KUKA

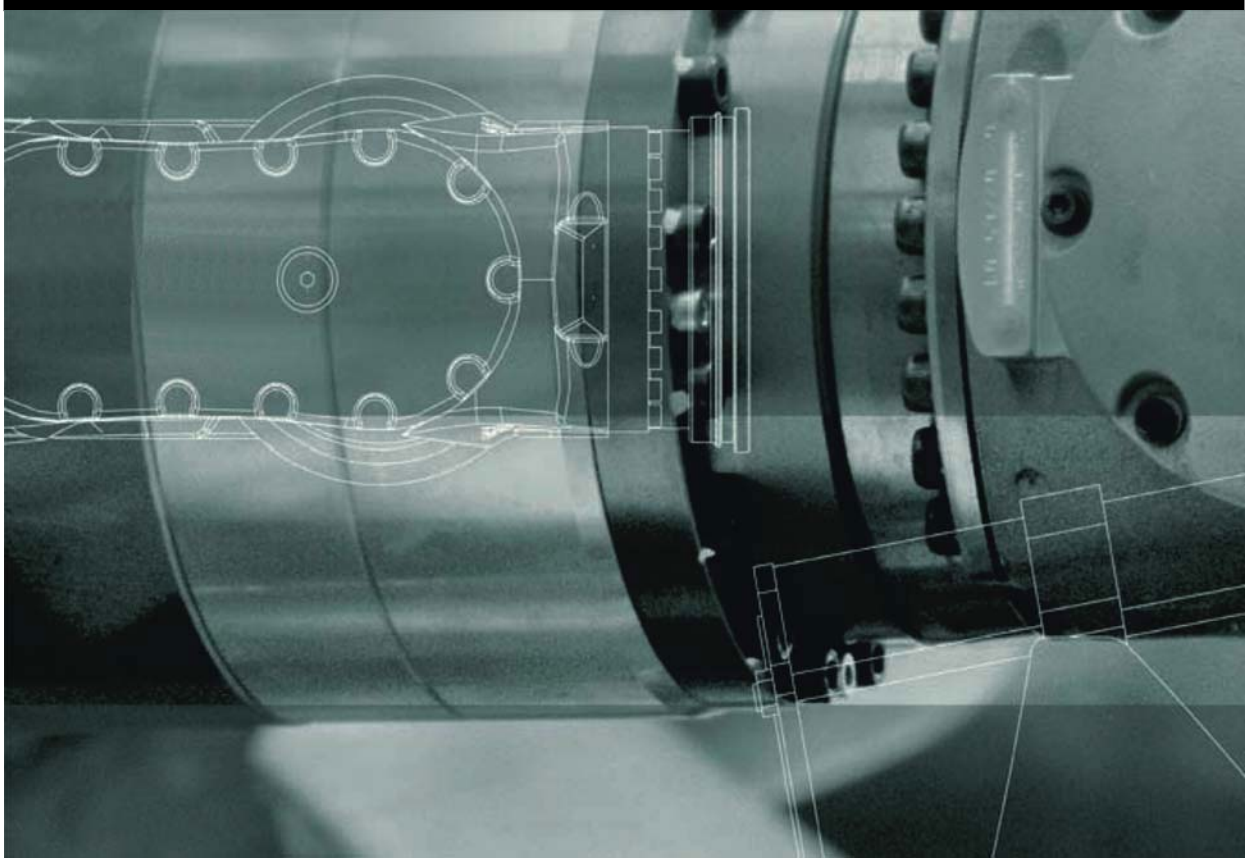
KUKA System Technology

KUKA Roboter GmbH

WorkVisual 3.0

For KUKA System Software 8.3 and 8.2

For VW System Software 8.2



Issued: 22.03.2013

Version: KST WorkVisual 3.0 V1 en (PDF)

KUKA Roboter GmbH
Zugspitzstraße 140
D-86165 Augsburg
Germany

Other functions not described in this documentation may be operable in the controller. The user has no claims to these functions, however, in the case of a replacement or service work.

We have checked the content of this documentation for conformity with the hardware and software described. Nevertheless, discrepancies cannot be precluded, for which reason we are not able to guarantee total conformity. The information in this documentation is checked on a regular basis, however, and necessary corrections will be incorporated in the subsequent edition.

Subject to technical alterations without an effect on the function.

Translation of the original documentation

KIM-PS5-DOC

Publication:	Pub KST WorkVisual 3.0 (PDF) en
Bookstructure:	KST WorkVisual 3.0 V1.1
Version:	KST WorkVisual 3.0 V1 en (PDF)

Contents

1 Introduction

1.1 Target group

This documentation is aimed at users with the following knowledge and skills:

- Advanced knowledge of the robot controller system
- Advanced knowledge of bus technologies

For optimal use of our products, we recommend that our customers take part in a course of training at KUKA College. Information about the training program can be found at www.kuka.com or can be obtained directly from our subsidiaries.

1.2 Representation of warnings and notes

Safety

These warnings are relevant to safety and **must** be observed.

DANGER These warnings mean that it is certain or highly probable that death or severe injuries **will** occur, if no precautions are taken.

WARNING These warnings mean that death or severe injuries **may** occur, if no precautions are taken.

CAUTION These warnings mean that minor injuries **may** occur, if no precautions are taken.

NOTICE These warnings mean that damage to property **may** occur, if no precautions are taken.

These warnings contain references to safety-relevant information or general safety measures.
These warnings do not refer to individual hazards or individual precautionary measures.

This warning draws attention to procedures which serve to prevent or remedy emergencies or malfunctions:

SAFETY INSTRUCTIONS Procedures marked with this warning **must** be followed exactly.

Notes

These hints serve to make your work easier or contain references to further information.

Tip to make your work easier or reference to further information.

1.3 Trademarks

Windows is a trademark of Microsoft Corporation.

Pentium is a trademark of Intel Corporation.

Step 7 are trademarks of Siemens AG.

PC WORX is a trademark of Phoenix Contact.

1.4 Licenses

This KUKA software product uses open-source software. The licensing terms are displayed during installation of the KUKA software product.

1.5 Terms used

Term	Description
CK	Customer-built Kinematics
DTM	Device Type Manager
KCP	KUKA Control Panel General name for KUKA teach pendants
KLI	KUKA Line Interface The KLI is the Ethernet interface of the robot controller for external communication. It is a physical interface and can contain multiple virtual interfaces. The KLI is configured in the KUKA system controller.
KRL	KUKA Robot Language
KSI	KUKA Service Interface Interface on the CSP on the control cabinet The WorkVisual PC can either connect to the robot controller via the KLI or it can be plugged into the KSI.
KSS	KUKA System Software
KUKA smartHMI	Name of the graphical user interface for the (V)KR C4 robot controller
KUKA smartPAD	Name of the KCP for the (V)KR C4 robot controller
Safety options	Generic term for options which make it possible to configure additional safe monitoring functions in addition to the standard safety functions. Example: SafeOperation

2 Product description

The **WorkVisual** software package is the engineering environment for KR C4 controlled robotic cells. It offers the following functionalities:

- Configuring and connecting field buses
- Programming robots offline
- Configuring machine data
- Configuring RoboTeams offline
- Editing the safety configuration
- Transferring projects to the robot controller
- Loading projects from the robot controller
- Comparing a project with another project and accepting differences where necessary
- Managing long texts
- Managing option packages
- Diagnostic functionality
- Online display of system information about the robot controller
- Configuring traces, starting recordings, evaluating traces (with the oscilloscope)

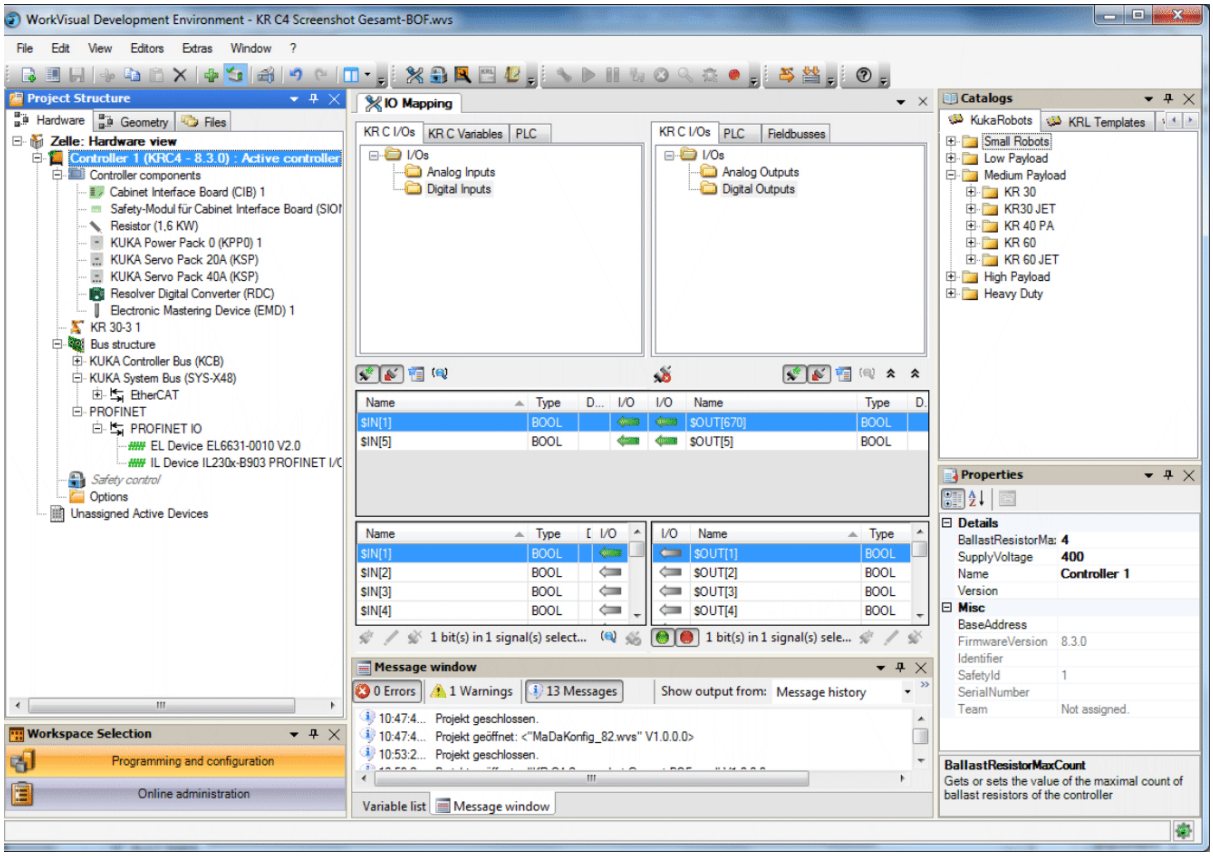


Fig. 2-1: WorkVisual graphical user interface

3 Safety

This documentation contains safety instructions which refer specifically to the software described here. The fundamental safety information for the industrial robot can be found in the “Safety” chapter of the Operating and Programming Instructions for System Integrators or the Operating and Programming Instructions for End Users.

The “Safety” chapter in the operating and programming instructions must be observed. Death to persons, severe injuries or considerable damage to property may otherwise result.

⚠ WARNING WorkVisual can be used with write access to modify outputs in the robot controller, without this being noticed by any persons located inside the system.
In the test modes, such access is not permitted. Outputs of the robot controller must not be modified using WorkVisual (“Single Point of Control” principle)! Death to persons, severe injuries or considerable damage to property may otherwise result.

⚠ WARNING WorkVisual can be used with write access to modify programs, I/O assignments, signal declarations and other parameters in the robot controller. The following applies here:
New or modified programs must always be tested first in Manual Reduced Velocity mode (T1).
After modifications to the industrial robot, existing programs must always be tested first in Manual Reduced Velocity mode (T1). This applies to all components of the industrial robot and includes modifications to the software and configuration settings. In particular, this also applies when a WorkVisual project has been activated on the robot controller.

⚠ WARNING After importing a safety configuration or parts thereof, the safety configuration must be checked! If this is not done, this can lead to the possibility of the robot being operated with incorrect data when the project is transferred to the real robot controller. Death to persons, severe injuries or considerable damage to property may result.

⚠ WARNING When activating a project on the KUKA smartHMI, an overview is displayed of the changes which will be made in comparison to the project that is still active on the robot controller.
If changes are listed in the overview under the heading **Safety-relevant communication parameters**, this means that the behavior of the Emergency Stop and “Operator safety” signal may have changed compared with the previous project.
After activation of the project, the Emergency Stop and the “Operator safety” signal must be checked for safe functioning. If the project is activated on several robot controllers, this check must be carried out for every robot controller. Failure to carry out this check may result in death to persons, severe injuries or considerable damage to property.

⚠ WARNING After activation of a project on the robot controller, the safety configuration must be checked there! If this is not done, the robot will possibly be operated with incorrect data. Death to persons, severe injuries or considerable damage to property may result.
(>>> 13.6 "Checking the safety configuration of the robot controller" Page 122)

⚠ WARNING If the activation of a project fails, an error message is displayed in WorkVisual. In this case, one of the following measures must be carried out:

- Either: Activate a project again (the same one or a different one).
- Or: Reboot the robot controller with a cold restart.

4 Installation

4.1 PC system requirements

Hardware

Minimum requirements

- PC with Pentium IV processor, min. 1500 MHz
- 512 MB RAM
- DirectX8-compatible graphics card with a resolution of 1024x768 pixels

Recommended specifications

- PC with Pentium IV processor and 2500 MHz
- 1 GB RAM
- DirectX8-compatible graphics card with a resolution of 1280x1024 pixels

Software

- Windows 7
  Both the 32-bit version and the 64-bit version can be used.
- Or: Windows XP
  32-bit version, with at least Service Pack 3
  The 64-bit version cannot be used.

If Multiprog is to be interfaced with WorkVisual:

- KUKA.PLC Multiprog 5-35 4.0 must be installed.
- Multiprog must be licensed.

4.2 System requirements, robot controller

Software

- KUKA System Software 8.3 or 8.2
- Or VW System Software 8.2

4.3 Installing WorkVisual

Precondition

- Local administrator rights

Procedure

1. Start the program **setup.exe**.
2. If the following components are not yet installed on the PC, an installation wizard opens:
   - .NET Framework 2.0, 3.0 and 3.5

   Follow the instructions in the installation wizard. .NET Framework is installed.
3. If the following component is not yet installed on the PC, an installation wizard opens:
   - SQL Server Compact 3.5

   Follow the instructions in the installation wizard. SQL Server Compact 3.5 is installed.
4. If the following components are not yet installed on the PC, an installation wizard opens:
   - Visual C++ Runtime Libraries
   - WinPcap

   Follow the instructions in the installation wizard. Visual C++ Runtime Libraries and/or WinPcap is installed.
5. The **WorkVisual […] Setup** window opens. Click on **Next**.
6. Accept the license agreement and click on **Next**.

7. Click on the desired installation type.
   (>>> "Installation types" Page 16)

> Only carry out step 8 if the type **Custom** has been selected. Otherwise, continue with step 9.

8. The **Custom Setup** window opens.

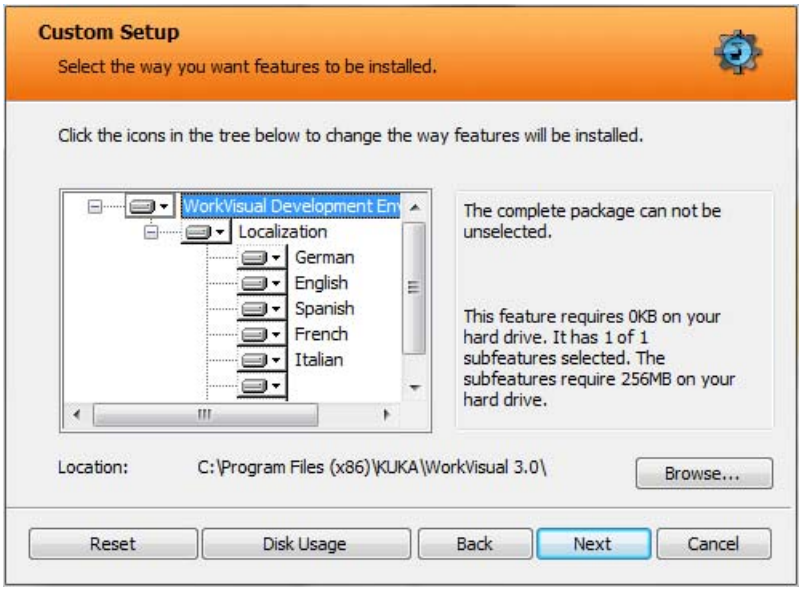


Fig. 4-1: Custom Setup window

   a. If required, select a different installation directory with **Browse...**. If **Browse…** is grayed out: select the level **WorkVisual Development Environment** in the tree. **Browse…** is then enabled.
   b. Select the desired languages in the tree. Only those languages that are installed here are available later for switching languages on the user interface.

Icon	Description
	Will be installed.
	Will be installed, including subelements (not relevant for language selection)
	Will not be installed.

   c. Continue with **Next**.
9. Click on **Install**. WorkVisual is installed.
10. Once installation is completed, click on **Finish** to close the installation wizard.

Installation types

Type	Installation directory	Languages
Typical	Default directory	English and the language of the operating system are installed.
Custom	Selectable	Selectable from list
Complete	Default directory	All are installed

Default directory: C:\Program Files (x86)\KUKA\WorkVisual 3.0

Only those languages that are installed are available later for switching languages on the user interface.

4.4 Uninstalling WorkVisual (Windows 7)

It is advisable to archive all relevant data before uninstalling a software package.

Precondition

- Local administrator rights
- The setting **Show hidden files, folders and drives** is activated in Windows Explorer.

Procedure

1. In the Windows Start menu, delete the entry **WorkVisual […]** under **Control Panel** > **Remove Program**.

The remaining steps are only necessary if the entire user configuration is to be deleted.

2. Delete the **WorkVisual Projects** folder in the directory C:\User*Username*\My Documents.
3. In the directory C:\ProgramData\KUKA Roboter GmbH, delete the folders **DeviceDescriptions** and **WorkVisual**.

4.5 Uninstalling WorkVisual (Windows XP)

It is advisable to archive all relevant data before uninstalling a software package.

Precondition

- Local administrator rights
- The setting **Show hidden files and folders** is activated in Windows Explorer.

Procedure

1. In the Windows Start menu, select **Settings** > **Control Panel** > **Software**, and delete the entry **WorkVisual […]**.

Steps 2-6 are only necessary if the entire user configuration is to be deleted.

2. In the directory C:\Program Files\KUKA, delete the folder **WorkVisual [...]**.
3. In the directory C:\Documents and Settings*Username*\Application Data\KUKA Roboter GmbH, delete the folder **WorkVisual**.
4. In the directory C:\Documents and Settings\All Users\Application Data\KUKA Roboter GmbH, delete the folders **DeviceDescriptions** and **WorkVisual**.
5. Delete the **WorkVisual Projects** folder in the **My Documents** directory.

5 Graphical user interface

5.1 Overview of the graphical user interface

Not all elements on the graphical user interface are visible by default, but they can be shown or hidden as required.

There are other windows and editors available in addition to those shown here. These can be displayed via the **Window** and **Editors** menus.

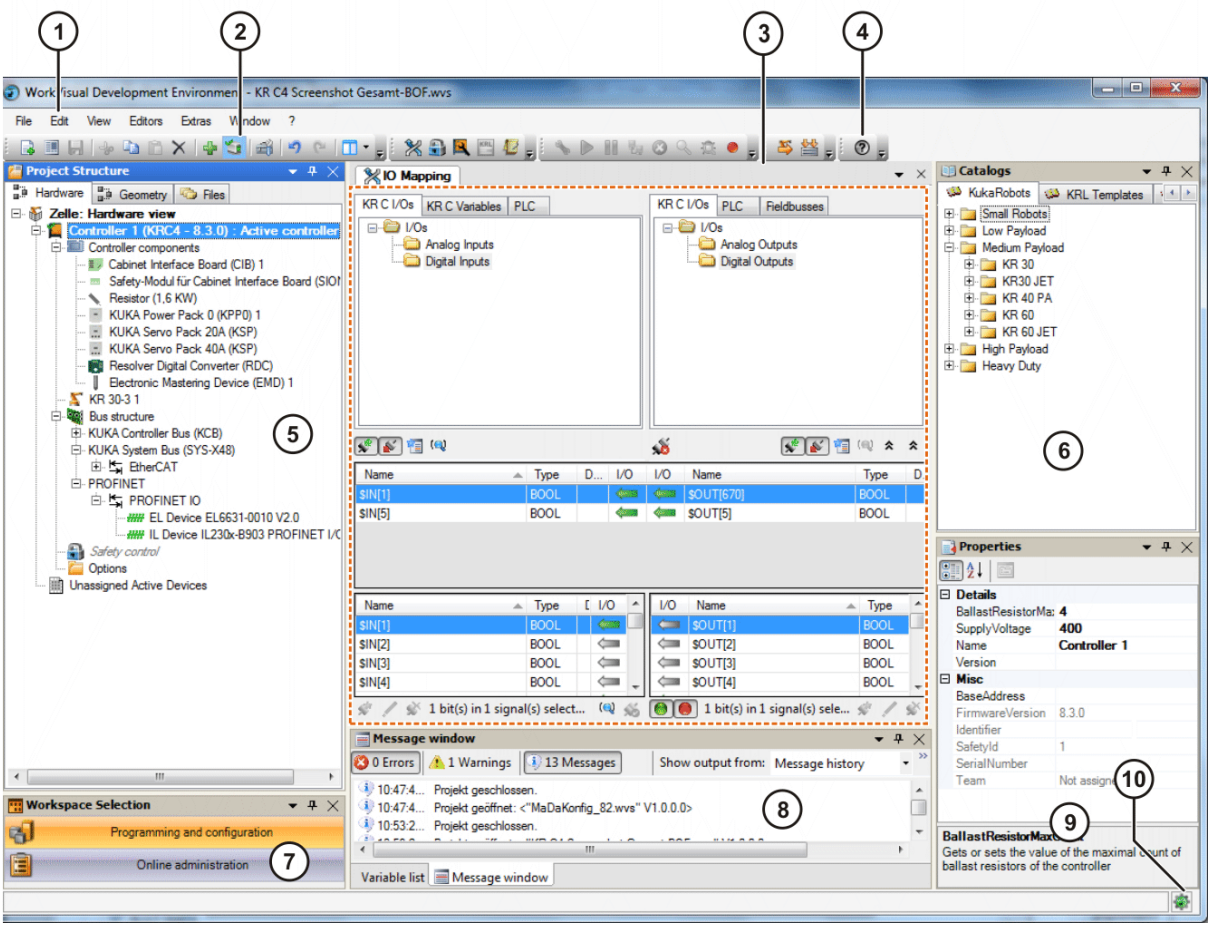


Fig. 5-1: Overview of the graphical user interface

Item	Description
1	Menu bar
2	Button bars (>>> 5.5 "Displaying/hiding buttons" Page 23) (>>> 5.6 "Button bar" Page 23)
3	Editor area If an editor is open, it is displayed here. More than one editor can be open simultaneously – as shown here in the example. In this case, they are stacked one on top of the other and can be selected via tabs.
4	Help button
5	**Project structure** window (>>> 5.8 "Project structure window" Page 26)

Item	Description
6	**Catalogs** window All inserted catalogs are displayed in this window. The elements in the catalogs can be inserted on the **Hardware** or **Geometry** tabs in the **Project structure** window.
7	**Workspace Selection** window (>>> 5.4 "Displaying different views of the user interface" Page 22)
8	**Messages** window (>>> 5.7 "Messages window" Page 25)
9	**Properties** window If an object is selected, its properties are displayed in this window. The properties can be changed. Individual properties in gray boxes cannot be changed.
10	**WorkVisual project analysis** icon (>>> 14.1 "Project analysis" Page 127)

5.2 Displaying/hiding windows

Procedure

1. Select the menu item **Window**. A list of available windows opens.
2. Click on a window in the list in order to display or hide it on the graphical user interface.

5.3 Repositioning the windows

Precondition

- The desired window is displayed on the graphical user interface.

Procedure

Free positioning of windows:

1. Right-click in the title bar of the window. A context menu is opened.
2. Select the option **Floating**.
3. Grip the window by the title bar and move it to the desired position on the graphical user interface.

If the mouse pointer is positioned over the edges or corners of the window, arrows appear which can be dragged to make the window larger or smaller.

Fixed positioning of windows:

1. Right-click in the title bar of the window. A context menu is opened.
2. Select the option **Dockable**.
3. Grip the window by the title bar and move it to the desired position on the graphical user interface.
   - Anchor points are displayed at the right, left, top and bottom of the user interface.
   - If the window is moved over another fixed window, an anchor cross is displayed.
     (>>> "Anchor cross" Page 21)
4. Drag the window onto an anchor point or the cross. The window is now anchored.

Automatic hiding and displaying of anchored windows:

1. Right-click in the title bar of the window. A context menu is opened.
2. Select the option **Auto-Hide**. The window is hidden. A tab with the name of the window remains at the edge of the user interface.

3. To show the window again, move the mouse pointer over the tab.
4. To hide the window again, move the mouse pointer off the window. If necessary, click on an area outside the window.

The **Auto-Hide** option creates more space for working in other areas of the user interface. Nonetheless, the window can still be quickly shown again at any time.

There is a pin symbol in the title bar of the window.

- Alternatively, **Auto-Hide** can also be activated or deactivated by clicking on this pin symbol.

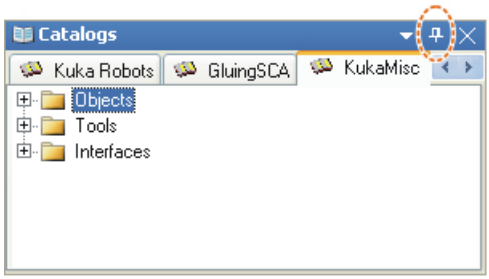


Fig. 5-2: Pin symbol

Anchor cross

If a window is moved over another fixed window, an anchor cross is displayed.

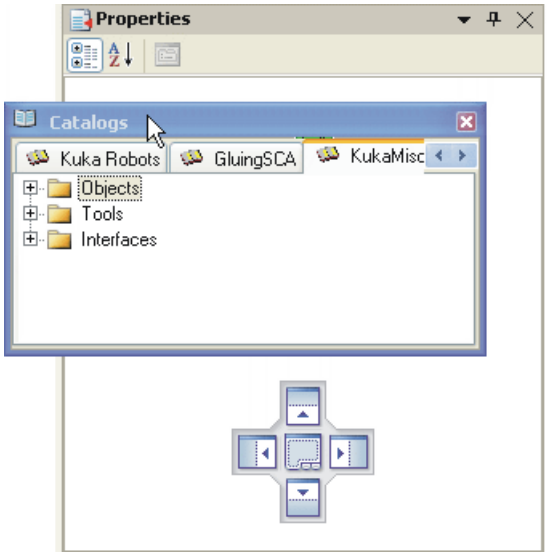


Fig. 5-3: Anchor cross

Depending on which side of the anchor cross the window is dragged, it is then anchored on this side of the previously window.

If the window is dragged over to the center of the anchor cross, both windows are anchored one on top of the other. Tabs are displayed underneath the windows, making it possible to switch between windows.

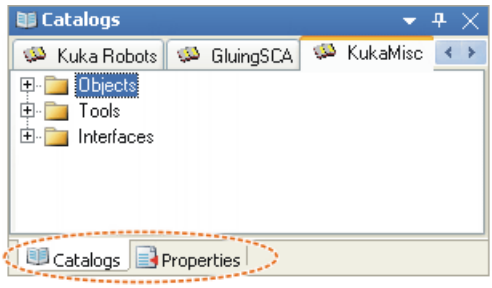


Fig. 5-4: Windows anchored on top of each other

To move windows that are anchored one on top of the other:

- Dragging on a tab moves only the corresponding window.
- Dragging on the title bar moves the whole stack of windows.

5.4 Displaying different views of the user interface

Description

The WorkVisual user interface can be displayed in 2 different views. These can be selected via the menu item **View** or via the **Workspace Selection** window.

The views are tailored to different types of work:

View	Focus
Programming and configuration	Area for project-related work e.g. cell configuration, I/O mapping and work with the KRL Editor.
Online administration	Area for project-independent work e.g. monitoring, recording The functions in this view are only available when there is no project opened.

Each view can be adapted separately to the needs of the user. Examples:

- Position the button bars differently in each view.
- Hide the message window in one view and not in another.

Procedure

Show the **Workspace Selection** window:

- Select the menu sequence **Window** > **Workspace Selection**.

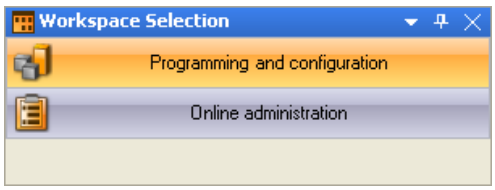


Fig. 5-5: Workspace Selection window

To reset the current view to the default settings:

- Select the menu sequence **Window** > **Reset active workspace**.

To reset the all views to the default settings:

- Select the menu sequence **Window** > **Reset all workspaces**.

5.5 Displaying/hiding buttons

Description The individual buttons can be added or removed. In this way, the button bar can be tailored to the needs of the user.

Procedure

1. Click on the arrow on the right of the button bar.

Fig. 5-6: Example: File button bar: Click on the arrow on the right

2. The menu item **Add or Remove Buttons** is displayed. Click on this, and then on the submenu item **[***BarName***]**.
3. An overview of all the buttons in this bar is displayed. Click on a button in the overview in order to add or remove it.

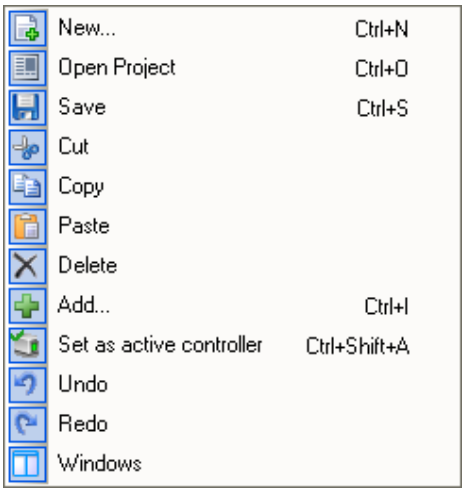


Fig. 5-7: Example: File button bar: Overview

5.6 Button bar

Button	Name / description
	**New…** Opens a new, empty project.
	**Open project** Opens the **Project Explorer**.
	**Save project** Saves the project.
	**Cut** Deletes the selected element from its original position and copies it to the clipboard.
	**Copy** Copies the selected element to the clipboard.
	**Paste** Inserts the cut or copied element at the selected position.
	**Delete** Deletes the selected element.

Button	Name / description
	**Opens the Add Point dialog.** Opens a window in which an element can be selected and added to the tree structure. Which element is available depends on what is selected in the tree structure. The button is only active if an element is selected on the **Hardware** or **Files** tab of the **Project structure** window.
	**Set as active controller** / **Reset active controller** Sets a robot controller to active/inactive. The button is only active if a robot controller is selected in the **Project structure** window.
	**Configuration proposal...** Opens a window in which WorkVisual proposes complete hardware configurations that match the existing kinematic systems. The user can select which proposal matches the real configuration and apply this configuration to the project
	**Undo** Undoes the last action.
	**Redo** Redoes the action that was undone.
	**Settings…** Opens a window with the hardware data. The button is only active if a device is selected on the **Hardware** tab of the **Project structure** window.
	**Connect with device** Establishes a connection with a field bus device. The button is only active if the field bus master is selected on the **Hardware** tab of the **Project structure** window.
	**Disconnect from device** Terminates the connection with a field bus device.
	**Scan Topology…** Scans a bus.
	**Abort last action** Cancels certain actions, e.g. a bus scan. The button is only active if a cancelable action is running.
	**Monitor** Currently without function.
	**Diagnosis…** Currently without function.
	**Perform network capture...** WorkVisual can record communication data from interfaces of the robot controller. This button opens the corresponding window.
	**Deploy…** Transfers the project to the robot controller.

Button	Name / description
	**Generate code** (>>> 13.1 "Generating code" Page 113)
	**Mapping editor** Opens the **I/O Mapping** window.
	**The local safety configuration of the controller** Opens the local safety configuration of the current robot controller.
	**Drive configuration** Opens a graphic editor for adapting the drive channels.
	**KRL Editor** Opens the selected file in the KRL Editor. The button is only active if a file is selected on the **Files** tab of the **Project structure** window which can be opened with the KRL Editor.
	**Symbol Table Editor** Opens the **Symbol Table Editor** window.
	**Help** Opens the Help.

Only in the **Online administration** workspace:

Button	Name / description
	Opens the **Online system information** window. (>>> 14.6 "Displaying online system information" Page 147)
	Opens the **Diagnostic monitor** window. (>>> 14.5 "Displaying diagnostic data about the robot controller" Page 144)
	Opens the **Trace configuration** window. (>>> 14.2.4 ""Trace configuration" window" Page 130)
	Opens the **Trace Analysis** window. (>>> 14.2.7 ""Trace Analysis" window" Page 136)
	Opens the **Log view** window. (>>> 14.4 "Displaying messages and system logs of the robot controller" Page 141)

5.7 Messages window

Description

Messages are displayed here. The following options can be set in the message window:

Language:

The desired language can be selected here.

Category:

- **Message history**: Displays all messages except errors relating to KRL code.

  Messages are not automatically deleted, even if they refer to a temporary state that is no longer active. Messages can be deleted by right-clicking on them and selecting the option **Delete all**.

- **KRL Parser**: Display of errors in the KRL code of the file currently open in the **KRL Editor** window.

5.8 Project structure window

The **Project structure** window contains the following tabs:

Hardware

The **Hardware** tab shows the relationship between the various devices. Here, the individual devices can be assigned to a robot controller.

Geometry

The **Geometry** tab displays all the geometrical objects used in the project in a tree structure (kinematic systems, tools, base objects). The properties of the objects can be edited.

If objects need to be linked geometrically, e.g. if a robot is to be assigned to a KUKA linear unit: this must be done here on the **Geometry** tab (Drag&Drop).

Files

The **Files** tab contains the program and configuration files belonging to the project.

Coloring of file names:

- Files generated automatically (with **Generate code** function): gray
- Files inserted manually in WorkVisual: blue
- Files transferred to WorkVisual from the robot controller: black

5.9 Resetting the graphical user interface

Description

All the settings affecting the graphical user interface and its behavior that the user has made in WorkVisual can be reset to the default state (as after installation).

This includes changes to the button bars, windows that have been displayed or hidden, and settings made in the **Options** window.

Procedure

1. Select the menu sequence **Window** > **Reset configuration**.
2. Close WorkVisual and restart it.

6 Operation

6.1 Starting WorkVisual

Procedure

1. Double-click on the WorkVisual icon on the desktop.
2. When WorkVisual is started for the first time, the DTM Catalog Management is opened. Here a catalog scan must be carried out.
   (>>> 6.9.1 "Updating the DtmCatalog (Catalog Scan)" Page 30)

6.2 Opening a project

Description

This procedure is used to open a project.

Projects can also be opened from older versions of WorkVisual. WorkVisual creates a backup copy of the older project and then converts the project. Before this happens, a dialog is displayed requesting the user to confirm the conversion.

Procedure

1. Select the menu sequence **File** > **Open project**.
   Or: Click on the **Open project** button.
2. The **Project Explorer** is opened. On the left, the **Open project** tab is selected. A list of projects is displayed.
   Select a project and click on **Open**. The project is opened.
3. Set the robot controller as the active controller.

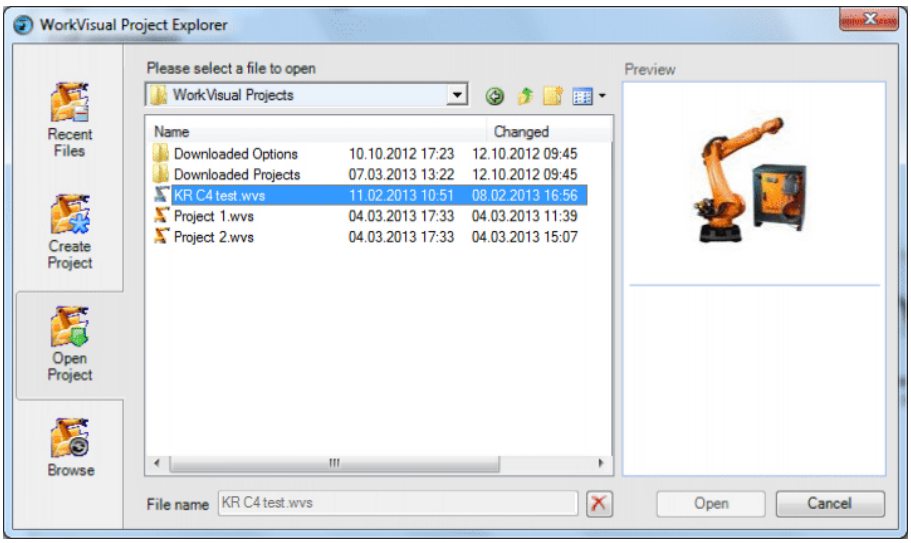


Fig. 6-1: Project Explorer

Alternative procedure

1. Select the menu sequence **File** > **Recent projects**. A submenu containing recently opened projects is opened.
2. Select a project. The project is opened.
3. Set the robot controller as the active controller.

Projects which are located on a robot controller and have not yet been saved on this PC can be loaded in WorkVisual and opened there. To do this, a different procedure must be used:

(>>> 13.7 "Loading the project from the robot controller" Page 122)

6.3 Creating a new project

6.3.1 Creating a new empty project

Procedure

1. Click on the **New…** button. The **Project Explorer** is opened. On the left, the **Create project** tab is selected.
2. Select the **Blank project** template.
3. Enter a name for the project in the **File name** box.
4. The default directory for projects is given in the **Location** box. If required, select a different directory.
5. Click on the **New** button. A new, empty project is opened.

6.3.2 Creating a project with a template

Procedure

1. Click on the **New…** button. The **Project Explorer** is opened. On the left, the **Create project** tab is selected.
2. Select the desired template in the **Available templates** area of the tab.
3. Enter a name for the project in the **File name** box.
4. The default directory for projects is given in the **Location** box. If required, select a different directory.
5. Click on the **New** button. The new project is opened.

Templates

The templates available for selection include:

Template	Description
Blank project	Blank project
KR C4 project	This project contains a KR C4 controller and the catalog **KRL Templates**.
VKR C4 project	This project contains a VKR C4 controller and the catalog **VW Templates**.

For templates with controller:

If the real robot controller is a VKR C4 retrofit, or if certain options are used, this must be activated in WorkVisual.

(>>> 6.16 "Activating the “Retrofit” variant or controller options" Page 34)

6.3.3 Creating a project on the basis of an existing project

Procedure

1. Click on the **New…** button. The **Project Explorer** is opened. On the left, the **Create project** tab is selected.
2. Select the desired project in the **Available projects** area of the tab.
3. Enter a name for the new project in the **File name** box.
4. The default directory for projects is given in the **Location** box. If required, select a different directory.
5. Click on the **New** button. The new project is opened.

6.4 Saving project information

Description

If required, the user can assign information to the project. The following information can be saved:

- A description
- A preview image (screenshot)

The following information is saved and displayed by default:

- The version
- The creation date and change date
- The current file location
- The project ID

Precondition

- A project is open.

Procedure

1. Select the menu sequence **Extras** > **Project info**. The window **Project info for ...** is opened.
2. Enter a description in the **Description** box (optional).
3. Click on the **Insert image from file** button (optional). Select an image and confirm with **Open**.
4. Click on **OK**. The window **Project info for ...** is closed and the project information is saved.

6.5 Saving the project

Description

Projects have the file format WVS ("WorkVisual Solution").

A project can be saved with one of the following functions:

- **Save**: Saves the open project.
- **Save as**: This function is used to save a copy of the open project.
  The open project itself is closed and remains unchanged.

Procedure for Save

- Select the menu sequence **File** > **Save**.
  Or click on the **Save project** button.

Procedure for Save as

1. Select the menu sequence **File** > **Save as**.
   The **Save as** window is opened. A file location for the project can be selected here.
2. Enter a name in the **File name** box and click on the **Save** button.

6.6 Closing the project

Procedure

- Select the menu sequence **File** > **Close**.
  If changes have been made, a request for confirmation is displayed, asking if the project should be saved.

6.7 Closing WorkVisual

Procedure

- Select the menu sequence **File** > **Exit**.
  If a project is open, a request for confirmation is displayed, asking if the project should be saved.

6.8 Importing device description files

Description

To be able to use a device in WorkVisual, WorkVisual requires the device description file for this device.

The device description files must be obtained from the manufacturer of the devices.

Precondition

- There is no project open.

Procedure

1. Select the menu sequence **File** > **Import / Export**. A window opens.

2. Select **Import device description file** and click on **Next >**.
3. Click on **Browse…** and navigate to the directory where the files are located. Confirm with **Next >**.
4. Another window opens. Select the required type in the **File type** box.
   For devices for KUKA buses, the type **EtherCAT ESI** must be selected.
5. Select the file to be imported and confirm with **Open**.
6. Click on **Finish**.
7. Close the window.

The imported files are now available in the **DtmCatalog**.

6.9 Catalogs

6.9.1 Updating the DtmCatalog (Catalog Scan)

Description

This procedure is used to update the **DtmCatalog**. As a rule, it only needs to be carried out when WorkVisual is started for the first time after installation or after an update.

An exception is EtherNet/IP if an EDS file was imported. After this, the catalog scan must be carried out.

Precondition

- There is no project open.

Procedure

1. The **DTM Catalog Management** window opens automatically.
   If necessary, it can also be opened via the menu sequence **Extras** > **DTM Catalog Management...**.
2. Click on **Search for installed DTMs**. WorkVisual searches the PC for relevant files. The search results are displayed.
3. Under **Known DTMs**, select the required files and click on the **Right arrow** button.
   If all files are to be accepted, click on the **Double right arrow** button.
4. The selected files are displayed under **Current DTM Catalog**. Click on **OK**.

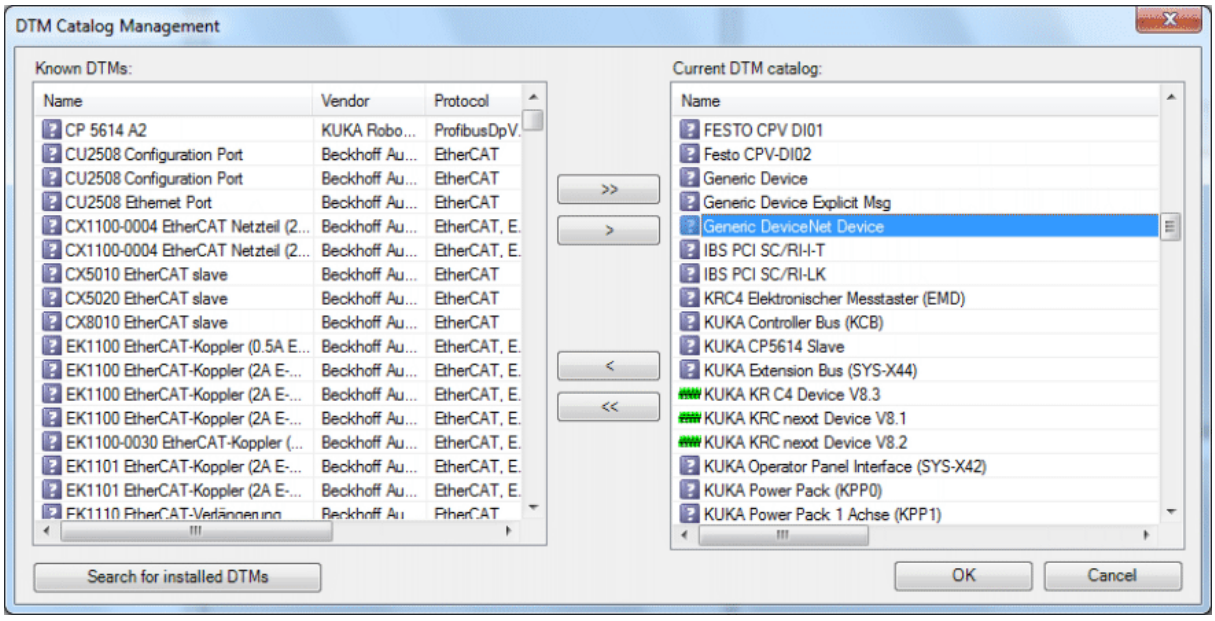


Fig. 6-2: DTM Catalog Management

6.9.2 Inserting a catalog in a project

Description

The catalogs contain all the elements that are required to generate programs. In order to be able to use a catalog, it must first be inserted in the project.

Procedure

1. Select the menu sequence **File** > **Catalog management...**. A window opens.
2. Double-click on the desired catalog in the **Available catalogs** area. The catalog is now displayed in the **Project catalogs** area.
3. Close the window.

   The catalog has been inserted in the project. It is now available in the **Catalogs** window.

6.9.3 Removing a catalog from the project

Procedure

1. Select the menu sequence **File** > **Catalog management...**. A window opens.
2. Double-click on the catalog to be removed in the **Project catalogs** area. The catalog is now displayed in the **Available catalogs** area.
3. Close the window.

6.9.4 Catalog descriptions (8.2)

Which catalogs are available depends on whether a robot controller with version 8.2 or 8.3 is used.

Catalog	Catalog contains ...
DtmCatalog	Device description files **Note:** The robot controller must already have been set once as the active controller in order for this catalog to be used.
KRL Templates	KRL program templates
KukaControllers	Robot controllers, hardware components for robot controllers, safety options, PROCONOS option
KukaExternalAxes	KUKA linear units, KUKA turn-tilt table **External Kinematics Templates**: Templates for external kinematic systems that are not supplied by KUKA. These templates can be used if the machine data belonging to the kinematic system are only available in the form of XML files.
KUKARobotsKRC4 Heavy Payload	KUKA robots
KUKARobotsKRC4 High Payload	
KUKARobotsKRC4 High Payload 2000 Series	
KUKARobotsKRC4 Low PayLoads	
KUKARobotsKRC4 Medium Payloads	

Catalog	Catalog contains ...
KukaSpecialRobots	KUKA robots for special applications ■ **Food**, **Foundry**, **Clean Room**
MGU_Motor-Gear-Unit	KUKA motor/gear units An element from this catalog is used if a non-KUKA external axis fitted with a KUKA motor/gear unit is used with the real controller.
Motor_als_Drive	**Note:** Do not use this catalog!
Motor_als_Kinematik	KUKA motors An element from this catalog is used if a non-KUKA external axis fitted with a KUKA motor is used with the real controller.
VW Templates	VW program templates

6.9.5 Catalog descriptions (8.3)

Which catalogs are available depends on whether a robot controller with version 8.2 or 8.3 is used.

Catalog	Catalog contains ...
DtmCatalog	Device description files **Note:** The robot controller must already have been set once as the active controller in order for this catalog to be used.
KRL Templates	KRL program templates
KukaControllers	Robot controllers, hardware components for robot controllers, safety options, PROCONOS option
KukaDrive-Kinematics	External kinematic systems with KUKA motors An element from this catalog is used if a non-KUKA external axis fitted with a KUKA motor is used with the real controller.
KukaDrives	**Note:** Do not use this catalog!
KukaExternalKine-matics	KUKA linear units, KUKA positioners
KukaRobots	KUKA robots
VW Templates	VW program templates

6.10 Inserting an element in the Project structure window

Description

The procedure for inserting an element, e.g. a robot controller, is described separately for each individual element in this documentation. The Drag&Drop procedure is described.

In addition to Drag&Drop, the elements can usually also be inserted via the context menu. This procedure is not additionally mentioned in the individual descriptions, but is described here in general terms.

Procedure

1. Right-click on the node in the tree structure under which the element is to be inserted. The type of node depends on the specific element concerned. The context menu is opened.
2. Select the **Add…** option from the context menu. A window opens.
3. Select the desired element in the window and accept it with **Add** or **OK**.

6.11 Removing an element from the Project structure window

Description

Inserted elements can be removed again from all tabs in the **Project structure** window. It is also possible to remove some – but not all – of the default elements there. The tree structure itself cannot be removed.

Procedure

- Right-click on the element in the tree structure. Select **Delete** from the context menu.

  Or:
- Select the element. Select the menu sequence **Edit** > **Delete**.

  Or:
- Select the element. Click on the **Delete** button in the toolbar, or press the Delete key on the keyboard.

6.12 Inserting a robot controller

Description

One or more robot controllers can be inserted in a project.

Precondition

- The catalog **KukaControllers** is available.

Procedure

1. Select the **Hardware** tab in the **Project structure** window.
2. Select the required robot controller in the **KukaControllers** catalog.
3. Drag the robot controller to **Cell: Hardware view** on the **Hardware** tab.

If the real robot controller is a VKR C4 retrofit, or if certain options are used, this must be activated in WorkVisual.

(>>> 6.16 "Activating the “Retrofit” variant or controller options" Page 34)

6.13 Setting the robot controller to active/inactive

Description

Most settings, actions and configurations performed in the **Programming and configuration** workspace are only possible if a robot controller is active. Furthermore, they apply to the currently active robot controller (e.g. settings in the safety configuration and I/O mappings).

If a project contains more than one robot controller, ensure that the correct robot controller is active.

Precondition

- A robot controller has been added.

Procedure

Setting the robot controller as the active controller:

1. Double-click on the inactive robot controller on the **Hardware** tab in the **Project structure** window.
2. Only if the robot controller is set to active for the first time: A window opens.
   - **Firmware version** box: Enter the version of the KUKA/VW System Software that is installed on the real robot controller: e.g. “8.2.15”.
   - **Number of I/Os** box: Select the maximum number of inputs/outputs used on the robot controller.

   The values can be changed subsequently. The correct values are necessary for code generation and project deployment.

   (>>> 6.14 "Changing the values “Firmware version” and/or “Number of I/Os”" Page 34)
3. Click on **OK** to save.

Instead of double-clicking, it is also possible to right-click on the robot controller. A context menu is opened. Select the option **Set as active controller**.

Setting the robot controller to inactive:

For a small number of actions in WorkVisual, it is necessary to set the robot controller to inactive. If these actions are started, a message is displayed to inform the user that the robot controller must first be set to inactive.

1. Save the project.
2. Double-click on the active robot controller on the **Hardware** tab in the **Project structure** window.

Instead of double-clicking, it is also possible to right-click on the robot controller. A context menu is opened. Select the option **Set as inactive controller**.

6.14 Changing the values “Firmware version” and/or “Number of I/Os”

Description

When the robot controller is set to active for the first time, the values **Firmware version** and **Number of I/Os** must be adapted or confirmed.

(>>> 6.13 "Setting the robot controller to active/inactive" Page 33)

The values can be changed subsequently. The correct values are necessary for code generation and project deployment.

Procedure

1. Save the project.
2. Right-click on the robot controller on the **Hardware** tab in the **Project structure** window.
3. Select **Controller options** from the context menu. The **Controller options** window is opened.
4. Enter the new value in the **Firmware version** box: e.g. “8.2.16”.
   And/or: Select a different number in the **Number of I/Os** box.
5. Click on **OK** to save.

6.15 Assigning a robot to the robot controller

Precondition

- The catalog containing the required robot has been inserted in the **Catalogs** window.
- The robot controller has been set as the active controller.

Procedure

1. Select the **Hardware** tab in the **Project structure** window.
2. Select the required robot in the **KukaRobots** catalog in the **Catalogs** window.
3. Drag the robot onto the robot controller in the **Hardware** tab. (Not onto the node **Unassigned active devices**.)
   The robot is now displayed underneath the robot controller.

6.16 Activating the “Retrofit” variant or controller options

Description

If the real robot controller is a VKR C4 retrofit, or if one of the following options is used, this must be activated in WorkVisual:

- **Transformer ((V)KR C4)**
- **Air conditioner ((V)KR C4)**
- **Fast Measurement inputs ((V)KR C4)**

Precondition

- The project contains a robot controller.
- Only for **Fast Measurement inputs ((V)KR C4)**: A robot has been assigned to the robot controller.

Procedure

1. Select the menu sequence **Editors** > **Additional controller settings**. The **Additional controller settings** window is opened.
2. Activate the check boxes for the options used.
3. Save the project.

6.17 Inserting a safety option and/or PROCONOS

Description

If a safety option (e.g. SafeOperation) and/or PROCONOS is used on the real robot controller, these options must also be inserted into the WorkVisual project.

Precondition

- The catalog **KukaControllers** is available.

Procedure

1. Select the **Hardware** tab in the **Project structure** window.
2. Expand the **Options** node in the **KukaControllers** catalog.
3. Drag the option onto the **Options** node on the **Hardware** tab.

When the option has been inserted, the version number is also displayed to the right of the name. It is always the compatible version for the robot controller.

6.18 Inserting hardware components

Description

The default hardware components for the robot controller are automatically present under the **Controller components** node.

If further components are present in the real robot controller, these must be added here. This can be done in one of the following ways:

- The components can be inserted individually.
- Or, for 8.3 only: WorkVisual can propose complete hardware configurations, one of which can be selected. The proposal always includes the hardware for all robots and external kinematic systems assigned to the robot controller.

Precondition

- The catalog **KukaControllers** is available.

Procedure

Inserting an individual component

1. Select the **Hardware** tab in the **Project structure** window.
2. Select the desired component in the **KukaControllers** catalog.
3. Drag the component onto the **Controller components** node on the **Hardware** tab.

For 8.3 only: Selecting a configuration proposal

1. Select the **Hardware** tab in the **Project structure** window.
2. Select the **Controller components** node and click on the **Configuration proposal...** button.

   The **Configuration proposal** window is opened. The commonest configuration for this controller and the associated kinematic systems is displayed.
3. If this configuration corresponds to the real configuration, confirm with **Accept**. The configuration is inserted in the **Controller components** node.

   If not, expand the **Further proposals** area and click on the matching configuration. It is now displayed in the upper part of the window and can be accepted.

Configuration proposal

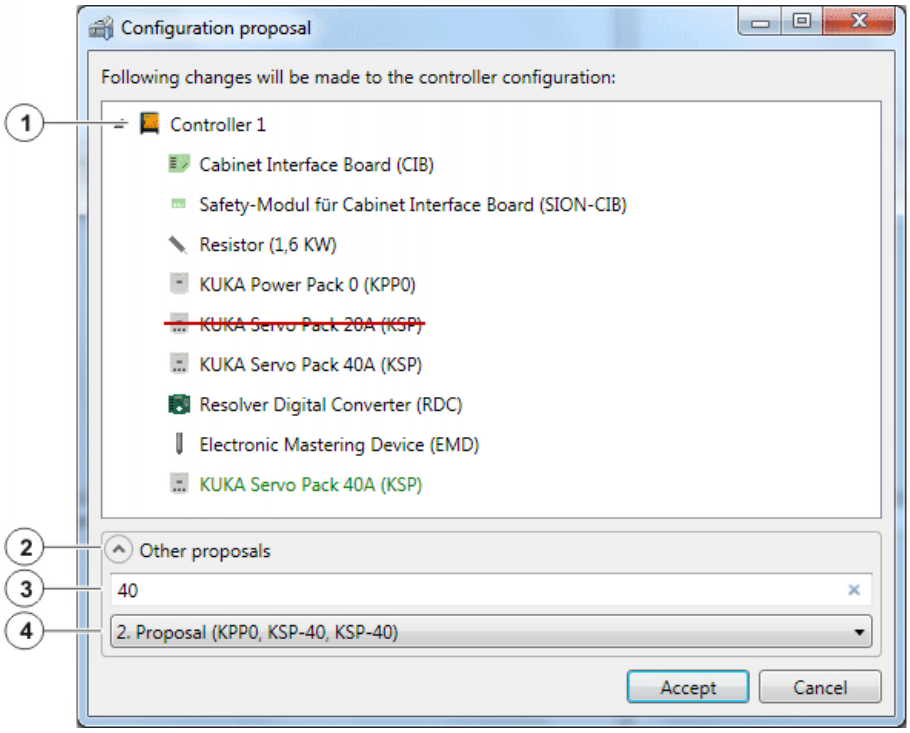


Fig. 6-3: Configuration proposal window

Item	Description
1	The selected proposal is displayed here. ■ Black text: Component that is already present under **Controller components** and which would remain present if the proposal is accepted. ■ Green text: Component which would be inserted. ■ Crossed-out component: Component which would be removed.
2	Items 3 and 4 can be displayed or hidden by clicking on the arrow.
3	Here the proposals displayed under item 4 can be filtered. If no filter is entered, all possible configurations for this controller and the associated kinematic systems are displayed.
4	This box can be expanded to display the list of proposals. Click on a proposal to select it.

6.19 Inserting an external axis

Preparation

In order for an external axis to be inserted into the project, the file structure of the robot controller must be present on the **Files** tab in the **Project structure** window. This can be achieved as follows:

- Do not create a new project in WorkVisual, but load the initial project from the robot controller.
  (Menu sequence: **File** > **Browse for project**.)
  (>>> 13.7 "Loading the project from the robot controller" Page 122)
- Or: Transfer the project to the robot controller. Then transfer it back to WorkVisual via the menu sequence **Extras** > **Compare projects**.
  (>>> 13.8 "Comparing projects (and accepting differences)" Page 122)

Precondition

- The required catalog has been inserted in the **Catalogs** window.
- The robot controller has been set as the active controller.

Procedure

1. Select the **Hardware** tab in the **Project structure** window.
2. Select the external axis in the catalog in the **Catalogs** window.
3. Drag the external axis onto the robot controller in the **Hardware** tab. (Not onto the node **Unassigned active devices**.)
   The external axis is now displayed underneath the robot controller.
4. Double-click on the external axis. The **Machine data configuration** editor.
5. For 8.2 only:
   In the **Axis ID** box in the area **General axis-specific machine data**, specify which drive the external axis is assigned to in the real cell.
6. If required: edit the other parameters.
   (>>> "Editor (8.2)" Page 38)
   (>>> "Editor (8.3)" Page 39)
7. If the external axis needs to be linked geometrically to a kinematic system:
   a. Select the **Geometry** tab.
   b. Assign the kinematic systems to each other as required by means of Drag&Drop.
      Example 1: If a KUKA linear unit has been added, drag the robot onto the linear unit.
      Example 2: If a servo gun (KUKA.ServoGun package) has been added that is to be used on the robot flange, drag the gun onto the **Flange Base** node of the robot.

6.20 Editing machine data for external axes (8.2)

Depending on the firmware version of the robot controller (8.2 or 8.3), a different editor opens for editing machine data. If the robot controller has not yet been assigned a firmware version, the editor for 8.3 opens.

Description

If a robot controller with version 8.2 is part of the project, only the machine data of external axes can be edited.

The machine data must be edited using the procedure described here, i.e. via the editor. Direct editing of files, e.g. $machine.DAT, is not permitted in WorkVisual. The files are overwritten with the data from the editor during code generation.

Precondition

- The robot controller has been set as the active controller.

Procedure

1. Double-click on any kinematic system on the **Hardware** tab in the **Project structure** window. The editor is opened.
2. In the editor, select the kinematic system that is to be edited.
3. Edit the machine data as required.
4. Save the project to accept the changes.

Editor (8.2)

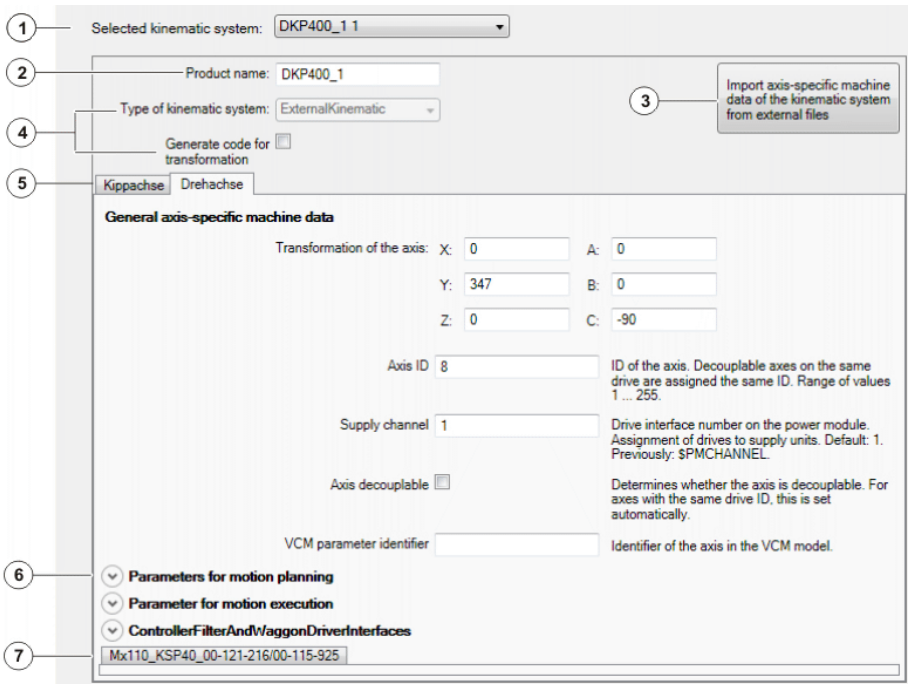


Fig. 6-4: Machine data configuration editor (8.2)

Item	Description
1	Here, select the kinematic system that is to be edited.
2	The product name of the selected kinematic system is displayed here. The box cannot be edited.
3	With one exception, this button never needs to be pressed. If an import is necessary, WorkVisual performs this automatically at the relevant time. Exception: If an XML file with machine data for a non-KUKA kinematic system has been added on the **Files** tab using **Add external file**, then the machine data must subsequently be imported manually from the XML file in a second step. This is done using this button.
4	These boxes have no effect.
5	The machine data of the selected kinematic system are displayed here, sorted by axis.
6	The data belonging to each heading can be displayed or hidden by clicking on the arrow.
7	Motor data The data can be displayed by clicking on the box.

6.21 Editing machine data (8.3)

Depending on the firmware version of the robot controller (8.2 or 8.3), a different editor opens for editing machine data. If the robot controller has not yet been assigned a firmware version, the editor for 8.3 opens.

Description

With KUKA robots, KUKA linear units and KUKA positioners, it is possible to change the software limit switches and the root point. With customer kinematic systems, it is usually possible to edit more data. This depends on the specific kinematic system, however.

Each kinematic system and each subordinate element belonging to it has its own editor with the respective data. A subordinate element can be an axis or a motor, for example. More than one editor can be open simultaneously.

The machine data must be edited using the procedure described here, i.e. via the editor. Direct editing of files, e.g. $machine.DAT, is not permitted in WorkVisual. The files are overwritten with the data from the editor during code generation.

Procedure

1. On the **Hardware** tab in the **Project structure** window, double-click on the element to be edited. The editor is opened.
2. Edit the machine data as required.
3. Save the project to accept the changes.

Editor (8.3)

Information about the individual machine data can be found in the documentation **Configuration of Kinematic Systems**.

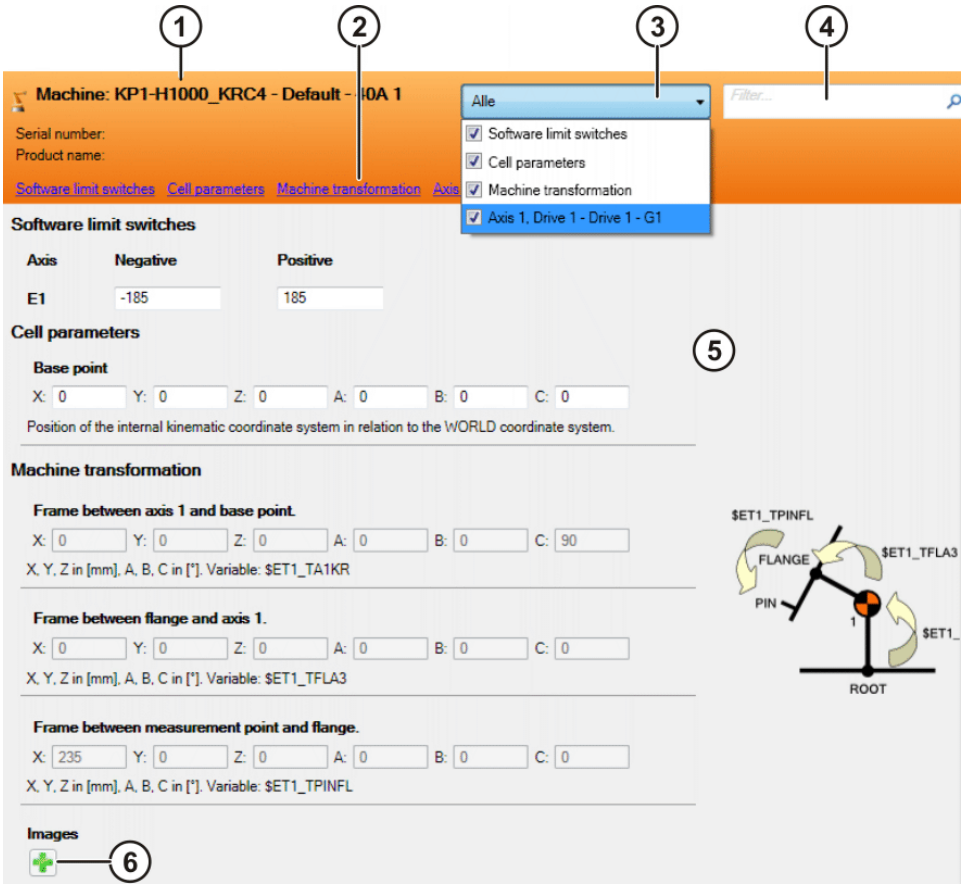


Fig. 6-5: Machine data configuration editor (8.3)

Item	Description
1	The name of the kinematic system is displayed here.
2	The parameter groups for this kinematic system are displayed here. Clicking on one group shows this group in the parameter display and hides all other groups.
3	This selection box indicates which groups are currently shown in the parameter display. The selection list contains all the existing groups. The groups can be displayed or hidden using the check boxes.

Item	Description
4	The parameter display can be filtered here. The filter refers to the parameter name. No distinction is made between uppercase and lowercase letters. **Example:** If *a1* is entered, only those parameters are displayed which have *a1* or *A1* in their names.
5	Parameter display (area with gray background) The parameters are sorted by group. They can be edited. If a parameter is changed, the value is displayed in blue until the change is saved. In addition, the tab of the editor is then marked with an asterisk (not shown) until the change is saved.
6	Graphics files can be loaded here. Once a file has been loaded, a minus symbol is also displayed, which can be used to delete it again. The graphic is shown here. Only one graphic is displayed at a time. If several files are loaded, a selection box is displayed for toggling between the graphics. Formats: JPG, JPEG, PNG, BMP

6.22 Option packages

6.22.1 Installing an option package in WorkVisual

Description

Option packages, e.g. technology packages, can be installed in WorkVisual. This makes it possible to insert the catalog of the option package in the individual projects, if required. The option package is then available for use in this project.

Advantage: if a project is transferred to a number of robot controllers, the settings relevant to the package only need to be carried out once in WorkVisual and not on each individual robot controller.

Precondition

- The option package is available as a KOP file.
  The KOP file is located on the CD of the option package. (Not yet available for all KUKA option and technology packages.)
- There is no project open.

Procedure

1. Select the menu sequence **Extras** > **Option package management...**. The **Option package management** window is opened.
2. Click on the **Install...** button. The **Select the package to be installed** window is opened.
3. Navigate to the path where the option package is located and select it. Click on **Open**.
4. The package is installed. If the KOP file contains device description files, the **Update catalog** window opens and closes during this operation.
   Once the operation has been completed, the package is displayed in the **Installed option packages** area of the **Option package management** window.

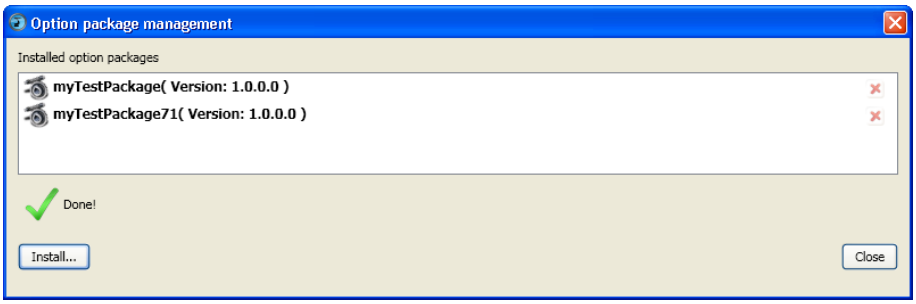


Fig. 6-6: Installed option packages

5. Only if the message *The application must be restarted for the changes to take effect* is displayed:
   - Either: click on the **Restart** button. WorkVisual restarts.
   - Or: close the **Option package management** window and restart WorkVisual later.
6. Only if the message stated in the previous step is NOT displayed: Close the **Option package management** window.

The catalog of the option package is now available under **File** > **Catalog management...**.

If the KOP file contains device description files, these are now available in WorkVisual. It is not necessary to perform a catalog scan.

6.22.2 Updating an option package

Description

Only option packages which do not contain an expansion for WorkVisual (e.g. an additional editor) can be updated. Other option packages must first be uninstalled before the new version can be installed.

For the user, it is not apparent beforehand whether a package is updatable or not. The update process can be started nonetheless. If the previous version has to be uninstalled first, WorkVisual displays a message to this effect.

Precondition

- There is no project open.

Procedure

1. Select the menu sequence **Extras** > **Option package management...**. The **Option package management** window is opened.
2. Click on the **Install...** button. The **Select the package to be installed** window is opened.
3. Navigate to the path where the option package is located and select it. Click on **Open**.
4. One of the following messages is displayed.
   - **Updating option packages with plug-ins is not possible. Please uninstall '{0}' before updating.**

     Confirm the message with **OK**. Do not continue with step 5, but uninstall the package. Then install the new version.
   - **The package has already been installed. Update the package to the selected version?**

     Confirm the message with **Yes**.

     The package is installed. If the KOP file contains new device description files, the **Update catalog** window opens and closes during this operation.
5. Only if the message *The application must be restarted for the changes to take effect* is displayed:
   - Either: click on the **Restart** button. WorkVisual restarts.

- Or: close the **Option package management** window and restart WorkVisual later.

6. Only if the message stated in the previous step is NOT displayed: Close the **Option package management** window.

6.22.3 Uninstalling an option package

Precondition

- There is no project open.

Procedure

1. Select the menu sequence **Extras** > **Option package management...**. The **Option package management** window is opened.
2. In the **Installed option packages** area, click on the red “X” to the right of the name of the package.
3. Only if the option package is now hidden in the **Installed option packages** area: Close the **Option package management** window.

   Uninstallation is now complete. No further steps are necessary.
4. Only if the message *The application must be restarted for the changes to take effect* is displayed:
   - Either: click on the **Restart** button. WorkVisual restarts.
   - Or: close the **Option package management** window and restart WorkVisual later.

If an option package that is used in a project is uninstalled and this project is opened again, the user is prompted to open the catalog for the option package.

If the catalog is not opened, WorkVisual displays the following warning in the message window: **The following option packages of the project are not installed in WorkVisual: {Name}**

6.22.4 Inserting the catalog of the option package into the project

Description

If an option package is to be used in a project, the catalog of the option package must be inserted in this project.

Precondition

- The option package has been installed in WorkVisual.

Procedure

(>>> 6.9.2 "Inserting a catalog in a project" Page 31)

6.22.5 Removing the catalog of the option package from the project

Elements from the catalog that are used in the project are retained even if the catalog is removed from the project.

Procedure

(>>> "Procedure" Page 31)

6.22.6 Inserting an option package in a project

This action is not necessary if a device is added to the project from the option package. In this case, the option package is also inserted automatically.

Description

In order to be able to use an option package on the real robot controller, it must be inserted into the project in WorkVisual.

If a project containing an option package is transferred to the robot controller, the procedure differs from the normal deployment procedure. Further information can be found in the section on project deployment.

Precondition
- The catalog of the option package has been added to the project.

Procedure
1. Select the **Hardware** tab in the **Project structure** window.
2. Right-click on the **Options** node and select **Add…**.
3. A window opens. Select the catalog of option package.
4. The uppermost element in the catalog is always the option package. Select this and click on the **Add** button.
   The option package is now displayed in the **Options** node.

6.22.7 Removing an option package from the project

Precondition
- The robot controller has not been assigned any devices from this option package.
  Any devices assigned must first be removed.

Procedure
1. Select the **Hardware** tab in the **Project structure** window.
2. Expand the **Options** node. All the option packages contained in the project are displayed.
3. Right-click on the package to be removed and select **Delete**.
   The option package is removed from the **Options** node.

6.22.8 Adding a device from an option package to the robot controller

Description

In order to be able to use devices from the option package on the real robot controller, the devices must be inserted into the project in WorkVisual.

A device is a catalog element to which the following configurations can be assigned:
- Configuration of the device
- Bus configuration
- I/O connections
- Long texts

A device is e.g. a weld controller from KUKA.ArcTech.

Precondition
- The catalog of the option package has been added to the project.
- Only if a device with a bus configuration and/or I/O connections is to be inserted:
  No robot controller has been set to active.

Procedure
1. Select the **Hardware** tab in the **Project structure** window.
2. Right-click on the robot controller and select **Add…**.
3. A window opens. Select the catalog of option package.
4. Select the required device from the list and click on the **Add** button.
5. If there are already configurations assigned to the device, a message is displayed asking if these configurations are to be transferred to the project.
   Select **Yes** or **No** as appropriate.
6. If I/O connections were transferred together with the device, the **Adjust signal connections** window is opened.

If the signals to which the device is to be connected in accordance with its default settings are already mapped in the current project, this is shown in the **Current conflicts** area.

(>>> Fig. 6-7)

7. If signals are displayed in the **Current conflicts** area:

   If desired, change the start addresses for the different I/O types until no further conflicts are displayed.

8. Either: Click on **OK**. Any signals remaining in the **Current conflicts** area are now overwritten with the new connections.

   A message is displayed in the message window for each overwritten connection. This makes it easier in the case of later changes.

   Or: Click on **Cancel**. The device is inserted in the **Project structure** window, but no signal connections are adopted.

The device is now displayed underneath the robot controller.

If bus configurations have been accepted together with the device, the device is also displayed under the **Bus structure** node when the robot controller is set back to active.

Adjust signal connections

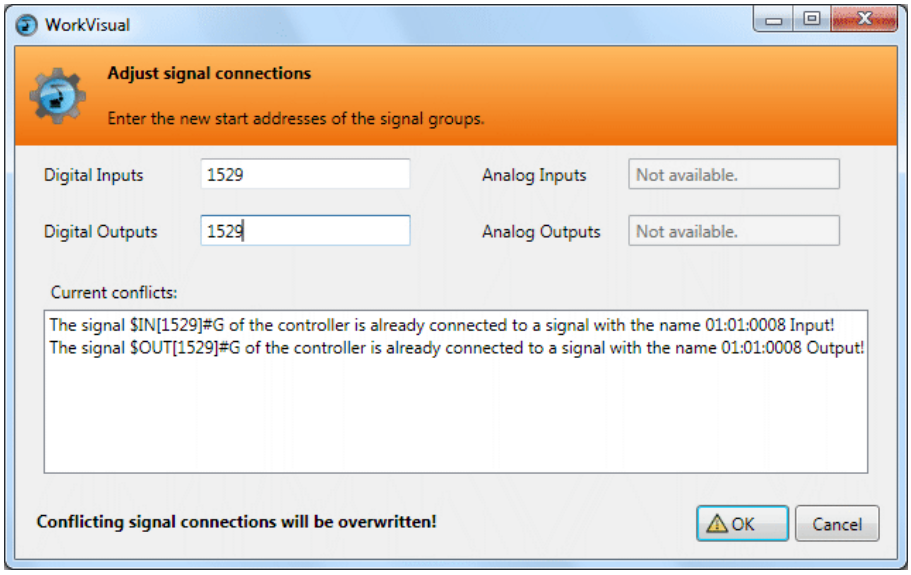


Fig. 6-7: Adjust signal connections – Current conflicts

6.22.9 Exporting a subproject

Description

This procedure enables parts of projects to be exported, e.g. a device and/or I/O connections. Subprojects can be processed further with the KUKA.OptionPackageEditor. The KUKA.OptionPackageEditor is a software product for manufacturers of technology packages and system integrators for the creation of option packages.

Subprojects have the file format WVPS (“WorkVisual Partial Solution”).

Precondition

- A project is open.
- The robot controller has not been set as the active controller.

Procedure

1. Select the menu sequence **File** > **Import / Export**. A window opens.
2. Select the entry **Export subproject**. The window is now called **Export subproject**.

   Click on **Next**.

3. All the controllers of the project are displayed. Select the controller from which data is to be exported and confirm with **Next**.
4. A tree structure is displayed. In the tree structure, activate the check boxes for the elements that are to be exported. Confirm with **Next**.
5. Select a path for saving the subproject and click on **Finish**. The subproject is exported.
6. If the export was successful, this is indicated by the following message in the **Export subproject** window: **Partial export successful**.

   Close the window.

6.23 Changing predefined properties of WorkVisual

6.23.1 Configuring booting and saving characteristics

Procedure

1. Select the menu sequence **Extras** > **Options**. The **Options** window is opened.
2. On the left of the window, in the **Environment** folder, select the subitem **ObjectStoreUI**.

   The corresponding settings are now displayed on the right of the window.
3. Make the desired settings.
4. Confirm the changes made with **OK**.

Description

Subitem **ObjectStoreUI**:

Parameter	Description
Solution directory	A directory can be specified here in which the projects are to be saved by default.
Catalog directory	This specifies the directory in which the catalogs are saved. If the catalogs are moved to a different directory, the directory given here must be changed.
Start application	Here it is possible to specify whether a new project, the most recently opened project or no project is offered for opening when WorkVisual is started.

6.23.2 Configuring keyboard shortcuts

Procedure

1. Select the menu sequence **Extras** > **Options**. The **Options** window is opened.
2. On the left of the window, in the **Environment** folder, select the subitem **Keyboard**.

   The corresponding settings are now displayed on the right of the window.
3. In the **Commands** box, select the command for which a keyboard shortcut is to be defined or changed.

   The contents of the **Command** box can be filtered:

   Enter a term in the box **List only commands with the following content**. Only commands whose names contain this term are now displayed in the **Command** box.
4. Place the cursor in the **New shortcut** box and confirm the desired key combination (or individual key) on the keyboard. Examples: **F8** or **Ctrl+W**

   The keyboard shortcut is displayed in the **New shortcut** box.
5. Click on **Assign**.

6. Confirm the change with **OK**.

   Or: If the keyboard shortcuts are already assigned, a request for confirmation is displayed:

   - If the keyboard shortcut is to be assigned to the new command, select **Yes** and confirm the changes with **OK**.
   - If the keyboard shortcut is to remain assigned to the old command, select **No**.

     Close the window by selecting **Cancel**. Or delete the keyboard shortcut from the **New shortcut** box using the **Esc** key, and enter a different one.

6.23.3 Changing the user interface language

Description

Which languages are available here depends on which languages were installed with WorkVisual.

Precondition

For Windows XP only:

- To be able to select Chinese, this language must also be installed as a Windows language.

Procedure

1. Select the menu sequence **Extras** > **Options**. The **Options** window is opened.
2. On the left of the window, select the **Localization** folder.

   The corresponding settings are now displayed on the right of the window.
3. Select the desired language from the **Language** box. Confirm with **OK**.
4. Close and restart the application.

6.24 Print functions

The procedure described here can be used to print the following:

- I/O connections
- Long texts
- Safety configuration

Procedure

1. Select the menu sequence **File** > **Print**. The **Print** window is opened.
2. Select the desired printer in the **Printer** area. If required, change the printer settings.
3. In the **Document** area, select the relevant checkboxes to indicate what should be printed.
4. If required, first display the print preview: To do this, click on the **Preview** button.

   Close the print preview again.
5. Click on the **Print** button to start printing.

It is also possible to print directly from the print preview, via the button with the printer symbol. In this case, the standard printer is used. Changes to the printer settings are not possible.

Description

Print window, **Documents** area:

Check box	Description
Global	This function is not yet assigned.
Cell	If this checkbox is activated, all the robot controllers belonging to this cell are automatically activated. Individual controllers can be deactivated again manually.
Controller […]	If this checkbox is activated, all the documents belonging to this robot controller are automatically selected for printing. Individual documents can be deactivated again manually.
Documents:	
Connection list	Prints the I/O connections defined in the **I/O Mappings** window.
Long texts	If long texts have been defined in various languages, it is also possible to select which languages should be printed.
Safety configuration	The printout contains a date and signature box and can be used as a sign-off sheet for the safety acceptance procedure.

7 Safety configuration

7.1 Safety configuration in WorkVisual

The safety configuration in WorkVisual comprises the following areas:

Area	Description
Local safety configuration	The local safety configuration comprises the parameters in the **Local safety configuration** window. The parameters can be edited.
Safety-relevant communication parameters	These include the parameters relevant to safe communication within a robot network. The safety-relevant communication parameters cannot be displayed or edited directly. However, various actions in WorkVisual have an effect on the safety-relevant communication parameters, e.g. if a RoboTeam is configured.

When a project is transferred to the real robot controller, the entire safety configuration is always transferred at the same time.

7.2 Editing the local safety configuration

Description

A newly added robot controller is without a local safety configuration in WorkVisual. A robot controller without a local safety configuration can be recognized by the fact that the text of the **Safety controller** node on the **Hardware** tab in the **Project structure** window is in italics: *Safety controller*

The robot controller is automatically assigned a local safety configuration in WorkVisual when the **Local safety configuration** window is opened. The robot controller is assigned a local safety configuration during code generation, if none has been assigned already.

The local safety configuration can be edited in WorkVisual. The changes always apply to the robot controller which is currently set as active.

Precondition

- The robot controller has been set as the active controller.
- A robot has been assigned to the robot controller.

Procedure

1. Double-click on the node **Safety controller** on the **Hardware** tab in the **Project structure** window. The **Local safety configuration** window is opened.
2. If a safety option, e.g. SafeOperation, is used:
   a. On the **General** tab, select the **Global parameters** area.
   b. Here, activate the **Safe monitoring** check box. Only then can the monitoring functions be edited.
3. Edit the parameters of the safety configuration as required.
4. Close the **Local safety configuration** window.

7.3 Parameters of the local safety configuration

The standard parameters are described here. Information about parameters which refer to a particular safety option can be found in the documentation for the specific safety option.

7.3.1 “General” tab (8.2)

Hardware options

Parameter	Description
Customer interface	Select here which interface is used: ■ **ProfiSafe** ■ **SIB** ■ **SIB, Extended SIB** ■ **SIB with operating mode output** ■ **SIB with operating mode output, Extended SIB** This option is available with System Software version 8.2.4 or higher. The following interfaces are available with the controller variant “KR C4 compact”: ■ **ProfiSafe** ■ **X11**
Input signal for peripheral contactor (US2)	Main contactor 2 can be used as a peripheral contactor, i.e. as a switching element for the power supply to peripheral devices. ■ **Deactivated**: Peripheral contactor is not used (default). ■ **By external PLC**: The peripheral contactor is switched by an external PLC via input US2. ■ **By KRC**: The peripheral contactor is switched in accordance with the motion enable. If motion enable is present, the contactor is energized. **Note:** This parameter is not available with the controller variant “KR C4 compact”.
Operator safety acknowledgement	If the Operator Safety signal is lost and reset in Automatic mode, it must be acknowledged before operation can be continued. ■ **By acknowledgement button**: Acknowledgement is given e.g. by an acknowledgement button (situated outside the cell). Acknowledgement is communicated to the safety controller. The safety controller re-enables automatic operation only after acknowledgement. ■ **External unit**: Acknowledgement is given by the system PLC.

Change log

Every modification to the local safety configuration and every saving operation are automatically logged. The log is displayed here.

Machine data

The machine data of the safety controller are displayed here.

It is not necessary to press the **Import machine data** button. There are currently no applications in which this is necessary.

7.3.2 “General” tab (8.3)

Hardware options

Parameter	Description
Customer interface	Select here which interface is used: ■ **automatically** ■ **SIB with operating mode output**
Input signal for peripheral contactor (US2)	Main contactor 2 can be used as a peripheral contactor, i.e. as a switching element for the power supply to peripheral devices. ■ **Deactivated**: Peripheral contactor is not used (default). ■ **By external PLC**: The peripheral contactor is switched by an external PLC via input US2. ■ **By KRC**: The peripheral contactor is switched in accordance with the motion enable. If motion enable is present, the contactor is energized. **Note:** ■ For the controller variant “KR C4 NA UL”, this parameter must be set to **per KRC**. ■ This parameter is not available with the controller variant “KR C4 compact”.
Operator safety acknowledgement	If the Operator Safety signal is lost and reset in Automatic mode, it must be acknowledged before operation can be continued. ■ **By acknowledgement button**: Acknowledgement is given e.g. by an acknowledgement button (situated outside the cell). Acknowledgement is communicated to the safety controller. The safety controller re-enables automatic operation only after acknowledgement. ■ **External unit**: Acknowledgement is given by the system PLC.

Change log

Every modification to the local safety configuration and every saving operation are automatically logged. The log is displayed here.

Machine data

The machine data of the safety controller are displayed here.

It is not necessary to press the **Import machine data** button. There are currently no applications in which this is necessary.

7.3.3 “Axis monitoring” tab (8.3)

Editable parameters

The following parameters can be set for each axis. It is not generally necessary to change the default values, however.

Parameter	Description
Braking time	Duration of the monitored axis-specific braking ramp for safety stop 1 and safety stop 2 Default: 1,500 ms (>>> 7.3.3.1 "Parameter: Braking time" Page 52)
Maximum velocity T1	Maximum velocity in T1 ■ Rotational axes: **1.00 … 100.00 °/s** Default: 30 °/s° ■ Linear axes: **1.00 … 1,500.00 mm/s** Default: 250 mm/s This parameter enables a servo gun, for example, to be calibrated in T1 with a higher velocity than 250 mm/s. **Note:** The Cartesian velocities at the flange and at the TCP are monitored independently of this parameter and cannot exceed 250 mm/s.
Axis angle tolerance	Tolerance for standstill monitoring in the case of safe operational stop. The axis may still move within this tolerance when a safe operational stop is active. ■ Rotational axes: **0.001 … 1 °** Default: 0.01 ° ■ Linear axes: **0.003 … 3 mm** Default: 0.1 mm

7.3.3.1 Parameter: Braking time

Description

If a safety stop 1 or 2 occurs, the safety controller monitors the braking process. Among other things, it monitors whether the axis-specific velocity remains below the braking ramp. If the velocity is too high, i.e. if the braking ramp is violated, then the safety controller triggers a safety stop 0.

The braking ramp results from an internal factor for the ramp gradient and from the value **Braking time**.

This means: the parameter **Braking time** influences a monitoring function. **Braking time** does not influence the actual motion characteristics of the kinematic system, however.

The parameter **Braking time** has no effect in T1/CRR, since the value refers to the axis-specific monitoring. In T1/CRR, however, there is another (non-configurable) monitoring function for the Cartesian velocity on the flange. This is stricter, which is why the axis-specific monitoring has no effect.

⚠ WARNING Only alter the default time if it is necessary to do so. This might be required, for example, in the case of very heavy machines and/or very heavy loads as these cannot stop within the default time.
The safety maintenance technician must check whether and to what extent the **Braking time** value needs to be modified in each specific application. He must also check whether the modification makes additional system-specific safety measures necessary, e.g. installation of a gate lock.

Braking time can be set individually for the different axes. At the moment of braking, however, the value used is always the highest value from all the axes.
Recommendation: Enter the same value for all axes.

Braking time modified

If the value "Braking time" is increased, this has the following consequences:

The braking ramp becomes longer and flatter, i.e. monitoring is now less strict. The same braking process is now less likely to violate the braking ramp than before.

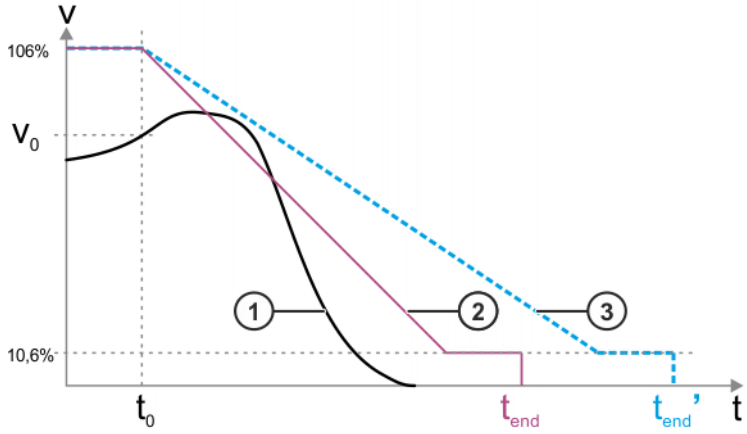


Fig. 7-1: Example: value is increased

1	Velocity profile during braking (example)
2	Braking ramp (original value **Braking time**)
3	Braking ramp (higher value of **Braking time**)
v_0	Velocity of the kinematic system at the moment when braking begins
t_0	Start time of the braking ramp
t_{end}	End of the braking ramp
t_{end}'	End of the braking ramp with a higher value for **Braking time**

The start velocity of the axis-specific braking ramp is always 106% of the rated speed of the axis. The ramp falls to 10.6%. The velocity then remains constant for 300 ms, before falling to 0%.

If the value "Braking time" is reduced, this has the following consequences:

The braking ramp becomes shorter and steeper, i.e. monitoring is now stricter. The same braking process is now more likely to violate the braking ramp than before.

7.4 Importing a local safety configuration

WARNING After importing a safety configuration or parts thereof, the safety configuration must be checked! If this is not done, this can lead to the possibility of the robot being operated with incorrect data when the project is transferred to the real robot controller. Death to persons, severe injuries or considerable damage to property may result.

Precondition

- The robot controller has been set as the active controller.

Procedure

1. Select the menu sequence **File** > **Import / Export**. A window opens.
2. Select **Import local safety configuration** and click on **Next**.
3. Navigate to the path where the SCG file is located and select it. Click on **Open**.
4. Click on **Finish**.
5. If the configuration was imported successfully, this is indicated by a message. Close the window.

7.5 Exporting a local safety configuration

Description

The local safety configuration is exported as an SCG file.

Precondition

- The robot controller has been set as the active controller.

Procedure

1. Select the menu sequence **File** > **Import / Export**. A window opens.
2. Select **Export local safety configuration** and click on **Next**.
3. Specify a directory and a file name. Click on **Finish**.
4. If the configuration was exported successfully, this is indicated by a message. Close the window.

7.6 Importing safety zones

⚠ WARNING After importing a safety configuration or parts thereof, the safety configuration must be checked! If this is not done, this can lead to the possibility of the robot being operated with incorrect data when the project is transferred to the real robot controller. Death to persons, severe injuries or considerable damage to property may result.

Description

Certain parts of the local safety configuration can be imported as an XML file. These parts are referred to here as “Safety zones” and comprise:

- Cell configuration
- Monitoring spaces (Cartesian spaces and/or axis spaces)
- Properties of the tools

The XML file can be created by the user on the basis of data from CAD systems, etc. The required structure of the XML file is described in the schema **SafetyConfigImport.xsd**. This is located in the following directory:

C:\Program Files (x86)\KUKA\WorkVisual [*Version no.*]\Schemes

Precondition

- The robot controller has been set as the active controller.
- A safety option is being used.

Procedure

1. Save the project. (Do not close.)
2. Select the menu sequence **File** > **Import / Export**. A window opens.
3. Select **Import local safety configuration** and click on **Next**.
4. Click on **Search…**. Navigate to the path where the XML file is located and select it. Click on **Open**.

   If the XML file contains schema errors, this is indicated by a message. (The data can still be imported.)
5. If required: Activate the check box *Show differences*.

   If this option is activated, the differences between the existing values and those to be imported are displayed before the import is carried out.
6. Click on **Finish**. In the background, the window **Local safety configuration** is opened, if not already open.

If *Show differences* is not activated: the data are now imported.

7. If *Show differences* is activated: the overview is displayed. (>>> Fig. 7-2)
   Click on **Import**. The data are now imported.
8. When the import is finished, this is indicated by the following message: **The local safety configuration was imported successfully.** This message is also displayed if errors were imported.
   Close the window.

> If errors were imported, this is indicated by messages in the message window.

9. Check the safety configuration. The data are displayed in the **Local safety configuration** window in the following colors:
   - **Red**: This value was changed by the import. The value is invalid.
   - **Blue**: This value was changed by the import. The value is valid.

> Blue does not automatically mean that this is the value from the XML file! It is possible, for example, that the XML file contained a value which cannot be interpreted by WorkVisual, e.g. “2” where only “0” or “1” is possible. In this case, WorkVisual sets the default value and displays this in blue.

10. Correct the invalid values. (If invalid values are present, the project cannot be saved.)
11. Save the project to accept the imported data.

> The imported data are only accepted when the project is saved. This also means that imported data can be discarded by closing the project without saving.

Show differences

Parameter name	Current value	Import value
⊟ Cell configuration		
Z min	234	234
Z max	1200	1200
⊟ Corner 1		
X	-800	-1000
Y	800	1000
enabled	enabled	enabled
⊞ Corner 2		
⊞ Corner 3		
⊞ Corner 4		
⊟ Tools		
⊞ Tool 1		
⊟ Monitoring spaces		
⊞ Space 1		
⊞ Space 2		
⊟ GlobalParameters		
Mastering test input	by Profisafe	by Profisafe
Cartesian maximum velocity	3000	3000
Reduced cartesian velocity	3000	3000
Reduced cartesian velocity T1	200	200
Maximum velocity rotational axis	120	120
Maximum velocity translational axis	3000	3000

Fig. 7-2: Example: Displaying the differences

Color	Meaning
Red	With this element (or its child elements), the existing value differs from the value to be imported.
Black	With this element (including all its child elements), the existing value is identical to the value to be imported.

8 Field bus configuration

8.1 Field bus set-up

8.1.1 Overview: field bus set-up

Step	Description
1	Install the device description files on the PC. (>>> 6.8 "Importing device description files" Page 29)
2	Insert the DTM Catalog in the **Catalogs** window. (>>> 6.9.2 "Inserting a catalog in a project" Page 31)
3	Insert the field bus master in the project. (>>> 8.1.2 "Inserting a field bus master in a project" Page 57)
4	Configure the field bus master. (>>> 8.1.3 "Configuring the field bus master" Page 57)
5	Add the devices to the bus, i.e. insert them under the field bus master. (>>> 8.1.4 "Inserting devices manually into the bus" Page 58) Or: (>>> 8.1.7 "Automatically inserting devices into the bus (Bus Scan)" Page 61)
6	Configure the devices. (>>> 8.1.5 "Configuring devices" Page 58) Or (only possible for PROFINET): (>>> 8.1.6 "Importing a PROFINET configuration" Page 59)
7	Edit the field bus signals (>>> 8.2 "Editing field bus signals" Page 62)
8	The bus I/Os can now be mapped. (>>> 8.3 "Mapping the bus I/Os" Page 67)

8.1.2 Inserting a field bus master in a project

Precondition

- The device description files are inserted in the DTM Catalog (Catalog Scan).
- The robot controller has been added and set as active.

Procedure

1. Expand the tree structure on the **Hardware** tab in the **Project structure** window until the **Bus structure** node is visible.
2. Select the required field bus master in the **DTM Catalog** window and drag it onto the **Bus structure** node.

8.1.3 Configuring the field bus master

Precondition

- The field bus master is inserted in the project.
- The robot controller has been set as the active controller.

Procedure

1. Right-click on the field bus master on the **Hardware** tab in the **Project structure** window.

2. Select **Settings…** from the context menu. A window opens with device data.
3. Set the data as required and save with **OK**.

NOTICE The following address ranges are used by default by the robot controller for internal purposes. IP addresses from this range must not therefore be assigned by the user.

- 192.168.0.0 … 192.168.0.255
- 172.16.0.0 … 172.16.255.255
- 172.17.0.0 … 172.17.255.255

Information about settings for particular bus systems can be found in the documentation for these bus systems.

8.1.4 Inserting devices manually into the bus

NOTICE The inserted device must correspond to the actual device used in reality. Substantial damage to property may otherwise result.

Precondition

- The devices are inserted in the DTM Catalog.
- The field bus master is inserted in the bus structure.
- The robot controller has been set as the active controller.

Procedure

1. Expand the tree structure on the **Hardware** tab in the **Project structure** window until the field bus master is visible.
2. Select the required device in the DTM Catalog and drag it onto the field bus master.
3. If necessary, repeat step 2 for further devices.

8.1.5 Configuring devices

Precondition

- The device has been added to the bus.
- The robot controller has been set as the active controller.

Procedure

1. Right-click on the device on the **Hardware** tab in the **Project structure** window.
2. Select **Settings…** from the context menu. A window with the device data is opened.
3. Set the data as required and save with **OK**.

NOTICE The following address ranges are used by default by the robot controller for internal purposes. IP addresses from this range must not therefore be assigned by the user.

- 192.168.0.0 … 192.168.0.255
- 172.16.0.0 … 172.16.255.255
- 172.17.0.0 … 172.17.255.255

Information about settings for particular bus systems can be found in the documentation for these bus systems.

8.1.6 Importing a PROFINET configuration

Description

A PROFINET bus can also be configured with Step 7 or PC WORX instead of with WorkVisual. This configuration must then be imported into WorkVisual.

Preparation

WorkVisual requires the GSDML files of the PROFINET devices used. (The device description files for PROFINET are called GSDML files.)

- Import the device description files.

Precondition

- The robot controller has been set as the active controller.
- The PROFINET configuration has been exported out of Step 7 or PC WORX and is available as an XML or CFG file.

> Information about configuring PROFINET with Step 7 or PC WORX can be found in the documentation **KR C4 PROFINET**. Information about procedures in Step 7 or PC WORX can be found in the documentation for this software.

Procedure

1. Select the menu sequence **File** > **Import / Export**. A window opens.
2. Select **Import Profinet configuration** and click on **Next**.
3. Click on the **Browse…** button and navigate to the path where the XML or CFG file is located and select it. Click on **Open**.
4. Click on **Next**.
5. A tree structure is displayed. This shows whether the PROFINET configuration corresponds to the devices in the project. If not, the difference is displayed. If necessary, the import can be canceled at this point with **Cancel**.

   (>>> 8.1.6.1 "Differences between the PROFINET configuration and the project" Page 59)

   Otherwise, click on **Finish**. This is also possible if the configuration differs from the devices in the project. If there is a difference:
   - The PROFINET configuration overwrites the state in the project.
   - The nature of the difference determines whether the I/O mappings in the project are retained or not.
6. If the configuration was imported successfully, this is indicated by a message. Close the window.

8.1.6.1 Differences between the PROFINET configuration and the project

If the device is marked with a green check mark, this means that there is no difference. The device is identical in the PROFINET configuration and in the project.

If there are differences, these are displayed during import of the PROFINET configuration as follows:

Device missing

Difference	The device is contained in the PROFINET configuration but not in the project.
Icon	Green cross
Effect on import	The device is inserted into the bus in the project.

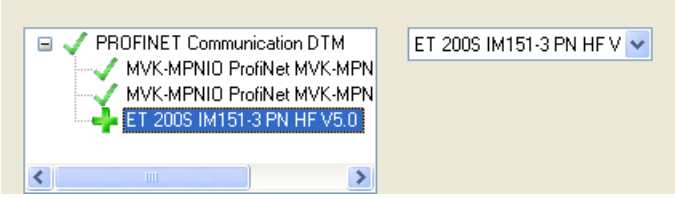


Fig. 8-1: Device not in project

Device too many

Difference	The device is contained in the project but not in the PROFINET configuration.
Icon	Red X
Effect on import	The device is deleted from the bus in the project. I/O mappings to this device are also deleted!

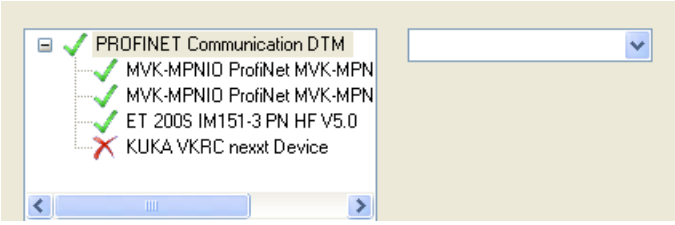


Fig. 8-2: Device not in import

IP settings

Difference	The IP settings of this device in the project are different from those in the PROFINET configuration. (boxes **IP address**, **subnet mask** or **standard gateway**)
Icon	Pen
Effect on import	The IP settings of the PROFINET configuration are applied to the project. The I/O mappings of this device are retained.

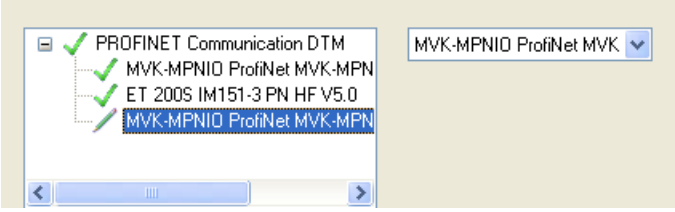


Fig. 8-3: IP settings changed in WorkVisual

Module assignment

Difference	The module assignment of this device in the project is different from that in the PROFINET configuration.
Icon	Double arrow
Effect on import	The module assignment of the PROFINET configuration is applied to the project. I/O mappings to this device are deleted!

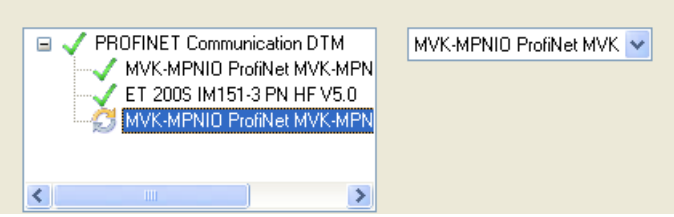


Fig. 8-4: Different module assignment

PROFINET name

Difference	The PROFINET name of this device in the project is different from that in the PROFINET configuration. WorkVisual regards the device as 2 different devices.
Icon	Red X and green cross
Effect on import	The device is added to the project from the configuration. The device that was previously in the project is deleted. The I/O mappings to this device are also deleted!

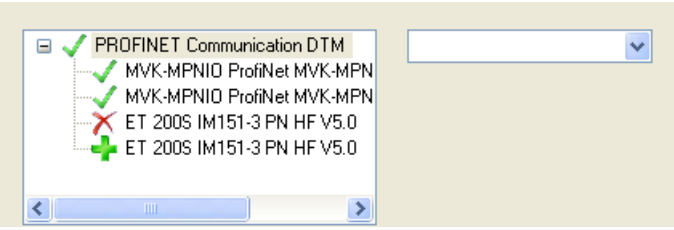


Fig. 8-5: Different PROFINET name

> In the tree structure, the product name is displayed, not the PROFINET name of the device. That is why the names are the same here.

Text color

The text color is normally black.

Text color	Meaning
Orange	No GSDML file can be clearly assigned to this device. The relevant possible files are listed in the selection box. The user must choose a file.
Red	No GSDML file is available in WorkVisual for this device. The user must make the file available. (>>> "Preparation" Page 59)

8.1.7 Automatically inserting devices into the bus (Bus Scan)

Description

The bus scan is available for Interbus and EtherCAT.

The bus devices can be inserted automatically. For this, the user can start a scan in WorkVisual to determine which devices are connected to the real bus. The corresponding devices are then inserted automatically into the bus structure in WorkVisual.

In contrast to manual insertion, this procedure is faster and less susceptible to error.

Precondition

- The devices are inserted in the DTM Catalog.
- The field bus master is inserted in the bus structure.
- The robot controller has been set as the active controller.

- Network connection to the real robot controller
- The devices are connected to the real robot controller.

There are further preconditions depending on the bus system used. Information about this is contained in the documentation for the different bus systems.

Procedure

1. Expand the tree structure of the robot controller on the **Hardware** tab in the **Project structure** window.
2. Right-click on the field bus master. Select the option **Scan Topology…** and then select a channel. The **Topology Scan Wizard** window is opened.
3. Click on **Continue** to start the scan. When the scan is completed, WorkVisual displays all the devices found in the window on the left. Each device is represented by a number (= product code).
4. Select a device. In the window on the right, WorkVisual displays a list of the device description files which have the same product code.
5. If the list contains a number of device description files, scroll down the list and check if the file of the device that is actually used is selected. If a different file is marked, select the option **Manual selection** and select the correct file.
6. Repeat steps 4 and 5 for all devices shown.
7. Click on **Continue** to confirm the assignment.
8. Click on **Finish** to assign the devices to the field bus master.

8.2 Editing field bus signals

Description

Field bus signals can be edited in WorkVisual. For example, the signal width can be changed or the byte order can be swapped.

Precondition

- The field bus devices are configured.

Procedure

1. Select the device on the **Field buses** tab in the **I/O Mapping** window.
2. In the **I/O Mapping** window, click on the **Edit signals at the provider** button. The **Signal Editor** window is opened. All inputs and outputs of the device are displayed.
   (>>> 8.2.1 "Signal Editor" Page 62)
3. Edit the signals as required.
4. Click on **OK** to save the changes and close the **Signal Editor** window.

8.2.1 Signal Editor

In the Signal Editor, the inputs of the selected device are displayed on the left and the outputs on the right.

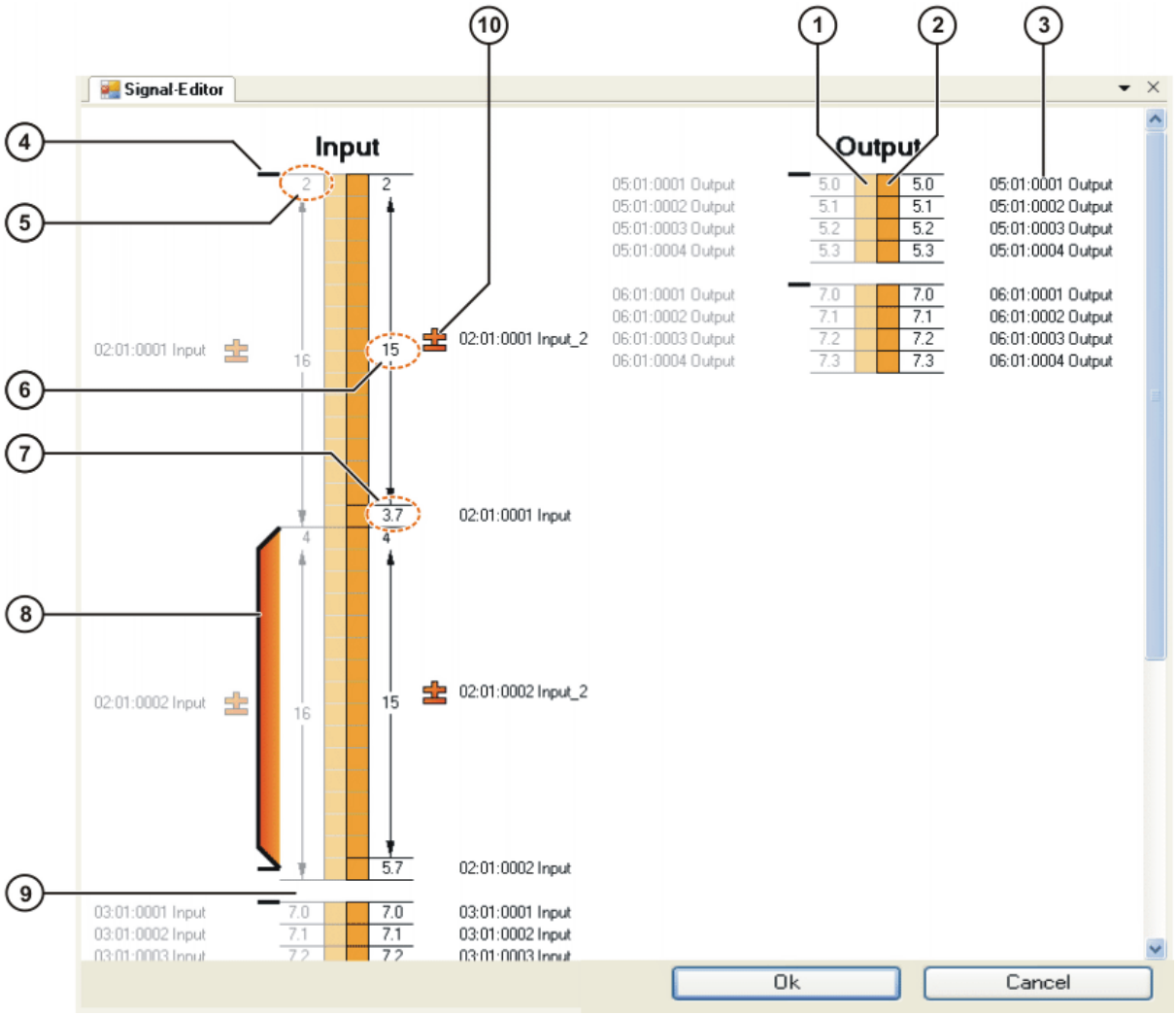


Fig. 8-6: Signal Editor

Item	Description
1	The left-hand column displays the original configuration of the inputs or outputs. Each box represents 1 bit.
2	The right-hand column can be edited and always displays the current configuration of the inputs or outputs. Each box represents 1 bit.
3	Signal name (>>> 8.2.5 "Changing signal names" Page 66)
4	Start mark for swapping (>>> 8.2.3 "Swapping signals (reversing the byte order)" Page 64)
5	Address at which this signal starts
6	Signal width (>>> 8.2.2 "Changing the bit width of signals" Page 64)
7	Address to which this bit belongs, and number of the bit
8	The bar indicates that the byte order has been swapped.
9	Boundary between memory segments
10	Data type of this signal (>>> 8.2.4 "Changing the data type" Page 66)

8.2.2 Changing the bit width of signals

Description

This procedure can be used to change the width of signals. Signals can be split or grouped. It is also possible to split signals more than once.

The signal boundaries can be moved only as far as the boundaries of the memory segments. Signal boundaries cannot be moved beyond the boundaries of swapped ranges.

Bits that are being edited are indicated in red.

Precondition

- The Signal Editor is open.
- The signals that are to be edited are not mapped.

Procedure

Moving a signal boundary:

1. In the right-hand column, position the mouse pointer over the boundary line between 2 signals. The mouse pointer changes into a vertical double arrow.
2. Click and hold down the mouse button and move the mouse pointer up or down. The boundary line is moved.
3. Drag the boundary line to the desired position and let go.

This procedure can be used to reduce a signal down to the size of 1 bit.

Splitting a signal:

1. In the right-hand column, position the mouse pointer over a bit.
2. Click and hold down the mouse button and move the mouse pointer up or down. A line is displayed over the output bit.
3. Drag the mouse pointer to another bit and let go. A line is also displayed over this bit. The two lines are the boundaries of the new signal.

Grouping signals:

1. In the right-hand column, position the mouse pointer over the first (or last) bit of a signal.
2. Click and hold down the mouse button and move the mouse pointer down (or up).
3. Drag the mouse pointer across a signal boundary to another signal boundary and let go. The intervening signal boundary disappears. The signals have been grouped.

8.2.3 Swapping signals (reversing the byte order)

Description

The byte order of signals can be swapped. It is possible to swap 2, 4 or 8 bytes at once. Sub-ranges of signals cannot be swapped. Furthermore, it is not possible to swap across the boundaries of memory segments.

The bits within a byte always remain unchanged.

The (V)KR C4 robot controller uses the Intel data format. Field bus signals in Motorola format must be converted to Intel. This is done by means of swapping.

It is not always clear from the manufacturer's data sheets whether a signal needs to be swapped or not. The signals of Siemens devices generally need to be swapped. The following procedure can provide information about whether it is necessary to swap an input:

1. Change the voltage on the input slowly and evenly.
2. Observe the values for this signal in the **Analog I/O** window on the KUKA.smartHMI.

If the values change abruptly and unevenly or in different directions, this is an indication that swapping is necessary.

It makes a difference whether a range is swapped as a whole or in parts:

Fig. 8-7: Example 1: Swapping the byte order

Item	Description
1	Original order
2	Result of swapping the bytes in two groups (i.e. the first two bytes are swapped and the second two bytes are swapped separately.)

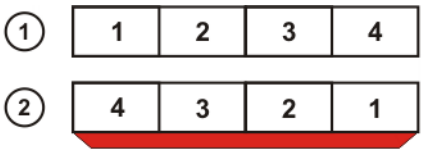


Fig. 8-8: Example 2: Swapping the byte order

Item	Description
1	Original order
2	Result of swapping all the bytes at once

Precondition

- The Signal Editor is open.

Procedure

1. Position the mouse pointer over a start mark for swapping. The mouse pointer changes into a vertical double arrow.
2. Click and hold down the mouse button. Move the mouse pointer downwards to the signal boundary.
3. A bar is displayed.
   - Either: Release the mouse button. The byte order has now been swapped.
   - Or: If a larger range is to be swapped, keep moving the mouse pointer without letting go. A longer bar is displayed. Release the mouse button. The byte order has now been swapped.

   An end mark for swapping is displayed.

To undo the swapping:

1. Position the mouse pointer over an end mark for swapping. The mouse pointer changes into a vertical double arrow.
2. Click and hold down the mouse button. Move the mouse pointer up towards the start mark.
3. The bar disappears. The swapping has been undone.

8.2.4 Changing the data type

Description

In the Signal Editor, the data type is displayed by an icon.

Icon	Description
	Integer data type with sign (depending on the length: SINT, INT, LINT or DINT)
	Integer data type without sign (depending on the length: USINT, UINT, ULINT or UDINT)
	Digital data type (depending on the length: BYTE, WORD, DWORD or LWORD)

(The exact data type of a signal is displayed in the **I/O Mapping** window.)

The data type must changed e.g. if a signal needs to be used as an analog output or input but is only designated as a digital data type in the device description file.

Precondition

- The Signal Editor is open.

Procedure

1. Click on the icon for the sign on the right-hand side of the input or output column. The icon changes.
2. Click until the desired symbol is displayed.

8.2.5 Changing signal names

Precondition

- The Signal Editor is open.

Procedure

1. Click on the name of the input or output in the right-hand column. The name can now be edited.
2. Enter the desired name and confirm with the Enter key.

   The name must be unambiguous within the current view of the Signal Editor.

The changed name is displayed in the **I/O Mapping** window.

8.3 Mapping the bus I/Os

8.3.1 I/O Mapping window

Overview

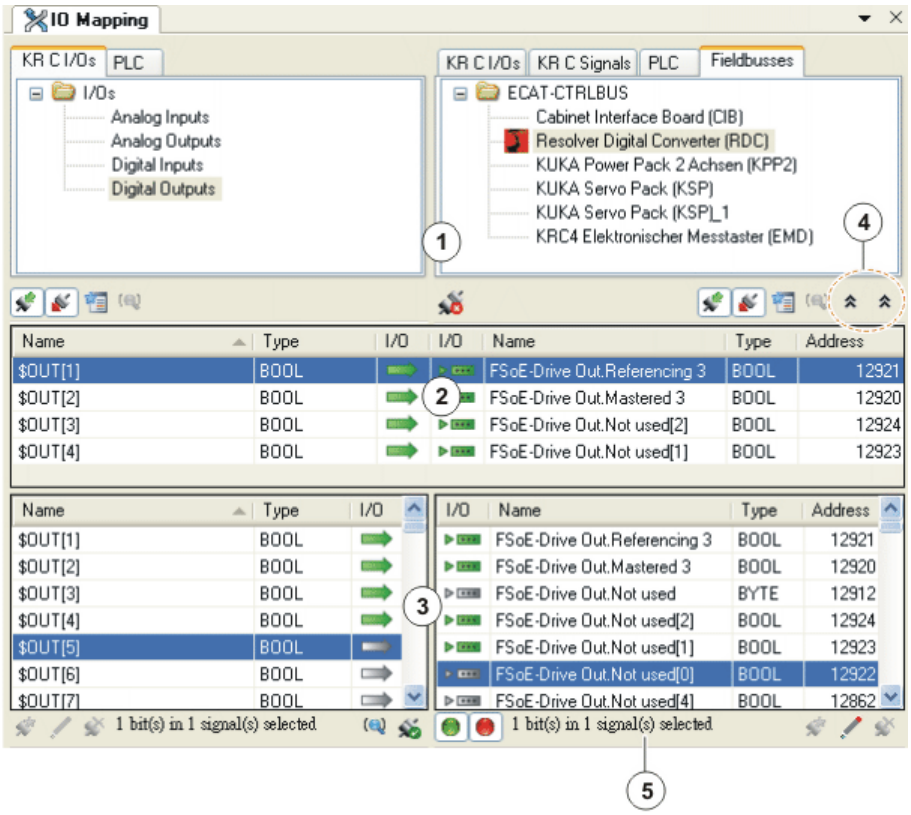


Fig. 8-9: I/O Mapping window

Item	Description
1	Display of the input/output types and field bus devices. The two areas to be connected are selected on the left and right via tabs. The signals in the areas selected here are displayed in the windows lower down.
2	Display of the mapped signals.
3	Display of all signals. The inputs/outputs can be mapped here. (>>> 8.3.3 "Mapping input to output" Page 69)
4	This allows the two signal displays to be collapsed and expanded independently of one another.
5	Displays how many bits the selected signals contain.

Mapped signals are indicated by green symbols.

Multiply mapped signals are indicated by double arrows: 

(>>> 8.3.2 "Buttons in the I/O Mapping window" Page 68)

Tabs:

Name	Description
KR C I/Os	Here the analog and digital inputs/outputs of the robot controller are displayed. There is a **KR C I/Os** tab on the left and on the right. This makes it possible to map inputs and outputs of the robot controller with each other.
PLC	These tabs are only relevant if Multiprog is used.
KR C signals	Here the other signals of the robot controller are displayed.
Field buses	Here the inputs/outputs of the field bus devices are displayed.

8.3.2 Buttons in the I/O Mapping window

Filter/ Search

Some of these buttons are displayed in several places. In such cases, they refer to the side of the **I/O Mapping** window on which they are located.

With some buttons, the tool tip changes depending on whether the signals they refer to are shown or hidden.

Button	Name / description
	**Filter inputs/Display all inputs**: Shows and hides the inputs.
	**Filter outputs/Display all outputs**: Shows and hides the outputs.
	**Filter dialog**: The **Filter signals** window is opened. Enter filter criteria (name, data type and/or signal range) and click on the **Filter** button. Signals that conform to these criteria are displayed. When a filter is set, the button displays a green check mark at bottom right. To remove a filter that has been set, click on the button and, in the **Signals** window, click on the **Reset** button and then on **Filter**.
	Buttons above the “connected signals” window: **Search for the connected signal**: Only available if a mapped signal is selected. (>>> 8.3.6 "Searching for assigned signals" Page 71)
	Button below the “all signals” window: **Search text**: Displays a search box. Here it is possible to search the signal displays for signal names (or parts of names), either upwards or downwards. When the search box is displayed, the button displays a cross at bottom right. To hide the search box again, click on the button.
	**Filter connected signals/Display all connected signals** Shows and hides the connected signals.
	**Filter disconnected signals/Display all unconnected signals** Shows and hides the unconnected signals.

Mapping

Button	Name / description
	**Disconnect**: Disconnects the selected mapped signals. It is possible to select and disconnect a number of connections simultaneously.
	**Connect**: Connects signals which are selected in the “all signals” display. It is possible to select a number of signals on both sides and connect them at one go. (Only possible if the same number of signals is selected on both sides.)

Edit

Button	Name / description
	**Creates signals at the provider** Only relevant if Multiprog is used.
	**Edit signals at the provider** For field bus signals: opens an editor in which the bit assignment of the signals can be edited. (>>> 8.2 "Editing field bus signals" Page 62) Editing options are also available here for the analog inputs/outputs of the KRC and for Multiprog signals. (>>> 8.3.8 "Editing analog KRC signals" Page 72)
	**Deletes signals at the provider** Only relevant if Multiprog is used.

Information about Multiprog is contained in the **KUKA.PLC Multiprog** documentation.

8.3.3 Mapping input to output

Description

This procedure is used to assign the inputs and outputs of the devices to the inputs and outputs of the robot controller.

By the same principle, it is also possible to map inputs and outputs of the robot controller to each other. (In this case, the **KR C I/Os** tab must be used in both halves of the window.)

Precondition

- The robot controller has been set as the active controller.
- The bus configuration in WorkVisual corresponds to the real bus configuration.
- The field bus devices are configured.

Procedure

1. Click on the **Mapping editor** button. The **I/O Mapping** window is opened.
2. On the **KR C I/Os** tab in the left-hand half of the window, select the area of the robot controller that is to be mapped, e.g. **Digital inputs**.
   The signals are displayed in the bottom area of the **I/O Mapping** window.
3. Select the device on the **Field buses** tab in the right-hand half of the window.
   The signals of the device are displayed in the bottom area of the **I/O Mapping** window.
4. Drag the signal of the robot controller onto the input or output of the device. (Or alternatively, drag the input or output of the device onto the signal of the robot controller.)
   The signals are now mapped.

Alternative procedure for mapping:

- Select the signals to be mapped and click on the **Connect** button.
- Or: Select the signals to be mapped and select the **Connect** option from the context menu.

Multiple mapping:

It is possible to select a number of signals simultaneously (on both sides) and connect them at one go. A further possibility is as follows:

1. Select a number of signals on one side and one signal on the other side.
2. Select the option **Connect continuously** from the context menu. The signals are connected (counting upwards), starting from the one selected signal.

8.3.4 Mapping bus input to bus output

Description

A bus input can be mapped to a bus output (in the same or a different bus). This is done indirectly. A total of 3 mappings are required for this.

Procedure

1. Map the bus input to an input of the robot controller.
2. Map the robot controller input to a robot controller output.
3. Map the robot controller output to a bus output.

The input and output of the robot controller are thus multiply mapped in this case.

Schematic

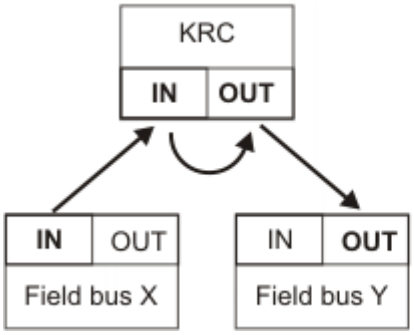


Fig. 8-10: Schematic: Mapping bus input to bus output

8.3.5 Multiple mapping or reverse mapping of signals

Possible

Signals can be multiply mapped. Multiply mapped signals are indicated in the **I/O Mapping** window by a double arrow: 

The following multiple mapping is possible:

- Map an input (robot controller) to an input (bus).
- Map the same input (robot controller) to one or more outputs (robot controller).

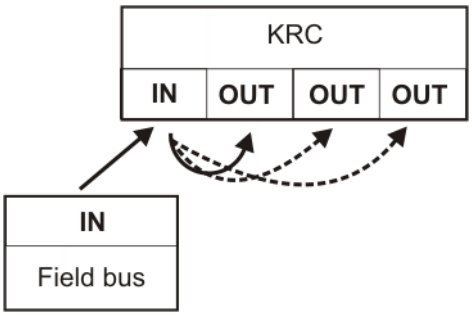


Fig. 8-11: Multiple mapping possible

The following reverse mapping is possible:

- Map an output (bus) to an input (robot controller).

Fig. 8-12: Reverse mapping possible

Not possible

The following multiple mappings are not possible:

- Map an input (robot controller) to several inputs (bus).
- Map an output (robot controller) to several outputs (bus).

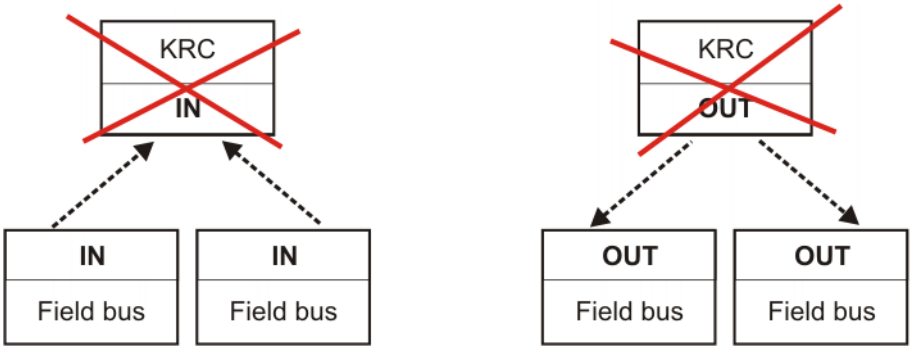


Fig. 8-13: Multiple mapping not possible

8.3.6 Searching for assigned signals

Procedure

1. Select a mapped signal.
2. In the part of the window in which the signal was selected (left-hand or right-hand half), click on the button **Searches for the connected signal**.
   - If a signal is mapped once: the assigned signal is now highlighted in the other half of the “all signals” window.
   - If a signal is multiply mapped: the **Search for signal** window opens. All signals connected with the selected signal are shown.

     Select a signal and confirm with **OK**.

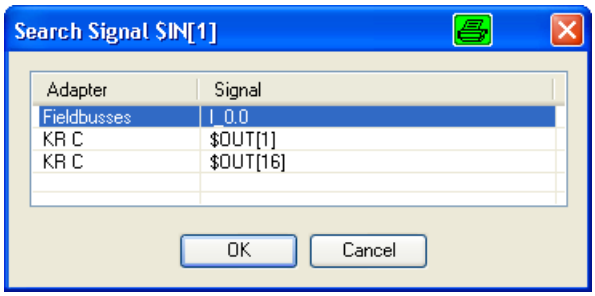


Fig. 8-14: Example: Multiply mapped signal

8.3.7 Grouping signals

Description

8 digital inputs or outputs of the robot controller can be grouped together to a signal of the data type BYTE. Grouped signals can be recognized by the name extension **#G**.

Precondition

- The signals that are to be grouped are not mapped.

Procedure

1. Below the **KR C I/Os** tab, select 8 consecutive signals and right-click on them.
2. Select **Group**.
   The signals are grouped to a signal of type BYTE. The name with the lowest index number is taken for the new signal.

To undo the grouping:

1. Right-click on a signal with the name extension **#G**.
2. Select **Ungroup**.

Example

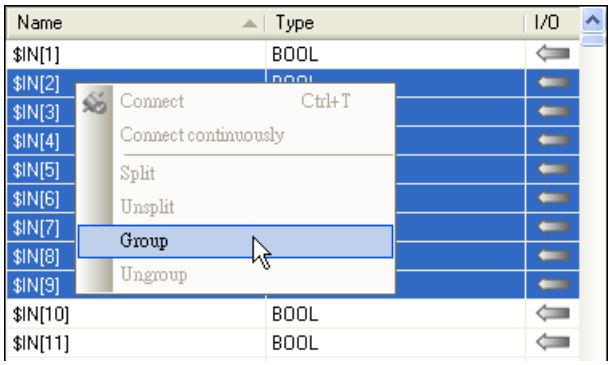


Fig. 8-15: Group signals

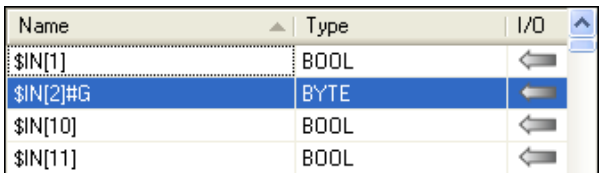


Fig. 8-16: A grouped signal

8.3.8 Editing analog KRC signals

Procedure

1. Select the analog signal on the left-hand **KR C I/Os** tab in the **I/O Mapping** window.

It is also possible to select and edit several signals at once: Consecutive signals can be selected using SHIFT + click. A number of individual signals can be selected using CTRL + click.

2. At the bottom left of the **I/O Mapping** window, click on the button **Edit signals at the provider**. A window opens.
3. Enter the required calibration factor and change the data type if necessary.
4. Click on **OK** to save the data and close the window.

Box	Description
Calibration factor	The required calibration factor can be entered here.
Type	Only signals of the same type can be connected. The data type can be changed here.

8.4 Exporting the bus configuration

Description

The bus-specific configuration can be exported in the form of XML files. This export makes it possible to check the configuration files if required.

Precondition

- The robot controller has been set as the active controller.

Procedure

1. Select the menu sequence **File** > **Import / Export**. A window opens.
2. Select **Export I/O configuration to .XML files** and click on **Next**.
3. Specify a directory. Click on **Next**.
4. Click on **Finish**.
5. The configuration is exported to the specified directory. If the configuration was successfully completed, this is indicated by a message. Close the window.

9 Long texts

9.1 Displaying / editing long texts

Precondition

- A robot controller has been added and set as active.

Procedure

1. Select the menu sequence **Editors** > **Symbol Table Editor**.
2. The long texts are sorted thematically. In the left-hand column, select which long texts are to be displayed, e.g. **Digital inputs**.
3. In the other columns, select the language or languages that are to be displayed.
4. Edit the long texts, if necessary.

Description

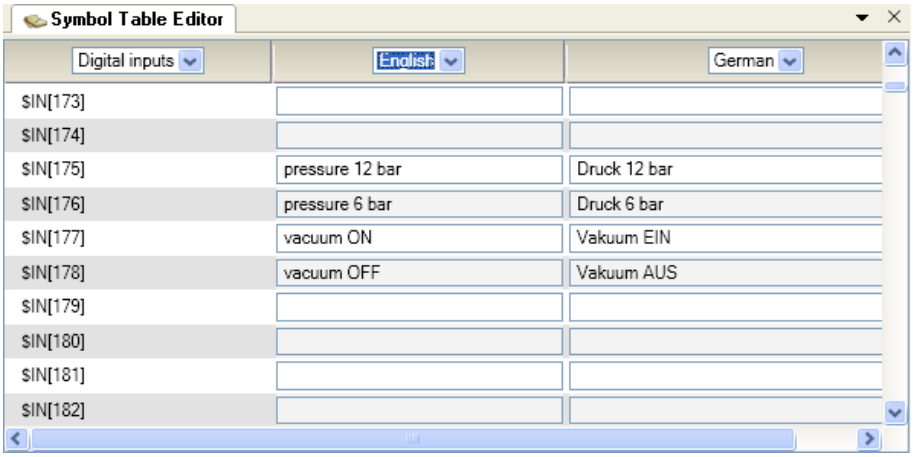


Fig. 9-1: Symbol Table Editor

The long texts of the digital inputs/outputs can also be edited in the **I/O Mapping** window via the **Edit signals at the provider** button. (>>> 8.3.1 "I/O Mapping window" Page 67)

9.2 Importing long texts

Description

The following file formats can be imported:

- .TXT
- .CSV

Imported long texts overwrite existing long texts.

Precondition

- A robot controller has been added and set as active.

Procedure

1. Select the menu sequence **File** > **Import / Export**. A window opens.
2. Select **Import Symbol Table** and click on **Next**.
3. Select the file to be imported and the language of the contained long texts.
4. If a signal already has a name and the file to be imported does not contain a name for this signal, the check box **Delete existing entries** determines what happens to the existing name.
   - **Activated**: The name is deleted.
   - **Not activated** The name is retained.

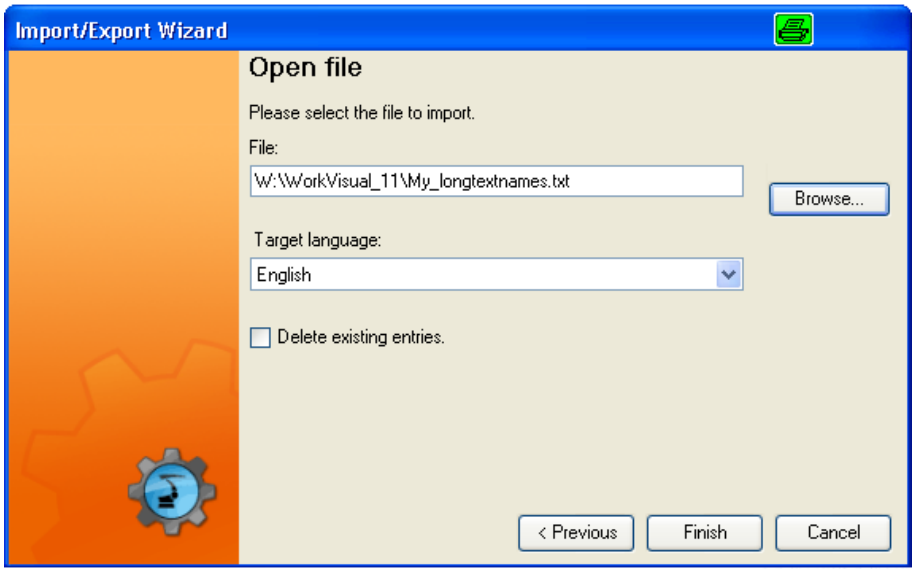


Fig. 9-2: Importing long texts

5. Click on **Finish**.
6. If the import was successful, this is indicated by a message. Close the window.

9.3 Exporting long texts

Description

Long texts can be exported in the following file formats:

- .TXT
- .CSV

Precondition

- A robot controller has been added and set as active.

Procedure

1. Select the menu sequence **File** > **Import / Export**. A window opens.
2. Select **Export SymbolTable** and click on **Next**.
3. Specify the path name and format of the file which is to be generated. Also select the language. Click on **Finish**.

Fig. 9-3: Exporting long texts

4. If the export was successful, this is indicated by a message in the window. Close the window.

10 Configuring KUKA buses: controller bus, system bus, extension bus

10.1 Overview

Description

The KUKA buses must be adapted in WorkVisual to the real bus configuration in the following cases:

- A device has been replaced by a device of a different type, e.g. a KPP0 by a KPP2.
- More than one device has been replaced by a device of a different type.
- One or more devices have been removed.
- One or more devices have been added.

Information about exchanging devices and about the possible device combinations is contained in the operating instructions or assembly instructions for the robot controller.

Procedure

1. Load the active project from the robot controller.

If settings have already been made in a project in WorkVisual which are to be transferred subsequently to the robot controller together with the bus configuration, then the active project must be transferred to WorkVisual using a comparison.
(>>> 13.8 "Comparing projects (and accepting differences)" Page 122)

2. Carry out the relevant configuration work.
3. Transfer the project to the robot controller and activate it there.

10.2 Configuring the KUKA bus (8.3)

Controller Bus

Using the **Configuration proposal** functionality, the controller bus can be set up or updated automatically in WorkVisual. Insertion of individual devices, connection of devices, insertion of wagon driver files, etc., is no longer necessary.

(>>> 6.18 "Inserting hardware components" Page 35)

The controller bus can still be edited manually if required. The procedure is the same as for the controller version 8.2.

(>>> 10.3.1 "Inserting devices on the KUKA bus (8.2)" Page 77)

System Bus
Extension Bus

The procedure is the same as for the controller version 8.2.

(>>> 10.3.1 "Inserting devices on the KUKA bus (8.2)" Page 77)

10.3 Configuring the KUKA bus (8.2)

10.3.1 Inserting devices on the KUKA bus (8.2)

Recommendation: Arrange the devices in the buses in the same order as they are arranged in reality.
The arrangement has no effect on its functionality of the bus, but it is easier to edit the connections on the **Topology** tab if the arrangement already corresponds to reality.

Preparation

Only if devices are to be inserted into the Extension Bus and the node **KUKA Extension Bus (SYS-X44)** is not yet present:

1. Right-click on the node **Bus structure** on the **Hardware** tab in the **Project structure** window.
2. Select **Add** from the context menu. The **DTM selection** window is opened.
3. Select the entry **KUKA Extension Bus (SYS-X44)** and confirm with **OK**.

Precondition

- The device description files are present.
  - If devices are to be inserted into the Extension Bus, the files must be imported beforehand.
    (>>> 6.8 "Importing device description files" Page 29)
  - The files for the controller bus and the system bus are present in WorkVisual.
- The robot controller has been set as the active controller.

Procedure

1. Right-click on the KUKA bus in the **Bus structure** node on the **Hardware** tab in the **Project structure** window.
2. Select **Add** from the context menu. The **DTM selection** window is opened.
3. Select the device used and confirm with **OK**. The device is inserted in the tree structure.
4. If required: Right-click on the device in the tree structure and select **Rename** from the context menu. Rename the device.

In a bus, more than one device of the same type may be present. To distinguish them in the bus structure, WorkVisual automatically appends a number to the name. It is recommended, however, to give the devices meaningful names, e.g. by including the abbreviation for the installation position of the devices.
The names that the devices have here in the bus structure are the names used in error messages.

5. Repeat steps 1 and 4 for all devices used in the real bus.
6. Check the device settings and change if necessary.
   (>>> 10.3.2 "Checking the device settings" Page 79)
7. Check the device connections and change if necessary.
   (>>> 10.3.3 "Connecting devices on the KUKA bus" Page 80)
8. Only if the change in the controller bus affects a KPP, or if the controller bus has been complete reconfigured: Insert the wagon driver configuration.
   (>>> 10.3.5 "Inserting the wagon driver configuration" Page 82)

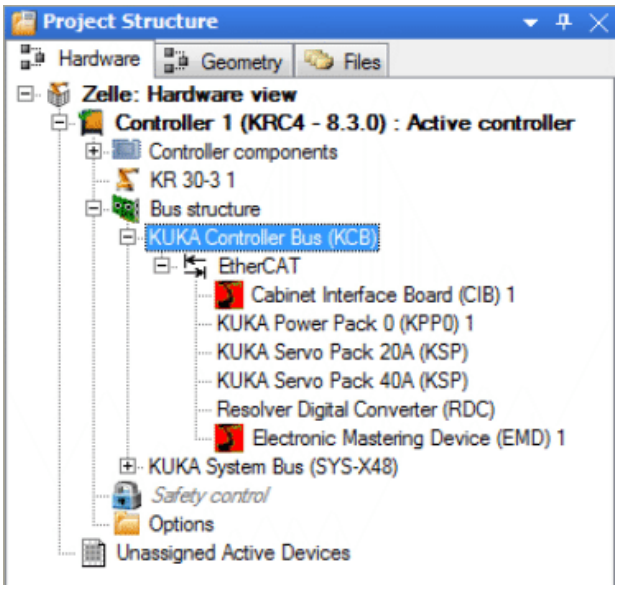


Fig. 10-1: Example of a controller bus

10.3.2 Checking the device settings

Procedure

1. Right-click on the device on the **Hardware** tab in the **Project structure** window.
2. Select **Settings…** from the context menu. The **Settings…** window is opened.
3. Select the **General** tab.
4. Check that the following settings have been made. If not, correct the settings.
   - **Check vendor ID**: active
   - **Check product code**: active
   - **Check revision number**: OFF
   - **Check serial number**: inactive
5. Close the window by clicking on **OK**.

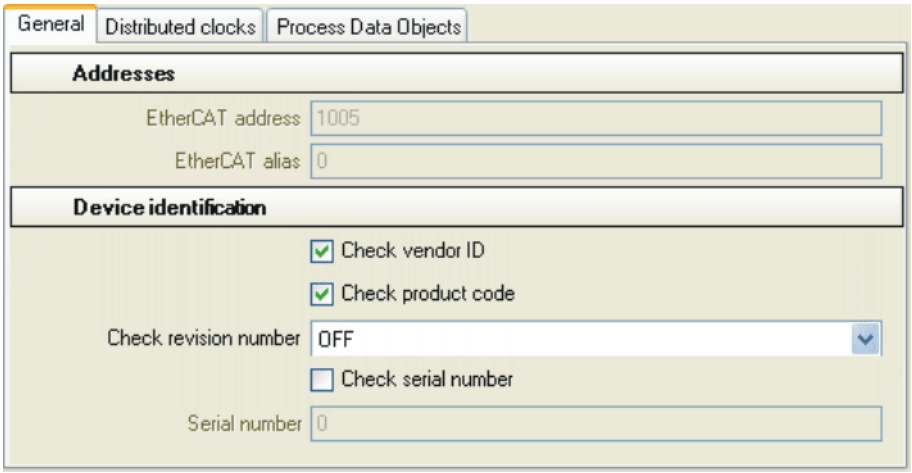


Fig. 10-2: Device settings, “General” tab

10.3.3 Connecting devices on the KUKA bus

Description

If devices are inserted into the bus, WorkVisual connects the devices automatically. As WorkVisual does not know the real bus configuration, the connections must be checked and changed where necessary.

> Information about the connector pin allocation of the devices can be found in the operating instructions for the robot controller.

Procedure

1. Right-click on the bus on the **Hardware** tab in the **Project structure** window.
2. Select **Settings…** from the context menu. The **Settings…** window is opened.
3. Select the **Topology** tab.
   (>>> 10.3.4 ""Topology" tab" Page 81)
4. Select and delete invalid connections. To do this, either press the Del key, or right-click and select **Delete**.
5. Insert missing connections. To do this, click on a connection and hold down the mouse button. Drag the mouse pointer to another connection and release the mouse button.
6. Mark temporary connections as such. To do this, right-click on the connection and select **Disconnectable** from the context menu. The connection is displayed as a broken line.

   A temporary connection is e.g. with the controller bus, the connection to the Electronic Mastering Device (EMD), because the EMD is not permanently connected.
7. Click on devices for which the address or alias address is not yet correct. A window appears. Enter the correct address.

   All temporarily connected devices require an alias address. For the EMD, the alias address 2001 must be entered!
8. If required: Rearrange the devices using Drag&Drop. This serves to increase the clarity of the **Topology** tab. It has no effect on the bus.
9. Click on **OK** at bottom right.

10.3.4 “Topology” tab

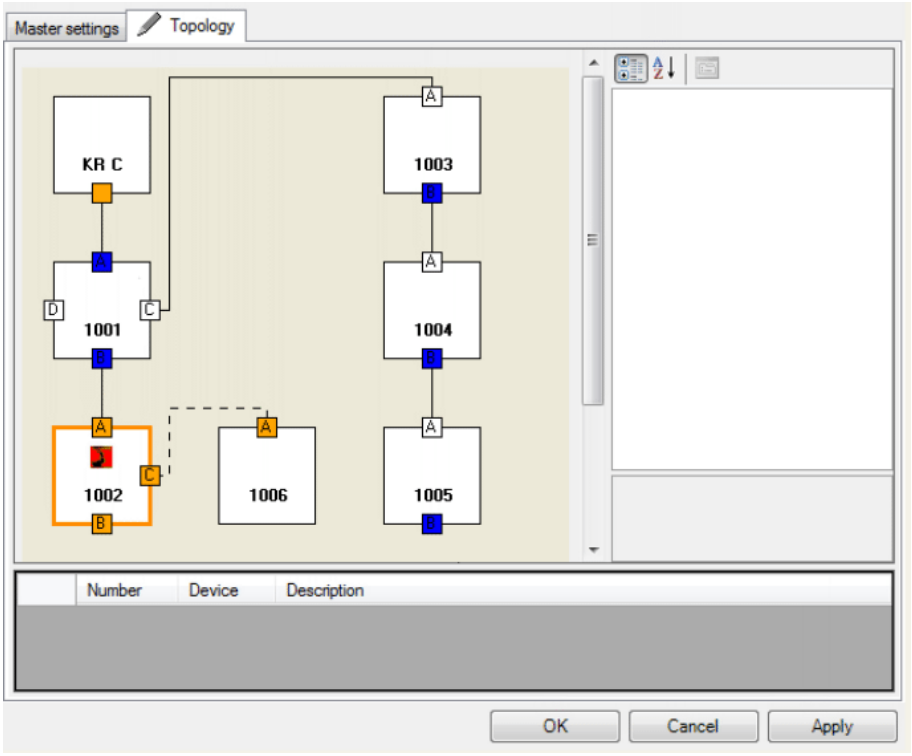


Fig. 10-3: “Topology” tab – example of a controller bus

Properties of the “Topology” tab:

- Each device in the bus is represented by 1 rectangle.
- The numbers of the devices specify their physical address.
- **To display the name of a device:**

  Move the mouse pointer onto the device. A tool tip is displayed with the name of the device.

  Or alternatively, select the device. The window on the right displays the properties of this device, e.g. the name.

  The devices in the figure:

Device	Name
1001	Cabinet Interface Board (CIB)
1002	Resolver Digital Converter (RDC)
1003	KUKA Power Pack 2 Axes (KPP2) (G1)
1004	KUKA Servo Pack Wrist Axes (KSP) (T1)
1005	KUKA Servo Pack Main Axes (KSP) (T2)
1006	Electronic Mastering Device (EMD)

- **To display the name of a connection:**

  Move the mouse pointer onto the connection. A tool tip is displayed with the name of the connection.
- Lines shows the connections between the devices.

  Solid lines indicate permanent connections. Broken lines indicate temporary connections.
- The devices can be reordered using Drag&Drop. This serves to increase the clarity of the **Topology** tab. It has no effect on the bus.

- The window on the right displays the properties of the selected device, e.g. the address and alias address. Some of the properties can be changed.

  All temporarily connected devices require an alias address. For the EMD, the alias address 2001 must be entered!
- The message area below the graphic shows if a device has an invalid address or alias address.

Editing connections:

- Select and delete invalid connections.

  To do this, either press the Del key, or right-click and select **Delete**.
- Insert missing connections.

  To do this, click on a connection and hold down the mouse button. Drag the mouse pointer to another connection and release the mouse button.
- Mark temporary connections as such.

  To do this, right-click on the connection and select **Disconnectable** from the context menu. A temporary connection is e.g. the connection to the Electronic Mastering Device (EMD), because the EMD is not permanently connected.

10.3.5 Inserting the wagon driver configuration

Description

The wagon driver configuration must be inserted into the WorkVisual project in the following cases:

- If the controller bus has been completely reconfigured.
- Or if a change has been made to the controller bus which affects a KPP.

For this, the following configuration files are required:

- CFCoreWaggonDriverConfig.xml
- EAWaggonDriverConfig.xml

These files are automatically installed together with WorkVisual. They are located in the directory: C:\Program Files (x86)\KUKA\WorkVisual[…]\WaggonDriverConfigurations. They can be found there in the subdirectory for the relevant controller bus variant.

Which wagon driver configuration should be used for which controller bus?

Controller bus with …	Directory
KPP without external axis	**KPP 600-20**
KPP with 1 external axis	**KPP 600-20-1x40 (1x64)**
KPP with 2 external axes	**KPP 600-20-2x40**
KPP with 1 external axis and ServoGun FC Sensor Box	**KPP 600-20-1x40 + SDC**
KPP with 2 external axes and ServoGun FC Sensor Box	**KPP 600-20-2x40 + SDC**
4-axis palletizer with external axis	**4Ax_PA_mit_ZA**
4-axis palletizer without external axis	**4Ax_PA_ohne_ZA**
5-axis palletizer with external axis	**5Ax_PA_mit_ZA**
5-axis palletizer without external axis	**5Ax_PA_ohne_ZA**
AGILUS sixx	**6Ax_CIBsr_KPPsr_KSPsr**

Precondition

- The robot controller has been set as the active controller.

Procedure

1. Expand the node of the robot controller on the **Files** tab in the **Project structure** window.
2. Then expand the following subordinate nodes: **Config** > **User** > **Common** > **Mada**.
3. Only if there are already wagon driver files in the **Mada** directory and these need to be removed:
   - Right-click on a file and select **Delete** from the context menu.
   - Repeat for the second file.
4. Right-click on the **Mada** folder and select **Add external file** from the context menu.
5. A window opens. In the **File type** box, select the entry **All files (*.*)**.
6. Navigate to the directory in which the files for the wagon driver configuration are located, select the files and confirm with **Open**.

   The files are now displayed in the tree structure below the **Mada** folder. (If not: collapse and expand all the folders in order to refresh the display.)

10.4 Assigning FSoE slave addresses (8.3)

This description is valid for the controller variant (V)KR C4. For KR C4 compact, please contact KUKA.
(>>> 15 "KUKA Service" Page 151)

Description

The robot controller is supplied with preconfigured FSoE addresses. The user needs to assign the addresses via WorkVisual only in the following cases:

- More than 1 RDC is connected.

  On delivery, RDCs are preconfigured with the FSoE address “2”. An address must not be used more than once on a robot controller.
- Several devices of the same type have been replaced at the same time.

The assignment of addresses to devices is predefined.
(>>> 10.4.1 "FSoE addresses" Page 85)

Preparation

- Determine the KUKA serial number of the real device.
  - With KSPs and KPPs, the serial number is given on the rating plate.
  - RDCs have a label with a barcode on the board. The serial number is specified in encrypted form.

    (>>> 10.4.2 "Determining the serial number of the RDC" Page 85)
- In the system software, determine the IP address of the robot controller:
  a. In the main menu, select **Diagnosis** > **Diagnostic monitor**.
  b. In the **Module** box, select the interface via which the WorkVisual PC is connected to the robot controller: **Network interface (Service)** (for KSI) or **Network interface (KLI)**.

     The relevant data for the interface, including the IP address, are now displayed.

Precondition

WorkVisual:

- The IP address of the WorkVisual PC is in the same subnet as the IP address of the interface to which it is connected (KLI or KSI).
- Network connection to the real robot controller
- The robot controller has been set as the active controller.

- The configuration in WorkVisual must correspond to the real bus architecture.

  Recommendation: Load the current project of the real robot controller in WorkVisual.
- The affected devices support address assignment by software.

  This is defined in the device description file. In certain cases, this feature may be present in the latest device description file, although the device was inserted into the bus structure in WorkVisual with an older version of the file. The new file must then be imported in WorkVisual and the device must be removed from the bus structure and then reinserted.

Real robot controller:

- Operating mode T1
- The safety controller does not give a drives enable signal.
  - This status can be checked as follows: In the status bar, click on the **Drives** status indicator. The **Motion conditions** window is opened. The box **Drives enabled from Safety** must be gray. It must not be green.

Information about the status bar can be found in the operating and programming instructions for the system software.

  - This state can be brought about in the following way: trigger an EMERGENCY STOP.

Procedure

1. Double-click on the **KUKA Controller Bus (KCB)** node on the **Hardware** tab in the **Project structure** window. The **Settings…** window is opened.
2. Enter the IP address of the robot controller. Click on **OK** to save the entries and close the window.
3. Right-click on the **KUKA Controller Bus (KCB)** node and select **Connect** from the context menu.

   The node is now displayed in green italics.
4. Right-click on the relevant device under the **KUKA Controller Bus (KCB)** node and select **Connect** from the context menu.

   The device description is now displayed in green italics.
5. Right-click again on the device and select **Functions** > **Assign FSoE slave address...** from the context menu. The **FSoE slave address assignment** window is opened.
6. Enter the serial number and the FSoE address. Leading zeros may be omitted.

   WorkVisual detects whether the serial number is correct: if not, a red exclamation point is displayed to the left of the box. This is also the case during entry, while the number is still incomplete and thus incorrect.

   The red exclamation point disappears as soon as the number is complete and correct.
7. If the serial number is correct, click on **Accept**. Then click on **OK**. The window closes.
8. Right-click again on the device and select **Disconnect** from the context menu.

   The data are now saved on the real device. The real controller bus cannot yet access the device, however.
9. Right-click on the **KUKA Controller Bus (KCB)** node and select **Disconnect** from the context menu.

   After a few seconds, the real controller bus accesses its devices again.

10.4.1 FSoE addresses

KSP and KPP

Controller variant with 1 row of drive modules		
KSP, left Address: **1022**	KSP, middle Address: **1021**	KPP, right Address: **1020**

Controller variant with 2 rows of drive modules		
KSP, top left Address: **1032**	KSP, top center Address: **1031**	KPP, top right Address: **1030**
KSP, bottom left Address: **1022**	KSP, bottom center Address: **1021**	KPP, bottom right Address: **1020**

RDC

RDC	Address
On the KUKA robot (but not on the KR 1000 titan)	**2**
On the KR 1000 titan (2 RDCs)	**2** and **3** It makes no difference which RDC has which address.
On other axes (e.g. on external axes or CKs)	**2**, **3**, **4** and/or **5** It makes no difference which RDC has which address. **2** and **3** can naturally only be used if they are not already used for robot RDCs.

Additional components

While it is possible to assign FSoE addresses to these components, in practice it is not necessary, as they only occur once per robot controller.

Component	Address
smartPAD	**13330**
SIB	**13331**
Extended SIB	**13332**
CIB	**1**

In exceptional cases, after consultation with KUKA, some KSPs, KPPs and RDCs may be assigned different addresses than those specified above. However, the addresses for smartPAD, SIB, Extended SIB and CIB must never be assigned to other components.

10.4.2 Determining the serial number of the RDC

Description

RDCs have a label with a barcode on the board. The serial number is specified in encrypted form. There are 2 types of barcode. The length of the serial number depends on the type.

If the RDC is located in the RDC box, the box must be opened in order to read the label.

Information about the RDC and opening the RDC box can be found in the operating instructions for the robot controller.

Label on the RDC

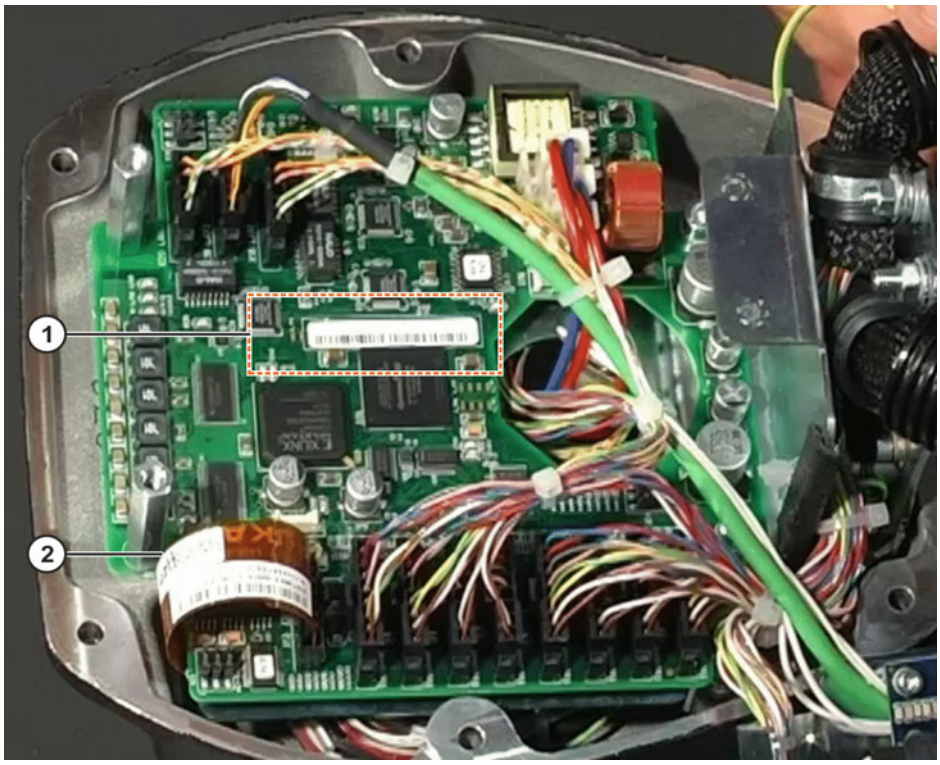


Fig. 10-4: Example: open box with RDC

Item	Description
1	The relevant label is located in the center of the board.
2	The labels on the EDS memory strip are not relevant.

Encrypted serial number

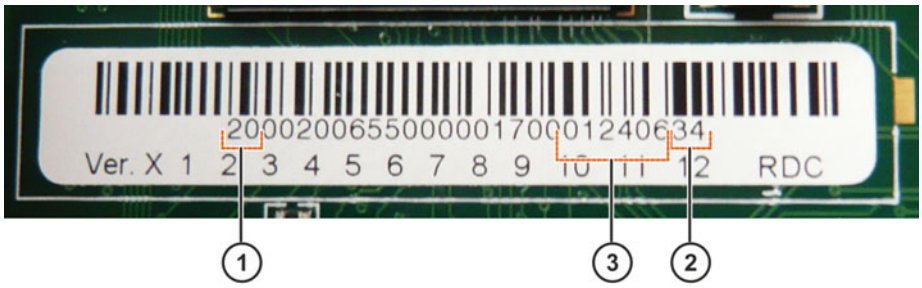


Fig. 10-5: Example: label on an RDC

Item	Description
1	The two leftmost digits specify the type. Possible values are: ■ Type 20 (in the example) ■ Type 26
2	The two rightmost digits specify the check digit. The check digit itself is not relevant.
3	To the left of the check digit is the serial number. The number of figures it comprises is dependent on the type: ■ With type 20: 6 digits (in the example: 012406) ■ With type 26: 7 digits

10.5 Assigning FSoE slave addresses (8.2)

> This description is valid for the controller variant (V)KR C4. For KR C4 compact, please contact KUKA.
> (>>> 15 "KUKA Service" Page 151)

Description

The steps for preparation and procedure are the same as for the controller version 8.3.

Up to and including version 8.2.21, the applications and preconditions differ partially from 8.3 and are therefore listed here.

≤ 8.2.21

For 8.2.21 or lower

Applications:

- The FSoE address must be assigned if a device has been replaced.
- It is not possible to replace more than one device of the same type at the same time.

Preconditions on the real robot controller:

- Operating mode T1
- $USER_SAF == TRUE (>>> "$USER_SAF == TRUE" Page 87)

$USER_SAF == TRUE

The conditions under which $USER_SAF is TRUE depend on the controller variant and the operating mode:

Controller	Operating mode	Condition
KR C4	T1/CRR, T2	■ Enabling switch is pressed
	AUT, AUT EXT	■ Operator safety is closed
VKR C4	T1/KRF	■ Enabling switch is pressed ■ E2 is closed
	T2	■ Enabling switch is pressed ■ E2 and E7 are closed
	AUT EXT	■ Operator safety is closed ■ E2 and E7 are open

11 RoboTeam

This documentation describes how RoboTeams can be configured offline with WorkVisual. Basic information about RobotTeam and about installation and programming on the robot controller can be found in the documentation **KUKA.RoboTeam**.

The “RoboTeam” functionality is not available for projects with VKR C4 robot controllers.

11.1 Creating a RoboTeam

11.1.1 Creating a new RoboTeam project

Description

WorkVisual provides templates which enable creation of a new project containing one or more RoboTeams. A wizard, the **Cell Configuration Wizard**, guides the user through the creation process.

Templates

Templates for projects containing RoboTeams:

Template	Description
Generic RoboTeam project	Creates a project in which the number of RoboTeams and independent robots is specified by the user. The user also specifies the number of robots and external axes in each RoboTeam.
Simple RoboTeam project	Creates a project with 1 RoboTeam. The RoboTeam contains 2 robots and 1 external axis.
Project with two RoboTeams	Creates a project with 2 RoboTeams. Each RoboTeam contains 2 robots and 1 external axis. The project also contains a handling robot.

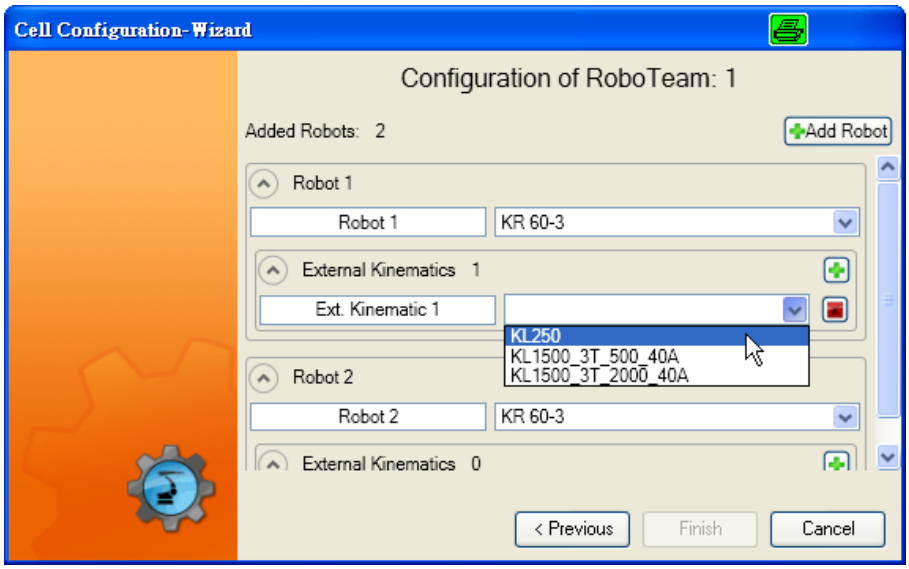


Fig. 11-1: Example screen: Cell Configuration Wizard

Procedure

1. Click on the **New…** button. The **Project Explorer** is opened. On the left, the **Create project** tab is selected.
2. Select one of the templates for a RoboTeam project in the **Available templates** area of the tab.
3. Enter a name for the project in the **File name** box.

4. The default directory for projects is given in the **Location** box. If required, select a different directory.
5. Click on the **New** button. The Cell Configuration Wizard opens.
6. Make the required settings in the wizard, e.g. select the robot type. Clicking on **Next** takes you to the next screen.
7. Once all the relevant settings have been made, click on **Finish** and then, in the next screen, on **Close**.
8. The robot network is now displayed on the **Hardware** tab of the **Project structure** window.

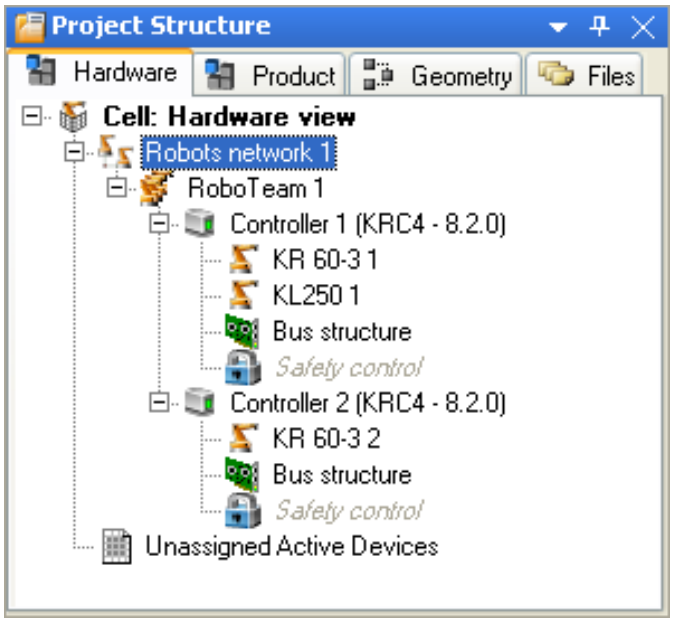


Fig. 11-2: Example: RoboTeam on the Hardware tab

11.1.2 Inserting a RoboTeam in an existing project

Description

A RoboTeam can be inserted in an existing project.

> If the RoboTeam is to be inserted in a new project, specific templates are available for project creation. This is quicker and easier than first creating an ordinary project and then inserting the RoboTeam.
> (>>> 11.1.1 "Creating a new RoboTeam project" Page 89)

Precondition

- The catalogs **KukaControllers** and **KUKARobots**[…] are available.
- If the RoboTeam is to contain external axes: The catalog **KukaExternalAxes** is available.

Procedure

1. Right-click on the node of the cell on the **Hardware** tab in the **Project structure** window and select the option **Add RoboTeam** from the context menu.

   The node **Robot network** and the subnode **RoboTeam** are inserted. The nodes are numbered by default. They can be renamed.
2. Add the required number of robot controllers to the **RoboTeam** node.

> It must always be the same robot controller that is added.

3. Assign robots to the robot controllers.
4. If required, assign external axes to the robot controllers.
5. If required, a further RoboTeam can be added to the network.

To do this, right-click on the **Robot network** node and select the option **Add RoboTeam** from the context menu. Then repeat steps 2 to 5.

11.2 Configuring the RoboTeam

11.2.1 Editors for the robot network and RoboTeam

RoboTeams and the associated network are configured using 2 different editors.

Precondition

- At least 1 RoboTeam has been created.

Procedure

Open the editor for the robot network:

1. Select the node **Robot network** on the **Hardware** tab in the **Project structure** window.
2. Double-click on the icon of the node.
   Or select the menu sequence **Editors** > **Configure robot network**.

Procedure

Open the editor for the RoboTeam:

1. Select the **Team** node on the **Hardware** tab in the **Project structure** window.
2. Double-click on the icon of the node.
   Or select the menu sequence **Editors** > **Configure RoboTeam...**.

Procedure

Rearranging elements in an editor:

The user can move elements to achieve a clear arrangement of the elements. This has no effect on the configuration of the robot network or RoboTeam.

1. Right-click in the empty space in the editor and select **Select elements** from the context menu.
2. Click on an element and hold down the mouse button. The element can now be moved as desired.

Overview

The editors display the following elements and information:

Robot network	RoboTeam
All robot controllers in the network	All kinematic systems in the team (robots and external axes)
The time master of the network	(Not displayed)
The safety master of each team	(Not displayed)
(Not displayed)	The motion master of the team
(Not displayed)	The workspaces
(Not displayed)	The access rights for the workspaces can be displayed.

Context menu

The following functions are available in the context menu:

Icon	Name / description
	**Select elements** Must be selected in order to move elements or to delete master/slave links.
	**Define master/slave link** In the editor for the robot network: Links individual RoboTeams to form a single safety circuit. (>>> 11.2.2 "Linking RoboTeams to form a single safety circuit" Page 92) In the editor for the RoboTeam: Defines the motion master(s). (>>> 11.2.4 "Defining the motion master" Page 94)
	**Delete master/slave link** (>>> 11.2.5 "Deleting a master/slave link" Page 95)
	**Set time master** Only available in the editor for the robot network. Defines the time master. (>>> 11.2.3 "Defining the time master" Page 93)
	**Open help** Calls the documentation for WorkVisual and displays the **RoboTeam** chapter.

11.2.2 Linking RoboTeams to form a single safety circuit

Description

If a robot network comprises more than one RoboTeam, by default the individual teams form separate safety circuits. To group 2 or more teams into a single safety circuit, a link must be made from the safety master of one team to a robot controller of another team. This robot controller is now the safety master of the first team.

It is possible to integrate all the teams in a network into a single safety circuit.

The safety masters of the individual RoboTeams are defined automatically by WorkVisual and cannot be changed. They are indicated by gray arrows in the editor for the robot network: a gray arrow links each slave with the master.

Precondition

- The robot network contains more than 1 RoboTeam.
- The editor for the robot network is open.

Procedure

1. Right-click in the empty space in the editor and select **Define master/slave link** from the context menu.
2. Click on the safety master of a team and hold down the mouse button.
3. Drag the mouse pointer to the robot controller of another team and release the mouse button.

   The robot controller of the other team is now the safety master of the first team. This is shown in the editor by a black arrow.

   Any previous link with another team is automatically deleted by the new one.

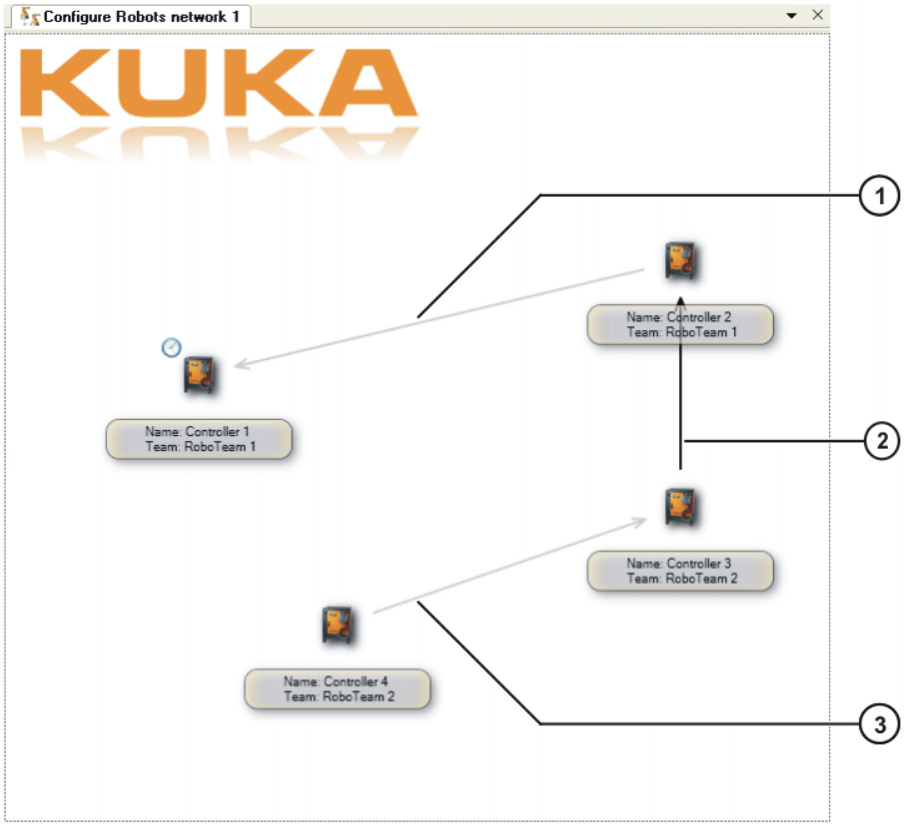


Fig. 11-3: Display of safety masters / safety circuits

Item	Description
1	Controller 1 is the safety master of team 1 (cannot be influenced by the user)
2	With this arrow, the user has linked team 1 and team 2 to form one safety circuit. Alternative: an arrow from controller 3 to controller 1
3	Controller 3 is the safety master of team 2 (cannot be influenced by the user)

11.2.3 Defining the time master

Description

After a robot network has been created, the message window displays which robot controller has been defined as the time master by WorkVisual. This assignment can be changed.

In the editor for the robot network, the time master is indicated by a small analog clock icon. There can be only 1 time master per network.

On the real robot controller, the time master is not visible and cannot be changed.

Precondition

- The editor for the robot network is open.

Procedure

1. Right-click in the empty space in the editor and select **Set time master** from the context menu.
2. Click on the robot controller that is to be set as the new time master.
   The new time master is now indicated in the editor by the analog clock icon. The clock has now disappeared from the previous time master.

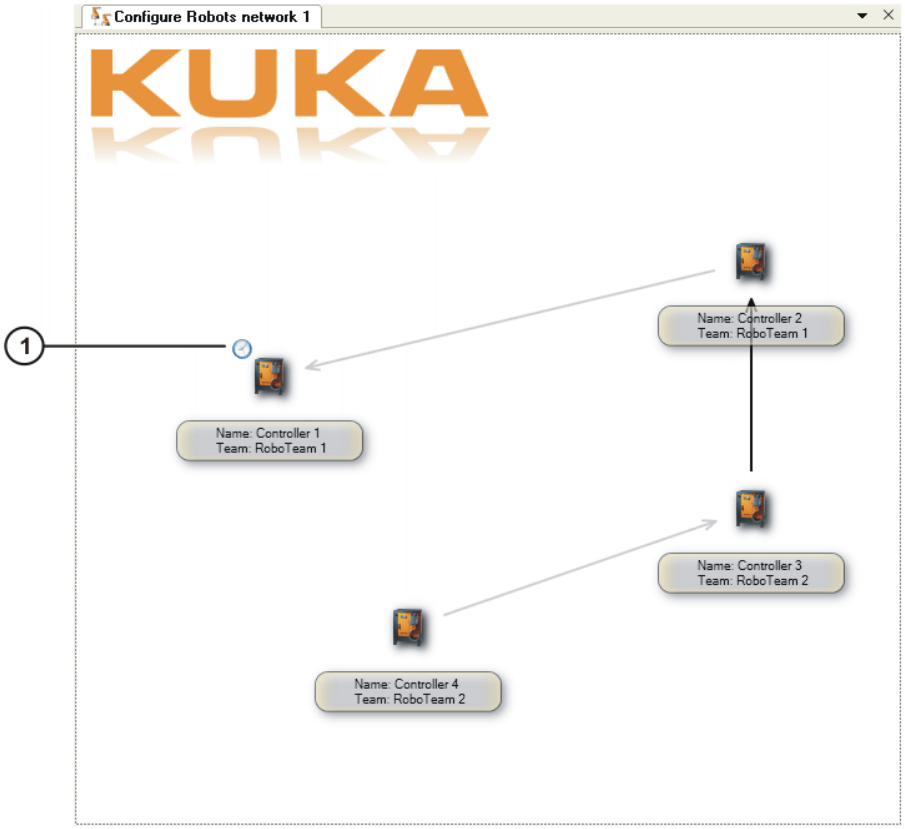


Fig. 11-4: Display of the time master

Item	Description
1	The clock indicates the time master.

11.2.4 Defining the motion master

Description

This procedure is used to define which kinematic system should be able to follow the motions of another kinematic system. The second kinematic system is then the motion master. This procedure therefore does not define which kinematic systems actually follow the motions of others, but merely which possibilities should apply. Only those kinematic systems that have been defined here in WorkVisual as master and/or slave can be used as such in the program.

Multiple connections and bidirectional connections are possible, as kinematic systems may be motion master and slave simultaneously.

Multiple connections between 2 kinematic systems in the same direction are not possible.

It is advisable to create only those connections which are actually required in the program. Do not connect every kinematic system to every other kinematic system in both directions, as this would take up TOOL and BASE coordinate systems unnecessarily. These would then be unavailable for other purposes.

Precondition

- The editor for the RoboTeam is open.

Procedure

1. Right-click in the empty space in the editor and select **Define master/slave link** from the context menu.
2. Click on a kinematic system (robot or external axis) and hold down the mouse button.

3. Drag the mouse pointer to another kinematic system and release the mouse button.

   The first kinematic system can now follow the other kinematic system. This is shown in the editor by a black arrow.

4. Repeat steps 2 and 3 until every kinematic system is connected to at least one other kinematic system.

   If there are still unconnected kinematic systems, the following error message is displayed on closing the editor: *Configuration of Motion Cooperation for [RoboTeam_name] is not complete!*

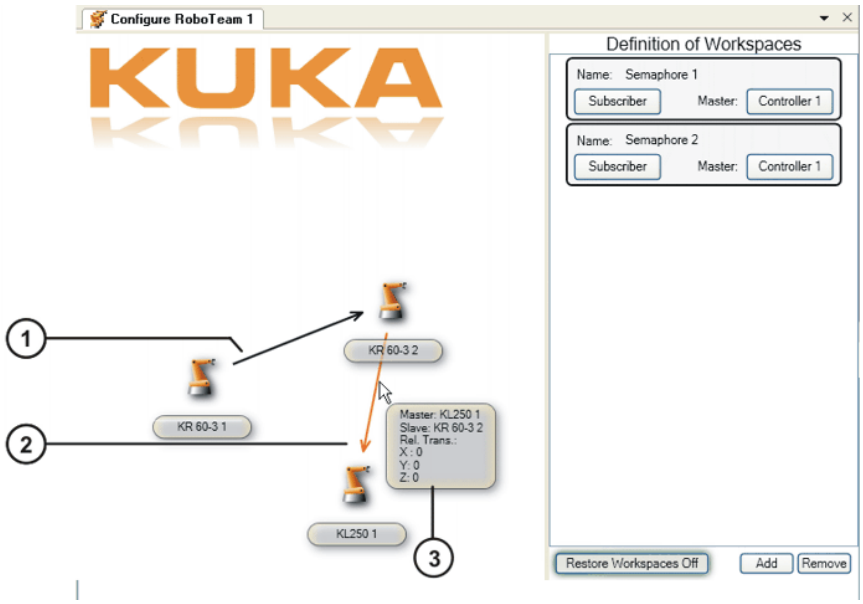


Fig. 11-5: Display of the motion master

Item	Description
1	KR 60-3 2 is the motion master of KR 60-3 1.
2	KL 250 1 is the motion master of KR 60-3 2. The arrow is orange instead of black because the mouse pointer is positioned on it.
3	Positioning the mouse pointer on an arrow opens an info box. Only for projects loaded from the robot controller: This displays the translation values of the slave relative to the WORLD coordinate system of the master.

11.2.5 Deleting a master/slave link

Description

If the link between a safety master and another team is to be changed, the existing link does not need to be deleted separately, as this happens automatically when a new link is established.

Links which define motion masters, however, do have to be deleted if they are no longer needed.

Procedure

1. Right-click in the empty space in the editor and select **Select elements** from the context menu.
2. Click on the arrow to be deleted. The color of the arrow changes to blue.
3. Right-click and select **Delete master/slave link** from the context menu. The arrow is deleted.

11.2.6 Creating and configuring workspaces

Description

> The workspaces described here are specific to RoboTeam and have nothing to do with the following workspaces:
> - Workspaces configured in the KUKA System Software via **Configuration** > **Extras** > **Workspace monitoring** > **Configuration**.
> - Workspaces configured in SafeOperation.

No workspaces can be created or configured for RoboTeam on the real robot controller.

Precondition

- The RoboTeam has been created.
- The editor for the RoboTeam is open.

Procedure

1. The editor for the RoboTeam, click on **Add** in the **Definition of the workspaces** area.
2. A workspace is inserted. The default name is **Semaphor** *[consecutive no.]*. The default name can be changed:
   a. Click on the name. The name can now be edited.
   b. Change the name and confirm with the Enter key.
3. A robot controller is defined as the workspace master. The workspace mastesr can be changed:
   a. Click on the name displayed next to the **Master** box.
   b. The robot controllers of the team are displayed. Click on the desired robot controller.
4. To configure the access rights to the workspace, click on the **Devices** button. A window opens.
5. Define the rights as required. (>>> "Access rights" Page 97)

Workspaces

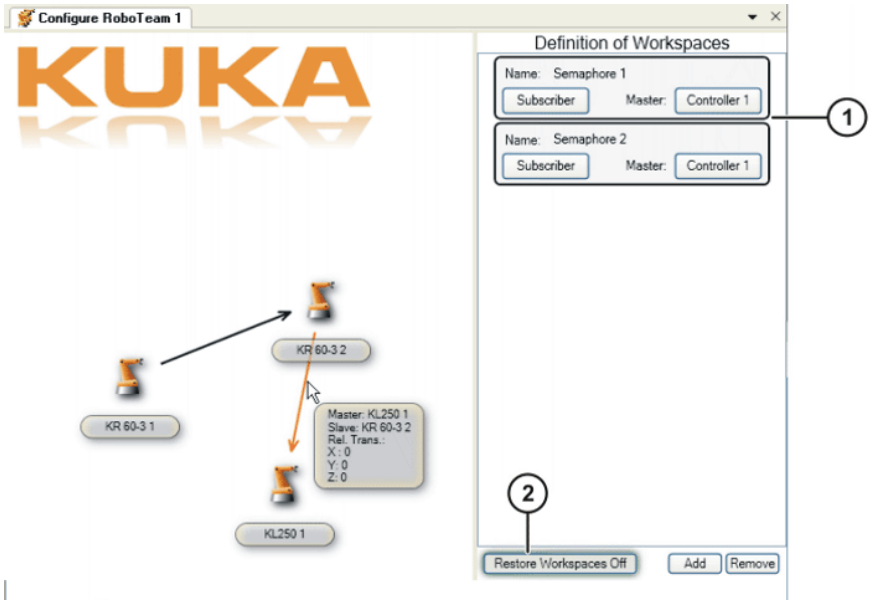


Fig. 11-6: Display of the workspaces

Item	Description
1	Display of the workspaces If there is more than one workspace, the highest workspace (no. 1) has the highest priority and the lowest workspace has the lowest priority.
2	The defines whether the status of the workspaces is restored after a cold start of the robot controller. ■ **Restore Workspaces On**: The status is not restored. Clicking on the button activates the “Restore status” function. ■ **Restore Workspaces Off**: The status is restored. Clicking on the button deactivates the “Restore status” function.

Access rights

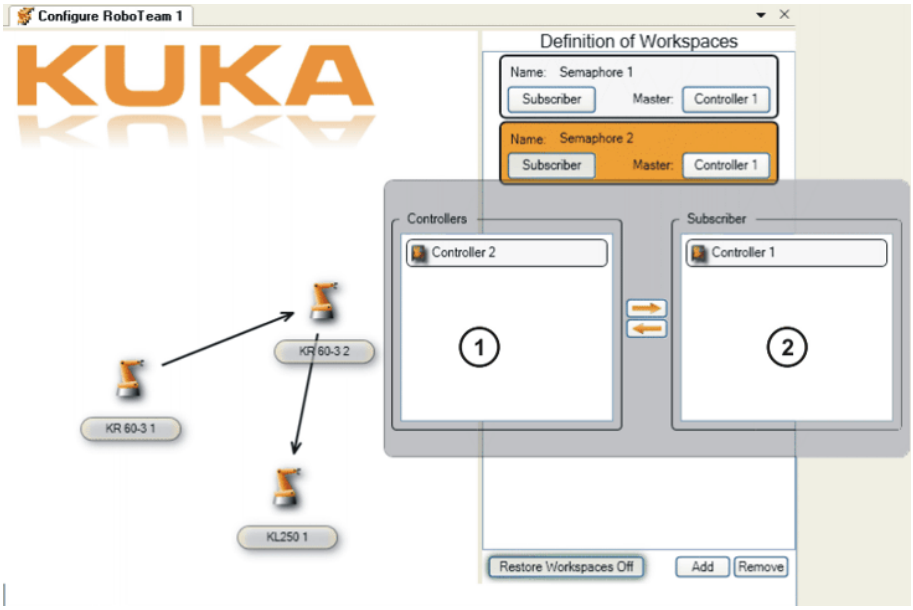


Fig. 11-7: Configuring access rights

Item	Description
1	Displays the robot controllers which may not access the workspace. RIGHT ARROW moves the selected robot controllers into the **Devices** area.
2	Displays the robot controllers which may access the workspace. Only 1 robot controller can access a workspace at a time. **Note**: The arrangement of the robot controllers in the display does not reflect the order in which they access the workspace. This order is determined solely by the KRL program. LEFT ARROW moves the selected robot controllers into the **Controllers** area.

11.3 Preventing data loss in RoboTeam projects

Description

If changes have been made on the real RoboTeam controllers which have not been made in WorkVisual (e.g. calibrating tools), these changes are lost if the RoboTeam project is transferred from WorkVisual to the robot controllers.

If changes are made to a RoboTeam project in WorkVisual without the current states of the real robot controllers having been updated, data can also be lost subsequently during transfer.

Procedure

- This data loss can be prevented by transferring the current states of all the real robot controllers to WorkVisual after opening and before editing a project.

  (>>> 13.8 "Comparing projects (and accepting differences)" Page 122)

To reminder the user of this, the following warning message is displayed after a RoboTeam project is opened: **This project contains at least one RoboTeam. To avoid data loss, please carry out a project merge with all involved controllers.**

11.4 Transferring a RoboTeam project to the robot controller

Procedure

The procedure is the same as for ordinary projects. The following must be observed, however, when transferring RoboTeam projects to a robot controller for the first time:

- To complete the project, select the active project on the real robot controller.
- Completely transfer the state of the real robot controller. For this, activate the check box for every robot controller in the **Selected value** column.

⚠ WARNING When activating a project on the KUKA smartHMI, an overview is displayed of the changes which will be made in comparison to the project that is still active on the robot controller.
If changes are listed in the overview under the heading **Safety-relevant communication parameters**, this means that the behavior of the Emergency Stop and "Operator safety" signal may have changed compared with the previous project.
After activation of the project, the Emergency Stop and the "Operator safety" signal must be checked for safe functioning. If the project is activated on several robot controllers, this check must be carried out for every robot controller. Failure to carry out this check may result in death to persons, severe injuries or considerable damage to property.

Example: Complete

In this example, a RoboTeam project containing 2 robot controllers is completed. The check box has been activated for both robot controllers in the **Selected value** column. The check boxes for the subordinate elements are activated automatically.

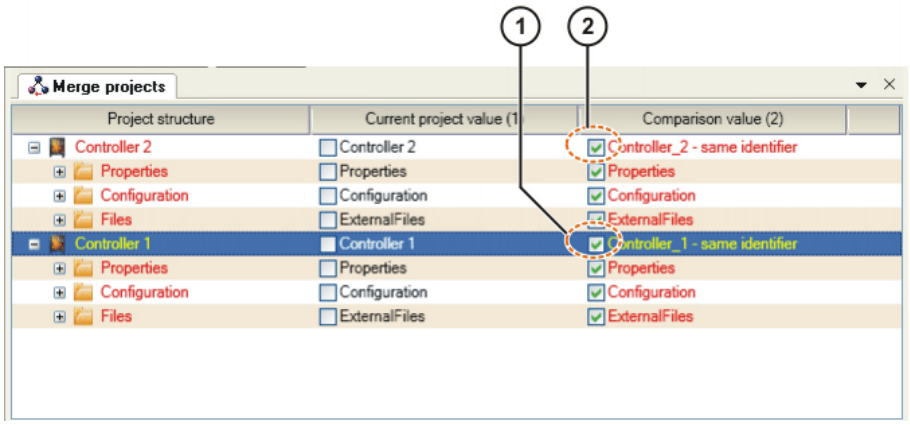


Fig. 11-8: Example: Completely transferring the state of the real robot controller

Item	Description
1	Check mark for robot controller 1
2	Check mark for robot controller 2

12 Programming

12.1 Creating a program

Precondition

- With use of a KR C4 controller: the **KRL Templates** catalog has been inserted in the **Catalogs** window.
- With use of a VKR C4 controller: the **VW Templates** catalog has been inserted in the **Catalogs** window.

Procedure

1. Expand the tree structure of the robot controller on the **Files** tab in the **Project structure** window.
2. Select the required template in the **KRL Templates** or **VW Templates** catalog and drag it onto a node in the tree structure. The program file is inserted in the tree structure.

   The file can now be edited with the KRL Editor.

12.2 Importing a program

Description

Files in the formats SRC, DAT, SUB and KRL can be imported.

Procedure

1. Expand the tree structure of the robot controller on the **Files** tab in the **Project structure** window.
2. Right-click on the node in which the program is to be created and select **Add external file** from the context menu.
3. Navigate to the directory where the file is located that is to be imported.
4. Select the file and confirm with **Open**. The file is inserted in the tree structure.

   The file can now be edited with the KRL Editor.

12.3 Displaying the variable declarations in a file

All the KRL variables that are declared in a particular file can be displayed in a list overview. With SRC files, the variables from the corresponding DAT file are always displayed at the same time, and vice versa.

Procedure

1. Only if the **Variable list** window is not yet displayed: Display it by selecting the menu sequence **Window** > **Variable list**.
2. Open the file in the KRL Editor, or, if it is already open, click on the tab for the file.
3. The variable list now displays all the variables that are declared in this module (SRC file and corresponding DAT file).
4. If necessary, a variable can be selected in the KRL Editor as follows:
   - Double-click on the line in the search results.
   - Or: Right-click on the line and select **Go to…** from the context menu.
   - Or: Select the line and press the Enter key.

A search function is available in the **Variable list** window, which allows a search to be carried out for local variables within the current file:

- Enter the variable name or part of the name in the search box. The search results are displayed immediately.

If the cursor is positioned in the search box, this can be emptied by pressing ESC.

Description

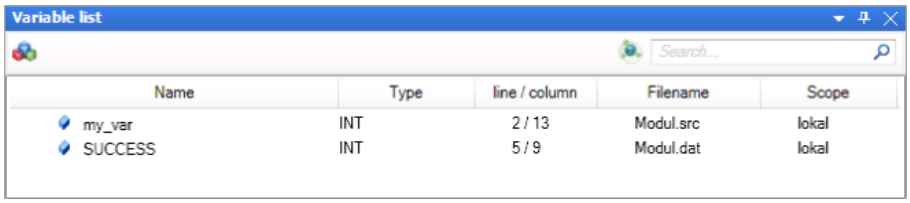


Fig. 12-1: “Variable list” window

Clicking on a column sorts the list by this column.

Button	Name / description
	**Groups the variables by local subfunctions** Button is pressed: The display is sorted by file type. (Within this sort mode, it is also possible to sort by column.) Button is not pressed: The display is not sorted by file type.

12.4 Searching and replacing within files

Description

WorkVisual provides a search function which allows the text of all files in the entire project to be searched. It is also possible to search an individual file or a selected area within a file. The range of the search can be selected in the search window.

Instead of searching, it is also possible to search and replace.

The search (or search and replace) function can be called from any place in the project, whatever workspace or editor is currently in focus.

Procedure

1. If an individual file is to be searched, this should be opened.
2. If an area within the file is to be searched, this should be selected.
3. Open the Search window: **Ctrl+F**
   Or: Open the window for Search and Replace: **Ctrl+H**
4. Make the desired settings and click on **Search**, or on **Replace** or **Replace all**.

12.5 KRL Editor

12.5.1 Opening a file in the KRL Editor

Precondition

- This is a file format that can be edited with the KRL Editor.
  (>>> "File formats" Page 101)

Procedure

1. Double-click on a file on the **Files** tab in the **Project structure** window.
   Or: Select the file and click on the **KRL Editor** button.
   Or: Select the file and select the menu sequence **Editors** > **KRL Editor**.
2. To close the file: Click on the “X” at top right.

The KRL Editor allows more than one file to be open simultaneously. If required, they can be displayed side by side or one above the other. This provides a convenient way of comparing contents, for example.

To display the files side by side:

1. Right-click in the title bar of the file in the KRL Editor. Select **New Vertical Tab Group** from the context menu.

2. To display the files one behind the other again: Right-click in the title bar of a file in the KRL Editor. Select **Move Next** or **Move Previous** from the context menu.

To display the files one above the other:

1. Right-click in the title bar of the file in the KRL Editor. Select **New Horizontal Tab Group** from the context menu.
2. To display the files one behind the other again: Right-click in the title bar of a file in the KRL Editor. Select **Move Next** or **Move Previous** from the context menu.

File formats

The KRL Editor is used primarily to edit files containing KRL code:

- SRC
- DAT
- SUB

In addition, the KRL Editor can be used to edit the following file formats:

- ADD
- BAT
- CONFIG
- CMD
- DEL
- INI
- KFD
- KXR
- LOG
- REG
- TXT
- XML

12.5.2 KRL Editor user interface

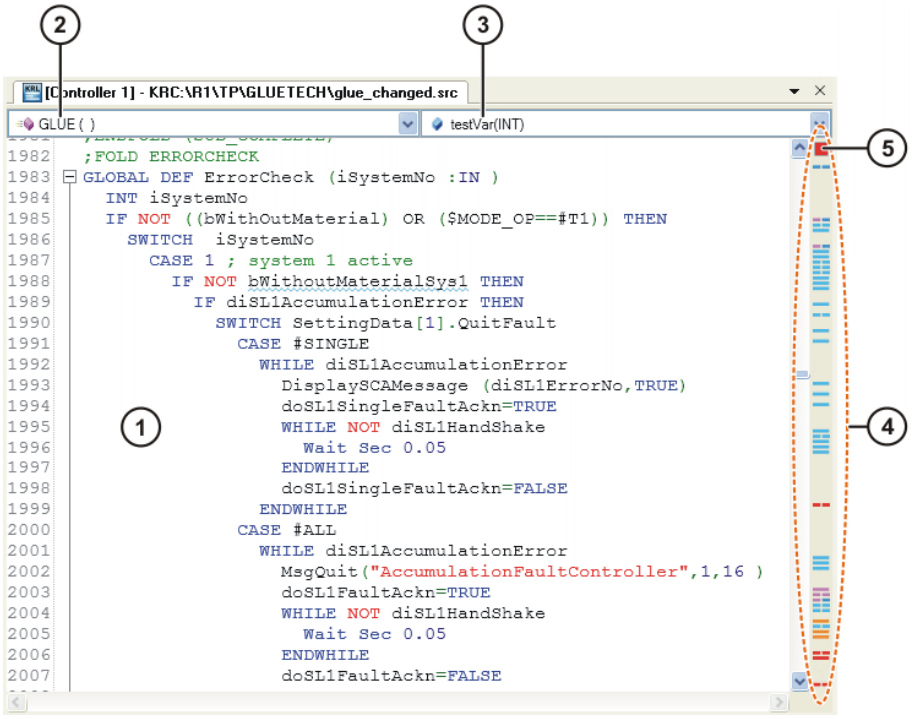


Fig. 12-2: KRL Editor user interface

Item	Description
1	Program area The code is entered and edited here. The KRL Editor provides numerous functions to support the programmer with this.
2	List of the subprograms in this file To go to a subprogram, select it from the list: the cursor then jumps to the DEF line of this subprogram. If the file does not contain any subprograms, the list is empty.
3	List of variable declarations This list always refers to the subprogram that is currently selected in the list of subprograms. To go to a declaration, select the variable from the list: the cursor then jumps to the line containing the declaration of these variables. If there are no variable declarations, the list is empty.
4	Analysis bar The marks indicate errors or discrepancies in the code. ■ Hovering with the mouse over a mark displays a tool tip with a description of the error. ■ Clicking on the mark makes the cursor jump to the relevant place in the program. An automatic correction is offered for some errors/discrepancies. (>>> 12.5.9 "Quickfix correction" Page 106)
5	The square has the color of the most serious error currently present. If there are no errors/discrepancies, the square is green.

12.5.3 Zooming in/out

Procedure

1. Click anywhere in the KRL Editor.
2. Hold down the CTRL key and move the mouse wheel.
   - Mouse wheel up: zoom in
   - Mouse wheel up: zoom out

12.5.4 Configuring KRL Editor

Preparation

Only necessary if it is desirable to see a preview of the effect of the settings:

1. Open a file in the KRL Editor.
2. To see a preview of the colors for the marks: select any point in the file.
   (Nothing can be selected in the file while the **Options** window is open.)

Procedure

1. Select the menu sequence **Extras** > **Options**. The **Options** window is opened.
2. On the left of the window, open the **Text editor** folder. In the folder, select a subitem.
   The corresponding settings are now displayed on the right of the window.

If the mouse pointer is moved over a field, a description is displayed for this field at the bottom of the window.

3. Make the desired changes.

The changes can be seen immediately if a file is currently open in the KRL Editor (e.g. if spaces are revealed or hidden).

4. Confirm with **OK**. The changes are saved.
   Or discard the changes with **Cancel**.

The color settings can be reset to the default settings at any time. The **Reset** button for this is situated on the corresponding page in the **Options** window. (At the bottom of the page; scrolling is required.)

12.5.5 Edit functions

12.5.5.1 General edit functions

Select

- To select an area: click where the selection should begin and hold down the left-hand mouse button. Drag the mouse until the desired area is selected, and then release the mouse button.

> If the ALT key is additionally held down during selection, it is possible to select a rectangular area.

- To select a line: click on the line number.

Edit

Standard edit functions can be called via the context menu. These include:

- **Cut**, **Paste**, **Copy**, **Delete**
- **Undo**, **Redo**
- **Search …** (>>> 12.4 "Searching and replacing within files" Page 100)

In addition, the following commands are available in the context menu.

> - Not all commands are available for every file format.
> - Commands which refer to a selected area affect the whole file if no area is selected.

Menu item	Description
Edit > **Make upper case**	Converts all the lower-case letters in the selected string into upper-case letters.
Edit > **Make lower case**	Converts all the upper-case letters in the selected string into lower-case letters.
Edit > **Title case**	Converts all the initial letters in the selected string into upper-case letters.
Edit > **Convert tabs into spaces**	Replaces the tabs in the selected string with spaces. **Note:** The number of spaces corresponding to one tab can be configured in the parameter **Indent size**.
Edit > **Convert spaces into tabs**	Replaces the spaces in the selected string with tabs.
Edit > **Indent**	Inserts additional spaces at the beginning of every line in the selected area. **Note:** The number of spaces inserted can be configured in the parameter **Indent size**.
Edit > **Remove leading whitespace**	Removes all the leading spaces from the lines in the selected area.
Folds > **Expand all**	Opens all folds in the currently displayed file.
Folds > **Collapse all**	Closes all folds in the currently displayed file.
Format	Indentations, line breaks, etc., are adapted throughout the file to conform to the standard. The applicable standard depends on the file format.

Menu item	Description
Comment selection	Uncomments the line.
Uncomment selection	Comments the line out.
Rename	(>>> 12.5.5.2 "Renaming a variable" Page 104)
Go to declaration	(>>> 12.5.7 "Jumping to the declaration of a variable" Page 106)
Insert snippet	(>>> 12.5.5.4 "Snippets – Fast entry of KRL instructions" Page 104)

12.5.5.2 Renaming a variable

Description

A variable name can be changed in a single action at all points where it occurs.

This is also possible if the variable is declared in a DAT file and used in various SRC files.

Precondition

- The files in which the variable name occurs do not contain any syntax errors.

  Automatic renaming cannot be executed in a file containing syntax errors.

Procedure

1. Select the desired variable at any point.
2. Right-click and select **Rename** from the context menu.
3. A window opens. Change the name and confirm with **OK**.

12.5.5.3 Auto-complete

An auto-complete function is available in the KRL Editor.

When entering code, a list containing the following elements is displayed automatically:

- KRL keywords
- Known variable names
- Known function names
- Known user-specific data types (STRUC or ENUM)
- Snippets (>>> 12.5.5.4 "Snippets – Fast entry of KRL instructions" Page 104)

Those elements that are compatible with the characters already entered are shown at the top of the list. These elements are also prioritized according to their frequency of use, i.e. the selection is dynamically adapted to the user's actions.

If required, an element in the list can be selected and inserted in the program text using the Enter key. This makes it unnecessary to type complex variable names, for example.

Navigation in the "Auto-complete" list:

- Scroll
- Or: Type the first letter of the desired element. The marker jumps to the relevant position.

12.5.5.4 Snippets – Fast entry of KRL instructions

Description

A fast entry function is available in the KRL Editor for common KRL instructions.

To program a FOR loop, for example, it is not necessary to enter the entire syntax `FOR … = … TO … STEP …`. Instead, the instruction can be selected from the “Auto-complete” list. All that is then required is to fill out the variable positions in the syntax manually.

Procedure

On starting to type the code, the “Auto-complete” list is shown. The required instruction is generally already selected.

1. Accept the selected instruction from the “Auto-complete” list using the Enter key. Or double-click on a different instruction.

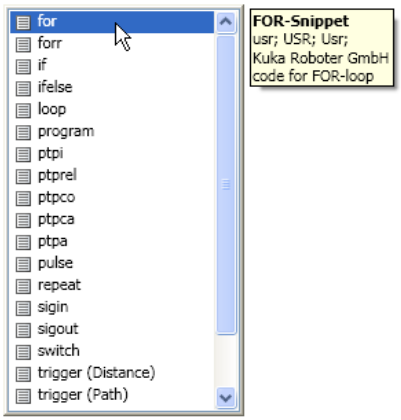


Fig. 12-3: Accept with the Enter key, or double-click

2. The KRL syntax is inserted automatically. The first variable position is highlighted in blue. Enter the desired value.

```
FOR counter = start TO stop STEP 1

ENDFOR
```

Fig. 12-4: The first variable position is highlighted in blue

3. Press the TAB key to jump to the next variable position. Enter the desired value.
4. Repeat step 3 for all other variable positions.
5. To finish editing, press the Enter key.

The snippet list can also be called separately: Right-click and select **Insert snippet** from the context menu.

It is also possible to enter a snippet as follows: Type in the abbreviation and press the TAB key.

(The abbreviation can be determined by calling the snippet list. Select the instruction. A tool tip is displayed. The 2nd line contains the possible abbreviations.)

12.5.6 Folds

Description

The content of the KRL Editor can be structured with folds just like any normal KRL program.

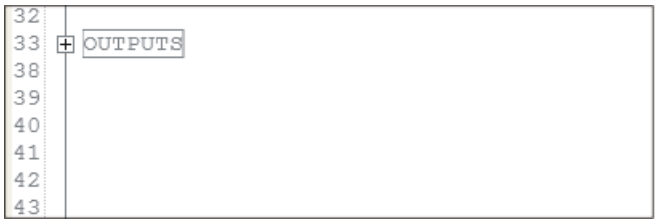


Fig. 12-5: Closed fold

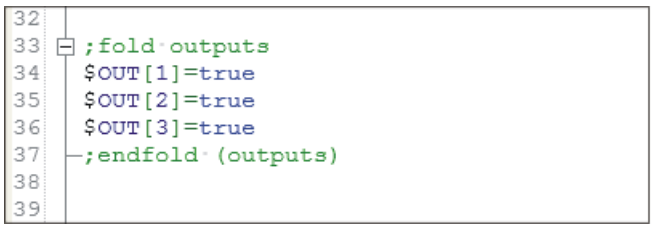


Fig. 12-6: Opened fold

Procedure

To open a fold:

- Double-click on the box of the closed fold.
- Or: Click on the plus sign.

To close a fold:

- Click on the minus sign.

To open or close all folds:

- Context menu: **Folds** > **Expand all** or **Collapse all**

12.5.7 Jumping to the declaration of a variable

Procedure

1. Place the cursor in the variable name, or directly in front of the first letter or directly after the last letter.
2. Right-click and select **Go to declaration** from the context menu.

12.5.8 Displaying all uses of a variable

Procedure

1. Only if the **Find uses** window is not yet displayed:
   Select the menu sequence Window > **Find uses**.
2. Place the cursor in the variable name, or directly in front of the first letter or directly after the last letter.
3. Right-click and select **Find uses** from the context menu.
   A tab with the name **Uses of [***Variable name***]** appears in the **Find uses** window. All uses are listed there in detail (file with path, line number, etc.)
4. If required: Double-click on a line in the list. The corresponding position in the program is highlighted.
   Rename, for example, is now possible.

12.5.9 Quickfix correction

Wavy red lines in the code and marks in the analysis bar indicate errors or discrepancies in the code.

For some of these errors/discrepancies, an automatic correction function – the “Quickfix” – is offered. A Quickfix light bulb is displayed. Via the arrow button

next to the light bulb, the user can display various possible solutions and select one.

Fig. 12-7: Quickfix light bulb

12.5.9.1 Correcting or automatically declaring undeclared variables

Description

Undeclared variables are displayed as follows:

- With a wavy red line in the code
- With a red mark in the analysis bar

The red color can also refer to a different error, however. If it refers to an undeclared variable, the following tool tip is displayed if you hover with the mouse over the wavy line or mark: *The declaration of variable [name] was not found*.

Procedure

1. Place the cursor in the name underlined with the wavy line, or directly in front of the first letter or directly after the last letter.
   Or: Click on the mark in the analysis bar.
   The Quickfix light bulb is now displayed next to the variable name.
2. Check if the variable name has been written incorrectly (differently from in the declaration).
   - If so: correct. The wavy red line / mark disappears. No further steps are necessary.
   - If not: continue with the next step.
3. Move the mouse pointer onto the Quickfix light bulb. An arrow is displayed next to the light bulb.
   Click on the arrow. The following options are displayed:
   - *Declare the variable locally*
   - *Declare the variable in the data list*
4. Click on the desired option.
5. Only with *Declare the variable in the data list*: The data list is opened.
   Open the fold BASISTECH EXT.
6. A snippet for the variable declaration has been automatically inserted. The expected data type is highlighted in blue. The declaration is followed by the comment: *; This variable is for ....*
   - Accept or change the data type, as required.
   - Press the TAB key to jump to the comment. Edit the comment if required.

This comment is displayed in the tool tip of the “Auto-complete” list if the variable is selected there.

12.5.9.2 Removing unused variables

Description

Unused variables are displayed as follows:

- With a wavy blue line in the code
- With a blue mark in the analysis bar

Hovering with the mouse over the wavy line or mark displays a tool tip with a description.

Procedure

1. Place the cursor in the name underlined with the wavy line, or directly in front of the first letter or directly after the last letter.
   Or: Click on the mark in the analysis bar.
   The Quickfix light bulb is now displayed next to the variable name.
2. Move the mouse pointer onto the Quickfix light bulb. An arrow is displayed next to the light bulb.
   Click on the arrow. The following options are displayed:
   - *Remove declaration*
   - *Comment out declaration*
3. Click on the desired option.

12.5.9.3 Standardizing the upper/lower case in a variable name

Description

If the use of upper/lower case in a variable name is not uniform in the declaration and in its other occurrences, this is displayed as follows:

- With a light blue wavy line in the code
- With a light blue mark in the analysis bar

Hovering with the mouse over the wavy line or mark displays a tool tip with a description.

Procedure

1. Place the cursor in the name underlined with the wavy line, or directly in front of the first letter or directly after the last letter.
   Or: Click on the mark in the analysis bar.
   The Quickfix light bulb is now displayed next to the variable name.
2. Move the mouse pointer onto the Quickfix light bulb. An arrow is displayed next to the light bulb.
   Click on the arrow. The following options are displayed:
   - *Change this use to [name as in declaration]*
   - *Change declaration to [name as at this point in the program]*
3. Click on the desired option.

12.5.10 Creating user-specific snippets

Description

Users can create their own snippets. For this, the required properties must be saved in a file with the SNIPPET format. This file must then be imported in WorkVisual. The snippet is then available in the KRL Editor.

A template for a SNIPPET file is provided on the WorkVisual CD in the DOC directory.

A snippet that has been imported into WorkVisual is also available in OptionPackageEditor and vice versa. A precondition for this is that WorkVisual and OptionPackageEditor are running on the same PC and the same user is logged on.

Procedure

Once the SNIPPET file has been created, it must be imported as follows:

1. Select the menu sequence **Extras** > **Import snippet from file …**. A window opens.
2. Navigate to the directory where the SNIPPET file is located and select it. Click on **Open**.
   The snippet is now available in the KRL Editor.

Example 1

A snippet is to be created to insert the following code structure:

```
MYTHING true

ENDTHING
```

Fig. 12-8: Code to be inserted by the snippet

The snippet is to have the name “User” in the snippet list, and the tool tip should contain the information shown here:

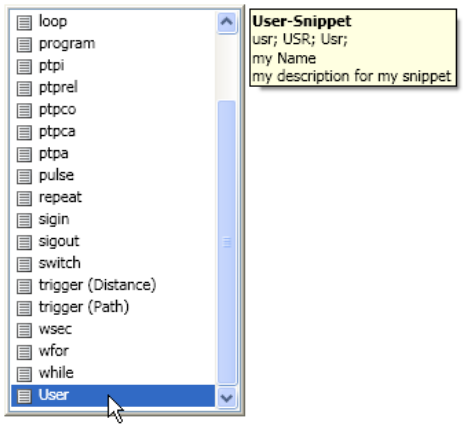


Fig. 12-9: Desired snippet

The SNIPPET file must have the following format:

```
2  <CodeSnippets>
3     <CodeSnippet Format="1.0.0">
4        <Header>
5
6           <!--Is displayed as header in the static ToolTip(on the right side) of the completion window-->
7           <Title>User-Snippet</Title>
8
9           <!--Is displayed in the completion window-->
10          <Text>User</Text>
11
12          <!--These shortcuts can be used-->
13          <Shortcut>usr</Shortcut>
14          <Shortcut>USR</Shortcut>
15          <Shortcut>Usr</Shortcut>
16
17          <!--For these file extensions the snippet will be shown -->
18          <Extensions>.src .sub</Extensions>
19
20          <!--Is displayed as description in the static ToolTip(on the right side) of the completion window-->
21          <Description>my description for my snippet</Description>
22
23          <!--Is displayed as author in the static ToolTip(on the right side) of the completion window-->
24          <Author>my Name</Author>
25
26          <!--Specifies the type of the snippet-->
27          <SnippetTypes>
28             <SnippetType>Expansion</SnippetType>
29             <SnippetType>SurroundsWith</SnippetType>
30          </SnippetTypes>
31       </Header>
32
33       <FileExtensions/>
34       <Snippet>
35          <Declarations>
36             <Literal>
37                <ID>element</ID>
38                <ToolTip>my tooltip for this element</ToolTip>
39                <Default>true</Default>
40             </Literal>
41          </Declarations>
42          <Code Language="KRL">
43             <![CDATA[MYTHING $element$
44  $end$$selection$
45 ENDTHING]]>
46          </Code>
47       </Snippet>
48    </CodeSnippet>
49 </CodeSnippets>
```

Fig. 12-10: Structure of the SNIPPET file

Line	Description
3 … 48	Section for 1 snippet A SNIPPET file may contain a number of these sections, i.e. a number of different snippets.
7	Title displayed in the tool tip
10	Name displayed in the snippet list **Note:** The “Auto-complete” function reacts to this character string, i.e. if this string is entered in the program, the “Auto-complete” list is shown and the corresponding snippet is selected.
13 … 15	Shortcuts for this snippet
18	The snippet is only displayed in the list in files with this extension
21	Description displayed in the tool tip
24	Name of the author displayed in the tool tip

Line	Description
27 … 30	This defines the ways in which the snippet can be inserted. ■ `Expansion`: The snippet is inserted at the current cursor position. ■ `SurroundsWith`: Before the snippet is inserted, program lines can be selected in the KRL Editor. The snippet is then automatically inserted so that it surrounds these lines. The exact position of these lines within the snippet is defined by the placeholder `$selection$`.
37	Placeholder occurring in lines 43 … 45, to which lines 38 and 39 refer
38	Tool tip displayed for this placeholder
39	Default value for the placeholder
43 … 45	Program text inserted by the snippet The text consists of hard text and/or placeholders. ■ `$selection$`: See description for `SurroundsWith`. ■ `$end$`: This placeholder defines the position of the cursor after insertion of the snippet has been completed with the Enter key.

Example 2 An example of the <Snippet> section only:

```
FOR counter = start TO stop STEP 1

ENDFOR
```

Fig. 12-11: Code inserted by the snippet

```
18        <Snippet>
19          <Declarations>
20            <Literal>
21              <ID>counter</ID>
22              <ToolTip>Counter variable, has to be declared</ToolTip>
23              <Default>counter</Default>
24            </Literal>
25            <Literal>
26              <ID>start</ID>
27              <ToolTip>start value for counter</ToolTip>
28              <Default>start</Default>
29            </Literal>
30            <Literal>
31              <ID>stop</ID>
32              <ToolTip>value for loop to stop</ToolTip>
33              <Default>stop</Default>
34            </Literal>
35            <Literal>
36              <ID>step</ID>
37              <ToolTip>step width for counter</ToolTip>
38              <Default>1</Default>
39            </Literal>
40          </Declarations>
41          <Code Language="KRL">
42            <![CDATA[FOR $counter$ = $start$ TO $stop$ STEP $step$
43  $selection$$end$
44  ENDFOR]]>
45          </Code>
46        </Snippet>
```

Fig. 12-12: Structure of the SNIPPET file

13 Transferring and activating the project

13.1 Generating code

Description

When a project is transferred to the robot controller, the code is always generated first. This procedure can be used to generate the code separately and thus to check in advance whether generation runs without error.

The code is displayed on the **Files** tab of the **Project structure** window.

Automatically generated code is displayed in pale gray.

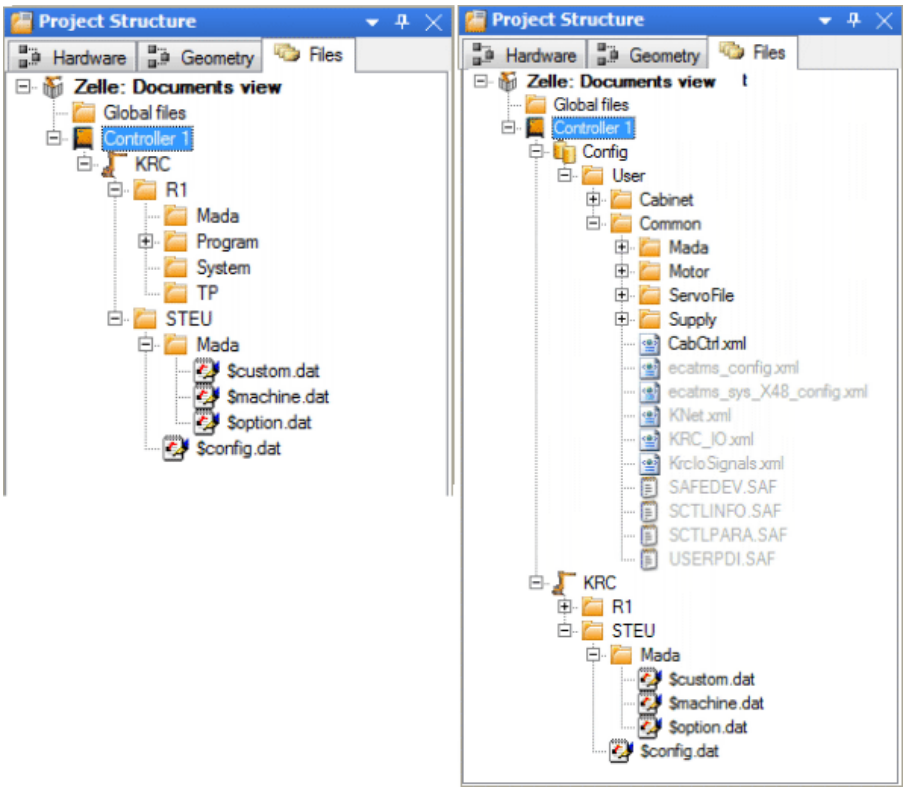


Fig. 13-1: Example of code generation: before – after

Procedure

- Select the menu sequence **Extras** > **Generate code**.

The code is generated. When the process is finished, the following messages are displayed in the message window: **The project <"{0}" V{1}> has been compiled. The results can be seen in the file tree.**

13.2 Pinning a project

Description

Projects that are present on the robot controller can be pinned. A project can be pinned directly on the robot controller or in WorkVisual.

Pinned projects cannot be changed, activated or deleted. They can be copied or unpinned, however. A project can thus be pinned e.g. to prevent it from being accidentally deleted.

Procedure

Pinning in WorkVisual:

1. Select the menu sequence: **File** > **Browse for project**. The **Project Explorer** is opened. On the left, the **Search** tab is selected.
2. In the **Available cells** area, expand the node of the desired cell. All the robot controllers of this cell are displayed.

3. Expand the node of the desired robot controller. All projects are displayed. Pinned projects are indicated by a pin symbol.
4. Select the desired project and click on the **Pin project** button. The project is pinned and labeled with a pin symbol in the project list.

Information about pinning on the robot controller can be found in the **Operating and Programming Instructions for System Integrators** for the KUKA System Software.

13.3 Assigning the robot controller to the real robot controller

Description

This procedure is used to assign every robot controller in the project to a real robot controller. The project can then be transferred from WorkVisual to the real robot controller.

Precondition

- A robot controller has been added in WorkVisual.
- Network connection to the real robot controller
- The real robot controller and the KUKA smartHMI are running.

If the project is subsequently to be transferred and also activated:

- The user group “Expert” or higher is selected on the real robot controller.
  Restriction: If the activation would cause changes in the area **Safety-relevant communication parameters**, the user group “Safety recovery” or higher must be selected.
- If the operating mode AUT or AUT EXT is selected on the real robot controller: The project contains only settings that affect KRL programs. If the project contains settings that would cause other changes, it cannot be activated.

Procedure

1. Click on the **Deploy…** button in the menu bar. The **Project deployment** window is opened.
2. The available cells are displayed under **Target cell**. (The cells can be renamed by right-clicking.)
   If the desired cell is not displayed, a new cell can be created:
   - Click on **New cell**. The **Cell properties** window opens. Enter a name and, if required, a description. Press **OK** to save.
     The new cell is now shown under **Target cell**.
3. Select the desired cell under **Target cell**. This cell must now be assigned to the real robot controller.
4. Select the desired real robot controller under **Available controllers**.
   Depending on the network topology, it is possible that the robot controller may not be displayed under **Available controllers**. If the IP address is known, the robot controller can be displayed as follows:
   - Click on  . A window opens. Enter the IP address and confirm with **OK**.
     The robot controller is now shown under **Available controllers**.

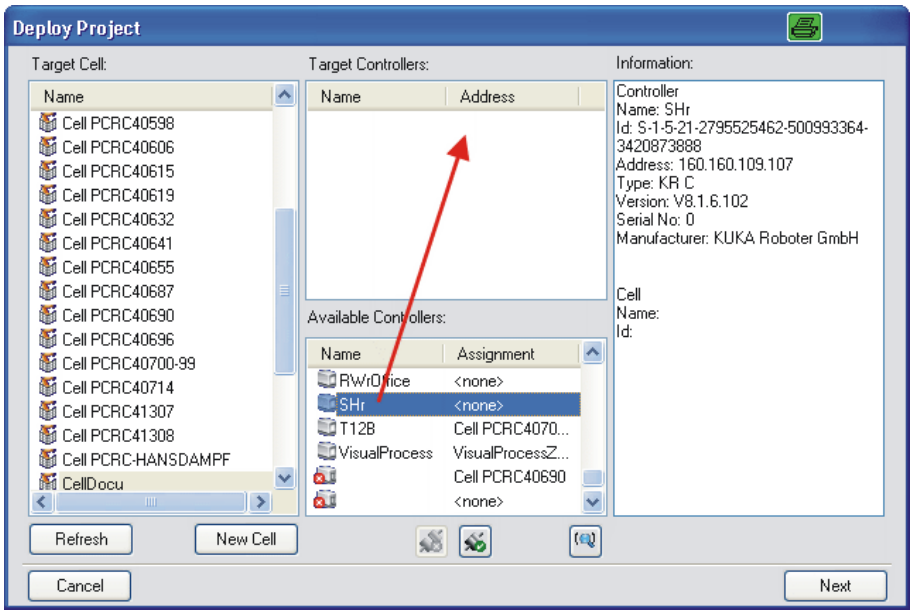


Fig. 13-2: Assigning the robot controller to the cell

5. Click on  . The robot controller is now shown under **Target controllers**.
6. If the project contain more than one robot controller, repeat steps 4 and 5 for the other robot controllers.
7. The virtual robot controller must now be assigned to the real robot controller: Click on **Next**.

Each virtual robot controller must be assigned to exactly one real robot controller.

8. Select the virtual controller under **Controllers in the project**.
9. Under **Controllers in the cell**, select the real robot controller and click on  . The real robot controller is assigned to the virtual robot controller.

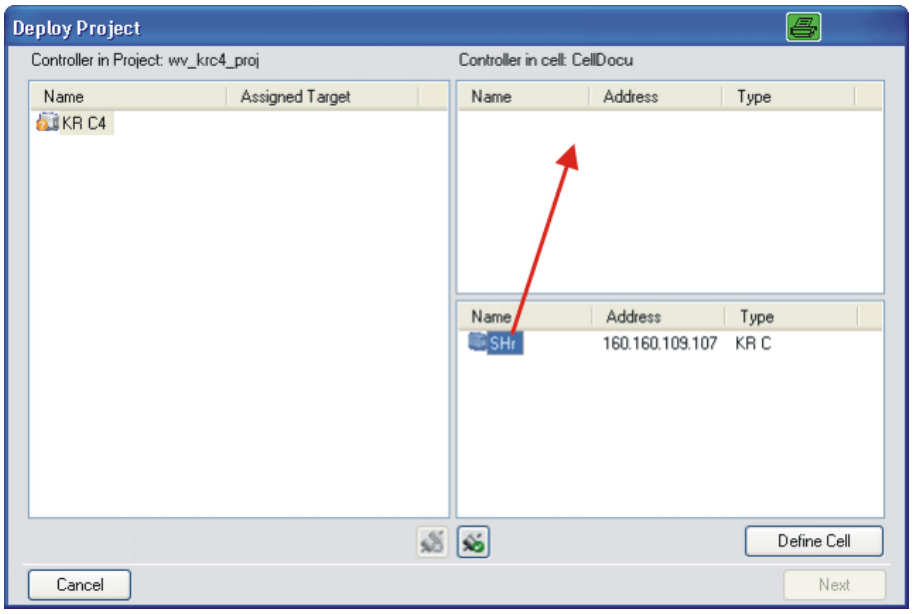


Fig. 13-3: Assigning a real robot controller to the virtual controller

10. If the project contain more than one robot controller, repeat steps 8 and 9 for the other robot controllers.

11. Click on **Next**. An overview is displayed. (Here it is still possible to change the assignment if necessary. To do this, click on **Change ...**.)

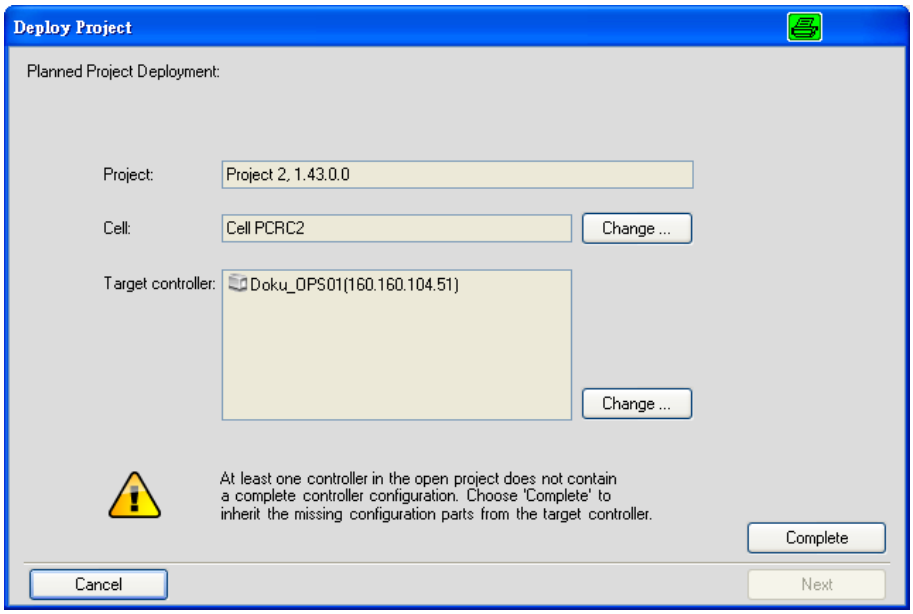


Fig. 13-4: Overview

12. The project can now be transferred to the robot controller.

    Alternatively, the project can be transferred at a later point in time. To do this, click on **Cancel**: the assignment is saved and the **Project deployment** window is closed.

13.4 Transferring the project to the robot controller

Description

This procedure is used to transfer the project from WorkVisual to the real robot controller.

> If a project was transferred to the real robot controller at an earlier time and has not yet been activated then this will be overwritten if a further project is transferred.
> Transferring and activating a project overwrites a project of the same name that already exists on the real robot controller (after a request for confirmation).

Precondition

- The project has been assigned to the real robot controller.
- Network connection to the real robot controller
- The real robot controller and the KUKA smartHMI are running.

If the project is also to be activated:

- The user group “Expert” or higher is selected on the real robot controller.

  Restriction: If the activation would cause changes in the area **Safety-relevant communication parameters**, the user group “Safety recovery” or higher must be selected.
- If the operating mode AUT or AUT EXT is selected on the real robot controller: The project contains only settings that affect KRL programs. If the project contains settings that would cause other changes, it cannot be activated.

If one of the options KUKA.SafeOperation or KUKA.SafeRangeMonitoring is installed on the robot controller, different user groups may apply. Information can be found in the documentation for these options.

If a project is transferred containing an option package that has not yet been installed on the robot controller, then the procedure differs from the normal one. The following procedure must be observed:

1. Transfer the project to the robot controller, but DO NOT activate it!
2. Install the option package on the robot controller.
   Installation is performed in the normal manner. Information about this can be found in the documentation for the option package.
3. Load the project back to WorkVisual using the comparison method, accepting the status as on the robot controller.
   (>>> 13.8 "Comparing projects (and accepting differences)" Page 122)
4. Transfer the project back to the robot controller.
5. Activate the project on the robot controller.

Procedure

1. Click on the **Deploy…** button in the menu bar. The **Project deployment** window is opened.

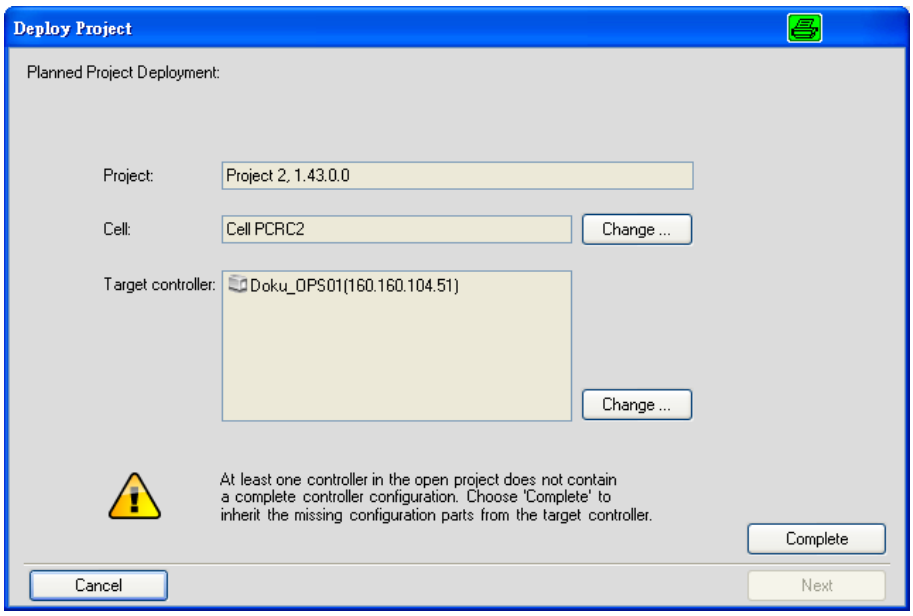


Fig. 13-5: Overview with warning about incomplete configuration

2. If the project has never been loaded from a robot controller before, it will not yet contain all the configuration files. This is indicated by a message. (The configuration files include machine data files, safety configuration files and many others.)
   - If this message is not displayed: Continue with step 13.
   - If this message is displayed: Continue with step 3.
3. Click on **Complete**. The following confirmation prompt is displayed: **The project must be saved and the active controller will be reset! Do you want to continue?**
4. Answer the query with **Yes**. The **Merge projects** window is opened.

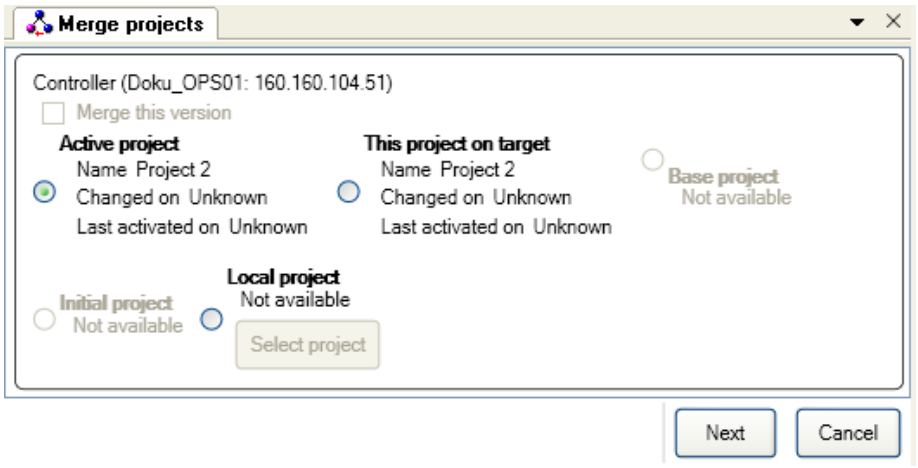


Fig. 13-6: Selecting a project for "Complete"

5. Select a project from which the configuration data are to be transferred, e.g. the active project on the real robot controller.

> If a RoboTeam project is being transferred to the robot controller, always select the active project.

6. Click on **Next**. A progress bar is displayed. (If the project contains more than one controller, a bar is displayed for each one.)
   (>>> "Progress bars" Page 123)
7. When the progress bar is full and the message **Status: Ready for merge** is displayed: Click on **Show differences**.
   The differences between the projects are displayed in an overview.
   (>>> "Comparison" Page 124)
8. For each difference, select which state to accept. This does not have to be done for all the differences at one go.
   If suitable, the default selection can also be accepted.

> If a RoboTeam project is being transferred to the robot controller for the first time, accept the complete state of the real robot controller. For this, activate the check box for every robot controller in the **Selected value** column.
> (>>> 11.4 "Transferring a RoboTeam project to the robot controller" Page 98)

9. Press **Merge** to transfer the changes.
10. Repeat steps 8 to 9 as required. This makes it possible to work through the different areas bit by bit.
    Once all the differences have been reconciled, the following message is displayed: **No further differences were detected.**
11. Close the **Comparing projects** window.
12. Click on the button **Deploy...** in the menu bar. The overview of the cell assignment is displayed again. The message about the incomplete configuration is no longer displayed.

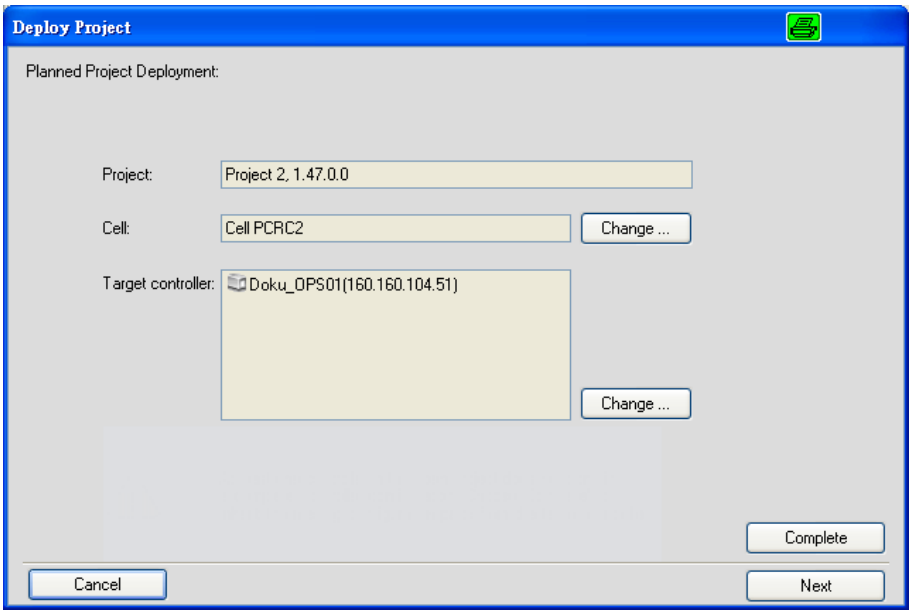


Fig. 13-7: Overview

13. Click on **Next**. Program generation begins. When the progress indicator bar reaches 100%, the program is generated and the project is transferred.

If a project has been transferred containing an option package that has not yet been installed on the robot controller:
Do not activate the project, i.e. do not continue with the next step! Observe the note about projects with option packages at the beginning of this section!

14. Click on **Activate**.

WARNING In the operating modes AUT and AUT EXT, the project is activated without any request for confirmation if there are only program changes.

15. Only in operating modes T1 and T2: The KUKA smartHMI displays the request for confirmation *Do you want to activate the project […]?*. In addition, a message is displayed as to whether the activation would overwrite a project, and if so, which.

    If no relevant project will be overwritten: Confirm with **Yes** within 30 minutes.

16. An overview is displayed of the changes which will be made in comparison to the project that is still active on the robot controller. The check box **Details** can be used to display details about the changes.

WARNING If changes are listed in the overview under the heading **Safety-relevant communication parameters**, this means that the behavior of the Emergency Stop and “Operator safety” signal may have changed compared with the previous project.
After activation of the project, the Emergency Stop and the “Operator safety” signal must be checked for safe functioning. If the project is activated on several robot controllers, this check must be carried out for every robot controller. Failure to carry out this check may result in death to persons, severe injuries or considerable damage to property.

17. The overview displays the request for confirmation *Do you want to continue?*. Confirm with **Yes**. The project is activated on the robot controller. A confirmation is displayed in WorkVisual.

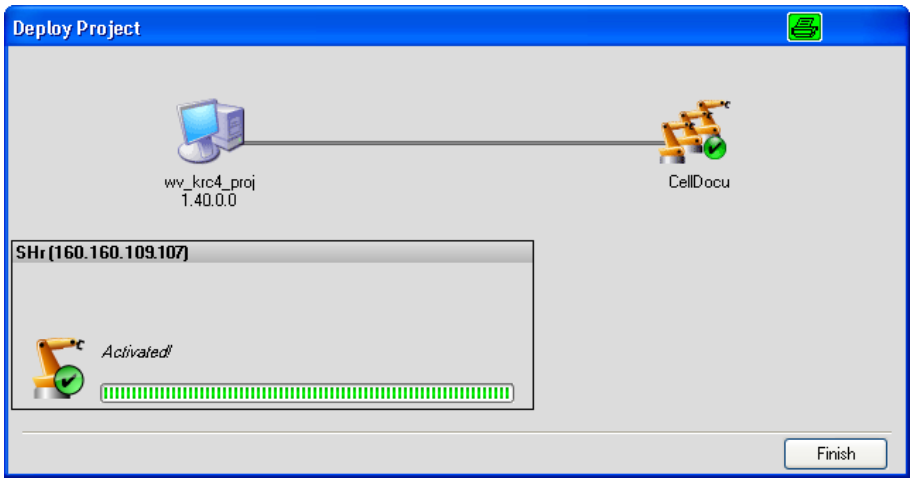


Fig. 13-8: Confirmation in WorkVisual

18. Close the **Project deployment** window by selecting **Finish**.
19. If the request for confirmation on the robot controller is not answered within 30 minutes, the project is still transferred, but is not activated on the robot controller. The project can then be activated separately.
    (>>> 13.5 "Activating a project" Page 120)

⚠ WARNING After activation of a project on the robot controller, the safety configuration must be checked there! If this is not done, the robot will possibly be operated with incorrect data. Death to persons, severe injuries or considerable damage to property may result.
(>>> 13.6 "Checking the safety configuration of the robot controller" Page 122)

⚠ WARNING If the activation of a project fails, an error message is displayed in WorkVisual. In this case, one of the following measures must be carried out:

- Either: Activate a project again (the same one or a different one).
- Or: Reboot the robot controller with a cold restart.

13.5 Activating a project

- A project can be activated on the robot controller from within WorkVisual.
  (>>> 13.5.1 "Activating a project (in WorkVisual)" Page 120)
- A project can be activated directly on the robot controller.

Information about activation on the robot controller can be found in the **Operating and Programming Instructions for System Integrators** for the KUKA System Software.

13.5.1 Activating a project (in WorkVisual)

Precondition

- Network connection to the real robot controller
- The real robot controller and the KUKA smartHMI are running.
- The user group “Expert” or higher is selected on the real robot controller.
  Restriction: If the activation would cause changes in the area **Safety-relevant communication parameters**, the user group “Safety recovery” or higher must be selected.
- If the operating mode AUT or AUT EXT is selected on the real robot controller: The project can only be activated if this affects only KRL programs.

If the project contains settings that would cause other changes, it cannot be activated.

If one of the options KUKA.SafeOperation or KUKA.SafeRangeMonitoring is installed on the robot controller, different user groups may apply. Information can be found in the documentation for these options.

If a project has been transferred containing an option package that has not yet been installed on the robot controller:
Do not activate the project! For such projects, the procedure differs from the usual procedure for transfer and activation. Further information can be found in the section on project deployment.
(>>> 13.4 "Transferring the project to the robot controller" Page 116)

Procedure

1. Select the menu sequence: **File** > **Browse for project**. The **Project Explorer** is opened. On the left, the **Search** tab is selected.
2. In the **Available cells** area, expand the node of the desired cell. All the robot controllers of this cell are displayed.
3. Expand the node of the desired robot controller. All projects are displayed. The active project is indicated by a small green arrow.
4. Select the desired project and click on the **Activate project** button. The **Project deployment** window is opened.
5. Click on **Next**.

⚠ WARNING In the operating modes AUT and AUT EXT, the project is activated without any request for confirmation if there are only program changes.

6. Only in operating modes T1 and T2: The KUKA smartHMI displays the request for confirmation *Do you want to activate the project […]?*. In addition, a message is displayed as to whether the activation would overwrite a project, and if so, which.

   If no relevant project will be overwritten: Confirm with **Yes** within 30 minutes.
7. On the KUKA smartHMI, an overview is displayed of the changes which will be made in comparison to the project that is still active on the robot controller. The check box **Details** can be used to display details about the changes.

⚠ WARNING If changes are listed in the overview under the heading **Safety-relevant communication parameters**, this means that the behavior of the Emergency Stop and “Operator safety” signal may have changed compared with the previous project.
After activation of the project, the Emergency Stop and the “Operator safety” signal must be checked for safe functioning. If the project is activated on several robot controllers, this check must be carried out for every robot controller. Failure to carry out this check may result in death to persons, severe injuries or considerable damage to property.

8. The overview displays the request for confirmation *Do you want to continue?*. Confirm with **Yes**. The project is activated on the robot controller. A confirmation is displayed in WorkVisual.
9. In WorkVisual, close the **Project deployment** window by selecting **Exit**.
10. Click on **Refresh** in the **Project Explorer**. The active project is now indicated by a small green arrow. (The small green arrow disappears from the project that was active before.)

⚠ WARNING After activation of a project on the robot controller, the safety configuration must be checked there! If this is not done, the robot will possibly be operated with incorrect data. Death to persons, severe injuries or considerable damage to property may result.
(>>> 13.6 "Checking the safety configuration of the robot controller" Page 122)

⚠ WARNING If the activation of a project fails, an error message is displayed in WorkVisual. In this case, one of the following measures must be carried out:

- Either: Activate a project again (the same one or a different one).
- Or: Reboot the robot controller with a cold restart.

13.6 Checking the safety configuration of the robot controller

Description

The safety configuration of the robot controller must be checked in the following cases:

- After activation of a WorkVisual project on the robot controller
- Generally after changes to the machine data (independent of WorkVisual).

⚠ WARNING If the safety configuration is not checked and updated where necessary, it may contain incorrect data. Death to persons, severe injuries or considerable damage to property may result.

Information about checking the safety configuration is contained in the Operating and Programming Instructions for System Integrators.

13.7 Loading the project from the robot controller

Description

On every robot controller to which a network connection is established, a project can be selected and loaded in WorkVisual. This is also possible if this project is not yet present on this PC.

The project is saved in the directory: …\WorkVisual Projects\Downloaded Projects.

Precondition

- Network connection to the real robot controller

Procedure

1. Select the menu sequence: **File** > **Browse for project**. The **Project Explorer** is opened. On the left, the **Search** tab is selected.
2. In the **Available cells** area, expand the node of the desired cell. All the robot controllers of this cell are displayed.
3. Expand the node of the desired robot controller. All projects are displayed.
4. Select the desired project and click on **Open**. The project is opened in WorkVisual.

13.8 Comparing projects (and accepting differences)

Description

A project in WorkVisual can be compared with another project. This can be a project on a robot controller or a locally saved project. The differences are clearly listed. The user can decide for each individual difference whether to leave the state as in the current project or to transfer the state from the other project.

Precondition

- The project that is to be compared is open in WorkVisual.

If the other project to be compared is located on a robot controller:

- The real robot controller is running.
- Network connection to the real robot controller

Procedure

1. In WorkVisual, select the menu sequence **Extras** > **Compare projects**. The **Comparing projects** window is opened.
2. Select the project with which the current WorkVisual project should be compared, e.g. the project of the same name on the real robot controller.

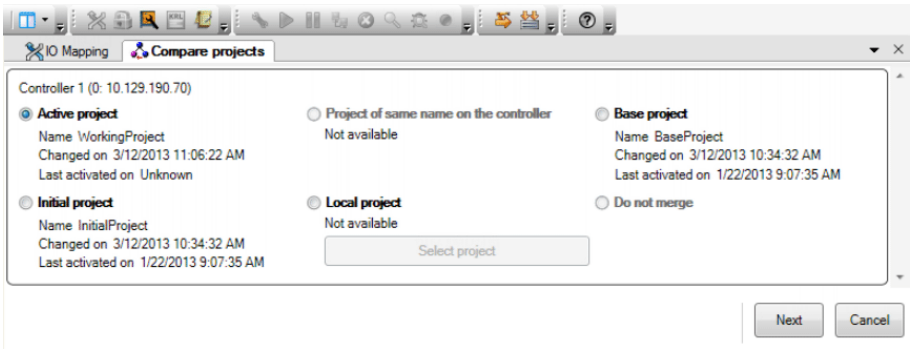


Fig. 13-9: Selecting a project for “Compare”

3. Click on **Next**. A progress bar is displayed. (If the project contains more than one controller, a bar is displayed for each one.)
   (>>> "Progress bars" Page 123)
4. When the progress bar is full and the message **Status: Ready for merge** is displayed: Click on **Show differences**. The differences between the projects are displayed in an overview.
   (>>> "Comparison" Page 124)
   If no differences were determined, this is indicated in the message window. Continue with step 8. After this, no further steps are necessary.
5. For each difference, select whether to retain the state of the current project or to adopt the state of the comparison project. This does not have to be done for all the differences at one go.
   If suitable, the default selection can also be accepted.
6. Press **Merge** to transfer the changes to WorkVisual.
7. Repeat steps 5 to 6 as required. This makes it possible to work through the different areas bit by bit.
   Once all the differences have been reconciled, the following message is displayed: **No further differences were detected.**
8. Close the **Comparing projects** window.
9. Save the project.

Progress bars

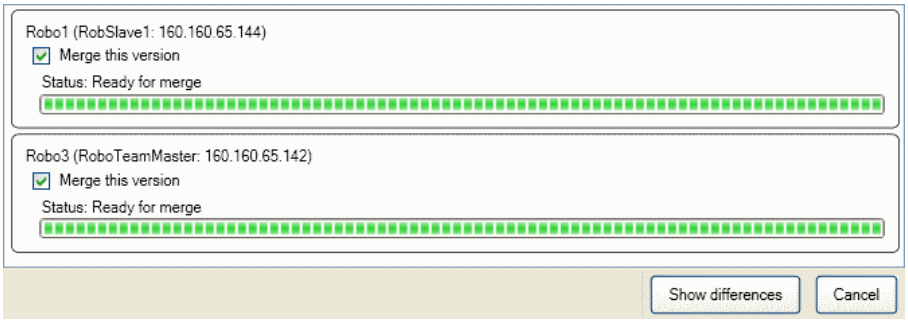


Fig. 13-10: Example: progress bar

This view shows all the robot controllers which are contained in the project. A separate bar is displayed for each of these robot controllers. For each bar, the

real robot controller to which the project was last transferred is also specified. The check boxes are used to select for which robot controllers the comparison should be carried out.

If additional robot controllers were added or removed in WorkVisual after deployment, these robot controllers are also displayed here. They are marked as invalid, however, and cannot be selected.

Comparison

The differences between the projects are displayed in an overview. For each difference, the user can select which state to accept. The default setting is as follows:

- For all elements that are present in the open project, the state of this project is selected.
- For all elements that are not present in the open project, the state of the comparison project is selected.

> Exception: For projects with a VKRC 4 controller, the state of the comparison project is always selected for the long texts.

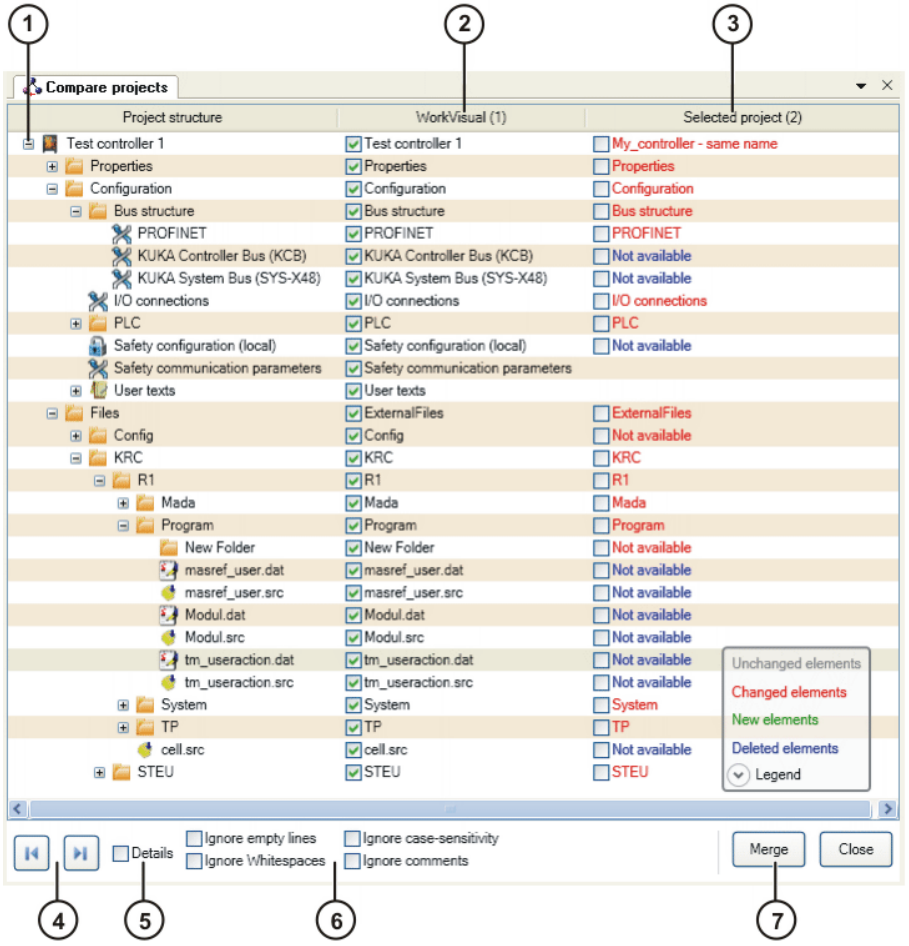


Fig. 13-11: Example: overview of differences

Item	Description
1	The node for the robot controller. The various project areas are represented by sub-nodes. The nodes can be expanded to display the comparisons. If several robot controllers are present, these are listed one after the other. ■ In each line, place a check mark in the box for the value that should be transferred. ■ A check mark next to **Not available** means that the element will not be transferred, or that it will be deleted from the project if already present. ■ If a check box is activated for a node, the check boxes for all subordinate elements are also automatically activated. If a check box is deactivated for a node, the check boxes for all subordinated elements are also automatically deactivated. The subordinate elements can also be edited individually, however. ■ A filled-in box means: at least one of the subordinate elements is selected, but not all.
2	State of the project that is open in WorkVisual
3	State of the comparison project
4	Back arrow: The focus in the display jumps to the previous difference. Forward arrow: The focus in the display jumps to the next difference. Collapsed nodes are automatically expanded.
5	TRUE: Detailed information is shown for the selected line in the overview.
6	Filter
7	Transfers the selected changes to the open project.

14 Diagnosis

14.1 Project analysis

14.1.1 Analyzing a project automatically for errors

Description

In WorkVisual, it is possible to analyze the current project continuously in the background. If configuration errors are detected, WorkVisual alerts the user. In addition, an automatic correction is offered for many errors.

An icon in the bottom right corner of the user interface indicates the status of the project analysis.

Icon	Color	Description
	Green	WorkVisual has not detected any errors.
	Yellow	WorkVisual has detected a discrepancy. The discrepancy will not prevent the project from running on a real robot controller. However, the discrepancy is probably not intended or desired by the user.
	Red	WorkVisual has detected an error. The project is unable to run on a real robot controller in this state. The error would come to light during code generation or, at the very latest, on the real robot controller.
	Gray	The analysis is deactivated.

The project analysis detects a wide range of errors and gives the user valuable support. A green icon cannot guarantee that the project is free from configuration errors, however.

Precondition

- Project analysis is activated.

Procedure

1. Depending on the configuration:
   - The **WorkVisual project analysis** window opens automatically if the icon is red or yellow.
   - Or: Click on the icon to open the **WorkVisual project analysis** window.
2. The window displays a brief description of the error. Often one or more possibilities for correction are displayed beneath the description.
   Click on the desired correction proposal.

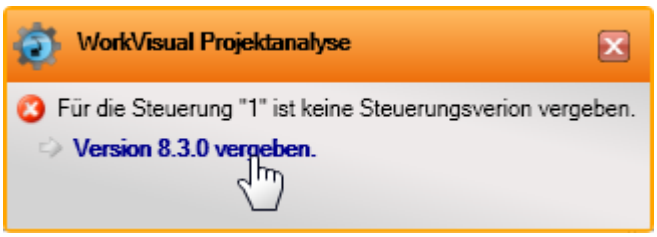


Fig. 14-1: Example: WorkVisual project analysis, with correction proposal

14.1.2 Configuring the project analysis function

Procedure

1. Select the menu sequence **Extras** > **Options**. The **Options** window is opened.

2. On the left of the window, select the **Project analysis** folder.
   The corresponding settings are now displayed on the right of the window.
3. Make the desired settings. Confirm with **OK**.

Description

Setting options in the **Project analysis** folder:

Item	Description
Analysis activated	■ **Check box active**: The project is analyzed continuously. If errors or discrepancies are detected, these are displayed in the **WorkVisual project analysis** window. ■ **Without**: The project is not analyzed and no messages are displayed.
Automatic notification activated	■ **Check box active**: The **WorkVisual project analysis** window opens automatically whenever an error or discrepancy is detected. ■ **Without**: The **WorkVisual project analysis** window opens only when the icon is clicked.

14.2 Trace

Trace recordings are an important diagnostic tool during start-up of the industrial robot and during troubleshooting. They are also used for optimization of the machine data. The trace function can be used to record different variables with the program running, e.g. actual current, setpoint current, states of inputs and outputs, etc. The recording can then be displayed using the oscilloscope.

In WorkVisual it is possible to configure trace recordings and transfer them to the robot controller. The recording can also be started in WorkVisual. In addition, trace configurations can be imported from the robot controller to WorkVisual. The results of trace recordings can also be imported to WorkVisual. The oscilloscope function is also available here for display and evaluation.

14.2.1 Configuring and starting the trace recording

Description

During configuration, the data to be recorded are specified. The robot controller saves the recording in the directory: C:\KRC\ROBOTER\TRACE.

Precondition

- **Online administration** workspace

Procedure

1. Select the menu sequence **Editors** > **Trace configuration**. The **Trace configuration** window is opened.
2. Select a configuration or create a new configuration on the **General** tab. Edit the configuration if required.
   (>>> 14.2.4 ""Trace configuration" window" Page 130)
3. In the **Cell view** window, select the robot controllers to which the configuration is to be transferred.
4. On the **General** tab, click on the **Save configuration on controller** button.
5. Respond to the request for confirmation asking whether the configuration should be activated by pressing **Yes**.
6. Click on the **Start trace** button to start the recording. The recording is started in accordance with the defined trigger.
   Or: Click on **Trigger**. The recording starts immediately.
   The **State** box jumps from #T_END to either #T_WAIT or #TRIGGERED.
7. The recording is ended when the **State** box displays the value #T_END again.

14.2.2 Importing a trace configuration

Description

Trace configurations can be imported. They are then available under **local** in the **Source** box of the **Trace configuration** window.

Procedure

1. The import/export function can be accessed in one of the following ways:
   - Select the menu sequence **Editors** > **Trace configuration**. The **Trace configuration** window is opened.
     On the **General** tab, click on the **Import/export of trace configurations** button.

   Or:

   - Select the menu sequence **File** > **Import / Export**. A window opens.
     Select **Import/export trace configurations** and click on **Next**.
2. Select the **Import** option.
3. If the desired directory is not displayed in the **Source directory** box:
   Click on **Browse** and navigate to the directory where the configuration is located. Select the directory and confirm selection with **OK**.
   The configurations located in the directory are displayed.
4. Specify whether existing data are to be overwritten.
5. Click on **Finish**.
6. The data are imported. If the import was successful, this is indicated by a message in the window. Close the window.

14.2.3 Exporting a trace configuration

Procedure

1. The import/export function can be accessed in one of the following ways:
   - Select the menu sequence **Editors** > **Trace configuration**. The **Trace configuration** window is opened.
     On the **General** tab, click on the **Import/export of trace configurations** button.

   Or:

   - Select the menu sequence **File** > **Import / Export**. A window opens.
     Select **Import/export trace configurations** and click on **Next**.
2. Select the **Export** option. All configurations stored locally are displayed.
3. If the desired directory is not displayed in the **Target directory** box:
   Click on **Browse** and navigate to the desired directory. Select the directory and confirm selection with **OK**.
4. Specify whether existing data are to be overwritten.
5. Click on **Finish**.
6. The data are exported. If the export was successful, this is indicated by a message in the window. Close the window.

14.2.4 “Trace configuration” window

14.2.4.1 “General” tab

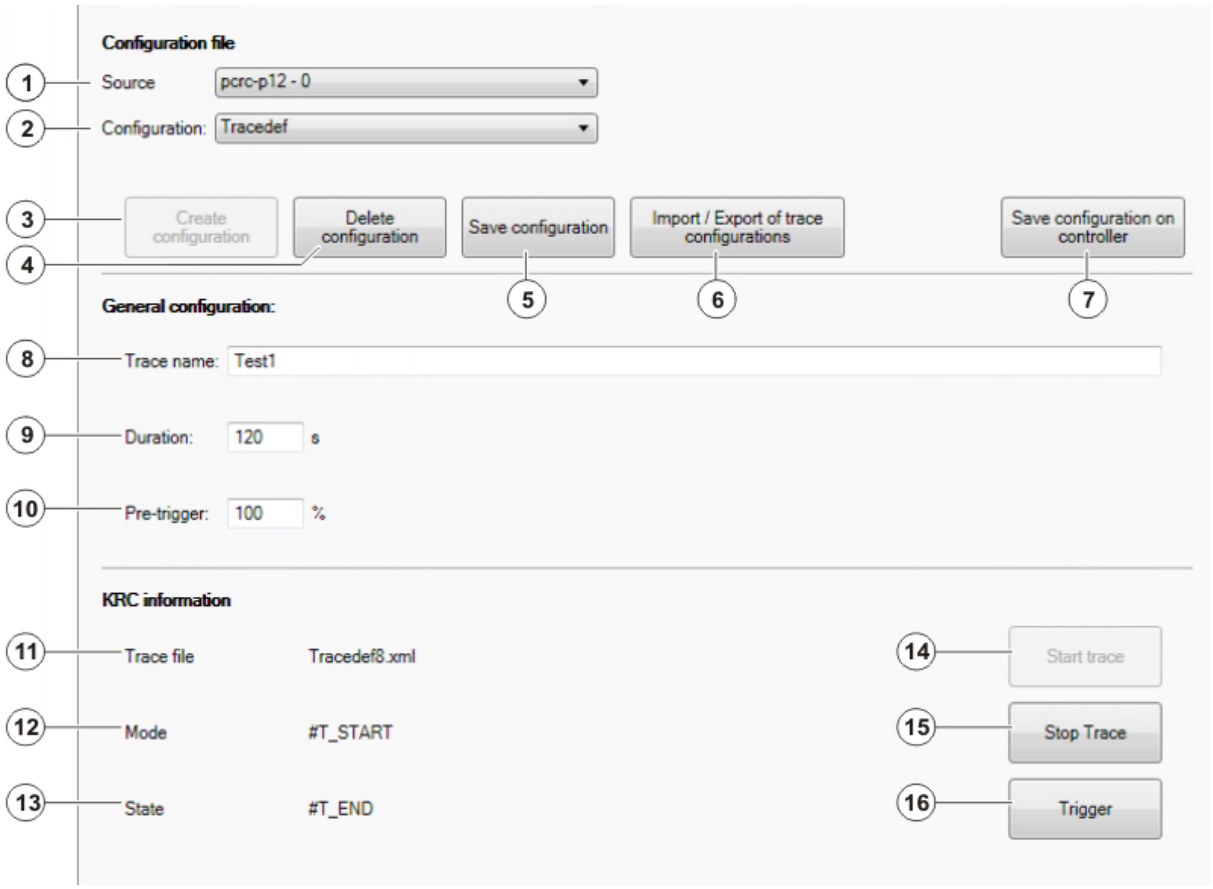


Fig. 14-2: “General” tab

Item	Description
1	■ **local**: The predefined and the locally saved configurations are available for selection in the **Configuration** box. ■ [*Robot controller*]: All the configurations saved on this robot controller are available for selection in the **Configuration** box. (In addition to those under **local**.) Robot controllers are only displayed in the **Source** box if they are selected in the **Cell view** window.
2	A configuration can be selected here. The configuration can be edited on the tabs and then saved locally or on a robot controller.
3	Opens a window in which a name for a new configuration can be entered. An existing local configuration can be selected as a template for the new configuration. On confirming the entries with **OK**, the new configuration is inserted in the list under **local**. This button is only displayed if the entry **local** is selected in the **Source** box.
4	Deletes the configuration displayed in the **Configuration** box.
5	Saves locally the configuration displayed in the **Configuration** box. The settings on the tabs are accepted.
6	Opens a window for the import/export of trace configurations.
7	Activates the configuration displayed in the **Configuration** box on the robot controllers selected in the **Cell view** window. If the request for confirmation is answered with **No**, the configuration is still saved on the robot controller, but is not activated there.

Item	Description
8	Name for the recording. The name can be changed. The robot controller adds extensions to the end of the name, indicating what data have been recorded.
9	Duration of the recording. Only whole numbers can be entered. Maximum value: 9999 s
10	The position of the time phase displayed in the recording relative to the trigger. The % value refers to the duration of the recording. Examples: ■ **0%**: The displayed time phase starts at the trigger. ■ **30%**: 30% of the displayed time phase comes before the trigger, 70% after the trigger. ■ **100%**: The displayed time phase ends at the trigger.
All of the following elements are only displayed if a robot controller is selected in the **Source** box.	
11	Trace configuration that is currently active on the robot controller.
12	■ **#T_START**: Recording is running. ■ **#T_STOP**: Recording is not running.
13	State of the recording ■ **#T_WAIT**: The recording is started and is waiting for the trigger. ■ **#TRIGGERED**: The recording continues for the time defined by the trace length and trigger. ■ **#T_END**: No recording is running.
14	Starts the recording with the configuration displayed under **Trace file**. This button is only displayed if no recording has been started yet.
15	Stops the recording. This button is only displayed if a recording has been started.
16	Starts the recording. This button is only displayed if a recording has already been started. Strictly speaking, data are recorded as soon as the **Start trace** button is pressed. The trigger merely controls which time phase of the recording is then displayed in the trace files.

14.2.4.2 “Trigger” tab

Triggers can be selected here. Triggers control when data is recorded.

Strictly speaking, data are recorded as soon as the **Start trace** button is pressed. The trigger merely controls which time phase of the recording is then displayed in the trace files.

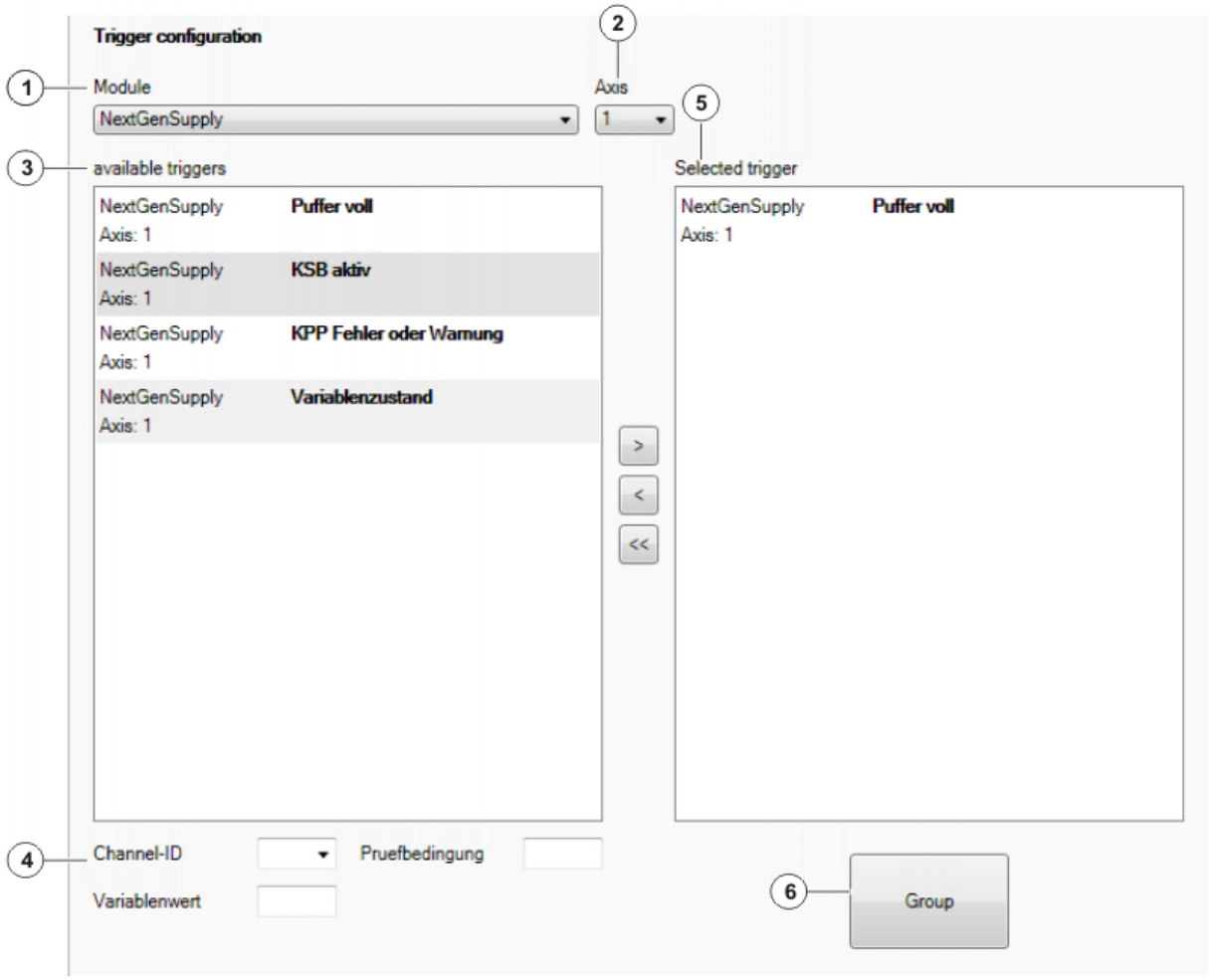


Fig. 14-3: “Trigger” tab

Item	Description
1	A module can be selected here. The modules contain numerous predefined triggers.
2	This box is only displayed if the selected module refers to the robot axes. It is possible to select the axes to which the triggers are to refer.
3	All the triggers for this module are displayed here. RIGHT ARROW copies triggers selected here to the **Selected trigger** box. (Alternatively: double-click on a trigger.)
4	Depending on the entry selected under **available triggers**, filters are available here for this entry.
5	Here the triggers are inserted that are to be used for the current configuration. LEFT ARROW removes the triggers selected here. (Alternatively: double-click on a trigger.) DOUBLE LEFT ARROW clears this box.
	Group combines all entries of the same type into a single entry. This gives greater clarity to the display. It has no effect on the recording. **Ungroup** undoes the grouping.

14.2.4.3 “I/O” tab

Here you can select which inputs or outputs are to be recorded.

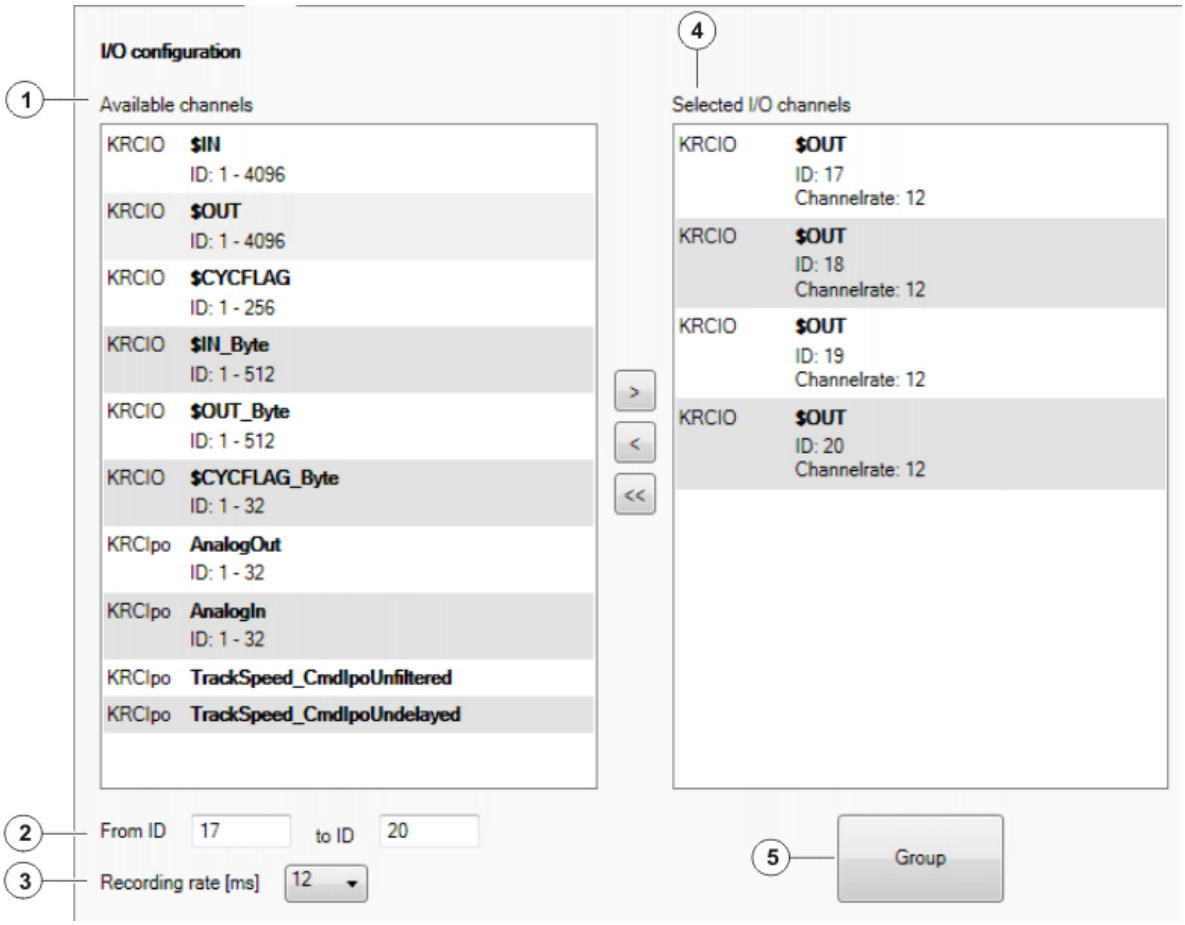


Fig. 14-4: “I/O” tab

Item	Description
1	All the available inputs/outputs are displayed here.
2	Here a number range can be specified from the entry selected under **Available channels**.
3	Select the desired recording rate.
4	Here the inputs/outputs are inserted that are to be recorded with the current configuration. RIGHT ARROW transfers all the inputs/outputs selected via **Available channels** and **From ID […] to ID […]** to this box. LEFT ARROW removes the inputs/outputs selected here. (Alternative to these arrow keys: double-click on a channel.) DOUBLE LEFT ARROW clears this box.
5	**Group** combines all entries of the same type into a single entry. This gives greater clarity to the display. It has no effect on the recording. **Ungroup** undoes the grouping.

14.2.4.4 “Configuration” tab

The settings on the **Extended configuration** tab are also displayed on the **Configuration** tab, and vice versa.

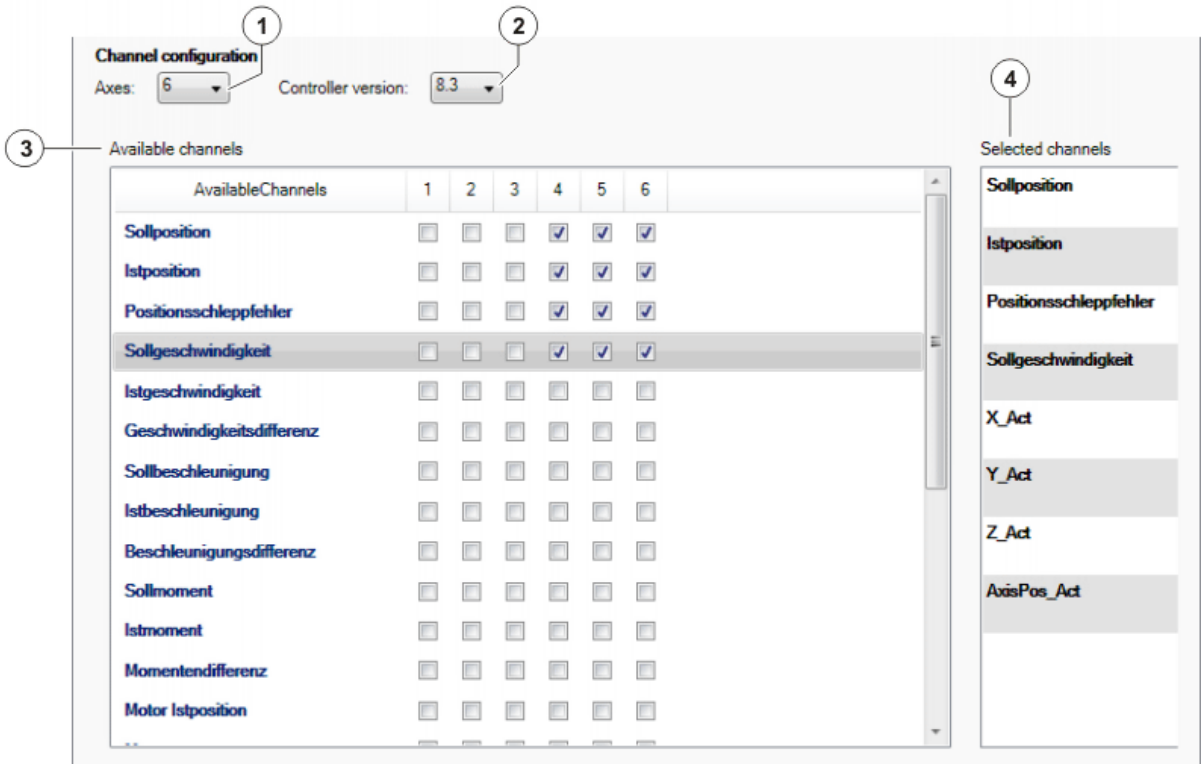


Fig. 14-5: “Configuration” tab

Item	Description
1	It is possible to select here how many axes are displayed in the **Available channels** display.
2	The version of the system software to which the entries on this tab refer must be selected here. **Note:** First select the correct version here, then make the other settings on this tab! Is the version is changed, any channels that have been selected are discarded.
3	Here you can select the channels that are to be recorded. ■ To select a channel for individual axes, check the box for the relevant axes. ■ To check or uncheck all the boxes in one row, double-click on the row. Channels that are not axis-specific have only one check box.
4	All the selected channels are displayed here. **Note:** It is possible that channels may be displayed here which cannot be selected on the **Configuration** tab. This is the case if these channels have been selected on the **Extended configuration** tab.

14.2.4.5 “Extended configuration” tab

The **Extended configuration** tab contains the same modules as the **Configuration** tab, but with more channels and more detailed selection options. **Extended configuration** is particularly suitable for expert users.

The settings on the **Extended configuration** tab are also displayed on the **Configuration** tab, and vice versa.

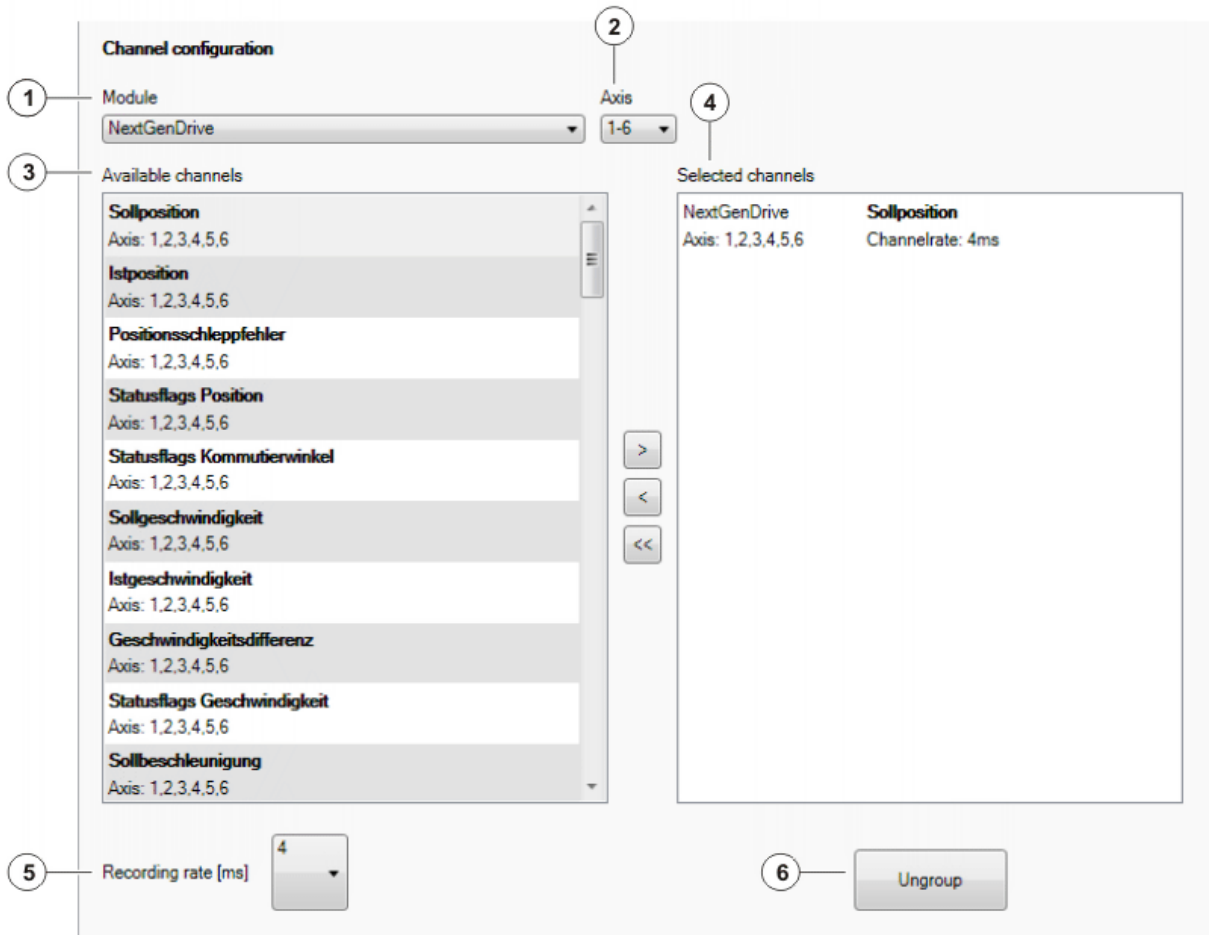


Fig. 14-6: “Extended configuration” tab

Item	Description
1	A module can be selected here. The modules contain different channels.
2	This box is only displayed if the selected module refers to the robot axes. It is possible to select the axes to which the channels are to refer.
3	All the channels for the selected module are displayed here.
4	Here the channels are inserted that are to be recorded with the current configuration. RIGHT ARROW transfers all the entries selected under **Available channels** to this box. LEFT ARROW removes the entries selected here. (Alternative to these arrow keys: double-click on an entry.) DOUBLE LEFT ARROW clears this box.
5	Select the desired recording rate.
6	**Group** combines all entries of the same type into a single entry. This gives greater clarity to the display. It has no effect on the recording. **Ungroup** undoes the grouping.

14.2.5 Importing a trace recording

Description To be able to display a trace recording in WorkVisual, it must first be imported.

Precondition
- The recording was created with KSS or VSS 8.1 or higher, or with 5.4.

Procedure
1. Select the menu sequence **File** > **Import / Export**. A window opens.
2. Select **Import trace results** and click on **Next**.

3. Click on **Browse** and navigate to the directory where the results are located. Select the directory and confirm selection with **OK**.
   All trace files located in the directory are displayed.
4. Select the traces to be imported.
5. Specify whether existing data are to be overwritten.
6. Select the appropriate entry in the **Format** box.
7. Click on **Finish**.
8. The data are imported. If the import was successful, this is indicated by a message in the window. Close the window.

14.2.6 Displaying a trace recording

Precondition

- **Online administration** workspace
- The recording has been imported to WorkVisual.

Procedure

1. Select the menu sequence **Editors** > **Trace Analysis (Oscilloscope)**. The **Trace Analysis (Oscilloscope)** window is opened.
2. On the **Channels** tab, select a recording.
   (>>> 14.2.7.1 ""Channels" tab" Page 136)
3. Select the channels to be displayed.
4. The channels are displayed on the **Oscilloscope** tab. Adapt the display, if necessary. (E.g. zoom or change the colors of the traces.)

14.2.7 "Trace Analysis" window

14.2.7.1 "Channels" tab

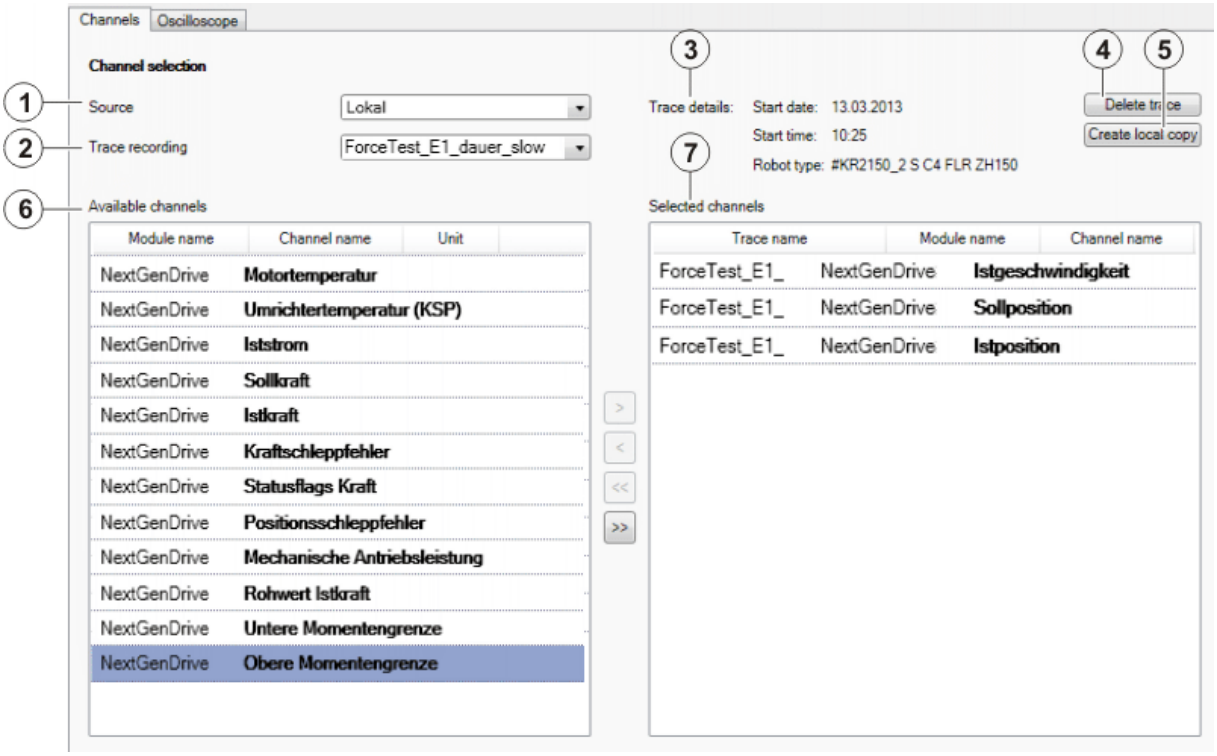


Fig. 14-7: "Channels" tab

Item	Description
1	■ **Local**: All the locally saved recordings are available for selection in the **Trace recording** box. ■ [*Robot controller*]: All the recordings saved on this robot controller are available for selection in the **Trace recording** box. (In addition to those under **local**.) Robot controllers are only displayed in the **Source** box if they are selected in the **Cell view** window.
2	A recording can be selected here.
3	Detailed information regarding the selected recording is displayed here.
4	Only active if the entry **Local** is selected in the **Source** box: Deletes the recording selected in the **Trace recording** box.
5	Only active if a robot controller is selected in the **Source** box: Creates a local copy of the selected recording.
6	All the channels contained in the selected recording are displayed here.
7	Here the channels are inserted that are to be displayed in the oscilloscope. It is possible to insert entries from different recordings in this box. RIGHT ARROW moves all the entries selected under **Available channels** to this box. LEFT ARROW removes the entries selected here. (Alternative to these arrow keys: double-click on the entry.) DOUBLE LEFT ARROW clears this box.

14.2.7.2 “Oscilloscope” tab

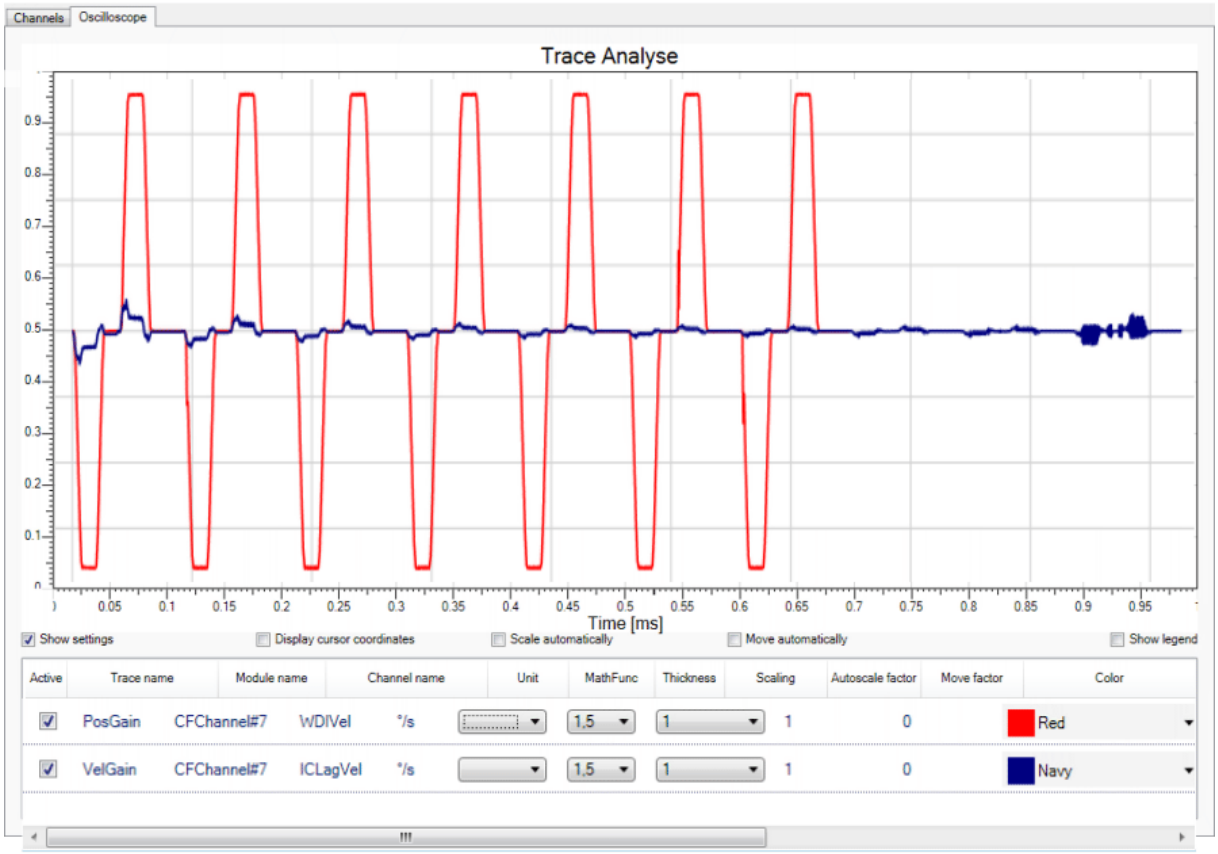


Fig. 14-8: “Oscilloscope” tab

Check box	Description
Show settings	Activated: The columns **Active**, **Trace name**, etc., are displayed.
Display cursor coordinates	Activated: The X and Y coordinates of the mouse pointer position are displayed in the diagram.
Scale automatically	Activated: The curves are adapted to one another in size so that they are easier to compare visually. The proportions between the curves then usually no longer correspond to reality. The current factor is displayed under **Autoscale factor**, however.
Move automatically	Activated: The midpoints of the curves are aligned. This option makes it possible to compare curves which lie far apart on the Y axis. The Y values then usually no longer correspond to reality. The current factor is displayed under **Move factor**, however.
Show legend	Activated: The diagram displays which channel name belongs to which trace color.

Column	Description
Active	Activated: The curve is displayed in the oscilloscope. Deactivated: The curve is displayed in the oscilloscope.
Trace name	Name of recording
Module name	Name of the module
Channel name	Name of channel
Unit	Unit for the Y axis of the oscilloscope display (can be different for each curve)
MathFunc	Mathematical functions that can be applied to the curve. The graph for the function is displayed in a similar color to that of the curve.
Thickness	Line thickness of the curve (unit: point)
Scaling	This selection box allows the amplitude to be increased or decreased in steps. In this way, it is also possible to make curves more visible which only have a low amplitude or which are hidden by other curves.
Autoscale factor	Factor resulting from the option **Scale automatically**.
Move factor	Factor resulting from the option **Move automatically**.
Color	Color of the curve
Points	Activated: The motion blocks of the robot are displayed. Start and end are shown for each block.
Values	Activated: The individual values which make up the curve are displayed as points.
RMS	Activated: The RMS value is shown. **Note:** The RMS value refers to the phase of the recording represented in the oscilloscope. In electrical engineering, the RMS value is the root-mean-square value of a signal that changes over time. RMS = Root Mean Square
Stairs	Activated: The curve runs horizontally on the X plane from one value until it reaches the Y value of the next value. From there it runs vertically up to this Y value. Deactivated: The curve takes the shortest path from one value to the next.
Offset X axis	Offsets this curve on the X axis by the specified value.
Offset Y axis	Offsets this curve on the Y axis by the specified value.

Column	Description
Min.	The minimum value of the curve, with reference to the currently visible segment
Max.	The maximum value of the curve, with reference to the currently visible segment

14.2.8 Panning and zooming the oscilloscope display

Procedure

Panning:

1. Click in the display and hold down the mouse button.
2. Drag with the mouse. The display moves with the mouse.

Zooming:

1. Click into the display.
2. Scroll with the mouse wheel.
   Scroll down: Zoom gets smaller. Scroll up: Zoom gets larger.

Enlarging a section:

1. Hold down the SHIFT key.
2. Click in the display and hold down the mouse button.
3. Move the mouse over the desired section. A gray rectangle is displayed. The size can be changed by moving the mouse. (The aspect ratio cannot be changed.)
4. Release the mouse button. The contents of the gray rectangle are displayed in enlarged form.

In this procedure, the aspect ratio of the selected section is adapted to the oscilloscope display:

1. Hold down the CTRL key.
2. Click in the display and hold down the mouse button.
3. Move the mouse over the desired section. A gray rectangle is displayed. The size and the aspect ratio can be changed by moving the mouse.
4. Release the mouse button. The contents of the gray rectangle are displayed in enlarged form.

Restoring the default view:

1. Right-click in the display.
2. Select **Fit to view** from the context menu.

14.2.9 Creating a screenshot of the oscilloscope display

Procedure

Creating a screenshot in the clipboard:

1. Right-click in the display.
2. Select **Copy screenshot** from the context menu.

Creating and saving the screenshot:

1. Right-click in the display.
2. Select **Save screenshot** from the context menu. A window opens in which the target directory can be selected. The screenshot is saved there as a PNG file.

14.3 Recording network traffic

This functionality is only available for robot controllers with version 8.3.

Description

WorkVisual can record the communication data of the Ethernet-based interfaces of the robot controller, e.g. PROFINET, EtherCAT and EtherNet/IP.

WorkVisual saves the recording in a PCAP file. The default directory is C:\User*Username*\My Documents. The directory and file name may be changed.

PCAP files can be displayed using software for the analysis of network communication connections (“sniffer” software). Sniffer software is not included in the scope of supply of WorkVisual.

Precondition

- Network connection to the real robot controller
- The active project has been loaded from the real robot controller.
- The robot controller has been set as the active controller in WorkVisual.

Procedure

1. If desired: in the bus structure of the project, select the element whose interface data are to be recorded. The interface is then automatically preselected later.
2. Click on the **Perform network capture...** button. The **Select the network interface** window is opened.
   (>>> Fig. 14-9)
3. Select the desired interface, if not already preselected.
4. If required: select the filter criteria.
5. Click on **Next >**.
6. To start recording, click on **Start**.
   A progress bar and a counter display the quantity of data recorded. The memory capacity is limited to 5 MB. If more data are recorded, the ring buffer is activated, i.e. the oldest data is progressively discarded and replaced by the newest incoming data.
   - As the memory fills for the first time, the progress bar grows to visualize how full the memory is.
   - When the ring buffer is activated, the text **Ring buffer active** is displayed. A green light now moves along the progress bar.
7. To stop recording, click on **Stop**.
   If required, recording can be started again via **Restart**. The existing data are then discarded.
8. To save the recording, click on **Next >** after stopping. The target directory and file name are displayed. The directory and file name may be changed.
9. Click on **Next >**. The recording is saved and the text **Import successful** is displayed.
10. Click on **Close**.

Select the network interface

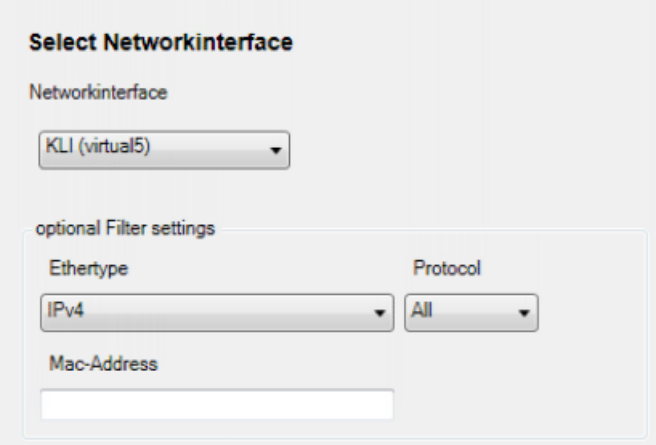


Fig. 14-9: "Select the network interface" window

Box	Description
Network interface	Select the interface whose communication data are to be recorded.
Ethertype	Here the data to be recorded can be limited to a particular type. If no limit is desired, select **All**.
Protocol	This box is only displayed if either **IPv4** or **IPv6** is selected under **Ethertype**. Here the data to be recorded can be limited to a particular protocol. If no limit is desired, select **All**.
MAC address	The data to be recorded can be limited to a particular MAC address. If no limit is desired, leave the box blank.

14.4 Displaying messages and system logs of the robot controller

This functionality is only available for robot controllers with version 8.3.

Description

The messages displayed in the message window on the smartHMI can also be displayed in WorkVisual. Messages generated by PROFINET or its field bus devices contain links in WorkVisual. These so-called "diagnostic links" guide the user to other areas of WorkVisual and help to trace the cause of the message.

In addition, the system logs of the robot controller can be displayed, i.e. the entries in the log memory. A search function and numerous filters are available here.

Precondition

- Network connection to the real robot controller
- The real robot controller and the KUKA smartHMI are running.
- **Online administration** workspace

Procedure

1. In the **Cell view** window, select the desired robot controller by activating the check box. It is also possible to select more than one controller.
2. Select the menu sequence **Editors** > **Log view**. The **Log view** window is opened. An entry is displayed for each robot controller selected.
3. Click on an entry to expand it. The following tabs are now displayed:
   - **MessageLogs**: Displays the messages of this robot controller.

(>>> 14.4.1 "MessageLogs tab" Page 142)

- **SystemLogs**: Displays the log entries of this robot controller.
  (>>> 14.4.2 ""“SystemLogs” tab" Page 143)

14.4.1 MessageLogs tab

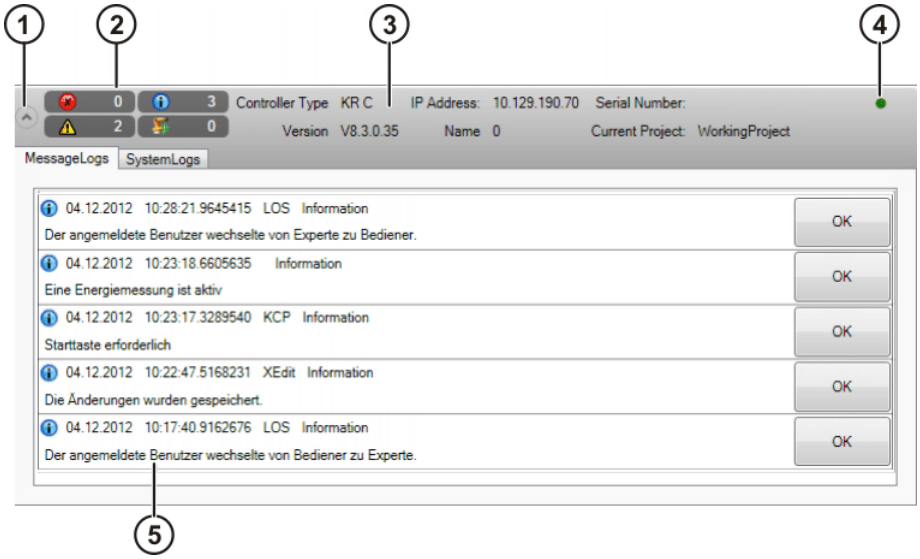


Fig. 14-10: Log view with “MessageLogs” tab

Item	Description
1	Click here (or on any part of the gray area) to expand or collapse the entry. The **MessageLogs** and **SystemLogs** tabs are visible when the entry is expanded.
2	Message counter The message counter indicates how many messages of each message type are active.
3	Information about the robot controller and the active project While the connection to the robot controller is being established, a lamp flashes next to the name of the active project. It disappears when the connection is established.
4	Status of the lamp: ■ Green: A connection has been established to the real robot controller. ■ Red: The connection to the real robot controller is terminated.
5	The messages displayed in the message window on the smartHMI are displayed here. ■ If a message is acknowledged in the message window, it is also acknowledged here in **MessageLogs**. ■ If a message is acknowledged here in **MessageLogs**, it is not acknowledged in the message window! Messages may contain diagnostic links.

Diagnostic links Messages generated by PROFINET or its field bus devices contain links in WorkVisual. These so-called “diagnostic links” guide the user to other areas of WorkVisual and help to trace the cause of the message.

For the links **Online device diagnosis** and **Profinet device list**, the following applies:

- If the active project has not yet been loaded from the robot controller, this is now done automatically. This is preceded by a request for confirmation.
- If another project is open, this is closed. If it contains unsaved changes, a dialog is displayed, asking whether these changes should be saved.

Diagnostic link	Description
Diagnostic monitor	The link opens the diagnostic monitor. The device from which the message comes is automatically selected in the module overview.
Online device diagnosis	The link sets the device causing the error to “Connected”, opens the **Diagnosis…** window and displays the **Device diagnosis** tab.
Profinet device list	The link sets the PROFINET node to “Connected”, opens the **Device list and PROFINET names...** window and displays the **Available devices** tab.

Information about the above-mentioned windows can be found in the documentation **KR C4 PROFINET**.

14.4.2 “SystemLogs” tab

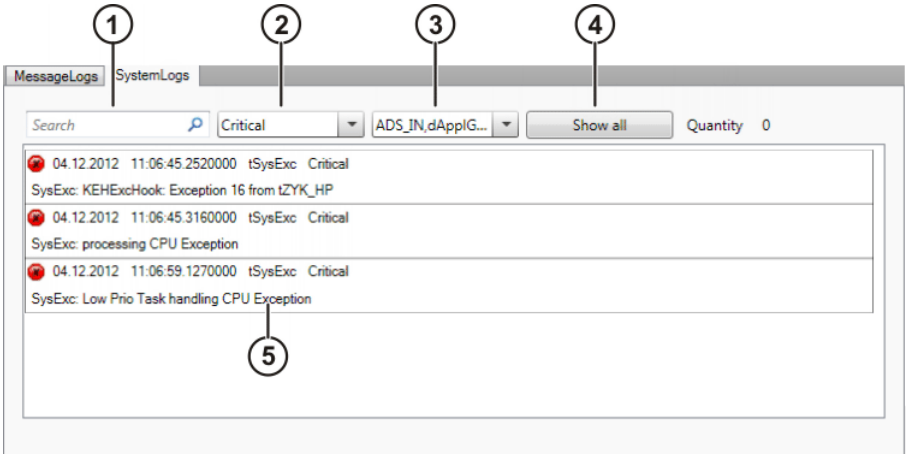


Fig. 14-11: SystemLogs

Item	Description
1	Here the system logs can be searched for one or more search terms. Upper and lower case are ignored. The order in which the search terms are entered in the search box is irrelevant. It is not necessary to search for complete words. Examples: ■ *tick syst* also finds entries containing *system tick*. ■ *tick tick* also finds entries in which *tick* occurs only once.
2	Filter: severity of the entry To set or remove a filter, expand the selection box and activate or deactivate the check boxes.
3	Filter: origin of the entry To set or remove a filter, expand the selection box and activate or deactivate the check boxes.

Item	Description
4	■ **Display none**: Removes all filters. ■ **Show all**: Sets all filters. This button has no effect on the search box.
5	System logs of the robot controller

14.5 Displaying diagnostic data about the robot controller

Description

The diagnostic functionality makes it possible to display a wide range of diagnostic data concerning numerous software modules of a robot controller. The parameters displayed depend on the selected module. The display includes states, fault counters, message counters, etc.

Examples of modules:

- **Kcp3 driver** (= drive for the smartPAD)
- Network driver

“Lamps” indicate the status of the parameters, etc.:

- **Green:** Status OK
- **Yellow:** Status critical, could be faulty
- **Red:** Error

Precondition

- Network connection to the real robot controller
- The real robot controller and the KUKA smartHMI are running.
- **Online administration** workspace

Procedure

1. In the **Cell view** window, select the desired robot controller by activating the check box. It is also possible to select more than one controller.
2. Select the menu sequence **Editors** > **Diagnostic monitor**. The **Diagnostic monitor** window is opened.
3. An entry is displayed for each robot controller selected. Click on an entry to expand it. The following tabs are now displayed:
   - **Module view** (>>> 14.5.1 "“Module view” tab" Page 145)
   - **Signal diagram** (>>> 14.5.2 "“Signal diagram” tab" Page 147)
4. Select a module in the **Module view**. Diagnostic data are displayed for the selected module.

14.5.1 “Module view” tab

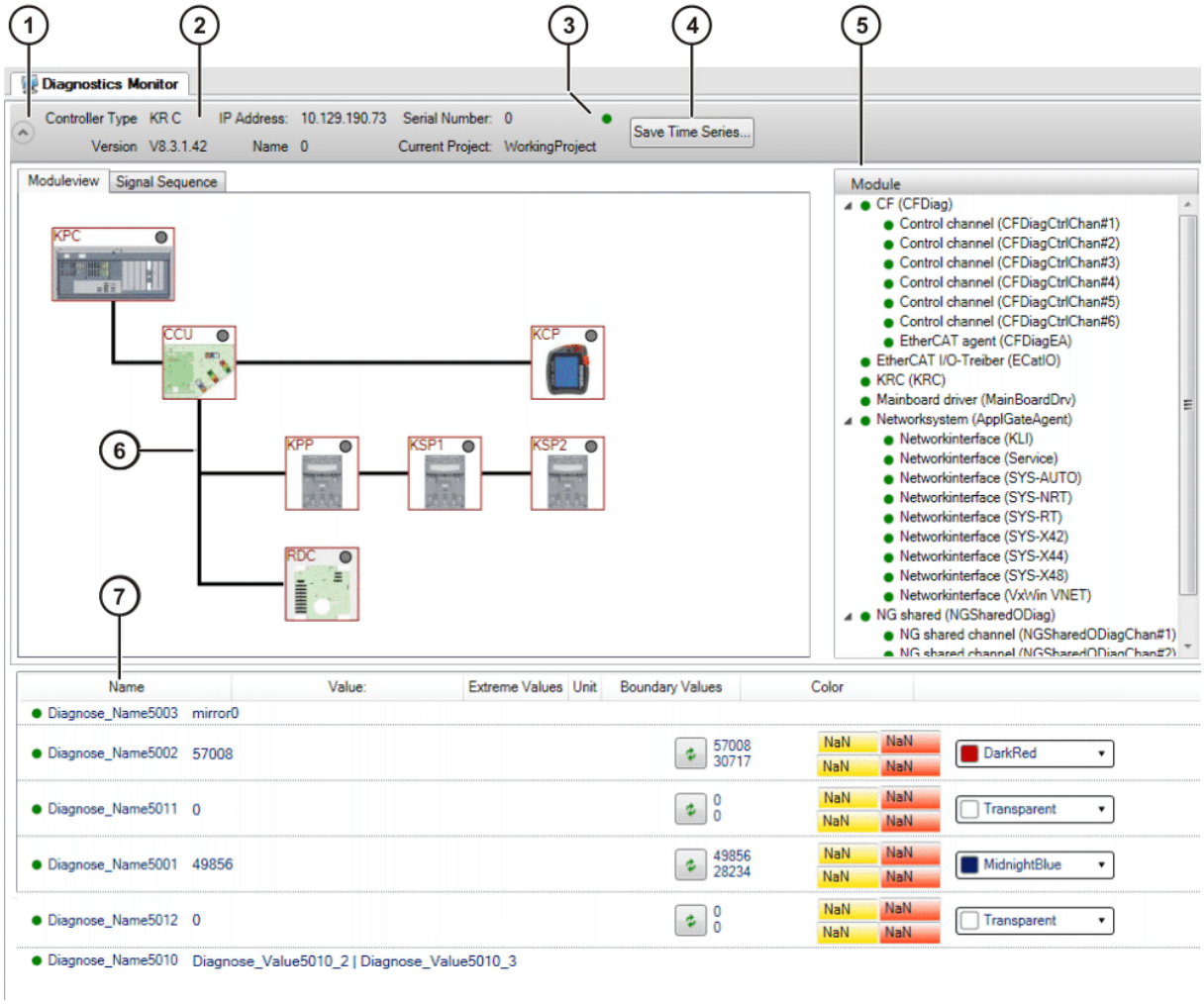


Fig. 14-12: Module view

Item	Description
1	Click here (or on any part of the gray area) to expand or collapse the entry. The **Module view** and **Signal diagram** tabs are visible when the entry is expanded.
2	Information about the robot controller and the active project While the connection to the robot controller is being established, a lamp flashes next to the name of the active project. It disappears when the connection is established.
3	This lamp indicates the status of the robot controller: ■ Red: When the status of at least one module is red. ■ Yellow: When the status of at least one module is yellow and no module is red. ■ Green: When the status of all modules is green.
4	Exports the chronological series of values to a LOG file. The values are sorted by time stamp. The time stamps start from the time at which the **Diagnostic monitor** was opened.
5	Module overview. Lamps indicate the status of the modules: ■ Red: When the status of at least one parameter is red. ■ Yellow: When the status of at least one parameter is yellow and no parameter is red. ■ Green: When the status of all parameters is green. **Note:** If the display refers to a robot controller with System Software 8.2, the module overview is not structured hierarchically.

Item	Description
6	Graphical representation of the topology for the following bus topologies: ■ Controller bus ■ KUKA Operator Panel Interface The lamp on a device is gray if the device is not connected to the real robot controller.
7	Diagnostic data about the selected module. Lamps indicate the status of the parameters: ■ Red: If the value lies outside of the range defined in the red box in the **Limit values** column. ■ Yellow: If the value lies outside of the range defined in the yellow box in the **Limit values** column. ■ Green: If the value lies within the range defined in the yellow box in the **Limit values** column.

Diagnostic data:

Column	Description
Name	Diagnosed parameter
Value	Current value of the diagnosed parameter
Extreme values	■ Upper value: Maximum diagnosed value ■ Lower value: Minimum diagnosed value The extreme values refer to the time since the diagnosis window was opened, unless the user clicks on the **Refresh** button (= green double arrow): determination of the extreme values then starts again.
Unit	If there is a unit associated with a parameter, this is displayed here. In some cases, the units can be changed (e.g. from seconds to milliseconds).
Limit values	This column partly contains default values. The values can be changed/specified by the user. Yellow box: ■ Upper value: If this value is exceeded, the parameter is marked yellow. ■ Lower value: If the current value falls below this value, the parameter is marked yellow. Red box: ■ Upper value: If this value is exceeded, the parameter is marked red. ■ Lower value: If the current value falls below this value, the parameter is marked red.
Color	Color of the curve on the **Signal diagram** tab

14.5.2 “Signal diagram” tab

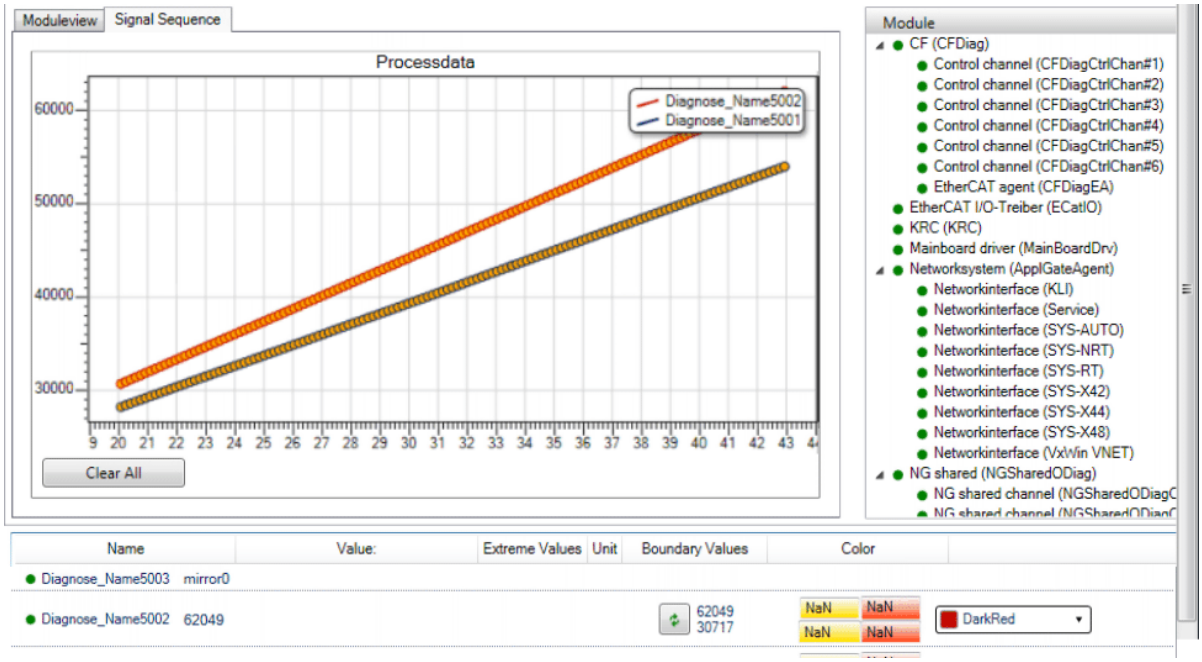


Fig. 14-13: Signal diagram

On the **Signal diagram** tab, the chronological sequence of values can be displayed graphically. Values to which a color has been assigned are displayed. If a different module is marked, the curves of the previous module are retained in the diagram. This makes it possible to compare graphs from different modules.

The **Clear all** button resets all color settings to **Transparent** and removes all curves from the diagram.

If the mouse pointer is moved over the diagram, the X and Y coordinates of the mouse pointer position are displayed. A context menu is available in the diagram, allowing the following actions:

- Adapting the size of the diagram so that the entire curve is displayed
- Creating a screenshot in the clipboard
- Saving the screenshot
- Opening the help function

  The help function contains useful information about zooming and keyboard shortcuts.

14.6 Displaying online system information

Precondition

- **Online administration** workspace

Procedure

1. In the **Cell view** window, select the desired robot controller by activating the check box. It is also possible to select more than one controller.
2. Select the menu sequence **Editors** > **System information editor**. The **Online system information** window is opened. An entry is displayed for each robot controller selected.

Description

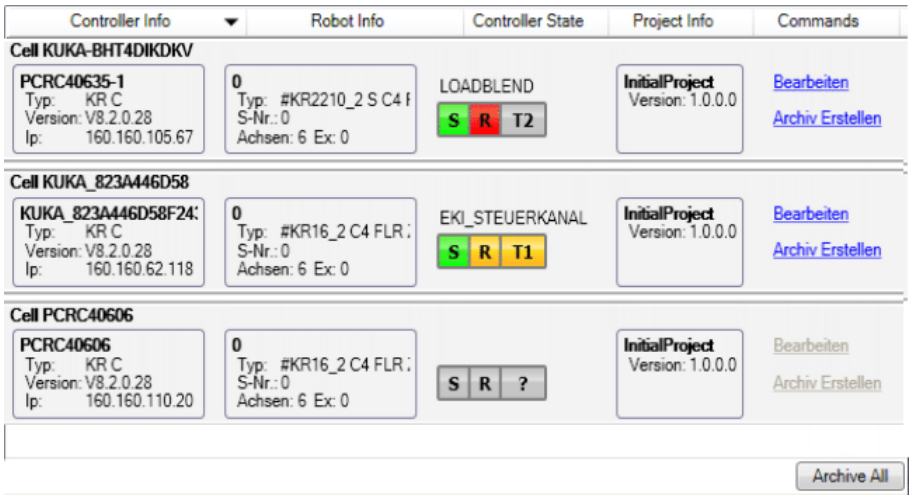


Fig. 14-14: "Online system information" window

Column	Description
Controller Info	Information about the robot controller is displayed here.
Robot info	Information about the robot is displayed here.
Controller status	Shows the status of the Submit interpreter and robot interpreter and the operating mode. The status displays correspond to the status displays on the KUKA smartHMI. Information about this can be found in the operating and programming instructions for the KUKA System Software (KSS).
Project Info	Information about the active project is displayed here.
Commands	**Edit**: Opens the **Device properties** window. **Create archive**: Opens the **Generate archives** window. (The data for this robot controller can be archived.)

Button	Description
Archive all	**Create archive**: Opens the **Generate archives** window. (The data for all robot controllers selected in the **Cell view** window can be archived.)

Device properties window:

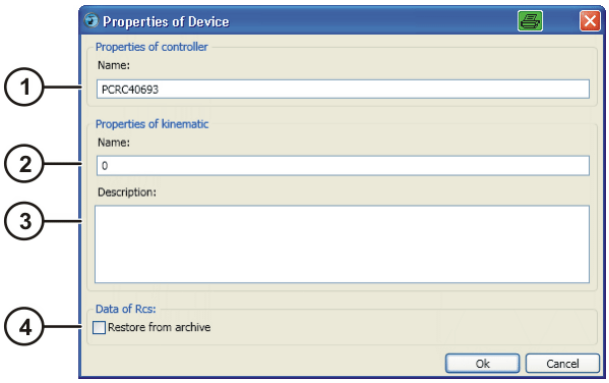


Fig. 14-15: "Device properties" window

Item	Description
1	The name of the robot controller can be changed here.
2	The name of the robot can be changed here.

Item	Description
3	A description can be entered here for information purposes. The description is displayed in the following places in the **Project deployment** window: ■ In the **Information** area ■ During activation in the lower window with the progress bar
4	**Activated**: If **OK** is pressed, the RDC data are transferred to the RDC memory from D:\BackupAll.zip.

Generate archives window:

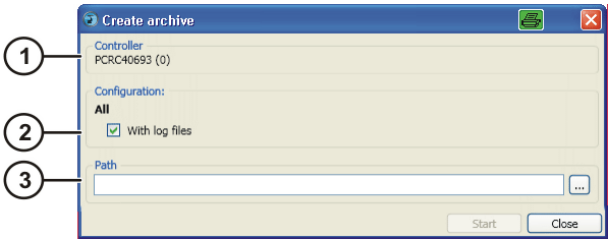


Fig. 14-16: “Generate archives” window

Item	Description
1	The name of the robot controller is displayed here. If the window was opened via the **Archive all** button, the window displays all the robot controllers that are selected in the **Cell view** window.
2	**Activated**: The log data are also archived. **Deactivated**: The log data are not archived.
3	A target directory for the archive can be selected here. A ZIP file is generated as an archive for each robot controller. The name of ZIP file always contains the name of the robot and the robot controller.

15 KUKA Service

15.1 Requesting support

Introduction

The KUKA Roboter GmbH documentation offers information on operation and provides assistance with troubleshooting. For further assistance, please contact your local KUKA subsidiary.

Information

The following information is required for processing a support request:

- Model and serial number of the robot
- Model and serial number of the controller
- Model and serial number of the linear unit (if applicable)
- Model and serial number of the energy supply system (if applicable)
- Version of the KUKA System Software
- Optional software or modifications
- Archive of the software

  For KUKA System Software V8: instead of a conventional archive, generate the special data package for fault analysis (via **KrcDiag**).
- Application used
- Any external axes used
- Description of the problem, duration and frequency of the fault

15.2 KUKA Customer Support

Availability

KUKA Customer Support is available in many countries. Please do not hesitate to contact us if you have any questions.

Argentina

Ruben Costantini S.A. (Agency)
Luis Angel Huergo 13 20
Parque Industrial
2400 San Francisco (CBA)
Argentina
Tel. +54 3564 421033
Fax +54 3564 428877
ventas@costantini-sa.com

Australia

Headland Machinery Pty. Ltd.
Victoria (Head Office & Showroom)
95 Highbury Road
Burwood
Victoria 31 25
Australia
Tel. +61 3 9244-3500
Fax +61 3 9244-3501
vic@headland.com.au
www.headland.com.au

Belgium

KUKA Automatisering + Robots N.V.
Centrum Zuid 1031
3530 Houthalen
Belgium
Tel. +32 11 516160
Fax +32 11 526794
info@kuka.be
www.kuka.be

Brazil

KUKA Roboter do Brasil Ltda.
Travessa Claudio Armando, nº 171
Bloco 5 - Galpões 51/52
Bairro Assunção
CEP 09861-7630 São Bernardo do Campo - SP
Brazil
Tel. +55 11 4942-8299
Fax +55 11 2201-7883
info@kuka-roboter.com.br
www.kuka-roboter.com.br

Chile

Robotec S.A. (Agency)
Santiago de Chile
Chile
Tel. +56 2 331-5951
Fax +56 2 331-5952
robotec@robotec.cl
www.robotec.cl

China

KUKA Robotics China Co.,Ltd.
Songjiang Industrial Zone
No. 388 Minshen Road
201612 Shanghai
China
Tel. +86 21 6787-1888
Fax +86 21 6787-1803
www.kuka-robotics.cn

Germany

KUKA Roboter GmbH
Zugspitzstr. 140
86165 Augsburg
Germany
Tel. +49 821 797-4000
Fax +49 821 797-1616
info@kuka-roboter.de
www.kuka-roboter.de

France

KUKA Automatisme + Robotique SAS
Techvallée
6, Avenue du Parc
91140 Villebon S/Yvette
France
Tel. +33 1 6931660-0
Fax +33 1 6931660-1
commercial@kuka.fr
www.kuka.fr

India

KUKA Robotics India Pvt. Ltd.
Office Number-7, German Centre,
Level 12, Building No. - 9B
DLF Cyber City Phase III
122 002 Gurgaon
Haryana
India
Tel. +91 124 4635774
Fax +91 124 4635773
info@kuka.in
www.kuka.in

Italy

KUKA Roboter Italia S.p.A.
Via Pavia 9/a - int.6
10098 Rivoli (TO)
Italy
Tel. +39 011 959-5013
Fax +39 011 959-5141
kuka@kuka.it
www.kuka.it

Japan

KUKA Robotics Japan K.K.
YBP Technical Center
134 Godo-cho, Hodogaya-ku
Yokohama, Kanagawa
240 0005
Japan
Tel. +81 45 744 7691
Fax +81 45 744 7696
info@kuka.co.jp

Canada

KUKA Robotics Canada Ltd.
6710 Maritz Drive - Unit 4
Mississauga
L5W 0A1
Ontario
Canada
Tel. +1 905 670-8600
Fax +1 905 670-8604
info@kukarobotics.com
www.kuka-robotics.com/canada

Korea

KUKA Robotics Korea Co. Ltd.
RIT Center 306, Gyeonggi Technopark
1271-11 Sa 3-dong, Sangnok-gu
Ansan City, Gyeonggi Do
426-901
Korea
Tel. +82 31 501-1451
Fax +82 31 501-1461
info@kukakorea.com

Malaysia

KUKA Robot Automation Sdn Bhd
South East Asia Regional Office
No. 24, Jalan TPP 1/10
Taman Industri Puchong
47100 Puchong
Selangor
Malaysia
Tel. +60 3 8061-0613 or -0614
Fax +60 3 8061-7386
info@kuka.com.my

Mexico

KUKA de México S. de R.L. de C.V.
Progreso #8
Col. Centro Industrial Puente de Vigas
Tlalnepantla de Baz
54020 Estado de México
Mexico
Tel. +52 55 5203-8407
Fax +52 55 5203-8148
info@kuka.com.mx
www.kuka-robotics.com/mexico

Norway

KUKA Sveiseanlegg + Roboter
Sentrumsvegen 5
2867 Hov
Norway
Tel. +47 61 18 91 30
Fax +47 61 18 62 00
info@kuka.no

Austria

KUKA Roboter Austria GmbH
Vertriebsbüro Österreich
Regensburger Strasse 9/1
4020 Linz
Austria
Tel. +43 732 784752
Fax +43 732 793880
office@kuka-roboter.at
www.kuka-roboter.at

Poland

KUKA Roboter Austria GmbH
Spółka z ograniczoną odpowiedzialnością
Oddział w Polsce
Ul. Porcelanowa 10
40-246 Katowice
Poland
Tel. +48 327 30 32 13 or -14
Fax +48 327 30 32 26
ServicePL@kuka-roboter.de

Portugal

KUKA Sistemas de Automatización S.A.
Rua do Alto da Guerra n° 50
Armazém 04
2910 011 Setúbal
Portugal
Tel. +351 265 729780
Fax +351 265 729782
kuka@mail.telepac.pt

Russia

OOO KUKA Robotics Rus
Webnaja ul. 8A
107143 Moskau
Russia
Tel. +7 495 781-31-20
Fax +7 495 781-31-19
kuka-robotics.ru

Sweden

KUKA Svetsanläggningar + Robotar AB
A. Odhners gata 15
421 30 Västra Frölunda
Sweden
Tel. +46 31 7266-200
Fax +46 31 7266-201
info@kuka.se

Switzerland

KUKA Roboter Schweiz AG
Industriestr. 9
5432 Neuenhof
Switzerland
Tel. +41 44 74490-90
Fax +41 44 74490-91
info@kuka-roboter.ch
www.kuka-roboter.ch

Spain

KUKA Robots IBÉRICA, S.A.
Pol. Industrial
Torrent de la Pastera
Carrer del Bages s/n
08800 Vilanova i la Geltrú (Barcelona)
Spain
Tel. +34 93 8142-353
Fax +34 93 8142-950
Comercial@kuka-e.com
www.kuka-e.com

South Africa

Jendamark Automation LTD (Agency)
76a York Road
North End
6000 Port Elizabeth
South Africa
Tel. +27 41 391 4700
Fax +27 41 373 3869
www.jendamark.co.za

Taiwan

KUKA Robot Automation Taiwan Co., Ltd.
No. 249 Pujong Road
Jungli City, Taoyuan County 320
Taiwan, R. O. C.
Tel. +886 3 4331988
Fax +886 3 4331948
info@kuka.com.tw
www.kuka.com.tw

Thailand

KUKA Robot Automation (M)SdnBhd
Thailand Office
c/o Maccall System Co. Ltd.
49/9-10 Soi Kingkaew 30 Kingkaew Road
Tt. Rachatheva, A. Bangpli
Samutprakarn
10540 Thailand
Tel. +66 2 7502737
Fax +66 2 6612355
atika@ji-net.com
www.kuka-roboter.de

Czech Republic

KUKA Roboter Austria GmbH
Organisation Tschechien und Slowakei
Sezemická 2757/2
193 00 Praha
Horní Počernice
Czech Republic
Tel. +420 22 62 12 27 2
Fax +420 22 62 12 27 0
support@kuka.cz

Hungary

KUKA Robotics Hungaria Kft.
Fö út 140
2335 Taksony
Hungary
Tel. +36 24 501609
Fax +36 24 477031
info@kuka-robotics.hu

USA

KUKA Robotics Corporation
51870 Shelby Parkway
Shelby Township
48315-1787
Michigan
USA
Tel. +1 866 873-5852
Fax +1 866 329-5852
info@kukarobotics.com
www.kukarobotics.com

UK

KUKA Automation + Robotics
Hereward Rise
Halesowen
B62 8AN
UK
Tel. +44 121 585-0800
Fax +44 121 585-0900
sales@kuka.co.uk

Index