



RA CONSULTING GMBH

DiagRA[®] X Manual

For more information or help, visit our website at www.rac.de

© RA CONSULTING GMBH. ALL RIGHTS RESERVED.

RA Consulting reserves the right to make changes to information and/or data in this user documentation without prior notice. This documentation or extracts thereof may not be copied or reproduced in any form without prior written consent of **RA Consulting**. All technical data, texts, graphics, pictures and their design are, as far as legally permissible, protected by copyright. Any unauthorized use may violate copyright law and other applicable laws or regulations.

Copyright 2015-2022, RA Consulting GmbH. All rights reserved.

Preface

Dear DiagRA® X-User, you are in the DiagRA® X-User's Manual, which will help you with questions about use and set-up.

If you have any further questions, feedback or suggestions, please feel free to contact us at any time.

DiagRA® X Manual Version 1.13

Copyright © 2015–2022 RA Consulting GmbH, RA Automotive Products, Bruchsal

RA Consulting GmbH

Zeiloch 6a

D-76646 Bruchsal

Contact & product information

Tel.: +49 7251 9819-500

Fax: +49 7251 3266882

E-Mail: info@rac.de

Website: <http://www.rac.de>

Technical support

Tel.: +49 7251 9819-415

E-Mail: support@rac.de

FAQs: <http://wiki.rac.de>

Disclaimer

The use of this product is potentially dangerous. Therefore, please observe the following information.

Using this software, you are able to manipulate and control an electronic connected system. Your actions can result in severe personal or material damage.

Therefore, only qualified persons who are aware of the potential consequences of their actions with this software and those who have been adequately trained may use this software. Should any other persons utilize the software, RA Consulting GmbH shall not be liable for any error recovery or any warranty costs or liability beyond the purchase price of the software.

If the software is controlled through an automation interface or integrated into other systems, RA Consulting GmbH shall also not be liable for any error recovery or any warranty costs or liability beyond the purchase price, as we have no influence on possible erroneous implementations of this system.

If you do not accept these liability restrictions please return the software to us at our cost within one (1) month following the purchase. You will be reimbursed for the purchase price immediately.

1 Commissioning	1
1.1 System requirements	1
1.2 Installation	1
1.3 Registration	2
1.4 Database	4
1.5 Define physical interface	4
1.6 Creating a workspace	4
1.6.1 <i>Creating a workspace</i>	5
1.6.2 <i>Adding a workspace</i>	5
1.6.3 <i>Adding a description file</i>	5
1.6.4 <i>Selecting the physical connection</i>	5
1.7 Create experiment	5
1.7.1 <i>Adding experiments</i>	6
1.7.2 <i>Defining visualization</i>	6
1.7.3 <i>Selecting variables</i>	7
1.8 Connect	7
2 Operating concept	8
2.1 User interface	8
2.1.1 <i>Upper menu bar area</i>	9
2.1.2 <i>Variable Monitor area</i>	9
2.1.3 <i>Worksheet bar</i>	9
2.1.4 <i>Worksheet content area</i>	9
2.2 Upper menu bar	10
2.3 Visual operating elements	12
2.3.1 <i>Groupings</i>	14
3 Workspace	15
3.1 Manage workspaces	15
3.1.1 <i>Add a workspace or group</i>	15
3.1.2 <i>Import workspace</i>	16

3.1.3	<i>Exporting a workspace</i>	18
3.1.4	<i>Renaming a workspace</i>	19
3.1.5	<i>Duplicating a workspace</i>	20
3.1.6	<i>Deleting a workspace</i>	21
3.2	Sources in the workspace	23
3.2.1	<i>Add source</i>	23
3.2.2	<i>Delete source</i>	24
3.2.3	<i>Copy source</i>	26
3.2.4	<i>Select control unit for page management</i>	27
3.3	Source properties	28
3.3.1	<i>Description</i>	28
3.3.2	<i>Protocol</i>	29
3.3.3	<i>Connection</i>	29
3.4	Detailed information on CSM-devices	30
3.5	Protocol adjustments	30
3.5.1	<i>CAN configuration</i>	30
3.5.2	<i>CCP Configuration</i>	32
3.5.3	<i>Flash programming configuration</i>	33
3.5.4	<i>Calibration configuration</i>	34
3.5.5	<i>Serial configuration</i>	35
3.5.6	<i>XCP configuration</i>	35
3.5.7	<i>IP configuration</i>	37
3.5.8	<i>XETK configuration</i>	37
4	Experiment	42
4.1	Adding an experiment or a group	42
4.2	Importing experiments	43
4.3	Exporting experiments	44
4.4	Renaming experiments	46
4.5	Duplicating experiments	47
4.6	Deleting experiments	48

5 Worksheets and visualisers	51
5.1 Worksheet	51
5.2 Worksheet overview	51
5.3 Visualizers	51
5.4 View lock	52
5.5 Create worksheet	52
5.5.1 Arrangement	52
5.5.2 Templates and Visualizers	52
5.5.3 Edit mode	53
5.6 Visualiser types	54
5.6.1 Measurement value color	54
5.6.2 Measurement value details	55
5.6.3 Status texts from text tables	55
5.6.4 Section header	55
5.6.5 Bar graph	56
5.6.6 Numerical display	57
5.6.7 Oscilloscope	57
5.6.8 Icon Monitor	66
5.6.9 Table	68
5.6.10 Pointer instrument	68
5.6.11 Trace Visualizer	69
5.7 Variables monitor	71
5.8 Display Limits	71
6 Variable management	73
6.1 Visualization Bar	74
6.1.1 Adding measured quantities	74
6.1.2 Measurements Only	74
6.2 Variable groups	75
6.2.1 Filters	75
6.2.2 Sources	75

6.3 List of Variables	75
6.3.1 Selection	76
6.3.2 Search	76
6.3.3 Exporting and importing	76
6.4 Variable details	76
6.4.1 Display Limits	77
7 Virtual variables	78
7.1 Add virtual variable	78
7.2 Duplicate virtual variable	79
7.3 Remove virtual variable from all visualisers	81
7.4 Delete virtual variable	82
7.5 Edit virtual variables	83
7.5.1 Edit properties of a virtual variable	83
7.5.2 Edit the formula of a virtual variable	84
7.6 Functions	87
7.6.1 Function overview	87
7.6.2 Integral	89
7.6.3 Gradient	90
7.7 Data types and conversion	92
7.7.1 Signals and bit signals for virtual variables	92
7.7.2 Supported data types	92
7.8 Operators and constants	93
7.8.1 Operators	93
7.8.2 Constants	94
8 Measurement and recording	96
8.1 Measurements	96
8.2 Recording	96
8.3 Recording list	96
8.3.1 New configuration	97

8.3.2 Available configuration	97
8.3.3 Select configuration	98
8.3.4 Folder symbol	98
8.3.5 Settings	98
9 Event-based functions	99
9.1 Event configuration	100
9.2 Tool list	100
9.3 Recorder	101
9.3.1 Recorder information	101
9.3.2 Start trigger	101
9.3.3 Stop trigger	102
9.3.4 Series recording	102
9.3.5 Recorder comment	102
9.4 Actions	102
9.4.1 Create an action	102
9.4.2 Edit action	103
9.4.3 Action Pause oscilloscope	103
10 Managing binary data	105
10.1 Selecting active control device for the page change and comparative pages	105
10.2 Switching between work page and reference page	107
10.2.1 Synchronizing the work page with the control device	109
10.2.2 Writing the work page to the control device	110
10.2.3 Reading the memory page from the control device	111
10.2.4 Copying memory page content	113
10.3 Importing memory pages	114
10.4 Exporting memory pages	116
10.5 Block write access	117
10.6 Change history and change counter	118

11 Calibrating values	119
11.1 Manual calibration entry	119
11.2 Calibration using formula entries	120
11.3 Calibration in the characteristic map	121
11.3.1 <i>Calibrating values</i>	122
11.3.2 <i>Function overview of the characteristic map</i>	122
11.4 Calibrating within the calibration table	123
11.4.1 <i>Calibrating values</i>	123
11.4.2 <i>Function overview of the calibration table</i>	124
11.5 Calibrating in the calibration diagram	124
11.5.1 <i>Calibrating values</i>	125
11.5.2 <i>Calibrating using drag and drop function</i>	125
11.5.3 <i>Axis zoom</i>	126
11.5.4 <i>Resetting areas</i>	126
11.5.5 <i>Show surface</i>	127
11.5.6 <i>Show all lines</i>	127
11.6 Configuring calibrations in the system settings	128
11.6.1 <i>Checking the memory pages</i>	128
11.6.2 <i>Comparing EPROM identifiers</i>	129
11.6.3 <i>Synchronizing memory pages after connection</i>	129
11.6.4 <i>Blocking access to the control device by default</i>	130
11.6.5 <i>Switching to the work page after connection is established</i> ...	130
11.7 Calibrating in several work pages	131
11.7.1 <i>Select active work page</i>	131
11.7.2 <i>Duplicating work pages</i>	132
11.7.3 <i>Deleting work pages</i>	132
11.8 Calibration using the keyboard	133
11.9 Calibrate floating point numbers	134
12 Comparing memory pages	135
12.1 Filtering the List of Variables	135

12.2	Highlighting differences	137
12.3	Selecting the comparison view	138
12.4	Add DCM	139
12.4.1	<i>Importing DCM via preview</i>	139
12.4.2	<i>Import DCM</i>	141
13	Resource monitor	143
14	Remote control	145
14.1	ASAP 3 Interface description	145
15	System settings	153
15.1	Export	153
15.2	Import	153
15.3	General system settings	153
15.3.1	<i>Language</i>	154
15.3.2	<i>Theme</i>	154
15.3.3	<i>Open last workspace and last experiment when starting</i>	154
15.3.4	<i>Go online when starting</i>	154
15.3.5	<i>Measurement value preview</i>	154
15.3.6	<i>Disable hardware rendering</i>	154
15.3.7	<i>Disable transparency effects</i>	155
15.4	Recording and analysis	155
15.4.1	<i>Storage directory</i>	155
15.4.2	<i>File model</i>	155
15.4.3	<i>Format for date and time</i>	156
15.4.4	<i>Adding comments at the end of the recording</i>	156
15.5	Memory dump	156
15.5.1	<i>Settings</i>	156
15.5.2	<i>Settings and execution in the top bar</i>	157
15.5.3	<i>Safety aspects</i>	158
15.5.4	<i>Preview of the written files</i>	158

15.6 Communication	159
15.6.1 Logical interface	159
15.6.2 Interface	160
15.7 Printing	160
15.7.1 Print settings	160
15.8 Keyboard shortcuts	161
15.8.1 Drop-down menu	161
15.8.2 Filters	161
15.8.3 Assigning / deleting keyboard shortcuts	162
15.9 Directories	162
15.9.1 Select	162
15.9.2 Open	162
15.10 Style templates	162
15.10.1 Name	163
15.10.2 Color and axis area	163
15.10.3 Axis area	163
15.10.4 Intervals	163
15.10.5 View	163
15.11 External tools	164
15.11.1 CSM Config	164
15.12 Remote	164
16 List of figures	166
17 List of tables	168
18 Keyword index	169



1 Commissioning

This chapter briefly explains the most important steps for a **quick start-up** of DiagRA® X. Detailed descriptions can be found in the other chapters of this manual.

1.1 System requirements

The following system requirements are necessary for DiagRA® X.

System requirements	Minimal	Recommended (Power User)
Operating System	Windows 7 or higher (64-bit), .NET	Framework >= 4.6.1
Processor	4 cores with 4 GHz each (e.g. Intel Core i5)	4 cores with > 4 GHz each (e.g. Intel Core i7)
RAM	8 GB	16 GB
HDD	20 GB free hard disk space	> 20 GB free hard disk space, fast SSD
Graphics card	Fast graphics card with DirectX 11	
Screen resolution	1280 x 800 pixel	1920 x 1080 pixel

Tab. 1-1 System requirements

1.2 Installation



From Windows 7 upwards, for one time only, you will need administrator rights for the installation of a USB drive. After this, you will also be able to fully use the USB sources as standard user. It may be necessary to restart the computer.



Hardware

You require a standard PC with Windows operating system and a free interface for the connection of your control devices. DiagRA® X supports various systems which work via USB or network card. To install the hardware, please follow the manufacturer's instructions.

Software

DiagRA® X runs on the following operating systems: Windows 7 and newer.

For the DiagRA® X installation, proceed as follows:

1. **Unpack** the file DiagRA® X* Setup.zip.
2. **Start** the installation process by double-clicking on the unpacked DiagRA® X* Setup.exe. The installation wizard will guide you through the next steps.



You have successfully installed DiagRA® X.

1.3 Registration



Please note that at least administrator user rights are required once during installation and user registration.

The first time you open DiagRA® X , the **registration wizard** opens automatically.

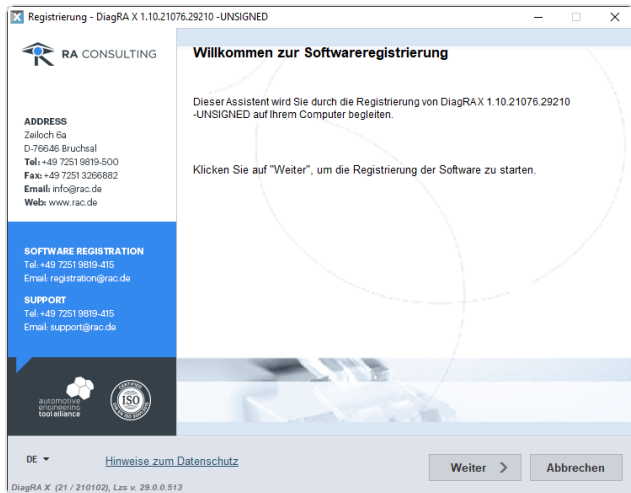


Fig. 1.1 : Registration Wizard of DiagRA® X and DiagRA® X Viewer

The registration wizard will guide you through the necessary steps to register the software.

Request activation data

You received a delivery number from us for the registration of the software. To request the activation data, proceed as follows:

1. Enter the delivery number in the corresponding input field. To do this, you can also copy the delivery number from the email and paste it here.
2. Request the activation data. You have the following options:
 - Online via RA registration server (active internet connection required)
 - Via a web page - registration data is sent via the web form
 - By sending e-mail directly from the registration wizard.
 - By sending a text file through another email account
 - Enter the delivery number in the corresponding input field. To do this, you can also copy the delivery number from the email and paste it here.
3. In each case, the wizard will guide you through the individual steps.

Completing registration

After you have requested the activation data, you will receive an e-mail from us. This contains:



- The corresponding license key.
- The license file DiagRA-X.bbb, which is automatically copied to the DiagRA® X directory in the case of online registration.

For all other registration types, proceed as follows:

1. Please copy the received license file to the directory C:\ProgramData\RA Consulting\DiagRA X\.
2. Restart the application and the registration wizard will appear again.
3. Select the **Complete registration** menu item, which will display your personal data.
4. Enter your company number, as well as the license key from the e-mail.



Now you can use DiagRA® X without any restrictions.

1.4 Database

DiagRA® X uses a database to store data, such as the working environment, experiment and configuration. Up to and including version 1.13, an Oracle Berkeley DB was used for this purpose. As of version 1.14 a LiteDB is used for this. **Stored data is automatically migrated from the old database to the new one.** As of version 1.19 (early 2024) of DiagRA® X, support for the Berkeley DB will be discontinued. Up to this point, migration can be performed by installing a version ≥ 1.14 and **starting the program once.**

1.5 Define physical interface



Please ensure that the drivers for the interface to be used are installed and the interface is physically connected to your PC.

For the **connection**, the **physical interface must be defined in the system settings.** In the Communication view, you will find the overview of your possible physical interfaces divided according to communication protocols, e.g. CAN.

1.6 Creating a workspace

In order to **work** with DiagRA® X, a **workspace is required.**



1.6.1 Creating a workspace

On the operating element in the menu bar, next to the home button, **No workspace selected** is initially displayed. Clicking this operating element **takes you** to the view for the definition of your **workspace**.

1.6.2 Adding a workspace

In this view, you first **create** a **new workspace**. To do this, use the **Add** operating element **+**. Give this workspace a descriptive name, such as Test Stand AAA or Vehicle xyz.

After that, **add a new source** to the workspace. This is done analogously to the workspace with the **Add source control element** **+**. Select the applicable **source type** in the **side detail view** and confirm your selection with **Done**.

The following chapters describe how to select a description file, the protocol and a physical connection in the source properties.

1.6.3 Adding a description file



After selection, it may take some time for the description file to load.

Open the list of description files by clicking the empty field and selecting the required **description file**. Using the **Browse** entry at the bottom, a new file can be selected from your computer or the connected network drives. Previously selected description files appear in the list and can be selected.

From the suggested protocols, select the protocol matching the physical interface , e.g. XCP, CCP, etc.

1.6.4 Selecting the physical connection

Finally, select the physical connection to a source in the workspace. You previously defined the source in the system settings under communication.

1.7 Create experiment

The **Experiment** lists the **available measured quantities** to be selected for visualization on a worksheet. The following describes simple selecting and visualizing steps.

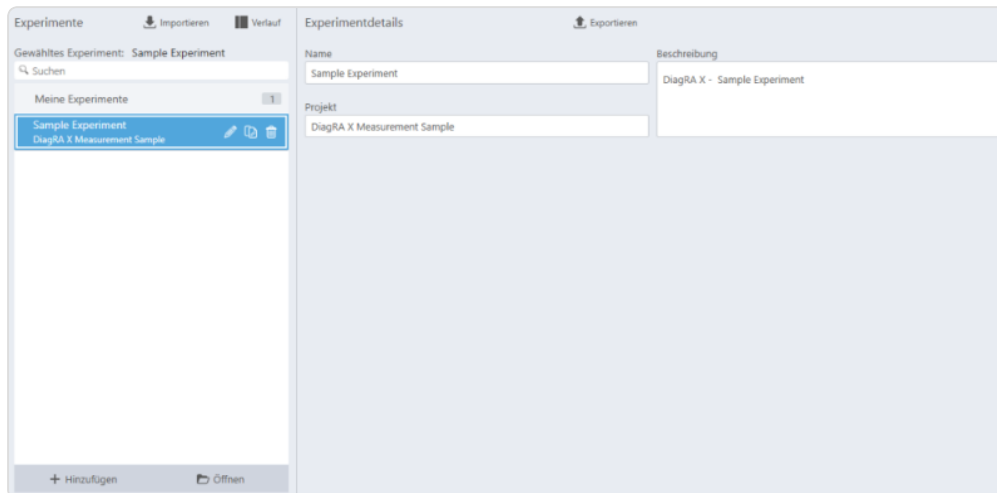


Fig. 1.2 : Experiment view

On the operating element in the menu bar, next to the workspace, **No experiment selected** is initially displayed. **Clicking** this element takes you to the view with the list of your **Experiments**.

1.7.1 Adding experiments

First create a new experiment in the list of experiments. To do this, use the **Add** operating element **+**. Give this experiment a descriptive name or alternatively the name of the workspace, such as Test Stand AAA or Vehicle xyz.

1.7.2 Defining visualization

Under **Visualization**, your selected **measurement and adjustment variables** are **displayed**. In order to define a visualization, you will require a worksheet.

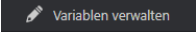
A worksheet is created as follows: **Click** the **+** operating element below the upper menu bar and above the Variable Manager.

Suggestions for the arrangement of a visualization are made in the drop-down menu. Many templates containing visualizers are available for use. It is possible to change the arrangement of the visualizers later.

Select the visualizers for the individual areas on the worksheet. This is carried out by **clicking** the **+** operating element in the respective area.



1.7.3 Selecting variables


The **variables**, which are available to work with, can be selected in the **Variable Manager**. The Variable Manager can be reached using the **operating element** . Arrange your variables in your visualization to the respective worksheet using the **drag and drop function**.

1.8 Connect

In order to be able to **measure**, a **connection with a source must be established**.

1. **Open** the workspace page.
2. **Select a source**.
3. In the source properties, **click** Connection and there click the connection control.

Alternatively, you can try the following.

1. Click on the **"Start Measurement"**  control in the upper menu bar.

The latter automatically establishes a connection in the course of starting the measurement.

2 Operating concept

A modern operating concept has been developed for DiagRA® X.

Characteristics of this concept are:

- Clear structuring of the interface without overlapping windows
- Grouping and division of the desktop by so-called worksheets
- Coordinated color concept with fixed color palette for a day and night design
- The transfer and saving after adjustments of settings is performed automatically
- Keyboard operation via so-called keytips, pre-assigned keyboard shortcuts (additionally configurable)
- Clean interface (data rich design)
- Data are in the foreground, additional operating elements are displayed according to the operating context

2.1 User interface

In order to make it easier for you to get started with DiagRA® X, **when first starting the software, you are provided with a completely functional workspace with experiment** for demonstration purposes.

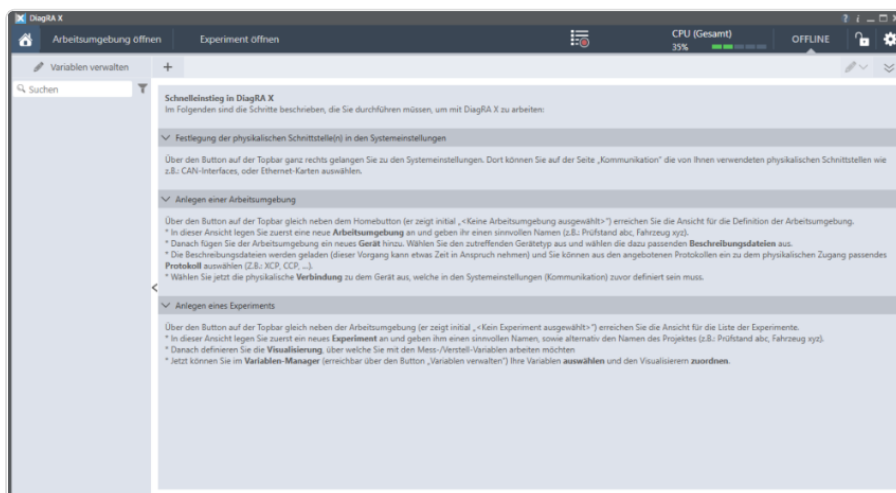


Fig. 2.1 : Main view

DiagRA® X is divided into individual areas which are represented graphically below.

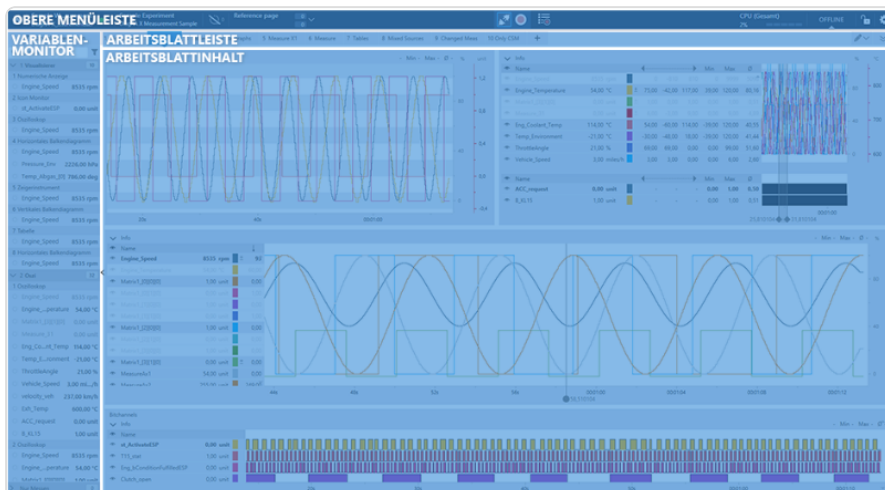


Fig. 2.2: Area division

2.1.1 Upper menu bar area

The upper menu bar on the upper border of the application provides **access to basic functions** in DiagRA® X.

2.1.2 Variable Monitor area

The **Variable Monitor** on the left of the application shows the **overview of all variables in the active experiment**.

2.1.3 Worksheet bar

The **worksheet bar** below the upper menu bar **enables navigation around the various worksheets**. The Variable Manager can also be reached here.

2.1.4 Worksheet content area

In this area, the **visualizers for measurement values and adjustment parameters** are displayed.

Firstly, you should get to know the operating elements and symbols used throughout the program. You can then create a workspace and an experiment. In order to be able to **communicate** with **sources** (control sources or measuring sources) you must **define** the **interface** via which you wish to communicate.





Various local adjustments can be made via the DiagRA® X system settings.





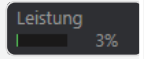





2.2 Upper menu bar

The **upper menu bar** is available in **DiagRA® X** at any time. It provides quick and easy access to the **most important views** in **DiagRA® X**. Some **operating elements are only shown when required or approved for editing**. **Clicking** the operating element **executes its function**.

The upper menu bar is divided into the following areas from left to right:

Position	Visual element	Element name	Element function
1		Home	Returns you to the worksheet with a mouse-click.
2	-	Workspace	Opens and closes the Configuration view for workspaces with a mouse-click.
3	-	Experiment	Opens and closes the Experiment view with a mouse-click.
4		Event configuration	Opens and closes the Event configuration with a mouse-click. The number of active events is also displayed next to the global trigger approval. The arrow symbol on the right border provides quick access to the specified events and their current status. It is also possible to end event-based recordings and to enable and disable events.
5		Switch memory pages	Switches between reference page and work page with a mouse-click.
6	-	Binary data manager	Opens and closes the Binary data manager with a mouse-click. Here, memory pages can be loaded, imported and exported and transferred to the source. They also contain the flash functions. The arrow symbol on the right border provides quick access to all memory pages available in the sources currently selected for the page management.
7		Compare pages	Opens and closes the memory page comparison view in which any two memory pages of a source can be compared. It is also possible to carry out a DCM import here.

Position	Visual element	Element name	Element function
8		Start/end measurement	Measurements are started or ended with a mouse-click. Here, measurement means that data from the defined sources are captured and displayed in the visualizers. In addition, measurement data can be recorded during a measurement.
9		Start/end recording	When the operating element is first clicked, DiagRA® X establishes a connection to your sources and displays measurement data on your worksheets. At the same time, the writing of measurement data to a measurement file is started. If a connection has already been established to your sources, only the writing of measurement data to a measurement file is started. The next mouse-click stops the recording. The connection to your sources and displays of the measurement data on your worksheets remains.
10		Recording list	A drop-down menu with the most recently completed recordings appears with a mouse-click.
11		Back / Repeat	Using the arrow symbol to the right next to the respective operating symbol, the completed operations can be viewed in a list and can be selected step-by-step.
12		System monitor	Opens and closes the system monitor, which displays the utilization of processor, working memory and hard disk.
13		Connection status	The text and color display of the connection status can be influenced by other operating elements.
14		Application block	Blocking the application protects you from accidental operations. The lock is opened when the application is unsecured. The block can only be set when worksheets are visible. It is also possible to switch worksheets when in secured state.
15		System settings	Opens and closes the system settings.



Position	Visual element	Element name	Element function
16	⋮	Function selection	Opens and closes the list of elements which can be shown and hidden in the upper menu bar with a mouse-click.

Tab. 2-1 Elements of the upper menu bar

The **color** below the menu bar changes **depending on the state of connection**. The state of connection is also displayed in written form and identical color.

Color	Meaning for the state of connection
Gray	DiagRA® X is offline.
Green	DiagRA® X is online, is receiving measurement data from control sources and displaying it in visualizers.
Red	DiagRA® X is online. Measurement data is received, displayed and simultaneously written to a measurement file.
Yellow	DiagRA® X is online. The triggers are enabled. Measurement data is received and displayed. As soon as trigger conditions are fulfilled, the received measurement data is written to a measurement file and the state is switched to recording.
Blue	DiagRA® X is offline. A description file is loaded.

Tab. 2-2 Meaning of colors below the upper menu bar for the connection state

2.3 Visual operating elements

Listed below are the most important **visual operating elements** which are used by DiagRA® X at different points. Clicking the operating element executes its function.

Visual element	Element meaning	Element function
	Refresh	The view is refreshed.
	ON / OFF switch	Enables or disables additional functions, e.g. triggers.



Visual element	Element meaning	Element function
	Details	Shows or hides additional detailed information.
	Edit	Enables an entry, a configuration or similar, to be edited.
	Drop-down arrow on the operating element	Opens or closes an additional view with further information. These are mostly lists.
	Duplicate	Creates a duplicate of the selected element.
	Remove	Removes the selected element (also via the drag and drop function).
	Export	Opens a dialog to selectively export configuration data.
	Filters	Opens a view to define and enable a filter.
	Add	Adds a new element to a list.
	Import	Opens a dialog to selectively export configuration data.
	Open	Opens and enables the selected list element or opens a dialog.
	Scroll arrow up, down, right and left	Moves the view in the corresponding direction.
	Search	<p>The text entry in the nearby search field suggests already recognized hits. Searching within a list reduces the complete list to a hit list. When the text entry is deleted from the search field, the complete list appears. Various placeholders are available:</p> <ul style="list-style-type: none"> * means any number of characters, ? any character and # any digit. <p>A space between input characters separates several search requests.</p>

Tab. 2-3 Visual operating elements



2.3.1 Groupings

Groupings can be independently created within a list. These emphasize a common bond between the entries and thus increase clarity. Ungrouped elements appear at the top followed by the created groupings. The number of elements within the same grouping and their subgroups are displayed right-justified next to the group names.

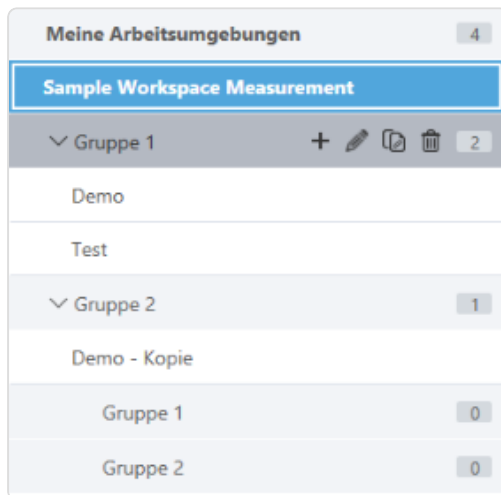


Fig. 2.3 : Figure: groupings

Groupings can be opened and deleted. The group name can be edited. The content of the group can be changed and edited. Subgroupings within a group are possible. Groupings on the same level can be recognized by the horizontal indentation of the group name.



3 Workspace

The **workspace** summarizes and stores all the information for a specific measurement or calibration task:

- **Define** and configure **sources**
- **Selecting description files** and binary files
- **Configuring and establishing a connection**

The workplace view is opened using the workplace control element in the top bar (second from the left).

3.1 Manage workspaces

The existing workspaces are listed in a tree structure. The name of the selected workspace is displayed above the workspace list.

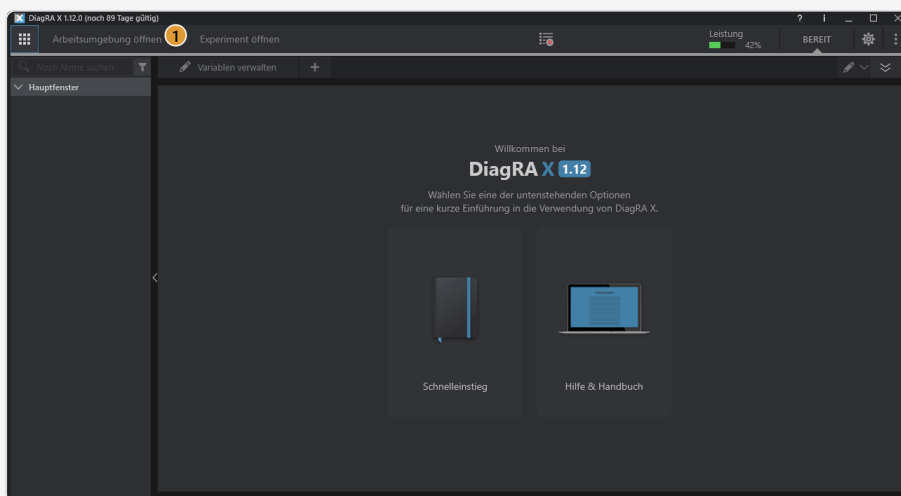


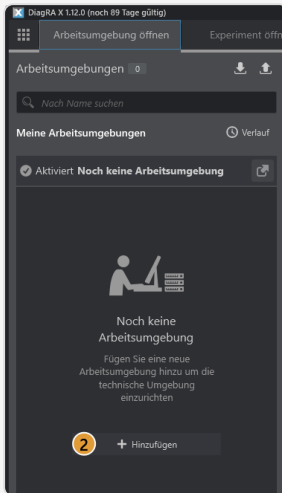
As soon as at least one workspace has been created within a group, the group can be expanded or collapsed. This helps to keep the list of workspaces clear and tidy.

3.1.1 Add a workspace or group

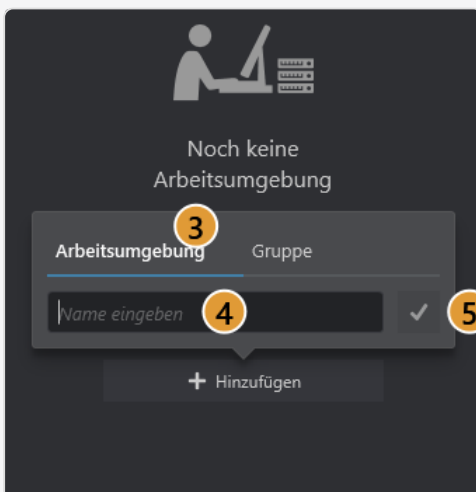
New workspaces or groups can be created in which work areas can be grouped.

1. **Open** the workspace page.



2. Click **Add**.

3. Click to select either a workspace or a group.



4. Enter a name.

5. Confirm by **clicking** ✓.

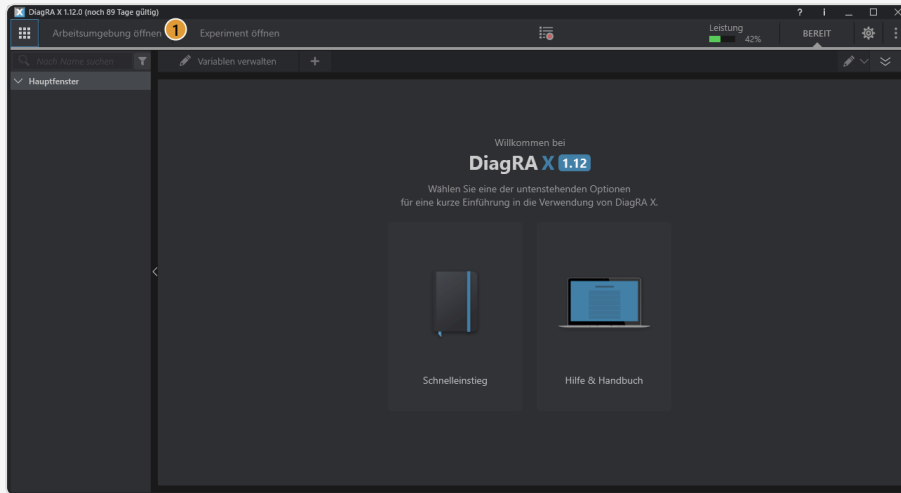
The workspace or group is now created.

3.1.2 Import workspace

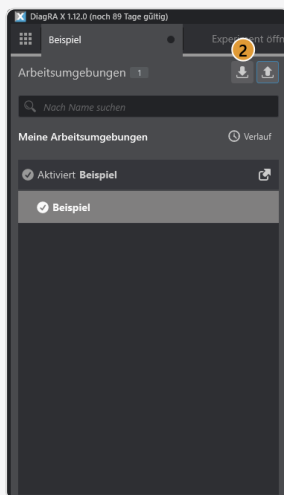
A workspace can be imported.



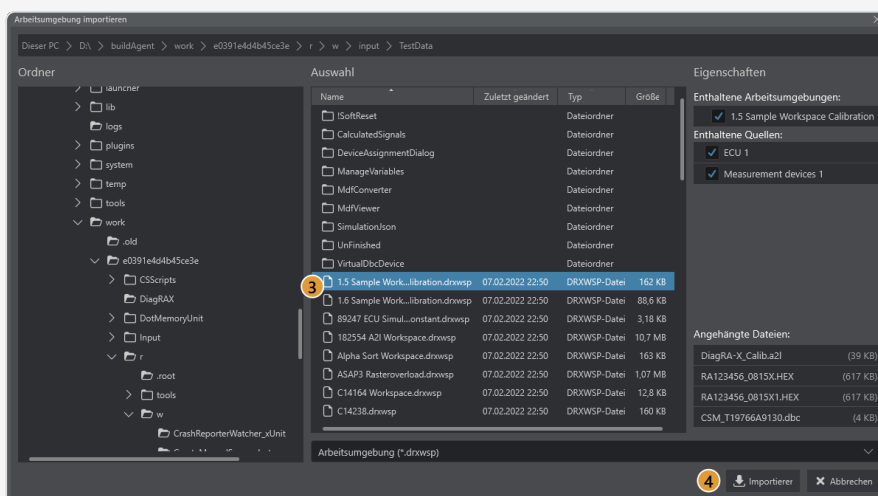
1. Open the workspace page.



2. Click Import.



3. Select the desired workspace.





4. Confirm by clicking ✓.

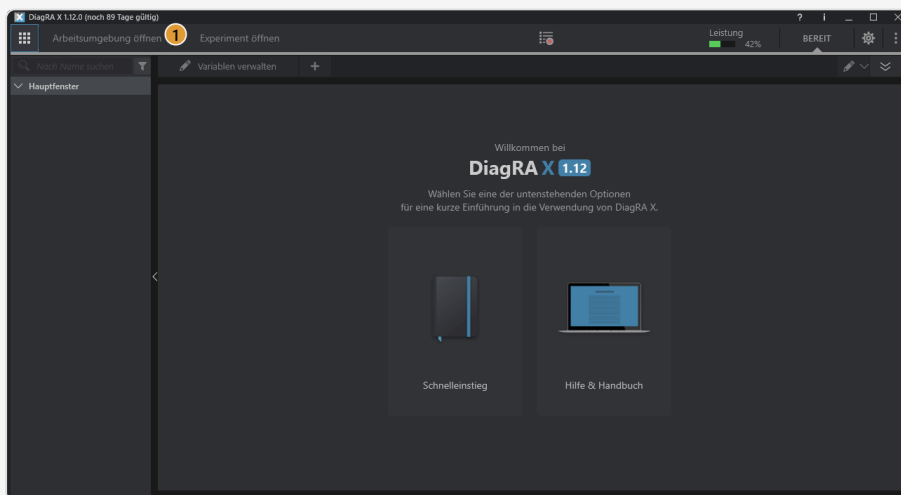


The workspace is now imported.

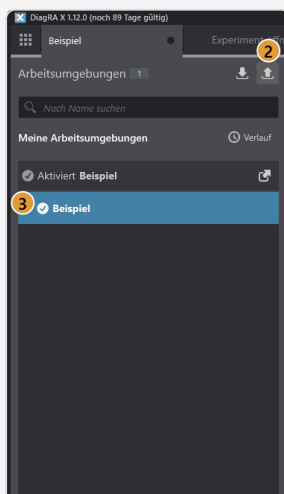
3.1.3 Exporting a workspace

A workspace can be exported.

1. Open the workspace page.

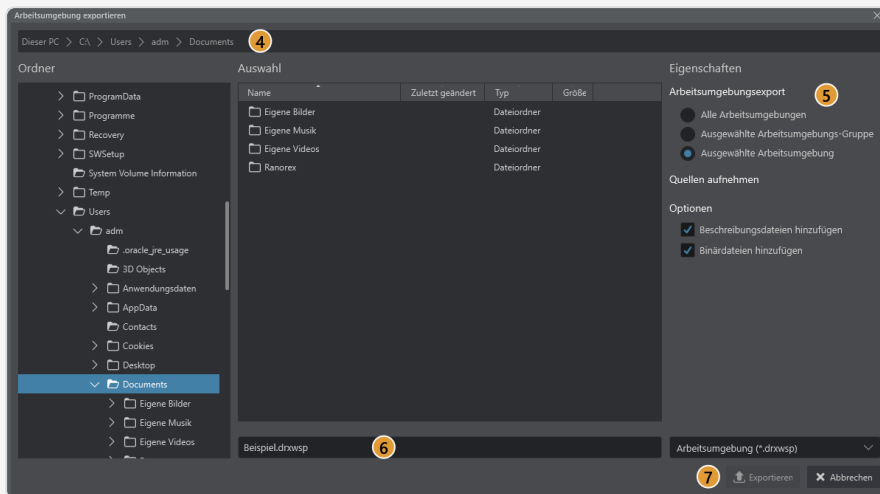


2. Select the desired workspace.
3. Click **Export**





4. Select the target directory.



5. Select whether the selected workspace or all workspaces are to be exported.
6. Select a file name.
7. Confirm by clicking ✓.

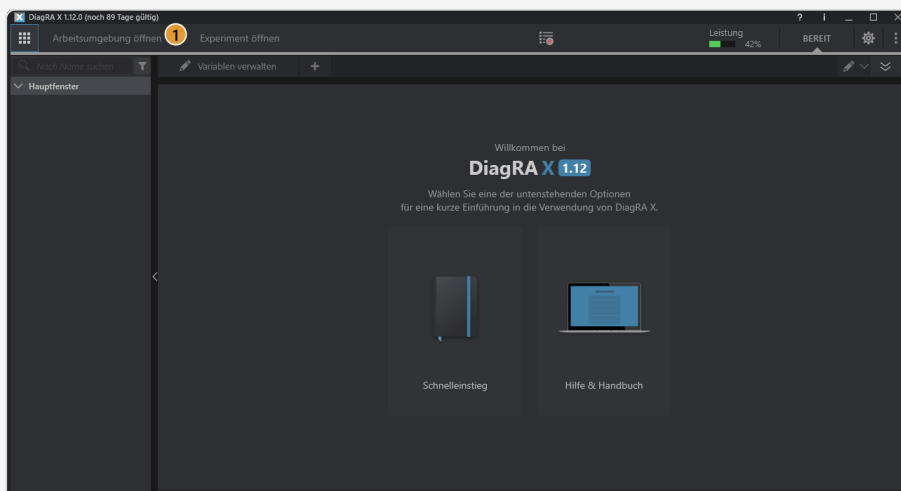


The workspace is now exported.

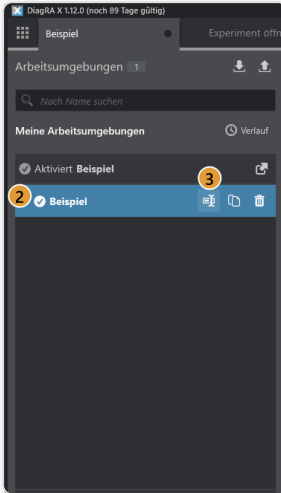
3.1.4 Renaming a workspace

A workspace can be renamed.

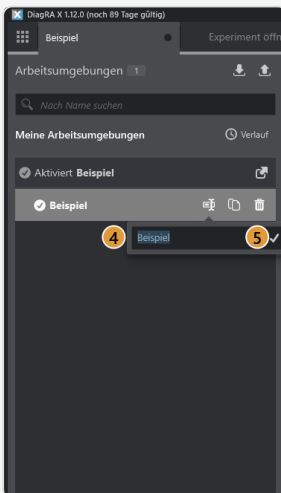
1. Open the workspace page.



2. Select the desired workspace.
3. Click **Rename**



4. Enter a name.



5. Confirm by clicking



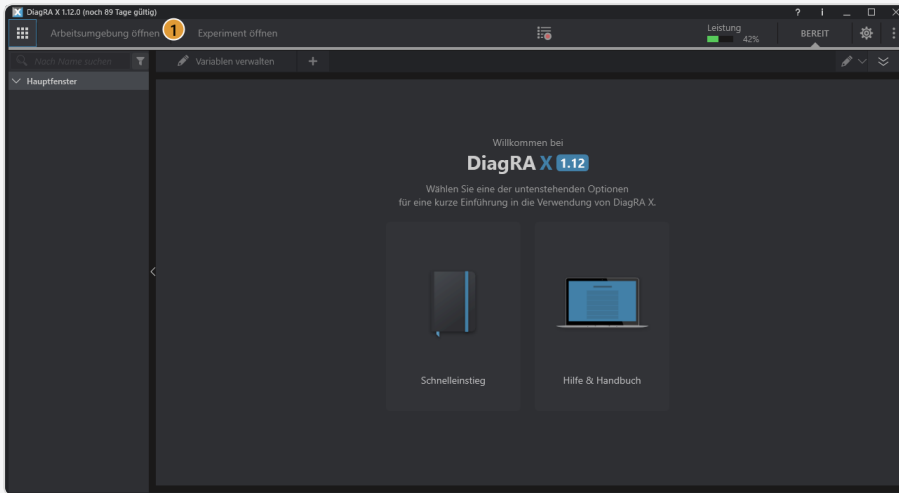
The workspace is now renamed.

3.1.5 Duplicating a workspace

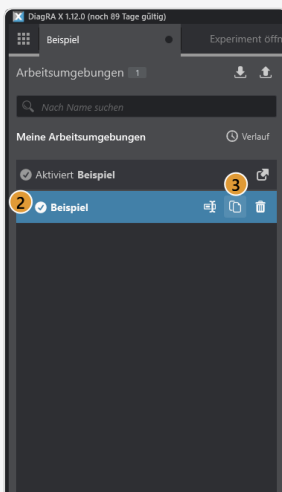
A workspace can be duplicated.



1. Open the workspace page.



2. Select the desired workspace.



3. Click **Duplicate** .



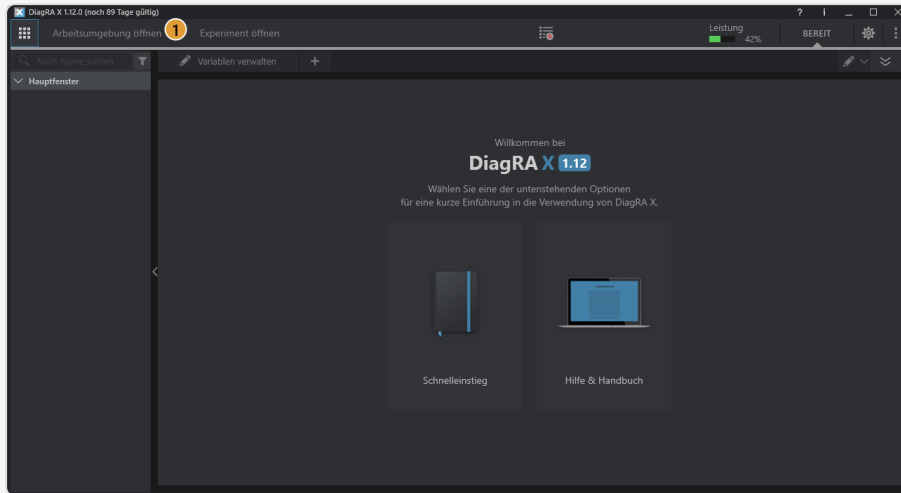
The workspace is now duplicated.

3.1.6 Deleting a workspace

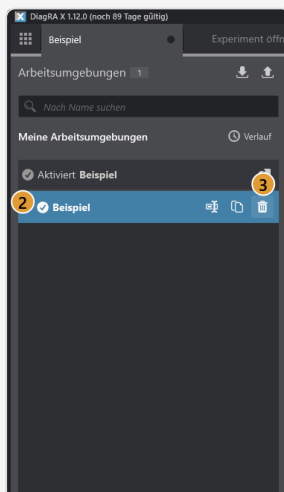
A workspace can be deleted.



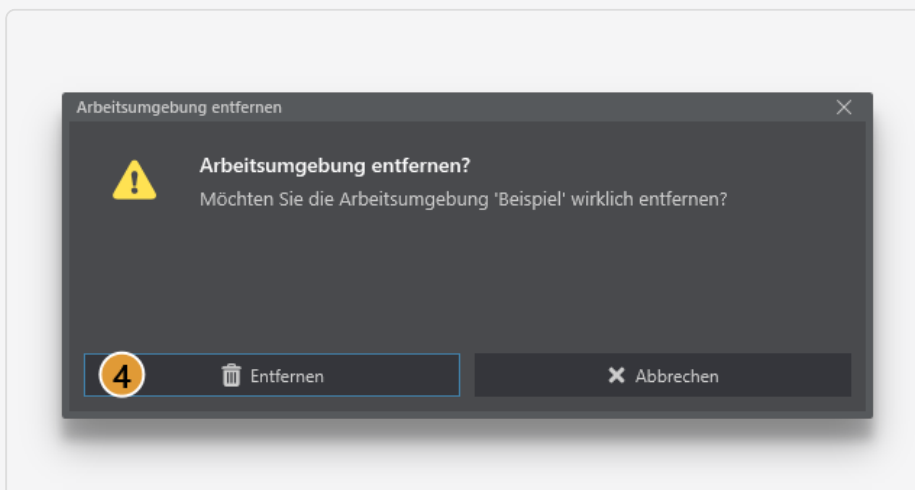
1. Open the workspace page.



2. Select the desired workspace.



3. Click **Delete** .
4. Confirm by clicking **delete**.





The workspace is now deleted.

3.2 Sources in the workspace

The **term sources** describes the **measuring devices and control devices** in the workspace. Multiple different sources can be configured, managed and updated in one workspace. Each source must be configured individually. DiagRA® X provides a selection of basic configurations.

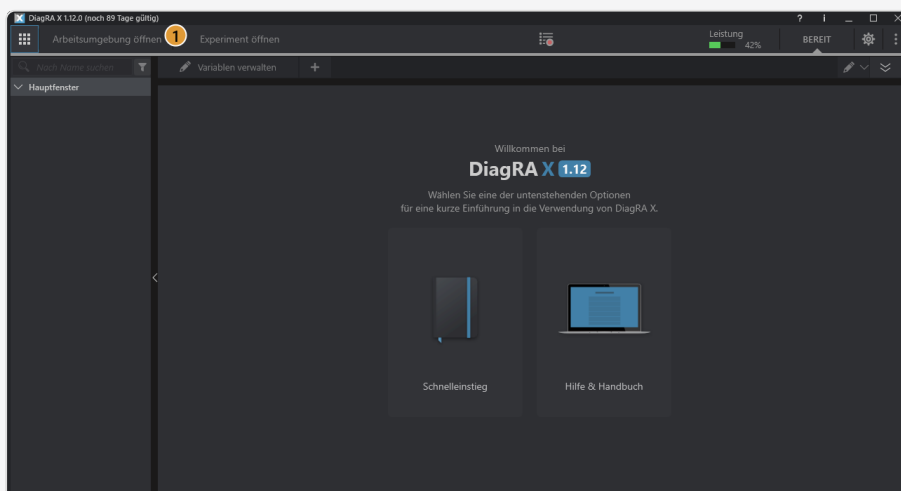


The selected workspace displays the sources it contains. Other sources in other work environments are not displayed. The selected workspace is displayed above the workspace list. There are two views in which sources can be added. If a source has not been created yet, follow the instructions A), if a source has already been created, follow the instructions B).

3.2.1 Add source

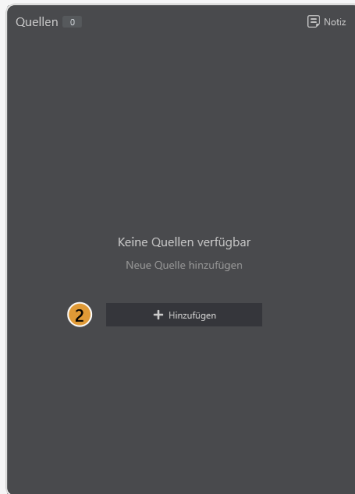
You can add a source.

1. **Open** the workspace page.






2. Click **Add** .



3. Select between a generic, CSM or ETAS source.



4. Confirm by **clicking** .

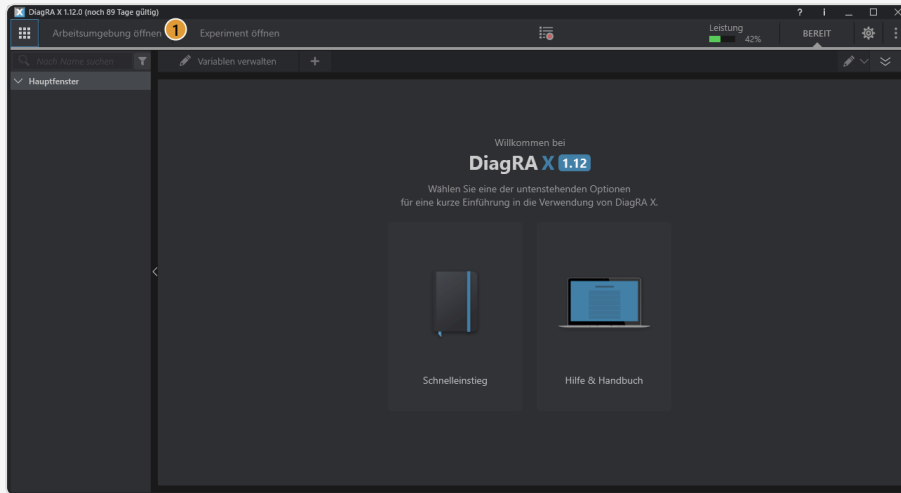


The source was added.

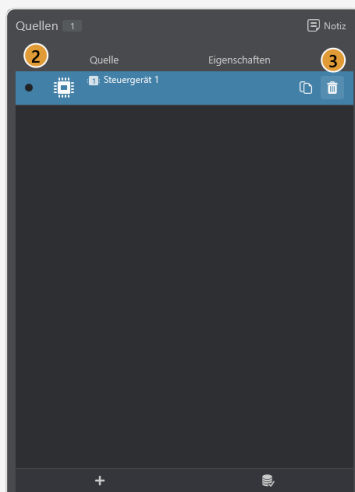
3.2.2 Delete source



You can delete a source.

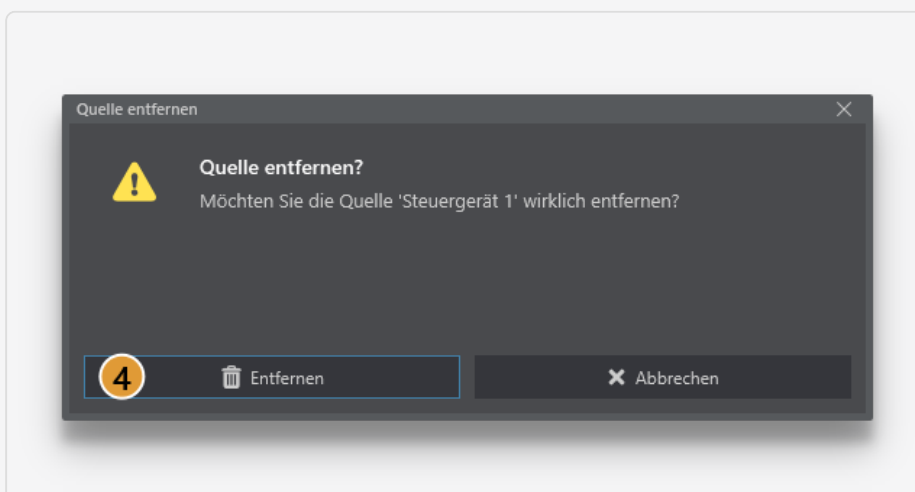
1. Open the workspace page.



2. Select the desired source.



3. Click **Delete** .
4. Confirm by clicking .



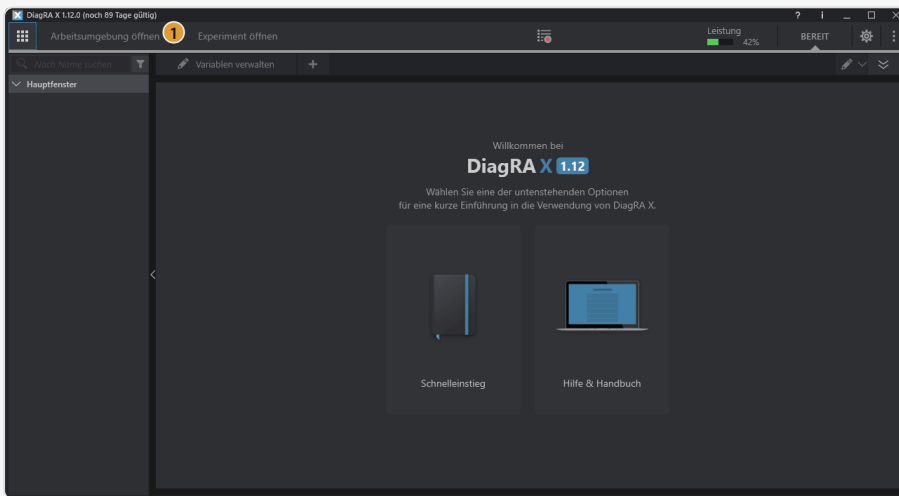


The source has been deleted.

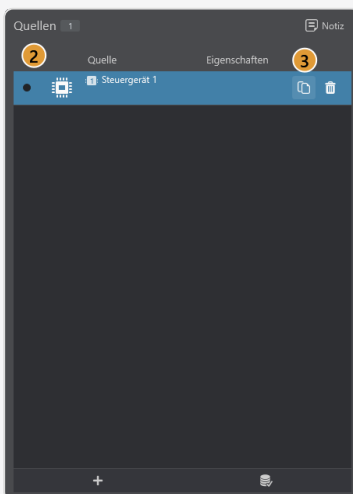
3.2.3 Copy source

You can copy a source.

1. Open the workspace page.



2. Select the desired source.



3. Click Copy .



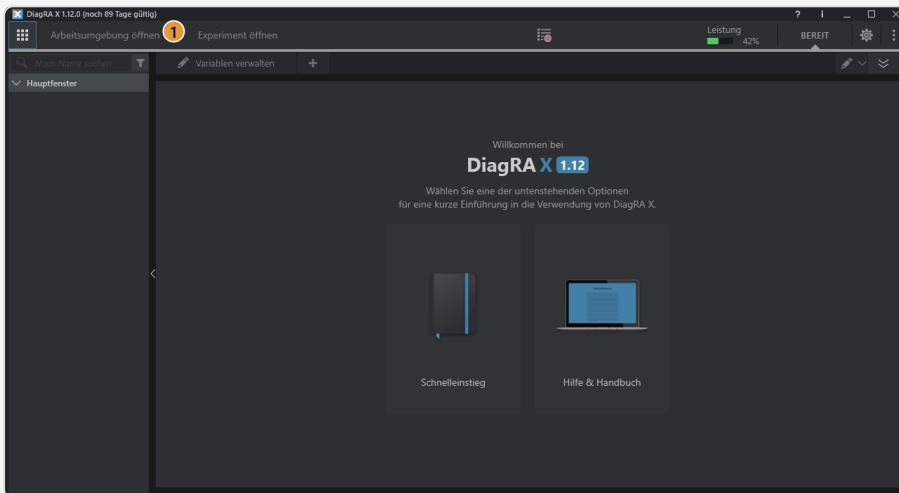
The source was copied.

3.2.4 Select control unit for page management

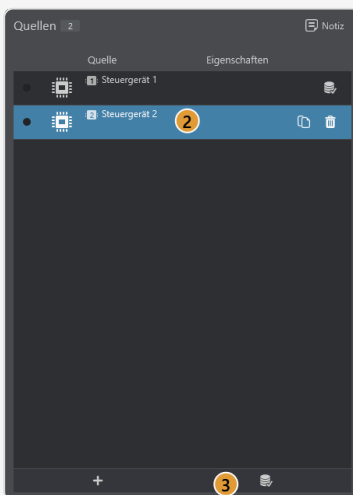
If the activated workspace contains at least one source of the 'Controller' type, the Binary Data Manager tab is displayed in the top bar. This tab shows information (page name, HEX filename, number of changes etc.) on the active memory page of the control source which is currently "selected for the page management".

A control source can be selected for the page management.

1. Open the workspace page.



2. Select the desired source (must be a control device).



3. Click on .

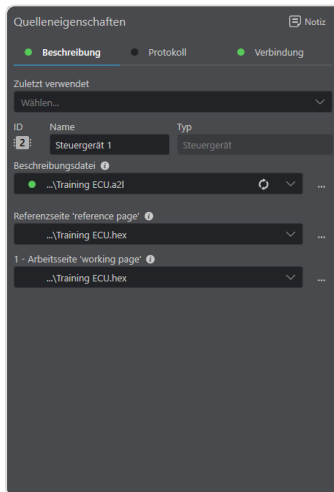


The control device has been selected for page management.

3.3 Source properties

The source properties are divided into three groups: Description, Protocol and Connection.

3.3.1 Description

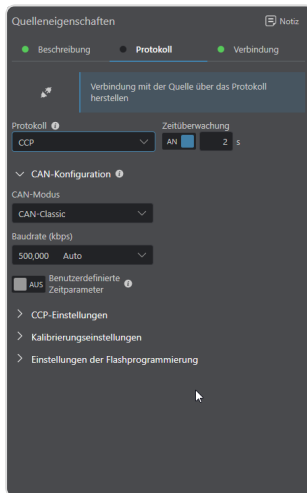


Select a **description file**, by selecting one of the **already used** files from the **selection list** or by opening the file selection dialog using the Browse button and selecting a file in the file system. If the source is a controller with memory pages, you can select binaries for it in the same way. **Alternatively**, a previously stored set of description files and binary files, which have already been used together in this combination, can be selected using the **“Last used” drop-down menu**.

Plausibility checks are carried out when loading the description file. If an error is detected, DiagRA® X displays a warning and identifies the source with a yellow warning triangle.



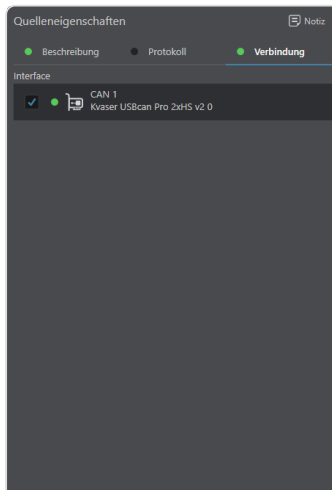
3.3.2 Protocol



Select the right communication protocol for your measurement source or control source.

Depending on your protocol selection you will get further configuration options. See section "Protocol adjustments"

3.3.3 Connection



Depending on your protocol selection, you are provided with a limited selection of logical interfaces. See section "Communication".



3.4 Detailed information on CSM-devices



Additional options are available for CSM measuring devices. In the **detailed views**, the **properties of the respective channel** provided in the description files can be referred to. These properties can be changed. Status texts for variable values can be displayed on the Visualizer.

The detailed displays vary depending on the CSM measuring device.

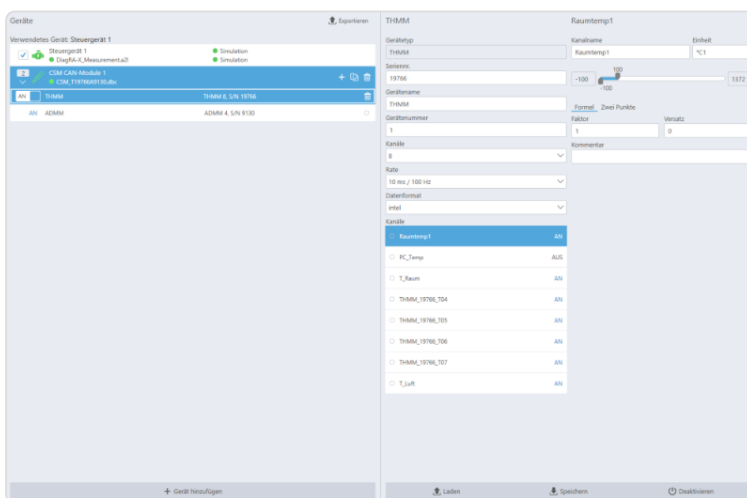


Fig. 3.1 : Detailed information for CSM devices

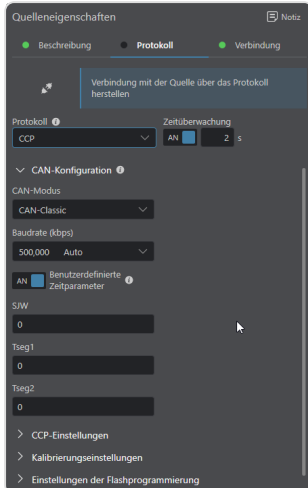
3.5 Protocol adjustments

3.5.1 CAN configuration

If a CAN-based protocol is selected, the associated parameters can be adjusted under "CAN configuration".

CAN Classic

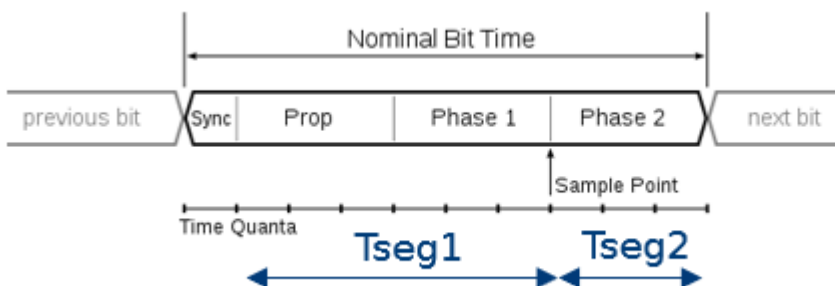
When selecting the **CAN Classic mode**, the baud rate and the timing parameters can be set.



The **baud rate (kbps)** is the bus speed in kbps.

If *User defined timing parameters* are activated, timing parameters can be adjusted in the configuration of the CAN interface.

Bit-Timing Parameter



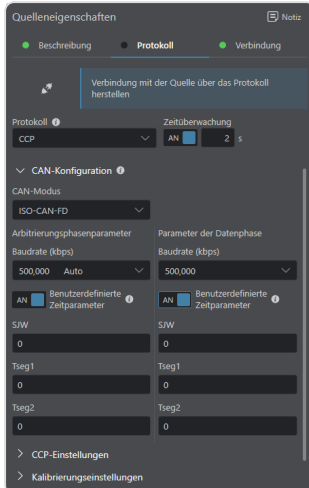
- **SJW** - Sample Jump Width
- **Tseg1** - time segment 1, i.e. the number of quanta from (but not including) the 1-quanta sync segment to the sampling point.
- **Tseg2** - time segment 2, i.e. the number of quanta from the sampling point to the end of the bit.



Control devices can adjust the number of quanta on both sides of the sample point by the SJW (Sample Jump Width).

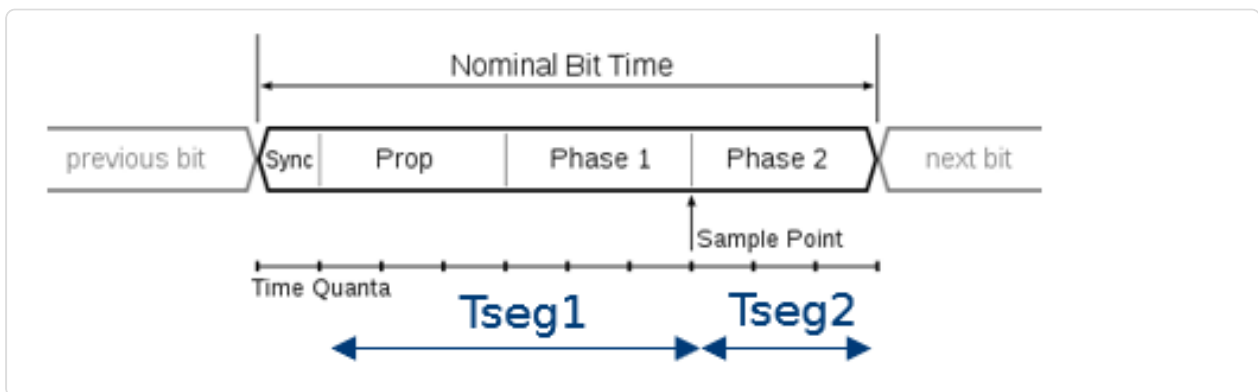
ISO CAN FD

When selecting the CAN mode **ISO CAN FD**, the baud rate and the timing parameters for the two phases can be set.



If the switch for the **user-defined timing parameters** is activated, the timing parameters for configuring the arbitration and data phase can be adjusted by the CAN interface:

Bit-Timing Parameter

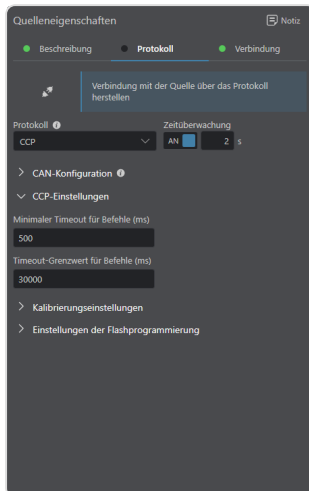


SJW - Sample Jump Width

- Control devices can adjust the number of quanta on both sides of the sample point by the SJW (Sample Jump Width).
- **Tseg1** - time segment 1, i.e. the number of quanta from (but not including) the 1-quanta sync segment to the sampling point.
- **Tseg2** - time segment 2, i.e. the number of quanta from the sampling point to the end of the bit.

3.5.2 CCP Configuration

The following options can be set if CCP is the selected protocol:



Minimum timeout for commands (ms)

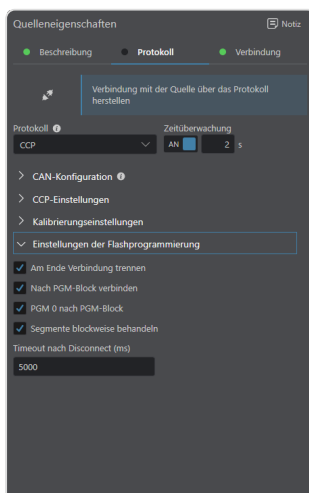
The minimum timeout used when sending CCP commands.

Timeout limit for commands (ms)

The limit value that determines whether a command should be resent after a timeout.

3.5.3 Flash programming configuration

The following options can be set if the protocol supports Flash programming and in which the Flash programming license is enabled:



Disconnect at the end

If the setting is enabled, the device will be disconnected after the flash process.

Connect after PGM block

If the setting is enabled, the connection with the device is established after the programming block.



PGM 0 after PGM block

If the setting is enabled, a block with size 0 is sent to the programming block.

Treat segments block by block

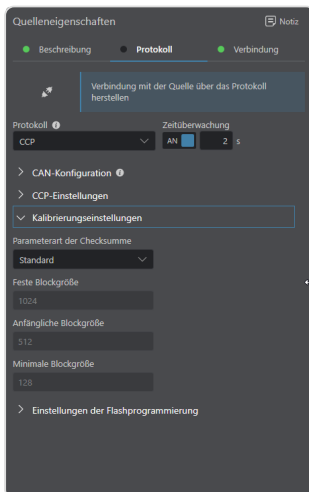
If the setting is enabled, segments are treated block by block.

Timeout after disconnect (ms)

Determines the timeout in milliseconds at the end of the flash process.

3.5.4 Calibration configuration

The following options can be set if the protocol supports calibration and calibration is enabled in the license:



Checksum parameter type

It can define which checksum comparison type is used for code checks.

Standard

The checksum comparison type is not defined.

Adaptive block size

The CheckSum calculation is performed by adaptively changing the block sizes to an appropriate value. Suitable here means a compromise between the number of CheckSum commands sent to the ECU when using a large block size AND the reduced number of upload/download commands to the ECU for subsequent synchronization when using a small block size.

The **initial block size** and the **minimum block size** must be defined.

Fixed block size

The CheckSum calculation is performed by using a fixed block size.



The **fixed block size** must be determined.

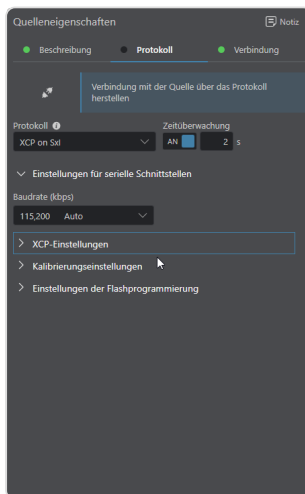
Try maximum block size

If the full segment size fails as the initial block size, the maximum block size allowed by the controller is used.

3.5.5 Serial configuration

When selecting a serial protocol, the baud rate can be set.

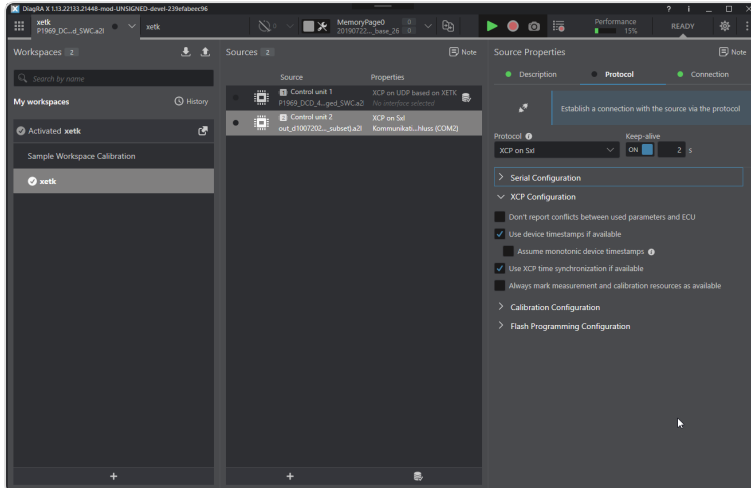
The **baud rate (kbps)** is the bus speed in kbps.



Tab. 3-1 Baud rate selection

3.5.6 XCP configuration

When selecting an XCP protocol, the following parameters can be set:



Tab. 3-2 Selection of XCP parameters

Use data from description file in case of conflicts

If the setting is enabled and information from the description file and the control unit do not match, the information from the description file is used.

Use device timestamp if available

If the setting is enabled, the device's timestamps will be used if the device supports it. Otherwise timestamps are generated internally.



Attention: The use of internal time stamps can lead to measurement inaccuracies.

- **Presume device timestamp to be monotonic**

This setting has an effect only if the "Use device timestamp if available" setting is enabled.

When measured values arrive, DiagRA® X checks whether their time stamps are monotonically increasing as expected and reports irregularities as possible time synchronization problems.

This option can be used to set how strict this check is.

If active, it is assumed that the device transmits all measured values in correct order (with monotonically increasing time stamps).

If inactive, it is assumed that the device ensures the order of the measured values only per raster.

Use XCP time synchronization, if available

If the setting is enabled and supported by the device, the time stamps between the device and DiagRA® X are synchronized by periodically polling the DAQ clock of the XCP slave to compensate for a time offset.



Mark all measurement and calibration resources as available

If the setting is activated, the measurement and adjustment resources are not taken over by the device, but are always marked as available.

3.5.7 IP configuration

For protocols communicating via TCP over IP or UDP over IP it is possible to configure the IP address of the source.

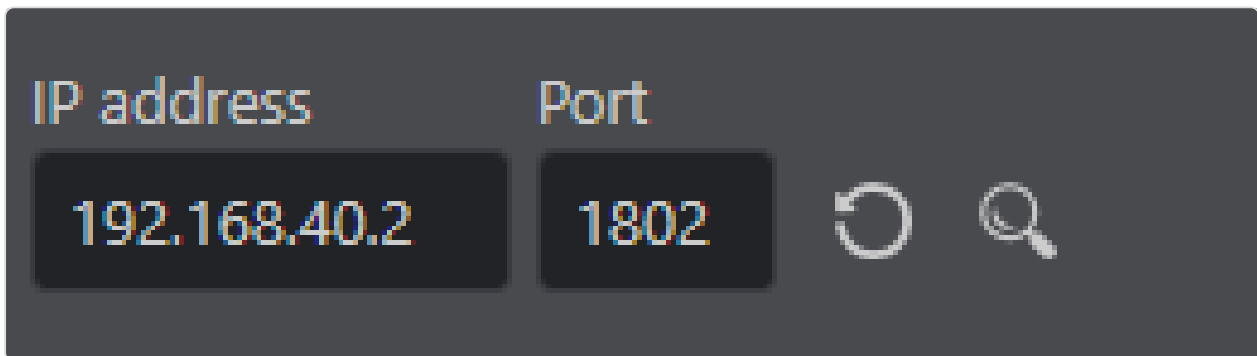
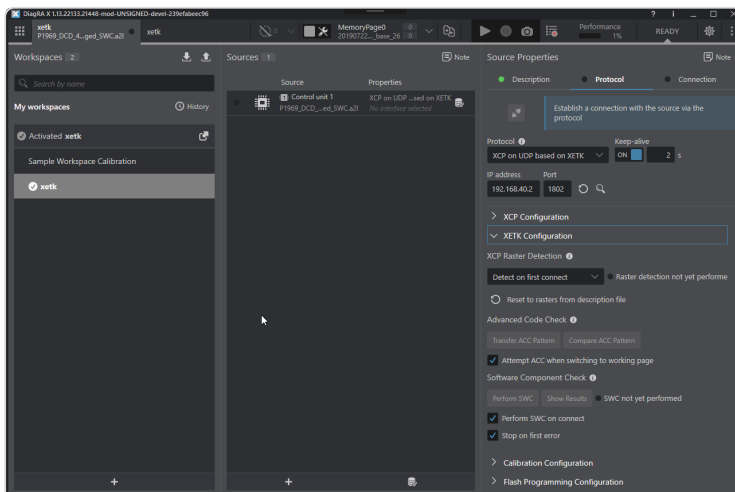


Fig. 3.2: IP address configuration

The magnifying glass button triggers an automatic identification of the IP settings by sending a broadcast message on the network. IP address and port of the first response are taken over.

3.5.8 XETK configuration

When selecting an XETK protocol, the following parameters can be set and actions can be performed:





XCP raster detection

XETK control units usually allow requesting of the supported measurement rasters. If enabled, DiagRA® X performs this query when establishing a connection and can thus determine whether the raster defined in the description file match those in the ECU. If this is not the case, variables assigned to an unsupported raster must be adjusted. DiagRA® X reports this case and makes a suggestion.

Disabled:

No automatic raster detection is performed. Differences in the raster definitions between description file and control unit are not recognized.

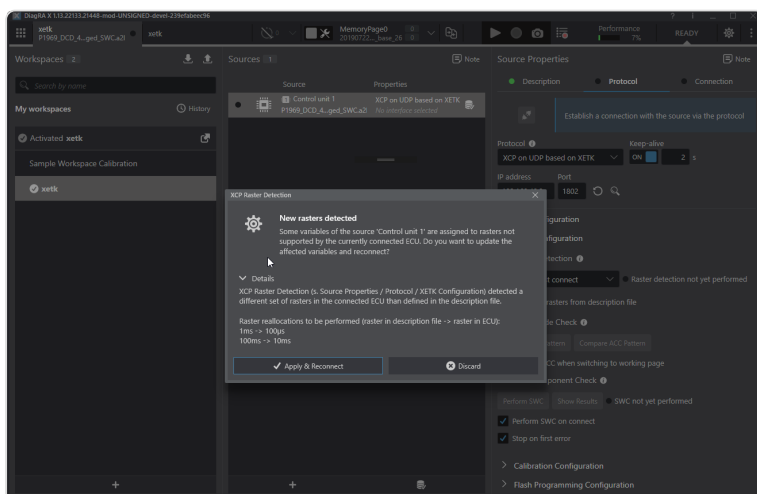
Detect when the connection is first established:

One-time execution after loading the workspace.

Detect every time a connection is established:

Execution at each connection establishment. May be useful if the control unit or its configuration (outside DiagRA® X) is changed regularly.

Query is displayed when new parameters are found:



Raster detection status

After performing the raster detection, DiagRA® X displays the result as a short status message:

- **Raster detection not yet performed**
- **No new raster discovered**
The raster defined in the description file match those in the control unit.
- **Recognized raster applied**
There are differences between the raster defined in the description file and those in the control unit. The raster of the control unit have been adopted and are used.

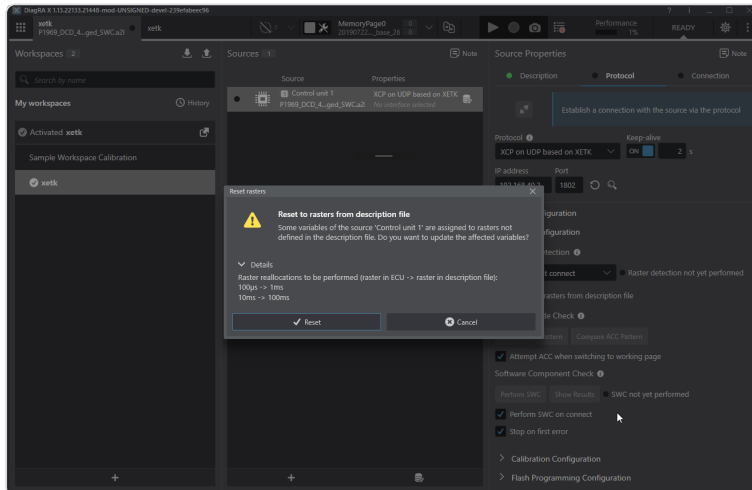


- **Recognized raster not applied**

There are differences between the raster defined in the description file and those in the control unit. The raster of the control unit have been discarded, the raster defined in the description file are still used.

In this condition, DiagRA® X may refuse to connect altogether due to existing differences. This can be worked around by using the option to ignore differences in the XCP settings.

Reset to raster from description file:

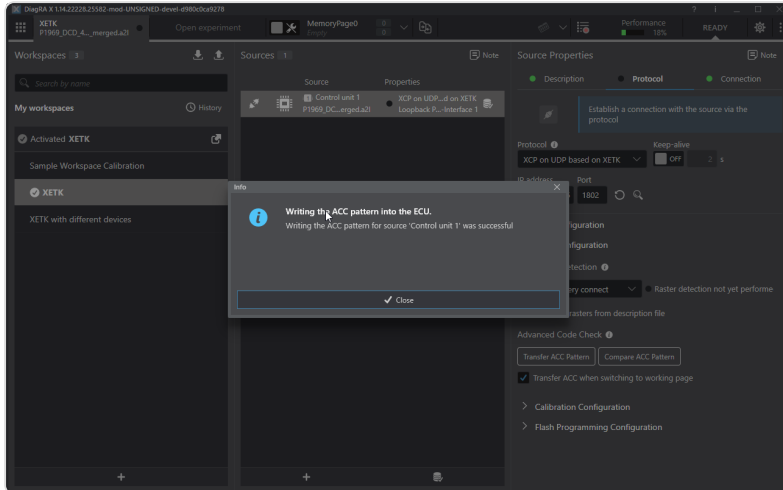


Advanced Code Check

ETK control units usually perform an Advanced Code Check (ACC) when switching to the working page. This checks whether the present combination of description and binary file matches the ECU software. To do this, DiagRA® X must write the data set to be adjusted from the binary file in advance to an address in the ECU that is predefined in the description file.

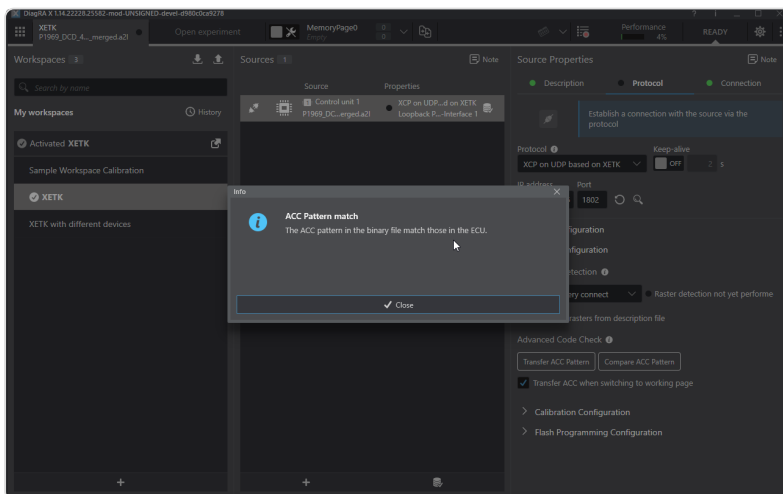
Transfer test data:

Writes the data to be adjusted to the control unit. Only available with existing connection.



Compare test data:

Reads the data to be adjusted from the control unit and compares them with those from the binary file. Only available with existing connection.



Transfer test data when changing to the working page:

If activated, DiagRA® X automatically writes the data to be adjusted to the control unit when switching to the work page.

Software Component Check

With the Software Component Check (SWC) it is possible to check whether the code segments described in the description file match those in the ECU. In XETK controllers, each code segment usually has a revision identifier. This is read by DiagRA® X and compared with the description file. The result is purely informative. A positive adjustment of all segments is not required by the control unit.

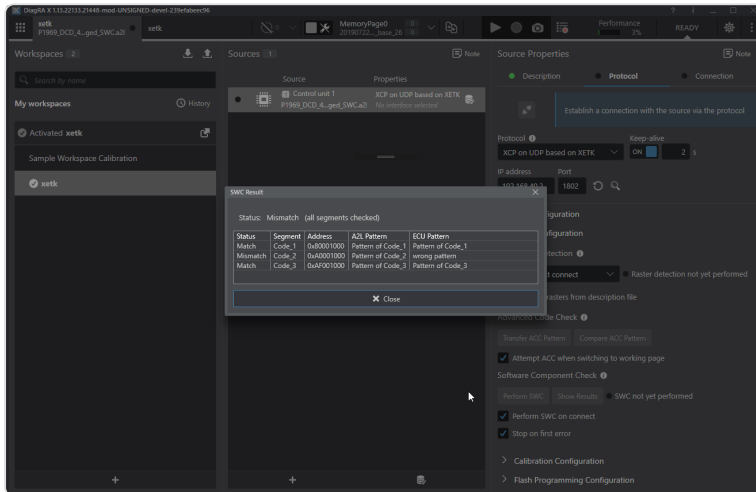


Perform SWC:

Compares the revision identifiers of all code segments and displays the result in tabular form. Only available with existing connection.

Show results:

Display the result of the last SWC.



Perform SWC when connecting:

If enabled, DiagRA® X automatically performs the SWC when the connection is established.

Cancel at the first error:

The test is ended prematurely at the first difference.

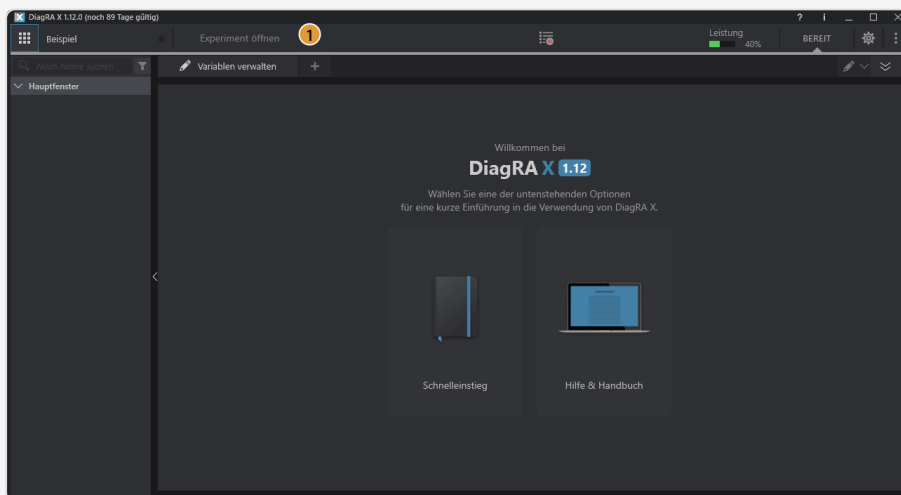
4 Experiment

The **available experiments** are listed and sorted alphabetically. The name of the selected experiment is displayed above the **list of experiments**. Within the list, the selected experiment is highlighted in color and bold font.

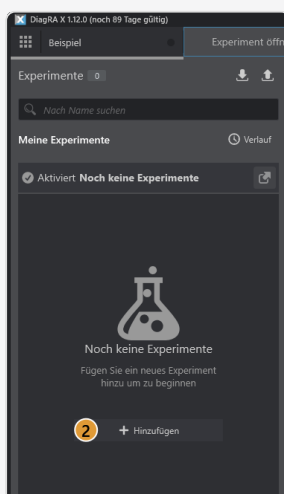
4.1 Adding an experiment or a group

A new experiment or group can be added in which experiments can be grouped.

1. **Open** the experiment page.

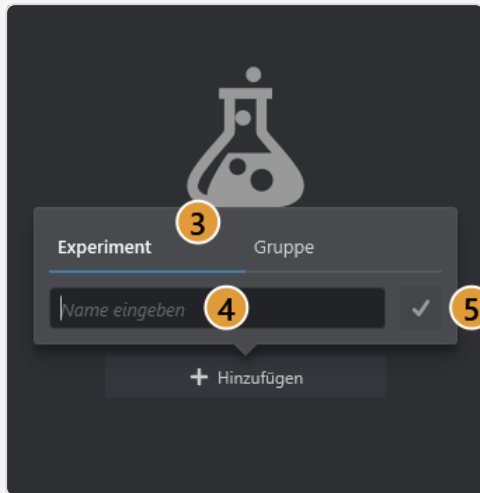


2. **Click Add.**





3. Click to select between an experiment and a group.



4. Enter a name.
5. Confirm by clicking ✓.

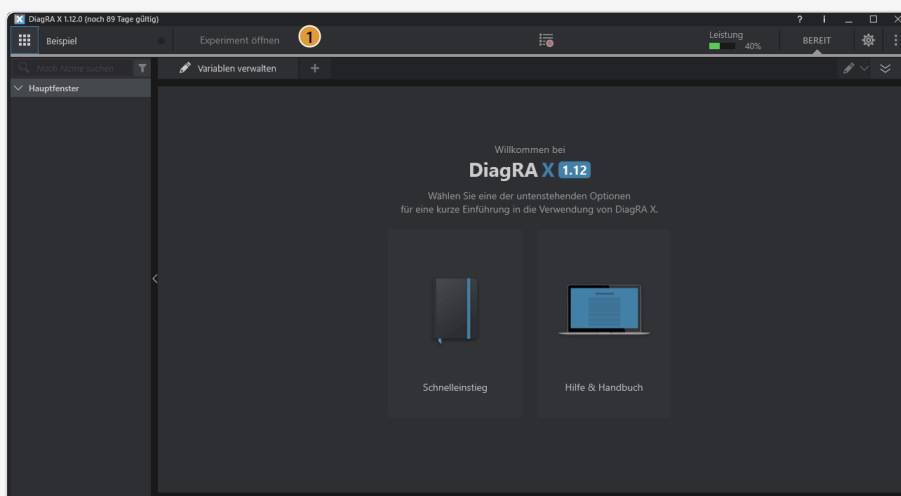



The experiment or group is now created.

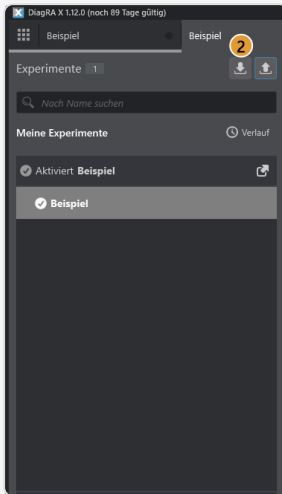
4.2 Importing experiments

An experiment can be imported.

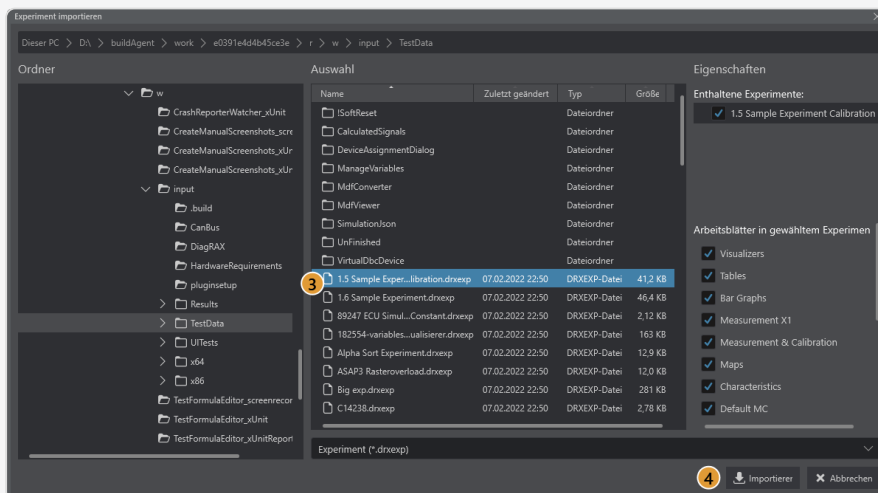
1. **Open** the experiment page.




2. Click **Import** .



3. Select the desired experiment.



4. Confirm by clicking .

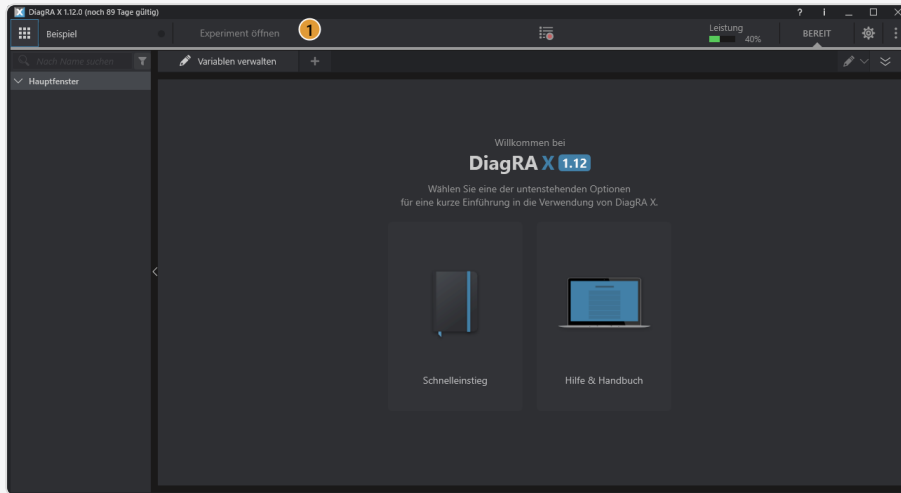


The experiment is now imported.

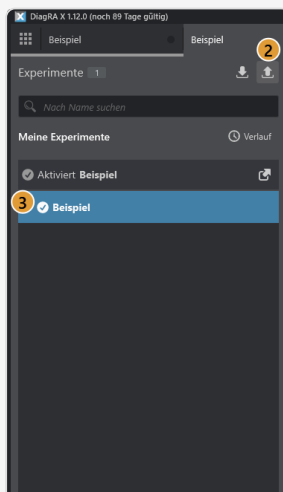
4.3 Exporting experiments


Experiments can be exported.

1. Open the experiment page.

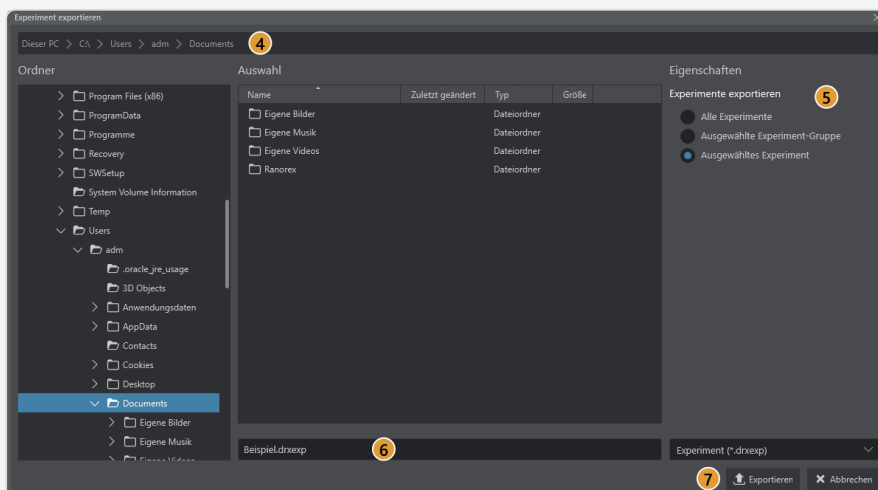


2. Select the desired experiment.



3. Click on **Export** .

4. Select the target directory.





5. Select whether all experiments, the group above the selected experiment or only the selected experiment are to be exported.
6. Select a file name.
7. Confirm by **clicking** ✓.

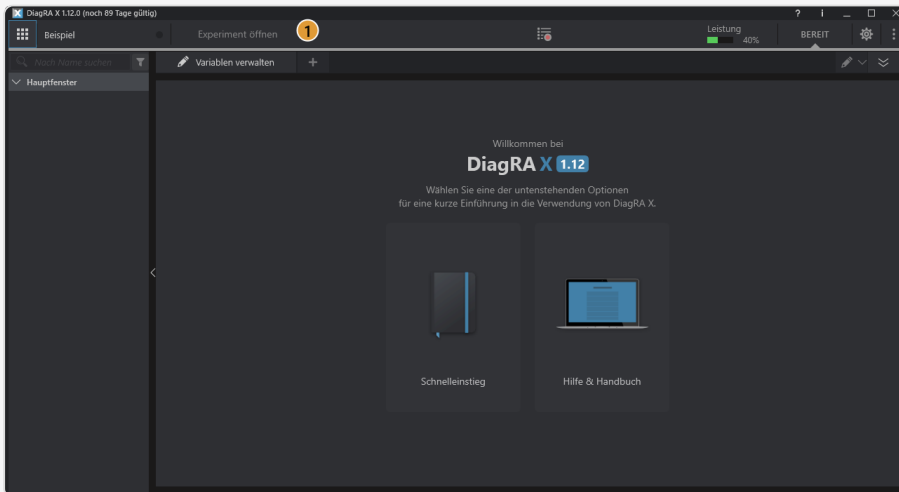


The experiment is now exported.

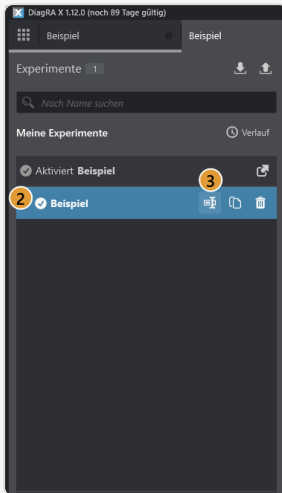
4.4 Renaming experiments

Experiments can be renamed.

1. **Open** the experiment page.

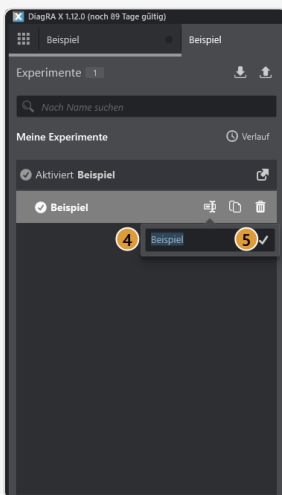


2. Select the desired experiment.



3. Click rename

4. Enter a name.



5. Confirm by clicking .

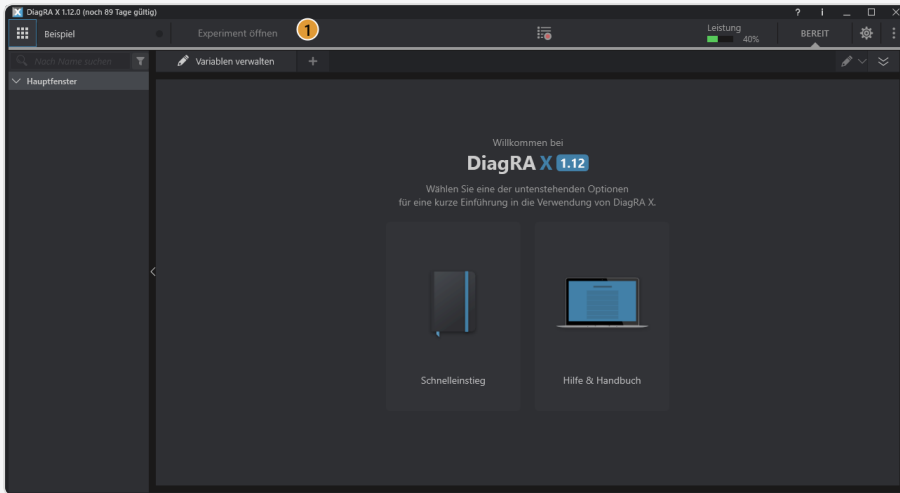


The experiment is now renamed.

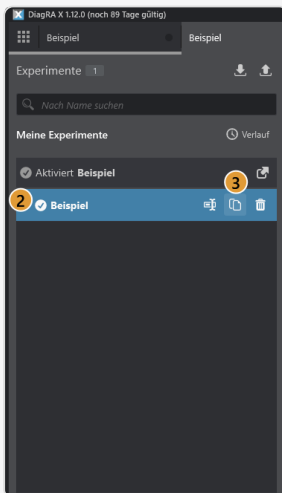
4.5 Duplicating experiments


Experiments can be duplicated.

1. Open the experiment page.



2. Select the desired experiment.



3. Click on **Duplicate** .

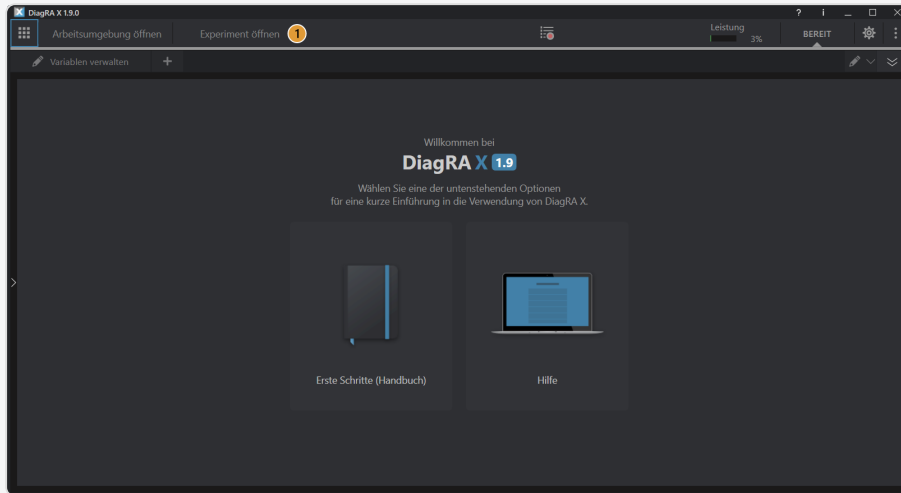


The experiment is now duplicated.

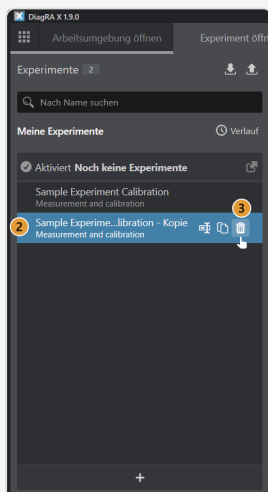
4.6 Deleting experiments


Experiments can be deleted.

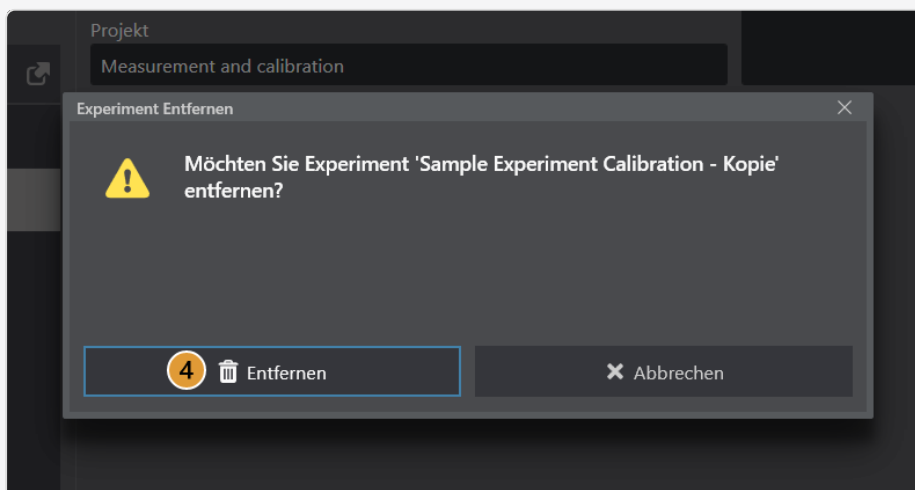
1. Open the page with experiments.



2. Select the desired experiment.



3. Click on **Delete** .
4. Confirm by clicking **Delete**.





The experiment is now deleted.



5 Worksheets and visualisers

5.1 Worksheet

A worksheet represents a set of visualisers in any arrangement and scale. Up to 30 visualisers can be placed on a worksheet and filled with variables. Any number of worksheets can be created. The **Home** button takes you to the last opened worksheet at any time.

5.2 Worksheet overview

A **worksheet overview** of all visible worksheets is available using the **double arrow symbol on the right border of the worksheet bar**. On the overview page, the search mask for the visualiser and worksheet names is applicable.

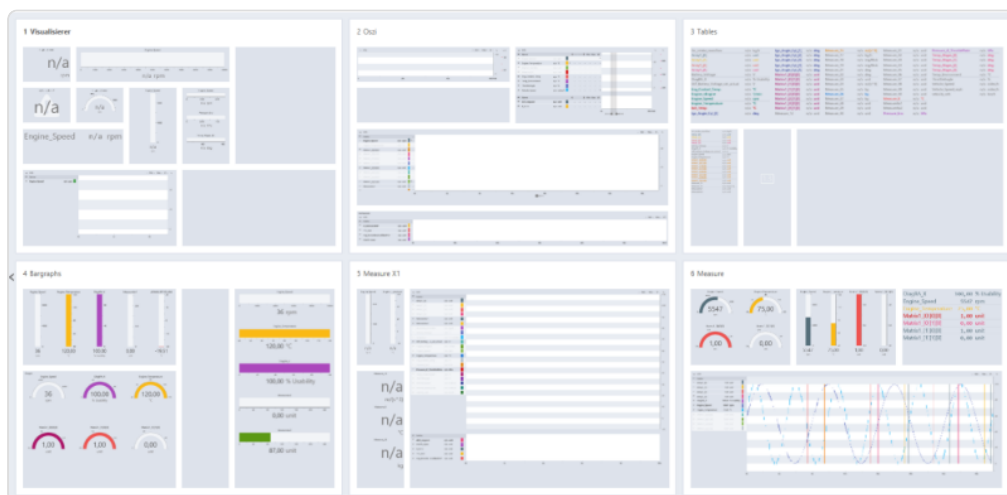


Fig. 5.1 : Worksheet overview


5.3 Visualizers

Visualizers serve to display and assess data. Visualisers offer a variety of ways to display variables. There are several different types of visualisers (e.g. numeric, bar, manometer, oscilloscope, etc.). **Each visualiser can contain several variables** that can be assigned with the help of the variable manager.

The **Worksheet Bar manages several worksheets**. Clicking the desired worksheet in the Worksheet Bar switches to the corresponding worksheet. The Worksheet Bar organizes the selected variables in containers for visualization.



5.4 View lock

Worksheets can be locked to prevent unintentional changes. To lock the current worksheet, click the lock symbol  in the top bar (if it is not visible, first select it in the “Select Functions” menu).

5.5 Create worksheet

5.5.1 Arrangement

During editing, predefined arrangements are offered on the right margin for quick selection.

Depending on the current occupancy of visualizers, not all arrangements can be selected. Incompatible arrangements are grayed out and cannot be applied.

By simply clicking on an arrangement, it will be applied. In the process, all visualizers are moved and scaled according to the new arrangement.

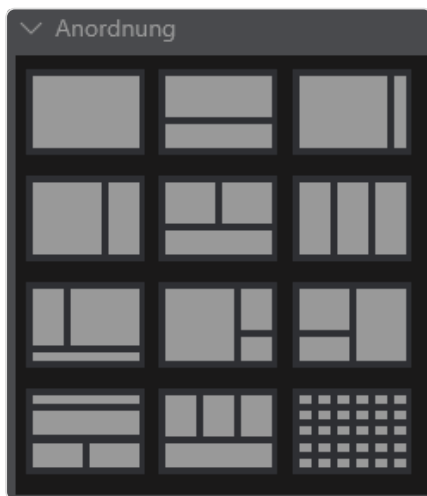


Fig. 5.2 : Arrangement suggestions

5.5.2 Templates and Visualizers

Templates are predefined arrangements with a respective predefined selection of visualizers. Arranging, adding and removing visualisers to a worksheet can be done at any time in edit mode.



Fig. 5.3 : Measurement visualizer

5.5.3 Edit mode

The Edit mode provides a comprehensive view of the worksheet. This Edit mode enables the size of the individual containers to be changed. Editing the size is carried out by holding down the left mouse button and dragging open the border.

The selection and arrangement of visualizers on the worksheet can be edited at any time. The worksheet settings available via the down arrow allow advanced editing with layouts, templates and names for each worksheet.

Layouts can be adapted on the basis of templates. The **currently selected layout is colored blue.**

Unavailable layouts, e.g. due to the number of visualizers which have already been assigned variables, **are gray. Alternative available layouts are displayed in white.**

A raster of 6x5 tiles is available for arranging visualizers on a worksheet. Visualizers can be placed on this raster at any position and in any size (except for some visualizers with minimum size > 1x1).



Changing the size of a container is only possible if visualizers have already been assigned. The largest possible raster which can be displayed on a worksheet is 5x6 containers. All adjustments must be made within this raster.

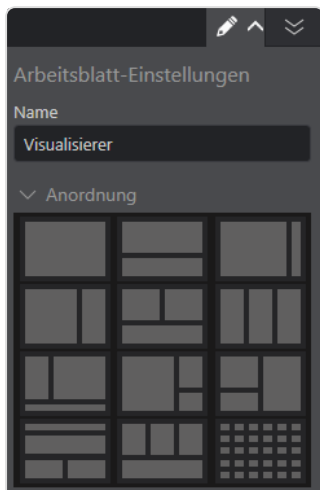


Fig. 5.4 : Worksheet Edit mode

5.6 Visualiser types

In the **Edit mode** for the worksheet, the **visualization type can be allocated for each tile**. The following visualization types are available for measurement values:

- Oscilloscope
- Numerical display
- Symbols
- Table
- Bar graph
- Pointer instrument

Independent of the visualization type, additional information can be displayed and adapted within the tile.

5.6.1 Measurement value color

The color of the measurement value can be changed. To access the color picker, simply click the visualization of the measurement value to be changed.

However it should be noted that the active style templates may influence the color of the measurement value.



5.6.2 Measurement value details

Clicking the name of the measurement value in the visualization container directly displays detailed information on the corresponding measurement value in the visualization container.

5.6.3 Status texts from text tables

Status texts from text tables are displayed in all visualizer types. In some visualizers, the cursor must be hovered over the variable value. These variable values are marked with an indicator, e.g. [ValueX].





5.6.4 Section header

In the **upper horizontal area** within a container, **additional information possibilities** appear for the measurement values available in the container. **The additional information is dependent on the visualization type.**

Switching the position of tiles with existing visualizers on a worksheet is possible using the **drag and drop function**.

Within a visualization area **the cursor must be moved slowly downwards from the upper tile border** for the header to appear. The header contains further additional display options and functions that are dependent on the visualizer type and which can be enabled or disabled.

The following functions are independent of the visualizer type:

Visual element	Element meaning	Element function
	Full screen	The tile is displayed on the entire display area.
	Reducing the size	The tile is rescaled to the original size. The control element is only visible when a tile is in full screen mode.
	Further operating elements	The operating element does not appear when there is insufficient space in the header to indicate further functions. The hidden operating elements are displayed by clicking the mouse.
	Remove	The set visualization including the variables are removed from the tile.

Tab. 5-1 Visualizer display options



5.6.5 Bar graph

Bar graphs show the **current value of a variable**. Bar graphs can be arranged horizontally or vertically. The initial scalings are defined by the description files.



Fig. 5.5 : Vertical bar graph (top) and horizontal bar graph (bottom)

Style menu

Right-clicking on a variable opens the style menu for the selected variables.

Display Limits

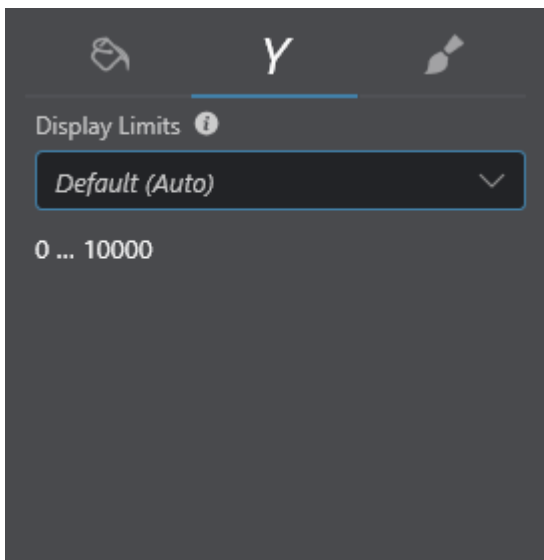


Fig. 5.6 : Tab for Display Limits in style menu



In the display limits tab, you can select the limits that will be used as minimum and maximum values in the bar graphs. See ["Display Limits"](#) on page 71.

5.6.6 Numerical display

The **numerical display** shows the **current values of the variables** with their unit. In addition, the minimum, maximum and average value can be displayed. The color differences of minimum, maximum, current and average value result from the use of style templates.

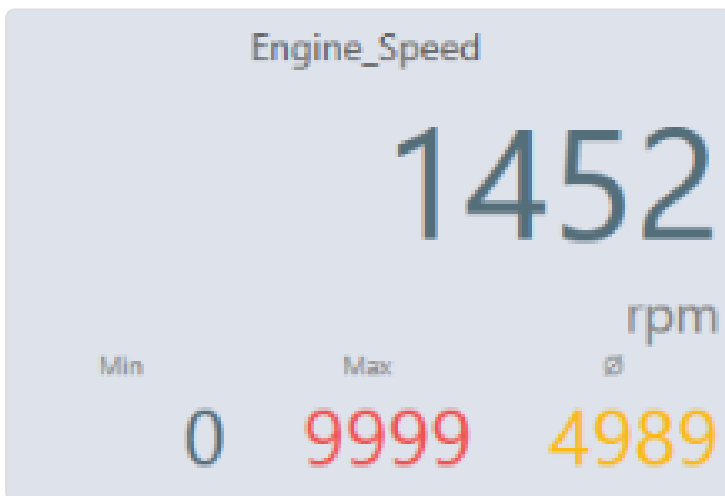


Fig. 5.7 : Numerical display

5.6.7 Oscilloscope

The **oscilloscope** displays **variables on a time axis**. Additional information and settings are available in some areas.

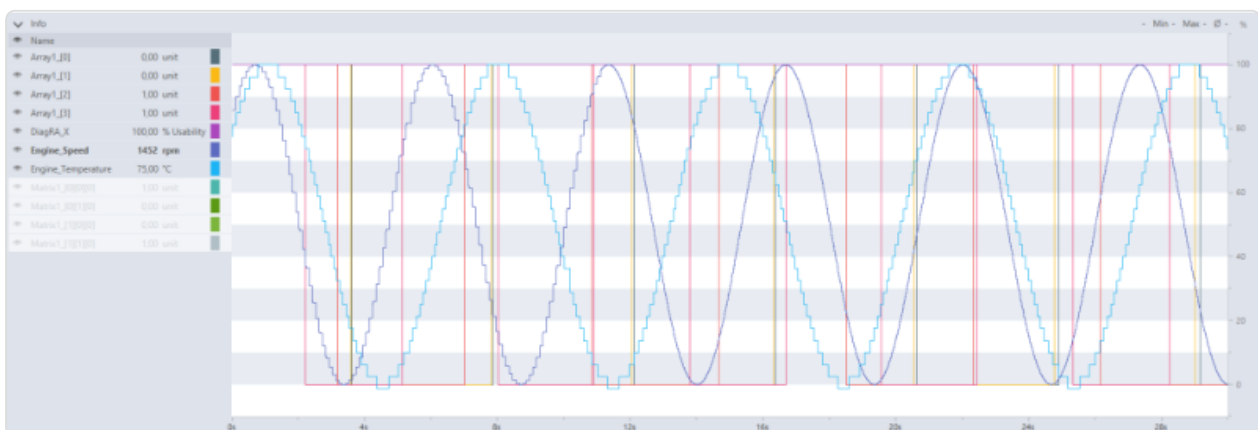



Fig. 5.8 : Oscilloscope areas

These areas are segmented from left to right in the list of optional variables, the visualization area and the expandable axis area. A header can be shown if needed.

List of Variables

The List of Variables can be displayed or hidden using the arrow control element. Within the **List of Variables**, **individual settings** are available for every variable. The options are described below.

Visible

The eye symbol  represents the visibility of the variables. **Clicking** this symbol can switch the variable in the visualization area from visible to hidden.

Colors

The color symbol accesses several settings. All **settings refer** to the display of the **selected variables** in the oscilloscope.

The style template is customizable. The axis' limits in the display area of the oscilloscope are adjusted according to the settings in the style template.

The **style template is customizable**. It is used to adjust the axis' limits in the display area of the oscilloscope according to the values in the style template. In the oscilloscope, colors are not used from the style template. The line colors can be permanently changed using the color symbol and the corresponding color palette. The selected line color is highlighted.

The displayed line style can be edited using the color symbol. The connection shape between the individual measurement values can be set. Different types of staircase shapes or smoothed connections as well as individual points are possible. An additional measurement point marker is available in different shapes.

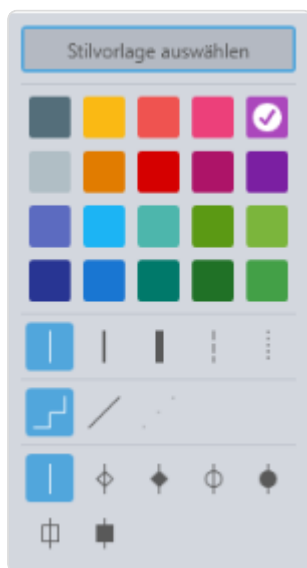


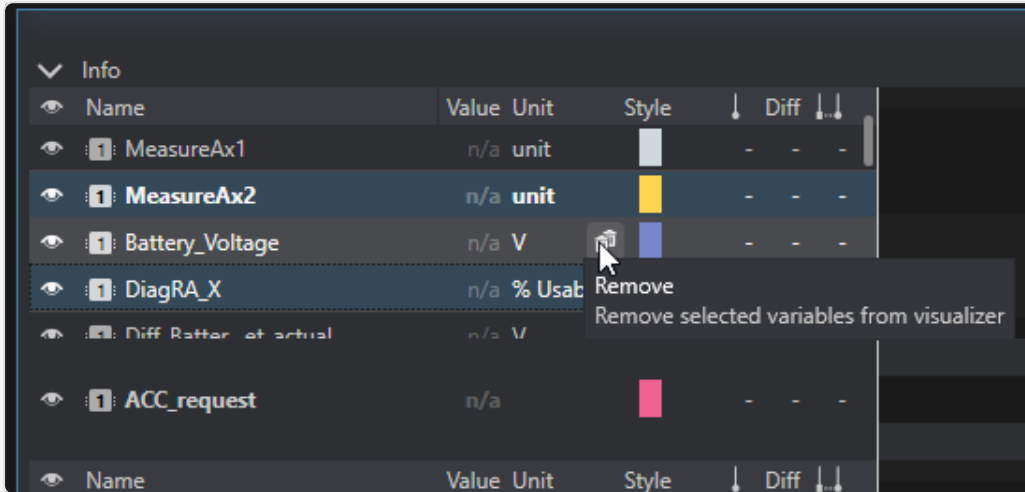
Fig. 5.9 : Oscilloscope style templates



Remove variables from variable list

You can remove variables from the variable list.

1. Move the mouse over the **variable**.



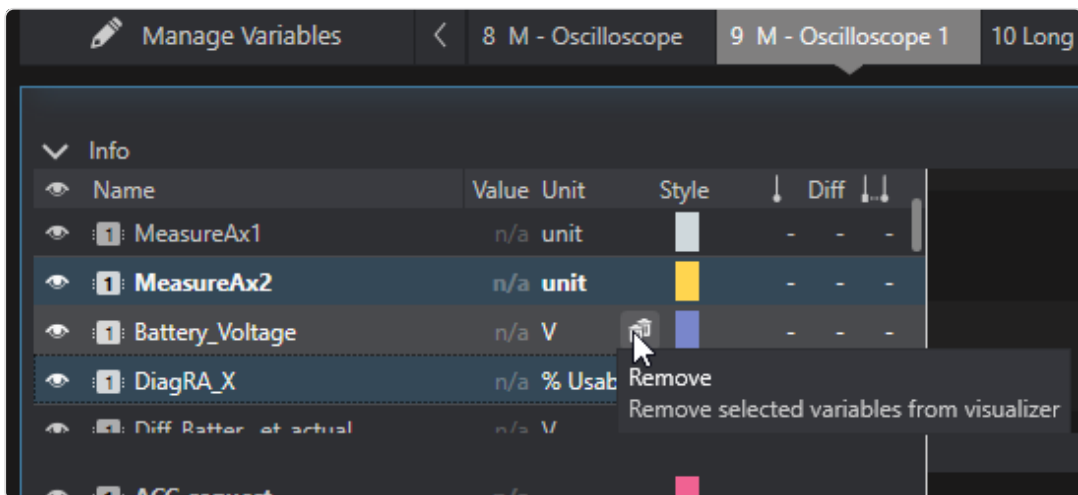
2. Click **Remove** .



The variable has been removed.



Multiple selection can be used to remove several variables at the same time.

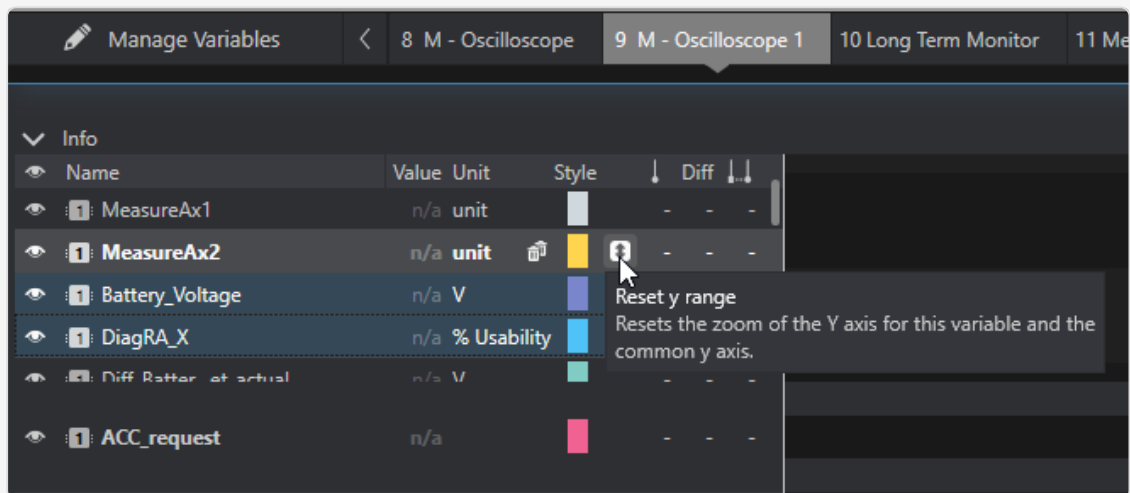




Reset Y-range

You can reset the Y-range.

1. Move the mouse over the **variable**.



2. Click Reset Y-Area .



The Y range has been reset.



Y-ranges can also be reset via shortcut.

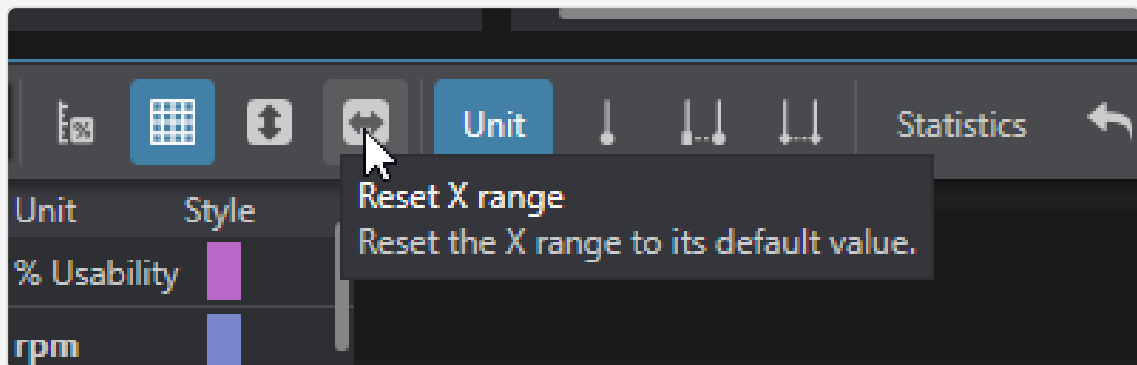
ALT + Y resets the Y-range of the selected variable.

ALT + SHIFT + Y resets the Y-range of all variables.

Reset X-Range

You can reset the X range.

1. Open the header of the visualizer.



2. Click Reset X Area .



The X area can also be reset via shortcut.
`ALT + SHIFT + X` resets the X area.

Reset X and Y range

You can reset the X and Y ranges at the same time.



The X and Y range can be reset via shortcut.
`ALT + SHIFT + F` resets the X and Y range of all variables.

Header

Right-clicking in the header opens a context menu in which the columns to be displayed can be selected. The name column can be resized in the header.

Visualization area

The visualization area displays the variables as lines. The **position** of the current value in the visualization area **depends on the selected step mode**. The step mode selection is available in the header.

Values

The measurement values of the variables **are displayed in different colors and regularly refreshed**. The refresh rate depends on the default set by the variable itself.



The time distance while moving can be kept constant by setting and using the mouse pointer for the drag and drop function between the cursors.

Left mouse button pressed

When the **left mouse button** is held down, the **visible area can be moved**. This changes the displayed area without changing the scaling. Move the mouse in the desired x or y direction.

Axis

The **Y-axis is always visible**. The scale of the main axis is set **dependent** on the **lower** and **upper limits** of the **selected variables**. The color and scale of the main axis depends on the variable. A secondary axis can be added. The scale of the second axis is set to a default value of 0 - 100%. Changes to the axis are possible at any time using the instructions below.

The X-axis is used for time and is always visible. When receiving measurement values online, the time axis can only be set using the header functions. When paused, the following actions can be used to modify the axis.

Zooming in X-direction via keyboard

The keyboard shortcut for zooming can be configured in the system settings/keyboard shortcuts/oscilloscope/zoom in(zoom out). Default value is +(-). Zooming is also possible with the NumPad plus (minus) keys.

Left mouse button pressed

By holding down the left mouse button, the respective axis can be moved. This changes the viewed area without influencing the scale.

Mouse wheel

The scale of the axis is adjustable using the mouse wheel.

Header

Additional visualization options and functionalities are provided in the header.

Visual element	Element description	Element function
-	Duration	The duration changes the displayed time range on the X-axis for all variables within the oscilloscope.
-	Scroll mode	The scroll mode refreshes the display area continually or step-by-step.



Visual element	Element description	Element function
	Show common Y-axis	In addition to the default axis 0 - 100%, an additional axis is shown. The selected variable provides the scaling and color of the additional axis.
	Raster	The raster in the background of the display area can be enabled or disabled.
	Reset Y-axis view	The Y-axis view is reset to its initial state.
	Reset X-axis view	The X-axis view is reset to its initial state.
Unit	Show and hide unit	The unit is shown and hidden in the variable list.
	Cursor	Values for a certain time can be displayed by setting the cursor. The cursor can be moved with the mouse or by entering an exact time. The corresponding time is shown next to the cursor. A variable must be selected by enabling the checkmark in the List of Variables.
	Second cursor	Values for a certain time can be displayed by setting the cursor. The cursor can be moved with the mouse or by entering an exact time. The corresponding time is shown next to the cursor. A variable must be selected by enabling the checkmark in the List of Variables.
	Range cursor	By setting the range cursor, the values and the difference between two specific times are shown. The cursors can be moved independently of each other using the mouse or by directly entering a time. In the same way, the cursors can be moved with unvarying time difference. The corresponding times are shown next to the cursors.
-	Statistics	Statistics are shown in the list. It contains all value details for the corresponding cursor positions as well as minimums, maximums, average values and difference.
	Reset statistics	The statistics values in the display are reset.
10 ^x	Scientific notation	In the variable list, the values of the variable are displayed in the notation a*10 ⁿ to make long values shorter.



Tab. 5-2 Function overview oscilloscope

Context menu for cursor

The cursors can be controlled via a context menu. Functions are available to set the display area to a cursor, to move a cursor into the display area and to show and hide a cursor.

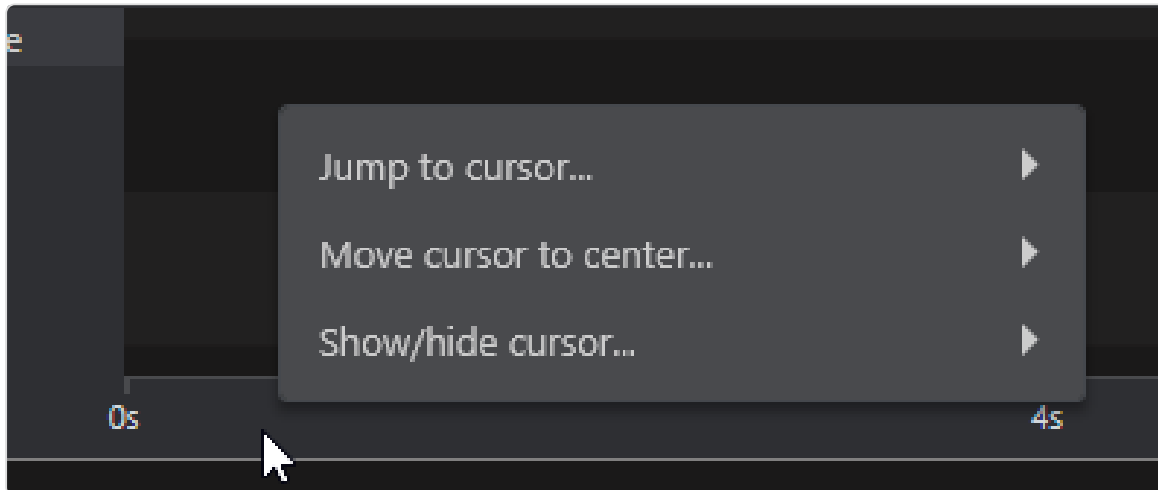


Fig. 5.10 : Cursor context menu

Context menu of the Y-axis

The display limits and group axis can be edited via the context menu of the Y-axis.

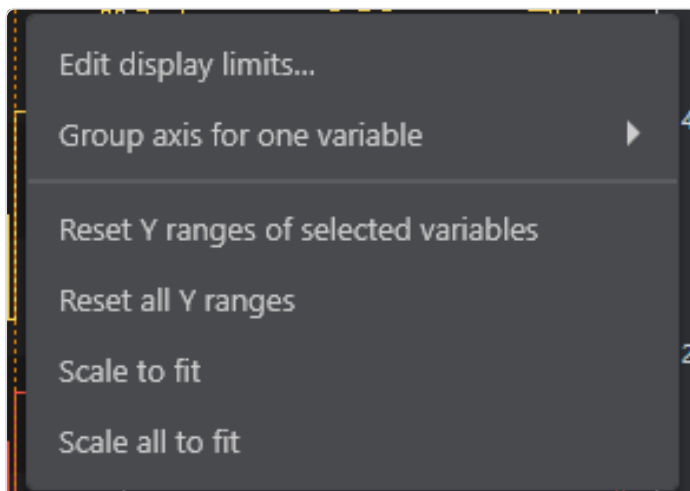


Fig. 5.11 : Context menu of the Y-axis of a variable with group axis

In addition to the display limits settings, other functions are available via the context menu:



Function	Description
Reset Y-range of the selected variable	Zoom level and shift of the Y-axis of the selected variable are reset to the default values.
Reset all Y-ranges	Zoom level and Y-axis shift of all variables are reset to default values.
Scale to fit	Time and Y range of the selected variable are scaled and shifted so that the values are completely visible.
All fit-scale	Time and Y range of all variables are scaled and shifted so that the values are completely visible.

Display Limits and group axis

In the style menu for a variable in the oscilloscope there is a tab for the display limits. The display limits are used to scale the Y-axis of a variable.

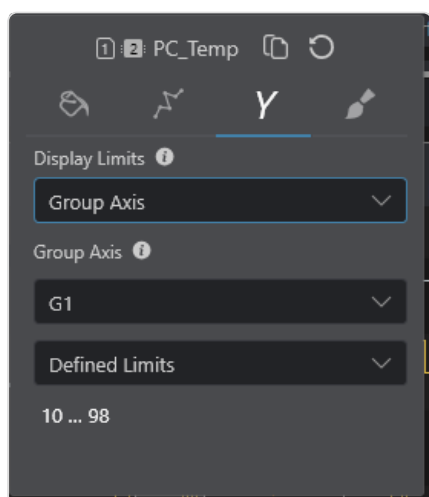


Fig. 5.12: Display Limits tab in the style menu

The available display limits can be found under ["Display Limits" on page 71](#).

Group axis

Any number of variables of an oscilloscope can be assigned to a group axis. All variables assigned to a group axis are scaled and moved together. To use a group axis, select "Group axis" as the display limits and select a group axis or create a new one.



Another possibility is to select several variables in the variable list of the oscilloscope and drag and drop them onto the Y-axis of the oscilloscope. This places all selected variables on the group axis of the marked variable, or creates a new group axis if the marked variable was not previously assigned to a group axis.

5.6.8 Icon Monitor

Binary variables are represented by **icons**. The color and the low/high sign can be individually set for every variable.

Change icon display

To change the icon display in the visualizer, proceed as follows:

1. **Open** the context menu by **right-clicking** the icon you want to change.
2. **Select** the new color or style for the icon.



The icon display has been changed.



The changes are saved automatically.

Icon	Example of use
	Warning general
	Snow warning
	Pressure warning
	Engine fault
	Oil level warning
	Battery warning
	Electricity



Icon	Example of use
	Switch ON
	Switch OFF
	LED ON
	LED OFF
	Transmission Fault
	ABS Fault
	Temperature Warning
	ESP Activation
	High Voltage
	Electrical System/Source (Dynamo)
	Direction right (Forward / Downstream)
	Current source
	Direction left (reverse / inflow)
	Current Mobile Bank
	Connected
	Disconnected
	Central Heating
	Cooling Fan
	Restart indicator

Fig. 5.13 : Selectable icons in the Icon Monitor



5.6.9 Table

The **table display** lists the **variable names**, the **current value** as well as the **unit (optional)**. In addition, colors and style templates can be applied.

Engine_Speed	1452 rpm
Engine_Temperature	75,00 °C
Matrix1_[0][0][0]	1,00 unit
Matrix1_[0][1][0]	0,00 unit
Matrix1_[1][0][0]	0,00 unit

Fig. 5.14 : Table

5.6.10 Pointer instrument

The **pointer instrument** is constructed similarly to the bar graph. The **display takes place in a semi-circle arc**. Further options are identical to those of the bar graph.

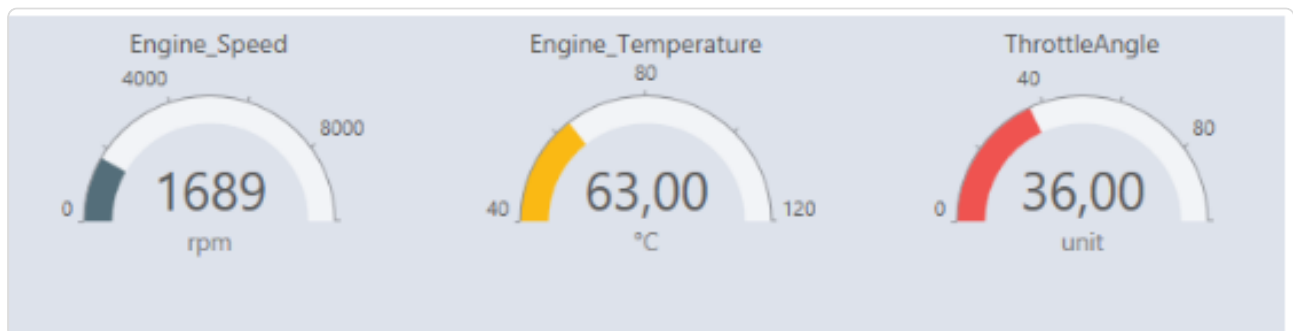


Fig. 5.15 : Pointer instrument

Style menu

Right-clicking on a variable opens the style menu for the selected variables.



Display Limits

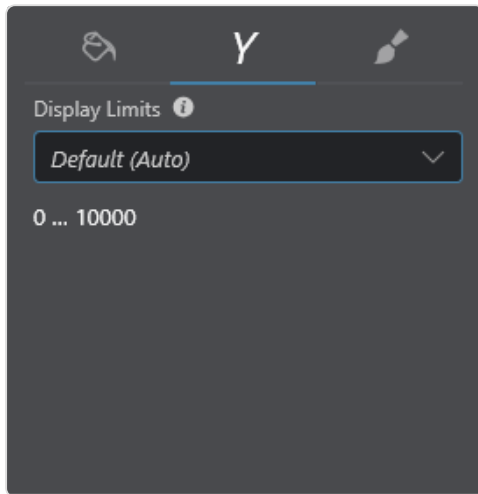


Fig. 5.16 : Tab for Display Limits in style menu

In the display limits tab, you can select the limits that will be used as minimum and maximum values in the pointer instruments. See "[Display Limits](#)" on page 71.

5.6.11 Trace Visualizer

The **Trace Visualizer** displays variable values in tabular form over time. The variable value, the associated timestamp and, if activated, the number of received values are displayed. The timestamp corresponds to the time since the start of the measurement.

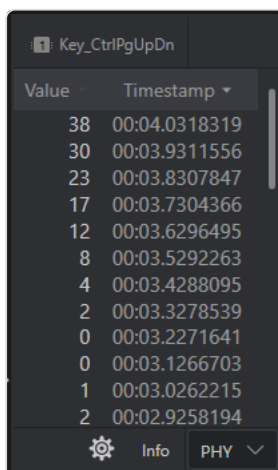


Fig. 5.17 : Trace Visualizer



Options

Unique values

If this option is active, not all received values are displayed, but only new values and the timestamp of the last occurrence as well as the number of received values.

Gray out old values

With this option it is possible to display values weaker that are older than a specified time. This is especially useful with the *Unique values* option to see at a glance which values are new.

Selection of the number format

In the footer of the visualizer you can set how the values should be formatted.

- **Physical:** The physical values are displayed
- **Hexadecimal:** The device-internal raw values are displayed hexadecimal
- **Binary:** The device-internal raw values are displayed in binary form
- **Decimal:** The device-internal raw values are displayed in decimal form

Sorting

By clicking on the header of a column, the sort order can be set. If the *Unique values* option is inactive, you can only sort by timestamp (ascending or descending). If it is active, you can additionally sort by the value (ascending or descending).

Variable selection

The visualizer always displays only the values of one variable. If several variables are assigned to the visualizer, the displayed variable in the header can be selected by a drop-down menu.

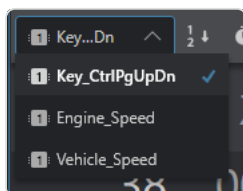


Fig. 5.18 : Selection of the variable in the visualizer header

5.7 Variables monitor

The variable monitor displays an overview of the existing worksheets and their contents. It is hierarchically divided into window, worksheet, visualizer and contained variables. The current value is displayed for the variables.

The variable monitor can be **expanded** \triangleright and **collapsed** \triangleleft by clicking on the icons. **Drag** the \triangleleft icon to **change** the width.

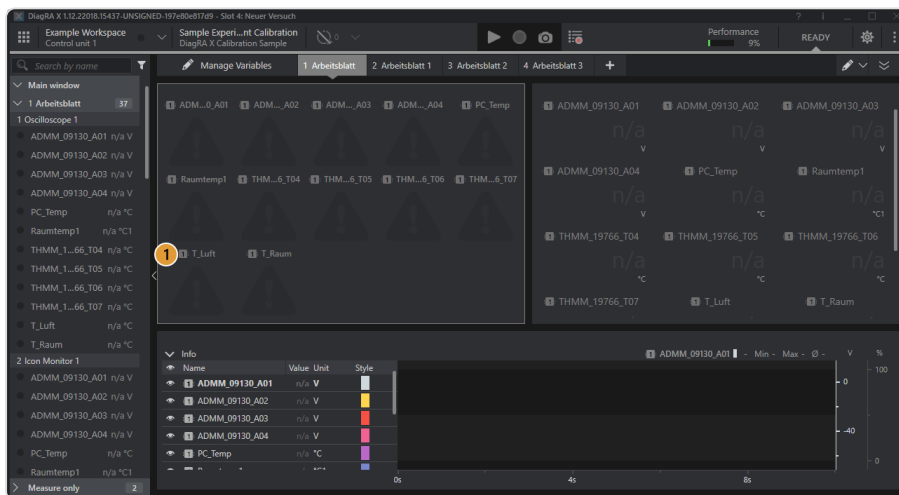


Fig. 5.19 : Variables monitor

5.8 Display Limits

The following selection options are available for the display limits:

Display Limits	Description
Auto	If available, the borders from the applied style sheet are used, otherwise the defined borders are used.
Defined Limits	The limits as defined in the description file file.
From Style Template	The limits of an applied style sheet.
Custom Limits	The limits can be entered freely.
Dynamic Limits	The limits adapt to the currently measured value range.



Display Limits	Description
Group axis	In the oscilloscope, a common group axis can be used for several variables. Variables with the same group axis are scaled synchronously. For a group axis, "Defined limits", "User defined" and "Dynamic" can be set as display limits. You can find more information at "Oscilloscope" on page57 .



6 Variable management

Variable Management is divided into a number of areas. The following figure shows the arrangement with the upper menu bar and the variable monitor and details that can be switched on at the side.

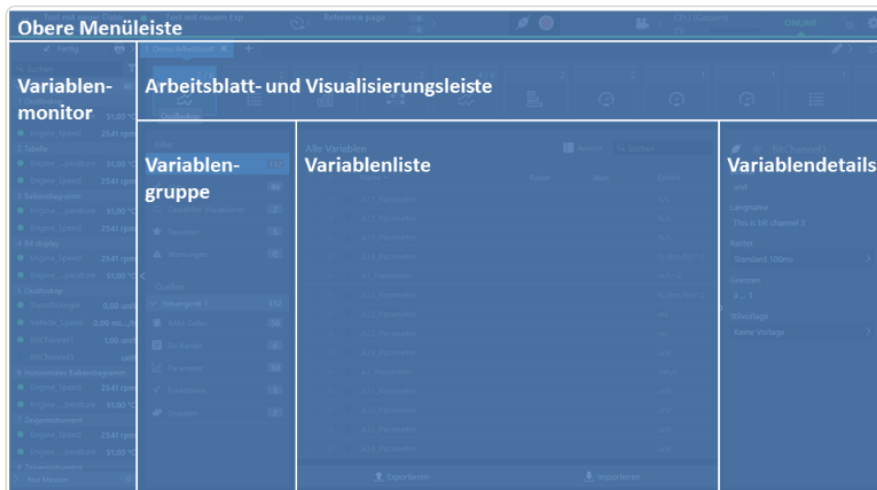


Fig. 6.1 : Variable Management layout

The Variable Management consists of the Worksheet Bar and Visualization Bar, the Variable Group, the List of Variables and the Variable Details. The variable management is available as soon as an experiment has been created. Worksheets do not necessarily have to be defined for this.



In the case of an existing physical connection with low refresh rate, the measurement values are read from the measurement device or control device and displayed in the Variable Management.

The actual measured values are displayed online with the set raster. For further settings, see section "General System Settings".

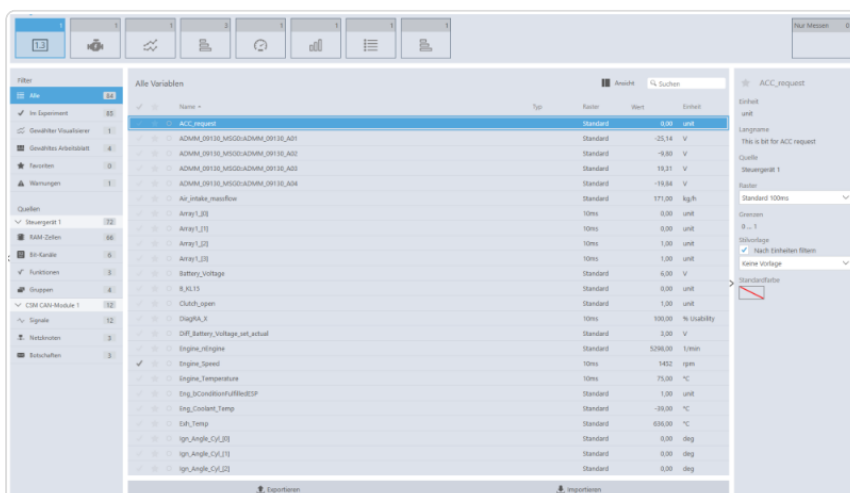




Fig. 6.2 : Variable Management overview

6.1 Visualization Bar

The **Visualization Bar** is located in the upper area of the **Variable Management**. This bar **individually displays the defined containers of the selected worksheet**. The Worksheet Container shows the visualization type and the number of variables already displayed on it.

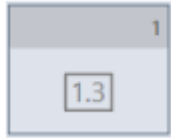


Fig. 6.3 : Example: Visualization container of type Numerical.



The maximum displayable number of variables in the containers is dependent on the set tile size on the worksheet.

6.1.1 Adding measured quantities

Use the drag and drop function to add the desired variable from the List of Variables section “List of Variables” to your Worksheet Container.

6.1.2 Measurements Only

On the **Visualization Bar**, there is always a **Container** listed with “**Measurements Only**”. The container is fixed to the right border. In this container, measured quantities can be stored, independent of the worksheet, whose measurements have been recorded but should not be graphically displayed.



Fig. 6.4 : Measurement container



6.2 Variable groups

Diverse categories display variables according to groups. The **Filters** and **Data sources** can be found on the **left border in the Variable Manager**. General filters are displayed above and can be applied to all data sources.

6.2.1 Filters

The **applied filter settings** are **applied to all available data sources**. The selected filter is highlighted in color and is displayed above the List of Variables with a corresponding text. It is possible to select multiple filters.

The filter in the experiment lists all active variables independent of their allocation to worksheets or variable types.

The Selected Visualizer filter lists only the variables available in the selected container.

The Selected Worksheet filter lists the variables available in the worksheet.

The Favorites With Subcategories filter displays the favorites from all available worksheets. An additional filtering is possible. The drop-down element above the list can be used for this.

Under **Warnings**, **all variables which cannot be correctly used** are listed.

6.2.2 Sources

In **Sources**, the **devices available in the workspace** are listed. Just as with the general filters, only the filtered quantities are displayed in the List of Variables. **Selection** and **deselection** are carried out with a **mouse-click**. The selected source is highlighted in color and is displayed above the List of Variables with a corresponding text.

6.3 List of Variables

In the **List of Variables**, the **variables are listed row by row**. Further information on each variable is displayed in abbreviated form within the row. **More detailed information** is available by **clicking** the desired variable. The detailed information is shown using the switchable Variable Details view on the right border.



6.3.1 Selection

The selection of a variable is carried out by clicking the mouse. **Multiple selection can be carried out using CTRL + mouse-click and SHIFT + mouse-click.**

Many details on variables are listed in the switchable Variable Details view and can be partly edited there.

6.3.2 Search

The text field can be used to search for specific quantity names.

6.3.3 Exporting and importing

The operating element Export can be used to create label lists in a Lab or ELI format for the selected variables. The Import function enables label lists to be imported from the formats Lab or ELI.

6.4 Variable details

To the right of the list of variables details are displayed about the selected variables.

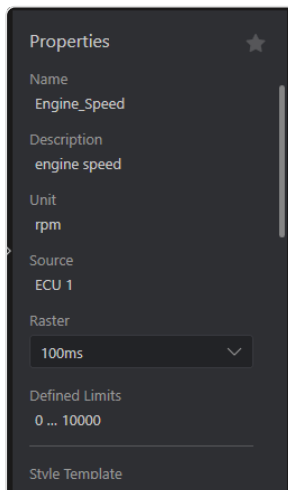


Fig. 6.5: Variable details of a measurement variable

In the details, information about variables can be read and settings can be made.



6.4.1 Display Limits

The default display limit can be selected for measurement variables. See here ["Display Limits" on page 71](#). If a variable is assigned to a visualizer, the setting is taken from the variable details. If other display limits are selected in the visualizer, this does not change the default value.

7 Virtual variables

Virtual variables are composed of several variables or constants that are combined by a series of operations or by an algorithm.

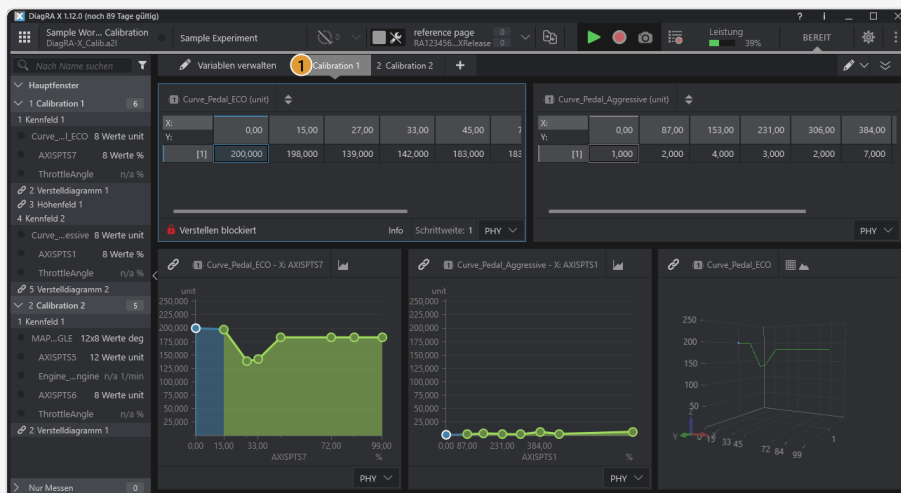


The virtual variables are available only in the DiagRA® X Viewer Pro license.

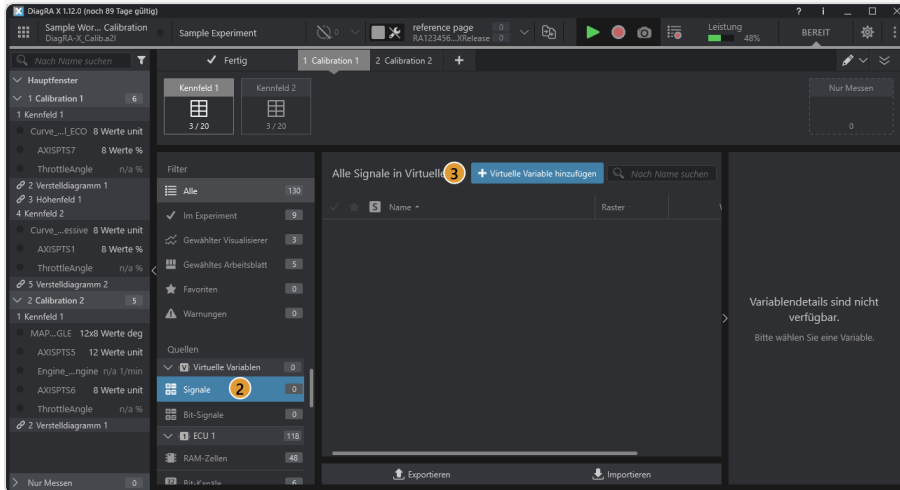
7.1 Add virtual variable

You can add a new virtual variable.

1. Open the **Variable Manager**.



2. Select the **source** of the virtual variables.



3. Click on Add Virtual Variable **+** (*Ctrl+N*).



The virtual variable was added.



The added virtual variable appears at the end of the variable list.

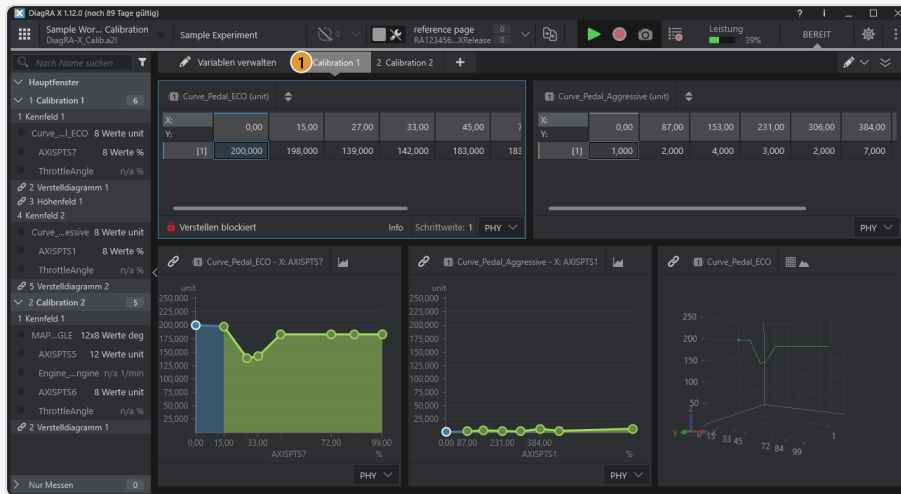
See ["Edit virtual variables" on page 83](#)

7.2 Duplicate virtual variable

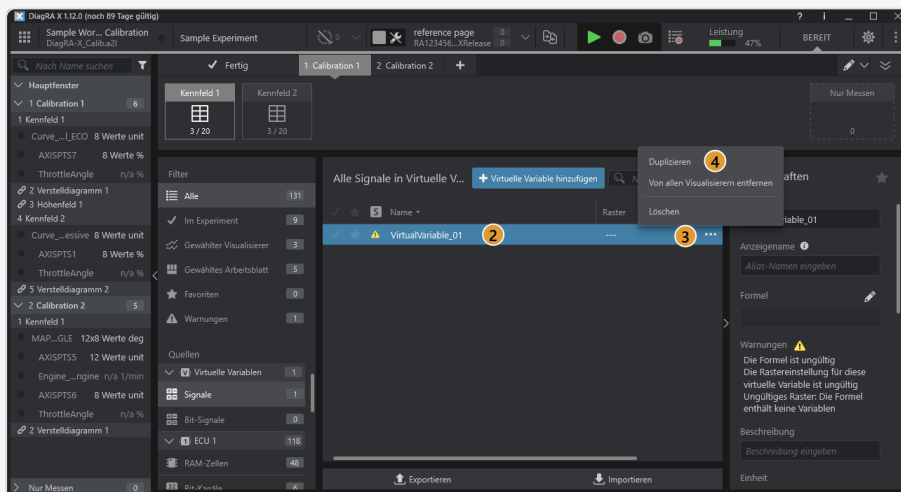
You can duplicate a virtual variable.



1. Open the Variable Manager.



2. Move the mouse over the Virtual Variable.



3. Click on Secondary Functions ***.

4. Click on Duplicate (Ctrl+D).



The virtual variable is duplicated.

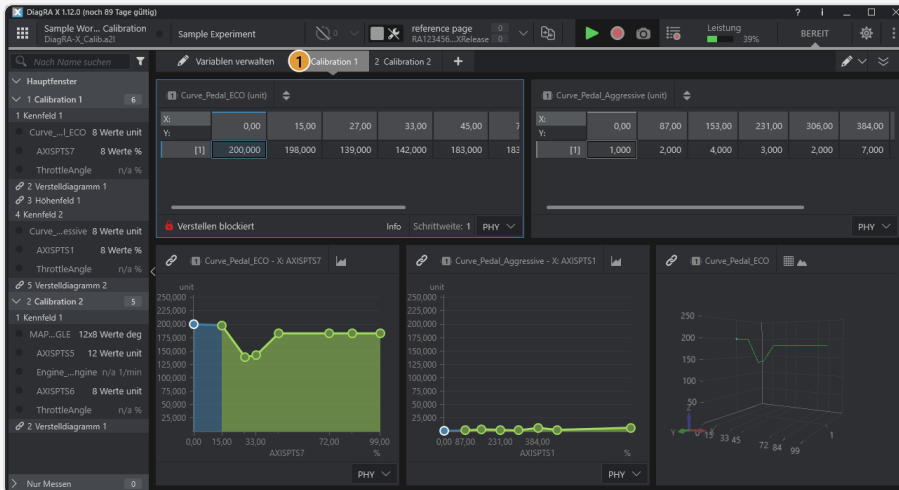


The added virtual variable appears at the end of the variable list.

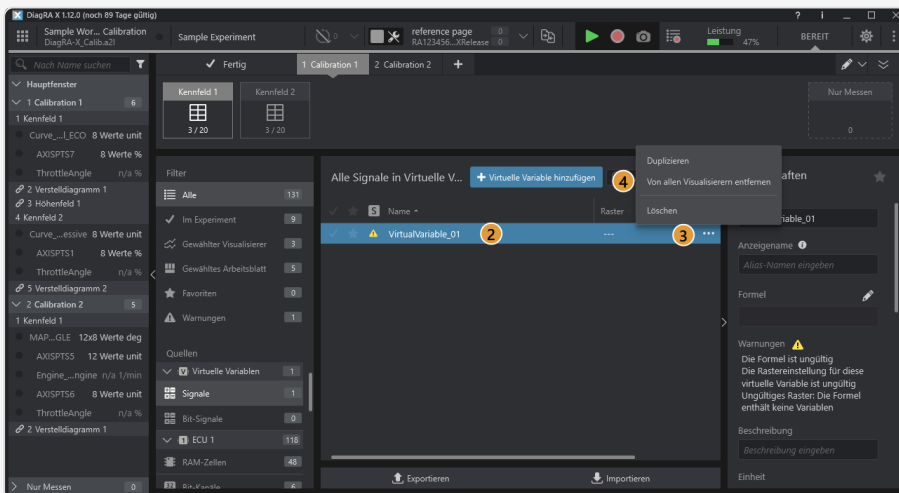
7.3 Remove virtual variable from all visualisers

You can remove the virtual variable from all visualisations.

1. Open the Variable Manager.



2. Move the mouse over the Virtual Variable.



3. Click on Secondary Functions **⋮**.
4. Click **Remove from all visualisers** (*Ctrl+Alt+Spacebar*).



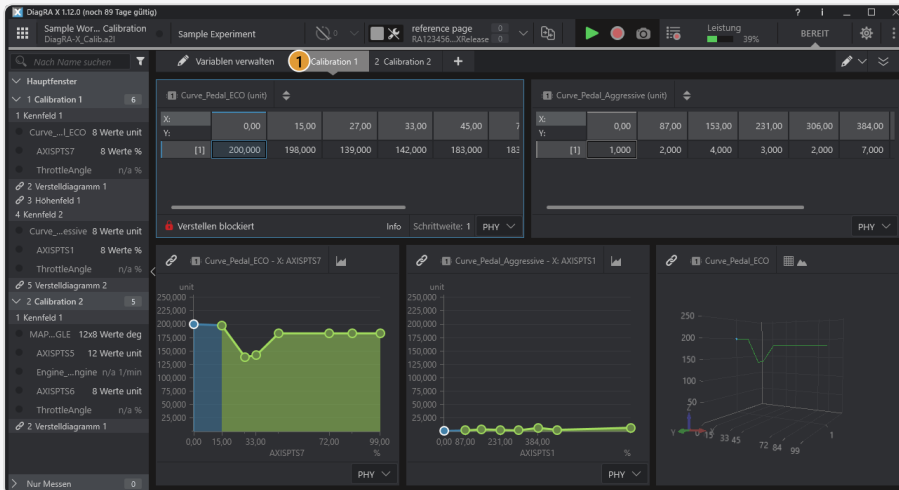
The Virtual Variable is removed from all visualisers.



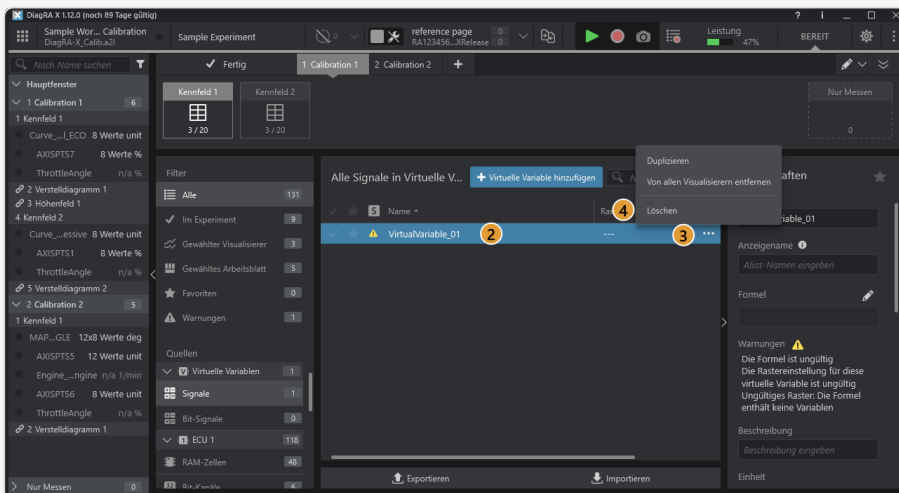
7.4 Delete virtual variable

You can delete a virtual variable.

1. Open the Variable Manager.



2. Move the mouse over the Virtual Variable.



3. Click on Secondary Functions ***.
4. Click on Delete (Del).

The virtual variable is deleted.



Related links

See ["Edit virtual variables"](#) below

7.5 Edit virtual variables



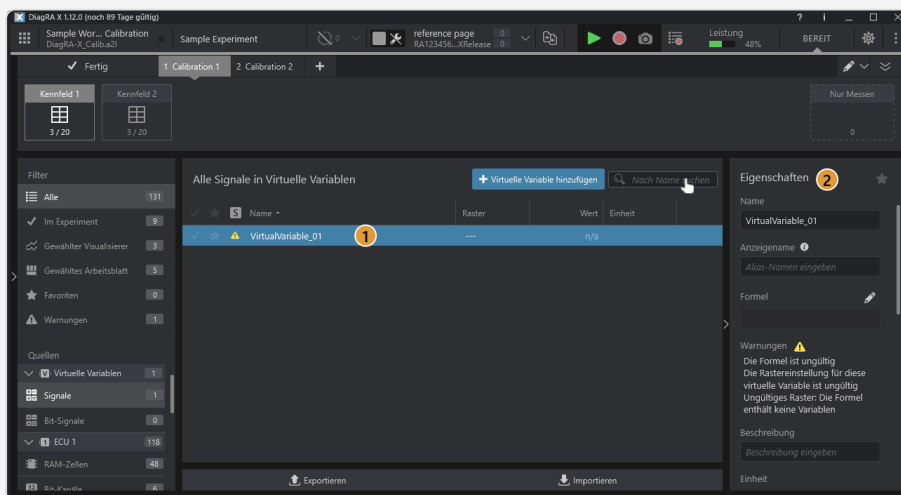
The virtual variables are available only in the DiagRA® X Viewer Pro license.

You can edit the properties and formula of a virtual variable.

7.5.1 Edit properties of a virtual variable

You can edit the properties of a virtual variable in the Variable Manager.

1. **Select** a virtual variable in the variable list.



2. You can **edit** the name, display name, unit and limits on the **right side** in the **properties**.



The properties of the variable are updated.



Raster selection

The input variables of the current formula are offered as raster variables. The raster variable determines when the virtual variable should be updated, namely whenever the raster variable changes.

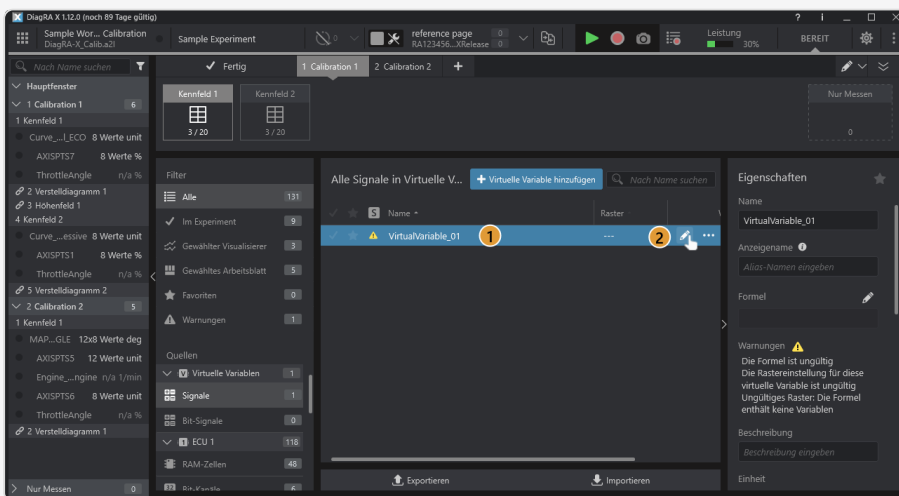



A fixed **cyclic raster** or an **input variable** can be selected as a trigger for a virtual variable. If multiple input variables are selected, their underlying raster must be controlled either by DiagRA® X (internal) or by external sources. If internal and external raster are mixed, the monotony of the time stamps cannot be guaranteed, which is why such a combination is not permitted.

7.5.2 Edit the formula of a virtual variable

You can edit the formula of a virtual variable in the formula editor.

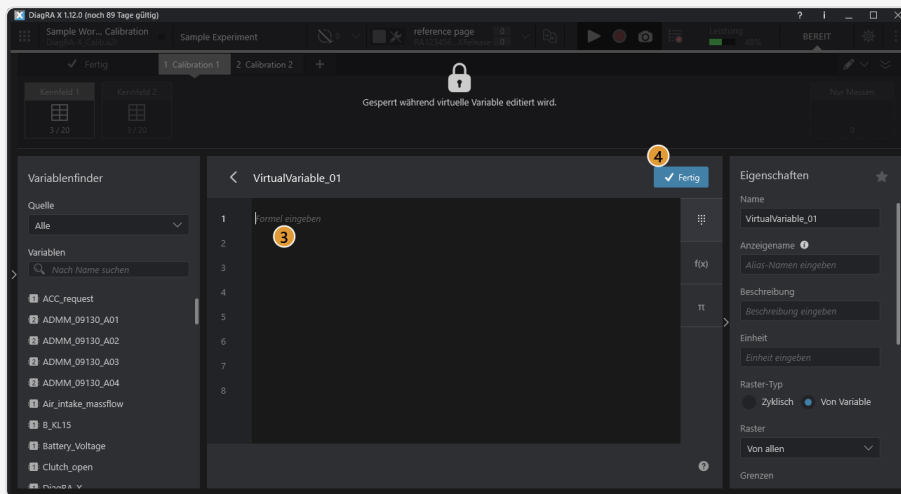
1. Move the mouse over the Virtual Variable.



2. Click on Edit  (F2).



3. Edit the Virtual Variable.



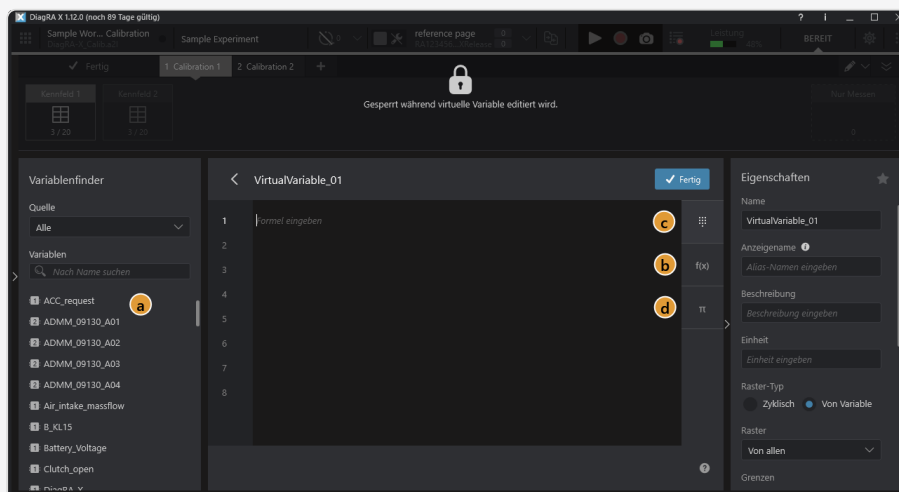
4. Click on Done to finish editing.



The formula of the virtual variable has been changed.

Function overview

1. Open the formula editor.



a. Insert variable:

Add a variable from the variable finder by drag-and-drop, double-click or the add button **+**.

**b. Insert function:**

Add a function from the function library using **drag-and-drop**, **double-click** or the **Add button** **+**.

c. Insert operator:

Add an operator from the operator library **using drag-and-drop** or **click**.

d. Insert constant:

Add a constant from the constant library by **drag-and-drop** or **click**.

Edit formula with keyboard

You can edit the formula of a virtual variable in the Formula Editor using the keyboard alone as an alternative to the mouse. You will be supported by a suggestion list that automatically displays elements that match your input.

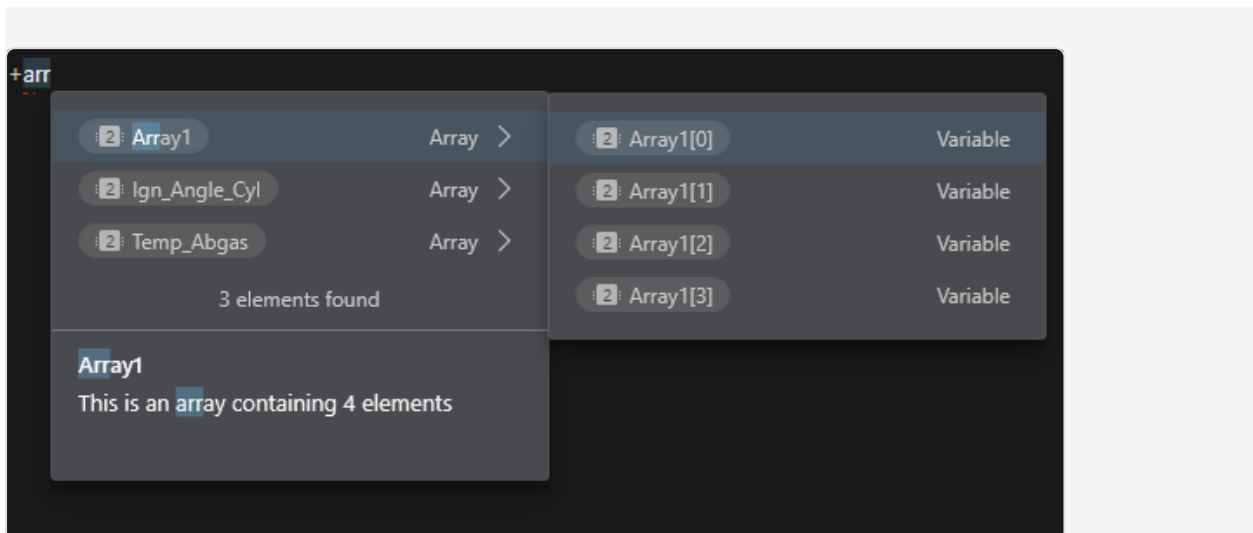
1. **Type** any string in the formula editor. The suggestion list is displayed.
2. **Select** a suggestion in the suggestion list using the arrow keys.
3. **Press ENTER** to accept the selected suggestion into the formula.



The proposal has been inserted into the formula and the proposal list is closed.

You can select an array element from the suggestion list.

1. **Select** the array.
2. **Press ENTER** to confirm.
3. **Select** the element using the arrow keys.



4. Press **ENTER** to add the selected element to the formula.



The selected array has been inserted.

7.6 Functions

DiagRA® X offers a number of functions that can be used in virtual variable formulas. Below you will find an overview as well as more detailed descriptions of these functions.

7.6.1 Function overview

Function	Notation in formula	Available in	
		DiagRA X	DiagRA X Viewer
Integral	integral(i)	✗	✓
Gradient	slope(i)	✗	✓
Deviation indicator	dm_hasDev(i, t, u, d)	✓	✓
Relative deviation	dm_relDev(i, t)	✓	✓



Function	Notation in formula	Available in	
		DiagRA X	DiagRA X Viewer
Square root	$\text{sqrt}(x)$	✓	✓
Potency	$\text{pow}(x, y)$	✓	✓
Square	$\text{sqare}(x)$	✓	✓
Cubic	$\text{cube}(x)$	✓	✓
Exponential	$\text{exp}(x)$	✓	✓
Amount	$\text{abs}(x)$	✓	✓
Logarithm with base 10	$\text{log10}(x)$	✓	✓
Natural logarithm	$\text{ln}(x)$	✓	✓
Logarithm	$\text{log}(x, b)$	✓	✓
Sinus	$\text{sin}(a)$	✓	✓
Cosinus	$\text{cos}(a)$	✓	✓
Tangens	$\text{tan}(a)$	✓	✓
Arcussinus	$\text{arcsin}(d), \text{asin}(d)$	✓	✓
Arcuscosinus	$\text{arccos}(d), \text{acos}(d)$	✓	✓
Arkustangens	$\text{arctan}(d), \text{atan}(d)$	✓	✓
Hyperbolic sinus	$\text{sinh}(a)$	✓	✓
Cosine hyperbolicus	$\text{cosh}(a)$	✓	✓
Tangent hyperbolicus	$\text{tanh}(a)$	✓	✓

7.6.2 Integral

Short description

Calculates the integral, i.e. the area of the surface between the graph and the x-axis, of the input signal.

Signature

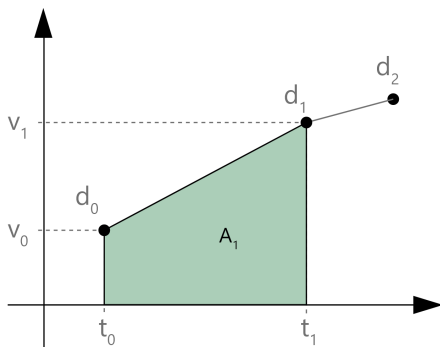
double **integral**(double input)

input - Numerical input signal.

Output: For each data point of the input signal, outputs the sum of the integrals of the functions linearly interpolated between all preceding data points.

Notes and examples

When calculating the integral, the *determined integral* of the linearly interpolated function in the range between the data point and its predecessor is calculated for each data point. The output value corresponds to the sum of all partial integrals of the data points received up to the point in time under consideration.



$$A_1 = \frac{(v_1 - v_0)(t_1 - t_0)}{2} + v_0(t_1 - t_0)$$

$$\int_0^k f(t) dt = \sum_{n=1}^k A_n = \sum_{n=1}^k \frac{(v_n - v_{n-1})(t_n - t_{n-1})}{2} + v_{n-1}(t_n - t_{n-1})$$



Restricted use in formulas



In DiagRA X, the `integral` function is not currently supported.



In the DiagRA X Viewer, for internal data processing reasons, the function `integral` can only be used alone and not as part of a compound expression.

To still calculate an integral in DaigRA X Viewer in more complex expressions, create a separate Virtual Variable for the integral and another for the expression in which the integral is to be used.

Allowed:

- $Vv1 = \text{integral}(\text{inputVar})$
- $Vv2 = \text{integral}(\text{inputVar} + 1)$

Not allowed:

- $Vv3 = \text{integral}(\text{inputVar}) + 1$
- $Vv4 = \text{integral}(\text{integral}(\text{inputVar}))$
- $Vv5 = \sin(\text{integral}(\text{inputVar} + 1) + 1)$

Workarounds:

- $Vv3 = Vv1 + 1$
- $Vv4 = \text{integral}(Vv1)$
- $Vv5 = \sin(Vv2 + 1)$

7.6.3 Gradient

Short description

Returns a signal for the slope (first order derivative) of the given input signal.

For each data point of the input signal, the slope of the connecting line between the data point and its predecessor is calculated.

Signature

```
double slope(double input)
```

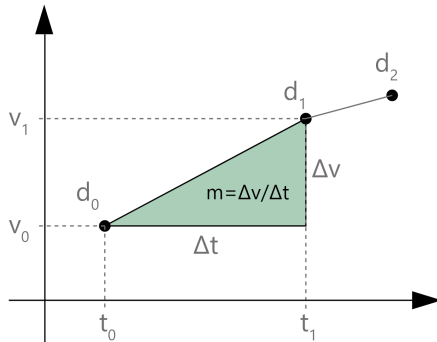
`input` : Numerical input signal.

Output: Signal with gradients between. adjacent data points of the input signal.



Notes and examples

The slope is calculated for each incoming data point with respect to its predecessor: let v_0 and v_1 be the values and t_0 and t_1 be the timestamps of the two successive incoming data points d_0 and d_1 . Then the slope m is calculated as follows:



$$m = \frac{\Delta v}{\Delta t} = \frac{v_1 - v_0}{t_1 - t_0}$$



Attention: It should be noted that due to measurement inaccuracies, Δt is usually not exactly equal to the set raster and is also not constant over time. This can lead to unexpected results when calculating the slope.

With a set raster of "1s", for example. $\Delta t = 1.023$ are present. For the neighboring values $v_0=0$ and $v_1=6$, "5.865" is then output as the result instead of the expected value "6".

Restricted use in formulas



In DiagRA X, the `slope` function is not currently supported.



In the DiagRA X Viewer, for internal data processing reasons, the function `slope` can only be used alone and not as part of a compound expression.

To still account for a slope in more complex expressions in DaigRA X Viewer, create a separate Virtual Variable for the slope and another for the expression in which the slope is to be used.

Allowed:

- $Vv1 = \text{slope}(\text{inputVar})$
- $Vv2 = \text{slope}(\text{inputVar} + 1)$

**Not allowed:**

- $Vv3 = \text{slope}(\text{inputVar}) + 1$
- $Vv4 = \text{slope}(\text{slope}(\text{inputVar}))$
- $Vv5 = \text{sin}(\text{slope}(\text{inputVar} + 1) + 1)$

Workarounds:

- $Vv3 = Vv1 + 1$
- $Vv4 = \text{slope}(Vv1)$
- $Vv5 = \text{sin}(Vv2 + 1)$

7.7 Data types and conversion

As a rule, DiagRA® X takes care of correctly processing or converting the data types present in formulas. If necessary, you can perform manual type conversions in formulas to get specific output types. Manual type conversions follow the principle known from programming languages in bracket notation:

- `VV_Bitsignal1 = (bool) sin(inputVar)`
 - The result of the sine function is converted to a boolean value. Here the value 0 is mapped to `false` and any other value to `true`.
- `VV_Signal1 = (int) (A || (bool) B)`
 - The value in B is converted to a boolean value, ORed with A, and the result is converted to an integer. Here, the `Wert false` is mapped to 0 and the `true` is mapped to 1.

7.7.1 Signals and bit signals for virtual variables

As with regular measurement variables, DiagRA X and DiagRA X Viewer distinguish between numeric *signals* and binary *bit signals* for virtual variables. Signals always have a numeric value and bit signals have a boolean value. Type conversions take place fully automatically in DiagRA X.

7.7.2 Supported data types

Type	Description
bool	boolean (true false)



Type	Description
byte	unsigned 8-bit integer
sbyte	signed 8-bit integer
ushort	unsigned 16-bit integer
short	signed 16-bit integer
int	signed 32-bit integer
uint	unsigned 32-bit integer
long	signed 64-bit integer
ulong	unsigned 64-bit integer
float	32-bit floating point value
double	64-bit floating point value

7.8 Operators and constants

A number of operators and constants are available for creating formulas.

7.8.1 Operators

Operator	Description
+	Plus
-	Minus
*	Multiplication
/	Division
%	Modulo
=	Equality



Operator	Description
<code>!=</code>	Inequality
<code>></code>	Greater than
<code><</code>	Smaller than
<code>>=</code>	Greater or equal
<code><=</code>	Smaller or equal
<code>(</code>	Bracket open
<code>)</code>	Bracket closed
<code>&&</code>	Logical AND
<code> </code>	Logical OR
<code>!</code>	Logical NOT
<code>&</code>	Bitwise AND
<code> </code>	Bitwise OR
<code>^</code>	Bitwise XOR
<code>~</code>	Bitwise NOT

7.8.2 Constants

Constant	Description
<code>pi</code>	Circle number Pi
<code>2 pi</code>	Circle number Pi times 2
<code>pi/2</code>	Circle number Pi divided by 2
<code>1/pi</code>	1 divided by the circle number Pi
<code>sqrt(2)</code>	Square root of 2



Constant	Description
g	Acceleration due to gravity
e	Euler's number
s/day	Seconds per day
s/h	Seconds per hour
s/min	Seconds per minute
pi	Circle number Pi
2 pi	Circle number Pi times 2
pi/2	Circle number Pi divided by 2
1/pi	1 divided by the circle number Pi
sqrt(2)	Square root of 2
g	Acceleration due to gravity
e	Euler's number
s/day	Seconds per day
s/h	Seconds per hour
s/min	Seconds per minute



8 Measurement and recording

8.1 Measurements


Measurements by the user can be **started** ► and **stopped** ■. In the visualizers on the worksheets, the measurement values **are refreshed by clicking the operating element**. **Stopping** the measurement is carried out with a **further mouse-click**.



The view is changed when a measurement is active.

8.2 Recording

In addition to measuring, it is also possible to **record measurement values**. The **selected measured variables** are recorded. The measured quantities are captured **independently of their allocation to worksheets or containers**. Stopping the recording works in the same way as starting the recording.

1. The operating element is enabled by a **mouse-click**. Stopping the recording works in the same way as starting the recording.
2. To use the made recording for further actions, just click on the drop-down menu for recordings .
3. Further recordings are available by using the scrollbar positioned on the right.



The stored data format is type mf4 and is based on ASAM MDF V4.0.0.

In order to use the completed recording for further actions, click the drop-down menu for the recordings (camera symbol). Further recordings are available by using the scrollbar positioned on the right.

8.3 Recording list



The recording list can be found in the upper menu bar as operating element. Click to open a list. The **last completed recordings** are shown sorted according to recording date. Further recordings are available using the scroll bar to the side.



Fig. 8.1 : Recording list

The recording list shows the completed recordings, each with filename, recording time and file size.

You can **open a recording** by clicking it. This will open the DiagRA® X Viewer. Before you can open a recording, additional options for the DiagRA® X Viewer will appear.

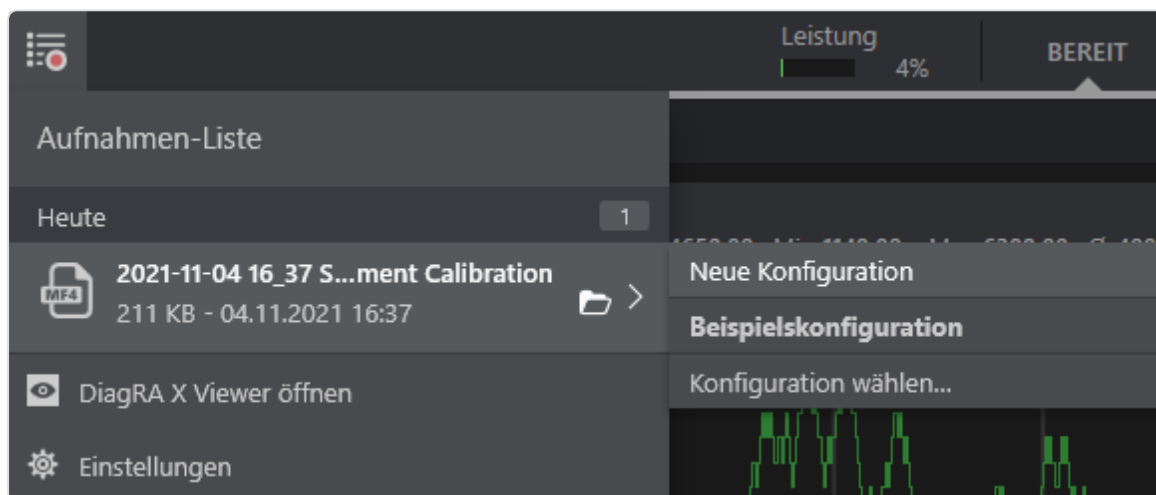


Fig. 8.2 : Recording list

8.3.1 New configuration

Select this option if you wish to use a configuration which is to be newly created in the DiagRA® X Viewer to view your recording. You can store your configuration in the DiagRA® X Viewer. The configuration can then be used independently of the DiagRA® X Viewer.

8.3.2 Available configuration

The names of the displayed configurations contain those you last used. From the existing configurations, choose one with which the selected recording should be displayed. The recording file previously used in the configuration is then replaced.




8.3.3 Select configuration

The DiagRA® X Viewer is first opened. In the overview of existing configurations, choose one with which the selected recording should be displayed. The overview shows all available configurations. The recording file previously used in the configuration is then replaced.

Before selecting a recording, you have further options.

8.3.4 Folder symbol

A mouse click on the folder icon  opens the set directory of recordings in the Explorer.

8.3.5 Settings

You will find the settings at the end of the recording list. The settings take you to the system settings for the recordings.



9 Event-based functions

Event-based functions are special processes or incidents which are based on selected triggers. Triggers use variable measurement values which are available in the experiment. The triggers are used to start and end recordings, to set markers and in order to carry out a detailed event analysis later. They can be selected from the variables allocated to visualizers.

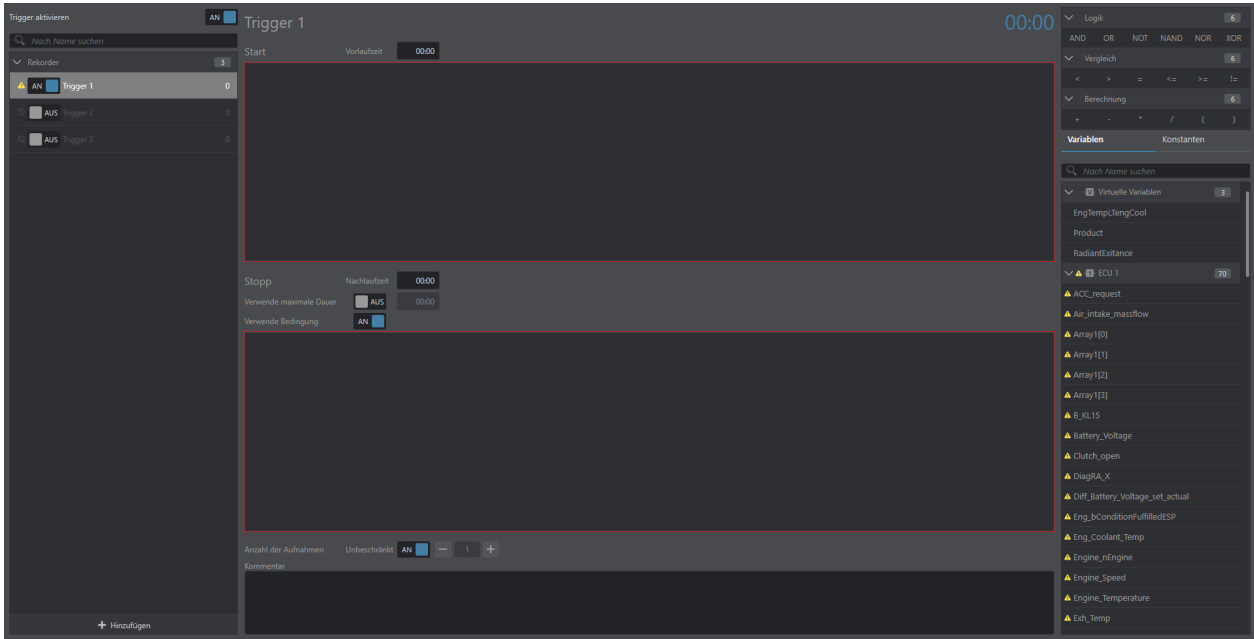


Fig. 9.1 : Event-based function overview

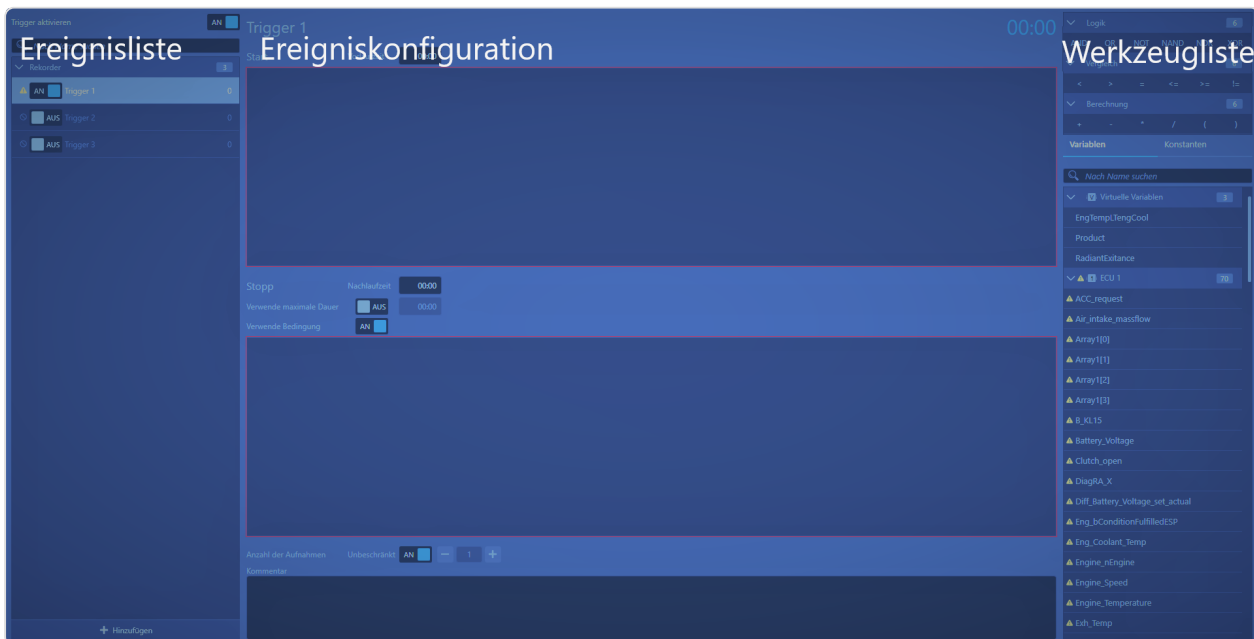


Fig. 9.2 : Organization of the event-based function view



The **list of event-based functions contains all defined events**. These events are grouped according to types.

Recorders are suitable for starting and ending recordings. The recorders are arranged in a list. The allocation of names is carried out when creating the recorder using the operating element **+**. Each recorder can be individually enabled or disabled using a switch. The completed recordings are displayed in the list according to the recorder names. If there is a limit to the number of recordings, the maximum is shown as additional number.

List elements can be edited, copied or deleted. This symbolism is explained in section “Visual operating elements”

9.1 Event configuration

Triggers are created for the event configuration. A correctly completed configuration can be enabled or disabled.

Event configurations **can only be edited offline**.

Individual elements from the tool list can be placed and combined in the trigger **using the drag and drop function**. Comparative values can be added using the keyboard. In order to use comparative values, a variable must first be available in the trigger. After this variable, a blue rectangle must be created for the entry **by clicking the mouse**. Comparative values can be operators and numerical values.

Individual comparable operations can be hierarchically linked using logical operations such as AND, OR or NOT, for example.

9.2 Tool list

The **tool list is linked to the selected experiment**.

The tool list **contains the variables from the experiment**. Elements from the tool list can be used for the trigger conditions. Operators and variables are arranged in lists. The variables are sorted according to their source affiliation. They can be selected from the variables allocated to visualizers.



In the tool list, variable measurement values are displayed which are available in the experiment and displayed on visualizers. This is equivalent to the filter in the experiment from the Variable Manager (see section “Variable groups”).



9.3 Recorder

Trigger 1 00:00/00:05

Start Vorlauf

1 CAN-Bus 1
2 CSM CAN-Module 1
3 Steuergerät 1

Stopp Nachlauf

Verwende maximale Dauer AN

Verwende Bedingung AN

1 CAN-Bus 1
2 CSM CAN-Module 1
3 Steuergerät 1

Anzahl Aufnahmen Unbeschränkt AN

Kommentar

Fig. 9.3 : Recorder view

9.3.1 Recorder information

The **recorder name** and the **current recording duration** as well as the **maximum recording duration** are displayed. The maximum recording duration is only displayed for a defined recording duration from the stop trigger.

9.3.2 Start trigger

The **start trigger** is used to define from **when a recording should start**.



The lead time is used to specify how many seconds of measurement data are to be written in the measurement file before the release of the start trigger.

9.3.3 Stop trigger

The **stop trigger** is used to define **when a recording should end**.

Conditions can be set for the event stop in the same way as for the event start. Instead of a lead time, a follow-up time can be entered, which defines how many seconds after the release of the stop trigger the measurement recording should continue to run.

A **recording** can either be ended **manually** by the operator or **automatically** by a record stop through a trigger or after a specified recording duration. Both automated cases, record stop through a trigger and specified recording duration, can be active at the same time.

9.3.4 Series recording

The series recording enables you to automatically carry out triggered measurement recordings with the same conditions in succession. The count begins from the start again every time the connection is established (when going online). The default value defines a measurement recording.

9.3.5 Recorder comment

The recorder comment defines a default comment which is entered in all measurement files which are created through this trigger case, for example: Created by J_Bloggs.

9.4 Actions

Actions triggered by events serve the automation and thus a more efficient operation of DiagRA® X.

9.4.1 Create an action

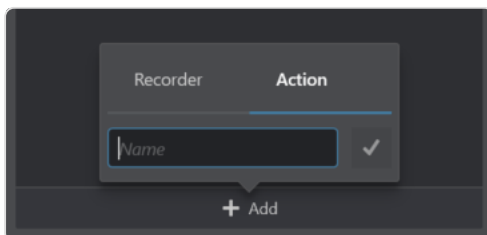


Fig. 9.4 : Create action



In the *event configuration*, you can select whether a *recorder* or an *action* is to be created by **clicking** on Add.

9.4.2 Edit action

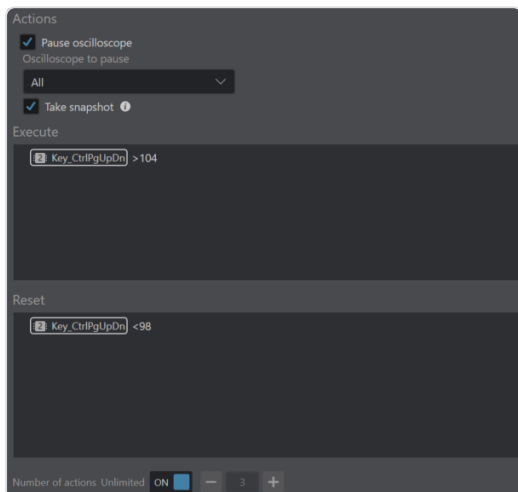


Fig. 9.5 : Edit action

In the settings of an action you can select which actions should be executed, what are the conditions for execution and resetting of the action, and how often (or unlimited) the action should be executed.

Execution

As with recorders, the condition for executing the action can be defined. If the action is executed, the event will be disabled until the reset condition is met.

Reset

If the action was performed, the event will not become active again until the reset condition is met.

Number of actions

It is possible to specify whether the action should be executed any number of times or only a limited number.

9.4.3 Action *Pause oscilloscope*

To allow immediate analysis of the situation when a specific event occurs, this action can be used to pause any oscilloscope. In addition, it is possible to create a snapshot recording at the same moment.



Options

It is possible to select which oscilloscope should be paused. Furthermore, it is possible to execute a snapshot when pausing the oscilloscope. The settings for the snapshot recorder can be found in the system settings. The snapshot is not executed if the oscilloscope is already paused.



10 Managing binary data

The **binary data manager organizes the information about the memory pages** and their content for every control device. The binary data of the memory pages can be specifically selected for reference page and work page and collated between software tool and control device.

10.1 Selecting active control device for the page change and comparative pages

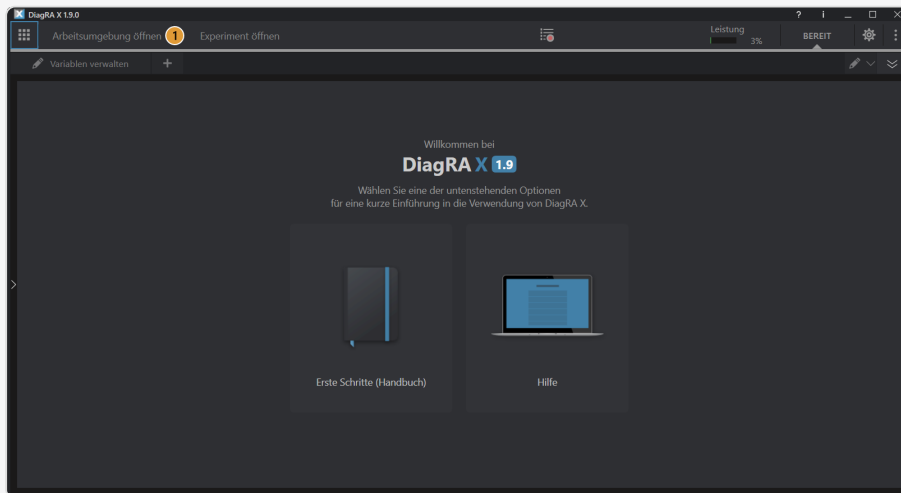
The following describes how to switch a control device to active in order to be able to use it for the page change and comparative pages.

Requirements

- At least two control devices have been configured in your workspace.

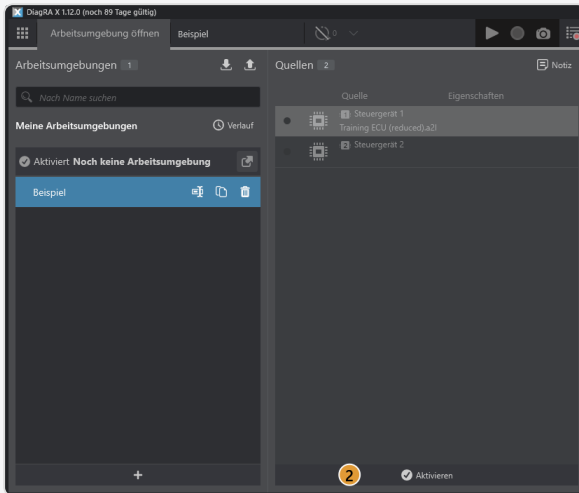
Procedure

1. Click **workspaces** to reach your workspaces.

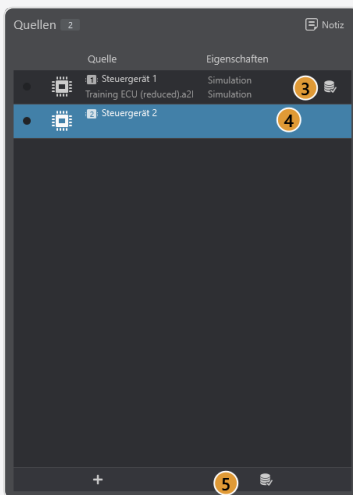




2. Click your **active workspace**.



3. Check that the control device with which you wish to work is the active control device. **The active control device has the symbol**



4. If the control device with which you wish to work does not have the symbol for the active control device, click to select the control device.
5. In the action menu below, **select the action**

Or

- Click in the **checkbox** of the control device with which you wish to work.



Your control device is now selected as active control device.



10.2 Switching between work page and reference page

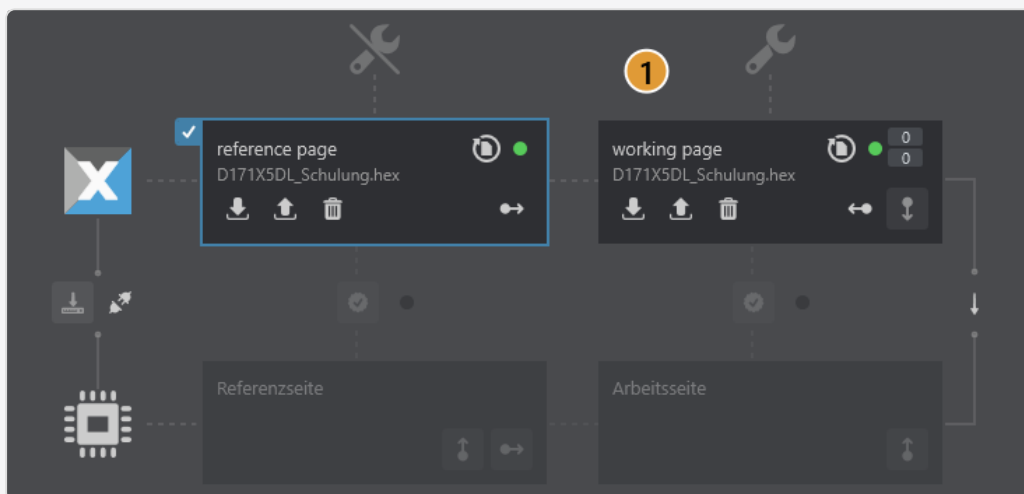
Only one memory page can be active at any time. This is either the reference page or a work page. The active memory page is the one whose binary data can be displayed and calibrated in the visualizers. This function switches between the reference page and the most recently active work page as *active memory page*.

Requirements

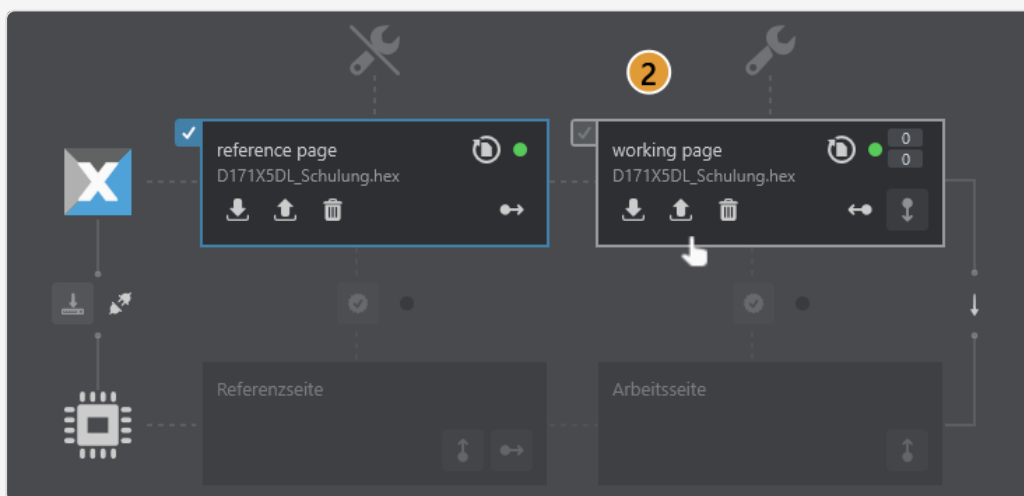
- At least one reference page and a work page are defined in the description file.

Procedure

1. Move the **cursor** over the reference page or work page in the row of the DiagRA® X product icon.



2. Click extended checkbox or double-click the tile to switch the page.



Or

- Click on the **button in the top bar (P)** to be able to switch between the work page and the reference page as quickly as possible in other views, e.g. when working in the worksheet.



In the binary data manager, the active memory page is highlighted in blue. The active memory page is now switched.


10.2.1 Synchronizing the work page with the control device

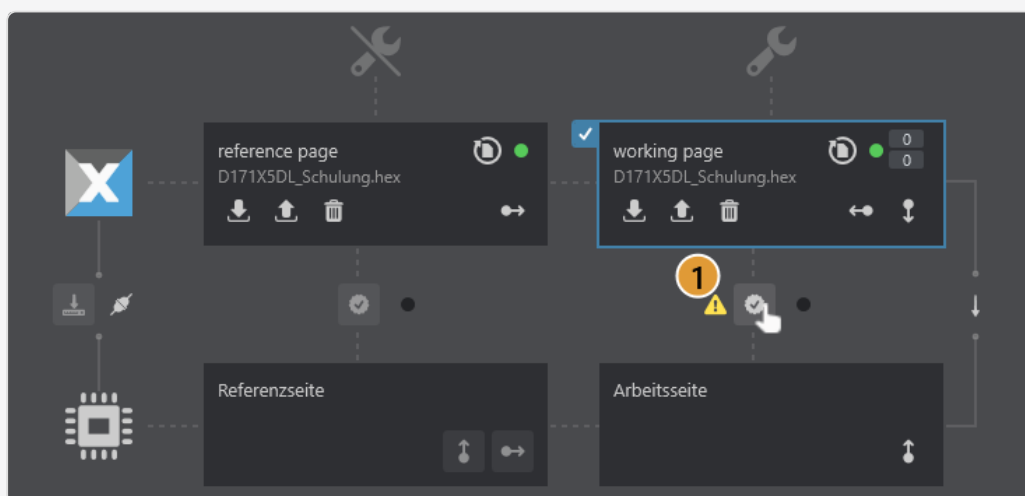
A comparison between the data on the work page in the control device and the data on the work page in DiagRA® X must be carried out in order to be able to carry out calibration actions on a correct data basis. Otherwise, there is the possibility that the data are inconsistent and cannot be used or calibrated.



Requirements

- The work page is filled with a binary file on the software side.
- The active memory page is the work page.
- There is a connection to the control device.
- The write access ↓ must be unlocked.

Procedure

1. Click **Checksum**  to start the synchronization.



The comparison has now taken place. If the synchronization was successful, the  icon appears. If the synchronization failed, the  icon appears.

10.2.2 Writing the work page to the control device

The data on the work page in DiagRA® X are transferred to the work page in the control device. Existing data on the work page in the control device are overwritten.



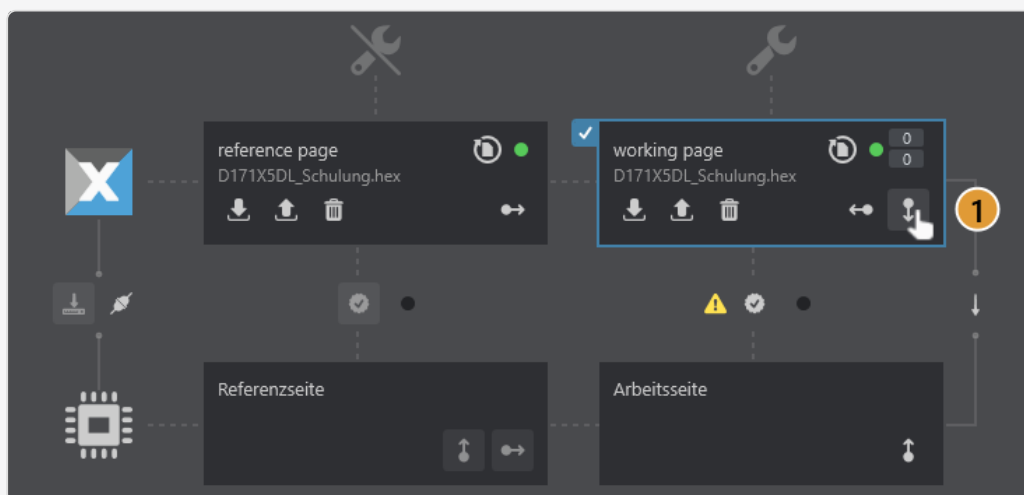
Attention: By overwriting the data on the work page of the control device, the previous data on the work page of the control device are deleted.

Requirements

- A configured workspace with a control device
- A valid binary file for the work page or reference page. The active memory page is the work page.
- There is a connection to the control device.
- The write access ↓ must be unlocked.


Procedure

1. Click **Write to control device** ↓.



2. Confirm the write dialogue.



The data are now transferred to the work page in the control device. The data are now synchronized and the  icon is displayed.



10.2.3 Reading the memory page from the control device


When reading the control device's memory page, the current data of the control device's memory page is transferred to DiagRA® X.

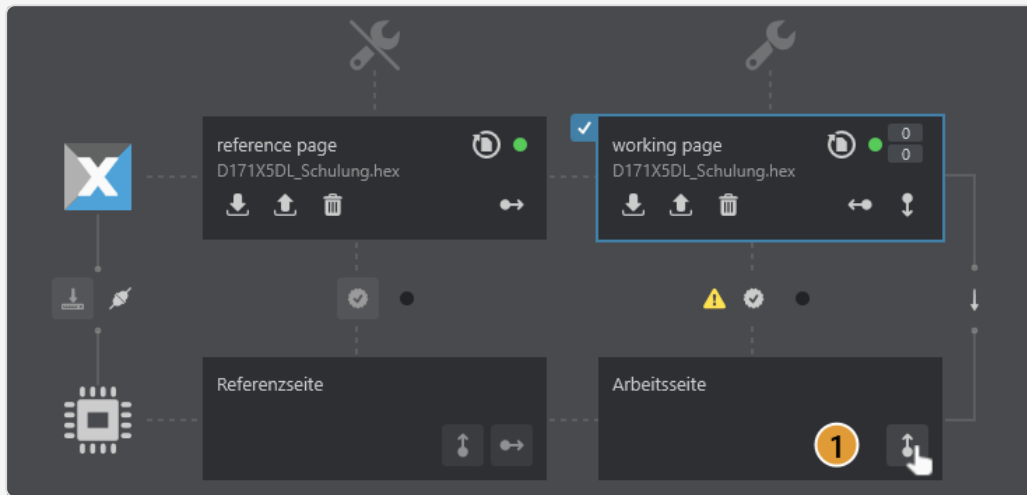
Requirements

- The memory page to be read is active.
- There is a connection to the control device.
- Write access ↓ must be unlocked.

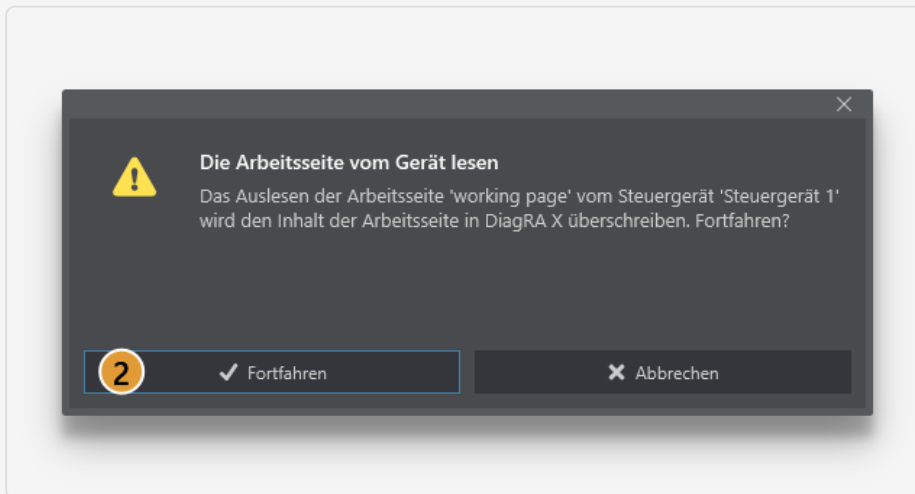


Procedure

1. Click **Read from control device** .



2. **Confirm** the reading dialogue.



The data are now copied from the control device.



10.2.4 Copying memory page content

By **copying** the data from one memory page to another, **the data becomes identical**. The previously used **data are overwritten**. The option of saving the data to be overwritten can be requested.


The function is available on the software side between both memory pages. The function is available on the control device page for the reference page to copy the data to the work page.

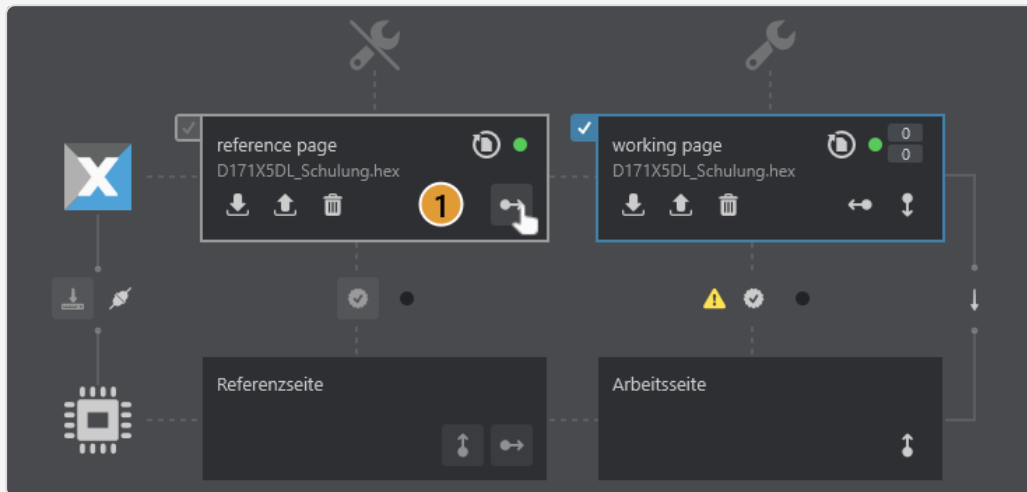
Requirements

- A memory page is filled with binary data.

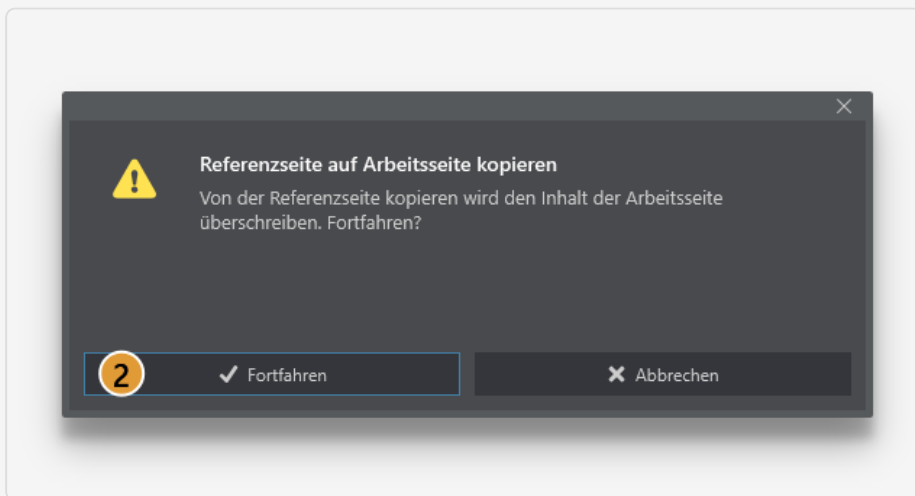


Procedure

1. Click **copy**  .



2. **Confirm** the user request.



The data are now copied to the memory page.


10.3 Importing memory pages

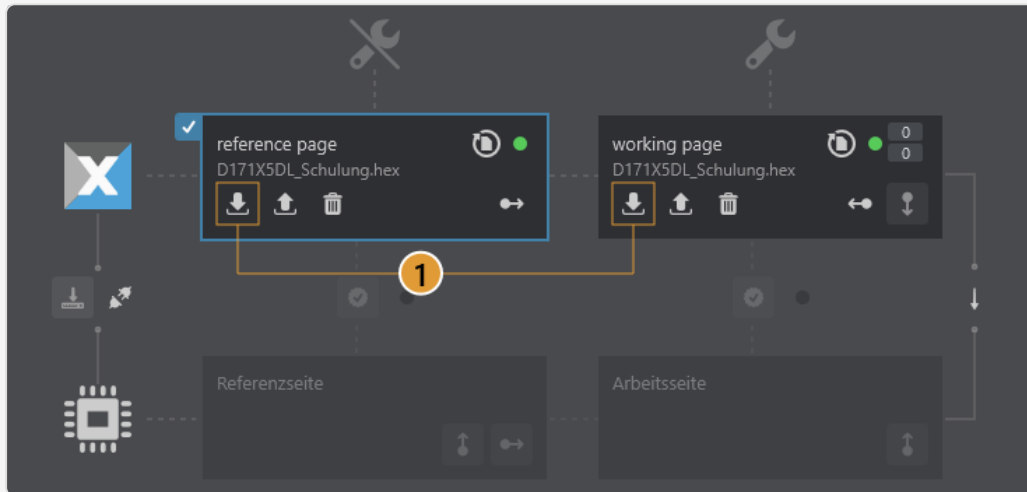
The data from binary files are imported to the memory page. After importing, the binary data are available for further processing on the software side.

Requirements

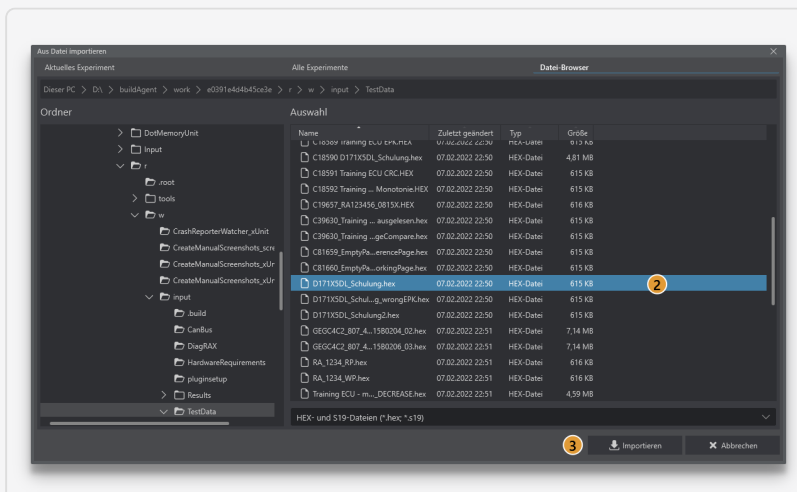
- None


Procedure

1. Click **Import** .



2. Select a binary file on your system.



3. Click **Import** .



The binary files are now imported and available on the memory page.




10.4 Exporting memory pages

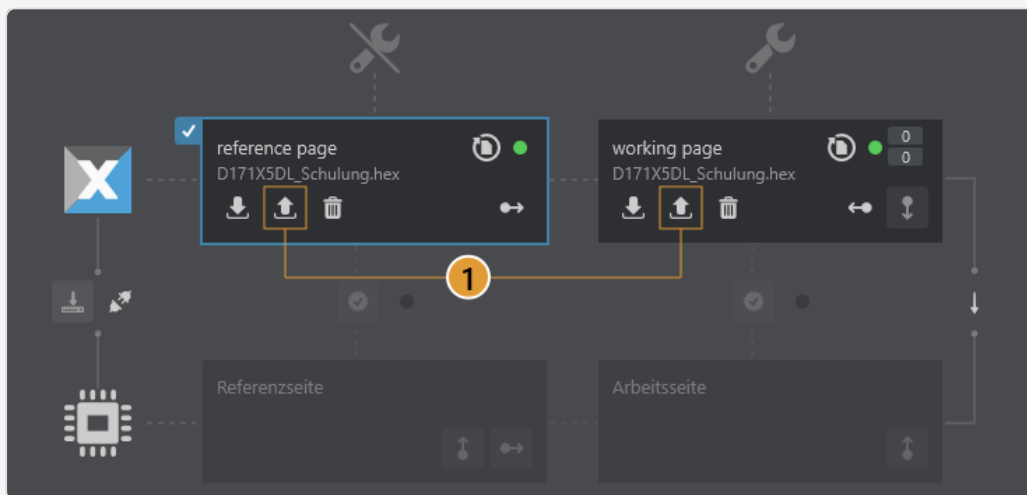
The data from the memory page of DiagRA® X are exported to a binary file. The binary file is then available for further processing in other systems.

Requirements

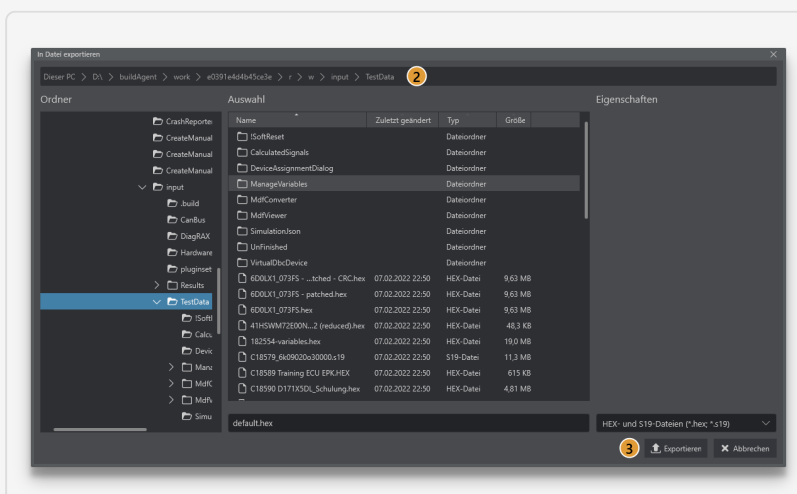
- Data are available on the memory page.


Procedure

1. Click **Export** .



2. Select a storage location for your file.



3. Click **Export** .



The binary data are now exported and available in a file.

10.5 Block write access

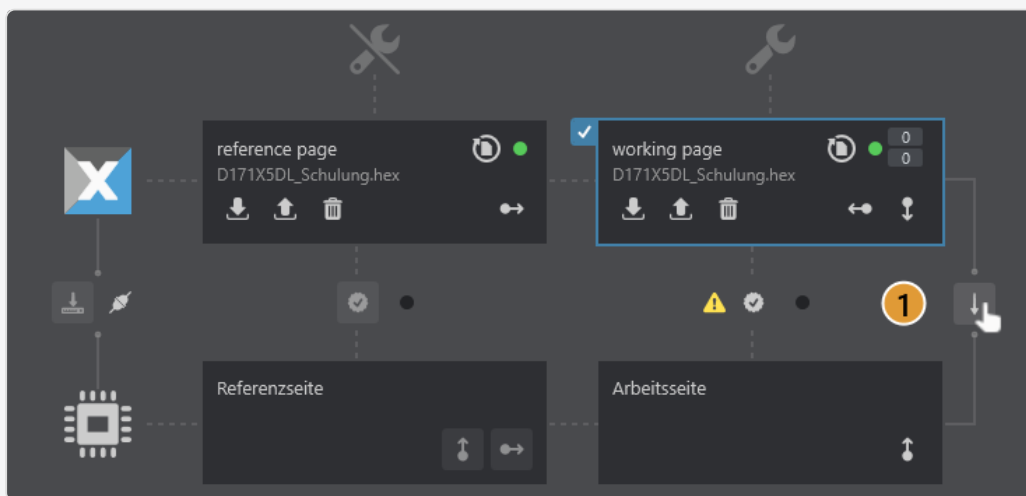
Access to the control device can be **blocked** in order to **prevent the sending of data** from the work page to the control device. Calibration values can still be calibrated in DiagRA® X. When access is enabled again, the calibrated values are collectively sent to the control device.

Requirements

- None

Procedure



1. Click **Block write access** ↓ to block access to the control device.



Blocked state is shown in the topbar. In blocked state, the work page in the binary data manager on the DiagRA® X page has a yellow border. In blocked state, no values are calibrated on the control device.



10.6 Change history and change counter

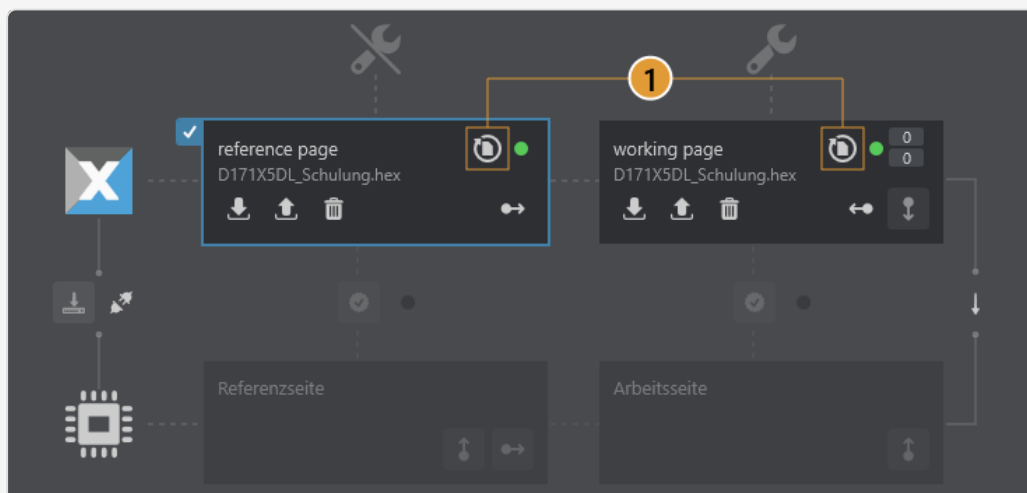
The change histories are displayed tool-sided in the binary data manager for the respective memory page. The change counter for the number of changed variables is only used on working pages on the tool side. The change history ,  logs all changes to the respective data record. The icon changes according to the last completed change (by the user or by a file operation). The change counter counts how many variables have been changed on the binary file since the last file operation (import / copy / read from control device).

Requirements

- Binary data are available on the respective memory page.

Procedure

1. Click  /  to **open** the change history.



The change history is now displayed.



11 Calibrating values

Calibration is carried out in DiagRA® X by incrementing or decrementing values within various calibration visualizers. By using the **manual entry** it is possible to **specifically set values**. By using a **formula** it is possible to **mathematically adjust values**.

11.1 Manual calibration entry

When manually entering the calibration, the value adjustment is carried out in a dialog.



Attention: When values are calibrated online, for example while operating a machine, hazardous calibration entries or incorrect entries may lead to accidents and consequently to serious injuries or to death.

In hazardous situations, use of the offline calibration possibilities (e.g. using the function “Block write access”).

Only use this function if you are qualified to use this functionality and you are aware of the potential hazards and consequences.



Attention: If an adjustment value is present in the control unit as a floating point number, rounding errors may occur during adjustment.

Requirements

- The work page must be selected.
- Valid binary data must be available.
- At least one variable must be displayed in the visualizer.
- At least one cell or one parameter (invariable/ASCII) must be selected.

Procedure

1. **Open the calibration popover** by double-clicking a selected cell or a parameter.
2. Enter your **numerical value** using the **keyboard**.
3. Click the **confirm button** ✓ to apply the entry.



The calibration popover is now closed. The entered value has been applied and is displayed in the cell / parameter

See also ["Calibrate floating point numbers" on page134](#)

11.2 Calibration using formula entries

Formula entries in an input mask (calibration popover) to adjust values.



Attention: When values are calibrated online, for example while operating a machine, hazardous calibration entries or incorrect entries may lead to accidents and consequently to serious injuries or to death.

In hazardous situations, use of the offline calibration possibilities (e.g. using the function "Block write access").

Only use this function if you are qualified to use this functionality and you are aware of the potential hazards and consequences.



Attention: If an adjustment value is present in the control unit as a floating point number, rounding errors may occur during adjustment.

Requirements

- The work page must be selected.
- Valid binary data must be available.
- At least one variable must be displayed in the visualizer.
- At least one cell or one parameter (invariable/ASCII) must be selected.

Procedure

1. **Open the calibration popover** by double-clicking a selected cell or a parameter.
2. Enter the formula in the **input field** beginning with an operand, followed by an operator character.
3. Click the **confirm button** ✓ to apply the entry.



The calculated result value is now applied and is displayed in the cell / parameter.

See also ["Calibrate floating point numbers" on page134](#)

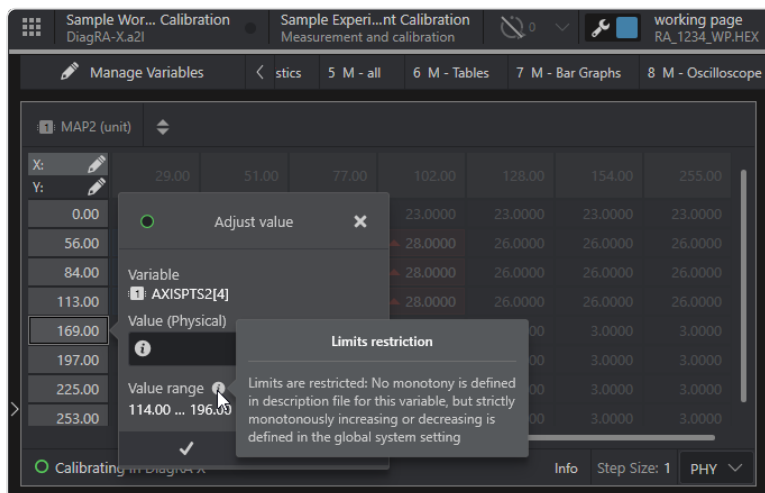
11.3 Calibration in the characteristic map

The **characteristic map** shows the **values to be calibrated** and their axis in the **form of a table**. The values of the X and Y axis define interpolation points for which map values (Z values) are calibrated. Both the map values and the axis values can be adjusted.

Axis values adjust



An info button is displayed when the limits are restricted. The monotonicity of the axis can be defined in the description file. If no constraint is defined, the setting for Monotonicity in the System Settings is used.





11.3.1 Calibrating values



Attention: When values are calibrated online, for example while operating a machine, hazardous calibration entries or incorrect entries may lead to accidents and consequently to serious injuries or to death.

In hazardous situations, use of the offline calibration possibilities (e.g. using the function "Block write access").

Only use this function if you are qualified to use this functionality and you are aware of the potential hazards and consequences.

Related links

See also ["Calibrating values" on page119](#)

See also ["Calibrate floating point numbers" on page134](#)



11.3.2 Function overview of the characteristic map

Various operating and display options can be set in the visualizer's action bar. In the simplest case, the operating elements have two states – active and inactive. Clicking an action causes the display of the map table to change. Some actions are dependent on others. If this is the case, these dependencies are indicated.

Requirements

- In the visualizer, at least one variable is available for display.
- In some cases, data for reference page and work page must be available.

Function overview

Visual element	Name of action	Description of action	Keyboard shortcuts
	Show operating point	The operating point and a chronological trend of the operating point are graphically displayed in the table.	<Alt> + P
	Show histogram	A graphic display shows the residence time of the operating point in the respective cell of the histogram since the start / deletion of meas-	<Alt> + H



Visual element	Name of action	Description of action	Keyboard shortcuts
		urement.	
-	Delete histogram	Deletes the previously determined data for the graphic display of the histogram and starts a new analysis.	<Alt> + <Shift> + H
-	Show differences	The differences between the values of the reference page and the selected work page are shown.	
-	Number format selection	The display of the values can be set. The options are physical, decimal, hexadecimal or binary.	<Alt> + F8
	Automatic cell selection	The cell selection automatically follows the operating point. A manual selection is then no longer possible.	<Alt> + F
	Edit axis points	In the axis point editing mode, the values of the selected axis are to be edited. If the axis point editing mode is deactivated, no axis values can be adjusted.	<Alt> + E

Tab. 11-1 Function overview of characteristic map

11.4 Calibrating within the calibration table

A **calibration table** enables the **Display and editing of variable types Invariable and ASCII**. The variable name, the value and the unit can be shown. The differences between reference page and work page can be shown.


11.4.1 Calibrating values



Attention: When values are calibrated online, for example while operating a machine, hazardous calibration entries or incorrect entries may lead to accidents and consequently to serious injuries or to death.

In hazardous situations, use of the offline calibration possibilities (e.g. using the function "Block write access").



 Only use this function if you are qualified to use this functionality and you are aware of the potential hazards and consequences.

See also ["Calibrating values" on page119](#)

See also ["Calibrate floating point numbers" on page134](#)

11.4.2 Function overview of the calibration table

Various operating and display options can be set in the visualizer's action bar. In the simplest case, the operating elements have two states – active and inactive. Clicking an action causes the display of the calibration table to change.

Requirements

- None

Function overview

Visual element	Name of action	Description of action	Keyboard shortcuts
-	Show unit	An additional column is shown when this option is enabled.	-
-	Show differences	The current values are shown next to the initial values when this option is enabled.	-

Tab. 11-2 Function overview of calibration table

11.5 Calibrating in the calibration diagram

A calibration diagram diagram is the graphical representation of adjustment values. The adjustment values are displayed on a horizontal axis. The adjustable value range is displayed on the vertical axis.



11.5.1 Calibrating values



Attention: When values are calibrated online, for example while operating a machine, hazardous calibration entries or incorrect entries may lead to accidents and consequently to serious injuries or to death.

In hazardous situations, use of the offline calibration possibilities (e.g. using the function "Block write access").

Only use this function if you are qualified to use this functionality and you are aware of the potential hazards and consequences.

See also ["Calibrating values" on page119](#)

See also ["Calibrate floating point numbers" on page134](#)

11.5.2 Calibrating using drag and drop function

The option of calibration using the **drag & drop function** is represented using indicators at the data point in a **positive and negative vertical direction**.

During the calibration process using the drag and drop function, the calibration values of the respective data point are shown.

Requirements

- The work page must be selected.
- A variable is shown in the visualizer. For this purpose, the calibration diagram must be linked to a characteristic map.
- Valid binary data must be available.

Procedure

1. **Click and hold** a data point with the left mouse button.
2. **Move** the cursor **up** to increment. Move the cursor **down** to decrement.
3. Complete the calibration process by **releasing** the **cursor** at a suitable point.



The value shown when releasing is now applied and is shown at the data point.

11.5.3 Axis zoom

The function describes the **enlarging or reducing** of a selected section within the calibration diagram in order to refine the display of the values.

Requirements

- A variable is shown in the visualizer. For this purpose, the calibration diagram must be linked to a characteristic map.
- Valid binary data must be available.

Procedure

1. **Move** the **cursor** over the X-axis or Y-axis area of the calibration diagram.
2. **Scroll** the mouse wheel **upwards** to zoom into this axis. Scroll the mouse wheel **downwards** to zoom out of this axis.



The axis section is now enlarged or reduced.

11.5.4 Resetting areas

If the displayed axis section has been adjusted using the axis zoom function, it can be reset to its initial state using this function.

Requirements

- The axis zoom function has been executed.

Procedure

- In the action bar, **click Reset Y-area** to reset the Y-axis to its initial state.
- In the action bar, **click Reset X-area** to reset the X-axis to its initial state.



You have successfully reset the axis to their initial state.

Related links:

["Axis zoom" on the previous page](#)

11.5.5 Show surface

Enable this action to fill the **surfaces** under the **data point lines with color**.



Through the overlapping of surfaces, you will learn to more effectively categorize graphs in the characteristic map.

Requirements

- A variable is shown in the visualizer. For this purpose, the calibration diagram must be linked to a characteristic map.
- Valid binary data must be available.

Procedure

1. In the action bar, click **Show surface** to enable this action.



The surface under every line is filled with color.

11.5.6 Show all lines

In order to categorize a **data point line** from the calibration diagram in the **overall context**, enable the action "Show all lines".



Requirements

- A variable is shown in the visualizer. For this purpose, the calibration diagram must be linked to a characteristic map.
- Valid binary data must be available.

Procedure

1. In the toolbar, click **Show all lines**.



All rows of the characteristic map are shown as lines in the calibration diagram. The selected cell or row should be highlighted.

11.6 Configuring calibrations in the system settings

Further configurations for the extended calibration are available in the system settings in the upper menu bar.

11.6.1 Checking the memory pages

The following functions can be enabled in this additional configuration:

- **Number of axis points**: check if the number of axis points is correct. This check always takes place when another check is carried out.
- **Monotony of axis points** (additional option: strict monotony): check that the axis points are rising or falling monotonously or strictly monotonously.
- **Min/Max**: check that the values lie within the value range defined in the A2I file.



If you are working with standards-compliant files, all checks should be turned on.

Requirements

- No measurement is running



Attention: If checks are deactivated, undefined system states may occur, causing the control unit to perform unpredictable reactions. Use this function only after instruction and understanding of the possible resulting consequences.

Procedure

1. Click the **switch** to enable the function.



The function is now active.

11.6.2 Comparing EPROM identifiers

EPROM identifiers from the ECU, description file and memory pages are compared. EPROM identifiers from the description file and binary files are checked by the tool when loading the description file and binary files. The EPROM identifier from the ECU is checked against the identifier from the description file when establishing the connection. Differences are displayed in the binary data manager.

Procedure

1. Click the **switch** to enable the function.



Checking of the EPROM identifiers is now enabled.

11.6.3 Synchronizing memory pages after connection

Memory pages are **automatically synchronized** when the connection to a control device is established. During synchronization, the work page is checked and then transferred to the control device.

Requirements

- None



Procedure

1. Click the **switch** to enable the function.



The memory pages will now be automatically synchronized after a connection is established.

11.6.4 Blocking access to the control device by default

When loading a workspace, write access to control devices is blocked. If a workspace is already loaded, changing this option has no effect on it.

Requirements

- None

Procedure

1. Click the switch to enable the function.



Blocked state is shown in the topbar.

In blocked state, the work page in the binary data manager on the DiagRA® X page has a yellow border.

In blocked state, no values are calibrated on the control device.

11.6.5 Switching to the work page after connection is established

After the connection is established to the control device, the work page is automatically set as active memory page.

Requirements

- The description file must contain a work page.

Procedure

1. Click the **switch** to enable the function.



After the connection is established to the control device, the work page is automatically set as active memory page.

11.7 Calibrating in several work pages

A work page represents a specific configuration of the parameter which can be calibrated in the control device. In order to be able to **efficiently edit, compare and test several such configurations, any number of work pages can** be created in DiagRA® X for a control device. Work pages can be duplicated, renamed and deleted.

In order to be able to calibrate parameters on a work page, it must previously have been activated. Fast switching between the work pages enables a direct comparison of the control device behavior for various configurations.

11.7.1 Select active work page

Any working page is set as active working page in the tool. The data of the active working page can be adjusted. The content of the working page can be transmitted to the control unit.

Requirements

- The experiment has at least two work pages

Procedure

1. **Enable** the control device for page switching and page comparison.
2. Click the **up arrow** for the binary data manager in the upper menu bar.
3. **Select** the work page to be activated by clicking the **left mouse button**.

Or



1. Click the **Binary data manager** in the upper menu bar.
2. Select the **control device** for which you wish to select the active work page in the control device list. The binary data manager now shows the memory pages belonging to the selected ECU in the center of the view.
3. Click the **up arrow** next to the name of the work page on the DiagRA® X side. A selection list opens.
4. Select the work page to be activated.
5. Click the **checkbox** at the upper left corner of the work page tile or double-click the tile.



The work page is now activated.


11.7.2 Duplicating work pages

Work pages can be **deleted**. The tool copies the existing binary data to another working page. The name of the created work page is adjusted.

Requirements

- At least one work page must be defined in the description file.

Procedure

1. Click the **up arrow** for the binary data manager in the upper menu bar. A selection list appears.
2. Move the **cursor** over the **work page** to be duplicated. An action menu appears.
3. Click **Duplicate** .



A copy of the work page is now added to the list.

11.7.3 Deleting work pages


The **working page** is **deleted by the tool**. The last remaining work page cannot be deleted.



Requirements

- There must be at least two work pages.

Procedure

1. Click the **up arrow** for the binary data manager in the upper menu bar. A selection list appears.
2. Move the **cursor** over the **work page** to be deleted. An action menu appears.
3. Click **Delete** .



The work page is now deleted.

11.8 Calibration using the keyboard

One keystroke will carry out the incremental / decremental calibration by the calibration increment set for each of the variables. The calibration direction can be both positive as well as negative. There is a separate button for each calibration direction.



Attention: If an adjustment value is present in the control unit as a floating point number, rounding errors may occur during adjustment.

Requirements

- One or more cells or a parameter must be selected.

Procedure

1. Press the **"K" button** to increase the value.
2. Press the **"J" button** to reduce the value.



The cell or the parameter is displayed showing the changed calibration increment.



See also ["Calibrate floating point numbers" below](#)

11.9 Calibrate floating point numbers



Attention: If an adjustment value is present in the control unit as a floating point number, rounding errors may occur during adjustment.

While an exact conversion from binary to decimal and vice versa is always possible for integer values, this does not apply to decimal values. Certain decimal values cannot be represented as exact binary values. For example, the number 17.33 as a float value is more like the number 17.32999999999998 and the number 17.35 is more like the number 17.35000000000001. Since the deviations initially only occur at the last digit, the rounding error appears negligible. However, with a larger number of calculation steps or larger values with many digits before the decimal point, the inaccuracy can increase and deviations can occur after only a few digits after the decimal point.

In DiagRA X, for example, this can lead to the following situations: After a sequence of increment and decrement actions, the result of which should mathematically be equal to the original value again, the value in DiagRA X is displayed as changed. This is correct because the rounding errors in the intermediate results after the additions and subtractions do not always balance out exactly.

In addition to rounding errors, the use of floating point values as internal ECU values can lead to performance bottlenecks with weaker CPUs/microcontrollers without a floating point unit, as all calculations must consequently be carried out in software.

It is usually better to use fixed-point values or, at best, integer data types in the control unit. These consume less memory and have a fixed resolution.



12 Comparing memory pages

The page comparison view shows the parameters of the active control device in the form of a list and offers the possibility of comparing the values of two different memory pages.

You can:

- Select the memory pages. The values from the selected memory pages are shown in the list. The differences are represented by symbols on the values.
- Filter the content of the List of Variables. A filter range can be shown or hidden for this purpose.
- Show the values in visualizers. For the selected variable, the differences are shown in a separate area in different visualizers.
- Export the values of the selected variables and memory pages as DCM.
- Transfer the content of a DCM file to a work page without a preview.
- Leave the content of a DCM file in a separate column in the list and then selectively transfer to a work page.
- Set a visualizer view. Various visualizers can be selected for the comparison of variable values.

12.1 Filtering the List of Variables

The **List of Variables** can be **filtered** using a page menu. You can search for a specific variable name.

Furthermore, you can limit the results to variables which are marked as **favorite** or correspond to the **status** "Contained in this experiment".

In addition, differences can be enabled as filter criteria in which

- All variables
- Only variables without differences
- Only variables with differences

Limit the filtering further. These can then be extended using the criteria "Changed by user" and / or "Changed by import".

The results can also be limited using the following parameter types:

- Axis points
- ASCII
- Block
- Characteristic map




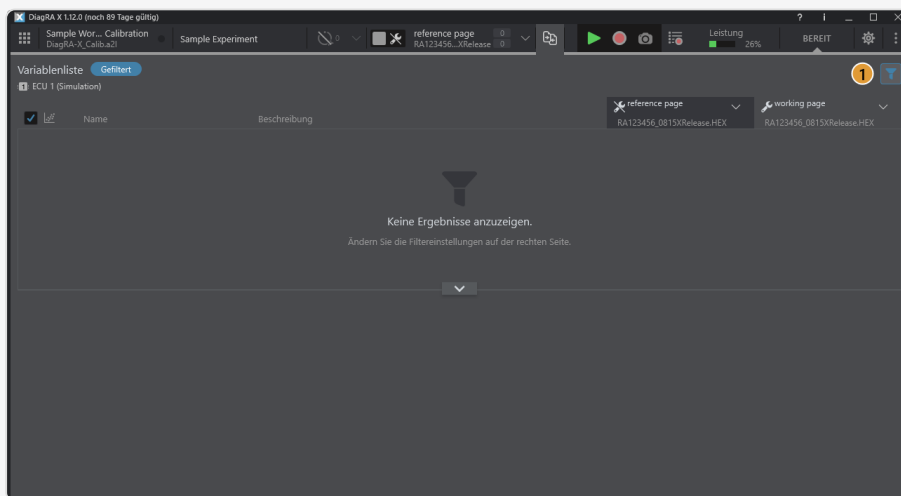
- Characteristic curve
- Invariable

Requirements

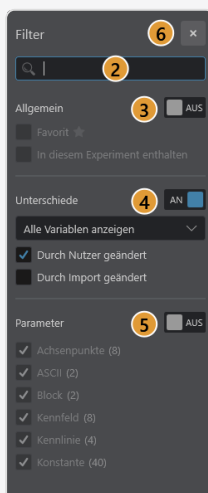
- At least one variable exists
- A binary file has been stored for both reference page and work page

Procedure

1. Click **Show filter** . The page menu with the filter selection opens.




2. Enter a **Variable name** to filter the variable list.



3. If necessary, **enable** the filter category "General" by clicking the corresponding **switch**. Then select the filter criteria for this category.



4. If necessary, **enable** the filter category “Differences” by clicking the corresponding **switch**. Then select the filter criteria for this category.
5. If necessary, **enable** the filter category “Parameter” by clicking the corresponding **switch**. Then select the filter criteria for this category.
6. **Close** the filter by clicking the **close cross** on the upper right border. If filters are still active, the filter icon  is highlighted in **blue**.



The List of Variables has now been filtered.

12.2 Highlighting differences

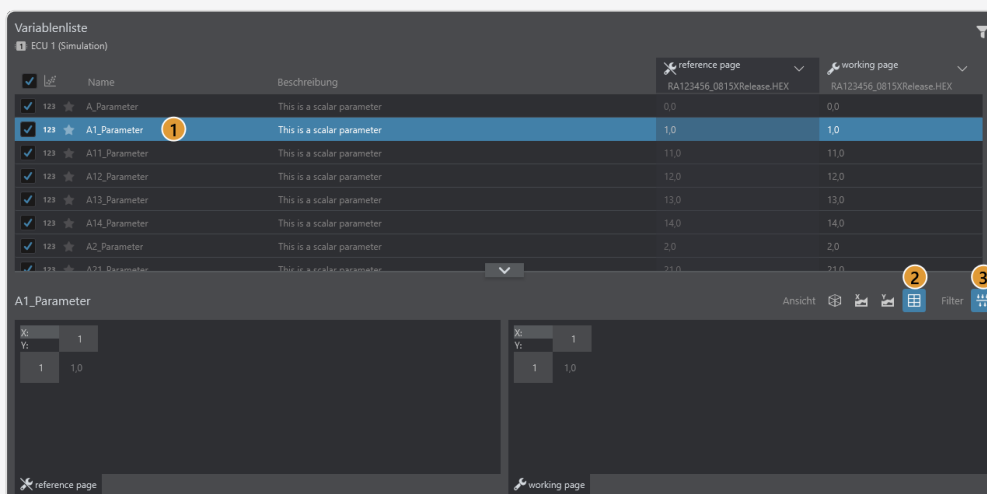
Due to the quantity of values within a characteristic map of the variable selected in the List of Variables, increased data noise can occur. In order to be able to more quickly recognize **calibrated values**, there is the possibility of **switching filters to active** which then highlights the differences.

Requirements



- At least one calibrated value.
- The comparison view is visualized as characteristic map.

Procedure

1. **Select** at least one variable of your choice from the List of Variables.





2. Click  to switch the comparison view to the map view.
3. Then **enable** the  **filter** to highlight the differences in the characteristic map.



The differences of a variable in your List of Variables is now highlighted.


12.3 Selecting the comparison view

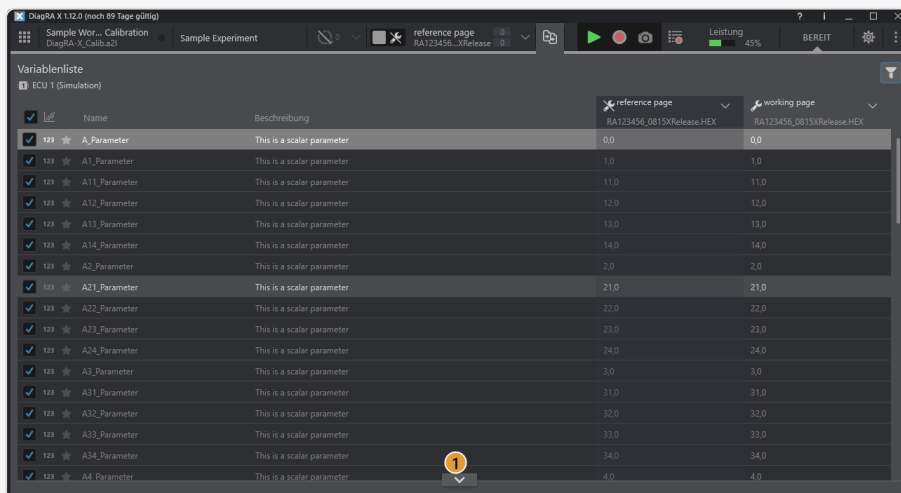
Using the comparison view, you can select **Unique values** in the List of Variables and juxtapose the visualization as **height map**, **calibration diagram** or **map table** of reference page to work page. This comparison enables changes to be clearly shown, which you have carried out yourself or which are a result of various data imports.

Requirements

- At least one variable exists.
- Ideally, at least one variable has already been calibrated on the work page.

Procedure

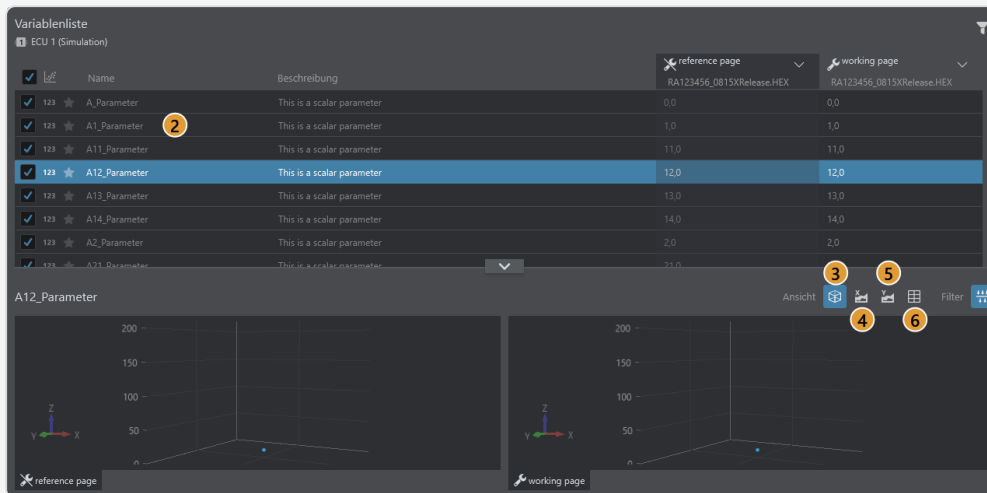
1. If the visualized comparison view is not visible, click the  button to open it.







Name	Beschreibung	reference page	working page
A_Parameter	This is a scalar parameter	0.0	0.0
A1_Parameter	This is a scalar parameter	1.0	1.0
A11_Parameter	This is a scalar parameter	11.0	11.0
A12_Parameter	This is a scalar parameter	12.0	12.0
A13_Parameter	This is a scalar parameter	13.0	13.0
A14_Parameter	This is a scalar parameter	14.0	14.0
A2_Parameter	This is a scalar parameter	2.0	2.0
A21_Parameter	This is a scalar parameter	21.0	21.0
A22_Parameter	This is a scalar parameter	22.0	22.0
A23_Parameter	This is a scalar parameter	23.0	23.0
A24_Parameter	This is a scalar parameter	24.0	24.0
A3_Parameter	This is a scalar parameter	3.0	3.0
A31_Parameter	This is a scalar parameter	31.0	31.0
A32_Parameter	This is a scalar parameter	32.0	32.0
A33_Parameter	This is a scalar parameter	33.0	33.0
A34_Parameter	This is a scalar parameter	34.0	34.0
A4_Parameter	This is a scalar parameter	4.0	4.0

2. In the list of variables (above the visualized comparison view), **select a variable** of your choice by clicking it. Observe how the charts in the comparison view

change when different variables are selected.



3. Click  to compare the height map of reference page and work page for the selected variable.
4. Click  to compare the side view of the X axes of the reference and working page of the selected variable
5. Click  to compare the lateral view of the Y-axis of reference page and work page for the selected variable.
6. Click  to compare the map view of reference page and work page for the selected variable.



The reference page and work page have now been juxtaposed using your selected variables with different visualizations.

12.4 Add DCM

Add a DCM file to the page comparison view. Compare the parameters specified in the DCM file with the existing information from the binary files. The parameters specified in the DCM file are displayed for preview. Select the parameters to be imported to the working page selectively.

12.4.1 Importing DCM via preview

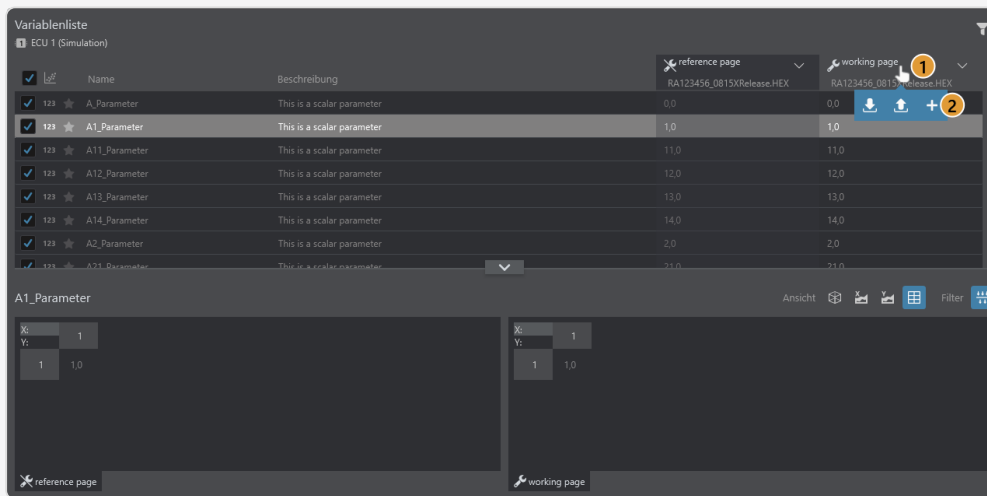
There are two options when importing a **DCM file**. Direct import and **import with a preview**. When using the preview, you can decide which data you wish to compare when importing.

Requirements

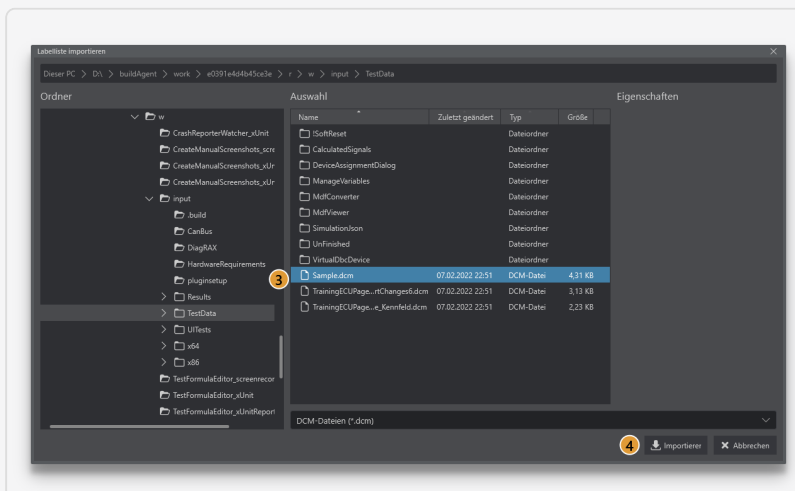
- A DCM file

Procedure

1. **Move** the mouse pointer over the button at the **top right edge** of the variable list in which your working page and the associated binary file are displayed. A choice of actions appears.

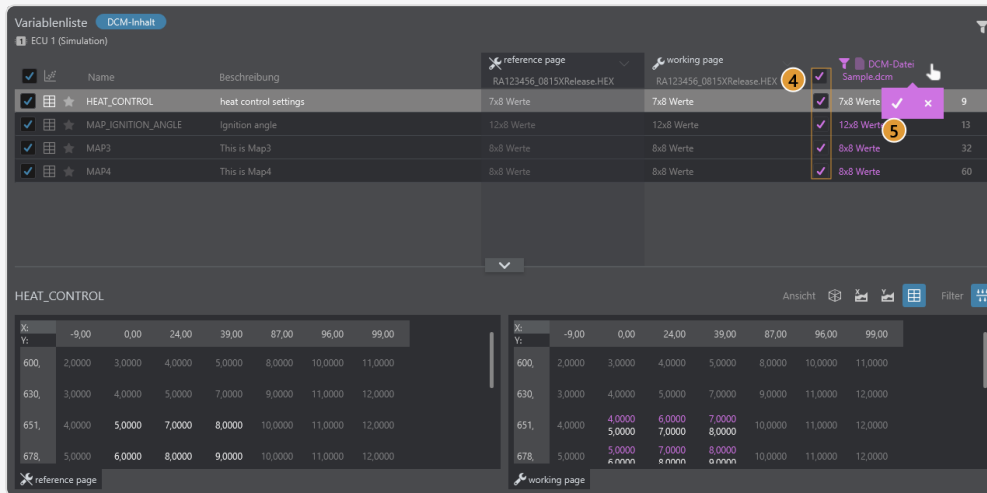


2. Click **Add DCM** **+** to add a DCM file to this work page. The file selection dialog opens.
3. Select the DCM file and click the **Import** button. A new column is added to the List of Variables as preview and the data of the work page and reference page is juxtaposed. The data from the DCM file is highlighted in color.





- Click on the **checkbox** in the preview column to select the variables that should transfer the data from the DCM file to the working page.



- Confirm** your selection by hovering over the column header and **clicking** . The data of the selected variables are imported to the working page. This is represented by the which shows that a change from a file has taken place and how many values have been changed due to this.

Or

- By clicking on you can discard the preview. This prevents data import.



A DCM file has now been selected, specific values have been selected in the preview and imported according to the selection.

12.4.2 Import DCM

Import all parameters with the specified values from a DCM file to the working page.

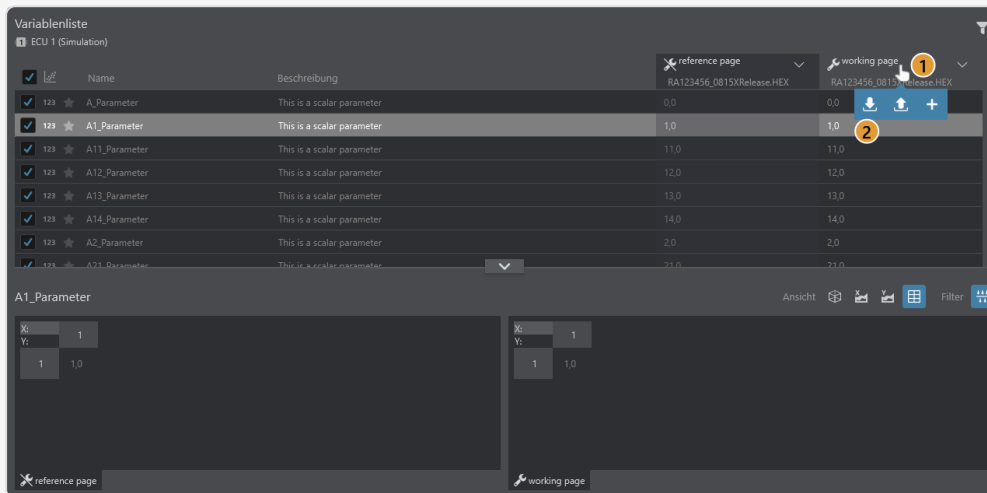
Requirements

- A DCM file

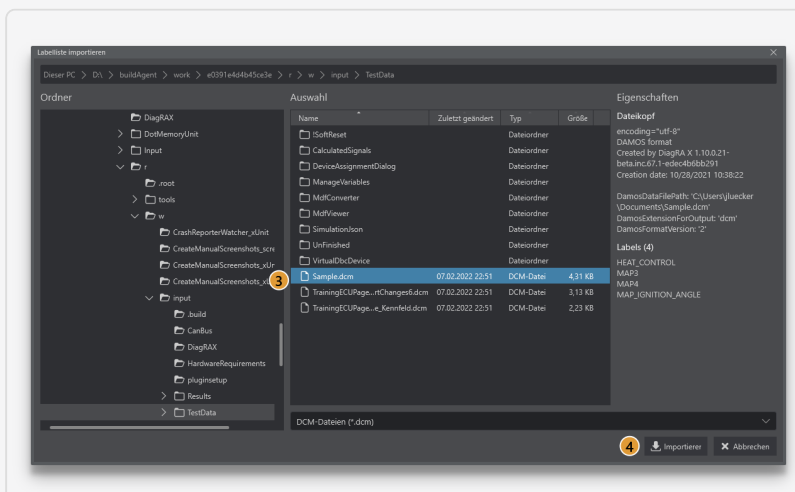


Procedure

1. **Move** the mouse pointer over the **button** at the top right edge of the variable list in which your working page and the associated binary file are displayed. A choice of actions appears.
2. Click **Import** . The file selection dialog opens.



3. Select the DCM file and click the **Import** button. Your data from the DCM file have now been directly transferred to the work page. This is represented by the indicator which shows that a change from a file has taken place and how many values have been changed due to this.

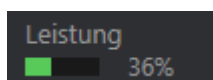


DCM data have now been imported.



13 Resource monitor

The resource monitor is available via the operating element in the upper menu bar.



Click to open the window with further information.

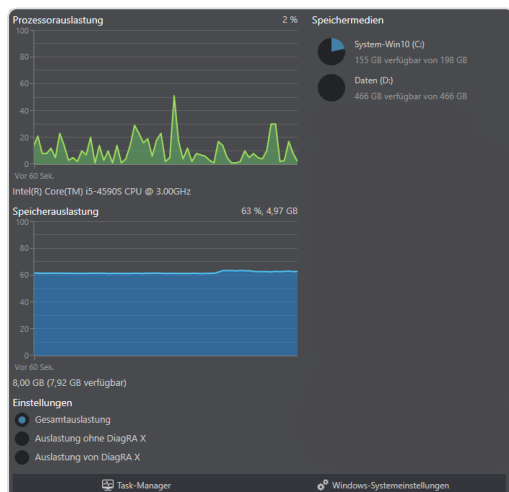


Fig. 13.1: Resource monitor



The resource monitor is divided into two columns. In the column on the left, you will see the processor utilization, the storage utilization and three options to filter the displayed data. On the right you will see the currently connected storage media. On the lower border of the view, you will also see two buttons which can be used to open the Windows task manager and system settings.

Processor utilization

In this graph, you will see the utilization of your CPU over time from the current time until 60 seconds ago. This data is continuously refreshed.

Below the graph you will see the identifier of your CPU.

Storage utilization



In this graph, you will see the utilization of your working memory over time from the current time until 60 seconds ago. This data is continuously refreshed.



Below the graphs, you will see the overall capacity of your working memory.

Settings

The displayed data can be filtered in three ways:

- Overall utilization: This option shows you all the data in your system.
- Utilization without DiagRA® X: This option shows you all the data in your system, apart from the resources which are used by DiagRA® X.
- Utilization of DiagRA® X: This option shows you only the resources which are used by DiagRA® X.

Storage media



In the list of storage media, you will find all drives on your computer, all connected network drives and all connected USB devices on which data can be stored.

For every list entry, you will be shown the name, the drive letter and the current utilization (as text and as diagram).

When clicking one of the entries, the selected drive opens in your file Explorer.



14 Remote control

DiagRA® X can be controlled remotely. This is useful, for example, when using DiagRA® X as a data source for test bench software. In such a case, the test stand software configures the quantity of measured values to be recorded and starts and stops the measurement in DiagRA® X fully automatically.

Currently, DiagRA® X supports remote control via [ASAP 3](#).

14.1 ASAP 3 Interface description

ASAP3 MC V2.1.1 (ASAM MCD 3MC V2.1.1) is an ASAM standard for specifying a procedural application programming interface (API) for measurement and calibration tools. Use the ASAP 3 API to control remotely DiagRA® X (e.g. from your test bench software). The settings for ASAP 3 can be found in the system settings under the [Remote](#) tab.

List of ASAP 3 commands in DiagRA® X

RETRY

Resends the last command

EMERGENCY

Zeigt einen Nachrichtendialog in DiagRA® X.

If a measurement is currently running, it is stopped.

If the selected page is a work page, a reference page will be selected.

INIT

Registers the caller as a the (unique) ASAP3 client.

IDENTIFY

Delivers the name and the protocol version number to DiagRA® X.

Returns the name and the protocol version number.



EXIT

Unregisters the caller as the (unique) ASAP3 client.

Resets the ASAP3 client data:

- Clears the variables list.
- Sets the case-sensitive flag to false (default value)

SELECT DESCRIPTION FILE AND BINARY FILE

Opens a workspace and an experiment in DiagRA® X.

“Description file name”: The name of the workspace or the name of the description file.

“Binary file name”: The name of the experiment.

COPY BINARY FILE

This command is not supported in DiagRA® X yet.

CHANGE BINARY FILE NAME

This command is not supported in DiagRA® X yet.

SELECT DESCRIPTION FILE AND BINARY FILE

Opens workspace and experiment.

“Description file name”: The name of the workspace or the name of the description file.

“Program code file name”: The name of the experiment.

SELECT LOOK-UP TABLE

This command is not supported in DiagRA® X yet.

PUT LOOK-UP TABLE



This command is not supported in DiagRA® X yet.

GET LOOK-UP TABLE

This command is not supported in DiagRA® X yet.

GET LOOK-UP TABLE VALUE

This command is not supported in DiagRA® X yet.

INCREASE LOOK-UP TABLE

This command is not supported in DiagRA® X yet.

SET LOOK-UP TABLE

This command is not supported in DiagRA® X yet.

EXTENDED SELECT LOOK-UP TABLE

This command is not supported in DiagRA® X yet.

EXTENDED PUT LOOK-UP TABLE

This command is not supported in DiagRA® X yet.

EXTENDED GET LOOK-UP TABLE

This command is not supported in DiagRA® X yet.

EXTENDED GET LOOK-UP TABLE VALUE

This command is not supported in DiagRA® X yet.

EXTENDED INCREASE LOOK-UP TABLE



This command is not supported in DiagRA® X yet.

EXTENDED SET LOOK-UP TABLE

This command is not supported in DiagRA® X yet.

PARAMETER FOR VALUE ACQUISITION

Defines which variables are to be measured in DiagRA® X.

A filter with these variables is shown in the variables manager in DiagRA® X.

EXTENDED PARAMETER FOR VALUE ACQUISITION

This command is not supported in DiagRA® X yet.

SWITCHING OFFLINE/ONLINE

Starts/stops the measurement.

Mode 0: Start measurement.

Mode 1: Stop measurement.

GET ONLINE VALUE

Returns the current values of the variables defined by PARAMETER FOR VALUE ACQUISITION.

EXTENDED GET ONLINE VALUE

This command is not supported in DiagRA® X yet.

GET USER DEFINED VALUE

Returns the current values of all variables of the experiment, regardless of which variables where defined with PARAMETER FOR VALUE ACQUISITION.



GET USER DEFINED VALUE LIST

Returns the names of all variables of the experiment, regardless of which variables were defined with PARAMETER FOR VALUE ACQUISITION.

GET PARAMETER

This command is not supported in DiagRA® X yet.

SET PARAMETER

This command is not supported in DiagRA® X yet.

EXTENDED GET PARAMETER

This command is not supported in DiagRA® X yet.

EXTENDED SET PARAMETER

This command is not supported in DiagRA® X yet.

DEFINE RECORDER PARAMETERS

This command is not supported in DiagRA® X yet.

DEFINE TRIGGER CONDITION

This command is not supported in DiagRA® X yet.

ACTIVATE RECORDER

Starts/stops the global recorder.

Mode 0: Stop recording.

Mode 1 or 2: Start recording.



GET RECORDER STATUS

Only "Recorder on" and "Recorder off" are supported.

Returns the following recorder status:

- Recorder status: "Recorder on" (1) or "Recorder off" (2).
 - "Recorder ready" (3) is not supported.
- Current Samples: always "0".
- Stop condition: always "manual" (1) (default).
 - "Trigger Stop" (2) is not supported.
 - "End of Recording" (3) is not supported.
 - "Stop due to error" (256) is not supported.
- Stop information: always "" (empty string).

GET RECORDER RESULT HEADER

This command is not supported in DiagRA® X yet.

EXTENDED GET RECORDER RESULT DATA TYPES

This command is not supported in DiagRA® X yet.

GET RECORDER RESULTS

This command is not supported in DiagRA® X yet.

EXTENDED GET RECORDER RESULTS

This command is not supported in DiagRA® X yet.

SAVE RECORDER FILE

This command is not supported in DiagRA® X yet.



LOAD RECORDER FILE

This command is not supported in DiagRA® X yet.

SET GRAPHIC MODE

This command is not supported in DiagRA® X yet.

RESET DEVICE

This command is not supported in DiagRA® X yet.

SET FORMAT

Sets the current datatype settings.

SET CASE SENSITIVE LABELS

If sent, DiagRA® X will process variable names as case sensitive.

Case insensitive processing is the default.

EXTENDED QueryAvailableServices

This command is not supported in DiagRA® X yet.

EXTENDED GetServiceInformation

This command is not supported in DiagRA® X yet.

EXTENDED ExecuteService

This command is not supported in DiagRA® X yet.

VW_GetDevicelDent



This command is not supported in DiagRA® X yet.

VW_ResetErrorEntries

This command is not supported in DiagRA® X yet.

VW_GetErrorEntries

This command is not supported in DiagRA® X yet.

VW_GetErrorEntryCount

This command is not supported in DiagRA® X yet.

VW_StartMeasurement

This command is not supported in DiagRA® X yet.

VW_GetErrorEntryCodes


This command is not supported in DiagRA® X yet.

15 System settings


The **system settings** are available via the operating element  in the upper menu bar.

This chapter describes the individual system settings. Configure DiagRA® X according to your requirements. The set options apply to the overall installation of DiagRA® X.

15.1 Export

Export the overall settings and setting options to a .drxsst file. A corresponding dialog box opens after clicking **Export** .

15.2 Import

Import the overall settings and setting options from a .drxsst file. A corresponding dialog box opens after clicking **Import** .

The various setting options are displayed as groups in the system settings. By selecting the respective group with a mouse click in the area in the left of the system settings, a detailed view of the selected group is displayed in the view on the right.

15.3 General system settings

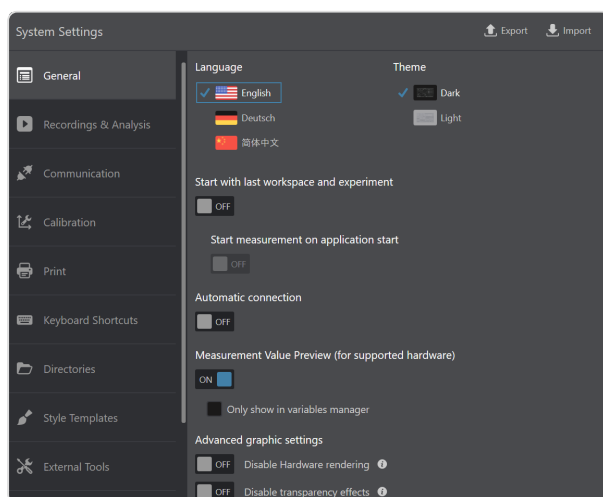


Fig. 15.1: General system settings



15.3.1 Language

By clicking one of the listed languages, the views in DiagRA® X are switched to the selected language. Language settings can be changed during ongoing operation. The active language is highlighted.

15.3.2 Theme

The user-controlled switch between day mode and night mode ensures clear contrasts during difficult light conditions. The active theme is highlighted.

15.3.3 Open last workspace and last experiment when starting

After selecting ON, when starting DiagRA® X, the most recently used workspace and the most recently used experiment is automatically applied. If the option is OFF, the user must load the workspace and experiment themselves.

15.3.4 Go online when starting

After selecting ON, when starting DiagRA® X, a connection to the available devices from the most recently used experiment is established. If the option is OFF, no connection is automatically established and the user must manually establish this connection.

15.3.5 Measurement value preview

In the case of an existing physical connection with low refresh rate, the measurement values are read from the measurement device or control device and displayed in the Variable Management.

The preview function can be extended to the Variable Monitor and the visualizers. The actual measured values are displayed online with the set raster.

15.3.6 Disable hardware rendering

The function disables hardware rendering. If the function is activated, all content is rendered by software. This option helps to determine whether a faulty graphics card driver can be responsible for application crashes in case of certain errors (e.g. UCCERR_RENDER_THREAD_FAILED). Enabling this option affects the performance of the entire application, as software rendering cannot work as efficiently as hardware rendering.

This function requires a restart of the software.

15.3.7 Disable transparency effects

The function disables the transparency effects for window and popup displays. If this function is activated, the backgrounds of windows and popups are displayed opaquely. This option helps to determine whether a faulty graphics card driver can be responsible for application crashes in case of certain errors (e.g. UCCERR_RENDER_THREAD_FAILED).

This function requires a restart of the software.

15.4 Recording and analysis

The recording area offers several settings for the recordings carried out in DiagRA® X.

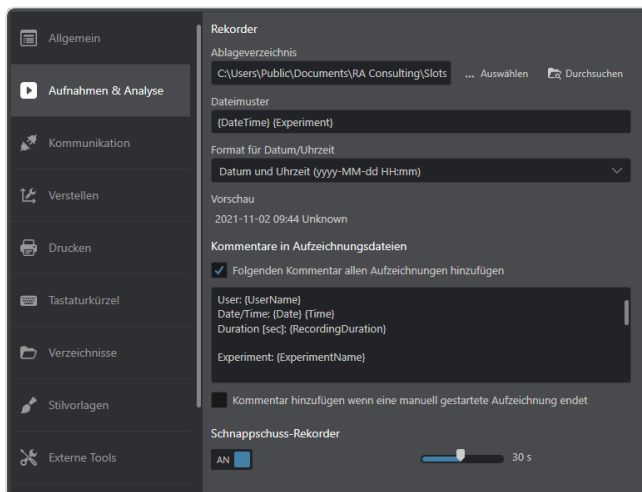


Fig. 15.2: Recording and analysis

15.4.1 Storage directory

The recordings are stored in the specified directory. The directory can be changed using Select. The Browse button opens the file explorer in the specified directory.

15.4.2 File model

The filename of the recording is made up of the specified file model.



15.4.3 Format for date and time

Using the drop-down menu, the specified date format for the file model can be selected from the templates.

15.4.4 Adding comments at the end of the recording

The selected marker field requires an additional comment from the user after a manual recording is completed.

For an analysis, the buffer size can be entered using the slider control. The maximum size is dependent on the raster of the variables.

15.5 Memory dump

15.5.1 Settings

The following settings for the memory dumps can be set in the system settings:

- Storage directory
 - Select in which folder the files will be saved.
- File model
 - Define how the file name is composed.
 - By entering "{" a suggestion list with possible placeholders is displayed.
- Format for date and time
 - Select how date and time are formatted in file names when using the placeholder "{DateTime}".
- File format
 - Select in which file format the memory dump will be saved. Multiple selection is possible.
- Segment size for binary file formats (bytes)
 - For the binary formats (.hex and .s19), select how large the contiguously written memory segments become.
- Options



- Decide whether
 - a written file is displayed immediately.
 - a file with the same name is already overwritten.
 - a snapshot (.mdf) is created simultaneously with the triggering of a snapshot.

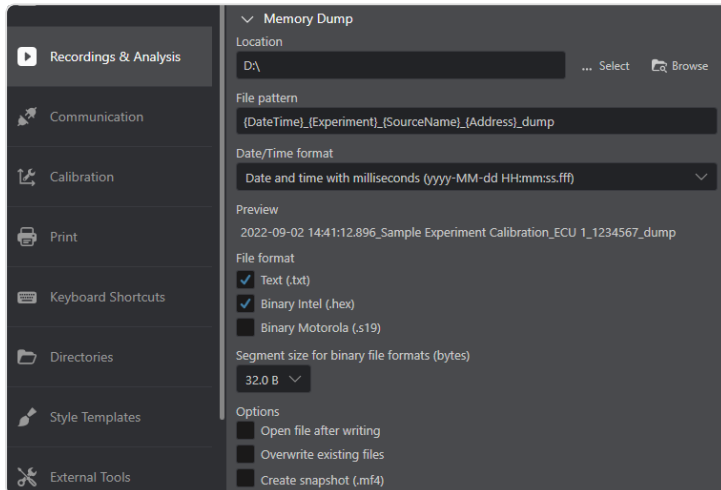



Fig. 15.3 : Settings for memory dumps in the system settings

15.5.2 Settings and execution in the top bar

The function for the memory dumps  can be activated via the function selection in the top bar.

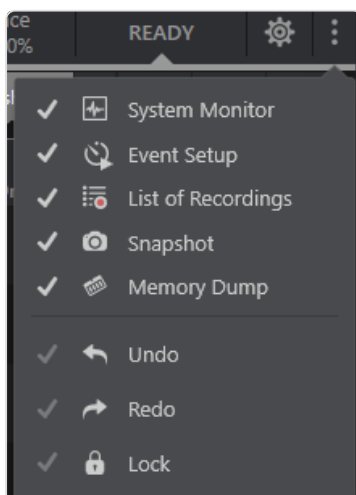





Fig. 15.4 : Function selection in the top bar



If the function is activated in the function selection, the memory dump button  appears in the top bar, with which a memory dump can be triggered and an arrow button  to open the configuration.

Click the arrow button  to open the configuration for memory dumps.

The following settings can be defined for each control device in the working environment:

1. Whether a memory dump is generated for the device via the button in the top bar.
2. The start address (in hexadecimal) at which the memory dump begins.
3. The byte length (in decimal) of the memory dump.
4. A button can be used to trigger a memory dump for this device.

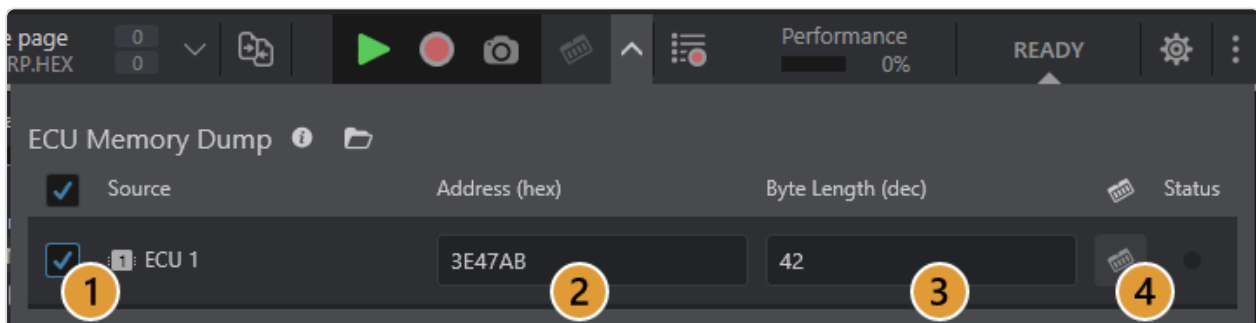


Fig. 15.5: Settings for memory dumps

15.5.3 Safety aspects



Attention: The written data may be corrupted if during reading the affected memory area was changed by adjustment actions or the control unit itself.

15.5.4 Preview of the written files

Written files are displayed below the configuration view. The address is displayed on the left, the content on the right. Binary files (.hex, .s19) are displayed interpreted.

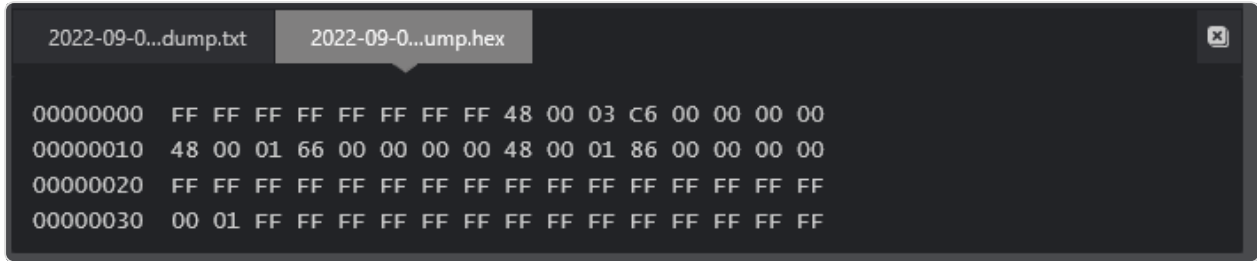


Fig. 15.6 : Preview of a binary file

15.6 Communication

The DiagRA® X **system settings** Communication can be reached via the upper menu bar. The view shown below opens containing all interfaces which were recognized on your system.

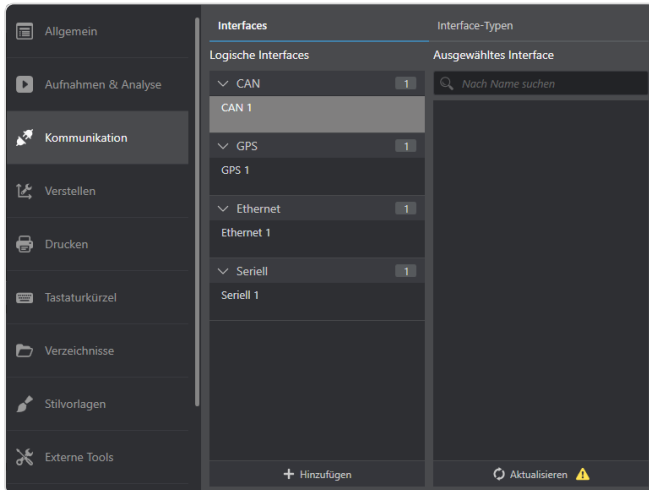


Fig. 15.7 : Communication settings

15.6.1 Logical interface

The logical interfaces are grouped according to their physical access to the respective device. The **connection from the interface to the device is decisive here**, not the connection to the PC. The number of available interfaces is displayed in the view after the physical access.

To add a new interface, simply click the operating element **Add +**. Removing no longer required interfaces is carried out via the operating element in the same way as adding. Below the name, the selected interface is displayed with its physical information.

The allocation and selection of logical interfaces to a physical interface is very simple:

15.6.2 Interface

The list of interfaces can be reloaded by clicking **Refresh**. Interfaces which are still shown but are no longer available can be permanently removed from DiagRA® X by clicking Remove.



Give your interfaces unique descriptions. It is recommended that a name is chosen. Position your cursor over the logical interface element. Use Edit to enter a name for the selected logical interface. You can, for example, describe an interface as Diagnosis and another as Measuring devices.

15.7 Printing

The DiagRA® X system settings Printing is available in the upper menu bar. The view shown below opens for printing and exporting.

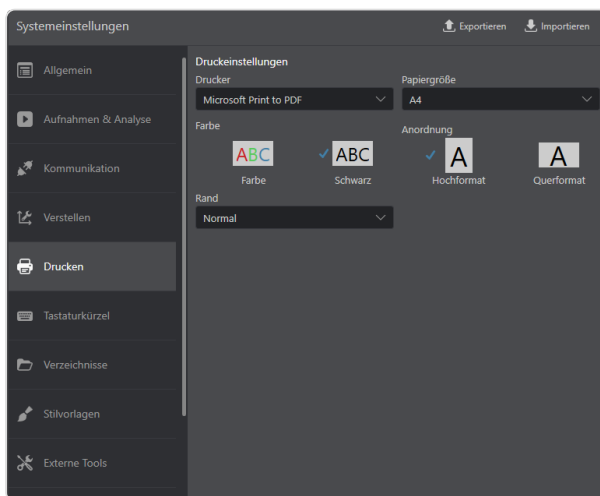


Fig. 15.8 : Print settings

15.7.1 Print settings

1. Select your printer from the drop-down menu. You will find all the printers available on your system.
2. Adjust the selected paper size to the selection in the drop-down menu.

3. The color or black/white printout is selected using the respective element.
4. The printout can be carried out in a portrait or landscape format by selecting the respective element.
5. Set the print distance to the border.

15.8 Keyboard shortcuts

DiagRA® X is supplied with a read-only keyboard shortcut set: DiagRA® X **Default**. Configure DiagRA® X for an **individual keyboard operation**. The view shown below opens. The detailed view is divided into various areas.

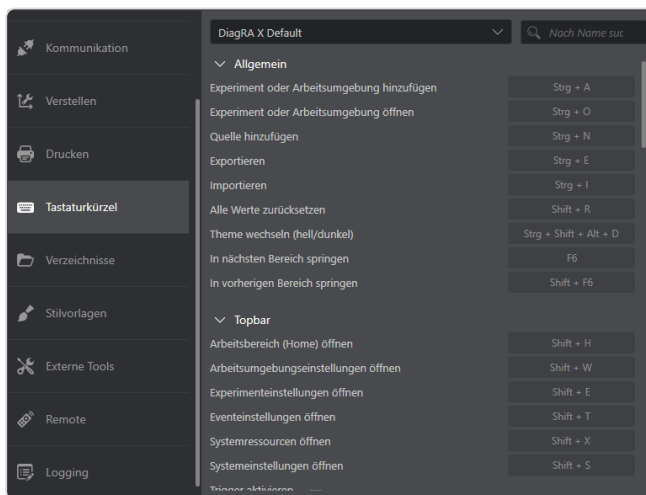


Fig. 15.9 : Keyboard shortcuts

15.8.1 Drop-down menu

The available keyboard assignment variants are listed for selection in the drop-down menu.

15.8.2 Filters

By making entries in the filter field, only the actions corresponding to the entry are shown.



15.8.3 Assigning / deleting keyboard shortcuts

1. Select Custom from the drop-down menu.
2. To assign a desired keyboard shortcut to an action, click in the field behind the text.
3. Now you can press the desired key for keyboard mapping. Compound keyboard shortcuts with CTRL, ALT or SHIFT are possible and are only applied after pressing an alphanumeric key.
4. Keyboard assignments can be removed individually using the **Delete symbol**

15.9 Directories

Different default directories for the respective data types can be set here.

15.9.1 Select

Set the corresponding directory. When the mouse button is clicked, a user dialog opens in which the directory can be selected. After selection, the path appears in the upstream text field.

15.9.2 Open

When the mouse button is clicked, the set directory opens in the Windows Explorer.

15.10 Style templates

Color distinctions for measured values in the customizable areas within the limits.

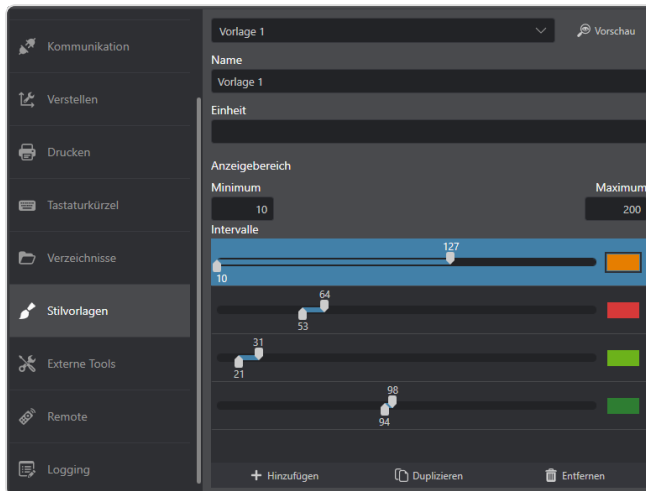


Fig. 15.10 : Style templates

The drop-down menu shows the selected and displayed style. Additional styles can be added and enabled using the drop-down menu.

15.10.1 Name

Enter a name for the created style here. The name can also be changed later.

15.10.2 Color and axis area

The default color is used for the specified axis area.

15.10.3 Axis area

The axis area limits the minimums and maximums to these values in the visualizers being used.

15.10.4 Intervals

Adding, duplicating and removing intervals is possible using the operating elements. Settings for the color and min/max limits within the above-mentioned Axis areas is also carried out here.

15.10.5 View

Opens and closes an additional preview of the created style to the side.

15.11 External tools

The DiagRA® X system settings **External Tools** can be reached via the upper menu bar. Information on additional tools which are used by DiagRA® X are displayed.

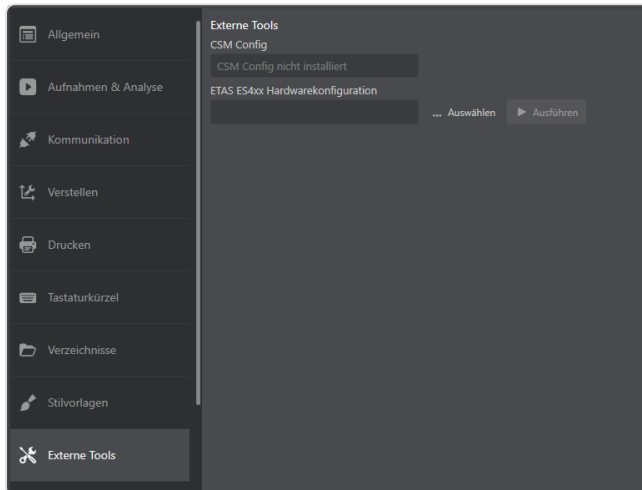


Fig. 15.11 : External tools

15.11.1 CSM Config

In order to enable a variation of CSM Config Tool versions on your system, use the drop-down menu for selection. The displayed version is used for CSM.

15.12 Remote

The DiagRA® X System Settings **Remote** can be reached via the upper menu bar. Here the ASAP 3 client can be configured as well as started and stopped.

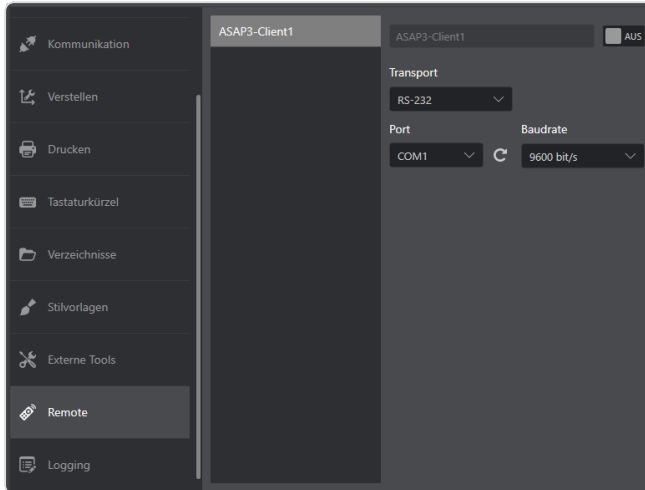


Fig. 15.12 : Remote settings



16 List of figures

Fig. 1.1 : Registration Wizard of DiagRA® X and DiagRA® X Viewer	3
Fig. 1.2 : Experiment view	6
Fig. 2.1 : Main view	8
Fig. 2.2 : Area division	9
Fig. 2.3 : Figure: groupings	14
Fig. 3.1 : Detailed information for CSM devices	30
Fig. 3.2 : IP address configuration	37
Fig. 5.1 : Worksheet overview	51
Fig. 5.2 : Arrangement suggestions	52
Fig. 5.3 : Measurement visualizer	53
Fig. 5.4 : Worksheet Edit mode	54
Fig. 5.5 : Vertical bar graph (top) and horizontal bar graph (bottom)	56
Fig. 5.6 : Tab for Display Limits in style menu	56
Fig. 5.7 : Numerical display	57
Fig. 5.8 : Oscilloscope areas	57
Fig. 5.9 : Oscilloscope style templates	58
Fig. 5.10 : Cursor context menu	64
Fig. 5.11 : Context menu of the Y-axis of a variable with group axis	64
Fig. 5.12 : Display Limits tab in the style menu	65
Fig. 5.13 : Selectable icons in the Icon Monitor	67
Fig. 5.14 : Table	68
Fig. 5.15 : Pointer instrument	68
Fig. 5.16 : Tab for Display Limits in style menu	69
Fig. 5.17 : Trace Visualizer	69
Fig. 5.18 : Selection of the variable in the visualizer header	70
Fig. 5.19 : Variables monitor	71
Fig. 6.1 : Variable Management layout	73
Fig. 6.2 : Variable Management overview	74
Fig. 6.3 : Example: Visualization container of type Numerical.	74
Fig. 6.4 : Measurement container	74
Fig. 6.5 : Variable details of a measurement variable	76
Fig. 8.1 : Recording list	97
Fig. 8.2 : Recording list	97



Fig. 9.1 : Event-based function overview	99
Fig. 9.2 : Organization of the event-based function view	99
Fig. 9.3 : Recorder view	101
Fig. 9.4 : Create action	102
Fig. 9.5 : Edit action	103
Fig. 13.1 : Resource monitor	143
Fig. 15.1 : General system settings	153
Fig. 15.2 : Recording and analysis	155
Fig. 15.3 : Settings for memory dumps in the system settings	157
Fig. 15.4 : Function selection in the top bar	157
Fig. 15.5 : Settings for memory dumps	158
Fig. 15.6 : Preview of a binary file	159
Fig. 15.7 : Communication settings	159
Fig. 15.8 : Print settings	160
Fig. 15.9 : Keyboard shortcuts	161
Fig. 15.10 : Style templates	163
Fig. 15.11 : External tools	164
Fig. 15.12 : Remote settings	165

17 List of tables

Tab. 1-1 System requirements	1
Tab. 2-1 Elements of the upper menu bar	12
Tab. 2-2 Meaning of colors below the upper menu bar for the connection state	12
Tab. 2-3 Visual operating elements	13
Tab. 3-1 Baud rate selection	35
Tab. 3-2 Selection of XCP parameters	36
Tab. 5-1 Visualizer display options	55
Tab. 5-2 Function overview oscilloscope	64
Tab. 11-1 Function overview of characteristic map	123
Tab. 11-2 Function overview of calibration table	124

18 Keyword index

A

Add description file

Create a workspace 5

Add workspace

Create a workspace 5

Adding measured variables

Visualization bar 74

B

Bar graph 54, 56

C

Communicationn 4, 29, 159

Connection 7, 11, 28

Create experiment

Creating an experiment 5

Creating a workspace 4

CSM Config

External Tools 164

D

Define visualization

Create an experiment 6

Directories 162

E

Experiment 5, 10, 42

External tools 164

G

General system settings 153

Go online after start

General system settings 154

H

Hardware

Einbau 2

I

Installation 1

Interface

Communication 145, 160

K

Keyboard shortcuts 122, 124, 161

L

Language

General system settings 154

Logical interface

Communication 159

M

Measurements 11, 74, 96

N

Numerical display 54, 57

O

Operating concept 8

Oscilloscope 54, 57

P

Pointer instrument 54, 68

Print settings

Print 160

Printing 160

R

Recorder 101, 150

Recording and analysis 155

Recording list 11, 96

Registration 2

Request activation data

Registration 3

Resource monitor 143

S

Select physical connection

Create a workspace 5

Select variables

Create an experiment 7

Software

Installation 2, 40

Style templates 162

Symbols 54

System requirements 1

T

Table 54, 68

Theme

General system settings 154

U

Upper menu bar 9-10

V

Variable management 73

Visual operating elements 12, 100

Visualization 6, 61, 73-74

W

Worksheet 9, 54, 73-75

Workspace 10, 15