Using Certificates with TIA Portal

SIMATIC, TIA Portal

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1 Introduction

1.1 Overview

Document contents

This document describes the handling of web server and OPC UA certificates in the PLC environment. You will learn what possibilities TIA Portal currently offers and how it is handled.

You will receive instructions for the following points:

- Establishing a secure connection to the web server of a SIMATIC S7-1500 CPU.
- Establishing a secure connection between the integrated OPC UA server of a SIMATC S7-1500 CPU and an OPC UA client.

Requirements

The following software environment is required for a successful implementation:

- TIA Portal V15.1
- Windows 7 Prof. or Windows 10
- An https-enabled browser, e.g. Internet Explorer V11 or Google Chrome V75
- An OPC UA client that supports a secure connection, e.g. UaExpert from Unified Automation
- One runtime license for the OPC UA server

A SIMATIC S7-1500 CPU from firmware V2.5 is required as hardware component, which serves as OPC UA server.

Preparation

Create a new TIA Portal project with your used CPU. Assign a network address to the CPU.

Make sure that the time of the CPU is set to the current time. A certificate always contains a period of time in which it is valid. To be able to encrypt with the certificate, the time of the S7 CPU must also be within this period of time. With a brand new S7-CPU or after an overall reset of the S7-CPU, the internal clock is set to a default value that lies outside the certificate runtime. The certificate is then marked as invalid.

1.2 Principle of operation

1.2.1 General information on certificates

Description

A device certificate (end-entity certificate) is required to establish a secure connection to a SIMATIC S7-1500 CPU. A device certificate is, for example, a server certificate for the Web or OPC server.

When the hardware configuration is loaded into the CPU, the device certificate generated by TIA Portal or created by the user is also loaded automatically.

Creating certificates

Device certificates for the CPU can be obtained in the following ways:

- Manually created and generated by the user.
- Automatically generated by TIA Portal.
 For S7-1500 CPUs with firmware V2.0 or higher, TIA Portal automatically generates the device certificate for the CPU as soon as you activate the web server of the CPU with the option "HTTPS" or the OPC UA server.

Certificate types

A distinction is made between the following certificate types:

Self-signed certificate:

Each participant generates his own certificate and signs it. No new certificates can be derived from a self-signed certificate. However, you must load all self-signed certificates of the partner devices into the CPU (STOP required).

<u>Application examples:</u> Static configuration with limited number of communication participants.

Device certificate signed via a certification authority (short: CA (Certificate Authority)) and its CA certificate:
 All certificates are created and signed by a certification authority.
 You only have to load the certificate of the certification authority into the CPU.
 The certification authority may generate new certificates. The addition of partner devices is possible without STOP of the CPU.

Application examples: Dynamically growing plants.

The automatically generated device certificates are issued and signed by the TIA Portal internal certification authority.

If you manually create the device certificates in TIA Portal, you can select the option "Self signed" or "Signed by certificate authority".

Figure 1-1

-		1
	CA	
	Choose how the new certificate is to be signed:	
	◯ Selfsigned	
	Signed by certificate authority	
	CA name: 2: Siemens TIA Project(5K0oVH59IU-D91-KLt 💌	

1.2.2 Certificate manager of TIA Portal

Description

You can use the TIA Portal project as a certification authority by selecting the option "Use global security settings for certificate manager". A certification authority is a trusted authority that confirms the identity of the certificate and its creator.

The option decides whether you have access to all certificates in the project or not and whether you can have the device certificates signed by the CA certificates of the certification authority or not.

- If you do not use the certificate manager in the global security settings, then you only have access to the local certificate store of the CPU. You have no access, for example, to imported certificates or root certificates. Without these certificates only a limited functionality is available. For example, you can only generate self-signed certificates.
- If you use the certificate manager in the global security settings, you have access to the global, project-wide certificate store. For example, you can assign imported certificates to the CPU or create device certificates issued and signed by the project's certification authority. TIA Portal provides two root certificates (CA certificates) for the entire project.
- **Note** In this example, the TIA Portal Global Certification Manager is activated and used.

Properties of the certificate manager

If you use the certificate manager in the global security settings, you get an overview of all certificates used in the project, such as CA certificates and device certificates, with information about the certificate owner, issuer, validity, use, and existence of a private key. With the appropriate authorization, you can also manage certificates for the project there.

Figure 1-2

				👔 Certificate autho	rity (CA)	😭 Devi	ce certificates	Directory of the second
Cert	ificate authority (CA)							
ID	Common name of subject	Issuer	Valid to	Used as	Private key			
1	Siemens TIA Project(sZuqHXriGka	Siemens TIA Project(s	06/27/2037	Certification authorit	Yes			
2	Siemens TIA Project(5K0oVH59IU	Siemens TIA Project(06/27/2037	Certification authorit	Yes			

Functions of the certificate manager

The following functions are available in the certificate manager of the global security settings:

- Import new certificates and certification authorities.
- Export the certificates and certification bodies used in the project.
- Renewal of expired certificates and certification bodies.
- Replace existing certification bodies.
- Add trusted certificates and certificate authorities.

Figure 1-3

	-								
	Cert	Certificate authority (CA)							
Į	ID	Common name of subject	Issuer	Valid to					
	1	Siemens TIA Project(sZuqHXriGka	Siemens TIA Project(s.	06/27/2037					
	2	Siemens TIA Project(5K0oVH59IU	Siemens TIA Project(Import					
				Export					
				Assian					
				Show					
				Renew					
				Replace					

1.2.3 Self-signed device certificate

Description

Self-signed certificates are certificates whose signature originates from the certificate holder and not from an independent certification authority.

If you use self-signed certificates, a device certificate is created in TIA Portal for each CPU and then loaded into the CPU. You must also install this device certificate in the PC that you are using to access the Web or Internet connection. OPC server of the CPU.

Self-signed certificates cannot be verified with the CA certificates of the TIA Portal project.

Manual acquisition

When creating device certificates in TIA Portal, you can select the "Self-signed" option. You can create self-signed certificates without being signed up for global security settings.

Automatic generation

If you do not use the certificate manager in the global security settings, TIA Portal generates the device certificate as a self-signed certificate.

Important note

If you address the Web or OPC server of the CPU via the IP address of the CPU, a new device certificate must be created and loaded with each change of the IP address of an Ethernet-interface of the CPU. The reason is that the identity of the CPU changes with the IP address.

You can avoid this problem by addressing the CPU with a domain name instead of its IP address, e.g. "myconveyer-cpu.room13.myfactory.com". To do this, you must manage the domain names of the CPUs via a DNS server.

1.2.4 Certificate signed by a certification authority

Description

Signed certificates are certificates whose signature comes from an independent certification authority.

If you use certificates signed by a certification authority, one device certificate per CPU is created in TIA Portal and then loaded into the CPU.

On the PC with which you want to access the web server or OPC server of the CPU, you do not have to perform any action first.

Manual acquisition

If you use the certificate manager in the global security settings of the CPU, then you can have the device certificates of the CPU signed by the certification authority of the project (CA certificate).

You can determine which CA certificate you want to use yourself.

Automatic generation

If you use the certificate manager in the global security settings, TIA Portal generates a device certificate signed using a CA certificate provided by TIA Portal.

When loading, the CA certificate of the project is also loaded automatically.

Important note

You can access the web server of the CPU via HTTPS from a PC. However, your web browser will warn you not to use this page, as the web server cannot be considered trustworthy. To see the page, you must explicitly add the Web page as an exception. The cause is the missing CA certificate with which the server certificate of the CPU was signed.

For this reason, it is recommended that you install the CA certificate of the CPU. Once the CA certificate is installed, your web browser will no longer display a warning because the web server can be verified.

To install the CA certificate, you have the following options:

- You can download the valid CA certificate directly from the "Intro" homepage of the web server under "Download certificate". (see <u>section 3.2</u>).
- You can export the CA certificate from TIA Portal and then import the CA certificate into the browser (see section 2.3).
- You can install the CA certificate directly from TIA Portal (see section 2.2).

Note For more information, refer to the section 3.

1.2.5 Decision-making aids

Whether it is better to use self-signed device certificates or device certificates that have been signed by a certification authority depends, among other things, on the number of CPUs to be reached and the number of accessing PCs.

Self-signed certificates

If you use self-signed device certificates, you must create a separate device certificate for each CPU, self-sign it, and install this device certificate on your PC.

It becomes complicated if you use several CPUs or PCs:

- If you have several CPUs, you must install the device certificates of all CPUs on the PC.
- If you want to reach multiple CPUs with multiple PCs, you must install the device certificates of all CPUs on all PCs.

You must also note that the IP address of the CPU must not change, otherwise you will have to generate, load and install new device certificates.

Device certificates signed by a CA

If you want to access different CPUs from different PCs or if you want to add more CPUs later, then the use of certification authorities is preferred.

You must also create a separate device certificate for each CPU. However, since all device certificates were signed with the same CA certificate, you only need to install this one CA certificate on the PC(s).

Regardless of whether you want to reach only one CPU or several CPUs, it is sufficient to install only one certificate (the CA certificate) on the PC.

You can easily install, export, or download the CA certificate directly from the Global Certification Manager from the web server home page of the CPU.

Since only the CA certificate must be installed on the PC, you can also change the IP address of the CPU afterwards without any consequences for the PC side.

Summary

The following table serves as an additional decision-making aid:

Table 1-1

	Self-signed	Certificate authority
1 CPU, 1PC / Client, no changes planned	+	-
n CPUs, m PC / Clients, changes possible	-	+
Download the certificate via web server	-	+

2 Using Certificate management

In TIA Portal, the certificates are managed in the certificate manager of the global security settings. The certificate manager contains an overview of all certificates used in the project. In the certificate manager, for example, you can import new certificates and export, renew, or replace existing certificates. Each certificate is assigned an ID that can be used to reference the certificate in the program modules.

2.1 Activate and understand

Activate Certificate management

To activate the global security settings, proceed as follows:

- 1. Mark the CPU in the device or network view. The properties of the CPU are displayed in the inspection window.
- In the area navigation of the "Properties" tab, select "Protection & Security > Certificate Manager". Activate the function "Use global security settings for certificate manager".

Figure 2-1



3. Confirm the following message with the "OK" button. Figure 2-2



Result

The Global Certification Manager is enabled.

Figure	2-3
Certific	ate manager
Glob	al security settings
0	The global security settings for the certificate manager are enabled. You do not have sufficient user rights to make changes in the certificate manager.
	Se global security settings for certificate manager

Protect project

After you have activated the global security settings for the certificate manager, you must protect the project from unauthorized access.

You protect the project by defining a project administrator and logging on with this user later. You cannot access the certificate manager of the global security settings without logging in.

Create a project administrator as described below:

1. Double-click on the entry "Settings" in the project navigation under "Security settings".

Click the "Protect this project" button.

Project protection Password policies	Project protection
	Your project will be protected as soon as removed again. This setting cannot be undone. Protect this project
	Project protection Password policies

2. Define a user name and password. Confirm the password. Click the "OK" button.

Figure	e 2-5			
Prote	ct project			×
Defi	ne credentials for the	project administra	tor	
	User name:	SuperAdmin		
	Password:	****		
	Confirm password:	*****		
	Comment:			
			ОК	Cancel

Result

You have protected the project and appointed a project administrator. From now on, you can only open the project if you have previously logged on as the project administrator.

If you have logged in, a line "Certificate manager" will appear under the entry "Security settings > Security functions" ("Security settings > Security features"). Figure 2-6

🔻 📴 Security settings
🙀 Settings
👬 Users and roles
 Security features
👷 Certificate manager
Log files (offline view)

Understanding the Certificate manager

With a double click on the newly appeared line "Certificate manager" in the project navigation you get access to all certificates in the project, divided into the registers

- Certification authority (CA),
- "Device certificates" and
- "Trusted certificates and root certificates".

TIA Portal provides two root certificates (CA certificates) for the entire project, which differ in the encryption strength of the hash algorithms for the certificate signature.:

- The CA certificate with the "ID: 1" contains the certificate signature encrypted with SHA1.
- The CA certificate with the "ID: 2" contains the certificate signature encrypted with SHA256.

Figure 2-7							
Devices			Certificate authorit	y (CA) 🛛 😭 Device	certificates 📃 T	rusted certificates a	nd root cert
- 1911 - 1912 -							2
	Cer	rtificate authority (CA)					
 Certificate 	ID	Common name of subject 🔺	Issuer	Valid to	Used as	Private key	
💣 Add new device	2	Siemens TIA Project(5K0oVH59IU	Siemens TIA Project(06/27/2037	Certification authorit	Yes	
Devices & networks	1	Siemens TIA Project(sZuqHXriGka	Siemens TIA Project(s	06/27/2037	Certification authorit	Yes	
PLC_1 [CPU 1516-3 PN/DP]							
Ungrouped devices							
🔻 📷 Security settings							
🛊 Settings							
Wers and roles							
 Security features 							
Certificate manager							
Log files (offline view)							

With the certificate manager in the global security settings, you now have the option to view, export, or import the two root certificates into the TIA portal.

Figure 2-8

Certificate authority (CA)						
🔺	Common name of subject		Issue	r		Valid to
1	Siemens TIA Project(sZuq	HXriGka	Siem	ens	TIA Project(s	06/27/2037
2	Siemens TIA Project(5K0d	Impor	t	ens	TIA Project(06/27/2037
		Expor	t			
		Assigi	n			
		Show	միր			
		Renev	NO.			
		Repla	ce			

2.2 Installing certificate directly

The certificates can also be installed directly on the local PC via the certificate manager of the global security settings. In the following instructions, the CA certificate is installed in the Windows certificate store.

Follow these steps for this purpose:

- 1. In the project navigation, open the "Security settings > Security features" menu. Double-click on the "Certificate manager" line.
- 2. Select a certificate and use the right mouse button to open the context menu. Select the "Show" entry.

Figure 2-9

Figure 2-10

Certificate authority (CA)								
🔺	Common name of subject							
1	Siemens TIA Project(sZuqHXriGka							
2	Siemens TIA Project(5K0d	Impor	t ^e					
		Expor	t					
		Assig	n					
		Show	ן ר					
		Renew						
		Replace						

3. The certificate is shown. To install the certificate locally on the PC, click the "Install certificate" button.

Certificate	-
General Details Certification Path	
Certificate Information	
This CA Root certificate is not trusted. To enable trust, install this certificate in the Trusted Root Certification Authorities store.	
Issued to: Siemens TIA Project(NrFxEMxUlUuac2nMg2FCvA)	
Issued by: Siemens TIA Project(NrFxEMxUlUuac2nMg2FCvA)	
Valid from 7/3/2019 to 7/3/2037	
Install Certificate] Issuer Statement	
ОК	

- 4. Follow the instructions of the Wizard.
 - Select the local storage as the storage location.
 - Select the certificate store yourself and locate the Trusted Root Certification Authorities folder.

The "Finish" button imports the certificate into the selected folder. Before the wizard issues a security warning, which must be acknowledged with "Yes". Figure 2-11

Certificate Import Wizard	
	Completing the Certificate Import Wizard The certificate will be imported after you click Finish.
	You have specified the following settings:
	Certificate Store Selected by User Trusted Root Certifica Content Certificate
	< •
	< Back Finish Cancel

5. The wizard completes the successful import process with the following message, which you can confirm with "OK".

Figure 2-12



Result

You have imported the certificate from TIA Portal into the Windows certificate store. To check the import, you can use the Microsoft mmc management console. To do this, add the Certificates snap-in to the console.

	~	
Figure	2-13	5

File Action view Favorites window Hel	P				
🤿 🖄 🐨 🤾 🖘 📓 🖬 🖬					
Console Root	Issued To	Issued By	Expiration Date	Intended Purposes	Frien
Certificates - Current User	GTE CyberTrust Global Root	GTE CyberTrust Global Root	8/14/2018	Secure Email, Client	Digi
Personal	localhost	localhost	1/9/2028	<all></all>	UM
Trusted Root Certification Authorities	Microsoft Authenticode(tm) Root Authority	Microsoft Authenticode(tm) Root	1/1/2000	Secure Email, Code	Mic
Certificates	Microsoft Root Authority	Microsoft Root Authority	12/31/2020	<all></all>	Mic
Enterprise Trust	Microsoft Root Certificate Authority	Microsoft Root Certificate Authori	5/10/2021	<all></all>	Mic
Intermediate Certification Authorities	Microsoft Root Certificate Authority 2010	Microsoft Root Certificate Authori	6/24/2035	<all></all>	Mic
Active Directory User Object Trusted Dublishers	Microsoft Root Certificate Authority 2011	Microsoft Root Certificate Authori	3/23/2036	<all></all>	Mic
Instead Publishers Instance Contificator	Microsoft Root Certificate Authority 2011	Microsoft Root Certificate Authori	3/23/2036	<all></all>	Mic
Third-Barty Poot Certification Authorities	NO LIABILITY ACCEPTED. (c)97 VeriSign. Inc.	NO LIABILITY ACCEPTED. (c)97 V	1/8/2004	Time Stamping	Ver
Trusted People	OuoVadis Root CA 2 G3	OuoVadis Root CA 2 G3	1/12/2042	Server Authenticati	Que
Other People	OuoVadis Root Certification Authority	QuoVadis Root Certification Auth	3/17/2021	Server Authenticati	Qui
NcmSecCertificates	SecureTrust CA	SecureTrust CA	12/31/2029	Server Authenticati	Tru
Certificate Enrollment Requests	Siemens Automation CA 2016	Siemens Automation CA 2016	3/3/2026	<all></all>	<n< td=""></n<>
SCT_STORE	Siemens TIA CA V12	Siemens TIA CA V12	1/1/2016	<all></all>	<n< td=""></n<>
SINEMA RC Client	Siemens TIA CA V13	Siemens TIA CA V13	1/1/2019	<all></all>	<n< td=""></n<>
Smart Card Trusted Roots	Siemens TIA Project(NrFxEMxUIUuac2nMg2FCvA)	Siemens TIA Project(NrFxEMxUIU	7/3/2037	<all></all>	<n< td=""></n<>
	Siemens.WinCC.AdHocSigner	Siemens, WinCC, AdHocSigner	12/31/9999	<all></all>	<n< td=""></n<>
	Siemens.WinCC.AdHocSigner	Siemens.WinCC.AdHocSigner	12/31/9999	<all></all>	<n< td=""></n<>
	Siemens.WinCC.AdHocSigner	Siemens.WinCC.AdHocSigner	12/31/9999	<all></all>	<n< td=""></n<>
	Siemens.WinCC.AdHocSigner	Siemens.WinCC.AdHocSigner	12/31/9999	<all></all>	<n< td=""></n<>
	Siemens.WinCC.AdHocSigner	Siemens.WinCC.AdHocSigner	12/31/9999	<all></all>	<n< td=""></n<>
	Siemens.WinCC.AdHocSigner	Siemens, WinCC, AdHocSigner	12/31/9999	<all></all>	<n< td=""></n<>
	Siemens.WinCC.AdHocSigner	Siemens, WinCC, AdHocSigner	12/31/9999	<all></all>	<n< td=""></n<>
	Starfield Class 2 Certification Authority	Starfield Class 2 Certification Auth	6/29/2034	Server Authenticati	Sta
	Starfield Root Certificate Authority - G2	Starfield Boot Certificate Authorit	1/1/2038	Server Authenticati	Star
	StartCom Certification Authority	StartCom Certification Authority	9/17/2036	Server Authenticati	Sta
	SwissSign Gold CA - G2	SwissSign Gold CA - G2	10/25/2036	Server Authenticati	Swi
	Thawte Premium Server CA	Thawte Premium Server CA	1/1/2021	Server Authenticati	tha
	Thavte Primary Root CA	thavte Primary Root CA	7/17/2036	Server Authenticati	tha
	thavte Primary Root CA - G3	thavte Primary Root CA - G3	12/2/2037	Server Authenticati	tha
	Thave Timestamping CA	Thawte Timestamping CA	1/1/2021	Time Stamping	The
		Liser DC TIAADMINI SVSTEM	12/5/2021	Server Authenticati	< Ni

Note The MMC does not update the display automatically. The MMC does not update the display automatically.

2.3 Export certificate

The certificates can also be exported in various formats via the certificate manager of the global security settings and installed at a later date or on another PC or imported into another application, e.g. UaExpert. In the following instructions, the CA certificate is exported.

Follow these steps for this purpose:

- 1. In the project navigation, open the "Security settings > Security features" menu. Double-click on the "Certificate manager" line.
- 2. Select a certificate and use the right mouse button to open the context menu. Select the entry "Export" ("Export").

Figure 2-14

-							
Се	Certificate Security features Certificate manager						
				[
	Cert	ificate authority (CA)					
_	ID	Common name of subject	Issuer	Valid to			
	1	Siemens TIA Project(sZuqHXriGka	Siemens TIA Project(s	06/27/2037			
	2	Siemens TIA Project(5K0oVH59IU-	roject(06/27/2037			
			Export				
			Assigh				
			Show				
			Renew				
			Replace				

3. A dialog box opens. Select the storage location of the certificate. Change the file type if necessary. Click on the "Save" button.

→ × ↑ 📙 « I	Benutzer > Siemens > Dokumente :	Automatisierung > Certificate :	>	~ Ū	"Certificate" durch	suchen
rganisieren 👻 Neu	ier Ordner					
🛃 Videos 🥤	Name	Änderungsdatum	Тур	Größe		
OneDrive	AdditionalFiles	27.06.2019 00:11	Dateiordner			
	IM	27.06.2019 00:11	Dateiordner			
Dieser PC	Logs	26.06.2019 23:54	Dateiordner			
3D-Objekte	System	27.06.2019 00:12	Dateiordner			
📰 Bilder	TMP	26.06.2019 23:54	Dateiordner			
Desktop	UserFiles	26.06.2019 23:54	Dateiordner			
🗄 Dokumente	XRef	26.06.2019 23:54	Dateiordner			
🕹 Downloads						
👌 Musik						
🚪 Videos						
🏪 Lokaler Datenträ						
🗙 Shared Folders (
· · · · ·	•					
Datei <u>n</u> ame: Sie	mens TIA Project(5K0oVH59IU-D91-KLt	ZWPQ)_X.509 Certificate_1				
Dateityp: Cert	tificate - DER coded (*.der)					

Note

By default, the certificate is exported as file type "*.der". If you need a different file type, you can change the default setting in the selection list under "File type" ("Data type").

Result

You have exported the certificate from TIA Portal and saved it on the PC. You can now transfer the certificate to another PC or import it into another application, e.g. UaExpert.

To install the exported certificate directly, double-click the exported certificate. The certificate is displayed and can be installed. (see step 2 in <u>section 2.2</u>).

3 Safe Web server connection

3.1 Web Server and Web Server Certificates

Overview

For a secure connection, the web server of the CPU is set up so that only one connection via HTTPS is allowed. For this the CPU needs a device certificate (server certificate).

For S7-1500 CPUs with firmware V2.0 or higher, TIA Portal automatically generates the server certificate for the CPU as soon as you activate the web server via HTTPS and translate the project. You can view the server certificate

- in the properties of the CPU.
- Generate a new server certificate.
- Assign another server certificate to the Web server.

Activating Web Servers via HTTPS

To configure the Web server using HTTPS, proceed as follows:

- 1. Mark the CPU in the device or network view. The properties of the CPU are displayed in the inspection window.
- 2. In the area navigation of the "Properties" tab, select the "Web Server" entry. Activate the option "Activate web server on this module" and the option "Permit access only with HTTPS".

Figure 3-1				
General IO tags	Syste	em constants	Texts	
System diagnostics	^	Webserver		
PLC alarms		web server		
Web server		Conoral		
DNS configuration				
Display				
Multilingual support				Activate web server on this module
Time of day				Permit access only with HTTPS
Protection & Security				<u> </u>
OPC UA	4	Automatic une	ate	

3. Translate your TIA Portal project.

Result

You have activated the web server with the "HTTPS" option. The web server of the CPU can be reached via the following address: "https://<IP address of the CPU>".

View Server Certificate

After you have enabled the "Permit access only with HTTPS" option and translated the TIA Portal project, TIA Portal generates a server certificate.

You can find the server certificate in the properties of the Web server.

In the area navigation, select Web Server > Security. Under "Server certificate" you can see that TIA Portal has already created a device certificate assigned to the web server.

Figure	3-2
--------	-----

-	
General IO tags	System constants Texts
 System diagnostics 	Security
PLC alarms	
✓ Web server	
General	The global security settings for the certificate manager have been selected.
Automatic update	Full functionality is available.
User management	The server certificate is used to verify the servers identity when it is accessed and to enable endpoint security.
Security	
Watch tables	
User-defined pages	Server certificate: PLC-1/Webserver-3
Entry page	
Overview of interfaces	
DNS configuration	
 Disates: 	

Note

TIA Portal stores the server certificate in the local certificate directory of the CPU. You can view and manage this directory in the local certificate manager of the CPU and also in the certificate manager of the global security settings (export or delete certificates).

Creating a New Server Certificate

To generate a new server certificate, proceed as follows:

- 1. In the area navigation, select Web Server > Security.
- 2. To select another server certificate or to generate a new server certificate, click on the button integrated in the "Server certificate" drop-down list.

Figure 3-3

0	
General IO tags	System constants Texts
PLC alarms	A Society
 Web server 	Security
General	
Automatic update	The global security settings for the certificate manager have been selected.
User management	Full functionality is available.
Security	The server certificate is used to verify the servers identity when it is accessed and to enable endpoint security.
Watch tables	
User-defined pages	
Entry page	Server certificate: PLC-1/Webserver-3
Overview of interfaces	
DNS configuration	
 Display 	

3. A dialog appears and lists all available server certificates. To create a new server certificate, click the "Add new" button.

Fi	Figure 3-4						
		1	1				
	ID	Common name of subject	Issuer	Valid until			
	3	PLC-1/Webserver-3	O=Siemens, C=DE, CN=Si	6/27/2037			
	r						
<				>			
			Add 🛀	new 🗸 🗙			

- 4. The dialog "Create new certificate" appears. You have the following options in this dialog:
 - You can choose between a self-signed certificate and a certificate signed by a certification authority.
 - If necessary, you can select the CA certificate of the certification authority.
 - You can determine the certificate parameters.

Figure 3-5

CA		
Choose how the new certificate	is to be signed:	
Selfsigned		
 Signed by certificate authori 	ty	
64 mm	De Gierre des The Designer/EKO-MUSONU	
CA name:	2: Siemens IIA Project(SK00VH59I0-	D91-KLT •
Certificate parameter		
Enter the parameters for the ne	w certificate:	
Common name of subject:	PLC-1/Webserver-6	
Signature:	sha256RSA	
Valid from:	June 28, 2019 02:25:53 AM	
Valid until:	June 28, 2037 12:00:00 AM	
Usage:	Web server	-
Subject Alternative Name	Type Value	
(SAN):	IP 192.168.0.1	
	DNS 192.168.0.1	
	IP 192.168.1.1	
	DNS 192.168.1.1	
	Add new	
	<	

 This example creates a server certificate with strong encryption "SHA256" signed by a certification authority. The CA certificate provided by TIA Portal with the "ID: 2". Set the parameters. Use the screenshot as a guide. To generate the new

•

-

-

>

certificate, click on the "OK" button. Figure 3-6 Ceate a new certificate CA Choose how the new certificate is to be signed: Self signed Signed by certificate authority CA name: 2: Siemens TIA Project(SK00VH59IU-D914LL) Certificate parameter Enter the parameters for the new certificate: Common name of subject: PLC-11/Webserver-6

Value

Value
192.168.0.1

Ш

192.168.0.1 192.168.1.1 192.168.1.1

OK Cancel

Note Coordinate the validity of the certificate with the plant operation

Signature: sha256RSA

Usage: Web serve

Subject Alternative Name (SAN):

Valid from: June 28, 2019 02:25:53 AM

Valid until: June 28, 2037 12:00:00 AM

Type IP

DNS

IP DNS Add new

<

 You can now use the newly created device certificate as the web server's server certificate. Figure 3-7



7. Translate your TIA Portal project and load the CPU. During the load process, the device certificate, the CA certificate, and the authorization for Web server access, among other things, are loaded into the CPU.

Result

The new device certificate is added to the existing device certificates in the "Device certificates" tab of the certificate manager.

Figure 3-8

Certificate authority (CA)						
Devi	ice certificates					
ID	Common name of su	Issuer	Valid to	Used as	Private key	
3	PLC-1/Webserver-3	Siemens TIA Project(06/27/2037	SSL certificate of mo	Yes	
6	PLC-1/Webserver-6	Siemens TIA Project(06/28/2037	SSL certificate of mo	Yes	

At this point, you can view, export, delete or renew the new device certificate, for example.

Figure 3-9

Dev	ice certificates			
ID	Common name of su	Issuer	Valid to	Used as
3	PLC-1/Webserver-3	Siemens TIA Project(06/27/2037	SSL certificate of mo
6	PLC-1/Webserver-6	Siemens TIA Project(06/28/2037	Delete te of mo
				Impoit
				Expol
				Assian
				Show
				Renew
				Replace
			L	Replace

3.2 Setting up and testing the browser

In the following instructions the following browsers are used:

- Internet Explorer
- Firefox
- Chrome

Description

With the addition "https" you achieve that the web server transfers its device certificate to the browser. If the CA certificate used to sign the Web server's device certificate is known to the browser, the Web page is considered trusted. Depending on your browser, a padlock may appear in the address bar, which you can click to get more information about the certificate and the issuing certificate company. However, if you try to open the HTTPS version of a page that does not have a valid certificate, a warning appears.

Note An activated virus scanner with additional browser or mail protection functions can prevent the proper exchange of certificates. You may need to customize these applications or replace them with another product.

Requirement

To establish a secure connection to the Web server, the CA certificate must be present in the certificate store that the browser accesses.

To import the CA certificate into the certificate store, you have the following options:

 You install the CA certificate directly from TIA Portal. (see <u>section 2.2</u>). However, the CA certificate is only stored in the Windows certificate store.

This procedure is not applicable for the Firefox browser, since Firefox uses its own certificate store.

Note

- You import and install the CA certificate directly into the browser's certificate store. To import and install the CA certificate, you must have saved the CA certificate on the local computer. You have the following options for this:
 - You export the CA certificate from TIA Portal in the format "*.der". ("Certificate-DER coded") (see section 2.3).
 - You download the CA certificate from the intro page of the web server.
- **Note** In the following instructions, the CA certificate is loaded, imported and installed from the intro page of the web server.

3.2.1 Internet Explorer or Edge

Note If you have already imported the CA certificate in the Windows central certificate store (see <u>section 2.2</u>), then the website of the CPU is already classified as trustworthy and you do not need to make any further adjustments.

Version

The instructions and screenshots were created with Internet Explorer version 11.

Certificate memory

Windows has a central certificate store. Many Windows programs can access the central certificate store if they work with certificates. This has the advantage that the certificates do not have to be imported into the certificate store of each software separately, but only once centrally in the Windows system itself.

If you import and install the CA certificate using Internet Explorer, the CA certificate is stored in the central certificate store. You can view and manage the central certificate store with the management console "mmc".

Figure 3-10

Download CA Certificate from Web Server and Install Directly

The CA certificate issued by the certification authority can simply be downloaded via web browser and then installed directly. Follow these steps for this purpose:

Open the intro page of the web server of the CPU via the address 1. "https://<IP address of the CPU>".

The web page is loading. Since the device certificate of the CPU cannot yet be verified by the missing CA certificate, the web page is classified as insecure. The following message is displayed: "There is a problem with this website's security certificate".

If you know the operator of the web page and if you know that he has no bad intentions, you can access the web page by clicking on the link "Continue to this website (not recommended)") despite the warning.

< ⊘(https://192.168.0.1/
<i> Certificate</i>	Error: Navigatio ×
File Edit \	View Favorites Tools Help
8	There is a problem with this website's security certificate.
	The security certificate presented by this website was not issued by a trusted certificate authority.
	Security certificate problems may indicate an attempt to fool you or intercept any data you send to the server.
	We recommend that you close this webpage and do not continue to this website.
	Click here to close this webpage.
	Sontinue to this website (not recommended).
	Some information

2. The intro page of the web server is opened as an insecure page. Internet Explorer colors the address bar red and reports the certificate error to the right of the address bar.

To download the CA certificate, click on the "Download certificate" menu. Figure 3-11

mall	simatic-controller	service&support	download certificate

3. You can choose whether you want to open or save the CA certificate directly. To install the CA certificate directly, click "Open".

Note If you want to save the CA certificate and install it later or on a different computer, follow the instructions in the next section.

4. The certificate is open. Click on "Install Certificate".

Figure 3-13

Certificate
General Details Certification Path
Certificate Information
This CA Root certificate is not trusted. To enable trust, install this certificate in the Trusted Root Certification Authorities store.
Issued to: Siemens TIA Project(NrFxEMxUlUuac2nMg2FCvA)
Issued by: Siemens TIA Project(NrFxEMxUlUuac2nMg2FCvA)
Valid from 7/ 3/ 2019 to 7/ 3/ 2037
Install Certificate Issuer Statement Learn more about certificates Issuer Statement
ОК

- 5. The wizard is started. Follow the instructions of the installation wizard.
 - Select the local storage as the storage location.
 - Select the certificate store yourself and locate the Trusted Root Certification Authorities folder.

The "Finish" button imports the certificate into the selected folder. Before the wizard issues a security warning, which must be acknowledged with "Yes". Figure 3-14

Certificate Import Wizard	
	Completing the Certificate Import Wizard The certificate will be imported after you click Finish.
	You have specified the following settings: Certificate Store Selected by User Content Certificate
	< <u> </u>

6. The wizard completes the successful import process with the following message, which you must confirm with "OK".

Figure 3-15



7. Close all instances of Internet Explorer, and then restart the program.

Result

You have imported the CA certificate into the Windows certificate store. The web page of the CPU is now classified as trustworthy.



Importing and Installing a CA Certificate

If you have saved the CA certificate on the local computer, for example, by exporting it from TIA Portal or downloading it and then saving it, you can import the CA certificate into the central certificate store as follows:

1. On your computer, navigate to the directory with the CA certificate. Open the CA certificate with a double-click and click on "Install Certificate".

Figure	3-17
--------	------

Certificate	
General Details Certification Path	
Certificate Information	
This CA Root certificate is not trusted. To enable trust, install this certificate in the Trusted Root Certification Authorities store.	
Issued to: Siemens TIA Project(NrFxEMxUlUuac2nMg2FCvA)	
Issued by: Siemens TIA Project(NrFxEMxUlUuac2nMg2FCvA)	
Valid from 7/ 3/ 2019 to 7/ 3/ 2037	
Install Certificate Issuer Statement Learn more about tertificates Issuer Statement	
OK	

- 2. Follow the instructions of the Wizard.
 - Select the local storage as the storage location.
 - Select the certificate store yourself and locate the Trusted Root Certification Authorities folder.

The "Finish" button imports the certificate into the selected folder. Before the wizard issues a security warning, which must be acknowledged with "Yes". Figure 3-18

Certificate Import Wizard	×
	Completing the Certificate Import Wizard The certificate will be imported after you click Finish.
	You have specified the following settings: Certificate Store Selected by User Trusted Root Certifica Content Certificate
	4 III >
	< Back Finish Cancel

3. The wizard completes the successful import process with the following message, which you must confirm with "OK".

Figure 3-19



4. Close all instances of Internet Explorer, and then restart the program.

Result

You have imported the CA certificate into the Windows certificate store. The web page of the CPU is now classified as trustworthy. Figure 3-20



3.2.2 **Google Chrome**

If you have already imported the CA certificate in the central certificate store of Note Windows (e.g. through section 2.2 or section 3.2.1), then the web page of the CPU is already classified as trustworthy and you do not need to make any further adjustments.

Version

The manual and the screenshots were created with Google Chrome Version 75.0.3770.100.

Certificate memory

The Google Chrome browser manages the certificates itself, but accesses the central Windows certificate store.

To check whether the CA certificate is known to the browser, proceed as follows:

1 Open the settings in Chrome Under "Advanced > Privacy and Security" you

Q Search settings	
rivacy and security	
Google Chrome may use web services to improve your browsing experience. You may optio services. Learn more	nally disable these
Use a web service to help resolve navigation errors	-
Use a prediction service to help complete searches and URLs typed in the address bar	-
Use a prediction service to load pages more quickly	
Automatically send some system information and page content to Google to help detect da apps and sites	ngerous
Protect you and your device from dangerous sites	
Automatically send usage statistics and crash reports to Google	
Send a "Do Not Track" request with your browsing traffic	0
Use a web service to help resolve spelling errors	

2. The "Certificates" window opens. Switch to the "Trusted Root Certification Authorities" tab. If you have already installed the CA certificate, it is displayed in the list. Close the dialog with "Close".

uthorities Trusted Root Co	ertification Aut	horities Trusted Publ	
uthorities Trusted Root Co	ertification Aut	horities Trusted Publ	
			4
Issued By	Expiratio	Friendly Name	*
QuoVadis Root CA 2 G3	1/12/2042	QuoVadis Root C	-
QuoVadis Root Certifi	3/17/2021	QuoVadis Root C	
SecureTrust CA	12/31/2029	Trustwave	
Siemens Automation	3/3/2026	<none></none>	
Siemens TIA CA V12	1/1/2016	<none></none>	
Siemens TIA CA V13	1/1/2019	<none></none>	
Siemens TIA Project(7/3/2037	<none></none>	
Siemens.WinCC.AdHo	12/31/9999	<none></none>	
Siemens.WinCC.AdHo	12/31/9999	<none></none>	Ψ.
Remove		Advan	nced
		View	
1		Clos	.e
	Issued By QuoVadis Root CA 2 G3 QuoVadis Root Certifi SecureTrust CA Siemens Automation Siemens TIA CA V12 Siemens TIA CA V13 Siemens TIA Project(Siemens.WinCC.AdHo Siemens.WinCC.AdHo	Issued By Expiratio QuoVadis Root CA 2 G3 1/12/2042 QuoVadis Root Certifi 3/17/2021 SecureTrust CA 12/31/2029 Siemens Automation 3/3/2026 Siemens TIA CA V12 1/1/2019 Siemens TIA CA V13 1/1/2019 Siemens TIA Project(7/3/2037 Siemens.WinCC.AdHo 12/31/9999 Remove 12/31/9999	Issued By Expiratio Friendly Name QuoVadis Root CA 2 G3 1/12/2042 QuoVadis Root C QuoVadis Root Certifi 3/17/2021 QuoVadis Root C SecureTrust CA 12/31/2029 Trustwave Siemens Automation 3/3/2026 <none> Siemens TIA CA V12 1/1/2016 <none> Siemens TIA CA V13 1/1/2019 <none> Siemens TIA CA V13 1/1/2019 <none> Siemens WinCC.AdHo 12/31/9999 <none> Siemens.WinCC.AdHo 12/31/9999 <none> Siemens.WinCC.AdHo 12/31/9999 <none> Siemens.WinCC.AdHo 12/31/9999 <none> Siemens.WinCC.AdHo 12/31/9999 <none></none></none></none></none></none></none></none></none></none>
Download CA Certificate from Web Server and Install Directly

The CA certificate issued by the certification authority can simply be downloaded via web browser and then installed directly. Follow these steps for this purpose:

1. Open the intro page of the web server of the CPU via the address "https://<IP address of the CPU>".

The web page is loading. Since the device certificate of the CPU cannot yet be verified by the missing CA certificate, the web page is classified as insecure. If you know the operator of the web page and if you know that he has no bad intentions, you can access the web page by clicking on the link ("Go to <IP address of CPU>(unsecure)") despite the warning. You can find the link by clicking on the "Advanced" button.

) Datenschutzfehler	× +			
\leftrightarrow \rightarrow X A Nich	t sicher https://192.168.0.1/Default.mwsl	☆	θ	:
				-
	A			
	Dies ist keine sichere Verbindung			
	Hacker könnten versuchen. Ihre Daten von 192.168.0.1 zu stehlen, zum Beispiel			
	Passwörter, Nachrichten oder Kreditkartendaten. Weitere Informationen			
	NET::ERR_CERT_AUTHORITY_INVALID			
	🗌 Sie können uns dabei helfen, Safe Browsing weiter zu verbessern, indem Sie einige			
	Systeminformationen und Seiteninhalte an Google senden. Datenschutzerklärung			
	Erweiterte Informationen ausblenden Zurück zu sicherer Website			
	Dieser Server konnte nicht beweisen, dass er 192.168.0.1 ist. Sein Sicherheitszertifikat wird			
	vom Betriebssystem Ihres Computers als nicht vertrauenswürdig eingestuft. Mögliche			
	abfängt.			
	-			
Side an Madria down original learner	Weiter zu 192.168.0.1 (unsicher)			

2. The intro page of the web server is opened as an insecure page. Chrome colors the "https" of the address red and reports the certificate error at the right edge of the address bar.

To download the CA certificate, click on the "Download certificate" menu. Confirm the safety instruction with "Keep".

Figure 3-24

SIEMENS	mall	simatic-controller	service&support	download certificate
← → C ▲ Nicht sicher https://192.168.0.1/Portal/Intro.mv	wsl			l≊ ☆ 😬 :
Intro × +				
•				

 The file will be saved in the preferred download folder. The file is also displayed in the lower left corner of the screen. Here you can choose whether you want to open the CA certificate directly or open the storage folder. To install the CA certificate directly, click on the displayed file and select "Open".

Confirm the Windows security note with "Open".

4. The certificate is open. Click on "Install Certificate".

Fig. 3-25
Certificate
General Details Certification Path
Certificate Information
This CA Root certificate is not trusted. To enable trust, install this certificate in the Trusted Root Certification Authorities store.
Issued to: Siemens TIA Project(NrFxEMxUlUuac2nMg2FCvA)
Issued by: Siemens TIA Project(NrFxEMxUlUuac2nMg2FCvA)
Valid from 7/ 3/ 2019 to 7/ 3/ 2037
Install Certificate Issuer Statement Learn more about tertificates Issuer Statement
ОК

- 5. The wizard is started. Follow the instructions of the installation wizard.
 - Select the local storage as the storage location.
 - Select the certificate store yourself and locate the Trusted Root Certification Authorities folder.

The "Finish" button imports the certificate into the selected folder. Before the wizard issues a security warning, which must be acknowledged with "Yes". Figure 3-26

Certificate Import Wizard	
	Completing the Certificate Import Wizard The certificate will be imported after you click Finish.
	You have specified the following settings: Certificate Store Selected by User Trusted Root Certifica Content Certificate
	۰ III ا
	< Back Finish Cancel

6. The wizard completes the successful import process with the following message, which you must confirm with "OK".

Figure 3-27



7. Close all instances of Chrome and then restart the program.

Result

You have imported the CA certificate into the Windows certificate store. The web page of the CPU is now classified as trustworthy.



Importing and Installing a CA Certificate

If you have saved the CA certificate on the local computer, for example, by exporting it from TIA Portal or downloading it and then saving it, you can import the CA certificate into the central certificate store as follows:

1. Open the settings in Chrome. Under "Advanced > Privacy and Security" you will find the entry "Manage certificates". Click on the entry:

Q Search settings	
rivacy and security	
Google Chrome may use web services to improve your browsing experience. You may optional services, Learn more	ly disable these
Use a web service to help resolve navigation errors	-
Use a prediction service to help complete searches and URLs typed in the address bar	
Use a prediction service to load pages more quickly	
Automatically send some system information and page content to Google to help detect dange apps and sites	rous 🔾
Protect you and your device from dangerous sites	
Automatically send usage statistics and crash reports to Google	
Send a "Do Not Track" request with your browsing traffic	
Use a web service to help resolve spelling errors Smarter spell-checking by sending what you type in the browser to Google	0
Manage certificates Manage HTTPS//SSL certificates and settings	Z

2. The "Certificates" window opens. Select the "Trusted Root Certification Authorities" tab and click the "Import" button.

tended purpose: <a>All> ntermediate Certification Au	thorities Trusted Root Co	ertification Aut	horities Trusted Publ	4
Issued To AddTrust External AffirmTrust Comme AffirmTrust Networ Baltimore CyberTru Certum CA Certum Trusted Ne Class 3 Public Prima Copyright (c) 1997 Deutsche Telekom	Issued By AddTrust External CA AffirmTrust Commercial AffirmTrust Networking Baltimore CyberTrust Certum CA Certum Trusted Netw Class 3 Public Primary Copyright (c) 1997 Mi Deutsche Telekom Ro	Expiratio 5/30/2020 12/31/2030 12/31/2030 5/13/2025 6/11/2027 12/31/2029 8/2/2028 12/31/1999 7/10/2019	Friendly Name Sectigo (AddTrust) AffirmTrust Com AffirmTrust Net DigiCert Baltimor Certum Certum Trusted VeriSign Class 3 Microsoft Timest Deutsche Teleko	•
Import Export Certificate intended purpose	Remove s		View	ced

 The wizard for importing the certificate is started. Use "Browse" to select the storage location of the certificate. Then click on the "Next" button.

Certificate Import Wizard	×
File to Import	
Specify the file you want to import.	
File name:	_
C:\User\User\Downloads\MiniWebCA_Cerlcrt Browse	
Note: More than one certificate can be stored in a single file in the following formation	ts:
Personal Information Exchange-PKCS #12 (.PFX,.P12)	
Cryptographic Message Syntax Standard- PKCS #7 Certificates (.P7B)	
Microsoft Serialized Certificate Store (.SST)	
Learn more about <u>certificate file formats</u>	
< Back Next > C	ancel

4. The wizard selects the correct location using the register preselection in step 2. Click on "Next".

Figure 3-32	
Certificate Import Wizard	x
Certificate Store Certificate stores are system areas where certificates are kept.	
Windows can automatically select a certificate store, or you can specify a location for the certificate.	
\bigcirc Automatically select the certificate store based on the type of certificate	
Place all certificates in the following store	
Certificate store:	
Trusted Root Certification Authorities Browse	
Learn more about <u>certificate stores</u>	
< Back Next > Cancel	

 The "Finish" button imports the certificate into the selected folder. Before the wizard issues a security warning, which must be acknowledged with "Yes". Figure 3-33

Completing the Certi Wizard	ficate Import
The certificate will be imported af	ter you dick Finish.
You have specified the following s	ettings:
Certificate Store Selected by Us	er Trusted Root Certifica
Content	Certificate
File Name	C:\Users\User\Downk
<	•

6. The wizard completes the successful import process with the following message, which you must confirm with "OK".

Figure 3-34



7. The CA certificate has been imported and can be viewed in the "Trusted Root Certification Authorities" tab. Close the dialog with "Close".

Figure 3-35				
Certificates				×
Intended purpose: <a>All>				-
Intermediate Certification A	uthorities Trusted Root C	ertification Aut	horities Trusted Pub	
Issued To	Issued By	Expiratio	Friendly Name	*
QuoVadis Root CA QuoVadis Root Cer SecureTrust CA Siemens Automatio Siemens TIA CA V12 Siemens TIA CA V13 Siemens TIA Projec Siemens.WinCC.Ad Siemens.WinCC.Ad	QuoVadis Root CA 2 G3 QuoVadis Root Certifi SecureTrust CA Siemens Automation Siemens TIA CA V12 Siemens TIA CA V13 Siemens TIA Project(Siemens.WinCC.AdHo Siemens.WinCC.AdHo	1/12/2042 3/17/2021 12/31/2029 3/3/2026 1/1/2016 1/1/2019 7/3/2037 12/31/9999 12/31/9999	QuoVadis Root C QuoVadis Root C Trustwave <none> <none> <none> <none> <none></none></none></none></none></none>	······································
Import Export Certificate intended purpose <all></all>	Remove		Advar	nced
Learn more about <u>certificates</u>	ł		Clos	se

8. Close all instances of Chrome and then restart the program.

Result

You have imported the CA certificate into the Windows certificate store. The web page of the CPU is now classified as trustworthy.





3.2.3 Firefox

Version

The instructions and screenshots were created with Firefox Quantum version 60.7.2.

Certificate memory

Unlike Internet Explorer or Google Chrome, Firefox uses its own certificate store by default.

Loading a CA Certificate from the Web Server

The CA certificate issued by the certification authority can easily be downloaded via web browser.

Follow these steps for this purpose:

1. Open the intro page of the web server of the CPU via the address "https://<IP address of the CPU>".

On web pages that are actually considered secure, Firefox checks the validity of the certificate issued by the web page. If the certificate cannot be verified, Firefox rejects the connection to the web page and instead displays a page with the error message "Warning: Potential Security Risk Ahead". If the web page operator is known and if you know that he has no bad intentions, you can add the web page as an exception by clicking on the "Advanced" button and open it despite the warning.

.	Warning: Potential Security Risk Ahead
	Firefox detected a potential security threat and did not continue to self-signed.badssl.com. If you visit this site, attackers could try to steal information like your passwords, emails, or credit card details.
	Learn more
	Go Back (Recommended) Advanced Report errors like this to help Mozilla identify and block malicious sites

 The intro page of the web server is opened as an insecure page. Firefox reports the certificate error at the right edge of the address bar. To download the CA certificate, click on the "Download certificate" menu.



3. Save the CA certificate on the local computer. Figure 3-39



Importing and Installing a CA Certificate

If you have saved the CA certificate on the local machine, for example, by exporting it from TIA Portal or downloading it and then saving it, you can import the CA certificate into the Firefox certificate store as follows

Proceed as follows:

Figure 3-41

 Open the settings in Firefox. Under "Privacy & Security" you will find the "Certificates" tab. Click on the button "View Certificates...". Figure 3-40



2. The certificate administration of Firefox is opened. Go to the tab "Authorities" and click on the button "Import...". ("Import...").

You have certificates on file that identify the	ese certificate authorities:	11.7
Certificate Name	Security Device	C.
VAC Camerfirma S.A.		-
Chambers of Commerce Root - 2008	Builtin Object Token	
Global Chambersign Root - 2008	Builtin Object Token	
VAC Camerfirma SA CIF A82743287		
Chambers of Commerce Root	Builtin Object Token	
Global Chambersign Root	Builtin Object Token	
VACCV		
ACCVRAIZ1	Builtin Object Token	-
View Edit Trust Import	ExportDelete or Distrust	

- 3. The wizard is started. Follow the instructions of the installation wizard.
 - Select the local storage as the storage location.
 - In the "Download this certificate" dialog, select the entry "Trust this CA to identify websites".

Confirm the dialog with "OK".

Downloading	Certificate	×
You have been	en asked to trust a new Certificate Authority (CA).	
Do you want	to trust ".fortinet.com" for the following purposes?	
Trust this	CA to identify websites.	
Trust this	CA to identify email users.	
Before trusti procedures (ng this CA for any purpose, you should examine its certificate and its policy and if available).	
View	Examine CA certificate	
	OK Can	cel

- 4. If the import process was successful, the CA certificate is listed in the Certificate Manager in the "Authorities" tab. Close the dialog by clicking "OK".
- 5. Close all instances of Firefox and then restart the program.

Result

You have imported the CA certificate into the Firefox certificate store. The web page of the CPU is now classified as trustworthy.



3.2.4 Operating system Android

Version

The manual and screenshots were tested with a Samsung Tablet 2016 with Android version 8.1.0. A lock screen type is not set up. Google Chrome version 75.0 was used.

Download CA Certificate from Web Server and Install Directly

The CA certificate issued by the certification authority can simply be downloaded via web browser and then installed directly. Follow these steps for this purpose:

1. Open the intro page of the web server of the CPU via the address "https://<IP address of the CPU>".

The web page is loading. Since the device certificate of the CPU cannot yet be verified by the missing CA certificate, the web page is classified as insecure. If the operator of the web page is known and if you know that he has no bad intentions, you can access the web page by clicking on the link "Proceed to <IP address of CPU>(unsafe)". You can find the link by clicking on the "Advanced" button.

Figure 3-44

$\blacksquare \forall$					🔌 🗟 43% 🛢 13:32
🕄 Pr	ivacy e	ror		\times +	
☆	←	\rightarrow	G	▲ https://192.168.178.197	☆ 🛓 :



Your connection is not private

Attackers might be trying to steal your information from **192.168.178.197** (for example, passwords, messages, or credit cards). <u>Learn more</u>

NET::ERR_CERT_AUTHORITY_INVALID

Help improve Safe Browsing by sending some <u>system information and page content</u> to Google. <u>Privacy policy</u>

Hide advanced



This server could not prove that it is **192.168.178.197**; its security certificate is not trusted by your device's operating system. This may be caused by a misconfiguration or an attacker intercepting your connection.

Proceed to 192.168.178.197 (unsafe)

2. The intro page of the web server is opened as an insecure page. Chrome colors the "https" of the address red and reports the certificate error at the right edge of the address bar.

To download the CA certificate, click on the "Download certificate" menu.



 The file will be saved in the preferred download folder. The file is also displayed in the lower left corner of the screen. Click on the link "Open".
 Figure 3-46

Skip Indro ViniWebCA Cer.crt. Open	×

4. The CA certificate is stored in the download folder and can be viewed. Figure 3-47



5. You cannot open the certificate directly in the download folder. Open the file manager on your tablet. will find the CA certificate.

Jnder "Download	ds" you w	ill find the	CA certificate
-----------------	-----------	--------------	----------------

Figure 3-48							
$\frac{1}{2}$ \bigcirc \blacksquare \cdot					* 4	\$ 43% 🖬	13:34
MY FILES Q Search					ļ,	▦	0
Recent files	My Files 🖒 I	Downloads					
CATEGORIES	Name		Date 🗸 From	Size			
🔊 Images	м	iniWeCer.cr	t 10 Jul 13:32 192.1	68.17 1,47 KB]	
J Audio							
Videos							
Documents							
坐 Downloads							
APK Installation files							

- 6. To install the CA certificate, press the "MiniWebCA_Cer" file. You must define a certificate name (in this example "Simatic"). The name can be chosen arbitrarily. For purpose of use, leave the default setting "VPN and apps" ("VPN and apps").
- Note If you have already stored a lock screen type in the tablet, such as a password or security pattern, you are prompted to enter it now.

Activate this setting Figure 3-49	with "OK".		
Certificate name			
Certificate name Simatic			
Used for VPN and apps			•
Package contains: One CA certificate			
		CANCEL	OK

7. When you install certificates, you must set up a lock screen type. Confirm the message with "OK".



- 8. Select the lock screen type. In this example, a PIN query is set up.
- **Note** From now on, the security prompt will always be prompted when you activate and switch on the tablet.

¥. 😤 43% 🗎 1:

9. Assign a PIN and then click on "Continue".

Set password	
Tap Continue wh	nen finished.
	व्र
Remember this Password. If you	forget it, you'll need to res
your tablet and all dat	ta will be erased.
	1111031311

10. Confirm the PIN and then click on the "OK" button. Figure 3-53

oct pasanoru			
Enter th	ne password a	gain to confirm	it.
			Ì
Remember this F	Password. If you tablet and all da	forget it, you'll ne ta will be erased.	ed to rese

11. Specify the type of notifications on your lock screen. Finish the installation process with "Done".

Figure 3-54	
Notifications ON	
G Settings 13:35 ↔ Lock screen Hello!	
Set display options for notifications on the Lock so	creen.
Hide content	
Notification icons only Hide notification details and show only the icon.	
Transparency	
Low	High
Auto-reverse text colour Reverse the colour of notification text automatically based on the background colour.	
	DONE

12. The CA certificate has been installed. Figure 3-55



13. The certificate can then be viewed under "Security > Other security settings > View security cetificates" in the "Users" tab.

	INGS Q (®)	< VIEW SECURITY CERTIFIC	¥ ≪ 40% 0
8	Connections Wi-Fi, Bluetooth, Data usage, Flight mode	SYSTEM	USER
⊲ »	Sound Sounds, Do not disturb	Siemens Siemens TIA Project(5K0oVH59IU-	D91-KLtZWPQ)
=	Notifications Block, allow, prioritise		
Ş	Display Brightness, Home screen		
~	Wallpaper Wallpaper		
ŧ	Advanced features Multi window		
0	Device maintenance Battery, Storage, Memory, Device security		
88	Apps Default apps, App permissions		
ð	Lock screen Screen lock type, Clock style		
(+)	Security		

14. Close all instances of Chrome and then restart the program.

Result

You have imported the CA certificate into the Android certificate store. The web page of the CPU is now classified as trustworthy.



3.2.5 Operating system iOS

Version

The manual and the screenshots were tested with an iPad with iOS version 12.1.4. A lock screen is configured with PIN entry. Safari was used.

Download CA Certificate from Web Server and Install Directly

The CA certificate issued by the certification authority can simply be downloaded via web browser and then installed directly. Follow these steps for this purpose:

1. Open the intro page of the web server of the CPU via the address "https://<IP address of the CPU>".

The web page is loading. Since the device certificate of the CPU cannot yet be verified by the missing CA certificate, the Web page is classified as insecure and the message "This Connection Is Not Private" is displayed. By clicking on the button "Show details" you can get further information.

fed 10. Jul			🕈 53 % 🔳
) m	192.168.178.197	C	
			O This Con
👔 This Co	nnection Is Not Private		
This website may personal or finan page.	be impersonating "192.168.178 cial information. You should go b	.197" to stea back to the p	al your previous
	Show	Details G	o Back
	This Con This website may personal or finan page.	Not the second secon	192.168.178.197 C This Connection Is Not Private This website may be impersonating "192.168.178.197" to stead personal or financial information. You should go back to the p page. Show Details

2. If the web page operator is known and you know that he has no bad intentions, you can use the link "visit this website" to access the website despite the warning.

Figure	3-59			
<	ົ 📖 💿	192.168.178.197	Ċ 🖞	+ 🗇
				O This Con
	👔 This Conn	ection Is Not Private		
	This website may be personal or financial page.	impersonating "192.168.178. information. You should go b	197" to steal you ack to the previo	r us
			Go Bac	ĸ
	Safari warns you w valid. This may hap attacker has comp	hen a website has a certific open if the website is misco romised your connection.	cate that is not infigured or an	
	To learn more, you the risks involved,	can <u>view the certificate</u> . If you can <mark>visit this website.</mark>	you understand	i

3. Confirm the security advice with "Visit Website".



4. The intro page of the web server opens.

To download the CA certificate, click on the "Download certificate" menu. Figure 3-61



5. The certificate is declared as a "Configuration profile" by iOS. To view the certificate (profile), the web page must have access to your settings in iPad. This requires your permission. Confirm the message with "Allow".



 To view the certificate (profile), you must enter the security ID that protects your iPad. In this example, the iPad is protected with a PIN entry. Figure 3-63



7. A security warning is displayed indicating that you must manually enable trust for a certificate (profile) that you have downloaded from a Web page after installation. The certificate trust administration addressed in the warning can be found in the iPad settings under "General > About > Certificate Trust Settings". Click "Install".

Figure 3-64						
Cancel	Warning	Install				
UNMANAGED ROOT O	UNMANAGED ROOT CERTIFICATE					
Installing the certificate "Siemens TIA Project(5K0oVH59IU-D91- KLtZWPQ)" will add it to the list of trusted certificates on your iPad. This certificate will not be trusted for websites until you enable it in Certificate Trust Settings.						
UNVERIFIED PROFILE						
The authenticity of KLtZWPQ)" cannot	"Siemens TIA Project(5K0oVH t be verified.	59IU-D91-				

8. Confirm the installation request again with "Install".

Figure 3-65



9. The certificate has been installed and is trusted. Close the dialog by clicking "Done".

	Profile Installed	Done
	Siemens TIA Project(5K0oVH59IU-D91-KLtZ	WPQ)
Signed by	Siemens TIA Project(5K0oVH59IU-D91-KLtZWPQ) Verified ✓	
Contains	Certificate	
More Detai	ls	\rightarrow

10. If you install a certificate (profile) that you downloaded from a Web page, you must manually activate trust for the CA certificate. You were already informed of this in the warning in step 7.

To activate the certificate, go to the iPad settings and go to the menu "General > About > Certificate Trust Settings".



11. Under "Enable full trust for root certificates", enable the trust for the certificate. Confirm the safety note with "Continue".



12. You can view and delete the certificate in the iPad settings under "General > Profile".

Figu	ıre 3-69		
08:01	Sat 13. Jul	/ Drofile	\$ 29 % ∎⊃
•	Didetootn	On	FIGHE
6	Notifications	Siemens TIA Project(5K0	ooVH59IU-D91-KLtZWPQ)
-0	Sounds		
C	Do Not Disturb	Signed by Siemens TIA Project(5K0oVH59IU Verified	I-D91-KLtZWPQ)
X	Screen Time	Contains Certificate More Details	5
Ø	General	0	
8	Control Centre	Rem	iove Profile
۸A	Display & Brightness		

13. Close all instances of Safari and restart the application.

Result

You have imported the CA certificate into the iOS certificate store. The web page of the CPU is now classified as trustworthy.



Alternative procedure

If security policies are installed to prevent unsecure access to the web server, the certificate must be installed in another way to download the certificate. The easiest way is to send the certificate via an encrypted e-mail. In iOS, the attachment of the e-mail is then opened, the certificate is displayed and can be installed.

3.3 Checking certificates

Note The verification of the certificates is shown by the browser "Internet Explorer".

Requirement

To establish a secure connection to the Web server and compare the certificates, you must have imported and installed the CA certificate in the Windows certificate store.

Testing certificates

Certificates are used to verify an identity or other security-critical applications. To determine that this certificate is genuine and has not been forged by an attacker, you should match the device certificate signature with the CA certificate signature.

To check the authenticity of the device certificate, proceed as follows:

1. Open the intro page of the web server of the CPU via the address "https://<IP address of the CPU>".

When you connect to the web server, the browser pulls the device certificate of the CPU and compares it with the CA certificate installed on the PC. If the certificates match in the signature, the intro page is classified as trustworthy and displayed without a security warning.

Figure 3-71	
https://192.168.0.1/Portal/Intro.mwsl	5 <u>6</u> -Q

2. For information about the device certificate, click the lock icon in the address bar.

Figure 3-72



3. A window with Web page identification information appears. Click on the "Show certificates" link.



4. The device certificate is open. Switch to the "Details" tab and search for the entry "Authority Key Identifier". Select the entry to display the contents. To compare the key with the CA certificate, copy the key to a text file.

Figure	3-74
--------	------

Zertifikat	×			
Allgemein Details Zertifizierungsp	fad			
Anzeigen: <a>Alle>	•			
Feld	Wert 🔺			
Öffentlicher Schlüssel	RSA (2048 Bits) Typ des Antragstellers=Endei			
Stallanschlüsselkennung	Schlüssel ID-c6 ab 0b b5 e3 c			
Schlusselvernung Schlussel-ID=c6 ab 00 b5 e3 c Schlusselverwendung Digitale Signatur, Zugelassen, E Alternativer Antragstellerna IP-Adresse=192.168.0.1, DN Fingerabdruckalgorithmus sha 1 Fingerabdruck 30.99.41 af d0.72.89 ch e2 e8				
Schlüssel-ID=c6 ab 0b b5 e3 c2 c2 3c 6e dd ab 18 53 e1 3c c5 ca c8 eb f9 Zertifikataussteller: Verzeichnisadresse: O=Siemens C=DE CN=Siemens TIA Project(5K0oVH59IU-D91-KLtZWPQ) Seriennummer des Zertifikats=00				
Eigenschaften bearbeiten In Datei kopieren Weitere Informationen über <u>Zertifikatdetails</u>				
ОК				

 Open the CA certificate. You can find the CA certificate from the management console, for example, or you have saved the CA certificate locally. Switch to the "Details" tab and search for the entry "Authority Key Identifier". Select the entry to display the contents.

Figure 3-75				
Zertifikat	X			
Allgemein Details Zertifizierungspf	ad			
Anzeigen: <alle></alle>	-			
Feld	Wert			
Basiseinschränkungen	Typ des Antragstellers=Zertifi c6 ab 0b b5 e3 c2 c2 3c 6e dd			
Stellenschlüsselkennung	Schlüssel-ID=c6 ab 0b b5 e3 c			
Netscape-Kommentar Alternativer Antragstellerna	"TIA Generated Certificate" RFC822-Name=ID-c75288a4 sha1			
Fingerabdruck	f0 fb 2b d9 e8 4a da 9c 44 03 🔻			
Schlüssel-ID=c6 ab 0b b5 e3 c2 c2 3c 6e dd ab 18 53 e1 3c c5 ca c8 eb f9 Zertifikataussteller: Verzeichnisadresse: O=Siemens C=DE CN=Siemens TIA Project(5K0oVH59IU-D91-KLtZWPQ) Seriennummer des Zertifikats=00				
, Eigenschaften bearbeite Weitere Informationen über <u>Zertifik</u> z	n In Datei <u>k</u> opieren atdetails			
	ОК			

6. Now you can compare the keys with each other. If both are identical, then the certificates are genuine.



Zertifikat	×	Zertifikat
Allgemein Detalls Zertifizierungspfad Anzeigen: <alle></alle>	6	Allgemein Details Zertifizierungspfad Anzeigen: <alle></alle>
Feld Wert Offentlicher Schlüssel RSA (2048 Bits) Schlüsselkennung des Antra th ff 99 di d4 3: 55 6 f a 2 to Schlüsselkennung Schlüssel-Dec da bob b5 e 3: c Schlüsselkennung Schlüsselkennung Schlüssel-Dec da bob b5 e 3: c Schlüsselkennung Digitale Signatur, Zugelassen, Schlüsselkennung Digitale Signatur, Zugelassen, Schlüssel-ID-co da bob b5 e 3: c. c.2 Schlüssel-ID-co da bob b5 e 3: c. c.2 Schlüssel-ID-co da bob b5 e 3: c. c.2 3: n 9: 41: af: dn 77: 89: ch = 2: 8 Schlüssel-ID-co da bob b5 e 3: c. c.2 3: c. 6: c. da eb Zertifikatuussteller: Verziehnisadresse: On-Siemens C-DE C-DE OI-Siemens TIA Project(SK0oVH59IU-D91-KL1ZWPQ) Seriennummer des Zertifikats=00 In Datei kopieren	A	Feld Wert Basiseinschränkungen
Weitere Informationen über <u>Zertifikatdetalis</u>		Weitere Informationen über Zerbfikatdetals

4 Secure OPC UA connection

Overview

With OPC UA, one system works as a server and makes the existing information available to other systems (clients).

OPC UA clients, for example, read and write data from an OPC UA server and call methods in the OPC UA server.

As of firmware V2.0, an S7-1500 CPU is equipped with an OPC UA server. As of firmware V2.6, an S7-1500 CPU also has an OPC UA client.

Security with OPC UA

OPC UA uses secure connections between client and server. OPC UA checks the identity of the communication partners. OPC UA uses certificates according to X.509-V3 of the ITU (International Telecommunication Union) for the authentication of client and server.

OPC UA uses the following security policies to protect messages:

- No security: All messages are unsecured.
- Signing: All messages are signed. This allows the integrity of received messages to be verified. Manipulations are detected.
- Sign & Encrypt: All messages are signed and encrypted. This allows the integrity of received messages to be verified. Manipulations are detected. In addition, no attacker can read the contents of the message (protection of confidentiality).

4.1.1 Security settings in the Server

OPC UA server

In this example, an S7-1500 CPU is set up as an OPC UA server.

Commissioning OPC UA servers

In the basic setting the OPC UA server of the CPU is not released for security reasons. OPC UA clients can neither read nor write access to the S7-1500 CPU.

The OPC UA server of the S7-1500 CPU is accessible via all internal PROFINET interfaces of the CPU (from firmware V2.0), but not via the PROFINET interfaces of CP/CM.

To activate the OPC UA-Server of the CPU, proceed as follows:

- 1. Mark the CPU in the device or network view. The properties of the CPU are displayed in the inspection window.
- Select the entry "OPC UA > Server" ("OPC UA > Server") in the area navigation of the "Properties" tab. Activate the OPC UA server of the CPU and confirm the security message.

Figure 4-1

_	-		
Γ	General IO tags	System constants Texts	
	DNS configuration	Server	
₽	Display	Server	
	Multilingual support	> General	
	Time of day		
۲	Protection & Security	Accessibility of the server	
Ŧ	OPC UA		_
	General	Activate OPC UA serve	er
	▶ Server		-
	Client	Server addresses	
۲	System power supply		
	Configuration control	Address	
	Connection resources	opc.tcp://192.168.0.1:4840	
	Overview of addresses		
	· · · ·		

3. Select the area "Runtime licenses" in the CPU properties and set the purchased runtime license for the OPC UA server in the selection list "Type of purchased license".

Figure 4-2

General IO tags	System constants Texts	
System diagnostics	OPC UA	
PLC alarms		-
Web server	Runtime licenses	
DNS configuration		
Display	Type of required license: SIMATIC OPC UA S7-1500 medium	
Multilingual support	Type of purchased license: SIMATIC OPC UA S7-1500 medium	
Time of day		
Protection & Security		
OPC UA	•	
 System power supply 		
Configuration control	•	
Connection resources		
Overview of addresses		
Isochronous mode		
 Runtime licenses 		
OPC UA		
ProDiag		
Energy Suite		

4. Translate the project and load the project into the CPU.

Result

You have activated the OPC UA server of the CPU. In the section "Server addresses" you can see which URLs can be used to establish connections to the OPC UA server of the CPU.

Figure 4-3


View Server Certificate

If you have activated the OPC UA server and confirmed the security instructions, TIA Portal automatically generates the certificate for the server. You can find the server certificate in the properties of the OPC UA server.

Select the entry "OPC UA > Server > Security" in the area navigation. Under "Server certificate" you can see that TIA Portal has already created a device certificate assigned to the OPC UA server.

Figure 4-4

Serve	er certificate	
0	The global security settings f Full functionality is available	the certificate manager have been selected.
	The server certificate is used	o verify the servers identity when it is accessed and to enable endpoint security.
	Server certificate:	LC-1/OPCUA-1-4

TIA Portal stores the server certificate in the local certificate directory of the CPU. You can view and manage this directory in the local certificate manager of the CPU and in the certificate manager of the global security settings (e.g. to export or delete certificates).

You can find the device certificate in the certificate manager of the global security settings in the "Device certificates" tab.

Fig. 4-5

			😭 Certific	cate authority (CA)	Povice certificates	
Device certificates						
ID	Common name of su	Issuer	Valid to	Used as	Private key	
3	PLC-1/Webserver-3	Siemens TIA Project(.	06/27/2037	SSL certificate of mo.	Yes	
4	PLC-1/OPCUA-1-4	Siemens TA Project(.	07/02/2037	OPC UA client / serve	r Yes	
		Delete				
		Import				
		Assian				
		Show				
		Renew				
		Replace				
		•				

Creating a New Server Certificate

To generate a new server certificate, proceed as follows:

- 1. Select the entry "OPC UA > Server > Security" in the area navigation.
- 2. To select another server certificate or to generate a new server certificate, click on the button integrated in the "Server certificate" drop-down list.

Figure 4-6

General IO tags	System constants Texts
Display	Security
Multilingual support	
Time of day	>> Secure channel
Protection & Security	
 OPC UA 	Server certificate
General	
▼ Server	The global security settings for the certificate manager have been selected.
General	 Full functionality is available.
Options	The server certificate is used to verify the servers identity when it is accessed and to enable endpoint security.
Security	
Export	1
Client	Server certificate: PLC-1/OPCUA-1-4
System power supply	

3. A dialog appears and lists all available server certificates. To create a new server certificate, click the "Add new" button.

Figure 4-7	
------------	--

_	ID	Common name of subject	Issuer	Valid until				
	3	PLC-1/Webserver-3	O=Siemens, C=DE, CN=Si	6/27/2037				
1	4	PLC-1/OPCUA-1-4	O=Siemens, C=DE, CN=Si	7/2/2037				
<				>				
			Add 🎽	new 🔥 🗸 🗙				

- 4. The dialog "Create new certificate" appears. You have the following options in this dialog:
 - You can choose between a self-signed certificate and a certificate signed by a certification authority.
 - If necessary, you can select the CA certificate of the certification authority.
 - You can determine the certificate parameters.

Selfsigned		
Signed by certificate authori	ty	
CA name:	2: Siemens TIA Project(5K0oVH59IU-D9	1-KLt 🔻
Certificate parameter		
Enter the parameters for the ne	w certificate:	
Common name of subject:	PLC-1/OPCUA-1-5	
Signature:	sha 256RSA	•
Valid from:	July 02, 2019 01:44:54 AM	•
Valid until:	July 02, 2037 12:00:00 AM	•
Usage:	OPC UA server	•
Subject Alternative Name	Type Value	
(SAN):	URI vrn:SIMATIC.S	7-1
	IP 192.168.0.1	
	IP 192.168.1.1	

 This example creates a server certificate with strong encryption "SHA256" signed by a certification authority. The CA certificate provided by TIA Portal with the "ID: 2". Set the parameters. Use the screenshot as a guide. To generate the new

LA						
hoose how the ne	ew certificate	e is to	be signed:			
Selfsigned						
Signed by certif	icate authori	ity				
	CA name:	2:5	iemens TIA	Proje	ct(!	5K0oVH59IU-D91-KLt
				-	-	
Certificate para	meter					
inter the paramet	ers for the ne	ew ce	ertificate :			
Common name	of subject:	PLC	-1/OPCUA-1-	5		
	Signature:	sha	256RSA			•
	Valid from:	July	02,2019	01:	: 4	4:54 AM
Valid until:		July	July 02 , 2037 12 : 00 : 00 AM			
	Usage:	OPC	UA server			
Subject Alterna	ative Name		Туре			Value
	(SAN):		URI		-	urn:SIMATIC.S7-1
			IP			192.168.0.1
			IP			192.168.1.1
			Add new			
			<			

certificate, click on the "OK" button.

Note Coordinate the validity of the certificate with the plant operator.

 You can now use the newly created device certificate as the server certificate of the OPC UA server. Figure 4-10

Server certificate:	PLC-1/OPCUA-1-5	
---------------------	-----------------	--

7. Translate your TIA Portal project and load the CPU. During the loading process the device certificate, the CA certificate and the authorization for the OPC UA server access are loaded into the CPU.

Result

The new device certificate is added to the existing device certificates in the "Device certificates" tab of the certificate manager.

Figure 4-11

Device certificates							
ID	Common name of su	Issuer	Valid to	Used as	Private key		
3	PLC-1/Webserver-3	Siemens TIA Project(06/27/2037	SSL certificate of mo	Yes		
4	PLC-1/OPCUA-1-4	Siemens TIA Project(07/02/2037	OPC UA client / server	Yes		
5	PLC-1/OPCUA-1-5	Siemens TIA Project(07/02/2037	OPC UA client / server	Yes		

At this point, you can view, export, delete or renew the new device certificate, for example.

•							
	Device certificates						
	ID	Common name of su	Issuer		Valid to	Used as	
	3	PLC-1/Webserver-3	Siemens TIA Pr	roject(06/27/2037	SSL certificate of mo	
	4	PLC-1/OPCUA-1-4	Siemens TIA Pr	roject(07/02/2037	OPC UA client / server	
	5	PLC-1/OPCUA-1-5	Ciana and TA D.	oject(07/02/2037	OPC UA client / server	
			Delete				
			Import	ւիթ			
			Export	6 .0			
			Assign				
			Show				
			Renew				
			Replace				
		L	•]			

Configure server security settings

The OPC UA server of the S7-1500 CPU provides multiple server security settings for signing and encrypting messages. You can find the Security Policy at "OPC UA > Server > Security > Secure Channel" in the section "Security policies". The following security policies are released:

Та	h	e	4-	1
10	v	U	-	

Policy	Description
None	Unsecured endpoint.
Basic128Rsa15 - Signing	Secure endpoint; supports a number of algorithms that use the RSA15 hash-algorithm and 128-bit encryption. This endpoint ensures the integrity of the data by signing it.
Basic128Rsa15 - Sign & Encrypt:	Secure endpoint; supports a number of algorithms that use the RSA15 hash-algorithm and 128-bit encryption. This endpoint ensures the integrity and confidentiality of the data by signing and encrypting it.
Basic256Rsa15 - Signing	Secure endpoint; supports a number of algorithms that use the RSA15 hash algorithm and 256-bit encryption. This endpoint ensures the integrity of the data by signing it.
Basic256Rsa15 - Sign & Encrypt:	Secure endpoint; supports a number of algorithms that use the RSA15 hash algorithm and 256-bit encryption. This endpoint ensures the integrity and confidentiality of the data by signing and encrypting it.
Basic256Sha256 - Signing	Secure endpoint supports a range of algorithms for 256-bit hashing and 256-bit encryption. This endpoint ensures the integrity of the data by signing it.
Basic256Sha256 - Sign & Encrypt:	Secure endpoint supports a range of algorithms for 256-bit hashing and 256-bit encryption. This endpoint ensures the integrity and confidentiality of the data by signing and encrypting it.

Note

If you use the settings "Basic256Sha256 Sign" and "Basic256Sha256 Sign & Encrypt", then the OPC UA server and the OPC UA clients must use signed certificates according to "SHA256".

In the Basic256Sha256 Signing and Basic256Sha256 Sign & Encrypt settings, TIA Portal's Certificate Authority automatically signs certificates with "SHA256". The following security policies are set by default in TIA Portal:

Figure 4-13	
Security policies	
	Note: When the 'No security' security policy is activated, any OPC UA client can still connect using this setting, regardless of any security settings that follow.
Security policies	available on the server:
Activate sec	Name
	No security
	Basic128Rsa15 - Sign
	Basic128Rsa15 - Sign & Encrypt
	Basic256 - Sign
	Basic256 - Sign & Encrypt
	Basic256Sha256 - Sign
	Basic256Sha256 - Sign & Encrypt

If you have activated all security policies in the secure channel settings of the S7-1500 OPC UA server (default), including the policy "No Security", then the data traffic between server and client is also possible unsecured (neither signed nor encrypted). The identity of the client remains unknown. Each OPC UA client can then connect to the server, regardless of any subsequent security settings.

When configuring the OPC UA server, make sure that only security policies that are compatible with the protection concept for your machine or system are activated. All other security policies must be deactivated.

To ensure a tap-proof connection, you should select "Basic256Sha256-Sign & Encrypt" ("Basic256Sha256-Sign & Encrypt") as the only possible access point.

Activate sec	Name
	No security
	Basic128Rsa15 - Sign
	Basic128Rsa15 - Sign & Encrypt
	Basic256 - Sign
	Basic256 - Sign & Encrypt
	Basic256Sha256 - Sign
~	Basic256Sha256 - Sign & Encrypt

Making the Client Certificate Known to the Server

A secure connection between the OPC UA server and an OPC UA client is only established if the server classifies the client's certificate as trustworthy.

If you use OPC UA clients from manufacturers or the OPC Foundation, a client certificate is automatically generated during the installation or the first program call.

For a secure connection, you must make the client certificate known to the server and add it to the Trusted Clients list. To add the client certificate to the Trusted Clients list, the client certificate must be imported into the Certificate Manager of TIA Portal's global security settings.

To make the client certificate available to the server, proceed as follows:

- 1. In the project navigation, open the "Security settings > Security features" menu. Double-click on the "Certificate manager" line.
- 2. The global certificate manager opens. Switch to the "Trusted certificates and root certification authorities" tab.

Figure 4-15



3. Right-click on an empty table row in the tab and select "Import" from the context menu.



4. The dialog for importing certificates is displayed. Select the client certificate that you want the server to trust. Click the "Open" button to import the certificate.

In this example, the certificate of UaExpert is added.





Note

Alternatively, you can import the CA certificate that was used to sign the client's device certificate.

By importing the CA certificate, all device certificates of the clients that were signed via this certification authority would be classified as trustworthy from now on.

5. The client's certificate is now included in the global security settings certificate manager. Note the ID of the currently imported client certificate.

Figure 4	1-18
----------	------

	Trusted certificates and root certification authorities								
	ID	Common name of 🔺	Issuer	Valid to	Used as	Private key			
l	8	UaExpert@myPC	UaExpert@myPC	07/07/2020	Certificate	No			
	_								

- 6. In the device or network view, mark the CPU that serves as OPC server. The properties of the CPU are displayed in the inspection window.
- In the area navigation of the Properties tab, select "OPC UA > Server > Security > Secure channel". Here you will find the "Trusted Clients" section. In the table, double-click the empty row with "<Add new>".



8. A button with three dots is displayed in the line. Click this button. Select the client certificate that you imported. Click on the button with the green checkmark.

Figure 4-20

7			
ID	Common name of subject	Issuer	Valid until
1	Siemens TIA Project(sZuq	O=Siemens, C=DE, CN=Si	6/27/2037
2	Siemens TIA Project(5K0	O=Siemens, C=DE, CN=Si	6/27/2037
3	PLC-1/Webserver-3	O=Siemens, C=DE, CN=Si	6/27/2037
4	PLC-1/OPCUA-1-4	O=Siemens, C=DE, CN=Si	7/2/2037
5	PLC-1/OPCUA-1-5	O=Siemens, C=DE, CN=Si	7/2/2037
6	OPC-Client	O=Siemens, C=DE, CN=Si	7/2/2037
7	PLC-3/Webserver-7	O=Siemens, C=DE, CN=Si	7/2/2037
8	UaExpert@myPC	O=Siemens, C=DE, CN=U	7/7/2020
<			>
		Add 🎽	new 🔽 🗙

9. Translate the project and load the configuration into the S7-1500 CPU.

Result

You have classified the client certificate as trusted by the server. The server now trusts the client. If the client now also classifies the server certificate as trustworthy, then server and client can establish a secure connection (see also <u>section 4.1.2</u>).



Note You can also configure the server to automatically accept the client certificates. If you enable the option "Automatically accept client certificates during runtime", the server will accept all client certificates. You will find this option below the "Trusted clients" list.

To avoid security risks, deactivate the option again after commissioning.

Automatically accept client certificates during runtime

User authentication

The security concept of the OPC UA connection is rounded off by user authentication.

With the OPC UA server of the S7-1500, you can set how a user of the OPC UA client must legitimize himself if he wants to access the server.

There are the following possibilities:

- Guest authentication: The user does not have to prove his authorization (anonymous access). The OPC UA server does not check the authorization of the client user.
- Authentication via user name and password: The user must prove his authorization (no anonymous access). The OPC UA server checks whether the client user is authorized to access the server. As proof the user name with the correct password is valid.
- User management via the security settings of the project: If you activate this option, the user administration of the opened project is also used for the user authentication of the OPC UA server: With OPC UA, the same user names and passwords are valid as in the current project.
- **Note** To increase security, you should only allow access to the OPC UA server with user authentication.

To set up authentication using a user name and password, proceed as follows:

- 1. In the device or network view, mark the CPU that serves as OPC server. The properties of the CPU are displayed in the inspection window.
- Select "OPC UA > Server > Security > User authentication" in the area navigation of the "Properties" tab. In the "Guest authentication" section, disable guest authentication.

Figure 4-22			
Web server		Guest authentication	
DNS configuration			
Display		Note:	The guest authentication allows access to the server without authentication by
Multilingual support			username/password.
Time of day			
Protection & Security			
 OPC UA 		r.	
General	4		Enable guest authentication
▼ Server			
General	≡ ►	User name and password aut	hentication
Options			
 Security 		Note:	Enabling this option allows users to authenticate themselves by providing a valid user name
Secure channel			and password.
User authentication			

3. In the "User name and password authentication" section, enable the "Enable user name and password authentication" option.

Figure 4-23

User name and password authentication								
Note:	Enabling this option allows users to authenticate themselves by providing a valid user name and password.							
[Enable user name and password authentication							

4. You can define users in the "User management" section. Enter the users in the table. To do this, click on the entry "<Add new user>".

User management							
		Name	Password				
		<add new="" user=""></add>					

5. A new user with an automatically assigned name is created.

Figur	e 4	-25		
Use	er m	anagement		
		Name	Password	
	Ì	user1	****	

6. You can edit the user name and enter the password associated with the user name.

To change the name, double-click in the line "user1" and change the name according to your wishes.

Figure 4-26

	Name
Ŷ.	UAExpert

 To define the password, click on the integrated button in the cell under "Password" and set a password. Close the dialog by clicking "OK".

Figure 4-27

rigato i Zi						
Name	Passwo	ord				
UAExpert	****	******	-			
<add new="" user=""></add>		Enter a new pas	swo	rd for the user		
		Passw	/ord	*****		Good
		Confirm passw	/ord	*****		
				[ОК	Cancel

Result

You have defined a user. If a client user wants to access the OPC UA server, the OPC UA server checks whether the client user is authorized to access the server. As proof, the user name just created with the correct password is valid. You can add a maximum of 21 users.

4.1.2 Security settings in the Client

OPC UA client

The following screenshots were taken with the free test client UaExpert Version 1.4.0 from UnifiedAutomation. The procedure for other clients may differ from the one shown.

Certificate management

If you use OPC UA clients from manufacturers or the OPC Foundation, the OPC UA clients have their own certificate manager. A client certificate is automatically generated during installation or when the program is called for the first time.

You can open UaExpert's certificate manager under "Settings > Manage Certificates".

Figure 4-28

Unified Automation UaExpert - The OPC Unified Architectu

File	Server	Docum	ent	Setti	ngs	Help	
	0	F	0		Тоо	lbars	•
Projec	t			20	Plug	gins	
× [1 Projec	:t		P	Con	figure UaExpert	
	📁 Se	ervers			Mar	nage Certificates	
~	/ 🗂 D/	ncuments					_

The various certificates that are currently stored are displayed here. Figure 4-29

💹 Manage (Certificates				? ×
Trusted Is	suers TLS I	Issuers			
Certificates					
Status Own .	Name UaExpert	Valid From 08.07.2019 23:4.	Valid To 07.07.2020	Organization Siemens	OrganizationUr BU
۲					>
Certificate R	evocation Lists Valid Fro	m Next Up	date Org	anization	OrganizationUnit
< Copy A	pplication Certif	icate To Create	e new Application	Certificate	> Open Certificate Location
					ОК

Note Here you will also find the OPC UA client certificate that must be imported into the list of trusted clients in TIA Portal at the OPC UA server. (see section 4.1.1).

Making the Server Certificate Known to the Server

A secure connection between OPC UA server and an OPC UA client is only established if the client classifies the certificate of the server as trustworthy. To do this, you must import the server certificate into the certificate manager of the client. In this example, the CA certificate from TIA Portal is used as the server certificate.

Note When you import the CA certificate from TIA Portal, all server device certificates signed with this CA are automatically trusted.

Alternatively, you can import only the server's device certificate. You can find the device certificate in the global certificate manager of TIA Portal in the "Device certification" tab (see also the "View server certificate" section of <u>section 4.1.1</u>)

To import the CA certificate, you must have saved the CA certificate on the local host in the following file formats:

 with the data type "*.der" ("Certificate-DER coded") Figure 4-30

Dateityp: Certificate - DER coded (*.der)

 with the data type "*.crl" ("Certificate - Certificate Revocation List, DER coded") Figure 4-31

Dateityp: Certificate - Certificate revocation list, DER coded (*.crl)

Export the CA certificate in the required formats from TIA Portal (see section 2.3).

Note You can export the certificates from TIA Portal in DER and CRL format. In addition to the certificate format "DER", UaExpert also requires the certificate revocation list (CRL-Certificate Revocation List), which can also be exported from theTIA portal via an export. For File type, select the "Certificate - Certificate Revocation List, DER coded" instead of "Certificate-DER coded". To add CA certificates to the UaExpert Certificate Manager, they must be copied to the UaExpert storage location.

Proceed as follows:

- 1. Open the certificate manager of UaExpert via "Settings > Manage Certificates".
- 2. To access the certificate manager's storage location, click on the "Open Certificate Location" button.

🧱 Manage Co	ertificates					?	×
Trusted Iss	uers TLS I	ssuers					
Certificates							
Status	Name UaExpert	Valid From 08.07.2019 23:4	Valid To 07.07.2020	Organization Siemens	n Organ BU	ization	Ur
<							>
Certificate Re	Vocation Lists Valid Fro	m Next Upd	ate Org	anization	Organizatio	onUnit	
< Copy Ap	plication Certifi	cate To Create	new Application	Certificate	Open Certifica	ate Loca	> ition
						O	к

 The directory "/unifiedautomation/uaexpert/PKI/trusted/certs" is opened. Copy the CA certificate of the server in the format "DER" into this folder. All server device certificates signed with this CA certificate are trusted by the client. Figure 4-33



4. Change to the "/unifiedautomation/uaexpert/PKI/trusted/crl" directory. Copy the certificate revocation list in "CRL" format into this folder.

Figure 4-34

Q)_X.509 Certif...



Result

You have imported the CA certificate and the certificate revocation list from TIA Portal into the certificate manager of UaExpert and have therefore classified it as trustworthy. Because this CA certificate signed the server's device certificate, the server's device certificate is also automatically trusted.

usted Iss	uers TLS Is	ssuers				
Certificates —						
Status	Name	Valid From	Valid To	Organizatio	on Org	anization
🧹 Trusted	Siemens	27.06.2019 00:1.	27.06.2037	Siemens		
Own	UaExpert	08.07.2019 23:4.	07.07.2020	Siemens	BU	
<	vocation Lists					
< Certificate Re Number	Vocation Lists Valid From	m Next Up	date 0	Prganization	Organiza	tionUnit
< Certificate Re Number V 1256360	Vocation Lists Valid Fror D 27.06.2019	m Next Up 9 00:1 27.06.20:	date C 37 00:00:00 S)rganization iemens	Organiza	tionUnit

Add server in the client

Before you can establish a connection with UaExpert, you must add a server. Follow these steps for this purpose:

- 1. Go to the "Server > Add..." menu.
 - Figure 4-36
- 2. The "Add Server" window appears. Change to the "Advanced" tab. Figure 4-37

Configuration Name	Add Serve	er.			?	×
Discovery Advanced Server Information Endpoint Url Endpoint Vrl Security Settings Security Policy None Message Security Mode None Authentication Settings Anonymous Username Password Store Certificate Private Key Session Settings Session Name 	Configuration I	Name				
Server Information Endpoint Url Security Settings Security Policy None Message Security Mode None Authentication Settings Authentication Settings Username Password Session Settings Session Settings Session Name	Discovery	Advanced				
Endpoint Url	Server Inf	ormation				
Security Settings Security Policy None Message Security Mode None Authentication Settings Authentication Settings Username Password Session Settings Session Name	Endpoint U	Jrl				
Security Policy None Message Security Mode None Authentication Settings Authentication Settings Authentication Settings Certificate Private Key Session Settings Session Name	Security Sec	ettings				
Message Security Mode None Authentication Settings Anonymous Username Password Store Certificate Private Key Session Settings Session Name	Security P	olicy	None		•	
Authentication Settings	Message S	Security Mode	None		-	
Anonymous Username Password Certificate Private Key Session Settings Session Name	Authentica	tion Settings -				
Username Password Session Name	Anony	mous				
Password Store Certificate Private Key Session Settings Session Name	Userna	ame			1	
Certificate Private Key Session Settings Session Name	O Passw	ord			Store	
Session Settings Session Name	Certifi	cate				
Session Name	Privati	екеу				
Session Name	Session Se	ttings				
	Session Na	ame				
	Connect A	utomatically				
Connect Automatically		, a court		ОК	Cancel	

- 3. Make the following settings:
 - In the "Configuration Name" section, define a display name for the server in UaExpert. In this example, the display name is "S7-1500".
 - In the "Server Information" section, enter the URL of the OPC UA server. You can find the URL in TIA Portal when configuring the server. (see <u>section 4.1.1</u>).
 - In the "Security Settings" section, select "Basic256Sha256" as the security policy.
 - In the "Security Settings" section, select "Sign & Encrypt" as the Message Security Mode.
 - In the "Authentication Settings" section, activate the "Username / Password" option and the "Store" option. Enter the user name and password set in TIA Portal. (see section 4.1.1).

Close the dialog by clicking "OK".

Add Server		? ×
Configuration Name S7-1500]	
Discovery Advanced		
Server Information		
Endpoint Url	opc.tcp://192.168.0.1:4840	
Security Settings		
Security Policy	Basic256Sha256	•
Message Security Mode	Sign & Encrypt	-
Authentication Settings		
Username UAExpert		
Password ••••••	•	Store 🗸
Certificate Private Key		
Session Settings		
Session Name		
Connect Automatically		
	ОК	Cancel

Result

You have added the S7-1500 CPU as an OPC UA server in UaExpert. Figure 4-39



4.1.3 Test secure OPC UA connection

Once you have configured all security settings in the server and client, you can use UaExpert to establish a secure connection to the OPA UA server of the S7-1500 CPU.

Figure 4-40

		🤌 🖯 🔀 💽 🔶		\$
Pro	ject		8	×
~		Project		
	~	📁 Servers		
		💸 S7-1500		
		M n .		

When establishing a connection, the certificates are exchanged and checked.

BadCertificateHostNameInvalid

When connecting to the server, you are confronted with the following error message:

Conr	nect Error	×
	Error 'BadCertificateHostNameInvalid' was returned during CreateSession, press 'Ignore' to suppress the error and continue connecting.	
	Ignore Abort	

This error is due to the fact that UaExpert checks both an IP address and the DNS name of the server.

However, the S7-1500 does not return a DNS name or there is also no DNS name entered in the device certificate under "Subject Alternative Name". Figure 4-42

💼 Zertifikat	×
Allgemein Details Zertifizierungspf	ad
Anzeigen: <alle></alle>	~
Feld	Wert ^
📴 Parameter für öffentlichen	05 00
Basiseinschränkungen	Typ des Antragstellers=Endei
Schlüsselkennung des Antra	e39bb3da77604e3877b8cb3c
Stellenschlüsselkennung	Schlüssel-ID=c6ab0bb5e3c2c2
Schlüsselverwendung	Digitale Signatur, Zugelassen,
Erweiterte Schlüsselverwen	Serverauthentifizierung (1.3.6
Alternativer Antragstellerna	URL=urn:SIMATIC.S7-1500.0
	14449211711119397851010710
URL=urn:SIMATIC.S7-1500.OPC-U IP-Adresse=192.168.0.1	A.Application:PLC_3
Eigenschaften bearbeiter	n In Datei kopieren
	ОК

Ignore error

The error has no effect on the encryption functionality. You can ignore it by clicking on the "Ignore" button.



Eliminate errors

You can permanently fix the error by creating your own device certificate for the OPC UA server in TIA Portal and manually adding a DNS record (see section "Creating a new server certificate" in <u>section 4.1.1</u>).

	e now the new certificate	e is to	be signed:		
) Self	signed				
🕑 Sign	ed by certificate authori	ity			
	CA name:	2: S	iemens TIA Projec	t(5K0oVH59IU-D91-KL	t 🔻
Certifi	icate parameter				
inter t	he parameters for the ne	ew ce	rtificate:		
Common name of subject: PLC-1/OPCUA-1-10					
	Signature:	sha	256RSA		-
	Valid from:	July	10, 2019 12:	06:21 AM	•
	Valid until:	July	10, 2037 12:	00:00 AM	•
	Usage:	OPC	UA server		-
Sul	bject Alternative Name		Туре	Value	E
	(SAN):		URI	urn:SIMATIC.S7-1	
			IP	192.168.0.1	
			IP	192.168.1.1	
			DNS	PLC_1	-
			Add new		
					4

On the OPC UA client computer you must then enter the IP address of the server. To do this, you must add an entry with IP address and DNS name to the "hosts" file. The Hosts file on Windows is an important Windows system file that is responsible for resolving IP addresses into hostnames.

You will find the file in the directory "%Windir%\System32\drivers\etc".

Note To edit this file, you need administrator rights.

```
Figure 4-45
```

```
# Copyright (c) 1993-2009 Microsoft Corp.
#
# This is a sample HOSTS file used by Microsoft TCP/IP for Windows.
#
# This file contains the mappings of IP addresses to host names. Each
# entry should be kept on an individual line. The IP address should
# be placed in the first column followed by the corresponding host name.
# The IP address and the host name should be separated by at least one
# space.
#
# Additionally, comments (such as these) may be inserted on individual
# lines or following the machine name denoted by a '#' symbol.
#
# For example:
#
#
       102.54.94.97
                        rhino.acme.com
                                                 # source server
        38.25.63.10
#
                        x.acme.com
                                                 # x client host
# localhost name resolution is handled within DNS itself.
        127.0.0.1
                        localhost
#
#
        ::1
                         localhost
        192.168.0.1
                        PLC 1
```

Then, in the UaExpert settings, you can use the DNS name as the endpoint URL instead of the IP address and the error will no longer be displayed. Figure 4-46

L.	Server Settings - S7-15	00	?	×
Г	Server Information			
	Endpoint Url	opc.tcp://PLC_1:4840		

Checking in on a connection

If the connection was successfully established, you can use a network analysis program, e.g. Wireshark, to check whether the security settings are working.

In the following screenshot, the connection between the server and client was monitored without encryption. The data is available in plain text.

Figure 4-47

	73 23.409382	192.168.0.241	192.168.0.4	OpcUa	178 UA Secure Conversation Message: BrowseRequest			
	74 23.411124	192.168.0.4	192.168.0.241	OpcUa	167 UA Secure Conversation Message: BrowseResponse			
	80 26.294087	192.168.0.241	192.168.0.4	OpcUa	150 UA Secure Conversation Message: ReadRequest			
	81 26.295258	192.168.0.4	192.168.0.241	OpcUa	128 UA Secure Conversation Message: ReadResponse			
-	93 31.304910	192.168.0.241	192.168.0.4	OpcUa	150 UA Secure Conversation Message: ReadRequest			
	94 31.306534	192.168.0.4	192.168.0.241	OpcUa	128 UA Secure Conversation Message: ReadResponse			
	101 34.205402	192.168.0.241	192.168.0.4	OpcUa	124 UA Secure Conversation Message: DeleteSubscriptionsRequest			
	102 34.210504	192.168.0.4	192.168.0.241	OpcUa	106 UA Secure Conversation Message: ServiceFault			
	103 34.211001	192.168.0.4	192.168.0.241	OpcUa	170 UA Secure Conversation Message: DeleteSubscriptionsResponse			
	105 34.216305	192.168.0.241	192.168.0.4	OpcUa	117 UA Secure Conversation Message: CloseSessionRequest			
	106 34.223976	192.168.0.4	192.168.0.241	OpcUa	106 UA Secure Conversation Message: CloseSessionResponse			
	107 34.227407	192.168.0.241	192.168.0.4	OpcUa	111 CloseSecureChannel message: CloseSecureChannelRequest			
	<pre>control sequent(i 52) to Security Request(i 52) to 4 Opclu Service : Encodeable Object > Type(i 1: ExpandedHodeld 4 Results: Array of DataWalue ArraySize: 1 4 (0): DataWalue > EncodingNask: 0x00, has value, has server timestamp 4 Value: Variant Useriant Variant Type: Int32 (0x06) Int32: 0 Int32: 0 Int32: 0</pre>							
0030	20 00 a9 43 00	00 4d 53 47 46 4a 06	00 00 38 70	CMS G[]8				
0040	ad 4e 01 00 00	00 66 00 00 00 34 00	00 00 01 00	.Nt4	1			
0050	7a 02 d7 0e b3	73 31 51 cd 01 73 42	2 01 00 00 00	zsrisB				
0000	00 00 00 00 00 00	00 00 00 00 00 01 00	00 00 09 00	- 34				
00/0	00 00 00 00 1/	01 03 73 31 31 CO 01	1 00 00 00 00	fl				

In the following screenshot, the connection between the server and client was monitored using encryption. The data can no longer be viewed with the encrypted connection.

Figure 4-48

No.	Time	Source	Destination	Protocol	Length Info
	4 2.145988	192.168.0.241	192.168.0.4	OpcUa	198 UA Secure Conversation Message: ServiceId 0
	5 2.147900	192.168.0.4	192.168.0.241	OpcUa	166 UA Secure Conversation Message: ServiceId 0
	9 3.197804	192.168.0.241	192.168.0.4	OpcUa	198 UA Secure Conversation Message: ServiceId 0
	10 3.197910	192.168.0.241	192.168.0.4	OpcUa	310 UA Secure Conversation Message: ServiceId 0
	12 3.201113	192.168.0.4	192.168.0.241	OpcUa	262 UA Secure Conversation Message: ServiceId 0
	13 3.201289	192.168.0.241	192.168.0.4	OpcUa	294 UA Secure Conversation Message: ServiceId 118
	14 3.202870	192.168.0.4	192.168.0.241	OpcUa	326 UA Secure Conversation Message: ServiceId 0
	15 3.204610	192.168.0.4	192.168.0.241	OpcUa	326 UA Secure Conversation Message: ServiceId 0
	17 3.204768	192.168.0.241	192.168.0.4	OpcUa	294 UA Secure Conversation Message: ServiceId 0
	18 3.206856	192.168.0.4	192.168.0.241	OpcUa	310 UA Secure Conversation Message: ServiceId 126
	19 3.384030	192.168.0.241	192.168.0.4	OpcUa	198 UA Secure Conversation Message: ServiceId 0
	20 3.385929	192.168.0.4	192.168.0.241	OpcUa	214 UA Secure Conversation Message: ServiceId 0

Frame 18: 310 bytes on wire (2480 bits), 310 bytes captured (2480 bits) on interface 0 Ethernet II, Src: Siemens-_ce:b8:17 (28:63:36:ce:b8:17), Dst: Fujitsu_66:61:41 (fc:08:4a:66:61:41) Internet Protocol Version 4, Src: 192.168.0.4, Dst: 192.168.0.241 Transmission Control Protocol, Src Port: 4840, Dst Port: 61680, Seq: 865, Ack: 1025, Len: 256 OpcUa Binary Protocol Message Type: MSG Chunk Type: F Message Size: 256 SecureChannelId: 83649873 Security Sequence Number: 39681260 Security Sequence Number: 39681260 Security RequestId: 4206467001 4 OpcUa Service : Encodeable Object 4 TypeId : ExpandedNodeId NodeId Identifier Numeric: Unknown (126)

5 Appendix

5.1 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: https://support.industry.siemens.com

Technical Support

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

www.siemens.com/industry/supportrequest

SITRAIN – Training for Industry

We support you with our globally available training courses for industry with practical experience, innovative learning methods and a concept that's tailored to the customer's specific needs.

For more information on our offered trainings and courses, as well as their locations and dates, refer to our web page: www.siemens.com/sitrain

Service offer

Our range of services includes the following:

- 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 web page:

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

5.2 Links and literature

Table 5-1

No.	Торіс	
\1\	Siemens Industry Online Support	
	https://support.industry.siemens.com	
\2\	Link to the entry page of the application example	
	https://support.industry.siemens.com/cs/ww/en/view/109769068	

5.3 Change documentation

Table 5-2

	Version	Date	Change
	V1.0	09/2019	First version