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SIMATIC S7-1200 FW V4.2, STEP 7 V15.1 (TIA Portal)

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1 Task

1.1 Overview

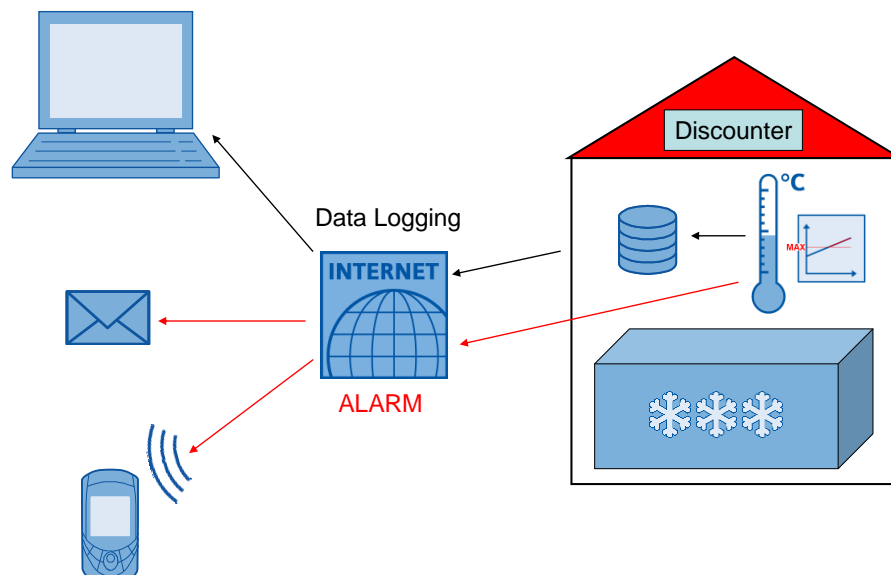
Introduction

Supermarkets and discounters must ensure the cooling of certain foods. If the cold chain is broken, the foods can no longer be sold and must be disposed of. For this reason, the cooling temperature is to be continuously recorded, archived and monitored (including a signaling function).

Overview of the automation task

The figure below provides an overview of the automation task.

Figure 1-1



Description of the automation task

The automation task is to include the following requirements:

- Remote access to the data log.
- Program changes via remote maintenance, if required.
- Automatic transmission of the logged data to a server in the company network at specified times and archiving.
- If a maximum temperature is exceeded, a message will be sent to a maintenance technician who will then identify the cause of the problem.

2 Solution

2.1 Overall solution overview

For the SIMATIC S7-1200, the STEP 7 (TIA Portal) development environment provides the “Data Log” instructions. These instructions allow you to store process data in CSV format (comma-separated values) in the CPU’s flash memory or on an inserted memory card.

You can access these CSV data logs (to analyze them, for example, in Microsoft Excel) as shown in the following table:

Table 2-1

Access type Read using ...	Stored in the flash memory ...	
	... of the CPU	... on the SIMATIC Memory Card (SMC)
... card reader	No	Yes (requires that the CPU be stopped)
... integrated PLC Web server	Yes	Yes
... SIMATIC Automation Tool version 3.0 or higher (\14)	No	Yes (also possible on an automated basis using the Application Programming Interface)

In the application example, the data logs are stored on a memory card plugged into the CPU. Manual access from the remote station is shown using the integrated PLC Web server. Automatic upload of the DataLog files from the company server takes place using the SIMATIC Automation Tool version 3.0 or higher.

The SIMATIC S7-1200 has routing capability, which enables remote access via the Internet. For secure communication, the connection via a VPN tunnel (Virtual Private Network) with the appropriate hardware is a suitable solution.

With the “TMAIL_C” instruction, emails can be sent using an existing account with an SMTP (Simple Mail Transfer Protocol) server email service provider ([\13](#)). This function is used to implement the alarm message.

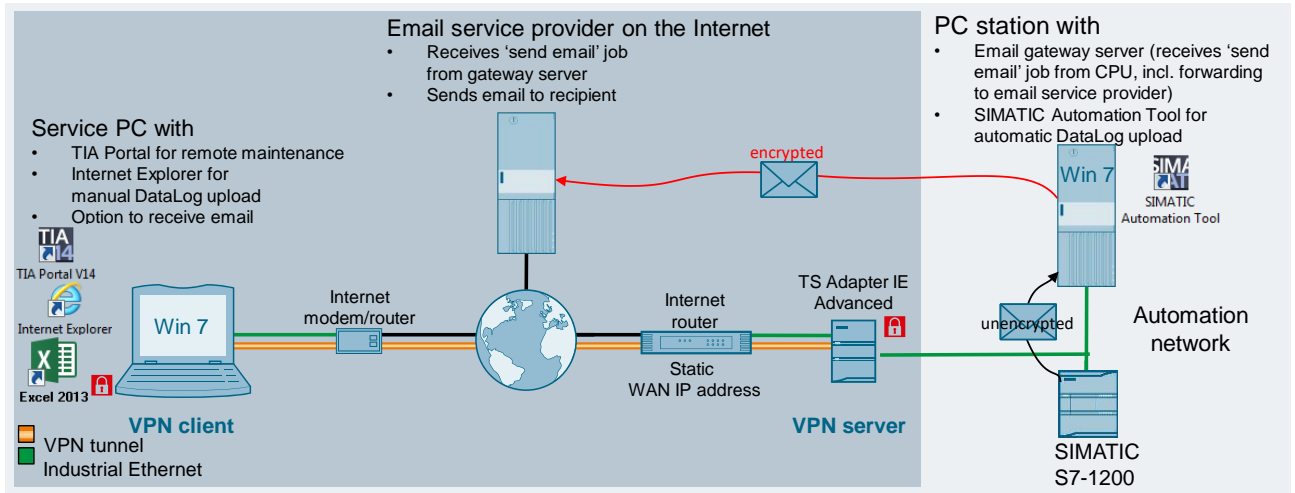
Using a communication extension, an inserted SIM card in a CP 1242-7 GPRS allows you to send the alarm message also as an SMS text message ([\15](#)).

The application example is implemented with the STEP 7 software and the S7-1200 CPU firmware V4.2.

Diagrammatic representation

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

Figure 2-1



The cooling temperature can be measured using thermocouples or resistance thermometers. For connection, the SIMATIC S7-1200 provides special analog signal expansion modules (TC and RTD).

The "Data Log" instruction is used to write the temperature to a CSV file in the load memory on the SMC at defined intervals.

Using a Web browser (e.g., Internet Explorer), you can access the CPU's Web server and download the CSV file to your service PC.

The remote connection between the service PC and the CPU is established via the Internet.

A VPN tunnel is established for secure data transfer. On the CPU side, this requires a VPN-capable modem router. On the PC side, the connection to the Internet requires suitable VPN software. On both sides, the IP addresses are assigned by the relevant Internet service provider (ISP). To access the CPU on the plant side, you need a static IP address.

The cooling temperature is continuously monitored. If a set maximum temperature is exceeded, the "TMAIL_C" function sends an unencrypted email job to a gateway server on the PC station in the company network. Then this server encrypts the job and sends it to the outgoing server of an email service provider (requires an account). The email recipient receives the alarm message from his provider; it informs him of a critical temperature rise, enabling him to respond accordingly. If the email service provider offers the "Mail2SMS" • service, the alarm message can even be sent to a cell phone as an SMS text message.

The temperature curves are logged on the PC station in the company network. The SIMATIC Automation Tool V3.0 or higher is used for logging. The Windows Task Scheduler is used to call an executable file at regular intervals. This file accesses the SIMATIC Automation Tool's API and stores the uploaded DataLog files on the hard drive.

Advantages

This application example offers the following advantages:

- Introduction to data logging with all its functions
- Alarm generation via email (and SMS)
- Introduction to using the API of the SIMATIC Automation Tool V3.0
- Basics of remote maintenance via a VPN tunnel

Scope

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

- For data logging:
 - DataLogCreate V1.0
 - DataLogOpen V1.1
 - DataLogWrite V1.0
 - DataLogClose V1.0
 - DataLogNewFile V1.1
- For sending email: "TMAIL_C" V4.0 [FB1032]

For a detailed description of these instructions, go to the TIA Portal Online Help, select the block and press F1 or refer to the "S7-1200 Programmable Controller" ([\3\](#)) and "STEP 7 Basic" system manuals ([\6\](#)).

This application example describes only the basics of creating a VPN tunnel. For a detailed description of "IP-based Remote Networks", refer to [\10\](#).

The secure sending of email is implemented using a gateway server. The configuration of appropriate software solutions is not part of this application example. However, you can also implement the direct secure sending to the email service provider using the communication extension with an S7-1200 Security CP ([\17\](#)).

This 'Send SMS text message' function can also be implemented using a CP 1242-7 ([\15\](#)).

The SIMATIC Automation Tool's API provides the basis for the automatic upload of the DataLog files. For a detailed description of the SIMATIC Automation Tool V3.0, refer to the user manual ([\19\](#)).

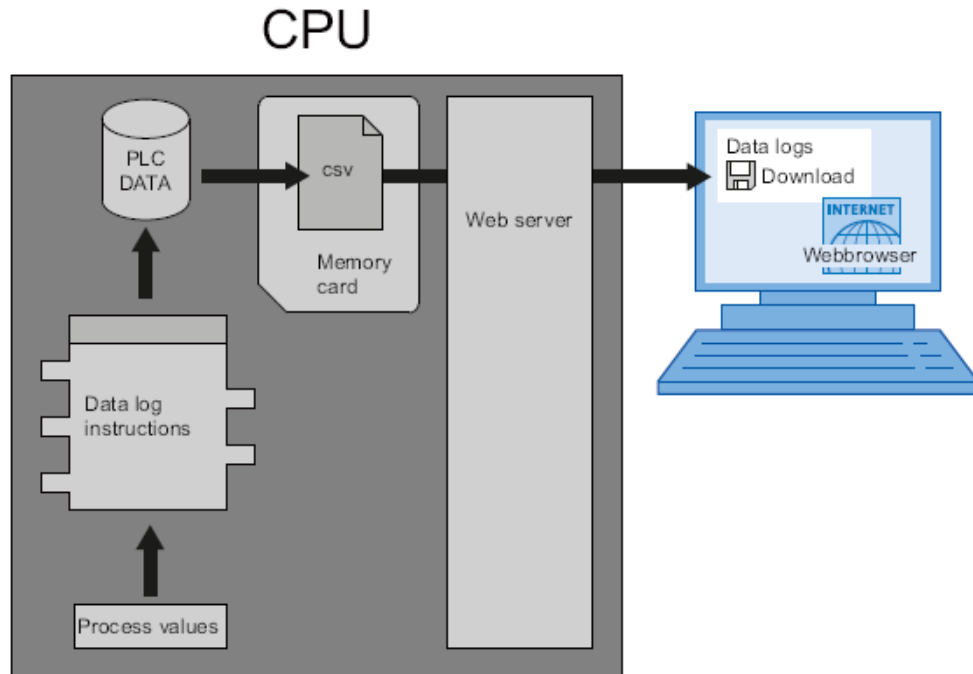
Required knowledge

Basic knowledge of "network communication" is required.

2.2 Description of the core functionality

The application example's core function is to log process values using data logging.

Figure 2-2



In the user program, the Data Log instructions are used to store process values in log files. These log files can be stored on the memory card (MC) or in the internal load memory of the CPU. The log files are stored in CSV format. When using a memory card, the csv file can be accessed using a card reader, or when accessed via a Web server, they can be downloaded with the aid of a Web browser.

In this application example, the “Data Log” functionality consists of the following 5 instructions:

“DataLogCreate”

Figure 2-3

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

The “DataLogCreate” instruction is used to create a data log file in the “\DataLogs” directory in the load memory that specifies the name (“NAME” parameter) and the maximum number of data records (“RECORDS” parameter•).

The “TIMESTAMP” parameter allows you to decide whether the date and time stamp will be included in each data record.

The data to be logged is specified by the “DATA” parameter .
 The “HEADER” parameter is used to specify the header (column headers) of the data to be logged in the data log.
 Creating the data log file with an assigned name generates a number (“ID” parameter) that identifies this file.

“DataLogOpen”

Figure 2-4

DataLogOpen	
EN	DONE
REQ	BUSY
MODE	ERROR
NAME	STATUS
ID	ENO

The “DataLogOpen” instruction opens an existing data log file. For new data records to be written, a data log file must be open. The “MODE” parameter allows you to decide whether the existing file data record entries will be overwritten. Opening the data log file via the “NAME” parameter returns the “ID” that allows “DataLogWrite” and “DataLogClose” to access this file.

“DataLogWrite”

Figure 2-5

DataLogWrite	
	DONE
	BUSY
EN	ERROR
REQ	STATUS
ID	ENO

The “DataLogWrite” instruction writes a data record to the specified data log. For a “DataLogWrite” instruction to be executed, the existing target data log must be open.

Use the “ID” parameter to select the data log.

“DataLogClose”

Figure 2-6

DataLogClose	
	DONE
	BUSY
EN	ERROR
REQ	STATUS
ID	ENO

The “DataLogClose” instruction closes an open data log.
 Use the “ID” parameter to select the data log.

“DataLogNewFile”

DataLogNewFile	
EN	DONE
REQ	BUSY
RECORDS	ERROR
NAME	STATUS
ID	ENO

The “DataLogNewFile” instruction is used to create a new data log with the same properties as an existing data log file and a new name. Use the “RECORDS” parameter to specify the maximum number of data records.

The “ID” parameter specifies the model file. When the new data log file has been created with a new name (“NAME” parameter), a new “ID” for this file will be generated and output.

Note

For more information about [program instructions that control data logs](#), go to the TIA Portal Online Help, select the block and press F1 or refer to the “S7-1200 Programmable Controller” ([13](#)) and “STEP 7 Basic” system manuals ([16](#)).

2.3 Hardware and software components used

The application example was created with the following components:

Hardware components

Table 2-2

Component	No.	Order no.	Note
S7-1200 PM1207 POWER SUPPLY	1	6EP1332-1SH71	
CPU 1211C, DC/DC/DC, 6DI/4DO/2AI	1	6ES7211-1AE40-0XB0	Firmware V4.2 (14)
SIMATIC S7 MEMORY CARD, 24 MB	1	6ES7954-8LF02-0AA0	Plug-in load memory; for storing DataLog files; designed as a program card (13)
Temperature sensor	1	Electrical retail outlets	Designed as an analog signal encoder, thermocouple or resistance thermometer
SIGNAL BOARD SB 1231, 1 AI, (12-bit resolution)	1	6ES7231-4HA30-0XB0	Optional (when using a temperature sensor with 0 to 20 mA current output)
SIGNAL BOARD SB 1231 RTD	1	6ES7231-5PA30-0XB0	Optional (when using a resistance thermometer)
SIGNAL BOARD SB 1231 TC, 1 AI	1	6ES7231-5QA30-0XB0	Optional (when using a thermocouple)
Remote service PC	1		With Ethernet port
Local PC station	1		With Ethernet port (LAN)
Ethernet cable TP CORD RJ45/RJ45 2M	4	6XV1870-3QH20	
Circuit breaker	1	5SY6116-6	1 pole B, 16A
Standard sectional rail	1	6ES5 710-8MA11	35mm
DSL modem	1 – 2	---	Depending on provider / router
TS Adapter IE Advanced	1	6ES7972-0EA00-0XA0	Optional (for other VPN server variants, see 10)

Standard software components

Table 2-3

Component	No.	Order no.	Note
SIMATIC STEP 7 Basic V15.1	1	6ES7822-0AA05-0YA5	- Includes WinCC Basic (17) ;
SIMATIC Automation Tool V3.0 or higher	1	6ES7853-1AE03-0YA5	(16) ; API use requires license
.NET Framework 4.6.1	1		Required for running the "UploadDataLog.exe" file
Microsoft Excel 2013	1		Part of Microsoft Office 2013
Task Scheduler			Part of the Windows 7 operating system

Sample files and projects

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

Table 2-4

Component	Note
64396156_S7-1200_DataLogging_PROJ_v3d0.zip	This zip file contains the STEP 7 project.
64396156_S7-1200_DataLogging_UploadDataLog.zip	This zip file contains the executable program for uploading DataLog files, "UploadDataLog.exe", in conjunction with the SIMATIC Automation Tool V3.0 or higher (16) and the source code in C#.
64396156_S7-1200_DataLogging_DOC_v3d0_en.pdf	This document.

Passwords

The "HMI access" access level has been selected for the CPU (Chapter [4.3.2](#)). The following passwords have been assigned:

Table 2-5

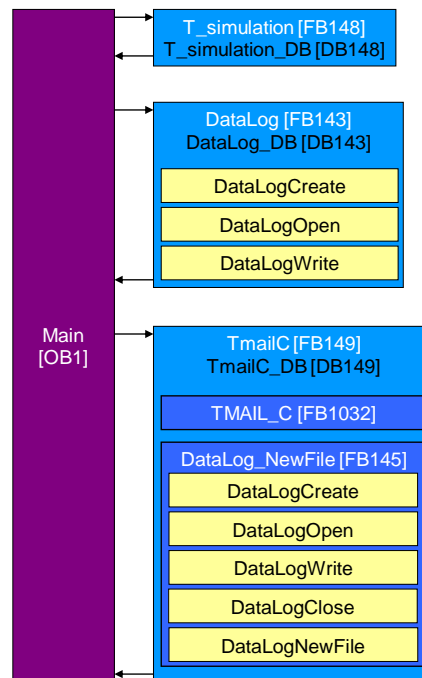
Access level	Password
Full access (no protection)	full
Read access	read

3 Functional Mechanisms of this Application Example

Complete overview

Figure 3-1 shows the chronological sequence of the block calls in the control part of the application example project.

Figure 3-1



The following function blocks are called from the main organization block (OB1):

- The “T_simulation” FB simulates the freezing temperature as a sine curve.
- The “DataLog” FB logs the freezing temperature. To this end, the following instructions are called in this function:
 - “DataLogCreate” creates the DataLog file.
 - “DataLogOpen” opens the DataLog file.
 - “DataLogWrite” writes the DataLog file.

When the maximum number of data record entries is reached, the logging restarts at the beginning and overwrites the first data record.

- The “TmailC” calls the “TMAIL_C” instruction [FB349] for sending an alarm email when a specific maximum temperature is exceeded. In addition, the “DataLog_NewFile” FB logs all send jobs with their results. Aside from the above DataLog system functions, “DataLog_NewFile” calls the following instructions:
 - “DataLogClose” closes the DataLog file.
 - “DataLogNewFile” creates a new DataLog file based on an existing one.

This ensures that the current DataLog file is closed when the maximum number of data record entries is reached and an identical one with a different name is created and written.

The tags for the interface configuration of the functions are in the “Tags” data block.

3.1 “T_simulation” FB

With the aid of the “T_simulation” FB, the temperature curve is simulated as a sine curve.

Figure 3-2

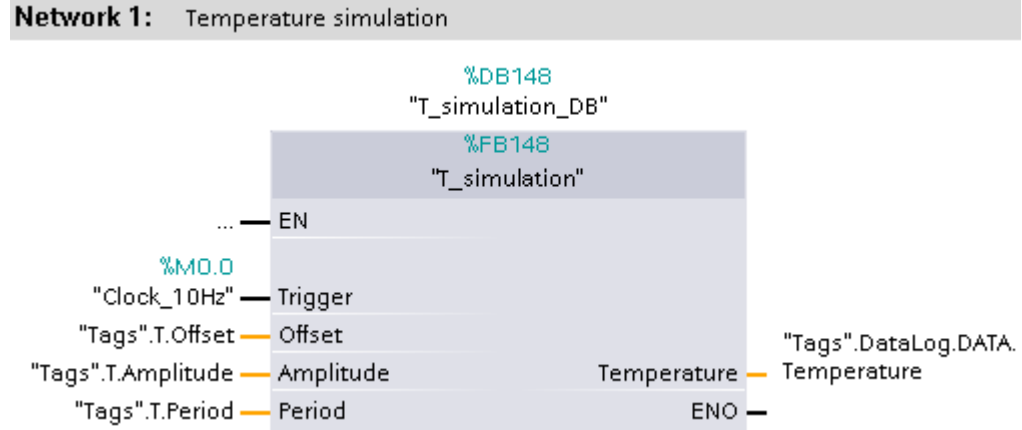


Table 3-1

	Name	Data type	Description
Input	Trigger	Bool	Trigger signal (positive edge) - increases the sine argument by $2 \cdot \pi / \text{period}$
	Offset	Real	Sine offset
	Amplitude	Real	Sine amplitude
	Period	Real	Number of period subdivisions (“0” is not allowed)
Output	Temperature	Real	Simulated temperature

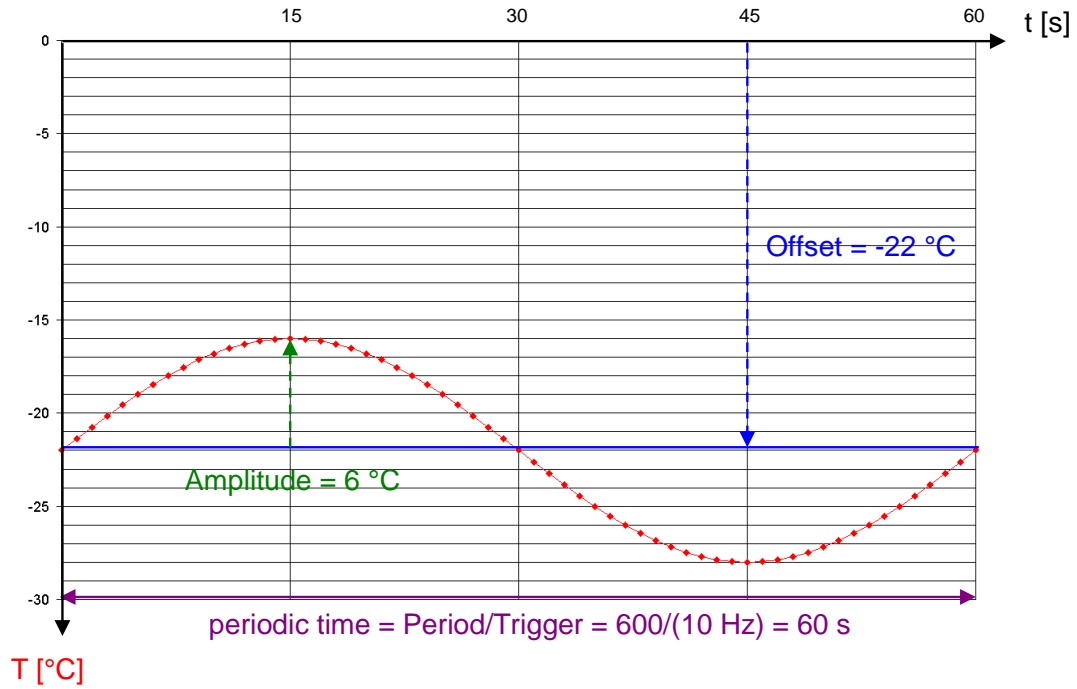
The output value is calculated using the following formula:

$$Temperature = Offset + Amplitude \cdot \sin\left(\frac{2 \cdot \pi}{Period} \cdot t\right)$$

3 Functional Mechanisms of this Application Example

By default, the temperature simulation performs a sinusoidal oscillation by the offset of -22°C with an amplitude of $\pm 6^{\circ}\text{C}$ and a period length of 1 minute with a 10 Hz resolution (see Figure 3-3).

Figure 3-3



3.2 “DataLog” FB

The “DataLog” function creates, opens and writes a DataLog file as specified. If the maximum number of entries is exceeded, the oldest entries are overwritten (ring buffer).

Figure 3-4

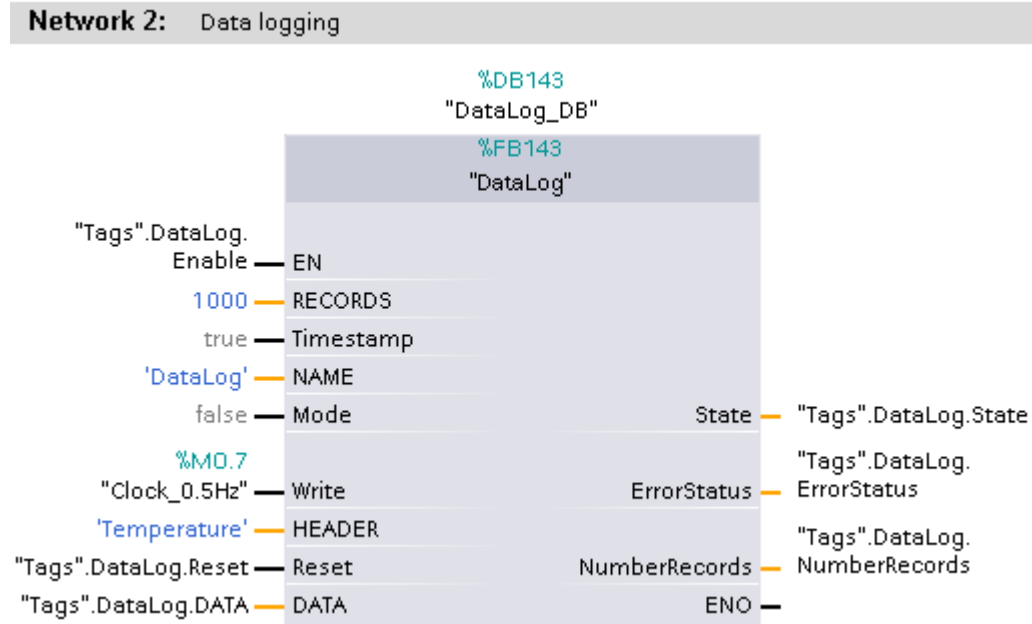


Table 3-2

	Name	Data type	Description
Input	RECORDS	UDInt	Number of data records in data log
	Timestamp	Bool	Time stamping: <ul style="list-style-type: none"> 0: No time stamping 1: Date and time
	NAME	String	Name of data log
	Mode	Bool	Mode for opening data log: <ul style="list-style-type: none"> MODE= “0” Retain data records of data log MODE= “1” Delete data records of data log
	Write	Bool	Execute “DataLogWrite” instruction at rising edge
	HEADER	String	Header of CSV file
	Reset	Bool	Reset input
Output	State	USInt	Status of function (identical with step)
	ErrorStatus	Word	Status parameter if an error occurs (the relevant DataLog SFB can be identified in conjunction with “State”)
	NumberRecords	UDInt	Current number of written data records
InOut	DATA	Variant	Pointer to structure or array of data to be written

The block is designed as a sequencer.

When the block is enabled ("EN"), the sequencer starts in step 0.

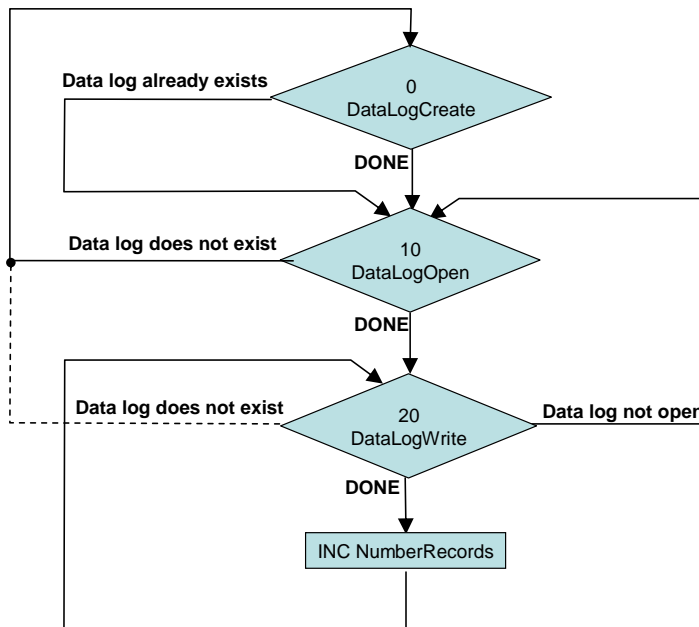
A DataLog file is created in the CPU's load memory in csv format with the "NAME", "RECORDS", "Timestamp", "HEADER" and "DATA" settings.

After positive feedback, "DONE", or the message that the file already exists, step 1 opens the file with "MODE" mode. If a message appears that the file does not exist, the sequencer returns to step 0. When there is positive feedback, "DONE", step 20 writes the file when the "Write" input is enabled. If the "Data log does not exist" or "Data log not open" error messages appear, the sequencer jumps to the relevant step to clear this error. When there is positive feedback, "DONE", from writing, the number of written data records ("NumberRecords") is incremented and the sequencer waits for the next write request ("Write").

If other errors occur, the sequencer remains in the current step. The error description of the relevant SFB can be determined from "State" and "ErrorStatus".

The sequencer and the counter of the written data records are reset via the "Reset" input.

Figure 3-5



3.3 “DataLog_NewFile” FB

The “DataLog_NewFile” FB creates, opens and writes a DataLog file as specified. If the maximum number of entries is exceeded, a new DataLog file with a name extension is created based on the example of the previous one (clone) and written. The oldest files are not overwritten until the maximum number of clone files is exceeded (ring buffer).

This function uses all the available system functions for data logging. For illustration purposes, the application example uses the function for logging email send jobs.

Figure 3-6

Network 4: Command 2 & 3: Data logging

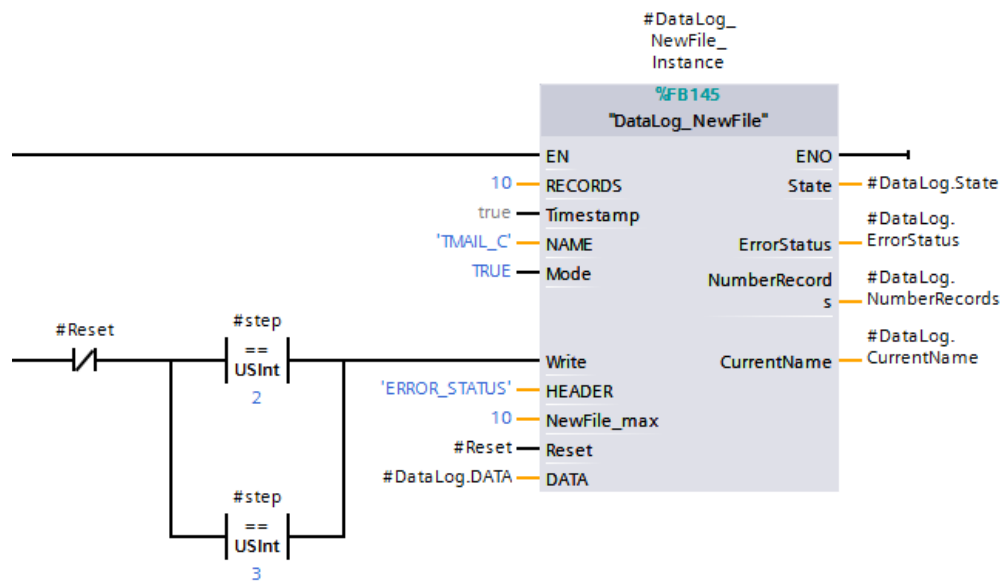


Table 3-3

	Name	Data type	Description
Input	RECORDS	UDInt	Number of data records in data log
	Timestamp	Bool	Time stamping: <ul style="list-style-type: none"> 0: No time stamping 1: Date and time
	NAME	String	Name of data log
	Mode	Bool	Mode for opening data log: <ul style="list-style-type: none"> MODE= "0" Retain data records of data log MODE= "1" Delete data records of data log
	Write	Bool	Execute "DataLogWrite" instruction at rising edge
	HEADER	String	Header of CSV file
	NewFile_max	USInt	Maximum number of clone files
	Reset	Bool	Reset input
Output	State	USInt	Status of function (identical with step)
	ErrorStatus	Word	Status parameter if an error occurs (the relevant DataLog SFB can be identified in conjunction with "State")
	NumberRecords	UDInt	Current number of written data records
	CurrentName	String	Name of the file to be currently written
InOut	DATA	Variant	Pointer to structure or array of data to be written

The block is designed as a sequencer.

When the block is enabled ("EN"), the sequencer starts in step 0.

A DataLog file is created in the CPU's load memory in csv format with the "NAME", "RECORDS", "Timestamp", "HEADER" and "DATA" settings.

After positive feedback, "DONE", or the message that the file already exists, step 5 transfers the name of the created file to the specified name of the "DataLogOpen" SFB. Step 8 deletes the default ID to ensure that the file to be opened is identified by its name and not by the ID.

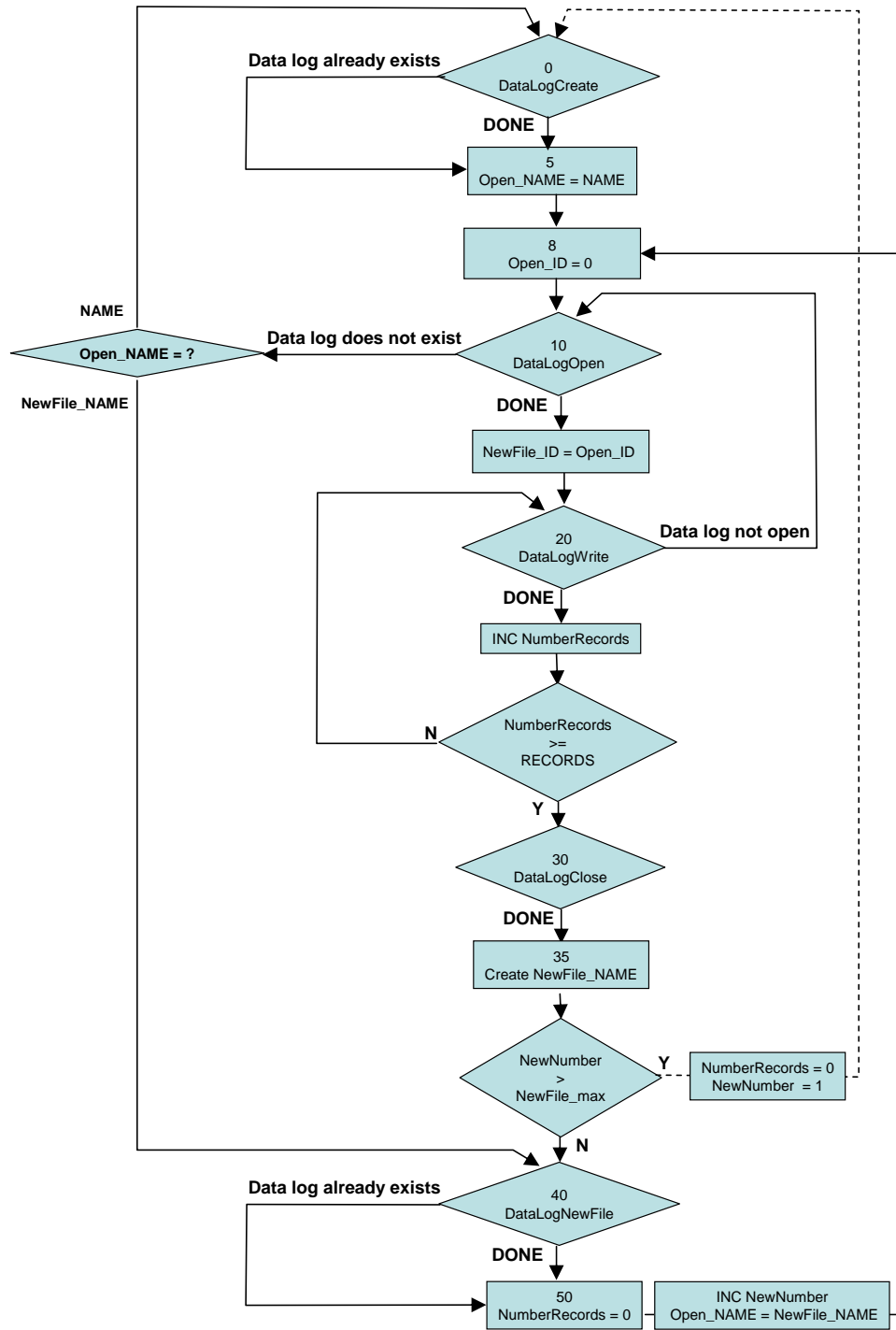
Step 10 opens the "Open_NAME" file with "MODE" mode. If a message appears that the file does not exist, the sequencer jumps to 'create original file' (step 0) or 'create clone file' (step 40), depending on the name of the file to be opened. When there is positive feedback, "DONE", the ID of the open file is transferred to the "DataLogNewFile" SFB.

When the "Write" input is enabled, step 20 writes the file. If the "Data log not open" error message appears, the sequencer jumps to step 10 to clear this error. When there is positive feedback, "DONE", from writing, the number of written data records ("NumberRecords") is incremented. As long as "NumberRecords" is less than the specified number of data records in the DataLog file ("RECORDS"), the sequencer waits for the next write request ("Write").

Otherwise, step 30 closes the currently written file ("CurrentName"). After successful execution of the "DataLogClose" function, step 35 creates the numeric extension, "_NewNumber", for the new file name.

3 Functional Mechanisms of this Application Example

Figure 3-7



3 Functional Mechanisms of this Application Example

If "NewNumber" exceeds the maximum number of clone files, the number of written data records is reset to "0" and the numeric name extension is reset to the start value "1" and the sequencer returns to its start.

If "NewFile_max" has not yet been reached, step 40 creates the new clone file using the "DataLogNewFile" system function. After positive feedback, "DONE", or the message that the file already exists, step 50 resets the number of written data records ("NumberRecords"), increments "NewNumber" for the name extension of the next clone file and transfers the name of the newly created file to the specified name of the "DataLogOpen" SFB. Then the sequencer jumps to step 8.

If other errors occur, the sequencer remains in the current step. The error description of the relevant instruction can be determined from "State" and "ErrorStatus".

The sequencer and the counter of the written data records are reset via the "Reset" input.

3.4 “TmailC” FB

The “TmailC” FB calls FB 1032 “TMAIL_C” for alarm generation via email and logs its calls, including the time stamp and return value, using the “DataLog_NewFile” FB.

Figure 3-8

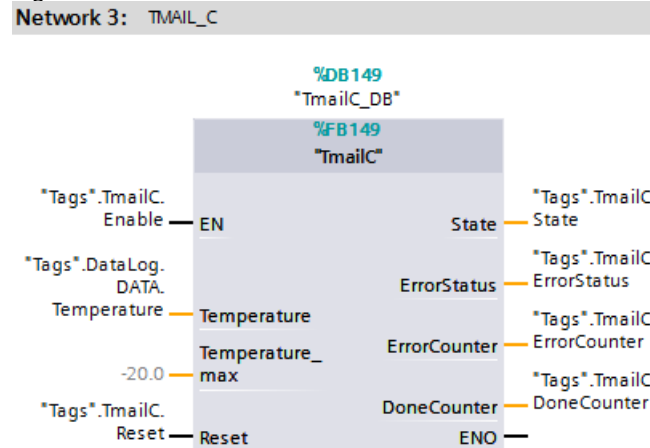
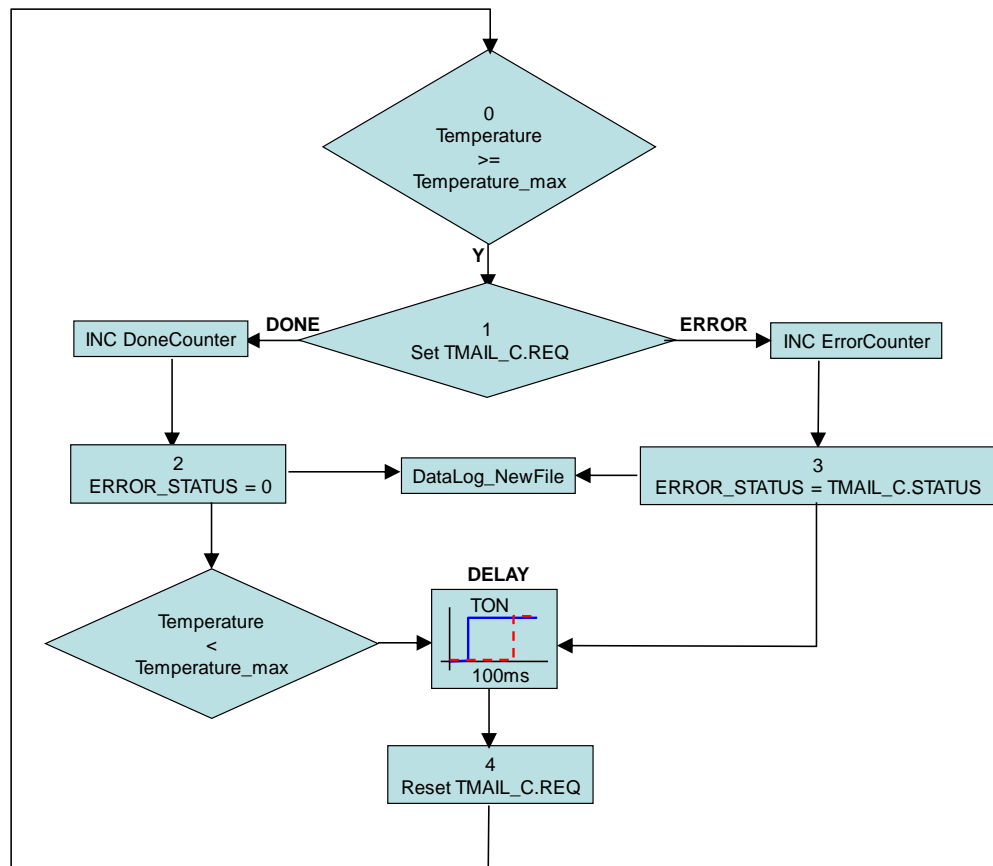


Table 3-4

	Name	Data type	Description
Input	Temperature	Real	Actual temperature value
	Temperature_max	Real	Temperature limit value <ul style="list-style-type: none"> If this value is exceeded, the “TMAIL_C” block is executed. Default = -20 °C
	Reset	Bool	Reset input <ul style="list-style-type: none"> Resets the sequencer and all output tags.
Output	State	USInt	Status of function (identical with step)
	ErrorStatus	Word	Status parameter in case of error feedback from TMAIL_C SFB
	ErrorCounter	UDInt	Current number of TMAIL_C calls with errors
	DoneCounter	UDInt	Current number of TMAIL_C calls without errors

Figure 3-9



The block is designed as a sequencer.

When the block is enabled ("EN"), the sequencer starts in step 0.

The actual temperature value "Temperature" is compared to the limit value "Temperature_max".

If this limit value is violated, step 1 sets the "REQ" request of the "TMAIL_C" block. Depending on the feedback ("DONE" or "ERROR"), the relevant counter ("DoneCounter" or "ErrorCounter") is incremented and, if errors occur, step 3 applies the status information as "ERROR_STATUS".

Following this feedback, the "DataLog_NewFile" block is called to log the "TMAIL_C" function. This process includes logging the "ERROR_STATUS" parameter with a time stamp.

After successful alarm generation, step 2 does not enable the next step until the value falls below the limit temperature so that the next alarm is not triggered until a new limit value violation occurs.

After a delay time of 100 ms, step 4 resets the request of the "TMAIL_C" block and the sequencer returns to step 0.

This delay time is required to write the log data to the CPU's load memory.

The step sequencer, the counters and the error status are reset via the "Reset" input.

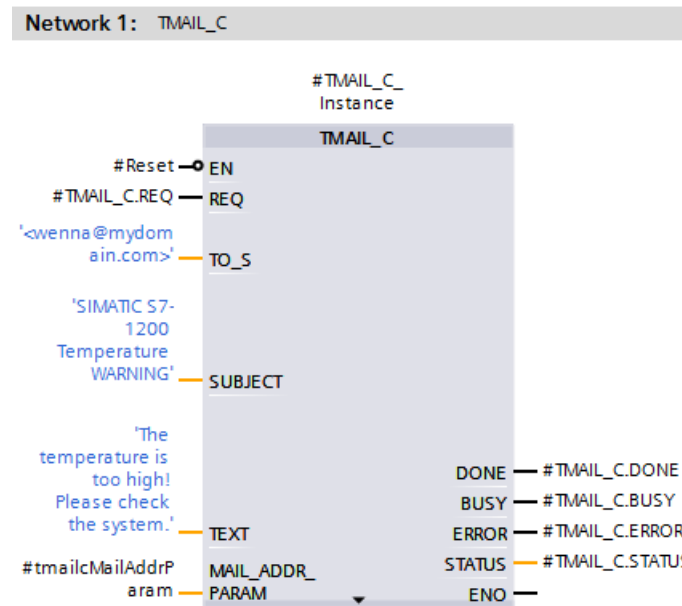
3.4.1 “TMAIL_C” FB

The “TMAIL_C” FB uses SMTP (Simple Mail Transfer Protocol) to send an email via TCP/IP over the Industrial Ethernet connection of the CPU.

“TMAIL_C” is executed asynchronously and the job extends over several calls of “TMAIL_C”. When you call “TMAIL_C”, you have to assign instance.

The “TMAIL_C” FB is called in the “TmailC” FB.

Figure 3-10:



The connection data, addressing and authentication for the mail server are transferred at the “MAIL_ADDR_PARAM” parameter.

In this application example, the email is sent via the integrated interface of the S7-1200. As a result, the email can only be sent via SMTP (non-secure). Therefore, a gateway server is required.

A gateway server is an internal email server that complies with the required security extensions to forward emails to an external email server via the Internet.

The “MAIL_ADDR_PARAM” parameter uses the “Tmail_v4” system data type.

When activated, “TMAIL_C” logs on to the gateway server with the access details (user name and password) and sends the email job with the specified recipient address and the specified text.

For V4.0 or higher, the “TMAIL_C” instruction offers direct sending of email using secure communication via the following modules:

- CP 1242-7 GPRS V2, firmware version V2.1
- CP 1243-7 LTE V2.1
- CP 1243-8 V2.1

For this purpose, the “MAIL_ADDR_PARAM” parameter provides the following system data types:

- TMAIL_V4_SEC
- TMAIL_V6_SEC
- TMAIL_QDN_SEC

They contain the data required for sending, including the TCP port of the email server (see the application example [\17\](#)).

Program details about the TMAIL_C block

This application example uses the “TMAIL_C” FB version 4.0.

For program details about the [“TMAIL_C”](#) block, go to the TIA Portal Online Help, select the block and press F1 or refer to the “S7-1200 Programmable Controller” ([\3\](#)), “STEP 7 Basic” ([\6\](#)) system manuals and FAQ [\13\](#).

3.5 SIMATIC Automation Tool V3.0

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

The “64396156_S7-1200_DataLogging_UploadDataLog.zip” download ([Table 2-4](#)) contains the “UploadDataLog.exe” console application. It was created in C# using Visual Studio 2015 and .NET Framework V4.6.1.

For the “UploadDataLog.exe” to be executable, you need a license for the SIMATIC Automation Tool V3.0 ([Table 2-3](#)). This license and .NET Framework V4.6.1 must be installed.

Specifying the following arguments, the “UploadDataLog.exe” file allows uploading DataLog files:

Table 3-5

No.	Argument	Description	Format
1.	Network card number	The application outputs 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.	DataLogFile name	DataLogFile name (case sensitive)	“DataLog.csv” or “ALL” for all DataLog files
4.	Destination folder	Destination folder where you want to save the DataLog files (must exist! + case sensitive)	For example: “c:\MyDataLogs”
5.	Password	CPU password (if there is one): Password level: “Full access” or “Read” (case sensitive)	For example: “read” or no password level if no password has been assigned

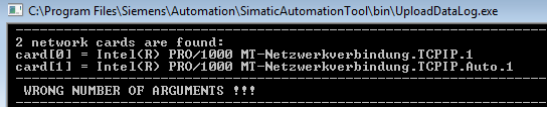
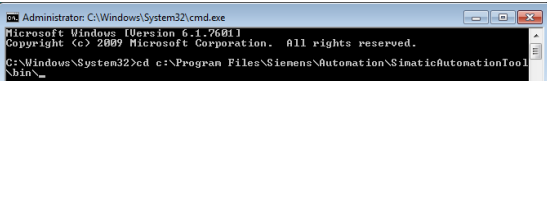
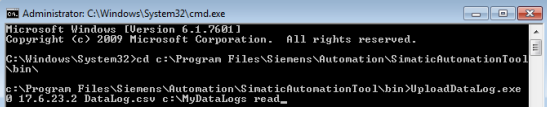
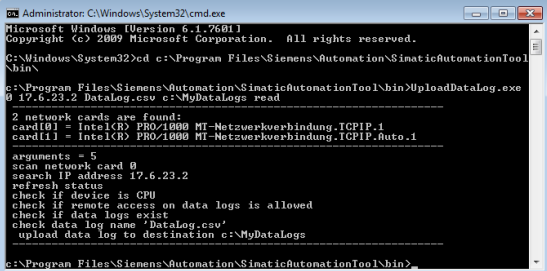
Note

The console application is run in the Windows “cmd.exe” (Command Prompt) window. [Table 3-5](#) specifies the argument order. Arguments are separated by spaces.

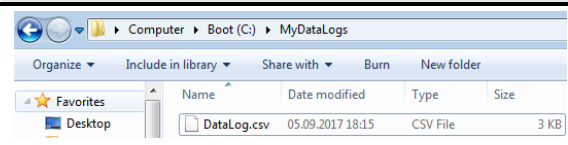
For the “UploadDataLog.exe” file to be executed correctly, proceed as follows:

3 Functional Mechanisms of this Application Example

Table 3-6

No.	Action	Comment
1.	Unzip the "64396156_S7-1200_DataLogging_UploadDataLog.zip" file to your computer.	See Table 2-4
2.	Copy the included "UploadDataLog.exe" console application to the installation folder of the SIMATIC Automation Tool V3.0 (default: "c:\Program Files\Siemens\Automation\SimaticAutomationTool\bin"). This may require administrator rights.	The folder contains the following files: <ul style="list-style-type: none"> AutomationToolAPI.dll DeviceManagerClient.dll hmitr.dm.client.proxy.dll hmitr.ipc.dll
3.	Double-click to run the "UploadDataLog.exe" file. <ul style="list-style-type: none"> The console application lists the available network cards and outputs the "WRONG NUMBER OF ARGUMENTS !!!" error message as the application requires that 4 or 5 arguments be transferred. Memorize the number of the network card to be scanned. 	 <pre> C:\Program Files\Siemens\Automation\SimaticAutomationTool\bin>UploadDataLog.exe 2 network cards are found: card[0] = Intel(R) PRO/1000 MT-Netzwerkverbindung.TCPIP.1 card[1] = Intel(R) PRO/1000 MT-Netzwerkverbindung.TCPIP.Auto.1 WRONG NUMBER OF ARGUMENTS !!! </pre>
4.	Select "Start > All Programs > Accessories" to open the Command Prompt window and navigate to the folder of the "UploadDataLog.exe" console application: "cd c:\Program Files\Siemens\Automation\SimaticAutomationTool\bin"	 <pre> Administrator: C:\Windows\System32\cmd.exe Microsoft Windows [Version 6.1.7601] Copyright (c) 2009 Microsoft Corporation. All rights reserved. C:\Windows\System32>cd c:\Program Files\Siemens\Automation\SimaticAutomationTool\bin </pre>
5.	Use the necessary arguments to open the console application (see Table 3-5): "UploadDataLog.exe 0 17.6.23.2 DataLog.csv c:\MyDataLogs read"	 <pre> Administrator: C:\Windows\System32\cmd.exe Microsoft Windows [Version 6.1.7601] Copyright (c) 2009 Microsoft Corporation. All rights reserved. C:\Windows\System32>cd c:\Program Files\Siemens\Automation\SimaticAutomationTool\bin c:\Program Files\Siemens\Automation\SimaticAutomationTool\bin>UploadDataLog.exe 0 17.6.23.2 DataLog.csv c:\MyDataLogs read </pre>
6.	The "UploadDataLog.exe" console application is executed as follows: <ul style="list-style-type: none"> List number of network cards found Output number of arguments: <i>arguments = 5</i> Scan selected network card: <i>scan network card 0</i> Search for selected IP address: <i>search IP address 17.6.23.2</i> Refresh status information: <i>refresh status</i> Check if device is CPU: <i>check if device is CPU</i> Check if remote access to DataLog files is allowed: <i>check if remote access on data logs is allowed</i> Check if DataLog files exist: <i>check if data logs exist</i> Check selected DataLog file name: <i>check data log name 'DataLog.csv'</i> Upload selected DataLog file to specified destination folder: <i>upload data log to destination c:\MyDataLogs</i> 	 <pre> Administrator: C:\Windows\System32\cmd.exe Microsoft Windows [Version 6.1.7601] Copyright (c) 2009 Microsoft Corporation. All rights reserved. C:\Windows\System32>cd c:\Program Files\Siemens\Automation\SimaticAutomationTool\bin c:\Program Files\Siemens\Automation\SimaticAutomationTool\bin>UploadDataLog.exe 0 17.6.23.2 DataLog.csv c:\MyDataLogs read 2 network cards are found: card[0] = Intel(R) PRO/1000 MT-Netzwerkverbindung.TCPIP.1 card[1] = Intel(R) PRO/1000 MT-Netzwerkverbindung.TCPIP.Auto.1 arguments = 5 scan network card 0 search IP address 17.6.23.2 refresh status check if device is CPU check if remote access on data logs is allowed check if data logs exist check data log name 'DataLog.csv' upload data log to destination c:\MyDataLogs c:\Program Files\Siemens\Automation\SimaticAutomationTool\bin> </pre>

3 Functional Mechanisms of this Application Example

No.	Action	Comment
7.	Open the destination folder and make sure that the selected DataLog file exists.	

Note

If an error message is displayed, make sure that the CPU can be reached – for example, using the ping command in the Command Prompt window – and check the network card settings (Chapter [4.2.2](#)).

3.6 Remote access to the controller

Secure remote access to the controller takes place via a VPN tunnel. A virtual private network (VPN) is a data network that is used to transport private data through a public network (e.g., the Internet). It allows secure transmission over an unsecure network.

On the controller side, using a VPN tunnel requires a VPN-capable router.

On the PC side, you only need suitable VPN client software that is used to establish the connection to the controller and any type of Internet access. The application example uses a WLAN router with DSL Internet access and the PC's WLAN network card.

In most cases, Internet users are assigned dynamic IP addresses. However, finding the VPN server (on the CPU side) requires a static IP address.

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

For an introduction to "IP-based Remote Networks" and the products and solutions offered by Siemens, refer to the Appendix ([\10](#)). An overview explains the possible configurations of an IP-based remote network, including prerequisites and links to the detailed configuration guide.

For example, the following application example is a suitable solution for secure access to the S7-1200 via the Internet and the shown use cases:

["VPN Tunnel between the TS Adapter IE Advanced and Windows 7"](#)

Remote access to the controller via the Internet is not mandatory for the manual download of the logged DataLog log files. For demonstration purposes, local access is sufficient.

However, sending email via external email service providers requires access to the Internet.

For sending email, you have to enable SMTPS for outgoing connections on the VPN server (router or TS Adapter IE Advanced).

4 Startup of the Application Example

4.1 Customizing the hardware

This application example was implemented with a CPU 1211C. If you are using a different CPU, change the CPU in the project's Device view.

The application example simulates the temperature curve using the "T_simulation" block (see Chapter 3.1). If you are using a real temperature sensor, you may have to add hardware.

Each S7-1200 CPU features 2 integrated analog inputs for receiving voltage signals from 0 to 10V. The SIMATIC S7-1200 additionally provides analog input modules for direct connection of thermocouples and resistance thermometers.

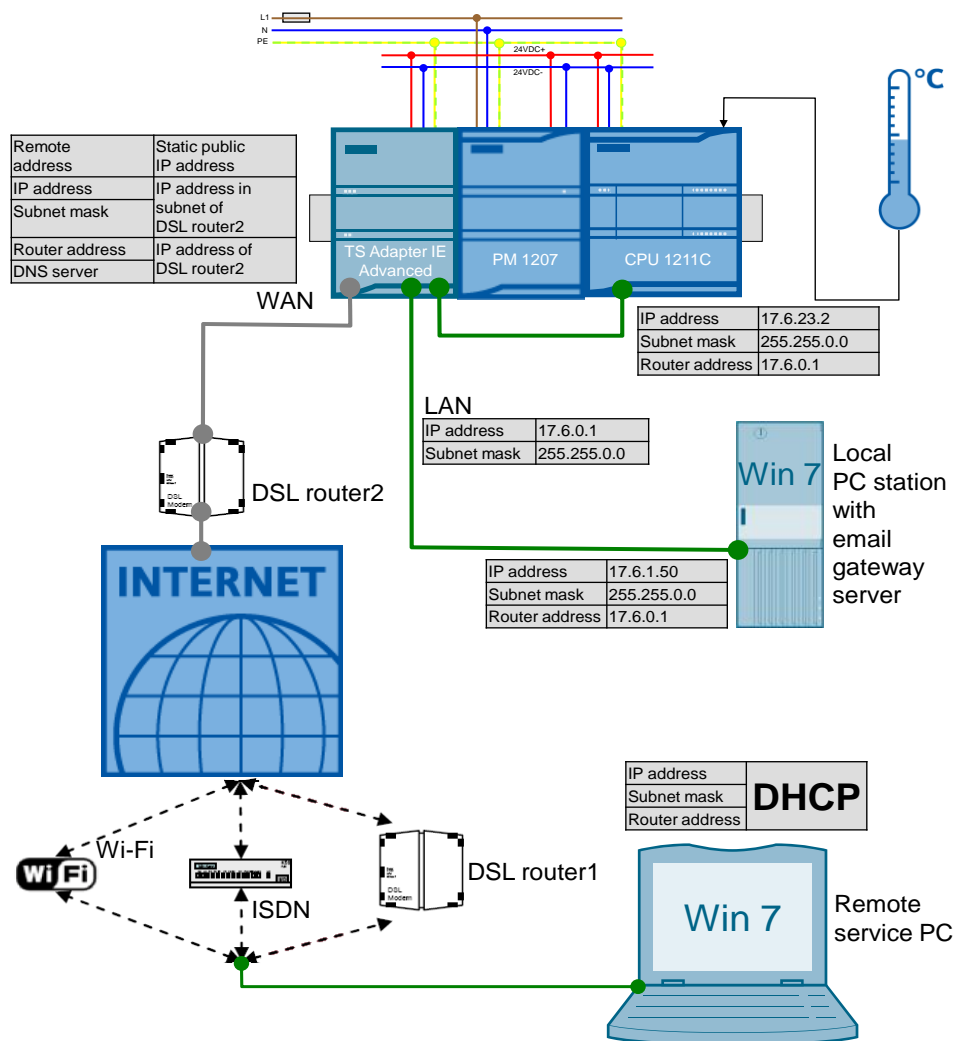
Note

For more information about the choice of your I/O and its wiring, see the ["Technical specifications"](#) in the S7-1200 manual (3).

Installing the hardware

The following figure shows the hardware configuration of the application.

Figure 4-1



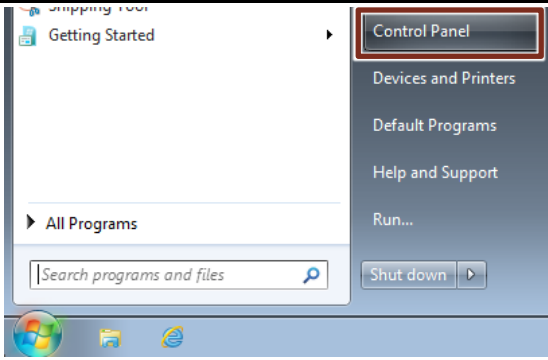
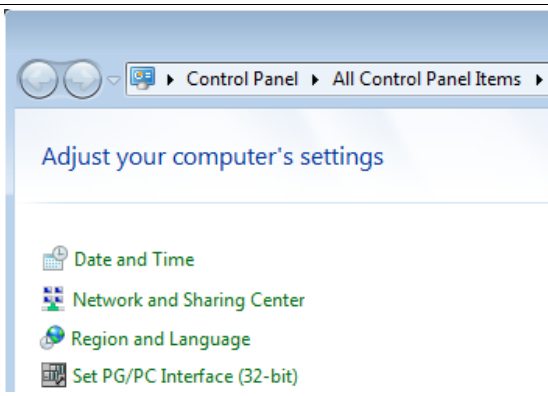
Note Always follow the [guidelines for installing S7-1200 devices](#) (S7-1200 manual \3, "Installation" chapter).

4.2 PG/PC system settings

The application example was implemented with the Microsoft Windows 7 Enterprise operating system, Service Pack 1.

The following system settings must be made in the operating system:

Table 4-1

No.	Action	Comment
1.	Select "Start > Control Panel" to open the system settings.	
2.	The below settings are described in the following sections: <ul style="list-style-type: none"> • Date and Time • Network and Sharing Center • Region and Language • Set PG/PC Interface (32-bit) 	

4.2.1 Date and Time

The date and time must be set to ensure that the correct system time (UTC) is transferred during the later CPU module time synchronization by the remote service PC.

Table 4-2

No.	Action	Comment
1.	Open the "Date and Time" control panel item. <ul style="list-style-type: none"> If necessary, select the "Change time zone..." button. 	
2.	The "Time Zone Settings" open. <ul style="list-style-type: none"> Select your time zone. If necessary, check the "Automatically adjust clock for Daylight Saving Time" check box. Select "OK" to apply the settings. 	

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4.2.2 Network connections

The remote service PC's network connection gets its IP address from the Internet service provider's **D**ynamic **H**ost **C**onfiguration **P**rotocol (DHCP) server.

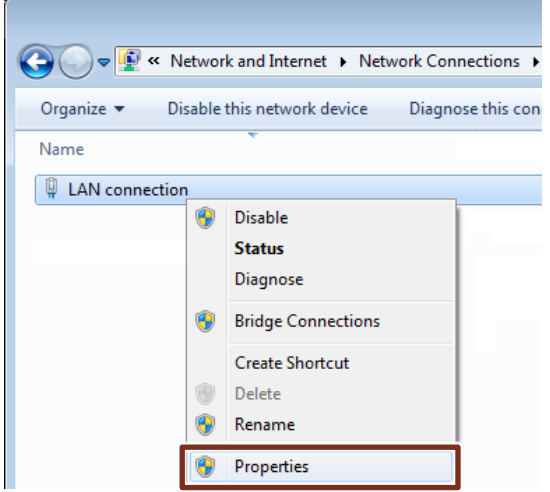
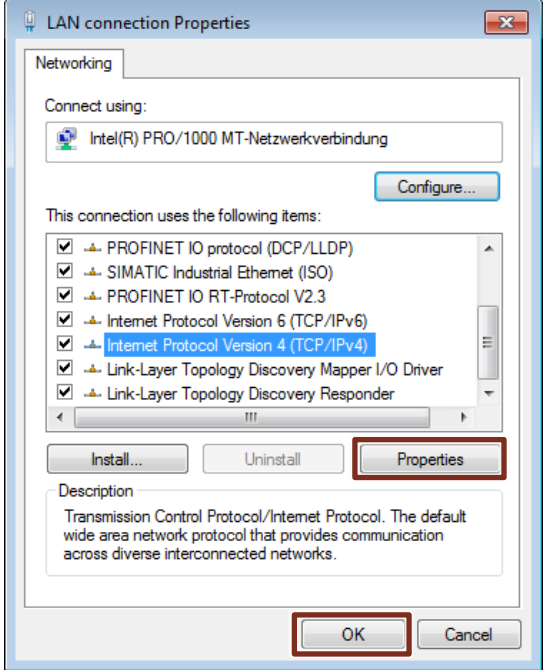
The network card of the PC station in the company network is assigned a static IP address to be reachable as a gateway server.

The following table describes the configuration of this LAN connection.

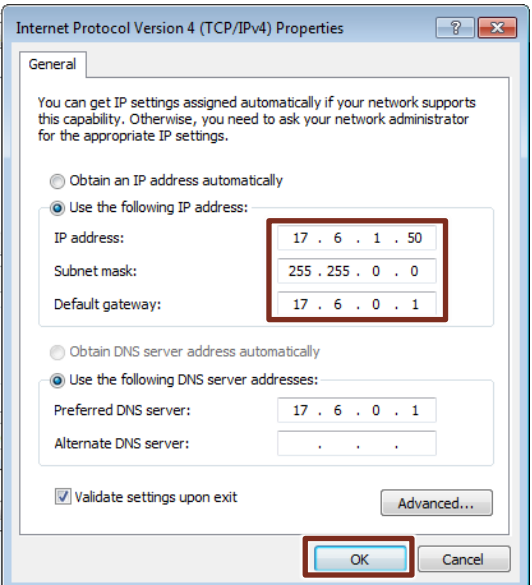
Table 4-3

No.	Action	Comment
1.	Open the "Network and Sharing Center". <ul style="list-style-type: none"> Open the "Change adapter settings" menu item. 	

4 Startup of the Application Example

No.	Action	Comment
2.	<p>The window lists the network connections.</p> <ul style="list-style-type: none"> • Select your network connection. • Right-click to open the properties. 	
3.	<p>In “This connection uses the following items:”, select the “Internet Protocol Version 4 (TCP/IPv4)” item and open its properties.</p>	

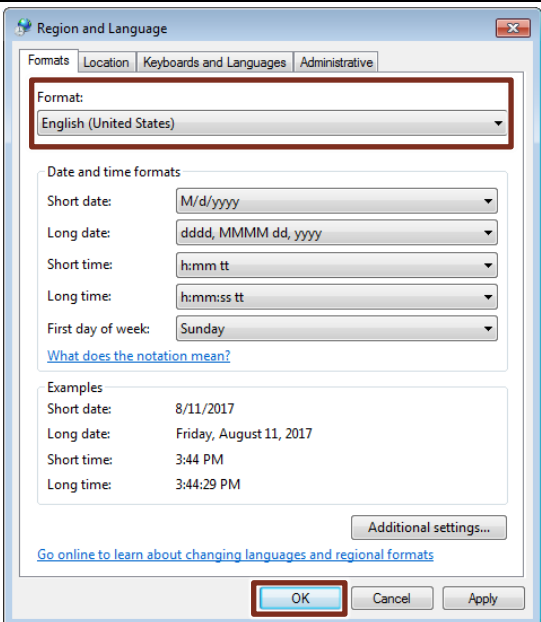
4 Startup of the Application Example

No.	Action	Comment
4.	<ul style="list-style-type: none"> Select “Use the following IP address:”. Assign the IP address, subnet mask and default gateway as shown in the screenshot on the right (see Figure 4-1). Select “OK” to apply the settings. 	

4.2.3 Region and Language

According to US standards, columns are separated by commas. This setting is required to ensure that the csv files are opened directly and correctly by Microsoft Excel on the remote service PC.

Table 4-4

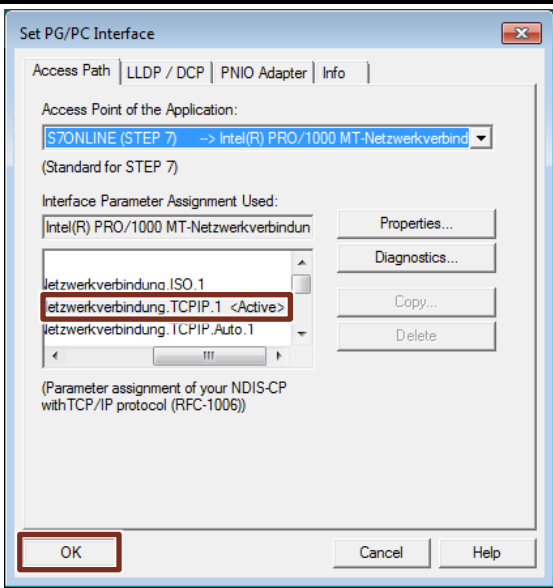
No.	Action	Comment
1.	<p>Open the “Region and Language” control panel item.</p> <ul style="list-style-type: none"> Set the format to “English (United States)”. Select “OK” to apply the setting. 	

Note

For information about how to [import CSV format data logs to non-USA/UK versions of Microsoft Excel](#), refer to the S7-1200 system manual ([13](#)) or use the DataLogConverter ([18](#)).

4.2.4 Setting the PG/PC interface

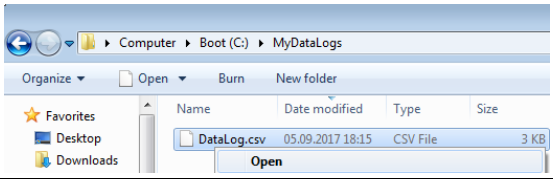
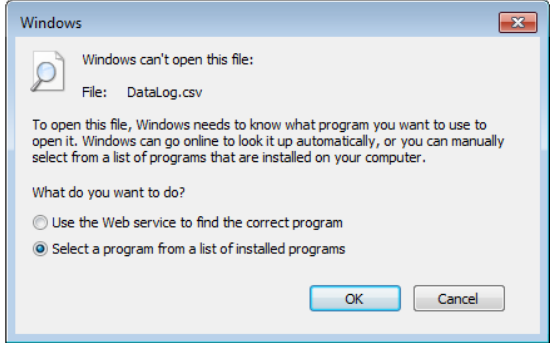
Table 4-5

No.	Action	Comment
1.	<p>On the remote service PC, open the PG/PC interface settings to set the correct access point for STEP 7 V11.</p> <ul style="list-style-type: none"> In “Access Point of the Application”, select “S7ONLINE (STEP 7)”. In “Interface Parameter Assignment Used”, select your network card with the “TCP/IP.1” extension. 	

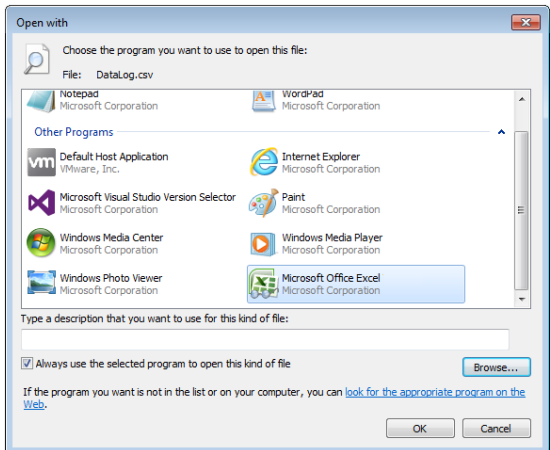
4.2.5 CSV files

To directly open csv files with Microsoft Excel, make the following settings on the remote service PC.

Table 4-6

No.	Action	Comment
1.	<ul style="list-style-type: none"> Select the uploaded csv file and right-click to open “Open”. 	
2.	<p>As long as a program for opening the “.csv” file format has not yet been selected, the “Windows can’t open this file:” message is displayed.</p> <ul style="list-style-type: none"> In “What do you want to do?”, choose “Select a program from a list of installed programs” and select “OK” to confirm your selection. 	

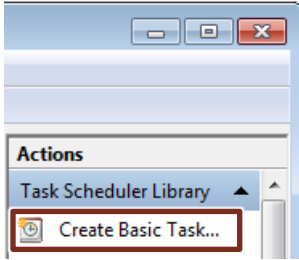
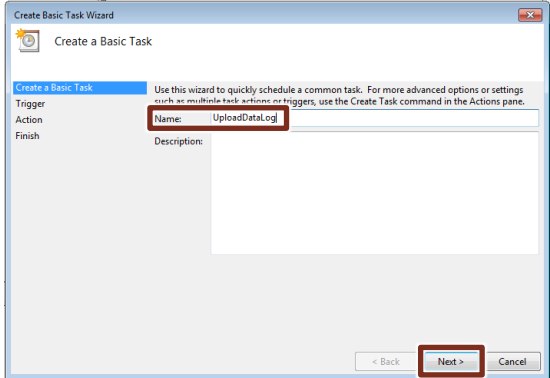
4 Startup of the Application Example

No.	Action	Comment
3.	<ul style="list-style-type: none"> In the “Open with” window, select “Microsoft Office Excel”. Navigate to the file’s storage location, if necessary. Check the “Always use the selected program to open this kind of file” check box. Select “OK” to apply the settings. 	

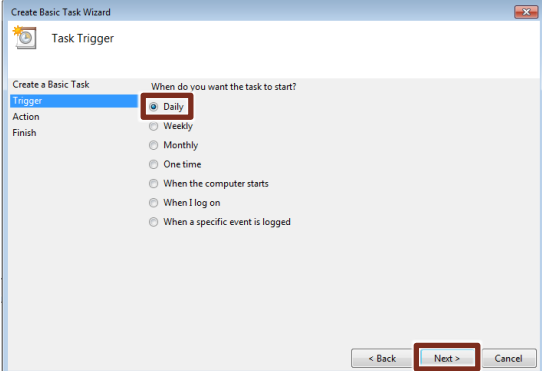
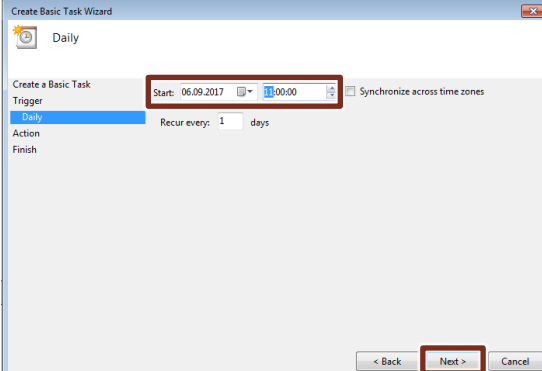
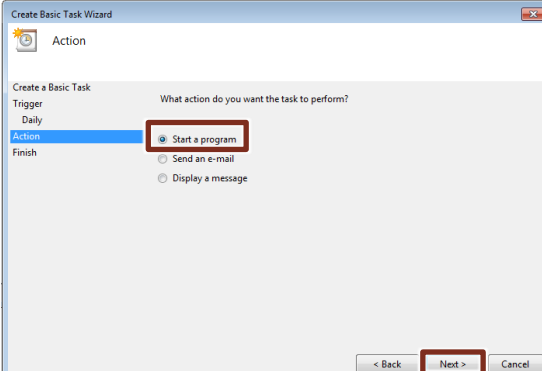
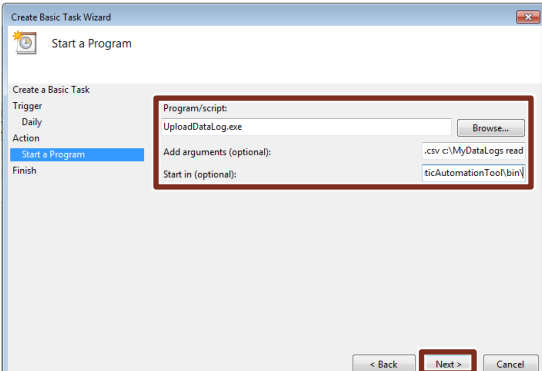
4.2.6 Task Scheduler

For automatic upload of DataLog files, a task is created in the Windows 7 Task Scheduler on the local PC station. This task calls the “UploadDataLog.exe” console application every 5 minutes. This application is used to download the “DataLog” csv file via the API of the SIMATIC Automation Tool V3.0 and save it on the computer (Chapter [3.5](#)).

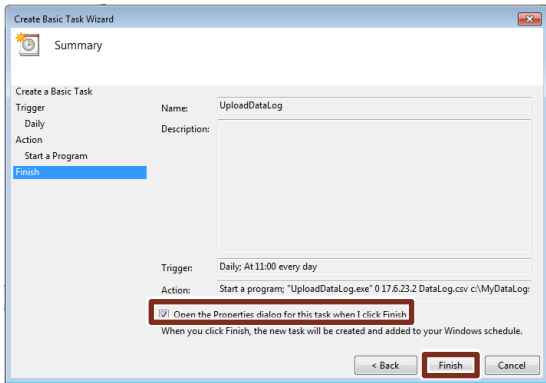
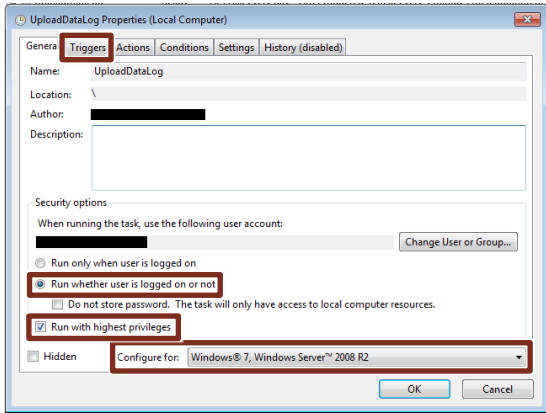
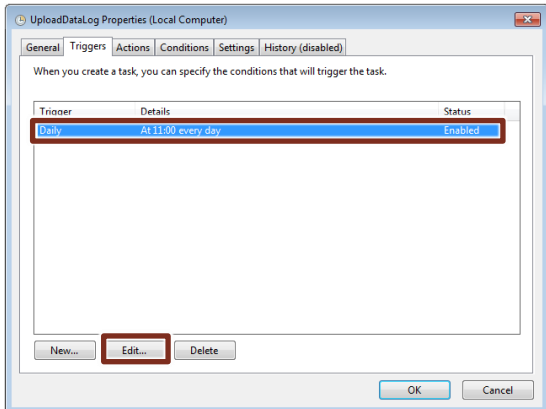
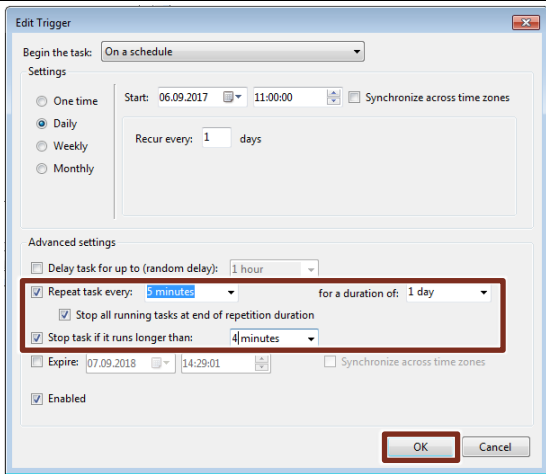
Table 4-7

No.	Action	Comment
1.	Select “Start > All Programs > Accessories > System Tools” to open the Windows “Task Scheduler”.	
2.	This opens the “Task Scheduler” overview. <ul style="list-style-type: none"> In the top right “Actions > Task Scheduler Library”, click “Create Basic Task...”. 	
3.	This opens the “Create Basic Task Wizard”. <ul style="list-style-type: none"> Assign an appropriate name. Click “Next >”. 	

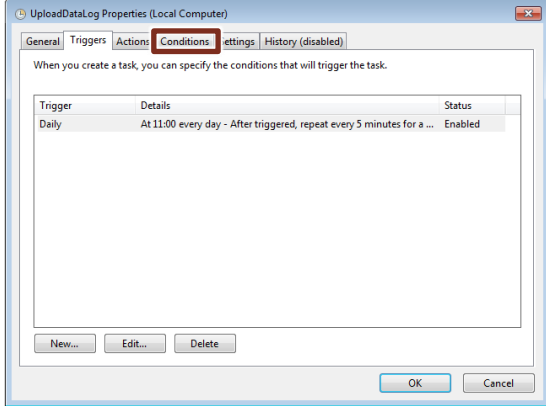
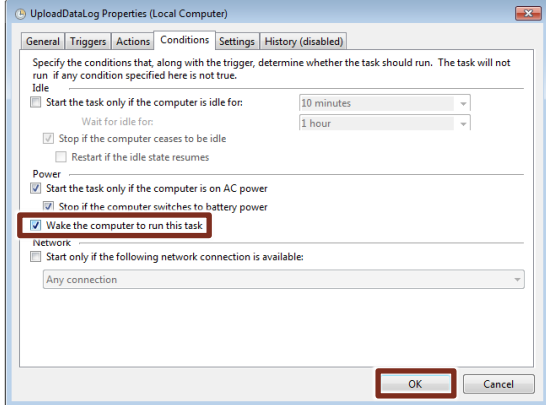
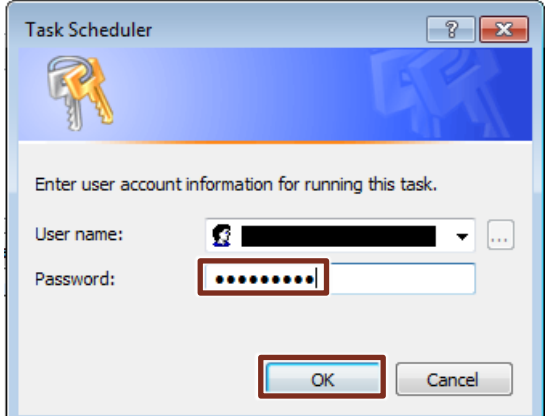
4 Startup of the Application Example

No.	Action	Comment
4.	<ul style="list-style-type: none"> In "Trigger", select "Daily". Click "Next >". 	
5.	<p>Use the current date as the start date.</p> <ul style="list-style-type: none"> Enter the start time. Click "Next >". 	
6.	<ul style="list-style-type: none"> In "Action", select "Start a program". Click "Next >". 	
7.	<p>In the "Start a program" settings window, make the following settings:</p> <ul style="list-style-type: none"> Program/script: <i>UploadDataLog.exe</i> Add arguments (optional): <i>0 17.6.23.2 DataLog.csv</i> <i>c:\MyDataLogs read</i> Start in (optional): <i>c:\Program</i> <i>Files\Siemens\Automation\SimaticAuto</i> <i>mationTool\bin\</i> <p>Click "Next >".</p>	

4 Startup of the Application Example

No.	Action	Comment
8.	<ul style="list-style-type: none"> Check the following check box: <i>Open the Properties dialog box for this task when I click Finish.</i> Click "Finish". 	
9.	<ul style="list-style-type: none"> In the "General" form, "Security options", select the "Run whether user is logged on or not" option. Check the "Run with highest privileges" check box. In "Configure for:", select "Windows 7, Windows Server 2008 R2". Go to the "Trigger" form. 	
10.	<ul style="list-style-type: none"> Select the created trigger entry and click "Edit...". 	
11.	<ul style="list-style-type: none"> In "Advanced settings", check the "Repeat task every:" check box. Select an interval of "5 minutes". In "for a duration of:", select "1 day". Check the "Stop all running tasks at end of repetition duration" check box. Check the "Stop task if it runs longer than:" check box. Select "4 minutes". Select "OK" to apply the settings. 	

4 Startup of the Application Example

No.	Action	Comment
12.	<ul style="list-style-type: none"> Go to the “Conditions” form. 	
13.	<ul style="list-style-type: none"> In “Power”, check the “Wake the computer to run this task” check box. Click “OK” to finish the settings of the scheduled task’s properties. 	
14.	<p>Due to the “Run whether user is logged on or not” security option selected in step 9, you must enter the user account information and confirm it with “OK” in order to run this task.</p>	

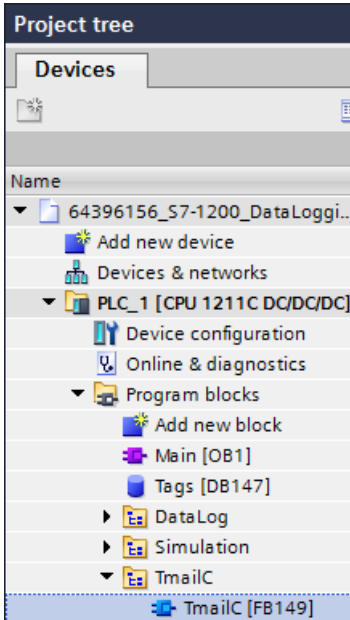
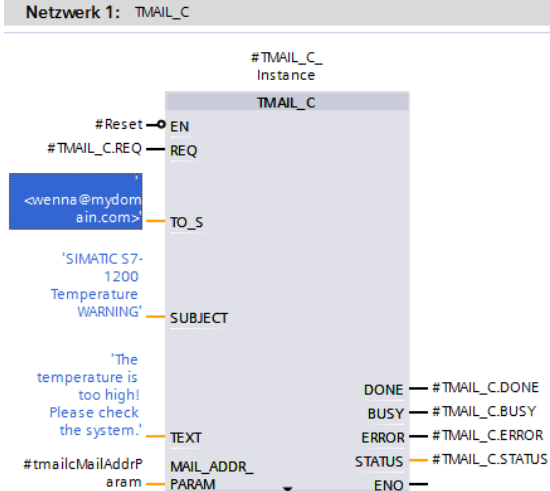
The “UploadDataLog.exe” console application is now called every 5 minutes and via network card “0” (1st argument) of the CPU’s SMC with IP address “17.6.23.2” (2nd argument), downloads the “DataLog.csv” DataLog file (3rd argument) and saves it to the “c:\MyDataLogs” directory (4th argument). The password for read access to the CPU is “read” (5th argument).

4.3 Customizing the project

4.3.1 TMAIL_C

The “TMAIL_C” FB for sending the alarm message by email must be provided with the access details of your email account and the email address of the recipient.

Table 4-8

No.	Action	Comment
1.	Use STEP 7 to open the “TmailC” function block in the project.	
2.	<p>At the “TO_S” parameter, enter the recipient’s email address as a string. Example: ' <wenna@mydomain.com>'</p> <p>Please note:</p> <ul style="list-style-type: none"> • Each address must be preceded by a space and an opening angle bracket (“<”). • Each address must be followed by a closing angle bracket (“>”). • When entering multiple addresses, the addresses must be separated by a comma. 	

4 Startup of the Application Example

No.	Action	Comment																																																																																				
3.	<p>Open the static parameters of the “tmailcMailAddrParam” instance in the interface of FB 149 “TmailC”.</p> <p>Enter the access details of your email account as defaults:</p> <ul style="list-style-type: none"> At the “MailServerAddress” parameter, enter the IP address of the email gateway server as an Array of Byte: For example: IP address = 17.6.1.50 At the “UserName” parameter, enter the access name of the gateway account as a string. For example, ‘gateway_account’ At the “PassWord” parameter, enter the password of the gateway account as a string. For example, ‘password’ <p>In “From”, enter the following parameters:</p> <ul style="list-style-type: none"> “LocalPartPlusAtSign”: the local part of the sender address of the gateway account, including the @ sign For example: ‘gateway_account@’ “FullQualifiedDomainName”: domain name of the gateway server Example: ‘gateway_server.com’ 	<table border="1"> <thead> <tr> <th colspan="4">TmailC</th> </tr> <tr> <th>Name</th> <th>Data type</th> <th colspan="2">Default value</th> </tr> </thead> <tbody> <tr> <td>Static</td> <td></td> <td></td> <td></td> </tr> <tr> <td>tmailcMailAddrParam</td> <td>TMail_V4</td> <td></td> <td></td> </tr> <tr> <td>InterfaceId</td> <td>HW_ANY</td> <td>64</td> <td></td> </tr> <tr> <td>ID</td> <td>CONN_OUC</td> <td>1</td> <td></td> </tr> <tr> <td>ConnectionType</td> <td>Byte</td> <td>16#20</td> <td></td> </tr> <tr> <td>ActiveEstablished</td> <td>Bool</td> <td>true</td> <td></td> </tr> <tr> <td>CertIndex</td> <td>Byte</td> <td>16#0</td> <td></td> </tr> <tr> <td>WatchDogTime</td> <td>Time</td> <td>T#1m</td> <td></td> </tr> <tr> <td>MailServerAddress</td> <td>IP_V4</td> <td></td> <td></td> </tr> <tr> <td> ADDR</td> <td>Array[1..4] of Byte</td> <td></td> <td></td> </tr> <tr> <td> ADDR[1]</td> <td>Byte</td> <td>17</td> <td></td> </tr> <tr> <td> ADDR[2]</td> <td>Byte</td> <td>6</td> <td></td> </tr> <tr> <td> ADDR[3]</td> <td>Byte</td> <td>1</td> <td></td> </tr> <tr> <td> ADDR[4]</td> <td>Byte</td> <td>50</td> <td></td> </tr> <tr> <td>UserName</td> <td>String[254]</td> <td colspan="2">‘gateway_account’</td> </tr> <tr> <td>PassWord</td> <td>String[254]</td> <td colspan="2">‘password’</td> </tr> <tr> <td>From</td> <td>EMAIL_ADDR</td> <td></td> <td></td> </tr> <tr> <td> LocalPartPlusAtSign</td> <td>String[64]</td> <td colspan="2">‘gateway_account@’</td> </tr> <tr> <td> FullQualifiedDomainName</td> <td>String[254]</td> <td colspan="2">‘gateway_server.com’</td> </tr> </tbody> </table>	TmailC				Name	Data type	Default value		Static				tmailcMailAddrParam	TMail_V4			InterfaceId	HW_ANY	64		ID	CONN_OUC	1		ConnectionType	Byte	16#20		ActiveEstablished	Bool	true		CertIndex	Byte	16#0		WatchDogTime	Time	T#1m		MailServerAddress	IP_V4			ADDR	Array[1..4] of Byte			ADDR[1]	Byte	17		ADDR[2]	Byte	6		ADDR[3]	Byte	1		ADDR[4]	Byte	50		UserName	String[254]	‘gateway_account’		PassWord	String[254]	‘password’		From	EMAIL_ADDR			LocalPartPlusAtSign	String[64]	‘gateway_account@’		FullQualifiedDomainName	String[254]	‘gateway_server.com’	
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PassWord	String[254]	‘password’																																																																																				
From	EMAIL_ADDR																																																																																					
LocalPartPlusAtSign	String[64]	‘gateway_account@’																																																																																				
FullQualifiedDomainName	String[254]	‘gateway_server.com’																																																																																				

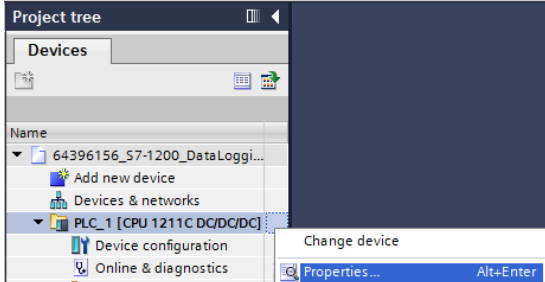
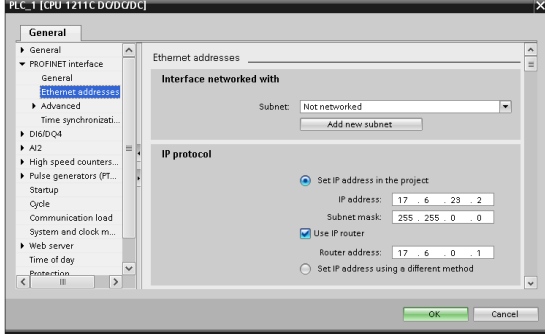

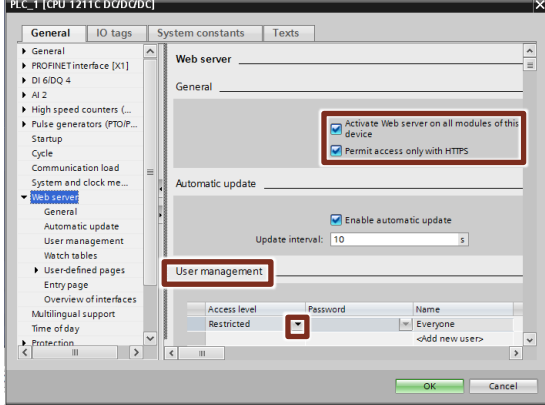

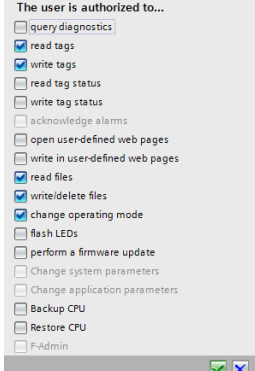
Note

The CPU forwards the unencrypted email to the local gateway server via SMTP (port 25). The gateway account created here directly forwards the encrypted email to an external email account of an email service provider. The provider then sends the email to the actual recipient (“TO_S”). The recipient therefore only sees the external email address as the sender.

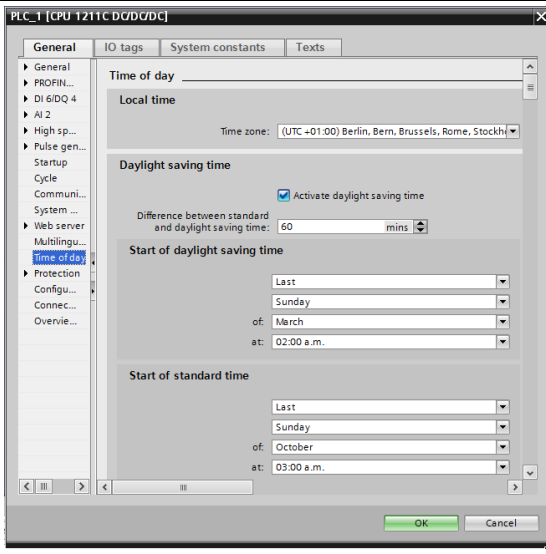

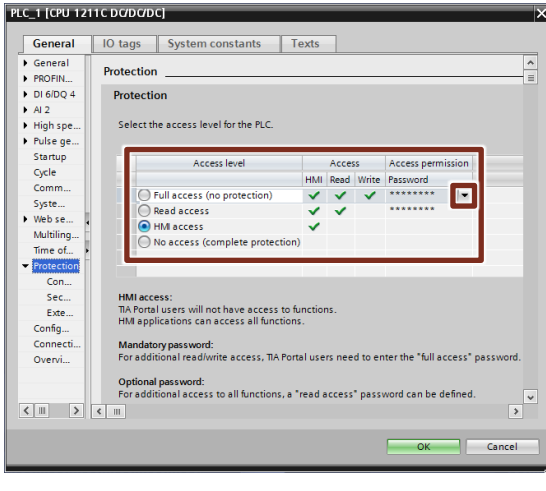


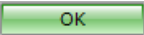
4.3.2 CPU properties

The 'Ethernet addresses' and 'Time of day' CPU properties must be customized. In addition, the Web server must be activated so that the DataLog files can be downloaded via remote access.

Table 4-9

No.	Action	Comment
1.	Select the controller and right-click to open "Properties..."	
2.	<ul style="list-style-type: none"> In "PROFINET interface > Ethernet addresses > IP protocol", check the "Use IP router" check box. Enter the IP address of your VPN-capable router (on the controller side). Customize the IP address and the subnet mask to your router network. 	
3.	<ul style="list-style-type: none"> Activate the Web server. Check the "Permit access only with HTTPS" check box. In "User management", use the  button to open the settings for the access level of the "Everyone" user. <p>The "Everyone" user does not need a password for Web server access. If you want to protect access with a password, "<Add [a] new user>", assign a password and make the following access level settings.</p>	
4.	<p>Check the following check boxes: "The user is authorized to..."</p> <ul style="list-style-type: none"> ...read tags ...write tags ...read files ...write/delete files ...change operating mode" <p>Select the  button to apply the settings.</p>	

4 Startup of the Application Example

No.	Action	Comment
5.	<ul style="list-style-type: none"> In “Time of day > Local time”, set your “Time zone”. If required, check the “Activate daylight saving time” check box and specify the start of daylight saving and standard time. <p>These settings are important for calculating the local time and setting the system time for the correct time stamp of the logged values.</p> <ul style="list-style-type: none"> Click “OK” to confirm all entries. 	
6.	<p>For access to the DataLog files, the SIMATIC Automation Tool needs the password for full or read access of the CPU.</p> <ul style="list-style-type: none"> Open the “Protection” settings. Enable the “HMI access” access level. Select the “Full access (no protection)” access level. Use the  button to open the password assignment. <p>Note: If you set the “No access (full protection)” option for the CPU’s access level, the “Everyone” user has no permission to access the Web server, regardless of the Web server user permissions that have been set! (See steps 3 and 4.)</p>	
7.	<ul style="list-style-type: none"> Enter the password “full”, confirm it and use the  button to apply the settings. Repeat steps 6 and 7 for the “Read access” access level using the password “read”. 	
8.	<ul style="list-style-type: none"> Use the  button to apply the CPU properties. 	

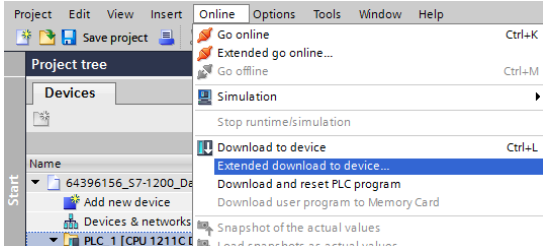
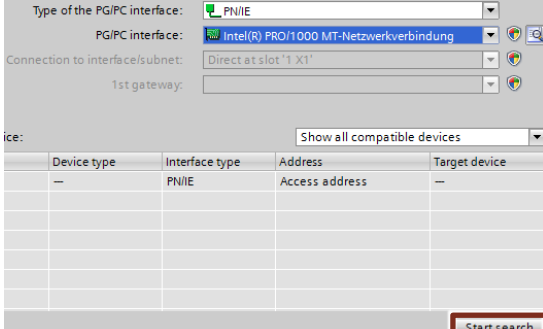
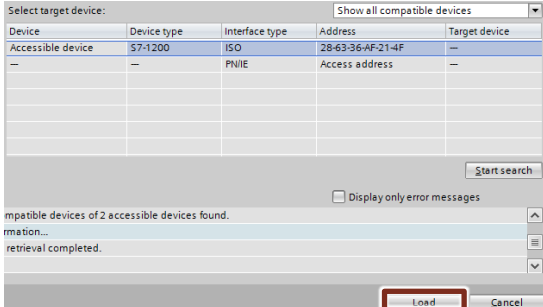
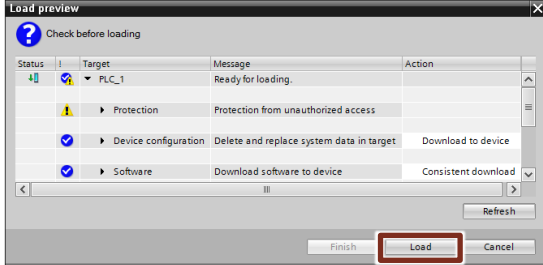
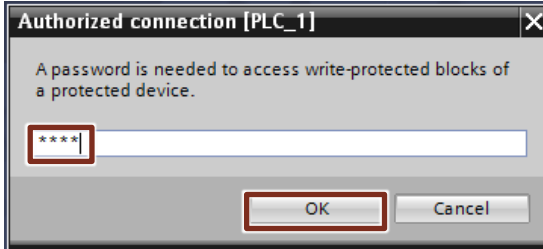
4.3.3 Downloading the project

Before remote access to the S7-1200, the interface of the CPU must be parameterized as specified (see [Figure 4-1](#)). This can be done on the local PC station using the [SIMATIC Automation Tool](#) ([\19](#)). Then the project can be downloaded from the service PC to the controller via VPN.

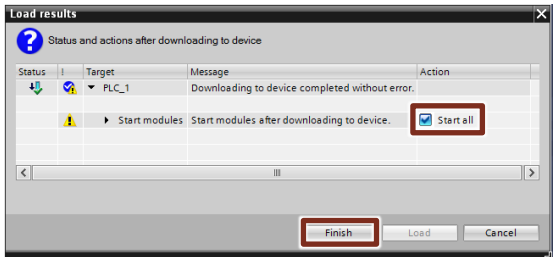
Or you can download the project with the service PC using a direct connection to the CPU on site as described in the following document:

4 Startup of the Application Example

Table 4-10

No.	Action	Comment															
1.	<ul style="list-style-type: none"> Save the project. Select the program folder of the S7-1200 and use “Online > Extended download to device...” to transfer the program to the controller. 																
2.	<ul style="list-style-type: none"> In “Type of the PG/PC interface”, select “PN/IE”. In “PG/PC interface”, select your LAN card. Select “Show all compatible devices”. Use the Start search button to start the search. 																
3.	<ul style="list-style-type: none"> Select your CPU from the target device list. Select the “Load” button. 	 <table border="1" data-bbox="815 936 1359 1070"> <thead> <tr> <th>Device</th> <th>Device type</th> <th>Interface type</th> <th>Address</th> <th>Target device</th> </tr> </thead> <tbody> <tr> <td>Accessible device</td> <td>S7-1200</td> <td>ISO</td> <td>28-63-36-AF-21-4F</td> <td>---</td> </tr> <tr> <td>---</td> <td>---</td> <td>PN/IE</td> <td>Access address</td> <td>---</td> </tr> </tbody> </table>	Device	Device type	Interface type	Address	Target device	Accessible device	S7-1200	ISO	28-63-36-AF-21-4F	---	---	---	PN/IE	Access address	---
Device	Device type	Interface type	Address	Target device													
Accessible device	S7-1200	ISO	28-63-36-AF-21-4F	---													
---	---	PN/IE	Access address	---													
4.	<ul style="list-style-type: none"> Use the “Load” button to confirm the Load preview. 																
5.	<ul style="list-style-type: none"> You may be required to enter the password for “full” access. Click “OK” to confirm your entries. 																

4 Startup of the Application Example

No.	Action	Comment
6.	<ul style="list-style-type: none"> In "Load results", check the "Start all" check box. To complete loading, select the "Finish" button. 	

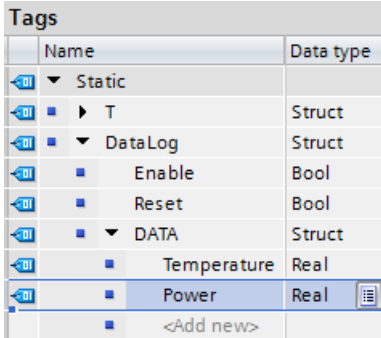
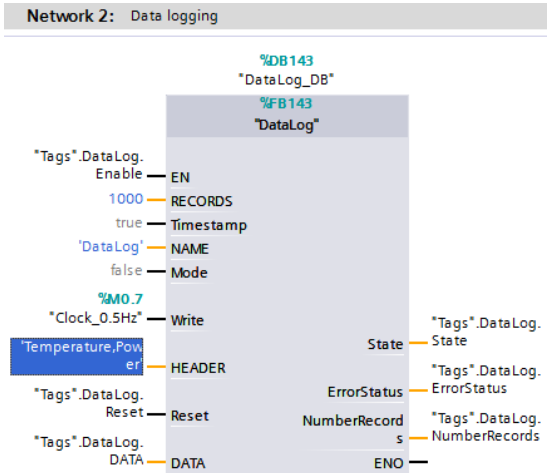
4.3.4 Changing the record data structure

If you change the record data structure "DATA" this will be transferred to the csv file only after a successful rebuild of the data log file via "DataLogCreate".


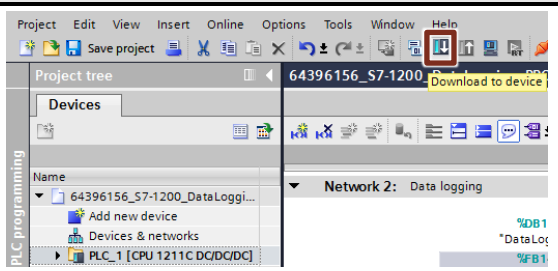

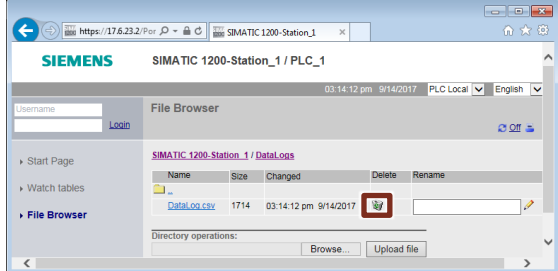
If you leave the name "NAME" of the data log file unchanged, step 0 "DataLogCreate" is skipped with the message "Data log already exists" ([Figure 3-5](#)) and the original data structure remains.

You can achieve the successful rebuilding of the data log file by additionally deleting the existing csv file via the web server after downloading the modified program code. Proceed as follows:

Table 4-11

No.	Action	Comment
1.	<ul style="list-style-type: none"> Open the data block "Tags". Open the struct "DataLog". Add an additional variable to the "DATA" structure. 	
2.	<ul style="list-style-type: none"> Open OB1 "Main". Open network 2. Change the "HEADER" according to the changed record data structure. <p>Note: The value generation of the new variable to be recorded must happen before the call of the FB "DataLog" (corresponding to network 1 for the variable "Temperature").</p>	

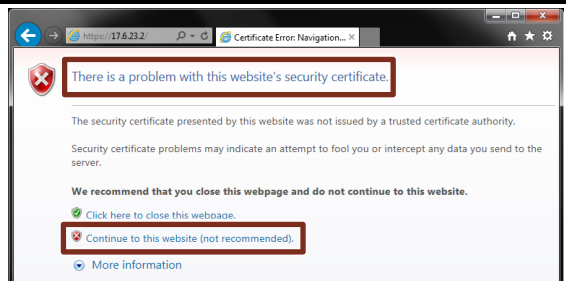

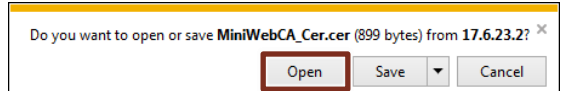
4 Startup of the Application Example

No.	Action	Comment
3.	<ul style="list-style-type: none"> Download the changed program code to the device via . 	
4.	<ul style="list-style-type: none"> Open the web server of the CPU via your internet browser (chapter 5.3). Navigate to the folder "DataLogs" via "File Browser". Delete the existing file "DataLog.csv" via symbol . <p>Then the file with the changed record data structure is recreated and you can access it (as described in chapter 5.3 and 5.4).</p>	

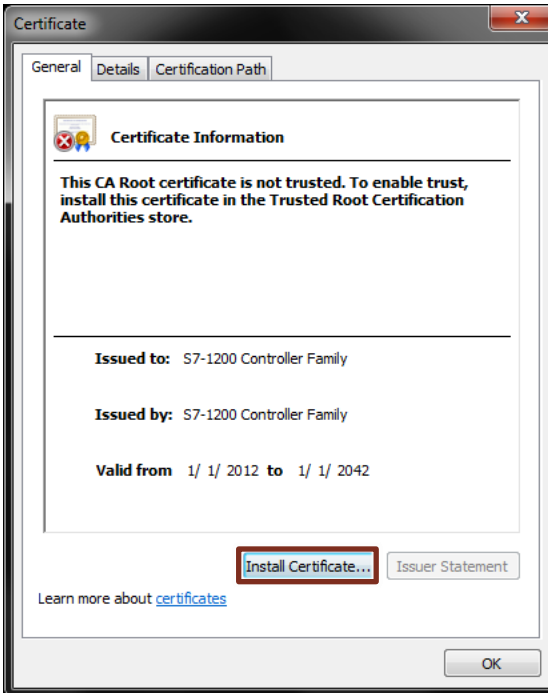
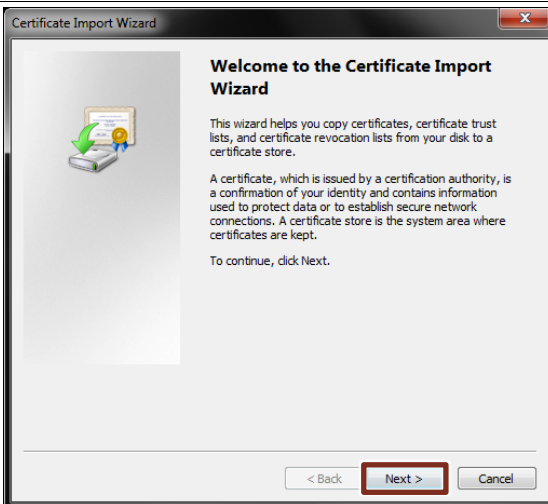
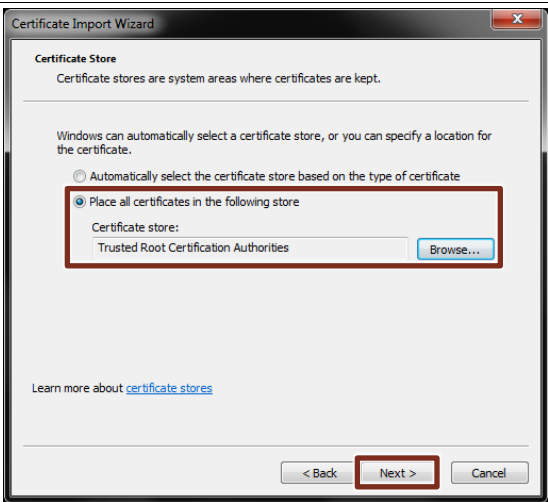
4.4 Internet browser settings (Internet Explorer 11)

For secure access to the Web server, the certificate of your S7-1200 CPU must be installed on the remote service PC as described in the following table:

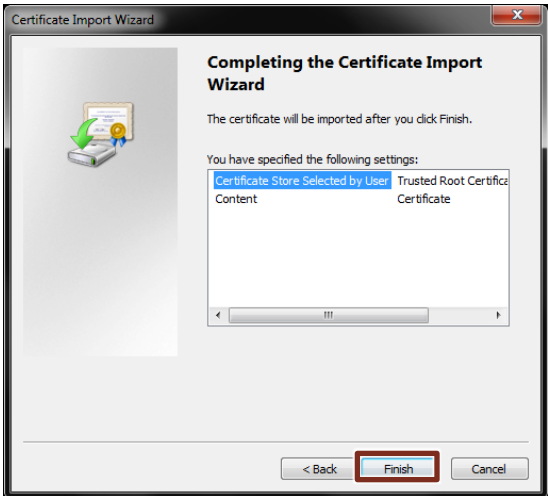
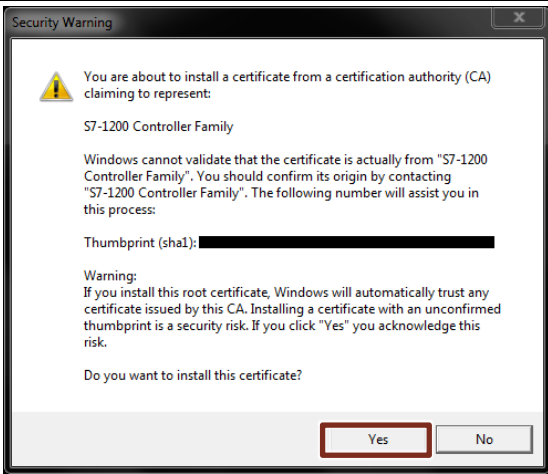
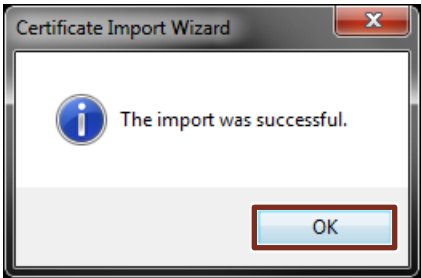
Table 4-12

No.	Action	Comment
1.	<ul style="list-style-type: none"> Start Internet Explorer. Specify the secure connection to the CPU's Web server: here: https://17.6.23.2 <p>If the "There is a problem with this website's security certificate." Message appears, click "Continue to this website (not recommended).".</p>	
2.	<p>The Web server's introduction page opens.</p> <ul style="list-style-type: none"> Click "download certificate". 	
3.	<p>You are asked if you want to open or save the "MiniWebCA_Cer.cer" certificate.</p> <ul style="list-style-type: none"> In the dialog, click "Open". 	

4 Startup of the Application Example

No.	Action	Comment
4.	<p>The "certificate" is displayed.</p> <ul style="list-style-type: none"> Click the "Install Certificate..." button to open the Certificate Import Wizard. 	
5.	<ul style="list-style-type: none"> Follow the "Certificate Import Wizard" dialogs to import the certificate. 	
6.	<ul style="list-style-type: none"> Select "Place all certificates in the following store". Click the "Browse..." button. Select the "Trusted Root Certification Authorities" certificate store. <p>Select "OK" and "Next >" to confirm your selection.</p>	

4 Startup of the Application Example

No.	Action	Comment		
7.	<ul style="list-style-type: none"> Click "Finish" to import the certificate. 	 <p>Certificate Import Wizard</p> <p>Completing the Certificate Import Wizard</p> <p>The certificate will be imported after you click Finish.</p> <p>You have specified the following settings:</p> <table border="1"> <tr> <td>Certificate Store Selected by User</td> <td>Trusted Root Certificate Content</td> </tr> </table> <p>< Back Finish Cancel</p>	Certificate Store Selected by User	Trusted Root Certificate Content
Certificate Store Selected by User	Trusted Root Certificate Content			
8.	<ul style="list-style-type: none"> Select "Yes" to confirm the security warning and the certificate installation. 	 <p>Security Warning</p> <p>Warning</p> <p>You are about to install a certificate from a certification authority (CA) claiming to represent:</p> <p>S7-1200 Controller Family</p> <p>Windows cannot validate that the certificate is actually from "S7-1200 Controller Family". You should confirm its origin by contacting "S7-1200 Controller Family". The following number will assist you in this process:</p> <p>Thumbprint (sha1): [REDACTED]</p> <p>Warning: If you install this root certificate, Windows will automatically trust any certificate issued by this CA. Installing a certificate with an unconfirmed thumbprint is a security risk. If you click "Yes" you acknowledge this risk.</p> <p>Do you want to install this certificate?</p> <p>Yes No</p>		
9.	<ul style="list-style-type: none"> When the "The import was successful" message is displayed, click "OK" to close all windows. <p>For the certificate to be recognized when opening the Web server, restart Internet Explorer.</p>	 <p>Certificate Import Wizard</p> <p>i The import was successful.</p> <p>OK</p>		

5 Operation of the Application Example

5.1 Overview

The functions of the application example are divided into:

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

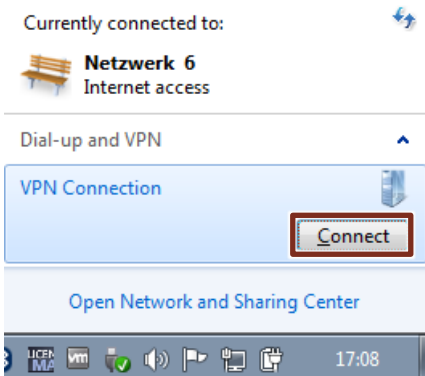

5.2 Remote maintenance

Access to the controller requires that the VPN tunnel be established by the service PC.


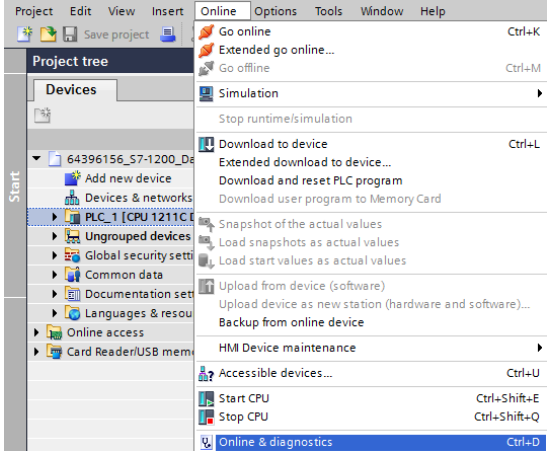
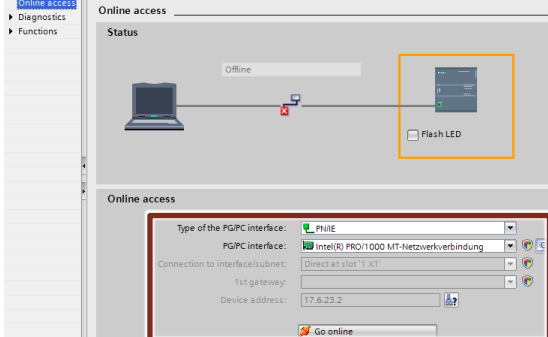
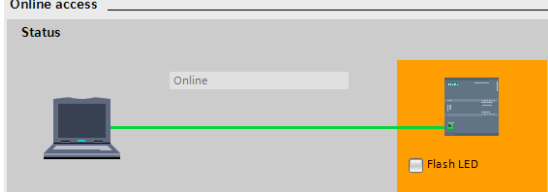
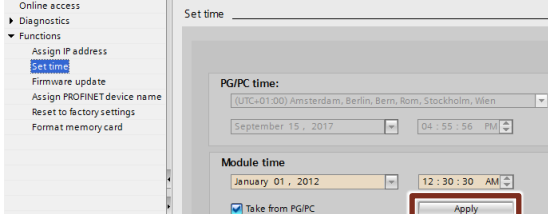
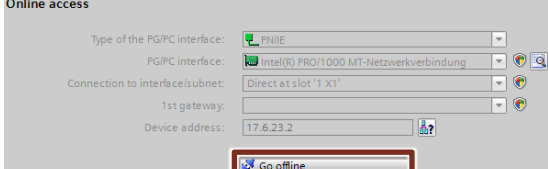
As is the case with a direct LAN connection, you can communicate with the controller via STEP 7 (requires an existing project).

Access to the CPU via STEP 7 is demonstrated using the example of time synchronization.

Table 5-1

No.	Action	Comment
1.	Establish the VPN connection (e.g., via the WAN Miniport (SSTP) in Windows).	
2.	Enter your connection data and establish the connection.	

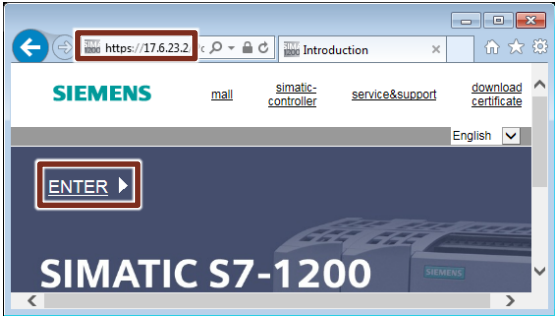
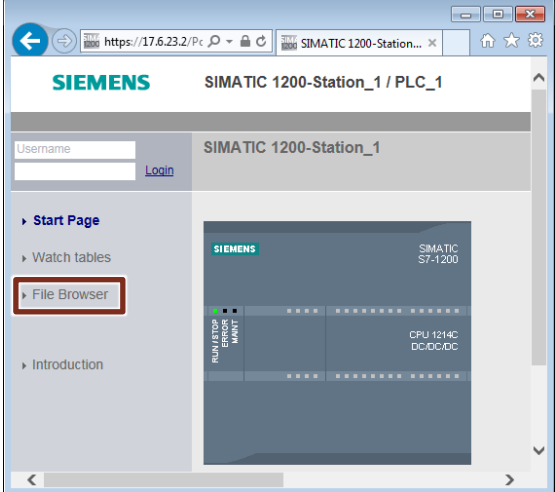
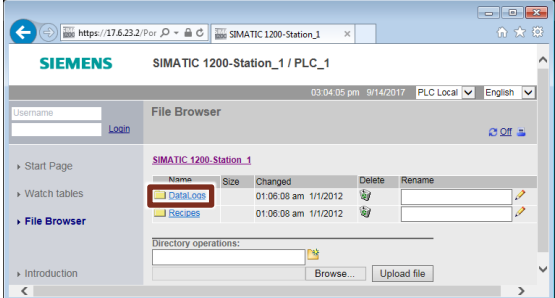
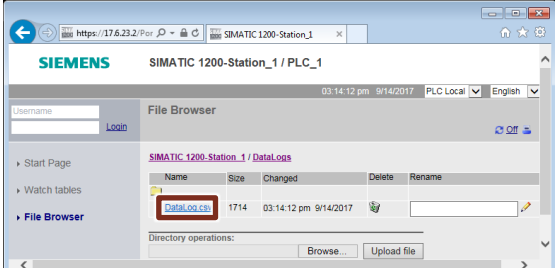
5 Operation of the Application Example

No.	Action	Comment
3.	Connection establishment is displayed.	
4.	<ul style="list-style-type: none"> In the project, select the program folder of the S7-1200. Select "Online/Online & diagnostics" to enable the diagnostic functions. 	
5.	<ul style="list-style-type: none"> In "Type of the PG/PC interface", select "PN/IE". In "PG/PC interface", select your connection to the Internet. Use the "Go online" button to connect to the CPU. 	
6.	The "Online" status is displayed.	
7.	<ul style="list-style-type: none"> Open the "Set time" function. Use the "Apply" button to synchronize the module time with the PG/PC time. <p>This synchronization requires that the date and time of the CPU / PG/PC be set correctly.</p>	
8.	The "Online access" menu item (see step 5) allows you to "Go offline".	

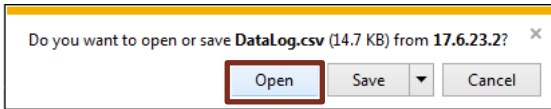
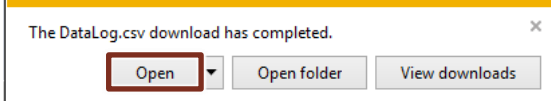
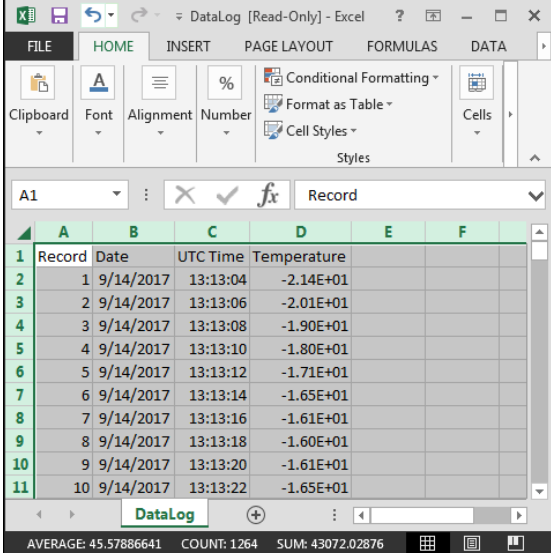
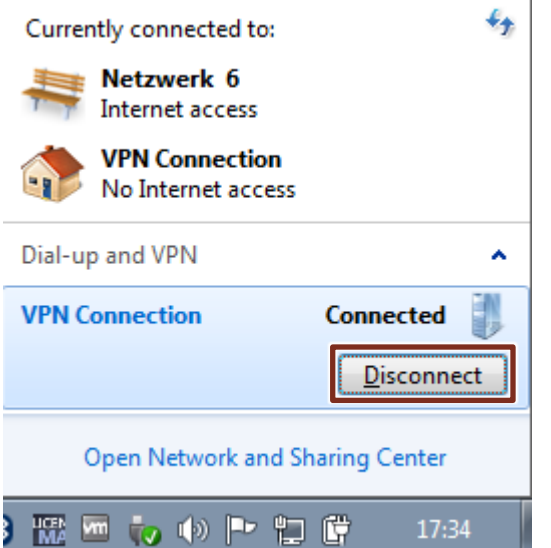
5.3 Manual upload of the DataLog file

Manual upload of the DataLog file is demonstrated using Microsoft Internet Explorer 11 of the service PC.

Table 5-2

No.	Action	Comment
1.	<ul style="list-style-type: none"> Start Internet Explorer. As the address, enter the IP address of the CPU: here: https://17.6.23.2 Click "ENTER". 	
<p>Note: If the "There is a problem with this website's security certificate." Message appears, download the Siemens security certificate as described in Chapter 4.4.</p>		
2.	<ul style="list-style-type: none"> Open the "File Browser". 	
3.	<p>Go to the "DataLogs" folder to open the list of log files.</p>	
4.	<p>A list of all existing DataLog files opens, including the size and time stamp of the last access.</p> <p>You can delete and rename files or upload files from the computer to the Web server.</p> <ul style="list-style-type: none"> Click the name of the desired file (here: "DataLog.csv"). 	

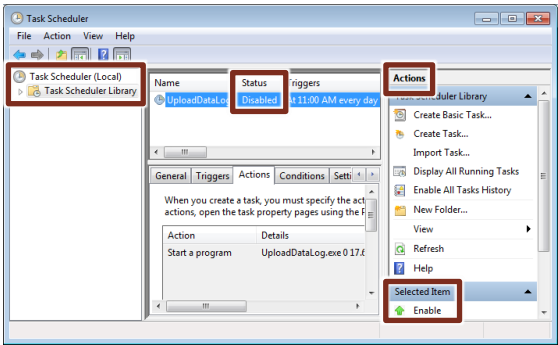
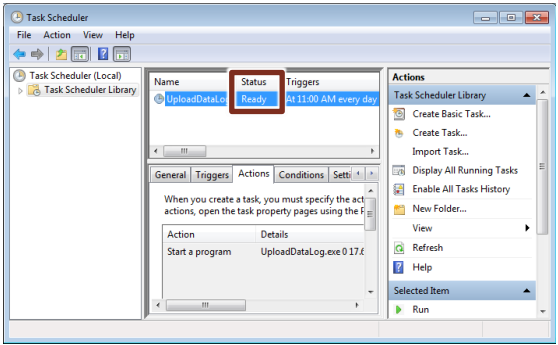
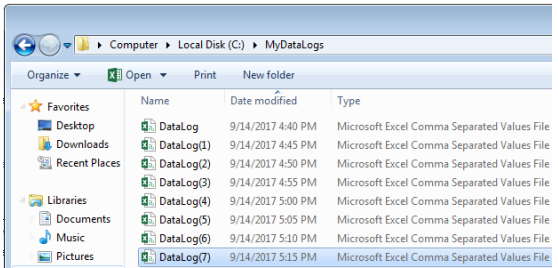
5 Operation of the Application Example

No.	Action	Comment
5.	<p>The display window allows you to open or save the csv file.</p> <ul style="list-style-type: none"> Click the "Open" button (2 x). 	 
6.	<p>Due to the default and format settings that have already been made (see Chapter 4.2.3), Microsoft Excel correctly displays the csv file with the following columns:</p> <ul style="list-style-type: none"> "Record" (record number) "Date" "UTC time" (time stamp) "Temperature" 	
7.	<p>Disconnect the VPN connection.</p>	

5.4 Automatic upload of the DataLog file

Automatic upload is shown using the Windows Task Scheduler on the local PC station (see Chapter 4.2.6). The “UploadDataLog.exe” file is executed every 5 minutes and after specifying arguments, downloads the “DataLog.csv” file from the CPU’s flash memory (MMC) and saves it to the “C:\MyDataLogs” folder on the programmer. During this process, the “UploadDataLog.exe” file accesses the API of the SIMATIC Automation Tool V3.0.

Table 5-3

No.	Action	Comment
1.	<ul style="list-style-type: none"> Select “Start > All Programs > Accessories > System Tools” to open the Windows “Task Scheduler”. 	
2.	<p>The “Task Scheduler Library”, “Task Scheduler (Local)”, lists the “UploadDataLog” task created in Chapter 4.2.6.</p> <ul style="list-style-type: none"> If this task is disabled (see the “Status” column), select the task and use “Actions > Selected Item” to enable it. 	
3.	<p>If the “Status” column displays “Ready”, the task is executed every 5 minutes.</p> <p>Due to the “Run whether user is logged on or not” security option (Table 4-7, step 9), the task is executed in the background without a console window appearing.</p>	
4.	<ul style="list-style-type: none"> Open the “C:\MyDataLogs” destination folder. <p>This where the downloaded “DataLog.csv” file is saved every 5 minutes. Newly saved files are incremented with their name extension. This ensures that data is not overwritten.</p>	

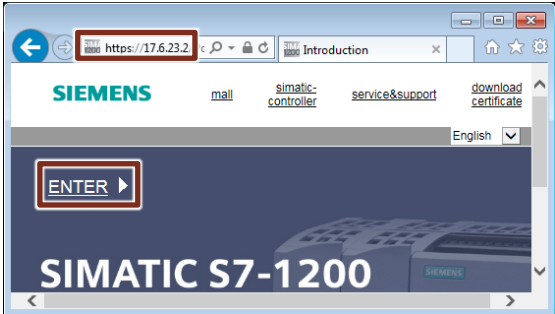
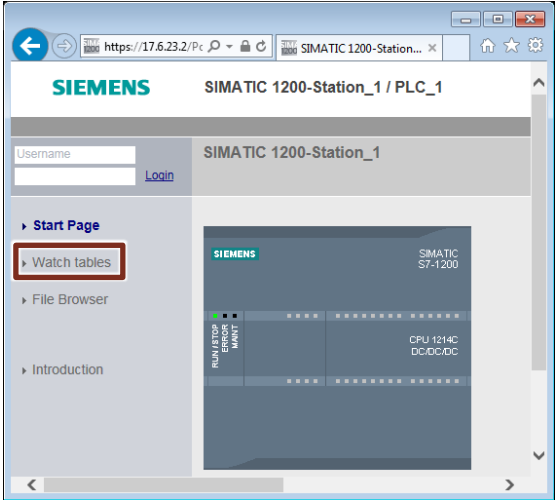
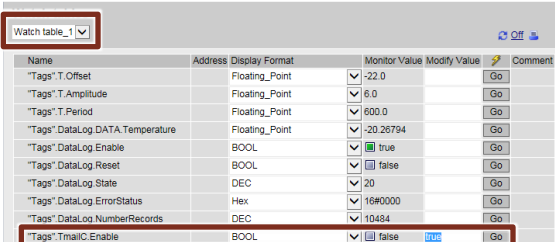
5.5 Alarm generation by sending an email

Alarms are generated by the “TmailC” FB.

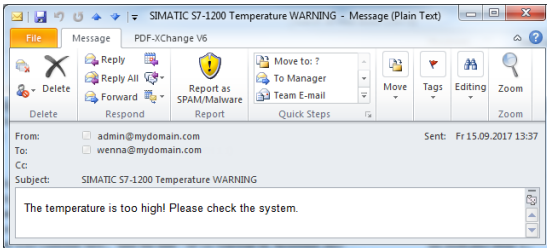
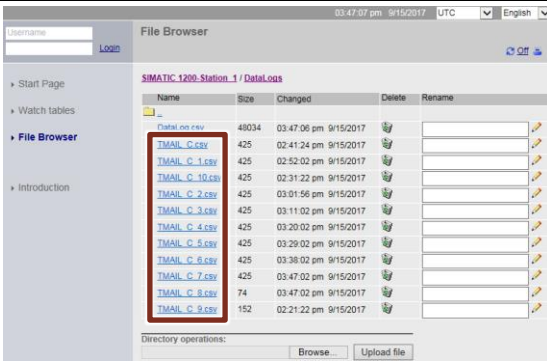
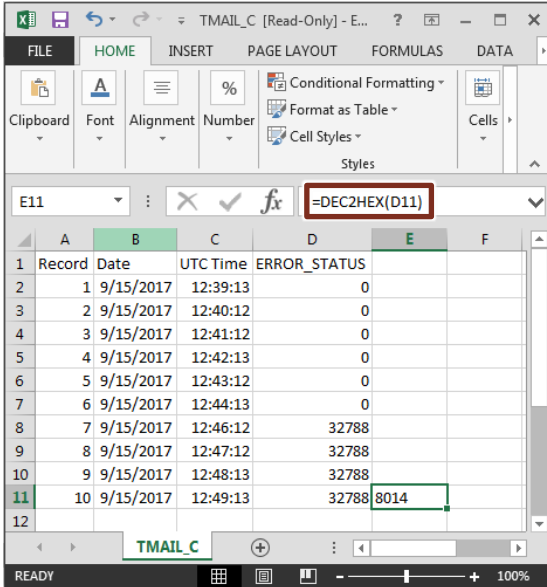
If the maximum cooling temperature of -20°C is exceeded, an email is sent to a predefined recipient with the aid of the “TMAIL_C” system function. The “TmailC” function block is disabled after initialization.

It is enabled on the remote service PC using the CPU’s Web server.

Table 5-4

No.	Action	Comment																																																																		
1.	<ul style="list-style-type: none"> Start Internet Explorer. As the address, enter the IP address of the CPU: here: https://17.6.23.2 Click “ENTER”. 																																																																			
2.	<p>Note: If the “There is a problem with this website’s security certificate.” Message appears, download the Siemens security certificate as described in Chapter 4.4.</p>																																																																			
3.	<ul style="list-style-type: none"> Open the “Watch tables” menu item. 																																																																			
4.	<p>“Watch table_1” opens.</p> <ul style="list-style-type: none"> Look for the row with the “Tags”.TmailC.Enable tag. The “Monitor Value” is “false”. In the “Modify Value” column, enter “true” and select the “Go” button. 	 <table border="1" data-bbox="815 1563 1361 1756"> <thead> <tr> <th>Name</th> <th>Address</th> <th>Display Format</th> <th>Monitor Value</th> <th>Modify Value</th> <th>Comment</th> </tr> </thead> <tbody> <tr> <td>"Tags".T.Offset</td> <td></td> <td>Floating_Point</td> <td>-22.0</td> <td></td> <td>Go</td> </tr> <tr> <td>"Tags".T.Amplitude</td> <td></td> <td>Floating_Point</td> <td>6.0</td> <td></td> <td>Go</td> </tr> <tr> <td>"Tags".T.Period</td> <td></td> <td>Floating_Point</td> <td>600.0</td> <td></td> <td>Go</td> </tr> <tr> <td>"Tags".DataLog.DATA.Temperature</td> <td></td> <td>Floating_Point</td> <td>-20.26794</td> <td></td> <td>Go</td> </tr> <tr> <td>"Tags".DataLog.Enable</td> <td></td> <td>BOOL</td> <td>true</td> <td></td> <td>Go</td> </tr> <tr> <td>"Tags".DataLog.Reset</td> <td></td> <td>BOOL</td> <td>false</td> <td></td> <td>Go</td> </tr> <tr> <td>"Tags".DataLog.State</td> <td></td> <td>DEC</td> <td>20</td> <td></td> <td>Go</td> </tr> <tr> <td>"Tags".DataLog.ErrorStatus</td> <td></td> <td>Hex</td> <td>16#0000</td> <td></td> <td>Go</td> </tr> <tr> <td>"Tags".DataLog.NumberRecords</td> <td></td> <td>DEC</td> <td>10484</td> <td></td> <td>Go</td> </tr> <tr> <td>"Tags".TmailC.Enable</td> <td></td> <td>BOOL</td> <td>false</td> <td>true</td> <td>Go</td> </tr> </tbody> </table>	Name	Address	Display Format	Monitor Value	Modify Value	Comment	"Tags".T.Offset		Floating_Point	-22.0		Go	"Tags".T.Amplitude		Floating_Point	6.0		Go	"Tags".T.Period		Floating_Point	600.0		Go	"Tags".DataLog.DATA.Temperature		Floating_Point	-20.26794		Go	"Tags".DataLog.Enable		BOOL	true		Go	"Tags".DataLog.Reset		BOOL	false		Go	"Tags".DataLog.State		DEC	20		Go	"Tags".DataLog.ErrorStatus		Hex	16#0000		Go	"Tags".DataLog.NumberRecords		DEC	10484		Go	"Tags".TmailC.Enable		BOOL	false	true	Go
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"Tags".DataLog.DATA.Temperature		Floating_Point	-20.26794		Go																																																															
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"Tags".TmailC.Enable		BOOL	false	true	Go																																																															

5 Operation of the Application Example

No.	Action	Comment																																																				
5.	<p>The simulated cooling temperature exceeds the maximum limit of -20°C at 1-minute intervals and now gives the command to send an email to the predefined recipient via the "TMAIL_C" block.</p> <ul style="list-style-type: none"> Open the recipient's inbox to check if the email has arrived. 																																																					
6.	<p>If the alarm email has not been received successfully, check the job logging of the "TMAIL_C" block:</p> <ul style="list-style-type: none"> Use the "DataLogs" menu item to open the list of log files. <p>The last written file is indicated by the time comparison in the "Changed" column.</p> <ul style="list-style-type: none"> Open the last written log file for the call of the "TMAIL_C" block. 																																																					
7.	<p>In the log file, you can view the status feedback with the time stamp of the "TMAIL_C" block.</p> <p>If the "ERROR_STATUS" column displays "0", this job has successfully completed (sent to the outgoing server of the gateway email account).</p> <p>Using the formula " =DEC2HEX", you can convert the "ERROR_STATUS" to a hexadecimal value; for its meaning, refer to the "TMAIL_C" block description.</p>	 <table border="1" data-bbox="810 1120 1358 1476"> <thead> <tr> <th>Record</th> <th>Date</th> <th>UTC Time</th> <th>ERROR_STATUS</th> </tr> </thead> <tbody> <tr><td>1</td><td>9/15/2017</td><td>12:39:13</td><td>0</td></tr> <tr><td>2</td><td>9/15/2017</td><td>12:40:12</td><td>0</td></tr> <tr><td>3</td><td>9/15/2017</td><td>12:41:12</td><td>0</td></tr> <tr><td>4</td><td>9/15/2017</td><td>12:42:13</td><td>0</td></tr> <tr><td>5</td><td>9/15/2017</td><td>12:43:12</td><td>0</td></tr> <tr><td>6</td><td>9/15/2017</td><td>12:44:13</td><td>0</td></tr> <tr><td>7</td><td>9/15/2017</td><td>12:46:12</td><td>32788</td></tr> <tr><td>8</td><td>9/15/2017</td><td>12:47:12</td><td>32788</td></tr> <tr><td>9</td><td>9/15/2017</td><td>12:48:13</td><td>32788</td></tr> <tr><td>10</td><td>9/15/2017</td><td>12:49:13</td><td>32788</td></tr> <tr><td>11</td><td>9/15/2017</td><td>12:49:13</td><td>32788</td></tr> <tr><td>12</td><td></td><td></td><td></td></tr> </tbody> </table>	Record	Date	UTC Time	ERROR_STATUS	1	9/15/2017	12:39:13	0	2	9/15/2017	12:40:12	0	3	9/15/2017	12:41:12	0	4	9/15/2017	12:42:13	0	5	9/15/2017	12:43:12	0	6	9/15/2017	12:44:13	0	7	9/15/2017	12:46:12	32788	8	9/15/2017	12:47:12	32788	9	9/15/2017	12:48:13	32788	10	9/15/2017	12:49:13	32788	11	9/15/2017	12:49:13	32788	12			
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11	9/15/2017	12:49:13	32788																																																			
12																																																						

6 Appendix

6.1 Service and Support

Industry Online Support

Do you have any questions or do you need support?

With Industry Online Support, our complete service and support know-how and services are available to you 24/7.

Industry Online Support is the place to go to for information about our products, solutions and services.

Product Information, Manuals, Downloads, FAQs and Application Examples – all the information can be accessed with just a few clicks:

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

Technical Support

Siemens Industry's Technical Support offers you fast and competent support for any technical queries you may have, including numerous tailor-made offerings ranging from basic support to custom support contracts.

You can use the web form below to send queries to Technical Support:

www.siemens.com/industry/supportrequest.

Service offer

Our service offer includes the following services:

- Product Training
- Plant Data Services
- Spare Part Services
- Repair Services
- Field & Maintenance Services
- Retrofit & Modernization Services
- Service Programs & Agreements

For detailed information about our service offer, please refer to the Service Catalog:

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

Industry Online Support app

The "Siemens Industry Online Support" app provides you with optimum support while on the go. The app is available for Apple iOS and Android:

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

6.2 Links and literature

Table 6-1

No.	Topic
\1\	Siemens Industry Online Support https://support.industry.siemens.com
\2\	Link to the entry page of the application example https://support.industry.siemens.com/cs/ww/en/view/64396156
\3\	“S7-1200 Programmable Controller” System Manual https://support.industry.siemens.com/cs/ww/de/view/109764129
\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\	Support packages for the hardware catalog in the TIA Portal (HSP) https://support.industry.siemens.com/cs/ww/en/view/72341852
\6\	SIMATIC STEP 7 Basic/Professional V15.1 and SIMATIC WinCC V15.1 https://support.industry.siemens.com/cs/ww/en/view/109755202
\7\	SIMATIC STEP 7 and WinCC V15.1 TRIAL Download https://support.industry.siemens.com/cs/ww/en/view/109761045
\8\	Updates for STEP 7 V15.1 and WinCC V15.1 https://support.industry.siemens.com/cs/ww/en/view/109763890
\9\	SIMATIC S7-1200 Easy Book https://support.industry.siemens.com/cs/ww/en/view/39710145
\10\	IP-based Remote Networks 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\	After compilation in STEP 7 V11 why is the message displayed indicating that the PID and USS library elements are defective or out of date? https://support.industry.siemens.com/cs/ww/en/view/59421832
\13\	How do you parameterize the “TMAIL_C” instruction to send e-mails with the SIMATIC S7-1200? https://support.industry.siemens.com/cs/ww/en/view/67262019
\14\	Sales and delivery release SIMATIC Automation Tool V3.0 https://support.industry.siemens.com/cs/ww/en/view/109749055
\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 commissioning and service operation tool for SIMATIC modules 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\	How do you convert Data Logs (“.csv” format) downloaded from the external load memory of the S7-1200 CPU into an easily readable Excel file? https://support.industry.siemens.com/cs/ww/en/view/87138437
\19\	SIMATIC Automation Tool V3.0 06/2017 User Guide https://support.industry.siemens.com/cs/ww/en/view/109748244

6.3 Change documentation

Table 6-2

Version	Date	Modifications
V1.0	01/2013	First version
V2.0	10/2017	Updated to STEP 7 V14
V2.0.1	12/2017	Adding chapter Changing the record data structure
V3.0	07/2019	Update TIA Portal V15.1