Manual

Evaluation Software CAMSIZER® X2

Translation

Table of Contents

1 Notes on the Manual

Dear user,
please read the following manual referring to this program carefully before starting any software installation and operation of the program.

This manual is a technical guide on how to operate the program safely and it contains all the information required for the areas specified in the table of contents. This technical documentation is a reference and instruction manual. The individual chapters are complete in themselves. Familiarity (of the respective target groups defined according to area) with the relevant chapters is a precondition for the safe and appropriate use of the program.

This manual does not contain any repair instructions. In case of any obscurities or questions with regards to this document or the program, as well as if errors arise or repairs are necessary, please contact your supplier or get in touch with Retsch Technology GmbH directly.

Application-technical information relating to samples to be processed are not or only to a certain extend included.

Revision status:
This document revision 0001 refers to the manual "Evaluation Software CAMSIZER® X2". The following manual describes the software version 6.7 or newer.

1.1 Disclaimer

This Manual has been prepared with great care. We reserve the right to make technical changes. We assume no liability for personal injuries resulting from the failure to follow the safety information and warnings in this Manual. No liability will be assumed for damage to property resulting from the failure to follow the information in this Manual.

1.2 Copyright

1.3 Explanations of the Safety Instructions

In this document the following **signs and symbols** are being used:

ⓘ	Reference to a recommendation and/or an important information
→	Reference to a chapter, table or figure
⇨	Action instruction
| Name |	Software menu function
[Name]	Software button
⟨Name⟩	Software checkbox

⚠ CAUTION C1.0000

Risk of injuries
Source of danger

- Possible consequences if the danger is ignored.
  - **Instructions and information on how to avoid the risk.**

Average to slight injuries may result if the “Caution” sign is disregarded. There is an average or slight risk of an accident or personal injury. The signal word **⚠ CAUTION** is additionally used in the running text or in instructions.

NOTICE N1.0000

Type of damage to property
Source of the damage to property

- Possible consequences if the information is ignored.
  - **Instructions and information on how to avoid the damage to property.**

Damage to property may result if the information is disregarded. The signal word ***NOTICE*** is additionally used in the running text or in instructions.

1.4 General Safety Instructions

Target group:
All persons concerned with this program in any form.

This program is a modern, high performance software from Retsch Technology GmbH and complies with the state of the art. Operational safety is given if the program is handled for the intended purpose and attention is given to this technical documentation.

Safety manager:
The managing operator himself must ensure that the people entrusted with this program…

- have noted and understood all the regulations regarding safety,
- are familiar before starting work with all the operating instructions and specifications for the target group relevant to their work,
- have unrestricted and free access to the technical documentation of this program,
- are familiar before starting work with the safe handling of the device and its use for its intended purpose either by verbal instructions from a competent person and/or by means of this technical documentation.

⚠ **CAUTION** Improper operation can result in personal injuries and property damage. The managing operator himself is responsible for his own safety and that of his employees. The managing operator himself is responsible that no unauthorised person has access to the program and the thereby controlled device.

1.5 Repairs

This manual does not contain any repair instructions. For safety reasons, repairs may only be carried out by Retsch Technology GmbH or an authorised representative or by qualified service technicians.

In case of repair, please inform…

…the Retsch Technology GmbH representative in your country,
…your supplier, or
…Retsch Technology GmbH directly.

Service address:

1.6 Confirmation Form for the Managing Operator

This manual contains essential instructions for operating the program which must be strictly observed. It is essential that they be read by the user and by the qualified staff responsible for the software prior to using the program. This manual must be available and accessible at the place of use at all times.

The user of the program herewith confirms to the managing operator (owner) that he has received sufficient instructions about the use of the program. The user has received the manual, has read and taken note of its contents and consequently has all the information required for safe operation and is sufficiently familiar with the program.

The managing operator should for legal protection have the user confirm the instruction about the use of the program.

I have read and taken note of the contents of all chapters in this manual as well as all safety instructions and warnings.

User
Surname, first name (block letters)
Position in the company
Place, date and signature

Managing operator or service technician
Surname, first name (block letters)
Position in the company
Place, date and signature

2 Technical Data

The Evaluation Software CAMSIZER® X2 is a program for particle size analysis. It is able to automatically perform the required measuring processes – from determining the size and shape of particles to evaluating the data.

The CAMSIZER® X2 program is able to directly communicate with the CAMSIZER® X2 of Retsch Technology GmbH and control it. It guides the user through the respective working steps. Available parameters, as well as the characteristics to be calculated can be entered in various edit boxes. Routine parameters can be edited, stored and recalled at any time.

The CAMSIZER® X2 program calculates all standard particle distributions, as well as the representative characteristics of the particle size and particle shape, and allows for the tabular and graphical presentation of results in a measurement report conforming to standards. Furthermore, the data can be exported to other software products (e.g. Microsoft Excel).

The CAMSIZER® X2 program is also available as AuditTrail enabled version in compliance with 21CFR Part 11.

2.1 System Requirements

NOTICE

N2.0029

System requirements

Non-observance of the minimum system requirements

- Insufficient random access memory (RAM) and/or available hard drive space might cause program crashes.
- Insufficient system performance can result in data loss.
- **Observe the minimum system requirements to ensure a stable and performant operation of the program.**

The minimum system requirements in the following table apply exclusively to the CAMSIZER® X2 program. In order to define the system requirements of the software bundle CAMSIZER® X2 including Particle X-Plorer program, the minimum system requirements of the particle library must be considered as well.

Component	Minimum requirements
Operating system	Windows 7 (64bit) Windows 10 (64bit)
Processor	Intel Core i7
Random access memory (RAM)	16 GB
Required hard drive space	100 GB
PCI Express slot	1 x8, full height, full length, double width (two adjacent slot brackets)
RS232 interface	1
DVD drive	1
USB interface	1 (2.0 or higher)
Network connection	recommended for automatic backups
Internet connection	recommended for remote support

As operating system, the CAMSIZER® X2 program requires Windows 7 or higher in the 64bit version. In addition, the following software is required:

- Matrox Imaging MIL10 64bit
- Pylon 5 Suite 64bit
- Microsoft Visual C++ 2010 Redistributable 64bit
- Microsoft Visual C++ 2012 Redistributable 64bit
- Microsoft Visual C++ 2015 Redistributable 64bit

The required installation files are located on the provided data storage medium. The installation procedures of the individual components are described in detail in Chapter "Installation".

NOTICE

N3.0030

Local administrator rights

The CAMSIZER® X2 program requires local administrator rights for installation and operation

- Without full read and write access a smooth installation and a failure-free operation is not guaranteed.
- Insufficient read and write access during operation could result in data loss.

- **Ensure that each Windows user has the necessary read and write access for the installation directory of the program.**

3 First Commissioning

⚠ CAUTION C2.0021

Danger of personal injury
External control

- During the external control via the CAMSIZER® X2 program, there exists a risk of an unexpected or unintended start-up of the device to be controlled.
- **The controlled device must always be placed in the field of view of the CAMSIZER® X2 program user.**
- **Observe also the manual and the warnings of the corresponding device.**

NOTICE N4.0035

Disturbance of communication between program and device
Removing the data cable during running program operation

- If the data cable is removed while the CAMSIZER® X2 program is running, data loss can result.
- A flawless communication cannot be ensured without rebooting the PC.
- **Never disconnect the data cable from the device and/or the PC, while the CAMSIZER® X2 program is executed and the controlled device is turned on.**

All supplied data cables as well as all connections on the device and the supplied PC are clearly labelled.

Connecting the data cable:

⇨ Connect the plug "RS232" of the supplied data cable to the COM interface "RS232" on the CAMSIZER® X2.
⇨ Connect the socket "RS232" to the COM interface "RS232" on the PC.

Connecting the two synchronisation cables:

⇨ Connect the plug "SYNC B" of the supplied synchronisation cable to the interface "SYNC B" on the CAMSIZER® X2.
⇨ Connect the socket "AUX/A" to the interface "AUX/A" on the framegrabber card in the PC.
⇨ Analogous connect the second supplied synchronisation cable to the interfaces "SYNC Z" on the device and "AUX/B" on the framegrabber card in the PC.

Connecting the four camera cables:

⇨ Connect the plugs "CH0", "CH1", "CH2" and "CH3" of the four camera cables of the CAMSIZER® X2 to the interfaces "Channel 0", "Channel 1", "Channel 2" and "Channel 3" on the framegrabber card in the PC, respectively.

⇨ Turn on the device via the mains switch.
⇨ Start the CAMSIZER® X2 program by double-clicking the respective desktop icon. The device can now be controlled via the CAMSIZER® X2 program.

3.1 Principle of Operation

A particle size analysis with the CAMSIZER® X2 program is performed in three separate steps:

1. Definition of a task file
2. Execution of a measurement
3. Evaluation of the results

By means of the CAMSIZER® X2 program, the device can be externally controlled. To do this, the CAMSIZER® X2 must be connected via data cables to the PC on which the appropriate drivers are installed.

The evaluation can be performed separately in time from the measurement by reading and evaluating the raw data files (RDF files) at any given time. In this process, always that particular task file (AFG file) is loaded, which was also used during the measurement. The evaluation is performed with the parameters (particle size characteristics, size classes and view settings), that are currently set in the AFG file. That provides the possibility to subsequently change the task file and re-evaluate the raw data with altered parameters.

To prevent accidental changes of the parameters of a task file, a password protection with three user levels can be activated in the CAMSIZER® X2 program.

User level	Description
Measurement mode	The measurement mode is particularly suitable for routine operation. Measurement and evaluation is possible, but no task files can be created or edited.
Parameter mode	The parameter mode is intended for the advanced user having a good knowledge of the CAMSIZER® X2 program. In addition to the measurement mode, task files can be created and edited, fitting files can be created and the device can be calibrated. It is possible to check calibration in parameter mode, but the device cannot be recalibrated.
Administrator mode	The administrator mode is reserved for the service and specially trained personnel. The administrator mode allows access to all software configurations and functions of the CAMSIZER® X2 program.

ⓘ Without activated password protection, the CAMSIZER® X2 program is always in parameter mode.

3.1.1 Used File Types

File type	Description
AFG	**Task file:** Contains all required settings for the measurement and the presentation of the results.
ALL	**Particle velocity file:** Contains all measurement data recorded during a velocity adaption measurement.
BMP	**Image file:** Shows all particles located in the camera's field of view at the time of the image recording. The BMP files are stored consecutively during the measurement for each camera separately.
CCG	**RETSCH file:** Contains part of the measurement data (sieve analysis) of a sieving process in ASCII format. A comma is used as decimal mark. By means of the CCG file created with the external program "EasySieve®" from the Retsch GmbH, the sieve analysis can be easily imported into the CAMSIZER® X2 program.
CDF	**Complete data file:** Includes all files used during the measurement, i.e. the task file, the size class file, all fitting files used, as well as the resulting raw data file. The CDF file is an archive file with which the measurement result can be displayed and evaluated again at any given time identically as directly after the measurement, even if the used files are no longer available. ⓘ If the software is used together with the AuditTrailManager in accordance with 21CFR part 11, CDF files are always created.
FIT	**Fitting file of a $Q_3(x)$ fitting:** Contains a simple fitting, which approximates the data measured with the CAMSIZER® X2 to the data of a sieve analysis. FIT files should only be applied to measurement data of samples that do not significantly differ in particle size range, particle shape and density from the sample used to create the FIT file.
FTE	**Fitting file of an elementary fitting:** Contains a complex, robust fitting, which approximates the data measured with the CAMSIZER® X2 to the data of a sieve analysis. Various methods are available for creating an FTE file. FTE files can also be applied to measurement data of samples that differ in the particle size range. However, the particle shape must not differ significantly from the sample used to create the FTE file.
FTV	**Velocity adaption file:** Contains an adaption, which corrects the different detection probability of the particles due to their different velocities.
GKL	**Size class file:** Contains the size classes to be used for the measurement. By default, up to 300 size classes can be stored in a GKL file.
MTF	**Fitting file of a meta fitting:** Contains a fitting, which was created with the external program "Metafitt" (→ manual "Metafitt").
RDF	**Raw data file (result file):** Contains the measurement data.

REF, RE0, RE2	**Reference file for the cumulative distribution:** Contains reference data (reference curves) of the cumulative distribution in ASCII format. Hereby, the REF file refers to the volume-based cumulative distribution $Q_3(x)$, the RE0 file to the number-based cumulative distribution $Q_0(x)$, and the RE2 file to the area-based cumulative distribution $Q_2(x)$. Up to two files can be displayed as reference curves simultaneously with the measurement result in the graph.
RP0, RP2, RP3	**Reference file for the fractions:** Contains size class-dependent reference data (reference limits) of fractions in ASCII format. Hereby, the RP0 file refers to the number-based fractions $p_0(x1,x2)$, the RP2 file to the area-based fractions $p_2(x1,x2)$, and the RP3 file to the volume-based fractions $p_3(x1,x2)$. One file at a time can be displayed as fraction limits simultaneously with the measurement result in the graph.
RS0, RS2, RS3	**Reference file for the particle shape:** Contains size class-dependent reference data (reference limits) of the particle shape in ASCII format. Hereby, the RS0 file refers to the number-based cumulative distribution Q_0(shape), the RS2 file to the area-based cumulative distribution Q_2(shape), and the RS3 file to the volume-based cumulative distribution Q_3(shape). Up to two files can be displayed as shape thresholds simultaneously with the measurement result in the table Q(x).
STA	**Status file:** Includes all warnings in ASCII format that appeared during a sequential measurement, as they are not displayed on the screen.
xConAlp	**Complete result file:** Contains all data acquired during the measurement (particle size, particle shape, particle contour) of all particles measured. The xConAlp file can be used to further analyse the measurement result with the external program "Particle X-Plorer" (→ manual "Particle X-Plorer"). ⓘ The xConAlp file do not contain the shape characteristics circularity, compactness and solidity.
xIdx	**Index file:** Contains the indices of all particles listed in the corresponding xConAlp file.
XLD	**Excel-readable file:** Contains the measurement data in Excel-readable ASCII format. A comma is used as decimal mark.
XLE	**Excel-readable file:** Contains the measurement data in Excel-readable ASCII format. A point is used as decimal mark.

3.1.2 Used Characteristics

The following list contains the most frequently used characteristics which can be determined with the CAMSIZER® X2 program. A detailed description of all available characteristics can be found in Chapter "List of Characteristics".

The CAMSIZER® X2 program allows to display the results either based on volume, number, or area. Accordingly, the characteristics are either displayed with index 3 for volume-based, index 0 for number-based, or index 2 for area-based.

Characteristic	Description
$1 - Q_3(x)$, $1 - Q_0(x)$, $1 - Q_2(x)$	**Cumulative distribution of residue:** Displays the ratio of all particles with a particle size > x.
AFS no.	**AFS number:** Displays the fineness of the sample. The higher the AFS number, the finer the sample material.
b/l_3, b/l_0, b/l_2	**Aspect ratio:** Displays the width/length ratio, which is determined from the individual particle widths $x_{c\ min}$ and Feret diameters $x_{Fe\ max}$.
$Conv_3$, $Conv_0$, $Conv_2$	**Convexity:** Displays the convexity. Convex particles have a convexity equal to 1. For all other particles, the convexity is < 1.
CV	**Coefficient of variation:** Displays the ratio of the standard deviation to the mean value, thus the relative dispersion of the sample.
MA	**Mean diameter:** Displays the x_{50} value (median) of the sample (particle size at position Q(x) = 50 %).
$p_3(x1,x2)$, $p_0(x1,x2)$, $p_2(x1,x2)$	**Fraction:** Displays the ratio of particles in the particle size range between > x1 and ≤ x2.
$Q_3(x)$, $Q_0(x)$, $Q_2(x)$	**Cumulative distribution:** Displays the ratio of all particles with a particle size ≤ x.
$q_3(x)$, $q_0(x)$, $q_2(x)$	**Frequency distribution:** Displays the ratio of particles with a particle size = x.
$SPAN_3$, $SPAN_0$, $SPAN_2$	**Span value:** Displays the width of the distribution.
$SPHT_3$, $SPHT_0$, $SPHT_2$	**Sphericity:** Displays the roundness. Perfect circles or spheres have a sphericity equal to 1. For all other shapes the sphericity is < 1.
U_3, U_0, U_2	**Non-uniformity:** Displays the symmetry of the distribution.
$x(Q_3)$, $x(Q_0)$, $x(Q_2)$	**Particle size:** Displays the particle size at a certain value of the cumulative distribution.
$x_{c\ min}$	**Particle width:** Displays the particle width, which is determined from the narrowest of all measured chords x_c. This characteristic is suitable for comparing the CAMSIZER® X2 results with a sieve analysis.

$x_{Fe\ max}$	**Particle length:** Displays the particle length, which is determined from the longest of all measured Feret diameters x_{Fe}. This characteristic is suitable for measuring straight extrudates, fibres or rice grains.

3.2 Perform First Measurement

Each measurement process is carried out by means of a task file (AFG file) suitable for the sample material. If a new sample material is measured for the first time, a new task file is usually created, i.e. an existing task file is modified accordingly and saved under a new name.

The preinstalled task file "measure0.afg", together with the size class file "measure0.gkl", is well suited to perform first measurements with the CAMSIZER® X2, and to get familiar with the functions of the program. However, in order to achieve the best possible measurement results, the task file should always be adapted to the respective sample.

If the task file and/or the size class file do not contain the desired parameters, the task file can be edited via the main menu function │File│Load task file│ (→ Chapter "Load Task File"). Successively, the desired settings of the measurement parameters, the size classes, the result files and the report can be made (→ Chapter "Measurement Parameters").

3.3 Evaluation of Measurement Results

For the evaluation, the measurement results can be displayed in graphs or tables. Via the main menu function │Results│, access is given to the submenu functions of the following, individual evaluation windows:

Menu function	Description evaluation window
│Table│	Displays the particle size characteristics of the sample in tabular form. The individual size classes are listed with their corresponding values.
│Characteristics│	Displays the sample-specific characteristics in tabular form.
│Graph│	Displays the particle sizes of the sample in graphical form. Up to ten measurement results can be displayed simultaneously.
│Graph, shape characteristics│	Displays the particle shapes of the sample in graphical form. Up to ten measurement results can be displayed simultaneously.
│Average measurements│	Allows for the calculation of the mean value of up to 50 measurement results of one task file. After the calculation, the mean value can be displayed in graphical and tabular form as well.
│Trend analysis│	Allows for the graphical comparison of multiple measurements of a series of measurements. Thus, the time-dependent behaviour of individual characteristics can be examined.
│Daily report│	Allows for the comparison of multiple measurements of a series of measurements in tabular form. Thus, the time-dependent behaviour of individual characteristics can be examined.
│Combine sieving and CAMSIZER® X2 results│	Allows for the combination of a sieving and a CAMSIZER® X2 measurement. After the calculation, the combination can be displayed in graphical and tabular form as well.

A detailed description of the individual menu functions can be found in the respective chapters of this manual.

Finally, the complete measurement data of all evaluation windows can be summarised in a measurement record (report) and printed. Likewise, all data of the individual evaluation windows can also be both, printed and copied to the clipboard.

4 Operation of the Program

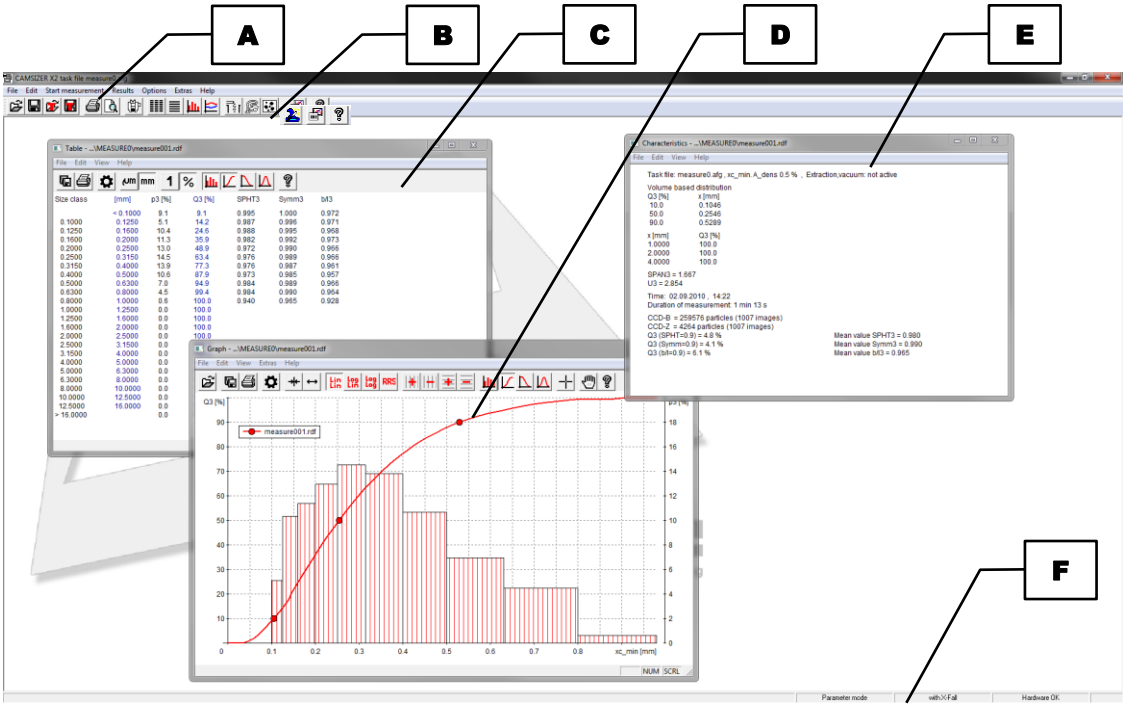


Fig. 1: Main window of the CAMSIZER® X2 program

All functions of the CAMSIZER® X2 program can be accessed from the main window via the menu bar (**A**). Frequently used functions are also available via the tool bar (**B**) or function keys on the keyboard. In the following table the icons and function keys are summarised.

Icon	Menu function	Function key
	File | Open result file	
	File | Save result file	
	File | Load task file	
	File | Save task file	
	File | Print report	
	File | Print preview	
	Start measurement	
	Results | Table	F5
	Results | Characteristics	F6
	Results | Graph	F7
	Results | Graph, shape characteristics	
	Extras | Feeder	
	Extras | Vacuum	
	Extras | Dispersion pressure	
	Extras | X-Flow	
	Extras | CCD image	
	Extras | Particle X-Plorer Wizard	

	| Extras | Restore standard |	
	| Help | Help |	F1

The measurement results are displayed in individual evaluation windows for the tabular (**C**), graphical (**D**) and sample-specific (**E**) characteristics presentation.

The status bar (**F**) displays additional information about the status of the CAMSIZER® X2 program.

Chapter "Operation of the Program" is structured analogous to the menu bar (**A**). Each function is described in detail in the following sections and can be referred to individually.

NOTICE The availability of individual functions depends on the settings in the software configuration of the CAMSIZER® X2 program. This manual describes all functions that are available ex works. For information on subsequently enabled functions, please contact the Retsch Technology GmbH representative in your country, or Retsch Technology GmbH directly.

4.1 Functions of the Main Menu Item "File"

The main menu item │File│ contains menu functions for opening, saving and exporting result files and task files. In addition, printer settings can be made and the report can be printed.

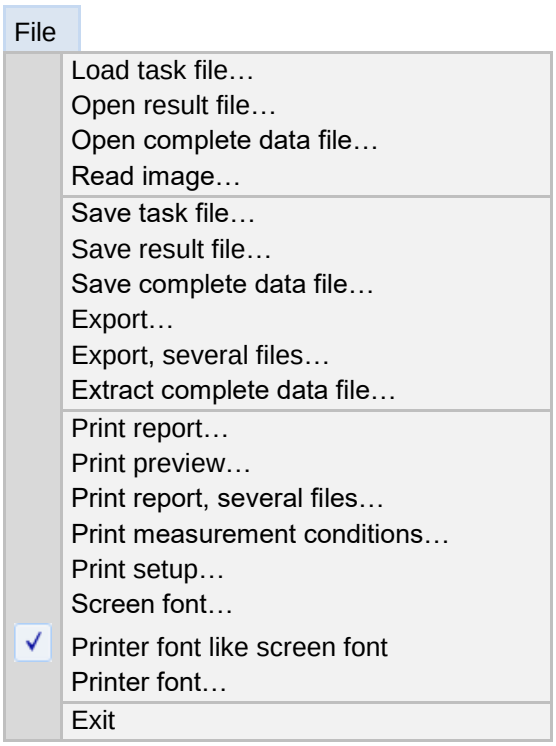


Fig. 2: Menu functions in the main menu item │File│

In the following subchapters, each menu function of the main menu item │File│ is described in detail and can be referred to individually.

4.1.1 Load Task File

Via the menu function │Load task file│, an existing task file (AFG file) can be loaded.

⇨ In the main window, click on the menu bar item │File│ and select │Load task file│ from the context menu. The corresponding dialogue box opens. Alternatively, the task file can also be loaded via the icon in the tool bar (**B**) of the main window.
⇨ Select the desired task file from the dropdown list (**ML1**).
⇨ To edit the task file, click the [Edit] button (**ML2**).
⇨ To load the selected task file, click [OK] (**ML3**).
⇨ To abort the process, click the [Cancel] button.

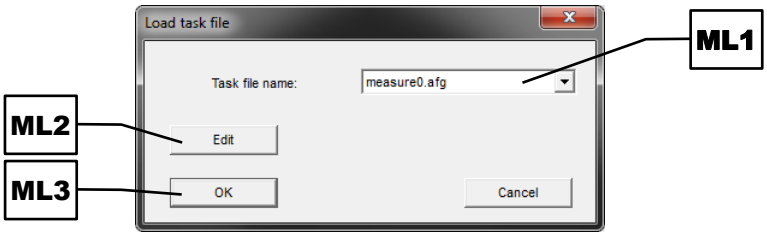


Fig. 3: Load task file

Load a task file:
Via the [OK] button (**ML3**), the task file is loaded. The name of the current task file is displayed in the header of the main window. With this task file, measurements can now be carried out or existing measurement results can be evaluated.

Edit a task file:
Via the [Edit] button (**ML2**), the dialogue box of the measurement conditions is opened. The function corresponds to the menu function │Measurement parameters│ (→ Chapter "Measurement Parameters").

NOTICE The task file cannot be edited in measurement mode.

4.1.2 Open Result File

Via the menu function │Open result file│, stored raw data files (RDF files) can be opened.

⇨ In the main window, click on the menu bar item │File│ and select │Open result file│ from the context menu. The corresponding dialogue box opens. Alternatively, the raw data file can also be opened via the  icon in the tool bar (**B**) of the main window.
⇨ Navigate to the directory containing the RDF files.
⇨ Select the desired file.
⇨ Click the [Open] button. The dialogue box closes and the selected file is loaded.
⇨ To abort the process, click the [Cancel] button.

If no evaluation window is yet open, the graph window opens and the measurement result of the loaded file is graphically displayed. Otherwise, the content of already opened evaluation windows is updated.

In each RDF file, the name of the corresponding task file (AFG file) is stored. This task file is loaded (if not already active) together with the RDF file. The evaluation and the presentation of the results are performed with the current settings of the AFG file. If changes were made in the AFG file after the measurement, differences in the presentation of the results may occur compared to the presentation displayed directly after the measurement.

4.1.3 Open Complete Data File

Via the menu function │Open complete data file│, stored complete data files (CDF files) can be opened.

- ⇨ In the main window, click on the menu bar item │File│ and select │Open complete data file│ from the context menu. The corresponding dialogue box opens.
- ⇨ Navigate to the directory containing the CDF files.
- ⇨ Select the desired file.
- ⇨ Click the [Open] button. The dialogue box closes and the selected file is loaded.
- ⇨ To abort the process, click the [Cancel] button.

If no evaluation window is yet open, the graph window opens and the measurement result of the loaded file is graphically displayed. Otherwise, the content of already opened evaluation windows is updated.

In each CDF file, the corresponding task file (AFG file), the used size class file (GKL file), as well as all used fitting files are stored. These files are loaded all together with the RDF file. The evaluation and the presentation of the results are performed with the settings set in the AFG file during measurement. If changes were made in the AFG file after the measurement, the CDF file nevertheless allows for an identical presentation of results as directly after the measurement.

4.1.4 Read Image

Via the menu function │Read image│, up to 10 000 stored image files (BMP files) can be loaded to an evaluation window.

- ⇨ In the main window, click on the menu bar item │File│ and select │Read image│ from the context menu. The corresponding dialogue box opens.
- ⇨ Navigate to the directory containing the BMP files. The images recorded during a measurement are stored in the subfolder "IMAGES" of the respective measurement directory.
- ⇨ Select the desired files.
- ⇨ Click the [Open] button. The dialogue box closes and the selected images are loaded to the evaluation window.
- ⇨ To abort the process, click the [Cancel] button.

Use the arrow keys on the keyboard to navigate through the loaded images in the evaluation window. The evaluation window is identical to the image evaluation window. All functions are described in detail in Chapter "Image Evaluation".

4.1.5 Save Task File

NOTICE This function is not available in measurement mode.

If changes were made to the current task file but not yet saved, it can be done subsequently via the menu function │Save task file│.

- ⇨ In the main window, click on the menu bar item │File│ and select │Save task file│ from the context menu. The corresponding tab of the dialogue box of the measurement conditions opens. Alternatively, the task file can also be saved via the  icon in the tool bar (**B**) of the main window.

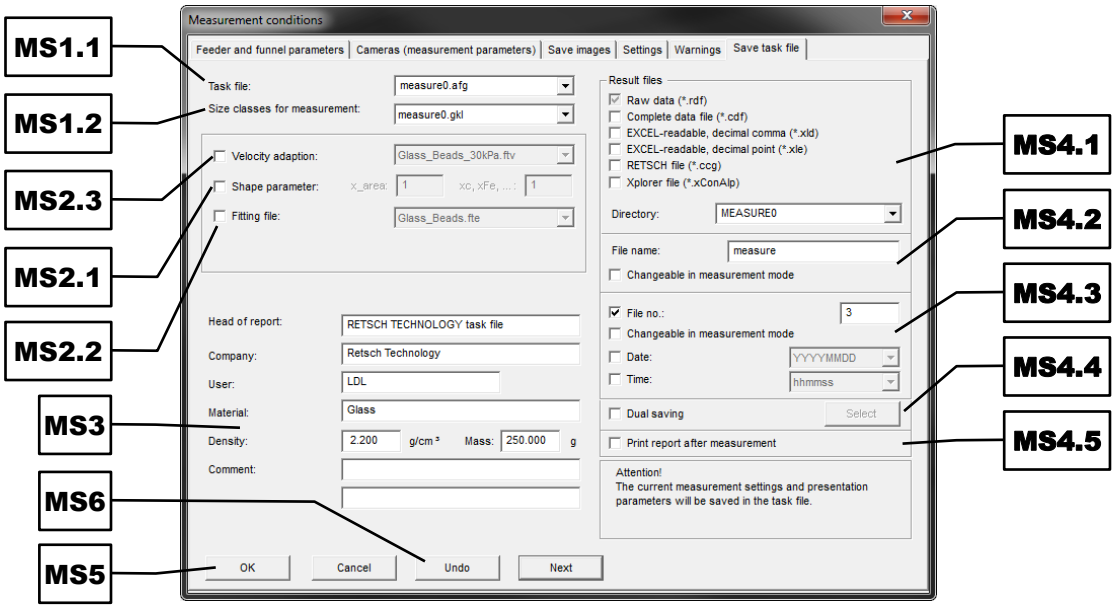


Fig. 4: Save task file

The "Save task file" tab corresponds entirely to the start window of the measurement (→ Chapter "Start Measurement"). In addition, access is also given to the other tabs of the dialog box for the measurement conditions.

⇨ Select the desired task file from the combo box (**MS1.1**), or enter a new name in the box.

⇨ Select the desired size class file from the dropdown list (**MS1.2**). ***NOTICE*** The dropdown list is identical with the dropdown list (**MBE2**) in the "Settings" tab. A modification here also causes a change in the other tab.

⇨ Check, if desired, the checkbox for the shape parameter (**MS2.1**), the fitting file (**MS2.2**), or the velocity adaption (**MS2.3**).

Checkbox	Description
Shape parameter	With the shape parameter, the distribution can be compressed or stretched in X direction. The scaling of the X axis is thereby multiplied by the value entered here. The shape parameter for the characteristic x_{area} must be defined separately. The corresponding edit box is only active, if x_{area} has also been set as size definition to be measured in the "Settings" tab.

<table>
<tr><td>Fitting file</td><td>A fitting file can be used to match the measurement results to the results of a sieve analysis of the same sample (→ Chapter "Create Fitting File"). Depending on the selected file type, additional setting options are available:
<table>
<tr><th>File type</th><th>Settings</th></tr>
<tr><td>FIT</td><td>⇨ Check the ⟨with x50 adjustment⟩ checkbox, if the sample to be analysed does not fit into the same size range, as the sample used to create the FIT file.</td></tr>
<tr><td>FTE</td><td>A warning is automatically displayed, as soon as the fitted distribution deviates more than a predefined threshold value from the actual measured distribution.
⇨ Enter the desired threshold value for the deviation in the "Warning, if difference of elementary fitting >" edit box.</td></tr>
<tr><td>MFT</td><td>⇨ Check the ⟨Warning, if difference >⟩ checkbox, if a warning is to be displayed, as soon as the fitted distribution differs more than the predefined threshold value from the actual measured distribution.
⇨ Enter the desired dimensionless threshold value for the deviation in the edit box.</td></tr>
</table></td></tr>
<tr><td>Velocity adaption</td><td>With a velocity adaption, adjustments are made during the measurement process, considering the different velocities of particles of different sizes. The measurement result is corrected to the effect that slower particles, which pass the field of view, are detected statistically more often by the cameras than faster particles (→ Chapter "Perform Entire Velocity Adaption"). NOTICE This adjustment of the raw data cannot be reversed afterwards!</td></tr>
</table>

⇨ Enter the desired information for the report (measurement record) in the respective edit boxes (**MS3**).

⇨ Select the desired additional result files (**MS4.1**) which are to be created together with the raw data file. Enter also the desired storage directory in the corresponding edit box.

⇨ Enter the desired file name of the measurement in the edit box (**MS4.2**). The measurement will be stored under this name. If the checkbox ⟨Changeable in measurement mode⟩ is checked, users in measurement mode can change the file name prior to the start of the measurement process, as well.

⇨ Enter the desired file number of the measurement in the edit box (**MS4.3**). Results in a series of measurements can be consecutively numbered by the file number and thus distinguished from each other. If the checkbox ⟨Changeable in measurement mode⟩ is checked, users in measurement mode can change the file number prior to the start of the measurement process, as well. If the checkbox ⟨Date⟩ and/or ⟨Time⟩ is checked, the file name is supplemented by the desired indication.

⇨ Check, if desired, the checkbox ⟨Dual saving⟩ (**MS4.4**) to enable a second storage location (e.g. server drive), where measurement results are to be stored as backup copy. The desired file format and the desired destination directory of the second storage location can be set via the [Select] button.

⇨ Check, if desired, the checkbox ⟨Print report after measurement⟩ (**MS4.5**) to automatically send a print job to the standard printer after the measurement.

- ⇨ Click [OK] (**MS5**), to save the task file and confirm the overwriting of the already existing task file in the following dialogue box by clicking [OK]. The selected task file is overwritten with the current settings.
- ⇨ To undo the changes, click the [Undo] (**MS6**) button. Changes can only be undone, as long as no other tab is selected.
- ⇨ To abort the process, click the [Cancel] button.

The remaining tabs of the dialogue box of the measurement conditions are described in detail in Chapter "Measurement Parameters".

4.1.6 Save Result File

NOTICE This function is not available in measurement mode.

If a mean value or a combination has been calculated from several measurement results, the resulting raw data file (RDF file) can be stored under a different name via the menu function │Save result file│.

- ⇨ In the main window, click on the menu bar item │File│ and select │Save result file│ from the context menu. The corresponding dialogue box opens. Alternatively, the raw data file can also be saved via the  icon in the tool bar (**B**) of the main window.
- ⇨ Navigate to the directory to which the RDF file is to be saved.
- ⇨ Enter the desired file name.
- ⇨ Click the [Save] button. The dialogue box closes and the RDF file is saved.
- ⇨ To abort the process, click the [Cancel] button.

4.1.7 Save Complete Data File

NOTICE This function is not available in measurement mode.

Via the menu function │Save complete data file│, the currently loaded raw data file (RDF file) can be stored as complete data file (CDF file).

- ⇨ In the main window, click on the menu bar item │File│ and select │Save complete data file│ from the context menu. The corresponding dialogue box opens.
- ⇨ Navigate to the directory to which the CDF file is to be saved.
- ⇨ Enter the desired file name.
- ⇨ Click the [Save] button. The dialogue box closes and the CDF file is saved.
- ⇨ To abort the process, click the [Cancel] button.

In addition to the raw data file, the CDF file contains also the currently loaded task file (AFG file), the size class file (GKL file), as well as all applied fitting files. Therefore, by means of the CDF file, the current measurement result can be displayed identically at any time and on every PC having the CAMSIZER® X2 program installed, even if one of the used files is not present or has been modified in the meantime.

4.1.8 Export

NOTICE This function is not available in measurement mode.

Via the menu function │Export│, the currently loaded raw data file (RDF file) can be exported to a different format.

- ⇨ In the main window, click on the menu bar item │File│ and select │Export│ from the context menu. The corresponding dialogue box opens.
- ⇨ Navigate to the directory to which the RDF file is to be saved in a different format.
- ⇨ Select the desired format from the dropdown list.
- ⇨ Enter the desired file name.

⇨ Click the [Save] button to store the file in a different format.
⇨ To abort the process, click the [Cancel] button.

RDF files can be exported as XLE, XLD, CCG, NSP, SIG, Q3, or Q0 file (all in ASCII format).

Format	Description
XLE file	**Excel-readable file with point as decimal mark:** Contains the measurement parameters used during the measurement, the characteristics selected in the characteristics window at the time of the export, as well as the used size classes (lower and upper limits of fractions) as displayed in the table window at the time of the export.
XLD file	**Excel-readable file with comma as decimal mark:** Contains the measurement parameters used during the measurement, the characteristics selected in the characteristics window at the time of the export, as well as the used size classes (lower and upper limits of fractions) as displayed in the table window at the time of the export.
CCG file	**RETSCH file:** Contains two columns: – the particle size x in mm (values of the size class file) – the cumulative distribution $Q_3(x)$ in values between 0 and 1
NSP file	**Non-spherical particle file:** Contains two columns: – the sphericity SPHT in values between 0 (non-spherical) and 1 (spherical), listed in steps of 0.01 – the cumulative distribution $Q_0(SPHT)$ in percent
SIG file	**Aspect ratio file:** Contains two columns: – the minimum aspect ratio b/l_{rec} in values between 0 (elongated) and 1 (round), listed in steps of 0.01 – the cumulative distribution $Q_0(b/l_{rec})$ in percent
Q3 file	**Volume-based cumulative distribution file:** Contains two columns: – the particle size x in mm (3 000 size classes in the particle size range of the sample) – the cumulative distribution $Q_3(x)$ in values between 0 and 1
Q0 file	**Number-based cumulative distribution file:** Contains two columns: – the particle size x in mm (3 000 size classes in the particle size range of the sample) – the cumulative distribution $Q_0(x)$ in values between 0 and 1

4.1.9 Export, Several Files

NOTICE This function is not available in measurement mode.

Via the menu function │Export, several files│, up to 200 raw data files (RDF files) can be successively exported to a different format.

⇨ In the main window, click on the menu bar item │File│ and select │Export, several files│ from the context menu. The corresponding dialogue box opens.
⇨ Navigate to the directory containing the RDF files.

- ⇨ Select the desired files and click the [Open] button. The dialogue box closes and a dialogue box for saving the files opens.
- ⇨ Navigate to the directory to which the RDF files are to be saved in a different format.
- ⇨ Select the desired format from the dropdown list.
- ⇨ Enter the desired file name.
- ⇨ Click the [Save] button to save the file in a different format.
- ⇨ Repeat the selection of the target directory, the file name, and the file type for each of the previously selected files.
- ⇨ To abort the process, click the [Cancel] button.

4.1.10 Extract Complete Data File

Via the menu function │Extract complete data file│, a stored complete data file (CDF file) can be extracted.

- ⇨ In the main window, click on the menu bar item │File│ and select │Extract complete data file│ from the context menu. The corresponding dialogue box opens.
- ⇨ Navigate to the directory containing the CDF files.
- ⇨ Select the desired file.
- ⇨ Click the [Open] button. The dialogue box closes and the selected file is extracted into a separate file folder.
- ⇨ To abort the process, click the [Cancel] button.

A notice containing the name of the newly created file folder is displayed. This folder contains all extracted files.

- ⇨ Click [OK].

The file folder is located in the same directory as the selected CDF file. It contains all files that were created or used at the time of the measurement (saving of the CDF file). To again use these files as usual with the CAMSIZER® X2 program, the files must to be moved to the appropriate directories CAMDAT and CAMSYS (→ Chapter "Installation").

4.1.11 Print Report

Via the menu function │Print report│, the report (measurement record) can be printed.

- ⇨ In the main window, click on the menu bar item │File│ and select │Print report│ from the context menu. The printer configuration dialogue box opens. Alternatively, the report can also be printed via the  icon in the tool bar (**B**) of the main window.
- ⇨ Make the desired print settings.
- ⇨ Click [OK] to print the report.
- ⇨ To abort the process, click the [Cancel] button.

The report consists, according to DIN 66165 and DIN ISO 9276-1, of the header information, the table, the graphs and the characteristics. The header information is preset in the task file and can be updated by the user at the beginning of each measurement process. The settings of the table, the graphs and the characteristics are determined by the current settings of the respective evaluation windows in the task file.

4.1.12 Print Preview

Via the menu function │Print preview│, the page view of the report can be opened.

⇨ In the main window, click on the menu bar item │File│ and select │Print preview│ from the context menu. The page view window opens and overlaps the main window. Alternatively, the page view can also be opened via the icon in the tool bar (**B**) of the main window.

⇨ Click [Close] to exit the page view again.

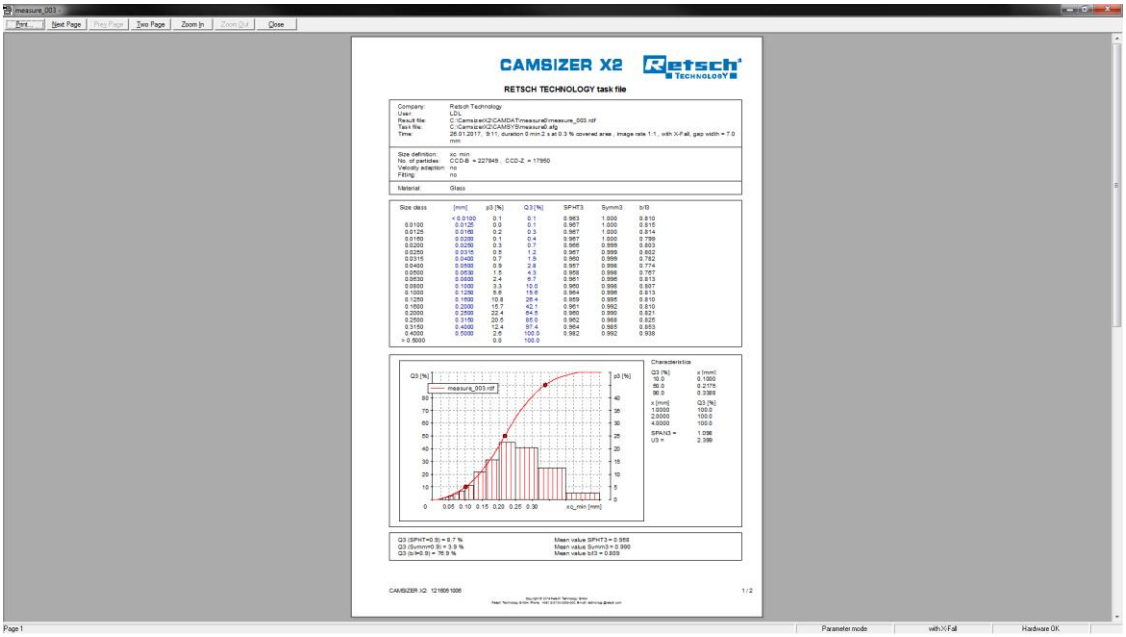


Fig. 5: Page view window

The functions of the page view window can be accesses via buttons in the menu bar.

Button	Description
[Print]	Closes the page view window and opens the printer configuration dialogue box, in which printer settings can be made and a print job can be started.
[Next Page]	Moves to the next page in a multiple-page report.
[Prev Page]	Moves to the previous page in a multiple-page report.
[Two Pages]	Displays two pages of a multiple-page report at once in the page view window. The button changes to [One Page] in double-page view.
[One Page]	Displays one single page of a multiple-page report in the page view window. The button changes to [Two Pages] in single-page view.
[Zoom In]	Zooms in the page view in two stages.
[Zoom Out]	Zooms out the page view in two stages.
[Close]	Closes the page view window. The main window is again on top.

4.1.13 Print Report, Several Files

Via the menu function │Print report, several files│, up to 200 reports (measurement records) can be printed.

⇨ In the main window, click on the menu bar item │File│ and select │Print report, several files│ from the context menu. The corresponding dialogue box opens.
⇨ Navigate to the directory containing the RDF files.
⇨ Select the desired files and click the [Open] button. The dialogue box closes and the printer configuration dialogue box opens.
⇨ Make the desired print settings.
⇨ Click [OK] to print the selected reports.
⇨ To abort the process, click the [Cancel] button.

4.1.14 Print Measurement Conditions

NOTICE This function is not available in measurement mode.

Via the menu function │Print measurement conditions│, the task file settings (device configuration) can be printed.

⇨ In the main window, click on the menu bar item │File│ and select │Print measurement conditions│ from the context menu. The printer configuration dialogue box opens.
⇨ Make the desired print settings.
⇨ Click [OK] to print the measurement conditions.
⇨ To abort the process, click the [Cancel] button.

The measurement conditions contain the settings of the tabs "Feeder and funnel parameters", "Cameras (measurement parameters)", "Settings" and "Warnings".

4.1.15 Print Setup

Via the menu function │Print setup│, printer-specific settings can be made.

⇨ In the main window, click on the menu bar item │File│ and select │Print setup│ from the context menu. The corresponding dialogue box opens.
⇨ Select the printer and make the desired settings.
⇨ Click [OK] to apply the settings.
⇨ To abort the process, click the [Cancel] button.

4.1.16 Screen Font

NOTICE This function is not available in measurement mode.

Via the menu function │Screen font│, the font type and font size displayed on screen in the report and evaluation windows can be selected. The settings are retained also on next program start.

⇨ In the main window, click on the menu bar item │File│ and select │Screen font│ from the context menu. The "Font" dialogue box opens.
⇨ Select the desired font, the font style, as well as the size from the corresponding combo boxes.
⇨ Click [OK] to apply the settings.
⇨ To discard the changes, click the [Cancel] button.

4.1.17 Printer Font Like Screen Font

NOTICE This function is not available in measurement mode.

With activated menu function │Printer font like screen font│, the font for the printouts is automatically adjusted according to the screen font.

⇨ In the main window, click on the menu bar item │File│ and select │Printer font like screen font│ from the context menu. The activated function is marked with the  icon in front of the context menu item and the menu function │Printer font│ is disabled.

⇨ To deactivate the function, click again on the menu bar item │File│ in the main window and select │Printer font like screen font│ from the context menu. The context menu item is unmarked and the menu function │Printer font│ is enabled again.

4.1.18 Printer Font

NOTICE This function is not available in measurement mode.

Via the menu function │Printer font│, the font type and font size for the printout of the report and evaluation windows can be selected. The settings are retained also on next program start.

⇨ In the main window, click on the menu bar item │File│ and select │Printer font│ from the context menu. The "Font" dialogue box opens.

⇨ Select the desired font, the font style, as well as the size from the corresponding combo boxes.

⇨ Click [OK] to apply the settings.

⇨ To discard the changes, click the [Cancel] button.

4.1.19 Exit

Via the menu function │Exit│, the CAMSIZER® X2 program can be quit.

⇨ In the main window, click on the menu bar item │File│ and select │Exit│ from the context menu. The main window closes together with all open evaluation windows.

4.2 Functions of the Main Menu Item "Edit"

The main menu item │Edit│ contains a menu function for copying measurement results as text to the clipboard.

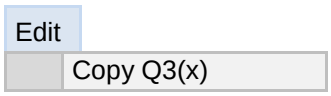


Fig. 6: Menu function in the main menu item │Edit│

In the following subchapter, the menu function of the main menu item │Edit│ is described in detail.

4.2.1 Copy Q_3(x)

Via the menu function │Copy Q3(x)│, the particle size x in mm and the cumulative distribution Q_3(x) with values between 0 and 1 are copied to the clipboard as a table with two columns in ASCII format (text format).

⇨ In the main window, click on the menu bar item │Edit│ and select │Copy Q3(x)│ from the context menu. The corresponding data of the currently loaded RDF file are copied as text to the clipboard.

ⓘ The clipboard content corresponds to the information which is stored in the CCG file. The size classes to be used can be defined via the menu function │Overview used size class files│.

ⓘ If the measured sample contains particle sizes which are outside the particle size range defined in the size class file, the table is extended by the smallest and/or largest measured particle size.

4.3 Functions of the Main Menu Item "Start measurement"

The main menu item │Start measurement│ contains menu functions for starting a measurement or a series of measurements.

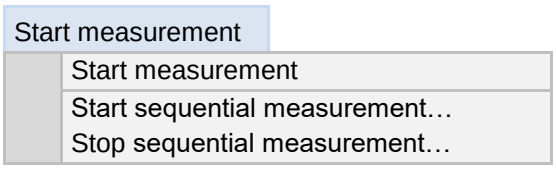


Fig. 7: Menu functions in the main menu item │Start measurement│

In the following subchapters, each menu function of the main menu item │Start measurement│ is described in detail and can be referred to individually.

NOTICE The following subchapters describe the procedure for a dry measurement with the X-Fall or X-Jet cartridge. The procedure for a wet measurement with the X-Flow module is described separately in Chapter "Wet Measurement".

4.3.1 Start Measurement

Via the menu function │Start measurement│, the measurement process is started.

⇨ In the main window, click on the menu bar item │Start measurement│ and select │Start measurement│ from the context menu. The start window of the measurement opens.

Alternatively, the measurement process can also be started via the icon in the tool bar (**B**) of the main window.

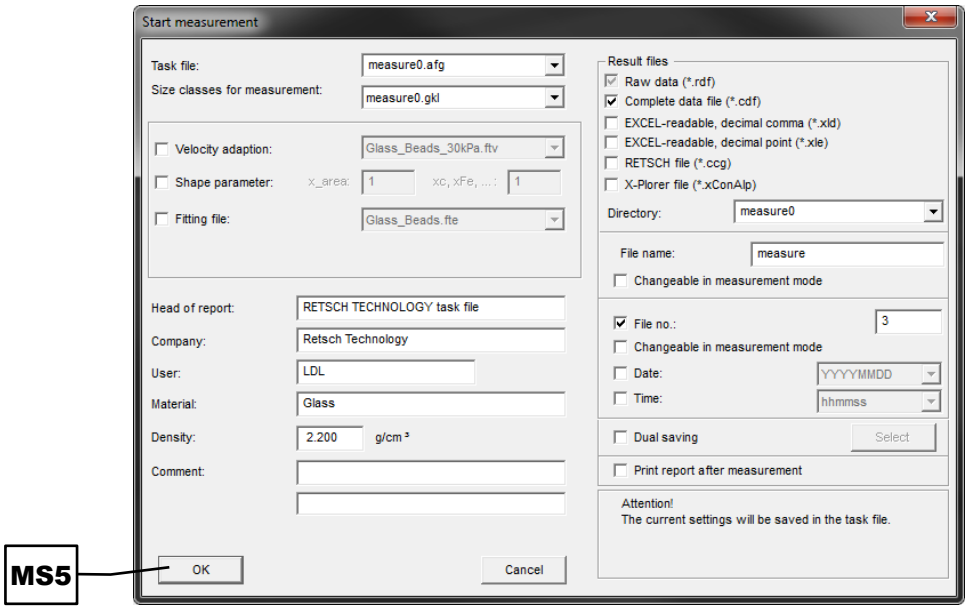


Fig. 8: Start window of the measurement in parameter mode

The start window of the measurement corresponds entirely to the "Save task file" tab (→ Chapter "Save Task File"). However, it is not possible to access the other tabs of the task

file. Prior to the start of the measurement, the user can update the settings according to the sample to be analysed.

⇨ If necessary, make additional changes.
⇨ Click [OK] (**MS5**) to start the measurement with the current settings.
⇨ To abort the process, click the [Cancel] button.

⚠ CAUTION Check the correct and firm fit of the feeder and funnel, before starting the measurement. Furthermore, the CAMSIZER® X2 must always be placed in the field of view of the user.

After clicking [OK] (**MS5**), the start window closes. Depending on the configuration of the software and the settings in the task file, several notification boxes can be displayed, which must all be confirmed by clicking [OK]. Subsequently, the dialogue box "Measure" opens. The appearance of the dialogue window and the further procedure depends on the measuring method used:

– Dry measurement with the X-Dry module (X-Fall or X-Jet cartridge) (→ Chapter "Dry Measurement")
– Wet measurement with the X-Flow module (→ Chapter "Wet Measurement")

4.3.1.1 Dry Measurement

The "Measure" dialogue box contains information on the running measurement process. Measurement and image information are displayed graphically in the upper part, as well as numerically in the lower part of the dialogue box.

NOTICE All data in this dialogue box are constantly updated guidelines and for preview purposes only. They may vary from the final measurement result.

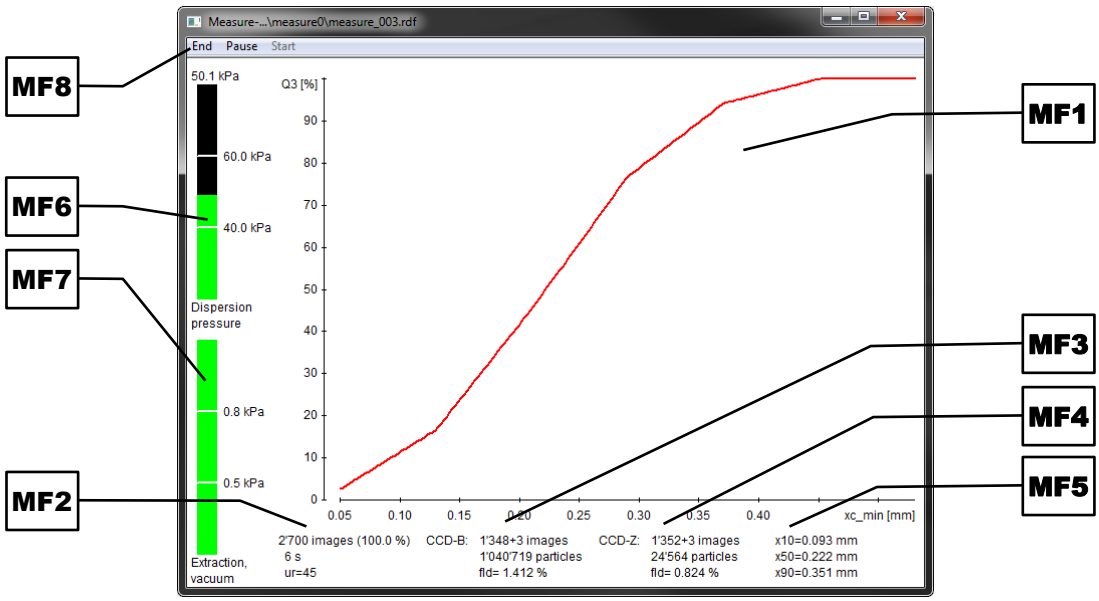


Fig. 9: "Measure" dialogue box during a dry measurement with the X-Jet cartridge

In the graph (**MF1**), the measured particle size $x_{c\,min}$ is continuously updated as a function of the volume-based cumulative distribution $Q_3(x)$.

In section (**MF2**), the total number of recorded images of both cameras is displayed. Thereby, the percentage of images actually analysed (image rate) is displayed in brackets. ***NOTICE*** To

achieve optimum measurement results, the image rate should not drop below 90 %. In order to increase an image rate that is too low, the nominal covered area can be reduced (→ Chapter "Measurement Parameters"). In addition, the elapsed measurement duration in seconds, and the current feeder power "ur" in percent are displayed.

In sections (**MF3**) and (**MF4**), the recorded images of the CCD Basic and CCD Zoom camera are listed, respectively. Images taken during the fast forward are shown as a summand. In addition, the measured number of particles and the nominal covered area in percent are listed.

In section (**MF5**), the x_{10}, x_{50} and x_{90} values are displayed.

During a measurement with the X-Jet cartridge, the dispersion pressure (**MF6**) and the negative pressure (vacuum) (**MF7**) are additionally displayed in the "Measure" dialogue box. The dispersion pressure can be set in the measurement parameters (→ Chapter "Measurement Parameters"). The negative pressure is generated by an industrial vacuum cleaner. If the negative pressure falls into the orange (< 0,8 kPa) or red area (< 0,5 kPa), the suction capacity is too low.

⇨ Set the industrial vacuum cleaner to a higher suction level, or replace the dust bag and/or filter.

In general, the measurement is automatically terminated, but can be manually paused or ended via the menu bar (**MF8**).

⇨ Click on the menu bar item │End│ to terminate the measurement process manually.
⇨ Click on the menu bar item │Pause│ to pause the measurement process. The menu bar item │Start│ is now enabled.
⇨ Click on the menu bar item │Start│ to continue the previously paused measurement process.

The "Measure" dialogue box closes, as soon as the condition for the automatic termination of the measurement process, which has been specified in the task file is fulfilled (→ Chapter "Measurement Parameters"). A dialogue box for confirming the end of the measurement appears.

⇨ Click **[Yes]** to end the measurement.
⇨ Click **[No]** to continue the measurement. The measurement is continued until the condition for the automatic termination of the measurement process is fulfilled again.

The result files previously defined in the task file are now created. If no evaluation window is yet open, the graph window opens and the measurement result is graphically displayed. Otherwise, the content of already opened evaluation windows is updated.

4.3.1.2 Start Measurement in Measurement Mode

In measurement mode, the user can only make very limited settings in the start window.

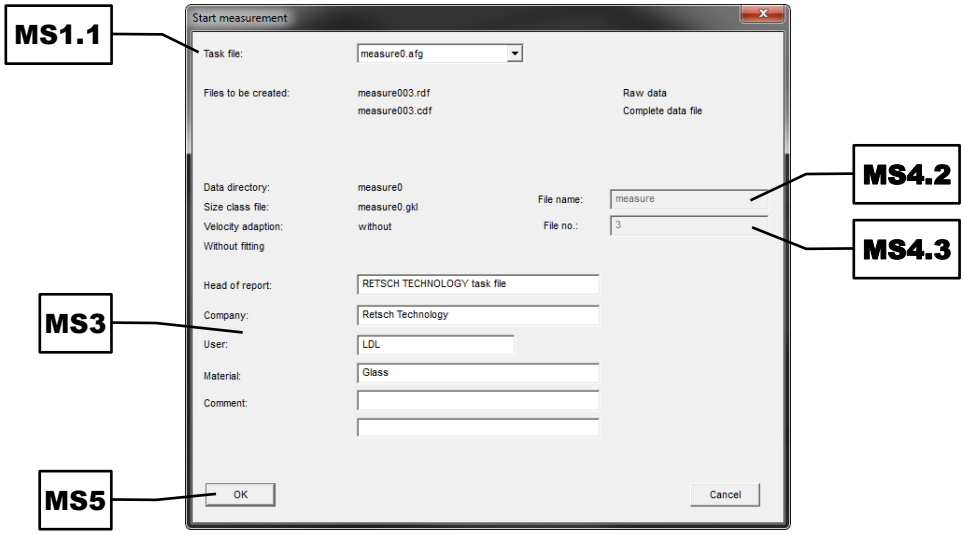


Fig. 10: Start window of the measurement in measurement mode

- ⇨ Select the desired task file from the dropdown list (**MS1.1**).
- ⇨ Enter the desired information for the report (measurement record) in the respective edit boxes (**MS3**).
- ⇨ If enabled in parameter mode, enter the desired file name of the measurement in the edit box (**MS4.2**). The measurement will be stored under this name.
- ⇨ If enabled in parameter mode, enter the desired file number of the measurement in the edit box (**MS4.3**). Results in a series of measurements can be consecutively numbered by the file number and thus distinguished from each other.
- ⇨ Click [OK] (**MS5**) to start the measurement process with the specified settings.
- ⇨ To abort the process, click the [Cancel] button.

After clicking the [OK] button (**MS5**), the start window closes and the "Measure" dialogue box opens. The further procedure corresponds to that in parameter mode.

4.3.2 Start Sequential Measurement

Via the menu function │Start sequential measurement│, a repeating measurement process is started. Thereby, several consecutive measurements are carried out with the selected task file, without the user having to interact with the CAMSIZER® X2 program between the measurements.

⇨ In the main window, click on the menu bar item │Start measurement│ and select │Start sequential measurement│ from the context menu. The start window of the measurement opens (→ Chapter "Start Measurement") and the menu function │Stop sequential measurement│ is enabled.
⇨ If necessary, make additional changes.
⇨ Click [OK] (**MS5**) to start the sequential measurement with the current settings.
⇨ To abort the process, click the [Cancel] button (**MS7**).

⚠ CAUTION Check the correct and firm fit of the feeder and funnel, before starting the measurement. Furthermore, the CAMSIZER® X2 must always be placed in the field of view of the user.

After clicking [OK] (**MS5**), the start window closes and the dialogue box "Measure" opens. The measurement ends, as soon as the condition for the automatic termination of the measurement process is fulfilled. ***NOTICE*** For the sequential measurement, a certain number of images or a certain number of particles should be selected as a condition for the automatic termination of the measurement process (→ Chapter "Measurement Parameters").

The result files previously defined in the task file are now created. If no evaluation window is yet open, the graph window opens and the measurement result is graphically displayed. Otherwise, the content of already opened evaluation windows is updated.

The "Measure" dialogue box reopens and the next measurement starts. This procedure is repeated until the sequential measurement is stopped via the menu function │Stop sequential measurement│.

NOTICE For the sequential measurement, the checkbox ⟨File no.⟩ must be checked in the task file (→ Chapter "Save Task File"), in order to create a new raw data file for each measurement. If this is not the case, each subsequent measurement will overwrite the previously generated raw data file without further notice.

NOTICE During the sequential measurement, warnings which have been activated in the "Warnings" tab of the task file (→ Chapter "Measurement Parameters") are not displayed on screen, but stored in a separate STA file in ASCII format in the subdirectory CAMSYS.

4.3.3 Stop Sequential Measurement

Via the menu function │Stop sequential measurement│, a previously started, repetitive measurement process can be stopped.

⇨ In the main window, click on the menu bar item │Start measurement│ and select │Stop sequential measurement│ from the context menu.

The abort occurs at the end of the current measurement, as soon as the condition for the automatic termination of the measurement process is fulfilled. Thereafter, no further sequential measurement is carried out.

4.4 Functions of the Main Menu Item "Results"

The main menu item │Results│ contains menu functions for analysing the measurement results. Measurement results can be displayed as table or graph. In addition, the mean value and combinations can be calculated, and trend analyses and daily reports can be created.

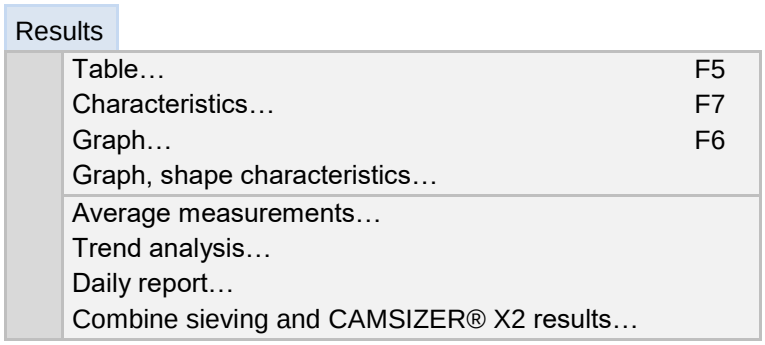


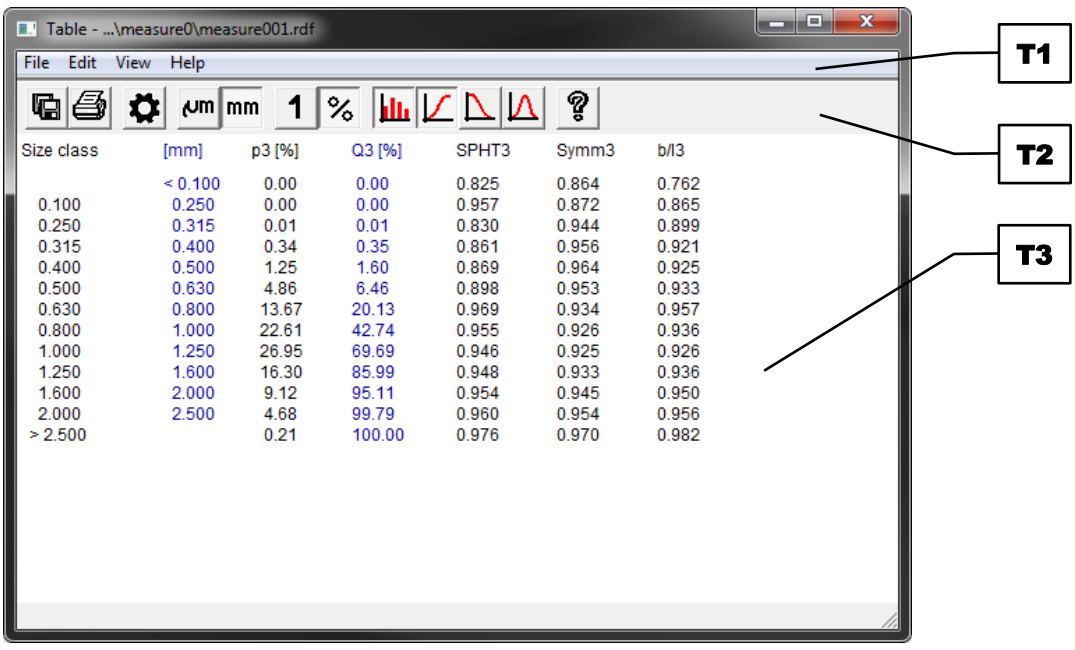
Fig. 11: Menu functions in the main menu item │Results│

In the following subchapters, each menu function of the main menu item │Results│ is described in detail and can be referred to individually.

4.4.1 Table

Via the menu function │Table│, size class-dependent characteristics are displayed in tabular form.

⇨ In the main window, click on the menu bar item │Results│ and select │Table│ from the context menu. The table window opens. Alternatively, the evaluation window can also be opened via the function key F5 on the keyboard or the  icon in the tool bar (**B**) of the main window.



Size class	[mm]	p3 [%]	Q3 [%]	SPHT3	Symm3	b/l3
	< 0.100	0.00	0.00	0.825	0.864	0.762
0.100	0.250	0.00	0.00	0.957	0.872	0.865
0.250	0.315	0.01	0.01	0.830	0.944	0.899
0.315	0.400	0.34	0.35	0.861	0.956	0.921
0.400	0.500	1.25	1.60	0.869	0.964	0.925
0.500	0.630	4.86	6.46	0.898	0.953	0.933
0.630	0.800	13.67	20.13	0.969	0.934	0.957
0.800	1.000	22.61	42.74	0.955	0.926	0.936
1.000	1.250	26.95	69.69	0.946	0.925	0.926
1.250	1.600	16.30	85.99	0.948	0.933	0.936
1.600	2.000	9.12	95.11	0.954	0.945	0.950
2.000	2.500	4.68	99.79	0.960	0.954	0.956
> 2.500		0.21	100.00	0.976	0.970	0.982

Fig. 12: Table window

In the client area (**T3**) of the table window, up to six basic characteristics (e.g. fraction, cumulative distribution, cumulative distribution of residue, frequency distribution) and/or shape characteristics (e.g. symmetry, sphericity, aspect ratio) can be displayed for the individual size classes.

All functions of the table window can be accessed via the menu bar (**T1**). Frequently used functions are also available via the tool bar (**T2**). In the following table the icons are summarised.

Icon	Menu function / description
	⎪Edit⎪Copy⎪
	⎪File⎪Print⎪
	⎪View⎪Characteristics⎪
	Display of the size classes in µm
	Display of the size classes in mm
	Normalised display of the results in the range of 0 – 1
	Display of the results in %
	Display of the fraction
	Display of the cumulative distribution
	Display of the cumulative distribution of residue
	Display of the frequency distribution
	⎪Help⎪

NOTICE If any changes of the settings made here shall remain effective also in subsequent measurements, the task file must be saved anew after the modification (→ Chapter "Save Task File").

4.4.1.1 Functions of the Menu Bar Item "File"

The menu bar item ⎪File⎪ contains menu functions for printing the window content and for closing the evaluation window.

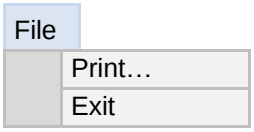


Fig. 13: Table window: menu functions of the menu bar item ⎪File⎪

Menu function ⎪Print⎪:
Via the menu function ⎪Print⎪ the content of the evaluation window can be printed.

⇨ In the evaluation window, click on the menu bar item ⎪File⎪ and select ⎪Print⎪ from the context menu. The printer configuration dialogue box opens.
⇨ Make the desired print settings.
⇨ Click [OK] to print the content of the evaluation window.
⇨ To abort the process, click the [Cancel] button.

NOTICE For better identification, the file names of the raw data file (RDF file) and the task file (AFG file) are inserted as header.

NOTICE The font size and font type are defined by the setting in the menu function ⎪Printer font⎪ of the main window (→ Chapter "Printer Font").

Menu function │Exit│:
Via the menu function │Exit│, the evaluation window can be closed.
⇨ In the evaluation window, click on the menu bar item │File│ and select │Exit│ from the context menu. The evaluation window closes.

4.4.1.2 Functions of the Menu Bar Item "Edit"

The menu bar item │Edit│ contains menu functions for copying the results to the clipboard.

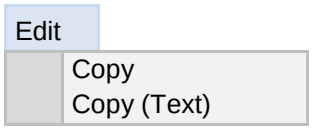


Fig. 14: Table window: menu functions of the menu bar item │Edit│

Menu function │Copy│:
Via the menu function │Copy│, the content of the evaluation window is copied to the clipboard as graphic.
⇨ In the evaluation window, click on the menu bar item │Edit│ and select │Copy│ from the context menu. The corresponding data of the currently loaded RDF file are copied as graphic to the clipboard.

NOTICE For better identification, the file names of the raw data file (RDF file) and the task file (AFG file) are inserted as header.

Menu function │Copy (Text)│:
Via the menu function │Copy (Text)│, all selected basic and shape characteristics are copied to the clipboard in ASCII format (text format). A comma is used as decimal mark.
⇨ In the table window, click on the menu bar item │Edit│ and select │Copy (Text)│ from the context menu. The corresponding data of the currently loaded RDF file are copied as text to the clipboard.

NOTICE For better identification, the file names of the raw data file (RDF file) and the task file (AFG file) are inserted as header.

4.4.1.3 Functions of the Menu Bar Item "View"

The menu bar item │View│ contains menu functions for selecting the characteristics and units to be displayed.

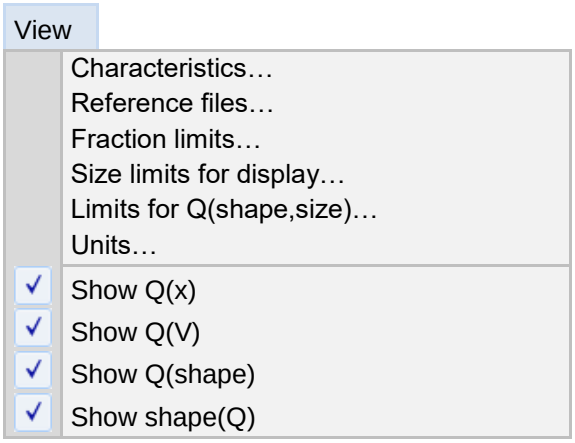


Fig. 15: Table window: menu functions of the menu bar item │View│

In the table window, one of four different views can be selected. Depending on the selection, the measurement results are displayed as follows:

- on activated menu function │Show Q(x)│, as distribution and/or particle shape as a function of the size classes.
- on activated menu function │Show Q(V)│, as distribution as a function of the volume classes.
- on activated menu function │Show Q(shape)│, as distribution as a function of the form classes.
- on activated menu function │Show shape(Q)│, as particle shape as a function of the cumulative distribution.

The selected view is marked with the ✓ icon in front of the context menu item. Depending on the selection, a different dialogue box is displayed for the menu function │Characteristics│.

Menu function │Characteristics│:
Via the menu function │Characteristics│, the columns (characteristics) can be selected. The first six of the selected characteristics are displayed in the table window. However, all selected characteristics can be copied in ASCII format to the clipboard, using the menu function │Copy (text)│.

⇨ In the table window, click on the menu bar item │View│ and select │Characteristics│ from the context menu. The dialogue box for selecting the columns opens. Alternatively, the dialogue box can also be opened via the ⚙ icon in the tool bar (**T2**) of the table window.
⇨ Make the desired modifications.
⇨ Click [OK] to apply the settings.
⇨ To discard the changes, click the [Cancel] button.

The four different dialogue boxes of the menu function │Characteristics│ for the tables Q(x), Q(V), Q(shape) and shape(Q) are described below.

Dialogue box of the characteristics for table Q(x):

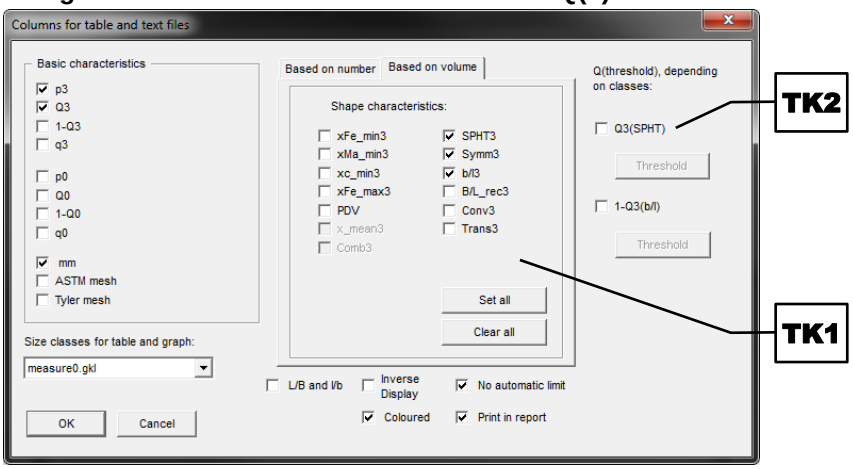


Fig. 16: Setting options of the table window for table Q(x)

The following characteristics and settings are available for table Q(x):

Characteristic / setting	Description
p_3, p_0, p_2	Displays the column of the fraction in the table. The checkbox corresponds to the icon in the tool bar (**T2**) of the table window.
Q_3, Q_0, Q_2	Displays the column of the cumulative distribution in the table. The checkbox corresponds to the icon in the tool bar (**T2**) of the table window.
$1 – Q_3$, $1 – Q_0$, $1 – Q_2$	Displays the column of the cumulative distribution of residue in the table. The checkbox corresponds to the icon in the tool bar (**T2**) of the table window.
q_3, q_0, q_2	Displays the column of the frequency distribution in the table. The checkbox corresponds to the icon in the tool bar (**T2**) of the table window.
mm	Displays the size classes in mm or µm in the table.
ASTM mesh	Displays the columns of the size classes as ASTM mesh values in the table. With activated characteristic, the Tyler mesh values cannot be displayed.
Tyler mesh	Displays the columns of the size classes as Tyler mesh values in the table. With activated characteristic, the ASTM mesh values cannot be displayed.
Size classes for table and graph	⇨ Select the desired size class file for display in the table window from the dropdown list. ***NOTICE*** The size class file selected here is also used for the display in the graph window.

Shape characteristics	⇨ Select the desired characteristics. ⇨ To select all shape characteristics, click the [Set all] button. ⇨ To deselect all shape characteristics, click the [Clear all] button. ***NOTICE*** Depending on the configuration of the software, different characteristics are available in the section of the shape characteristics (**TK1**). In addition, only characteristics which have been activated during the measurement can be selected. Greyed out characteristics were not measured.
L/B and l/b	Inverse display of the aspect ratio.
Inverse display	Reverses the table so that the results are displayed in descending order of size classes.
Coloured	Displays the columns of the upper size class limit, the cumulative distribution, the cumulative distribution of residue, as well as the frequency distribution in blue.
No automatic limit	Disables the automatic expansion of the size classes with the smallest and largest measured particle size.
Print in report	Prints the client area of the table window (**T3**) in the report (measurement record).

NOTICE The function "Q(threshold), depending on classes" (**TK2**) is only available, if the software is configured accordingly. Furthermore, the function can only be enabled, if the corresponding class-dependent values Q(threshold) where activated during the measurement in the task file (→ Chapter "Measurement Parameters").

The function "Q(threshold), depending on classes " displays the class-dependent, percentage share of those particles which have exceeded of fallen below certain thresholds of up to two shape characteristics previously set in the task file.

⇨ Check the checkbox of the desired shape characteristic. The dialogue box of the threshold opens.

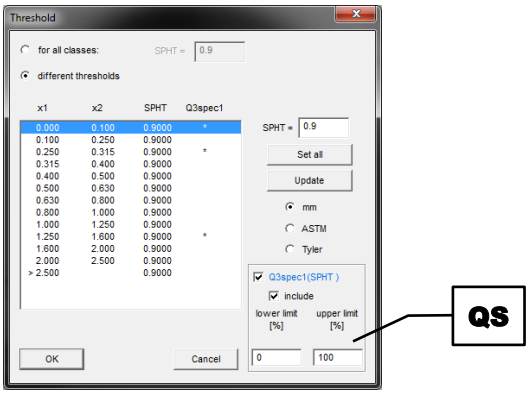


Fig. 17: Threshold dialogue box

⇨ Select the radio button ⟨for all classes⟩ to use the same threshold for all size classes.
⇨ Enter the desired threshold in the edit box.
⇨ Select the radio button ⟨different thresholds⟩ to set a separate threshold for each size class.
⇨ Select the desired display of the size classes in this dialogue box via the radio buttons ⟨mm⟩, ⟨ASTM⟩ or ⟨Tyler⟩.
⇨ Mark the desired size class and enter the desired threshold in the edit box.

⇨ Click the [Update] button. The threshold is applied to the selected size class.
⇨ To apply the threshold to all size classes, click the [Set all] button.

The characteristic Q_{spec1}(shape) or Q_{spec2}(shape) in section (**QS**) can be used to calculate a mean value over selected size classes for the first or second selected shape characteristic Q(threshold). The volume-based characteristic is additionally supplemented by the index 3, the number-based characteristic by the index 0, and the area-based characteristic by the index 2. For example, to calculate the volume-based mean value of the first shape characteristic $Q_{3\ spec1}$(shape), proceed as follows:

⇨ Check the ⟨$Q_{3\ spec1}$(shape)⟩ checkbox to average the shape characteristic over selected size classes.
⇨ Mark the size class to be included to calculate the mean value $Q_{3\ spec1}$(shape) and check the ⟨include⟩ checkbox. The size class is marked with an asterisk "*".
⇨ Repeat this procedure for all size classes to be included.

In addition, a warning can be issued, if a certain proportion of particles exceeds or falls below a predefined limit value for the mean value of the characteristic Q_{spec1}(shape) and/or Q_{spec2}(shape) (→ Chapter "Measurement Parameters").

⇨ Enter the desired lower limit in the corresponding edit box in section (**QS**).
⇨ Enter the desired upper limit in the corresponding edit box in section (**QS**).

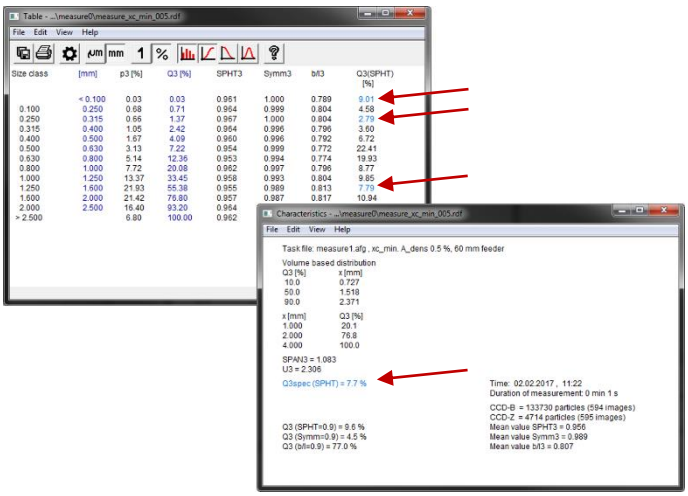


Fig. 18: Display of the mean value of the shape characteristic in the evaluation windows by the example of characteristic $Q_{3\ spec}$(SPHT)

Size classes, selected to calculate the mean value Q_{spec1}(shape) and/or Q_{spec2}(shape) are displayed in blue in the table window in column "Q(shape)". The mean value Q_{spec1}(shape) and/or Q_{spec2}(shape) per se is shown in the characteristics window and displayed in blue as well.

Dialogue box of the characteristics for table Q(V):

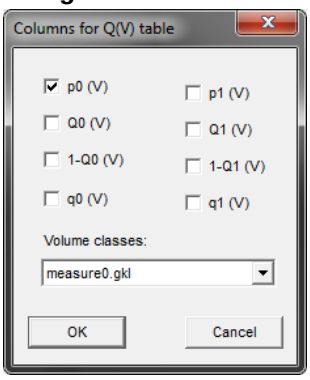


Fig. 19: Setting options of the table window for table Q(V)

The following characteristics and settings are available for table Q(V):

Characteristic / setting	Description
$p_0(V)$	Displays the column of the fraction $p_0(V1,V2)$ in the table. It shows the number-based ratio of particles in the particle volume range between > V1 and ≤ V2. The checkbox corresponds to the icon in the tool bar (**T2**) of the table window.
$p_1(V)$	Displays the column of the fraction $p_1(V1,V2)$ in the table. It shows the volume-based ratio of particles in the particle volume range between > V1 and ≤ V2.
$Q_0(V)$	Displays the column of the cumulative distribution $Q_0(V)$ in the table. It shows the number-based ratio of all particles with a particle volume ≤ V. The checkbox corresponds to the icon in the tool bar (**T2**) of the table window.
$Q_1(V)$	Displays the column of the cumulative distribution $Q_1(V)$ in the table. It shows the volume-based ratio of all particles with a particle volume ≤ V.
$1 – Q_0(V)$	Displays the column of the cumulative distribution of residue $1 – Q_0(V)$ in the table. It shows the number-based ratio of all particles with a particle volume > V. The checkbox corresponds to the icon in the tool bar (**T2**) of the table window.
$1 – Q_1(V)$	Displays the column of the cumulative distribution of residue $1 – Q_1(V)$ in the table. It shows the volume-based ratio of all particles with a particle volume > V.
$q_0(V)$	Displays the column of the frequency distribution $q_0(V)$ in the table. It shows the number-based ratio of particles with a particle volume = V. The checkbox corresponds to the icon in the tool bar (**T2**) of the table window.
$q_1(V)$	Displays the column of the frequency distribution $q_1(V)$ in the table. It shows the volume-based ratio of particles with a particle volume = V.
Volume classes	⇨ Select the desired volume class file for display in the table window from the dropdown list. ***NOTICE*** The volume class file selected here is also used for the display in the graph window.

Dialogue box of the characteristics for table Q(shape):

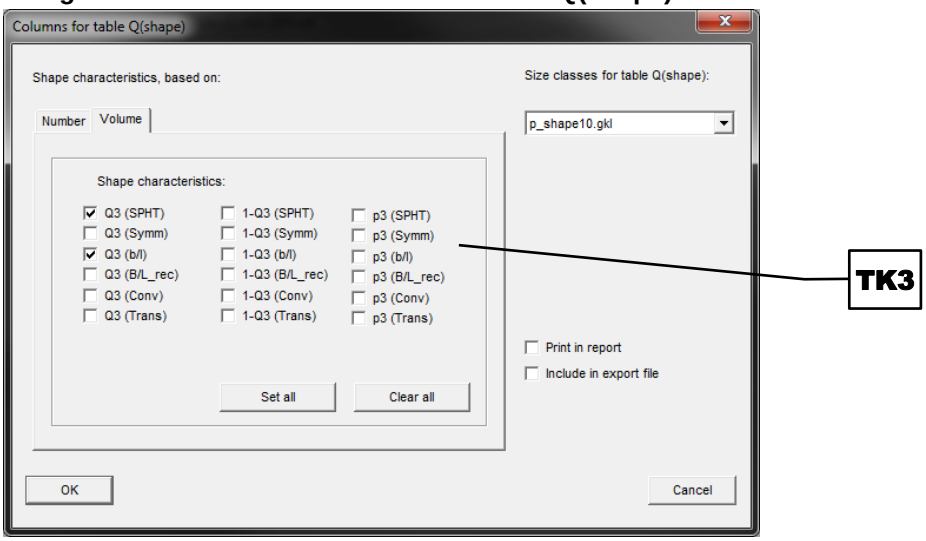


Fig. 20: Setting options of the table window for table Q(shape)

The following characteristics and settings are available for table Q(shape):

Characteristic / setting	Description
Shape characteristics	⇨ Select the desired characteristics. ⇨ To select all shape characteristics, click the [Set all] button. ⇨ To deselect all shape characteristics, click the [Clear all] button. ***NOTICE*** Depending on the configuration of the software, different characteristics are available in the section of the shape characteristics (**TK3**). In addition, only characteristics which have been activated during the measurement can be selected. Greyed out characteristics were not measured.
Size classes for table Q(shape)	⇨ Select the desired size class file for display in the table window from the dropdown list. ***NOTICE*** A suitable size class file must be selected for correct display. The size class range for shape characteristics is always between 0 and 1. The preinstalled size class file "p_shape10.gkl" lists the size classes between 0 and 1 in steps of 0.1. ***NOTICE*** The size class file selected here is also used for the display in the table window shape(Q), as well as in the graph window of shape characteristics of the Q(shape) distribution.
Print in report	Prints the client area of the table window (**T3**) in the report (measurement record).
Include in export file	Includes the data of all selected characteristics in the export files.

Dialogue box of the characteristics for table shape(Q):

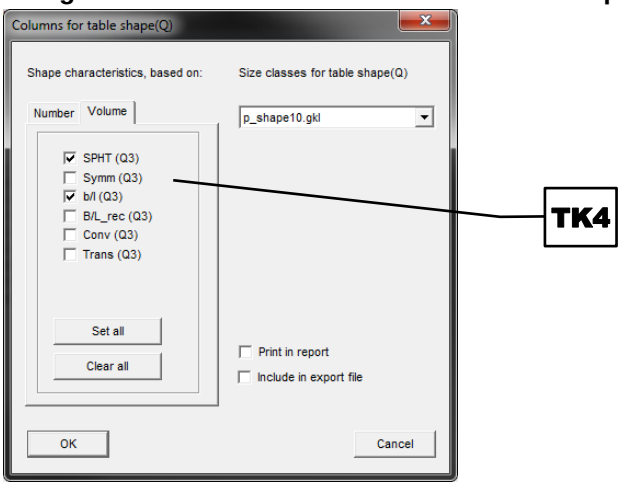


Fig. 21: Setting options of the table window for table shape(Q)

The following characteristics and settings are available for table shape(Q):

Characteristic / setting	Description
Shape characteristics	⇨ Select the desired characteristics. ⇨ To select all shape characteristics, click the [Set all] button. ⇨ To deselect all shape characteristics, click the [Clear all] button. ***NOTICE*** Depending on the configuration of the software, different characteristics are available in the section of the shape characteristics (**TK4**). In addition, only characteristics which have been activated during the measurement can be selected. Greyed out characteristics were not measured.
Size classes for table shape(Q)	⇨ Select the desired size class file for display in the table window from the dropdown list. ***NOTICE*** A suitable size class file must be selected for correct display. The size class range for shape characteristics is always between 0 and 1. The preinstalled size class file "p_shape10.gkl" lists the size classes between 0 and 1 in steps of 0.1. ***NOTICE*** The size class file selected here is also used for the display in the table window Q(shape), as well as in the graph window of shape characteristics of the Q(shape) distribution.
Print in report	Prints the client area of the table window (**T3**) in the report (measurement record).
Include in export file	Includes the data of all selected characteristics in the export files.

Menu function │Reference files│:
Via the menu function │Reference files│, up to two columns with reference data can be displayed in table Q(x).

⇨ In the table window, click on the menu bar item │View│ and select │Reference files│ from the context menu. The dialogue box for selecting the first and second reference file opens.
⇨ Check the checkbox of the desired reference files.

⇨ Select the desired reference file for display in the table window from the respective dropdown list.
⇨ Click [OK] to apply the settings.
⇨ To discard the changes, click the [Cancel] button.

Menu function │Fraction limits│:
Via the menu function │Fraction limits│, one column for the lower and upper fraction limit can be displayed in table Q(x), respectively.
⇨ In the table window, click on the menu bar item │View│ and select │Fraction limits│ from the context menu. The dialogue box for selecting the fraction limits opens.
⇨ Check the checkbox of the desired fraction limits.
⇨ Select the desired faction limits for display in the table window from the respective dropdown list.
⇨ Click [OK] to apply the settings.
⇨ To discard the changes, click the [Cancel] button.

NOTICE To display the values of the fraction limits, the task file must be saved or overwritten anew after the selection of the fraction limits (→ Chapter "Save Task File").

NOTICE The fraction limits selected here are also used for the display in the graph window.

Menu function │Size limits for display│:
Via the menu function │Size limits for display│, the lower and/or upper limit of the size classes can be set. This function is used, when a certain part of the sample has been separated (oversize and/or undersize particles), but still shall be included in the measurement result.
NOTICE The size limits set here are also applied to the characteristics window and the graph window.
⇨ In the table window, click on the menu bar item │View│ and select │Size limits for display│ from the context menu. The corresponding dialogue box opens.

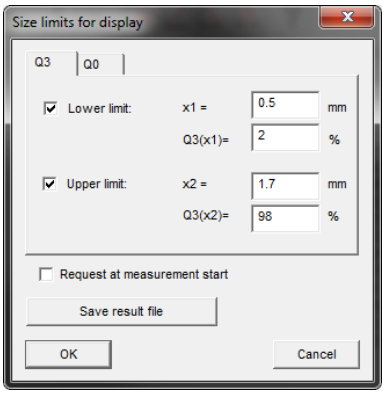


Fig. 22: Size limits for display

⇨ Check the checkboxes for the desired limits.
⇨ Enter the particle size x for which the limit is to be set in the corresponding edit box.
⇨ Enter the value of the cumulative distribution at the position of the set particle size x in the corresponding edit box.
⇨ Click [OK] to apply the settings.
⇨ To discard the changes, click the [Cancel] button.

If a sample contains a fine fraction which is below the detection limit of the CAMSIZER® X2, it can be separated via a sieve cut. For example, 5 % of the total sample mass were separated

with a 63 µm test sieve. Accordingly, the checkbox ⟨Lower limit⟩ in the "Q3" tab can be checked, and the values 0.063 and 5 can be entered in the edit boxes "x1" and "Q3(x1)", respectively. The measurement result is now "shifted" in the table and the graph, so that the measured volume-based distribution starts at 63 µm with a cumulative distribution value of 5 %.

⇨ To save the measurement result with the size limits, click the [Save result file] button. The corresponding dialogue box opens.
⇨ Navigate to the directory to which the RDF file is to be saved.
⇨ Enter the desired file name.
⇨ Click the [Save] button. The dialogue box closes and the RDF file is saved.
⇨ To abort the process, click the [Cancel] button.

The dialogue box "Size limits for display" can be displayed with the checkbox ⟨Request at measurement start⟩ on each measurement start. Thus, it is possible to set individual lower and/or upper size limits for each single sample and store directly in the result file.

NOTICE The dialogue box for setting the size limits for display is the same in the table window, the graph window and the characteristics window. A modification in one evaluation window therefore also affects the display in the other two evaluation windows.

Menu function │Limits for Q(shape,size)│:
Via the menu function │Size limits for Q(shape,size)│, a column with the lower and the upper limit of the shape characteristic can be displayed in the table Q(x) for two cumulative distributions. ***NOTICE*** This function is only available, if the software is configured accordingly. Furthermore, the function can only be enabled, if the corresponding class-dependent values Q(threshold) where activated during the measurement in the task file (→ Chapter "Measurement Parameters"). In addition, the corresponding checkboxes of the function "Q(threshold), depending on classes" (**TK2**) must be checked.
⇨ In the table window, click on the menu bar item │View│ and select │Size limits for Q(shape,size)│ from the context menu. The dialogue box for selecting the two reference files for the cumulative distribution of the shape characteristics opens.
⇨ Check the checkbox of the desired reference files.
⇨ Select the desired reference file for display in the table window from the respective dropdown list.
⇨ Click [OK] to apply the settings.
⇨ To discard the changes, click the [Cancel] button.

Menu function │Units│:
Via the menu function │Units│, the measurement units to be displayed can be selected.
⇨ In the table window, click on the menu bar item │View│ and select │Units│ from the context menu. The dialogue box for selecting the measurement units opens.
⇨ Select whether the size classes are to be displayed in mm, µm or inch. The radio buttons ⟨mm⟩ and ⟨µm⟩ correspond to the mm or µm icons in the tool bar (**T2**) of the table window, respectively.
⇨ Select whether the distributions are to be displayed normalised in the rage of 0 – 1 or in percent. The radio buttons correspond to the 1 or % icons in the tool bar (**T2**) of the table window, respectively.
⇨ Select whether the fractions are to be displayed normalised in the rage of 0 – 1 or in percent.
⇨ Click [OK] to apply the settings.
⇨ To discard the changes, click the [Cancel] button.

Fig. 23: Dialogue box of measurement units

NOTICE The selection of the time unit is only enabled in the trend analysis window (→ Chapter "Trend Analysis").

NOTICE The dialogue box of the measurement units is the same in the table window, the graph window, the graph window of shape characteristics, the characteristics window and the daily report window. A modification in one evaluation window therefore also affects the display in the other evaluation windows.

4.4.1.4 Functions of the Menu Bar Item "Help"

The menu bar item │Help│ opens the manual as PDF file.

4.4.2 Characteristics

Via the menu function │Characteristics│, the sample-specific characteristics are displayed in tabular form.

⇨ In the main window, click on the menu bar item │Results│ and select │Characteristics│ from the context menu. The characteristics window opens. Alternatively, the evaluation window can also be opened via the function key F7 on the keyboard or the icon in the tool bar (**B**) of the main window.

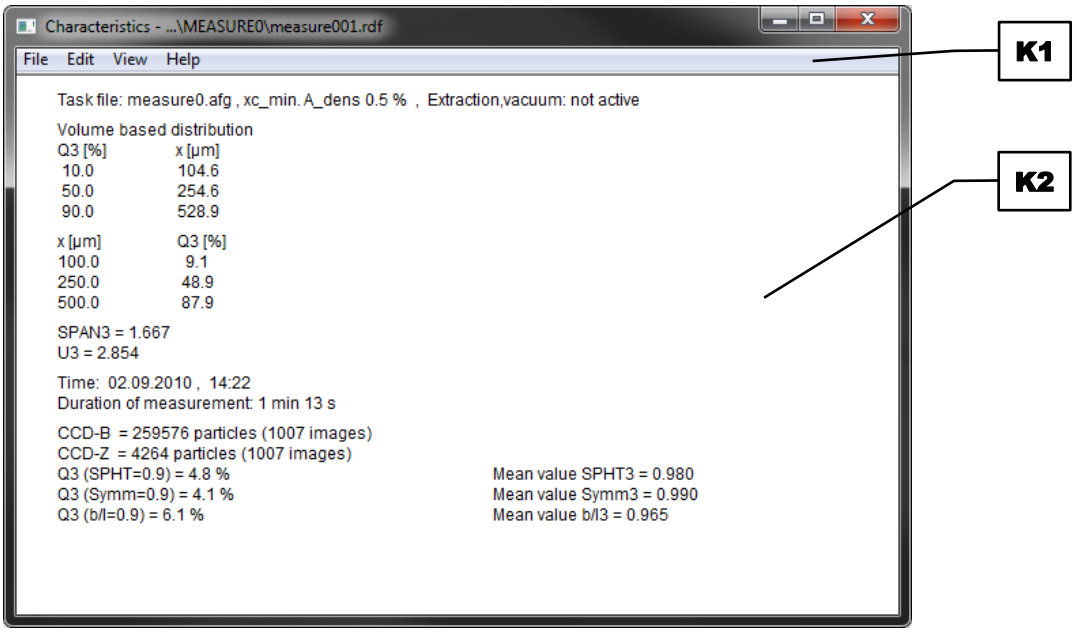


Fig. 24: Characteristics window

In the client area (**K2**) of the characteristics window, the sample-specific characteristics of the current raw data file are displayed.

All functions of the characteristics window can be accessed via the menu bar (**K1**).

NOTICE If any changes of the settings made here shall remain effective also in subsequent measurements, the task file must be saved anew after the modification (→ Chapter "Save Task File").

4.4.2.1 Functions of the Menu Bar Item "File"

The menu bar item │File│ contains menu functions for printing the window content and for closing the evaluation window.

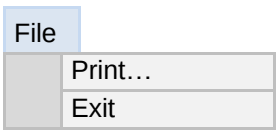


Fig. 25: Characteristics window: menu functions of the menu bar item │File│

Menu function │Print│:
Via the menu function │Print│ the content of the evaluation window can be printed.

⇨ In the evaluation window, click on the menu bar item │File│ and select │Print│ from the context menu. The printer configuration dialogue box opens.
⇨ Make the desired print settings.
⇨ Click [OK] to print the content of the evaluation window.
⇨ To abort the process, click the [Cancel] button.

NOTICE For better identification, the file names of the raw data file (RDF file) and the task file (AFG file) are inserted as header.

NOTICE The font size and font type are defined by the setting in the menu function │Printer font│ of the main window (→ Chapter "Printer Font").

Menu function │Exit│:
Via the menu function │Exit│, the evaluation window can be closed.
⇨ In the evaluation window, click on the menu bar item │File│ and select │Exit│ from the context menu. The evaluation window closes.

4.4.2.2 Functions of the Menu Bar Item "Edit"

The menu bar item │Edit│ contains menu functions for copying the results to the clipboard and for switching the displayed information.

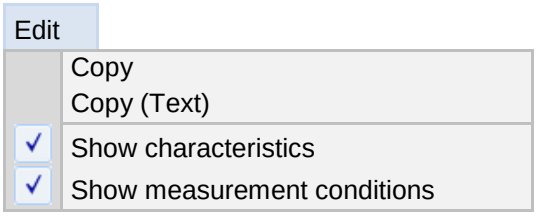


Fig. 26: Characteristics window: menu functions of the menu bar item │Edit│

Menu function │Copy│:
Via the menu function │Copy│, the content of the evaluation window is copied to the clipboard as graphic.
⇨ In the evaluation window, click on the menu bar item │Edit│ and select │Copy│ from the context menu. The corresponding data of the currently loaded RDF file are copied as graphic to the clipboard.

NOTICE For better identification, the file names of the raw data file (RDF file) and the task file (AFG file) are inserted as header.

Menu function │Copy (Text)│:
Via the menu function │Copy (Text)│, the content of the client area (**K3**) (either the measurement conditions or the currently selected characteristics) are copied to the clipboard in ASCII format (text format).
⇨ In the characteristics window, click on the menu bar item │Edit│ and select │Copy (Text)│ from the context menu. The corresponding data of the currently loaded RDF file are copied as text to the clipboard.

NOTICE For better identification, the file names of the raw data file (RDF file) and the task file (AFG file) are inserted as header.

Menu function │Show characteristics│:
Via the menu function │Show characteristics│, information on the selected characteristics are displayed in the client area (**K2**). In addition, the date and time of the measurement process is listed.

⇨ In the characteristics window, click on the menu bar item │Edit│ and select │Show characteristics│ from the context menu. The corresponding data of the currently loaded RDF file are displayed in the client area (**K2**).

Menu function │Show measurement conditions│:
Via the menu function │Show measurement conditions│, the measurement conditions under which the measurement process was performed are displayed in the client area (**K2**). This also includes the information entered for the report in section (**MS3**) of the "Save task file" tab in the dialogue box of the measurement conditions (→ Chapters "Save Task File").

⇨ In the characteristics window, click on the menu bar item │Edit│ and select │Show measurement conditions│ from the context menu. The corresponding data of the currently loaded RDF file are displayed in the client area (**K2**).

ⓘ If the software has been configured accordingly, it is possible to subsequently modify the data entered in the report section (**MS3**). Double-clicking the lines "Head of report", "Company", "User", "Material" and/or "Comment" opens a dialogue box for changing the text.

NOTICE Either the characteristics, or the measurement conditions can be displayed in the client area (**K3**). The selected view is marked with the ✓ icon in front of the respective context menu item.

4.4.2.3 Functions of the Menu Bar Item "View"

The menu bar item │View│ contains menu functions for selecting the characteristics and units to be displayed.

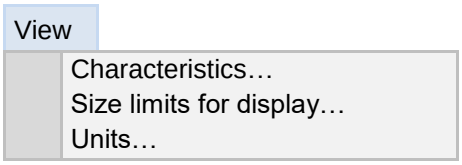


Fig. 27: Characteristics window: menu functions of the menu bar item │View│

Menu function │Characteristics│:
Via the menu function │Characteristics│, the sample-specific characteristics to be displayed can be selected.

⇨ In the characteristics window, click on the menu bar item │View│ and select │Characteristics│ from the context menu. The dialogue box for characteristics selection opens.
⇨ Select the desired characteristics and make the desired modification.
⇨ Click [OK] to apply the settings.
⇨ To discard the changes, click the [Cancel] button.

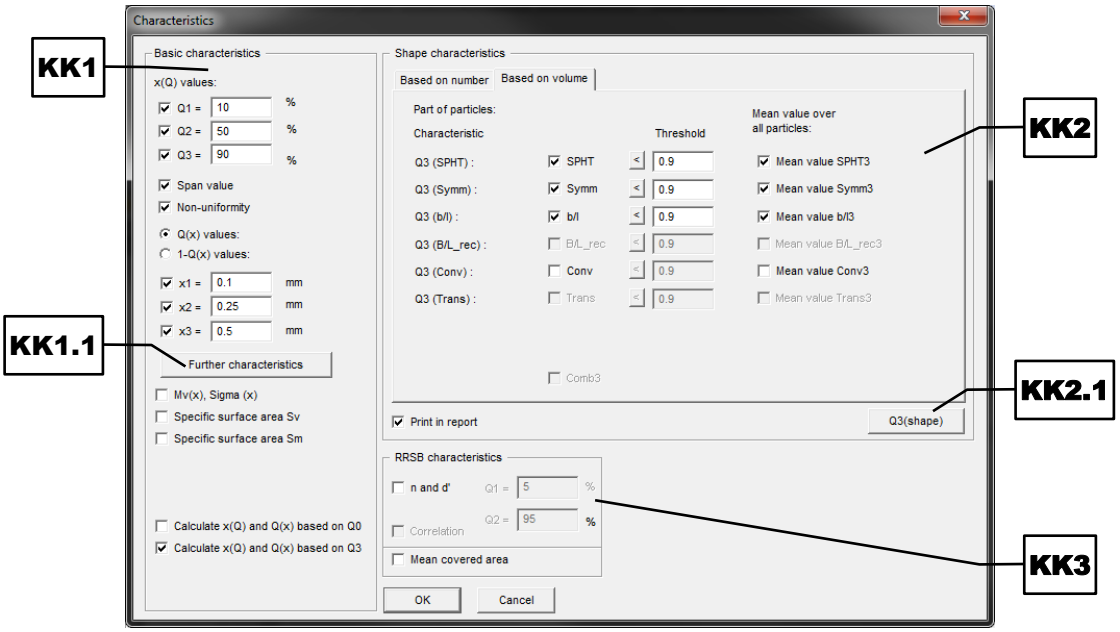


Fig. 28: Setting options of the characteristics window

NOTICE Depending on the configuration of the software, different characteristics are available in the dialogue box. In addition, only characteristics which have been activated during the measurement can be selected. Greyed out characteristics were not measured.

In default configuration, the following characteristics and settings are available in the "Basic characteristics" section (**KK1**):

Characteristic \ setting	Description
Q1	Displays the particle size x(Q1), which is located in the cumulative distribution at the position of the value entered in the edit box "Q1". By default, Q1 = 10 %.
Q2	Displays the particle size x(Q2), which is located in the cumulative distribution at the position of the value entered in the edit box "Q2". By default, Q2 = 50 %.
Q3	Displays the particle size x(Q3), which is located in the cumulative distribution at the position of the value entered in the edit box "Q3". By default, Q3 = 90 %.
Span value	Displays the width of the distribution. The Span value depends on the values entered in the edit boxes "Q1", "Q2" and "Q3". $Span = \frac{Q3 - Q1}{Q2}$
Non-uniformity	Displays the symmetry (U value) of the distribution. $U = \frac{x(Q_{60\,\%})}{x(Q_{10\,\%})}$
Q(x) values	Displays the values of the cumulative distribution Q(x) at the particle size positions x1, x2 and x3.
1 – Q(x) values	Displays the values of the cumulative distribution of residue 1 – Q(x) at the particle size positions x1, x2 and x3.
x1	Displays the value of the distribution, which is located at the particle size value entered in the edit box "x1".
x2	Displays the value of the distribution, which is located at the particle size value entered in the edit box "x2".

x3	Displays the value of the distribution, which is located at the particle size value entered in the edit box "x3".
$M_V(x)$, Sigma(x)	Displays the mean value M_V of the particle size x with the corresponding standard deviation σ (sigma).
Specific surface area S_V	Displays the volume-based specific surface area in mm^{-1}.
Specific surface area S_m	Displays the mass-based specific surface area in cm^2/g.
Calculate x(Q) and Q(x) based on Q_0, Calculate x(Q) and Q(x) based on Q_2, Calculate x(Q) and Q(x) based on Q_3	Displays the measurement results of the number-based (index 0), area-based (index 2) and/or volume-based (index 3) particle sizes and cumulative distributions.

Additional particle sizes x(Q), cumulative distribution values Q(x), cumulative distribution of residue values 1 – Q(x) and/or fractions p(x1,x2) can be displayed via the [Further characteristics] button (**KK1.1**).

⇨ Click the [Further characteristics] button (**KK1.1**). The corresponding dialogue box opens.
⇨ Select the desired characteristics and enter the desired values in the respective edit boxes.
⇨ Click the [Update] button.
⇨ To fill all edit boxes in the dialogue box with default values, click the [Standard] button.
⇨ To print the selected characteristics also in the report (measurement record), check the ⟨Print in report⟩ checkbox.
⇨ Click [OK] to apply the settings.
⇨ To discard the changes, click the [Cancel] button.

In section "Shape characteristics" (**KK2**), thresholds can be set for the cumulative distribution or the cumulative distribution of residue of the shape characteristics, and their mean values can be displayed.

⇨ Select the desired characteristics and enter the desired thresholds in the respective edit boxes.
⇨ Click the [Update] button.
⇨ To display the threshold value of the cumulative distribution of residue 1 – Q(x), click the [<] button. The button changes to [>].
⇨ To display the threshold value of the cumulative distribution Q(x), click the [>] button. The button changes to [<].
⇨ Check the checkboxes of the desired characteristics for the mean value display.
⇨ To print the selected shape characteristics and mean values also in the report (measurement record), check the ⟨Print in report⟩ checkbox.

Up to 20 additional threshold values for shape characteristics can be displayed via the [Q_3(shape)] button (**KK2.1**).

⇨ Click the [Q_3(shape)] button (**KK2.1**). The corresponding dialogue box opens.
⇨ Click the [Add] button, to define a new threshold for a shape characteristic. The dialogue boy for selection the shape characteristic opens.
⇨ Select whether the shape characteristic is based on number, area or volume.
⇨ Select the radio button of the desired shape characteristic.
⇨ Select the radio button of the desired type of the shape characteristic.
⇨ Enter the desired threshold in the edit box.
⇨ Click the [Update] button.
⇨ Click [OK] to add the settings to the list of additional thresholds for shape characteristics.
⇨ To discard the changes, click the [Cancel] button.

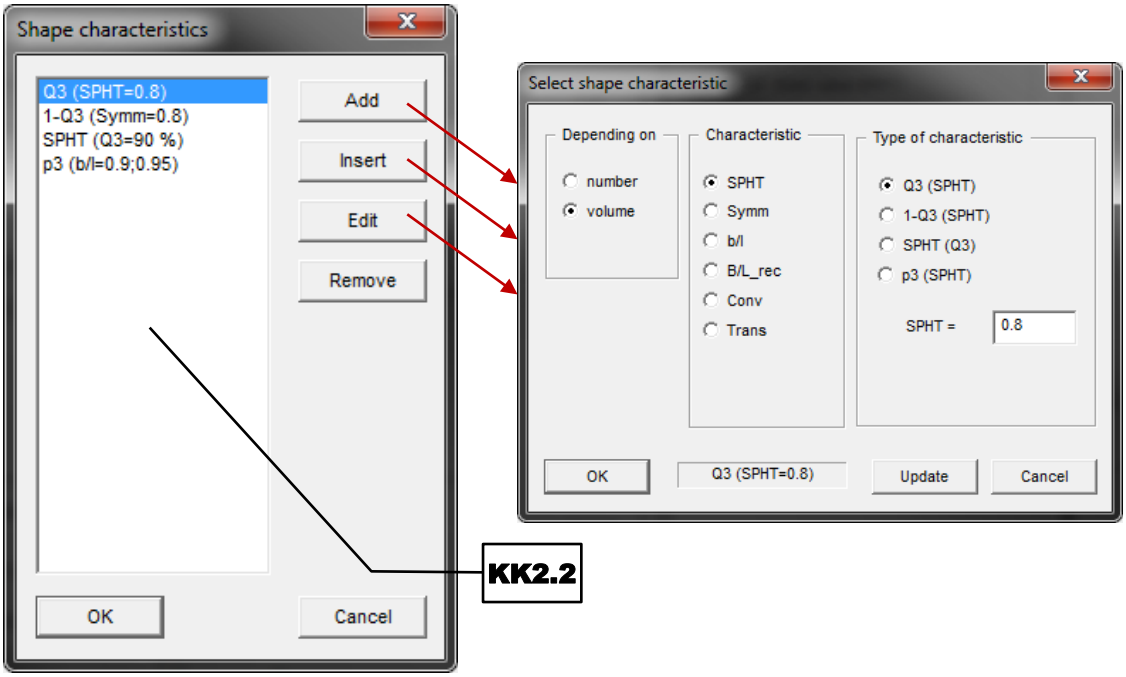


Fig. 29: Setting options of the [Q_3(shape)] button

⇨ Click the [Insert] button to insert a further entry above the entry marked in the characteristics list (**KK2.2**). The dialogue boy for selecting the shape characteristic opens.
⇨ Make the desired settings.
⇨ Click the [Edit] button to change the entry marked in the characteristics list (**KK2.2**). The dialogue boy for selecting the shape characteristic opens.
⇨ Make the desired modifications.
⇨ Click the [Remove] button to delete the entry marked in the characteristics list (**KK2.2**).
⇨ If all desired additional thresholds are listed in the characteristics list (**KK2.2**), click [OK] to apply the settings.
⇨ To discard the changes, click the [Cancel] button.

In default configuration, the following characteristics and settings are available in the "RRSB characteristics" section (**KK3**):

Characteristic / setting	Description
n and d'	The characteristic n displays the slope of the RRSB curve. The characteristic d' displays the particle size x at position Q(x) = 63.2 %.
Q1, Q2	Calculates the slope n of the RRSB curve only in a defined range {Q1,Q2} of the cumulative distribution. ⇨ Enter the desired lower cumulative distribution value Q1 in the respective edit box. ⇨ Enter the desired upper cumulative distribution value Q2 in the respective edit box.
Correlation	Displays the correlation of the RRSB curve (cumulative distribution) to an ideal straight line (Gaussian distribution).
Mean covered area	Displays the mean covered area of each camera, the standard deviation (sigma) of the mean covered area, as well as the minimum and maximum value of the covered area.

NOTICE The mass-based specific surface area S_m can only be calculated, if prior to the measurement process, the material density has been defined in the start window of the measurement.

A detailed description of the individual characteristics can be found in Chapter "List of Characteristics".

Menu function │Size limits for display│:
Via the menu function │Size limits for display│, the lower and/or upper limit of the size classes can be set. This function is used, when a certain part of the sample has been separated (oversize and/or undersize particles), but still shall be included in the measurement result.

⇨ In the evaluation window, click on the menu bar item │View│ and select │Size limits for display│ from the context menu. The corresponding dialogue box opens.
⇨ Make the desired settings as described in Chapter "Table".
⇨ Click [OK] to apply the settings.
⇨ To discard the changes, click the [Cancel] button.

NOTICE The dialogue box for setting the size limits for display is the same in the table window, the graph window and the characteristics window. A modification in one evaluation window therefore also affects the display in the other two evaluation windows.

Menu function │Units│:
Via the menu function │Units│, the measurement units to be displayed can be selected.

⇨ In the evaluation window, click on the menu bar item │View│ and select │Units│ from the context menu. The dialogue box for selecting the measurement units opens.
⇨ Make the desired settings as described in Chapter "Table".
⇨ Click [OK] to apply the settings.
⇨ To discard the changes, click the [Cancel] button.

NOTICE The dialogue box of the measurement units is the same in the table window, the graph window, the graph window of shape characteristics, the characteristics window and the daily report window. A modification in one evaluation window therefore also affects the display in the other evaluation windows.

4.4.2.4 Functions of the Menu Bar Item "Help"

The menu bar item │Help│ opens the manual as PDF file.

4.4.3 Graph

Via the menu function │Graph│, the measurement results of the particle sizes are displayed graphically. The X axis indicates the particle size, while the Y axis represents the currently selected characteristic.

⇨ In the main window, click on the menu bar item │Results│ and select │Graph│ from the context menu. The graph window opens. Alternatively, the evaluation window can also be opened via the function key F6 on the keyboard or the  icon in the tool bar (**B**) of the main window.

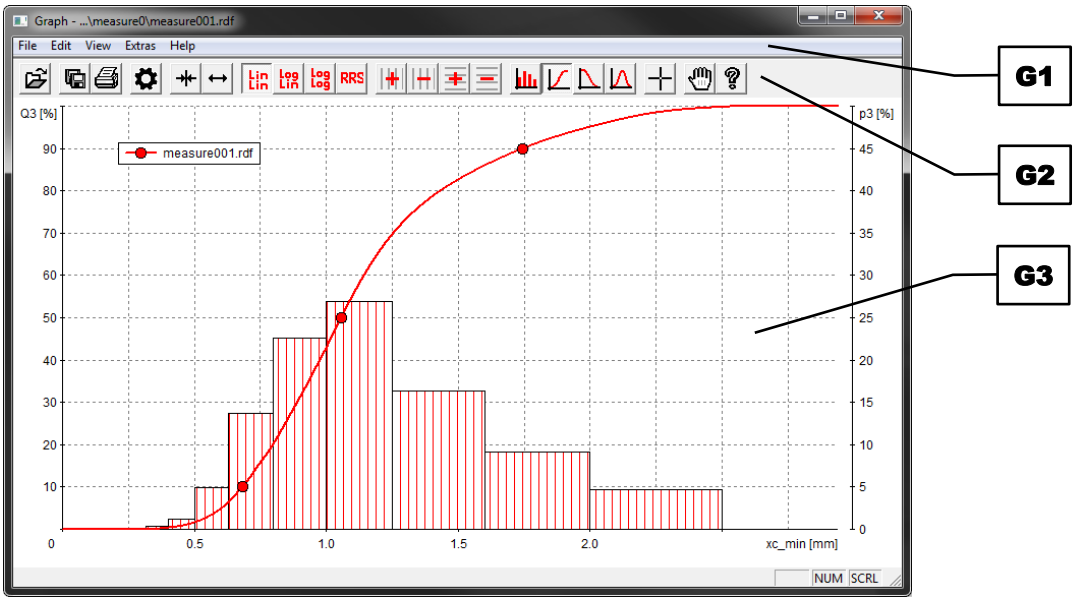


Fig. 30: Graph window

In the client area (**G3**) of the graph window up to two characteristics can be displayed simultaneously. Furthermore, up to nine comparison files can be loaded additionally.

All functions of the graph window can be accessed via the menu bar (**G1**). Frequently used functions are also available via the tool bar (**G2**). In the following table the icons are summarised.

Icon	Menu function / description
	| File | Read comparison file |
	| Edit | Copy |
	| File | Print |
	| View | Characteristics |
	Scales the X and Y axis so that the complete measurement range is displayed
	Expands the measurement range in the direction of the X and Y axis
	Linear display of the X axis, linear display of the Y axis
	Logarithmic display of the X axis, linear display of the Y axis
	Logarithmic display of the X axis, logarithmic display of the Y axis
	Display of the cumulative distribution in the RRSB grid including the threshold line at 63.2 %
	Adds vertical grid lines
	Removes vertical grid lines
	Adds horizontal grid lines
	Removes horizontal grid lines
	Display of the fraction on the first Y axis (left)
	Display of the cumulative distribution on the first Y axis (left)
	Display of the cumulative distribution of residue on the first Y axis (left)
	Display of the frequency distribution on the first Y axis (left)
	| View | Activate/deactivate cross hairs |
	| View | Hand tool |
	| Help |

Zooming in the display in the direction of the X and Y axis is possible by dragging over the area of interest using the right mouse button. The selected area is enlarged in such a way, that the size classes contained in it are displayed in full. By clicking the  icon, the original view is restored.

NOTICE If any changes of the settings made here shall remain effective also in subsequent measurements, the task file must be saved anew after the modification (→ Chapter "Save Task File").

4.4.3.1 Functions of the Menu Bar Item "File"

The menu bar item \| File \| contains menu functions for reading comparison files, for printing the window content and for closing the evaluation window.

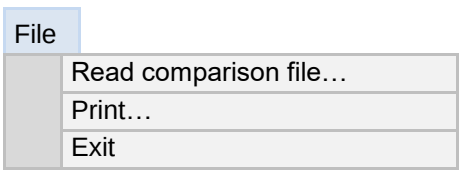


Fig. 31: Graph window: menu functions of the menu bar item \| File \|

Menu function \| Read comparison file \| :
Via the menu function \| Read comparison file \| , up to nine additional measurement results can be displayed in the evaluation window.

⇨ In the evaluation window, click on the menu bar item │File│ and select │Read comparison file│ from the context menu. The "Open File" dialogue box opens.
⇨ Select the desired comparison files.
⇨ Click the [Open] button. The dialogue box closes and the selected comparison files are read.
⇨ To abort the process, click the [Cancel] button.

The individual comparison files can be removed again by right-clicking on the respective file name in the legend. When closing the evaluation window, all comparison files are removed again.

NOTICE Each of the individual comparison files is displayed with the settings of that task file with which it was created. The measurement results can therefore have additional deviations due to different fitting files or shape parameter settings.

In order to display all comparison files with the settings of the same task file, the desired task file must also be reloaded after all desired comparison files are loaded (→ Chapter "Load Task File"). This ensures that the same task file is used for the display of all comparison files in the evaluation window.

NOTICE The loaded comparison files are not displayed in the report. However, in the evaluation window, the comparison files can be printed via the menu function │Print│, or copied to the clipboard via the menu function │Copy│.

Menu function │Print│:
Via the menu function │Print│ the content of the evaluation window can be printed.
⇨ In the evaluation window, click on the menu bar item │File│ and select │Print│ from the context menu. The printer configuration dialogue box opens.
⇨ Make the desired print settings.
⇨ Click [OK] to print the content of the evaluation window.
⇨ To abort the process, click the [Cancel] button.

NOTICE For better identification, the file names of the raw data file (RDF file) and the task file (AFG file) are inserted as header.

NOTICE The font size and font type are defined by the setting in the menu function │Printer font│ of the main window (→ Chapter "Printer Font").

Menu function │Exit│:
Via the menu function │Exit│, the evaluation window can be closed.
⇨ In the evaluation window, click on the menu bar item │File│ and select │Exit│ from the context menu. The evaluation window closes.

4.4.3.2 Functions of the Menu Bar Item "Edit"

The menu bar item │Edit│ contains a menu function for copying the results to the clipboard.

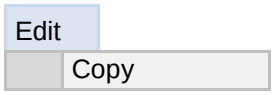


Fig. 32: Graph window: menu function of the menu bar item │Edit│

Menu function │Copy│:
Via the menu function │Copy│, the content of the evaluation window is copied to the clipboard as graphic.

⇨ In the evaluation window, click on the menu bar item │Edit│ and select │Copy│ from the context menu. The corresponding data of the currently loaded RDF file are copied as graphic to the clipboard.

NOTICE For better identification, the file names of the raw data file (RDF file) and the task file (AFG file) are inserted as header.

4.4.3.3 Functions of the Menu Bar Item "View"

The menu bar item │View│ contains menu functions for selecting the characteristics and units to be displayed.

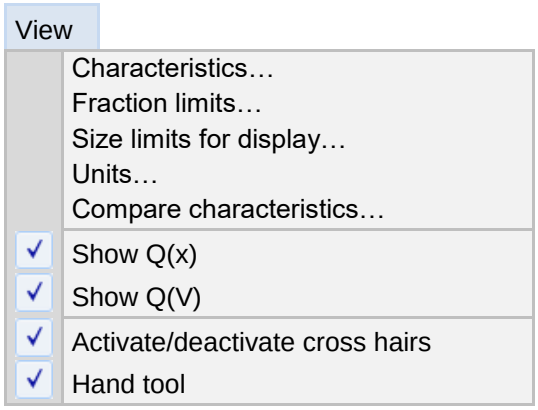


Fig. 33: Graph window: menu functions of the menu bar item │View│

In the graph window, one of two different views can be selected. Depending on the selection, the measurement results are shown as follows:

- on activated menu function │Show Q(x)│, as distribution as a function of the size classes.
- on activated menu function │Show Q(V)│, as distribution as a function of the volume classes.

The selected view is marked with the ✓ icon in front of the context menu item. Depending on the selection, a different dialogue box is displayed for the menu function │Characteristics│.

Menu function │Characteristics│:
Via the menu function │Characteristics│, the characteristics for both Y axes, the scaling of the X axis, as well as up to two reference files can be selected.

⇨ In the graph window, click on the menu bar item │View│ and select │Characteristics│ from the context menu. The dialogue box of the graph settings opens. Alternatively, the dialogue box can also be opened via the icon in the tool bar (**G2**) of the graph window.
⇨ Make the desired modifications.
⇨ Click [OK] to apply the settings.
⇨ To discard the changes, click the [Cancel] button.

The two different dialogue boxes of the menu function │Characteristics│ for the graphs Q(x) and Q(V) are described below.

Dialogue box of the characteristics for graph Q(x):

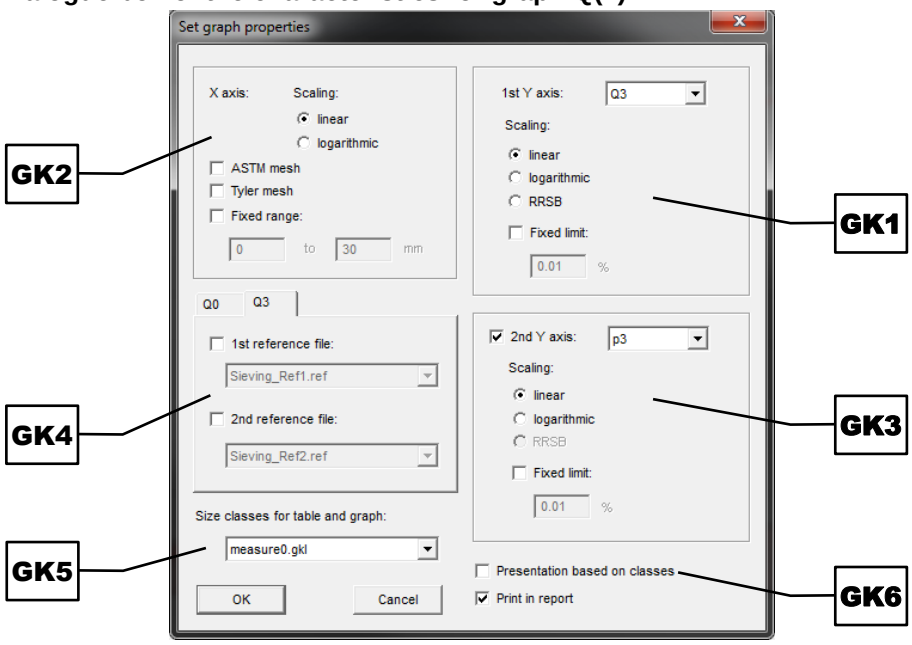


Fig. 34: Setting of the graph window for graph Q(x)

⇨ Select the characteristic to be displayed from the dropdown list in the section of the first Y axis (**GK1**). The selection of the list corresponds to the icons , , , and in the tool bar (**G2**) of the graph window.
⇨ Select the scaling in the section of the first Y axis (**GK1**). The selection of the RRSB grid is only possible for the cumulative distribution. Furthermore, the combination of linear X axis with RRSB formatted Y axis is not applicable.
⇨ Enter, if desired, a fixed upper limit between 0.01 % and 120 % for the first Y axis.
NOTICE The fixed limit cannot be used to hide the upper area of the measurement curve. The display is automatically adjusted so that the maximum value of the measurement curve remains visible, regardless of the entered fixed limit.
⇨ Select the scaling in the section of the X axis (**GK2**).
⇨ Enter, if desired, a fixed range for the X axis.
⇨ Select, if desired, the characteristic to be displayed from the dropdown list in the section of the second Y axis (**GK3**).
⇨ Select the scaling in the section of the second Y axis (**GK3**).
⇨ Enter, if desired, a fixed upper limit between 0.01 % and 120 % for the second Y axis.
⇨ Select, if desired, the first (lower) and/or second (upper) reference file from the respective dropdown list in the section of the reference files (**GK4**). Reference files are only displayed, if the cumulative distribution or the cumulative distribution of residue is selected for the Y axis.

⇨ Select the desired size class file for display in the graph window from the dropdown list (**GK5**). *NOTICE* The size class file selected here is also used for the display in the table window.
⇨ Check the ⟨Presentation based on classes⟩ checkbox (**GK6**), if the measurement curve is to be displayed in discrete steps according to the loaded size class file (GKL file).
⇨ Check the ⟨Print in report⟩ checkbox, if the client area of the graph window (**G3**) is to be printed in the report (measurement record).
⇨ Click [OK] to apply the settings.
⇨ To discard the changes, click the [Cancel] button.

Dialogue box of the characteristics for graph Q(V):

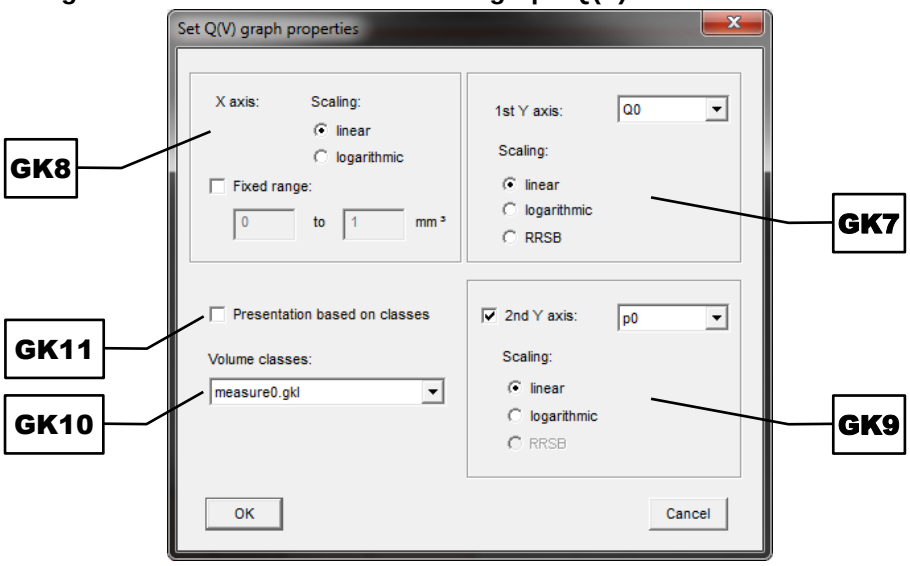


Fig. 35: Setting of the graph window for graph Q(V)

⇨ Select the characteristic to be displayed from the dropdown list in the section of the first Y axis (**GK7**). The selection of the list corresponds to the icons , , , and in the tool bar (**G2**) of the graph window.
⇨ Select the scaling in the section of the first Y axis (**GK7**). The selection of the RRSB grid is only possible for the cumulative distribution.
⇨ Select the scaling in the section of the X axis (**GK8**).
⇨ Enter, if desired, a fixed range for the X axis.
⇨ Select, if desired, the characteristic to be displayed from the dropdown list in the section of the second Y axis (**GK9**).
⇨ Select the scaling in the section of the second Y axis (**GK9**).
⇨ Select the desired volume class file for display in the graph window from the dropdown list (**GK10**). *NOTICE* The volume class file selected here is also used for the display in the table window.
⇨ Check the ⟨Presentation based on classes⟩ checkbox (**GK11**), if the measurement curve is to be displayed in discrete steps according to the loaded volume class file (GKL file).
⇨ Click [OK] to apply the settings.
⇨ To discard the changes, click the [Cancel] button.

Menu function │Fraction limits│:
Via the menu function │Fraction limits│, lower and upper fraction limits can be displayed in graph Q(x).
⇨ In the graph window, click on the menu bar item │View│ and select │Fraction limits│ from the context menu. The dialogue box for selecting the fraction limits opens.

⇨ Check the checkbox of the desired fraction limits.
⇨ Select the desired faction limits for display in the graph window from the respective dropdown list.
⇨ Click [OK] to apply the settings.
⇨ To discard the changes, click the [Cancel] button.

The fraction limits are displayed as soon as one of the two Y axes in the diagram represents the fractions.

NOTICE The fraction limits selected here are also used for the display in the table window.

Menu function │Size limits for display│:
Via the menu function │Size limits for display│, the lower and/or upper limit of the size classes can be set. This function is used, when a certain part of the sample has been separated (oversize and/or undersize particles), but still shall be included in the measurement result.
⇨ In the evaluation window, click on the menu bar item │View│ and select │Size limits for display│ from the context menu. The corresponding dialogue box opens.
⇨ Make the desired settings as described in Chapter "Table".
⇨ Click [OK] to apply the settings.
⇨ To discard the changes, click the [Cancel] button.

Menu function │Units│:
Via the menu function │Units│, the measurement units to be displayed can be selected.
⇨ In the evaluation window, click on the menu bar item │View│ and select │Units│ from the context menu. The dialogue box for selecting the measurement units opens.
⇨ Make the desired settings as described in Chapter "Table".
⇨ Click [OK] to apply the settings.
⇨ To discard the changes, click the [Cancel] button.

NOTICE The dialogue box of the measurement units is the same in the table window, the graph window, the graph window of shape characteristics, the characteristics window and the daily report window. A modification in one evaluation window therefore also affects the display in the other evaluation windows.

Menu function │Compare characteristics│:
Via the menu function │Compare characteristics│, the mean values over all loaded measurement curves can be calculated for selected characteristics, and their coefficients of variation can be computed.
⇨ In the graph window, click on the menu bar item │View│ and select │Compare characteristics│ from the context menu. The corresponding dialogue box opens.

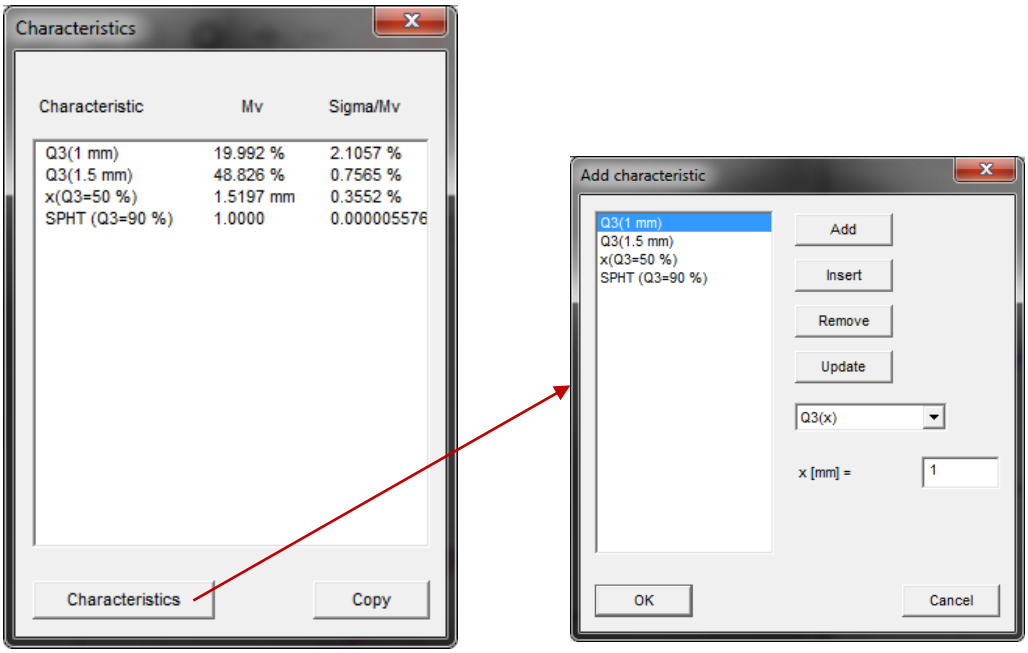


Fig. 36: Setting options of the menu function │Compare characteristics│

⇨ Click the [Characteristics] button. The corresponding dialogue box opens.
⇨ Select the desired characteristic from the dropdown list.
⇨ Enter the desired value in the edit box.
⇨ Click the [Add] button to add the new characteristic to the list.
⇨ Click the [Insert] button to insert a further characteristic above the entry marked in the list.
⇨ Click the [Update] button to overwrite the entry marked in the list with the selected parameters in the dropdown list and the edit box.
⇨ Click the [Remove] button to delete the entry marked in the list.
⇨ If all desired characteristics are specified in the list, click [OK] to apply the settings.
⇨ To discard the changes, click the [Cancel] button.

The characteristics list now also displays the mean values M_V over all measurement curves loaded in the graph window for the selected characteristics. In addition, the coefficient of variation CV (specified as Sigma/M_V in the list) is listed.

$$CV = \frac{\sigma(x)}{M_V(x)}$$

If measurement curves are added or removed in the graph window, the mean values and coefficients of variation are updated accordingly in the dialogue box.

By means of the [Copy] button, the content of the list can be copied to the clipboard in ASCII format (text format).

Menu function │Activate/deactivate cross hairs│:
Via the menu function │Activate/deactivate cross hairs│, cross hairs can be displayed which continuously show the X and Y coordinates of the current mouse pointer position.
⇨ In the evaluation window, click on the menu bar item │View│ and select │Activate/deactivate cross hairs│ from the context menu. The cross hairs are enabled and the X and Y coordinates of the mouse pointer position are displayed. In addition, the activated function is marked with the ✓ icon in front of the context menu item.

⇨ To disable the cross hairs, click again on the context menu item │Activate/deactivate cross hairs│. The context menu item is now unmarked.

Menu function │Hand tool│:
Via the menu function │Hand tool│, the mouse pointer can be converted into a hand tool which can be used to move the graph in the evaluation window by clicking and dragging.

⇨ In the evaluation window, click on the menu bar item │View│ and select │Hand tool│ from the context menu. The mouse pointer converts to an open hand.
⇨ Click on the graph, keep the mouse button pressed and drag the graph to the desired position. During the positioning the mouse pointer is displayed as a closed hand. In addition, the activated function is marked with the ✓ icon in front of the context menu item.
⇨ To deactivate the hand tool, click again on the context menu item │Hand tool│. The context menu item is now unmarked.

NOTICE Either the cross hairs can be enabled, or the hand tool can be used.

4.4.3.4 Functions of the Menu Bar Item "Extras"

The menu bar item │Extras│ contains menu functions for selecting the colour of curves, the type of curves, the type of bars, the type of grid, and the legend.

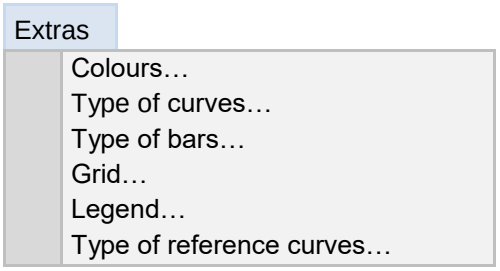


Fig. 37: Graph window: menu functions of the menu bar item │Extras│

Menu function │Colours│:
The menu function │Colours│ allows for the free colour mapping of each curve (and each bar).

⇨ In the graph window, click on the menu bar item │Extras│ and select │Colours│ from the context menu. The corresponding dialogue box opens.
⇨ Click on the colour field of an arbitrary curve number of the left or right Y axis, or of a reference file. The dialogue box for selecting the colours opens.
⇨ Select one of the basic colours, or define a new colour via the [Define Custom Colors >>] button.
⇨ Confirm the colour selection with [OK].
⇨ To abort the colour selection, click the [Cancel] button.

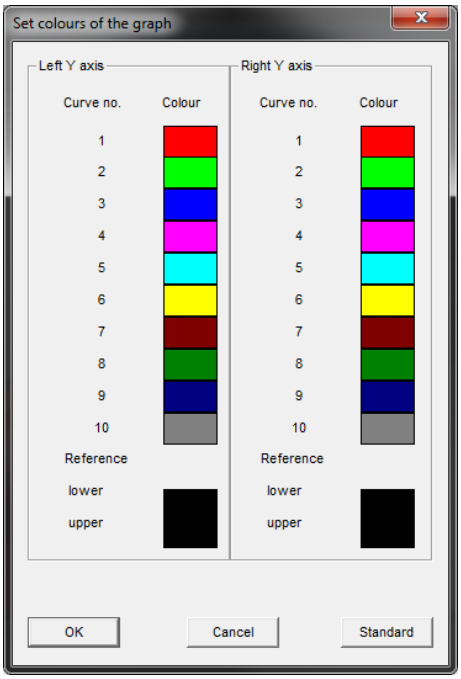


Fig. 38: Colours of the curves settings in the graph window

⇨ Click [OK], to apply the changed colour selection to the individual curves (bars).
⇨ To restore the colour selection, click the [Standard] button.
⇨ To discard the changes, click the [Cancel] button.

Menu function │Type of curves│:
Via the menu function │Type of curves│, the display of the curves can be defined.
⇨ In the graph window, click on the menu bar item │Extras│ and select │Type of curves│ from the context menu. The corresponding dialogue box opens.
⇨ Check the ⟨with marking⟩ checkbox, if the measurement curves are to be displayed with a marking of the d_{10}, d_{50} and d_{90} measurement points.
⇨ Click [OK] to apply the changes.
⇨ To discard the changes, click the [Cancel] button.

Menu function │Type of bars│:
Via the menu function │Type of bars│, the display of the bars for the fractions can be defined.
⇨ In the graph window, click on the menu bar item │Extras│ and select │Type of bars│ from the context menu. The dialogue box for selecting the type of bars opens.
⇨ Select the desired type of bar for the left and right Y axis from the dropdown list.
⇨ Click [OK] to apply the changes.
⇨ To discard the changes, click the [Cancel] button.

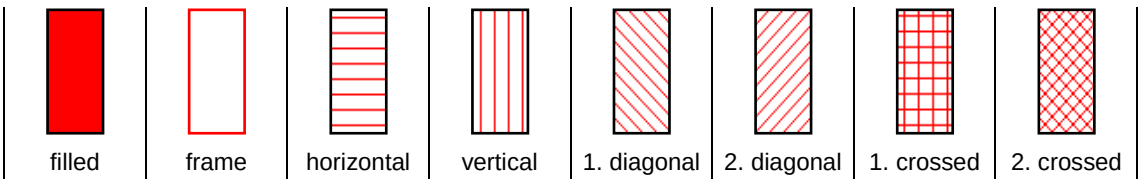


Fig. 39: Available types of bars

ⓘ As soon as more than one measurement curve is displayed in the graph window, the bar type "frame" is used.

Menu function │Grid│:
Via the menu function │Grid│, the display of the grid can be defined.

⇨ In the graph window, click on the menu bar item │Extras│ and select │Grid│ from the context menu. The dialogue box for selecting the type of grid opens.
⇨ Select one of the two radio buttons, to display the grid lines either solid or dashed.
⇨ Click the [Select colour] button to set the colour of the grid lines. The corresponding dialogue box opens.
⇨ Select one of the basic colours, or define a new colour via the [Define Custom Colors >>] button.
⇨ Confirm the colour selection with [OK].
⇨ To abort the colour selection, click the [Cancel] button.

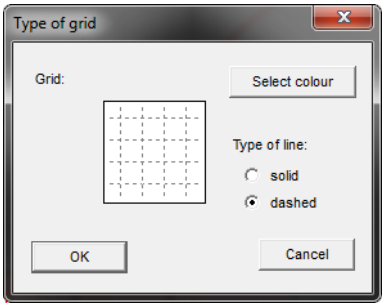


Fig. 40: Type of grid settings

⇨ Click [OK] to apply the changes.
⇨ To discard the changes, click the [Cancel] button.

Menu function │Legend│:
Via the menu function │Legend│, the display of the legend (labelling of the measurement curves) can be defined.

⇨ In the graph window, click on the menu bar item │Extras│ and select │Legend│ from the context menu. The dialogue box for setting the legend opens.
⇨ Check the ⟨Legend of curves⟩ checkbox, if the legend is to be displayed in the graph window.
⇨ Select the ⟨with one line⟩ radio button, if the marking of the first measurement curve of the Y axis is to be displayed on the left in the legend.
⇨ Select the ⟨with two lines⟩ radio button, if the markings of the first and second measurement curve of the Y axis are to be displayed on the left and right in the legend.
⇨ Select one of the three radio buttons, to display the legend either ⟨without frame⟩, ⟨with frame⟩ or ⟨with shaded frame⟩.
⇨ Click [OK] to apply the changes.
⇨ To discard the changes, click the [Cancel] button.

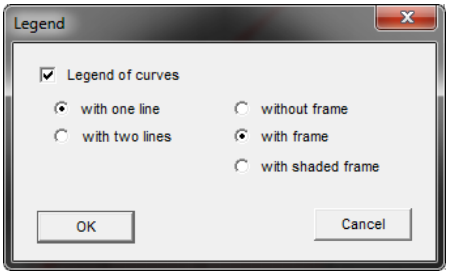


Fig. 41: Legend settings

Menu function │Type of reference curves│:
Via the menu function │Type of reference curves│, the display of the reference curves can be defined.

⇨ In the graph window, click on the menu bar item │Extras│ and select │Type of reference curves│ from the context menu. The corresponding dialogue box opens.
⇨ Check the ⟨Representation as curves⟩ checkbox, if the individual reference points are to be connected by lines and thus be represented as a curve.
⇨ Check the ⟨with marking⟩ checkbox, if the reference curves are to be displayed with a marking of the individual reference points.
⇨ Click [OK] to apply the changes.
⇨ To discard the changes, click the [Cancel] button.

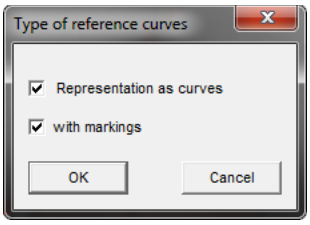


Fig. 42: Reference curves settings

4.4.3.5 Functions of the Menu Bar Item "Help"

The menu bar item │Help│ opens the manual as PDF file.

4.4.4 Graph, Shape Characteristics

Via the menu function │Graph, shape characteristics│, the measurement results of the particle shapes are displayed graphically. The X axis indicates the currently selected particle shape, while the Y axis represents the currently selected distribution.

⇨ In the main window, click on the menu bar item │Results│ and select │Graph, shape characteristics│ from the context menu. The graph window of shape characteristics opens. Alternatively, the evaluation window can also be opened via the icon in the tool bar (**B**) of the main window.

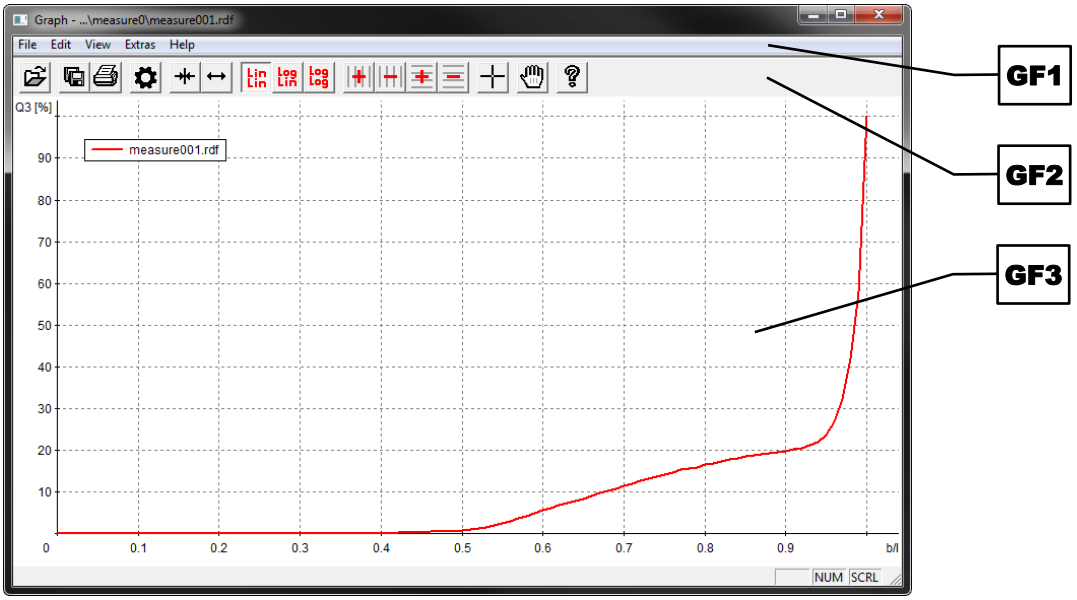


Fig. 43: Graph window of shape characteristics

In the client area (**GF3**) of the graph window of shape characteristics up to two characteristics can be displayed simultaneously. Furthermore, up to nine comparison files can be loaded additionally.

All functions of the graph window of shape characteristics can be accessed via the menu bar (**GF1**). Frequently used functions are also available via the tool bar (**GF2**). In the following table the icons are summarised.

Icon	Menu function / description
	│File│Read comparison file│
	│Edit│Copy│
	│File│Print│
	│View│Characteristics│
	Scales the X and Y axis so that the complete measurement range is displayed
	Expands the measurement range in the direction of the X and Y axis
	Linear display of the X axis, linear display of the Y axis
	Logarithmic display of the X axis, linear display of the Y axis
	Logarithmic display of the X axis, logarithmic display of the Y axis
	Adds vertical grid lines

	Removes vertical grid lines
	Adds horizontal grid lines
	Removes horizontal grid lines
	|View| Activate/deactivate cross hairs |
	|View| Hand tool |
	|Help|

Zooming in the display in the direction of the X and Y axis is possible by dragging over the area of interest using the right mouse button. By clicking the  icon, the original view is restored.

NOTICE If any changes of the settings made here shall remain effective also in subsequent measurements, the task file must be saved anew after the modification (→ Chapter "Save Task File").

4.4.4.1 Functions of the Menu Bar Item "File"

The menu bar item \|File\| contains menu functions for reading comparison files, for printing the window content and for closing the evaluation window.

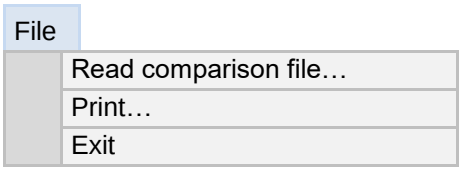


Fig. 44: Graph window of shape characteristics: menu functions of the menu bar item \|File\|

Menu function \|Read comparison file\|:
Via the menu function \|Read comparison file\|, up to nine additional measurement results can be displayed in the evaluation window.

⇨ In the evaluation window, click on the menu bar item \|File\| and select \|Read comparison file\| from the context menu. The "Open File" dialogue box opens.
⇨ Select the desired comparison files.
⇨ Click the [Open] button. The dialogue box closes and the selected comparison files are read.
⇨ To abort the process, click the [Cancel] button.

The individual comparison files can be removed again by right-clicking on the respective file name in the legend. When closing the evaluation window, all comparison files are removed again.

NOTICE Each of the individual comparison files is displayed with the settings of that task file with which it was created. The measurement results can therefore have additional deviations due to different fitting files or shape parameter settings.

In order to display all comparison files with the settings of the same task file, the desired task file must also be reloaded after all desired comparison files are loaded (→ Chapter "Load Task File"). This ensures that the same task file is used for the display of all comparison files in the evaluation window.

NOTICE The loaded comparison files are not displayed in the report. However, in the evaluation window, the comparison files can be printed via the menu function \|Print\|, or copied to the clipboard via the menu function \|Copy\|.

Menu function │Print│:
Via the menu function │Print│ the content of the evaluation window can be printed.
⇨ In the evaluation window, click on the menu bar item │File│ and select │Print│ from the context menu. The printer configuration dialogue box opens.
⇨ Make the desired print settings.
⇨ Click [OK] to print the content of the evaluation window.
⇨ To abort the process, click the [Cancel] button.

NOTICE For better identification, the file names of the raw data file (RDF file) and the task file (AFG file) are inserted as header.

NOTICE The font size and font type are defined by the setting in the menu function │Printer font│ of the main window (→ Chapter "Printer Font").

Menu function │Exit│:
Via the menu function │Exit│, the evaluation window can be closed.
⇨ In the evaluation window, click on the menu bar item │File│ and select │Exit│ from the context menu. The evaluation window closes.

4.4.4.2 Functions of the Menu Bar Item "Edit"

The menu bar item │Edit│ contains a menu function for copying the results to the clipboard.

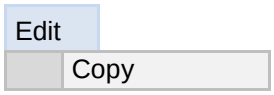


Fig. 45: Graph window of shape characteristics: menu function of the menu bar item │Edit│

Menu function │Copy│:
Via the menu function │Copy│, the content of the evaluation window is copied to the clipboard as graphic.
⇨ In the evaluation window, click on the menu bar item │Edit│ and select │Copy│ from the context menu. The corresponding data of the currently loaded RDF file are copied as graphic to the clipboard.

NOTICE For better identification, the file names of the raw data file (RDF file) and the task file (AFG file) are inserted as header.

4.4.4.3 Functions of the Menu Bar Item "View"

The menu bar item │View│ contains menu functions for selecting the characteristics and units to be displayed.

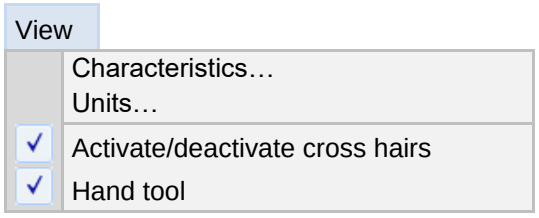


Fig. 46: Graph window of shape characteristics: menu functions of the menu bar item │View│

Menu function │Characteristics│:
Via the menu function │Characteristics│, the characteristics for the X axis and both Y axes can be selected.

⇨ In the graph window of shape characteristics, click on the menu bar item │View│ and select │Characteristics│ from the context menu. The dialogue box of the graph settings opens.
Alternatively, the dialogue box can also be opened via the icon in the tool bar (**GF2**) of the graph window of shape characteristics.
⇨ Make the desired modifications.
⇨ Click [OK] to apply the settings.
⇨ To discard the changes, click the [Cancel] button.

Depending on the selection of the characteristic for the X axis, different setting options are available in the dialogue box. The display in the graph window of shape characteristics is accordingly as follows:

– if a shape characteristic is assigned to the X axis, a threshold-dependent distribution Q(shape) is displayed in the client area (**GF3**).
– if the particle size "x" is assigned to the X axis, a class-dependent distribution shape(x) is displayed in the client area (**GF3**).

The two different dialogue boxes of the menu function │Characteristics│ for a Q(shape) distribution and shape(x) distribution are described below.

Dialogue box of the characteristics for a Q(shape) distribution:

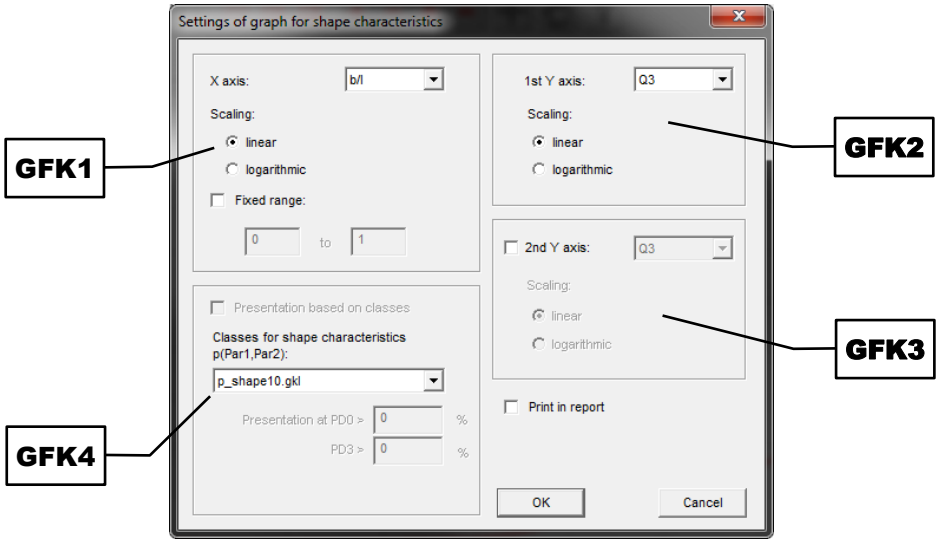


Fig. 47: Setting of the graph window for a Q(shape) distribution

⇨ Select the shape characteristic to be displayed from the dropdown list in the section of the X axis (**GFK1**).
⇨ Select the scaling in the section of the X axis (**GFK1**).
⇨ Enter, if desired, a fixed range for the X axis.
⇨ Select the characteristic to be displayed from the dropdown list in the section of the first Y axis (**GFK2**).
⇨ Select the scaling in the section of the first Y axis (**GFK2**).
⇨ Select, if desired, the characteristic to be displayed from the dropdown list in the section of the second Y axis (**GFK3**).
⇨ Select the scaling in the section of the second Y axis (**GFK3**).
⇨ Select the desired size class file for display in the graph window of shape characteristics from the dropdown list (**GFK4**). ***NOTICE*** A suitable size class file must be selected for correct display. The size class range for shape characteristics is always between 0 and 1. The preinstalled size class file "p_shape10.gkl" lists the size classes between 0 and 1 in

steps of 0.1. Furthermore, the size class file selected here is also used for the display in the table windows Q(shape) and shape(Q).

⇨ Check the ⟨Print in report⟩ checkbox, if the client area of the graph window of shape characteristics (**GF3**) is to be printed in the report (measurement record).

⇨ Click [OK] to apply the settings.

⇨ To discard the changes, click the [Cancel] button.

Dialogue box of the characteristics for a shape(x) distribution:

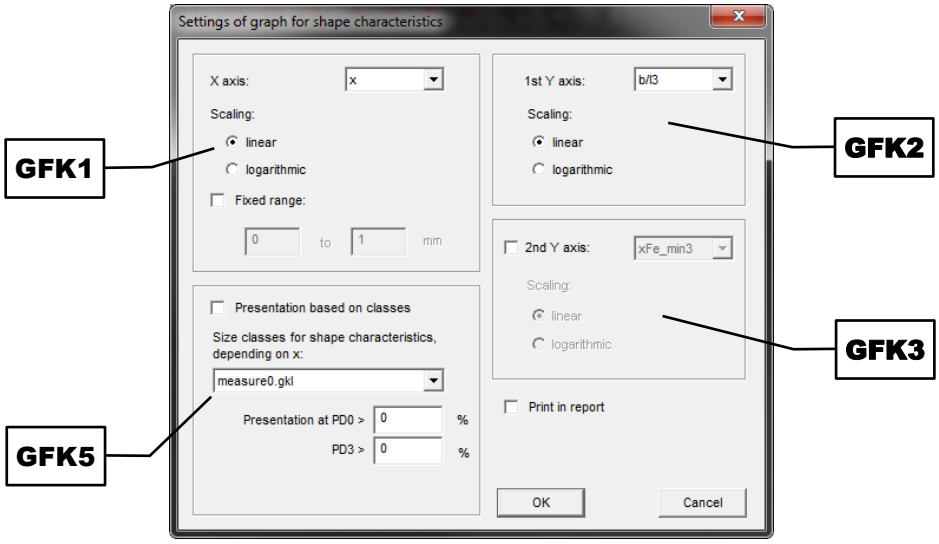


Fig. 48: Setting of the graph window for a shape(x) distribution

⇨ Select the particle size "x" from the dropdown list in the section of the X axis (**GFK1**).

⇨ Select the scaling in the section of the X axis (**GFK1**).

⇨ Enter, if desired, a fixed range for the X axis.

⇨ Select the characteristic to be displayed from the dropdown list in the section of the first Y axis (**GFK2**).

⇨ Select the scaling in the section of the first Y axis (**GFK2**).

⇨ Select, if desired, the characteristic to be displayed from the dropdown list in the section of the second Y axis (**GFK3**).

⇨ Select the scaling in the section of the second Y axis (**GFK3**).

⇨ Select the desired size class file for display in the graph window of shape characteristics from the dropdown list (**GFK5**).

⇨ Check the ⟨Presentation based on classes⟩ checkbox, if the measurement curve is to be displayed in discrete steps according to the loaded size class file (GKL file).

⇨ Enter, if desired, a limit value for the display of the individual size classes in the respective edit boxes. With this function, size classes can be hidden which contain an insufficient number of measured particles in order to be of statistical relevance. Typically, a value of 1 % is selected here.

⇨ Check the ⟨Print in report⟩ checkbox, if the client area of the graph window of shape characteristics (**GF3**) is to be printed in the report (measurement record).

⇨ Click [OK] to apply the settings.

⇨ To discard the changes, click the [Cancel] button.

Menu function │Units│:

Via the menu function │Units│, the measurement units to be displayed can be selected.

⇨ In the evaluation window, click on the menu bar item │View│ and select │Units│ from the context menu. The dialogue box for selecting the measurement units opens.

⇨ Make the desired settings as described in Chapter "Table".

⇨ Click [OK] to apply the settings.
⇨ To discard the changes, click the [Cancel] button.

NOTICE The dialogue box of the measurement units is the same in the table window, the graph window, the graph window of shape characteristics, the characteristics window and the daily report window. A modification in one evaluation window therefore also affects the display in the other evaluation windows.

Menu function │Activate/deactivate cross hairs│:
Via the menu function │Activate/deactivate cross hairs│, cross hairs can be displayed which continuously show the X and Y coordinates of the current mouse pointer position.
⇨ In the evaluation window, click on the menu bar item │View│ and select │Activate/deactivate cross hairs│ from the context menu. The cross hairs are enabled and the X and Y coordinates of the mouse pointer position are displayed. In addition, the activated function is marked with the ✓ icon in front of the context menu item.
⇨ To disable the cross hairs, click again on the context menu item │Activate/deactivate cross hairs│. The context menu item is now unmarked.

Menu function │Hand tool│:
Via the menu function │Hand tool│, the mouse pointer can be converted into a hand tool which can be used to move the graph in the evaluation window by clicking and dragging.
⇨ In the evaluation window, click on the menu bar item │View│ and select │Hand tool│ from the context menu. The mouse pointer converts to an open hand.
⇨ Click on the graph, keep the mouse button pressed and drag the graph to the desired position. During the positioning the mouse pointer is displayed as a closed hand. In addition, the activated function is marked with the ✓ icon in front of the context menu item.
⇨ To deactivate the hand tool, click again on the context menu item │Hand tool│. The context menu item is now unmarked.

NOTICE Either the cross hairs can be enabled, or the hand tool can be used.

4.4.4.4 Functions of the Menu Bar Item "Extras"

The menu bar item │Extras│ contains menu functions for selecting the colour of curves, the type of curves, the type of bars, the type of grid, and the legend.

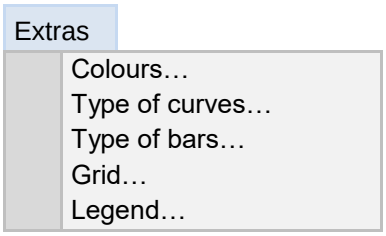


Fig. 49: Graph window of shape characteristics: menu functions of the menu bar item │Extras│

Menu function │Colours│:
The menu function │Colours│ allows for the free colour mapping of each curve (and each bar).
⇨ In the evaluation window, click on the menu bar item │Extras│ and select │Colours│ from the context menu. The corresponding dialogue box opens.
⇨ Make the desired settings as described in Chapter "Graph".
⇨ Click [OK] to apply the settings.
⇨ To discard the changes, click the [Cancel] button.

Menu function │Type of curves│:
Via the menu function │Type of curves│, the display of the curves can be defined.
⇨ In the evaluation window, click on the menu bar item │Extras│ and select │Type of curves│ from the context menu. The corresponding dialogue box opens.
⇨ Make the desired settings as described in Chapter "Graph".
⇨ Click [OK] to apply the settings.
⇨ To discard the changes, click the [Cancel] button.

Menu function │Type of bars│:
Via the menu function │Type of bars│, the display of the bars for the fractions can be defined.
⇨ In the evaluation window, click on the menu bar item │Extras│ and select │Type of bars│ from the context menu. The dialogue box for selecting the type of bars opens.
⇨ Make the desired settings as described in Chapter "Graph".
⇨ Click [OK] to apply the settings.
⇨ To discard the changes, click the [Cancel] button.

Menu function │Grid│:
Via the menu function │Grid│, the display of the grid can be defined.
⇨ In the evaluation window, click on the menu bar item │Extras│ and select │Grid│ from the context menu. The dialogue box for selecting the type of grid opens.
⇨ Make the desired settings as described in Chapter "Graph".
⇨ Click [OK] to apply the settings.
⇨ To discard the changes, click the [Cancel] button.

Menu function │Legend│:
Via the menu function │Legend│, the display of the legend (labelling of the measurement curves) can be defined.
⇨ In the evaluation window, click on the menu bar item │Extras│ and select │Legend│ from the context menu. The dialogue box for setting the legend opens.
⇨ Make the desired settings as described in Chapter "Graph".
⇨ Click [OK] to apply the settings.
⇨ To discard the changes, click the [Cancel] button.

4.4.4.5 Functions of the Menu Bar Item "Help"

The menu bar item │Help│ opens the manual as PDF file.

4.4.5 Average Measurements

Via the menu function │Average measurements│, an average of several measurement results can be calculated and displayed in the evaluation windows.
⇨ In the main window, click on the menu bar item │Results│ and select │Average measurements│ from the context menu. The "Open File" dialogue box opens.
⇨ Navigate to the directory containing the RDF files.
⇨ Select up to 50 files of the same task file, from which the mean value is to be calculated.
⇨ Click the [Open] button. The dialogue box closes and the mean value is calculated from the selected files.
⇨ To abort the process, click the [Cancel] button.

If no evaluation window is yet open, the graph window opens and the mean value is graphically displayed. Otherwise, the content of already opened evaluation windows is updated. In each evaluation window "Mean value" appears in the window header. In the graph window and the graph window of shape characteristics, "Mean value" is also written in the legend.

Prerequisite for the mean value formation is the use of the same task file for all of the RDF files to be averaged. If this is not the case, a corresponding warning is issued.

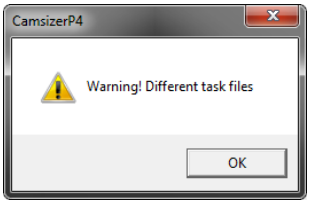


Fig. 50: Warning, that the selected RDF files do have different task files

The result of the mean value can be subsequently stored as RDF or CDF file via the main menu functions │File│Save result file│ or │File│Save complete data file│, respectively, or exported via the main menu function │File│Export│ (→ Chapters "Save result file", "Save complete data file" and "Export").

4.4.6 Trend Analysis

Via the menu function │Trend analysis│, a series of measurements can be evaluated, in order to graphically monitor the chronological course of the selected characteristics and their changes. By default, the characteristic x_{50} is displayed (particle size x at position Q(x) = 50 %). The X axis either displays the file number (**TR3**) or the time (date of the measurement), whereas the Y axis displays the selected characteristic.

⇨ In the main window, click on the menu bar item │Results│ and select │Trend analysis│ from the context menu. The "Open File" dialogue box opens.
⇨ Navigate to the directory containing the RDF files.
⇨ Select an arbitrary file of the desired series of measurements, from which the trend analysis is to be created, or mark all desired RDF files directly.
⇨ Click the [Open] button. The dialogue box closes and the "Trend analysis" dialogue box is opened.
⇨ To abort the process, click the [Cancel] button.

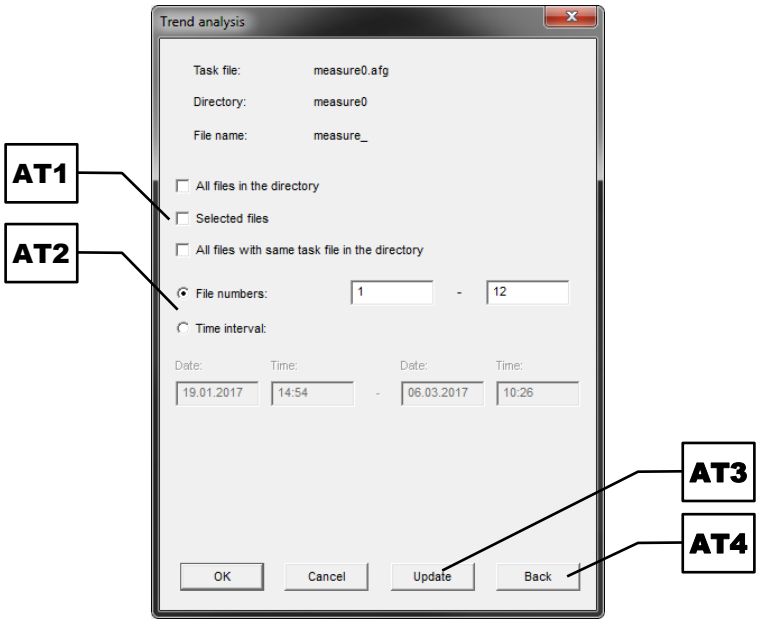


Fig. 51: Dialogue box for file selection for the trend analysis

NOTICE A trend analysis should be carried out only with measurement results from the same series of measurements (i.e. measured with the same task file). The files must all be located in the same directory, but not necessarily have the same file name.

With the selection of the first RDF file, the task file, the storage directory, as well as the file name are specified and displayed in the upper section of the "Trend analysis" dialogue box.

⇨ Select one of the three checkboxes (**AT1**) for the selection of the RDF files to be analysed:

- ⟨All files in the directory⟩: all RDF files in the specified directory will be added to the trend analysis, regardless of the file name.
- ⟨Selected files⟩: all files previously marked in the "Open File" dialogue box will be added to the trend analysis.
- ⟨All files with the same task file in the directory⟩: all RDF files in the specified directory having the same task file will be added to the trend analysis, regardless of the file name.

If one of the checkboxes (**AT1**) is selected, only the radio button ⟨Time interval⟩ (**AT2**) is enabled. By entering a specific time interval, the selection can be restricted further.
If none of the checkboxes (**AT1**) is selected, the selection of the RDF files to by analysed can also be done via the two radio buttons (**AT2**):

- ⟨File numbers⟩: all RDF files with the specified file name are added to the trend analysis, whereas the range of the file numbers can be selected.
- ⟨Time interval⟩: all RDF files with the specified file name are added to the trend analysis, whereas the time interval can be selected.

⇨ If a modification in the setting is made, click the [Update] button (**AT3**) to update the edit boxes of the time interval and the file number accordingly.
⇨ Click [OK], to confirm the selection.
⇨ To select another series of measurements, click the [Back] button (**AT4**). The "Open File" dialogue box opens again.
⇨ To abort the process, click the [Cancel] button.

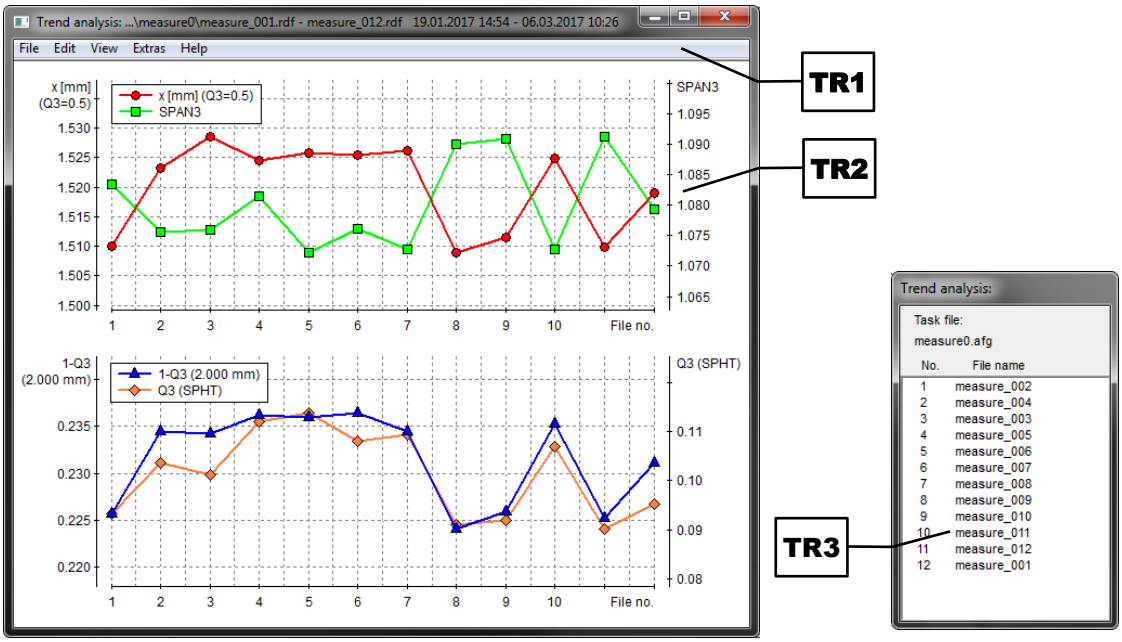


Fig. 52: Trend analysis window

In the client area (**TR2**) of the trend analysis window, up to two coordinate systems, each with up to two characteristics can be displayed simultaneously. The selected RDF files are listed as file list in a separate dialogue box (**TR3**).

All functions of the trend analysis window can be accessed via the menu bar (**TR1**).

NOTICE If any changes of the settings made here shall remain effective also in subsequent measurements, the task file must be saved anew after the modification (→ Chapter "Save Task File").

4.4.6.1 Functions of the Menu Bar Item "File"

The menu bar item │File│ contains menu functions for printing the window content and for closing the evaluation window.

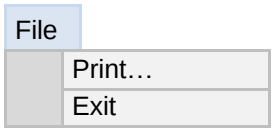


Fig. 53: Trend analysis window: menu functions of the menu bar item │File│

Menu function │Print│:
Via the menu function │Print│ the content of the evaluation window can be printed.
- ⇨ In the evaluation window, click on the menu bar item │File│ and select │Print│ from the context menu. The printer configuration dialogue box opens.
- ⇨ Make the desired print settings.
- ⇨ Click [OK] to print the content of the evaluation window.
- ⇨ To abort the process, click the [Cancel] button.

NOTICE For better identification, the file names of the raw data file (RDF file) and the task file (AFG file) are inserted as header.

NOTICE The font size and font type are defined by the setting in the menu function │Printer font│ of the main window (→ Chapter "Printer Font").

Menu function │Exit│:
Via the menu function │Exit│, the evaluation window can be closed.
- ⇨ In the evaluation window, click on the menu bar item │File│ and select │Exit│ from the context menu. The evaluation window closes.
- ⇨ Click [Yes] in the following dialogue box to save the trend analysis settings in the task file.
- ⇨ To discard the trend analysis settings, click [No].

4.4.6.2 Functions of the Menu Bar Item "Edit"

The menu bar item │Edit│ contains a menu function for copying the results to the clipboard.

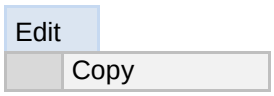


Fig. 54: Trend analysis window: menu function of the menu bar item │Edit│

Menu function │Copy│:
Via the menu function │Copy│, the content of the evaluation window is copied to the clipboard as graphic.

⇨ In the evaluation window, click on the menu bar item │Edit│ and select │Copy│ from the context menu. The corresponding data of the currently loaded RDF file are copied as graphic to the clipboard.

NOTICE For better identification, the file names of the raw data file (RDF file) and the task file (AFG file) are inserted as header.

4.4.6.3 Functions of the Menu Bar Item "View"

The menu bar item │View│ contains menu functions for selecting the characteristics and units to be displayed.

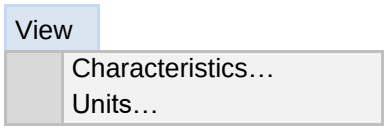


Fig. 55: Trend analysis window: menu functions of the menu bar item │View│

Menu function │Characteristics│:
Via the menu function │Characteristics│, sample-specific characteristics to be displayed can be selected.

⇨ In the trend analysis window, click on the menu bar item │View│ and select │Characteristics│ from the context menu. The dialogue box for selecting the characteristics opens.

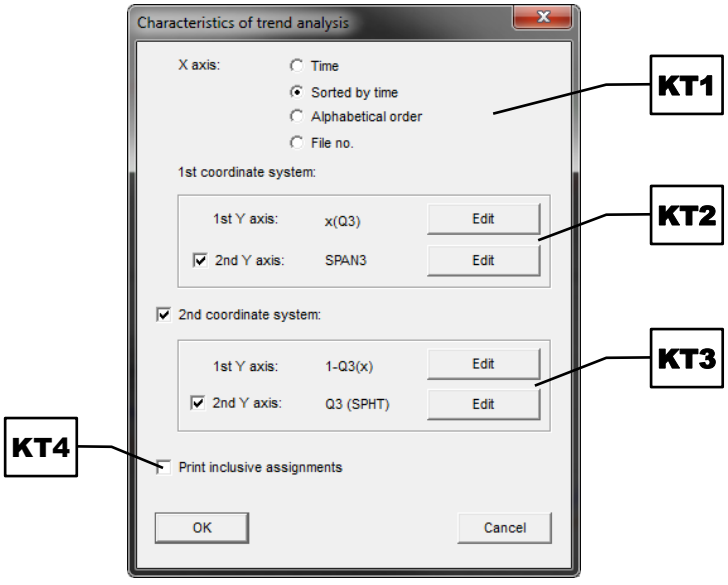


Fig. 56: Setting options of the trend analysis window

⇨ Select one of the four radio buttons in the section of the X axis (**KT1**) to set the X axis accordingly:
- ⟨Time⟩: the X axis indicates the time elapsed between the individual measurements. Hereby, the creation date of the oldest RDF file is defined as the origin of the coordinate system.
- ⟨Sorted by time⟩: the X axis indicates the measurements consecutively numbered and sorted by creation date.
- ⟨Alphabetical order⟩: the X axis indicates the measurements consecutively numbered and sorted by file name.

– ⟨File no.⟩: the X axis indicates the file number. This radio button is only enabled, if all selected RDF files have the same file name and differ only by a consecutive number.

⇨ Click on the [Edit] button(s) in the section of the first coordinate system (**KT2**) in order to select the characteristic for the first and/or second Y axis. The dialogue box for selecting the characteristic of the Y axis opens.

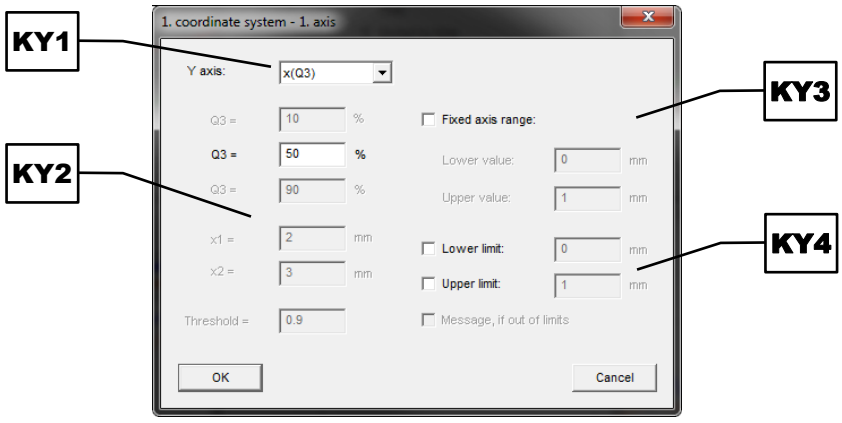


Fig. 57: Selection of the characteristic for the Y axis

⇨ Select the characteristic of the Y axis from the dropdown list (**KY1**). Depending on the selection, different edit boxes (**KY2**) will be activated. ***NOTICE*** The available characteristics depend on the configuration of the software. A detailed description of the individual characteristics can be found in Chapter "List of Characteristics".

⇨ Enter the desired value in the relevant edit boxes (**KY2**).

⇨ Enter, if desired, a fixed axis range (**KY3**) for the Y axis. Otherwise, the limits are set automatically.

In the trend analysis, limit lines for the first Y axis can be defined if required, illustrating the exceeding or falling below of certain thresholds.

⇨ Enter, if desired, fixed limits (**KY4**) for the Y axis.

In the graph, the fixed upper and/or lower limit is indicated by a line. In addition, a message can be displayed, if the measurement results fall below or exceed the fixed limits.

If desired, a second coordinate system (**KT3**) can be displayed in the trend analysis window by checking the respective checkbox. The selection of the characteristics is carried out in the same way as described for the first coordinate system. The second coordinate system is always displayed below the first coordinate system in the trend analysis window.

⇨ Check the ⟨Print inclusive assignments⟩ checkbox (**KT4**) to output the file list (**TR3**) as well, when printing.

⇨ Click [OK] to apply the settings.

⇨ To discard the changes, click the [Cancel] button.

Menu function │Units│:

Via the menu function │Units│, the measurement units to be displayed can be selected.

⇨ In the trend analysis window, click on the menu bar item │View│ and select │Units│ from the context menu. The dialogue box for selecting the measurement units opens.

⇨ Select whether the size classes are to be displayed in mm, µm or inch.

⇨ Select whether the distributions are to be displayed normalised in the rage of 0 – 1 or in percent.

- ⇨ Select whether the fractions are to be displayed normalised in the rage of 0 – 1 or in percent.
- ⇨ Select whether the time is to be displayed in minutes, hours or days for the X axis when configured accordingly.
- ⇨ Click [OK] to apply the settings.
- ⇨ To discard the changes, click the [Cancel] button.

4.4.6.4 Functions of the Menu Bar Item "Extras"

The menu bar item │Extras│ contains menu functions for selecting the colour of curves, the type of curves and the type of grid.

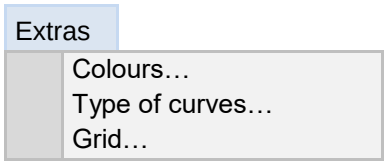


Fig. 58: Trend analysis window: menu functions of the menu bar item │Extras│

Menu function │Colours│:
The menu function │Colours│ allows for the free colour mapping of each curve and limit line.

- ⇨ In the trend analysis window, click on the menu bar item │Extras│ and select │Colours│ from the context menu. The corresponding dialogue box opens.
- ⇨ Click on the colour field of an arbitrary Y axis or limit line of the first or second coordinate system. The dialogue box for selecting the colours opens.
- ⇨ Select one of the basic colours, or define a new colour via the [Define Custom Colors >>] button.
- ⇨ Confirm the colour selection with [OK].
- ⇨ To abort the colour selection, click the [Cancel] button.

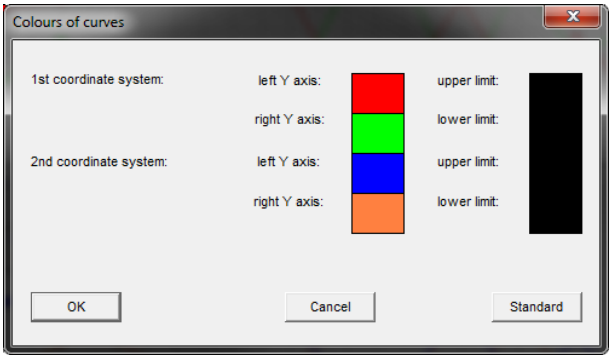


Fig. 59: Settings for the colour of the curves in the trend analysis window

- ⇨ Click [OK], to apply the changed colour selection to the individual Y axes and/or limit lines.
- ⇨ To restore the colour selection, click the [Standard] button.
- ⇨ To discard the changes, click the [Cancel] button.

Menu function │Type of curves│:
Via the menu function │Type of curves│, the display of the curves can be defined.

- ⇨ In the evaluation window, click on the menu bar item │Extras│ and select │Type of curves│ from the context menu. The corresponding dialogue box opens.
- ⇨ Make the desired settings as described in Chapter "Graph".
- ⇨ Click [OK] to apply the settings.
- ⇨ To discard the changes, click the [Cancel] button.

Menu function │Grid│:

Via the menu function │Grid│, the display of the grid can be defined.

⇨ In the evaluation window, click on the menu bar item │Extras│ and select │Grid│ from the context menu. The dialogue box for selecting the type of grid opens.

⇨ Make the desired settings as described in Chapter "Graph".

⇨ Click [OK] to apply the settings.

⇨ To discard the changes, click the [Cancel] button.

4.4.6.5 Functions of the Menu Bar Item "Help"

The menu bar item │Help│ opens the manual as PDF file.

4.4.7 Daily Report

Via the menu function │Daily report│, the data of a series of measurements can be compared in tabular form, in order to analyse and record the chronological course of the selected characteristics and their changes.

⇨ In the main window, click on the menu bar item │Results│ and select │Daily report│ from the context menu. The "Open File" dialogue box opens.

NOTICE A daily report should be carried out only with measurement results from the same series of measurements (i.e. measured with the same task file). The files must all be located in the same directory, but not necessarily have the same file name.

The file selection is carried out analogous to the trend analysis (→ Chapter "Trend Analysis").

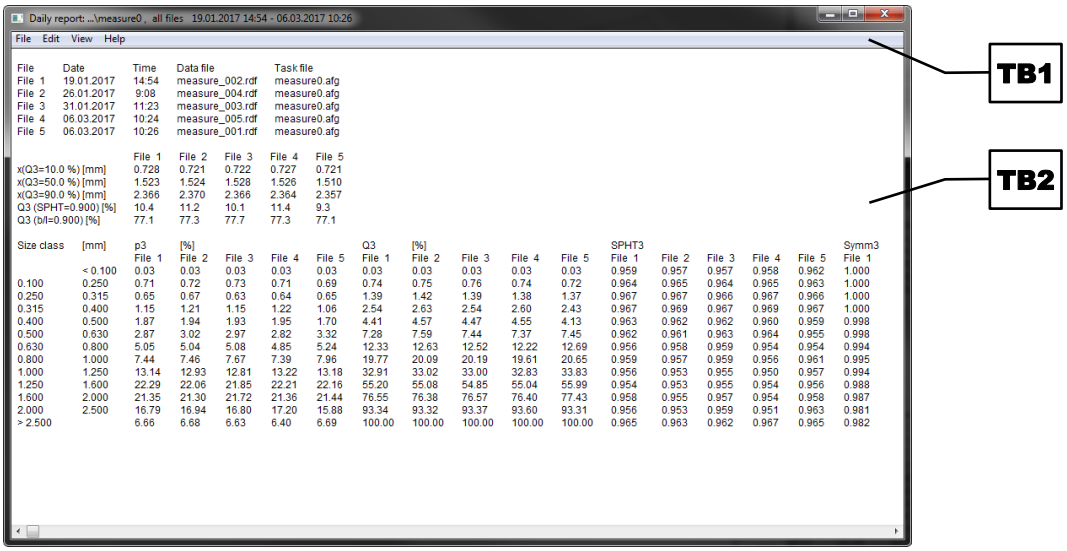


Fig. 60: Daily report window

In the client area (**TB2**) of the daily report window, size class-dependent distributions as well as sample-specific characteristics can be displayed. The selected RDF files are listed in the upper section of the daily report window.

All functions of the daily report window can be accessed via the menu bar (**TB1**).

NOTICE If any changes of the settings made here shall remain effective also in subsequent measurements, the task file must be saved anew after the modification (→ Chapter "Save Task File").

4.4.7.1 Functions of the Menu Bar Item "File"

The menu bar item │File│ contains menu functions for exporting and printing the window content and for closing the evaluation window.

Fig. 61: Daily report window: menu functions of the menu bar item │File│

Menu function │Export│:
Via the menu function │Export│, the content of the daily report window can be exported as an Excel-readable file (XLD or XLE file).

- ⇨ In the daily report window, click on the menu bar item │File│ and select │Export│ from the context menu. The corresponding dialogue box opens.
- ⇨ Navigate to the directory to which the export file is to be saved.
- ⇨ Select the desired format from the dropdown list.
- ⇨ Enter the desired file name.
- ⇨ Click the [Save] button to store the export file.
- ⇨ To abort the process, click the [Cancel] button.

Menu function │Print│:
Via the menu function │Print│ the content of the evaluation window can be printed.

- ⇨ In the evaluation window, click on the menu bar item │File│ and select │Print│ from the context menu. The printer configuration dialogue box opens.
- ⇨ Make the desired print settings.
- ⇨ Click [OK] to print the content of the evaluation window.
- ⇨ To abort the process, click the [Cancel] button.

NOTICE The font size and font type are defined by the setting in the menu function │Printer font│ of the main window (→ Chapter "Printer Font").

Menu function │Exit│:
Via the menu function │Exit│, the evaluation window can be closed.

- ⇨ In the evaluation window, click on the menu bar item │File│ and select │Exit│ from the context menu. The evaluation window closes.

4.4.7.2 Functions of the Menu Bar Item "Edit"

The menu bar item │Edit│ contains a menu function for copying the results to the clipboard.

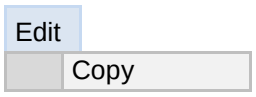


Fig. 62: Daily report window: menu function of the menu bar item │Edit│

Menu function │Copy│:
Via the menu function │Copy│, the content of the daily report window is copied to the clipboard in ASCII format (text format). A comma is used as decimal mark.

- ⇨ In the daily report window, click on the menu bar item │Edit│ and select │Copy│ from the context menu. The corresponding data are copied as text to the clipboard.

4.4.7.3 Functions of the Menu Bar Item "View"

The menu bar item │View│ contains menu functions for selecting the characteristics and units to be displayed.

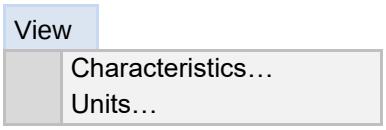


Fig. 63: Daily report window: menu functions of the menu bar item │View│

Menu function │Characteristics│:
Via the menu function │Characteristics│, size class-dependent distributions and/or sample-specific characteristics can be selected.

⇨ In the daily report window, click on the menu bar item │View│ and select │Characteristics│ from the context menu. The corresponding dialogue box opens.

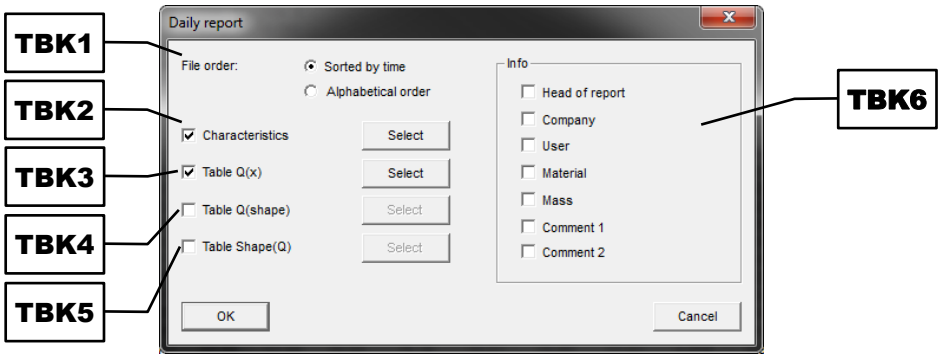


Fig. 64: Setting options of the daily report window

⇨ Select one of the two radio buttons (**TBK1**), to display the files either sorted by time or alphabetically.
⇨ To list **shape characteristics**, check the checkbox (**TBK2**) and click the respective [Select] button. The dialogue box for selecting the characteristics opens. ***NOTICE*** The dialogue box is the same as in the characteristics window. The settings selected here are also used for the display in the characteristics window.
⇨ Make the desired modifications as described in Chapter "Characteristics".
⇨ To list **characteristics for table Q(x)**, check the checkbox (**TBK3**) and click the respective [Select] button. The dialogue box for selecting the characteristics opens. ***NOTICE*** The dialogue box is the same as in the table window for table Q(x). The settings selected here are also used for the display in the table window.
⇨ Make the desired modifications as described in Chapter "Table".
⇨ To list **characteristics for table Q(shape)**, check the checkbox (**TBK4**) and click the respective [Select] button. The dialogue box for selecting the characteristics opens. ***NOTICE*** The dialogue box is the same as in the table window for table Q(shape). The settings selected here are also used for the display in the table window.
⇨ Make the desired modifications as described in Chapter "Table".
⇨ To list **characteristics for table shape(Q)**, check the checkbox (**TBK5**) and click the respective [Select] button. The dialogue box for selecting the characteristics opens. ***NOTICE*** The dialogue box is the same as in the table window for table shape(Q). The settings selected here are also used for the display in the table window.
⇨ Make the desired modifications as described in Chapter "Table".

⇨ In the "Info" section (**TBK6**), check the desired checkboxes, to display the information entered for the report in section (**MS3**) of the "Save task file" tab in the dialogue box of the measurement conditions (→ Chapters "Save Task File") for the selected RDF files.
⇨ Click [OK] to apply the settings.
⇨ To discard the changes, click the [Cancel] button.

Menu function │Units│:
Via the menu function │Units│, the measurement units to be displayed can be selected.
⇨ In the evaluation window, click on the menu bar item │View│ and select │Units│ from the context menu. The dialogue box for selecting the measurement units opens.
⇨ Make the desired settings as described in Chapter "Table".
⇨ Click [OK] to apply the settings.
⇨ To discard the changes, click the [Cancel] button.

NOTICE The dialogue box of the measurement units is the same in the table window, the graph window, the graph window of shape characteristics, the characteristics window and the daily report window. A modification in one evaluation window therefore also affects the display in the other evaluation windows.

4.4.7.4 Functions of the Menu Bar Item "Help"

The menu bar item │Help│ opens the manual as PDF file.

4.4.8 Combine Sieving and CAMSIZER® X2 Results

Via the menu function │Combine sieving and CAMSIZER® X2 results│, a combination of several measurement results can be calculated and displayed in the evaluation windows. Thus, the results of a sieve analysis can be combined with CAMSIZER® X2 measurement data in order to analyse a sample whose particle size range exceeds the measuring range of the CAMSIZER® X2.

Sample preparation:
In a first step, the sample to be analysed is divided into two subsamples by means of a sieve cut. For example, a sample in the particle size range of 0 mm to 5 mm is divided into the two subsamples 0 mm to ≤ 2 mm and > 2 mm to 5 mm using a test sieve of 2 mm.

Subsequently, the individual subsamples are weighed in order to determine the percentages of mass. For example, 60 % of the sample are located in the particle size range 0 mm to ≤ 2 mm (subsample 1) and 40 % in the particle size range > 2 mm to 5 mm (subsample 2).

The two subsamples are then analysed using the appropriate method. For example, subsample 1 is measured with the CAMSIZER® X2, whereas subsample 2 is analysed with a sieve shaker.

Creating a reference file:
A reference file (REF file) must now be created for the subsample, which has not been measured with the CAMSIZER® X2.
⇨ Create a reference file for the sieve analysis as described in Chapter "Input Reference Distribution".

NOTICE In this respect, ensure that the entire particle size range of the sample is contained in the REF file. Therefore, the first line in the edit box (**RK3**) is to be entered with "0 0". The second line then corresponds to the first reference point of the sieve analysis, for example 2 mm and 60 %.

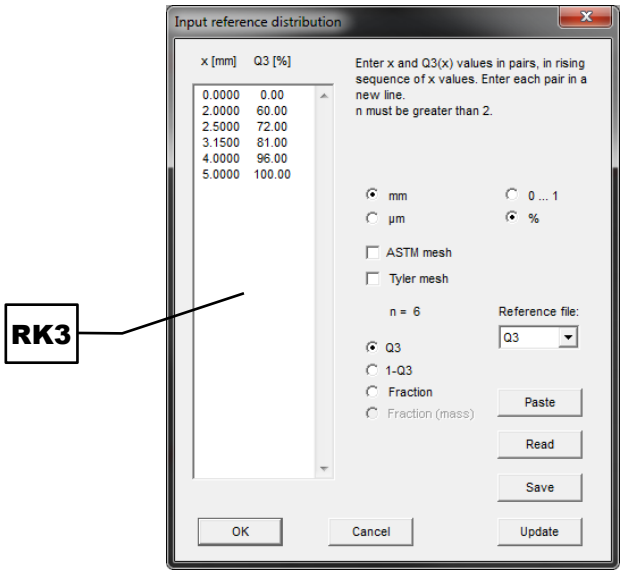


Fig. 65: Input of a reference curve for the combination of sieving and CAMSIZER® X2 results

Combining of results:

- ⇨ In the main window, click on the menu bar item ⎪Results⎪ and select ⎪Combine sieving and CAMSIZER® X2 results⎪ from the context menu. The corresponding dialogue box opens.
- ⇨ Click the [Select] button (**KO1**) to select the reference file of the sieve analysis.
- ⇨ Use the radio buttons (**KO2**) to select, whether the size classes in the edit box (**KO3**) are to be displayed in mm or µm, and the fractions normalised in the rage of 0 – 1 or in percent.
- ⇨ In the edit box (**KO3**), mark the fraction which is to be displayed in the combination by the CAMSIZER® X2 measurement. For example, this is the fraction from 0 mm to 2 mm.
- ⇨ Check the ⟨CAMSIZER® X2 data⟩ checkbox (**KO4**) and click the respective [Select] button. The "Open File" dialogue box opens.
- ⇨ Navigate to the directory containing the desired RDF file.
- ⇨ Click the [Open] button. The dialogue box closes and the selected file is displayed in the edit box (**KO3**) next to the corresponding fraction.
- ⇨ Click [OK]. The dialogue box closes and the combination from the sieving and the CAMSIZER® X2 measurement is calculated.
- ⇨ To abort the process, click the [Cancel] button.

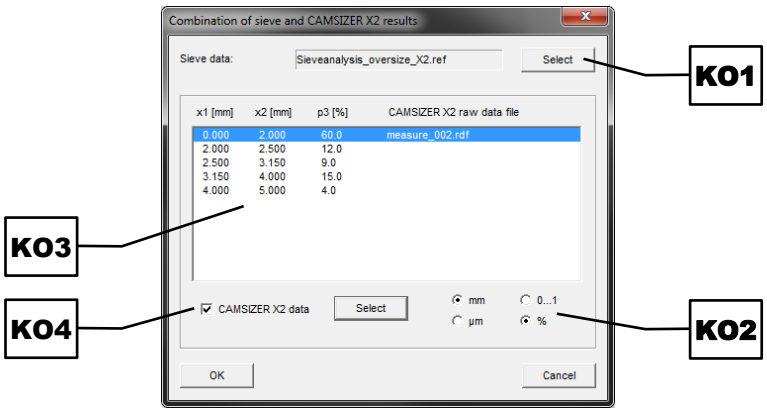


Fig. 66: Combination of sieving and CAMSIZER® X2 measurement

If no evaluation window is yet open, the graph window opens and the combination is graphically displayed. Otherwise, the content of already opened evaluation windows is updated. In each evaluation window "Combination" appears in the window header. In the graph window, "Combination" is also written in the legend.

NOTICE Since a sieve analysis or a REF file does not contain any information on the shape of particles, it is also not possible to open the graph window of shape characteristics. Instead, a corresponding notice is displayed.

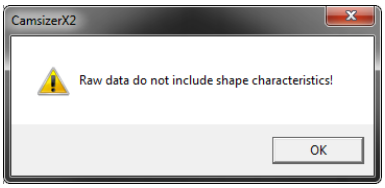


Fig. 67: Notice, that the raw data do not include shape characteristics

The result of the combination can be subsequently stored as RDF or CDF file via the main menu functions │File│Save result file│ or │File│Save complete data file│, respectively, or exported via the main menu function │File│Export│ (→ Chapters "Save result file", "Save complete data file" and "Export").

4.5 Functions of the Main Menu Item "Options"

The main menu item │Options│ contains menu functions for adjusting the measurement parameters and size classes. In addition, reference distributions and threshold values can be entered, as well as fitting files can be created and viewed.

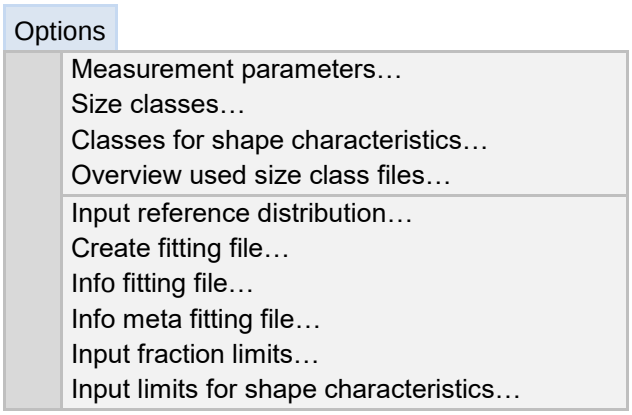


Fig. 68: Menu functions in the main menu item │Options│

In the following subchapters, each menu function of the main menu item │Options│ is described in detail and can be referred to individually.

4.5.1 Measurement Parameters

NOTICE This function is not available in measurement mode.

Via the menu function │Measurement parameters│, the measurement conditions of the currently loaded task file (AFG file) can be modified.

⇨ In the main window, click on the menu bar item │Options│ and select │Measurement parameters│ from the context menu. The dialogue box of the measurement conditions opens.

Dialogue box of the measurement conditions:
The dialogue box of the measurement conditions consists of several tabs. Access to the dialogue box is given via various menu functions, whereby, depending on the menu function, the dialogue box opens with the respective tab on top.

Tab	Access via	Description in Chapter
Feeder and funnel parameters	│File│Load task file│ and subsequent clicking on the [Edit] button, or navigation within the dialogue box	"Feeder and Funnel Parameters" Tab
Cameras (measurement conditions)	│Options│Measurement parameters│, or navigation within the dialogue box	"Cameras (Measurement Parameters)" Tab
Save images	Navigation within the dialogue box	"Save Images" Tab
Settings	Navigation within the dialogue box	"Settings" Tab
Warnings	Navigation within the dialogue box	"Warnings" Tab
Save task file	│File│Save task file│, or navigation within the dialogue box	Save Task File

In the following subchapters, each tab of the dialogue box of the measurement conditions is described in detail and can be referred to individually.

NOTICE If any changes of the settings made here shall remain effective also in subsequent measurements, the task file must be saved anew after the modification (→ Chapter "Save Task File").

4.5.1.1 "Feeder and Funnel Parameters" Tab

The appearance of the dialogue box depends on the measuring method used:

- This chapter describes the dry measurement with the X-Dry module (X-Fall or X-Jet cartridge)
- The wet measurement with the X-Flow module is described in detail in Chapter "Wet Measurement"

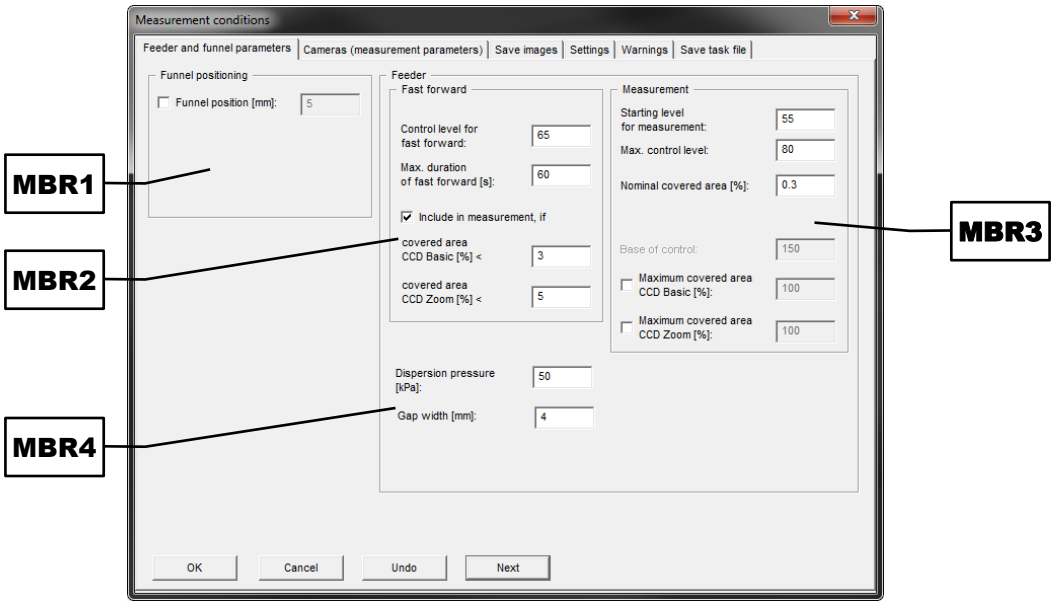


Fig. 69: "Feeder and funnel parameters" tab for the X-Jet cartridge

Funnel positioning (MBR1):

Function	Description
Funnel position [mm]	⇨ Check this checkbox to display a message before measurement informing on the height to which the funnel is to be set. No automatic funnel height adjustment takes place. In order to avoid blockages below the funnel, the funnel should be positioned during the measurement about 2.5 times higher above the feed chute than the largest particle diameter in the sample. ⇨ Enter the desired funnel position in mm in the corresponding edit box.

Feeder during fast forward (MBR2):
During fast forward, the sample material is transported to the sample chamber. The feed chute is controlled by the settings of the fast forward until the first particles fall into the sample chamber. As soon as the measurement starts, the settings in section (**MBR3**) take over the feeder control.

Function	Description
Control level for fast forward	The control level regulates the power of the feeder during fast forward. Is depends on the used feed chute and the properties of the sample material (→ Chapter "Feeder"). In general, the power of the feeder during fast forward is set approx. 10 % higher than during measurement, in order to transport the sample material quickly enough to the sample chamber. ⇨ Enter the desired power of the feeder in percent in the edit box.
Max. duration of fast forward [s]	The maximum fast forward duration is typically set to 30 – 60 seconds. During this time, the sample material should be transported to the sample chamber and the measurement should then be started. ⇨ Enter the desired maximum fast forward duration in seconds in the edit box. If no measurement start was triggered (i.e. no sample material has fallen into the sample chamber) after expiry of the maximum fast forward time, a measurement is started automatically nevertheless. The measurement is then terminated as soon as the set condition for ending the measurement is fulfilled (→ Chapter ""Cameras (measurement parameters)" Tab").
Include in measurement, if covered area CCD Basic [%] < covered area CCD Zoom [%] <	During the fast forward, sample material can fall into the sample chamber even before the actual measurement is triggered. In order to also add these particles to the measurement, maximum covered areas for the individual cameras can be set. ⇨ Check this checkbox to also add those particles to the measurement that have fallen into the sample chamber during fast forward. ⇨ Enter the desired maximum covered area in percent in the edit box for the CCD Basic camera. Images with a higher covered area do not contribute to the measurement result. ⇨ Enter the desired maximum covered area in percent in the edit box for the CCD Zoom camera. Images with a higher covered area do not contribute to the measurement result.

Feeder during measurement (MBR3):
During the measurement, the CAMSIZER® X2 program takes over the feeder control. The power of the feeder is automatically controlled, whereby the set nominal covered area is the decisive parameter.

Function	Description
Starting level for measurement	The starting level sets the power of the feeder at the beginning of the measurement. In general, the power of the feeder during measurement is approx. 10 % lower than during fast forward. ⇨ Enter the desired starting level in percent in the edit box.

Max. control level	The maximum control level is typically set to 70 – 90 percent. Depending on the sample material, an excessively high power of the feeder towards the end of the measurement can eject the last remaining particles from the feed chute, instead of transporting them to the sample chamber. ⇨ Enter the desired maximum control level in percent in the edit box.
Nominal covered area [%]	The nominal covered area represents the actual control value of the feeder. The CAMSIZER® X2 program automatically regulates the power of the feeder in such a way, that the nominal covered area is as constant as possible corresponding to the entered value during the measurement. Typically, a value between 0.3 % (very fine sample material) and 2 % (very coarse sample material) is selected. Whereas in most cases, a value between 0.5 % and 1 % is recommended. ⇨ Enter the desired nominal covered area in percent in the edit box. ***NOTICE*** The nominal covered area is defined as the percentage of particle projections with respect to the complete field of view of the camera. Too high a nominal covered area has a negative effect on the measurement results, as the higher the nominal covered area, … … the more particles are present on the recorded image and hence, the higher the probability that two particle projections will overlap and lead to incorrect measurement results. … the higher the computing power required by the PC, which leads to a reduction in the image rate and thus to the loss of measurement data. Too low a nominal covered area only results in a longer measurement duration.
Base of control	The base of control displays the number of images taken to calculate the average nominal covered area. Based on the average nominal covered area, the CAMSIZER® X2 program regulates the power of the feeder.
Maximum covered area CCD Basic [%] < Maximal covered area CCD Zoom [%] <	During the measurement, images containing too many particles can be discarded. The maximum covered area can be set for each camera separately. ⇨ Check the checkbox of the CCD Basic camera and enter the desired maximum covered area in percent in the corresponding edit box. Images with a higher covered area do not contribute to the measurement result. ⇨ Check the checkbox of the CCD Zoom camera and enter the desired maximum covered area in percent in the corresponding edit box. Images with a higher covered area do not contribute to the measurement result.

Feeder settings (MBR4):

For the dry measurement with the X-Fall cartridge, the following settings can be made:

Function	Description
Gap width [mm]	⇨ Enter the gap width of the used gravity nozzle in the edit box. The following gravity nozzles are available from Retsch Technology GmbH: 7 mm, 10 mm and 14 mm.
Vacuum	⇨ Check this checkbox to turn on the negative pressure during the measurement. Turning on the negative pressure is recommended when the sample has a high content of fines. ***NOTICE*** The device must be connected to a constant compressed air supply via a compressed air hose. The compressed air supply to the device should be approx. 6 bar.

For the dry measurement with the X-Jet cartridge, the following settings can be made:

Function	Description
Dispersion pressure [kPa]	⇨ Enter the desired dispersion pressure between 20 kPa (0.2 bar) and 450 kPa (4.5 bar) in the edit box. ***NOTICE*** The choice of the dispersion pressure depends on the sample material. For highly agglomerating particles, a higher dispersion pressure is required. For fragile particles, a lower dispersion pressure is needed. To find the correct pressure, a series of tests should be carried out. First, a low pressure of approx. 50 kPa should be set to begin with, which is then gradually increased. The correct pressure has been found when the cumulative distribution does not shift further towards smaller particle sizes. If the pressure is too low, particle agglomerations can be measured instead of the individual particles, leading to a too coarse distribution. If the pressure is too high, the particles can be "ground" by shear forces in the dispersion nozzle and thus, break into fragments, resulting in a too fine distribution. For further questions or supporting consultation, please contact the Retsch Technology GmbH application laboratory.
Gap width [mm]	⇨ Enter the gap width of the used dispersion nozzle in the edit box. The following dispersion nozzles are available from Retsch Technology GmbH: 2 mm, 3.8 mm, 5.2 mm, 9 mm and 13.5 mm.

⇨ To undo changes, click the [Undo] button. Changes can only be undone, as long as no other tab is selected.

⇨ Click the [Next] button to switch to the next tab.

⇨ To save the changes in the task file, click [OK]. The dialogue box changes to the "Save task file" tab. Click [OK] again and confirm the overwriting of the already existing task file in the following dialogue box.

⇨ To discard the changes, click the [Cancel] button.

4.5.1.2 "Cameras (Measurement Parameters)" Tab

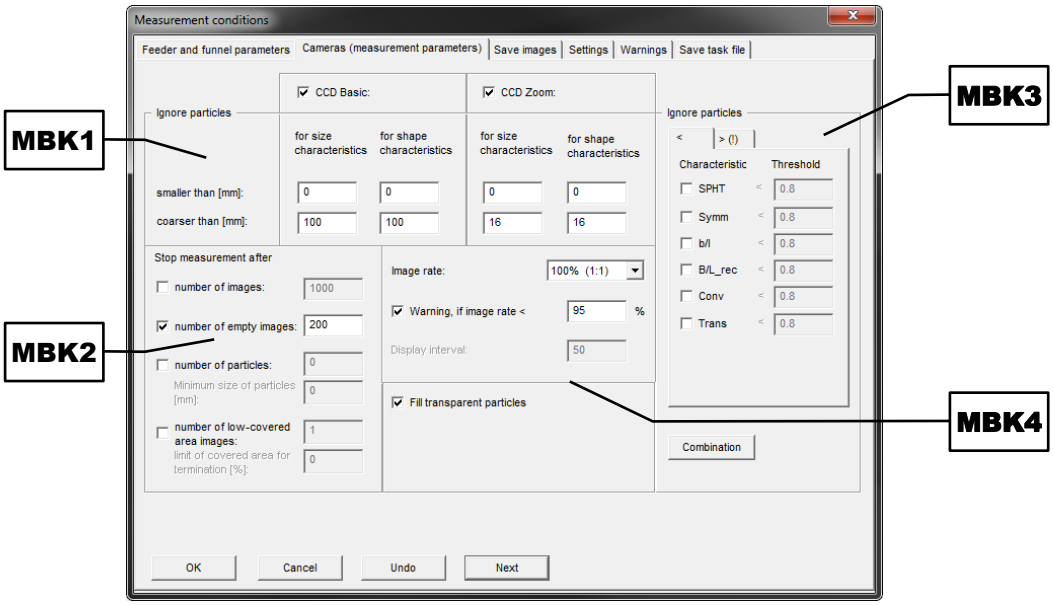


Fig. 70: "Cameras (measurement parameters)" tab

Ignore particles (MBK1):
In general, all particles are recorded with both cameras over the complete measuring range of the CAMSIZER® X2 during measurement. However, if a sample contains only very coarse or only very small particles, or if only particles of a certain size are of interest, the measuring range can be restricted and/or one of the cameras can be switched off.

NOTICE Ignored particles are not stored in the result file and cannot be added to the measurement result afterwards!

Function	Description
CCD Basic, CCD Zoom	⇨ Check the ⟨CCD Basic⟩ checkbox, to turn on the CCD Basic camera for the measurement. ⇨ Check the ⟨CCD Zoom⟩ checkbox, to turn on the CCD Zoom camera for the measurement.

<table>
<tr><td>for size characteristics,
for shape characteristics

smaller than [mm],
coarser than [mm]</td><td>By means of the edit boxes, particles of a certain size can be excluded from the measurement.
⇨ Enter the desired thresholds in mm for the size characteristics and the shape characteristics for both cameras in the respective edit boxes.

<table>
<tr><td></td><td colspan="2">CCD Basic</td><td colspan="2">CCD Zoom</td></tr>
<tr><td></td><td>for size characteristics</td><td>for shape characteristics</td><td>for size characteristics</td><td>for shape characteristics</td></tr>
<tr><td>smaller than [mm]</td><td>all particles of the CCD Basic camera which are smaller than the specified value are ignored for the size characteristics</td><td>all particles of the CCD Basic camera which are smaller than the specified value are ignored for the shape characteristics</td><td>all particles of the CCD Zoom camera which are smaller than the specified value are ignored for the size characteristics</td><td>all particles of the CCD Zoom camera which are smaller than the specified value are ignored for the shape characteristics</td></tr>
<tr><td>coarser than [mm]</td><td>all particles of the CCD Basic camera which are coarser than the specified value are ignored for the size characteristics</td><td>all particles of the CCD Basic camera which are coarser than the specified value are ignored for the shape characteristics</td><td>all particles of the CCD Zoom camera which are coarser than the specified value are ignored for the size characteristics</td><td>all particles of the CCD Zoom camera which are coarser than the specified value are ignored for the shape characteristics</td></tr>
</table>
</td></tr>
</table>

Stop measurement after (MBK2):

By means of specific thresholds, the CAMSIZER® X2 program can automatically terminate a measurement. As soon as the defined condition has been fulfilled, a dialogue box for confirming the termination of the measurement appears.

⇨ Confirm the end of the measurement by clicking [Yes] in the dialogue box.

⇨ To continue the measurement, click [No] in the dialogue box. The measurement continues until the specified condition is met again.

The following conditions can be defined:

Function	Description
number of images	The measurement is terminated as soon as the defined number of images has been processed by the PC. The number of images refers to the sum of images of both cameras. ⇨ Enter the desired number of images in the edit box.
number of empty images	The measurement is terminated as soon as the defined consecutive number of empty images (images without particles) has been processed by the PC. The number of empty images refers to the sum of images of both cameras. ⇨ Enter the desired number of empty images in the edit box.

number of particles Minimum size of particles [mm]	The measurement is terminated as soon as the defined number of particle projections has been processed by the PC. The number of particles refers to the sum of measured particle projections of both cameras. ⇨ Enter the desired number of particles in the edit box. In order to ignore dust particles or a certain fine fraction in the sample for the number of particles, a lower limit value for the particle size can be set. Particles that are smaller than the specified threshold are not included in the number of particles. ⇨ Enter the desired lower limit value for the particle size in mm in the "Minimum size of particles" edit box.
number of low-covered area images limit of covered area for termination [%]	The measurement is terminated as soon as the defined consecutive number of images below a defined nominal covered area has been processed by the PC. The number of low-covered area images refers to the sum of images of both cameras. ⇨ Enter the desired number of low-covered area images in the corresponding edit box. ⇨ Enter the desired limit value of the nominal covered area in percent in the corresponding edit box. Typically, a value between 0.1 % and 0.3 % is set here.

ⓘ The conditions can also be linked. If, for example, the checkboxes ⟨number of images⟩ and ⟨number of particles⟩ are checked at the same time, the measurement is only terminated automatically when both, the set number of images has been processed and the specified number of particles has been measured.

Ignore particles (MBK3):
In general, all particles are detected during a measurement regardless of their shape. If, however, only particles of a particular form are of interest in a sample, particles can be ignored depending on their shape.

NOTICE Ignored particles are not stored in the result file and cannot be added to the measurement result afterwards!

Function	Description
tab "<", tab ">"	By means of the edit boxes in the two tabs, particles of a certain shape can be excluded from the measurement. ⇨ Select the "**<**" tab to exclude particles that **fall below** a certain threshold for the selected shape characteristic. ⇨ Select the "**>**" tab to exclude particles that **exceed** a certain threshold for the selected shape characteristic. ⇨ Check the desired shape characteristic and enter the desired threshold in the corresponding edit box. ***NOTICE*** Depending on the configuration of the software, different characteristics are available in the "<" and ">" tabs. ⓘ To prevent unintentional ignoring of particles during the measurement, the tab that is currently in the background is marked by an exclamation mark (!), if any thresholds for shape characteristics have been set there.

Combination	By means of this function, particles with a certain combination of shape characteristic and particle size can be excluded from the measurement. ⇨ Click the [Combination] button. The corresponding dialogue box opens.

Fig. 71: Dialog box for combining characteristics

The dialogue box consists of the three sections (**IKK1**), (**IKK2**) and (**IKK3**). Within one section two characteristics can be linked together by "OR". The sections themselves are linked to each other by "AND".

⇨ Check the desired checkbox and select the desired characteristic from the dropdown list.
⇨ Enter the thresholds in the corresponding edit boxes for which the particles are to be ignored if they exceed or fall below them.
⇨ Click the [Update] button.
⇨ Click [OK] to apply the settings.
⇨ To discard the settings, click the [Cancel] button.

In the example shown here, all particles which have an aspect ratio < 0.95 (**IKK1**) AND a convexity < 0.98 (**IKK2**) AND a length > 2 mm (**IKK3**) are ignored.

ⓘ To prevent unintentional ignoring of particles during the measurement, the button is marked by an exclamation mark (!), if any thresholds for characteristics have been set here.

Image settings (MBK4):

Function	Description
Image rate	By default, the image rate is set to 100 % (1:1), i.e. 100 % of the recorded images are also processed and evaluated. If the used PC does not have enough performance, the number of images to be processed can be reduced. ⇨ Select the desired image rate from the dropdown list.
Warning, if image rate <	⇨ Check this checkbox to display a warning after the measurement when the image rate has fallen below a certain threshold during the measurement. ⇨ Enter the threshold for the image rate in percent in the corresponding edit box. A typical limit value is 95 %, i.e. 95 % of the images could have been processed and evaluated. ***NOTICE*** If the warning appears after the measurement, … … too many fine particles have been measured in combination with a too high nominal covered area. … the used PC is not performant enough.
Display interval	Displays the interval at which the live view of the CCD cameras is updated. For the live view, each x^{th} camera image (related to the sum of images of both cameras) is displayed, with x corresponding to the number in the edit box.
Fill transparent particles	Due to the measuring principle of the CAMSIZER® X2, internal areas of transparent particles can appear brighter than the contour of the particle. Such projections may possibly not be recognised correctly and may be ignored by the CAMSIZER® X2 program. ⇨ Check this checkbox to fill all brighter areas inside transparent particles and thus also declare them as "associated with the particle". ***NOTICE*** This function should strictly be activated at all times in order to prevent incorrect measurements.

⇨ To undo changes, click the [Undo] button. Changes can only be undone, as long as no other tab is selected.

⇨ Click the [Next] button to switch to the next tab.

⇨ To save the changes in the task file, click [OK]. The dialogue box changes to the "Save task file" tab. Click [OK] again and confirm the overwriting of the already existing task file in the following dialogue box.

⇨ To discard the changes, click the [Cancel] button.

4.5.1.3 "Save Images" Tab

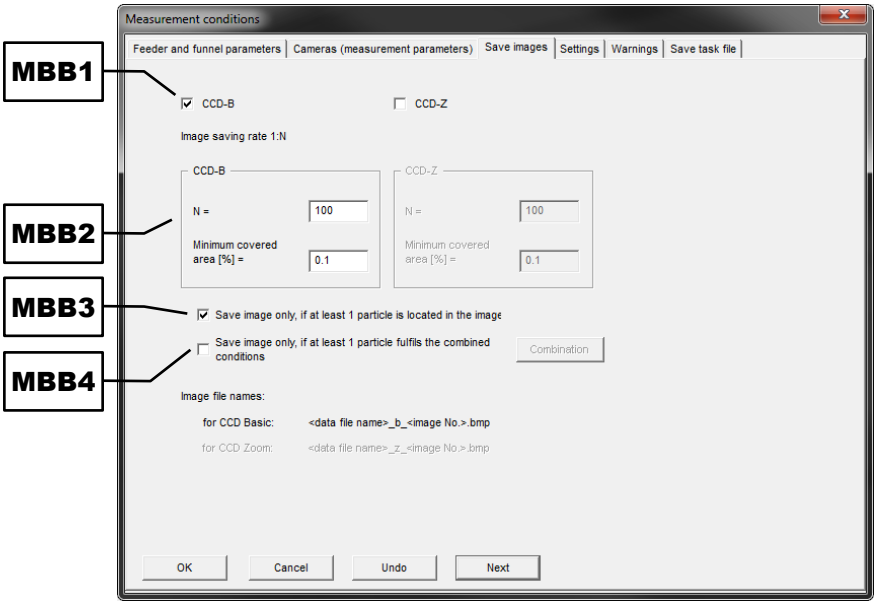


Fig. 72: "Save images" tab

If required, the images of the CCD Basic and CCD Zoom cameras can also be stored as BMP files. However, this function is deactivated by default, since the saving of images results in a higher processor load of the PC and furthermore very quickly requires a lot of disk space. Stored images can later be evaluated via the menu function "Image evaluation" or with the separate program "Particle X-Plorer".

- ⇨ Check the checkbox (**MBB1**) of the desired camera.
- ⇨ In the camera settings section (**MBB2**), enter the saving rate N in the corresponding edit box. For example, if N = 100, every hundredth image of the corresponding camera is stored.
  NOTICE In order not to overload the PC and not to affect the measurement, N should never be set too small!
- ⇨ In the camera settings section (**MBB2**), enter the minimum covered area in percent in the corresponding edit box for which an image is to be saved. This prevents the storage of empty images or images only containing dust particles.
- ⇨ Check the checkbox (**MBB3**) to only store those images, with at least one particle present. To avoid empty images, this function should always be enabled.
- ⇨ Check the checkbox (**MBB4**) to only store images containing at least one particle that meets the condition set via the [Combination] button.
- ⇨ Click the [Combination] button. The corresponding dialogue box opens. The settings in the dialogue box are to be set similar to those described in Chapter ""Cameras (Measurement Parameters)" Tab".

The images are consecutively numbered and automatically saved during the measurement as BMP file in the subfolder "IMAGES" in the directory of the corresponding result files.

- ⇨ To undo changes, click the [Undo] button. Changes can only be undone, as long as no other tab is selected.
- ⇨ Click the [Next] button to switch to the next tab.
- ⇨ To save the changes in the task file, click [OK]. The dialogue box changes to the "Save task file" tab. Click [OK] again and confirm the overwriting of the already existing task file in the following dialogue box.
- ⇨ To discard the changes, click the [Cancel] button.

4.5.1.4 "Settings" Tab

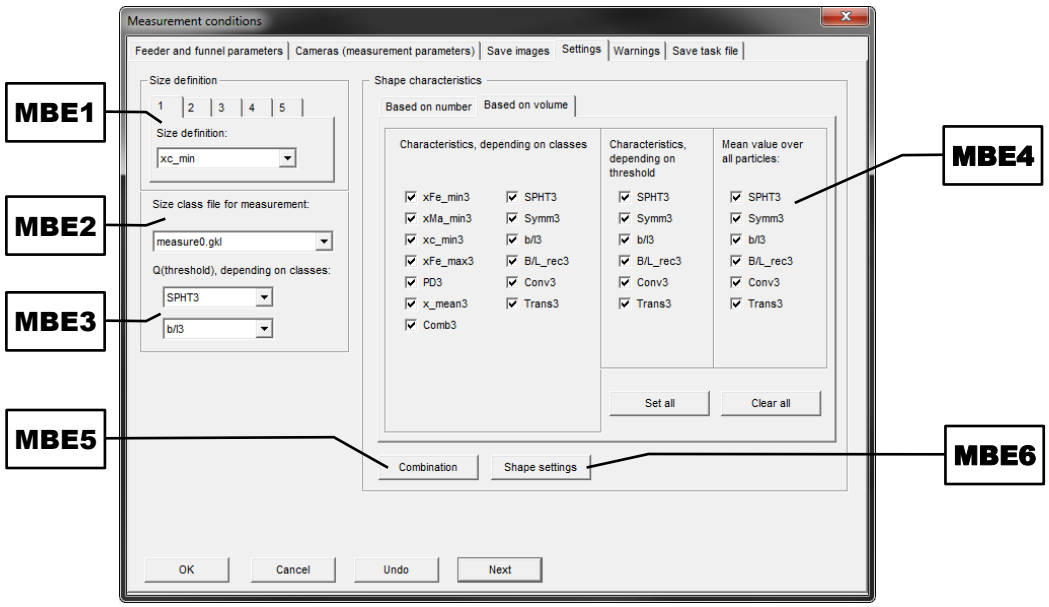


Fig. 73: "Settings" tab

Size definition (MBE1):
Up to five size definitions can be measured and stored simultaneously for each measurement. Each size definition is saved as a separate raw data file.

⇨ Select the desired characteristic from the dropdown list in tab "1". By default, $x_{c\,min}$ is set.

⇨ If desired, select up to four additional size definitions in the tabs "2" to "5". By default, no characteristics are set here.

In the following table, the five most common size definitions are listed. A detailed description of all available characteristics can be found in Chapter "List of Characteristics".

Characteristic	Description
$x_{c\,min}$	**Particle width:** Displays the particle width, which is determined from the narrowest of all measured chords x_c. This characteristic is suitable for comparing the CAMSIZER® X2 results with a sieve analysis.
$x_{Fe\,max}$	**Particle length:** Displays the particle length, which is determined from the longest of all measured Feret diameters x_{Fe}. This characteristic is suitable for measuring straight extrudates, fibres or rice grains.
$x_{Ma\,min}$	**Narrowest particle width:** Displays the particle width, which is determined from the narrowest of all measured Martin diameters x_{Ma} (area bisecting line). This characteristic is suitable for comparing the CAMSIZER® X2 results of elongated particles with a sieve analysis and for measuring extrudates.
X_{area}	**Particle diameter:** Displays the equivalent particle diameter that corresponds to the diameter of a circle with equivalent area. This characteristic is suitable for comparing the CAMSIZER® X2 results with a laser scattered light analysis.

$X_{stretch}$	**Stretched particle length:** Displays the particle length, which is determined from the particle area and the narrowest Martin diameter. This characteristic is suitable for measuring bent extrudates or fibres.

NOTICE Depending on the configuration of the software, different characteristics are available in the dropdown list.

Size class file for measurement (MBE2):

⇨ Select the desired size class file for display in the dialogue box "Measure" (during the measurement process) from the dropdown list.

NOTICE The dropdown list is identical with the dropdown list (**MS1.2**) in the "Save task file" tab. A modification here also causes a change in the other tab.

Q(threshold), depending on classes (MBE3):

⇨ If desired, select one or two shape characteristics from the respective dropdown lists.

The selected shape characteristics are saved size class-dependent in the raw data file. The data is required for the functions in the dialogue box of the characteristics for table Q(x) (**TK2**).

NOTICE Depending on the configuration of the software, different characteristics are available in the dropdown lists.

Shape characteristics (MBE4):

This section is divided into three areas:

Area	Description
Characteristics, depending on classes	These characteristics can be displayed in the table window.
Characteristics, depending on threshold	These characteristics can be displayed in the characteristics window, the graph window of shape characteristics, and the table window for the tables Q(shape) and shape(Q).
Mean value over all particles	These characteristics can be displayed in the characteristics window.

⇨ Select the desired characteristics.
⇨ To select all shape characteristics, click the [Set all] button.
⇨ To deselect all shape characteristics, click the [Clear all] button.

NOTICE Depending on the configuration of the software, different characteristics are available in the section of the shape characteristics (**MBE4**).

Combination (MBE5):

The settings in the dialogue box of the combination define the characteristic "Comb" in the area of the characteristics depending on classes (**MBE4**).

⇨ Click the [Combination] button. The corresponding dialogue box opens. The settings in the dialogue box are to be set similar to those described in Chapter ""Cameras (Measurement Parameters)" Tab".

Shape settings (MBE6):
In order to obtain optimum measurement results, the particle shape of the sample to be measured should be determined before the measurement.

⇨ Click the [Shape settings] button. The corresponding dialogue box opens.
⇨ Select the shape of the particles in the sample to be measured from the dropdown list.
⇨ Check the ⟨Print in report⟩ checkbox to print the particle shape setting in the report (measurement record).

Particle shape setting	Description
Spherical particles	Select this setting, if the particles in the sample are rather spherical.
Angular particles	Select this setting, if the particles in the sample are rather angular.
Cylindrical particles	Select this setting, if the particles in the sample are rather cylindrical.
Product specific settings	***NOTICE*** Only select this setting, if a service or application technician from Retsch Technology GmbH has adjusted the CAMSIZER® X2 program specifically for the sample and has given a detailed instruction on this function!

⇨ To undo changes, click the [Undo] button. Changes can only be undone, as long as no other tab is selected.
⇨ Click the [Next] button to switch to the next tab.
⇨ To save the changes in the task file, click [OK]. The dialogue box changes to the "Save task file" tab. Click [OK] again and confirm the overwriting of the already existing task file in the following dialogue box.
⇨ To discard the changes, click the [Cancel] button.

4.5.1.5 "Warnings" Tab

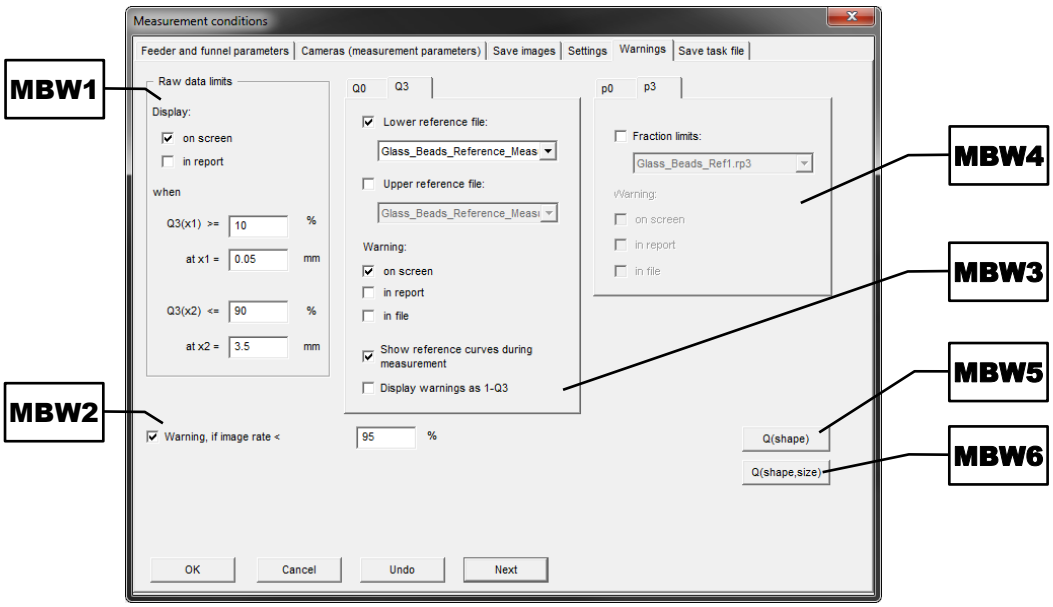


Fig. 74: "Warnings" tab

If the measured results deviate from predetermined tolerance values (product specifications), warnings can be displayed or recorded in the report.

Raw data limits (MBW1):
If a sample contains too many fine and/or too many oversize particles, a respective warning is displayed. For example, the warning is triggered if more than 10 % of the particles in the sample are smaller than 0.05 mm and/or larger than 3.5 mm.

- ⇨ Check the desired checkboxes to display the warning for the raw data limits ⟨on screen⟩ and/or ⟨in report⟩.
- ⇨ Enter the lower limit value of the cumulative distribution for the particle size x1 in percent in the corresponding edit box.
- ⇨ Enter the particle size x1 for which the limit is to be set in mm in the corresponding edit box.
- ⇨ Enter the upper limit value of the cumulative distribution for the particle size x2 in percent in the corresponding edit box.
- ⇨ Enter the particle size x2 for which the limit is to be set in mm in the corresponding edit box.

NOTICE The raw data limits are only applied to the measured data, but not to the measurement curves that have been modified by a fitting file.

Image rate (MBW2):
The image rate warning is identical to the function in section (**MBK4**) in the "Cameras (measurement parameters) tab". A modification here also causes a change in the other tab.

Reference files (MBW3):
In contrast to the raw data limits, with which a maximum of two limit values can be defined, the complete distribution can be monitored by means of reference files containing an arbitrary number of reference points.

- ⇨ Check the checkbox of the lower and/or upper reference file.
- ⇨ Select the desired lower and/or upper reference file from the corresponding dropdown list.

- ⇨ Check the desired checkboxes to display the warning ⟨on screen⟩ and/or ⟨in report⟩, when the measured data exceed or fall below the reference files.
- ⇨ Check the ⟨in file⟩ checkbox to save the warning in the results files (RDF file, XLE file, …).
- ⇨ Check the ⟨Show reference curves during measurement⟩ checkbox to display the reference files as cumulative distribution during the measurement process in the "Measure" dialogue box.
- ⇨ Check the ⟨Display warnings as 1-Q_3⟩ checkbox to display the warning as cumulative distribution of residue.

NOTICE The reference files are also applied to fitted measurement curves.

Fraction limits (MBW4):
For quality controls via sieve analysis, minima and maxima are often specified for the individual sieve fractions. By means of the fraction limits, these limit values can also be monitored by the CAMSIZER® X2 program during the measurement process.

- ⇨ Check the checkbox and select the desired fraction limits from the dropdown list.
- ⇨ Check the desired checkboxes to display the warning ⟨on screen⟩ and/or ⟨in report⟩, when the measured data exceed or fall below the fraction limits.
- ⇨ Check the ⟨in file⟩ checkbox to save the warning in the results files (RDF file, XLE file, …).

NOTICE The fraction limits are also applied to fitted measurement curves.

Q(shape) (MBW5):
Via the [Q(shape)] button (**MBW5**), warnings for up to 20 thresholds for shape characteristics can be displayed.

- ⇨ Click the [Q(shape)] button (**MBW5**). The corresponding dialogue box opens.
- ⇨ Click the [Add] button to define a new warning for a shape characteristic. The dialogue box for selecting the shape characteristic opens.
- ⇨ Select whether the shape characteristic is based on number, area or volume.
- ⇨ Select the radio button of the desired shape characteristic.
- ⇨ Select the radio button of the desired type of the shape characteristic.
- ⇨ Enter the desired threshold for the type of the shape characteristic in the edit box.
- ⇨ Enter the desired lower and/or upper limit values for the warnings in the corresponding edit boxes.
- ⇨ Click the [Update] button.
- ⇨ Click [OK] to add the setting to the list of warnings for shape characteristics.
- ⇨ To discard the changes, click the [Cancel] button.

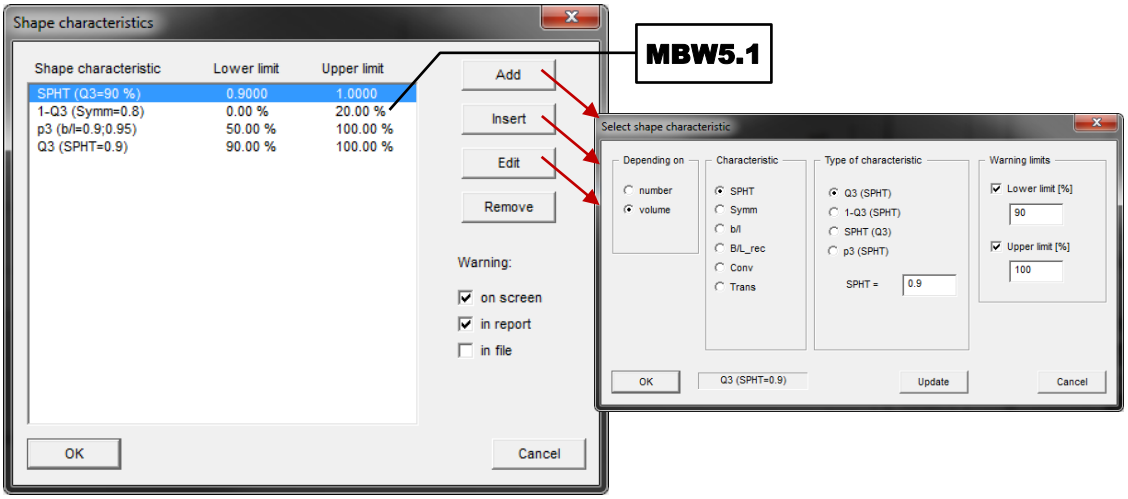


Fig. 75: Setting options of the [Q(shape)] button

- ⇨ Click the [Insert] button to insert a further entry above the entry marked in the characteristics list (**MBW5.1**). The dialogue box for selection the shape characteristic opens.
- ⇨ Make the desired settings.
- ⇨ Click the [Edit] button to change the entry marked in the characteristics list (**MBW5.1**). The dialogue box for selection the shape characteristic opens.
- ⇨ Make the desired modifications.
- ⇨ Click the [Remove] button to delete the entry marked in the characteristics list (**MBW5.1**).
- ⇨ Check the desired checkboxes to display the warning ⟨on screen⟩ and/or ⟨in report⟩, when the measured data exceed or fall below the thresholds for shape characteristics.
- ⇨ Check the ⟨in file⟩ checkbox to save the warning in the results files (RDF file, XLE file, …).
- ⇨ If all desired warnings for shape characteristics are listed in the characteristics list (**MBW5.1**), click [OK] to apply the settings.
- ⇨ To discard the changes, click the [Cancel] button.

Q(shape,size) (MBW6):

Via the [Q(shape,size)] button (**MBW6**), warnings can be displayed for two cumulative distributions when the measured data exceed or fall below the lower and/or upper limits for shape characteristics. ***NOTICE*** This function is only available, if the software is configured accordingly. Furthermore, the function can only be enabled, if the corresponding class-dependent values Q(threshold) are activated in the task file (→ Chapter "Measurement Parameters").

- ⇨ Click the [Q(shape,size)] button (**MBW6**). The dialogue box for selecting the reference files opens.
- ⇨ Check the checkbox of the desired reference files.
- ⇨ Select the desired reference file for the warnings from the corresponding dropdown list.
- ⇨ Check the desired checkboxes to display the warning ⟨on screen⟩ and/or ⟨in report⟩, when the measured data exceed or fall below the class-dependent thresholds for shape characteristics.
- ⇨ Check the ⟨in file⟩ checkbox to save the warning in the results files (RDF file, XLE file, …).
- ⇨ Click [OK] to apply the settings.
- ⇨ To discard the changes, click the [Cancel] button.

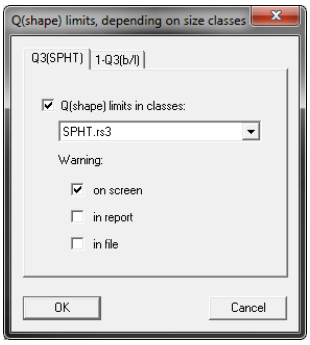


Fig. 76: Setting options of the [Q(shape,size)] button

- ⇨ To undo changes, click the [Undo] button. Changes can only be undone, as long as no other tab is selected.
- ⇨ Click the [Next] button to switch to the next tab.
- ⇨ To save the changes in the task file, click [OK]. The dialogue box changes to the "Save task file" tab. Click [OK] again and confirm the overwriting of the already existing task file in the following dialogue box.
- ⇨ To discard the changes, click the [Cancel] button.

4.5.1.6 "Save Task File" Tab

- ⇨ Make the desired settings as described in Chapter "Save Task File".
- ⇨ To undo changes, click the [Undo] button. Changes can only be undone, as long as no other tab is selected.
- ⇨ Click [OK], to save the task file and confirm the overwriting of the already existing task file in the following dialogue box by clicking [OK]. The selected task file is overwritten with the current settings.
- ⇨ To discard the changes, click the [Cancel] button.

ⓘ The [Next] button can be used to switch to the dialogue box of the display parameters (→ Chapter "Size Classes").

4.5.2 Size Classes

Via the menu function │Size classes│, the size classes can be created and further display parameters of the currently loaded task file (AFG file) can be set.

- ⇨ In the main window, click on the menu bar item │Options│ and select │Size classes│ from the context menu. The corresponding tab of the dialogue box of the display parameters opens.

Dialogue box of the display parameters:
The dialogue box of the display parameters consists of several tabs. Access to the dialogue box is given via various menu functions, whereby, depending on the menu function, the dialogue box opens with the respective tab on top.

Tab	Access via	Description in Chapter
Size classes	│Options│Size classes│, or navigation within the dialogue box	"Size Classes" Tab
Shape char. classes	│Options│Classes for shape characteristics│, or navigation within the dialogue box	"Shape Characteristics Classes" Tab
Table	Navigation within the dialogue box	"Table" Tab
Characteristics	Navigation within the dialogue box	"Characteristics" Tab

Graph	Navigation within the dialogue box	"Graph" Tab
Graph, shape characteristics	Navigation within the dialogue box	"Graph, Shape Characteristics" Tab
Save task file	| File | Save task file |, or navigation within the dialogue box	Save Task File

In the following subchapters, each tab of the dialogue box of the display parameters is described in detail and can be referred to individually.

NOTICE If any changes of the settings made here shall remain effective also in subsequent measurements, the task file must be saved anew after the modification (→ Chapter "Save Task File").

4.5.2.1 "Size Classes" Tab

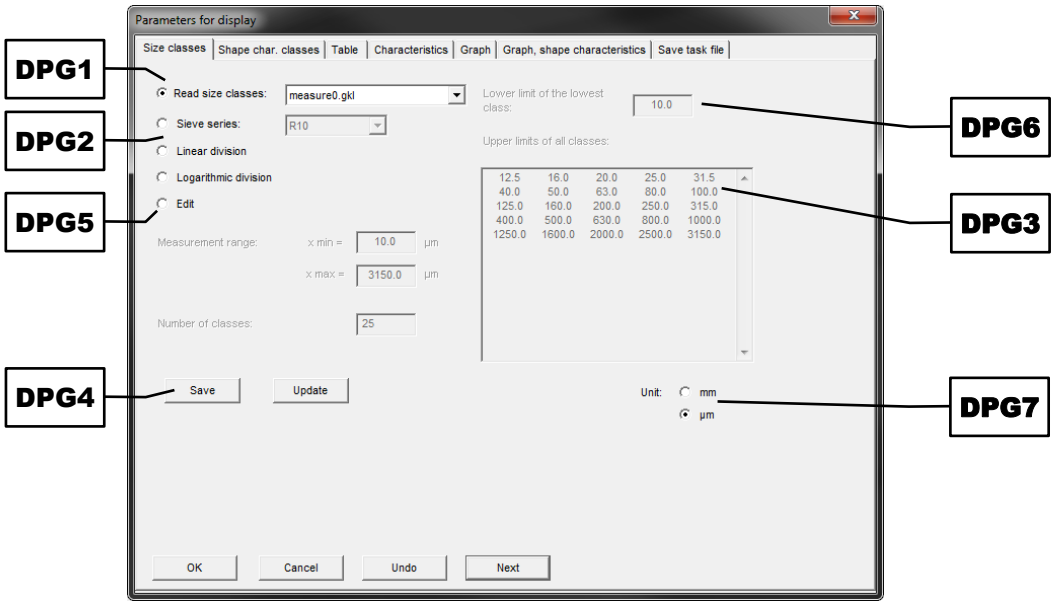


Fig. 77: "Size classes" tab

⇨ Select one of the two radio buttons (**DPG7**) in order to select whether the size classes are to be displayed in ⟨mm⟩ or ⟨µm⟩.

Load size class file:

⇨ Select the ⟨Read size classes⟩ radio button (**DPG1**).

⇨ Select the desired GKL file from the dropdown list. The size classes contained in the selected GKL file are listed in the edit box (**DPG3**).

Create size class file:

⇨ Select one of the following radio buttons (**DPG2**):

Radio button	Description
Sieve series	⇨ Select the desired sieve series from the dropdown list. The following sieve series are available: Renard series R5, R20/3, R10, R40/3, R20, R40, R80, as well as ASTM mesh, and Tyler mesh. ⇨ Enter the desired size range from x_{min} to x_{max} in the corresponding edit boxes. The number of classes is automatically set. ⇨ Click the [Update] button. The edit box (**DPG3**) is updated according to the input.
Linear division	⇨ Enter the desired size range from x_{min} to x_{max} in the corresponding edit boxes. ⇨ Set the desired number of classes in the corresponding edit box. ⇨ Click the [Update] button. The edit box (**DPG3**) is updated according to the input.
Logarithmic division	⇨ Enter the desired size range from x_{min} to x_{max} in the corresponding edit boxes. ⇨ Set the desired number of classes in the corresponding edit box. ⇨ Click the [Update] button. The edit box (**DPG3**) is updated according to the input.

Save size class file:

⇨ To save modifications made, click the [Save] button (**DPG4**). The corresponding dialogue box opens.

⇨ To overwrite an existing GKL file with the size classes currently entered in the edit box (**DPG3**), select the desired file from the combo box.

⇨ To create a new GKL file with the size classes currently entered in the edit box (**DPG3**), enter a new name in the combo box.

⇨ Click [OK]. If an existing GKL file is now to be overwritten, confirm this in the following dialogue box.

⇨ To abort the process, click the [Cancel] button.

Edit size class file:

⇨ Select the radio button ⟨Edit⟩ (**DPG5**).

⇨ Enter the desired lower limit of the lowest class in the edit box (**DPG6**). ***NOTICE*** With the logarithmic division, the minimum lower limit is 0.03 mm.

In the edit box (**DPG3**), size classes can be removed by deleting the respective entries. To add size classes, the individual values can be typed in separated by a space. The order of input can be made arbitrarily.

⇨ Make the desired modifications in the edit box (**DPG3**).

⇨ Click the [Update] button. The size classes are sorted by size.

⇨ To undo changes, click the [Undo] button. Changes can only be undone, as long as no other tab is selected.

⇨ Click the [Next] button to switch to the next tab.

⇨ To save the changes in the task file, click [OK]. The dialogue box changes to the "Save task file" tab. Click [OK] again and confirm the overwriting of the already existing task file in the following dialogue box.

⇨ To discard the changes, click the [Cancel] button.

4.5.2.2 Size Classes in Measurement Mode

In measurement mode, the access to the tabs of the dialogue box of the display parameters is blocked. Instead of the "Size class" tab, a separate "Size class" dialogue box with restricted functions is opened.

In the dialogue box, a size class file can be loaded, edited, or created. Saving a size class file is not possible.

The settings of the available functions correspond to those in parameter mode.

4.5.2.3 "Shape Characteristics Classes" Tab

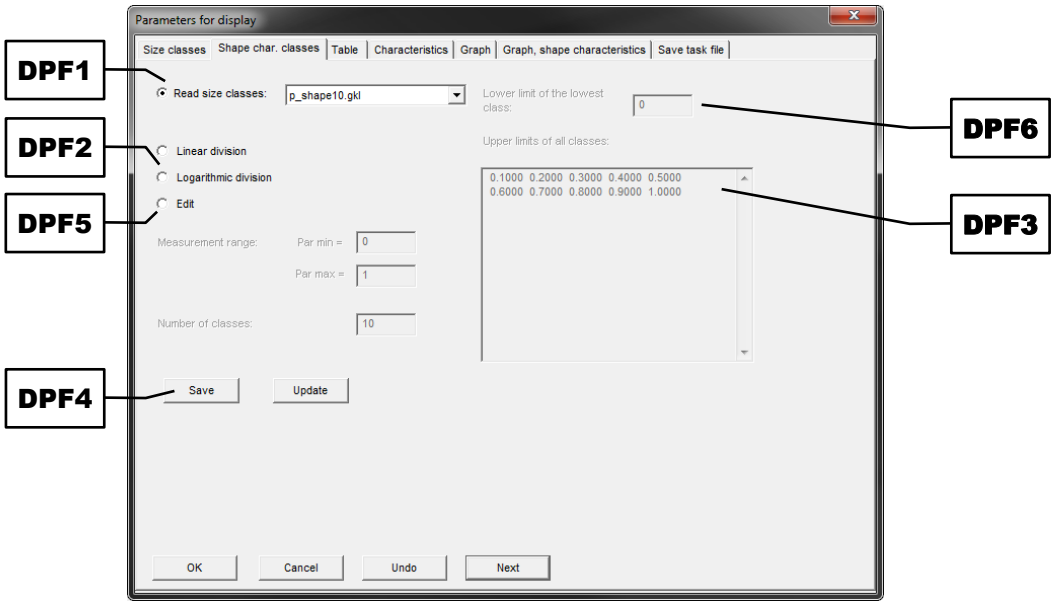


Fig. 78: "Shape characteristics classes" tab

Load shape characteristics class file:

⇨ Select the ⟨Read size classes⟩ radio button (**DPF1**).

⇨ Select the desired GKL file from the dropdown list. The shape characteristics classes contained in the selected GKL file are listed in the edit box (**DPF3**).

Create shape characteristics class file:

⇨ Select one of the two radio buttons ⟨Linear division⟩ or ⟨Logarithmic division⟩ (**DPF2**).

⇨ Enter the desired size range from Par_{min} to Par_{max} in the corresponding edit boxes.

⇨ Set the desired number of classes in the corresponding edit box.

⇨ Click the [Update] button. The edit box (**DPF3**) is updated according to the input.

NOTICE The size range of shape characteristics classes is always between 0 and 1.

Save shape characteristics class file:

⇨ To save modifications made, click the [Save] button (**DPF4**). The corresponding dialogue box opens.

⇨ To overwrite an existing GKL file with the shape characteristics classes currently entered in the edit box (**DPF3**), select the desired file from the combo box.

- ⇨ To create a new GKL file with the shape characteristics classes currently entered in the edit box (**DPF3**), enter a new name in the combo box.
- ⇨ Click [OK]. If an existing GKL file is now to be overwritten, confirm this in the following dialogue box.
- ⇨ To abort the process, click the [Cancel] button.

Edit shape characteristics class file:

- ⇨ Select the radio button ⟨Edit⟩ (**DPF5**).
- ⇨ Enter the desired lower limit of the lowest class in the edit box (**DPF6**). ***NOTICE*** With the logarithmic division, the minimum lower limit is 0.03 mm.

In the edit box (**DPF3**), shape characteristics classes can be removed by deleting the respective entries. To add shape characteristics classes, the individual values can be typed in separated by a space. The order of input can be made arbitrarily.

- ⇨ Make the desired modifications in the edit box (**DPF3**).
- ⇨ Click the [Update] button. The shape characteristics classes are sorted by size.
- ⇨ To undo changes, click the [Undo] button. Changes can only be undone, as long as no other tab is selected.
- ⇨ Click the [Next] button to switch to the next tab.
- ⇨ To save the changes in the task file, click [OK]. The dialogue box changes to the "Save task file" tab. Click [OK] again and confirm the overwriting of the already existing task file in the following dialogue box.
- ⇨ To discard the changes, click the [Cancel] button.

4.5.2.4 Shape Characteristics Classes in Measurement Mode

In measurement mode, the access to the tabs of the dialogue box of the display parameters is blocked. Instead of the "Shape characteristics classes" tab, a separate dialogue box with restricted functions is opened.

In the dialogue box, a shape characteristics class file can be loaded, edited, or created. Saving a shape characteristics class file is not possible.

The settings of the available functions correspond to those in parameter mode.

4.5.2.5 "Table" Tab

In this tab, the display parameters of the evaluation window can be set. The settings can be made either here or directly in the evaluation window.

The functions of this tab are identical to those in the table window. A detailed description of each function can be found in Chapter "Table".

- ⇨ To undo changes, click the [Undo] button. Changes can only be undone, as long as no other tab is selected.
- ⇨ Click the [Next] button to switch to the next tab.
- ⇨ To save the changes in the task file, click [OK]. The dialogue box changes to the "Save task file" tab. Click [OK] again and confirm the overwriting of the already existing task file in the following dialogue box.
- ⇨ To discard the changes, click the [Cancel] button.

4.5.2.6 "Characteristics" Tab

In this tab, the display parameters of the evaluation window can be set. The settings can be made either here or directly in the evaluation window.

The functions of this tab are identical to those in the characteristics window. A detailed description of each function can be found in Chapter "Characteristics".

- ⇨ To undo changes, click the [Undo] button. Changes can only be undone, as long as no other tab is selected.
- ⇨ Click the [Next] button to switch to the next tab.
- ⇨ To save the changes in the task file, click [OK]. The dialogue box changes to the "Save task file" tab. Click [OK] again and confirm the overwriting of the already existing task file in the following dialogue box.
- ⇨ To discard the changes, click the [Cancel] button.

4.5.2.7 "Graph" Tab

In this tab, the display parameters of the evaluation window can be set. The settings can be made either here or directly in the evaluation window.

The functions of this tab are identical to those in the graph window. A detailed description of each function can be found in Chapter "Graph".

- ⇨ To undo changes, click the [Undo] button. Changes can only be undone, as long as no other tab is selected.
- ⇨ Click the [Next] button to switch to the next tab.
- ⇨ To save the changes in the task file, click [OK]. The dialogue box changes to the "Save task file" tab. Click [OK] again and confirm the overwriting of the already existing task file in the following dialogue box.
- ⇨ To discard the changes, click the [Cancel] button.

4.5.2.8 "Graph, Shape Characteristics" Tab

In this tab, the display parameters of the evaluation window can be set. The settings can be made either here or directly in the evaluation window.

The functions of this tab are identical to those in the graph window of shape characteristics. A detailed description of each function can be found in Chapter "Graph, Shape Characteristics".

- ⇨ To undo changes, click the [Undo] button. Changes can only be undone, as long as no other tab is selected.
- ⇨ Click the [Next] button to switch to the next tab.
- ⇨ To save the changes in the task file, click [OK]. The dialogue box changes to the "Save task file" tab. Click [OK] again and confirm the overwriting of the already existing task file in the following dialogue box.
- ⇨ To discard the changes, click the [Cancel] button.

4.5.2.9 "Save Task File" Tab

- ⇨ Make the desired settings as described in Chapter "Save Task File".
- ⇨ To undo changes, click the [Undo] button. Changes can only be undone, as long as no other tab is selected.
- ⇨ Click [OK], to save the task file and confirm the overwriting of the already existing task file in the following dialogue box by clicking [OK]. The selected task file is overwritten with the current settings.
- ⇨ To discard the changes, click the [Cancel] button.

ⓘ The [Next] button can be used to switch to the dialogue box of the measurement conditions (→ Chapter "Measurement Parameters").

4.5.3 Classes for Shape Characteristics

Via the menu function │Classes for shape characteristics│, the size classes for shape characteristics can be created and further display parameters of the currently loaded task file (AFG file) can be set.

⇨ In the main window, click on the menu bar item │Options│ and select │Classes for shape characteristics│ from the context menu. The corresponding tab of the dialogue box of the display parameters opens.

The functions of the "Shape char. classes" tab are in detail described in Chapter "'Shape Characteristics Classes" Tab". The descriptions to all tabs of the dialogue box of the display parameters can be found in the respective subchapters of Chapter "Size Classes".

NOTICE If any changes of the settings made here shall remain effective also in subsequent measurements, the task file must be saved anew after the modification (→ Chapter "Save Task File").

4.5.4 Overview Used Size Class Files

Via the menu function │Overview used size class files│, all size class files currently used in the loaded task file can be viewed and changed in an overview dialogue box.

⇨ In the main window, click on the menu bar item │Options│ and select │Overview used size class files│ from the context menu.

In part, different size class files (GKL files) are used in the individual evaluation windows for the display of the measurement results.

⇨ Select the desired GKL files for the individual evaluation windows from the respective dropdown lists.
⇨ Click [OK] to apply the changes.
⇨ To discard the changes, click the [Cancel] button.

NOTICE If any changes of the settings made here shall remain effective also in subsequent measurements, the task file must be saved anew after the modification (→ Chapter "Save Task File").

4.5.5 Input Reference Distribution

NOTICE This function is not available in measurement mode.

Via the menu function │Input reference distribution│, reference files (RE0, RE2, REF file) can be created, edited and stored.

⇨ In the main window, click on the menu bar item │Options│ and select │Input reference distribution│ from the context menu. The corresponding dialogue box opens.

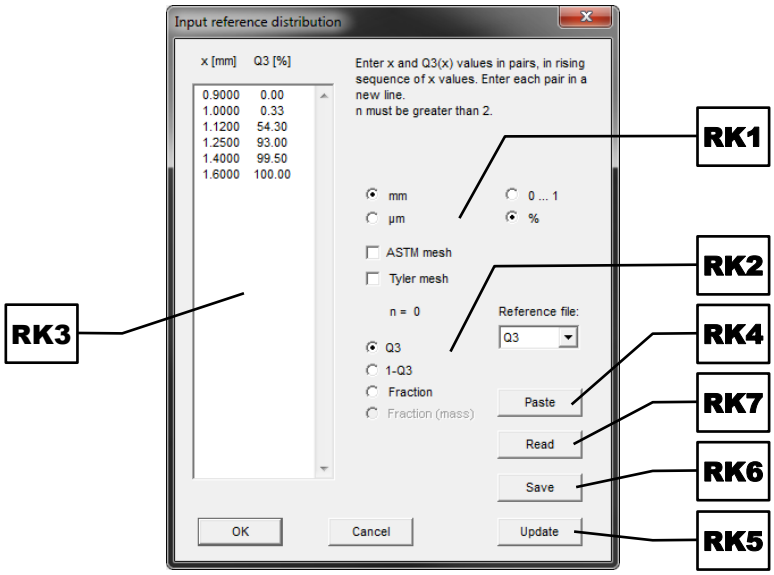


Fig. 79: Input reference distribution

Create reference file:

- ⇨ Select the units (**RK1**) with which the data of the reference distribution is to be entered. The particle size can either be entered in ⟨mm⟩ or ⟨µm⟩, the distribution either in ⟨%⟩ or normalised from ⟨0…1⟩. The input of ⟨ASTM mesh⟩ or ⟨Tyler mesh⟩ mesh sizes is possible, as well. Values already listed in the edit box (**RK3**) will be converted and updated.
- ⇨ Select the type of the distribution (**RK2**), which is to be entered. The values can be entered as cumulative distribution, cumulative distribution of residue, fraction, or mass-based fraction. In this respect, the dropdown list "Reference file" allows to specify whether the distribution is based on number, area or volume. ***NOTICE*** The radio button ⟨Fraction (mass)⟩ is only enabled for volume-based reference files.
- ⇨ Enter the values in pairs and separated by a space in the edit box (**RK3**) as described in the dialogue box. When entering fractions, the sum must amount 100 % or 1. Alternatively, the data can be inserted from the clipboard in text format via the [Paste] button (**RK4**).
- ⇨ Click the [Update] button (**RK5**) to check the input and update the formatting.

Save reference file:

- ⇨ Click the [Save] button (**RK6**). The corresponding dialogue box opens.
- ⇨ To overwrite an existing reference file with the values currently entered in the edit box (**RK3**), select the desired file from the combo box.
- ⇨ To create a new reference file with the values currently entered in the edit box (**RK3**), enter a new name in the combo box.
- ⇨ Click [OK]. If an existing reference file is now to be overwritten, confirm this in the following dialogue box.
- ⇨ To abort the process, click the [Cancel] button.

Load reference file:

- ⇨ Click the [Read] button (**RK7**). The "Open File" dialogue box opens.
- ⇨ Select the desired reference file. It is also possible to read a text file created by a text editor. This file must consist of the two columns particle size x and cumulative distribution Q(x), whereas x must be listed in ascending order.
- ⇨ Click the [Open] button. The dialogue box closes and the selected file is loaded. Values, that might have been already contained in the edit box (**RK3**) are overwritten.
- ⇨ To abort the process, click the [Cancel] button.

NOTICE For both, the pasting from the clipboard, and the loading of text files, tabulators or spaces are interpreted as a delimiter. Commas or dots are interpreted as decimal mark.

Edit reference file:
Values can be added to or removed from the edit box (**RK3**).
⇨ Make the desired modifications in the edit box (**RK3**).
⇨ Click the [Update] button (**RK5**).
⇨ To save any changes made, click the [Save] button (**RK6**).

Afterwards, up to two reference distributions can be displayed in the graph window and for example construed as comparison curves or min./max. threshold curves (→ Chapter "Graph").

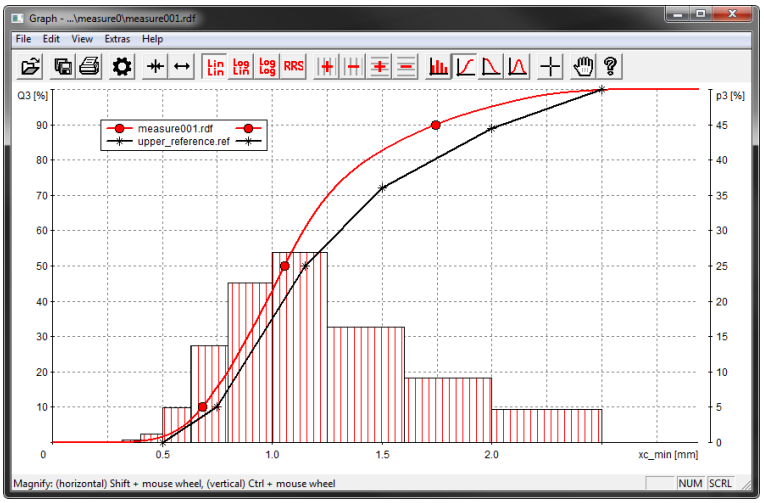


Fig. 80: Graph with reference distribution

4.5.6 Create Fitting File

NOTICE This function is not available in measurement mode.

Via the menu function │Create fitting file│, fitting files (FIT, FTE file) can be created and stored.

⇨ In the main window, click on the menu bar item │Options│ and select │Create fitting file│ from the context menu. The corresponding dialogue box opens.

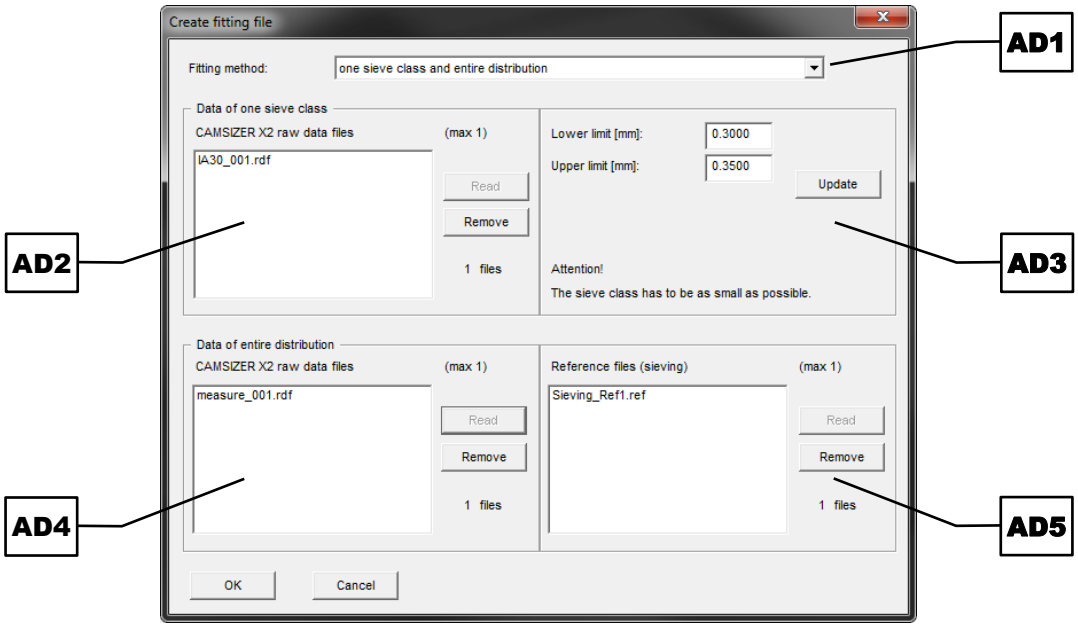


Fig. 81: Create fitting file

During the measurement process with the CAMSIZER® X2, the particle projections recorded by the cameras represent random perspectives of the freely moving and rotating particles. A three-dimensional particle can therefore generate different two-dimensional projections depending on its orientation. In a sieve analysis, on the other hand, the particles are always falling aligned, i.e. with their narrowest width through the sieve mesh. This circumstance inevitably leads to discrepancies between a CAMSIZER® X2 measurement and a sieve analysis for one and the same sample. The more irregular the particles of the sample are, the greater the deviations of the measurement results.

For non-spherical particles, the distribution of a CAMSIZER® X2 measurement is always broader than that of a sieve analysis. By means of fitting files, the measurement results of the CAMSIZER® X2 can be adapted to a sieve analysis.

In order to create a fitting file, measurement results from both, a sieve analysis and a CAMSIZER® X2 measurement are required from the same sample.

⇨ Divide the desired sample into two subsamples.
⇨ Perform a sieve analysis with the first subsample.
⇨ Create a reference file from the results of the sieve analysis (→ Chapter "Input Reference Distribution").
⇨ Perform a CAMSIZER® X2 measurement with the second subsample.
⇨ Take the sieve residue from one of the test sieves and perform a CAMSIZER® X2 measurement of this single sieve class. **NOTICE** The sieve class should preferably be located in the centre of the distribution, be as narrow as possible and contain enough material for a CAMSIZER® X2 measurement.

Fitting method:

⇨ Select the desired fitting method from the dropdown list (**AD1**):

Fitting method	Description
$Q_3(x)$ fitting, $Q_0(x)$ fitting, $Q_2(x)$ fitting	Creates a simple FIT file, which leads to a good match between the CAMSIZER® X2 data and the sieve data. However, the created FIT file is only applicable to a limited degree to other samples. The samples may only differ slightly in distribution width, particle size, particle shape and mean value from the sample used to create the fitting file.
One sieve class	Creates an FTE file that, unlike the FIT file, is also applicable to samples that differ in the distribution width and the mean value from the sample used to create the fitting file. However, the particle shape may only differ slightly.
One sieve class and entire distribution	Creates an FTE file, which allows an exact matching between a sieve analysis and the measurement results of the CAMSIZER® X2, since also the shape of the particles is taken into account. This fitting file can also be applied to samples that differ in the particle size distribution and the mean value from the sample used to create the fitting file. Nevertheless, the particle shape should not differ too much.
Entire distribution, using symmetrical Weibull distribution	Creates an FTE file whose calculation is based on a symmetric Weibull distribution, i.e. whose parameters have been selected in such a way that it resembles a Gaussian distribution. This fitting should only be applied to samples with a symmetrical particle distribution. In addition, the particles should have the same particle shape over the entire distribution width.

Selection of files for the Q(x) fitting:

⇨ Click the [Read] button in section (**AD4**). The "Open File" dialogue box opens.
⇨ Select the CAMSIZER® X2 raw data file of the measurement over the entire distribution (measurement of the second subsample).
⇨ Click the [Open] button. The dialogue box closes and the selected file is listed in the edit box in section (**AD4**).
⇨ Click the [Read] button in section (**AD5**). The "Open File" dialogue box opens.
⇨ Select the reference file of the sieve analysis (analysis of the first subsample).
⇨ To remove a loaded file from the respective edit box, mark the desired file and click the [Remove] button in the respective section.

Selection of files for the fitting with one sieve class:

⇨ Click the [Read] button in section (**AD2**). The "Open File" dialogue box opens.
⇨ Select the CAMSIZER® X2 raw data file of the measurement over one selected sieve class (measurement of the sieve residue from one of the test sieves).
⇨ Click the [Open] button. The dialogue box closes and the selected file is listed in the edit box in section (**AD2**).
⇨ To remove the loaded file from the edit box, mark the file and click the [Remove] button.
⇨ Enter the lower limit (mesh size of the test sieve) and the upper limit (mesh size of the overlying test sieve) in mm in the corresponding edit boxes in section (**AD3**).
⇨ Enter, if necessary, the sieve factor in section (**AD3**). The sieve factor shifts the adjusted CAMSIZER® X2 distribution on the X axis. An adjustment of the sieve factor is only

necessary in rare cases, e.g. if the sieve meshes of the test sieve no longer correspond to the specified mesh size due to wear.

⇨ Click the [Update] button to apply the values.

Selection of files for the fitting with one sieve class and the entire distribution:

⇨ Click the [Read] button in section (**AD2**). The "Open File" dialogue box opens.

⇨ Select the CAMSIZER® X2 raw data file of the measurement over one selected sieve class (measurement of the sieve residue from one of the test sieves).

⇨ Click the [Open] button. The dialogue box closes and the selected file is listed in the edit box in section (**AD2**).

⇨ Enter the lower limit (mesh size of the test sieve) and the upper limit (mesh size of the overlying test sieve) in mm in the corresponding edit boxes in section (**AD3**).

⇨ Click the [Update] button to apply the values.

⇨ Click the [Read] button in section (**AD4**). The "Open File" dialogue box opens.

⇨ Select the CAMSIZER® X2 raw data file of the measurement over the entire distribution (measurement of the second subsample).

⇨ Click the [Open] button. The dialogue box closes and the selected file is listed in the edit box in section (**AD4**).

⇨ Click the [Read] button in section (**AD5**). The "Open File" dialogue box opens.

⇨ Select the reference file of the sieve analysis (analysis of the first subsample).

⇨ To remove a loaded file from the respective edit box, mark the desired file and click the [Remove] button in the respective section.

Selection of files for the fitting with the entire distribution, using the symmetrical Weibull distribution:

The file selection is the same as for the Q(x) fitting.

Creating a fitting file:

⇨ Click [OK] to start the calculation after the selection of the fitting method and the corresponding files. The dialogue box with a preview of the fitting opens.

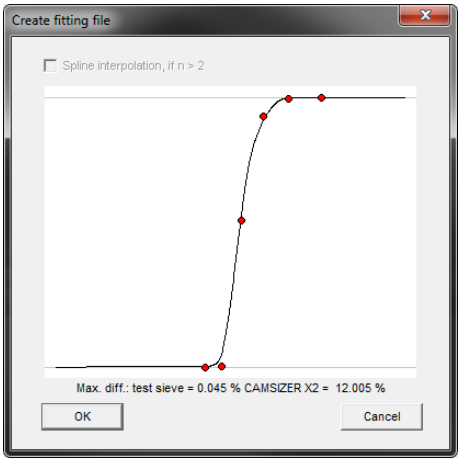


Fig. 82: Preview of the fitting

The curve represents the adjusted CAMSIZER® X2 distribution, while the points illustrate the data of the sieve analysis. Depending on the fitting method, different information and setting options are available.

Fitting method	Information / functions
$Q_3(x)$ fitting, $Q_0(x)$ fitting, $Q_2(x)$ fitting	For this fitting method, the possibility exists to perform a spline interpolation, if the curve shows "kinks". ⇨ Check, if necessary, the ⟨Spline interpolation, if n > 2⟩ checkbox.
One sieve class	Below the graph, information on the accuracy of the adjustment is displayed: – Max. diff.: CAMSIZER® X2: the adjusted distribution is compared with the measured distribution and the maximum difference is expressed in percent. The smaller the maximum deviation, the less the CAMSIZER® X2 measurement curve had to be adjusted to correspond to the sieve data.
One sieve class and entire distribution Entire distribution, using symmetrical Weibull distribution	Below the graph, information on the accuracy of the adjustment is displayed: – Max. diff.: test sieve: the adjusted distribution is compared with the sieve analysis and the maximum difference is expressed in percent. The smaller the maximum deviation, the better the fitting. – Max. diff.: CAMSIZER® X2: the adjusted distribution is compared with the measured distribution and the maximum difference is expressed in percent. The smaller the maximum deviation, the less the CAMSIZER® X2 measurement curve had to be adjusted to correspond to the sieve data.

⇨ Click [OK] to create the fitting file. The corresponding dialogue box opens.
⇨ To overwrite an existing fitting file, select the desired file from the combo box.
⇨ To create a new fitting file, enter a new name in the combo box.
⇨ Click [OK]. If an existing fitting file is now to be overwritten, confirm this in the following dialogue box.
⇨ To abort the process, click the [Cancel] button.

4.5.7 Info Fitting File

NOTICE This function is not available in measurement mode.

Via the menu function │Info fitting file│, information on existing fitting files can be viewed.
⇨ In the main window, click on the menu bar item │Options│ and select │Info fitting file│ from the context menu. The corresponding dialogue box opens.
⇨ Select the desired fitting file from the dropdown list.

The following information are displayed in the dialogue box:
– Date of creation
– Shape parameters (only for Q(x) fitting)
– Spline interpolation (only for Q(x) fitting)
– x value (used particle size definition, such as $x_{c\,min}$)
– Fitting method
– Sieve class (only for the fitting with one sieve class, or one sieve class and the entire distribution)
– Used raw data files

- Used reference files

Copying the fitting file information:

⇨ Click the [Copy] button to copy the information of the fitting file to the clipboard in ASCII format (text format).

Printing the fitting file information:

⇨ Click the [Print] button to print the information of the fitting file. The printer configuration dialogue box opens.
⇨ Make the desired print settings.
⇨ Click [OK] to print the information.
⇨ To abort the process, click the [Cancel] button.

4.5.8 Info Meta Fitting File

NOTICE This function is not available in measurement mode.

Via the menu function │Info meta fitting file│, information on existing meta fitting files (MTF file), that were created with a separate program, can be viewed.

⇨ In the main window, click on the menu bar item │Options│ and select │Info meta fitting file│ from the context menu. The "Open File" dialogue box opens.
⇨ Select the desired meta fitting file.
⇨ Click the [Open] button. The dialog box closes and the information of the selected file is displayed in another dialogue box.

The following information are displayed in the dialogue box:

- Used fitting files
- The raw data files used in the respective fitting file
- The reference files used in the respective fitting file
- Characteristics, value and weight
- Date of creation

⇨ Click [OK] to close the dialogue box.

4.5.9 Input Fraction Limits

NOTICE This function is not available in measurement mode.

Via the menu function │Input fraction limits│, size class-dependent reference data (reference thresholds) of fractions (RP0, RP2, RP3 file) can be created, edited and stored.

⇨ In the main window, click on the menu bar item │Options│ and select │Input fraction limits│ from the context menu. The corresponding dialogue box opens.

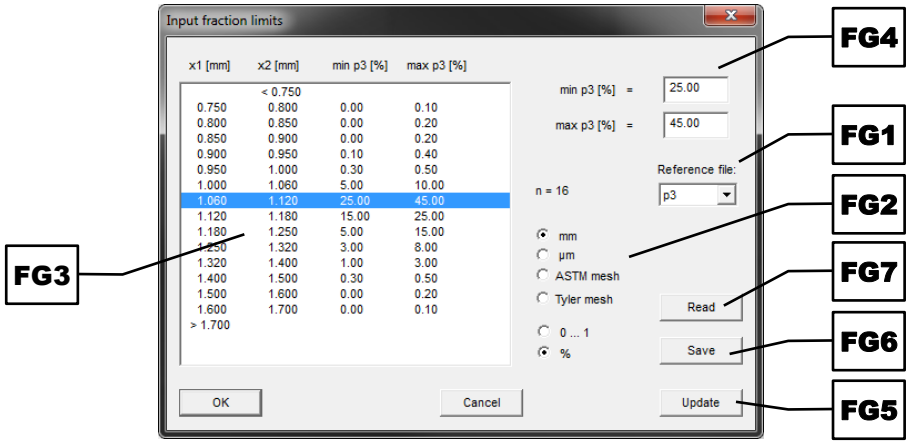


Fig. 83: Input fraction limits

Create fraction limits:

⇨ Select from the dropdown list (**FG1**) whether the fraction limits of the file are number-based $p_0(x1,x2)$, area-based $p_2(x1,x2)$, or volume-based $p_3(x1,x2)$.

⇨ Select the units (**FG2**) with which the data of the fraction limits are to be entered. The fractions ("x1" and "x2") can either be entered in ⟨mm⟩, ⟨µm⟩, ⟨ASTM mesh⟩ or ⟨Tyler mesh⟩, the fraction limits ("min" and "max") either in ⟨%⟩ or normalised from ⟨0…1⟩. Values already listed in the edit box (**FG3**) will be converted and updated.

⇨ Mark the desired fraction in the edit box (**FG3**).

⇨ Enter the desired value of the lower (minimum) and/or upper (maximum) fraction limit in the corresponding edit box (**FG4**).

⇨ Click the [Update] button (**FG5**) to apply the input.

Save fraction limits:

⇨ Click the [Save] button (**FG6**). The corresponding dialogue box opens.

⇨ To overwrite an existing fraction limits file with the values currently entered in the edit box (**FG3**), select the desired file from the combo box.

⇨ To create a new fraction limits file with the values currently entered in the edit box (**FG3**), enter a new name in the combo box.

⇨ Click [OK]. If an existing fraction limits file is now to be overwritten, confirm this in the following dialogue box.

⇨ To abort the process, click the [Cancel] button.

Load fraction limits:

⇨ Click the [Read] button (**FG7**). The "Open File" dialogue box opens.

⇨ Select the desired fraction limits file.

⇨ Click the [Open] button. The dialogue box closes and the selected file is loaded. Values, that might have been already contained in the edit box (**FG3**) are overwritten.

⇨ To abort the process, click the [Cancel] button.

Edit fraction limits:

⇨ Mark the desired fraction in the edit box (**FG3**).
⇨ Make the desired modifications in the edit boxes (**FG4**).
⇨ Click the [Update] button (**FG5**).
⇨ To save any changes made, click the [Save] button (**FG6**).

Afterwards, the created fraction limits can be used as warning (→ Chapter "Measurement Parameters"), displayed in the graph window (→ Chapter "Graph"), or listed in the table window (→ Chapter "Table").

4.5.10 Input Limits for Shape Characteristics

Via the menu function │Input limits for shape characteristics│, size class-dependent reference data (reference thresholds) of the particle shape (RS0, RS2, RS3 file) can be created, edited and stored.

⇨ In the main window, click on the menu bar item │Options│ and select │Input limits for shape characteristics│ from the context menu. The corresponding dialogue box opens.

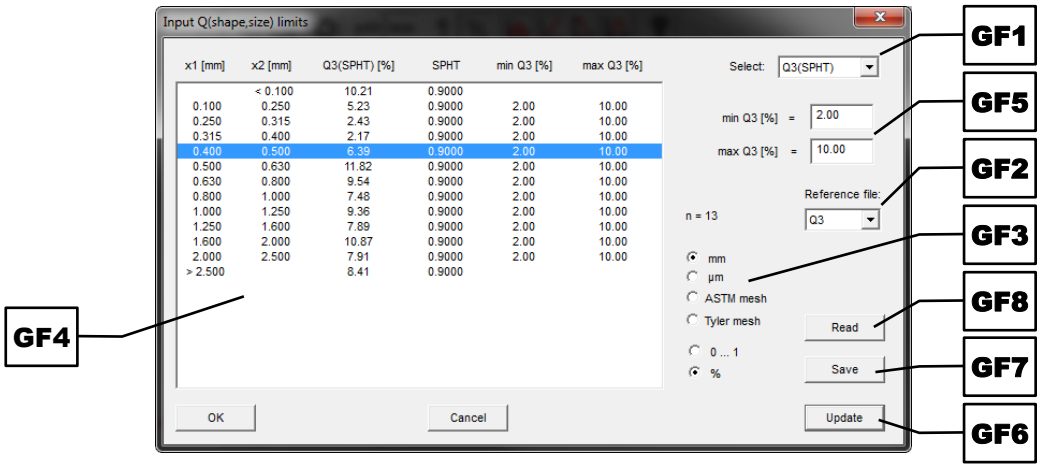


Fig. 84: Input limits for shape characteristics

NOTICE The following steps must have been carried out beforehand, in order to be able to enter limits for shape characteristics in this dialogue box:

1. The corresponding class-dependent values Q(threshold) must be selected in the task file (→ Chapter "Measurement Parameters").
2. A measurement with this task file must have been performed.
3. The checkboxes of the class-dependent values Q(threshold) must be checked in the table window (→ Chapter "Table").

Create limits for shape characteristics:

⇨ Select one of the two previously defined shape characteristics from the dropdown list (**GF1**) for which the limit values are intended to apply.
⇨ Select from the dropdown list (**GF2**) whether the limits for shape characteristics are number-based Q_0(shape), area-based Q_2(shape), or volume-based Q_3(shape).
⇨ Select the units (**GF3**) with which the data of the limits for shape characteristics is to be entered. The fractions ("x1" and "x2") can either be entered in ⟨mm⟩, ⟨µm⟩, ⟨ASTM mesh⟩ or ⟨Tyler mesh⟩, the limits for shape characteristics ("min" and "max") either in ⟨%⟩ or normalised from ⟨0…1⟩. Values already listed in the edit box (**GF4**) will be converted and updated.

⇨ Mark the desired fraction in the edit box (**GF4**).
⇨ Enter the desired value of the lower (minimum) and/or upper (maximum) limit for the shape characteristic in the corresponding edit box (**GF5**).
⇨ Click the [Update] button (**GF6**) to apply the input.

Save limits for shape characteristics:
⇨ Click the [Save] button (**GF7**). The corresponding dialogue box opens.
⇨ To overwrite an existing file of shape characteristics limits with the values currently entered in the edit box (**GF4**), select the desired file from the combo box.
⇨ To create a new file of shape characteristics limits with the values currently entered in the edit box (**GF4**), enter a new name in the combo box.
⇨ Click [OK]. If an existing file of shape characteristics limits is now to be overwritten, confirm this in the following dialogue box.
⇨ To abort the process, click the [Cancel] button.

ⓘ It is recommended to include the shape characteristic selected in the dropdown list (**GF1**) when assigning the file name.

Load limits for shape characteristics:
⇨ Click the [Read] button (**GF8**). The "Open File" dialogue box opens.
⇨ Select the desired file of shape characteristics limits.
⇨ Click the [Open] button. The dialogue box closes and the selected file is loaded. Values, that might have been already contained in the edit box (**GF4**) are overwritten.
⇨ To abort the process, click the [Cancel] button.

Edit limits for shape characteristics:
⇨ Mark the desired fraction in the edit box (**GF4**).
⇨ Make the desired modifications in the edit boxes (**GF5**).
⇨ Click the [Update] button (**GF6**).
⇨ To save any changes made, click the [Save] button (**GF7**).

Afterwards, the created limits for shape characteristics can be used in further measurements as warning (→ Chapter "Measurement Parameters").

4.6 Functions of the Main Menu Item "Extras"

The main menu item │Extras│ contains menu functions for adjusting program-specific settings. Here, the password protection can also be enabled or disabled, as well. In addition, the device can be calibrated and a velocity adaption can be performed.

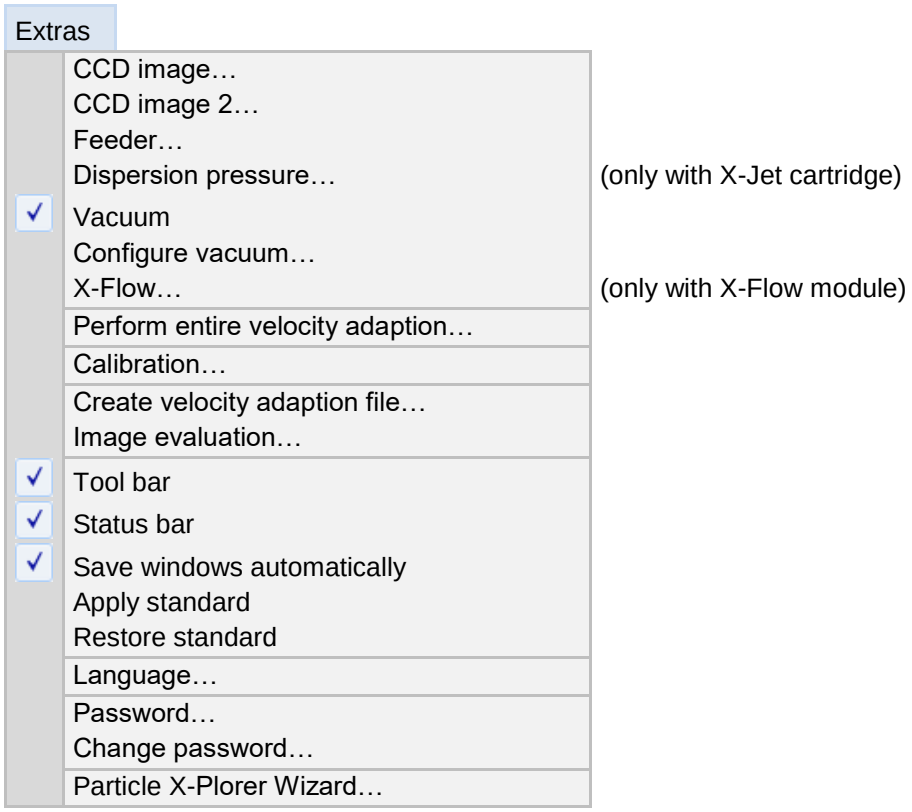


Fig. 85: Menu functions in the main menu item │Extras│

In the following subchapters, each menu function of the main menu item │Extras│ is described in detail and can be referred to individually.

4.6.1 CCD Image

Via the menu function │CCD image│, the image of the CCD Basic camera is displayed.

⇨ In the main window, click on the menu bar item │Extras│ and select │CCD image│ from the context menu. The image window opens. Alternatively, the image window can also be opened via the icon in the tool bar (**B**) of the main window.

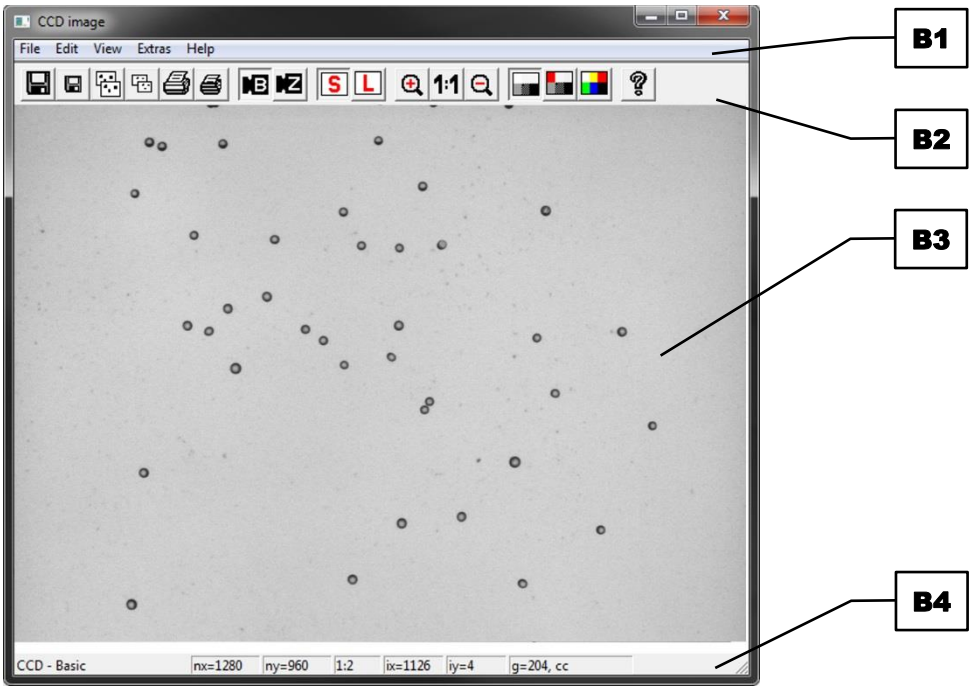


Fig. 86: Image window

In the client area (**B3**) of the image window, a live view or a snapshot (single image) of the CCD Basic or CCD Zoom camera can be displayed and individual images can be stored. Additional information about the images is displayed in the status bar (**B4**).

All functions of the image window can be accessed via the menu bar (**B1**). Frequently used functions are also available via the tool bar (**B2**). In the following table the icons are summarised.

Icon	Menu function
	│File│Save image│
	│File│Save image section│
	│Edit│Copy image│
	│Edit│Copy image section│
	│File│Print image│
	│File│Print image section│
	│View│CCD Basic│
	│View│CCD Zoom│
	│View│Snap│
	│View│Live│

	|View| Zoom in |
	|View| Factor 1 |
	|View| Zoom out |
	|View| Grey levels |
	|View| Grey levels with red |
	|View| Coloured |
	|Help|

4.6.1.1 Functions of the Menu Bar Item "File"

The menu bar item \|File\| contains menu functions for saving and printing the image or part of the image and for closing the image window.

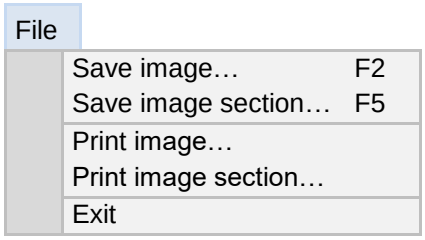


Fig. 87: Image window: menu functions of the menu bar item \|File\|

Menu function \|Save image\|:
Via the menu function \|Save image\|, the current, complete image can be saved as a Windows bitmap (BMP file), picture exchange (PCX file) or binary file (BID file).

⇨ In the image window, click on the menu bar item \|File\| and select \|Save image\| from the context menu. The corresponding dialogue box opens.
⇨ Navigate to the directory to which the image file is to be saved.
⇨ Select the desired format from the dropdown list.
⇨ Enter the desired file name.
⇨ Click the [Save] button to store the image file.
⇨ To abort the process, click the [Cancel] button.

Menu function \|Save image section\|:
Via the menu function \|Save image section\|, the current image section (part of the image currently visible in the client area (**B3**)) can be saved as a Windows bitmap (BMP file), picture exchange (PCX file) or binary file (BID file).

⇨ In the image window, click on the menu bar item \|File\| and select \|Save image section\| from the context menu. The corresponding dialogue box opens.
⇨ Navigate to the directory to which the file of the image section is to be saved.
⇨ Select the desired format from the dropdown list.
⇨ Enter the desired file name.
⇨ Click the [Save] button to store the file of the image section.
⇨ To abort the process, click the [Cancel] button.

Menu function \|Print image\|:
Via the menu function \|Print image\| the current, complete image can be printed.

⇨ In the image window, click on the menu bar item \|File\| and select \|Print image\| from the context menu. The printer configuration dialogue box opens.
⇨ Make the desired print settings.
⇨ Click [OK] to print the image.

⇨ To abort the process, click the [Cancel] button.

Menu function │Print image section│:
Via the menu function │Print image section│ the current image section (part of the image currently visible in the client area (**B3**)) can be printed.
⇨ In the image window, click on the menu bar item │File│ and select │Print image section│ from the context menu. The printer configuration dialogue box opens.
⇨ Make the desired print settings.
⇨ Click [OK] to print the image section.
⇨ To abort the process, click the [Cancel] button.

Menu function │Exit│:
Via the menu function │Exit│, the image window can be closed.
⇨ In the image window, click on the menu bar item │File│ and select │Exit│ from the context menu. The image window closes.

4.6.1.2 Functions of the Menu Bar Item "Edit"

The menu bar item │Edit│ contains menu functions for copying the image or part of the image to the clipboard.

Fig. 88: Image window: menu functions of the menu bar item │Edit│

Menu function │Copy image│:
Via the menu function │Copy image│, the current, complete image is copied to the clipboard as graphic.
⇨ In the image window, click on the menu bar item │Edit│ and select │Copy image│ from the context menu. The image is copied as graphic to the clipboard.

Menu function │Copy image section│:
Via the menu function │Copy image section│, the current image section (part of the image currently visible in the client area (**B3**)) is copied to the clipboard as graphic.
⇨ In the image window, click on the menu bar item │Edit│ and select │Copy image section│ from the context menu. The image section is copied as graphic to the clipboard.

4.6.1.3 Functions of the Menu Bar Item "View"

The menu bar item │View│ contains menu functions for the configuration of the image presentation.

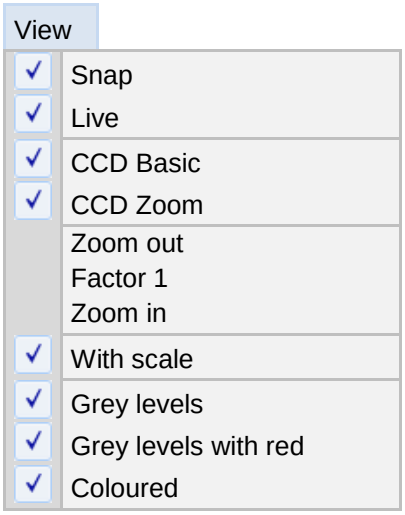


Fig. 89: Image window: menu functions of the menu bar item │View│

Menu function │Snap│:
Via the menu function │Snap│, the live view is switched to single image. The image window displays the image recorded by the camera at the time the menu function was activated. Since the two cameras permanently transmit a live view to the CAMSIZER® X2 program, the single image can be updated, i.e. replaced by the next snapshot by repeatedly selecting this menu function.

⇨ In the image window, click on the menu bar item │View│ and select │Snap│ from the context menu. The image window displays the single image at the time the menu function is activated. In addition, the activated function is marked with the ✓ icon in front of the context menu item.

NOTICE This menu function is not available when the image window is opened during a measurement process.

Menu function │Live│:
Via the menu function │Live│, the single image is switched to live view. The image window displays the live view with the display interval defined in the task file (→ Chapter "Measurement Parameters").

⇨ In the image window, click on the menu bar item │View│ and select │Live│ from the context menu. The image window displays the live view of the camera. In addition, the activated function is marked with the ✓ icon in front of the context menu item.

NOTICE This menu function is not available when the image window is opened during a measurement process.

Menu function │CCD Basic│:
Via the menu function │CCD Basic│, the images of the CCD Basic camera are displayed in the client area (**B3**) of the image window.

⇨ In the image window, click on the menu bar item │View│ and select │CCD Basic│ from the context menu. The image window displays the transmission of the CCD Basic camera. In addition, the activated function is marked with the ✓ icon in front of the context menu item.

Menu function │CCD Zoom│:
Via the menu function │CCD Zoom│, the images of the CCD Zoom camera are displayed in the client area (**B3**) of the image window.
⇨ In the image window, click on the menu bar item │View│ and select │CCD Zoom│ from the context menu. The image window displays the transmission of the CCD Zoom camera. In addition, the activated function is marked with the ✓ icon in front of the context menu item.

Menu function │Zoom out│:
Via the menu function │Zoom out│, the current image in the client area (**B3**) of the image window is displayed in a reduced size. By repeatedly selecting the menu function, the view can be decreased in size gradually to scales of 1:2, 1:3, 1:4, …, 1:32.
⇨ In the image window, click on the menu bar item │View│ and select │Zoom out│ from the context menu. The image is displayed reduced by one stage.

Menu function │Factor 1│:
Via the menu function │Factor 1│, the current image in the client area (**B3**) of the image window is displayed in the scale 1:1.
⇨ In the image window, click on the menu bar item │View│ and select │Factor 1│ from the context menu. The image is displayed in full scale.

Menu function │Zoom in│:
Via the menu function │Zoom in│, the current image in the client area (**B3**) of the image window is displayed enlarged. The images can be displayed at a maximum scale of 2:1. If the view had previously been reduced, the image can be magnified gradually up to a scale of 2:1 by repeatedly selecting the menu function.
⇨ In the image window, click on the menu bar item │View│ and select │Zoom in│ from the context menu. The image is displayed enlarged by one stage.

ⓘ Zooming in the display in the direction of the X and Y axis is possible by dragging over the area of interest using the right mouse button. The selected area is positioned in the centre of the client area (**B3**) and enlarged to the scale of 2:1.

Menu function │With scale│:
Via the menu function │With scale│, a scale is displayed in the client area (**B3**) of the image window.
⇨ In the image window, click on the menu bar item │View│ and select │With scale│ from the context menu. A scale is displayed centrally in the lower part of the image window. In addition, the activated function is marked with the ✓ icon in front of the context menu item.

Menu function │Grey levels│:
Via the menu function │Grey levels│, the images in the client area (**B3**) of the image window are displayed in grey scale.
⇨ In the image window, click on the menu bar item │View│ and select │Grey levels│ from the context menu. The images are displayed in 256 grey levels (0 – 255). In addition, the activated function is marked with the ✓ icon in front of the context menu item.

Menu function │Grey levels with red│:
Via the menu function │Grey levels with red│, the images in the client area (**B3**) of the image window are displayed in grey scale and one red level.

⇨ In the image window, click on the menu bar item │View│ and select │Grey levels with red│ from the context menu. The images are displayed in 255 grey levels (0 – 254) and one red level. Here, red corresponds to the grey scale value 255, i.e. white. In addition, the activated function is marked with the ✓ icon in front of the context menu item.

Menu function │Coloured│:
Via the menu function │Coloured│, the images in the client area (**B3**) of the image window are displayed in false colour.

⇨ In the image window, click on the menu bar item │View│ and select │Coloured│ from the context menu. The darker image areas are displayed in blue, green and yellow, while the lighter areas are displayed in grey, white and red. In addition, the activated function is marked with the ✓ icon in front of the context menu item.

4.6.1.4 Functions of the Menu Bar Item "Extras"

The menu bar item │Extras│ contains menu functions for adjusting window-specific settings.

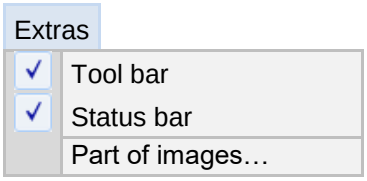


Fig. 90: Image window: menu functions of the menu bar item │Extras│

Menu function │Tool bar│:
Via the menu function │Tool bar│, the tool bar (icon bar) can be displayed or hidden.

⇨ In the image window, click on the menu bar item │Extras│ and select │Tool bar│ from the context menu. The tool bar is displayed. In addition, the activated function is marked with the ✓ icon in front of the context menu item.

⇨ To hide the tool bar, click again on the context menu item │Tool bar│. The context menu item is unmarked again.

Menu function │Status bar│:
Via the menu function │Status bar│, the status bar can be displayed or hidden.

⇨ In the image window, click on the menu bar item │Extras│ and select │Status bar│ from the context menu. The status bar is displayed. In addition, the activated function is marked with the ✓ icon in front of the context menu item.

⇨ To hide the status bar, click again on the context menu item │Status bar│. The context menu item is unmarked again.

The status bar of the image window displays additional information on the image pixel of the current mouse curser position.

Information	Description
CCD Basic, CCD Zoom	Specifies the camera from which the displayed image is transferred.
nx, ny	Specifies the size of the displayed image in pixels. Here, "nx" refers to the image width (X direction), whereas "ny" indicates the image height (Y direction).
Scaling	Specifies the current scaling of the image. With a factor of 2:1, the image is magnified. With factor 1:1, the image is displayed in original size. With image factors of 1:2, 1:3, … 1:32, the image is displayed in a reduced size.
ix, iy	Specifies the current mouse curser position in pixels. Hereby, "ix" and "iy" correspond to the X and Y coordinate, respectively, with the zero point located in the upper left corner of the image.
g	Specifies the grey value of the pixel at the current mouse curser position as decimal value from 0 to 255 and as hexadecimal value from 00 to FF.

Menu function │Part of images│:
Via the menu function │Part of images│, the image area can be restricted and thus parts of the image can be excluded from the measurement. Particles located in disabled image areas are discarded, i.e. are not included in the measurement result.

⇨ In the image window, click on the menu bar item │Extras│ and select │Part of images│ from the context menu. The corresponding dialogue box opens.

⇨ Select the desired ratio "image part size to image size" for the CCD Basic and CCD Zoom camera from the respective dropdown lists.

For each camera, one of the following ratios can be selected:

Ratio	Description
1:1	No image areas are excluded from the measurement.
2:3	The lowest third of the image is excluded from the measurement.
1:2	The lower half of the image is excluded from the measurement.
1:3	Only the top third of the image contributes to the measurement.
1:6	Only the top sixth of the image contributes to the measurement.
Centre	The top and lowest tenth of the image are excluded from the measurement.
u 1:6, l 1:3	The top sixth and the lowest third of the image are excluded from the measurement.
u 1:10, l 1:3	The top tenth and the lowest third of the image are excluded from the measurement.
user defined	The upper and lower image areas to be excluded from the measurement can be specified as desired. ⇨ Enter the desired number of pixels in the corresponding edit boxes for the upper and lower border.

The image areas excluded from the measurement are displayed crossed out in the client area (**B3**) of the image window.

⇨ To refresh the image window, when changing the selected part of image, switch to the live view.

4.6.1.5 Functions of the Menu Bar Item "Help"

The menu bar item │Help│ opens the manual as PDF file.

4.6.2 CCD Image 2

Via the menu function │CCD image 2│, a second image window opens. Thus, the images of both cameras can be viewed at the same time.

⇨ If an image window is already open, click on the menu bar item │Extras│ in the main window and select │CCD image 2│ from the context menu. The second image window opens.

Alternatively, the second image window can also be opened via the  icon in the tool bar (**B**) of the main window.

All settings and functions correspond to those of the first image window and are described in detail in Chapter "CCD Image".

4.6.3 Feeder

The conveying behaviour of the sample to be measured on the feed chute depends on the sample material and the selected feed chute. In order to test the behaviour of the sample material on the selected feed chute, some sample material can be placed on the feed chute and the optimum feeder power (conveying speed) can be set by means of the manual feeder control.

Via the menu function │Feeder│, the feeder power can be manually adjusted between 0 % and 100 %.

⇨ In the main window, click on the menu bar item │Extras│ and select │Feeder│ from the context menu. The corresponding dialogue box opens. Alternatively, the dialogue box can also be opened via the  icon in the tool bar (**B**) of the main window.

⇨ Move the slider to the right to increase the feeder power.

⇨ Move the slider to the left to decrease the feeder power.

⇨ Click the [Stop] button to set the feeder power to 0 %.

Once the desired conveying speed has been found, the optimum values of the feeder power for the fast forward and the measurement can be entered in the respective edit boxes in the task file (AFG file) (→ Chapter "Measurement Parameters").

4.6.4 Dispersion Pressure

Via the menu function │Dispersion pressure│, the compressed air supply can be manually switched on or off for the CAMSIZER® X2 configured for the X-Jet measurement method.

⇨ In the main window, click on the menu bar item │Extras│ and select │Dispersion pressure│ from the context menu. The corresponding dialogue box opens. Alternatively, the dialogue box can also be opened via the  icon in the tool bar (**B**) of the main window.

⇨ Enter the desired dispersion pressure in kPa in the edit box (maximum 460 kPa).

⇨ Press the Return key on the keyboard. The vacuum (industrial vacuum cleaner) is switched on, followed by the compressed air supply. ***NOTICE*** To avoid contamination in the device, please ensure that the industrial vacuum cleaner is connected and ready for operation before switching on the dispersion pressure.

⇨ To switch the dispersion pressure off again, close the dialogue box or enter 0 kPa in the edit box.

4.6.5 Vacuum

Via the menu function │Vacuum│, the industrial vacuum cleaner connected to the CAMSIZER® X2 can be manually switched on or off.

⇨ In the main window, click on the menu bar item │Extras│ and select │Vacuum│ from the context menu. The vacuum, i.e. the industrial vacuum cleaner is switched on. In addition, the activated function is marked with the ✓ icon in front of the context menu item. Alternatively, the vacuum can also be switched on via the icon in the tool bar (**B**) of the main window.

⇨ To switch off the vacuum (industrial vacuum cleaner), click again on the context menu item │Vacuum│. The context menu item is unmarked again.

4.6.6 Configure Vacuum

NOTICE This function is not available in measurement mode.

Via the menu function │Configure vacuum│, the display for the vacuum in the dialogue box "Measure" can be adjusted. ***NOTICE*** An adjustment is only necessary in exceptional cases. It is recommended to keep the default settings.

⇨ In the main window, click on the menu bar item │Extras│ and select │Configure vacuum│ from the context menu. The corresponding dialogue box opens.

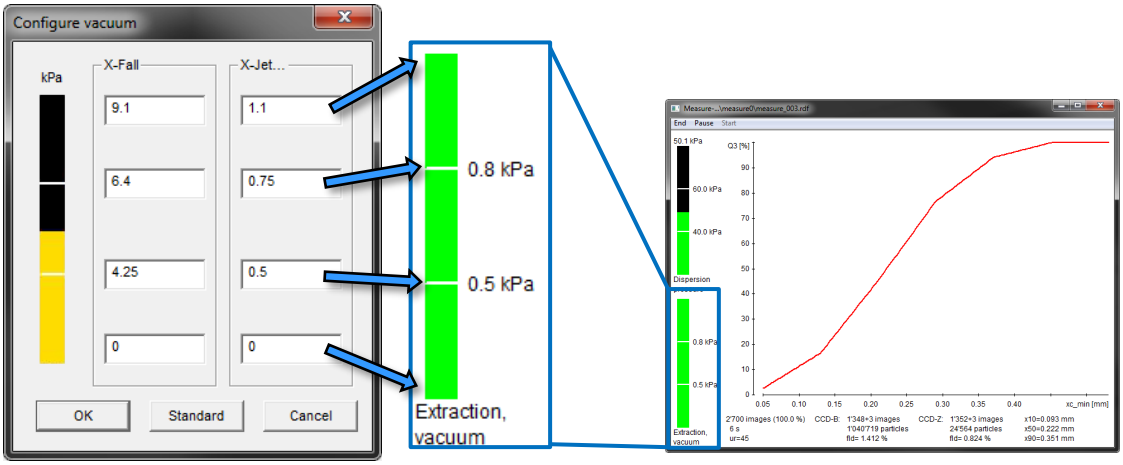


Fig. 91: Configure vacuum: configuration (left) and display (right)

⇨ Enter the desired limit values in the respective edit boxes for the X-Fall and X-Jet measurement methods.

⇨ Click [OK] to apply the values. The display in the dialogue box "Measure" is adjusted accordingly, with the set values rounded to one decimal place.

⇨ To reset the input, click the [Standard] button.

⇨ To discard the changes, click the [Cancel] button.

4.6.7 X-Flow

Via the menu function │X-Flow│, the X-Flow module can be controlled manually and the corresponding parameters can be set.

⇨ In the main window, click on the menu bar item │Extras│ and select │X-Flow│ from the context menu. The corresponding dialogue box opens. Alternatively, the dialogue box can also be opened via the  icon in the tool bar (**B**) of the main window.

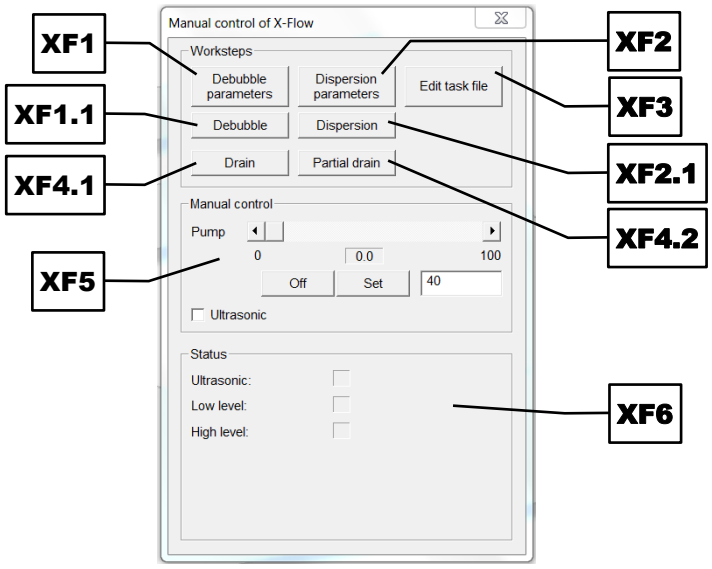


Fig. 92: Manual control of the X-Flow

Debubble parameters:

The degassing of the dispersant should be carried out before each measurement. Thereby, air bubbles, which can falsify the measurement result, are removed from the dispersant.

⇨ Click the [Debubble parameters] button (**XF1**). The corresponding dialogue box opens.

⇨ Enter the desired limit of the covered area in percent in the respective edit box. The limit value indicates the minimum covered area, from which no degassing is required.

⇨ Enter the maximum number of cycles and the desired number of steps per cycle in the respective edit boxes. One cycle consists of up to six steps.

⇨ For each step, enter the desired pump capacity in percent and the desired time in seconds in the respective edit boxes, and, if desired, activate the ultrasonic sound.

⇨ Click [OK] to apply the values.

⇨ To restore the settings, click the [Standard] button.

⇨ To discard the changes, click the [Cancel] button.

ⓘ The optimum degassing parameters depend on the dispersant. Since the degassing takes place before the addition of the sample to the dispersant, it is recommended to set the limit value of the nominal covered area very low to max. 0.01 %. Generally, within one cycle, the steps are performed alternately with circulation (e.g. with a pump capacity of 20 %) and without circulation (pump capacity 0 %).

ⓘ When using water as a dispersant, it is recommended to use clean, deionised, pre-degassed water. For this purpose, the water should be allowed to stand for at least 24 hours and, if necessary, be filtered. The ultrasonic sound can also be switched on as support for degassing the water.

ⓘ Too low a level of the dispersant or too high a pump capacity can lead to bubble formation. Bubbles can also remain irremovable on the glass walls of the flow cell. Usually these bubbles can be removed with maximum pump capacity (100 %), otherwise the dispersant must be drained and refilled to achieve the desired low nominal covered area.

Debubble:

⇨ Click the [Debubble] button (**XF1.1**). The degassing is carried out according to the specified degassing parameters.

In the status area (**XF6**) of the dialogue box for manual control, the nominal covered area and the currently executed step and cycle are now displayed additionally. Furthermore, a graphical display of the nominal covered area with the defined limit value appears.

If the nominal covered area is higher than the set limit value, i.e. if there are still too many air bubbles in the dispersant, the nominal covered area is displayed as a red bar. If the nominal covered area drops below the set limit value by the degassing, the bar turns green.

⇨ Click the [Debubble] button (**XF1.1**) again. The degassing process is terminated and the sample can now be added and dispersed.

Dispersion parameters:

After degassing, the sample material must be added to the dispersant and distributed evenly by the pump. The dispersion parameters to be used can be defined via the [Dispersion parameters] button.

⇨ Click the [Dispersion parameters] button (**XF2**). The corresponding dialogue box opens.

⇨ Enter the desired lower and upper limit values of the covered area in percent in the respective edit boxes.

The maximum limit value is synonymous with the nominal covered area defined for a dry measurement (→ Chapter "Measurement Parameters"). Falling below the minimum limit value only results in a longer measurement duration.

The other settings can be made analogous to the degassing parameters.

The optimum dispersion parameters depend on the dispersant and the sample material. It is recommended to choose the pump capacity sufficiently high that sedimentation of the sample can be prevented, but not so high that additional air bubbles are produced.

Dispersion:

⇨ Click the [Dispersion] button (**XF2.1**). The dispersion is carried out according to the specified dispersion parameters.

In the status area (**XF6**) of the dialogue box for manual control, the nominal covered area and the currently executed step and cycle are now displayed additionally. Furthermore, a graphical display of the nominal covered area with the defined limit values appears.

⇨ Gradually add some sample material in the dispersing bath.

⇨ After each addition, wait until the sample material is distributed in the circulation system before adding further sample material.

⇨ Continue to add sample material until the nominal covered area increases above the set minimum limit (the red bar in the graphical display turns green and is now between the set limits).

⇨ Click the [Dispersion] button (**XF2.1**) again. The dispersing process is terminated and the measurement can be started.

ⓘ Depending on the sample material, it is recommended to pre-disperse the sample in a beaker and to drop it into the dispersing bath with a pipette. In the case of fine material, a few drops or a spatula tip can already be sufficient to achieve the desired covered area.

NOTICE If too much sample material has been added (the bar in the graphical display is red and above the upper limit), the particle density can be reduced by partial draining.

⇨ Click the [Partial drain] button (**XF4.2**). Part of the dispersant is drained.
⇨ Click on the [Dispersion] button (**X2.1**) and fill up the dispersant.
⇨ Repeat this process until the nominal covered area has decreased to a value between the two limit values (the graphical display shows a green bar again).

Edit task file:

The set degassing and dispersion parameters can be stored in the task file and can thus also be used for the automatic measurement (→ Chapter "Wet Measurement").

⇨ Click the [Edit task file] button (**XF3**). The "Save task file" tab of the task file opens.
⇨ Save the task file (→ Chapter "Save Task File").

Drain:

⇨ Click the [Drain] button (**XF4.1**). The pump capacity is set to 100 % and the dispersant is completely drained. The function is automatically terminated by the CAMSIZER® X2 program.

NOTICE It is recommended to drain the dispersant with the sample at the end of a measurement process and to rinse the X-Flow module three or four times with clean, deionised water.

Partial drain:

⇨ Click the [Partial drain] button (**XF4.2**). The pump capacity is set to the currently set value and a portion of the dispersant is drained. The function is automatically terminated by the CAMSIZER® X2 program.

This function can be used to drain part of the dispersant if the filling level is too high or if the nominal covered area is too high.

Manual control:

The pump can be manually controlled for test purposes. The pump capacity can be controlled via the slider or set by direct input.

⇨ In the manual control area (**XF5**), drag the slider to the required pump capacity. The pump capacity is set directly to the selected value.
⇨ Alternatively enter the desired pump capacity in the edit box and click the [Set] button.
⇨ To activate or deactivate the ultrasonic sound, check or uncheck the corresponding checkbox.
⇨ Click the [Off] button to turn off the pump.

4.6.8 Perform Entire Velocity Adaption

NOTICE This function is not available in measurement mode.

Ideally, during a measurement, all particles should move at the same velocity through the field of view of the cameras. Correspondingly, the detection probability would be the same for all particles. In practice, however, the particle velocity depends on the size, material and shape of the particles due to the different aerodynamic resistance.

In the X-Jet measurement method, for example, larger particles are accelerated less strongly in the nozzle than smaller particles. Thus, the larger particles travel more slowly through the field of view of the cameras, which in turn increases their detection probability. With the X-Fall measurement method, large, heavy particles are accelerated faster by gravity than smaller, lighter particles. Here, in turn, the detection probability of larger particles is lower.

This size-dependent detection probability leads to a shifted particle size distribution. With a measurement of the average velocity for each particle size, this shift of the particle size distribution can be corrected.

Since the velocity adaption is different for each sample material and for each dispersion pressure, a corresponding velocity adaption measurement should be performed for each sample type and its dispersion pressure. Once the velocity adaption for the sample type is determined, it can be activated via the task file. For each new measurement of the sample type, the velocity adaption is now applied and the resulting particle size distribution is corrected accordingly with the size-dependent detection probability.

NOTICE Since for a measurement with activated velocity adaption, the corrected measurement values are written to the result file (RDF file), a subsequently deactivation of the velocity adaption or a subsequent overwriting of the measurement results with a different velocity adaption is not possible.

Principle of double exposure:
A velocity adaption file (FTV file) is created with the CAMSIZER® X2 program using double exposed images.

In both cameras, the apertures are briefly opened twice within very short time intervals. Thereby, the camera images are double exposed and each particle appears twice on the same photograph. The velocity of the particles can be determined from the distances which the particles have covered within the known period of time between the opening of the apertures. The CAMSIZER® X2 program automatically detects which two silhouettes belong to one particle and form a particle pair. For each particle pair, the associated particle velocity and particle size is then calculated.

Procedure:
A velocity adaption measurement with the CAMSIZER® X2 program is performed in five separate steps:

1. Sample preparation
2. Definition of a task file **for** the velocity adaption
3. Performing a measurement **for** the velocity adaption
4. Definition of a task file **with** velocity adaption
5. Performing a measurement **with** velocity adaption

4.6.8.1 Sample Preparation

The sample for the velocity adaption measurement should represent the sample material to be measured later on as typically as possible. It is therefore recommended to divide the sample to be measured into a plurality of subsamples by means of a sample division. This ensures that the particle size distribution and the sample quantity are identical to the sample to be measured.

⇨ Divide the sample into several subsamples, each with sufficient material for one measurement.

ⓘ Take enough subsamples into account for the measurements to create the velocity adaption file (determination of the correct time intervals). The remaining subsamples can later be used for the actual measurements with activated velocity adaption.

4.6.8.2 Definition of a Task File for the Velocity Adaption

The task file for the creation of a FTV file must be identical to the task file with which the sample is to be measured later on. Only the nominal covered area should be set as low as possible so that not too many particle pairs appear in one image.

⇨ Create a task file for the velocity adaption with a nominal covered area of 0.1 – 0.15 % (→ Chapter "Measurement Parameters").

⇨ Make sure to keep all other parameters identical to those in the task file with which the sample will be measured later.

⇨ Save the task file.

ⓘ Since the velocity adaption depends on the dispersion pressure, it is recommended to include the used dispersion pressure in the name of the task file and the result files. This can prevent the usage of a wrong FTV file in a later measurement with velocity adaption.

4.6.8.3 Performing a Measurement for the Velocity Adaption

⇨ Place one of the subsamples in the funnel.

Via the menu function │Perform entire velocity adaption│, the required parameters for the double exposure can be set and then the velocity adaption file (FTV file) can be created.

⇨ In the main window, click on the menu bar item │Extras│ and select │Perform entire velocity adaption│ from the context menu. The start window of the measurement opens.

⇨ Make the desired settings (→ Chapter "Start Measurement").

⇨ Click [OK]. The start window closes and a further dialogue box for setting the parameters for the double exposure opens.

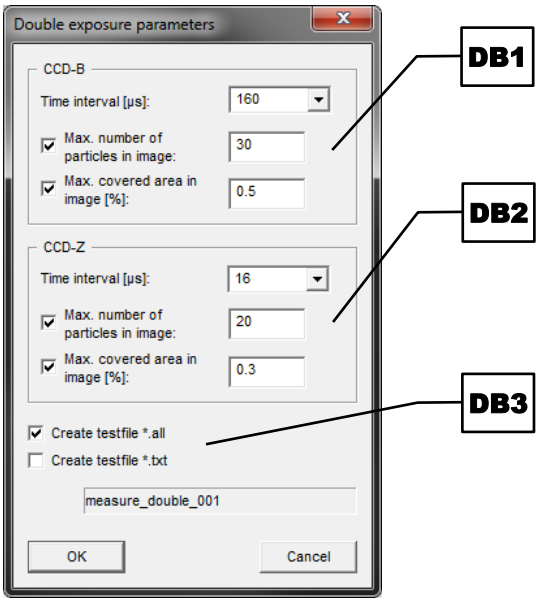


Fig. 93: Parameters for the double exposure

The parameters for the double exposure must be set individually for both cameras. Enter the parameters in the sections for the CCD Basic (**DB1**) and CCD Zoom (**BD2**) camera, respectively.

⇨ Select the desired time intervals between two exposures in µs from the corresponding dropdown lists. The time intervals must be suitably selected according to the velocity of the particles. Recommended starting values:

- CCD Basic camera: 160 µs
- CCD Zoom camera: 16 µs (rule of thumb: approx. ten times shorter as for the CCD Basic camera)

The CAMSIZER® X2 program determines the recommended time intervals with these starting values and displays the recommendation in a separate dialogue box after the measurement. If the set time intervals are outside the recommended ranges, the measurement should be repeated with the values recommended by the CAMSIZER® X2 program.

To avoid incorrect assignments, images containing more than a specified number of particles are not evaluated.

⇨ Check the ⟨Max. number of particles in image⟩ checkbox and enter the desired values in the respective edit boxes. Recommended values:

- CCD Basic camera: 30
- CCD Zoom camera: 20

For a better result, images whose nominal covered area is greater than a specified value can also be discarded.

⇨ Check the ⟨Max. covered area in image⟩ checkbox and enter the desired values in the respective edit boxes. Recommended values:

- CCD Basic camera: 0.5 %
- CCD Zoom camera: 0.3 %

⇨ Check the ⟨Create testfile *.all⟩ checkbox in section (**DB3**) to save the results in two ALL files. ALL files can be used to subsequently recalculate the velocity adaption file (FTV file) (→ Chapter "Create Velocity Adaption File"). It is recommended to keep this checkbox enabled at all times.

⇨ Check, if desired, the ⟨Create testfile *.txt⟩ checkbox in section (**DB3**) to save the results in four TXT files. The TXT files contain information on the particles and their coordinates.
⇨ Click [OK] to start the measurement. The "Measure" dialogue box opens.
⇨ To abort the process, click the [Cancel] button.

⚠ CAUTION Check the correct and firm fit of the feeder and funnel, before starting the measurement. Furthermore, the CAMSIZER® X2 must always be placed in the field of view of the user.

Observe the images of both cameras during the measurement. If the selected time intervals are too short, the particle pairs overlap in the images. If the selected time intervals are too long, the particle pairs are so far apart that the particle has already left the field of view of the camera at the time of the second exposure and thus, an assignment is no longer possible.

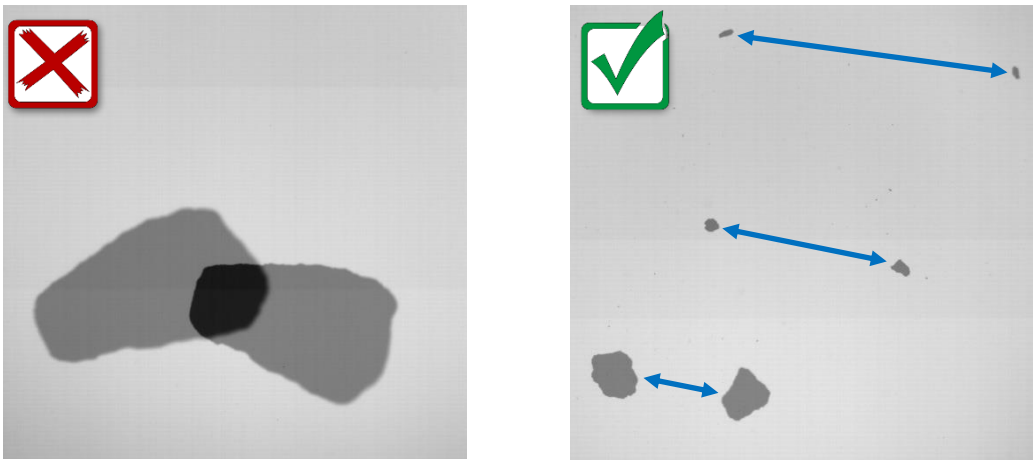


Fig. 94: Double exposed images: time interval too short (left), time interval ok (right)

After the measurement has ended automatically, the dialogue box for creating the velocity adaption file opens.

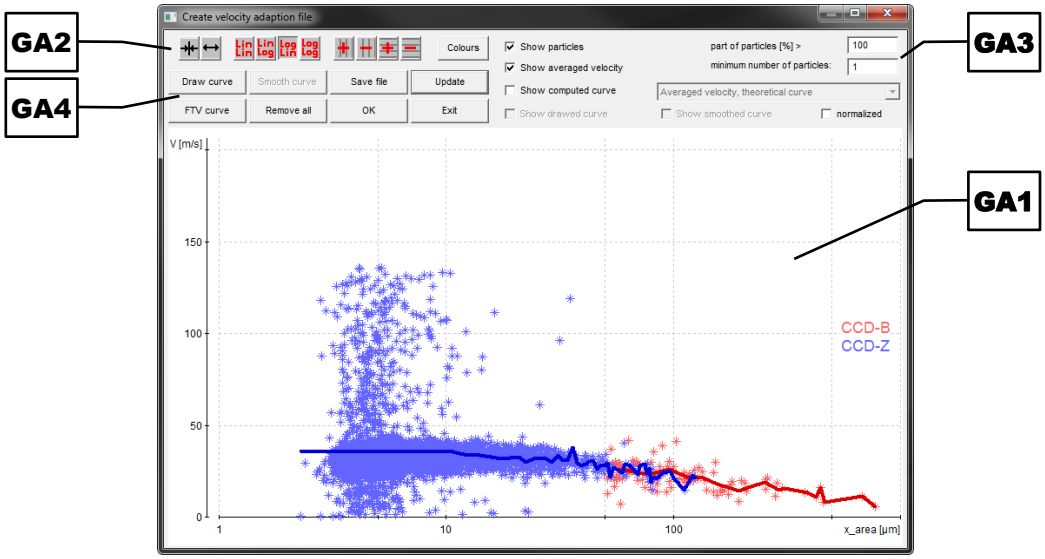


Fig. 95: Dialogue box for creating the velocity adaption file

The distribution of the particle velocities is visualised in the client area (**GA1**) of the dialogue box. Each point of the particle cloud represents a particle whose velocity has been detected by means of double exposure. Particles measured with the CCD Basic camera are shown in red. Particles measured with the CCD Zoom camera are displayed in blue. The X axis shows the particle size x_{area}, whereas the Y axis represents the particle velocity in m/s. The red and blue mean value curve show the average particle velocity, which were determined for the measurement with the CCD Basic and CCD Zoom camera, respectively.

In section (**GA2**), the display in the client area (**GA1**) can be customised:

Function	Description
	Scales the X and Y axis so that the complete measurement range is displayed
	Expands the measurement range in the direction of the X and Y axis
	Linear display of the X axis, linear display of the Y axis
	Linear display of the X axis, logarithmic display of the Y axis
	Logarithmic display of the X axis, linear display of the Y axis
	Logarithmic display of the X axis, logarithmic display of the Y axis
	Adds vertical grid lines
	Removes vertical grid lines
	Adds horizontal grid lines
	Removes horizontal grid lines
[Colours]	By clicking the [Colours] button, user-specific colours can be assigned to the individual curves and measurement points. ⇨ Click the [Colours] button. The corresponding dialogue box opens. ⇨ Click on the colour field of the desired curve or measurement points. The dialogue box for selecting the colours opens. ⇨ Select one of the basic colours, or define a new colour via the [Define Custom Colors >>] button. ⇨ Confirm the colour selection with [OK]. ⇨ To abort the colour selection, click the [Cancel] button. ⇨ Click [OK], to apply the changed colour selection. ⇨ To restore the colour selection, click the [Standard] button. ⇨ To discard the changes, click the [Cancel] button.

Zooming in the display in the direction of the X and Y axis is possible by dragging over the area of interest using the right mouse button. By clicking the  icon, the original view is restored.

In section (**GA3**), correction curves can be displayed and calculated:

Function	Description
⟨Show particles⟩	Displays the particles measured with the CCD Basic camera as red points, those of the CCD Zoom camera as blue points.
⟨Show average velocity⟩	Displays the mean value curve of the CCD Basic camera as red line, that of the CCD Zoom camera as blue line.
⟨Show computed curve⟩	Displays the velocity adaption curve calculated by the CAMSIZER® X2 program as green line. ⇨ Select the calculation method from the dropdown list for which the resulting, calculated curve "fits best". The calculated curve should be monotonically decreasing for the X-Jet measurement method, or monotonically increasing for the X-Fall measurement method. ***NOTICE*** If none of the curves computed by the CAMSIZER® X2 program is satisfactory (i.e. not monotonic or smooth enough), the curve should be drawn manually (→ Section (**GA4**)).
⟨Show drawn curve⟩	Displays the manually drawn curve as black line with white points.
⟨Show smoothed curve⟩	Displays the smoothed curve as light blue line.
⟨normalized⟩	Displays all FTV files loaded via the [FTV curve] button normalised to the first loaded FTV file. This allows an estimation of how the differences in the adaption files effectively affect the result.
Part of particles	Reduces the number of particles to the value entered in the edit box. Highly scattering values (i.e. possibly wrong assigned particle pairs) can thus be ignored and the mean value curve can be smoothed more strongly. ⇨ Enter the desired value in percent in the edit box. ⓘ A value between 60 – 80 % is recommended. Thus, 20 – 40 % of the particles which are farthest from the area of greatest frequency are ignored.
Minimum number of particles	Specifies the minimum number of particles that must be present in a size class. Size classes that contain less than the entered number of particles are excluded from the calculation. ⇨ Enter the desired number of particles in the edit box. By default, the value is set to 1. If the entered value is too high, too many size classes are excluded and a calculation of the mean value curve is no longer possible.

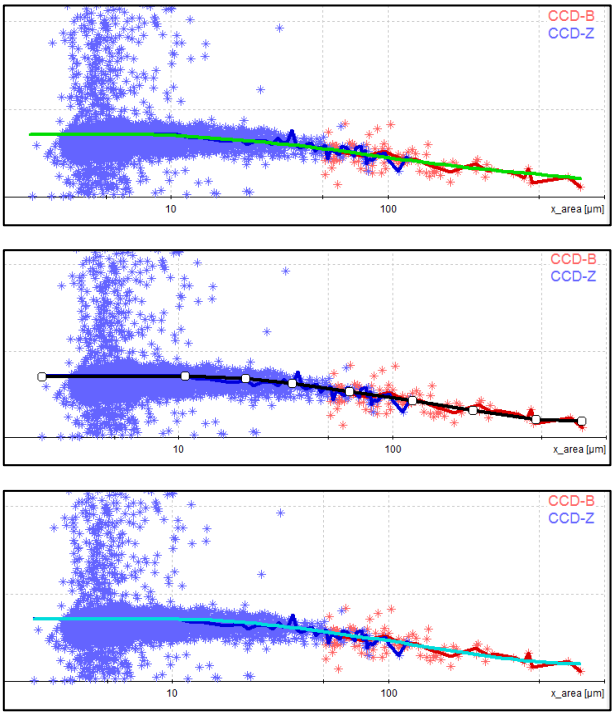


Fig. 96: Adaption curve for the X-Jet measurement method: calculated (top), drawn (centre) and smoothed (bottom)

In section (**GA4**), the adaption curve can be drawn manually, the velocity adaption can be saved or existing adaptions can be loaded:

Function	Description
[Draw curve]	Allows the manual drawing of an adaption curve. ⇨ Draw the desired curve with a series of consecutive clicks in the client area (**GA1**). The white points set with the mouse button are automatically linked by black straight lines and thus sketch the drawn curve progression. ⇨ To redraw the curve, click twice on the [Draw curve] button. The previous input is deleted and the curve can be redrawn.
[Smooth curve]	Smooths the manually drawn curve. The smoothed curve is displayed light blue.
[Save file]	Opens the corresponding dialogue box. ⇨ Select the curve to be stored from the corresponding dropdown list: – drawn (not recommended) – smoothed (recommended for manual input) – calculated (recommended for automatic calculation) ⇨ To save the selected curve as FTV file, enter the desired name in the combo box. ⇨ To overwrite an existing FTV file with the selected curve, select the desired file name from the combo box and confirm the overwriting.
[Update]	Refreshes the display.

[FTV curve]	Allows the loading and therefore the comparison of existing FTV files. ⇨ Navigate to the directory containing the FTV files. ⇨ Select the desired files. ⇨ Click the [Open] button. The dialogue box closes and the selected files are loaded. ⇨ To abort the process, click the [Cancel] button. Similar to the graphical evaluation windows, a legend is displayed. The individual curves can be removed by right-clicking on the corresponding file name in the legend.
[Remove all]	Removes all curves loaded via the [FTV curve] button from the client area (**GA1**).
[OK]	Opens the dialogue box for saving the FTV file. After saving, the CAMSIZER® X2 program calculates the recommended intervals for the double exposure. ***NOTICE*** If the time intervals set for the performed measurement are not within the recommended intervals, the measurement for the velocity adaption should be repeated with time intervals located within the ranges recommended here. ⇨ Confirm the recommended time intervals with [OK]. The dialogue box for creating the velocity adaption file closes.
[Exit]	Closes the dialogue box for creating the velocity adaption file. Where necessary, a warning appears that no FTV file has yet been saved. In a separate dialogue box, recommended time intervals are displayed. ⇨ Decide, if necessary, whether the FTV file should be saved. ⇨ Confirm the recommended time intervals with [OK].

NOTICE Ensure that the mean value curve of the CCD Basic (red) and CCD Zoom camera (blue) continuously overlap each other and that they are monotonically decreasing or increasing, depending on the measurement method. In addition, the measured particles should overlap sufficiently in the border area of the two cameras. If this should not be the case, check the parameters for the double exposure and, if necessary, repeat the measurement for the velocity adaption.

4.6.8.4 Definition of a Task File with Velocity Adaption

⇨ In the "Save task file" tab of the task file, select the previously created velocity adaption file (FTV file) from the dropdown list (**MS2.3**) (→ Chapter "Save Task File").
⇨ Make sure to keep all other parameters the same as in the task file with which the FTV file was created. In particular, the dispersion pressure must be identical!
⇨ Save the task file.
ⓘ The velocity adaption can only be applied to the measurement results during a measurement. A supplementary application will not be possible.

4.6.8.5 Performing a Measurement with Velocity Adaption

⇨ Place another subsample in the funnel.
⇨ Load the task file with activated velocity adaption (→ Chapter "Load Task File").
⇨ Start the measurement (→ Chapter "Start Measurement").

NOTICE Ensure that the correct dispersion pressure is entered in the task file and the appropriate FTV file is activated. The velocity adaption cannot be reversed or added afterwards in the result file (RDF file).

4.6.9 Calibration

NOTICE This function is not available in measurement mode.

The CAMSIZER® X2 was calibrated by Retsch Technology GmbH. For compliance with the quality guidelines it is recommended to carry out a calibration at regular intervals. A calibration should always be carried out after transporting the device. A tested and certified calibration reticle is available from your supplier or directly from Retsch Technology GmbH.

NOTICE A calibration should only be carried out by suitably trained personnel.
NOTICE Observe the preparatory work in the separate manual of the device before starting the calibration process via the CAMSIZER® X2 program.

Via the menu function │Calibration│, the calibration process is started.

⇨ In the main window, click on the menu bar item │Extras│ and select │Calibration│ from the context menu. The dialogue box for the background measurement opens.
⇨ Confirm the implementation of the background measurement with [OK]. ***NOTICE*** Ensure that no objects are in the field of view of the cameras!
⇨ Insert the calibration reticle when prompted by a subsequent dialogue box. Ensure the correct alignment of the calibration reticle (→ separate manual of the device).
⇨ Confirm the insertion of the calibration reticle with [OK]. The CAMSIZER® X2 is now calibrated.

After the completion of the calibration, the result is displayed in a further dialogue box.

Result	Measures
Calibration is OK	The calibration was successful and the deviations from the previous calibration result are minimal. An optimization is not necessary. ⇨ Click the [Yes] button to nevertheless optimise the calibration. ⇨ Click the [No] button, if the calibration process is to be continued without optimization.
Calibration is not OK	The calibration was not successful because the deviations from the previous calibration result exceeded the tolerance values. An optimization is imperative. ⇨ Click the [Yes] button to optimise the calibration. ⓘ The existing calibration can only be checked in measurement and parameter mode, but the device cannot be recalibrated. A new calibration is only possible at higher user levels. If an adjustment is not possible, it will be indicated by a further dialogue box. ⇨ Contact service. ⇨ ***NOTICE*** Do not carry out any further measurements since the measurement results may deviate to an unknown extend!

At the end of the calibration process, the calibration report can be printed.

⇨ Click the [Yes] button in the corresponding dialogue box to print the calibration report.
⇨ Click the [No] button, if no calibration report is to be printed.
⇨ Remove the calibration reticle from the device and click [OK] in the final dialogue box.

4.6.10 Create Velocity Adaption File

NOTICE This function is not available in measurement mode.

In a measurement for a velocity adaption and with the corresponding configuration (→ Chapter "Perform Entire Velocity Adaption"), two ALL files were created. One containing the data of the CCD Basic camera and one with the data of the CCD Zoom camera.

Via the menu function │Create velocity adaption file│, the velocity adaption file (FTV file) can be created subsequently from the saved pair of ALL files.

⇨ In the main window, click on the menu bar item │Extras│ and select │Create velocity adaption file│ from the context menu. The "Open File" dialogue box opens.
⇨ Navigate to the directory containing the ALL files.
⇨ Select the desired file of the **CCD Basic** camera.
⇨ Click the [Open] button. The dialogue box closes and another "Open File" dialogue box opens.
⇨ Now select the appropriate file of the **CCD Zoom** camera.
⇨ Click the [Open] button. The dialogue box closes and the dialogue box of the parameters for the velocity adaption opens.
⇨ To abort the process, click the [Cancel] button.

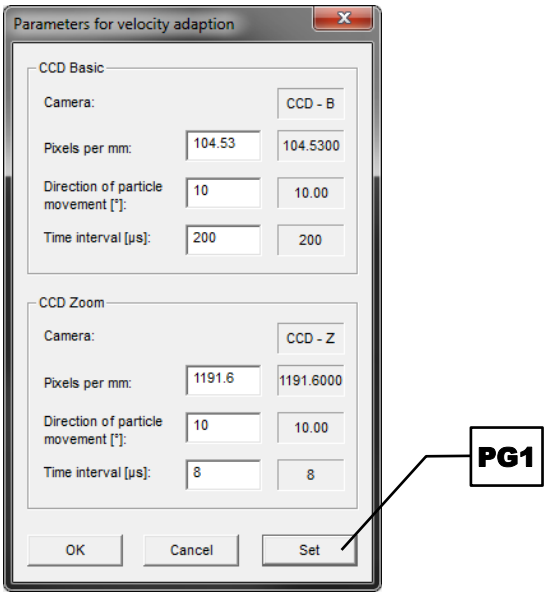


Fig. 97: Parameters for the velocity adaption

The parameters used for the measurement for the velocity adaption are stored in the loaded ALL files and are listed in the right-hand column in the dialogue box. For a correct calculation, the parameters of the CAMSIZER® X2 program listed in the left column must be identical.

⇨ Click the [Set] button (**PG1**). The parameters of the right column are transferred to the left column.
⇨ Click [OK]. The dialogue box closes and the dialogue box for creating the velocity adaption file opens.
⇨ To abort the process, click the [Cancel] button.

The further procedure, including all functions and settings in the dialogue box for creating the velocity adaption file, is described in detail in Chapter "Perform Entire Velocity Adaption".

4.6.11 Image Evaluation

Via the menu function │Image evaluation│, stored images of both cameras can be evaluated.

⇨ In the main window, click on the menu bar item │Extras│ and select │Image evaluation│ from the context menu. The image evaluation window opens.

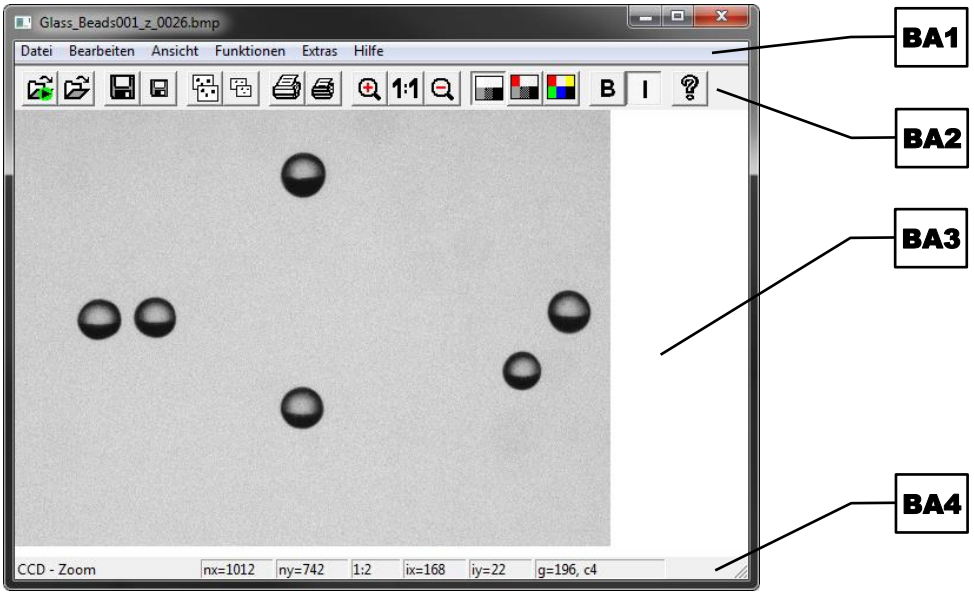


Fig. 98: Image evaluation window

The functions in the image evaluation window are nearly identical to those in the image window (→ Chapter "CCD Image"), but also allow the evaluation of the stored images. In the client area (**BA3**) of the image evaluation window, previously saved images can be displayed and the particles contained therein can be evaluated. Additional information about the images is displayed in the status bar (**BA4**).

All functions of the image evaluation window can be accessed via the menu bar (**BA1**). Frequently used functions are also available via the tool bar (**BA2**). In the following table the icons are summarised.

Icon	Menu function
	│File│Open and evaluate image│
	│File│Read image│
	│File│Save image│
	│File│Save image section│
	│Edit│Copy image│
	│Edit│Copy image section│
	│File│Print image│
	│File│Print image section│
	│View│Zoom in│
1:1	│View│Factor 1│
	│View│Zoom out│
	│View│Grey levels│

	|View| Grey levels with red |
	|View| Coloured |
	|View| Background |
	|View| Image |
	|Help|

NOTICE In order to be able to use the image evaluation, images must be saved during the measurement by the CAMSIZER® X2 program, i.e. the image saving must have been enabled in the task file before the measurement (→ Chapter "Measurement Parameters").

4.6.11.1 Functions of the Menu Bar Item "File"

The menu bar item \|File\| contains menu functions for saving and printing the image or part of the image and for closing the image evaluation window.

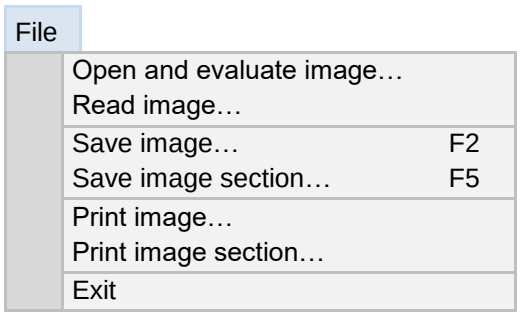


Fig. 99: Image evaluation window: menu functions of the menu bar item \|File\|

Menu function \|Open and evaluate image\|:
Via the menu function \|Open and evaluate image\|, the images to be evaluated can be selected.

⇨ In the image evaluation window, click on the menu bar item \|File\| and select \|Open and evaluate image\| from the context menu.

In order to correctly evaluate the particle data of the images, background information (empty images) of both cameras must be available to the CAMSIZER® X2 program. If no image evaluation has been carried out yet, the dialogue box for selecting the parameters for image evaluation now opens.

⇨ Make the desired settings (→ Menu function \|Parameters\|).

When the background information is available, the "Open File" dialogue box opens.

⇨ Navigate to the directory where the file folder "IMAGES" is located containing the stored image files (BMP file). ***NOTICE*** Ensure that the images to be evaluated and the background information are from the same file folder. If necessary, change the settings via the menu function \|Parameters\|.

⇨ Mark the desired image files.

⇨ Click the [Open] button to load the image files.

⇨ To abort the process, click the [Cancel] button.

ⓘ If several image files have been selected, use the arrow keys on the keyboard to navigate through the images. The name of the currently displayed image file is displayed in the header of the image evaluation window.

For each particle in the currently displayed image, the particle data can now be retrieved.

⇨ Click on the desired particle. A separate dialogue box containing the associated particle information opens.

⇨ Click [OK] to close the dialogue box.

Menu function │Read image│:

Via the menu function │Read image│, images can be loaded and viewed. A subsequent evaluation is not possible with this menu function.

⇨ In the image evaluation window, click on the menu bar item │File│ and select │Read image│ from the context menu. The "Open File" dialogue box opens.

⇨ Navigate to the directory where the file folder "IMAGES" is located containing the stored image files (BMP file).

⇨ Mark the desired image files.

⇨ Click the [Open] button to load the image files.

⇨ To abort the process, click the [Cancel] button.

ⓘ If several image files have been selected, use the arrow keys on the keyboard to navigate through the images. The name of the currently displayed image file is displayed in the header of the image evaluation window.

The following menu functions are identical to those in the image window and described in detail in Chapter "CCD Image":

- Menu function │Save image│
- Menu function │Save image section│
- Menu function │Print image│
- Menu function │Print image section│
- Menu function │Exit│

4.6.11.2 Functions of the Menu Bar Item "Edit"

The menu bar item │Edit│ contains menu functions for copying the image or part of the image to the clipboard.

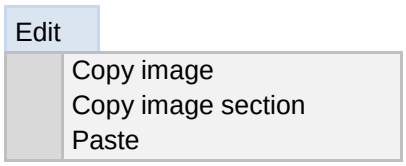


Fig. 100: Image evaluation window: menu functions of the menu bar item │Edit│

The following menu functions are identical to those in the image window and described in detail in Chapter "CCD Image":

- Menu function │Copy image│
- Menu function │Copy image section│

Menu function │Paste│:

Via the menu function │Paste│, a CAMSIZER® X2 image currently stored in the clipboard is inserted into the client area (**BA3**) of the image evaluation window.

⇨ In the image evaluation window, click on the menu bar item │Edit│ and select │Paste│ from the context menu. The CAMSIZER® X2 image is inserted from the clipboard.

4.6.11.3 Functions of the Menu Bar Item "View"

The menu bar item │View│ contains menu functions for the configuration of the image presentation.

Fig. 101: Image evaluation window: menu functions of the menu bar item │View│

The following menu functions are identical to those in the image evaluation window and described in detail in Chapter "CCD Image":

- Menu function │Zoom out│
- Menu function │Factor 1│
- Menu function │Zoom in│
- Menu function │With scale│
- Menu function │Grey levels│
- Menu function │Grey levels with red│
- Menu function │Coloured│

Menu function │Background│:
Via the menu function │Background│, the background image (empty image) is displayed in the client area (**BA3**) of the image evaluation window, which has been selected for the background information for the respective camera.

⇨ In the image evaluation window, click on the menu bar item │View│ and select │Background│ from the context menu. The background image is displayed. In addition, the activated function is marked with the ✓ icon in front of the context menu item.

NOTICE This menu function is only available when the parameters for the image evaluation (image and background information) have been selected.

Menu function │Image│:
Via the menu function │Image│, the image selected for evaluation is displayed in the client area (**BA3**) of the image evaluation window.

⇨ In the image evaluation window, click on the menu bar item │View│ and select │Image│ from the context menu. The selected image is displayed. In addition, the activated function is marked with the ✓ icon in front of the context menu item.

NOTICE This menu function is only available when the parameters for the image evaluation (image and background information) have been selected.

4.6.11.4 Functions of the Menu Bar Item "Functions"

The menu bar item │Functions│ contains menu functions for the setting of the parameters and the calling up of image information.

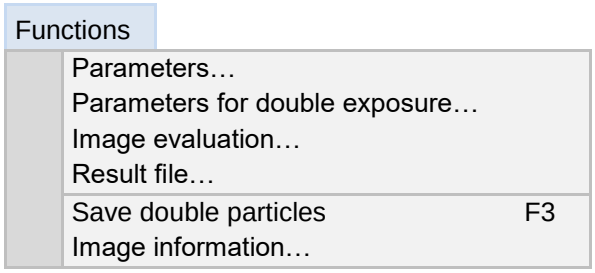


Fig. 102: Image evaluation window: menu functions of the menu bar item │Functions│

Menu function │Parameters│:
Via the menu function │Parameters│, the image evaluation can be configured.

⇨ In the image evaluation window, click on the menu bar item │Functions│ and select │Parameters│ from the context menu. The corresponding dialogue box opens.

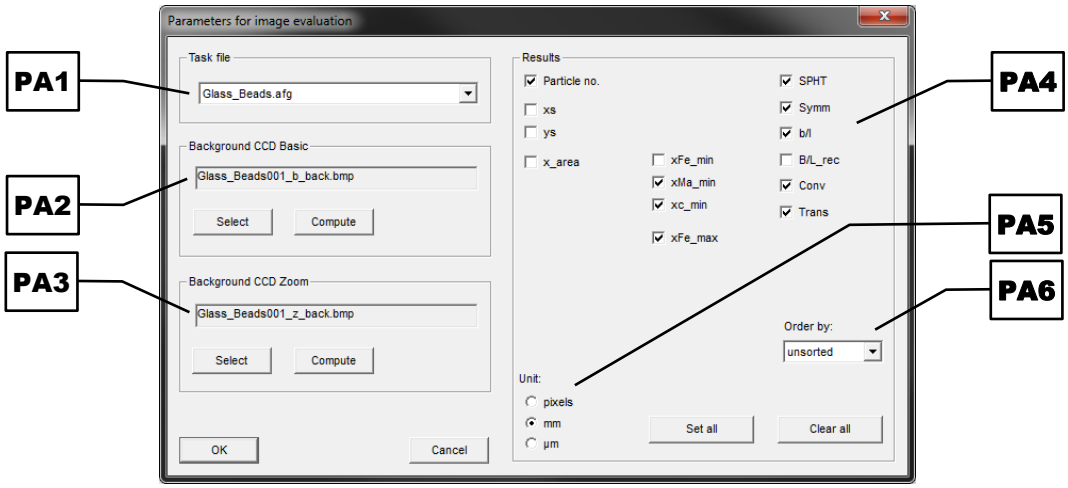


Fig. 103: Parameters for image evaluation

⇨ Select the task file from the dropdown list (**PA1**), with which the images to be evaluated have been recorded.
⇨ Click the [Select] button in the CCD Basic camera section (**PA2**) to select the corresponding empty image (background image). The corresponding dialogue box opens.
⇨ Navigate to the directory where the file folder "IMAGES" is located containing the stored image files (BMP file).
⇨ Mark the desired background image file. ***NOTICE*** Only the background images with the suffix "back" in the file name are displayed for selection. Ensure that the correct background image of the CCD Basic camera is selected for the image evaluation. This is indicated by the suffix "**b**_back" in the file name.
⇨ Click the [Open] button to load the background image file.
⇨ Click the [Select] button in the CCD Zoom camera section (**PA3**) and select again the corresponding background image. ***NOTICE*** Ensure that the correct background image of the CCD Zoom camera is selected for the image evaluation. This is indicated by the suffix "**z**_back" in the file name.

If there should be no background images available from one or both cameras, the required background information can be calculated. Hereby, the CAMSIZER® X2 program compares several recorded images to create the missing background image.

⇨ Click the [Compute] button in the CCD Basic camera section (**PA2**). The corresponding dialogue box opens.
⇨ Navigate to the directory where the file folder "IMAGES" is located containing the stored image files (BMP file).
⇨ Select as many files as possible recorded by the CCD Basic camera from the **same** measurement. These images do all contain the suffix "**b**" in the file name.
⇨ Click the [Open] button. The CAMSIZER® X2 program now calculates the corresponding background image of the CCD Basic camera.
⇨ Save the background image via the following dialogue box. ***NOTICE*** Ensure that the calculated background image contains the suffix "**b_back**" in the file name.
⇨ Click the [Compute] button in the CCD Zoom camera section (**PA3**) and repeat the procedure with the existing image files of the CCD Zoom camera. These images do all contain the suffix "**z**" in the file name. ***NOTICE*** Ensure that the calculated background image contains the suffix "**z_back**" in the file name.

In section (**PA4**), the information can be defined, that is to be displayed for the individual particles. Depending on the configuration of the software, different characteristics are available in section (**PA4**).

⇨ Select the desired characteristics in section (**PA4**).
⇨ To select all characteristics, click the [Set all] button.
⇨ To deselect all characteristics, click the [Clear all] button.
⇨ Check the desired radio buttons (**PA5**) to display the values either in ⟨pixels⟩, ⟨mm⟩ or ⟨µm⟩.
⇨ Select the order in which the particles are to be exported from the dropdown list (**PA6**) (→ Menu function │Result file│).
⇨ Click [OK] to apply the settings.
⇨ To discard the settings, click the [Cancel] button.

Menu function │Parameters for double exposure│:
Via the menu function │Parameters for double exposure│, double-exposed images can be evaluated and the particle information contained can be exported.

⇨ In the image evaluation window, click on the menu bar item │Functions│ and select │Parameters for double exposure│ from the context menu. The corresponding dialogue box opens.
⇨ Check the ⟨Show particle pairs⟩ checkbox to number the associated particle pairs in the image evaluation window and display them connected by a line.
⇨ Enter the direction of movement of the particles in the image in degrees in the respective edit box. In an X-Jet measurement, this is 10°, in the case of an X-Fall measurement 90°.
⇨ Enter the time interval of the double exposure used in the measurement in µs in the respective edit box. ***NOTICE*** Ensure to enter the correct double exposure time for the loaded image. The times are different for the CCD Basic camera and the CCD Zoom camera. An incorrectly entered double exposure time results in incorrect results in the result file!
⇨ Click the [Result file] button. The corresponding dialogue box opens.
⇨ Navigate to the directory to which the result file is to be saved in text format (TXT file).
⇨ Enter the desired file name.
⇨ Click the [Save] button. The dialogue box closes.

ⓘ The text file is not created until the first particle data of the currently loaded image is saved via the menu function │Save double particles│.

Menu function │Image evaluation│:
The menu function │Image evaluation│ is identical to the menu function │Open and evaluate image│. If the parameters have already been set, the desired image can be loaded for evaluation. If the parameter settings are not available, the corresponding dialogue box opens (→ Menu function │Parameters│).

Menu function │Result file│:
Via the menu function │Result file│, the particle information of all particles present in the currently loaded image can be exported in text format (TXT or DAT file).
⇨ In the image evaluation window, click on the menu bar item │Functions│ and select │Result file│ from the context menu. The corresponding dialogue box opens.
⇨ Navigate to the directory where the particle information of the current image is to be stored.
⇨ Select the desired format from the dropdown list.
⇨ Enter the desired file name.
⇨ Click the [Save] button to save the particle information of the currently displayed image.
⇨ To abort the process, click the [Cancel] button.

Menu function │Save double particles│:
Via the menu function │Save double particles│, the particle information of all particles in the currently loaded image are stored in a text file.
⇨ In the image evaluation window, click on the menu bar item │Functions│ and select the │Save double particles│ from the context menu.

The TXT file defined via the menu function │Parameters for double exposure│ is now created and the particle information are transferred. For each further execution of the function, the particle data of the currently loaded image are supplemented in the text file. The following information are stored in the text file:
- Pixel factor (pixels per mm)
- Double exposure time
- Particle size x_{area} in pixels and µm
- Distance of the particle pair in pixels and µm
- Sharpness of the particle
- Particle velocity in m/s

Menu function │Image information│:
Via the menu function │Image information│, information about the currently loaded image can be displayed.
⇨ In the image evaluation window, click on the menu bar item │Functions│ and select │Image information│ from the context menu. The corresponding dialogue box opens.

The dialogue box contains the serial number of the device, the software version, the camera and its reproduction scale, as well as the date and time of the recording.

4.6.11.5 Functions of the Menu Bar Item "Extras"

The menu bar item │Extras│ contains menu functions for adjusting window-specific settings.

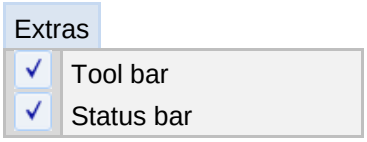


Fig. 104: Image evaluation window: menu functions of the menu bar item │Extras│

Both menu functions are identical to those in the image window and described in detail in Chapter "CCD Image".

4.6.11.6 Functions of the Menu Bar Item "Help"

The menu bar item │Help│ opens the manual as PDF file.

4.6.12 Tool Bar

Via the menu function │Tool bar│, the tool bar (**B**) (icon bar) of the main window can be displayed or hidden.

⇨ In the main window, click on the menu bar item │Extras│ and select │Tool bar│ from the context menu. The tool bar is displayed. In addition, the activated function is marked with the ✓ icon in front of the context menu item.

⇨ To hide the tool bar, click again on the context menu item │Tool bar│. The context menu item is unmarked again.

4.6.13 Status Bar

Via the menu function │Status bar│, the status bar (**F**) of the main window can be displayed or hidden.

⇨ In the main window, click on the menu bar item │Extras│ and select │Status bar│ from the context menu. The status bar is displayed. In addition, the activated function is marked with the ✓ icon in front of the context menu item.

⇨ To hide the status bar, click again on the context menu item │Status bar│. The context menu item is unmarked again.

The status bar (**F**) of the main window displays additional information about the status of the CAMSIZER® X2 program in various sections.

Section	Description
left	Displays an additional description of the menu function or the icon over which the mouse pointer is currently positioned.
centre	Displays the mode with which the user is currently logged on.
centre-right	Displays the current measurement method, i.e. the installed module or the inserted cartridge.
right	Displays the status of the hardware.

4.6.14 Save Windows Automatically

Via the menu function │Save windows automatically│, the size and the position of the evaluation windows in the main window can be saved automatically.

⇨ In the main window, click on the menu bar item │Extras│ and select │Save windows automatically│ from the context menu. The size and the position of the evaluation windows at the time of the termination of the CAMSIZER® X2 program are saved and restored on next program start. In addition, the activated function is marked with the ✓ icon in front of the context menu item.

⇨ To deactivate the automatic saving of the size and the position of the evaluation windows, click again on the context menu item │Save windows automatically│. The context menu item is unmarked again.

4.6.15 Apply Standard

NOTICE This function is not available in measurement mode.

Via the menu function │Apply standard│, the current size and position of the evaluation windows in the main window can be set as default.

⇨ In the main window, click on the menu bar item │Extras│ and select │Apply standard│ from the context menu. The current size and position of the evaluation windows are saved as default.

4.6.16 Restore Standard

Via the menu function │Restore standard│, the size and the position of the evaluation windows in the main window can be displayed again as they were previously set as default (→ Chapter "Apply Standard").

⇨ In the main window, click on the menu bar item │Extras│ and select │Restore standard│ from the context menu. The size and the position of the evaluation windows are restored.

Alternatively, the view can also be restored as default via the  icon in the tool bar (**B**) of the main window.

4.6.17 Language

Via the menu function │Language│, the menu language of the CAMSIZER® X2 program can be selected.

⇨ In the main window, click on the menu bar item │Extras│ and select │Language│ from the context menu. The dialogue box for selecting the language opens.

⇨ Select the desired language from the dropdown list.

⇨ Click [OK]. The language of the CAMSIZER® X2 program switches accordingly.

4.6.18 Password

Via the menu function │Password│, the user level can be changed after entering the correct password.

⇨ In the main window, click on the menu bar item │Extras│ and select │Password│ from the context menu. The dialogue box for entering the password opens.

⇨ Enter the password in the edit box.

⇨ Click [OK]. The CAMSIZER® X2 program switches to the user level, which is enabled by the password and a corresponding dialogue box is displayed.

⇨ To abort the process, click the [Cancel] button.

4.6.19 Change Password

NOTICE This function is not available in measurement mode.

To prevent accidental changes of the parameters of a task file, the CAMSIZER® X2 program can be password protected via the menu function │Change password│. Users who do not know the correct password can only use the CAMSIZER® X2 program in measurement mode. In this mode, it is only possible for the user to carry out measurements and perform evaluations.

⇨ In the main window, click on the menu bar item │Extras│ and select │Change password│ from the context menu. The dialogue box for entering the password opens.

⇨ Check the ⟨Password protection active⟩ checkbox.

⇨ Enter the password in the first edit box.

⇨ Repeat the input in the second edit box.

⇨ Click [OK]. The password is saved and the CAMSIZER® X2 program is in measurement mode on next program start.

⇨ To abort the process, click the [Cancel] button.

ⓘ Without activated password protection, the CAMSIZER® X2 program is always in parameter mode.

NOTICE It is to maintain a careful handling of passwords in order to prevent abuse and unwanted program locking! If a password has been set, the CAMSIZER® X2 program remains in measurement mode on next program start. A return to parameter mode is only possible with the correct password!

4.6.20 Particle X-Plorer Wizard

Via the menu function │Particle X-Plorer Wizard│, the separate evaluation program "Particle X-Plorer" can be started.

⇨ In the main window, click on the menu bar item │Extras│ and select │Particle X-Plorer Wizard│ from the context menu. The separate evaluation program opens.

Alternatively, the evaluation program can also be started via the  icon in the tool bar (**B**) of the main window.

A detailed description of all functions of the "Particle X-Plorer" program can be found in the separate manual.

NOTICE The menu function is only enabled, if the "Particle X-Plorer" program has been installed and configured accordingly.

⇨ Follow the instructions in Chapter "First Commissioning" of the separate manual for the "Particle X-Plorer" program.

4.7 Functions of the Main Menu Item "Help"

The main menu item │Help│ contains menu functions for opening the help and the remote control, as well as for displaying device and program information.

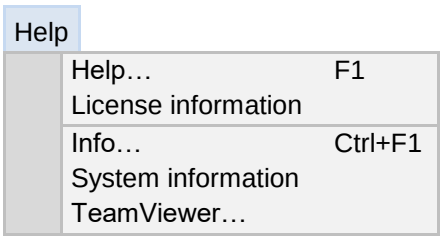


Fig. 105: Menu functions in the main menu item │Help│

In the following subchapters, each menu function of the main menu item │Help│ is described in detail and can be referred to individually.

4.7.1 Help

The menu function │Help│ opens the manual as PDF file.

⇨ In the main window, click on the menu bar item │Help│ and select │Help│ from the context menu. The manual opens. Alternatively, the help can also be opened via the function key F1 on the keyboard or the icon in the tool bar (**B**) of the main window.

4.7.2 License Information

Via the menu function │License information│, the license agreement is opened in a separate dialogue box.

⇨ In the main window, click on the menu bar item │Help│ and select │License information│ from the context menu. The corresponding dialogue box opens.

⇨ Click [OK] to close the dialogue box.

4.7.3 Info

Via the menu function │Info│, a dialogue box opens, displaying the version number of the CAMSIZER® X2 program, the serial number of the device and the path to the CAMDAT directory.

⇨ In the main window, click on the menu bar item │Help│ and select │Info│ from the context menu. The corresponding dialogue box opens.

⇨ Click [OK] to close the dialogue box.

4.7.4 System Information

Via the menu function │System information│, a dialogue box opens, containing information on the operating system, the hardware and the memory of the PC used.

⇨ In the main window, click on the menu bar item │Help│ and select │System information│ from the context menu. The corresponding dialogue box opens.

⇨ Click [OK] to close the dialogue box.

4.7.5 TeamViewer

The menu function │TeamViewer│ opens the separate remote control program "TeamViewer". If the PC has an Internet connection, the program allows the service of the Retsch Technology GmbH access to the PC in order to remedy possible errors and problems.

⇨ In the main window, click on the menu bar item │Help│ and select │TeamViewer│ from the context menu. The "TeamViewer" program opens in a separate window.

⇨ Follow the instructions of the service technician.

5 Wet Measurement

WARNING W1.0001

Danger to life through electric shock
Wet measurement

- An electric shock can cause burns, cardiac arrhythmia, respiratory arrest, as well as cardiac arrest.
- **Do not touch the device, if liquid has entered the interior!**
- **Always operate the device with a mains socket protected by a residual current circuit breaker (RCCB).**

Most samples can be measured dry. However, when agglomerates, electrostatic charges or a high degree of fines impede the measurement process, or if only a small amount of material is present, a wet measurement can be performed.

In the wet measurement, the sample material is dispersed in a liquid, preferably water, and circulated in a closed circuit. Existing agglomerations can be broken with the aid of ultrasonic sound. A condition for the wet measurement, however, is that the material to be measured does not swell, dissolve or otherwise change in the liquid. The wet measurement is particularly suitable for materials which are already in suspension and may not be dried.

For a wet measurement, the X-Flow module is used whose measurement range is typically between 1 µm and 600 µm. For detailed information on the operation of the X-Flow module, refer to the separate manual of the CAMSIZER® X2.

Depending on the sample material, different dispersants can be used. The X-Flow module is solvent resistant and is therefore approved for almost all conventional organic and inorganic solvents.

⇨ If in doubt, please contact the Retsch Technology GmbH representative in your country, or Retsch Technology GmbH directly.

5.1 Wet Measurement with Highly Flammable Materials

Wet measurements using highly flammable materials are permissible with this device when complying with specific precautionary measures.

When using highly flammable materials as dispersant, such as hexane, isopropanol, ethanol, petrol or similar, it is to be assumed that the inside of the X-Flow module should be classified as zone 0, i.e. a constantly present explosive mix.

Therefore, it is necessary to prevent potentially explosive vapours from escaping during the measurement process from the X-Flow module and from entering areas in which the requisite ignition energy is present.

It is therefore urgently recommended that the managing operator (employer) using the device assesses the dangers that exist before using corresponding solvents, taking local conditions into account, as part of a coherent explosion protection concept. If necessary, supplementary organisational measures should be recorded in writing in an explosion protection document.

This procedure is regulated in the EU under Articles 118 and 118a of Directive 89/391/EEC. In other countries outside the EU, the comparable provisions are to be observed.

5.2 Performing the Wet Measurement

Before the start of the wet measurement, the following preparatory steps must be carried out:

1. Cleaning of the flow cell
2. Connecting the X-Flow module
3. Filling the X-Flow module
4. Sample preparation (e.g. sample division, pre-dispersion in the beaker)

Detailed descriptions of the flow cell cleaning and the connection and filling of the X-Flow module can be found in the separate manual of the CAMSIZER® X2.

As for the dry measurement, the measurement parameters for the wet measurement are defined in the task file (AFG file). The wet measurement can be performed either automatically or manually. The individual measurement parameters and the two measurement methods are described in detail in the following chapters.

5.2.1 Measurement Parameters of the Wet Measurement

NOTICE This function is not available in measurement mode.

The measurement conditions for the wet measurement can be modified via the menu function │Measurement parameters│.

⇨ In the main window, click on the menu bar item │Options│ and select │Measurement parameters│ from the context menu. The dialogue box of the measurement conditions opens.

Except for the first tab, the dialogue box of the measurement conditions for the wet measurement consists of the same tabs as for the dry measurement. The following subchapter therefore describes only the "X-Flow Parameters" tab of the dialogue box of the measurement conditions. The descriptions of the other tabs can be found in Chapter "Measurement Parameters".

NOTICE If any changes of the settings made here shall remain effective also in subsequent measurements, the task file must be saved anew after the modification (→ Chapter "Save Task File").

5.2.1.1 "X-Flow Parameters" Tab

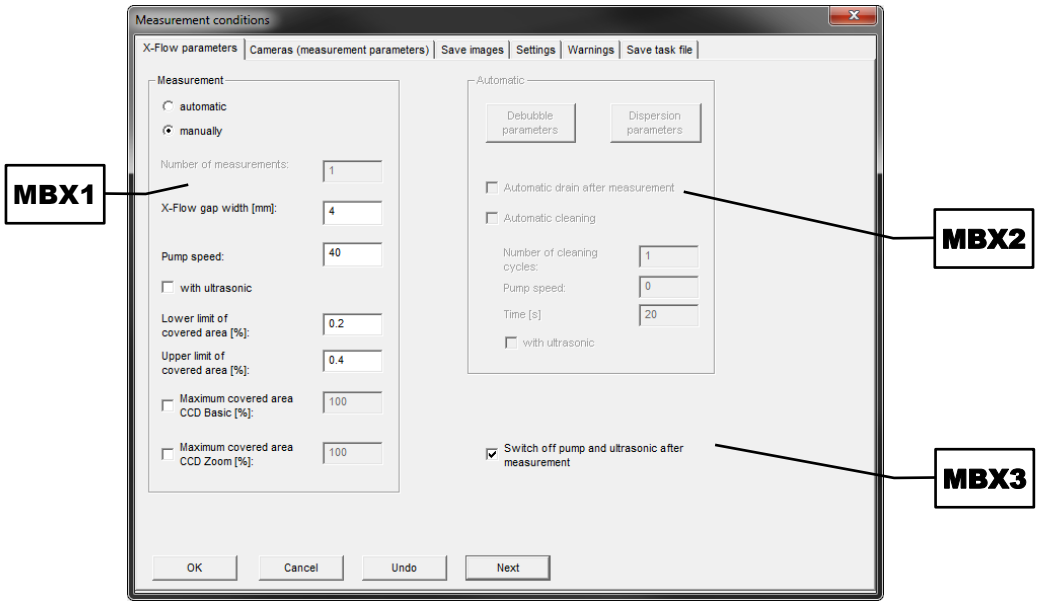


Fig. 106: "X-Flow parameters" tab for the X-Flow module

Measurement (MBX1):

Function	Description
automatic, manually	The measurement can be performed either automatically or manually. In the case of the automatic measurement, the user is guided through the measurement process. In the case of the manual measurement, the individual work steps must be carried our manually. ⇨ Activate the desired radio button. ⓘ The automatic measurement is only recommended for recurring, identical sequential measurements.
Number of measurements	Specifies the number of measurements that are started as a self-repetitive measurement process, similar to the sequential measurement. This function is only available for the automatic measurement. ⇨ Enter the desired number of measurements in the edit box.
X-Flow gab width [mm]	⇨ Enter the gap width of the used flow cell in the edit box. The following flow cells are available from Retsch Technology GmbH: 1 mm, 2 mm and 4 mm.
Pump speed, with ultrasonic	⇨ Enter the desired pump capacity for the measurement in percent in the edit box. ⇨ If desired, check the checkbox to turn on the ultrasonic sound during the measurement.

Lower limit of covered area [%]	The nominal covered area is a measure of the concentration of particles in the dispersant. Typically, a value between 0.1 % (very fine sample material) and 1 % (very coarse sample material) is selected. Whereas in most cases, a value between 0.3 % and 0.6 % is recommended. By setting the lower and upper limits, the particle concentration can be assessed during the wet measurement. ⇨ Enter the desired lower limit of the nominal covered area in percent in the edit box. The lower limit is displayed as a line in the graphical display of the nominal covered area. Falling below the lower limit during the measurement is indicated by a red bar in the graphical display, but only results in a longer measurement duration.
Upper limit of covered area [%]	⇨ Enter the desired upper limit of the nominal covered area in percent in the edit box. The upper limit is displayed as a line in the graphical display of the nominal covered area. ***NOTICE*** Too high a nominal covered area has a negative effect on the measurement results, as the higher the nominal covered area, … … the more particles are present on the recorded image and hence, the higher the probability that two particle projections will overlap and lead to incorrect measurement results. … the higher the computing power required by the PC, which leads to a reduction in the image rate and thus to the loss of measurement data.
Maximum covered area CCD Basic [%] Maximum covered area CCD Zoom [%]	During the measurement, images containing too many particles can be discarded. The maximum covered area can be set for each camera separately. ⇨ Check the checkbox of the CCD Basic camera and enter the desired maximum covered area in percent in the corresponding edit box. Images with a higher covered area do not contribute to the measurement result. ⇨ Check the checkbox of the CCD Zoom camera and enter the desired maximum covered area in percent in the corresponding edit box. Images with a higher covered area do not contribute to the measurement result.

Automatic (MBX2):
If the automatic wet measurement is selected, the degassing of the dispersant and the dispersion of the sample are carried out automatically before the measurement. These functions are only available for the automatic measurement.

⇨ Click the [Debubble parameters] button. The corresponding dialogue box opens.
⇨ Make the desired settings. A detailed description of the dialogue box can be found in Chapter "X-Flow".
⇨ Click the [Dispersion parameters] button. The corresponding dialogue box opens.
⇨ Make the desired settings. A detailed description of the dialogue box can be found in Chapter "X-Flow".

In addition, an automatic emptying and cleaning can also be activated in section (**MBX2**).

- ⇨ Check the ⟨Automatic drain after measurement⟩ checkbox to automatically drain the dispersant after the specified measurement cycles have been completed.
- ⇨ Check the ⟨Automatic cleaning⟩ checkbox to enable the automatic cleaning after the measurement. The edit boxes for the specification of the cleaning parameters are activated.
- ⇨ Enter the desired number of cleaning cycles, the pump capacity during the cleaning cycles, and the duration of one cleaning cycle in the corresponding edit boxes.
- ⇨ Check, if desired, the checkbox to switch on the ultrasonic sound during cleaning.

For cleaning, a cleaning liquid must be filled. For this purpose, clean, deionised water is used in most cases. The selected cleaning liquid must be manually refilled by the user for each cleaning cycle. It is recommended to set three to four cleaning cycles for cleaning.

After completion of the measurement, the pump capacity can be automatically set to 0 % and the ultrasonic sound can be switched off. This function can be activated for the automatic as well as for the manual measurement. ***NOTICE*** However, to prevent sedimentation, it is recommended to keep the particles constantly in motion.

- ⇨ Check the checkbox (**MBX3**) to automatically switch off the pump and the ultrasonic sound after the completion of the measurement.
- ⇨ To undo changes, click the [Undo] button. Changes can only be undone, as long as no other tab is selected.
- ⇨ Click the [Next] button to switch to the next tab.
- ⇨ To save the changes in the task file, click [OK]. The dialogue box changes to the "Save task file" tab. Click [OK] again and confirm the overwriting of the already existing task file in the following dialogue box.
- ⇨ To discard the changes, click the [Cancel] button.

5.2.2 Automatic Measurement

After setting the measurement parameters in the task file, the automatic measurement can be started via the menu function │Start measurement│.

- ⇨ In the main window, click on the menu bar item │Start measurement│ and select │Start measurement│ from the context menu. The start window of the measurement opens. Alternatively, the measurement process can also be started via the  icon in the tool bar (**B**) of the main window.
- ⇨ If necessary, make additional changes (→ Chapter "Start Measurement").
- ⇨ Click [OK] (**MS5**) to start the measurement with the current settings.
- ⇨ To abort the process, click the [Cancel] button.

CAUTION Check the correct connection of all hoses and the collecting vessel, before starting the measurement. Furthermore, the CAMSIZER® X2 must always be placed in the field of view of the user.

After clicking [OK] (**MS5**), the start window closes and the "Measurement with X-Flow" dialogue box opens. The user is now guided through the following individual working steps of the automatic measurement:

1. Fill in the dispersant
2. Degassing
3. Fill in the sample
4. Measurement
5. Fill in the cleaning medium

- ⇨ Fill in the dispersant.

After the upper fill level has been reached, the degassing process starts automatically with the previously set degassing parameters. The fill levels are specified by design. The lower fill level must be reached at least in order to activate the ultrasonic sound function. When the preselected limit of the nominal covered areas is reached, the CAMSIZER® X2 program automatically switches to the next working step. It is also possible to change manually to the next working step by clicking the [Next] button.

⇨ Place the sample in the dispersing bath.

During the addition of the sample, the sample material is dispersed by the pump with the previously set dispersing parameters. When the preselected limits of the nominal covered area are reached, the CAMSIZER® X2 program automatically switches to the next working step. It is also possible to change manually to the next working step by clicking the [Next] button.

NOTICE If the maximum nominal covered area is exceeded, i.e. if too much sample material has been added, no correction can be made during the automatic measurement. It is therefore recommended to add the sample slowly and stepwise until the desired nominal covered area is reached.

The "Measure" dialogue box opens and the measurement starts. The "Measure" dialogue box contains information on the running measurement process. The pump capacity "up" is displayed in percent. A detailed description of all other information can be found in Chapter "Start Measurement".

The "Measure" dialogue box closes, as soon as the condition for the automatic termination of the measurement process, which has been specified in the task file is fulfilled (→ Chapter "Measurement Parameters"). ***NOTICE*** For a wet measurement, only the settings "number of images" and/or "number of particles" are useful since no empty images are generated with this measurement method.

If the automatic emptying and cleaning is activated, the user can now decide whether the X-Flow module is to be emptied.

⇨ Click **[Yes]** to drain the dispersant with the sample and to start the automatic cleaning process.
⇨ Click **[No]** to leave the dispersant with the sample in the X-Flow module. The automatic measurement process is now completed.

The measurement is terminated and the result files previously defined in the task file are now created. If no evaluation window is yet open, the graph window opens and the measurement result is graphically displayed. Otherwise, the content of already opened evaluation windows is updated.

⇨ If prompted, fill in the cleaning medium.
⇨ Confirm the filling by clicking the [Next] button.

The cleaning process starts with the previously set cleaning parameters. The cleaning medium is then drained automatically. It is also possible to change manually to the next working step by clicking the [Next] button.

⇨ Repeat the cleaning process according to the previously entered number of cleaning cycles.

5.2.3 Manual Measurement

After setting the measurement parameters in the task file, the manual measurement can be started via the menu function │Start measurement│.

⇨ In the main window, click on the menu bar item │Start measurement│ and select │Start measurement│ from the context menu. The start window of the measurement opens.

Alternatively, the measurement process can also be started via the icon in the tool bar (**B**) of the main window.

⇨ If necessary, make additional changes (→ Chapter "Start Measurement").

⇨ Click [OK] (**MS5**) to start the measurement with the current settings.

⇨ To abort the process, click the [Cancel] button.

⚠ CAUTION Check the correct connection of all hoses and the collecting vessel, before starting the measurement. Furthermore, the CAMSIZER® X2 must always be placed in the field of view of the user.

After clicking [OK] (**MS5**), the start window closes and the "Manual measurement with X-Flow" dialogue box opens. The user must now work through the following working steps of the measurement manually one after the other:

1. Set the degassing parameters
2. Set the dispersion parameters
3. Fill in the dispersant
4. Degassing
5. Fill in the sample
6. Measurement
7. Emptying and Cleaning

Except for the additional [Measure] button (**XF7**), the "Manual measurement with X-Flow" dialogue box is completely equivalent to the "Manual control of X-Flow" dialogue box (→ Chapter "X-Flow").

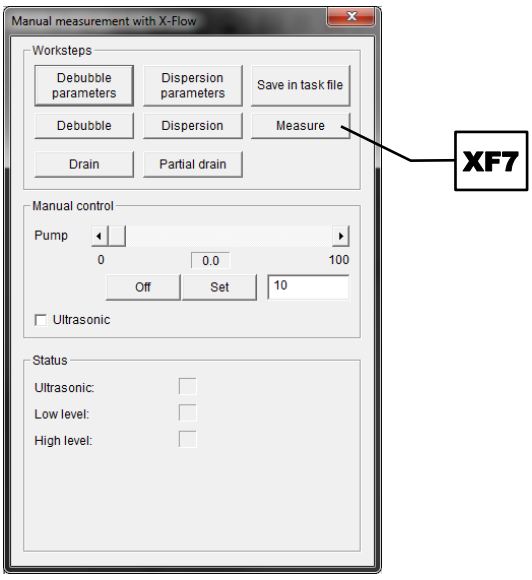


Fig. 107: Manual measurement with X-Flow

⇨ Define the degassing and dispersion parameters as described in Chapter "X-Flow".

⇨ Fill in the dispersant.
⇨ Degas the dispersant.
⇨ Fill in the sample in the dispersing bath.
⇨ Disperse the sample.

NOTICE If the maximum nominal covered area is exceeded, i.e. if too much sample material has been added, the dispersant can be partly drained during manual measurement as described in Chapter "X-Flow".

⇨ Click the [Measure] button (**XF7**).

The "Measure" dialogue box opens and the measurement starts. The "Measure" dialogue box contains information on the running measurement process. The pump capacity "up" is displayed in percent. A detailed description of all other information can be found in Chapter "Start Measurement".

The "Measure" dialogue box closes, as soon as the condition for the automatic termination of the measurement process, which has been specified in the task file is fulfilled (→ Chapter "Measurement Parameters"). ***NOTICE*** For a wet measurement, only the settings "number of images" and/or "number of particles" are useful since no empty images are generated with this measurement method.

As soon as the measurement is finished, the result files previously defined in the task file are created. If no evaluation window is yet open, the graph window opens and the measurement result is graphically displayed. Otherwise, the content of already opened evaluation windows is updated.

⇨ Drain the dispersant with the sample and fill in the cleaning medium.
⇨ Set the pump capacity to 100 % and allow the cleaning liquid to circulate for approx. 10 seconds.
⇨ Drain the X-Flow module and refill it with the cleaning medium.
⇨ Repeat the cleaning process three to four times.

5.2.4 Start Wet Measurement in Measurement Mode

In measurement mode, the user can only make very limited settings in the start window. A detailed description can be found in Chapter "Start Measurement".

After clicking the [OK] button (**MS5**), the start window closes and the dialogue box for the measurement with the X-Flow module opens. The further procedure corresponds to that in parameter mode.

6 Error Messages and Information Notes

Description	Measures
The camera images display vertical lines.	⇨ Ensure that all four camera cables, as well as the two synchronisation cables are correctly connected to the PC and fixed with the screws. ⇨ If the error persists, contact service.
A MIL error message is displayed.	⇨ Ensure that all necessary programs and drivers are installed correctly and all necessary settings have been carried out (→ Chapter "Installation"). ⇨ Restart the PC and the device. ⇨ If the error persists, contact service.
The error message "Device dependent basic settings are missing!" is displayed.	⇨ Close the CAMSIZER® X2 program. ⇨ Copy the most recent, correctly functioning configuration file (CFG file) in the main directory of the CAMSIZER® X2 program (→ Chapter "Copying the Configuration File"). ⇨ Restart the PC and the device. ⇨ If the error persists, contact service.
The CAMSIZER® X2 program is only executed in English and a message is displayed that the language-DLL files are missing.	⇨ Ensure that all supplied Visual C++ Redistributables are installed (→ Chapter "Installation"). ⇨ Reinstall all Visual C++ Redistributables.
One or more Visual C++ Redistributables cannot be installed correctly.	⇨ If listed in the programs, uninstall the respective Visual C++ Redistributables. ⇨ Install all current Windows updates. ⇨ Reinstall the respective Visual C++ Redistributables.
The xConAlp files are not created.	⇨ Make sure that the path of the CAMDAT directory has been configured accordingly (→ separate manual of the "Particle X-Plorer" program).
When the measurement starts, a message is displayed indicating that a specific directory has not been found.	⇨ Make sure that the directory of the second storage location in the task file is correctly set and accessible (→ Chapter "Save Task File").

7 Accessories

Information on available accessories as well as the respective manuals are accessible directly on the Retsch Technology GmbH homepage (http://www.retsch-technology.com) under the heading "Downloads" of the device.

Information on wear parts and small accessories can be found in the Retsch Technology GmbH general catalogue also available on the homepage.

In case of any questions concerning spare parts please contact the Retsch Technology GmbH representative in your country, or Retsch Technology GmbH directly.

8 Disposal

In the case of a disposal, the respective statutory requirements must be observed. In the following, information on the disposal of electrical and electronic devices in the European Community are given.

Within the European Community the disposal of electrically operated devices is regulated by national provisions that are based on the EU Directive 2012/19/EU on Waste Electrical and Electronic Equipment (WEEE).

Accordingly, all devices supplied after August 13th 2005 in the business-to-business area, to which this product is classified, may no longer be disposed of with municipal or household waste. To document this, the devices are provided with the disposal label.

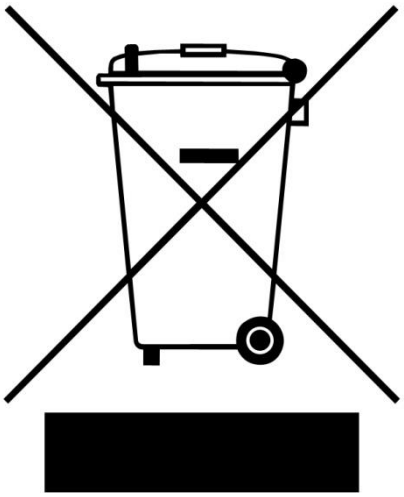


Fig. 108: Disposal label

Since the disposal regulations worldwide and also within the EU may differ from country to country, the supplier of the device should be consulted directly in case of need.

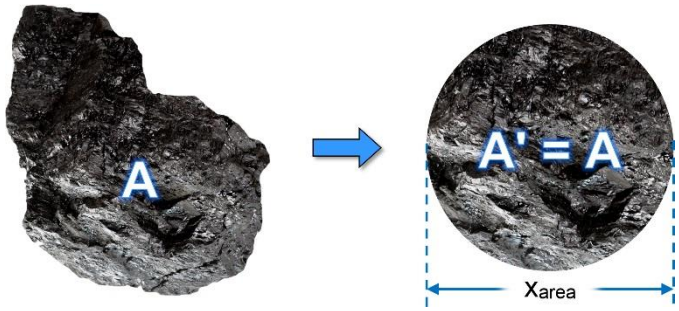
This labelling obligation is applied in Germany since March 23rd 2006. From this date on, the manufacturer must provide an adequate possibility of returning all devices delivered since August 13th 2005. For all devices delivered before August 13th 2005 the end user is responsible for the proper disposal.

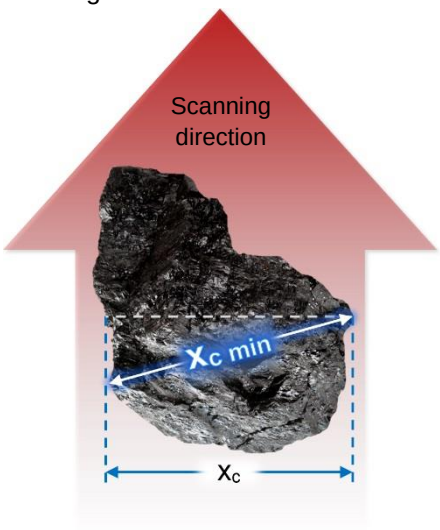
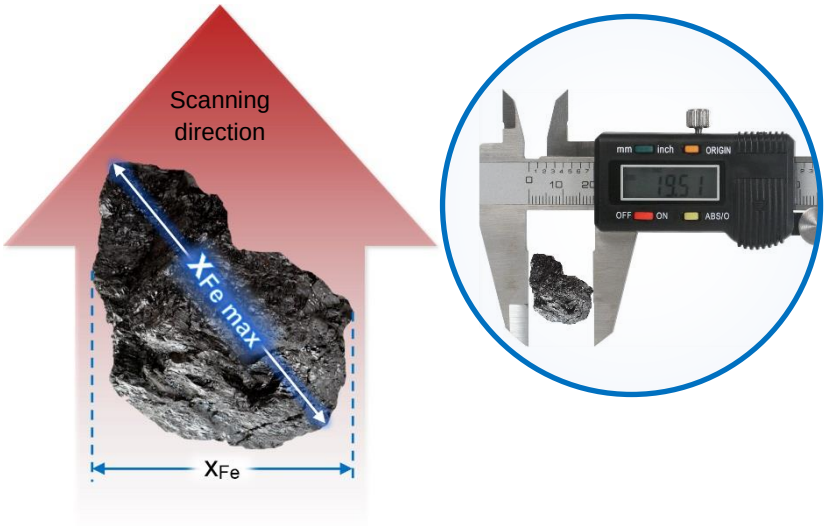
9 List of Characteristics

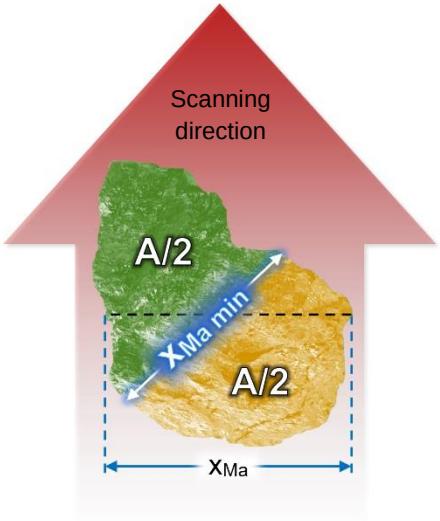
The CAMSIZER® X2 program allows to display the results either based on volume, number, or area. Accordingly, the characteristics are, if not otherwise described, either displayed with index 3 for volume-based, index 0 for number-based, or index 2 for area-based.

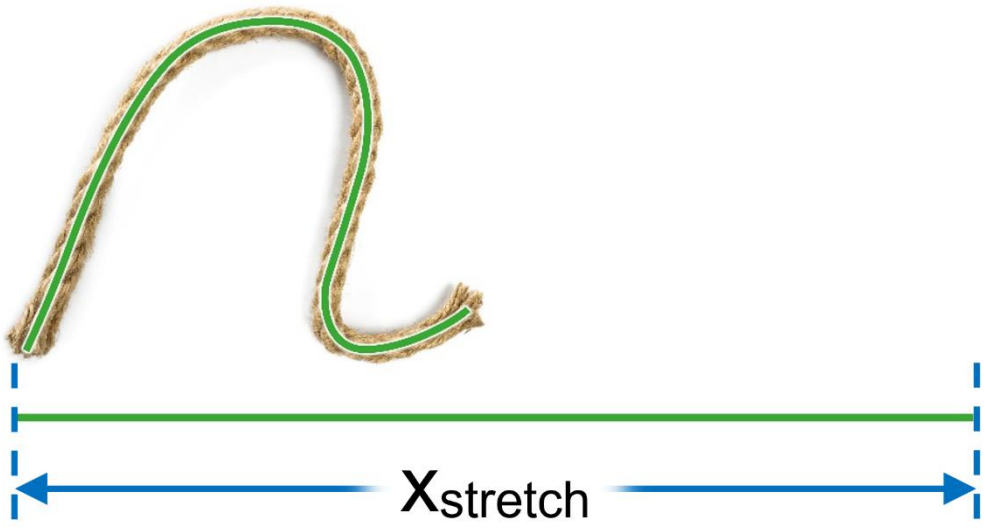
9.1 Particle-specific Characteristics

9.1.1 Size Characteristics

Characteristic	Description
$x(Q_3)$, $x(Q_0)$, $x(Q_2)$	**Particle size:** Displays the particle size x at a certain value of the cumulative distribution.
x_{area}	**Particle diameter:** Displays the equivalent particle diameter that corresponds to the diameter of a circle with equivalent area. This characteristic is suitable for comparing the CAMSIZER® X2 results with a laser scattered light analysis. $x_{area} = \sqrt{\frac{4A}{\pi}}$ Where A is the measured particle area.  **Fig. 109:** Illustration of x_{area}

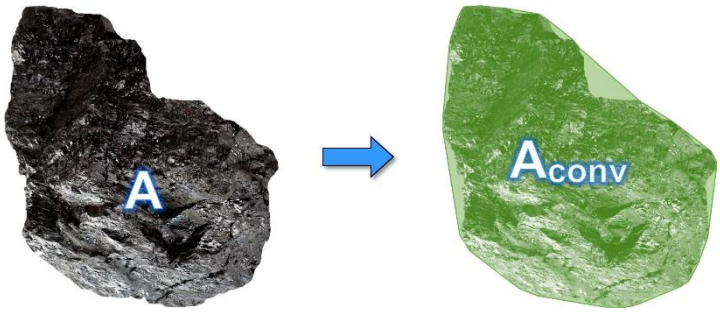
x_c	**Chord:** Each particle is scanned by the CAMSIZER® X2 program in all directions. While doing so, the maximum chord x_c is determined in each scanning direction, and is defined as the maximum distance between two boundary points perpendicular to the scanning direction.  **Fig. 110:** Illustration of x_c and $x_{c\ min}$
$x_{c\ min}$	**Particle width:** Displays the particle width, which is determined from the narrowest of all measured chords x_c. This characteristic is suitable for comparing the CAMSIZER® X2 results with a sieve analysis.
x_{Fe}	**Feret diameter:** Each particle is scanned by the CAMSIZER® X2 program in 64 directions. The Feret diameter x_{Fe} is determined for each of these scanning directions, and is defined as the maximum distance between two parallel tangents (in the same way as a measurement using the calliper gauge).  **Fig. 111:** Illustration of x_{Fe} and $x_{Fe\ max}$
$x_{Fe\ max}$	**Particle length:** Displays the particle length that is determined from the longest of all measured Feret diameters x_{Fe}. This parameter is useful, for example, when measuring the length of straight fibres or grains of rice.

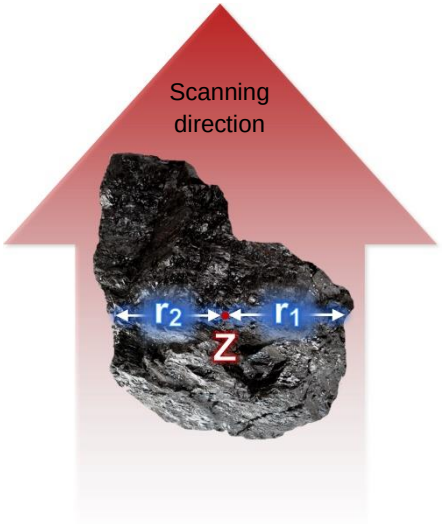
$x_{Fe\ min}$	**Outer particle width:** Displays the particle width, which is determined from the shortest of all measured Feret diameters x_{Fe}.
$x_{Fe\ rec}$	**Vertical particle length:** Displays the Feret diameter, which is perpendicular to the narrowest particle width $x_{Ma\ min}$. This characteristic is suitable for measuring irregularly broken extrudates.
$x_{Fe\ rec2}$	**Vertical particle length 2:** Displays the Feret diameter, which is perpendicular to the outer particle width $x_{Fe\ min}$.
x_{length}	**Particle length:** Displays the particle length, which is determined from the particle length $x_{Fe\ max}$ and the narrowest particle width $x_{Ma\ min}$. $x_{length} = \sqrt{x_{Fe\ max}^2 - x_{Ma\ min}^2}$ Or if $x_{length} < x_{Ma\ min}$ $x_{length} = x_{Ma\ min}$, This characteristic is suitable for measuring extrudates or cylindrical rods.
$x_{length2}$	**Particle length 2:** Displays the particle length, which is determined from the particle length $x_{Fe\ max}$ and the particle width $x_{c\ min}$. $x_{length2} = \sqrt{x_{Fe\ max}^2 - x_{c\ min}^2}$
$x_{length3}$	**Particle length 3:** Displays the particle length, which is determined from the particle length $x_{Fe\ max}$ and the particle width $x_{c\ min}$. $x_{length3} = \sqrt{x_{Fe\ max}^2 - x_{c\ min}^2}$ Or if $x_{length3} < x_{c\ min}$ $x_{length3} = x_{c\ min}$, if
x_{Ma}	**Martin diameter:** Each particle is scanned by the CAMSIZER® X2 program in all directions. The Martin diameter x_{Ma} is determined for each of these scanning directions, and is defined as the area bisector perpendicular to the scanning direction.  **Fig. 112:** Illustration of x_{Ma} and $x_{Ma\ min}$

$x_{Ma\ min}$	**Narrowest particle width:** Displays the particle width, which is determined from the narrowest of all measured Martin diameters x_{Ma} (area bisecting line). This characteristic is suitable for comparing the CAMSIZER® X2 results of elongated particles with a sieve analysis and for measuring extrudates.
$x_{Ma\ rec}$	**Vertical particle width:** Displays the Martin diameter, which is perpendicular to the particle length $x_{Fe\ max}$.
x_{mean3}, x_{mean0}, x_{mean2}	**Mean value of the particle size:** Displays the mean value of the particle size for each size class. ⓘ Within a size class, the particle sizes can be unevenly distributed, so that the mean value of the particle size is to be understood as a reference value for x_c, x_{Fe} and x_{Ma} in the respective size class.
x_{mesh}	**Side length:** Displays the side length of the smallest possible square surrounding the particle (analogous to the mesh size of a test sieve).
$x_{stretch}$	**Stretched particle length:** Displays the particle length, which is determined from the particle area A and the narrowest particle width $x_{Ma\ min}$. $x_{stretch} = \frac{A}{x_{Ma\ min}}$ Or if $x_{stretch} < x_{Ma\ min}$ $x_{stretch} = x_{Ma\ min}$ ⓘ This parameter is useful for measuring bent extrudates or fibres.  **Fig. 113:** Illustration of Xstretch
$x_{stretch2}$	**Stretched particle length 2:** Displays the particle length, which is determined from the particle area A and the narrowest particle width $x_{Ma\ min}$. $x_{stretch2} = \frac{A}{x_{Ma\ min}}$ ⓘ This parameter is useful for measuring bent extrudates or fibres.

9.1.2 Shape Characteristics

Characteristic	Description
b/l_3, b/l_0, b/l_2	**Aspect ratio:** Displays the width/length ratio, which is determined from the particle width $x_{c\ min}$ and the particle length $x_{Fe\ max}$. $\frac{b}{l} = \frac{x_{c\ min}}{x_{Fe\ max}}$
b/l_{rec3}, b/l_{rec0}, b/l_{rec2}	**Minimum aspect ratio:** Each particle is scanned by the CAMSIZER® X2 program in up to 64 directions. For each of these scanning directions, the width/length ratio is determined from the corresponding chord x_c and the Feret diameter x_{Fe} perpendicular thereto. The smallest resulting width/length ratio is then displayed as minimum aspect ratio. $\left(\frac{b}{l}\right)_{rec} = \min\left(\frac{x_c}{x_{Fe}}\right)$
B/L_3, B/L_0, B/L_2	**Aspect ratio:** Displays the width/length ratio, which is determined from the outer particle width $x_{Fe\ min}$ and the particle length $x_{Fe\ max}$. $\frac{B}{L} = \frac{x_{Fe\ min}}{x_{Fe\ max}}$
B/L_{rec3}, B/L_{rec0}, B/L_{rec2}	**Minimum aspect ratio:** Each particle is scanned by the CAMSIZER® X2 program in up to 64 directions. For each of these scanning directions, the width/length ratio is determined from the corresponding Feret diameter x_{Fe1} and the Feret diameter x_{Fe2} perpendicular thereto. The smallest resulting width/length ratio is then displayed as minimum aspect ratio. $\left(\frac{B}{L}\right)_{rec} = \min\left(\frac{x_{Fe1}}{x_{Fe2}}\right)$
C_3, C_0, C_2	**Circularity:** Displays the roundness C, which is determined from the particle perimeter P and the particle area A. Perfect circles or spheres have a circularity equal to 1. For all other shapes the circularity is < 1. $C = \sqrt{\frac{4\pi A}{P^2}}$ ⓘ This shape parameter cannot be portrayed using the X-Plorer.
$Compct_3$, $Compct_0$, $Compct_2$	**Compactness:** Displays the degree to which the particle is similar to a circle, considering the particle shape. The compactness is determined from the particle length $x_{Fe\ max}$ and the particle area A. Perfect circles or spheres have a compactness equal to 1. For all other shapes the compactness is < 1. $Compct = \frac{\sqrt{\frac{4A}{\pi}}}{x_{Fe\ max}}$ ⓘ This shape parameter cannot be portrayed using the X-Plorer.

$Conv_3$, $Conv_0$, $Conv_2$	**Convexity:** Displays the convexity, which is determined from the measured particle area A and the convex particle area A_{conv}. Convex particles have a convexity equal to 1. For all other particles, the convexity is < 1. $$Conv = \sqrt{\frac{A}{A_{conv}}}$$  **Fig. 114:** Illustration of the convexity
$Solid_3$, $Solid_0$, $Solid_2$	**Solidity:** Displays the concavity, which is determined from the measured particle area A and the convex particle area A_{conv}. Convex particles have a solidity equal to 1. For all other particles, the solidity is < 1. $$Solid = \frac{A}{A_{conv}}$$
$SPHT_3$, $SPHT_0$, $SPHT_2$	**Sphericity:** Displays the roundness SPHT, which is determined from the particle perimeter P and the particle area A. Perfect circles or spheres have a sphericity equal to 1. For all other shapes the sphericity is < 1. $$SPHT = \frac{4\pi A}{P^2}$$

$Symm_3$, $Symm_0$, $Symm_2$	**Symmetry:** Each particle is scanned by the CAMSIZER® X2 program in up to 64 directions. For each of these scanning directions, the two distances r_1 and r_2 are determined from the centre of area Z to the particle boundary perpendicular to the scanning direction. The smallest resulting radii ratio is then displayed as symmetry. Perfect symmetrical shapes have a symmetry equal to 1. For all other shapes the symmetry is < 1. If the centre of area Z is located outside of the particle, the symmetry is < 0.5. $Symm = \frac{1}{2}\left[1 + \min\left(\frac{r_1}{r_2}\right)\right]$ In addition, the following applies: $x_{Ma} = r_1 + r_2$  **Fig. 115:** Illustration of the symmetry

9.1.3 Other particle-specific Characteristics

Characteristic	Description
$Trans_3$, $Trans_0$, $Trans_2$	**Transparency:** Displays the transparency, which is determined from the measured particle area A and the particle area A_{T1} with a brightness greater than a defined $threshold_1$. Opaque particles have a transparency equal to 0. The more transparent the particle, the more the value converges to 1. $Trans = \frac{A_{T1}}{A}$ Thereby, the particle area A_{T1} is determined by the $threshold_1$: $Threshold_1 = I_{min} + 0.25(I_{max} - I_{min})$ with I_{min} = minimum brightness of the particle I_{max} = maximum brightness of the background
Trans a_3, Trans a_0, Trans a_2	**Transparency a:** Displays the transparency a, which is determined from the measured particle area A and the particle area A_{T2} with a brightness greater than a defined $threshold_2$. Opaque particles have a transparency equal to 0. The more transparent the particle, the more the value converges to 1. $Trans\ a = \frac{A_{T2}}{A}$ Thereby, the particle area A_{T2} is determined by the $threshold_2$: $Threshold_2 = I_{min} + 0.5(I_{max} - I_{min})$ with I_{min} = minimum brightness of the particle I_{max} = maximum brightness of the background
Trans b_3, Trans b_0, Trans b_2	**Transparency b:** Displays the transparency b, which is determined from the measured particle area A and the particle area A_{T3} with a brightness greater than a defined $threshold_3$. Opaque particles have a transparency equal to 0. The more transparent the particle, the more the value converges to 1. $Trans\ b = \frac{\int_{A_{T3}}[I(x,y) - I_{fix}]dA_{T3}}{(I_{max} - I_{fix})A}$ Thereby, the particle area A_{T3} is determined by the $threshold_3$: $Threshold_3 = I_{fix} + 0.25(I_{max} - I_{fix})$ with I_{fix} = minimum brightness of the unlit background (illumination off) I_{max} = maximum brightness of the background

9.2 Sample-specific Characteristics

<table>
<tr><th>Characteristic</th><th>Description</th></tr>
<tr><td>AFS no.</td><td>
AFS number:
Displays the fineness of the sample . The AFS number (American Foundry Society number) is calculated from specified p_3 fractions in the particle size range of between 0.02 mm and 5.6 mm, whereby each size class is multiplied by a fixed weighting factor M_3. The sample share in the smaller size class has greater weighting. This means the higher the AFS number, the finer the sample material.
$$AFS = \frac{\sum_{i=1}^{n} p_3(x_i,x_{i+1})M_3(x_i,x_{i+1})}{\sum_{i=1}^{n} p_3(x_i,x_{i+1})}$$
<u>Example 1 AFS (ISO):</u>
After measurement, the following result is determined:
<table>
<tr><th colspan="2">Size class [mm]
from | to</th><th>ASTM mesh</th><th>Fraction p_3 [%]</th><th>Weighting factor M_3</th><th>p_3M_3</th></tr>
<tr><td colspan="2">> 1.000</td><td>18</td><td>–</td><td>–</td><td>–</td></tr>
<tr><td>0.710</td><td>1.000</td><td>25</td><td>0</td><td>18</td><td>0</td></tr>
<tr><td>0.500</td><td>0.710</td><td>35</td><td>0.75</td><td>25</td><td>18.75</td></tr>
<tr><td>0.355</td><td>0.500</td><td>45</td><td>13.70</td><td>35</td><td>479.50</td></tr>
<tr><td>0.250</td><td>0.355</td><td>60</td><td>28.60</td><td>45</td><td>1 287</td></tr>
<tr><td>0.180</td><td>0.250</td><td>80</td><td>30.05</td><td>60</td><td>1 803</td></tr>
<tr><td>0.125</td><td>0.180</td><td>120</td><td>15.90</td><td>80</td><td>1 272</td></tr>
<tr><td>0.090</td><td>0.125</td><td>170</td><td>6.00</td><td>120</td><td>720</td></tr>
<tr><td>0.063</td><td>0.090</td><td>230</td><td>2.30</td><td>170</td><td>391</td></tr>
<tr><td>0.020</td><td>0.063</td><td>635</td><td>0.70</td><td>230</td><td>161</td></tr>
<tr><td colspan="2">Collecting pan</td><td>–</td><td>2.00</td><td>635</td><td>1 270</td></tr>
<tr><td colspan="3">Sum</td><td>100</td><td></td><td>7 402.25</td></tr>
</table>
This results in:
$$AFS = \frac{7402.25}{100} = 74.02$$
<u>Example 2 AFS (ASTM):</u>
After measurement, the following result is determined:
<table>
<tr><th colspan="2">Size class [mm]
from | to</th><th>ASTM mesh</th><th>Fraction p_3 [%]</th><th>Weighting factor M_3</th><th>p_3M_3</th></tr>
<tr><td colspan="2">> 1,7</td><td>6</td><td>-</td><td>3</td><td></td></tr>
<tr><td>0.85</td><td>1.7</td><td>20</td><td>0</td><td>10</td><td>0</td></tr>
<tr><td>0.6</td><td>0.85</td><td>30</td><td>0.5</td><td>20</td><td>10</td></tr>
<tr><td>0.425</td><td>0.6</td><td>40</td><td>6.7</td><td>30</td><td>201</td></tr>
<tr><td>0.3</td><td>0.425</td><td>50</td><td>20.5</td><td>40</td><td>820</td></tr>
<tr><td>0.212</td><td>0.3</td><td>70</td><td>31.8</td><td>50</td><td>1590</td></tr>
<tr><td>0.15</td><td>0.212</td><td>100</td><td>22.4</td><td>70</td><td>1568</td></tr>
<tr><td>0.106</td><td>0.15</td><td>140</td><td>11.3</td><td>10</td><td>1130</td></tr>
<tr><td>0.075</td><td>0.106</td><td>200</td><td>4.2</td><td>140</td><td>588</td></tr>
<tr><td>0.053</td><td>0.075</td><td>270</td><td>0.6</td><td>200</td><td>120</td></tr>
<tr><td colspan="2">Collecting pan</td><td>–</td><td>2</td><td>300</td><td>600</td></tr>
<tr><td colspan="3">Sum</td><td>100</td><td></td><td>6627</td></tr>
</table>
This results in:
$$AFS = \frac{6627}{100} = 66.27$$
</td></tr>
</table>

	ⓘ The AFS number can only be calculated if the corresponding size classes have been used, i.e. the selected size classes must be a complete subset of the ASTM sieve series , as specified below.

AFS (ISO)	AFS (ASTM)
0.020 mm	0.053 mm
0.063 mm	0.075 mm
0.090 mm	0.106 mm
0.125 mm	0.150 mm
0.180 mm	0.212 mm
0.250 mm	0.300 mm
0.355 mm	0.425 mm
0.500 mm	0.600 mm
0.710 mm	0.850 mm
1.000 mm	1.700 mm
1.400 mm	3.350 mm
2.000 mm	5.600 mm
2.800 mm	
4.000 mm	
5.600 mm	

CV	**Coefficient of variation:** Displays the ratio of the standard deviation to the mean value, i.e. the relative dispersion of the sample. $CV = 50\frac{x_{84} - x_{16}}{x_{50}}$ Thereby, the following applies: $x_{16} = x(Q)$ with $Q = 16\,\%$ $x_{50} = x(Q)$ with $Q = 50\,\%$ $x_{84} = x(Q)$ with $Q = 84\,\%$
d'	**RRSB particle size:** Displays the particle size x at the position Q(x) = 63.2 %, often also referred to as the $x_{63.2}$ value of the sample. Thereby, the following applies: $x_{63.2} = x(Q)$ with $Q = 63.2\,\%$

<table>
<tr><td>d_{10}, d_{50}, d_{90}</td><td>Particle size at a certain value of the cumulative distribution:
The d_{10}, d_{50} and d_{90} values serve to characterise a sample in the particle size analysis. Thereby, the following applies:
$d_y = x_y = x(Q)$ with $Q = y\,\%$

<table><tr><th>Value</th><th>Description</th></tr><tr><td>d_{10}</td><td>10 % of all particles in the sample are smaller or equal to the d_{10} value. The particle size is also often depicted as x_{10}. It is a measure of the smallest particles in the sample.</td></tr><tr><td>d_{50}</td><td>50 % of all particles in the sample are smaller or equal to the d_{50} value. The particle size is referred to as median or mean diameter and often also depicted as x_{50}.</td></tr><tr><td>d_{90}</td><td>90 % of all particles in the sample are smaller or equal to the d_{90} value. The particle size is also often depicted as x_{90}. It is a measure of the biggest particles in the sample.</td></tr></table>
ⓘ The closer together the d_{10} and d_{90} values are, the narrower the particle size distribution.</td></tr>
<tr><td>shape(Q_3),
shape(Q_0),
shape(Q_2)</td><td>Shape characteristic mean value of the cumulated distribution:
Displays the mean value of the selected shape characteristic at position Q(x) of the cumulated distribution. Thereby, the mean value of the shape characteristic includes all particles with a particle size ≤ x.</td></tr>
<tr><td>Correlation</td><td>RRSB correlation:
Displays the correlation of the RRSB curve (cumulative distribution) to an ideal straight line (Gaussian distribution). The more the cumulative distribution differs from a Gaussian distribution, the more the correlation value deviates from 1.</td></tr>
<tr><td>MA</td><td>Mean diameter:
Displays the particle size x at the position Q(x) = 50 %, often also referred to as x_{50} or d_{50} value (median) of the sample. Thereby, the following applies:
$MA = d_{50} = x_{50} = x(Q)$ with $Q = 50\,\%$</td></tr>
<tr><td>$Mv_{2\,Sv}$(x)</td><td>Mean value of the volume-based specific surface area:
Displays the mean value of the volume-based specific surface area, which is determined from the particle area A and the specific surface area S_V.
$Mv_{2\,S_V} = \frac{\sum_{i=1}^{n} A_i S_{V_i}}{\sum_{i=1}^{n} A_i}$</td></tr>
<tr><td>Mv_3(x), Mv_0(x),
Mv_2(x)</td><td>Mean value:
Displays the weighted mean value of particle size x.
$Mv_0(x) = \frac{1}{n}\sum_{i=1}^{n} x_i$
$Mv_2(x) = \frac{\sum_{i=1}^{n} A_i x_i}{\sum_{i=1}^{n} A_i}$
$Mv_3(x) = \frac{\sum_{i=1}^{n} V_i x_i}{\sum_{i=1}^{n} V_i}$</td></tr>
</table>

n	**Slope of the RRSB curve:** Displays the slope n of the RRSB curve. $n = \frac{\Delta(Y\ axis)}{\Delta(X\ axis)}$
$p_{2\ Sv}$(x1,x2)	**Fraction of the volume-based specific surface area:** Displays the volume-based ratio of the specific surface area S_V including all particles within the particle size range between > x1 and ≤ x2. $p_{2\ S_V}(x1,x2) = \frac{\sum_{j=1}^{m} A(x_j)}{\sum_{i=1}^{n} A(x_i)}$ with $x_j \in\ ]x1,x2]$
p_3(shape), p_0(shape), p_2(shape)	**Shape characteristic fraction:** Displays the ratio of particles in the shape characteristic range between > y1 and ≤ y2. $p_r(y1,y2) = Q_r(y2) - Q_r(y1)$ with $r = 0,2,3$
PD_3, PD_0, PD_2	**Limit of particle detections:** Displays the limit of particle detections in percent, which must be achieved in a size class to calculate the shape characteristics. For a good reliability of the statistical shape characteristic calculation, a sufficiently high number of particle detections is essential. The more particles have been detected in a size class, the more reliable the values of the shape characteristics. By default, the limit of particle detections is set to 1 %, i.e. size classes containing less than 1 % of all measured particles are excluded from the calculation of the shape characteristics.
PDV, PDN, PDA	**Number of particle detections:** Displays the number of particle detections PD, whereby the volume-based number is additionally marked with the letter V, the number-based number with N, and the area-based number with A.
PI	**Polydispersity index:** Displays the polydispersity index PI, which is a measure of the particle size distribution in the sample. The smaller the PI value, the narrower the particle size distribution. $PI(Q1,Q2) = \frac{x(Q1)}{x(Q2)}$ ⓘ For the calculation, it is recommended to set a Q1 value in the range of 5 % to 20 % and a Q2 value in the range of 80 % to 95 %.
Q_3(shape), Q_0(shape), Q_2(shape)	**Shape characteristic cumulative distribution:** Displays the ratio of all particles with a shape characteristic ≤ y.
$Q_{3\ spec}$(shape), $Q_{0\ spec}$(shape), $Q_{2\ spec}$(shape)	**Class-dependent mean value of threshold-dependent shape characteristics:** Displays the mean value of the shape characteristic for each size class taking account of defined thresholds. $Q_{r\ spec}(shape) = \frac{\sum_{i=1}^{n} Q_{r,i}(shape) p_{r,i}}{\sum_{i=1}^{n} p_{r,i}}$ with $r = 0,2,3$

rD	**Relative density:** Displays the relative density rD (specific density), which is determined from the sample mass m and the sample volume V. $rD = \frac{m}{V}$ ***NOTICE*** The relative density can only be calculated, if prior to the measurement process, the sample mass has been defined in the start window of the measurement.
RRSB	**RRSB curve:** The RRSB curve (named after Rosin, Rammler, Sperling and Bennet) describes a mathematically manipulated particle size distribution, to reflect an approximately linear relationship between the cumulative distribution Q(x) and the particle size x. In the RRSB grid, the X axis is scaled in $\log(x)$, and the Y axis in $\log\left[\log\left(\frac{1}{1-Q_3(x)}\right)\right]$. Thus, in this grid, a Gaussian distribution is displayed as an ideal straight line.
SGN	**Size Guide Number:** Displays the size guide number SGN, which is determined from the mean diameter MA in mm. $SGN = 100 \cdot MA\,[mm]$ Thereby, the following applies: $MA = d_{50} = x_{50} = x(Q)$ with $Q = 50\,\%$ The calculation is applied to the size classes of the Tyler mesh sieve series #65 (0.212 mm) / #48 (0.3 mm) / #35 (0.425 mm) / #28 (0.6 mm) / #20 (0.85 mm) / #14 (1.18 mm) / #10 (1.7 mm) / #8 (2.36 mm) / #6 (3.35 mm) / #4 (4.75 mm) / #3 (6.7 mm). If the mean diameter MA is between two Tyler mesh size classes, the x_{50} value is interpolated from the next lower and higher Tyler mesh size class. If the mean diameter MA is outside the Tyler mesh size classes, the measured x_{50} value is used for the calculation.
$Sigma_0(V)$, $Sigma_1(V)$	**Volume-based standard deviation:** Displays the volume-based standard deviation, which is determined from the minimum aspect ratio b/l_{rec}. The standard deviation is weighted according to the choice of the display either number-based (index 0) or volume-based (index 1). $Sigma_0(V) = \sqrt{\frac{1}{n}\sum_{i=1}^{n}(1-v_i)^2}$ $Sigma_1(V) = \sqrt{\frac{\sum_{i=1}^{n} V_i(1-v_i)^2}{\sum_{i=1}^{n} V_i}}$ with $v_i = \left(\frac{b_i}{l_i}\right)^{-1}_{rec}$
$Sigma_{2\,Sv}(x)$	**Standard deviation of the volume-based specific surface area:** Displays the standard deviation of the volume-based specific surface area S_V, which is determined from the mean value $Mv_{2\,Sv}(x)$.

$Sigma_3(x)$, $Sigma_0(x)$, $Sigma_2(x)$	**Standard deviation:** Displays the standard deviation, which is determined from the mean value Mv(x). $$Sigma_r(x) \approx \sqrt{\sum_{i=1}^{n} [x_i - Mv_r(x_i)]^2 \, q_r(x_i) \Delta x_i}$$ with $r = 0,2,3$
S_m	**Mass-based specific surface area:** Displays the ratio between the surface area A and the mass m of all particles x_i in the sample in cm^2/g. $$S_m = \frac{\sum_{i=1}^{n} A(x_i)}{\sum_{i=1}^{n} m(x_i)}$$ ***NOTICE*** The mass-based specific surface area can only be calculated, if prior to the measurement process, the material density has been defined in the start window of the measurement.
$SPAN_3$, $SPAN_0$, $SPAN_2$	**Span value:** Displays the width of the distribution. $$SPAN_r = \frac{x(Q_r3) - x(Q_r1)}{x(Q_r2)}$$ with $r = 0,2,3$ The Q_r values can be defined individually in the CAMSIZER® X2 program. However, in most cases, the following cumulative distribution values are used: $Q_r1 = 10\,\%$ $Q_r2 = 50\,\%$ $Q_r3 = 90\,\%$
S_V	**Volume-based specific surface area:** Displays the ratio between the surface area A and the volume V of all particles x_i in the sample in mm^{-1}. $$S_V = \frac{\sum_{i=1}^{n} A(x_i)}{\sum_{i=1}^{n} V(x_i)}$$
TG	**Tamaño granulado (grain size):** Displays the particle size x at the position Q(x) = 37 % on a linear trend line. The linear trend line is calculated by the CAMSIZER® X2 program based on the measured cumulative distribution.
U_3, U_0, U_2	**Non-uniformity factor:** Displays the symmetry of the distribution. $$U = \frac{x_{60}}{x_{10}}$$ Thereby, the following applies: $x_{10} = x(Q)$ with $Q = 10\,\%$ $x_{60} = x(Q)$ with $Q = 60\,\%$

UI	**Uniformity index:** Displays the uniformity index UI in percent, which is a measure of the consistency of the particle sizes within the sample. The higher the UI value, the greater the number of particles with a particle size close to the SGN value, i.e. the mean diameter MA. If all particles of the sample are of the same size, the UI value is equal to 100 %. At a UI value of 50 %, the sample contains in equal parts "fine" and "coarse" particles. $UI = 100\frac{x_5}{x_{90}}$ Thereby, the following applies: $x_5 = x(Q)$ with $Q = 5\,\%$ $x_{90} = x(Q)$ with $Q = 90\,\%$
UI_{gkl}(Q1,Q2)	**Class-dependent uniformity index:** Displays the class-dependent uniformity index UI_{gkl} in percent, which is a measure of the consistency of the particle sizes within the size classes. The higher the UI_{gkl} value, the more particles have the same particle size within the size class. $UI_{gkl}(Q1, Q2) = 100\frac{x(Q1)}{x(Q2)}$ ⓘ For the calculation, it is recommended to set a Q1 value in the range of 5 % to 20 % and a Q2 value in the range of 80 % to 95 %. The UI values are calculated in each size class with the same Q1 and Q2 values.

9.3 Distributions

Distribution	Description
$p_3(x1,x2)$, $p_0(x1,x2)$, $p_2(x1,x2)$	**Fraction:** Displays the ratio of particles in the particle size range between > x1 and ≤ x2. $p_r(x1,x2) = Q_r(x2) - Q_r(x1)$ with $r = 0,2,3$
$Q_3(x)$, $Q_0(x)$, $Q_2(x)$	**Cumulative distribution:** Displays the ratio of all particles with a particle size ≤ x.
$1 - Q_3(x)$, $1 - Q_0(x)$, $1 - Q_2(x)$	**Cumulative distribution of residue:** Displays the ratio of all particles with a particle size > x.
$q_3(x)$, $q_0(x)$, $q_2(x)$	**Frequency distribution:** Displays the ratio of particles with a particle size = x. The frequency distribution is determined from the first derivative of the cumulative distribution. $q_r(x) = \frac{d}{dx} Q_r(x)$ with $r = 0,2,3$
$q_3^*(x)$, $q_0^*(x)$, $q_2^*(x)$	**Logarithmic frequency distribution:** Displays the ratio of particles with a particle size = x, whereas the frequency distribution is derived from the logarithmic cumulative distribution. $q_r^*(x) = \frac{d}{dx} \log[Q_r(x)]$ with $r = 0,2,3$
$Q_0(V)$, $Q_1(V)$	**Volume-based cumulative distribution:** Displays the volume-based ratio of particles with a particle volume ≤ V. The volume-based cumulative distribution is weighted according to the choice of the display either number-based (index 0) or volume-based (index 1). $Q_0(V) = \frac{k(V)}{n}$ with k(V) = number of particles with a particle volume ≤ V n = number of all particles in the sample $Q_1(V) = \frac{\sum_{j=0}^{V} V_j}{\sum_{i=1}^{n} V_i}$

10 Appendix

10.1 Manual COM Port Number Assignment

The CAMSIZER® X2 program communicates with the device via a COM interface. During the installation of the virtual device driver, Windows automatically assigns a COM port number to the COM interface. In order to ensure a failure-free communication, this COM port number should be single-digit.

If problems occur during the communication due to a double-digit COM port number, another number can be manually assigned to the COM interface.

- ⇨ Open the Device Manager in the Windows Control Panel.
- ⇨ Expand the category "Port (COM & LPT)".
- ⇨ Double-click the corresponding communication port. The dialogue box of the COM interface properties opens.
- ⇨ Change to the tab "Port Settings".
- ⇨ Click on the [Advanced] button. The dialogue box of the advanced settings for the selected COM interface opens.
- ⇨ Select a free, single-digit COM port number from the dropdown list "COM Port Number".
- ⇨ Click [OK].
- ⇨ Confirm all following dialogue boxes.
- ⇨ Restart the PC.

11 Index

G

H

I