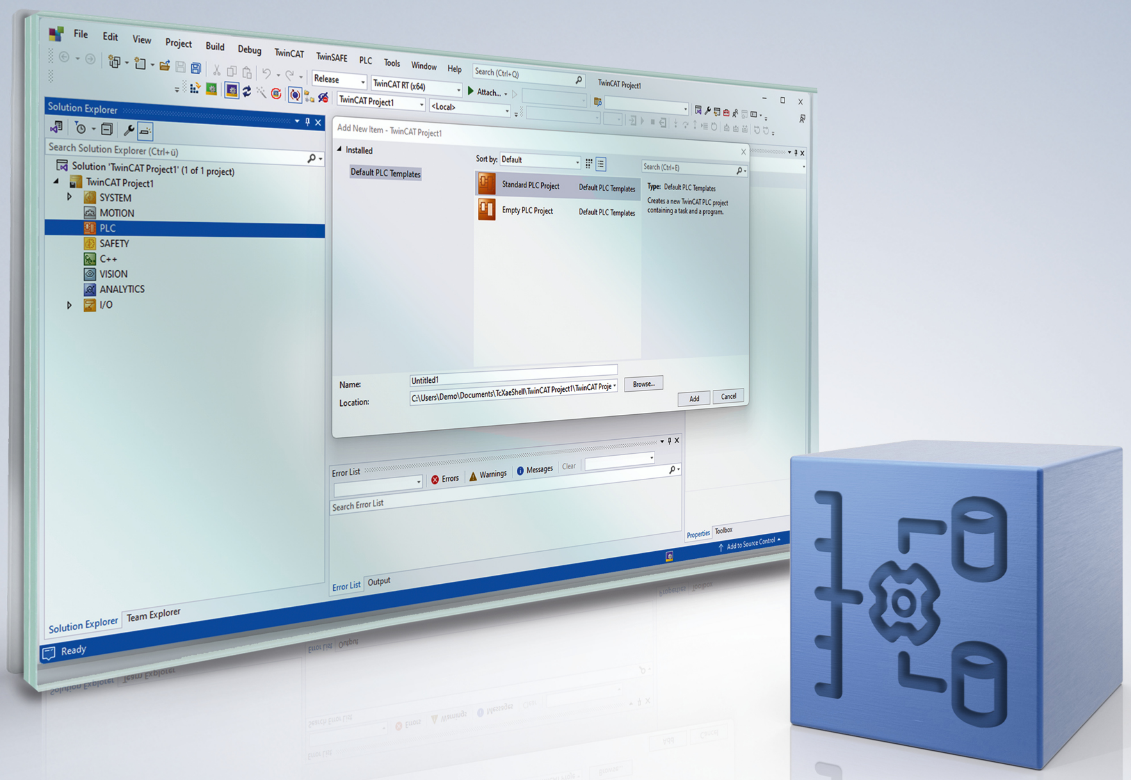
BECKHOFF New Automation Technology

Manual | EN

TF3520

TwinCAT 3 | Analytics Storage Provider



2025-10-23 | Version: 1.7.1

Table of contents

1 Foreword

1.1 Notes on the documentation

This description is intended exclusively for trained specialists in control and automation technology who are familiar with the applicable national standards.
The documentation and the following notes and explanations must be complied with when installing and commissioning the components.
The trained specialists must always use the current valid documentation.

The trained specialists must ensure that the application and use of the products described is in line with all safety requirements, including all relevant laws, regulations, guidelines, and standards.

Disclaimer

The documentation has been compiled with care. The products described are, however, constantly under development.
We reserve the right to revise and change the documentation at any time and without notice.
Claims to modify products that have already been supplied may not be made on the basis of the data, diagrams, and descriptions in this documentation.

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1.2 For your safety

Safety regulations

Read the following explanations for your safety.
Always observe and follow product-specific safety instructions, which you may find at the appropriate places in this document.

Exclusion of liability

All the components are supplied in particular hardware and software configurations which are appropriate for the application. Modifications to hardware or software configurations other than those described in the documentation are not permitted, and nullify the liability of Beckhoff Automation GmbH & Co. KG.

Personnel qualification

This description is only intended for trained specialists in control, automation, and drive technology who are familiar with the applicable national standards.

Signal words

The signal words used in the documentation are classified below. In order to prevent injury and damage to persons and property, read and follow the safety and warning notices.

Personal injury warnings

⚠ DANGER
Hazard with high risk of death or serious injury.

⚠ WARNING
Hazard with medium risk of death or serious injury.

⚠ CAUTION
There is a low-risk hazard that could result in medium or minor injury.

Warning of damage to property or environment

NOTICE
The environment, equipment, or data may be damaged.

Information on handling the product

This information includes, for example:
recommendations for action, assistance or further information on the product.

1.3 Notes on information security

The products of Beckhoff Automation GmbH & Co. KG (Beckhoff), insofar as they can be accessed online, are equipped with security functions that support the secure operation of plants, systems, machines and networks. Despite the security functions, the creation, implementation and constant updating of a holistic security concept for the operation are necessary to protect the respective plant, system, machine and networks against cyber threats. The products sold by Beckhoff are only part of the overall security concept. The customer is responsible for preventing unauthorized access by third parties to its equipment, systems, machines and networks. The latter should be connected to the corporate network or the Internet only if appropriate protective measures have been set up.

In addition, the recommendations from Beckhoff regarding appropriate protective measures should be observed. Further information regarding information security and industrial security can be found in our https://www.beckhoff.com/secguide.

Beckhoff products and solutions undergo continuous further development. This also applies to security functions. In light of this continuous further development, Beckhoff expressly recommends that the products are kept up to date at all times and that updates are installed for the products once they have been made available. Using outdated or unsupported product versions can increase the risk of cyber threats.

To stay informed about information security for Beckhoff products, subscribe to the RSS feed at https://www.beckhoff.com/secinfo.

2 Overview

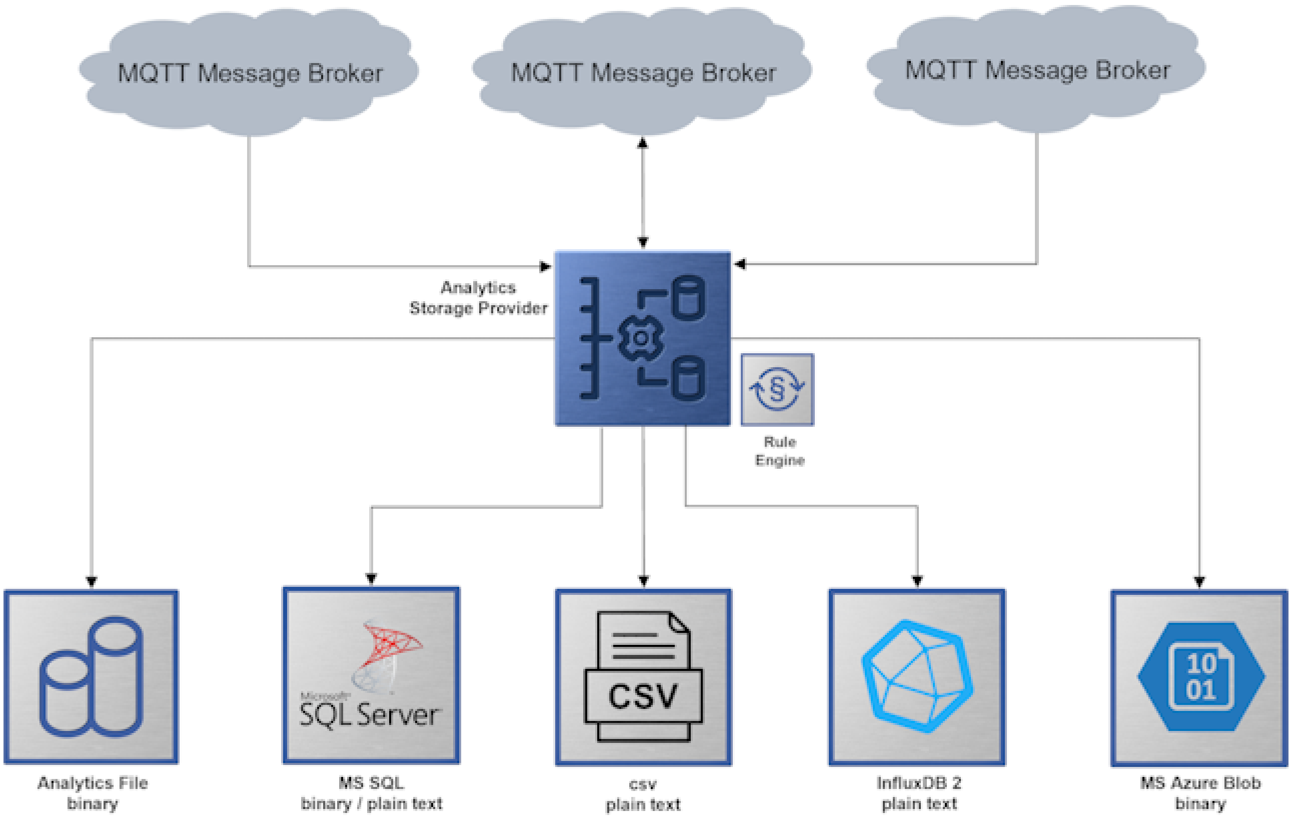
With the TwinCAT Analytics Storage Provider, Beckhoff offers a way to continuously store high-resolution data in a binary format or in plain text. The decisive factor is that the user does not have to worry about data storage. The storage provider takes care of this automatically. The configuration is done with a few clicks in engineering. Complex SQL commands are not necessary. Classic databases can be used, but also binary blob stores.

Components

- TwinCAT Analytics Storage Provider service: A Windows service that manages the communication.
- TwinCAT Analytics Storage Provider PLC Library: A TwinCAT 3 PLC library with functions for controlling the storage provider from a PLC application.
- TwinCAT Analytics Storage Provider Client: A console application with functions for controlling the Storage Provider via the command line.
- TwinCAT Analytics Storage Provider Configurator: An engineering application for configuring the various data sinks and data sources.
- TwinCAT Analytics Storage Provider Manager: An engineering application for managing the recorded data and controlling the Storage Provider.

Principle of operation

The Analytics Storage Provider receives and sends data via MQTT communication protocol. For this purpose, it is connected to a native MQTT message broker in the network and on the other side to the corresponding data sink.



Supported databases/storage

- TwinCAT Analytics Binary File [▸ 48]
- Microsoft SQL (binary format / plain text [▸ 49])
- CSV file [▸ 51]
- InfluxDB [▸ 52]

- Microsoft Azure Blob [▶ 53]

3 Installation

3.1 System requirements

The requirements of the Service and the PLC library of the Analytics Storage Provider can be found in the following tables. It is also possible to install both on one system as well.

Technical data Service	TF3520 TwinCAT 3 Analytics Storage Provider
Target System	Windows 10, TwinCAT/BSD
.NET Framework	.Net 4.5.1 or higher
Min. TwinCAT version	3.1.4022.25
Min. TwinCAT level	TC1000 | TwinCAT 3 ADS

Technical data Library	TF3520 TwinCAT 3 Analytics Storage Provider
Target System	Windows 10, TwinCAT/BSD
Min. TwinCAT version	3.1.4022.29
Min. TwinCAT level	TC1200 | TwinCAT 3 PLC

3.2 Installation

Setup installation (TwinCAT 3.1 Build 4024)

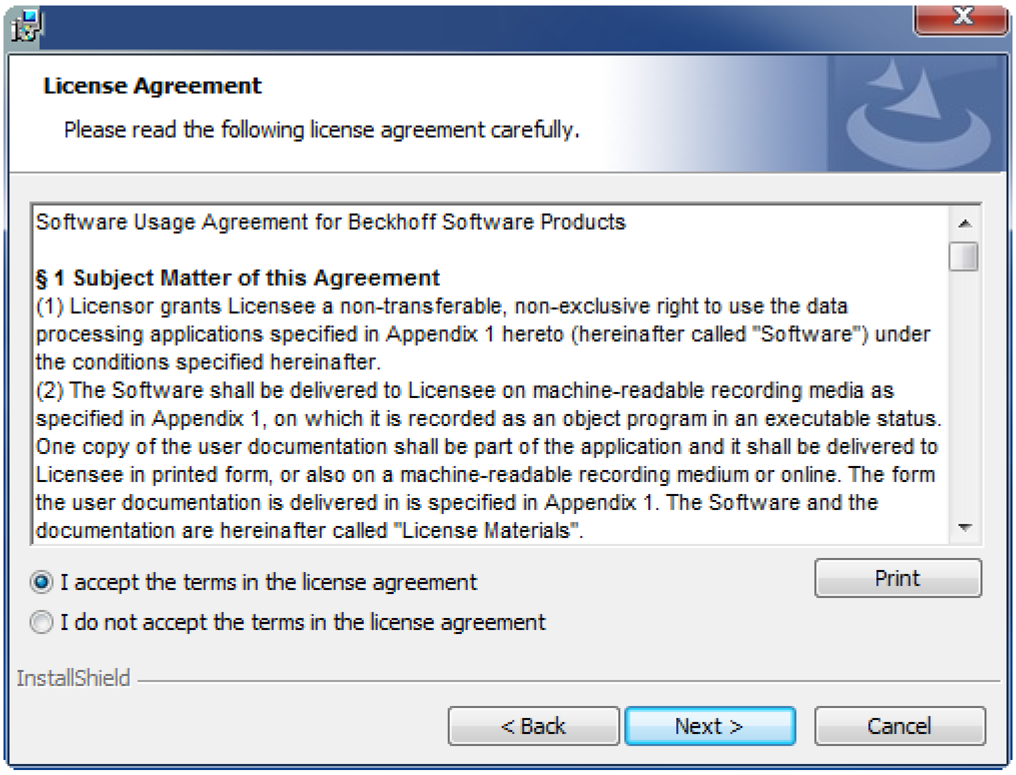
The following section describes how to install the TwinCAT 3 function for Windows-based operating systems.

✓ The TwinCAT 3 function setup file was downloaded from the Beckhoff website.

1. Run the setup file as administrator. To do this, select the **Run As Admin** command in the context menu of the file.

   ⇨ The installation dialog opens.

2. Accept the end user licensing agreement and click **Next**.



License Agreement

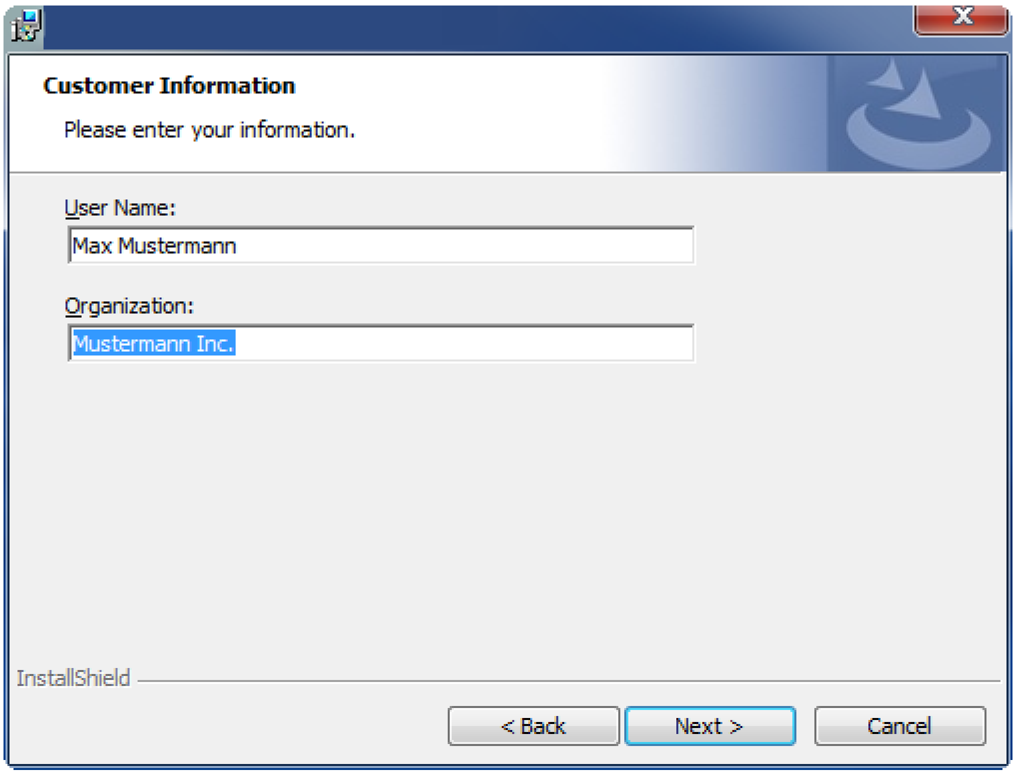
Please read the following license agreement carefully.

Software Usage Agreement for Beckhoff Software Products

§ 1 Subject Matter of this Agreement
(1) Licensor grants Licensee a non-transferable, non-exclusive right to use the data processing applications specified in Appendix 1 hereto (hereinafter called "Software") under the conditions specified hereinafter.
(2) The Software shall be delivered to Licensee on machine-readable recording media as specified in Appendix 1, on which it is recorded as an object program in an executable status. One copy of the user documentation shall be part of the application and it shall be delivered to Licensee in printed form, or also on a machine-readable recording medium or online. The form the user documentation is delivered in is specified in Appendix 1. The Software and the documentation are hereinafter called "License Materials".

[✓ I accept the terms in the license agreement]
I do not accept the terms in the license agreement

3. Enter your user data.


Customer Information

Please enter your information.

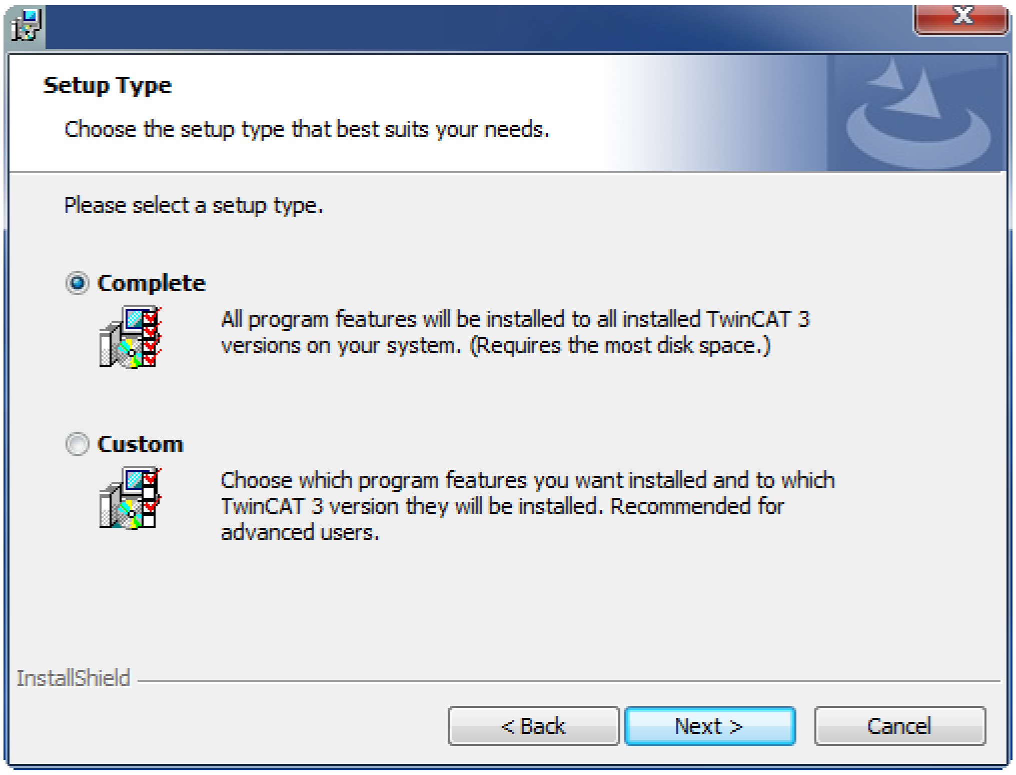
User Name:

Max Mustermann

Organization:

Mustermann Inc.

4. If you want to install the full version of the TwinCAT 3 function, select **Complete** as the installation type. If you want to install the TwinCAT 3 function components separately, select **Custom**.


Setup Type

Choose the setup type that best suits your needs.

Please select a setup type.

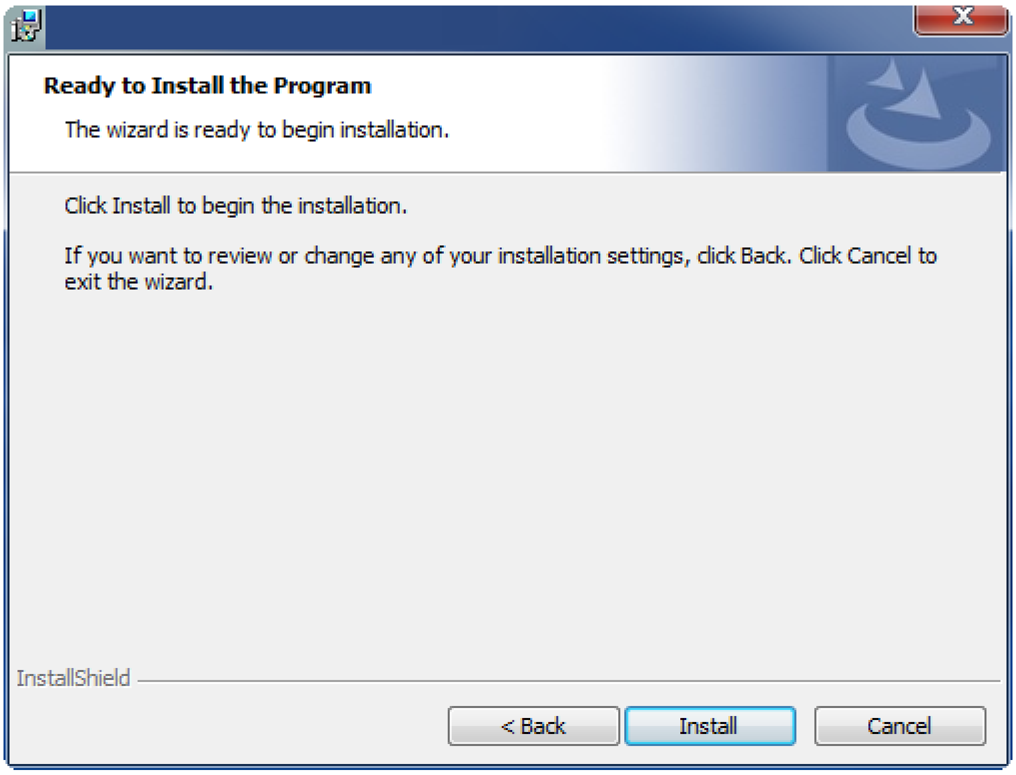
[✓ Complete]

All program features will be installed to all installed TwinCAT 3 versions on your system. (Requires the most disk space.)

Custom

Choose which program features you want installed and to which TwinCAT 3 version they will be installed. Recommended for advanced users.

5. Click **Next**, then **Install** to start the installation.


Ready to Install the Program

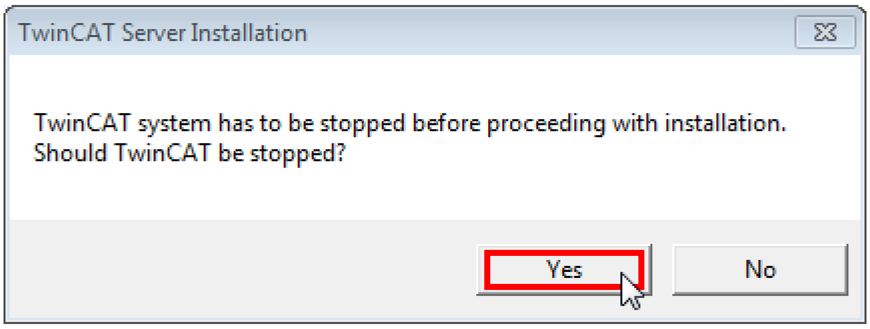
The wizard is ready to begin installation.

Click Install to begin the installation.

If you want to review or change any of your installation settings, click Back. Click Cancel to exit the wizard.

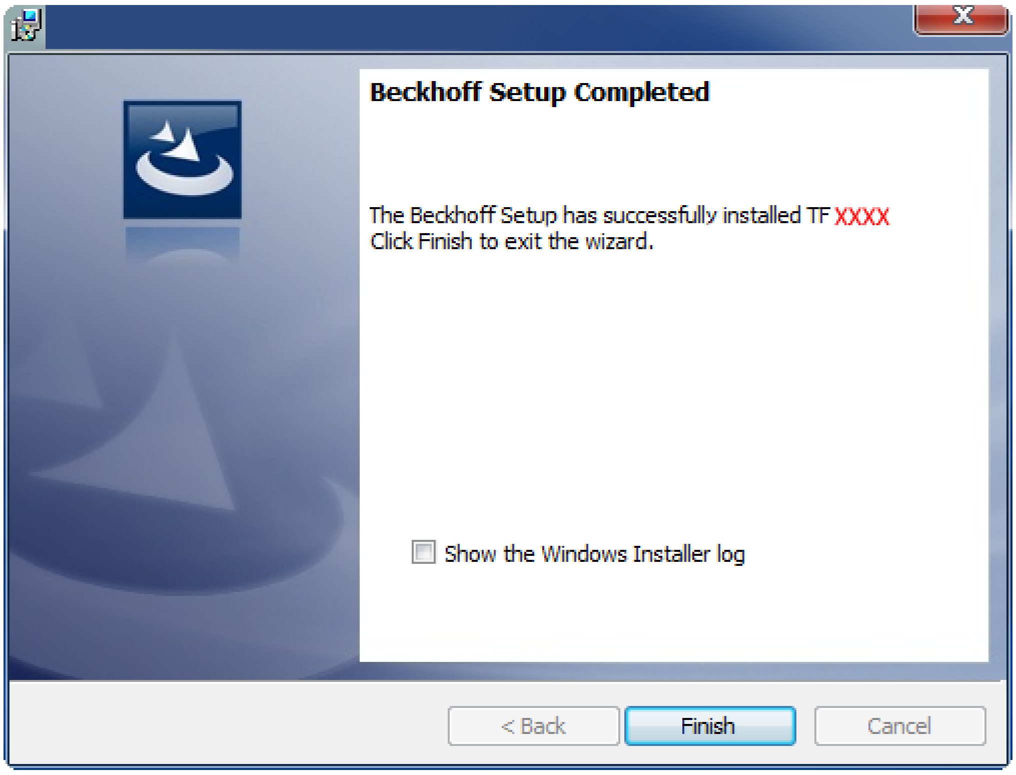
⇨ A dialog box informs you that the TwinCAT system must be stopped to proceed with the installation.

6. Confirm the dialog with **Yes.**


TwinCAT Server Installation

TwinCAT system has to be stopped before proceeding with installation.
Should TwinCAT be stopped?

7. Click **Finish** to exit the setup.



Beckhoff Setup Completed

The Beckhoff Setup has successfully installed TF XXXX
Click Finish to exit the wizard.

⇨ The TwinCAT 3 function has been installed successfully.

3.3 Installation under TwinCAT4026

TwinCAT Package Manager

If you are using TwinCAT 3.1 Build 4026 (and higher) on the Microsoft Windows operating system, you can install this function via the TwinCAT Package Manager, see Installation documentation.

Normally you install the function via the corresponding workload; however, you can also install the packages contained in the workload individually. This documentation briefly describes the installation process via the workload.

Command line program TcPkg

You can use the TcPkg **C**ommand **L**ine **I**nterface (CLI) to display the available workloads on the system:

```
tcpkg list TF3520
```

You can use the following command to install the Workload of the TF3520 TC3 Analytics Storage Provider function.

```
tcpkg install TF3520.AnalyticsStorageProvider.XAE
tcpkg install TF3520.AnalyticsStorageProvider.XAR
```

TwinCAT Package Manager UI

You can use the **U**ser **I**nterface (UI) to display all available workloads and install them if required.
To do this, follow the corresponding instructions in the interface.

3.4 Licensing

The TwinCAT 3 function can be activated as a full version or as a 7-day test version. Both license types can be activated via the TwinCAT 3 development environment (XAE).

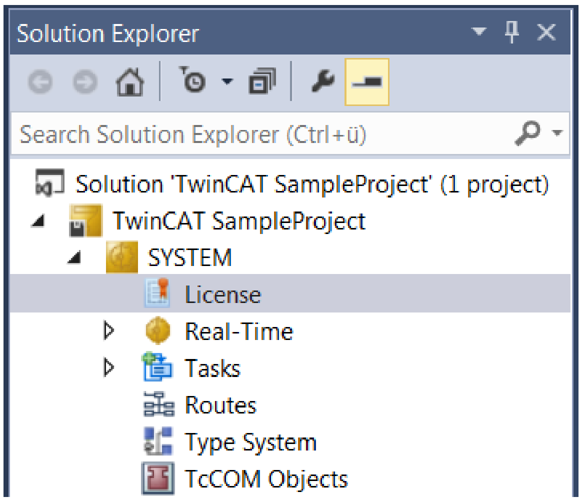
Licensing the full version of a TwinCAT 3 Function

A description of the procedure to license a full version can be found in the Beckhoff Information System in the documentation "TwinCAT 3 Licensing".

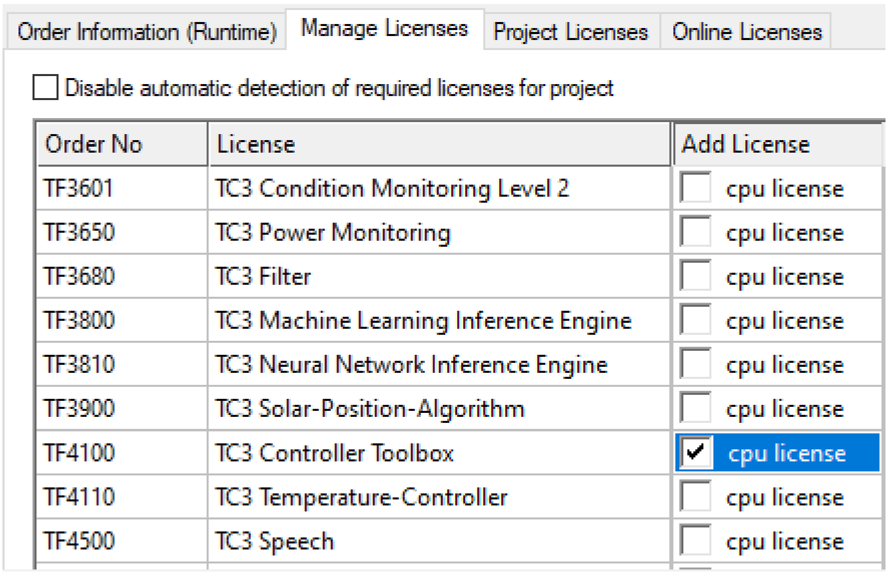
Licensing the 7-day test version of a TwinCAT 3 Function

A 7-day test version cannot be enabled for a TwinCAT 3 license dongle.

1. Start the TwinCAT 3 development environment (XAE).
2. Open an existing TwinCAT 3 project or create a new project.
3. If you want to activate the license for a remote device, set the desired target system. To do this, select the target system from the **Choose Target System** drop-down list in the toolbar.
   ⇨ The licensing settings always refer to the selected target system. When the project is activated on the target system, the corresponding TwinCAT 3 licenses are automatically copied to this system.
4. In the **Solution Explorer**, double-click **License** in the **SYSTEM** subtree.



   ⇨ The TwinCAT 3 license manager opens.
5. Open the **Manage Licenses** tab. In the **Add License** column, check the check box for the license you want to add to your project (e.g. "TF4100 TC3 Controller Toolbox").

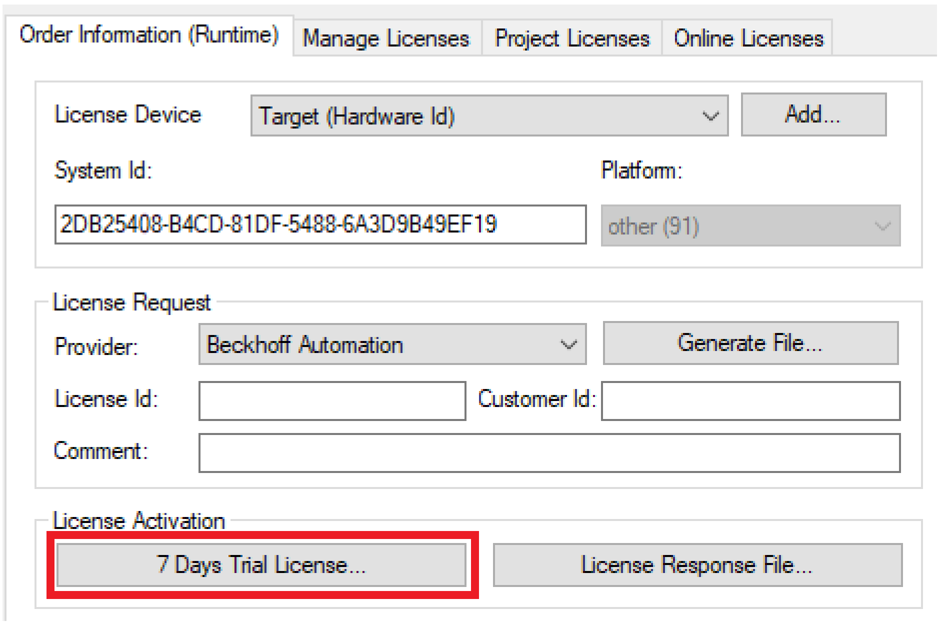


☐ Disable automatic detection of required licenses for project

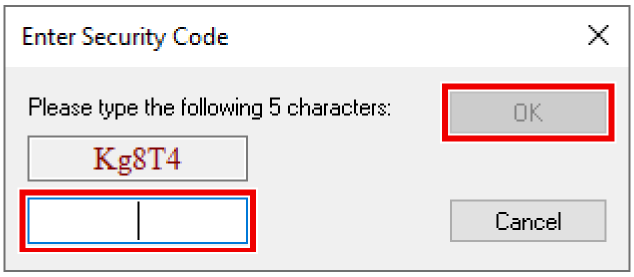
Order No	License	Add License
TF3601	TC3 Condition Monitoring Level 2	☐ cpu license
TF3650	TC3 Power Monitoring	☐ cpu license
TF3680	TC3 Filter	☐ cpu license
TF3800	TC3 Machine Learning Inference Engine	☐ cpu license
TF3810	TC3 Neural Network Inference Engine	☐ cpu license
TF3900	TC3 Solar-Position-Algorithm	☐ cpu license
TF4100	TC3 Controller Toolbox	✓ cpu license
TF4110	TC3 Temperature-Controller	☐ cpu license
TF4500	TC3 Speech	☐ cpu license

6. Open the **Order Information (Runtime)** tab.
   ⇨ In the tabular overview of licenses, the previously selected license is displayed with the status “missing”.

7. Click **7-Day Trial License...** to activate the 7-day trial license.



⇨ A dialog box opens, prompting you to enter the security code displayed in the dialog.



8. Enter the code exactly as it is displayed and confirm the entry.
9. Confirm the subsequent dialog, which indicates the successful activation.
   ⇨ In the tabular overview of licenses, the license status now indicates the expiry date of the license.
10. Restart the TwinCAT system.

⇨ The 7-day trial version is enabled.

3.5 Installing the TwinCAT/BSD

The TwinCAT 3 Analytics Storage Provider Server is available as a package for TwinCAT/BSD in the package repository. Under the package name "TF3520 Analytics Storage Provider" it can be installed via the following command:

```
doas pkg install TF3520-Analytics-Storage-Provider
```

Further information about the Package Server can be found in the Embedded PC section of the TwinCAT/ BSD manual.

After a system restart or restart of TwinCAT, the TwinCAT 3 Analytics Storage Provider Server is also started and can be configured by a client via MQTT.

MQTT port enabling

To use the Analytics Storage Provider and Console Configurator/Client [▸ 99] under TwinCAT/ BSD, the corresponding MQTT port must be enabled for communication. For more info see: Port enabling under TwinCAT/BSD

After installation, the Client.dll for the console is located under the path */usr/local/etc/TwinCAT/Functions/ TF3520-Analytics-Storage-Provider/Client*.

The Analytics Storage Provider service can be started by the following command if the license is activated:

```
doas service TcAnalyticsStorageProvider start
```

4 Analytics Workflow - First Steps

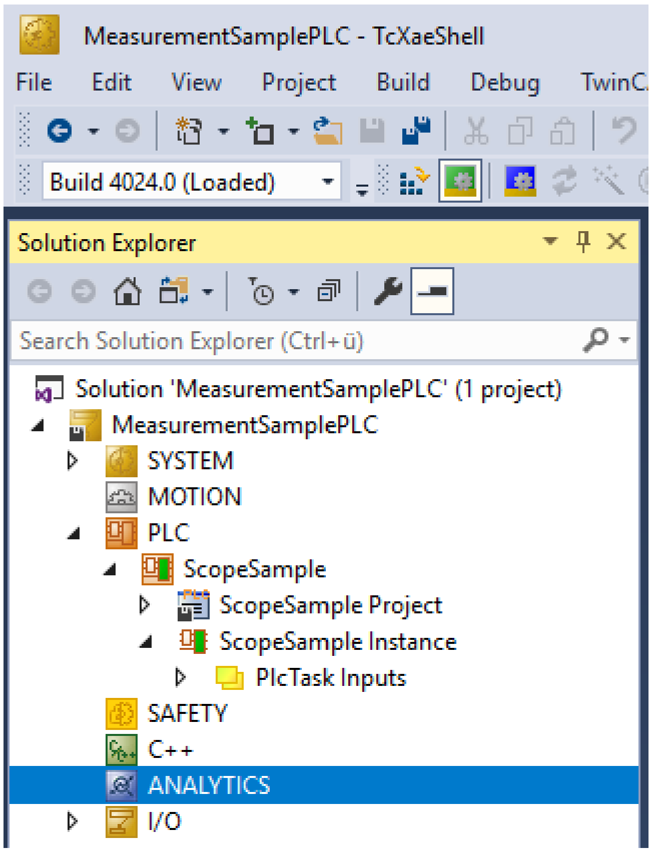
This step by step documentation presents the complete TwinCAT Analytics workflow. From the data acquisition over the communication and historizing up to the evaluation and analysis of the data and to the presentation of the data in web-based dashboard.

4.1 Recording data from the machine

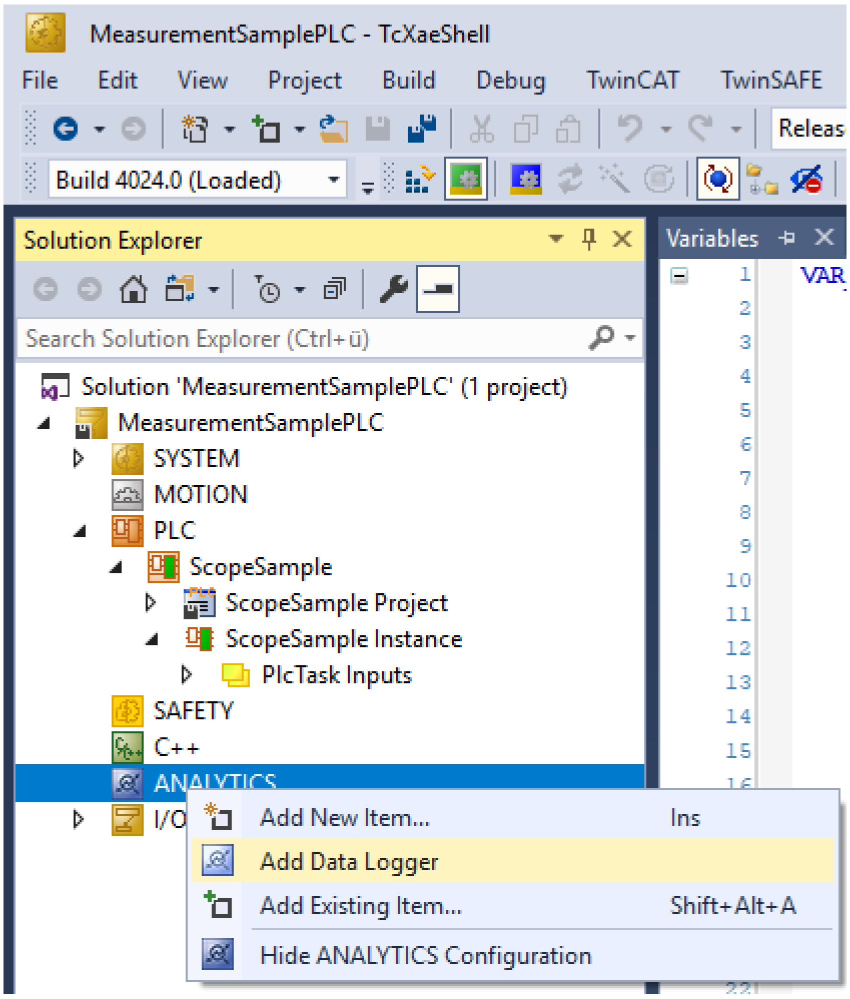
On the machine side is the Analytics Logger the recorder of process data from the machine image, PLC, NC and so on. The Logger is working in the real-time context of TwinCAT.

The TwinCAT Analytics Logger is installed with TwinCAT XAE and XAR. The Logger can act as MQTT Client to communicate the recorded data to a native MQTT Message Broker or store the data in the same data format in a local binary file. By the usage as MQTT Client the Logger is able to bypass short disconnects to the Message Broker with a ring buffer functionality. You can configure a ring buffer as well for the local binary file storage.

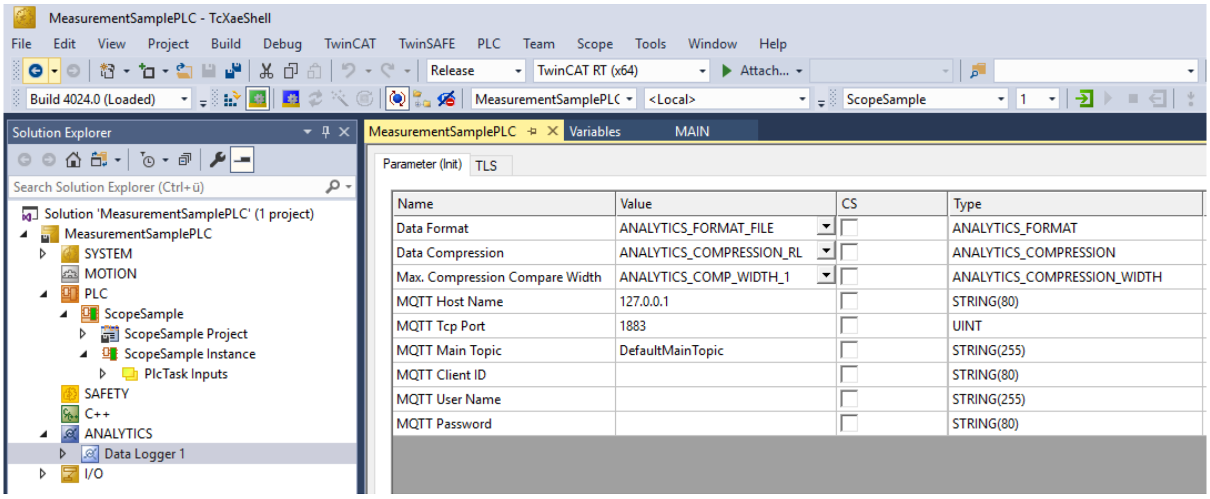
- To configure the Analytics Logger you have to navigate in your existing TwinCAT Project to the Analytics tree node



- Right click on this node and click on “Add Data Logger” to add one new instance to your configuration



- For configuring the base settings, please double click on the new tree item



Name	Value	CS	Type
Data Format	ANALYTICS_FORMAT_FILE		ANALYTICS_FORMAT
Data Compression	ANALYTICS_COMPRESSION_RL		ANALYTICS_COMPRESSION
Max. Compression Compare Width	ANALYTICS_COMP_WIDTH_1		ANALYTICS_COMPRESSION_WIDTH
MQTT Host Name	127.0.0.1		STRING(80)
MQTT Tcp Port	1883		UINT
MQTT Main Topic	DefaultMainTopic		STRING(255)
MQTT Client ID			STRING(80)
MQTT User Name			STRING(255)
MQTT Password			STRING(80)

You can make your specific Analytics Logger settings

-Data Format: Binary file or MQTT stream

-FILE format: Analytics Logger stores the data in local binary files and all other settings are not necessary anymore. The files will be stored in C:\TwinCAT\3.1\Boot\Analytics.

-BINARY: Data will be sent to the configured MQTT Message Broker. You can have multiple Logger in one TwinCAT project to communicate data to different MQTT Message Broker.

-Data Compression: on (default) or off

-Max Compression: mode of the compression

-MQTT host name

-MQTT Tcp port

-MQTT main topic for own hierarchical levels to keep the identification easy

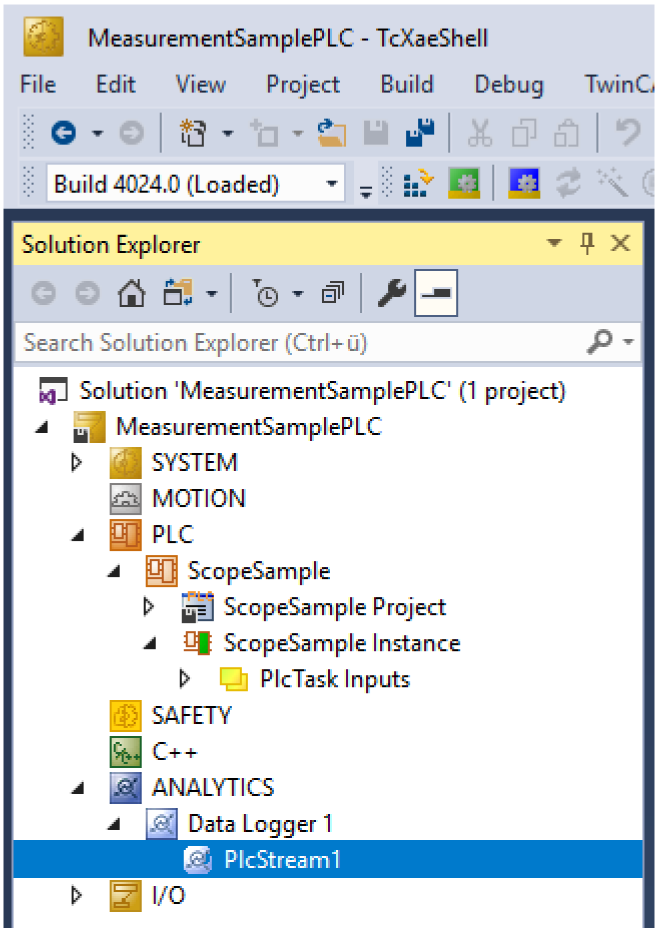
-MQTT Client ID should be unique in the network

-MQTT username

-MQTT password to make authentication at the message broker

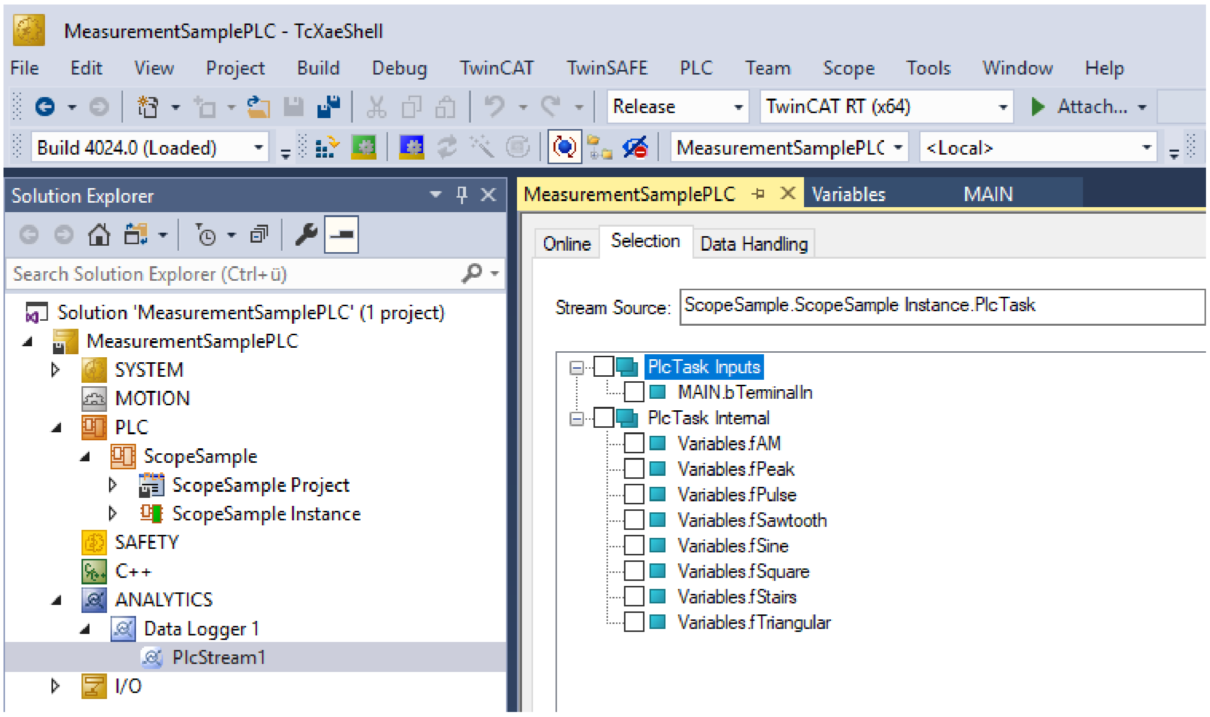
-At the TLS (Transport Layer Security) tab, security settings can be configured. TLS is a secure communication channel between client and server. By the usage of certificates, the TCP port 8883 is exclusively reserved for MQTT over TLS. Analytics Logger is supporting the modes CA Certificates, CA Certificates & Client Certificate and Preshared Key (PSK) mode.

- If variables in your PLC application are marked in the declaration with the attribute {attribute 'TcAnalytics'} they will be shown automatically as a stream below the Data Logger tree node.



An additional device stream will be shown if your configuration provides an EtherCAT Process Image.

- In the stream a Selection tab is available to choose the variables that should be recorded

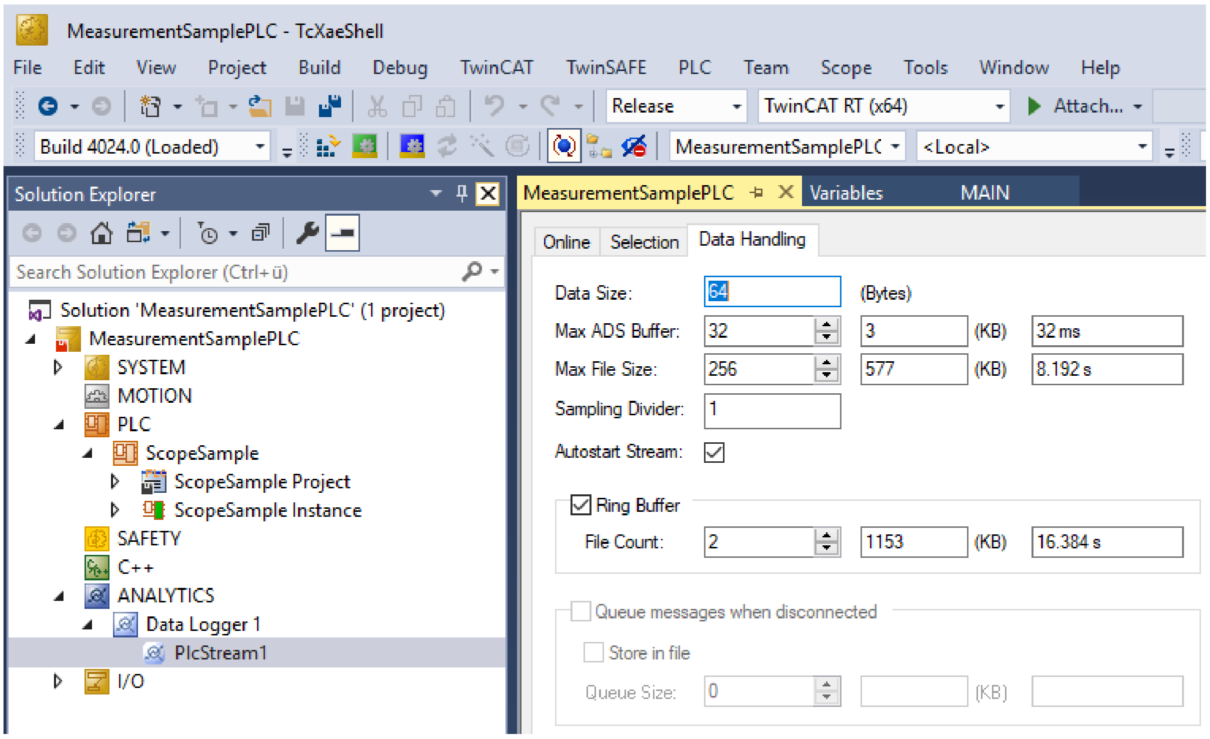


Solution 'MeasurementSamplePLC' (1 project)
- MeasurementSamplePLC
  - SYSTEM
  - MOTION
  - PLC
    - ScopeSample
      - ScopeSample Project
      - ScopeSample Instance
  - SAFETY
  - C++
  - ANALYTICS
    - Data Logger 1
      - PlcStream1
  - I/O

Stream Source: ScopeSample.ScopeSample Instance.PlcTask

- ☐ PlcTask Inputs
  - ☐ MAIN.bTerminalIn
- ☐ PlcTask Internal
  - ☐ Variables.fAM
  - ☐ Variables.fPeak
  - ☐ Variables.fPulse
  - ☐ Variables.fSawtooth
  - ☐ Variables.fSine
  - ☐ Variables.fSquare
  - ☐ Variables.fStairs
  - ☐ Variables.fTriangular

- Finally it is possible to change the package size for the frames or to configure the ring buffer for disconnects and file in the Data Handling tab.



Solution 'MeasurementSamplePLC' (1 project)
- MeasurementSamplePLC
  - SYSTEM
  - MOTION
  - PLC
    - ScopeSample
      - ScopeSample Project
      - ScopeSample Instance
  - SAFETY
  - C++
  - ANALYTICS
    - Data Logger 1
      - PlcStream1
  - I/O

Data Size:	64	(Bytes)		
Max ADS Buffer:	32	3	(KB)	32 ms
Max File Size:	256	577	(KB)	8.192 s
Sampling Divider:	1			
Autostart Stream:	✓			

☑ Ring Buffer

File Count:	2	1153	(KB)	16.384 s

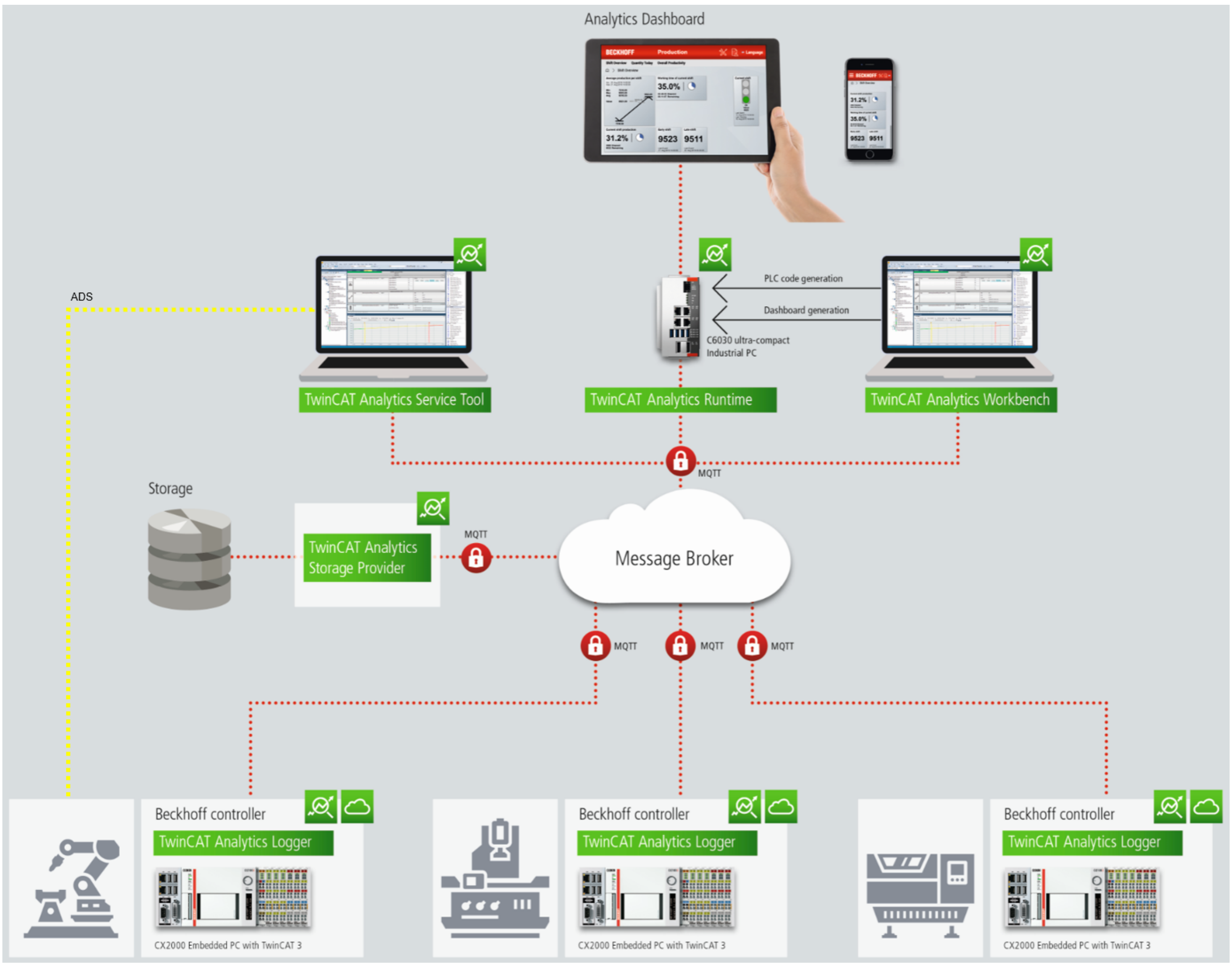
☐ Queue messages when disconnected

☐ Store in file

Queue Size:	0		(KB)	

4.2 Communication

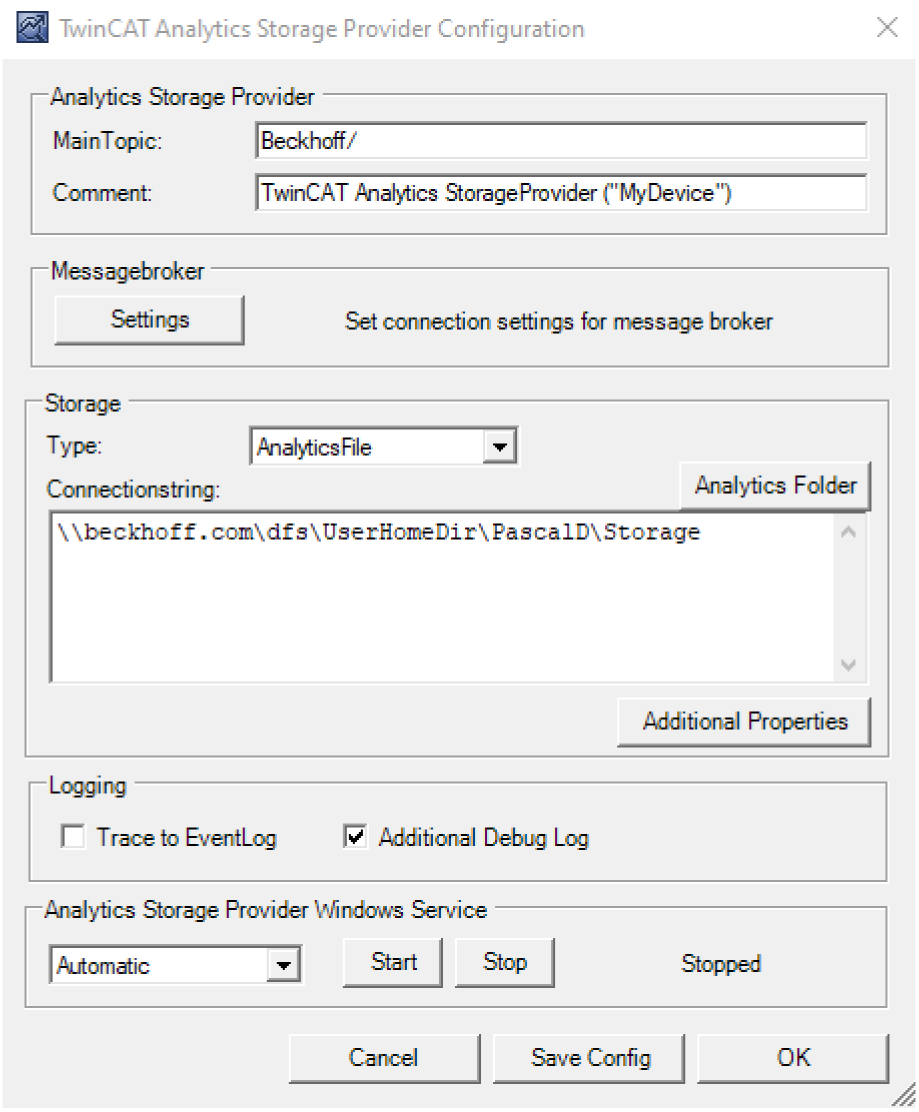
Currently, the Analytics workflow is fully mappable via MQTT. The engineering tools can also access the data of the machines via ADS and carry out analyzes.


Analytics Dashboard
ADS
PLC code generation
Dashboard generation
C6030 ultra-compact Industrial PC
TwinCAT Analytics Service Tool
TwinCAT Analytics Runtime
TwinCAT Analytics Workbench
MQTT
Storage
TwinCAT Analytics Storage Provider
MQTT
Message Broker
MQTT
MQTT
MQTT
Beckhoff controller
TwinCAT Analytics Logger
CX2000 Embedded PC with TwinCAT 3
Beckhoff controller
TwinCAT Analytics Logger
CX2000 Embedded PC with TwinCAT 3
Beckhoff controller
TwinCAT Analytics Logger
CX2000 Embedded PC with TwinCAT 3

If you choose for the IoT communication protocol MQTT you have to setup a native MQTT Message Broker somewhere in the network (VM in a cloud system is also possible). This Message Broker provides a decoupling of the different applications in the Analytics Workflow.

4.3 Historicize data

After the TwinCAT Analytics Storage Provider has been installed, the service running in the background can be configured. You will find the TwinCAT Analytics.StorageProvider.Configurator application in the folder *C:\TwinCAT\Functions\TF3520-Analytics-StorageProvider\Tools*.


TwinCAT Analytics Storage Provider Configuration

Analytics Storage Provider
MainTopic: Beckhoff/
Comment: TwinCAT Analytics StorageProvider ("MyDevice")

Messagebroker

Set connection settings for message broker

Storage
Type: AnalyticsFile
Connectionstring:

```
\\beckhoff.com\dfs\UserHomeDir\PascalD\Storage
```

Logging
☐ Trace to EventLog ☑ Additional Debug Log

Analytics Storage Provider Windows Service
Automatic

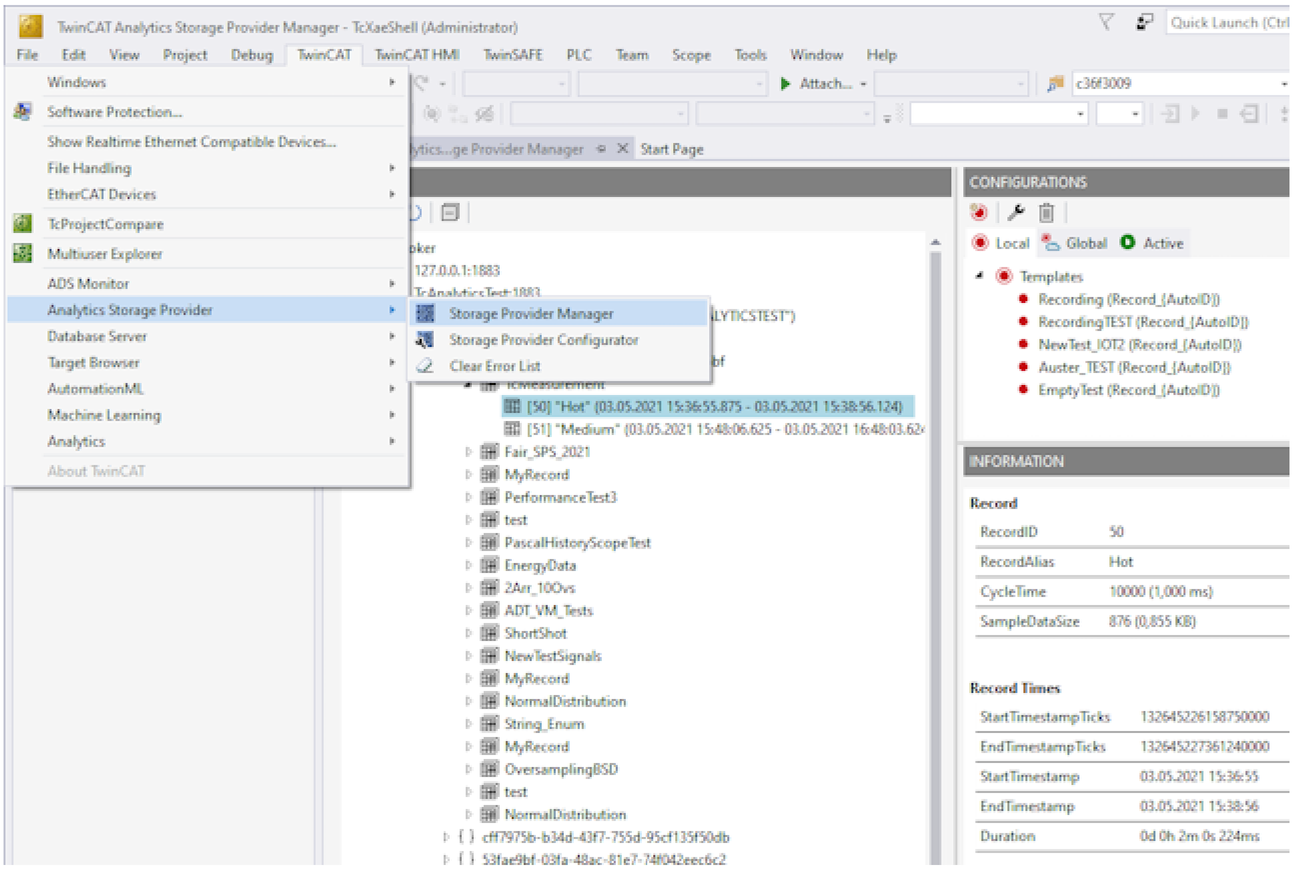
Stopped

The main part of the topic can be defined in the configuration as well as the comment, which is used for identification if more than one Storage Provider is registered with the message broker.

You can make the message broker settings and decide on a storage type:

- Analytics File (binary file)
- CSV file
- Microsoft SQL (binary / plain text)
- InlfuxDB (plain text)
- Microsoft Azure Blob (Azure Cloud required)

At last you can save the configuration and start the service. The next step is to configure the specific recording. For this you should select the **Storage Provider Manager** in your development environment.


TwinCAT Analytics Storage Provider Manager - TcXaeShell (Administrator)
File Edit View Project Debug TwinCAT TwinCAT HMI TwinSAFE PLC Team Scope Tools Window Help
Windows
Software Protection...
Show Realtime Ethernet Compatible Devices...
File Handling
EtherCAT Devices
TcProjectCompare
Multiuser Explorer
ADS Monitor
Analytics Storage Provider
Database Server
Target Browser
AutomationML
Machine Learning
Analytics
About TwinCAT
Storage Provider Manager
Storage Provider Configurator
Clear Error List
CONFIGURATIONS
Local Global Active
Templates
Recording (Record_{AutoID})
RecordingTEST (Record_{AutoID})
NewTest_IOT2 (Record_{AutoID})
Auster_TEST (Record_{AutoID})
EmptyTest (Record_{AutoID})
[50] "Hot" (03.05.2021 15:36:55.875 - 03.05.2021 15:38:56.124)
[51] "Medium" (03.05.2021 15:48:06.625 - 03.05.2021 16:48:03.62
Fair_SPS_2021
MyRecord
PerformanceTest3
test
PascalHistoryScopeTest
EnergyData
2Arr_100vs
ADT_VM_Tests
ShortShot
NewTestSignals
MyRecord
NormalDistribution
String_Enum
MyRecord
OversamplingBSD
test
NormalDistribution
cff7975b-b34d-43f7-755d-95cf135f50db
53fae9bf-03fa-48ac-81e7-74f042eec6c2
INFORMATION

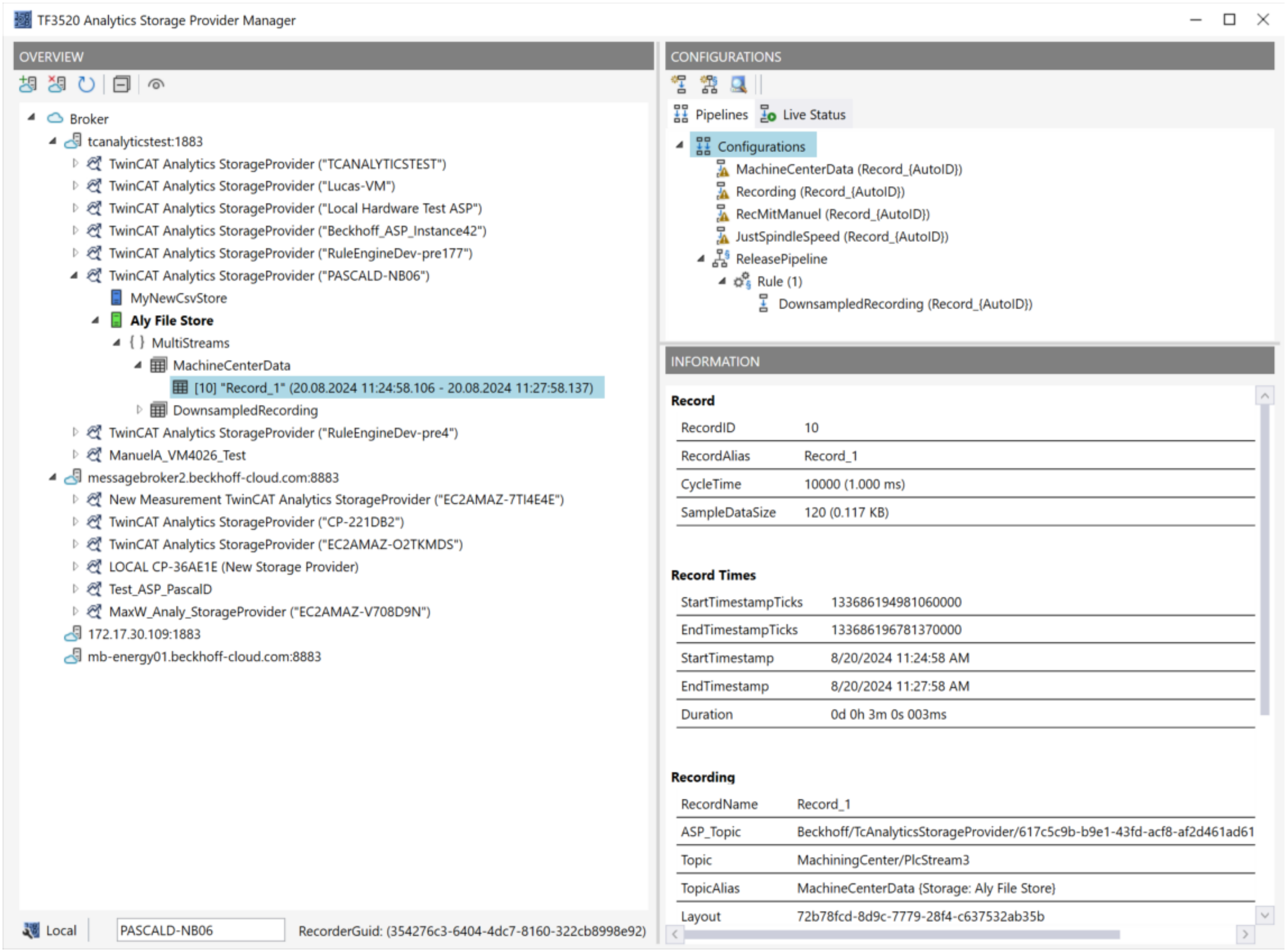
Record

RecordID	50
RecordAlias	Hot
CycleTime	10000 (1,000 ms)
SampleDataSize	876 (0,855 KB)

Record Times

StartTimestampTicks	132645226158750000
EndTimestampTicks	132645227361240000
StartTimestamp	03.05.2021 15:36:55
EndTimestamp	03.05.2021 15:38:56
Duration	0d 0h 2m 0s 224ms

With the Storage Provider Recorder recording definitions can be created, started and managed. In addition, it is possible to manage the data memories of individual Analytics Storage Providers. All important properties of the found Analytics Storage Providers and historized data are clearly displayed.


TF3520 Analytics Storage Provider Manager
OVERVIEW
Broker
tcanalyticstest:1883
TwinCAT Analytics StorageProvider ("TCANALYTICSTEST")
TwinCAT Analytics StorageProvider ("Lucas-VM")
TwinCAT Analytics StorageProvider ("Local Hardware Test ASP")
TwinCAT Analytics StorageProvider ("Beckhoff_ASP_Instance42")
TwinCAT Analytics StorageProvider ("RuleEngineDev-pre177")
TwinCAT Analytics StorageProvider ("PASCALD-NB06")
MyNewCsvStore
Aly File Store
MultiStreams
MachineCenterData
[10] "Record_1" (20.08.2024 11:24:58.106 - 20.08.2024 11:27:58.137)
DownsampledRecording
TwinCAT Analytics StorageProvider ("RuleEngineDev-pre4")
ManuelA_VM4026_Test
messagebroker2.beckhoff-cloud.com:8883
New Measurement TwinCAT Analytics StorageProvider ("EC2AMAZ-7TI4E4E")
TwinCAT Analytics StorageProvider ("CP-221DB2")
TwinCAT Analytics StorageProvider ("EC2AMAZ-O2TKMDS")
LOCAL CP-36AE1E (New Storage Provider)
Test_ASP_PascalD
MaxW_Analy_StorageProvider ("EC2AMAZ-V708D9N")
172.17.30.109:1883
mb-energy01.beckhoff-cloud.com:8883
Local
PASCALD-NB06
RecorderGuid: (354276c3-6404-4dc7-8160-322cb8998e92)
CONFIGURATIONS
Pipelines Live Status
Configurations
MachineCenterData (Record_{AutoID})
Recording (Record_{AutoID})
RecMitManuel (Record_{AutoID})
JustSpindleSpeed (Record_{AutoID})
ReleasePipeline
Rule (1)
DownsampledRecording (Record_{AutoID})
INFORMATION

Record

RecordID	10
RecordAlias	Record_1
CycleTime	10000 (1.000 ms)
SampleDataSize	120 (0.117 KB)

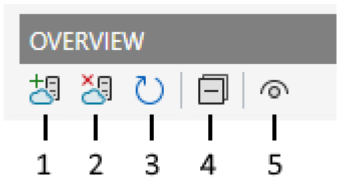
Record Times

StartTimestampTicks	133686194981060000
EndTimestampTicks	133686196781370000
StartTimestamp	8/20/2024 11:24:58 AM
EndTimestamp	8/20/2024 11:27:58 AM
Duration	0d 0h 3m 0s 003ms

Recording

RecordName	Record_1
ASP_Topic	Beckhoff/TcAnalyticsStorageProvider/617c5c9b-b9e1-43fd-acf8-af2d461ad61
Topic	MachiningCenter/PlcStream3
TopicAlias	MachineCenterData (Storage: Aly File Store)
Layout	72b78fcd-8d9c-7779-28f4-c637532ab35b

Toolbar Manager window ("OVERVIEW")

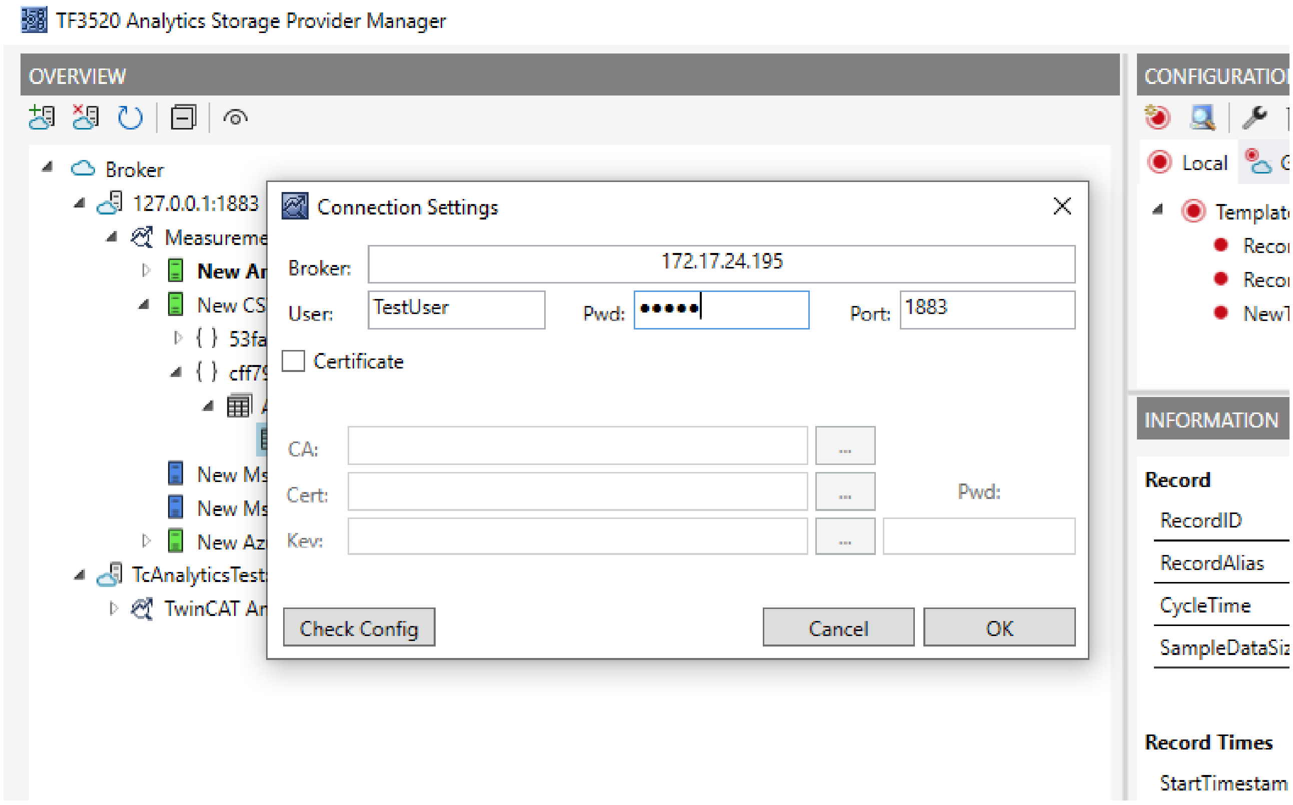


1	Add new broker
2	Remove selected broker
3	Refresh display
4	Collapse all nodes
5	View switch between dark/light mode

Function Manager window ("OVERVIEW")

First assign a **RecorderAlias**. This helps to group the started recordings and to find its self started ones again.

After that, one or more brokers can be set up. This is done via the already known input mask for MQTT connection properties.



Connection Settings

Broker: 172.17.24.195

User: TestUser Pwd: ●●●●● Port: 1883

☐ Certificate

CA:

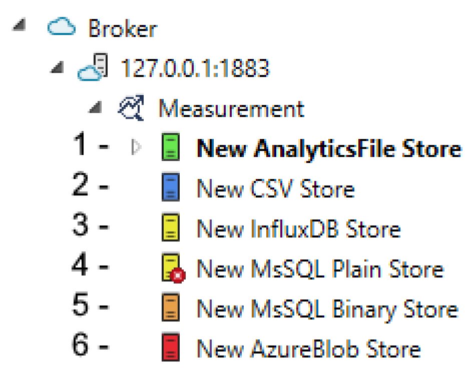
Cert: Pwd:

Key:

Check Config Cancel OK

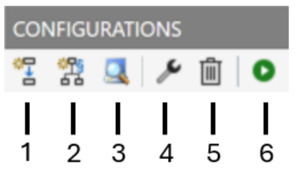
Once a connection to the broker could be established, all Analytics Storage Providers connected to it will be listed.

"Storage" status



1	Storage Online
2	Storage Offline
3	Storage starts
4	Storage starts with error. Still trying to start it
5	Storage is shut down
6	Storage is in the error state

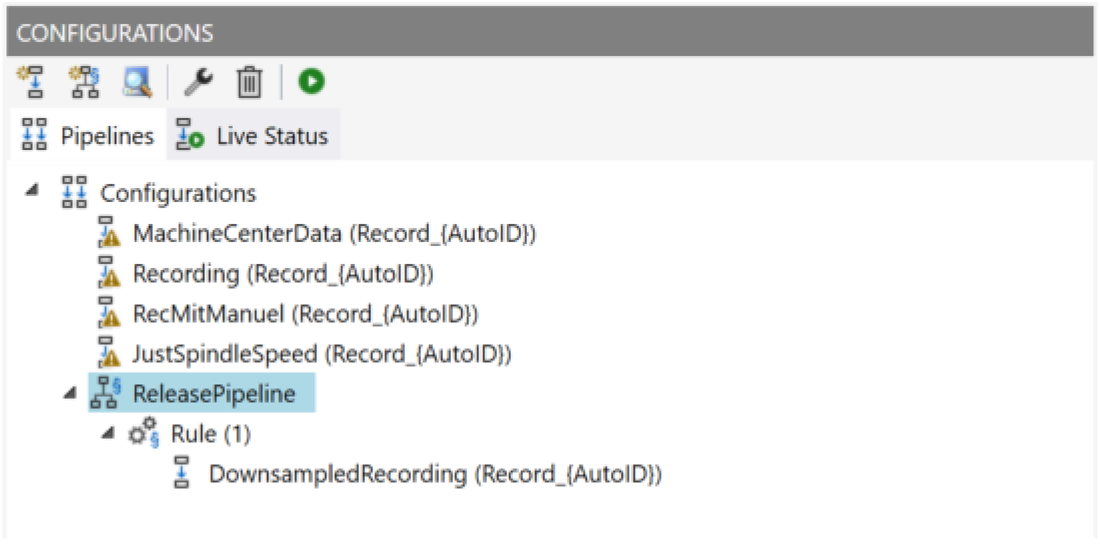
Toolbar Manager window ("CONFIGURATIONS")



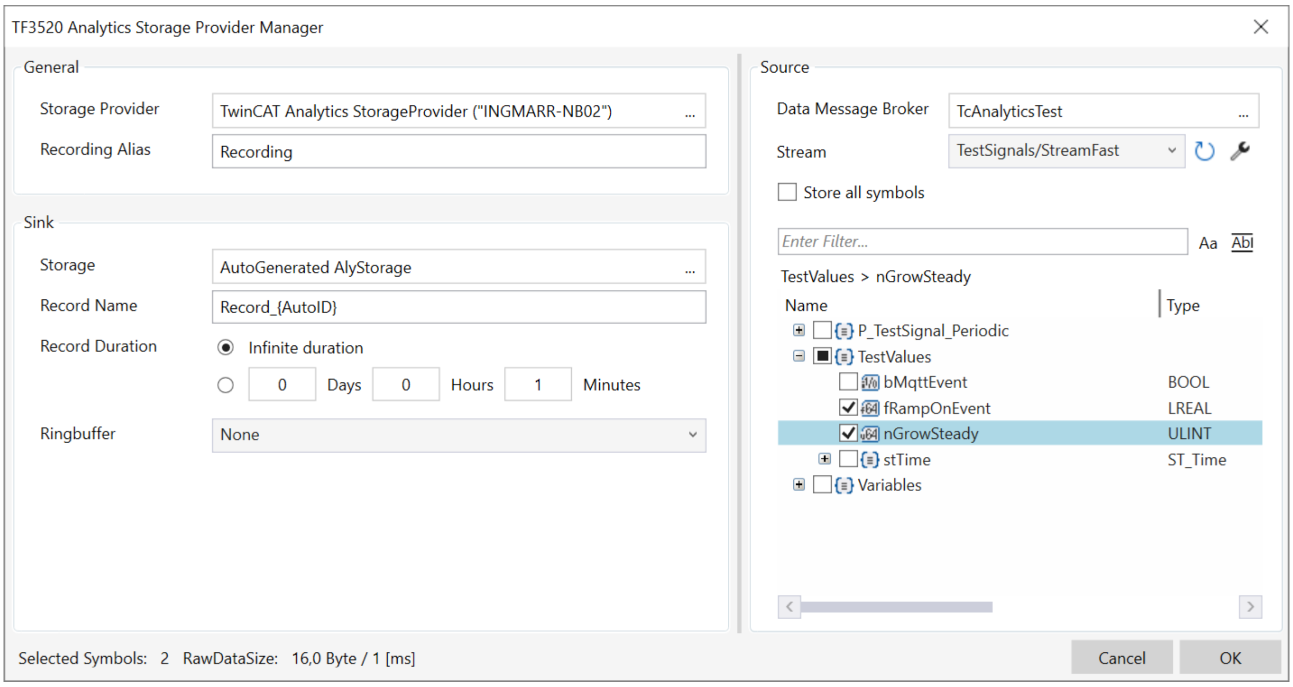
1	Create a new pipeline
2	Create a new pipeline with Rule Engine
3	Open Target Browser for connecting simple pipelines
4	Edit a selected pipeline
5	Delete a selected pipeline
6	Start a selected pipeline

Function Manager window ("CONFIGURATIONS")

The window is divided into two tabs. Pipelines and Live Status. Under Pipelines you will find the configurations of your pipelines. You can define new pipelines from here. Edit existing. Delete or start.


CONFIGURATIONS
Pipelines
Live Status
Configurations
MachineCenterData (Record_{AutoID})
Recording (Record_{AutoID})
RecMitManuel (Record_{AutoID})
JustSpindleSpeed (Record_{AutoID})
ReleasePipeline
Rule (1)
DownsampledRecording (Record_{AutoID})

To create a new simple pipeline, click the "Create new pipeline" button. The following dialog opens.


TF3520 Analytics Storage Provider Manager

General
Storage Provider: TwinCAT Analytics StorageProvider ("INGMARR-NB02")
Recording Alias: Recording

Sink
Storage: AutoGenerated AlyStorage
Record Name: Record_{AutoID}
Record Duration: (●) Infinite duration
( ) 0 Days 0 Hours 1 Minutes
Ringbuffer: None

Source
Data Message Broker: TcAnalyticsTest
Stream: TestSignals/StreamFast
Store all symbols: ☐

TestValues > nGrowSteady

Name	Type
☐ P_TestSignal_Periodic	
■ TestValues	
☐ bMqttEvent	BOOL
✓ fRampOnEvent	LREAL
✓ nGrowSteady	ULINT
☐ stTime	ST_Time
☐ Variables	

Selected Symbols: 2 RawDataSize: 16,0 Byte / 1 [ms]

You can now drag and drop the symbols you want to record from the Target Browser into the dialog. You also assign a Recording Alias and a Record Name.

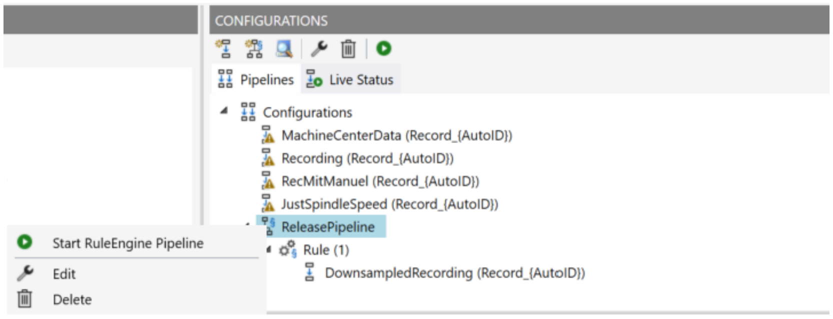
Various placeholders are available for the Record Name:

"{AutoID}"	
"{Topic}"	
"{SystemID}"	
"{Layout}"	
"{CycleTime}"	
"{SampleSize}"	
"{RecordStart}"	

You can also configure recording names and a duration (otherwise the recording will run endlessly until it is stopped manually). A ring buffer can be set according to storage space or time.

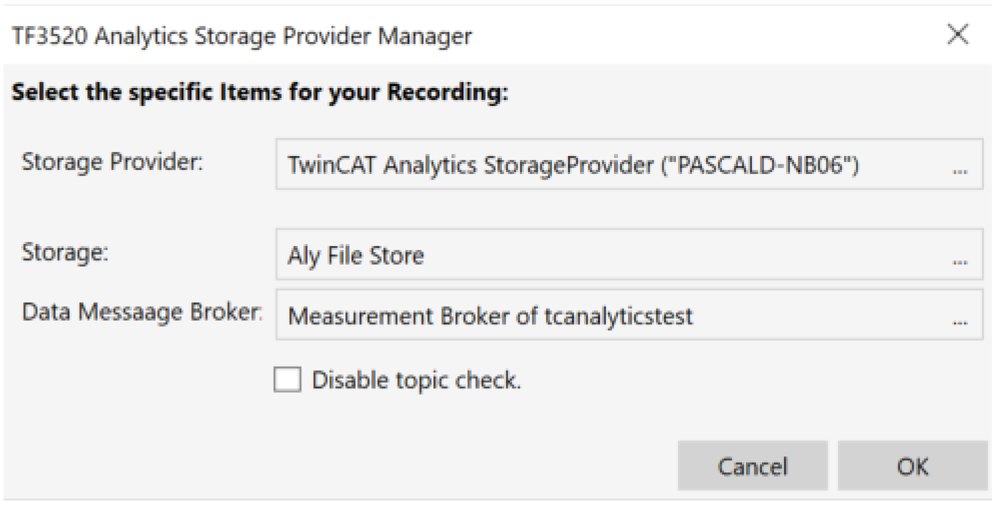
The entries are confirmed with **OK** and a new local recording definition is created.

It is now possible to start this definition directly via the toolbar or the context menu.


CONFIGURATIONS
Pipelines
Live Status
Configurations
MachineCenterData (Record_{AutoID})
Recording (Record_{AutoID})
RecMitManuel (Record_{AutoID})
JustSpindleSpeed (Record_{AutoID})
ReleasePipeline
Rule (1)
DownsampledRecording (Record_{AutoID})
Start RuleEngine Pipeline
Edit
Delete

However, it is also possible to make the definition globally accessible. This can be done via the context menu with the entry **Publish Recording**.

The following dialog then opens:



TF3520 Analytics Storage Provider Manager

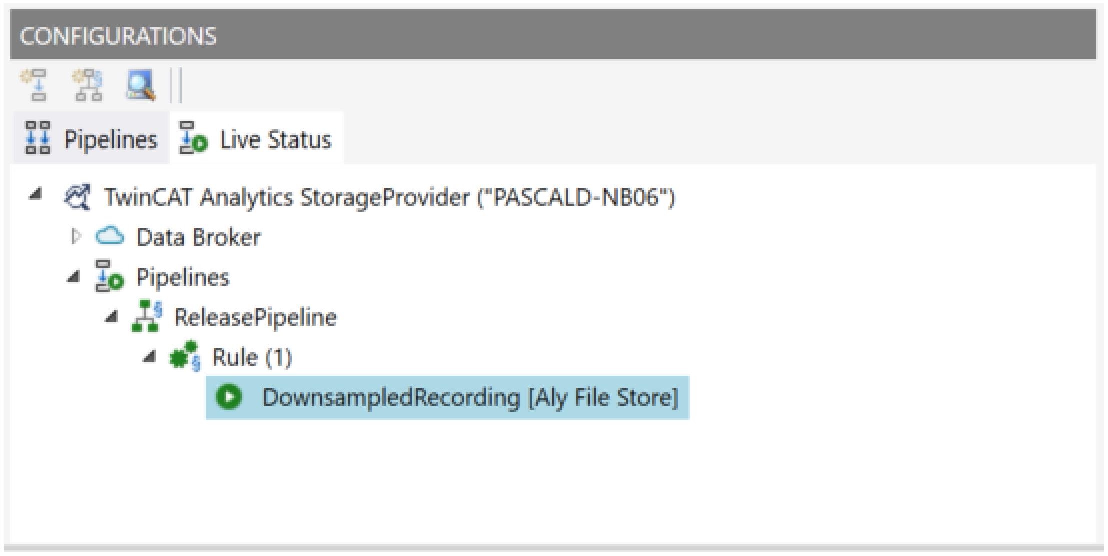
Select the specific Items for your Recording:

Storage Provider:	TwinCAT Analytics StorageProvider ("PASCALD-NB06")
Storage:	Aly File Store
Data Messaage Broker:	Measurement Broker of tcanalyticstest

☐ Disable topic check.

Here you can now select the desired Analytics Storage Provider via which the definition is to be published. In addition, the definition is assigned a Storage and a Data Broker of the selected Analytics Storage Provider. After the selection, the recording definition is confirmed with **OK** and published to the selected Analytics Storage Provider. This means that it can be found by any Storage Provider Manager that is connected to the MQTT Broker.

After starting a pipeline, the view automatically jumps to the second tab, the Live Status.

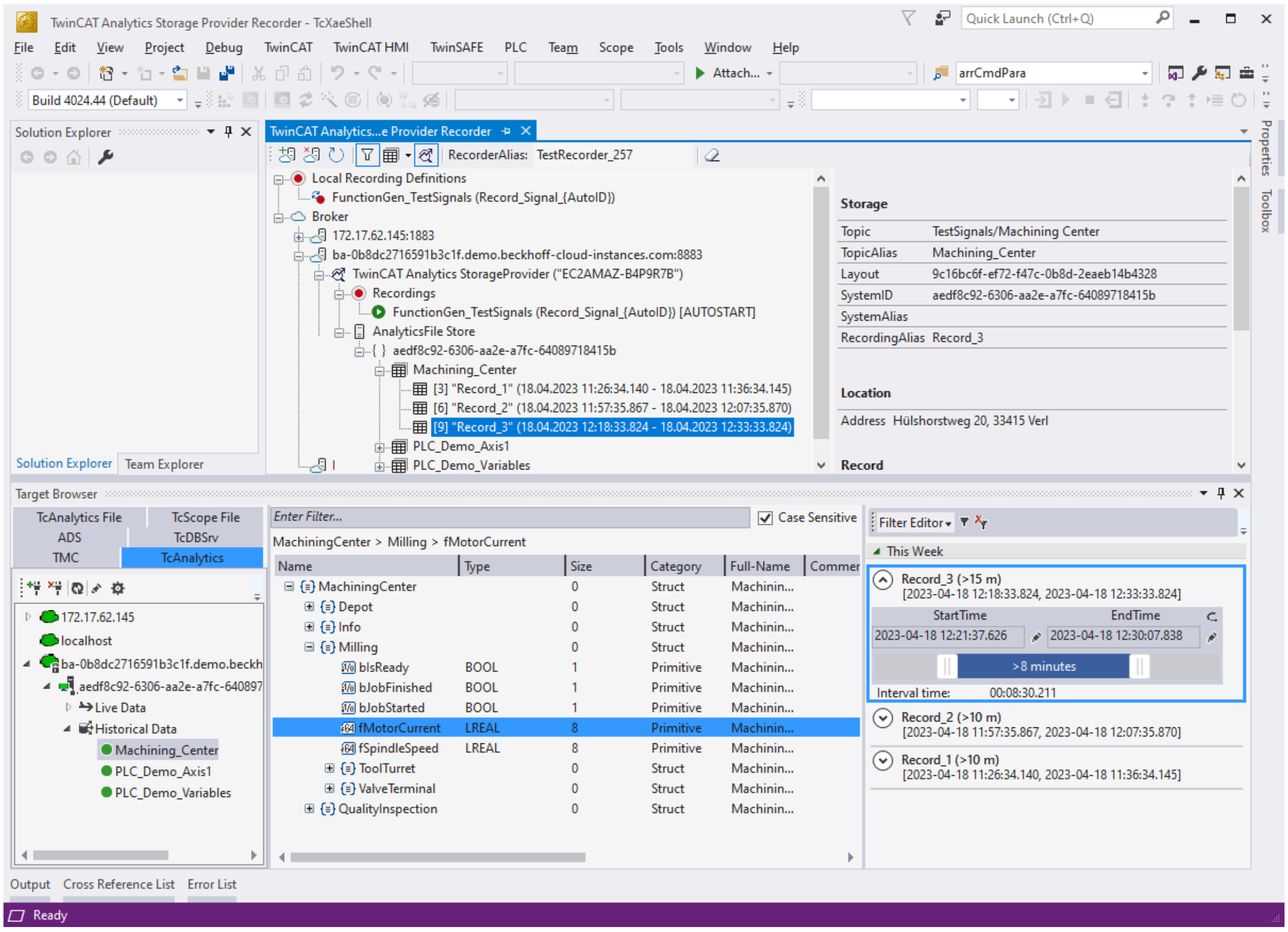


- TwinCAT Analytics StorageProvider ("PASCALD-NB06")
  - Data Broker
  - Pipelines
    - ReleasePipeline
      - Rule (1)
        - DownsampledRecording [Aly File Store]

All active recordings from all users are listed here. The recordings can be ended in this tab and it is also possible to jump to the resulting record.

Use historized data

After and also during recording, you can select the historical data as input for your analysis in Target Browser. In the Target Browser, you will find a new control on the right side for the historical data. There you can select the timespan for your data.


TwinCAT Analytics Storage Provider Recorder - TcXaeShell
File Edit View Project Debug TwinCAT TwinCAT HMI TwinSAFE PLC Team Scope Tools Window Help
Solution Explorer
TwinCAT Analytics...e Provider Recorder
Target Browser
Output Cross Reference List Error List
Ready

RecorderAlias: TestRecorder_257

```
Local Recording Definitions
    FunctionGen_TestSignals (Record_Signal_{AutoID})
Broker
    172.17.62.145:1883
    ba-0b8dc2716591b3c1f.demo.beckhoff-cloud-instances.com:8883
        TwinCAT Analytics StorageProvider ("EC2AMAZ-B4P9R7B")
            Recordings
                FunctionGen_TestSignals (Record_Signal_{AutoID}) [AUTOSTART]
            AnalyticsFile Store
                aedf8c92-6306-aa2e-a7fc-64089718415b
                    Machining_Center
                        [3] "Record_1" (18.04.2023 11:26:34.140 - 18.04.2023 11:36:34.145)
                        [6] "Record_2" (18.04.2023 11:57:35.867 - 18.04.2023 12:07:35.870)
                        [9] "Record_3" (18.04.2023 12:18:33.824 - 18.04.2023 12:33:33.824)
                    PLC_Demo_Axis1
                    PLC_Demo_Variables
```

Storage

Topic	TestSignals/Machining Center
TopicAlias	Machining_Center
Layout	9c16bc6f-ef72-f47c-0b8d-2eaeb14b4328
SystemID	aedf8c92-6306-aa2e-a7fc-64089718415b
SystemAlias	
RecordingAlias	Record_3

Location

Address Hülshorstweg 20, 33415 Verl

Record

TcAnalytics File | TcScope File | ADS | TcDBSrv | TMC | TcAnalytics

```
172.17.62.145
localhost
ba-0b8dc2716591b3c1f.demo.beckh
    aedf8c92-6306-aa2e-a7fc-640897
        Live Data
        Historical Data
            Machining_Center
            PLC_Demo_Axis1
            PLC_Demo_Variables
```

Enter Filter... ☑ Case Sensitive

MachiningCenter > Milling > fMotorCurrent

Name	Type	Size	Category	Full-Name	Commer
MachiningCenter		0	Struct	Machinin...	
Depot		0	Struct	Machinin...	
Info		0	Struct	Machinin...	
Milling		0	Struct	Machinin...	
bIsReady	BOOL	1	Primitive	Machinin...	
bJobFinished	BOOL	1	Primitive	Machinin...	
bJobStarted	BOOL	1	Primitive	Machinin...	
fMotorCurrent	LREAL	8	Primitive	Machinin...	
fSpindleSpeed	LREAL	8	Primitive	Machinin...	
ToolTurret		0	Struct	Machinin...	
ValveTerminal		0	Struct	Machinin...	
QualityInspection		0	Struct	Machinin...	

Filter Editor

This Week

Record_3 (>15 m)
[2023-04-18 12:18:33.824, 2023-04-18 12:33:33.824]

StartTime	EndTime
2023-04-18 12:21:37.626	2023-04-18 12:30:07.838

>8 minutes

Interval time: 00:08:30.211

Record_2 (>10 m)
[2023-04-18 11:57:35.867, 2023-04-18 12:07:35.870]

Record_1 (>10 m)
[2023-04-18 11:26:34.140, 2023-04-18 11:36:34.145]

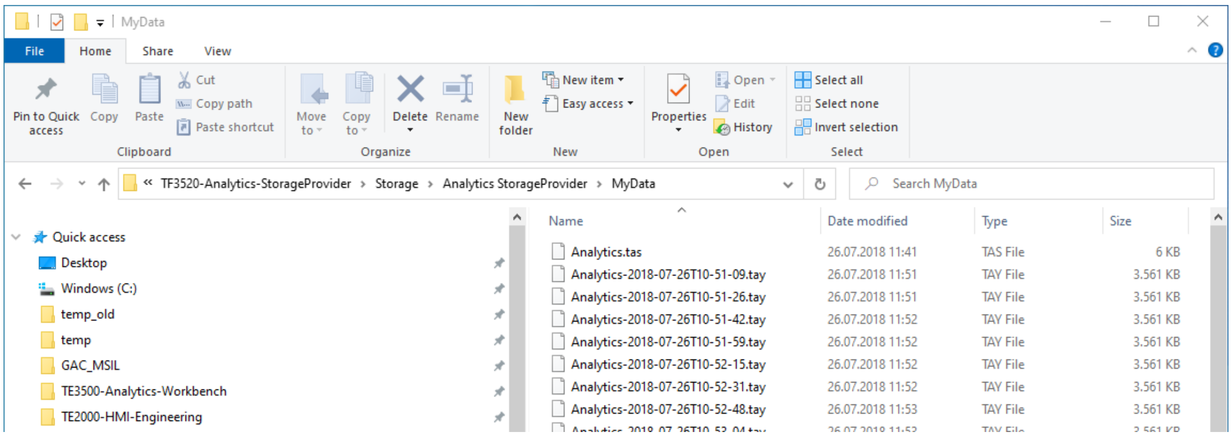
4.4 Importing/converting Analytics Files

In the following it is assumed that you have installed TwinCAT under "C:/TwinCAT". Otherwise, you must adjust the specified paths accordingly.

You can import recordings from the Analytics Logger stored in Analytics File Format (*Analytics.tas, Analytics-<Date>.tay*) into the Storage Provider. In general, you can convert data saved by the Storage Provider as an Analytics File into other formats. Analytics File is always the source format.

To do this, perform the following steps:

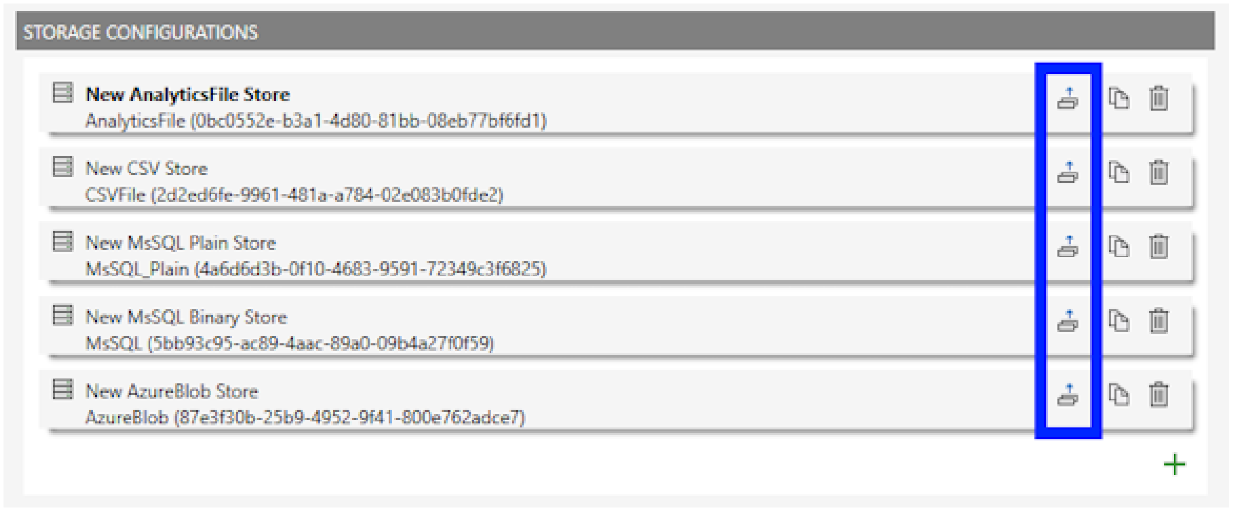
1. Save the folder with the Analytics Files in your Storage Provider location
   By default, here: *C:\TwinCAT\Functions\TF3520-Analytics-StorageProvider\Storage\Analytics StorageProvider* (create the folders manually if they do not exist)


MyData
File Home Share View
Pin to Quick access Copy Paste Cut Copy path Paste shortcut
Clipboard
Move to Copy to Delete Rename
Organize
New folder New item Easy access
New
Properties Open Edit History
Open
Select all Select none Invert selection
Select
Search MyData
Quick access
Desktop
Windows (C:)
temp_old
temp
GAC_MSIL
TE3500-Analytics-Workbench
TE2000-HMI-Engineering

« TF3520-Analytics-StorageProvider > Storage > Analytics StorageProvider > MyData

Name	Date modified	Type	Size
Analytics.tas	26.07.2018 11:41	TAS File	6 KB
Analytics-2018-07-26T10-51-09.tay	26.07.2018 11:51	TAY File	3.561 KB
Analytics-2018-07-26T10-51-26.tay	26.07.2018 11:51	TAY File	3.561 KB
Analytics-2018-07-26T10-51-42.tay	26.07.2018 11:52	TAY File	3.561 KB
Analytics-2018-07-26T10-51-59.tay	26.07.2018 11:52	TAY File	3.561 KB
Analytics-2018-07-26T10-52-15.tay	26.07.2018 11:52	TAY File	3.561 KB
Analytics-2018-07-26T10-52-31.tay	26.07.2018 11:52	TAY File	3.561 KB
Analytics-2018-07-26T10-52-48.tay	26.07.2018 11:53	TAY File	3.561 KB

2. Open *TwinCAT.Analytics.StorageProvider.Configurator.exe*. The program can be found under the path *C:\TwinCAT\Functions\TF3520-Analytics-StorageProvider\Tools*
3. Select the Storage into which the Analytics File is to be imported and press the **DataImport** button.


STORAGE CONFIGURATIONS

New AnalyticsFile Store
AnalyticsFile (0bc0552e-b3a1-4d80-81bb-08eb77bf6fd1)

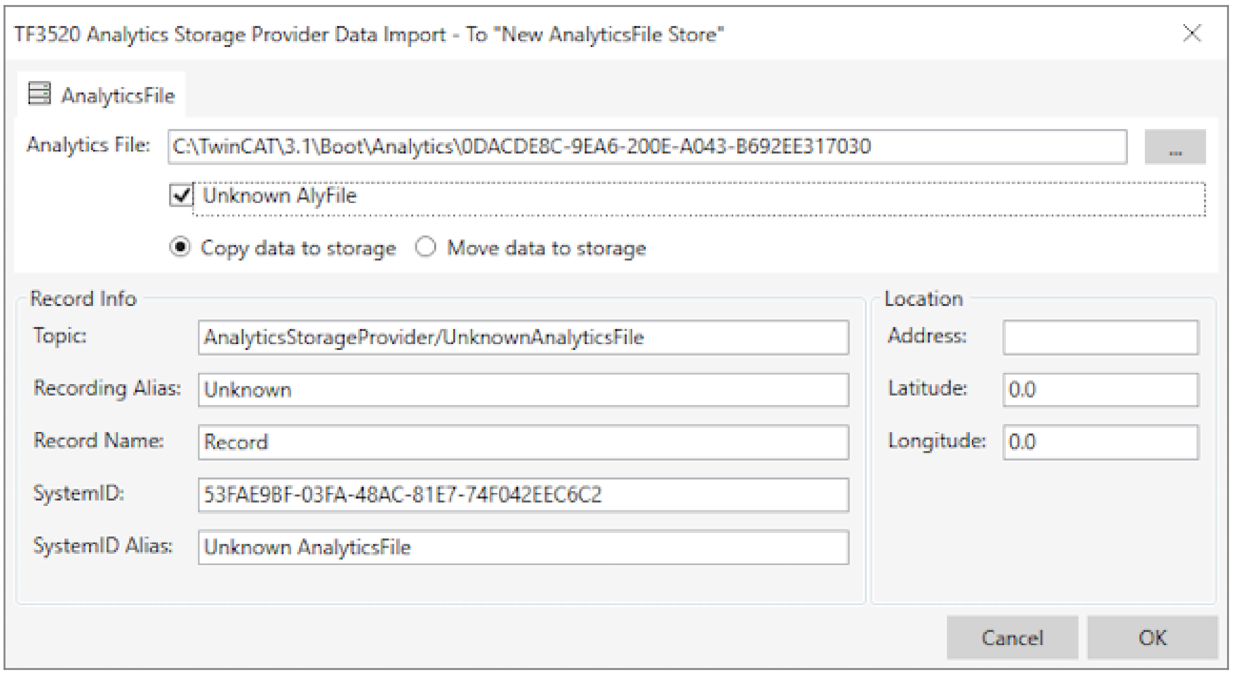
New CSV Store
CSVFile (2d2ed6fe-9961-481a-a784-02e083b0fde2)

New MsSQL Plain Store
MsSQL_Plain (4a6d6d3b-0f10-4683-9591-72349c3f6825)

New MsSQL Binary Store
MsSQL (5bb93c95-ac89-4aac-89a0-09b4a27f0f59)

New AzureBlob Store
AzureBlob (87e3f30b-25b9-4952-9f41-800e762adce7)

4. Then select the path to the Analytics File in the DataImport dialog and enter all other known parameters for this recording.


TF3520 Analytics Storage Provider Data Import - To "New AnalyticsFile Store"

AnalyticsFile

Analytics File: C:\TwinCAT\3.1\Boot\Analytics\0DACDE8C-9EA6-200E-A043-B692EE317030

[✓] Unknown AlyFile

[● Copy data to storage] ○ Move data to storage

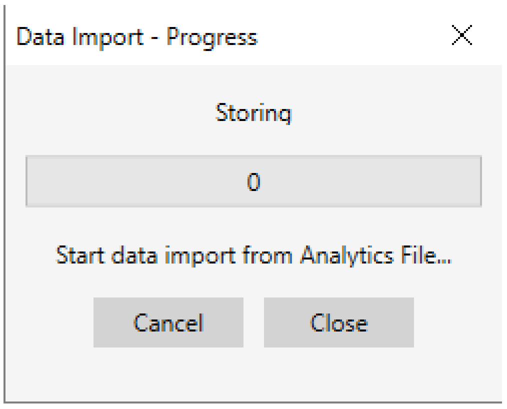
Record Info

Topic: AnalyticsStorageProvider/UnknownAnalyticsFile
Recording Alias: Unknown
Record Name: Record
SystemID: 53FAE9BF-03FA-48AC-81E7-74F042EEC6C2
SystemID Alias: Unknown AnalyticsFile

Location

Address:
Latitude: 0.0
Longitude: 0.0

5. Press **OK** and the data import begins.


Data Import - Progress

Storing

0

Start data import from Analytics File...

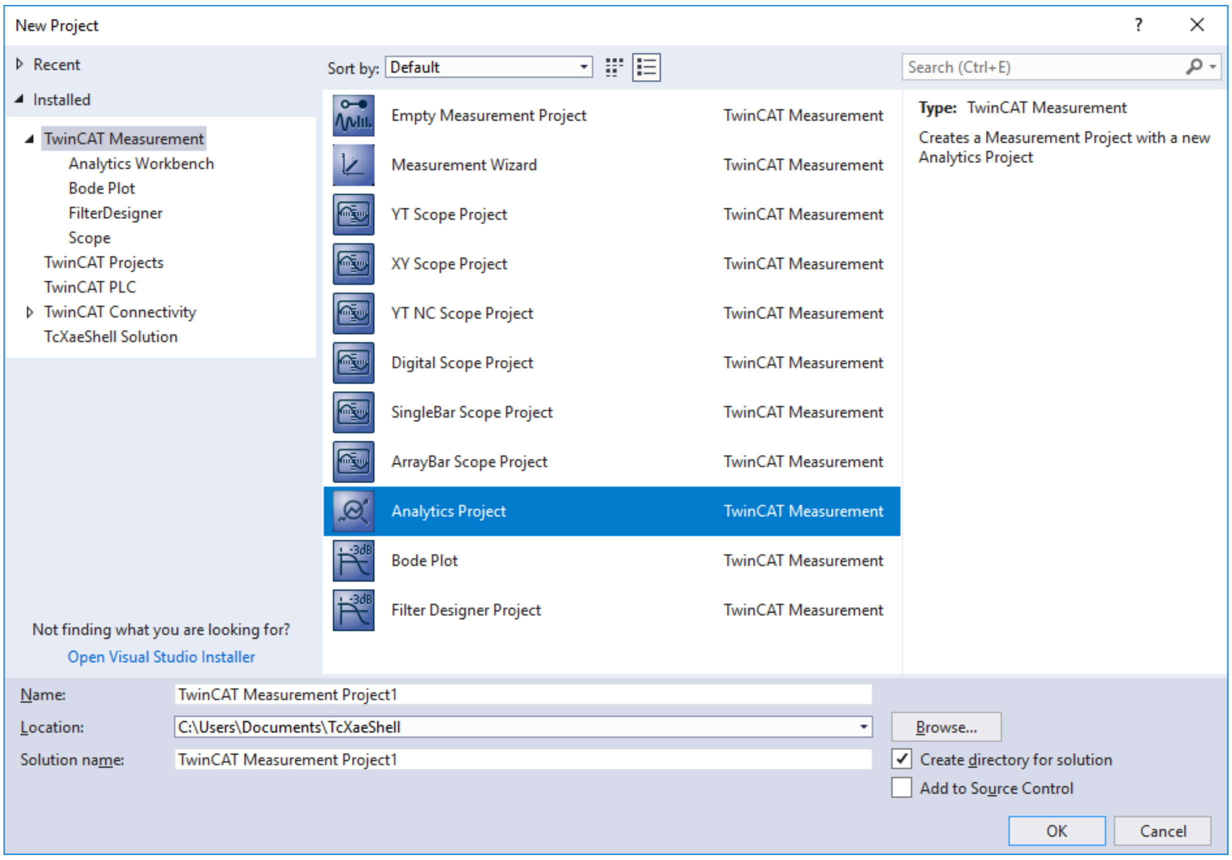
⇨ Now you can see your imported data in the TwinCAT Target Browser [▶ 95].

⇨ You may have to wait a short time or restart your Storage Provider.

4.5 Analyse data

✓ Open your TwinCAT Engineering environment to start the data analysis.

1. Open **Visual Studio® > File > New > Project…**
2. Select the **Analytics project template** from **TwinCAT Measurement**.


New Project

Sort by: Default

Search (Ctrl+E)

Empty Measurement Project	TwinCAT Measurement
Measurement Wizard	TwinCAT Measurement
YT Scope Project	TwinCAT Measurement
XY Scope Project	TwinCAT Measurement
YT NC Scope Project	TwinCAT Measurement
Digital Scope Project	TwinCAT Measurement
SingleBar Scope Project	TwinCAT Measurement
ArrayBar Scope Project	TwinCAT Measurement
Analytics Project	TwinCAT Measurement
Bode Plot	TwinCAT Measurement
Filter Designer Project	TwinCAT Measurement

Type: TwinCAT Measurement

Creates a Measurement Project with a new Analytics Project

Not finding what you are looking for?

Open Visual Studio Installer

Name: TwinCAT Measurement Project1

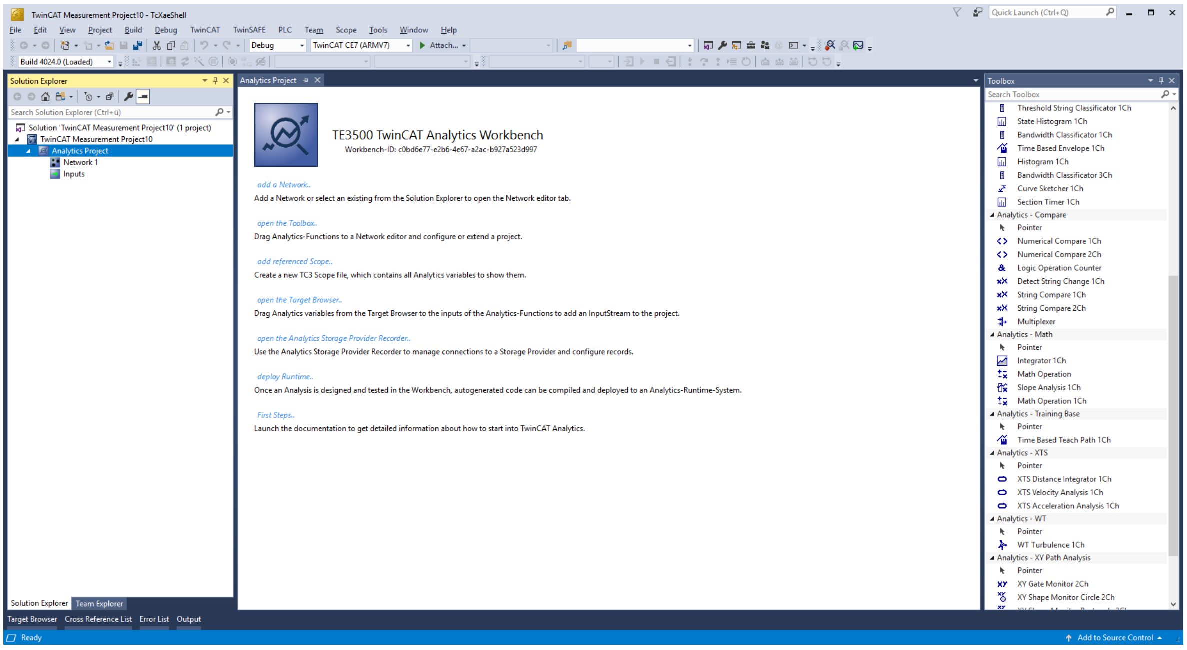
Location: C:\Users\Documents\TcXaeShell

Solution name: TwinCAT Measurement Project1

✓ Create directory for solution

Add to Source Control

⇨ The new project is displayed in the Solution Explorer. After clicking the **Analytics Project** tree node element a start window opens where you can select your first action. From here you can add a network, open the **Toolbox**, open the **Target Browser** or open the **Analytics Storage Provider Recorder**. In the following steps you will perform all these actions.


TE3500 TwinCAT Analytics Workbench

Workbench-ID: c0bd6e77-e2b6-4e67-a2ac-b927a523d997

add a Network..

Add a Network or select an existing from the Solution Explorer to open the Network editor tab.

open the Toolbox..

Drag Analytics-Functions to a Network editor and configure or extend a project.

add referenced Scope..

Create a new TC3 Scope file, which contains all Analytics variables to show them.

open the Target Browser..

Drag Analytics variables from the Target Browser to the inputs of the Analytics-Functions to add an InputStream to the project.

open the Analytics Storage Provider Recorder..

Use the Analytics Storage Provider Recorder to manage connections to a Storage Provider and configure records.

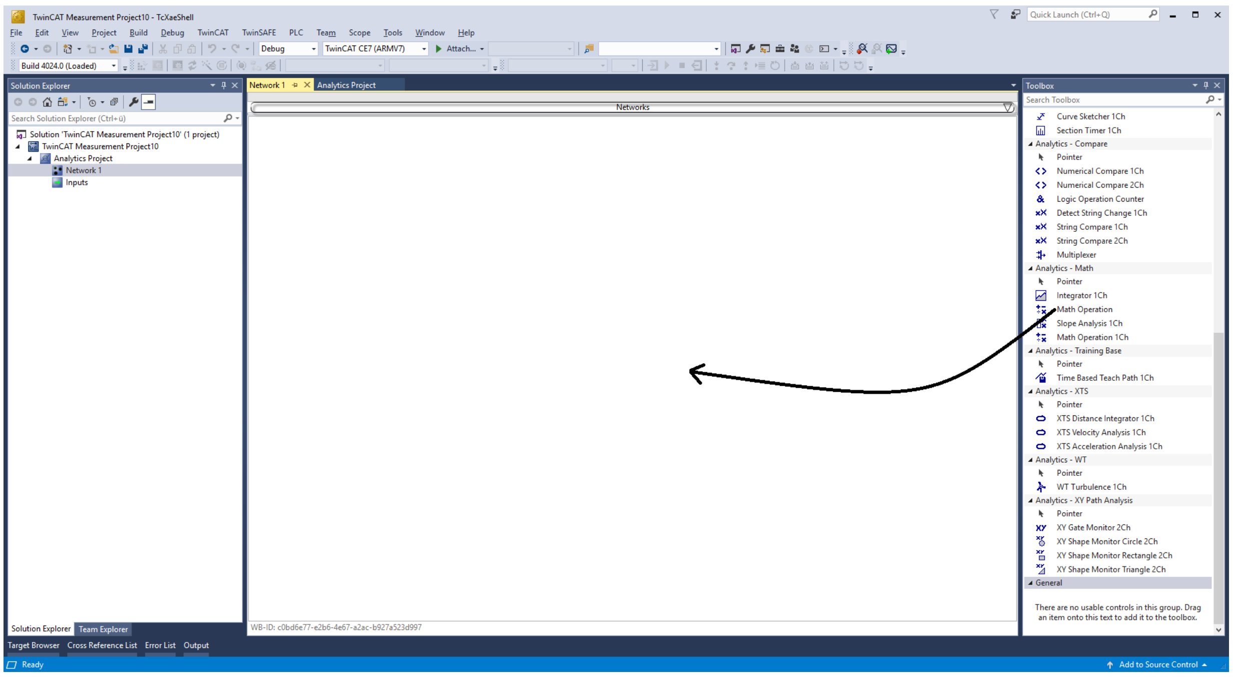
deploy Runtime..

Once an Analysis is designed and tested in the Workbench, autogenerated code can be compiled and deployed to an Analytics-Runtime-System.

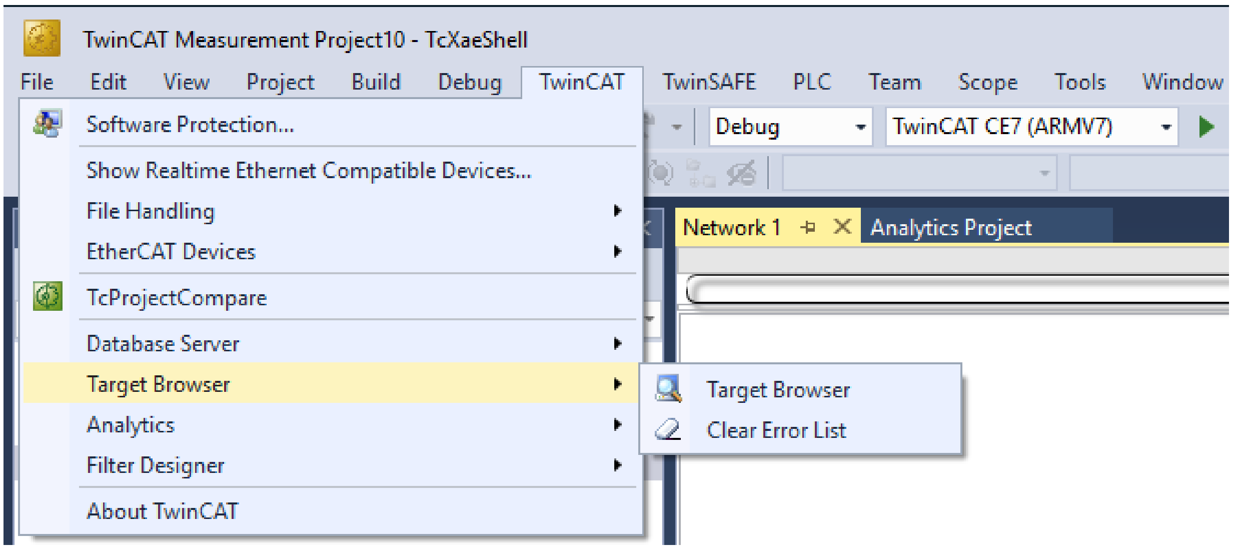
First Steps..

Launch the documentation to get detailed information about how to start into TwinCAT Analytics.

3. It makes sense to open the **Toolbox** of Visual Studio® first. There you will find all the algorithms supported by TwinCAT Analytics. Algorithms need to be grouped and organized into networks. Right-click **Analytics Project** to add a new network, or add a network using the start page. The first network is always generated by default.

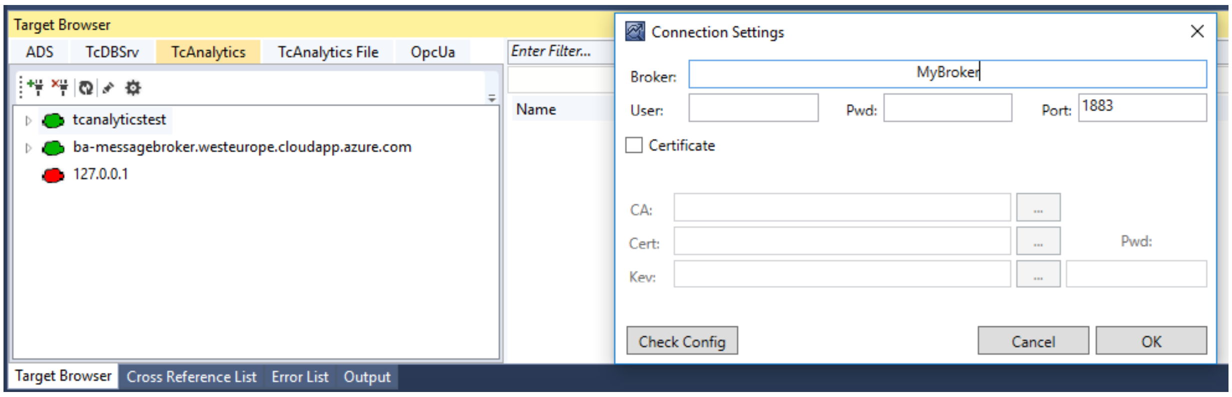

TwinCAT Measurement Project10 - TcXaeShell
File Edit View Project Build Debug TwinCAT TwinSAFE PLC Team Scope Tools Window Help
Debug
TwinCAT CE7 (ARMV7)
Attach...
Build 4024.0 (Loaded)
Quick Launch (Ctrl+Q)
Solution Explorer
Search Solution Explorer (Ctrl+ü)
Solution 'TwinCAT Measurement Project10' (1 project)
TwinCAT Measurement Project10
Analytics Project
Network 1
Inputs
Network 1
Analytics Project
Networks
Toolbox
Search Toolbox
Curve Sketcher 1Ch
Section Timer 1Ch
Analytics - Compare
Pointer
Numerical Compare 1Ch
Numerical Compare 2Ch
Logic Operation Counter
Detect String Change 1Ch
String Compare 1Ch
String Compare 2Ch
Multiplexer
Analytics - Math
Pointer
Integrator 1Ch
Math Operation
Slope Analysis 1Ch
Math Operation 1Ch
Analytics - Training Base
Pointer
Time Based Teach Path 1Ch
Analytics - XTS
Pointer
XTS Distance Integrator 1Ch
XTS Velocity Analysis 1Ch
XTS Acceleration Analysis 1Ch
Analytics - WT
Pointer
WT Turbulence 1Ch
Analytics - XY Path Analysis
Pointer
XY Gate Monitor 2Ch
XY Shape Monitor Circle 2Ch
XY Shape Monitor Rectangle 2Ch
XY Shape Monitor Triangle 2Ch
General
There are no usable controls in this group. Drag an item onto this text to add it to the toolbox.
WB-ID: c0bd6e77-e2b6-4e67-a2ac-b927a523d997
Solution Explorer Team Explorer
Target Browser Cross Reference List Error List Output
Ready
Add to Source Control

4. When you click on the network, an editor opens. Now you can drag and drop the desired algorithm into the editor interface.
5. After selecting the algorithm, you need to connect input variables to the modules (algorithm). To do this, open the **Target Browser**.
TwinCAT > Target Browser > Target Browser



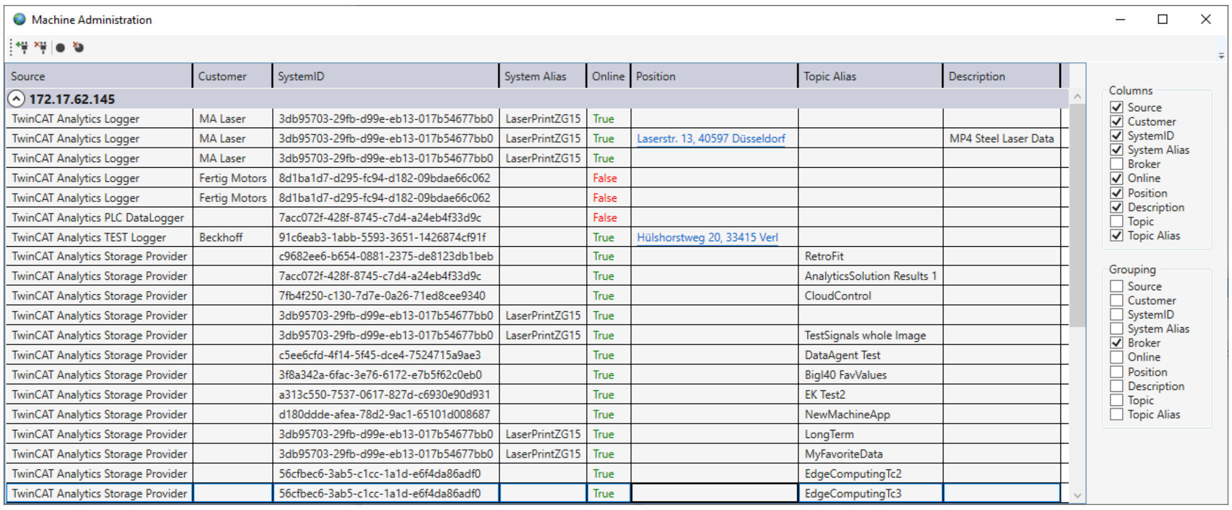
6. Now select the **TcAnalytics** or **TcAnalyticsFile** tab in the Target Browser. Continue with the tab **TcAnalytics** (MQTT).

7. Click the icon highlighted in green in the toolbar of this Analytics extension. A window opens in which you can specify the connectivity data of your message broker.



Broker:	MyBroker
User:	
Pwd:	
Port:	1883
Certificate	☐
CA:	
Cert:	
Kev:	
Pwd:	

8. Select your MQTT Analytics client (TwinCAT Analytics Logger, TwinCAT IoT Data Agent or Beckhoff EK9160). There is a unique ID for each control. This ID is displayed in the Target Browser.
9. Clicking on the **gear icon**, you will get to the Machine Administration page. Here you can assign a system alias name that will be displayed in the Target Browser instead of the ID.



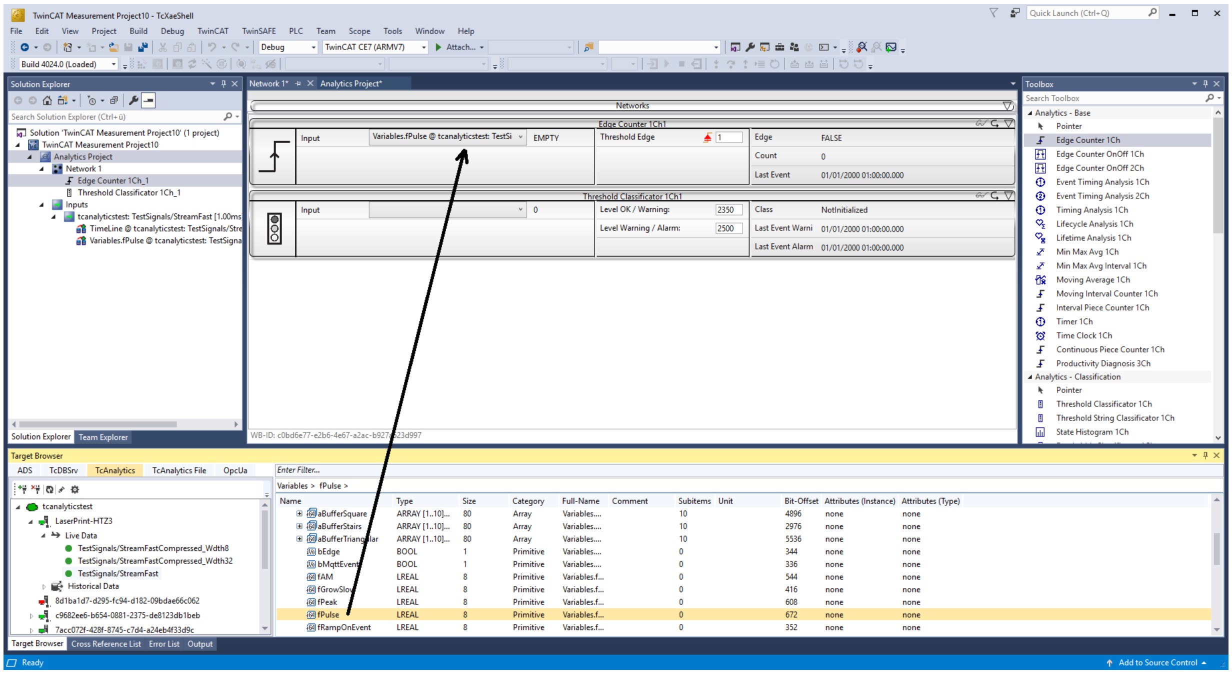
172.17.62.145

Source	Customer	SystemID	System Alias	Online	Position	Topic Alias	Description
TwinCAT Analytics Logger	MA Laser	3db95703-29fb-d99e-eb13-017b54677bb0	LaserPrintZG15	True			
TwinCAT Analytics Logger	MA Laser	3db95703-29fb-d99e-eb13-017b54677bb0	LaserPrintZG15	True	Laserstr. 13, 40597 Düsseldorf		MP4 Steel Laser Data
TwinCAT Analytics Logger	MA Laser	3db95703-29fb-d99e-eb13-017b54677bb0	LaserPrintZG15	True			
TwinCAT Analytics Logger	Fertig Motors	8d1ba1d7-d295-fc94-d182-09bdae66c062		False			
TwinCAT Analytics Logger	Fertig Motors	8d1ba1d7-d295-fc94-d182-09bdae66c062		False			
TwinCAT Analytics PLC DataLogger		7acc072f-428f-8745-c7d4-a24eb4f33d9c		False			
TwinCAT Analytics TEST Logger	Beckhoff	91c6eab3-1abb-5593-3651-1426874cf91f		True	Hülshorstweg 20, 33415 Verl		
TwinCAT Analytics Storage Provider		c9682ee6-b654-0881-2375-de8123db1beb		True		RetroFit	
TwinCAT Analytics Storage Provider		7acc072f-428f-8745-c7d4-a24eb4f33d9c		True		AnalyticsSolution Results 1	
TwinCAT Analytics Storage Provider		7fb4f250-c130-7d7e-0a26-71ed8cee9340		True		CloudControl	
TwinCAT Analytics Storage Provider		3db95703-29fb-d99e-eb13-017b54677bb0	LaserPrintZG15	True			
TwinCAT Analytics Storage Provider		3db95703-29fb-d99e-eb13-017b54677bb0	LaserPrintZG15	True		TestSignals whole Image	
TwinCAT Analytics Storage Provider		c5ee6cfd-4f14-5f45-dce4-7524715a9ae3		True		DataAgent Test	
TwinCAT Analytics Storage Provider		3f8a342a-6fac-3e76-6172-e7b5f62c0eb0		True		BigI40 FavValues	
TwinCAT Analytics Storage Provider		a313c550-7537-0617-827d-c6930e90d931		True		EK Test2	
TwinCAT Analytics Storage Provider		d180ddde-afea-78d2-9ac1-65101d008687		True		NewMachineApp	
TwinCAT Analytics Storage Provider		3db95703-29fb-d99e-eb13-017b54677bb0	LaserPrintZG15	True		LongTerm	
TwinCAT Analytics Storage Provider		3db95703-29fb-d99e-eb13-017b54677bb0	LaserPrintZG15	True		MyFavoriteData	
TwinCAT Analytics Storage Provider		56cfbec6-3ab5-c1cc-1a1d-e6f4da86adf0		True		EdgeComputingTc2	
TwinCAT Analytics Storage Provider		56cfbec6-3ab5-c1cc-1a1d-e6f4da86adf0		True		EdgeComputingTc3	

Columns	
✓	Source
✓	Customer
✓	SystemID
✓	System Alias
☐	Broker
✓	Online
✓	Position
✓	Description
☐	Topic
✓	Topic Alias

Grouping	
☐	Source
☐	Customer
☐	SystemID
☐	System Alias
✓	Broker
☐	Online
☐	Position
☐	Description
☐	Topic
☐	Topic Alias

10. In the next step, you can choose between live data and historical data for each MQTT Analytics client. In this case, the historical data is provided by the TwinCAT Analytics Storage Provider.



Edge Counter 1Ch1

Input	Variables.fPulse @ tcanalyticstest: TestSi	EMPTY	Threshold Edge	1	Edge: FALSE
					Count: 0
					Last Event: 01/01/2000 01:00:00.000

Threshold Classificator 1Ch1

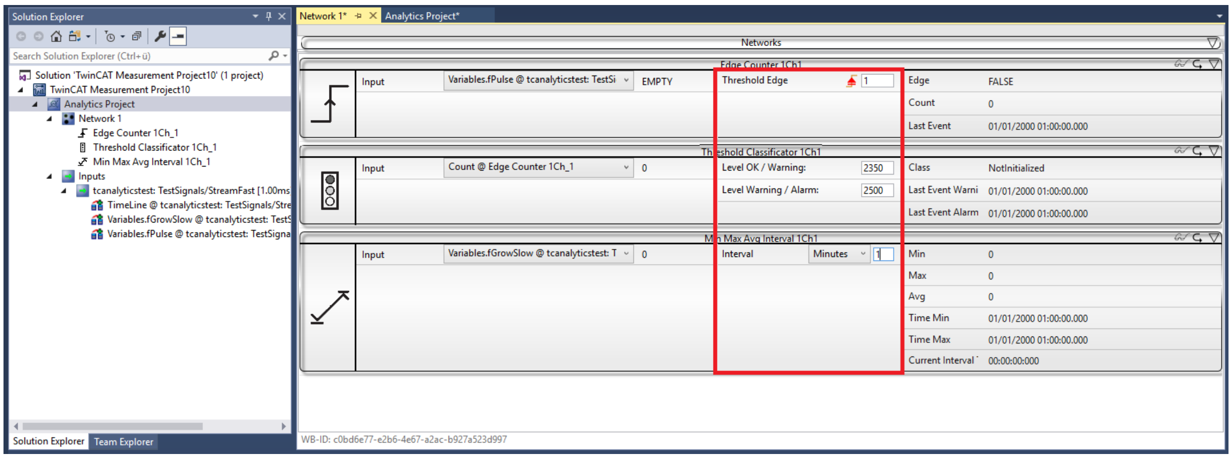
Input		0	Level OK / Warning:	2350	Class: NotInitialized
			Level Warning / Alarm:	2500	Last Event Warni: 01/01/2000 01:00:00.000
					Last Event Alarm: 01/01/2000 01:00:00.000

WB-ID: c0bd6e77-e2b6-4e67-a2ac-b927a623d997

Variables > fPulse >

Name	Type	Size	Category	Full-Name	Comment	Subitems	Unit	Bit-Offset	Attributes (Instance)	Attributes (Type)
aBufferSquare	ARRAY [1..10]...	80	Array	Variables....		10		4896	none	none
aBufferStairs	ARRAY [1..10]...	80	Array	Variables....		10		2976	none	none
aBufferTriangular	ARRAY [1..10]...	80	Array	Variables....		10		5536	none	none
bEdge	BOOL	1	Primitive	Variables....		0		344	none	none
bMqttEvent	BOOL	1	Primitive	Variables....		0		336	none	none
fAM	LREAL	8	Primitive	Variables.f...		0		544	none	none
fGrowSlow	LREAL	8	Primitive	Variables.f...		0		416	none	none
fPeak	LREAL	8	Primitive	Variables.f...		0		608	none	none
fPulse	LREAL	8	Primitive	Variables.f...		0		672	none	none
fRampOnEvent	LREAL	8	Primitive	Variables.f...		0		352	none	none

11. You can drag and drop the variables into the inputs of the specific algorithm. In most algorithms, conditions such as thresholds, time intervals, logical operators etc. can be specified. These settings are made in the middle of each module.



Edge Counter 1Ch1

Input	Variables.fPulse @ tcanalyticstest: TestSi	EMPTY	Threshold Edge	1	Edge	FALSE
					Count	0
					Last Event	01/01/2000 01:00:00.000

Threshold Classificator 1Ch1

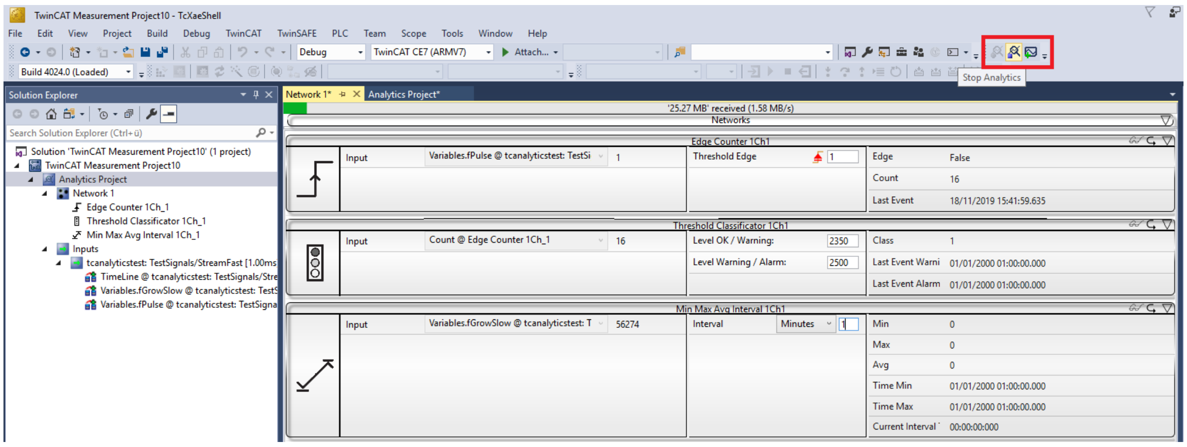
Input	Count @ Edge Counter 1Ch_1	0	Level OK / Warning:	2350	Class	NotInitialized
			Level Warning / Alarm:	2500	Last Event Warni	01/01/2000 01:00:00.000
					Last Event Alarm	01/01/2000 01:00:00.000

Min Max Avg Interval 1Ch1

Input	Variables.fGrowSlow @ tcanalyticstest: T	0	Interval	Minutes 1	Min	0
					Max	0
					Avg	0
					Time Min	01/01/2000 01:00:00.000
					Time Max	01/01/2000 01:00:00.000
					Current Interval	00:00:00:000

WB-ID: c0bd6e77-e2b6-4e67-a2ac-b927a523d997

⇨ Finally, your first Analytics Project is complete. To start the analysis, click **Start Analytics**. To stop the analysis, click **Stop Analytics**.



'25.27 MB' received (1.58 MB/s)

Edge Counter 1Ch1

Input	Variables.fPulse @ tcanalyticstest: TestSi	1	Threshold Edge	1	Edge	False
					Count	16
					Last Event	18/11/2019 15:41:59.635

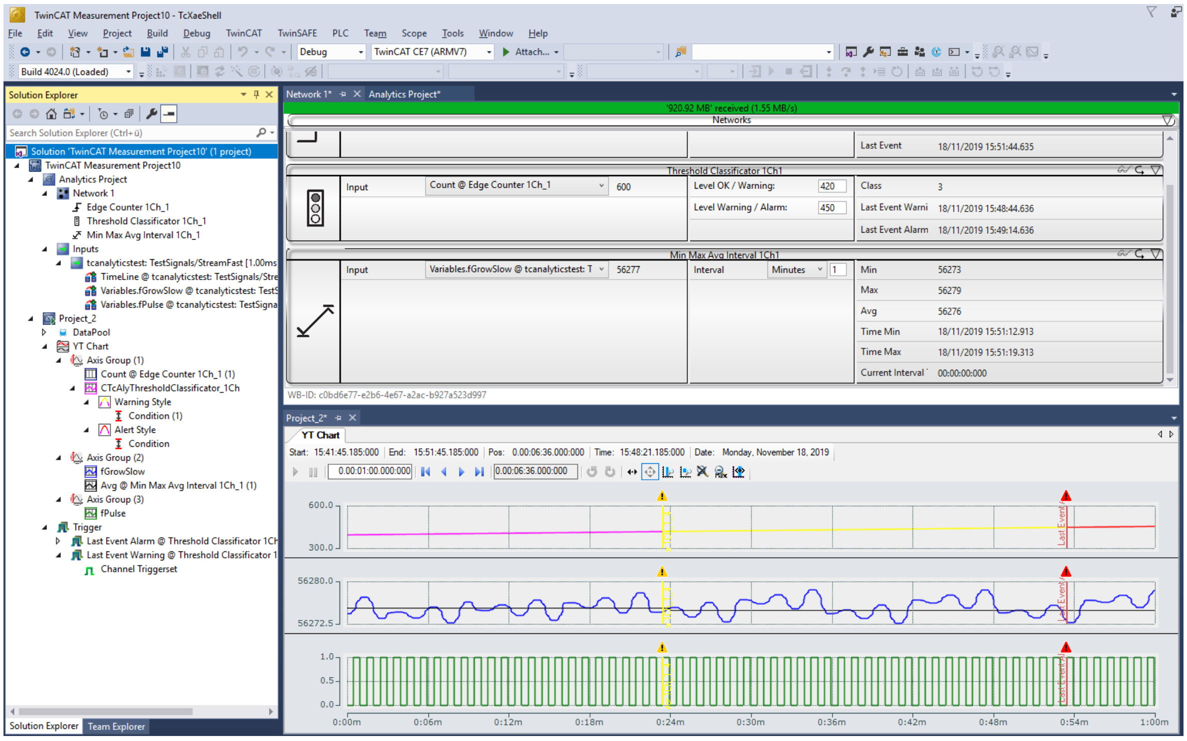
Threshold Classificator 1Ch1

Input	Count @ Edge Counter 1Ch_1	16	Level OK / Warning:	2350	Class	1
			Level Warning / Alarm:	2500	Last Event Warni	01/01/2000 01:00:00.000
					Last Event Alarm	01/01/2000 01:00:00.000

Min Max Avg Interval 1Ch1

Input	Variables.fGrowSlow @ tcanalyticstest: T	56274	Interval	Minutes 1	Min	0
					Max	0
					Avg	0
					Time Min	01/01/2000 01:00:00.000
					Time Max	01/01/2000 01:00:00.000
					Current Interval	00:00:00:000

⇨ Before starting the analysis or during runtime, you can click the **Add Reference Scope** button. This will automatically create a Scope configuration that matches your Analytics project.



'920.92 MB' received (1.55 MB/s)

					Last Event	18/11/2019 15:51:44.635

Threshold Classificator 1Ch1

Input	Count @ Edge Counter 1Ch_1	600	Level OK / Warning:	420	Class	3
			Level Warning / Alarm:	450	Last Event Warni	18/11/2019 15:48:44.636
					Last Event Alarm	18/11/2019 15:49:14.636

Min Max Avg Interval 1Ch1

Input	Variables.fGrowSlow @ tcanalyticstest: T	56277	Interval	Minutes 1	Min	56273
					Max	56279
					Avg	56276
					Time Min	18/11/2019 15:51:12.913
					Time Max	18/11/2019 15:51:19.313
					Current Interval	00:00:00:000

WB-ID: c0bd6e77-e2b6-4e67-a2ac-b927a523d997

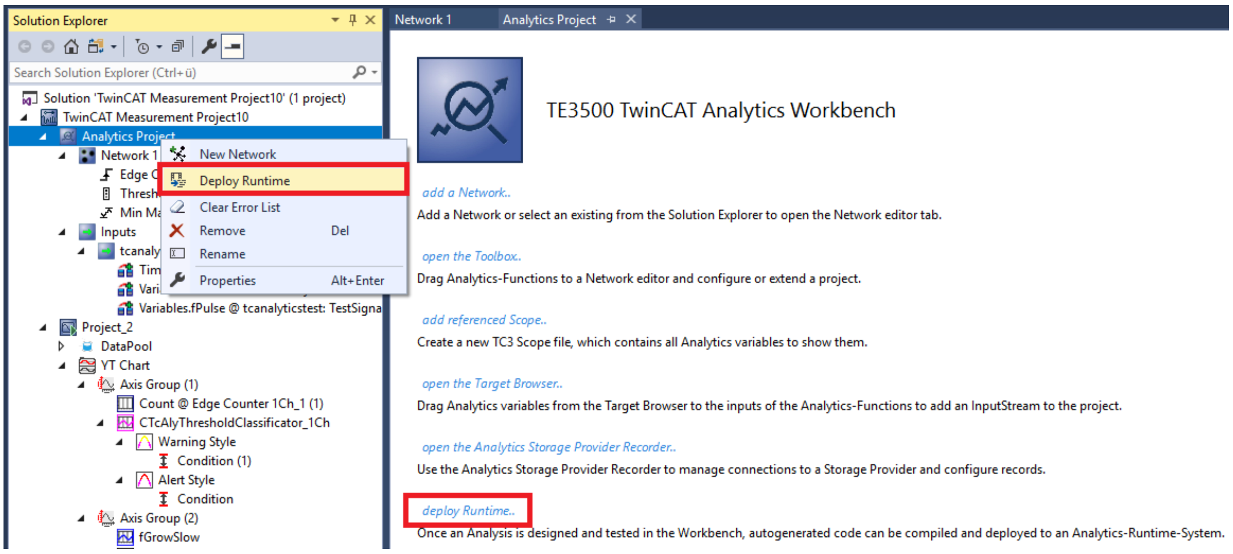
YT Chart
Start: 15:41:45.185:000 End: 15:51:45.185:000 Pos: 0.00:06:36.000:000 Time: 15:48:21.185:000 Date: Monday, November 18, 2019

⇨ The analysis results can be displayed in the Scope View graphs using drag-and-drop. For example, a mean value can be displayed as a new channel in the view. Timestamps as markers on the X-axes show significant values.

4.6 24h Analytics application

The last major step in the TwinCAT Analytics workflow is the continuous 24-hour machine analysis. It runs in parallel with the machine applications in the field. To make this very easy, the TwinCAT Analytics Workbench can automatically generate PLC code and an HTML5-based dashboard of your Analytics configuration. Both can be downloaded into a TwinCAT Analytics Runtime (TC3 PLC and HMI Server) and provide the same analysis results as the configurator tool in the engineering environment.

✓ First, save your configuration and open the Analytics Deploy Runtime Wizard. This can be done from the context menu in the Analytics Project tree item or from the start page.



Add a Network or select an existing from the Solution Explorer to open the Network editor tab.

Drag Analytics-Functions to a Network editor and configure or extend a project.

Create a new TC3 Scope file, which contains all Analytics variables to show them.

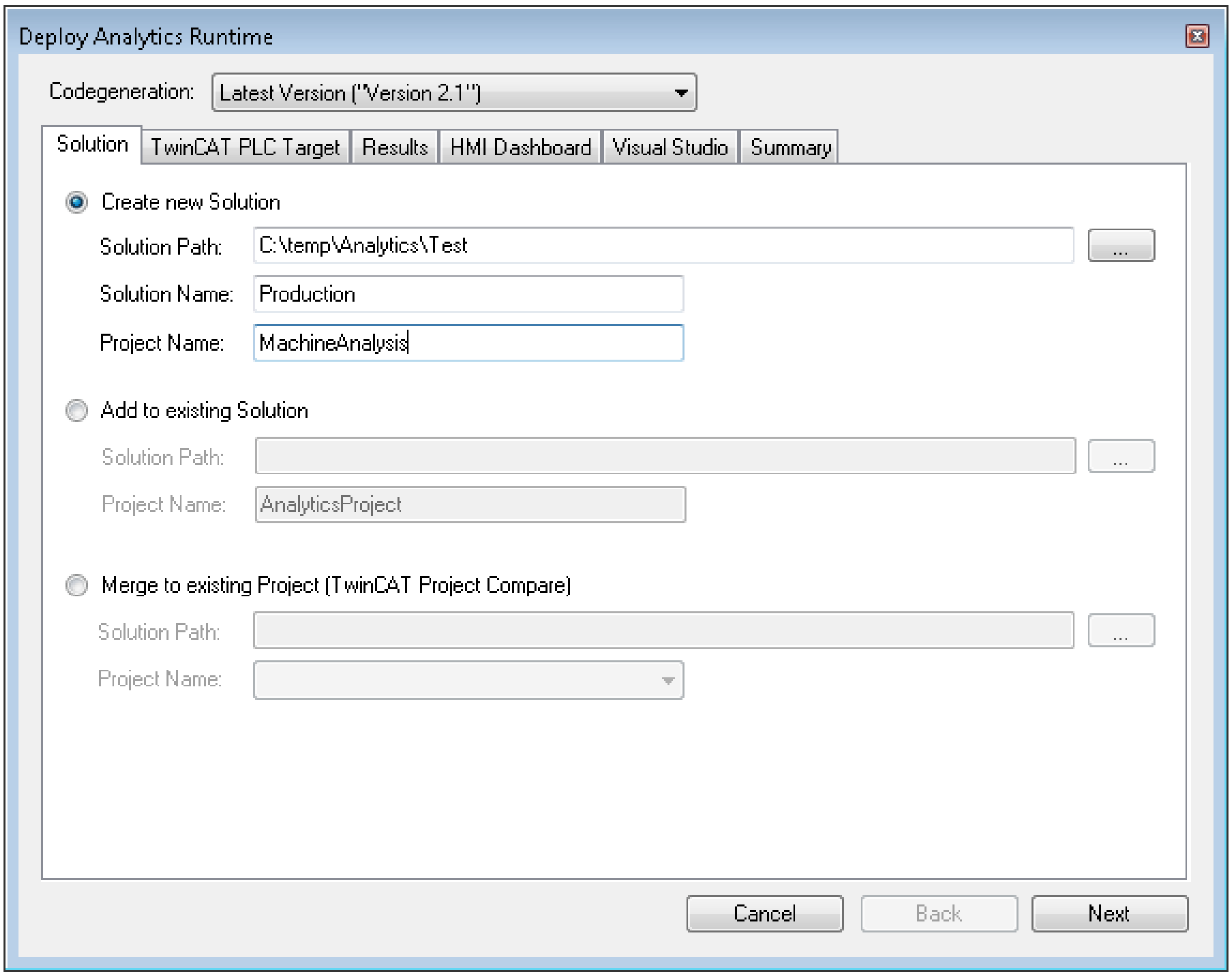
Drag Analytics variables from the Target Browser to the inputs of the Analytics-Functions to add an InputStream to the project.

Use the Analytics Storage Provider Recorder to manage connections to a Storage Provider and configure records.

Once an Analysis is designed and tested in the Workbench, autogenerated code can be compiled and deployed to an Analytics-Runtime-System.

1. When the wizard is open, you can click through some tabs. The first one is called Solution. Here you can decide how your Analytics project should be used in the PLC code: As...
completely new solution.

part of an existing solution.
update of an existing Analytics solution.



Deploy Analytics Runtime

Codegeneration: Latest Version ("Version 2.1")

Solution | TwinCAT PLC Target | Results | HMI Dashboard | Visual Studio | Summary

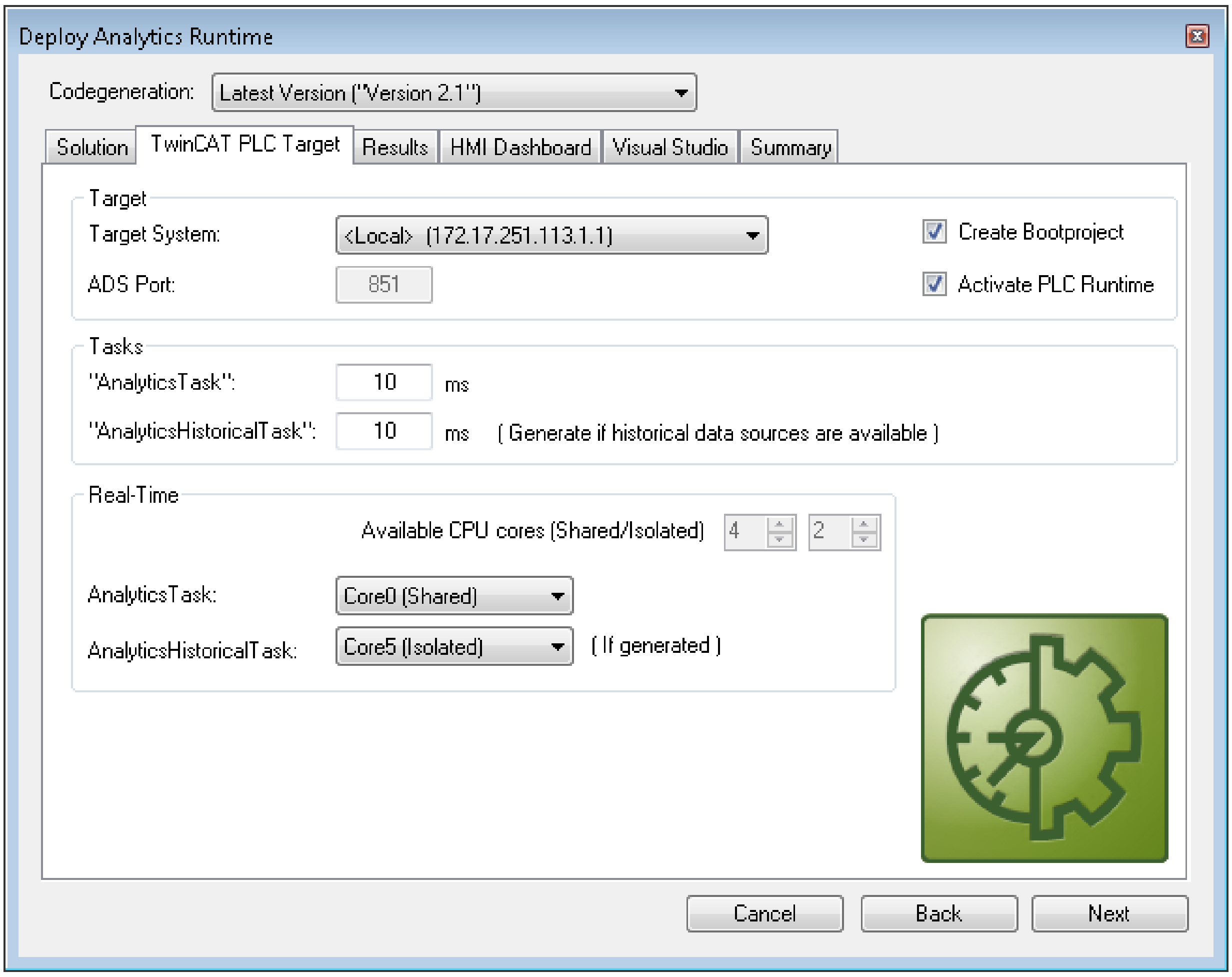
(●) Create new Solution
Solution Path: C:\temp\Analytics\Test
Solution Name: Production
Project Name: MachineAnalysis

( ) Add to existing Solution
Solution Path:
Project Name: AnalyticsProject

( ) Merge to existing Project (TwinCAT Project Compare)
Solution Path:
Project Name:

Cancel | Back | Next

2. In the **TwinCAT PLC Target** tab you can select the ADS target system that runs the TwinCAT Analytics Runtime (TF3550). The created project is immediately executable. For this purpose you can set the Activate PLC Runtime option. In addition, it can be selected that a boot project is created directly.


Deploy Analytics Runtime

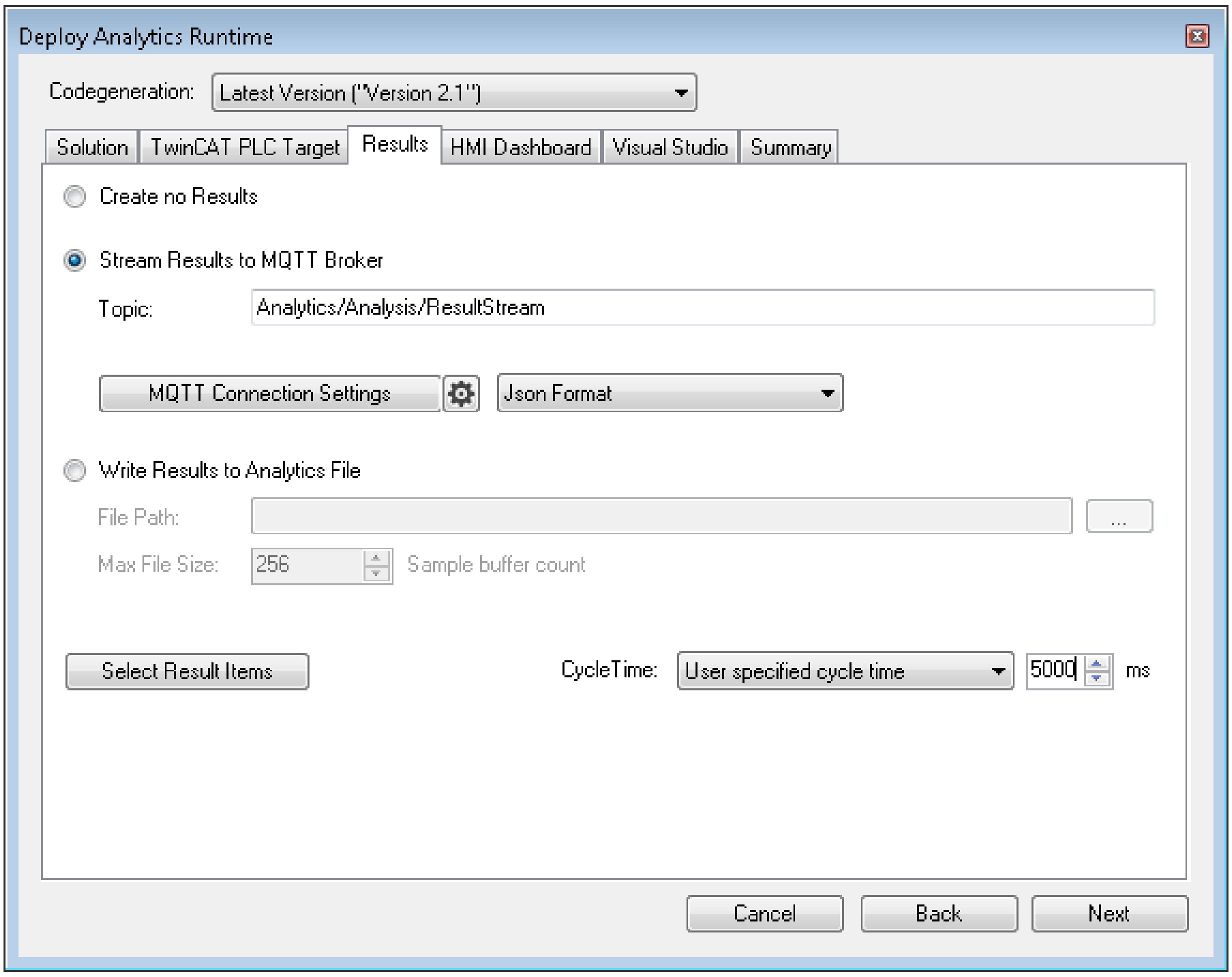
Codegeneration: Latest Version ("Version 2.1")

Target
Target System: <Local> (172.17.251.113.1.1)
ADS Port: 851
[✓] Create Bootproject
[✓] Activate PLC Runtime

Tasks
"AnalyticsTask": 10 ms
"AnalyticsHistoricalTask": 10 ms (Generate if historical data sources are available)

Real-Time
Available CPU cores (Shared/Isolated) 4 2
AnalyticsTask: Core0 (Shared)
AnalyticsHistoricalTask: Core5 (Isolated) (If generated)

3. Especially for virtual machines, it is important to run the project on isolated cores, which is also an option in this tab. The next tab **Results** is needed only if you have selected the **Stream Results** option in the algorithm properties. If you want to send results, you can decide here in which way (locally in a file/ through MQTT) and which format (binary/JSON) this should be done. This is also generated automatically and executed immediately after activation.



Deploy Analytics Runtime

Codegeneration: Latest Version ("Version 2.1")

Solution | TwinCAT PLC Target | Results | HMI Dashboard | Visual Studio | Summary

- ○ Create no Results
- ● Stream Results to MQTT Broker

Topic: Analytics/Analysis/ResultStream

MQTT Connection Settings | Json Format

- ○ Write Results to Analytics File

File Path:

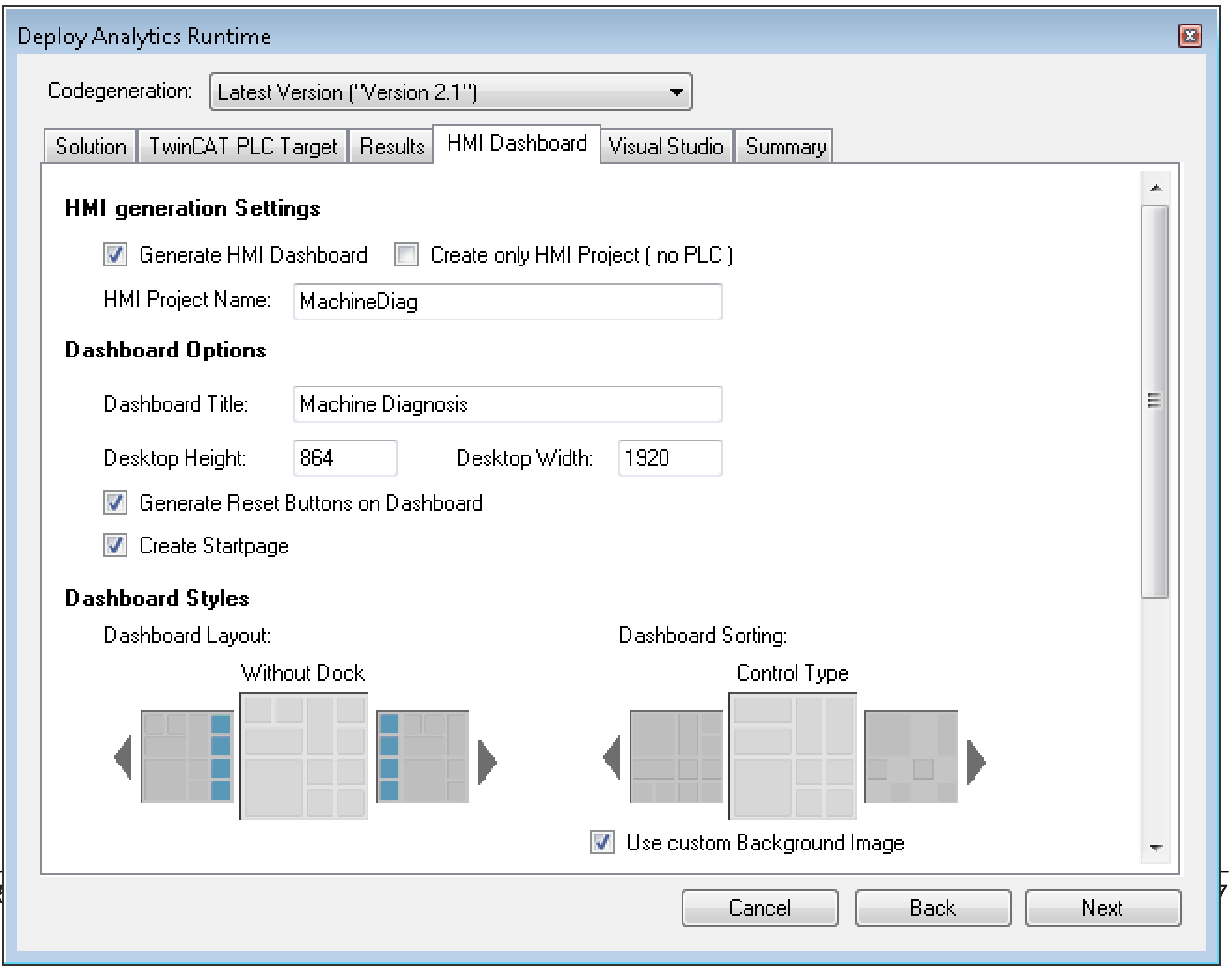
Max File Size: 256 Sample buffer count

Select Result Items

CycleTime: User specified cycle time 5000 ms

Cancel | Back | Next

Downsampling of the results is possible by specifying a cycle time. The next tab is for the **HMI Dashboard**. A prerequisite for the automatic generation of the dashboard is the selection of HMI Controls for the corresponding algorithms whose results are to be displayed in the dashboard.



Deploy Analytics Runtime

Codegeneration: Latest Version ("Version 2.1")

Solution | TwinCAT PLC Target | Results | HMI Dashboard | Visual Studio | Summary

HMI generation Settings

- ✓ Generate HMI Dashboard
- ☐ Create only HMI Project (no PLC)

HMI Project Name: MachineDiag

Dashboard Options

Dashboard Title: Machine Diagnosis

Desktop Height: 864 Desktop Width: 1920

- ✓ Generate Reset Buttons on Dashboard
- ✓ Create Startpage

Dashboard Styles

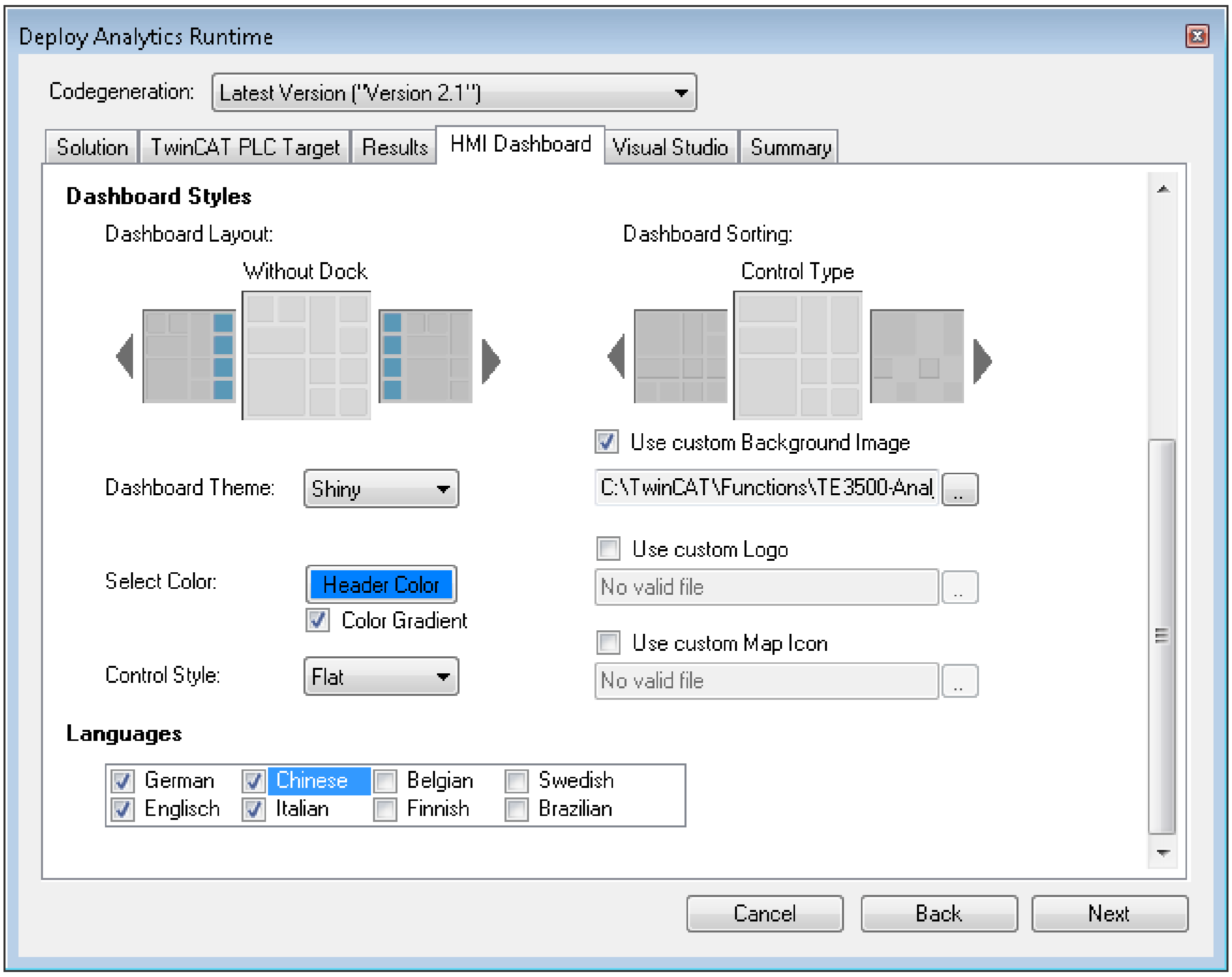
Dashboard Layout: Without Dock

Dashboard Sorting: Control Type

- ✓ Use custom Background Image

Cancel | Back | Next

4. You can choose different options for your Analytics Dashboard, such as a start page with a map, layouts, sorting algorithms, custom colors and logos. If you select multiple languages for the Analytics Controls, a language switching menu will also be generated.



Deploy Analytics Runtime

Codegeneration: Latest Version ("Version 2.1")

Dashboard Styles

Dashboard Layout: Without Dock

Dashboard Sorting: Control Type

[✓] Use custom Background Image: C:\TwinCAT\Functions\TE3500-Anal

Dashboard Theme: Shiny

Select Color: Header Color

[✓] Color Gradient

[ ] Use custom Logo: No valid file

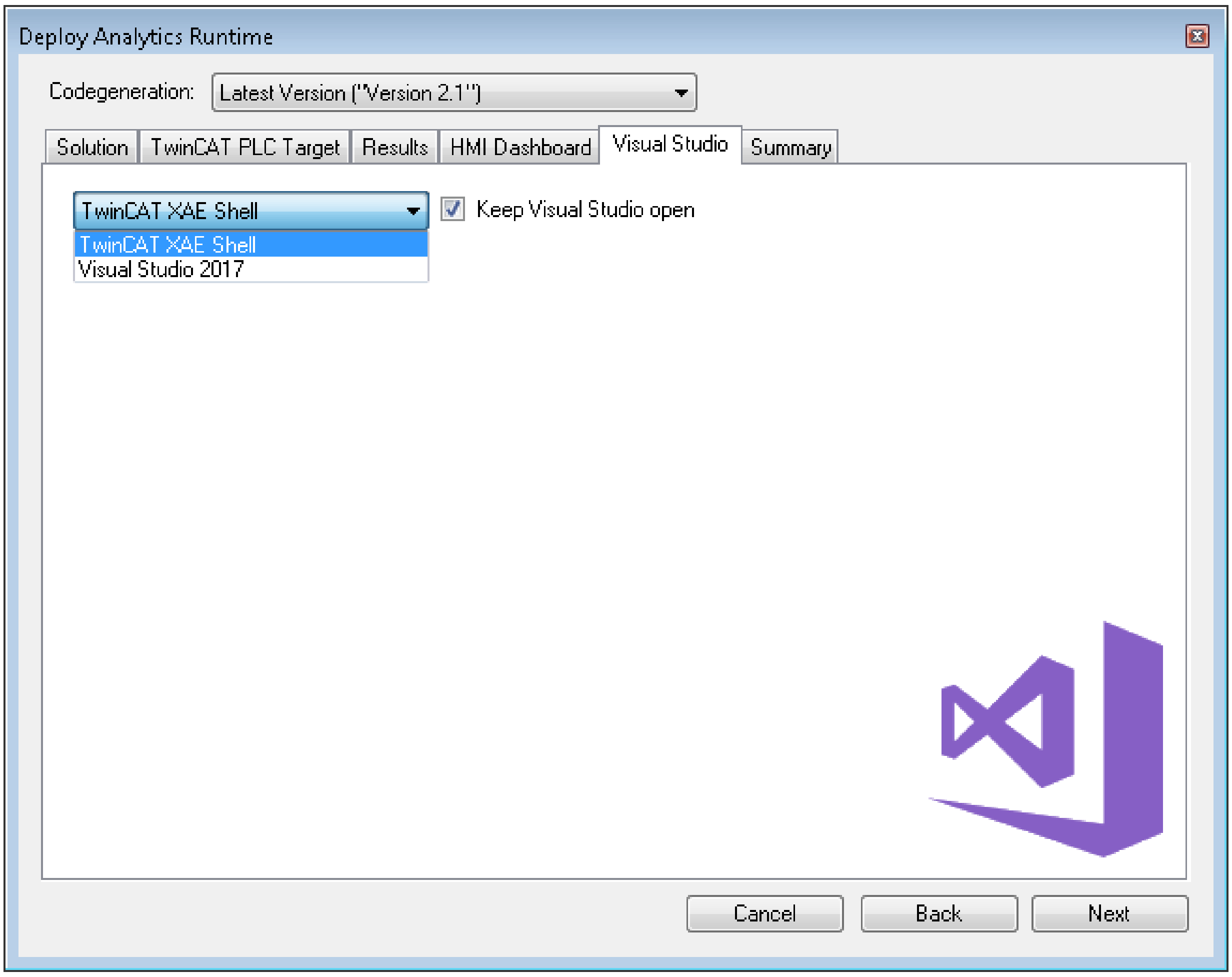
[ ] Use custom Map Icon: No valid file

Control Style: Flat

Languages

[✓] German	[✓] Chinese	[ ] Belgian	[ ] Swedish
[✓] Englisch	[✓] Italian	[ ] Finnish	[ ] Brazilian

5. Select one of the installed versions of Visual Studio® and, whether the instance should start visibly or just be set up and activated in the background.

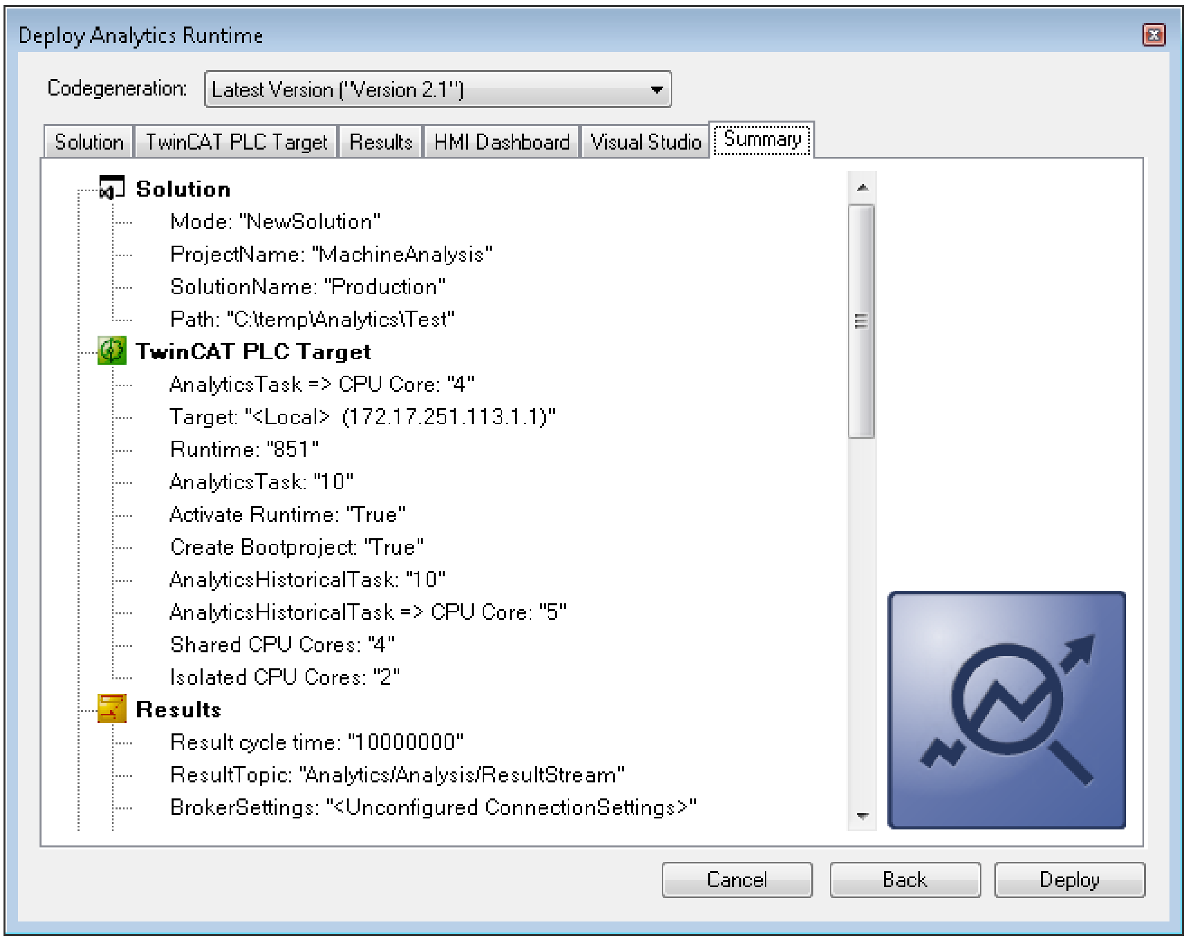

Deploy Analytics Runtime

Codegeneration: Latest Version ("Version 2.1")

TwinCAT XAE Shell [✓ TwinCAT XAE Shell] Visual Studio 2017

[✓] Keep Visual Studio open

⇨ At last you can find an overview.



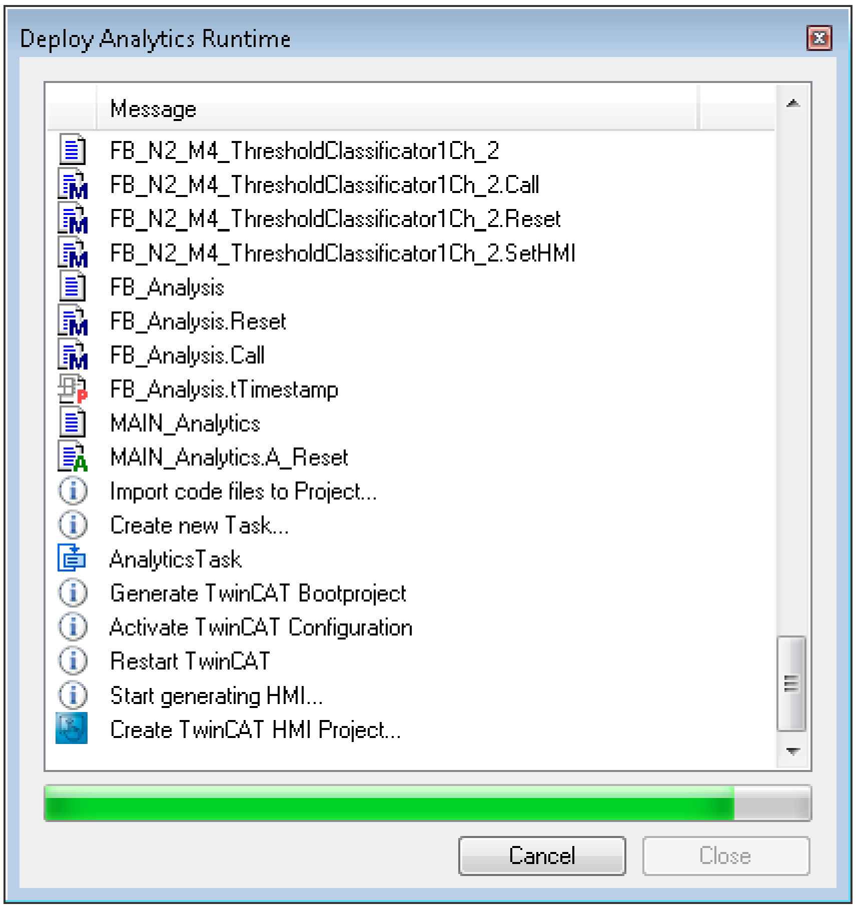
Codegeneration: Latest Version ("Version 2.1")

Solution
- Mode: "NewSolution"
- ProjectName: "MachineAnalysis"
- SolutionName: "Production"
- Path: "C:\temp\Analytics\Test"

TwinCAT PLC Target
- AnalyticsTask => CPU Core: "4"
- Target: "<Local> (172.17.251.113.1.1)"
- Runtime: "851"
- AnalyticsTask: "10"
- Activate Runtime: "True"
- Create Bootproject: "True"
- AnalyticsHistoricalTask: "10"
- AnalyticsHistoricalTask => CPU Core: "5"
- Shared CPU Cores: "4"
- Isolated CPU Cores: "2"

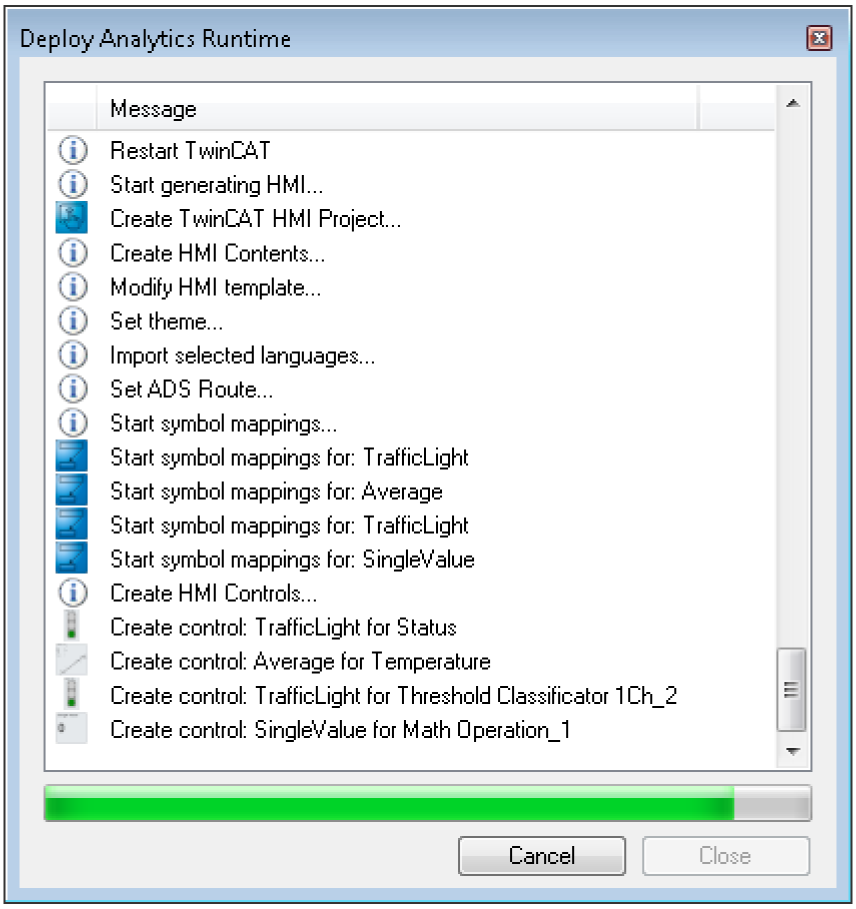
Results
- Result cycle time: "10000000"
- ResultTopic: "Analytics/Analysis/ResultStream"
- BrokerSettings: "<Unconfigured ConnectionSettings>"

6. Now you can click the **Deploy** button to start the generation process. The PLC project and the HMI dashboard are now generated.



Message

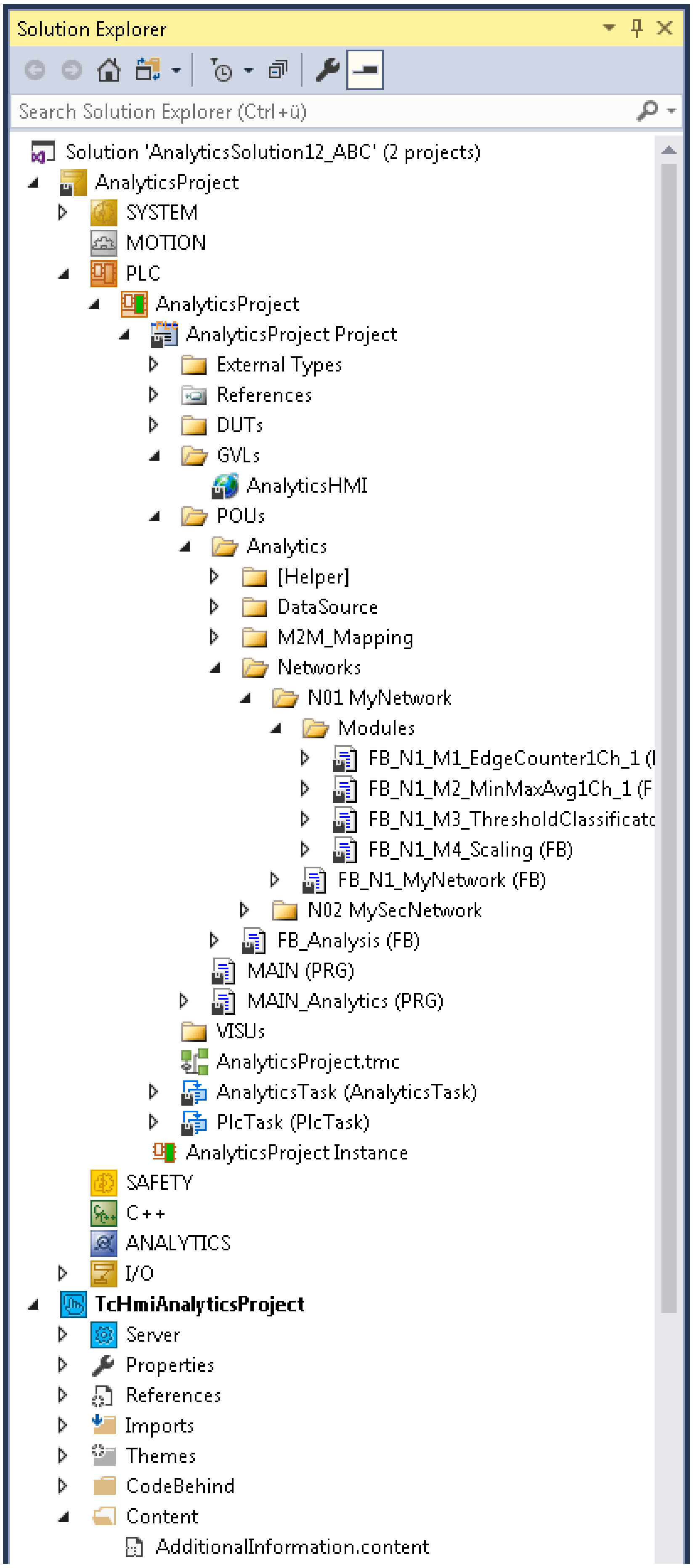
FB_N2_M4_ThresholdClassificator1Ch_2
FB_N2_M4_ThresholdClassificator1Ch_2.Call
FB_N2_M4_ThresholdClassificator1Ch_2.Reset
FB_N2_M4_ThresholdClassificator1Ch_2.SetHMI
FB_Analysis
FB_Analysis.Reset
FB_Analysis.Call
FB_Analysis.tTimestamp
MAIN_Analytics
MAIN_Analytics.A_Reset
Import code files to Project...
Create new Task...
AnalyticsTask
Generate TwinCAT Bootproject
Activate TwinCAT Configuration
Restart TwinCAT
Start generating HMI...
Create TwinCAT HMI Project...



Message

Restart TwinCAT
Start generating HMI...
Create TwinCAT HMI Project...
Create HMI Contents...
Modify HMI template...
Set theme...
Import selected languages...
Set ADS Route...
Start symbol mappings...
Start symbol mappings for: TrafficLight
Start symbol mappings for: Average
Start symbol mappings for: TrafficLight
Start symbol mappings for: SingleValue
Create HMI Controls...
Create control: TrafficLight for Status
Create control: Average for Temperature
Create control: TrafficLight for Threshold Classificator 1Ch_2
Create control: SingleValue for Math Operation_1

⇨ After the "Deploy Runtime succeeded" message, you will find a new Visual Studio®/XAE shell instance on your desktop. The new Solution and both projects are created.



```
Solution 'AnalyticsSolution12_ABC' (2 projects)
◢ AnalyticsProject
    ▷ SYSTEM
      MOTION
    ◢ PLC
        ◢ AnalyticsProject
            ◢ AnalyticsProject Project
                ▷ External Types
                ▷ References
                ▷ DUTs
                ◢ GVLs
                      AnalyticsHMI
                ◢ POUs
                    ◢ Analytics
                        ▷ [Helper]
                        ▷ DataSource
                        ▷ M2M_Mapping
                        ◢ Networks
                            ◢ N01 MyNetwork
                                ◢ Modules
                                    ▷ FB_N1_M1_EdgeCounter1Ch_1 (I
                                    ▷ FB_N1_M2_MinMaxAvg1Ch_1 (F
                                    ▷ FB_N1_M3_ThresholdClassificato
                                    ▷ FB_N1_M4_Scaling (FB)
                                ▷ FB_N1_MyNetwork (FB)
                            ▷ N02 MySecNetwork
                        ▷ FB_Analysis (FB)
                      MAIN (PRG)
                    ▷ MAIN_Analytics (PRG)
                  VISUs
                  AnalyticsProject.tmc
                ▷ AnalyticsTask (AnalyticsTask)
                ▷ PlcTask (PlcTask)
              AnalyticsProject Instance
      SAFETY
      C++
      ANALYTICS
    ▷ I/O
◢ TcHmiAnalyticsProject
    ▷ Server
    ▷ Properties
    ▷ References
    ▷ Imports
    ▷ Themes
    ▷ CodeBehind
    ◢ Content
          AdditionalInformation.content
```

5 Technical introduction

The basic idea of the TwinCAT Analytics Storage Provider (ASP) is to have a gateway that largely frees the user from configuring a data sink, i.e. a storage or a database. The user does not need to set up his own table structure in a database. He only has to configure which of the supported data sinks he wants to use for storing his data.

Service Management

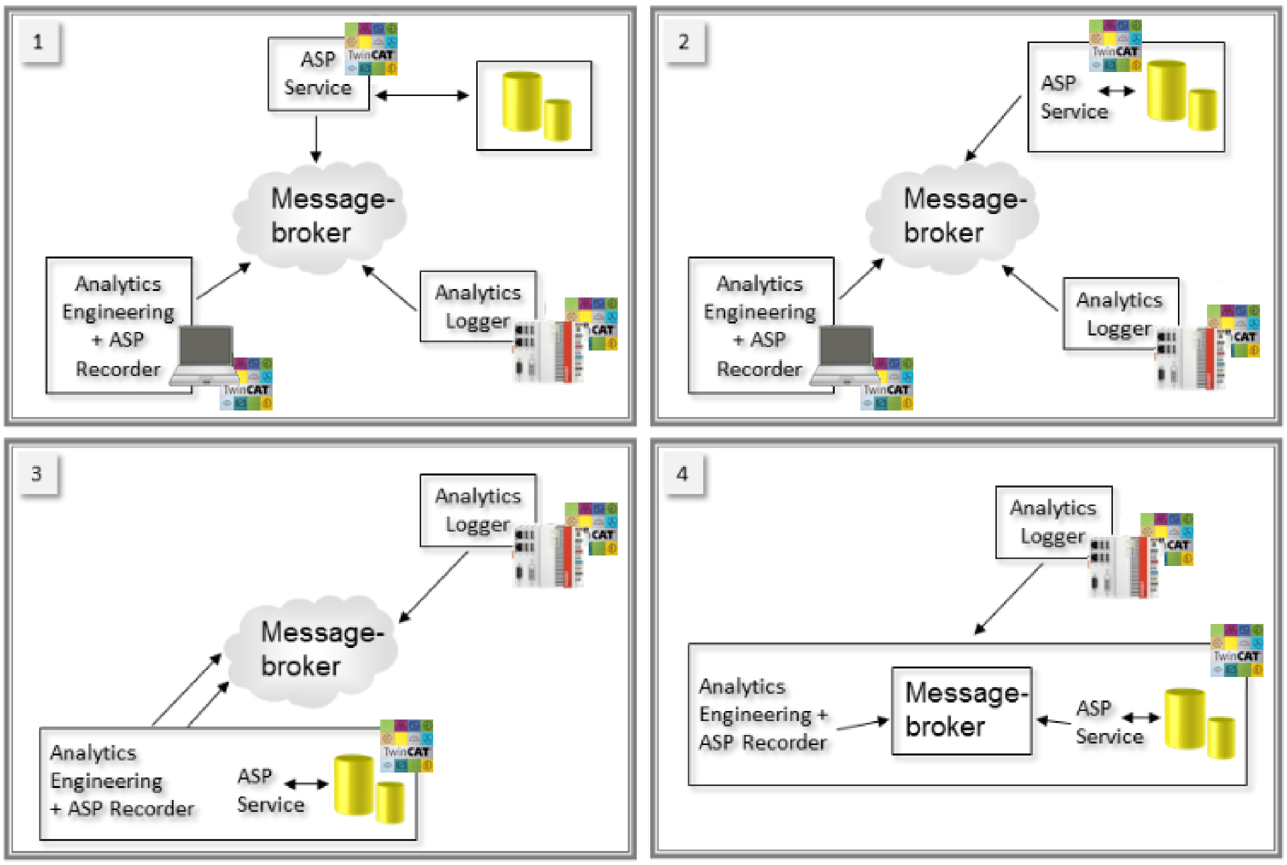
The Analytics Storage Provider service can run anywhere on the network. It is implemented as a Windows service. The service can run on hardware devices, such as industrial PCs or embedded PCs in the local network, and also on virtual machines in the same network, or in a cloud system, for example.

Data Management

The Storage Provider works with the binary format of TwinCAT Analytics. This allows it to receive and store streams from an MQTT message broker and to create and send new streams itself. The user only needs the recorder, which is integrated with the TwinCAT Analytics Workbench or the service tool in his own engineering system. The variables themselves are displayed in the TwinCAT Target Browser. For the Analytics binary format, they are divided into live and historical data. Live data can be used as input to the Analytics Storage Provider. Historical data are the values from the database/storage provided by the Storage Provider.

Topologies

The many degrees of freedom offered by IoT technologies enable different topologies. The following picture shows the most important constellations.



1. Each SW package runs on its own HW device or virtual machine.
2. The Analytics Storage Provider Windows service runs on the same device as the database/storage.
3. Analytics Engineering, Analytics Storage Provider, and database or storage are on the same device. Only the Message Broker and Analytics Logger (data source) run on other devices.

4. In this topology view, only the Analytics Logger runs on its own PC. This may be the case in a machine application. All other tools in the Analytics tool chain reside on one device, including the MQTT message broker.

Topologies with additional ASP clients

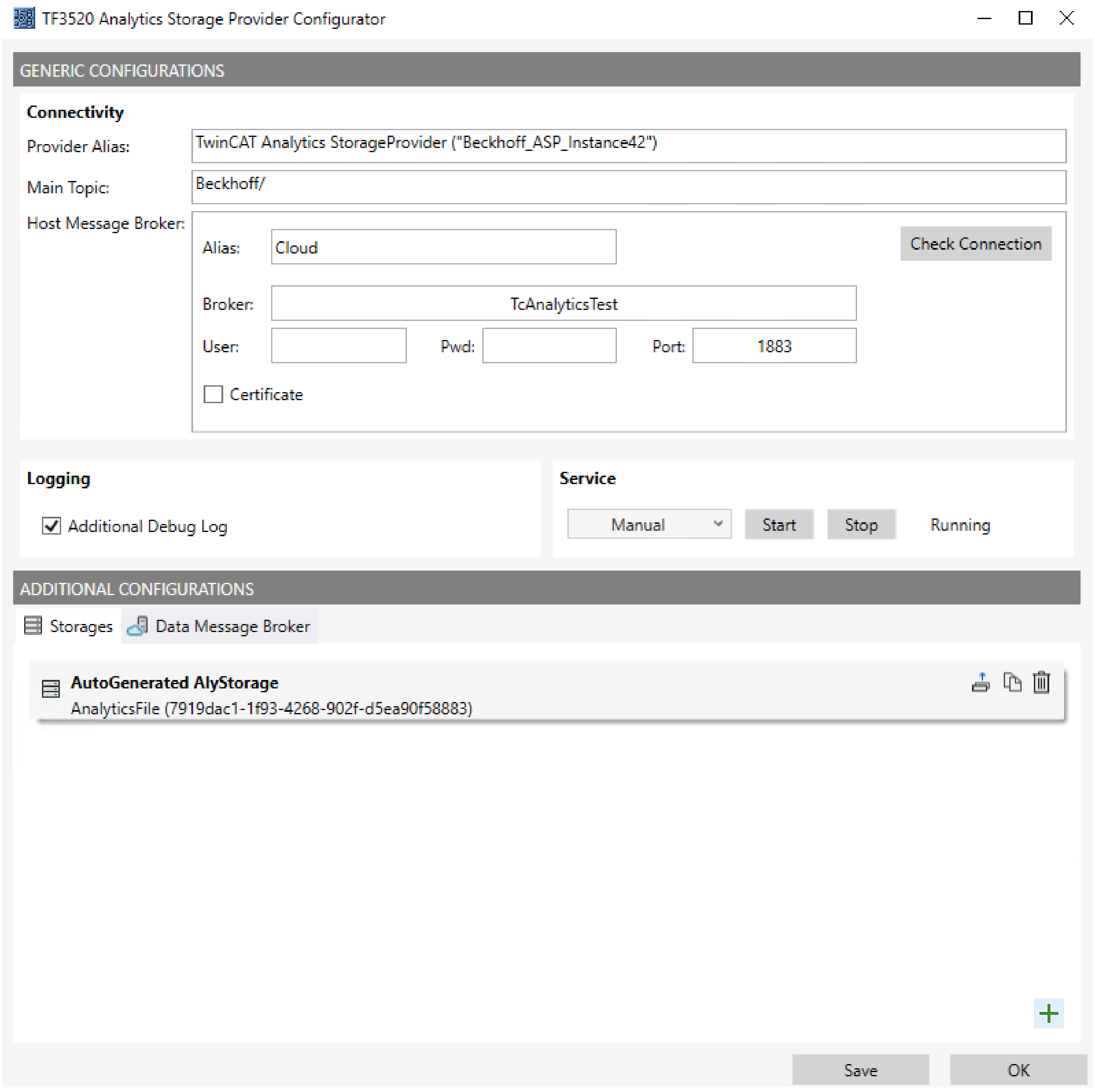
Currently, two additional clients are available from the Analytics Storage Provider perspective. A command line based client that allows execution from almost any application. And a PLC library that can also be used to influence the actions of the storage provider.

6 Configuration

The configuration of the Analytics Storage Provider is divided into two main parts. First, you need to configure the service with its stores. This is done in the TwinCAT Analytics Storage Provider Configurator. You must also configure the recordings and pipelines yourself. In other words, which variables should be stored in which stores under which conditions. To do this, go to the TwinCAT Analytics Storage Provider Manager. In this chapter you will also find the supported databases and storages.

6.1 Configurator

You can configure the service with its message brokers and stores in the TwinCAT Analytics Storage Provider Configurator. A distinction is made between a Host Message Broker and various Data Message Brokers. A Host Message Broker can also be a Data Message Broker at the same time. The Host Message Broker is special because this is where the Storage Provider's service registers.



Provider Alias: TwinCAT Analytics StorageProvider ("Beckhoff_ASP_Instance42")
Main Topic: Beckhoff/
Host Message Broker:
Alias: Cloud
Broker: TcAnalyticsTest
User:
Pwd:
Port: 1883
☐ Certificate
☑ Additional Debug Log
Manual
Running
AutoGenerated AlyStorage
AnalyticsFile (7919dac1-1f93-4268-902f-d5ea90f58883)

6.1.1 Generic Configurations

General settings for the Storage Provider service can be made in the Generic Configurations.

GENERIC CONFIGURATIONS

Provider Alias:
Each Analytics Storage Provider Service has its own GUID for identification. You can enter a provider alias in the general configuration area so that this can be replaced by a meaningful name.

Main Topic:
Basically, you do not have to worry about the topic. However, you can enter the so-called Main Topic here. It describes the first part of the overall topic. Beckhoff-specific additions are then added. This results in a very simple plug-and-play system with TwinCAT Analytics.

Host Message Broker:
The so-called Host Message Broker can be configured here. The Storage Provider Service logs on to this message broker itself and makes its data available. This broker can also be a so-called Data Message Broker, which is used to receive data to the Storage Provider Service. There can only be one Host Broker in the system, but several Data Brokers.

Logging:
Check various logging options.

Service:
Displays the status and default settings for starting the Windows service.

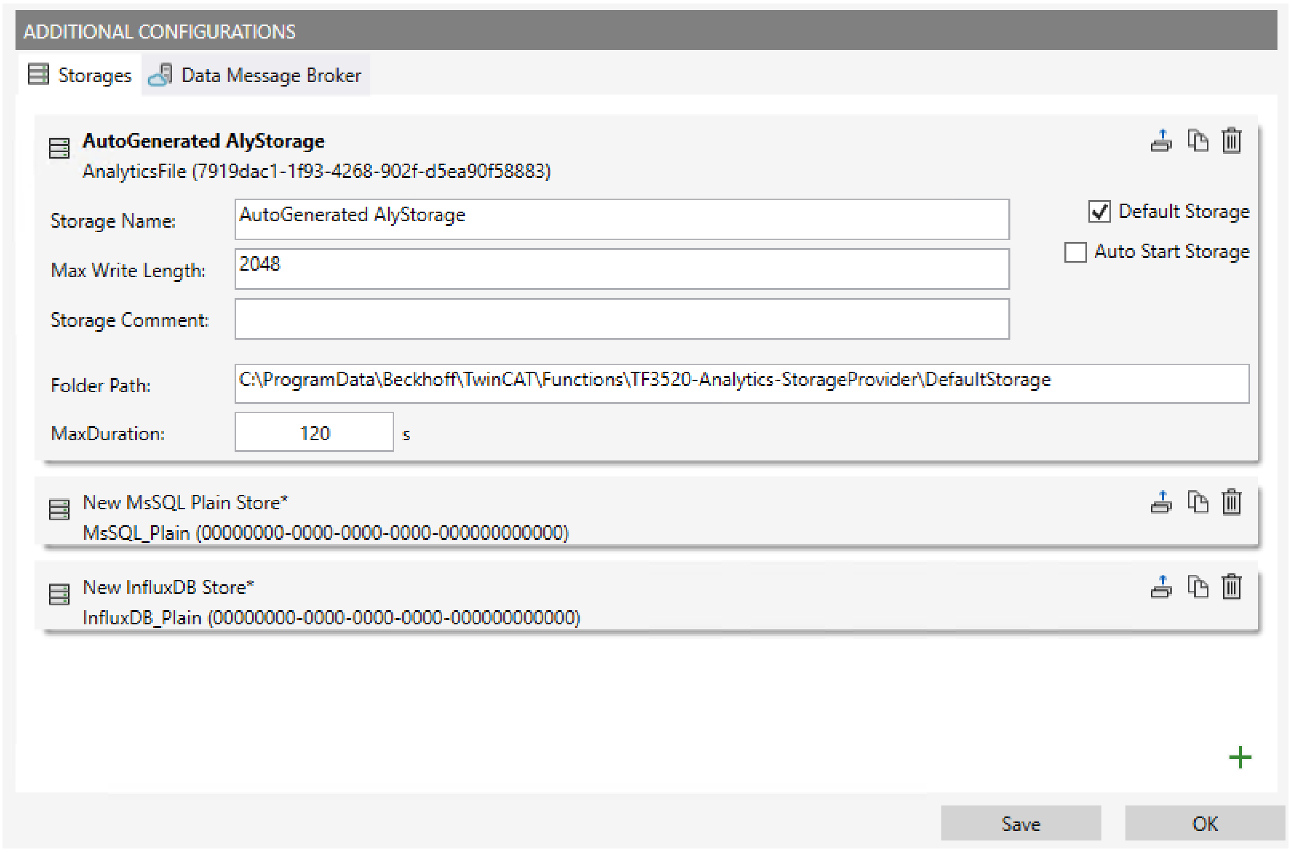
6.1.2 Additional Configurations

The Stores and Data Message Broker of the Storage Provider Services are set under Additional Configurations.

ADDITIONAL CONFIGURATIONS

Storages

The stores that are available to the Analytics Storage Provider Service can be created in the Storages tab. These can be of various types, such as Microsoft SQL® or csv files. New stores can be added in binary or plain text format using the plus sign in the bottom right-hand corner. The configuration of the individual stores is described in this sub-chapter [▶ 47].



AutoGenerated AlyStorage
AnalyticsFile (7919dac1-1f93-4268-902f-d5ea90f58883)

Storage Name: AutoGenerated AlyStorage
Max Write Length: 2048
Storage Comment:
Folder Path: C:\ProgramData\Beckhoff\TwinCAT\Functions\TF3520-Analytics-StorageProvider\DefaultStorage
MaxDuration: 120 s

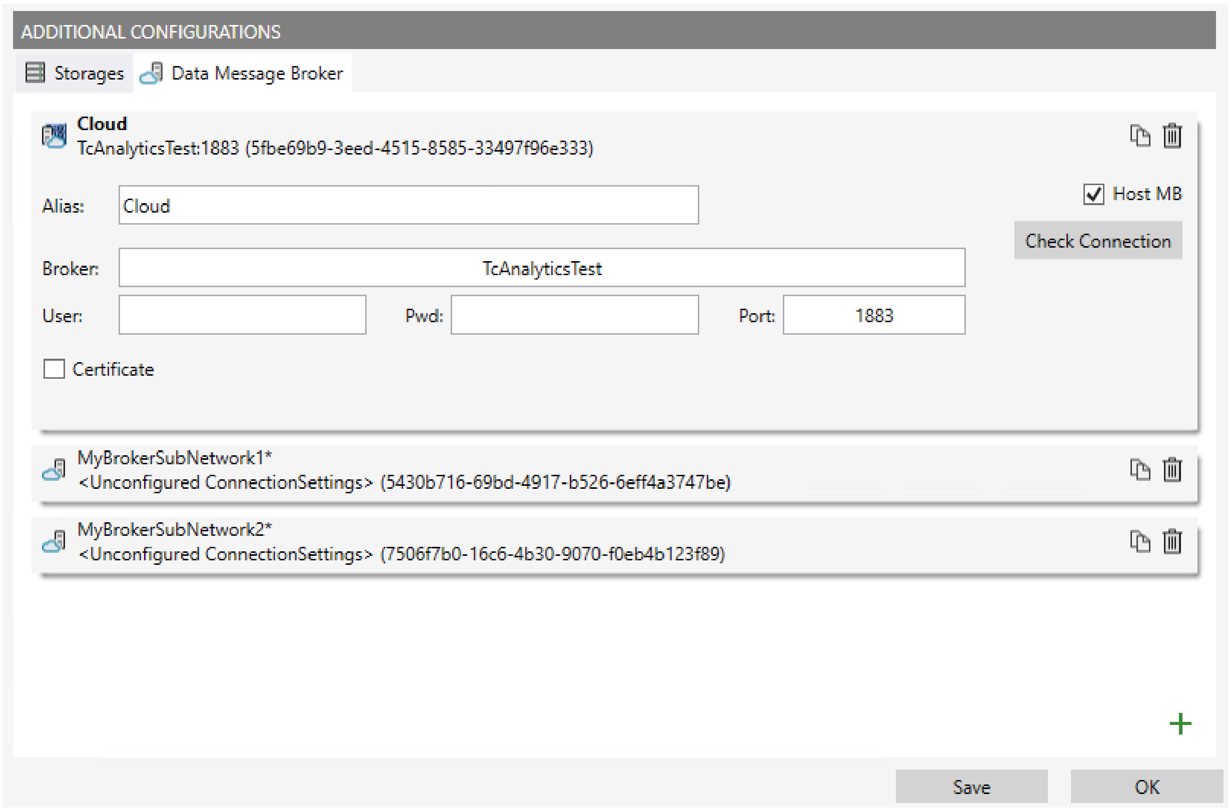
[✓] Default Storage
[ ] Auto Start Storage

New MsSQL Plain Store*
MsSQL_Plain (00000000-0000-0000-0000-000000000000)

New InfluxDB Store*
InfluxDB_Plain (00000000-0000-0000-0000-000000000000)

Data Message Broker

1. In the Data Message Broker tab, you can create the message brokers that can provide input data for the Storage Provider in addition to the Host Message Broker.



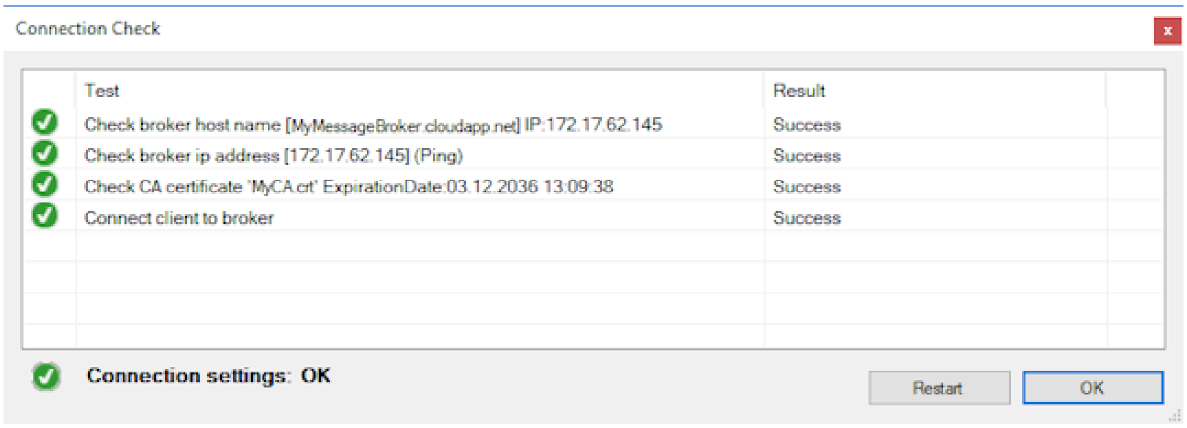
Cloud
TcAnalyticsTest:1883 (5fbe69b9-3eed-4515-8585-33497f96e333)

Alias: Cloud
[✓] Host MB
Check Connection
Broker: TcAnalyticsTest
User:
Pwd:
Port: 1883
☐ Certificate

MyBrokerSubNetwork1*
<Unconfigured ConnectionSettings> (5430b716-69bd-4917-b526-6eff4a3747be)

MyBrokerSubNetwork2*
<Unconfigured ConnectionSettings> (7506f7b0-16c6-4b30-9070-f0eb4b123f89)

2. The settings can be checked using the Check Connection button.
   ⇨ The result is displayed in the following window:



Connection Check

	Test	Result
✓	Check broker host name [MyMessageBroker.cloudapp.net] IP:172.17.62.145	Success
✓	Check broker ip address [172.17.62.145] (Ping)	Success
✓	Check CA certificate 'MyCA.crt' ExpirationDate:03.12.2036 13:09:38	Success
✓	Connect client to broker	Success

✓ **Connection settings: OK**

If you click on **Save**, the settings are saved in the directory *C:\TwinCAT\Functions\TF3520-Analytics-StorageProvider\Configurations*.

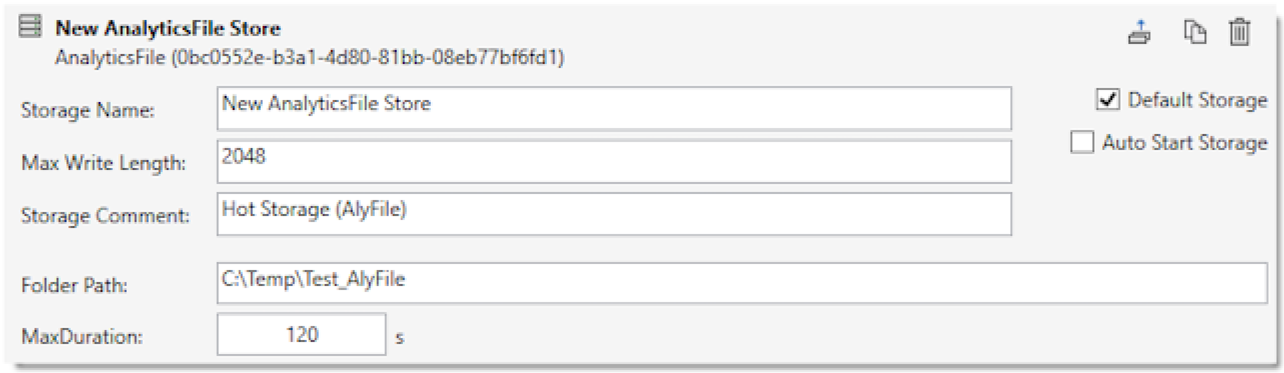
6.1.2.1 Databases/Stores

The following overview shows which database connections are supported by which platform.

Database	Windows		TwinCAT/BSD	
	Local	Remote	Local	Remote
Analytics File	X	X	X	X
CSV	X	X	X	X
MS SQL	X	X	-	X
PostgreSQL	X	X	-	X
InfluxDB 2	X	X	-	X
AzureBlob	-	X	-	X

6.1.2.1.1 TwinCAT Analytics Binary File

TwinCAT Analytics Binary File is a TwinCAT-specific Storage. Therefore no external software is necessary. You can use this type of storage directly after installing the Analytics Storage Provider. This is the same file that the TwinCAT Analytics Logger provides in its "offline" configuration without MQTT Message Broker.



New AnalyticsFile Store
AnalyticsFile (0bc0552e-b3a1-4d80-81bb-08eb77bf6fd1)

Storage Name: New AnalyticsFile Store
Max Write Length: 2048
Storage Comment: Hot Storage (AlyFile)
Folder Path: C:\Temp\Test_AlyFile
MaxDuration: 120 s

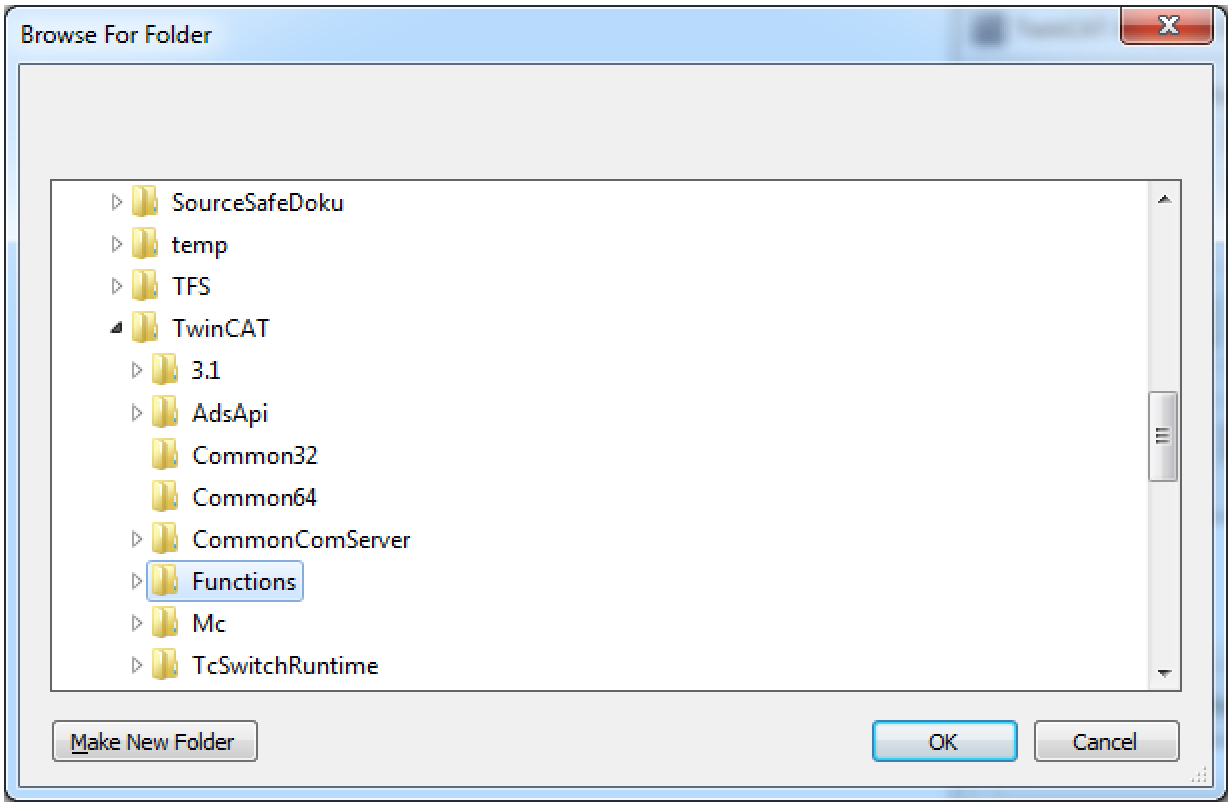
[✓] Default Storage
[ ] Auto Start Storage

Storage Name:
Assign a descriptive name that describes the purpose of the storage well. It will reappear in various places during configuration in the Manager.

Max Write Length:
The amount of data that is written to the .tay file in one call is specified here.

Storage Comment:
You can enter additional information about the storage here.

File Path:
For the configuration, you must select your preferred folder on the local device on which the Storage Provider is running.



The folder used is displayed in the Connection String window for confirmation.

The folder architecture that is created after the pipeline is started is currently divided into five hierarchical levels:

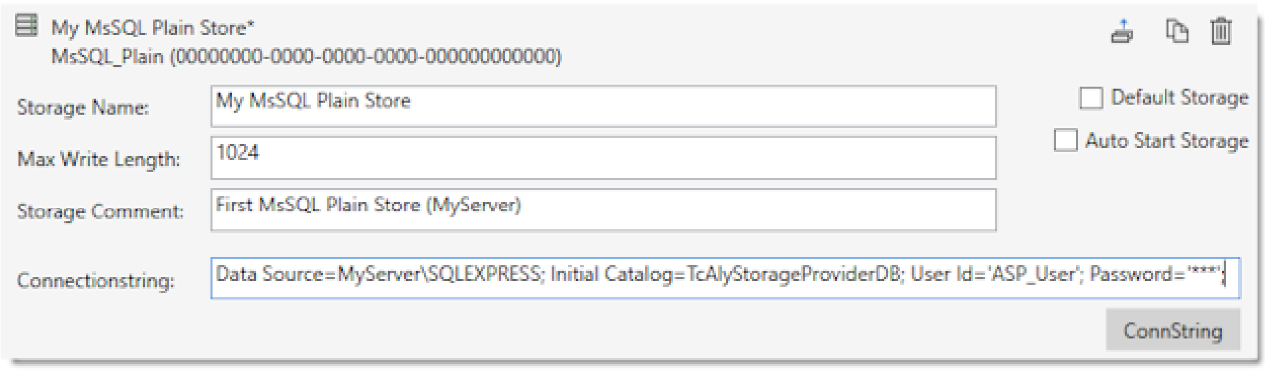
1. System ID (this is a GUID of the system sending the data) - can be replaced by the alias name in the Analytics Logger settings or in local engineering by the Machine Administration Page.
2. Recording name - can be set using the configurator.
3. Record name - can be set by the configurator and automatically influenced with auto IDs, date, cycle time and other placeholders at runtime.
4. Internal ID - cannot be changed.
5. Layout GUID - cannot be changed and corresponds to the data storage of the Analytics Logger.

Max Duration:
This value specifies in seconds how much data is written to a .tay file. After time X, the data is written to a new .tay file. Ring buffers that are configured in the Manager only affect complete .tay files of a current recording.

6.1.2.1.2 Microsoft SQL (binary / plain text)

With Microsoft SQL Server, you have another On-Premises solution for storing the Analytics binary data.

Enter the Connection String for your MS SQL server here.


My MsSQL Plain Store*
MsSQL_Plain (00000000-0000-0000-0000-000000000000)

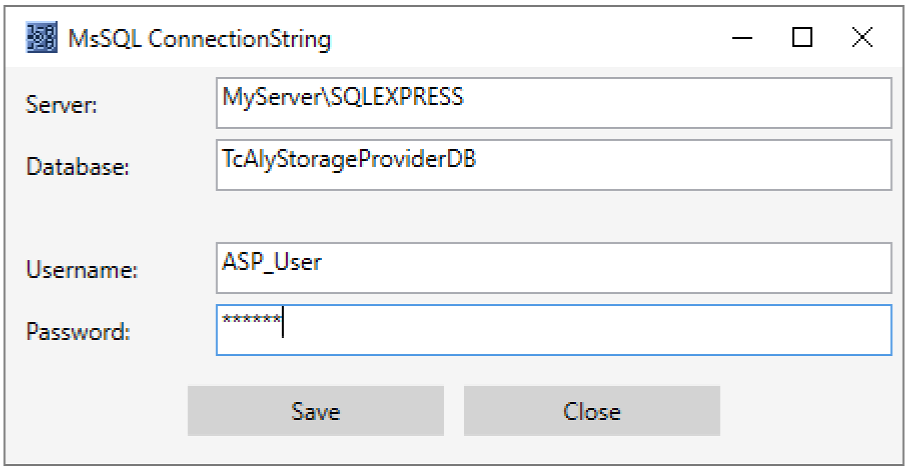
Storage Name: My MsSQL Plain Store
Max Write Length: 1024
Storage Comment: First MsSQL Plain Store (MyServer)
Connectionstring: Data Source=MyServer\SQLEXPRESS; Initial Catalog=TcAlyStorageProviderDB; User Id='ASP_User'; Password='***';

Storage Name:
Assign a descriptive name that describes the purpose of the storage well. It will reappear in various places during configuration in the Manager.

Max Write Length:
The amount of data that is saved in a tbl_Data record is specified here.

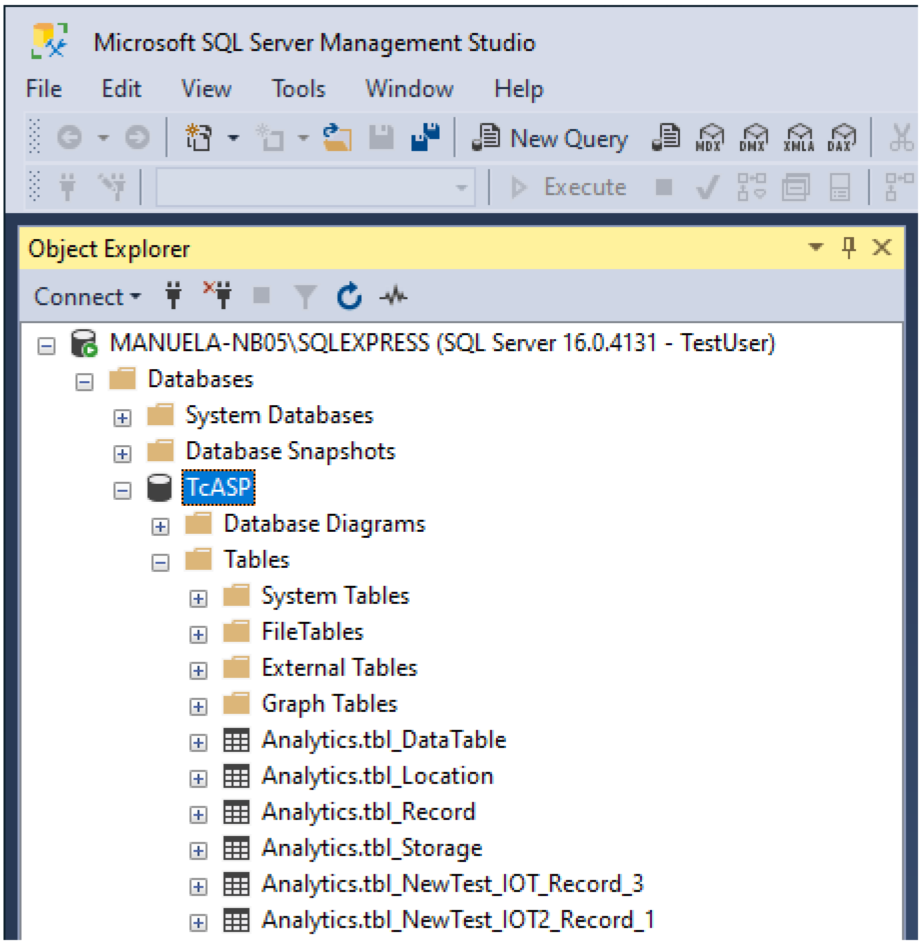
Storage Comment:
You can enter additional information about the storage here.

Connection String:
Click on the **ConnString** button to open the input mask. Make the configuration settings there, including for remote databases that are accessible via network connections.


MsSQL ConnectionString

Server: MyServer\SQLEXPRESS
Database: TcAlyStorageProviderDB
Username: ASP_User
Password: ******

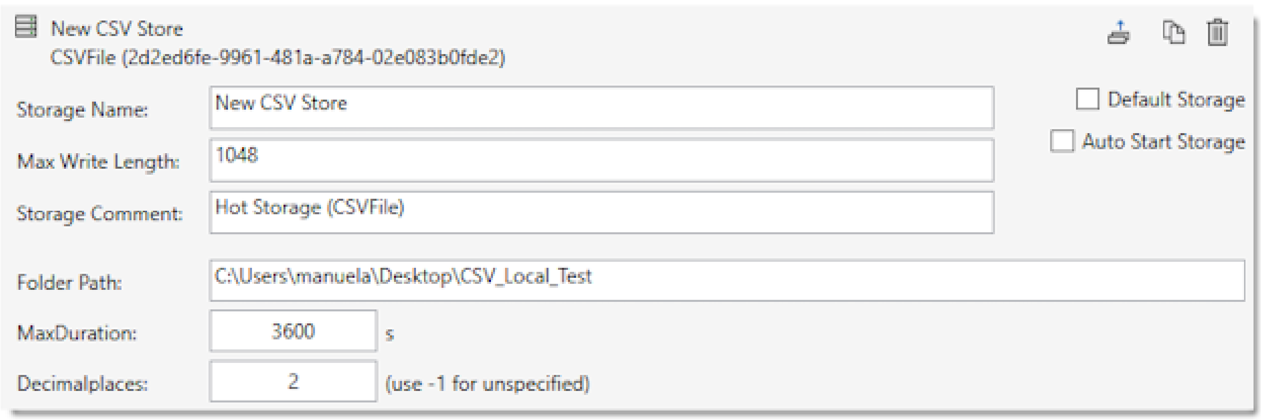
After starting the storage, communication with the database begins. At this point, the Storage Provider itself creates the four required tables. Each recording configuration is saved in a separate table. As an example, you can see the following screenshot from Microsoft SQL Server Management Studio.



MANUELA-NB05\SQLEXPRESS (SQL Server 16.0.4131 - TestUser)
- Databases
  - System Databases
  - Database Snapshots
  - TcASP
    - Database Diagrams
    - Tables
      - System Tables
      - FileTables
      - External Tables
      - Graph Tables
      - Analytics.tbl_DataTable
      - Analytics.tbl_Location
      - Analytics.tbl_Record
      - Analytics.tbl_Storage
      - Analytics.tbl_NewTest_IOT_Record_3
      - Analytics.tbl_NewTest_IOT2_Record_1

The ring buffer functionality for the Microsoft SQL® database can also be set in the Manager.

6.1.2.1.3 CSV file


New CSV Store
CSVFile (2d2ed6fe-9961-481a-a784-02e083b0fde2)

Storage Name:	New CSV Store
Max Write Length:	1048
Storage Comment:	Hot Storage (CSVFile)
Folder Path:	C:\Users\manuela\Desktop\CSV_Local_Test
MaxDuration:	3600 s
Decimalplaces:	2 (use -1 for unspecified)

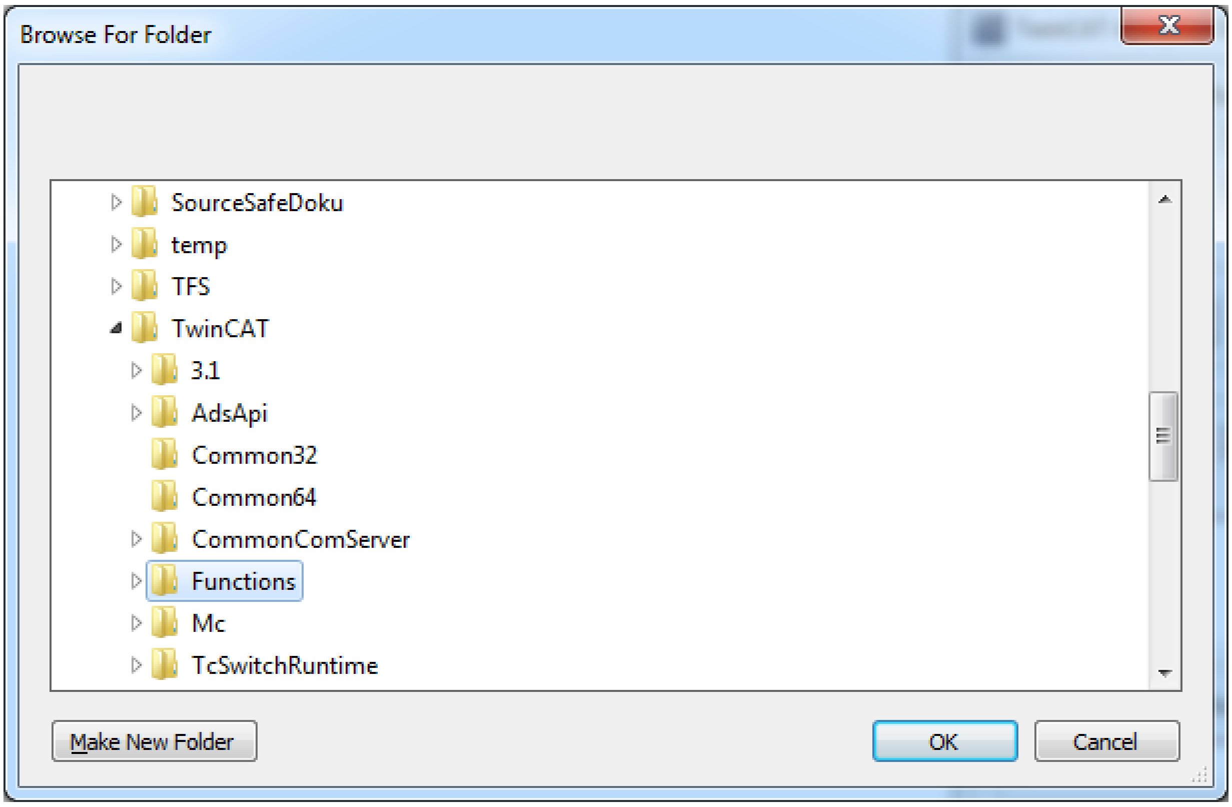
☐ Default Storage
☐ Auto Start Storage

Storage Name:
Assign a descriptive name that describes the purpose of the storage well. It will reappear in various places during configuration in the Manager.

Max Write Length:
The amount of data that is written to the .csv file in one call is specified here.

Storage Comment:
You can enter additional information about the storage here.

File Path:
For the configuration, you must select your preferred folder on the local device on which the Storage Provider is running.



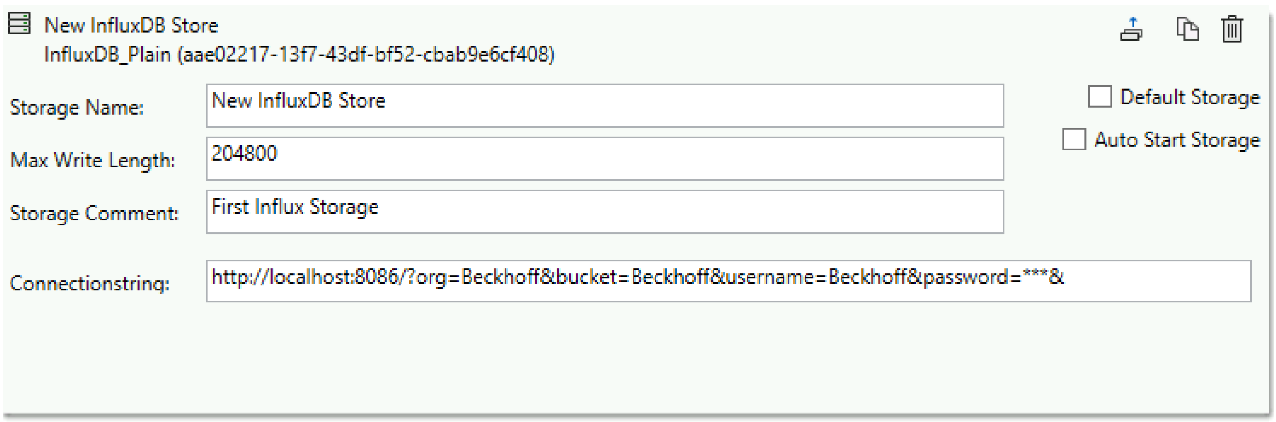
The folder used is displayed in the Connection String window for confirmation.

Max Duration:
It is also possible to define the timespan to be saved in a CSV file. The decimal places of floating point numbers can also be limited.

Decimalplaces:
The number of decimal places can be set here. The value "-1" stands for unspecified, the value "2" stands for two decimal places, for example.

6.1.2.1.4 InfluxDB 2

With the support of InfluxDB, you have another on-premises solution for storing Analytics binary data.



New InfluxDB Store
InfluxDB_Plain (aae02217-13f7-43df-bf52-cbab9e6cf408)

Storage Name:	New InfluxDB Store
Max Write Length:	204800
Storage Comment:	First Influx Storage
Connectionstring:	http://localhost:8086/?org=Beckhoff&bucket=Beckhoff&username=Beckhoff&password=***&

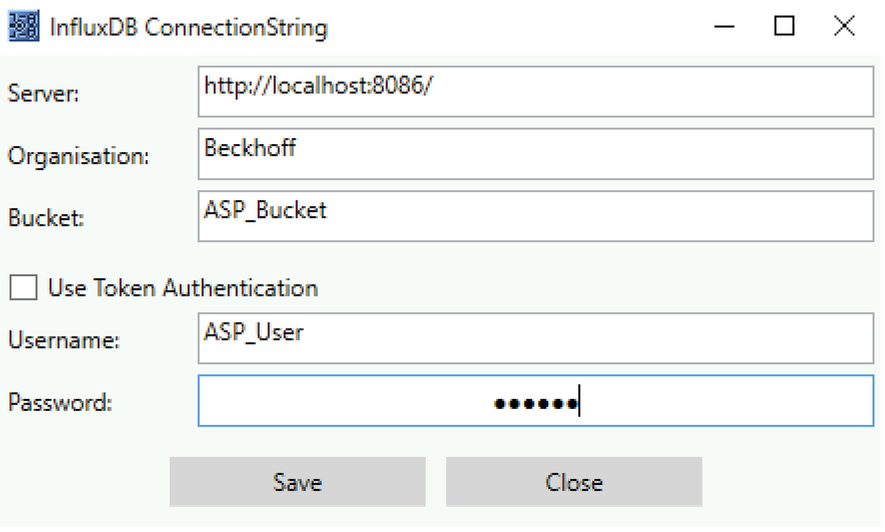
☐ Default Storage
☐ Auto Start Storage

Storage Name:
Assign a descriptive name that describes the purpose of the storage well. It will reappear in various places during configuration in the Manager.

Max Write Length:
The amount of data that is written to the Influx in one call is specified here.

Storage Comment:
You can enter additional information about the storage here.

Connection String:
Click on the **ConnString** button to open the input mask. You can make the configuration settings there, including for remote databases that are accessible via network connections. The server should always be specified with the port number.



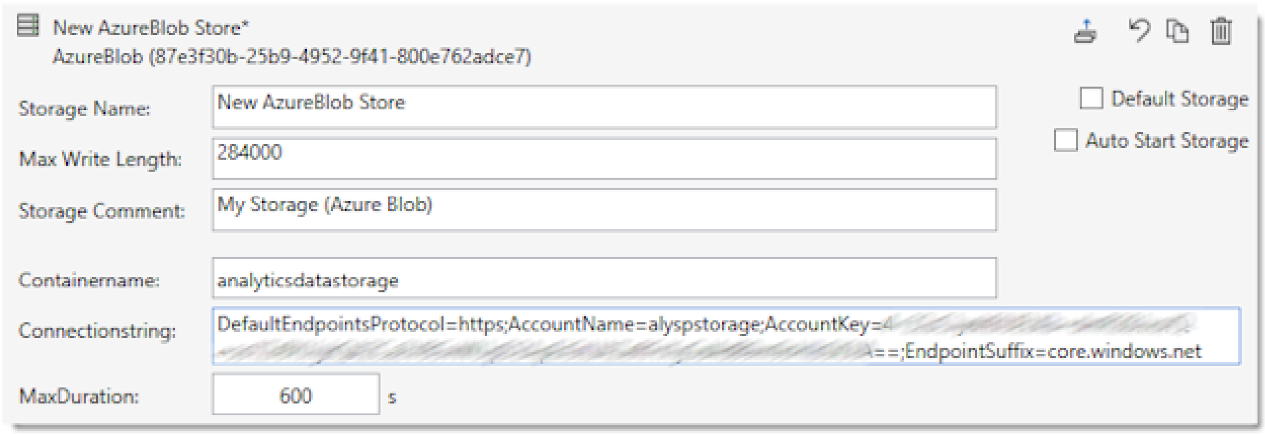
InfluxDB ConnectionString

Server:	http://localhost:8086/
Organisation:	Beckhoff
Bucket:	ASP_Bucket
☐ Use Token Authentication	
Username:	ASP_User
Password:	••••••

After starting the storage, communication with the database begins.

6.1.2.1.5 Microsoft Azure Blob

To use Microsoft Azure Blob Storage, you need a Microsoft Azure Cloud account. There you get also your individual Connection String for the configuration of the TwinCAT Analytics Storage Provider.



New AzureBlob Store*
AzureBlob (87e3f30b-25b9-4952-9f41-800e762adce7)

Storage Name:	New AzureBlob Store
Max Write Length:	284000
Storage Comment:	My Storage (Azure Blob)
Containername:	analyticsdatastorage
Connectionstring:	DefaultEndpointsProtocol=https;AccountName=alyspstorage;AccountKey=4[redacted]==;EndpointSuffix=core.windows.net
MaxDuration:	600 s

☐ Default Storage
☐ Auto Start Storage

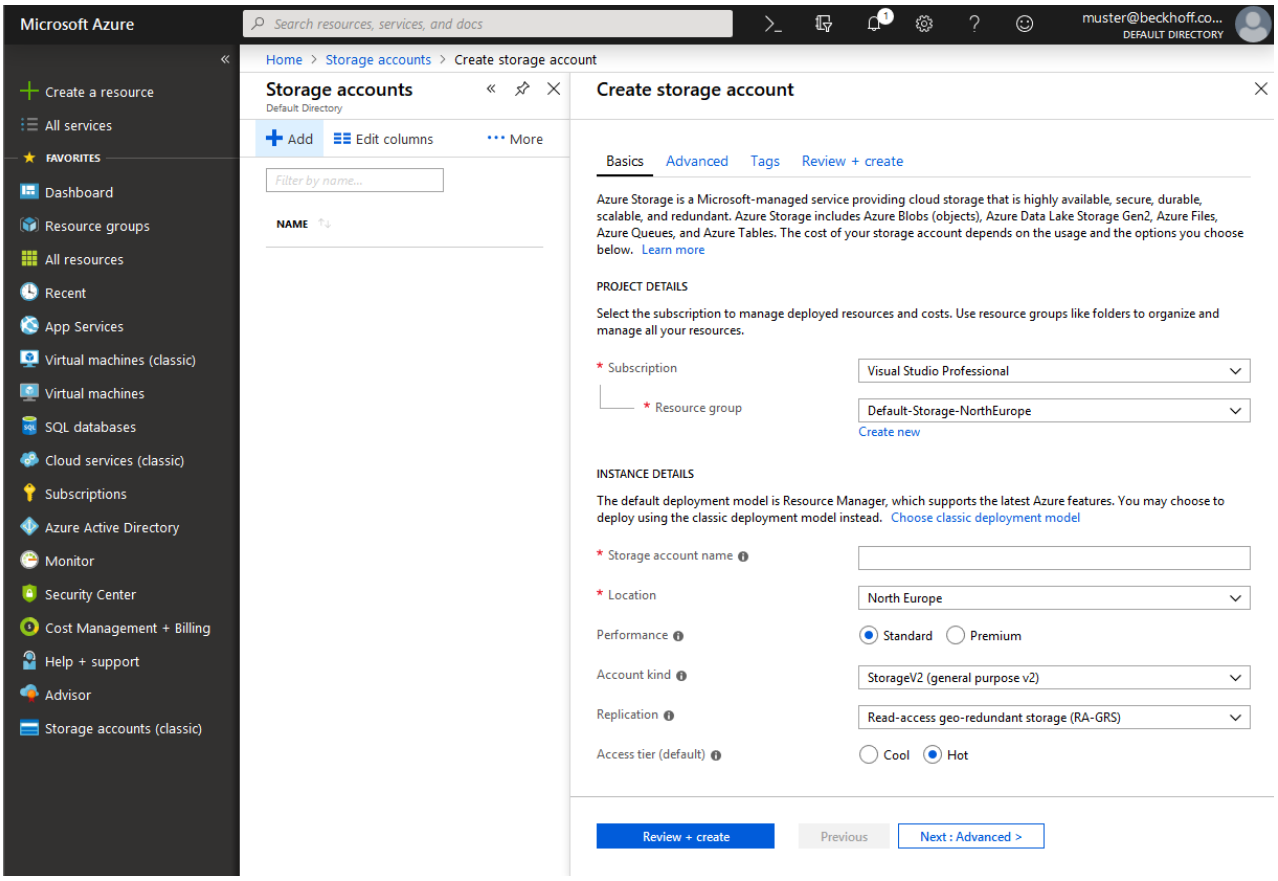
Storage Name:
Assign a descriptive name that describes the purpose of the storage well. It will reappear in various places during configuration in the Manager.

Max Write Length:
The amount of data that is written to the blob store in one call is specified here.

Storage Comment:
You can enter additional information about the storage here.

Copy the Connection String into the description field. The storage must be created in Azure itself.

Select **Storage accounts (classic)**.



Create storage account

Basics | Advanced | Tags | Review + create

Azure Storage is a Microsoft-managed service providing cloud storage that is highly available, secure, durable, scalable, and redundant. Azure Storage includes Azure Blobs (objects), Azure Data Lake Storage Gen2, Azure Files, Azure Queues, and Azure Tables. The cost of your storage account depends on the usage and the options you choose below. Learn more

PROJECT DETAILS

Select the subscription to manage deployed resources and costs. Use resource groups like folders to organize and manage all your resources.

* Subscription	Visual Studio Professional
* Resource group	Default-Storage-NorthEurope
	Create new

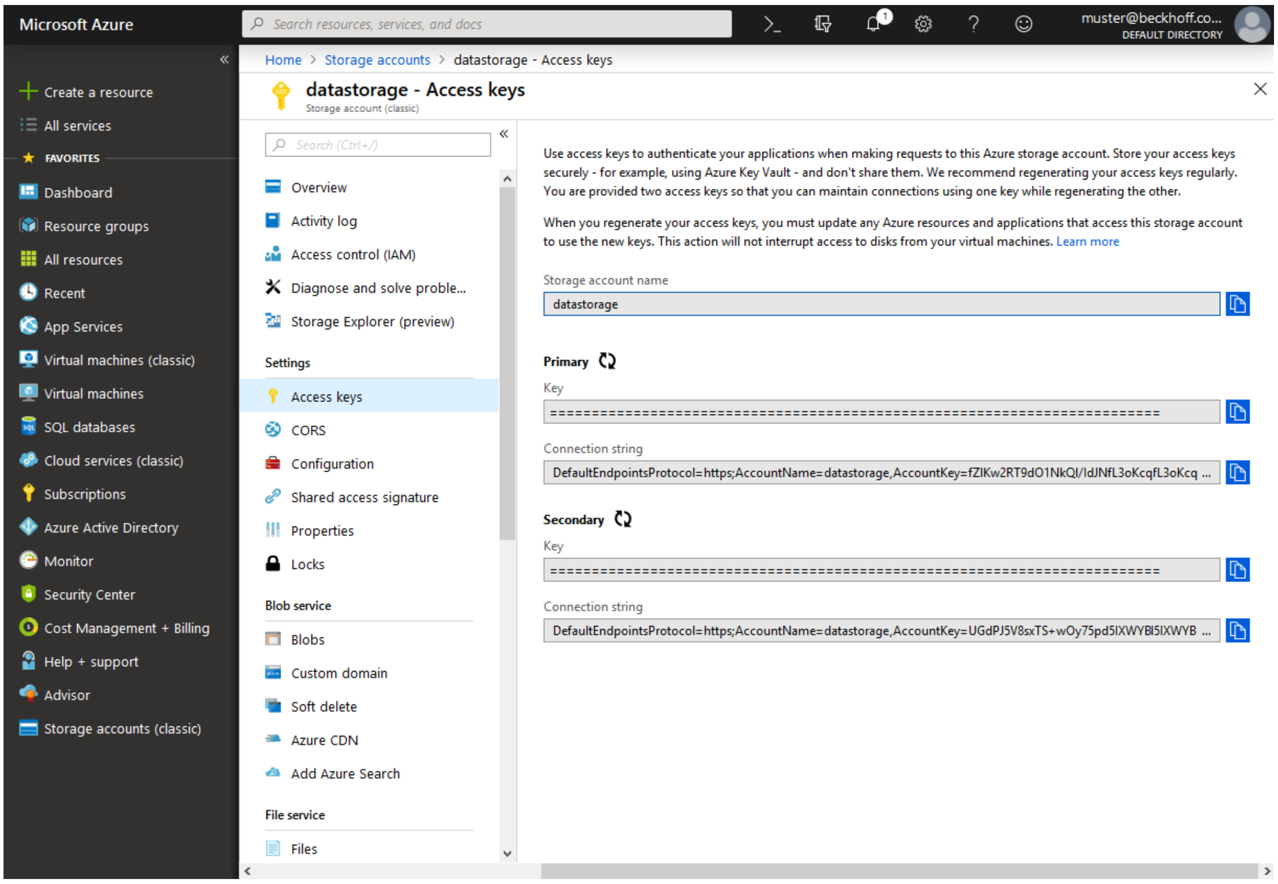
INSTANCE DETAILS

The default deployment model is Resource Manager, which supports the latest Azure features. You may choose to deploy using the classic deployment model instead. Choose classic deployment model

* Storage account name	
* Location	North Europe
Performance	[✓ Standard] Premium
Account kind	StorageV2 (general purpose v2)
Replication	Read-access geo-redundant storage (RA-GRS)
Access tier (default)	Cool [✓ Hot]

Review + create | Previous | Next : Advanced >

After creating the Storage, you will find the secondary Connection String under **Access keys**. This string must be used in the configuration of the Analytics Storage Provider.



datastorage - Access keys
Storage account (classic)

Use access keys to authenticate your applications when making requests to this Azure storage account. Store your access keys securely - for example, using Azure Key Vault - and don't share them. We recommend regenerating your access keys regularly. You are provided two access keys so that you can maintain connections using one key while regenerating the other.

When you regenerate your access keys, you must update any Azure resources and applications that access this storage account to use the new keys. This action will not interrupt access to disks from your virtual machines. Learn more

Storage account name
datastorage

Primary

Key
==

Connection string
DefaultEndpointsProtocol=https;AccountName=datastorage,AccountKey=fZIKw2RT9dO1NkQI/IdJNfL3oKcqfL3oKcq ...

Secondary

Key
==

Connection string
DefaultEndpointsProtocol=https;AccountName=datastorage,AccountKey=UGdPJ5V8sxTS+wOy75pd5IXWYBI5IXWYB ...

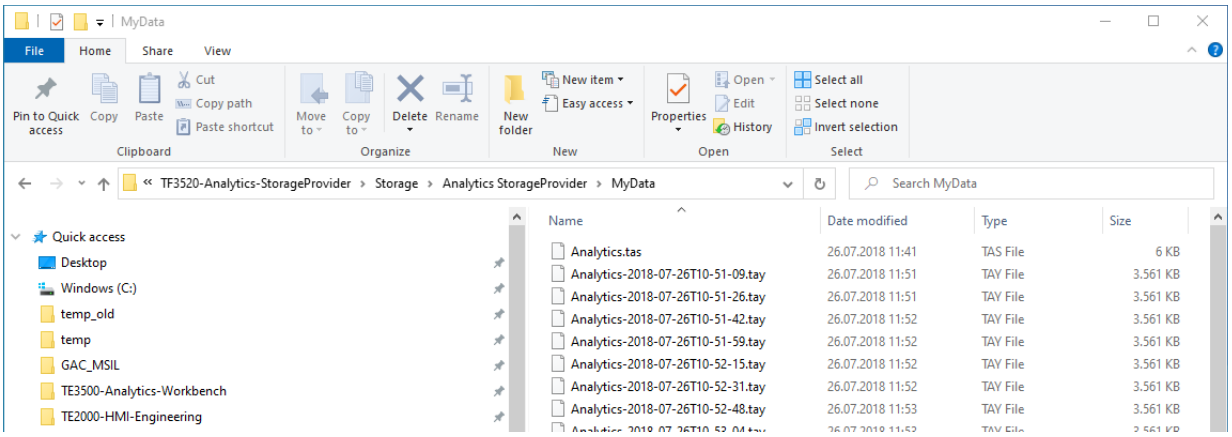
6.1.3 Importing/converting Analytics Files

In the following it is assumed that you have installed TwinCAT under "C:/TwinCAT". Otherwise, you must adjust the specified paths accordingly.

You can import recordings from the Analytics Logger stored in Analytics File Format (*Analytics.tas, Analytics-<Date>.tay*) into the Storage Provider. In general, you can convert data saved by the Storage Provider as an Analytics File into other formats. Analytics File is always the source format.

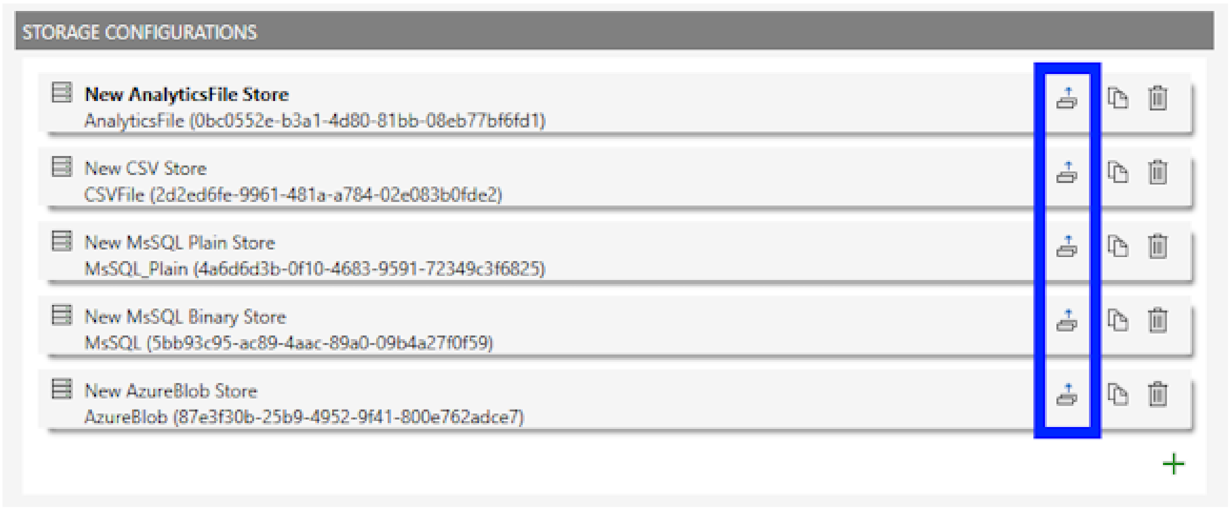
To do this, perform the following steps:

1. Save the folder with the Analytics Files in your Storage Provider location
   By default, here: *C:\TwinCAT\Functions\TF3520-Analytics-StorageProvider\Storage\Analytics StorageProvider* (create the folders manually if they do not exist)



Name	Date modified	Type	Size
Analytics.tas	26.07.2018 11:41	TAS File	6 KB
Analytics-2018-07-26T10-51-09.tay	26.07.2018 11:51	TAY File	3.561 KB
Analytics-2018-07-26T10-51-26.tay	26.07.2018 11:51	TAY File	3.561 KB
Analytics-2018-07-26T10-51-42.tay	26.07.2018 11:52	TAY File	3.561 KB
Analytics-2018-07-26T10-51-59.tay	26.07.2018 11:52	TAY File	3.561 KB
Analytics-2018-07-26T10-52-15.tay	26.07.2018 11:52	TAY File	3.561 KB
Analytics-2018-07-26T10-52-31.tay	26.07.2018 11:52	TAY File	3.561 KB
Analytics-2018-07-26T10-52-48.tay	26.07.2018 11:53	TAY File	3.561 KB

2. Open *TwinCAT.Analytics.StorageProvider.Configurator.exe*. The program can be found under the path *C:\TwinCAT\Functions\TF3520-Analytics-StorageProvider\Tools*
3. Select the Storage into which the Analytics File is to be imported and press the **DataImport** button.


STORAGE CONFIGURATIONS

New AnalyticsFile Store
AnalyticsFile (0bc0552e-b3a1-4d80-81bb-08eb77bf6fd1)

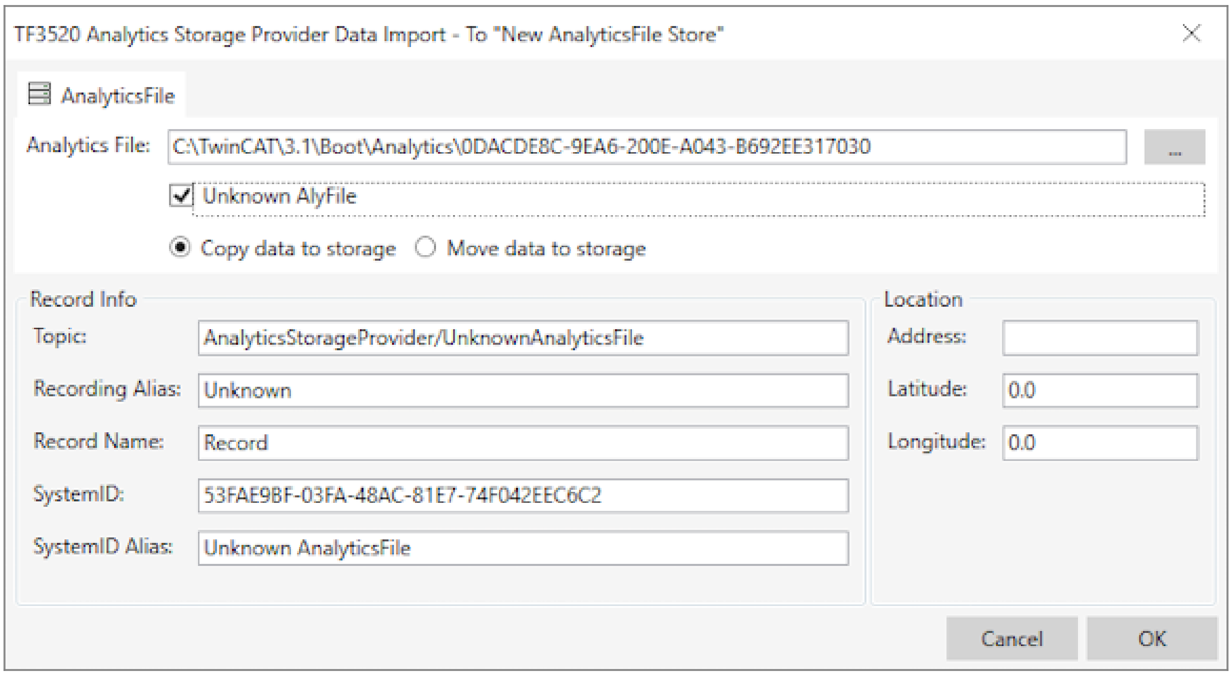
New CSV Store
CSVFile (2d2ed6fe-9961-481a-a784-02e083b0fde2)

New MsSQL Plain Store
MsSQL_Plain (4a6d6d3b-0f10-4683-9591-72349c3f6825)

New MsSQL Binary Store
MsSQL (5bb93c95-ac89-4aac-89a0-09b4a27f0f59)

New AzureBlob Store
AzureBlob (87e3f30b-25b9-4952-9f41-800e762adce7)

4. Then select the path to the Analytics File in the DataImport dialog and enter all other known parameters for this recording.


TF3520 Analytics Storage Provider Data Import - To "New AnalyticsFile Store"

AnalyticsFile

Analytics File: C:\TwinCAT\3.1\Boot\Analytics\0DACDE8C-9EA6-200E-A043-B692EE317030

[✓] Unknown AlyFile

[● Copy data to storage] ○ Move data to storage

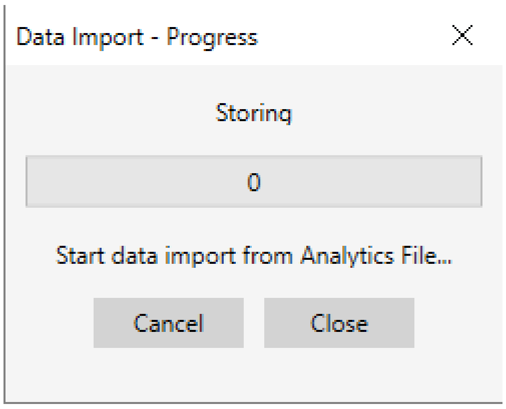
Record Info

Topic:	AnalyticsStorageProvider/UnknownAnalyticsFile
Recording Alias:	Unknown
Record Name:	Record
SystemID:	53FAE9BF-03FA-48AC-81E7-74F042EEC6C2
SystemID Alias:	Unknown AnalyticsFile

Location

Address:	
Latitude:	0.0
Longitude:	0.0

5. Press **OK** and the data import begins.


Data Import - Progress

Storing

0

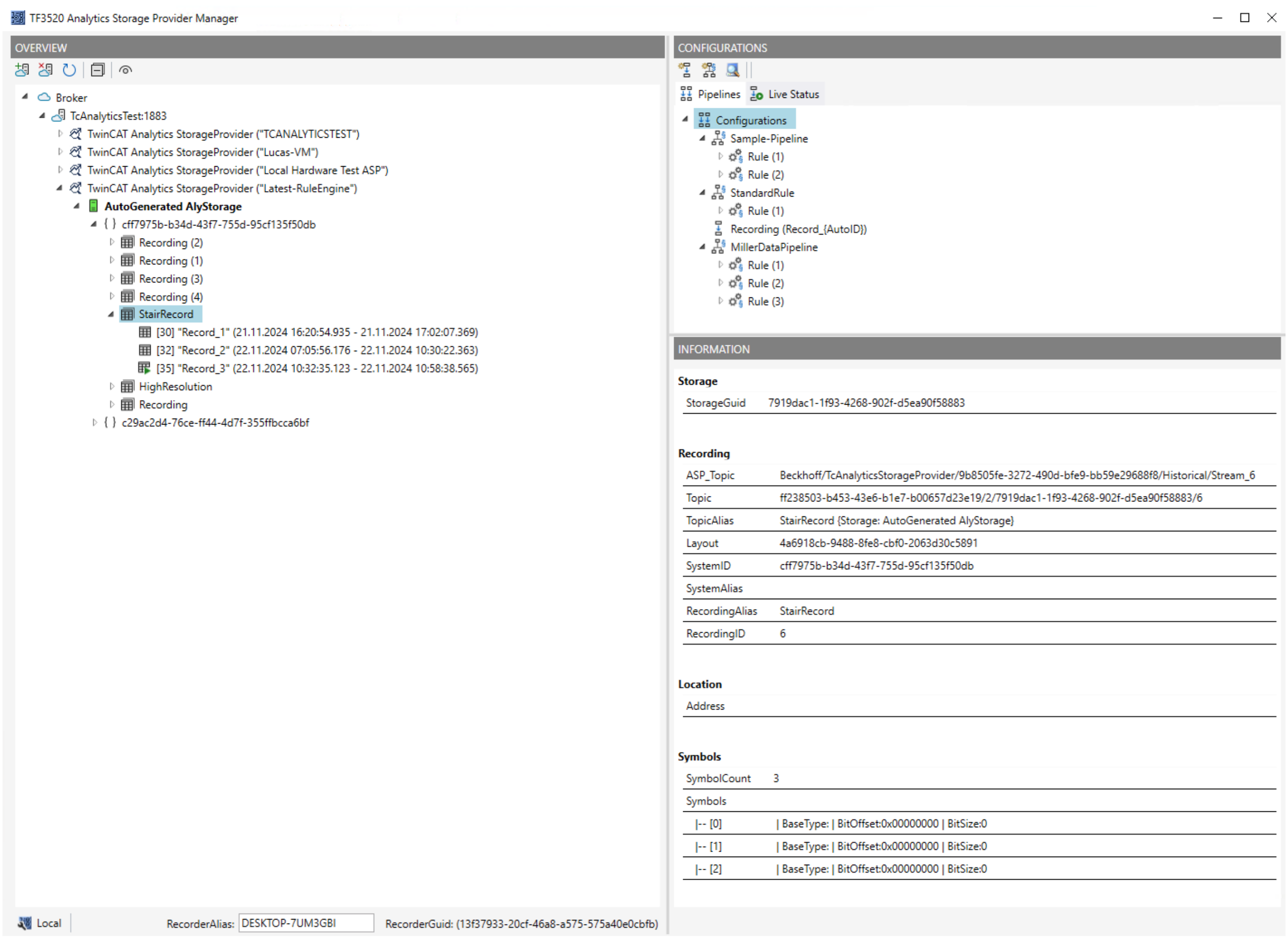
Start data import from Analytics File...

⇨ Now you can see your imported data in the TwinCAT Target Browser [▶ 95].

⇨ You may have to wait a short time or restart your Storage Provider.

6.2 Manager

You can define your data pipelines in the TwinCAT Analytics Storage Provider Manager. A pipeline is defined in such a way that you can select the data sources (Data Message Broker) and the symbols available there. Optionally pre-process the data using rules and ultimately store the data in one or more stores. The stores must have been created in the Configurator [▶ 45] for this.


TF3520 Analytics Storage Provider Manager

OVERVIEW

```
Broker
  TcAnalyticsTest:1883
    TwinCAT Analytics StorageProvider ("TCANALYTICSTEST")
    TwinCAT Analytics StorageProvider ("Lucas-VM")
    TwinCAT Analytics StorageProvider ("Local Hardware Test ASP")
    TwinCAT Analytics StorageProvider ("Latest-RuleEngine")
      AutoGenerated AlyStorage
        { } cff7975b-b34d-43f7-755d-95cf135f50db
          Recording (2)
          Recording (1)
          Recording (3)
          Recording (4)
          StairRecord
            [30] "Record_1" (21.11.2024 16:20:54.935 - 21.11.2024 17:02:07.369)
            [32] "Record_2" (22.11.2024 07:05:56.176 - 22.11.2024 10:30:22.363)
            [35] "Record_3" (22.11.2024 10:32:35.123 - 22.11.2024 10:58:38.565)
          HighResolution
          Recording
        { } c29ac2d4-76ce-ff44-4d7f-355ffbcca6bf
```

Local | RecorderAlias: DESKTOP-7UM3GBI | RecorderGuid: (13f37933-20cf-46a8-a575-575a40e0cbfb)

CONFIGURATIONS

Pipelines | Live Status

```
Configurations
  Sample-Pipeline
    Rule (1)
    Rule (2)
  StandardRule
    Rule (1)
    Recording (Record_{AutoID})
  MillerDataPipeline
    Rule (1)
    Rule (2)
    Rule (3)
```

INFORMATION

Storage

StorageGuid	7919dac1-1f93-4268-902f-d5ea90f58883

Recording

ASP_Topic	Beckhoff/TcAnalyticsStorageProvider/9b8505fe-3272-490d-bfe9-bb59e29688f8/Historical/Stream_6
Topic	ff238503-b453-43e6-b1e7-b00657d23e19/2/7919dac1-1f93-4268-902f-d5ea90f58883/6
TopicAlias	StairRecord {Storage: AutoGenerated AlyStorage}
Layout	4a6918cb-9488-8fe8-cbf0-2063d30c5891
SystemID	cff7975b-b34d-43f7-755d-95cf135f50db
SystemAlias	
RecordingAlias	StairRecord
RecordingID	6

Location

Address	

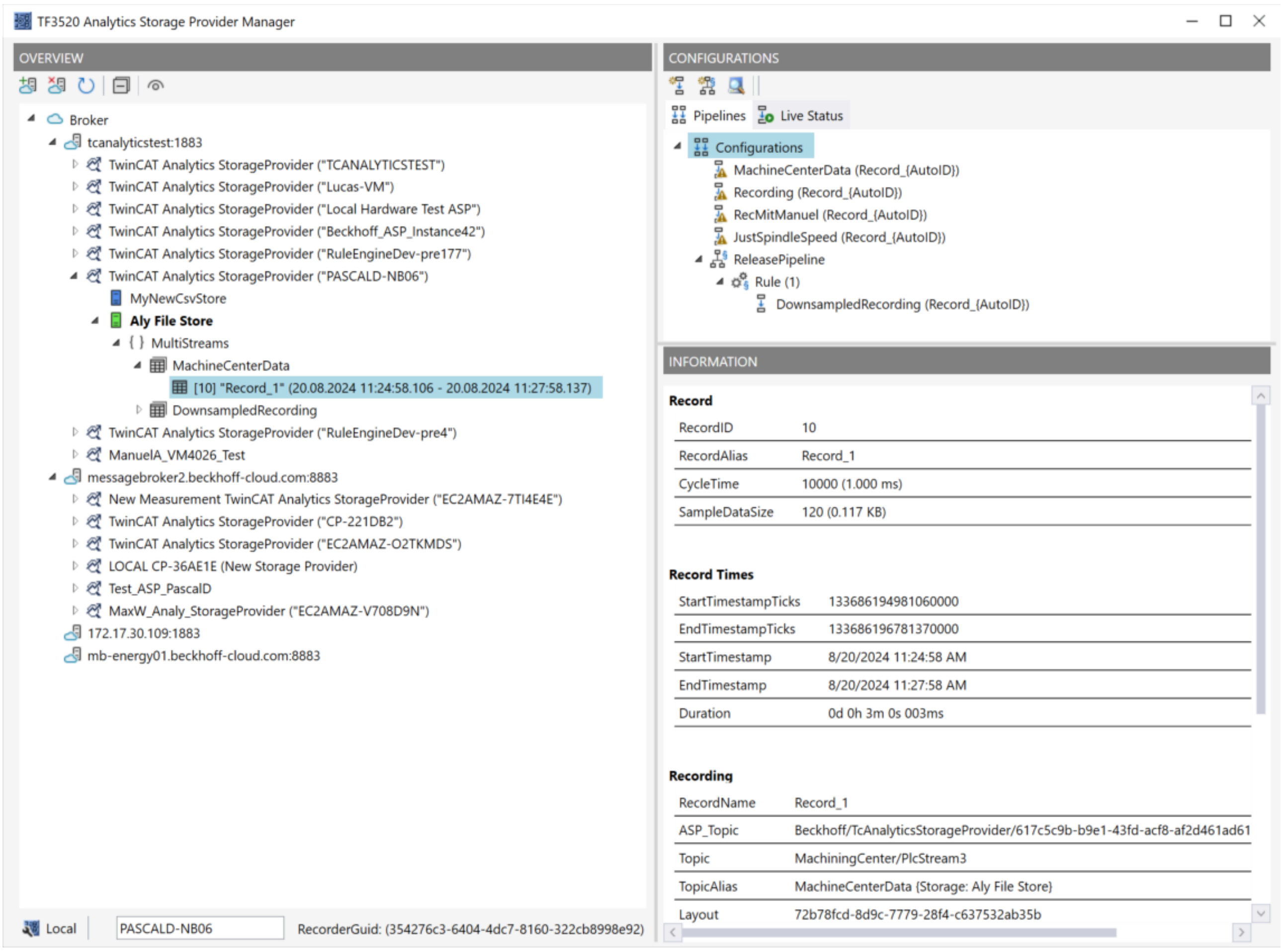
Symbols

SymbolCount	3
Symbols	
|-- [0]	| BaseType: | BitOffset:0x00000000 | BitSize:0
|-- [1]	| BaseType: | BitOffset:0x00000000 | BitSize:0
|-- [2]	| BaseType: | BitOffset:0x00000000 | BitSize:0

6.2.1 Manager ("Recorder")

The Analytics Storage Provider Recorder is part of the Analytics Engineering setups. Therefore, you can find the recorder in the installation of the TwinCAT Analytics Workbench and the TwinCAT Analytics Service Tool.

With the Storage Provider Recorder recording definitions can be created, started and managed. In addition, it is possible to manage the data memories of individual Analytics Storage Providers. All important properties of the found Analytics Storage Providers and historized data are clearly displayed.



TF3520 Analytics Storage Provider Manager

OVERVIEW

- Broker
  - tcanalyticstest:1883
    - TwinCAT Analytics StorageProvider ("TCANALYTICSTEST")
    - TwinCAT Analytics StorageProvider ("Lucas-VM")
    - TwinCAT Analytics StorageProvider ("Local Hardware Test ASP")
    - TwinCAT Analytics StorageProvider ("Beckhoff_ASP_Instance42")
    - TwinCAT Analytics StorageProvider ("RuleEngineDev-pre177")
    - TwinCAT Analytics StorageProvider ("PASCALD-NB06")
      - MyNewCsvStore
      - **Aly File Store**
        - { } MultiStreams
          - MachineCenterData
            - [10] "Record_1" (20.08.2024 11:24:58.106 - 20.08.2024 11:27:58.137)
          - DownsampledRecording
    - TwinCAT Analytics StorageProvider ("RuleEngineDev-pre4")
    - ManuelA_VM4026_Test
  - messagebroker2.beckhoff-cloud.com:8883
    - New Measurement TwinCAT Analytics StorageProvider ("EC2AMAZ-7TI4E4E")
    - TwinCAT Analytics StorageProvider ("CP-221DB2")
    - TwinCAT Analytics StorageProvider ("EC2AMAZ-O2TKMDS")
    - LOCAL CP-36AE1E (New Storage Provider)
    - Test_ASP_PascalD
    - MaxW_Analy_StorageProvider ("EC2AMAZ-V708D9N")
  - 172.17.30.109:1883
  - mb-energy01.beckhoff-cloud.com:8883

Local | PASCALD-NB06 | RecorderGuid: (354276c3-6404-4dc7-8160-322cb8998e92)

CONFIGURATIONS

Pipelines | Live Status

- Configurations
  - MachineCenterData (Record_{AutoID})
  - Recording (Record_{AutoID})
  - RecMitManuel (Record_{AutoID})
  - JustSpindleSpeed (Record_{AutoID})
  - ReleasePipeline
    - Rule (1)
      - DownsampledRecording (Record_{AutoID})

INFORMATION

Record

RecordID	10
RecordAlias	Record_1
CycleTime	10000 (1.000 ms)
SampleDataSize	120 (0.117 KB)

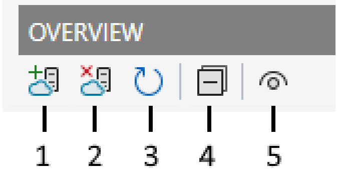
Record Times

StartTimestampTicks	133686194981060000
EndTimestampTicks	133686196781370000
StartTimestamp	8/20/2024 11:24:58 AM
EndTimestamp	8/20/2024 11:27:58 AM
Duration	0d 0h 3m 0s 003ms

Recording

RecordName	Record_1
ASP_Topic	Beckhoff/TcAnalyticsStorageProvider/617c5c9b-b9e1-43fd-acf8-af2d461ad61
Topic	MachiningCenter/PlcStream3
TopicAlias	MachineCenterData {Storage: Aly File Store}
Layout	72b78fcd-8d9c-7779-28f4-c637532ab35b

Toolbar Manager window ("OVERVIEW")

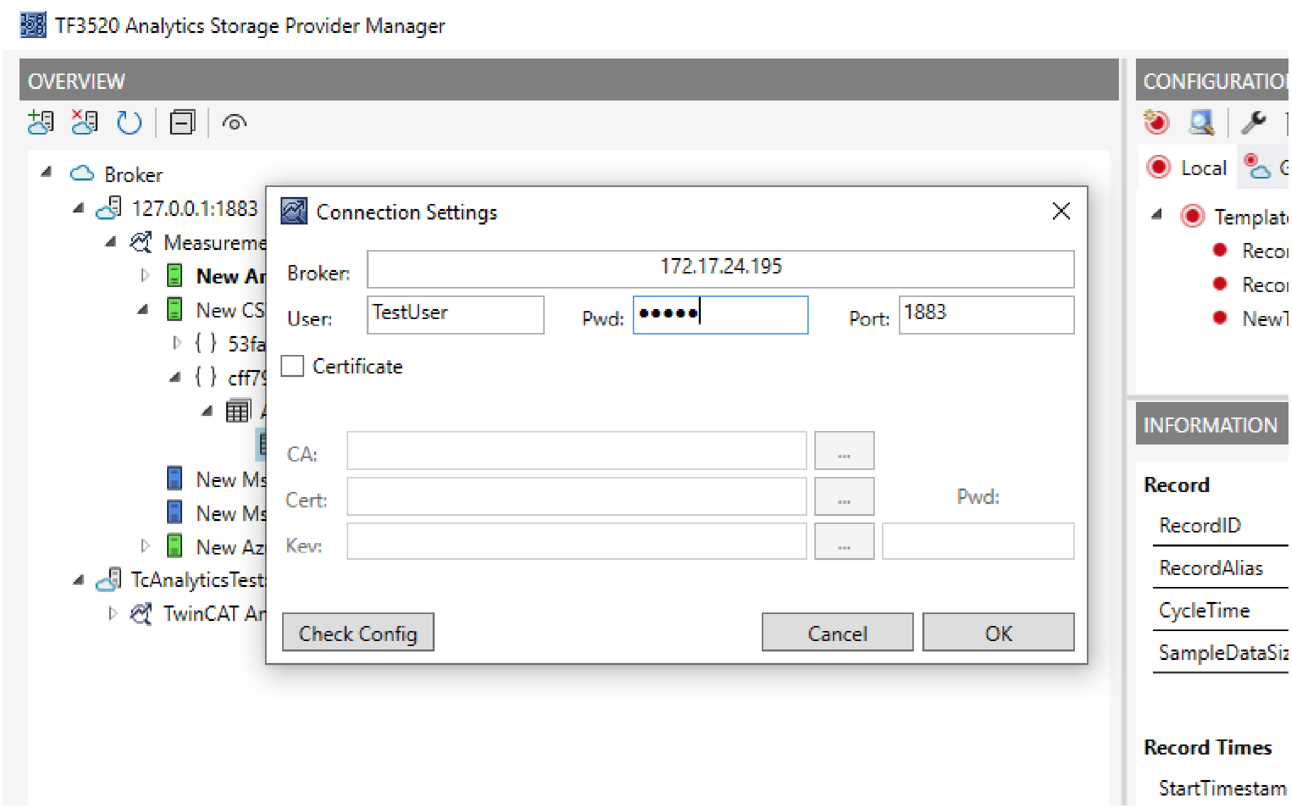


1	Add new broker
2	Remove selected broker
3	Refresh display
4	Collapse all nodes
5	View switch between dark/light mode

Function Manager window ("OVERVIEW")

First assign a **RecorderAlias**. This helps to group the started recordings and to find its self started ones again.

After that, one or more brokers can be set up. This is done via the already known input mask for MQTT connection properties.



Connection Settings

Broker: 172.17.24.195

User: TestUser Pwd: ●●●●● Port: 1883

☐ Certificate

CA:

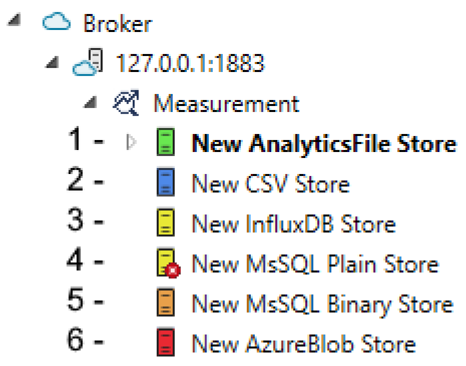
Cert: Pwd:

Key:

Check Config Cancel OK

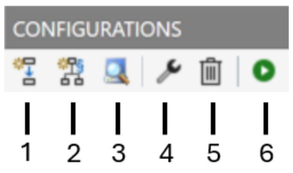
Once a connection to the broker could be established, all Analytics Storage Providers connected to it will be listed.

"Storage" status



1	Storage Online
2	Storage Offline
3	Storage starts
4	Storage starts with error. Still trying to start it
5	Storage is shut down
6	Storage is in the error state

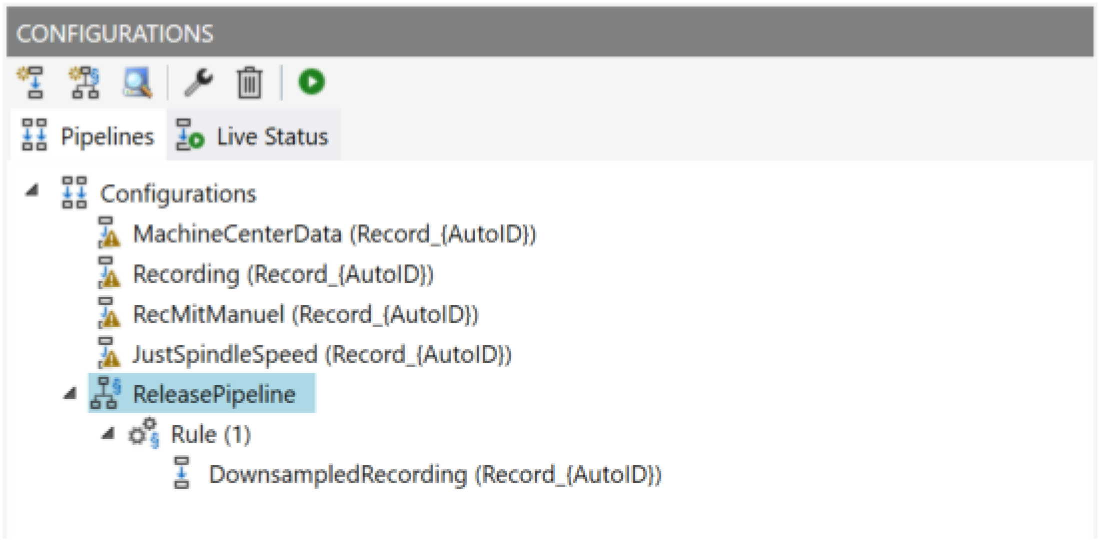
Toolbar Manager window ("CONFIGURATIONS")



1	Create a new pipeline
2	Create a new pipeline with Rule Engine
3	Open Target Browser for connecting simple pipelines
4	Edit a selected pipeline
5	Delete a selected pipeline
6	Start a selected pipeline

Function Manager window ("CONFIGURATIONS")

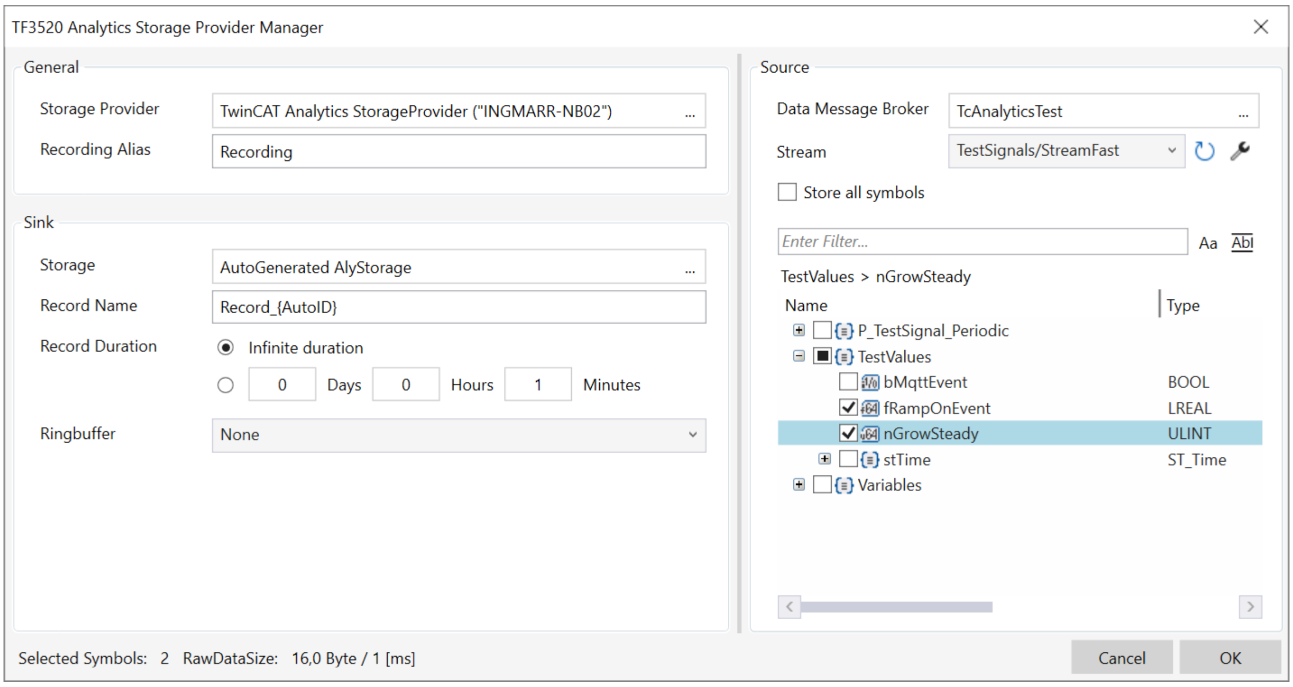
The window is divided into two tabs. Pipelines and Live Status. Under Pipelines you will find the configurations of your pipelines. You can define new pipelines from here. Edit existing. Delete or start.


CONFIGURATIONS

Pipelines | Live Status

- Configurations
  - MachineCenterData (Record_{AutoID})
  - Recording (Record_{AutoID})
  - RecMitManuel (Record_{AutoID})
  - JustSpindleSpeed (Record_{AutoID})
  - ReleasePipeline
    - Rule (1)
      - DownsampledRecording (Record_{AutoID})

To create a new simple pipeline, click the "Create new pipeline" button. The following dialog opens.


TF3520 Analytics Storage Provider Manager

General

Storage Provider: TwinCAT Analytics StorageProvider ("INGMARR-NB02")

Recording Alias: Recording

Sink

Storage: AutoGenerated AlyStorage

Record Name: Record_{AutoID}

Record Duration: [✓ Infinite duration] 0 Days 0 Hours 1 Minutes

Ringbuffer: None

Source

Data Message Broker: TcAnalyticsTest

Stream: TestSignals/StreamFast

Store all symbols

Enter Filter...

TestValues > nGrowSteady

Name	Type
P_TestSignal_Periodic	
TestValues	
bMqttEvent	BOOL
✓ fRampOnEvent	LREAL
✓ nGrowSteady	ULINT
stTime	ST_Time
Variables	

Selected Symbols: 2 RawDataSize: 16,0 Byte / 1 [ms]

You can now drag and drop the symbols you want to record from the Target Browser into the dialog. You also assign a Recording Alias and a Record Name.

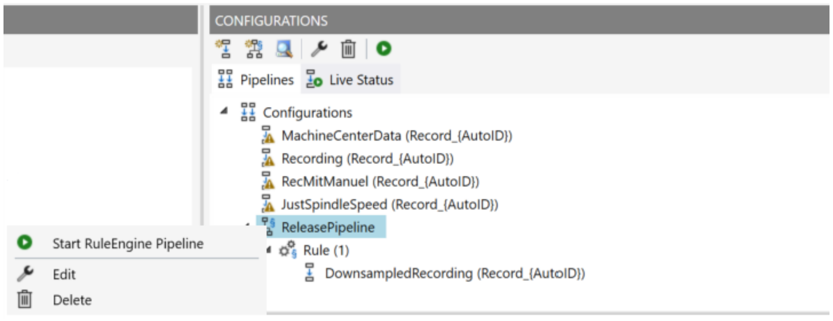
Various placeholders are available for the Record Name:

"{AutoID}"	
"{Topic}"	
"{SystemID}"	
"{Layout}"	
"{CycleTime}"	
"{SampleSize}"	
"{RecordStart}"	

You can also configure recording names and a duration (otherwise the recording will run endlessly until it is stopped manually). A ring buffer can be set according to storage space or time.

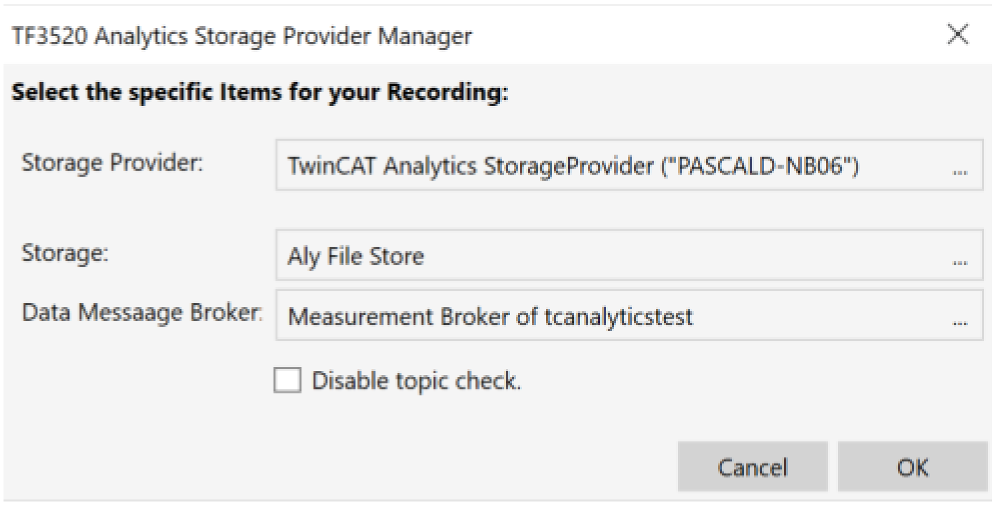
The entries are confirmed with **OK** and a new local recording definition is created.

It is now possible to start this definition directly via the toolbar or the context menu.


CONFIGURATIONS
Pipelines
Live Status
Configurations
MachineCenterData (Record_{AutoID})
Recording (Record_{AutoID})
RecMitManuel (Record_{AutoID})
JustSpindleSpeed (Record_{AutoID})
ReleasePipeline
Rule (1)
DownsampledRecording (Record_{AutoID})
Start RuleEngine Pipeline
Edit
Delete

However, it is also possible to make the definition globally accessible. This can be done via the context menu with the entry **Publish Recording**.

The following dialog then opens:


TF3520 Analytics Storage Provider Manager

Select the specific Items for your Recording:

Storage Provider: TwinCAT Analytics StorageProvider ("PASCALD-NB06")

Storage: Aly File Store

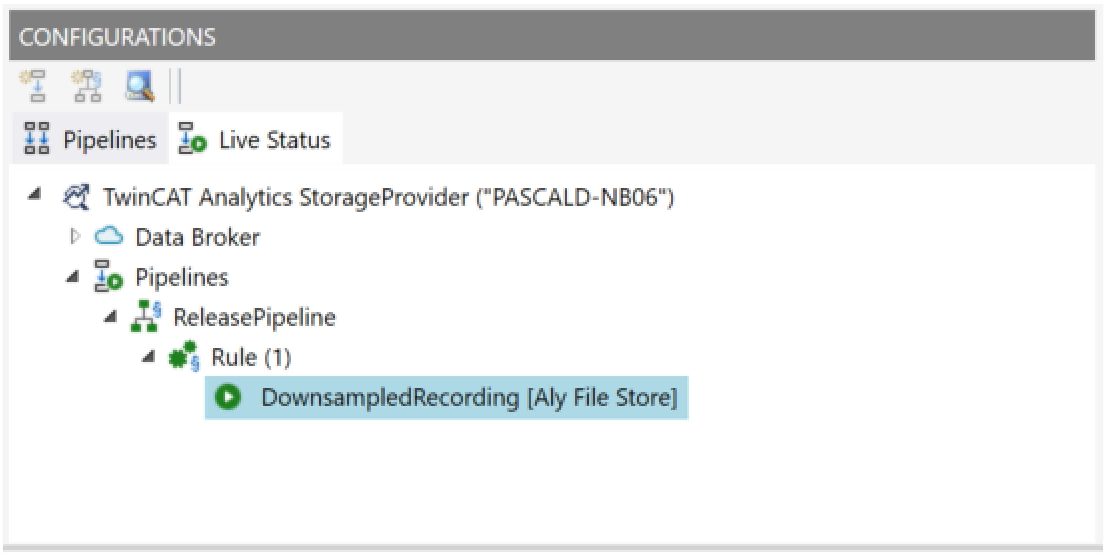
Data Messaage Broker: Measurement Broker of tcanalyticstest

☐ Disable topic check.

Cancel OK

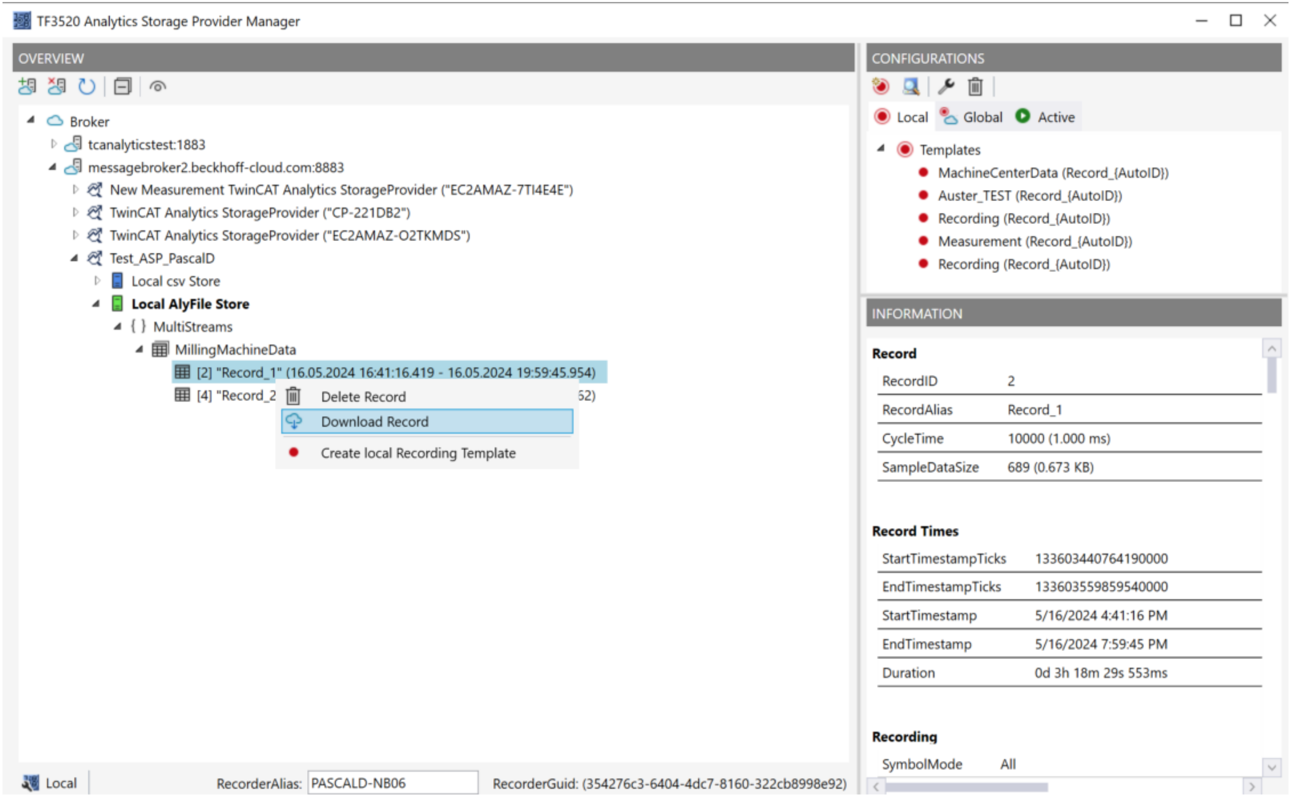
Here you can now select the desired Analytics Storage Provider via which the definition is to be published. In addition, the definition is assigned a Storage and a Data Broker of the selected Analytics Storage Provider. After the selection, the recording definition is confirmed with **OK** and published to the selected Analytics Storage Provider. This means that it can be found by any Storage Provider Manager that is connected to the MQTT Broker.

After starting a pipeline, the view automatically jumps to the second tab, the Live Status.


CONFIGURATIONS
Pipelines
Live Status
TwinCAT Analytics StorageProvider ("PASCALD-NB06")
Data Broker
Pipelines
ReleasePipeline
Rule (1)
DownsampledRecording [Aly File Store]

All active recordings from all users are listed here. The recordings can be ended in this tab and it is also possible to jump to the resulting record.

Furthermore, a download function is available in the Manager to download data to your local engineering. Select the corresponding record and start the download via the context menu. Regardless of the store in which the data is stored, it is always saved as an Analytics File on the local engineering system.


TF3520 Analytics Storage Provider Manager
OVERVIEW
Broker
tcanalyticstest:1883
messagebroker2.beckhoff-cloud.com:8883
New Measurement TwinCAT Analytics StorageProvider ("EC2AMAZ-7TI4E4E")
TwinCAT Analytics StorageProvider ("CP-221DB2")
TwinCAT Analytics StorageProvider ("EC2AMAZ-O2TKMDS")
Test_ASP_PascalD
Local csv Store
Local AlyFile Store
MultiStreams
MillingMachineData
[2] "Record_1" (16.05.2024 16:41:16.419 - 16.05.2024 19:59:45.954)
[4] "Record_2 52)
Delete Record
Download Record
Create local Recording Template
Local
RecorderAlias: PASCALD-NB06
RecorderGuid: (354276c3-6404-4dc7-8160-322cb8998e92)
CONFIGURATIONS
Local
Global
Active
Templates
MachineCenterData (Record_{AutoID})
Auster_TEST (Record_{AutoID})
Recording (Record_{AutoID})
Measurement (Record_{AutoID})
Recording (Record_{AutoID})
INFORMATION

Record

RecordID	2
RecordAlias	Record_1
CycleTime	10000 (1.000 ms)
SampleDataSize	689 (0.673 KB)

Record Times

StartTimestampTicks	133603440764190000
EndTimestampTicks	133603559859540000
StartTimestamp	5/16/2024 4:41:16 PM
EndTimestamp	5/16/2024 7:59:45 PM
Duration	0d 3h 18m 29s 553ms

Recording

SymbolMode	All

In combination with the data import function [▶ 55] in the Storage Configurator, the Analytics File also serves as a practical exchange format. Both functions can be used to move data from a CSV file to an InfluxDB2, for example, or from a Microsoft SQL® to a CSV file, etc.

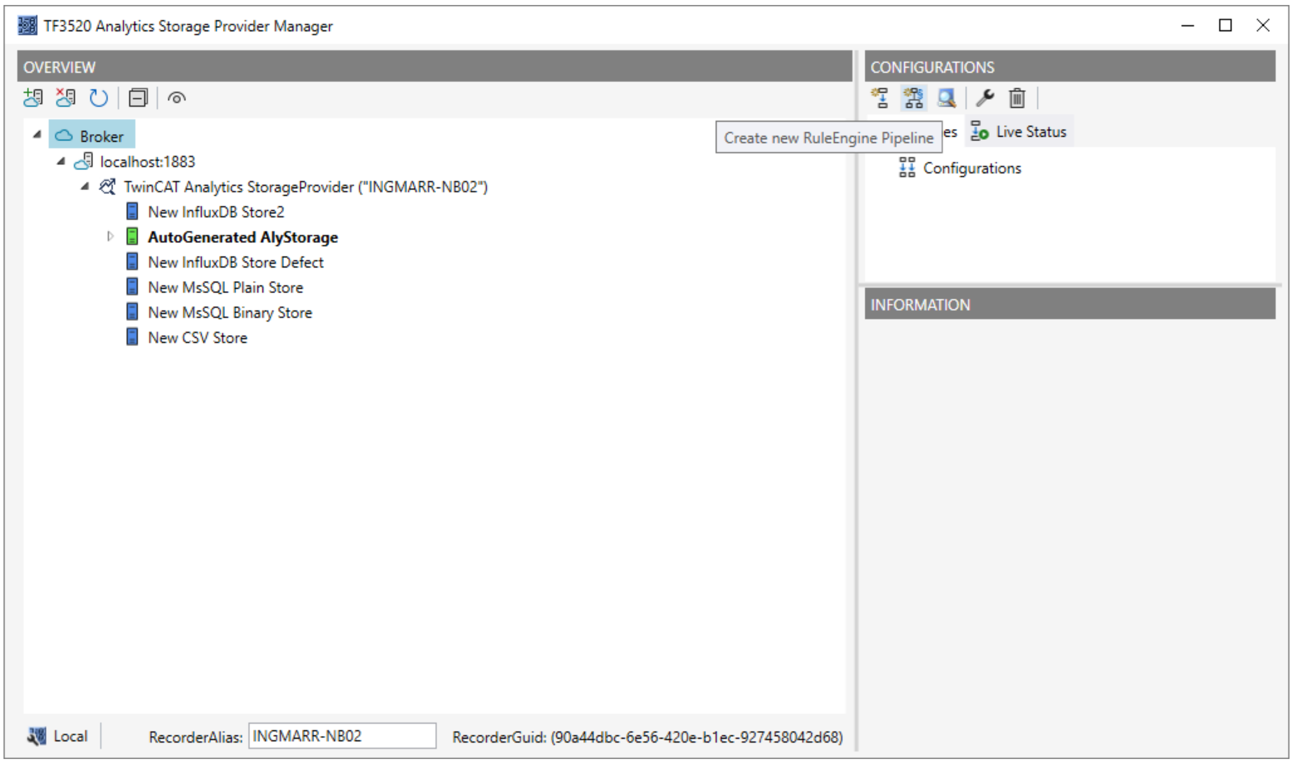
6.2.2 Data handling with Rule Engine

Rule Engine pipelines can be used to automatically map a wide variety of storage scenarios. Data can be collected from multiple MQTT data sources, processed and stored in Recordings. In addition, data from recordings can be read and processed on an event or timer-controlled basis, as well as manually triggered. Possible processing operations include aggregating, filtering and sampling the data sources.

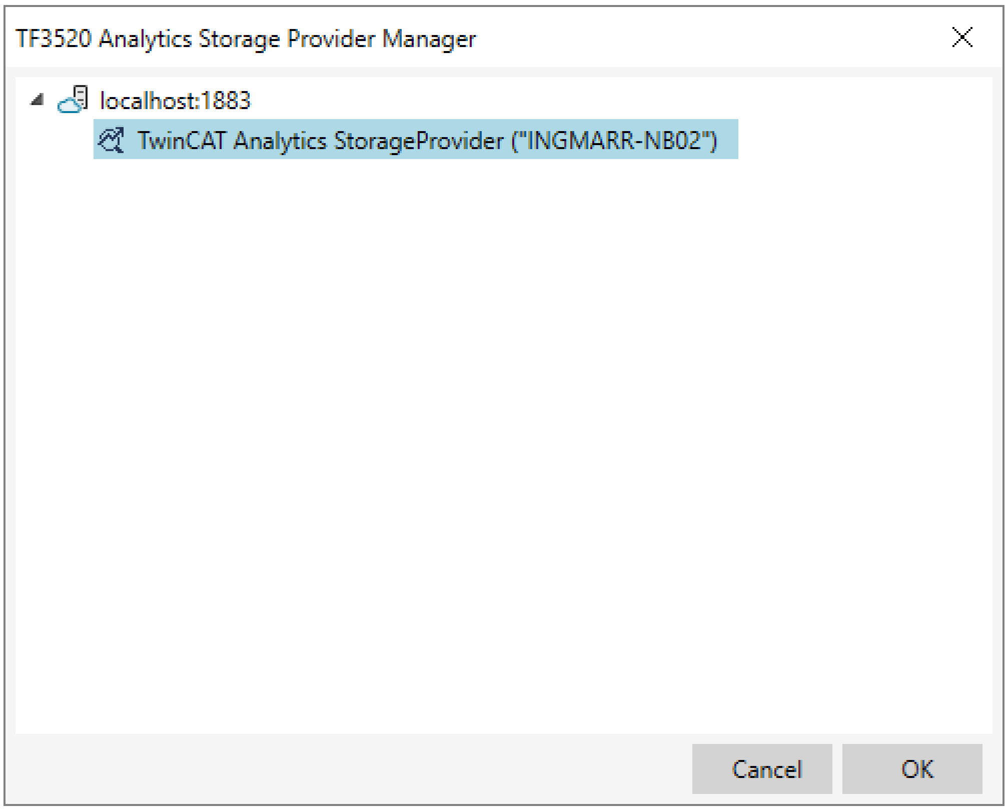
The RuleEngine pipeline function is available from Storage Provider version 3.15. onwards.

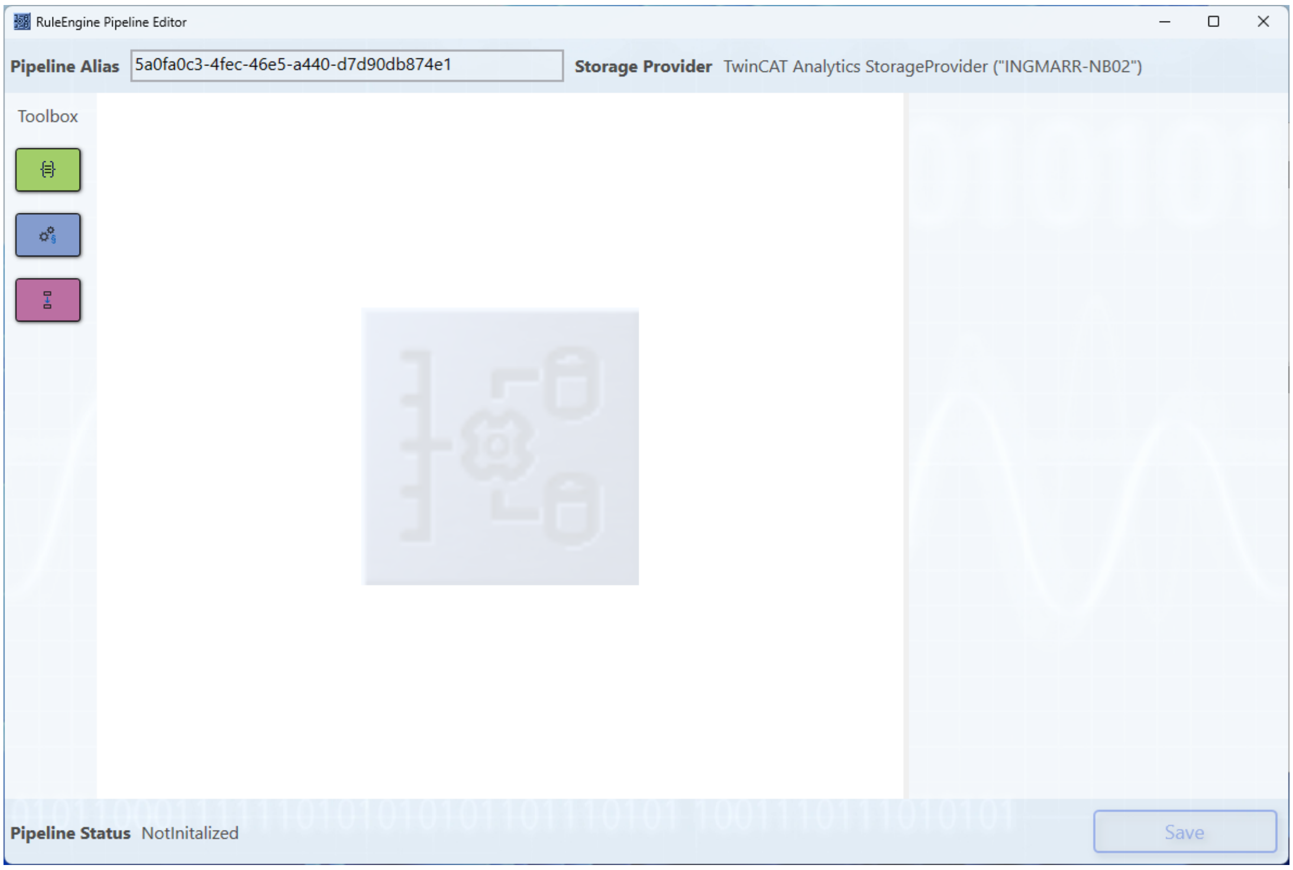
6.2.2.1 Configuration

A RuleEngine pipeline is configured graphically in the RuleEngine Pipeline Editor. This can be opened via the Manager.


TF3520 Analytics Storage Provider Manager
OVERVIEW
CONFIGURATIONS
Create new RuleEngine Pipeline
Live Status
Configurations
INFORMATION
Broker
localhost:1883
TwinCAT Analytics StorageProvider ("INGMARR-NB02")
New InfluxDB Store2
AutoGenerated AlyStorage
New InfluxDB Store Defect
New MsSQL Plain Store
New MsSQL Binary Store
New CSV Store
Local
RecorderAlias: INGMARR-NB02
RecorderGuid: (90a44dbc-6e56-420e-b1ec-927458042d68)

First, the desired Storage Provider must be selected. A RuleEngine pipeline is developed specifically for a Storage Provider. This cannot be changed subsequently. In the RuleEngine Pipeline Editor, the name of the selected Storage Provider is displayed at the top right.


TF3520 Analytics Storage Provider Manager
localhost:1883
TwinCAT Analytics StorageProvider ("INGMARR-NB02")
Cancel
OK

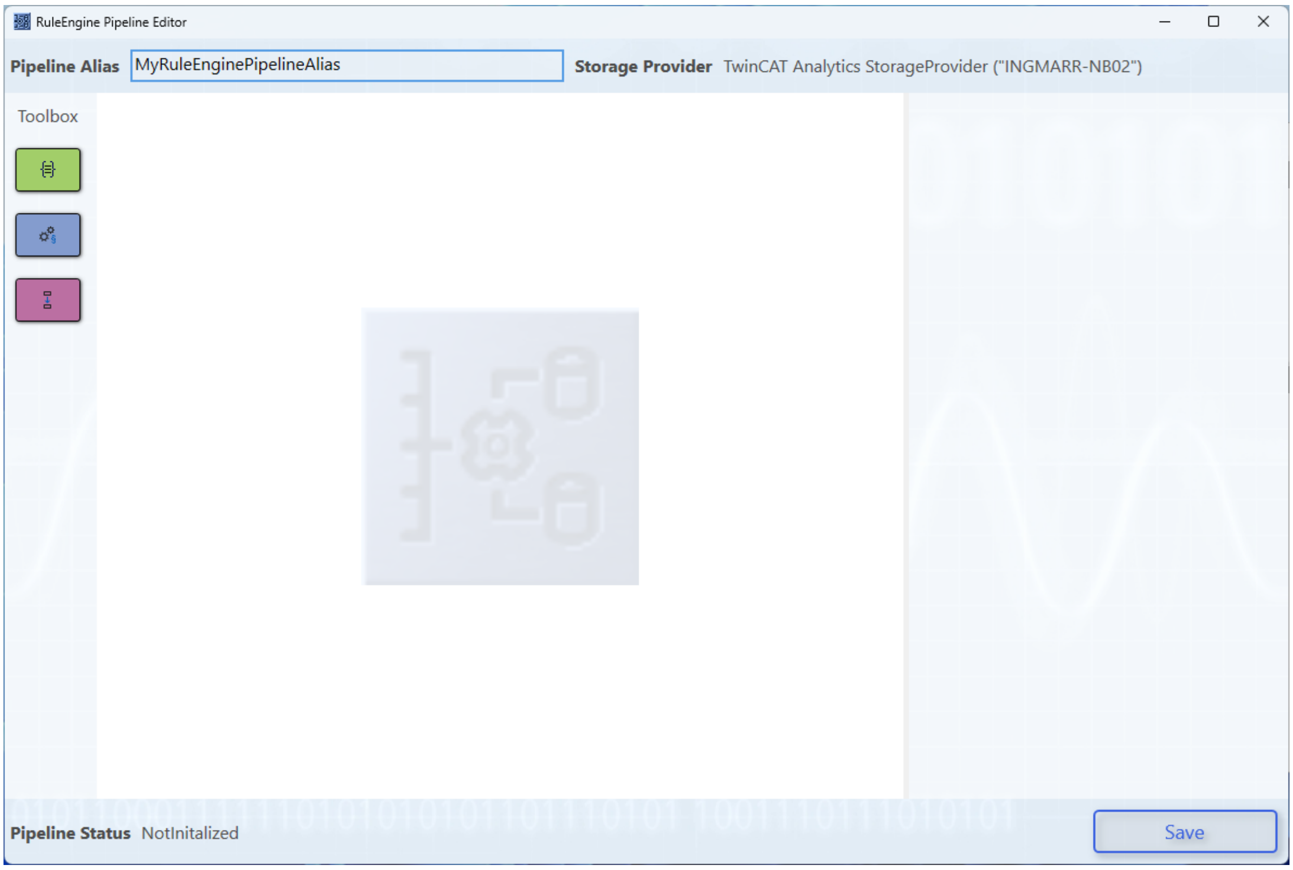


Pipeline Alias 5a0fa0c3-4fec-46e5-a440-d7d90db874e1

Storage Provider TwinCAT Analytics StorageProvider ("INGMARR-NB02")

Pipeline Status NotInitalized

An alias can be assigned for a RuleEngine pipeline. The alias is freely selectable and can be edited via the text field at the top left of the RuleEngine Pipeline Editor.



Pipeline Alias MyRuleEnginePipelineAlias

Storage Provider TwinCAT Analytics StorageProvider ("INGMARR-NB02")

Pipeline Status NotInitalized

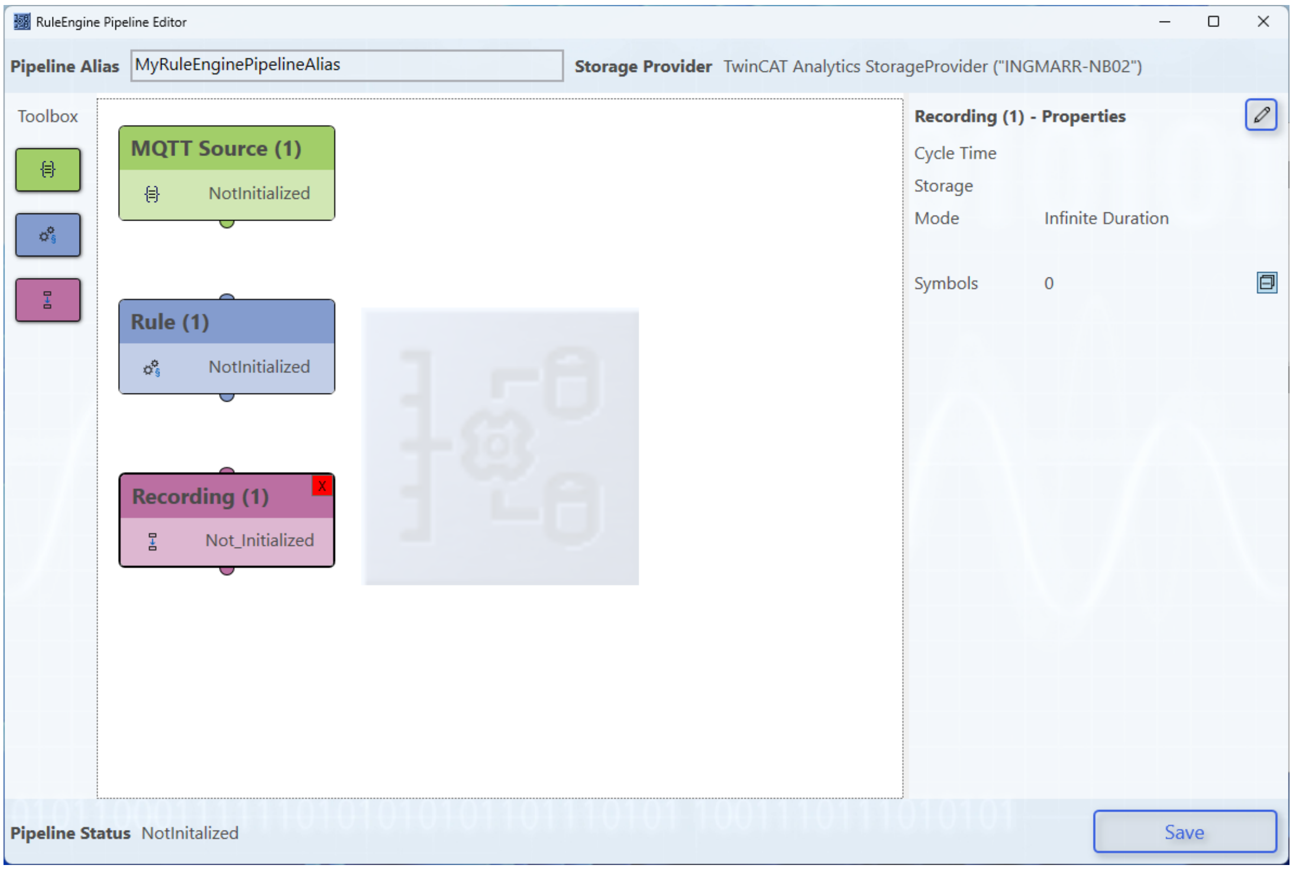
6.2.2.1.1 Adding elements

Various elements can be dragged from the toolbox (left) in the RuleEngine Pipeline Editor into the configuration area (center). The following elements can be used:

MQTT-Source: Corresponds to a data source (e.g. TwinCAT Analytics Logger or TwinCAT IoT Data Agent).

Rule: Pre-processing steps can be defined with a rule.

Recording: Describes a data recording (previously known recording).



Pipeline Alias MyRuleEnginePipelineAlias

Storage Provider TwinCAT Analytics StorageProvider ("INGMARR-NB02")

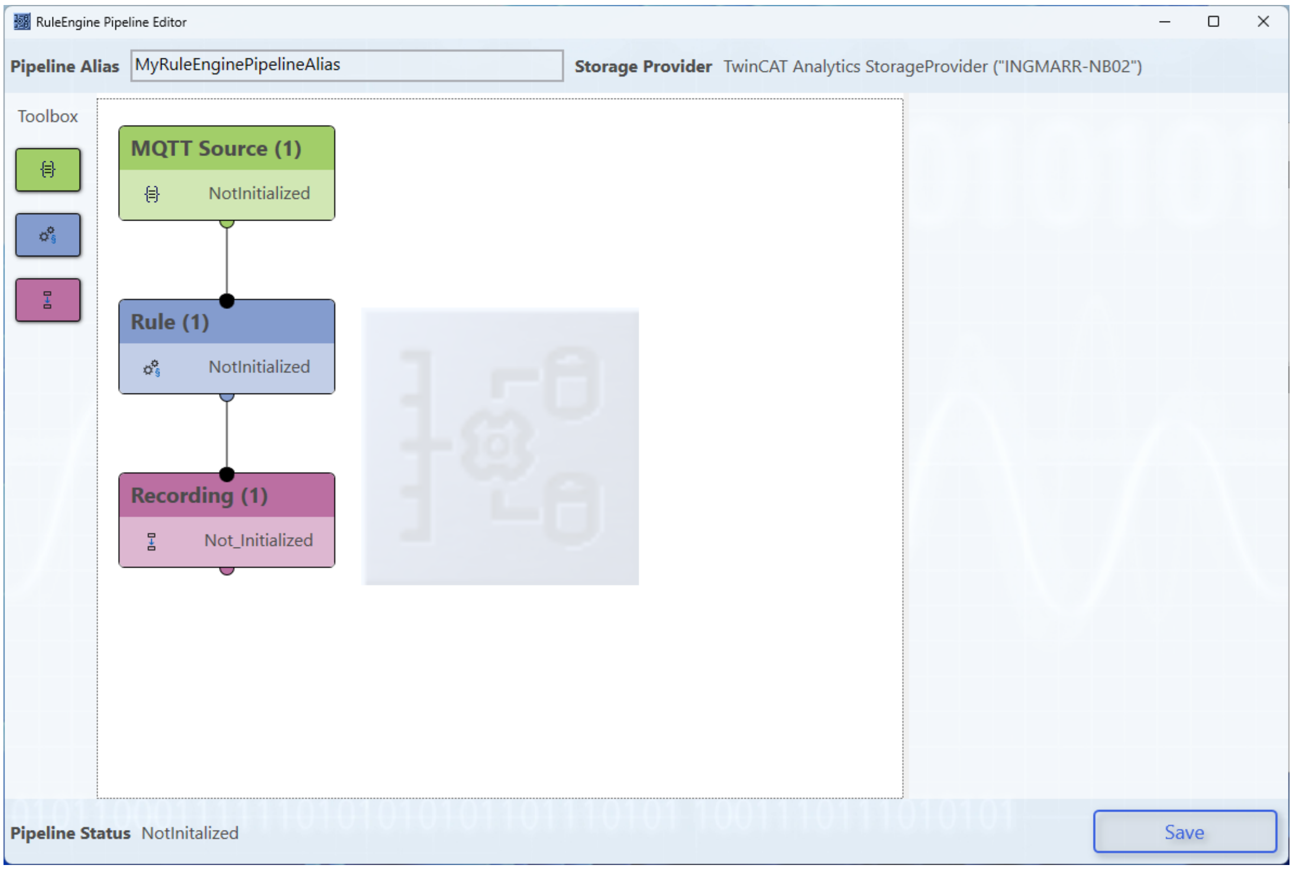
Recording (1) - Properties

Cycle Time	
Storage	
Mode	Infinite Duration
Symbols	0

Pipeline Status NotInitalized

6.2.2.1.2 Linking elements

The added elements can be linked to each other via connections. A connection can be created via the output of an element. The mouse can be used to drag the connection to another element and thus create a link in the data flow. If you release the connector in the free area, a subsequent element is automatically created or a selection of available element types is offered.



Pipeline Alias MyRuleEnginePipelineAlias

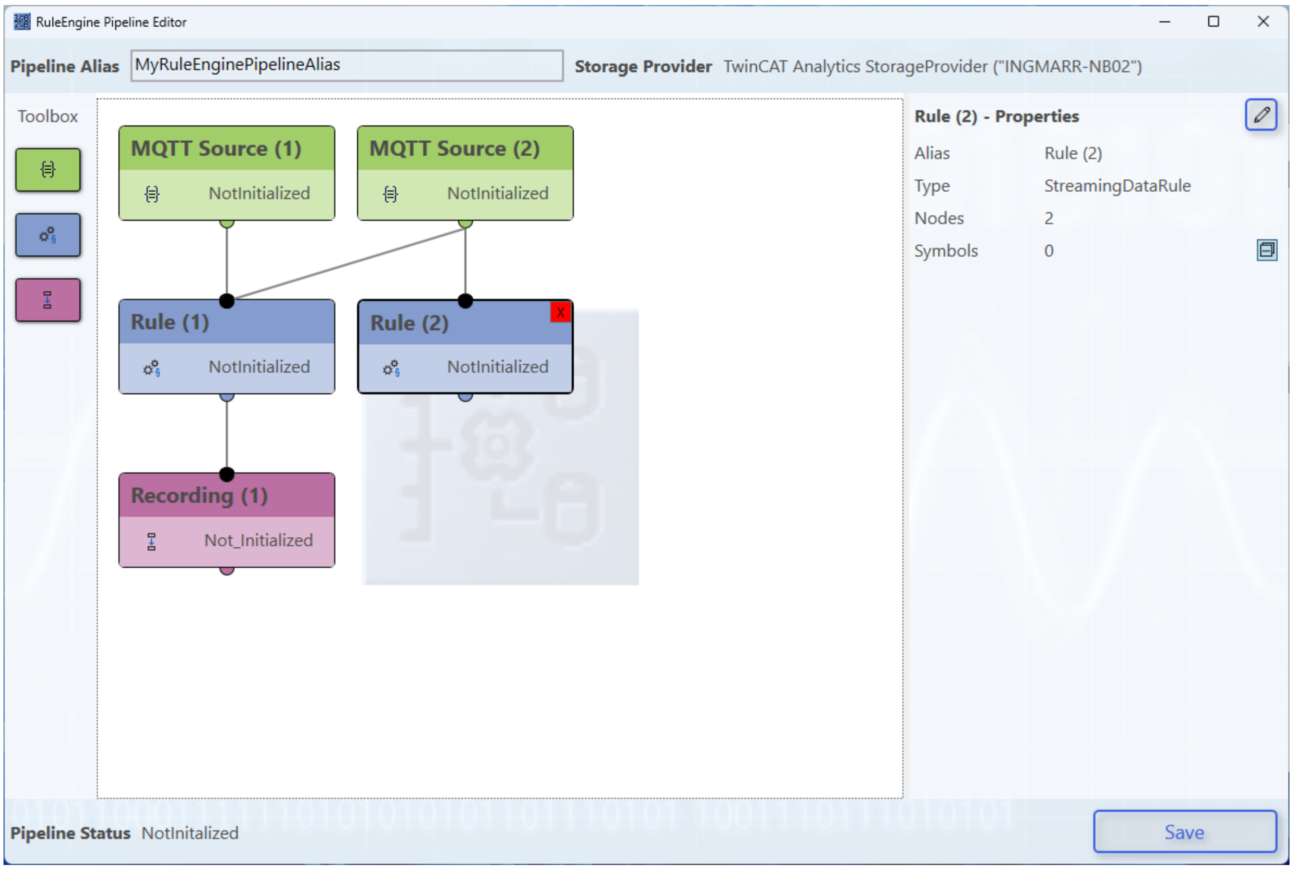
Storage Provider TwinCAT Analytics StorageProvider ("INGMARR-NB02")

Pipeline Status NotInitalized

The following connections are possible:

MQTT-Source - Rule:

An MQTT-Source can be used in several rules. In addition, several MQTT-Sources can be used in a rule, provided they run with similar system times. If this is not the case, the editor recognizes this and issues a corresponding warning.



Pipeline Alias MyRuleEnginePipelineAlias **Storage Provider** TwinCAT Analytics StorageProvider ("INGMARR-NB02")

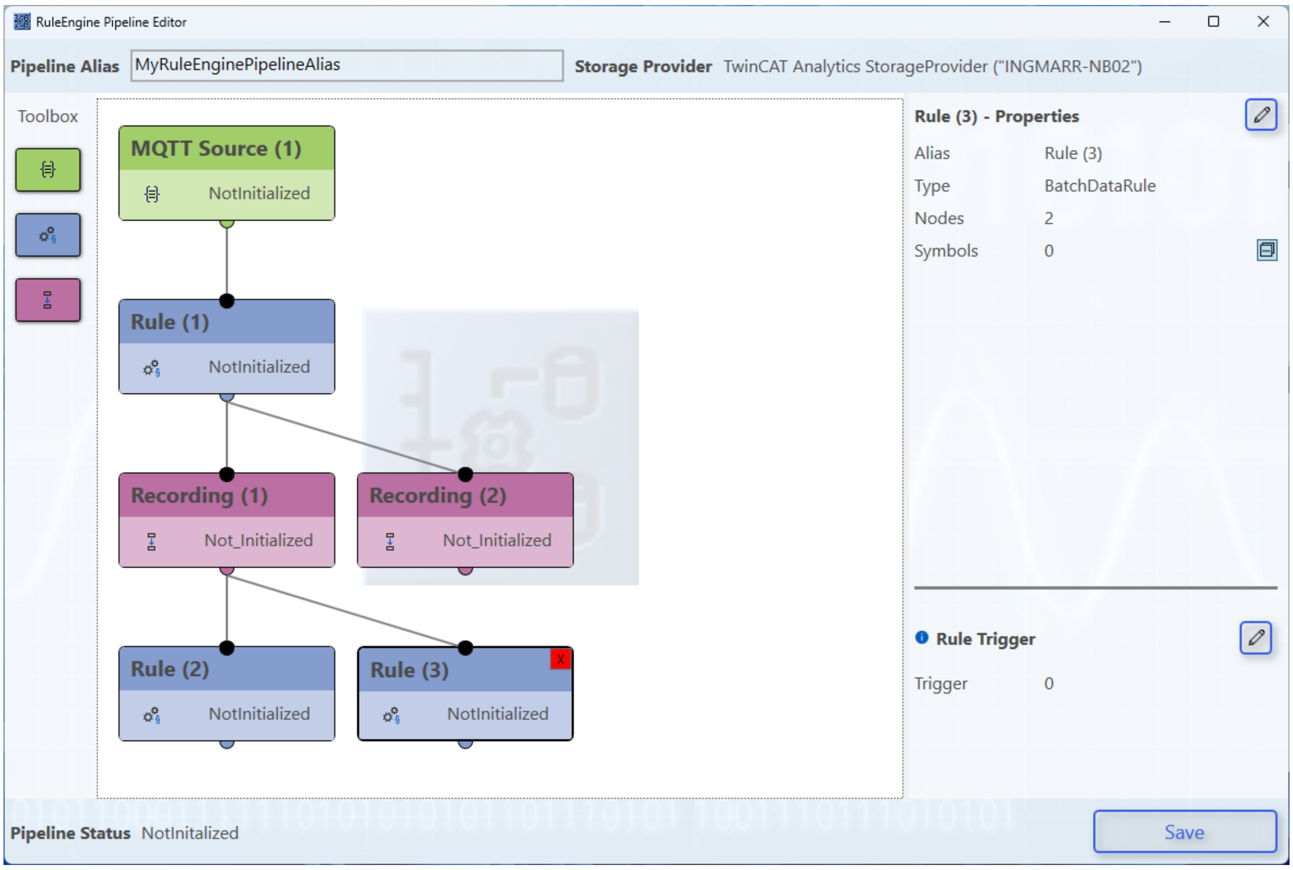
Rule (2) - Properties

Alias	Rule (2)
Type	StreamingDataRule
Nodes	2
Symbols	0

Pipeline Status NotInitalized

Rule - Recording:

Any number of recordings for saving data can be defined for a rule. However, only data from one rule can flow into a recording. For a recording, any number of rules can be created for further processing of the saved data. Here too, a rule can only accept data from a recording. No subsequent rules can currently be created for recordings with a ring buffer. It is also not possible to combine data from an MQTT-Source and a recording as data sources for a rule.



Pipeline Alias MyRuleEnginePipelineAlias

Storage Provider TwinCAT Analytics StorageProvider ("INGMARR-NB02")

Rule (3) - Properties

Alias	Rule (3)
Type	BatchDataRule
Nodes	2
Symbols	0

Rule Trigger

Trigger	0

Pipeline Status NotInitalized

MQTT-Source - Recording:

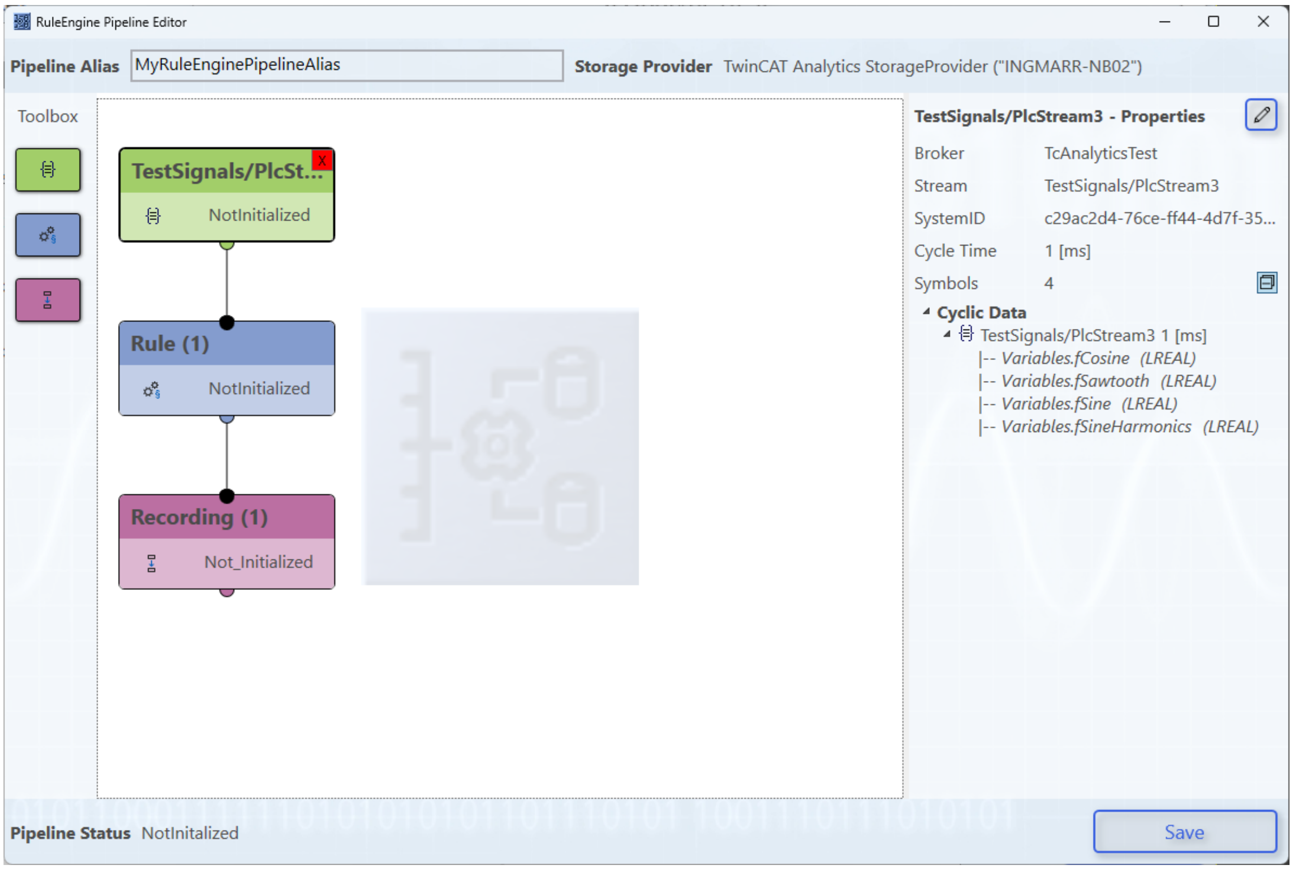
This connection is not possible. A rule must always be inserted as an intermediate connection.

6.2.2.1.3 Viewing properties of the elements

The properties of the selected element can be viewed via the Properties window on the right-hand side of the RuleEngine Pipeline Editor. The properties vary depending on the type.

MQTT source

- **Broker:** Message broker of the data source.
- **Stream**: Topic of the data source
- **SystemID**: System ID of the data source
- **Cycle time**: Cycle time of the data source
- **Symbols**: Number and names of the symbols selected at the data source.



RuleEngine Pipeline Editor

Pipeline Alias MyRuleEnginePipelineAlias **Storage Provider** TwinCAT Analytics StorageProvider ("INGMARR-NB02")

TestSignals/PlcStream3 - Properties

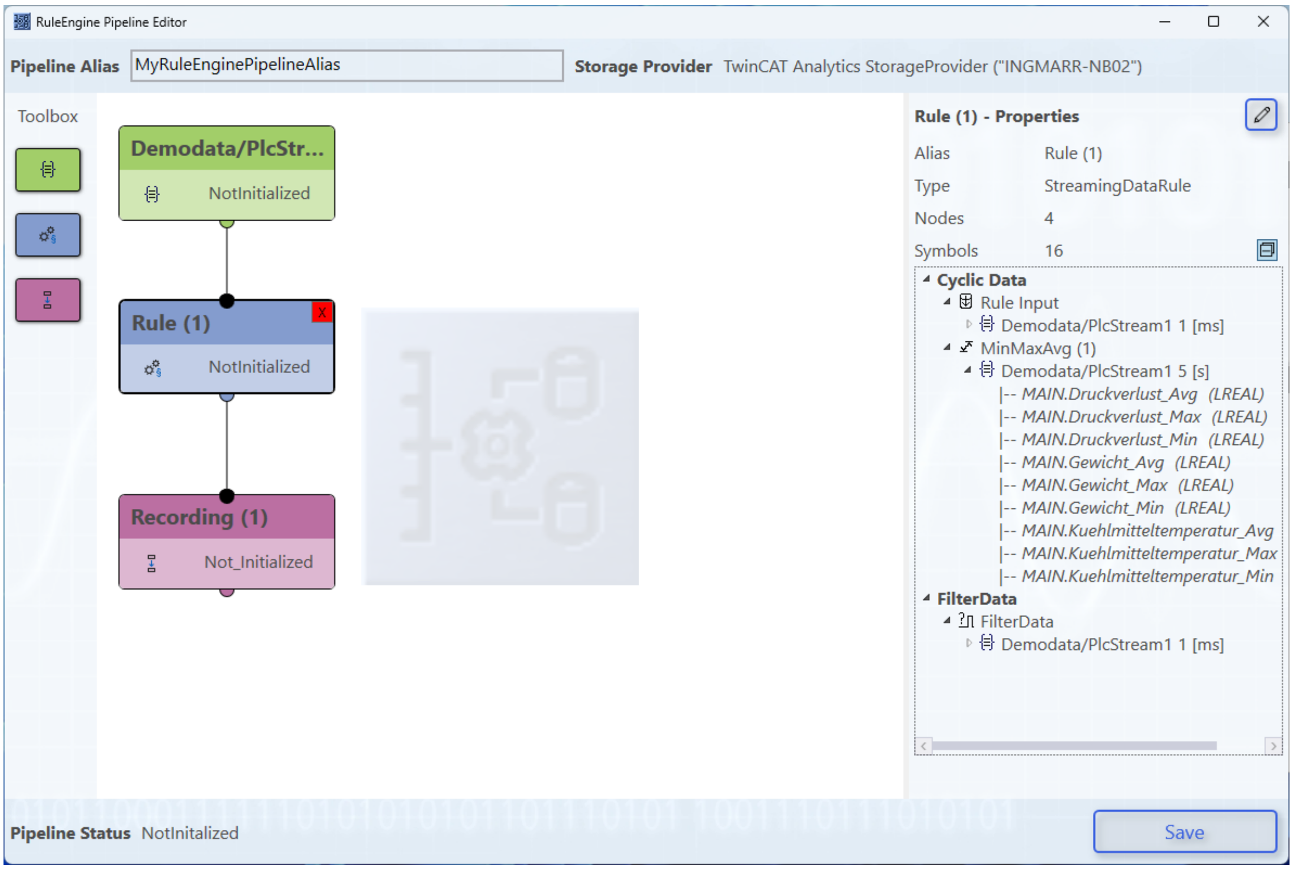
Broker	TcAnalyticsTest
Stream	TestSignals/PlcStream3
SystemID	c29ac2d4-76ce-ff44-4d7f-35...
Cycle Time	1 [ms]
Symbols	4

```
Cyclic Data
  TestSignals/PlcStream3 1 [ms]
    |-- Variables.fCosine  (LREAL)
    |-- Variables.fSawtooth  (LREAL)
    |-- Variables.fSine  (LREAL)
    |-- Variables.fSineHarmonics  (LREAL)
```

Pipeline Status NotInitalized

Rule

- **Alias**: Alias name of the rule
- **Type**: Type of rule. There are currently StreamingDataRules and BatchDataRules. StreamingDataRules refer to streamed data and run continuously to process the streamed data. BatchDataRules refer to data that has already been saved. These do not run continuously, but are started via triggers. They process a certain amount of stored data and then shut down again.
- **Nodes**: Number of nodes in a rule.
- **Symbols**: Number and names of the symbols that are output from the rule.
- **RuleTrigger** (only for BatchDataRules): Number of configured triggers.


RuleEngine Pipeline Editor

Pipeline Alias MyRuleEnginePipelineAlias

Storage Provider TwinCAT Analytics StorageProvider ("INGMARR-NB02")

Rule (1) - Properties

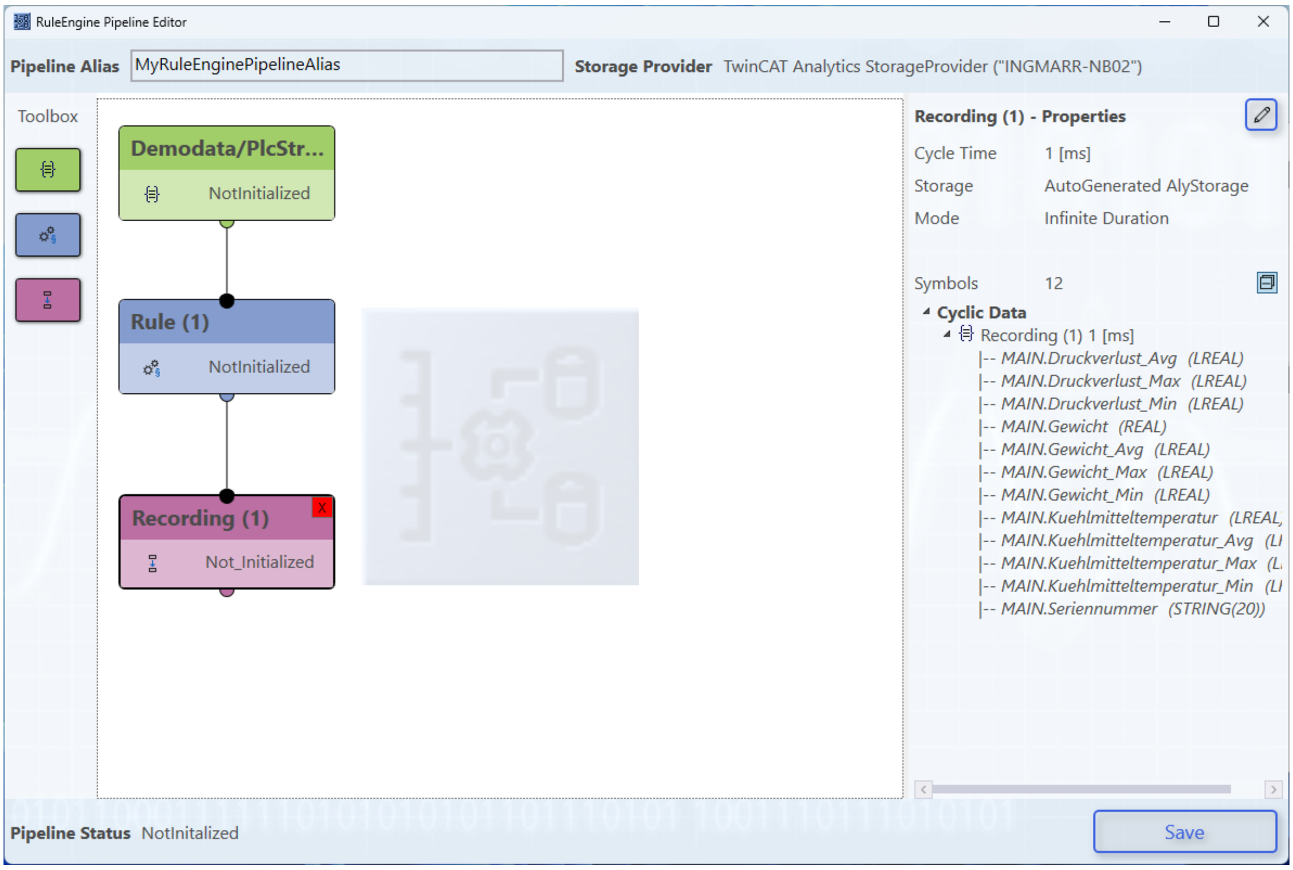
Alias Rule (1)
Type StreamingDataRule
Nodes 4
Symbols 16

```
Cyclic Data
  Rule Input
    Demodata/PlcStream1 1 [ms]
  MinMaxAvg (1)
    Demodata/PlcStream1 5 [s]
      |-- MAIN.Druckverlust_Avg  (LREAL)
      |-- MAIN.Druckverlust_Max  (LREAL)
      |-- MAIN.Druckverlust_Min  (LREAL)
      |-- MAIN.Gewicht_Avg  (LREAL)
      |-- MAIN.Gewicht_Max  (LREAL)
      |-- MAIN.Gewicht_Min  (LREAL)
      |-- MAIN.Kuehlmitteltemperatur_Avg
      |-- MAIN.Kuehlmitteltemperatur_Max
      |-- MAIN.Kuehlmitteltemperatur_Min
FilterData
  FilterData
    Demodata/PlcStream1 1 [ms]
```

Pipeline Status NotInitalized

Recording

- **CycleTime**: Cycle time of the data recording
- **Storage**: Name of the data memory
- **Mode**: Recording mode (Infinite duration or ring buffer)
- **Symbols**: Number and names of the selected symbols



RuleEngine Pipeline Editor

Pipeline Alias MyRuleEnginePipelineAlias **Storage Provider** TwinCAT Analytics StorageProvider ("INGMARR-NB02")

Recording (1) - Properties

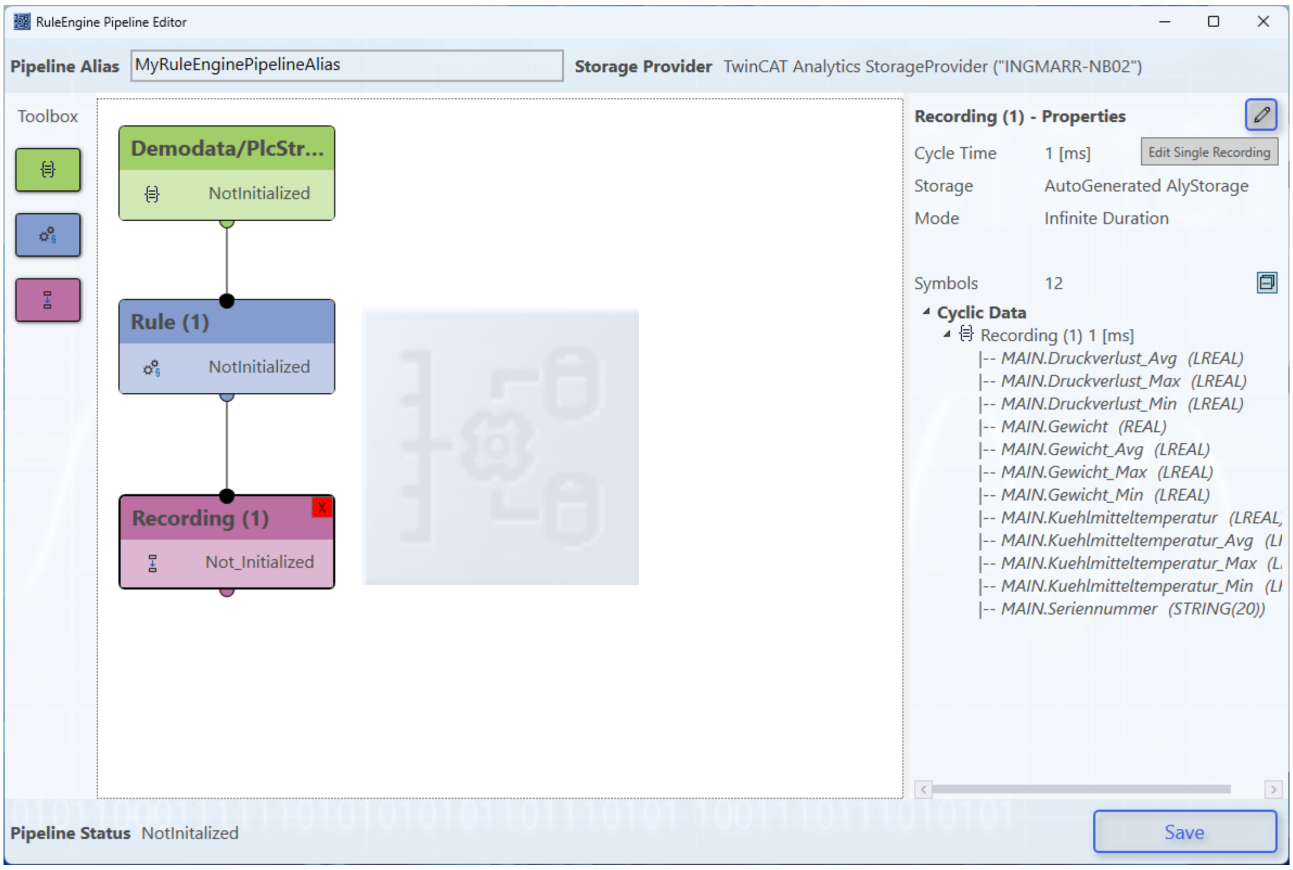
Cycle Time	1 [ms]
Storage	AutoGenerated AlyStorage
Mode	Infinite Duration
Symbols	12

```
◢ Cyclic Data
  ◢ Recording (1) 1 [ms]
      |-- MAIN.Druckverlust_Avg  (LREAL)
      |-- MAIN.Druckverlust_Max  (LREAL)
      |-- MAIN.Druckverlust_Min  (LREAL)
      |-- MAIN.Gewicht  (REAL)
      |-- MAIN.Gewicht_Avg  (LREAL)
      |-- MAIN.Gewicht_Max  (LREAL)
      |-- MAIN.Gewicht_Min  (LREAL)
      |-- MAIN.Kuehlmitteltemperatur  (LREAL,
      |-- MAIN.Kuehlmitteltemperatur_Avg  (LI
      |-- MAIN.Kuehlmitteltemperatur_Max  (L.
      |-- MAIN.Kuehlmitteltemperatur_Min  (LI
      |-- MAIN.Seriennummer  (STRING(20))
```

Pipeline Status NotInitalized

6.2.2.1.4 Editing elements

Editing takes place in a separate window. This can be opened by double-clicking on the element or by clicking the Edit icon in the properties.



RuleEngine Pipeline Editor

Pipeline Alias MyRuleEnginePipelineAlias **Storage Provider** TwinCAT Analytics StorageProvider ("INGMARR-NB02")

Recording (1) - Properties

Cycle Time	1 [ms]
Storage	AutoGenerated AlyStorage
Mode	Infinite Duration
Symbols	12

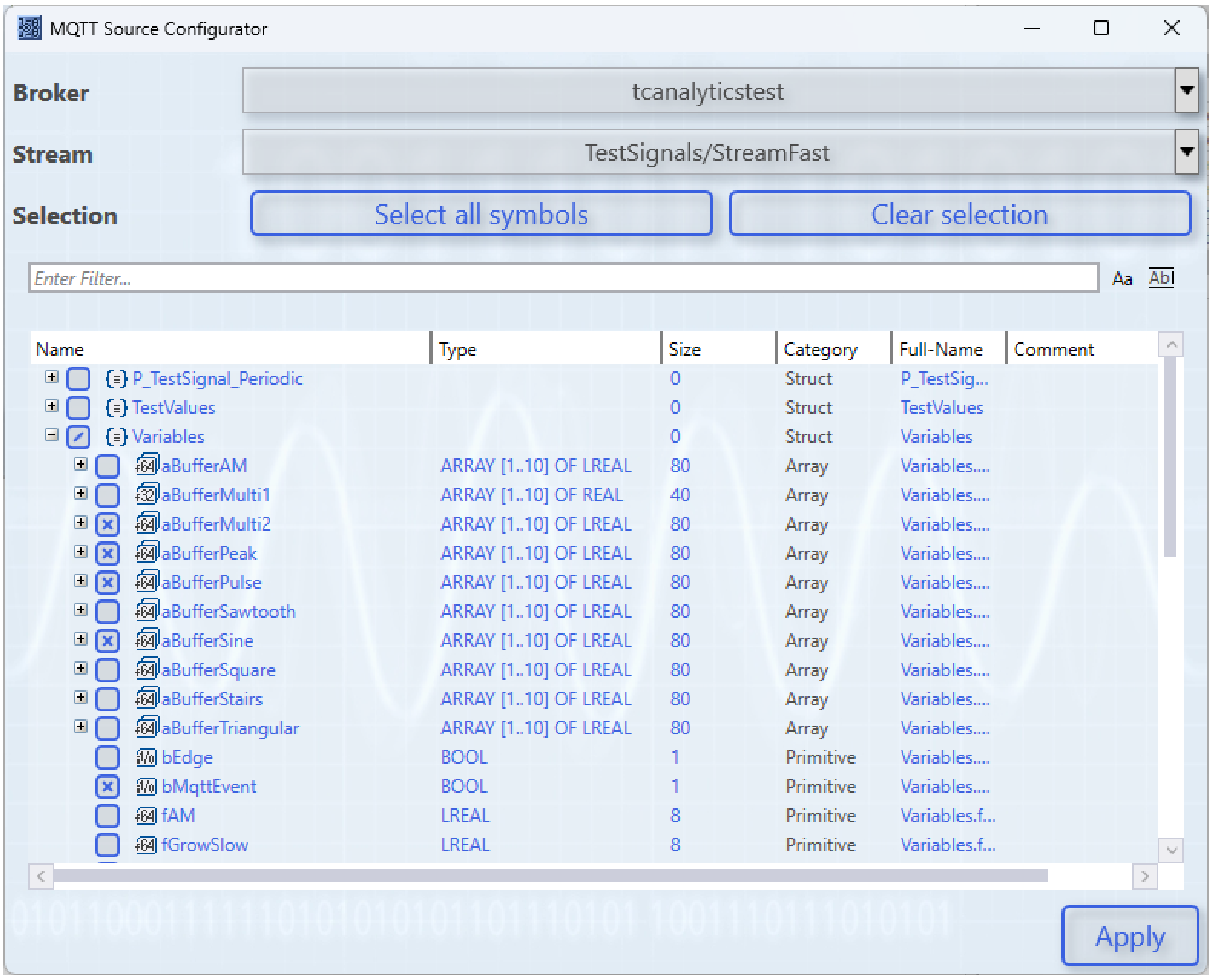
```
◢ Cyclic Data
  ◢ Recording (1) 1 [ms]
      |-- MAIN.Druckverlust_Avg  (LREAL)
      |-- MAIN.Druckverlust_Max  (LREAL)
      |-- MAIN.Druckverlust_Min  (LREAL)
      |-- MAIN.Gewicht  (REAL)
      |-- MAIN.Gewicht_Avg  (LREAL)
      |-- MAIN.Gewicht_Max  (LREAL)
      |-- MAIN.Gewicht_Min  (LREAL)
      |-- MAIN.Kuehlmitteltemperatur  (LREAL,
      |-- MAIN.Kuehlmitteltemperatur_Avg  (LI
      |-- MAIN.Kuehlmitteltemperatur_Max  (L.
      |-- MAIN.Kuehlmitteltemperatur_Min  (LI
      |-- MAIN.Seriennummer  (STRING(20))
```

Pipeline Status NotInitalized

6.2.2.1.4.1 Editing MQTT-Sources

An MQTT-Source is edited in the MQTT Source Configurator. First, a message broker must be selected at Broker. All Data Brokers of the Storage Provider used for the RuleEngine pipeline that have also been added in the Manager can be selected. An MQTT-Stream (Stream) can then be selected based on its topic.

As soon as a stream has been added, the available symbols for the stream are displayed. Individual symbols can be selected using the checkboxes. All displayed symbols can be selected or deselected using the **Select all symbols** and **Clear selection** buttons.

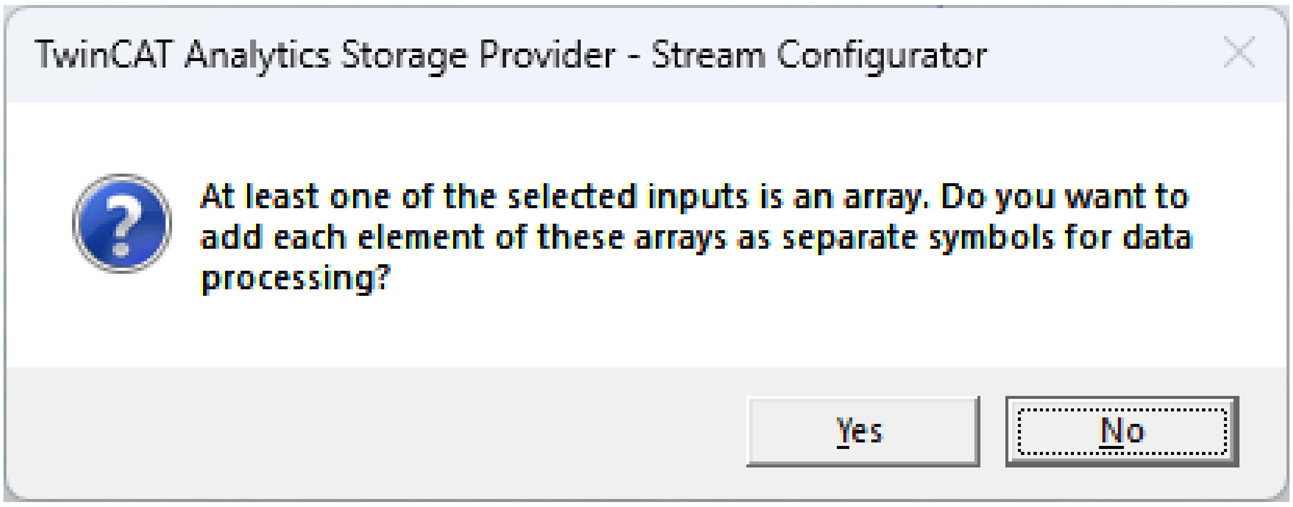


Broker: tcanalyticstest

Stream: TestSignals/StreamFast

Name	Type	Size	Category	Full-Name	Comment
☐ P_TestSignal_Periodic		0	Struct	P_TestSig...	
☐ TestValues		0	Struct	TestValues	
☑ Variables		0	Struct	Variables	
☐ aBufferAM	ARRAY [1..10] OF LREAL	80	Array	Variables....	
☐ aBufferMulti1	ARRAY [1..10] OF REAL	40	Array	Variables....	
☒ aBufferMulti2	ARRAY [1..10] OF LREAL	80	Array	Variables....	
☒ aBufferPeak	ARRAY [1..10] OF LREAL	80	Array	Variables....	
☒ aBufferPulse	ARRAY [1..10] OF LREAL	80	Array	Variables....	
☐ aBufferSawtooth	ARRAY [1..10] OF LREAL	80	Array	Variables....	
☒ aBufferSine	ARRAY [1..10] OF LREAL	80	Array	Variables....	
☐ aBufferSquare	ARRAY [1..10] OF LREAL	80	Array	Variables....	
☐ aBufferStairs	ARRAY [1..10] OF LREAL	80	Array	Variables....	
☐ aBufferTriangular	ARRAY [1..10] OF LREAL	80	Array	Variables....	
☐ bEdge	BOOL	1	Primitive	Variables....	
☒ bMqttEvent	BOOL	1	Primitive	Variables....	
☐ fAM	LREAL	8	Primitive	Variables.f...	
☐ fGrowSlow	LREAL	8	Primitive	Variables.f...	

If the selected symbols include arrays or structures, a user dialog will prompt you to confirm whether the subsymbols should be added as separate symbols when the configuration is saved. If these are added, the subsymbols can be used individually in rules or recordings for processing and saving.



At least one of the selected inputs is an array. Do you want to add each element of these arrays as separate symbols for data processing?

6.2.2.1.4.2 Editing rules

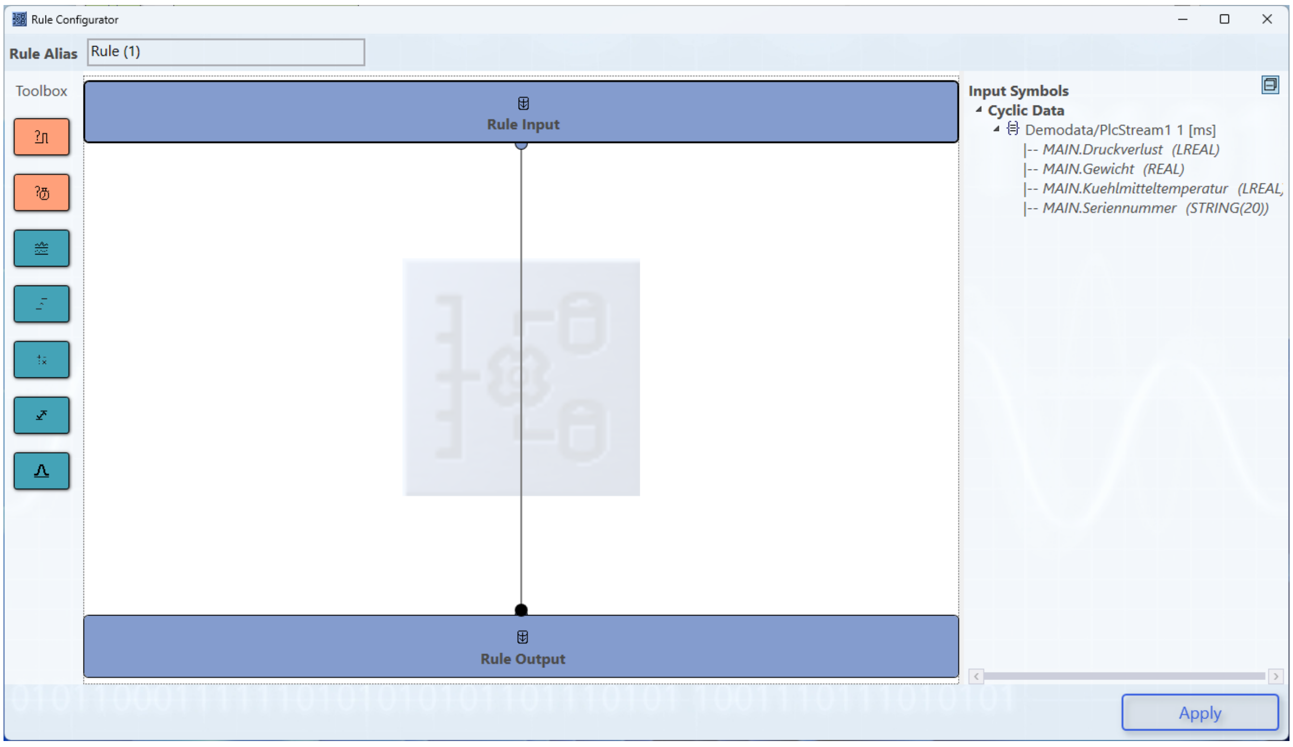
A rule is edited in the Rule Configurator. An alias name can be assigned to a rule at the top left. A rule consists of the following elements:

Rule Input:

Corresponds to the start point within a rule. All symbols added to the rule are displayed here. For BatchDataRules, the time range for which the data is loaded when the rule is triggered can be selected here.

Rule Output:

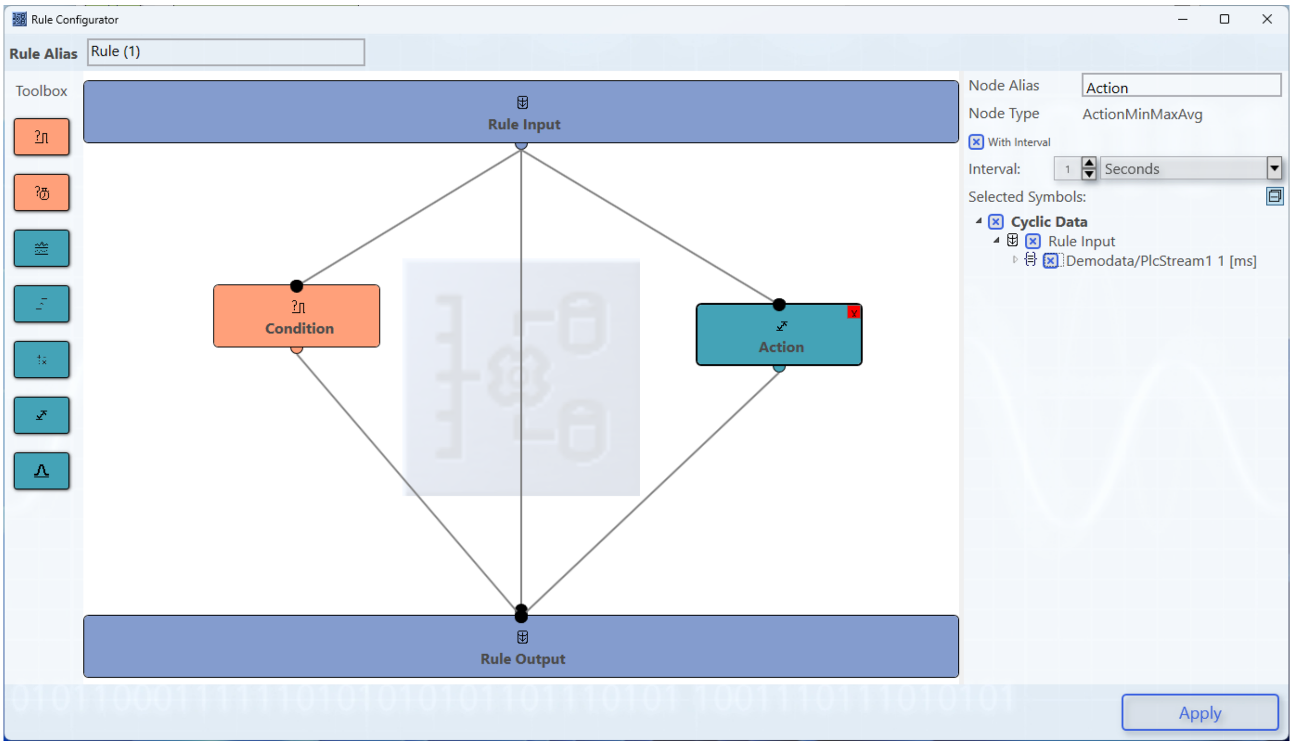
Corresponds to the output of the rule. All symbols of the blocks that are connected to the rule output can be selected for subsequent recordings.



Rule Alias: Rule (1)

Input Symbols
Cyclic Data
Demodata/PlcStream1 1 [ms]
|-- MAIN.Druckverlust (LREAL)
|-- MAIN.Gewicht (REAL)
|-- MAIN.Kuehlmitteltemperatur (LREAL
|-- MAIN.Seriennummer (STRING(20))

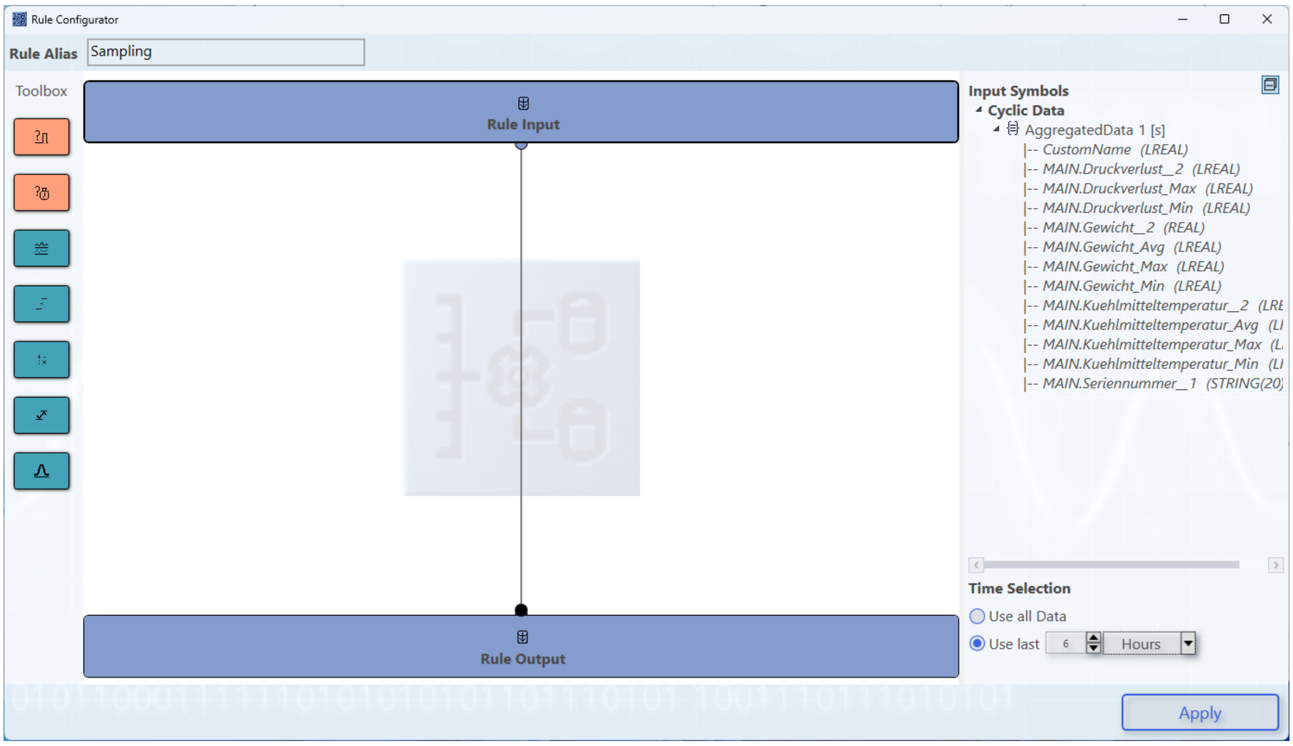
Additional blocks can be added for processing via the toolbox (left). A distinction is made between Condition blocks and Action blocks. Condition blocks serve as filters and enable incoming data to be filtered on a time basis or data basis. Action blocks offer the option of aggregating data (e.g. calculating min/max/avg or other operations). All blocks can be linked to each other with connections.



Node Alias: Action
Node Type: ActionMinMaxAvg
[✓ With Interval]
Interval: 1 Seconds
Selected Symbols:
Cyclic Data
Rule Input
Demodata/PlcStream1 1 [ms]

6.2.2.1.4.2.1 *Input*

Corresponds to the start point within a rule. All symbols added to the rule are displayed here. For BatchDataRules, the time range for which the data is loaded when the rule is triggered can be selected here.

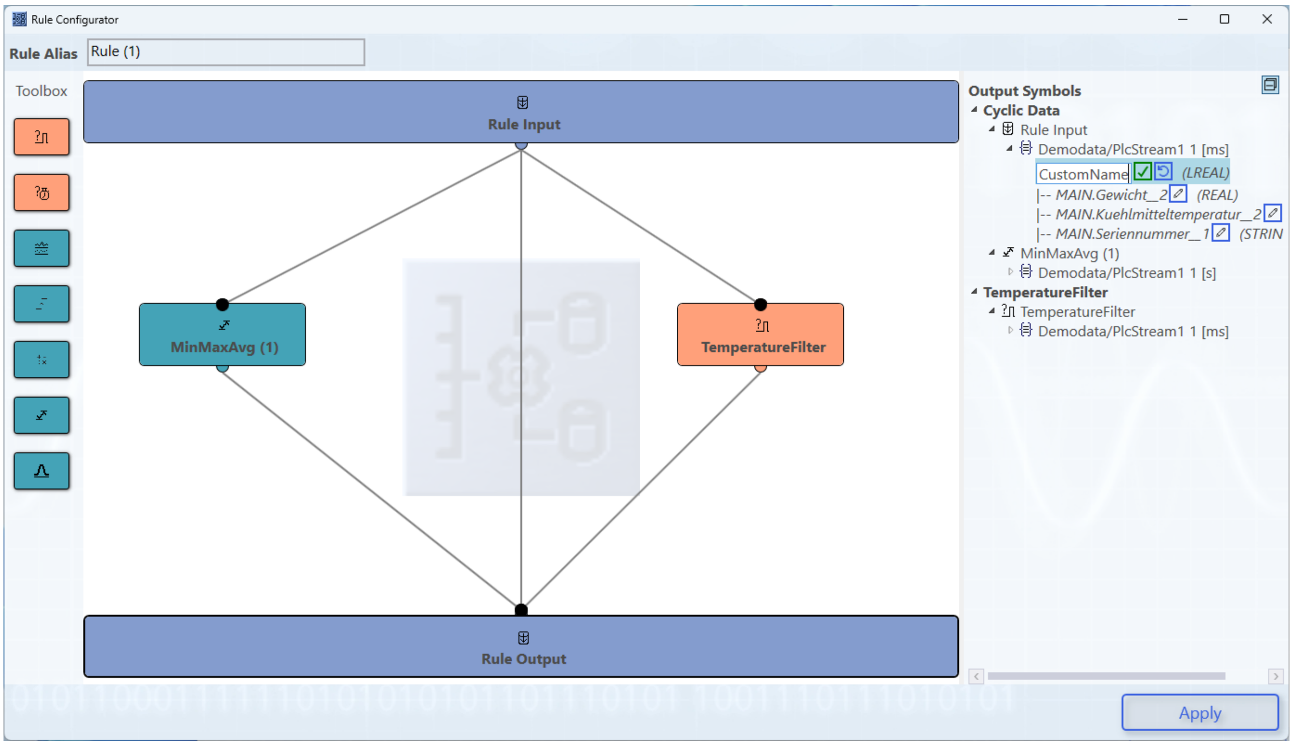


Input Symbols
Cyclic Data
AggregatedData 1 [s]
|-- CustomName (LREAL)
|-- MAIN.Druckverlust_2 (LREAL)
|-- MAIN.Druckverlust_Max (LREAL)
|-- MAIN.Druckverlust_Min (LREAL)
|-- MAIN.Gewicht_2 (REAL)
|-- MAIN.Gewicht_Avg (LREAL)
|-- MAIN.Gewicht_Max (LREAL)
|-- MAIN.Gewicht_Min (LREAL)
|-- MAIN.Kuehlmitteltemperatur_2 (LRE
|-- MAIN.Kuehlmitteltemperatur_Avg (LI
|-- MAIN.Kuehlmitteltemperatur_Max (L.
|-- MAIN.Kuehlmitteltemperatur_Min (LI
|-- MAIN.Seriennummer_1 (STRING(20)

Time Selection
Use all Data [✓ Use last] 6 Hours

6.2.2.1.4.2.2 *Output*

Corresponds to the output of the rule. All symbols of the blocks that are connected to the rule output can be selected for subsequent recordings. Variables can be renamed at the output node. To do this, you can click on the Edit icon behind the corresponding variable.



Output Symbols
Cyclic Data
Rule Input
Demodata/PlcStream1 1 [ms]
CustomName (LREAL)
|-- MAIN.Gewicht_2 (REAL)
|-- MAIN.Kuehlmitteltemperatur_2
|-- MAIN.Seriennummer_1 (STRIN
MinMaxAvg (1)
Demodata/PlcStream1 1 [s]
TemperatureFilter
TemperatureFilter
Demodata/PlcStream1 1 [ms]

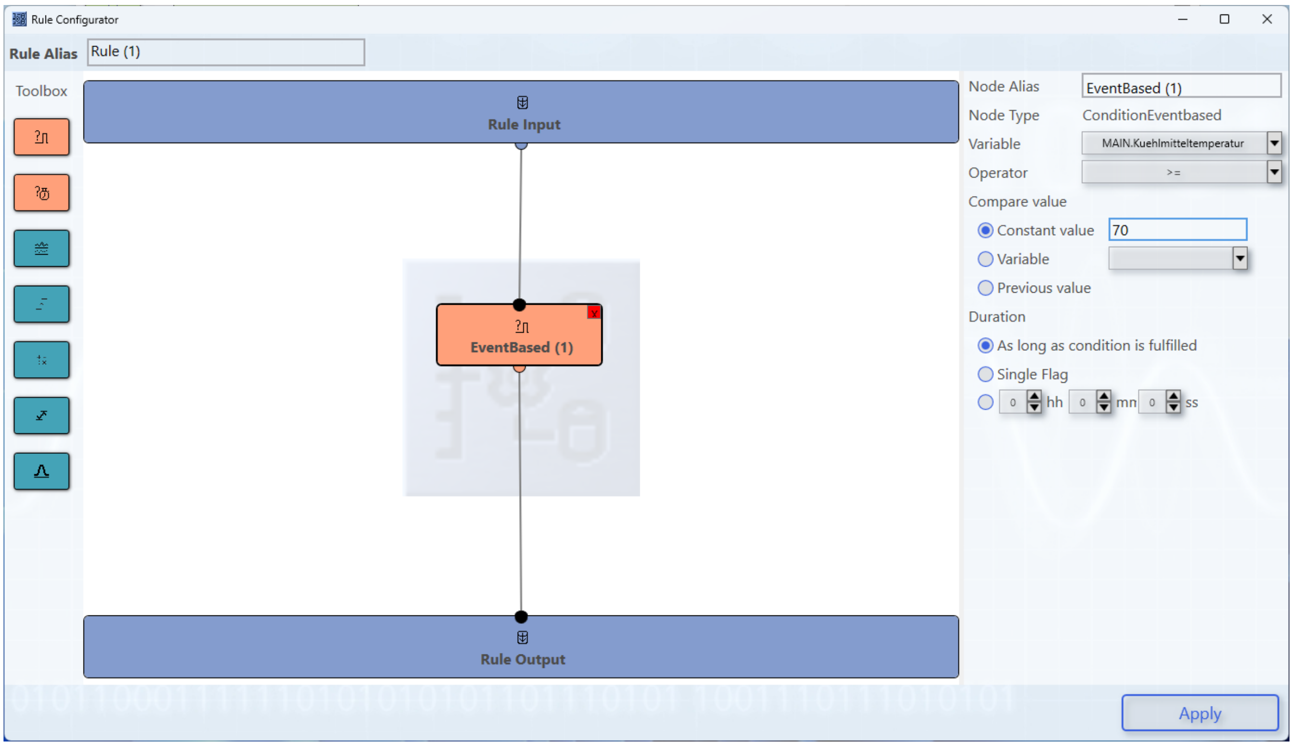
6.2.2.1.4.2.3 Conditions

Condition blocks serve as filters and enable incoming data to be filtered on a time basis or data basis.

6.2.2.1.4.2.3.1 Eventbased

The EventBased-Condition can be used to filter for data within the data where a specific event must have occurred. The following configurations can be made:

- **Variable**: Selection of the variables to which the condition must apply.
- **Operator**: Selection of the operator for the condition
- **Compare value**: Selection of the comparison value
    - **Constant value**: Comparison with a constant value
    - **Variable**: Comparison with another variable
    - **Previous value**: Comparison with the previous value of the selected variable.
- **Duration**: Selection of how long the data should be forwarded once the condition is fulfilled.
    - **As long as condition is fulfilled**: The data is forwarded as long as the condition is fulfilled.
    - **Single Flag**: The data is forwarded once when the condition is fulfilled, i.e. as with a rising edge.
    - Alternatively, the data can also be forwarded for a specific time, which can be configured manually.



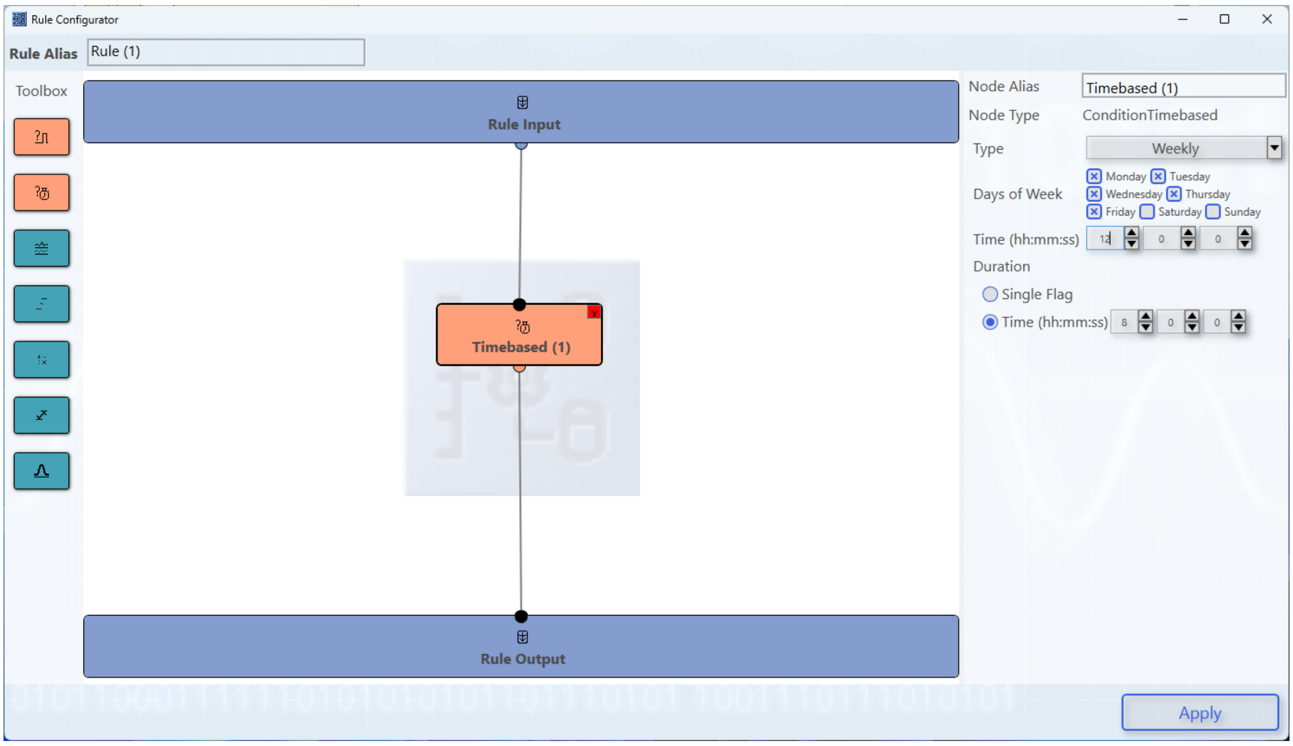
Rule Alias: Rule (1)

Node Alias: EventBased (1)
Node Type: ConditionEventbased
Variable: MAIN.Kuehlmitteltemperatur
Operator: >=
Compare value
[✓ Constant value] 70
Variable
Previous value
Duration
[✓ As long as condition is fulfilled]
Single Flag
0 hh 0 mn 0 ss

6.2.2.1.4.2.3.2 Timebased

The Timebased-Condition can be used to filter within the data on a time basis. The time on which this is based is the respective timestamp of the data. The following configurations can be made:

- **Type**: Selection of the type of Timebased Condition. Three types are available
  - **Interval**: The condition is fulfilled as soon as the interval is reached.
  - **Weekly**: The condition is fulfilled on certain days of the week at a certain time.
  - **Monthly**: The condition is fulfilled in certain months on a certain day at a certain time.
- **Duration**: Selection of how long the data should be forwarded once the condition is fulfilled.
  - **Single Flag**: The data is forwarded once when the condition is fulfilled, i.e. as with a rising edge.
  - **Time**: Alternatively, the data can also be forwarded for a specific time, which can be configured manually.



Rule Alias: Rule (1)

Node Alias: Timebased (1)
Node Type: ConditionTimebased
Type: Weekly
Days of Week: [✓ Monday] [✓ Tuesday] [✓ Wednesday] [✓ Thursday] [✓ Friday] Saturday Sunday
Time (hh:mm:ss): 12 0 0
Duration
Single Flag [✓ Time (hh:mm:ss)] 8 0 0

6.2.2.1.4.2.4 *Actions*

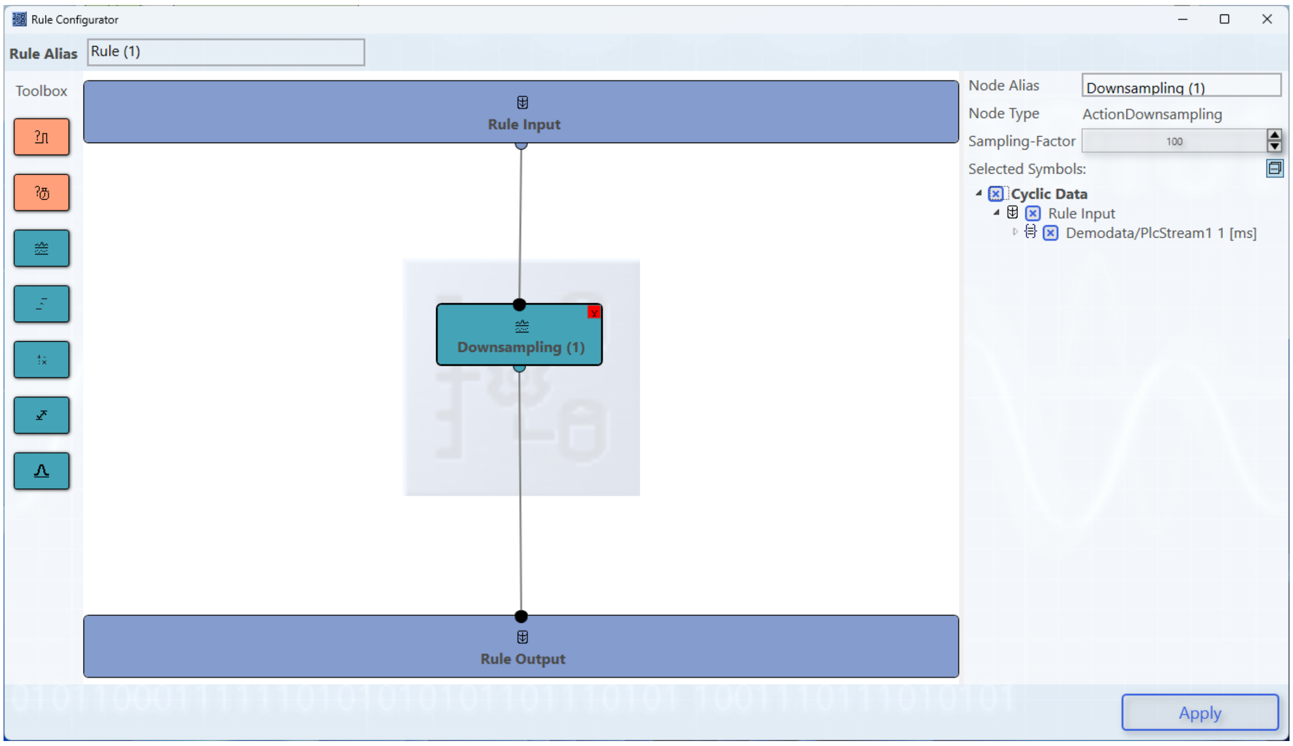
Action blocks offer the option of aggregating data (e.g. calculating min/max/avg or other operations).

6.2.2.1.4.2.4.1 Downsampling

Configuration of a downsampling of individual variables. The sampling factor indicates the sampling rate. In the Selected Symbols area, you can select the variables to which downsampling is to be applied. If you want to sample all the data in a rule, you can configure this in the corresponding recording.

The following symbols are provided for each selected symbol:

- _Sampled: Sampled symbol



Rule Alias: Rule (1)

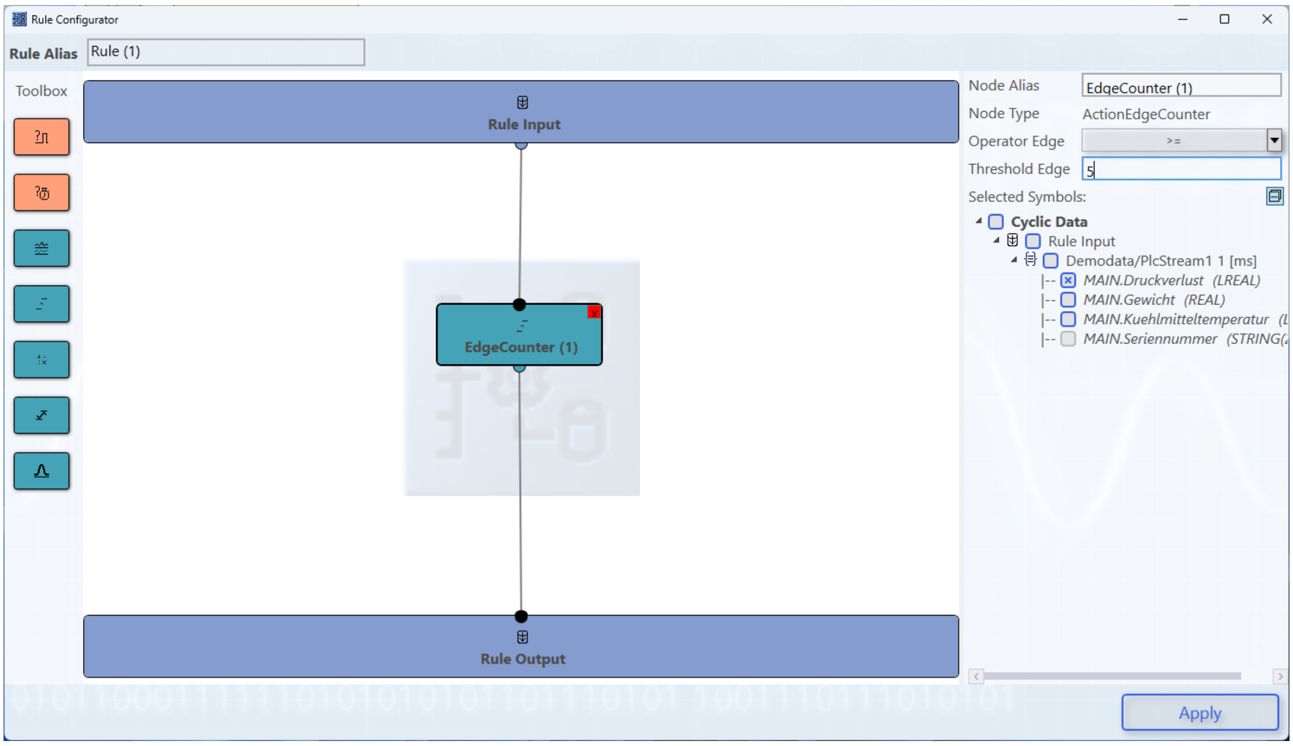
Node Alias: Downsampling (1)
Node Type: ActionDownsampling
Sampling-Factor: 100
Selected Symbols:
- [✓ Cyclic Data]
  - [✓ Rule Input]
    - [✓ Demodata/PlcStream1 1 [ms]]

6.2.2.1.4.2.4.2 EdgeCounter

Determines the edges within the data. The Operator Edge and the threshold value to be compared must be configured for this. In the Selected Symbols area, you can select the variables to which the Edge Counter is to be applied.

The following symbols are provided for each selected symbol:

- _Count: Number of edges counted
- _Edge: Boolean whether an edge is detected
- _LastEvent: Timestamp of the last event


Rule Configurator

Rule Alias: Rule (1)

Node Alias: EdgeCounter (1)
Node Type: ActionEdgeCounter
Operator Edge: >=
Threshold Edge: 5
Selected Symbols:

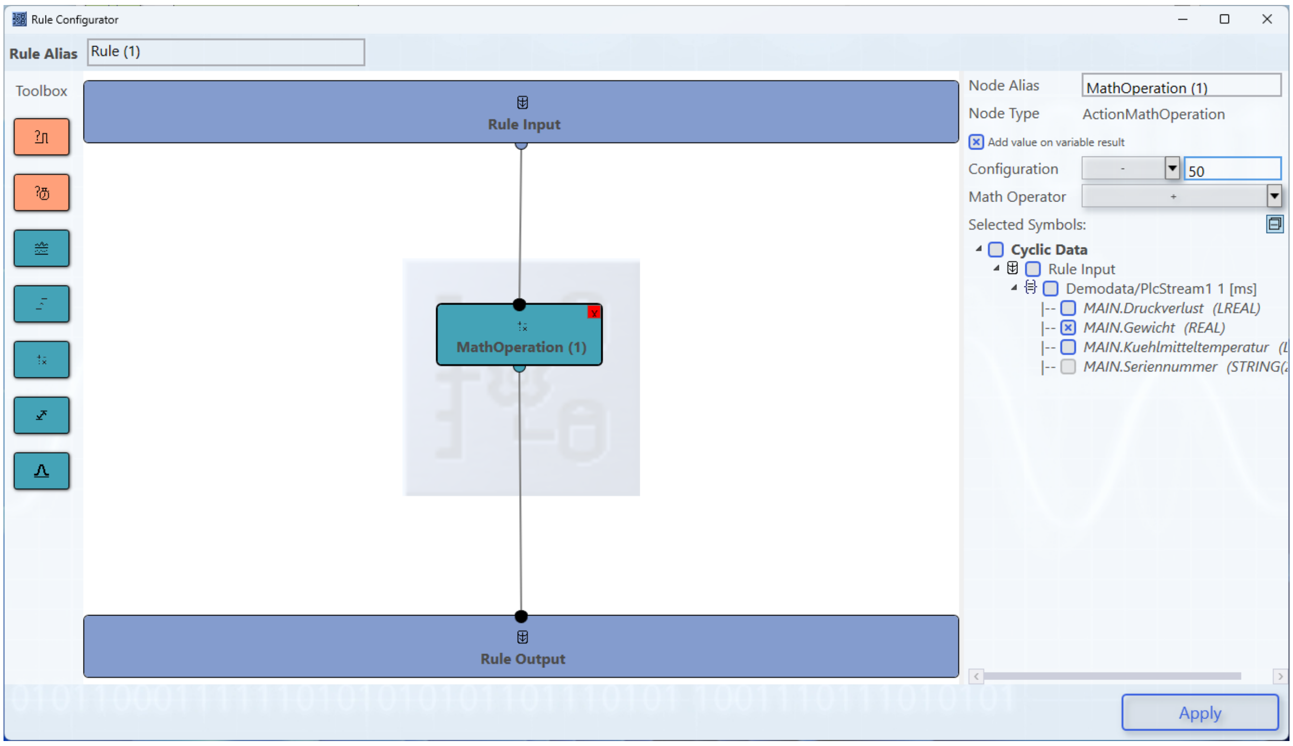
```
Cyclic Data
  Rule Input
    Demodata/PlcStream1 1 [ms]
      |-- [x] MAIN.Druckverlust  (LREAL)
      |-- [ ] MAIN.Gewicht  (REAL)
      |-- [ ] MAIN.Kuehlmitteltemperatur  (L
      |-- [ ] MAIN.Seriennummer  (STRING(
```

6.2.2.1.4.2.4.3 MathOperation

Symbols can be calculated with each other using the MathOperation block. The symbols to be calculated with each other can be selected under **Selected Symbols**. The operator can be selected under **MathOperator**. If the result is to be calculated with an additional constant value, activate the **Add value on variable result** checkbox. In the **Configuration** area, you can configure the operator and the constant value with which the result of the symbols is to be calculated.

The following symbol is provided:

- **Result**: Result of the calculation



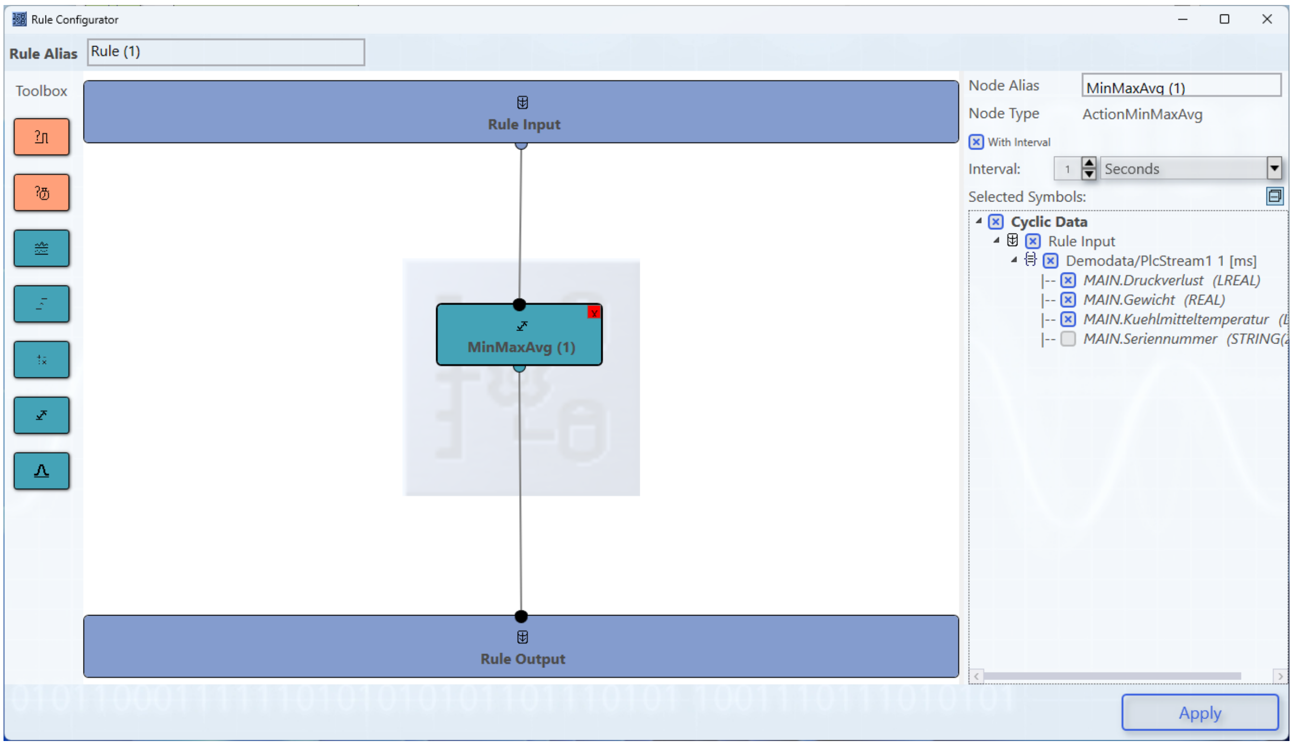
Node Alias MathOperation (1)
Node Type ActionMathOperation
☒ Add value on variable result
Configuration - 50
Math Operator +
Selected Symbols:
Cyclic Data
Rule Input
Demodata/PlcStream1 1 [ms]
|-- ☐ *MAIN.Druckverlust (LREAL)*
|-- ☒ *MAIN.Gewicht (REAL)*
|-- ☐ *MAIN.Kuehlmitteltemperatur*
|-- ☐ *MAIN.Seriennummer (STRING*

6.2.2.1.4.2.4.4 Min/Max/Avg

Calculation of the minimum/maximum and average value for selected symbols. In the **Selected Symbols** area, you can select the variables for which the values are to be calculated. If you activate the **With Interval** checkbox, you can configure an interval for which the values are to be calculated.

The following symbols are provided for each selected symbol:

- **_Min**: Minimum of the symbol
- **_Max**: Maximum of the symbol
- **_Avg**: Average of the symbol



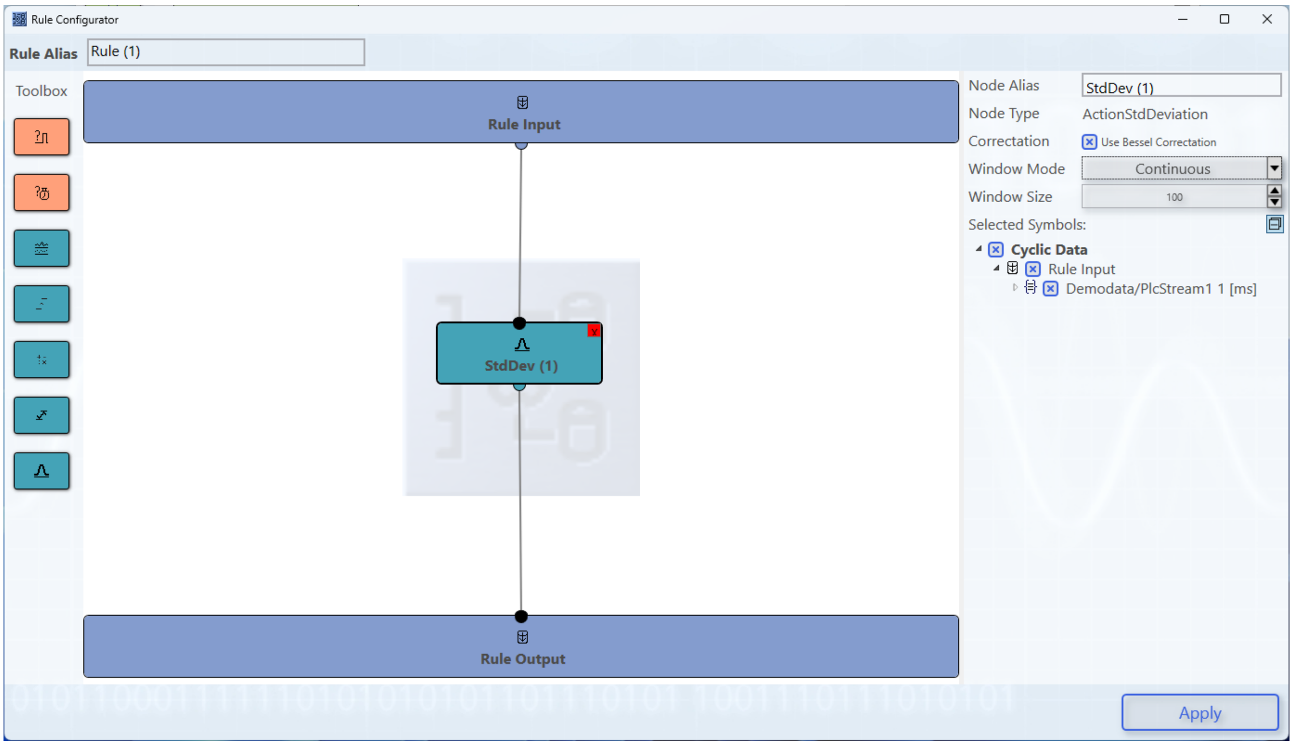
Node Alias MinMaxAvg (1)
Node Type ActionMinMaxAvg
☒ With Interval
Interval: 1 Seconds
Selected Symbols:
☒ Cyclic Data
☒ Rule Input
☒ Demodata/PlcStream1 1 [ms]
|-- ☒ *MAIN.Druckverlust (LREAL)*
|-- ☒ *MAIN.Gewicht (REAL)*
|-- ☒ *MAIN.Kuehlmitteltemperatur*
|-- ☐ *MAIN.Seriennummer (STRING*

6.2.2.1.4.2.4.5 StandardDeviation

Calculation of the standard deviation for selected symbols. In the **Selected Symbols** area, you can select the variables for which the values are to be calculated. The calculation of the standard deviation can be configured according to the block.

The following symbols are provided for each selected symbol:

- **_STD**: Standard deviation of the symbol

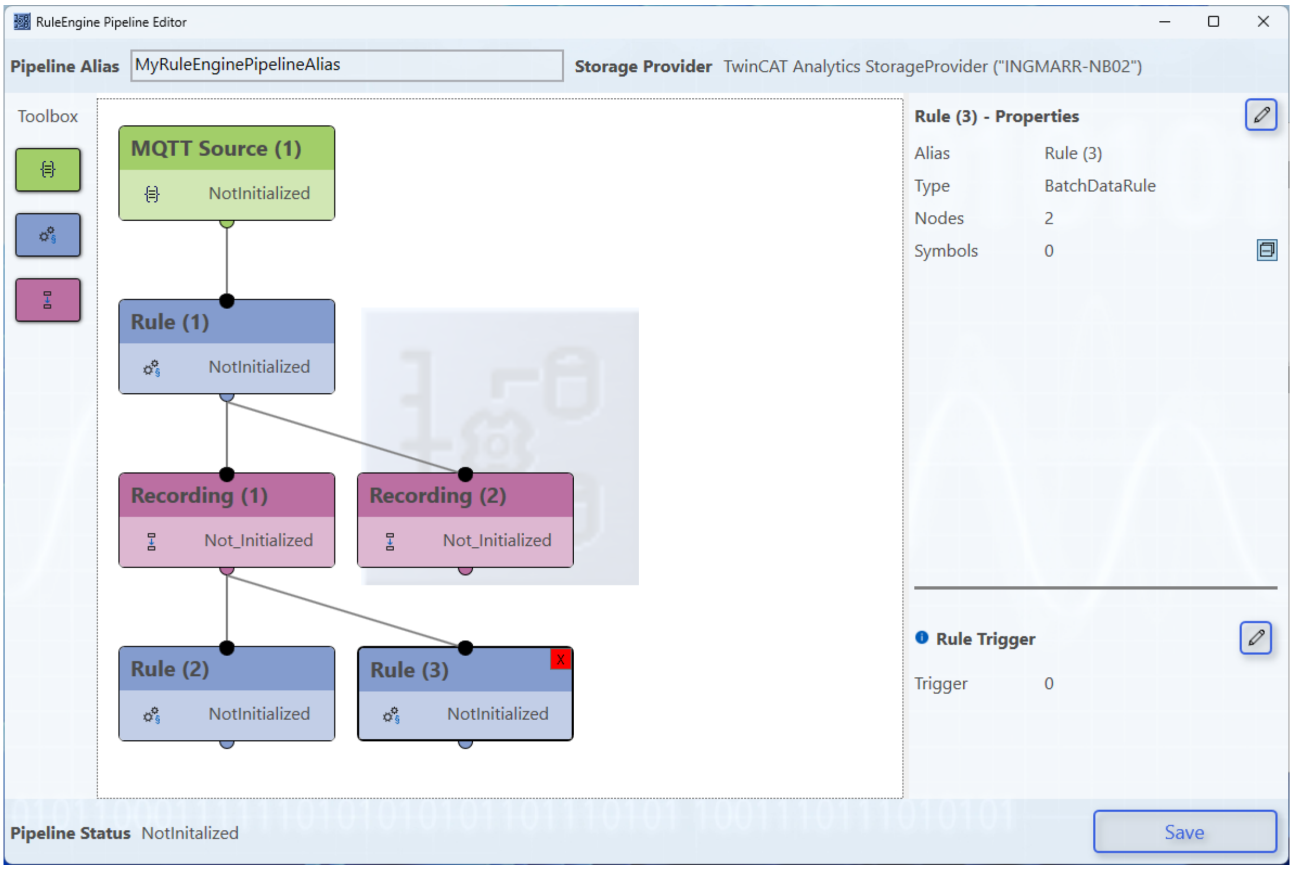


Rule Alias: Rule (1)

Node Alias: StdDev (1)
Node Type: ActionStdDeviation
Correctation: Use Bessel Correctation
Window Mode: Continuous
Window Size: 100
Selected Symbols:
- Cyclic Data
  - Rule Input
    - Demodata/PlcStream1 1 [ms]

6.2.2.1.4.2.5 Trigger

Triggers can be configured for a BatchDataRule (based on data from a recording). These triggers allow the rule to start time-based or event-based. A rule can also be triggered manually at any time. The triggers are configured in the Rule Trigger Configurator. This can be opened via the property window of the rule. The time-based and event-based triggers can be configured in the Rule Trigger Configurator. Currently, only time-based or event-based triggers can be used for a rule.



Pipeline Alias MyRuleEnginePipelineAlias

Storage Provider TwinCAT Analytics StorageProvider ("INGMARR-NB02")

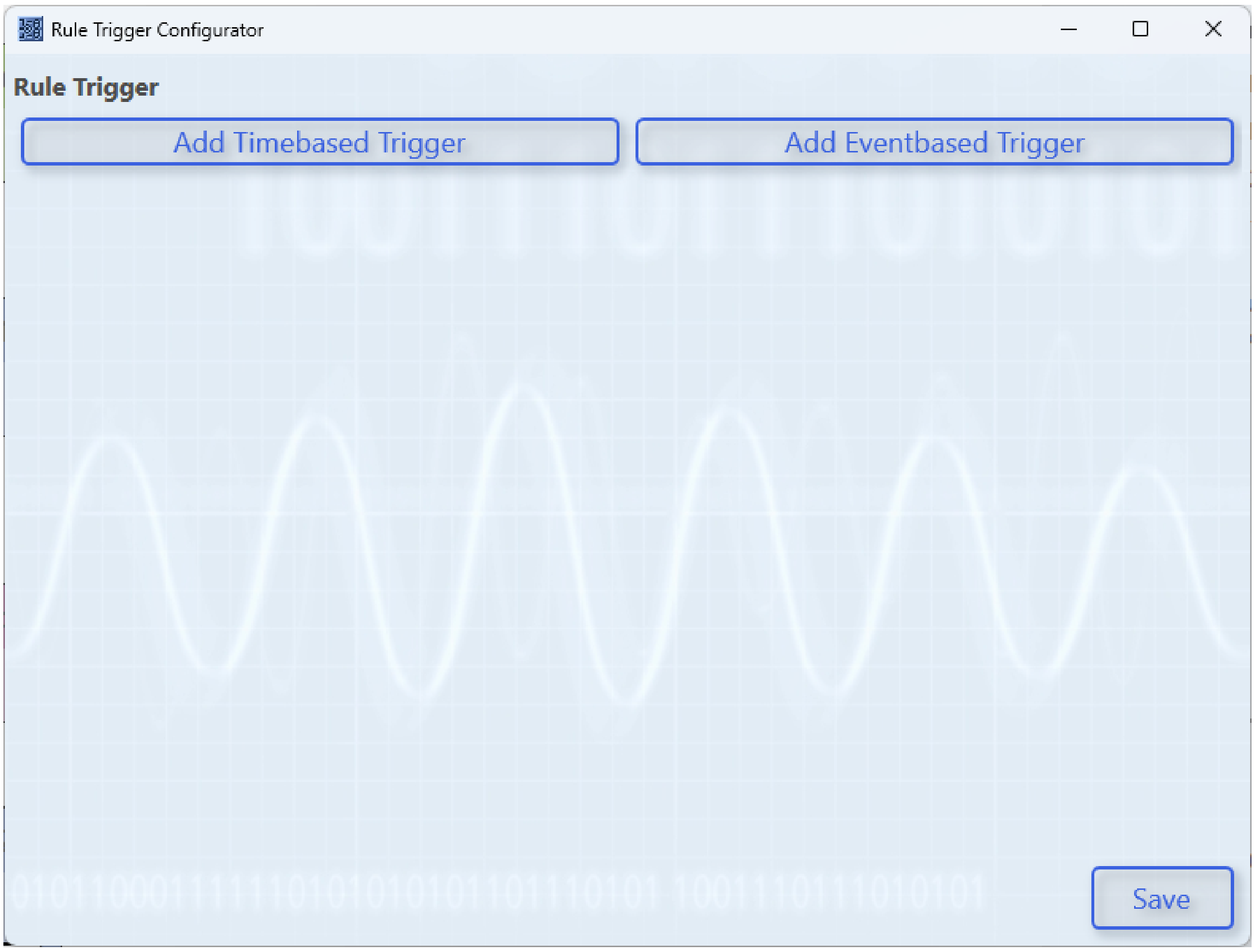
Rule (3) - Properties

Alias	Rule (3)
Type	BatchDataRule
Nodes	2
Symbols	0

Rule Trigger

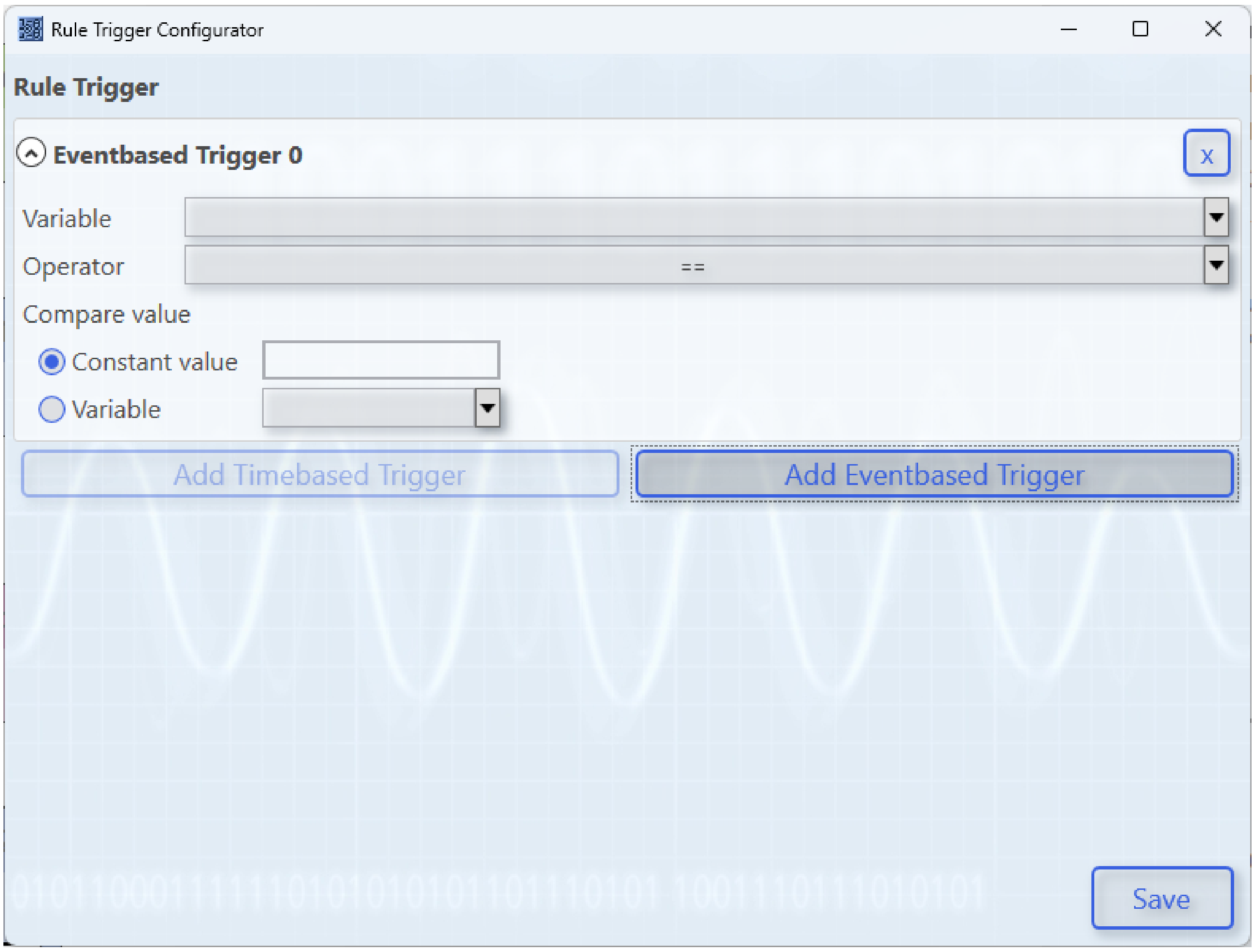
Trigger	0

Pipeline Status NotInitalized



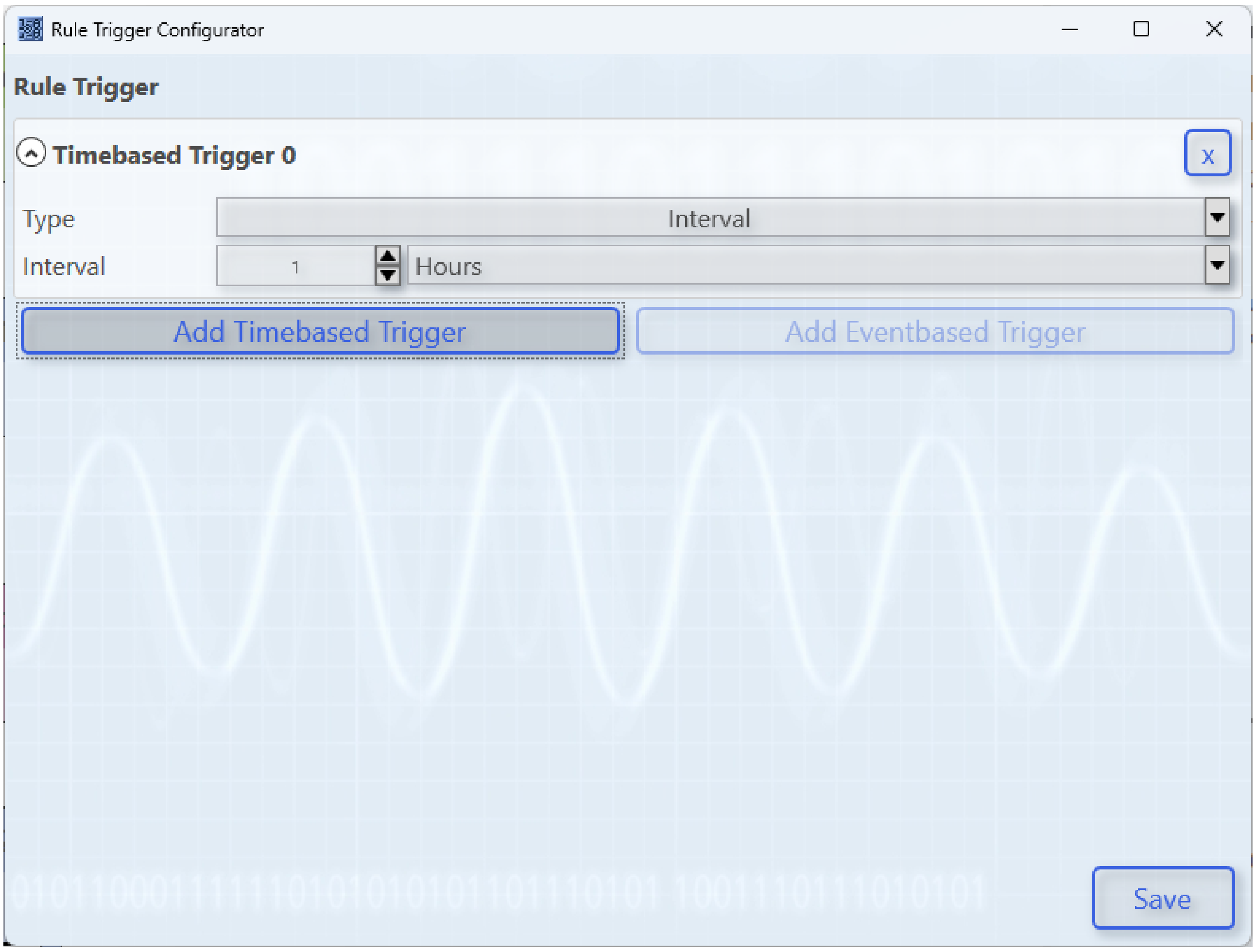
6.2.2.1.4.2.5.1 Eventbased

The configuration of an event-based trigger corresponds to an Eventbased-Condition [▶ 76] within the rule. The underlying data is the data that is currently being written to the recording that serves as the data source for the rule. It is not possible or necessary to configure the duration. If the trigger condition is fulfilled, the rule runs until the data has been processed accordingly and is then disabled until the next trigger.



6.2.2.1.4.2.5.2 Timebased

The configuration of a time-based trigger corresponds to a Timebased-Condition [▶ 77] within the rule. The underlying time is the system time of the device on which the Storage Provider is running. It is not possible or necessary to configure the duration. If the trigger condition is fulfilled, the rule runs until the data has been processed accordingly and is then disabled until the next trigger.

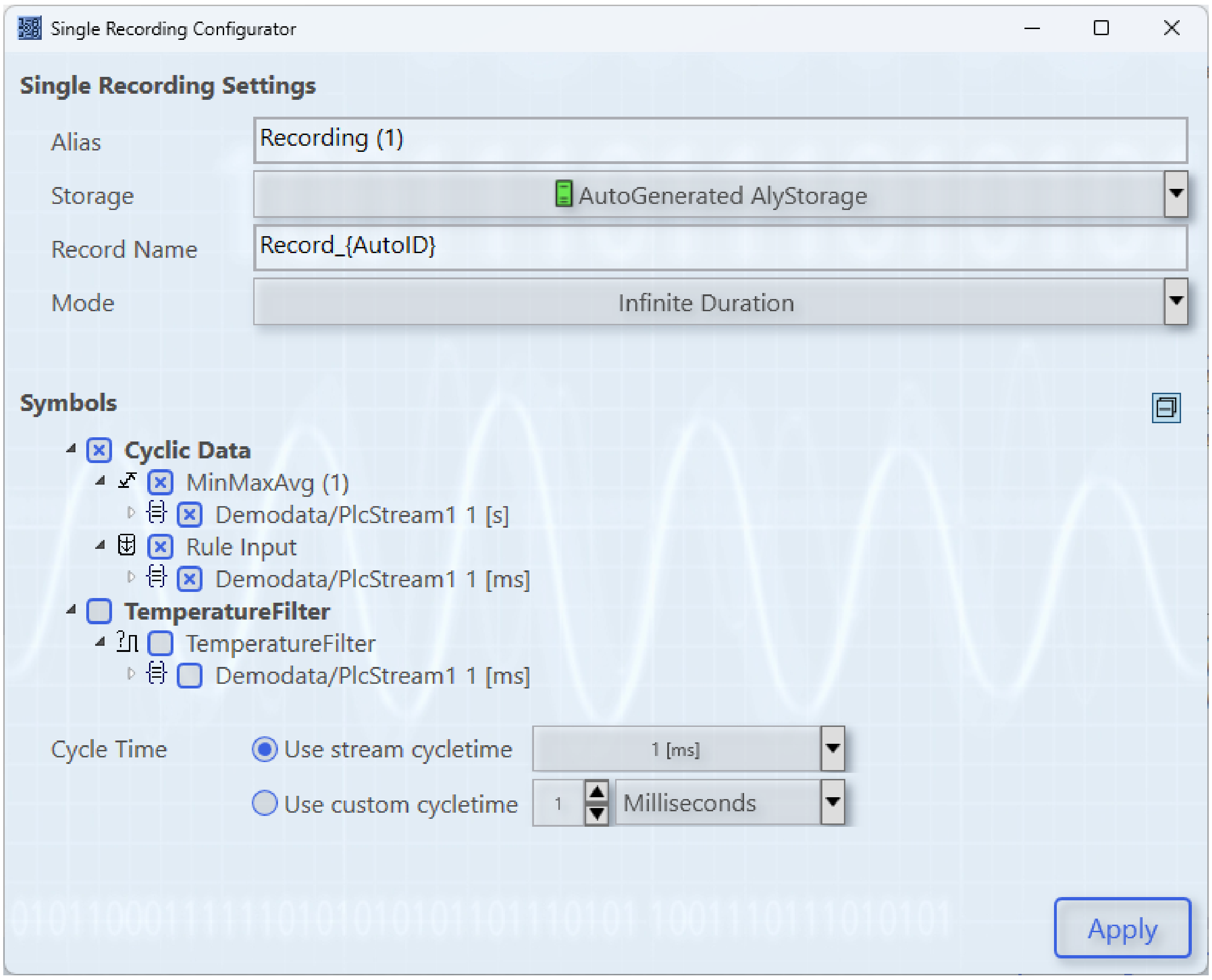


Type: Interval
Interval: 1 Hours

6.2.2.1.4.3 Editing recordings

Recordings are edited in the Single Recording Configurator. The following settings are available here:

- **Alias**: Recording alias
- **Storage**: Data sink for recording (configured in the Storage Provider Configurator)
- **Record Name**: Name of the record
- **Mode**: Mode of the record
  - **Infinite Duration**: The record runs as long as the RuleEngine pipeline is running and data is available for the record.
  - **Timebased Ringbugger**: The record runs as long as the RuleEngine pipeline is running and data is available for the record. The data is stored in a time-limited ring buffer.
  - **Databased Ringbugger**: The record runs as long as the RuleEngine pipeline is running and data is available for the record. The data is stored in a ring buffer with a limited storage capacity.
- **Symbols**: Selection of symbols to be saved with the recording. You can choose between cyclic data or data filtered by conditions.
- **CycleTime**: Selection of the cycle time for recording. This selection can only be made if you want to save cyclic (unfiltered) data. You have the option of configuring a cycle time based on the variables or your own cycle time for recording. Note that data will be lost if the cycle time is greater than the minimum cycle time of the data. In this case, a message appears.



Single Recording Configurator

Single Recording Settings

Alias	Recording (1)
Storage	AutoGenerated AlyStorage
Record Name	Record_{AutoID}
Mode	Infinite Duration

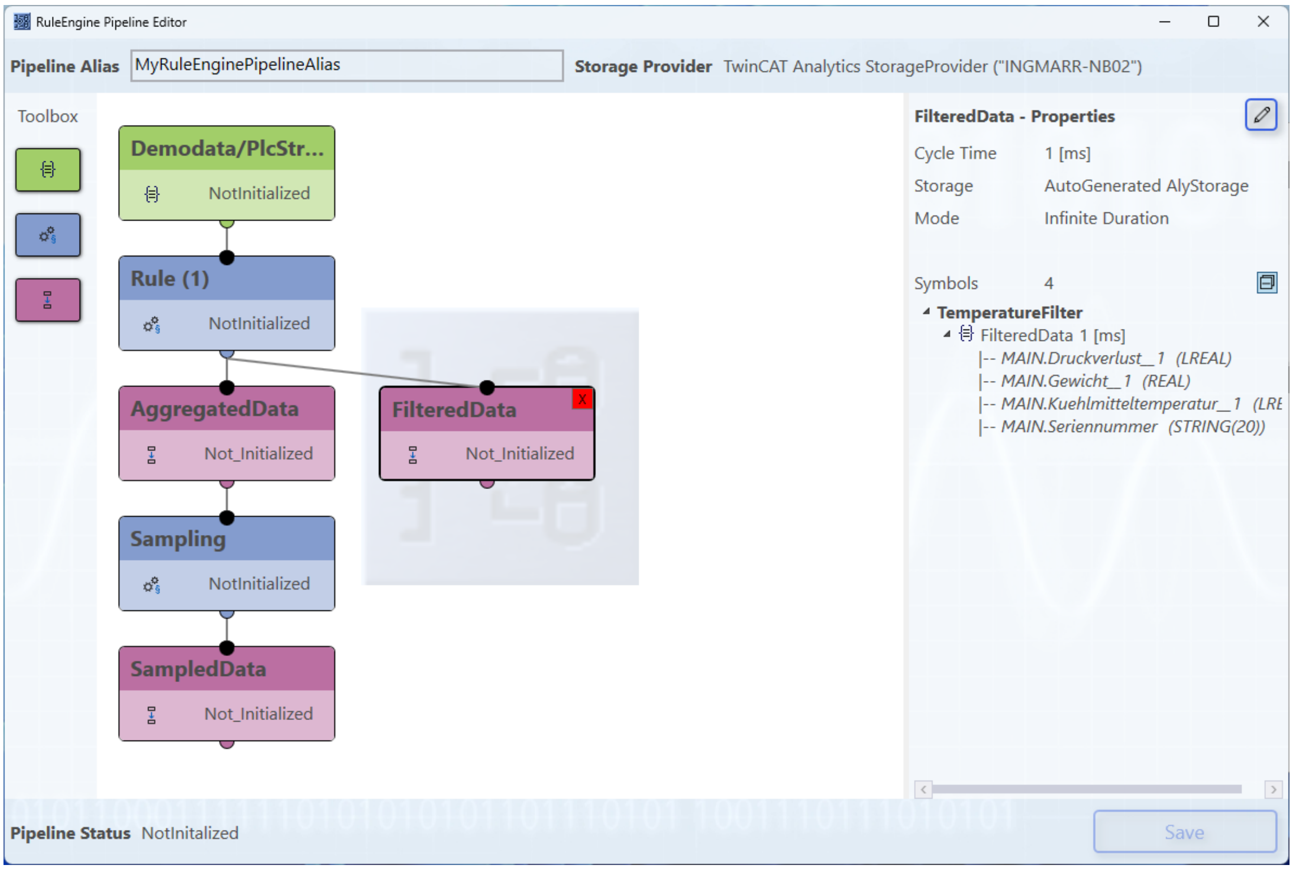
Symbols

- [✓] **Cyclic Data**
  - [✓] MinMaxAvg (1)
    - [✓] Demodata/PlcStream1 1 [s]
  - [✓] Rule Input
    - [✓] Demodata/PlcStream1 1 [ms]
- [ ] **TemperatureFilter**
  - [ ] TemperatureFilter
    - [ ] Demodata/PlcStream1 1 [ms]

Cycle Time: [✓ Use stream cycletime] 1 [ms] / Use custom cycletime 1 Milliseconds

6.2.2.1.5 Saving a RuleEngine pipeline

A configured RuleEngine pipeline can be saved using the **Save** button (bottom right) in the RuleEngine Pipeline Editor. Saving is only possible if the configuration is error-free. Any errors are displayed via a message and the incorrectly configured blocks are highlighted graphically.



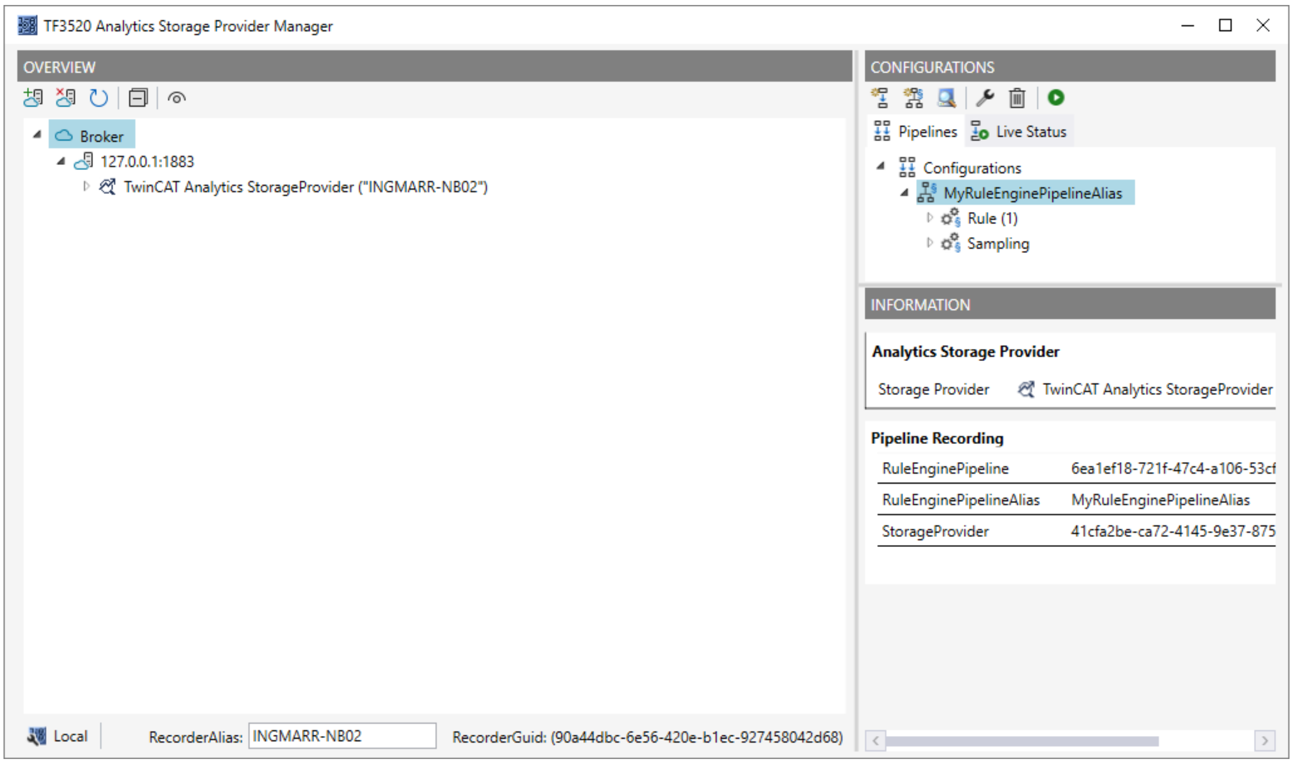
Pipeline Alias MyRuleEnginePipelineAlias
Storage Provider TwinCAT Analytics StorageProvider ("INGMARR-NB02")

FilteredData - Properties

Cycle Time	1 [ms]
Storage	AutoGenerated AlyStorage
Mode	Infinite Duration
Symbols	4

TemperatureFilter
FilteredData 1 [ms]
|-- *MAIN.Druckverlust_1 (LREAL)*
|-- *MAIN.Gewicht_1 (REAL)*
|-- *MAIN.Kuehlmitteltemperatur_1 (LRE*
|-- *MAIN.Seriennummer (STRING(20))*

Pipeline Status NotInitalized



Broker
127.0.0.1:1883
TwinCAT Analytics StorageProvider ("INGMARR-NB02")

Configurations
MyRuleEnginePipelineAlias
Rule (1)
Sampling

Analytics Storage Provider

Storage Provider TwinCAT Analytics StorageProvider

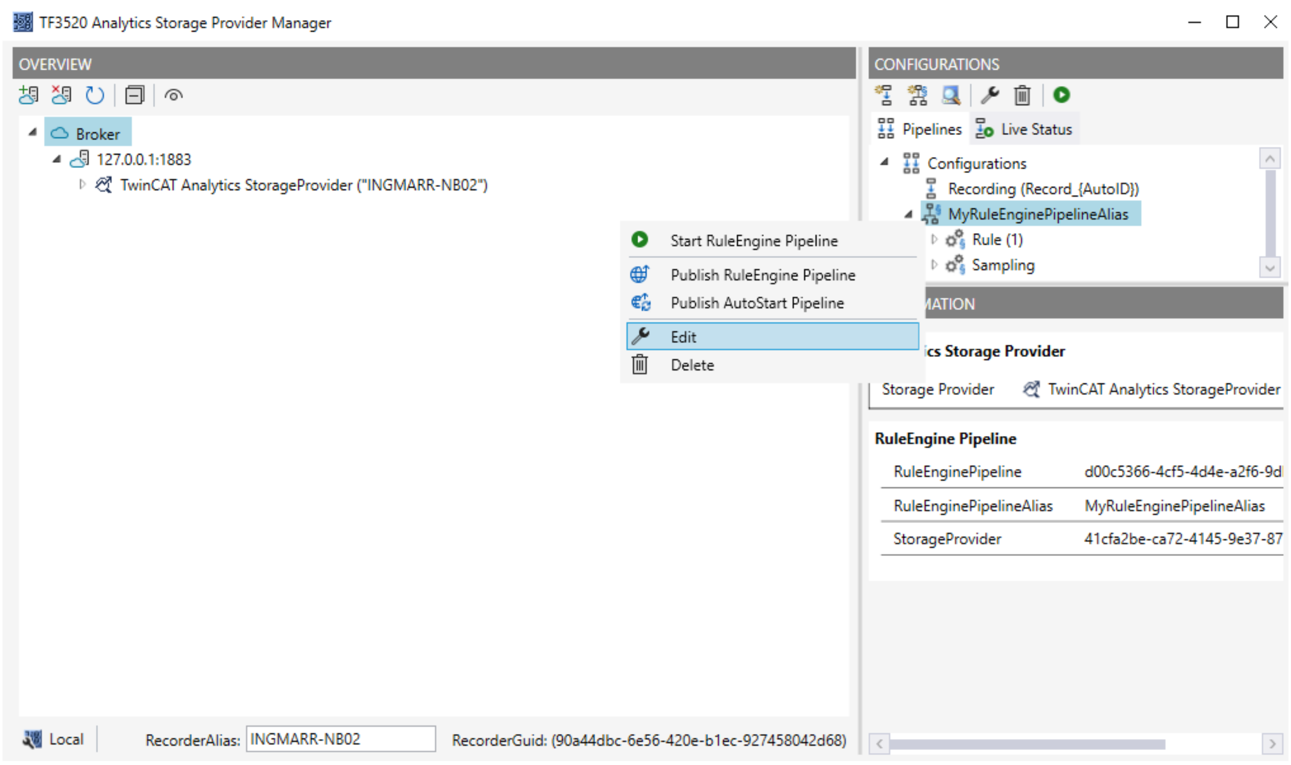
Pipeline Recording

RuleEnginePipeline	6ea1ef18-721f-47c4-a106-53cf
RuleEnginePipelineAlias	MyRuleEnginePipelineAlias
StorageProvider	41cfa2be-ca72-4145-9e37-875

Local RecorderAlias: INGMARR-NB02 RecorderGuid: (90a44dbc-6e56-420e-b1ec-927458042d68)

6.2.2.1.6 Subsequent editing of a RuleEngine pipeline

A RuleEngine pipeline that has been created can be edited and modified by right-clicking **Edit** in the context menu. Please note that existing data can no longer be used in the pipeline if the recordings contained in the pipeline are adjusted.


TF3520 Analytics Storage Provider Manager
OVERVIEW
Broker
127.0.0.1:1883
TwinCAT Analytics StorageProvider ("INGMARR-NB02")
Start RuleEngine Pipeline
Publish RuleEngine Pipeline
Publish AutoStart Pipeline
Edit
Delete
CONFIGURATIONS
Pipelines
Live Status
Configurations
Recording (Record_{AutoID})
MyRuleEnginePipelineAlias
Rule (1)
Sampling
MATION
ics Storage Provider
Local

Storage Provider	TwinCAT Analytics StorageProvider

RuleEngine Pipeline

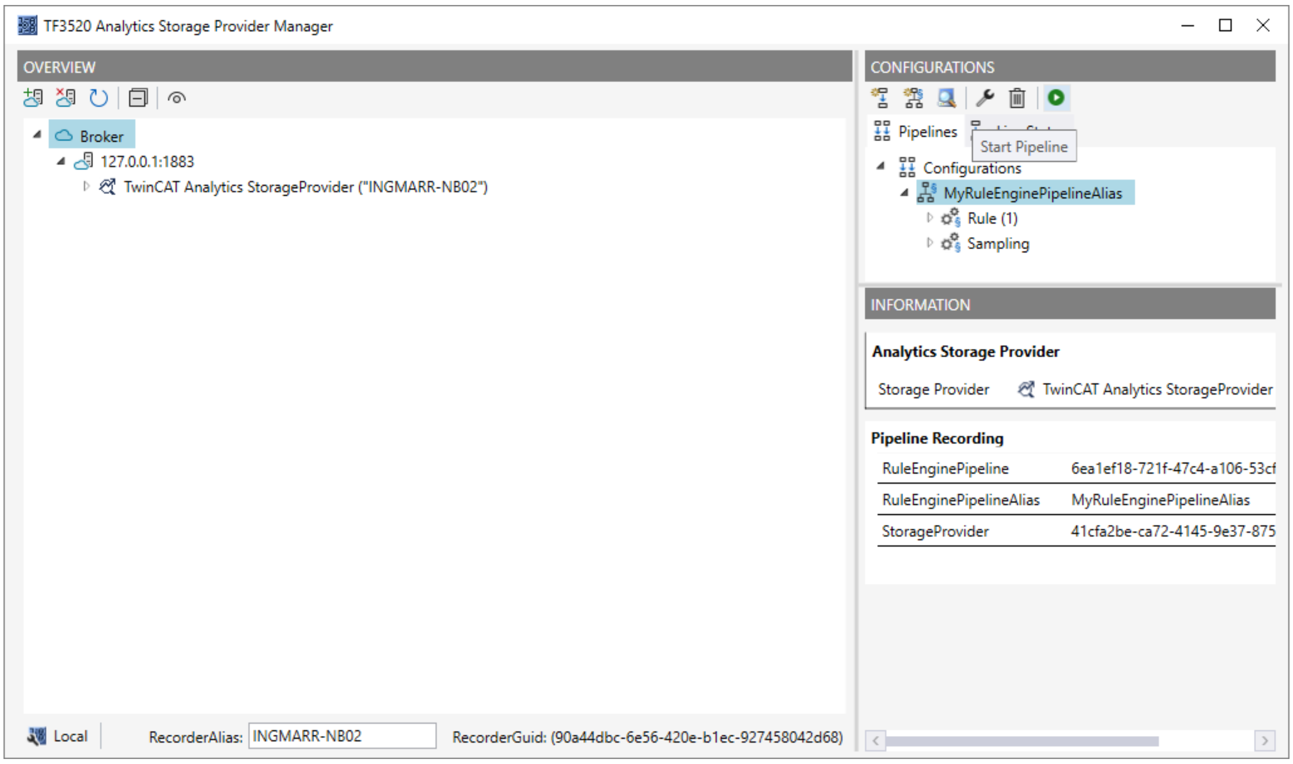
RuleEnginePipeline	d00c5366-4cf5-4d4e-a2f6-9d
RuleEnginePipelineAlias	MyRuleEnginePipelineAlias
StorageProvider	41cfa2be-ca72-4145-9e37-87

RecorderAlias: INGMARR-NB02 RecorderGuid: (90a44dbc-6e56-420e-b1ec-927458042d68)

6.2.2.2 Application

6.2.2.2.1 Starting/stopping a RuleEngine pipeline

A configured RuleEngine pipeline can be started via the **Start** icon.


TF3520 Analytics Storage Provider Manager
OVERVIEW
Broker
127.0.0.1:1883
TwinCAT Analytics StorageProvider ("INGMARR-NB02")
CONFIGURATIONS
Pipelines
Start Pipeline
Configurations
MyRuleEnginePipelineAlias
Rule (1)
Sampling
INFORMATION
Local

Analytics Storage Provider

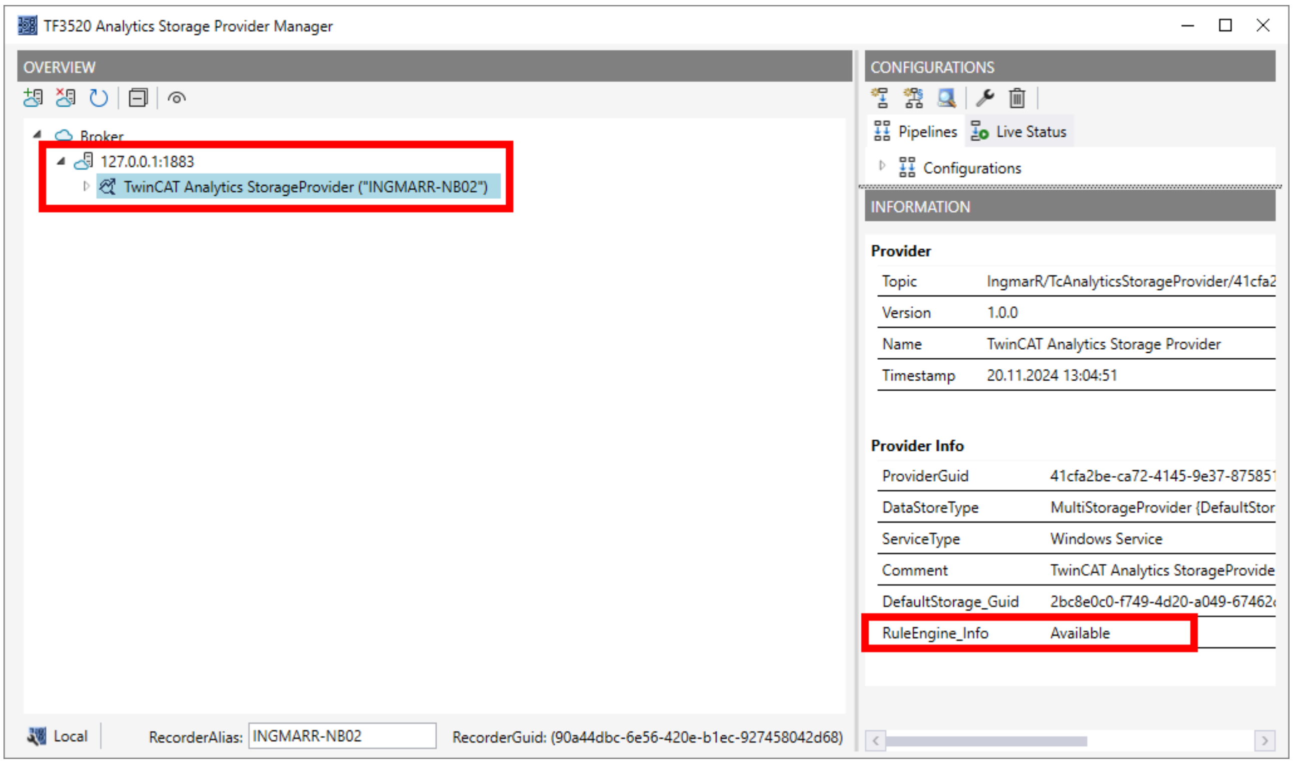
Storage Provider	TwinCAT Analytics StorageProvider

Pipeline Recording

RuleEnginePipeline	6ea1ef18-721f-47c4-a106-53cf
RuleEnginePipelineAlias	MyRuleEnginePipelineAlias
StorageProvider	41cfa2be-ca72-4145-9e37-875

RecorderAlias: INGMARR-NB02 RecorderGuid: (90a44dbc-6e56-420e-b1ec-927458042d68)

A start is only possible if the Storage Provider is running and the RuleEngine in the Storage Provider is running without errors. The status of the RuleEngine can be read via the information of the respective Storage Provider.


TF3520 Analytics Storage Provider Manager

OVERVIEW

Broker
127.0.0.1:1883
TwinCAT Analytics StorageProvider ("INGMARR-NB02")

Local RecorderAlias: INGMARR-NB02 RecorderGuid: (90a44dbc-6e56-420e-b1ec-927458042d68)

CONFIGURATIONS

Pipelines | Live Status

Configurations

INFORMATION

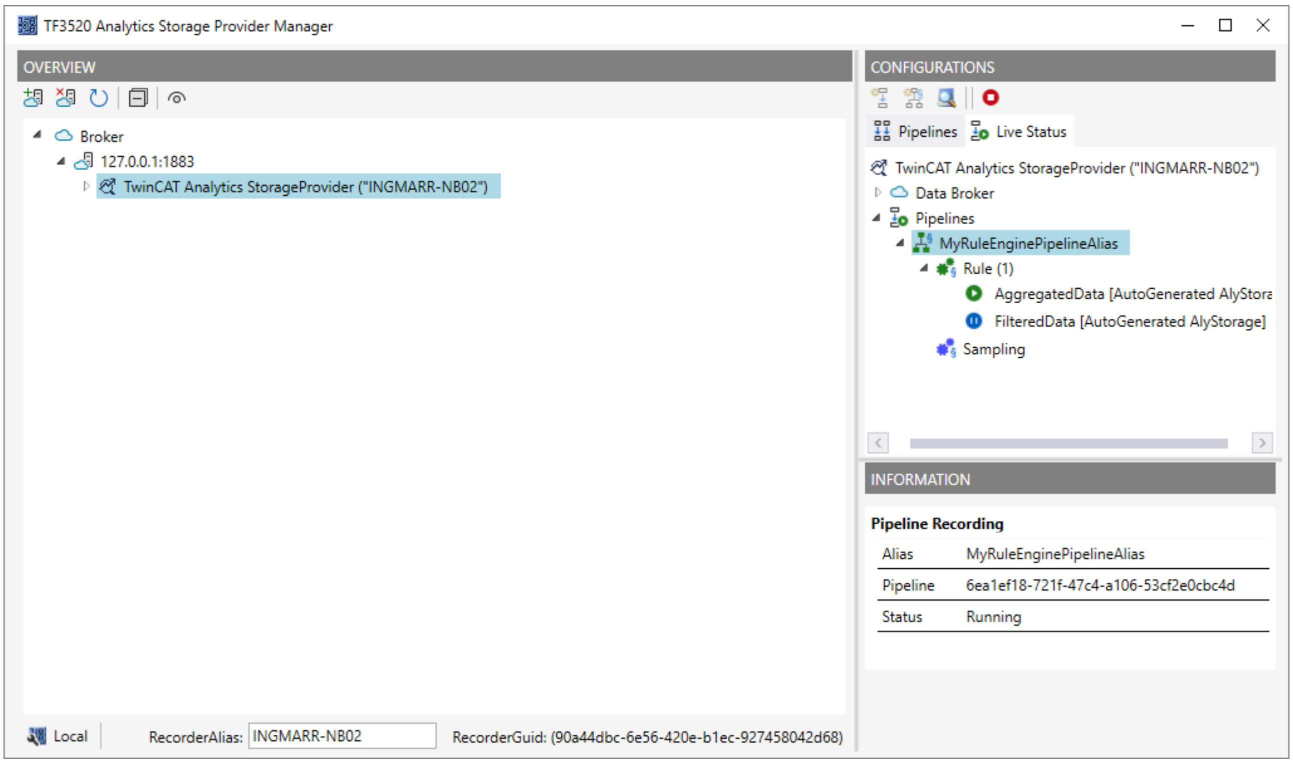
Provider

Topic	IngmarR/TcAnalyticsStorageProvider/41cfa2
Version	1.0.0
Name	TwinCAT Analytics Storage Provider
Timestamp	20.11.2024 13:04:51

Provider Info

ProviderGuid	41cfa2be-ca72-4145-9e37-87585
DataStoreType	MultiStorageProvider {DefaultStor
ServiceType	Windows Service
Comment	TwinCAT Analytics StorageProvide
DefaultStorage_Guid	2bc8e0c0-f749-4d20-a049-67462
RuleEngine_Info	Available

You can view RuleEngine pipelines that have been started in the Live Status tab and stop them there again.


TF3520 Analytics Storage Provider Manager

OVERVIEW

Broker
127.0.0.1:1883
TwinCAT Analytics StorageProvider ("INGMARR-NB02")

Local RecorderAlias: INGMARR-NB02 RecorderGuid: (90a44dbc-6e56-420e-b1ec-927458042d68)

CONFIGURATIONS

Pipelines | Live Status

TwinCAT Analytics StorageProvider ("INGMARR-NB02")
Data Broker
Pipelines
MyRuleEnginePipelineAlias
Rule (1)
AggregatedData [AutoGenerated AlyStora
FilteredData [AutoGenerated AlyStorage]
Sampling

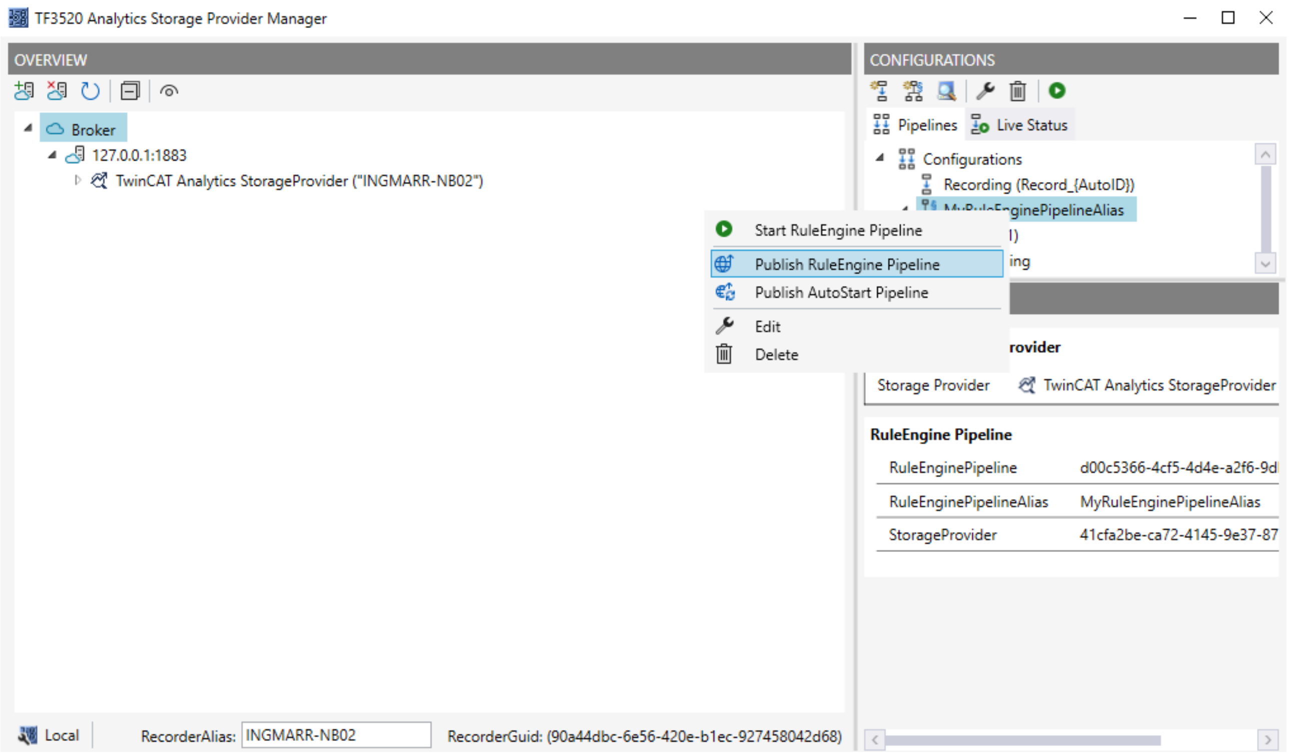
INFORMATION

Pipeline Recording

Alias	MyRuleEnginePipelineAlias
Pipeline	6ea1ef18-721f-47c4-a106-53cf2e0cbc4d
Status	Running

6.2.2.2.2 Publishing RuleEngine pipelines

Locally configured RuleEngine pipelines can be published to the stored Storage Provider. This means that the RuleEngine pipeline is also stored at the Storage Provider and is globally available. Other users can download, edit or start it. To publish, right-click on the locally configured pipeline in the **Publish RuleEngine Pipeline** context menu. In addition, RuleEngine pipelines can be published in Autostart mode. This means that the pipelines are started automatically after the Storage Provider Service is started.


TF3520 Analytics Storage Provider Manager
OVERVIEW
Broker
127.0.0.1:1883
TwinCAT Analytics StorageProvider ("INGMARR-NB02")
CONFIGURATIONS
Pipelines
Live Status
Configurations
Recording (Record_{AutoID})
MyRuleEnginePipelineAlias
Start RuleEngine Pipeline
Publish RuleEngine Pipeline
Publish AutoStart Pipeline
Edit
Delete
Local

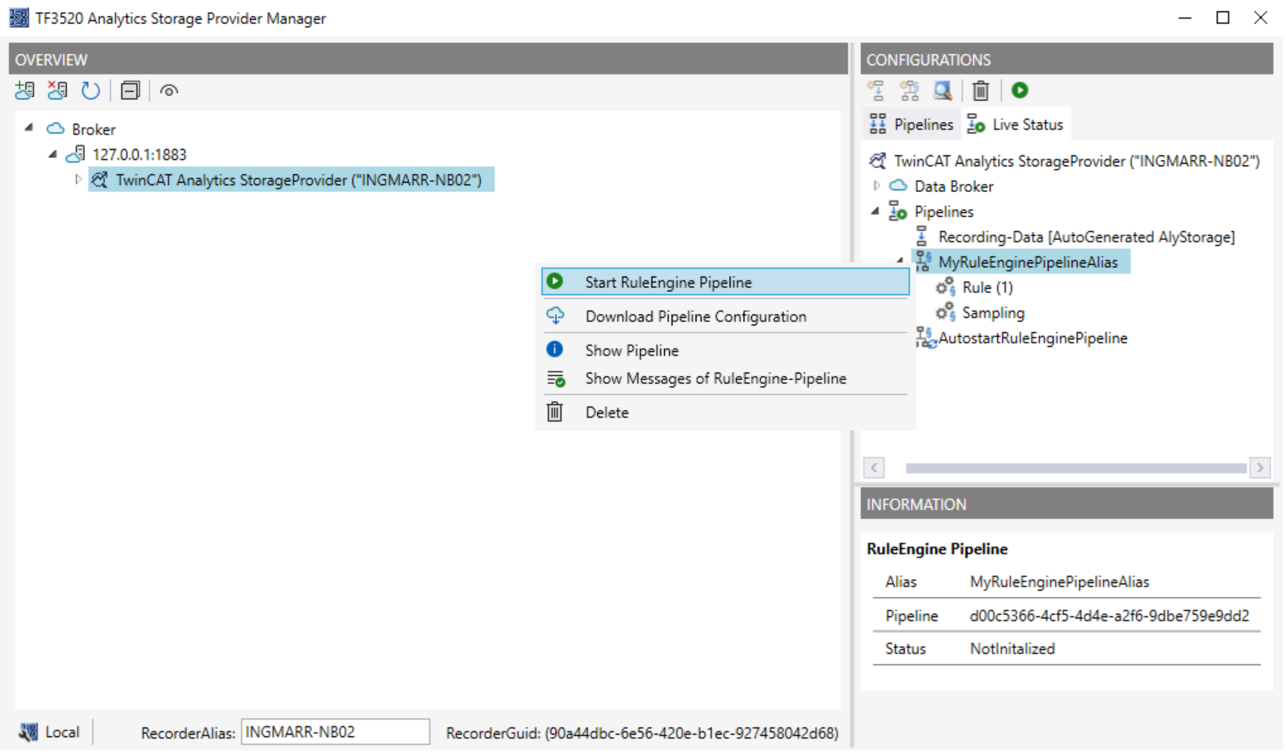
Storage Provider	TwinCAT Analytics StorageProvider

RuleEngine Pipeline

RuleEnginePipeline	d00c5366-4cf5-4d4e-a2f6-9d
RuleEnginePipelineAlias	MyRuleEnginePipelineAlias
StorageProvider	41cfa2be-ca72-4145-9e37-87

RecorderAlias: INGMARR-NB02 RecorderGuid: (90a44dbc-6e56-420e-b1ec-927458042d68)

All published pipelines can be viewed under **Live Status**. These can be started, deleted or downloaded.


TF3520 Analytics Storage Provider Manager
OVERVIEW
Broker
127.0.0.1:1883
TwinCAT Analytics StorageProvider ("INGMARR-NB02")
CONFIGURATIONS
Pipelines
Live Status
TwinCAT Analytics StorageProvider ("INGMARR-NB02")
Data Broker
Pipelines
Recording-Data [AutoGenerated AlyStorage]
MyRuleEnginePipelineAlias
Rule (1)
Sampling
AutostartRuleEnginePipeline
Start RuleEngine Pipeline
Download Pipeline Configuration
Show Pipeline
Show Messages of RuleEngine-Pipeline
Delete
INFORMATION
Local

RuleEngine Pipeline

Alias	MyRuleEnginePipelineAlias
Pipeline	d00c5366-4cf5-4d4e-a2f6-9dbe759e9dd2
Status	NotInitalized

RecorderAlias: INGMARR-NB02 RecorderGuid: (90a44dbc-6e56-420e-b1ec-927458042d68)

6.2.2.2.3 RuleEngine pipeline states

A RuleEngine pipeline can have the following states:

	NotInitalized: The started RuleEngine pipeline was received by the Storage Provider but not processed.
	Initalizing: The RuleEngine pipeline is initialized. The corresponding rules are created.
	IsStarting: The RuleEngine pipeline is starting. Included rules are started.
	Running: The RuleEngine pipeline is running. All rules are at least in the Pending state and there is no error.
	IsStopping: The RuleEngine pipeline is stopping, all rules are stopping.
	Stopped: The RuleEngine pipeline is stopped, all rules are stopped.
	Error: There is an error in at least one rule.

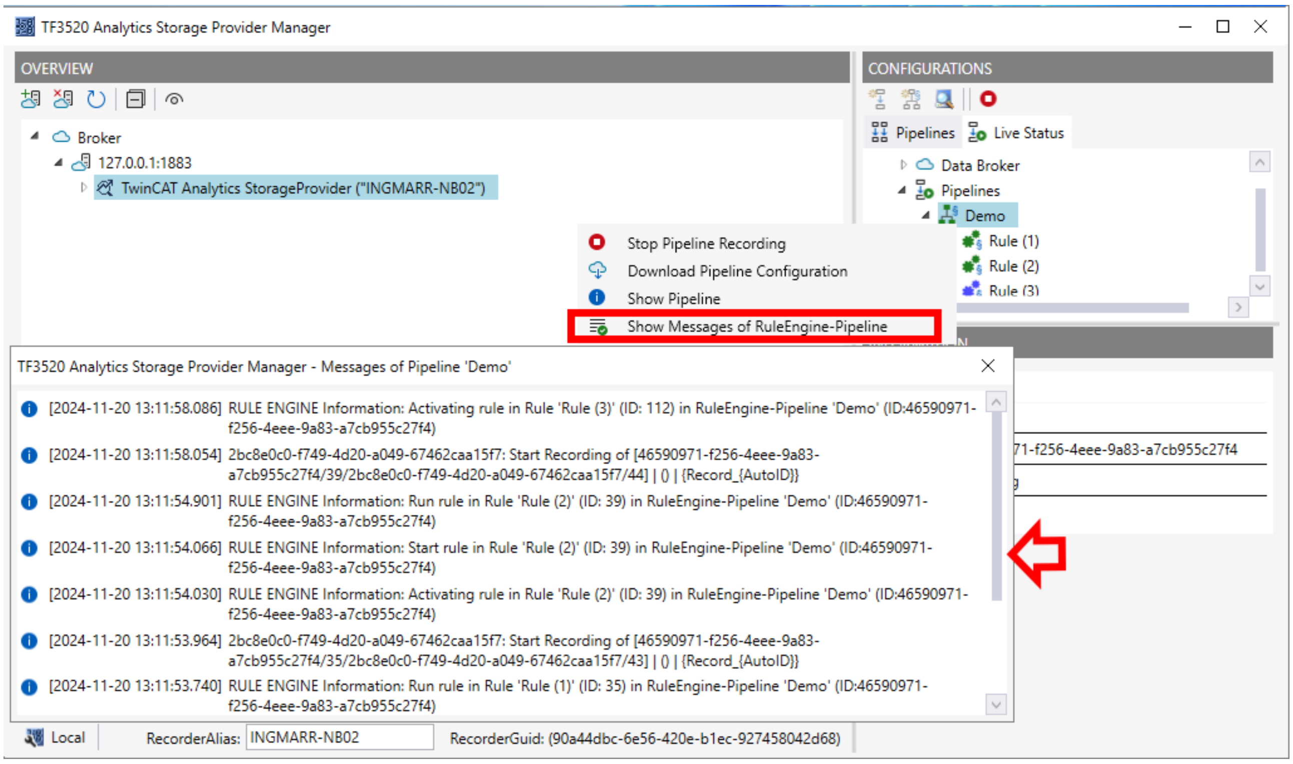
6.2.2.2.4 Rule states

You can also view the state of the rules from the RuleEngine pipeline in the Live Status. A rule has the following states:

	NotInitialized: The configuration of the rule has been read, but the rule has not yet been processed.
	Initializing: The rule is initializing. The necessary sources are generated in the RuleEngine.
	Deactivated: The rule is ready for activation. It is not currently running.
	Activating: The rule will be activated. Any triggers will be started.
	Pending: The rule is activated. Any triggers have been started. The rule can now be triggered manually. StreamingDataRules go directly from the Pending state to the Starting state.
	Starting: The rule is starting. The corresponding processing modules are generated and a connection to the data sources is established.
	Running: The rule runs and processes data.
	Stopping: The rule is stopping. Stopping is called when the RuleEngine pipeline will be stopped. BatchDataRules also stop when all data has been processed. The rule then switches to the Pending state.
	Deactivating: The rule will be deactivated. It is no longer possible to start up using a trigger.
	Invalid: The rule is in an invalid state and must be restarted.
	Error: The rule is in an error state. This can happen, for example, if a data source (Analytics Logger) is not available. In this case, the rule restarts automatically as soon as the data source is available again. For all other errors, the rule must be restarted manually. This can be done via the Storage Provider Manager or the API or PLC library.

6.2.2.2.5 Messages from RuleEngine pipelines

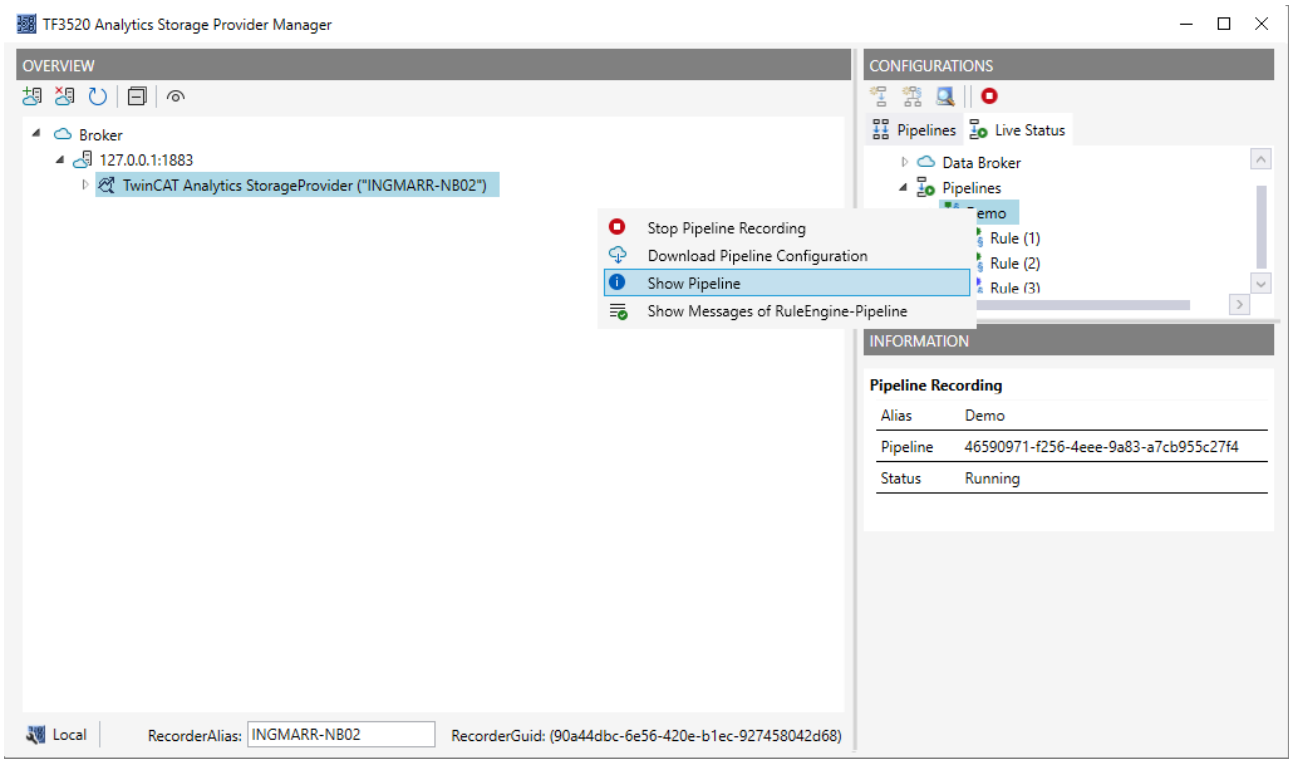
The messages from RuleEngine pipelines provide more detailed information about errors and status information. The messages can be viewed via the context menu of a running RuleEngine pipeline. To do this, click on **Show Messages of RuleEngine-Pipeline**. A window with all available messages opens. If there are no messages in the window, these messages are no longer available. More accurate information can be found in the log from the Storage Provider, if this is activated.


TF3520 Analytics Storage Provider Manager
OVERVIEW
Broker
127.0.0.1:1883
TwinCAT Analytics StorageProvider ("INGMARR-NB02")
CONFIGURATIONS
Pipelines
Live Status
Data Broker
Pipelines
Demo
Rule (1)
Rule (2)
Rule (3)
Stop Pipeline Recording
Download Pipeline Configuration
Show Pipeline
Show Messages of RuleEngine-Pipeline
TF3520 Analytics Storage Provider Manager - Messages of Pipeline 'Demo'
Local
RecorderAlias: INGMARR-NB02
RecorderGuid: (90a44dbc-6e56-420e-b1ec-927458042d68)

```
[2024-11-20 13:11:58.086] RULE ENGINE Information: Activating rule in Rule 'Rule (3)' (ID: 112) in RuleEngine-Pipeline 'Demo' (ID:46590971-
                          f256-4eee-9a83-a7cb955c27f4)
[2024-11-20 13:11:58.054] 2bc8e0c0-f749-4d20-a049-67462caa15f7: Start Recording of [46590971-f256-4eee-9a83-
                          a7cb955c27f4/39/2bc8e0c0-f749-4d20-a049-67462caa15f7/44] | () | {Record_{AutoID}}
[2024-11-20 13:11:54.901] RULE ENGINE Information: Run rule in Rule 'Rule (2)' (ID: 39) in RuleEngine-Pipeline 'Demo' (ID:46590971-
                          f256-4eee-9a83-a7cb955c27f4)
[2024-11-20 13:11:54.066] RULE ENGINE Information: Start rule in Rule 'Rule (2)' (ID: 39) in RuleEngine-Pipeline 'Demo' (ID:46590971-
                          f256-4eee-9a83-a7cb955c27f4)
[2024-11-20 13:11:54.030] RULE ENGINE Information: Activating rule in Rule 'Rule (2)' (ID: 39) in RuleEngine-Pipeline 'Demo' (ID:46590971-
                          f256-4eee-9a83-a7cb955c27f4)
[2024-11-20 13:11:53.964] 2bc8e0c0-f749-4d20-a049-67462caa15f7: Start Recording of [46590971-f256-4eee-9a83-
                          a7cb955c27f4/35/2bc8e0c0-f749-4d20-a049-67462caa15f7/43] | () | {Record_{AutoID}}
[2024-11-20 13:11:53.740] RULE ENGINE Information: Run rule in Rule 'Rule (1)' (ID: 35) in RuleEngine-Pipeline 'Demo' (ID:46590971-
                          f256-4eee-9a83-a7cb955c27f4)
```

6.2.2.2.6 Triggering and restarting rules

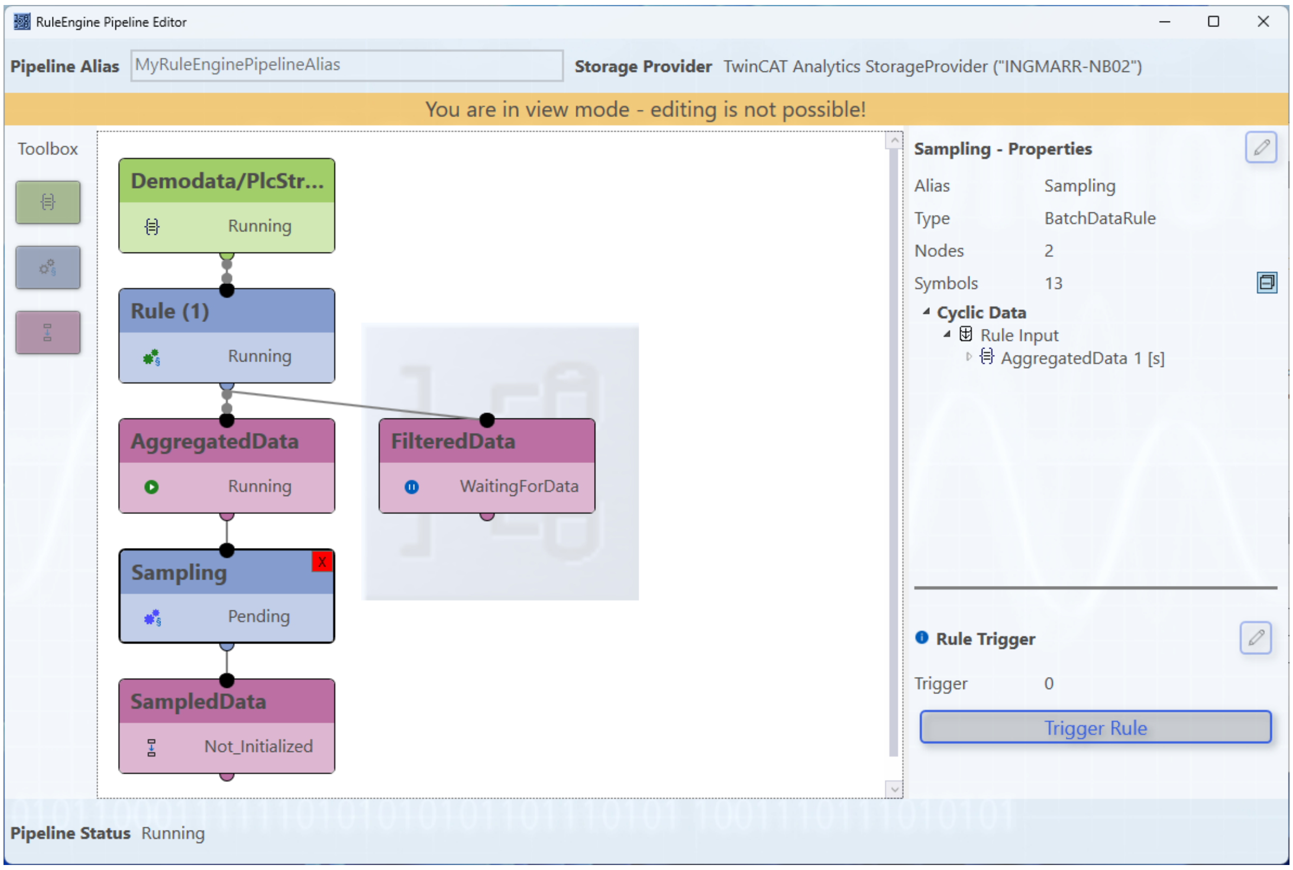
Rules can be triggered or restarted via the RuleEngine Pipeline Editor. The editor must be opened via a running RuleEngine pipeline (**context menu > Show Pipeline**).


TF3520 Analytics Storage Provider Manager
OVERVIEW
Broker
127.0.0.1:1883
TwinCAT Analytics StorageProvider ("INGMARR-NB02")
CONFIGURATIONS
Pipelines
Live Status
Data Broker
Pipelines
emo
Rule (1)
Rule (2)
Rule (3)
Stop Pipeline Recording
Download Pipeline Configuration
Show Pipeline
Show Messages of RuleEngine-Pipeline
INFORMATION
Local
RecorderAlias: INGMARR-NB02
RecorderGuid: (90a44dbc-6e56-420e-b1ec-927458042d68)

Pipeline Recording

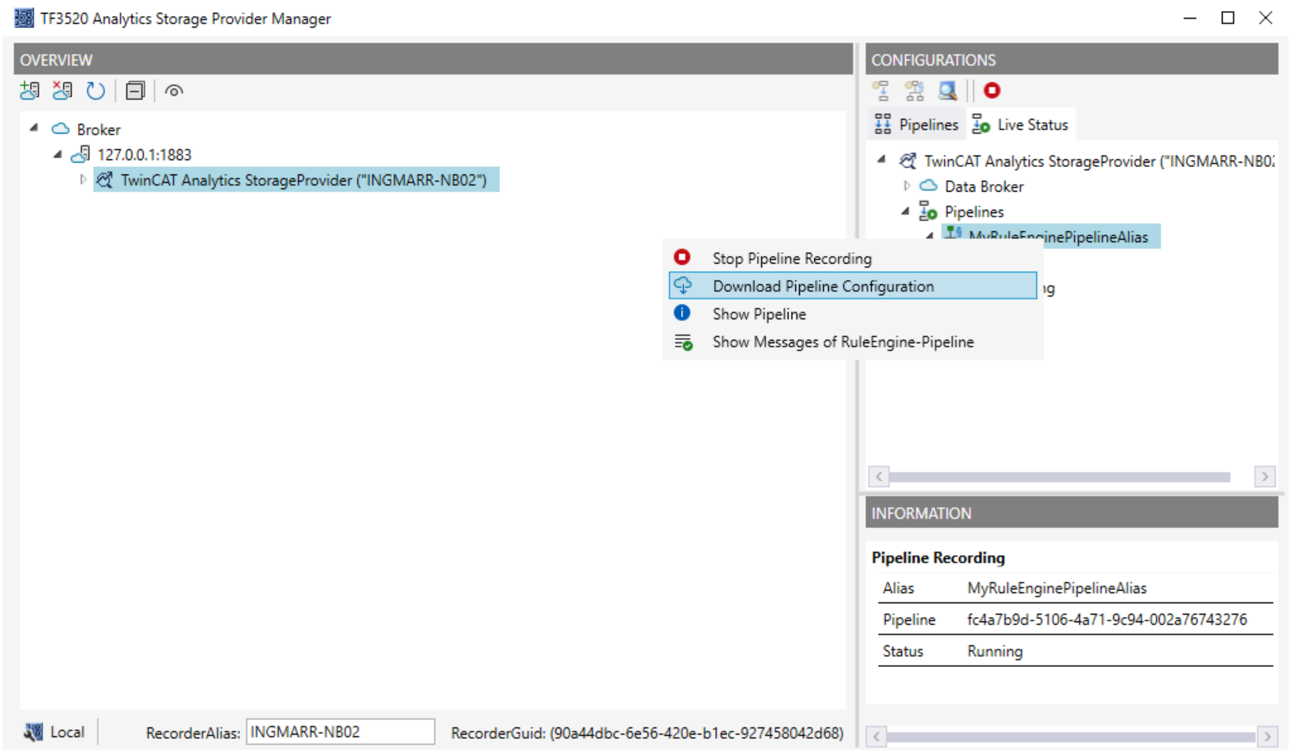
Alias	Demo
Pipeline	46590971-f256-4eee-9a83-a7cb955c27f4
Status	Running

The RuleEngine Pipeline Editor opens in view mode. Processing is not possible there. In view mode, the status of the individual elements can be viewed and the corresponding rule can be triggered or restarted. Triggering is only possible when the rule is in the Pending state. A restart can only be performed if the rule is in an error state or has not been initialized.


RuleEngine Pipeline Editor
Pipeline Alias MyRuleEnginePipelineAlias
Storage Provider TwinCAT Analytics StorageProvider ("INGMARR-NB02")
You are in view mode - editing is not possible!
Toolbox
Demodata/PlcStr... Running
Rule (1) Running
AggregatedData Running
FilteredData WaitingForData
Sampling Pending
SampledData Not_Initialized
Sampling - Properties
Alias Sampling
Type BatchDataRule
Nodes 2
Symbols 13
Cyclic Data
Rule Input
AggregatedData 1 [s]
Rule Trigger
Trigger 0
Trigger Rule
Pipeline Status Running

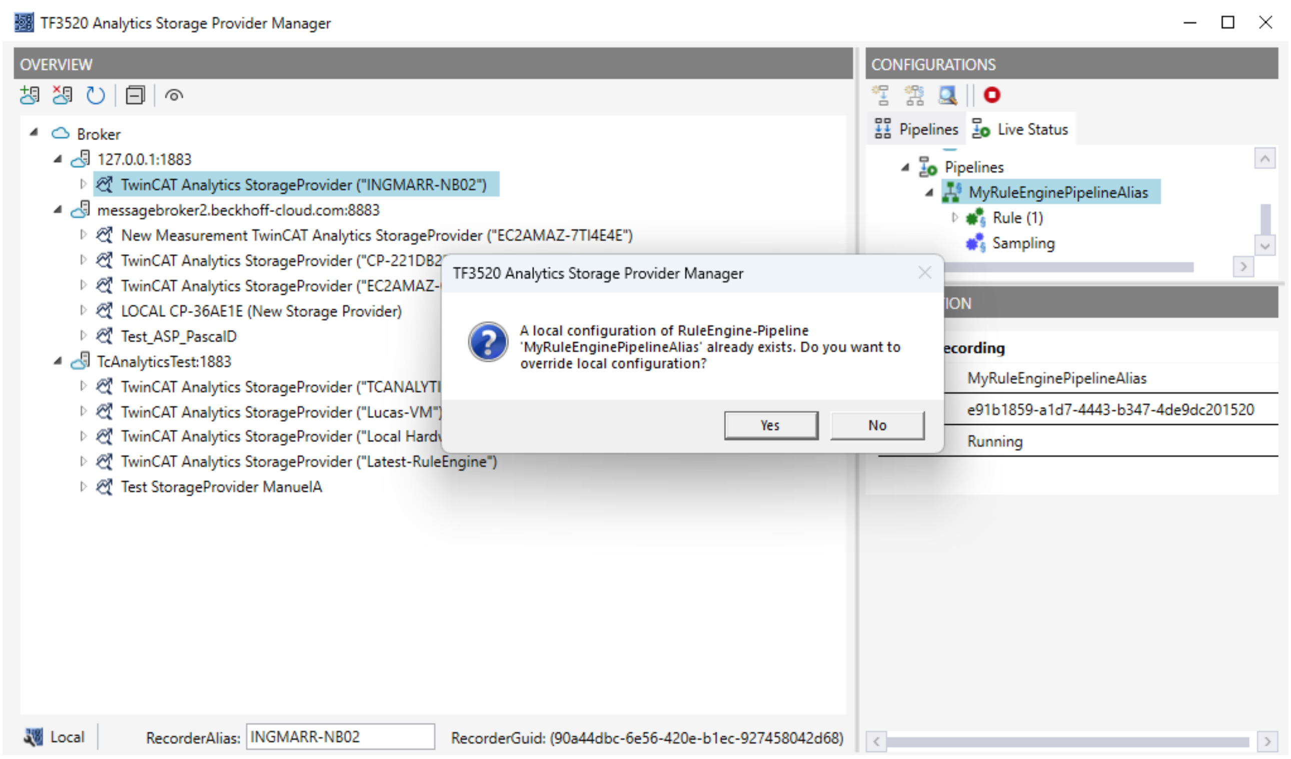
6.2.2.2.7 Download RuleEngine pipelines

A copy of a running RuleEngine pipeline can be downloaded to the local manager by **right-clicking > Download**. If a RuleEngine pipeline with the same pipeline ID already exists, you can choose to overwrite it or create a copy with a new pipeline ID.

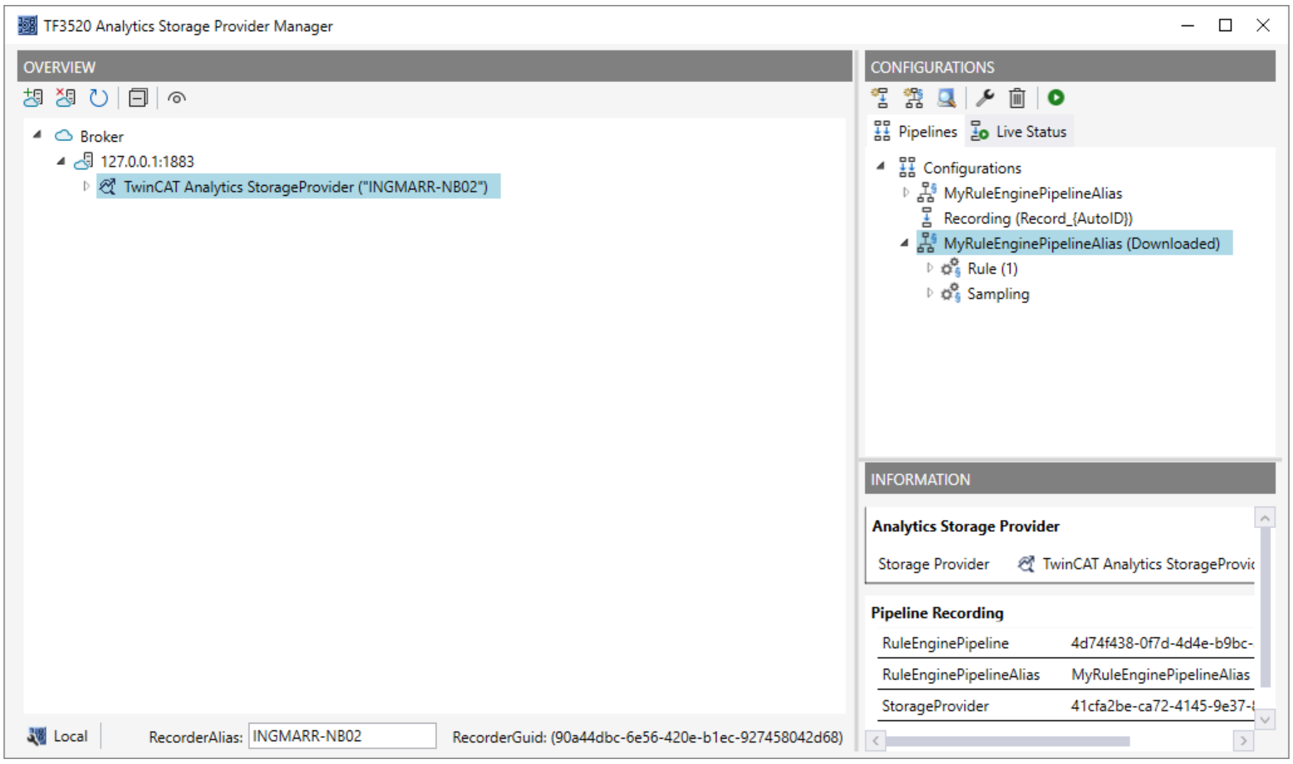

TF3520 Analytics Storage Provider Manager
OVERVIEW
Broker
127.0.0.1:1883
TwinCAT Analytics StorageProvider ("INGMARR-NB02")
CONFIGURATIONS
Pipelines
Live Status
TwinCAT Analytics StorageProvider ("INGMARR-NB0
Data Broker
Pipelines
MyRuleEnginePipelineAlias
Stop Pipeline Recording
Download Pipeline Configuration
Show Pipeline
Show Messages of RuleEngine-Pipeline
INFORMATION
Pipeline Recording
Local

Alias	MyRuleEnginePipelineAlias
Pipeline	fc4a7b9d-5106-4a71-9c94-002a76743276
Status	Running

RecorderAlias: INGMARR-NB02 RecorderGuid: (90a44dbc-6e56-420e-b1ec-927458042d68)


TF3520 Analytics Storage Provider Manager
OVERVIEW
CONFIGURATIONS
Broker
127.0.0.1:1883
TwinCAT Analytics StorageProvider ("INGMARR-NB02")
messagebroker2.beckhoff-cloud.com:8883
New Measurement TwinCAT Analytics StorageProvider ("EC2AMAZ-7TI4E4E")
TwinCAT Analytics StorageProvider ("CP-221DB2
TwinCAT Analytics StorageProvider ("EC2AMAZ-
LOCAL CP-36AE1E (New Storage Provider)
Test_ASP_PascalD
TcAnalyticsTest:1883
TwinCAT Analytics StorageProvider ("TCANALYTI
TwinCAT Analytics StorageProvider ("Lucas-VM")
TwinCAT Analytics StorageProvider ("Local Hardv
TwinCAT Analytics StorageProvider ("Latest-RuleEngine")
Test StorageProvider ManuelA
Pipelines
Live Status
Pipelines
MyRuleEnginePipelineAlias
Rule (1)
Sampling
ION
ecording
MyRuleEnginePipelineAlias
e91b1859-a1d7-4443-b347-4de9dc201520
Running
Local
RecorderAlias: INGMARR-NB02
RecorderGuid: (90a44dbc-6e56-420e-b1ec-927458042d68)
TF3520 Analytics Storage Provider Manager
Yes
No

A local configuration of RuleEngine-Pipeline 'MyRuleEnginePipelineAlias' already exists. Do you want to override local configuration?


TF3520 Analytics Storage Provider Manager
OVERVIEW
CONFIGURATIONS
Broker
127.0.0.1:1883
TwinCAT Analytics StorageProvider ("INGMARR-NB02")
Pipelines
Live Status
Configurations
MyRuleEnginePipelineAlias
Recording (Record_{AutoID})
MyRuleEnginePipelineAlias (Downloaded)
Rule (1)
Sampling
INFORMATION
Local
RecorderAlias: INGMARR-NB02
RecorderGuid: (90a44dbc-6e56-420e-b1ec-927458042d68)

Analytics Storage Provider

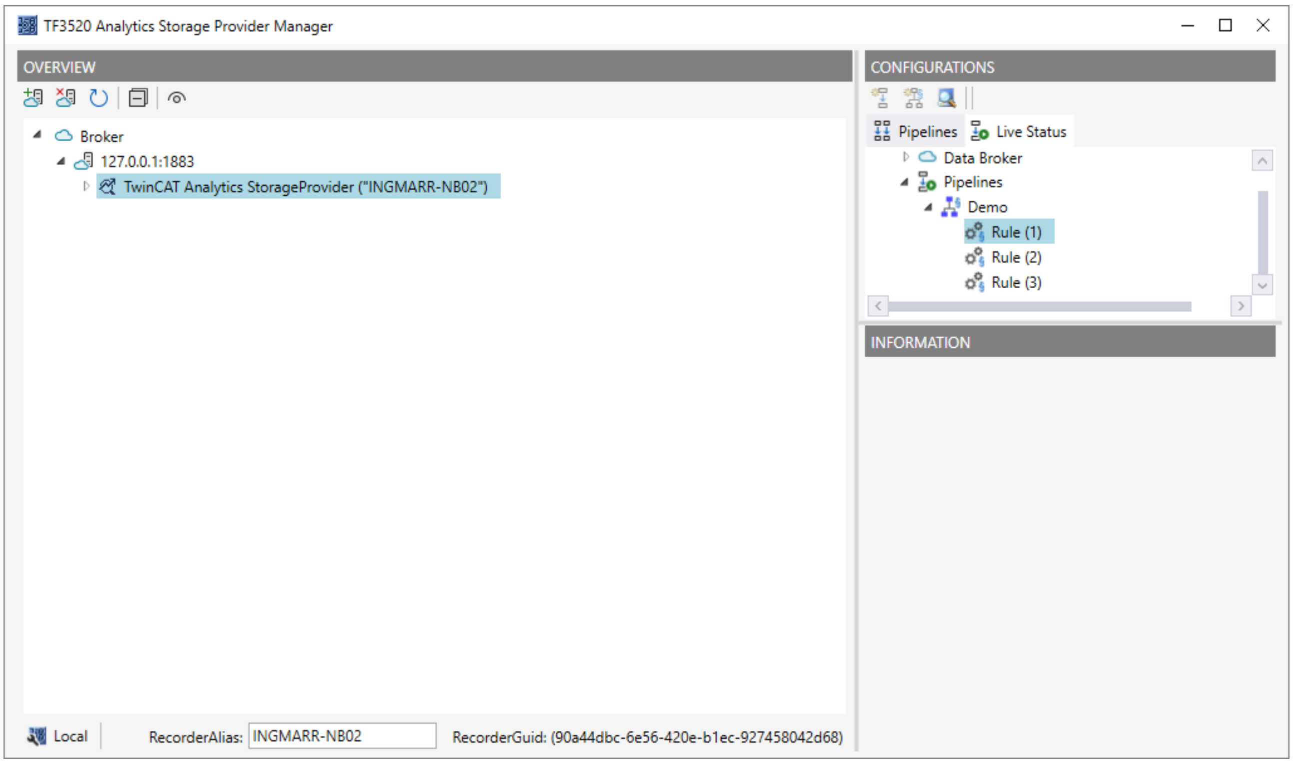
Storage Provider	TwinCAT Analytics StorageProvic

Pipeline Recording

RuleEnginePipeline	4d74f438-0f7d-4d4e-b9bc-
RuleEnginePipelineAlias	MyRuleEnginePipelineAlias
StorageProvider	41cfa2be-ca72-4145-9e37-(

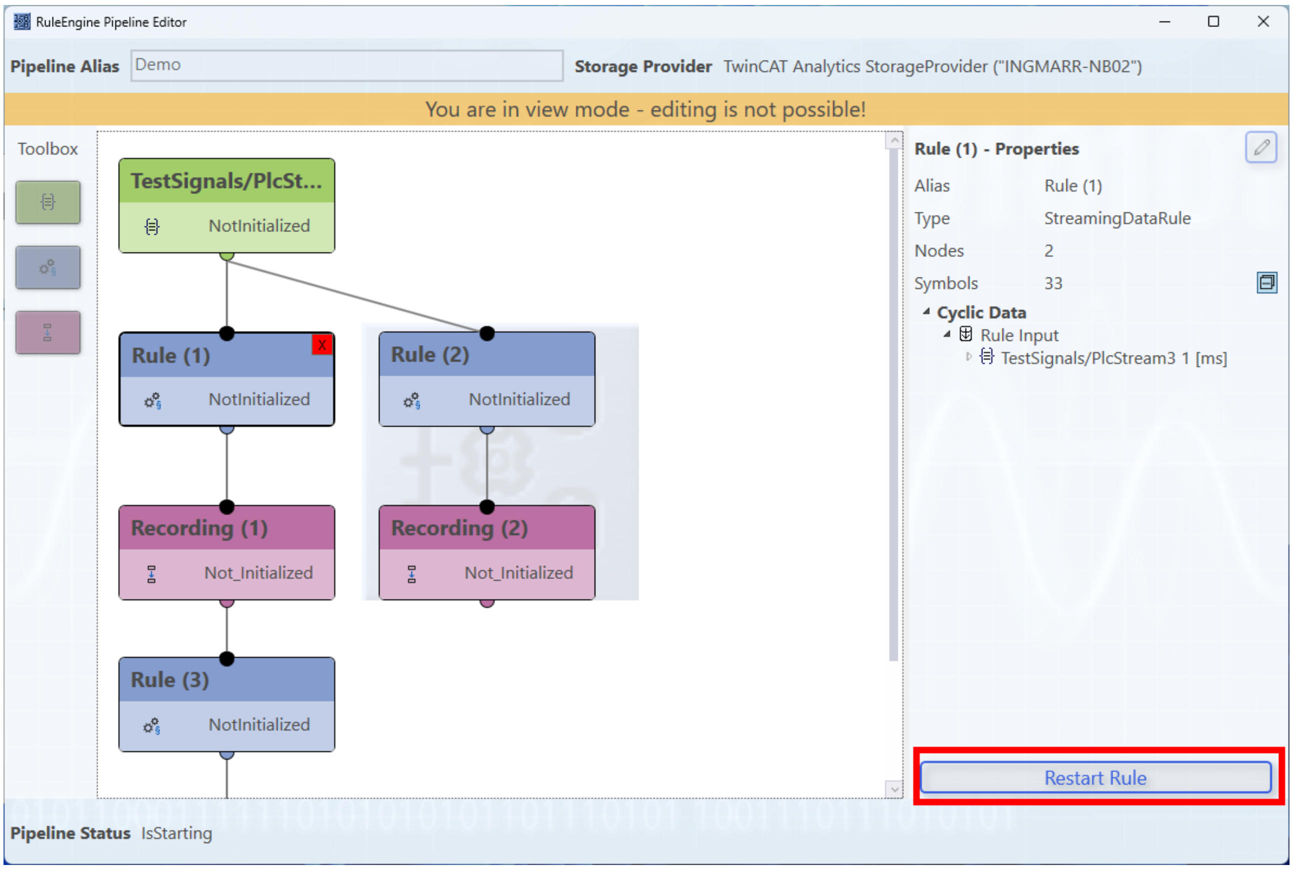
6.2.2.2.8 RuleEngine error case

If an error occurs within the RuleEngine that it cannot resolve on its own, the RuleEngine is restarted. All existing RuleEngine pipelines are shut down for this purpose. After the RuleEngine is restarted, the RuleEngine pipelines are created again. However, the rules contained therein are not automatically restarted. This must be done manually [▸ 91] using the RuleEngine Pipeline Editor.



RecorderAlias: INGMARR-NB02

RecorderGuid: (90a44dbc-6e56-420e-b1ec-927458042d68)



Pipeline Alias: Demo

Storage Provider: TwinCAT Analytics StorageProvider ("INGMARR-NB02")

You are in view mode - editing is not possible!

Rule (1) - Properties

Alias	Rule (1)
Type	StreamingDataRule
Nodes	2
Symbols	33

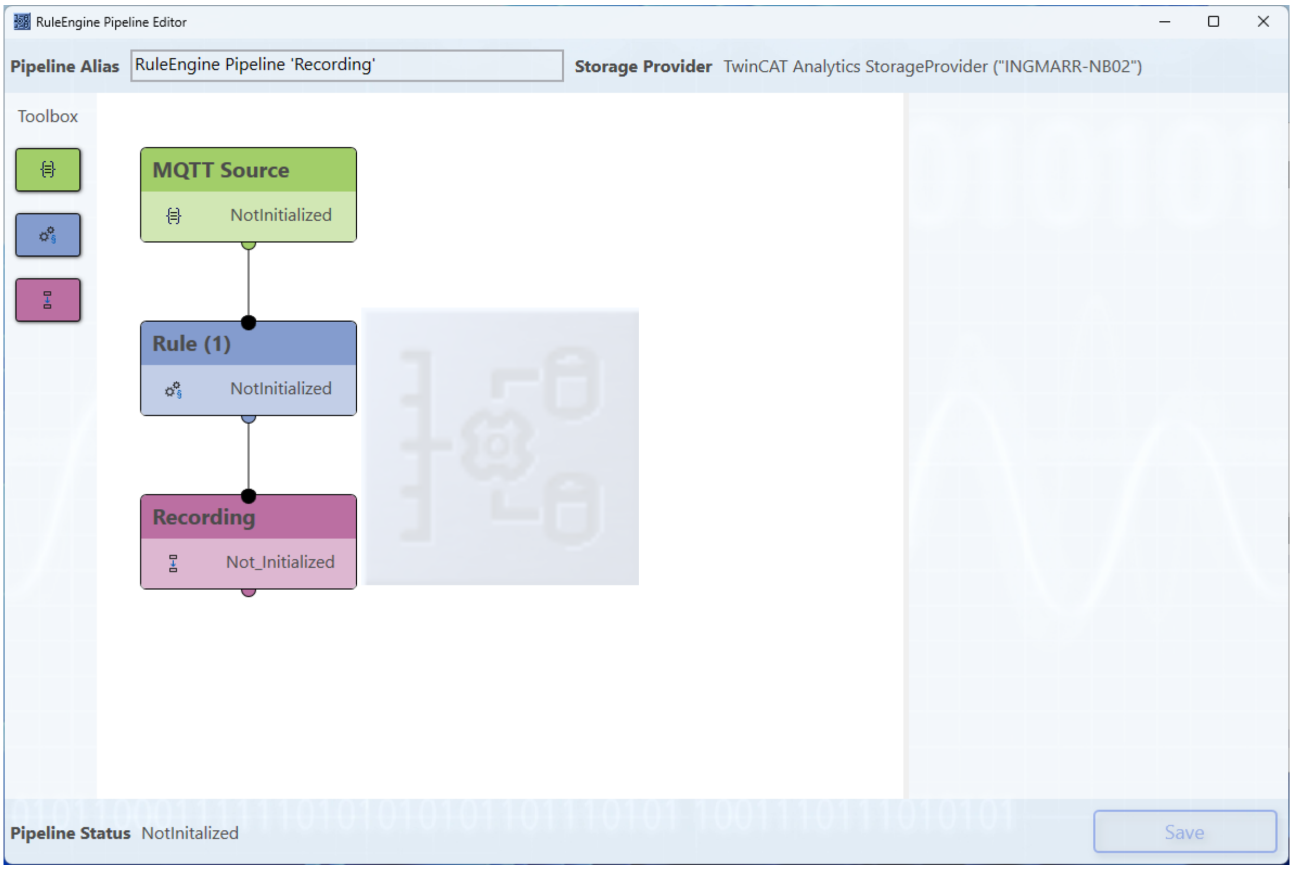
Cyclic Data
- Rule Input
  - TestSignals/PlcStream3 1 [ms]

Pipeline Status: IsStarting

For a more detailed description of the error, see the messages or the log of the Storage Provider.

6.2.2.3 Converting old recordings

An existing pipeline (previous recording) can be converted into a RuleEngine by right-clicking **Convert to RuleEngine-Pipeline**. The new configuration opens in the RuleEngine Pipeline Editor and can be edited there.



RuleEngine Pipeline Editor

Pipeline Alias RuleEngine Pipeline 'Recording' **Storage Provider** TwinCAT Analytics StorageProvider ("INGMARR-NB02")

Pipeline Status NotInitalized

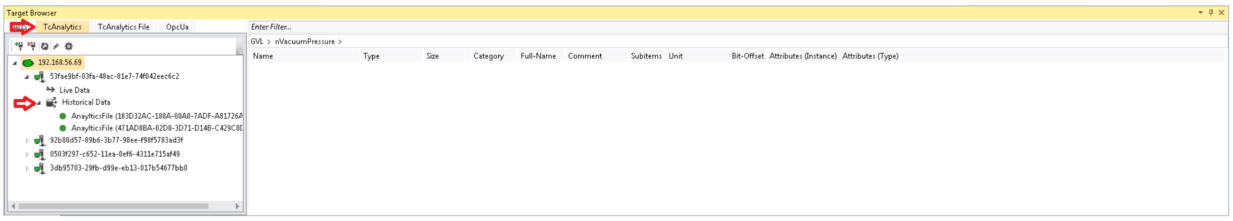
6.3 Working with Historical Data

Historical Data can be analysed with the Analytics Workbench or the Analytics Service Tool. To see your recorded data, you need the TwinCAT Target Browser.

Selection of data from the TwinCAT Target Browser

The historical data can be pulled directly from the Target Browser to an input of an analysis algorithm.

1. First, you need to click **TcAnalytics** in the left corner of Target Browser. There you can see your configured broker, which lists live and historical data from your various devices. This should look like the following figure.



Target Browser

ADS | TcAnalytics | TcAnalytics File | OpcUa

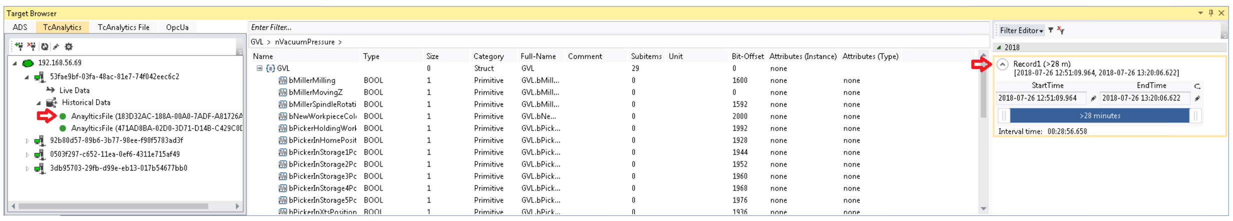
```
192.168.56.69
  53fae9bf-03fa-48ac-81e7-74f042eec6c2
    Live Data
    Historical Data
      AnayIticsFile (183D32AC-188A-00A0-7ADF-A81726A
      AnayIticsFile (471AD8BA-02D0-3D71-D14B-C429C0D
  92b80d57-89b6-3b77-98ee-f98f5783ad3f
  0503f297-c652-11ea-0ef6-4311e715af49
  3db95703-29fb-d99e-eb13-017b54677bb0
```

Enter Filter...

GVL > nVacuumPressure >

Name	Type	Size	Category	Full-Name	Comment	Subitems	Unit	Bit-Offset	Attributes (Instance)	Attributes (Type)

2. Go to the historical stream you created and select the recording to be analyzed. All your records are listed in the **Record** window on the right. The last recording is selected by default.



Target Browser

ADS | TcAnalytics | TcAnalytics File | OpcUa

```
192.168.56.69
  53fae9bf-03fa-48ac-81e7-74f042eec6c2
    Live Data
    Historical Data
      AnayIticsFile (183D32AC-188A-00A0-7ADF-A81726A
      AnayIticsFile (471AD8BA-02D0-3D71-D14B-C429C0D
  92b80d57-89b6-3b77-98ee-f98f5783ad3f
  0503f297-c652-11ea-0ef6-4311e715af49
  3db95703-29fb-d99e-eb13-017b54677bb0
```

Enter Filter...

GVL > nVacuumPressure >

Name	Type	Size	Category	Full-Name	Comment	Subitems	Unit	Bit-Offset	Attributes (Instance)	Attributes (Type)
GVL		0	Struct	GVL		29		0	none	
bMillerMilling	BOOL	1	Primitive	GVL.bMill...		0		1600	none	none
bMillerMovingZ	BOOL	1	Primitive	GVL.bMill...		0		0	none	none
bMillerSpindleRotati	BOOL	1	Primitive	GVL.bMill...		0		1592	none	none
bNewWorkpieceCol	BOOL	1	Primitive	GVL.bNe...		0		2000	none	none
bPickerHoldingWork	BOOL	1	Primitive	GVL.bPick...		0		1992	none	none
bPickerInHomePosit	BOOL	1	Primitive	GVL.bPick...		0		1928	none	none
bPickerInStorage1Pc	BOOL	1	Primitive	GVL.bPick...		0		1944	none	none
bPickerInStorage2Pc	BOOL	1	Primitive	GVL.bPick...		0		1952	none	none
bPickerInStorage3Pc	BOOL	1	Primitive	GVL.bPick...		0		1960	none	none
bPickerInStorage4Pc	BOOL	1	Primitive	GVL.bPick...		0		1968	none	none
bPickerInStorage5Pc	BOOL	1	Primitive	GVL.bPick...		0		1976	none	none
bPickerInXtsPosition	BOOL	1	Primitive	GVL.bPick...		0		1936	none	none

Filter Editor

2018

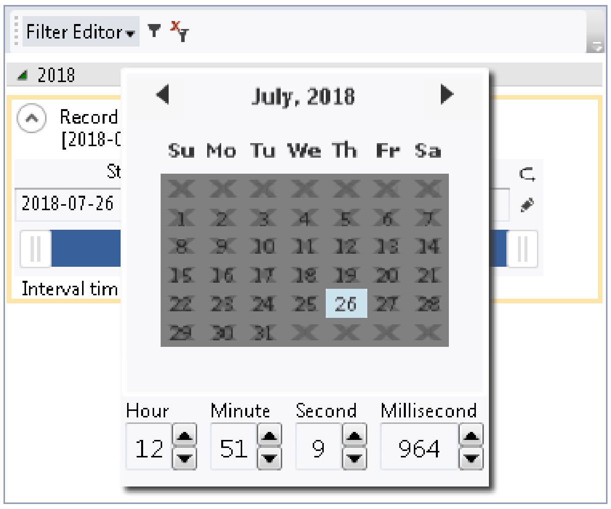
Record1 (>28 m)
[2018-07-26 12:51:09.964, 2018-07-26 13:20:06.622]

StartTime	EndTime
2018-07-26 12:51:09.964	2018-07-26 13:20:06.622

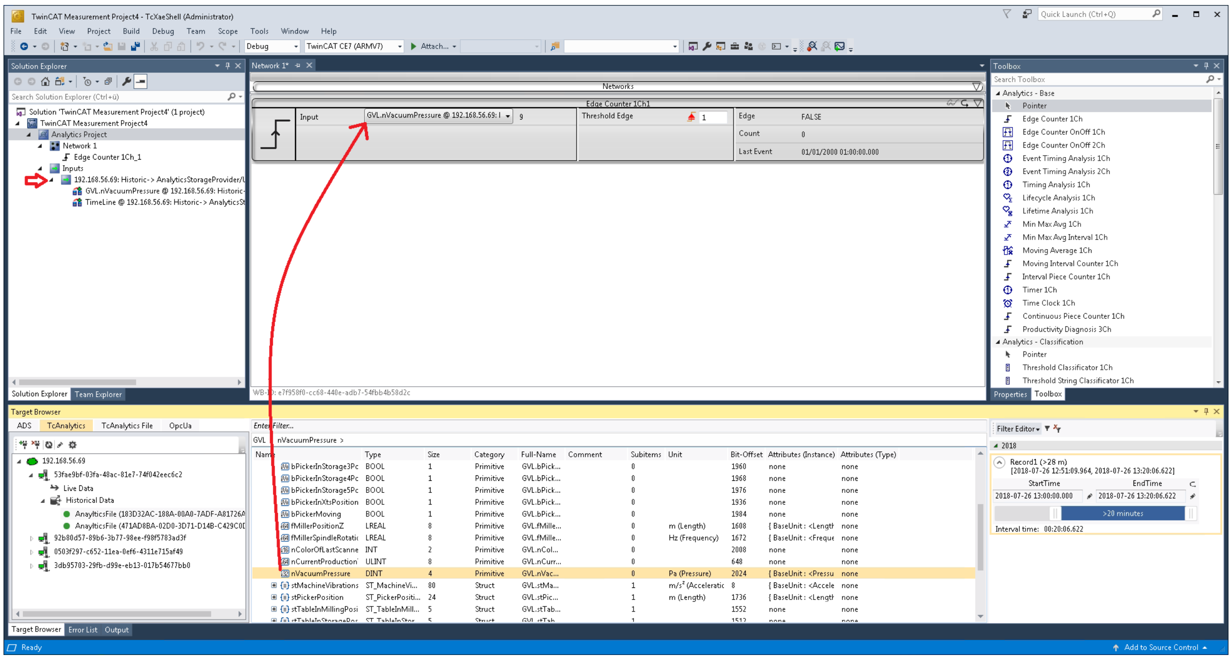
>28 minutes

Interval time: 00:28:56.658

3. When you record live, the time range of the recording is updated every few seconds. The entire time range of a recording is used by default. You can also edit the start and end time to analyze your desired data area. This can be done with a slider, text fields or in a graphical calendar view. If you click on the symbol to the right of the text fields, the calendar view will be displayed.



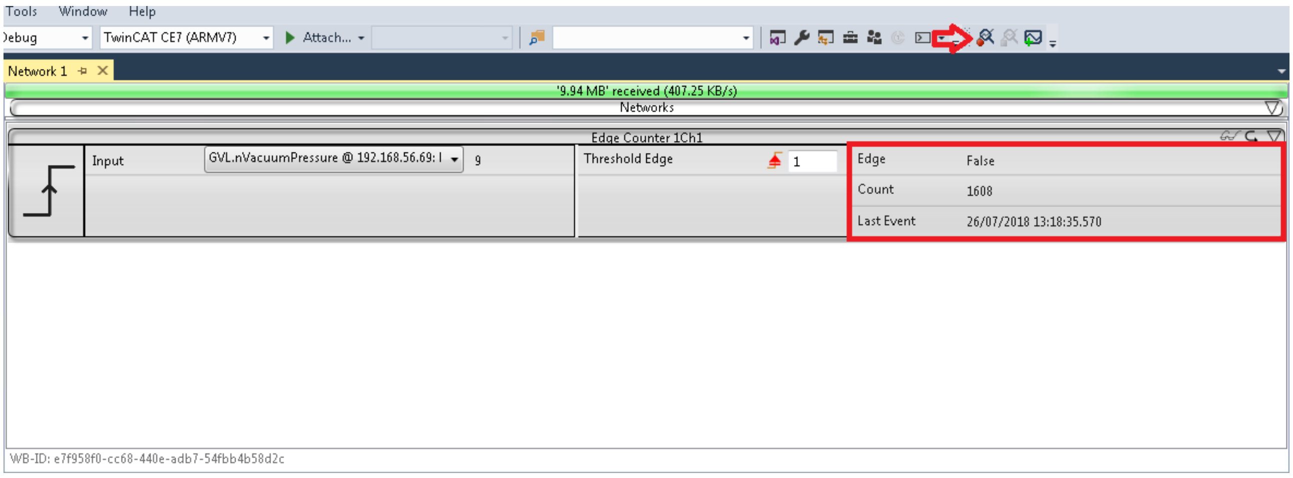
4. After these steps, you can drag and drop a symbol to an input of an algorithm just as you do with the symbols of the live data.



⇨ A new input source for your historical stream is then generated and can be displayed in the Solution Explorer of your Visual Studio®. First, the dragged symbol and a timestamp of the current device time are listed under this stream. Also new drawn symbols of this stream are listed there.

Analyse your historical data in the Analytics Configurator

To analyse your historical data press on the Start Analytics button. In contrast to analysing live data, a green progress bar appears. The speed of your analysis depends on your record length, the amount and size of your symbols as well as on your broadband speed to the broker. The analysis stops automatically when the progress bar ends. The results will remain visible.



Input GVL.nVacuumPressure @ 192.168.56.69: 9

Threshold Edge 1

Edge	False
Count	1608
Last Event	26/07/2018 13:18:35.570

WB-ID: e7f958f0-cc68-440e-adb7-54fbb4b58d2c

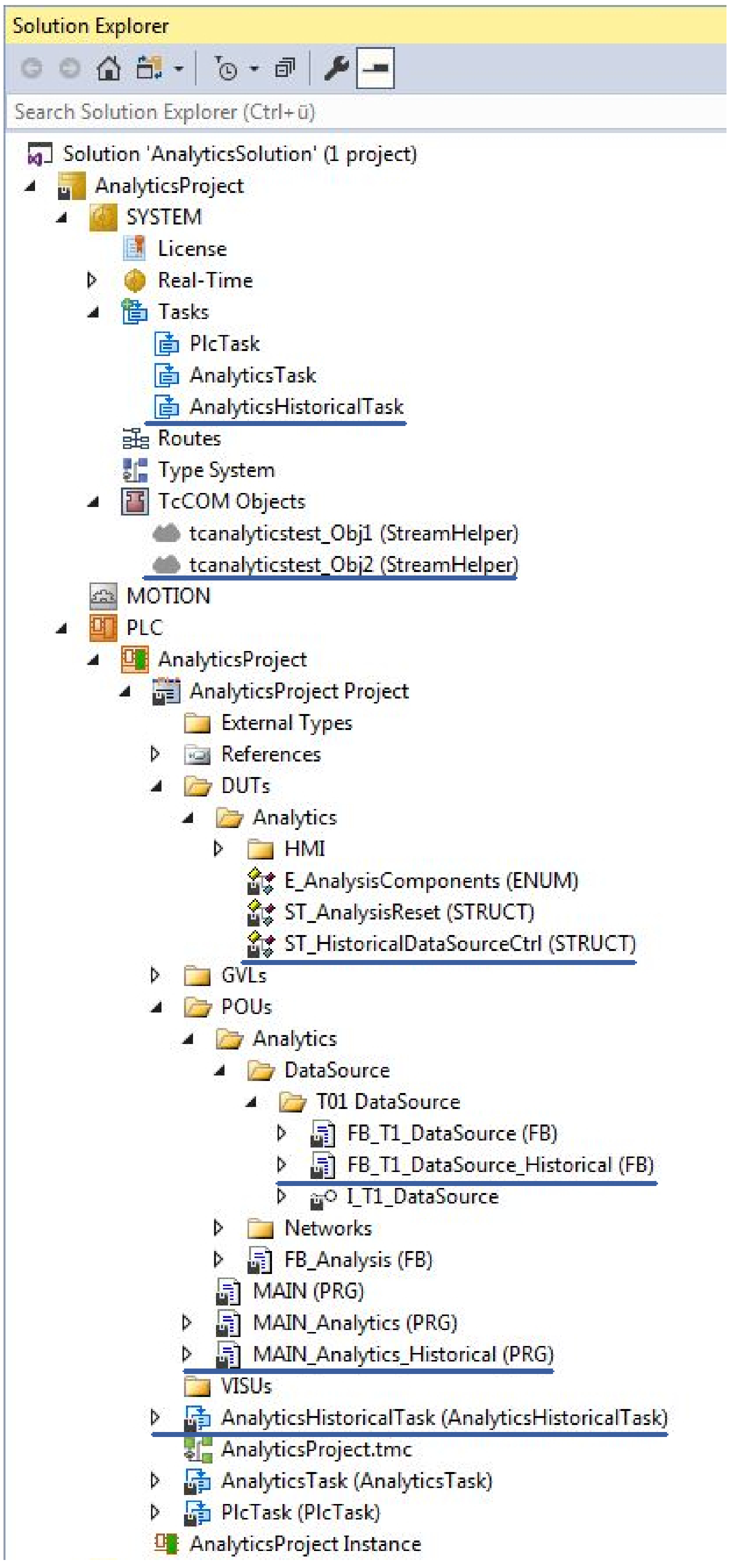
Analysis of your historical data in your Analytics Runtime

You can provide the configuration with your historical data to an Analytics Runtime (PLC). In addition to the historical data, the live data is also analyzed. This allows you to switch between them and not lose live data by streaming historical data. The reason for this is that they are separated into two different tasks. The start of the analysis of historical data must be triggered.

Computing time for historical data

Unlike the Analytics Configurator, the analysis of historical data in the PLC takes a similar amount of time as the original recording of the data. Depending on the packet size and the set sampling rate, the processing of the data can be shortened compared to the recording. However, cycle overruns due to excessively large packets must be taken into account.

Main differences of the folder structure in the created PLC project:



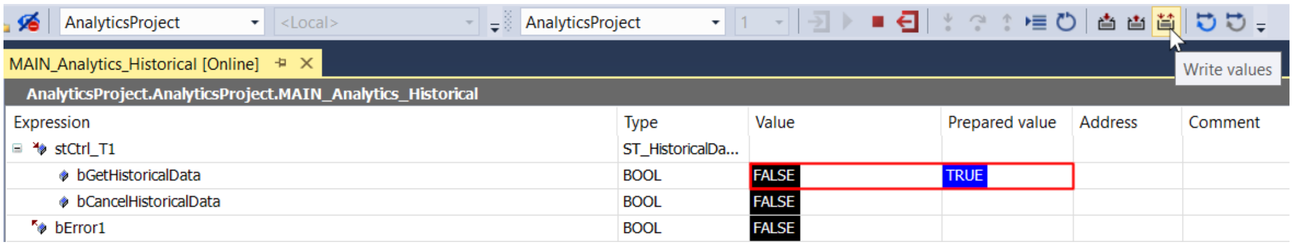
```
Solution 'AnalyticsSolution' (1 project)
  AnalyticsProject
    SYSTEM
      License
      Real-Time
      Tasks
        PlcTask
        AnalyticsTask
        AnalyticsHistoricalTask
      Routes
      Type System
      TcCOM Objects
        tcanalyticstest_Obj1 (StreamHelper)
        tcanalyticstest_Obj2 (StreamHelper)
    MOTION
    PLC
      AnalyticsProject
        AnalyticsProject Project
          External Types
          References
          DUTs
            Analytics
              HMI
              E_AnalysisComponents (ENUM)
              ST_AnalysisReset (STRUCT)
              ST_HistoricalDataSourceCtrl (STRUCT)
          GVLs
          POUs
            Analytics
              DataSource
                T01 DataSource
                  FB_T1_DataSource (FB)
                  FB_T1_DataSource_Historical (FB)
                  I_T1_DataSource
              Networks
              FB_Analysis (FB)
            MAIN (PRG)
            MAIN_Analytics (PRG)
            MAIN_Analytics_Historical (PRG)
          VISUs
          AnalyticsHistoricalTask (AnalyticsHistoricalTask)
          AnalyticsProject.tmc
          AnalyticsTask (AnalyticsTask)
          PlcTask (PlcTask)
        AnalyticsProject Instance
```

NOTICE

Implementation of the logic in your TwinCAT HMI

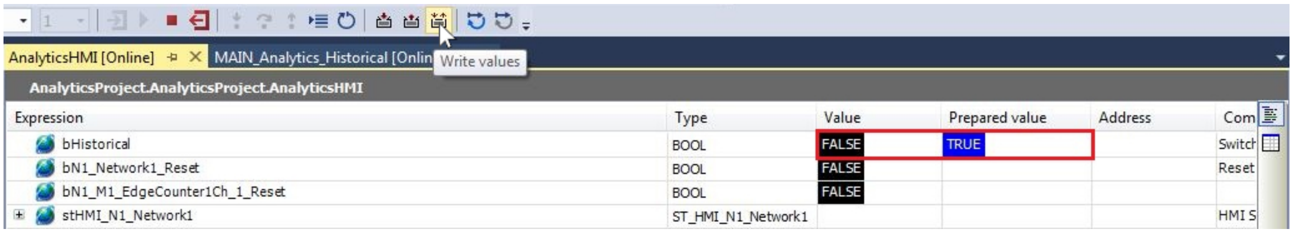
The preparation and writing of values in your PLC are for testing purposes. It is recommended to implement this and other logic in the PLC code with interactions from your TwinCAT HMI application if required.

You can start historical data analysis by triggering **bGetHistoricalData** in **stCtrl_T1**. The cancellation takes place by triggering **bCancelHistoricalData**.
This can be done in the **MAIN_Analytics_Historical** file as shown in the following figure:



```
AnalyticsProject.AnalyticsProject.MAIN_Analytics_Historical
Expression              Type                 Value   Prepared value  Address  Comment
stCtrl_T1               ST_HistoricalDa...
  bGetHistoricalData    BOOL                 FALSE   TRUE
  bCancelHistoricalData BOOL                 FALSE
bError1                 BOOL                 FALSE
```

To switch between live and historical data results for your HMI dashboard, you can set the **bHistorical** symbol in the **AnalyticsHMI** GVL. With this option, you do not need any additional controls to display historical data (of course, you can also use your own controls for historical data). The analysis of the live data is not interrupted by calling up some historical data. After viewing the historical data, you can switch back to the current live results. This change only affects the variables in your GVL.

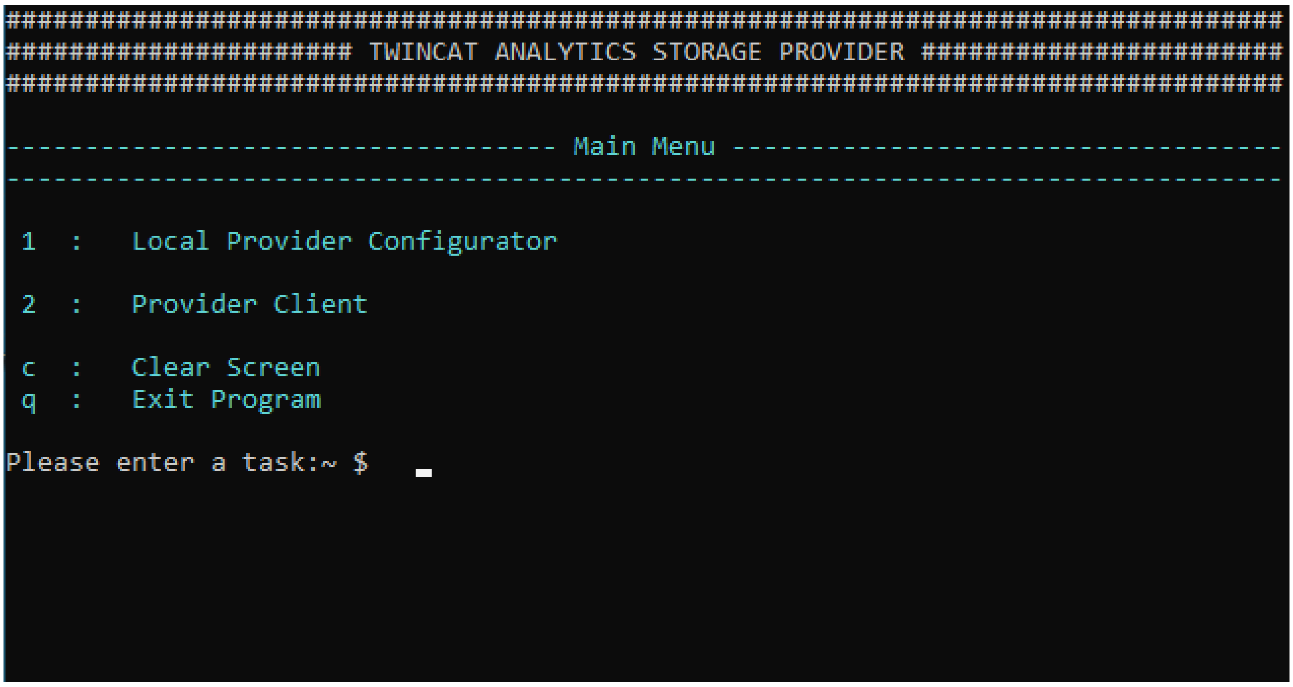


```
AnalyticsProject.AnalyticsProject.AnalyticsHMI
Expression                    Type               Value   Prepared value  Address  Com
bHistorical                   BOOL               FALSE   TRUE                     Switch
bN1_Network1_Reset            BOOL               FALSE                            Reset
bN1_M1_EdgeCounter1Ch_1_Reset BOOL               FALSE
stHMI_N1_Network1             ST_HMI_N1_Network1                                  HMI S
```

6.4 Console Configurator/Client

In addition to the graphical configurator and the recorder, the Analytics Storage Provider can also be operated via a console. This means that configuration and access to a Storage Provider can also be performed under TwinCAT/BSD in addition to Windows. In addition, the console application can be used to generate Batch files for control [▸ 107] of the Analytics Storage Provider.

After launching the console client, there are four options to choose from:



```
#################################################################################
###################### TWINCAT ANALYTICS STORAGE PROVIDER ########################
#################################################################################

----------------------------------- Main Menu ------------------------------------
---------------------------------------------------------------------------------

 1  :   Local Provider Configurator

 2  :   Provider Client

 c  :   Clear Screen
 q  :   Exit Program

Please enter a task:~ $  _
```

1	Opens the console Configurator [▸ 100] for the local Analytics Storage Provider
2	Opens the Analytics Storage Provider Client [▸ 104]
c	Clears the console configurator/client history
q	Closes the console configurator/client

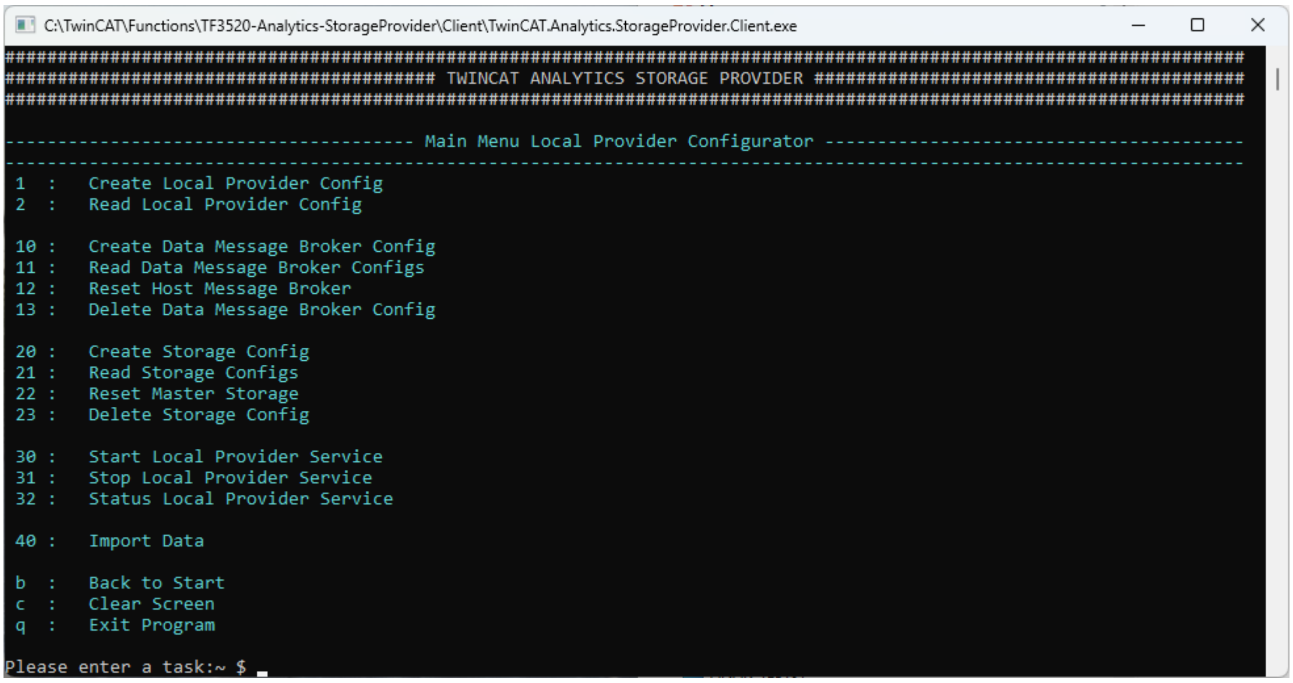
By entering one of the identifiers and confirming with the **[Enter]** key, the corresponding function is executed.

6.4.1 Configurator

In this menu, the local Analytics Storage Provider can be configured. The following additional inputs are available for this purpose:

1	Starts a dialog for configuring the local Analytics Storage Provider.
2	Outputs the configuration of the local Analytics Storage Provider.
10	Starts a dialog for configuring a Data Message Broker.
11	Returns all Data Message Broker configurations.
12	Resetting the Master Message Broker (commands can only be received via this broker).
13	Deletes a Data Message Broker.
20	Starts a dialog for configuring a Storage.
21	Returns all Storage configurations.
22	Resetting the Master Storage (default Storage).
23	Deleting a Storage configuration.
30	Starts the Analytics Storage Provider with the local configuration.
31	Stops the local Analytics Storage Provider.
32	Outputs the status of the Analytics Storage Provider.
40	Importing binary Analytics files into an existing Storage.
b	Switches back to the main menu.

The configuration parameters are the same as in the graphical configurator of the Analytics Storage Provider.


C:\TwinCAT\Functions\TF3520-Analytics-StorageProvider\Client\TwinCAT.Analytics.StorageProvider.Client.exe

```
########################################################################################################################
######################################### TWINCAT ANALYTICS STORAGE PROVIDER ###########################################
########################################################################################################################

--------------------------------------- Main Menu Local Provider Configurator ------------------------------------------
------------------------------------------------------------------------------------------------------------------------
 1  :   Create Local Provider Config
 2  :   Read Local Provider Config

 10 :   Create Data Message Broker Config
 11 :   Read Data Message Broker Configs
 12 :   Reset Host Message Broker
 13 :   Delete Data Message Broker Config

 20 :   Create Storage Config
 21 :   Read Storage Configs
 22 :   Reset Master Storage
 23 :   Delete Storage Config

 30 :   Start Local Provider Service
 31 :   Stop Local Provider Service
 32 :   Status Local Provider Service

 40 :   Import Data

 b  :   Back to Start
 c  :   Clear Screen
 q  :   Exit Program

Please enter a task:~ $ _
```

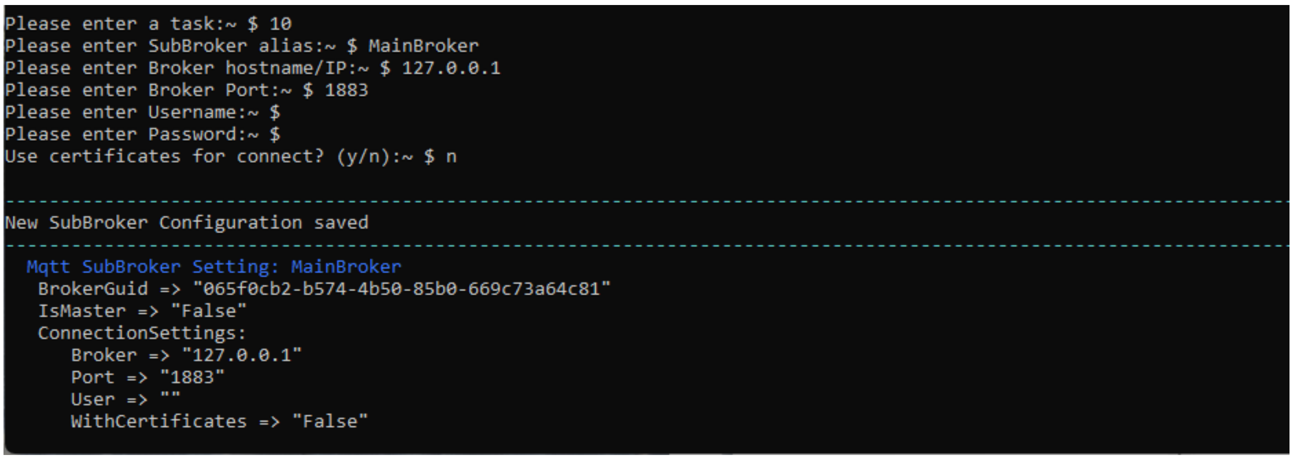
By pressing the **[ESC]** key, the dialog can be aborted at any time and you can return to the configuration menu.

Use

This section describes step by step how you can configure and start the local Storage Provider using the Storage Provider Client.

Adding a Message Broker configuration

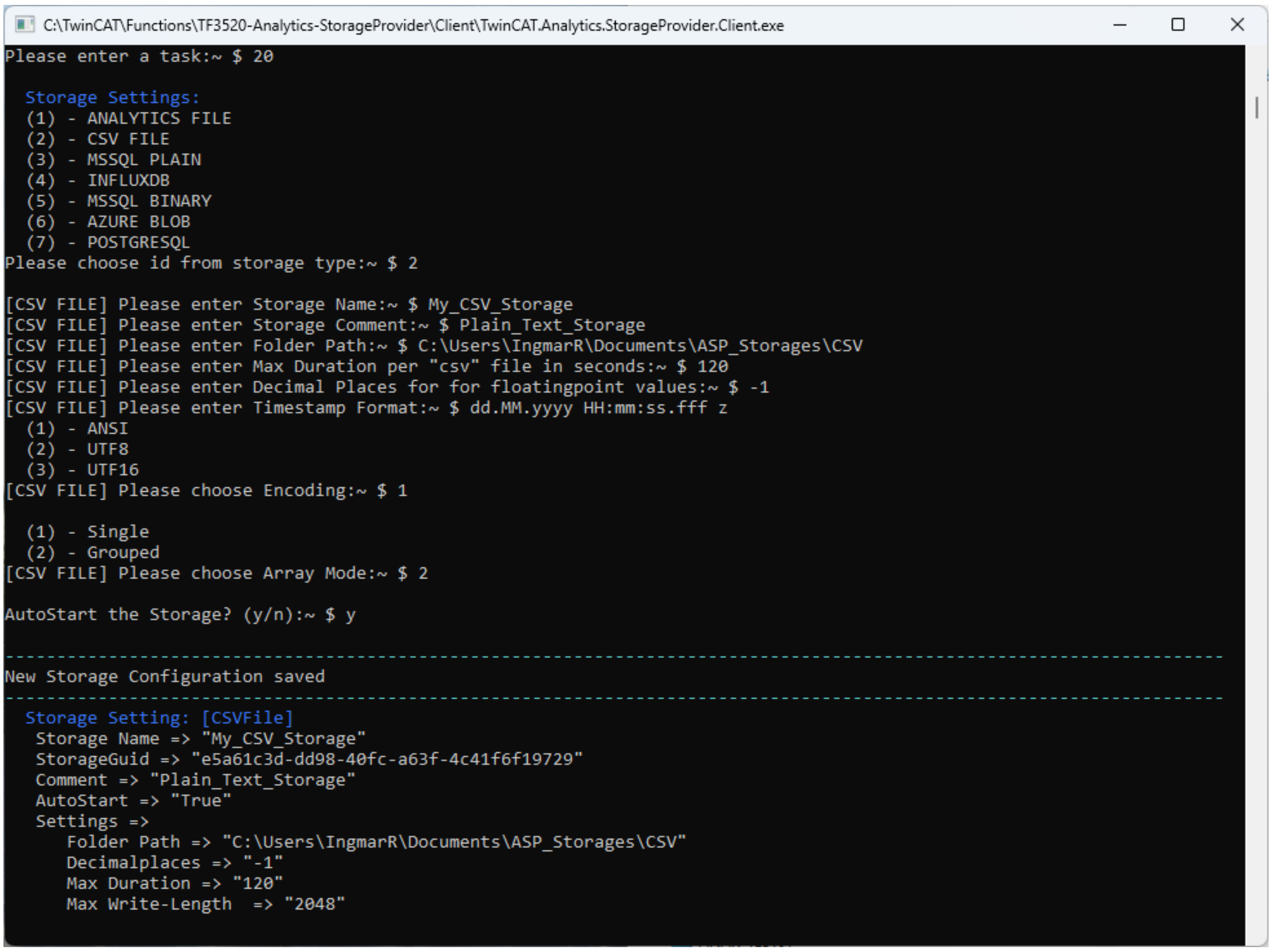
To create a new Message Broker configuration, first press the "10" key. A dialog box will then open in which you must enter all the necessary parameters (e.g. host, port, user name, password, etc.). Once the entry is complete, the configuration data is automatically saved.



```
Please enter a task:~ $ 10
Please enter SubBroker alias:~ $ MainBroker
Please enter Broker hostname/IP:~ $ 127.0.0.1
Please enter Broker Port:~ $ 1883
Please enter Username:~ $
Please enter Password:~ $
Use certificates for connect? (y/n):~ $ n

-----------------------------------------------------------------------------------------------------------------
New SubBroker Configuration saved
-----------------------------------------------------------------------------------------------------------------
  Mqtt SubBroker Setting: MainBroker
   BrokerGuid => "065f0cb2-b574-4b50-85b0-669c73a64c81"
   IsMaster => "False"
   ConnectionSettings:
      Broker => "127.0.0.1"
      Port => "1883"
      User => ""
      WithCertificates => "False"
```

Creating a Storage configuration (data sink)

To configure a new Storage, such as a CSV storage, press the "20" key. Here, too, a dialog box will ask you for all the necessary parameters step by step. The following is an example of the configuration of a CSV storage:



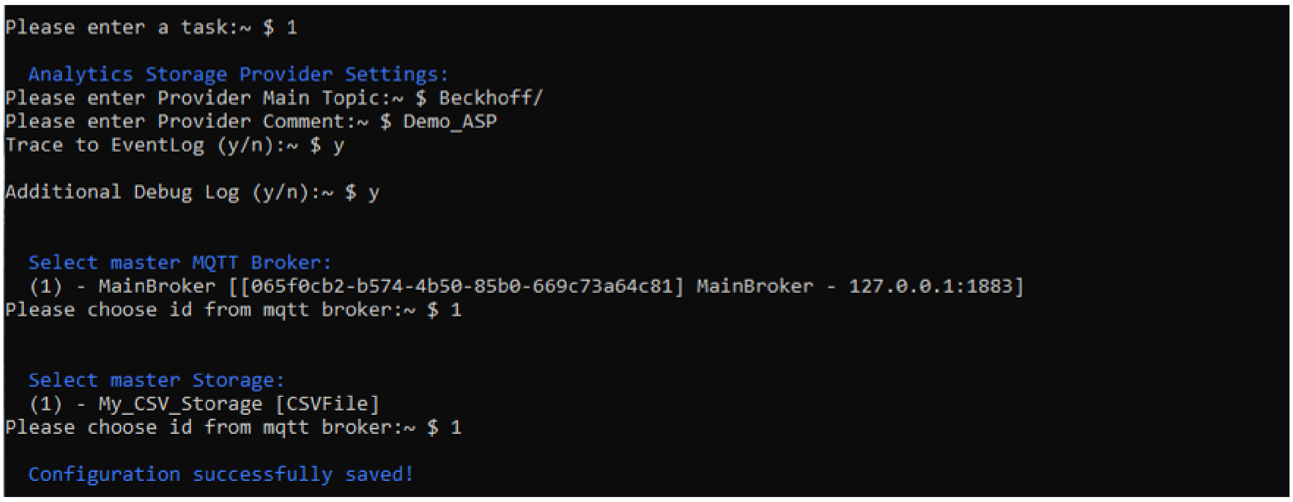
C:\TwinCAT\Functions\TF3520-Analytics-StorageProvider\Client\TwinCAT.Analytics.StorageProvider.Client.exe

```
Please enter a task:~ $ 20

  Storage Settings:
  (1) - ANALYTICS FILE
  (2) - CSV FILE
  (3) - MSSQL PLAIN
  (4) - INFLUXDB
  (5) - MSSQL BINARY
  (6) - AZURE BLOB
  (7) - POSTGRESQL
Please choose id from storage type:~ $ 2

[CSV FILE] Please enter Storage Name:~ $ My_CSV_Storage
[CSV FILE] Please enter Storage Comment:~ $ Plain_Text_Storage
[CSV FILE] Please enter Folder Path:~ $ C:\Users\IngmarR\Documents\ASP_Storages\CSV
[CSV FILE] Please enter Max Duration per "csv" file in seconds:~ $ 120
[CSV FILE] Please enter Decimal Places for for floatingpoint values:~ $ -1
[CSV FILE] Please enter Timestamp Format:~ $ dd.MM.yyyy HH:mm:ss.fff z
  (1) - ANSI
  (2) - UTF8
  (3) - UTF16
[CSV FILE] Please choose Encoding:~ $ 1

  (1) - Single
  (2) - Grouped
[CSV FILE] Please choose Array Mode:~ $ 2

AutoStart the Storage? (y/n):~ $ y

-----------------------------------------------------------------------------------------------------------------
New Storage Configuration saved
-----------------------------------------------------------------------------------------------------------------
  Storage Setting: [CSVFile]
   Storage Name => "My_CSV_Storage"
   StorageGuid => "e5a61c3d-dd98-40fc-a63f-4c41f6f19729"
   Comment => "Plain_Text_Storage"
   AutoStart => "True"
   Settings =>
      Folder Path => "C:\Users\IngmarR\Documents\ASP_Storages\CSV"
      Decimalplaces => "-1"
      Max Duration => "120"
      Max Write-Length  => "2048"
```

The data entered is automatically applied and saved.

Configuration of the Storage Provider

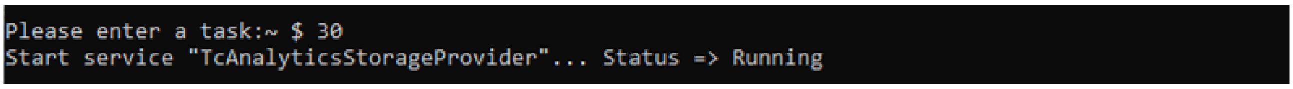
To configure the Storage Provider yourself, press the "1" key. Enter the necessary parameters in the dialog that appears. You can also define the Host Message Broker and the Default Storage here. Once the dialog has been completed, the configuration is saved automatically.



```
Please enter a task:~ $ 1

  Analytics Storage Provider Settings:
Please enter Provider Main Topic:~ $ Beckhoff/
Please enter Provider Comment:~ $ Demo_ASP
Trace to EventLog (y/n):~ $ y

Additional Debug Log (y/n):~ $ y


  Select master MQTT Broker:
  (1) - MainBroker [[065f0cb2-b574-4b50-85b0-669c73a64c81] MainBroker - 127.0.0.1:1883]
Please choose id from mqtt broker:~ $ 1


  Select master Storage:
  (1) - My_CSV_Storage [CSVFile]
Please choose id from mqtt broker:~ $ 1

  Configuration successfully saved!
```

Starting the local Storage Provider

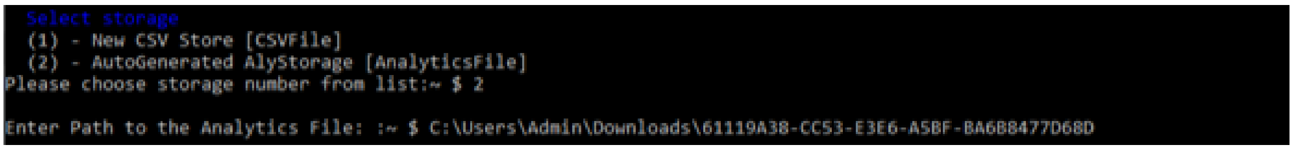
Once all settings have been made, the Storage Provider is configured and ready to start. To do this, press the "30" key in the client. If the local Storage Provider Service has been started successfully, the following message appears:



```
Please enter a task:~ $ 30
Start service "TcAnalyticsStorageProvider"... Status => Running
```

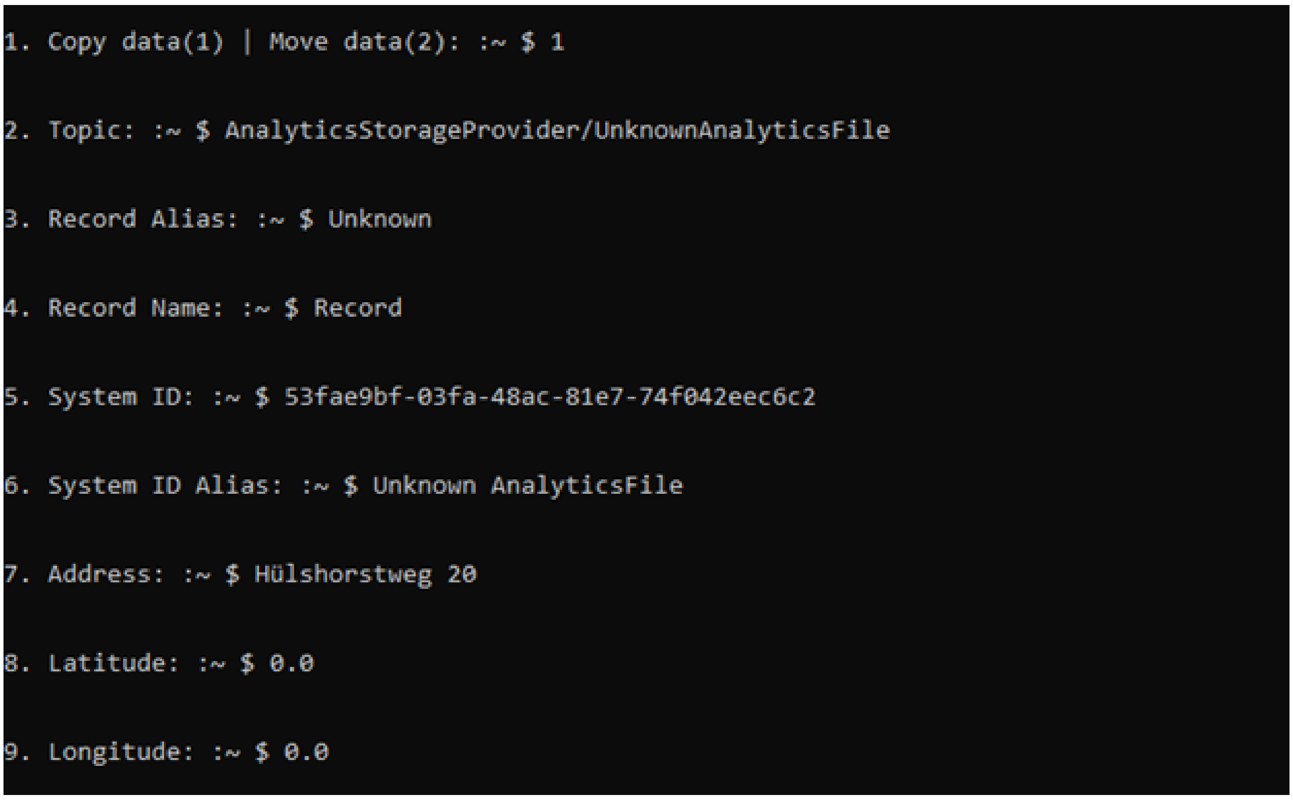
Importing historical data

In this dialog, Analytics Files can be imported into a selected storage. First choose the storage you want to import to by entering the number in the brackets on the left-hand side of the storage in the list. Once you have made your choice of storage, you will be asked to enter the folder path to the files to be imported.



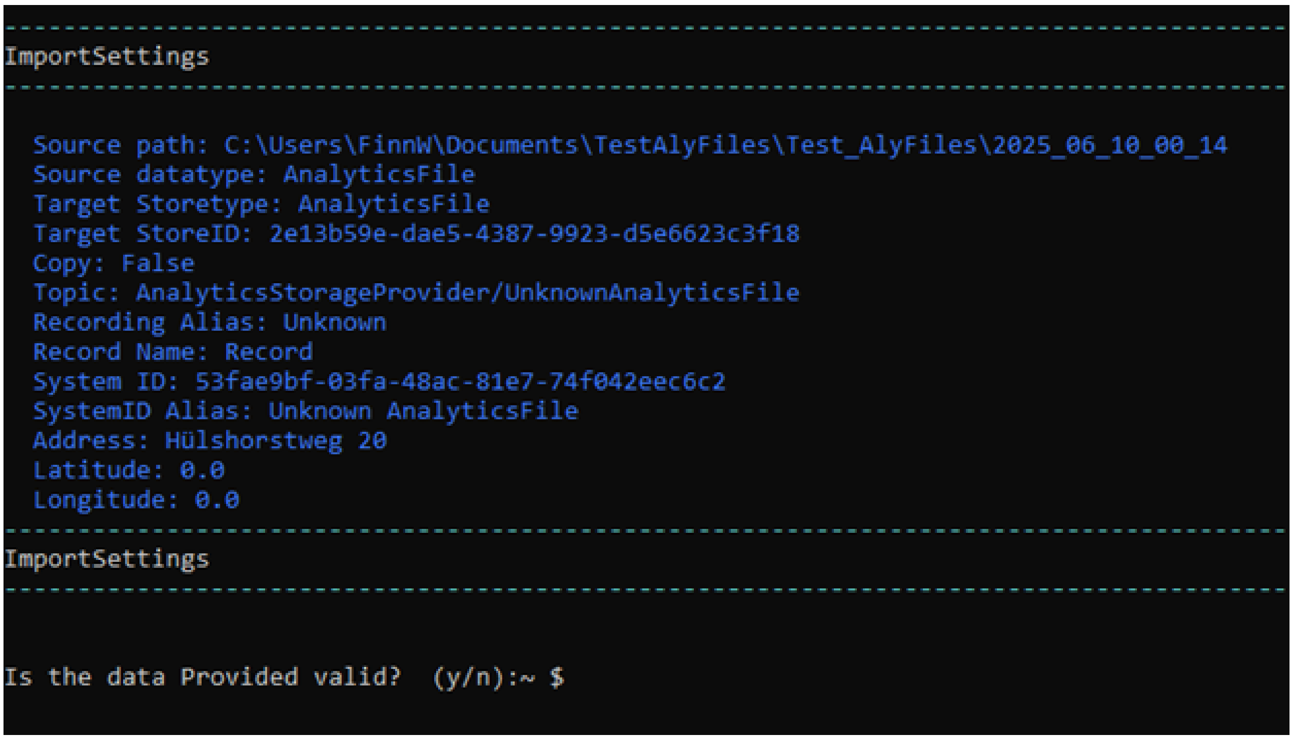
```
  Select storage
  (1) - New CSV Store [CSVFile]
  (2) - AutoGenerated AlyStorage [AnalyticsFile]
Please choose storage number from list:~ $ 2

Enter Path to the Analytics File: :~ $ C:\Users\Admin\Downloads\61119A38-CC53-E3E6-A5BF-BA6B8477D68D
```

You can then specify whether the contents of the folder should be copied or moved. You must also enter some basic information about the data to be imported:



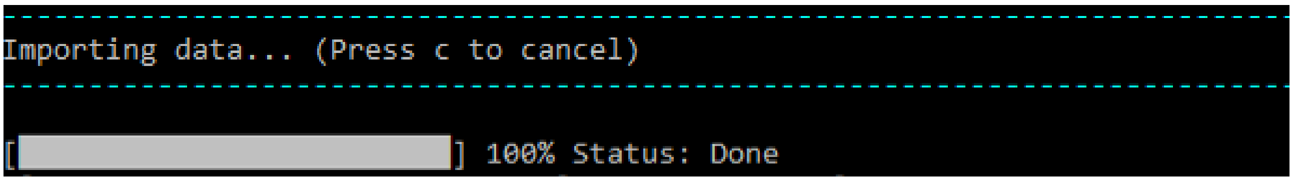
```
1. Copy data(1) | Move data(2): :~ $ 1

2. Topic: :~ $ AnalyticsStorageProvider/UnknownAnalyticsFile

3. Record Alias: :~ $ Unknown

4. Record Name: :~ $ Record

5. System ID: :~ $ 53fae9bf-03fa-48ac-81e7-74f042eec6c2

6. System ID Alias: :~ $ Unknown AnalyticsFile

7. Address: :~ $ Hülshorstweg 20

8. Latitude: :~ $ 0.0

9. Longitude: :~ $ 0.0
```

The import configuration is now complete - you can check it again in the next step. You can use CTRL + Z to correct entries. Otherwise, the import can be started.



```
------------------------------------------------------------------------------------
ImportSettings
------------------------------------------------------------------------------------
  Source path: C:\Users\FinnW\Documents\TestAlyFiles\Test_AlyFiles\2025_06_10_00_14
  Source datatype: AnalyticsFile
  Target Storetype: AnalyticsFile
  Target StoreID: 2e13b59e-dae5-4387-9923-d5e6623c3f18
  Copy: False
  Topic: AnalyticsStorageProvider/UnknownAnalyticsFile
  Recording Alias: Unknown
  Record Name: Record
  System ID: 53fae9bf-03fa-48ac-81e7-74f042eec6c2
  SystemID Alias: Unknown AnalyticsFile
  Address: Hülshorstweg 20
  Latitude: 0.0
  Longitude: 0.0
------------------------------------------------------------------------------------
ImportSettings
------------------------------------------------------------------------------------


Is the data Provided valid?  (y/n):~ $
```

As soon as the import is successfully completed, the following message is displayed:



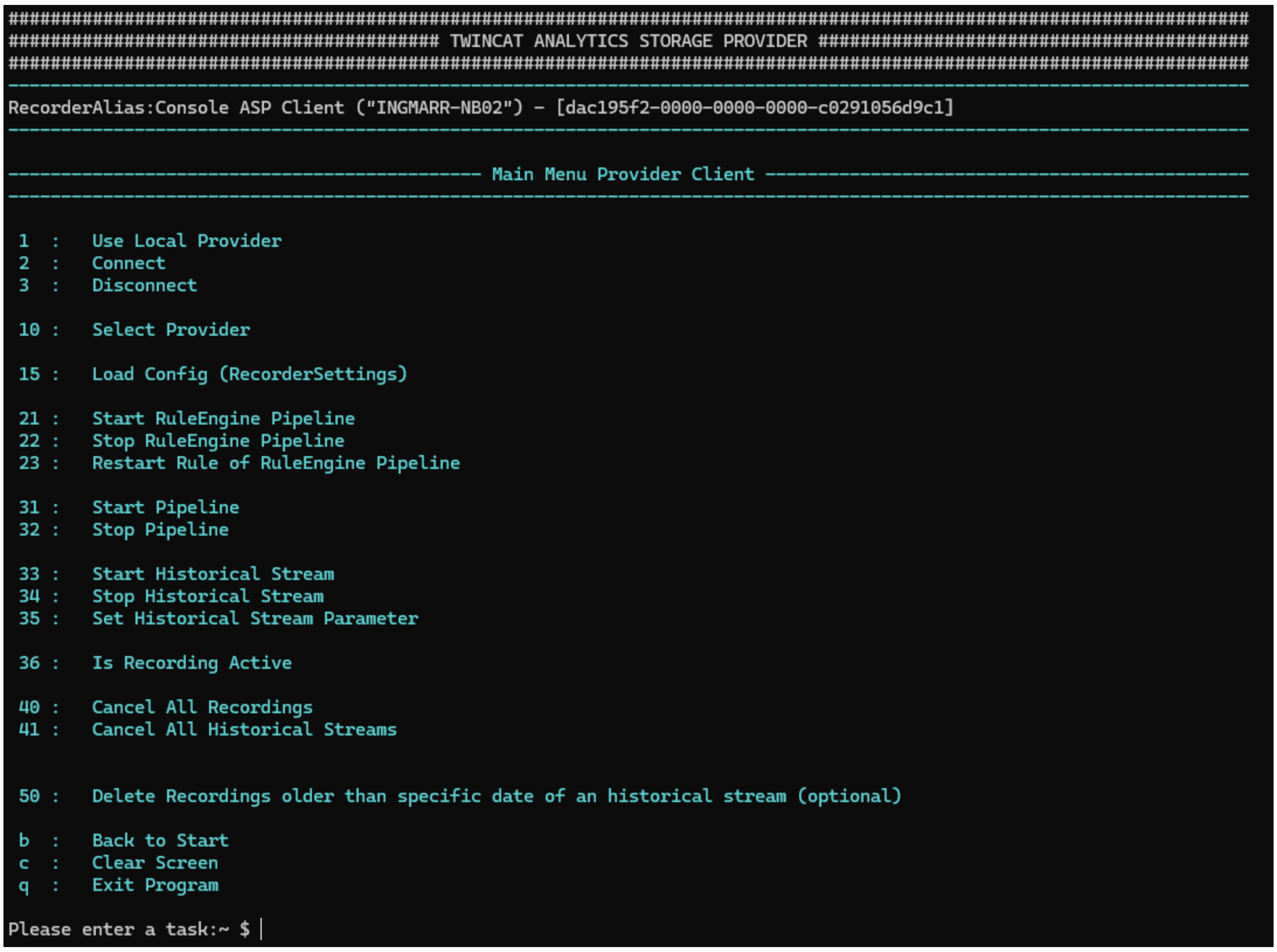
```
------------------------------------------------------------
Importing data... (Press c to cancel)
------------------------------------------------------------

[                              ] 100% Status: Done
```

6.4.2 Client

In the Analytics Storage Provider Client it is possible to connect to an Analytics Storage Provider. This does not necessarily have to run locally on the device, but can also be addressed via an external MQTT broker. Thus, it is not mandatory to configure an Analytics Storage Provider locally to use the client. Recordings can then be started and stopped on a connected Analytics Storage Provider, as well as historical data streams to a configurable MQTT topic.

The following inputs are available for this:

1	Establishes a connection with the MQTT broker from the local configuration and selects the configured Analytics Storage Provider.
2	Starts a dialog to connect to an MQTT broker.
3	Closes the connection to the current MQTT broker.
10	Provides the Analytics Storage Providers that are available under the MQTT broker for selection.
15	Reads a configuration file from an Analytics Storage Provider Recorder, with the recordings configured in it.
21	Starts a RuleEngine pipeline.
22	Stops a RuleEngine pipeline.
23	Restarts a rule of a RuleEngine pipeline.
31	Starts a recording.
32	Stops a recording based on the alias and the MQTT topic.
33	Starts a historical data stream.
34	Stops a historical data stream based on the result MQTT topic.
35	Updates streaming parameters of a running historical data stream.
36	Checks whether a recording is active.
40	Stops all active recordings.
41	Stops all historical data streams.
50	Deletes recordings that are older than a certain date. Optionally, a data stream can be specified.

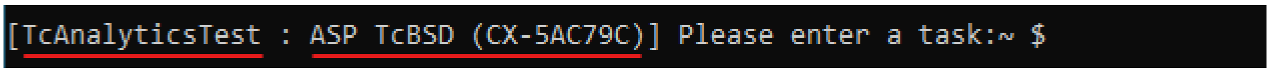


```
####################################################################################################################
######################################## TWINCAT ANALYTICS STORAGE PROVIDER ########################################
####################################################################################################################
--------------------------------------------------------------------------------------------------------------------
RecorderAlias:Console ASP Client ("INGMARR-NB02") - [dac195f2-0000-0000-0000-c0291056d9c1]
--------------------------------------------------------------------------------------------------------------------

--------------------------------------------- Main Menu Provider Client ---------------------------------------------
--------------------------------------------------------------------------------------------------------------------

 1  :   Use Local Provider
 2  :   Connect
 3  :   Disconnect

 10 :   Select Provider

 15 :   Load Config (RecorderSettings)

 21 :   Start RuleEngine Pipeline
 22 :   Stop RuleEngine Pipeline
 23 :   Restart Rule of RuleEngine Pipeline

 31 :   Start Pipeline
 32 :   Stop Pipeline

 33 :   Start Historical Stream
 34 :   Stop Historical Stream
 35 :   Set Historical Stream Parameter

 36 :   Is Recording Active

 40 :   Cancel All Recordings
 41 :   Cancel All Historical Streams


 50 :   Delete Recordings older than specific date of an historical stream (optional)

 b  :   Back to Start
 c  :   Clear Screen
 q  :   Exit Program

Please enter a task:~ $ |
```

Use

To use the Analytics Storage Provider Client, a connection to an MQTT broker must first be established. Entering "2" starts a dialog in which the already configured MQTT brokers are presented for selection. There a new MQTT broker can be configured and connected by entering "0". Then, by entering "10" in the client main menu, an Analytics Storage Provider can be selected, which is available under the MQTT broker. Alternatively, by entering "1" in the client main menu, a connection to the MQTT broker and Analytics Storage Provider can be established directly from the local configuration file.

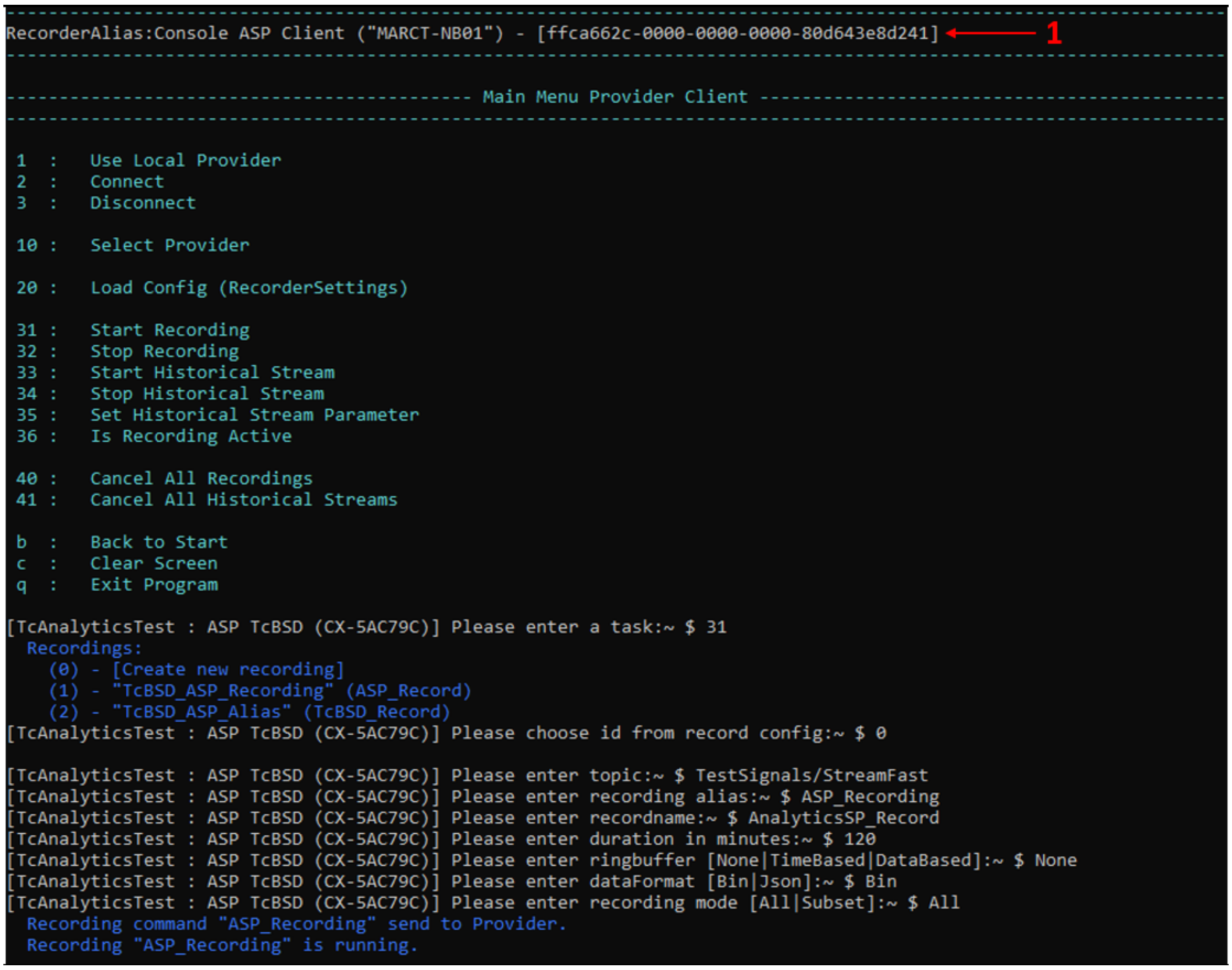
After the connection is successfully established, information about the connected MQTT broker and the selected Analytics Storage Provider is displayed in the prompter display before the prompt:



```
[TcAnalyticsTest : ASP TcBSD (CX-5AC79C)] Please enter a task:~ $
```

(MQTT broker: Analytics Storage Provider)

To start recordings, a dialog is started by entering "31". It is possible to start a recording that has already been created, provided that recordings have already been configured or read in via a recorder configuration file. In addition to the listed recordings, a new recording can also be configured and started by entering "0":

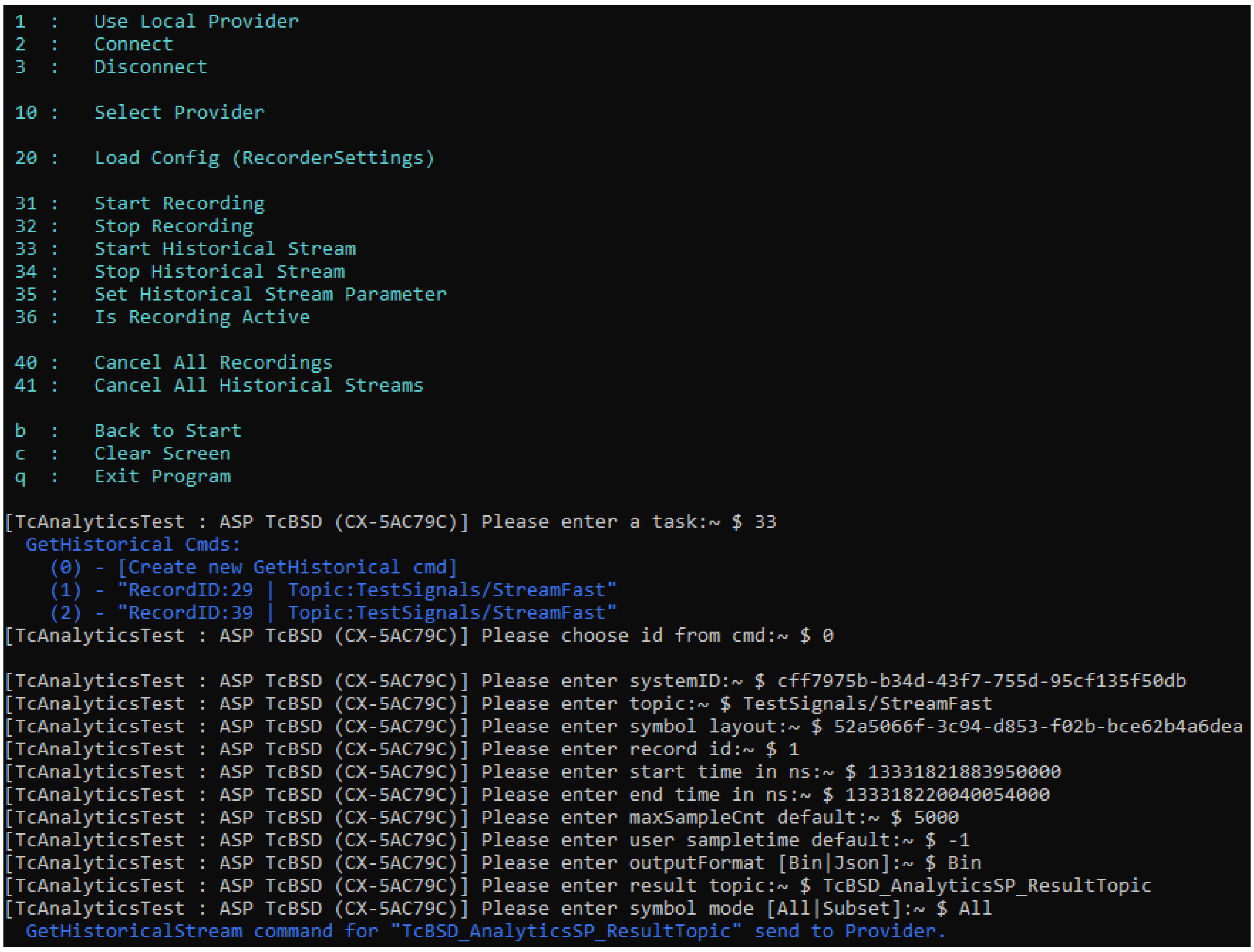


```
--------------------------------------------------------------------------------------------------------------------------
RecorderAlias:Console ASP Client ("MARCT-NB01") - [ffca662c-0000-0000-0000-80d643e8d241]
--------------------------------------------------------------------------------------------------------------------------

-------------------------------------------- Main Menu Provider Client -------------------------------------------------
--------------------------------------------------------------------------------------------------------------------------

 1  :   Use Local Provider
 2  :   Connect
 3  :   Disconnect

 10 :   Select Provider

 20 :   Load Config (RecorderSettings)

 31 :   Start Recording
 32 :   Stop Recording
 33 :   Start Historical Stream
 34 :   Stop Historical Stream
 35 :   Set Historical Stream Parameter
 36 :   Is Recording Active

 40 :   Cancel All Recordings
 41 :   Cancel All Historical Streams

 b  :   Back to Start
 c  :   Clear Screen
 q  :   Exit Program

[TcAnalyticsTest : ASP TcBSD (CX-5AC79C)] Please enter a task:~ $ 31
  Recordings:
    (0) - [Create new recording]
    (1) - "TcBSD_ASP_Recording" (ASP_Record)
    (2) - "TcBSD_ASP_Alias" (TcBSD_Record)
[TcAnalyticsTest : ASP TcBSD (CX-5AC79C)] Please choose id from record config:~ $ 0

[TcAnalyticsTest : ASP TcBSD (CX-5AC79C)] Please enter topic:~ $ TestSignals/StreamFast
[TcAnalyticsTest : ASP TcBSD (CX-5AC79C)] Please enter recording alias:~ $ ASP_Recording
[TcAnalyticsTest : ASP TcBSD (CX-5AC79C)] Please enter recordname:~ $ AnalyticsSP_Record
[TcAnalyticsTest : ASP TcBSD (CX-5AC79C)] Please enter duration in minutes:~ $ 120
[TcAnalyticsTest : ASP TcBSD (CX-5AC79C)] Please enter ringbuffer [None|TimeBased|DataBased]:~ $ None
[TcAnalyticsTest : ASP TcBSD (CX-5AC79C)] Please enter dataFormat [Bin|Json]:~ $ Bin
[TcAnalyticsTest : ASP TcBSD (CX-5AC79C)] Please enter recording mode [All|Subset]:~ $ All
  Recording command "ASP_Recording" send to Provider.
  Recording "ASP_Recording" is running.
```

The configuration parameters correspond to the known parameters from the graphical Analytics Storage Provider Recorder. The default values can be deleted if necessary and replaced by individual entries. With the **recording mode** after the input "Subset" a subset of the symbolism can be defined by the recording data. Immediately after configuration, a command to start recording is sent to the connected Analytics Storage Provider. Running recordings can be stopped by entering "32". They are referenced by the MQTT topic from which the data comes and by the recording alias. If a recording is to be stopped by another client, the corresponding **Recorder Guid** must also be specified. The **Recorder Guid** is displayed together with the **Recorder Alias** above the input options in the client main menu (red 1).

Recording configurations created in the console client are not persisted. So after closing the client, the list of recording configurations is no longer available. Therefore, reading recorder configuration files (enter "20" in the client main menu) can be very helpful. The configuration file of a recorder is stored on Windows systems under the path *C:\Users\*** \AppData\Roaming\Beckhoff\TwinCAT Analytics Storage Provider* (replace *** with the corresponding user).

The historized data of the Analytics Storage Provider can be transmitted as a data stream to a definable result MQTT topic via the input "33". This also starts a dialog in which a previously configured data stream can be started. By entering "0", a new historical data stream can also be configured:



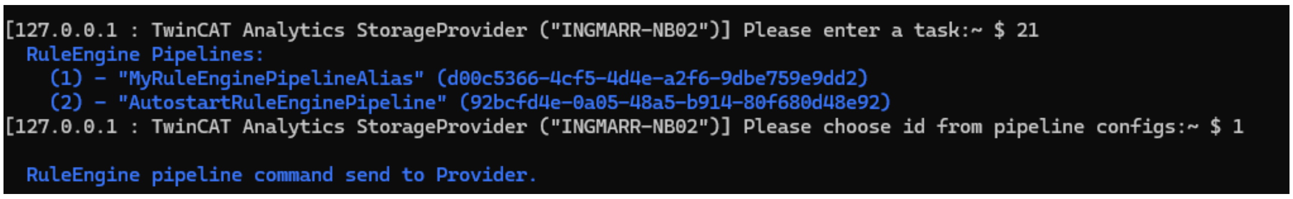
```
1  :   Use Local Provider
2  :   Connect
3  :   Disconnect

10 :   Select Provider

20 :   Load Config (RecorderSettings)

31 :   Start Recording
32 :   Stop Recording
33 :   Start Historical Stream
34 :   Stop Historical Stream
35 :   Set Historical Stream Parameter
36 :   Is Recording Active

40 :   Cancel All Recordings
41 :   Cancel All Historical Streams

b  :   Back to Start
c  :   Clear Screen
q  :   Exit Program

[TcAnalyticsTest : ASP TcBSD (CX-5AC79C)] Please enter a task:~ $ 33
  GetHistorical Cmds:
    (0) - [Create new GetHistorical cmd]
    (1) - "RecordID:29 | Topic:TestSignals/StreamFast"
    (2) - "RecordID:39 | Topic:TestSignals/StreamFast"
[TcAnalyticsTest : ASP TcBSD (CX-5AC79C)] Please choose id from cmd:~ $ 0

[TcAnalyticsTest : ASP TcBSD (CX-5AC79C)] Please enter systemID:~ $ cff7975b-b34d-43f7-755d-95cf135f50db
[TcAnalyticsTest : ASP TcBSD (CX-5AC79C)] Please enter topic:~ $ TestSignals/StreamFast
[TcAnalyticsTest : ASP TcBSD (CX-5AC79C)] Please enter symbol layout:~ $ 52a5066f-3c94-d853-f02b-bce62b4a6dea
[TcAnalyticsTest : ASP TcBSD (CX-5AC79C)] Please enter record id:~ $ 1
[TcAnalyticsTest : ASP TcBSD (CX-5AC79C)] Please enter start time in ns:~ $ 133318218839500000
[TcAnalyticsTest : ASP TcBSD (CX-5AC79C)] Please enter end time in ns:~ $ 133318220040054000
[TcAnalyticsTest : ASP TcBSD (CX-5AC79C)] Please enter maxSampleCnt default:~ $ 5000
[TcAnalyticsTest : ASP TcBSD (CX-5AC79C)] Please enter user sampletime default:~ $ -1
[TcAnalyticsTest : ASP TcBSD (CX-5AC79C)] Please enter outputFormat [Bin|Json]:~ $ Bin
[TcAnalyticsTest : ASP TcBSD (CX-5AC79C)] Please enter result topic:~ $ TcBSD_AnalyticsSP_ResultTopic
[TcAnalyticsTest : ASP TcBSD (CX-5AC79C)] Please enter symbol mode [All|Subset]:~ $ All
  GetHistoricalStream command for "TcBSD_AnalyticsSP_ResultTopic" send to Provider.
```

The parameters define a historized recording, whereby the parameter **result topic** defines the MQTT topic to which the data is to be streamed. After configuration, a command to start the historical stream is automatically sent to the Analytics Storage Provider.

By entering "35" in the client main menu, the parameters of an active historical stream can be adjusted. The historical stream is referenced by its result MQTT topic. The parameters can be used, for example, to adjust the speed or packet size of the data stream while it is running. Canceling a historical data stream is possible by entering "34" and specifying the result MQTT topic.

RuleEngine pipelines

It is also possible to start RuleEngine pipelines that have already been published. The entry "21" must be made for this. The appropriate RuleEngine pipeline can then be selected. RuleEngine pipelines can also be stopped (input "22"). It is also possible to restart individual rules (input "23").



```
[127.0.0.1 : TwinCAT Analytics StorageProvider ("INGMARR-NB02")] Please enter a task:~ $ 21
  RuleEngine Pipelines:
    (1) - "MyRuleEnginePipelineAlias" (d00c5366-4cf5-4d4e-a2f6-9dbe759e9dd2)
    (2) - "AutostartRuleEnginePipeline" (92bcfd4e-0a05-48a5-b914-80f680d48e92)
[127.0.0.1 : TwinCAT Analytics StorageProvider ("INGMARR-NB02")] Please choose id from pipeline configs:~ $ 1

  RuleEngine pipeline command send to Provider.
```

6.4.3 Batch files for control

The console client can be used to create batch files to control the Analytics Storage Provider. Some parameters are provided for this purpose:

`-Help / -H / -?`	Returns a description of all parameters.

Parameters for the configuration settings:

`-CreateASPConfig`	Create a new Analytics Storage Provider settings XML.
`-MainTopic <mainTopic>`	Analytics Storage Provider Main Topic.
`-Comment <comment>`	Analytics Storage Provider comment.
`-EventLogTrace <True|False>`	Trace to the event log.
`-DebugLog <True|False>`	Additional DebugLog.
`-StorageType <type>`	Storage type (**ANALYTICSFILE**, **AZURESQL**, **AZUREBLOB**).
`-StorageConnString <connString>`	Connection string or path to storage.
`-TlsType <Tls1.0|Tls1.1|Tls1.2>`	Tls type (for AzureBlob).
`-MaxDuration <duration (sec)>`	Maximum duration of a TAY file.
`-MaxWriteLen <writeLen (bytes)>`	Maximum length of a data packet.

Configuration parameters:

`-LocalProvider`	Use the connection settings of the locally installed Analytics Storage Provider.
`-ConfigFile <path>`	Use all configurations from the configuration file of an Analytics Storage Provider Recorder window.
`-ProviderGuid <guid>`	Provider of the Analytics Storage Provider to be used.
`-ConfigCmdID <id>`	ID number of the preconfigured recording in the configuration file.
`-ConfigCmdAlias <alias>`	Alias of the preconfigured recording in the configuration file.

Connection parameters:

`-Broker /-Host <hostname>`	Host name or IP address of the broker used.
`-Port <port>`	Broker port (default value: 1883).
`-User <username>`	Username for the connection.
`-Password / -Pwd <password>`	Password for the connection.
`-CA <path>`	Path to the CA certificate for the connection.
`-Cert <path>`	Path to the certificate for the connection.
`-Key_Cert <path>`	Path to the key file for the connection.
`-Key_Pwd <password>`	Password for the key file for the connection.

Function parameters:

`-StartRecord`	Sends a StartRecord command.
`-StopRecord`	Sends a StopRecord command.
`-IsRecordingActive`	Checks whether a recording is currently active.
`-GetHistorical`	Sends a GetHistoricalData command.
`-StopHistorical`	Sends a StopHistoricalData command.
`-UpdateHistorical`	Sends a HistoricalUpdate command.
`-CancelAllRec`	Sends a Cancel command to all active recordings.
`-CancelAllHist`	Sends a Cancel command to all active historical data streams.
`-StartPipeline`	Sends a StartRuleEngine pipeline command.
`-StopPipeline`	Sends a StopRuleEngine pipeline command.
`-RestartRule`	Sends a RestartRule command.
`-DeleteRecordingsOlderThan`	Deletes recordings whose end time is older than a specified timestamp. Optionally, the topic of the historical stream can also be specified. Only the active historical streams are taken into account.

Recording start/stop parameters:

`-Alias <alias>`	Alias name of the recording.
`-RecName <record>`	Alias name of the data set.
`-Topic <topic>`	Topic to be included.
`-DataFormat <Bin|Json>`	Data format of the live data stream.
`-Duration <seconds>`	Recording duration.
`-Ringbuffer <None|TimeBased|DataBased>`	Ring buffer mode (default value: **Default**).
`-RinbufferPara <minutes/MB>`	Parameters for the ring buffer (in seconds or megabytes).
`-Mode <All|Subset>`	Mode of recording. Takes all symbols and a subset of the symbols.
`-Symbols / -Sym <Symbol1,Symbol2>`	List of symbol subset as comma-separated list.
`-RecorderGuid <guid>`	Guid of the Analytics Storage Provider Recorder window.
`-Storage <guid>`	Guid from Storage where to write.
`-SubBroker <guid>`	Guid from the Sub Broker from which the data is to be recorded.

Historical data stream start/stop parameters:

`-SystemID <systemID guid>`	System ID of the recorded data set.
`-Topic <topic>`	Topic of the recorded data set.
`-Layout <layout guid>`	Layout of the recorded data set.
`-RecordID <id>`	ID of the data set to be streamed.
`-StartTime <time ns>`	Start time of the data set to be streamed in nanoseconds.
`-EndTime <time ns>`	End time of the data set to be streamed in nanoseconds.
`-MaxSamples <samples>`	Maximum number of samples (default value: 5000)
`-UsrSampleTime <ms>`	Sampling rate. (Default value: -1; sampling rate of the recording)
`-DataFormat <Bin|Json>`	Data format of the data stream.
`-ResultTopic <topic>`	Result MQTT topic to which the data will be streamed.
`-Mode <All|Subset>`	Streaming mode. Streams all or a subset of the symbols.
`-Symbols / -Sym <Symbol1,Symbol2>`	List of symbol subset as comma-separated list.

Historical data stream update parameters:

`-MaxSamples <samples>`	Maximum number of samples (default value: 5000)
`-UsrSampleTime <ms>`	Sampling rate. (Default value: -1; sampling rate of the recording)
`-MaxPackSize <samples>`	Maximum message size in kilobytes
`-SendDuration <ms>`	Waiting time between sending messages in milliseconds.
`-ResultTopic <topic>`	Result MQTT topic to which the data will be streamed.

RuleEngine pipeline parameter:

`- PipelineGuid <guid>`	Guid of the RuleEngine pipeline.
`- RuleID <id>`	ID of the rule within a RuleEngine pipeline.

Delete recordings Parameters:

`- DateTimeOlderThan <datetime>`	Timestamp in the format "yyyy-MM-dd hh:mm". Any recording with an end time older than this timestamp will be deleted.
`- HistoricalStreamTopic <topic>`	Topic of the historical stream (optional).

Data Import Parameters:

`-SourcePath <Path>`	Path to the folder with the files to be imported.
`-StorageType <StorageType>`	Choice of Storage type: AnalyticsFile Apache_IoTDB AzureBlob CSVFile InfluxDB_Plain MsSQL MsSQL_Plain PostgreSQL
`-Storage <StorageGuid>`	Guid of the Storage.
`-CopyData <true|false>`	Copy or move the data.
`-Topic <string>`	Topic name of the data to be imported.
`-Alias <string>`	Alias name of the data to be imported.
`-RecName <string>`	Record name of the data to be imported
`-SystemID <Guid>`	System ID of the data to be imported.
`-SysIDAlias <string>`	System alias of the data to be imported.
`-Address <string>`	Address of the data to be imported.
`-Latitude <double>`	Latitude of the data to be imported.
`-Longitude <double>`	Longitude of the data to be imported.

Command line samples:

Create configuration:

```
TwinCAT.Analytics.StorageProvider.Client
     -CreateASPConfig
          -MainTopic Beckhoff/ASPTest
          -Comment Analytics Storage Provider (Test)
          -EventLogTrace False
          -DebugLog False
          -StorageType ANALYTICSFILE
               -StorageConnString C:\TwinCAT\Functions\TF3520-Analytics-StorageProvider\Storage
               -MaxDuration 120
               -MaxWriteLen 2048
          -Broker 172.17.62.135
               -Port 1883
               -User tcanalytics
               -Pwd 123
```

Start recording with local Analytics Storage Provider:

```
TwinCAT.Analytics.StorageProvider.Client
     -localprovider
     -startrecord
          -alias cmdTest
          -recname cmdRec1
          -topic TestSignals/TestStream
          -dataformat Bin
          -Duration 30
          -mode Subset
          -Symbols Variables.fCosine,Variables.fSine
```

Start configuration file of a recording:

```
TwinCAT.Analytics.StorageProvider.Client
     -ConfigFile "C:
\Users\User\AppData\Roaming\Beckhoff\TwinCAT Analytics Storage Provider\TcAnalyticsStorageProvider_R
ecorder.xml"
     -ProviderGuid 76141a7f-e580-4281-99d8-1b8a75ca014d
     -startrecord
     -ConfigCmdAlias cmdTest
```

Check recording status

```
TwinCAT.Analytics.StorageProvider.Client
     -Broker 172.17.62.135
          -Port 1883
          -User tcanalytics
          -Pwd 123
     -ProviderGuid 76141a7f-e580-4281-99d8-1b8a75ca014d
     -IsRecordingActive
          -alias cmdTest
          -recorderGuid a8e171d2-712d-bd8e-da15-7eef28b71ad2
```

Stop all recordings:

```
TwinCAT.Analytics.StorageProvider.Client
     -Broker 172.17.62.135
          -Port 1883
          -User tcanalytics
          -Pwd 123
     -ProviderGuid 76141a7f-e580-4281-99d8-1b8a75ca014d
     -CancelAllRec
```

Start historical data stream:

```
TwinCAT.Analytics.StorageProvider.Client
     -localprovider
     -GetHistorical
          -systemID c29ac2d4-76ce-ff44-4d7f-355ffbcca6bf
          -layout 9a8e171d-712d-bd8e-da15-7eef28b71ad2
          -topic TestSignals/TestStream
          -recordID 1
          -startTime 132696863612730000
          -endTime 132696864177720000
          -maxSamples 5000
          -usrSampleTime -1
          -resultTopic _TestSignals/TestStream/123
          -dataformat Bin
          -mode Subset -symbols Variables.fSine
```

Start RuleEngine pipeline:

```
TwinCAT.Analytics.StorageProvider.Client
     -localprovider
     -StartPipeline
          -PipelineGuid d00c5366-4cf5-4d4e-a2f6-9dbe759e9dd2
```

Stop RuleEngine pipeline:

```
TwinCAT.Analytics.StorageProvider.Client
     -localprovider
     -StopPipeline
          -PipelineGuid d00c5366-4cf5-4d4e-a2f6-9dbe759e9dd2
```

Start a special rule of a RuleEngine pipeline:

```
TwinCAT.Analytics.StorageProvider.Client
     -localprovider
     -RestartRule
          -PipelineGuid d00c5366-4cf5-4d4e-a2f6-9dbe759e9dd2
          -RuleID 2
```

Delete old recordings:

```
TwinCAT.Analytics.StorageProvider.Client
     -localprovider
     -DeleteRecordingsOlderThan
          -DateTimeOlderThan yyyy-MM-dd 00:00
          - HistoricalStreamTopic Beckhoff /TcAnalyticsStorageProvider/41cfa2be-
ca72-4145-9e37-875851502aa6/Historical/Stream_65
```

Importing data

```
TwinCAT.Analytics.StorageProvider.Client
     -DataImport
     -SourcePath C:\\temp\\ED6A9F45-04D7-2D3A-7834-D3D1CF5EB21D
     -StorageType CSVFile
     -Storage e5a61c3d-dd98-40fc-a63f-4c41f6f19729
     -CopyData true
     -Topic AnalyticsStorageProvider/UnknownAnalyticsFile
     -Alias Unknown
     -RecName Record
     -SystemID 53fae9bf-03fa-48ac-81e7-74f042eec6c2
     -SysIDAlias Unknown AnalyticsFile
     -Address TestAddress
     -Latitude 1.0
     -Longitude 5.0
```

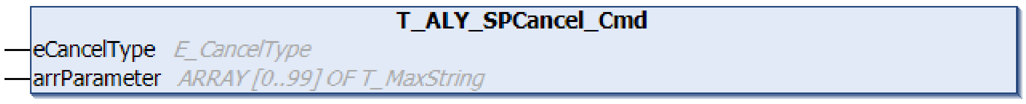
7 PLC API

7.1 Function blocks

7.1.1 Topic Architecture

7.1.1.1 Commands

7.1.1.1.1 T_ALY_SPCancel_Cmd



Syntax

Definition:

```
FUNCTION_BLOCK T_ALY_SPCancel_Cmd EXTENDS T_ALY_JsonPayload
VAR_INPUT
    eCancelType : E_CancelType;
    arrParameter : ARRAY [0..99] OF T_MaxString;
END_VAR
```

Inheritence hierarchy

T_ALY_JsonPayload

  T_ALY_SPCancel_Cmd

Inputs

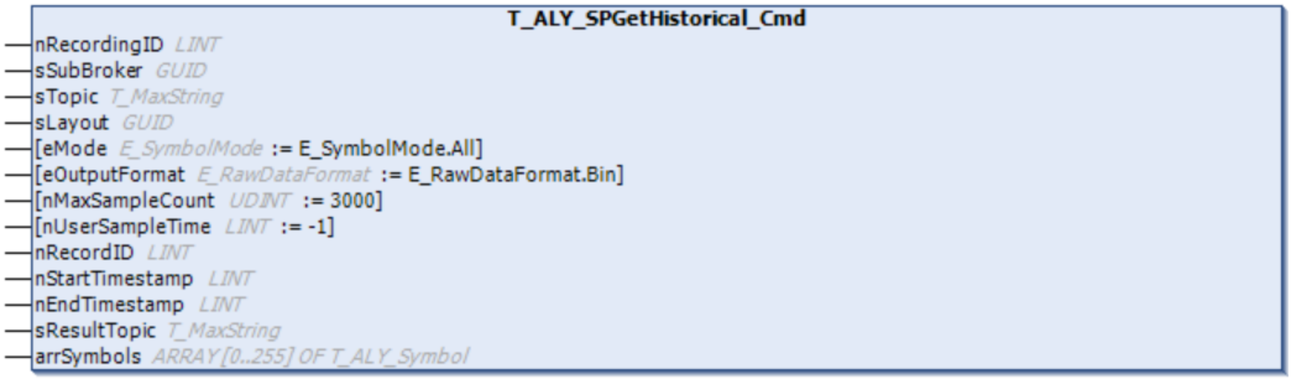
Name	Type	Description
eCancelType	E_CancelType [▶ 145]	
arrParameter	ARRAY [0..99] OF T_MaxString	

Methods

Name	Definition location	Description
Reset		Reset all values in the payload FB.
Init_JsonValue	Inherited from T_ALY_JsonPayload	Initialization of the FB with JSON object.

Development Environment	Target platform	PLC libraries to include
TwinCAT v3.1.4022.25	PC or CX (x64, x86, Arm®)	Tc3_AnalyticsStorageProvider

7.1.1.1.2 T_ALY_SPGetHistorical_Cmd


T_ALY_SPGetHistorical_Cmd
nRecordingID LINT
sSubBroker GUID
sTopic T_MaxString
sLayout GUID
[eMode E_SymbolMode := E_SymbolMode.All]
[eOutputFormat E_RawDataFormat := E_RawDataFormat.Bin]
[nMaxSampleCount UDINT := 3000]
[nUserSampleTime LINT := -1]
nRecordID LINT
nStartTimestamp LINT
nEndTimestamp LINT
sResultTopic T_MaxString
arrSymbols ARRAY [0..255] OF T_ALY_Symbol

Syntax

Definition:

```
FUNCTION_BLOCK T_ALY_SPGetHistorical_Cmd EXTENDS T_ALY_JsonPayload
VAR_INPUT
    nRecordingID : LINT;
    sSubBroker : GUID;
    sTopic   : T_MaxString;
    sLayout : GUID;
    eMode    : E_SymbolMode := E_SymbolMode.All;
    eOutputFormat    : E_RawDataFormat := E_RawDataFormat.Bin;
    nMaxSampleCount : UDINT := 3000;
    nUserSampleTime : DINT := -1;
    nRecordID : DINT;
    nStartTimestamp : LINT;
    nEndTimestamp    : LINT;
    sResultTopic : T_MaxString;
    arrSymbol : ARRAY [0..255] OF T_ALY_Symbol;
END_VAR
```

Inheritence hierarchy

T_ALY_JsonPayload

  T_ALY_SPGetHistorical_Cmd

Inputs

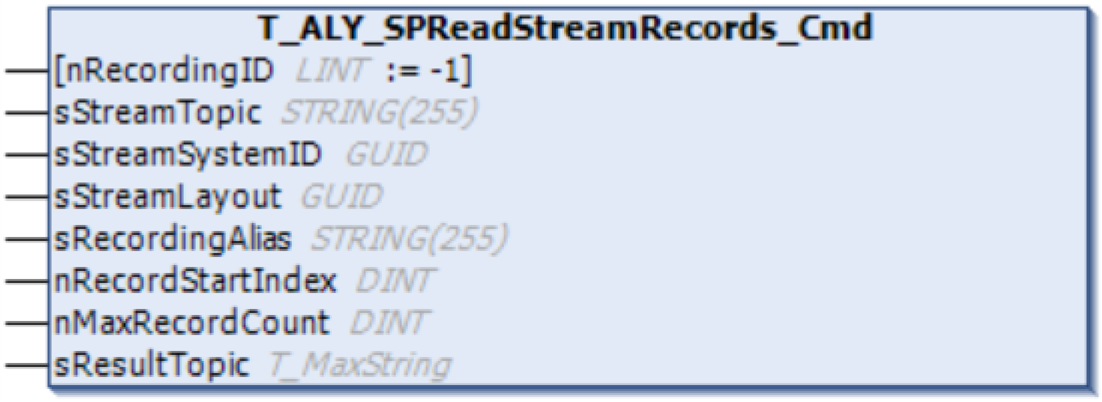
Name	Type	Description
nRecordingID	LINT	Specific ID of the recording to be used
sSubBroker	GUID	Individual GUID of the MessageBroker via which the data is sent.
sTopic	T_MaxString	Topic name of the recorded live stream.
sLayout	GUID	Layout GUID of the recording.
eMode	E_SymbolMode [▶ 150]	Get all symbols or only a subset.
eOutputFormat	E_RawDataFormat [▶ 147]	Format of the returned data (actually only “Bin” supported).
nMaxSampleCount	UDINT	Maximum number of samples in a payload package.
nUserSampleTime	DINT	Sample time in milliseconds of the returned stream. (-1 uses the recorded sample time.)
nRecordID	DINT	Number of the record.
nStartTimestamp	LINT	Start time
nEndTimestamp	LINT	End time
sResultTopic	T_MaxString	Topic name of the result stream.
arrSymbol	ARRAY [0..255] OF T_ALY_Symbol [▶ 130]	If SymbolMode is Subset, only the list of this symbols will be returned.

Methods

Name	Definition location	Description
Reset		Reset all values in the payload FB.
Init_JsonValue	Inherited from T_ALY_JsonPayload	Initialization of the FB with JSON object.

Development Environment	Target platform	PLC libraries to include
TwinCAT v3.1.4022.25	PC or CX (x64, x86, Arm®)	Tc3_AnalyticsStorageProvider

7.1.1.1.3 T_ALY_SPReadStreamRecords_Cmd



Syntax

Definition:

```
FUNCTION_BLOCK T_ALY_SPReadStreamRecords_Cmd EXTENDS T_ALY_JsonPayload
VAR_INPUT
    nRecordingID : LINT := -1;
    sStreamTopic  : STRING(255);
    sStreamSystemID : GUID;
    sStreamLayout : GUID;
    nRecordStartIndex : DINT;
    nMaxRecordCount : DINT;
    sResultTopic : T_MaxString;
END_VAR
```

Inheritance hierarchy

T_ALY_JsonPayload

  T_ALY_SPReadStreamRecords_Cmd

Inputs

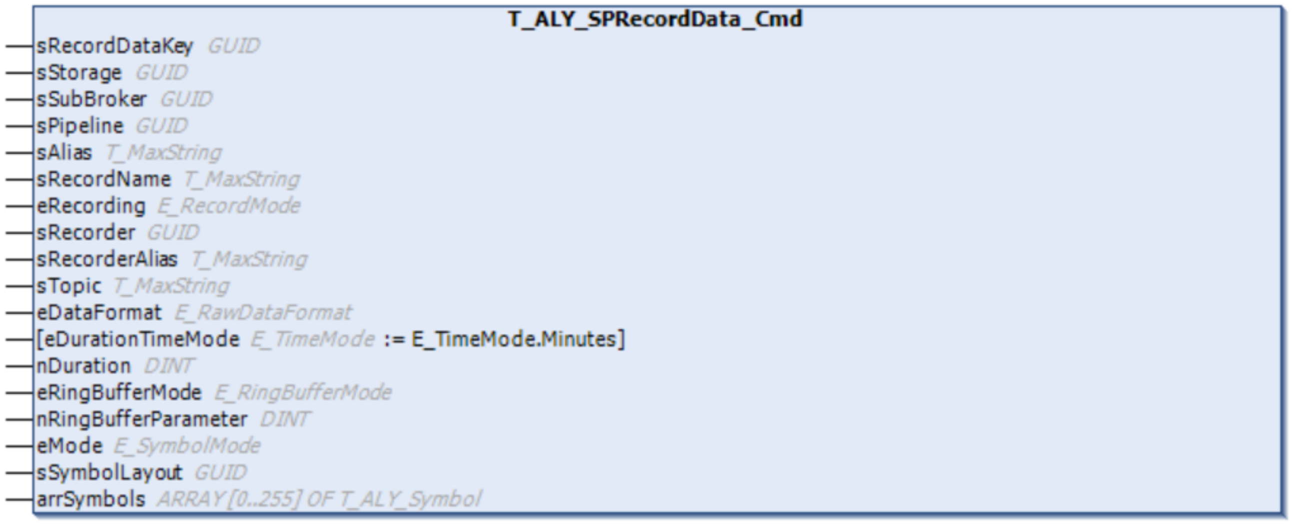
Name	Type	Description
nRecordingID	LINT	Specific ID of the recording to be used
sStreamTopic	STRING(255)	Topic name of the recorded live stream.
sStreamSystemID	GUID	SystemID of the target system from where the live stream was sent
sStreamLayout	GUID	Layout GUID of the recording
nRecordStartIndex	DINT	Start index of the first record to be read.
nMaxRecordCount	DINT	Total number of records to be read.
sResultTopic	T_MaxString	Topic name of the result stream

Methods

Name	Definition location	Description
Reset		Reset all values in the payload FB.
Init_JsonValue	Inherited from T_ALY_JsonPayload	Initialization of the FB with JSON object.

Development Environment	Target platform	PLC libraries to include
TwinCAT v3.1.4022.25	PC or CX (x64, x86, Arm®)	Tc3_AnalyticsStorageProvider

7.1.1.1.4 T_ALY_SPRecordData_Cmd



Syntax

Definition:

```
FUNCTION_BLOCK T_ALY_SPRecordData_Cmd EXTENDS T_ALY_JsonPayload
VAR_INPUT
    sRecordDataKey : GUID;
    sStorage : GUID;
    sSubBroker : GUID;
    sPipeline : GUID;
    sAlias : T_MaxString;
    sRecordName : T_MaxString;
    eRecording : E_RecordMode;
    sRecorder : GUID;
    sRecorderAlias : T_MaxString;
    sTopic : T_MaxString;
    eDataFormat : E_RawDataFormat;
    eDurationTimeMode : E_TimeMode := E_TimeMode.Minutes;
    nDuration : DINT;
    eRingBufferMode : E_RingBufferMode;
    nRingBufferParameter : DINT;
    eMode : E_SymbolMode;
    sSymbolLayout : GUID;
    arrSymbols : ARRAY [0..255] OF T_ALY_Symbol;
END_VAR
```

Inheritence hierarchy

T_ALY_JsonPayload

  T_ALY_SPRecordData_Cmd

Inputs

Name	Type	Description
sRecordDataKey	GUID	Individual GUID to identify the recording
sStorage	GUID	Individual GUID of the Storage to be used
sSubBroker	GUID	Individual GUID of the message broker to be used
sPipeline	GUID	Optional – GUID of the RuleEngine pipeline
sAlias	T_MaxString	Alias name for the recording.
sRecordName	T_MaxString	Name for this record.
eRecording	E_RecordMode [▸ 147]	Start or Stop the recording.
sRecorder	GUID	Individual GUID of the recorder.
sRecorderAlias	T_MaxString	Alias name for the recorder.
sTopic	T_MaxString	Topic name of the live stream.
eDataFormat	E_RawDataFormat [▸ 147]	Saving the data format (currently only binary format is supported).
eDurationTimeMode	E_TimeMode [▸ 148]	Resolution of the nDuration parameter
nDuration	DINT	Duration of the recording in minutes. (-1 unlimited)
eRingBufferMode	E_RingBufferMode [▸ 148]	Ring buffer mode

nRingBufferParameter	DINT	TimeBased => parameter in minutes.
		DataBased => parameter in megabytes.

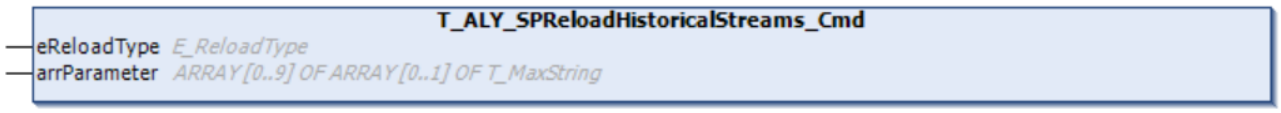
eMode	E_SymbolMode [▸ 150]	Record all symbols or only a subset.
sSymbolLayout	GUID	
arrSymbols	ARRAY [0..255] OF T_ALY_Symbol [▸ 130]	If SymbolMode is Subset, only the list of this symbols will be recorded.

Methods

Name	Definition location	Description
Reset		Reset all values in the payload FB.
Init_JsonValue	Inherited from T_ALY_JsonPayload	Initialization of the FB with JSON object.

Development Environment	Target platform	PLC libraries to include
TwinCAT v3.1.4022.25	PC or CX (x64, x86, Arm®)	Tc3_AnalyticsStorageProvider

7.1.1.1.5 T_ALY_SPReloadHistoricalStreams_Cmd


T_ALY_SPReloadHistoricalStreams_Cmd
eReloadType E_ReloadType
arrParameter ARRAY [0..9] OF ARRAY [0..1] OF T_MaxString

Syntax

Definition:

```
FUNCTION_BLOCK T_ALY_SPReloadHistoricalStreams_Cmd EXTENDS T_ALY_JsonPayload
VAR_INPUT
    eReloadType : E_ReloadType;
    arrParameter : ARRAY [0..9] OF ARRAY [0..1] OF T_MaxString;
END_VAR
```

Inheritance hierarchy

T_ALY_JsonPayload

T_ALY_SPReloadHistoricalStreams_Cmd

Inputs

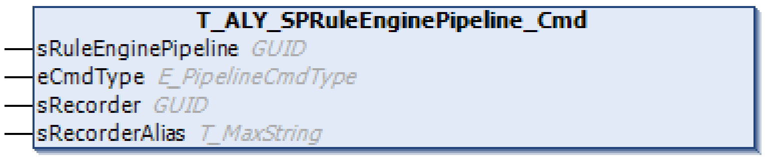
Name	Type	Description
eReloadType	E_ReloadType [▶ 148]	Update mode selection
arrParameter	ARRAY [0..9] OF ARRAY [0..1] OF T_MaxString	Additional parameters

Methods

Name	Definition location	Description
Reset		Reset all values in the payload FB.
Init_JsonValue	Inherited from T_ALY_JsonPayload	Initialization of the FB with JSON object.

Development Environment	Target platform	PLC libraries to include
TwinCAT v3.1.4022.25	PC or CX (x64, x86, Arm®)	Tc3_AnalyticsStorageProvider

7.1.1.1.6 T_ALY_SPRuleEnginePipeline_Cmd


T_ALY_SPRuleEnginePipeline_Cmd
sRuleEnginePipeline GUID
eCmdType E_PipelineCmdType
sRecorder GUID
sRecorderAlias T_MaxString

Syntax

Definition:

```
FUNCTION_BLOCK T_ALY_SPRecordData_Cmd EXTENDS T_ALY_JsonPayload
VAR_INPUT
    sRuleEnginePipeline : GUID;
    eCmdType : E_PipelineCmdType;
    sRecorder : GUID;
    sRecorderAlias : T_MaxString;
END_VAR
```

Inheritance hierarchy

T_ALY_JsonPayload

T_ALY_SPRuleEnginePipeline_Cmd

Inputs

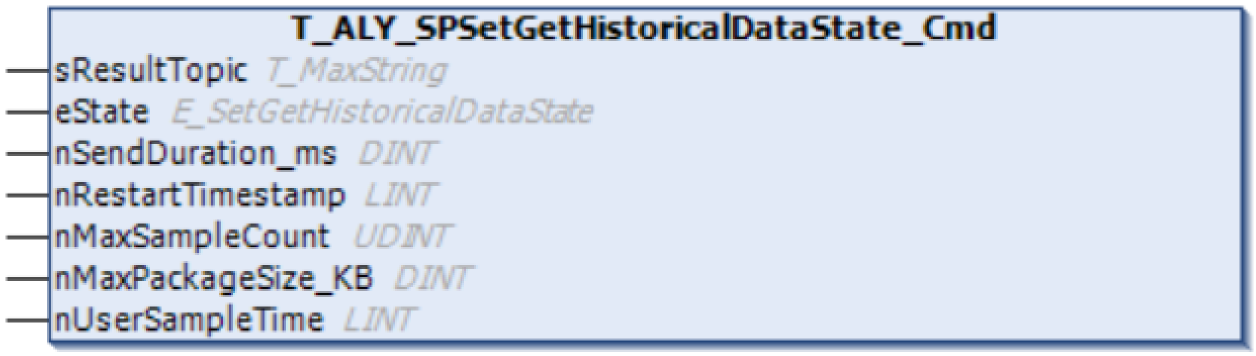
Name	Type	Description
sRuleEnginePipeline	GUID	Individual GUID of the RuleEngine pipeline.
eCmdType	E_PipelineCmdType [▶ 150]	Start or Stop the recording.
sRecorder	GUID	Individual GUID of the recorder.
sRecorderAlias	T_MaxString	Alias name for the recorder.

Methods

Name	Definition location	Description
Reset		Reset all values in the payload FB.
Init_JsonValue	Inherited from T_ALY_JsonPayload	Initialization of the FB with JSON object.

Development Environment	Target platform	PLC libraries to include
TwinCAT v3.1.4022.25	PC or CX (x64, x86, Arm®)	Tc3_AnalyticsStorageProvider

7.1.1.1.7 T_ALY_SPSetGetHistoricalDataState_Cmd



Syntax

Definition:

```
FUNCTION_BLOCK T_ALY_SPSetGetHistoricalDataState_Cmd EXTENDS T_ALY_JsonPayload
VAR_INPUT
    sResultTopic  : T_MaxString;
    eState : E_SetGetHistoricalDataState;
    nSendDuration_ms : DINT;
    nRestartTimestamp : LINT;
    nMaxSampleCount : UDINT;
    nMaxPackageSize_KB: DINT;
    nUserSampleTime : LINT;
END_VAR
```

Inheritance hierarchy

T_ALY_JsonPayload

  T_ALY_SPSetGetHistoricalDataState_Cmd

Inputs

Name	Type	Description
sResultTopic	T_MaxString	Topic name of the result stream (used like a handle).
eSta.te	E_SetGetHistoricalDataState [▶ 149]	Historical stream state
nSendDuration_ms	DINT	Waiting time between sending the individual packages
nRestartTimestamp	LINT	Timestamp at which the result stream is continued.
nMaxSampleCount	UDINT	Maximum number of entries in a package
nMaxPackageSize_KB	DINT	Maximum size of a package
nUserSampleTime	LINT	Sample time in milliseconds of the returned stream (-1 uses the recorded sample time).

Methods

Name	Definition location	Description
Reset		Reset all values in the payload FB.
Init_JsonValue	Inherited from T_ALY_JsonPayload	Initialization of the FB with JSON object.

Development Environment	Target platform	PLC libraries to include
TwinCAT v3.1.4022.25	PC or CX (x64, x86, Arm®)	Tc3_AnalyticsStorageProvider

7.1.1.1.8 T_ALY_SPStorageCtrl_Cmd

T_ALY_SPStorageCtrl_Cmd
eCtrlMode E_ControlMode
sStorageGuid GUID

Syntax

Definition:

```
FUNCTION_BLOCK T_ALY_SPStorageCtrl_Cmd EXTENDS T_ALY_JsonPayload
VAR_INPUT
    eCtrlMode : E_ControlMode;
    sStorageGuid : GUID;
END_VAR
```

Inheritence hierarchy

T_ALY_JsonPayload

T_ALY_SPRecordData_Cmd

Inputs

Name	Type	Description
eCtrlMode	E_ControlMode [▶ 146]	Start, stop, etc. of the Storage.
sStorageGuid	GUID	Individual GUID of the Storage.

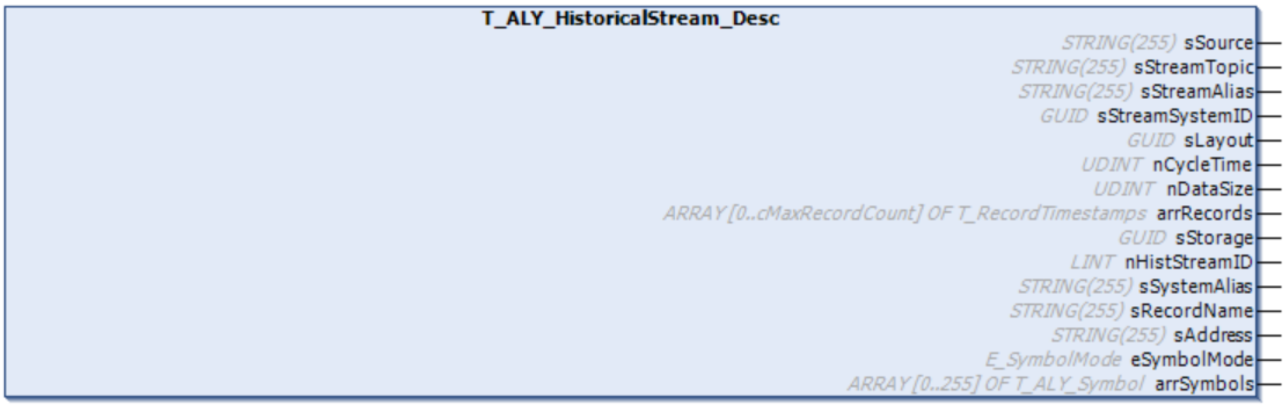
Methods

Name	Definition location	Description
Reset		Reset all values in the payload FB.
Init_JsonValue	Inherited from T_ALY_JsonPayload	Initialization of the FB with JSON object.

Development Environment	Target platform	PLC libraries to include
TwinCAT v3.1.4022.25	PC or CX (x64, x86, Arm®)	Tc3_AnalyticsStorageProvider

7.1.1.2 Descriptions

7.1.1.2.1 T_ALY_HistoricalStream_Desc



Syntax

Definition:

```
FUNCTION_BLOCK T_ALY_HistoricalStream_Desc EXTENDS T_ALY_JsonPayload
VAR_OUTPUT
    sSource  : STRING(255);
    sStreamTopic : STRING(255);
    sStreamAlias : STRING(255);
    sStreamSystemID : GUID;
    sLayout : GUID;
    nCycleTime: UDINT;
    nDataSize : UDINT;
    arrRecords : ARRAY [0..cMaxRecordCount] OF T_RecordTimestamps;
    sStorage : GUID;
    nHistStreamID : LINT;
    sSystemAlias : STRING(255);
    sRecordName : STRING(255);
    sAddress : STRING(255);
    eSymbolMode : E_SymbolMode;
    arrSymbols : ARRAY [0..255] OF T_ALY_Symbol;
END_VAR
```

Inheritance hierarchy

T_ALY_JsonPayload

  T_ALY_HistoricalStream_Desc

Outputs

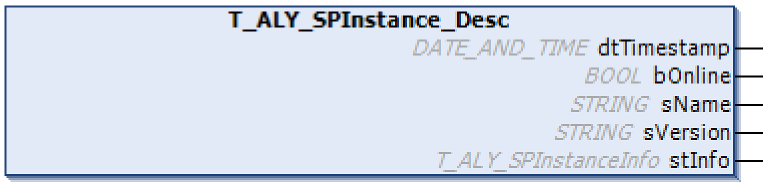
Name	Type	Description
sSource	STRING(255)	Data source name
sStreamTopic	STRING(255)	Topic name of the recorded stream
sStreamAlias	STRING(255)	Alias name of the stream
sStreamSystemID	GUID	SystemID GUID of the stream
sLayout	GUID	Layout GUID of the recording
nCycleTime	UDINT	Cycle time of the recording
nDataSize	UDINT	Data size of an entry of the recording
arrRecords	ARRAY [0..cMaxRecordCount] OF T_RecordTimestamps [▶ 130]	Timestamp of the various recordings
sStorage	GUID	Individual GUID of the Storage
nHistStreamID	LINT	Specific ID of the historical stream
sSystemAlias	STRING(255)	The system alias of the recorded data.
sRecordName	STRING(255)	The name of the recording
sAddress	STRING(255)	The address of the recorded data.
eSymbolMode	E_SymbolMode [▶ 150]	Recording mode
arrSymbols	ARRAY [0..255] OF T_ALY_Symbol	List of recorded symbols

Methods

Name	Definition location	Description
Reset		Reset all values in the payload FB.
Init_JsonValue	Inherited from T_ALY_JsonPayload	Initialization of the FB with JSON object.

Development Environment	Target platform	PLC libraries to include
TwinCAT v3.1.4022.25	PC or CX (x64, x86, Arm®)	Tc3_AnalyticsStorageProvider

7.1.1.2.2 T_ALY_SPInstance_Desc



Syntax

Definition:

```
FUNCTION_BLOCK T_ALY_SPInstance_Desc EXTENDS T_ALY_JsonPayload
VAR_OUTPUT
    dtTimestamp : DATE_AND_TIME;
    bOnline     : BOOL;
    sName       : STRING;
    sVersion    : STRING;
    stInfo      : T_ALY_SPInstanceInfo;
END_VAR
```

Inheritance hierarchy

T_ALY_JsonPayload

T_ALY_SPInstance_Desc

Outputs

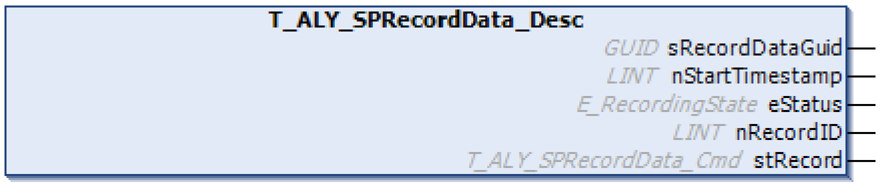
Name	Type	Description
dtTimestamp	DATE_AND_TIME	Start time of the Storage Provider Service
bOnline	BOOL	Indicates whether the service is online.
sName	STRING	IoT Device name "TwinCAT Analytics Storage Provider"
sVersion	STRING	Version of the Storage Provider
stInfo	T_ALY_SPInstanceInfo [▶ 127]	Detailed description of the Storage Provider

Methods

Name	Definition location	Description
Reset		Reset all values in the payload FB.
Init_JsonValue	Inherited from T_ALY_JsonPayload	Initialization of the FB with JSON object.

Development Environment	Target platform	PLC libraries to include
TwinCAT v3.1.4022.25	PC or CX (x64, x86, Arm®)	Tc3_AnalyticsStorageProvider

7.1.1.2.3 T_ALY_SPRecordData_Desc



Syntax

Definition:

```
FUNCTION_BLOCK T_ALY_SPRecordData_Desc EXTENDS T_ALY_JsonPayload
VAR_OUTPUT
    sRecordDataGuid    : GUID;
    nStartTimestamp    : LINT;
    eStatus            : E_RecordingState;
    nRecordID          : LINT;
    stRecord           : T_ALY_SPRecordData_Cmd;
END_VAR
```

Inheritance hierarchy

T_ALY_JsonPayload

T_ALY_SPRecordData_Desc

Outputs

Name	Type	Description
sRecordDataGuid	GUID	GUID "Key" to identify the recording
nStartTimestamp	LINT	Start time of the recording.
eStatus	E_RecordingState [▶ 147]	Recording state
nRecordID	LINT	Recording ID
stRecord	T_ALY_SPRecordData_Cmd [▶ 117]	Associated recording command

Methods

Name	Definition location	Description
Reset		Reset all values in the payload FB.
Init_JsonValue	Inherited from T_ALY_JsonPayload	Initialization of the FB with JSON object.

Development Environment	Target platform	PLC libraries to include
TwinCAT v3.1.4022.25	PC or CX (x64, x86, Arm®)	Tc3_AnalyticsStorageProvider

7.1.1.2.4 T_ALY_SPRecording_Desc

T_ALY_SPRecording_Desc
ARRAY [0..99] OF T_ALY_SPRecordData_Desc arrRecordings

Syntax

Definition:

```
FUNCTION_BLOCK T_ALY_SPRecording_Desc EXTENDS T_ALY_JsonPayload
VAR_OUTPUT
    aRecordings : ARRAY [0..99] OF T_ALY_SPRecordData_Desc;
END_VAR
```

Inheritance hierarchy

T_ALY_JsonPayload

    T_ALY_SPRecording_Desc

Outputs

Name	Type	Description
aRecordings	ARRAY [0..99] OF T_ALY_SPRecordData_Desc [▶ 124]	List of all current recordings

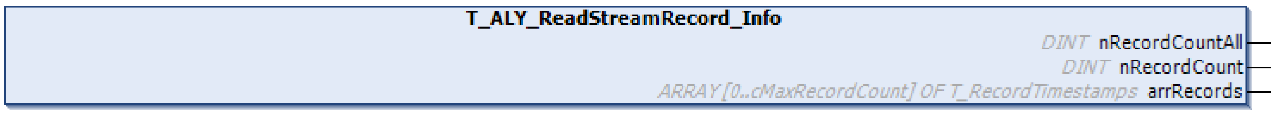
Methods

Name	Definition location	Description
Reset		Reset all values in the payload FB.
Init_JsonValue	Inherited from T_ALY_JsonPayload	Initialization of the FB with JSON object.

Development Environment	Target platform	PLC libraries to include
TwinCAT v3.1.4022.25	PC or CX (x64, x86, Arm®)	Tc3_AnalyticsStorageProvider

7.1.1.3 Info

7.1.1.3.1 T_ALY_ReadStreamRecord_Info


T_ALY_ReadStreamRecord_Info
DINT nRecordCountAll
DINT nRecordCount
ARRAY [0..cMaxRecordCount] OF T_RecordTimestamps arrRecords

Syntax

Definition:

```
FUNCTION_BLOCK T_ALY_HistoricalStream_Desc EXTENDS T_ALY_JsonPayload
VAR_OUTPUT
    nRecordCountAll: UDINT;
    nRecordCount : UDINT;
    arrRecords : ARRAY [0..cMaxRecordCount] OF T_RecordTimestamps;
END_VAR
```

Inheritance hierarchy

T_ALY_JsonPayload

  T_ALY_ReadStreamRecord_Info

Outputs

Name	Type	Description
nRecordCountAll	UDINT	Number of all existing records
nRecordCount	UDINT	Number of records read out
arrRecords	ARRAY [0..cMaxRecordCount] OF T_RecordTimestamps [▶ 130]	Timestamp of the records read out

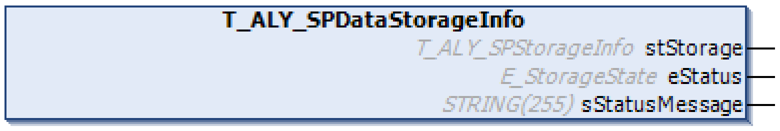
Methods

Name	Definition location	Description
Reset		Reset all values in the payload FB.
Init_JsonValue	Inherited from T_ALY_JsonPayload	Initialization of the FB with JSON object.

Development Environment	Target platform	PLC libraries to include
TwinCAT v3.1.4022.25	PC or CX (x64, x86, Arm®)	Tc3_AnalyticsStorageProvider

7.1.1.4 SubTypes

7.1.1.4.1 T_ALY_SPDataStorageInfo



Syntax

Definition:

```
FUNCTION_BLOCK T_ALY_SPDataStorageInfo EXTENDS T_ALY_JsonPayload
VAR_OUTPUT
    stStorage         : T_ALY_SPStorageInfo;
    eStatus           : E_StorageState;
    sStatusMessage    : STRING(255);
END_VAR
```

Inheritance hierarchy

T_ALY_JsonPayload

  T_ALY_SPDataStorageInfo

Outputs

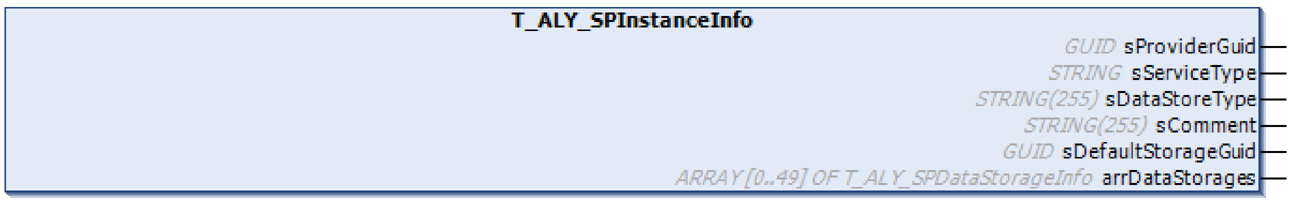
Name	Type	Description
stStorage	T_ALY_SPStorageInfo [▶ 128]	Detailed Storage information
eStatus	E_StorageState [▶ 149]	Status of the Storage
sStatusMessage	STRING(255)	Storage status message

Methods

Name	Definition location	Description
Reset		Reset all values in the payload FB.
Init_JsonValue	Inherited from T_ALY_JsonPayload	Initialization of the FB with JSON object.

Development Environment	Target platform	PLC libraries to include
TwinCAT v3.1.4022.25	PC or CX (x64, x86, Arm®)	Tc3_AnalyticsStorageProvider

7.1.1.4.2 T_ALY_SPInstanceInfo



Syntax

Definition:

```
FUNCTION_BLOCK T_ALY_SPInstanceInfo EXTENDS T_ALY_JsonPayload
VAR_OUTPUT
    sProviderGuid       : GUID;
    sServiceType        : STRING;
    sDataStoreType      : STRING(255);
    sComment            : STRING(255);
    sDefaultStorageGuid : GUID;
    arrDataStorages     : ARRAY [0..49] OF T_ALY_SPDataStorageInfo;
END_VAR
```

Inheritance hierarchy

T_ALY_JsonPayload

  T_ALY_SPInstanceInfo

Outputs

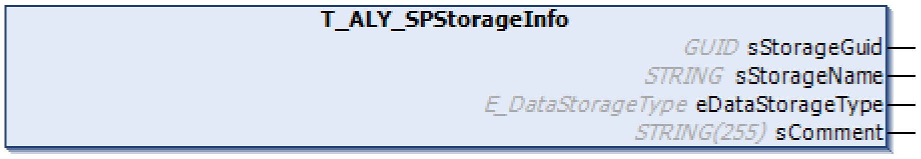
Name	Type	Description
sProviderGuid	GUID	Individual GUID of a Storage Provider instance
sServiceType	STRING	Service type
sDataStoreType	STRING(255)	Storage type
sComment	STRING(255)	Comment on the Storage Provider instance
sDefaultStorageGuid	GUID	Storage GUID of the Standard Storage
arrDataStorages	ARRAY [0..49] OF T_ALY_SPDataStorageInfo [▶ 126]	List of configured Storages

Methods

Name	Definition location	Description
Reset		Reset all values in the payload FB.
Init_JsonValue	Inherited from T_ALY_JsonPayload	Initialization of the FB with JSON object.

Development Environment	Target platform	PLC libraries to include
TwinCAT v3.1.4022.25	PC or CX (x64, x86, Arm®)	Tc3_AnalyticsStorageProvider

7.1.1.4.3 T_ALY_SPStorageInfo



Syntax

Definition:

```
FUNCTION_BLOCK T_ALY_SPStorageInfo EXTENDS T_ALY_JsonPayload
VAR_OUTPUT
    sStorageGuid        : GUID;
    sStorageName         : STRING;
    eDataStorageType      : E_DataStorageType;
    sComment             : STRING(255);
END_VAR
```

Inheritance hierarchy

T_ALY_JsonPayload

  T_ALY_SPStorageInfo

Outputs

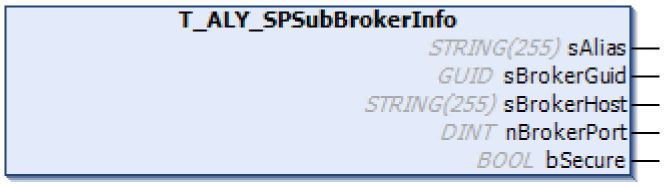
Name	Type	Description
sStorageGuid	GUID	Individual GUID of a Storage
sStorageName	STRING	Name of the Storage
eDataStorageType	E_DataStorageType [▶ 146]	Storage type
sComment	STRING(255)	Comment on Storage

Methods

Name	Definition location	Description
Reset		Reset all values in the payload FB.
Init_JsonValue	Inherited from T_ALY_JsonPayload	Initialization of the FB with JSON object.

Development Environment	Target platform	PLC libraries to include
TwinCAT v3.1.4022.25	PC or CX (x64, x86, Arm®)	Tc3_AnalyticsStorageProvider

7.1.1.4.4 T_ALY_SPSubBrokerInfo



Syntax

Definition:

```
FUNCTION_BLOCK T_ALY_SPSubBrokerInfo EXTENDS T_ALY_JsonPayload
VAR_OUTPUT
    sAlias         : STRING(255);
    sBrokerGuid    : GUID;
    sBrokerHost    : STRING(255);
    nBrokerPort    : DINT;
    bSecure        : BOOL;
END_VAR
```

Inheritance hierarchy

T_ALY_JsonPayload

  T_ALY_SPSubBrokerInfo

Outputs

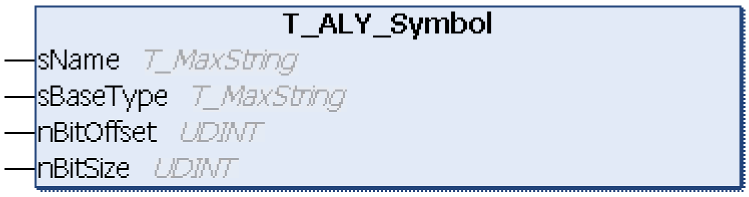
Name	Type	Description
sAlias	STRING(255)	Alias name of the broker configuration
sBrokerGuid	GUID	Individual GUID of the broker configuration
sBrokerHost	STRING(255)	Broker Host Name
nBrokerPort	DINT	Broker port
bSecure	BOOL	TRUE if communication is established via certificates.

Methods

Name	Definition location	Description
Reset		Reset all values in the payload FB.
Init_JsonValue	Inherited from T_ALY_JsonPayload	Initialization of the FB with JSON object.

Development Environment	Target platform	PLC libraries to include
TwinCAT v3.1.4022.25	PC or CX (x64, x86, Arm®)	Tc3_AnalyticsStorageProvider

7.1.1.4.5 T_ALY_Symbol



Syntax

Definition:

```
FUNCTION_BLOCK T_ALY_Symbol EXTENDS T_ALY_JsonPayload
VAR_INPUT
    sName   : T_MaxString;
    sBaseType   : T_MaxString;
    nBitOffset : UDINT;
    nBitSize    : UDINT;
END_VAR
```

Inheritence hierarchy

T_ALY_JsonPayload

T_ALY_Symbol

Inputs

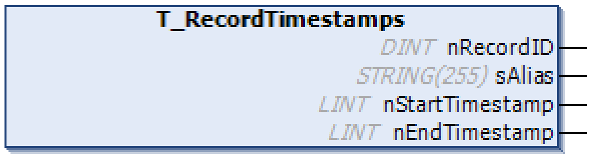
Name	Type	Description
sName	T_MaxString	Name of the symbol
sBaseType	T_MaxString	DataType of the symbol
nBitOffset	UDINT	BitOffset of the symbol
nBitSize	UDINT	BitSize of the symbol

Methods

Name	Definition location	Description
Reset		Reset all values in the payload FB.
Init_JsonValue	Inherited from T_ALY_JsonPayload	Initialization of the FB with JSON object.

Development Environment	Target platform	PLC libraries to include
TwinCAT v3.1.4022.25	PC or CX (x64, x86, Arm®)	Tc3_AnalyticsStorageProvider

7.1.1.4.6 T_RecordTimestamps



Syntax

Definition:

```
FUNCTION_BLOCK T_RecordTimestamps EXTENDS T_ALY_JsonPayload
VAR_OUTPUT
    nRecordID  : DINT;
    sAlias    : STRING(255);
    nStartTimestamp : LINT;
    nEndTimestamp   : LINT;
END_VAR
```

Inheritance hierarchy

T_ALY_JsonPayload

  T_RecordTimestamps

Outputs

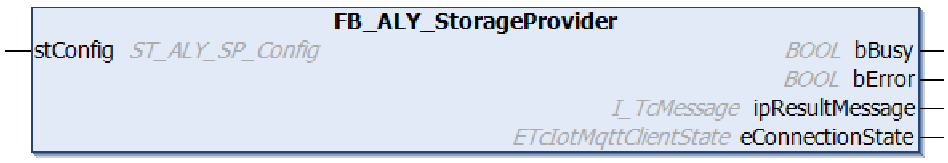
Name	Type	Description
nRecordID	DINT	Recording number
sAlias	STRING(255)	Alias name of the recording
nStartTimestamp	LINT	Start timestamp of the recording
nEndTimestamp	LINT	End timestamp of the recording

Methods

Name	Definition location	Description
Reset		Reset all values in the payload FB.
Init_JsonValue	Inherited from T_ALY_JsonPayload	Initialization of the FB with JSON object.

Development Environment	Target platform	PLC libraries to include
TwinCAT v3.1.4022.25	PC or CX (x64, x86, Arm®)	Tc3_AnalyticsStorageProvider

7.1.2 FB_ALY_StorageProvider


FB_ALY_StorageProvider
stConfig ST_ALY_SP_Config
BOOL bBusy
BOOL bError
I_TcMessage ipResultMessage
ETcIotMqttClientState eConnectionState

The FB_ALY_StorageProvider is a client FB for communication with a Storage Provider instance. The FB provides methods to trigger historical data or start/stop recordings.

Syntax

Definition:

```
FUNCTION_BLOCK FB_ALY_StorageProvider
VAR_INPUT
    stConfig : ST_ALY_SP_Config;
END_VAR
VAR_OUTPUT
    bBusy   : BOOL;
    bError : BOOL;
    ipResultMessage   : I_TcMessage;
    eConnectionState : ETcIotMqttClientState;
END_VAR
```

Inputs

Name	Type	Description
stConfig	ST_ALY_SP_Config [▸ 144]	Structure for the configuration of the FB.

Outputs

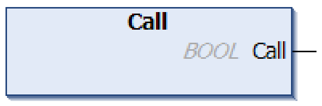
Name	Type	Description
bBusy	BOOL	TRUE as soon as a method of the function block is active.
bError	BOOL	Becomes TRUE when an error situation occurs.
ipResultMessage	I_TcMessage	Message interface of the TwinCAT 3 EventLogger, which provides further information about the return value.
eConnectionState	ETcIotMqttClientState	Specifies the state of the connection between client and broker as an enumeration ETcIotMqttClientState.

Methods

Name	Definition location	Description
Call [▸ 132]	Local	Method for background communication with the TwinCAT driver. The method must be called cyclically.
Cancel [▸ 133]	Local	Method for aborting activities of the TwinCAT Analytics Storage Provider.
GetHistoricalData [▸ 133]	Local	Method for requesting historical data.
GetInstanceInfo [▸ 134]	Local	Method for receiving the instance information of the Storage Provider.
GetRecordingInfoByAlias [▸ 134]	Local	Method for receiving recording information.
GetRecordingInfoByKey [▸ 135]	Local	Method for receiving recording information.
ReadHistoricalStreams [▸ 135]	Local	Method for reading all historical streams.
ReadStreamRecords [▸ 136]	Local	Method for reading all records of a historical stream.
ReadSubBroker [▸ 136]	Local	Method for reading all declared message brokers.
ResetCommunication [▸ 137]	Local	Method to reset the MQTT connection to the broker.
RestartPipelineRule [▸ 137]	Loca	Restarts a rule of a pipeline.
SendCommand [▸ 138]	Local	Generic method for sending various commands.
SetHistoricalDataState [▸ 138]	Local	Method for setting various parameters of a historical stream.
StartPipeline [▸ 139]	Local	Starts recording a live MQTT binary stream.
StartRecord [▸ 139]	Local	Starts recording a live MQTT binary stream.
StartRecordEx [▸ 140]	Local	Starts recording a live MQTT binary stream.
StopPipeline [▸ 140]	Local	Stops the selected recording.
StopRecord [▸ 141]	Local	Stops the selected recording.
StorageControlling [▸ 141]	Local	Method for controlling the declared storages.

Development Environment	Target platform	PLC libraries to include
TwinCAT v3.1.4022.25	PC or CX (x64, x86, Arm®)	Tc3_AnalyticsStorageProvider

7.1.2.1 Call



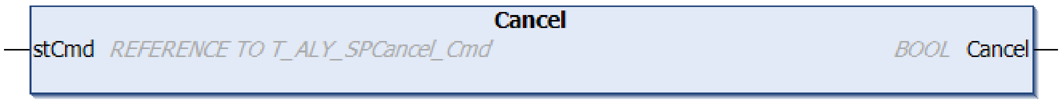
Syntax

```
METHOD Call : BOOL
```

Return value

Name	Type	Description
Call	BOOL	

7.1.2.2 Cancel



Syntax

```
METHOD Cancel : BOOL
VAR_INPUT
    stCmd : REFERENCE TO T_ALY_SPCancel_Cmd;
END_VAR
```

Inputs

Name	Type	Description
stCmd	REFERENCE TO T_ALY_SPCancel_Cmd [▶ 113]	JSON command to cancel operations of the TwinCAT Analytics Storage Provider.

Return value

Name	Type	Description
Cancel	BOOL	Is TRUE if done

7.1.2.3 GetHistoricalData

GetHistoricalData
stCmd
REFERENCE TO T_ALY_SPGetHistorical_Cmd
BOOL
GetHistoricalData

Syntax

```
METHOD GetHistoricalData : BOOL
VAR_INPUT
    stCmd : REFERENCE TO T_ALY_SPHistorical_Cmd;
END_VAR
```

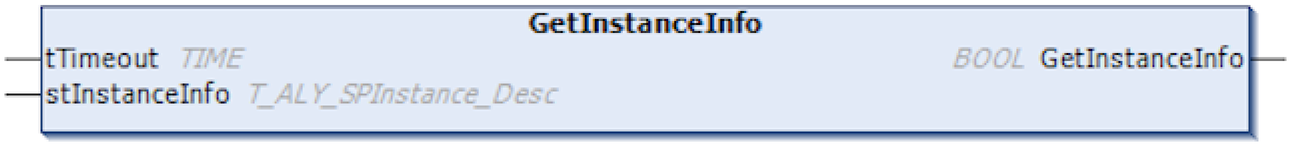
Inputs

Name	Type	Description
stCmd	REFERENCE TO T_ALY_SPGetHistorical_Cmd [▶ 114]	JSON command to get historical data from TwinCAT Analytics Storage Provider.

Return value

Name	Type	Description
GetHistoricalData	BOOL	Is TRUE if done

7.1.2.4 GetInstanceInfo



Syntax

```
METHOD GetInstanceInfo : BOOL
VAR_INPUT
    tTimeout : TIME;
    stInstanceInfo : T_ALY_SPInstance_Desc;
END_VAR
```

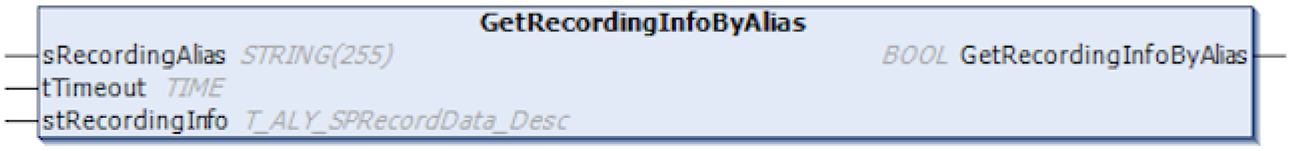
Inputs

Name	Type	Description
tTimeout	TIME	Duration until the procedure is aborted.
stInstanceInfo	T_ALY_SPInstance_Desc [▶ 123]	JSON description of the Storage Provider instance.

Return value

Name	Type	Description
GetInstanceInfo	BOOL	Is TRUE when completed

7.1.2.5 GetRecordingInfoByAlias


GetRecordingInfoByAlias
sRecordingAlias STRING(255)
tTimeout TIME
stRecordingInfo T_ALY_SPRecordData_Desc
BOOL GetRecordingInfoByAlias

Syntax

```
METHOD GetRecordingInfoByAlias : BOOL
VAR_INPUT
    sRecordingAlias  : STRING(255);
    tTimeout         : TIME;
    stRecordingInfo  : T_ALY_SPRecordData_Desc;
END_VAR
```

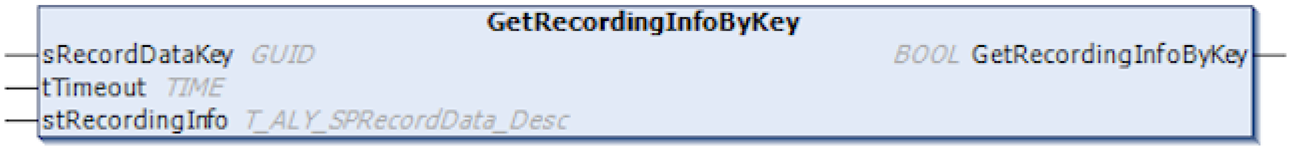
Inputs

Name	Type	Description
sRecordingAlias	STRING(255)	Search criterion "Alias"
tTimeout	TIME	Duration until the procedure is aborted.
stRecordingInfo	T_ALY_SPRecordData_Desc [▶ 124]	JSON description of the recording.

Return value

Name	Type	Description
GetRecordingInfoByAlias	BOOL	Is TRUE when completed

7.1.2.6 GetRecordingInfoByKey


GetRecordingInfoByKey
sRecordDataKey GUID
tTimeout TIME
stRecordingInfo T_ALY_SPRecordData_Desc
BOOL GetRecordingInfoByKey

Syntax

```
METHOD GetRecordingInfoByKey : BOOL
VAR_INPUT
    sRecordDataKey  : GUID;
    tTimeout        : TIME;
    stRecordingInfo : T_ALY_SPRecordData_Desc;
END_VAR
```

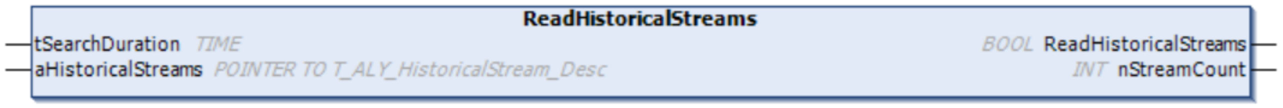
Inputs

Name	Type	Description
sRecordDataKey	GUID	Search criterion "RecordDataKey"
tTimeout	TIME	Duration until the procedure is aborted.
stRecordingInfo	T_ALY_SPRecordData_Desc [▸ 124]	JSON description of the recording.

Return value

Name	Type	Description
GetRecordingInfoByKey	BOOL	Is TRUE when completed

7.1.2.7 ReadHistoricalStreams


ReadHistoricalStreams
tSearchDuration TIME
aHistoricalStreams POINTER TO T_ALY_HistoricalStream_Desc
BOOL ReadHistoricalStreams
INT nStreamCount

Syntax

```
METHOD GetHistoricalData : BOOL
VAR_INPUT
    tSearchDuration    : TIME := TIME#5s0ms
    aHistoricalStreams : POINTER TO T_ALY_HistoricalStream_Desc;
END_VAR
VAR_OUTPUT
    nStreamCount       : INT;
END_VAR
```

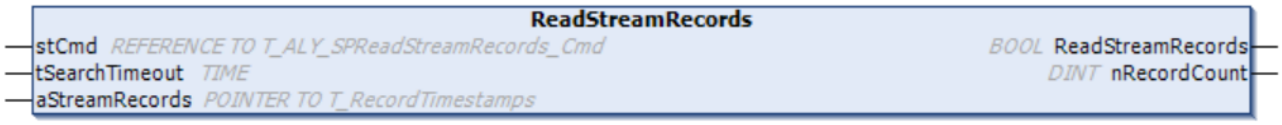
Inputs

Name	Type	Description
tSearchDuration	TIME	Time period in which to wait for feedback.
aHistoricalStreams	POINTER TO T_ALY_HistoricalStream_Desc [▸ 122]	Description of the different historical streams

Return value

Name	Type	Description
ReadHistoricalStreams	BOOL	Is TRUE when completed
nStreamCount	INT	Number of streams read out

7.1.2.8 ReadStreamRecords


ReadStreamRecords
stCmd REFERENCE TO T_ALY_SPReadStreamRecords_Cmd
tSearchTimeout TIME
aStreamRecords POINTER TO T_RecordTimestamps
BOOL ReadStreamRecords
DINT nRecordCount

Syntax

```
METHOD ReadStreamRecords : BOOL
VAR_INPUT
    stCmd          : REFERENCE TO T_ALY_SPReadStreamRecords_Cmd;
    tSearchTimeout : TIME := TIME#5s0ms;
    aStreamRecords : POINTER TO T_RecordTimestamps;
END_VAR
VAR_OUTPUT
    nRecordCount   : DINT;
END_VAR
```

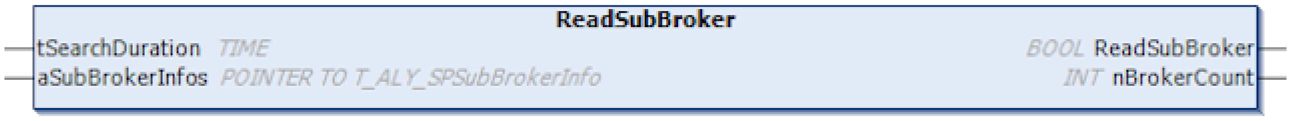
Inputs

Name	Type	Description
stCmd	REFERENCE TO T_ALY_SPReadStreamRecords_Cmd [▶ 115]	JSON command to get recordings of a historical stream from TwinCAT Analytics Storage Provider.
tSearchTimeout	TIME	Waiting time for the response.
aStreamRecords	POINTER TO T_RecordTimestamps [▶ 130]	Recordings read out

Return value

Name	Type	Description
ReadStreamRecords	BOOL	Is TRUE when completed
nRecordCount	DINT	Number of records read out

7.1.2.9 ReadSubBroker



Syntax

```
METHOD ReadSubBroker : BOOL
VAR_INPUT
    tSearchDuration   : TIME;
    aSubBrokerInfos   : POINTER TO T_ALY_SPSubBrokerInfo;
END_VAR
VAR_OUTPUT
    nBrokerCount      :INT;
END_VAR
```

Inputs

Name	Type	Description
tSearchDuration	TIME	Duration until the search is completed
aSubBrokerInfo	POINTER TO T_ALY_SPSubBrokerInfo [▶ 129]	Address to an array in which the broker information found is stored.

Return value

Name	Type	Description
ReadSubBroker	BOOL	Is TRUE when completed.
nBrokerCount	INT	Number of brokers found.

7.1.2.10 ResetCommunication

ResetCommunication
BOOL ResetCommunication

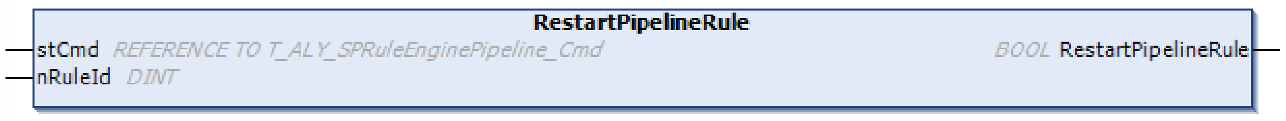
Syntax

```
METHOD ResetCommunication : BOOL
VAR_INPUT

END_VAR
```

Return value

Name	Type	Description
ResetCommunication	BOOL	Is TRUE when completed

7.1.2.11 RestartPipelineRule



Syntax

```
METHOD RestartPipelineRule : BOOL
VAR_INPUT
    stCmd : REFERENCE TO T_ALY_SPRuleEnginePipeline_Cmd;
    nRuleId : DINT;
END_VAR
```

Inputs

Name	Type	Description
stCmd	REFERENCE TO T_ALY_SPRuleEnginePipeline_Cmd [▶ 119]	JSON command to start the recording a live stream.
nRuleId	DINT	ID of the rule to be restarted.

Return value

Name	Type	Description
RestartPipelineRule	BOOL	Is TRUE when completed.

7.1.2.12 SendCommand

SendCommand
stCmd I_ALY_SPCommand
BOOL SendCommand

Syntax

```
METHOD SendCommand : BOOL
VAR_INPUT
    stCmd : I_ALY_SPCommand;
END_VAR
```

Inputs

Name	Type	Description
stCmd	I_ALY_SPCommand	JSON command to interact with the TwinCAT Analytics Storage Provider.

Return value

Name	Type	Description
SendCommand	BOOL	Is TRUE when completed

7.1.2.13 SetHistoricalDataState

SetHistoricalDataState
stCmd REFERENCE TO T_ALY_SPSetGetHistoricalDataState_Cmd
BOOL SetHistoricalDataState

Syntax

```
METHOD SetHistoricalDataState : BOOL
VAR_INPUT
    stCmd : REFERENCE TO T_ALY_SPGetSetHistoricalDataState_Cmd;
END_VAR
```

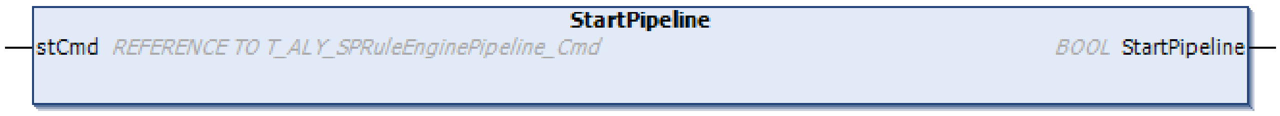
Inputs

Name	Type	Description
stCmd	REFERENCE TO T_ALY_SPGetSetHistoricalDataState_Cmd [▸ 120]	JSON command to set parameters of a started historical stream from the TwinCAT Analytics Storage Provider.

Return value

Name	Type	Description
SetHistoricalDataState	BOOL	Is TRUE when completed

7.1.2.14 StartPipeline



Syntax

```
METHOD StartPipeline : BOOL
VAR_INPUT
    stCmd : REFERENCE TO T_ALY_SPRuleEnginePipeline_Cmd;
END_VAR
```

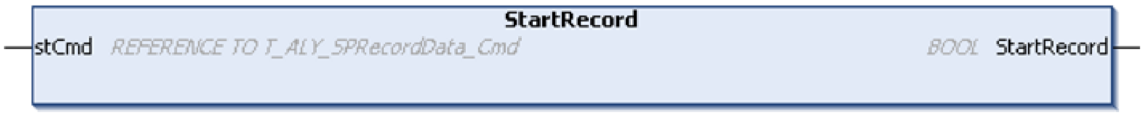
Inputs

Name	Type	Description
stCmd	REFERENCE TO T_ALY_SPRuleEnginePipeline_Cmd [▸ 119]	JSON command to start the recording a live stream.

Return value

Name	Type	Description
StartPipeline	BOOL	Is TRUE when completed.

7.1.2.15 StartRecord



Syntax

```
METHOD StartRecord : BOOL
VAR_INPUT
    stCmd : REFERENCE TO T_ALY_SPRecordData_Cmd;
END_VAR
```

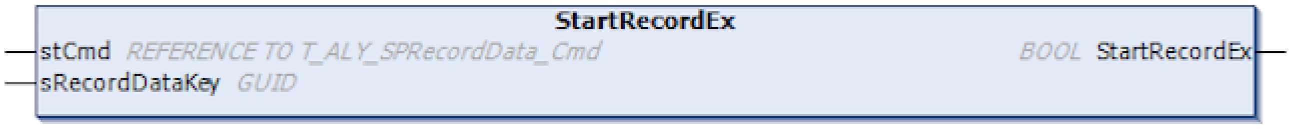
Inputs

Name	Type	Description
stCmd	REFERENCE TO T_ALY_SPRecordData_Cmd [▸ 117]	JSON command to start the recording a live stream.

Return value

Name	Type	Description
StartRecord	BOOL	Is TRUE if done

7.1.2.16 StartRecordEx



In contrast to the StartRecord [▶ 139] method, a RecordDataKey can be specified here. This key makes it easier to find the recording you have started in order to check the status of the recording. The GetRecordingInfoByKey [▶ 135] method can be used to retrieve the recording information.

Syntax

```
METHOD StartRecordEx : BOOL
VAR_INPUT
    stCmd : REFERENCE TO T_ALY_SPRecordData_Cmd;
    sRecordDataKey : GUID;
END_VAR
```

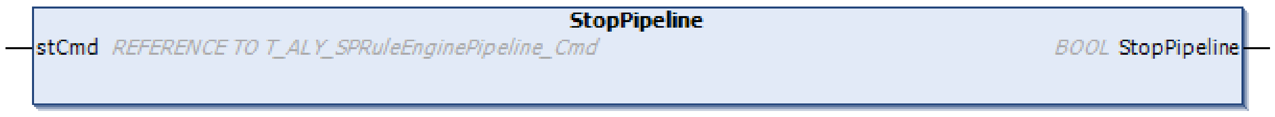
Inputs

Name	Type	Description
stCmd	REFERENCE TO T_ALY_SPRecordData_Cmd [▶ 117]	JSON command to start the recording a live stream.
sRecordDataKey	GUID	Guid "Key" to identify the recording that has been started.

Return value

Name	Type	Description
StartRecordEx	BOOL	Is TRUE when completed

7.1.2.17 StopPipeline



Syntax

```
METHOD StopPipeline : BOOL
VAR_INPUT
    stCmd : REFERENCE TO T_ALY_SPRuleEnginePipeline_Cmd;
END_VAR
```

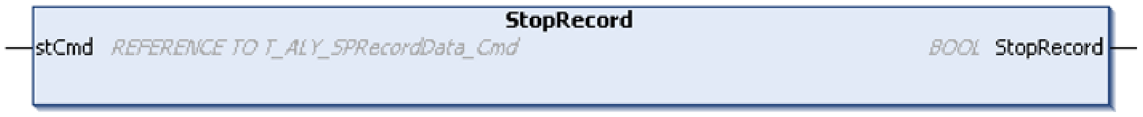
Inputs

Name	Type	Description
stCmd	REFERENCE TO T_ALY_SPRuleEnginePipeline_Cmd [▶ 119]	JSON command to stop recording of a live stream.

Return value

Name	Type	Description
StopPipeline	BOOL	Is TRUE when completed.

7.1.2.18 StopRecord



Syntax

```
METHOD StopRecord : BOOL
VAR_INPUT
    stCmd : REFERENCE TO T_ALY_SPRecordData_Cmd;
END_VAR
```

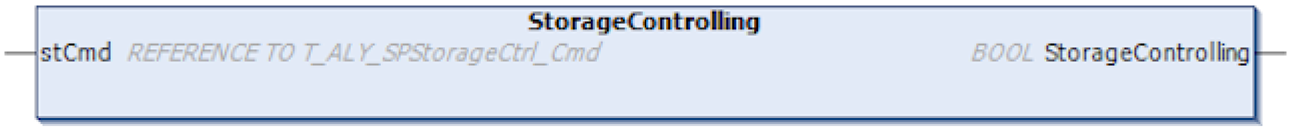
Inputs

Name	Type	Description
stCmd	REFERENCE TO T_ALY_SPRecordData_Cmd [▶ 117]	JSON command to stop recording of a live stream.

Return value

Name	Type	Description
StopRecord	BOOL	Is TRUE when completed.

7.1.2.19 StorageControlling



Syntax

```
METHOD StorageControlling : BOOL
VAR_INPUT
    stCmd : REFERENCE TO T_ALY_SPStorageCtrl_Cmd;
END_VAR
```

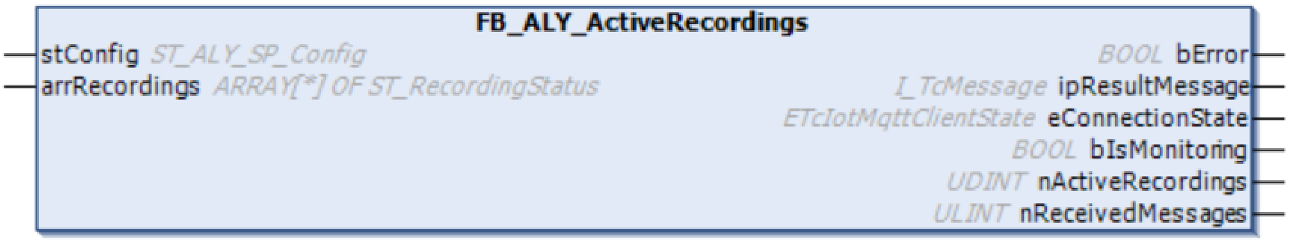
Inputs

Name	Type	Description
stCmd	REFERENCE TO T_ALY_SPStorageCtrl_Cmd [▶ 121]	JSON command to control the storages.

Return value

Name	Type	Description
StorageControlling	BOOL	Is TRUE when completed

7.1.3 FB_ALY_ActiveRecordings


FB_ALY_ActiveRecordings
stConfig ST_ALY_SP_Config
arrRecordings ARRAY[*] OF ST_RecordingStatus
BOOL bError
I_TcMessage ipResultMessage
ETcIotMqttClientState eConnectionState
BOOL bIsMonitoring
UDINT nActiveRecordings
ULINT nReceivedMessages

The FB_ALY_ActiveRecordings is a client FB for monitoring the active recordings of a Storage Provider instance. The FB provides methods to start and stop monitoring. The active recordings found are output at arrRecordings with the corresponding status information.

Syntax

Definition:

```
FUNCTION_BLOCK FB_ALY_ActiveRecordings
VAR_INPUT
    stConfig : ST_ALY_SP_Config;
END_VAR
VAR_IN_OUT
    arrRecordings : ARRAY [*] OF ST_RecordingStatus;
END_VAR
VAR_OUTPUT
    bError : BOOL;
    ipResultMessage  : I_TcMessage;
    eConnectionState : ETcIotMqttClientState;
    bIsMonitoring : BOOL;
    nActiveRecordings : UDINT;
    nReceivedMessages : ULINT;
END_VAR
```

Inputs

Name	Type	Description
stConfig	ST_ALY_SP_Config [▸ 144]	Structure for the configuration of the FB.

Inputs/outputs

Name	Type	Description
arrRecordings	ARRAY [*] OF ST_RecordingStatus [▸ 145]	List of active recordings found

Outputs

Name	Type	Description
bError	BOOL	Becomes TRUE when an error situation occurs.
ipResultMessage	I_TcMessage	Message interface of the TwinCAT 3 EventLogger, which provides further information about the return value.
eConnectionState	ETcIotMqttClientState	Specifies the state of the connection between client and broker as an enumeration ETcIotMqttClientState.
bIsMonitoring	BOOL	Becomes TRUE as soon as monitoring is started.
nActiveRecordings	UDINT	Number of active recordings found
nReceivedMessages	ULINT	Number of MQTT messages received

Methods

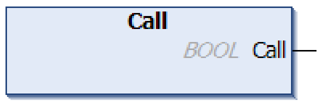
Name	Definition location	Description
Call [▸ 143]	Local	Method for background communication with the TwinCAT driver. The method must be called cyclically.
StartMonitoring [▸ 143]	Local	Starts the monitoring of active recordings
StopMonitoring [▸ 143]	Local	Stops the monitoring of active recordings

Development Environment	Target platform	PLC libraries to include
TwinCAT v3.1.4022.25	PC or CX (x64, x86, Arm®)	Tc3_AnalyticsStorageProvider

Also see about this

- ST_RecordingStatus [▸ 145]
- ST_RecordingStatus [▸ 145]

7.1.3.1 Call



Syntax

```
METHOD Call : BOOL
```

Return value

Name	Type	Description
Call	BOOL	

7.1.3.2 StartMonitoring

StartMonitoring
BOOL StartMonitoring

Syntax

```
METHOD StartMonitoring : BOOL
VAR
END_VAR
```

Return value

Name	Type	Description
StartMonitoring	BOOL	Is TRUE when completed

7.1.3.3 StopMonitoring

StopMonitoring
BOOL StopMonitoring

Syntax

```
METHOD StopMonitoring : BOOL
VAR_INPUT
END_VAR
```

Return value

Name	Type	Description
StopMonitoring	BOOL	Is TRUE when completed.

7.2 Data types

7.2.1 ST_ALY_SP_Config

Syntax

Definition:

```
TYPE ST_Msg :
STRUCT
    sMainTopic      : T_MaxString;
    sProviderGuid   : GUID;
    stConnSettings  : ST_ConnectionSettings
END_STRUCT
END_TYPE
```

Parameter

Name	Type	Descriptiom
sMainTopic	T_MaxString	The main topic where the TwinCAT Analytics Storage Provider is located on the message broker
sProviderGuid	GUID	The individual GUID of the TwinCAT Analytics Storage Provider Instance
stConnSettings	ST_ConnectionSettings [▸ 144]	MQTT connection settings to connect with the message broker

7.2.2 ST_ConnectionSettings

Syntax

Definition:

```
TYPE ST_ConnectionSettings :
STRUCT
    sHostName    : T_MaxString;
    nHostPort    : UINT := 1883;
    sUserId      : T_MaxString;
    sPassword    : T_MaxString;
    bWithCertificate : BOOL := FALSE;
    sCA      : T_MaxString;
    sCert    : T_MaxString;
    sKey     : T_MaxString;
sKeyPwd : T_MaxString;
END_STRUCT
END_TYPE
```

Parameter

Name	Type	Descriptiom
sHostName	T_MaxString	sHostName can be specified as name or as IP address. If no information is provided, the local host is used.
nHostPort	UINT	The host port can be specified here. The default is 1883.
sUserId	T_MaxString	Optionally, a user name can be specified.
sPassword	T_MaxString	A password for the user name can be entered here.
bWithCertificate	BOOL	If TRUE the certificates will be used for communication
sCA	T_MaxString	Certificate of the certificate authority (CA)
sCert	T_MaxString	Client certificate to be used for authentication at the broker
sKey	T_MaxString	Private key of the client
sKeyPwd	T_MaxString	Password of the private key, if applicable

7.2.3 ST_RecordingStatus

Syntax

Definition:

```
TYPE ST_RecordingStatus :
STRUCT
    sAlias : T_MaxString;
    sRecordName : T_MaxString;
    sRecordDataKey : GUID;
    nRecordID : LINT;
    nStartTimestamp : LINT;
    nLastReceivedSample : LINT;
    eStatus : E_RecordingState;
END_STRUCT
END_TYPE
```

Parameters

Name	Type	Description
sAlias	T_MaxString	sAlias contains the alias name of the recording.
sRecordName	T_MaxString	sRecordName contains the name of the record.
sRecordDataKey	GUID	Individual GUID of the recording.
nRecordID	LINT	Specific ID of the recording.
nStartTimestamp	LINT	Start time of the recording.
nLastReceivedSample	LINT	Time of the last received data packet of the recording.
eStatus	E_RecordingState [▶ 147]	Status of the recording.

7.2.4 E_CancelType

Syntax

Definition:

```
TYPE E_CancelType :
(
    HistoricalData := 0,
    AllRecordData
)INT;
END_TYPE
```

Parameter

Name	Descriptiom
HistoricalData	Canceled the selected historical data stream
AllRecordData	Canceled all running recordings

7.2.5 E_ControlMode

Syntax

Definition:

```
TYPE E_ControlMode :
(
    Start := 0,
    Stop,
    DeleteSettings
)INT;
END_TYPE
```

Parameters

Name	Description
Start	Starting the "Storage" is triggered.
Stop	Stopping the "Storage" is triggered.
DeleteSettings	"Storage" configuration should be deleted (only works if the "Storage" is not online).

7.2.6 E_DataStorageType

Syntax

Definition:

```
TYPE E_DataStorageType :
(
    Empty := 0,
    AnalyticsFile,
    AzureBlob,
    MsSQL_Binary,
    InfluxDB,
    MsSQL_Plain,
    CSVFile
)INT;
END_TYPE
```

Parameters

Name	Description
Empty	Unknown "Storage" type
AnalytticsFile	Analytics File (TwinCAT Analytics own data format)
AzureBlob	Microsoft Azure Blob
MsSQL_Binary	Microsoft SQL Server (data in binary format)
InfluxDB	Influx 2.x database
MsSQL_Plain	Microsoft SQL Server (data in plain text)
CSVFile	CSV file

7.2.7 E_RawDataFormat

Syntax

Definition:

```
TYPE E_RawDataFormat :
(
    Bin := 0,
    Json
)INT;
END_TYPE
```

Parameter

Name	Descriptiom
Bin	Analytics Binary Stream Format
Json	TwinCAT Json Format (actually not supported)

7.2.8 E_RecordingState

Syntax

Definition:

```
TYPE E_RecordingState :
(
    Not_Initialized := 0,
    Initializing,
    RecordingCanceled,
    Running,
    Running_QueueHyst,
    Stopping_ReceivingDataStopped,
    RecordingDone,
    WaitingForData,
    Error
)INT;
END_TYPE
```

Parameters

Name	Description
Not_Initialized	Recording triggered. Waits for input data description for initialization.
Initialized	Recording successfully initialized.
RecordingCanceled	Recording canceled.
Running	Recording running. Input data is saved.
Running_QueueHyst	Recording running. Input data cannot be saved fast enough. Data loss!
Stopping_ReceivingDataStopped	Recording is stopped.
RecordingDone	Recording is done.
WaitingForData	Recording running. No data arrives from the Analytics Logger.
Error	An error has occurred during recording.

7.2.9 E_RecordMode

Syntax

Definition:

```
TYPE E_RecordMode :
(
    Start := 0,
    Stop
)INT;
END_TYPE
```

Parameter

Name	Descriptiom
Start	Starts the recording of the configured record
Stop	Stops the recording

7.2.10 E_ReloadType

Syntax

Definition:

```
TYPE E_ReloadType :
(
    All := 0,
    Specific
)INT;
END_TYPE
```

Parameters

Name	Description
All	All records are read in again.
Specific	Only one specific record will be reread.

7.2.11 E_RingBufferMode

Syntax

Definition:

```
TYPE E_RingBufferMode:
(
    None := 0,
    TimeBased,
    DataBased
)INT;
END_TYPE
```

Parameter

Name	Descriptiom
None	Recording without ringbuffer mode
TimeBased	Ringbuffer based on a given time periode
DataBased	Ringbuffer based on a given max data size

7.2.12 E_TimeMode

Syntax

Definition:

```
TYPE E_TimeMode :
(
    Milliseconds := 0,
    Seconds,
    Minutes,
    Hours,
    Days
) INT;
END_TYPE
```

Parameters

Name	Description
Milliseconds	Resolution of the "Duration" parameter in milliseconds.
Seconds	Resolution of the "Duration" parameter in seconds.
Minutes	Resolution of the "Duration" parameter in minutes.
Hours	Resolution of the "Duration" parameter in hours.
Days	Resolution of the "Duration" parameter in days.

7.2.13 E_SetGetHistoricalDataState

Syntax

Definition:

```
TYPE E_SetGetHistoricalDataState :
(
    Pause,
    Continue_,
Restart,
Stop,
Update
)INT;
END_TYPE
```

Parameters

Name	Description
Break	Playback of the recording is paused.
Continue_	Playback of the recording continues.
Restart	Playback of the recording is restarted.
Stop	Playback of the recording is stopped.
Update	Parameters for playing the recording are updated.

7.2.14 E_StorageState

Syntax

Definition:

```
TYPE E_StorageState :
(
    unknown := 0,
    error,
    starting,
    online,
    shuttingDown,
    offline
)INT;
END_TYPE
```

Parameters

Name	Description
Unknown	Status of the "Storage" is unknown
Error	"Storage" is in the error state. No more requests will be processed.
Starting	The "Storage" starts up and connects.
Online	The "Storage" is running and ready for requests.
ShuttingDown	The "Storage" is shut down.
Offline	The "Storage" is off and cannot be reached.

7.2.15 E_SymbolMode

Syntax

Definition:

```
TYPE E_SymbolMode :
(
    All := 0,
    Subset
)INT;
END_TYPE
```

Parameter

Name	Descriptiom
All	All symbols of the stream will be used
Subset	Only a subset of symbols will be used

7.2.16 E_PipelineCmdType

Syntax

Definition:

```
TYPE E_PipelineCmdType :
(
    RestartRule := 5,
    Start := 6,
    Stop :=  7
)INT;
END_TYPE
```

Parameters

Name	Description
RestartRule	Restarts a specific rule of a RuleEnginePipeline.
Start	Starts a RuleEnginePipeline
Stop	Stops a RuleEnginePipeline

8 Samples

8.1 PLC Client

This PLC sample shows the use of the TwinCAT Analytics Storage Provider library. The sample code shows reading and writing. For the sample to work coherently, both the use of the Analytics Logger for sending measured data to an MQTT Message Broker and the import of historical data via the Analytics Stream Helper are shown.

The basis is an appropriately set up native MQTT Message Broker and an Analytics Storage Provider service.

The PLC sample shows the following steps:

1. Analytics Logger: stream of variables from a Global Variable List to a MQTT Message Broker.
2. Analytics Storage Provider: starting and stopping stores and recordings, as well as reading recordings and historical data.
3. Analytics Stream Helper: receiving the historical data from the Analytics Storage Provider and mapping the data into a Global Variable List for the historical data.

Analytics Storage Provider GUID Glossary

When using the Storage Provider, various GUIDs occur that are required to identify services and data. The following describes where the GUIDs come from, what purpose they serve and where they can be viewed if necessary.

The analytics data stream sent by the Analytics Logger is basically described by three parameters:

1. **Topic** [STRING]
   Where is the data sent to?
2. **TwinCAT SystemID** [GUID]
   From which TwinCAT system is the data sent?
3. **LayoutID / Symbol Info ID** [GUID]
   What does the data look like? The GUID is a hash of the symbol information.

The above parameters are required to identify recordings at the Storage Provider.

Several Storage Providers can be connected to an MQTT Message Broker. Two parameters are required to identify a Storage Provider.

1. **MainTopic** [STRING](Where are the data/services provided?)
2. **ProviderGuid** [GUID](Unique identifier of the service)

RecorderGuid is used to recognize who has started a recording at the Storage Provider. This GUID is automatically generated at each Storage Provider Manager or client and attached to the StartRecord commands. In the PLC, this can be freely assigned at the StartRecord command.

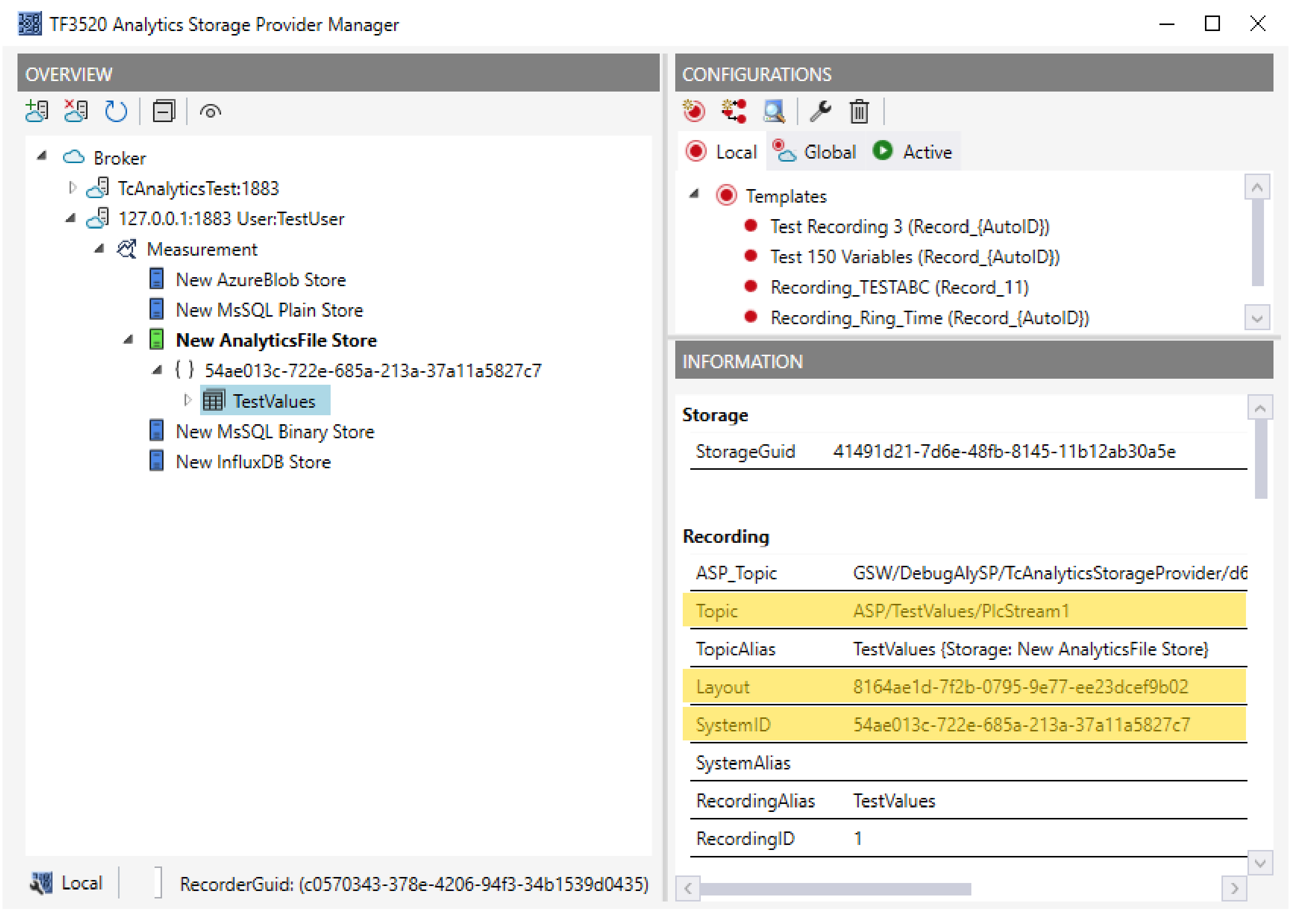
From version 3.2.14, three additional GUIDs can be specified on the StartRecord command.

1. **Storage** [GUID]
   This GUID specifies the storage in which the data is to be saved. The GUID is generated automatically in the Analytics Storage Provider Configurator. It can be read there or in the Analytics Storage Provider Manager. If no GUID is specified, the Master Storage is used.
2. **SubBroker/DataBroker** [GUID]
   This GUID specifies the data broker from which the Analytics Stream is to be received. The Analytics Storage Provider offers the option of recording from several message brokers. The GUID is generated automatically in the Analytics Storage Provider Configurator. It can be read there or in the Analytics Storage Provider Manager. If no GUID is specified, the Master Data Broker is used.

3. **DataKey** [GUID]
   The DataKey can be used to find, read and monitor recordings in progress. This DataKey can be freely selected in the PLC. If no DataKey is specified, a DataKey is automatically generated by the Storage Provider.

The following screenshots contain the parameters and GUIDs described above.

Topic / TwinCAT system ID / Layout (System Info ID)


TF3520 Analytics Storage Provider Manager

OVERVIEW

- Broker
  - TcAnalyticsTest:1883
  - 127.0.0.1:1883 User:TestUser
    - Measurement
      - New AzureBlob Store
      - New MsSQL Plain Store
      - **New AnalyticsFile Store**
        - { } 54ae013c-722e-685a-213a-37a11a5827c7
          - TestValues
      - New MsSQL Binary Store
      - New InfluxDB Store

Local RecorderGuid: (c0570343-378e-4206-94f3-34b1539d0435)

CONFIGURATIONS

Local Global Active

- Templates
  - Test Recording 3 (Record_{AutoID})
  - Test 150 Variables (Record_{AutoID})
  - Recording_TESTABC (Record_11)
  - Recording_Ring_Time (Record_{AutoID})

INFORMATION

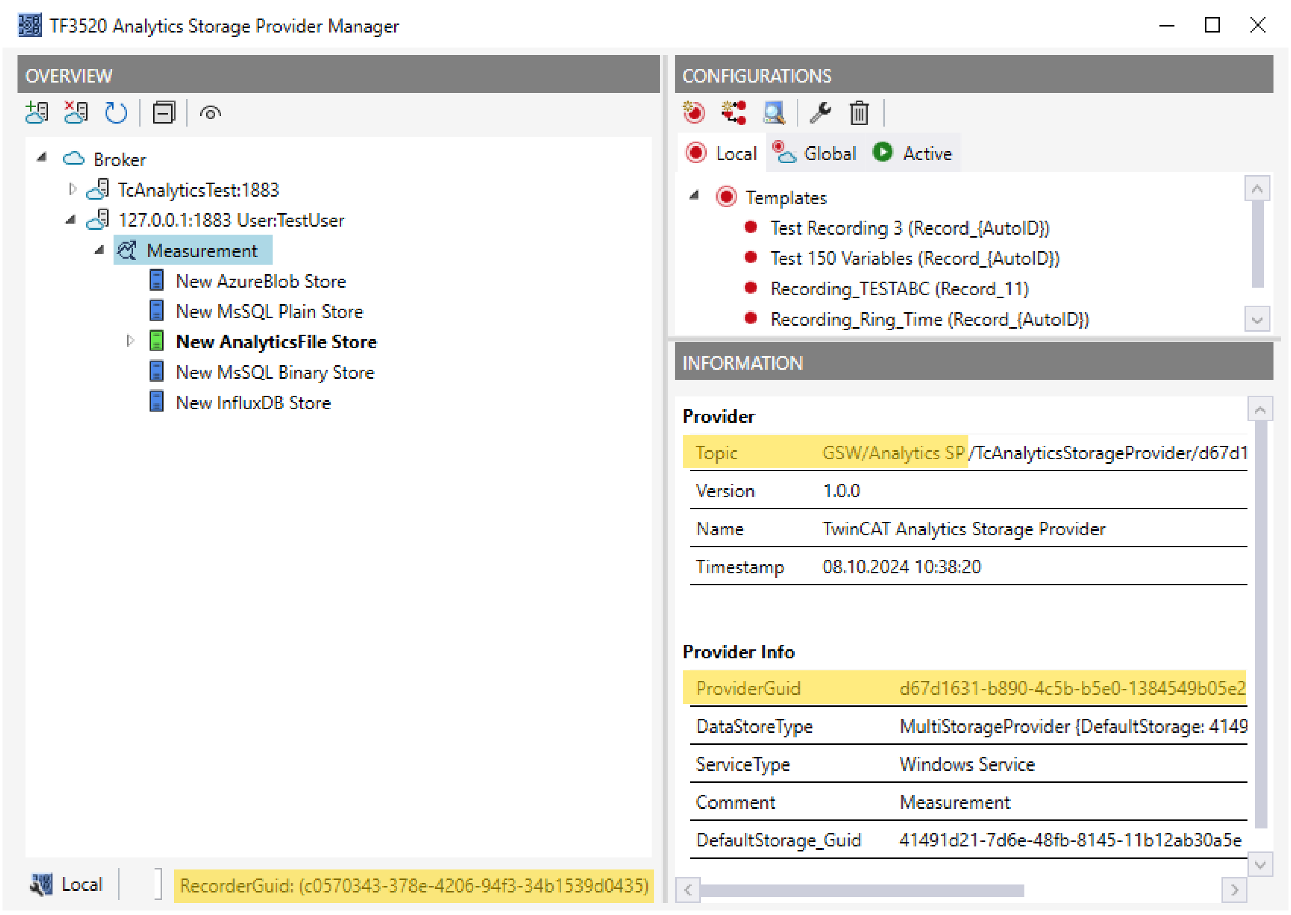
Storage

StorageGuid	41491d21-7d6e-48fb-8145-11b12ab30a5e

Recording

ASP_Topic	GSW/DebugAlySP/TcAnalyticsStorageProvider/d6
Topic	ASP/TestValues/PlcStream1
TopicAlias	TestValues {Storage: New AnalyticsFile Store}
Layout	8164ae1d-7f2b-0795-9e77-ee23dcef9b02
SystemID	54ae013c-722e-685a-213a-37a11a5827c7
SystemAlias	
RecordingAlias	TestValues
RecordingID	1

Storage Provider MainTopic / ProviderGuid / RecorderGuid



Broker
- TcAnalyticsTest:1883
- 127.0.0.1:1883 User:TestUser
  - Measurement
    - New AzureBlob Store
    - New MsSQL Plain Store
    - **New AnalyticsFile Store**
    - New MsSQL Binary Store
    - New InfluxDB Store

Templates
- Test Recording 3 (Record_{AutoID})
- Test 150 Variables (Record_{AutoID})
- Recording_TESTABC (Record_11)
- Recording_Ring_Time (Record_{AutoID})

Provider

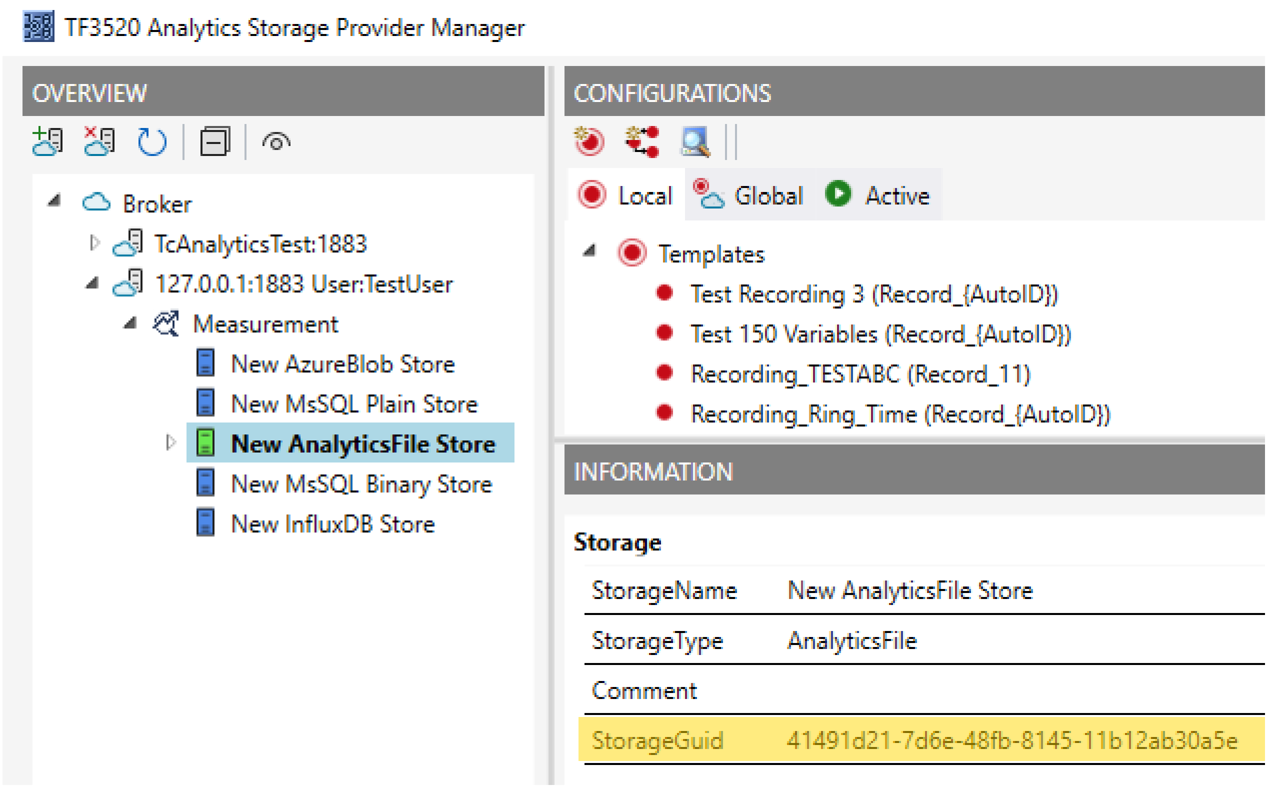
Topic	GSW/Analytics SP/TcAnalyticsStorageProvider/d67d1
Version	1.0.0
Name	TwinCAT Analytics Storage Provider
Timestamp	08.10.2024 10:38:20

Provider Info

ProviderGuid	d67d1631-b890-4c5b-b5e0-1384549b05e2
DataStoreType	MultiStorageProvider {DefaultStorage: 4149
ServiceType	Windows Service
Comment	Measurement
DefaultStorage_Guid	41491d21-7d6e-48fb-8145-11b12ab30a5e

Local RecorderGuid: (c0570343-378e-4206-94f3-34b1539d0435)

Storage GUID



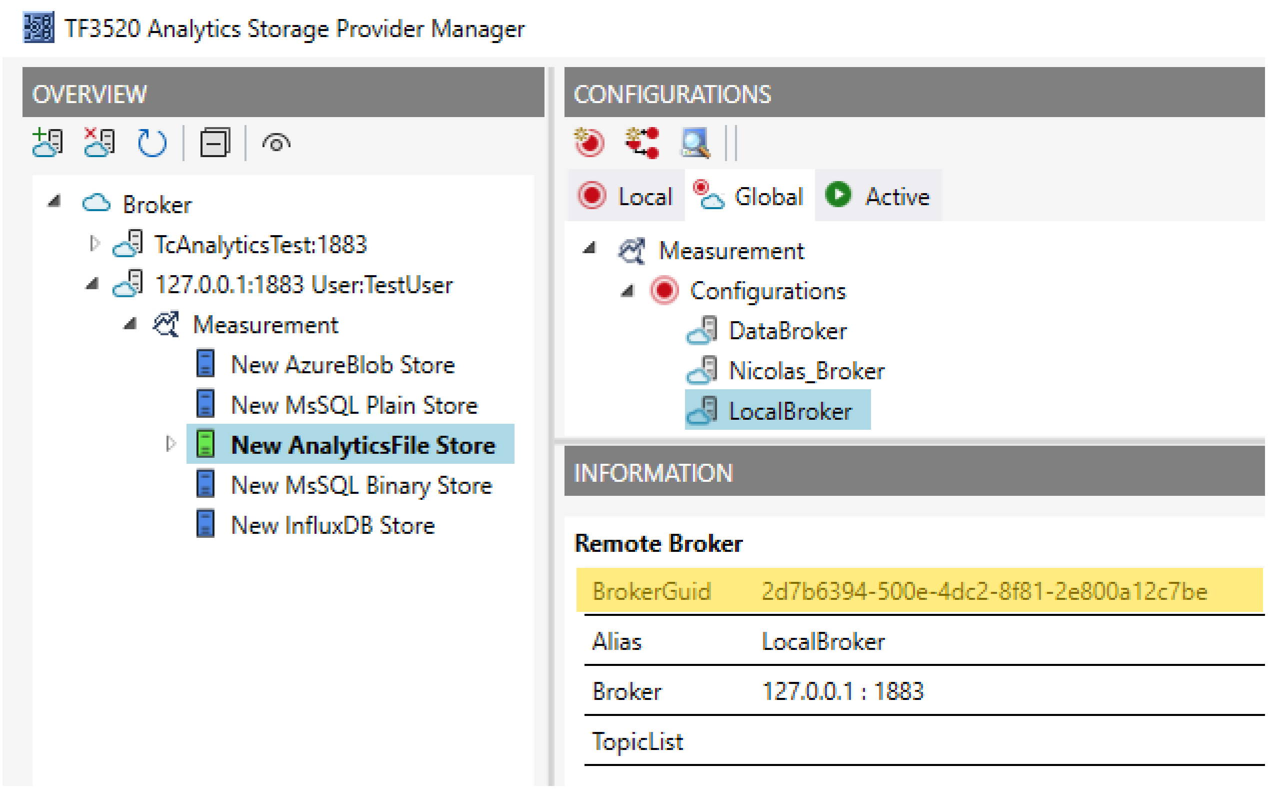
Broker
- TcAnalyticsTest:1883
- 127.0.0.1:1883 User:TestUser
  - Measurement
    - New AzureBlob Store
    - New MsSQL Plain Store
    - **New AnalyticsFile Store**
    - New MsSQL Binary Store
    - New InfluxDB Store

Templates
- Test Recording 3 (Record_{AutoID})
- Test 150 Variables (Record_{AutoID})
- Recording_TESTABC (Record_11)
- Recording_Ring_Time (Record_{AutoID})

Storage

StorageName	New AnalyticsFile Store
StorageType	AnalyticsFile
Comment	
StorageGuid	41491d21-7d6e-48fb-8145-11b12ab30a5e

Data Broker GUID

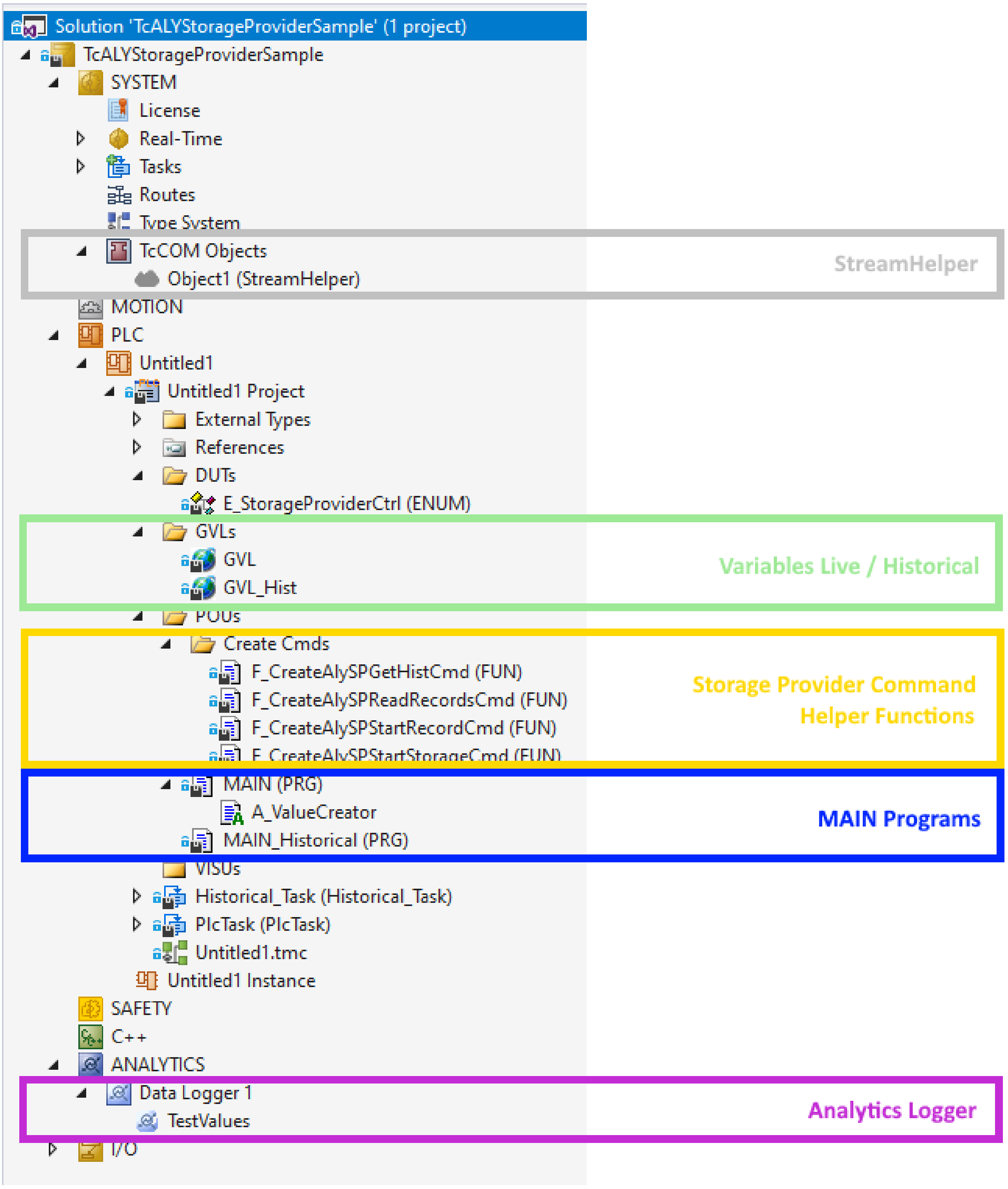


Remote Broker

BrokerGuid	2d7b6394-500e-4dc2-8f81-2e800a12c7be
Alias	LocalBroker
Broker	127.0.0.1 : 1883
TopicList	

Sample code architecture

All relevant parts of the configuration and the program code are marked in the following picture:



Stream Helper

For receiving the historical data sent by the Analytics Storage Provider via MQTT.

Variable Live/Historical

The GVL is for the live data and the GVL_Hist is for the historical data.

Storage Provider Command Helper Functions

These Helper Functions generate the commands for communication with the Storage Provider Service in JSON format.

MAIN program

The Main program invokes communication to the Analytics Storage Provider. The Main Historical program implements the mapping of historical data from the Stream Helper into the GVL_Hist.

Analytics Logger

Sends the variables of the GVL to an MQTT Message Broker.

Sample Start

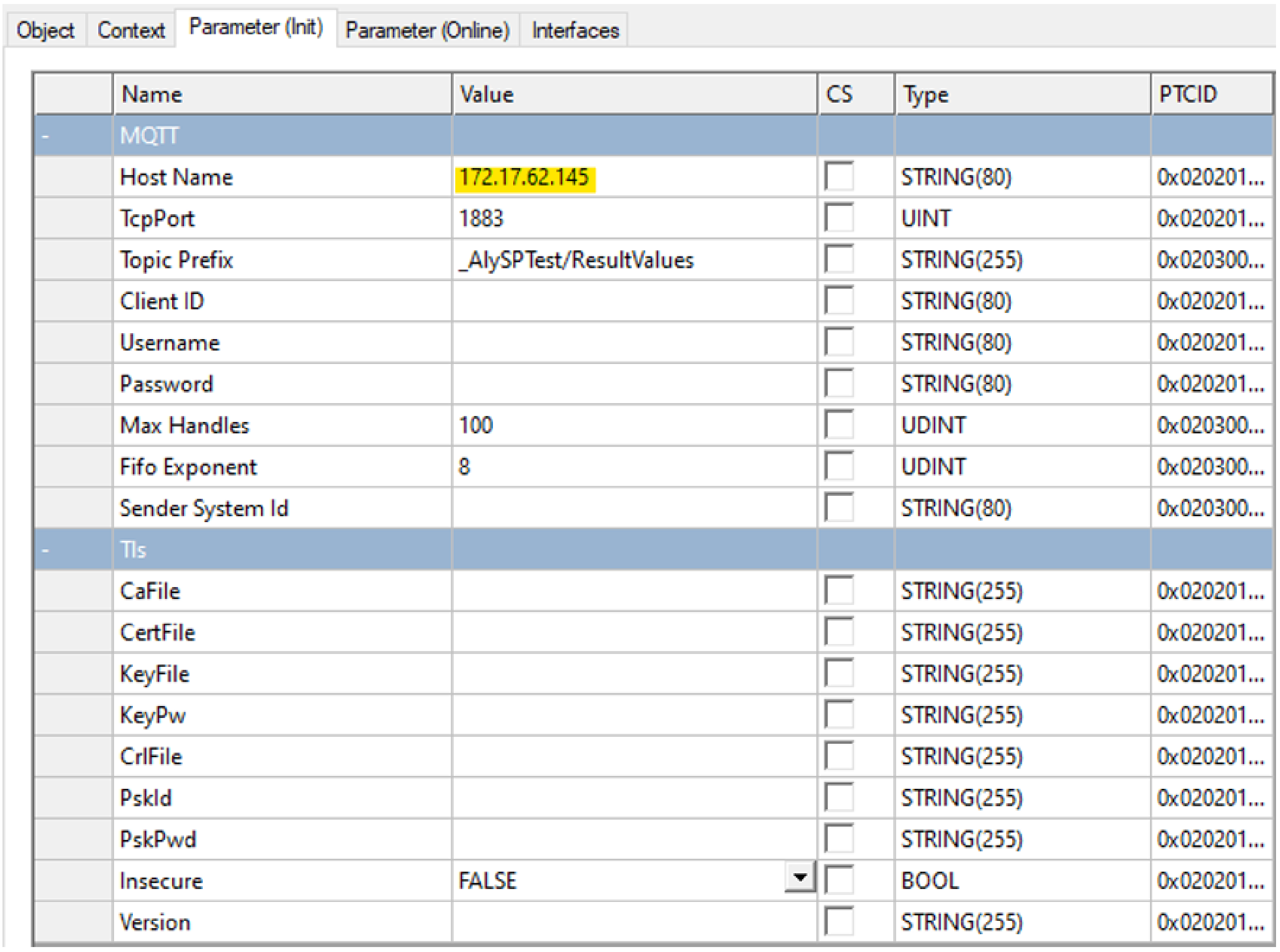
NOTICE

Too little router memory can lead to system crashes

Increase the router memory in the real-time settings to 256 MB. It is also recommended to increase the maximum stack size of the global task configuration to 512 KB.

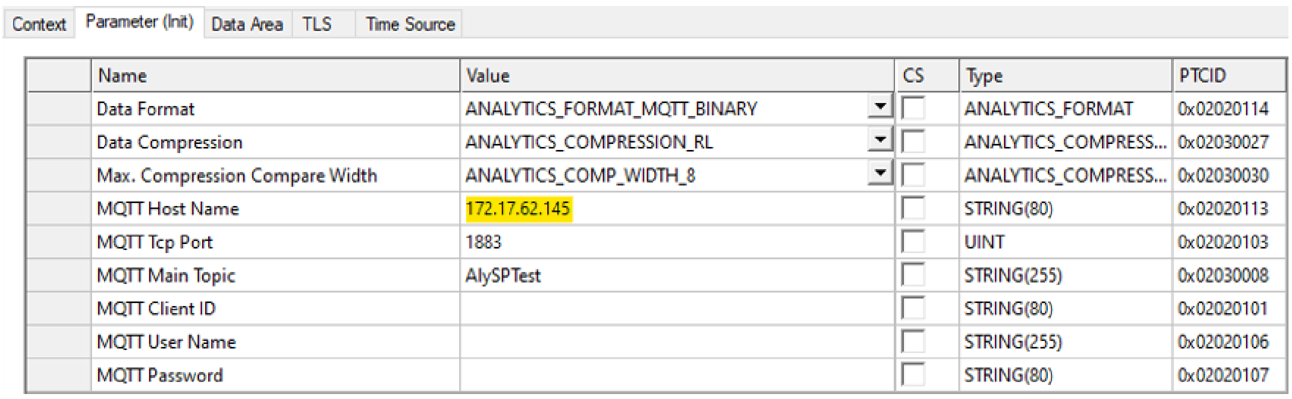
Before the sample can be started, you must set the MQTT Message Broker you are using in three different places.

Analytics Stream Helper:



	Name	Value	CS	Type	PTCID
-	MQTT				
	Host Name	172.17.62.145	☐	STRING(80)	0x020201...
	TcpPort	1883	☐	UINT	0x020201...
	Topic Prefix	_AlySPTest/ResultValues	☐	STRING(255)	0x020300...
	Client ID		☐	STRING(80)	0x020201...
	Username		☐	STRING(80)	0x020201...
	Password		☐	STRING(80)	0x020201...
	Max Handles	100	☐	UDINT	0x020300...
	Fifo Exponent	8	☐	UDINT	0x020300...
	Sender System Id		☐	STRING(80)	0x020300...
-	Tls				
	CaFile		☐	STRING(255)	0x020201...
	CertFile		☐	STRING(255)	0x020201...
	KeyFile		☐	STRING(255)	0x020201...
	KeyPw		☐	STRING(255)	0x020201...
	CrlFile		☐	STRING(255)	0x020201...
	PskId		☐	STRING(255)	0x020201...
	PskPwd		☐	STRING(255)	0x020201...
	Insecure	FALSE	☐	BOOL	0x020201...
	Version		☐	STRING(255)	0x020201...

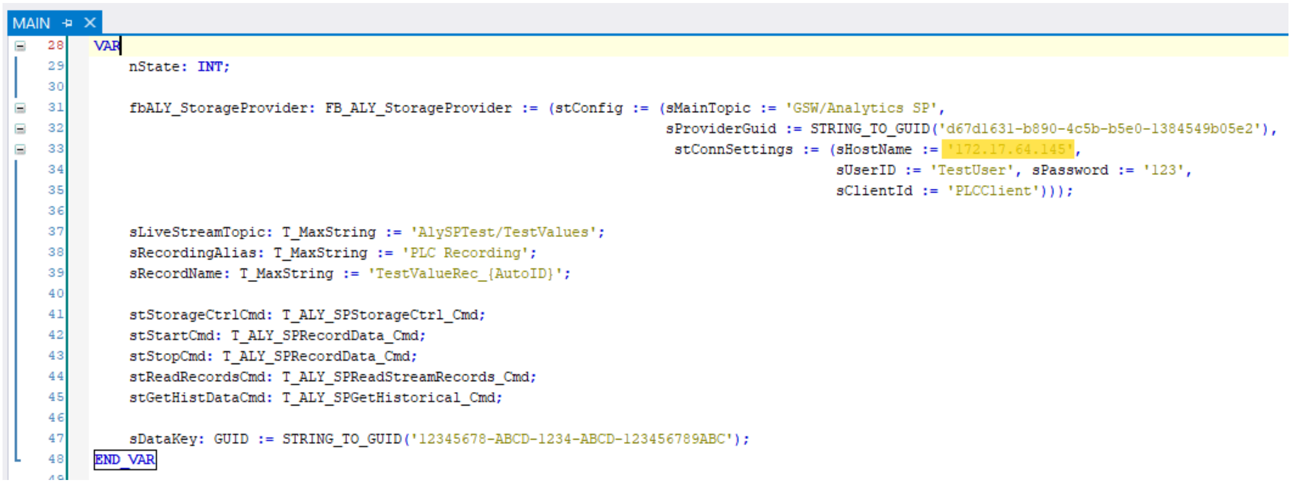
Analytics Logger:



Context | Parameter (Init) | Data Area | TLS | Time Source

	Name	Value	CS	Type	PTCID
	Data Format	ANALYTICS_FORMAT_MQTT_BINARY	☐	ANALYTICS_FORMAT	0x02020114
	Data Compression	ANALYTICS_COMPRESSION_RL	☐	ANALYTICS_COMPRESS...	0x02030027
	Max. Compression Compare Width	ANALYTICS_COMP_WIDTH_8	☐	ANALYTICS_COMPRESS...	0x02030030
	MQTT Host Name	172.17.62.145	☐	STRING(80)	0x02020113
	MQTT Tcp Port	1883	☐	UINT	0x02020103
	MQTT Main Topic	AlySPTest	☐	STRING(255)	0x02030008
	MQTT Client ID		☐	STRING(80)	0x02020101
	MQTT User Name		☐	STRING(255)	0x02020106
	MQTT Password		☐	STRING(80)	0x02020107

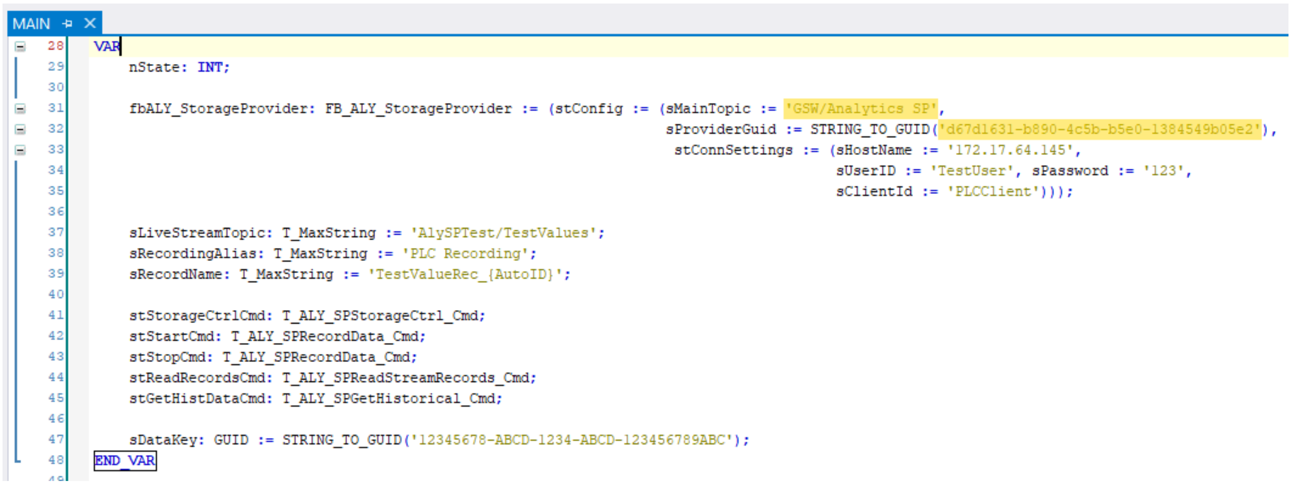
MAIN program:



MAIN

```
VAR
    nState: INT;

    fbALY_StorageProvider: FB_ALY_StorageProvider := (stConfig := (sMainTopic := 'GSW/Analytics SP',
                                                               sProviderGuid := STRING_TO_GUID('d67d1631-b890-4c5b-b5e0-1384549b05e2'),
                                                                stConnSettings := (sHostName := '172.17.64.145',
                                                                                   sUserID := 'TestUser', sPassword := '123',
                                                                                   sClientId := 'PLCClient')));

    sLiveStreamTopic: T_MaxString := 'AlySPTest/TestValues';
    sRecordingAlias: T_MaxString := 'PLC Recording';
    sRecordName: T_MaxString := 'TestValueRec_{AutoID}';

    stStorageCtrlCmd: T_ALY_SPStorageCtrl_Cmd;
    stStartCmd: T_ALY_SPRecordData_Cmd;
    stStopCmd: T_ALY_SPRecordData_Cmd;
    stReadRecordsCmd: T_ALY_SPReadStreamRecords_Cmd;
    stGetHistDataCmd: T_ALY_SPGetHistorical_Cmd;

    sDataKey: GUID := STRING_TO_GUID('12345678-ABCD-1234-ABCD-123456789ABC');
END_VAR
```

You must then change the sMainTopic and the sProviderGUID for the FB_ALY_StorageProvider. This can be found as described above in this document.



MAIN

```
VAR
    nState: INT;

    fbALY_StorageProvider: FB_ALY_StorageProvider := (stConfig := (sMainTopic := 'GSW/Analytics SP',
                                                               sProviderGuid := STRING_TO_GUID('d67d1631-b890-4c5b-b5e0-1384549b05e2'),
                                                                stConnSettings := (sHostName := '172.17.64.145',
                                                                                   sUserID := 'TestUser', sPassword := '123',
                                                                                   sClientId := 'PLCClient')));

    sLiveStreamTopic: T_MaxString := 'AlySPTest/TestValues';
    sRecordingAlias: T_MaxString := 'PLC Recording';
    sRecordName: T_MaxString := 'TestValueRec_{AutoID}';

    stStorageCtrlCmd: T_ALY_SPStorageCtrl_Cmd;
    stStartCmd: T_ALY_SPRecordData_Cmd;
    stStopCmd: T_ALY_SPRecordData_Cmd;
    stReadRecordsCmd: T_ALY_SPReadStreamRecords_Cmd;
    stGetHistDataCmd: T_ALY_SPGetHistorical_Cmd;

    sDataKey: GUID := STRING_TO_GUID('12345678-ABCD-1234-ABCD-123456789ABC');
END_VAR
```

Now go to the MAIN program to control the sample. With the enum eCtrl you can set the action you would like to perform. The available options are:

- ReadASPDescription (also contains the storage description)
- ReadDataBroker
- StartStorage
- ShutdownStorage
- StartRecord
- StopRecord
- IsRecordingRunning
- ReadHistoricalStreams

- ReadRecords
- GetHistorical

With a rising edge at the variable bExecute the action selected in the enum is executed. If you have made more than one record, you can see this in the array aRecordInfo. With the index it is then possible to select the different records. The timespans are also displayed, you could theoretically still adjust these within the timespan. To do this, you would need to modify the logic of the sample in the helper function F_CreateAlySPGetHistCmd accordingly.

The Storage Provider Recorder GUID selected in the document above can optionally be set in the PLC in the F_CreateAlySPStartRecordCmd function. Theoretically, it can be any GUID, it is only used to identify the recorder.

Download: https://infosys.beckhoff.com/content/1033/tf3500_tc3_analytics_logger/Resources/11270100747.zip

9 Appendix

9.1 Glossary

The following table explains key terms in connection with the Storage Provider.

Name	Function	Unique identifier (automatically generated)	Descriptive parameters (configurable by the user)
Storage Provider Configurator	Software tool for configuring the local Storage Provider.		
Storage Provider Manager	Software tool for working with the Storage Provider. This can be used to start, stop and manage data recordings. The Storage Provider Manager can be used for both the local and the remote Storage Provider.		
Storage Provider CLI Client	Command line tool for interactions with the Storage Provider.		
Storage Provider PLC library	PLC library for interactions with the Storage Provider.		
Storage Provider	Software application for historicizing data such as from the Analytics Logger. Both the acquisition of the data to be stored and the provision of stored data is carried out via MQTT. The Storage Provider can be operated under Windows and FreeBSD®.	ProviderGuid	ProviderAlias
Storage	Data sink of a Storage Provider (e.g. MS SQL or CSV).	StorageGuid	StorageAlias
Message Broker	MQTT message broker via which data can be transmitted using the MQTT protocol.		
HostBroker	Central message broker on which the Storage Provider provides information and receives commands.	BrokerGuid	BrokerAlias
DataBroker	Additional message broker from which the Storage Provider can obtain data to be recorded.	BrokerGuid	BrokerAlias
Pipeline	Description of a data flow. Components are data sources (Input Sources), processing steps (Rules) and data storage (Recordings).	PipelineGuid	PipelineAlias (can be set before starting the pipeline)
RuleEngine	Processing unit within the Storage Provider.		
Rule	Processing rule within a pipeline that is used for filtering, aggregating and sampling data.	RuleID	RuleAlias
Recording	Recording configuration for data. This includes which data should be recorded in which storage.	RecordingID	RecordingAlias (can be set before starting the pipeline)
Record	Data recording based on a defined recording configuration (Recording).	RecordID, additionally RecordDataKey if recording is running	RecordAlias (can be set before starting the pipeline)
Input Source	Data source for a pipeline. This can be an MQTT livestream or a HistoricalStream.		
LiveStream	Data from the Analytics Logger, IoT Data Agent or EK9160.		
HistoricalStream	MQTT data stream from the Storage Provider, which contains all information about a recording and the associated records. One HistoricalStream is generated per recording.	HistStreamID	HistStreamAlias - this corresponds to the RecordingAlias

Name	Function	Unique identifier (automatically generated)	Descriptive parameters (configurable by the user)
Recorder	Identification of the client that communicates with the provider. It is provided when the pipeline is started in order to be able to trace who started the pipeline.	RecorderGuid	RecorderAlias

9.2 FAQ - frequently asked questions and answers

In this section frequently asked questions are answered, in order to facilitate your work with the TwinCAT Analytics Storage Provider (ASP). If you have any further questions, please contact our support team at support@beckhoff.com.

1. How can I manage the table schema of MS SQL with ASP? [▶ 161]
2. Can I control the Storage Provider in a programmable way? [▶ 161]
3. Is it also possible to save results from the Analytics Runtime? [▶ 161]
4. Are open source software components used in TwinCAT Measurement products? [▶ 161]
5. What factors influence the data throughput of the storage provider? [▶ 161]

How can I manage the table schema of MS SQL with ASP?

You don't have to worry about the table schema. This is done completely by the Analytics Storage Provider. You only have to specify on which database server the data should be stored. If you want to see data in your own table structure, you have to stream the data into a TwinCAT Analytics Runtime and have the TwinCAT Database Server write the data in your structure.

Can I control the Storage Provider in a programmable way?

Yes, via the PLC interface for the TwinCAT Storage Provider. You can start/stop recordings or retrieve historical data (raw data or result data).

Is it also possible to save results from the Analytics Runtime?

Yes, this is possible. For this purpose, you can choose to send the results to an MQTT Message Broker when generating the Analytics Runtime from the Analytics Workbench configurator. This data stream can be captured by the Storage Provider.

Are open source software components used in TwinCAT Measurement products?

Yes, various open source components are used.

Please see the information on the page Third-party components [▶ 162].

What factors influence the data throughput of the storage provider?

The data throughput depends on many influencing variables. Primarily of system and network resources. An overview:

- System properties (CPU, RAM)
- Writing speed and quality of the storage medium (SSD)
- Network properties
- Complexity of symbolism (data type, structures, arrays, etc.)
- Mode of historization (total symbolism allows higher throughput, a subset may be more costly depending on its size)
- Compression level of the stream (the stronger the compression, the higher the system load)
- The size of a sample
- Total size of a data packet (number of samples per packet)
- The number of parallel recordings that the storage provider manages

9.3 Third-party components

This software contains third-party components.
Please refer to the license file provided in the following folder for further information:
C:\Program Files(x86)\Beckhoff\Legal\TwinCAT-XAR-AnalyticsStorageProvider

10 Support and Service

Beckhoff and their partners around the world offer comprehensive support and service, making available fast and competent assistance with all questions related to Beckhoff products and system solutions.

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