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# Connection of the SIMATIC RTU3041C via MQTT to MindSphere

SIMATIC RTU3041C / MindSphere / SITRANS store IQ

<https://support.industry.siemens.com/cs/ww/en/view/109810580>

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# Table of contents

<b>Legal information</b> .....	<b>2</b>
<b>1 Introduction</b> .....	<b>4</b>
1.1 Overview .....	4
1.2 Principle of operation .....	7
1.3 Components used .....	9
<b>2 Engineering</b> .....	<b>11</b>
2.1 Hardware setup .....	11
2.2 Configuration and Project Planning .....	13
2.2.1 Create CA certificates with OpenSSL.....	14
2.2.2 Manage MQTT certificates in MindSphere .....	18
2.2.3 Create data model (asset model) .....	25
2.2.4 Configure SIMATIC RTU3041C .....	33
2.2.5 Configure SITRANS LR120 .....	53
2.2.6 Project SITRANS store IQ .....	60
2.2.7 Loading the Configuration File .....	67
<b>3 Useful Information</b> .....	<b>73</b>
3.1 Adapt supplied data model (Asset Model) .....	73
3.2 Customize included instance demo.....	77
<b>4 Appendix</b> .....	<b>78</b>
4.1 Service and support.....	78
4.2 Industry Mall .....	79
4.3 Application support .....	79
4.4 Links and literature .....	79
4.5 Change documentation.....	80

# 1 Introduction

## 1.1 Overview

### Starting point

The battery-powered SIMATIC RTU3000C are used to monitor and control outstations that are geographically distributed and not connected to a power supply network. The SIMATIC RTU3000C can store process data and transmit it via mobile radio or via the LAN interface and an external router to a control center or cloud system.

As of firmware V5.0, the SIMATIC RTU3000C acts as an MQTT client and supports cloud connections. The SIMATIC RTU3000C can send topics directly via MQTT to cloud platforms that communicate via MQTT (Publisher) and also receive topics from them (Subscriber).

The communication is aligned with the following cloud systems and supports the following services and functions:

Table 1-1

Platform	Service	Function RTU	
		Publisher	Subscriber
MindSphere (Siemens)	Native MQTT Agent	x	-
AWS (Amazon)	IoT Core	x	x
Azure (Microsoft)	IoT Hub	x	x
IBM Cloud (IBM)	Watson IoT Platform	x	x

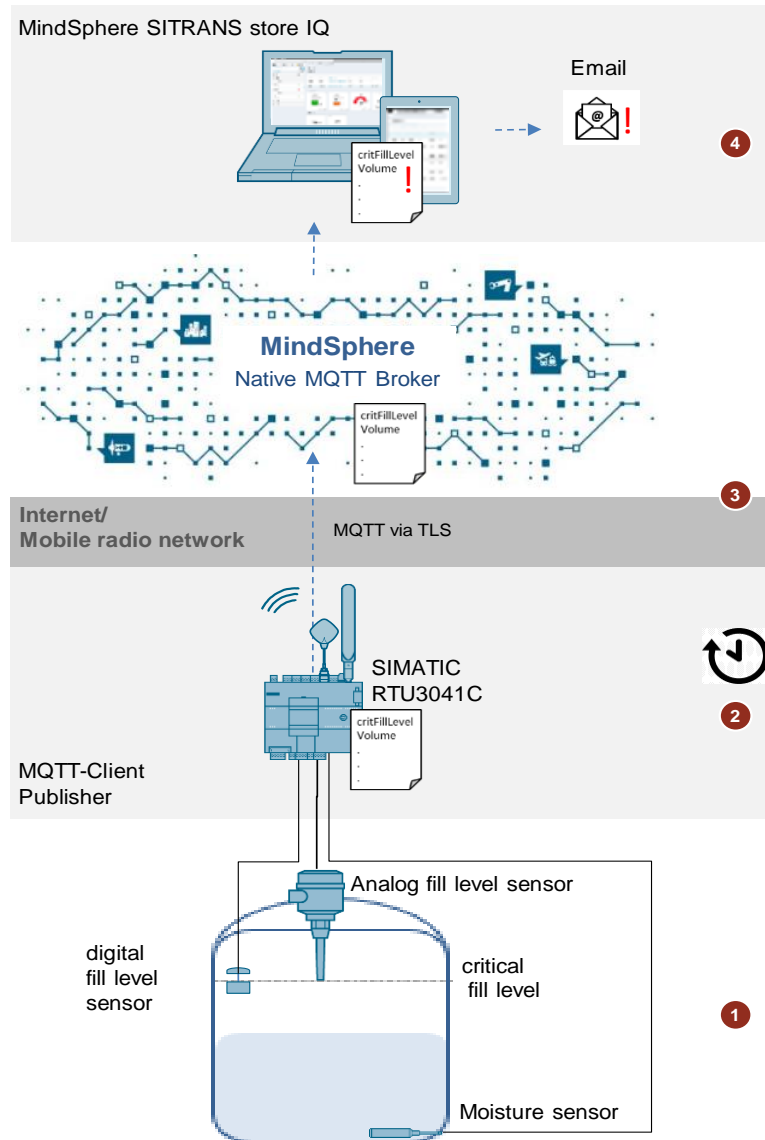
**Requirement**

The SIMATIC RTU3000C is to monitor process data from widely distributed sensors, such as the level of a rainwater overflow basin, and send the current values in a secure manner to a cloud system via MQTT.

The process data should be stored in the cloud system and read out via cloud applications. In the event of critical values, operators should also be informed by e-mail outside planned communication cycles.

To save energy, the SIMATIC RTU3000C shall be in sleep mode a large part of the time and switch to update or communication mode in predefined cycles.

Figure 1-1





### Solution approach

1. The SIMATIC RTU3041C uses a SITRANS LR120 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.
2. At configurable, timed intervals, the RTU switches from sleep mode to update mode to read the inputs and process the program.
3. Then the data is sent securely (MQTT via TLS) via Native MQTT to MindSphere and stored there.
4. SITRANS store IQ, which is based on Siemens MindSphere, is used to read out the data. If the level exceeds a critical value, the operator is informed via SITRANS store IQ via e-mail.

**Note**

The SIMATIC RTU3000C can also send e-mails or SMS to the operator with the program blocks "Send e-mail" and "Send SMS":  
(<https://support.industry.siemens.com/cs/ww/en/view/109739240>).

## 1.2 Principle of operation

### Implemented functions

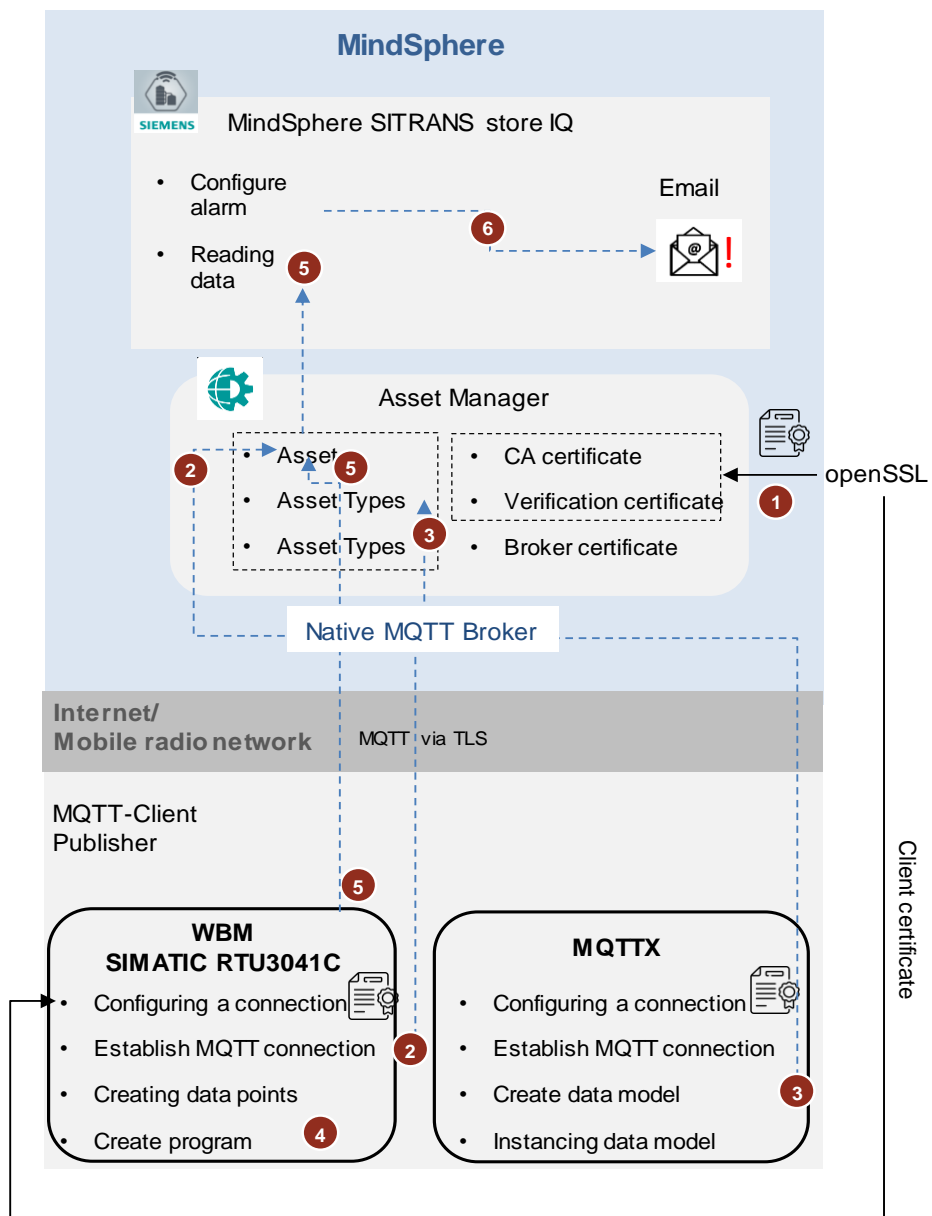
The following functions are implemented in the application example:

- Connection of the SIMATIC RTU3041C to MindSphere
- Sending the current data to the MindSphere "Native MQTT" service
- Reading out the data with SITRANS store IQ
- Sending an e-mail via SITRANS store IQ to a defined recipient when a critical level is exceeded or not reached.

### Diagram

The following figure shows the connection of the SIMATIC RTU3041C to the MindSphere and the sending and reading of the current data:

Figure 1-2



1. The certificates for the connection of the SIMATIC RTU3041C to MindSphere are managed in the Asset Manager:
  - CA certificate
  - Verification certificate
  - Broker certificate
2. The connection of the SIMATIC RTU3041C to MindSphere is configured via the Web Based Management (WBM) of the RTU.  
An asset for the SIMATIC RTU3041C is automatically created in the Asset Manager when the MQTT client "MQTTX" first connects to MindSphere.
3. The data model for the asset/aspect types and the variables to be sent to MindSphere is created and instantiated via the MQTT client "MQTTX".
4. The blocks for monitoring the fill level are displayed and programmed graphically via the WBM of the SIMATIC RTU3041C.
5. The current data is sent to MindSphere and read out with SITRANS store IQ.
6. The alarm that triggers the e-mail notification is configured directly in SITRANS store IQ.

**Note**

You can also read out the transmitted data in MindSphere with "Fleet Manager" or "Operations Insight".

### Advantages of the solution

- Easy connection of field devices via DI/AI/DO, HART or Modbus RTU via mobile radio to a cloud system
- Use in locations without power supply incl. data buffering
- Easy configuration via Web Based Management (WBM)



## 1.3 Components used

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

Table 1-2

Component	Quantity	Item number	Note
SIMATIC RTU3041C From V5.0	1	6NH3112-4BB00-0XX0	It is also possible to use another SIMATIC RTU3000C with firmware V5.0 or higher. used in this example.  <b>Firmware V5.0:</b> <a href="https://support.industry.siemens.com/cs/ww/en/view/109810215">https://support.industry.siemens.com/cs/ww/en/view/109810215</a>
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 LR120 analog level sensor	1	7ML532.-.....-.....	Up to 5 m
Digital level sensor	1		Available from specialist dealers
Digital moisture sensor	1		Available from specialist dealers
SITRANS store IQ	1		MindSphere Store: <a href="https://www.dex.siemens.com/mindsphere/step-4-book-apps-and-extras/sitrans-store-iq-entry-package">https://www.dex.siemens.com/mindsphere/step-4-book-apps-and-extras/sitrans-store-iq-entry-package</a>  DevOps for the product: <a href="mailto:del.operations.us@siemens.com">del.operations.us@siemens.com</a>
SITRANS Mobile IQ App	1		App Store: Free download
MQTT-Client "MQTTX"	1		<ul style="list-style-type: none"> <li>To create the data model and map the data</li> <li>Free download: <a href="https://mqtx.app">https://mqtx.app</a></li> </ul>
OpenSSL			Free download: <a href="https://www.openssl.org/source/">https://www.openssl.org/source/</a>

## 1 Introduction

---

This application example consists of the following components:

Table 1-3

Component	Note
109810580_RTU3041C_MQTT_DOC_V10_de.pdf	This document
109810580_RTU3041C_MQTT_PROJ_V10.zip	<ul style="list-style-type: none"><li>• Configuration file of the SIMATIC RTU3041C</li><li>• Data Model Demo</li><li>• Instance Demo</li></ul>

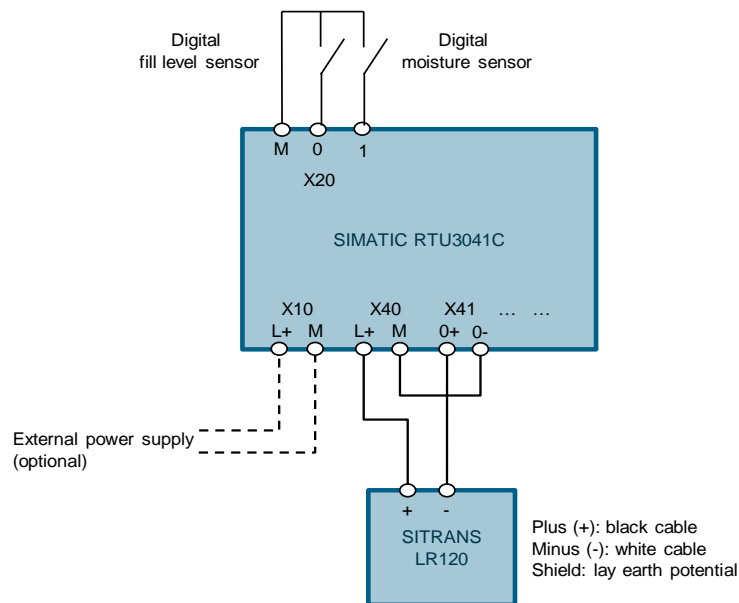
## 2 Engineering

### 2.1 Hardware setup

[Chapter 1.3](#) lists the required hardware components.

The following figure shows the hardware structure of the SIMATIC RTU3041C.

Figure 2-1: Circuit diagram SIMATIC RTU



1. Insert the SIM card into the SIMATIC RTU3041C.
2. Insert two batteries at a time into a battery module housing.
3. Mount the SIMATIC 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, DI0.
5. Connect the digital moisture sensor to terminal block X20, DI1.
6. Connect the SITRANS LR120 analog level sensor (2-wire transmitter) to terminal blocks X40 and X41.
7. Connect the antennas to the SIMATIC RTU3041C.
8. Connect the battery module housing to the SIMATIC RTU3041C.

**Note** You can also operate the SIMATIC 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 transmitter types can be found in the operating instructions (Connecting the analog inputs):

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

## 2 Engineering

---

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

Table 2-1

Component	IP address	Description
Engineering station	192.168.0.100	
SIMATIC 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 chapter describes the most important steps of the project engineering for the connection of the SIMATIC RTU3041C to the MindSphere and the sending and reading of the current data:

- Create CA certificates with OpenSSL ([Chapter 2.2.1](#)):
  - CA certificate
  - Client certificate
- Manage MQTT certificates in MindSphere ([Chapter 2.2.2](#))
  - Uploading the CA certificate to the MindSphere
  - Uploading the Verification certificate to the MindSphere
  - Downloading the Broker certificate from Mindsphere

### Hinweis

The verification certificate is created with OpenSSL and then uploaded to MindSphere.

- Create and instantiate data model ([Chapter 2.2.3](#))
- Configure SIMATIC RTU3041C ([Chapter 2.2.4](#)) or load supplied configuration file ([Chapter 2.2.7](#))
- Configure SITRANS LR120 ([Chapter 2.2.5](#))
- Read out data with SITRANS store IQ ([Chapter 2.2.6](#)).

### Requirements

- You have created a MindSphere account with MQTT native functionality enabled:
  - Login page of the MindSphere tenant
  - User name
  - Password
- You have purchased SITRANS store IQ and set it up in MindSphere.

### Note

If you do not have a MindSphere tenant, SITRANS store IQ comes with a MindSphere Base Tenant that provides the necessary resources to run SITRANS store IQ.

- You have the following tools installed on your computer:
  - OpenSSL for the creation of the certificates
  - MQTTX to create and instantiate the asset model.

### 2.2.1 Create CA certificates with OpenSSL

The communication between the SIMATIC RTU3041C and the MindSphere is secured via TLS v1.2. For this purpose, server- and client-side authentication is supported by certificates. The following certificates are required for communication:

Table 2-2

Certificate	Description
CA certificate	<ul style="list-style-type: none"> <li>Public certificate of the certification authority (CA) used to validate signed user certificates.</li> <li>The CA certificate is created with OpenSSL.</li> </ul>
Verification certificate	<ul style="list-style-type: none"> <li>The verification certificate is created (once) to ensure that client certificates can be derived from the CA certificate uploaded in MindSphere.</li> <li>The verification certificate is created with OpenSSL.</li> </ul>
Client certificate	<ul style="list-style-type: none"> <li>Certificate of the RTU With a secured connection via TLS, the authenticity of the RTU is proven to the broker using its own certificate/key.</li> <li>The client certificate is created with OpenSSL.</li> </ul>

#### Create CA certificate with OpenSSL

- Open the command prompt ("cmd") from the Start menu.
- Change to the folder where the "openssl.exe" file is located with the following command:

```
cd C:\OpenSSL-Win64\bin
```

```
C:\Users\...> cd C:\OpenSSL-Win64\bin
```

- Create a private key for the certification authority (CA) with the following command:

```
openssl genrsa -out <tenant>.key 2048
```

```
C:\OpenSSL-Win64\bin>openssl genrsa -out sitrain.key 2048
Generating RSA private key, 2048 bit long modulus
.....+++
.....+++
e is 65537 (0x010001)
C:\OpenSSL-Win64\bin>
```

- The key is called "<tenant>.key" and is 2048 Bits long.
- <tenant>: Your MindSphere-Tenant



4. Generate the CA certificate that you will need to import later using the following command:

```
openssl req -x509 -new -nodes -key <tenant>.key -sha256 -days 3650 -out  
<tenant>.pem -subj  
"/C=<Land>/ST=<Stadt>/O=<Unternehmen>/OU=<Abteilung>/CN=<tenant>"
```

```
C:\OpenSSL-Win64\bin>openssl req -x509 -new -nodes -key sitrain.key -sha256 -days 3650 -out sitrain.pem -subj "/C=de/  
Nbg/O=Siemens/OU=FA/CN=sitrain"  
C:\OpenSSL-Win64\bin>
```

- The CA certificate is named "<tenant>.pem" and is valid for 3650 days.
- <tenant>: Your MindSphere-Tenant

Enter the following attributes:

- C (Country Name / two-letter code) =<Land>
- ST (State) = <Stadt>
- O (Organization Name) =<Unternehmen>
- OU (Organizational unit Name) =<Abteilung>
- CN (Common name) =<MindSphere-Tenant>

**Note**

If the command does not include the above attributes, they will be requested during generation.

**Note**

The newly generated certificates are automatically stored in the "OpenSSL > bin" folder.

## Create client certificate for the SIMATIC RTU3041C with OpenSSL

With a secured connection via TLS, the authenticity of the RTU is proven to the broker using its own certificate/key.

### Requirement

The CA certificate was created with OpenSSL and stored in the "OpenSSL > bin" folder (see [Create CA certificate](#)).

### Procedure

1. Open the command prompt ("cmd") from the Start menu.
2. Change to the folder where the "openssl.exe" file is located with the following command:

```
cd C:\OpenSSL-Win64\bin
```

```
C:\Users\%i 9>cd C:\OpenSSL-Win64\bin
```

1. Create a private key for the client certificate with the following command:

```
openssl genrsa -out <DeviceName>.key 2048
```

```
C:\OpenSSL-Win64\bin>openssl genrsa -out RTU_HowTo.key 2048
Generating RSA private key, 2048 bit long modulus
.....+++
....+++
e is 65537 (0x010001)
C:\OpenSSL-Win64\bin>
```

- The key is named "<DeviceName>.key" and is 2048 bits long.
- <DeviceName>: Device name for the SIMATIC RTU3041C, e.g., "RTU\_HowTo"

2. Create a certificate request using the following command:

```
openssl req -new -key <DeviceName>.key -out <DeviceName>.csr -subj
"/C=<Land>/ST=<Stadt>/O=<Unternehmen>/OU=<Abteilung>/CN=<DeviceName>
```

```
C:\OpenSSL-Win64\bin>openssl req -new -key Rtu_HowTo.key -out RTU_HowTo.csr -subj "/C=de/ST=nbg/O=siemens/OU=Fa/CN=RTU_HowTo"
C:\OpenSSL-Win64\bin>
```

- The certificate request is called "<DeviceName>.csr".
- <DeviceName>: Device name for the SIMATIC RTU3041C, e.g. "RTU\_HowTo"

Enter the following attributes:

- C (Country Name/ two-letter code) =<Land>
- ST (State) = <Stadt>
- O (Organization Name) =<Unternehmen>
- OU (Organizational unit Name) =<Abteilung>
- CN (Common name) =<DeviceName>

### Note

A CSR (Certificate Signing Request), is a specially formatted and encrypted message. It is sent to the CA for the creation of the client certificate. The CSR confirms the information that the CA needs to be able to issue the certificate.

3. Generate the client certificate for the SIMATIC RTU3041C with the following command:

```
openssl x509 -req -in <DeviceName>.csr -CA <tenant>.pem -CAkey  
<tenant>.key -CAcreateserial -out <DeviceName>.pem -days 365 -sha256
```

```
C:\OpenSSL-Win64\bin>openssl x509 -req -in Rtu_HowTo.csr -CA sitrain.pem -CAkey sitrain.key -CAcreateserial -out Rtu_HowTo.pem -days 365 -sha256  
Signature ok  
subject=C = de, ST = nbg, O = siemens, OU = Fa, CN = RTU_HowTo  
Getting CA Private Key  
C:\OpenSSL-Win64\bin>
```

- "<DeviceName>.csr": The certificate request  
<DeviceName>: Device name for the SIMATIC RTU3041C, e.g. "RTU\_HowTo".
- <tenant>.pem: CA certificate ("public key" of the CA)
- <tenant>.key: Private key for the certification body (CA)  
<tenant>: Your MindSphere-Tenant
- "<DeviceName>.pem": Client certificate (Public Key)

**Note**

The client certificate must be derived from the [CA certificate](#) uploaded in MindSphere.

**Note**

The newly generated certificates are automatically stored in the "OpenSSL > bin" folder.

**Note**

If you want to connect further clients to MindSphere repeat steps 1-4 with different "DeviceName"

### 2.2.2 Manage MQTT certificates in MindSphere

The communication between the SIMATIC RTU3041C and the MindSphere is secured via TLS v1.2. For this purpose, server- and client-side authentication is supported by certificates. A CA certificate must be uploaded to MindSphere for the authentication.

**Note**

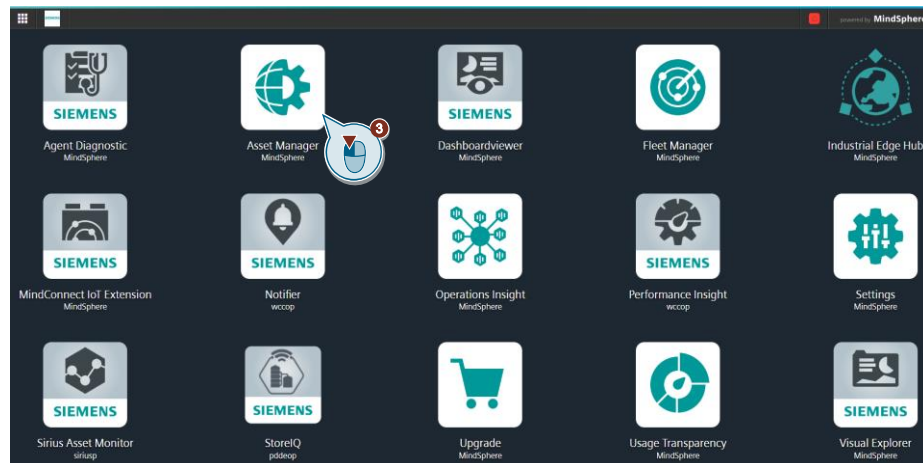
You can upload up to two CA certificates to MindSphere.

#### Requirement

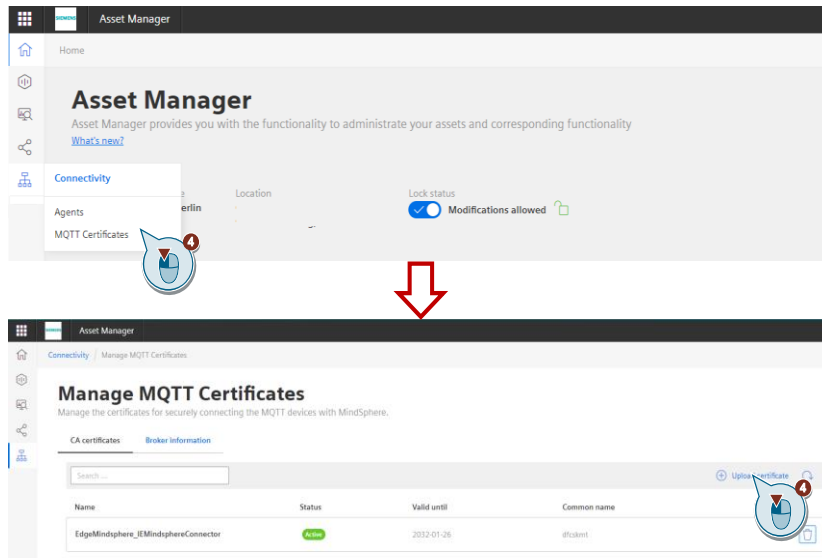
The CA certificate was created with OpenSSL and stored in the "OpenSSL > bin" folder (see [Create CA certificate](#)).

#### Procedure

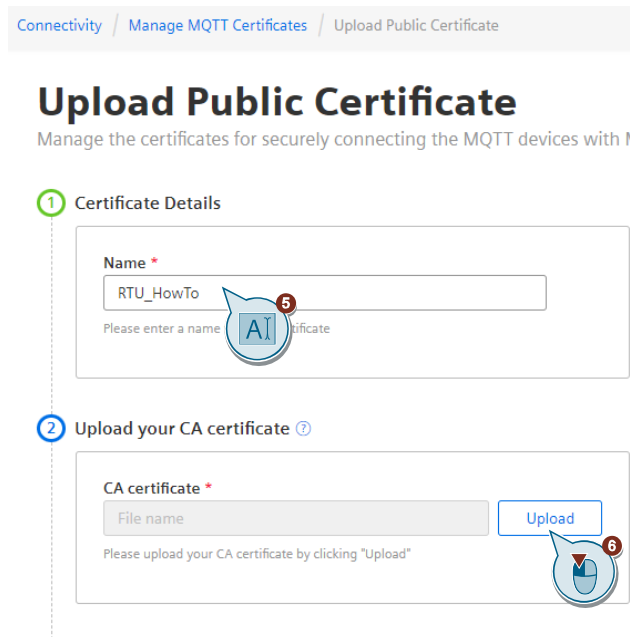
1. Open the login page to your MindSphere tenant in your internet browser.
2. Enter your username and password and log in.
3. Start MindSphere "Asset Manager".



4. Upload a new CA certificate  
"Connectivity > MQTT Certificates > CA certificates > upload certificate".



5. Assign a name to the new certificate.
6. Upload the created CA certificate.



**Note**

The CA certificate was created with OpenSSL and stored in the folder "OpenSSL > bin" (see [Create CA certificate](#)).  
The CA certificate is named "<tenant>.pem".

**Result:**

After the CA certificate is uploaded, the registration code needed to create the verification certificate is generated.

Connectivity / Manage MQTT Certificates / Upload Public Certificate

### Upload Public Certificate

Manage the certificates for securely connecting the MQTT devices with MindSp

- 1 Certificate Details**  

**Name \***  
RTU\_HowTo  
Please enter a name for your certificate
- 2 Upload your CA certificate ?**  

**CA certificate \***  
sitrain.pem   
Please upload your CA certificate by clicking "Upload"
- 3 Upload your verification certificate ?**  

**Registration Code**  
8477966047a71ad251b8541c0c6c6a08c76b054091780ef64t   
Registration code will be generated after uploading your CA certificate

**Verification certificate \***  
File name   
Please upload your verification certificate by clicking "Upload"

See here for how to create a device certificate ?



7. Copy the registration code.

Connectivity / Manage MQTT Certificates / Upload Public Certificate

### Upload Public Certificate

Manage the certificates for securely connecting the MQTT devices with MindSp

- Certificate Details**

Name \*

Please enter a name for your certificate
- Upload your CA certificate**

CA certificate \*

Please upload your CA certificate by clicking "Upload"
- Upload your verification certificate**

Registration Code

Registration code will be generated after uploading your CA certificate

Verification certificate \*

Please upload your verification certificate by clicking "Upload"

See here for how to create a device certificate

**Create verification certificate with OpenSSL**

- Open the command prompt ("cmd") from the Start menu.
- Change to the folder where the "openssl.exe" file is located with the following command:

```
cd C:\OpenSSL-Win64\bin
```

```
C:\Users\%> cd C:\OpenSSL-Win64\bin
```

- Create a private key for the verification certificate with the following command:

```
openssl genrsa -out verificationCert.key 2048
```

```
C:\OpenSSL-Win64\bin>openssl genrsa -out verificationCert.key 2048
Generating RSA private key, 2048 bit long modulus
.....+++
.....+++
e is 65537 (0x010001)
```

The key is named "verificationCert.key" and is 2048 bits long.

11. Create a certificate request (CSR) using the following command:

```
openssl req -new -key verificationCert.key -out verificationCert.csr -subj /CN=<registration code>
C:\OpenSSL-Win64\bin>openssl req -new -key verificationCert.key -out verificationCert.csr -subj /CN=8477966047a71ad251b8541c0c6c6a08c76b054091780ef6408cf43ad863e42e
C:\OpenSSL-Win64\bin>
```

- The certificate request (CSR) is named "verificationCert.csr".
- Common Name (CN) is the <registration code> generated after uploading the CA certificate in MindSphere.

**Note** A CSR (Certificate Signing Request), is a specially formatted and encrypted message. It is sent to the CA for the creation of the verification certificate. The CSR confirms the information that the CA needs to be able to issue the certificate.

12. Generate the verification certificate that you need to import into MindSphere with the following command:

```
openssl x509 -req -in verificationCert.csr -CA <tenant>.pem -CAkey <tenant>.key -CAcreateserial -out verificationCert.pem -days 7 -sha256
C:\OpenSSL-Win64\bin>openssl x509 -req -in verificationCert.csr -CA sitrain.pem -CAkey sitrain.key -CAcreateserial -out verificationCert.pem -days 7 -sha256
Signature ok
subject=CN = 8477966047a71ad251b8541c0c6c6a08c76b054091780ef6408cf43ad863e42e
Getting CA Private Key
C:\OpenSSL-Win64\bin>
```

- The verification certificate is named "verificationCert.pem".
- <tenant>.key: Private key for the certification body (CA)
- <tenant>.pem: CA certificate (Public Key of the CA)

**Note** The verification certificate must be derived from the [CA certificate](#) uploaded in the MindSphere.

**Note** The newly generated certificates are automatically stored in the "OpenSSL > bin" folder.  
The verification certificate is named "verificationCert.pem".

13. Change to MindSphere.

14. Upload the created verification certificate to MindSphere.

Connectivity / Manage MQTT Certificates / Upload Public Certificate

## Upload Public Certificate

Manage the certificates for securely connecting the MQTT devices with MindSp

- Certificate Details**

**Name \***  
  
Please enter a name for your certificate
- Upload your CA certificate ?**

**CA certificate \***  
   
Please upload your CA certificate by clicking "Upload"
- Upload your verification certificate ?**

**Registration Code**  
   
Registration code will be generated after uploading your CA certificate

**Verification certificate \***  
   
Please upload your verification certificate by clicking "Upload"

[See here for how to create a device certificate ?](#)

**Result:**

The CA certificate was successfully uploaded to MindSphere.

Asset Manager

Connectivity / Manage MQTT Certificates

### Manage MQTT Certificates

Manage the certificates for securely connecting the MQTT devices with MindSphere.

CA certificates [Broker information](#)

Search ...

Name	Status	Valid until	Common name
EdgeMindSphere_IEMindSphereConnector	Active	2032-01-26	dfcskmt
RTU_HowTo	Active	2032-05-01	dfcskmt

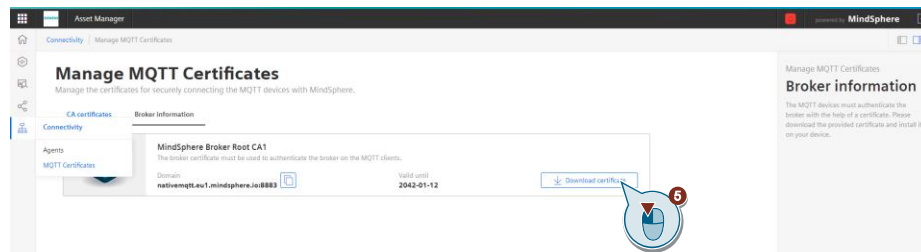
## Broker certificate download

The broker certificate is used to authenticate the broker on the SIMATIC RTU3041C. Download and install the certificate on your SIMATIC RTU3041C:

1. Open the login page to your MindSphere tenant in your internet browser.
2. Enter your username and password and log in.
3. Start MindSphere "Asset Manager".
4. Navigate to the menu "Connectivity > MQTT Certificates > Broker information".



5. Download the Broker certificate.



### 2.2.3 Create data model (asset model)

A data model defines the logical subdivision and assignment of the data from the connected device or from MindSphere-internal data sources.

All transferred data is stored in a database in MindSphere, as so-called "TimeSeries".

This data must be referenced to the data model for later processing ("mapping").

Later on, the data model or its variables can be accessed symbolically within MindSphere.

A data model consists of the following components:

- Asset  
represents a logical unit; derived from "type".

Note

When the MQTT client is connected to MindSphere for the first time, an asset for the client (MQTTX or SIMATIC RTU3041C) is automatically created in the MindSphere Asset Manager.

- Asset type  
Template for a logical unit; includes "Aspects".  
It is created via the MQTT client "MQTTX".
- Aspect type  
Template for summarized values; contains the variables from the RTU.  
It is created via the MQTT client "MQTTX".

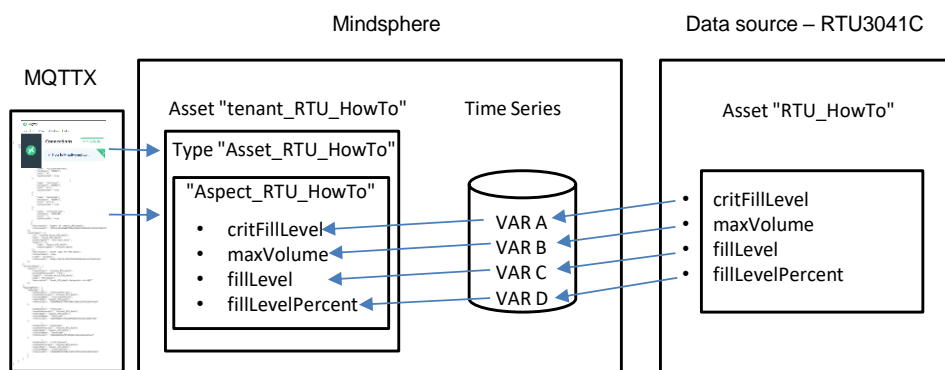
Note

The MQTTX client is used to create the data model and map the data.

<https://documentation.mindsphere.io/MindSphere/howto/howto-create-data-model-mqtt-agent.html>

The following figure shows the data model for this application example.

Figure 2-2



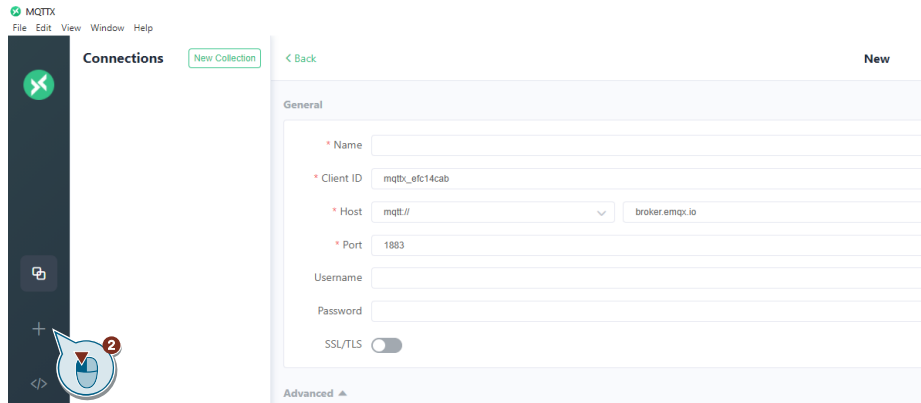
Note

The logical division and allocation are made individually according to your specifications.

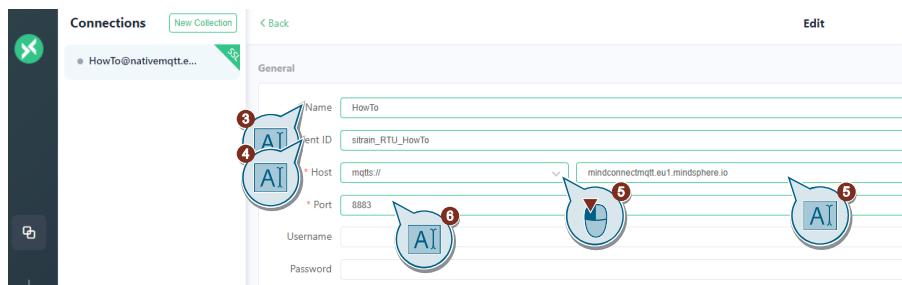
### Connecting the MQTTX client to MindSphere

To create the data model, proceed as follows:

1. Open the MQTTX program
2. Add a new connection.

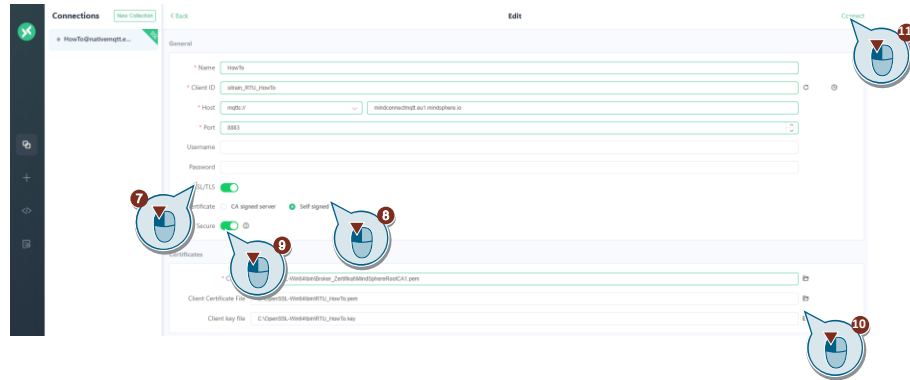


3. Give the new connection a name.
4. Enter the Client-ID:  
 "Client-ID"= <tenant>\_<DeviceName>  
 - <tenant>: Your MindSphere-Tenant  
 - <DeviceName>: Device name for the SIMATIC RTU3041C, e.g. "RTU\_HowTo".
5. Enter the address of the broker "mqtxs://" and "mindconnectmqtt.eu1.mindsphere.io".
6. Enter the port number "8883".



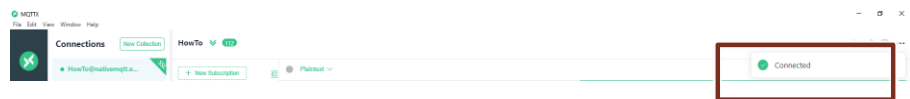


7. Enable the connection with TLS.
8. Enable the Self signed option.
9. Activate the connection with "SSL Secure".
10. Upload the Broker and client certificates and the client key (see [Chapter 2.2.1](#)).
11. Then click on "Connect".



**Result:**

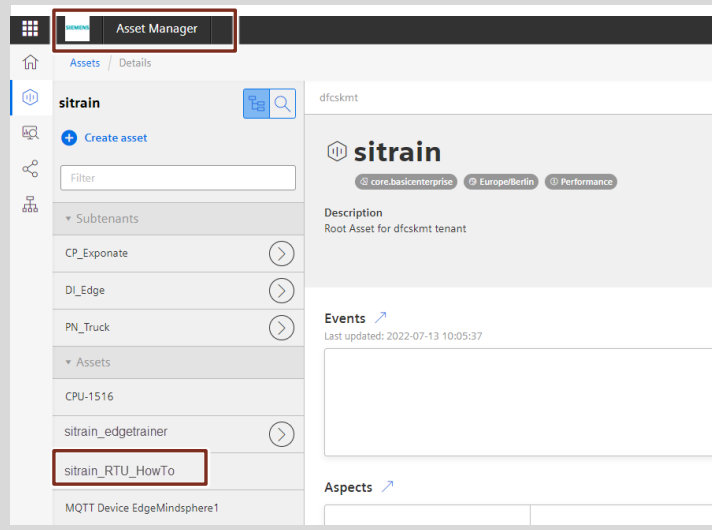
The MQTTX client is connected to the MindSphere.



When the MQTT client first connects to the MQTT broker, an asset "Client-ID" for the client (MQTTX or SIMATIC RTU3041C) is automatically created in the MindSphere Asset Manager:  
 "Client-ID"= <tenant>\_<DeviceName>

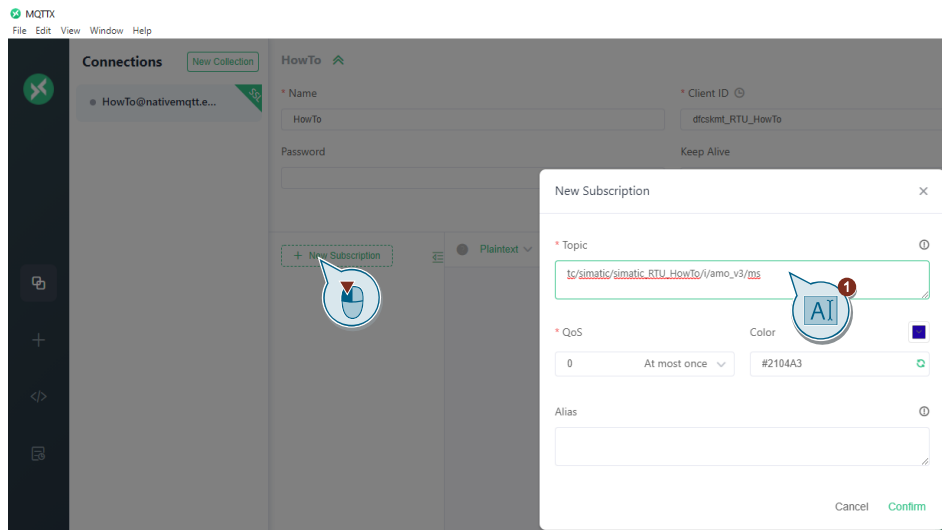
- <tenant>: Your MindSphere-Tenant
- <DeviceName>: Device name for the SIMATIC RTU3041C, e.g. "RTU\_HowTo".

**Note**



**Create data model**

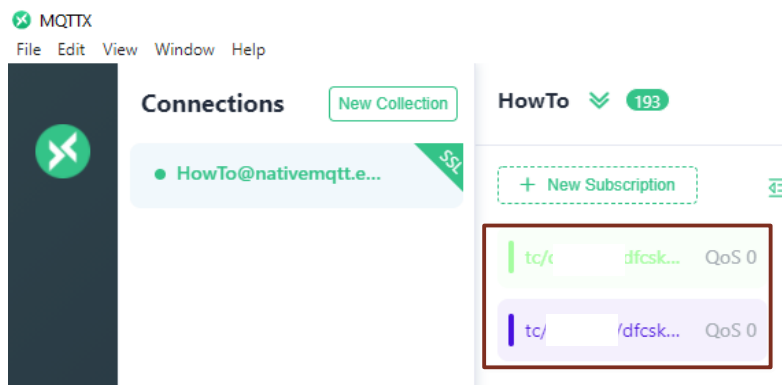
1. Add two new subscriptions for MindSphere feedback storage:
    - tc/<tenant>/<Client-ID>/i/amo\_v3/ms  
Obtains the model creation results for the last model request.
    - tc/<tenant>/<Client-ID>/i/amo\_v3/ip  
Obtains the instantiation results for the last instantiation request.
- "Client-ID"= <tenant>\_<DeviceName>  
 <tenant>: Your MindSphere-Tenant  
 <DeviceName>: Device name for the SIMATIC RTU3041C, e.g. "RTU\_HowTo".



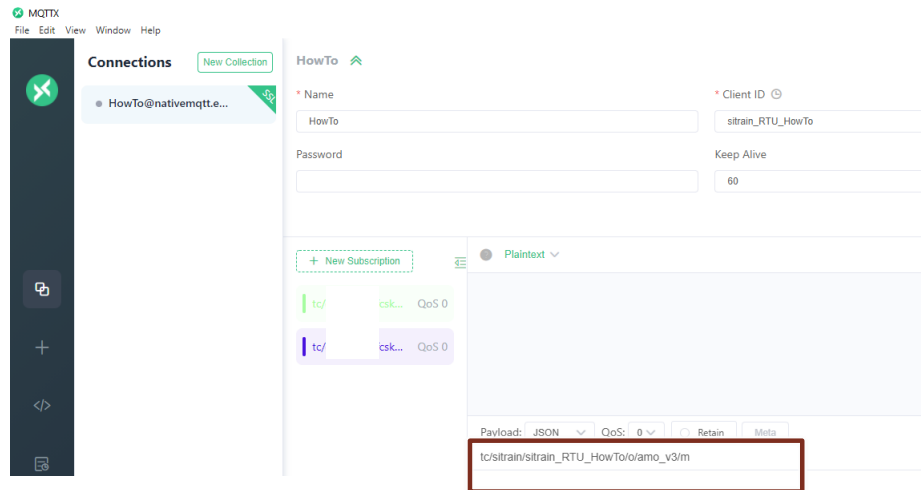
2. Then click on "Confirm".

**Result:**

The two subscriptions were created:



- Enter the topic "tc/<tenant>/<Client-ID>/o/amo\_v3/m" for publishing the data model:
  - <tenant>: Your MindSphere-Tenant
  - <Client-ID>= <tenant>\_<DeviceName>  
 <tenant>: Your MindSphere-Tenant  
 <DeviceName>: Device name for the SIMATIC RTU3041C, e.g. "RTU\_HowTo".

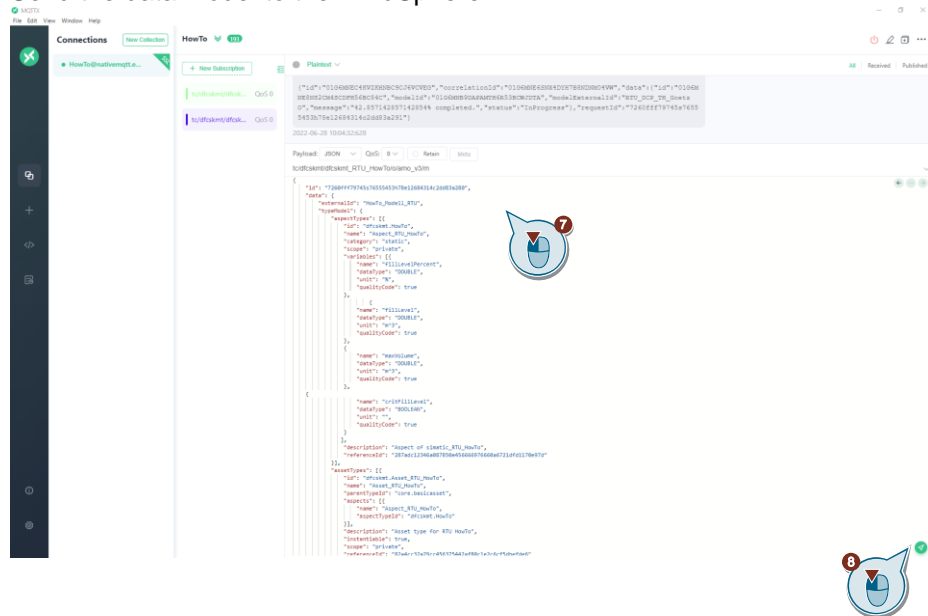


- Open the attached file "109810580\_Datamodel\_Demo.txt" with the data model for this application example.

```
{
  "id": "7260fff79745s76555453h78e12684314c2dd83a280",
  "data": {
    "externalId": "HowTo_Modell_RTU",
    "typeModel": {
      "aspectTypes": [{
        "id": "tenant.HowTo",
        "name": "Aspect_RTU_HowTo",
        "category": "static",
        "scope": "private",
        "variables": [{
          "name": "fillLevelPercent",
          "dataType": "DOUBLE",
          "unit": "%",
          "qualityCode": true
        }],
        "name": "fillLevel",
        "dataType": "DOUBLE",
        "unit": "m^3",
        "qualityCode": true
      }],
        "name": "maxVolume",
        "dataType": "DOUBLE",
        "unit": "m^3",
        "qualityCode": true
      }],
        "name": "critFilllevel",
        "dataType": "BOOLEAN",
        "unit": "",
        "qualityCode": true
      }
    ],
    "description": "Aspect of tenant_RTU_HowTo",
    "referenceId": "287adc12346a887850e456666976668a6721dfd1170e97d"
  }
}
```

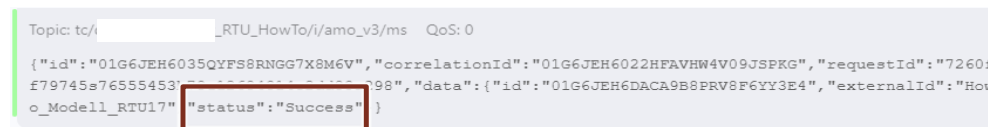
- Adapt the contents of the file to your application (see [Chapter 3.1](#)).
- Copy the content.

7. Paste it into the text input window in the MQTTX client.
8. Send the data model to the MindSphere.



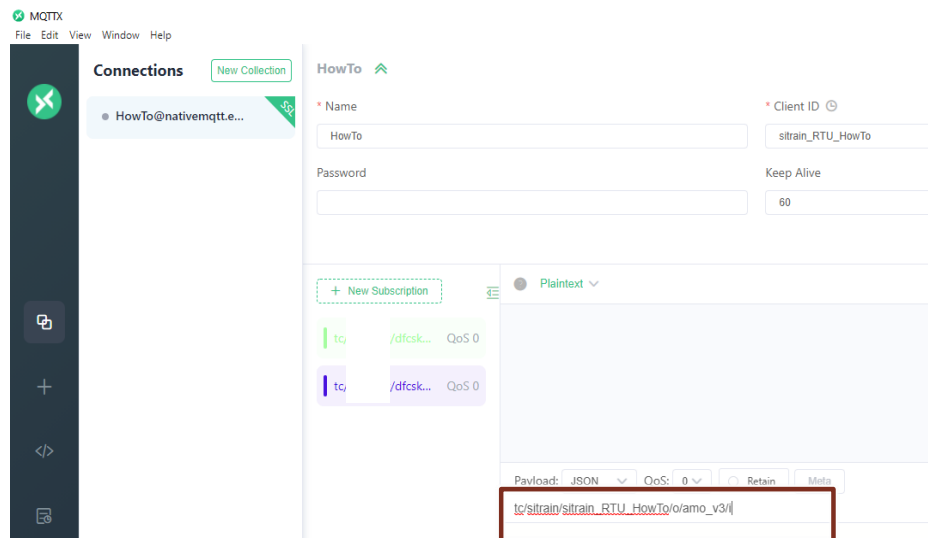
**Result:**

The data model was successfully transferred to MindSphere:



9. Enter the topic "tc/<tenant>/<Client-ID>/o/amo\_v3/i" for the instantiation of the data model:
  - <tenant>: Your MindSphere-Tenant
  - <Client-ID>= <tenant>\_<DeviceName>

<tenant>: Your MindSphere-Tenant  
 <DeviceName>: Device name for the SIMATIC RTU3041C, e.g. "RTU\_HowTo".

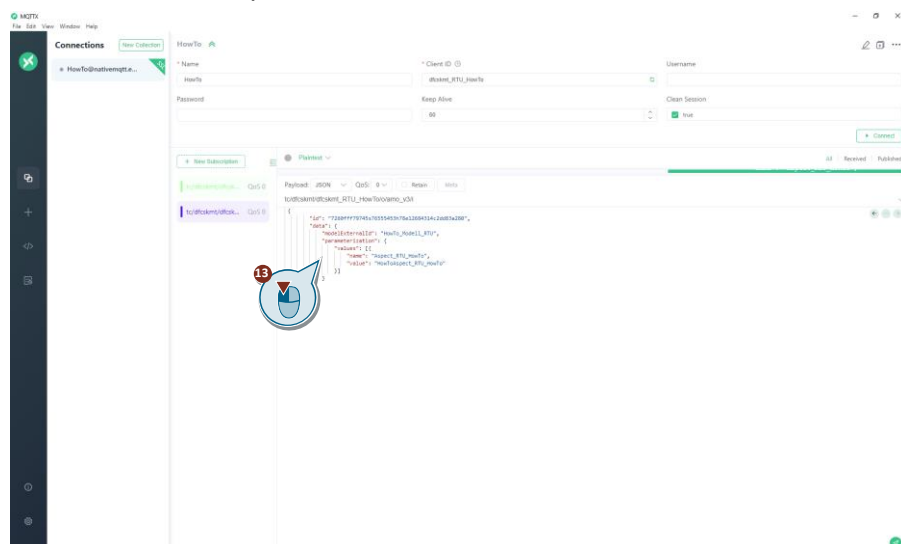


- Open the attached file "109810580\_Instance\_Demo.txt" for the instantiation of the data model for this application example.

```

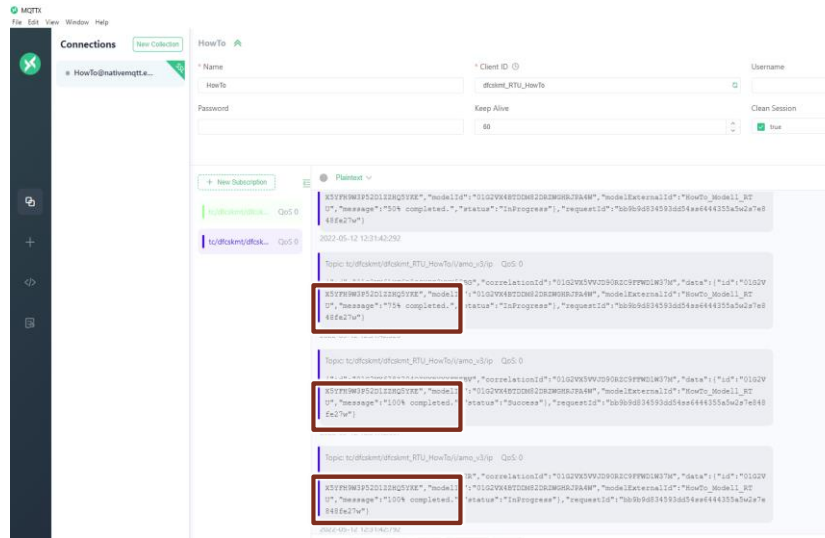
{
  "id": "7260fff79745s76555453h78e12684314c2dd83a280",
  "data": {
    "modelExternalId": "HowTo_Modell_RTU",
    "parameterization": {
      "values": [{
        "name": "Aspect_RTU_HowTo",
        "value": "HowToAspect_RTU_HowTo"
      }]
    }
  }
}
    
```

- Adapt the contents of the file to your application (see [Chapter 3.2](#)).
- Copy the content.
- Paste it into the text input window in the MQTTX client.
- Send it to the MindSphere.

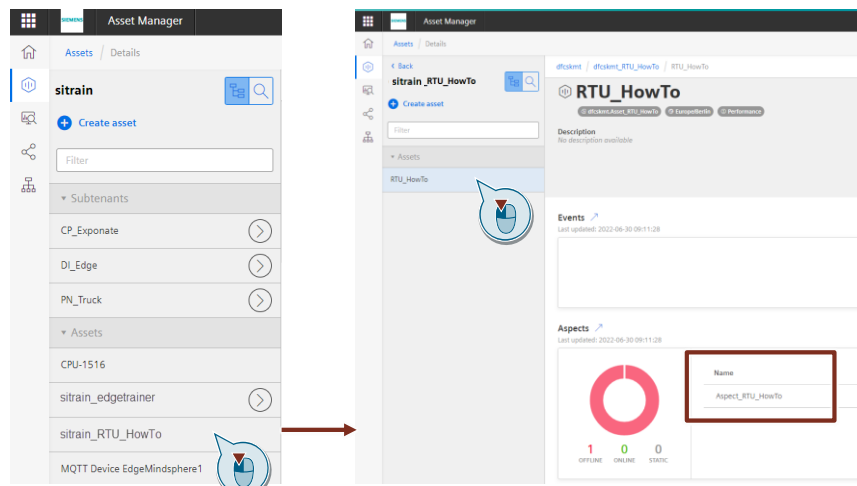


**Result:**

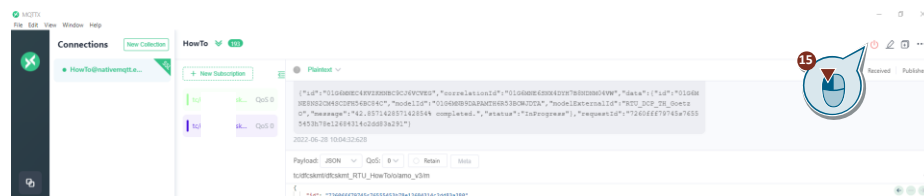
- The data model has been successfully created and instantiated:



- The data model with the asset type "Asset\_RTU\_HowTo" and aspect type "Aspect\_RTU\_HowTo" was created under the newly created asset "Client-ID" in the MindSphere:



**15. Disconnect from MindSphere.**





## 2.2.4 Configure SIMATIC RTU3041C

This chapter shows you all necessary steps to configure the SIMATIC RTU3041C for the application described here:

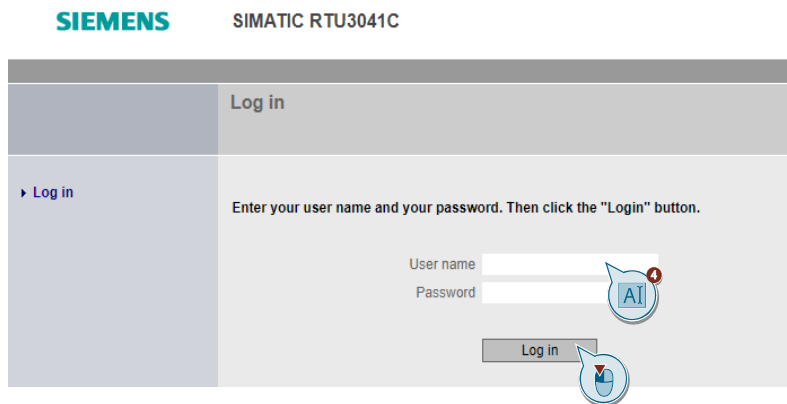
**Note** The supplied project "109810580\_RTU3041C\_MQTT\_PROJ\_V10.zip" contains the finished configuration file ("\*.cfg"), which you can load into your SIMATIC RTU3041C and adapt to your application in just a few steps (see [Chapter 2.2.7](#)).  
This chapter is for information only.

### General configuration

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

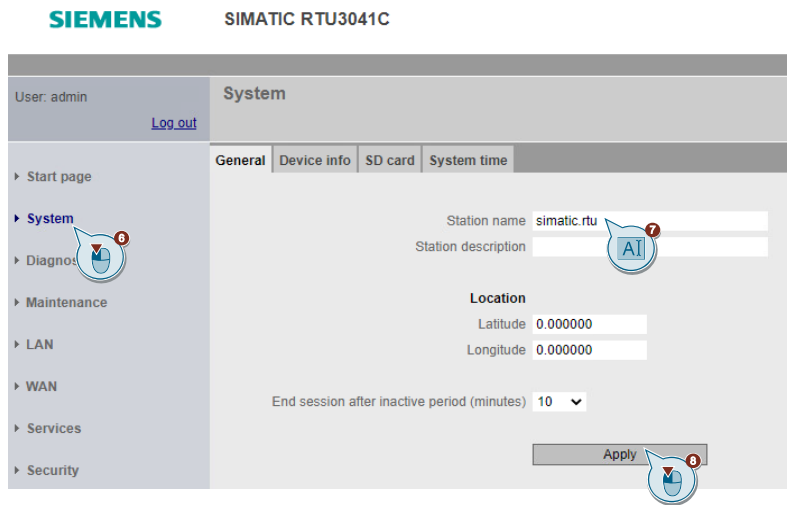
**Note** If you are using multiple RTUs, address conflicts may occur during initial startup because each RTU is assigned the same IP address by default. Therefore, during commissioning, ensure that only one RTU is connected to your network at a time.

2. If necessary, change the IP address of your PG/PC (according to [Table 2-1](#)) so that it and the SIMATIC RTU3041C are in the same subnet.
3. In a browser, open the web server of the RTU3041C at the address "[192.168.0.3](#)".
4. Log in with the username "admin" and the password "admin".

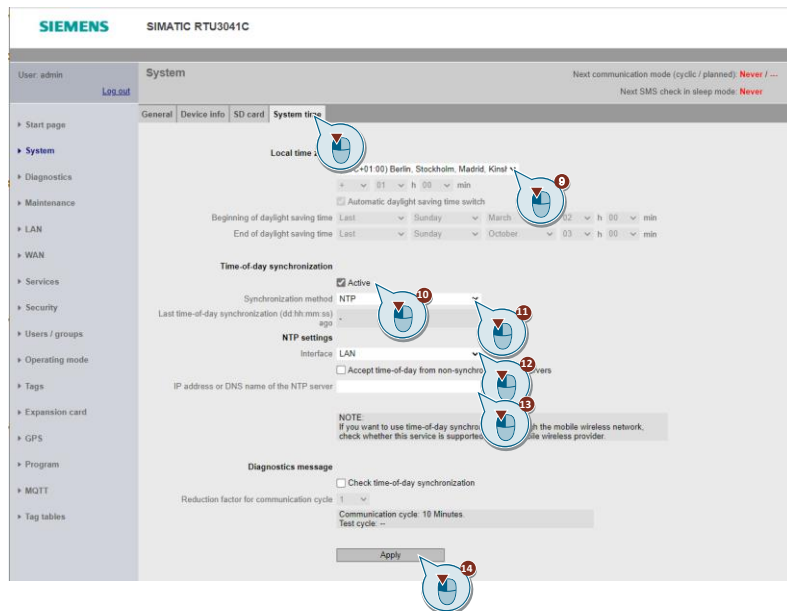


5. Assign a new password.

6. Navigate to the "System" menu.
7. Assign a unique station name.
8. Then click "Apply".



9. Open the System time tab and select your local time zone.
10. Enable "Time-of-day synchronization".
11. Select "NTP" as Synchronization method.
12. Select the interface via which the RTU will be synchronized.
13. Assign the address of the NTP server.
14. 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](http://192.168.0.4)).

### Configure LAN

1. To do this, navigate to the "LAN" menu.
2. Enter an IP address and subnet mask.
3. Then click "Apply".

SIEMENS SIMATIC RTU3041C

User: admin [Log out](#)

LAN

Overview Configuration

Control of the external router in the communication mode

Activate the LAN interface in communication mode

Control of external routers: Signal unused

Lead time before communication mode (s): 0

Monitoring of external routers: Signal unused

IP parameter

Specify IP address manually

IP address: 192.168.0.3

Subnet mask: 255.255.255.0

Specify DNS server addresses manually

Preferred DNS server: 0.0.0.0

Alternative DNS server: 0.0.0.0

Specify default router manually

Default router: 0.0.0.0

DHCP server active

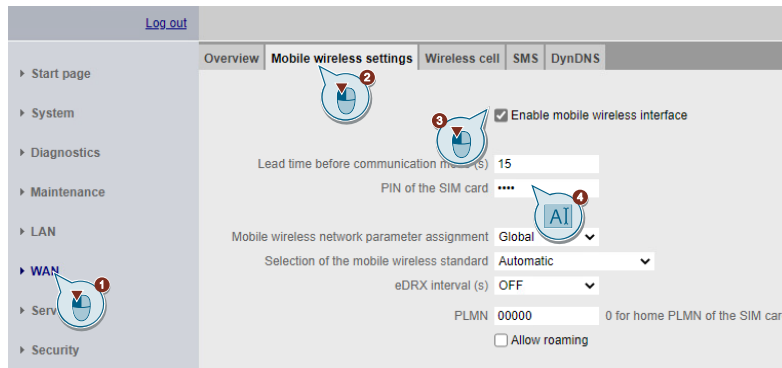
Apply

#### Note

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

### Configure WAN

1. Navigate to the "WAN" menu.
2. Open the Mobile wireless settings tab.
3. Enable the mobile function interface.
4. Enter the PIN of the inserted SIM card.



5. Enable the mobile data service.
6. Enter the APN of your mobile operator. If necessary, enter your username and password.
7. Then click "Apply".



## Configuring operating modes

To save energy, the SIMATIC RTU3041C shall be in sleep mode a large part of the time and switch to an update or communication mode in predefined cycles.

1. Navigate to the "Operating mode" menu.
2. Enter the cycle of the update mode, e.g. "30 seconds" ("30 seconds") for test purposes or "1 hour" ("1 hour") for the application described here.
3. Set the communication mode to "Cyclic" and specify the cycle of the communication mode, e.g. "3 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 SIMATIC RTU3041C dials into the mobile network every 12 hours. If the SIMATIC RTU3041C is to dial into the mobile network more frequently, the power consumption increases.

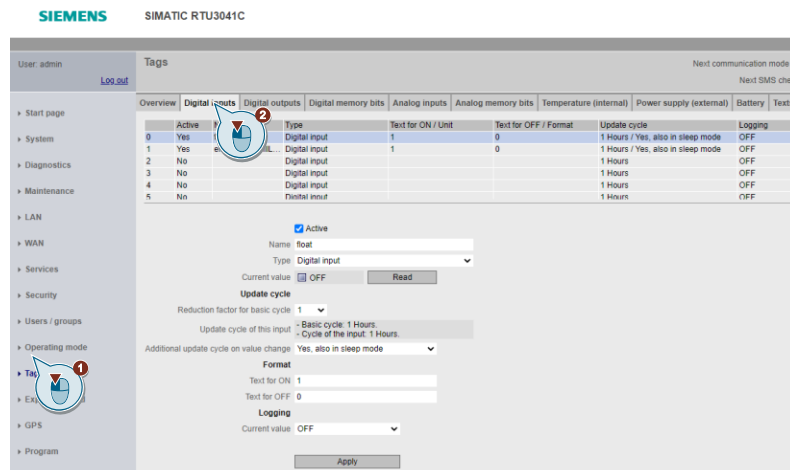
6. Then click "Apply".

## Creating variables for programming in the SIMATIC RTU3041C

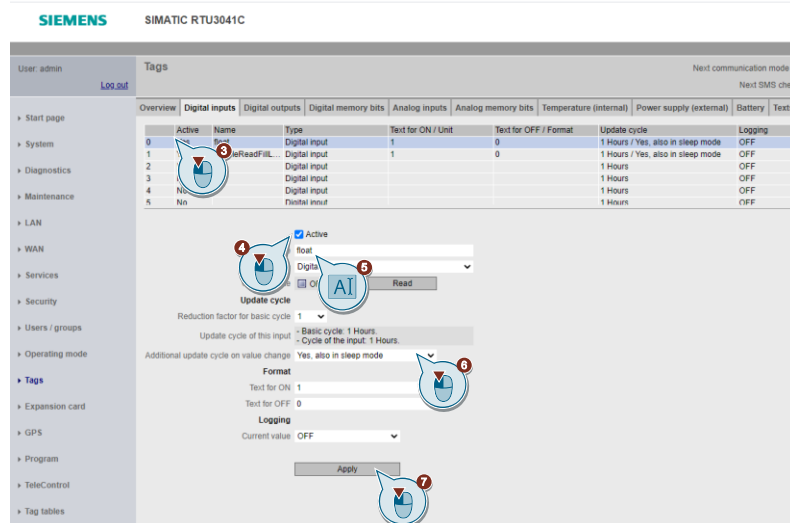
Before you start programming in the RTU, configure the inputs, outputs and flags.

### Digital inputs

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".

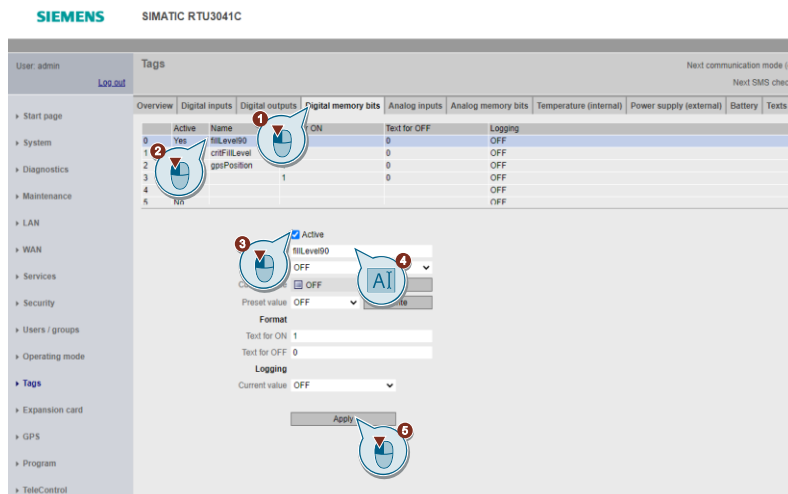


8. Click on input 1.
9. Enable the "Active" checkbox.
10. Assign the name "enableReadFillLevel".
11. Select that an additional update cycle is also performed in sleep mode when the value changes.
12. Then click "Apply".

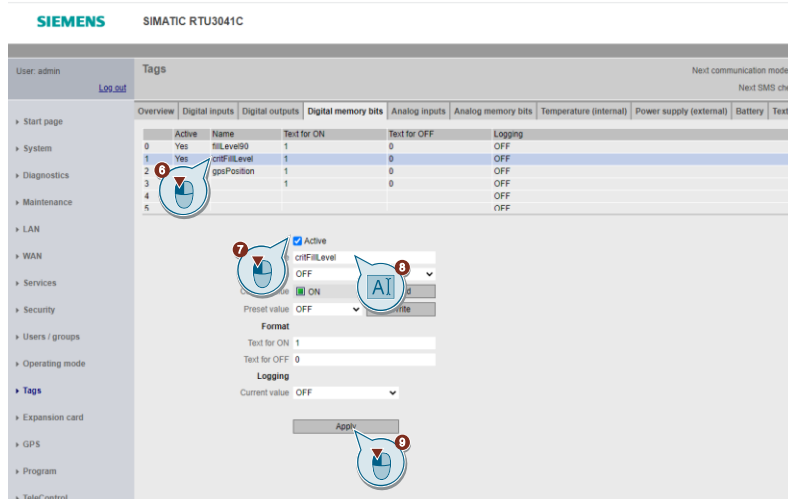


### Digital flags

1. Open the "Digital memory bits" tab.
2. Click on the 0 memory bit.
3. Enable the "Active" checkbox.
4. Assign the name "fillLevel90".
5. Then click "Apply".

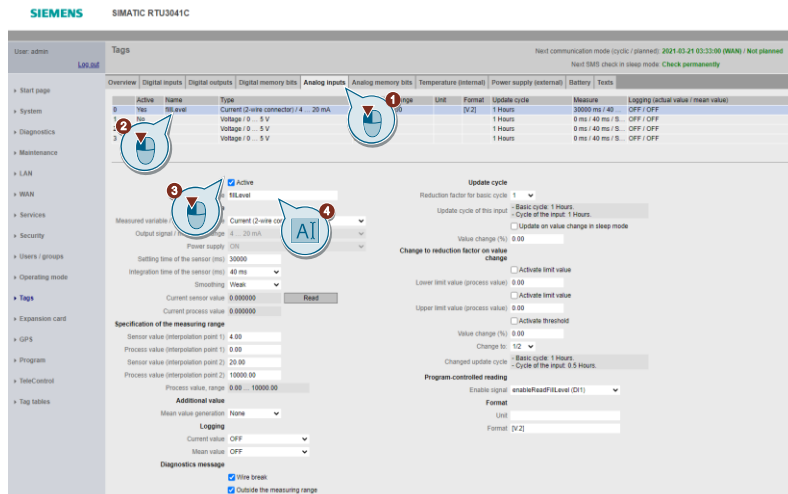


6. Click memory bit 1.
7. Enable the "Active" checkbox.
8. Assign the name "critFillLevel".
9. Then click "Apply".



### Analog inputs

1. Open the "Analog inputs" tab.
2. Click the analog input 0.
3. Enable the "Active" checkbox.
4. Assign the name "fillLevel".

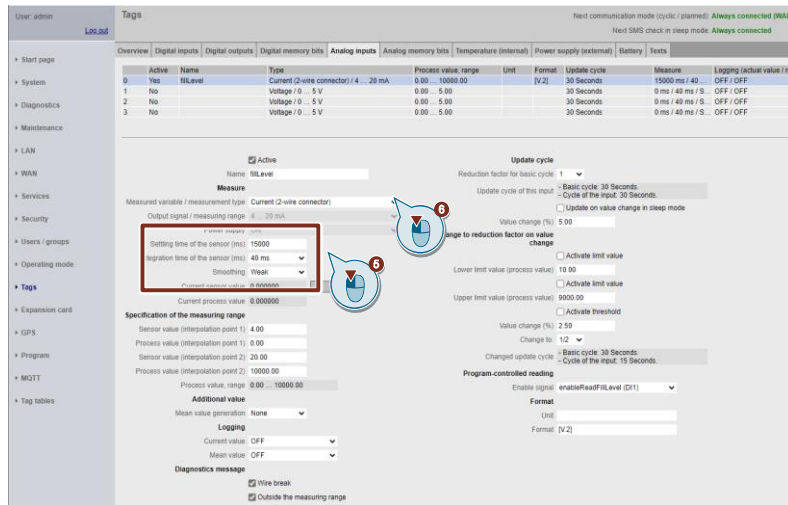




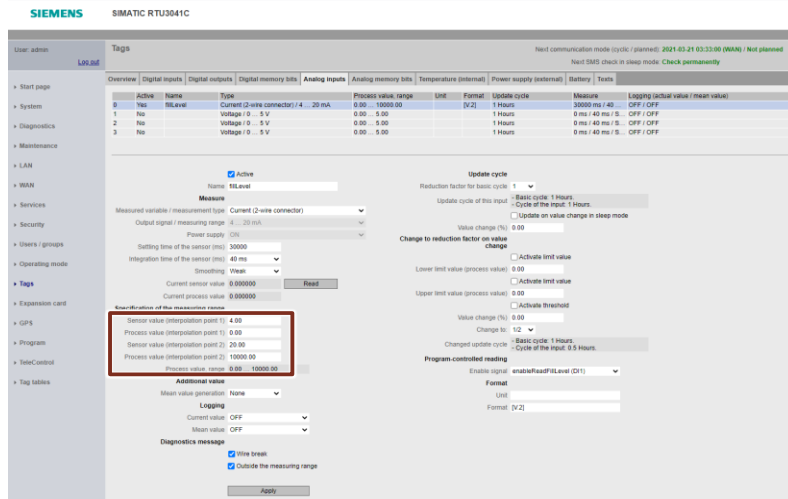
5. Select the measurement type of your analog level sensor. For the SITRANS LR120 sensor you have to set the measuring mode "Current (2-wire connector)".
6. Enter the settling and integration time as well as the smoothing of the signal of your sensor. The following settings are recommended for the SITRANS LR120 sensor:
  - Settling time: 15.000 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.



7. 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.

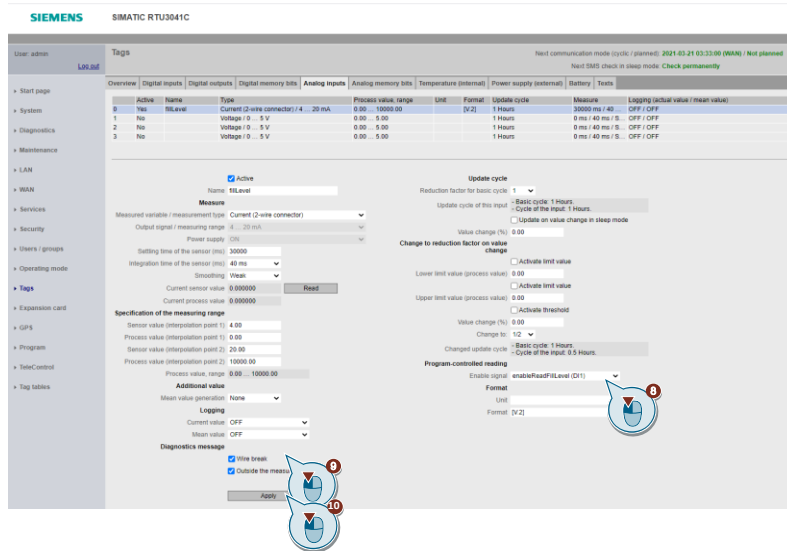


- Select the digital input "enableReadFillLevel (D11)" as the "enable signal".

**Note**

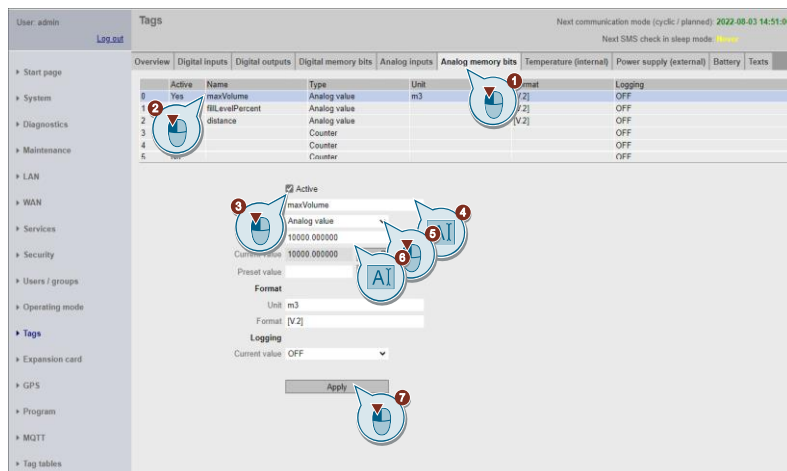
With this setting, the analog input "fillLevel" is only activated and read if the digital input "enableReadFillLevel" is activated. This can significantly reduce power consumption.

- Enable the "Diagnostics messages" to diagnose the errors.
- Then click "Apply".

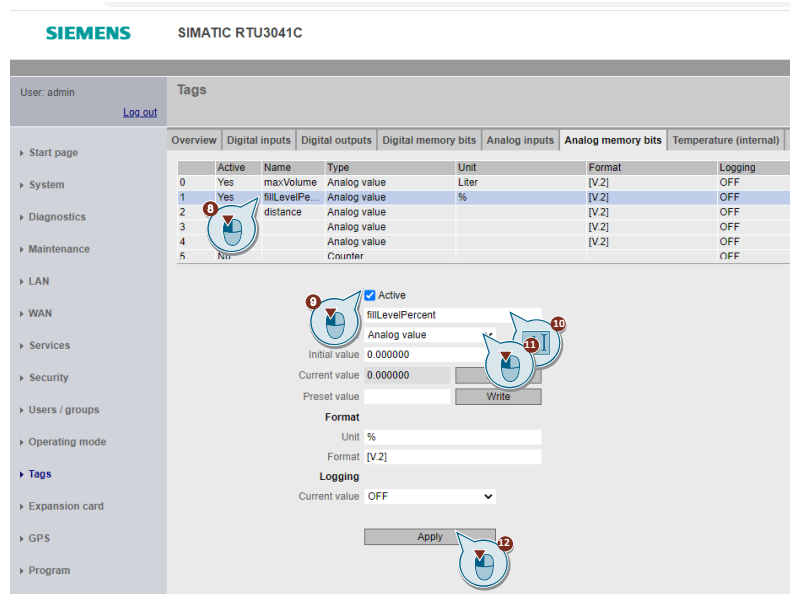


**Analog flag**

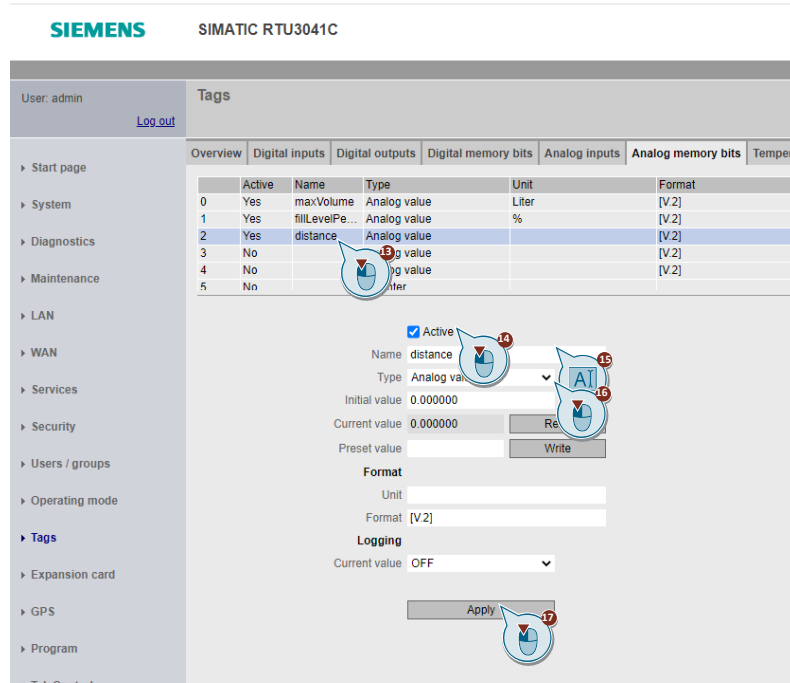
- Open the "Analog memory bits" tab.
- Click the analog memory bit 0.
- Enable the "Active" checkbox.
- Assign the name "maxVolume".
- Select the type "Analog value".
- Enter the maximum fill level of the rainwater overflow tank in cubic meters (m<sup>3</sup>) as the initial value.
- Then click "Apply".



8. Click the analog memory bit 1.
9. Enable the "Active" checkbox.
10. Assign the name "fillLevelPercent".
11. Select the type "Analog value".
12. Then click "Apply".



13. Click on the analog memory bit 2.
14. Enable the "Active" checkbox.
15. Assign the name "distance".
16. Select the type "Analog value".
17. Then click "Apply".

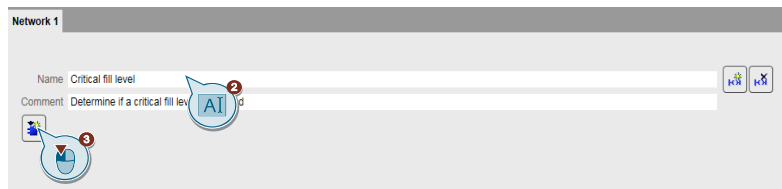


### Creating a program in the SIMATIC RTU3041C

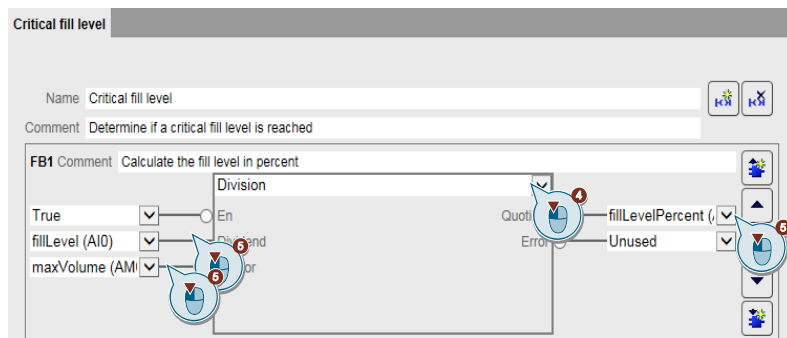
To enable the SIMATIC RTU3041C to react appropriately to events, you must create a program. Programming is comparable to "FBD" in the TIA Portal.

#### Program comparison of the current level with a critical value

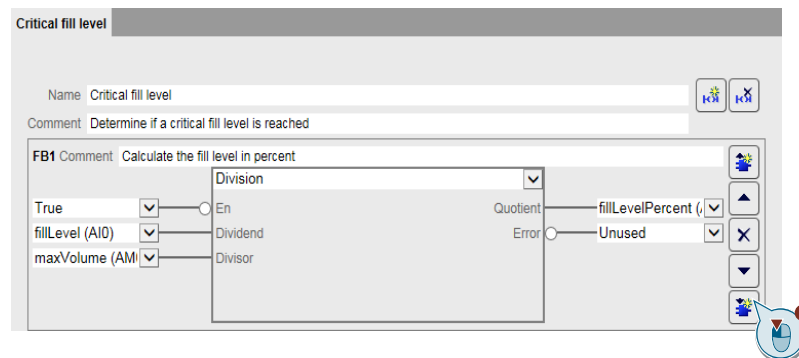
1. Navigate to the "Program" menu.
2. Assign the name "Critical fill level" to the network.
3. Add a new function block (FB1).



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



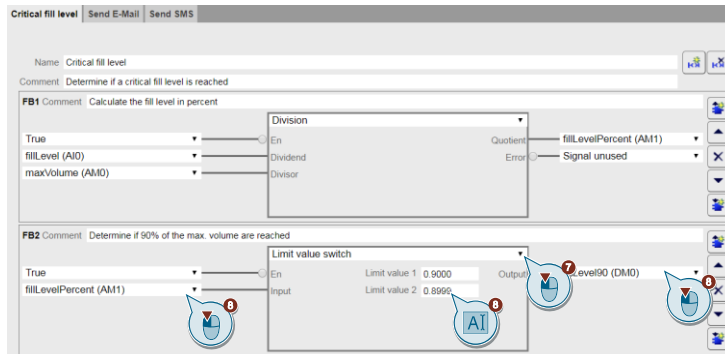
6. Add a new function block (FB2) below it.



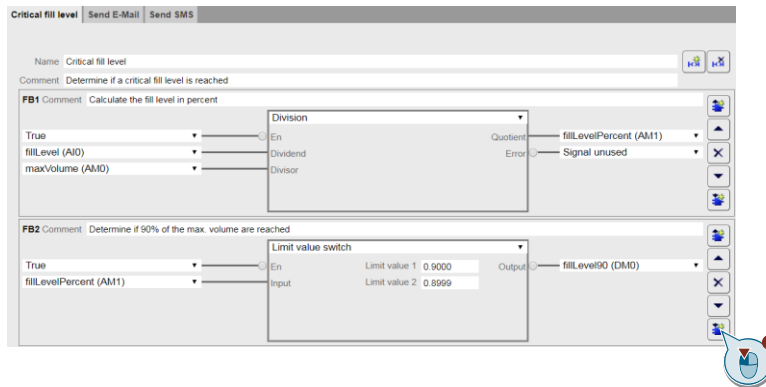
7. Select "Limit value switch" as the function.

8. Interconnect the parameters as follows:

- Input: fillLevelPercent (AM1)
- Output: fillLevel90 (DM0)
- Limit value 1: 0.9000
- Limit value 2: 0.8999



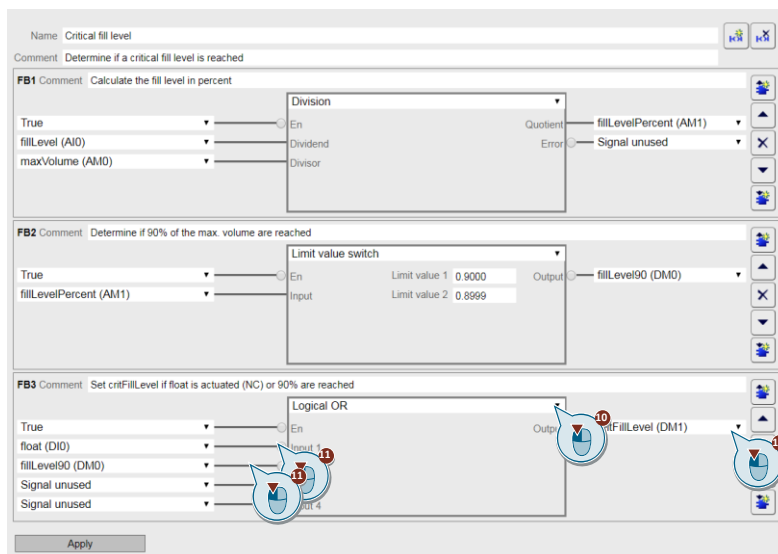
9. Add a new function block (FB3) below.



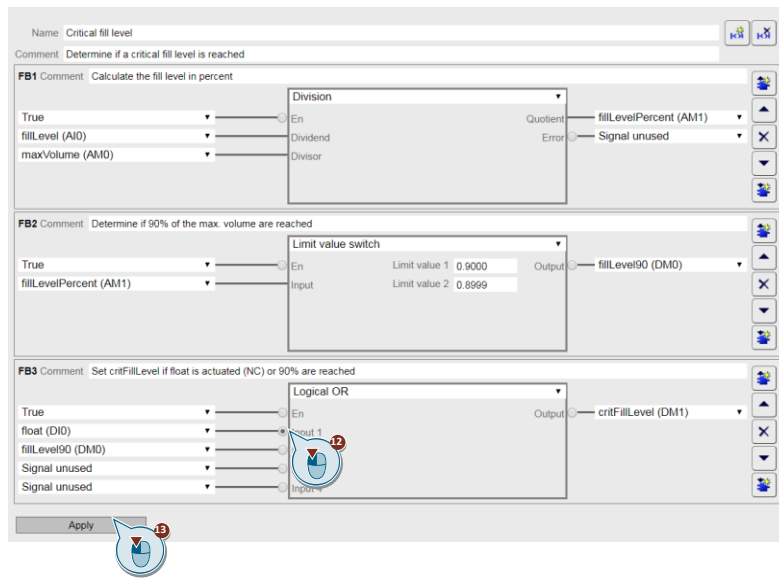
10. Select "Logical OR" as the function.

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".

## Setting up the connection between the MQTT broker and the SIMATIC RTU3041C

To connect the SIMATIC RTU3041C to MindSphere, proceed as follows:

1. Navigate to the "MQTT" menu.
2. Open the "MQTT Broker" tab.
3. Enter the address of the broker "mindconnectmqtt.eu1.mindsphere.io".
4. Select "WAN" as the interface.
5. Enter the port number "8883".
6. Enter the Client-ID:

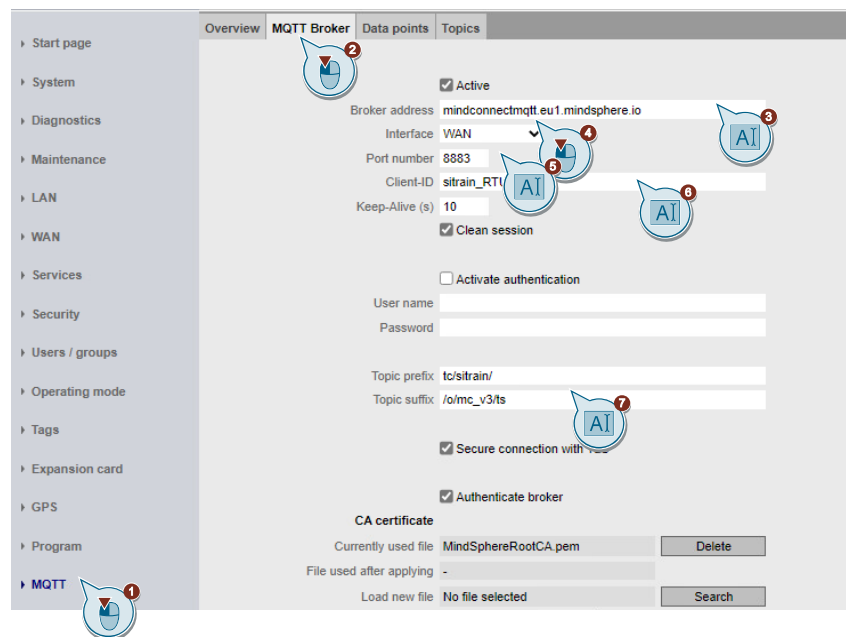
"Client-ID"= <tenant>\_<DeviceName>

- <tenant>: Your MindSphere-Tenant
- <DeviceName>: Device name for the SIMATIC RTU3041C, e.g. "RTU\_HowTo".

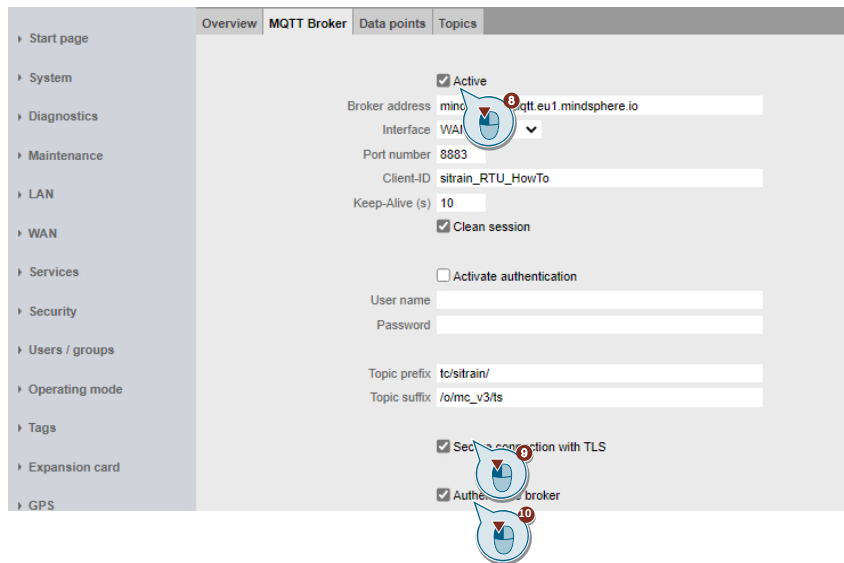
### Note

These values must match the configuration of the SIMATIC RTU3041C (see [Chapter 2.2.3](#))

7. Enter the topic prefix "tc/<tenant>/" and suffix "/o/mc\_v3/ts".  
<tenant>: Your MindSphere-Tenant

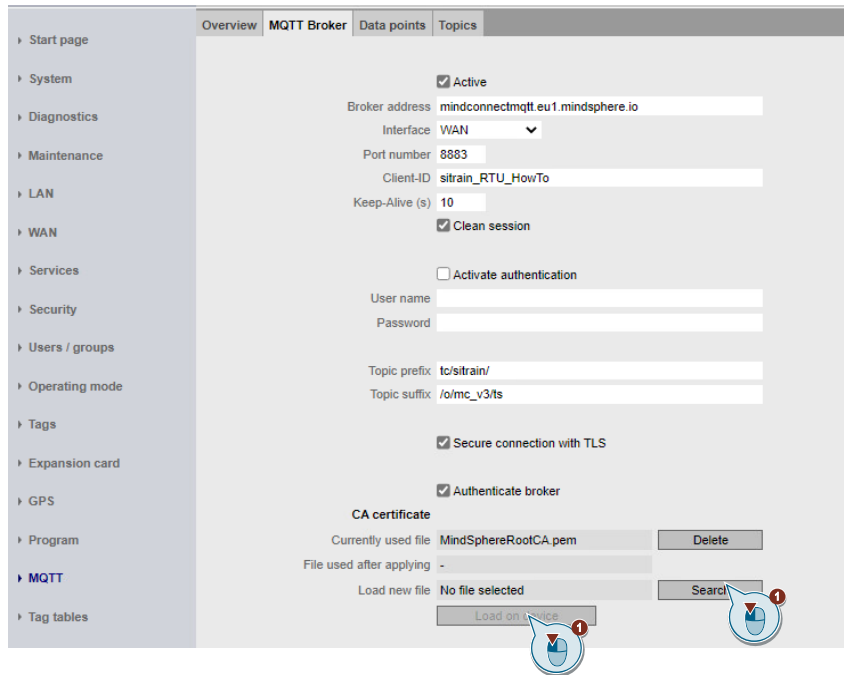


8. Enable MQTT.
9. Enable the connection with TLS.
10. Activate the authentication of the broker.



### Load certificates

1. Upload the broker certificate to the RTU that you downloaded from Mindsphere ([Broker certificate](#)).





2. Activate the authentication of the RTU.
3. Upload the client certificate and key ([Client certificate/key](#)).
4. Then click "Apply".

The screenshot displays the 'MQTT Broker' configuration page. The left sidebar shows a navigation menu with 'MQTT' selected. The main content area is divided into sections for general settings, authentication, and certificate/key management.

**General Settings:**

- Active
- Broker address: mindconnectmqtt.eu1.mindsphere.io
- Interface: WAN
- Port number: 8883
- Client-ID: sitrain\_RTU\_HowTo
- Keep-Alive (s): 10
- Clean session

**Authentication:**

- Activate authentication
- User name: [empty]
- Password: [empty]
- Topic prefix: tc/sitrain/
- Topic suffix: /o/mc\_v3/its
- Secure connection with TLS
- Authenticate broker

**CA certificate:**

- Currently used file: MindSphereRootCA.pem [Delete]
- File used after applying: -
- Load new file: No file selected [Search]
- [Load on device]

**Own certificate:**

- Authenticate RTU
- Currently used file: RTU\_...no.pem [Delete]
- File used after applying: -
- Load new file: No file selected [Search]
- [Load on device]

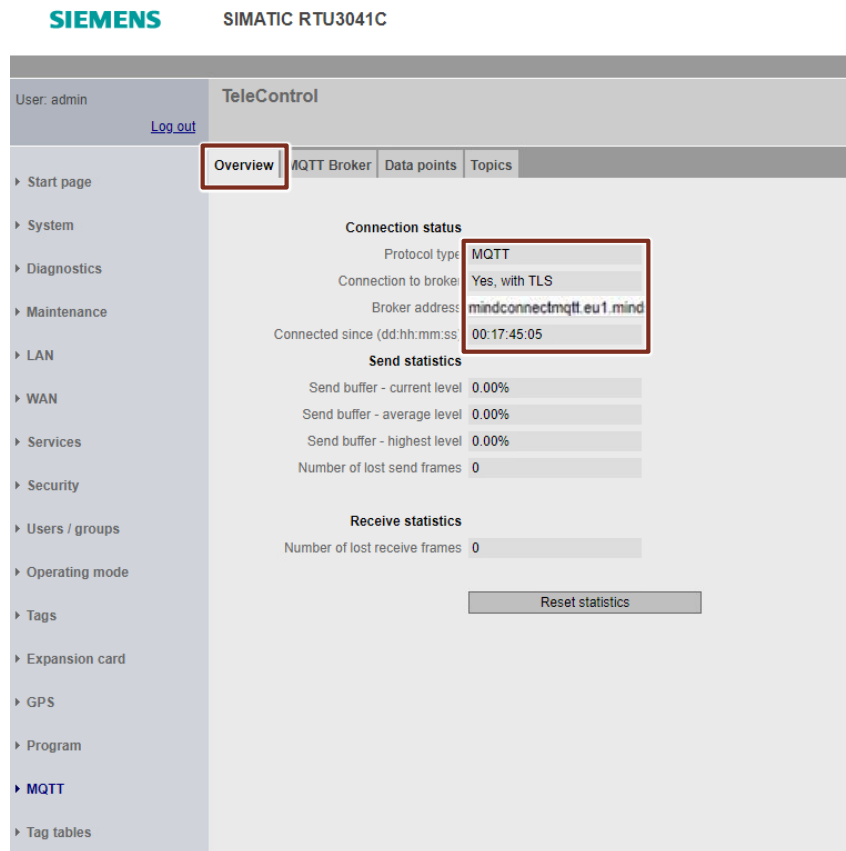
**Own key:**

- Currently used file: RTU\_HowTo.key [Delete]
- File used after applying: -
- Load new file: No file selected [Search]
- [Load on device]

[Apply]

**Result:**

The SIMATIC RTU3041C connects securely to the MindSphere MQTT broker.



5. Open the Data points tab.

**Note**

In the "Data points" tab, all projected variables are mapped as data points and grouped according to variable types.

6. Select the "Publish" transfer type for the data points to be transferred to MindSphere.

**Note**

Up to 8 publish topics can be assigned to the data point. The value triggers or topic triggers are used to store the assigned topics in the send buffer in chronological order.

7. Then click "Apply".

SIEMENS SIMATIC RTU3041C

2022-06-19 09:06:44 English

User: admin TeleControl Next communication mode (cyclic / planned): Always connected (WAN) / ... Number of active sessions: 1

Next SMS check in sleep mode: Always connected

Overview | MQTT Broker | Data points | Topics

Name	Data point type	Type of transfer	Value trigger	Threshold (%)	Threshold (acc.)	Transfer mode
<b>Digital inputs</b>						
STATUS_ERROR	BOOL	Only internal use	Change	--	--	Cyclic
<b>Read (DI)</b>						
enableReadFilLevel (DI1)	BOOL	Publish	0 trigger	--	--	Change immediately to comm
FilLevel90 (DM0)	BOOL	Only internal use	range	--	--	Cyclic
chFilLevel (DM1)	BOOL	Publish	0 trigger	--	--	Change immediately to comm
<b>Analog inputs</b>						
FilLevel (AM0)	SINGLE_FLOAT	Publish	0 trigger	1.00	100.00	Change immediately to comm
maxVolume (AM0)	SINGLE_FLOAT	Publish	0 trigger	--	0.00	Change immediately to comm
FilLevelPercent (AM1)	SINGLE_FLOAT	Publish	0 trigger	--	0.00	Change immediately to comm
FilLevelPercent100 (AM2)	SINGLE_FLOAT	Publish	0 trigger	--	0.00	Change immediately to comm
<b>Counter inputs</b>						
STATUS_NEXT_COM_CYCLE	UINT32	Only internal use	change	--	--	Cyclic
MOB_SIG_QUAL	UINT32	Only internal use	change	--	--	Cyclic
MOB_CELL_ID	UINT32	Only internal use	change	--	--	Cyclic
MOB_TX_RX	UINT32	Only internal use	change	--	--	Cyclic
MOB_RX_RX	UINT32	Only internal use	change	--	--	Cyclic
BAT_RES_CHARGE	UINT32	Only internal use	change	--	--	Cyclic
<b>Digital outputs</b>						
FilLevel90 (DM0)	BOOL	Only internal use	--	--	--	Cyclic
chFilLevel (DM1)	BOOL	Only internal use	--	--	--	Cyclic
<b>Analog outputs</b>						
maxVolume (AM0)	SINGLE_FLOAT	Only internal use	--	--	--	Cyclic
FilLevelPercent (AM1)	SINGLE_FLOAT	Only internal use	--	--	--	Cyclic
FilLevelPercent100 (AM2)	SINGLE_FLOAT	Only internal use	--	--	--	Cyclic
FilLevelDiv (AM3)	SINGLE_FLOAT	Only internal use	--	--	--	Cyclic

Apply



## Configure topics

1. Open the Topics tab.

In the "Topics" tab, you configure the topics that the RTU is to use for MQTT communication.

### Note

You can define max. 32 topics. A data point can be assigned to a maximum of 8 topics.

The table lists all 32 possible topics with their current settings.

By clicking on a line you can change the settings of the respective topic.

2. By clicking on a line you can change the settings of the respective topic.

Structure of the topic name: [Topic-Präfix, -Suffix](#).

3. Activate the data points that are to be transferred to MindSphere.

4. Use the time trigger with time factor "1".

The data is transferred to the MindSphere every 10 seconds.

5. Select the format of the user data to be transferred "MindSphere generic" ("MindSphere generic").

6. Then click "Apply".

Active	Topic	Type	Quality	Trigger	Number of DPs	Format
1 Yes	strain_RTU_HowTo	Publish	QoS1	Scan Cycle	4	MindSphere generic
2 No		Publish	QoS1	DP-Trigger	0	JSON generic
3 No		Publish	QoS1	DP-Trigger	0	JSON generic
4 No		Publish	QoS1	DP-Trigger	0	JSON generic
5 No		Publish	QoS1	DP-Trigger	0	JSON generic
6 No		Broadcast	Pub-1	Pub-Trigger	8	JSON generic

Configuration for the selected topic:

- Active:
- Topic: strain\_RTU\_HowTo
- Quality: Publish
- Trigger: Scan Cycle
- Format: MindSphere generic
- Time factor: 1
- Apply:

## 2.2.5 Configure SITRANS LR120

### Requirements

In this application example, the SITRANS LR120 is connected to terminal blocks X40 and X41 of the SIMATIC RTU3041C.

To configure the SITRANS LR120 or for test purposes, the device must be permanently powered:

1. The output voltage in the SIMATIC RTU3041C must be assigned with 24 V.

SIEMENS SIMATIC RTU3041C

User: admin [Log out](#)

Operating mode

Operating modes | Logging | Power supply | Battery lifetime

Start page

System

Diagnostics

Maintenance

LAN

WAN

Services

Security

Users / groups

**Operating mode**

Tags

Expansion card

GPS

Program

MQTT

Tag tables

External power supply  Connected

Battery module 1

Connected

Expansion module 1 connected

Expansion module 2 connected

Battery status --

Connect battery

Disconnect battery

Battery module 2

Connected

Expansion module 1 connected

Expansion module 2 connected

Battery status --

Connect battery

Disconnect battery

Battery switchover

Use the preset value

Switchover threshold 80 % of the battery rated voltage

Control outputs

Output voltage 24V

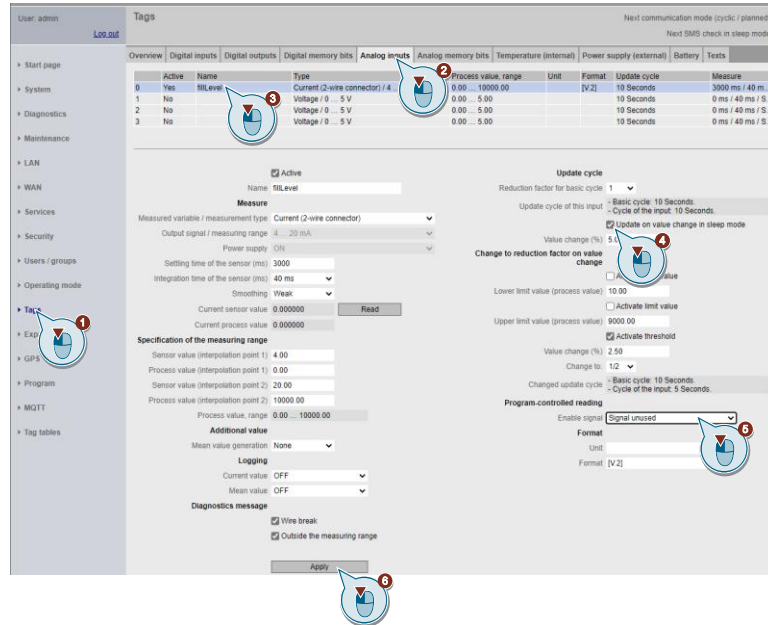
Supply X10 with battery if external voltage fails.

Supply X10 with battery if external voltage fails.

Supply X11 with voltage in update mode

X11 - Lead time before update cycle 500

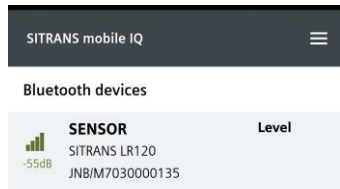
2. The analog input AI0 must also be read during sleep mode if the value at the input changes
  - Enable "Update on value change in sleep mode"
  - "Enable signal" unused - The analog signal is read in with each update cycle.



**Configuration**

To configure the SITRANS LR120, proceed as follows:

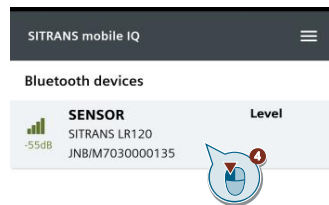
1. Download the SITRANS mobile IQ app from the App Store to your mobile device and install the app.
2. Enable Bluetooth and location information on your mobile device.
3. Launch the app.



**Result:**

The devices within range appear.

4. Click on the device you want to connect to.

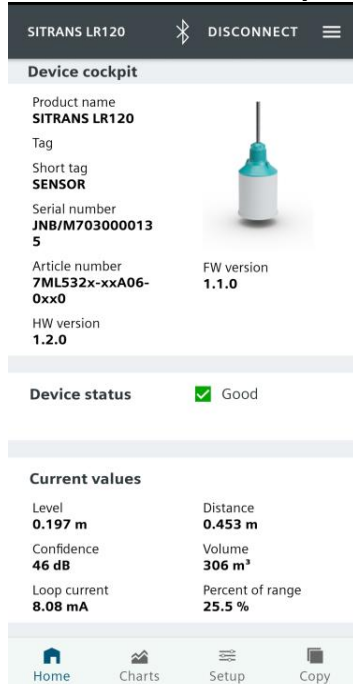


5. Enter the PIN code.



**Note**

The PIN code was delivered with the device.

After successful PIN entry, the information about the device is displayed.



6. Go to Setup > Quick commissioning to configure the SITRANS LR120 for your application type.

SITRANS LR120  DISCONNECT 

**Device cockpit**

Product name  
**SITRANS LR120**

Tag

Short tag  
**SENSOR**


Serial number  
**JNB/M703000013**


**5**

Article number  
**7ML532x-xxA06-0xx0**

FW version  
**1.1.0**






HW version  
**1.2.0**



**Device status**  Good

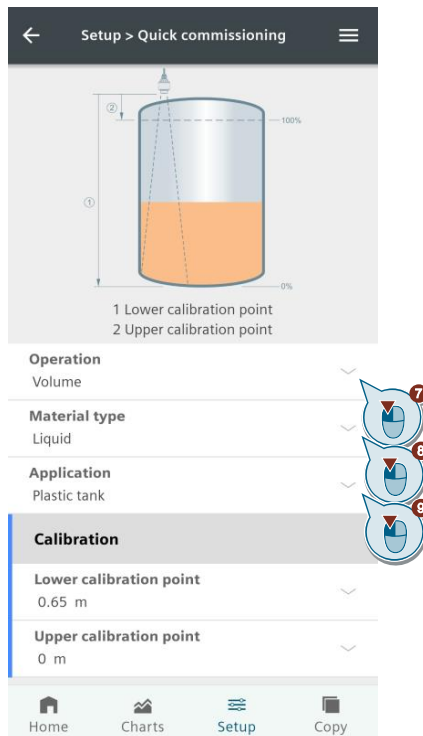
**Current values**

Level <b>0.197 m</b>	Distance <b>0.453 m</b>
Confidence <b>46 dB</b>	Volume <b>306 m³</b>
Loop current <b>8.08 mA</b>	Percent of range <b>25.5 %</b>

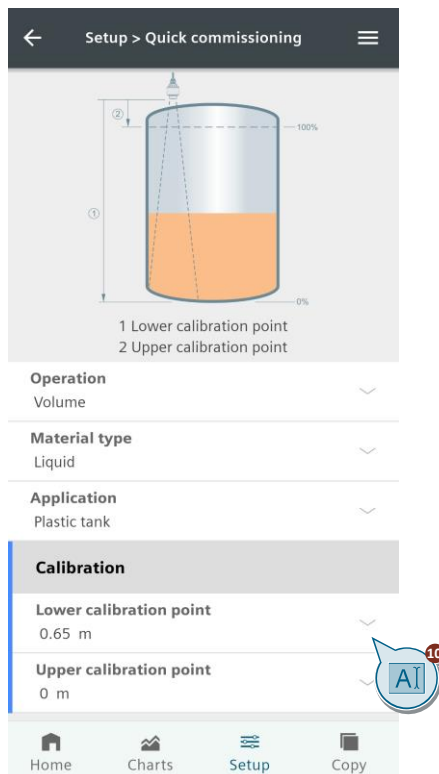
 Home  Charts  Setup  Copy 



7. Select "Volume" as the operation.
8. Select "Liquid" as the material type.
9. Select "Plastic tank" as the application.

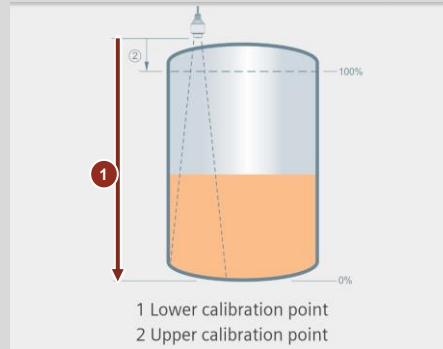


10. Enter the lower calibration point (0-60 m).

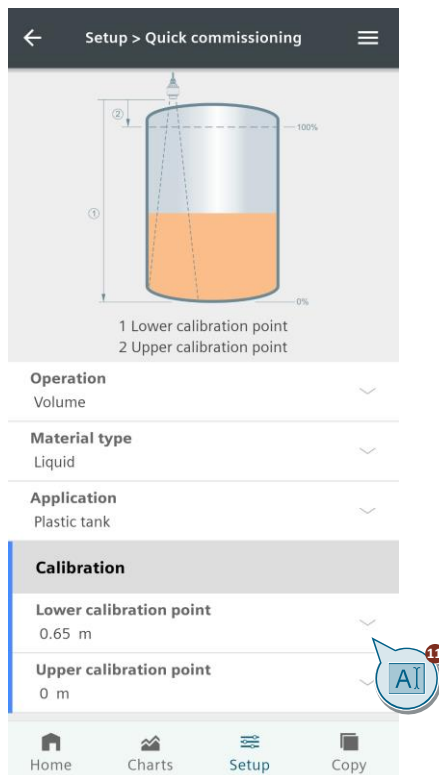


Note

Sets the distance from the sensor reference point to the lower calibration point. Mostly corresponds to the zero point of the process.

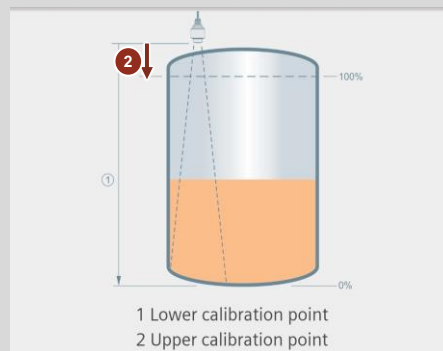


11. Enter the upper calibration point (e.g. :0 m).

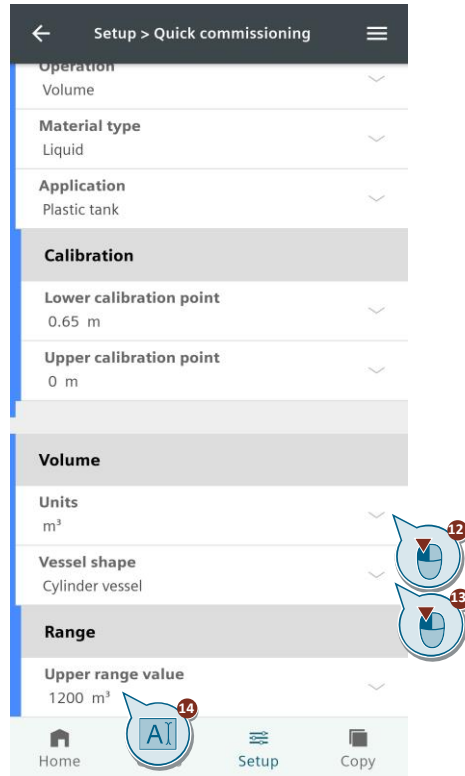


Note

Sets the distance from the sensor reference point to the upper calibration point. Usually corresponds to the full level.



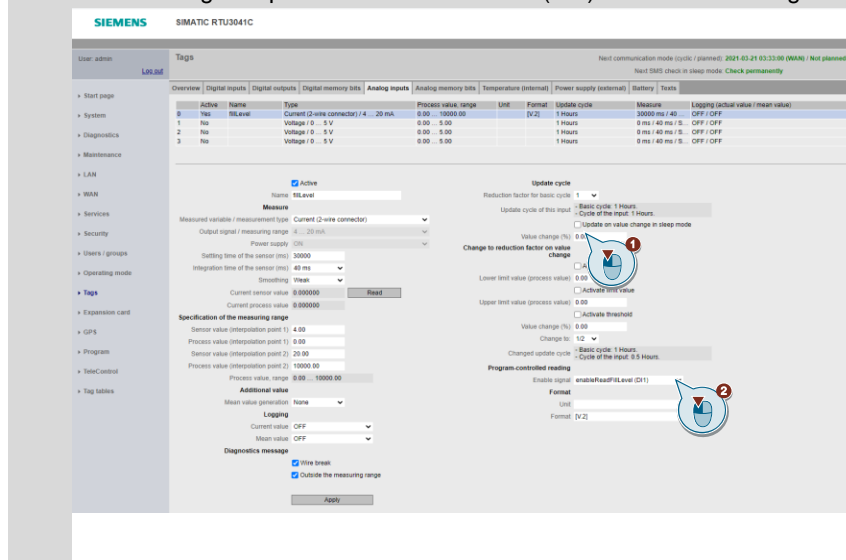
12. Select "m3" as the unit.
13. Select "Cylinder container" as the container shape.
14. Enter as measuring end the initial value of the variable "maxVolume", which you have defined in the RTU project engineering (see [Chapter 2.2.4](#)).



After the configuration of the SITRANS LR120

- disable "Update on value change in sleep mode"
- select the digital input "enableReadFillLevel (DI1)" as the "enable signal".

**Note**



## 2.2.6 Project SITRANS store IQ

### Requirements

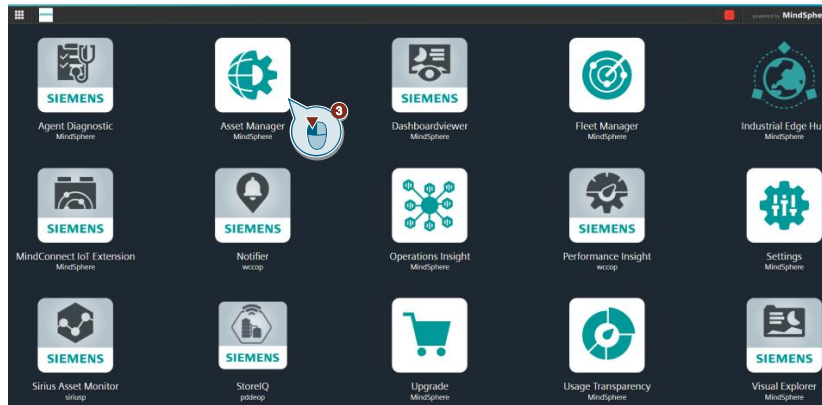
- You have purchased MindSphere SITRANS store IQ  
MindSphere Store:  
<https://www.dex.siemens.com/mindsphere/step-4-book-apps-and-extras/sitrans-store-iq-entry-package>
- You have set up SITRANS store IQ in MindSphere.

### Note

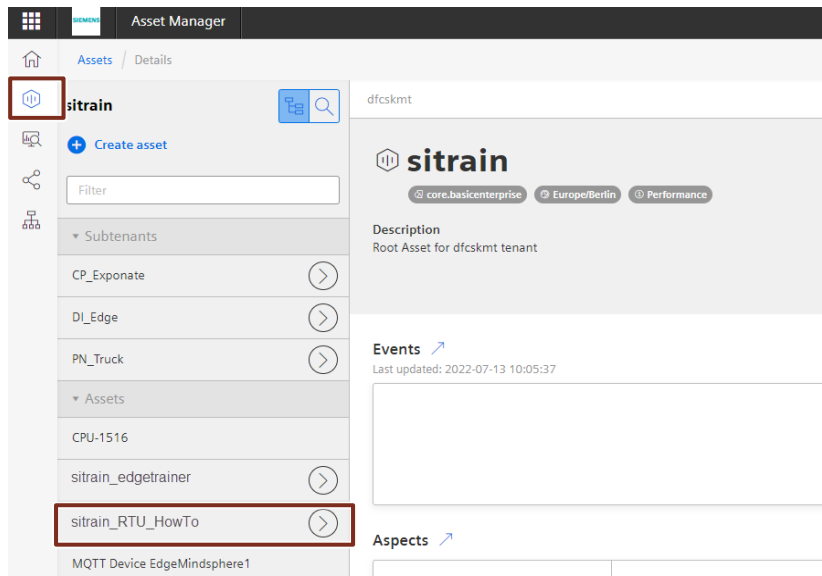
To deploy and set up SITRANS store IQ in your MindSphere tenant, contact the DevOps for the product:

[de-l.operations.us@siemens.com](mailto:de-l.operations.us@siemens.com)

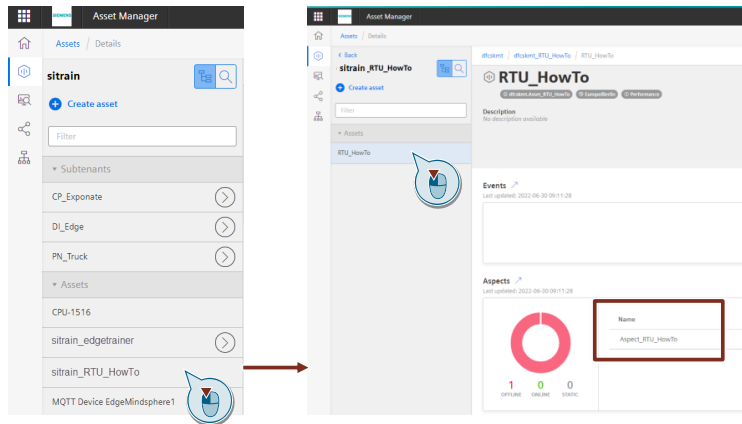
1. Open the login page to your MindSphere tenant in your internet browser.
2. Enter your username and password and log in.
3. Start MindSphere "Asset Manager".



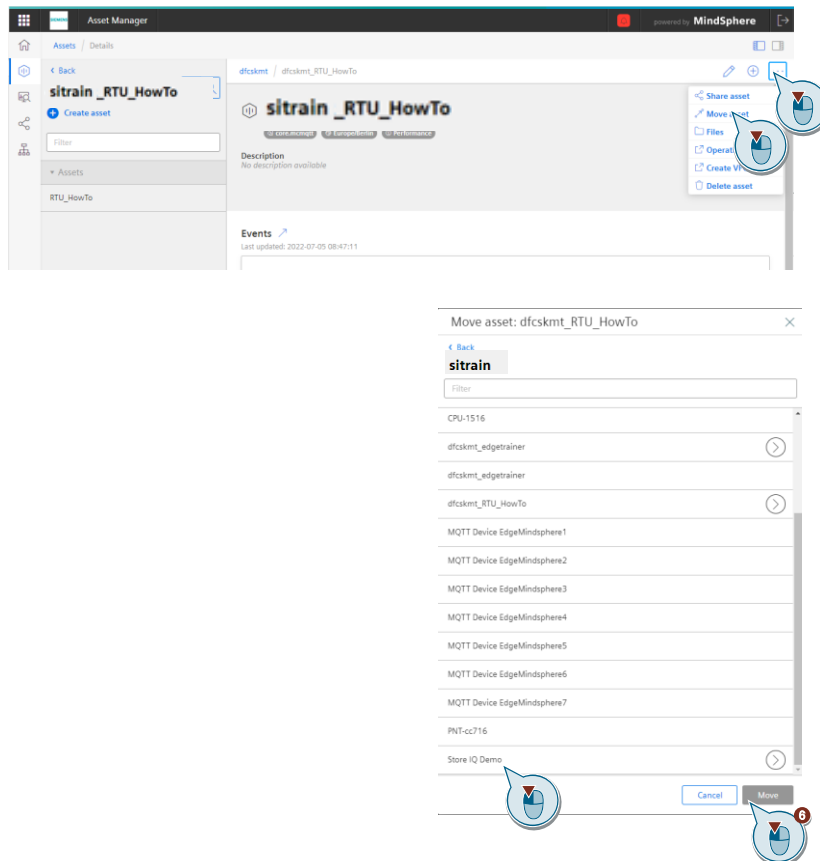
4. Navigate to your newly created asset "Client-ID" ("tenant\_RTU\_How\_To") (see [Chapter 2.2.3](#)).



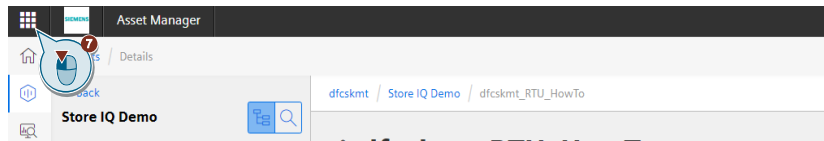
5. Navigate to the child assets.



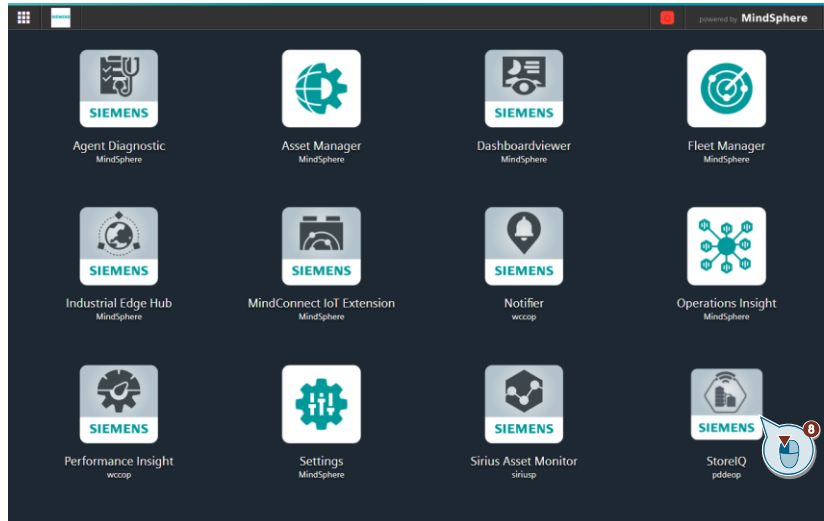
6. Move the child asset with the data model (see [Chapter 2.2.3](#)) to the asset that has access to the SITRANS store IQ.



7. Switch to the MindSphere main menu.

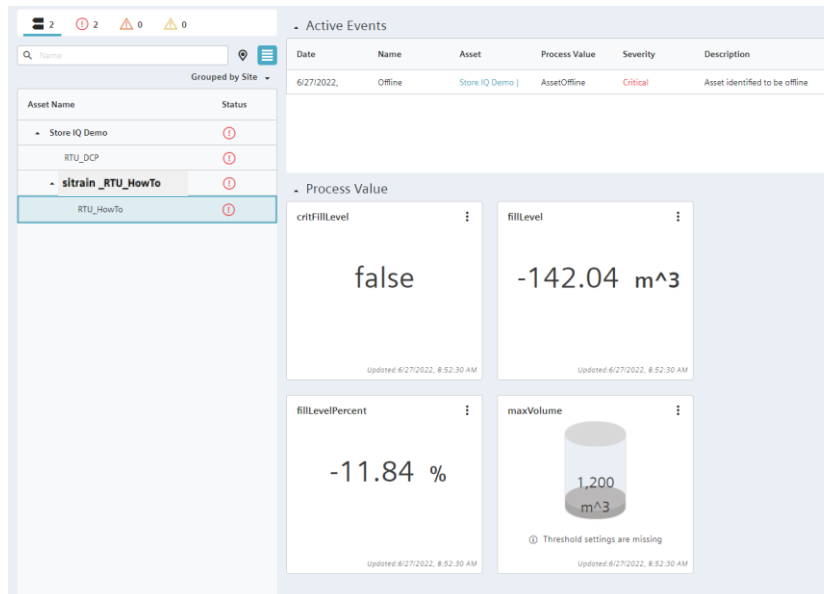


8. Start MindSphere SITRANS store IQ.



**Result:**

The data is read out via SITRANS store IQ.



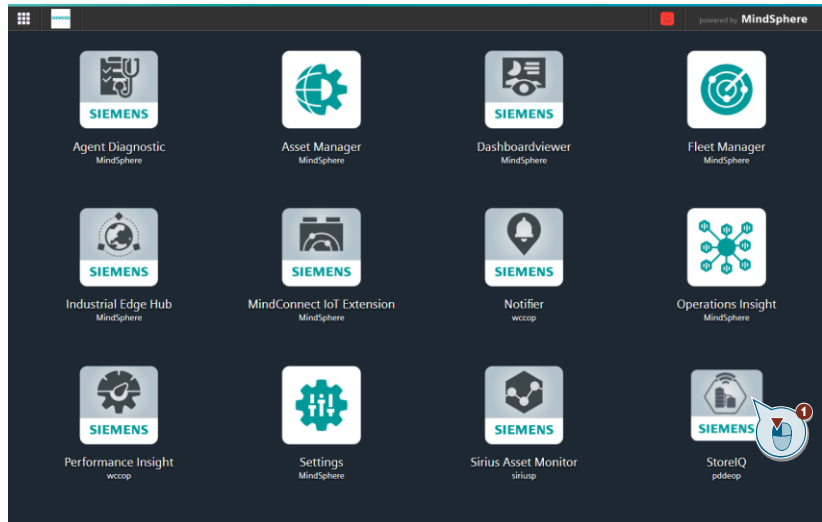
### Configure alarm

When a critical level is exceeded or undershot, an E-mail sent to a defined recipient via SITRANS store IQ.

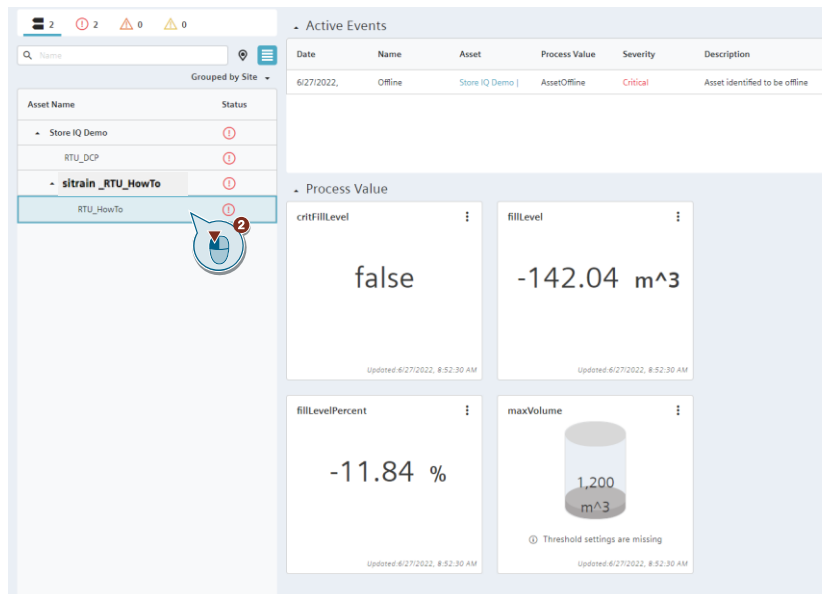
The alarm that triggers the e-mail notification is configured directly in SITRANS store IQ.

To configure the alarm, proceed as follows:

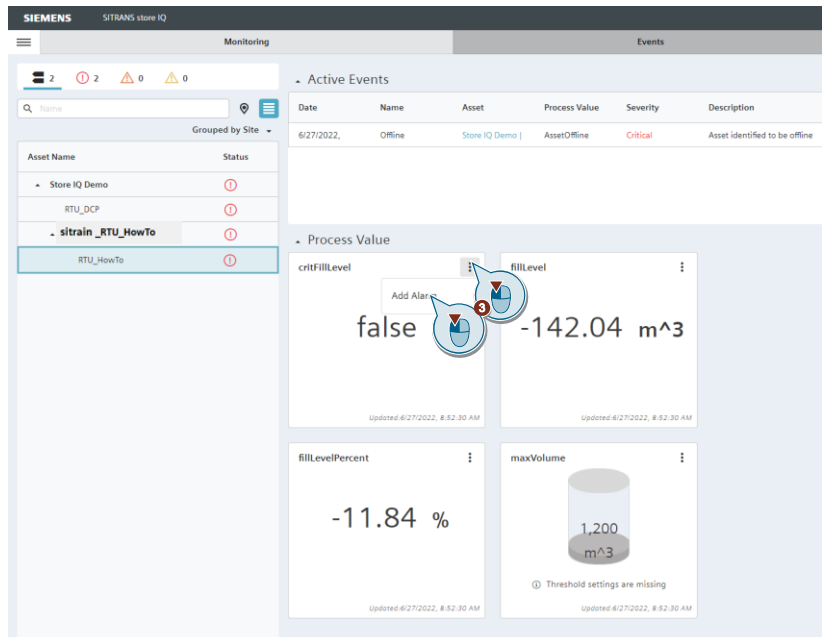
1. Start MindSphere SITRANS store IQ.



2. Unfold your newly created SITRANS store IQ demo.

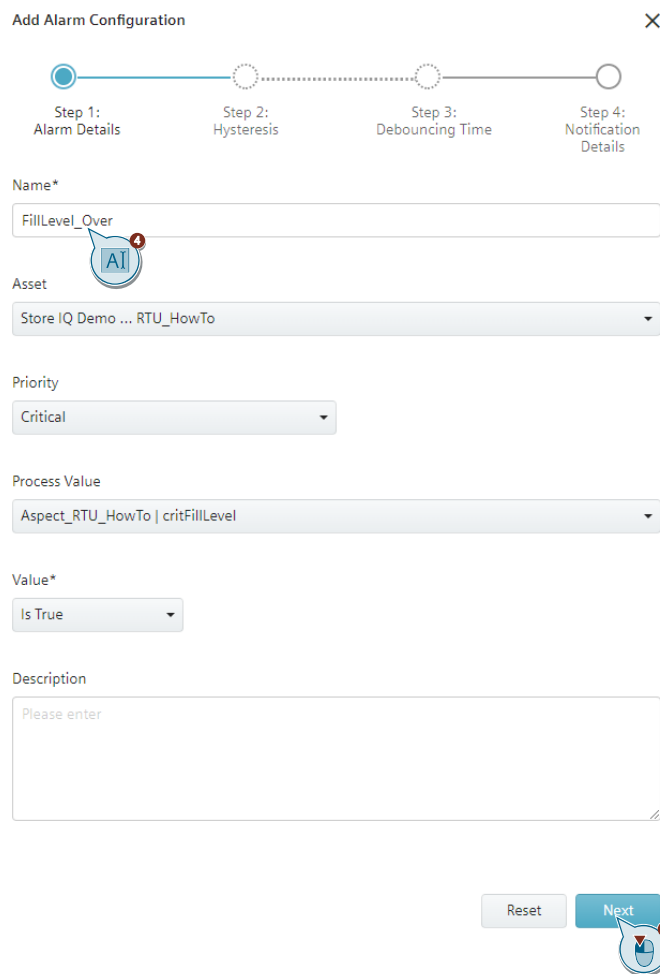


3. Configure an alarm for the variable "critFillLevel".



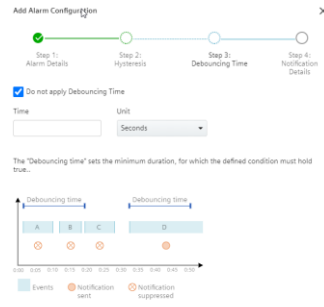
4. Assign a name for the alarm.

5. Click on "Next".





6. Do not make any selection in the following two windows.
7. Click on "Next".





8. Select the recipient and the type of message.
9. Click on "Add".

Add Alarm Configuration ✕

Step 1: Alarm Details Step 2: Hysteresis Step 3: Debouncing Time Step 4: Notification Details

Notify

Configured Users	SMS	Email	Call
L	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>		<input type="checkbox"/>
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>



## 2.2.7 Loading the Configuration File

The supplied archive "109810580\_RTU3041C\_MQTT\_PROJ\_V10.zip" contains the ready-made configuration file "109810580\_RTU3041C\_MQTT\_Configuration.cfg", which you can load into your SIMATIC RTU3041C and adapt to your application in just a few steps.

Note

The configuration file can only be loaded from an RTU3041C. For other types, the configuration file must be adjusted manually.

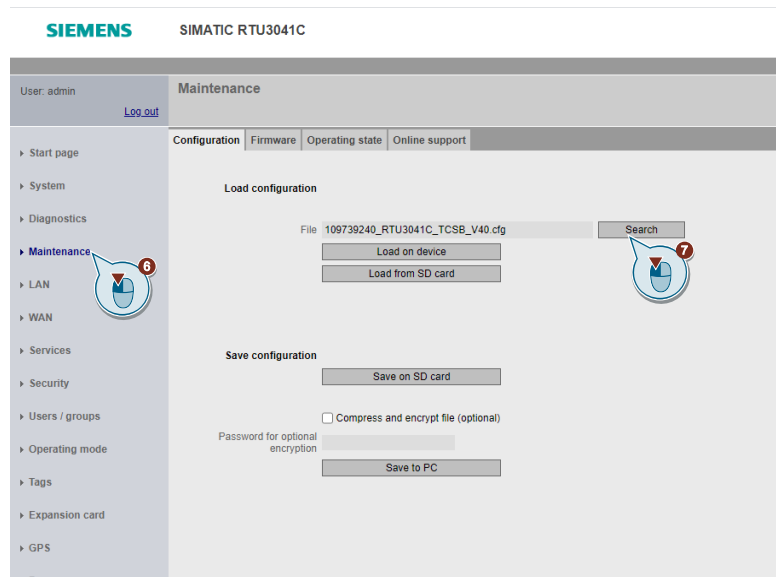
To load the supplied configuration into your SIMATIC RTU3041C, proceed as follows:

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

Note

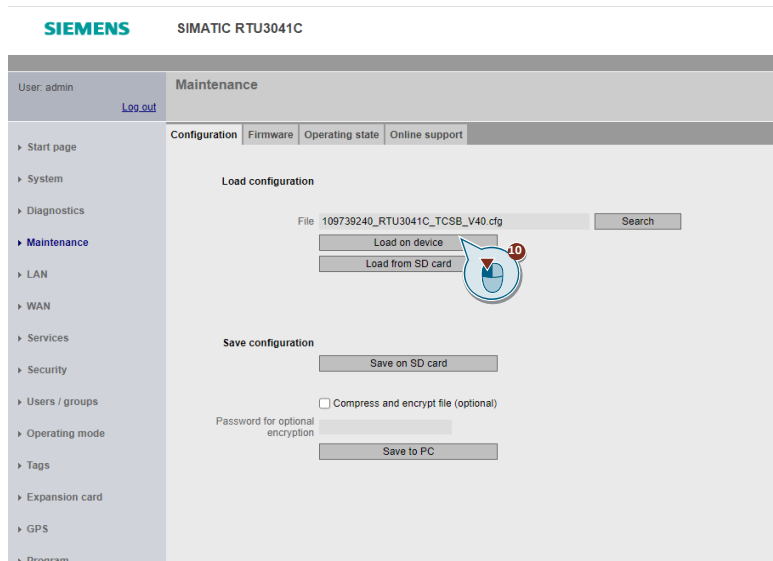
Ensure that only one RTU is connected to your network at a time during commissioning, as each RTU is assigned the same IP address at the factory.

2. If necessary, change the IP address of your PG/PC (according to [Table 2-1](#)), so that it and the SIMATIC RTU3041C are in the same subnet.  
The factory default IP address "[192.168.0.3](#)" is set in the RTU3041C.
3. In a browser, open the web server of the RTU3041C at the address "[192.168.0.3](#)".
4. Log in with the username "admin" and the password "admin".
5. Assign a new password.
6. Navigate to the "Maintenance" menu.
7. Under "Load configuration", click "Search".



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

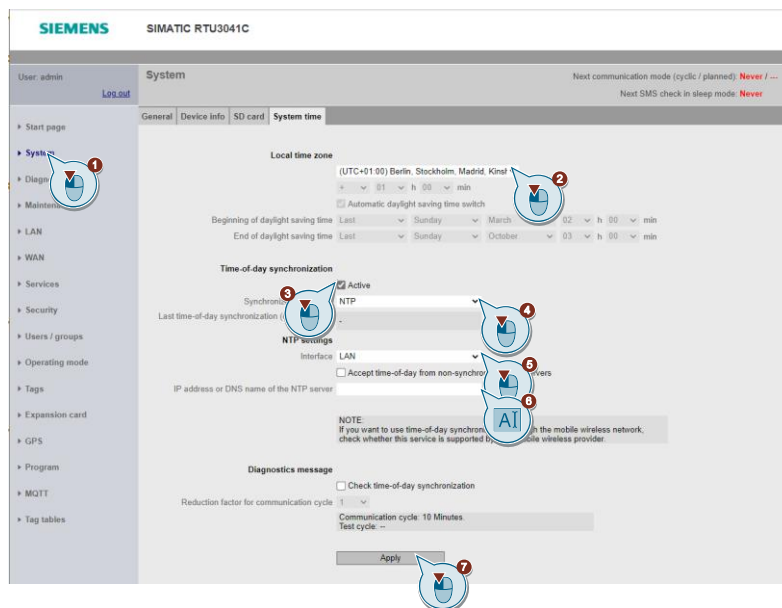
10. Click "Load on device".



11. The previously set password is overwritten with the password "Siemens123!" stored in the configuration file.

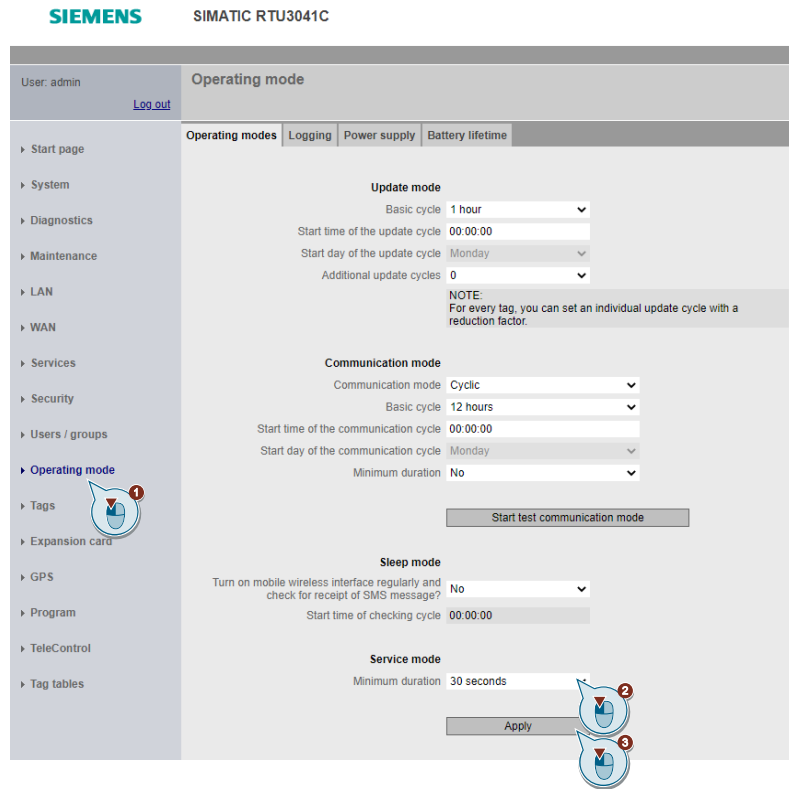
### General configuration

1. Navigate to the "System" menu.
2. Open the System time tab and select your local time zone.
3. Enable "Time-of-day synchronization".
4. Select "NTP" as Synchronization method.
5. Select the interface via which the RTU will be synchronized.
6. Assign the address of the NTP server.
7. Then click "Apply".



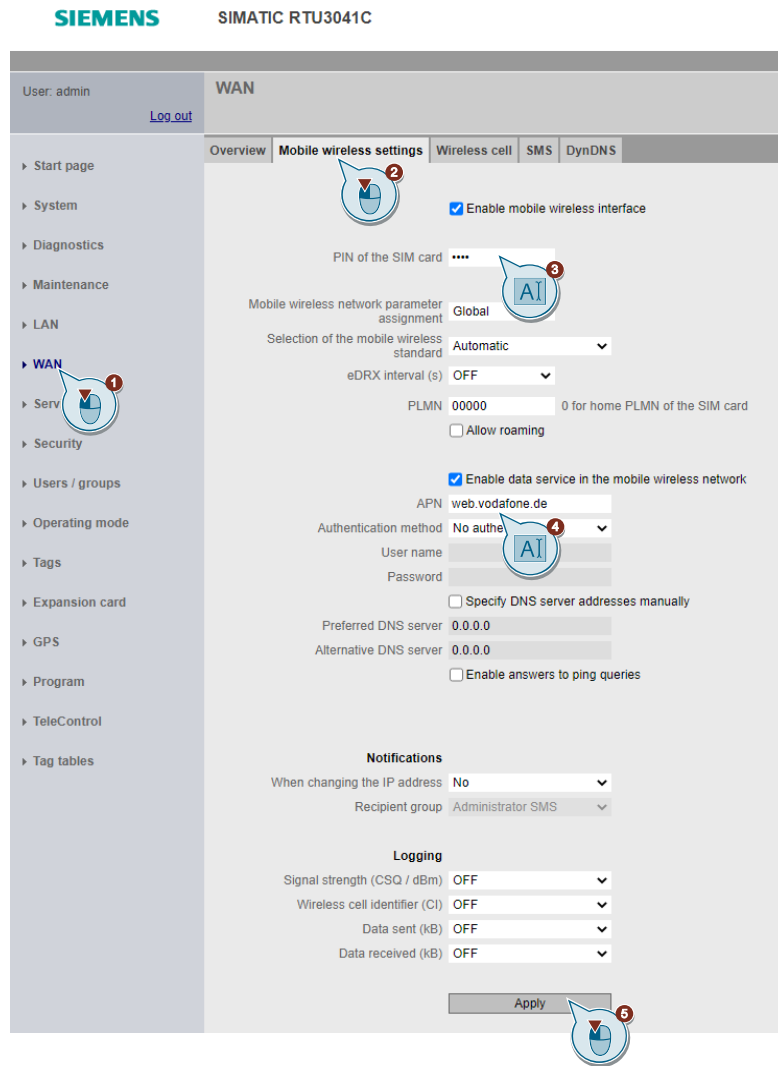
### Configuring operating modes

1. Navigate to the "Operating mode" menu.
2. Enter the minimum duration of the service mode, e.g. "30 seconds" ("30 seconds") für die hier beschriebene Anwendung.
3. Then click "Apply".



## Configure WAN

1. Navigate to the "WAN" menu.
2. Open the Mobile wireless settings tab.
3. Enter the PIN of the inserted SIM card.
4. Enter the APN of your network operator.
5. Then click "Apply".



### Configure MQTT

1. Navigate to the "MQTT" menu.
2. Open the "MQTT Broker" tab.
3. Enter your Client-ID  
 "Client-ID"= <tenant>\_<DeviceName>
  - <tenant>: Your MindSphere-Tenant
  - <DeviceName>: Device name for the SIMATIC RTU3041C, e.g. "RTU\_HowTo".

**Note**

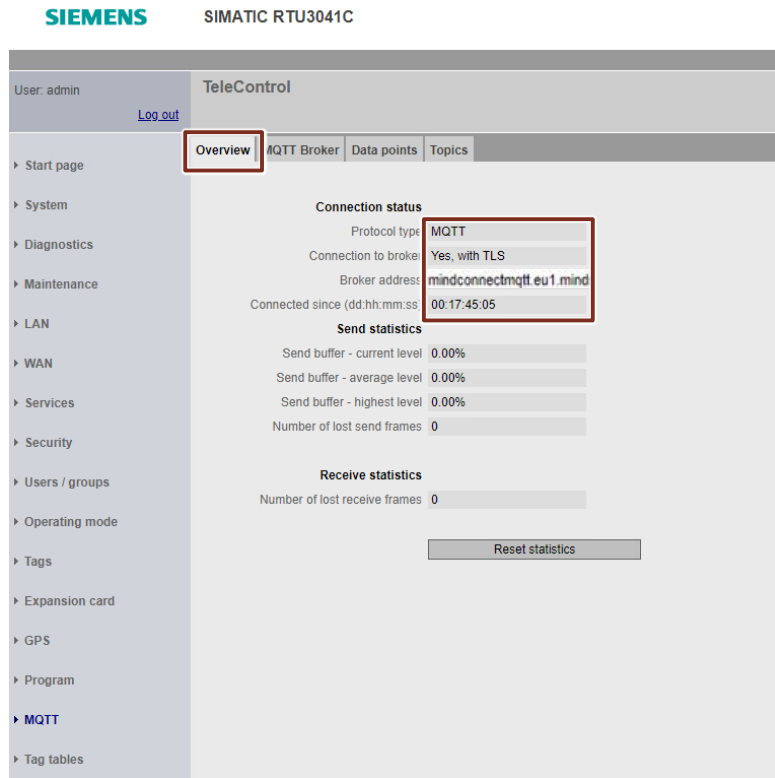
These values must match the configuration of the SIMATIC RTU3041C (see [Chapter 2.2.3](#))

4. Adjust the topic prefix "tc/<tenant>/"  
 <tenant>: Your MindSphere-Tenant.
5. Upload your broker certificate ([Broker certificate](#)).
6. Upload the client certificate and key ([Client certificate/key](#)).
7. Enable MQTT.
8. Then click "Apply".

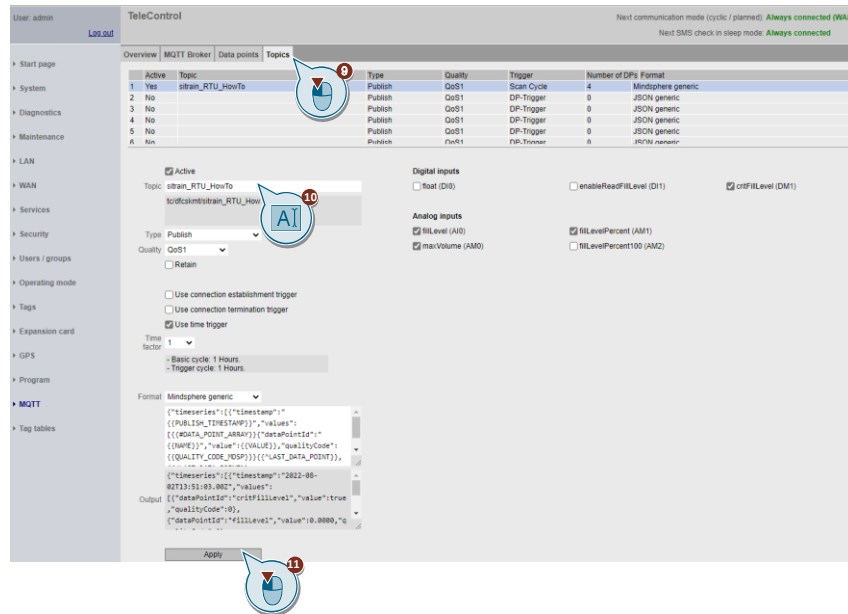


**Result:**

The SIMATIC RTU3041C connects securely to the MindSphere MQTT broker.



9. Open the Topics tab.
10. Adjust the Topic "<tenant>\_<DeviceName>":
  - <tenant>: Your MindSphere-Tenant
  - <DeviceName>: Device name for the SIMATIC RTU3041C
11. Then click "Apply".





## 3 Useful Information

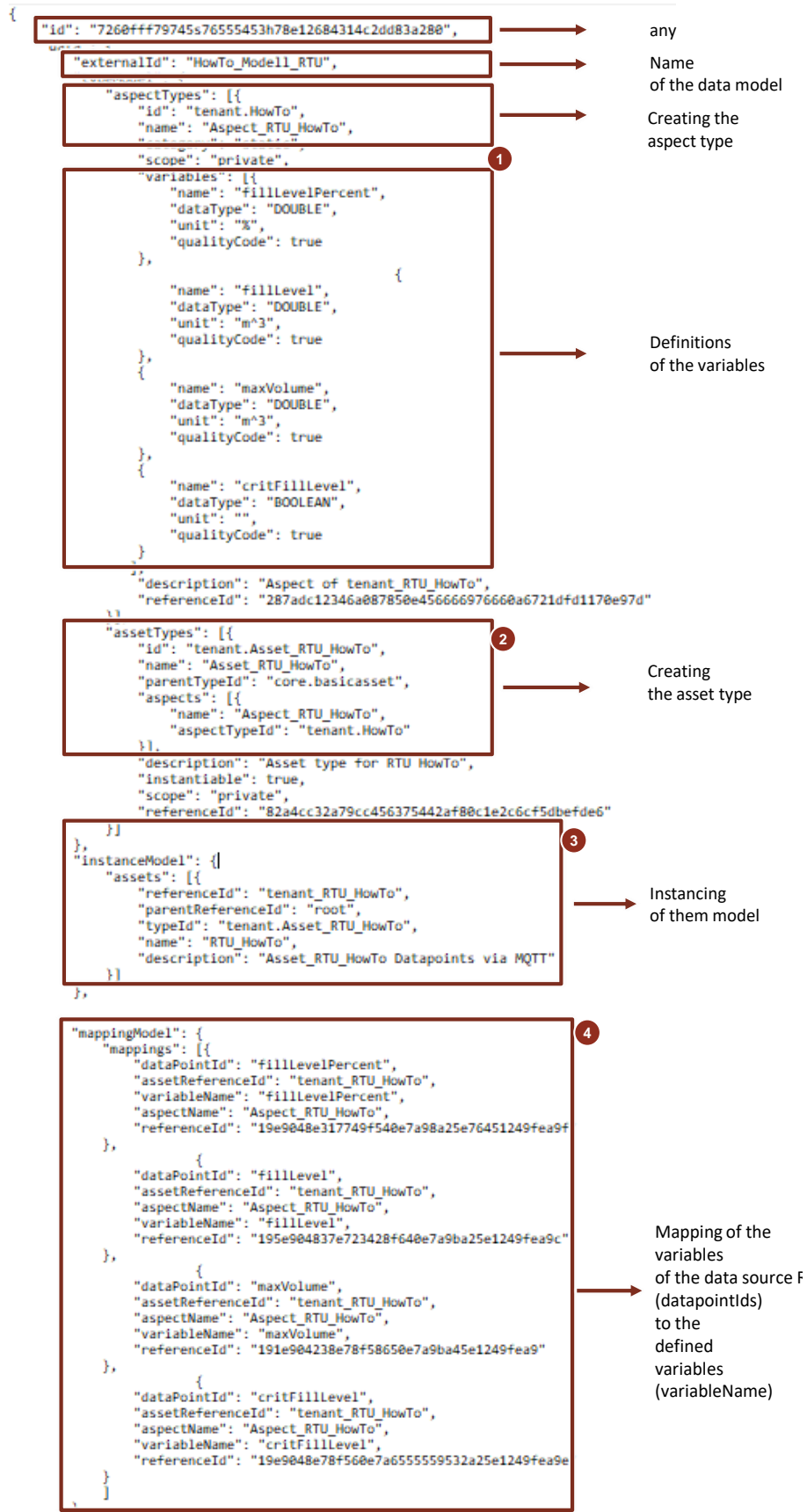
### 3.1 Adapt supplied data model (Asset Model)

The supplied archive "109810580\_RTU3041C\_MQTT\_PROJ\_V10.zip " contains the data model "109810580\_Datamodel\_Demo.txt" for this application example, which you can load into MindSphere ([Chapter 2.2.3](#)) and adapt to your application in just a few steps.

The model consists of the following components:

1. Aspect-Typ "Aspect\_RTU\_HowTo"
  - Create aspect type
  - Define variables
2. Asset type "Asset\_RTU\_HowTo"
  - Create asset type
  - Add aspect type
3. Asset "Client-ID"
  - Add asset type
  - Instantiate model
4. Mapping of the variables of the data source (SIMATIC RTU3041C) to the defined variables

Figure 3-1



### 3 Useful Information

---

**Note**

You can also create your own data model and load it into MindSphere.

**Note**

More information about creating your own data model can be found at the following link:

<https://developer.mindsphere.io/howto/howto-create-data-model-mqtt-agent.html>

Before you load the supplied data model into MindSphere, adapt it to your application:

1. Open the attached file "109810580\_Datamodel\_Demo.txt".
2. Replace "tenant" with your own MindSphere tenant.

```
{
  "id": "7260fff79745s76555453h78e12684314c2dd83a280",
  "data": {
    "externalId": "HowTo_Model1_RTU",
    "typeModel": {
      "aspect": {
        "id": "tenant.HowTo",
        "name": "Asset_RTU_HowTo",
        "category": "static",
        "scope": "private",
        "variables": [
          {
            "name": "fillLevelPercent",
            "dataType": "DOUBLE",
            "unit": "%",
            "qualityCode": true
          },
          {
            "name": "fillLevel",
            "dataType": "DOUBLE",
            "unit": "m^3",
            "qualityCode": true
          },
          {
            "name": "maxVolume",
            "dataType": "DOUBLE",
            "unit": "m^3",
            "qualityCode": true
          },
          {
            "name": "critFillLevel",
            "dataType": "BOOLEAN",
            "unit": "",
            "qualityCode": true
          }
        ]
      },
      "description": "Aspect of tenant_RTU_HowTo",
      "referenceId": "287adc12346a087850e456666976660a6721dfd1170e97d"
    },
    "assetType": {
      "id": "tenant.Aspect_RTU_HowTo",
      "name": "Asset_RTU_HowTo",
      "parentTypeId": "core.basicasset",
      "aspects": [
        {
          "name": "Aspect_RTU_HowTo",
          "aspectTypeId": "tenant.HowTo"
        }
      ],
      "description": "Asset type for RTU HowTo",
      "instantiable": true,
      "scope": "private",
      "referenceId": "82a4cc32a79cc456375442af80c1e2c6cf5dbefde6"
    }
  }
}
```

3. Replace the asset's "referenceId" with your Client-ID.

```
}
},
"instanceModel": {
  "assets": [
    {
      "referenceId": "tenant_RTU_HowTo",
      "parentReferenceId": "tenant_RTU_HowTo",
      "typeId": "tenant.Asset_RTU_HowTo",
      "name": "RTU_HowTo",
      "description": "Asset_RTU_HowTo Datapoints via MQTT"
    }
  ]
},
"mappingModel": {
  "mappings": [
    {
      "dataPointId": "fillLevelPercent",
      "assetReferenceId": "tenant_RTU_HowTo",
      "variableName": "fillLevelPercent",
      "aspectName": "Aspect_RTU_HowTo",
      "referenceId": "19e9048e317749f540e7a98a25e76451249fea9f"
    },
    {
      "dataPointId": "fillLevel",
      "assetReferenceId": "tenant_RTU_HowTo",
      "aspectName": "Aspect_RTU_HowTo",
      "variableName": "fillLevel",
      "referenceId": "195e904837e723428f640e7a9ba25e1249fea9c"
    },
    {
      "dataPointId": "maxVolume",
      "assetReferenceId": "tenant_RTU_HowTo",
      "aspectName": "Aspect_RTU_HowTo",
      "variableName": "maxVolume",
      "referenceId": "191e904238e78f58650e7a9ba45e1249fea9"
    },
    {
      "dataPointId": "critFillLevel",
      "assetReferenceId": "tenant_RTU_HowTo",
      "aspectName": "Aspect_RTU_HowTo",
      "variableName": "critFillLevel",
      "referenceId": "19e9048e78f560e7a655559532a25e1249fea9e"
    }
  ]
}
```

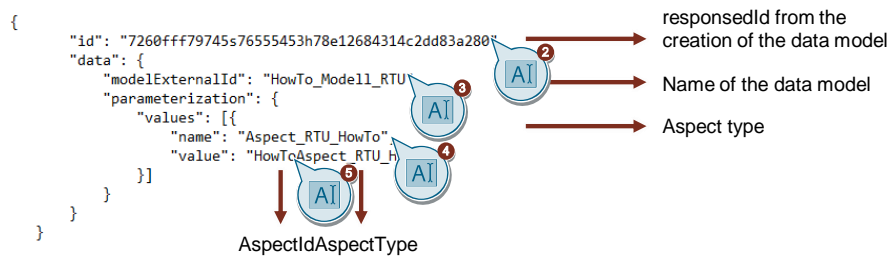
4. Save the changes.

### 3.2 Customize included instance demo

The provided archive "109810580\_RTU3041C\_MQTT\_PROJ\_V10.zip " contains the instantiation of the data model "109810580\_Instance\_Demo.txt" for this application example.

Before you load the provided instance demo into MindSphere, adapt it to your application:

1. Open the supplied file "109810580\_Instance\_Demo.txt".
2. Adjust the "Id". Enter the "Id" of your data model in this field.
3. Adjust the "modelExternalId". Enter the name (externalId) of your data model in this field.
4. Enter the name of the created aspect type in the "name" field.
5. Enter the AspectId and the name of the created aspect type in the "value" field.



**Note**

The data entered in the instance demo must match the corresponding data in the data model.

## 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](https://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](https://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](https://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](https://support.industry.siemens.com/cs/sc)

#### Industry Online Support app

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

[support.industry.siemens.com/cs/ww/en/sc/2067](https://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](https://mall.industry.siemens.com)

## 4.3 Application support

Siemens AG  
 Digital Factory Division  
 Factory Automation  
 Production Machines  
 DF FA PMA APC  
 Frauenaauracher Str. 80  
 91056 Erlangen, Germany

mailto: [tech.team.motioncontrol@siemens.com](mailto:tech.team.motioncontrol@siemens.com)

## 4.4 Links and literature

Table 4-1

No.	Topic
\1\	Siemens Industry Online Support <a href="https://support.industry.siemens.com">https://support.industry.siemens.com</a>
\2\	Link to the article page of the application example <a href="https://support.industry.siemens.com/cs/ww/en/view/109810580">https://support.industry.siemens.com/cs/ww/en/view/109810580</a>
\3\	SIMATIC: TeleControl - RTU - RTU3030C/RTU30x1C <a href="https://support.industry.siemens.com/cs/ww/en/view/109750942">https://support.industry.siemens.com/cs/ww/en/view/109750942</a>
\4\	Sales and delivery release Firmware V5.0 for SIMATIC RTU3000C with cloud connection incl. download <a href="https://support.industry.siemens.com/cs/ww/en/view/109810215">https://support.industry.siemens.com/cs/ww/en/view/109810215</a>
\5\	SITRANS LR120, HART <a href="https://support.industry.siemens.com/cs/ww/en/view/109776478">https://support.industry.siemens.com/cs/ww/en/view/109776478</a>
\6\	MindSphere MindConnect MQTT Broker <a href="https://developer.mindsphere.io/concepts/concept-mindsphere-mqtt-broker.html">https://developer.mindsphere.io/concepts/concept-mindsphere-mqtt-broker.html</a>
\7\	Managing CA Certificates using UI <a href="https://developer.mindsphere.io/howto/howto-managing-ca-certificates.html">https://developer.mindsphere.io/howto/howto-managing-ca-certificates.html</a>
\8\	Creating Data Model from MQTT Agent <a href="https://developer.mindsphere.io/howto/howto-create-data-model-mqtt-agent.html">https://developer.mindsphere.io/howto/howto-create-data-model-mqtt-agent.html</a>

## 4.5 Change documentation

Table 4-2

Version	Date	Change
V1.0	08/2022	First version