TM610

Working with Integrated Visualization

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Prerequisites and requirements	
Training modules	TM210 – Working with Automation Studio TM600 – Introduction to Visualization
Software	Automation Studio 4.0
Hardware	Automation Runtime Simulation (ArSim) / Power Panel with a 10.4" touch screen

Table of contents

1 Introduction

This training module provides a quick introduction to visualization with Visual Components.

B&R Visual Components provides an environment for creating simple or complex visualization applications.

Figure 1: Visual Components editor

This training module shows how to develop a visualization project in Automation Studio and how to utilize the components of the visualization editor effectively.

1.1 Learning objectives

This training module uses selected examples to demonstrate how to easily and effectively create a visualization application in Automation Studio.

- You will learn how to create and configure Visual Components objects in Automation Studio.
- You will learn about the many features of the Visual Components editor and become comfortable using them. You will learn how to use the integrated help system to find the information you need.
- You will learn about various visualization resources, data sources and window areas within a Visual Components object.
- You will learn about Visual Components controls and their corresponding help documentation.
- You will learn how to add and configure controls in a visualization project using the Automation Studio help system as a reference.
- You will learn how to create static process graphics and layers.
- You will learn how to create dynamic text elements, graphics and color schemes.
- You will learn how to scale process variables, configure languages and switch between them at runtime.
- You will learn about the concept behind touch screen and keypad operations in Visual Components and how to configure key actions on your own.

2 Visual Components

Visual Components is a visualization environment integrated in Automation Studio.

This means that the visualization application is managed, edited and executed together with the control project.

Process images can be displayed on a target system with a display, separately from the controller on a remote terminal (e.g. Power Panel) or on a virtual VNC display (**V**irtual **N**etwork **C**omputing).

Figure 2: Integrated visualization

Unlike ordinary visualization – where the application runs separately from the control unit with the controller relying on separate communication to the values displayed – Visual Components is integrated with the controller tasks.

All the examples in this training module are executed using Automation Runtime simulation (ARsim). The visualization is displayed using a VNC viewer. Because the software elements are managed modularly, any target system can be used.

Visualization \ Visual Components VC4

3 Your first VNC visualization application

In this section, we will use the Automation Studio help documentation to create a new project with a visualization application, transfer it to Automation Runtime simulation (ARsim) and then test the program using Automation Studio.

Exercise: Creating a new project with the support of the help system

Create a new Automation Studio project with a VNC visualization application.

This sample is documented in the Getting Started section of the Automation Studio help system.

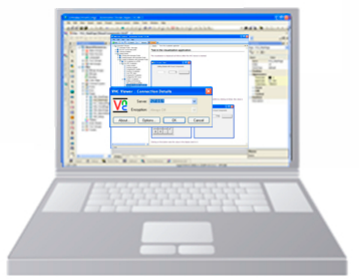


Figure 3: Generating a first project

Automation Software \ Getting started \ Create a visualization application in Automation Studio \ First VNC visualization

1) Creating a new project
2) Insert a program.
3) Insert a visualization.
4) Insert a VNC server object and configure it.
5) Open the Visual Components editor and configure the image objects.
6) Compile the project and transfer it to the PC-based Automation Runtime simulation.
7) Open the VNC viewer and connect to the Automation Runtime simulation (ARsim).
8) Test the visualization in the VNC viewer

With the support of the Automation Studio help system, you were able to create your first visualization application using Visual Components.

The next few sections will provide additional information about the structure of an Automation Studio project with the help of an example project.

4 The Visual Components editor

An Automation Studio sample project is used to describe the Visual Components editor and the structure of a visualization project.

4.1 "CoffeeMachine" sample project

An Automation Studio installation includes several example projects. One of these sample projects is used in this training module to describe the Visual Components environment and the extensive functions it provides.

Exercise: The "CoffeeMachine" example project in Automation Studio

This example project can be opened from the start page.

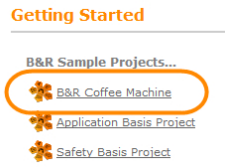


Figure 4: Choosing a sample project

1) Open the Automation Studio example project from the start page.
2) Open the visualization object **"Visu"** from the **Logical View**.

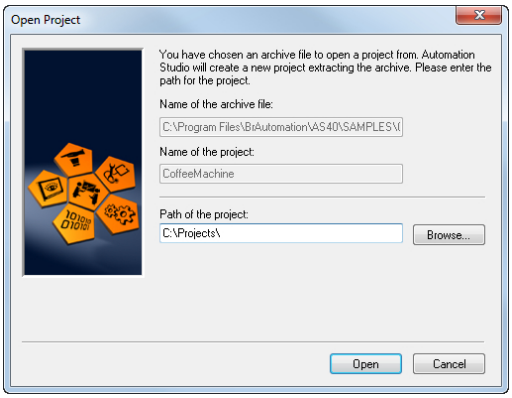


Figure 5: Opening the project with Automation Studio

4.2 Visual Components help system

The Automation Studio help system is an invaluable resource throughout the development, configuration and commissioning of a project.

It serves as a reference guide for using Automation Studio and its editors, for creating a program or visualization application, for configuring drives, and also provides access to all hardware documentation.

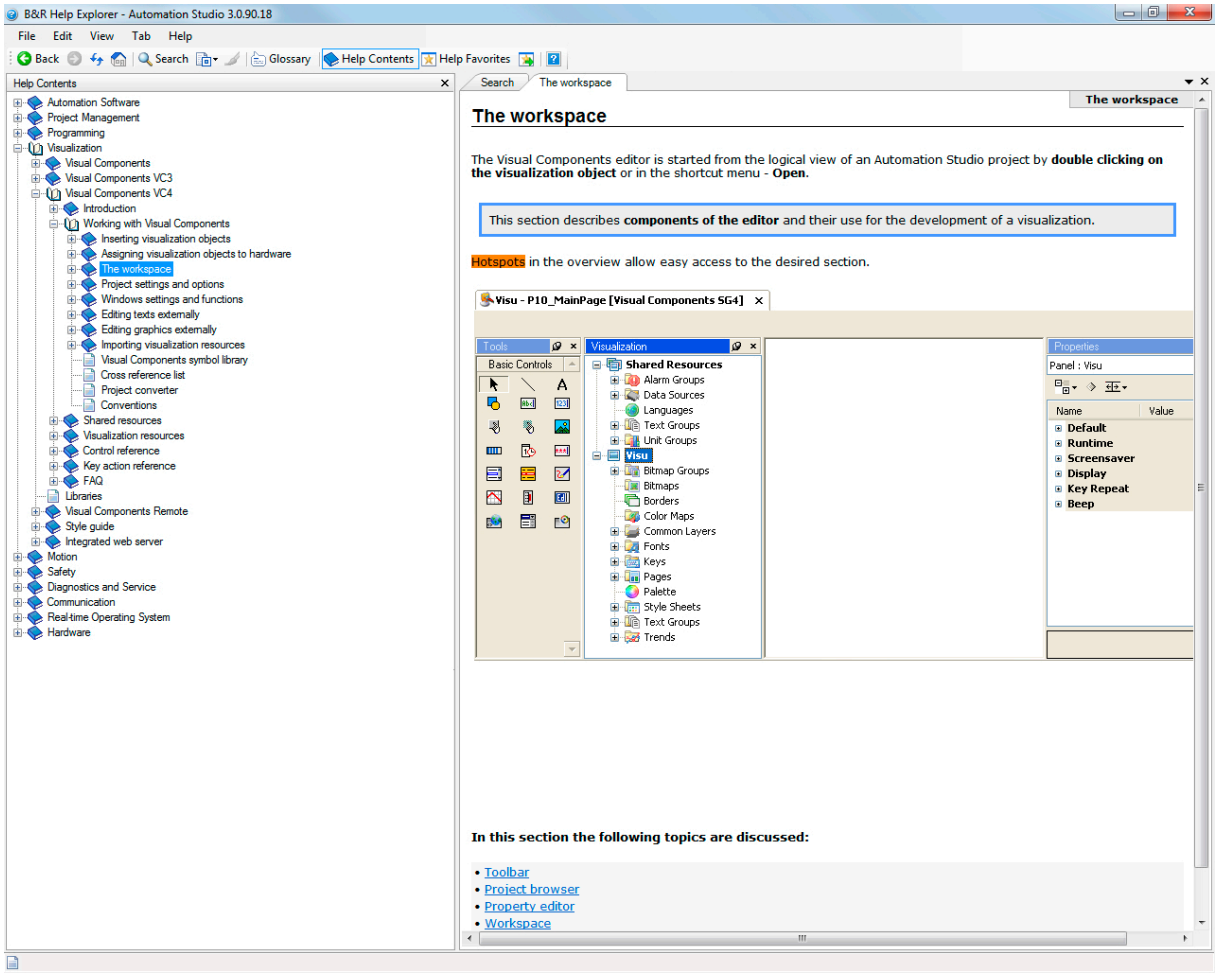


Figure 6: Visual Components help system

The Visual Components training documents frequently refer to the help files because they are available at all times and – most importantly – during project creation.

> All help references in this training module refer to the Automation Studio help sections "Visualization \ Visual Components VC4" or "Visualization \ Visual Components Remote".

4.3 The workspace

The Visual Components editor is divided into several areas, each with a different function.

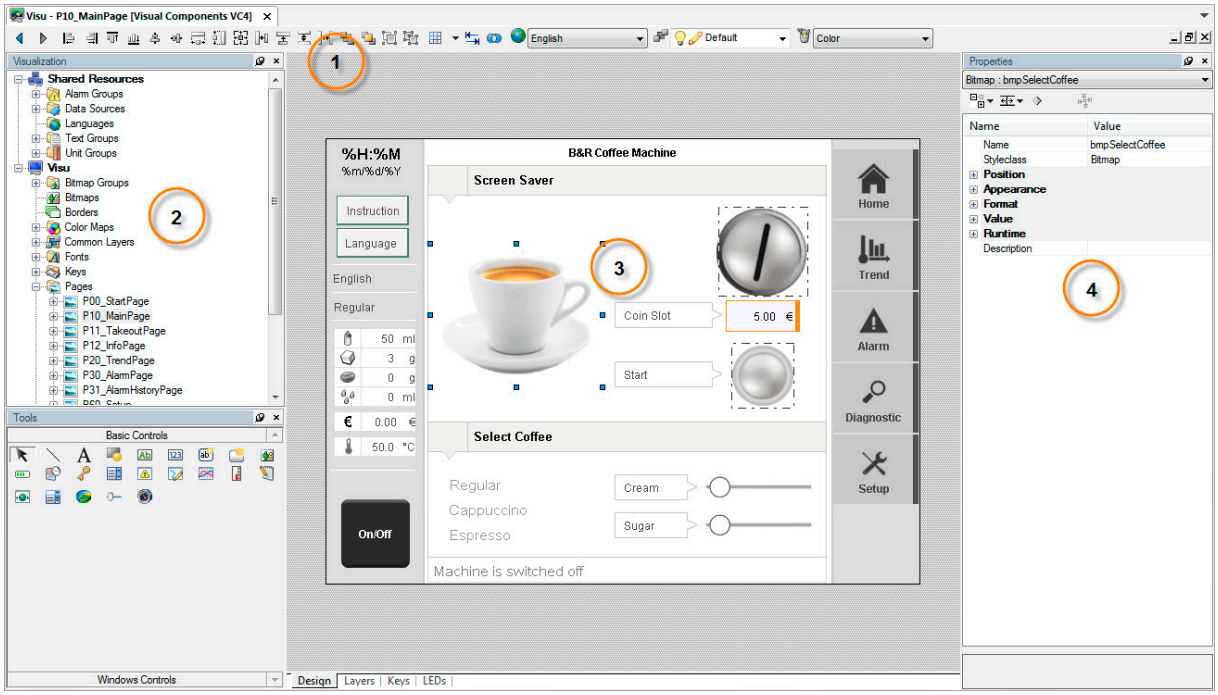


Figure 7: The Visual Components workspace

1 The menus and toolbars provide access to the functions of the Visual Components editor.
2 The components of a visualization are created, managed and edited in the respective nodes on the left.
3 The editor for configuring a component is shown in the workspace in the middle.
4 The properties of a component or a selected object are shown on the right.

Working with Visual Components \ Workspace

Exercise: Working in Visual Components

The goal of this exercise is to become familiar with using the Visual Components editor.

Open each node of the visualization project explorer, and then double-click on the desired object to open the corresponding editor. The properties of the object are listed on the right side of the screen.

Hiding the Project Explorer opens more space on the screen for creating the Visual Components application.

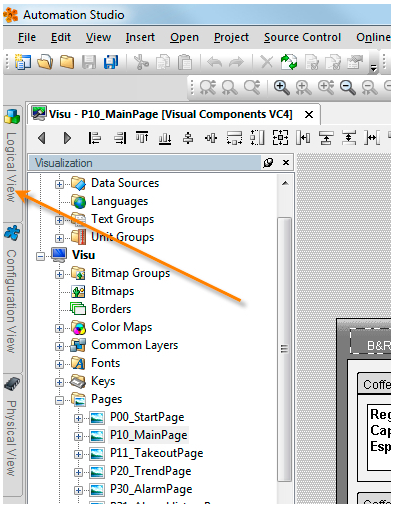


Figure 8: Hiding the project explorer

Working with Visual Components \ The workspace \ Toolbar

Working with Visual Components \ The workspace \ Project browser

Working with Visual Components \ The workspace \ Property editor

Working with Visual Components \ The workspace \ Workspace

Working with Visual Components \ The workspace \ Controls

4.4 The structure of a visualization application

A visualization application consists of multiple pages, or process images, and each of these pages has a specific task for displaying the process sequence.

Interaction between the operator and the machine takes place using a keypad or touch screen.

Process images are displayed as text, values and graphics. In Visual Components, these display elements are called controls.

Controls have various properties that determine their appearance. A control may have static properties, which can't be changed during runtime, or dynamic properties, which can.

Process variables represent the interface between a control and a control program.

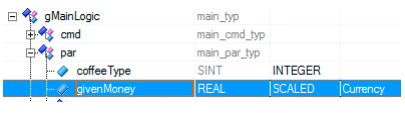
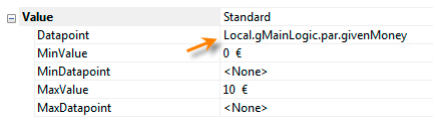
Control element	Data source	Control properties
		

Figure 9: Select control

Figure 10: Organization of variables in the data sources

Figure 11: Assignment of data source to the control's "Value" property

Table 1: Relationship between process variables and controls

Data points are process variables that can be configured in Visual Components with additional properties, such as units or limits.

Input in a control triggers an action in the visualization application or changes the value of a process variable. How this input takes place is configured using properties.

4.4.1 Global and local visualization elements

In addition to containing local elements, a visualization application is also composed of global elements for all objects in the Automation Studio project.

Global resources, such as data points, languages and alarms, are managed in the Project Explorer under "**Shared resources**".

Local resources only apply for one visualization and are managed under the component with the "**name of the visualization object**".

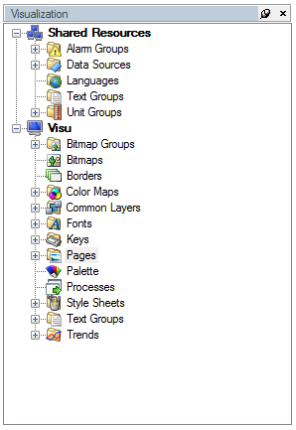


Figure 12: Resources of the visualization object

4.4.2 Conventions in Visual Components

Just like when programming in Automation Studio, there are some guidelines to follow when creating a visualization application in Visual Components.

Working with Visual Components \ Conventions

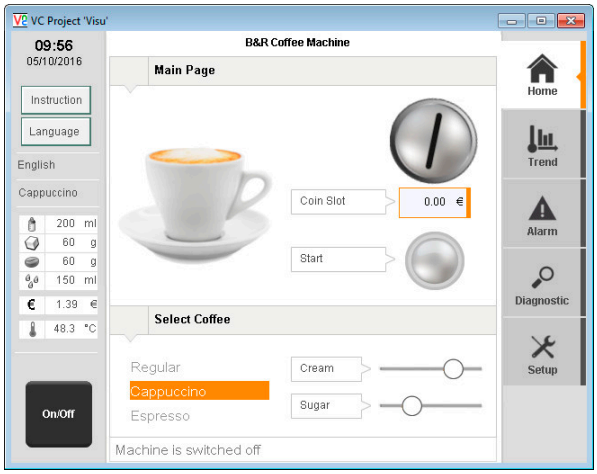
4.4.3 The visualization template

When a new object is inserted in Visual Components, it has a number of predefined elements that you can use in your project.

The following elements are prepared:

- The start page (Init_Page)
- Fonts and two languages - English and German
- Unit groups (SI units)
- Predefined style classes for all controls
- Key configurations for touchpads
- Basic alarm system
- Bitmap groups for touchpads and the alarm system
- Borders and buttons

5 Developing a visualization project



The previous exercises illustrated the structure of the Visual Components editor and its components using an Automation Studio sample program.

In this section, you will create a visualization application in Visual Components based on the "**CoffeeMachine**" program.

Figure 13: Visual Components sample program

The following project sections will be explained and performed

Exercise: Executing the "CoffeeMachine" sample program

Start the "CoffeeMachine" sample program using Automation Studio.

The goal is to transfer the example program to the Automation Runtime simulation (ARsim) and operate the visualization application in the VNC viewer. This will make it possible to complete the remaining tasks.

Automation Software \ Getting started \ Create programs in Automation Studio \ CoffeeMachine example

The "Visu" visualization object found in the sample program can be used as a reference at any time. Keep in mind that only one visualization can be opened in Visual Components at a time.

5.1 Task definition

Your task is to recreate the existing program for the "CoffeeMachine" in your own visualization application.

5.1.1 Process sequence

The coffee machine is turned on first; then the water is heated up. After a certain temperature has been reached, preparation of the selected coffee type can begin.

Payment for the coffee is simulated by entering an amount. If the amount matches the price of the respective type of coffee, preparation can begin.

Once preparation is complete, the coffee can be removed and the change dispensed.

5.1.2 Process variables used

The following process variables are used for communication between the visualization and user applications.

Activity	VC components	Process variable
Select coffee type	Listbox, button	gMainLogic.par.coffeeType
Coffee ingredients	Numeric field	gMainLogic.par.recipe.coffee gMainLogic.par.recipe.milk gMainLogic.par.recipe.sugar gMainLogic.par.recipe.water
Coffee price	Numeric field	gMainLogic.par.recipe.price
Payment	Numeric field	gMainLogic.par.givenMoney
Switching on/off	Button	gMainLogic.cmd.switchOnOff
Start the preparation phase	Button	diStartCoffee
Water temperature	Numeric field	gHeating.status.actTemp
Status display	Text field	gMainLogic.cmd.vis.messageIndex

5.1.3 Picture composition

The image should be structured as follows:

Main page

The main page is structured similarly to the template. There are no borders or design elements. The recipe data is changed here by entering the values in numeric fields.

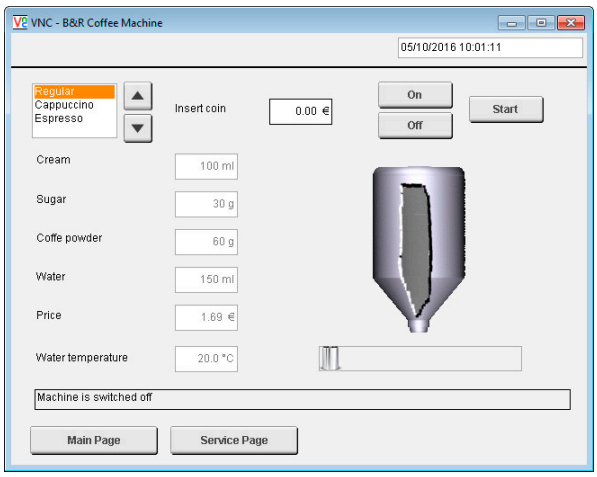


Figure 14: Structure of the main page

Service page

In this training module, the service page is used to switch languages. This page is opened manually from the main page.

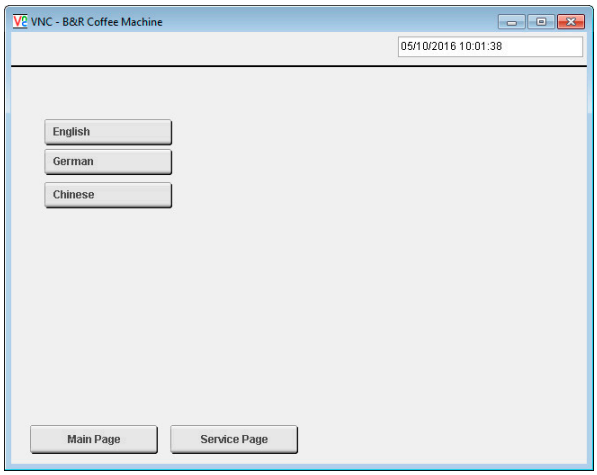


Figure 15: Structure of the service page

5.2 Inserting a new visualization object

New visualization objects are created and managed in the Logical View.

This process was completed when creating the first project.

Exercise: Adding a visualization object - "TM610"

Insert a new visualization object in the Logical View and name it "TM610". Select a resolution of 640 x 480 in landscape format.

1) Close the open visualization.
2) Switch to the Logical View. Using the toolbox, add a new VC4 visualization in the "visualization" package.
3) Select the standard template "Basic"
4) Add this object to the active configuration.

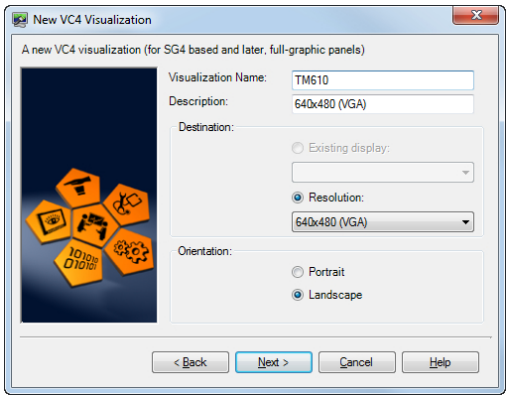


Figure 16: Inserting a new visualization object

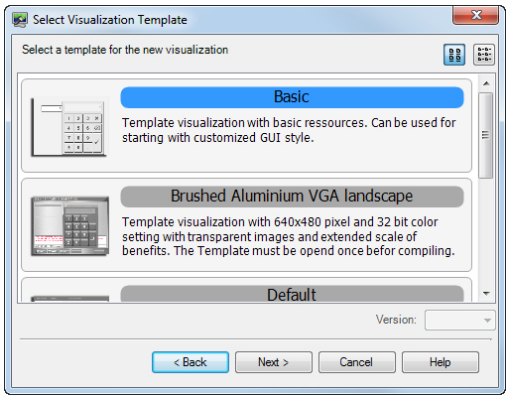


Figure 17: Selecting the standard template "Basic"

A new visualization object has been added in the Logical View.

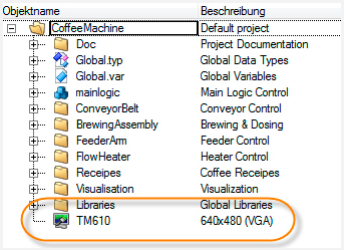


Figure 18: TM610 in the Logical View

The visualization object is displayed in the corresponding position in the software configuration.

Figure 19: TM610 in the software configuration

Working with Visual Components \ Inserting visualization objects

The original "CoffeeMachine" visualization application contains not only the default languages English and German, but also Chinese for displaying UNICODE text. This language is added to the new visualization application automatically when it is opened (4.4.1 "Global and local visualization elements" on page 11).

This is indicated by a message in the output window.

```
Warning: New language "zh(CN)" was added to the project.
```

5.3 Assigning the visualization to the hardware

Before the visualization can be configured, it must first be assigned to the corresponding hardware.

A visualization object can be used for the following types of visualization:

- Visualization on a local display
- Visualization using a VNC viewer
- Visualization on a terminal connected via Ethernet

5.3.1 Visualization on the local display

For every target system with a display, visualization objects can be assigned in the Physical View. In the shortcut menu for the "Display" entry, select **Configuration** .

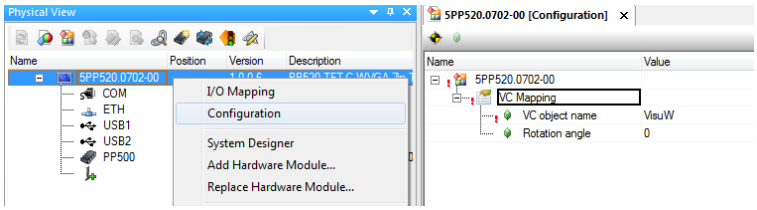


Figure 20: Assign a visualization object to a display

In the VC mapping, any visualization object assigned in the software configuration that fits the resolution of the display can be selected.

Figure 21: Local visualization on a Power Panel PP520

5.3.2 Visualization via VNC

For each VNC server object, a visualization object can be assigned in the properties of the Ethernet interface. In the shortcut menu for the Ethernet interface, select **Settings** to open the configuration. The visualization object can be assigned under "**VNC Servers**". This allows multiple VNC servers to be configured with different visualization objects.

Below the assignment of a visualization object there are additional settings for the VNC server, such as passwords and connection settings.

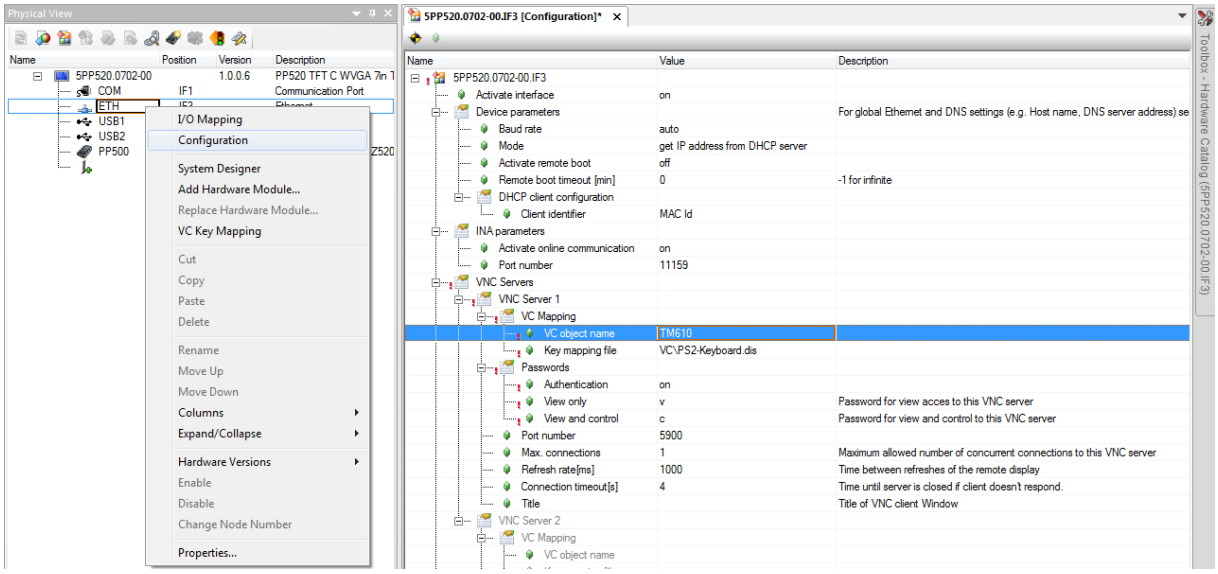


Figure 22: Mapping visualization object "TM610" to the VNC server

Exercise: Adding and configuring a VNC server entry

Your task is to insert a new VNC server object in the Physical View for the "Simulation" configuration.

Then you will assign the visualization object "TM610" to the new VNC server object. A password for read and write access must be defined in the **VNC server configuration**.

1) In the Physical View, open the configuration settings for the Ethernet interface
2) Below the entry "VNC server", assign the visualization object "TM610"
3) Define a password for read and write access
4) Set the port number to 5901
5) Transfer the project to the target system and open the VNC viewer

In the VNC viewer, the IP address and port 5901 need to be entered for the connection. After the password is entered, an empty visualization page is displayed.

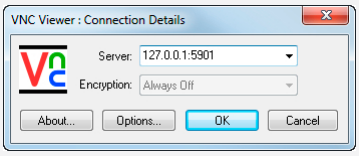


Figure 23: Displaying a visualization in the VNC viewer

Visual Components Remote \ VNC \ VNC project development

5.3.3 Visualization on a terminal

Like a VNC visualization, a terminal visualization is also displayed remotely from the CPU.

A terminal is connected to the CPU's Ethernet interface, i.e the terminal server. The terminal can be dragged and dropped from the Hardware Catalog to the Ethernet interface in the Physical View.

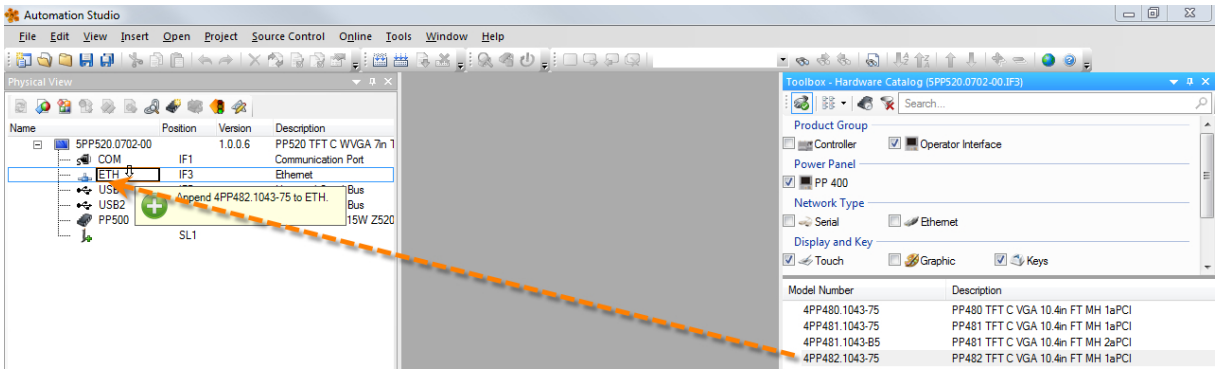


Figure 24: Connect a terminal to the Ethernet interface

Once the terminal has been added, you can go to its properties and assign the visualization object and configure the network connection settings.

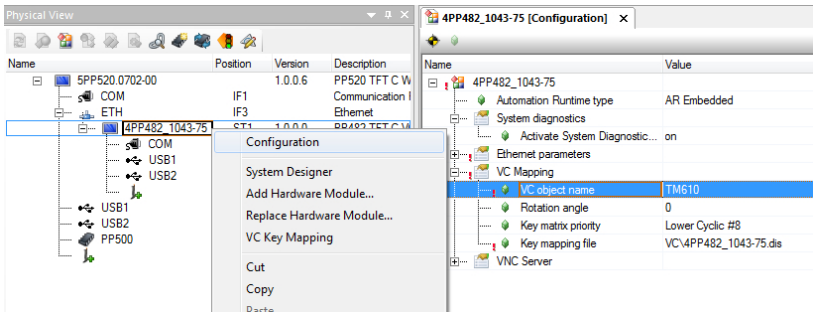


Figure 25: Configuration settings for a terminal

Visual Components Remote \ Terminal mode \ Terminal server project development

5.4 Managing variables and data points

A screen can be "given life" using the variables programmed in Automation Studio.

Variables in the application are managed in Visual Components as **data points**, which form the interface between the process and the visualization.

In the Visual Components editor, data points are created and managed under the "**Data sources**" node.

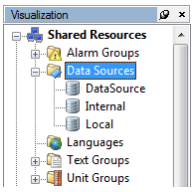


Figure 26: Data sources

5.4.1 Relationship between process variables and data points

A process variable deals with physical values in the application.

However, a data point in Visual Components has several properties. In addition to the value of the process variable, the data point can also be scaled, limited or displayed with decimal places.

Data point = Variable with additional properties.

5.4.2 Data points

The sample project already contains the data points for the existing application program. Double-clicking on the **Local** data source displays all the variables found in the Automation Studio project as data points.

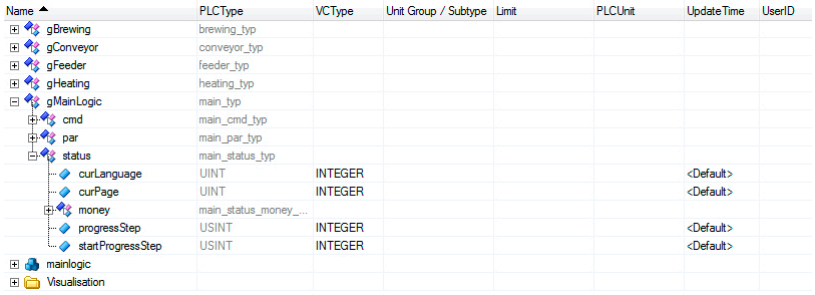


Figure 27: Variables as data points in Visual Components

If the variables in the application program change or if new variables are added, the view in the data sources editor can be refreshed by pressing <F5> or using the button on the toolbar.

Shared resources \ Data sources

5.4.3 Displaying a value with its units

If a data point is connected to a control, the control takes on all of the properties of that data point.

This means that the properties of a data point (e.g. decimal places and/or unit text) are configured for the data point and not for the control. In the Visual Components editor, unit groups are created and managed under the "Unit groups" node.

Figure 28: Unit change - °F to °C

Data points with units will be described further on.

Shared resources \ Unit groups

5.5 Global properties of a visualization object

A visualization object has global properties that can be used to influence the runtime behavior of the visualization application.

The following global properties are available:

- The language in which the visualization starts
- The page displayed after startup
- Screen saver configuration
- Data points for switching and monitoring the image number and switching languages in the application program
- Color depth of the visualization
- Key reaction configuration

In the Visual Components editor, these settings are made under the node of the visualization object.

Exercise: Defining the default language

A new project automatically contains two languages (English / German). Create the visualization in your local language.

Set the desired default language in the global properties.

1) Select the node "TM610".

2) Change the language in the default properties.

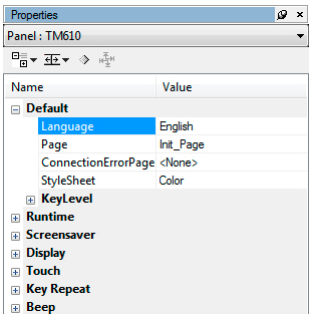


Figure 29: Select the default language

5.6 The layering method when designing pages

A process image can be made up of multiple layers.

Repeated global image information is created once centrally and can be used by an unlimited number of process images throughout the application.

- Template for common image areas
- The various layers are combined to form the overall image.
- Layers can be locked, hidden and shown individually during runtime.

Figure 30: The layering method when designing pages

Before the individual images are created, it is important to determine what information will be shown in all the images.

In this example, the date and time are displayed in the header at the top right of the screen.

The header is separated from the rest of the image area by a horizontal line.

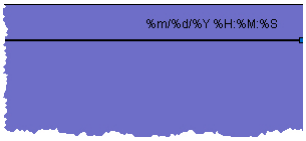


Figure 31: Sample global page

Exercise: Inserting a global layer to display the time

Your task is to create a new global image layer named "**globalArea**" under the "**Common Layers**" node. This image layer is used to display the time in the header of a page.

The time format is determined by selecting the format as text in a text group named "DateTimeFormat".

Date and time formats can be configured independently of the language using a flexible **format string**.

1) Create a local text group named "**DateTimeFormat**".
2) Insert text with these formats:

German	English
%d.%m.%Y %H:%M:%S	%m/%d/%Y %H:%M:%S

Table 2: Date and time format

3) Insert a global image layer.
4) Insert a "**DateTime**" control in the top right of the page and link the text from the text group "**DateTimeFormat**".
5) Draw a horizontal line with a width of 2 pixels.

Proposed solution:

The following images show the steps in the Visual Components editor. As the training module progresses, there will be fewer and fewer of these images and they will only show new functions.

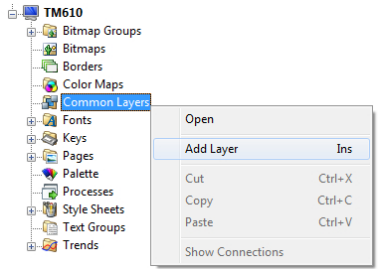


Figure 32: Insert a global layer

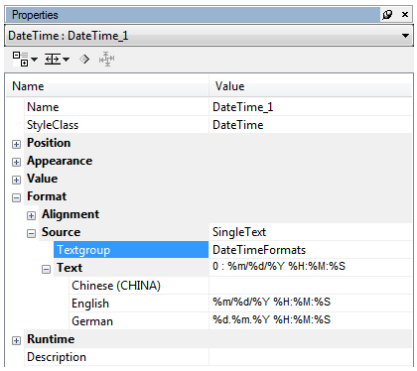


Figure 33: Configuring the Date & Time control

A global layer contains all the information that remains the same throughout multiple process images.

In the next step, you will create a process image that uses this global image layer.

It is recommended to give each control in a visualization a name that corresponds to its function. A large project can quickly become confusing if only the default names are used.

The background color of the global layer is not applied to the overall process image.

Regardless of your local language, it is best to use English names for the objects in your project. This makes it easier for the project to be edited by international colleagues. This recommendation is practiced throughout this training module.

Visualization resources \ Common layers

Control reference \ DateTime

5.7 Process images

Process images consist of one or more image layers.

An image layer contains controls used to display text or values or to enable interaction between the user and the system. When a new visualization project is created, it already contains an image with a local image layer.

This example requires the following pages:

- Machine operation
- Service page
- Display of temperature curves
  (See training module "TM640 – Alarm System, Trends and Diagnostics")
- Display of alarms and messages
  (See training module "TM640 – Alarm System, Trends and Diagnostics")

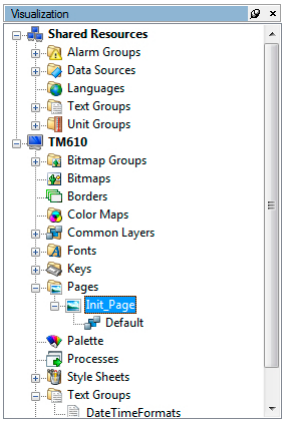


Figure 34: Managing visualization pages

A new process image can be added by right clicking on the **"Pages"** node and selecting **<Add Page>** from the shortcut menu, or using the **<Insert>** button.

A reference to the global layer can be added by right-clicking on the node for the page, selecting <**Add Layer Reference**> from the shortcut menu and then selecting the global layer.

Exercise: Creating the main page and service page

The main page is used to operate the machine. The service page allows the language for the visualization to be changed.

Add the global layer "globalArea" to each of these pages.

Proposed solution:

- Rename the "**Init_Page**" to "**MainPage**"
- Create a new page and name it "**ServicePage**".
- Add the global layer to both of the pages.

The properties of a page define the appearance of the control itself as well as the input fields. For example, if you would like to define a focus color for a touch screen display with active input fields, you can do so in the appearance properties.

There are now two pages under the "Pages" node, each with a local "**default**" layer and a reference to the global layer.

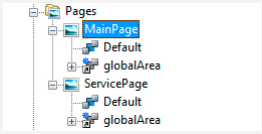


Figure 35: Local levels and level references

In the image editor, the local and the referenced global layers are shown overlapping.

If an image contains layers that will be shown and hidden dynamically during runtime (e.g. dialog or message boxes), they can be hidden during editing in order to make it easier to work on your project.

This is done using the visibility icon in the image editor toolbar.

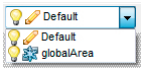


Figure 36: Visibility of image layers

Exercise: Changing visibility of image layers in the editor

Open the combo box for each image layer in the status bar of the image editor and change the visibility of the layers using the visibility icon.

Visualization resources \ Pages

5.8 Styles and style sheets

A **style** defines the appearance of an object by allowing its basic properties to be defined.

A **style sheet** is a collection of styles. Assigning a style sheet for the visualization is an easy way to give it a uniform appearance.

Advantages of a style sheet

- The properties used to design an object are managed centrally (e.g. colors of an input or output field).
- Multiple styles can be created for the same object.
- Properties only need to be changed in one place and are applied to all objects in the project with the same style.

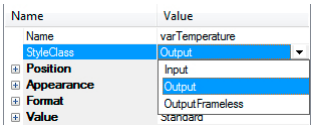


Figure 37: Example of a style for numeric fields

In this training module, different styles will be used to differentiate between input and output controls.

Visualization resources \ Style sheets

5.9 Static and dynamic texts

In Visual Components, text can be added directly on the **Text** control where it is to be shown, or set as a reference to a text group.

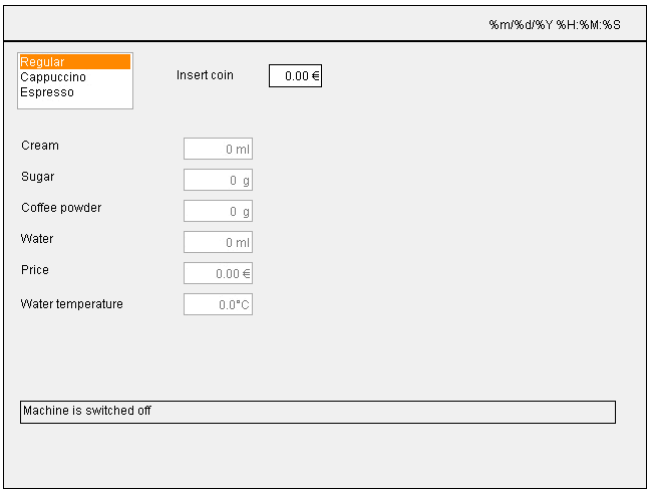


Figure 38: Static and dynamic texts

Managing static and dynamic text centrally in a text group allows it to be used multiple times throughout the project.

For the sample program, this means that all text will be created and managed in text groups. The text, button and listbox controls will only contain a reference to the corresponding property.

Text will be required for the following controls:

- Type of coffee – "Listbox" control
- Preparation of coffee – "Text" control
- Payment – "Text" control
- Water temperature display – "Text" control
- Message texts – "Text" control as dynamic text

Visualization resources \ Text groups

Control reference \ Text

Exercise: Creating text groups for description texts

Create the following local text groups:

- Control
- Recipe
- Messages
- CoffeeTypes

Enter all text for the languages English and German. The values in parentheses indicate the index. Insert the text groups in the local node named "Text Groups".

1) Text group "**Control**"

Index	German	English
0	Ein	On
1	Aus	Off
2	Start	Start
3	Geld einwerfen	Insert coin

Table 3: Texts in the "Control" text group

2) Text group "**Recipe**"

Index	German	English
0	Preis	Price
1	Milch	Cream
2	Zucker	Sugar
3	Kaffeepulver	Coffee powder
4	Wasser	Water
5	Wassertemperatur	Water temperature

Table 4: Texts in the "Recipe" text group

3) Text group "**Messages**"

Index	German	English
0	Maschine ist ausgeschaltet	Machine is switched off
1	Wassertemperatur noch nicht erreicht	Water temperature not yet stable
2	Wassertemperatur erreicht	Water set temperature reached

Table 5: Texts from the "Messages" text group

4) Text group "**CoffeeTypes**"

Index	German	English
0	Normal	Regular
1	Cappuccino	Cappuccino
2	Espresso	Espresso

Table 6: Texts from the "CoffeeTypes" text group

The texts can now be used to display static or dynamic text on controls in either English or German.

A third language, Chinese, has been defined in the shared resources (see 5.10 "Languages and fonts" on page 30).

When an object is inserted, it is given a default name (e.g. TextGroup_1). Text groups should always been given meaningful names, so that they can be easily identified later.

The possible types of coffee are shown in a list.

Exercise: Selecting coffee type from a listbox

As shown, the available coffee types are displayed in a listbox.

Insert a "**Listbox**" control on the "MainPage" and connect the "CoffeeType" text group to it.

Property	Value
Name	lstCoffeeType
StyleClass	Output
Value / Source	MultipleTexts
Value / Source / Textgroup	CoffeeType
Value / Source / IndexDatapoint	gMainLogic.par.CoffeeType
Format / alignment / Horizontal	Left
Format / Buttons / Slider	Never

Table 7: Listbox properties

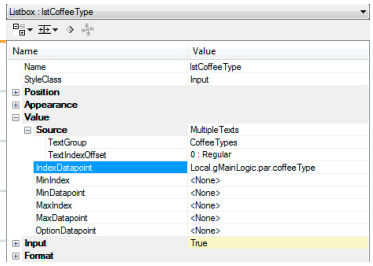


Figure 39: Properties of the listbox

1) Drag and drop the listbox control from the list of controls into the image editor.
2) Adjust the size of the control by clicking and dragging the points on its border.
3) Edit the properties.

There is now a listbox for selecting the type of coffee that looks like this:

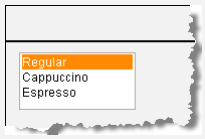


Figure 40: "Listbox" control

Control reference \ Listbox

To check whether the texts for all languages fit into the control at its current size (text length, height and content), use the icon in the toolbar to switch the language.

Figure 41: Language switching in the visualization editor

A "**Text**" control is used to display a description of an object or text that changes during runtime.

Figure 42: Text control

Control reference \ Text

Exercise: Displaying description texts

For the recipe data, the simulation of payment and the water temperature display, create description texts on the "**MainPage**" using a "**Text**" control.

The procedure is the same for all of the texts. The text for the water temperature display is used here as an example.

Property	Value
Name	txtWaterTemperature
Value / Source	SingleText
Value / Source / TextGroup	Recipe
Value / Source / Text	5: Water temperature

Table 8: Text field properties

The description texts have been created using a "**Text**" control and now look like this:

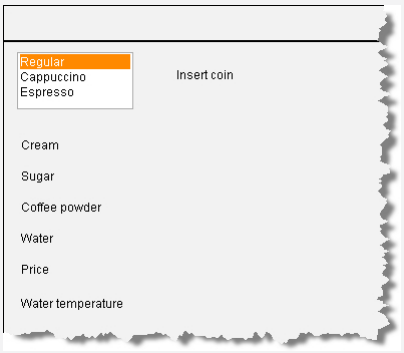


Figure 43: "Text" control

If multiple controls are selected by holding down the <**CTRL**> key and clicking on them, they can be aligned using the alignment tool in the toolbar.

Figure 44: Alignment of controls

The last step for the texts is to display a dynamic text in a "Text" control.

Unlike a static text, a dynamic text is controlled by a process variable.

Exercise: Displaying message text

Create a message text on the "**MainPage**" using a "**Text**" control. Place a border around the text.

Property	Value
Name	txtMessage
Value / Source	MultipleTexts
Value / Source / TextGroup	Messages
Value / Source / IndexData-point	Local.gMainLogic.cmd.vis.messageIndex
Appearance / Border	Flat_Black

Table 9: Text field properties

The message texts have been created using "Text" controls and now look like this:

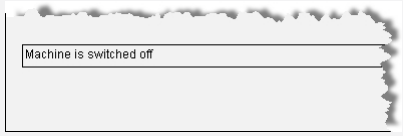


Figure 45: "Text" control for dynamic texts

5.10 Languages and fonts

A **language** refers to a specific language such as German or Japanese.

Spoken languages are divided into language families. Using "**Language Codes**" (according to ISO[1] 649-1 and 639-2) allows any international language to be identified clearly.

Languages can be added and managed under the shared resources in the **Languages** node.

Shared resources \ Languages

A **fall-back language** can be defined for all texts that can't be translated during development. For these texts, any empty text field is filled with the fall-back language when the project is built.

The fall-back language is defined under the "**Languages**" node using the "FallBackLanguage" property.

In the field of typography, a **font** refers to the graphic design of a set of characters. In Visual Components fonts are managed under the "Fonts" node.

[1] ISO:International Organization for Standardization

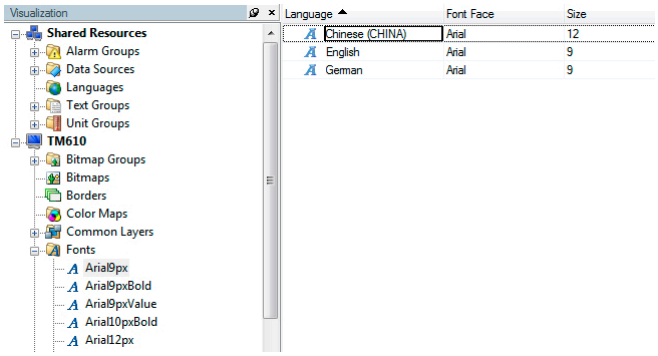


Figure 46: Visual Components fonts

So far we've been using the fonts defined by the styles.

A font must be configured for each language used in the project.

A font in Visual Components manages the font itself for each language as well as its properties:

- TrueType typeface
- Font size (in pixels)
- Bold and/or italics

The default project contains the fonts shown above. Specifying a font allows you to define its size and type when it is used in a property of a control.

Switching the language can also affect the font type and size (e.g. Asian text). If this is the case, the control must be configured to accommodate both font sizes.

Figure 47: Different font sizes depending on language

Exercise: Changing the font size of a language

For the language "**Chinese**", change the size of the font "Arial9px" from 9 to 12 pixels.

Apply the Chinese text to the "**Messages**" text group. In the image editor for the "MainPage", switch the language to check the text size.

Figure 48: Switching the language in the visualization editor

Check the control named "txtMessage" (now we'll see who named their controls) or "Text_n" to see whether the font is set correctly:

Property	Value
Name	txtMessage

Table 10: Text field properties

Property	Value
Appearance / Font	Arial9px

Table 10: Text field properties

The text in the messages' text field is larger. If the height and width of the text doesn't fit within the borders, the size of the text field must be increased.

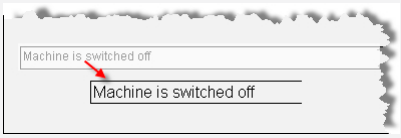


Figure 49: "Text" control after switching the language

Switching the language during runtime is dealt with in one of the following sections (see 5.12 "Touch and keypad control" on page 39).

In addition to the fonts contained in Windows, a number of fonts are installed for Visual Components when Automation Studio is installed (licensing agreement must be accepted during installation):

The following fonts are installed:

- Arial and Arial Unicode
- Bitstream Vera Sans

These fonts do not require an additional license during runtime.

Many Windows fonts are protected by copyright. There may be certain licensing conditions limiting their use in Visual Components. Not all fonts can be used free of charge. This legal aspect should therefore always be checked before using a font!

Unicode is an international standard with the goal of defining a digital code for each graphic character or element in all text and character systems.

Figure 50: Unicode

Visualization resources \ Fonts

Visualization resources \ Fonts \ Using fonts

Shared resources \ Languages \ Unicode

Visualization resources \ Fonts \ Unicode fonts

Working with Visual Components \ Editing texts externally

Anti-aliasing smooths the edges of a font.

Anti-aliasing can be enabled or disabled for all texts in the project in the properties of the visualization object.

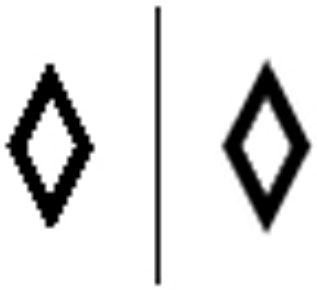


Figure 51: Antialiasing

Visualization resources \ Visualization object \ Anti-aliasing

5.11 Displaying and modifying process values

In Visual Components, a numeric or alphanumeric control can be used to display or edit the value of a process variable.

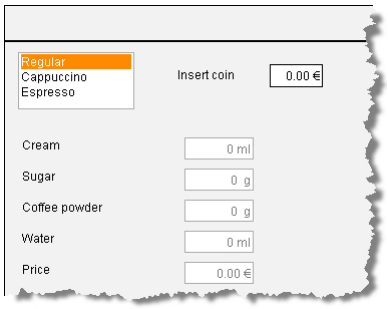


Figure 52: Displaying and modifying process values

In the sample program, the process values are displayed and input using a numeric control.

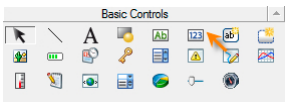


Figure 53: Numeric control

The following elements should be displayed as numerical values:

- Simulation of payment – Input in a numeric field
- Preparation of the coffee – Display as a numeric field
- Insertion of money – Displayed as text
- Water temperature display – Displayed as **scaled** numeric field

Activity	VC components	Process variable
Coffee ingredients	Numeric field	gMainLogic.par.recipe.coffee gMainLogic.par.recipe.milk gMainLogic.par.recipe.sugar gMainLogic.par.recipe.water
Coffee price	Numeric field	gMainLogic.par.recipe.price
Payment	Numeric field	gMainLogic.par.givenMoney
Water temperature	Numeric field	gHeating.status.actTemp

Exercise: Simulating payment – Numeric input

Input takes place by clicking or touching inside the numeric control.

A "**NumPad**" touchpad found in the Visual Components project is used to provide input. The input is limited to a value between 1 and 10.

Property	Value
Name	valueInsertCoin
StyleClass	Input
Value / Data point	gMainLogic.par.givenMoney
Value / MinValue	0
Value / MaxValue	10
Format / UnitText	Abbreviation

1) Drag and drop the numeric control from the list of controls into the image editor next to the description text "Insert money".
2) Change the StyleClass to "Input".
3) Connect the process variables, the limits and the unit text.

Changing the "**StyleClass**" property from **Output** to **Input** automatically sets the properties needed for inputs such as "Input = True", "Input/TouchPad = NumPad" and the border for differentiating between input and output fields.

Connecting the process variable "**gMainLogic.par.givenMoney**" and a unit text displays two decimal places and the limits with units.

Control reference \ Numeric

Value with unit text

The data point "**gMainLogic.par.givenMoney**" is a variable of type "**Real**". Visual Components automatically displays data points with this data type with decimal places.

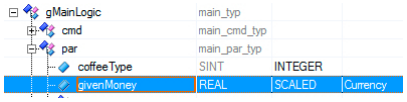


Figure 54: Data type gMainLogic.par.givenMoney

To display this data point with a defined number of decimal places and/or with a unit text (e.g. Euro €), the data point must be connected to a unit group.

Units and data points (data sources) are global resources. These have already been configured in the "Visu" visualization object and can also be used in this visualization. The following description shows how they are created.

Units are created and managed under the "**Unit groups**" node.

A unit text and the number of decimal places are defined in the unit group called "**Currency**".

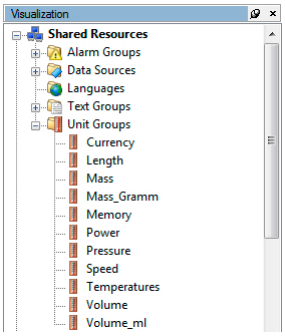


Figure 55: Unit groups

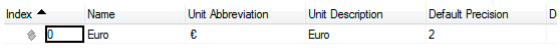


Figure 56: "Currency" unit group

The Currency unit group only has one unit - Euro (€).

Since this unit group is not switched during runtime, the unit is automatically given Index 0 when it is assigned to a data point.

Since this unit only requires the unit short text, no scaling is necessary. Only the properties of the short text and the default precision are defined.

The Currency unit group is assigned to the data point of the **gMainLogic.par.givenMoney** process variable in the **Data Sources** view. The assignment can only take place if the setting **VCType = SCALED** has been made.

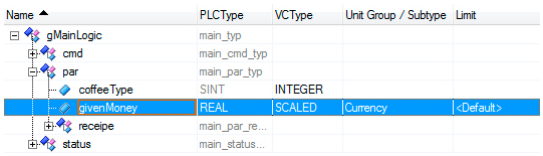


Figure 57: Connect the "Currency" unit group to a scaled data point

Shared resources \ Unit groups

FAQ \ Display \ Displaying a value with unit text

The units and a scaling value are not configured for the control, but instead on the data point (process variable + properties).

Exercise: Outputting recipe values – Numeric output

The values for the recipe data are displayed in a numeric control.

The properties are described for the process variable "Sugar" and should be configured similarly for the rest of the recipe data.

Property	Value
Name	valSugar
Value / Data point	gMainLogic.par.receipe.sugar
Format / UnitText	Abbreviation

Table 11: Properties of the numeric output

1) Place the numeric controls next to the description texts.
2) Change the properties to match the ingredients.

For each process variable used to display the recipe data, a unit group containing the unit text is connected to the data point.

The values for the recipe data are displayed with units.

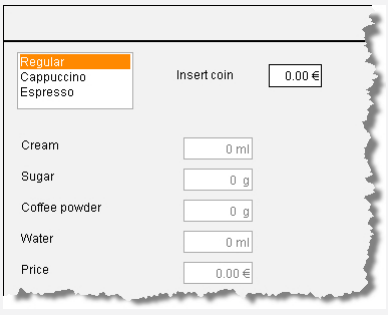


Figure 58: "Numeric" control

Value with unit switching

In the "CoffeeMachine" example, the current temperature of the water is mapped to the data point "**gHeating.status.actTemp**".

The temperature is specified with a resolution of 0.1°C.

This causes the temperature sensor to return a temperature using a resolution of 0.1 degrees Celsius. Not all countries use Celsius, however. For some countries, the display needs to be in degrees Fahrenheit.

In order to display the water temperature, the following requirements must therefore be met:

- Scaling of raw value in °C
- Scaling of raw value in °F
- Scaling must switch depending on the language setting
- Display with one decimal place
- Display of the unit text °C or °F

Figure 59: Temperature

Before we continue explaining how to fulfill these requirements, we'll begin by creating the control for displaying the temperature.

Exercise: Outputting water temperature – Numeric output

The water temperature is displayed using a numeric control.

Property	Value
Name	valTemperature
Value / Data point	gHeating.status.actTemp
Format / UnitText	Abbreviation

Table 12: Properties of the numeric output

The scaled temperature value is displayed with one decimal place and the unit text (°C or °F).

Figure 60: "Numeric" control with a scaled value and unit text

The scaling converts the physical value of the process variable into a value that can be displayed (process value) according to the linear equation **y=k*x+d**.

With a resolution of 1/10 degree, a physical value of 200 would correspond to a displayable value of 20.0°C.

K = 0.1 (incrementation by decimal)

d = 0 (offset)

y = 0.1 * 200 + 0 = 20.0

The following formula is used to display degrees Fahrenheit:

°F = °C * 9/5 + 32

Scaling formulas based on the same physical value can be grouped into a **unit group**.

To switch the unit displayed with the temperature, the "**Temperatures**" unit group is used.

This group contains two units – **Celsius** and **Fahrenheit**. Each unit has a name, an abbreviated text, a long text and a precision (decimal places).

Index	Name	Unit Abbreviation	Unit Description	Default Precision	D
0	Fahrenheit	°F	fahrenheit	1	
1	Celsius	°C	celsius	1	

Figure 61: "Temperatures" unit group

A process variable connected to the properties of the units group is used to switch the units during runtime.

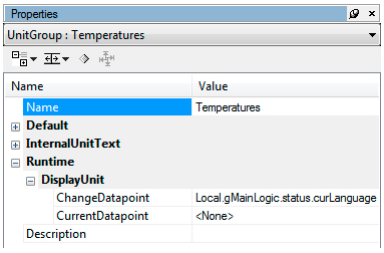


Figure 62: Switching the units

Fahrenheit scaling

In the properties of each unit, the scaling is determined according to the linear equation. For Fahrenheit, the scaling uses a static value pair (Type = StaticPairs). Using the formula °F = 9/5 x °C + 32 we get internal values of 0°C = 32°F and for any other point on the line, e.g. 1000°C = 1832°F.

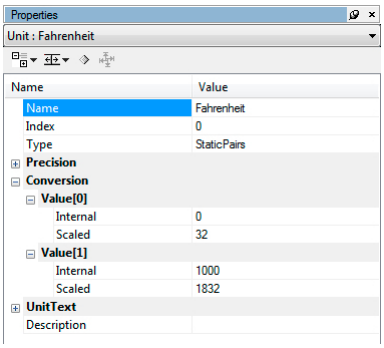


Figure 63: "Fahrenheit" units

Celsius scaling

No conversion is necessary for Celsius because the process variable already provides the value in degrees Celsius. Therefore, it is scaled by a factor of 1.

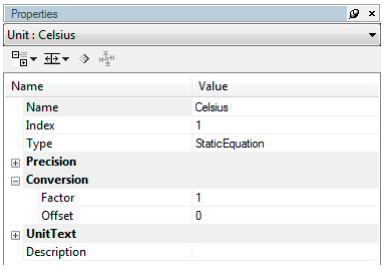


Figure 64: "Celsius" units

The unit group is assigned to the data point of the process variable "**gHeating.status.actTemp**". The assignment can only take place if the setting **VCType = SCALED** has been made.

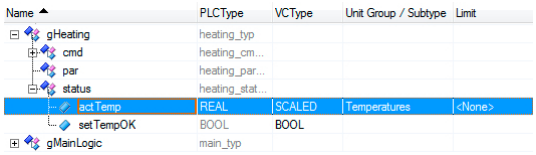


Figure 65: "Temperatures" unit group connected to data point

Shared resources \ Unit groups

FAQ \ Display \ Displaying a value with unit text

5.12 Touch and keypad control

Input takes place on a touch screen using buttons, hotspots or hardware keys.

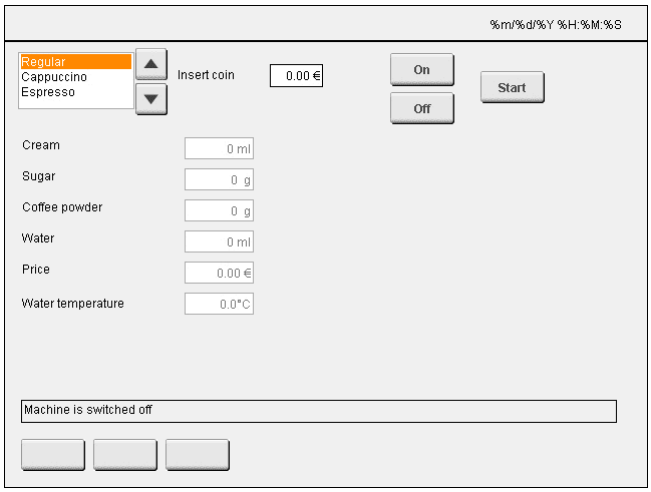


Figure 66: Touch and keypad operation

In Visual Components, each **key action** is mapped to a **virtual key**. This makes it possible to configure a key action independent of what hardware is used.

In the current exercise, operation will look like this:

- Selecting the coffee type
- Turning the coffee machine on and off
- Start the preparation phase
- Switching the page on the screen
- Switching the language

A virtual key can be compared to a global image layer: It also has no function on its own until it is connected to the actual process image.

Virtual keys and key actions

A **virtual key** has no relation to a physical key or field on the touch screen.

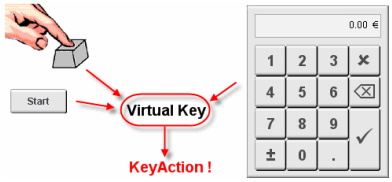


Figure 67: Using virtual keys

It describes the behavior of a key using a key action. The location where this action takes place does not matter. The assigned action is not executed until the virtual key is linked to a physical key.

Hardware-independent configuration of key actions

Visualization resources \ Keys

A **key action** refers to the action that is performed when a key or touch screen button is pressed.

For the current example, this means that a data point is changed by a button in the following cases:

- When changing the type of coffee selected
- When writing 0/1 when turning off/on
- When writing 1 to start the preparation phase
- When writing to switch the language

A page change is not performed using a data point, but rather using a separate key action.

Visual Components differentiates between local and global key actions.

Local key actions are only designed for one layer and only apply when this layer is active.

A local key action is created by inserting a button or hotspot (invisible button) in the image editor.

Before a key action is assigned to a virtual key, the virtual key must first be created. A virtual key is created using the "Keys" property of a button or hotspot by pressing the "Browse" button.

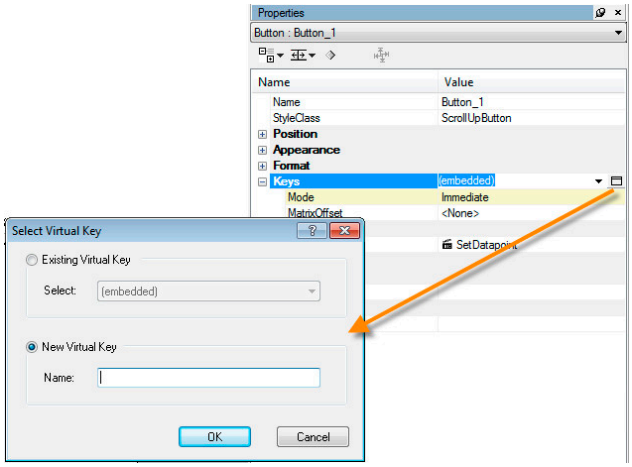


Figure 68: Creating a new virtual key

Enter a name that describes the action, then select a key action.

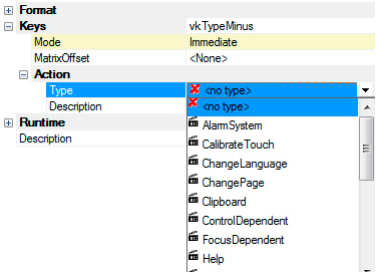


Figure 69: Selecting key actions

Visualization resources \ Keys \ Key actions

Global key actions apply for the whole visualization and are available on every image layer.

Virtual keys with global key actions are created in the workspace by double clicking on the "**Keys**" node.

Exercise: Changing the coffee type using two buttons

Use two buttons to change the type of coffee. The buttons should switch the process variable **"gMainLogic.cmd.coffeeType"** between the values 0 and 2.

The key action "**UpDownDatapoint**" for one button should increase the value of the data point from 0 to 2, and the key action for the other button should decrease the value from 2 to 0.

Select a style to differentiate between the two buttons.

Property	Value
Name	cmdCoffeeTypeMinus
StyleClass	ScrollUpButton

Table 13: Settings for the scroll button

Property	Value
Keys	vkTypeMinus
Keys / Action / Type	UpDownDatapoint
Keys / Action / Repeat	False
Keys / Action / Value / Data point	gMainLogic.par.coffeeType
Keys / Action / Value / MinValue	0
Keys / Action / Value / MaxValue	2
Keys / Action / Value / StepValue	-1

Table 13: Settings for the scroll button

1) Insert two buttons next to the listbox.
2) Arrange them and adjust their sizes (e.g. 32x32 pixels).
3) Insert a new virtual key for each button.
4) "**UpDownDatapoint**" key action
5) Configure the properties for each button.

A negative value for the "**StepValue**" property reduces the value of the process variable, a positive value increases the value.

Setting the "StepValue" property to -1 and 1 allows the process variable to be decreased or increased.

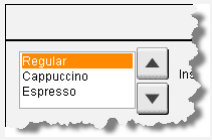


Figure 70: "UpDownDatapoint" key action

Selecting appropriate styles helps differentiate between the two buttons visually.

Additional local key actions can be set for a virtual key with a global key action. When doing so, remember that there are also **exclusive key actions**, which prevent additional local key actions from being created.

Key action reference \ UpDownDatapoint

Visualization resources \ Keys \ Key actions

In this training manual, only local key actions are used.

Next, we will create controls to turn the CoffeeMachine on and off and start preparation.

Exercise: Buttons for turning on and off

Use two buttons to turn the machine on and off. The buttons should write the values 0 (=off) and 1 (=on) to the process variable "**gMainLogic.cmd.switchOnOff**".

A button's "**SetDatapoint**" key action writes the defined value to the process variable.

Features	Value
Name	cmdCoffeeOn
Keys	vkCoffeeOn
Keys / Action / Type	SetDatapoint
Keys / Action / Value / Data point	gMainLogic.cmd.switchOnOff
Keys / Action / Value / SetValue	1
Format / TextSource	Single Text - Text Group "Control"; Index 0

Table 14: Properties for the "On" button

1) Insert two buttons.
2) Arrange them and adjust their size.
3) Insert a new virtual key for each button.
4) "SetDatapoint" key action
5) Configure the properties for each button.

When the "**gMainLogic.cmd.switchOnOff**" data point is written with the value 1, the heating phase begins and the temperature rises. A message appears in the message line when the set temperature for the selected coffee type has been reached.

To have a button remain in a pressed state after being pressed, use the "ToggleDatapoint" key function.

Key action reference \ SetDatapoint

Key action reference \ ToggleDatapoint

A button is pressed to begin preparing the coffee.

The following states are queried in the application program so that the preparation phase can be started:

- The "CoffeeMachine" must be turned on.
- The water temperature must be correct.
- Payment must have taken place.

Exercise: Creating a button to start preparation

Create a button that starts preparation of the coffee. It must write the value 1 to the local process variable "**visCtrl.cmdStartCoffee**" as long as the button is pressed.

The "**MomentaryDatapoint**" key action writes a value to the process variable when the button is pressed and a different value when it is released.

Property	Value
Name	cmdStartCoffee
Keys	vkStartCoffee
Keys / Action / Type	MomentaryDatapoint
Keys / Action / Value / Data point	visCtrl.cmdStartCoffee
Keys / Action / Value / SetValue	1
Keys / Action / Value / ResetValue	0
Format / TextSource	Single Text - Text Group "Control"; Index 2

Table 15: Properties for the "Start" button

1) Insert a button
2) Arrange them and adjust their size.
3) Insert a new virtual key.
4) "MomentaryDatapoint" key action
5) Configure the properties.

Key action reference \ MomentaryDatapoint

Pressing the button begins preparation of the coffee. If all requirements are not met, the application program prevents preparation from starting.

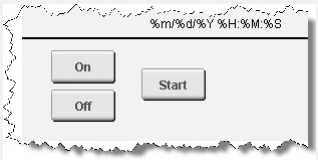


Figure 71: Buttons with key actions

The next step will be to configure a page change between the main and service pages. The service page is used to switch the language.

These tasks should be performed on your own, using the Visual Components help system as a reference.

Exercise: Page changing and language switching

Configure a page change between the main page and the service page, as shown in the overview image (see 5.1 "Task definition" on page 13). On the service page, a button can be used to switch the language.

1) Use the "**ChangePage**" key action.
2) Use the "**ChangeLanguage**" key action.

5.13 Using graphic objects

The graphic elements in a visualization are inserted, edited and managed under the "**Bitmaps**" node.

The graphic elements can be displayed in a process image using a **Bitmap** control.

In this example, an image of a tank is displayed.

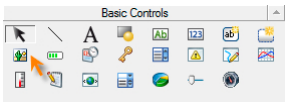


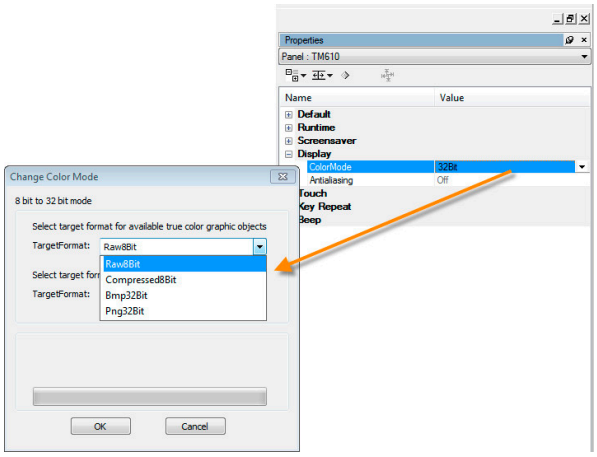
Figure 72: Bitmap control in the toolbar

Under the "**Bitmap groups**" node, multiple graphic elements with the same size can be placed in logical groups. There is the option to switch bitmaps during runtime using an index data point.

Exercise: Displaying a bitmap graphic

In order to display a tank graphic, an existing bitmap should be imported from the "B&R symbol" category. In order to retain the color depth in the original, the color depth of the visualization is changed to 32-bit beforehand.

1) Adjusting the color depth of the visualization to 32-bit
2) Adding in the graphic from the "B&R symbol" category ("Tanks" folder)
3) Adding in the bitmap control on the "**MainPage**" page
4) Set the background color of the bitmap control to that of the page



The graphic output is configured in the properties of the visualization object. All bitmaps are output in the configured color depth. When adjusting the color depth, bitmaps present in the project can be converted.

Figure 73: Setting the color depth in the properties of the visualization object

When Automation Studio is installed, many graphics and symbols are stored in the installation folder for unrestricted use. These are inserted when inserting a new bitmap in the "**Add bitmap**" dialog box.

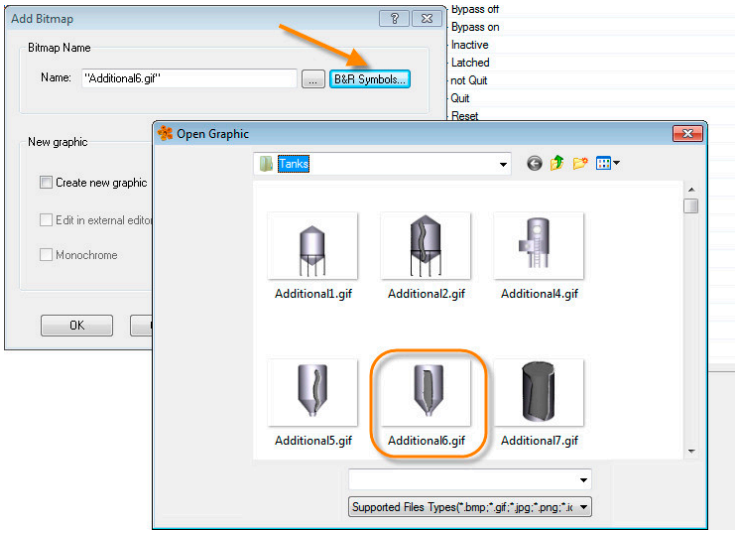


Figure 74: Inserting bitmaps

The bitmaps from the "B&R Symbols" category can be found in the following directory: "**C:\BrAutomation\Resources\BR_Symbols**"

Visualization resources \ Bitmap groups

Visualization resources \ Bitmaps

Control reference \ Bitmap

After adding the graphic and adjusting the background color, the tank graphic is displayed on the "MainPage" page.

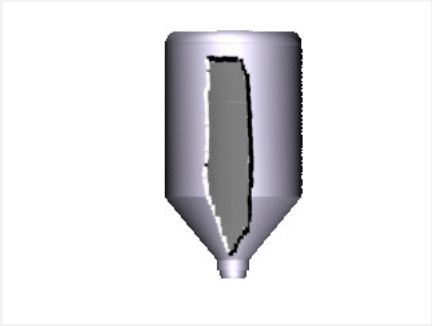


Figure 75: "Bitmap" control

So far, we have seen many of the features of Visual Components.

With the support of the Automation Studio help system, you can create your own visualization applications according to specific requirements.

The **FAQ** section of the Visual Components VC4 chapter provides solution approaches for completing various tasks.

FAQ

5.14 Dynamization of objects

Using the "Slider" control element, a value adjustment is enabled via touchpad entry. Alternatively, the slider control can be used to change the position of a bitmap depending on the process value.

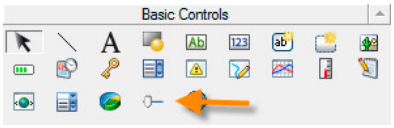


Figure 76: "Slider" control

Exercise: Animating the coffee cup

A slider control must be used to animate the movement of the coffee cup in the "TM610" visualization.

The position of the bitmap is animated from the application program using the process variable "**gMainLogic.status.progressStep**".

1) Inserting the "trashcan_empty.png" bitmap

   The bitmap is located in the path: "C:\BrAutomation\Resources\BR_Symbols\Icons and Bitmaps\32x32\Devices"

2) Inserting the slider control

3) Configuration of the slider control

Property	Value
Name	sldCupPosition
Format / Pitchlines / Style	<None>
Format / Thumb / Bitmap	trashcan_empty
Format / Thumb / Spacing	10
Appearance / Border	Flat_grey
Value / Data point	gMainLogic.status.progressStep
Value / MinValue	0
Value / MaxValue	2

Table 16: Properties of the slider control

4) Animation control

The slider control is now used exclusively for changing the position of the selected bitmap. Depending on the connected process value, the position of the graphic changes at runtime.

Figure 77: Position change of a bitmap using the slider control

6 Summary

Now that you've completed this training module, you are able to create a visualization application using the Visual Components editor.

Due to the countless possibilities provided by the Visual Components editor, we are not able to cover all of the editor's functions and features in this introductory training module.

Figure 78: Visual Components editor

A visualization object is configured independently of the hardware being used. This allows the application to be displayed either on a local display, on a remote terminal or with a VNC viewer.

The features for creating and managing one or more visualization projects in Automation Studio thus make it considerably easier to develop your projects.

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Programming and configuration	Diagnostics and service
SEM210 – Basics SEM246 – IEC 61131-3 programming language ST* SEM250 – Memory management and data storage	SEM920 – Diagnostics and service for end users SEM920 – Diagnostics and service with Automation Studio SEM950 – POWERLINK configuration and diagnostics*
SEM410 – Integrated motion control* SEM441 – Motion control: Electronic gears and cams** SEM480 – Hydraulics** SEM1110 – Axis groups and path-controlled movements**	If you don't happen to find a seminar on our website that suits your needs, keep in mind that we also offer customized seminars that we can set up in coordination with your sales representatives: SEM099 – Individual training day
SEM510 – Integrated safety technology* SEM540 – Safe motion control***	
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TM400 – Introduction to Motion Control TM410 – Working with Integrated Motion Control TM440 – Motion Control: Basic Functions TM441 – Motion control: Electronic gears and cams TM1110 – Integrated Motion Control (Axis Groups) TM1111 – Integrated Motion Control (Path Controlled Movements) TM450 – Motion Control Concept and Configuration TM460 – Initial Commissioning of Motors	TM280 – Condition Monitoring for Vibration Measurement TM480 – The Basics of Hydraulics TM481 – Valve-based Hydraulic Drives TM482 – Hydraulic Servo Pump Drives TM490 – Printing Machine Technology In addition to a printed version, our training modules are also available on our website for download as electronic documents (login required):
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Process control seminars and training modules

Process control standard seminars	Process control training modules
SEM841 – Process Control Training: Basic 1 SEM842 – Process Control Training: Basic 2 SEM890 – Advanced Process Control Solutions	TM800 – APROL System Concept TM810 – APROL Setup, Configuration and Recovery TM811 – APROL Runtime System TM812 – APROL Operator Management TM813 – APROL Web Portal TM820 – APROL Solutions TM830 – APROL Project Engineering TM835 – APROL ST-SFC Configuration TM840 – APROL Parameter Management and Recipes TM850 – APROL Controller Configuration and INA TM860 – APROL Library Engineering TM865 – APROL Library Guide Book TM870 – APROL Python Programming TM880 – APROL Reporting TM890 – The Basics of LINUX

* SEM210 - Basics is a prerequisite for this seminar.
** SEM410 - Integrated motion control is a prerequisite for this seminar.
*** SEM410 - Integrated motion control and SEM510 - Integrated safety technology are prerequisites for this seminar.
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