BECKHOFF New Automation Technology

Manual | EN

TF355x TwinCAT 3 | Analytics Runtime



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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.

For installation and commissioning of the components, it is absolutely necessary to observe the documentation and the following notes and explanations.

The qualified personnel is obliged to always use the currently valid documentation.

The responsible staff must ensure that the application or use of the products described satisfies all requirements for safety, including all the relevant laws, regulations, guidelines, and standards.

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The documentation has been prepared with care. The products described are, however, constantly under development.

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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

Hazard with high risk of death or serious injury.				
Hazard with medium risk of death or serious injury.				
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.

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

2 Overview

The TwinCAT Analytics Runtime ensures that a continuous data analysis runs parallel to the actual machine applications. The PLC code that is downloaded to the Analytics Runtime can be automatically generated with the help of the engineering product TE3500 Analytics Workbench. Optionally, a complete Analytics Dashboard can be generated based on the HTML5-based TwinCAT HMI.

If you already have your own visualizations that you would like to integrate into continuous data analysis via OPC UA or ADS, we offer two different runtime products. TF3550 includes the HMI Server and the HMI Client Pack 3, while TF3551 does not include the HMI as a Runtime Base.

TF3550 components

- PLC Runtime (TC1200)
- Analytics PLC Library (TF3510)
- IoT connectivity with MQTT and HTTPS/Rest (TF6701 and TF6760)
- Analytics Storage Provider Library
- HMI Server (TF2000)
- HMI Client Pack 3 (TF2020)
- HMI Scope (TF2300)
- Scope Server (TF3300)

TF3551 components

- PLC Runtime (TC1200)
- Analytics PLC Library (TF3510)
- IoT connectivity with MQTT and HTTPS/Rest (TF6701 and TF6760)
- Scope Server (TF3300)
- Analytics Storage Provider Library

Since TwinCAT Build 4024.57, the number of sources to be analyzed (Analytics Logger, Analytics Data Exchange API, IoT Data Agent and EK9160) is no longer limited, no additional Controller Packs need to be licensed.

3 Installation

3.1 System requirements

The Analytics Runtime setup is an all-around setup. It includes a current version of TwinCAT 3.1 XAR and of the TwinCAT HMI Server.

Technical data	TF3550 TwinCAT 3 Analytics Runtime			
Target System	Windows 7/8/10			

3.2 Installation

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 command **Run as administrator** in the context menu of the file.

 \Rightarrow The installation dialog opens.

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

🖶 💻 💻						
License Agreement Please read the following license agreement carefully.						
Coffeener Union American for Darable ff Coffeener Darable to						
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 Appendix 1. The Software and the						
I accept the terms in the license agreement Print I do not accept the terms in the license agreement]					
InstallShield 						

3. Enter your user data.

Customer Information	
Please enter your information.	
<u>U</u> ser Name:	
Max Mustermann	j
Organization:	
Mustermann Inc.	
InstallShield	
< Back N	ext > Cancel

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

7	
Setup Type Choose the set	up 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.
InstallShield	< Back Next > Cancel

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

	×
Ready to Install the Program The wizard is ready to begin installation.	5
Click Install to begin the installation.	
If you want to review or change any of your installation settings, click Back. Click Cance exit the wizard.	l to
InstallShield	
< Back Install Can	cel

⇒ 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	8
TwinCAT system has to be stopped before Should TwinCAT be stopped?	ore proceeding with installation.
	Yes No

7. Select Finish to exit the setup.



⇒ The TwinCAT 3 Function has been successfully installed.

3.3 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.

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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").

0	Order Information (Runtime) Manage Licenses Project Licenses				Onlir	ne Licenses	
Disable automatic detection of required licenses for project							
	Order No License			Add License			
	TF3601	TC3 Cor	ndition Monitoring	g Level 2		cpu licens	e
	TF3650	TC3 Pov	ver Monitoring			cpu licens	e
	TF3680 TC3 Filter TF3800 TC3 Machine Learning Inference Engine					cpu licens	e
				erence Engine		cpu licens	e
	TF3810	TC3 Neu	ural Network Infer	ence Engine		cpu licens	e
TF3900 TC3 Solar-Position-Alg		ar-Position-Algori	rithm		cpu licens	e	
	TF4100 TC3 Controller Toolbox			$\overline{}$	cpu licens	e	
	TF4110 TC3 Temperature-Controller				cpu licens	e	
	TF4500	TC3 Spe	ech			cpu licens	e
		1					

- 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.

Order Information (Runtime)	Manage Licenses	Project License	s Online L	icenses		
License Device Tar	get (Hardware Id)		~	Add		
System Id:		Plat	om:			
2DB25408-B4CD-81DF-	5488-6A3D9B49EF	19 oth	er (91)	\sim		
License Request						
Provider: Beckhoff	Automation	~	Generat	e File		
License Id:		Customer Id:				
Comment:						
License Activation						
7 Days Trial Li	cense	Licens	e Response	File		

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

Enter Security Code				
Please type the following 5 characters: Kg8T4	OK			
	Cancel			

- 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.
- \Rightarrow The 7-day trial version is enabled.

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

MeasurementSamplePLC - TcXaeShell								
File Edit View Project Build Debug TwinCAT TwinSAFE PLC Team Scope Tools Window Help								
🕈 🖸 🔹 🖆 + 🎦 🔐 🔐 😹 🗗 🗇 🖓 - 🦿 - 📔 Release 🔹 TwinCAT RT (x64) 🔹 🕨 Attach + 💦 🃁 🔎								
🔋 Build 4024.0 (Loaded) 🔷 🚽 🔛 🛄 💆 🔅 🗐	🔋 Build 4024.0 (Loaded) 🔹 🚚 🚼 🔄 🖉 🖉 🔨 🚫 🖗 🧙 🌾 MeasurementSamplePLC 🔹 <local> 🔹 📮 ScopeSample 🔹 1 🔹 🔁 🕨 🖷 🤤</local>							
Solution Explorer - A × MeasurementSamplePLC - × × Variables MAIN								
© ⊃ ☆ ╬ ·]o · @ / ≠ -	Parameter (Init) TLS							
Search Solution Explorer (Ctrl+ü)			-					
Solution 'MeasurementSamplePLC' (1 project)	Name	Value	CS	Туре				
MeasurementSamplePLC	Data Format	ANALYTICS_FORMAT_FILE		ANALYTICS_FORMAT				
SYSTEM	Data Compression	ANALYTICS_COMPRESSION_RL		ANALYTICS_COMPRESSION				
A MOTION	Max. Compression Compare Width	ANALYTICS_COMP_WIDTH_1	-	ANALYTICS_COMPRESSION_WIDTH				
	MQTT Host Name	127.0.0.1		STRING(80)				
ScopeSample ScopeSample	MQTT Tcp Port	1883		UINT				
ScopeSample Instance	MQTT Main Topic	DefaultMainTopic		STRING(255)				
PlcTask Inputs	MQTT Client ID			STRING(80)				
🛃 SAFETY	MQTT User Name			STRING(255)				
% C++	MQTT Password			STRING(80)				
A GANALYTICS								
 Ødra Lögger 1 Ødra Lögger 1 								

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

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-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

MeasurementSamplePLC - TcXaeShell							
File Edit View Project Build Debug TwinCAT	TwinSAFE PLC Team Scope Tools Window Help						
🖸 - 🗢 🕆 📩 🖬 📲 🕌 🖧 🗗 台 🏷 - 🦿	· Release · TwinCAT RT (x64) · Attach ·						
🔋 Build 4024.0 (Loaded) 🔷 🚽 👬 🔝 🛛 🖉 🖉 🔨 🌀 🛛	🍋 🐾 🌠 MeasurementSamplePLC 👻 <local> 🔹 🛫</local>						
Solution Explorer 🚽 🕂 Meas	asurementSamplePLC 🗢 🗶 Variables MAIN						
© © ☆ ☵ - '⊙ - @ 🖋 🗕 🛛 🗖	nline Selection Data Handling						
Search Solution Explorer (Ctrl+ü)							
 Solution 'MeasurementSamplePLC' (1 project) MeasurementSamplePLC SYSTEM MOTION PLC ScopeSample ScopeSample Project ScopeSample Instance SAFETY C++ ANALYTICS Data Logger 1 PloStream1 	Stream Source: ScopeSample.ScopeSample Instance.PlcTask Image: ScopeSample I						

• 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.

MeasurementSamplePLC - TcXaeShell	
File Edit View Project Build Debug TwinC	AT TwinSAFE PLC Team Scope Tools Window Help
🛛 🗢 🗢 🖹 🔹 📩 - 🖕 🍟 🔛 🖓 🖄 🗇 台 🛛 🎾	- C - Release - TwinCAT RT (x64) - Attach
🔋 Build 4024.0 (Loaded) 🛛 🚽 🚽 🔛 🎑 🛛 🧔 🕫	🗑 💽 🐜 🔏 MeasurementSamplePLC 🔹 <local> 🔹 🖕</local>
Solution Explorer 👻 🕂 🗙	MeasurementSamplePLC 🕫 🗙 Variables MAIN
© ⊃ ☆ 🛱 - ™ - ₱ 🖋 🗕	Online Selection Data Handling
Search Solution Explorer (Ctrl+ü)	Data Size: (Bytes)
Solution 'MeasurementSamplePLC' (1 project)	Max ADS Buffer: 32 + 3 (KB) 32 ms
SYSTEM	Max File Size: 256 🔷 577 (KB) 8.192 s
	Sampling Divider: 1
ScopeSample	Autostart Stream:
General ScopeSample Project	Ring Buffer
SAFETY	File Count: 2
▲ Ø Data Logger 1	Queue messages when disconnected
	Store in file
▶ 🔀 I/O	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.



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/ TwinCAT Analytics StorageProvider ("MyDevice") Comment: Messagebroker Settings Set connection settings for message broker Storage Type: AnalyticsFile Ŧ Analytics Folder Connectionstring: \\beckhoff.com\dfs\UserHomeDir\PascalD\Storage Additional Properties Logging Trace to EventLog Additional Debug Log Analytics Storage Provider Windows Service Start Stop Automatic Stopped Ŧ Cancel Save Config OK

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.

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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.

OVERVIEW Image: Strategy and St	CONFIGURATIONS
Jocal BecorderAlias: Manuel TEST RecorderGuid: (r0570343-378e-4206-94f3-34b1539d0435)	StartTimestampTicks 133644853769810000 EndTimestampTicks 133644854072399000 StartTimestamp 03.07.2024 15:02:56 EndTimestamp 03.07.2024 15:03:27 Duration 0d 0h 0m 30s 225ms Storage StorageGuid 2d2ed6fe-9961-481a-a784-02e083bi

Toolbars

OVERVIEW					
넝	<u>×</u> 9	U		0	
1	2	3	4	5	

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



1	Create new recording definition
2	Open Target Browser
3	Edit selected definition
4	Delete selected definition
5	Start selected definition

Set up 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.

IF3520 Analytics Storage Provider Manager

		CONFIGURATIO
Broker		🥘 🔍 🎤
▲ 🛃 127.0.0.1:1883 📲 ▲ 🏹 Measureme ▷ 🚦 New Ar	Connection Settings ×	Templati Recoi Recoi
▲ ■ New CS ▷ { } 53fa ▲ { } cff75 ▲ Ⅲ ↓	User: TestUser Pwd: ••••• Port: 1883	New
New Ms	CA: Pwd: Pwd:Pwd:Pwd:PWd:PWd:PWd:PWd:PWd:PWd:PWd:PWd:PWd:PWd:PWd:PWd:PWd:PWd:PWd:PPWd:	Record RecordID RecordAlias
▷ 🏹 TwinCAT Ar	Check Config Cancel OK	CycleTime SampleDataSiz
		Record Times StartTimestam

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

"Storage" status



- 127.0.0.1:1005
- 🔺 🕂 Measurement
- 1 🕒 🚦 New AnalyticsFile Store
- 2 🚦 New CSV Store
- 3 📱 New InfluxDB Store
- 4 🔒 New MsSQL Plain Store
- 5 🔋 New MsSQL Binary Store
- 6 📕 New AzureBlob Store

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

Recording definitions ("CONFIGURATIONS")

Local:



- Recording (Record_{AutoID})
- RecordingTEST (Record_{AutoID})
- NewTest_IOT2 (Record_{AutoID})

Recording definitions that are saved locally are listed in the "Local" tab. New definitions can also be created here. To do this, press the "Create new definition" button. The following dialog opens.

TF3520 Analytics Storage Provider Manager		\times
TestSignals/StreamFast		
Recording Alias	Record Name	
Recording_TestSignals	Record_{AutoID}	
Record Duration	Ringbuffer Days Hours Minutes	
0 Days 0 Hours 10 Minutes	None ~ 0 0 0	
Store Subset of Symbols Store whole process image		
Variables.fAM	LREAL	^
Variables.fGrowSlow	LREAL	
Variables.fPeak	LREAL	
Variables.fPulse	LREAL	
Variables.fRampOnEvent	LREAL	
Variables.fSawtooth	LREAL	
Variables.fSine	LREAL	
Variables.fSquare	LREAL	
Variables.fStairs	LREAL	\sim
	Cancel OK	

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}"	

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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 by storage 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. 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:				
MessageBroker:	127.0.0.1:1883		2	
Storage Provider:	Measurement		~	
Store:	New AnalyticsFile Store		Ŷ	
Sub Broker:	DataBroker		v	
	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 Sub 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 under the "Global" tab by any Storage Provider Manager that is connected to the MQTT broker.

Global:



All global recording definitions of the selected Analytics Storage Provider are listed here. The definitions are assigned to the Sub Brokers. These global definitions can be changed, downloaded and started.

Started recording definitions are listed in the "Active" tab.

Active:



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.

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TwinCAT Analytics Storage Provider R <u>File E</u> dit <u>V</u> iew <u>P</u> roject <u>D</u> ebug	ecorder - TcXaeShell TwinCAT TwinCAT HMI Tw	inSAFE PLC	Tea <u>m</u> Sco	pe <u>T</u> ools <u>V</u>	/indow <u>H</u> elp		V P Quick Launch (Ctrl+Q)	×
0-0 🎦 - 🖆 - 😫 🔐 🎝	6日白 ツ・ペ・				Attach 👻		- 🏓 arrCmdPara - 🔽 🎜 🏛	Ŧ
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4.4 Analyse data

- $\checkmark\,$ 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.

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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.

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		TR Math Operation 1Ch
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	Launch the documentation to get detailed information about how to start into TwinCAT Analytics.	 Pointer
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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.

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- 4. When you click on the network, an editor opens. Now you can drag and drop the desired algorithm into the editor interface.
- 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

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

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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.

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- 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.

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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.

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- 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.

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

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⇒ 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.

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Solution 'TwinCAT Measurement Project10' (1 project)								10/11/2015 15:51.44:055	
A Analytics Project	<u></u>	0.000	0	Threst	hold Classificator 1Ch1	[G∕ Ç, ∀
A Metwork 1		Input Count @ Edge	Counter ICh_I v 600)	Level OK / Warning:	420	Class	3	
Edge Counter 1Ch_1	ğ				Level Warning / Alarm:	450	Last Event Warni	18/11/2019 15:48:44.636	
Threshold Classificator 1Ch_1							Last Event Alarm	18/11/2019 15:49:14.636	
▲ Inputs	\equiv			16.1	4 4 1 4 11/211				
🖌 🧧 tcanalyticstest: TestSignals/StreamFast [1.00ms		Input Variables (Gro	wSlow @ tcanabyticstest: T_vS6	Min (Max Avg Interval 1Ch1 Interval Minuter	× 1	Min	56273	~~
TimeLine @ tcanalyticstest: TestSignals/Stre		input innoicinoici	soon e teoriory testest i soo		Windes			50270	
Variables (GrowSlow @ tcanalyticstest: Tests)							Max	56279	
 Project_2 							Avg	56276	
DataPool	\mathbf{Y}						Time Min	18/11/2019 15:51:12.913	
A 🔀 YT Chart							Time Max	18/11/2019 15:51:19.313	
Axis Group (1)							Current Interval	00:00:00:000	
CTcAlyThresholdClassificator_1Ch		C 77 01 C 4 C7 0 1 007 C00 1007							
 Warning Style 	WB-ID: CODO	0e//-e200-4e0/-a2aC-D92/a523099/							
Condition (1)	Project_2* -4	×							
I Condition	YT Chart	1							4 Þ
🔺 🕵 Axis Group (2)	Start: 15:41:4	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			
fGrowSlow		0.00:01:00.000:000	0.00:06:36.000:000 0 0	ee 💿 ⊵ ⊵	🕺 🔒 🔮				
Avg @ Min Max Avg Interval 1Ch_1 (1)									A
Rulse	600.0 -] [1		Ţ		1
🖌 🕂 Trigger									<u>м</u>
All Last Event Alarm @ Threshold Classificator 1CF	300.0 -								2
A M Last Event Warning @ Inreshold Classificator I Channel Triggerset									
11	56280.0 -	1 r	······	<u> </u>					
				$\cap R$	$\sim \rightarrow \sim \sim$	$ \gamma $		$\gamma \gamma$	
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	5027215								
	1.0-			<u> </u>					<u> </u>
	0.5-					****			
	0.0-			UUUUUU		JUUU	UUUUUU		JUUUUUUU
Solution Explorer Team Explorer	0	:00m 0:06m	0:12m 0:18m	0:24m	0:30m	0:36m	0:42m	0:48m	0:54m 1:00m

⇒ 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.

4.5 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.



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 Runtin	ne	X
Codegeneration: Lat	est Version ("Version 2.1") 🔹	
Solution TwinCAT P	PLC Target Results HMI Dashboard Visual Studio Summary	
 Create new Solution 	tion	
Solution Path:	C:\temp\Analytics\Test	
Solution Name:	Production	
Project Name:	MachineAnalysis	
Add to existing S	olution	
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") 🔹	
Solution TwinCAT PLC Target	Results HMI Dashboard Visual Studio Summary	
Target		
Target System:	.ocal> (172.17.251.113.1.1) 🔹 🗸	ireate Bootproject
ADS Port:	851 🗸 🗸	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: Co	ore0 (Shared) 🔹	
AnalyticsHistoricalTask:	ore5 (Isolated) (If generated)	
	6	6
		KT 5
	Canad Back	Neut

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 Apolutice File	
File Pathr	
May File Size: 256 Sample buffer count	
Select Result Items Cycle I me: User specified cycle time V	ms 📄
Lancel 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 V	/ersion ("Version 2.1")	
Solution TwinCAT PLC 1	arget Results HMI Dashboard Visual Studio Summary	_
HMI generation Setti	ngs	
📝 Generate HMI D	ashboard 🔲 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		4
Dashboard Layout:	Dashboard Sorting:	
With	out Dock Control Type	
	Vse custom Background Image 👻	
	Cancel Back Next	

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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			×
Cod	legeneration: Latest V	ersion ("Version 2.	1") 🔹	
Sol	lution TwinCAT PLC T	arget Results	HMI Dashboard Visual Studio Summary	_
D	ashboard Styles			^
	Dashboard Layout:		Dashboard Sorting:	
	Witho	out Dock	Control Type	
			💟 Use custom Background Image	
	Dashboard Theme:	Shiny 🔻	C:\TwinCAT\Functions\TE3500-Anal	
	Select Color:	Header Color	Use custom Logo	
	Control Style:	Flat -	Use custom Map Icon No valid file	E
Li	anguages			
	☑ German ☑ C ☑ Englisch ☑ Ita	hinese 🔲 Belgi alian 📄 Finni:	an 📄 Swedish sh 📄 Brazilian	•
			Cancel Back Next	
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	3
Codegeneration: Latest Version ("Version 2.1")	
Solution TwinCAT PLC Target Results HMI Dashboard Visual Studio Summary	
TwinCAT XAE Shell Visual Studio open	
Visual Studio 2017	
Cancel Back Next	

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 \Rightarrow At last you can find an overview.

Deploy Analytics Runtime	X
Codegeneration: Latest Version ("Version 2.1")	
Solution TwinCAT PLC Target Results HMI Dashboard Visual Studio Summary	
Solution	
Mode: "NewSolution"	
ProjectName: "MachineAnalysis"	
SolutionName: "Production"	
Path: "CitemplAnalytics\Test"	
WinCAT PLC Target	
AnalyticsTask => CPU Core: "4"	
Runtime: "851"	
Analytics I ask: "10"	
Activate Runtime: "I rue"	
Create Bootproject: "I rue"	
AnalyticsHistorical Lask: "10"	
AnalyticsHistorical Lask => CPU Core: "5"	
Isolated CPU Cores: "2"	
Result cycle time: "10000000"	
Result I opic: "Analysis/ResultStream"	
BrokerSettings: " <unconfigured connectionsettings="">"</unconfigured>	
Cancel Back Deploy	

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

Deploy Analytics Runtime	X
Message Image: Control of the state o	
Cancel Close	
Deploy Analytics Runtime	X
Deploy Analytics Runtime Message I Restart TwinCAT I Start generating HMI I Create TwinCAT HMI Project I Create HMI Contents I Create HMI Contents I Modify HMI template I Set theme I Import selected languages Set ADS Route Start symbol mappings for: TrafficLight Start symbol mappings for: Average Start symbol mappings for: Average Start symbol mappings for: SingleValue Create HMI Controls I Create HMI Controls I Create control: TrafficLight for Status I Create control: Average for Temperature I Create control: TrafficLight for Threshold Classificator 1Ch_2 I 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.



5 Technical introduction

Regarding the TwinCAT Analytics workflow the Analytics Runtime is able to make a continuous analysis of data from different remote controller. The Analytics Runtime based on a standard TwinCAT PLC Runtime. The application code can be generated automatically by the Analytics Workbench. So, the user has no additional engineering effort, but is free to do code changes or to add own analysis code. The usage of other standard Beckhoff PLC libraries like Tc3_Database or Tc3_ConditionMonitoring is possible, too.

Connection handling with remote devices

The number of devices/controller to be analyzed is limited. The Analytics Runtime itself allows four connections to controller without additional packages.

Currently **one** connection is counted for the following controllers:

- · Controller with TF3500 Analytics Logger
- Controller with TF6720 IoT Data Agent (can have many underlaid controllers)
- · EK9160 IoT Coupler



If you need more than four connections in your application, you can add Controller Packs. Possible packs are shown here.

The picture below shows an application architecture with 11 connected controller. In this case you have to order a license for Controller Pack 8 on the Analytics Runtime device/VM in addition to the TwinCAT Analytics Runtime license.





TwinCAT HMI

Based on the analysis PLC code the engineer is able to design an own HTML 5 dashboard with TE2000 which is integrated in the setup of TE3500 Analytics Workbench. The Analytics Runtime includes the HMI Server. The HMI Server provides the HTML 5 web pages for at least four clients at the same time. The Server provides one client connection by himself and the Analytics Runtime includes the licence for the Client Pack 3. Which gives you the possibility of 4 connections.



6 Configuration

The configuration of the Analytics Runtime is carried out in the engineering tool TE3500 Analytics Workbench. The necessary steps are explained again here. If you need more information about the configuration in TE3500, please go to the documentation of TE3500.

6.1 Runtime deployment

PLC code can be generated with all modules and parameters configured in the TwinCAT Analytics Workbench Configurator. This code can be downloaded into a TwinCAT Analytics runtime to realize 24/7 data analysis.

NOTICE

Compatibility of automatically generated PLC code

The automatically generated PLC code is based on the TwinCAT Analytics Library. Interfaces of the base models of the library are compatible with earlier versions after release of the library. The automatically generated code itself is only a sample code! This code generation may change from version to version. As far as possible, this is solved by the code generation version.

1. After configuration, you can click on the **Deploy Analytics Runtime** command in the context menu, as shown in the image below.



2. The Deploy Wizard starts and it is possible to set up the entire required configuration step by step for use.

Deploy Analytics Runt	ime	
Codegeneration: Late	est Version ("Version 4.0") V	
Solution TwinCAT PL	LC Target Results HMI Dashboard Visual Studio Summary	
Create new Soluti	ion	
Solution Path:	C:\Users\Beckhoff\Documents	
Solution Name:	AnalyticsSolution	
Project Name:	AnalyticsProject PLC Name: AnalysisPLC	
Solution Path:	New TwinCAT Project O New PLC Project O Include to PLC Project	
Project Name:	AnalyticsProject V PLC Name: AnalysisPLC V	
O Merge to existing Solution Path: Project Name:	Project (TwinCAT Project Compare) V PLC Name: V	
	Cancel Back	Next

3. On the first tab **Solution** you can select whether a new project folder is created, whether the analysis PLC code is integrated or added to an existing project folder as a new project, new PLC or to an existing PLC, or whether the new project is inserted into an existing project folder using the TwinCAT Project Compare Tool.

Deploy Analytics Runtime		x
Codegeneration: Latest Version ("V	(ersion 4.0")	
Solution TwinCAT PLC Target R	esults HMI Dashboard Visual Studio Summary	
Target		
Target System:	DESKTOP-P3914EA (172.17.251.193.1.1) ~	Create Bootproject
ADS Port:	851 Enable UTF8 Encoding	Activate PLC Runtime
Tasks		
"AnalyticsTask":	10 ms	
"AnalyticsHistoricalTask":	10 ms (Generate if historical data sources are available)	
Real-Time		
	Available CPU cores (Shared/Isolated) 3 🐳 1 🐳	15
AnalyticsTask:	Core3 (Isolated) \checkmark	6-6 5
AnalyticsHistoricalTask:	Core3 (Isolated) \sim (If generated)	5
	Cancel	Back Next

4. On the second tab, **TwinCAT PLC Target**, all PLC-specific parameters such as target system, task cycle time or the task assignment to corresponding CPU cores can be defined.

Deploy Analytics Runtime		x
Codegeneration: Latest Vers	rsion ("Version 4.0") \sim	
Solution TwinCAT PLC Tar	rget Results HMI Dashboard Visual Studio Summary	
O Create no Results		
Stream Results to MQT	TT Broker	
Topic:	Beckhoff/Results/test	
messagebroker.beckho	off-cloud.com	
MQTT Co	Connection Settings 🗘 Analytics Binary Stream Format 🗸	
O Write Results to Analytic	ics File	
File Path:		
Max File Size:	256 Sample buffer count	
Select Resul	ult Items Cycle Time: Cycle time of target DataSource V	
	Cancel Back N	lext

5. If you have set the "PLC Result" property of some functions in the configurator, the **Result** tab is enabled in the Deploy wizard. There you can set up where the results will be streamed or stored.



46

6. By clicking **Select Result Items** it is possible to select only the desired values.

Deploy Analytics Runtime		x
Codegeneration: Latest Version (*	"Version 4.0") 🗸	
Solution TwinCAT PLC Target	Results HMI Dashboard Visual Studio Summary	
HMI generation Settings		^
Generate HMI Dashboa	ard Create only HMI Project (no PLC)	
HMI Project Name:	AnalyticsHMIProject	
Dashboard Options		
Dashboard Title:	Analytics Dashboard	
Desktop Height:	864 Desktop Width: 1920	
Create Startpage	Show current time	
Dashboard Styles		
Dashboard Layout:	Dashboard Sorting:	
Witho	but Dock Space Saving	
		~
	Cancel Back	Next

 If you have assigned HMI controls to one or more functions, the HMI Dashboard tab is enabled in the Deploy wizard. Here, various settings can be made to generate a customized Dashboard that fits your needs.

Deploy Analytics Runtime x
Codegeneration: Latest Version ("Version 4.0")
Solution TwinCAT PLC Target Results HMI Dashboard Visual Studio Summary
✓ Keep Visual Studio open ✓ Show Visual Studio during generating code
Target VS Version:
TwinCAT XAE Shell ~
Create HMI in another Visual Studio
TwinCAT XAE Shell
Cancel Back Next

8. On the next tab, **Visual Studio**, you can select which Visual Studio version or TwinCAT XAE shell should be used for generation, if several are installed.

Deploy Analytics Runtime
Codegeneration: Latest Version ("Version 4.0")
Solution TwinCAT PLC Target Results HMI Dashboard Visual Studio Summary
Solution
Mode: "NewSolution"
ProjectName: "AnalyticsProject"
SolutionName: "AnalyticsSolution"
Path: "C:\Users\Beckhoff\Documents"
PLCName: "AnalysisPLC"
Create New TwinCAT Project: "True"
WinCAT PLC Target
Target: " <local> (172.17.66.89.1.1)"</local>
Runtime: "851"
AnalyticsTask: "10"
Activate Runtime: "True"
Create Bootproject: "True"
UTF8 Encoding Supported: "False"
AnalyticsTask => CPU Core: "0"
AnalyticsHistoricalTask: "10"
AnalyticsHistoricalTask => CPU Core: "0"
Shared CPU Cores: "4"
Isolated CPU Cores: "0"
i Doculto
Cancel Back Deploy

9. The last tab shows you all the settings you have made for the generation. Now you can start the generation process by clicking **Deploy**.

⇒ In the overview window, each step during the generation process is displayed, clearly arranged and divided into categories.

Deploy Analytics Rur	ntime	x
	Deploy preparation Read the project, check the configuration and transform objects. O Errors O Warning O Messages	
N °	Visual Studio Creates a new instance of the Visual Studio / TcXaeShell and create an empty solution.	
ø	TwinCAT PLC code generation Creates a new TwinCAT PLC project with all FBs and other needed components. Image: O Errors Image: O Warning Image: O Marking 114 Messages	
	Done Deploy Runtime succeeded	
✓ Bring to Front	Save to File Cancel Close	

6.1.1 Algorithm properties

Each algorithm of the Analytics Configurator is providing some properties. The sections of HMI and PLC are necessary for the automatic code generation.

Properties	▼ 및 ×
	asurement.AnalyticsrunctionNodeProper +
Color	Black
Comment	
SortPriority	100
∃ Function	
ClassId	02040101-0000-0000-f000-00000000064
ClassName	
FactoryName	TcAnalyticsKernel
Group	TcAnalyticsKernel Base
Title	Edge Counter 1Ch_1
🗆 HMI	
Generate GVL	False
GlobalVariableType	InOutVariables
Network	
NetworkID	1
E PLC	
Persistent Results	False
Stream Results	False
A	
Apperance	

HMI

- **Generate GVL:** Enable the generation of an Global Variable List with a collection of variables and corresponding data type mapping for TwinCAT HMI
- **GlobalVariableType:** Choose the type with InOutVariables just for inputs and outputs of the algorithm or KeyValuePairs for general mapping to STRING for tables

PLC

•

- **Persistent Results:** Enable this flag to store results of algorithm persistent to target system of the Analytics Runtime
- **Stream Results:** Enable this flag to add the In- and Outputs of the algorithm to a result stream which will be generated by the code generation

Version: 1.2.1

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6.1.2 PLC Code

AnalyticsSolution - TcXaeShell (Administrator) <u>Eile Edit View Project Build D</u> ebug TwinCAT TwinSAFE	PLC 1	Tea <u>m</u>	Cuick Launch (Ctrl+	Q P =	×
🛛 😋 🕶 🗟 🗸 🔄 🖕 🎴 🔐 👗 🗗 台 🗇 - 🤆 - 🛛 Release	e +	Tw	inCAT RT (x64) - 🕨 Attach 🃁 🏓 pSQLCr	md - 🕢	
🛛 Build 4024.12 (Loaded) 🕞 🚽 🔛 🧧 🚺 🤹 🌾 🎯 🍡 🐔	Analytic	sProj	ject • <local> • = AnalysisPLC •</local>		
Solution Explorer				MAIN Analytics C1 🛎 🗙 👻 著	P
		1	PROGRAM MAIN_Analytics_C1		nert
Search Solution Evaluator (Chd. ii)		2	VAR_INPUT	e e e e e e e e e e e e e e e e e e e	Ř.
	-	3	stReset: ST_AnalysisReset; END VAR		5
Solution 'AnalyticsSolution' (1 project)		5	VAR OUTPUT	- Do	ho l
SYSTEM		e	bError: BOOL;		
MOTION		7	<pre>ipTcResult: I_TcMessage;</pre>		
PLC		8	END_VAR	100 🖳 🗸	
AnalysisPLC		1	A_Reset();	^	
AnalysisPLC Project		2			
External Types		3	fbResults.Call();		
References		4	TP fbDeculte bInitialized WURN		
DUTs		6	IF TestAndSet (Analytics block TL) THEN		
▷ GVLs		7	IF Analytics.fbTl DataSource.bNewData THEN		
A by POUs		8			
Analytics		9	WHILE NOT Analytics.fbTl_DataSource.bEndOfData DO		
▷ 🔁 [Helper]	8 1	10			
DataSource	1	11	<pre>Analytics.fbTl_DataSource.NextData();</pre>		
Networks	1	12			
A Construction	1	13	fbAnalysis.Call();		
File Diagonal Constant Charles		14	IF IDANALYSIS.DETTOT THEN		
FB_N1_M1_EdgeCounterren (FB) FB_N1_M2_MinMaxAv(a1Ch (FB)		16	EALT; FISF		
B EB N1 Network1 (EB)		17	fbAnalysis.ResultStream(fbResults):		
b C Results	1	18	END IF		
FB Analysis (FB)	1	19	-		
bNewInputData	2	20	END_WHILE		
Call	2	21			
D nContext	⊟ 2	22	ELSE		
Reset	2	23	fbAnalysis.Call();		
ResultStream	2	24	END_IF		
Timestamp	2	26	Analytics block Tit- FALSE:		
MAIN (PRG)	2	27	END IF		
MAIN_Analytics (PRG)	2	28			
MAIN_Analytics_C1 (PRG)	2	29	//Error Handling		
VISUs	3	30	bError:= fbAnalysis.bError;		
AnalyticsTask (AnalyticsTask)	r 3	31	<pre>ipTcResult:= fbAnalysis.ipTcResult;</pre>		
Solution Explorer Team Explorer	3	32		100 🔍 🗸	
Target Browser Error List Output					
🗇 Ready 🙀 🙀 Ln 1	Col 1		Ch 1 INS	↑ Add to Source Control ▲	.#

NOTICE

Compatibility of automatically generated PLC code

The automatically generated PLC code is based on the TwinCAT Analytics Library. Interfaces of the base models of the library are compatible with earlier versions after release of the library. The automatically generated code itself is only a sample code! This code generation may change from version to version.

Code generation version compatibility

	Version 2.1 (obsolete)	Version 3.0 (obsolete)	Version 4.0	Version 4.1	Version 5.0
Analytics algorithms	(X)	(X)	X	Х	Х
Filter algorithms	(X)	(X)	Х	Х	Х
HMI support	(X)	(X)	Х	Х	Х
HMI with advanced input stream handling	-	(X)	X	Х	Х
Support of array inputs	(X)	(X)	Х	Х	Х
Support of oversampling inputs	-	-	Х	Х	Х
Network templates	(X)	(X)	Х	Х	Х
"Closed" network templates	-	-	Х	Х	Х
Network with inputs, outputs and parameters	-	-	X	Х	Х
"Condition Monitoring" network templates	-	-	X	Х	Х
Lambda algorithms	-	-	Х	Х	Х
Writing parameters via HMI	-	-	-	Х	Х
"Power Monitoring" algorithms	-	-	X	Х	Х
Scope Support	-	-	-	-	Х

6.1.2.1 Code version 2.1

Solution Explorer 🔹		
○ ○ ☆ 'o - ≠ 副 ≠ <u>-</u>		
Search Solution Explorer (Ctrl+ü)		
Solution 'AnalyticsSolution4' (1 project)		
A AnalyticsProject		
SYSTEM		
🔝 License		
👂 🧅 Real-Time		
Tasks		
💼 PlcTask		
💼 AnalyticsTask	-	Task
ia Routes		
Type System		
TcCOM Objects		Charles and Laboration
MOTION		StreamHelper
A MANA Analytics Depinent		
AnalyticsProject		
Analytics roject roject		
References		
🔺 🗁 Analytics		
HMI		
🔺 🗁 Results		DataTunas
😭 ST_Results (STRUCT)		DataTypes
😭 E_AnalysisComponents (ENUM)		
😭 ST_AnalysisReset (STRUCT)		
🔺 📴 GVLs		
🎒 AnalyticsHMI		HMI GVL
POUs A Construction		
POUs Analytics DataSource		
 POUs Analytics DataSource T01 DataSource 		
 POUs Analytics DataSource DataSource T01 DataSource FB T1 DataSource (FB) 		DataSource /
 POUs Analytics DataSource T01 DataSource FB_T1_DataSource (FB) m < 1 T1 DataSource 		DataSource /
 POUs Analytics DataSource T01 DataSource FB_T1_DataSource (FB) G LT1_DataSource M2M_Mapping 		DataSource / M2M Mapping
 POUs Analytics DataSource T01 DataSource FB_T1_DataSource (FB) FB_T1_DataSource M2M_Mapping FB_ValueMapping_M2M (FB) 		DataSource / M2M Mapping
 POUs Analytics DataSource T01 DataSource FB_T1_DataSource (FB) FB_T1_DataSource M2M_Mapping FB_ValueMapping_M2M (FB) FB_ValueMapping_M2M 		DataSource / M2M Mapping
 ∠ POUs ∠ Analytics ∠ DataSource ∠ T01 DataSource ▷ FB_T1_DataSource (FB) ▷ ○ I_T1_DataSource ∠ M2M_Mapping ▷ FB_ValueMapping_M2M (FB) ▷ ○ I_ValueMapping_M2M ∠ Networks 		DataSource / M2M Mapping
 ∠ POUs ∠ Analytics ∠ DataSource ∠ T01 DataSource ∠ FB_T1_DataSource (FB) ∠ CT1_DataSource ∠ M2M_Mapping ∠ FB_ValueMapping_M2M (FB) ∠ Networks ∠ Not Network1 		DataSource / M2M Mapping Network
 POUs Analytics DataSource T01 DataSource FB_T1_DataSource (FB) FB_T1_DataSource M2M_Mapping FB_ValueMapping_M2M (FB) FB_ValueMapping_M2M Networks Not Network1 Modules 		DataSource / M2M Mapping Network
 POUs Analytics DataSource T01 DataSource FB_T1_DataSource (FB) FB_T1_DataSource M2M_Mapping FB_ValueMapping_M2M (FB) FB_ValueMapping_M2M Networks Not Network1 Modules FB_N1_M1_MovingAverage1Ch_1 (FB) 		DataSource / M2M Mapping Network
 POUs Analytics DataSource T01 DataSource FB_T1_DataSource (FB) FB_V1_DataSource M2M_Mapping FB_ValueMapping_M2M (FB) FB_ValueMapping_M2M Networks Not Network1 Modules FB_N1_M1_MovingAverage1Ch_1 (FB) FB_N1_M2_MinMaxAvgInterval1Ch_1 (FB) FB_N1_M2_MinMaxAvgInterval1Ch_1 (FB) FB_N1_M2_MinMaxAvgInterval1Ch_1 (FB) 		DataSource / M2M Mapping Network Modules
 POUs Analytics DataSource T01 DataSource FB_T1_DataSource (FB) FB_T1_DataSource M2M_Mapping FF_ValueMapping_M2M (FB) FF_ValueMapping_M2M Networks Not Network1 Modules FF_N1_M1_MovingAverage1Ch_1 (FB) FF_N1_M1_MovingAverage1Ch_1 (FB) FF_N1_M1_M1_MovingAverage1Ch_1 (FB) FF_N1_M3_EdgeCounter1Ch_1 (FB) FF_N1_M3_EdgeCounter1Ch_1 (FB) FF_N1_M3_EdgeCounter1Ch_1 (FB) 		DataSource / M2M Mapping Network Modules
 POUs Analytics DataSource T01 DataSource FB_T1_DataSource (FB) FB_T1_DataSource M2M_Mapping FF_ValueMapping_M2M (FB) FValueMapping_M2M Networks Not Network1 Modules FB_N1_M1_M1_MovingAverage1Ch_1 (FB) FB_N1_M3_EdgeCounter1Ch_1 (FB) FB_N1_M4_ThresholdClassificator1Ch_1 (FB) FB_N1_M4_ThresholdClassificator1Ch_1 (FB) FB_N1_M4_ThresholdClassificator1Ch_1 (FB) 		DataSource / M2M Mapping Network Modules
 POUs Analytics DataSource T01 DataSource FB_T1_DataSource (FB) FB_T1_DataSource M2M_Mapping FF ValueMapping_M2M (FB) FF ValueMapping_M2M Vetworks Not Network1 Modules FB_N1_M1_MovingAverage1Ch_1 (FB) FB_N1_M2_MinMaxAvgInterval1Ch_1 (FB) FB_N1_M3_EdgeCounter1Ch_1 (FB) FB_N1_M4_ThresholdClassificator1Ch_1 (FB) FB_N1_Network1 (FB) 		DataSource / M2M Mapping Network Modules
 POUs Analytics DataSource T01 DataSource FB_T1_DataSource (FB) FB_T1_DataSource M2M_Mapping FF ValueMapping_M2M (FB) FF ValueMapping_M2M Not Networks Not Networks Not Network1 FB_N1_M1_MovingAverage1Ch_1 (FB) FB_N1_M3_EdgeCounter1Ch_1 (FB) FB_N1_M4_ThresholdClassificator1Ch_1 (FB) FB_N1_Metwork1 (FB) FB_N1_Metwork1 (FB) 		DataSource / M2M Mapping Network Modules
 POUs Analytics DataSource T01 DataSource T01 DataSource (FB) FB_T1_DataSource (FB) T1_DataSource M2M_Mapping FB_ValueMapping_M2M (FB) T4ueMapping_M2M Networks Networks No1 Network1 FB_N1_M1_MovingAverage1Ch_1 (FB) FB_N1_M3_EdgeCounter1Ch_1 (FB) FB_N1_M4_ThresholdClassificator1Ch_1 (FB) FB_N1_M4_ThresholdClassificator1Ch_1 (FB) FB_N1_Network1 (FB) FB_N1_Secults I_Results 		DataSource / M2M Mapping Network Modules Results
 POUs Analytics DataSource T01 DataSource T01 DataSource (FB) FB_T1_DataSource (FB) T1_DataSource M2M_Mapping FB_ValueMapping_M2M (FB) FB_ValueMapping_M2M (FB) IValueMapping_M2M Networks Not Network1 FB_N1_M1_MovingAverage1Ch_1 (FB) FB_N1_M3_EdgeCounter1Ch_1 (FB) FB_N1_M4_ThresholdClassificator1Ch_1 (FB) FB_N1_Network1 (FB) FB_N1_Network1 (FB) FB_N1_Network1 (FB) FB_N1_Network1 (FB) FB_N1_Network1 (FB) 		DataSource / M2M Mapping Network Modules Results Analysis
 ▲ POUs ▲ Analytics ▲ DataSource ▲ T01 DataSource ▶ FB_T1_DataSource (FB) ▶ △ [T1]_DataSource ▲ M2M_Mapping ▶ △ [T1]_DataSource ▲ M2M_Mapping_M2M (FB) ▶ △ [ValueMapping_M2M (FB) ▶ △ [ValueMapping_M2M ▲ Networks ▲ Not Network1 ▲ Modules ▶ △ FB_N1_M1_MovingAverage1Ch_1 (FB) ▶ △ FB_N1_M3_EdgeCounter1Ch_1 (FB) ▶ △ FB_N1_M4_ThresholdClassificator1Ch_1 (FB) ▶ △ FB_N1_M4_ThresholdClassificator1Ch_1 (FB) ▶ △ FB_N1_Network1 (FB) ▲ ○ Results ▶ △ FB_Analysis (FB) ➡ MAIN (PRG) 		DataSource / M2M Mapping Network Modules Results Analysis
Analytics Analytics Analytics Analytics DataSource Amathetic provide the second s		DataSource / M2M Mapping Network Modules Results Analysis Main
 Analytics Analytics DataSource T01 DataSource FB_T1_DataSource (FB) FB_T1_DataSource M2M_Mapping FB_ValueMapping_M2M (FB) FB_ValueMapping_M2M Networks Not Network1 FB_N1_M1_MovingAverage1Ch_1 (FB) FB_N1_M2_MinMaxAvgInterval1Ch_1 (FB) FB_N1_M4_ThresholdClassificator1Ch_1 (FB) FB_N1_M4_ThresholdClassificator1Ch_1 (FB) FB_N1_M4_ThresholdClassificator1Ch_1 (FB) FB_N1_M4_ThresholdClassificator1Ch_1 (FB) FB_N1_M4_ThresholdClassificator1Ch_1 (FB) FB_N1_Network1 (FB) FB_Analysis (FB) MAIN (PRG) MAIN_Analytics (PRG) A_Reset 		DataSource / M2M Mapping Network Modules Results Analysis Main
 Analytics Analytics DataSource T01 DataSource FB_T1_DataSource (FB) FB_T1_DataSource M2M_Mapping FB_ValueMapping_M2M (FB) FB_ValueMapping_M2M Networks Not Network1 Not Network1 FB_N1_M1_MovingAverage1Ch_1 (FB) FB_N1_M2_MinMaxAvgInterval1Ch_1 (FB) FB_N1_M4_ThresholdClassificator1Ch_1 (FB) FB_N1_M4_ThresholdClassificator1Ch_1 (FB) FB_N1_M4_ThresholdClassificator1Ch_1 (FB) FB_N1_Network1 (FB) FB_Analysis (FB) FB_Analysis (FB) MAIN (PRG) MAIN_Analytics (PRG) A_Reset ValueMapting_M2 		DataSource / M2M Mapping Network Modules Results Analysis Main
 Analytics Analytics DataSource T01 DataSource T01 DataSource FB_T1_DataSource (FB) FB_T1_DataSource M2M_Mapping FB_ValueMapping_M2M (FB) FB_ValueMapping_M2M Networks Not Network1 Modules FB_N1_M1_MovingAverage1Ch_1 (FB) FB_N1_M2_MinMaxAvgInterval1Ch_1 (FB) FB_N1_M3_EdgeCounter1Ch_1 (FB) FB_N1_M4_ThresholdClassificator1Ch_1 (FB) FB_N1_M4_ThresholdClassificator1Ch_1 (FB) FB_N1_Network1 (FB) FB_Analysis (FB) FB_Analysis (FB) MAIN (PRG) MAIN_Analytics (PRG) A_Reset VISUs AnalyticsTask (AnalyticsTask) 		DataSource / M2M Mapping Network Modules Results Analysis Main Task
 Analytics Analytics DataSource T01 DataSource T01 DataSource FB_T1_DataSource (FB) FB_T1_DataSource M2M_Mapping FB_ValueMapping_M2M (FB) FB_ValueMapping_M2M Networks Not Network1 Modules FB_N1_M1_MovingAverage1Ch_1 (FB) FB_N1_M2_MinMaxAvgInterval1Ch_1 (FB) FB_N1_M4_ThresholdClassificator1Ch_1 (FB) FB_N1_M4_ThresholdClassificator1Ch_1 (FB) FB_N1_Network1 (FB) FB_Rsults FB_Results FB_Analysis (FB) MAIN (PRG) MAIN_Analytics (PRG) A_Reset VAIN_Analytics MAIN_Analytics 		DataSource / M2M Mapping Network Modules Results Analysis Main Task
 Analytics Analytics DataSource T01 DataSource T01 DataSource FB_T1_DataSource (FB) FB_T1_DataSource M2M_Mapping FB_ValueMapping_M2M (FB) FB_ValueMapping_M2M Networks Not Network1 Modules FB_N1_M1_MovingAverage1Ch_1 (FB) FB_N1_M2_MinMaxAvgInterval1Ch_1 (FB) FB_N1_M4_ThresholdClassificator1Ch_1 (FB) FB_N1_M4_ThresholdClassificator1Ch_1 (FB) FB_N1_Network1 (FB) FB_Results FB_Results FB_Raulysis (FB) FB_Analysis (FB) MAIN (PRG) MAIN_Analytics (PRG) A_Reset VSUs AnalyticsTask (AnalyticsTask) MAIN_Analytics 		DataSource / M2M Mapping Network Modules Results Analysis Main Task

Task:

A separate task is created for the analytics analysis.

StreamHelper:

If one or more data sources are of type MQTT binary stream, the code generation creates an instance of a StreamHelper object to process the incoming binary stream patterns.

DataTypes:

The data types are created for the analysis. They contain STRUCTs for the reset function or result processing and ENUMs to select the various components.

HMI GVL:

To conveniently map module inputs and outputs with the HMI dashboard, selected variables are generated as global variables.

DataSource/M2M Mapping:

The FB DataSource manages the receipt of input values from the various sources. In the OUTPUT declaration you will find all configured inputs. The FB ValueMapping_M2M manages the value mapping between the modules (M2M - Module to Module) from the module INPUTs to the module OUTPUTs.

Network:

All modules are sorted in a specific network to achieve a better overview and structure of the configured analysis.

Modules:

The module FBs contain all inputs and outputs of the configured modules from the workbench configurator. It is also possible to reconfigure the modules during runtime. To do this, simply change the parameter and then start the reconfiguration process with a rising edge at INPUT bReconfigure.

Results:

If analysis results need to be saved or streamed, the FB Results manages this and streams the selected variables to the message broker or saves the data to the Analytics binary file.

Analysis:

The entire analysis routine is defined in the FB Analysis. All configured networks with their modules and error handling are created.

MAIN:

The FB Analysis is called in the program MAIN_Analytics. The program is assigned to the separate task.

It is also possible to reset single modules, whole networks or all defined networks with only one rising flag. First, select the component to be reset. Then a rising edge at INPUT bReset starts the reset process.

All reset calls are defined in the action A_Reset.

Requirements

Development environment	Target platform	Plc libraries to include
TwinCAT v3.1.4024.0	PC or CX (x64, x86)	Tc3_Analytics Version >= 3.1.0.0

6.1.2.1.1 FB_DataSource

The DataSource FB manage the receiving of the input values of the different sources. In the OUTPUT declaration you can find all configured inputs.

Syntax

Definition:

```
FUNCTION_BLOCK FB_T[n]_DataSource IMPLEMENTS I_T[n]_DataSource
VAR
END VAR
```

Methods

Name	Definition location	Description
<u>Call [▶ 55]</u>	Local	Method for background communication with the TwinCAT driver. The method must be called cyclically.
GetData [55]	Local	Method to get the data of the specified element

Requirements

Development environment	Target platform	Plc libraries to include
TwinCAT v3.1.4024.0	PC or CX (x64, x86)	Tc3_Analytics

6.1.2.1.1.1 GetData

Syntax

```
METHOD GetData : BOOL
VAR_INPUT
nElement : UDINT;
END_VAR
```

🐔 Inputs

Name	Туре	Description
nElement	UDINT	Element ID to get the specific
		sample

Return value

Name	Туре	Description
GetData	BOOL	Is TRUE if a new element is
		selected

6.1.2.1.1.2 Call

Syntax

METHOD Call : BOOL

Return value

Name	Туре	Description
Call	BOOL	

6.1.2.1.2 FB_Network

All modules are sorted in a specific network to get a better overview and structure of the configured analysis.

Syntax

Definition:

```
FUNCTION_BLOCK FB_N[n]_[Network1]
VAR_INPUT
[module FBs]
END_VAR
VAR_OUTPUT
bError: BOOL;
```

ipTcResult: I_TcMessage; END_VAR

🐔 Inputs

Name	Туре	Description
Module FBs		FBs of the configured modules

Solution Outputs

Name	Туре	Description
bError	BOOL	Becomes TRUE as soon as an error situation occurs.
ipTcResult	I_TcMessage	Message interface from the TwinCAT 3 EventLogger, which provides details on the return value.

🔹 Methods

Name	Definition location	Description
<u>Call [▶ 60]</u>	Local	Method for background communication. The method must be called cyclically.
Reset [60]	Local	Reset the Network with all sub modules
ValueMapping [> 56]	Local	Map the input values to the different module inputs
SetHMIValues [▶ 57]	Local	Optional: Map in- outputs of the modules to the global HMI variable

Requirements

Development environment	Target platform	Plc libraries to include
TwinCAT v3.1.4024.0	PC or CX (x64, x86)	Tc3_Analytics

6.1.2.1.2.1 ValueMapping

Syntax

```
METHOD ValueMapping : BOOL
VAR_INPUT
ipDataSource : I_T[n]_DataSource;
END_VAR
```

🔁 Inputs

Name	Туре	Description
ipDataSource	I_T[n]_DataSource	Data for the analysis from the
		specific data source

Return value

Name	Туре	Description
ValueMapping	BOOL	

BECKHOFF

6.1.2.1.2.2 SetHMIValues

Syntax

```
METHOD SetHMIValues : BOOL
VAR_INPUT
    pHMI_N[n]_[Network1] : POINTER TO ST_HMI_N[n]_[Network1];
END_VAR
```

🐔 Inputs

Name	Туре	Description
pHMI_N[n]_[Network1]	POINTER TO	Pointer to global HMI struct
	ST_HMI_N[n]_[Network1]	

Return value

Name	Туре	Description
SetHMIValues	BOOL	Is TRUE if done

6.1.2.1.2.3 Reset

Syntax

```
METHOD Reset : BOOL
VAR
END_VAR
```

Return value

Name	Туре	Description
Reset	BOOL	Is TRUE if done

6.1.2.1.2.4 Call

Syntax

```
METHOD Call : BOOL
VAR_INPUT
    ipDataSource: I_T[n]_DataSource;
    [ipValueMapping_M2M: I_ValueMapping_M2M;]
END VAR
```

🔁 Inputs

Name	Туре	Description
ipDataSource	I_T[n]_DataSource	Data for the analysis.
ipValueMapping_M2M	I_ValueMapping_M2M	Optional: Needed for mapping values between modules

Return value

Name	Туре	Description
Call	BOOL	

6.1.2.1.3 FB_Module

The module FBs contains all inputs and outputs of the configured modules from the Workbench Configurator. It is also possible to reconfigure the modules at runtime. You only have to change the parameter and then start the reconfigure process with a rising edge at the bReconfigure INPUT.

Syntax

Definition:

```
FUNCTION_BLOCK FB_N[n]_M[n]_[Module]
VAR_INPUT
    [module inputs]
END_VAR
VAR_OUTPUT
    bError: BOOL;
    ipTcResult: I_TcMessage;
    [module outputs]
END_VAR
```

🐔 Inputs

Name	Туре	Description
Module inputs		Inputs of the selected module

Solution Outputs

Name	Туре	Description
bError	BOOL	Becomes TRUE as soon as an error situation occurs.
ipTcResult	I_TcMessage	Message interface from the TwinCAT 3 EventLogger, which provides details on the return value.
Module outputs		Outputs of the selected module

🔹 Methods

Name	Definition location	Description
<u>Call [▶ 58]</u>	Local	Method for background communication. The method must be called cyclically.
<u>Reset [> 59]</u>	Local	Reset the module
<u>SetHMI [Þ 59]</u>	Local	Optional: Sets the in- outputs to the global HMI structs

Requirements

Development environment	Target platform	Plc libraries to include
TwinCAT v3.1.4024.0	PC or CX (x64, x86)	Tc3_Analytics

6.1.2.1.3.1 Call

Syntax

METHOD Call : BOOL VAR END_VAR

Return value

Name	Туре	Description
Call	BOOL	

6.1.2.1.3.2 Reset

Syntax

```
METHOD Reset : BOOL
VAR
END_VAR
```

Return value

Name	Туре	Description
Reset	BOOL	Is TRUE if done

6.1.2.1.3.3 SetHMI

Syntax

```
METHOD SetHMIValues : BOOL
VAR_INPUT
    pHMI_N[n]_[Network1] : POINTER TO ST_HMI_N[n]_[Network1];
END_VAR
```

🐔 Inputs

Name	Туре	Description
pHMI_N[n]_[Network1]	POINTER TO	Pointer to global HMI struct
	ST_HMI_N[n]_[Network1]	

Return value

Name	Туре	Description
SetHMI	BOOL	Is TRUE if done

6.1.2.1.4 FB_Analysis

In the analysis FB the whole analytics routine is defined. All configured networks with their modules and error handling is created.

Syntax

Definition:

```
FUNCTION_BLOCK FB_Analysis
VAR_INPUT
[network FBs]
END_VAR
VAR_OUTPUT
bError: BOOL;
ipTcResult: I_TcMessage;
END_VAR
```

🐔 Inputs

Name	Туре	Description
Network FBs		FBs of the configured networks

Outputs

Name	Туре	Description
bError	BOOL	Becomes TRUE as soon as an error situation occurs.
ipTcResult	I_TcMessage	Message interface from the TwinCAT 3 EventLogger, which provides details on the return value.

🔹 Methods

Name	Definition location	Description
<u>Call [▶ 60]</u>	Local	Method for background communication with the TwinCAT driver. The method must be called cyclically.
<u>Reset [} 60]</u>	Local	Reset the whole analysis
ResultStream [> 61]	Local	Optional: If a result stream has to be created

Requirements

Development environment	Target platform	Plc libraries to include
TwinCAT v3.1.4024.0	PC or CX (x64, x86)	Tc3_Analytics

6.1.2.1.4.1 Call

Syntax

```
METHOD Call : BOOL
VAR_INPUT
ipDataSource: I_T[n]_DataSource;
END_VAR
```

🔁 Inputs

Name	Туре	Description
ipDataSource	I_T[n]_DataSource	Data for the analysis.

Return value

Name	Туре	Description
Call	BOOL	

6.1.2.1.4.2 Reset

Syntax

```
METHOD Reset : BOOL
VAR_IN_OUT
stReset: ST_AnalysisReset;
END_VAR
```

BECKHOFF

🐔 Inputs

Name	Туре	Description
stReset	ST_AnalysisReset	Struct to define witch module or network should be reset.

Return value

Name	Туре	Description
Reset	BOOL	Is TRUE if done

6.1.2.1.4.3 ResultStream

Syntax

```
METHOD ResultStream : BOOL
VAR_INPUT
ipResults: I_Results;
END_VAR
```

🐔 Inputs

Name	Туре	Description
ipResults	I_Results	Interface pointer to the Result FB

Return value

Name	Туре	Description
Call	BOOL	

6.1.2.1.5 FB_Results

If results of the analysis has to be stored or streamed, the result FB managed this and streamed the selected variables to the message broker or store the data into the analytics binary file.

Syntax

Definition:

```
FUNCTION_BLOCK FB_Results
VAR_OUTPUT
stResults: ST_Results;
END_VAR
```

Outputs

Name	Туре	Description
stResults	ST_Results	Result struct which contains all items of the result
		stream

🔹 Methods

Name	Definition location	Description
<u>Call [▶ 62]</u>	Local	Method for background communication. The method must be called cyclically.
AddResult [62]	Local	Add a sample to the result stream
SendResults [62]	Local	Sends all buffered samples of the result stream
Release [63]	Local	Close stream or file of the result stream

Requirements

Development environment	Target platform	PIc libraries to include
TwinCAT v3.1.4024.0	PC or CX (x64, x86)	Tc3_Analytics

6.1.2.1.5.1 Call

Syntax

```
METHOD Call : BOOL
VAR
END_VAR
```

Return value

Name	Туре	Description
Call	BOOL	

6.1.2.1.5.2 AddResult

Syntax

```
METHOD AddResult : BOOL
VAR_INPUT
tTimestamp: ULINT;
stSample: ST_Results;
END_VAR
```

🐔 Inputs

Name	Туре	Description
tTimestamp	ULINT	Timestamp of the sample
stSample	ST_Results	Sample struct

Return value

Name	Туре	Description
AddResult	BOOL	

6.1.2.1.5.3 SendResults

Syntax

```
METHOD SendResults : BOOL
VAR
END_VAR
```

BECKHOFF

Return value

Name	Туре	Description
SendResults	BOOL	

6.1.2.1.5.4 Release

Syntax

```
METHOD Release : BOOL
VAR
END_VAR
```

Return value

Name	Туре	Description
Release	BOOL	

6.1.2.1.6 MAIN_Analytics

In the MAIN_Analytics program the analysis FB is called. The program is assign to the separated Task.

It is also possible to reset single modules, whole networks or all defined networks with only one rising flag. First you have to choose the component you would like to reset. Then a rising edge at the bReset INPUT starts the reset process.

Inside of the A_Reset Action all reset calls are defined.

Syntax

Definition:

```
PROGRAM MAIN_Analytics
VAR_INPUT
stReset: ST_AnalysisReset;
END_VAR
VAR_OUTPUT
bError: BOOL;
ipTcResult: I_TcMessage;
END_VAR
```

Requirements

Development environment	Target platform	Plc libraries to include
TwinCAT v3.1.4024.0	PC or CX (x64, x86)	Tc3_Analytics

6.1.2.2 Code version 3.0



Tasks:

A separate task is created for the analytics analysis and for each configuration of a Virtual Input Source.

StreamHelper:

For each data source of type MQTT binary stream, the code generation creates an instance of a stream helper object to process the incoming binary stream patterns.

DataTypes:

The data types are created for the analysis. They contain STRUCTs for the reset function or result processing and ENUMs to select the various components.

GVLs:

To conveniently map module inputs and outputs with the HMI dashboard, selected variables are generated as global variables. In addition, the Data Source function block instances and various parameters are generated as global variables.

VirtualInputSource / DataSource / M2M Mapping:

The Virtual Input Source interfaces abstract the Data Source symbols from the analysis. The FB DataSource manages the receipt of input values from the various sources. In the OUTPUT declaration you will find all configured inputs. The FB ValueMapping_M2M manages the value mapping between the modules (M2M - Module to Module) from the module INPUTs to the module OUTPUTs.

Network:

All modules are sorted in a specific network to achieve a better overview and structure of the configured analysis.

Modules:

The module FBs contain all inputs and outputs of the configured modules from the workbench configurator. It is also possible to reconfigure the modules during runtime. To do this, simply change the parameter and then start the reconfiguration process with a rising edge at INPUT bReconfigure.

Results:

If analysis results need to be saved or streamed, the FB Results manages this and streams the selected variables to the message broker in binary or Json format, or saves the data locally to an Analytics binary file.

Analysis:

The entire analysis routine is defined in the FB Analysis. All configured networks with their modules and error handling are created.

MAIN PRGs:

In the MAIN_Analytics program, the DataSource FBs are called, the reset function is managed and, if appropriate, the values are mapped with the HMI dashboard. The program is assigned to a separate task.

The FB Analysis is called in the programs MAIN_Analytics_Vx_Cx. The programs are each assigned to a separate task.

It is also possible to reset single modules, whole networks or all defined networks with only one rising flag. First, select the component to be reset. Then a rising edge at INPUT bReset starts the reset process.

All reset calls are defined in the action A_Reset.

Requirements

Development environment	Target platform	Plc libraries to include
TwinCAT v3.1.4024.0	PC or CX (x64, x86)	Tc3_Analytics Version >= 3.1.0.0

6.1.2.2.1 FB_DataSource

The FB DataSource manages the receipt of input values from the various sources. In the OUTPUT declaration you will find all configured inputs.

Syntax

Definition:

```
FUNCTION_BLOCK FB_T[n]_DataSource IMPLEMENTS I_DataSource, I_V[n]_Virtual_Input_Source
VAR_OUTPUT
eDataState: E_DataSourceState;
END_VAR
```

🔹 Methods

Name	Definition location	Description
<u>Call [▶ 66]</u>	Local	Method for background communication with the TwinCAT driver. The method must be called cyclically.
GetData [> 66]	Local	Method to retrieve the data of the specified element.
GetDataOversampling [▶_67]	Local	Method to retrieve the oversampling data of the specified element.
NewDataAvailable [▶ 67]	Local	Method to check if new data is available.
HistoricalCtrl [67]	Local	Method for retrieving historical data.
UpdateRecordList [68]	Local	Method for updating the historical record list.

Requirements

Development environment	Target platform	Plc libraries to include
TwinCAT v3.1.4024.0	PC or CX (x64, x86)	Tc3_Analytics

6.1.2.2.1.1 GetData

Syntax

```
METHOD GetData : BOOL
VAR_INPUT
nElement : UDINT;
END_VAR
```

🔁 Inputs

Name	Туре	Description
nElement	UDINT	Element ID to obtain the specific example.

Return value

Name	Туре	Description
GetData	BOOL	Is TRUE if a new element is selected.

6.1.2.2.1.2 Call

Syntax

METHOD Call : BOOL

Return value

Name	Туре	Description
Call	BOOL	

BECKHOFF

6.1.2.2.1.3 GetDataOversampling

Syntax

METHOD GetDataOversampling : BOOL VAR_INPUT nElement : UDINT; nSample: : UDINT; END VAR

🐔 Inputs

Name	Туре	Description
nElement	UDINT	Element ID to obtain the specific sample element.
nSample	UDINT	Sample ID to obtain the specific sample.

Return value

Name	Туре	Description
GetDataOversampling	BOOL	Is TRUE if a new element is selected.

6.1.2.2.1.4 NewDataAvailable

Syntax

```
METHOD NewDataAvailable : BOOL
VAR_INPUT
nLastDataHandle : ULINT;
END_VAR
```

🟓 Inputs

Name	Туре	Description
nLastDataHandle	ULINT	Handle from the last fetched data packet.

Return value

Name	Туре	Description
NewDataAvailable	BOOL	Is TRUE if new data is available.

6.1.2.2.1.5 HistoricalCtrl

Syntax

```
METHOD HistoricalCtrl : BOOL
VAR_INPUT
stCtrl : REFERENCE TO ST_HMI_DataSourceCtrl;
stHistStreamInfo : REFERENCE TO ST_HMI_DataSourceHist;
stRecordInfo : REFERENCE TO ST_HMI_DataSourceHistRecordInfo;
END VAR
```

🐔 Inputs

Name	Туре	Description
stCtrl	ST_HMI_DataSourceCtrl	
stHistStreamInfo	ST_HMI_DataSourceHist	
stRecordInfo	ST_HMI_DataSourceHistR ecordInfo	

Return value

Name	Туре	Description
HistoricalCtrl	BOOL	

6.1.2.2.1.6 UpdateRecordList

Syntax

```
METHOD UpdateRecordList : BOOL
VAR_INPUT
stCtrl : REFERENCE TO ST_HMI_DataSourceCtrl;
stHistStreamInfo : REFERENCE TO ST_HMI_DataSourceHist;
sStreamSystemID : GUID;
END_VAR
```

🐔 Inputs

Name	Туре	Description
stCtrl	ST_HMI_DataSourceCtrl	
stHistStreamInfo	ST_HMI_DataSourceHist	
sStreamSystemID	GUID	

Return value

Name	Туре	Description
UpdateRecordList	BOOL	

6.1.2.2.2 FB_Network

All modules are sorted in a specific network to achieve a better overview and structure of the configured analysis.

Syntax

Definition:

```
FUNCTION_BLOCK FB_N[n]_[Network1]
VAR_INPUT
    [module FBs]
END_VAR
VAR_OUTPUT
    bError: BOOL;
    ipTcResult: I_TcMessage;
END_VAR
```

🔁 Inputs

Name	Туре	Description
Module FBs		Function blocks of the configured modules.

Outputs

Name	Туре	Description
bError	BOOL	Becomes TRUE when an error situation occurs.
ipTcResult	I_TcMessage	Message interface of the TwinCAT 3 EventLogger, which provides further information about the return value.

🔹 Methods

Name	Definition location	Description
<u>Call [▶ 73]</u>	Local	Method for background communication. The method must be called cyclically.
Reset [] 73]	Local	Resetting the network with all submodules.
ValueMapping [▶ 69]	Local	Assignment of the input values to the various module inputs.
SetHMIValues [• 69]	Local	Optional: Mapping of the inputs/outputs of the modules to the global HMI variable.

Requirements

Development environment	Target platform	Plc libraries to include
TwinCAT v3.1.4024.0	PC or CX (x64, x86)	Tc3_Analytics

6.1.2.2.2.1 ValueMapping

Syntax

```
METHOD ValueMapping : BOOL
VAR_INPUT
    ipVirtual_Input_Source : I_V[n]_Virtual_Input_Source;
END_VAR
```

🐔 Inputs

Name	Туре	Description
ipVirtual_Input_Source	I_V[n]_Virtual_Input_Sourc e	Data for analysis from the specific data source.

Return value

Name	Туре	Description
ValueMapping	BOOL	

6.1.2.2.2.2 SetHMIValues

Syntax

```
METHOD SetHMIValues : BOOL
VAR_INPUT
    pHMI_N[n]_[Network1] : POINTER TO ST_HMI_N[n]_[Network1];
END_VAR
```

🐔 Inputs

Name	Туре	Description
pHMI_N[n]_[Network1]	POINTER TO ST_HMI_N[n]_[Network1]	Pointer to the global HMI structure.

Return value

Name	Туре	Description
SetHMIValues	BOOL	Is TRUE when completed.

6.1.2.2.2.3 Reset

Syntax

```
METHOD Reset : BOOL
VAR
END_VAR
```

Return value

Name	Туре	Description
Reset	BOOL	Is TRUE when completed.

6.1.2.2.2.4 Call

Syntax

🐔 Inputs

Name	Туре	Description
ipVirtual_Input_Source	I_T[n]_Virtual_Input_Sourc e	Data for the analysis.
ipValueMapping_M2M	I_ValueMapping_M2M	Optional: Necessary for mapping values between modules.

Return value

Name	Туре	Description
Call	BOOL	

6.1.2.2.3 FB_Module

The module FBs contain all inputs and outputs of the configured modules from the workbench configurator. It is also possible to reconfigure the modules during runtime. To do this, simply change the parameter and then start the reconfiguration process with a rising edge at INPUT bReconfigure.

Syntax

Definition:

```
FUNCTION_BLOCK FB_N[n]_M[n]_[Module]
VAR_INPUT
    [module inputs]
END_VAR
VAR_OUTPUT
    bError: BOOL;
    ipTcResult: I_TcMessage;
    [module outputs]
END_VAR
```

🐔 Inputs

Name	Туре	Description
Module inputs		Inputs of the selected module.

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Outputs

Name	Туре	Description
bError	BOOL	Becomes TRUE when an error situation occurs.
ipTcResult	I_TcMessage	Message interface of the TwinCAT 3 EventLogger, which provides further information about the return value.
Module outputs		Outputs of the selected module.

🔹 Methods

Name	Definition location	Description
<u>Call [▶ 71]</u>	Local	Method for background communication. The method must be called cyclically.
<u>Reset [) 71]</u>	Local	Resetting the module.
<u>SetHMI [▶ 72]</u>	Local	Optional: Sets the inputs/outputs to the global HMI structures.

Requirements

Development environment	Target platform	Plc libraries to include
TwinCAT v3.1.4024.0	PC or CX (x64, x86)	Tc3_Analytics

6.1.2.2.3.1 Call

Syntax

```
METHOD Call : BOOL
VAR_INPUT
ipVirtual_Input_Source : I_V[n]_Virtual_Input_Source;
[ipValueMapping_M2M : I_ValueMapping_M2M;]
END VAR
```

🐔 Inputs

Name	Туре	Description
ipVirtual_Input_Source	I_V[n]_Virtual_Input_Sourc e	Data for the analysis.
ipValueMapping_M2M	I_ValueMapping_M2M	Optional: Necessary for mapping values between modules.

Return value

Name	Туре	Description
Call	BOOL	

6.1.2.2.3.2 Reset

Syntax

```
METHOD Reset : BOOL
VAR
END_VAR
```

Return value

Name	Туре	Description
Reset	BOOL	Is TRUE when completed.

6.1.2.2.3.3 SetHMI

Syntax

```
METHOD SetHMIValues : BOOL
VAR_INPUT
    pHMI_N[n]_[Network1] : POINTER TO ST_HMI_N[n]_[Network1];
END_VAR
```

🐔 Inputs

Name	Туре	Description
pHMI_N[n]_[Network1]	POINTER TO	Pointer to the global HMI structure.
	SI_HMI_N[n]_[Network1]	

Return value

Name	Туре	Description
SetHMI	BOOL	Is TRUE when completed.

6.1.2.2.4 FB_Analysis

The entire analysis routine is defined in the FB Analysis. All configured networks with their modules and error handling are created.

Syntax

Definition:

```
FUNCTION_BLOCK FB_Analysis
VAR_INPUT
       [network FBs]
END_VAR
VAR_OUTPUT
       bError: BOOL;
       ipTcResult: I_TcMessage;
END_VAR
```

🕫 Inputs

Name	Туре	Description
Network FBs		Function blocks of the configured networks.

Outputs

Name	Туре	Description
bError	BOOL	Becomes TRUE when an error situation occurs.
ipTcResult	I_TcMessage	Message interface of the TwinCAT 3 EventLogger, which provides further information about the return value.
🔹 Methods

Name	Definition location	Description
<u>Call [▶ 73]</u>	Local	Method for background communication with the TwinCAT driver. The method must be called cyclically.
<u>Reset [) 73]</u>	Local	Resets the entire analysis.
ResultStream [74]	Local	Optional: If a result stream needs to be created.

Requirements

Development environment	Target platform	Plc libraries to include
TwinCAT v3.1.4024.0	PC or CX (x64, x86)	Tc3_Analytics

6.1.2.2.4.1 Call

Syntax

```
METHOD Call : BOOL
VAR_INPUT
    ipVirtual_Input_Source: I_V[n]_Virtual_Input_Source;
END VAR
```

🔁 Inputs

Name	Туре	Description
ipVirtual_Input_Source	I_V[n]_Virtual_Input_Sourc	Data for the analysis.

Return value

Name	Туре	Description
Call	BOOL	

6.1.2.2.4.2 Reset

Syntax

```
METHOD Reset : BOOL
VAR_IN_OUT
stReset: ST_AnalysisReset;
END_VAR
```

🐔 Inputs

Name	Туре	Description
stReset	ST_AnalysisReset	Structure to define which module or network is to be
		reset.

Name	Туре	Description
Reset	BOOL	Is TRUE when completed.

6.1.2.2.4.3 ResultStream

Syntax

```
METHOD ResultStream : BOOL
VAR_INPUT
ipResults: I_Results;
END_VAR
```

🐔 Inputs

Name	Туре	Description
ipResults	I_Results	Interface pointer to the FB Results.

Return value

Name	Туре	Description
Call	BOOL	

6.1.2.2.5 FB_Results

If analysis results need to be saved or streamed, the FB Results manages this and streams the selected variables to the message broker or saves the data to the Analytics binary file.

Syntax

Definition:

```
FUNCTION_BLOCK FB_Results
VAR_OUTPUT
stResults: ST_Results;
END_VAR
```

Outputs

Name	Туре	Description
stResults	ST_Results	Result structure that contains all elements of the result stream.

🔹 Methods

Name	Definition location	Description
<u>Call [▶ 75]</u>	Local	Method for background communication. The method must be called cyclically.
AddResult [75]	Local	Add a sample to the result stream
SendResults [> 75]	Local	Sends all buffered samples of the result stream
Release [) 75]	Local	Close stream or file of the result stream

Requirements

Development environment	Target platform	Plc libraries to include
TwinCAT v3.1.4024.0	PC or CX (x64, x86)	Tc3_Analytics

6.1.2.2.5.1 Call

Syntax

```
METHOD Call : BOOL
VAR
END_VAR
```

Return value

Name	Туре	Description
Call	BOOL	

6.1.2.2.5.2 AddResult

Syntax

```
METHOD AddResult : BOOL
VAR_INPUT
tTimestamp: ULINT;
stSample: ST_Results;
END_VAR
```

🔁 Inputs

Name	Туре	Description
tTimestamp	ULINT	Timestamp of the sample
stSample	ST_Results	Sample structure

Return value

Name	Туре	Description
AddResult	BOOL	

6.1.2.2.5.3 SendResults

Syntax

```
METHOD SendResults : BOOL
VAR
END_VAR
```

Return value

Name	Туре	Description
SendResults	BOOL	

6.1.2.2.5.4 Release

Syntax

```
METHOD Release : BOOL
VAR
END VAR
```

Name	Туре	Description
Release	BOOL	

6.1.2.2.6 MAIN_Analytics

In the MAIN_Analytics program, the DataSource FBs are called, the reset function is managed and, if appropriate, the values are mapped with the HMI Dashboard. The program is assigned to a separate task.

Syntax

Definition:

```
PROGRAM MAIN_Analytics
VAR_INPUT
    sCurrentStreamSystemID: GUID;
    stHistStreamInfo: REFERENCE TO ST_HMI_DataSourceHist;
    stHistRecordInfo: REFERENCE TO ST_HMI_DataSourceHistRecordInfo;
END_VAR
VAR_OUTPUT
    bError: BOOL;
    ipTcResult: I_TcMessage;
END_VAR
```

Requirements

Development environment	Target platform	Plc libraries to include
TwinCAT v3.1.4024.0	PC or CX (x64, x86)	Tc3_Analytics

6.1.2.2.7 MAIN_Analytics_V[n]_C[n]

The FB Analysis is called in the program MAIN_Analytics_V[n]_C[n]. The program is assigned to the separate task.

It is also possible to reset single modules, whole networks or all defined networks with only one rising flag. First, select the component to be reset. Then a rising edge at INPUT bReset starts the reset process.

All reset calls are defined in the action A_Reset.

Mapping of the HMI values takes place in the action A_MapToHMI.

Syntax

Definition:

```
PROGRAM MAIN_Analytics_V[n]_C[n]
VAR_INPUT
stReset: ST_AnalysisReset;
END_VAR
VAR_OUTPUT
bError: BOOL;
ipTcResult: I_TcMessage;
nLastDataHandle: ULINT;
END VAR
```

Requirements

Development environment	Target platform	Plc libraries to include
TwinCAT v3.1.4024.0	PC or CX (x64, x86)	Tc3_Analytics

6.1.2.3 Code version 4.x

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Tasks:

A separate task is created for the analytics analysis and for each configuration of a Virtual Input Source.

StreamHelper:

For each data source of type MQTT binary stream, the code generation creates an instance of a stream helper object to process the incoming binary stream patterns.

DataTypes:

The data types are created for the analysis. They contain STRUCTs for the reset function or result processing and ENUMs to select the various components.

GVLs:

To conveniently map module inputs and outputs with the HMI dashboard, selected variables are generated as global variables. In addition, the Data Source function block instances and various parameters are generated as global variables.

ClosedNetwork:

The ClosedNetwork FBs are generated once with all subnetworks and modules. They can be instantiated multiple times in the analysis. In this way, the generated code can be reduced and simplified.

VirtualInputSource / DataSource:

The VirtualInputSource interfaces abstract the DataSource symbols from the analysis. The FB DataSource manages the receipt of input values from the various sources. In the OUTPUT declaration you will find all configured inputs.

Network:

All modules are sorted in a specific network to achieve a better overview and structure of the configured analysis.

Modules:

The module FBs contain all inputs and outputs of the configured modules from the workbench configurator. It is also possible to reconfigure the modules during runtime. To do this, simply change the parameter and then start the reconfiguration process with a rising edge at INPUT bReconfigure.

ClosedNetwork Instance:

In this FB the corresponding ClosedNetwork is instantiated for the analysis. Internally used modules are no longer generated as module FBs in this case.

Results:

If analysis results need to be saved or streamed, the FB Results manages this and streams the selected variables to the message broker in binary or Json format, or saves the data locally to an Analytics binary file.

Analysis:

The entire analysis routine is defined in the FB Analysis. All configured networks with their modules and error handling are created.

MAIN PRGs:

In the MAIN_Analytics program, the DataSource FBs are called, the reset function is managed and, if appropriate, the values are mapped with the HMI dashboard. The program is assigned to a separate task.

The FB Analysis is called in the programs MAIN_Analytics_Vx_Cx. The programs are each assigned to a separate task.

It is also possible to reset single modules, whole networks or all defined networks with only one rising flag. First, select the component to be reset. Then a rising edge at INPUT bReset starts the reset process.

All reset calls are defined in the action A_Reset.

Requirements

Development environment	Target platform	Plc libraries to include
TwinCAT v3.1.4024.0	PC or CX (x64, x86)	Tc3_Analytics Version >= 3.1.0.0

6.1.2.3.1 FB_DataSource

The FB DataSource manages the receipt of input values from the various sources. In the OUTPUT declaration you will find all configured inputs.

Syntax

Definition:

```
FUNCTION_BLOCK FB_T[n]_DataSource IMPLEMENTS I_DataSource, I_V[n]_Virtual_Input_Source
VAR_OUTPUT
eDataState: E_DataSourceState;
END_VAR
```

Methods

Name	Definition location	Description
<u>Call [▶ 80]</u>	Local	Method for background communication with the TwinCAT driver. The method must be called cyclically.
GetData [> 79]	Local	Method to retrieve the data of the specified element.
GetDataOversampling [▶ 80]	Local	Method to retrieve the oversampling data of the specified element
NewDataAvailable [▶ 80]	Local	Method to check if new data is available.
HistoricalCtrl [80]	Local	Method for retrieving historical data
UpdateRecordList [> 81]	Local	Method for updating the historical record list.

Requirements

Development environment	Target platform	Plc libraries to include
TwinCAT v3.1.4024.0	PC or CX (x64, x86)	Tc3_Analytics

6.1.2.3.1.1 GetData

Syntax

```
METHOD GetData : BOOL
VAR_INPUT
nElement : UDINT;
END_VAR
```

🐔 Inputs

Name	Туре	Description
nElement	UDINT	Element ID to obtain the specific sample

Name	Туре	Description
GetData	BOOL	Is TRUE if a new element is selected

6.1.2.3.1.2 Call

Syntax

METHOD Call : BOOL

Return value

Name	Туре	Description
Call	BOOL	

6.1.2.3.1.3 GetDataOversampling

Syntax

```
METHOD GetDataOversampling : BOOL
VAR_INPUT
nElement : UDINT;
nSample: : UDINT;
END_VAR
```

🐔 Inputs

Name	Туре	Description
nElement	UDINT	Element ID to obtain the specific sample element
nSample	UDINT	Sample ID to obtain the specific sample

Return value

Name	Туре	Description
GetDataOversampling	BOOL	Is TRUE if a new element is selected

6.1.2.3.1.4 NewDataAvailable

Syntax

```
METHOD NewDataAvailable : BOOL
VAR_INPUT
nLastDataHandle : ULINT;
END_VAR
```

🐔 Inputs

Name	Туре	Description
nLastDataHandle	ULINT	Handle of the last fetched data packet

Return value

Name	Туре	Description
NewDataAvailable	BOOL	Is TRUE if new data is available

6.1.2.3.1.5 HistoricalCtrl

```
Syntax
```

```
METHOD HistoricalCtrl : BOOL
VAR_INPUT
stCtrl : REFERENCE TO ST_HMI_DataSourceCtrl;
```

```
stHistStreamInfo : REFERENCE TO ST_HMI_DataSourceHist;
stRecordInfo : REFERENCE TO ST_HMI_DataSourceHistRecordInfo;
END_VAR
```

🐔 Inputs

Name	Туре	Description
stCtrl	ST_HMI_DataSourceCtrl	
stHistStreamInfo	ST_HMI_DataSourceHist	
stRecordInfo	ST_HMI_DataSourceHistR ecordInfo	

Return value

Name	Туре	Description
HistoricalCtrl	BOOL	

6.1.2.3.1.6 UpdateRecordList

Syntax

```
METHOD UpdateRecordList : BOOL
VAR_INPUT
stCtrl : REFERENCE TO ST_HMI_DataSourceCtrl;
stHistStreamInfo : REFERENCE TO ST_HMI_DataSourceHist;
sStreamSystemID : GUID;
END VAR
```

🐔 Inputs

Name	Туре	Description
stCtrl	ST_HMI_DataSourceCtrl	
stHistStreamInfo	ST_HMI_DataSourceHist	
sStreamSystemID	GUID	

Return value

Name	Туре	Description
UpdateRecordList	BOOL	

6.1.2.3.1.7 NextData

Syntax

```
METHOD NextData : BOOL
VAR_INPUT
END_VAR
```

6.1.2.3.1.8 NextDataOversample

Syntax

```
METHOD GetDataOversampling : BOOL
VAR_INPUT
nMaxOversampling : UDINT;
END_VAR
```

🐔 Inputs

Name	Туре	Description
nMaxOversampling	UDINT	Specifies the maximum oversampling factor.

Return value

Name	Туре	Description
NextDataOversample	BOOL	Is TRUE if a new element is selected

6.1.2.3.2 FB_Network

All modules are sorted in a specific network to achieve a better overview and structure of the configured analysis.

Syntax

Definition:

```
FUNCTION_BLOCK FB_N[n]_[Network1]
VAR_OUTPUT
    bError: BOOL;
    ipTcResult: I_TcMessage;
END_VAR
VAR
    [module FBs]
END VAR
```

Outputs

Name	Туре	Description
bError	BOOL	Becomes TRUE when an error situation occurs.
ipTcResult	I_TcMessage	Message interface of the TwinCAT 3 EventLogger, which provides further information about the return value.

🔹 Methods

Name	Definition location	Description
<u>Call [} 73]</u>	Local	Method for background communication. The method must be called cyclically.
<u>Reset [) 73]</u>	Local	Resetting the network with all submodules.
ValueMapping [83]	Local	Assignment of the input values to the various module inputs.
SetHMIValues [> 83]	Local	Optional: Mapping of the inputs/outputs of the modules to the global HMI variable.

Requirements

Development environment	Target platform	Plc libraries to include
TwinCAT v3.1.4024.0	PC or CX (x64, x86)	Tc3_Analytics

6.1.2.3.2.1 ValueMapping

Syntax

```
METHOD ValueMapping : BOOL
VAR_INPUT
pAnalysis : POINTER TO FB_Analysis;
END_VAR
```

🔁 Inputs

Name	Туре	Description
pAnalysis	FB_Analysis	Instance of the analysis FB

Return value

Name	Туре	Description
ValueMapping	BOOL	

6.1.2.3.2.2 SetHMIValues

Syntax

```
METHOD SetHMIValues : BOOL
VAR_INPUT
    pHMI_N[n]_[Network1] : POINTER TO ST_HMI_N[n]_[Network1];
END_VAR
```

🔁 Inputs

Name	Туре	Description
pHMI_N[n]_[Network1]	POINTER TO ST_HMI_N[n]_[Network1]	Pointer to the global HMI structure

Return value

Name	Туре	Description
SetHMIValues	BOOL	Is TRUE when completed

6.1.2.3.2.3 Call

Syntax

```
METHOD Call : BOOL
VAR_INPUT
pAnalysis: POINTER TO FB_Analysis;
END_VAR
```

🐔 Inputs

Name	Туре	Description
pAnalysis	FB_Analysis	Instance of the analysis FB.

Name	Туре	Description
Call	BOOL	

6.1.2.3.2.4 Reset

Syntax

```
METHOD Reset : BOOL
VAR
END_VAR
```

Return value

Name	Туре	Description
Reset	BOOL	Is TRUE when completed.

6.1.2.3.3 FB_Module

The module FBs contain all inputs and outputs of the configured modules from the workbench configurator. It is also possible to reconfigure the modules during runtime. To do this, simply change the parameter and then start the reconfiguration process with a rising edge at INPUT bReconfigure.

Syntax

Definition:

```
FUNCTION_BLOCK FB_N[n]_M[n]_[Module]
VAR_INPUT
    [module inputs]
END_VAR
VAR_OUTPUT
    bError: BOOL;
    ipTcResult: I_TcMessage;
    [module outputs]
END_VAR
```

🐔 Inputs

Name	Туре	Description
Module inputs		Inputs of the selected module.

Outputs

Name	Туре	Description
bError	BOOL	Becomes TRUE when an error situation occurs.
ipTcResult	I_TcMessage	Message interface of the TwinCAT 3 EventLogger, which provides further information about the return value.
Module outputs		Outputs of the selected module.

🔹 Methods

Name	Definition location	Description
<u>Call [▶ 85]</u>	Local	Method for background communication. The method must be called cyclically.
<u>Reset [} 85]</u>	Local	Resetting the module.
<u>SetHMI [) 85]</u>	Local	Sets the inputs/outputs to the global HMI structures.
<u>GetHMI [Þ 86]</u>	Local	Optional: Sets the inputs of the global HMI structures to the inputs of the module

Requirements

Development environment	Target platform	Plc libraries to include
TwinCAT v3.1.4024.0	PC or CX (x64, x86)	Tc3_Analytics

6.1.2.3.3.1 Call

Syntax

```
METHOD Call : BOOL
VAR_INPUT
    ipVirtual_Input_Source : I_V[n]_Virtual_Input_Source;
    [ipValueMapping_M2M : I_ValueMapping_M2M;]
END_VAR
```

🐔 Inputs

Name	Туре	Description
ipVirtual_Input_Source	I_V[n]_Virtual_Input_Sourc e	Data for the analysis
ipValueMapping_M2M	I_ValueMapping_M2M	Optional: Necessary for mapping values between modules

Return value

Name	Туре	Description
Call	BOOL	

6.1.2.3.3.2 Reset

Syntax

```
METHOD Reset : BOOL
VAR
END VAR
```

Return value

Name	Туре	Description
Reset	BOOL	Is TRUE when completed.

6.1.2.3.3.3 SetHMI

Syntax

```
METHOD GetHMI : BOOL
VAR_INPUT
    nContent : DINT
    pContent : PVOID
    bHMIReinit : BOOL
END_VAR
VAR
    pHMI_C[n]_[Content] : POINTER TO ST_HMI_C[n]_[Content];
END VAR
```

🐔 Inputs

Name	Туре	Description
nContent	DINT	HMI Content Index
pContent	PVOID	Pointer to the HMI content structure
bHMIReinit	BOOL	Initialize the HMI content structure

Return value

Name	Туре	Description
SetHMI	BOOL	Is TRUE when completed

6.1.2.3.3.4 GetHMI (4.1)

Syntax

```
METHOD GetHMI : BOOL
VAR_INPUT
    nContent : DINT
    pContent : PVOID
END_VAR
VAR
    pHMI_C[n]_[Content] : POINTER TO ST_HMI_C[n]_[Content];
END_VAR
```

🔁 Inputs

Name	Туре	Description
nContent	DINT	HMI Content Index
pContent	PVOID	Pointer to the HMI content structure

Return value

Name	Туре	Description
GetHMI	BOOL	Is TRUE when completed

6.1.2.3.4 FB_Analysis

The entire analysis routine is defined in the FB Analysis. All configured networks with their modules and error handling are created.

Syntax

Definition:

```
FUNCTION_BLOCK FB_Analysis
VAR_INPUT
    ipV[n]_VirtualInputs: I_V[n]_Virtual_Input_Source;
END_VAR
VAR_OUTPUT
    bError: BOOL;
    ipTcResult: I_TcMessage;
END_VAR
VAR
    [network FBs]
END_VAR
```

🐔 Inputs

Name	Туре	Description
ipV[n]_VirtualInputs	I_V[n]_Virtual_Input_Source	Data for analysis from the specific data source

Outputs

Name	Туре	Description
bError	BOOL	Becomes TRUE when an error situation occurs.
ipTcResult	I_TcMessage	Message interface of the TwinCAT 3 EventLogger, which provides further information about the return value.

🔹 Methods

Name	Definition location	Description
<u>Call [▶ 87]</u>	Local	Method for background communication with the TwinCAT driver. The method must be called cyclically.
<u>Reset [} 87]</u>	Local	Reset the whole analysis
ResultStream [> 88]	Local	Optional: If a result stream has to be created

Requirements

Development environment	Target platform	Plc libraries to include
TwinCAT v3.1.4024.0	PC or CX (x64, x86)	Tc3_Analytics

6.1.2.3.4.1 Call

Syntax

```
METHOD Call : BOOL
VAR_INPUT
    ipVirtual_Input_Source: I_V[n]_Virtual_Input_Source;
END_VAR
```

🔁 Inputs

Name	Туре	Description
ipVirtual_Input_Source	I_V[n]_Virtual_Input_Sourc	Data for the analysis.
	е	

Return value

Name	Туре	Description
Call	BOOL	

6.1.2.3.4.2 Reset

Syntax

```
METHOD Reset : BOOL
VAR_IN_OUT
stReset: ST_AnalysisReset;
END_VAR
```

🐔 Inputs

Name	Туре	Description
stReset	ST_AnalysisReset	Structure to define which module or network is to be reset.

Return value

Name	Туре	Description
Reset	BOOL	Is TRUE when completed.

6.1.2.3.4.3 ResultStream

Syntax

```
METHOD ResultStream : BOOL
VAR_INPUT
ipResults: I_Results;
END_VAR
```

🐔 Inputs

Name	Туре	Description
ipResults	I_Results	Interface pointer to the FB Results

Return value

Name	Туре	Description
Call	BOOL	

6.1.2.3.5 FB_Results

If analysis results need to be saved or streamed, the FB Results manages this and streams the selected variables to the message broker or saves the data to the Analytics binary file.

Syntax

Definition:

```
FUNCTION_BLOCK FB_Results
VAR_OUTPUT
stResults: ST_Results;
END_VAR
```

Outputs

Name	Туре	Description
stResults	ST_Results	Result structure that contains all elements of the result stream.

🐳 Methods

Name	Definition location	Description
<u>Call [▶ 89]</u>	Local	Method for background communication. The method must be called cyclically.
AddResult [89]	Local	Add a sample to the result stream
SendResults [89]	Local	Sends all buffered samples of the result stream
Release [90]	Local	Close stream or file of the result stream

Requirements

Development environment	Target platform	Plc libraries to include
TwinCAT v3.1.4024.0	PC or CX (x64, x86)	Tc3_Analytics

6.1.2.3.5.1 Call

Syntax

```
METHOD Call : BOOL
VAR
END_VAR
```

Return value

Name	Туре	Description
Call	BOOL	

6.1.2.3.5.2 AddResult

Syntax

```
METHOD AddResult : BOOL
VAR_INPUT
tTimestamp: ULINT;
stSample: ST_Results;
END_VAR
```

🐔 Inputs

Name	Туре	Description
tTimestamp	ULINT	Timestamp of the sample
stSample	ST_Results	Sample structure

Return value

Name	Туре	Description
AddResult	BOOL	

6.1.2.3.5.3 SendResults

Syntax

```
METHOD SendResults : BOOL
VAR
END_VAR
```

Return value

Name	Туре	Description
SendResults	BOOL	

6.1.2.3.5.4 Release

Syntax

```
METHOD Release : BOOL
VAR
END VAR
```

Return value

Name	Туре	Description
Release	BOOL	

6.1.2.3.6 MAIN_Analytics

In the MAIN_Analytics program, the DataSource FBs are called, the reset function is managed and, if appropriate, the values are mapped with the HMI Dashboard. The program is assigned to a separate task.

Syntax

Definition:

```
PROGRAM MAIN_Analytics
VAR_INPUT
    sCurrentStreamSystemID: GUID;
    stHistStreamInfo: REFERENCE TO ST_HMI_DataSourceHist;
    stHistRecordInfo: REFERENCE TO ST_HMI_DataSourceHistRecordInfo;
END_VAR
VAR_OUTPUT
    bError: BOOL;
    ipTcResult: I_TcMessage;
END VAR
```

Requirements

Development environment	Target platform	Plc libraries to include
TwinCAT v3.1.4024.0	PC or CX (x64, x86)	Tc3_Analytics

6.1.2.3.7 MAIN_Analytics_C[n]

The FB Analysis is called in the program MAIN_Analytics_C[n]. The program is assigned to the separate task.

It is also possible to reset single modules, whole networks or all defined networks with only one rising flag. First, select the component to be reset. Then a rising edge at INPUT bReset starts the reset process.

All reset calls are defined in the action A_Reset.

Mapping of the HMI values takes place in the action A_MapToHMI.

Syntax

Definition:

```
PROGRAM MAIN_Analytics_C[n]
VAR_INPUT
stReset: ST_AnalysisReset;
END_VAR
VAR OUTPUT
```

bError: BOOL; ipTcResult: I_TcMessage; nLastDataHandle: ULINT; END_VAR

Requirements

Development environment	Target platform	Plc libraries to include
TwinCAT v3.1.4024.0	PC or CX (x64, x86)	Tc3_Analytics

6.1.2.4 Code version 5.0

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AnalysisPLC	
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Results Results GTRUCT	
Sources	
🕼 E_AnalysisComponents (ENUM)	3
답응 E_DataSourceContext (ENUM) 않⊄ E_DataSourceState (ENUM)	
ar E_VirtualInput (ENUM)	
ST_AnalysisReset (STRUCT)	
GVLs	
Analytics	4
POUs	
Analytics	
 Helper] Analysis 	
🔺 🗁 Networks	5
Modules	5
FB_N1_M1_MovingAverage1Ch (FB)	-
► FB_N1_M2_MinMaxAvg1Ch (FB)	6
P I FB_N1_M4_ThresholdClassifier1Ch (FB)	
FB_N1_Network (FB)	
FB Analysis (FB)	7
ClosedNetworks	,
CN01 ClosedNetwork Modules	
FB_CN1_ClosedNetwork_M1 (FB)	8
FB_CN1_ClosedNetwork_M2 (FB) FB_CN1_ClosedNetwork_M2 (FB)	
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I_InputSourceHistorical	10
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VirtualInputSources	
 I_V1_Virtual_Input_Source 	
♦ ≝○ L_VirtualInputSource	11
C1_Config_Hist III FB V1 C1 Virtual Input Source (FB)	- 11
C2_Config_Live	
FB_V1_C2_Virtual_Input_Source (FB) MAIN_Analytics (PRG)	
MAIN_Analytics_C1 (PRG)	12
MAIN_Analytics_C2 (PRG)	
👔 VIAIN (PKG)	
AnalyticsTask (AnalyticsTask)	
MAIN_Analytics AnalyticsTask_C1 (AnalyticsTask_C1)	12
AllN_Analytics_C1	13
 AnalyticsTask_C2 (AnalyticsTask_C2) MAIN Analytics C2 	
PicTask (PicTask)	
I AnalysisPLC Instance	

1: Tasks

A separate task is created for the analytics analysis and for each configuration of a Virtual Input Source.

2: StreamHelper

For each data source of type MQTT binary stream, the code generation creates an instance of a stream helper object to process the incoming binary stream patterns.

3: DataTypes

The data types are created for the analysis. They contain STRUCTs for the reset function or result processing and ENUMs to select the various components.

4: GVLs

To conveniently map module inputs and outputs with the HMI dashboard, selected variables are generated as global variables. In addition, the Data Source function block instances and various parameters are generated as global variables.

5: Network

All modules are sorted in a specific network to achieve a better overview and structure of the configured analysis.

6: Modules

The module FBs contain all inputs and outputs of the configured modules from the workbench configurator. It is also possible to reconfigure the modules during runtime. To do this, simply change the parameter and then start the reconfiguration process with a rising edge at INPUT bReconfigure.

7: Analysis

The entire analysis routine is defined in the FB Analysis. All configured networks with their modules and error handling are created.

8: ClosedNetwork

The ClosedNetwork FBs are generated once with all subnetworks and modules. They can be instantiated multiple times in the analysis. In this way, the generated code can be reduced and simplified.

9: Results

If analysis results need to be saved or streamed, the FB Results manages this and streams the selected variables to the message broker in binary or Json format, or saves the data locally to an Analytics binary file.

10: InputSource

The FB InputSource manages the receipt of input values from the various sources. In the OUTPUT declaration you will find all configured inputs.

11: VirtualInputSource

The VirtualInputSource interfaces abstract the InputSource symbols from the analysis.

12: MAIN PRGs

In the MAIN_Analytics program, the DataSource FBs are called, the reset function is managed and, if appropriate, the values are mapped with the HMI dashboard. The program is assigned to a separate task.

In the programs MAIN_Analytics_Vx_Cx the FB-Analysis is called. The programs are each assigned to a separate task.

It is also possible to reset single modules, whole networks or all defined networks with only one rising flag. First, select the component to be reset. Then a rising edge at INPUT bReset starts the reset process.

All reset calls are defined in the action A_Reset.

Requirements

Development environment	Target platform	Plc libraries to include
TwinCAT v3.1.4024.0	PC or CX (x64, x86)	Tc3_Analytics Version >= 3.1.0.0

6.1.2.4.1 FB_Analysis

The entire analysis routine is defined in the FB Analysis. All configured networks with their modules and error handling are created.

Syntax

Definition:

🐔 Inputs

Name	Туре	Description
nConfigurationID	INT	Configuration index
ipV[n]_VirtualInputs	I_V[n]_Virtual_Input_Source	Data for analysis from the specific data source

Outputs

Name	Туре	Description
bError	BOOL	Becomes TRUE when an error situation occurs.
ipTcResult	I_TcMessage	Message interface of the TwinCAT 3 EventLogger, which provides further information about the return value.

Properties

Name	Туре	Access	Description
nContext	DWORD	Get	Context index

🔹 Methods

Name	Definition location	Description
<u>Call [▶_95]</u>	Local	Method for background communication with the TwinCAT driver. The method must be called cyclically.
<u>Reset [) 95]</u>	Local	Resets the entire analysis.
ResultStream [96]	Local	Optional: If a result stream needs to be created.
SetHMIValues [96]	Local	Method for filling the HMI structures
GetHMIValues [▶_96]	Local	Method for setting the parameters from the HMI into the analysis

Requirements

Development environment	Target platform	PIc libraries to include
TwinCAT v3.1.4024.0	PC or CX (x64, x86)	Tc3_Analytics

6.1.2.4.1.1 Call

Syntax

```
METHOD Call : BOOL
VAR_INPUT
    ipVirtual_Input_Source: I_V[n]_Virtual_Input_Source;
END_VAR
```

🔁 Inputs

Name	Туре	Description
ipVirtual_Input_Source	I_V[n]_Virtual_Input_Sourc	Data for the analysis.
	е	

Return value

Name	Туре	Description
Call	BOOL	

6.1.2.4.1.2 Reset

Syntax

```
METHOD Reset : BOOL
VAR_IN_OUT
stReset: ST_AnalysisReset;
END_VAR
```

🐔 Inputs

Name	Туре	Description
stReset	ST_AnalysisReset	Structure to define which module or network is to be reset.

Name	Туре	Description
Reset	BOOL	Is TRUE when completed.

6.1.2.4.1.3 ResultStream

Syntax

```
METHOD ResultStream : BOOL
VAR_INPUT
ipResults: I_Results;
END_VAR
```

🔁 Inputs

Name	Туре	Description
ipResults	I_Results	Interface pointer to the FB results

Return value

Name	Туре	Description
Call	BOOL	

6.1.2.4.1.4 SetHMIValues

Syntax

```
METHOD SetHMIValues : BOOL
VAR_INPUT
    pHMI_N[n]_[Network1] : POINTER TO ST_HMI_N[n]_[Network1];
END_VAR
```

🔁 Inputs

Name	Туре	Description
pHMI_N[n]_[Network1]	POINTER TO ST_HMI_N[n]_[Network1]	Pointer to the global HMI structure

Return value

Name	Туре	Description
SetHMIValues	BOOL	Is TRUE when completed

6.1.2.4.1.5 GetHMIValues

Syntax

```
METHOD GetHMIValues : BOOL
VAR_INPUT
    pHMI_N[n]_[Network1] : POINTER TO ST_HMI_N[n]_[Network1];
END_VAR
```

🐔 Inputs

Name	Туре	Description
pHMI_N[n]_[Network1]	POINTER TO ST_HMI_N[n]_[Network1]	Pointer to the global HMI structure

Name	Туре	Description
SetHMIValues	BOOL	Is TRUE when completed

6.1.2.4.2 FB_Network

All modules are sorted in a specific network to achieve a better overview and structure of the configured analysis.

Syntax

Definition:

```
FUNCTION_BLOCK FB_N[n]_[Network1]
VAR_OUTPUT
    bError: BOOL;
    ipTcResult: I_TcMessage;
END_VAR
VAR
    [module FBs]
END_VAR
```

Outputs

Name	Туре	Description
bError	BOOL	Becomes TRUE when an error situation occurs.
ipTcResult	I_TcMessage	Message interface of the TwinCAT 3 EventLogger, which provides further information about the return value.

🔹 Methods

Name	Definition location	Description
<u>Call [▶ 73]</u>	Local	Method for background communication. The method must be called cyclically.
<u>Reset [} 73]</u>	Local	Resetting the network with all submodules.
ValueMapping [98]	Local	Assignment of the input values to the various module inputs.

Requirements

Development environment	Target platform	Plc libraries to include
TwinCAT v3.1.4024.0	PC or CX (x64, x86)	Tc3_Analytics

6.1.2.4.2.1 Call

Syntax

```
METHOD Call : BOOL
VAR_INPUT
pAnalysis: POINTER TO FB_Analysis;
END_VAR
```

🕫 Inputs

Name	Туре	Description
pAnalysis	FB_Analysis	Instance of the analysis FB.

Name	Туре	Description
Call	BOOL	

6.1.2.4.2.2 Reset

Syntax

```
METHOD Reset : BOOL
VAR
END_VAR
```

Return value

Name	Туре	Description
Reset	BOOL	Is TRUE when completed.

6.1.2.4.2.3 ValueMapping

Syntax

```
METHOD ValueMapping : BOOL
VAR_INPUT
pAnalysis : POINTER TO FB_Analysis;
END_VAR
```

🐔 Inputs

Name	Туре	Description
pAnalysis	FB_Analysis	Instance of the analysis FB

Return value

Name	Туре	Description
ValueMapping	BOOL	

6.1.2.4.3 FB_Module

The module FBs contain all inputs and outputs of the configured modules from the workbench configurator. It is also possible to reconfigure the modules during runtime. To do this, simply change the parameter and then start the reconfiguration process with a rising edge at INPUT bReconfigure.

Syntax

Definition:

```
FUNCTION_BLOCK FB_N[n]_M[n]_[Module]
VAR_INPUT
    [module inputs]
END_VAR
VAR_INPUT PERSISTENT
    [module persistent parameter inputs]
END_VAR
VAR_OUTPUT
    bError: BOOL;
    ipTcResult: I_TcMessage;
    [module outputs]
END_VAR
```

🐔 Inputs

Name	Туре	Description
Module inputs		Inputs of the selected module.

Outputs

Name	Туре	Description
bError	BOOL	Becomes TRUE when an error situation occurs.
ipTcResult	I_TcMessage	Message interface of the TwinCAT 3 EventLogger, which provides further information about the return value.
Module outputs		Outputs of the selected module.

Properties

Name	Туре	Access	Description
nContext	DWORD	Get	Context index

🔹 Methods

Name	Definition location	Description
<u>Call [▶ 99]</u>	Local	Method for background communication. The method must be called cyclically.
<u>Reset [} 100]</u>	Local	Resetting the module.
SetHMI [100]	Local	Sets the inputs/outputs to the global HMI structures.
<u>GetHMI [▶ 100]</u>	Local	Optional: Sets the inputs of the global HMI structures to the inputs of the module

Requirements

Development environment	Target platform	Plc libraries to include
TwinCAT v3.1.4024.0	PC or CX (x64, x86)	Tc3_Analytics

6.1.2.4.3.1 Call

Syntax

🔁 Inputs

Name	Туре	Description
ipVirtual_Input_Source	I_V[n]_Virtual_Input_Sourc e	Data for the analysis
ipValueMapping_M2M	I_ValueMapping_M2M	Optional: Necessary for mapping values between modules

Name	Туре	Description
Call	BOOL	

6.1.2.4.3.2 Reset

Syntax

```
METHOD Reset : BOOL
VAR
END_VAR
```

Return value

Name	Туре	Description
Reset	BOOL	Is TRUE when completed.

6.1.2.4.3.3 SetHMI

Syntax

```
METHOD SetHMI : BOOL
VAR_INPUT
    nContent : DINT
    pContent : PVOID
    bHMIReinit : BOOL
END_VAR
VAR
    pHMI_C[n]_[Content] : POINTER TO ST_HMI_C[n]_[Content];
END_VAR
```

🐔 Inputs

Name	Туре	Description
nContent	DINT	HMI Content Index
pContent	PVOID	Pointer to the HMI content structure
bHMIReinit	BOOL	Initialize the HMI content structure

Return value

Name	Туре	Description
SetHMI	BOOL	Is TRUE when completed

6.1.2.4.3.4 GetHMI

Syntax

```
METHOD GetHMI : BOOL
VAR_INPUT
    nContent : DINT
    pContent : PVOID
END_VAR
VAR
    pHMI_C[n]_[Content] : POINTER TO ST_HMI_C[n]_[Content];
END VAR
```

🔁 Inputs

Name	Туре	Description		
nContent	DINT	HMI Content Index		
pContent	PVOID	Pointer to the HMI content structure		

Return value

Name	Туре	Description
GetHMI	BOOL	Is TRUE when completed

6.1.2.4.4 FB_InputSource

The FB DataSource manages the receipt of input values from the various sources. In the OUTPUT declaration you will find all configured inputs.

Syntax

Definition:

```
FUNCTION_BLOCK FB_T[n]_InputSource IMPLEMENTS I_InputSource VAR
END_VAR
```

Interfaces

Туре	Description
I_InputSource	Interface for communication with a data source

Methods

Name	Definition location	Description
<u>Call [▶ 101]</u>	Local	Method for background communication with the TwinCAT driver. The method must be called cyclically.
GetData [102]	Local	Method to retrieve the data of the specified element.
NewDataAvailable [▶ 102]	Local	Method to check if new data is available.
AddClient [103]	Local	Method for adding data Clients
ClientDone [103]	Local	Method to signal that the client has received all data.

Properties

Name	Туре	Access	Description
bReadNewData	BOOL	Get	
eDataState	E_DataSourceSt ate	Get	
nDataHandle	ULINT	Get	
nElements	UDINT	Get	
nMaxOversamplingFactor	UDINT	Get	

Requirements

Development environment	Target platform	Plc libraries to include
TwinCAT v3.1.4024.0	PC or CX (x64, x86)	Tc3_Analytics

6.1.2.4.4.1 Call

Syntax

METHOD Call : BOOL

Return value

Name	Туре	Description
Call	BOOL	

6.1.2.4.4.2 GetData

Syntax

METH	IOD	GetDat	a	:	BOO	L	
VAR_	INE	PUT					
	nEl	ement		:	UD	INT;	
	pIr	nputs		:	PV	OID;	
	nIr	nputsSi	ze	:	UD	INT	
END_	VAF	ર					
VAR	OUI	PUT					
	nTi	mestam	ıp	:	UL	INT;	
	nCo	ontext		:	DW	ORD;	
END	VAF	2					

🐔 Inputs

Name	Туре	Description
nElement	UDINT	Element ID to obtain the specific sample
pInputs	PVOID	Pointer to the data structure
nInputsSize	UDINT	Size of the data structure

Outputs

Name	Туре	Description
nTimestamp	ULINT	Timestamp data
nContext	DWORD	Data context

Return value

Name	Туре	Description
GetData	BOOL	Is TRUE if a new element is selected

6.1.2.4.4.3 NewDataAvailable

Syntax

```
METHOD NewDataAvailable : BOOL
VAR_INPUT
nLastDataHandle : ULINT;
END_VAR
```

🔁 Inputs

Name	Туре	Description
nLastDataHandle	ULINT	Handle of the last fetched data packet

Name	Туре	Description
NewDataAvailable	BOOL	Is TRUE if new data is available

6.1.2.4.4.4 AddClient

Syntax

METHOD AddClient : BOOL VAR_OUTPUT nClientID : DWORD; END_VAR

Outputs

Name	Туре	Description
nClientID	LWORD	Client-ID

6.1.2.4.4.5 ClientDone

Syntax

```
METHOD ClientDone : BOOL
VAR_OUTPUT
nClientID : DWORD;
END_VAR
```

Solution Outputs

Name	Туре	Description
nClientID	LWORD	Client-ID

6.1.2.4.5 FB_VirtualInputSource

The FB VirtualInputSource abstracts the InputSources for the different analysis configurations. The virtual inputs configured in the Analytics Workbench are set here.

Syntax

Definition:

```
FUNCTION_BLOCK FB_V[n]_C[n]_VirtualInputSource IMPLEMENTS I_VirtualInputSource,
I_V[n]_VirtualInputSource
VAR
END_VAR
```

Interfaces

Туре	Description
I_VirtualInputSource	Interface for communication with a data source
I_V[n]_VirtualInputSource	Interface that provides all defined virtual inputs

🔹 Methods

Name	Definition location	Description
SourceSync [104]	Local	Method for synchronizing multiple FB instances
NextData [104]	Local	Method to accept the next data set
<u>Done [▶ 104]</u>	Local	Method of signaling that the entire data packet has been processed.

Properties

Name	Туре	Access	Description
bEndOfData	BOOL	Get	Signals the end of the data packet
dtTimestamp	DCTIMESTRUC T	Get	Timestamp of the currently accepted data set
nDataHandle	ULINT	Get	Data handle
nContext	DWORD	Get	Data context
tTimestamp	ULINT	Get	Timestamp of the currently received data set

Requirements

Development environment	Target platform	Plc libraries to include
TwinCAT v3.1.4024.0	PC or CX (x64, x86)	Tc3_Analytics

6.1.2.4.5.1 SourceSync

Syntax

METHOD SourceSync : BOOL

6.1.2.4.5.2 NextData

Syntax

```
METHOD NextData : BOOL
VAR_INPUT
nMaxOversampling : UDINT;
END_VAR
```

🔁 Inputs

Name	Туре	Description
nMaxOversampling	UDINT	Specifies the maximum oversampling value

Return value

Name	Туре	Description
NextData	BOOL	Is TRUE if a new element is selected

6.1.2.4.5.3 Done

Syntax METHOD Done : BOOL VAR_INPUT END_VAR

6.1.2.4.6 FB_Results

If analysis results need to be saved or streamed, the FB Results manages this and streams the selected variables to the message broker or saves the data to the Analytics binary file.

Syntax

Definition:

FUNCTION_BLOCK FB_Results VAR_OUTPUT nTimestamp: ULINT; stResults: ST_Results; END_VAR

Outputs

Name	Туре	Description
nTimestamp	ULINT	Associated timestamp of the result structure data
stResults	ST_Results	Result structure that contains all elements of the result stream.

Properties

Name	Туре	Access	Description
blnitialized	BOOL	Get	Indicates whether the function block has been properly initialized
nMaxSamples	INT	Get	Maximum number of buffered results
nResultCount	INT	Get	Current number of buffered results

🔹 Methods

Name	Definition location	Description
<u>Call [▶ 105]</u>	Local	Method for background communication. The method must be called cyclically.
AddResult [105]	Local	Add a sample to the result stream
SendResults [106]	Local	Sends all buffered samples of the result stream
Release [106]	Local	Close stream or file of the result stream

Requirements

Development environment	Target platform	Plc libraries to include
TwinCAT v3.1.4024.0	PC or CX (x64, x86)	Tc3_Analytics

6.1.2.4.6.1 Call

Syntax

```
METHOD Call : BOOL
VAR
END_VAR
```

Return value

Name	Туре	Description
Call	BOOL	

6.1.2.4.6.2 AddResult

Syntax

```
METHOD AddResult : BOOL
VAR_INPUT
tTimestamp: ULINT;
stSample: ST_Results;
END_VAR
```

🐔 Inputs

Name	Туре	Description
tTimestamp	ULINT	Timestamp of the sample
stSample	ST_Results	Sample structure

Return value

Name	Туре	Description
AddResult	BOOL	

6.1.2.4.6.3 SendResults

Syntax

```
METHOD SendResults : BOOL
VAR
END VAR
```

Return value

Name	Туре	Description
SendResults	BOOL	

6.1.2.4.6.4 Release

Syntax

METH	HOD	Release	:	BOOL
VAR				
END	VAF	ર		

Return value

Name	Туре	Description
Release	BOOL	

6.1.2.4.7 MAIN_Analytics

In the MAIN_Analytics program, the InputSource FBs are called, the reset function is managed and, if necessary, the values are mapped with the HMI dashboard. The program is assigned to a separate task.

Syntax

Definition:

```
PROGRAM MAIN_Analytics
VAR
END_VAR
```

Requirements

Development environment	Target platform	PIc libraries to include
TwinCAT v3.1.4024.0	PC or CX (x64, x86)	Tc3_Analytics

6.1.2.4.8 MAIN_Analytics_C[n]

The FB Analysis is called in the program MAIN_Analytics_C[n]. The program is assigned to the separate task.

It is also possible to reset single modules, whole networks or all defined networks with only one rising flag. First, select the component to be reset. Then a rising edge at INPUT bReset starts the reset process.

All reset calls are defined in the action A_Reset.

The handling of the "InputSources" is done in the action A_InputSources.

The mapping of the HMI values is done in the action A_MapToHMI.

Syntax

Definition:

```
PROGRAM MAIN_Analytics_C[n]
VAR_INPUT
stReset: ST_AnalysisReset;
END_VAR
VAR_OUTPUT
bError: BOOL;
ipTcResult: I_TCMessage;
nAnalysisResultsTimestamp: ULINT;
stAnalysisResults: ST_Results;
END_VAR
```

Requirements

Development environment	Target platform	Plc libraries to include
TwinCAT v3.1.4024.0	PC or CX (x64, x86)	Tc3_Analytics

6.2 HMI One-Click Dashboard

It is possible to automatically generate an HMI dashboard with HMI Controls for all modules and parameters configured in the TwinCAT Analytics Workbench Configurator. The HMI Dashboard is based on the <u>TwinCAT</u> <u>HMI</u> and visualizes the PLC data from the <u>runtime deployment [\blacktriangleright 43].</u>



The automatically generated One-Click Dashboard is only available with the new HMI version 1.12. An Analytics Runtime license is required in order to use the Analytics HMI Controls.



- ✓ After configuring your Analytics Workbench project, an HMI Control can be selected for each algorithm.
- Open the Properties window of the module and select an HMI Control from the dropdown list. You can change the display text for the title in the HMI dashboard (display text). You can also choose whether the control should be docked to the start page (Dock on Desktop). In the Solution Explorer all the controls

					7.0	0 -
WinCAT Measurement Project339 - TcXaeShell (Administrator)					V P Quick Launch (Ctrl+Q)	P = = ×
File Edit View Project Build Debug TwinCAT TwinCAT HMI Twin	nSAFE PLC Team Scope Tools Window He	lp				
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004#- 0-5 <i>0 /</i> -		Network 1	$\boxtimes \& \subset \lor$	CTcAlyMinMaxAvg_1Ch Function - Properties		•
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Solution 'TwinCAT Measurement Project339' (1 project)	\checkmark	\checkmark				
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Network 1			Avg Em	Sort Priority	100	
Min Max Avg 1Ch	×		Time Min Em	Title	Min Max Avg 1Ch	
P inputs			Time Max Em	E HMI		
				Displaytext	Min Max Avg 1Ch	
				Generate GVI	True	
				GlobalVariableType	ControlSpecific	
				HMI Control	Average Chart	~
				Network	Angelfed	^
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	¹⁹ Description					
	1					
				HMI Control		
Solution Explorer Team Explorer	Target Browser Error List Output			Properties Toolbox		
C7 Ready					* A	dd to Source Control

to be generated are stored under the <u>Manage dashboard structure and content in Analytics project</u> [<u>110]</u>

- 2. After completion of the configuration, click the **Deploy Analytics Runtime** command in the context menu. The Deploy Wizard starts and it is possible to set up the entire required configuration step by step for use.
 - ⇒ You can configure your HMI Dashboard on the **HMI Dashboard** tab.
- Activate the Generate HMI Dashboard checkbox. It is also possible to create only one HMI project without a PLC. Furthermore, you can also assign an HMI Project Name to the dashboard and set a Dashboard Title as well as the Desktop Height and Desktop Width in order to generate a tailor-made dashboard that suits your needs. The remaining configurations are explained in <u>Dashboard Configuration</u> [▶ 142].

eploy Analytics Runtime			
Codegeneration: Latest Versio	n ("Version 2.1")		
Solution TwinCAT PLC Targe	Results HMI Dashboard Visual Studio S	jummary	
HMI generation Settings			^
Generate HMI Dash	board Create only HMI Project	(no PLC)	
HMI Project Name:	AnalyticsHMIProject		
Dashboard Options			
Dashboard Title:	HMI Dashboard		
Desktop Height:	864 Desktop Width:	1920	
🗹 Create Startpage	Show current time		
Dashboard Styles			
Dashboard Layout:		Dashboard Sorting:	
_	Dock Left	Space Saving	
		Cancel Back	Next
- ⇒ As usual, the last tab shows you all the settings you have made for the generation.
- 4. Now you can start the generation process by clicking Deploy.
- ⇒ The HMI generation begins immediately after runtime deployment (if selected). Each step for generating the HMI dashboard is also displayed in the overview window during the generation process.



⇒ The dashboard opens automatically in your default browser.



6.2.1 Manage dashboard structure and content in Analytics project

An Analytics project has a configuration of HMI contents (pages) and HMI controls (display elements) that are created during dashboard generation. This configuration can be viewed and changed via the **Dashboard node** in the Solution Explorer. You can rename the contents and controls at any time, move them to other contents via drag & drop, copy them (**Ctrl-C, Ctrl-V**) or delete them. A control can also be edited by double-clicking on it.

Solution Explorer	- 4 ×
◎ ◎ 🏠 🛗 - 🐚 - ≒ 🗗 🏓 💻	
Search Solution Explorer (Ctrl+ü)	<i>۹</i> - م
 Solution 'TwinCAT Measurement Project' (1 project) TwinCAT Measurement Project Analytics Project Network Min Max Avg 1Ch 	
Threshold String Classifier 1Ch	
 Dashboard Network Min Max Avg 1Ch Inputs 	

Each Analytics module has existing control mappings, which can be selected via the window **Properties** (you can also create/edit these yourself via "Create new Mapping Template" or via the <u>Use customized and</u> <u>own controls [▶ 120]</u> (point 2)). Once a control is selected for a module, it is listed under the **Dashboard** node.



You can create new content for the Dashboard and Content nodes by right-clicking.



Likewise, you can add new controls by right-clicking on a Content node.



This opens the **Analytics Dashboard Wizard**. This wizard guides you step-by-step through the configuration for adding a control.



Analytics Dashboard Wizard

Familiarize yourself with the wizard by adding a control (select a control from the Properties window of the module). You can then look up the entire configuration in the wizard by double-clicking on the control. There you can follow the individual configuration steps.

Analytics Dashboard Wizard

Select a control. All available controls are listed on the left. By default, only controls that are not algorithmspecific are listed. All controls can be made available by unchecking the **Show only default Controls** checkbox.

1. Select **Single Value** to display a single value in the dashboard. Click the **Next** button to continue.



2. You can now link data from one module (**1-Module**), several modules (**N-Modules**) or from virtual inputs (**Virtual Inputs**). For this example, select **1-Module**.

Analytics Dashboard \	Wizard		×
Control Selection Mapping Type	Choose your Mapping intention		ntion
	1-Module	N-Modules	Virtual Inputs
	T		\mathbf{v}
	Map data from a single Module to your Control	Map data from multiple Modules to your Control	Map data from virtual inputs to your Control
	← Back ?		

Configuration

3. All modules from the Analytics project are listed. Select the module from which you want to display the data. A preview of the selected module is available on the right.

Analytics Dashboard	l Wizard	×
Control Selection		
Mapping Type	Select a Module	
Module Selection	 Analytics Project Network Min Max Avg 1Ch Threshold String Classifier 1Ch 	\checkmark
	Preview Input In Result Mi Av Tin Tin Confi	w of Module Properties & put ts (Output) in lax vg me Min me Max g winistent Pacults
	← Back ?	\rightarrow Next

BECKHOFF

4. Here the first control property is linked to a module variable. To do this, select the **Value** to be displayed with the variable **Max**.

Control Selection Mapping Type Module Selection Select Mapping A Analytic Value Unit Show Last Show Show	ect the Control Pro	perty and the Module Data to map
Module Selection Select Mapping Single Analytic Value Unit Show Last I Show Show	e Value	<pre></pre>
 Analytic Value Unit Show Last I Show 		
	s 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	 Input Input Results (Output) Min Max Avg Time Min Time Max Config Persistent Results
Enable inv	valid mappings (not recommended It value	d)

5. This overview page lists all existing links. Add another link with **Add**.

🦉 Analytics Dashboard W	ïzard					×
Control Selection Mapping Type		Ma	pping Overvi	ew		
Select Mapping	Single Value		CTcAlyMinMax	Avg1Ch		
Mapping Overview	Control Property	Data				
	Value	Max		-	- Add	
						1
	Control Title:	Min Max Avg 1Ch				
		_				
	\leftarrow Back ?	<u>'</u>			✓ Creat	e

6. Select **Unit** and check **Set default value** to assign a static value. A text field opens on the right; enter °C.

Analytics Dashboard W	izard		×
Control Selection Mapping Type	Select the Control	Property and the Module	Data to map
Module Selection Select Mapping	Single Value	Ger Default Value:	440
Select Mapping	 Analytics Value Unit Show Last Event Last Event Show Only Unit Show Title 		
	Enable invalid mappings (not recom	mended)	ত Reset
0404400	← Back ?		\rightarrow Next



7. Change the title of the control to Max Temperature and add the control mapping via Create.

Analytics Dashboard W	/izard		×
Control Selection Mapping Type Module Selection		Mapping Overview	
Select Mapping	Single Value	CTcAlyMinMaxAvg1Ch	
Select Mapping	Control Property	Data	+ Add
Mapping Overview	Value	Max	
	Unit	°	<u>-</u>
	Control Title:	lax Temperature	
	← Back ?	1 100111011101010101	✓ Create

8. The **Max Temperature** control that was created appears in the **Dashboard** node. **Right-click** > **Rename** to rename the content.



⇒ After a successful HMI and PLC generation, you can open the previously created **My Custom Page** via the navigation. There you can see the manually created control.



6.2.2 Use customized and own controls

HMI Control Mapping Wizard

The HMI Control Mapping wizard enables the following:

- 1. Adding your own controls.
- 2. Mapping controls to module classes or changing existing mappings.
- 3. Mapping controls to module instances or virtual inputs (Analytics project must be open)

Open the wizard via the tab TwinCAT > Analytics > HMI Control Mapping.

TwinCAT Measurement Project - TcXaeShell File Edit View Project Build Debug	TwinCAT TwinCAT HMI TwinSAFE PLC Team Scope Tools Window Help
Image: Solution Explorer Image: So	Windows Attach • Attach • Software Protection Show Realtime Ethernet Compatible Devices File Handling EtherCAT Devices TcProjectCompare TcProject
 TwinCAT Measurement Project Analytics Project Network 1 Threshold String Classifier 1Ch Dashboard Inputs 	Analytics About TwinCAT About TwinCAT About TwinCAT About TwinCAT About TwinCAT About TwinCAT Analytics Messages Storage Provider Recorder Target Browser HMI Control Mapping

Additional help is offered via the question mark ? in the wizard.

1. Adding your own Controls

The TwinCAT 3 HMI allows you to create your own HMI Framework controls and export them as a NuGet package.

1. To assign your own framework controls to the Analytics modules, click Import HMI Controls



2. Select the NuGet package via **Browse**.

🕌 HMI Control Mapping W	izard	×
Mapping Starting Point Import Control Package		
	Import your existing controls	
	Select the nuget package with your HMI framework controls:	
	C:\TwinCAT\Functions\TE2000-HMI-Engineering\References \SchirmerControls.1.0.0.nupkg	
	Your controls (2) have been imported successfully. Please configure them in the next steps (just a few things like the default size).	
	\overleftarrow{Back}	



3. Next, choose a name, size and image for your control. Then click **Next** and for the last control click **Create**.

HMI Control Mapping V	Vizard			×
Mapping Starting Point Import Control Package				
Profile Production		Control	Options	
Temperature Monitor				
	Name:	Width:	Height:	
	Profile Production	470	470	
	Select control image	e (optional):		
	C:\Bilder\Zeichnung-Profil	png		🔄 Browse
	Image preview:			
	← Back ?			→ Next

⇒ You will automatically be redirected so that you can create a mapping between your controls and Analytics modules.

2. a) Mapping of controls to modules (further to 1.)

Under 2. b) this step is explained in more detail using "Binary State" control.

1. Now select your control.

🙆 HMI Control Mapping	Wizard		\times
Mapping Starting Point			
Control Selection			
	Sele	ect a Control	
	 Custom Controls Profile Production Temperature Monitor Analytics Controls Average Chart Bandwidth Classifier Binary State Comparisons Curve Sketcher Data Table Edge Counter On Off Event Timing Histogram Integrator 	Width: 470 px Height: 470 px Preview of Control Properties Profile bars Profile bars Profile seals Screws Message	
	 Moving Interval Counter Multi State Pie Chart 	Message Warning Message Alarm	
	← Back ?	→ Next	

2. Now select the module to which you want to assign the control.

HMI Control Mapping	Wizard	×
Mapping Starting Point		
Control Selection		
Module Selection	Select	a Module
	∡ [★] MinMaxAvgInterval_1Ch	_
	MovingAvg_1Ch	
	MovingIntervalCounter_1Ch	ŏ
	ProductivityDiagnosis_3Ch	X
	ProductivityInterval_1Ch	
	TimeClock_1Ch	
	① Timer_1Ch	Drawiew of Medule Drawatice
	TimingAnalysis_1Ch	Preview of Module Properties an
	4 Classification	▲ Input
	BandwidthClassificator_1Ch	Input
	BandwidthClassificator_3Ch	4 Results (Output)
	✓ ^T CurveSketcher_1Ch	Output String
	山 Histogram_1Ch	Last Event
	L SectionTimer_1Ch	4 Config
	III StateHistogram_1Ch	Level 1 / 2
	ThresholdClassificator_1Ch	Level 2 / 3
	ThresholdStringClassificator_1Ch	String Level 1
	N	Christian Laural D
	← Back	→ Next
	Contraction of the second s	The second se

3. Select Continue with Mapping.



4. In the next steps, connect the control inputs to the module data.



5. Last, click **Create** to add the mapping to the Analytics workbench.

HMI Control Mapping	Wizard		×
Mapping Starting Point			
Control Selection			
Module Selection		Mapping Overview	
Additional Module?			
Select Mapping	Des Cile Des des l'as		
Select Mapping	Profile Production	ThresholdStringClassific	atori
Select Mapping	Control Property	Data	
Select Mapping	Message	Output String) I Add
Mapping Overview	Message Okay	String Level 1	
	Message Warning	String Level 2	
	Message Alarm	String Level 3 🛛 🔁 🔁	
	Mapping Name: Profile	Production	
	← Back ?		Create



6. You can now close the wizard and the mapping will automatically be available for the module. Select it and generate your dashboard.



 \Rightarrow The dashboard is ready.

2.b) Mapping controls to modules (without own controls)

Analogous to 2.a), this section describes how to perform a mapping between a control and a module. An existing Analytics Control is used as an example. You can try this example directly.

1. To do this, select the item **Mapping Template**.



- BECKHOFF
- 2. Select a control. The properties of the control are displayed on the right. It also shows how big the control will be on the dashboard.

🚰 HMI Control Mapping V	Vizard		×
Mapping Starting Point			
Control Selection			
	S	Select a Control	
	Custom Controls	Width: Binary Sta	te
	Profile Production	150 px	
	Temperature Monitor	Height:	
	Analytics Controls	150 px	
	Average Chart		
	Bandwidth Classifier		
	Binary State	Preview of Control Proper	ties
	Comparisons	4 Analytics	
	A Curve Sketcher	- Analyucs	
	📖 Data Table	Title	
	Edge Counter On Off	Chautitle	
	Event Timing	EnsteineTitle	
	Histogram	Color Gradient	
	Integrator	ChowPasat	
	- Moving Interval Counter	4 Colors	
	Multi State	- Cools	
	Pie Chart	OnColor	
	← Back ?	$\rightarrow N$	ext
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3. Select the module from which you want to display the data. The inputs, outputs and parameters are displayed as a preview, which can then be linked to the properties of the selected control. Modules that have already been mapped are underlined. These mappings can also be edited.

🚰 HMI Control Mapping) Wizard	×
Mapping Starting Point		
Control Selection		
Module Selection	Select	t a Module
Additional Module?		
	4 Base	
	ContinuousPieceCounter 1Ch	
	DownsamplingBuffer 1Ch	L11
	FidgeCounter 1Ch	レーフ
	Find EdgeCounterOnOff 1Ch	
	FT EdgeCounterOnOff 2Ch	-
	EventTimingAnalysis 1Ch	Description of Mardula Description
	EventTimingAnalysis 2Ch	Preview of Module Properties a
	IntervalPieceCounter 1Ch	Input
	S LifecycleAnalysis 1Ch	Input
	LifetimeAnalysis 1Ch	A Results (Output)
	MinMaxAvg_1Ch	ls On
	✓ MinMaxAvgInterval 1Ch	Current Interval
	MovingAvg 1Ch	On Min
	MovingIntervalCounter_1Ch	On Max
	% ProductivityDiagnosis 3Ch	On Avg
	% ProductivityInterval_1Ch	On Total
		Off Mis
	← Back 2	
101100111		THEAT

4. In the future, a control will be able to display data from different modules. Since this is not currently possible, select **Continue with Mapping**.



5. Next, select a control property to be mapped. All impossible variables that cannot be assigned due to their data type are grayed out. All others can be mapped. Ν

	0,		
Now select the	module variable	you want to map with	the control property.

HMI Control Mapping	Wizard	×
Mapping Starting Point Control Selection Module Selection Additional Module?	Select the Control Pro	operty and the Module Data to map
Select Mapping	Binary State) EventTimingAnalysis_1Ch 🛔 🚓
	Analytics	▲ Input
	State	Input
	Title	A Results (Output)
	ShowTitle	<u>ls On</u>
	FontsizeTitle	Current Interval
	Color Gradient	On Min
	ShowReset	On Max
	4 Colors	On Avg
	OffColor	On Total
	OnColor	Off Min
	FontColor	Off Max
	ControlColorDark	Off Avg
	ControlColorMiddle	Off Total
	ControlColorLight	Count On
	Enable invalid mappings (not recommend Set default value	led) U Reset
	← Back ?	\rightarrow Next

6. Likewise, you can check the **Set default value** checkbox to assign a default value to the control. This can be used, for example, to change default colors or to set Boolean values such as "ShowTitle" to "False" if no title is to be displayed in the Analytics control.

In this example, the "OnColor" is changed. Based on the data type, a specific selection option is provided.



7. As far as you do not want to add any more entries via **Add**, you can complete the mapping via **Create**. It is recommended to assign a meaningful mapping name.

HMI Control Mapping	Wizard		×
Mapping Starting Point			
Control Selection Module Selection		Mapping Overview	
Additional Module? Select Mapping Select Mapping	Binary State	EventTimingAnalysis1Ch	
Mapping Overview	Control Property	Data + Add	
	State	Is On	
	OnColor	{ "color": "rgba(73, 222, 137, 1)" -	
	Mapping Name: ← Back ?	Binary State Example	3



8. You can close the wizard and the mapping will automatically be available for the module. Select it and generate your dashboard.



 \Rightarrow The dashboard is ready.

3. Mapping of controls to module instances

In addition to mapping controls to module classes, the module instances of a project can also be directly linked to controls. This is possible via the <u>Manage dashboard structure and content in Analytics project</u> $[\blacktriangleright 110]$ as well as via the wizard.

1. At the beginning of the wizard, click HMI Dashboard Configurator.



2. There you have several choices.

Analytics HMI Control M	lanager		×
Mapping Starting Point Dashboard Configurator	Dashboard Configurator		
		Dashboard Overview 1. Dashboard Overview of your C 2. Edit of Control-Mappings 3. Remove of Control-Mappings	ontrol-Mappings
	Create Control-Mapping		
	2. Inputs	3. From Template	4. From Scratch
	Map Inputs to a HMI Control	Add Control to your Dashboard - using a template.	Add Control to you Dashboard - start from scratch.
	← Back		

- 1. Overview and editing options for all controls
 - This function is also available by double-clicking a control in the Solution Explorer.
- 2. Adding a control that displays your input data
 - This function is also possible via the <u>Manage dashboard structure and content in Analytics project</u>
 [<u>110</u>].
- 3. Adding a control that displays module data (selection via a template)
 - This function can also be set for an individual module via the *Properties* window. This is the only way to display data from several modules.
 - You can see directly which data from the template are linked and can adjust them directly.
- 4. Adding a control that displays data from modules (fully manual)
 - This function is also possible via the <u>Manage dashboard structure and content in Analytics project</u>
 [<u>110</u>].

For the individual points you have to follow the steps of the wizard. The steps are the same or very similar to section "2. Mapping of controls to modules".

6.2.3 Configure user management and access rights

Users and user groups can be generated individually via the user management. Access rights to contents and controls can be defined for user groups.



Note that user management and access rights are only transferred to the HMI project from Dashboard version 2.0.

6.2.3.1 Definition in the Analytics Project

Defined users, user groups and access rights are automatically transferred to the HMI project during code generation. Changes to users and access rights can be made in the web browser after generation.

6.2.3.1.1 User management

IwinCAT Measurement Project61 - TcXaeShell File Edit Yiew Project Build Debug TwinCAT TwinCAT Image: State of the state of th	NT HMI TwinSAFE PLC T sbug • TwinCAT CE7 (A	[eamScopeIoolsWindo ،RMV7) → Attach → → → →	w <u>H</u> elp 	2 *	- 쿄 권) = 린 : ?
Solution Explorer マリン Solution Explorer マリン Search Solution Explorer (Ctrlath)	 ✓ Dashboard → × User Management 	Liser Gr			
Solution TwinCAT Measurement Project61' (1 project) ▲ Image: TwinCAT Measurement Project61 ▲ Image: TwinCAT Measurement P	Username Third I Password •••• Language: Englis Create User Dele	User View View View View View View View View	iministrators ers lests istom user group		
	Username	Groupn. Default Create Group	ame Editor Group Delete Group s	v Language	
Math Operation (1)	First User Second user	Administrators Users, Custom user group		English English	

Users (outlined in red) can be created under the Analytics project dashboard node. For a new user, a username and password must be set, as well as a language. In addition, it is necessary to assign one or more user groups to the user, which gives the user the access rights of the respective group(s).

By default, there are the following user groups:

- · Administrators
- Users
- Guests

For a more precise classification, additional user groups can be created (outlined in green). For this purpose, a name and the access authorization must be entered.



		0	0			
	TwinCAT Measurement Project61 - TcXaeShell					🗸 🚱 Quick Launch (Ctrl+Q) 🛛 👂 💶 🕫 🗙
	File Edit View Project Build Debug TwinCAT	TwinCAT HMI TwinSAFF DIC Team Scone T	Iools Window Help			
	0.0 \$. 1 X . A	Debug TwinCAT CE7 (ARMV7) TwinCAT CE7 (ARMV7)	Attach * × × × 2	·	· _	
	Red 4024 22 (leaded)				÷	
	Solution Explorer 👻 👎 🗙	Network* Dashboard* 4 ×			•	Properties • # ×
	○ ○ ☆ Ħ - `o - # ≯ <u>-</u>	User Management				Network AnalyticsHMIContentNode - Properties -
	Search Solution Explorer (Ctrl+0)	Us	er Groups:			18 94 P
	Solution 'TwinCAT Measurement Project61' (1 project)	Username	Administrators			Access Permissions
	 TwinCAT Measurement Project61 	Password	Users			No Access empty
	Analytics Project		Guests			Viewer Guests, Custom user group
	F Edge Counter 1Ch	Language: English v	_ catom asi group			Common Administrators
	√ [®] Min Max Avg 1Ch					Title Users
	AT Math Operation	Create Liner Delete Liner Advanced				Content Custom user group
	A Dashboard	Cicule Old Delete Old Delete Old				content El y
	Edge Counter 1Ch	Gr	oupname			
	Min Max Avg 1Ch	De	efault Access Viewer v			
	Math Operation					
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		Second user Users. Custom user group	English			
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Solido Esplorer Team Esplorer						
Solution Explorer Team Team Team Team Team Team Team Team						
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Copy with view permission Copy with view per						Viewer
Solution Explorer Team Explore						Groups with view permission
C Reads	Solution Explorer Team Explorer	TwinCAT Analytics Storage Provider Recorder Target B	trowser Error List Output Exception Settings			Properties Toolbox
	/7 Ready					↑ Add to Source Control ◆

6.2.3.1.2 Configure access rights

Access rights can be configured for objects below the dashboard node (contents and controls). Access permissions (outlined in red) can be set for each user group.

The following access rights are available:

- Editor: Access to the object is permitted, and changes (such as layout adjustments for content objects) can also be made.
- · Viewer: Access to the object allowed but no changes can be made.
- No Access: No access allowed to the object and the objects subordinate to it in the Solution Explorer.



Access rights for content objects can be subsequently adjusted via the web browser.

6.2.3.2 Customize users and access rights in the web browser

Note that the menu control and the configuration of users and access rights are only available from Dashboard version 2.0.

Configure user



The menu control can be used to make changes to the users and access rights. To do this, please click on your username (at the top of the menu).



The following options are available via the popup (outlined in red):

- Switch user: Change of the logged in user
- Edit user properties: Change the properties of the own user
- · User management: Create new users, remove existing users and set user properties
- · User permission configurator: Configuring the access rights of user groups to content objects

Note that when creating new users, individually configured layouts of the creating user are taken over.

6.2.4 Dashboard Configuration

HMI Dashboard tab

The HMI Dashboard tab contains all the configurations for the dashboard.



Configuration

HMI generation Settings

Generate HMI Dashboard	Enables the generation of the HMI Dashboard, if enabled. This automatically activates/deactivates the checkboxes Create Bootproject and Activate PLC Runtime on the TwinCAT PLC Target tab.
Create only HMI Project (No PLC)	Creates only one HMI project and not a PLC project, if enabled.
HMI Project Name	Name of the TwinCAT HMI project.
Dashboard version	Selection of the dashboard version.

Dashboard Options

Dashboard Title	Title of the HMI Dashboard, which is displayed in the dashboard header.
Desktop Height	Height of the target screen in pixels.
Desktop Width	Width of the target screen in pixels.
Create Startpage	Creates a start page for the dashboard that displays a map with all machine locations. The location data is adopted from the machine management data.
Show current time	Creates a clock in the dashboard header that shows the current local time.

Dashboard Styles

Dashboard Layout	Defines the layout of the dashboard. Dock requires the "Dock" property of a module to be TRUE.
	Dock Left: fixed left column Dock Right: fixed right column Without Dock: no fixed column
Dashboard Sorting	Defines the sorting of the dashboard.
	Space Saving: arranges the controls without free space. Control Type: arranges the controls by Control type. Control Size: arranges the controls by size from large to small. Filled: arranges the controls so that the entire screen is filled. Network Groups: groups the controls by network and summarizes them on a screen. Grouping begins at the defined level (0 = All, 1 = First Level)
Dashboard Theme	Defines the topic of the HMI dashboard, affects controls and backgrounds:
	Light: bright skin, especially for day mode. Shiny: similar to the bright skin, color gradient in the controls. Dark: dark skin, especially for night mode.
Select Color	Defines the color of the dashboard header with color gradient, if enabled.
Control Style	Defines the style of the controls:
	Round: the controls have rounded corners. Flat: the controls have angular corners.
Change default background image	If enabled, a customer-specific background image can be set for the HMI Dashboard. If nothing is defined, the default image is used.
Use Logo	If enabled, a logo is added to the dashboard header. A customer- specific image can be defined for the logo.
Use custom Map Icon	If enabled, a customer-specific map icon can be defined for the map on the start page. If nothing is defined, the default icon is used.

Languages

Languages	Enables the enabled language for the language change in the HMI
	Dashboard. (Only for standard text)

HMI Server

Publish to TwinCAT HMI Server	Publishes the dashboard to a TwinCAT HMI server, if enabled.
Address	Enter the IP address or host name of the TwinCAT HMI server.
Port	Enter the port of the TwinCAT HMI Server (by default 1010 without encryption and 1020 with encryption).
User	Enter the user name.
Password	Enter the password. (The administrator password must be set on the server via the configuration page).
Validate Connection	Press the button to validate your server connection.


In order to publish to a remote HMI server, the HMI port and IP of the development computer must be shared in the HMI server. Also an inbound rule with the HMI ports must be set up in the Windows firewall from the remote PC.

TcHmiSrv ADS T	HmiEventLogger	TcHmiLua	TcHmiSa	liteLogger	TcHmiUserM	anagement	Client	Log								
General Advanced	Security Symbols	Webserve				Ŭ										
UmiCny																
ning as service with name '	[cHmiProject'				Diagnostics											
					 Accepted so 	ckets	57									
SSDP discovery	Enabled on altern	native port		×	 Active session 	ons	3									
server restart	-				 Active socket 	cs	2									
 Endpoints IPvi and IPv6 endpoints are sup 	orted. Only HTTPS endpoints	should be enabled f	or remote access. Us	e the	 Architecture 		win-x64									
wildcard addresses '0.0.0.0' and	1:3 to accept remote connection	ons on all network in	cerfaces.		> O .NET Classic	framework ver	rsions									
> 0 https://0.0.0.0:102)			×	> O .NET Core fr	amework versi	ions									
> • http://0.0.0.0:1010				×	> O .NET Classic	runtime versio	ons									
+ Add					/ Cicense											
Vindows Defender Firewall wi	h Advanced Security															
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Vindows Defender Firewall wi Action View Help 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	h Advanced Security Inbound Rules Name	Local Port	Group	Enabled .	Action Override	Program	Local Address	Profile	Remote	e Address	Prot	ocol	Remote Port	^	Actions Inbound Rules	

Visual Studio tab

On the **Visual Studio** tab you can select which version of Visual Studio® or TwinCAT XAE shell is to be used to generate PLC and HMI. In addition, it is possible to generate HMI and PLC in two different solutions.

Deploy Analytics Runtime	
Codegeneration: Latest Version ("Version 2.1")	
Solution TwinCAT PLC Target Results HMI Dashboard Visual Studio Summary	
☑ Keep Visual Studio open	
Target VS Version:	
Visual Studio 2015 V	
Create HMI in another Visual Studio	
Visual Studio 2017 V	
Cancel Back Next	

Keep Visual Studio open	Keeps Visual Studio® open after the generation, if checked.							
Target VS Version	The target Visual Studio® version for PLC and HMI.							
Create HMI in another Visual Studio	If enabled, the HMI is generated into a second solution. A different Visual Studio® version can be selected.							
Requirement: TwinCAT or TwinCAT HMI must be installed in the selected Visual Studio® version.								

Click **Next** to display the **Summary** tab, then click **Deploy** to start generating the dashboard.

Impressions

Topics



Styles





📕 T1 📃 T2 📃 T3

Views for mobile devices





Map on customer-specific dashboard



Historical data and machine switching





6.2.5 Modifying a generated dashboard in HMI engineering

TwinCAT 3 HMI project

The result of dashboard generation is a complete TwinCAT 3 HMI project. Therefore, all options offered by <u>TwinCAT 3 HMI Engineering</u> can be used and included.



Fig. 1:

Note that many dashboard customizations can also be made in the web browser at runtime.

6.2.6 Configuration of the dashboard at runtime in the web browser

At runtime, different configurations can be made in the web browser:

- Create individual user-specific layouts
- Manage users (see Configuring user management and access rights)
- · Customize access rights to contents (see Configuring user management and access rights)
- · Changing control properties in the browser

- Customize parameters
- · Changing global dashboard options

Note that not all configuration options are available with Dashboard version 1.0.

6.2.6.1 Customizing layouts with the Interactive function

With the interactive function, controls can be arranged within a content in a user-specific way. The customized layout is stored centrally in the HMI server extension "TcHmiAnalytics".



Note that layout editing is available only from Dashboard version 2.0. In addition, the layout can only be edited if the user has the necessary access rights.

Edit mode

Editing a layout is done in a special editing mode. The editing mode can be called via the menu control. Alternatively, the edit mode can also be started with the key combination "CTRL" + "E".



In edit mode, a grid is visible in the background, on which the controls can be arranged as desired.



Edit layouts

The following options are available:

- **Positioning:** For positioning, a control must be clicked or pressed. Thus, it is released from its anchorage and can be moved. The light blue frame indicates the new position within the layout. When the control is released, it anchors itself in its new position.
- Scale: Using the arrow in the lower right corner of a control, its size can be changed.
- **Hide controls:** By using the visibility button (bottom right inside a control) it can be shown or hidden. Hidden controls are displayed semi-transparently in edit mode.

BECKHOFF	15:15:00 08. Feb 2023	Analy	tics Dashl	board				
Network								
🚖 > Network							e e 5	
	Min Max Avg (Ch) - Min (6) Feb 2023 15 15 02 Max (6) Feb 2023 15 15 02 Min - 5 Max 5 Avg - 0.00 Value -1.55 -1.55 -0.00 -5.00 	Min Max Avg 1Ch (1) Him (0) Ire 3/223 15 25 00 Max (0) Ire 3/223 15 55 00 Min 0.00 Max 5.00 Avg 2.50 Value 3.68 3.68 2.50 0.00 C	Edge Counter 1Ch 4 Maritan 8 Maritan 6 Maritan	Edge Counter 1Ch (1) 4 Merview 8 Merview 6	Math Operation (1) 50.00 	Math Operation 4.68		

Editing menu

In edit mode, different actions can be performed via an additional menu (outlined in red):

- Save the layout (alternatively key combination "CTRL" + "S")
- Saving the layout and exiting the editing mode (alternatively key combination "CTRL" + "Q")
- Reset the changes made (alternatively key combination "CTRL" + "R")
- Move controls upwards so that free lines are removed (alternatively key combination "CTRL" + "U")
- Undo last action (alternatively key combination "CTRL" + "Z")
- Repeat last action (alternatively key combination "CTRL" + "Y")

Save layouts

Customized layouts can be saved via the edit menu or via the menu control. A popup shows the result of the save operation.

BECKHOFF 15:17:05 08. Feb 2023		Analytics D	ashboard	- 2
Network				
Min Max Ang 1Ch Max (06 Feb 2023 15 17:06 Max (06 Feb 2023 15 17:06 Max 5 Ang -0.00 Value 4.05 500 500 500 500 500 500 500	Min Max Avg 1Ch (1) Min: 01 (16 2023) 16/24 08 Max: 01 (16 2023) 15/70 4 Min: 0.00 Max: 5.00 Avg 2.50 Value 4.32 Value 4.32	Edge Counter TCh 4 Edge Counter TCh (1) 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	Math Operation (1) 55.00 57.60 55.00 55.	Layout stored successfully
		Angolae Contraction of the second sec		

If an error occurs during saving, check in the <u>server configuration</u> whether the "TcHmiAnalytics" extension is activated.

Mobile layout

For mobile devices, a user-specific mobile layout can additionally be generated. This is independent from the normal layout and has only 2 columns. Editing and saving is done in the same way.



6.2.6.2 Changing control properties in the browser

Recommendation: make changes in the Analytics Workbench project

Usually, the changes made here can already be made in the Analytics Workbench before you generate the dashboard (see Mapping Wizard or also Dashboard node). This has the advantage that the changes are saved when the dashboard is generated again.

Each Analytics Control has selected properties that can be changed dynamically in the browser. This option is available from Analytics version 3.4.3145.0 or with Control Package version 1.1.31. You can use it to easily update the NuGet package for older HMI projects.

1. Open a generated HMI project and click on the title of a control where you want to change a property.



2. There a menu opens where you can click on Edit Properties.



- ⇒ Each control has different properties that can be customized. Here, for demonstration purposes, the properties of the *Traffic Light* control are changed
- 3. Change the title and uncheck the bottom three selection boxes to display only the traffic light with the changed title.

BECKHOFF 14:29:49 10. Jan 2022	Analytics Dashboard	Identifier	State	×
Network	State - Machine 1	Title Show Title Fontsize Title Show Values Amount Decimals Show Last Marring Show Last Alarm Show Milliseconds	State-Machine 1	
				Ŀ

⇒ The changes made are saved client-side (on the device where you open the dashboard) and are only displayed there. In the future, storage will be performed via the HMI server, which means that changes will be made globally on each device.

6.2.6.3 Changing parameters in the browser

Numerical parameters such as limit values can be changed dynamically in the dashboard. This is possible with the Data Table Control. The values are persistently written back to the PLC there and are thus also available after a restart.

- 1. Open a generated HMI project and click on the title of the table control where you want to change a parameter.
- 2. There a menu opens where you click on **Change parameters**. A module without parameters does not have this menu item.

BECKHOFF 15:21:15 10.Jan 2022	Analytics Dashboard	💥 📄 = Language
Network		
BECKHOFF 18.2 MB 18. July 2022 Network > Sensor 02	Analytics Dashboard	Language

 $\Rightarrow\,$ The changeable fields change to an input field with a white background.

3. Change the values there and then click the save icon in the top right corner.

BECKHOFF 15:22:14 10. Jan 2022	Analytics Dashboard							×	Language	
Network										
	State~			_	_		<u>.</u>			
		Level OK / Warning	Level Warning / Alarm	Input	Class	Last Event Warning	Last Event Alarm			
	State	5.75	18.5	18.02		10. Jan 2022 15:21:29				

After saving the parameters, you will see a message in the upper right area of the dashboard. There you will be told if the reconfiguration worked.

BECKHOFF 15:23:23 10. Jan 2022			Analy	tics C	ashb	oard	
Network							
A Network > Sensor 02							
	State~						_
	100	Level OK / Warning	Level Warning / Alarm	Input	Class	Last Event Warning	Last Event Alarm
	State	5.75	18.5	19.42		10. Jan 2022 15:23:23	10. Jan 2022 15:23:23

6.2.6.4 Customizing global dashboard options

On the Options page, general settings for the dashboard can be edited.

BECKHOFF 15:58:08 22. Feb 2023	Analytics Dashboard	
MachineA		Corrector A
☐ > Options		Layout
Layout		Event Viewer
Select dashboard theme: Shiny		Settings ↓ Logout
Select control style: Round		
Show background image:		
Networks		
Reset buttons for networks:		
Controls		
Reset buttons for controls:		
Show control titles:		
Color gradient: 12 - +		
Preview:		
42.0%		
42 Elapsed 58 Remaining		
Lavout		

Layout

Select dashboard theme	Change the dashboard theme between shiny, dark and light.
Select control style	Change the control style between flat and round.
Show background image	Displays the standard or customer-specific background image.
Networks	
Reset buttons for networks	Enables reset buttons for entire networks. Reset all controls within the selected network.
Controls	
Reset buttons for controls	Enables reset buttons for controls. Reset a single control.
Show control titles	Enables control titles for all controls.

6.2.7 Switching multiple machines in the HMI Dashboard

In TwinCAT Analytics you can use different data streams from several machines, which you can switch in an analysis. This is possible both in the Analytics Workbench via the Virtual Input Source and in the fully generated PLC and HMI. Both live and historical data can be used. For each data stream, you can add a brief description and the location either in the <u>Analytics Logger</u> or in the <u>Machine Administration [} 27]</u>.

Machine Administration page

If not already done in the Overview, set the metadata of your machine on the <u>Analyse data [> 27]</u> page. Open the TwinCAT Target Browser (**TwinCAT > Target Browser > Target Browser**) and click the gear icon. Now you can enter the location of your machine, a short description and the name of your machine. Note that existing data in an Analytics project is not assigned this meta information, since the information is only transferred from the Target Browser during drag and drop. In this case, you can delete the data stream and recreate it.

For each data stream you use in your Analytics configuration, the <u>Runtime deployment [] 43]</u> creates a map entry. These map entries are used as input variables for the general map on the start page of your HMI dashboard.

Target Browser												- 4 ×
TcAnalytics TcAnalytics File TcScope File	Enter Filter							1	×			
14 × 10 × 0		Machine Administration Page									- 0	×
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Production Berlin	(ii) MISCHVERTEILER	TwinCAT Analytics Logger	172.17.62.145		3db95703-29fb-d99e-eb13-017b54677bb0	Production Verl	True	Huelshorstweg 20, 33415 Verl		TestSig	Customer	
→ Live Data		TwinCAT Analytics Logger	172.17.62.145		3db95703-29fb-d99e-eb13-017b54677bb0	Production Verl	True	Huelshorstweg 20, 33415 Verl		TestSig	SystemiD	as
A Historical Data		TwinCAT Analytics Storage Provider	172.17.62.145		3db95703-29fb-d99e-eb13-017b54677bb0	Production Verl	False	Huelshorstweg 20, 33415 Verl		_TestSi	✓ Broker	
AnalyticsFile (183D32AC-188A-00A0		TwinCAT lot Device	172.17.62.145		a313c550-7537-0617-827d-c6930e90d931	EK	True			EK916	✓ Online	
AnayiticsFile (U08/F9EF-C538-C2D/-		TwinCAT Analytics Storage Provider	172.17.62.145		53fae9bf-03fa-48ac-81e7-74f042eec6c2	Production Berlin	False	Fasanenstraße 81, 10623 Berlin		_Analy	 Position Description 	n
AnayticsFile (103D32AC+106A+00A0		TwinCAT Analytics Storage Provider	172.17.62.145		1d038f10-a40a-273a-578b-3fb5aa747c5e	Production Hanover	True	Podbielskistraße 342, 30655 Hannover		Beckho	Topic	
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⊳ – EK		TwinCAT Analytics Storage Provider	172.17.62.145		3db95703-29fb-d99e-eb13-017b54677bb0	Production Verl	True	Huelshorstweg 20, 33415 Verl		Beckho	Constant	
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		TwinCAT Analytics Storage Provider	172.17.62.145		3db95703-29fb-d99e-eb13-017b54677bb0	Production Verl	True	Huelshorstweg 20, 33415 Verl		Beckho	SystemID	
		TwinCAT Analytics Storage Provider	172.17.62.145		3db95703-29fb-d99e-eb13-017b54677bb0	Production Verl	True	Huelshorstweg 20, 33415 Verl		Beckho	System Alla	35
		TwinCAT Analytics Storage Provider	172.17.62.145		3db95703-29fb-d99e-eb13-017b54677bb0	Production Verl	True	Huelshorstweg 20, 33415 Verl		Beckho	Online	
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		TwinCAT Analytics Storage Provider	172.17.62.145		3db95703-29fb-d99e-eb13-017b54677bb0	Production Verl	True	Huelshorstweg 20, 33415 Verl		Beckho	Description Topic	1
		TwinCAT Analytics Storage Provider	172.17.62.145		3db95703-29fb-d99e-eb13-017b54677bb0	Production Verl	True	Huelshorstweg 20, 33415 Verl		Beckho	Topic Alias	e - 1
		TwinCAT Analytics Storage Provider	172.17.62.145		3db95703-29fb-d99e-eb13-017b54677bb0	Production Verl	True	Huelshorstweg 20, 33415 Verl		Beckho		
		TwinCAT Analytics Storage Provider	172.17.62.145		3db95703-29fb-d99e-eb13-017b54677bb0	Production Verl	True	Huelshorstweg 20, 33415 Verl		Beckho		
		TwinCAT Analytics Storage Provider	172.17.62.145		3db95703-29fb-d99e-eb13-017b54677bb0	Production Verl	True	Huelshorstweg 20, 33415 Verl		Beckho		
		TwinCAT Analytics Storage Provider	172.17.62.145		53fae9bf-03fa-48ac-81e7-74f042eec6c2	Production Berlin	True	Fasanenstraße 81, 10623 Berlin		Beckho		
		TwinCAT Analytics Storage Provider	172.17.62.145		53fae9bf-03fa-48ac-81e7-74f042eec6c2	Production Berlin	True	Fasanenstraße 81, 10623 Berlin		Beckho		
		TwinCAT Analytics Storage Provider	172.17.62.145		53fae9bf-03fa-48ac-81e7-74f042eec6c2	Production Berlin	True	Fasanenstraße 81, 10623 Berlin		Beckho		
		TwinCAT Analytics Storage Provider	172.17.62.145		53fae9bf-03fa-48ac-81e7-74f042eec6c2	Production Berlin	True	Fasanenstraße 81, 10623 Berlin		Beckho		
		TwinCAT Analytics Storage Provider	172.17.62.145		7acc072f-428f-8745-c7d4-a24eb4f33d9c		True			Beckhe		
		TwinCAT Analytics Storage Provider	172.17.62.145		a313c550-7537-0617-827d-c6930e90d931	EK	True			Beckhe		
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		TwinCAT Analytics Storage Provider	172.17.62.145		53fae9bf-03fa-48ac-81e7-74f042eec6c2	Production Berlin	True	Fasanenstraße 81, 10623 Berlin		BBP_d		
		TwinCAT Analytics Storage Provider	172.17.62.145		53fae9bf-03fa-48ac-81e7-74f042eec6c2	Production Berlin	False	Fasanenstraße 81, 10623 Berlin		Analy		
		TwinCAT Analytics Storage Provider	172.17.62.145		53fae9bf-03fa-48ac-81e7-74f042eec6c2	Production Berlin	False	Fasanenstraße 81, 10623 Berlin		Analy		
		TwinCAT Analytics Storage Provider	172.17.62.145		53fae9bf-03fa-48ac-81e7-74f042eec6c2	Production Berlin	False	Fasanenstraße 81, 10623 Berlin		Analy		
		,,							1			
	4	<								>		
Target Browser Marker Window Error List Output												

In the <u>Analyse data [>27]</u> the data streams are listed under **Sources**. These are created by using data from various sources from the TwinCAT Target Browser. These sources are listed in the Virtual Input Source. It is possible to switch between the sources. Check that all individual inputs are linked and that none is set to **Empty** by clicking each source once (which corresponds to a switch in the workbench). You can then generate an HMI with PLC.



Deploy Wizard

In <u>Runtime deployment [> 43]</u>, any number of configurations can be created at **Input Source**, which can be switched in the HMI. This makes it possible in the analysis HMI to analyze and switch live as well as historical data from possibly different machines. Each of the listed configurations can be analyzed in parallel. A configuration always has as many Virtual Input Sources as are configured in the Analytics Workbench.

Deploy Analytics Runtime						
Codegeneration: Latest Version ("Version 5.0")	ons					
Solution Input Source TwinCAT PLC Target Results HMI Dashboard Visual Studio Summary Imput Source Virtual Input Source Input						
Virtual Input Source (2)	[Configuration] 172.17.62.145: EnergyData/Build V					
	Cancel Back Next					

After a successful HMI and PLC generation, the names, positions, and descriptions of the input sources are entered into the global variable list of the PLC. If something is not right or you want to change a value afterwards, you can do this directly in the PLC.

AnalyticsSolution973 - KOardball (Administrator)	🏹 🖓 Quick Launch (Ctrl+Q) 🛛 👂 🗖 🗙
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Port Control Contervice Control Control Control Control Control Control Control C	hemajson AnalyticsHMIPro AnalyticsHMIPro 2 AnalyticsHMIPro AnalyticsHMIPro 2 AnalyticsHMIPro AnalyticsHMIPro 2
	NIC Adda Course Control of

Map with machines

If you selected to create a start page, the *Map Control* will be created on the homepage of your HMI Dashboard. The map shows all machine locations and lists the names of the machines (system alias) in the legend. The legend can be opened and closed using the arrow on the right. The icon color indicates the current machine status: green = OK, yellow = Warning, red = Alarm.



You can zoom in on a single icon by double-clicking it and zoom out to an overview of all machines using the icons on the left. It is also possible to click on an icon on the map. The corresponding legend entry is automatically highlighted. This also works the other way around, i.e. when you click on a legend entry, the corresponding icon is automatically highlighted.



Switching machine data

In addition to the map with the individual machine configurations, the analyses for the individual configurations can be switched. In the PLC all analyses run in separate tasks, which means that all analysis data is available at the same time. In the generated HMI, the various machines can be switched over in a specially developed control. The control can be opened and closed via the icon highlighted in the image below (black arrow).

BECKHOFF	10:53:24 22. Jul 2022			Analytics Dashboard		🖌 📄 🗕 Language
Network						
+ dear - http://www.international.com		Production Berlin	Production Berlin			Artivete
	3	Production Hanover	3/3 not started			Configuration
		Production Verl	w: Hall 1	Lan Bourdine	Long Recording	Ourrent Time
	- Baglin Island - De de Baglin		Long Recording (+35 d) 07. Apr 2022 14:00:00 - 13. May 2022 06:00:00 Record 3 (+3 h)	Start Time Current Time Stap Time 607. Apr. 2022. - 133. Hoy. 2022. 14: 005:002 - 133. Hoy. 2022.		
	Dave Strar		07. Apr 2022 17:00:00 - 07. Apr 2022 20:00:00 > 2021 > 2019			
			iii Hall 2		Long Recording	Current Time
			✓ Last six membe Long Recording (>35 d) 07. Apr 2022 14:00:00 - 13. May 2022 06:00:00 > 3021 Record 1 (>2 d) 05. Mar 2021 17:00:00 - 07. Mar 2021 20:00:00	Sam Time Current Time Samg Time 09. a pr - 2022 34.1400 cm - 13. May 2022 60.000 cm		01, Apr 2022 140000 * 13, Heg 2022 000000
			v: Hall 3	10 monatore 35 say 16:00.000 5	Long Recording	Current Time - 🗸
			C Table 3 Control (Control (Contro) (Control (Contro) (Control (Contro) (Contro) (Co	Set Time Center Time Stop Time (0:, arr 2022) 12, fing 2022 Stop Time 14:00:00 Stop Time Stop Time 14:00:00 Stop Time Stop Time	■ Long necolong	07, Apr 2022 1400 00 - 13 May 2022 06:00 00
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The configurations that were previously shown on the map with the locations can be selected in the control. A configuration can consist of live and historical data, whereby only historical data is configured for the **Production Berlin**. Historical data can be analyzed equivalently as in Working with Historical Data in the HMI.

When clicking on another machine, this configuration is only displayed in the control. To activate, click **Activate Configuration**.

The control is explained below.

- 1. The currently active configuration.
- 2. Button to activate the selected configuration.
- 3. Selection window to minimize (and automatically activate the selected configuration).
- 4. Reloading the record list. This allows data recorded subsequently to be dynamically loaded and analyzed in the dashboard.
- 5. Selection of the start and end times via a slider.
- 6. Selection of the start and end date via a selection window with calendar.
- 7. Resetting the start and end times.
- 8. Starting the analysis of the selected Input Source.
- 9. Cancel the analysis of the selected Input Source.
- 10. Starting the entire analysis
- 11. Cancel the entire analysis

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The slider is ideal for quick tests and approximate setting of the start and end times. For an exact setting down to the millisecond, click on the **text field**. This opens a selection window with calendar for selecting the date and setting the exact time.

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As soon as you click the button **Start**, the analysis is triggered with all input sources in the PLC. A loading symbol appears for the first time until the analysis starts. It turns green when the first data appears. Likewise, a marker shows the current time of the historical analysis in the slider. The process speed depends on the bandwidth, the number of data and the recorded cycle time. It is possible to analyze several historical recordings at the same time by simply switching machines. Internally, all analyses continue in parallel. This makes it easy to switch between analyses in the dashboard.

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The button **Minimize** in the upper right corner hides the selection of configurations and records. This allows you to work with the records from the input sources and view the data at the same time. You can hide the window completely by clicking the blue icon at the top. Only the configuration name is always in the bottom right corner of the dashboard.





6.2.8 Integration of a language switch

In the Deploy wizard configuration window, up to 8 languages can be selected for language switching in the HMI area.

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If you use the user administration, the languages of the created users are already selected. These cannot be deselected.

The texts in the supplied Analytics Controls and all other texts can be switched automatically. Only your network and module names have to be translated, if you want them to be included in language switching. In the following screenshot, the main affected names are marked in the **Solution Explorer**.

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In the generated TwinCAT HMI Engineering project this is easily possible, since the translation entries are already prepared. The texts for the respective languages are stored in the **Localization** files. The names of your networks and modules are automatically entered there and only have to be translated. To do this, open all the files of the languages for which you need a translation. The following screenshot lists the entries that need to be translated for German. The number of entries to be processed varies depending on the complexity of the Analytics project.

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Once completed, you can open the dashboard by clicking the **Google Chrome** button (or the name of your default browser). Simply reloading in the browser is not sufficient, because the project has to be rebuilt internally. In the following image the texts which are now also switched with the language switch are highlighted.



The language can be changed via the flag in the upper right corner.

BECKHOFF	14:54:55 22. Feb 2023	Analytics Dashboard		
Please select your language	2:			Close $ imes$
≡ German	💷 English (US)	Chinese (CN)	💶 Italian	
💶 Belgian	🖶 Finnish	Swedish	Portugese	



The language can be set and saved user-specifically from Dashboard version 2.0.

6.3 Analytics Reporting

24/7 reporting is also possible in Analytics Runtime. The TwinCAT Analytics Workbench Configurator can be used to configure the Reporting modules provided for this purpose (see 24/7 Reporting). The Reporting Collectors collect the data and send it to the Reporting Server. The Reporting Triggers trigger the creation of a report in the Reporting Server.

PLC function blocks are also generated for the Reporting modules via <u>Runtime deployment [} 43</u>]. This PLC code can then be downloaded to a TwinCAT Analytics Runtime.

In order for the Reporting Server to be available on the TwinCAT Analytics Runtime system, the Measurement Setup must be executed on this system. After successful setup, the Reporting Sever is started as a Windows service.

Provided that the TwinCAT Analytics Runtime is on the same system, the parameter for the AmsNetId in the constructor of the PLC function blocks can be left empty. If this is not the case, an Ads connection must be established between the two systems and the AmsNetId of the system with the Reporting Server must be entered in the constructor of the PLC function blocks.

7 Appendix

7.1 FAQ - frequently asked questions and answers

In this section frequently asked questions are answered in order to make your work with TwinCAT Analytics Runtime easier. If you have further questions, please contact our support team <u>support@beckhoff.com</u>.

It is possible to extend the number of connected HMI clients on the Analytics Runtime device? [167]

?It is possible to extend the number of connected HMI clients on the Analytics Runtime device?

!Yes. Four HMI Clients are already included in the Analytics Runtime. But it is a standard TwinCAT system. So you can book additional licenses like TF2030 Client Pack 10 or TF2040 Client Pack 25.

More Information: www.beckhoff.com/tf3550

Beckhoff Automation GmbH & Co. KG Hülshorstweg 20 33415 Verl Germany Phone: +49 5246 9630 info@beckhoff.com www.beckhoff.com

