rexroth
A Bosch Company

Application Manual

OPC UA Pub/Sub App

OPC UA Pub/Sub for ctrlX CORE

R911418736, Edition 01

Liability

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DOK-XCORE*-OPC*PUBSUB*-AP01-EN-P DC-AE/EPI5 (TaDo/MePe)

756f6e4aeb3c057c0a347e885f0f12e5, 1, en_US

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1 About this documentation

Editions of this documentation

Edition	Release date	Note
01	2022-10	First edition

2 Important directions on use

2.1 Intended use

2.1.1 Introduction

Rexroth products are developed and manufactured to the state-of-the-art.

The products are tested prior to delivery to ensure operational safety and reliability.

⚠ WARNING	**Personal injury and damage to property due to incorrect use of products!** The products may only be used as intended. Failure to use the products as intended may cause situations resulting in property damage and personal injury.

NOTICE	**Damages resulting from unintended use** Rexroth As the manufacturer does not assume any warranty, liability or compensatory claims for damages resulting from unintended use of the products. The user alone shall bear the risks of an unintended use of the products. Before using Rexroth products, make sure that all the prerequisites for an intended use of the products are met: – Personnel that in any way, shape or form uses Rexroth products must first read and understand the relevant safety instructions and be familiar with their intended use – Leave hardware products in their original state, i.e., do not make any structural modifications. It its not permitted to decompile software products or alter source codes – Do not install damaged or defective products or commission them – It has to be ensured that the products have been installed as described in the relevant documentation

2.1.2 Areas of use and application

Products of the ctrlX series are suitable for Motion/Logic applications.

NOTICE	Products of the ctrlX series may only be used with the accessories, mounting parts, and other components specified in this documentation. Components that are not expressly mentioned must neither be attached nor connected. The same applies to cables and lines. Only to be operated with the hardware component configurations and combinations expressly specified and with the software and firmware specified in the corresponding documentations and functional descriptions.

Products of the ctrlX series are suitable for single-axis as well as for multi-axis drive and control tasks. Device types with different equipment and interfaces are available for using the system in specific applications.

Typical areas of application:

- Building automation
- IoT and Security Gateway or Device
- Handling & Robotic

Controls of the ctrlX CORE series may only be operated under the mounting and installation conditions, in the position of normal use and under the ambient conditions (temperature, degree of protection, humidity, EMC, etc.) specified in the related documentations.

2.2 Unintended use

"Unintended use" refers to using the ctrlX products outside of the above-mentioned areas of application or under operating conditions and technical data other than described and specified in the documentation.

ctrlX products must not be used if they are exposed to following conditions:

- Operating conditions that do not meet the specified ambient conditions. Operation under water, under extreme temperature fluctuations or under extreme maximum temperatures is prohibited
- Applications that have not been expressly authorized by Rexroth

3 Safety instructions

The Safety instructions contained in the available application documentation feature specific signal words (DANGER, WARNING, CAUTION or NOTICE) and, where required, a safety alert symbol (in accordance with ANSI Z535.6-2006).

The signal word is meant to draw the reader's attention to the safety instruction and identifies the hazard severity.

The safety alert symbol (a triangle with an exclamation point), which precedes the signal words DANGER, WARNING and CAUTION, is used to alert the reader to personal injury hazards.

The Safety instructions in this documentation are designed as follows:

⚠ DANGER	In case of non-compliance with this safety instruction, death or serious injury **will** occur.
⚠ WARNING	In case of non-compliance with this safety instruction, death or serious injury **could** occur.
⚠ CAUTION	In case of non-compliance with this safety instruction, minor or moderate injury could occur.
NOTICE	In case of non-compliance with this safety instruction, property damage could occur.

4 This "OPC UA Pub/Sub" app

4.1 ctrlX OPC UA Pub/Sub on the ctrlX CORE

ctrlX OPC UA Pub/Sub is executed as standalone app on the ctrlX CORE.

Install the app on the ctrlX CORE to connect the control to other devices supporting the OPC UA Pub/Sub standard and to exchange data.

Typical use cases:

- M2M communication via controls:
  - Between ctrlX CORE controls
  - Between ctrlX CORE controls and controls of other manufacturers supporting the OPC UA Pub/Sub standard
- Data connection to control systems
- Data connection to data recording systems

The OPC UA Pub/Sub app supports the following functions:

- A Publisher can use unicast/multicast to send datasets
- A Subscriber can use unicast/multicast to receive datasets
- Connecting to the Data Layer RT (realtime) of the ctrlX CORE
- Connecting to the Data Layer NRT (non-realtime) of the ctrlX CORE
- Configuring via the Unified Automation tool UaExpert
- Communication cycle time up to 2 ms depending on the load of the network and the ctrlX CORE

The OPC UA Pub/Sub app is not installed on the ctrlX CORE by default. Thus, install it on the ctrlX CORE first.

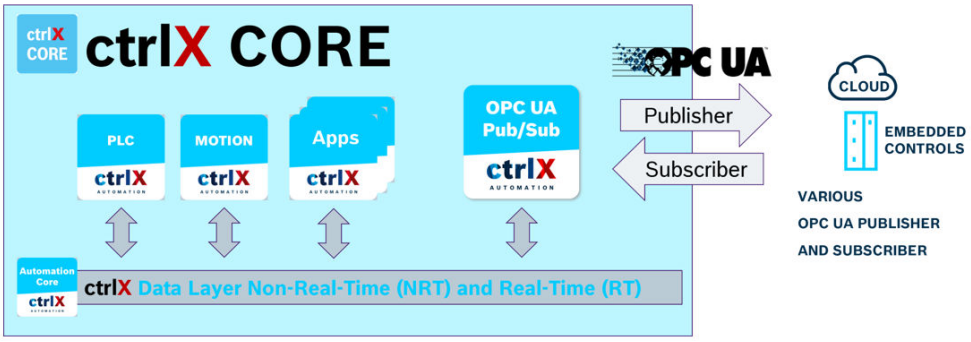

Fig. 1: ctrlX OPC UA Pub/Sub in the ctrlX CORE

4.2 Prerequisites

The OPC UA Pub/Sub app is available from the ctrlX CORE version 01.16.

The OPC UA Pub/Sub app requires the OPC UA Server for the configuration.

4.3 Installing on ctrlX CORE

Before using the OPC UA Pub/Sub app for the first time, install it on the ctrlX CORE. Use the Package Manager of the ctrlX CORE. The installation does not depend on other apps. The installation takes a few minutes.

To install on the ctrlX CORE, the user needs the user permission “Apps: Manage apps" or "Administration: Full Access".

For the Package Manager, go to the web interface under *“Settings → Apps”*.

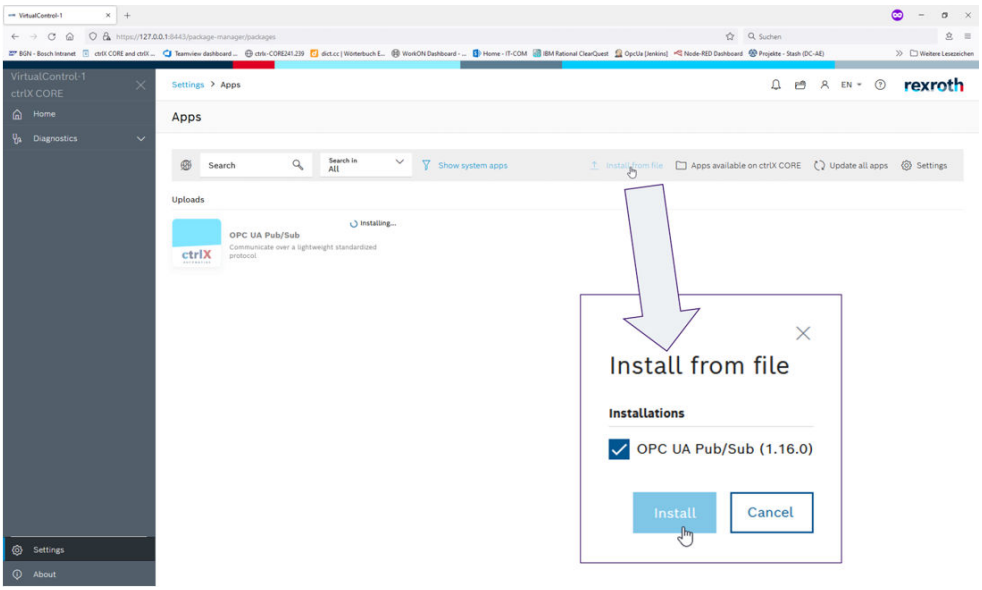

Fig. 2: For the installation of the OPC UA Pub/Sub app, go to *"Settings → Apps"*

To install, proceed with the following steps as shown in Fig. 2:

1. Select "Apps" from the "Settings" menu
2. Select Install from file to install the app from the file system
3. Select the installation file.
4. Install via the button "Install".

4.4 Licensing

ctrlX OPC UA Pub/Sub can only be used with a valid license. This license can be loaded before or after the installation.

To operate the ctrlX OPC UA Pub/Sub, one of the following licenses is required:

- CORESWL-XCx-UAP-OPCUAPUBSUBxx-NNNN on a real ctrlX CORE hardware
- ctrlX CORE - 4 h Engineering License on a ctrlX CORE Virtual.
  Note that the ctrlX CORE Virtual has to be restarted exactly after 4 hours.

For the configuration, it is additionally required to install the OPC UA Server app with the respective license.

Further information

- ctrlX CORE Runtime, Application Manual, chapter "➦ctrlX licenses" (R911403768, DOK-XCORE*-BASE*******-APRS-EN-P)
- ➦ctrlX Automation website

4.5 General information

OPC UA Pub/Sub is based on a communication architecture without connection, i.e. the Publisher for the data transfer does not set up any connection to the Subscriber, but sends data directly to the Subscriber. Thus, managing connections in the devices is omitted in the OPC UA Pub/Sub.

The OPC UA Pub/Sub describes mappings for two transport protocols, the User Datagram Protocol (UDP) and a Layer 2 communication. The protocols can use unicast, multicast or broadcast to send messages.

4.6 Supported protocols

Protocol	Connection XF10/eth0	Connection XF51/eth1
UDP unicast	✓	✓
UDP multicast	✓	✓
Layer 2 unicast	✘	✘
Layer 2 multicast	✘	✘

The OPC UA Pub/Sub app does not support the connection XF50.

4.7 Supported data types

- Basic data types, no arrays and structures

4.8 Unsupported configurations

- Combining variables from Data Layer RT (realtime) and Data Layer NRT non-realtime) in one dataset
- Combining real-time variables from different real-time Data Layer areas (e.g. from Motion and PLC) in one dataset

4.9 Configuration

The ctrlX OPC UA Pub/Sub can be configured using the tool UaExpert if the ctrlX OPC UA Server is also installed on the ctrlX CORE.

UaExpert is available on the website of Unified Automation:

➦ https://www.unified-automation.com/de/downloads/opc-ua-clients.html

To download, register on the Unified Automation website.

4.9.1 Multicast and unicast

Depending on the use case, you can define a Publisher as unicastPublisher or as multicast Publisher.

- Select unicast if the Publisher is to be received by a Subscriber
- Select multicast if the dataset of a Publisher is to be received by multiple Subscribers

4.9.2 Example of a configuration for a C2C communication

Example of a C2C communication

Unicast Publishing

For a C2C communication (control-to-control communication), selected data from the PLC should be exchanged between two OPC UA Pub/Sub controls via ctrlX CORE.

Therefore, as shown in Fig. 3, data should be published from ctrlX #1 and subscribed from ctrlX #2.

In the ctrlX CORE control, data should be exchanged between the PLC and the OPC UA Pub/Sub app via Data Layer RT (realtime).

PLC data to be provided via Data Layer RT have to be specified as given in the description ➦ Object "DataLayer_Realtime".

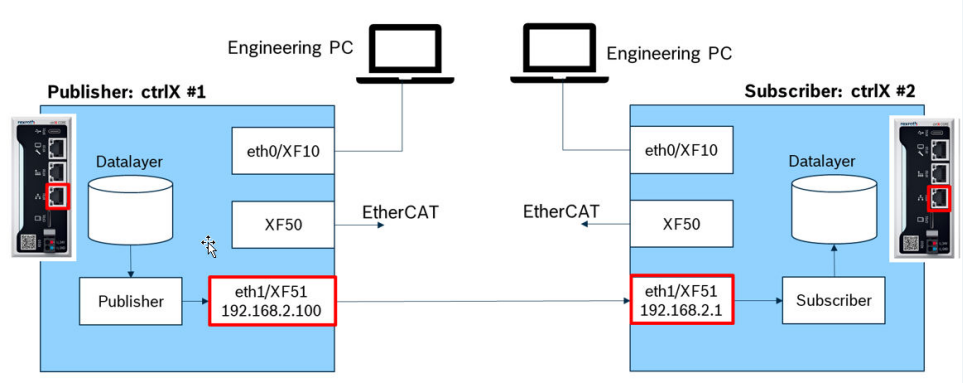

Fig. 3: Example of a use case for Unicast Publishing

The following prerequisites have to be met:

- The OPC UA Pub/Sub app and the OPC UA Server app are installed with valid licenses on both controls.
- The user of the ctrlX CORE control has the permission "OPC UA Pub/Sub access". In this example, the user has the permission "Full access" in the category "Administration" that also includes the permission "OPC UA Pub/Sub access".

  For more information on the user and rights management on the ctrlX CORE, click ➦ here.
- The Ethernet port XF51 is used for the C2C communication.

  In the example, IP addresses in the range 192.168.2.x are selected.

  Better not to use the address range 192.168.1.x for the C2C communication, as the address 192.168.1.1 is used for the engineering port XF10 by default.

  The configuration of IP addresses is described in ➦ Window - "Connectivity".

To configure the Pub/Sub communication, execute the steps described in the following sections:

1. ➦ Create required server in UaExpert
2. ➦ Connect the UaExpert to the ctrlX OPC UA servers
3. ➦ Configure the Publisher
4. ➦ Configure the Subscriber
5. ➦ Download of the Pub/Sub configuration to the control

Adding the required server to UaExpert

1. Start UaExpert.

2. Connect to the OPC UA Server on both ctrlX CORE controls.
   Right-click on the “Servers” and then on “Add...”.

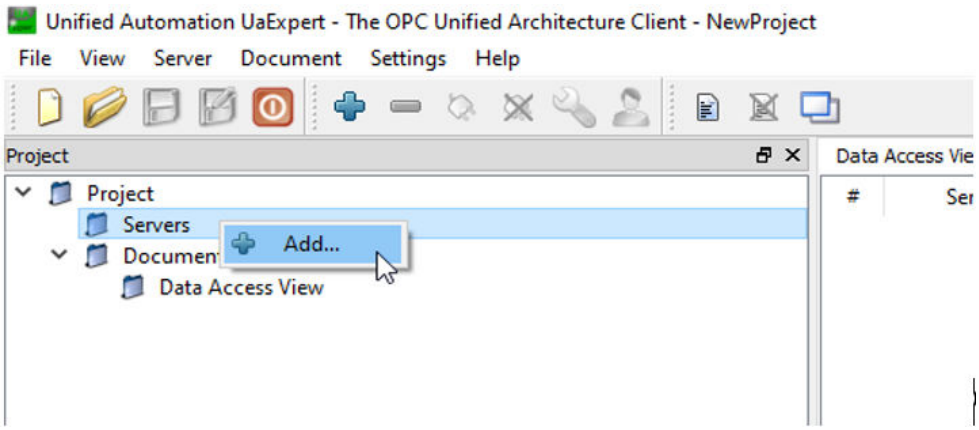

Fig. 4: UaExpert - Adding an OPC UA Server to the UaExpert project

3. In the following dialog, double-click below the node on "*Custom Discovery*" and enter the IP address of your ctrlX CORE control.

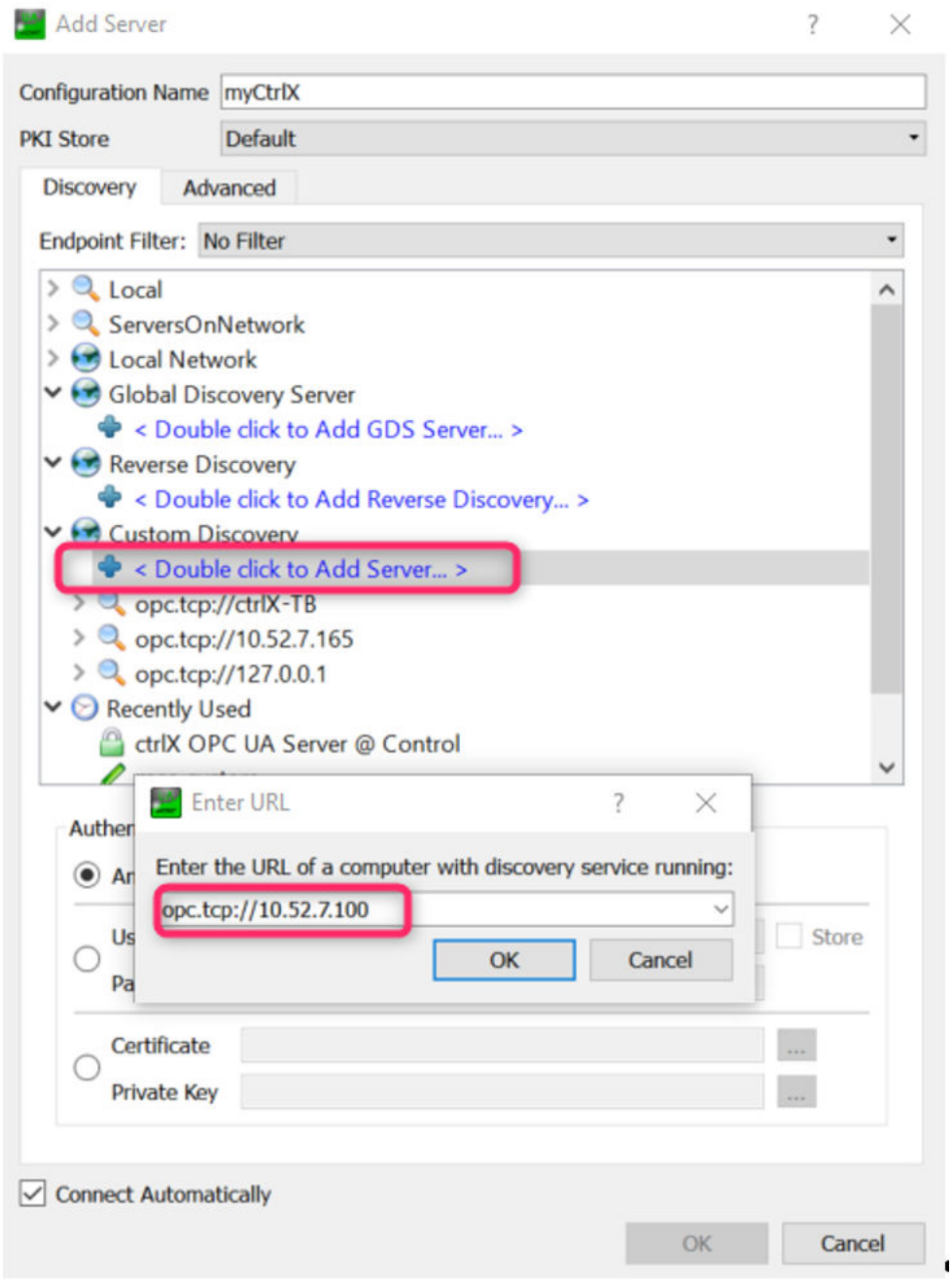

Fig. 5: UaExpert - Entering URL details

4. Expand the tree below the generated entry to define the server settings:
   - Select an encryption mode.
   - Enter the name of a user for whom the access permissions "OPC UA Server access" and "OPC UA Pub/Sub access" are set up on the ctrlX CORE control.
   - Select the checkbox “Store”.
   - Enter the password.
   - To close the dialog, select “OK”.

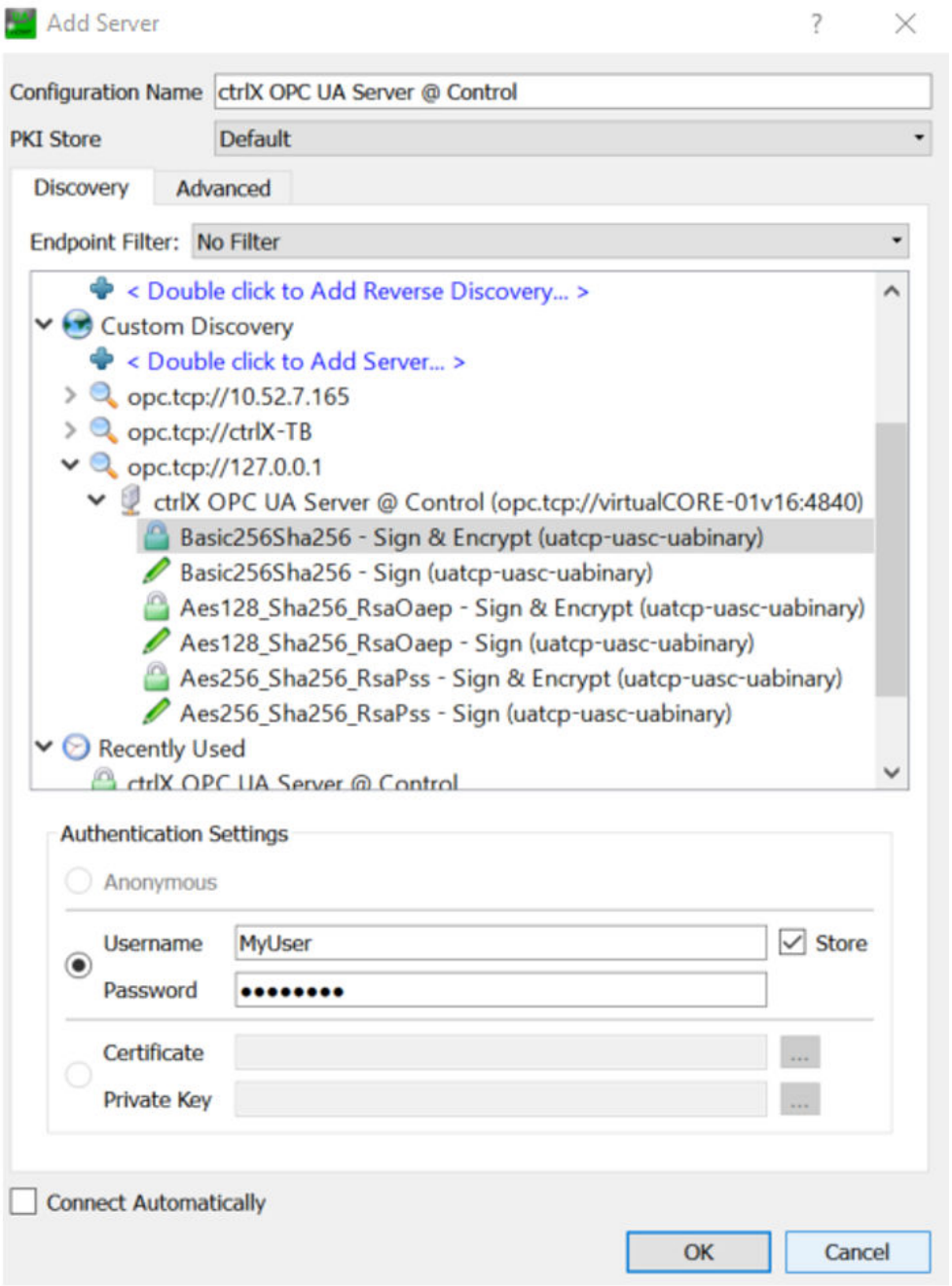

Fig. 6: UaExpert - Specifying authentication settings

Connecting the UaExpert to the ctrlX OPC UA Servers

1. After adding both ctrlX OPC UA Servers to the UaExpert, specify unique names for the servers.

   Right-click on the connected server and select “Properties...”. You can now change the configuration name (in the example for server 1 "ctrlx1:4840" and for server 2 "ctrlx2:4840").

2. In the next step, select both ctrlX OPC UA Server from the UaExpert project tree. To connect to the servers, right-click and select the menu item “Connect”.

   ➡ When setting up the initial connection, you are requested to trust the ctrlX OPC UA Server certificate in UaExpert.

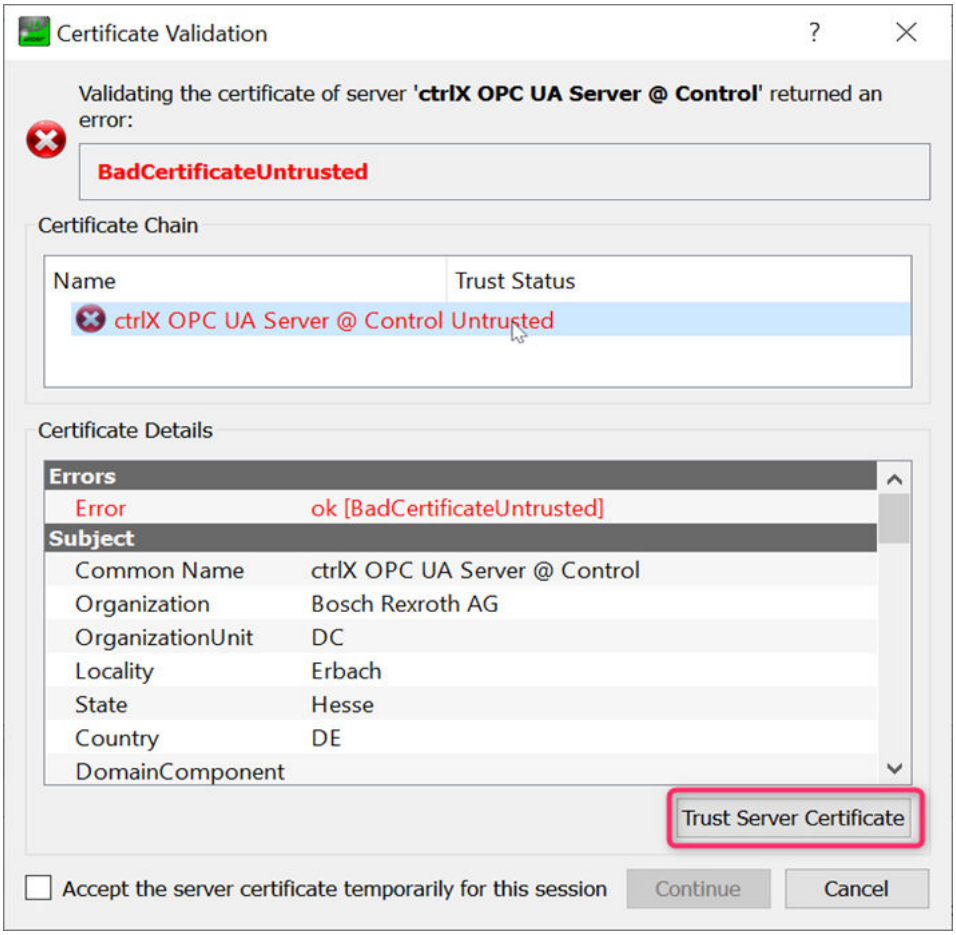

Fig. 7: UaExpert - Trust the ctrlX OPC UA Server certificate in UaExpert

3. Confirm the server certificate and close the dialog with “Continue”.

   ➡ The error message “Error 'BadSecurityChecksFailed' was returned during OpenSecureChannel” is shown in the log. A connection is not set up to the OPC UA Server.

4. To avoid this error message, make the UaExpert certificate known to the ctrlX OPC UA Server via the ctrlX CORE web interface as trusted certificate. In the site navigation of the ctrlX CORE, go to *“Settings → Certificates & Keys → OPC UA Server”*.

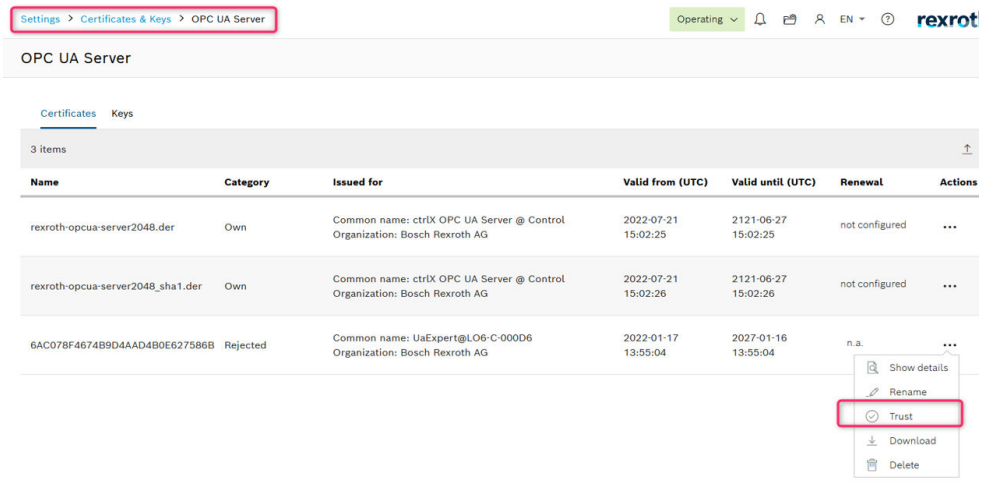

Fig. 8: ctrlX CORE web interface - Trust the UaExpert certificate in the ctrlX CORE OPC UA Server

5. You can now connect to the servers.
   ➡ The following error message might be output “Error 'BadCertificateHostNameInvalid' was returned during CreateSession, press 'Ignore' to suppress the error and continue connecting”. Ignore this error message with “Ignore”.

Configuring the Publisher

When connected to the servers, UaExpert automatically loads the current Pub/Sub configuration to the "PubSub Config View" available on the ctrlX CORE control.

If "PubSub Config View" is not shown, add the view. Therefore, select the "Documents" node in the UaExpert project tree and right-click to open the menu “ Add”.

In the following dialog, select the document type "PubSub Config View" and close the dialog with the “ Add” button.

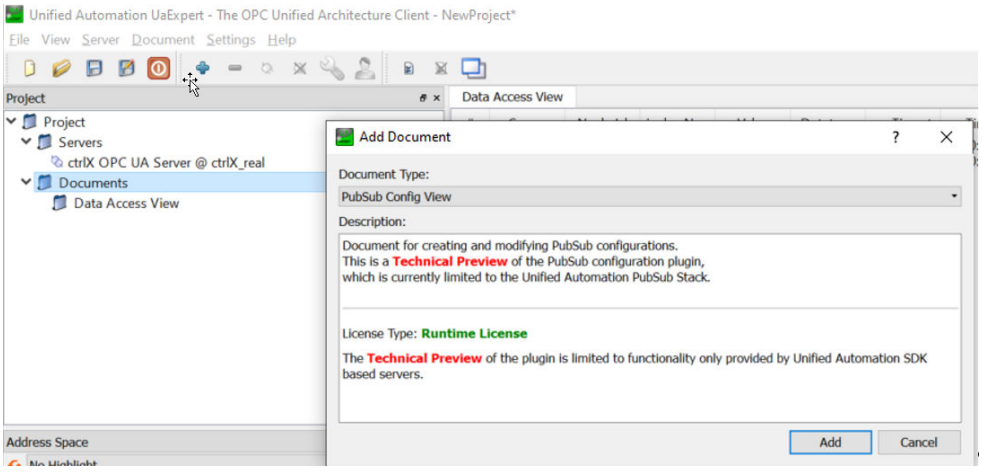

Fig. 9: UaExpert - Adding "PubSub Config View"

The UaExpert version 1.6.1 allows to use two different views in the "PubSub Config View" to create Pub/Sub configurations.

The configuration via "Network View" is shown in the following. It focuses on the user perspective.

It can also be configured via "Configuration View". This will no further be explained here.

Changes can only be made at the existing configuration or this configuration can be deleted.

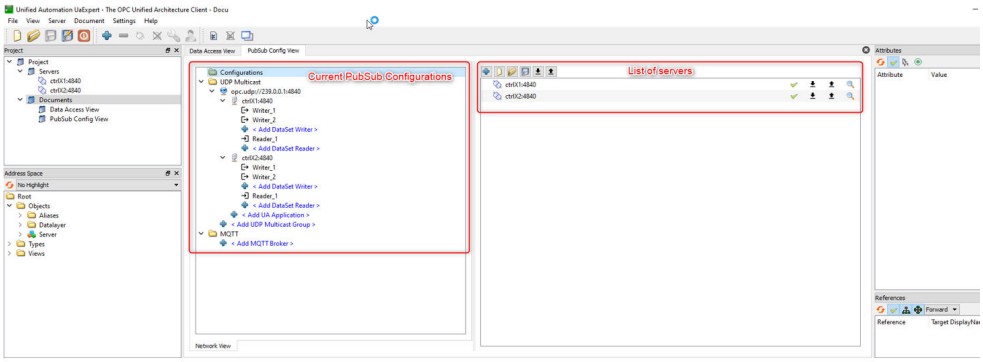

Fig. 10: UaExpert - Overview on the current Pub/Sub configuration in the "PubSub Config View"

The example shows how to delete the existing configuration and how to create a new configuration.

1. To delete a configuration, right-click on the configuration, in the example *opc.udp://239.0.01*, and select “Remove”.
2. In the next step, define the configuration of the Publisher dataset of the ctrlX1 control.

   Only the command “<Add UDP Multicast Group>” is available in UaExpert.

   Des following description shows how the multicast group is used for the unicast publishing.
3. In "PubSub Config View", double-click on the entry “<Add UDP Multicast Group>”.
4. Enter the IP address of the Subscriber control into the editing field on the right side of the "*opc.udp://<IP Address>:4840*". Use the format PubSub Config View.

   ➧ In the example, the Subscriber is ctrlX2 with the IP address 192.168.2.1.
5. Save the settings with “OK” at the lower edge of the "PubSub Config View".

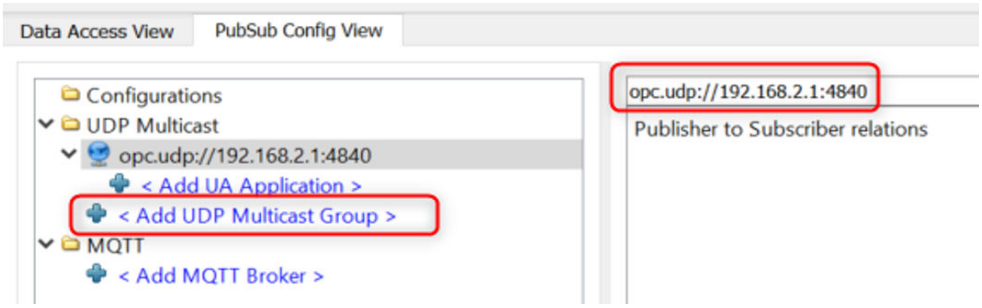

Fig. 11: UaExpert - Adding a UDP multicast group

6. Double-click on the entry “<Add UA Application>” in the "PubSub Config View" to add a UA application (see Fig. 12).
7. Select ctrlX1 as server, as ctrlX1 is the device on which the Publisher should run.

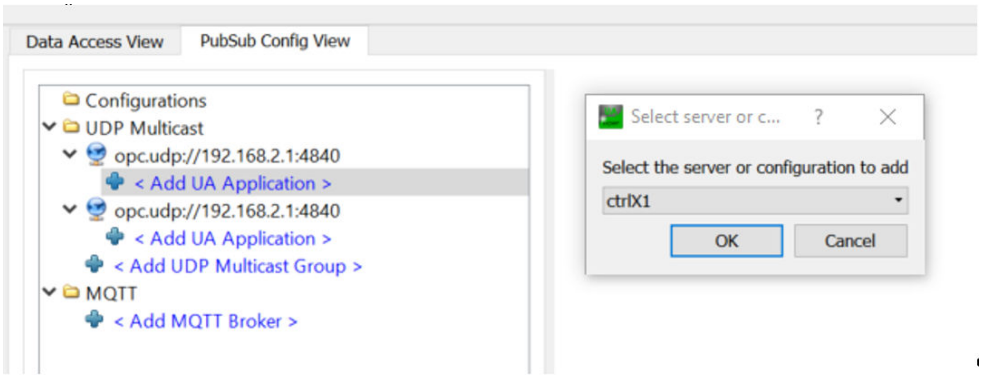

Fig. 12: UaExpert - Adding a UA application

The following steps are required to configure the Publisher dataset:

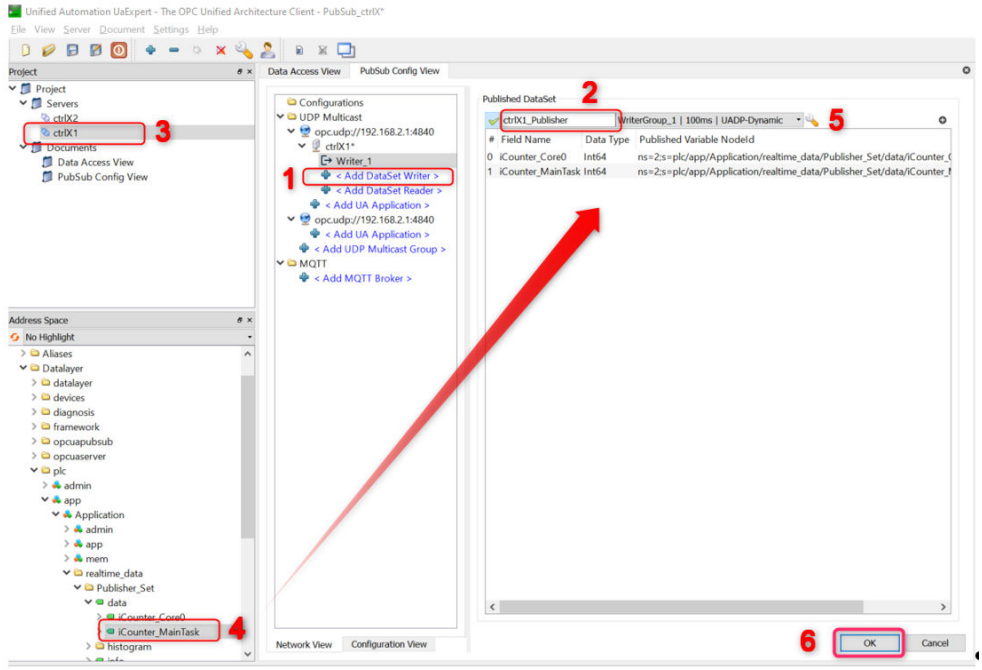

Fig. 13: UaExpert - Defining the Publisher dataset

1. Double-click on the entry “<Add DataSet Writer>” in the "PubSub Config View".
2. Enter a customized name for the Publisher dataset.
3. Select the Publisher control ctrlX1 in the UaExpert project tree and right-click to connect the control to “Connect” if ctrlX1 is not yet connected.

4. The available nodes on the ctrlX1 are shown in the window below the UaExpert project tree.

   The PLC variables are stored under the following path if you assigned PLC variables to the ctrlX Data Layer RT:

   Datalayer/plc/app/<PLC application name>/realtime_data/<publisher set name>.

   Select data to be assigned to the Publisher dataset and drag the data to the “Published DataSet” window.

   ℹ The following combinations are **not** allowed in a dataset:
   - Combination of Data Layer NRT and RT variables
   - Data from different Data Layer RT ranges

5. Click on 🔧 to change the settings of the dataset, e.g. the publishing interval of the dataset.

   The default value for the publishing interval is 100 ms. Depending on the CPU load on the ctrlX CORE and the communication load in the network, the publishing interval can be reduced to 2 ms.

6. Save the dataset with “OK”.

Configuring the Subscriber

The Subscriber is configured analogously to the ➦Publisher.

Double-click on “<Add UA Application>” to add the Subscriber.

Select the OPC UA Server of the ctrlX2 in the dialog for the server selection.

The control ctrlX2 should read the published dataset as Subscriber.

1. Double-click on ctrlX2<“>” below Add DataSet Reader.
2. Select ctrlX1 and the previously defined name of the Publisher dataset ("ctrlX1_Publisher") in the dialog to select data to be published.

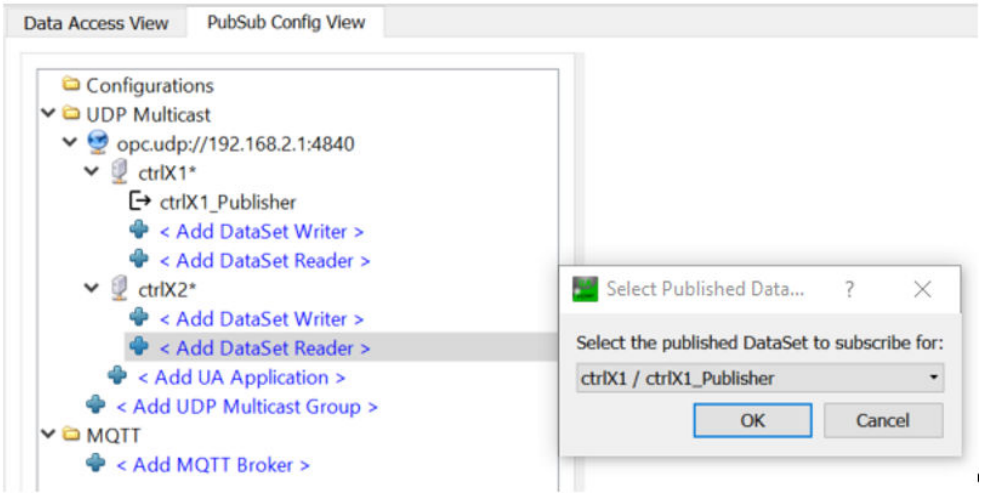

Fig. 14: UaExpert - Selecting the Publisher

The following steps are required to configure the Subscriber dataset:

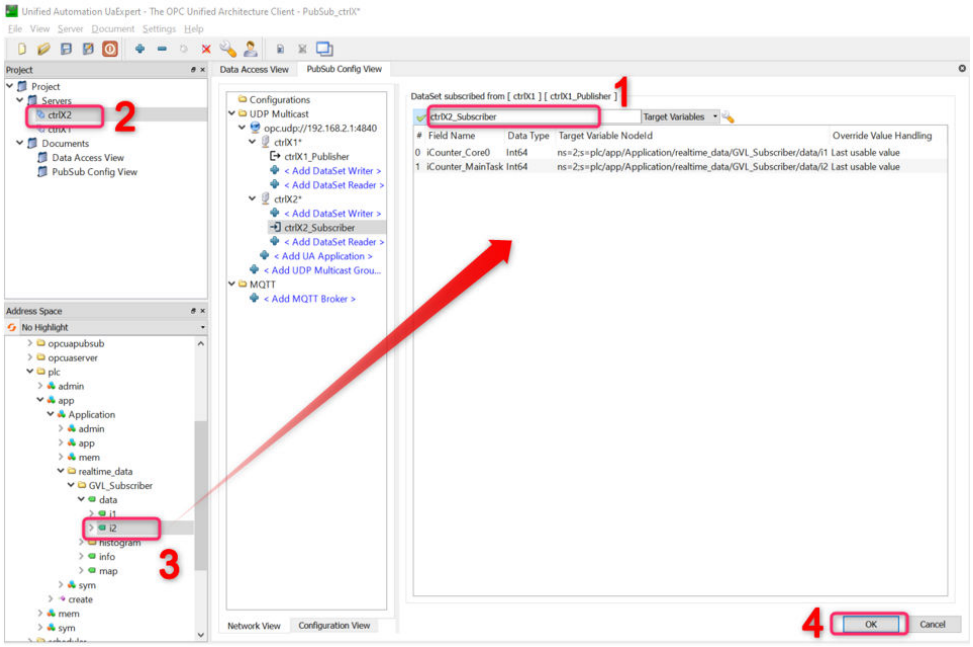

Fig. 15: UaExpert - Drag&drop the variables

1. Change a default name to a customized name. This step is optional.

   In the example, the dataset is named "ctrlX2_Subscriber".

2. Select ctrlX2 in the UaExpert project tree and right-click to connect the control with “Connect” if ctrlx2 is not yet connected.

3. The available nodes on the ctrlX2 are shown in the window below the UaExpert project tree.

   The PLC variables are stored under the following path if you assigned PLC variables to the ctrlX Data Layer RT:

   Datalayer/plc/app/<PLC application name>/realtime_data/<subscriber set name>.

   Select a variable in the Data Layer RT of the Subscriber control ctrlX2 and drag it to the line with the respective variables of the Publisher dataset.

   The following assignments are made in the example:

   - The Subscriber variable "i1" is assigned to the Publisher variable "iCounter_Core0".
   - The Subscriber variable "i2" is assigned to the Publisher variable "iCounter_MainTask".

4. To save the Subscriber configuration, select “OK”.

4.10 Downloading the configurations from the Publisher and the Subscriber to the ctrlX CORE control

To load the configurations to the respective controls, proceed as follows:

1. In the "PubSub Config View", click from UaExpert to “Configurations”.
2. Click on the button “Download”.
   ➡ A dialog opens.
3. Select the configurations to be downloaded and confirm the dialog with “OK”.
   ➡ The configuration is automatically set to active after the download and no further actions are required.

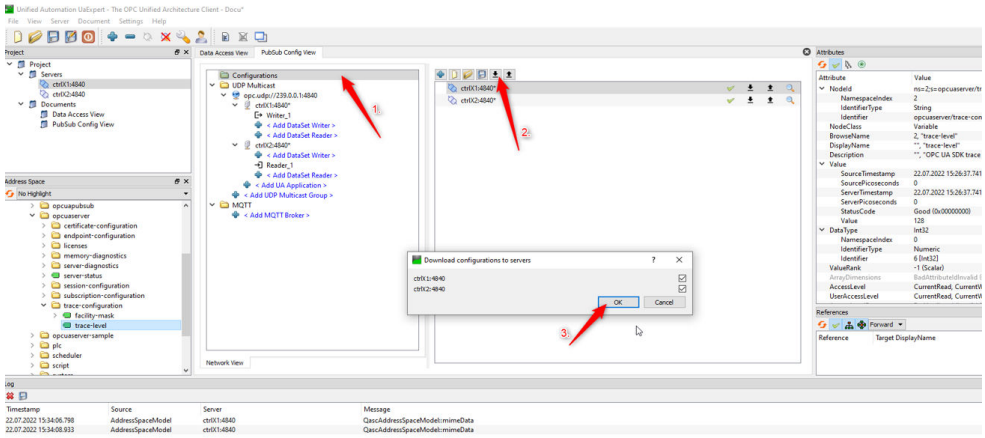

Fig. 16: UaExpert - Loading the Pub/Sub configurations on both ctrlX CORE controls

4.10.1 Example of a use case: Publishing and subscribing PLC variables via the Data Layer RT (realtime)

The OPC UA Pub/Sub app does currently not support any real-time communication.

To use the Data Layer RT, enable the nth buffer.

The procedure is described in ➦ Chapter 4.11 Using the Data Layer RT nth buffer for OPC UA Pub/Sub on page 27.

The PLC application supports the creation of Data Layer RT variables to minimize latency of PLC and Pub/Sub applications are used together.

The following steps are required to create a sample program to use this functionality:

1. In the PLC program, right-click on the “DataLayer_Realtime” and then on *“Add → PLC real-time data”* to add a new PLC real-time data function block.

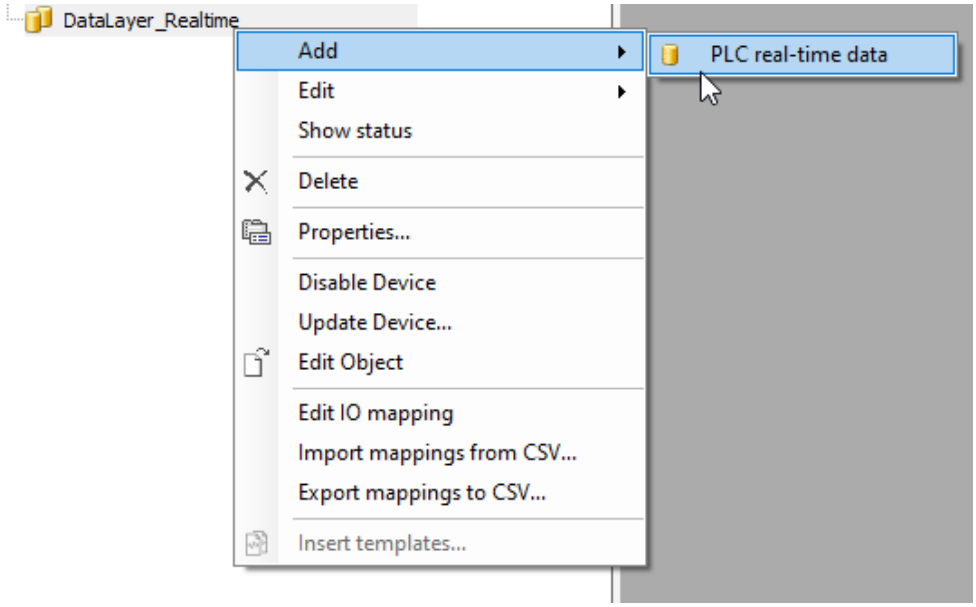

Fig. 17: ctrlX PLC Engineering - PLC real-time data

2. Go to *"Application → Add Object → Global Variable List"* to insert a Global Variable List for your defined variables and define the global variables to be published.

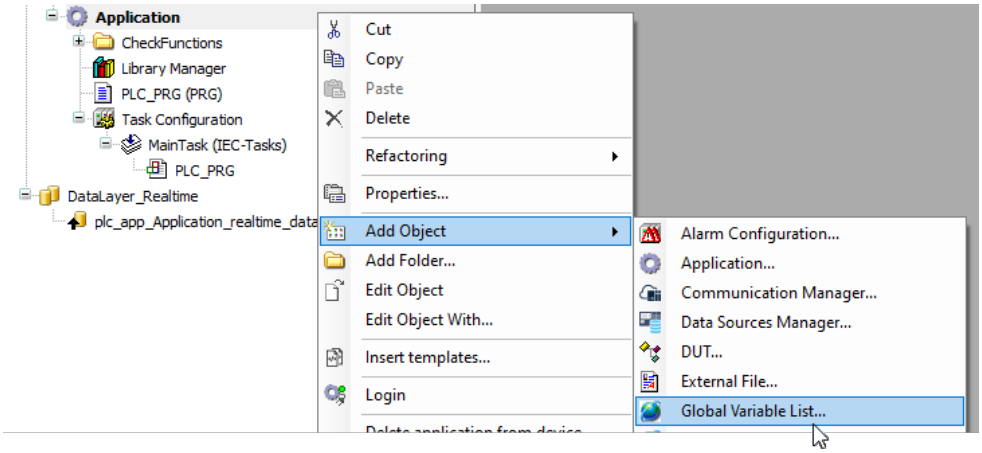

Fig. 18: ctrlX PLC Engineering - Adding Global Variable List

3. Define the Global Variable List as output to be used as PLC real-time data via the right mouse button. This variable list defines data read via the Data Layer RT and sent via OPC UA Publisher.

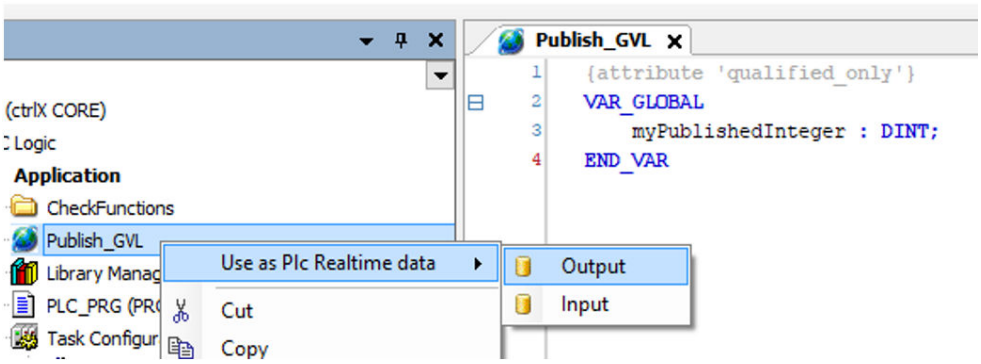

Fig. 19: ctrlX PLC Engineering - Adding an output

4. Repeat the last two steps for the variables to be subscribed and select "Input".

   These variables can be written via Data Layer RT and thus received via the OPC UA Subscriber.

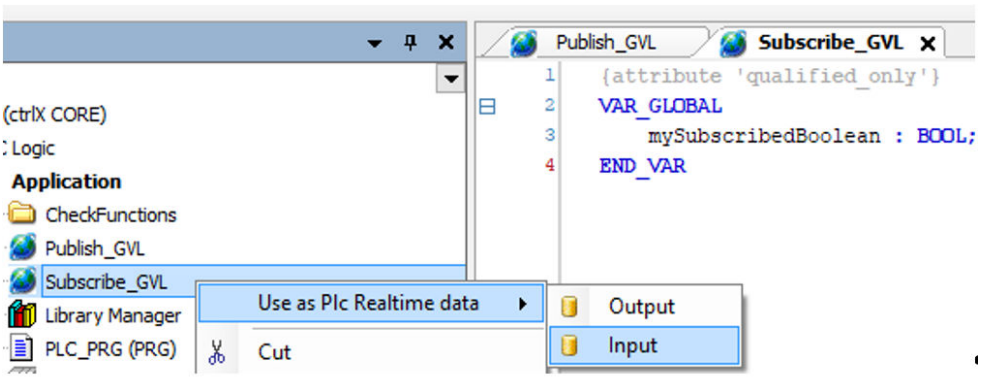

Fig. 20: ctrlX PLC Engineering - Adding an input

5. Use these global variables in your PLC program.

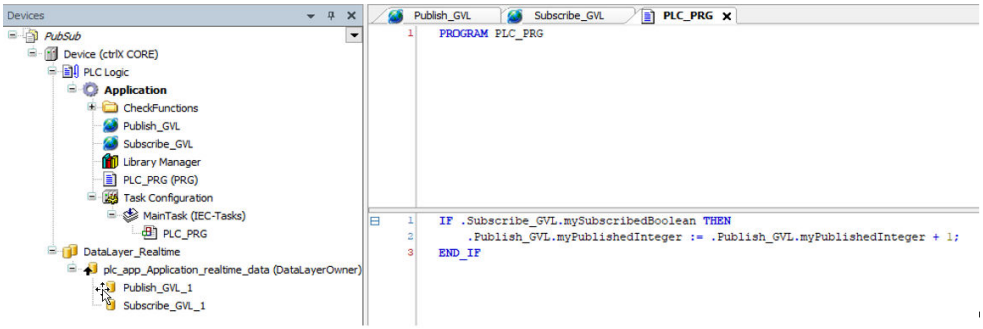

Fig. 21: ctrlX PLC Engineering - Example of adding a PLC logic

Sample code

```
IF .Subscribe_GVL.mySubscribedBoolean THEN
    .Publish_GVL.myPublishedInteger_01 := .Publish_GVL.myPublis
hedInteger_01 + 1;
END_IF
```

After compiling and uploading the PLC program to the control, the variables are available in the Data Layer (OPC UA Namespace 2) under the following address:

plc/app/<app name>/realtime_data/<global variable list name>/data/<variable name>

In this example, the variables are available under the following address:

plc/app/Application/realtime_data/Publish_GVL/data/myPublishedInteger

plc/app/Application/realtime_data/Subscribe_GVL/data/mySubscribedBoolean

These variables can be used in a DataSetWriter and in a DataSetReader of the Pub/Sub configuration, refer to the sections ➦ Chapter Configuring the Subscriber on page 22 and ➦ Chapter Configuring the Publisher on page 19.

The following combinations are not allowed in a dataset:

- Combination of Data Layer NRT and RT variables
- Data from different Data Layer RT ranges

4.10.2 Example of a use case: Multicast publishing

A multicast Publisher is configured analogously to a unicast Publisher except for:

- A gateway has to be configured on your ctrlX CORE device.

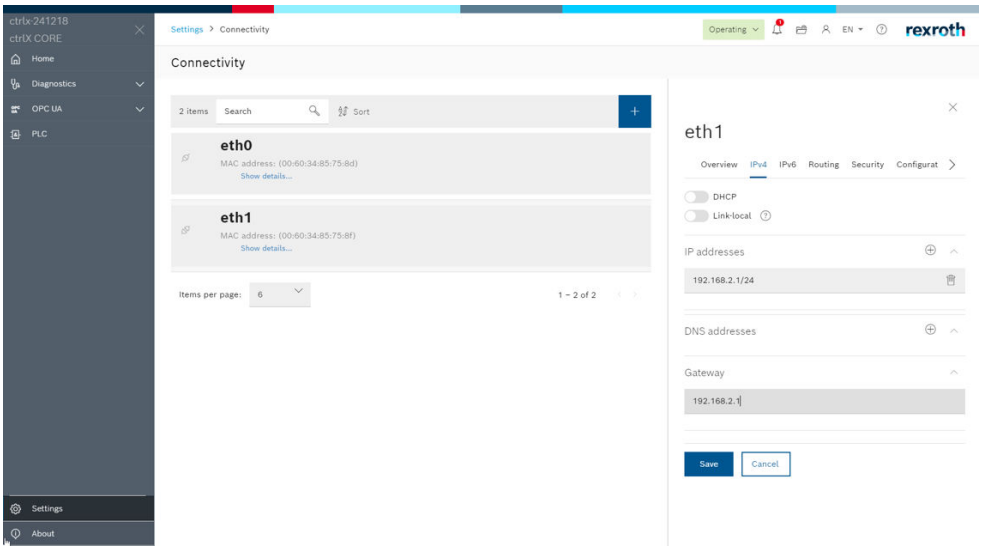

Fig. 22: Website – Configuration example of the gateway address

- Specify the address network interface to be used to publish your multicast messages.

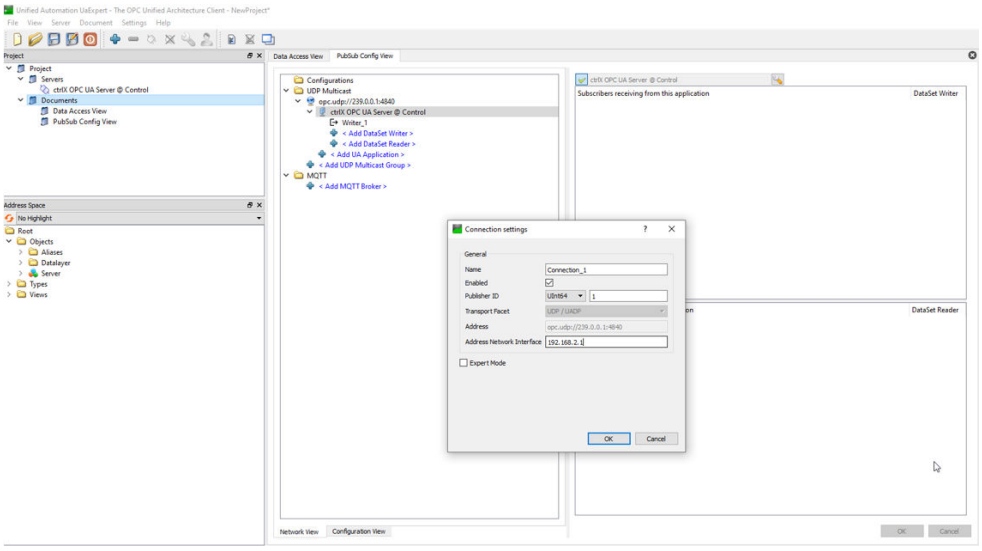

Fig. 23: UaExpert - Example of setting an address network interface

4.11 Using the Data Layer RT nth buffer for OPC UA Pub/Sub

The nth buffer is a function of the Data Layer RT.

Why and when to use nth buffers

For a real-time capable data exchange in the Data Layer RT, a triple buffer (nth buffer with n = 3) is used by default. It allows only a realtime-capable read-only access to data when it is accessed from one process. When accessing from other processes, it is thus required to increase the number of available buffers. The OPC UA Pub/Sub app runs in a separate process. It is thus recommended to configure an nth buffer with at least four buffers (n>=4).

How to activate the nth buffer

The nth buffer can be configured via specific nodes in the Data Layer.

The Data Layer can be accessed via the Data Layer editor integrated into the web interface or via OPC UA.

The value modification with UaExpert is described in the following:

1. Navigate to the node *Datalayer/datalayer/realtime/broker/settings*.
2. In the dialog, change the value from "defaultInputAcessType" to "3".
3. In the dialog, change the value from "defaultN" to the favored number of buffers, but at least four buffers.

   When selecting the number of buffers, note that the nth buffers are not blocked for the n-2 user!

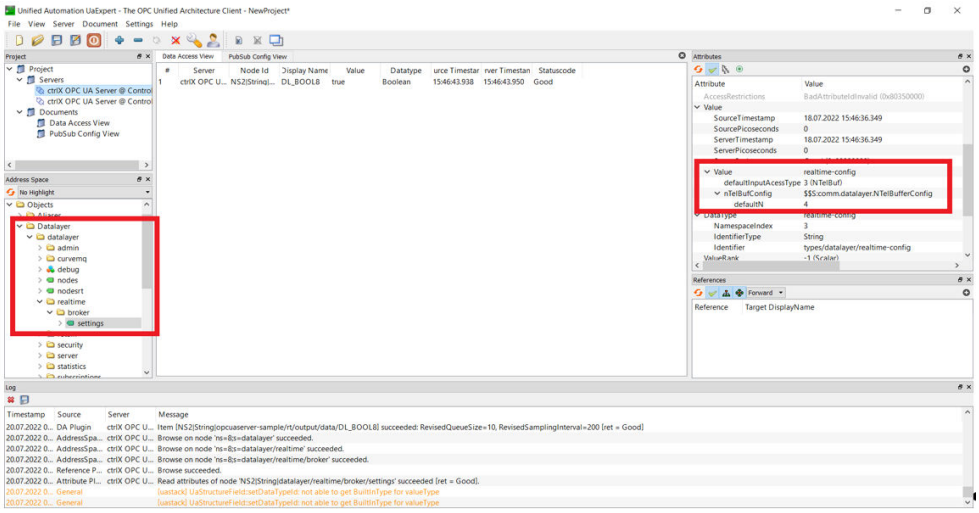

Fig. 24: UaExpert – Changing the properties of the nth buffer

5 Related documentation

5.1 Overview

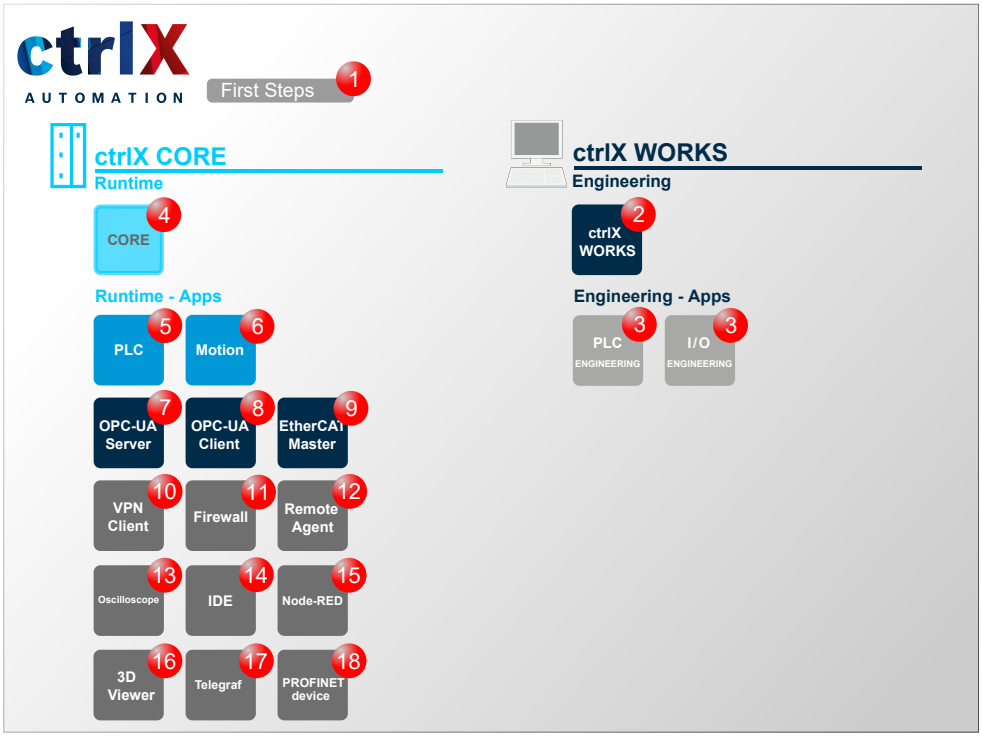

Fig. 25: Overview on further documentations

5.2 ctrlX AUTOMATION

No.	Documentation
1	**ctrlX WORKS First Steps** Quick Start Guide ➦ Web documentation link Ordering information: • DOK-XWORKS-F*STEP*****-QURS-EN-P • R911403760

5.3 ctrlX WORKS

No.	Documentation
2	**ctrlX WORKS Basic System** Application Manual ➥ Web documentation link Ordering information: • DOK-XWORKS-**********-APRS-EN-P • R911403761
3	**ctrlX PLC Engineering - PLC Programming System** Application Manual ➥ Web documentation link Ordering information: • DOK-XPLC**-ENGINEERING-APRS-EN-P • R911403764
3	**ctrlX PLC Engineering - PLC Libraries** Reference ➥ Web documentation link Ordering information: • DOK-XPLC**-LIBRARY****-RERS-EN-P • R911403766

5.4 ctrlX CORE

No.	Documentation
4	**ctrlX CORE - Runtime** Application Manual ➥ Web documentation link Ordering information: • DOK-XCORE*-BASE*******-APRS-EN-P • R911403768
	ctrlX CORE - Diagnostics Reference ➥ Web documentation link Ordering information: • DOK-XCORE*-DIAG*******-RERS-EN-P • R911403770

5.5 ctrlX CORE apps

No.	Documentation
5	**PLC App - PLC Runtime Environment for ctrlX CORE** Application Manual ➥ Web documentation link Ordering information: • DOK-XCORE*-PLC********-APRS-EN-P • R911403787

No.	Documentation
6	**Motion App - Motion Runtime Environment for ctrlX CORE** Application Manual ➦ Web documentation link Ordering information: • DOK-XCORE*-MOTION*****-APRS-EN-P • R911403791
7	**OPC UA Server App - OPC UA Server for ctrlX CORE** Application Manual ➦ Web documentation link Ordering information: • DOK-XCORE*-OPCUA*SERV*-APRS-EN-P • R911403778
8	**OPC UA Client App - OPC UA Client for ctrlX CORE** Application Manual ➦ Web documentation link Ordering information: • DOK-XCORE*-OPCUA*CLIEN-APRS-EN-P • R911403781
9	**EtherCAT Master App - EtherCAT master for ctrlX CORE** Application Manual ➦ Web documentation link Ordering information: • DOK-XCORE*-ETHERCAT***-APRS-EN-P • R911403773
10	**VPN Client App - Remote Support Software for ctrlX CORE** Application Manual ➦ Web documentation link Ordering information: • DOK-XCORE*-VPN********-APRS-EN-P • R911403775
11	**Firewall App - Security Functions for ctrlX CORE** Application Manual ➦ Web documentation link Ordering information: • DOK-XCORE*-FIREWALL***-APRS-EN-P • R911403783
12	**Remote Agent App - ctrlX Device Portal Connection for ctrlX Devices** Application Manual ➦ Web documentation link Ordering information: • DOK-XCORE*-REMOTE*AG**-APRS-EN-P • R911403785

No.	Documentation
13	**Oscilloscope App - Oscilloscope Function for ctrlX Devices** Application Manual ➥ Web documentation link Ordering information: • DOK-XCORE*-OSCI*******-APRS-EN-P • R911409806
14	**IDE App - Integrated Development Environment** Application Manual ➥ Web documentation link Ordering information: • DOK-XCORE*-IDE********-APRS-EN-P • R911410625
15	**Node RED App - Graphic Programming for ctrlX CORE** Application Manual ➥ Web documentation link Ordering information: • DOK-XCORE*-NODE*RED***-APRS-EN-P • R911403789
16	**3D Viewer App - Browser-based 3D Kinematic Simulation for ctrlX CORE** Application Manual ➥ Web documentation link Ordering information: • DOK-XCORE*-3D*VIEWER**-APRS-EN-P • R911416124
17	**Telegraf App - Server Agent for Collecting Data in the Data Layer** Application Manual ➥ Web documentation link Ordering information: • DOK-XCORE*-TELEGRAF***-AP01-EN-P • R911416836
18	**PROFINET device App - PROFINET device for ctrlX CORE** Application Manual ➥ Web documentation link Bestellinformationen: • DOK-XCORE*-PROFINET***-AP01-EN-P • R911417857

6 Service and support

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Internet:	➦http://www.boschrexroth.com

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Preparing information

To be able to help you more quickly and efficiently, please have the following information ready:

- Detailed description of malfunction and circumstances
- Type plate specifications of the affected products, in particular type codes and serial numbers
- Your contact data (phone and fax number as well as your e-mail address)

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rexroth
A Bosch Company

Bosch Rexroth AG
Bgm.-Dr.-Nebel-Str. 2
97816 Lohr a.Main
Germany
Tel. +49 9352 18 0
Fax +49 9352 18 8400
www.boschrexroth.com/electrics

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