

TM611

Working with mapp View



Prerequisites and requirements

Training modules	TM210 - Working with Automation Studio
Software	Automation Studio 4.4.4 Automation Runtime 4.44 Technology Package – mapp View 5.3
Hardware	ARsim X20 CPU with ETAL611.1T10-1 <u>www.br-automation.com/eta-system</u>



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Introduction

1 Introduction

Smart devices such as tablets, smartphones, etc. are considered perfect examples of technology with ultimate usability. Unsurprisingly, operators of industrial machines and systems – and therefore also manufacturers of such equipment – desire nothing less when interacting with the machinery they use every day.

With mapp View, B&R now offers access to web technology that can be used to develop HMI systems for B&R automation applications. Application engineers can use mapp View to create powerful and intuitive HMI solutions. The web technology used here is encapsulated with mapp View. Learning a broad field of technology is not necessary. HMI developers can focus entirely on creating a solution for the task at hand.



Figure 1: mapp View HMI application

mapp View is fully integrated in B&R's Automation Studio engineering environment. mapp View is the first web-based HMI solution in the world that does not require knowledge of web programming languages.

1.1 Learning objectives

The training module uses selected exercise examples illustrating typical HMI tasks to help you learn how required functions are structured and used in Automation Studio.

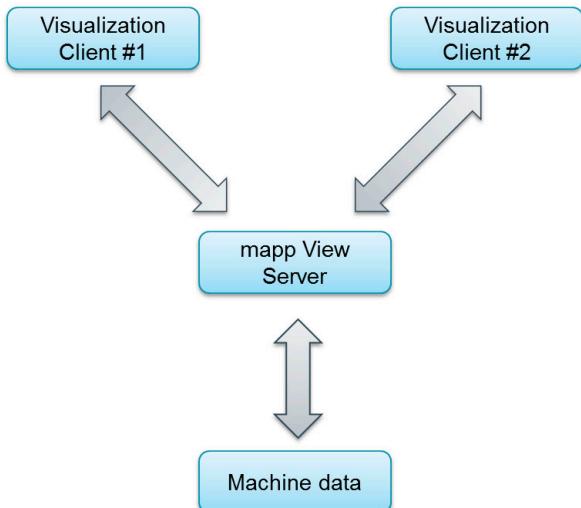
- Participants will learn the basic concepts of mapp View and gain a better understanding of the characteristics of these concepts.
- Participants will be able to add a new mapp View visualization object to an Automation Studio project and configure it.
- Participants will be able to develop the content for a mapp View HMI application and use layout features to add the content to HMI pages.
- Participants will be able to use mapp View widgets to manage mapp View HMI application content.
- Participants will be familiar with the different ways to configure navigation between various pages of a mapp View HMI application.
- Participants will be able to include process data from the automation application in a mapp View HMI application.
- Participants will be able to implement images to organize the visual design of mapp View HMI application content.
- Participants will learn how the user role system is used to configure the properties of a mapp View HMI application depending on the logged in user.
- Participants will learn how the text system functions and will be able to configure language switching.
- Participants will become familiar with the unit system and learn how to configure unit conversion.
- Participants will learn how to configure triggering specific actions when events occur.

1.2 Symbols and safety notices

Unless otherwise specified, the descriptions of symbols and safety notices listed in "TM210 – Working with Automation Studio" apply.

mapp View concept

2 mapp View concept



mapp View is an integrated system for HMI applications. This system, which is integrated in the existing automation software, is used to design HMI interfaces for machines.

mapp View has a modular structure. It allows monitoring and operation of technical processes on machinery and equipment. mapp View architecture is devised as a client-server system that consists of an HMI server connected to one or more HMI clients. The HMI server is decoupled from the automation application (in the machine or system logic).

Figure 2: mapp View architecture

The modularity of mapp View is also highlighted by the fact that the content and layout can be edited separately. This increases reusability of the HMI elements and reduces development time.

mapp View is devised as a multi-client and multi-user system. Various users can view customized content from different HMI clients. mapp View allows you to view role-based content without having to program this in the automation application. Customized HMI content can be displayed simultaneously on different HMI clients independently of each other.

mapp View is based on web technology, but the developer of a mapp View HMI application does not have to deal directly with this technology. mapp View encapsulates the complexity of web technology and gives HMI developers the freedom to focus on designing the human-machine interface. HMI elements (widgets) are used via drag-and-drop to easily design HMI content.



Figure 3: mapp View - Easy configuration through reusable elements

2.1 Installation: mapp View Technology Package

Automation Studio 4.4.4 is the minimum version required to install the "mapp View Technology Package".

The mapp View Technology Package can be downloaded from the B&R website and then installed using the upgrade dialog box.

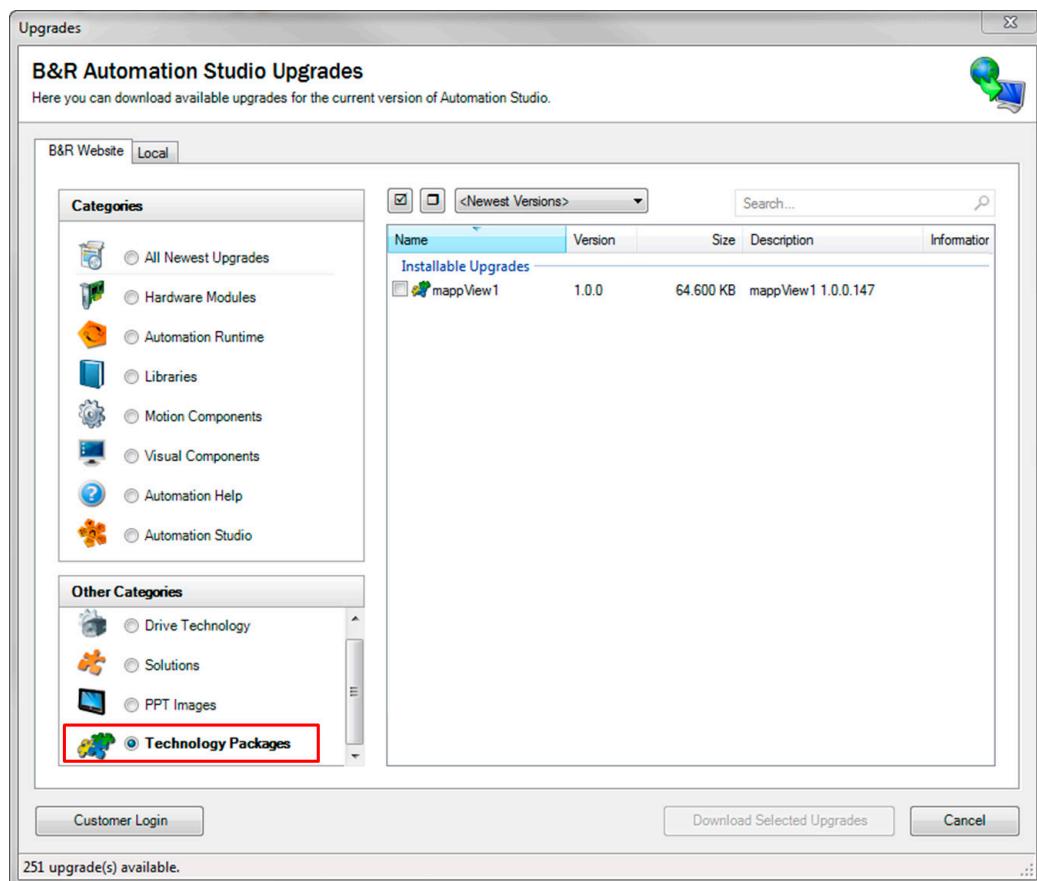


Figure 4: Automation Studio upgrade dialog box – Technology Packages

During installation of the Technology Packages, Automation Help specific to mapp View is also installed.

2.2 Licensing

A mapp View HMI application can be used in ARsim without a license or restrictions.

To operate mapp View in ARemb and ARwin, a base license (model number 1TGMPVIEW.00-01) is required. This base license makes it possible to use one instance of mapp View and connect to a client. Additional client licenses (model number 1TGMPCLIENT.10-01) are necessary when connecting multiple clients to a mapp View server.

The number of necessary client licenses is determined by the licensing model in the mapp View configuration.



If the necessary licenses are missing, a corresponding entry is made in the logbook.

mapp View concept

2.3 Structure of an HMI application

Like the automation application, the elements of a mapp View HMI application are configured and managed in Automation Studio.

HMI pages, texts and image files are managed in the Logical View. In the Configuration View, one or more HMI applications are added to the active configuration from the elements in the Logical View. In this way, there is a clear separation between the source files for HMI elements and the necessary HMI for a machine configuration.

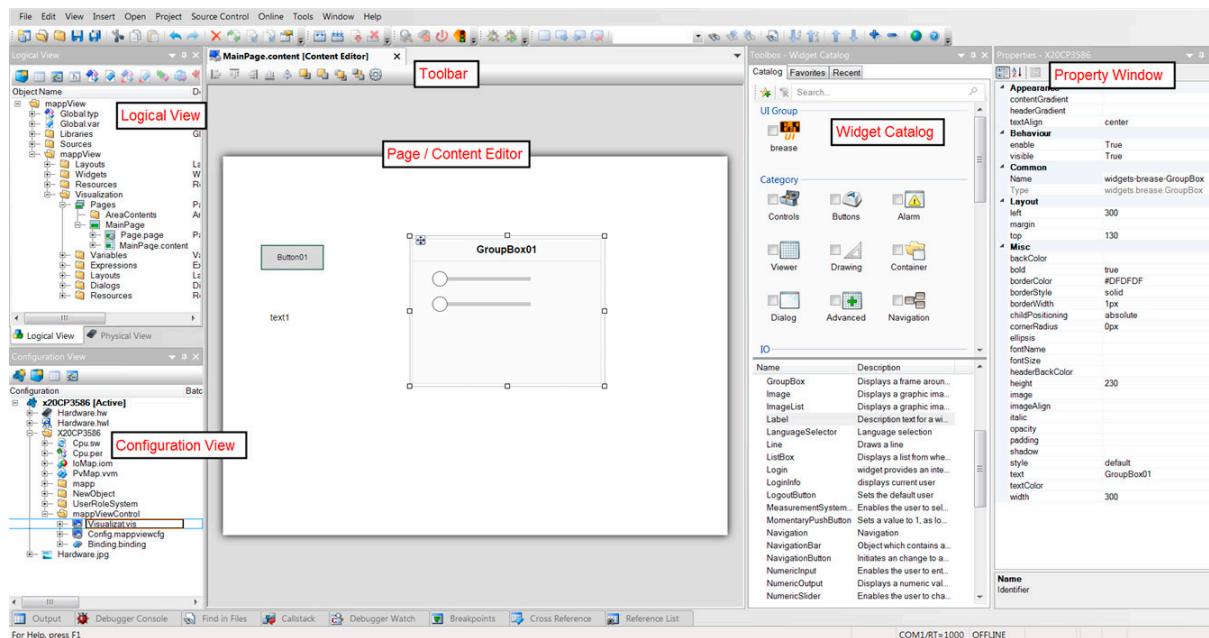


Figure 5: Organization of the HMI application in Automation Studio

Logical View

In the Logical View, elements of an HMI application (pages, pieces of content, texts, media files, etc.) are managed in a mapp View package.

Configuration View

The Configuration View is where one or more HMI applications are configured and managed.

Content Editor

The Content Editor is a visual editor used to create HMI content (pieces of content). HMI content can also be processed in a text editor (XML editor).

Toolbar

The toolbar in the visual editor provides tools for working with widgets during the design phase.

Widget Catalog

When a piece of content is opened (graphically or in XML form), widgets can be added from the catalog and configured.

Properties window

Elements of an HMI application are configured in the Properties window. Depending on the property (of a widget, for example), different dialog boxes are available for editing.

Page creation and navigation

3 Page creation and navigation

A mapp View HMI application usually consists of several HMI pages. On the HMI client, the machine operator sees the content of one page at a time. For the content of other pages to be seen, it is necessary to switch between the HMI application pages.

The HMI application navigation determines how the machine operator switches between HMI application pages.

This section describes how pages are created and the possible ways to navigate between the pages.

3.1 Overview – Creating a page

For design purposes, a mapp View page is divided into areas. The content of these areas can be designed independently of each other.

A layout defines how the areas that make up a page are structured. A layout is an independent construct and consists of the areas defined on a page.

To design a page, it is necessary to first define how the areas on the page should be structured. This is done by selecting a layout that includes the required number of areas in the required size. For a specific page, defined content can be assigned to each area.

Figure [Structure of a page](#) shows the elements used to design a page in the form of a practical example.

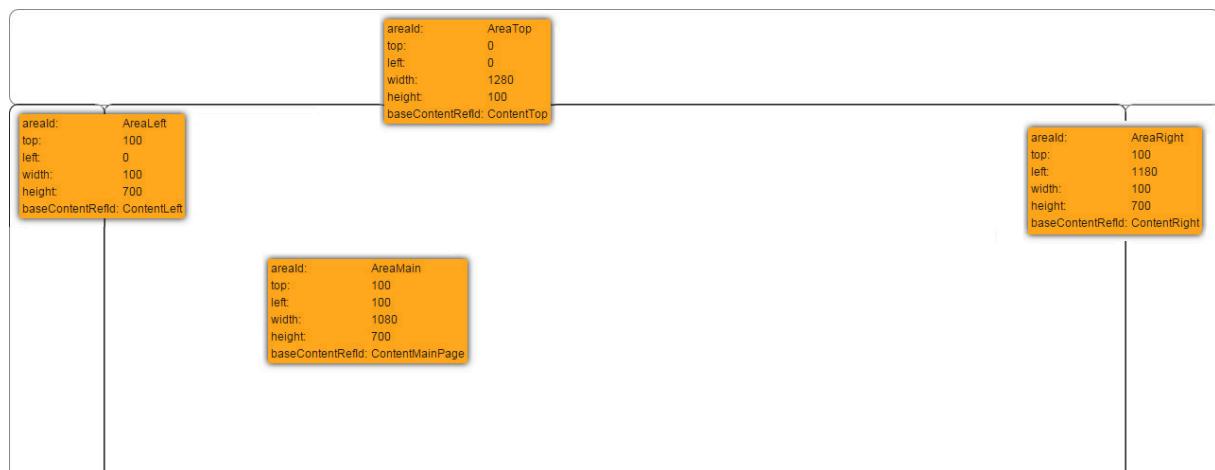


Figure 6: Structure of a page

3.1.1 Layout

A layout defines the space in which multiple areas are structured. The space structured by the layout is defined using the parameters "width" and "height". For clear identification, each layout has a unique "ID". Figure [Layout overview](#) shows an overview of a layout.

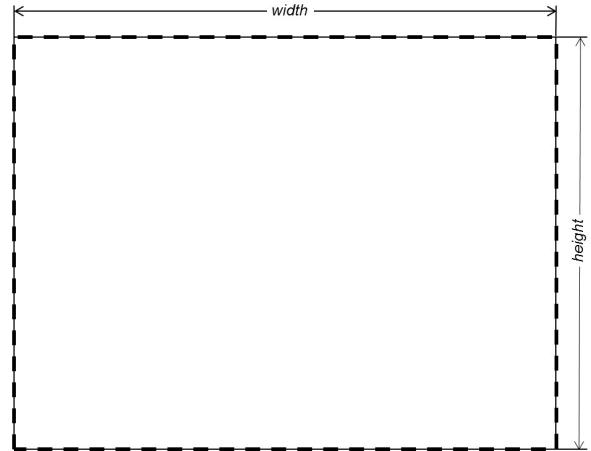
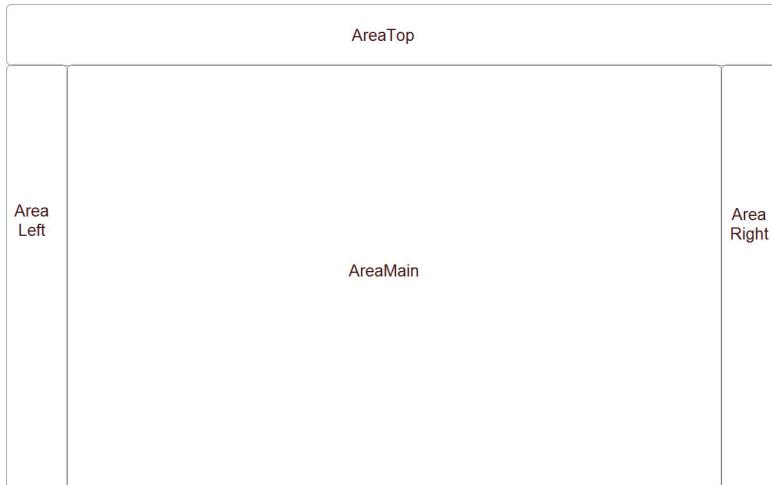


Figure 7: Layout overview

3.1.2 Area



Areas are defined portions of a layout.

Figure 8: Layout with 4 areas

Each area within a layout has a unique "ID". An area is defined according to its size ("width" and "height"), and its position ("top" and "left") within the layout, which is also specified in pixels.

The reference point for an area's position within a layout is the upper left corner.

Page creation and navigation

3.1.3 Content

Content refers to a piece of content that can be displayed in an HMI application. A piece of content is identified using a globally unique "ID" and its size ("width" and "height").

Widgets can be positioned within a piece of content.

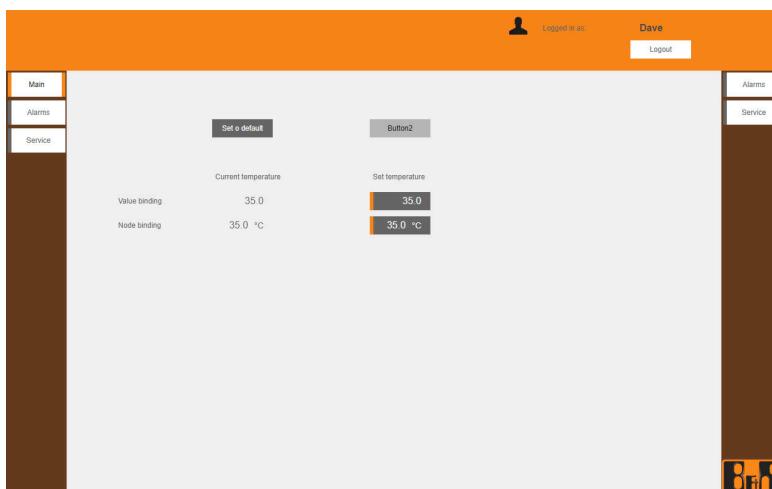
Figure "Content with widgets" shows a piece of content with the following widgets:

- Button
- Label
- Numeric output
- Numeric input
- image



Figure 9: Content with widgets

3.1.4 Page



A page defines the content that can be displayed in the visible space of an HMI application client.

The page is identified using a globally unique "ID". The page defines which layout will be used to structure the areas and which content will be assigned to the individual areas.

Figure 10: Page with referenced areas, content and widgets

Figure "Page with referenced areas, content and widgets" shows an example of a page. The four areas have different background colors to make them more distinctive.

3.2 Step-by-step page creation

The objective of this first exercise is to create an HMI application with a page based on the Automation Studio project "mappViewGettingStarted". This project already includes the automation application and the required images.

The page uses a layout with four areas and each area is assigned specific content. Different background colors will be used to better identify the four pieces of content. Figure [MainPage with referenced layout, areas and content](#) shows an overview of the structure of the page being designed and the "IDs" of the elements used (page, layout, areas, pieces of content).

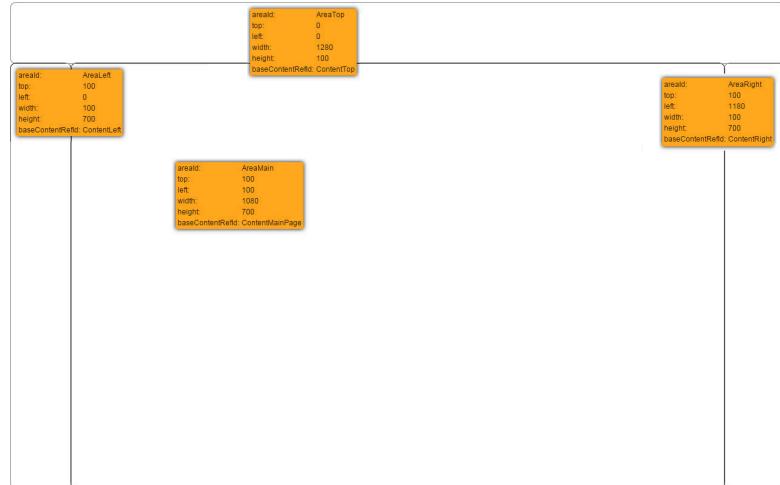


Figure 11: MainPage with referenced layout, areas and content

Exercise: Create the first page

In the following section, a mapp View HMI application with one page will be created.

The following steps must be carried out:

- 1) Open the mappViewGettingStarted project
- 2) Add packages in the Logical View
- 3) Create a layout
- 4) Create content
- 5) Create a page
- 6) Add files in the Configuration View
- 7) Configure the mapp View server (.mappviewcfg)
- 8) Customize the visualization object (.vis file)
- 9) Compiling and transferring the project
- 10) Display the HMI application in a browser

3.2.1 mappViewGettingStarted project

The mappViewGettingStarted project is available for the training as a .zip file and serves as the basis for creating the mapp View HMI application.

Page creation and navigation

Exercise: Open the mappViewGettingStarted project

Open the mappViewGettingStarted project.

3.2.2 Add packages in the Logical View

Add packages

After the mappViewGettingStarted project has been opened, the mapp View package and the visualization package will be added from the Object Catalog in the Logical View. The visualization package will be added in the mapp View package.

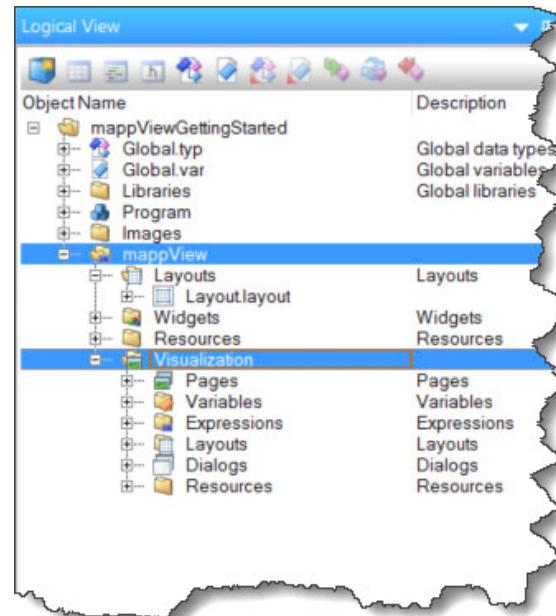


Figure 12: mapp View package and visualization package have been added

Exercise: Add packages

- 1) Add the mapp View package
- 2) Add the visualization package



HMI application / mapp View / Engineering / HMI organization / Logical View

- mapp View package
- The mapp View visualization package

3.2.3 Create a layout

Adding a layout

A layout is needed to divide everything up into areas. The layout is added to the Logical View.

If the Layout package is selected in the Logical View , a new layout can be added from the Object Catalog. The layout file added is then renamed to "MyLayout".

Property name	Value
id	"MyLayout"
height	"800"
width	"1280"

Table 1: Properties in the layout file

Double-clicking on the "MyLayout.layout" file opens the XML editor in the Automation Studio workspace. The parameters from the table must be entered in the XML file:

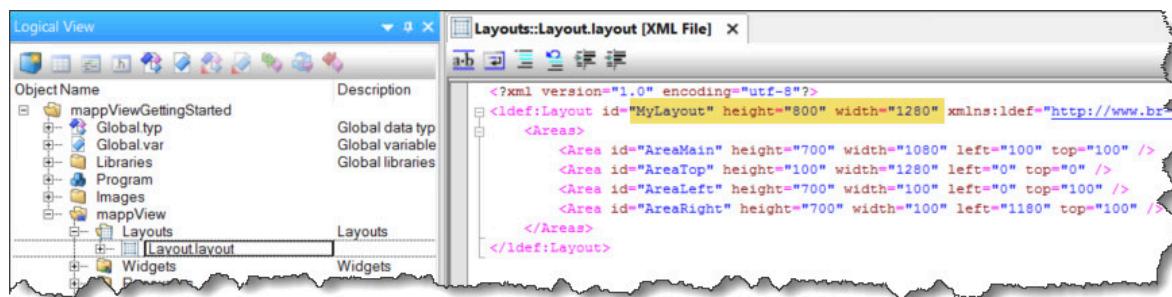


Figure 13: Add the MyLayout file in the Logical View and edit the XML file



HMI application / mapp View / Engineering / Layout and areas / Adding a layout

3.2.4 Creating areas

The page is divided into different regions by defining the areas in the layout.

Exercise: Define areas (XML)

Four areas will be created in "MyLayout.layout" with parameters that must be set to the values specified in the table.

ID	height	width	left	top
AreaMain	700	1080	100	100
AreaTop	100	1280	0	0
AreaLeft	700	100	0	100
AreaRight	700	100	1180	100

Table 2: Properties for the areas used in the layout

Page creation and navigation

Final result

The figure shown represents the definition for the four areas in "MyLayout".

```
<?xml version="1.0" encoding="utf-8"?>
<ldef:Layout id="MyLayout" height="800" width="1280"
  xmlns:ldef="http://www.br-automation.com/iat2015/layoutDefinition/v2">
  <Areas>
    <Area id="AreaMain" height="700" width="1080" left="100" top="100" />
    <Area id="AreaTop" height="100" width="1280" left="0" top="0" />
    <Area id="AreaLeft" height="700" width="100" left="0" top="100" />
    <Area id="AreaRight" height="700" width="100" left="1180" top="100" />
  </Areas>
</ldef:Layout>
```

3.2.5 Creating content

Adding content

Next, three pieces of content will be added to the "AreaContents" folder. The "AreaContents" folder is used to store the various piece of content, which can be used on multiple pages.

Select the "AreaContents" folder and add three content files.

After adding the content files in the Logical View, they must be renames to "ContentTop", "ContentLeft" and "ContentRight".

Figure [Content files added](#) shows the three content files that have been added (with their distinctive filenames).

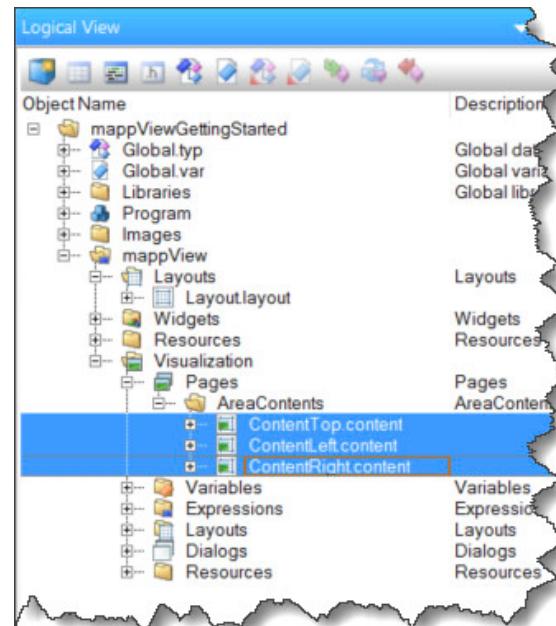


Figure 14: Content files added

Edit contents

A piece of content can be opened and edited with the visual editor or text editor.

The following section describes the process when using the visual editor.

The process for editing content using the XML editor is described in the help documentation.

Visual editor

Double-clicking the content file opens the visual editor and the Properties window. The Properties window can be used to edit content attributes ("Name", "width" and "height").

In the Properties window, a unique "Name" will be entered as well as the "width" and "height" of the content.

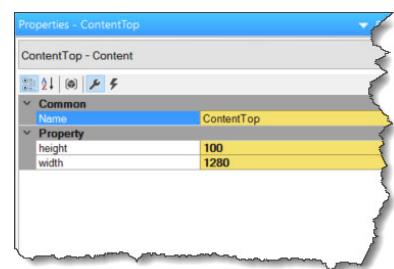


Figure 15: ContentTop Properties – Visual editor



We recommend selecting the name entered in the Logical View for the content file as the unique "Name".

Exercise: Edit all pieces of content

The parameter name, height and width for pieces of content must be defined as follows:

Name	height (px)	width (px)
ContentTop	100	1280
ContentLeft	700	100
ContentRight	700	100

Table 3: Properties for Top, Left and Right content



HMI application / mapp View / Engineering / HMI page content / Adding content

3.2.6 Creating a page

A page object is added to an existing "Pages" package from the Object Catalog using drag-and-drop or by double-clicking on it. The "Pages" package is part of a mapp View visualization package.

The next step is to create a page with the name "MainPage" where the areas and the pieces of content can then be referenced.

Selecting the "Pages" package allows a page from the Object Catalog to be added to the Logical View and renamed.

In addition, a piece of content with the name "Content MainPage" will be added under the MainPage package, opened by double-clicking on it and configured as follows:

Property name	Value
Name	"Content MainPage"
height	"700"

Page creation and navigation

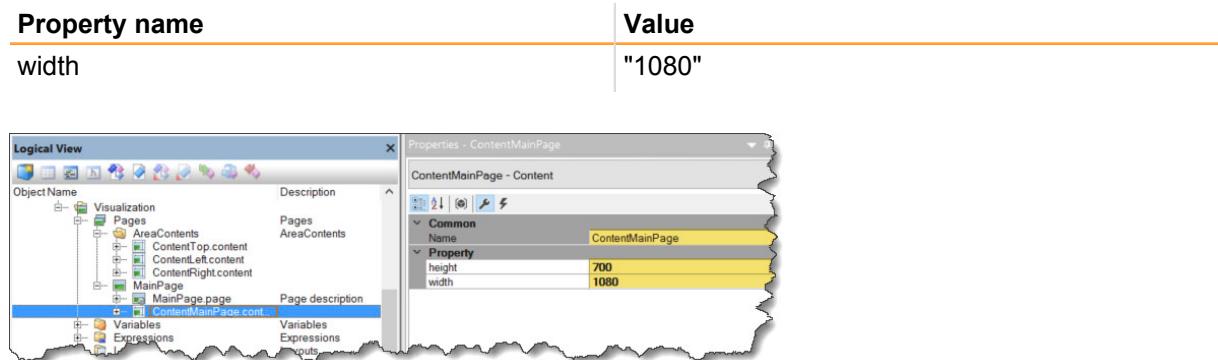


Figure 16: ContentMainPage in the Properties window

Double-clicking on the " MainPage.page" file opens the visual editor.

In order to uniquely identify the page, a globally unique "pageId" must be specified.

To use the previously defined layout on the "MainPage", property "layoutId" must be selected for layout "MyLayout".

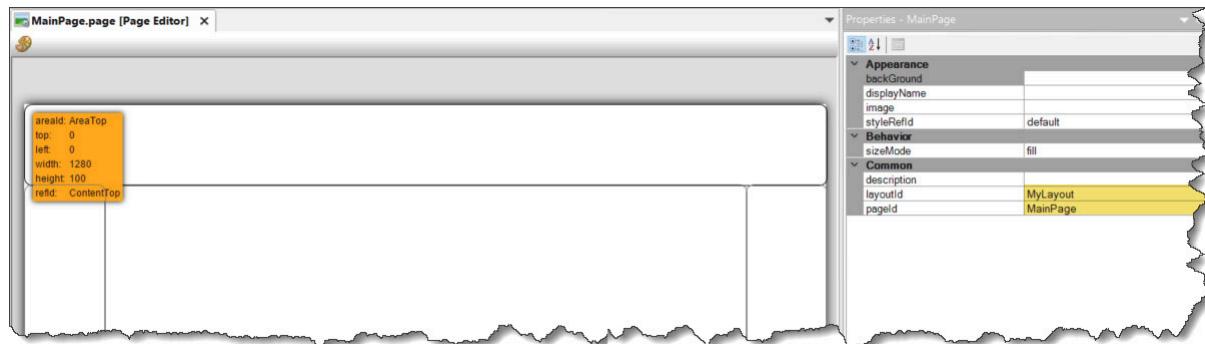
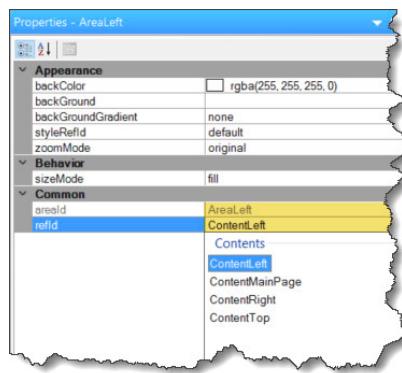


Figure 17: Visual editor for the page with a layout assigned



When selecting an area in the visual editor, the properties of the area are displayed. Assigning the corresponding content is done here.

Figure 18: Content can be assigned when an area is selected

In order for the respective pieces of content to be clearly recognizable at runtime, a unique background color (backColor) will be defined for each piece of content. A color code is specified as a hexadecimal code for the "backColor" attribute:

refId	areaId	backColor
ContentMainPage	AreaMain	rgba(240,240,240,1)
ContentTop	AreaTop	rgba(255,133,0,1)
ContentLeft	AreaLeft	rgba(102,53,0,1)
ContentRight	AreaRight	rgba(102,53,0,1)

Table 4: Main Page



HMI application / mapp View / Engineering / HMI pages / Adding HMI pages

3.2.7 Adding files in the Configuration View

After " MainPage" has been created and configured, the mapp View server and the HMI application must be configured. This is done in the Configuration View under the mapp View node by adding the files "mapp View Configuration" ("Config.mappviewcfg") and "Visualization" ("Visualizat.vis") from the Object Catalog.

mapp View visualization object (.vis)

The mapp View visualization object (.vis) defines which visualization components in the Logical View and Configuration View are involved in displaying pages on the client. Each configuration can contain 1-n visualization objects (.vis).

All definitions and parameters that need to be entered in the .vis file are described in Automation Help.



HMI application / mapp View / Engineering / HMI organization / Configuration View / mapp View visualization object

mapp View server configuration (.mappviewcfg)

This static configuration makes it possible to configure various settings for the mapp View server.

The precise settings to be made on the server are described In Automation Help.



HMI application / mapp View / Engineering / HMI organization / Configuration View / mapp View configuration

Page creation and navigation

Exercise: Configure the server and add a visualization object

The following files must be added to the Configuration View:

- 1) mapp View configuration ("Config.mappviewcfg")
- 2) Visualization object ("Visualizat.vis")

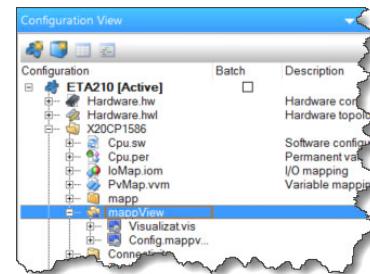


Figure 19: Configuration and visualization object added to Configuration View

Configuring Config.mappviewcfg

The default settings for file .mappviewcfg can be used without modifications.

Configuring Visualizat.vis

Element "Visualization ID" determines how the HMI application is launched from the client. Element <StartPage> defines which page is displayed when the HMI application is delivered to the client. The list of <Pages> elements contains all pages that are part of this HMI application.

The image shows the relevant content for practicing with this visualization object (.vis).

```
<?xml version="1.0" encoding="utf-8"?>
<vdef:Visualization id="Training"
xmlns:vdef="http://www.br-automation.com/iat2015/visualizationDefinition/v2">
  <StartPage pageRefId="MainPage" />
  <Pages>
    <Page refId="MainPage"/>
  </Pages>
```

3.2.8 Opening the HMI application in a browser

Exercise: Open the HMI application in a browser

After the first page (" MainPage") has been created and referenced in the visualization object (.vis), the project can be compiled and transferred to ARsim.

The HMI application can be displayed using the following URL:

<http://127.0.0.1:81/index.html?visuld=Training>

Expected result

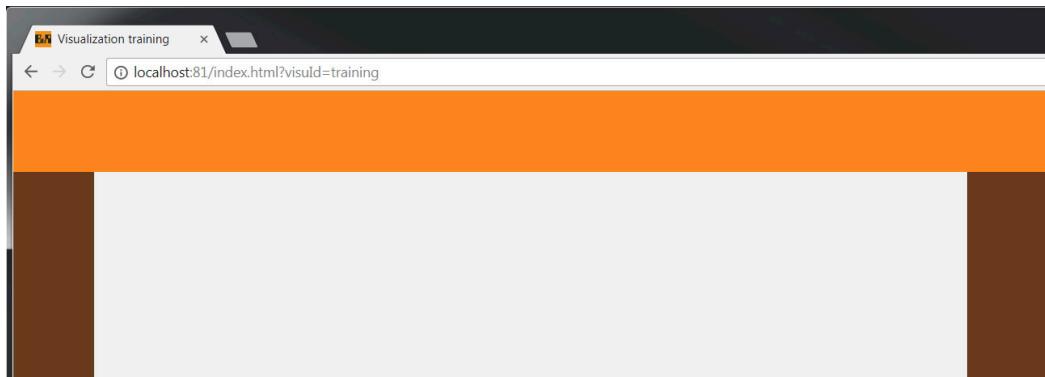


Figure 20: The HMI application containing a layout with 4 areas shown in browser



HMI application / mapp View / Guides / Getting started / Testing the HMI application

Page creation and navigation

3.3 Navigation overview

More often than not, an HMI application consists of more than one page. A system of navigation is needed in order to access these pages.

This system determines how these pages are navigated in the HMI application.

The example in figure [Schema for manual navigation](#) shows the three pages " MainPage ", " ServicePage " and " AlarmPage " as well as the options for navigating between them.

In this example, it is possible to navigate to any page from any other page.

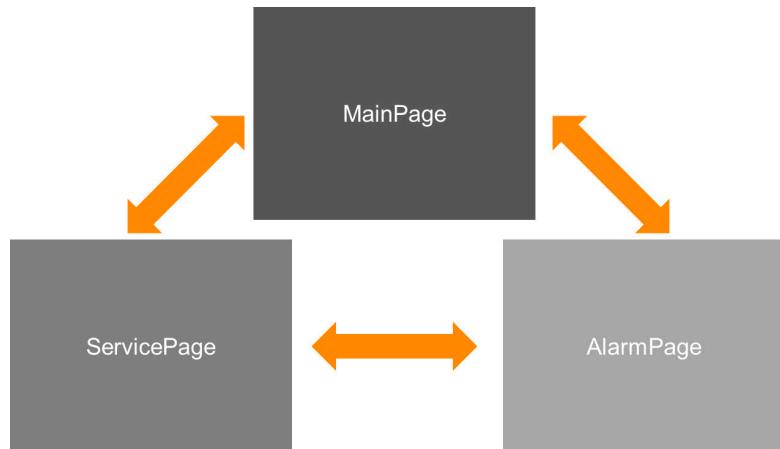


Figure 21: Schema for manual navigation

Two options are available for navigation in an HMI application, manual and automatic navigation. Both types of navigation can be combined.

3.3.1 Manual navigation

Manual navigation is implemented using an individual "NavigationButton" widget. In this case, a "NavigationButton" widget must be placed and configured for each page that can be navigated to from the current page.

Image [Schema for manual navigation](#) shows that three "NavigationButton" widgets that have been placed and configured on each page. Each individual "Navigation-Button" widget is configured with the ID of the page that should be opened when the button is pressed.

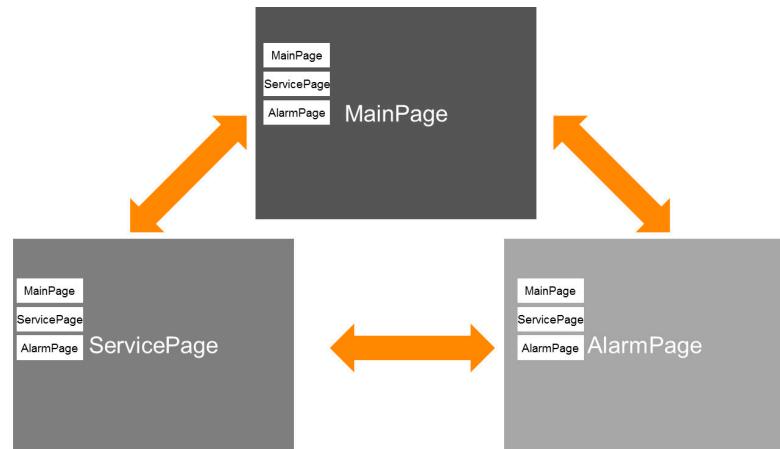


Figure 22: Schema for manual navigation

Manual navigation is well-suited to situations where the same "NavigationButton" widgets can be used for all pages. In this case, they have to be positioned in a piece of content and configured there. This navigation content can then be reused (referenced) on each page.

One drawback of manual navigation is that it is context-independent. The placement and configuration of the "NavigationButton" widget is the same on every page. If the placement and configuration of the "NavigationButton" widgets should vary depending on the page, you will have to create different pieces of content for navigation and reference them individually on the corresponding pages.

In HMI applications with a large number of pages, a great deal of work can be required here. Although there is a lot of work upfront developing the navigational structure of an extensive HMI application, the maintainability of manual navigation is very easy. The alternative to manual navigation in mapp View is automatic navigation.



HMI application / mapp View / Engineering / HMI organization / Configuration View / Navigation

3.3.2 Automatic navigation

Automatic navigation relies on the definition of a navigation structure. This is used to define the different navigation paths, i.e. which pages can be navigated to from which other pages. mapp View takes care of placing the corresponding "NavigationButton" widgets on each page at runtime.

Each page only displays the target pages for which a navigation path from the current page has been defined. Displaying the "NavigationButton" widget is context-sensitive.

Image [Automatic navigation paths](#) shows automatic navigation for the three pages "MainPage", "ServicePage" and "AlarmPage". It is possible to navigate from any page to any other page, but each page shows only the context-sensitive navigation targets.

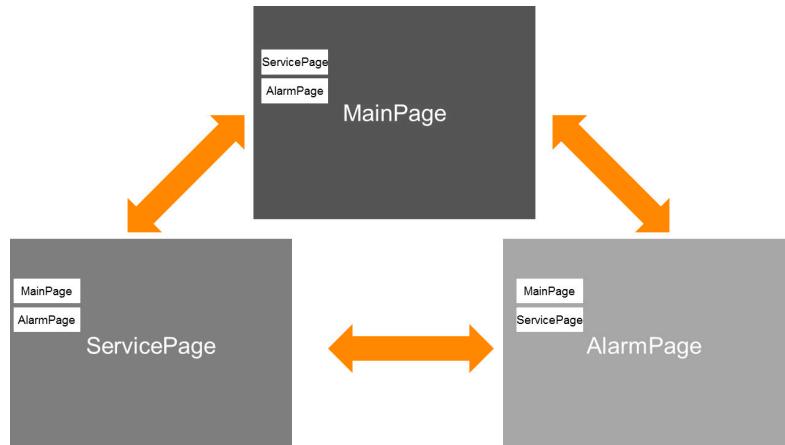


Figure 23: Automatic navigation paths



HMI application / mapp View / Engineering / HMI organization / Configuration View / Navigation

Page creation and navigation

3.4 Using manual navigation

The goal of this exercise is to create a manual navigation system that can then be used to switch between different pages. To use manual navigation, 2 additional pages must be created ("ServicePage" and "AlarmPage"). The manual navigation system should be positioned and configured in content "ContentLeft" in the visual editor.

Exercise: Set up manual navigation

The following sections will be used to set up manual navigation.

The following steps must be carried out:

- 1) Create ServicePage and AlarmPage
- 2) Add and configure the NavigationBar widget
- 3) Add and configure the NavigationButton widget
- 4) Reference ServicePage and AlarmPage in the .vis file
- 5) Compile/Transfer the project and display it in a browser

3.4.1 Creating ServicePage and AlarmPage

In order to be able to show manual navigation, 2 additional pages must be created with new content on each ("ContentServicePage" and "ContentAlarmPage"). The 2 pages should have the same layout ("MyLayout") as "MainPage" and reference pieces of content "ContentServicePage" and "ContentAlarmPage".

Exercise: Create ServicePage and AlarmPage

For information about creating pages, see section "Step-by-step page creation".

- 1) Create ServicePage with ContentServicePage
- 2) Create AlarmPage with ContentAlarmPage

In order to give the pages a different appearance, property "backColor" will be configured individually when assigning to the respective main content.

Name	ServicePage	AlarmPage
ContentServicePage/AreaMain	x	
ContentAlarmPage/AreaMain		x
ContentTop/AreaTop	x	x
ContentLeft/AreaLeft	x	x
ContentRight/AreaRight	x	x

Table 5: Assigning areas and pieces of content

3.4.2 NavigationBar widget

The "NavigationBar" widget is used as a container for "NavigationButton" widgets. When "Navigation-Button" widgets are added to the navigation bar, they can be automatically positioned or aligned with other "NavigationButton" widgets that have been added. This saves the user from having to manually align each individual "NavigationButton" widget.

NavigationBar widget

After "ServicePage" and "AlarmPage" have been created, a "NavigationBar" widget is added to "ContentLeft" and configured as follows:

Property name	Value
Layout/Size	100;300
Behavior / Child positioning	relative
Common/Name	NavigationBar1

Table 6: NavigationBar widget properties

Add the "NavigationBar" widget from the Widget Catalog to "ContentLeft" using drag-and-drop.

Set the size of the container. "Layout/Size" = 100; 300

In order for "NavigationButton" widgets to be aligned relative to one another, change the "Behavior/child positioning" property to "relative".

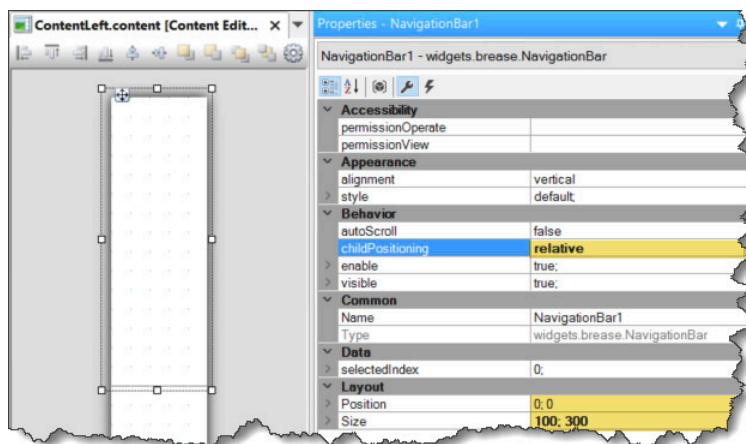


Figure 24: NavigationBar widget in the Properties window

3.4.3 NavigationButton widget

A "NavigationButton" widget makes it possible to navigate to a certain page.

Adding and configuring "NavigationButton" widgets

After the "NavigationBar" widget has been added and configured, a "NavigationButton" widget is added and configured for " MainPage".

Page creation and navigation

"NavigationButton" widgets from the Widget Catalog are added to the "NavigationBar" widget using drag-and-drop. The text displayed on the "NavigationButton" is specified by the "Appearance/text" property. The unique name of the "NavigationButton" widget is defined by the "Common/Name" property, and the page that should be navigated to when actuating the "NavigationButton" widget is selected using property "Data / pagId".

Image [NavigationButton in the Properties window](#) shows the values for the "NavigationButton" widget for navigating to "MainPage".

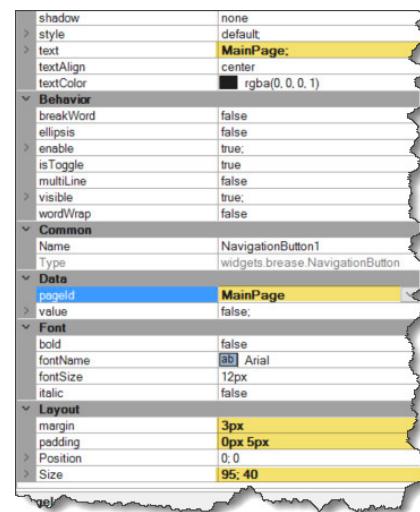


Figure 25: NavigationButton in the Properties window

Exercise: Add navigation buttons to ServicePage and AlarmPage

This procedure must be repeated with the following parameters for navigating to "ServicePage" and "AlarmPage".

NavigationButton name	Appearance / text	Common/Name	Data / pagId
MainPage	MainPage	MainPageButton	MainPage
ServicePage	ServicePage	ServicePageButton	ServicePage
AlarmPage	AlarmPage	AlarmPageButton	AlarmPage

Table 7: Properties of the navigation buttons

3.4.4 Entering ServicePage and AlarmPage in the .vis file

In order for the newly created pages to be taken into account in the HMI application, the pages must be referenced in the visualization object (.vis).

"ServicePage" and "AlarmPage" must be entered in element <Pages> as shown in the following image.

```
<StartPage pageRefId=" MainPage" />
<Pages>
    <Page refId=" MainPage" />
    <Page refId=" ServicePage" />
    <Page refId=" AlarmPage" />
</ Pages>
```

3.4.5 Transferring a modification

Exercise: Compiling the project and opening it in a browser

After all "NavigationButton" widgets have been added and configured, the project can be compiled and transferred to ARsim.

The HMI application can be displayed using the following URL:

<http://127.0.0.1:81/index.html?visuid=Training>

Expected result



Figure 26: HMI application in the browser with manual navigation

3.5 Using automatic navigation

The goal of this exercise is to create an automatic navigation system that can then be used to navigate between pages.

The "Navigation" widget that is used to display the automatic navigation options will be added to "ContentRight" using the visual editor.

Unlike manual navigation, the "NavigationButton" widget should not show the current page. This is implemented by configuring automatic navigation in a "navigation object".

Exercise: Set up automatic navigation

Automatic navigation should be set up with the help of the following sections.

- 1) Add the navigation object to the Configuration View and configuring the navigation paths
- 2) Add the "Navigation" widget to "ContentRight" and configuring it
- 3) Enter the navigation ID in the .vis file
- 4) Compile/Transfer the project and display it in a browser

Page creation and navigation

3.5.1 Navigation file in the Configuration View

With automatic navigation, the navigation paths are defined in a separate navigation object in the Configuration View. The "NavigationButton" widgets are displayed in the "Navigation" widget automatically at runtime.

A navigation object must be added to the "mappView" package from the Object Catalog.

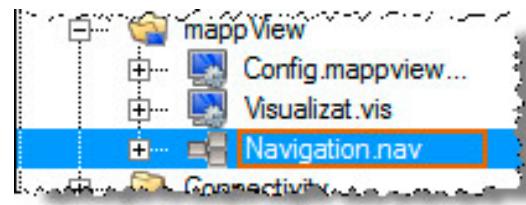


Figure 27: Added navigation object

Each navigation object must contain a unique "ID" as well as navigation paths that define from which source page (NavigationPath refId="") it is possible to navigate to which target page (Destination refId=""). Attribute "index" specifies the order in which the "NavigationButton" widgets are placed in the "Navigation" widget at runtime.

Configuring the navigation object

The first step is to assign unique <Navigation ID> "AutoNavigation".

The navigation paths are then defined as follows:

```
<?xml version="1.0" encoding="utf-8"?>
<nndef:Navigation id="AutoNavigation"
xmlns:nndef="http://www.br-automation.com/iat2015/navigationDefinition/v2">
<NavigationPaths>
    <NavigationPath refId="MainPage">
        <Destination refId="AlarmPage" index="0" />
        <Destination refId="ServicePage" index="1" />
    </NavigationPath>

    <NavigationPath refId="AlarmPage">
        <Destination refId=" MainPage" index="0" />
        <Destination refId="ServicePage" index="1" />
    </NavigationPath>

    <NavigationPath refId="ServicePage">
        <Destination refId=" MainPage" index="0" />
        <Destination refId="AlarmPage" index="1" />
    </NavigationPath>
</NavigationPaths>
</nndef:Navigation>
```

3.5.2 Adding and configuring the Navigation widget

The "Navigation" widget automatically displays the navigation buttons for a page based on the defined navigation paths.

Adding the Navigation widget

Add a "Navigation" widget from the toolbox using drag-and-drop and configure it as follows:

First define the size of the "Navigation" widgets under "Layout / Size". In order for the "NavigationButton" widget to be shown correctly without being cut off, the default value of the "NavigationButton" widget must be changed under "Layout.Size / buttonWidth".

The unique name for the widget is entered under "Common / Name".

In order for the correct navigation paths to be used, the reference ID of the navigation object ("AutoNavigation") is specified under "Data / navRefId".

Property name	Value
Layout/Size	100;250
Layout.Size / buttonWidth	94
Layout.Size / buttonHeight	40
buttonMargin	3
Data/navRefId	AutoNavigation

Table 8: Properties of AutoNavigationWidget

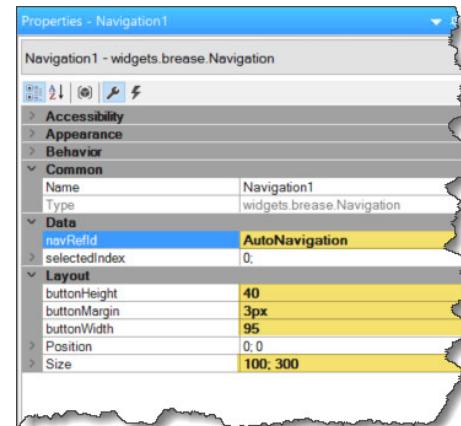


Figure 28: Properties window for Navigation widget

3.5.3 Referencing navigation in the .vis file

In order for the navigation object to be incorporated in the HMI application, its "Navigation ID" must be referenced in the .vis file.

Comment out attribute <Navigations> in the XML and enter "AutoNavigation" for the "refId" attribute.

```
<Navigations>
    <Navigation refId="AutoNavigation" />
</Navigations>

<Navigations>
    <Navigation refId="AutoNavigation" />
</Navigations>
```

Page creation and navigation

Expected result



Figure 29: HMI application with manual and automatic navigation



In the previous navigation examples, the "ID" of the page was displayed as a label for the "NavigationButton" widget. How to make a customized label is explained in section "Localization".



The mapp View server can now also be transferred directly to a controller. Simulation mode is thus deactivated and the project is transferred. Then the HMI device is accessed via the IP address of the controller (e.g. <http://10.43.15.46:81/index.html?visuld=Training>).

See:

- ["Putting the mapp View server into operation on the controller" on page 84](#)

4 Visual appearance - Styling

Styling refers to the ability to design the appearance of an HMI application without affecting how it actually functions.

4.1 Styling overview

The way an HMI application looks in its entirety as well as the appearance of its individual elements is determined using styleable properties, styles and themes.

4.1.1 Styleable property

A styleable property refers to a single property of an HMI element (e.g. widget or page) that influences its appearance. Examples of styleable properties include the background color of a widget or the width of its border.

4.1.2 Style

A style groups together all of a visualization element type's styleable properties. There can be several styles for each type of a visualization element. A style for the button widget type (button style) contains a concrete value for each styleable property of a button. Multiple styles are possible for the button widget type by setting each styleable property of a button to a certain value. For example, the background color for one button style can be green; for another, it can be set to blue. Styles are assigned to the different visualization element instances during project development. When a style is assigned to an instance of a visualization element (e.g. Button01), all of the instance's styleable properties are set to the values from the assigned style.

4.1.3 Theme

A theme is a grouping of styles for different types of visualization elements. A theme can therefore contain styles that set the background color to different shades of blue for all visualization element types. Another theme can contain styles that set the background color to different shades of green for all visualization element types. In this way, it is possible to design blue and green themes. The values of the styleable properties in a theme's styles make it so they fit very well together. Another use case for themes involves

Visual appearance - Styling

toggling between day/night display in HMI applications where natural light plays a role. The night theme can show widgets with dark background colors and bright text fonts while daylight styles can include bright background colors and dark text fonts.



Figure 30: Displaying an HMI application with different themes

4.2 Using styles

The goals of this exercise are to change the visual appearance of the already existing "NavigationButton" widgets for manual navigation using styles, to create custom styles for the "Button" widgets and to use themes.

4.2.1 Styleable property

The subset of styleable properties is defined for each widget type. The properties that affect the appearance of a widget instance will vary depending on the type of widget.



HMI application / mapp View / Widgets / Buttons / Navigation Button

Styling the NavigationButton widgets

The goal of the next exercise is to change the appearance of the "NavigationButton" widgets for manual navigation located on "ContentLeft".

In the Properties window, the background color should be changed to light red for "NavigationButton" widget " MainPage" and to light green for "NavigationButton" widgets "ServicePage" and "AlarmPage".

Exercise: Apply styling to the "MainPage" button

After selecting the "NavigationButton" widget called "MainPage", the color light yellow (`rgba(255, 255, 192, 1)`) can then be selected in the Properties window under "Appearance / backColor".

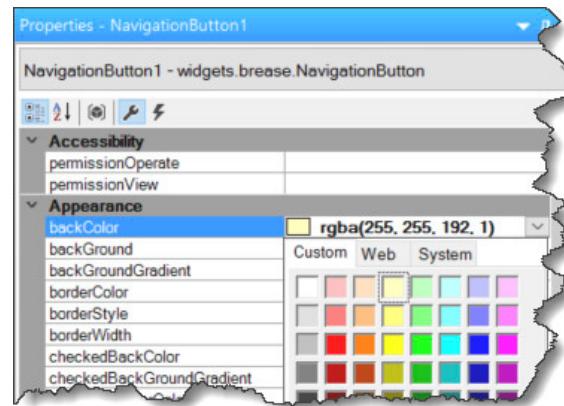


Figure 31: Excerpt styleable property `backColor` in the Properties window

Exercise: Apply styling to the "NavigationButtons" widgets for ServicePage and AlarmPage

Repeat the same procedure for the "NavigationButton" widgets for "ServicePage" and "AlarmPage".

Use the color value for light green (`rgba(192, 255, 192, 1)`).

Expected result

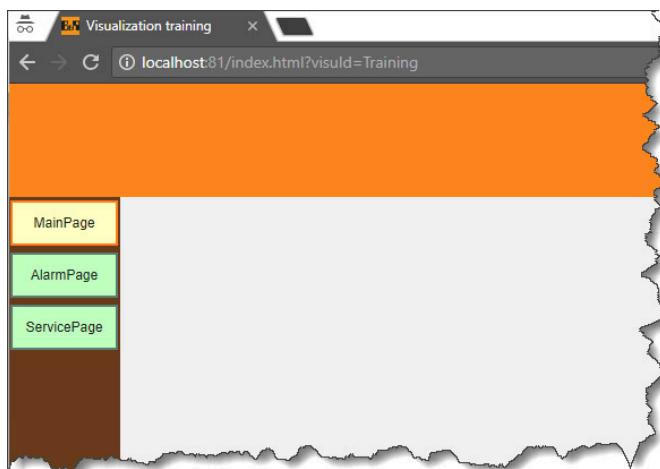


Figure 32: HMI application in the browser with changed "backColor" for the navigation buttons

In this HMI application, there were only 3 "NavigationButton" widgets whose appearance was changed. In real HMI applications, you have to think that there can be an enormous number of widgets whose appearance needs to be adjusted. If you were to do this using the styleable properties of each widget instance, the work needed to do so – as well as the probability of error – would be unreasonably high.

To change the appearance of a larger number of widget instances, the use of styles is a better option.

Visual appearance - Styling

4.2.2 B&R theme and styles

B&R provides a theme that makes it possible to quickly and easily give an appealing appearance to an HMI application. This theme contains predefined custom styles for all widget types that can be used by specifying the style name.

The goal of this exercise is to use the provided BuRTheme packages and included styles for new "Button" and "NavigationButton" widgets for manual and automatic navigation.

The following section explains how to create styles and themes in more detail.

Adding the B&R theme

The first step is to add theme "B&RThemeFlat1" from the Object Catalog to the Logical View under package "Resources / Themes".

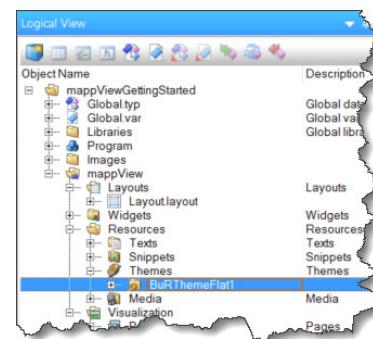


Figure 33: B&R theme package in the Logical View



HMI application / mapp View / Engineering / Themes and styles / Adding a theme

Adding the button widgets

Two "Button" widgets are added to content "Content MainPage", one to the left and one to the right.

Predefined style "Command1" should be assigned to the left "Button", while predefined style "Operate1" should be assigned to the right "Button".

Exercise: Add two "Button" widgets to Content MainPage

Add two "Button" widgets to "Content MainPage", one to the left and one to the right.

The content editor is displayed with a white background by default. If widgets that are predominantly white are added, an editor background can be set via the designer settings. This is opened in the content editor toolbar.

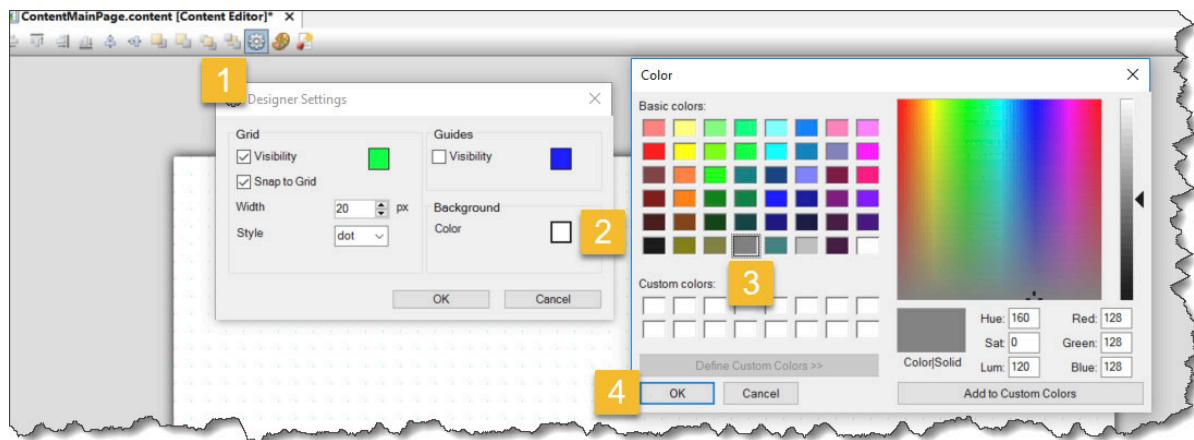


Figure 34: Adjusting the background color in the content editor

Selecting a theme that has been added in the Logical View is done via the drop-down box for theme selection.

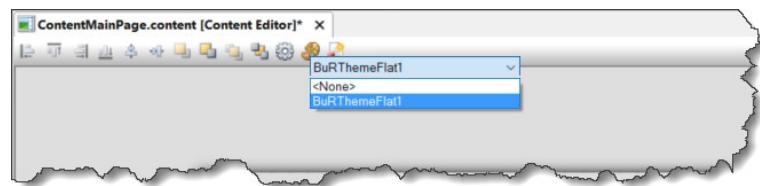


Figure 35: Selecting a theme in the content editor

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Assign a style to the button widgets

The predefined styles in the B&R theme can be assigned to the "Button" widgets in the Properties window.

After selecting the respective "Button" widget, style "Command1" can be assigned to the left button and style "Operate1" to the right button.

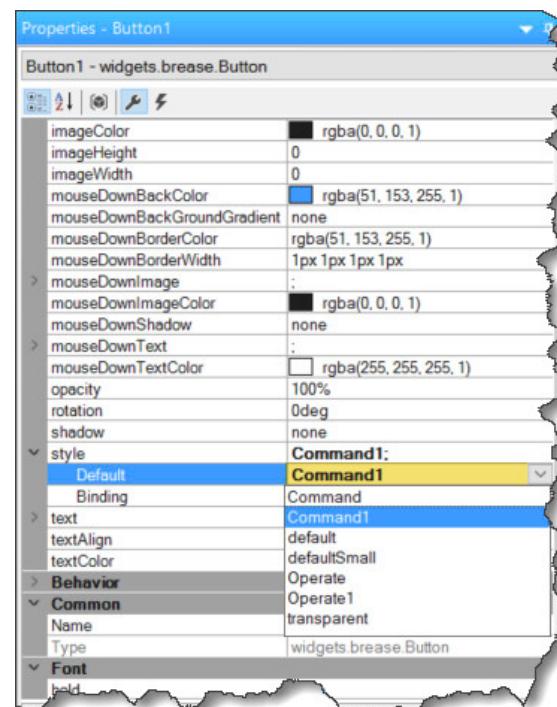


Figure 36: Selecting a style in the Properties window

Exercise: Assign a style to the button widgets

Assign style "Command1" to the left button and style "Operate1" to the right button.

Expected result:

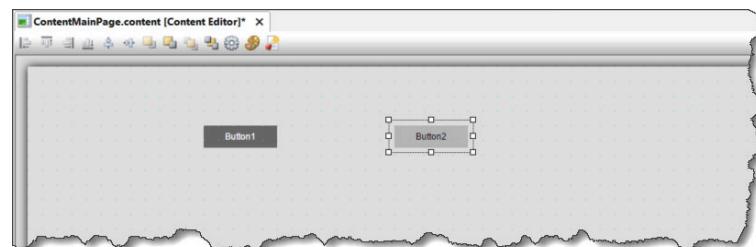


Figure 37: Assigned styles in the visual editor

Default style

Each widget has a default style that is used automatically whenever a style called "default" is included in a theme.

Since a default style is defined in the B&R theme package for each widget, it will be used automatically for each widget instance as long as the user does not change the style property. This way, a style does not have to be assigned to the "NavigationView" widgets for manual and automatic navigation. The appearance of the navigation buttons styled in section "Styleable property" changes automatically when the B&R theme is added.

Entering the B&R theme in the .vis file

In order for the B&R theme to be used in the HMI application, it must be referenced in the .vis file in the Configuration View.

```
<StartTheme themeRefId="BuRThemeFlat1" />
<Themes>
    <Theme refId="BuRThemeFlat1"/>
</Themes>
```

Expected result

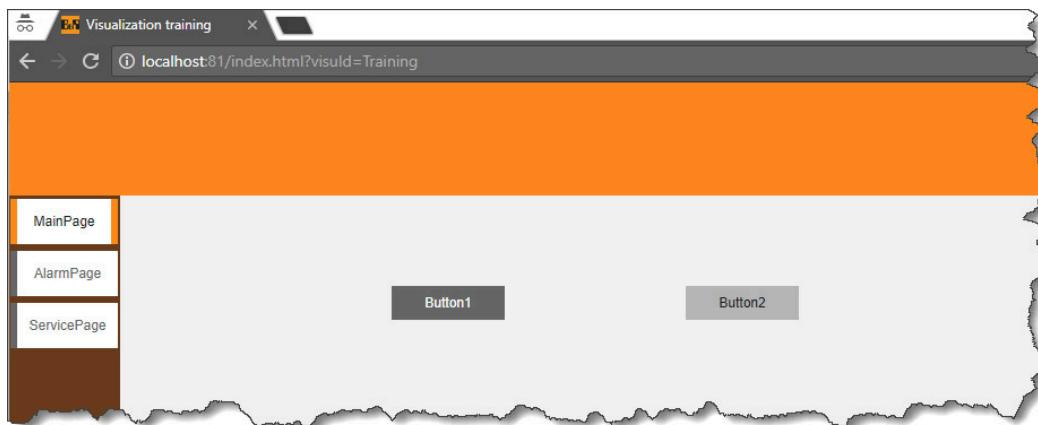


Figure 38: HMI application in the browser with B&R theme

4.2.3 Changing the default style

In this section, the default style of the "SystemNavButton" widget is adjusted so that the text is correctly displayed in the width of the widget.

Exercise: Change the default style for the "SystemNavButton" widget

The goal of this exercise is to change the default style of the "SystemNavButton" widget for automatic navigation in the B&R theme so that the text in the "SystemNavButton" widget has sufficient space.

The procedure looks like this:

- 1) Open the B&R theme from the Logical View
- 2) Open the styles file Default.styles
- 3) Search for the entry `<Style id="default" xsi:type="widgets.brease.SystemNavButton" ...>`
- 4) Copy the properties of the "NavigationButton" widget.
- 5) Add styleable property `padding="0px 5px"`
- 6) Compile/Transfer the project and display the HMI application

Visual appearance - Styling

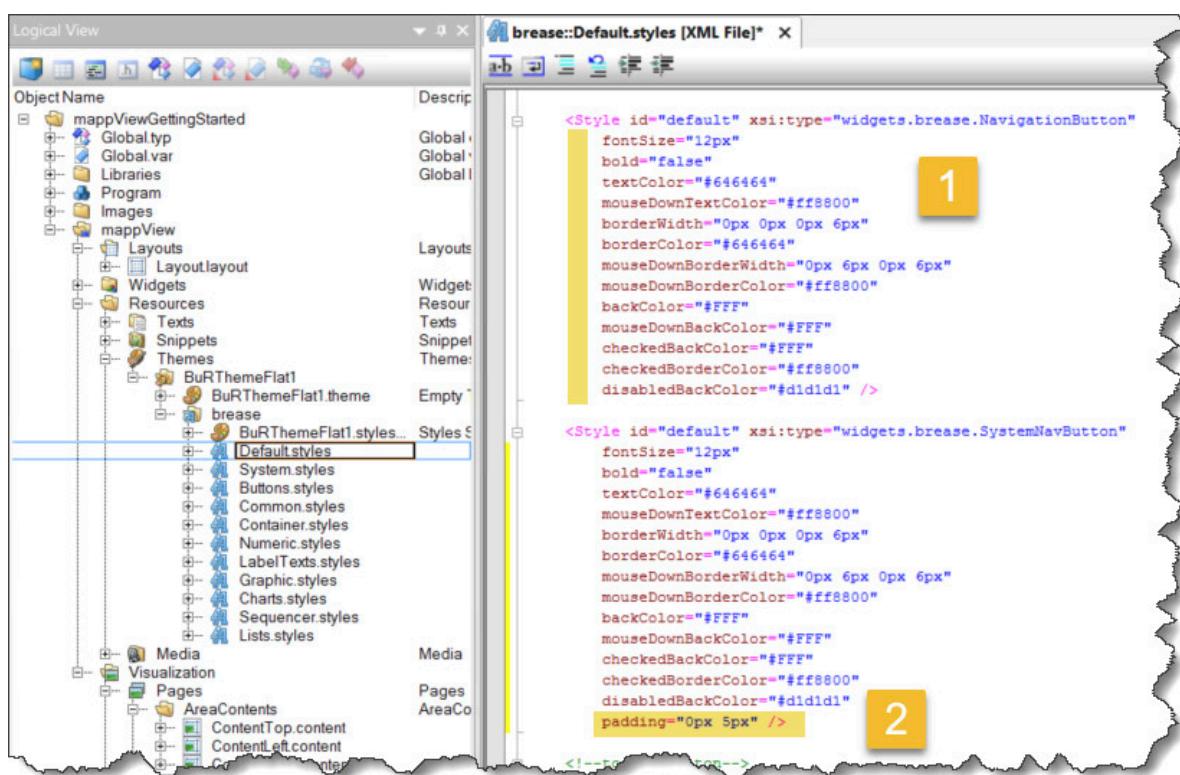


Figure 39: Adjust the default style for the "SystemNavButton" widget

Expected result

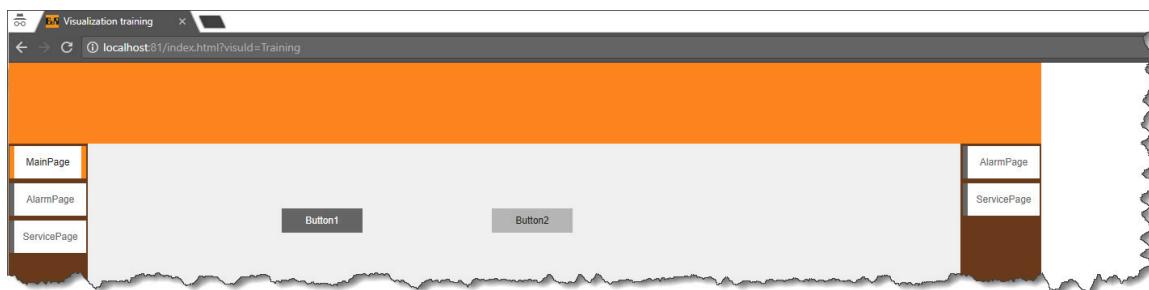


Figure 40: NavigationButton with changed default style

5 Data binding

5.1 Data binding overview

5.1.1 OPC UA

OPC Unified Architecture (OPC UA) is a standard for interoperability that ensures secure and reliable data exchange in industrial automation and other industries. OPC UA is platform-independent and can be used to seamlessly exchange data between devices from different vendors.

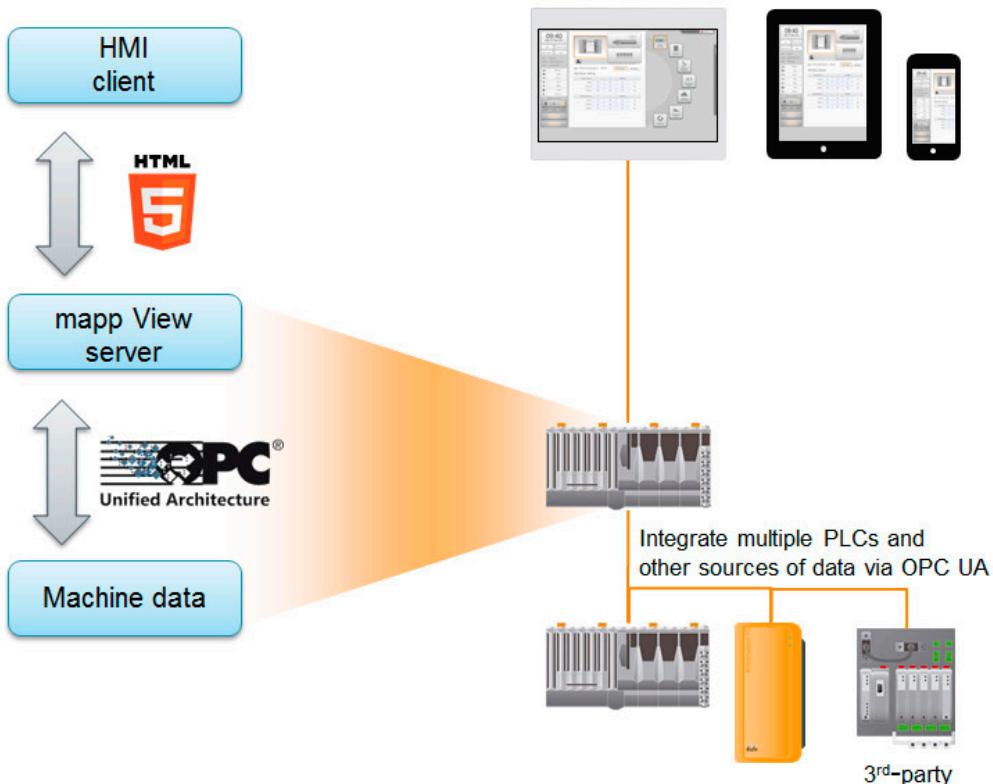


Figure 41: OPC UA architecture

OPC UA node

If a process variable from an automation application is made available via the OPC UA system, it can be read or written from OPC UA clients as an OPC UA node. Properties such as engineering unit or EU range can be added to an OPC UA node.

Engineering unit

The engineering unit for an OPC UA node specifies the physical unit to be used when interpreting the value. Automation Studio provides 1,400 engineering units for seven physical quantities: length, mass, time, current, temperature, material amount and luminosity as well as derived physical quantities (e.g. speed, force, pressure, acceleration).

EU range

The EU range (engineering unit range) determines the valid range of values for an OPC UA node. The EU range is defined by a lower and upper limit value.

Data binding

OPC UA default view

The OPC UA default view contains all process variables in an automation application that are made available by the OPC UA server on the B&R controller to the OPC UA clients.

5.1.2 Binding

An HMI application facilitates interactions between people and a machine. The HMI application must be able to display data from the automation application (current sensor values, current machine states, etc.).

It must also be possible for machine operators to intervene in the automation application (to deploy a new setpoint, for example). For these reasons, elements of an HMI application (e.g. widget instances) must be connected with elements from the automation application in order for data to be exchanged between the HMI application and automation application.

In mapp View, this connection is implemented using what is known as binding (data binding). The binding in a mapp View HMI application defines which data sources (OPC UA nodes in an automation application) are connected to which HMI elements (e.g. widget instances), the type of binding as well as the binding mode (how the data is exchanged).

mapp View differentiates between the following types of bindings:

- "Value binding" for binding single values
- "Node binding" for binding OPC UA nodes with a unit and limits
- "Array binding" for binding arrays
- "List binding" for selecting variables from a list

Only binding types "value binding" and "node binding" will be included in this seminar. All other types are included in the mapp View advanced seminars.

Binding modes

Specifying the binding mode defines the direction in which data should flow.

Binding mode "oneWay" (Read only)

The "oneWay" binding mode is used for read access to the source.

Example: Binding between an OPC UA node and an output widget (e.g. NumericOutput widget)

Binding mode "twoWay" (Read / Write)

The "twoWay" binding mode is used for read and write access to the source.

Example: Binding between an OPC UA node and an input widget (e.g. NumericInput widget)

Binding mode "oneWayToSource" (Init Read / Write)

The "oneWayToSource" binding mode is only used for write access to the source.

Example: Binding between an OPC UA node and a PushButton widget.

5.2 Using data binding

The goal of the next exercises is to display the values of process variables from the automation application in the HMI application using various types of binding and binding modes.

5.2.1 Displaying data in the HMI application

The goal of this exercise is to display the value of the "Current temperature" OPC UA node in the HMI application.

Exercise: Display the CurrentTemperature variable value using the NumericOutput widget

In order to achieve this goal, a "NumericOutput" widget and "Read only" binding mode are used to display the value.

The following steps must be carried out here:

- 1) Program and variables
- 2) Enable OPC UA server
- 3) Add OPC UA default view and enable the OPC UA node
- 4) Add binding file from the Object Catalog
- 5) Add NumericOutput widget and assign the OPC UA node
- 6) Define BindingSet ID and .enter it in the .vis file
- 7) Compile the project, transfer it and display it in the HMI application

Program and variables

The program and the required global variable (CurrentTemperature) for displaying the value in the "NumericOutput" widget already exist.

It is not necessary to create other programs or additional variables.

Name	Type
SetTemperature	INT
CurrentTemperature	INT

```

st Program::Main.st [Structured Text] x
PROGRAM _INIT
    SetTemperature := 35;
END_PROGRAM

PROGRAM _CYCLIC
    (*
        Using function block MTBasicsPT1() to
        implement a 1st order delay element (PT1).
    *)
    MTBasicsPT1_0.Enable := 1;
    MTBasicsPT1_0.Gain := 1;
    MTBasicsPT1_0.TimeConstant := 1;
    MTBasicsPT1_0.In := INT_TO_REAL(SetTemperature);

    MTBasicsPT1_0();

    CurrentTemperature := REAL_TO_INT(MTBasicsPT1_0.Out);
END_PROGRAM

```

Figure 42: Global variable CurrentTemperature

Data binding

Enable OPC UA server

For communication to take place between the automation application and the HMI application, the OPC UA server must be enabled.

The OPC UA server is enabled in the CPU configuration in the Physical View under the OPC UA system node.

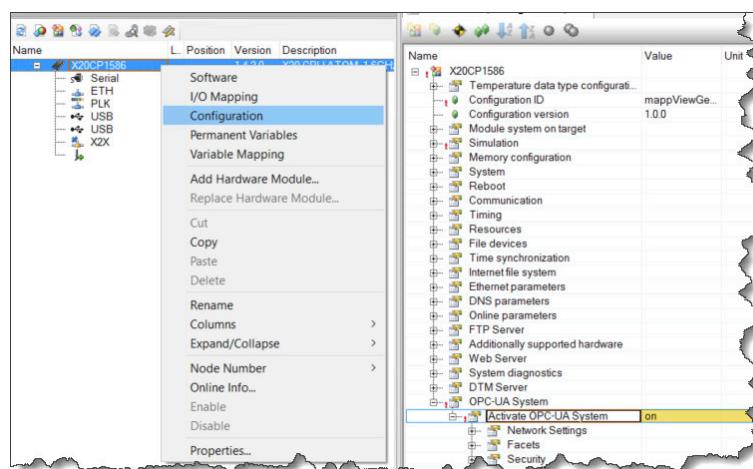


Figure 43: Enable OPC UA server



Communication / OPC UA / Configuration in AS / Activate OPC UA system

Add OPC UA default view and enable the OPC UA node

In order to use process variables that have been created, they must be declared as an OPC UA node. To do this, the OPC UA default view must be added in the Configuration View under the "Connectivity/OpcUA" node from the Object Catalog via drag-and-drop.

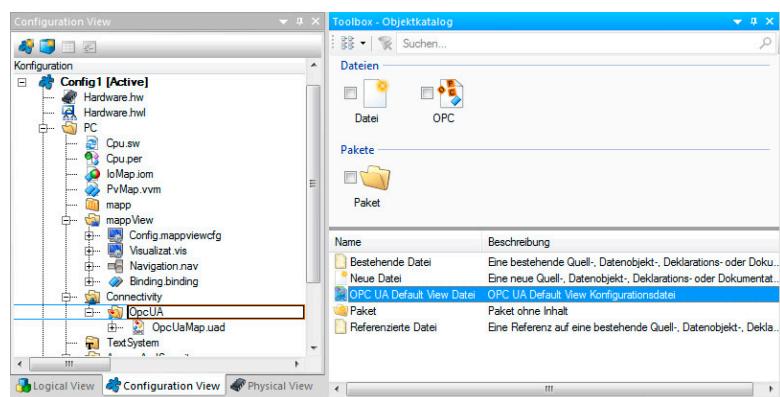


Figure 44: Add OPC UA default view from the Object Catalog



Communication / OPC UA / Configuration in AS / OPC UA default view configuration / OPC UA default view editor

The global process variable can then be enabled as an OPC UA node.

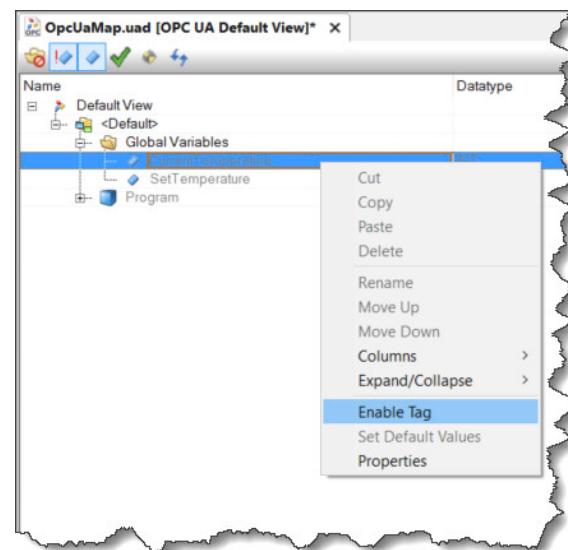


Figure 45: Enable the global process variable in the OPC UA default view

Add the binding file from the Object Catalog and specify the ID

All bindings created using the "Select Variable dialog box" are automatically entered in a binding file by the system.

By selecting the mapp View node, a binding file can be added from the Object Catalog.

For the system to know the binding file where the binding has to be entered, a unique "ID" must be defined for the binding file.

"MainContent_binding" should be entered as the unique "ID"

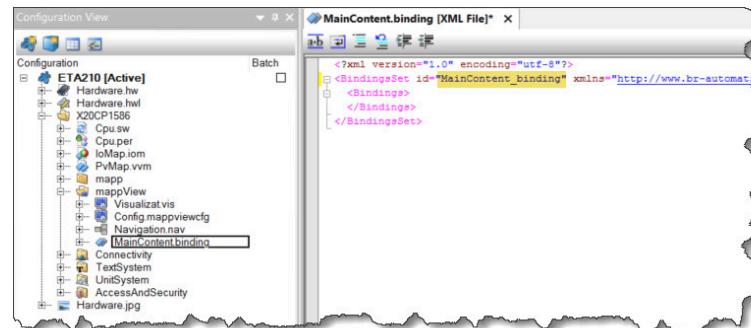


Figure 46: Added binding file and assigned ID



It is recommended to create a separate binding or event binding file for each piece of content. The binding can then be saved to the corresponding file in the variable selection dialog box when configuring a widget on a piece of content.

This way, associated components can be managed together when using version control systems.

Data binding

Add NumericOutput widget and assign the OPC UA node

In order for the value of the OPC UA node to be displayed in the HMI application, a "NumericOutput" widget must be added to the " MainPage" content.

Value binding is used if only the numeric value is needed without units or limits. Data forwarding only involves the value of the bound variable.

Double-clicking on "ContentMainPage" opens the visual editor and a "NumericOutput" widget from the Object Catalog can be placed.

By selecting the "NumericOutput" widget, the "Select Variable dialog box" can be opened in the Properties window under "Data/Value/Binding". The OPC UA node is then selected in the dialog box.

Since this is a "NumericOutput" widget, "Read-only" binding mode is used. "MainContent_binding" is selected as binding set because the bindings that have been created will be saved here.

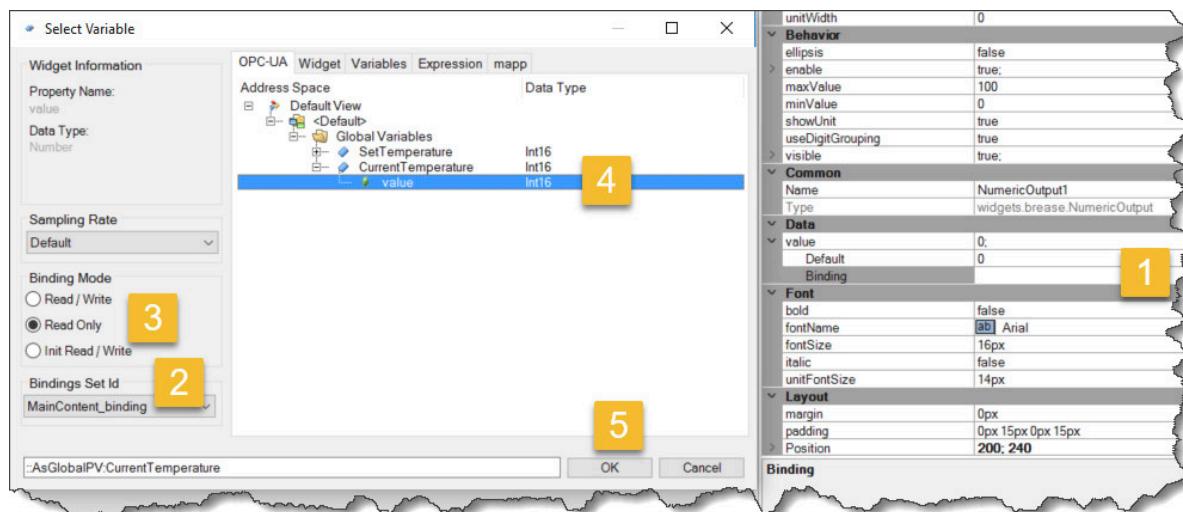


Figure 47: Open the binding dialog box and select the properties

Reference the binding file in the .vis file

For the binding file that has been created to also be taken into account, the unique "ID" for the file ("MainContent_binding") must now be entered in the .vis file.

Under <BindingSets>, the BindingSet section can be commented out and the unique "ID" ("MainContent_binding") can be entered.

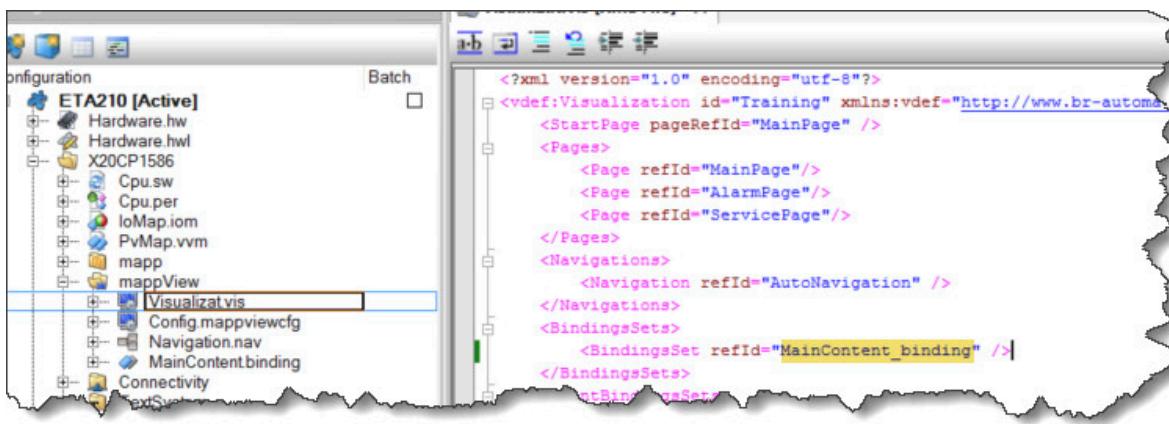


Figure 48: Reference the binding file in the .vis file.

Expected result:

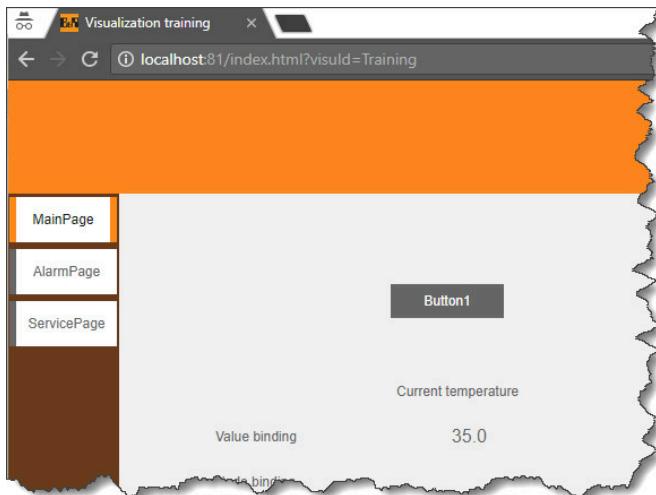


Figure 49: HMI application displayed in the browser with value shown the NumericOutput widget

5.2.2 Setpoint entry

The goal of this exercise is to change the setpoint of the OPC UA node (SetTemperature) when a user makes an entry in the HMI application.

Exercise: Change setpoint using a NumericInput widget

To achieve this goal, a "NumericInput" widget will be placed in the "MainPage" content and connected to the corresponding OPC UA node in the automation application via binding. In order for the value changed in the HMI application to be written, TwoWay ("Read / Write") binding mode will be selected.

The following steps must be carried out here:

- 1) Go to program and process variable
- 2) Enable the variable as an OPC UA node

Data binding

- 3) Add NumericInput widget and assign the OPC UA node
- 4) Compile the project, transfer it and display it in the HMI application

Program and variables

The program and the required global variables (CurrentTemperature and SetTemperature) for displaying the value in the "NumericOutput" widget already exist.

It is not necessary to create other programs or additional variables.

The screenshot shows two windows side-by-side. On the left is a 'Program:Main.st [Structured Text]' window containing the following code:

```
PROGRAM _INIT
    SetTemperature := 35;
END_PROGRAM

PROGRAM _CYCLIC
    (*
        Using function block MTBasicsPT1() to
        implement a 1st order delay element (PT1).
    *)
    MTBasicsPT1_0.Enable := 1;
    MTBasicsPT1_0.Gain := 1;
    MTBasicsPT1_0.TimeConstant := 1;
    MTBasicsPT1_0.In := INT_TO_REAL(SetTemperature);

    MTBasicsPT1_0();

    CurrentTemperature := REAL_TO_INT(MTBasicsPT1_0.Out);
END_PROGRAM
```

On the right is a 'Global.var [Variable Declaration]' window showing two global variables:

Name	Type
SetTemperature	INT
CurrentTemperature	INT

Figure 50: Global variables CurrentTemperature and SetTemperature)

Exercise: Enable the process variable as an OPC UA node

Since the OPC UA server has already been enabled and the OPC UA default view can only be added once, the variable (SetTemperature) can be enabled right away in the OPC UA default view.

- 1) Enable the variable as an OPC UA node

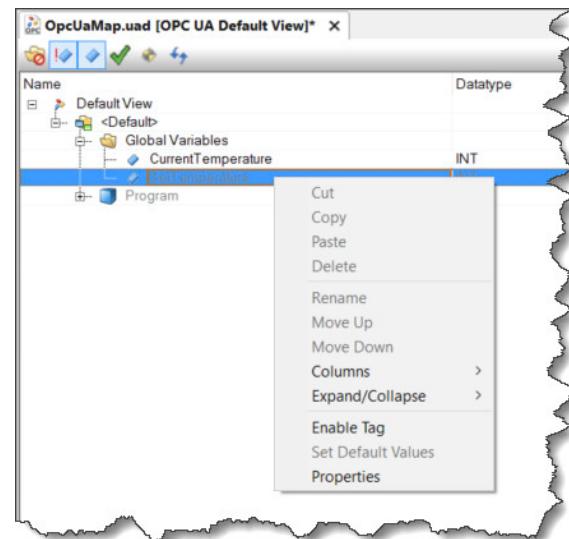


Figure 51: Enable the SetTemperature process variable in the OPC UA default view

Add NumericInput and assign the variable

Since the bindings for the active content are stored in the same file, another binding file does not have to be created.

Therefore a "NumericInput" widget can now be added to "Content MainPage".

Since it is necessary to interact with the "NumericInput" widget and the value of the OPC UA node should be configurable by the user, "Read / Write" must be selected as binding mode. This makes it possible for the operator to change the value.

Exercise: Add and configure the NumericInput widget

- 1) Add the NumericInput widget to Content MainPage
- 2) Assign NumericInput to the SetTemperature OPC UA node
- 3) Select "MainContent_binding" as the binding set ID
- 4) Use Read / Write as binding mode

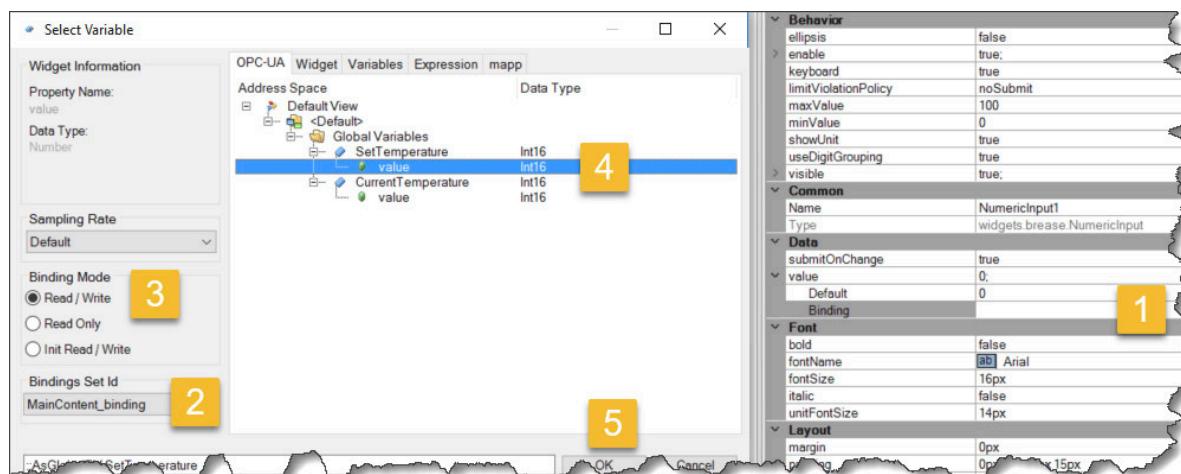


Figure 52: In the binding dialog box, connect the numeric input with the SetTemperature OPC UA node

Data binding

Expected result

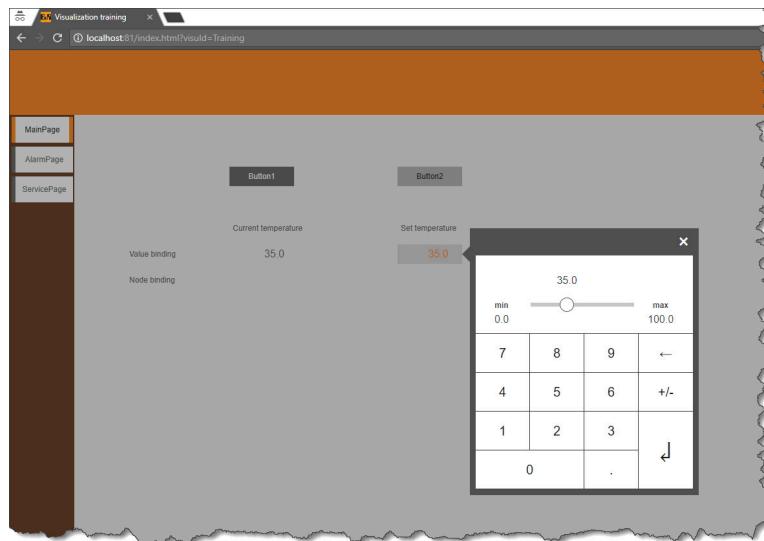


Figure 53: Display the HMI application in the browser with the selected NumericInput widget

5.2.3 Specify the value range

Up to now, the temperature setpoint (SetTemperature) can be set to any value. This is not always useful. To prevent the user from entering arbitrary or impermissible values, the EU range (low/high limit values) for an OPC UA node can be defined. Defining the EU range therefore makes it impossible for the user to enter impermissible values.

Exercise: Limit the value range of the numeric input

The goal of this exercise is to prevent the user from entering an impermissible value.

In order to achieve this goal, limits will be assigned to the OPC UA node.

The following steps must be carried out:

- 1) Define low/high values for the OPC UA node "SetTemperature"
- 2) Add the "NumericInput" widget
- 3) Configuring a node binding
- 4) Compile the project, transfer it and display it in the HMI application

Define low/high values for the OPC UA node

Double-click on the OPC UA default view and select the OPC UA node (SetTemperature) to update the Properties window.

Then the low and high value for the node can be set under the "EU range" node.

EU range	Value
Low	25
High	50

Table 9: EU range properties for the SetTemperature OPC UA node

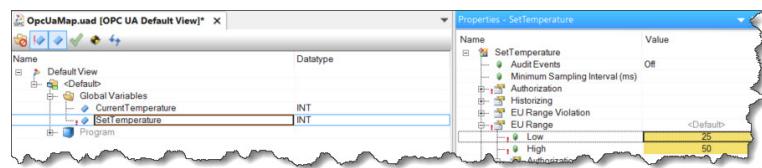


Figure 54: Define the EU range for the SetTemperature OPC UA node



Communication / OPC UA / Configuration in AS / OPC UA default view configuration / OPC UA default view editor / Properties of OPC UA tags / Range of values / Role-based range of values

Change the binding to NodeBinding

To ensure that the EU range for the OPC UA nodes will be taken into account, binding must be changed from value binding to node binding.

Node binding is configured by selecting the entire OPC UA node ("SetTemperature").

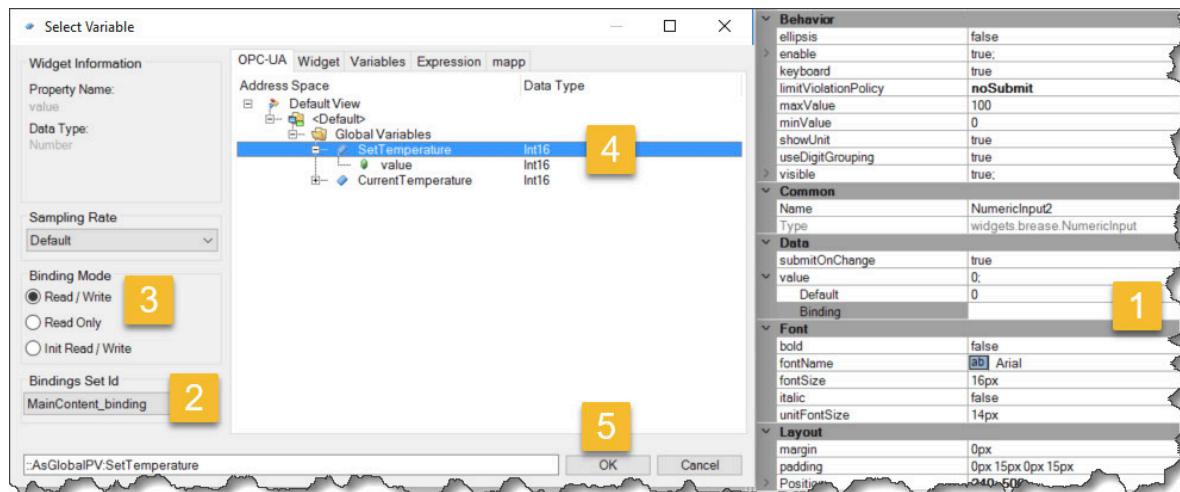


Figure 55: Assign NumericInput to the SetTemperature OPC UA node

For the operator, it is now no longer possible to enter a value larger or smaller than what is defined in the EU range.

Data binding

Expected result

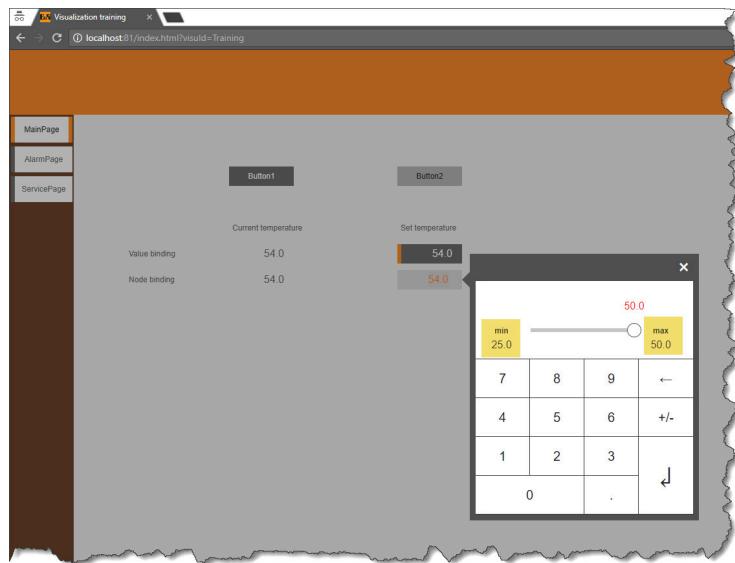


Figure 56: Display the HMI application in the browser with defined EU range for SetTemperature OPC UA node

6 Media files

6.1 Overview – Media files

Media files can be added to mapp View in order to improve the appearance of an HMI application.

6.2 Adding media files

6.2.1 Inserting an image

The Media package is automatically made available in new mapp View projects and is used to logically manage additional files such as images used in the HMI application. It can be structured using packages.

All common image formats such as .png, .jpg, .svg, etc. can be used.

All files in this folder will be transferred to the target system.

The path to reference images always begins with the "Media" package followed by the filename of the image or the sub-package and then the filename of the image.

Example for the image "Test.png", which is stored directly in the Media package:

URL= "Media/Test.png"

Example for the image "Test.png", which is stored in the "SmallPictures" sub-package in the Media folder:

URL= "Media/SmallPictures/Test.png"



HMI application / mapp View / Engineering / HMI organization / Logical View / mapp View media package

Exercise: Add image

The goal of this exercise is to display a company logo on every page.

The company logo should be added in the lower right corner of "ContentRight" using the "Image" widget.

The following steps are necessary for this:

- 1) Save the image in the Media folder
- 2) Add the image widget and place it as needed
- 3) Configure the image in the widget
- 4) Compile the project, transfer it and display it in the HMI application

Media files

Save the image in the Media folder

Using drag-and-drop, images can be easily added to the Media package in the Logical View. In the prepared project, the B&R logo is already saved in the Images package outside of the mapp View package and therefore only needs to be moved to the mapp View Media package.

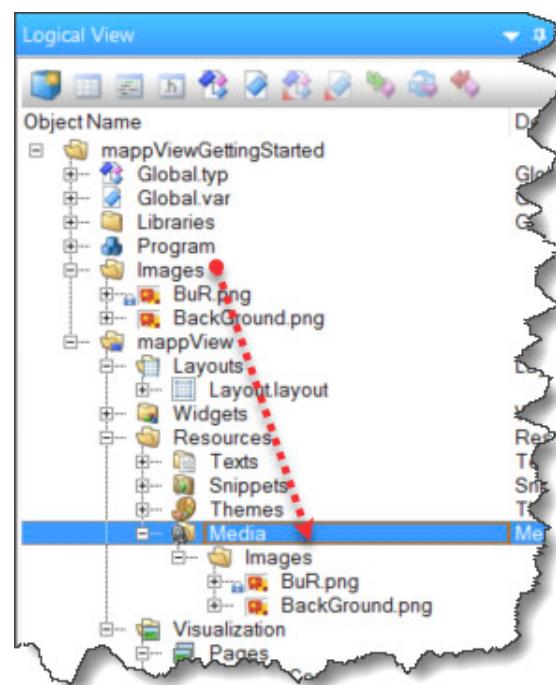


Figure 57: Save the images in Media package

Add, place and configure the Image widget

After selecting the content, an Image widget from the Object Catalog can be added.

Then the size and position of the widget is defined in the Properties window.

The following values can be set for the widget under "Layout/..":

Name	value (px)
Position "top"	640
Position "left"	0
Size "width"	100
Size "height"	60

Table 10: Image widget properties

Configure the image in the widget

To reference the B&R logo that has already been added in the widget, the location and the name of the image must be specified in the selection dialog box under "Appearance/image".

Since the image is stored directly in the "Media" package and is named "BuR.png", the path is as follows:
"Media/Images/BuR.png"

Since the size of the "Image" has already been adjusted and the default property setting is "sizeMode"="contain", the "Image" widget is completely filled by the image.

Descriptions of additional "sizeMode" properties can be found in the help documentation for the widget.

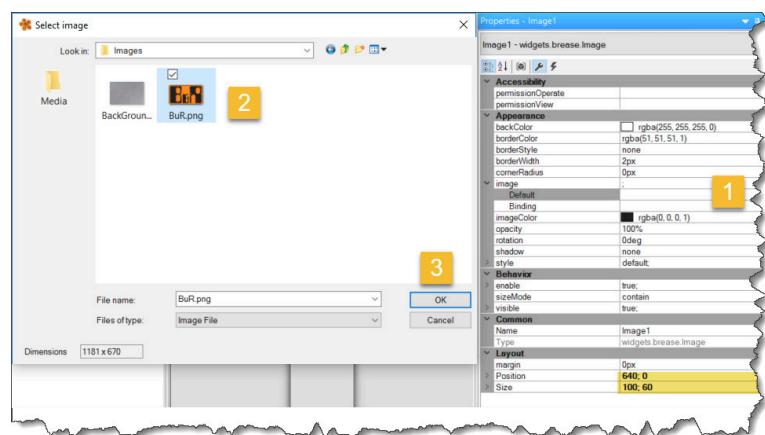


Figure 58: Image widget properties

? HMI application / mapp View / Widgets

Expected result:

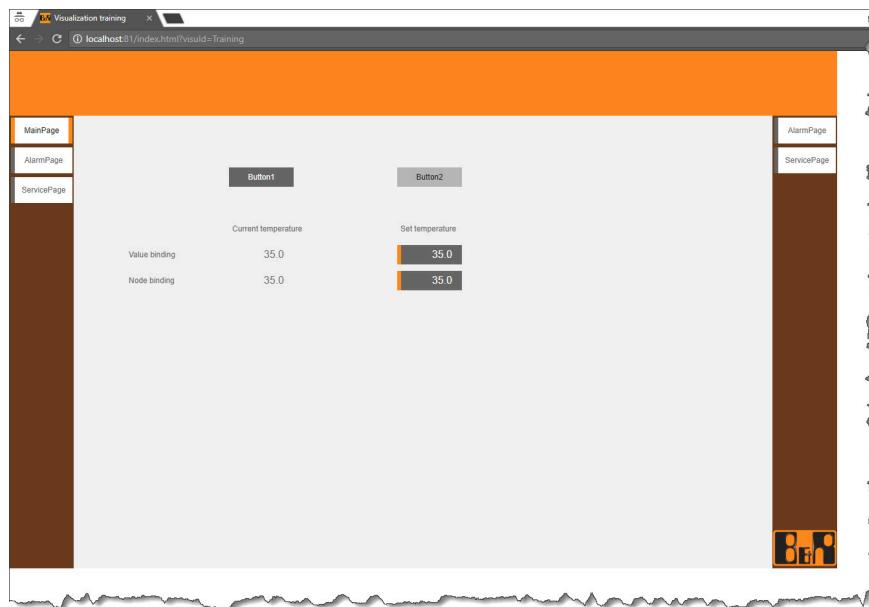


Figure 59: Displaying the HMI application in the browser with a B&R logo added

6.2.2 SVG icon library

mapp View provides an extensive SVG icon library for unrestricted use in a mapp View HMI application.

Exercise: Add a icon library

The SVG icon library is used to prepare for subsequent exercises in this training manual. This is added to the "Media" package from the Object Catalog.

The following steps must be carried out:

- 1) Select "Media" package
- 2) Add icon library from the Object Catalog

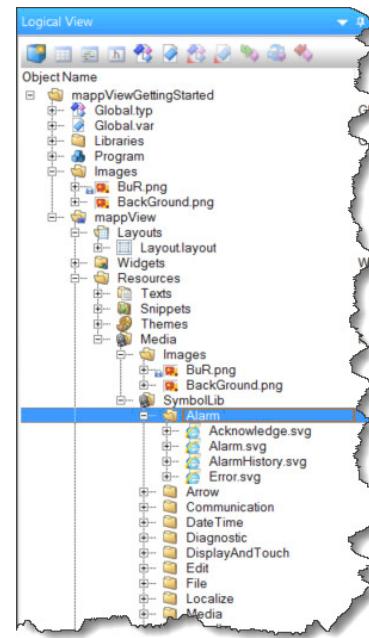


Figure 60: SVG icon library added in the mapp View project



This is a good time to start up the HMI application on a terminal. This is done, for example, by adding a Power Panel T50 to the hardware configuration. Next, the configuration is transferred to the terminal using a USB flash drive. Now the HMI application can be operated directly on the terminal.

See

- ["Putting the mapp View client into operation on a T50" on page 85](#)

7 User role system

The automation software provides a user role system which is used by mapp View. This system implements role-based access control (RBAC) as defined in ANSI standard 359-2004.

7.1 Overview – User role system

Role-based access control deals with users, roles and rights. Rights are assigned to roles and roles are associated with users. Users can have several roles at once. Users are not assigned rights directly because this has proven to be complex and error-prone in practical situations.

In the system, a user is a "real" person, who is identified by first and last name, etc. A user also incorporates information used for authentication in the system. With this authentication, a "real" person can prove to the system that they are who they claim to be. The most commonly used authentication method consists of a unique identification of the user (User ID) and a secret password that only the "real" person and the system know.

A role describes how a user interacts with a system to carry out specific tasks. Examples of roles can be: administrator, service engineer, machine operator. Different permissions are normally required to complete various tasks, and rights and role are assigned to handle this. If a "real" person's duties change, it is only necessary to change corresponding user to the new roles for this person to have the rights needed to complete the new tasks.

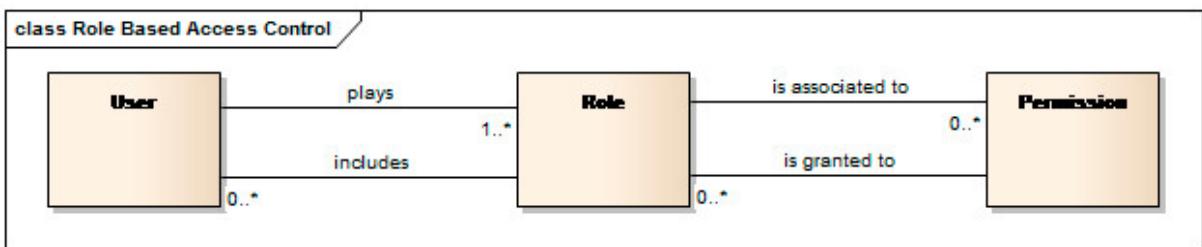


Figure 61: Correlations within the user role system



Programming / Access & Security / User role system / General

User role system

7.2 Using the user role system

7.2.1 Limiting write access to OPC UA nodes

One right that can be assigned to roles is the right to change the value of a process variable in the automation application (write access). In this case, the right to change the process variable must be assigned to a role. This is done in the OPC UA configuration.

For a user to be able to change the value of an OPC UA node, the user must be assigned to a role that has write access. Only users assigned to a role with write access are permitted to change values.

Exercise: Limit write access for users

The goal of this exercise is to prevent write access to setpoint SetTemperature for non-authorized users. The conditions for this will be created using the user role system. It is also possible to add authentication to the HMI application.

The following steps are necessary for this:

- 1) Add "Operator" role and "Service" role
- 2) Add a new user and assign a role
- 3) Define write access in the OPC UA default view
- 4) Place the Login, LogoutButton and LoginInfo widgets
- 5) Compile the project, transfer it and display it in the HMI application

Add a new role



Programming / Access & Security / User role system / Configuration / Configuration in Automation Studio / Editing roles in the user role system

Add "Operator" role and "Service" role

In Automation Studio, the roles "Administrators" and "Everyone" already exist in each new project. Add "Operator" and "Service" roles to the existing roles. Double-clicking on the Role.role file in the Configuration View opens the editor where the roles are managed.

Then add two new roles and rename them to "Operator" and "Service". The assigned "IDs" remain unchanged.

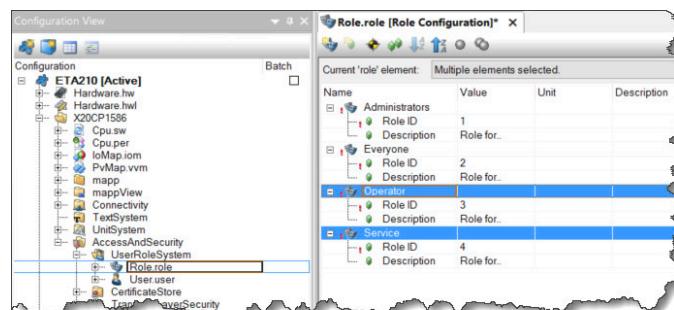


Figure 62: Add "Operator" and "Service" roles

Add a new user and assign a role

In Automation Studio, the user "Anonymous" already exists in each new project.

After the new roles have been created, two new users can be created and assigned roles.

Double-clicking on the User.user file opens the editor where the users are managed.

Then create users "John" and "Dave".

The user "John" is assigned the "Operator" role and the user "Dave" is assigned the "Service" role. The respective name is used as the password.

Username	Password	Role
John	John	Operator
Dave	Dave	Service

Table 11: Overview of users and assigned roles

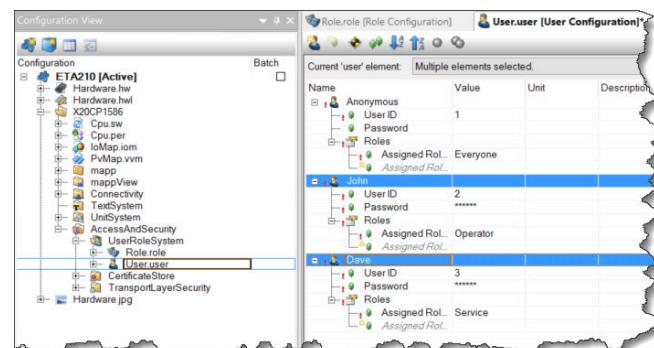


Figure 63: Add and configure users "John" and "Dave"



Programming / Access & Security / User role system / Configuration / Configuration in Automation Studio / Editing users in the user role system

Define write access in the OPC UA default view

After the user has been created and roles have been assigned, the rights for the roles are defined in the OPC UA default view.

Selecting the "Default View" node sets the default permissions, from which all permissions for the underlying variables are derived.

The permissions for each role can be defined by adding the various roles.

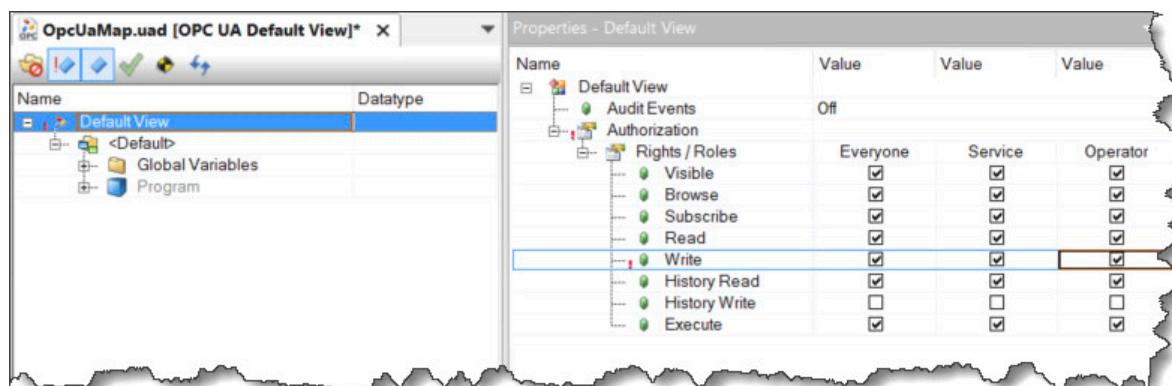


Figure 64: Define write access for roles in the OPC UA default view

User role system



Before assigning write access rights, it is necessary to check if OPC UA write access rights are to be restricted to only a few OPC UA variables or most of them. Otherwise write access can also be restricted to the OPC UA variables themselves.

In this documentation, write access is restricted only to OPC UA variable "SetTemperature". I.e. Node "Default View" is where write access is enabled for each role.

To ensure that write access to OPC UA nodes is only given to users assigned the "Service" role, "Write" is only set for the "Service" role.

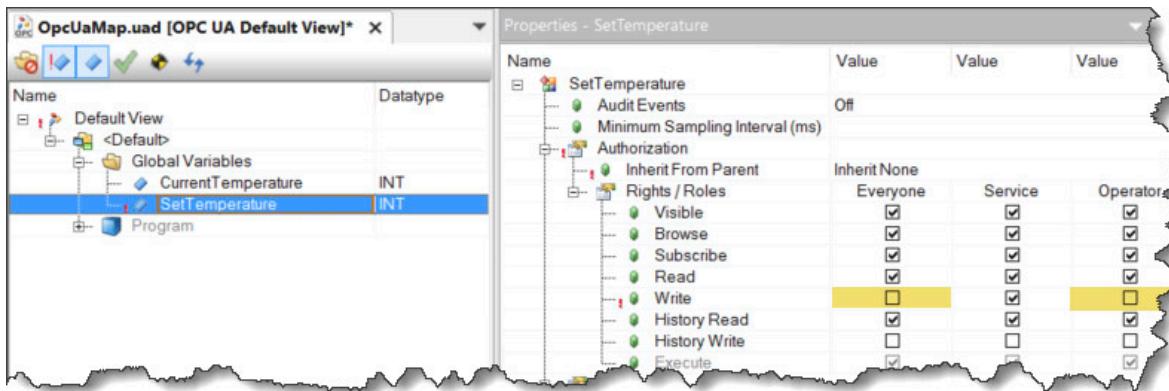


Figure 65: Write access rights for OPC UA variable "SetTemperature" is only for the Service role.



If a user is not authenticated, the system assumes that user "Anonymous" is interacting with it. The rights given to all roles assigned to user "Anonymous" are valid during non-authenticated use of the system. By default, user "Anonymous" is assigned role "Everyone".

Place the Login, LogoutButton and LoginInfo widgets

For the permissions set for each user to take effect, the user needs to be authenticated on the system. There are widgets available to log in and log out as well as to display detailed login information.

- **Login widget**
The "Login" widget can be placed on the content of the service page from the Widget Catalog using drag-and-drop.
- **LoginInfo widget**
In order to see which user is currently logged in, the "LoginInfo" widget should be placed in "ContentTop".
- **LogoutButton widget**
In order for the user to be able to log out again, a logout button should be placed in "ContentTop".
- **Label and Image widget**
In order to make the HMI application clearer and better looking, an Image widget with a user icon and a Label widget with the text "Logged in as:" will be placed in "ContentTop". The image of the user icon is already contained in the "Media" folder in the SVG icon library with "Media\SymbolLib\User\User.svg".



If a logged in user is logged out using the LogoutButton, the rights assigned to user "Anonymous" are once again valid.

Set property "Layout.Padding/padding" to 0px.

Widget	Content	Top	Left	Width	Height
Login widget	Service page	40	50	300	160
Login info	Content Top	15	1030	230	30
Logout Button	Content Top	50	1030	100	30
Label	Content Top	15	880	140	30
image	Content Top	11	830	30	38

Table 12: Widgets, content and properties for login information

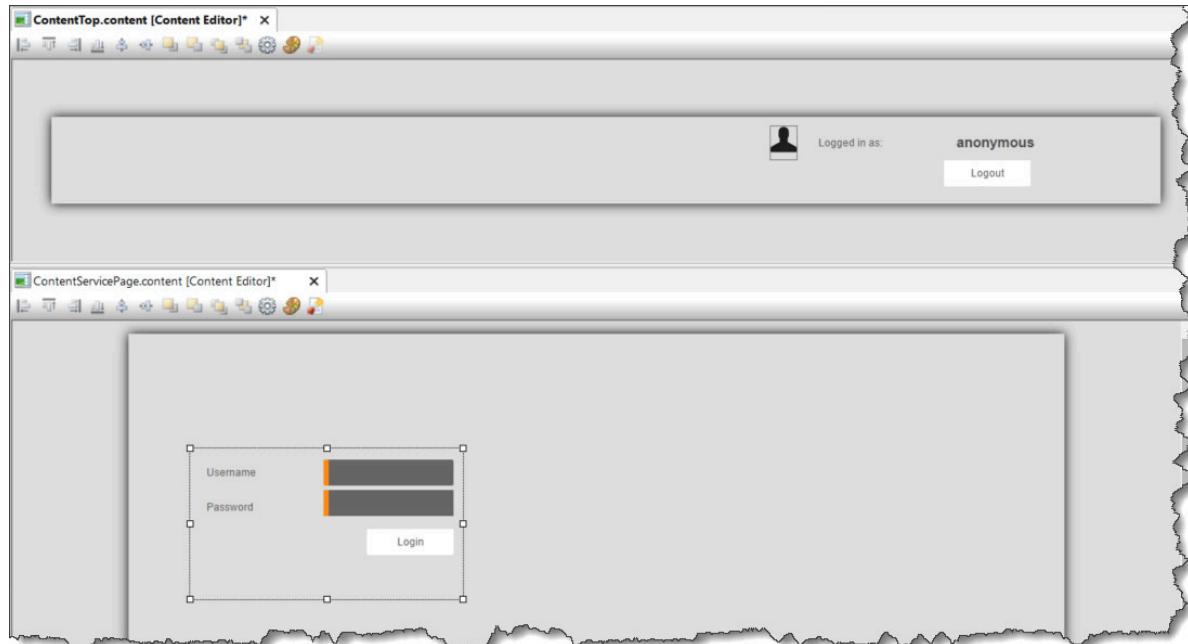


Figure 66: Login, Logout, Label and Image widgets placed on ContentServicePage and ContentTop



If property "Layout.padding/padding" is set to 0px, the distance between the text and the frame of the widget changes.

User role system

Expected result



Figure 67: HMI application with Login widgets

After logging in as the user "Dave", entries can be made in the NumericInput widget on the MainPage. For all other users, input is automatically deactivated due to the lack of write access on the OPC UA node.

7.2.2 Limit the range of values

EU range OPC UA node

OPC UA nodes make it possible to limit the range of values (EU range) when making entries. Using the user role system, the EU range can be defined individually for the various roles.

Exercise: Extend range of values for the "Service" role

The goal of this exercise is to extend the EU range of the OPC UA node for the existing "Service" role. To achieve this goal, a new role and a new user must be created and the EU range of the OPC UA nodes must be defined.

The following steps must be carried out:

- 1) Add EU range for "Service" role
- 2) Compile the project, transfer it and display it in the HMI application

Add EU range for "Service" role

Through the configuration of roles, the range of values can be defined individually for each role in the OPC UA default view. Previously, the "Default" EU range for the OPC UA node was used. By adding a role in the EU range category, the range of values can be extended or limited.

The "Service" role will be added under "EU range". The range of values is derived from the "Default" values based on "Low=20" and "High=60".

Role	EU range LOW	EU range HIGH
Service	20	60

Table 13: Extended EU range for the "Service" role

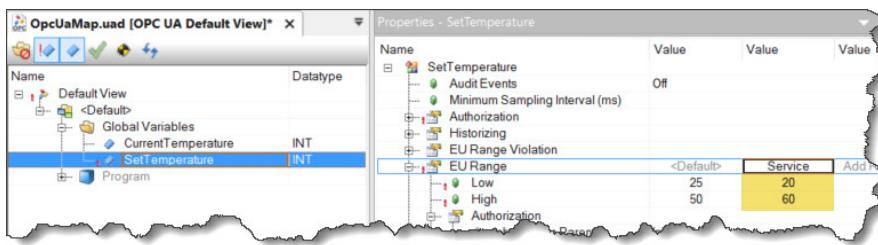


Figure 68: EU range for "Service" role extended

Since a customized EU range has not been defined for the other roles that have write access to the OPC UA node, the default values are valid for these roles.

The EU range violation response is the behavior that should occur when you enter a value outside of the EU range.

The following EU range violations responses exist:

EU range violation	Description
Accept	Entry of the value will be accepted even if the value is outside of the EU range.
Reject	The entered value will not be applied.
Clamp	The entered value is truncated at the high/low limits.

Table 14: Overview – EU range violation

The project can then be compiled and the HMI application can be tested by logging in the various users and therefore setting the respective permissions (read/write access + default/extended value range).

User role system

Expected result

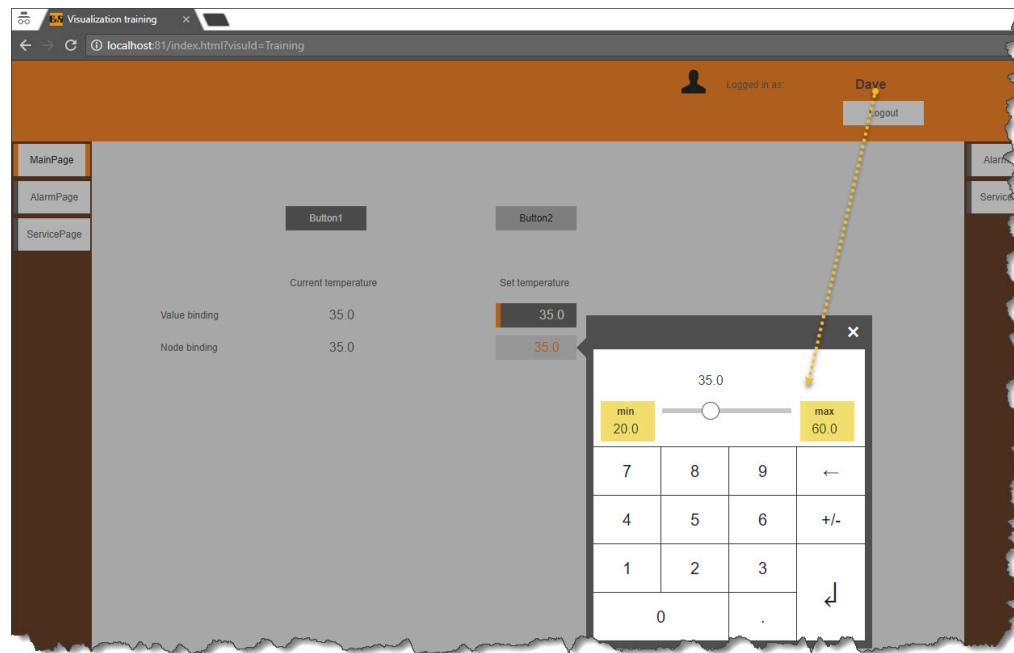


Figure 69: HMI application in the browser with the user Dave logged in and NumericInput selected

8 Localization

With mapp View, localization means adapting the content of an HMI application to the local language and local cultural norms. mapp View allows texts and units to be adapted at runtime for localization of the HMI application.

The text system is used for localization of texts and the unit system is used to adjust the units. The text system and the unit system are not integral parts of mapp View. The functionality of these systems is used by mapp View, so an introduction to use of the text system and unit system is part of this training manual.

8.1 Overview – Text system

Automation Studio provides the text system for localization of texts. This infrastructure functionality is not an integral part of mapp View. The text system makes texts available in multiple languages and can be thought of as a two-dimensional, tabular structure, as shown in the following table.

One dimension lists semantic meanings that are represented by a unique identifier, and the other dimension is formed by all languages with a text-based representation of the semantic information. Each line in this table corresponds to a semantic meaning with texts in the respective languages. Each column in this table represents the texts in a specific language with the various semantic meanings. Each table cell is thus a text for the semantic meaning (identifier in the first column) in the language that this table column represents.

Identifier	de	en	fr	es
Text_Cancel	Abbrechen	Cancel	Annuler	Cancelar
Text_Yes	Ja	Yes	Oui	Si
Text_No	Nein	No	Non	No

Table 15: Example schematic representation of localized texts

The example in the table shows the semantic meanings of "Cancel", "Yes" and "No" in different languages. These semantic meanings are clearly designated using identifiers "Text_Cancel", "Text_Yes" and "Text_No".

For semantic meaning "cancel", there is text in German ("Abbrechen"), English ("Cancel"), French ("Annuler") and Spanish ("Cancelar").

If text statements are used in a system with localizable text, identifiers for the semantic meanings of these textual statements must be used. If the system is used in linguistic context "German", the system replaces the identifier for the semantic meanings with the German language texts. Here, the texts from table column "de" are used for the identifier. If the same system is used in linguistic context "English", the system replaces the identifier for the semantic meanings with the English language texts (table column "en").

8.1.1 Identifier

An identifier is a semantic statement that can be represented as text in different languages. Because a large quantity of semantic statements can be contained in an automation system, it is necessary to be able to structure them in order to prevent having the same identifier assigned to different semantic statements. This is particularly important because semantic statements can be defined by different people independently of each other. For example, the developer of the automation application can define semantic statements for use within logger entries and, independent of this, the developer of the HMI application can define semantic statements that are used in HMI elements.

The text system provides the ability to structure identifiers for semantic statements in namespaces. An identifier for a semantic statement is composed of several parts:

Identifier = Namespace+NamespaceSeparator+Text_ID

A namespace can in turn also be part of a different namespace. Namespaces can therefore be structured hierarchically. For a namespace:

Namespace = NamespaceName [+ NamespaceSeparator+Namespace]

Identifiers are also referred to as fully qualified Text_IDs. For Text_IDs and NamespaceName, there are rules described in detail in the help documentation. The NamespaceSeparator is a single character, which is also described in the help documentation.

A few identifier examples are shown below (fully qualified Text_IDs).

- 1) Texts/AppEvents/Internal/FatalError
- 2) Texts/Alarms/Alarm1
- 3) Texts/Program/Alarms/AlarmID1

For all examples, the NamespaceSeparator is the character "/". The Text_IDs in the examples are "Fatal Error", "Alarm1" and "AlarmID1". The first example contains a namespace called "Texts", which includes another namespace called "AppEvents" and this namespace also includes another namespace called "Internal".

8.1.2 Configuring languages in the project

In an Automation Studio project, it is necessary to define which languages can have texts specified for the semantic statements. The number of project languages must also be specified.

In addition to specifying the project languages that should be provided, the "design language" must also be defined. The design language defines the language used when displaying the texts in Automation Studio during configuration.

8.1.3 Configuring the languages for the target system

From the languages configured in the Automation Studio project, it is possible for the languages that should be transferred from the Automation Studio project to the target system for this specific configuration to be defined for each project configuration.

The "system language" and "fallback language" are also defined. The "system language" determines the language used to display the texts on the target by default. The "fallback language" defines the language used to display the texts if no texts are available in the "system language".

8.1.4 Text system in mapp View

In mapp View, localized texts from the text system can be used. Text files are used in order to be able to make your own texts in mapp View. If your own texts are entered in the system using text files, they will be made available for use by the text system.

Your own localized texts and the text system are the basis used to allow mapp View HMI applications to be displayed in different languages. mapp View provides the capability to switch languages for an HMI application.

8.2 Using the text system

Localized texts can be used in multiple locations in a mapp View HMI application. The following exercises demonstrate this in the form of a few examples.

8.2.1 Texts for manual navigation

The goal of this exercise is to configure the "NavigationButton" widget texts for manual navigation in the required language and then to switch languages at runtime.

Exercise: Localize texts for manual navigation

To achieve this goal, the following steps must be carried out:

- 1) Set up project languages (e.g. "de" and "en")
- 2) Create texts in the project language
- 3) Configure the localized texts on the widget
- 4) Configure the textconfig file
- 5) Add the Language Selector widget
- 6) Compile and transfer the project and display it in the browser

Set up project language

To define the languages to be used in a project, the language configuration file Project.language must be added from the Object Catalog in any position in the Logical View.



Programming / Text System / Managing project languages

First, a Project.language file must be added in the Logical View from the Object Catalog via drag-and-drop.

Double-clicking on the file opens a table editor. Languages English ("en"), German ("de") and French ("fr") already exist after inserting the .language file. The French language is not needed in our example and can therefore be removed.

Localization

The "design language" remains "English" as set by default.

Name	Value	Description
en		
Language name (English)	English	
Language name	English	
Design Language	TRUE	
de		
Language name (English)	German	
Language name	Deutsch	
Design Language	FALSE	

Figure 70: The project languages editor with languages DE and EN defined

Create texts in the project language

After the required languages have been specified, a "mapp View LocalizableTexts.tmx" file can be added from the "mappView/Resources/Texts" node in the Object Catalog and renamed as "VisualizationTexts".



Namespace "IAT" must be entered for the text file in order to use it in a mapp View HMI application. This namespace is reserved for mapp View and is required at runtime for reading the HMI application texts from the text system. This enables faster image or text changes.

Object Name	Dest	Glob	Glob	Glob	Res:	Text:
mappViewGettingStarted						
Globaltyp						
Globalvar						
Libraries						
Program						
Images						
mappView						
Layouts						
Layout.layout						
Widgets						
Resources						
Texts						
VisualizationTexts.tmx						
Snippets						
Themes						
Media						

Texts::VisualizationTexts.tmx [Text module]			
Text ID	German (de)	English (en)	Description
1 Samples.HELLO_WORLD	Servus Welt!	Hello world!	
2 New_Text_ID			

Figure 71: Defined NameSpace IAT in the text file

Then the texts for the manual "NavigationButton" widget will be created in the table editor in English and German with a unique "Text ID".

Texts::VisualizationTexts.tmx [Text module]			
Text ID	German (de)	English (en)	Description
1 MainPage	Start	Main	
2 ServicePage	Service	Service	
3 AlarmPage	Alarme	Alarms	
4 New_Text_ID			

Figure 72: Localizable text file with defined texts

Configuring the localized texts

Once all texts have been created in German and English, they can be referenced in the "NavigationButton" widget for manual navigation.

This requires "ContentLeft" to be opened in the visual editor and a "NavigationButton" to be selected.

Then the text can be assigned to the widget in the Property window using 2 variants:

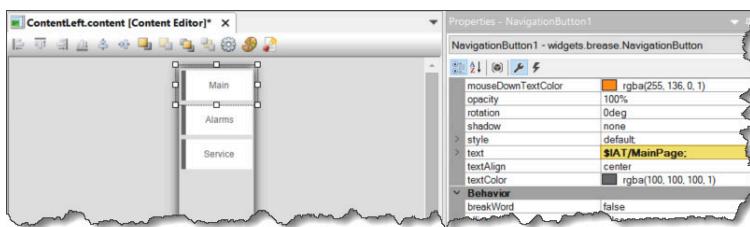


Figure 73: Assigning the manual navigation button widget localized texts with "\$IAT/" as prefix

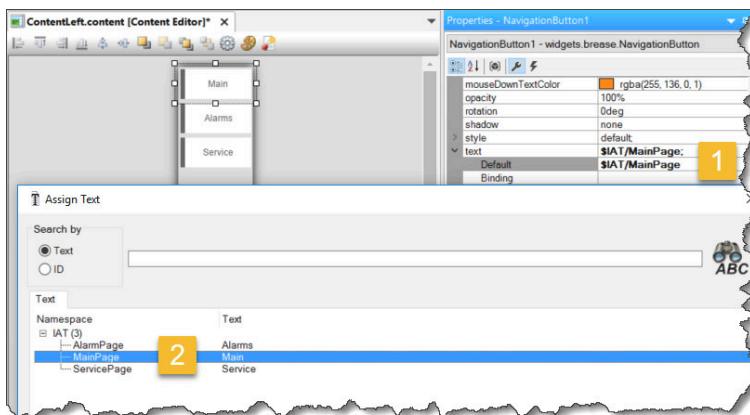


Figure 74: Assigning the manual navigation button localized texts using the "Assign Text" dialog box

Configure the textconfig file

For the texts that have been created to be transferred to the target system, a "TC.textconfig" file from the Object Catalog must be added to the "Text System" package in the Configuration View.

Then the "system language" and the "fallback language" are defined in the "TC.textconfig" file. It is also necessary to define which languages will be transferred to the target system (Target Language 1, etc.).

The TMX file with the texts that have been created must be selected under "TMX files for target" for text files to also be available on the target system.



Programming / Text system / Text system configuration

1.) The text ID can be entered directly with a "\$IAT/" character as a prefix.

2.) The text ID can be searched for using the "Assign Text" dialog box.

Localization

A complete definition looks like this:

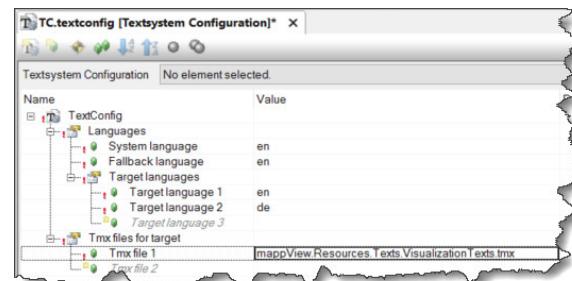


Figure 75: Configured TextConfig file

Adding the LanguageSelector widget

To be able to change the language in the HMI application, a LanguageSelector widget from the Object Catalog must also be added to the "ServicePage" content. The LanguageSelector that has been added makes languages available in a drop-down list.

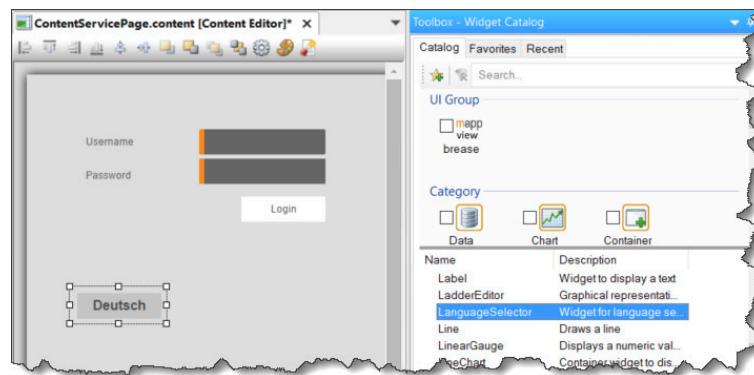


Figure 76: Language selector added to ServicePage

Expected result:

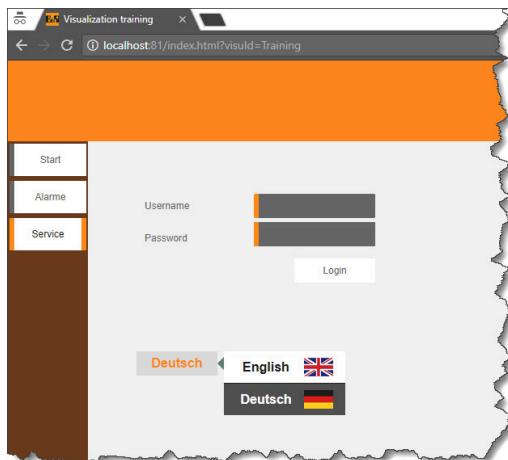


Figure 77: HMI application displayed in the browser with localized texts for the manual navigation button and a language selector

8.2.2 Texts for automatic navigation

The goal of this exercise is to configure texts for the automatic "NavigationButton" widget in German and English and then switch languages at runtime. The "NavigationButton" widget for automatic navigation uses texts that are configured on the pages to which they link.

Exercise: Localize the texts for automatic navigation

To achieve this goal, the following steps must be carried out:

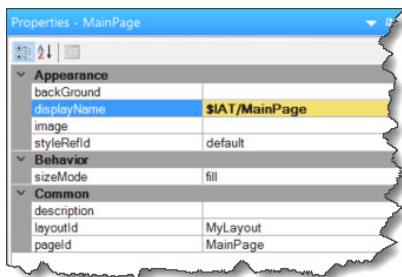
- 1) Configure the TextID on the respective page
- 2) Compile and transfer the project and display it in the browser

Configure the text ID on the respective page

Since the project languages "de" and "en" and the texts with unique text IDs in "de" and "en" have already been created and configured for the manual navigation buttons, these steps are no longer necessary in this exercise.

To localize the texts for the automatic navigation buttons and thus display them in the HMI application, the attribute "displayName" must be entered in the .page file for the respective page.

Double-clicking on the "MainPage.page" file opens the visual editor for the page.



Then the attribute "displayName=" must be set on the page. Specifying the relevant text "ID" starting with "\$IAT/" in the "displayName" attribute allows the text for the "NavigationButton" widget to be referenced for automatic navigation.

Figure 78: Configuring localized texts for automatic navigation buttons

Exercise: Enter text IDs for ServicePage and AlarmPage

Repeat the described procedure for the "ServicePage" and "AlarmPage".

Page	displayName
ServicePage	"\$IAT/ServicePage"
AlarmPage	"\$IAT/AlarmPage"

Table 16: Assign the text IDs for automatic navigation

Localization

Expected result

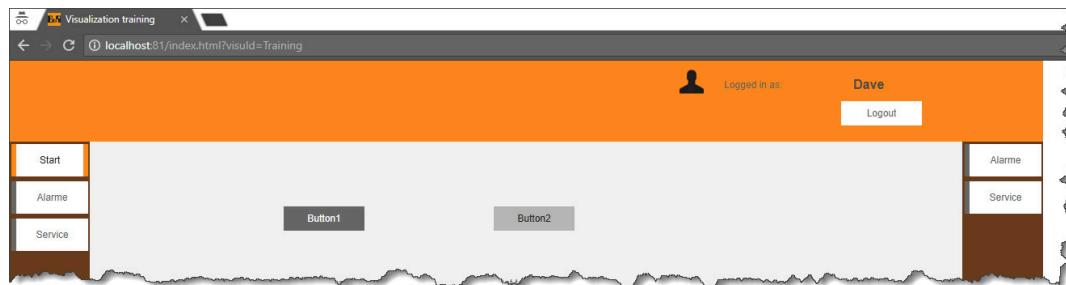


Figure 79: HMI application displayed in the browser with language switched to German

8.2.3 Texts for LogoutButton and LabelLoginInfo widget

The goal of this exercise is to localize the texts for the "Label" widget with information about logged in users and the text for the "LogoutButton".

Exercise: Localize widget texts

The texts for the "Label" widget with the information about logged in users and the text for the logout button should be localized in order to be able to switch between German and English using the "Language Selector".

Expected result:

A screenshot of the Content Editor interface. On the left, there's a 'ContentTop.content [Content Editor]' tab showing a user profile icon, the text 'Angemeldet als: anonymous', and a 'Logout' button. Below it is a 'Texts:VisualizationTexts.tmx [Text module]' tab containing a table of localized texts. The table has columns for 'Namespace', 'Text ID', 'Text ID', and 'Description'. It lists entries for 'MainPage', 'ServicePage', 'AlarmPage', 'Loggedin', 'Logout', and 'New_Text_ID'. The 'Loggedin' entry shows 'Angemeldet als:' in the German namespace and 'Logged in as:' in the English namespace. On the right, there's a 'Properties - Label1' panel showing the properties for the 'Label1' widget. Under the 'text' property, the German value '\$!AT.Loggedin' is highlighted in yellow, indicating it's the current selection. Other properties like 'textColor' and 'textAlign' are also visible.

Figure 80: Localized texts for the label and the logout button

8.3 Overview – Unit system

Automation Studio provides users an integrated unit system with automatic unit conversion. For localization of units, users have the "metric", "imperial" and "imperial-us" systems of measurement and more than 1400 units available to them.

With an OPC UA node, the engineering unit can be configured in addition to the EU range. The engineering unit for an OPC UA node specifies the physical unit to be used when interpreting its value.

With a widget, the unit used to display the value for a bound OPC UA node can be defined for the selected system of measurement.

If the unit used for the value prepared by the automation application is known as well as the unit that should be used to display the value, then the system automatically converts the value to the desired unit.

All units as well as the common code (e.g. degrees Celsius = CEL) to be entered in the "unit" property for each unit are described in Automation Help.



Programming / Unit system / Available standard units

Localization

8.4 Using the unit system

To display the unit of a value from the automation application in the HMI application, it is necessary to bind the unit in addition to the numeric value.

8.4.1 Displaying a value with a unit and switching the system of measurement

Exercise: Display the unit "degrees Celsius" in the NumericOutput widget.

The goal of this exercise is to define degrees Celsius (°C) as the unit for OPC UA nodes "CurrentTemperature" and "SetTemperature" and then display them in an existing "NumericInput" widget as well as an additional "NumericOutput" widget and to be able to use the "MeasurementSystemSelector" widget to switch between °C and °F.

The following steps must be carried out here:

- 1) Configure OPC UA nodes "SetTemperature", "CurrentTemperature" and engineering unit as "degrees Celsius"
- 2) Add NumericOutput and select node binding for "CurrentTemperature"
- 3) Configure unit switching
- 4) Add "MeasurementSystemSelector" widget
- 5) Compile the project, transfer it and display it in the HMI application

Append "degrees Celsius" to OPC UA node Engineering unit

In the OPC UA default view, a unit can be configured for an OPC UA node after it has been enabled.

Add unit "degree Celsius" from the Object Catalog via drag-and-drop in the Properties window for the OPC UA default view after selecting the "Engineering unit" node.

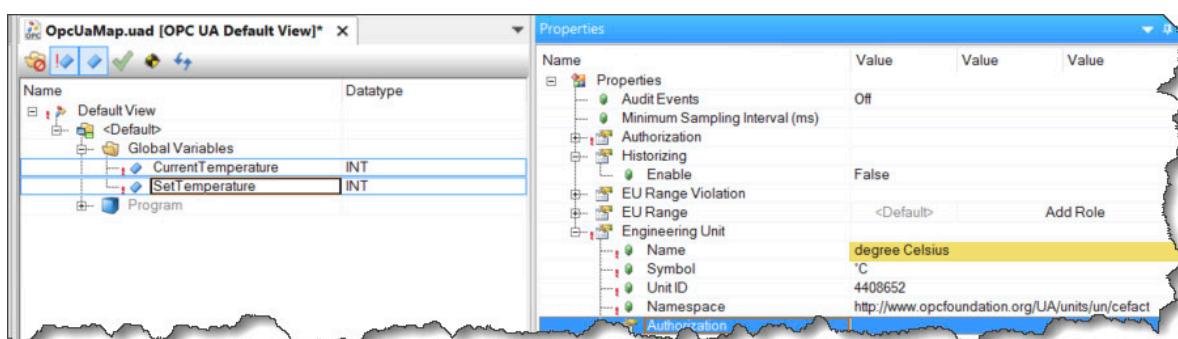


Figure 81: Appending "degrees Celsius" unit to the OPC UA node CurrentTemperature



HMI application / mapp View / Guides / Getting started / Connecting widgets to data / Displaying values and units

Adding the NumericOutput widget

After another "NumericOutput" widget has been added to the "MainPage" content and increased in size, node binding must be selected instead of value binding so the appropriate unit can also be displayed in the "NumericOutput" widget.

Procedure:

- Add a numeric output, change the size and select it
- Open the Select Variable dialog box

Selecting the OPC UA node (and not its value) sets up node binding.

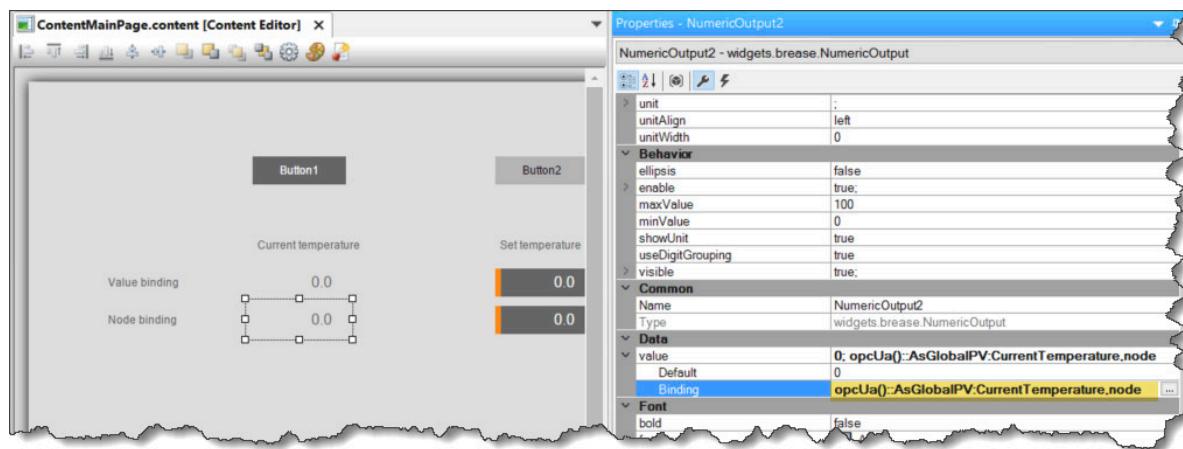


Figure 82: Select node binding in the Binding dialog box for the ActualTemperature node

Configuring unit switching

In order for the unit to also be displayed in the "NumericInput" and "NumericOutput" widgets, the corresponding "unit" property must also be configured. The unit that should be displayed must be specified for each system of measurement ("metric", "imperial", "imperial-us"). The unit is specified using its common code. Information about the common codes for supported units is provided in Automation Help. Conversion of the value from the unit provided by the automation application to the unit in which the value is to be displayed is performed automatically.

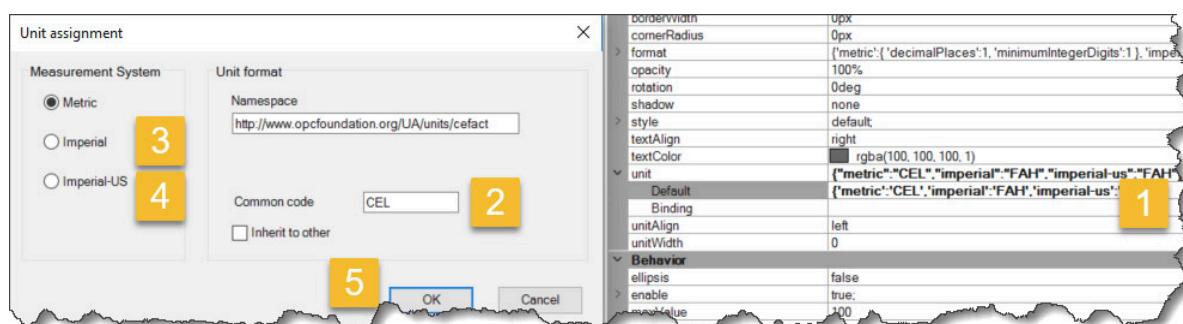


Figure 83: Defining the unit properties

The unit properties must always be specified as follows:

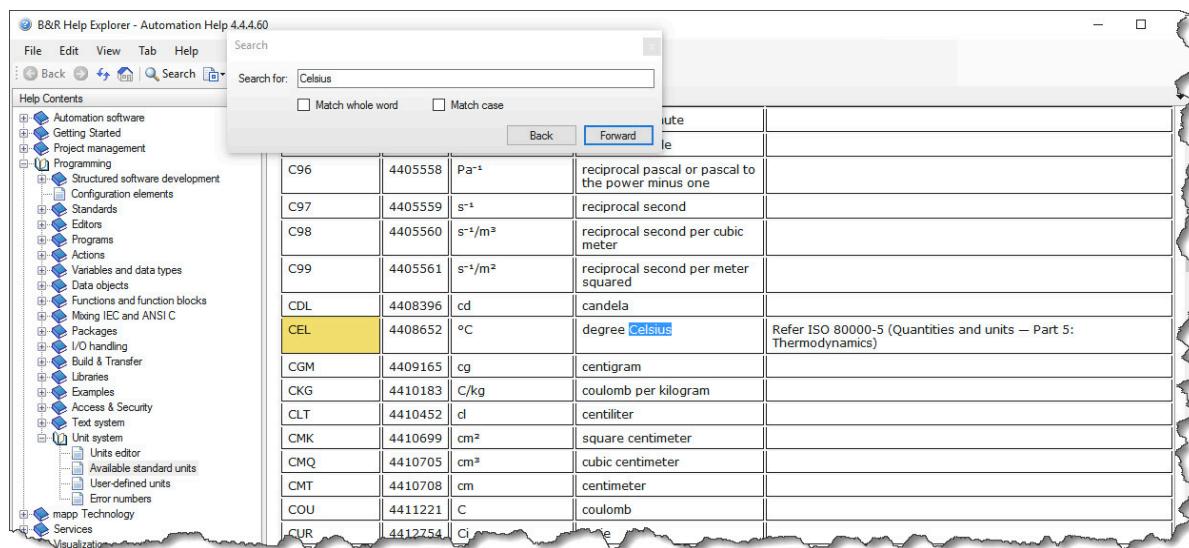
```
{'metric':'<CommonCode>','imperial':'<CommonCode>','imperial-us':'<CommonCode>'}
```

Localization

For our example, the unit string looks as follows after selection using the Unit dialog box:

```
{"metric": "CEL", "imperial": "FAH", "imperial-us": "FAH"}
```

The unit and the displayed value can be aligned using the "ImageAlign" property. In our case, we output the unit to the right of the value by setting the property to "right".



The screenshot shows the B&R Help Explorer interface with the title 'B&R Help Explorer - Automation Help 4.4.4.60'. The left sidebar contains a tree view of help contents under 'Help Contents'. The main area has a search bar at the top with the placeholder 'Search for:' and a dropdown menu. Below the search bar is a table of search results. The table has columns for 'Code', 'ID', 'Unit', and 'Description'. One row is highlighted with a yellow background, corresponding to the 'CEL' entry in the search results table.

Code	ID	Unit	Description
C96	4405558	Pa ⁻¹	reciprocal pascal or pascal to the power minus one
C97	4405559	s ⁻¹	reciprocal second
C98	4405560	s ⁻¹ /m ³	reciprocal second per cubic meter
C99	4405561	s ⁻¹ /m ²	reciprocal second per meter squared
CDL	4408396	cd	candela
CEL	4408652	°C	degree Celsius Refer ISO 80000-5 (Quantities and units – Part 5: Thermodynamics)
CGM	4409165	cg	centigram
CKG	4410183	C/kg	coulomb per kilogram
CLT	4410452	cl	centiliter
CMK	4410699	cm ²	square centimeter
CMQ	4410705	cm ³	cubic centimeter
CMT	4410708	cm	centimeter
COU	4411221	C	coulomb
CUR	4412754	ci	e

Figure 84: Finding the unit in Automation Help

Adding the MeasurementSystemSelector widget

After the unit for the OPC UA node has been configured and the units that should be displayed have been defined for the system of measurement, the possibility to switch the system of measurement must be configured. To switch the units, the "MeasurementSystemSelector" widget from the Object Catalog will be placed on the "ServicePage" contents.

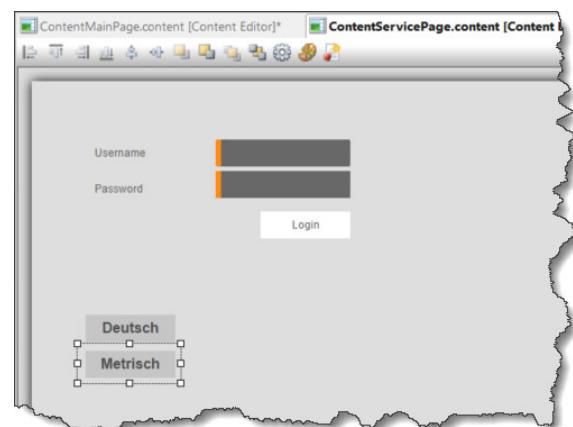


Figure 85: Placing MeasurementSelector on ServicePage

Expected result

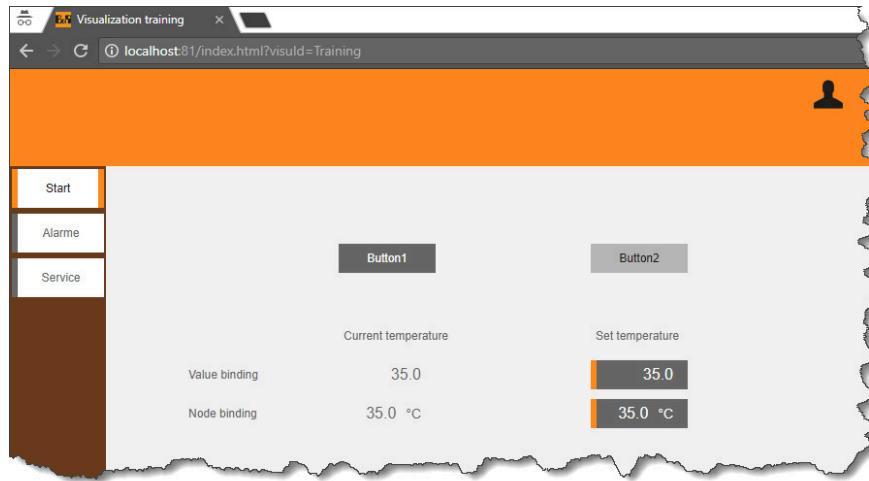


Figure 86: HMI application displayed in a browser with the corresponding unit

Events and actions

9 Events and actions

For configuring the behavior of the HMI application, we have already become familiar with the possibilities for data binding and navigation. Navigation determines how users can move between the various pages in the HMI application. Data binding determines which data is exchanged between the automation application and the HMI application and in which direction.

For some HMI applications, these options may not be sufficient. mapp View provides events and actions to individually configure the behavior of an HMI application.

Events are occurrences that can be used to trigger responses. An action is a response triggered by an event. The combination of the triggering event and the subsequent action is referred to as event handling.

9.1 Overview – Events

An event is an occurrence that can be used to trigger a response. mapp View provides HMI application developers several types of events.

OPC UA events

mapp View defines events to provide information about changes to values in the automation application. For this purpose, mapp View provides event type "opcUa.Event" with the name "ValueChanged".

Widget events

Widget events provide information about occurrences in specific widget instances. Different types of widget can provide information about different occurrences in the form of events. An example of this is the "Click" event for the "Button" widget.

Session events

mapp View defines events in order to detect occurrences in a client session. Session events are covered in the mapp View Advanced training module.

9.2 Overview – Actions

An action is a response triggered by an event.

Actions are grouped together by provider. The following action providers exist in mapp View:

- OPC UA
- Session
- Client
- Widgets

Each provider defines one or more groups of actions.

Provider "OPC UA" provides group "opcUa.NodeAction" and provider "Widgets" provides group "widgets.brease.<WidgetType>".

Providers "Session" and "Client" are topics of the mapp View Advanced training course. In this training course, we will only cover providers "OPC UA" and "Widgets".

Each group defines one or more actions.



HMI application / mapp View / Engineering / Events and actions / Action

9.2.1 OPC UA actions

For OPC UA, actions are made available that have an effect on OPC UA nodes.



HMI application / mapp View / Engineering / Events and actions / Action/ INIT NC Actions / OPC UA actions

9.2.2 Widget actions

For widgets, actions are available that have an effect on instances of widgets.

There are specific actions for each widget type. To find out more about actions available for a widget type, see the documentation for that widget.



HMI application / mapp View / Engineering / Events and actions / Action/ INIT NC Actions / Widget actions

Events and actions

9.3 Using events and actions

9.3.1 Setting a value

The goal of this exercise is to reset the setpoint for the "SetTemperature" OPC UA node displayed in the "NumericInput" widget to the default value (35) by clicking on a button.

Exercise: Reset the setpoint for the OPC UA node by clicking a button.

To achieve this goal, a suitable event will be used and an appropriate action will be configured as a response to this event.

The following steps must be carried out:

- 1) Configure existing button widget "Button1"
- 2) Configuring the result of clicking on the button
- 3) Reference the event binding file in the .vis file
- 4) Compile the project, transfer it and display it in the HMI application



HMI application / mapp View / Engineering / Events and actions / Event

Configure button

In the " MainPage" content, the existing button with the ID "Button1" is renamed and a descriptive text is defined. The new "ButtonSetToDefault" ID makes it easier to identify it in event binding. Then the button text will be localized so it can be displayed in German and English.

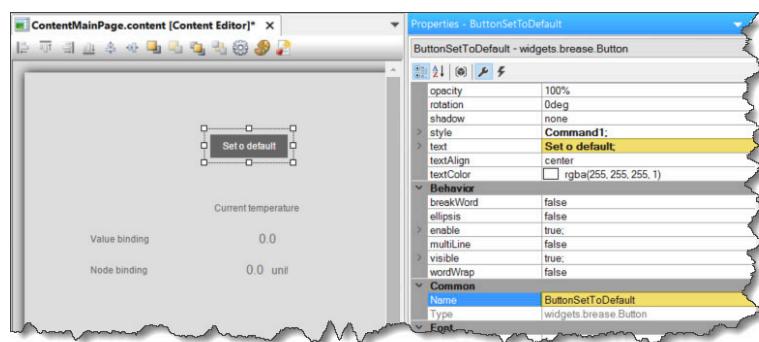


Figure 87: Button configured

Configuring the result of a click in the Button widget

Widget events can be configured in the Properties window of the content editor. To do this, switch to the "Events" display. When creating a new event for a widget, a new event binding file is generated in the Configuration View and the source of the event is entered. The EventBinding ID always consists of the content reference, the widget and the widget event. The ID is displayed in the widget event after saving a valid event binding file.

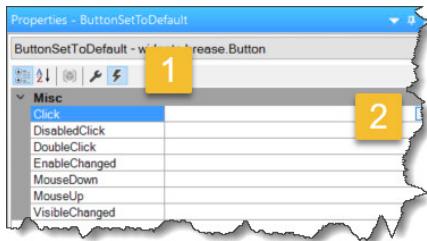


Figure 88: Creating a new widget event in the content editor

The opened EventBinding file already contains an automatically generated ID, which consists of the content ID with the suffix "_eventbinding". The event binding is automatically preset with <Source>.

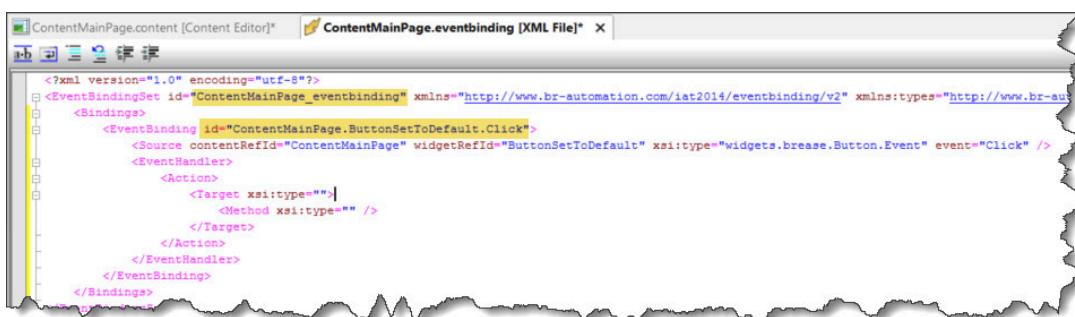
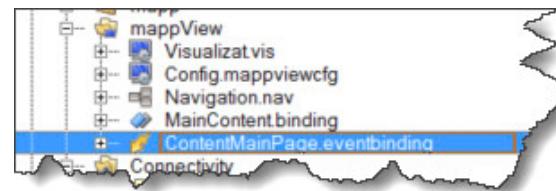


Figure 89: Automatically generated event binding

The event binding file is entered in the mappView node of the Configuration View.



The source consists of the widget type, the widget instance and the content where the widget is located. The event attribute describes which widget event should be responded to.

For the widget event, only the method to be executed must be defined in the <Action> element.

The parameters that can be selected are defined in Automation Help.



HMI application / mapp View / Engineering / Events and actions / Actions / OPC UA actions

The entry for the action consists of the "opcUa.NodeAction" attribute and the global variable (SetTemperature) that should be changed.

Events and actions

The definition then looks like this:

```
<Target xsi:type="opcUa.NodeAction" refId="::AsGlobalPV:SetTemperature">
    <Method xsi:type="opcUa.NodeAction.SetValueNumber" value="35" />
</Target>
```

Reference event binding in the .vis file

After the event and the action have been defined, the entered EventBindingSet ID (ContentMain_Page_eventbinding) must be referenced in the .vis file so that event binding also is taken into account.

Double-clicking on the .vis file allows the event binding element to be commented out and the "ID" entered.

Test the HMI application with various roles

The value of the numeric input widget will only be set if all defined parameters (OPC UA default view) and permissions for the logged-in role/user are met.



Figure 90: HMI application in the browser with the user "Dave" logged in

9.3.2 Displaying and hiding a widget

The goal of this exercise is to show an image in the "MainPage" content (action) when a certain value has been reached on the "CurrentTemperature" OPC UA node (event).

Exercise: Display and hide an image when a value is reached.

To achieve this goal, an image will be added on the MainPage content and its visibility set to "false". Then, the event when reaching the value and the action for displaying the image will be defined in EventBinding.

The following steps must be carried out here:

- 1) Add and configure the image
- 2) Define event to trigger the value change in the event binding
- 3) Configure the action for displaying the image in event binding
- 4) Compile the project, transfer it and display it in the HMI application

Add and configure the image

First, an "Image" widget will be added from the Object Catalog and placed on the " MainPage" content via drag-and-drop. Next, an image of the SVG icon library is referenced in the ImageWidget. Afterwards, the "visible" property must be set to "false" in order for the image to only become visible when triggered by the event. The CommonName for the widget is changed to "ImageWarning" for easier identification in event binding.

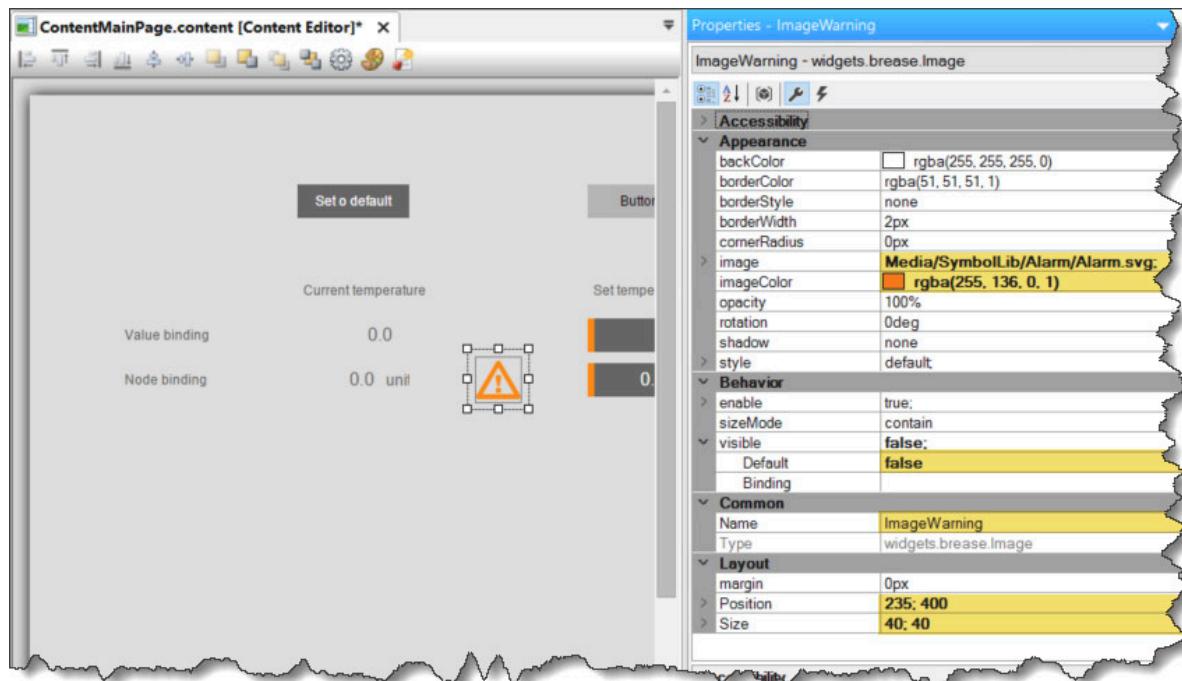


Figure 91: Image widget properties

Define the event and action for displaying the image

The events and the subsequent actions will be defined in the event binding file.

The EventBinding file has already been added in the "Setting a value" exercise and referenced in the .vis file.

First, the event is defined for when the value "45" has been reached on the "CurrentTemperature" OPC UA node. This event is for "OPC UA". The event type is therefore "opcUA.Event". The entry for the EventBinding element <Source> looks as like this:

```
<Source xsi:type="opcUA.Event"
refId="::AsGlobalPV:CurrentTemperature" event="ValueChanged"/>
```

In the String element <Source>, the "refId" of the corresponding OPC UA node and the "ValueChanged" event will be specified in addition to the xsi:type.

EventHandler describes the response to the event. For EventHandler, a condition can be defined that must be fulfilled in order for the configured actions to be executed.

```
<EventHandler condition="newValue &gt;= 45">
```

Now the action will be defined as a response to the event.

Events and actions

The `<Target>` element defines the object to which the action is applied. In our example, the action is applied to a widget that has been placed in content.

```
<Target xsi:type="widgets.brease.Image.Action"  
widgetRefId="ImageWarning" contentRefId="ContentMainPage">
```

For the "visible" property of the image to change from "false" to "true", the "value" attribute will be set to "true" in the "Method" element in addition to the `xsi:type`.

```
<Method xsi:type="widgets.brease.Image.Action.SetVisible"  
value="true" />
```

The finished EventBinding looks like this:

```
<EventBinding>  
    <Source xsi:type="opcUa.Event"  
    refId="::AsGlobalPV:CurrentTemperature" event="ValueChanged"/>  
    <EventHandler condition="newValue &gt;= 45">  
        <Action>  
            <Target xsi:type="widgets.brease.Image.Action"  
            contentRefId="ContentMainPage" widgetRefId="ImageWarning">  
                <Method xsi:type="widgets.brease.Image.Action.SetVisible"  
                value="true" />  
            </Target>  
        </Action>  
    </EventHandler>  
</EventBinding>
```

Defining the event and action for hiding the image

For the "warning" image to be hidden again when the value drops below "45", another `<EventHandler>` and subsequent action must be defined for the same event.

To hide the image, the `<EventHandler>` for displaying the image will be copied and the condition parameters changed to "newValue < 45" and the "SetVisible" action changed to "false".

Final result:

```

<EventBinding>
    <Source xsi:type="opcUa.Event"
        refId="::AsGlobalPV:CurrentTemperature" event="ValueChanged"/>
    <EventHandler condition="newValue &gt;= 45">
        <Action>
            <Target xsi:type="widgets.brease.Image.Action"
                contentRefId="ContentMainPage" widgetRefId="ImageWarning">
                <Method xsi:type="widgets.brease.Image.Action.SetVisible"
                    value="true" />
            </Target>
        </Action>
    </EventHandler>
    <EventHandler condition="newValue &lt; 45">
        <Action>
            <Target xsi:type="widgets.brease.Image.Action"
                contentRefId="ContentMainPage" widgetRefId="ImageWarning">
                <Method xsi:type="widgets.brease.Image.Action.SetVisible"
                    value="false" />
            </Target>
        </Action>
    </EventHandler>
</EventBinding>

```

Expected result:

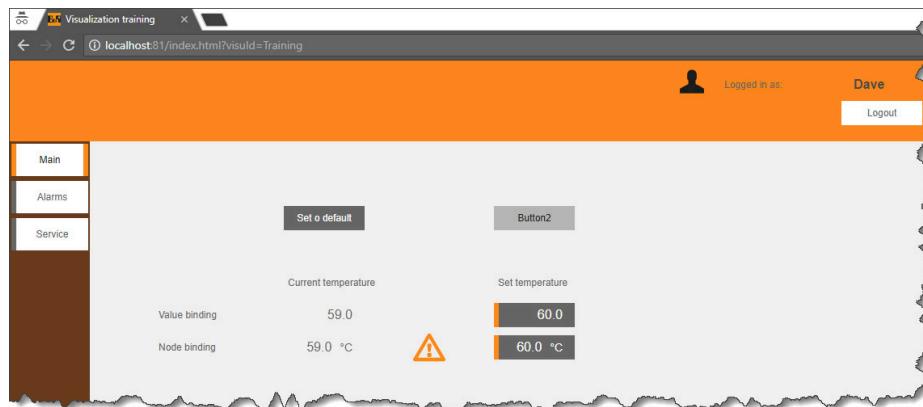


Figure 92: HMI application in the browser with image shown

Notes on putting systems into operation

10 Notes on putting systems into operation

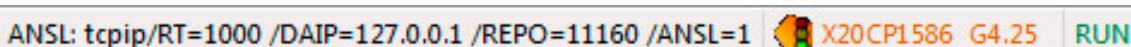
This section briefly describes how mapp View server is installed on the controller and the mapp View client is installed on a terminal.

10.1 Putting the mapp View server into operation on the controller

Exiting simulation mode

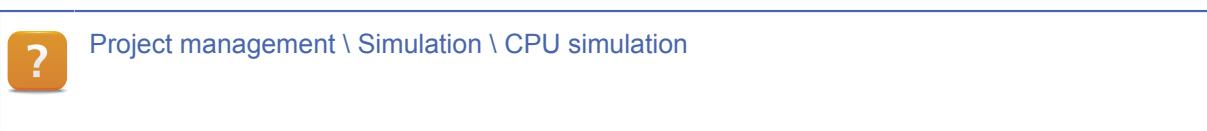
To start up the mapp View server on the controller, simulation mode must first be ended in the Automation Studio.

The Automation Studio status bar indicates when a CPU simulation is running.



ANSL: tcpip/RT=1000 /DAIP=127.0.0.1 /REPO=11160 /ANSL=1 | X20CP1586 G4.25 | RUN

Figure 93: Automation Studio status bar - Simulation running



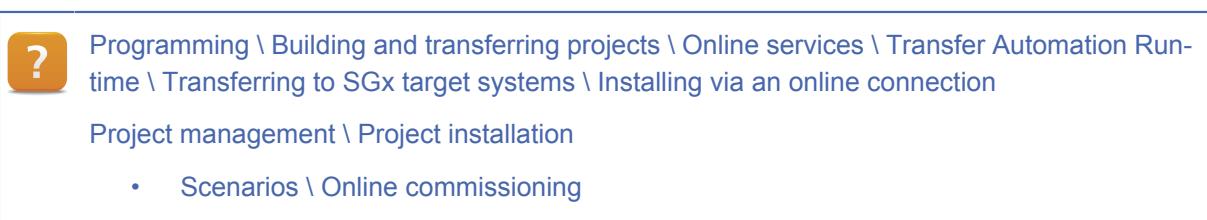
Project installation

The project is then compiled and transferred to the controller.

A connection to the controller is established using the "Browse for target system" feature in Automation Studio. This function searches the network for B&R controllers. The connection settings of the controllers can be temporarily changed in the search dialog box.



Automation Runtime can be transferred or online installation performed once the connection has been established.



For offline installation, Automation Studio is used to generate an installation medium (CompactFlash or CFast card). This is then inserted into the target system. When the supply voltage is switched on, Automation Runtime and the application are started.



Automation Runtime and the application software can be included in a project installation package and transferred to the target system on a USB flash drive, CompactFlash card or via a DHCP server.



Project management \ Project installation

- Scenarios \ Offline commissioning
- Overview \ Transfer \ Project installation package

Programming \ Libraries \ Configuration, system information, runtime control \ ArProject

Display the HMI application in a browser

To test the connection, the URL is entered in the address line of the Chrome browser as previously. The IP address of the controller is used here:

e.g. <http://10.43.15.46:81/index.html?visuld=Training>

Exercise: Put mapp View server into operation on X20 CPU

The objective of this exercise is to operate the mapp View server on a controller:

- 1) Disable simulation mode in the project
- 2) Building the project
- 3) Transfer the project to the controller
- 4) Display the HMI application in a browser

10.2 Putting the mapp View client into operation on a T50

The Power Panel T50 can be configured directly via the Service menu item or Automation Studio project.

Configuration via the Service menu item

When defining the configuration via the Service menu item, all necessary settings are made directly on the terminal. Then the configuration is saved and the terminal restarted.



Hardware / Power Panel / Power Panel T50 / Configuration / Service pages

10.2.1 Configuration in Automation Studio

When defining the configuration for the terminal, it is first added to the Ethernet interface on the controller using the Hardware Catalog toolbox.

Notes on putting systems into operation

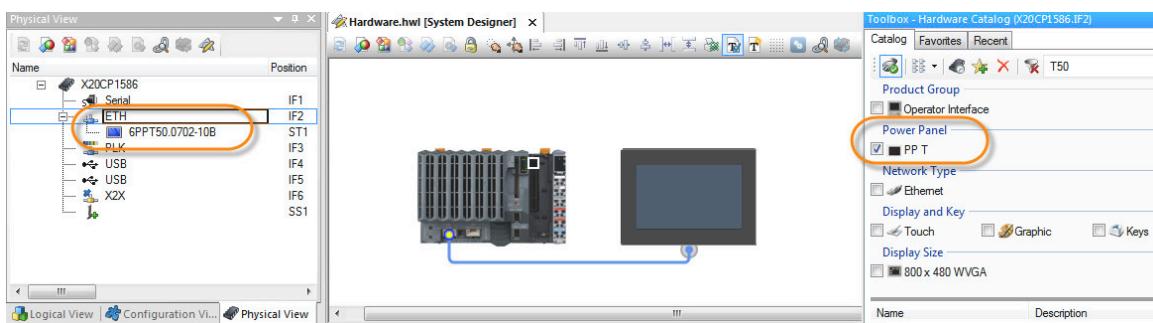


Figure 94: Power Panel T50 in the Physical View and System Designer

The second step is the configuration of the device. All parameters are described in the configuration manual for the respective device. The sample configuration looks like this:

Name	Value	Description
6PPT50.0702-10B	PPT50 GS	
Operating System	Web	
Startup		get IP address from DHCP server
Network		
Mode		
Hostname		
DNS parameters		
Time		
Screen		
Audio		
Gesture		
VNC		
Web		
Active web sever	10.43.15.46.81/index.html?visuld=Training	IP address or hostname of server
Web server list		Selectable servers
Enable virtual keyboard	off	Virtual keyboard appears when clicking on a text input in web
Storage		
Update		
Security		

Figure 95: Setting required to connect to the mapp View server

In the sample configuration, the following parameters have been set:

Parameter	Value	Note
Start mode	Web	After switching on, the device immediately attempts to establish a connection to the configured web server.
Network	Settings depend on the corresponding network infrastructure	
Active web server	10.43.15.46:81/index.html?visuld=Training	
Enable virtual keyboard	off	The mapp View virtual keyboard is shown

Table 17: Sample configuration for the terminal

?
Hardware / Power Panel / Power Panel T50 / Configuration / Service pages

- Service page "Startup"
- Service page "Network"
- Service page "Web"

10.2.2 Transferring the configuration to the terminal

The configuration for the terminal is transferred in Automation Studio directly to the controller. In Automation Studio, the configuration can either be copied to a USB flash drive as a project installation package or loaded directly onto the terminal from the controller.

Generate project installation package

The project installation package is created via the Project menu item. In the dialog box, select the device for which the project installation package should be created. The terminal is selected here.

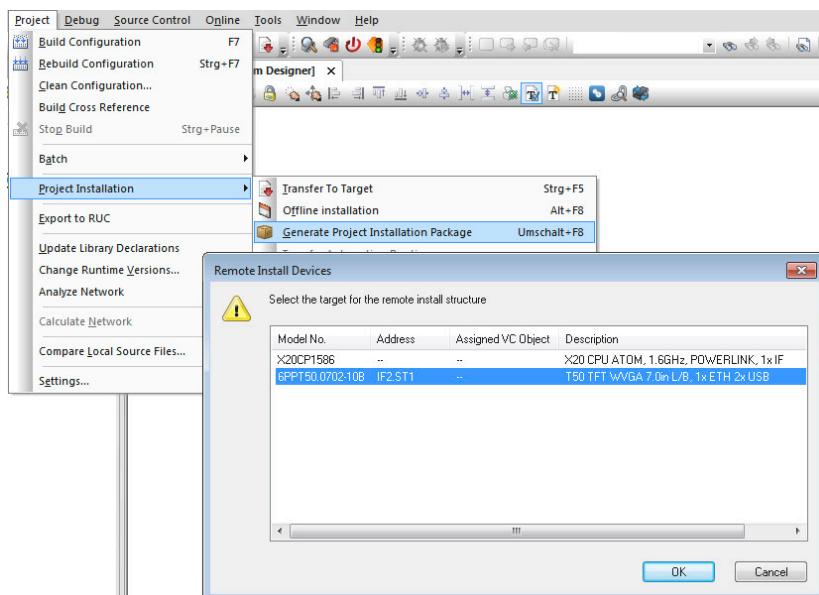


Figure 96: Generate project installation package for terminal

Load the configuration onto the terminal

The Service menu item on the terminal can be used to either import a project installation package from a USB flash drive or load it directly from the controller.

Once the USB flash drive is connected to the terminal, the configuration can be loaded by selecting "Load settings from USB" on the "Update" service page. After confirmation, the terminal is restarted, the configuration is updated and the device then starts in the configured mode.



Hardware / Power Panel / Power Panel T50 / Configuration / Service pages

- Service page "Update"
- Service page "Backup & reset"

Exercise: Put mapp View client into operation on Power Panel T50

Now the terminal will be configured for accessing the mapp View HMI application.

- 1) Add the terminal in Physical View or System Designer
- 2) Configure the device (see sample configuration)
- 3) Create a project installation package

Notes on putting systems into operation

- 4) Update the terminal configuration
- 5) Test the HMI application

10.2.3 Improving performance with content caching

When requesting a page from the terminal, each page is delivered from the mapp View server and set up on the mapp View client. The loading time depends on the complexity of the page.

The mapp View server supports the "content caching" function so pages that are already loaded do not have to be sent to the client again. Content that has already been loaded on the client is kept in memory and can be re-used on demand. This improves performance significantly when changing pages.

The settings for content caching are made in the advanced mapp View server settings.

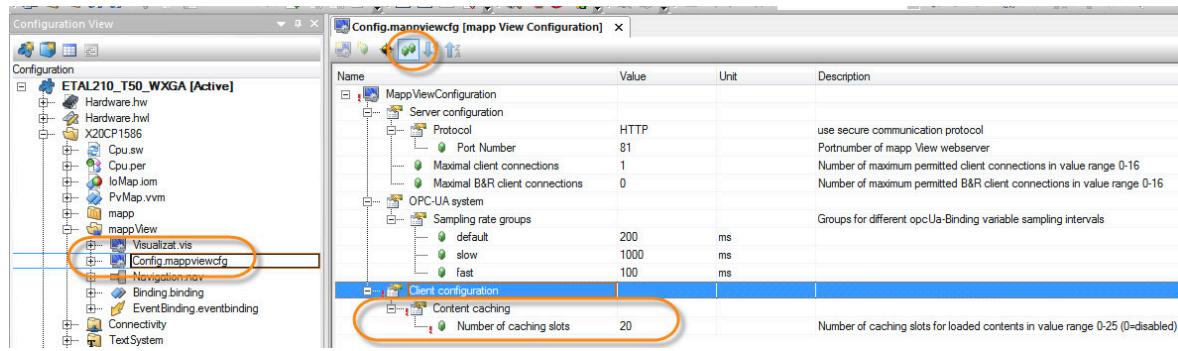


Figure 97: mapp View configuration - Enable content caching



HMI application / mapp View / Engineering / HMI organization / Configuration View / mapp View configuration

- Client configuration / Caching strategy

11 Summary

After completing this training module, a mapp View HMI application with multiple HMI pages can be created. Navigation between the HMI pages can be configured for both manual and automatic navigation. Displaying values from the automation application can also be configured as well as entering data. When doing so, value range limits defined in the automation application can be automatically checked in the HMI application. Value range limits defined differently for specific roles can also be checked. To allow role-specific behavior of the HMI application, the user role system in Automation Studio can be used for HMI user authentication. Widgets and media can be modified using themes and styles in order to adapt the appearance of the HMI application to individual needs. Texts and units can be adapted to linguistic and cultural conditions via localization. As a conclusion to this training module, the definition of actions as responses to events has been covered.



Figure 98: mapp View glasses

Seminar participants are now able to create simple HMI applications using mapp View.

Creating more complex HMI applications is covered in the "mapp View Advanced" training module.

Offered by the Automation Academy

Offered by the Automation Academy

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- ⇒ Diagnostics and service
- ⇒ POWERLINK and openSAFETY

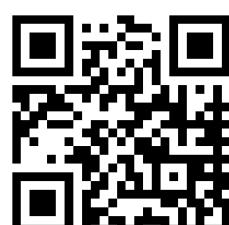
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