

Recording and monitoring process data

SIMATIC S7-1200 / S7-1500, STEP 7 V16 (TIA Portal)

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1 Task

1.1 Overview

Introduction

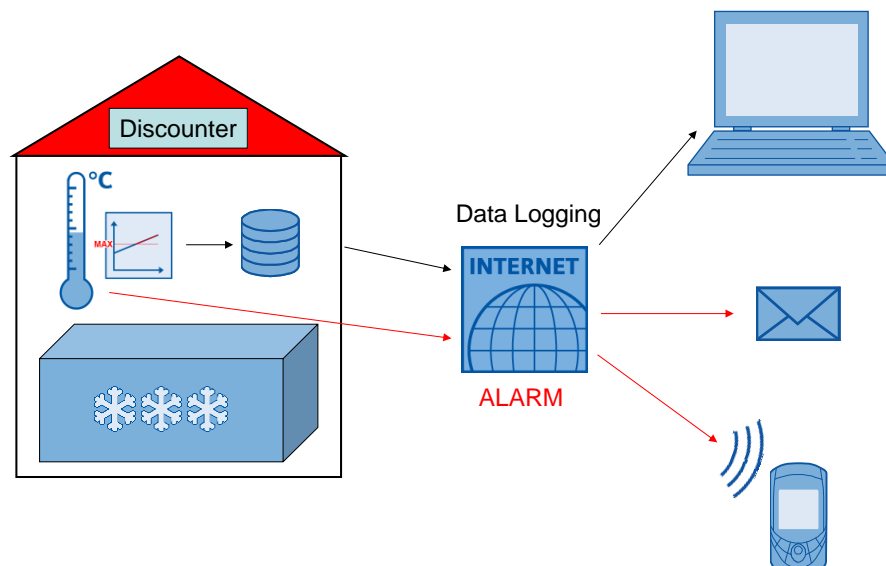
Supermarkets and discount retailers must guarantee certain foodstuffs remain refrigerated. If the cooling chain is broken, these foodstuffs can no longer be sold but must be discarded.

This is why the cooling temperature must be continually recorded, archived and monitored (with reporting functionality).

Overview of the automation task

The following Figure provides an overview of the automation task.

Figure 1-1



Description of the automation task

The automation task must contain the following requirements:

- It must be possible to invoke the data log via remote access.
- Program modifications should be implemented via remote management where needed.
- The recorded data must be automatically transmitted (to a server) and archived.
- If a maximum temperature is exceeded, a message must be issued to a maintenance technician who then investigates the cause.

2 Solution

2.1 Overview of the overall solution

The STEP 7 development environment (TIA Portal) provides "Data log" data recording for the SIMATIC S7-1200/S7-1500. Using these instructions, process data can be saved in CSV format (comma-separated value) in the CPU's flash memory (only with S7-1200) or on an inserted Memory Card.

You can access these CSV data logs as follows (for instance, to analyze them in Microsoft Excel):

Table 2-1

No.	Access type Reading out via...	Saved in flash memory...	
		...of the CPU (S7-1200 only)	...On the SIMATIC Memory Card (SMC)
1.	...card reader	no	yes (CPU must be stopped for this)
2.	...integrated PLC web server	yes	yes
3.	...SIMATIC Automation Tool Version V3.1.4 (\16\)	no	yes (also possible to automate using Application Programming Interface)
4.	...as an attachment to an email sent from the CPU	yes	yes (automated by calling the instruction "TMAIL_C" V6.0)

In the application example, the data logs will be saved on a Memory Card that is inserted into the CPU. Manual access from the remote station will be displayed via the integrated PLC web server. The DataLog files will be automatically uploaded through the SIMATIC Automation Tool Version 3.1 SP4.

The SIMATIC S7-1x00¹ is capable of routing, which makes remote access over the internet possible. For secure communication, the connection is available via a VPN tunnel (virtual private network) with the appropriate hardware.

The "TMAIL_C" instruction V6.0 offers encrypted email sending through the internal interface of the CPU, along with optional attachment functionality for files in the file browser (such as Data Logs). To do this, the CPU needs an internet connection and an existing account with an email provider with SMTP server (simple mail transfer protocol) ([\17\](#)).

This function is used to implement alarm messaging and sending of the data log file.

You can also send the alarm message as an SMS using a communications extension:

- via SCALANCE M router or ([\14\](#))
- via the CP 1242-7 GPRS for the S7-1200 ([\15\](#))

This application example was tested with

- STEP 7 V16 (TIA Portal)
- S7-1200 CPU Firmware V4.4
- S7-1500 CPU Firmware V2.8

Note

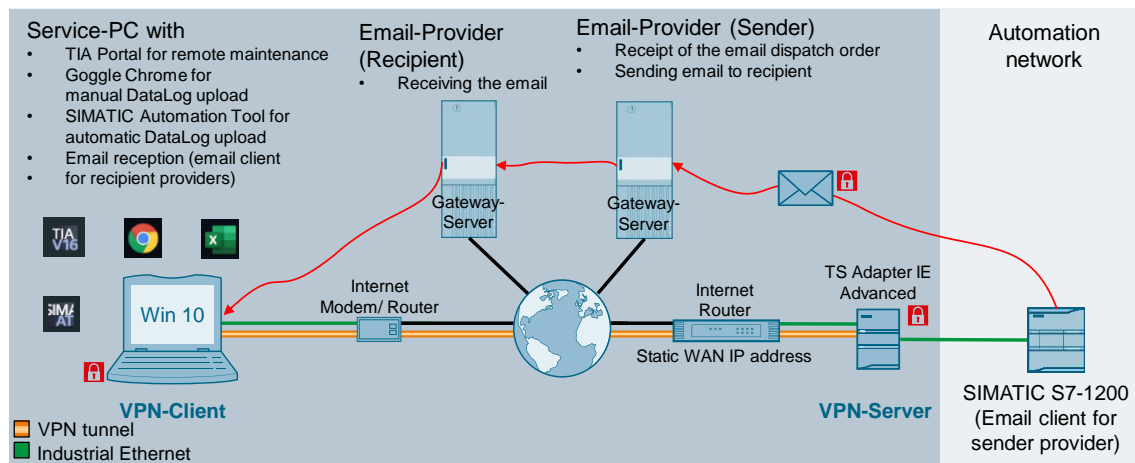
Additional information on calculating the service life of the SIMATIC Memory Card can be found under [\13\](#).

¹ In the following, the S7-1200 and S7-1500 will be collectively referred to as S7-1x00.

Diagram

The following figure shows the most important components of the solution:

Figure 2-1



The cooling temperature can be measured using thermo elements or resistance thermometers. The SIMATIC S7-1x00 offers specialized signal expansion modules (TC and RTD) for interfacing.

Using the "Data Log" instruction, the temperature is written to a CSV file in the storage on the SMC at a specified interval.

You can access the CPU's web server through a web browser (such as Google Chrome) to download the CSV file to your service PC.

The remote connection between service PC and CPU is made via the internet.

A VPN tunnel is established for secure data transmission. A VPN-capable modem/router is required on the CPU side in order to do this. On the PC side, the internet connection is tied to suitable VPN software. The respective internet service provider (ISP) assigns IP addresses on both sides. In order to address the CPU on the plant side, you will need a static public IP address.

The cooling temperature is monitored continuously. If the specified maximum temperature is exceeded, the "TMAIL_C" function sends an encrypted email request via the internal Ethernet interface of the S7-1x00 to the output server of a sender email provider (account required). Via its email provider, the recipient receives the alarm message about the critical temperature increase and can respond to it.

If the email provider offers the "Mail2SMS" service, it is even possible to send the alarm message to a cellular phone as an SMS.

The logged temperature process values are archived as an attachment in a separate encrypted email from the CPU.

The SIMATIC Automation Tool can also be used. An executable file is run at regular intervals using the Windows Task Scheduler. The Task Scheduler access the SIMATIC Automation Tool's API and saves the uploaded data log files to the hard drive.

Advantages

This application example offers you the following advantages:

- Introduction to data logging with all functions
- Alarm generation via secure email
- Transmission of data logging, event-triggered as an email attachment
- Transmission of data logging, time-triggered via the API of the SIMATIC Automation Tool
- Basics of remote maintenance through a VPN tunnel

Delimitation

The following system function blocks are called according to their function and described:

- For data logging:
 - DataLogCreate V1.0
 - DataLogOpen V1.1
 - DataLogWrite V1.0
 - DataLogClear V1.1
 - DataLogClose V1.0
 - DataLogDelete V1.1
 - DataLogNewFile V1.1
- "TMAIL_C" V6.0 for email sending

A detailed description of these instructions can be found in the Online Help in TIA Portal by selecting the block and pressing F1, or in the system manual for STEP 7 (TIA Portal) ([\6](#)).

This application example only describes the basics on creating a VPN tunnel. Please refer to [\10](#) for a detailed description of the topic "Secure remote access with VPN".

Secure email sending is implemented with the CPU's internal interface. This variant also offers data log file sending as an email attachment. Further information on sending secure requests to the email provider, even via the communications extension with a Security CP, can be found in the application example "Sending e-mails to the SMTP server with an S7 CPU" ([\17](#)).

Refer to the application examples [\14](#) and [\15](#) for the alarm message via SMS function.

The API of the SIMATIC Automation Tool provides the basis for automatic uploading of data log files. A detailed description of the SIMATIC Automation Tool V3.1 SP4 can be found in the user manual ([\19](#)).

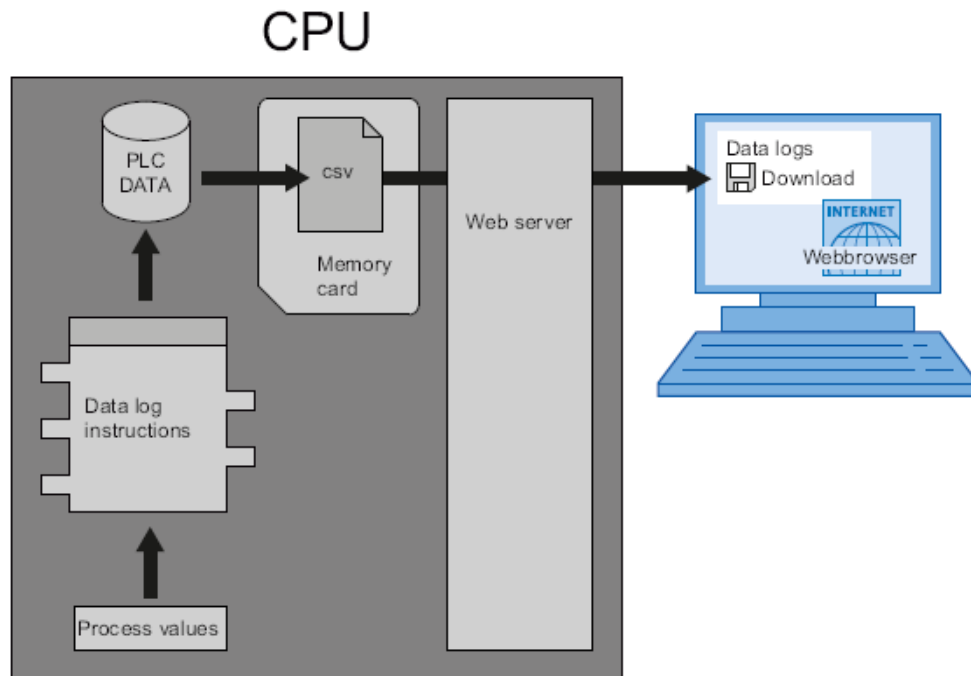
Required knowledge

Basic knowledge on the topic of "network communication" is assumed.

2.2 Description of the core functionality

Recording process values with data logging constitutes the core function of the application example.

Figure 2-2



The data log instructions are used in the user program to save process values to log files. The log files can be stored on the Memory Card (MC) or in the internal storage of the CPU (only S7-1200). The log files are saved in CSV format. You can access the CSV file as described in [Table 2-1](#).

In this application example, the "Data Log" functionality consists of the following seven instructions:

"DataLogCreate"

Figure 2-3

DataLogCreate	
EN	
REQ	
RECORDS	
FORMAT	
TIMESTAMP	DONE
NAME	BUSY
ID	ERROR
HEADER	STATUS
DATA	ENO

Use the "DataLogCreate" instruction to create data log file in the "\DataLogs" folder of the load memory and specify the name ("NAME" parameter) and the maximum number of data records ("RECORDS" parameter).

Choose the time stamp format with the "TIMESTAMP" parameter.

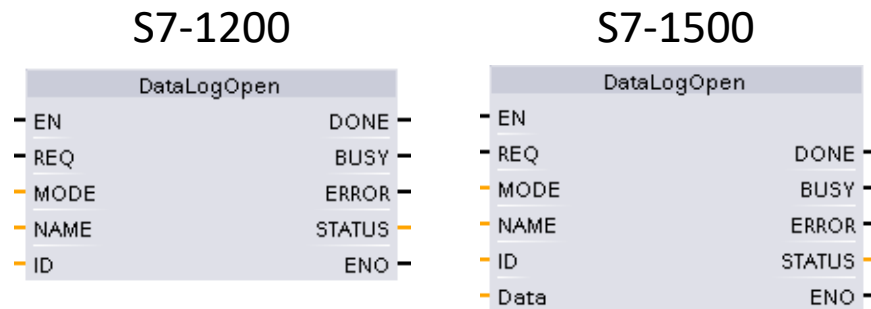
The data to be recorded are specified as a structure or PLC data type via the "DATA" parameter.

Specify the headers (column headers) of the recorded data in the data log with the "HEADER" parameter.

Creating a data log file with a specified name will generate a number ("ID" parameter), which can be used to identify this file.

"DataLogOpen"

Figure 2-4



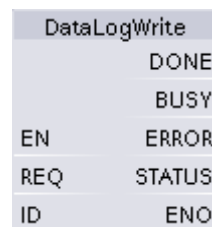
The "DataLogOpen" instruction opens an already existing data log file. A data log file must be opened in order to write new data records to the file. You can use the parameter "MODE" to decide whether the existing data records will be overwritten. You can select the data log with the "ID" parameter. When "ID" = 0, the data log to be opened will be specified by the name "NAME".

Opening the data log file with the "NAME" parameter will return the "ID" that other DataLog instructions can use to access this file.

For the S7-1500, the "DataLogOpen" instructions also contain the interface parameter "Data" (pointer to the data structure of the data log). In comparison to the S7-1200, this enables verification of data consistency.

"DataLogWrite"

Figure 2-5



The "DataLogWrite" instruction writes a data record to the specified data log. The already existing target data log must be opened so that the "DataLogWrite" instruction can be run.

You can select the data log with the "ID" parameter.

"DataLogClear"

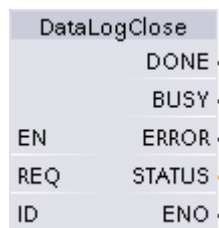
Figure 2-6



The "DataLogClear" instruction deletes all data records of a data log. You can select the data log with the "ID" parameter.

"DataLogClose"

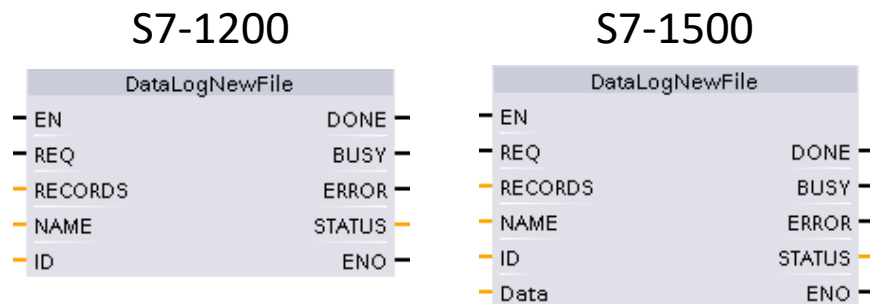
Figure 2-7



The "DataLogClose" instruction closes an open data log. You can select the data log with the "ID" parameter.

"DataLogNewFile"

Figure 2-8



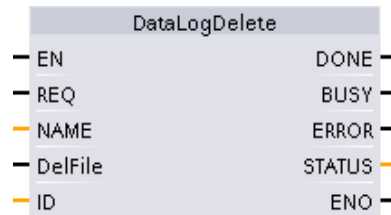
You will use the "DataLogNewFile" instruction to create a new data log with the same properties as an existing data log file and a new name. Specify the maximum number of data records with the "RECORDS" parameter.

The template file is specified with the "ID" parameter. Once the new data log file with a new name ("NAME" parameter) is created, a new "ID" will be generated and output for this file.

For the S7-1500, the "DataLogNewFile" instructions also contain the interface parameter "Data" (pointer to the data structure of the data log). In comparison to the S7-1200, this enables verification of data consistency.

"DataLogDelete"

Figure 2-9



The "DataLogDelete" instruction deletes the data log. You can select the data log with the "ID" parameter. When "ID" = 0, the data log to be deleted will be specified by the name "NAME". The "DelFile" parameter must be "TRUE" in order to delete the data log.

Note

More detailed information on [Data Logging](#) can be found in the Online Help in TIA Portal by selecting the block and pressing F1, or in the system manual for STEP 7 (TIA Portal) ([\6\](#)).

2.3 Hardware and software components used

The application example was created with the following components:

Hardware components

Table 2-2

Components	Qty.	Order number	Note
POWER SUPPLY S7-1200 PM1207	1	6EP1332-1SH71	
CPU 1211C, DC/DC/DC, 6DI/4DO/2AI	1	6ES7211-1AE40-0XB0	Firmware V4.4.0 (\4\)
CPU 1511C-1 PN	1	6ES7511-1CK01-0AB0	Firmware V2.8.2 (\5\)
SIMATIC S7 MEMORY CARD, 24 MB	1	6ES7954-8LF02-0AA0	Insertable load memory; for saving the DataLog files; created as Program card (\3\)
Remote service PC	1		With internet connection
Ethernet cable TP CORD RJ45/RJ45 2M	4	6XV1870-3QH20	
Circuit breakers	1	5SY6116-6	1-pin B, 16A
DSL modem	1 – 2	---	Depends on provider and router
TS Adapter IE Advanced	1	6ES7972-0EA00-0XA0	Optional (for other VPN server variants, see \10\)

Standard software components

Table 2-3

No.	Components	Qty.	Order number	Note
5.	SIMATIC STEP 7 Basic V16	1	6ES7822-0AA06-0YA5	<ul style="list-style-type: none"> With update 1 (\8\) For configuration of the S7-1200
6.	SIMATIC STEP 7 Professional V16	1	6ES7822-1AA06-0YA5	<ul style="list-style-type: none"> With update 1 (\8\) For configuration of the S7-1200 and S7-1500
7.	SIMATIC Automation Tool V3.1 SP4	1	6ES7853-1AE03-0YA5	\16\ ; license required for use of the API
8.	.NET Framework 4.6.2	1		Required to run the "UploadDataLog.exe" file
9.	Microsoft Excel	1		Component of Microsoft Office
10.	Task Scheduler			Part of Windows 10 operating system

Sample files and projects

The following list contains all files and projects used in this example.

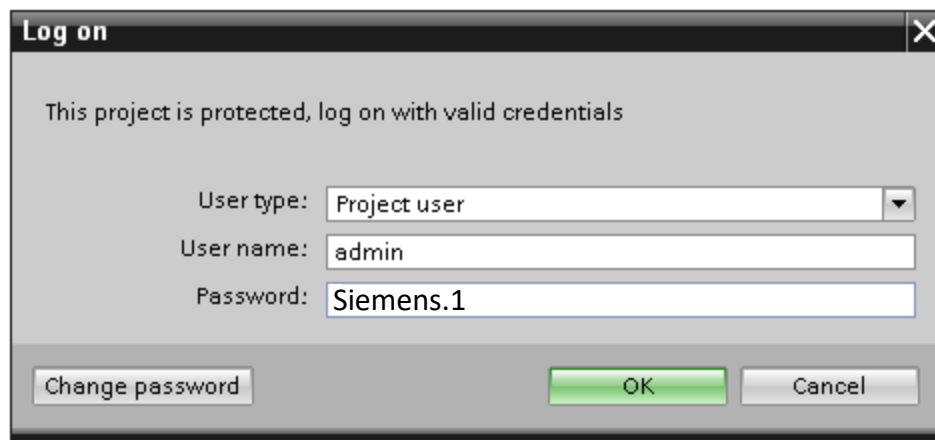
Table 2-4

No.	Components	Note
1.	64396156_S7-1x00_DataLogging_TiaV16_CODE_V4.0.zip	This compressed file contains the STEP 7 project.
2.	64396156_SAT_UploadDataLog_SatV3.1.4_EXE_V1.4.zip	This packed file contains the executable program, "UploadDataLog.exe", for uploading the DataLog data in connection with the SIMATIC Automation Tool V3.1.4 or later (\16\), as well as the source code in C#.
3.	64396156_S7-1x00_DataLogging_DOC_V4.0_en.pdf	This document.

Passwords

Project registration

Figure 2-10



The image shows a 'Log on' dialog box with a title bar containing a close button (X). The main text inside the dialog reads 'This project is protected, log on with valid credentials'. Below this text are three input fields: 'User type:' with a dropdown menu showing 'Project user', 'User name:' with the text 'admin', and 'Password:' with the text 'Siemens.1'. At the bottom of the dialog are three buttons: 'Change password', 'OK' (highlighted in green), and 'Cancel'.

For the S7-1x00, the access level "HMI access" is selected (chapter [4.3.2](#)).
The following passwords are assigned:

Table 2-5

Access level	Password
Full access (no protection)	full
Read access	read

3 Function Mechanisms of this application example

Complete overview

[Figure 3-1](#) shows the chronological sequence of the block calls in the example project.

The cyclic interrupt OB "CyclicInterrupt" calls the FB "LGF_SinusCI". This imulates the freezer temperature as a sine curve.

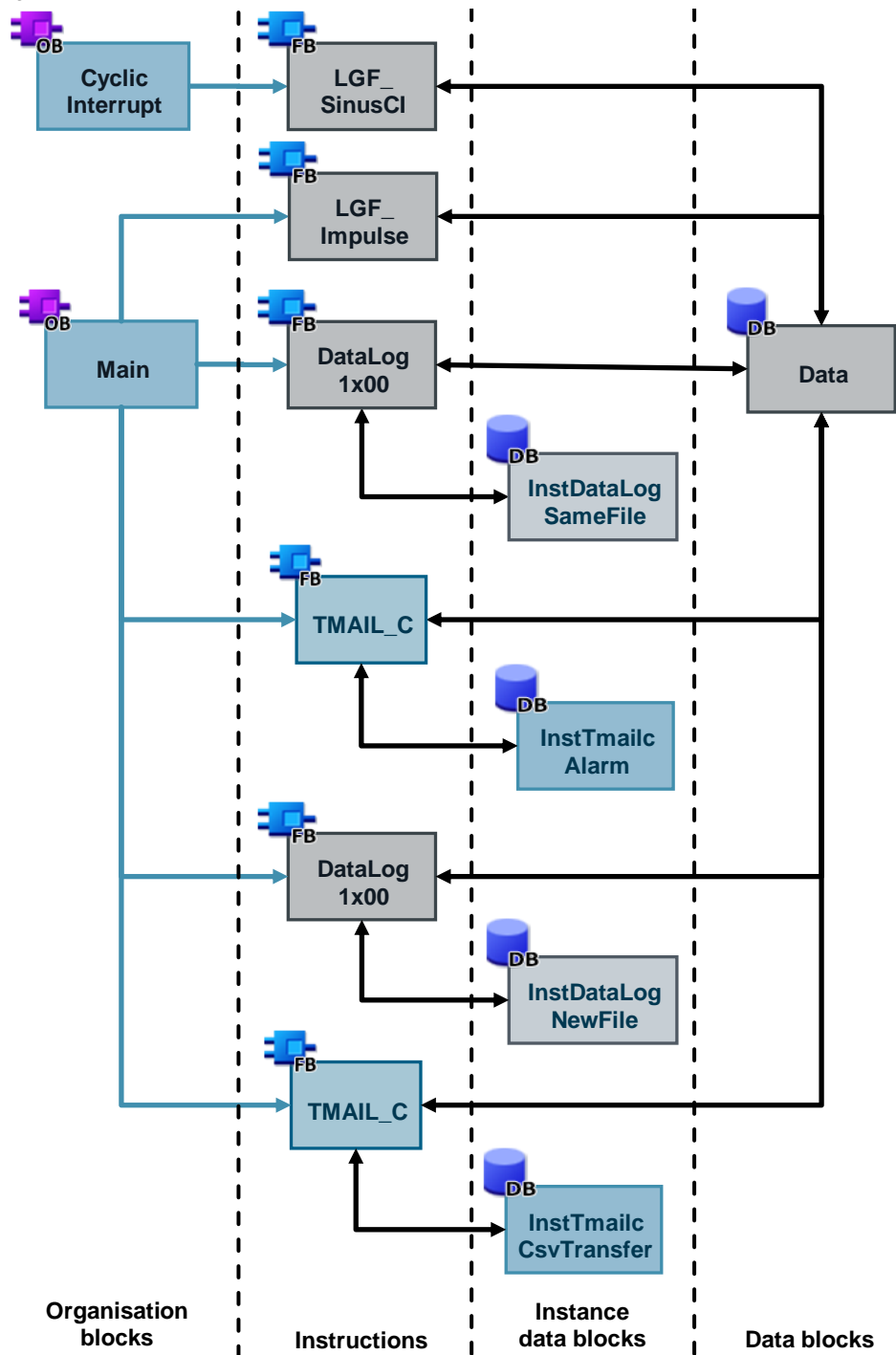
The following function blocks are called from the cyclic OB:

- FB "LGF_Impulse" supplies the trigger signal to log the temperature via the FB "DataLog1x00".
- FB "DataLog1x00", together with the instance DB "InstDataLogSameFile", coordinates the logging of the freezer temperature. Once the maximum number of data records is reached, the recording begins again at the first data record and overwrites it (with the already configured parameters).
- FB "TMAIL_C", together with the instance DB "InstTmailcAlarm", sends an alarm email when a certain maximum temperature is exceeded.
- FB "DataLog1x00", together with the instance DB "InstDataLogNewFile", coordinates the logging of the freezer temperature. Once the maximum number of data records is reached, the current data log is closed and an identical one with a different name is created and written to. This process repeats until the specified maximum number of new data logs is reached and the labeling begins again from the start in the original data log. Using the preset parameters, the data records are deleted before the first recording.
- FB "TMAIL_C", together with the instance DB "InstTmailcCsvTransfer" sends an email with the temperature data log as an attachment once the maximum number of data records has been reached (FB "DataLog1x00" with instance DB "InstDataLogNewFile").

The tags for parameter entry of the interfaces for the function blocks are located in the DB "Data".

The last error-free and error-containing runs through the functions described above are each retained with a time stamp. In the event of a run with errors, the status and sub-status will be saved.

Figure 3-1



3.1 General functions

The following blocks used in the application example originate from the library with general functions (LGF) for SIMATIC STEP 7 (TIA Portal) and SIMATIC S7-1200/S7-1500 ([\18\](#)); they are described there in detail.

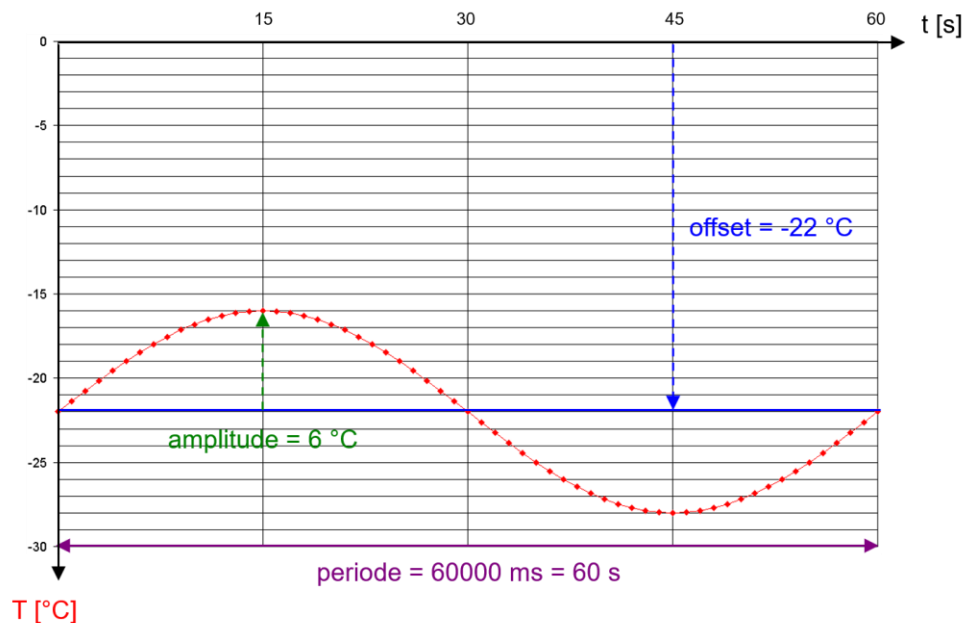
3.1.1 FB "LGF_SinusCI"

The FB "LGF_SinusCI" V3.0.0 simulates the temperature progression as a sine curve.

Based on the parameterization in the application example, the temperature simulation proceeds through a sine wave oscillation with an offset of $-22\text{ }^{\circ}\text{C}$ with an amplitude of $\pm 6\text{ }^{\circ}\text{C}$ and a period length of one minute (see [Figure 3-2](#)).

The FB "LGF_SinusCI" is called with a cycle time of 100 ms in the cyclic interrupt OB "CyclicInterrupt".

Figure 3-2



3.1.2 FB "LGF_Impulse"

The FB "LGF_Impulse" V3.0.0 supplies the trigger signal to call the FB "DataLog1x00".

With the parameters assigned in the application example, the FB "DataLog1x00" is called every 2 seconds ("frequency" = 0.5 Hz) (input "write") in order to write an entry in the data logging.

The FB "LGF_Impulse" is called in the cyclic OB "Main".

3.2 FB "DataLog1200"/"DataLog1500"

The FB "DataLog1x00" coordinates data logging. The aim is to write a data record into the data log (data logging file). To do this, the data log is created, opened and written to, depending on the initial circumstances.

You can program the behavior in the event of an overflow (maximum number of data records exceeded):

- Write to the existing data log with/without prior emptying (ring buffer)
- Close the existing data log and create/open and write to a new data log with/without prior emptying

You also have the option of deleting the (newly) created data log.

The FB "DataLog1x00" exists for the SIMATIC S7-1200 (FB "DataLog1200") and the S7-1500 (FB "DataLog1500"), as the interfaces for the instructions "DataLogOpen" and "DataLogNewFile" contained therein differ depending on controller.

The functionality of the FB "DataLog1x00" is identical, however.

Figure 3-3: FB "DataLog1x00"

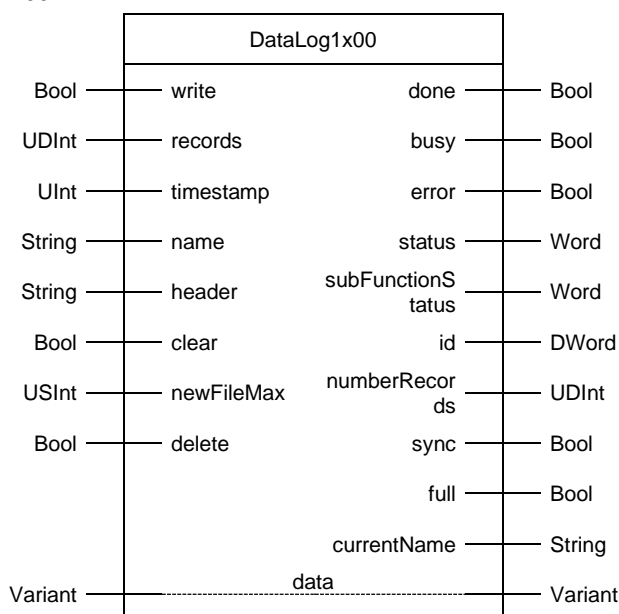


Table 3-1: Parameters of the FB "DataLog1x00"

Name	P type	Data type	Description		
write	IN	Bool	Writes a data record ("data" data structure) into the data log "currentName" upon a rising edge Precondition: "delete" = FALSE		
records	IN	UDInt	Maximum number of data records in the data log (DataLogCreate parameter*)		
timestamp	IN	UInt	Time stamping: 0: No time stamping		
				S7-1200	S7-1500
			1: System time Default: S7-1200	mm/dd/yyyy, hh:mm:ss	yyyy-mm-dd, hh:mm:ss.999
			2: Local time	mm/dd/yyyy,	mm/dd/yyyy,

3 Function Mechanisms of this application example

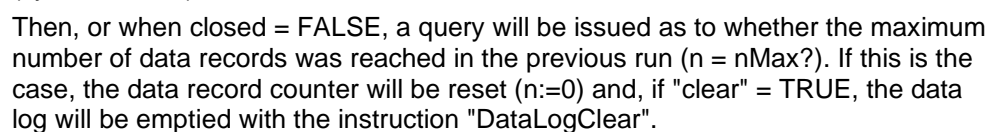
Name	P type	Data type	Description												
			<table><tr><td></td><td>hh:mm:ss</td><td>hh:mm:ss[.999]</td></tr><tr><td>3: System time Default: S7-1500</td><td></td><td>mm/dd/yyyy, hh:mm:ss[.999]</td></tr><tr><td>4: Local time</td><td></td><td>yyyy-mm-dd, hh:mm:ss[.999]</td></tr><tr><td>5: System time</td><td></td><td>yyyy-mm-dd, hh:mm:ss[.999]</td></tr></table>		hh:mm:ss	hh:mm:ss[.999]	3: System time Default: S7-1500		mm/dd/yyyy, hh:mm:ss[.999]	4: Local time		yyyy-mm-dd, hh:mm:ss[.999]	5: System time		yyyy-mm-dd, hh:mm:ss[.999]
				hh:mm:ss	hh:mm:ss[.999]										
			3: System time Default: S7-1500		mm/dd/yyyy, hh:mm:ss[.999]										
			4: Local time		yyyy-mm-dd, hh:mm:ss[.999]										
			5: System time		yyyy-mm-dd, hh:mm:ss[.999]										
(DataLogCreate-Parameter*)															
name	IN	String	Name of the data log (DataLogCreate parameter*)												
header	IN	String	Header of the data log (DataLogCreate parameter*)												
clear	IN	Bool	TRUE: Delete all data records in the data log "currentName" before writing the first data record after overflow ("full" = TRUE)												
newFileMax	IN	USInt	Maximum number of new data logs that will be created/opened in the event of an overflow ("full" = TRUE)												
delete	IN	Bool	TRUE: Delete all data logs with the name "<name>" until "<name>_<newFileMax>" - invalidates "write"												
done	OUT	Bool	TRUE: The function was processed successfully												
busy	OUT	Bool	TRUE: The function is being processed												
error	OUT	Bool	TRUE: An error occurred during processing												
status	OUT	Word	16#0000 - 16#7FFF: Error-free status of the FB 16#8000 - 16#FFFF: Error source 16#8601: Instruction " DataLogCreate " 16#8602: Instruction " DataLogOpen " 16#8603: Instruction " DataLogWrite " 16#8604: Instruction " DataLogClear " 16#8605: Instruction " DataLogClose " 16#8606: Instruction " DataLogNewFile " 16#8607: Instruction " DataLogDelete "												
subFunctionStatus	OUT	Word	status of the sub-function (see "status")												
id	OUT	DWord	Object ID of the data log												
numberRecords	OUT	UDInt	Current number of written data records												
sync	OUT	Bool	"numberRecords" is synchronized (retentive memory available)												
full	OUT	Bool	TRUE: "numberRecords" = "records"												
currentName	OUT	String	Name of the data log												
data	IN_OUT	Variant	Pointer to the data structure which is written as data record												

*DataLogCreate parameter: These parameters pertain to the creation of the data logs via the instruction "DataLogCreate" and therefore have no effects on existing data logs for the runtime!

Note

The FB "DataLog1x00" counts the number of written data records ("numberRecords") on its own. A comparison only occurs when a data log is created and its value is initialized with "0" and "sync" is set. "numberRecords" and "sync" are retentive. As long as "sync" = TRUE, "numberRecords" is synchronized with the real number of written data records in the data log. In order to ensure this happens, you must delete the data log after program modifications ("delete" = TRUE).

Figure 3-4



Then the data log will be written to with the current data record using the "DataLogWrite" instruction. When writing is successful (done) the data record counter will be incremented ($n:=n+1$) and queried whether the maximum number of data records has been reached ($n = nMax?$). If so, this will be signaled (full $:=TRUE$).

A query will then be issued whether the maximum number of new data logs has been reached ($m = mMax?$). If this is not yet true, the current data log will be closed using the instruction "DataLogClose", this will be registered (closed $:= TRUE$) and the counter incremented for new data logs ($m:=m+1$).

Furthermore, in the event of an error message (error) for the DataLog instructions, the following statuses will be stepped accordingly:

- In the event of non-existent data log ("Not exist"), jump to instruction "DataLogCreate".
- In the event of data log not opened ("Not open"), jump to instruction "DataLogOpen".
- In the event of existing data log ("Already exist"), also jump to instruction "DataLogOpen".

When the data log is created successfully (done), the data record counter will be reset ($n:=0$) using the instruction "DataLogCreate", and is thus synchronized (sync $:= TRUE$).

All data logs with the name "<name>" to "<name>_<newFileMax>" will be deleted using the input "delete" ($= TRUE$). The "delete" input has a higher priority than the "write" input. Therefore "delete" must $= FALSE$ in order to execute a write command with "write".

Difference between FB "DataLog1200" and FB "DataLog1500"

For the S7-1500, the "DataLogOpen" and "DataLogNewFile" instructions also contain the interface parameter "data" (pointer to the data structure of the data log). In comparison to the S7-1200, this enables verification of data consistency when both instructions are called. Corresponding status messages are output via "subFunctionStatus". The functionality of the FB "DataLog1x00" is identical with the S7-1200 and S7-1500, however.

In the application example, the FB "DataLog1x00" for data logging the temperature is called twice in the cyclic OB "Main":

- with the instance DB "InstDataLogSameFile" for writing to the existing data log (without prior emptying) in the event of an overflow: Using this data log, the automatic upload is performed via the SIMATIC Automation Tool ([Table 2-1](#) no. 3).
- with the instance DB "InstDataLogNewFile" for creating/opening and writing to a new data log (with prior emptying) in the event of an overflow: Upon reaching the maximum number of data records, the current data log will be sent as an email attachment while the new data log can continue being written to ([Table 2-1](#) no. 4).

3.2.1 FC "Num2Name"

The FC "Num2Name" takes the string "nameIn" and "number" and generates the "nameOut" in the form "<nameIn>_<number>".

It is called in the FB "DataLog1x00" and specifies for "newFileMax" > 0 the name of the new data log for the instructions "DataLogNewFile" and "DataLogOpen" and "DataLogDelete".

Figure 3-5: FC "Num2Name"

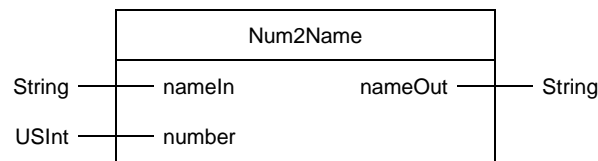


Table 3-2: Parameters of the FC "Num2Name"

Name	P type	Data type	Description
nameIn	IN	String	Name of the original data log
number	IN	USInt	Number of the data log as attachment
nameOut	OUT	String	Name of the new data log in the form "<nameIn>_<number>"

3.3 FB "TMAIL_C"

The FB "TMAIL_C" uses SMTP (Simple Mail Transfer Protocol) to send an email over TCP/IP on the CPU's Industrial Ethernet connection.

"TMAIL_C" is executed asynchronously and the command extends over multiple calls of "TMAIL_C". If you call "TMAIL_C", you must assign an instance.

In the application example, the FB "TMAIL_C" is called twice in the cyclic OB "Main":

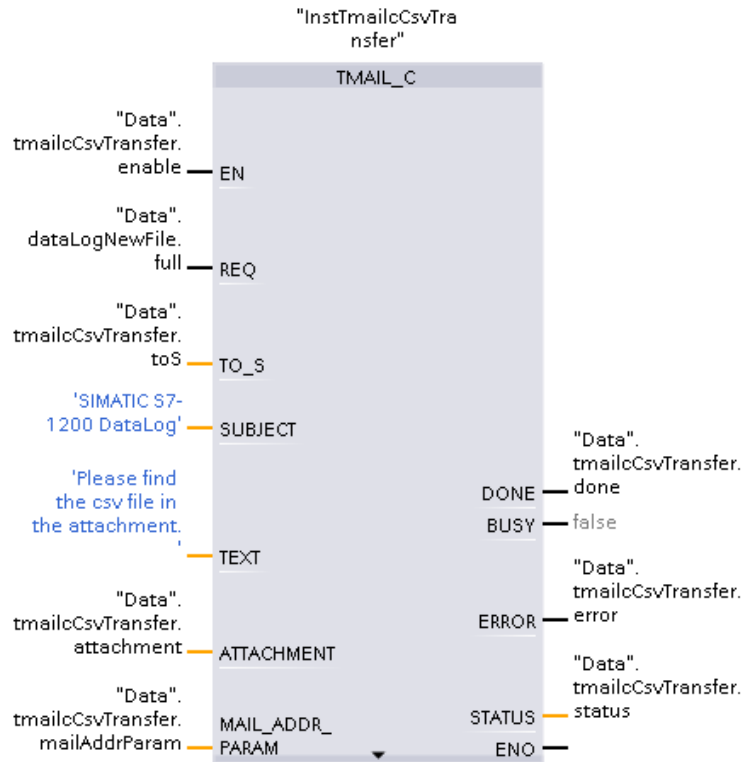
- with the instance DB "InstTmailcAlarm" for sending an alarm email when a specific maximum temperature is exceeded
- with the instance DB "InstTmailcCsvTransfer" for sending an email with the temperature data log as an attachment when the maximum number of data records is reached

[Figure 3-6](#) illustrates the call of the FB "TMAIL_C" with interconnection of the parameter "ATTACHMENT" for sending the data log.

The system data type "TMail_FileReference" is passed at the parameter "ATTACHMENT". It contains the path and the name of the file to be attached (see ["Description of TMAIL_C as of version V6.0" in \6\](#)).

Figure 3-6

Network 10: Transfer data logging csv file via Email



The connection data, addressing and authentication for the mail server are passed at the parameter "MAIL_ADDR_PARAM".

The email is sent via the integrated interface of the CPU by means of a secured connection (SNMP over TLS) to an external email server.

The system data type "TMAIL_QDN_SEC" is used at the parameter "MAIL_ADDR_PARAM".

Once activated, "TMAIL_C" logs in to the mail server (specified with the fully-qualified domain name) with the access credentials (username and password) and the X.509 V3 certificate loaded on the CPU (CA) for the mail server (with which the TLS client validates the authentication from the TLS server); it then sends the email request with the specified recipient address and the specified text (as well as attachment).

Refer to application example [17](#) for more information on the topic "Sending emails over secured email connections".

Program details of block TMAIL_C

This application example uses the FB "TMAIL_C" in version 6.0.

You can find program details on the block ["TMAIL_C"](#) in the Online Help in TIA Portal by selecting the block and pressing F1, or in the system manual for STEP 7 (TIA Portal) ([16](#)).

3.4 SIMATIC Automation Tool

With the SIMATIC Automation Tool, you can perform commissioning and service tasks on SIMATIC S7-1200, S7-1500, ET200, HMI, SITOP devices, SCALANCE switches and SIMATIC RFID as well as MOBY Ident modules independently of TIA Portal. The licensed tool provides an API (e.g. for automated use of the supported operations with C#). These operations also include loading the CPU data log data (saved to an inserted SIMATIC Memory Card).

Download no. 2 in [Table 2-4](#) contains the console application "UploadDataLog.exe". This was created in C# using Visual Studio 2015 and .NET Framework V4.6.2.

The prerequisite for being able to run "UploadDataLog.exe" is an existing license for the SIMATIC Automation Tool V3 ([Table 2-3](#)), which must be installed, along with the installation of .NET Framework V4.6.2.

The file "UploadDataLog.exe" V1.4 makes it possible to upload DataLog files (also over a router) when the following arguments are specified:

Table 3-3

No.	Argument	Description	Format
1.	Network card number	The application displays a list of available network cards. Select the list number.	"0" to "n"
2.	IP address	IP address of CPU	"xxx.xxx.xxx.xxx"
3.	DataLog file name	DataLog file name (Case sensitive)	"DataLog.csv" or "ALL" for all DataLog files
4.	Destination folder	Destination folder in which the DataLog file(s) will be stored (Must exist + Case sensitive!)	e.g.: "c:\MyDataLogs"
5.	Password	CPU password (if available): Password level "Full access" or "write-protected" (Case sensitive)	e.g.: "read" or omit if no password is assigned

To upload the DataLog files, the application requires write-protected access to the S7-1x00. When choosing a different access level as the lowest:

- "Full access incl. fail-safe (no protection)" for a failsafe CPU
- "Full access (no protection)" for a standard CPU

you must at least give the application the password of the next-lower access level with write-protected access (chapter [4.3.2](#)).

For example, the application may access an S7-1x00 with access level "HMI access" using the passwords (if they exist) for the following access levels:

- "Read access"
- "Full access (no protection)"
- "Full access incl. fail-safe (no protection)" (only available for a failsafe CPU)

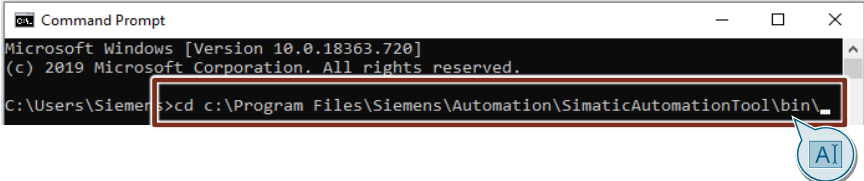
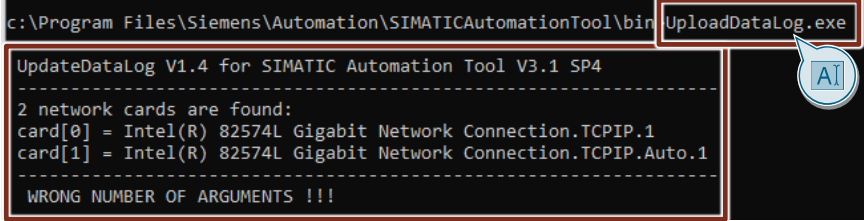
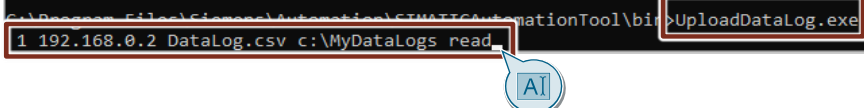
Note

The console application runs at the Windows Command Prompt "cmd.exe". The sequence of the arguments is specified in [Table 3-3](#). The arguments are separated by spaces.

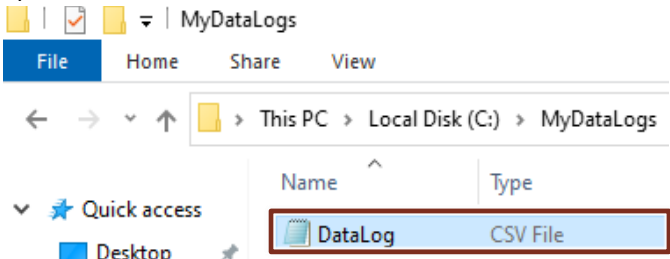
3 Function Mechanisms of this application example

Proceed as follows to ensure the file "UploadDataLog.exe" performs cleanly:

Table 3-4

No.	Action
1.	Extract the compressed file (Table 2-4 no. 2) on your computer.
2.	Copy the console application, "UploadDataLog.exe", in it to the installation folder of the SIMATIC Automation Tool V3.1 SP4. (default: "c:\Program Files\Siemens\Automation\SimaticAutomationTool\bin"). Administrator rights may be required for this.
3.	Open the Command Prompt and navigate to the "UploadDataLog.exe" console application folder: "cd c:\Program Files\Siemens\Automation\SimaticAutomationTool\bin\" 
4.	Start the application "UploadDataLog.exe".  <ul style="list-style-type: none">• The console application lists the available network adapters and displays the error message "WRONG NUMBER OF ARGUMENTS !!!", since the application requires that 4 or 5 arguments be passed.• Remember the number of the network adapter to browse to. Note: The network adapter with the "Auto" affix makes it possible to reach the CPU for the network adapter setting DHCP.
5.	Start the console application with the necessary arguments (see Table 3-3): "UploadDataLog.exe 1 192.168.0.2 DataLog.csv c:\MyDataLogs read" 
6.	The "UploadDataLog.exe" console application runs as follows: <ul style="list-style-type: none">• List of found network adapters• Output of the number of arguments: <i>arguments = 5</i>• Scan the selected network adapter: <i>scan network card 1</i>• Insert the selected IP address: <i>insert device by IP address 192.168.0.2</i>• Search the selected IP address: <i>find IP address 192.168.0.2</i>• Check whether it is a CPU: <i>check if device is CPU</i>• Check whether CPU is password protected: <i>check if CPU is protected</i>• Check if remote access to DataLog files is permitted: <i>check if remote access on data logs is allowed</i>• Check if the "Data logs" ["Datenprotokolle"] folder exists:

3 Function Mechanisms of this application example

No.	Action
	<p><i>check if folder 'DataLogs' exists</i></p> <ul style="list-style-type: none"> • Display number of data logs found <i>1 data log files are found</i> • Check the found data logs with the searched file names: <i>check data log name 'DataLog.csv'</i> • Upload the selected DataLog file to the specified destination folder: <i>upload data log to destination c:\MyDataLogs</i> <pre> C:\Program Files\Siemens\Automation\SIMATICAutomationTool\bin>UploadDataLog.exe 1 192.168.0.2 DataLog.csv c:\MyDataLogs read UpdateDataLog V1.4 for SIMATIC Automation Tool V3.1 SP4 ----- 2 network cards are found: card[0] = Intel(R) 82574L Gigabit Network Connection.TCPIP.1 card[1] = Intel(R) 82574L Gigabit Network Connection.TCPIP.Auto.1 ----- arguments = 5 scan network card 1 insert device by IP address 192.168.0.2 find IP address 192.168.0.2 check if device is CPU check if CPU is protected check if remote access on data logs is allowed check if folder 'DataLogs' exists 6 data log files are found check data log name 'DataLog.csv' upload data log to destination c:\MyDataLogs ----- C:\Program Files\Siemens\Automation\SIMATICAutomationTool\bin> </pre>
7.	<p>Open the destination folder and check whether the selected DataLog file exists.</p> 

Note

If you receive an error message, please check the accessibility of the CPU - for example via the ping command in the Command Prompt - and modify the settings of the network adapter if you absolutely must.

A simultaneous online connection to the S7-1200, for example with STEP 7 (TIA Portal), will prevent access to the data logs.

If you wish to modify the program code of the file "UploadDataLog.exe", you will find a description of how to create a console application in Microsoft Visual Studio in chapter 3.1 of the application example "Automated loading and archiving of the CPU service data by means of the SIMATIC Automation Tool via the Application Programming Interface (API)" ([\12\](#)).

3.5 Remote access to the controller

Secure remote access to the controller is established via a VPN tunnel.

A virtual private network (VPN) is a data network that is used to transfer private data through a public network (such as the internet). It thus enables secure transmission over an unsecure network.

Use of a VPN tunnel is tied to a VPN-capable router on the controller side.

On the PC side, you only need appropriate VPN client software that will establish the connection to the controller, as well as any internet connection.

This application example uses a wifi router with DSL internet access, and the wifi network adapter of the PC.

In the internet, subscribers are usually assigned dynamic IP addresses.

However, a static IP address is required to find the VPN server on the internet (on the CPU side).

The VPN connection described here is a client-server connection.

Please refer to appendix [\10\](#) and the Siemens portfolio for an introduction to the topic of "Secure remote access with VPN". The overview document explains the possible constellations of an IP-based remote network with the requirements and the links to in-depth configuration instructions.

For example, the application example ["VPN tunnel between the TS Adapter IE Advanced and Windows 7"](#) is a good reference on secure access to an S7-1x00 over the internet and the demonstrated use cases.

Remote access to the controller via the internet is not necessarily required for manual downloading of the recorded DataLog files. Local access is also sufficient for demonstration purposes.

However, internet access is required to send emails via external providers.

For email sending, you must enable the port or protocol for outgoing connections on the VPN server (router or TS Adapter IE Advanced):

- TCP port 465: SMTPS (Simple Mail Transfer Protocol over Secure Socket Layer) or
- TCP port 587: MSA (Mail Submission Agent) with STARTTLS
- UDP port 123: NTP (Network Time Protocol)

The following protocols must be enabled for incoming connections on the VPN server (router or TS Adapter IE Advanced):

- Simple Network Management Protocol (SNMP) for email sending
- Hyper Text Transfer Protocol over Secure Socket Layer (HTTPS) for retrieving the CPU web server in an internet browser
- Internet Control Message Protocol (ICMP) to ping the CPU

4 Commissioning the application example

4.1 Hardware customization

The application example has been implemented both with a CPU 1211C and CPU 1511C-1 PN. If you use a different CPU you must change the corresponding CPU in the project.

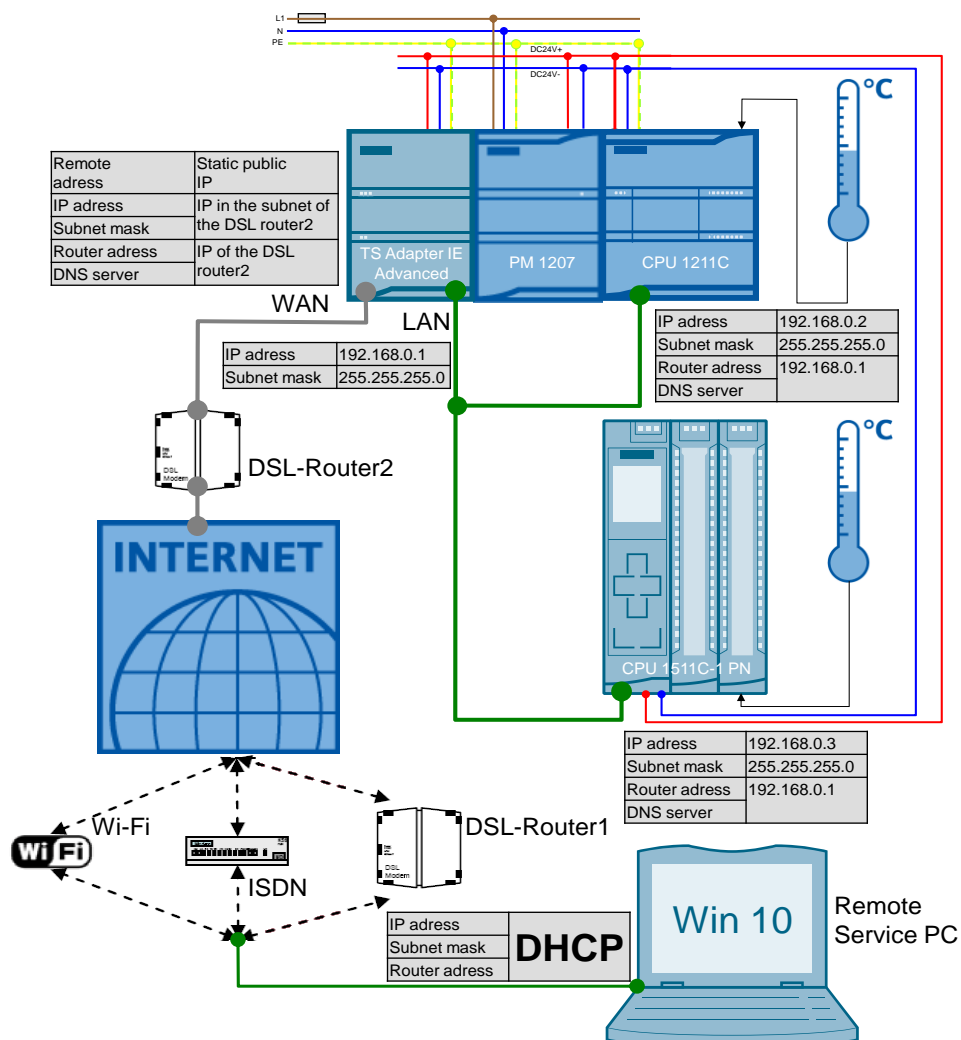
In the application example, the temperature curve is simulated using the block "LGF_SinusCI" (see chapter 3.1.1). If you use an actual temperature sensor, you may have to extend your hardware.

Both selected controllers have integrated analog inputs. You can find additional modules in the hardware catalog in TIA Portal or in the TIA Selection Tool ([7](#)).

Hardware installation

The following figure shows the hardware setup of the application.

Figure 4-1



4.2 PG/PC system settings

The application example has been implemented with the Microsoft Windows 10 Enterprise operating system.


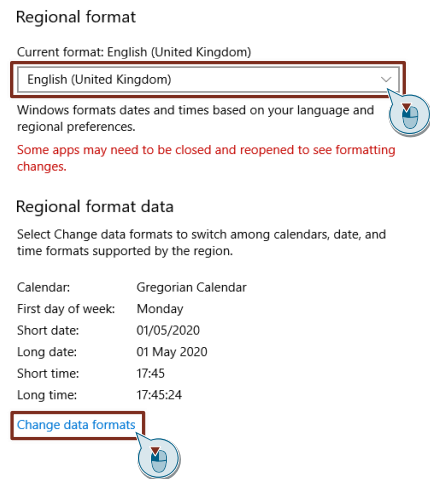
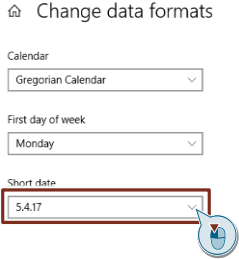
The following settings must be made in the operating system:

4.2.1 Regional settings

By default in English-speaking countries columns are divided by a comma separator.

The following settings will allow you to open the CSV files in Microsoft Excel directly and properly.

Table 4-1

No.	Action
1.	Open the "Region settings" in Windows. 
2.	<ul style="list-style-type: none"> Select the regional format "English (United Kingdom)". Switch to "Change date formats". 
3.	Make the "Short date" appear in the format "dd.mm.yy". 

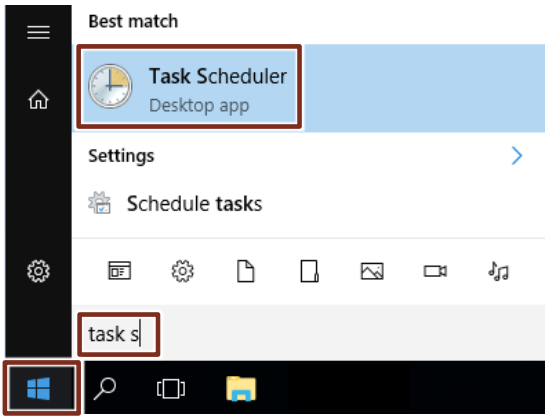
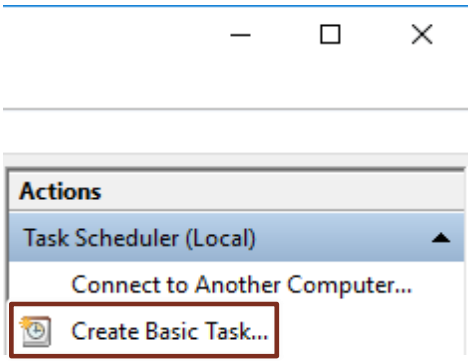
Note

Please refer to the S7-1200 system manual ([\3\](#)) for how to [Import CSV format data logs to non-USA/UK versions of Microsoft Excel](#).

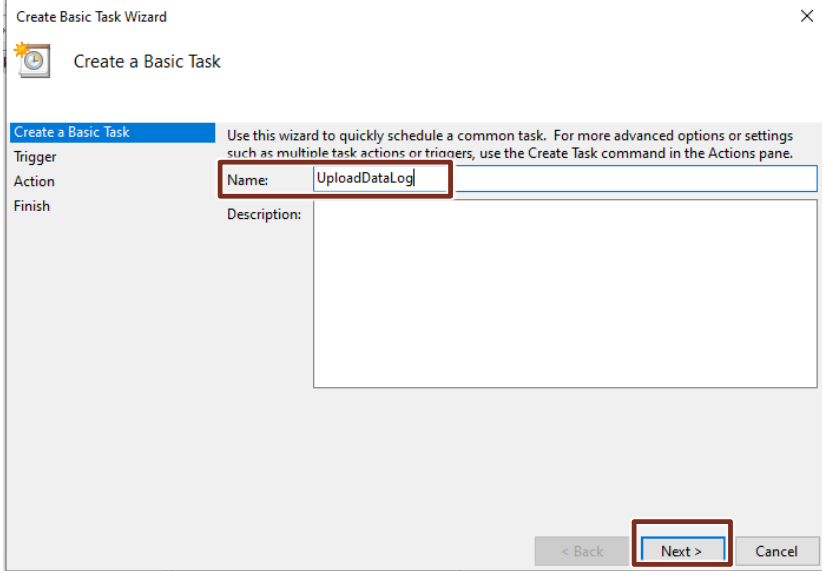
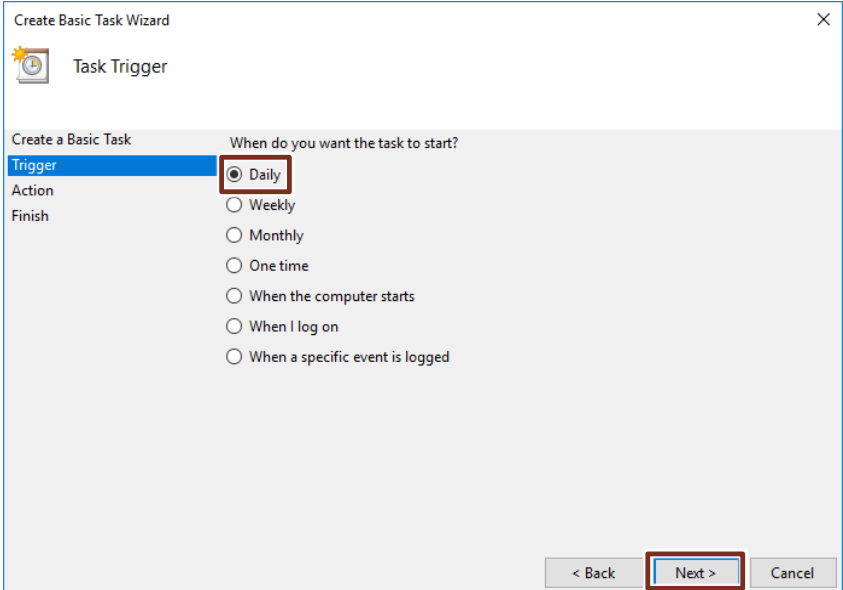
4.2.2 Task Scheduler

A task is created in the Windows Task Scheduler on the remote service PC to automatically upload DataLog files. This will run the console application "UploadDataLog.exe" every 5 minutes. This will load the CSV file "DataLog" using the API of the SIMATIC Automation Tool V3.1.4 and save it to the computer (chapter [3.4](#)).

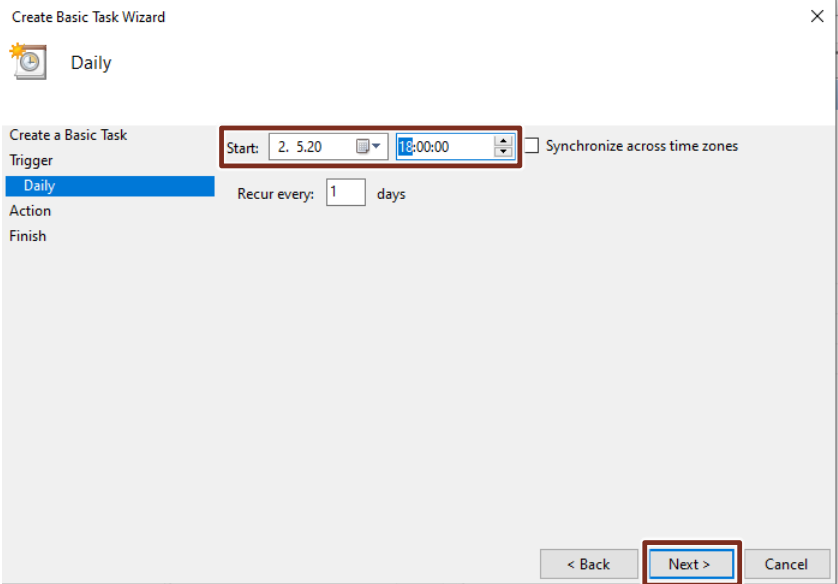
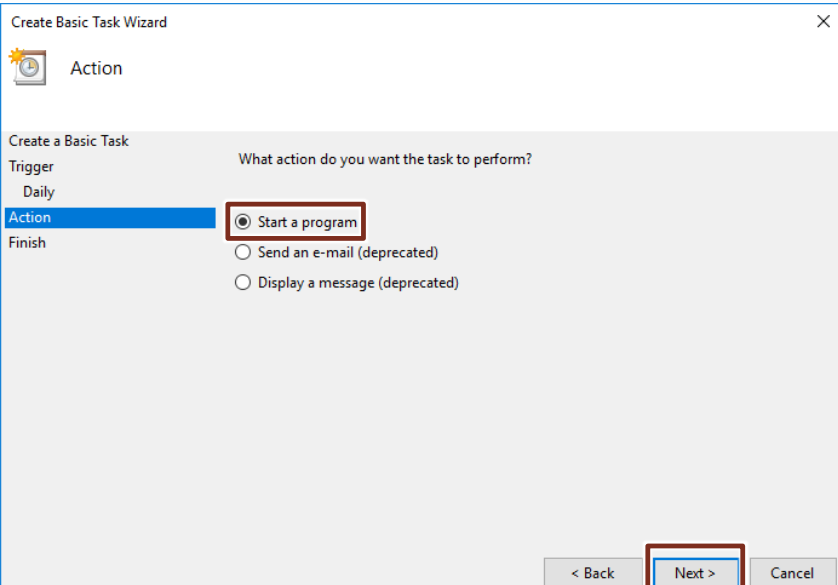
Table 4-2

No.	Action
1.	<p>Open the Windows Task Scheduler by clicking the Windows 10 icon and searching for it.</p> 
2.	<p>The "Task Scheduler" overview window will open.</p> <ul style="list-style-type: none"> In the upper right hand corner, click "Actions > Task Scheduler (Local) > Create Basic Task...". 

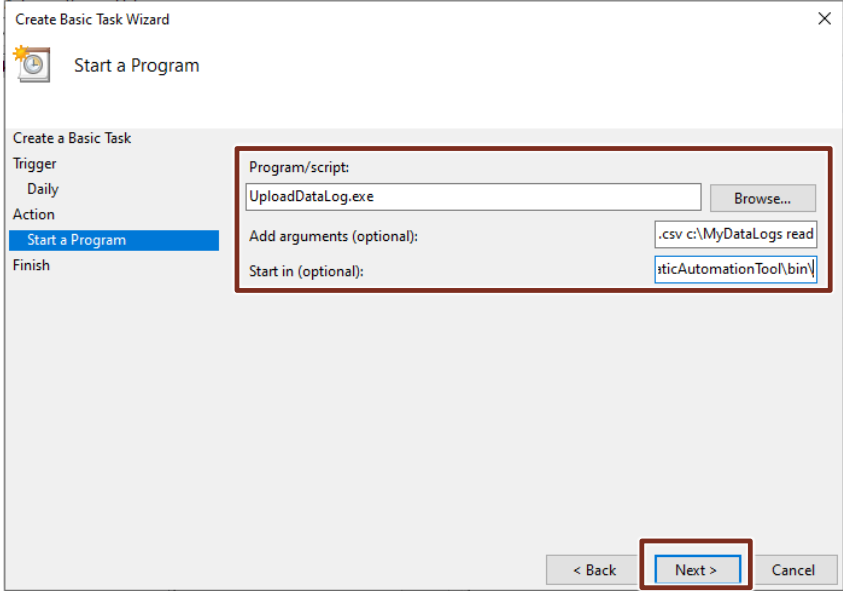
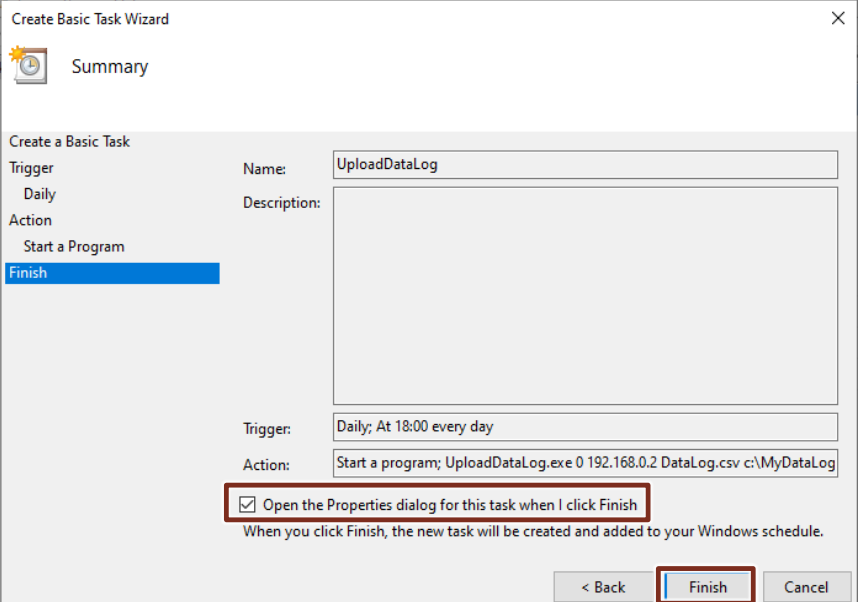
4 Commissioning the application example

No.	Action
3.	<p>This will open the "Create Basic Task Wizard".</p> <ul style="list-style-type: none"> Assign a name. Click on "Next >". 
4.	<ul style="list-style-type: none"> Select the setting "Daily" under Trigger. Click on "Next >". 

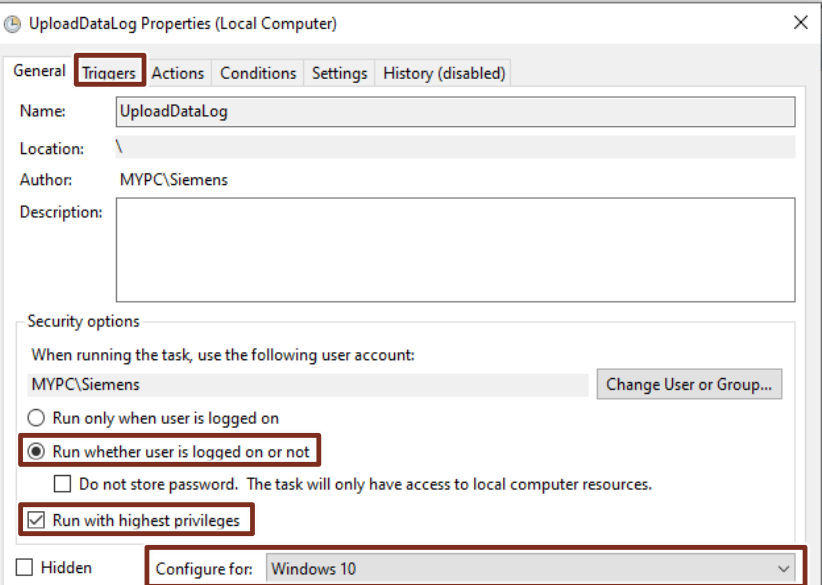
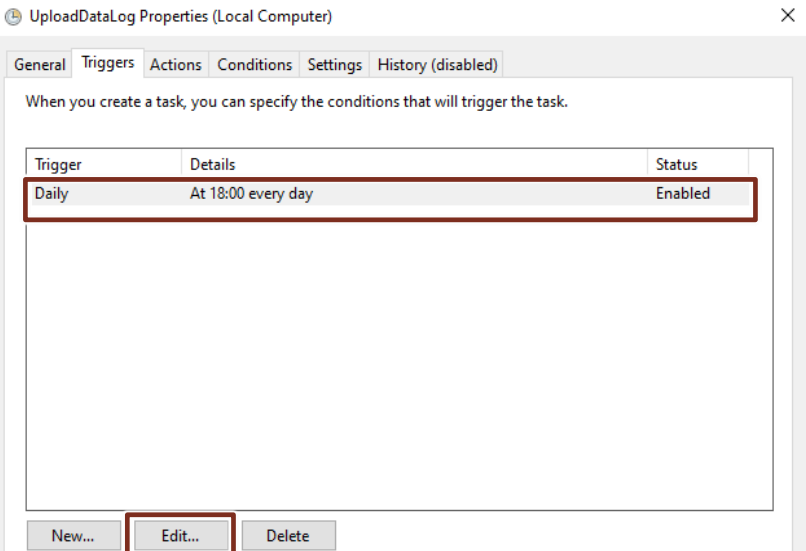
4 Commissioning the application example

No.	Action
5.	<p>The current date is used as the start date.</p> <ul style="list-style-type: none"> Input a start time. Click on "Next >". 
6.	<ul style="list-style-type: none"> As the action, select "Start a program". Click on "Next >". 

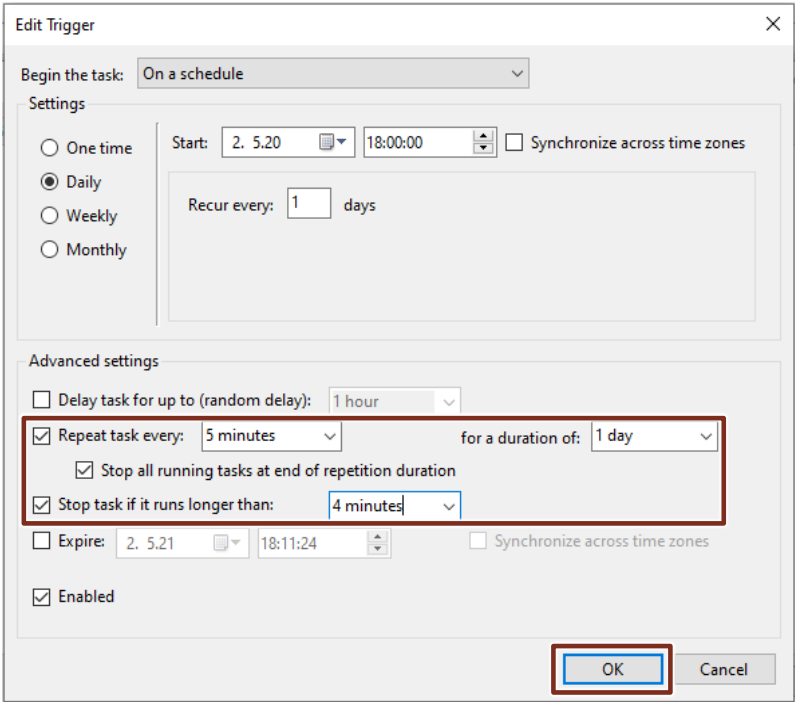
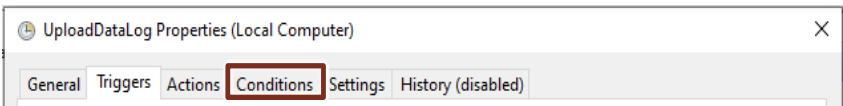
4 Commissioning the application example

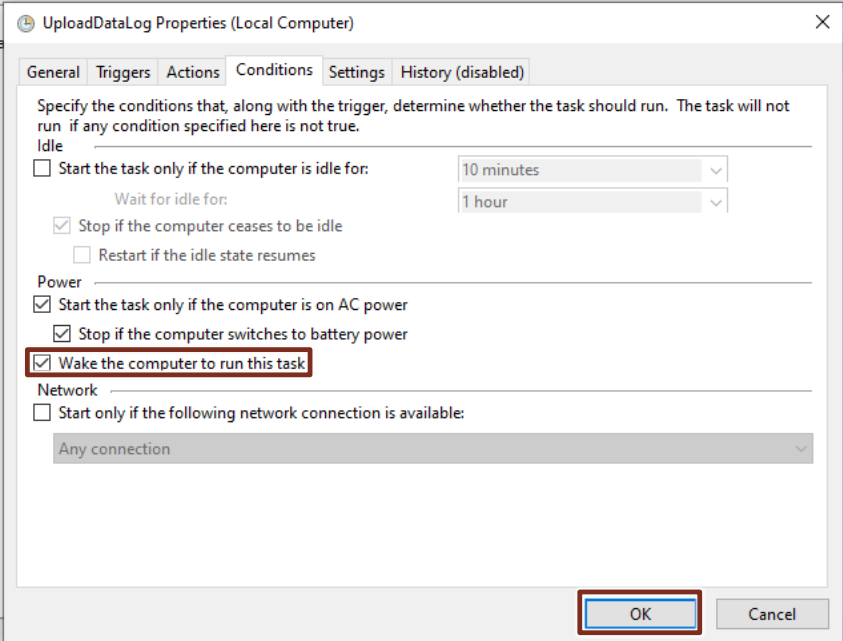
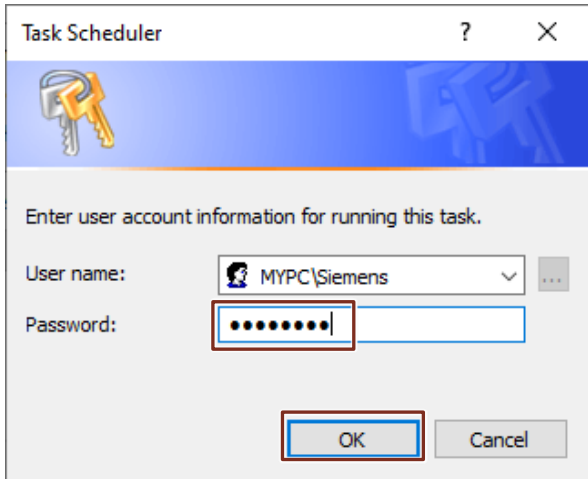
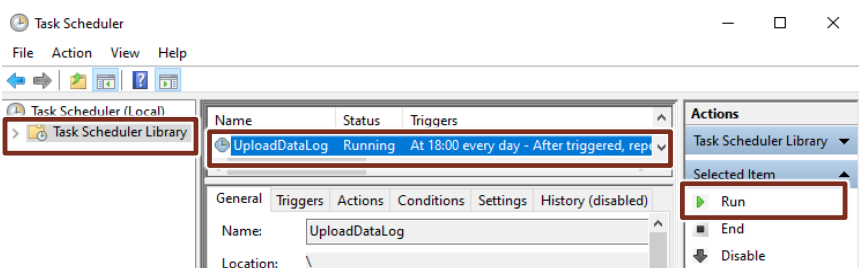
No.	Action
7.	<p>Enter the following entries in the "Start a program" settings window:</p> <ul style="list-style-type: none"> Program/script: <i>UploadDataLog.exe</i> Adding arguments (optional): <i>1 192.168.0.2 DataLog.csv c:\MyDataLogs read</i> Start in (optional): <i>c:\Program Files\Siemens\Automation\SimaticAutomationTool\bin\</i> <p>Click on "Next >".</p> 
8.	<ul style="list-style-type: none"> Activate the option <i>Open the Properties dialog for this task when I click Finish.</i> Click "Finish". 

4 Commissioning the application example

No.	Action
9.	<ul style="list-style-type: none"> In the "General" screen under "Security options", select the option "Run whether user is logged on or not". Select the "Run with highest privileges" option. Under "Configure for:" select "Windows 10" Switch to the "Triggers" screen. 
10.	<p>Select the created trigger entry and click on "Edit..."</p> 

4 Commissioning the application example

No.	Action
11.	<ul style="list-style-type: none"> • In "Advanced settings" activate the option "Repeat task every:" • Select "5 minutes" as the interval. • Select "for a duration of:" "1 day" • Check the option "Stop all running tasks at end of repetition duration". • Check "Stop task if it runs longer than:" • Select "4 minutes" as the time. • Accept the settings with "OK". 
12.	<p>Switch to the "Conditions" screen.</p> 

No.	Action
13.	<ul style="list-style-type: none"> Under "Power", select the option "Wake the computer to run this task". Finish setting the properties of the scheduled task by clicking "OK". 
14.	<p>Due to the security option "Run whether user is logged on or not" in step 9, you must enter the user account information assigned to perform this task and confirm with "OK".</p> 
15.	<p>You can check this function in the "Task Scheduler Library" view. The created tasks are listed here. Select the task "UploadDataLog" and press the action "Run" under "Selected Item".</p> 

The console application "UploadDataLog.exe" will now run every 5 minutes and loads the DataLog file "DataLog.csv" (3rd argument) via the network adapter "1" (1st argument) from the CPU's SIMATIC Memory Card with IP address "192.168.0.2" (2nd argument) and saves it in the folder "c:\MyDataLogs" (4th argument). The password for write-protected access to the CPU is "read" (5th argument).

4.3 Modifying the project

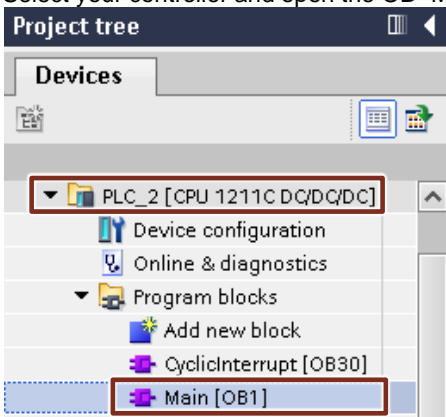
4.3.1 TMAIL_C

In order to send the email, the FB "TMAIL_C" needs the email address of the recipient and the access credentials to your email account, as well as the certificate of the email provider (sender).

The example project was tested with a Gmail (equivalent to a Google Mail) account.

The presets and certificate import have already been completed for this.

Table 4-3

No.	Action																																								
1.	<p>Select your controller and open the OB "Main" in STEP 7 (TIA Portal).</p> 																																								
2.	<p>Open the data structure "tmailAlarm" in the DB "Data".</p> <p>At the "toS" parameter, enter the email address of the recipient of the alarm email as a string.</p> <p>Example: <code>'receiver@siemens.de'</code></p> <p>Please note that a comma must be entered between addresses if there are more than one.</p> <table border="1"><thead><tr><th colspan="4">Data</th></tr><tr><th></th><th>Name</th><th>Data type</th><th>Start value</th></tr></thead><tbody><tr><td>1</td><td>Static</td><td></td><td></td></tr><tr><td>2</td><td>rdSysT</td><td>Struct</td><td></td></tr><tr><td>3</td><td>simulation</td><td>Struct</td><td></td></tr><tr><td>4</td><td>write</td><td>Bool</td><td>false</td></tr><tr><td>5</td><td>dataLogSameFile</td><td>Struct</td><td></td></tr><tr><td>6</td><td>tmailAlarm</td><td>Struct</td><td></td></tr><tr><td>7</td><td>enable</td><td>Bool</td><td>TRUE</td></tr><tr><td>8</td><td>toS</td><td>String[240]</td><td><code>'receiver@siemens.de'</code></td></tr></tbody></table> <p>Note: Of course, you can also enter the email address of the sender in order to receive the email generated by the FB "TMAIL_C" yourself.</p>	Data					Name	Data type	Start value	1	Static			2	rdSysT	Struct		3	simulation	Struct		4	write	Bool	false	5	dataLogSameFile	Struct		6	tmailAlarm	Struct		7	enable	Bool	TRUE	8	toS	String[240]	<code>'receiver@siemens.de'</code>
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4 Commissioning the application example

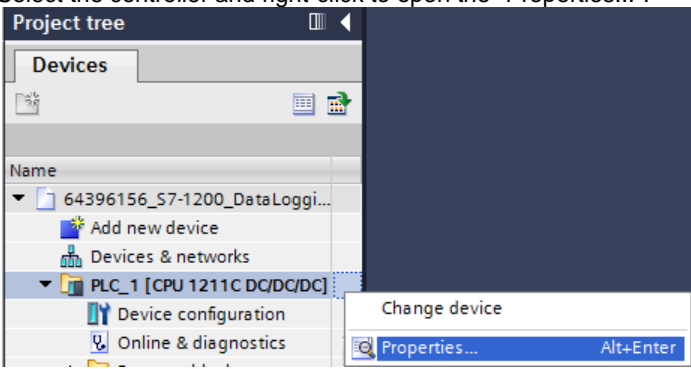
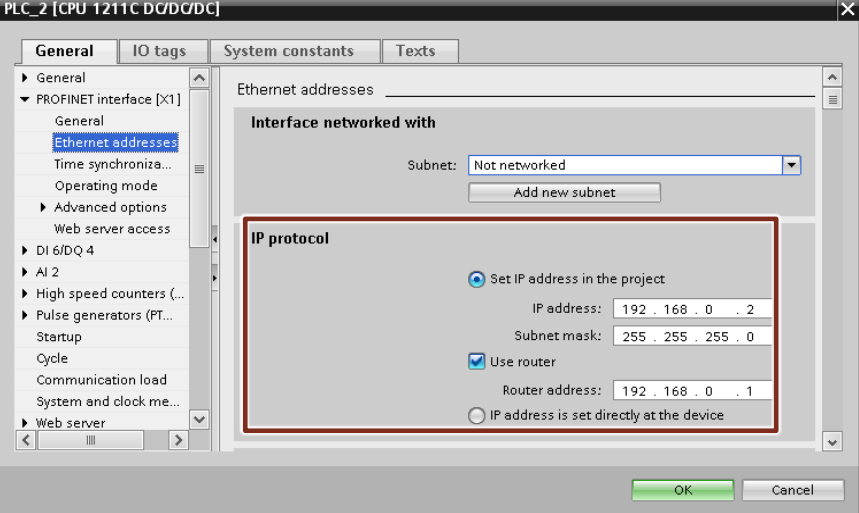
No.	Action																																																																																																								
3.	<p>Open the data structure "tmailcAlarm > mailAddrParam" in the DB "Data".</p> <p>Enter the access credentials for your email account as starting value:</p> <p>Sending of emails has been tested with a Gmail/Google Mail account. The data structure "mailAddrParam" contains the presets for this.</p> <p>You must enter the following starting values if you have a Gmail or Google Mail account:</p> <ul style="list-style-type: none">At the "UserName" parameter, enter the access name of the email account as a string. e.g.: 'sender@googlemail.com'At the "PassWord" parameter, enter the password of the email account as a string. e.g.: 'Password' <p>Enter the following parameters under "From":</p> <ul style="list-style-type: none">"LocalPartPlusAtSign" - the local part of the sender email account address including the @ character e.g.: 'sender@'"FullQualifiedDomainName" - the name of the email account domain name e.g.: 'googlemail.com' <table><thead><tr><th colspan="4">Data</th></tr><tr><th></th><th>Name</th><th>Data type</th><th>Start value</th></tr></thead><tbody><tr><td>1</td><td>Static</td><td></td><td></td></tr><tr><td>2</td><td>rdSysT</td><td>Struct</td><td></td></tr><tr><td>3</td><td>simulation</td><td>Struct</td><td></td></tr><tr><td>4</td><td>write</td><td>Bool</td><td>false</td></tr><tr><td>5</td><td>dataLogSameFile</td><td>Struct</td><td></td></tr><tr><td>6</td><td>tmailcAlarm</td><td>Struct</td><td></td></tr><tr><td>7</td><td>enable</td><td>Bool</td><td>TRUE</td></tr><tr><td>8</td><td>toS</td><td>String[240]</td><td>'receiver@siemens.de'</td></tr><tr><td>9</td><td>mailAddrParam</td><td>TMail_QDN_SEC</td><td></td></tr><tr><td>10</td><td>InterfaceId</td><td>HW_ANY</td><td>64</td></tr><tr><td>11</td><td>ID</td><td>CONN_OUC</td><td>1</td></tr><tr><td>12</td><td>ConnectionType</td><td>Byte</td><td>16#22</td></tr><tr><td>13</td><td>ActiveEstablished</td><td>Bool</td><td>true</td></tr><tr><td>14</td><td>WatchDogTime</td><td>Time</td><td>T#60s</td></tr><tr><td>15</td><td>MailServerQDN</td><td>String[254]</td><td>'smtp.gmail.com.'</td></tr><tr><td>16</td><td>UserName</td><td>String[254]</td><td>'sender@googlemail.com'</td></tr><tr><td>17</td><td>PassWord</td><td>String[254]</td><td>'Password'</td></tr><tr><td>18</td><td>From</td><td>EMAIL_ADDR</td><td></td></tr><tr><td>19</td><td>LocalPartPlusAtSign</td><td>String[64]</td><td>'sender@'</td></tr><tr><td>20</td><td>FullQualifiedDomainName</td><td>String[254]</td><td>'googlemail.com'</td></tr><tr><td>21</td><td>RemotePort</td><td>UInt</td><td>587</td></tr><tr><td>22</td><td>ActivateSecureConn</td><td>Bool</td><td>true</td></tr><tr><td>23</td><td>ExtTLSCapabilities</td><td>Byte</td><td>16#0</td></tr><tr><td>24</td><td>TLSServerCertRef</td><td>UDInt</td><td>43</td></tr></tbody></table> <p>Note: If the email provider is different, you will also need the following data:</p> <ul style="list-style-type: none">FQDN (Fully Qualified Domain Name) of the email server, "MailServerQDN" (line 15)TCP port of the email server, "RemotePort" (line 21)Reference to the previously imported X.509 V3 (CA) certificate of the email server "TLSServerCertRef" (line 24) <p>Additional information on downloading and importing the necessary certificates can be found in chapter 2.2 of the application example "Sending Emails to SMTP Servers with an S7 CPU" 17.</p>	Data					Name	Data type	Start value	1	Static			2	rdSysT	Struct		3	simulation	Struct		4	write	Bool	false	5	dataLogSameFile	Struct		6	tmailcAlarm	Struct		7	enable	Bool	TRUE	8	toS	String[240]	'receiver@siemens.de'	9	mailAddrParam	TMail_QDN_SEC		10	InterfaceId	HW_ANY	64	11	ID	CONN_OUC	1	12	ConnectionType	Byte	16#22	13	ActiveEstablished	Bool	true	14	WatchDogTime	Time	T#60s	15	MailServerQDN	String[254]	'smtp.gmail.com.'	16	UserName	String[254]	'sender@googlemail.com'	17	PassWord	String[254]	'Password'	18	From	EMAIL_ADDR		19	LocalPartPlusAtSign	String[64]	'sender@'	20	FullQualifiedDomainName	String[254]	'googlemail.com'	21	RemotePort	UInt	587	22	ActivateSecureConn	Bool	true	23	ExtTLSCapabilities	Byte	16#0	24	TLSServerCertRef	UDInt	43
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16	UserName	String[254]	'sender@googlemail.com'																																																																																																						
17	PassWord	String[254]	'Password'																																																																																																						
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24	TLSServerCertRef	UDInt	43																																																																																																						
4.	Repeat steps 2 and 3 in the data structure "tmailcCsvTransfer" in the DB "Data" for the DataLog transfer.																																																																																																								

No.	Action
5.	<p>Make the necessary settings in your Gmail or Google Mail account:</p> <ul style="list-style-type: none"> • Enable IMAP • Access through less secure apps <p>A detailed description of this topic can be found in chapter 2.2.2 of the application example "Sending Emails to SMTP Servers with an S7 CPU" (17).</p>

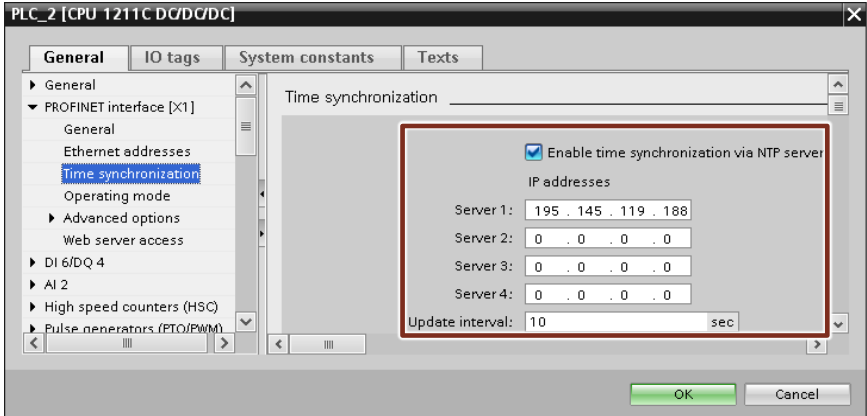
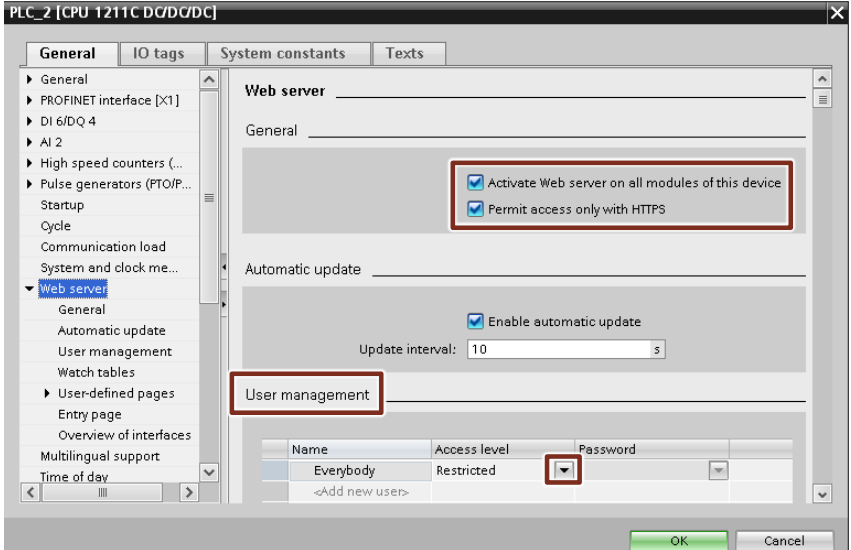
4.3.2 CPU properties

The CPU Ethernet address and time of day properties must be individually customized. In addition, the web server must be enabled so that the DataLog files can be loaded via remote access.


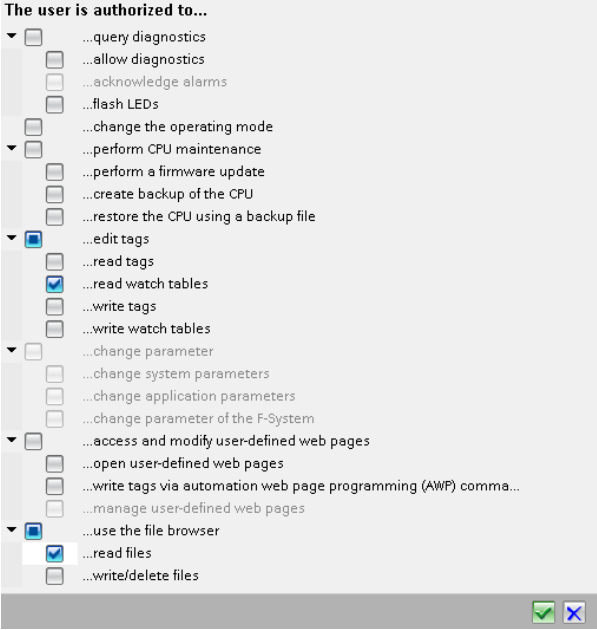

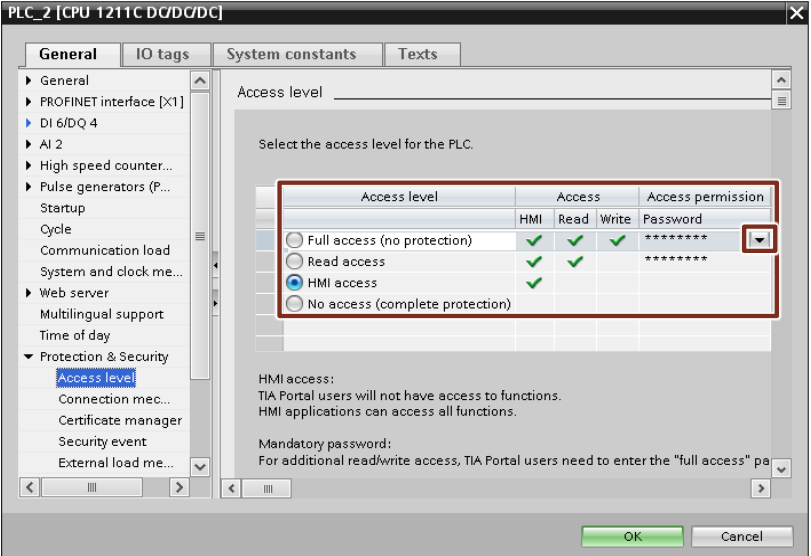
Table 4-4

No.	Action
1.	<p>Select the controller and right-click to open the "Properties..."</p> 
2.	<ul style="list-style-type: none"> • Under "PROFINET interface > Ethernet addresses > IP protocol", enable the option "Use router". • Enter the IP address of your VPN-capable router (on the controller side). • Adjust the IP address and the subnet mask to match your router network. 


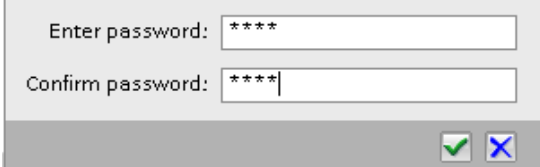
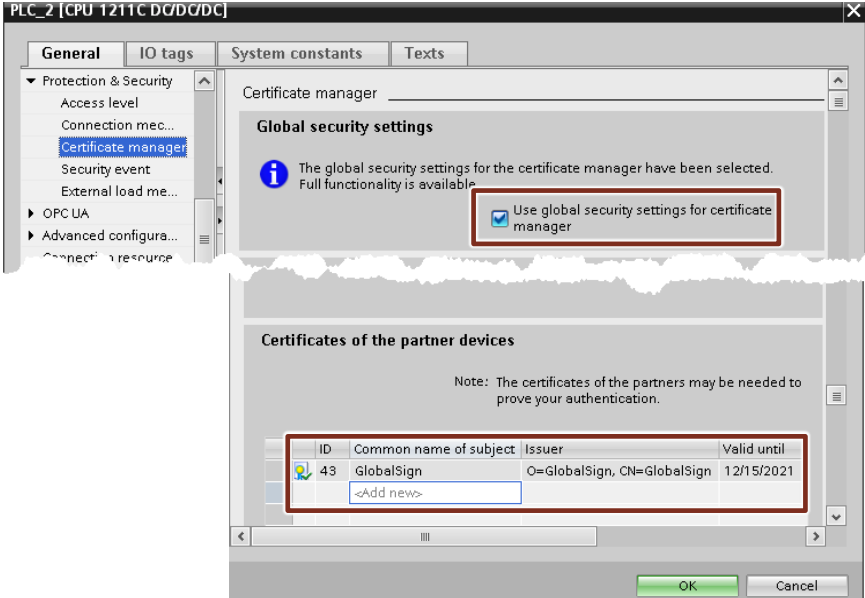
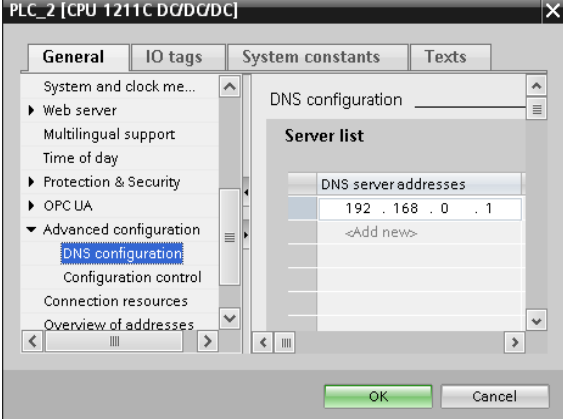
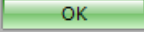
4 Commissioning the application example

No.	Action
3.	<ul style="list-style-type: none"> Under "PROFINET interface > Time synchronization", select the option "Enable time synchronization via NTP server". Enter at least one IP address of your reachable NTP server. <p>Note: NTP requires that port 123 be enabled for the UDP networking protocol.</p> <p>The IP address of the Deutsche Telekom AG, Darmstadt NTP server "ntp1.sda" is already filled in this project.</p> <p>The correct CPU system time is required for certificate comparison.</p> 
4.	<ul style="list-style-type: none"> Activate the web server. Activate the option "Allow access only via HTTPS". Under "User management", open the settings for the access level of the user "Everyone" with the ▾ button. <p>The "Everyone" user does not need a password for web server access. If you wish to secure access with a password, you must "<Add new user>", assign a password and make the following settings for the access level.</p> 

4 Commissioning the application example

No.	Action
5.	<p>Enable the settings: "The user is authorized to..."</p> <ul style="list-style-type: none"> ...read watch tables ...read files <p>Apply the settings with the  button.</p> 
6.	<p>One function of the preconfigured password protection is to prevent unauthorized persons from reading sensitive access data to the email account over an online connection.</p> <ul style="list-style-type: none"> Open "Access level" under "Protection & Security". Enable the access level "HMI access". Select the access level "Full access (no protection)". Open the password assignment with the  button. 

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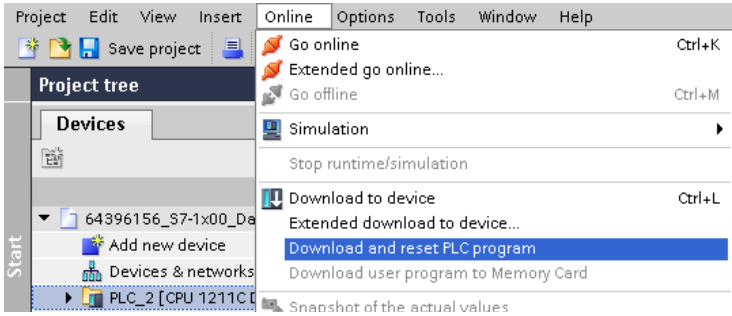
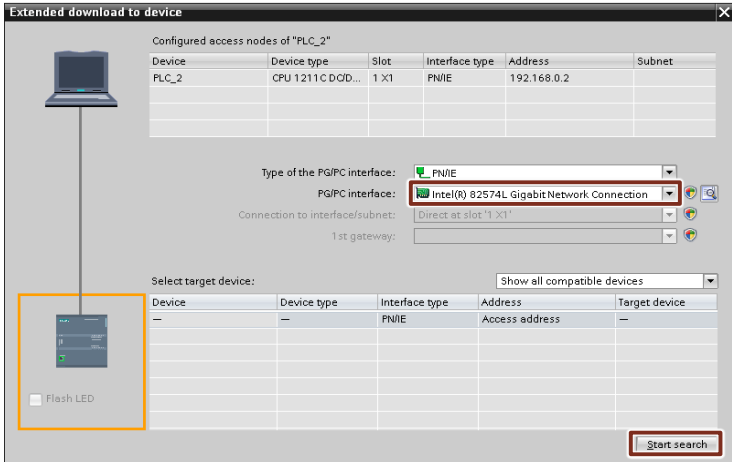
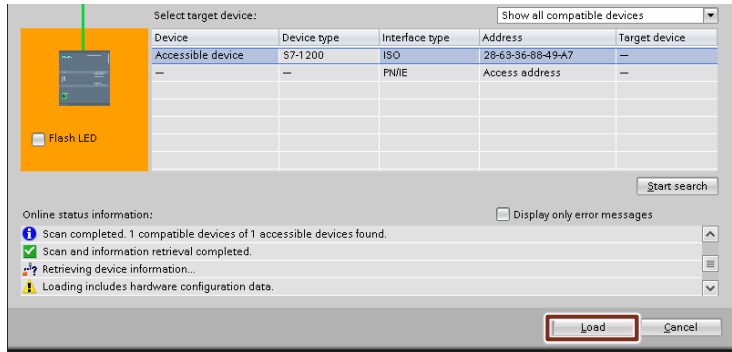
No.	Action
7.	<ul style="list-style-type: none"> Enter the password "full", confirm it and apply the settings with the  button. Repeat steps 6 and 7 for the access level "Read access" with the password "read". 
8.	<ul style="list-style-type: none"> Open the "Certificate manager" under "Protection & Security". Enable the function "Use global security settings for certificate manager". Scroll down to "Certificates of the partner devices". Here you can find the certificate of the email server that is being used (see Table 4-3, no. 3, row 24).  <p>You can use "Add new" for other previously imported certificates (see 17 chapter 2.2).</p>
9.	<ul style="list-style-type: none"> Under "Advanced configuration", open "DNS configuration". Enter the DNS server address (see Figure 4-1). 
10.	Click the  button to apply the CPU properties.

4.3.3 Downloading the project

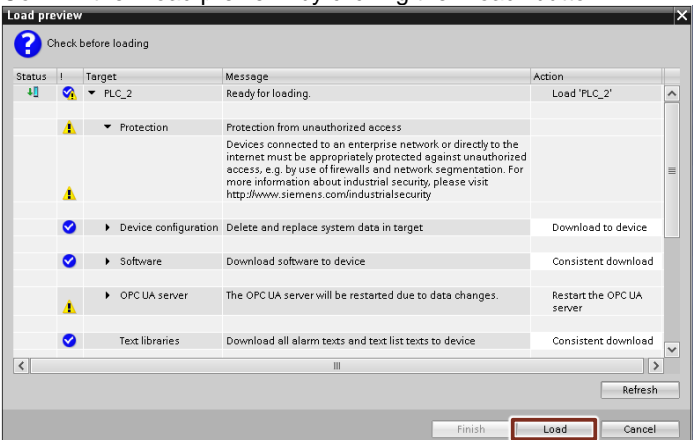
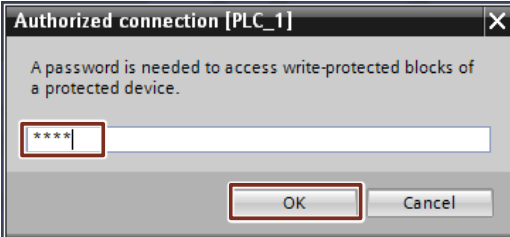
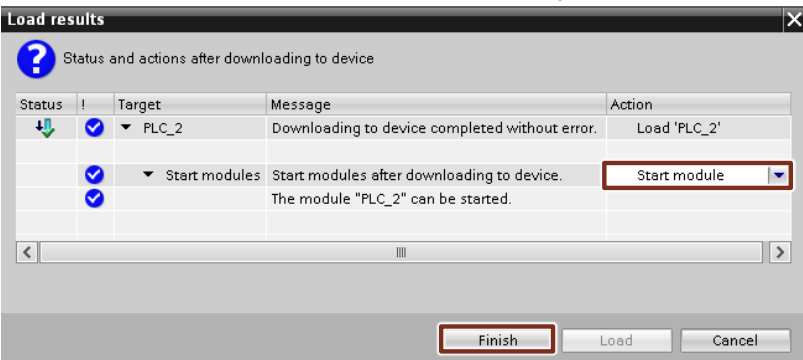
Before remotely accessing the S7-1x00, the CPU interface must be parameterized according to specification (see [Figure 4-1](#)).

To do this, load the project to the CPU via direct connection on site, as described below:

Table 4-5

No.	Action
1.	<ul style="list-style-type: none"> Save the project. Select the program folder of the S7-1x00 and transfer the program to the controller with "Online > Download and reset PLC program". 
2.	<ul style="list-style-type: none"> Select "PN/IE" as the type of PG/PC interface. Select your LAN card as PG/PC interface. Select "Show all compatible devices". Start the search with the Start search button. 
3.	<ul style="list-style-type: none"> Select your CPU from the list of target devices. Press the "Load" button. 

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No.	Action
4.	<p>Confirm the "Load preview" by clicking the "Load" button.</p> 
5.	<ul style="list-style-type: none"> You may need to enter the password "full" for full access. Confirm the entry with "OK". 
6.	<ul style="list-style-type: none"> Activate the option "Start module" in "Load results". Press the "Finish" button to complete the loading process. 

Note

Data logs are stored persistently ("non-volatile") in the load memory of the controller, thus making them secured against power failure and program changes.

You can delete the data logs as follows:

- With the "DataLogDelete" instruction (as in FB "DataLog1x00")
- Via the enabled function in the web server
- With the SIMATIC Automation Tool
- Via direct access to the SIMATIC Memory Card using a card reader
- Through online access to the SIMATIC Memory Card via TIA Portal:
Format the SIMATIC Memory Card and/or reset CPU to factory settings

4.3.4 Changing the recorded data

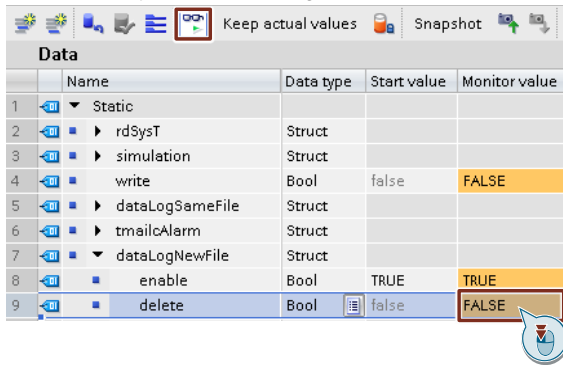
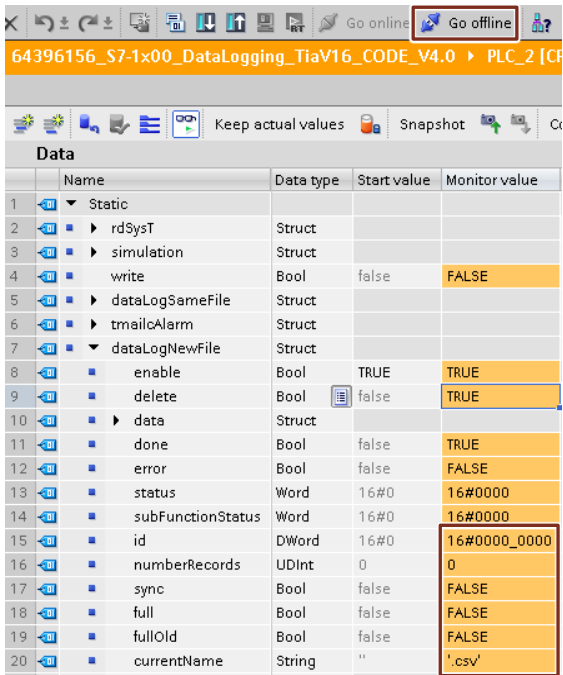
If you modify the recorded data ("data") of the FB "DataLog1x00", they will only be transferred to the CSV file after the data log file has successfully been generated again with "DataLogCreate".

If you leave the name of the data log ("name") unchanged, the FB "DataLog1x00" will try to write to the existing data log with the original data structure.

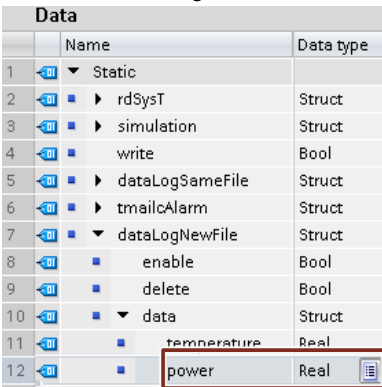
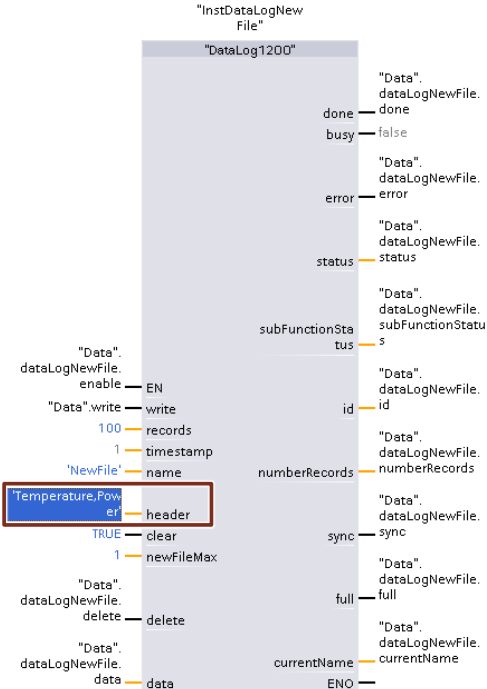
You can successfully re-generate the data log file by deleting the existing data log(s) with the "delete" input.

Proceed as follows to do this:

Table 4-6

No.	Action
1.	<ul style="list-style-type: none"> Open the data block "Data". Press the "Monitor all" button. Change the tag "delete" (here shown with the example "dataLogNewFile") to TRUE by double-clicking. 
2.	<p>The data logs ("NewFile" and "NewFile_1") are now deleted. You can also check this using the web server: https://192.168.0.2/Portal/Portal.mwsl?PriNav=DataLogs</p> <ul style="list-style-type: none"> Press "Go offline". 

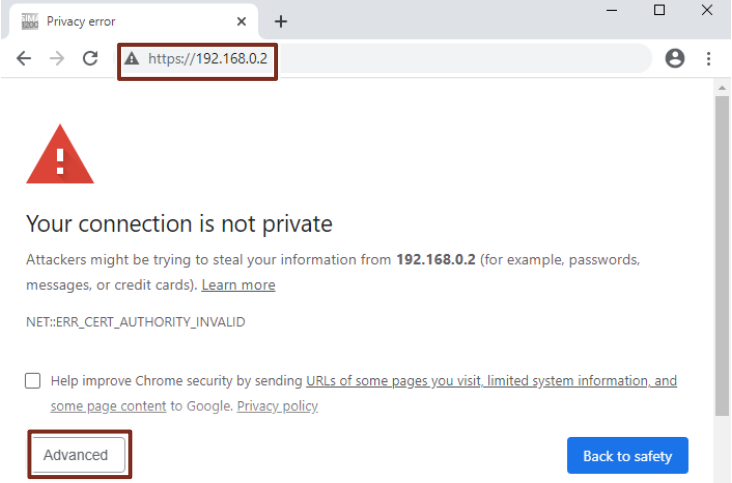
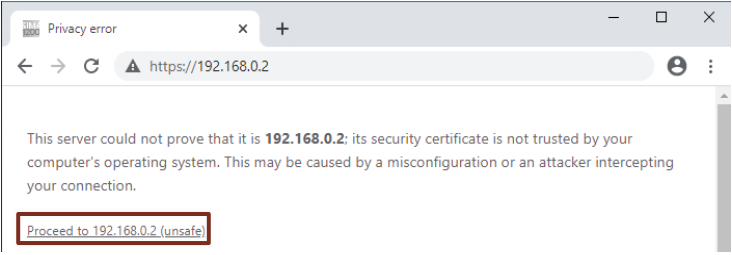
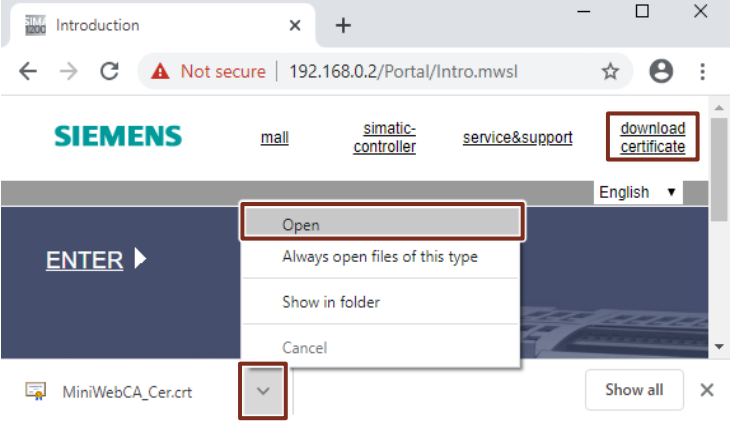
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No.	Action
3.	<ul style="list-style-type: none"> Open the structure "dataLogNewFile". Add a new tag to the "data" structure, for example. 
4.	<ul style="list-style-type: none"> Open OB1 "Main". Open Network 7 by calling the FB "DataLog1x00" with the instance DB "InstDataLogNewFile". Change the "HEADER" according to the modified recorded data. <p>Note: The new tags to be recorded must have their values generated before the FB "DataLog1x00" is called.</p> <p>Network 7: writing data log (create/open and write in new file when the maximum of records is reached)</p> 
5.	<ul style="list-style-type: none"> Then download the modified project to the CPU (see chapter 4.3.3). <p>The modified data log will be re-generated at a positive edge at the "write" input ("Data".write).</p>

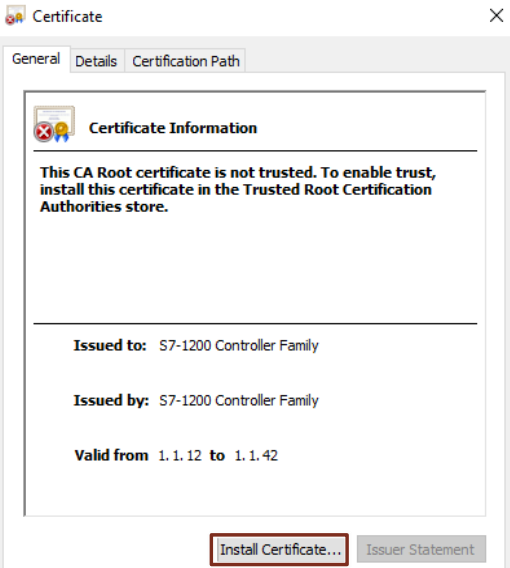
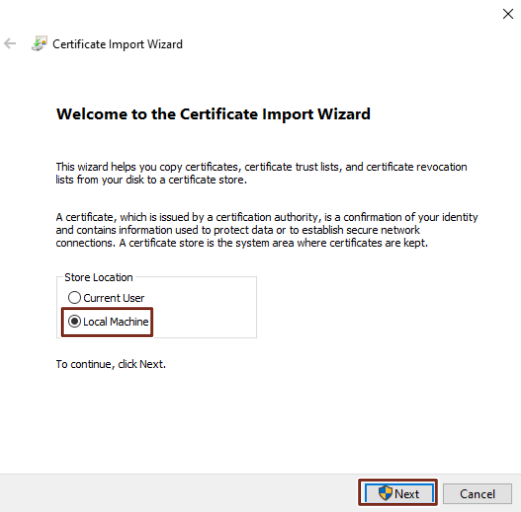

4.4 Internet browser settings (Google Chrome)

For secure access to the web server, the certificate of your S7-1x00 CPU must be installed on the remote service PC as follows:

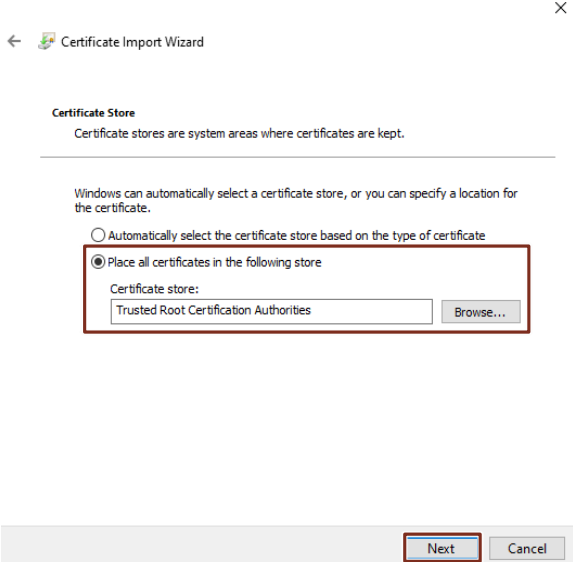
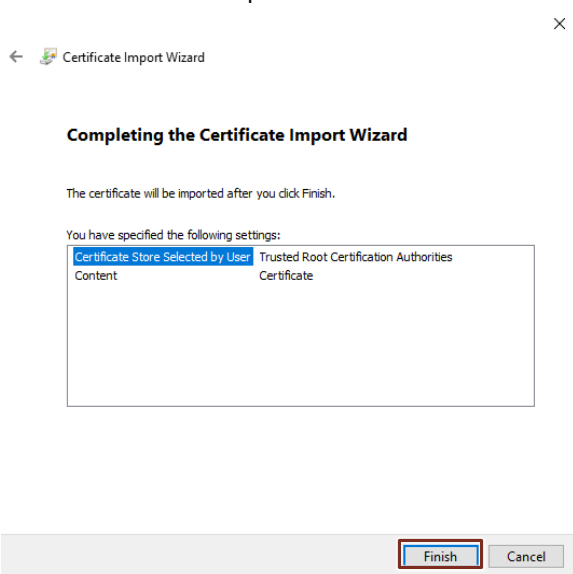
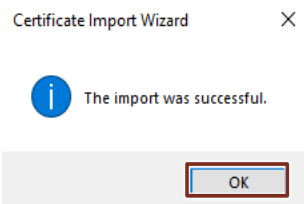
Table 4-7

No.	Action
1.	<ul style="list-style-type: none"> Start Google Chrome. Enter the secured connection to the CPU's web server: here: https://192.168.0.2 <p>If a "Your connection is not private" message appears, click "Advanced".</p> 
2.	<p>The "advanced information" will be displayed.</p> <ul style="list-style-type: none"> Click "Proceed to 192.168.0.x (unsafe)". 
3.	<p>The intro for the web server will be shown.</p> <ul style="list-style-type: none"> Click "download certificate". <p>The certificate "MiniWebCA_Cer.crt" will be downloaded.</p> <ul style="list-style-type: none"> Open the dialog and click "Open". 

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No.	Action
4.	<p>The certificate is shown.</p> <ul style="list-style-type: none"> Click the "Install certificate..." to start the Certificate Import Wizard. 
5.	<ul style="list-style-type: none"> Select "Local Machine" as save location and press "Next" to proceed. 
6.	<ul style="list-style-type: none"> Approve the changes with "Yes". 

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No.	Action
7.	<ul style="list-style-type: none"> • Select "Place all certificates in the following store". • Click the "Browse" button. • Select "Trusted Root Certification Authorities" as certificate store. • Click "OK" to confirm your selection, then press "Next". 
8.	<ul style="list-style-type: none"> • Click "Finish" to import the certificate. 
9.	<ul style="list-style-type: none"> • Click "OK" to close all windows once the certificate has successfully imported.  <p>You must then restart Google Chrome so that the certificate will be recognized when the web server is retrieved.</p>

5 Operating the application example

5.1 Overview

The functions of the application example are divided between

- Remote maintenance
- Manual download of the DataLog file
- Automatic download of the DataLog file
- Alarm generation by sending an email
- Data log sending as email attachment

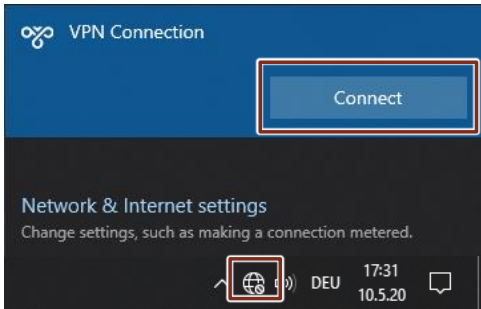
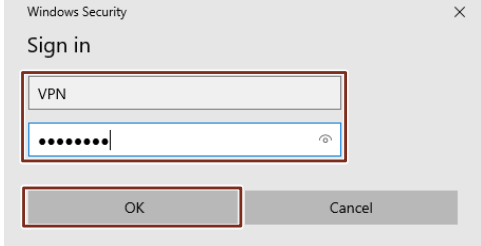
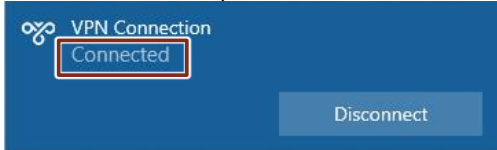
5.2 Remote maintenance

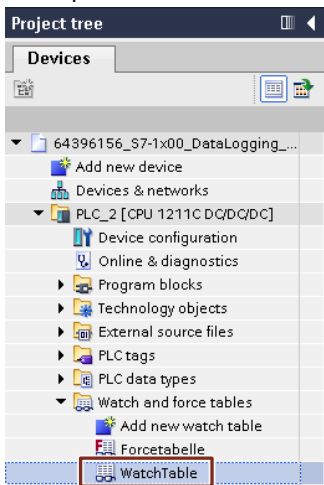
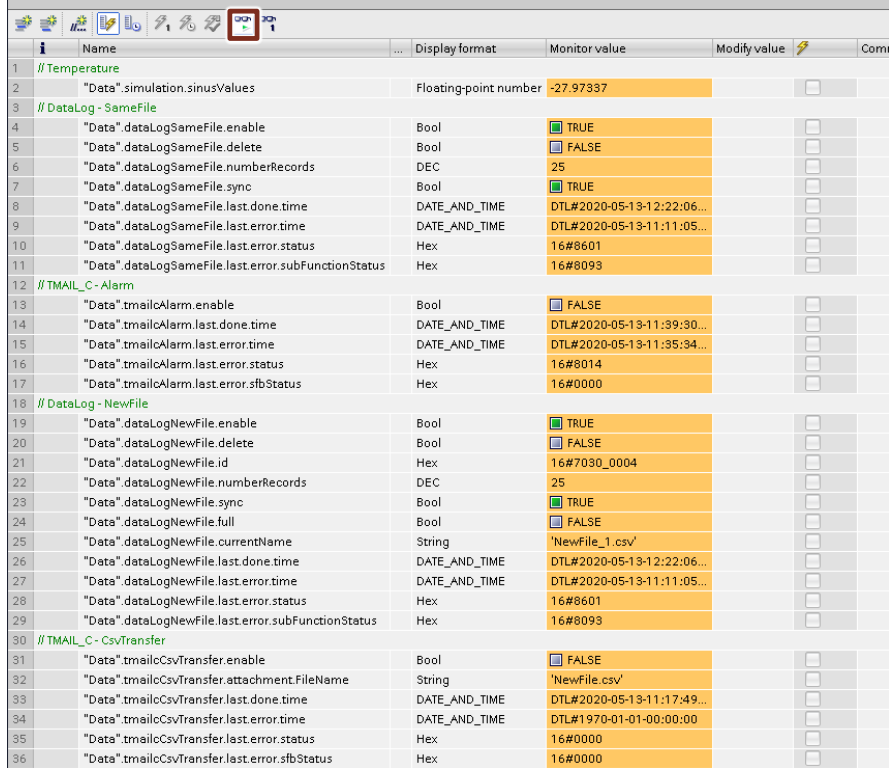
The VPN tunnel from the PC service must be established in order to gain access to the controller.

Therefore, you can communicate with the controller exactly as you would with a direct LAN connection via STEP 7 (requirement: project available).

The example of an online connection via the watch table demonstrates access to the CPU via STEP 7.

Table 5-1

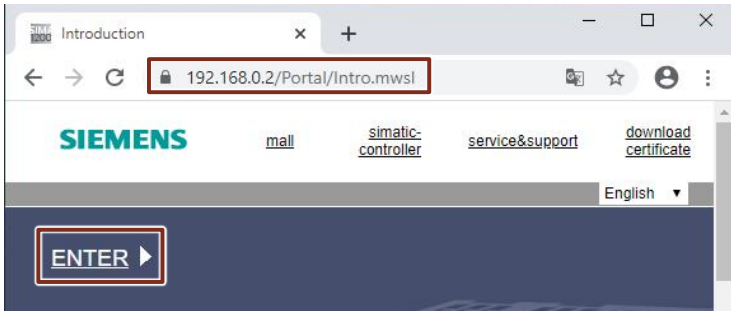
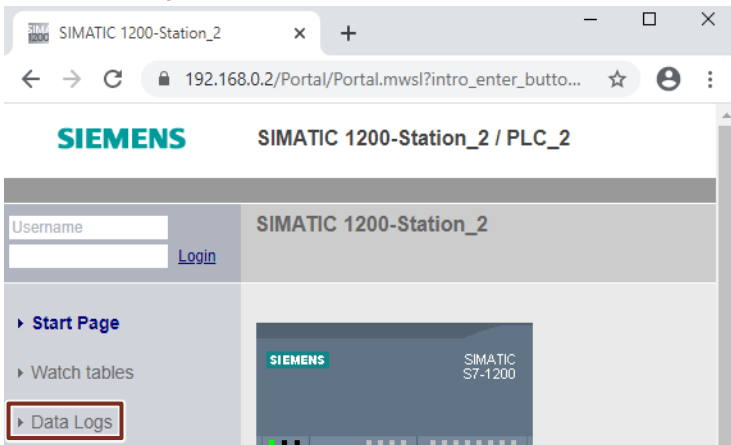
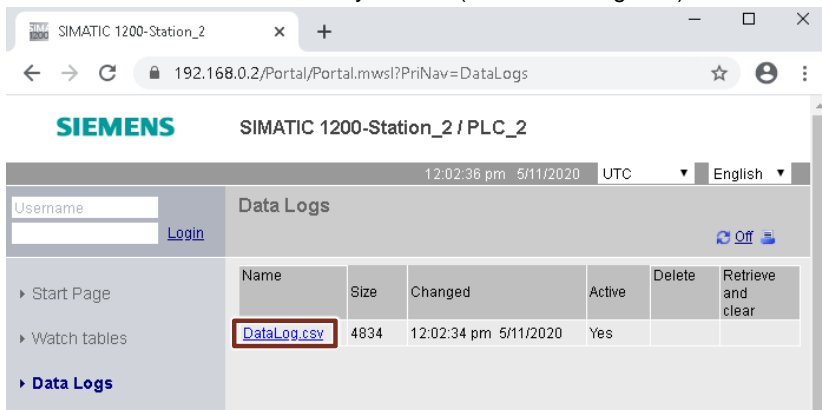
No.	Action
1.	Establish the VPN connection. 
2.	Enter your connection data and establish the connection. 
3.	The connection setup is shown. 

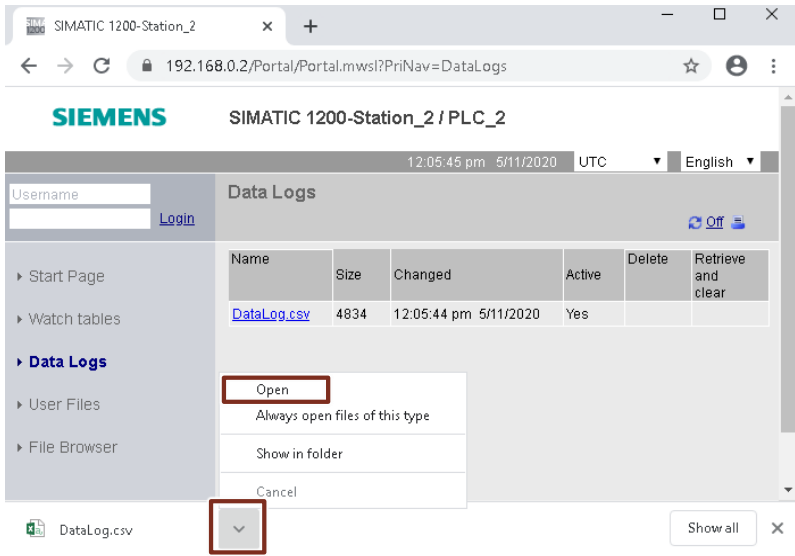
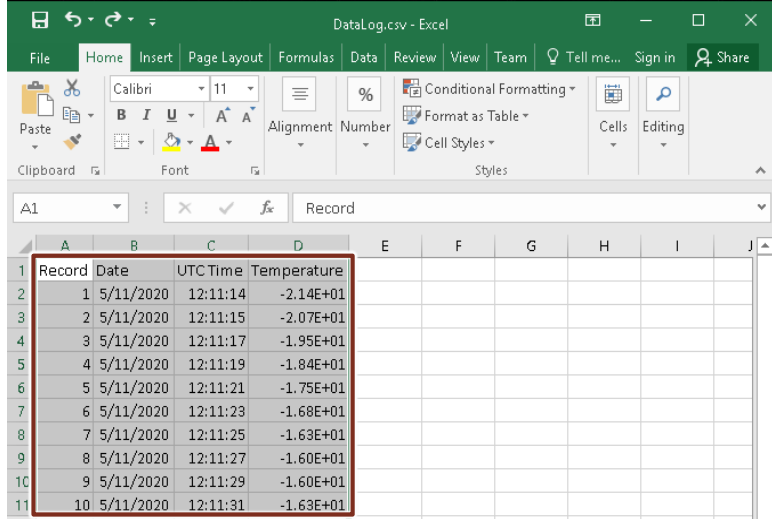
No.	Action																																																																																																																																																																																									
4.	<ul style="list-style-type: none">Open the watch table "WatchTable" in STEP 7 (TIA Portal). <div></div>																																																																																																																																																																																									
5.	<ul style="list-style-type: none">Click the "Monitor all" button. <p>The watch table "WatchTable" shows the most important supply parameters of the application example:</p> <ul style="list-style-type: none">Temperature display ("//Temperature")FB "DataLog1x00" with IDB "InstDataLogSameFile" ("// DataLog - SameFile")FB "TMAIL_C" with IDB "InstTmailcAlarm" ("// TMAIL_C - Alarm")FB "DataLog1x00" with IDB "InstDataLogNewFile" ("// DataLog - NewFile")FB "TMAIL_C" with IDB "InstTmailcCsvTransfer" ("// TMAIL_C - CsvTransfer") <div><div>64396156_S7-1x00_DataLogging_TiaV16_CODE_V4.0 > PLC_2 [CPU 1211C DC/DC/DC] > Watch and force tables > WatchTable</div><div></div><table><thead><tr><th>Name</th><th>Display format</th><th>Monitor value</th><th>Modify value</th><th>Comment</th></tr></thead><tbody><tr><td colspan="5">// Temperature</td></tr><tr><td>"Data".simulation.sinusValues</td><td>Floating-point number</td><td>-27.97337</td><td></td><td></td></tr><tr><td colspan="5">// DataLog - SameFile</td></tr><tr><td>"Data".dataLogSameFile.enable</td><td>Bool</td><td>TRUE</td><td></td><td></td></tr><tr><td>"Data".dataLogSameFile.delete</td><td>Bool</td><td>FALSE</td><td></td><td></td></tr><tr><td>"Data".dataLogSameFile.numberRecords</td><td>DEC</td><td>25</td><td></td><td></td></tr><tr><td>"Data".dataLogSameFile.sync</td><td>Bool</td><td>TRUE</td><td></td><td></td></tr><tr><td>"Data".dataLogSameFile.last.done.time</td><td>DATE_AND_TIME</td><td>DTL#2020-05-13-12:22:06...</td><td></td><td></td></tr><tr><td>"Data".dataLogSameFile.last.error.time</td><td>DATE_AND_TIME</td><td>DTL#2020-05-13-11:11:05...</td><td></td><td></td></tr><tr><td>"Data".dataLogSameFile.last.error.status</td><td>Hex</td><td>16#8601</td><td></td><td></td></tr><tr><td>"Data".dataLogSameFile.last.error.subFunctionStatus</td><td>Hex</td><td>16#8093</td><td></td><td></td></tr><tr><td colspan="5">// TMAIL_C - Alarm</td></tr><tr><td>"Data".tmailcAlarm.enable</td><td>Bool</td><td>FALSE</td><td></td><td></td></tr><tr><td>"Data".tmailcAlarm.last.done.time</td><td>DATE_AND_TIME</td><td>DTL#2020-05-13-11:39:30...</td><td></td><td></td></tr><tr><td>"Data".tmailcAlarm.last.error.time</td><td>DATE_AND_TIME</td><td>DTL#2020-05-13-11:35:34...</td><td></td><td></td></tr><tr><td>"Data".tmailcAlarm.last.error.status</td><td>Hex</td><td>16#8014</td><td></td><td></td></tr><tr><td>"Data".tmailcAlarm.last.error.sfbStatus</td><td>Hex</td><td>16#0000</td><td></td><td></td></tr><tr><td colspan="5">// DataLog - NewFile</td></tr><tr><td>"Data".dataLogNewFile.enable</td><td>Bool</td><td>TRUE</td><td></td><td></td></tr><tr><td>"Data".dataLogNewFile.delete</td><td>Bool</td><td>FALSE</td><td></td><td></td></tr><tr><td>"Data".dataLogNewFile.id</td><td>Hex</td><td>16#7030_0004</td><td></td><td></td></tr><tr><td>"Data".dataLogNewFile.numberRecords</td><td>DEC</td><td>25</td><td></td><td></td></tr><tr><td>"Data".dataLogNewFile.sync</td><td>Bool</td><td>TRUE</td><td></td><td></td></tr><tr><td>"Data".dataLogNewFile.full</td><td>Bool</td><td>FALSE</td><td></td><td></td></tr><tr><td>"Data".dataLogNewFile.currentName</td><td>String</td><td>'NewFile_1.csv'</td><td></td><td></td></tr><tr><td>"Data".dataLogNewFile.last.done.time</td><td>DATE_AND_TIME</td><td>DTL#2020-05-13-12:22:06...</td><td></td><td></td></tr><tr><td>"Data".dataLogNewFile.last.error.time</td><td>DATE_AND_TIME</td><td>DTL#2020-05-13-11:11:05...</td><td></td><td></td></tr><tr><td>"Data".dataLogNewFile.last.error.status</td><td>Hex</td><td>16#8601</td><td></td><td></td></tr><tr><td>"Data".dataLogNewFile.last.error.subFunctionStatus</td><td>Hex</td><td>16#8093</td><td></td><td></td></tr><tr><td colspan="5">// TMAIL_C - CsvTransfer</td></tr><tr><td>"Data".tmailcCsvTransfer.enable</td><td>Bool</td><td>FALSE</td><td></td><td></td></tr><tr><td>"Data".tmailcCsvTransfer.attachment.FileName</td><td>String</td><td>'NewFile.csv'</td><td></td><td></td></tr><tr><td>"Data".tmailcCsvTransfer.last.done.time</td><td>DATE_AND_TIME</td><td>DTL#2020-05-13-11:17:49...</td><td></td><td></td></tr><tr><td>"Data".tmailcCsvTransfer.last.error.time</td><td>DATE_AND_TIME</td><td>DTL#1970-01-01-00:00:00</td><td></td><td></td></tr><tr><td>"Data".tmailcCsvTransfer.last.error.status</td><td>Hex</td><td>16#0000</td><td></td><td></td></tr><tr><td>"Data".tmailcCsvTransfer.last.error.sfbStatus</td><td>Hex</td><td>16#0000</td><td></td><td></td></tr></tbody></table></div>	Name	Display format	Monitor value	Modify value	Comment	// Temperature					"Data".simulation.sinusValues	Floating-point number	-27.97337			// DataLog - SameFile					"Data".dataLogSameFile.enable	Bool	TRUE			"Data".dataLogSameFile.delete	Bool	FALSE			"Data".dataLogSameFile.numberRecords	DEC	25			"Data".dataLogSameFile.sync	Bool	TRUE			"Data".dataLogSameFile.last.done.time	DATE_AND_TIME	DTL#2020-05-13-12:22:06...			"Data".dataLogSameFile.last.error.time	DATE_AND_TIME	DTL#2020-05-13-11:11:05...			"Data".dataLogSameFile.last.error.status	Hex	16#8601			"Data".dataLogSameFile.last.error.subFunctionStatus	Hex	16#8093			// TMAIL_C - Alarm					"Data".tmailcAlarm.enable	Bool	FALSE			"Data".tmailcAlarm.last.done.time	DATE_AND_TIME	DTL#2020-05-13-11:39:30...			"Data".tmailcAlarm.last.error.time	DATE_AND_TIME	DTL#2020-05-13-11:35:34...			"Data".tmailcAlarm.last.error.status	Hex	16#8014			"Data".tmailcAlarm.last.error.sfbStatus	Hex	16#0000			// DataLog - NewFile					"Data".dataLogNewFile.enable	Bool	TRUE			"Data".dataLogNewFile.delete	Bool	FALSE			"Data".dataLogNewFile.id	Hex	16#7030_0004			"Data".dataLogNewFile.numberRecords	DEC	25			"Data".dataLogNewFile.sync	Bool	TRUE			"Data".dataLogNewFile.full	Bool	FALSE			"Data".dataLogNewFile.currentName	String	'NewFile_1.csv'			"Data".dataLogNewFile.last.done.time	DATE_AND_TIME	DTL#2020-05-13-12:22:06...			"Data".dataLogNewFile.last.error.time	DATE_AND_TIME	DTL#2020-05-13-11:11:05...			"Data".dataLogNewFile.last.error.status	Hex	16#8601			"Data".dataLogNewFile.last.error.subFunctionStatus	Hex	16#8093			// TMAIL_C - CsvTransfer					"Data".tmailcCsvTransfer.enable	Bool	FALSE			"Data".tmailcCsvTransfer.attachment.FileName	String	'NewFile.csv'			"Data".tmailcCsvTransfer.last.done.time	DATE_AND_TIME	DTL#2020-05-13-11:17:49...			"Data".tmailcCsvTransfer.last.error.time	DATE_AND_TIME	DTL#1970-01-01-00:00:00			"Data".tmailcCsvTransfer.last.error.status	Hex	16#0000			"Data".tmailcCsvTransfer.last.error.sfbStatus	Hex	16#0000		
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"Data".dataLogNewFile.currentName	String	'NewFile_1.csv'																																																																																																																																																																																								
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"Data".tmailcCsvTransfer.enable	Bool	FALSE																																																																																																																																																																																								
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"Data".tmailcCsvTransfer.last.error.sfbStatus	Hex	16#0000																																																																																																																																																																																								

5.3 Manual upload of the DataLog file

Manual uploading of the DataLog file through Google Chrome from the service PC will be demonstrated.

Table 5-2

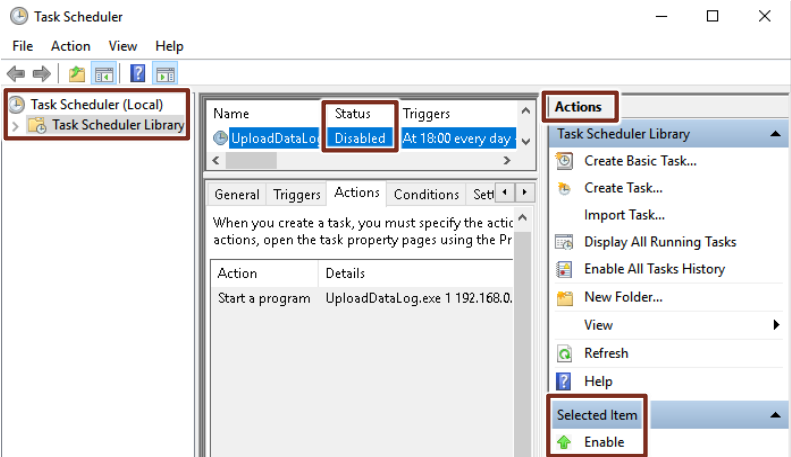
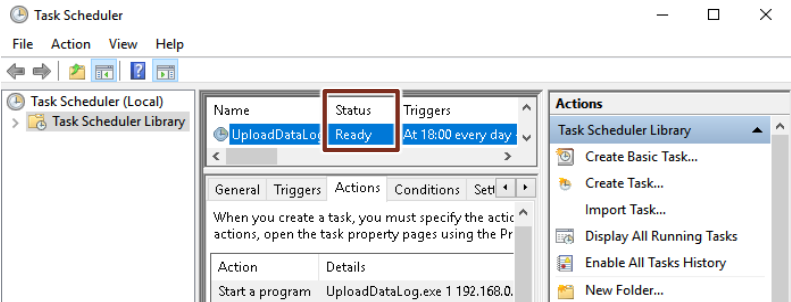
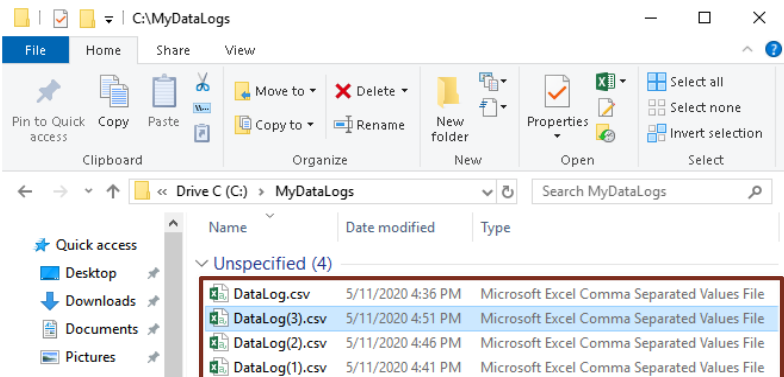
No.	Action
1.	<div><ul style="list-style-type: none">Start Internet Explorer.For the address, enter the IP address of the CPU: here: https://192.168.0.2Click on "ENTER".</div> <div></div> <div><p>Note: If you then receive a message "There is a problem with this website's security certificate.", then download the Siemens security certificate as described in chapter 4.4.</p></div>
2.	<div>Open "Data Logs".</div> <div></div>
3.	<div>You will then see a list of all existing DataLog files with file size and time stamp of most recent access.</div> <div><ul style="list-style-type: none">Click on the name of the file you want (here: "DataLog.csv").</div> <div></div>

No.	Action
4.	<p>Using the display window, you have the ability to open the CSV file or save it.</p> <ul style="list-style-type: none"> Click "Open" (2x). 
5.	<p>Thanks to the region settings made earlier (see chapter 4.2.1), the CSV file will be shown in Microsoft Excel properly divided into columns for</p> <ul style="list-style-type: none"> Data record number "Record" Date "Date" Time stamp "UTC Time" Temperature "Temperature" 

5.4 Automatic upload of the DataLog file

The automatic upload is demonstrated with the Windows Task Scheduler on the local PC station (see section 4.2.2). Here the file "UploadDataLog.exe" is run every 5 minutes and loads the file "DataLog.csv" from the flash memory (SMC) of the CPU according to the specified arguments and saves it on the PG in the folder "C:\MyDataLogs". In the process, "UploadDataLog.exe" accesses the API of the SIMATIC Automation Tool V3.1.4.

Table 5-3

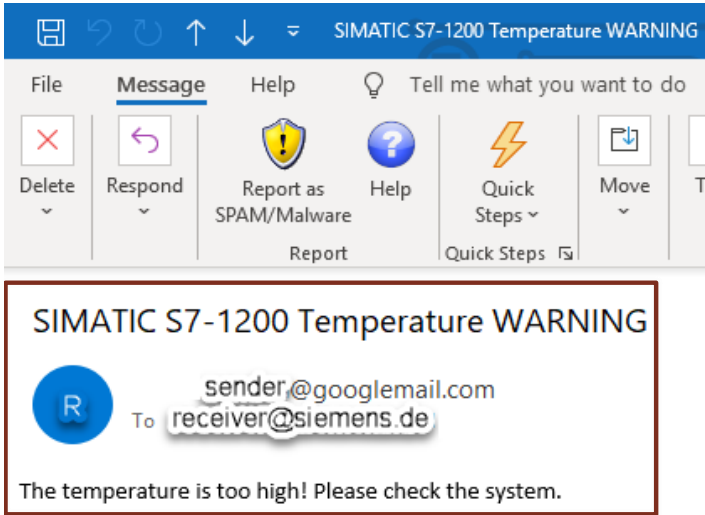
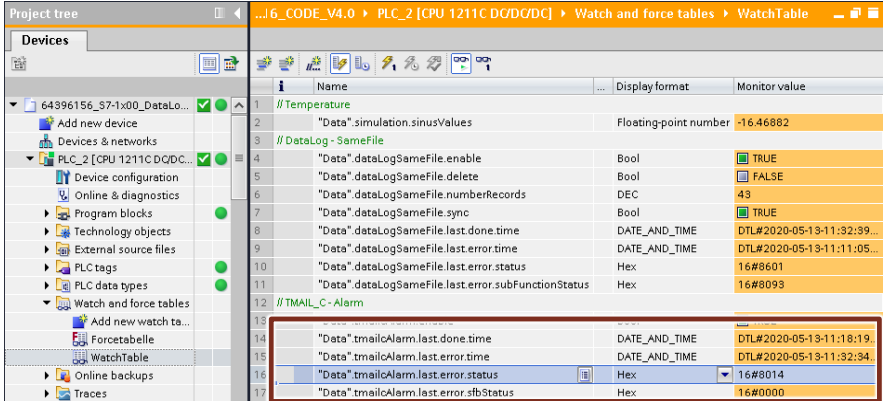
No.	Action
1.	<ul style="list-style-type: none"> Open the Windows Task Scheduler program.
2.	<p>The task "UploadDataLog" task created in chapter 4.2.2 is listed in the "Task Scheduler Library" under "Task Scheduler (Local)".</p> <ul style="list-style-type: none"> If this task is disabled (see column "Status"), select the task and enable it via "Actions > Selected item". 
3.	<p>When the status indicates "Ready", the task is performed every 5 minutes. The security option "Run whether user is logged on or not" (Table 4-2 step 9) executes the task in the background without a console window appearing.</p> 
4.	<ul style="list-style-type: none"> Open the destination folder "C:\MyDataLogs". <p>In this case the loaded file "DataLog.csv" is saved every five minutes. Newly saved files are incremented with name extension. In this way, no data will be overwritten.</p> 

5.5 Alarm generation by sending an email

The alarms are generated by the FB "TMAIL_C" (with the instance DB "InstTmailcAlarm").

When the maximum cooling temperature of -20 °C is exceeded, the S7-1x00 functions as an email client and sends a send request to the email provider over a secure connection; the email provider then carries out the send request.

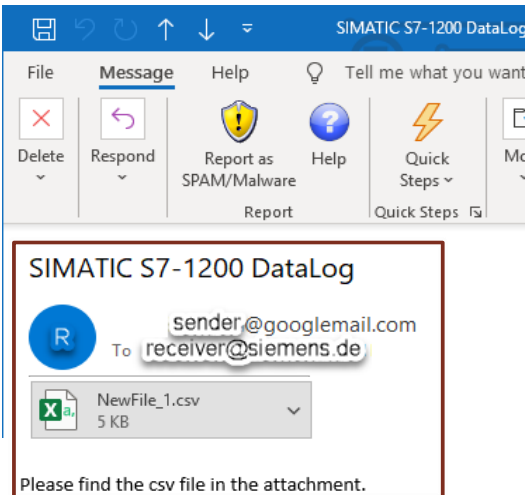
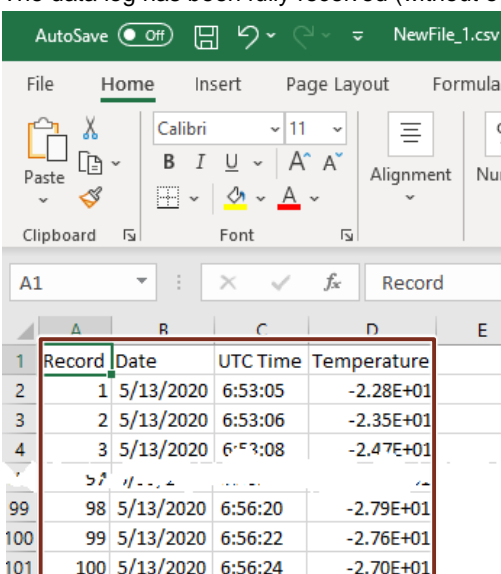
Table 5-4

No.	Action
1.	<p>Every minute, the simulated cooling temperature exceeds the maximum specification of -20 °C and issues the command via the "TMAIL_C" block to send an email to the pre-defined recipient.</p> <ul style="list-style-type: none"> Open the inbox of the recipient to check whether the email has been received. 
2.	<p>If the alarm email was not successfully received, please check the last status messages of the "TMAIL_C" block (with the instance DB "InstTmailcAlarm").</p> <ul style="list-style-type: none"> To do this, open the watch table "WatchTable". <p>Under "TMAIL_C - Alarm" you will find the time stamp for the last successful ("done") or faulty ("error") runs of the FB "TMAIL_C", as well as the returned status ("status") and SFB_STATUS ("sfbStatus") in the event of an error. Refer to the description of the "TMAIL_C" block for an interpretation (16).</p> 

5.6 Data log sending as email attachment

The data log is also sent by the FB "TMAIL_C" (with the instance DB "InstTmailCsvTransfer") as an attachment via the parameter "ATTACHMENT". Once the maximum number of temperature logging data records has been reached (through the FB "DataLog1x00" with the instance DB "InstDataLogNewFile"), the current CSV file will be sent to a predefined recipient as an email attachment.

Table 5-5

No.	Action																												
1.	<p>Depending on the internet connection and the size of the data log, the email may send with some delay. For this reason, the data log sending is shown using the example of data logging with new generation in the event of an overflow. Thus, when the maximum number of data records is reached, the current data log will be sent while the newly-created data log can be written to. The data logs "NewFile" and "NewFile_1" are sent in alternating order as an attachment via the FB "TMAIL_C".</p> <ul style="list-style-type: none">Open the inbox of the recipient to check whether the email has been received. 																												
2.	<ul style="list-style-type: none">Open the email attachment. <p>The data log has been fully received (without overwritten data records).</p>  <table><thead><tr><th>Record</th><th>Date</th><th>UTC Time</th><th>Temperature</th></tr></thead><tbody><tr><td>1</td><td>5/13/2020</td><td>6:53:05</td><td>-2.28E+01</td></tr><tr><td>2</td><td>5/13/2020</td><td>6:53:06</td><td>-2.35E+01</td></tr><tr><td>3</td><td>5/13/2020</td><td>6:53:08</td><td>-2.47E+01</td></tr><tr><td>98</td><td>5/13/2020</td><td>6:56:20</td><td>-2.79E+01</td></tr><tr><td>99</td><td>5/13/2020</td><td>6:56:22</td><td>-2.76E+01</td></tr><tr><td>100</td><td>5/13/2020</td><td>6:56:24</td><td>-2.70E+01</td></tr></tbody></table>	Record	Date	UTC Time	Temperature	1	5/13/2020	6:53:05	-2.28E+01	2	5/13/2020	6:53:06	-2.35E+01	3	5/13/2020	6:53:08	-2.47E+01	98	5/13/2020	6:56:20	-2.79E+01	99	5/13/2020	6:56:22	-2.76E+01	100	5/13/2020	6:56:24	-2.70E+01
Record	Date	UTC Time	Temperature																										
1	5/13/2020	6:53:05	-2.28E+01																										
2	5/13/2020	6:53:06	-2.35E+01																										
3	5/13/2020	6:53:08	-2.47E+01																										
98	5/13/2020	6:56:20	-2.79E+01																										
99	5/13/2020	6:56:22	-2.76E+01																										
100	5/13/2020	6:56:24	-2.70E+01																										

6 Appendix

6.1 Service and support

Industry Online Support

Do you have any questions or need assistance?

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

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

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

support.industry.siemens.com

Technical Support

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

www.siemens.com/industry/supportrequest

SITRAIN – Digital Industry Academy

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:

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 iOS and Android:

support.industry.siemens.com/cs/ww/en/sc/2067

6.2 Links and literature

Table 6-1

No.	Subject
\1\	Siemens Industry Online Support https://support.industry.siemens.com
\2\	Link to the article page of the application example https://support.industry.siemens.com/cs/ww/en/view/64396156
\3\	System manual, "SIMATIC S7-1200 Automation system" https://support.industry.siemens.com/cs/ww/en/view/109772940
\4\	Where do you find the latest operating system updates (firmware) for SIMATIC S7-1200 controllers? https://support.industry.siemens.com/cs/ww/en/view/77430184
\5\	Firmware update S7-1500 CPUs incl. Displays and ET 200 CPUs (ET 200SP, ET 200pro) https://support.industry.siemens.com/cs/ww/en/view/109478459
\6\	SIMATIC STEP 7 Basic/Professional V16 and SIMATIC WinCC V16 https://support.industry.siemens.com/cs/ww/en/view/109773506
\7\	TIA Selection Tool – quick, easy, smart https://support.industry.siemens.com/cs/ww/en/view/109767888
\8\	Updates for STEP 7 V16, S7-PLCSIM V16 and WinCC V16 https://support.industry.siemens.com/cs/ww/en/view/109775861
\10\	Overview document: Secure remote access with VPN https://support.industry.siemens.com/cs/ww/en/view/26662448
\11\	Why is the "Certificate error" message shown in the address line when downloading the web page of an S7-300/400/1200 CPU over "https://..."? https://support.industry.siemens.com/cs/ww/en/view/63314183
\12\	Automated loading and archiving of the CPU service data by means of the SIMATIC Automation Tool via the Application Programming Interface (API) https://support.industry.siemens.com/cs/ww/en/view/109760829
\13\	How do you calculate the service life of a memory card of the S7-1500/S7-1200 and ET 200? https://support.industry.siemens.com/cs/ww/en/view/109482591
\14\	Sending and Receiving SMS Messages via a SCALANCE M Router https://support.industry.siemens.com/cs/ww/en/view/54361177
\15\	Signaling and Switching via SMS with S7-1200 and CP 1242-7 GPRS V2 (Set 32) https://support.industry.siemens.com/cs/ww/en/view/58638283
\16\	SIMATIC Automation Tool - the tool for support during commissioning, service and maintenance of SIMATIC devices https://support.industry.siemens.com/cs/ww/en/view/98161300
\17\	Sending Emails to SMTP Servers with an S7 CPU https://support.industry.siemens.com/cs/ww/en/view/46817803
\18\	Library with general functions (LGF) for SIMATIC STEP 7 (TIA Portal) and SIMATIC S7-1200 / S7-1500 https://support.industry.siemens.com/cs/ww/en/view/109479728
\19\	SIMATIC Automation Tool V3.1 SP4 User manual https://support.industry.siemens.com/cs/ww/en/view/109774222

6.3 Change documentation

Table 6-2

Version	Date	Change
V1.0	01/2013	First version
V2.0	10/2017	Updated to STEP 7 V14
V2.0.1	12/2017	Addition to the chapter Changing the recorded data
V3.0	07/2019	Update, TIA Portal V15.1
V4.0	06/2020	Update, TIA Portal V16