SIEMENS

SIMOTION CamTool

Configuration Manual

12.2004
6AU1900-1AB32-0BA0

Safety Guidelines

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring to property damage only have no safety alert symbol. These notices shown below are graded according to the degree of danger.

Danger

indicates that death or severe personal injury **will** result if proper precautions are not taken.

Warning

indicates that death or severe personal injury **may** result if proper precautions are not taken.

Caution

with a safety alert symbol, indicates that minor personal injury can result if proper precautions are not taken.

Caution

without a safety alert symbol, indicates that property damage can result if proper precautions are not taken.

Attention

indicates that an unintended result or situation can occur if the corresponding information is not taken into account.

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

Qualified Personnel

The device/system may only be set up and used in conjunction with this documentation. Commissioning and operation of a device/system may only be performed by **qualified personnel**. Within the context of the safety notes in this documentation qualified persons are defined as persons who are authorized to commission, ground and label devices, systems and circuits in accordance with established safety practices and standards.

Prescribed Usage

Note the following:

Warning

This device may only be used for the applications described in the catalog or the technical description and only in connection with devices or components from other manufacturers which have been approved or recommended by Siemens. Correct, reliable operation of the product requires proper transport, storage, positioning and assembly as well as careful operation and maintenance.

Trademarks

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Disclaimer of Liability
We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

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Preface

Contents of manual

The accompanying manual describes the SIMOTION CamTool option package.

The document is part of the SIMOTION Engineering System documentation package with order number: 6AU1900-1AB32-0BA0, Edition 12.2004

Scope

The accompanying manual applies to SIMOTION SCOUT in conjunction with the SIMOTION CamTool option package.

Standards

The SIMOTION system was developed in accordance with the ISO 9001 quality guidelines.

Information blocks:

The following is a description of the purpose and use of the product manual.

- Description chapter

  This chapter provides a short overview of the basic functions of the SIMOTION CamTool and the inclusion in SIMOTION SCOUT.

- Installation chapter

  This chapter describes how the SIMOTION CamTool is installed and which prerequisites must be satisfied to allow the use of SIMOTION CamTool.

- Configuration chapter

  This chapter describes the basic functions of SIMOTION CamTool. It shows you how to process cams with CamTool.

- Functions chapter

  In this chapter you learn how to create a cam with CamTool.

SIMOTION documentation

An overview of the SIMOTION documentation is provided in a separate list of references.

The list of references is supplied on the "SIMOTION SCOUT" CD and is included in each print copy order of the documentation package.

The list of references can be obtained separately under the following MLFB number:

Order no.: 6AU1900-1AA32-0BA0

Edition 12.2004

SIMOTION documentation consists of 10 documentation packages containing approximately 50 SIMOTION documents and documents on other products (e.g., SINAMICS).

The following documentation packages are available for SIMOTION V3.2:

- SIMOTION Engineering System
- SIMOTION System and Function Descriptions
- SIMOTION Diagnostics
- SIMOTION Programming
- SIMOTION Programming - Reference Lists
- SIMOTION C230
- SIMOTION P350
- SIMOTION D4xx (incl. SINAMICS S120)
- SIMOTION Supplementary Documentation
- SIMOTION Function Library

Hotline

If you have any questions, please contact our hotline (worldwide):

- A & D Technical Support: Phone: +49 (180) 50 50 222
- Fax: +49 (180) 50 50 223
- E-mail: ad.support@siemens.com

If you have any questions, suggestions, or corrections regarding the documentation, please fax or e-mail them to the following:

- Fax: +49 (9131) 98 2176
- E-mail: motioncontrol.docu@erlf.siemens.de
- Fax form: refer to the reply form at the end of the document

Additional support

We also offer introductory courses to help you familiarize yourself with SIMOTION.

Please contact your regional training center or our main training center at D-90027 Nuremberg/Germany, phone +49 (911) 895 3202.

Siemens Internet address

The latest information on SIMOTION products can be found on the Internet at:

General information **http://www.siemens.com/simotion**

Technical information **http://www4.ad.siemens.de/view/cs/de/10805438**

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Description

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Introduction

The graphical user interface in SIMOTION CamTool allows you to create, edit and optimize cams.

SIMOTION CamTool is fully integrated in SIMOTION SCOUT. This allows you to also use in SIMOTION CamTool information configured in SIMOTION SCOUT (e.g. axis settings).

Basic functions

SIMOTION CamTool provides the following basic functions:

- Insert and edit cams.

  Cams can be added to a SCOUT project using SIMOTION CamTool. In addition, you can edit with CamTool a cam created with CamEdit: Cams can also be imported from a text file or uploaded from a SIMOTION device.

- Modifying the representation of the cam in CamTool

  In SIMOTION CamTool, you can show and hide diagrams, change the representation parameters of the axes and diagrams, and adapt the lines and fonts. You can also represent auxiliary lines in the diagram.

- Converting cams from SIMOTION CamTool to SIMOTION CamEdit.

  To edit with SIMOTION CamEdit a cam edited in SIMOTION CamTool, the cam must be converted.

- Exporting cams into a text file.
- Downloading cams to a SIMOTION device
- Printing a cam.

Installing the Software

2

2.1 Installing SIMOTION CamTool

Introduction

SIMOTION CamTool is an option package for SIMOTION SCOUT.

SIMOTION SCOUT must have been installed on the system on which you want to install SIMOTION CamTool. For further information, refer to the system prerequisites.

Notice

You require administrator rights for the installation.

After the installation, every user (also those without administrator rights) can work with SIMOTION CamTool.

System requirements

The following table provides a detailed overview of the system requirements for SIMOTION CamTool.

Table 2-1 SIMOTION CamTool system requirements

	Minimum requirement
Programming device or PC	• Processor: Intel Pentium II or compatible. 400 MHz (WIN NT 4.0, WIN 2000) • Processor: Intel Pentium III or compatible. 500 MHz (WIN XP Professional) • 256 MB RAM; 512 MB recommended • Screen resolution: 1024 x 768 pixels
Operating system	• Microsoft Windows NT 4.0 ≥ Service Pack 6 or • Microsoft Windows 2000 ≥ Service Pack 3 • Microsoft Windows XP Professional ≥ Service 1
Software required	• Microsoft Internet Explorer Version 5.0.1 • SIMATIC STEP 7 Version 5.1 ≥ Service Pack 6 or STEP 7 Version 5.2 (required for SIMOTION D435) • SIMOTION SCOUT ≥ Version 2.1

Installing SIMOTION CamTool

To install SIMOTION CamTool:

1. Insert the CD with installation software into the CD-ROM drive.
2. Start Windows Explorer and select the CD-ROM drive.
3. Open the **CamTool\Disk1** directory.
4. Double-click on **setup.exe**. The installation program is started.
5. Run through the installation program. SIMOTION CamTool will be installed.

2.2 Deinstalling SIMOTION CamTool

Deinstalling SIMOTION CamTool

To deinstall SIMOTION CamTool:

1. Click **Start > Settings > System Control** in the Windows taskbar. The **System Control** window appears.
2. Double-click **Add/Remove Programs**. The **Software Properties** window is displayed.
3. Mark the **SIMOTION SCOUT CamTool** entry in the **Install/Deinstall** tab.
4. Click **Add/Remove**. The deinstallation program is started.
5. Run through the deinstallation program. SIMOTION CamTool will be deinstalled.

Notice

You require administrator rights for the deinstallation.

Configuring

3

3.1 Content

Overview

This chapter describes how you work with SIMOTION CamTool. You learn how

- to customize the display of the working area
- to edit a cam with CamTool
- to save a cam
- to customize the display of the cam
- to download a cam to a SIMOTION device

Note

The following operating instructions primarily describe the operation of SIMOTION CamTool using the functions in the menu bar.

You can also execute the functions from the context menus. In this case, right-click the element that you want to edit.

You can also execute the most import functions using the icons in the SIMOTION CamTool toolbar. Pay attention to the tooltip which is displayed when you place the mouse pointer on an icon in the toolbar.

3.2 Customizing the Working Area Display

3.2.1 Changing the representation using the toolbar

Introduction

You can show or hide the scaled curve, the V diagram (velocity diagram), the A diagram (acceleration diagram) and the J diagram (jerk diagram) via icons in the toolbar. You can use the zoom tool to increase or reduce the size of the display or use the hand tool to move the display.

Changing the representation using the toolbar

To change the representation of the diagrams via the toolbar

1. When the mouse pointer is placed on an icon in the toolbar, a tooltip is displayed.
2. Click the icon of the function that you want to use.

Toolbar icons

The screen display can be changed using the following functions:

Table 3-1 SIMOTION CamTool toolbar icons

Symbol	Explanation / instructions
	With this icon, you can activate or deactivate the display of the scaled curve. If you have not specified a scaling, the icon is shown grayed-out. **Note:** If the scaled curve is displayed, you cannot edit the original curves in the diagram displays.
	With this icon, you can show or hide the V diagram (velocity diagram).
	With this icon, you can show or hide the A diagram (acceleration diagram).
	With this icon, you can show or hide the J diagram (jerk diagram).

Symbol	Explanation / instructions
	With this icon, you can activate or deactivate the zoom tool. You can also deactivate the zoom tool using the ESC key. You can perform various functions with the activated zoom tool. The function is dependent on whether the mouse pointer is on the diagram area or on a coordinate axis and whether the SHIFT key is also pressed: **Zoom tool on the diagram area (zoom in all directions at the same time)** Left-click to increase the size of the display by the factor 2. Right-click to decrease the size of the display by the factor 2. **Zoom tool on the coordinate axis (zoom in all directions at the same time)** Left-click to increase the size of the display by the factor 2 in the direction of the coordinate axis on which you are pointing. Right-click to decrease the size of the display by the factor 2 in the direction of the coordinate axis on which you are pointing. **Zoom tool with pressed SHIFT key** The mouse pointer is activated as a hand tool while you keep the SHIFT key pressed. With activated hand tool, you can move the diagram area with drag&drop. All displayed diagrams are adjusted to the move.
	With this icon, you can activate or deactivate the zoom function. You can also deactivate the zoom function using the ESC key. **Zoom function on the diagram area** With activated zoom function, you can lasso a section of the diagram area that you want to enlarge with the mouse button pressed. **Zoom function on the coordinate axis** With activated zoom function, you can lasso a section of a coordinate axis that you want to enlarge with the mouse button pressed. The enlargement is in the direction in which you lasso the section of the coordinate axis.
	With this icon, you can restore the previous zoom setting.
	With this icon, you can activate or deactivate the hand tool. You can also deactivate the hand tool using the ESC key. With activated hand tool, you can move the diagram area with drag&drop. All displayed diagrams are adjusted to the move.
	With this icon, you can restore the whole display to the normal view.

3.2.2 Maximizing working area

Maximizing the working area

To set the largest possible working area for SIMOTION CamTool:

1. In the **View** menu, click **Maximized working area**. Detail view and project navigator are closed.
2. Maximize the window with the diagrams of the cam.

or

1. Close the project navigator via the menu **View > Project navigator**.
2. Close the detail view via the menu **View > Detail view**.
3. Maximize the window with the diagrams of the cam.

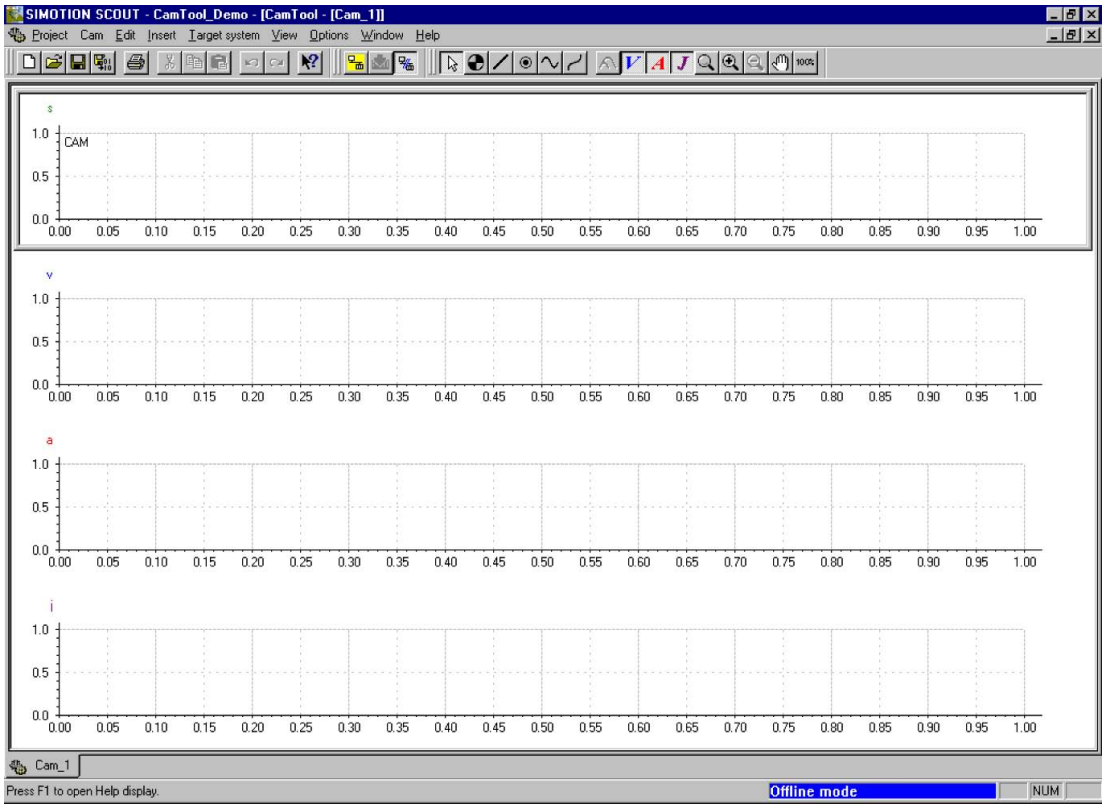

Figure 3-1 Maximized cam diagrams in the SIMOTION SCOUT working area

3.3 Editing a Cam with CamTool

3.3.1 Content

Overview

With SIMOTION CamTool, you can edit a cam that is inserted in a SCOUT project.

You can use the following methods to insert and edit a cam. You can

- add a cam to a SCOUT project using SIMOTION CamTool.
- edit with CamTool a cam created with CamEdit.
- import and edit a cam from a text file.
- upload and edit a cam from a SIMOTION device.

3.3.2 Adding a cam to a SCOUT project using CamTool

Requirements

SIMOTION CamTool is installed as an option package for SIMOTION SCOUT.

The project, into which you want to insert the cam, is opened in SIMOTION SCOUT. At least one SIMOTION device is configured in this project.

Inserting a cam in a SCOUT project

To insert a cam in a SCOUT project:

1. In the project navigator, find the SIMOTION device under which you want to insert a new cam.
2. Open the **Cams** folder and double-click **Insert cam with CamTool**.

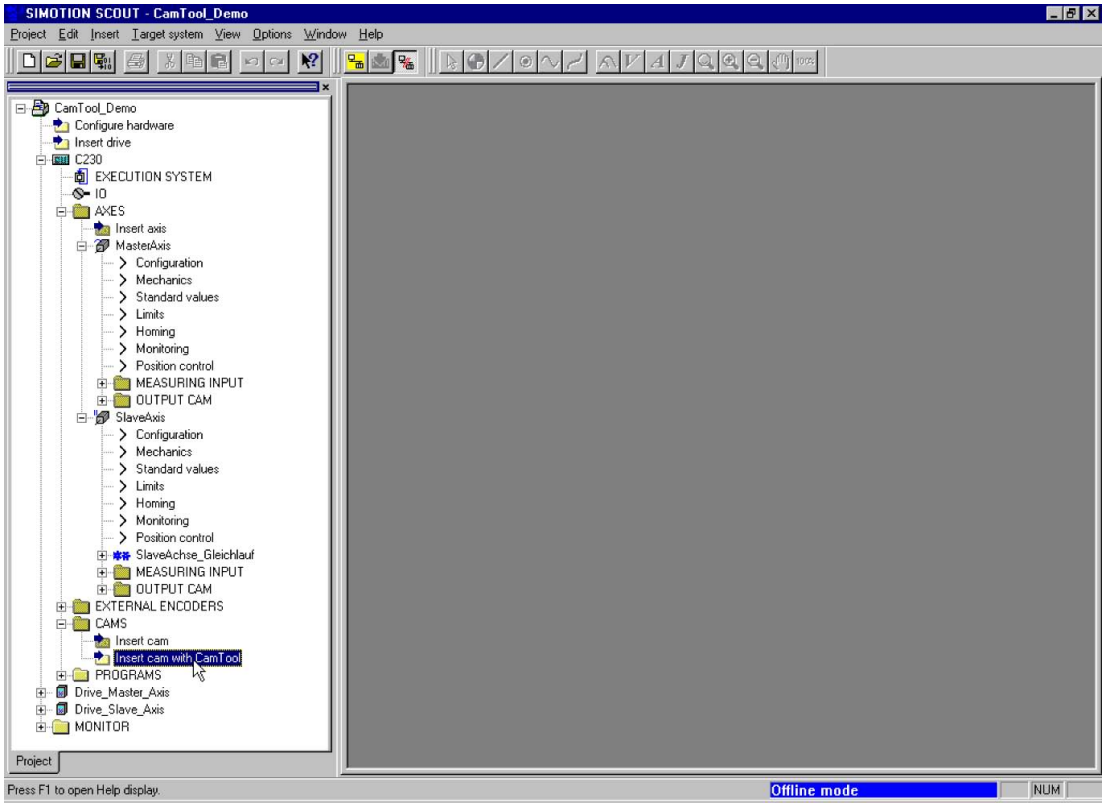

Figure 3-2 Inserting a cam with CamTool

3. The **Insert Cam** window appears. Under **Name**, enter a unique name for the cam (all the cams existing in the project are displayed under **Existing cams**).

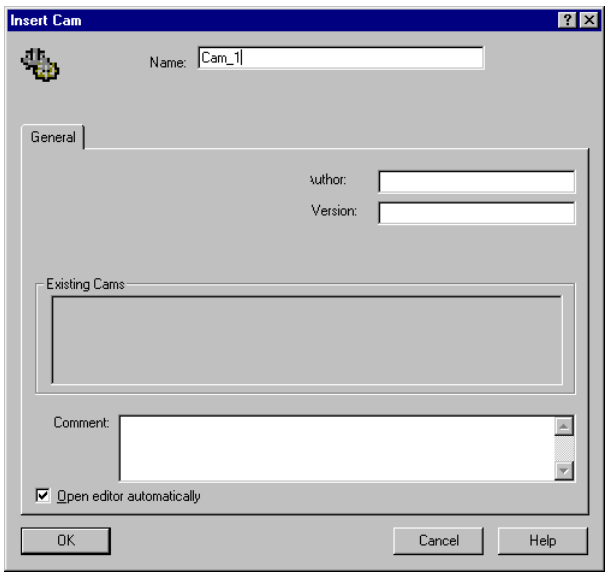

Figure 3-3 Window for inserting a cam

4. Click **OK**. A window appears in the working area of SIMOTION SCOUT. The diagrams of the cam depending on the settings in the menu **Cam > Diagrams** are displayed in this window.

Notice

The following are represented in the cam diagrams:

- the master axis in the horizontal direction (X-axis) and
- the slave axis in the vertical direction (Y-axis).

3.3.3 Edit cam created with CamEdit with CamTool

Editing a Cam with CamTool

To edit a cam created with CamEdit with CamTool:

1. Close the cam in SIMOTION CamEdit.
2. Find the cam that you want to edit with SIMOTION CamTool in the project navigator.
3. Right-click the cam and select **Convert to CamTool** in the displayed context menu. The cam is then opened the next time with SIMOTION CamTool.

4. Double-click the cam. The cam is opened with SIMOTION CamTool and displayed. Segment limits between individual cam segments are marked in the S diagram (distance diagram).

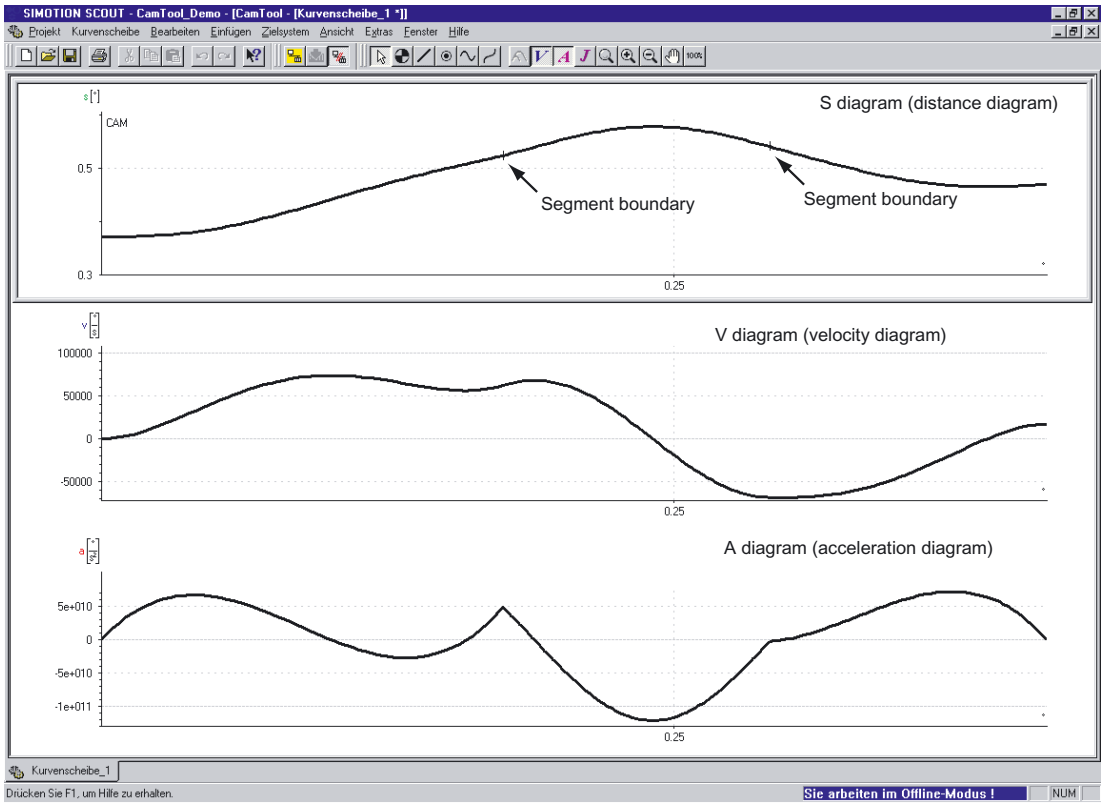

Figure 3-4 Open with CamTool a cam created with CamEdit

5. Select the cam segment that you want to edit. Note the displayed segment limits.

6. Delete the cam segment by pressing the DEL key. The cam segment is replaced by an interpolation curve (transition) by SIMOTION CamTool. If required, fixed points are inserted in the curve to maintain the corner points of the original curve.

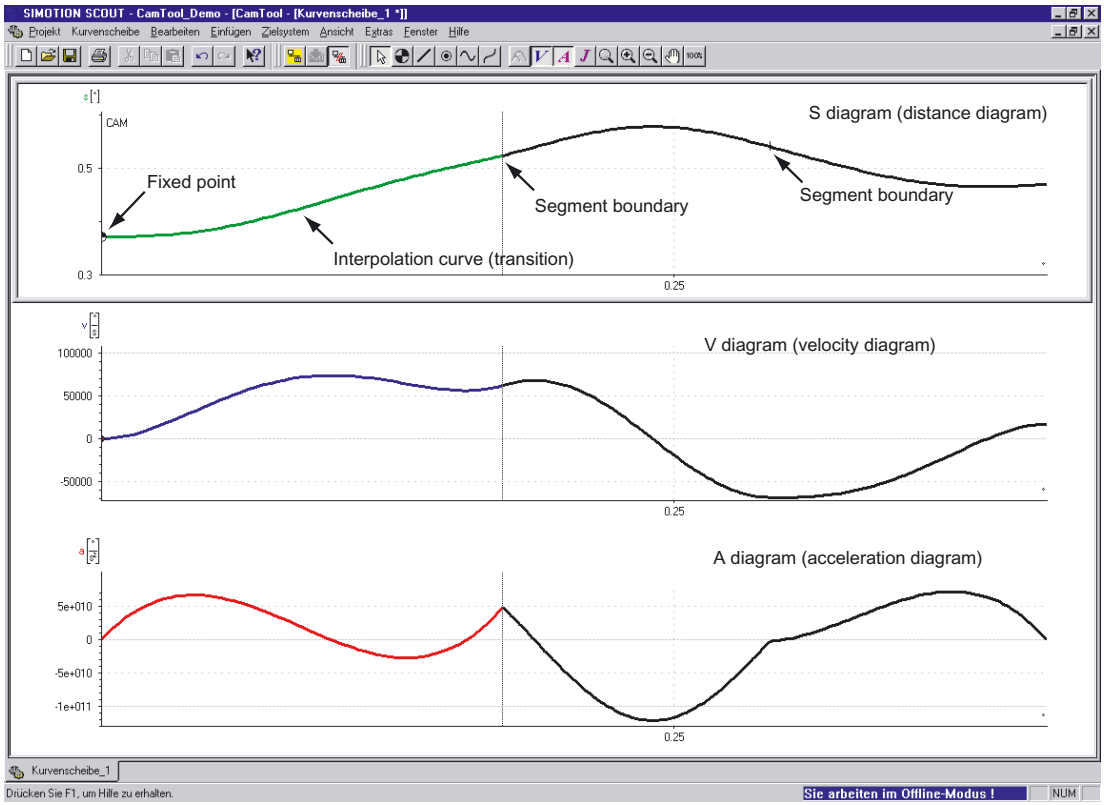

Figure 3-5 Cam segment replaced by SIMOTION CamTool with fixed point and transition (interpolation polynomial)

7. The cam segment (e.g. fixed point) inserted by SIMOTION CamTool can be edited (e.g. change position).
8. The interpolation curve (transition) inserted by SIMOTION CamTool can be optimized (e.g. velocity).

Notice

With SIMOTION CamTool, you can edit all cams created with SIMOTION CamEdit.

3.3.4 Import cam from text file

Introduction

You can re-import a cam exported as text file from SIMOTION CamTool back into CamTool (e.g. to re-import a cam edited in an external program).

Notice

The cam representation in the text file must correspond to the Microsoft Excel CSV format.

Importing a cam

To import a cam from a text file:

1. Open with SIMOTION CamTool the cam in which you want to import the cam from the text file.

   or

   Add a new cam in which you want to import the cam from the text file.

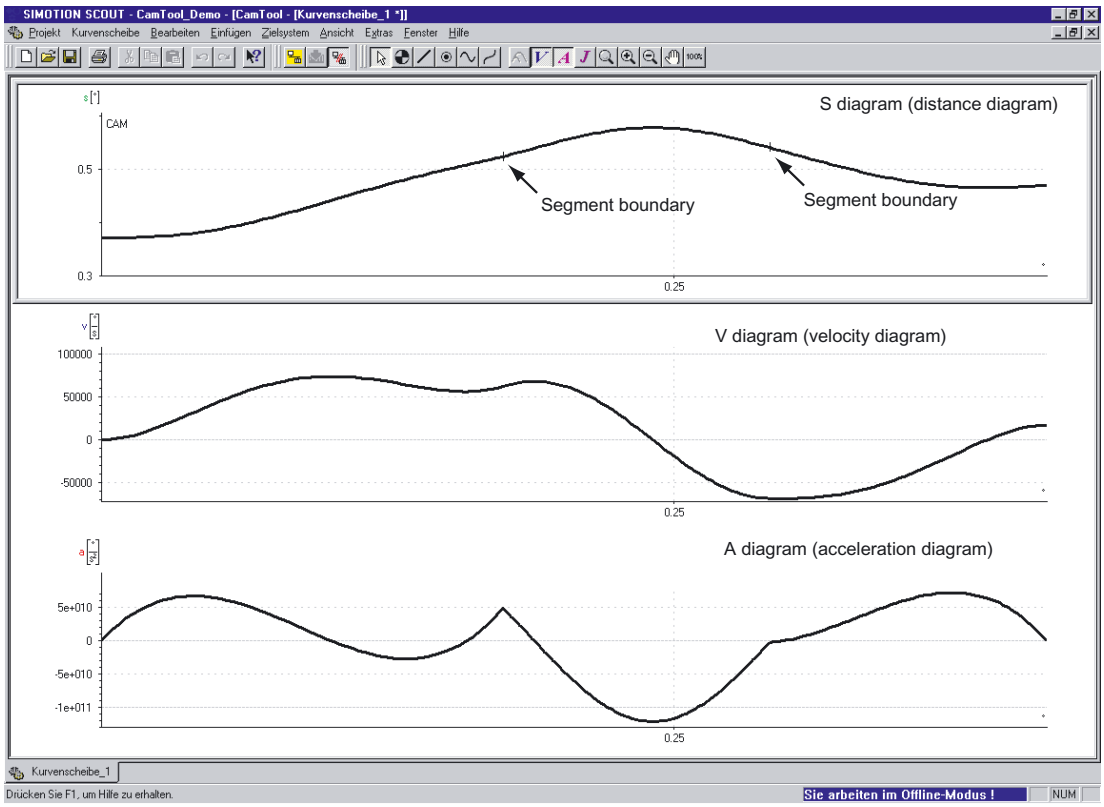

Figure 3-6 Cam imported from a text file

2. Click a diagram to show the **Cam** menu.

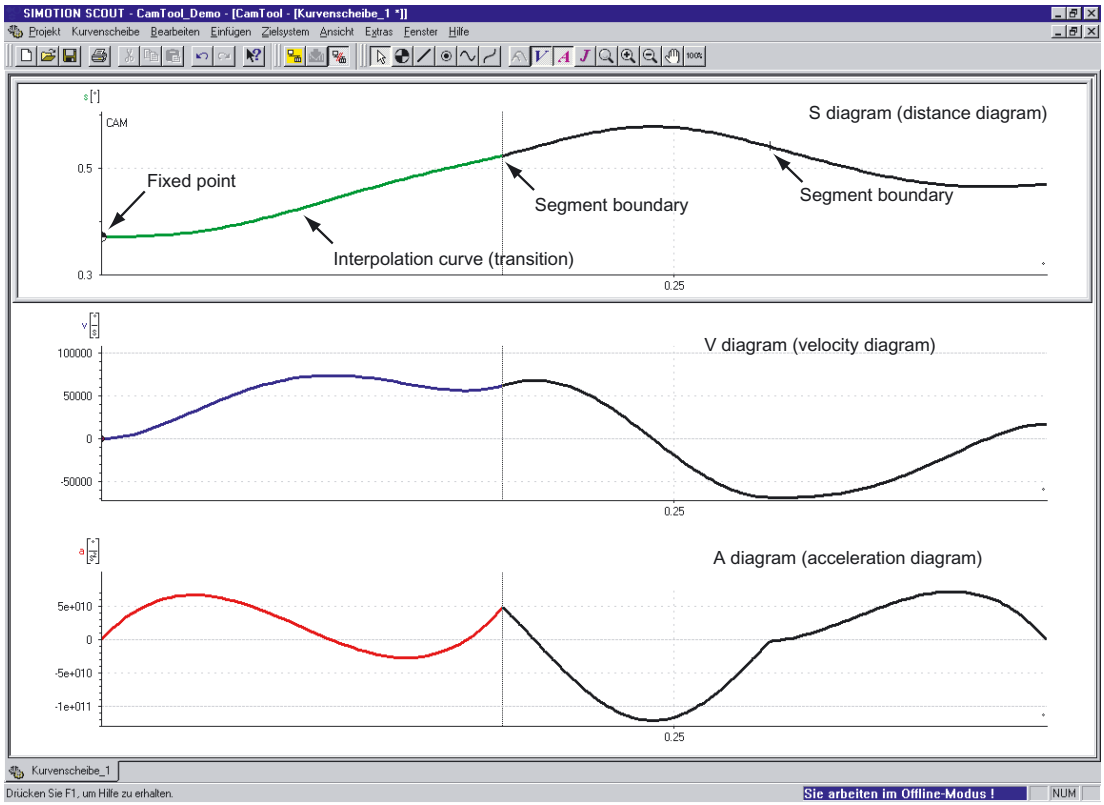

Figure 3-7 Cam segment replaced by SIMOTION CamTool with fixed point and transition (interpolation polynomial)

3. Click the menu **Cam > Import**. The file selection window is displayed.

   Navigate under **Find in** to the text file that contains the cam and select the text file. The name of the text file is entered under **Name**.

4. Click **OK** in the file selection window. The cam is imported.

Notice

When you import a cam from a text file and have previously changed the displayed cam, a window appears. You can accept the changed cam into the project via the window. The cam is then imported from the text file.

Edit imported cam

To edit a cam imported into SIMOTION CamTool:

1. The cam imported from a text file is displayed in SIMOTION CamTool. Segment limits between individual cam segments are marked in the S diagram (distance diagram).

   Select the cam segment that you want to edit. Note the displayed segment limits.
2. Delete the cam segment by pressing the DEL key. The cam segment is replaced by an interpolation curve (transition) by SIMOTION CamTool. If required, fixed points are inserted in the curve to maintain the corner points of the original curve.
3. The cam segment (e.g. fixed point) inserted by SIMOTION CamTool can be edited (e.g. change position).
4. The interpolation curve (transition) inserted by SIMOTION CamTool can be optimized (e.g. velocity).

3.3.5 Upload cam from SIMOTION device

Requirements

The cam is opened with SIMOTION CamTool.

Notice

If you create a cam and the cam has never been previously downloaded to the SIMOTION device, you must first download the entire configuration **with** the new cam to the SIMOTION device.

Only then can you upload the cam currently opened with SIMOTION CamTool from the SIMOTION device. The upload is only possible in ONLINE status.

Upload cam

To upload a cam from a SIMOTION device:

1. Click the menu **Project > Connect to target system**. The system changes to ONLINE status.

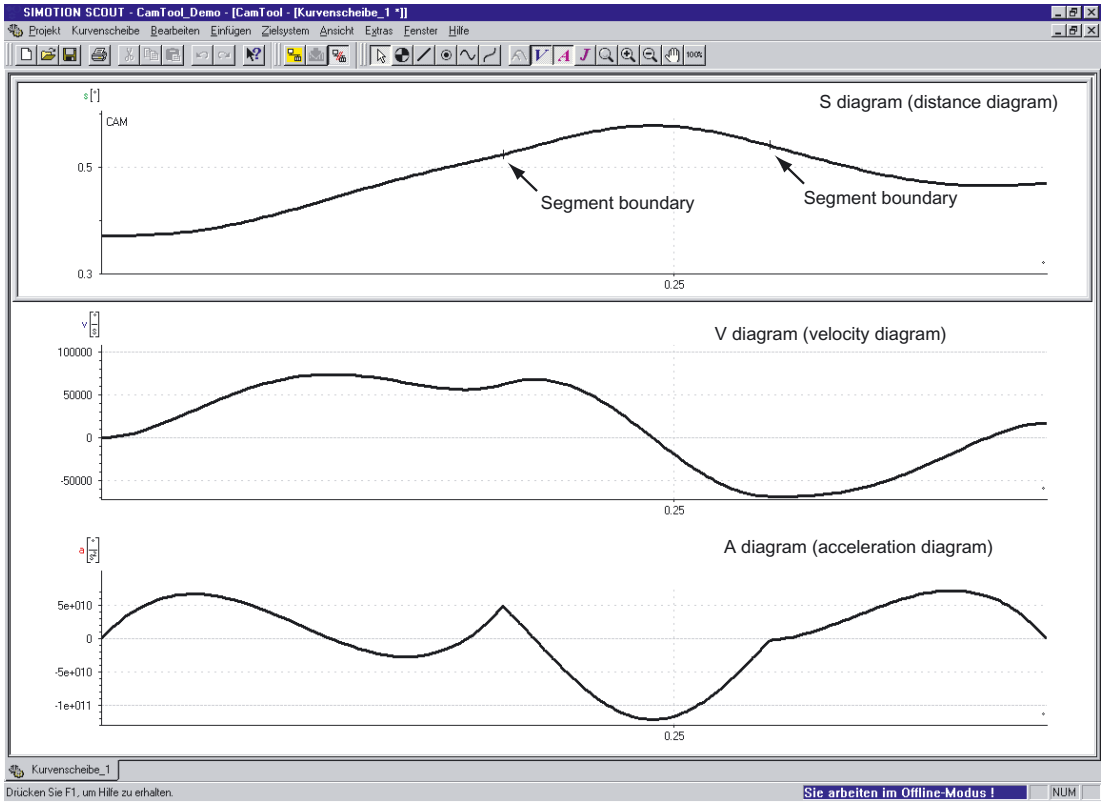

Figure 3-8 Cam uploaded from SIMOTION device

2. Click a diagram to show the **Cam** menu.

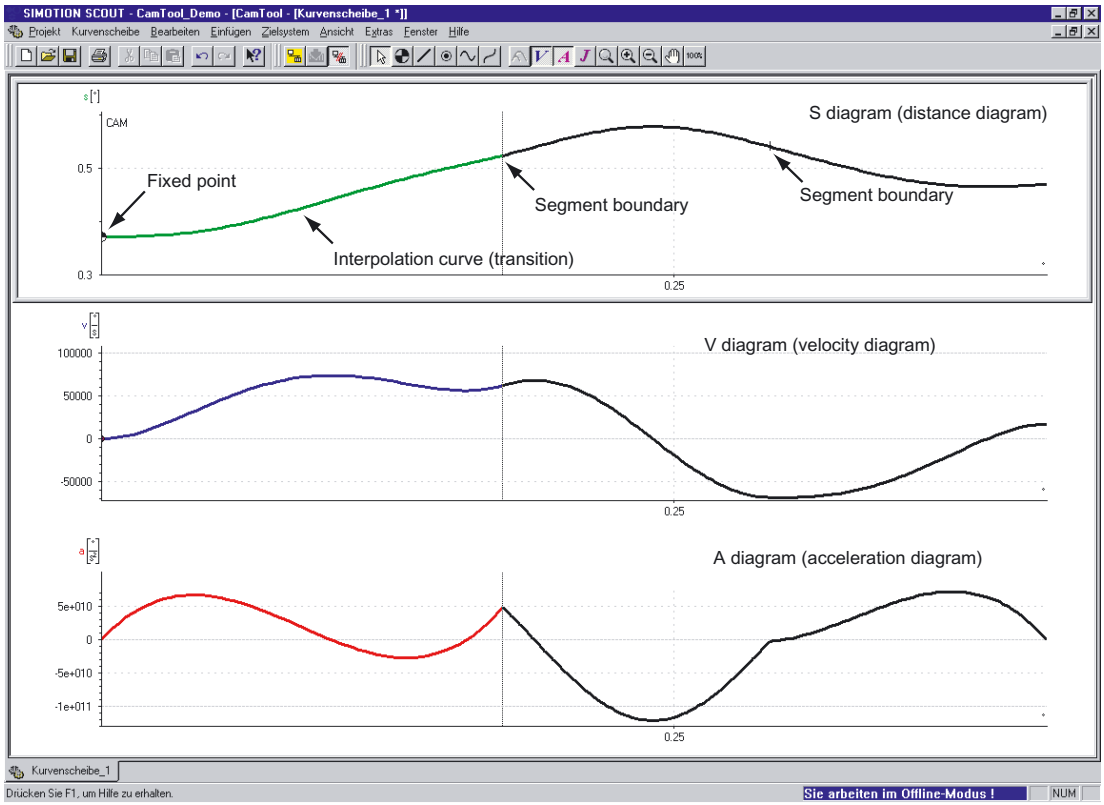

Figure 3-9 Cam segment replaced by SIMOTION CamTool with fixed point and transition (interpolation polynomial)

3. Click the menu **Cam > Upload cam**. The cam is uploaded from the SIMOTION device.
4. After the upload, you can change back to OFFLINE status. Click the menu **Project > Disconnect from target system**.

Notice

When you upload a cam from the SIMOTION device and have previously changed the displayed cam, a window appears. You can accept the changed cam into the project via the window. The cam is then uploaded from the SIMOTION device.

Edit uploaded cam

To edit a cam uploaded from a SIMOTION device:

1. The uploaded cam is displayed in SIMOTION CamTool. Segment limits between individual cam segments are marked in the S diagram (distance diagram).

   Select the cam segment that you want to edit. Note the displayed segment limits.
2. Delete the cam segment by pressing the DEL key. The cam segment is replaced by an interpolation curve (transition) by SIMOTION CamTool. If required, fixed points are inserted in the curve to maintain the corner points of the original curve.
3. The cam segment (e.g. fixed point) inserted by SIMOTION CamTool can be edited (e.g. change position).
4. The interpolation curve (transition) inserted by SIMOTION CamTool can be optimized (e.g. velocity).

3.4 Save cam

Requirements

The cam is opened with SIMOTION CamTool.

Notice

When you exit SIMOTION CamTool and have previously changed the cam, a window appears. You can accept the changed cam into the project via the window. SIMOTION CamTool is then closed.

When you upload a cam from a SIMOTION device and have previously changed the displayed cam, a window appears. You can accept the changed cam into the project via the window. The cam is then uploaded from the SIMOTION device.

When you import a cam from a text file and have previously changed the displayed cam, a window appears. You can accept the changed cam into the project via the window. The cam is then imported from the text file.

Save cam

To save a cam:

1. Click the menu **Project > Save**. The cam is transferred to the SCOUT project.

3.5 Customize the display of the cam

3.5.1 Display the cam

Diagram display

The S diagram (distance diagram) of the cam is always displayed in the SIMOTION SCOUT working area. You can show or hide the V diagram (velocity diagram), the A diagram (acceleration diagram) and the J diagram (jerk diagram) via icons in the toolbar.

Representation parameters

You can customize the display parameters (e.g. representation range) for the master axis, the slave axis and the individual diagrams. This also includes the fonts and lines used for the display.

3.5.2 Show/hide diagram

Requirements

The cam is opened with SIMOTION CamTool.

Show/hide diagram

To show/hide a diagram:

1. Click a diagram to show the **Cam** menu.

2. Click the diagram that you want to show or hide under menu **Cam > Diagrams**. The diagram is shown or hidden.

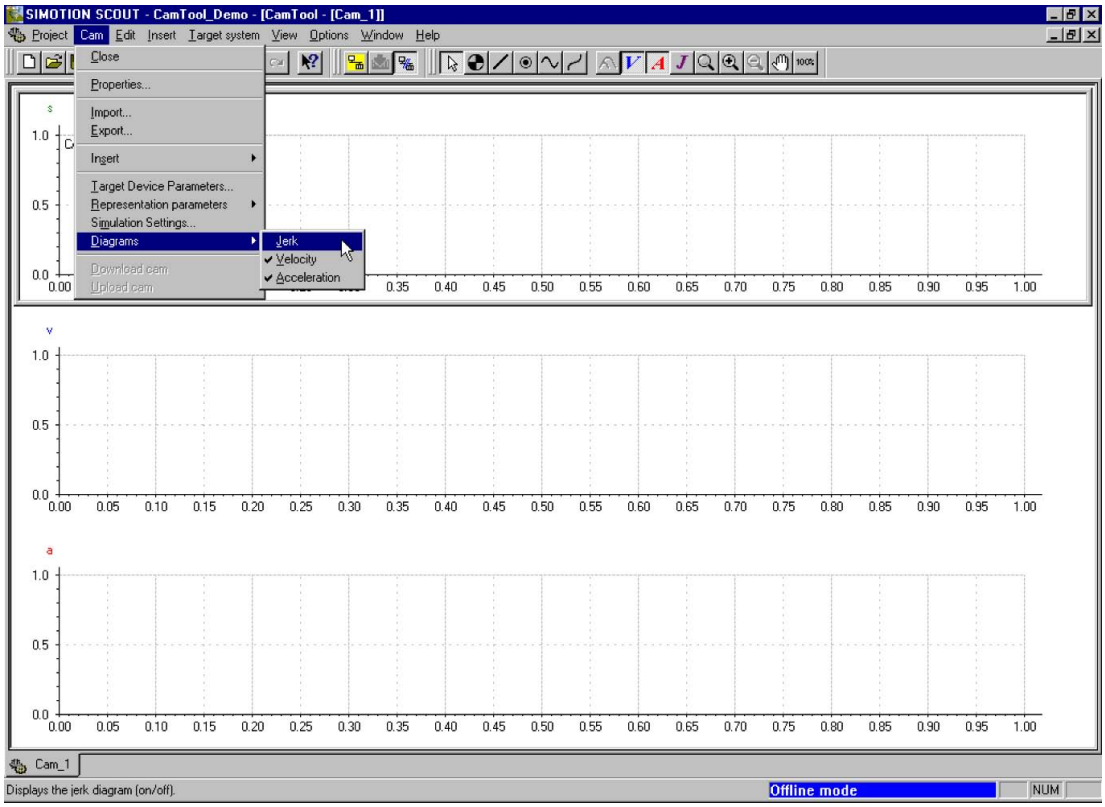

Figure 3-10 Show/hide diagrams again

3.5.3 Change axis representation parameters

Requirements

The cam is opened with SIMOTION CamTool.

Change axis representation parameters

To change the representation parameters for the master or slave axis:

1. Click a diagram to show the **Cam** menu.
2. Click the axis whose representation parameters you want to change under menu **Cam > Representation parameters**.

3. Either the window **Master Properties** (for the master axis) or the window **S Diagram Properties (Slave)** (for the slave axis) is displayed.

For the master axis, change the representation parameters in the window **Master Properties.**

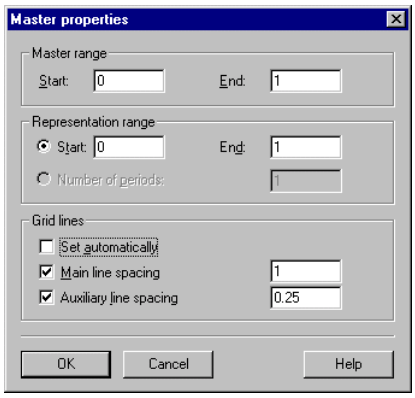

Figure 3-11 Master Properties window

For the slave axis, change the representation parameters in the window **S Diagram (Slave) Properties.**

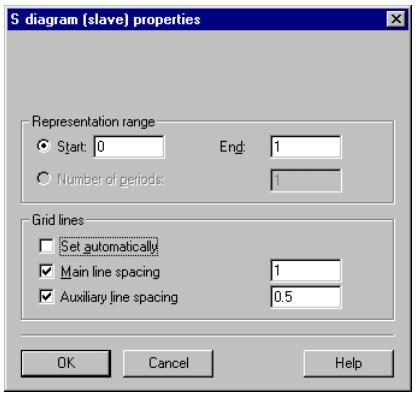

Figure 3-12 Slave Properties window

Table 3-2 Parameters in the Master Properties or S Diagram (Slave) Properties

Field/button		Explanation/instructions
Master Range (Master Properties)		You specify the **master range** (definition range) of the curve via start and end points. Cam segments must lie within this master range (see also **Master range** under **Target device properties** in the **Coordinates** tab).
	Start	Enter the **start** point of the curve, or the start of the master range of the curve here.
	End	Enter the **end** point of the curve, or the end of the master range of the curve here.

Field/button		Explanation/instructions
Representation range		
	Start (Number of periods deactivated)	Specify here the **Start** point of the representation range. If the **Number of periods** option has been activated, the system will determine the start point.
	End (Number of periods deactivated)	Specify here the **End** point of the representation range. If the **Number of periods** option has been activated, the system will determine the end point.
	Number of periods (cyclical absolute, cyclical relative)	If under **Target device parameters** in the **Coordinates** tab, you have specified the **cyclic absolute execution type** or the **cyclic relative execution type**, you can select the option **Number of periods**. Enter the number of periods that you want to display.
Grid lines		
	Set automatically	If you activate **Set automatically**, the grid lines will be displayed automatically with an optimum spacing. If you deactivate **Set automatically**, you can use **Main line spacing** or **Auxiliary line spacing** to specify the grid line spacing.
	Main line spacing	You can activate the display of the grid lines for the **main line spacing** here. If you deactivate the **Set automatically** option, you can specify the grid line spacing for the main line spacing. **Note**: The spacing that you specify for the grid lines in the main line spacing must be a multiple of the spacing that you specify for the grid lines in the auxiliary line spacing.
	Auxiliary line spacing (Main line spacing activated)	If the **main line spacing** option has been activated, you can also activate the display of the grid lines for the **auxiliary line spacing**. If you deactivate the **Set automatically** option, you can specify the grid line spacing for the auxiliary line spacing. **Note**: The spacing that you specify for the grid lines in the main line spacing must be a multiple of the spacing that you specify for the grid lines in the auxiliary line spacing.

3.5.4 Change diagram representation parameters

Requirements

The cam is opened with SIMOTION CamTool.

Change diagram representation parameters

To change the representation parameters for the V diagram (velocity diagram), the A diagram (acceleration diagram) or the J diagram (jerk diagram):

1. Click a diagram to show the **Cam** menu.
2. Click the diagram whose representation parameters you want to change under menu **Cam > Representation parameters**.
3. Either the window **V Diagram Properties** (for the velocity diagram), the window **A Diagram Properties** (for the acceleration diagram) or the window **J Diagram Properties** (for the jerk diagram) is displayed.

For the V diagram (velocity diagram), change the representation parameters in the window **V Diagram Properties.**

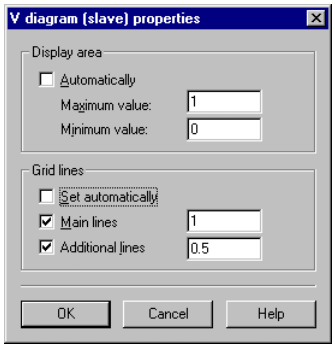

Figure 3-13 V Diagram Properties window

For the A diagram (acceleration diagram), change the representation parameters in the window **A Diagram Properties.**

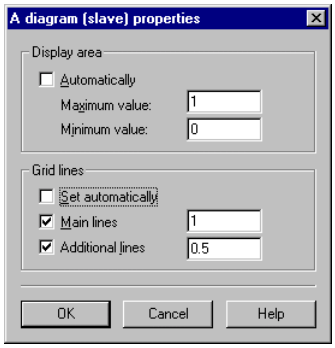

Figure 3-14 A Diagram Properties window

For the J diagram (jerk diagram), change the representation parameters in the window **J Diagram Properties.**

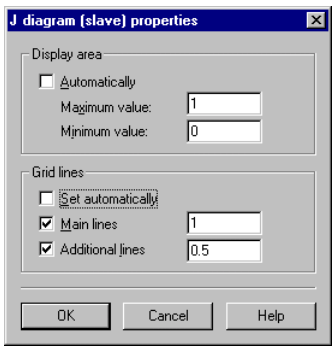

Figure 3-15 J Diagram Properties window

Table 3-3 Parameters for the V, A or J Diagram Properties windows

Field/button		Explanation/instructions
Representation range		
	Automatically	If you activate **Automatically**, the representation range in the Y-direction will be automatically changed to the value range of the displayed curve. If you deactivate **Automatically**, you can use **maximum value** and **minimum value** to specify the representation range in the Y-direction.
	Maximum value (automatically deactivated)	Specify here the **maximum value** of the representation range. If the **Automatically** option has been activated, the system will determine the maximum value.
	Minimum value (automatically deactivated)	Specify here the **minimum value** of the representation range. If the **Automatically** option has been activated, the system will determine the minimum value.
Grid lines		
	Set automatically	If you activate **Set automatically**, the grid lines will be displayed automatically with an optimum spacing. If you deactivate Set automatically, you can use **Main line spacing** or **Auxiliary line spacing** to specify the grid line spacing.
	Main line spacing	You can activate the display of the grid lines for the **main line spacing** here. If you deactivate the **Set automatically** option, you can specify the grid line spacing for the main line spacing. **Note:** The spacing that you specify for the grid lines in the main line spacing must be a multiple of the spacing that you specify for the grid lines in the auxiliary line spacing.

	Field/button	Explanation/instructions
	Auxiliary line spacing (Main line spacing activated)	If the **main line spacing** option has been activated, you can also activate the display of the grid lines for the **auxiliary line spacing**. If you deactivate the **Set automatically** option, you can specify the grid line spacing for the auxiliary line spacing. **Note:** The spacing that you specify for the grid lines in the main line spacing must be a multiple of the spacing that you specify for the grid lines in the auxiliary line spacing.

3.5.5 Change lines and fonts representation parameters

For the representation of the diagrams, default parameters are used for the lines and fonts. You can change these default settings.

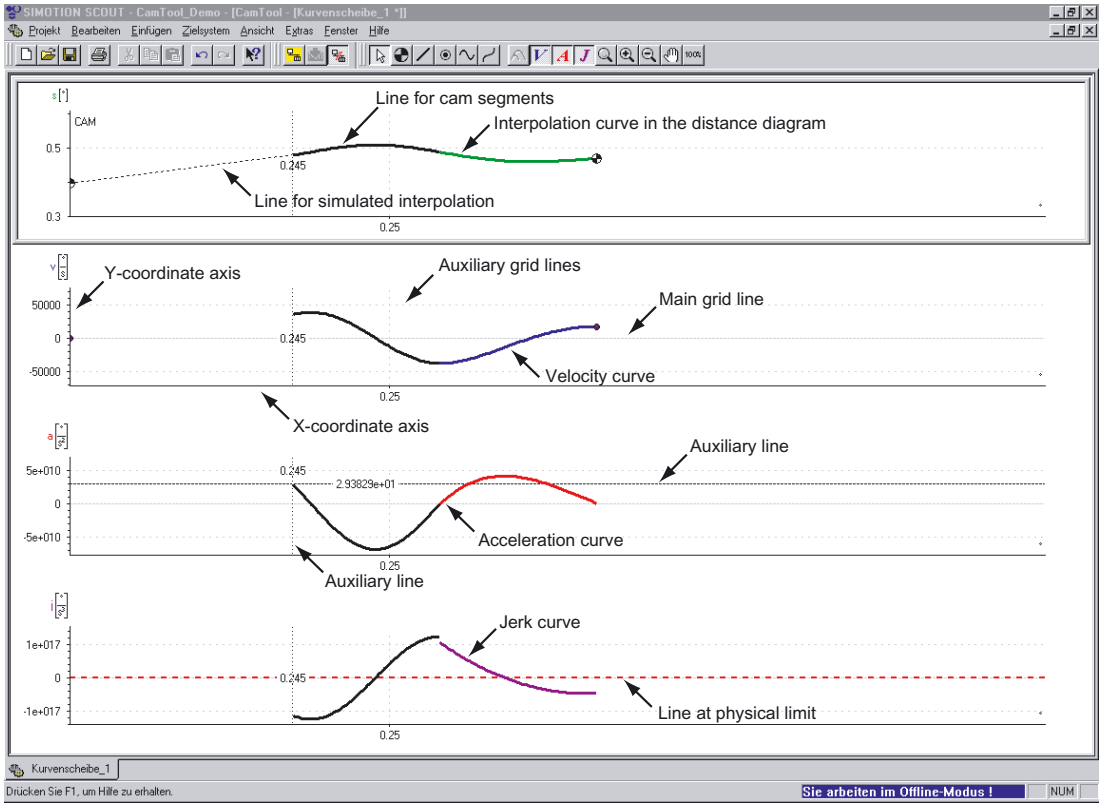

Figure 3-16 Representation parameters in the diagrams (line for the scaling not shown)

Table 3-4 Representation parameters in the diagrams

Representation parameters	Note
Main grid line	Type and color of the line can be changed.
Auxiliary grid lines	Type and color of the line can be changed.
Auxiliary line	Type, color and width of the line can be changed.
Line at physical limit	Type, color and width of the line can be changed.
X-coordinate axis	Color and width of the line can be changed.
Y-coordinate axis	Color and width of the line can be changed.
Line for simulated interpolation	Color and width of the line can be changed. The **line for simulated interpolation** is used to display a transition interpolated by the target device.
Interpolation curve in the distance diagram	Color and width of the line can be changed.
Velocity curve	Color and width of the line can be changed.
Acceleration curve	Color and width of the line can be changed.
Jerk curve	Color and width of the line can be changed.
Line for cam segments	Color and width of the line can be changed.
Line for scaling	Color and width of the line can be changed. The **line for scaling** is used to display a scaled and offset curve.

Requirements

The cam is opened with SIMOTION CamTool.

Change lines and fonts representation parameters

To change the representation parameters for lines and fonts:

1. Click a diagram to show the **Cam** menu.
2. Click **Lines and fonts** under menu **Cam > Representation parameters**.
3. The **Lines and Fonts** window appears.

You can change the representation parameters for the lines in the **Line** tab.

Table 3-5 Parameters in the Line tab

Field/button		Explanation/instructions
Line type		Select the **line type** that you want to specify here. Under **Settings**, the associated parameters are displayed and the line type shown.
Settings		**Note:** Grayed-out parameters cannot be changed.
	Type	Specify the **type** of the line. The line type is displayed in the **Preview**.

Field/button		Explanation/instructions
	Color	Specify the **color** of the line. The line is displayed in the **Preview**.
	Width	Specify the **thickness** of the line. The line type is displayed in the **Preview**.
	Preview	Under **Preview**, the line type specified via **type**, **color** and **width** is shown.

You can change the representation parameters for the fonts in the **Font** tab.

Table 3-6 Parameters in the Font tab

Field/button		Explanation/instructions
Settings		
	Font	Select the **font** here. The font is displayed in the **Preview**.
	Font style	Select the **font style** here. The font is displayed in the **Preview**.
	Font size	Select the **font size** here. The font is displayed in the **Preview**.
	Preview	Under **Preview**, the font specified via **font**, **font style** and **font size** is shown.

3.5.6 Displaying auxiliary lines in the diagram

You can represent horizontal and vertical auxiliary lines in the individual diagrams. You can, for example, determine the position of individual points of the curve via auxiliary lines.

Requirements

The cam is opened with SIMOTION CamTool.

Representing a horizontal auxiliary line in a diagram

To represent a horizontal auxiliary line (in the direction of the x-coordinate) in a diagram:

1. Click in the diagram, in which you want to represent a horizontal auxiliary line, on the x-coordinate and keep the mouse button pressed. The current position of the auxiliary line is displayed in the position window.

2. Drag the auxiliary line to the position at which you want to represent the auxiliary line and release the mouse button. The auxiliary line and the position window with the current position are displayed in the diagram.

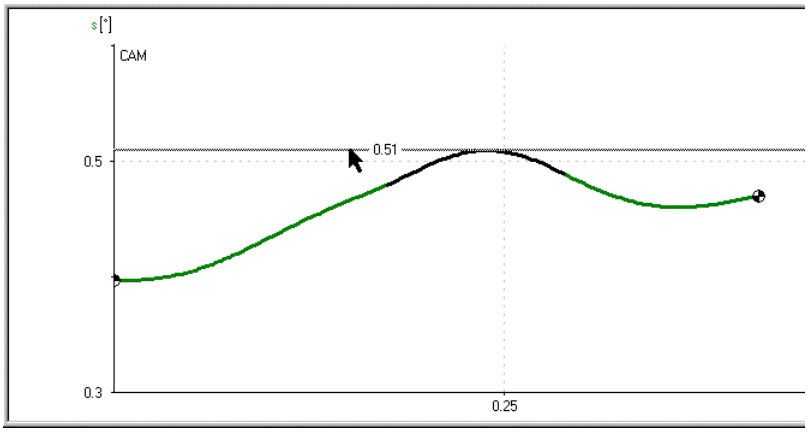

Figure 3-17 Displaying a horizontal auxiliary line

Representing vertical auxiliary lines in all displayed diagrams

To represent a vertical auxiliary line (in the direction of the y-coordinate) in all displayed diagrams:

1. Click in a diagram on the y-coordinate axis and keep the mouse button pressed. The current position of the auxiliary line is displayed in the position window.
2. Drag the auxiliary line to the position at which you want to represent the auxiliary line and release the mouse button. The auxiliary line and the position window with the current position are both displayed in all the displayed diagrams.

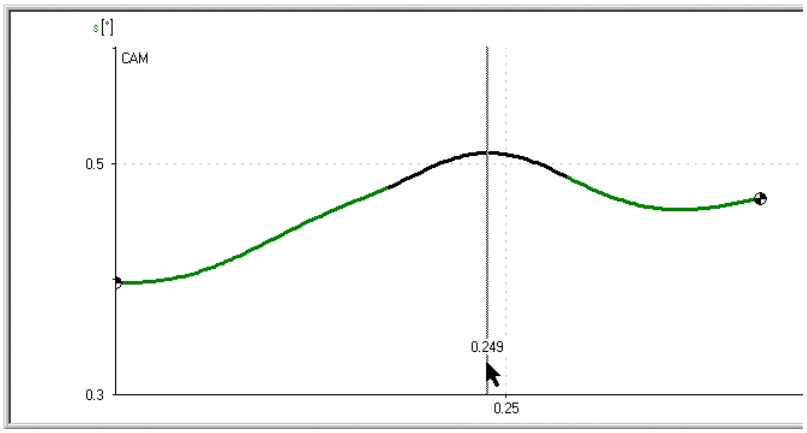

Figure 3-18 Displaying a vertical auxiliary line

Moving the position window along an auxiliary line

To move a position window with the current position of the auxiliary line along the horizontal or vertical auxiliary line:

1. Point at the position window. The mouse pointer shows the direction in which you can move the window. Drag the window with the current position with drag&drop to the new position.

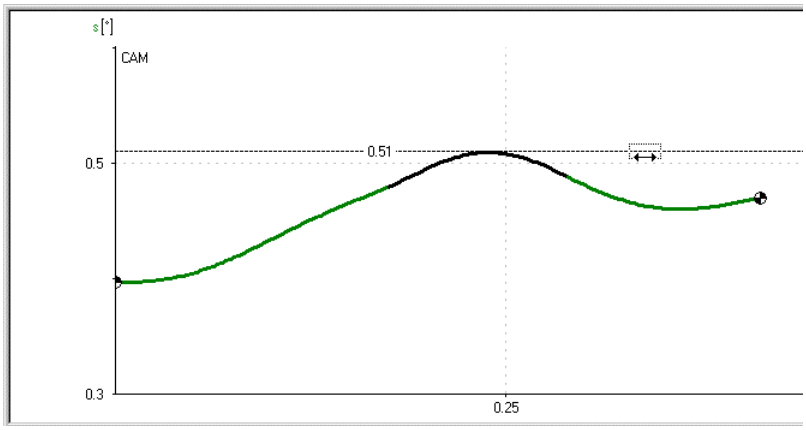

Figure 3-19 Moving the position window horizontally

Deleting an auxiliary line in a diagram

To delete a horizontal or vertical auxiliary line in a diagram:

1. Select the auxiliary line that you want to delete.
2. Press the DEL key. The auxiliary line is deleted.

3.6 Download cam to SIMOTION device

Requirements

The cam is opened with SIMOTION CamTool.

Notice

If you create a cam and the cam has never been previously downloaded to the SIMOTION device, you must first download the entire configuration **with** the new cam to the SIMOTION device.

Only then can you download the cam independent of the other technology objects in the SIMOTION device. The download is only possible in ONLINE status.

Download cam to SIMOTION device

To download a cam to a SIMOTION device:

1. Click the menu Project > Connect to target system. The system changes to ONLINE status.
2. Click a diagram to show the Cam menu.
3. Click the menu Cam > Download cam. The cam is downloaded to the SIMOTION device.
4. After the download, you can change back to OFFLINE status. Click the menu Project > Disconnect from target system.

Functions

4

4.1 Content

Overview

In this chapter you learn how you can use SIMOTION CamTool to create and optimize a cam, and to make the simulation settings. In addition, you learn how you can use CamTool to edit a cam created with CamEdit and how you can export a cam as a text file.

Note

The following operating instructions primarily describe the operation of SIMOTION CamTool using the functions in the menu bar.

You can also execute the functions from the context menus. In this case, right-click the element that you want to edit.

You can also execute the most import functions using the icons in the SIMOTION CamTool toolbar. Pay attention to the Tooltip which is displayed when you place the mouse pointer on an icon in the toolbar.

4.2 Structure of a cam

Introduction

Create the cam in the S diagram (distance diagram). The curve represents the path-related dependency between the master axis (X-axis in the diagram) and the slave axis (Y-axis in the diagram).

Structure of a cam

The cam consists of individual cam segments.

Under SIMOTION CamTool, you can use fixed points, straight lines, sine curves, arc sine curves and interpolation points as cam segments.

SIMOTION CamTool calculates interpolation curves between the individual cam segments and displays the V diagram (velocity diagram), the A diagram (acceleration diagram) and the J diagram (jerk diagram).

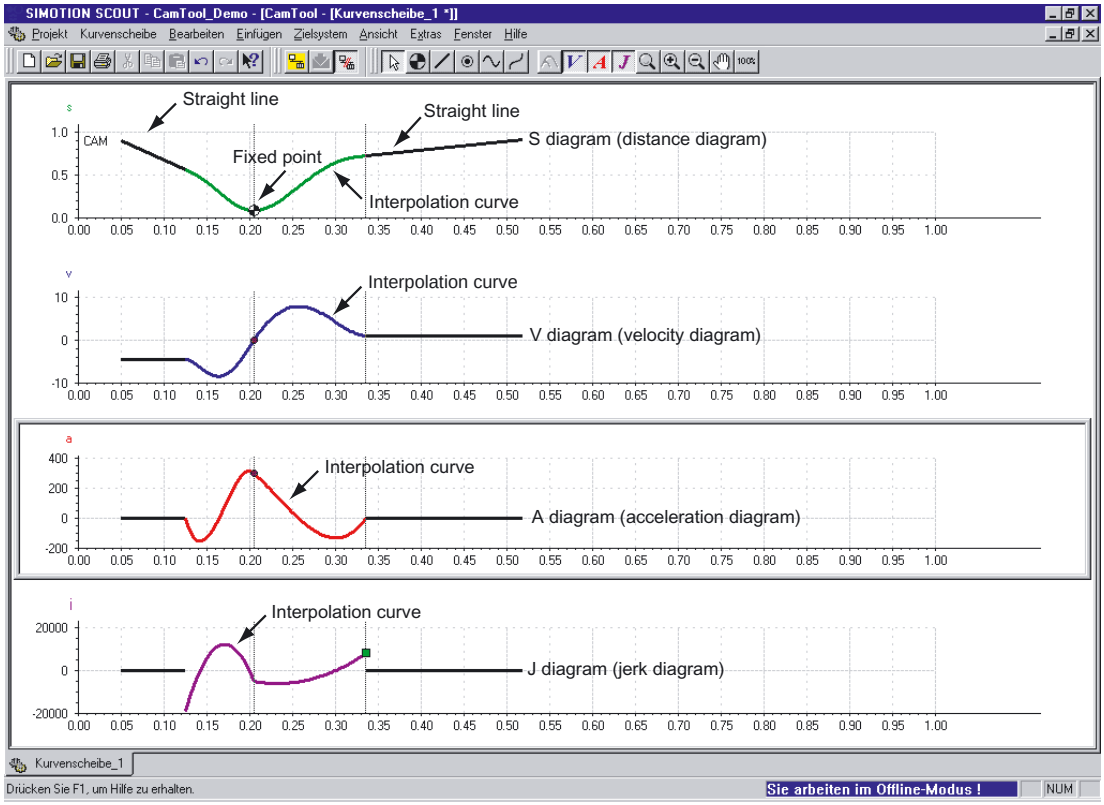

Figure 4-1 Example of a cam with interpolation curves

4.3 Fixed point

4.3.1 Fixed Point Definition

Definition

The cam consists of individual cam segments. Under SIMOTION CamTool, you can use fixed points, straight lines, sine curves, arc sine curves and interpolation points as cam segments.

A fixed point is a specified position of the slave axis for a certain position of the master axis. You can specify the velocity and acceleration at the fixed point position.

Notice

With a fixed point, you define a single fixed position. The transitions between adjacent cam segments are optimally calculated by CamTool.

If you want to specify an arbitrary characteristic, you must use interpolation points. The individual interpolation points are connected by CamTool with cubic splines in order to generate a curve specified by the interpolation points which is as exact as possible.

4.3.2 Insert fixed point

Requirements

The cam is opened with SIMOTION CamTool.

Insert fixed point

To insert a fixed point:

1. Click in the S diagram (distance diagram) to activate the diagram.
2. Click under menu Cam > Insert at fixed point. The mouse pointer changes.
3. With the changed mouse pointer, click the position in the S diagram (distance diagram) at which you want to insert the fixed point.

The fixed point is displayed in the diagram. The position of the fixed point shown in the tooltip.

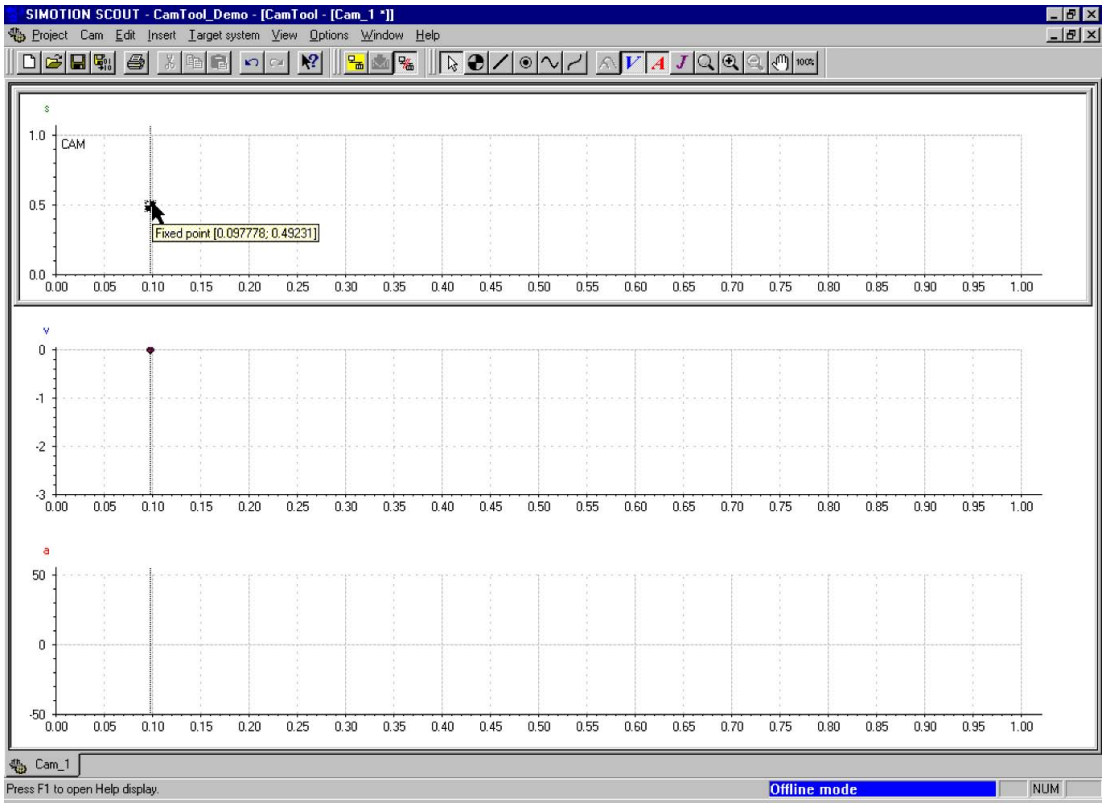

Figure 4-2 Insert fixed point

Notice

Once the function **Cam > Insert > Fixed point** is activated, you can insert fixed points in the S diagram (distance diagram) until

- you press the ESC key,
- you press the right mouse button (this activates the selection tool in the toolbar) or
- you activate another cam segment (straight line, sine curve, arc sine curve, interpolation point) for insertion.

4.3.3 Change fixed point position

Requirements

The cam is opened with SIMOTION CamTool.

Change fixed point position

To change the position of a fixed point:

1. Select the fixed point in the S diagram (distance diagram). The position of the fixed point shown in the tooltip.
2. Move the fixed point with drag&drop to the new position.

or

1. Double-click the fixed point. The **Fixed Point Properties** window appears.
2. Enter the new x- or y-position of the fixed point in the **Position** tab and click **OK**. The representation of the fixed point in the diagram will be updated and displayed at the new position.

4.3.4 Changing the velocity at the position of a fixed point:

Requirements

The cam is opened with SIMOTION CamTool.

Change velocity at fixed point

To change the velocity at the fixed point position:

1. The velocity at a fixed point position is represented by a handle in the V diagram (velocity diagram).

   Select the handle. The mouse pointer shows the direction in which you can move the handle.
2. Move the handle with drag&drop to the new position.

or

1. Double-click the fixed point. The **Fixed Point Properties** window appears.
2. Enter the new velocity as specified in the following table in the **Dynamic response** tab and click **OK**. The handle in the V diagram (velocity diagram) is shown at the new position.

Field/button	Explanation/instructions
v =	Under **v** =, the current velocity at the position of the fixed point is displayed. (see note below)
a = (manual input activated)	Under **a** =, the current acceleration at the position of the fixed point is displayed. If **Manual input** is deactivated, the acceleration value is calculated by the system. The jerk diagram (J diagram) is smooth at the position of the fixed point. If **Manual input** is activated, you can enter an acceleration value. To change the acceleration, enter the new acceleration under **a** = and click **Accept** or **OK**. The display of the fixed point in the diagrams is refreshed.
Manual input	If you activate **Manual input**, you can enter an acceleration value under **a** =. If you deactivate **Manual input**, the acceleration value is calculated by the system. The jerk diagram (J diagram) is smooth at the position of the fixed point.

Notice

To specify an absolute slave velocity, you must select an absolute **master velocity for calculations** in the **Simulation Settings** window.

4.3.5 Changing the acceleration at a fixed point position:

Requirements

The cam is opened with SIMOTION CamTool.

Change acceleration at fixed point

To change the acceleration at the fixed point position:

1. Right-click the fixed point and select **Direct entry for acceleration** in the displayed context menu.
2. The acceleration at a fixed point position is represented by a handle in the A diagram (acceleration diagram).

   Select the handle. The mouse pointer shows the direction in which you can move the handle.
3. Move the handle with drag&drop to the new position.

or

1. Double-click the fixed point. The **Fixed Point Properties** window appears.
2. In the **Dynamic response** tab, activate the option **Manual input** and enter the new acceleration.
3. Click **OK**. The handle in the A diagram (acceleration diagram) is shown at the new position.

Notice

To specify an absolute slave acceleration, you must select an **absolute master velocity for calculations** in the **Simulation Settings** window.

4.3.6 Delete fixed point

Requirements

The cam is opened with SIMOTION CamTool.

Delete fixed point

To delete a fixed point:

1. Select the fixed point that you want to delete.
2. Press the DEL key. The fixed point is deleted and the representation of the cam adjusted in all diagrams.

4.4 Straight line

4.4.1 Definition straight line

Definition

The cam consists of individual cam segments. Under SIMOTION CamTool, you can use fixed points, straight lines, sine curves, arc sine curves and interpolation points as cam segments.

A straight line defines a synchronous distance in the cam. You can specify the velocity along the straight line.

4.4.2 Insert straight line

Requirements

The cam is opened with SIMOTION CamTool.

Insert straight line

To insert a straight line:

1. Click in the S diagram (distance diagram) to activate the diagram.
2. Click **Straight line** under menu **Cam > Insert**. The mouse pointer changes.

   With the changed mouse pointer, click the position in the S diagram (distance diagram) at which you want to insert the straight line. The straight line is inserted with a default size.

   The current position of the straight line is shown in the tooltip.

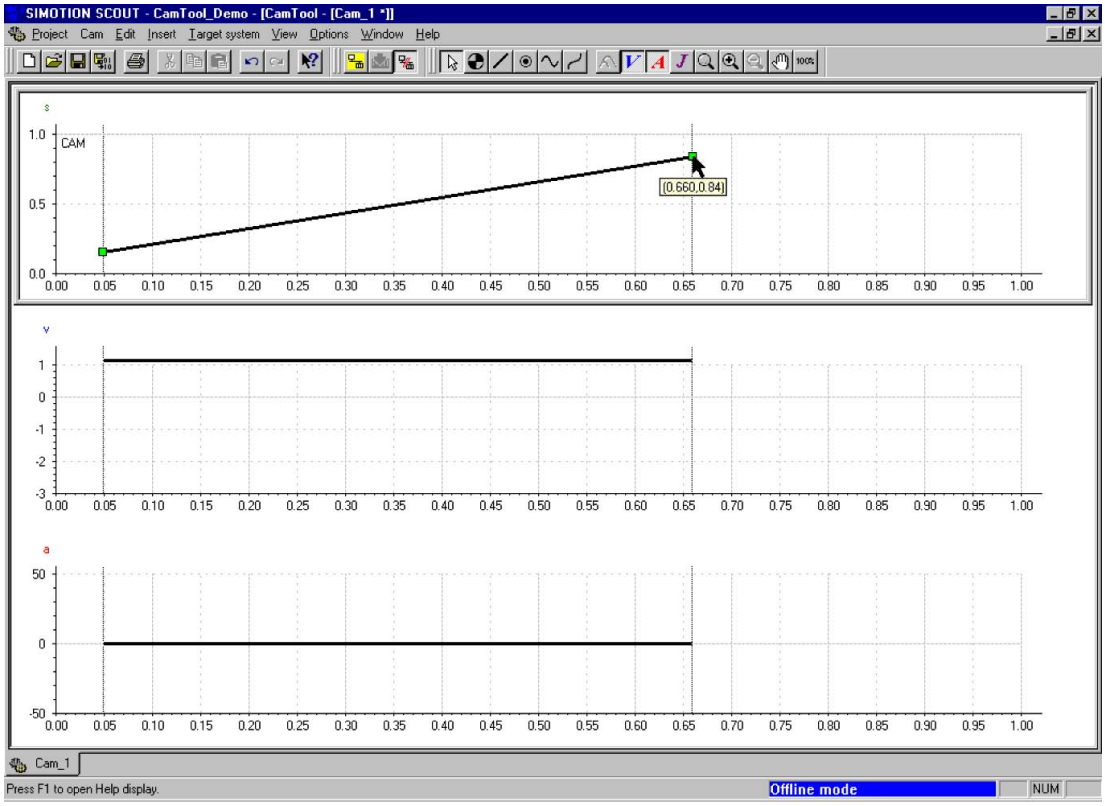

Figure 4-3 Insert straight line

Notice

Once the function **Cam > Insert > Straight line** is activated, you can insert straight lines in the S diagram (distance diagram) until

- you press the ESC key,
- you press the right mouse button (this activates the selection tool in the toolbar) or
- you activate another cam segment (fixed point, sine curve, arc sine curve, interpolation point) for insertion.

4.4.3 Change straight line position

Requirements

The cam is opened with SIMOTION CamTool.

Change straight line position

To change the position of a straight line:

1. Select the straight line in the S diagram (distance diagram). The position of the straight line is shown in the tooltip.
2. The straight line is shown with handles. Move the handles of the straight line with drag&drop to the new positions.

or

1. Select the straight line in the S diagram (distance diagram). The position of the straight line is shown in the tooltip.
2. Move the whole straight line with drag&drop to the new position.

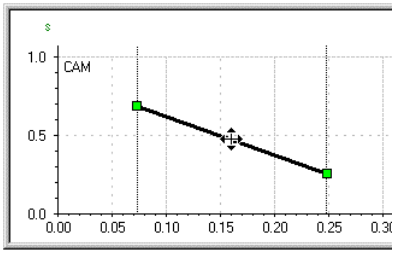

Figure 4-4 Change the position of all straight lines

or

1. Double-click the straight line. The **Straight Line Properties** window appears.
2. Enter the new positions in the **Position** tab (left: x1 and y1, right: x2 and y2), and click **OK**. The representation of the straight lines in the diagram will be updated and displayed at the new positions.

4.4.4 Changing the velocity along a straight line

Requirements

The cam is opened with SIMOTION CamTool.

Change velocity along a straight line

To change the velocity along a straight line:

1. The velocity along a straight line is represented by a line in the V diagram (velocity diagram).

   Select the line. The mouse pointer shows the direction in which you can move the line.

2. Move the line with drag&drop to the new position. The S diagram (distance diagram) is automatically adjusted.

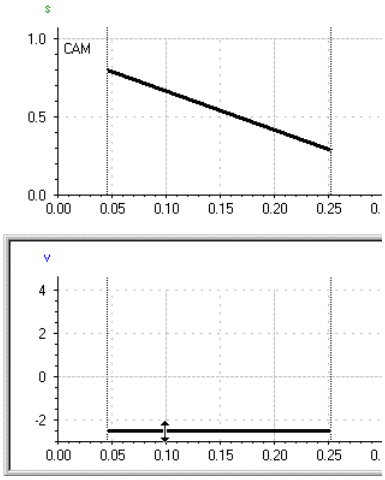

Figure 4-5 Changing the velocity along a straight line

or

1. Double-click the straight line. The **Straight Line Properties** window appears.
2. Enter the new velocity in the **Dynamic response** tab and click **OK**. The line in the V diagram (velocity diagram) is shown at the new position. The S diagram (distance diagram) is automatically adjusted.

Notice

To specify an absolute slave velocity, you must select an **absolute master velocity for calculations** in the **Simulation Settings** window.

4.4.5 Delete straight line

Requirements

The cam is opened with SIMOTION CamTool.

Deleting a straight line

To delete a straight line:

1. Select the straight line that you want to delete.
2. Press the DEL key. The straight line is deleted and the representation of the cam adjusted in all diagrams.

4.5 Sine curve

4.5.1 Insert sine curve

Requirements

The cam is opened with SIMOTION CamTool.

Insert sine curve

To insert a sine curve:

1. Click in the S diagram (distance diagram) to activate the diagram.
2. Click **Sine** under menu **Cam > Insert > Functions**. The mouse pointer changes.
3. With the changed mouse pointer, click the position in the S diagram (distance diagram) at which you want to insert the sine curve. The sine curve is inserted with a default size.

The current position of the sine curve is shown in the tooltip.

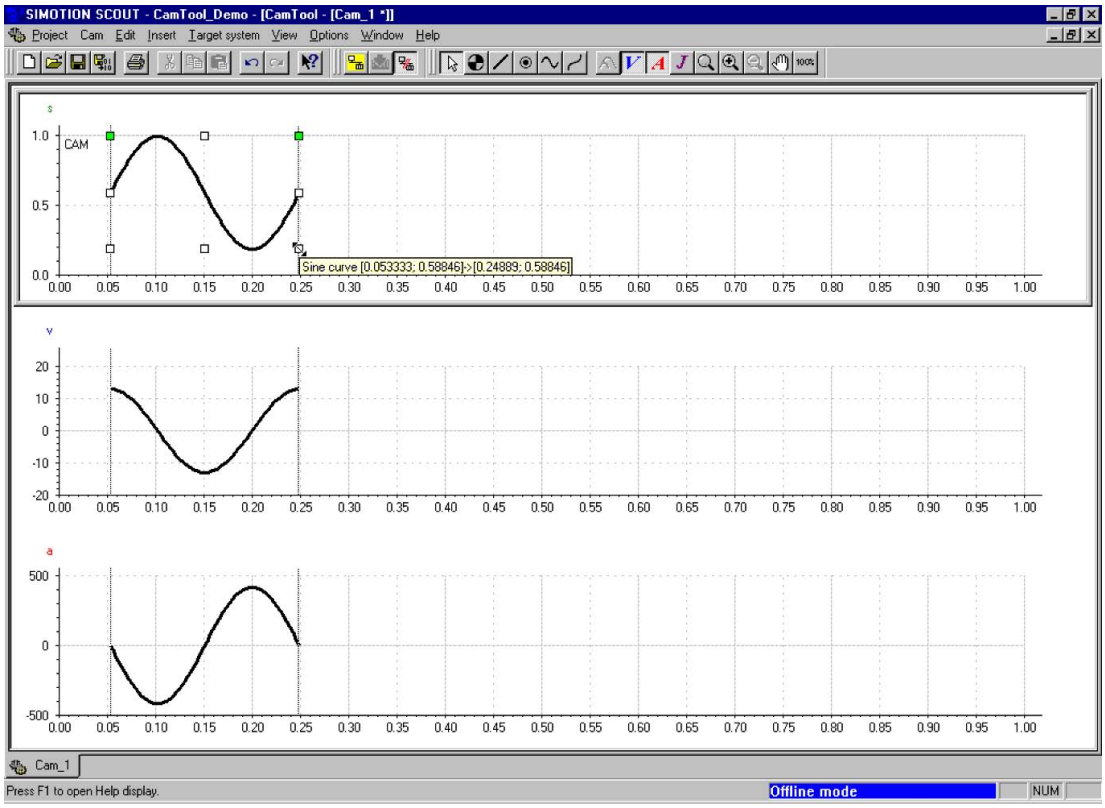

Figure 4-6 Insert sine curve

Notice

Once the function **Cam > Insert > Sine** is activated, you can insert sine curves in the S diagram (distance diagram) until

- you press the ESC key,
- you press the right mouse button (this activates the selection tool in the toolbar) or
- you activate another cam segment (fixed point, straight line, arc sine curve, interpolation point) for insertion.

4.5.2 Change sine curve position

Requirements

The cam is opened with SIMOTION CamTool.

Change sine curve position

To change the position of a sine curve:

1. Select the sine curve in the S diagram (distance diagram).

   The current position of the sine curve is shown in the tooltip.
2. The sine curve is shown with handles. Point to a handle. The mouse pointer shows the direction in which you can move the handle.
3. Move the handles with drag&drop to the new positions.

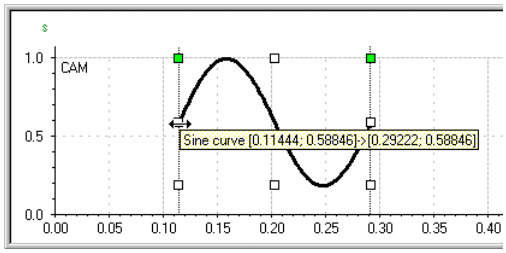

Figure 4-7 Change sine curve position

or

1. Select the sine curve in the S diagram (distance diagram).

   The current position of the sine curve is shown in the tooltip.
2. Move the whole sine curve with drag&drop to the new position.

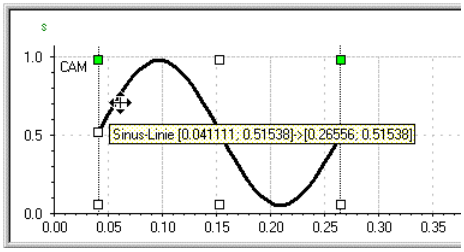

Figure 4-8 Changing the position of the complete sine curve

or

1. Double-click the sine curve. The **Fx Sine Properties** window appears.

2. Enter the new position in the **Position** tab and click **OK**. The sine curve is shown at the new position.

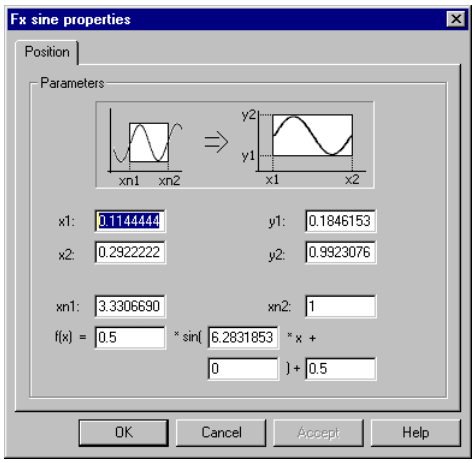

Figure 4-9 Position (Fx Sine Properties) tab

4.5.3 Change sine curve definition range

Requirements

The cam is opened with SIMOTION CamTool.

Change sine curve definition range

To change the definition range of a sine curve:

1. Select the sine curve in the S diagram (distance diagram).

   The current position of the sine curve is shown in the tooltip.

2. The sine curve is shown with handles. The handles for the definition range are shown in green. Point to a green handle. The mouse pointer shows the direction in which you can move the handle.

3. Move the green handles with drag&drop to the new positions. While moving, the current value of the respective limit of the definition range is displayed in the tooltip.

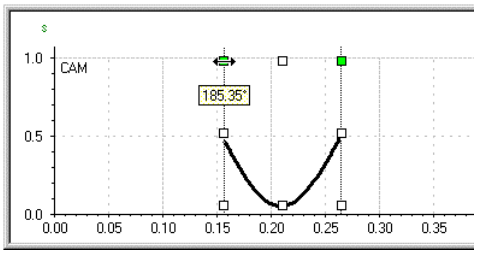

Figure 4-10 Change sine curve definition range

4.5.4 Delete sine curve

Requirements

The cam is opened with SIMOTION CamTool.

Delete sine curve

To delete a sine curve:

1. Select the sine curve that you want to delete.
2. Press the DEL key. The sine curve is deleted and the representation of the cam adjusted in all diagrams.

4.6 Arc Sine Curve

4.6.1 Insert arc sine curve

Requirements

The cam is opened with SIMOTION CamTool.

Notice

The arc sine curve is calculated as an interpolation point table. The number of interpolation points can be specified in the **Fx Arc Sine Properties** window. Double-click the arc sine curve to show the window.

Insert arc sine curve

To insert an arc sine curve:

1. Click in the S diagram (distance diagram) to activate the diagram.
2. Click **Arc sine** under menu **Cam > Insert > Functions**. The mouse pointer changes.
3. With the changed mouse pointer, click the position in the S diagram (distance diagram) at which you want to insert the arc sine curve. The arc sine curve is inserted with a default size.

The current position of the arc sine curve is shown in the tooltip.

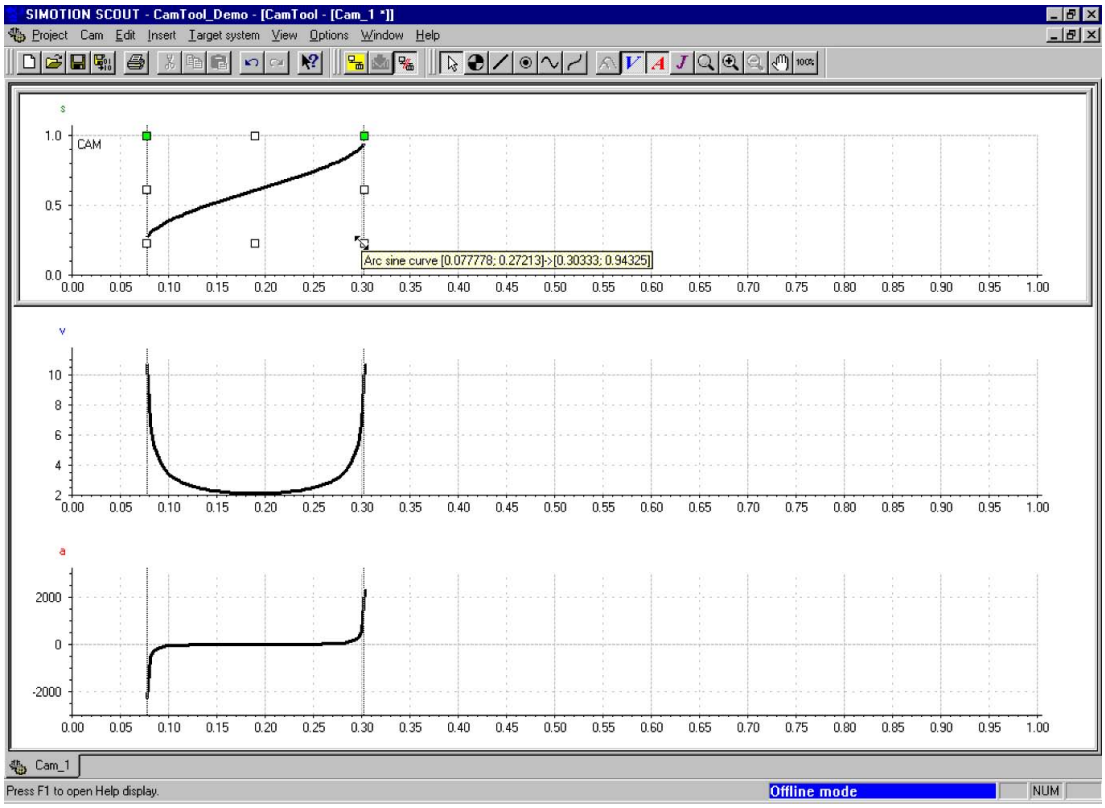

Figure 4-11 Insert arc sine curve

Notice

Once the function **Cam > Insert > Arc sine** is activated, you can insert arc sine curves in the S diagram (distance diagram) until

- you press the ESC key,
- you press the right mouse button (this activates the selection tool in the toolbar) or
- you activate another cam segment (fixed point, straight line, sine curve, interpolation point) for insertion.

4.6.2 Change arc sine curve position

Requirements

The cam is opened with SIMOTION CamTool.

Change arc sine curve position

To change the position of an arc sine curve:

1. Select the arc sine curve in the S diagram (distance diagram).

   The current position of the arc sine curve is shown in the tooltip.
2. The arc sine curve is shown with handles. Point to a handle. The mouse pointer shows the direction in which you can move the handle.
3. Move the handles with drag&drop to the new positions.

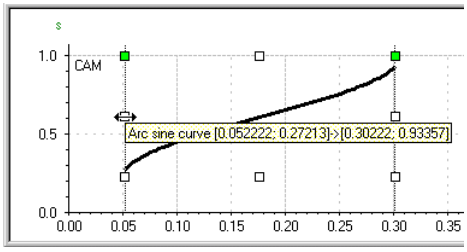

Figure 4-12 Change arc sine curve position

or

1. Select the arc sine curve in the S diagram (distance diagram).

   The current position of the arc sine curve is shown in the tooltip.
2. Move the whole arc sine curve with drag&drop to the new position.

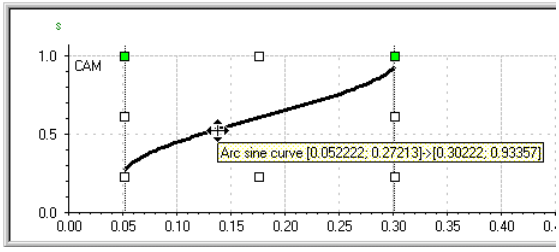

Figure 4-13 Changing the position of the complete arc sine curve

or

1. Double-click the sine curve.

   The **Fx Arc Sine Properties** window appears.

2. Enter the new position and the number of interpolation points in the **Position** tab and click OK. The arc sine curve is shown at the new positions. The arc sine curve is saved by the system as an interpolation point table.

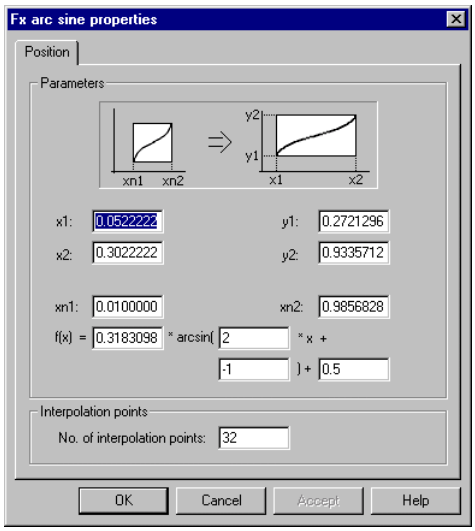

Figure 4-14 Position tab

4.6.3 Change arc sine curve definition range

Requirements

The cam is opened with SIMOTION CamTool.

Change arc sine curve definition range

To change the definition range of an arc sine curve:

1. Select the arc sine curve in the S diagram (distance diagram).

   The current position of the arc sine curve is shown in the tooltip.

2. The arc sine curve is shown with handles. The handles for the definition range are shown in green. Point to a green handle. The mouse pointer shows the direction in which you can move the handle.

3. Move the green handles with drag&drop to the new positions. While moving, the current value of the respective limit of the definition range is displayed in the tooltip.

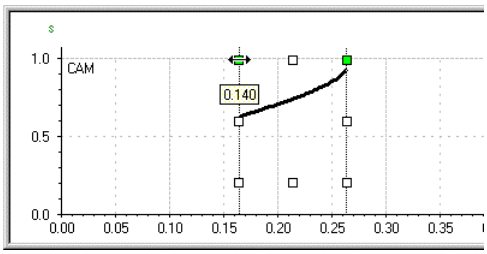

Figure 4-15 Change arc sine curve definition range

4.6.4 Delete arc sine curve

Requirements

The cam is opened with SIMOTION CamTool.

Delete arc sine curve

To delete an arc sine curve:

1. Select the arc sine curve that you want to delete.
2. Press the DEL key. The arc sine curve is deleted and the representation of the cam adjusted in all diagrams.

4.7 Interpolation point

4.7.1 Interpolation Point Definition

Definition

The cam consists of individual cam segments. Under SIMOTION CamTool, you can use fixed points, straight lines, sine curves, arc sine curves and interpolation points as cam segments.

An interpolation point is a specified position in the S diagram (distance diagram).

4.7.2 Insert interpolation point

Requirements

The cam is opened with SIMOTION CamTool.

Notice

With a fixed point, you define a single fixed position. The transitions between adjacent cam segments are optimally calculated by CamTool.

If you want to specify an arbitrary characteristic, you must use interpolation points. The interpolation points are connected by CamTool with cubic splines in order to generate a curve specified by the interpolation points which is as exact as possible.

Insert interpolation point

To insert an interpolation point:

1. Click in the S diagram (distance diagram) to activate the diagram.
2. Click **Interpolation point** under menu **Cam > Insert.** The mouse pointer changes.
3. With the changed mouse pointer, click the position in the S diagram (distance diagram) at which you want to insert the interpolation point.

The interpolation point is displayed in the diagram. The position of the interpolation point is shown in the tooltip.

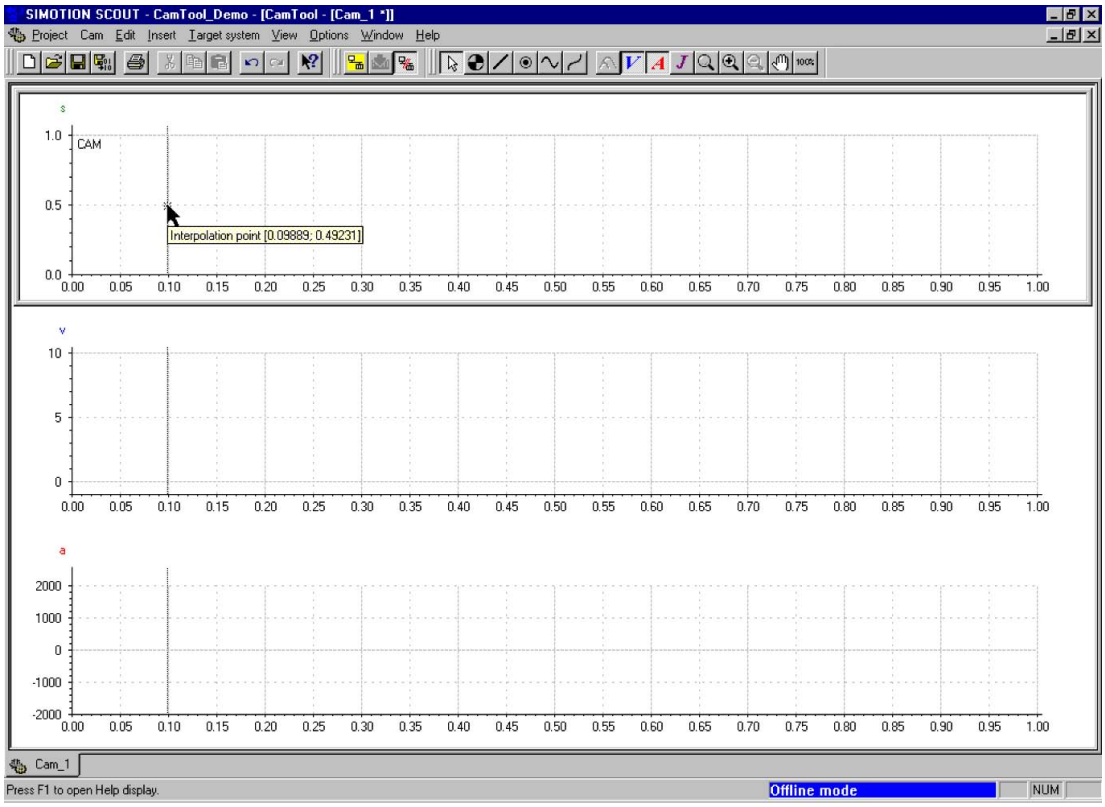

Figure 4-16 Insert interpolation point

Notice

Once the function **Cam > Insert > Interpolation point** is activated, you can insert interpolation points in the S diagram (distance diagram) until

- you press the ESC key,
- you press the right mouse button (this activates the selection tool in the toolbar) or
- you activate another cam segment (fixed point, straight line, sine curve, arc sine curve) for insertion.

4.7.3 Changing the interpolation point position

Requirements

The cam is opened with SIMOTION CamTool.

Changing an Interpolation Point Position

To change the position of an interpolation point:

1. Select the interpolation point in the S diagram (distance diagram). The position of the interpolation point is shown in the tooltip.
2. Move the interpolation point with drag&drop to the new position.

or

1. Double-click the interpolation point. The Interpolation Point Properties window appears.
2. Enter the new position in the **Position** tab and click **OK**. The interpolation point is displayed at the new position.

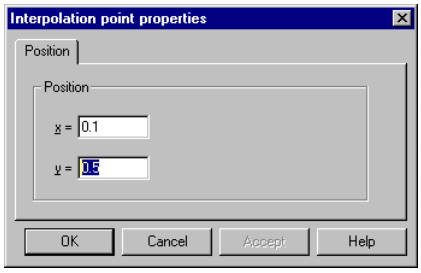

Figure 4-17 Position tab

4.7.4 Delete interpolation point

Requirements

The cam is opened with SIMOTION CamTool.

Delete interpolation point

To delete an interpolation point:

1. Select the interpolation point that you want to delete.
2. Press the DEL key. The interpolation point is deleted and the representation of the cam adjusted in all diagrams.

4.8 Optimizing a Cam

4.8.1 Optimizing a Cam

Introduction

Create the cam in the S diagram (distance diagram). The curve represents the path-related dependency between the master axis (X-axis in the diagram) and the slave axis (Y-axis in the diagram).

Structure of a cam

The cam consists of individual cam segments.

Under SIMOTION CamTool, you can use fixed points, straight lines, sine curves, arc sine curves and interpolation points as cam segments.

SIMOTION CamTool calculates interpolation curves between the individual cam segments and displays the V diagram (velocity diagram), the A diagram (acceleration diagram) and the J diagram (jerk diagram).

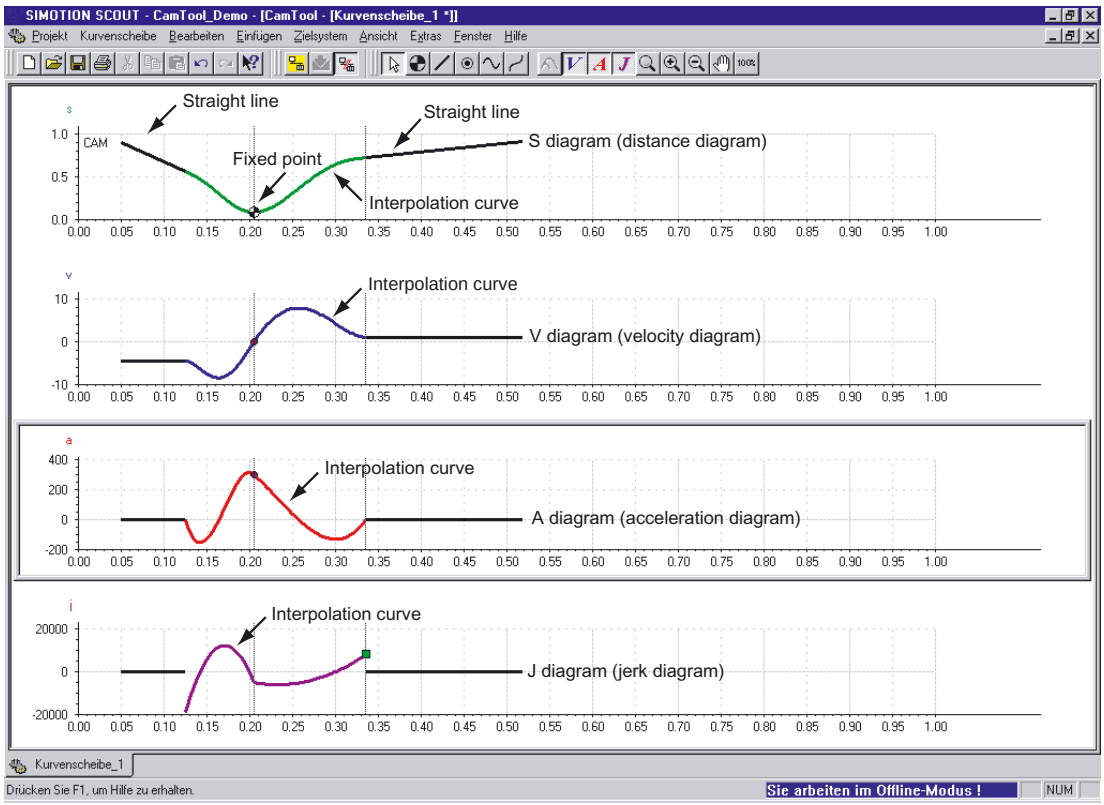

Figure 4-18 Example of a cam with interpolation curves

4.8.2 Optimize transition

Requirements

The cam is opened with SIMOTION CamTool.

Optimize transition

To optimize a transition:

1. Right-click the transition that you want to optimize and select **Properties** in the displayed context menu.

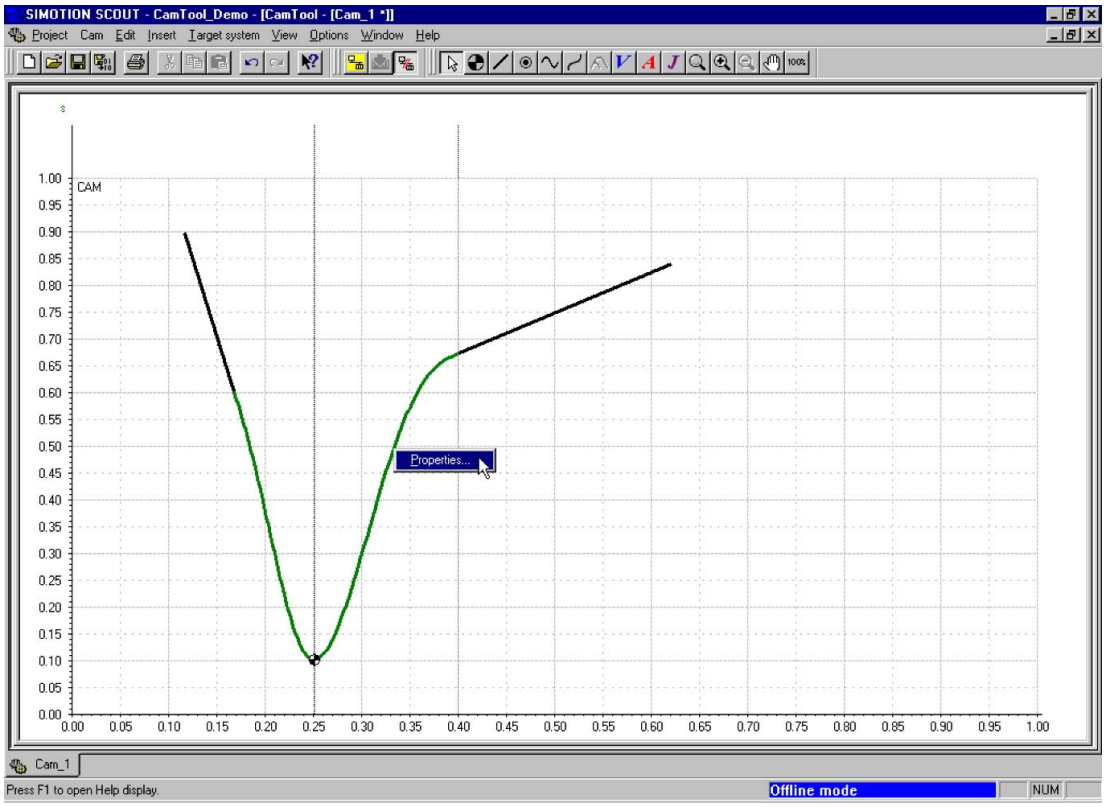

Figure 4-19 Selecting the transition to be optimized

2. The **Interpolation Curve Properties** window appears. Specify the parameters in the **Type** tab.
3. Click the **Parameters** tab and specify the parameters.

4. Click the **Limits** tab to display the minimum and maximum values of the interpolation curve.

Notice

For the slave axis, you can take over the settings of an axis already existing in the project via the menu **Cam > Simulation settings** and specify the limits of the axis. These simulation settings for the slave axis are used for the calculation of the percentage values which are displayed in the **Limits** tab.

---

or

1. Use the handles, which are dependent on the settings in the **Interpolation Curve Properties** window, to optimize the cam.
2. The mouse pointer shows the direction in which you can move the handle.
3. Move the handle with drag&drop to the new position. The display of the cam is adjusted in all diagrams.

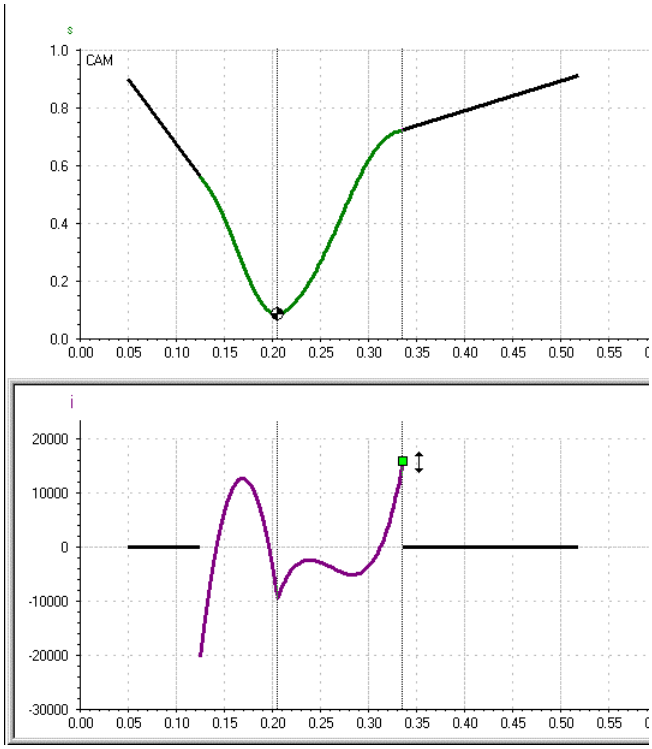

Figure 4-20 Optimizing a cam with handle using drag&drop

4.8.3 Interpolation Curve properties

Type

You can specify the **type** of the interpolation curve for the transition here.

You can set the following parameters:

Table 4-1 Parameters in the Type tab (Interpolation Curve Properties window)

Field/button		Explanation/instructions
Transition		The type of transition is displayed here.
Allow interpolation by target device		If you activate this option, the system does not generate an interpolation curve. The transition is interpolated by the target device. The representation of the transition is refreshed in the diagrams when you click Accept or OK.
Optimize for (allow interpolation by target device deactivated)		
	Do not optimize	If you select this option, all the interpolation curves which are suitable for the transition are displayed under Applicable motion rules.
	Velocity	If you select this option, all the interpolation curves which are suitable for the transition for the optimization of the velocity are displayed under Applicable motion rules.
	Acceleration	If you select this option, all the interpolation curves which are suitable for the transition for the optimization of the acceleration are displayed under Applicable motion rules.
	Jerk	If you select this option, all the interpolation curves which are suitable for the transition for the optimization of the jerk are displayed under Applicable motion rules.
Applicable motion rules (allow interpolation by target device deactivated)		The applicable motion rules are displayed here. Select the motion rule that you want to use for the transition. The representation of the transition is refreshed in the diagrams when you click Accept or OK. Depending on the motion rule used, you can specify further parameters in the Parameters tab.

Parameters

You can specify the **parameters** of the interpolation curve for the transition here.

You can set the following parameters:

Table 4-2 Parameters in the Parameters tab (Interpolation Curve Properties window)

Field/button		Explanation/instructions
Jerk at boundary point (allow interpolation by target device deactivated) (for 6th degree polynomial)		
	Automatically	If you activate **Automatically**, the jerk value at the boundary points is calculated by the system. A polynomial of the 5th degree is used for the calculation. **Note:** You can activate this function via the context menu in the diagram representation: Right-click the transition and select **Automatic jerk characteristic** in the context menu.
	Left (automatically deactivated)	If you activate **Left**, you can specify the jerk at the left boundary point of the interpolation curve. Enter the jerk value in the input field.
	Right (automatically deactivated)	If you activate **Right**, you can specify the jerk at the right boundary point of the interpolation curve. Enter the jerk value in the input field.
	(Jerk value) (automatically deactivated)	If you activate the option **Left** or the option **Right**, you can enter the jerk value here. **Note**: To specify an absolute jerk value, you must select an absolute **master velocity for calculations** in the **Simulation Settings** window.
Curve point of inflexion (allow interpolation by target device deactivated) (for inclined sine curve) (for modified sine curve) (for modified acceleration trapezoid) (for harmonic combination)		
	Valid values are between 0 and 1	You can enter the turning point of the curve here.
	Optimum value	If you click this button, the **optimum value** for the turning point of the curve is calculated by the system and entered under **Valid values are between 0 and 1**. **Note**: You can activate this function via the context menu in the diagram representation: Right-click the transition and select **Optimum value** in the context menu.

Limit values

The **limits** of the interpolation curve for the transition are displayed here.

You can set the following parameters:

Table 4-3 Parameters in the Type tab (Interpolation Curve Properties window)

Field/button		Explanation/instructions
Position		
	Min	The minimum value is displayed here as absolute value and as percentage value depending on the physical limit. If the physical limit is undershot, the minimum value is displayed with a red background.
	Max	The maximum value is displayed here as absolute value and as percentage value depending on the physical limit. If the physical limit is exceeded, the maximum value is displayed with a red background.
Velocity		
	Min	The minimum value is displayed here as absolute value and as percentage value depending on the physical limit. If the physical limit is undershot, the minimum value is displayed with a red background.
	Max	The maximum value is displayed here as absolute value and as percentage value depending on the physical limit. If the physical limit is exceeded, the maximum value is displayed with a red background.
Acceleration (v > 0)		
	Min	The minimum value is displayed here as absolute value and as percentage value depending on the physical limit. If the physical limit is undershot, the minimum value is displayed with a red background.
	Max	The maximum value is displayed here as absolute value and as percentage value depending on the physical limit. If the physical limit is exceeded, the maximum value is displayed with a red background.
Acceleration (v < 0)		
	Min	The minimum value is displayed here as absolute value and as percentage value depending on the physical limit. If the physical limit is undershot, the minimum value is displayed with a red background.
	Max	The maximum value is displayed here as absolute value and as percentage value depending on the physical limit. If the physical limit is exceeded, the maximum value is displayed with a red background.

Field/button		Explanation/instructions
Jerk (v > 0)		
	Min	The minimum value is displayed here as absolute value and as percentage value depending on the physical limit. If the physical limit is undershot, the minimum value is displayed with a red background.
	Max	The maximum value is displayed here as absolute value and as percentage value depending on the physical limit. If the physical limit is exceeded, the maximum value is displayed with a red background.
Jerk (v < 0)		
	Min	The minimum value is displayed here as absolute value and as percentage value depending on the physical limit. If the physical limit is undershot, the minimum value is displayed with a red background.
	Max	The maximum value is displayed here as absolute value and as percentage value depending on the physical limit. If the physical limit is exceeded, the maximum value is displayed with a red background.

Notice

For the slave axis, you can take over the settings of an axis already existing in the project via the menu Cam > Simulation settings and specify the limits of the axis. These simulation settings for the slave axis are used for the calculation of the percentage values which are displayed in the Limits tab.

4.9 Specify parameters for target device

4.9.1 Specify parameters for target device

Via the parameters for the target device, you can adjust the cam to the SIMOTION device (e.g. scale cam).

Requirements

The cam is opened with SIMOTION CamTool.

Specify parameters for target device

To specify the parameters for the target device:

1. Click a diagram to show the **Cam** menu.
2. Click the menu **Cam > Target device parameters**. The **Target Device Parameters** window appears.

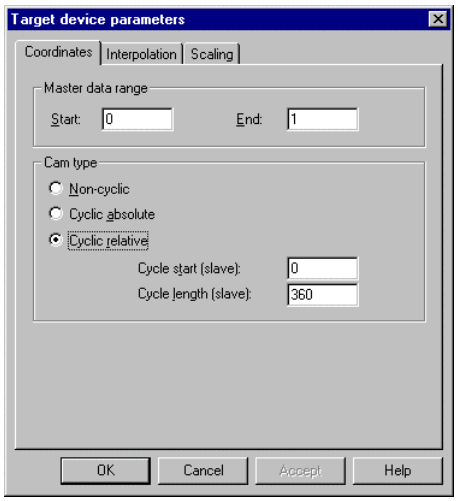

Figure 4-21 Target Device Parameters window

3. Specify the parameters in the **Coordinates** tab.
4. Click the **Interpolation** tab and specify the parameters.
5. Click the **Scaling** tab and specify the parameters.

Notice

If you specify a scaling, you can show and hide the scaled curve via the menu **Cam > Representation parameters > Display scaling**.

If the scaled curve is displayed, you cannot edit the original curve in the diagram displays.

4.9.2 Target device parameters

coordinates

Specify the **coordinates** for the target device here.

You can set the following parameters:

Table 4-4 Parameters in the Coordinates tab (Target Device Parameters window)

Field/button		Explanation/instructions
Master Range		You specify the **master range** (definition range) of the curve via start and end points. Cam segments must lie within this master range (see also **Master range** under **S Diagram (Master) properties**).
	Start	Enter the **start** point of the curve, or the start of the master range of the curve here.
	End	Enter the **end** point of the curve, or the end of the master range of the curve here.
Execution type		The **Execution type** specifies the interpolation of the cam by the target device at the boundary points of the master range.
	Non-cyclic	If you select the **Non-cyclic** execution type. The cam cycle ends when the end value of the curve is reached. The function values of the cam (slave position) at the start and end point of the master range are normally different. **Note:** If you activate **Non-cyclic**, the master range in the horizontal direction is displayed once.
	Cyclic absolute	If you select the **cyclic absolute** execution type, a return is made from the end value of the slave axis to the start point of the slave axis and the cam is repeated. The function values of the cam (slave position) at the start and end point of the master range are identical. Possibly an identical value (average value) is forced from the target device. **Note**: If you activate **Cyclic absolute**, the master range in the horizontal direction can be displayed repeatedly.

Field/button			Explanation/instructions
	Cyclic relative		If you select the **cyclic relative** execution type, the cam will be repeated starting at the end value of the slave axis. The first derivation of the cam (velocity) in the start and end point of the master range are identical. Possibly an identical value (average value) is forced from the target device. **Note:** If you activate **Cyclic relative**, the master range in the horizontal and vertical direction can be displayed repeatedly. You can optimize the display via the parameters **Cycle start (slave)** and **Cycle length (slave)**.
		Cycle start (slave)(Cyclic relative activated)	Under **Cycle start (slave)**, enter the start point for the display in the vertical direction.
		Cycle length (slave)(Cyclic relative activated)	Under **Cycle length (slave)**, enter the length of the displayed range in the vertical direction.

Interpolation

Specify the **interpolation** for the target device here.

You can set the following parameters:

Table 4-5 Parameters in the Interpolation tab (Target Device Parameters window)

Field/button			Explanation/instructions
Interpolation type			The curve in the master range can be made up of individual segments. Gaps may occur between the curve segments. If the gaps are greater than the maximum specified gap size, interpolation for the target device is performed between the end points of the curve segments. Under **Interpolation type**, specify the type of target device for which the interpolation is to be performed between the gaps.
	Linear		If you select the interpolation type **Linear**, there is a smooth closure of the gap through the insertion of a straight line segment between the interpolation points.
	Cubic splines		If you select the interpolation type **Cubic splines**, there is a smooth differentiable closure of the gap. The curve runs through the specified interpolation points.
	Bezier splines		If you select the interpolation type **Bezier splines**, the approximation curve runs along the specified interpolation points.
With gaps up to			
	Master		
		Leave gaps	Gaps may occur between the curve segments of the master axis. Here you can specify up to which size the gaps are maintained.
		Merge points	Gaps may occur between the curve segments of the master axis. Here you can specify up to which size the gaps are closed by merging the end points.
	Slave		
		Leave gaps	Gaps may occur between the curve segments of the slave axis. Here you can specify up to which size the gaps are maintained.
		Merge points	Gaps may occur between the curve segments of the slave axis. Here you can specify up to which size the gaps are closed by merging the end points.

Scaling

You can specify the **scaling** for the target device here.

Notice

To display the scaled curve, select menu **Cam > Representation parameters > Display scaling**.

If the scaled curve is displayed, you cannot edit the original curve. To edit the original curve again, reselect menu **Cam > Representation parameters > Display scaling**.

You can set the following parameters:

Table 4-6 Parameters in the Scaling tab (Target Device Parameters window)

Field/button			Explanation/instructions
Master axis			
	Basic scaling		Enter the **basic scaling** of the master axis here. The center of the scaling is always the coordinate origin. **Note**: Do not use any scaling values which are greater than 5. Greater values cause a roughness in the curve characteristic.
	Scalings		You can specify the **scalings** of two ranges of the master axis here. The center of the scaling is the start point of the scaling range. **Note**: If you specify two ranges, the ranges cannot overlap.
		(Range1)	Under **From** and **To**, enter the range that you want to scale. Under **Factor**, enter the scaling factor. **Note**: Do not use any scaling values which are greater than 5. Greater values cause a roughness in the curve characteristic.
		(Range2)	Under **From** and **To**, enter the range that you want to scale. Under **Factor**, enter the scaling factor. **Note**: Do not use any scaling values which are greater than 5. Greater values cause a roughness in the curve characteristic.
	Offset		You can enter a factor for the **offset** of the master axis here. If you have specified a scaling, the offset applies to the scaled curve. If you have not specified a scaling, the offset applies to the unscaled curve.

Field/button			Explanation/instructions
Slave axis			
	Basic scaling		Enter the **basic scaling** of the slave axis here. The center of the scaling is always the coordinate origin. **Note**: Do not use any scaling values which are greater than 5. Greater values cause a roughness in the curve characteristic.
	Scalings		You can specify the **scalings** of two ranges of the slave axis here. The center of the scaling is the start point of the scaling range. **Note**: If you specify two ranges, the ranges cannot overlap.
		(Range1)	Under **From** and **To**, enter the range that you want to scale. Under **Factor**, enter the scaling factor. **Note**: Do not use any scaling values which are greater than 5. Greater values cause a roughness in the curve characteristic.
		(Range2)	Under **From** and **To**, enter the range that you want to scale. Under **Factor**, enter the scaling factor. **Note**: Do not use any scaling values which are greater than 5. Greater values cause a roughness in the curve characteristic.
	Offset		You can enter a factor for the **offset** of the slave axis here. If you have specified a scaling, the offset applies to the scaled curve. If you have not specified a scaling, the offset applies to the unscaled curve.

4.10 Specify simulation settings

4.10.1 Specify simulation settings

You can take over the axis settings of the master and slave axes from the axes configured in the SCOUT project or specify them independently.

Requirements

The cam is opened with SIMOTION CamTool.

Specify simulation settings

To specify the simulation settings:

1. Click a diagram to show the **Cam** menu.
2. Click the menu Cam > Simulation settings. The Simulation Settings window appears.

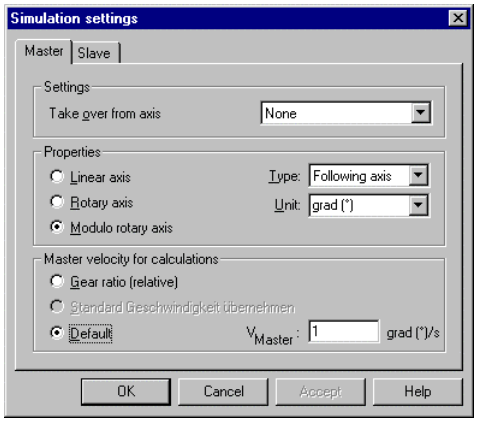

Figure 4-22 Simulation Settings window

3. Specify the parameters in the **Master** tab.
4. Click the **Slave** tab and specify the parameters.

4.10.2 Simulation settings

Master tab

You specify here the simulation settings for the **Master** tab.

You can set the following parameters:

Table 4-7 Parameters in the Master tab (Simulation Settings window)

Field/button		Explanation/instructions
Setting		
	Accept from axis	• **(Axis)** When you create the cam for an axis that already exists in the project, you can select the axis here. The configured values are taken over and displayed. You can change the **master velocity for calculations**. • **(External encoder)** When you create the cam for an external encoder that already exists in the project, you can select the external encoder here. The configured values are taken over and displayed. • **None** If you select **None**, you can specify all parameters. • **Time axis** If you select **Time axis**, you can specify the **unit of measure** under **Properties**.
Properties (Setting: None) (Setting: Time axis)		
	Linear axis (Setting: None)	If you select this option, you simulate the master axis as a **linear axis**.
	Rotary axis (Setting: None)	If you select this option, you simulate the master axis as a **rotary axis**.
	Modulo rotary axis (Setting: None)	If you select this option, you simulate the master axis as a **modulo rotary axis**.
	Type (Setting: None)	Here you select the axis **type**.
	Unit of measure (Setting: None) (Setting: Time axis)	Here you specify the unit of measure for the axis. Select a unit of measure or enter the unit of measure. The representation of the unit of measure is refreshed in the diagrams when you click **Accept** or **OK**. **Note**: The unit of measure is only used for the display. If the unit of measure is changed, the represented values are not converted.

Field/button		Explanation/instructions
Master velocity for calculations (Setting (axis)) (Setting: None)		
	Gear ratio (relative)	If you activate this option, all calculations are based on relative values (values relative to the master axis).
	Use standard velocity (Setting (axis))	If you activate this option, the configured standard velocity of the axis which you specified under **Accept from axis** is accepted. All calculations are based on absolute values.
	User-defined	If you activate this option, you must enter a velocity under **V master**. All calculations are based on absolute values.
	V Master (User-defined activated)	If you activate user-defined, you must enter the master velocity under **V master**.

Slave tab

You specify here the simulation settings for the Slave tab.

You can set the following parameters:

Table 4-8 Parameters in the Slave tab (Simulation Settings window)

Field/button		Explanation/instructions
Setting		
	Accept from axis	• **(Axis)** When you create the cam for an axis that already exists in the project, you can select the axis here. The configured values are taken over and displayed. • **None** If you select **None**, you can specify all parameters.
Properties (Setting: None)		
	Linear axis	If you select this option, you simulate the slave axis as a **linear axis**.
	Rotary axis	If you select this option, you simulate the slave axis as a **rotary axis**.
	Modulo rotary axis	If you select this option, you simulate the slave axis as a **modulo rotary axis**.
	Type	Here you select the axis **type**.
	Unit of measure	Here you specify the unit of measure for the axis. Select a unit of measure or enter the unit of measure. The representation of the unit of measure is refreshed in the diagrams when you click **Accept** or **OK**. **Note**: The unit of measure is only used for the display. If the unit of measure is changed, the represented values are not converted.

Field/button		Explanation/instructions
Limit (Setting: None)		
	Minimum	Enter the **minimum** limit of the slave axis here.
	Maximum	Enter the **maximum** limit of the slave axis here.
Modulo values (Setting: None) (Simulation of slave axis as modulo rotary axis activated)		
	Base	If the simulation of slave axis as modulo rotary axis is activated, you must enter the modulo **base** here.
	Length	If the simulation of slave axis as modulo rotary axis is activated, you must enter the modulo **length** here.

4.11 Edit cam created with CamTool with CamEdit

Convert a cam created with CamTool for CamEdit

To edit a cam created with CamTool with CamEdit:

1. Close the cam in SIMOTION CamTool.
2. Find the cam that you want to edit with SIMOTION CamEdit in the project navigator.
3. Right-click the cam and select **Convert to CamEdit** in the displayed context menu. The cam is then opened the next time with SIMOTION CamEdit.

Notice

With SIMOTION CamEdit, you can edit all cams that contain only polynomials or only interpolation points. In general, those are all the cams created with SIMOTION CamTool that do not contain any cam segments with arc sine curves.

4.12 Export cam as text file

You can export a cam created with SIMOTION CamTool as a text file (e.g. to edit the cam in an external program).

Notice

The cam is shown in the text file in Microsoft Excel CSV format.

Export cam as text file

To export a cam as text file:

1. Open the cam with SIMOTION CamTool.
2. Click a diagram to show the **Cam** menu.
3. Click the menu **Cam > Export**. The file selection window is displayed.
4. Under **Save as**, select the destination for the text file and enter a name for the text file under **Name**.
5. Click **OK** in the file selection window. The cam is saved as a text file at the selected destination under the entered name.

4.13 Print cam

You can print a cam opened with SIMOTION CamTool via SIMOTION SCOUT. The individual parameters and the diagrams of the cam are printed.

Notice

The diagrams of the cam are printed as they are in the screen view.

Print cam

To print a cam:

1. Open the cam with SIMOTION CamTool.
2. Click a diagram to show the **Cam** menu.
3. Activate the diagrams that you want to display via the menu **Cam > Diagrams**. The diagrams are displayed.
4. Click the menu **Project > Print**. The printer selection window is displayed.
5. Specify the printer, printing range and number of copies.
6. Click **OK**. The cam is printed.

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