SIEMENS

Data Communication of S7-1200 Stations with TeleControl Server Basic V3

CP 1242-7 V2, CP 1243-1, TCSB V3

Warranty and Liability

Note

The Application Examples are not binding and do not claim to be complete with regard to configuration, equipment or any contingencies. The Application Examples do not represent customer-specific solutions. They are only intended to provide support for typical applications. You are responsible for the correct operation of the described products. These Application Examples do not relieve you of the responsibility of safely and professionally using, installing, operating and servicing equipment. When using these Application Examples, you recognize that we cannot be made liable for any damage/claims beyond the liability clause described. We reserve the right to make changes to these Application Examples at any time and without prior notice. If there are any deviations between the recommendations provided in this Application Example and other Siemens publications – e.g. Catalogs – the contents of the other documents shall have priority.

We do not accept any liability for the information contained in this document. Any claims against us – based on whatever legal reason – resulting from the use of the examples, information, programs, engineering and performance data etc., described in this Application Example shall be excluded. Such an exclusion shall not apply in the case of mandatory liability, e.g. under the German Product Liability Act ("Produkthaftungsgesetz"), in case of intent, gross negligence, or injury of life, body or health, guarantee for the quality of a product, fraudulent concealment of a deficiency or breach of fundamental contractual obligations ("wesentliche Vertragspflichten"). The damages for a breach of a substantial contractual obligation are, however, limited to the foreseeable damage, typical for the type of contract, except in the event of intent or gross negligence or injury to life, body or health. The above provisions do not imply a change of the burden of proof to your detriment.

Any form of duplication or distribution of these Application Examples or excerpts hereof is prohibited without the expressed consent of Siemens AG.

Security informa- tion

Siemens provides products and solutions with industrial security functions that support the secure operation of plants, solutions, machines, equipment and networks.

To protect plants, systems, machines and networks against cyber threats, it is necessary to implement (and continuously maintain) a holistic, state-of-the-art industrial security concept. Products and solutions from Siemens are only one part of such a concept.

The customer is responsible for preventing unauthorized access to the customer's plants, systems, machines and networks. Systems, machines and components should be connected to the company network or the Internet only if and to the extent necessary and if appropriate protective action (e.g., use of firewalls and network segmentation) was taken.

In addition, Siemens' recommendations regarding appropriate protective action should be followed. For more information about industrial security, visit http://www.siemens.com/industrialsecurity.

Siemens' products and solutions undergo continuous development to make them even more secure. Siemens strongly recommends to perform updates as they become available and use only the latest product versions. Using versions that are out of date or no longer supported can increase the risk of cyber threats.

To continually stay informed about product updates, subscribe to the Siemens Industrial Security RSS Feed under http://www.siemens.com/industrialsecurity.

Table of Contents

Table of Contents

1 Task

Introduction

The infrastructure of a discharge treatment plant comprises two SIMATIC S7-1200 substations. One station shall communicate with a central station via mobile communications network and the other station via Ethernet.

The TeleControl Server Basic V3 software is installed in the central station. Any OPC_Client, e.g. OPC Scout, can be connected via your OPC interface.

Overview of the automation task

The figure below provides an overview of the automation task.

Figure 1-1
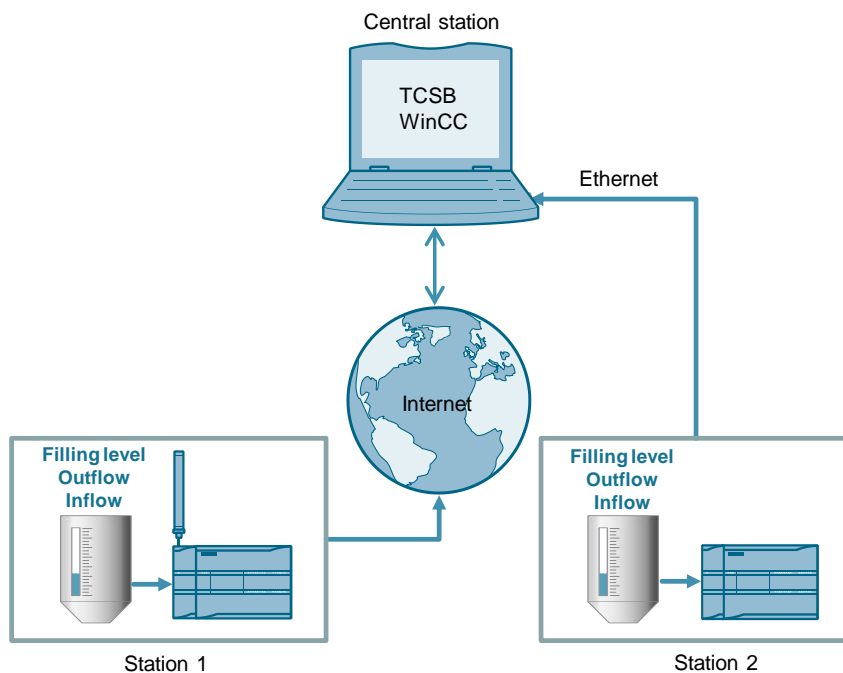
Problem description

This Application Example shall meet the following requirements:

- Both remote stations send some process tags to the central station (**"threshold-triggered"**).
- Both remote stations send important process tags **cyclically** to the central station.
- Both remote stations send some process tags to the central station (**"event-triggered"**).
- The central station monitors the status of the connected remote stations.

Using visualization software, the simulated process shall be operated and controlled in the remote stations.
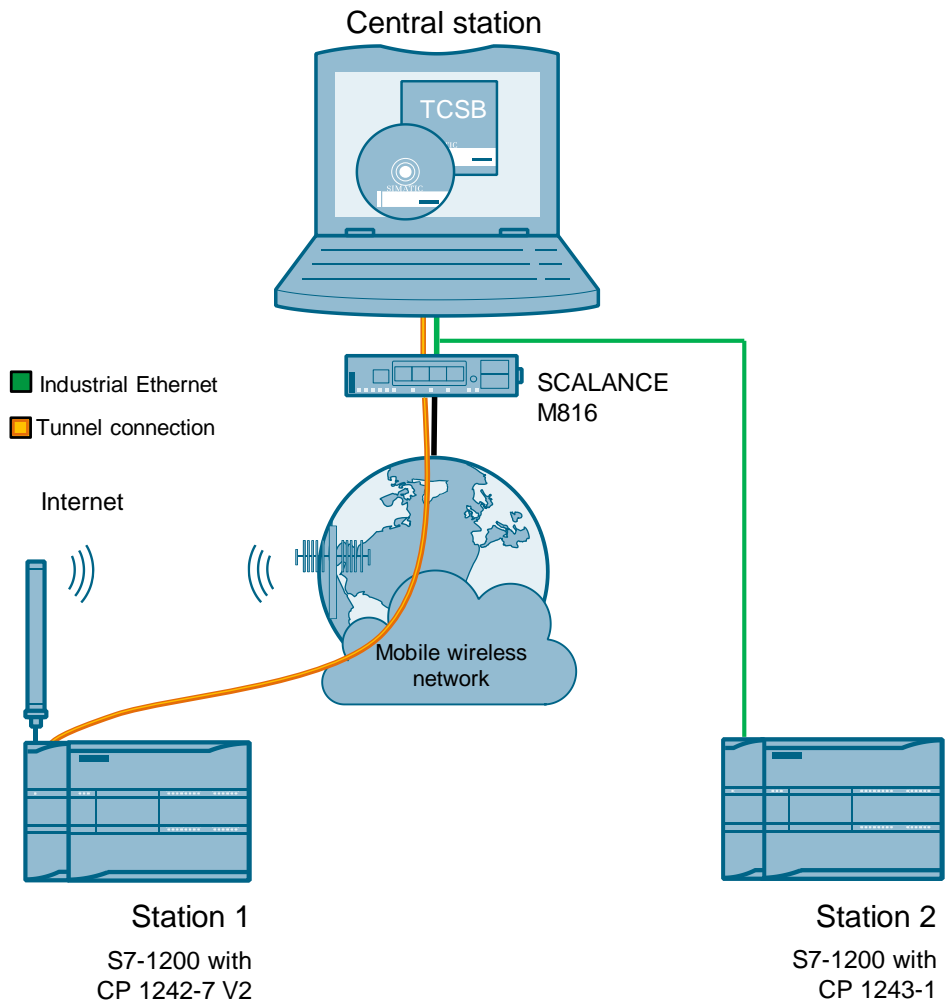
2   Solution

2.1   Overview

Schematic layout

The following figure displays the key components of the solution:

Figure 2-1

2.1 Overview

Setup

The TeleControl Server Basic V3 (TCSB) in the central station allows a direct connection to the S7-1200 stations.

Communication takes place via the following paths and communication modules:

- S7-1200 with CP 1242-7 V2: communication via mobile wireless network and the Internet

- S7-1200 with CP 1243-1: communication via Ethernet. By means of single-mode optical fiber technology, it is possible to reach ranges of several kilometers here as well.

Any OPC client visualizes the data via the integrated OPC DA/UA server of the TCSB V3. In this example, the functions shall be demonstrated by means of the OPC Scout V10.

The visualization of the application is carried out via WinCC Advanced.

Advantages

The solution presented here offers the following advantages:

- TeleControl Server Basic V3 enables economic data communication between remote stations and the central station.

- The core application areas are industrial applications where data shall be sent wirelessly and in a cost-effective way, such as in waste water treatment plants, for water purification or in pump stations.

- The OPC interfaces of TCSB provide the data of the connected stations to one or several connected OPC clients.

- GPRS and internet: Always-on functionality.

- To increase reliability, the CPs can buffer the data of different types of events and transmit the bundled data to the TeleControl server.

Delimitation

This application does not contain any description of:

- SIMATIC NET TeleControl Server Basic. See also document \3\.

- SIMATIC HMI operator panels

- the LAD/ FBD/ STL/ SCL programming languages.

Basic knowledge of these topics is assumed.

2.2 Description of the core functionality

Realized functions

The following core functions have been realized in the Application Example:

Table 2-1

Station / Function	Station 1	Station 2	central station
Threshold-triggered	✓	✓	✗
Time-triggered	✓	✓	✗
Event-triggered	✓	✓	✗
Status monitoring	✗	✗	✓

Threshold-triggered

The data are transmitted, if the current data have changed by a threshold compared to the last data sent.

Time-triggered

The data are transmitted from the CP to the TCSB in a specified time interval.

Event-triggered

The data are transmitted, if a configured trigger signal is triggered. As a signal, the edge change (0 → 1) of a trigger tag will be evaluated which is set by the user program. The trigger tag will be reset upon successful data transmission.

Status monitoring

The central station monitors the status of the connected remote stations.

Note	You can find a detailed description of these functions from Chapter 3 onwards.

2.3 Overview and description of the user interface

The Application Example is visualized with WinCC Advanced by means of two configured screens called "TCSB Communication" and "S7-1200 Application".

"TCSB Communication"

The "TCSB Communication" screen shows the connection status with both substations. Furthermore, information on the data traffic is provided.
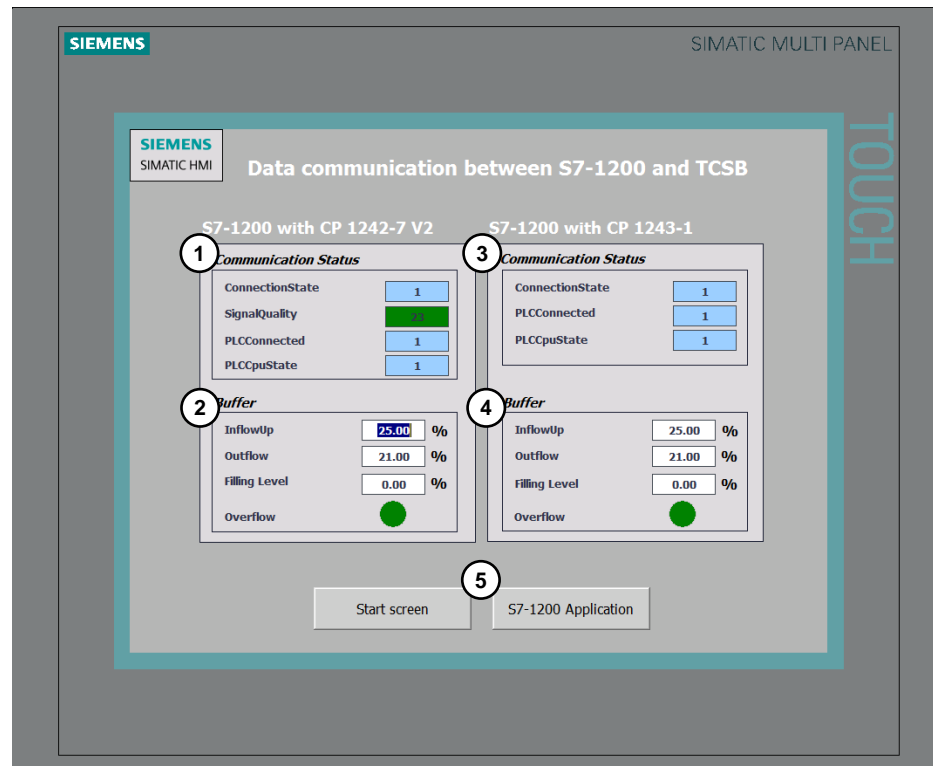
Figure 2-2

Table 2-2

No.	Element	Description
1.	Communication status: • ConnectionState • SignalQuality • PLCConnected • PLCCpuState	Information on the communication status of station 1 The values are determined by TCSB itself.
2.	Buffer	Maximum inflow, outflow and filling level of station 1 that are saved in the central station.
3.	Communication status: • ConnectionState • PLCConnected • PLCCpuState	Information on the communication status of station 2 The values are determined by TCSB itself.
4.	Buffer	Maximum inflow, outflow and filling level of station 2 that are saved in the central station.
5.	Screen change	Click on the buttons to change the display to the respective screens.

2.3 Overview and description of the user interface

"S7-1200 Application"

The "S7-1200Application" screen visualizes the processes of stations 1 and 2.

Figure 2-3
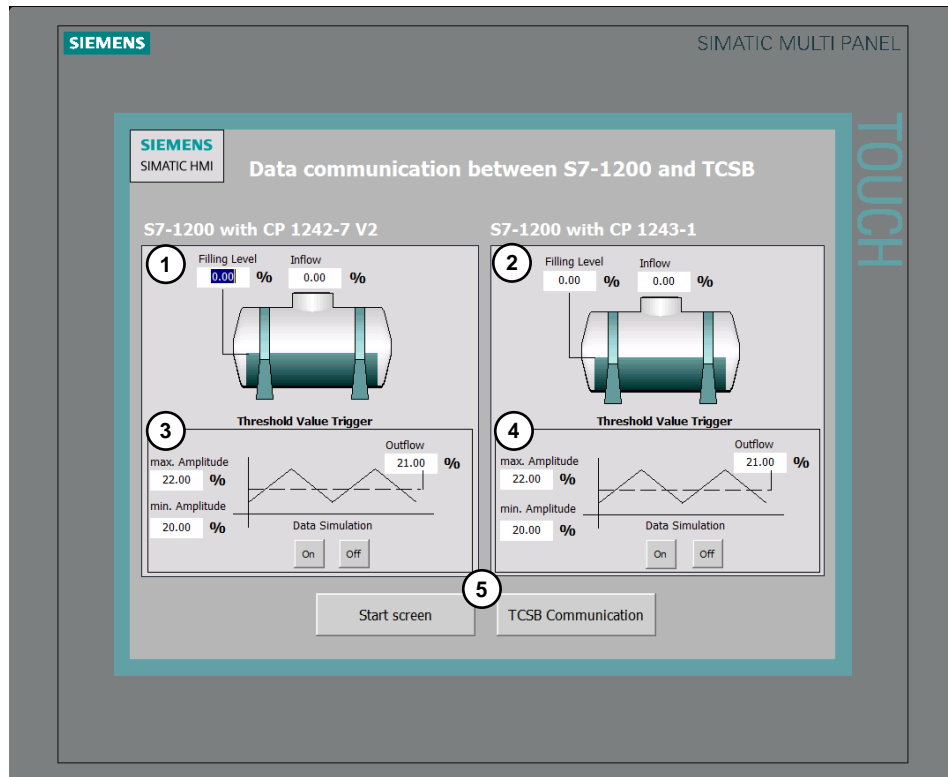
Table 2-3

No.	Element	Description
1.	Filling level and inflow	Current filling level and inflow of station 1.
2.	Filling level and inflow	Current filling level and inflow of station 2.
3.	Parameters for the "threshold-trigger" process of station 1.	• Max amplitude: Maximum value for the triangle function • Min amplitude: Minimum value for the triangle function • Outflow: current outflow • On: starts the data simulation • Off: ends the data simulation
4.	Parameters for the "threshold-trigger" process of station 2.	• Max amplitude: Maximum value for the triangle function • Min amplitude: Minimum value for the triangle function • Outflow: current outflow • On: starts the data simulation • Off: ends the data simulation
5.	Screen change	Click on the buttons to change the display to the respective screens.

2.4 Hardware and software components

2.4.1 Validity

This application is valid for

- CP 1242-7 V2
- CP 1243-1 (V2.1)
- STEP 7 V13 SP1 update 5
- S7-1200 CPU as of V4.1
- TCSB V3 SP1

2.4.2 Components used

The following components were used to create the application:

Hardware components of station 1

Table 2-4

Component	Qty	Article number	Note
S7-1200 PM1207	1	6EP1332-1SH71	Power supply
SIMATIC S7-1200 CPU 1217C DC/DC/DC	1	6ES7217-1AG40-0XB0	Any S7-1200 CPU as of V4.1 can be used.
COMMUNICATION PROCESSOR CP 1242-7 V2	1	6GK7242-7KX31-0XE0	
ANTENNA ANT794-4MR	1	6NH9860-1AA00	GSM Quadband and UMTS and LTE (Europe)
SIMATIC Memory Card	1	6ES7954-8LF01-0AA0	Memory card for S7-1200 CPU

Hardware components of station 2

Table 2-5

Component	Qty	Article number	Note
S7-1200 PM1207	1	6EP1332-1SH71	Power supply
SIMATIC S7-1200 CPU 1217C DC/DC/DC	1	6ES7217-1AG40-0XB0	Any S7-1200 CPU as of V4.1 can be used.
COMMUNICATION PROCESSOR CP 1243-1	1	6GK7243-1BX30-0XE0	
SIMATIC Memory Card	1	6ES7954-8LF01-0AA0	Memory card for S7-1200 CPU

2.4 Hardware and software components

Accessorial equipment

Table 2-6

Component	Qty	Article number	Note
SIM card	1	Available from your mobile communications provider	Activated for data communication
DSL router + modem	1	Specialist retailers	SCALANCE M816
Fixed IP address for DSL (broadband) connection or DynDNS	1	Can be ordered at your provider	

Software components

Table 2-7

Component	Qty	Article number	Note
STEP 7 V13 SP1	1	6ES7822-1AA03-0YA5	
Software TCSB 8 V3 SP1	1	6NH9910-0AA21-0AA0	Number of connectable stations: 8. The product is available for further expansion stages and licenses, see document \3\.
WinCC Advanced V13 SP1, update 5 Runtime&Configuration	1	6AV2102-0AA03-0AA7	Trial download: The software is subject to export restrictions. The download is available for registered users only \4\.
SIMATIC OPC Scout		On the SIMATIC NET CD	For testing the OPC interface of the TeleControl Server Basic

Example files and projects

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

Table 2-8

Component	Note
39863979_S7_1200_with_TCSB_PROJ_V10.zip	This zip file includes: • the STEP 7 V13/ WinCC Advanced project • TCSB project • OPC Scout project
39863979_S7_1200_with_TCSB_DOC_V10_de.pdf	This document.

3 Mode of operation

This Application Example includes the following key elements:

- Configuration of a S7-1200 station with CP 1242-7 V2 for data communication with the central station via mobile wireless network and the Internet

- Configuration of a S7-1200 station with CP 1243-1 for data communication with the central station via Ethernet

- Configuration of TeleControl Server Basic in the central station

- Data exchange between the stations and the central station

3.1 General overview for configuration

With the CP, no programming of program blocks is required to transmit data to the central station. The data areas in the memory of the S7-1200 CPU intended for communication with the central station are configured in the CP with reference to data points. For this, every data point is linked with a PLC tag in the CPU.

In this example, the current filling level, outflow value and inflow of the station is read and then transmitted to the central station by the CP. The following transmission modes are specified in the STEP 7 data configuration:

3.1 General overview for configuration

Threshold-triggered

The current outflow is transmitted to the central station, if it has changed by a threshold compared to the last outflow sent.

For the threshold calculations, not the total amount of the deviation of the current outflow value from the last saved outflow value is evaluated, but the amount of the integrated deviation.

Deviations in the current outflow value are added in every calculation cycle (500 ms). Once the added up value reaches the configured value of the threshold trigger (here 2), the trigger is set and the current outflow is transmitted.

Figure 3-1
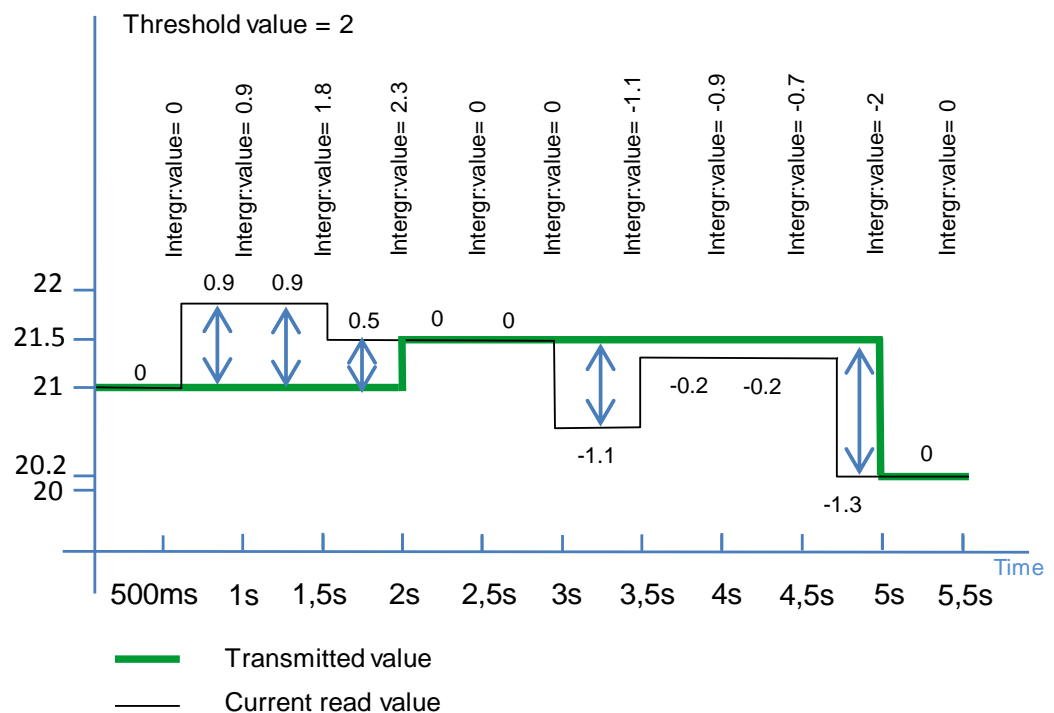
Time-triggered

The current filling level is transmitted cyclically (here: 30s) to the central station.

Event-triggered

The inflow alarm bit (overflow) is transmitted to the central station, if the trigger signal is triggered. The trigger signal is set by the user program, if the current inflow is higher than the limit value. The trigger signal is reset upon transmission of the alarm bit.

3.1 General overview for configuration

The following figure shows the configuration of the S7-1200 station for data communication with the central station.

Figure 3-2

Central station/ TCSB

Table 3-1

No.	Station 1	Station 2
1.	• The data point "fillLevel" is configured via the PLC tag in the CPU "Data.fillLevel" (current filling value) and the configuration of the transmission mode (time-triggered), (see Chapter 4.2). • The data point "overflow" is configured via the PLC tag in the CPU "Data.overflow" (True if Inflow> InflowUp) and the configuration of the transmission mode (event-triggered), (see Chapter 4.2). • The data point "outflow" is configured via the PLC tag in the CPU "Data.outflow" and the configuration of the transmission mode (threshold-triggered), (see Chapter 4.2).	
2.	The outflow value is transmitted to the central station, if it has changed by a threshold compared to the last outflow value sent. **Note:** For the threshold calculations, not the total amount of the deviation of the outflow value from the last saved outflow value is evaluated, but the amount of the integrated deviation.	
3.	The current filling level (fillLevel) is transmitted cyclically to the central station. The cyclic data transmission is specified in the data point configuration.	
4.	• If the inflow of station 1 or station 2 is higher than the limit value (inflow > inflowUp), a timer will be started in the user program. • After the time has elapsed, the trigger signal "statTriggerOverflow" is set in the user program and the inflow status (Overflow) is transmitted to the central station. • The trigger signal is reset upon transmission of the status.	

3.1 General overview for configuration

Note	It is recommended to set the trigger signal for the event-triggered process with a time delay of approx. 500 ms in order to make sure that the value change of the PLC tag has been reliably accepted for the corresponding data point.
Note	The trigger signal should be linked with a **static** tag in the instance data block in the CPU each.
	If the trigger signal is interconnected with a global tag, it may happen that the trigger signal will not be reset automatically. This is due to the delay difference of CPU and CP cycle.

Program overview of station 1 / station 2

The structure for the simulation program is identical for both stations. The figure below shows the most important elements.

Figure 3-3
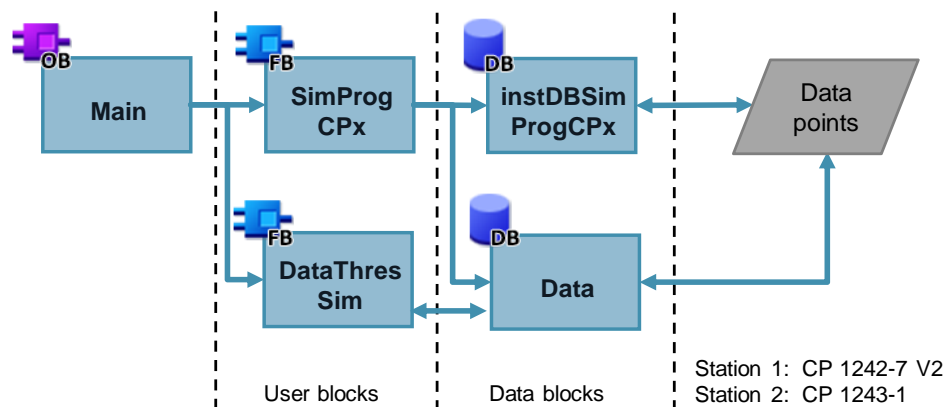
Table 3-2

Element	Symbolic name	Description
OB1	Main	Cyclic OB: Calling the user program
FB1	SimProgCPx	The FB "SimProgCPx" contains the simulation for the event-triggered process (Table 3-1, Step 4).
FB2	DataThresSim	The FB "DataThresSim" simulates the "outflow" for the threshold-triggered process.
DB2	instDBSimProgCPx	Instance data block of the user block "SimProgCPx".
DB3	instDBDataThresSim	Instance data block of the user block "DataThresSim".
DB1	Data	Global data block for saving the data: • send data • Status tags • Tags for the data simulation
Data points		Configured data points for data exchange between a station and the central station

Global data block "Data" (DB1)

The DB "Data" contains:

- the PLC tags required for the data configuration of the CP12xx-x,
- The PCL tags used for the data simulation of the threshold-triggered process,
- The Status tags.

The structure of the global data block is identical for both stations.

Figure 3-4

		Name	Data type	Start value	Retai
1		▼ Static			
2		fillLevel	Real	0.0	
3		inflow	Real	0.0	
4		inflowUp	Real	25.0	
5		overflow	Bool	false	
6		start	Bool	false	
7		maxAmplitude	Real	22.0	
8		minAmplitude	Real	20.0	
9		period	Time	T#16s	
10		outflow	Real	21.0	
11		done	Bool	false	
12		partnerStatus	Word	16#0	
13		networkStatus	UInt	0	
14		triggerDiag	Bool	true	

Table 3-3

Name	Data type	Description
fillLevel	Real	Current filling level of station 1 or station 2
inflow	Real	Current inflow of station 1 or station 2.
inflowUp	Real	Limit value of the inflow of station 1 or station 2. Start value: 25.0
overflow	Bool	Display of the status of the current inflow. True: Current inflow has exceeded the limit value. False: Current inflow is lower than the limit value.

3.1 General overview for configuration

Name	Data type	Description
start	Bool	True: The data simulation for the threshold-triggered process is active. False: The data simulation for the threshold-triggered process was terminated.
maxAmplitude	Real	Maximum value for the realized function in the simulation program "DataThresSim" (triangle function) Start value: 22.0
minAmplitude	Real	Minimum value for the realized function in the simulation program "DataThresSim" (triangle function) Start value: 20.0
period	Time	Duration of the realized function (start value: 16 s)
outflow	Real	Current value of the inflow of station 1 or station 2. Start value: 21.0
done	Bool	Data have been transmitted successfully to the CP
partnerStatus	Word	Status of the connection with TCSB (see Chapter 3.3).
networkStatus	UInt	Status of the connection with data service in the mobile communications network (see Chapter 3.4). Only relevant for CP1242-7 V2
triggerDiag	Bool	Diagnostics trigger tag. Is set when starting the example plant for the first time in order to activate the advanced diagnostics (networkStatus) of the CP 1242-7 V2. Only relevant for CP1242-7 V2

3.2 Functionality of station 1/ station 2

3.2.1 Program details for FB "SimProgCP12xx"

The function block "SimProgCPxx" sets the trigger signal for sending an alarm bit ("overflow") to the central station, if the current inflow of station 1 or station 2 is greater than the limit value (inflowUp).

Figure 3-5
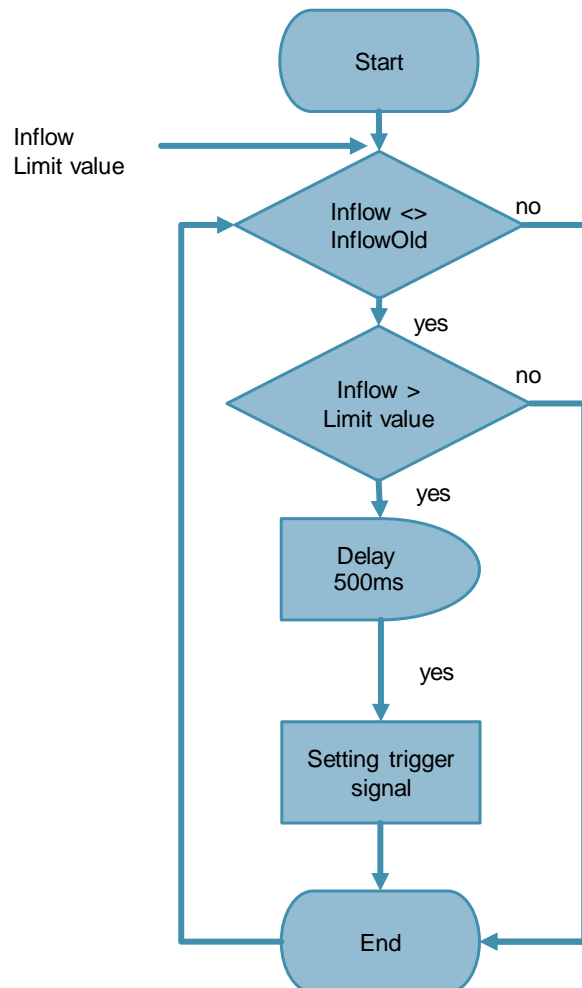
| Note | The trigger signal is reset automatically upon transmission of the data to the CP. |

| Note | In the function block, the trigger signal is set with a time delay of 500 ms in order to make sure that the value change of the tag "overflow" is reliably accepted for the corresponding data points (DP, overflow). |

3.2 Functionality of station 1/ station 2

The following figure and table show the call interface of user block FB "SimProgCP12xx" (FB1). It is identical for both stations.

Figure 3-6
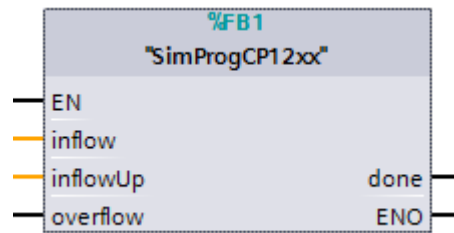
Table 3-4

	Name	Data type	Description
Input	inflow	Real	Current inflow of station 1 or station 2.
	inflowUp	Real	Limit value of the inflow of station 1 or station 2. Is entered manually by the user. Start value: 25 %.
InOut	overflow	Bool	Display of the status of the current inflow. True: Current inflow has exceeded the limit value. False: Current inflow is lower than the limit value.
Out	done	Bool	True: Data have been transmitted successfully to the CP (only for one cycle)

3.2.2 Calling FB "SimProgCP12xx" in OB1

FB "SimProgCP12xx" (FB1) is called cyclically in OB1. The input and output parameters are stored in the global data block "Data".

Figure 3-7

3.2 Functionality of station 1/ station 2
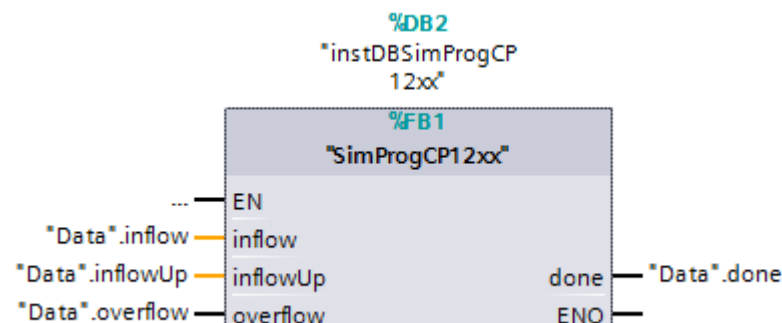
3.2.3 Program details for FB "DataThresSim"

The function block "DataThresSim" simulates the "outflow" of the process via a cyclic triangle function.

Figure 3-8
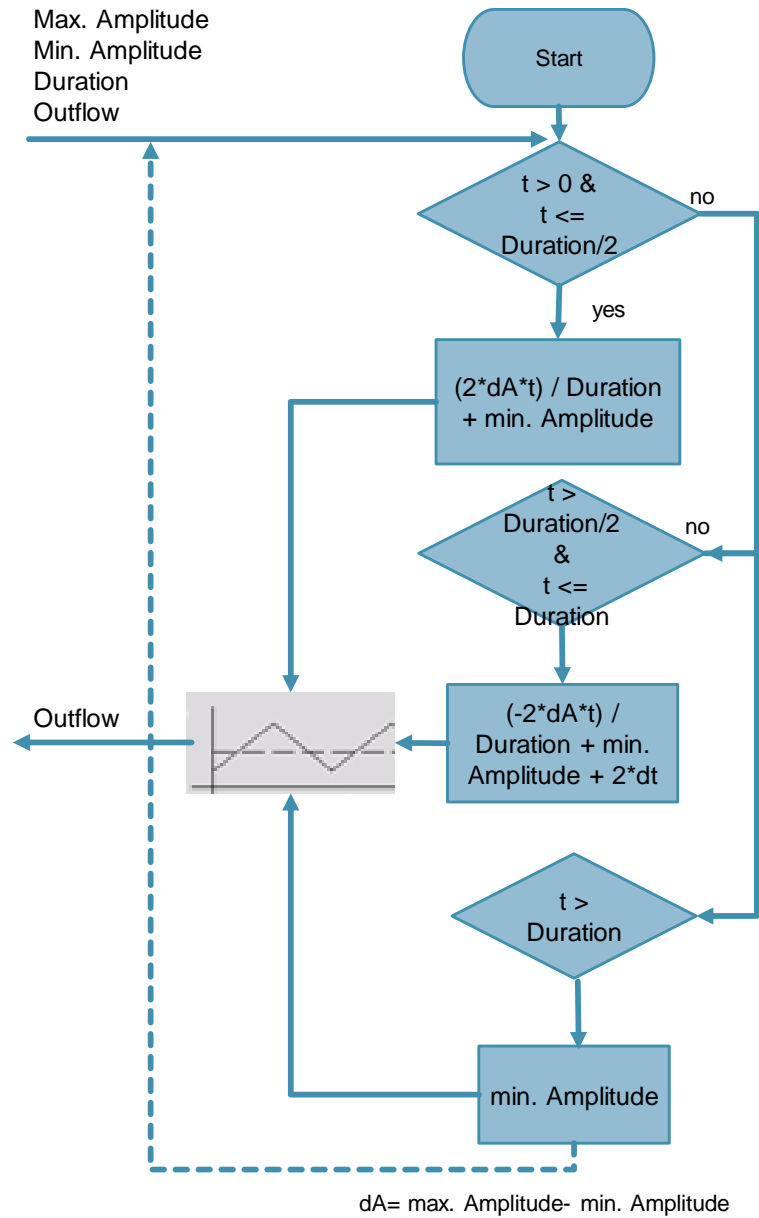
Max. Amplitude
Min. Amplitude
Duration
Outflow

Start

t > 0 &
t <=
Duration/2

no

yes

(2*dA*t) / Duration
+ min. Amplitude

t >
Duration/2
&
t <=
Duration

no

(-2*dA*t) /
Duration + min.
Amplitude + 2*dt

Outflow

t >
Duration

min. Amplitude

dA= max. Amplitude- min. Amplitude

3.2 Functionality of station 1/ station 2

The following figure and table show the call interface of user block FB "DataThresSim" (FB2). It is identical for both stations.

Figure 3-9
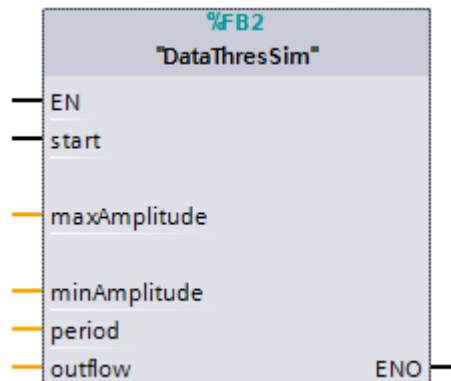
Table 3-5

	Name	Data type	Description
Input	start	Bool	True: The data simulation for the threshold-triggered process is active. False: The data simulation for the threshold-triggered process was terminated.
	maxAmplitude	Real	Maximum value for the realized function in the simulation program "DataThresSim" (triangle function) Start value: 22.0
	minAmplitude	Real	Minimum value for the realized function in the simulation program "DataThresSim" (triangle function) Start value: 20.0
	period	Time	Duration of the realized function (start value: 16 s)
InOut	outflow	Real	Current value of the inflow of station 1 or station 2. Start value: 21.0 ..

3.2.4 Calling FB "DataThresSim" in OB1

FB "DataThresSim" (FB2) is called cyclically in OB1. The input and output parameters are stored in the global data block "Data".

Figure 3-10
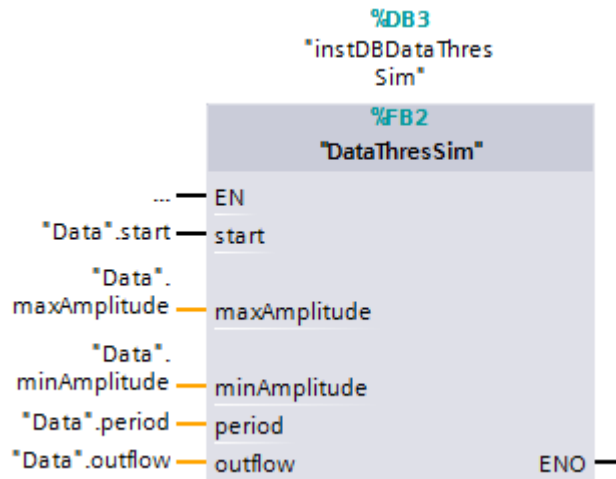
3.3 Partner status

With the "Report partner status" function being activated in the CP configuration, the CP signals the status of communication with TCSB to the CPU. This information is written into the PLC tag "partnerStatus" in the DB "Data".

The figure below shows the bit assignment of the tag "partnerStatus" (Word).

Figure 3-11
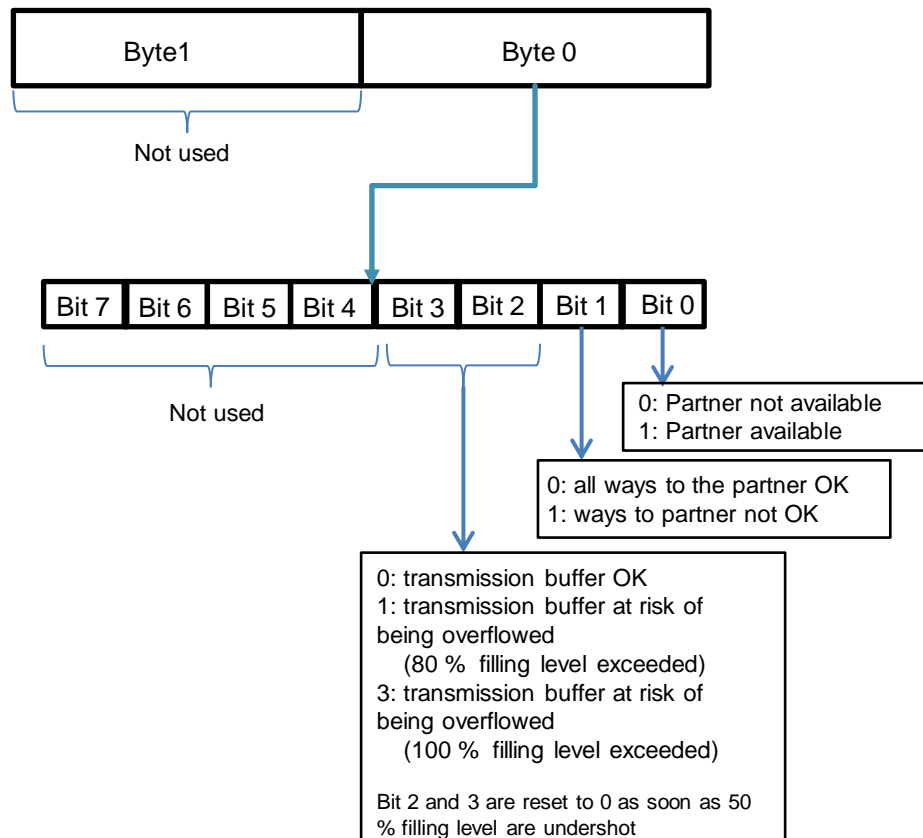
3.4 CP diagnostics

Via the extended "CP diagnosis" in the CP 1242-7 configuration (see\5\) the status of the connection to the data service in the mobile communications network can be read out from the CP.

This information is written into the PLC tag "networkStatus" (UInt) in the DB "Data".

Table 3-6

networkStatus	Meaning
0	Status of the mobile communications network: not connected
1	Wrong PIN number
2	Missing or defective SIM card
3	Waiting for PIN entry
4	Status of the mobile communications network: connected

4 Configuration and Settings

Note	The configuration and settings are fully implemented in the project. This chapter is for information purposes only.
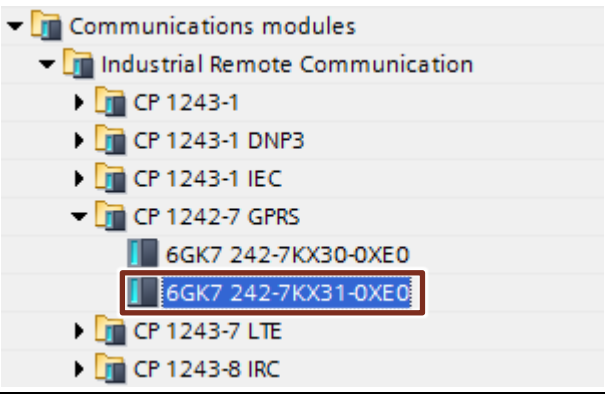
For configuration, the following configuration tools are used subsequently:

- STEP 7 V13 SP1:
    - configuration of station 1 (S7-1200 CPU with CP 1242-7 GPRS V2)
    - configuration of station 2 (S7-1200 CPU with CP 1243-1)
    - configuration of the data points for both stations
- TeleControl Server Basic:
    - create and configure a project
    - create and configure connections
    - configure general parameters
- OPC Scout V10
    - establish a connection with the server
    - configure OPC items

4.1 Configuration of station 1
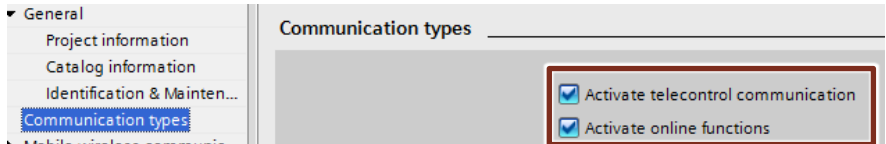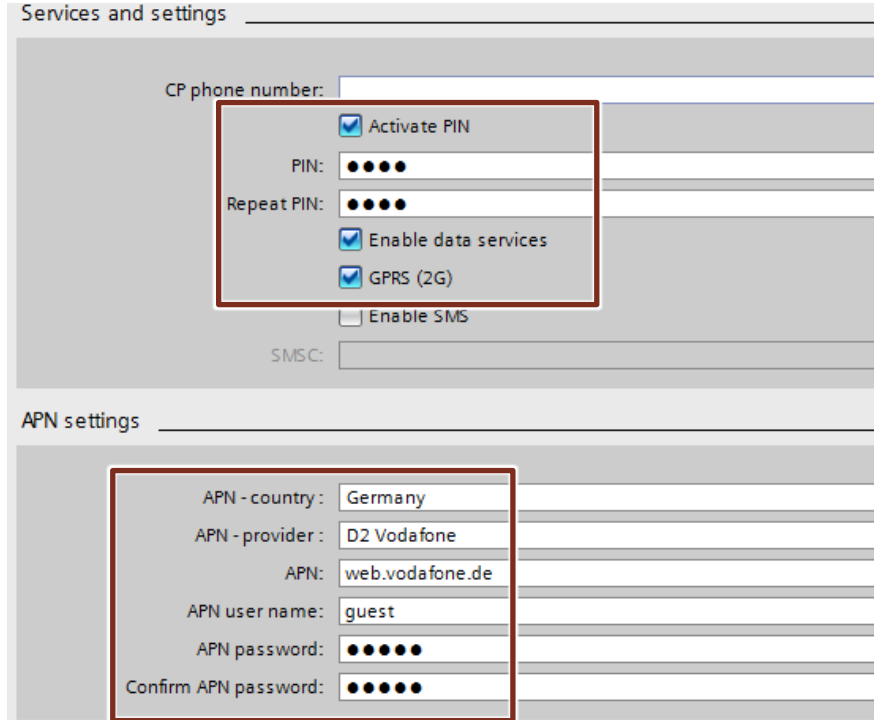
The table below shows how to configure a S7-1200 station with CP 1242-7 GPRS V2 for data communication with the central station via the mobile communications network and the Internet.

Table 4-1

No.	Action
1.	Create a STEP 7 V13 project.
2.	Add the S7-1200 CPU (as of V4.1) for the SIMATIC station 1.
3.	Add the CP 1242-7 GPRS V2 to the station.
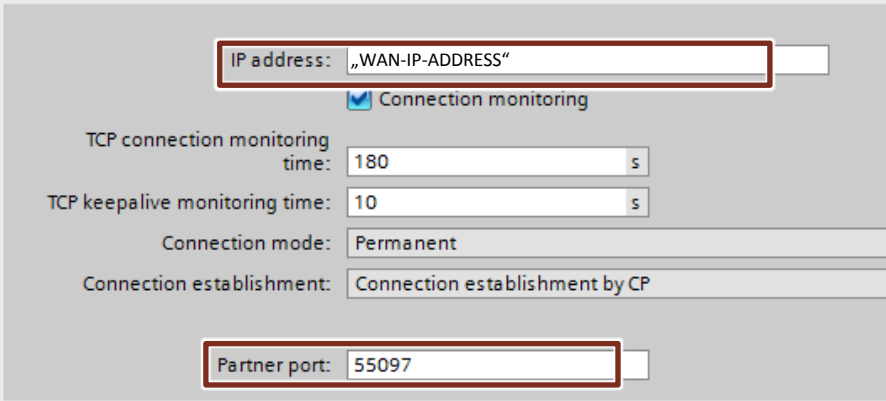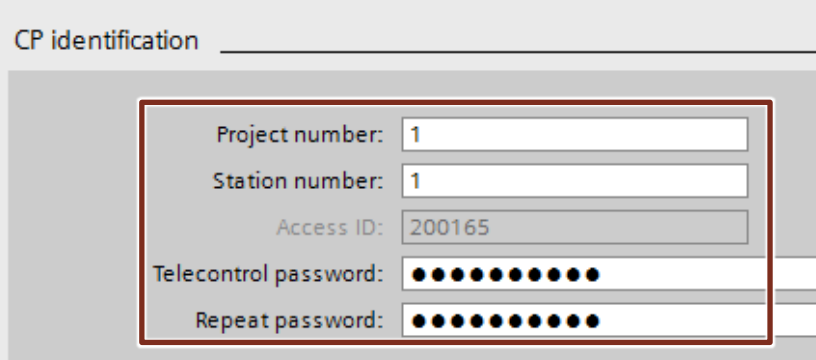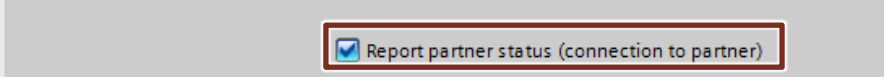
4.1 Configuration of station 1

No.	Action
4.	Activate the TeleControl und S7 communication: "Properties of the CP 1242-7 GPRS V2 > General > Communication types".
5.	Make the required mobile communication settings: "Properties of the CP 1242-7 GPRS V2 > Mobile wireless communications settings": • Activate the PIN number. • Enable data services and GPRS. • Making the APN settings / Provider-dependent
6.	Activate the security functions. Create a user for the security functions. "Properties of the CP 1242-7 GPRS V2 > Security > Security properties"

4.1 Configuration of station 1

No.	Action
7.	Configure the CP parameters required for configuring the TeleControl Server: "Properties of the CP 1242-7 GPRS V2 > Partner stations > Connection to partner" • Partner IP address (static IP address / provider-dependent) • Partner port "Properties of the CP 1242-7 GPRS V2 > Security > CP identification" • Project number • Station number • Telecontrol password (here "CP1242-7) The parameters assigned here must be identical with the parameters in the TCSB.
8.	Activate the partner status: "Properties of the CP 1242-7 GPRS V2 > Partner stations > Advanced settings" Link a PLC tag you created in the user program.

4.1 Configuration of station 1

No.	Action
9.	Enable the advanced CP diagnostics: "Properties of the CP 1242-7 GPRS V2 > Communication with the CPU > CP diagnostics". **CP diagnostics** ☑ Enable advanced CP diagnostics Diagnostics trigger tag: "CP1242-7_with_TCSB_DB".statDiagosticTrigger [...] PLC tag for send buffer overflow warning: "CP1242-7_with_TCSB_DB".statBufferOverflow [...] Send buffer level: [...] Current IP address: [...] Mobile wireless signal quality (LED): [...] Mobile wireless signal quality (dBm): [...] 'NETWORK" LED: "CP1242-7_with_TCSB_DB".statNetworkStatus [...] Date of last successful logon to network: [...] Date of last unsuccessful logon to network: [...] Date of last successful logon to TCSB: [...] Date of last unsuccessful logon to TCSB: [...] Link the "Diagnostics trigger tag" and the PLC tags you want to read out from the CP 1242-7 GPRS V2.
10.	Configure the desired data point (see Chapter 4.2).
11.	Load the project data to the station.

4.2 Configuration of the data points for station 1
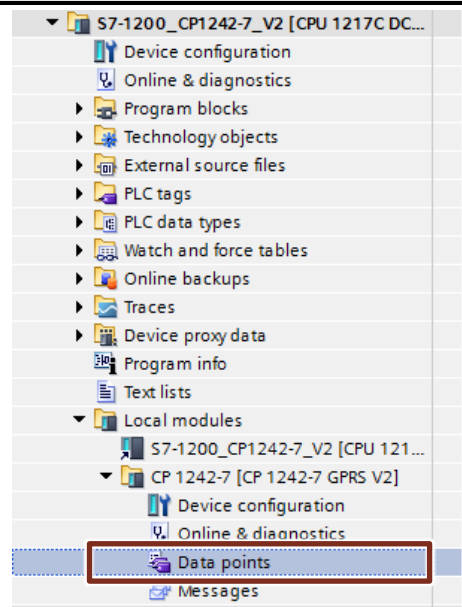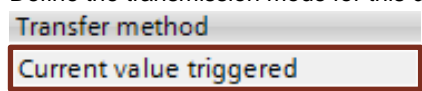
With the CP 1242-7 GPRS V2, the transmission of user data between station and central station does not require any programming of program blocks. The data areas in the memory of the CPU intended for communication with the central station are configured in the CP 1242-7 GPRS V2 with reference to data points. For this, every data point is linked with a PLC tag in the CPU (see Figure 3-2).

Threshold trigger

The value of the data point is transmitted, if it reaches a certain threshold.
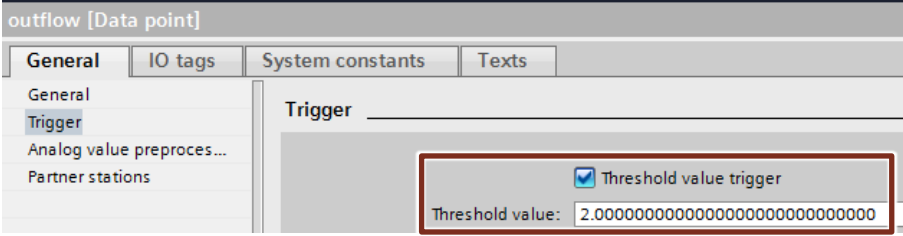
For the threshold calculations, not the total amount of the deviation of the process value from the last saved value will be evaluated, but the amount of the integrated deviation (see Figure 3-1).

Table 4-2

No.	Action	
1.	Open the editor for the data point configuration.	
2.	Add the data point "outflow" as analog input and connect it with the PLC tag "Data.outflow".	
3.	Define the transmission mode for this data point (here Current Value triggered).	

4.2 Configuration of the data points for station 1

No.	Action
4.	Define the data point index. | Transfer method	Data point index
Current value triggered	0
Current value triggered	1 | **Note:** The index of an input-type data point has to be clear for all data point types (Digital inputs, analog inputs etc.).
5.	As communication partner, select "Telecontrol Server". | Data point index	Partner of data point
0	Telecontrol server
1	Telecontrol server	
6.	Configure the "threshold trigger": "Properties > General > Trigger > threshold value trigger". outflow [Data point] General / IO tags / System constants / Texts General Trigger Analog value preproces... Partner stations Trigger ☑ Threshold value trigger Threshold value: 2.0000000000000000000000000000

Time trigger
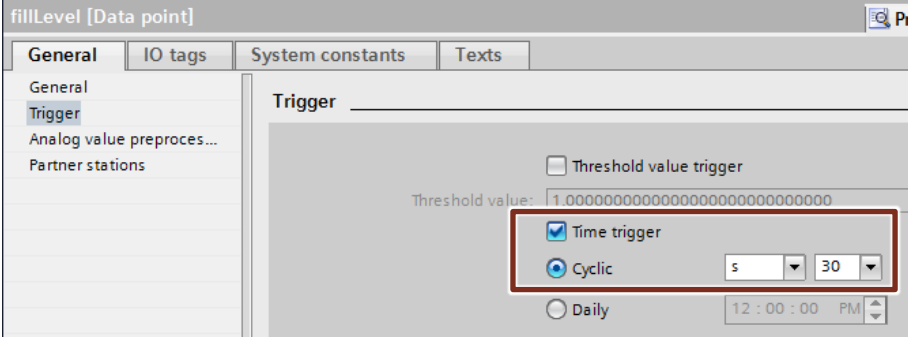
The data point value is transmitted cyclically (30 s).

Table 4-3

No.	Action
1.	In the editor for data point configuration, add the data point "fillLevel" as analog input and connect it with the PLC tag "Data.fillLevel". |	Name	PLC tag	Data point type
1	fillLevel	Data.fillLevel	Analog input
2	outflow	Data.outflow	Analog input
3	overflow	Data.overflow	Digital input	
2.	Define the transmission mode for this data point (here Current Value triggered). Transfer method Current value triggered
3.	Define the data point index. 	Transfer method	Data point index
Current value triggered	0 | **Note:** The index of an input-type data point has to be clear for all data point types (Digital inputs, analog inputs etc.).

4.2 Configuration of the data points for station 1

No.	Action
4.	For communication partner, select "Telecontrol Server". | Data point index	Partner of data point
0	Telecontrol server
1	Telecontrol server	
5.	Configure the "time trigger": "Properties > General > Trigger > time trigger".

Event trigger
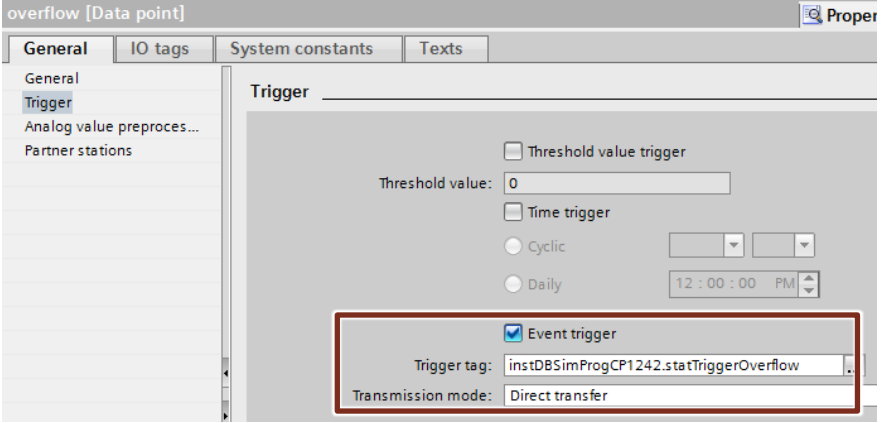
The value of the data point is transmitted, if a configured trigger signal is triggered.

Table 4-4

No.	Action
1.	In the editor for data point configuration, add the data point "overflow" as analog input and connect it with the PLC tag "Data.overflow". |	Name	PLC tag
1	fillLevel	Data.fillLevel
2	outflow	Data.outflow
3	overflow	Data.overflow	
2.	Define the transmission mode for this data point (here Current Value triggered). Transfer method Current value triggered
3.	Define the data point index. 	Transfer method	Data point index
Current value triggered	0
Current value triggered	1
Current value triggered	2 | **Note:** The index of an input-type data point has to be clear for all data point types (Digital inputs, analog inputs etc.).

4.2 Configuration of the data points for station 1

No.	Action
4.	For communication partner, select "Telecontrol Server". 	Data point index	Partner of data point	 	0	Telecontrol server	 	1	Telecontrol server	 	2	Telecontrol server	
5.	Configure the "event trigger": "Properties > General > Trigger > event trigger". overflow [Data point] General / IO tags / System constants / Texts General Trigger Analog value preproces... Partner stations Trigger ☐ Threshold value trigger Threshold value: 0 ☐ Time trigger ○ Cyclic ○ Daily 12 : 00 : 00 PM ☑ Event trigger Trigger tag: instDBSimProgCP1242.statTriggerOverflow Transmission mode: Direct transfer In the user program, a trigger tag has to be created and linked with the "event trigger".

Note   It is recommended to set the trigger tag with a time delay of approx. 500 ms in order to make sure that the value change of the inflow has been reliably accepted for the corresponding data point.
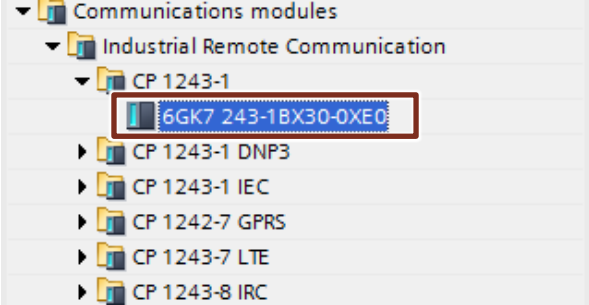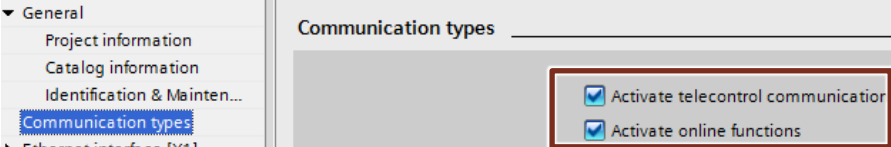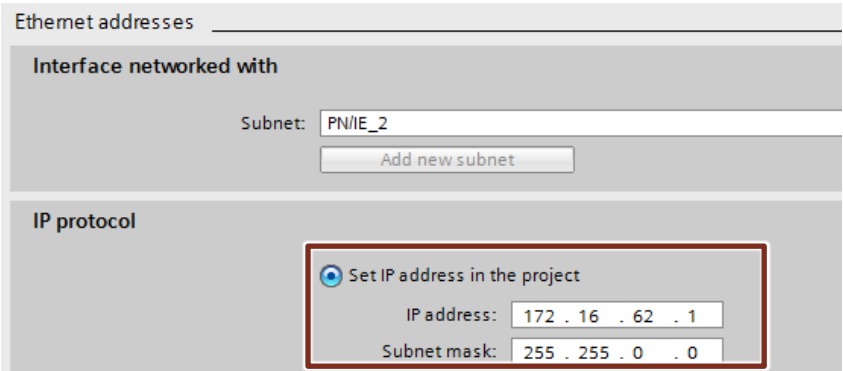
Note   The trigger signal should be linked with a static tag in the instance data block in the CPU.

If the trigger signal is connected with a global tag, it may happen that the trigger signal will not be reset automatically. This is due to the delay difference of CPU and CP cycle.

4.3 Configuration of station 2
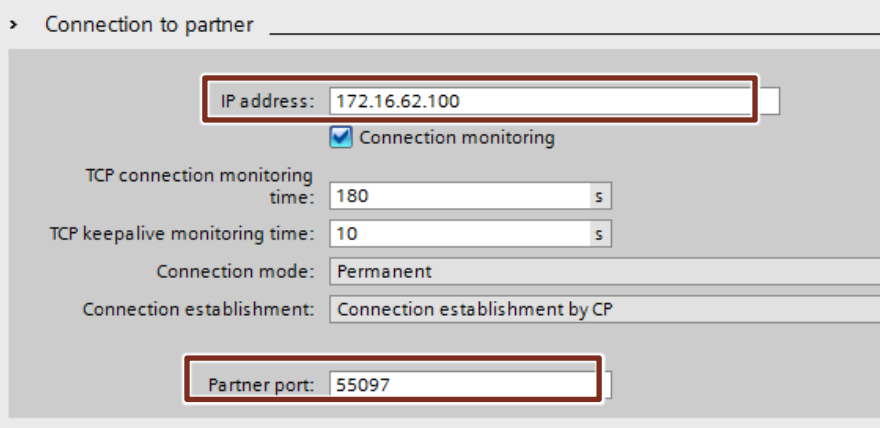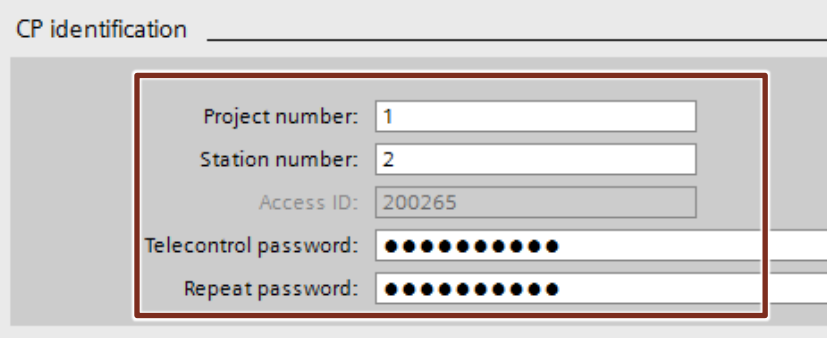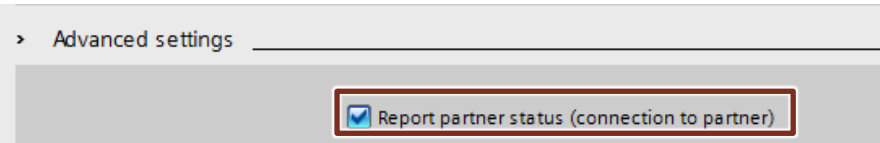
The table below shows how to configure a S7-1200 station with CP 1243-1 for data communication with the central station via Ethernet.

Table 4-5

No.	Action
1.	Add a second S7-1200 CPU (as of V4.0) for the SIMATIC station 2.
2.	Add the CP 1243-1 (V2.1) to the station. ▼ Communications modules ▼ Industrial Remote Communication ▼ CP 1243-1 6GK7 243-1BX30-0XE0 ▶ CP 1243-1 DNP3 ▶ CP 1243-1 IEC ▶ CP 1242-7 GPRS ▶ CP 1243-7 LTE ▶ CP 1243-8 IRC
3.	Activate the TeleControl and S7 communication: "Properties of the CP 1243-1 > General > Communication types". ▼ General Project information Catalog information Identification & Mainten... Communication types ▶ Ethernet interface [X1] Communication types ☑ Activate telecontrol communication ☑ Activate online functions
4.	Create an Ethernet network and connect the CP to the Ethernet network. "Properties of the CP 1243-1 > Properties > Ethernet interface". Ethernet addresses Interface networked with Subnet: PN/IE_2 Add new subnet IP protocol ◉ Set IP address in the project IP address: 172 . 16 . 62 . 1 Subnet mask: 255 . 255 . 0 . 0
5.	Activate the security functions. Create a user for the security functions. "Properties of the CP 1243-1 > Security > Security properties".
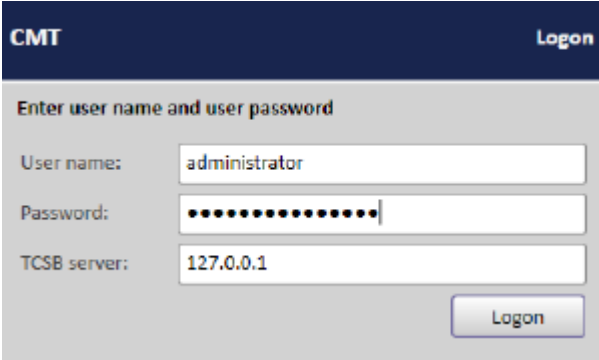
4.3 Configuration of station 2

No.	Action
6.	Configure the CP parameters required for configuring the TeleControl Server: "Properties of the CP 1243-1 > Partner stations > Connection to partner" • partner IP address • partner port "Properties of the CP 1243-1 > Security > CP identification" • Project number • Station number • Telecontrol password (here "CP1243-1) The parameters assigned here must be identical with the parameters in the TCSB.
7.	Activate the partner status: "Properties of the CP 1243-1 > Partner stations > Advanced settings" Link a PLC tag you created in the user program.
8.	Configure the desired data points (see Chapter 4.2). The configuration is identical to that of Station 1.
9.	Load the project data to the station.
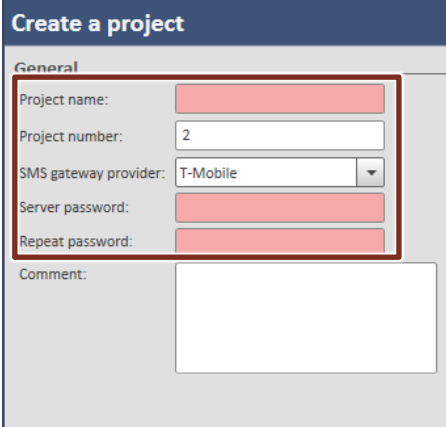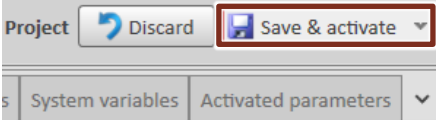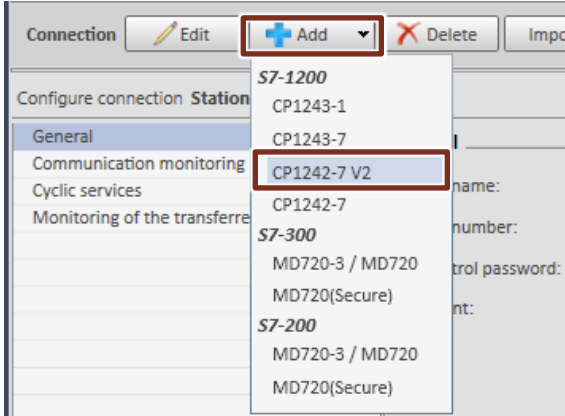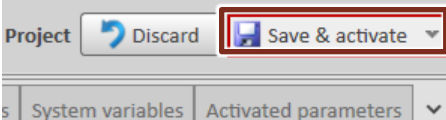
4.4 Configuration of TeleControl Server Basic (TCSB)

Table 4-6

No.	Action
1.	Start the configuration and monitoring user interface of TCSB (CMT): "Windows Start menu > All Programs > Siemens Automation > SIMATIC > TCS Basic > Config and Monitoring Tool".

2.	After program start, the login window of the CMT opens.
	
	 • Enter a configured user name or keep the default user name.
	 • Enter the respective password.
	 • Enter the IP address or the TeleControl server name resolved by DNS:
	  - computer name
	  or
	  - IP address (default IP address: 127.0.0.1)
	
	 The factory settings for the user data are:
	
	 User name: administrator
	 Password: 0000

3.	Create a new project: • In the navigation pane, select the entry "Projects". • In the commands bar, click on the "Add" button. The new project appears in the navigation pane and in the object area.
4.	Configure the new project: Select the project in the navigation pane or object area and click on the "Settings" tab.
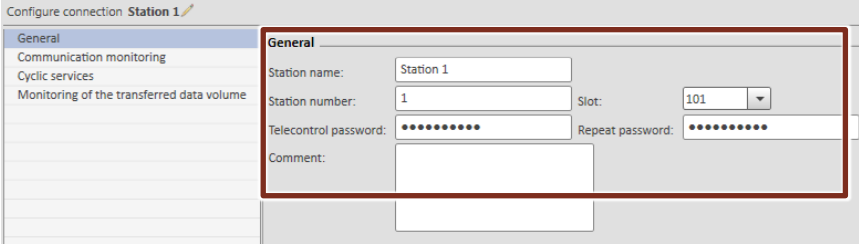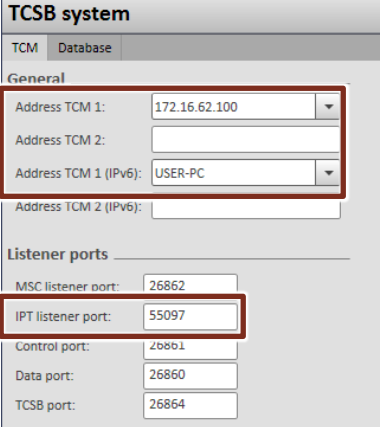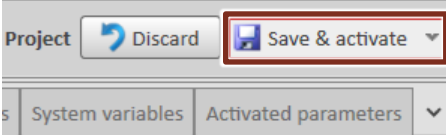
4.4 Configuration of TeleControl Server Basic (TCSB)

No.	Action	
5.	Fill in the parameters "Project name", "Project number" and "Server password" of the project. Click on "Create".	**Create a project** **General** Project name: Project number: 2 SMS gateway provider: T-Mobile Server password: Repeat password: Comment:
6.	Save and activate the configuration in order to ensure that the configuration data become effective for establishing the connection.	**Project** Discard	Save & activate System variables	Activated parameters
7.	Create a new connection for station 1: • In the navigation pane, select a project for which a new connection shall be established. • In the commands bar, select the required connection type from the "Connection type" drop-down list. • In the commands bar of the object area, click on the "Add" button. Select the desired CP. Connection Edit Add Delete Impo Configure connection Station General Communication monitoring Cyclic services Monitoring of the transferre S7-1200 CP1243-1 CP1243-7 CP1242-7 V2 CP1242-7 S7-300 MD720-3 / MD720 MD720(Secure) S7-200 MD720-3 / MD720 MD720(Secure) The new connection appears in the object area.	
8.	Save the changes and activate the project.	**Project** Discard	Save & activate System variables	Activated parameters

4.4 Configuration of TeleControl Server Basic (TCSB)

No.	Action
9.	Configure the new connection: • Select the connection. • In the object area, select the "Connections" tab. In the parameter area, various parameter groups are displayed for this connection.
10.	In parameter group "General", enter the following parameters for station 1: Station name Station number Telecontrol password **Note:** The parameters assigned here must be identical with the parameters in the STEP 7 V13 project.
11.	Repeat steps 7 to 10 for station 2.
12.	Configure the IP address and the ports of the TeleControl server: "TCSB system > "TCM" tab > General > Address TCM 1".
13.	Save the changes and activate the project.
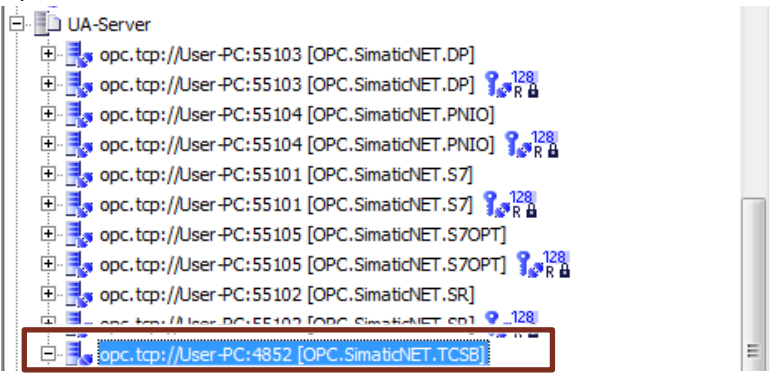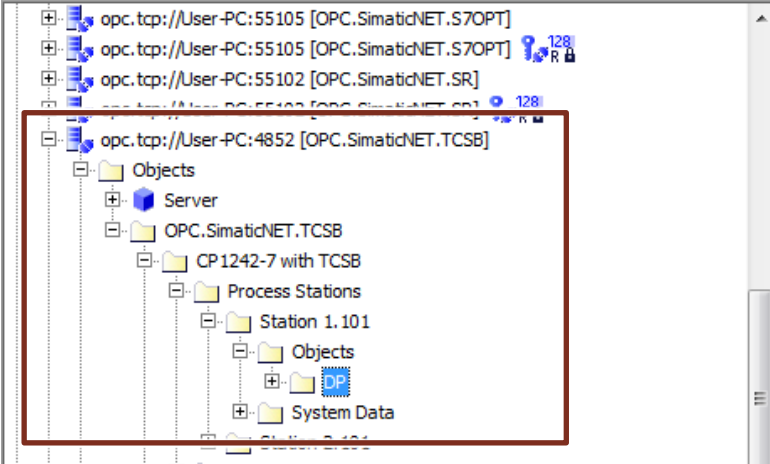
Note   When creating a new TCSB project for this Application Example, you have to adjust the affected HMI tags in the visualization software.

4.5 Configuring OPC Scout V10
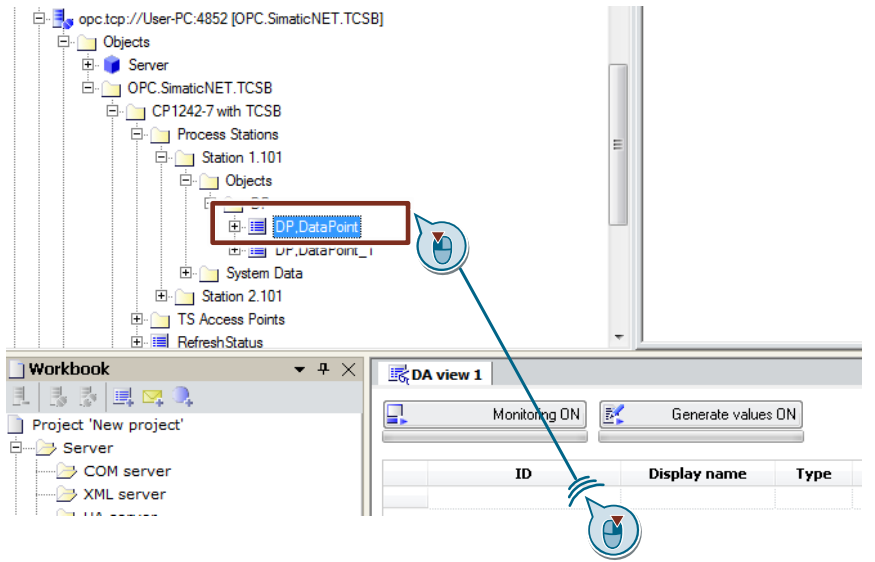
The OPC server of the TCSB enables OPC clients (OPC Scout) to access the process tags of the connected stations and status information of the individual connections. The OPC server of TCSB is displayed with the name "OPC.SimaticNET.TCSB". For monitoring the OPC items, an existing connection with TCSB is assumed.

Table 4-7

No.	Action
1.	Open OPC Scout V10: "Windows Start menu > All Programs > Siemens Automation > SIMATIC > SIMATIC NET > OPC Scout V10".
2.	Open the "OPC.SimaticNET.TCSB" server.
3.	Open the DP directory of the first station: "OPC.SimaticNET.TCSB > CP1242 with TCSB > Process stations > Station 1.101 > Objects > DP" ("OPC.SimaticNET.TCSB > TeleControl project > Process stations > Station x > Objects > DP").

4.5 Configuring OPC Scout V10

No.	Action
4.	Move any data points into the view area via drag & drop.
5.	Repeat steps 3 and 4 for the second station.

Note	When creating a new OPC Scout project for this Application Example, you have to adjust the affected HMI tags in the visualization software.

5 Installation and Commissioning

5.1 Installing the hardware

The required hardware components are listed in Chapter 2.4 .

Note	Always observe the installation guidelines for all components.

ATTENTIO N	**Before you switch on the power supply, complete and check the installation!**

5.1.1 Hardware setup of station 1

The figure below shows the hardware setup of station 1: S7-1200 CPU with CP 1242-7 GPRS V2

Figure 5-1

Industrial Ethernet
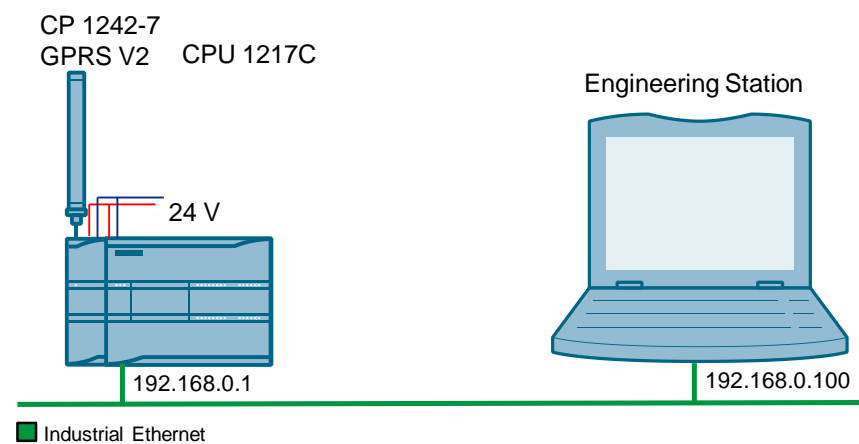
Table 5-1

No.	Action
1.	Insert your SIM card into the CP 1242-7 GPRS V2.
2.	Insert the individual modules to a suitable module rack.
3.	Connect the CPU with the CP 1242-7 GPRS V2.
4.	Connect the antenna to the CP 1242-7 GPRS V2.
5.	Connect the engineering PG to the PROFINET interface of the S7-CPU.
6.	Connect the CPU 1217C and the CP 1242-7 GPRS V2 to a 24 V DC power source.
7.	Connect the DC supply to the power grid (220 / 230 V AC).

5.1 Installing the hardware

5.1.2 Hardware setup of station 2

The figure below shows the hardware setup of station 2: S7-1200 CPU with CP 1243-1

Figure 5-2
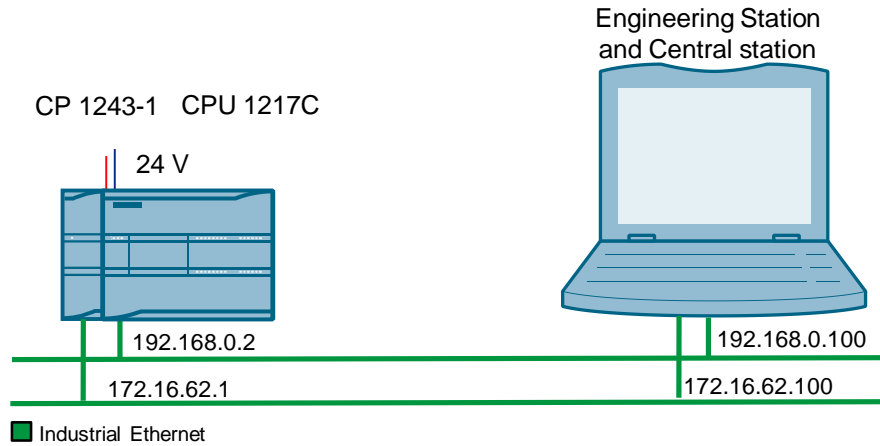
Table 5-2

No.	Action
1.	Insert the individual modules to a suitable module rack.
2.	Connect the CPU with the CP 1243-1.
3.	Connect the engineering PG to the PROFINET interface of the S7-CPU.
4.	Connect the central station with the PROFINET interface of the CP 1243-1.
5.	Connect all corresponding components to a 24 V DC power source.
6.	Connect the DC supply to the power grid (220 / 230 V AC).

5.1.3 Hardware setup of central station

The figure below shows the hardware setup of the central station.

Figure 5-3
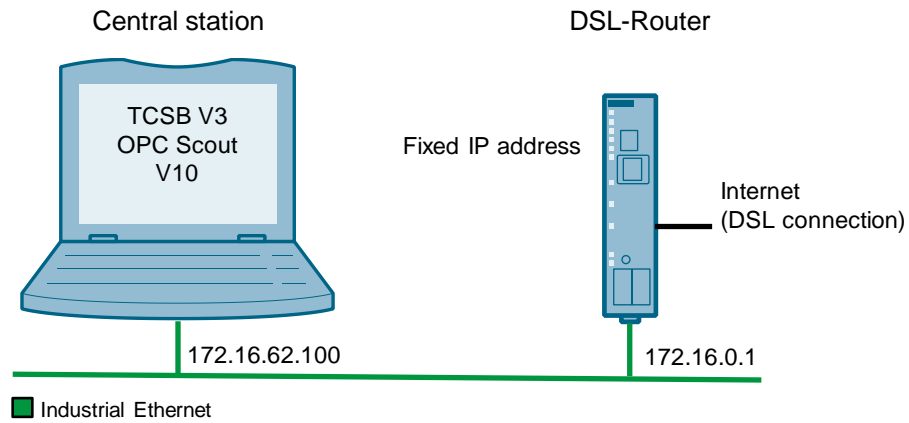
Table 5-3

No.	Action
1.	Connect your PC, on which TeleControl Server Basic runs, to the router via Ethernet.
2.	If the DSL modem has not been integrated in the router, connect the router to the DSL modem.

5.2 Installing the software

Engineering PC/PG

Table 5-4

No.	Action	Remark
1.	Install STEP 7 V3 SP1, update 5	Follow the instructions of the installation program.
2.	Install WinCC Advanced SP1, update 5	

PC/PG as central station

Table 5-5

No.	Action	Remark
1.	Install TeleControl Server Basic V3 SP1	Follow the instructions of the installation program.
2.	Install OPC Scout V10	

5.3 Installing the application software

Unzip the file "39863979_S7_1200_with_TCSB_PROJ_V10.zip" This folder contains:

- The archived STEP 7 project "39863979_S7-1200_with_TCSB_CODE_V10.zip":
    - station 1 project "S7-1200_CP1242-7"
    - station 2 project "S7-1200_CP1243-1"
    - WinCC project „Data communication TCSB"
- the TCSB configuration file "39863979_S7-1200_with_TCSB.bak"
- the OPC Scout configuration file "39863979_S7-1200_with_TCSB.opf"

5.4 Commissioning

5.4.1 Setting the IP addresses

The following table shows the configured IP addresses:

Table 5-6

Module	IP address	Subnet mask
Station 1: CPU 1217C DC/DC/DC	192.168.0.1	255.255.255.0
Station 2: CPU 1217C DC/DC/DC	192.168.0.2	255.255.255.0
Engineering PC/PG	192.168.0.100	255.255.255.0
SIMATIC Multi Panel MP377	192.168.0.3	255.255.255.0
CP 1243-1	172.16.62.1	255.255.0.0
PC/PG central station	172.16.62.100	255.255.0.0

5.4.2 Assigning the IP address to the engineering station
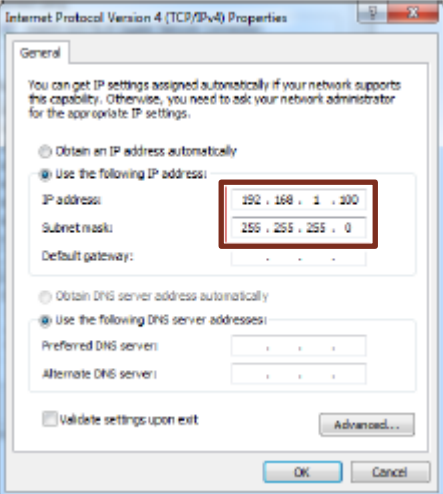
The table below shows the network setting to which you have to change the engineering station.

Table 5-7

No.	Action
1.	Open the Internet Protocol (TCP/IP) Properties: "Start > Settings > Network Connections > Local Connections"
2.	In the open window, select Internet Protocol (TCP/IP) and open Properties.

No.	Action
3.	Select the option box "Use the following IP address" and fill in the box as shown in the figure. Close the dialog boxes with "OK".
4.	If your PG has an IWLAN interface, switch it off.

5.4.3 Configuring the DSL router

No specific router is discussed for the configuration, as the operating screens differ from router to router.

Note

For the configuration of the router you have to assign an IP address located in the internal network of the router to your PG/PC.

Table 5-8

No.	Action	
1.	Open the configuration user interface of the router.	This can be an additional software, "Telnet" or a website.
2.	Enter the connection data for your Internet connection.	Login, password, etc. you received from your provider.
3.	Enter your DNS server.	You will receive the address together with your access data.
4.	Specify a LAN IP address for the router.	In this example: 172.16.0.1.
5.	Forward the partner port.	TCP port 55097 to port 55097 of 172.16.62.100.
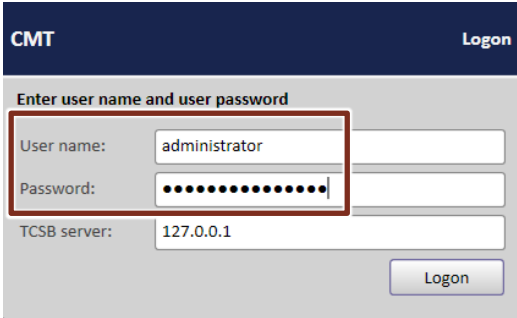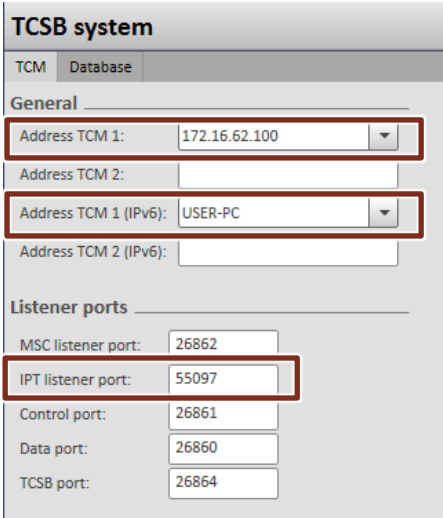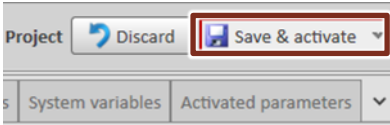
5.4.4 Including the backup copy of database "39863979_S7 1200_with_TCSB.bak" into TCSB V3

Table 5-9

No.	Action
1.	Stop the existing database by stopping the service "TSC Basic Database Service" by means of the Windows Task Manager in the "Services" tab (as administrator).
2.	Start "SQL Server Management Studio" **as administrator**: "Start > All Programs > Microsoft SQL Server 2008 R2 > SQL Server Management Studio". The "Connect to server" dialog opens with the following settings: • Server type: Database Engine • Server name: \<PC-Name\>\TCSB • Authentication: Windows Authentication
3.	Keep all settings and click on "Connect". The SQL Server Management Studio opens with the object navigation of the database.
4.	Select the "Databases" entry.
5.	Select the context menu (right mouse button) "Restore Database...". The "Restore Database - TCSB" dialog opens.
6.	In the "Destination for restore" field, select the database ("To database") "TCSB".
7.	In the "Source for restore" field, activate the option ("From device") and open the "Specify Backup" dialog via the "..." button.
8.	Select the backup copy "39863979_S7-1200_with_TCSB.bak" by first opening the file browser via the "Add" button.
9.	In the "Restore Database - TCSB" dialog, select the selected "backup set" in the "Restore" column and click on "OK".
10.	Close Management Studio via "OK".
11.	Restart the computer.

5.4.5 Configuring IP address and ports of TeleControl Server Basic V3
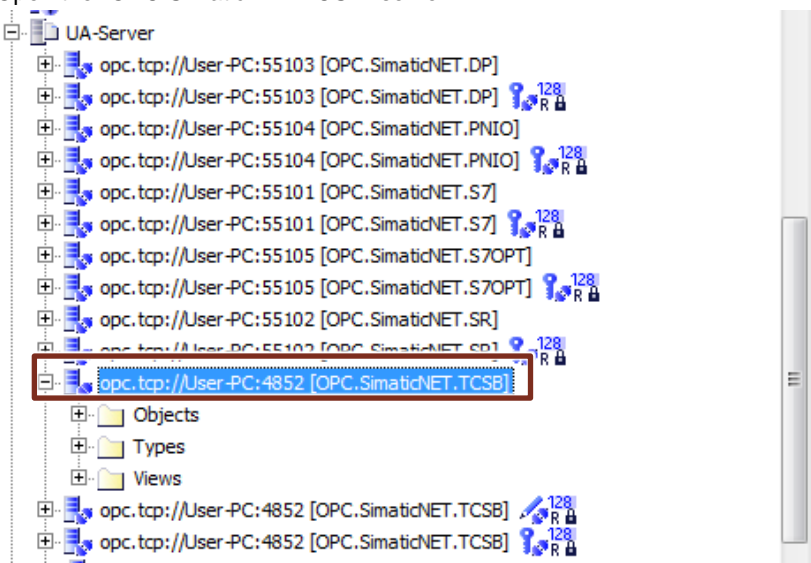
Table 5-10

No.	Action
1.	Start the configuration and monitoring user interface of TCSB (CMT): "Windows Start menu > All programs > Siemens Automation > SIMATIC > TCS Basic > Config and Monitoring Tool".

2.	After program start, the login window of the CMT opens.
	
	 • User name: administrator
	 • Password: administrator
	 • Enter the IP address or the TeleControl server name resolved by DNS:
	   – computer name
	   or
	   – IP address (default IP address: 127.0.0.1)

3.	Configure the IP address and the ports of the TeleControl server: "TCSB system > "TCM" tab > General > Address TCM 1".
4.	Save the changes and activate the project.
5.	Restart the computer.

5.4.6 Opening the OPC Scout configuration file "39863979_S7-1200_with_TCSB.opf"

To monitor the process data at the central station, you have to open the OPC Scout configuration file "39863979_S7-1200_with_TCSB.opf" included in the project.

Table 5-11
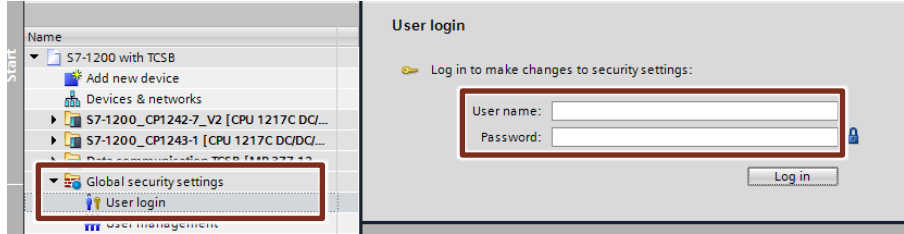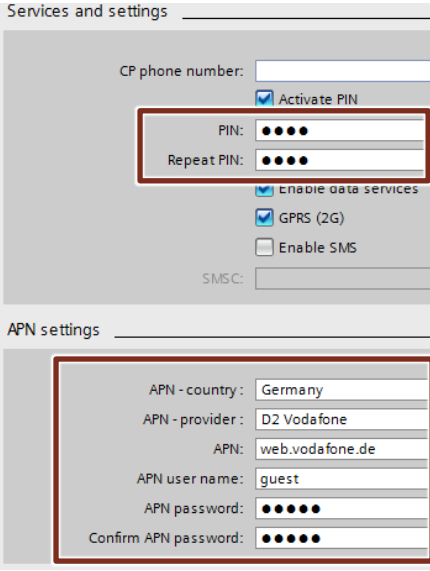
No.	Action
1.	Open the OPC Scout: "Windows Start menu > All Programs > Siemens Automation > SIMATIC > SIMATIC NET > OPC Scout".
2.	Open the "39863979_S7-1200_with_TCSB.opf" file: "File > Open …"
3.	Open the "OPC.SimaticNET.TCSB" server.

5.4.7 Loading station 1 or station 2

Requirements
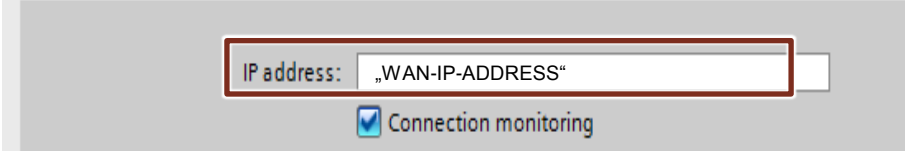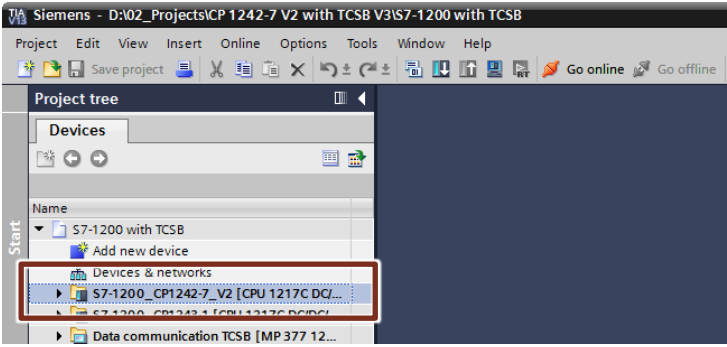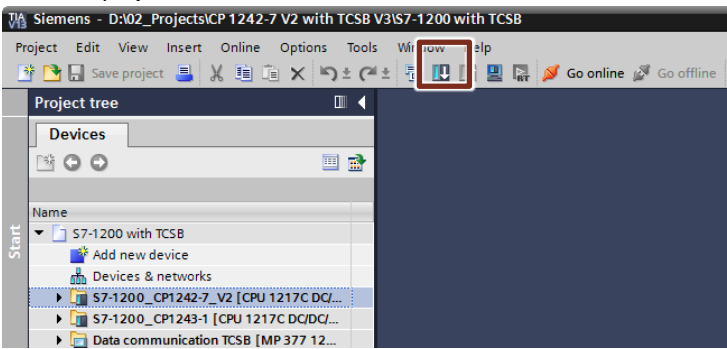
- There is an existing connection between your engineering station and the CPU (e. g. via the PROFINET interface).
- The CPU must be in an operating state that allows loading.
- Prior to loading the user program, a general reset of the CPU should be performed to ensure that none of the "old" blocks still exist on the CPU.

Table 5-12

No.	Action
1.	Unzip the project "39863979_S7-1200_with_TCSB_CODE_V10.zip".
2.	Open the STEP 7 V13 project "S7-1200 with TCSB.ap13".
3.	Enable the security functions of the CP: "S7-1200 with TCSB > Global security settings > User login" User name: administrator Password: administrator
4.	Adjust the mobile communication settings of the CP 1242-7 GPRS V2: "Properties of the CP 1242-7 GPRS V2 > Mobile wireless communications settings": • Adjust the PIN. • Adjust the APN settings.

5.4 Commissioning

No.	Action
5.	Adjust the partner IP address (fixed IP address of your DSL router) required for connection with the TeleControl server at the central station: "Properties of the CP 1242-7 GPRS V2 > Partner stations > Connection to partner" This step is only required for the CP 1242-7 GPRS V2.
6.	Select station "S7-1200_CP1242-7" or "S7-1200_CP1243-1".
7.	Load the project into station 1 or station 2.

6 Operating the application

6.1 Overview

Menu navigation of the HMI

The Application Example is visualized with WinCC Advanced by means of two configured screens called "TCSB Communication" and "S7-1200 Application".

Figure 6-1

Main menu

TCSB Communication   S7-1200 Application
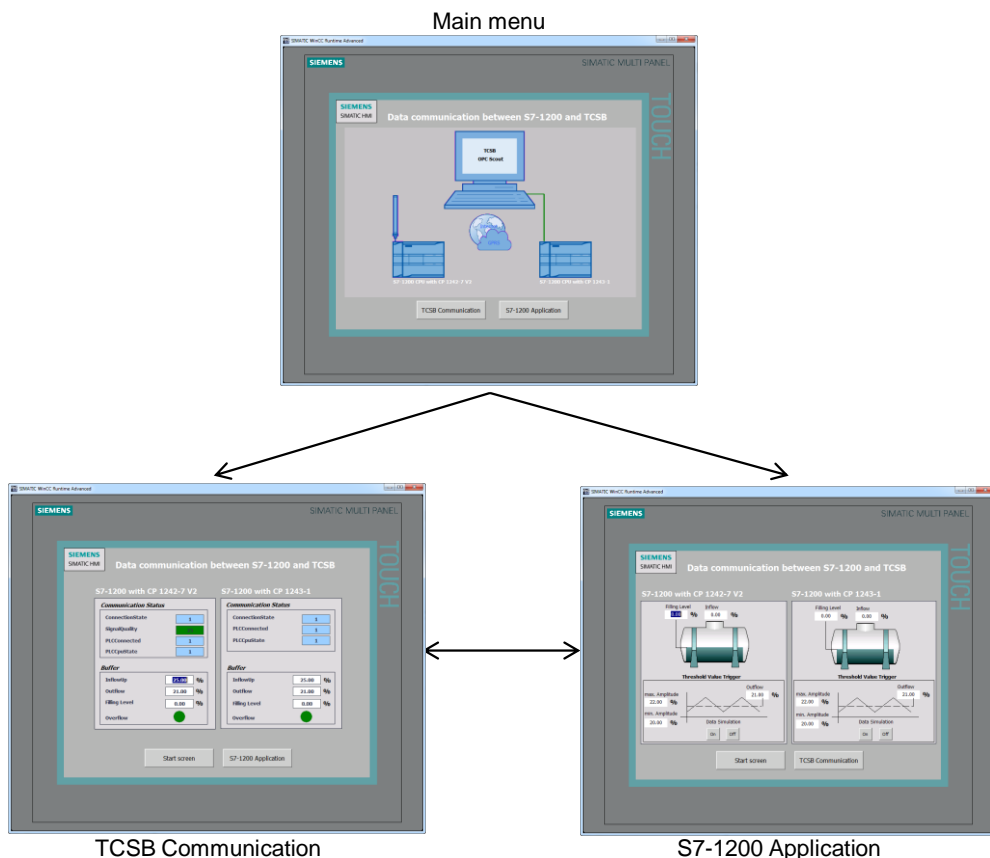
Main menu

The Application Example can be opened via the main menu and toggled between "TCSB Communication" and "S7-1200 Application".

"TCSB Communication" screen

The "TCSB Communication" screen shows the status of the connection with the remote stations. Furthermore, information on the data traffic is provided. It is possible to toggle between "Main menu" and "S7-1200 Application".

"S7-1200 Application" screen

The "S7-1200 Application" screen visualizes the processes of stations 1 and 2. It is possible to toggle between "Main menu" and "TCSB Communication".

6.2 Station 1 or station 2 sends data to the central station ("threshold-triggered")

Watch table of station 1 or station 2

As an alternative to the HMI, the "WT_SetResetParameter" table can be used for monitoring or controlling the tags of the DB "Data". You can find a description of the tags in .
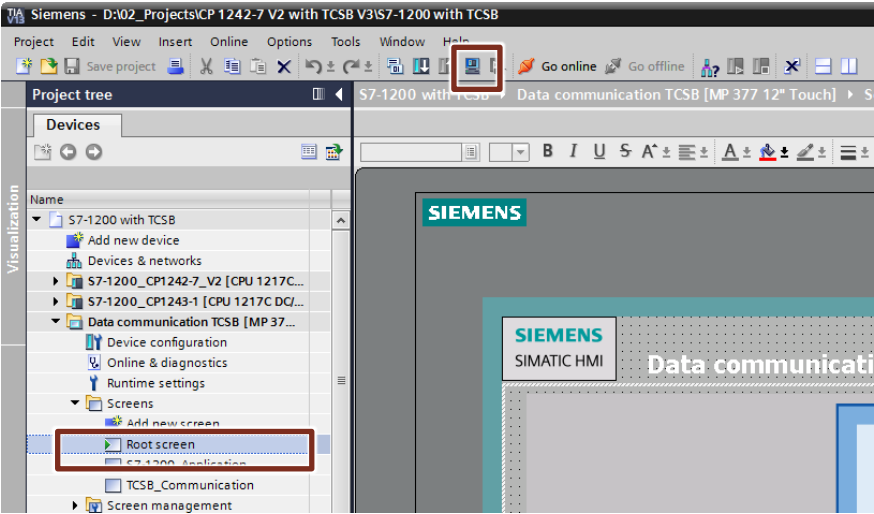
Figure 6-2

6.2 Station 1 or station 2 sends data to the central station ("threshold-triggered")
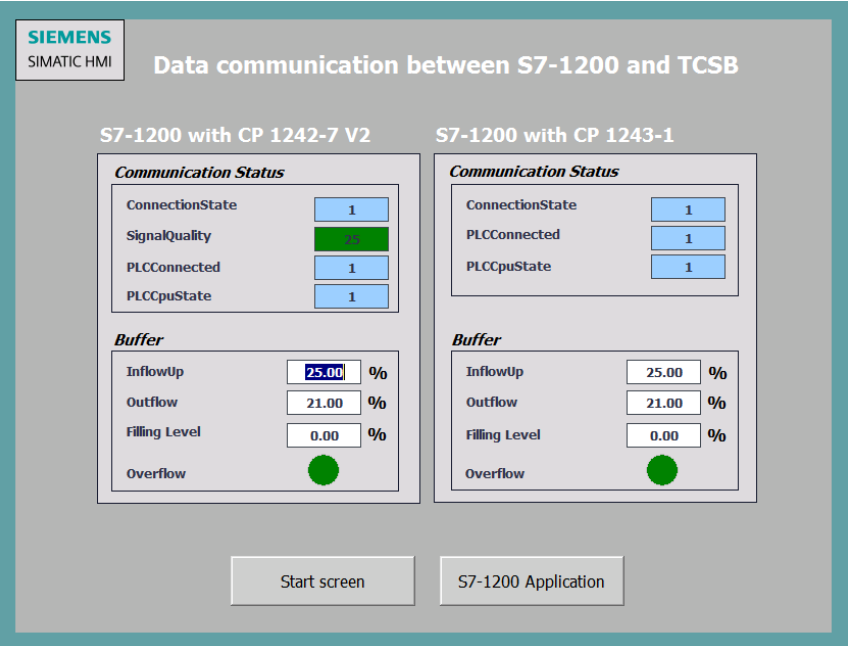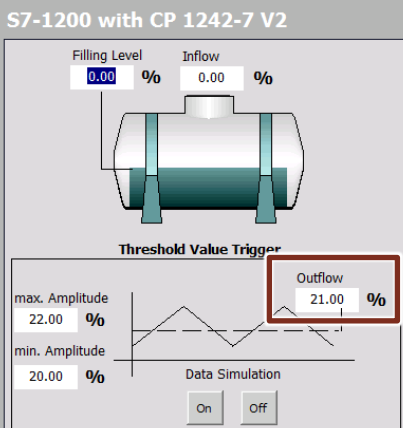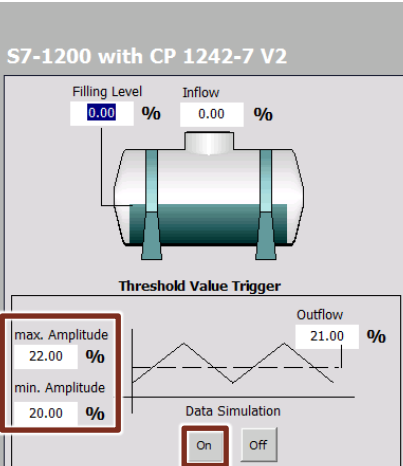
Station 1 or station 2 sends its outflow value threshold-triggered to the TeleControl Server Basic in the central station. An instruction for this job is given in the following table.

Table 6-1

No.	Action
1.	Start the WinCC Advanced simulation by clicking on the "Start Simulation" icon.

6.2 Station 1 or station 2 sends data to the central station ("threshold-triggered")

No.	Action
2.	Open the "TCSB Communication" screen.
3.	Open the "S7-1200 Application" screen and enter an outflow value. **Note:** For the threshold value to be reached after a certain time, the outflow value (Outflow) has to be greater than the minimum amplitude (here 20%) and lesser than the maximum amplitude (here 22%).
4.	Enter the values for the data simulation and start it.
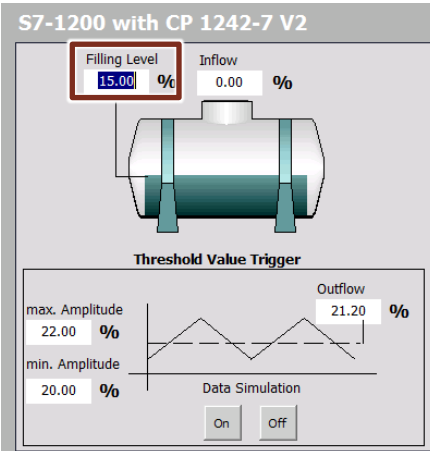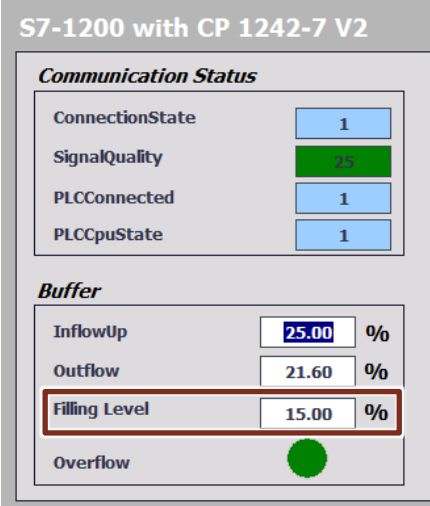
6.2 Station 1 or station 2 sends data to the central station ("threshold-triggered")

No.	Action
5.	Go the "TCSB Communication" screen. If the threshold value "2" is reached (see Figure 3-1), the outflow value is saved in the TCSB. The data can also be monitored with OPC Scout V10 via "Monitoring ON". **Note:** The "threshold trigger"=2 has been configured in the data point configuration (see Chapterl 4-2).
6.	Repeat the process for station 2.

6.3 Station 1 or station 2 sends data cyclically to the central station

Station 1 or station 2 sends its filling level value to the TeleControl Server Basic in the central station in a fixed time interval. An instruction for this job is given in the following table. The WinCC Advanced Simulation has been started (see Table 6-1, No1).
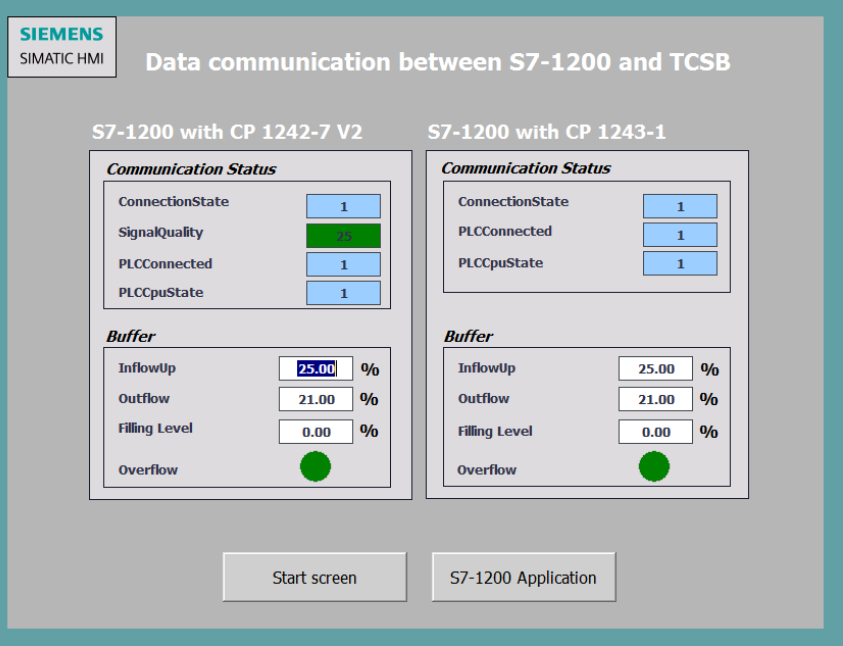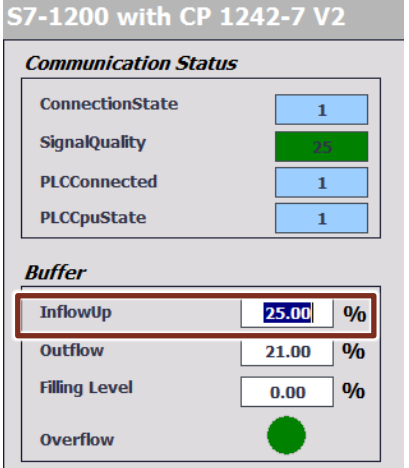
Table 6-2

No.	Action
1.	Open the "S7-1200 Application" screen and enter the current filling level value.
2.	Go the "TCSB Communication" screen. After 30 seconds, the filling level value will be saved in the TCSB. The data can also be monitored with OPC Scout V10 via "Monitoring ON".
3.	Repeat the process for station 2.

6.4 Station 1 or station 2 sends data to the central station ("event-triggered")
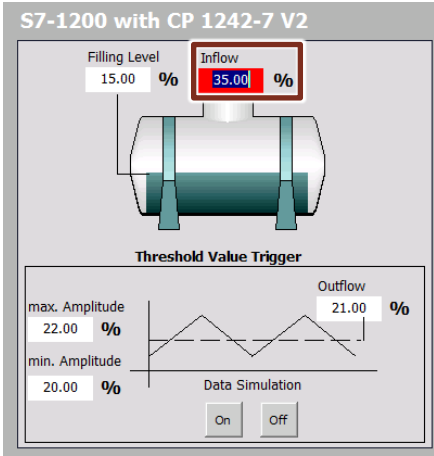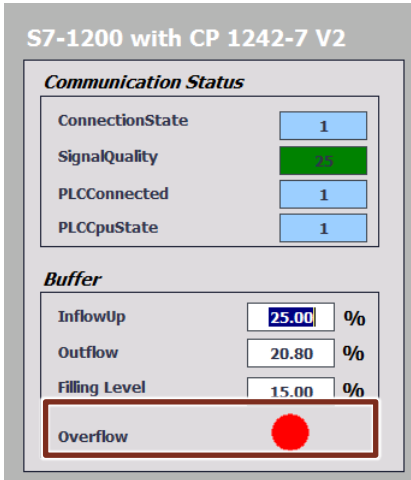
If the inflow of station 1 or station 2 exceeds a maximum value, the inflow value will be sent to the central station. An instruction for this job is given in the following table. The WinCC Advanced Simulation has been started (see Table 6-1, No1).

Table 6-3

No.	Action
1.	Open the "TCSB Communication" screen.
2.	Enter any maximum inflow value in the "InflowUp" field. Start value: 25%.

6.4 Station 1 or station 2 sends data to the central station ("event-triggered")

No.	Action
3.	Open the "S7-1200 Application" screen and enter an inflow value that exceeds the maximum inflow value (e. g. 35 %).
4.	The overflow alarm is immediately set and transferred to the TCBS. "TCSB Communication" screen The data can also be monitored with OPC Scout V10 via "Monitoring ON".
5.	Repeat the process for station 2.

7 Related Literature

Table 7-1

	Topic	Title
\1\	Siemens Industry Online Support	http://support.industry.siemens.com
\2\	Download page of the entry	https://support.industry.siemens.com/cs/ww/en/view/39863979
\3\	SIMATIC NET Industrial Remote Communication - TeleControl TeleControl Server Basic V3	https://support.industry.siemens.com/cs/ww/en/view/107536367
\4\	SIMATIC WinCC V13 SP1 TRIAL Download	https://support.industry.siemens.com/cs/ww/en/view/106567563
\5\	How do you read out advanced diagnostics data from the CP 1242-7 GPRS V2?	https://support.industry.siemens.com/cs/ww/en/view/109480967

8 History

Table 8-1

Version	Date	Modifications
V1.0	05/2016	First version