <ul style="list-style-type: none"> • In the TP900 Comfort Panel project tree, open the OPC settings. "Project tree > Runtime settings > OPC settings". • Uncheck the "None" check box. • Transfer the configuration to the TP900 Comfort Panel.

3.2.3 TP700 Comfort Panel plant screen

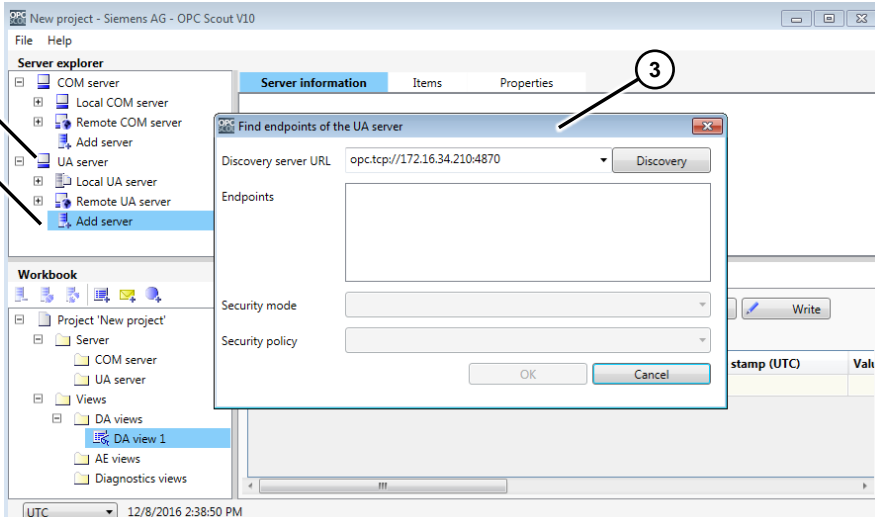
Table 3-8

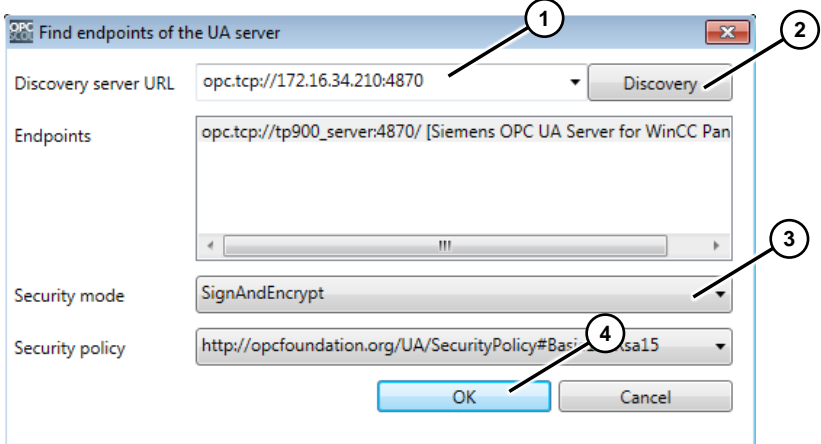
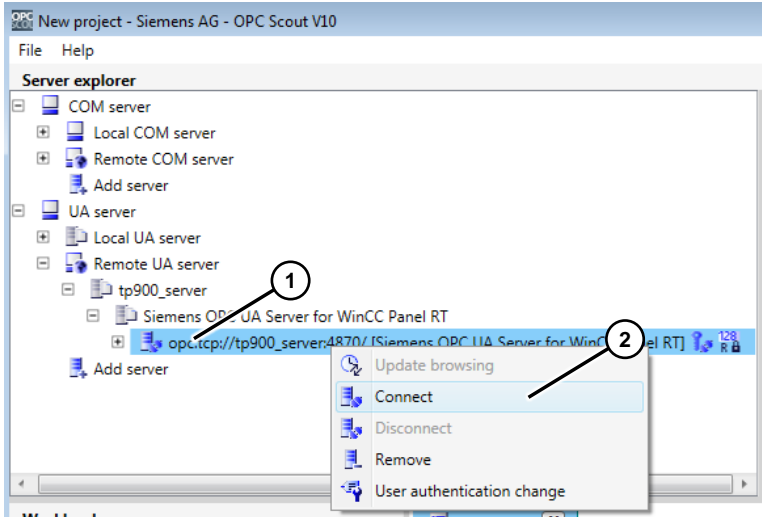
No.	Action
1.	<p>For illustration purposes, the plant screen contains five symbolic containers to test data exchange between the TP900 Comfort Panel and the TP700 Comfort Panel. The tags that are output on this plant screen match the tags from Chapter 3.2.2 "Online browsing to the TP900 Comfort Panel tags".</p> 

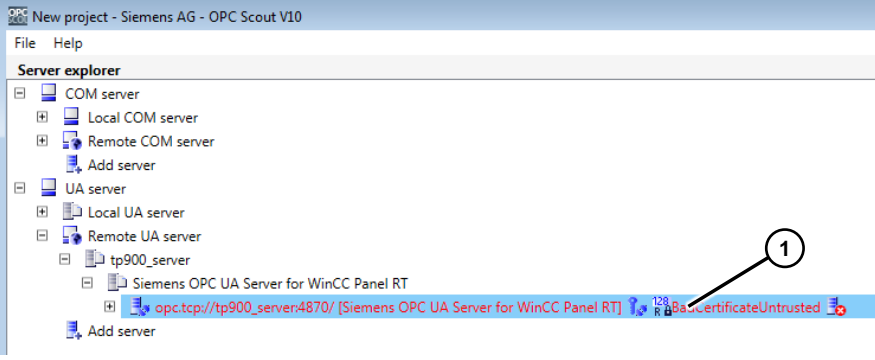
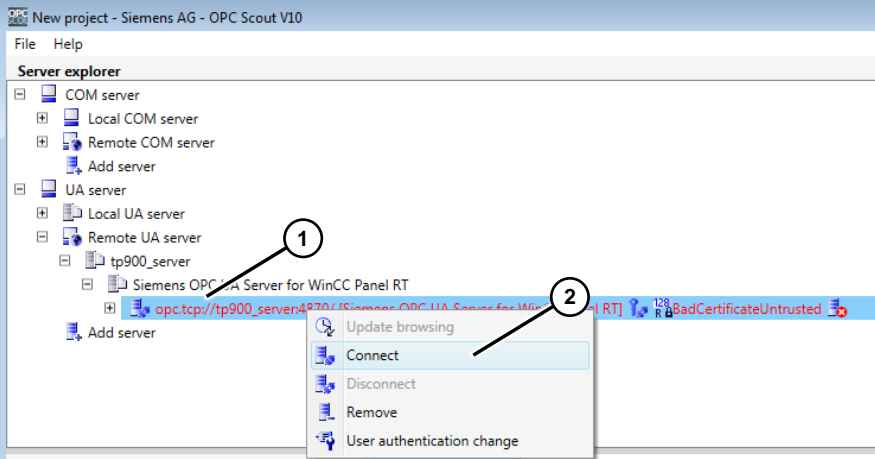
3.3 OPC Scout V10 configuration

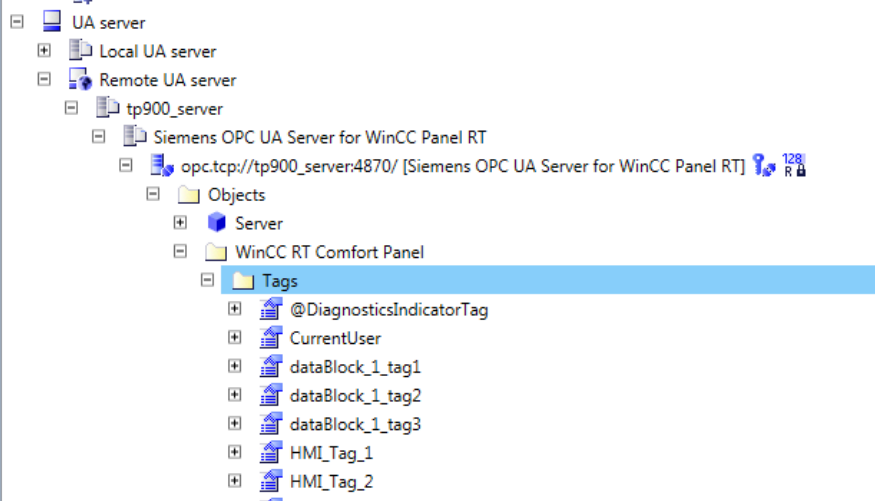
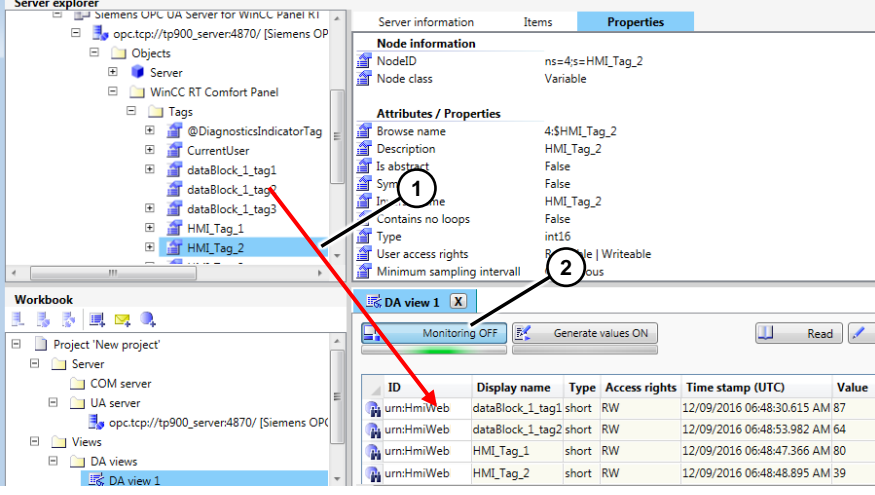
Requirements: SIMATIC OPC Scout must be installed on the PC and the TP900 Comfort Panel (server) must be connected to the PC. .

Table 3-9

No.	Action
1.	<p>TP900 Comfort Panel (server)</p> <p>Start the TP900 Comfort Panel runtime.</p>
2.	<p>SIMATIC OPC Scout V10</p> <ul style="list-style-type: none"> Open SIMATIC OPC Scout V10 "Start > Programs > SIMATIC > SIMATIC NET" <p>Note The file path may differ. Alternatively, type "OPC Scout" in the "Search Programs and Files" search box.</p> <ul style="list-style-type: none"> In OPC Scout, use "Server explorer" to navigate to the "UA server" folder (1). Double-click "Add server" (2). The "Find endpoints of the UA server" dialog opens (3). 

No.	Action
3.	<p>Parameterizing the "Find endpoints of the UA server" dialog</p> <ul style="list-style-type: none"> In the "Discovery server URL" field, enter the OPC UA address of the TP900 Comfort Panel (1). In this application example: <code>opc.tcp://172.16.34.210:4870</code> Click the "Discovery" button (2). OPC Scout attempts to establish a connection to the server. When the connection has been successfully established, the recognized data is output (3). Use the "OK" button to confirm the data (4). "Server explorer" displays the found "server address". <p>Note: Establishing the connection is not the same as accessing the tags of the TP900 Comfort Panel. For this purpose, first assign an OPC Scout certificate to the server.</p> 
4.	<p>Transferring the OPC Scout certificate to the server</p> <ul style="list-style-type: none"> In the "Server explorer" field, right-click the displayed server address of the TP900 Comfort Panel (1). In the context menu, click "Connect" (2). 

No.	Action
5.	<p>Connection establishment failed view</p> <p>When the "Connect" function is executed, OPC Scout transfers the certificate to the TP900 Comfort Panel (server). On the panel, it is stored in the "rejected" file folder. Copy the certificate from the "rejected" folder to the "certs" folder. Chapter 3.4.2 "Comfort Panel (server) ↔ OPC Scout (client)" describes the detailed procedure for moving the certificate.</p> <p>Note: As long as the server has no valid certificate, OPC Scout cannot access the server. The connection is silhouetted in "red" (1).</p> 
6.	<p>Connecting OPC Scout to the server</p> <p>Condition</p> <ul style="list-style-type: none"> • In the TP900 Comfort Panel, the OPC Scout certificate was copied from the "rejected" folder to the "certs" folder. • The TP900 Comfort Panel runtime has started. <p>Establishing the connection</p> <ul style="list-style-type: none"> • In the "Server explorer" field, right-click the displayed server address of the TP900 Comfort Panel (1). • In the context menu, click "Connect" (2). The connection to the TP900 Comfort Panel is being established. 

No.	Action
7.	<p>Displaying tag values</p> <p>When the connection to the TP900 Comfort Panel has been established, a folder tree is displayed.</p> <ul style="list-style-type: none"> The "Objects > WinCC RT Comfort Panel > Tags" folder displays the configured tags of the panel.  <ul style="list-style-type: none"> Use drag and drop to move the tags to the "DA_view 1" window (1). The "Monitoring ON/Monitoring OFF" button enables/disables monitoring of the tag values.  <p>For more details about OPC Scout, please refer to the help.</p>

3.4 Handling the certificates

3.4.1 Comfort Panel (server) ↔ Comfort Panel (client)

General information

Make sure that all nodes are connected to each other.

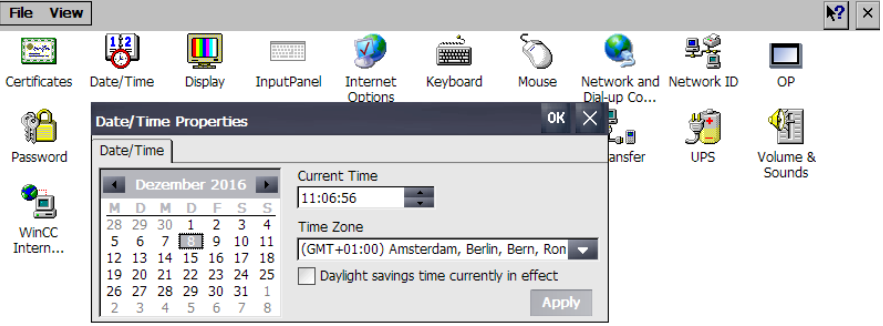
When starting the Comfort Panel runtime, each Comfort Panel generates a certificate. As 'valid from', both certificates apply the system time displayed on the Comfort Panel.

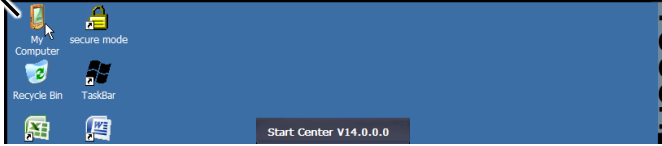
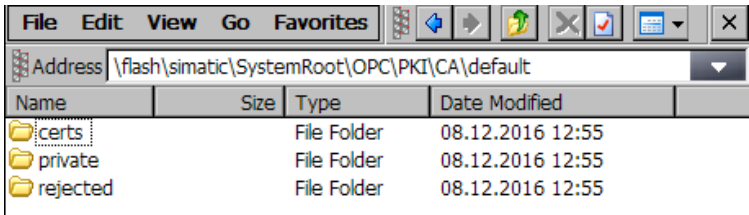
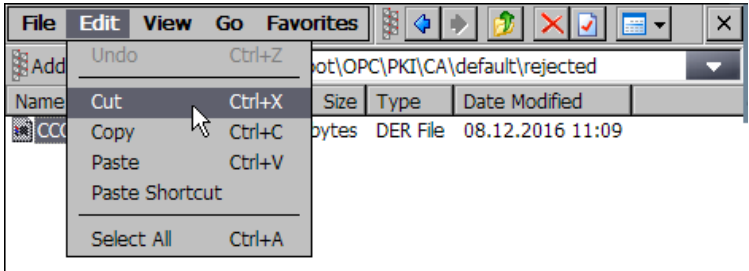
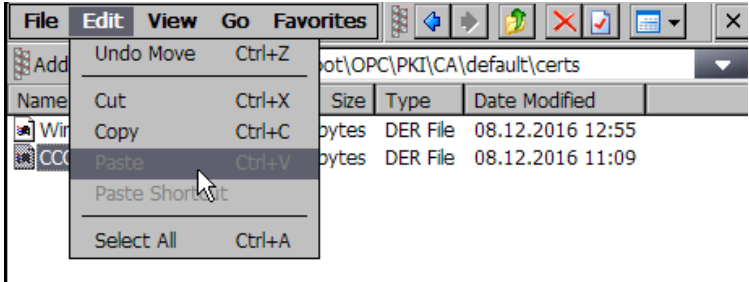
In the "client" certificate, the 'valid from' time can differ by up to two hours – relating to the Comfort Panel system time.

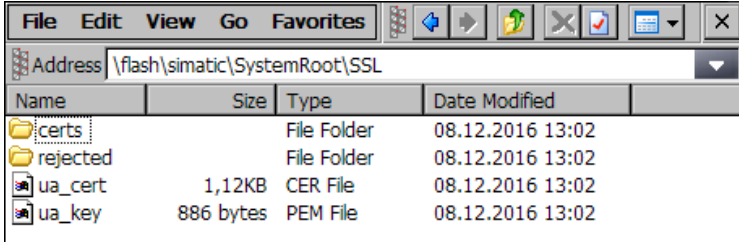
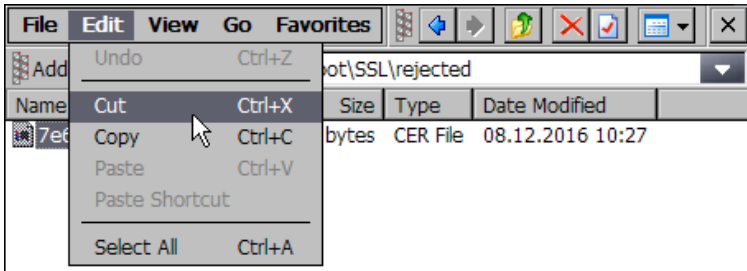
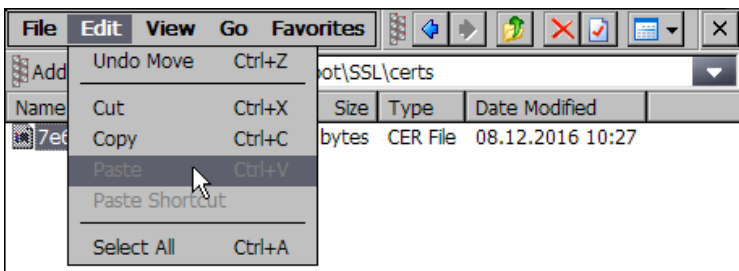
As a result of this time difference, it is possible that initially no connection is established, although both certificates are stored correctly.

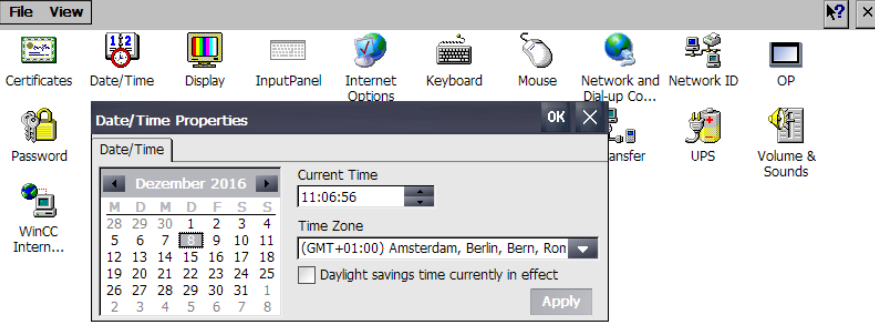
The difference is caused by the evaluation of UTC.

Table 3-10

No.	Action
8.	<p>Setting the date and time on the Comfort Panel</p> <ul style="list-style-type: none"> Stop the runtime of both Comfort Panels. On both panels, open the "Settings". On both panels, use the "Date/Time" icon to open the "Date/Time Properties".  <ul style="list-style-type: none"> TP900s (server) Set "current time – 3 hours" as the time. (Example: current time: 15:00h → setting: 12:00h) TP700 (client) Set "current time – 2 hours" as the time. (Example: current time: 15:00h → setting: 13:00h) On both Comfort Panels, enter the same date. On both Comfort Panels, close the "Date/Time Properties". On both Comfort Panels, close the "Settings".
9.	<p>Starting the Comfort Panel runtime</p> <ul style="list-style-type: none"> Start the "runtime" of both Comfort Panels. Wait until the start screen appears on both Comfort Panels. Stop the runtime of both panels.

No.	Action
10.	<p>General information (opening the file folder)</p> <p>The TP900 Comfort Panel and TP700 Comfort Panel certificates are stored in a special file folder on the panel. To open the file folders, click the "My Computer" icon (1).</p> <p>The following sections describe details about the storage path.</p> 
11.	<p>Moving the TP700 Comfort Panel (client) certificate</p> <p>In the TP700 Comfort Panel, navigate to the following directory: "\"My Computer\\flash\\simatic\\SystemRoot\\OPC\\PKI\\CA\\default\""</p>  <ul style="list-style-type: none"> Open the "rejected" folder and cut (do not copy) the "hexadecimal number..." certificate (Edit > Cut).  <p>In the same folder tree, open the "certs" folder and paste the certificate you have just cut into this folder.</p>  <ul style="list-style-type: none"> Moving the certificate is now complete. Close the file system.

No.	Action
12.	<p>Starting the Comfort Panel runtime</p> <ul style="list-style-type: none"> Start the "runtime" of both Comfort Panels. Wait until the start screen appears on both Comfort Panels. Stop the TP900 Comfort Panel (server) runtime.
13.	<p>Moving the TP900 Comfort Panel (server) certificate</p> <p>In the TP900 Comfort Panel, navigate to the following directory: "My Computer\flash\simatic\SystemRoot\SSL"</p>  <ul style="list-style-type: none"> Open the "rejected" folder and cut (do not copy) the "hexadecimal number..." certificate (Edit > Cut).  <p>In the same folder tree, open the "certs" folder and paste the certificate you have just cut into this folder.</p>  <ul style="list-style-type: none"> Moving the certificate is now complete. Close the file system.

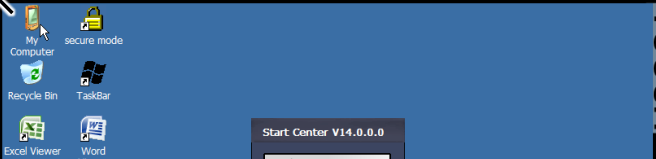
No.	Action
14.	<p>Updating the time on the Comfort Panels</p> <ul style="list-style-type: none"> On both panels, open the "Settings". On both panels, use the "Date/Time" icon to open the "Date/Time Properties".  <ul style="list-style-type: none"> On both panels, enter the current time. Make sure that the same date is set on both Comfort Panels. Close the "Date/Time Properties". Close the "Settings".

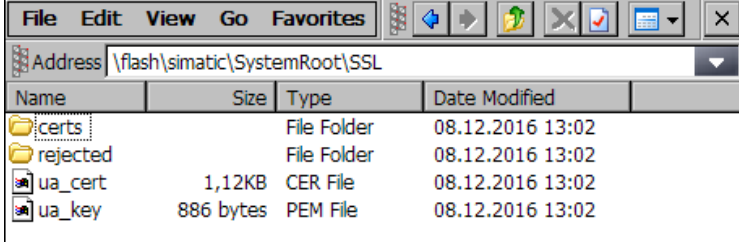
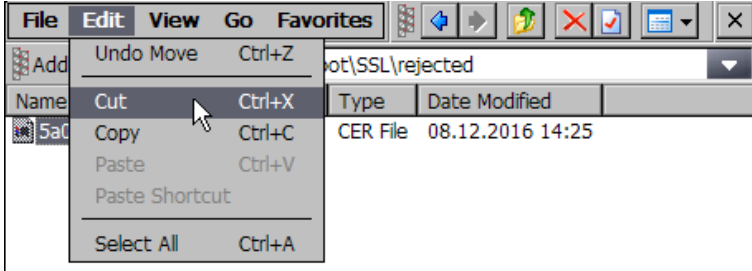
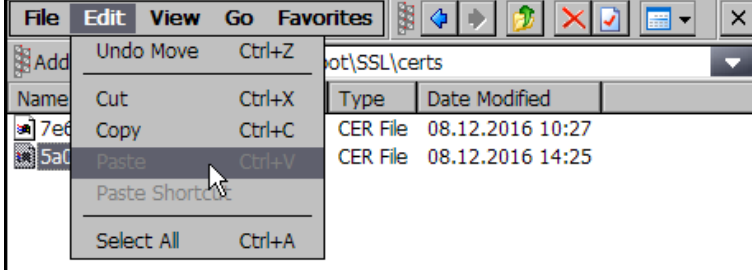
The OPC UA communication settings are now complete on both panels.

3.4.2 Comfort Panel (server) ↔ OPC Scout (client)

When the connection between OPC Scout and the TP900 Comfort Panel is established for the first time, the OPC Scout certificate is transferred to the Comfort Panel. To this end, connect all the nodes and start the TP900 Comfort Panel runtime. For a description, please refer to Chapter [3.3 "OPC Scout V10 configuration"](#).

Table 3-11

No.	Action
1.	<p>General information (opening the file folder)</p> <p>The certificates are stored in a special file folder in the Comfort Panel. To go to the file folders, click the "My Computer" icon (1). The following sections describe details about the storage path.</p> 

No.	Action
2.	<p>Moving the TP900 Comfort Panel (server) certificate</p> <p>Condition You have made the settings described in Chapter 3.3 "OPC Scout V10 configuration".</p> <p>In the TP900 Comfort Panel, navigate to the following directory: "My Computer\flash\simatic\SystemRoot\SSL"</p>  <ul style="list-style-type: none"> Open the "rejected" folder and cut (do not copy) the "hexadecimal number..." certificate (Edit > Cut).  <p>In the same folder tree, open the "certs" folder and paste the certificate you have just cut into this folder.</p>  <ul style="list-style-type: none"> Moving the OPC Scout certificate is now complete. Close the file system. Make the settings described in Chapter 3.3 "OPC Scout V10 configuration".

4 Installation and Startup

4.1 Installation

Requires that the software described in Chapter [2.1](#) be installed.

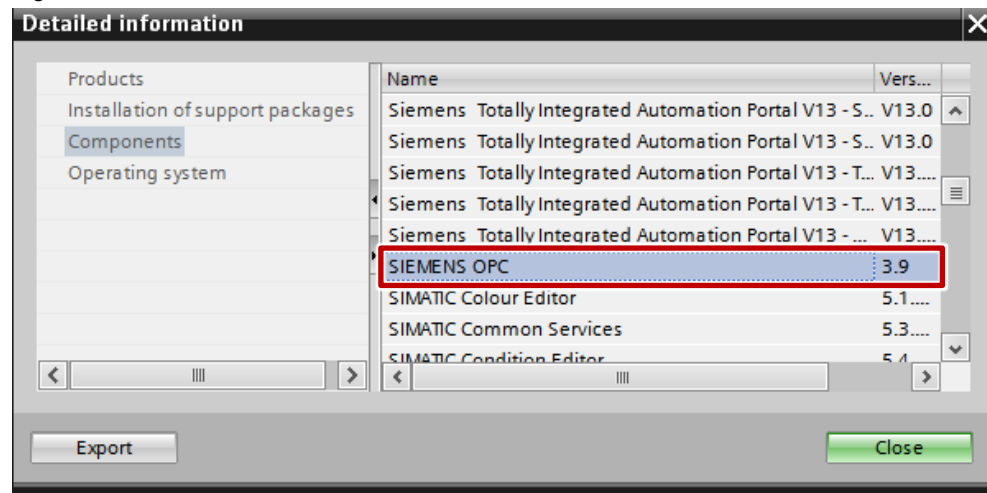
For communication between the Comfort Panel and WinCC Runtime Advanced, WinCC Runtime Advanced must be installed with the "SIEMENS OPC" option. If necessary, you can install this option at a later time.

The online help allows you to check whether "SIEMENS OPC" is installed on the PC.

Click "Help > Installed software... > Detailed information about installed software > Components".

If the option has been installed, you will find the "SIEMENS OPC" item.

Figure 4-1



4.2 Startup of the application example

Table 4-1

No.	Description
1.	Unzip the supplied application example to a folder and open the configuration.
2.	Make sure that all nodes are on and connected to each other.
3.	Transfer the two HMI configurations to the Comfort Panels and start the runtime.
4.	Move the certificates (see Chapter 3.4 "Handling").

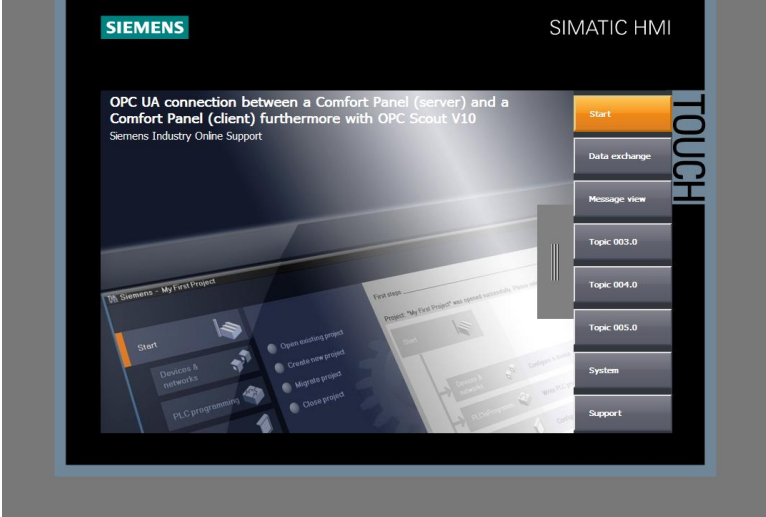
5 Operation of the Application Example

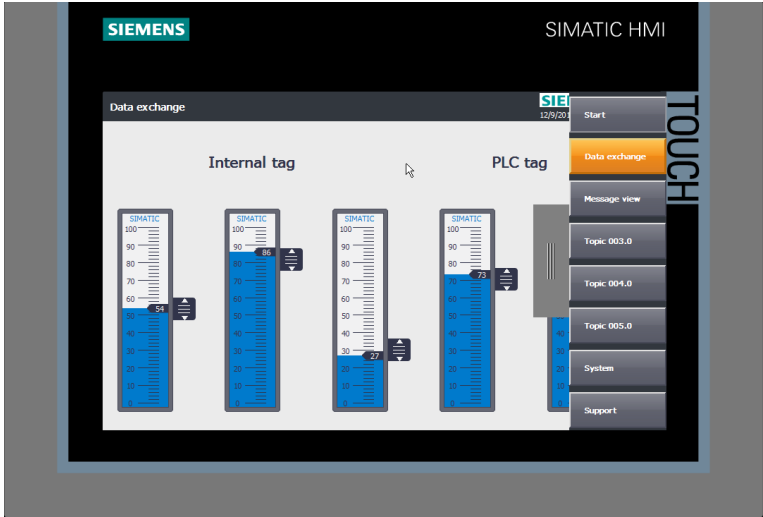
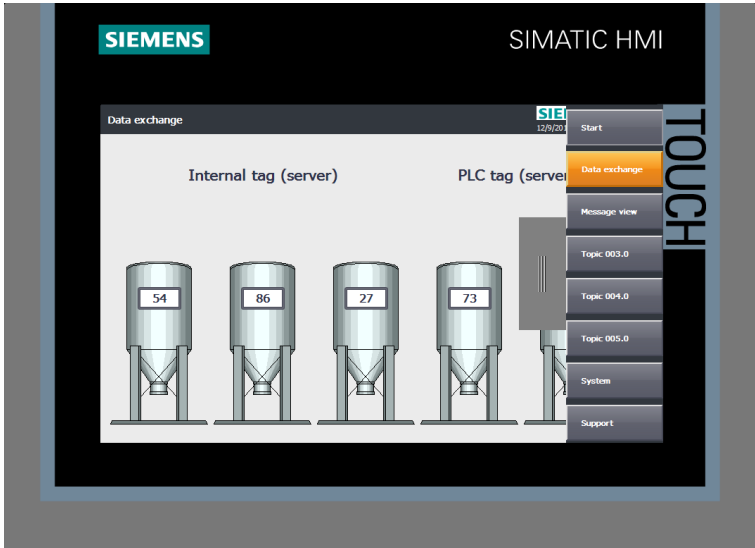
Overview and description of the Comfort Panel user interface

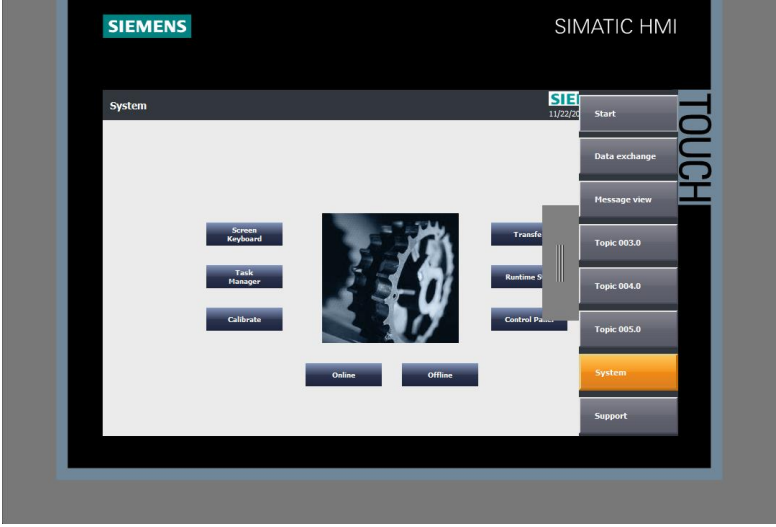
The following sections provide a brief description of the three most important screens:

- Start screen
- Data exchange
- System screen

Table 5-1

No.	Action
1.	<p>Start screen (TP900 / TP700 Comfort Panel)</p> <ul style="list-style-type: none"> • Starting the Comfort Panel runtime opens the following screen. • To navigate through the project, open the right-hand "slide-in screen". 

No.	Action
2.	<p>Data exchange (TP900 Comfort Panel)</p> <ul style="list-style-type: none"> • Select the "Data exchange" button. The screen allows you to test communication between the TP900 Comfort Panel and the TP700 Comfort Panel. • To simulate process values, you can specify values using the sliders. 
3.	<p>Data exchange (TP700 Comfort Panel)</p> <ul style="list-style-type: none"> • Click the "Data exchange" button. The screen allows you to test communication between the TP900 Comfort Panel and the TP700 Comfort Panel. • The simulated process values of the T900 Comfort Panel are read via the OPC UA interface on the TP700 Comfort Panel. 

No.	Action
4.	<p>System screen (TP900 / TP700 Comfort Panel)</p> <ul style="list-style-type: none"> Click the "System" button. The screen allows you to execute the system functions shown on the screen, for example "Runtime Stop". 
5.	<p>Other screens (TP900 / TP700 Comfort Panel)</p> <p>The "Message view" screen is used to open the message history. The "Support" screen provides you with related online support information.</p>

6 Appendix

6.1 Service and Support

Industry Online Support

Do you have any questions or need assistance?

Siemens Industry Online Support offers round the clock access to our entire service and support know-how and portfolio.

The Industry Online Support is the central address for information about our products, solutions and services.

Product information, manuals, downloads, FAQs, application examples and videos – all information is accessible with just a few mouse clicks at:

<https://support.industry.siemens.com>

Technical Support

The Technical Support of Siemens Industry provides you fast and competent support regarding all technical queries with numerous tailor-made offers – ranging from basic support to individual support contracts. You send queries to Technical Support via Web form:

www.siemens.com/industry/supportrequest

Service offer

Our range of services includes, inter alia, the following:

- Product trainings
- Plant data services
- Spare parts services
- Repair services
- On-site and maintenance services
- Retrofitting and modernization services
- Service programs and contracts

You can find detailed information on our range of services in the service catalog:

<https://support.industry.siemens.com/cs/sc>

Industry Online Support app

You will receive optimum support wherever you are with the "Siemens Industry Online Support" app. The app is available for Apple iOS, Android and Windows Phone:

<https://support.industry.siemens.com/cs/ww/en/sc/2067>

6.2 Related literature

Table 6-1

	Topic
\1\	Siemens Industry Online Support https://support.industry.siemens.com
\2\	https://support.industry.siemens.com/cs/ww/en/view/63481236

6.3 History

Table 6-2

Version	Date	Modifications
V1.0	04/2017	First version