Monitoring of Remote Measurement Points using an RTU3041C

SIMATIC RTU3041C / TeleControl Server Basic V3.1

https://support.industry.siemens.com/cs/ww/en/view/109739240

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1 Introduction

1.1 Overview

Starting point

The battery-powered SIMATIC RTU30X1C is used to monitor and control remote stations that are geographically distributed and not connected to a power supply network. The RTU30X1C can store process data and transmit it to a central station via mobile wireless or via the LAN interface and an external router.

Furthermore, the RTU30X1C has 4 additional digital outputs and supports position determination and time synchronization via GPS.

Requirements

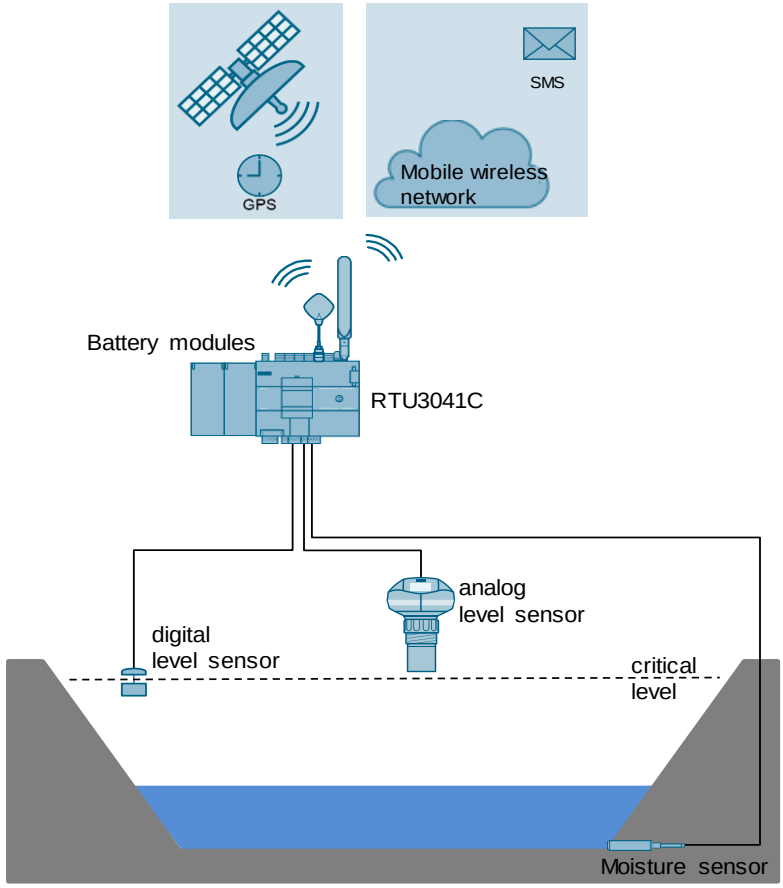
An RTU30X1C monitors the fill level of a rain overflow basin.

To conserve power, the RTU30X1C is in sleep mode much of the time, switching to an update or communication mode in predetermined cycles.

If the level exceeds a critical value, the RTU30X1C informs the operator by email and SMS, even outside scheduled communication cycles.

In addition, the RTU30X1C informs the operator via SMS when its predefined target position is reached. The actual position should be within a parameterized radius.

Figure 1-1 Level monitoring overview



Use case

The RTU3041C uses an analog level sensor to monitor the level of a rain overflow basin. A digital moisture sensor starts the measurement.

In addition, a digital level sensor (float) is installed, which is activated when a critical level is exceeded.

At configurable, timed intervals, the RTU switches from sleep mode to update mode to read the inputs and process the program.

The position determination and the time synchronization of the RTU3041C is done via GPS.

Subsequently, the current data is sent to the TeleControl Server Basic (TCSB).

To read out the data of the TCSB, UaExpert is used as OPC UA Client.

Solution approach

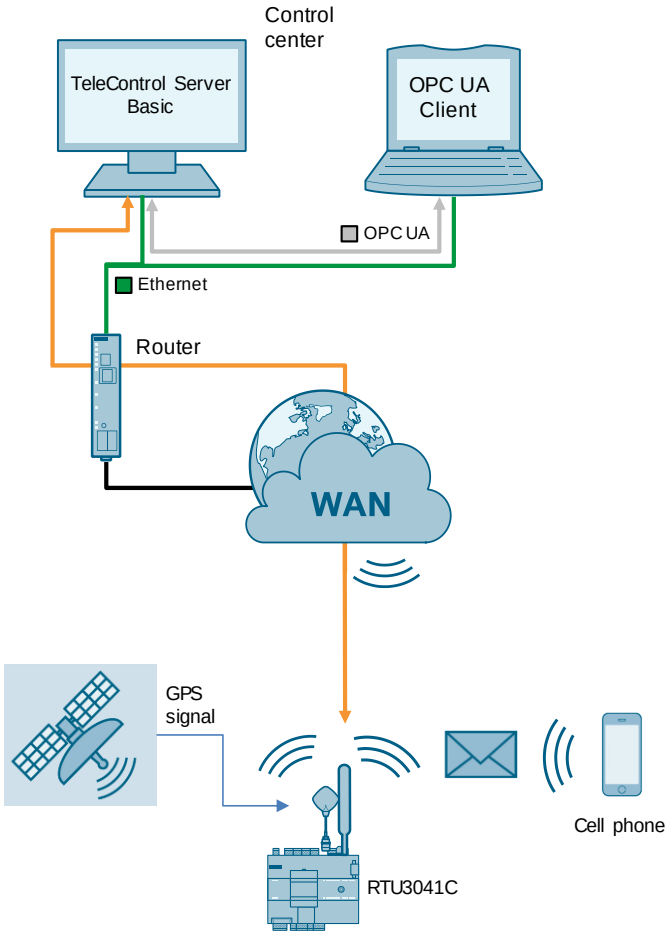
- An application program with the program blocks "Send email" and "Send SMS" implements the sending of emails and SMS messages.
- The position determination is done with the "GPS position" block. The block checks whether the RTU is moving outside the specified range.
- The RTU3041C is configured via the Web-Based Management (WBM) of the RTU.
- The blocks are graphically displayed and programmed via the Web-Based Management (WBM) of the RTU3041C.

1.2 Principle of Operation

Diagram

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

Figure 1-2



Implemented functions

The following functions are implemented in the application example:

- Receiving a wake-up SMS to wake up the RTU3041C from sleep mode.
- Sending an email/SMS to a defined recipient when a critical level is exceeded or not reached.
- Time synchronization via GPS.
- Position determination of the RTU3041C via GPS.
- Sending an SMS to a defined recipient when the RTU3041C moves outside the defined range.

1.3 Components Used

This application example was created with the following hardware and software components:

Table 1-1

Components	Quantity	Article number	Note
SIMATIC RTU3041C	1	6NH3112-4BB00-0XX0	The SIMATIC RTU3031C (6NH3112-3BB00-0XX0) can also be used.
Battery module housing	2	6NH3112-3BA00-1XX2	2 pieces per RTU
Battery	4		2 pieces per battery module housing (e.g., SAFT LSH20)
Mobile wireless antenna	1	6NH9860-1AA00	
Antenna ANT895-6ML	1	6GK5895-6ML00-0AA0	For receiving GPS position and time information
SIM card	1		Any mini SIM card with a data option
SITRANS LU150 analog level sensor	2	7ML5201-0FB0	Up to 5 m
Digital level sensor	2		Available from specialist dealers
Digital moisture sensor	1		Available from specialist dealers
SCALANCE M816-1	1	6GK5816-1AA00-2AA2	Another DSL router can also be used.
TeleControl Server Basic 8 V3.1, Update 3	1	6NH9910-0AA31-0AA0	
UaExpert	1	Freeware	Download at https://www.unified-automation.com/downloads/opc-ua-clients.html

This application example consists of the following components:

Table 1-2

109739240_RTU3041C_TCSB_DOC_V30_en.pdf	This document
109739240_RTU3041C_TCSB_PROJ_V30.zip	Configuration file of the RTU3041C

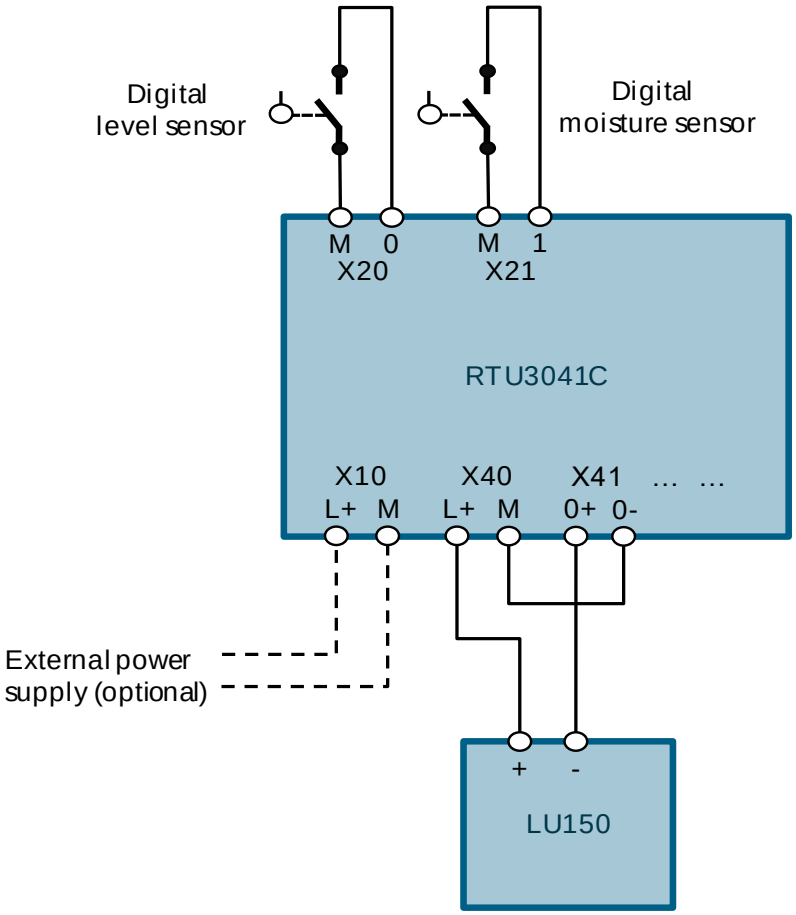
2 Engineering

2.1 Hardware Setup

Section 1.3 lists the required hardware components.

The following diagram shows the hardware setup of the RTU3041C.

Figure 2-1: Circuit diagram RTU



1. Insert the SIM card into the RTU3041C.
2. Insert two batteries at a time into a battery module housing.
3. Mount the RTU3041C and, to the left of it, the battery module housing on a top-hat rail.
4. Connect the digital level sensor to the terminal block X20.
5. Connect the digital moisture sensor to terminal block X21.
6. Connect the analog level sensor to terminal blocks X40 and X41. For instructions on how to operate the SITRANS LU150, refer to the instruction manual: https://support.industry.siemens.com/cs/ww/en/view/109739505.
7. Connect the antennas to the RTU3041C.
8. Connect the battery module housing to the RTU3041C.

Note You can also operate the RTU3041C with an external power supply instead of batteries. To do this, connect the external power supply with DC 12 to 24 V to terminal block X10 IN.

Note Connection examples for other sensors can be found in the instruction manual:

https://support.industry.siemens.com/cs/ww/en/view/109750942.

The following table provides an overview of all IP addresses used in this example. Assignment of static IP addresses is assumed.

Table 2-1

Components	IP address	Description
Engineering station	192.168.0.100	• TeleContol Server Basic • OPC UA Client
RTU3041C	192.168.0.3	Access to WBM

The subnet mask in all network components is 255.255.255.0.

Note Adjust the IP addresses of the components in your project so that they are on the same subnet.

2.2 Configuration and project planning

This section describes the most important steps of the configuration:

- Configure the SIMATIC RTU3041C (Section 2.2.1) or load the supplied configuration file (Section 2.2.4)
- Configuring the TeleControl Server Basic (Section 2.2.2)
- Configure OPC UA Clients (UaExpert) (Section 2.2.3).

2.2.1 Configuring the SIMATIC RTU3041C

This section shows you all necessary steps to configure the RTU3041C for the application described here.

Note The supplied project "109739240_RTU3041C_ PROJ_V30.zip" contains the finished configuration file ("*.cfg"), which you can load into your RTU3041C and adapt to your application in just a few steps (see Section 2.2.4).

This section is for information only.

Note Insert a SIM card into the RTU3041C before configuring.

For each RTU, you need a SIM card with data option. You can obtain this from your mobile provider.

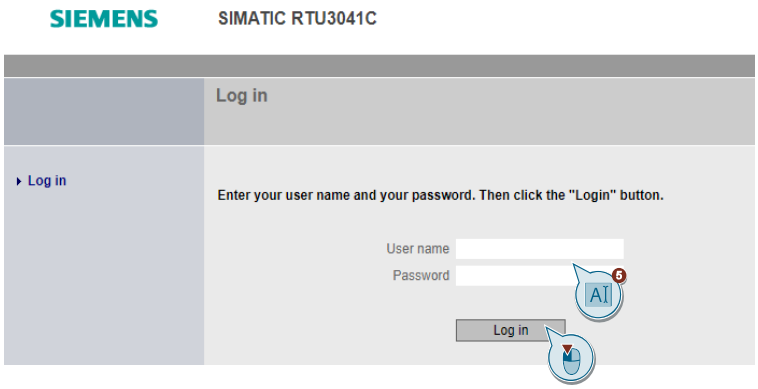
General configuration

1. Connect the RTU3041C to your PG/PC via a network cable.

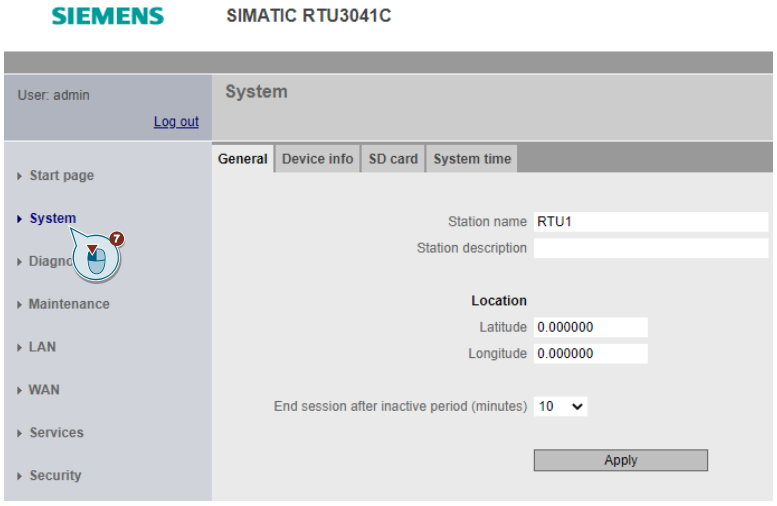
Note If you are using multiple RTUs, address conflicts may occur during initial startup because each RTU is assigned the same IP address by default. Therefore, during commissioning, ensure that only one RTU is connected to your network at a time.

2. If necessary, change the IP address of your PG/PC (according to Table 2-1) so that it and the RTU3041C are in the same subnet.
3. Wake up the RTU3041C by briefly pressing the WKUP/RESET button on the RTU3041C.
4. In a browser, open the web server of the RTU3041C at the address "192.168.0.3".

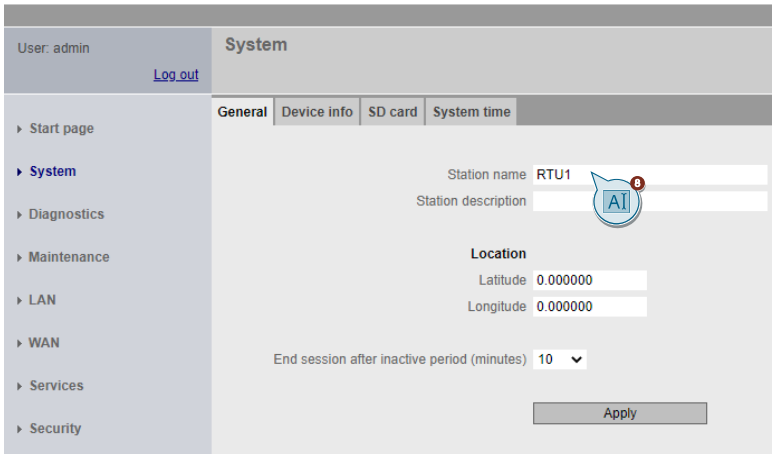
5. Log in with the username "admin" and the password "admin".



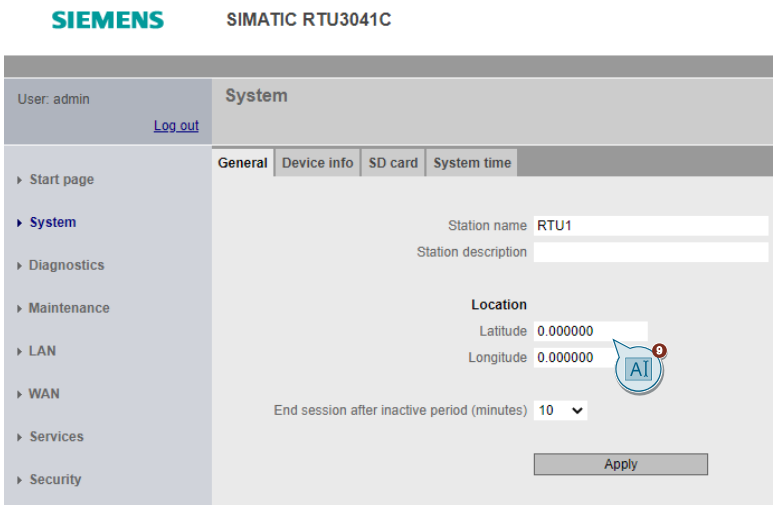
6. Assign a new password.
7. Navigate to the "System" menu.



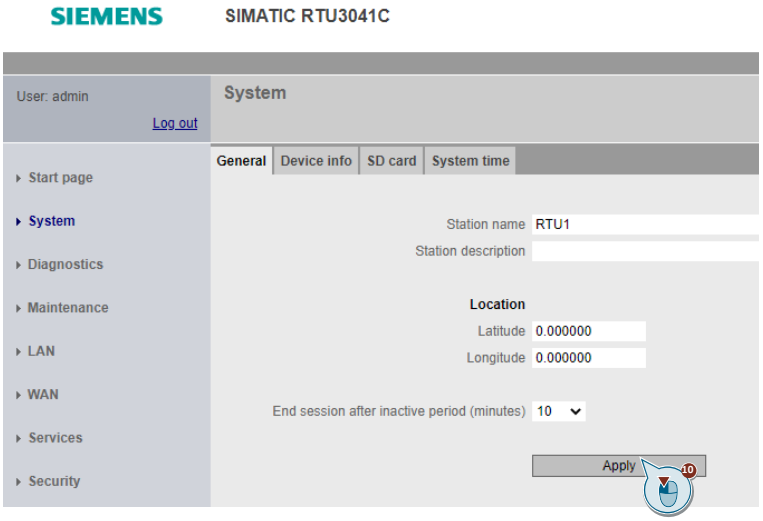
8. Assign a unique station name.



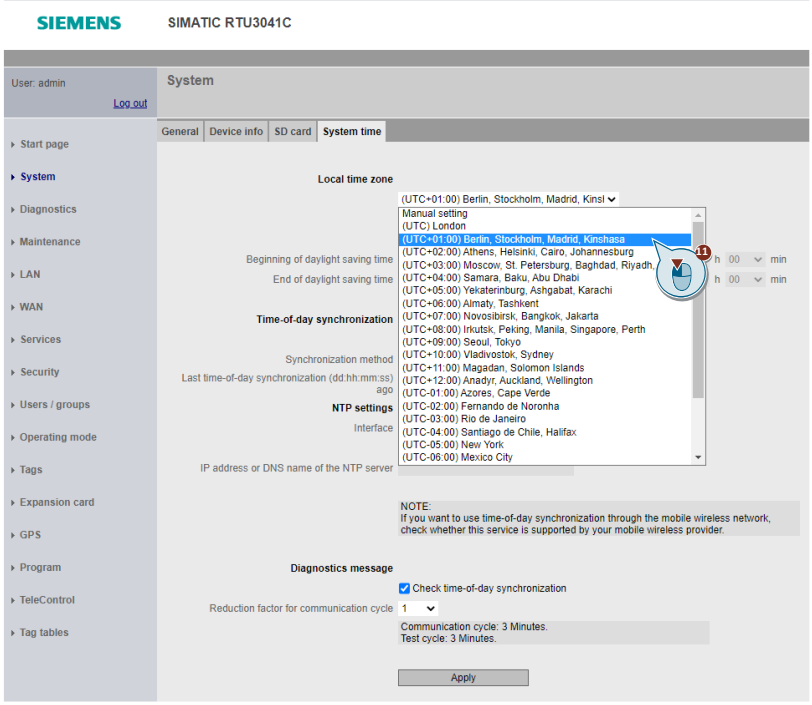
9. Assign the coordinates for the RTU3041C.



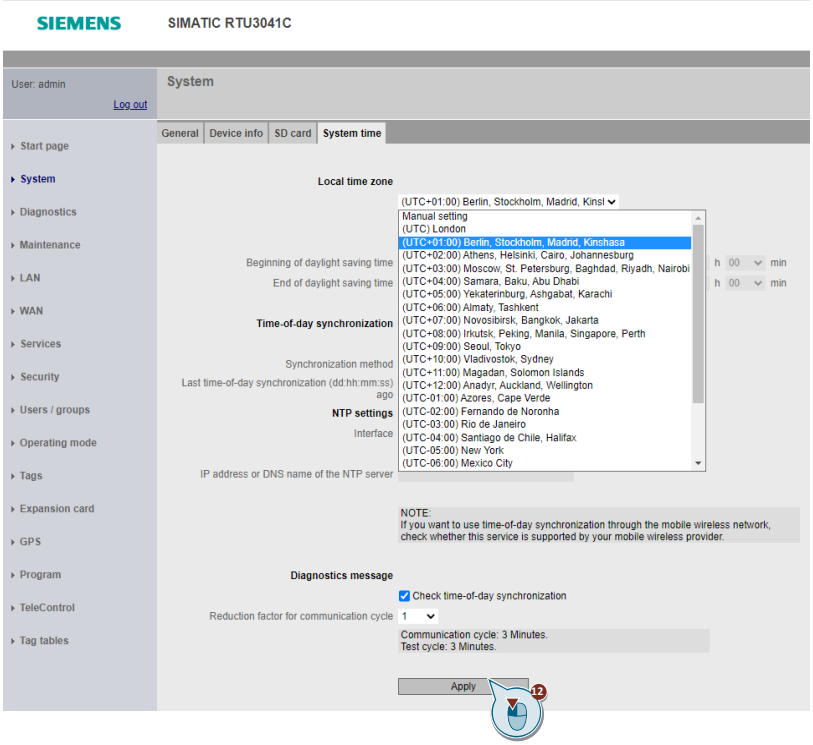
10. Then click "Apply".



11. Open the System time tab and select your local time zone.

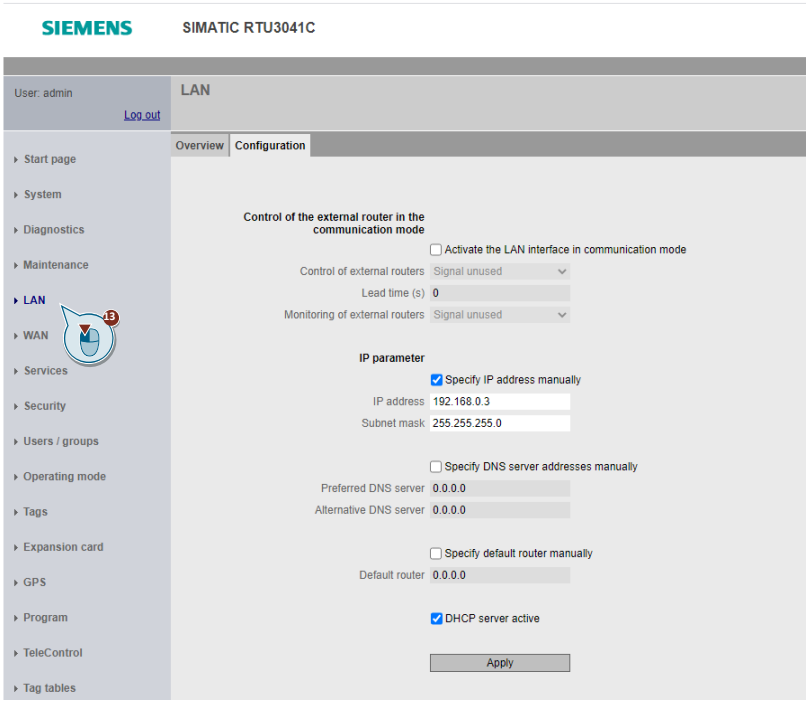


12. Then click "Apply".

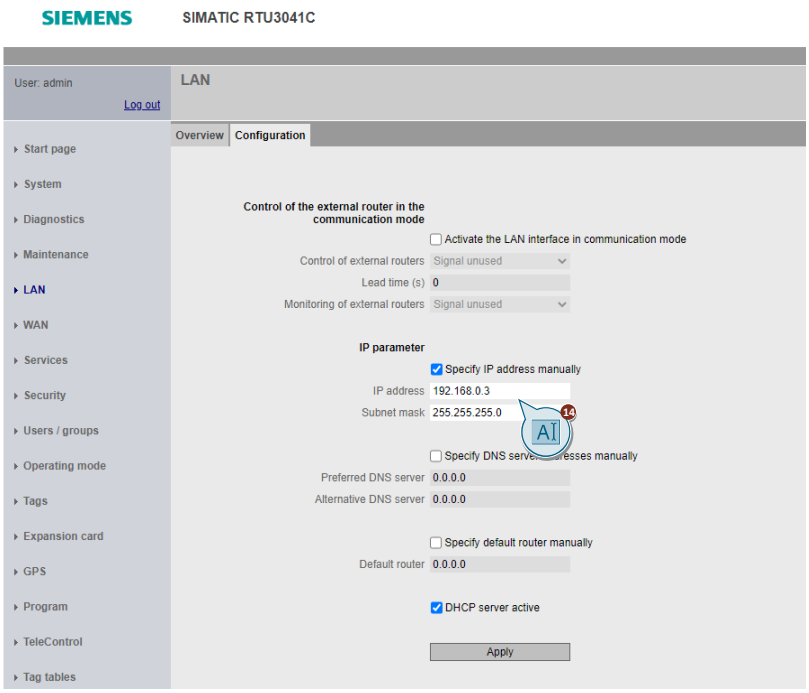


Note If you are running multiple RTUs on a network, you must assign a unique IP address. Assign an IP address according to your network settings (e.g., 192.168.0.4).

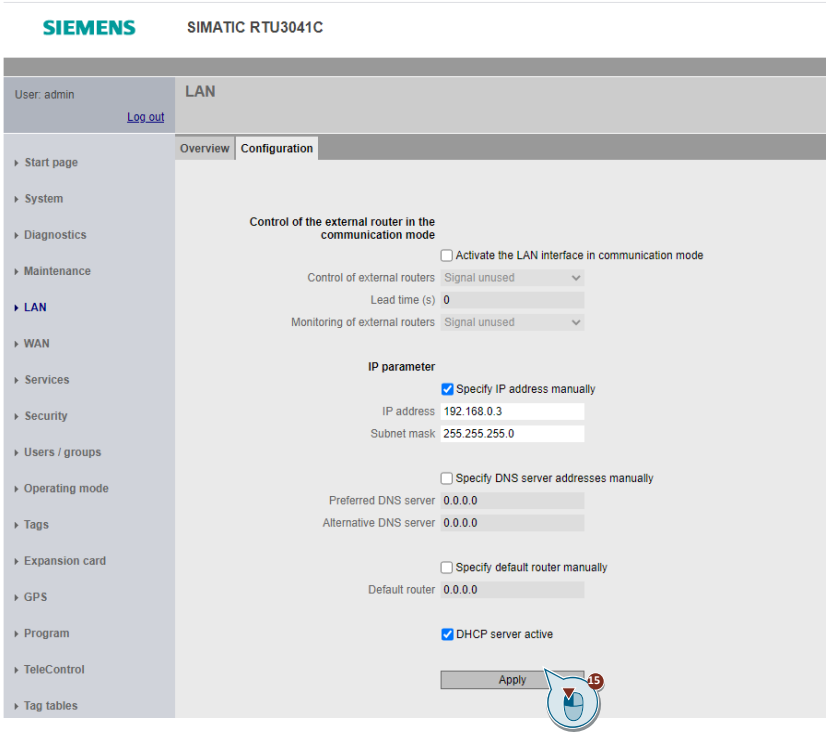
13. To do this, navigate to the "LAN" menu.



14. Enter an IP address and subnet mask.

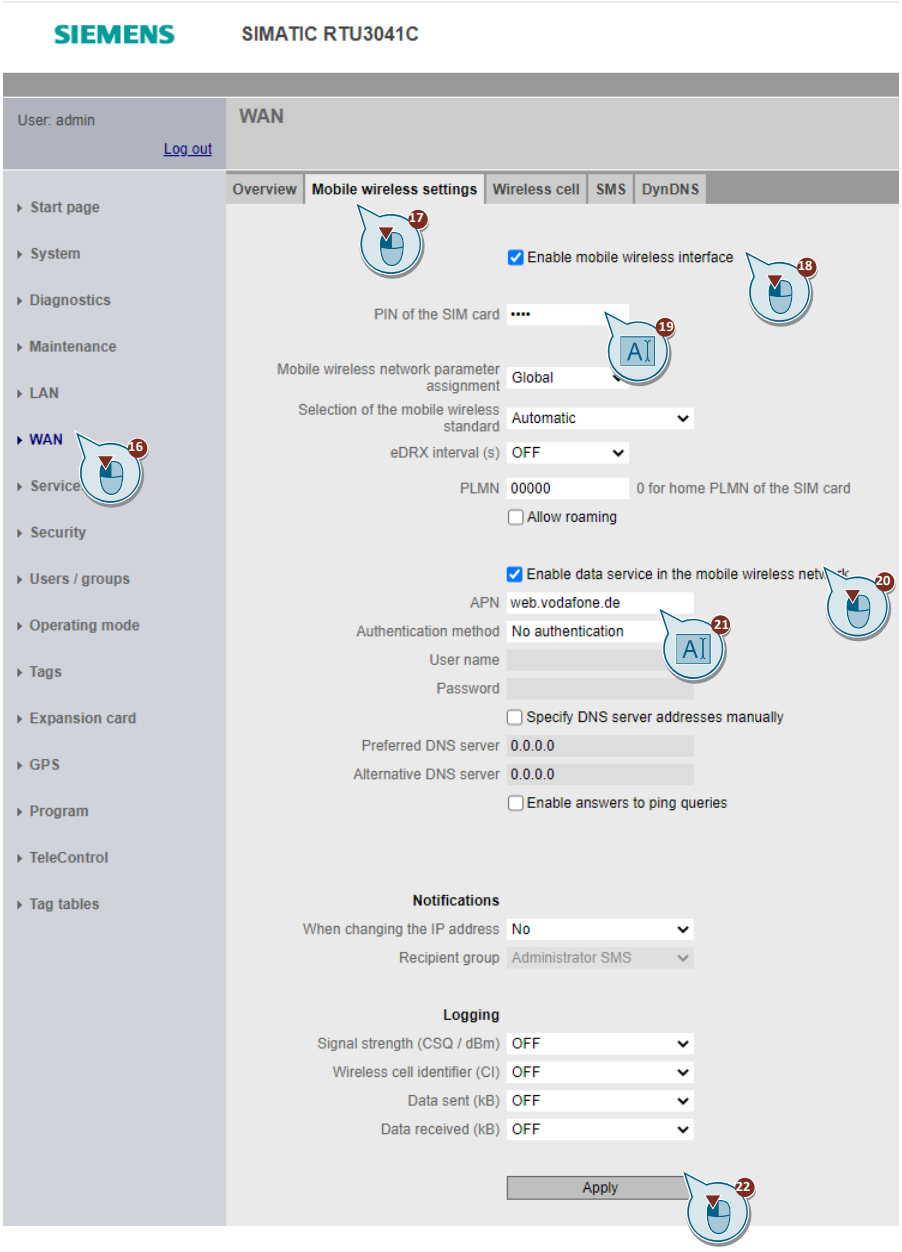


15. Then click "Apply".



Note If you have changed the IP address of the RTU3041C, then open the web server of the RTU3041C again in a browser under the new IP address.

16. Navigate to the "WAN" menu.
17. Open the Mobile wireless settings tab.

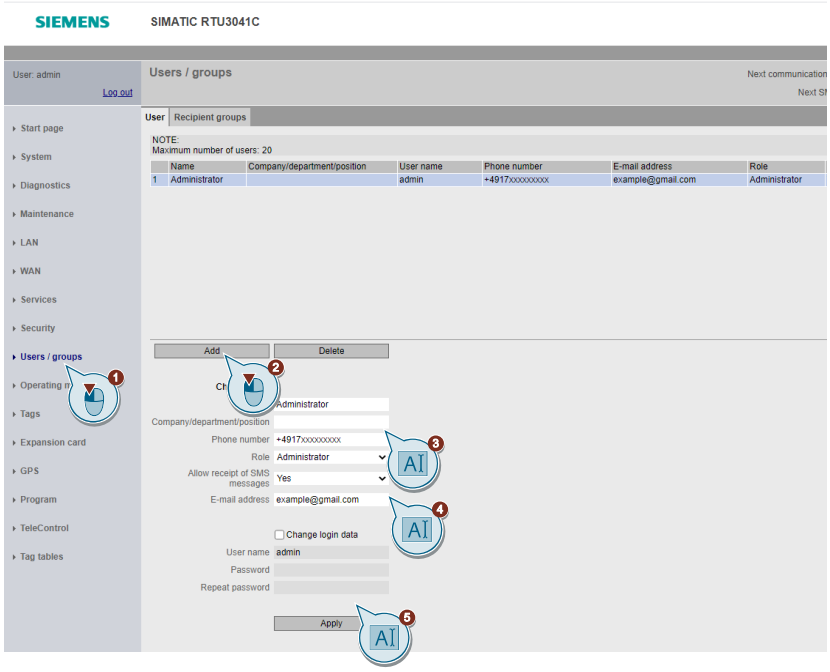


18. Enable the mobile function interface.
19. Enter the PIN of the inserted SIM card.
20. Enable the mobile data service.
21. Enter the APN of your mobile operator. If necessary, enter your username and password.
22. Then click "Apply".

Configuring SMS/email sending/receiving

To enable the RTU3041C to send messages and data for configurable event classes (diagnostic buffer entries), either as SMS or as email to an operator, proceed as follows:

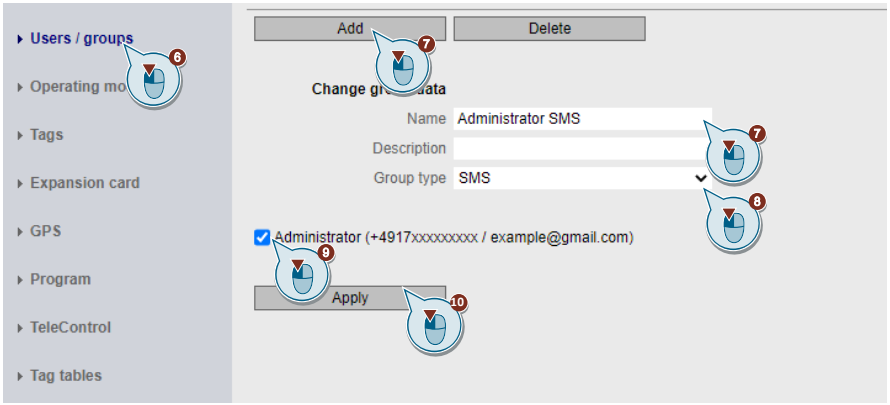
1. Navigate to the "Users / groups" menu.



2. Add a new user with the name "Administrator".
3. Enter the phone number with country code (e.g., "+49" for Germany).
4. Enter the email address for the "Administrator" user.
5. Then click "Apply".

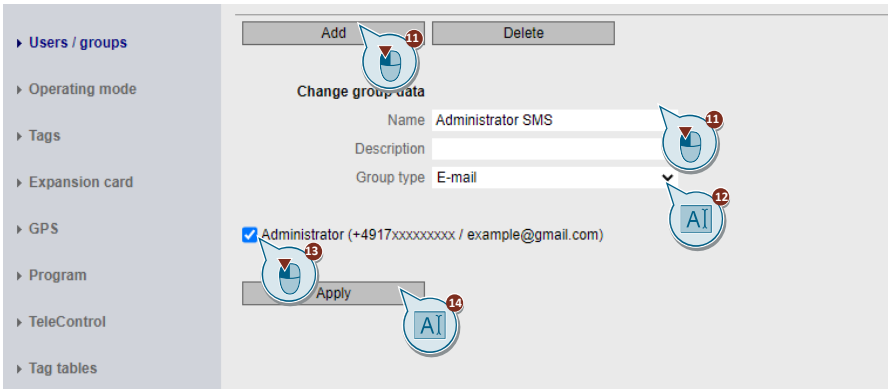
Note The RTU3041C only accepts wake-up SMS messages from phone numbers that are stored here.

6. Open the "Recipient groups" tab.

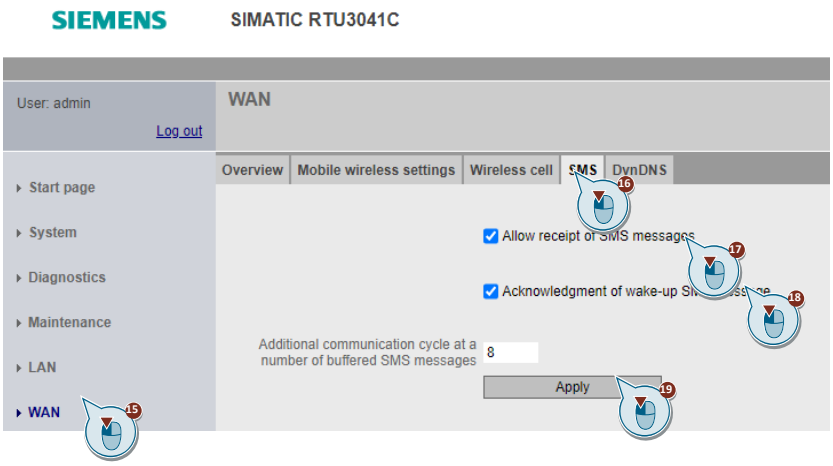


7. Add a new group named "Administrator SMS".
8. Select the type "SMS".
9. Enable the "Administrator" user.
10. Then click "Apply".

11. Add a new group named "Administrator Email".
12. Select the "Email" type.
13. Enable the "Administrator" user.

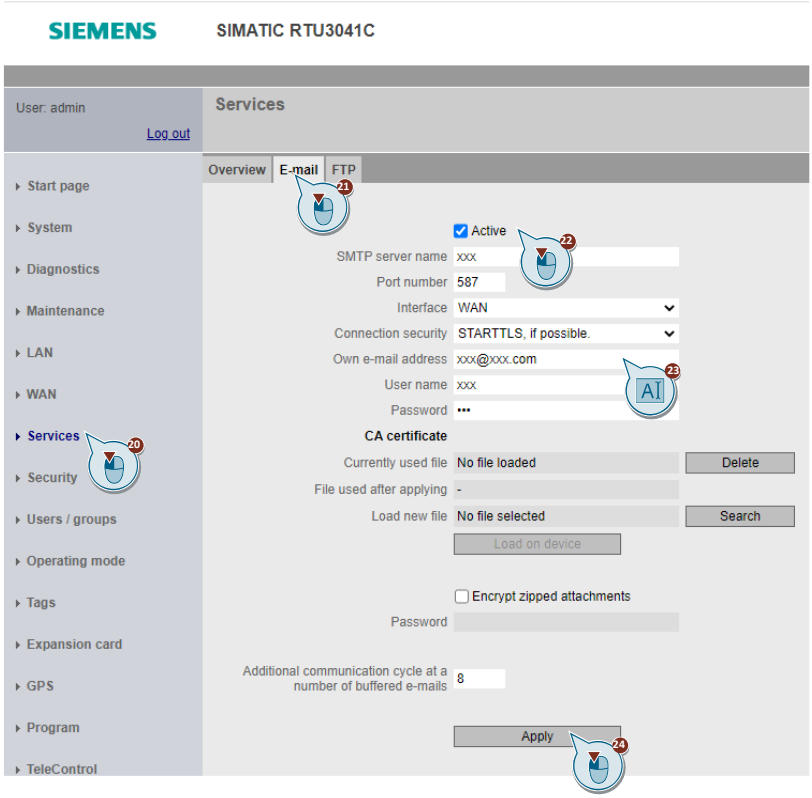


14. Then click "Apply".
15. Navigate to the "WAN" menu.
16. Open the "SMS" tab.



17. Enable the "Allow receipt of SMS messages" checkbox.
18. Enable the "Acknowledgment of wake-up SMS message" checkbox.
19. Then click "Apply".

20. Navigate to the "Services" menu.
21. Open the "E-mail" tab.

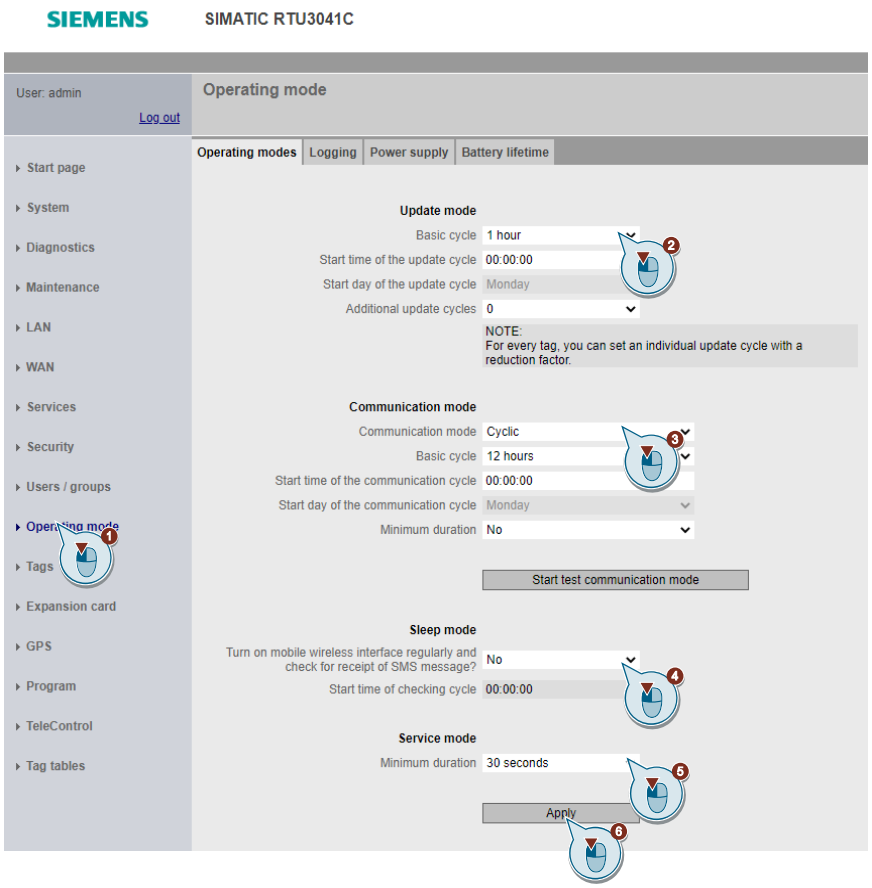


22. Enable the "Active" option there.
23. Enter the server data of the email account that the RTU3041C should use to send emails.
24. Then click "Apply".

Configuring operating modes

To conserve power, the RTU3041C is in sleep mode much of the time, switching to an update or communication mode in predetermined cycles.

1. Navigate to the "Operating mode" menu.



2. Enter the cycle of the update mode e.g., "1 minute" for test purposes or choose"1 hour" for the application described here.
3. Set the communication mode to "Cyclic" and specify the cycle of the communication mode e.g., "10 minutes" for test purposes or "12 hours" for the application described here.
4. Enter how often the mobile wireless interface should be switched on to fetch SMS. This is not necessary for the application described here. Select "No" for this purpose
5. Enter the minimum duration of the service mode e.g., "always" for test purposes or "30 seconds" for the application described here.

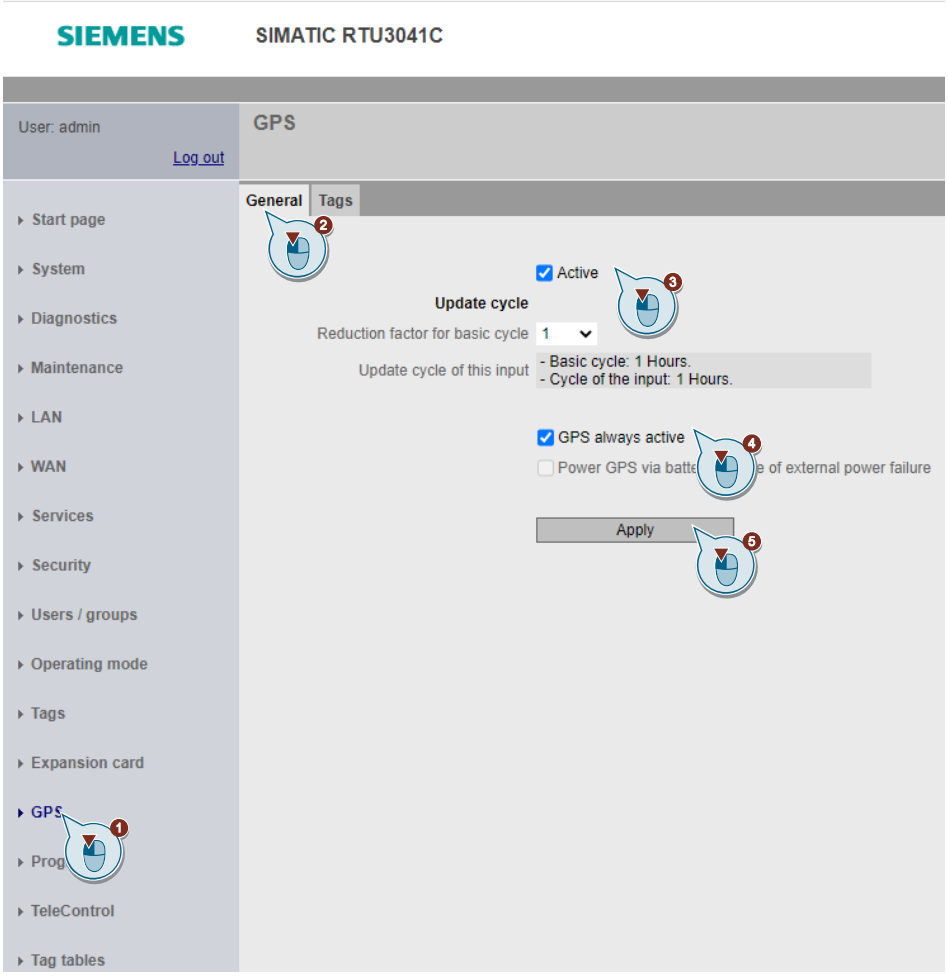
Note The RTU3041C dials into the mobile wireless network every 12 hours. If the RTU3041C dials into the mobile wireless network more frequently, the power consumption will increase.

6. Then click "Apply".

Configuring the GPS functionality of the RTU3041C

To enable communication between the RTU3041C and its communication partner via GPS, proceed as follows:

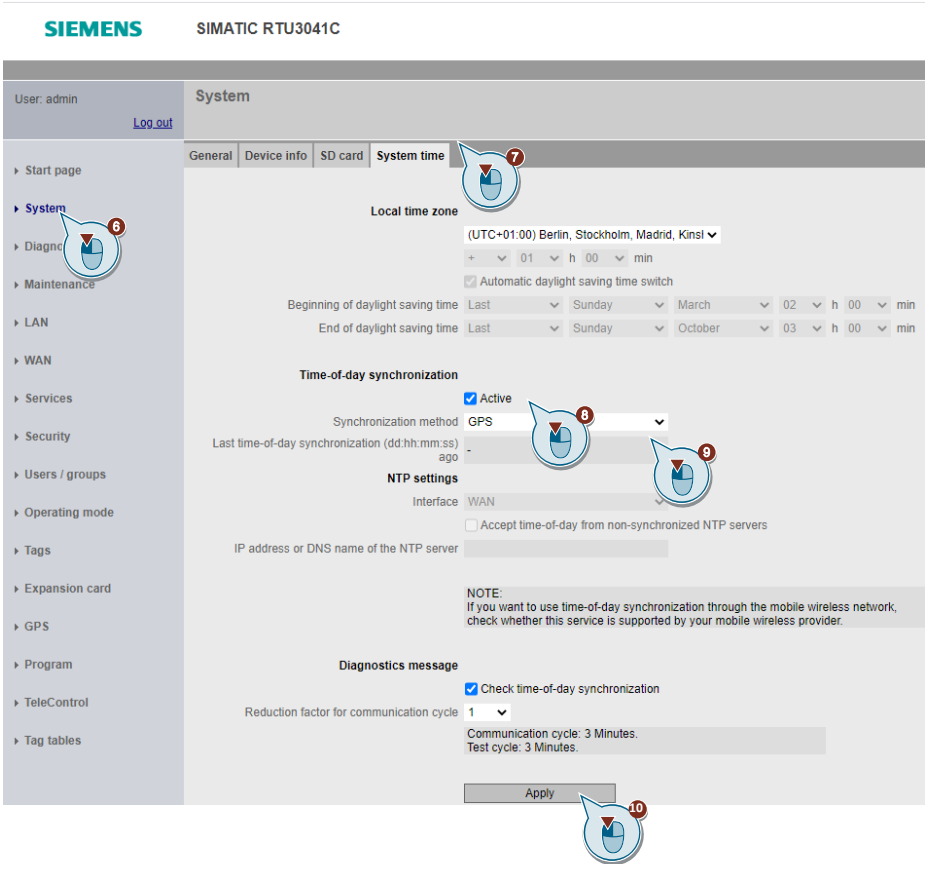
1. Navigate to the "GPS" menu.
2. Open the "General" tab.



3. Enable the "Active" checkbox.
4. Select the "GPS always active" check box.
5. Then click "Apply".

To enable the time synchronization via GPS, proceed as follows:

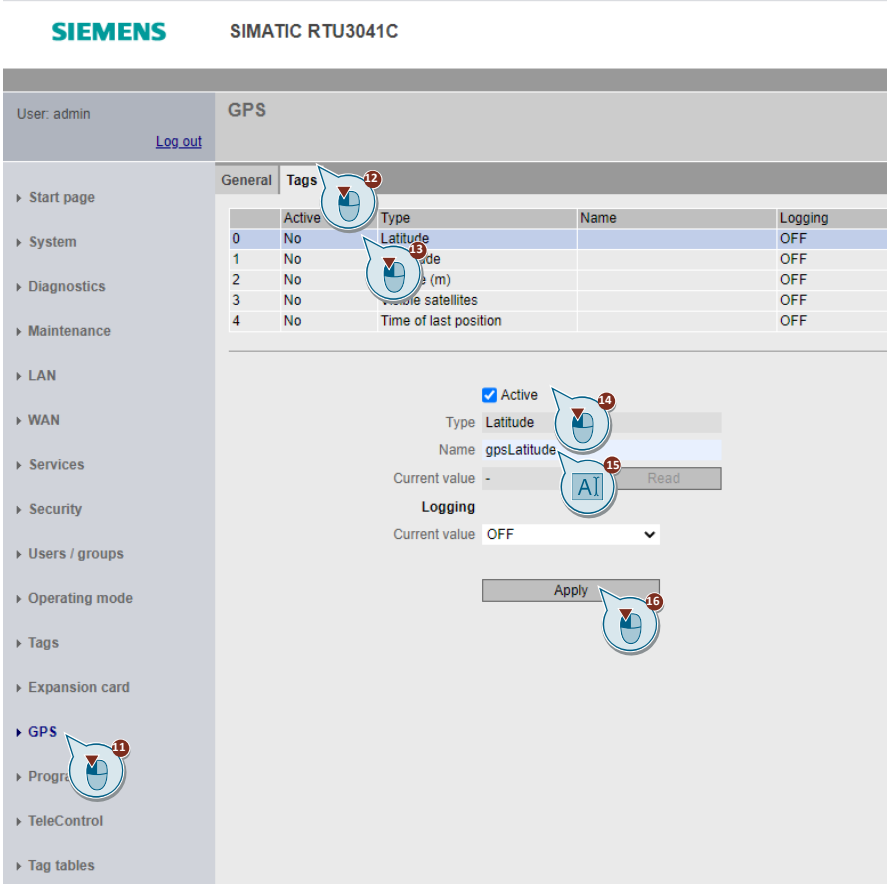
6. Navigate to the "System" menu.
7. Open the "System time" tab.



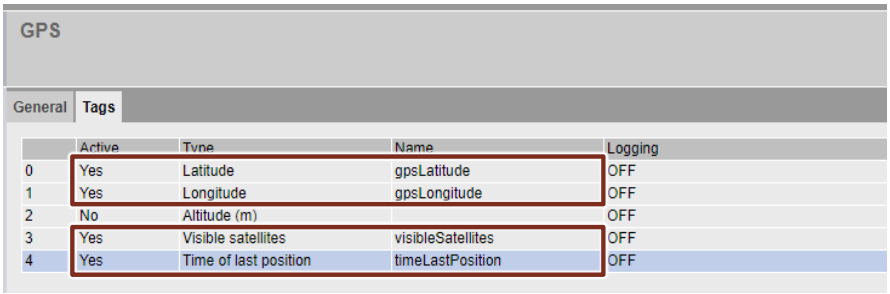
8. Enable the time synchronization.
9. Select "GPS" as the synchronization method.
10. Then click "Apply".

In order to send the determined GPS position of the RTU3041C to the TeleControl Server Basic (TCSB), and to read it out via the OPC UA Client, enable the GPS tags:

11. Navigate to the "GPS" menu.
12. Open the "Tags" tab.



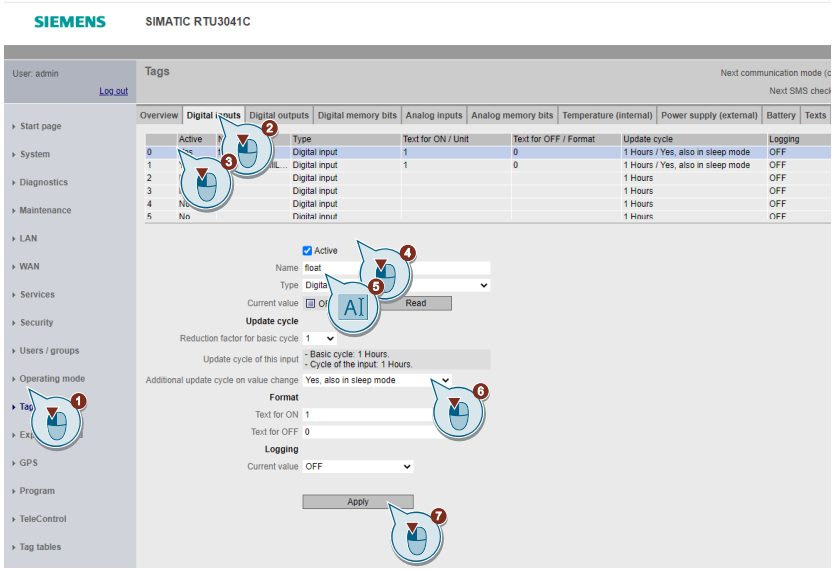
13. Click the "Latitude" tag.
14. Enable the "Active" checkbox.
15. Enter a name for the desired tag.
16. Then click "Apply".
17. Repeat steps 9-12 for the tags "Longitude", "Visible satellites", and "Time of last position".



Creating tags for programming in the RTU3041C

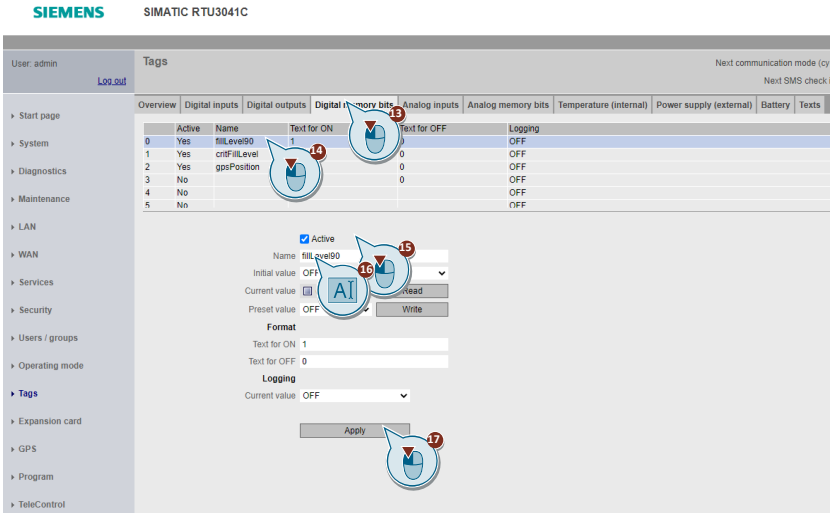
Before you start programming in the RTU, configure the inputs, outputs, and memory bits.

1. Navigate to the "Tags" menu.
2. Open the "Digital inputs" tab.



3. Click on input 0.
4. Enable the "Active" checkbox.
5. Assign the name "float".
6. Select that an additional update cycle is also performed in sleep mode when the value changes.
7. Then click "Apply".
8. Click on input 1.
9. Enable the "Active" checkbox.
10. Assign the name "enableReadFillLevel".

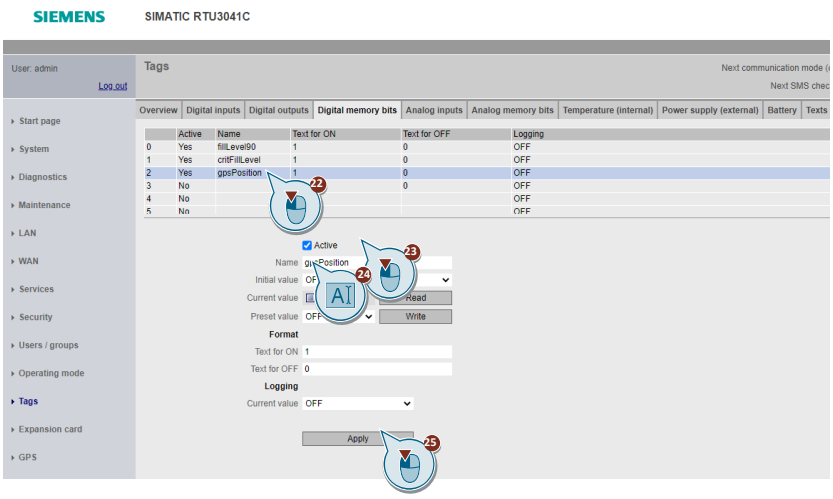
11. Select that an additional update cycle is also performed in sleep mode when the value changes.
12. Then click "Apply".
13. Open the "Digital memory bits" tab.



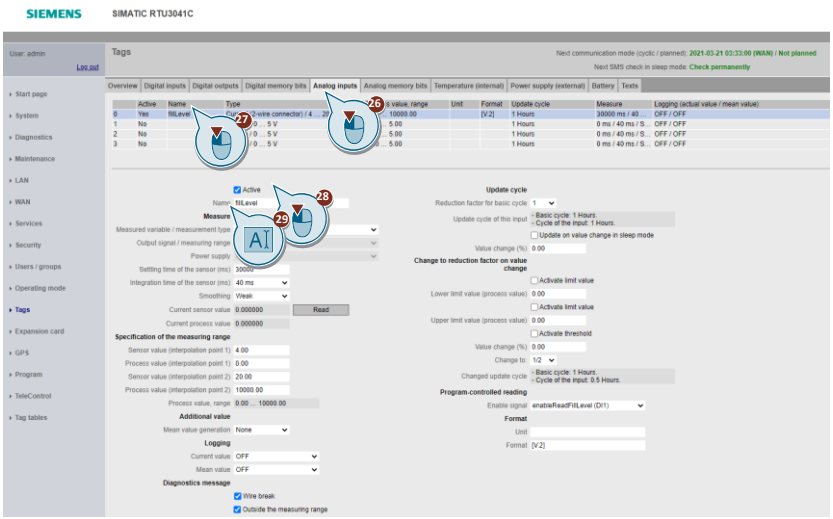
14. Click on the 0 memory bit.
15. Enable the "Active" checkbox.
16. Assign the name "fillLevel90".
17. Then click "Apply".
18. Click memory bit 1.
19. Enable the "Active" checkbox.
20. Assign the name "critFillLevel".

21. Then click "Apply".

22. Click memory bit 2.
23. Enable the "Active" checkbox.
24. Assign the name "gpsPosition".

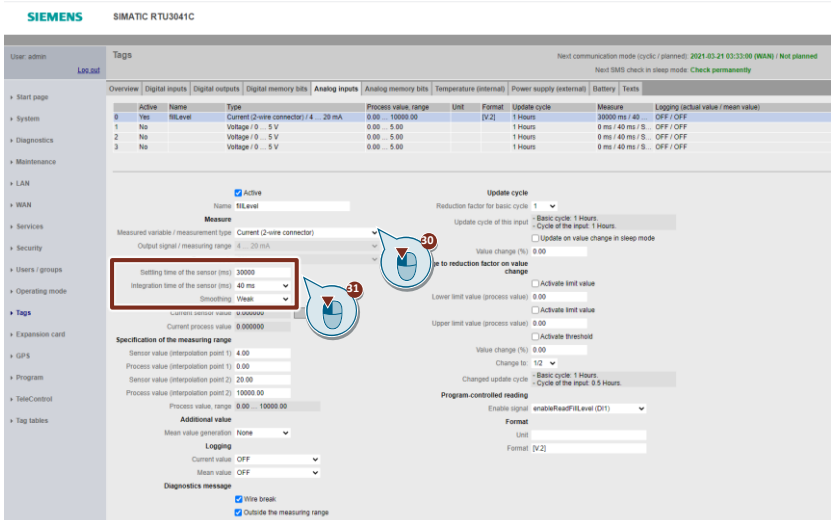


25. Then click "Apply".
26. Open the "Analog inputs" tab.



27. Click the analog input 0.
28. Enable the "Active" checkbox.
29. Assign the name "fillLevel".

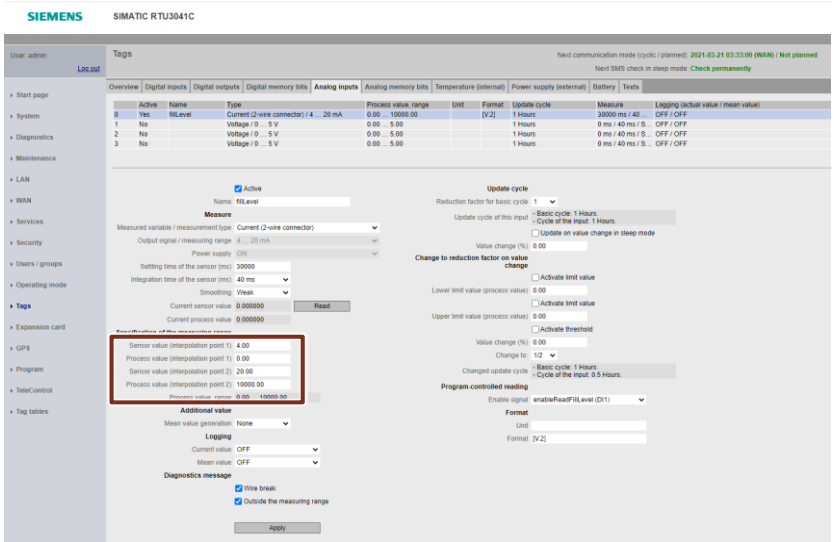
30. Select the measurement type of your analog level sensor. The SITRANS Probe LU150 sensor must be set to "Current (2-wire connector)".



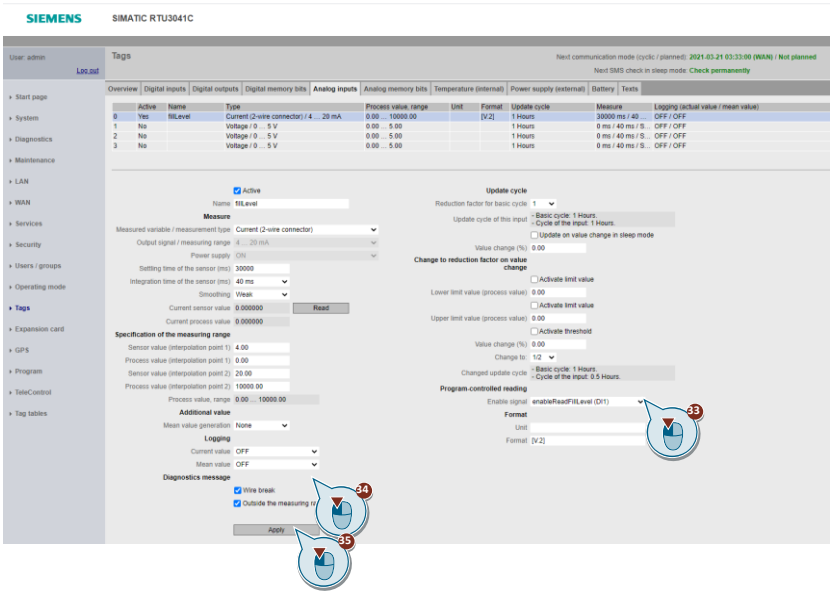
31. Enter the settling and integration time as well as the smoothing of the signal of your sensor. The following settings are recommended for the SITRANS Probe LU150 sensor:
    - Settling time: 30,000 ms
    - Integration time: 40 ms
    - Smoothing: Weak

Note Note that (settling time + integration time) * smoothing factor must not be longer than the update mode cycle.

32. Enter the sensor and process values for your application. In this application example, a sensor signal of 20 mA corresponds to a level of 10,000 m³.

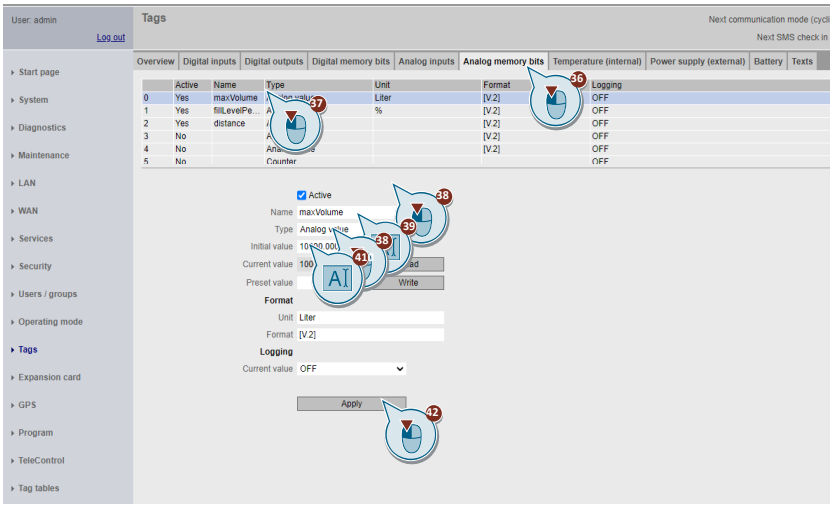


33. Select the digital input "enableReadFillLevel (DI1)" as the "enable signal".



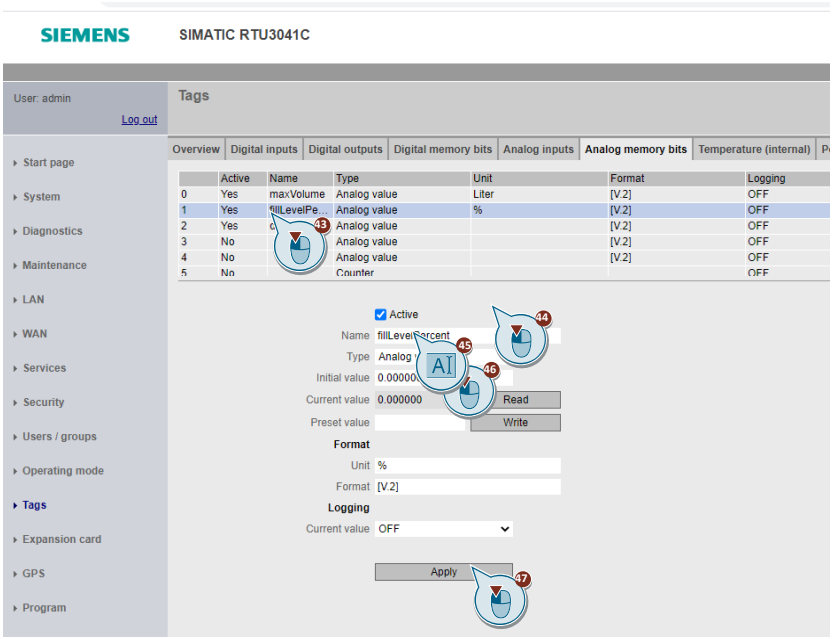
Note This setting means that the analog input "fillLevel" is only read if the digital input "enableReadFillLevel" is activated. This can significantly reduce power consumption.

34. Enable the "Diagnostics messages" to diagnose the errors.
35. Then click "Apply".
36. Open the "Analog memory bits" tab.
37. Click the analog memory bit 0.
38. Enable the "Active" checkbox.
39. Assign the name "maxVolume".



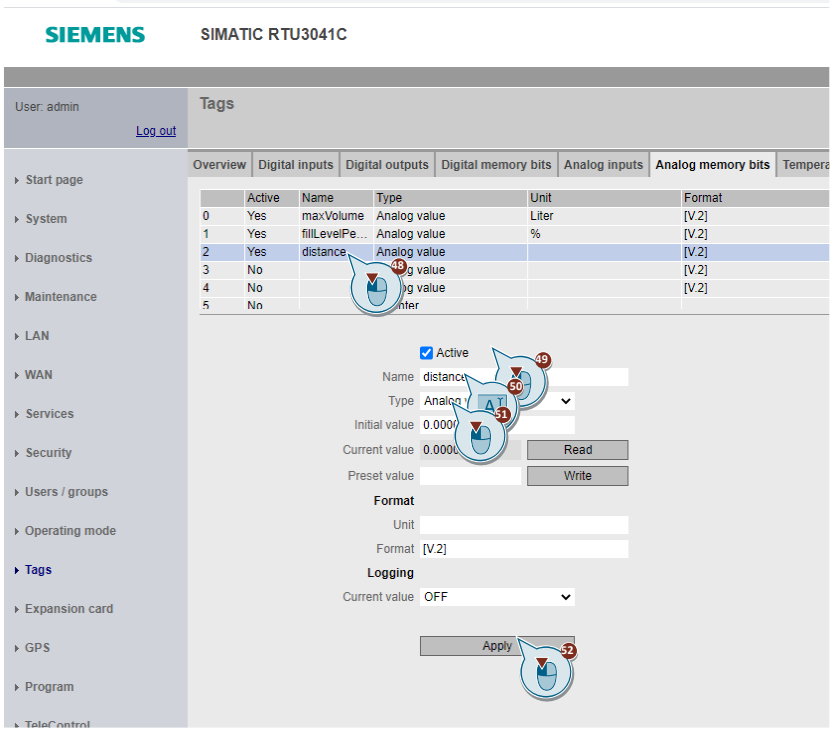
40. Select the type "Analog value".
41. Enter the maximum fill level of the rainwater overflow tank in cubic meters (m^3) as the initial value.
42. Then click "Apply".
43. Click the analog memory bit 1.

44. Enable the "Active" checkbox.
45. Assign the name "fillLevelPercent".
46. Select the type "Analog value".



47. Then click "Apply".
48. Click on the analog memory bit 2.
49. Enable the "Active" checkbox.
50. Assign the name "distance".

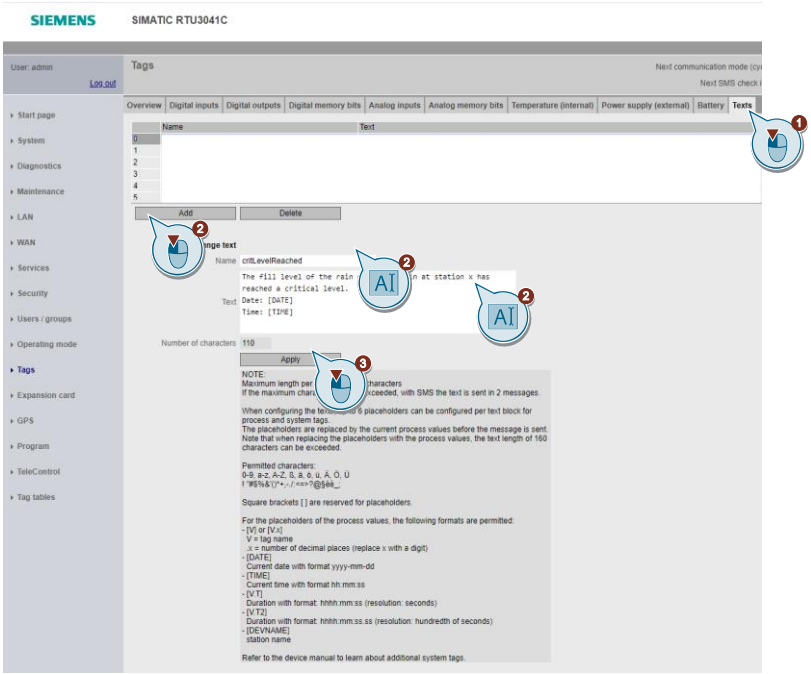
51. Select the type "Analog value".



52. Then click "Apply".

Configuring texts for SMS/email dispatch

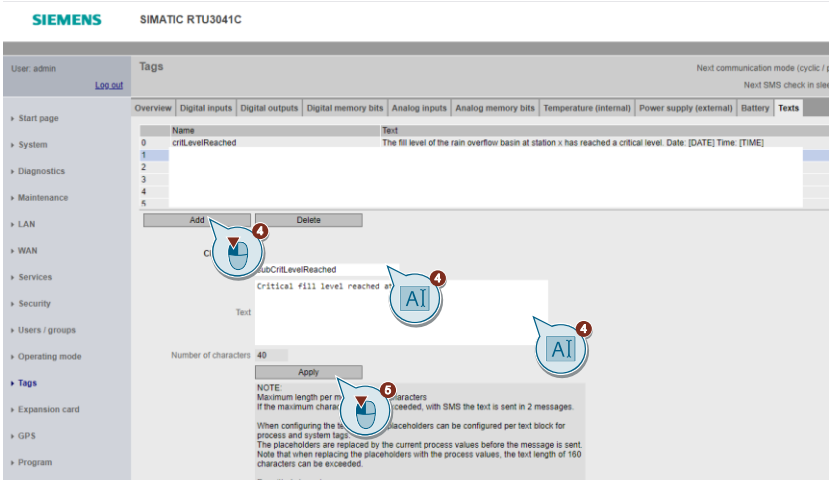
1. Open the "Texts" tab.



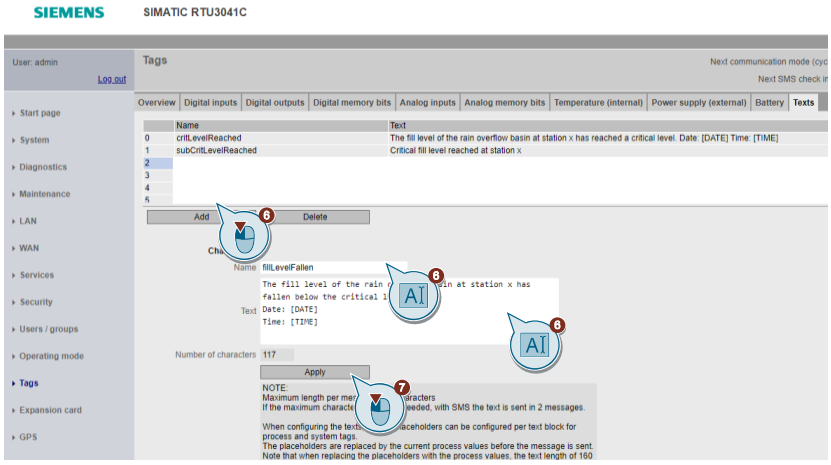
2. Add a new text to be sent via SMS and email when the critical level is exceeded:
   - Name: critLevelReached
   - Text: The fill level of the rain overflow basin at station x has reached a critical level.

- Date: [DATE]
- Time: [TIME]

3. Then click "Apply".
4. Add a new text to be sent when the critical level is exceeded in the subject of the email:
   - Name: subCritLevelReached
   - Text: Critical fill level reached at station x



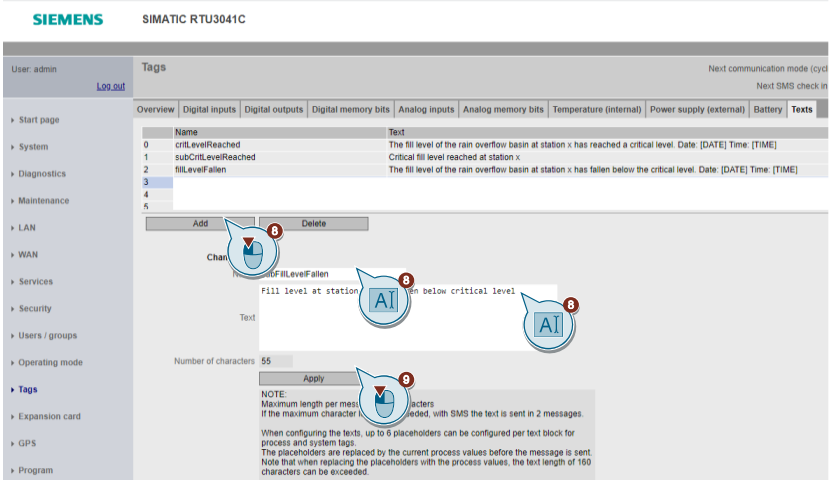
5. Then click "Apply".
6. Add a new text to be sent by SMS and email when the level falls below the critical level:



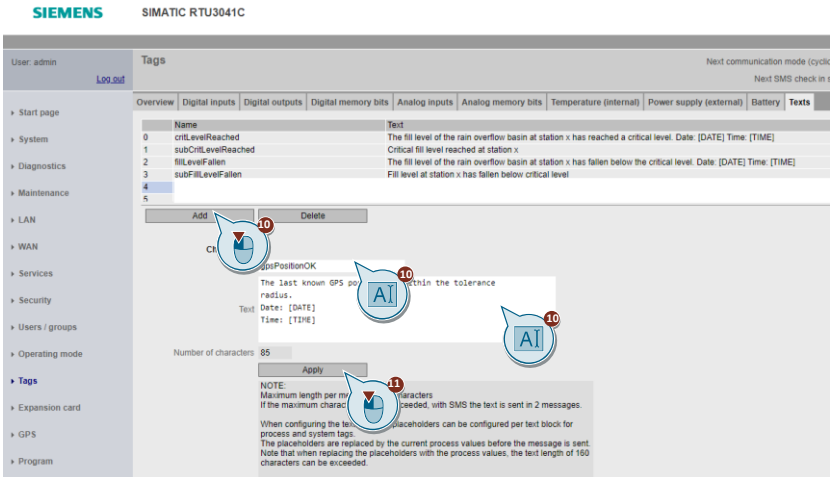
   - Name: fillLevelFallen
   - Text: The fill level of the rain overflow basin at station x has fallen below the critical level.
   - Date: [DATE]
   - Time: [TIME]

7. Then click "Apply".

8. Add a new text to be sent when the level falls below the critical level in the subject of the email:
   - Name: subFillLevelFallen
   - Text: Fill level at station x has fallen below critical level



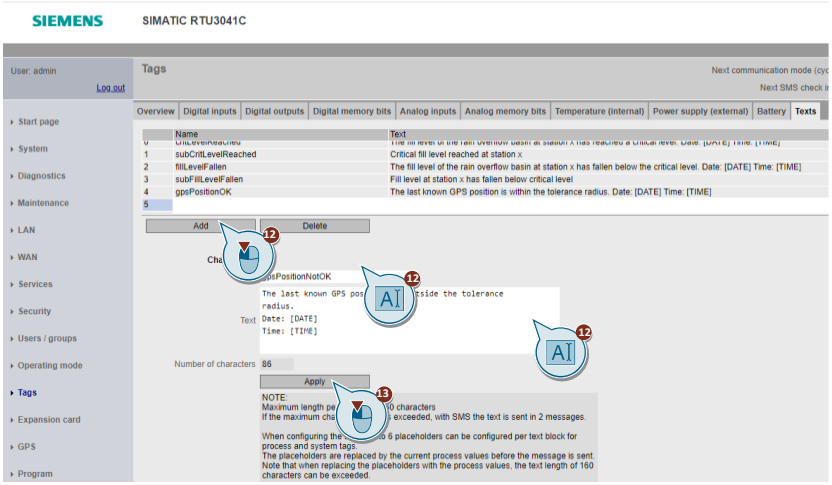
9. Then click "Apply".
10. Add a new text to be sent by SMS when the RTU3041C moves within a parameterized radius:



   - Name: gpsPositionOK
   - Text: The last known GPS position is within the tolerance radius.
   - Date: [DATE]
   - Time: [TIME]

11. Then click "Apply".

12. Add a new text to be sent by SMS when the RTU3041C moves outside a parameterized radius:



- Name: gpsPositionNotOK
- Text: The last known GPS position is outside the tolerance radius.
- Date: [DATE]
- Time: [TIME]

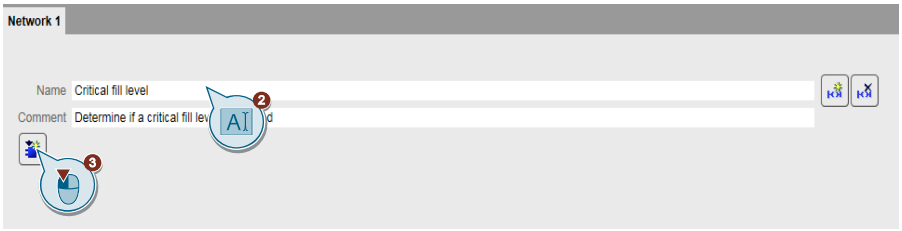
13. Then click "Apply".

Creating a program in the SIMATIC RTU3041C

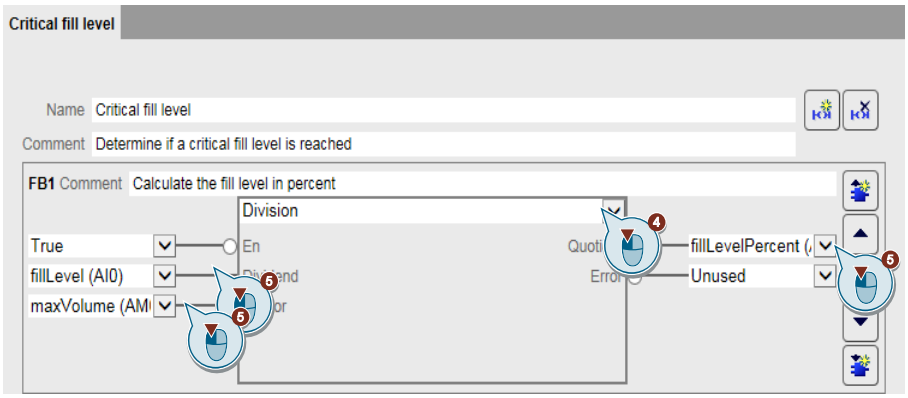
In order for the RTU3041C to respond appropriately to events, you must create a program. Programming is comparable to "FBD" in the TIA Portal.

Program comparison of the current level with a critical value

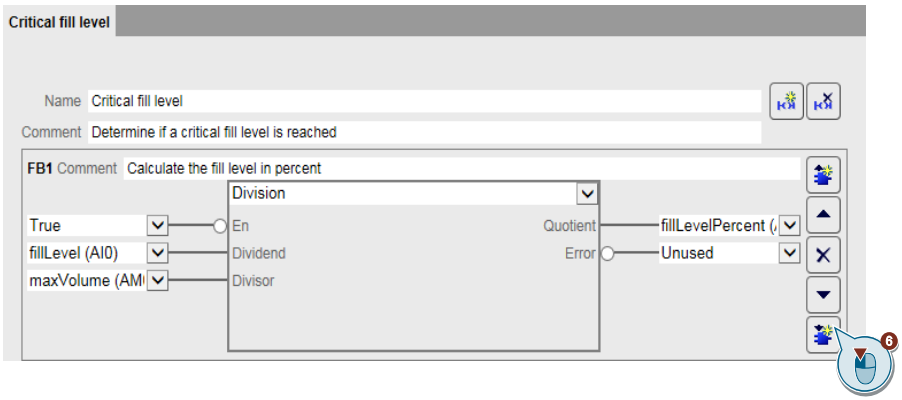
1. Navigate to the "Program" menu.
2. Assign the name "Critical fill level" to the network.
3. Add a new function block (FB1).



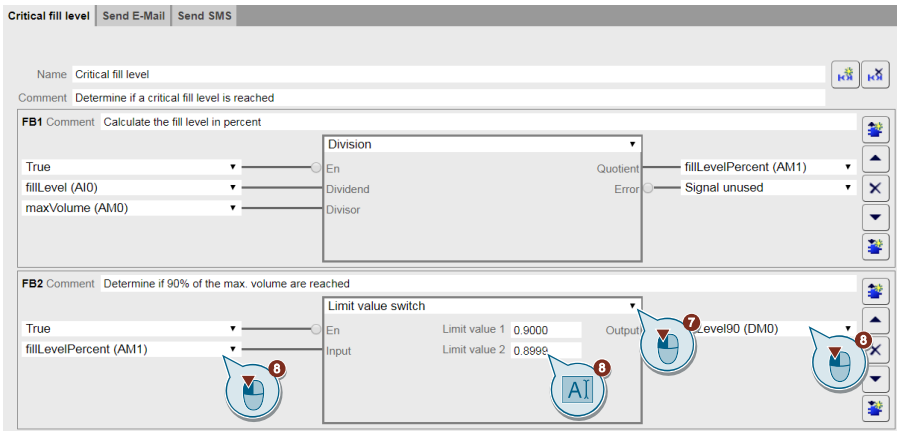
4. Select "Division" as the function.
5. Interconnect the parameters as follows:
   - Dividend: fillLevel (AI0)
   - Divisor: maxVolume (AM0)
   - Quotient: fillLevelPercent (AM1)



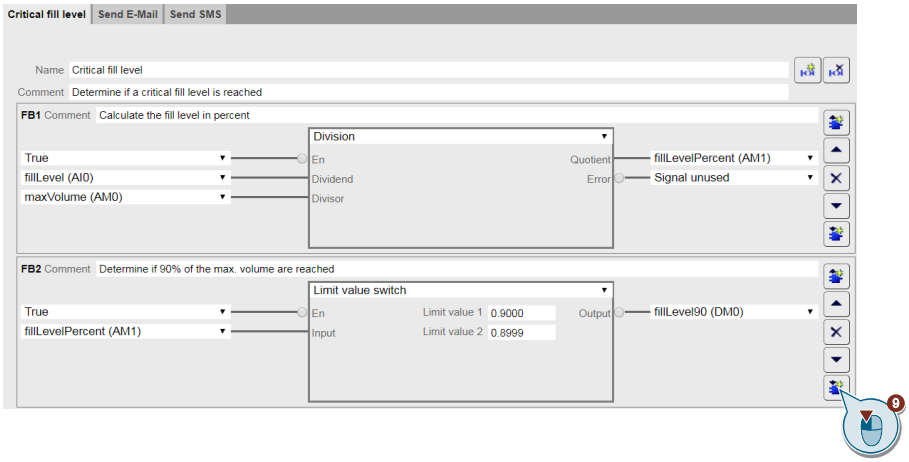
6. Add a new function block (FB2) below it.



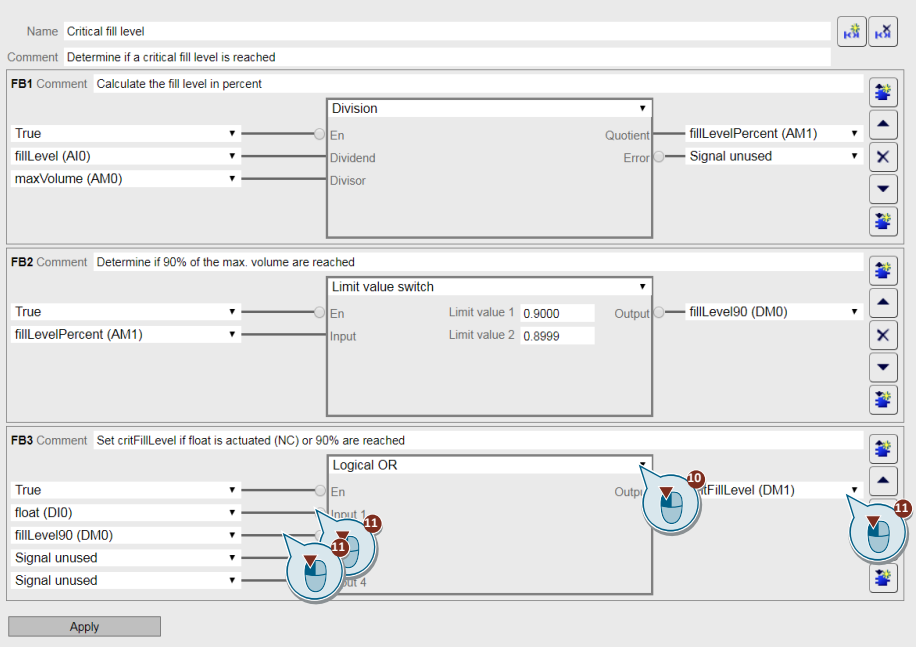
7. Select "Limit value switch" as the function.
8. Interconnect the parameters as follows:
   - Input: fillLevelPercent (AM1)
   - Output: fillLevel90 (DM0)
   - Limit value 1: 0.9000
   - Limit value 2: 0.8999



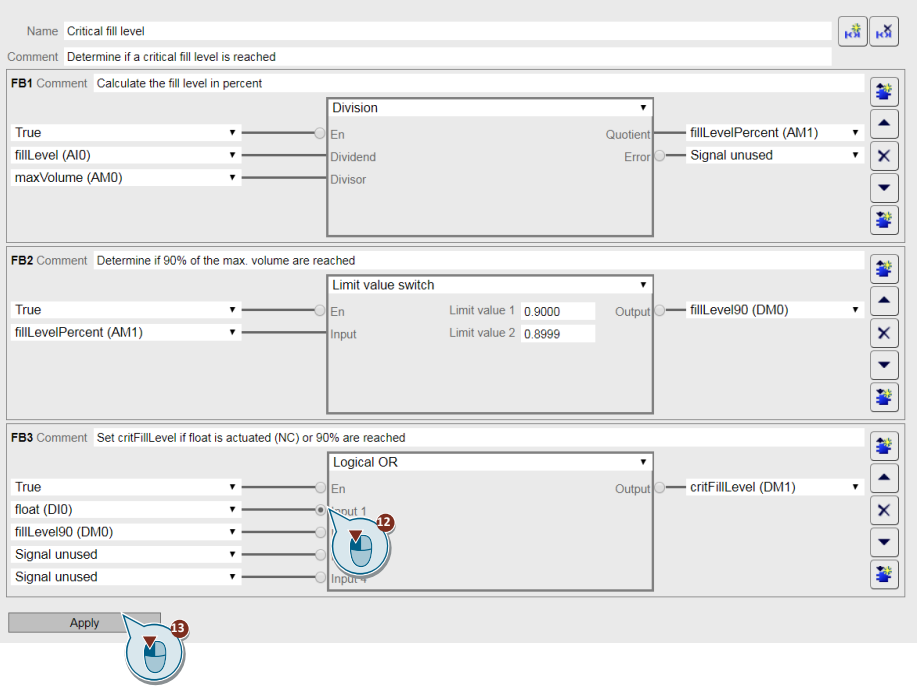
9. Add a new function block (FB3) below.



10. Select "Logical OR" as the function.
11. Interconnect the parameters as follows:
    - Input 1: float (DI0)
    - Input 2: fillLevel90 (DM0)
    - Output: critFillLevel (DM1)



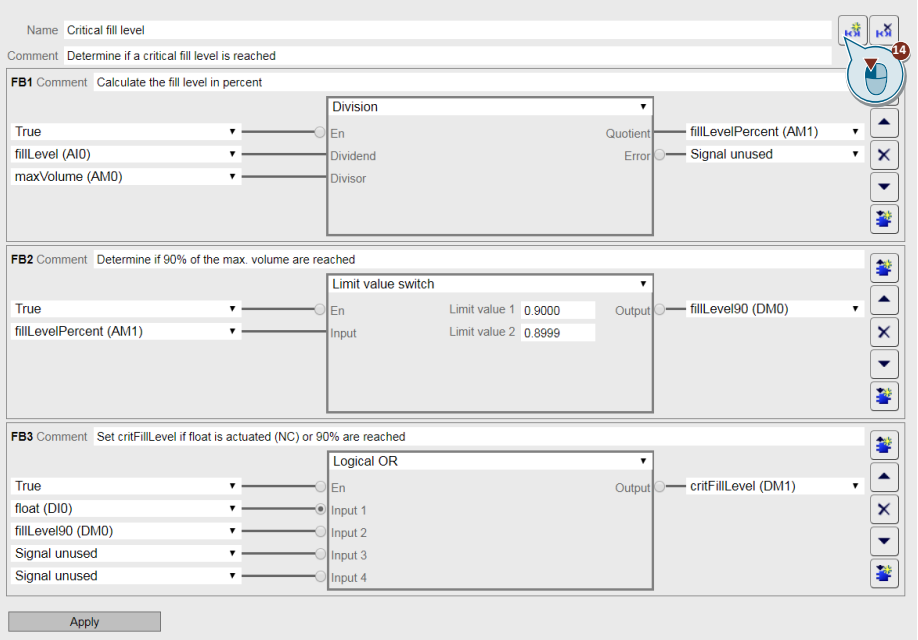
12. Negate input 1.



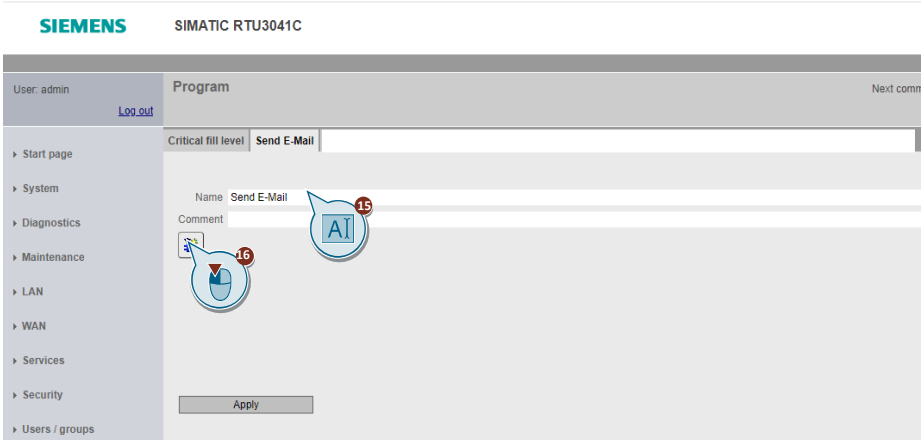
13. Then click "Apply".

Programming email transmission

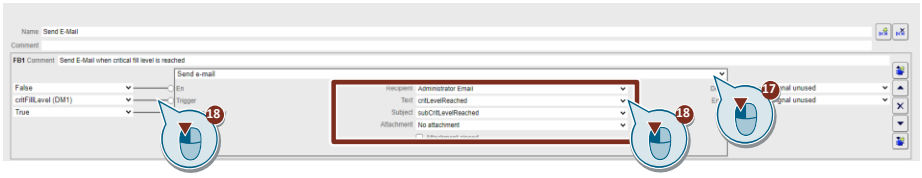
14. Add a new network.



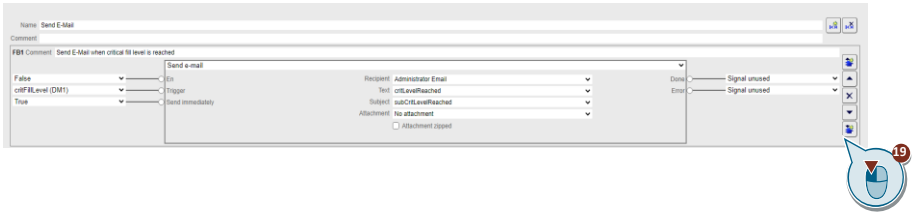
15. Assign the name "Send email" to the network.
16. Add a new function block (FB1).



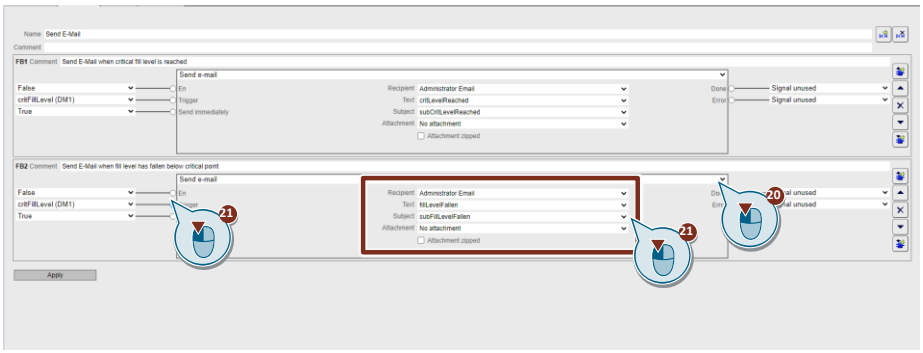
17. Select "Send email" as the function.
18. Interconnect the parameters as follows:
    - Trigger: critFillLevel (DM1)
    - Send immediately: True
    - Recipient: Administrator email
    - Text: critFillLevelReached
    - Subject: subCritFillLevelReached



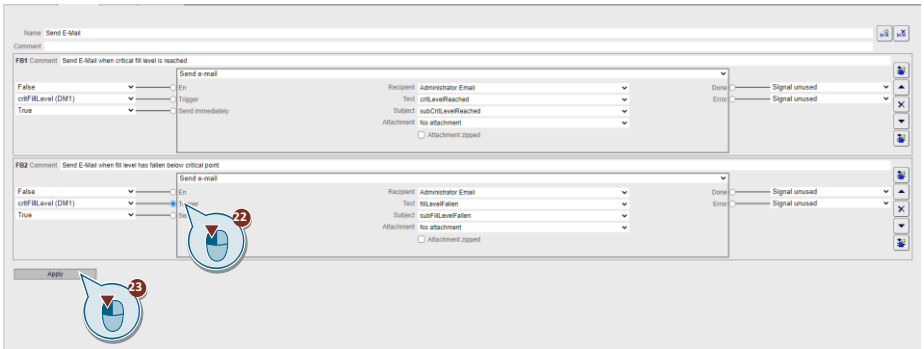
19. Add a new function block (FB2).



20. Select "Send email" as the function.
21. Interconnect the parameters as follows:
    - Trigger: critFillLevel (DM1)
    - Send immediately: True
    - Recipient: Administrator email
    - Text: fillLevelFallen
    - Subject: subFillLevelFallen



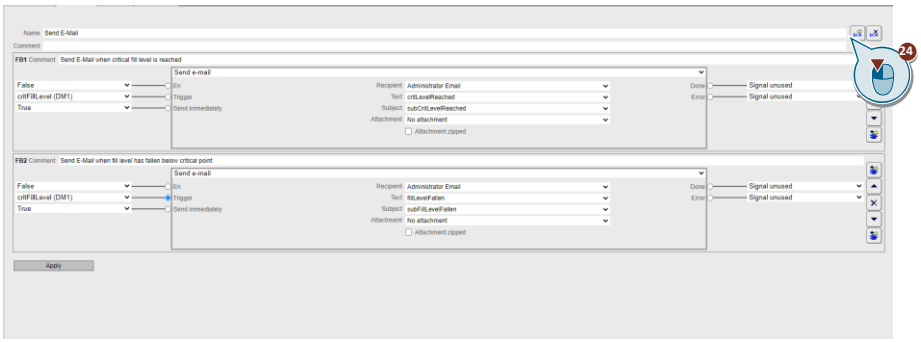
22. Negate the "Trigger" input.



23. Then click "Apply".

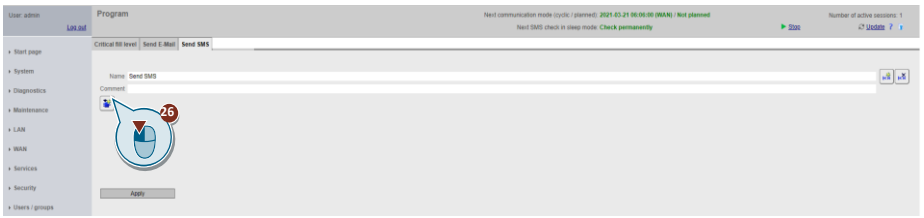
Programming SMS transmission

24. Add a new network.

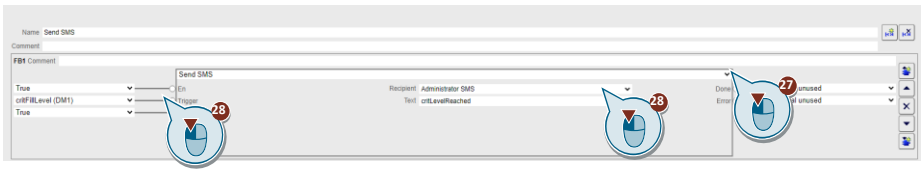


25. Assign the name "Send SMS" to the network.

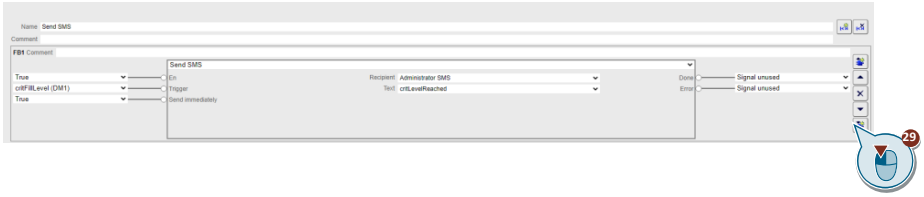
26. Add a new function block (FB1).



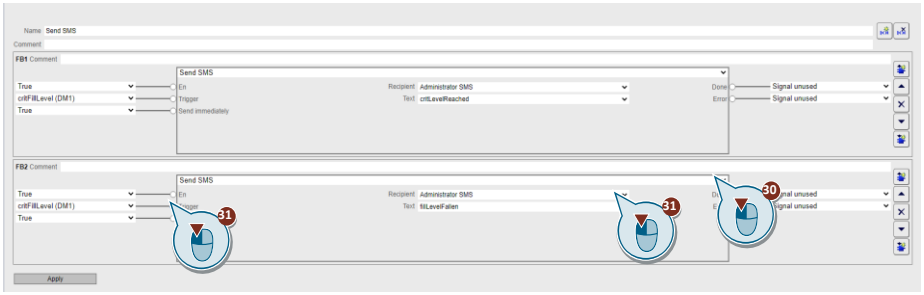
27. Select "Send SMS" as the function.
28. Interconnect the parameters as follows:
    - Trigger: critFillLevel (DM1)
    - Send immediately: True
    - Recipient: Administrator SMS
    - Text: critLevelReached



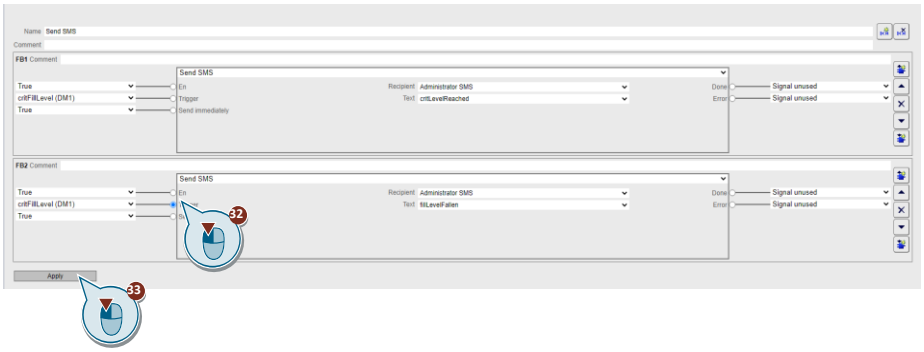
29. Add a new function block (FB2) below it.



30. Select "Send SMS" as the function.
31. Interconnect the parameters as follows:
    - Trigger: critFillLevel (DM1)
    - Send immediately: True
    - Recipient: Administrator SMS
    - Text: fillLevelFallen



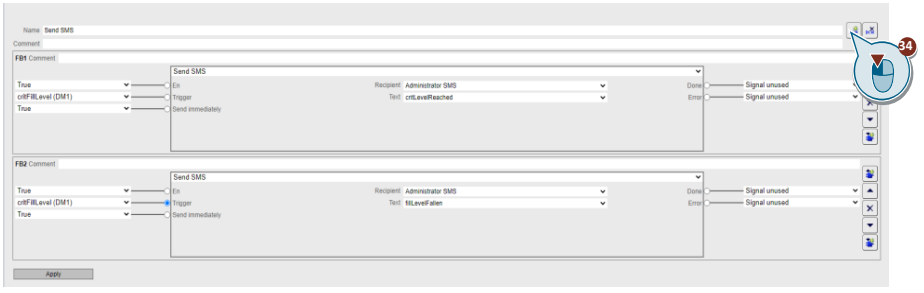
32. Negate the "Trigger" input.



33. Then click "Apply".

Programming GPS position

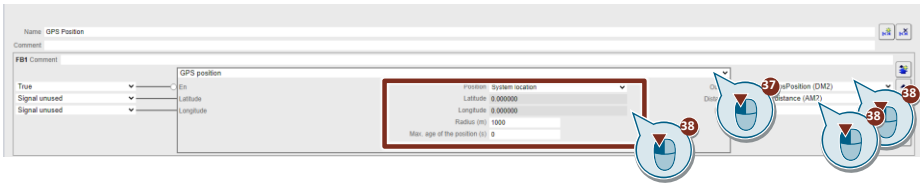
34. Add a new network.



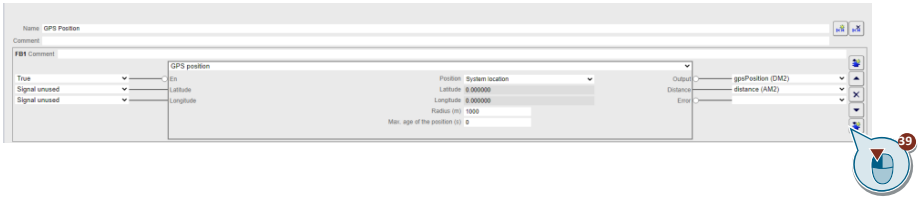
35. Assign the name "GPS Position" to the network.

36. Add a new function block (FB1).

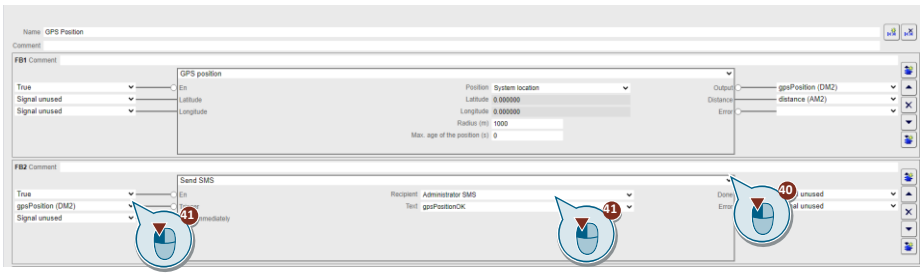
37. Select "GPS position" as the function.
38. Interconnect the parameters as follows:
    - Postion: System location
    - Radius (m): 1000
    - Output: gpsPosition (DM2)
    - Distance: distance (AM2)



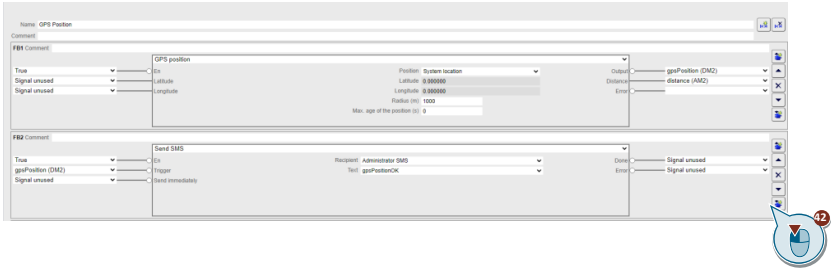
39. Add a new function block (FB2) below it.



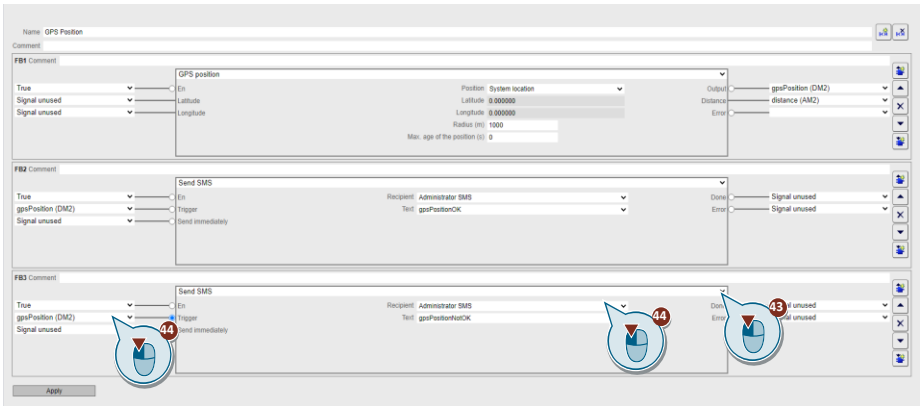
40. Select "Send SMS" as the function.
41. Interconnect the parameters as follows:
    - Trigger: gpsPosition (DM2)
    - Send immediately: True
    - Recipient: Administrator SMS
    - Text: gpsPositionOK



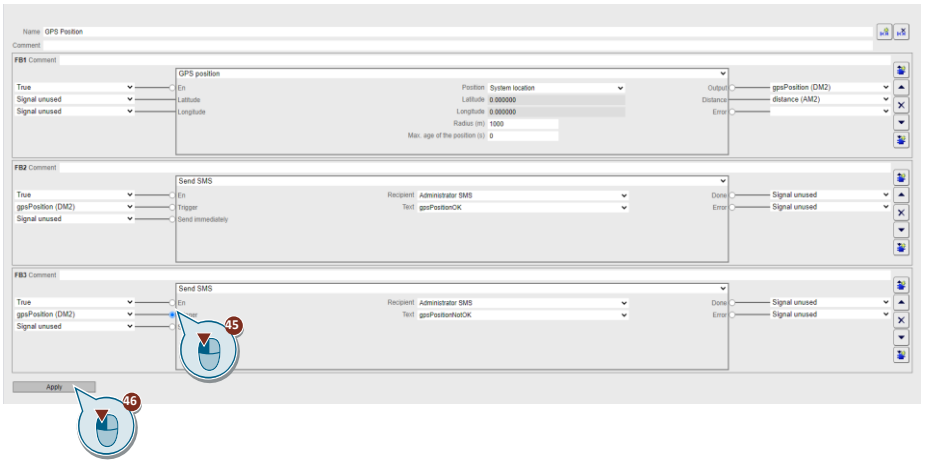
42. Add a new function block (FB3) below.



43. Select "Send SMS" as the function.
44. Interconnect the parameters as follows:
    - Trigger: gpsPosition (DM2)
    - Send immediately: True
    - Recipient: Administrator SMS
    - Text: gpsPositionNotOK



45. Negate the "Trigger" input.

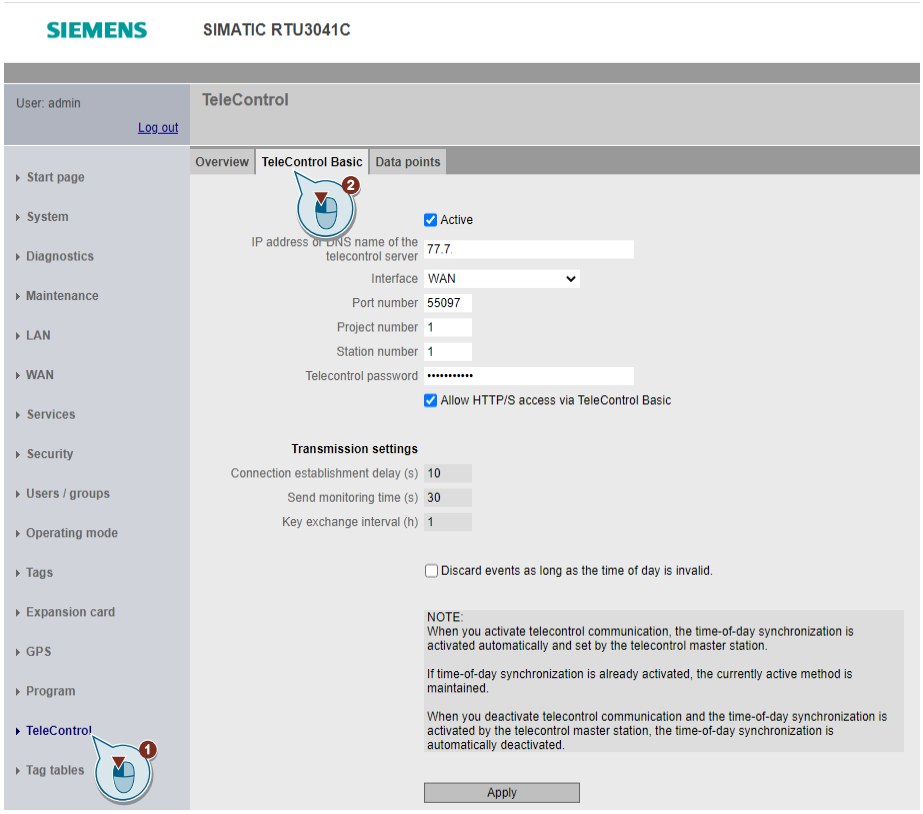


46. Then click "Apply".

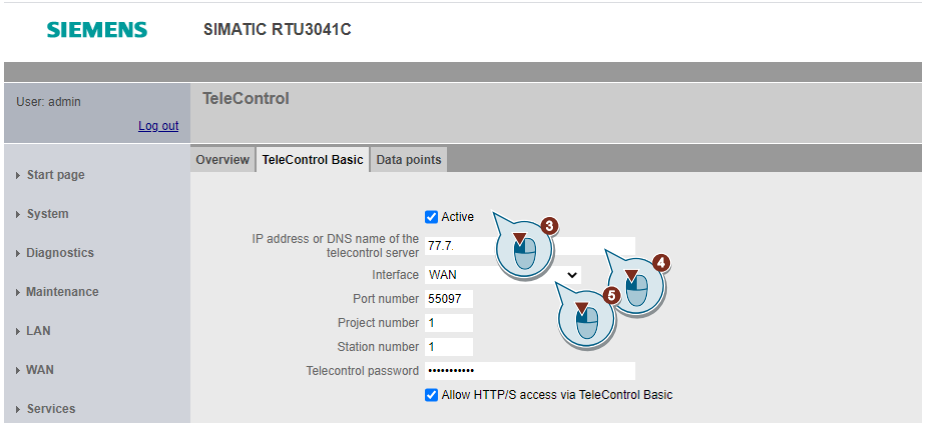
Configuring the connection to the TeleControl Server

A connection to the TeleControl Server must be established so that the RTU3041C can reach the TeleControl Server.

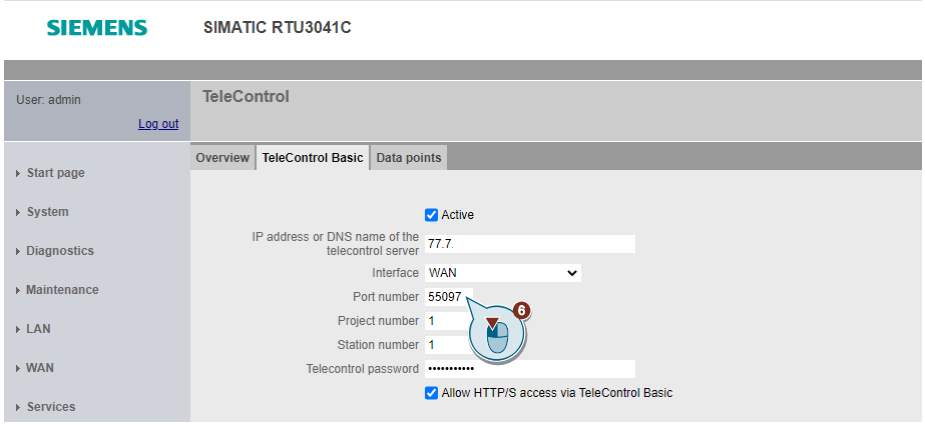
1. Navigate to the "TeleControl" menu.
2. Open the "TeleControl Basic" tab.



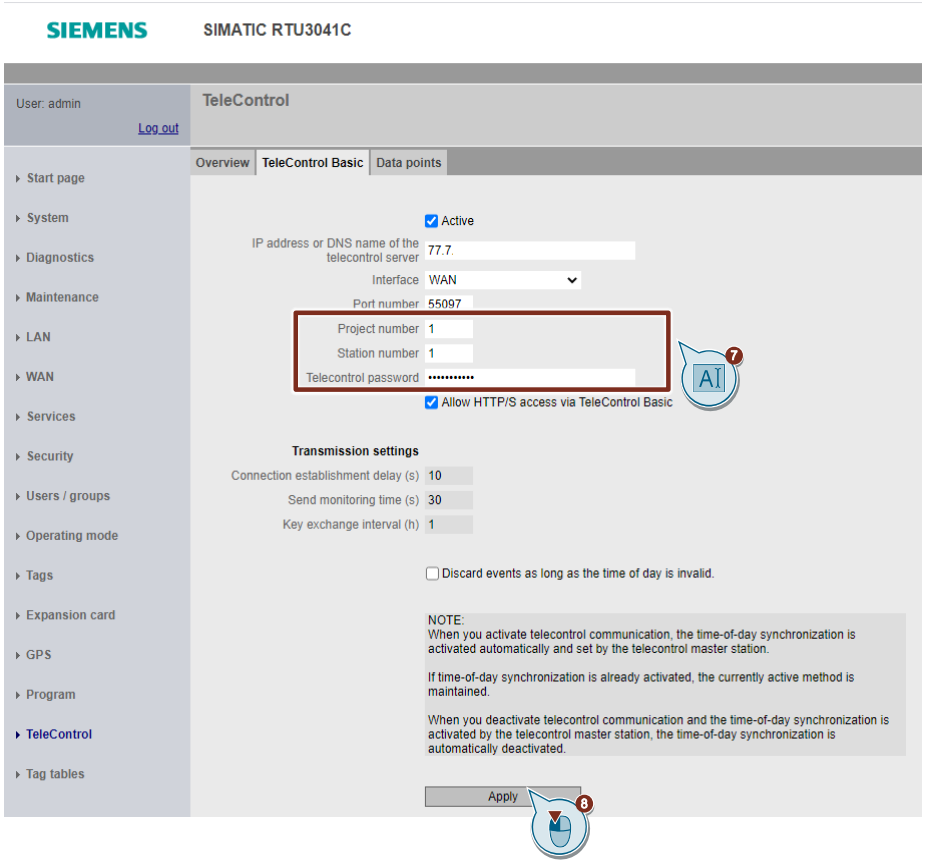
3. Enable the "Active" checkbox.
4. Enter the static IP address of the TeleControl server.
5. Select "WAN" as the interface.



6. Enter the IPT listener port of the TeleControl server that you have enabled in your router (55097 by default) as the port number.

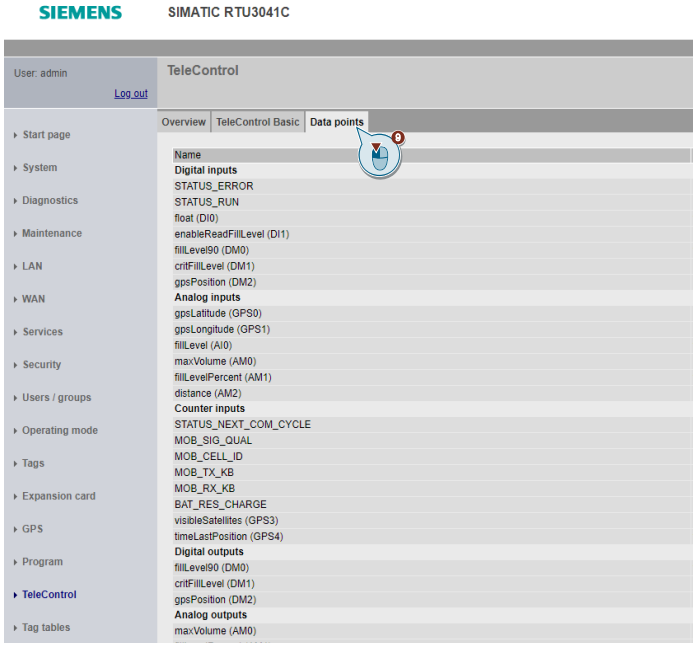


7. Enter
   - a unique project number
   - a unique station number and
   - a TeleControl password.



8. Then click "Apply".

9. Open the Data points tab.



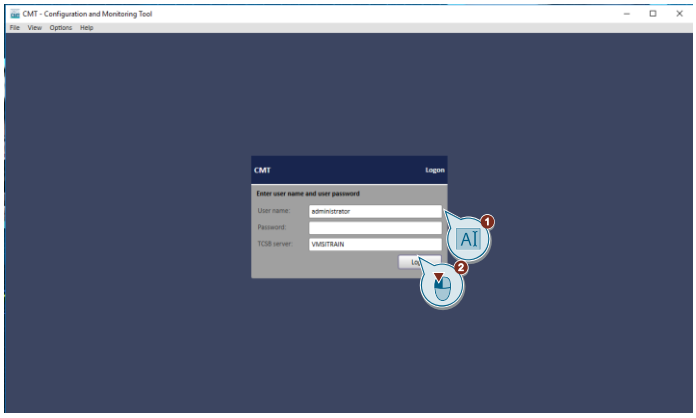
10. Set the following settings for the digital input "float (DI0)":
    - Transmission method: (Event (only current values))
    - Trigger: Change
    - Transfer mode: Buffered transfer
11. Set the following settings for the digital input "enableReadFillLevel (DI1)":
    - Transmission method: (Event (only current values))
    - Trigger: Change
    - Transfer mode: Buffered transfer
12. Set the following settings for the digital input "gpsPosition (DM2)":
    - Transmission method: (Event (only current values))
    - Trigger: Change
    - Transfer mode: Buffered transfer
13. Set the following settings for the digital memory bit "critFillLevel (DM1)":
    - Transmission method: (Event (only current values))
    - Trigger: Change
    - Transfer mode: Unsolicited transfer
14. Set the following settings for the analog input "fillLevel (AI0)":
    - Transmission method: (Event (only current values))
    - Trigger: Change
    - Threshold (%): 5.00
    - Transfer mode: Buffered transfer

15. Set the following settings for the analog input "gpsLatitude (GPS0)":
    - Transmission method: (Event (only current values))
    - Trigger: Change
    - Transfer mode: Buffered transfer
16. Set the following settings for the analog input "gpsLongitude (GPS1)":
    - Transmission method: (Event (only current values))
    - Trigger: Change
    - Transfer mode: Buffered transfer
17. Set the following settings for the counter input "visibleSatellites (GPS3)":
    - Transmission method: (Event (only current values))
    - Trigger: Change
    - Transfer mode: Buffered transfer
18. Set the following settings for the counter input "timeLastPosition (GPS4)":
    - Transmission method: (Event (only current values))
    - Trigger: Change
    - Transfer mode: Buffered transfer
19. Then click "Apply".

2.2.2 Configuring the TeleControl Server Basic

To configure the TeleControl Server Basic, proceed as follows:

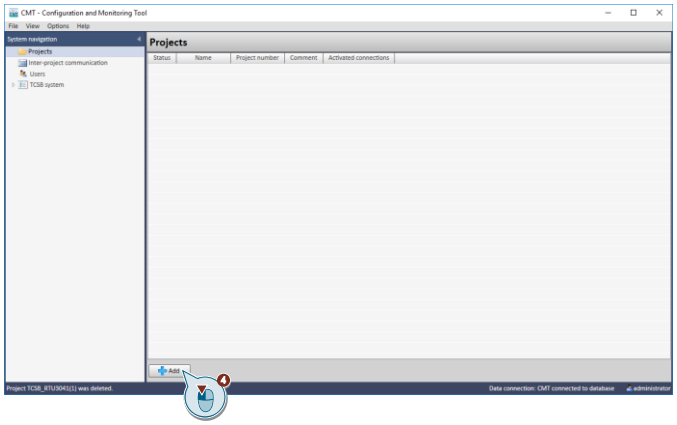
1. Open the program "CMT - Configuration and Monitoring Tool" on your PG/PC. TeleControl Server Basic must be installed on the PG/PC.
2. Log in with your user data.



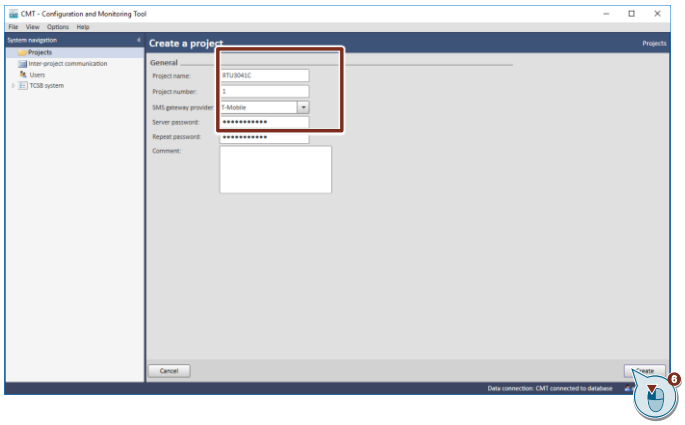
The following user data is preset at the factory:

- User: administrator
- Password: 0000

3. When you log in for the first time, assign your own password.
4. Create a new project by clicking "Add".

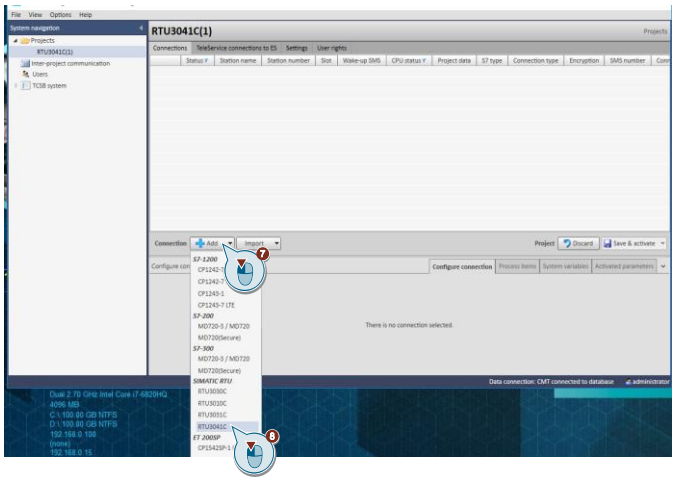


5. Assign a project name and a server password with which Engineering Stations can connect to the TeleControl server.
   - The server password is not relevant for this application example but must be assigned.
   - The SMS gateway operator is not relevant for this application example.

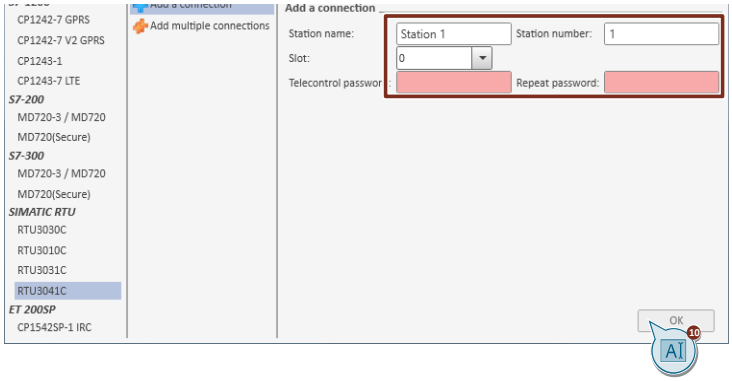


Note The parameter "Project number" must match the parameter in Section 2.2.1 in the configuration of the connection to the TeleControl Server (Step 7).

6. Then click "Create".
7. Click "Add".
8. Select "RTU3041C".



9. Enter
   - a station name
   - a unique station number and
   - a TeleControl password.

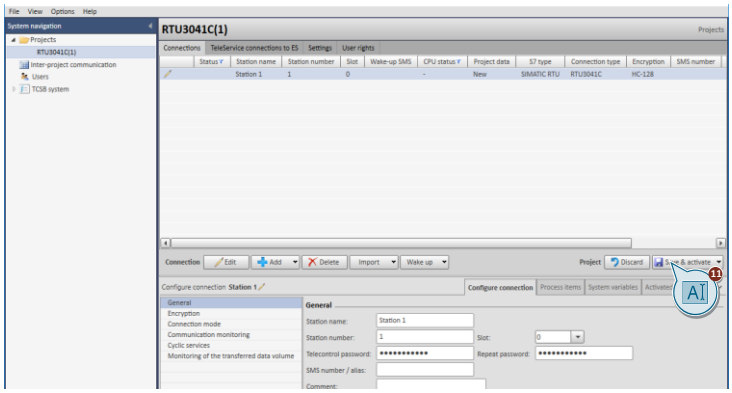


Note The parameters "Station number" and "TeleControl password" must match the parameters in Section 2.2.1 in the configuration of the connection to the TeleControl Server (Step 7).

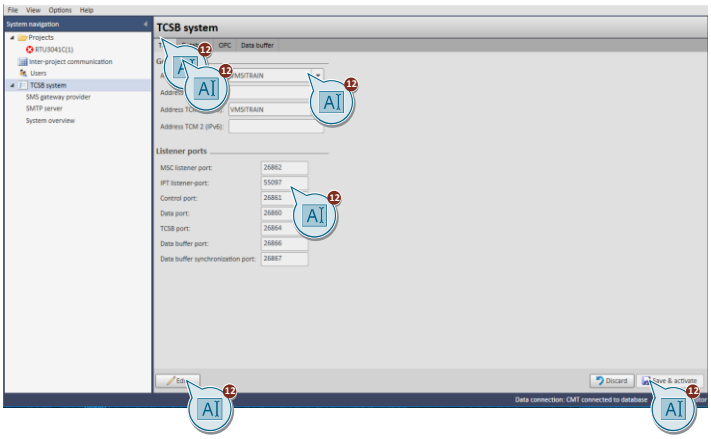
10. Click "OK".

Note If you use more than one RTU, you can configure all RTUs in this step. To do this, select "Add multiple connections" and assign the station data. Click "OK".

11. Click "Save & activate" and confirm the action in the drop-down list.

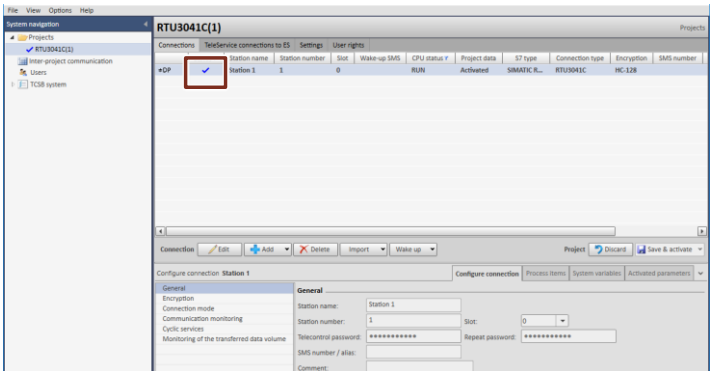


12. Configure the IP address and the IPT listener port (55097) of the TeleControl server:
"TCSB system > "TCM" tab > General> Address TCM 1".



Note The "55097" must be enabled for communication in your DSL router.

The configuration of the TeleControl Server is now completed.



Note The status "Connected" is only displayed when the TeleControl server has a connection with the RTU3041C whose configuration data has been transferred to the runtime system.

2.2.3 Configuring OPC UA Clients (UaExpert)

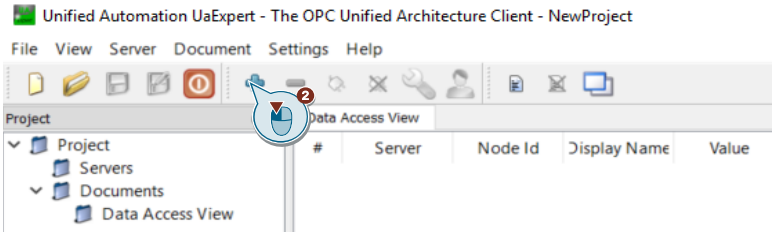
This section explains how to monitor the data points of the TCSB via OPC UA.

The following is required to use the OPC UA Client "UaExpert":

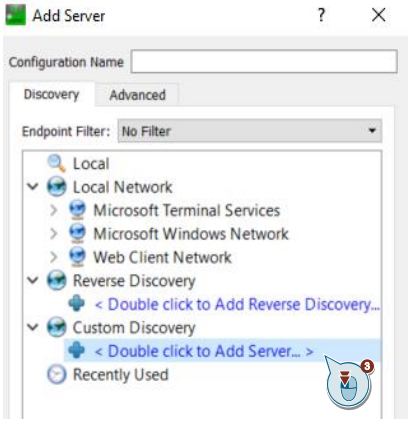
- "UaExpert" is installed on your PC.
- OPC UA Server (TCSB) is activated (see Section 2.2.2).
- The configuration of the RTU3041C is loaded into the RTU.

To read the data via the OPC UA Client "UaExpert", proceed as follows:

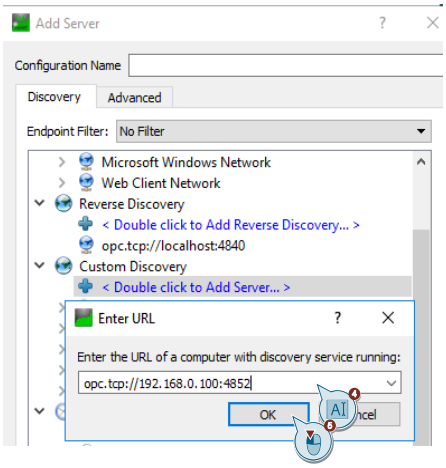
1. Assign the PG/PC Client an IP address in the subnet of the router (according to Table 2-1).
2. Start "UaExpert" and click the "Add Server" button.



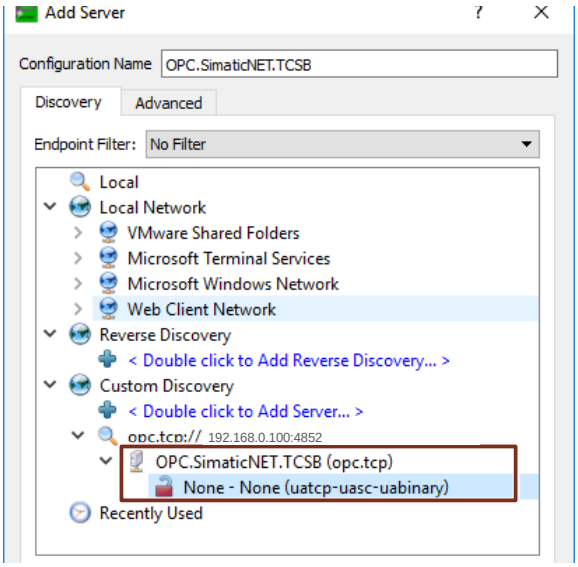
3. In the dialog, double-click "< Double click to Add Server... >" in the "Custom Discovery" list area.



4. In the following dialog, enter the URL and the port of the OPC UA Server (TCSB) (e.g., opc.tcp://192.168.0.100:4852).
5. Click on "OK".

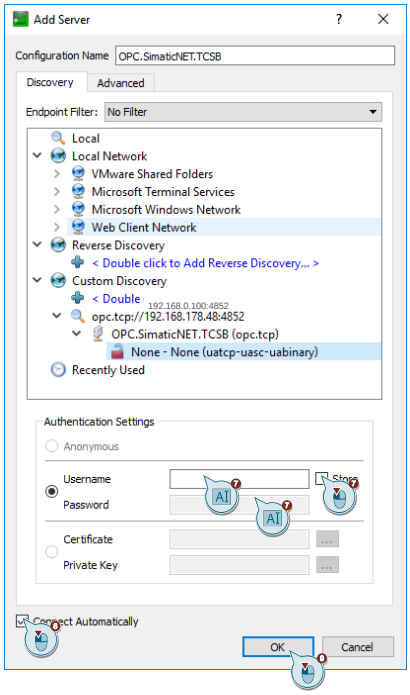


6. Select an endpoint of the OPC UA Server to which you want to establish a connection (for example: OPC.SimaticNET.TCSB (opc.tcp)/ None -None).

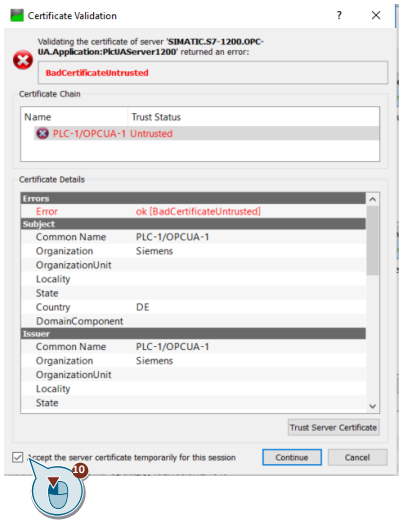


Note For test purposes, you can also create the connection without exchanging certificates. If you want a certificate exchange, you have to accept the certificate manually in the "CMT - Configuration and Monitoring Tool".

7. Enter the user data for the "CMT - Configuration and Monitoring Tool".
8. Set the "Connect Automatically" checkbox.
9. Then confirm with "OK".



10. In the following dialog, accept the server certificate by setting the checkbox "Accept the server certificate temporarily for this session".

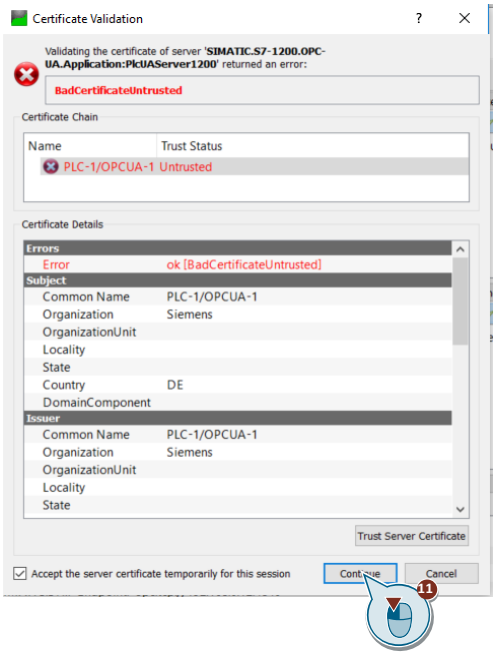


The certificate is not stored in the "UaExpert" trusted list.

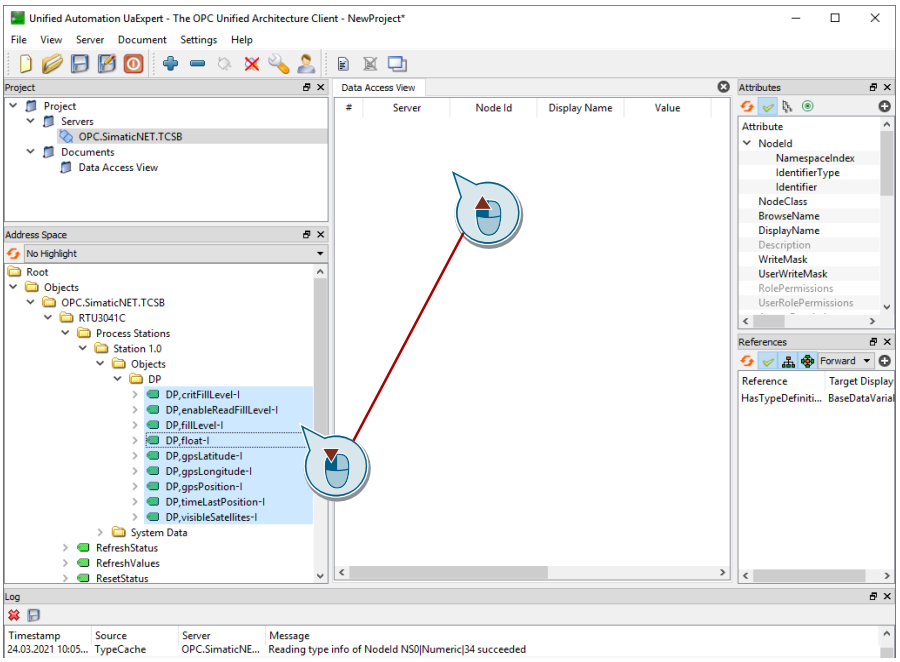
Note

To permanently add the certificate to the "UaExpert" trusted list, you must select "Trust Server Certificate".

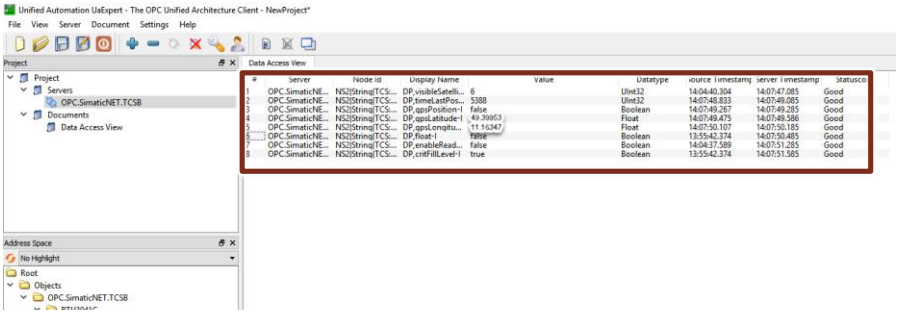
11. Then click "Continue".



12. Then locate the desired data points and drag them into the "Data Access view" window.



Result:



2.2.4 Loading the Configuration File

The supplied archive "109739240_RTU3041C_ PROJ_V30.zip" contains the finished configuration file ("*.cfg"), which you can load into your RTU3041C and adapt to your application in just a few steps.

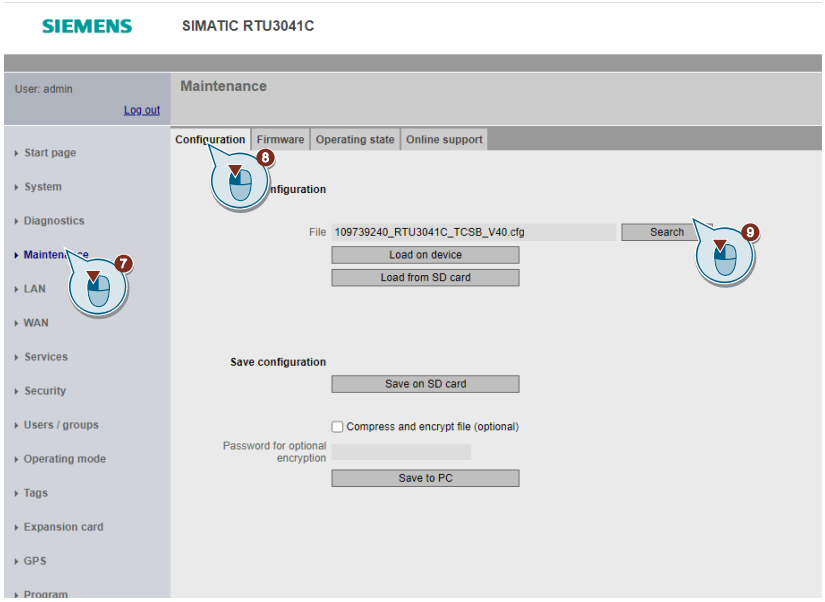
To load the supplied configuration into your RTU3041C, proceed as follows:

1. Connect the RTU3041C to your PG/PC via a network cable.

Note Ensure that only one RTU is connected to your network at a time during commissioning, as each RTU is assigned the same IP address at the factory.

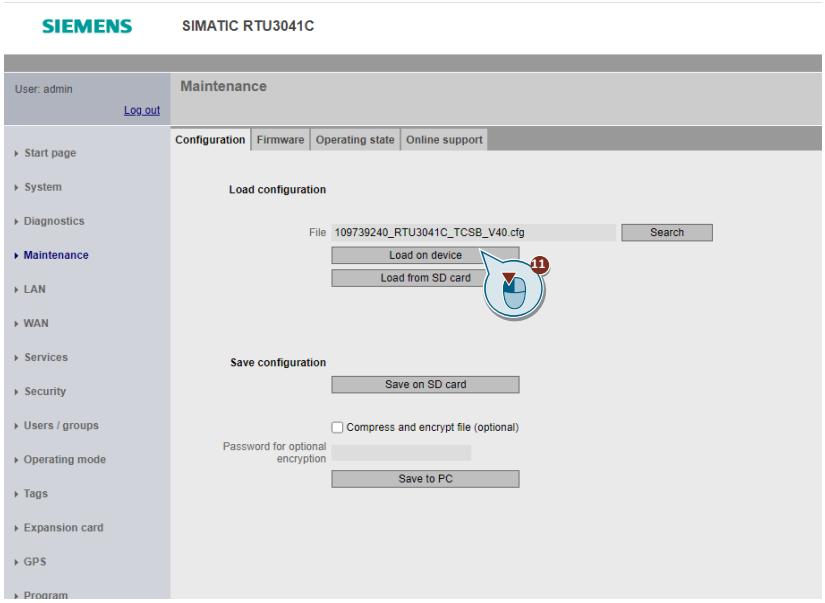
2. If necessary, change the IP address of your PG/PC (according to Table 2-1) so that it and the RTU3041C are in the same subnet.

   The factory default IP address "192.168.0.3" is set in the RTU3041C.
3. Wake up the RTU3041C by briefly pressing the WKUP/RESET button on the RTU.
4. In a browser, open the web server of the RTU3041C at the address "192.168.0.3".
5. Log in with the username "admin" and the password "admin".
6. Assign a new password.
7. Navigate to the "Maintenance" menu.
8. Under "Load configuration", click "Search".

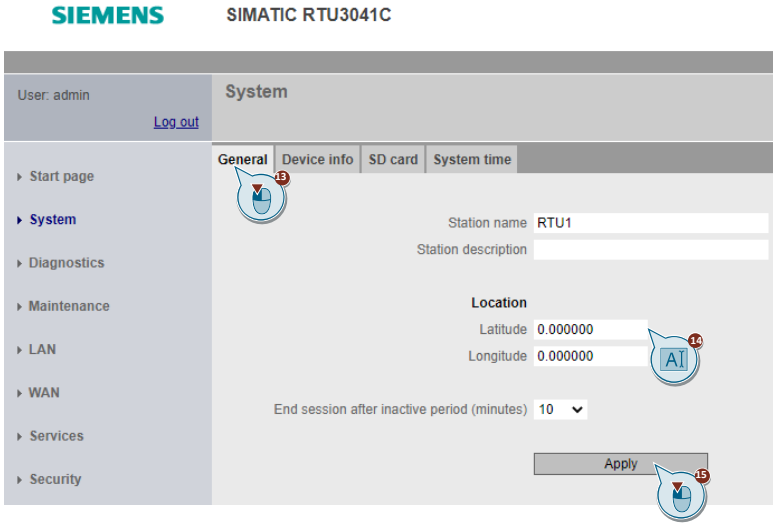


9. Select the downloaded configuration file.
10. Confirm with "Ok".

11. Click "Load on device".



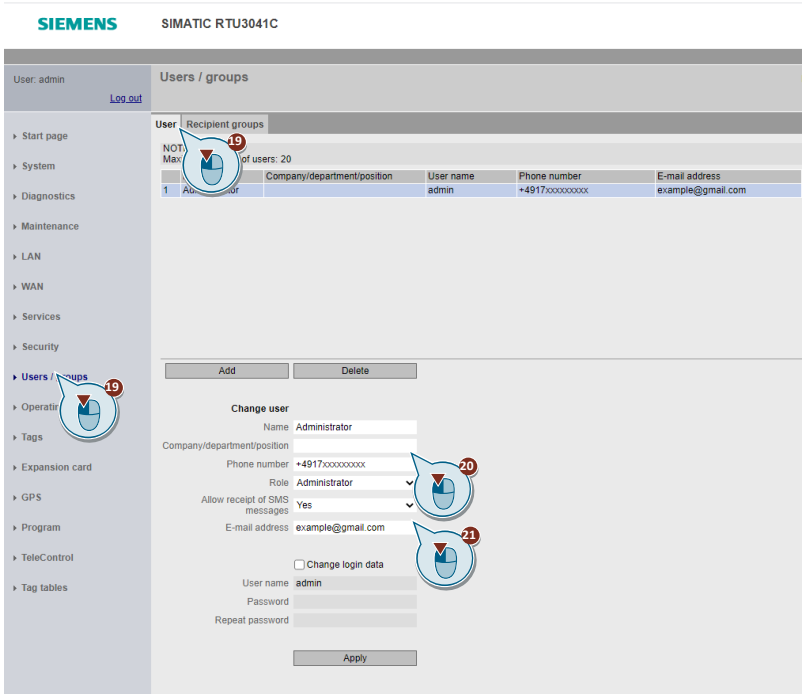
12. The previously set password is overwritten with the password "RTU3041c!" stored in the configuration file.
13. Navigate to the "System > General" menu.
14. Assign the coordinates for your RTU3041C.



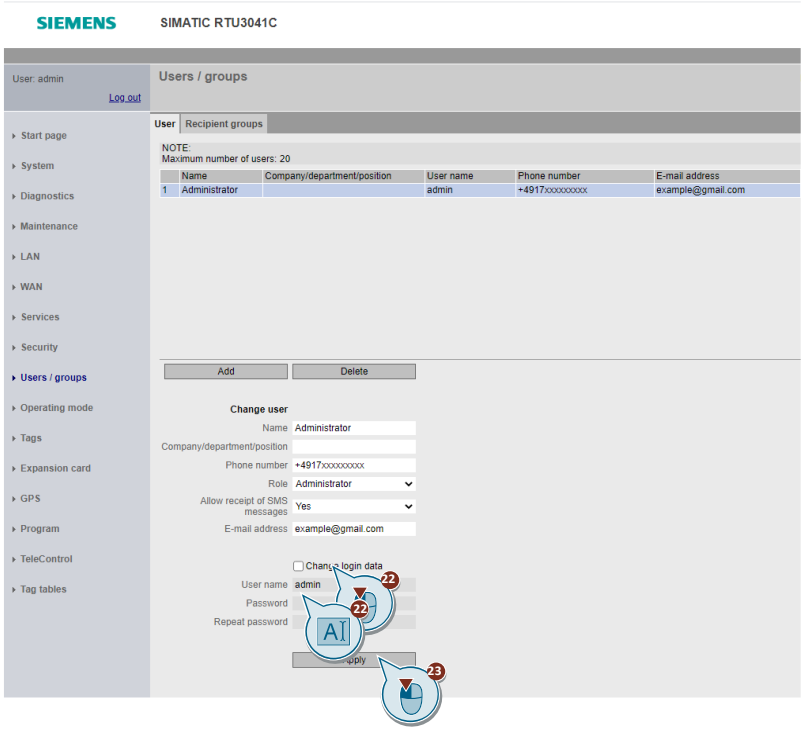
15. Then click "Apply".

16. Navigate to the "Operating mode" menu.
17. Enter the minimum duration of the service mode (e.g., "30 seconds") for the application described here.

18. Then click "Apply".
19. Navigate to the "Users / groups" menu.

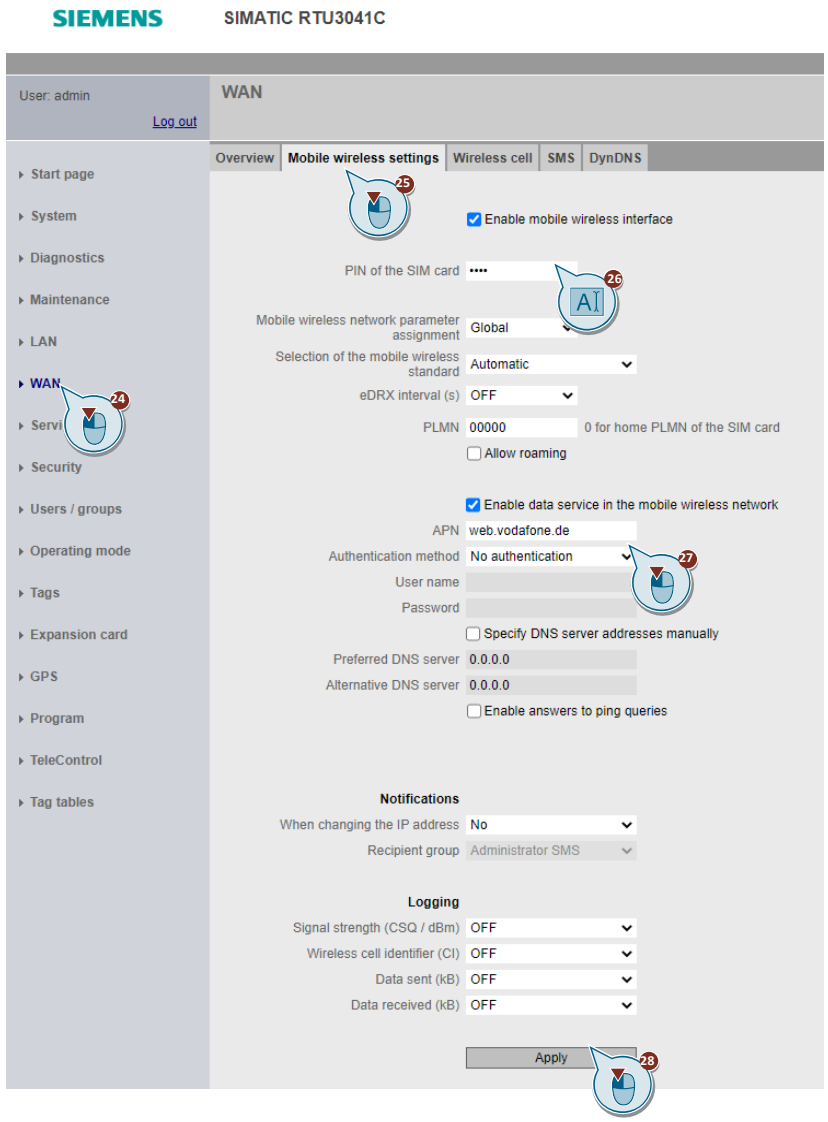


20. Enter the phone number with country code (e.g., "+49" for Germany).
21. Enter the email address for the "Administrator" user.
22. Change the password.



23. Then click "Apply".

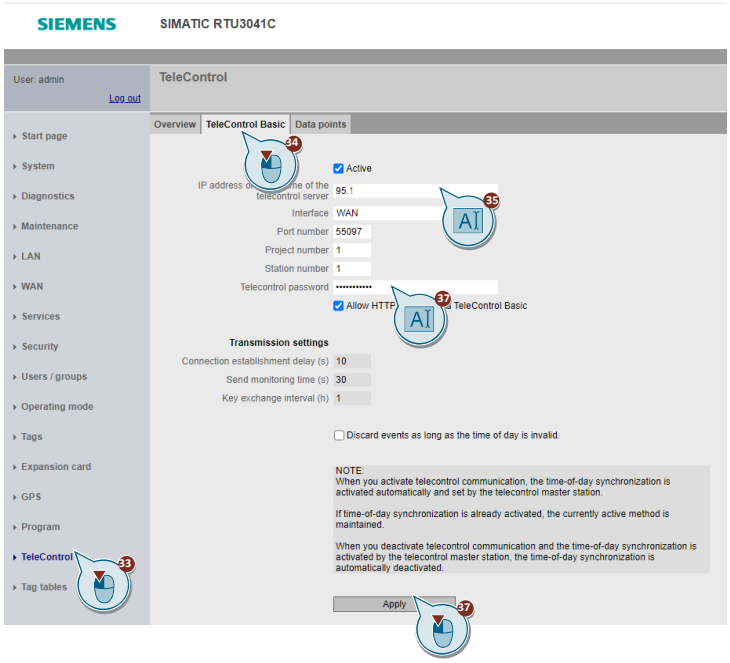
24. Navigate to the "WAN" menu.
25. Open the Mobile wireless settings tab.



26. Enter the PIN of the inserted SIM card.
27. Enter the APN of your network operator.
28. Then click "Apply".

29. Navigate to the "Services" menu.
30. Open the "Email" tab.

31. Enter the server data of the email account that the RTU3041C should use to send emails.
32. Then click "Apply".
33. Navigate to the "TeleControl" menu.
34. Open the "TeleControl Basic" tab.



35. Enter the static WAN IP address of the DSL router to which the TeleControl Server is connected.
36. Enter the Telecontrol password.
37. Then click "Apply".

2.3 Operation

2.3.1 RTU3041C Wake-Up by Mobile Phone

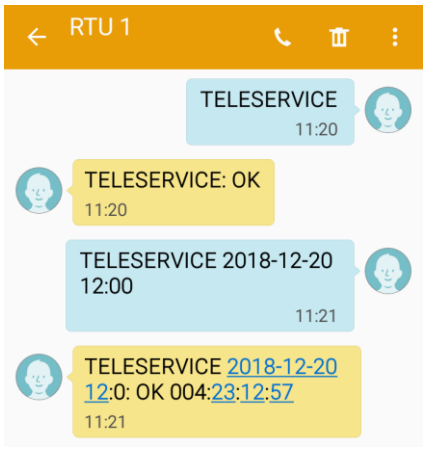
To read current process values, you can wake the RTU from sleep mode between two communication cycles.

1. To do this, send an SMS with the text "TELESERVICE" to the mobile phone number of the SIM card inserted in the RTU3041C.
2. The RTU acknowledges receipt of the wake-up SMS at the next time the mobile wireless interface turns on and connects to the TeleControl server.

Note If you specify an appointment in the wake-up SMS, the RTU3041C will establish a connection with its communication partner at the exact time you specify in the SMS.

3. To do this, send **"TELESERVICE YYYY-MM-DD hh:mm:ss"** to the mobile phone number of the SIM card inserted in the RTU3041C.

Figure 2-2: Alarm SMS



Note The telephone number from which the RTU is woken up must be stored and authorized in the RTU. You can find the setting in the web interface of the RTU under "Users / groups", see Section 2.2.1.

Note How often the RTU activates the mobile wireless interface and fetches received SMS depends on the configuration. The setting can be found in the web interface of the RTU under "Operating mode", see Section 2.2.1.

Note that enabling the mobile wireless interface increases the power consumption of the RTU.

2.3.2 Determining the Exact Position of the RTU3041C via GPS

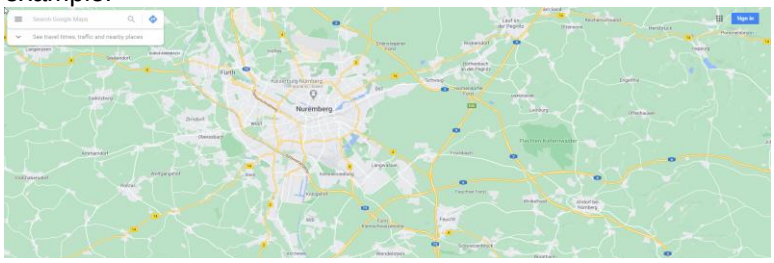
The exact position of the RTU3041C can be monitored via GPS. This section shows you how to determine the exact position of your RTU3041C via GPS.

For this scenario, the following is assumed:

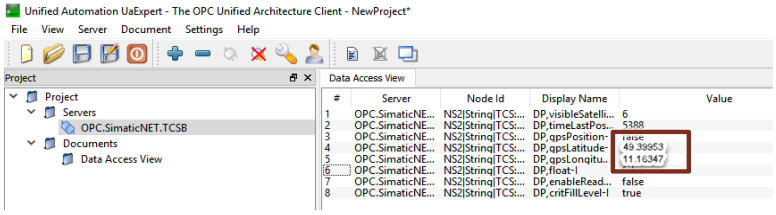
- The configuration of the RTU3041C is loaded into the RTU (see Section 2.2.1).
- OPC UA Server (TCSB) is activated (see Section 2.2.2)
- OPC UA Client (UaExpert) is connected to the OPC UA Server (TCSB) (see Section 2.2.3).

To display the exact position of the RTU, proceed as follows:

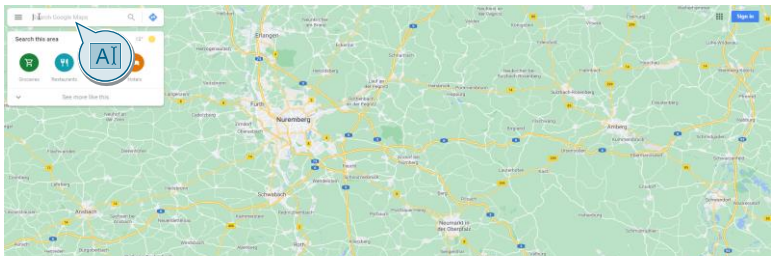
1. To enter the GPS coordinates of the RTU3041C, open Google Maps, for example.



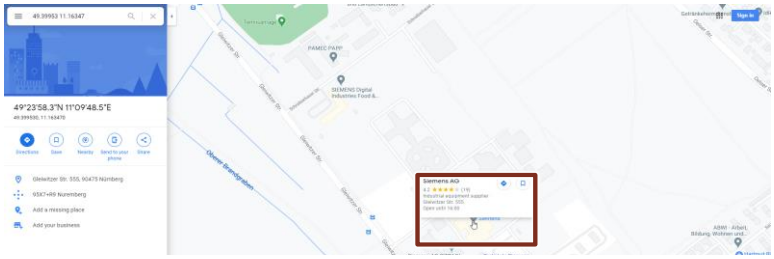
2. Get the GPS coordinates of your RTU3041C from UaExpert (follow the steps from Section 2.2.3).



3. Enter the GPS coordinates (49.39953,11.16347) into Google Maps.



4. The exact location of your RTU is shown on Google Maps.

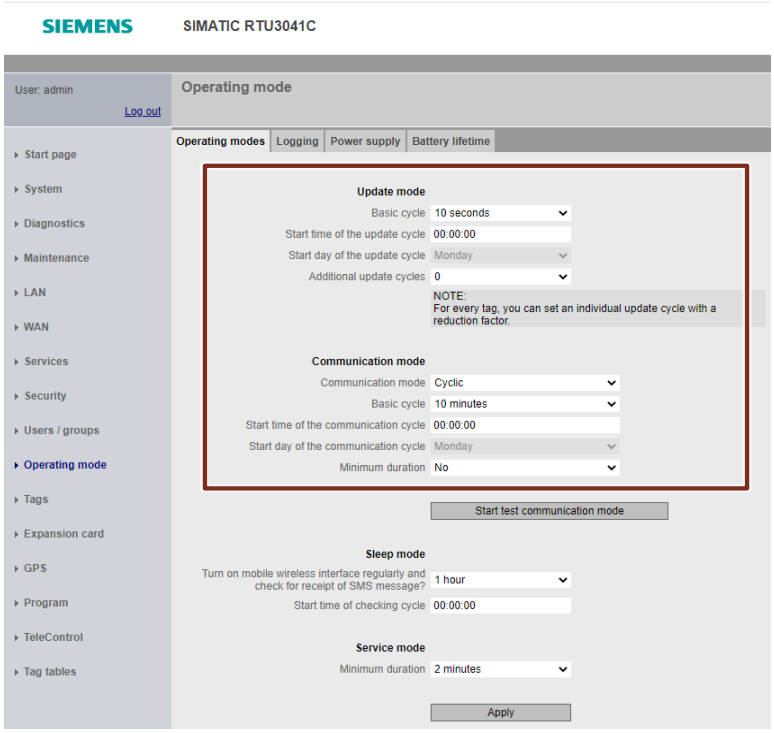


3 Useful Information

3.1.1 Update and Communication Mode

The RTU cyclically changes from sleep mode to update or communication mode. The frequency of the update and communication cycles can be defined.

Figure 3-1: Parameterization of the operating mode



Update mode

In update mode, the RTU goes through the following steps:

- Reading the inputs that were configured for the current cycle
- Editing the program blocks
- Writing of outputs
- Saving the process data to the SD card (with activated logging)

After the update mode, the RTU falls back into sleep mode or switches to communication mode if this is configured. The update and communication cycles can also run independently of each other.

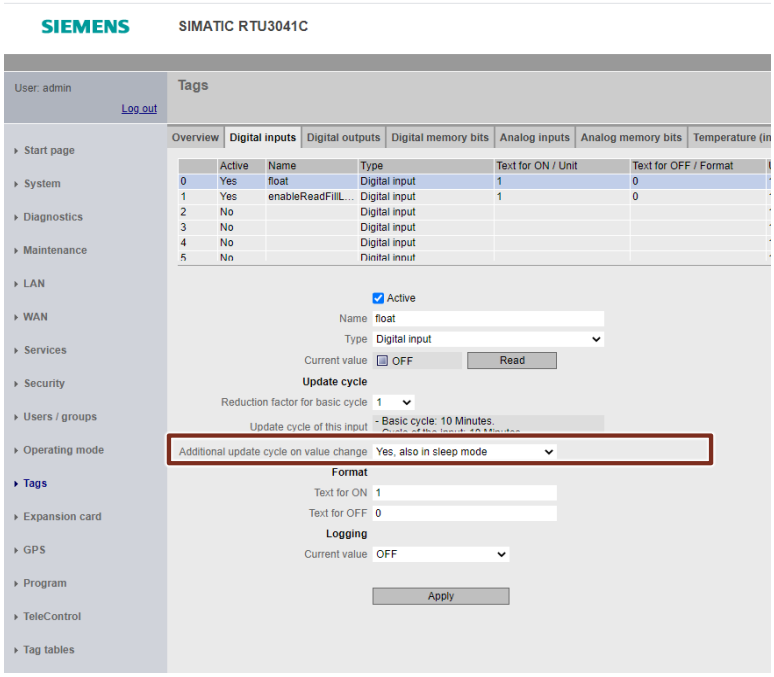
Note In order for the RTU to transmit current values of the data points, the update cycle must be parameterized at least as frequently as the communication cycle.

Configurable events

In addition to the configured update cycle, the RTU switches from sleep mode to update mode when configurable events occur. You can configure the following events:

- Value change at analog input "AI0"
- Edge change at a digital input
- Triggering timers of program blocks (e.g., with the pulse generator or with the on/off delay).

Figure 3-2: Parameterization of the additional update mode



Note Note that monitoring configured events will result in higher power consumption.

Communication mode

In communication mode, the RTU performs the following tasks:

- Sending the data telegrams to the configured communication partner in the control center
- Sending saved messages (SMS, emails)
- Synchronization of the time (if configured)

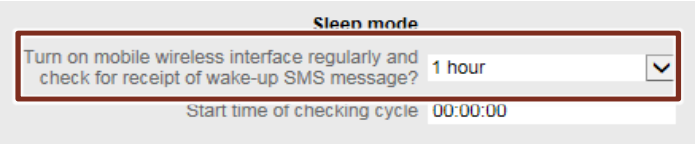
In addition to the previously mentioned tasks, a connection from the TeleControl server or the configuration PC to the WBM of the RTU can be established in communication mode. This enables diagnosis of the RTU and maintenance work.

Switching on the mobile wireless interface

Independently of the communication cycle, you can define how often the mobile wireless interface should be switched on to pick up possible wake-up SMS messages. Thereby, no connection to the TeleControl server is established.

You also specify this in the web interface under "Operating mode".

Figure 3-3: Switching on the mobile wireless interface



Note Note that this will increase the power consumption of the RTU.

3.1.2 Transmission Types of the Data Points

The RTU has different transmission modes to transfer data points. You can parameterize the transmission type for each data point individually.

Figure 3-4: Set transmission type

Name	Data point name	Data type	Type of transfer	Index	Threshold (%)	Threshold (abs.)	Transfer mode
Digital inputs							
STATUS_ERROR	STATUS_ERROR-I	1 Bit (1.1)	Only internal use	4000	--	--	Buffered transfer
STATUS_RUN	STATUS_RUN-I	1 Bit (1.1)		4001	--	--	Buffered transfer
floatCritFillLevel (DI0)	floatCritFillLevel-I	1 Bit (1.1)	Event (only current value)		--	--	Buffered transfer
fillLevel90 (DM0)	fillLevel90-I	1 Bit (1.1)	Only internal use		--	--	Buffered transfer
critFillLevel (DM1)	critFillLevel-I	1 Bit (1.1)	Event (only current value)		--	--	Unsolicited transfer
Analog inputs							
fillLevel (AI0)	fillLevel-I	32 Bit Float (3.3)	Event (only current value)		5.00	500.00	Buffered transfer
maxVolume (AM0)	maxVolume-I	32 Bit Float (3.3)			--	0.00	Buffered transfer
fillLevelPercent (AM1)	fillLevelPercent-I	32 Bit Float (3.3)	Only internal use	4	--	5.00	Buffered transfer
Counter inputs							
--							
Digital outputs							
fillLevel90 (DM0)	fillLevel90-Q	1 Bit (2.1)	Only internal use	7	--	--	Buffered transfer
critFillLevel (DM1)	critFillLevel-Q	1 Bit (2.1)	Only internal use	9	--	--	Buffered transfer
Analog outputs							
maxVolume (AM0)	maxVolume-Q	32 Bit Float (4.3)	Only internal use	3	--	--	Buffered transfer
fillLevelPercent (AM1)	fillLevelPercent-Q	32 Bit Float (4.3)	Only internal use	5	--	--	Buffered transfer

Transfer after call

The current value of the data point is stored in the RTU. New values of a data point overwrite the last stored value.

In communication mode, the current value at that time is transmitted.

Event (current value)

If the transmission type "Event" is selected, a threshold (absolute or percentage) can be specified for each data point. Only if the value of the data point has changed beyond this threshold is this is evaluated as an event and the new value stored. New values of a data point overwrite the last stored value.

In communication mode, the last stored value is transmitted.

Event (any value)

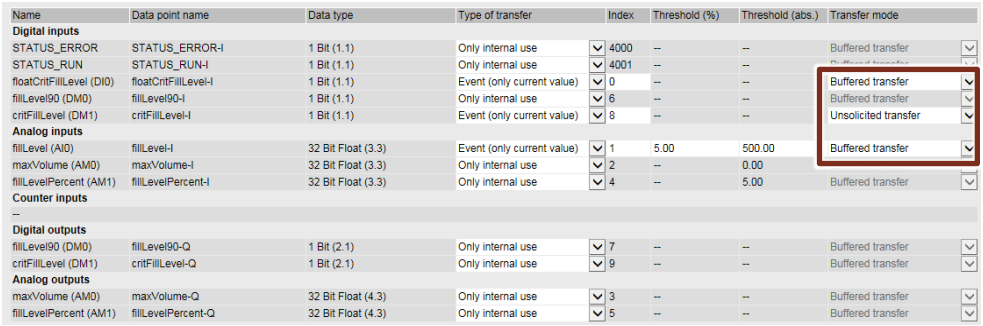
All values that differ from the last stored value are stored in chronological order and transmitted to the communication partner during the communication mode.

Since the HMI does not support the OPC UA function "HistoryRead" and only the last value is always transferred, this transfer type has no advantage for this example.

3.1.3 Transmission Mode of the Data Points

If you parameterize "Event (current value)" or "Event (any value)" as the transmission type, you can additionally select a transmission mode for each data point.

Figure 3-5: Transmission modes



Name	Data point name	Data type	Type of transfer	Index	Threshold (%)	Threshold (abs.)	Transfer mode
Digital inputs							
STATUS_ERROR	STATUS_ERROR-I	1 Bit (1.1)	Only internal use	4000	--	--	Buffered transfer
STATUS_RUN	STATUS_RUN-I	1 Bit (1.1)	Only internal use	4001	--	--	
floatCritFillLevel (DI0)	floatCritFillLevel-I	1 Bit (1.1)	Event (only current value)	0	--	--	Buffered transfer
fillLevel90 (DM0)	fillLevel90-I	1 Bit (1.1)	Only internal use	6	--	--	Buffered transfer
critFillLevel (DM1)	critFillLevel-I	1 Bit (1.1)	Event (only current value)	8	--	--	Unsolicited transfer
Analog inputs							
fillLevel (AI0)	fillLevel-I	32 Bit Float (3.3)	Event (only current value)	1	5.00	500.00	Buffered transfer
maxVolume (AM0)	maxVolume-I	32 Bit Float (3.3)	Only internal use	2	--	0.00	
fillLevelPercent (AM1)	fillLevelPercent-I	32 Bit Float (3.3)	Only internal use	4	--	5.00	Buffered transfer
Counter inputs							
--							
Digital outputs							
fillLevel90 (DM0)	fillLevel90-Q	1 Bit (2.1)	Only internal use	7	--	--	Buffered transfer
critFillLevel (DM1)	critFillLevel-Q	1 Bit (2.1)	Only internal use	9	--	--	Buffered transfer
Analog outputs							
maxVolume (AM0)	maxVolume-Q	32 Bit Float (4.3)	Only internal use	3	--	--	Buffered transfer
fillLevelPercent (AM1)	fillLevelPercent-Q	32 Bit Float (4.3)	Only internal use	5	--	--	Buffered transfer

Table 3-1: Differences between the transmission modes

Transmission mode	Explanation
Buffered transmission	The stored value of the data point is transmitted in the next communication mode.
Unsolicited transfer	A value change of the datapoint (event) starts an additional communication mode. The data point is transmitted immediately. In this application example, this is parameterized at the memory bit "critFillLevel".

4 Appendix

4.1 Service and support

Industry Online Support

Do you have any questions or need assistance?

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

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

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

support.industry.siemens.com

Technical Support

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

Please send queries to Technical Support via Web form:

support.industry.siemens.com/cs/my/src

SITRAIN – Digital Industry Academy

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

For more information on our offered trainings and courses, as well as their locations and dates, refer to our web page:

siemens.com/sitrain

Service offer

Our range of services includes the following:

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

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

support.industry.siemens.com/cs/sc

Industry Online Support app

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

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

4.2 Industry Mall

The Siemens Industry Mall is the platform on which the entire siemens Industry product portfolio is accessible. From the selection of products to the order and the delivery tracking, the Industry Mall enables the complete purchasing processing – directly and independently of time and location:
mall.industry.siemens.com

4.3 Application support

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4.4 Links and literature

Table 4-1

No.	Subject
\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/109739240
\3\	SIMATIC: TeleControl - RTU - RTU3030C/RTU30x1C https://support.industry.siemens.com/cs/ww/en/view/109750942
\4\	Instruction manual SITRANS LU150 https://support.industry.siemens.com/cs/ww/en/view/109739505
\5\	Manual and download for UaExpert: https://www.unified-automation.com/downloads/opc-ua-clients.html

4.5 Change documentation

Table 4-2

Version	Date	Change
V1.0	10/2016	First version
V2.0	01/2019	• Migration to TeleControl Server Basic V3.1 • Using UaExpert as OPC UA Client
V3.0	06/2021	Expansion with the GPS functions of a RTU30x1C: • Time synchronization • Position determination