Manual

Dust Analyser DustMon RD 100

Translation

Table of Contents

1 Notes on the manual

This manual provides technical guidelines for the safe operation of the device. Read this manual through carefully before installing, putting into service and operating the device. Reading and understanding this manual is essential for handling the device safely and as intended.

This manual does not contain any repair instructions. Please contact your supplier or contact Retsch GmbH directly if anything is unclear or you have questions about these guidelines or the device, or in the case of any faults or necessary repairs.

You can find further information about your device at **https://www.retsch.com** on the pages for the specific device concerned.

Amendment status:
The document amendment 0001 of the "Dust Analyser DustMon RD 100" manual has been prepared in accordance with the Machinery Directive 2006/42/EC.

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 Explanation of signs and symbols

The following signs and symbols are used in this manual:

Signs and symbols	Meaning
ⓘ	Indicates a recommendation and/or important information.
Bold type	Indicates an important term.
• < Point 1> • < Point 2> • < Point 3>	List of equivalent points.
⇨	Steps for following an instruction.

1.4 Explanations of the Safety Instructions

⚠ DANGER D1.0000

Risk of fatal injuries
Source of danger

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

Fatal or serious injuries may result if the “Danger” sign is disregarded. There is a **very high risk** of a life-threatening accident or lasting personal injury. The signal word **⚠ DANGER** is additionally used in the running text or in instructions.

⚠ WARNING W1.0000

Risk of life-threatening or serious injuries
Source of danger

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

Life-threatening or serious injuries may result if the “Warning” sign is disregarded. There is an **increased risk** of a serious accident or of a possibly fatal personal injury. The signal word **⚠ WARNING** is additionally used in the running text or in instructions.

⚠ 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.

2 Safety

⚠ CAUTION

C2.0002

Risk of injury
Lack of knowledge of the manual

- The manual contains all safety-related information. Disregarding the manual can therefore lead to injuries.
- **Read the manual carefully before operating the device.**

Target group:

The DustMon RD 100 has been designed for preparing samples in a laboratory environment. laboratory environment. This manual is therefore directed at persons who work with this device in a comparable environment and who already have experience with similar equipment.

The DustMon RD 100 is a modern, efficient, state-of-the-art product from Retsch GmbH. Its reliability is ensured when used as intended and with knowledge of this technical documentation.

2.1 Intended use of the device

As a laboratory device, the DustMon RD 100 may only be used for sample preparation and not as a production machine.

The device has been designed for stationary operation in a dry and clean working environment.

Operating company and operating staff must have read the Manual and be familiar with the full range of functions of the device.

2.2 Improper use

The DustMon RD 100 may only be used as intended.

Any uses other than the described intended use are regarded as improper use.

The DustMon RD 100 is **not** suitable for processing sample materials that can form explosive air mixtures.

Any form of claims for damage to equipment or personal injury resulting from improper use and/or the failure to comply with the safety instructions shall be ruled out.

2.3 Obligations of the operating company

2.3.1 Provisions

The user bears responsibility for ensuring that people working with the device and the corresponding equipment have taken note of and understood all relevant safety regulations.

2.3.2 Personnel

- Ensure that only trained personnel are deployed whose training and experience enable them to recognise risks and avoid potential hazards.
- Staff should be given regular training on using the device, and in particular regarding sudden events.
- Only allow trainee staff to work on the device when they are being supervised by qualified personnel.
- Check the safety awareness of staff regularly.
- Define staff responsibilities according to qualification and job description.
- Provide staff with personal protective equipment (PPE).
- Ensure that the following conditions have been met:
  - Staff have read and understood this Manual, and in particular the chapter on Safety.
  - Staff are aware and take note of the relevant accident prevention and safety regulations.
  - Staff wear the designated personal protective equipment (PPE) when working with the device.

2.3.3 Workstation and device

- Ensure that there is sufficient lighting and ventilation at the workstation.
- Ensure that the exhaust air is properly conducted outside.
- All signs on the device must be kept in a legible condition.
- Ensure that all inspections and servicing work prescribed in this Manual are carried out.

2.3.4 Qualification of personnel

Work/operating phase	Qualification
Transport Installation Commissioning Operation Controlling Servicing Disposal	Qualified employee who has been trained in the safe use of the device.
Work on the electrical equipment on the device	Electrician who, on the basis of his/her training, knowledge and experience is able

Work/operating phase	Qualification
	to evaluate the work assigned and recognise potential hazards.

2.3.5 Personal protective equipment (PPE)

Work/operating phase	Personal protective equipment (PPE)
Transport Installation	Safety footwear
Commissioning Installation of additional equipment Servicing	No PPE needed.
Disposal	Safety footwear
Normal operation (operation and control)	No PPE needed.

2.4 Repairs

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

In case of repair, please inform…

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

Service address:

2.5 Preventing risks during normal operation

The failure to comply with the following safety instructions constitutes improper use and presents a risk to personnel and to operational safety.

Transport and installation

- Wear safety footwear for transport and installation.
- Only connect the device to sockets with a PE protective conductor.
- When connecting the device, the values on the type plate must correspond to those for the power connection.

Operation

- Read the manual before commissioning the device.
- Only operate the device at a workstation of sufficient size that offers adequate stability.
- Check the mains lead for damage before operating the device.
- Never operate the device if damage is visible or suspected.
- Only operate the device according to the technical application limits.
- Before operating the device, take measures that take account of restricted communication during operation of the device.
- Do not operate the device in potentially explosive atmospheres.
- Take note of the safety data sheets for the samples and follow instructions by taking appropriate measures in advance.
- Do not use explosive and/or flammable substances.

Servicing and repair

- Before servicing, switch the device off at the main switch.
- Only clean the device with a dry or damp cloth.
- Do not clean the device with compressed air.
- Have all repairs carried out by the device manufacturer or by an authorised agent.

2.6 Preventing damage to equipment

- Protect the device against condensation if large fluctuations in temperature are to be expected (e.g. during air transport.
- Do not knock, shake or throw the device during transport and installation.
- Comply with conditions at the installation site when installing the device.
- Only clean the device with a dry or damp cloth.
- Do not use any solvent or aggressive detergent for cleaning.
- Only use original spare parts for maintenance work.

2.7 Confirmation Form for the Managing Operator

This manual contains essential instructions for operating and maintaining the device which must be strictly observed. It is essential that they be read by the user and by the qualified staff responsible for the device before the device is commissioned. This manual must be available and accessible at the place of use at all times.

The user of the device herewith confirms to the managing operator (owner) that he has received sufficient instructions about the operation and maintenance of the system. 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 device.

The managing operator should for legal protection have the user confirm the instruction about the operation of the device.

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

3 The DustMon RD 100

The DustMon RD 100 from Retsch GmbH is a laboratory device used for dust measurement.

DustMon RD 100 is an independent measuring system to determine the dust content in powders and granulates. DustMon RD 100 is a newly-designed measuring system based on the principle of light attenuation. The robust design and simple operation guarantee fast, reliable results under even the toughest conditions.

The DustMon RD 100 is offered with a white light source (LED).

The DustMon RD 100 can be used as a standalone measuring system, or in combination with a PC and the DustMon software. The measurement can be started using the integrated display, and this display also shows the results at the end of the measurement. When connected to a PC, the results can be saved and printed out.

The DustMon RD 100 comprises the following components:

- Sample holder
- Tube
- Sample collection receptacle
- Light source
- Detector

The sample is placed in the sample container, the flap opens immediately (or with a delay depending on the setting defined by the user), then the measurement begins. The dust present in the product rises and gets between the light source and detector, thereby causing light attenuation. The light attenuation is directly related to the dust concentration in the sample to be measured.

The DustMon software produces a measurement based on a dust index scale, where the dust index value is determined as follows:
Maximum value measured
Value measured after 30 seconds
Dust index = maximum value measured + value measured after 30 seconds

Fig. 1: The DustMon RD 100

3.1 Technical data

General information	
Area of application	Agriculture, biology, chemistry / plastics, building materials, engineering / electronics, environment / recycling, food, geology / metallurgy, glass / ceramics, medicine / pharmaceuticals / detergents / fertilisers / powdered foods / grain processing and storage
Specifications	
Mains connection	100 – 240 VAC 50/60 Hz (external 12 V (DC) power supply unit)
Protection rating	IP 20
Electromagnetic compatibility (EMC)	EMC class in acc. with EN 50081-2:1992 or EN 50082-2:1992
Light source	White 30.6 mW LED
Measurement principle	Light opacity
Measuring system	Photosensor – 635 nm light voltage transformer
Measurement parameters	Dust index, dust surface, maximum and final value
Feed quantity	10 g – 200 g, usually 30 g

General information	
Measurement time	30 seconds (adjustable up to 999 seconds)
Ambient temperature	5 – 40 °C
W x H x D	320 x 900 x 220 mm Height of device 340 mm, height of tube 560 mm
Weight, net	5 kg
Conformity	CE

3.2 Views of the device

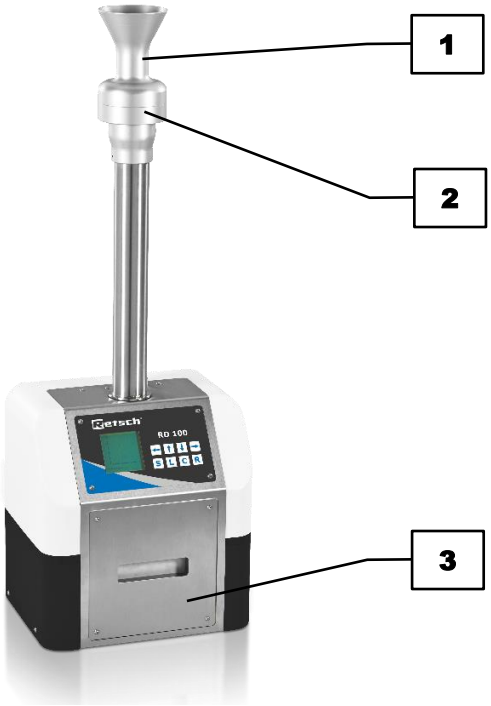


Fig. 2: Front view of the DustMon RD 100

	Components	**Function**
1	Sample container	For filling the sample
2	Sample flap with tube	Opens and allows the sample to fall into the collecting box
3	Sample collection receptacle	Collects the sample and the rising dust is measured

The connector panel is on the right-hand side of the DustMon RD 100:

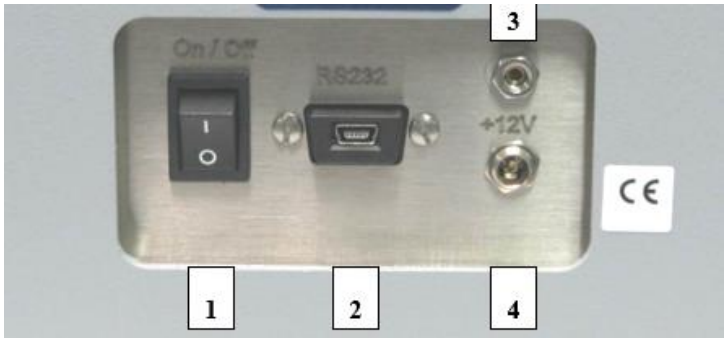


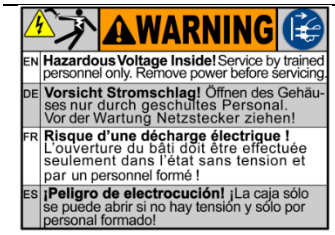
Fig. 3: View of the connector panel

	Components
1	On/Off switch
2	Mini-USB (PC connection)
3	Opening for cleaning with compressed air
4	Power supply unit connection (12 V / DC)

Fig. 4: View of detaching the tube

	Components	**Function**
6	Button to detach the tube	Press to remove the tube (e.g. for cleaning)

3.3 Signs on the device

	Notice	Meaning
	Read the Manual	Safety notice: The device manual must be read before commissioning and operating the device.
	Electrical current warning	Caution – electric shock! The housing may only be opened by trained personnel. Pull out the power plug prior to servicing!
	Type plate	Information: Performance and connection data for the device.

3.4 Type Plate Description

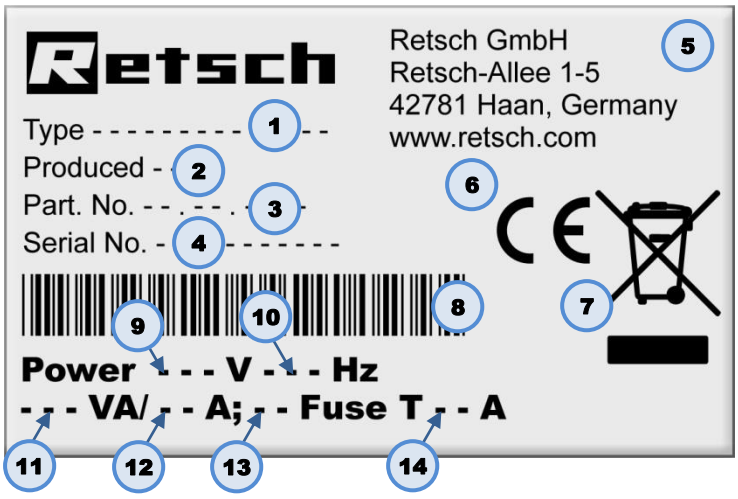


Fig. 5: Type plate

1 Device name
2 Year of manufacture
3 Article number
4 Serial number
5 Manufacturer's address
6 CE mark
7 Disposal sign
8 Barcode
9 Voltage version

10 Supply frequency
11 Power
12 Current
13 Number of fuses
14 Fuse type and fuse rating

ⓘ Please always specify the device name (1) or the article number (3) as well as the serial number (4) for the device if you have any questions.

4 Packaging, Transport and Installation

4.1 Accessories included with delivery

Fig. 6: Scope of delivery

	Components
1	DustMon RD 100 housing and electronics
2	Sample collection receptacle
3	DustMon RD 100 tube
4	Power supply unit
5	White light inspection glass
6	USB cable to connect DustMon RD 100 to the PC

4.2 Packaging

The packaging has been adapted to the mode of transport. It complies with the generally applicable packaging guidelines.

NOTICE N2.0001

Complaint or return
Keeping the packaging

– Inadequate packaging and insufficient securing of the device can jeopardise the warranty claim in the event of a complaint or return.
- **Keep the packaging for the duration of the warranty period.**

4.3 Transport

⚠ CAUTION C3.0000

Risk of injury caused by the device falling down
Incorrect transport of the device

– Due to its weight, the device can cause injuries if it falls down.
- **Wear safety shoes during transport.**

NOTICE N3.0017

Damage to components
Transport

– Mechanical or electronic components may be damaged during transport. The device must not be knocked, shaken or thrown during transport.
- **Move the device gently during transport**.

NOTICE N4.0014

Complaints
Incomplete delivery or transport damage

– The forwarding agent and Retsch GmbH must be notified immediately in the event of transport damage. It is otherwise possible that subsequent complaints will not be recognised.
- **Please check the delivery on receipt of the device for its completeness and intactness.**
- **Notify your forwarding agent and Retsch GmbH within 24 hours.**

4.4 Temperature Fluctuations and Condensation

NOTICE N5.0016

Damaged components due to condensation
Temperature fluctuations

– The device may be exposed to substantial fluctuations in temperature during transport. The ensuing condensation can damage electronic components.
- **Wait until the device has acclimatised before putting it into service.**

Temporary storage:
Also in case of an interim storage the device must be stored dry and within the specified ambient temperature range.

4.5 Conditions for the Installation Site

⚠ CAUTION C4.0047

Risk of injury caused by the device falling down
Incorrect installation of the device

- Due to its weight, the device can cause injuries if it falls down.
- **Only operate the device on a sufficiently large, strong and stable workstation.**
- **Ensure that all of the device feet are securely supported.**

NOTICE N6.0002

Setting up the device
Disconnecting the device from the mains

- A separation of the device from the mains must be possible at any time.
- **Set up the device in such a way, that the connection for the power cable is always easily accessible.**

NOTICE N7.0021

Ambient temperature
Temperatures outside the permitted range

- Electronic and mechanical components may be damaged.
- The performance data alter to an unknown extent.
- **Do not exceed or fall below the permitted temperature range (5 °C to 40 °C ambient temperature) of the device.**

- Maximum relative humidity < 80 % (at ambient temperatures ≤ 31 °C)

For ambient temperatures U_T between 31 °C and 40 °C, the maximum relative humidity value L_F linearly decreases according to $L_F = -(U_T - 55) / 0.3$:

Ambient temperature	Max. rel. humidity
≤ 31 °C	80 %
33 °C	73.3 %
35 °C	66.7 %
37 °C	60 %
39 °C	53.3 %
40 °C	50 %

NOTICE N8.0015

Humidity
High relative humidity

- Electronic and mechanical components may be damaged.
- The performance data alter to an unknown extent.
- **The relative humidity in the vicinity of the device should be kept as low as possible.**

- Installation height: max. 2 000 m above sea level

4.6 Electrical Connection

⚠ WARNING W2.0015

Risk to life caused by an electric shock
Connection to socket without a protective earth conductor

- Connecting the device to sockets without a protective earth conductor can lead to life-threatening injuries caused by an electric shock.
- **Always operate the device using sockets with a protective earth conductor (PE).**

NOTICE N9.0022

Electrical connection
Failure to observe the values on the type plate

- Electronic and mechanical components may be damaged.
- **Connect the device only to a mains supply matching the values on the type plate.**

⚠ WARNING When connecting the power cable to the mains supply, use an external fuse that complies with the regulations applicable to the place of installation.

- Check the type plate for details on the necessary voltage**,** frequency, and maximum external current source fuse for the device.
- The listed values must agree with the existing mains supply.
- Only use the supplied power cable to connect the device to the mains supply.

5 First Commissioning

WARNING W3.0015

Risk to life caused by an electric shock
Connection to socket without a protective earth conductor

- Connecting the device to sockets without a protective earth conductor can lead to life-threatening injuries caused by an electric shock.

• **Always operate the device using sockets with a protective earth conductor (PE).**

WARNING W4.0002

Danger to life through electric shock
Damaged power cable

- Operating the device with a damaged power cable or plug can lead to life-threatening injuries caused by an electric shock.

• **Before operating the device, check the power cable and plug for damage.**
• **Never operate the device with damaged power cable or plug!**

NOTICE N10.0022

Electrical connection
Failure to observe the values on the type plate

- Electronic and mechanical components may be damaged.

• **Connect the device only to a mains supply matching the values on the type plate.**

The DustMon RD 100 must be connected to the power supply on site for initial commissioning.

Ensure the following before connecting the device to the power supply:

- The application site complies with the installation requirements;
- The device is securely and firmly in place;
- The power values for the device (type plate) correspond to the values of the power supply at the site.

5.1 Instrument Assembly

The DustMon RD 100 can be assembled and ready for taking measurements in minutes.

5.1.1 Sample Collection Box

The sample collection box or chamber is a removable stainless steel assembly that slides in and out of the front of the DustMon RD 100 analyzer. It captures and contains each sample and subsequent dust cloud during the measurement cycle. It must be fully seated into the instrument cavity before each measurement.

5.1.2 Lab Valve

The lab valve (feeder tube or drop tube) is a removable stainless steel / aluminum assembly that fits into the 12 mm diameter port on the top of the DustMon RD 100. There is a push button on the top of the instrument that is used to uncouple the tube assembly from the instrument cabinet.

The sample beaker at the top of this assembly receives the measurement sample and holds it until the measurement begins. For best repeatability it is important that this tube remains vertically level during operation. Use of a simple bubble level along the tube during set-up can determine if the designated work space is adequate.

Abb. 7: Uncouple the tube assembly

5.2 Connecting the device to the power supply

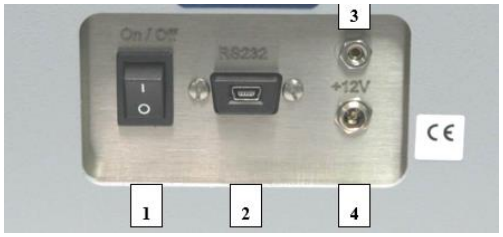


Abb. 8: Connecting the device to the power supply

Connect the device to the power supply as described below:

⇨ Compare the voltage and frequency on the type plate of the device to the values on site.
⇨ Plug the supplied mains lead into the appliance socket (4).
⇨ Plug the other end of the mains lead into a socket at the installation side.
⇨ Provide external fusing according to the regulations at the installation site.

6 Operating the Device

⚠ WARNING W5.0002

Danger to life through electric shock
Damaged power cable

– Operating the device with a damaged power cable or plug can lead to life-threatening injuries caused by an electric shock.

- **Before operating the device, check the power cable and plug for damage.**
- **Never operate the device with damaged power cable or plug!**

⚠ CAUTION C5.0005

Risk of injury
Potentially explosive atmosphere

– The device is not suitable for use in potentially explosive atmospheres. Operating the device in a potentially explosive atmosphere can lead to injuries caused by an explosion or fire.

- **Never operate the device in a potentially explosive atmosphere!**

6.1 Switching the device on/off

Fig. 9: On/Off switch (1)

⇨ You can turn the device on or off using the On/Off switch (1) on the right-hand side of the device.

7 DustMon RD 100 – Measurement using the internal control unit

The DustMon RD 100 as a basic system (stand-alone unit) operates with an internal PC that controls the entire measurement and shows the results as values and as a graph on the display.

Only two keys are required to perform measurements:
R key (Run) to start the measurement and
S key (Stop) to stop/cancel a measurement.

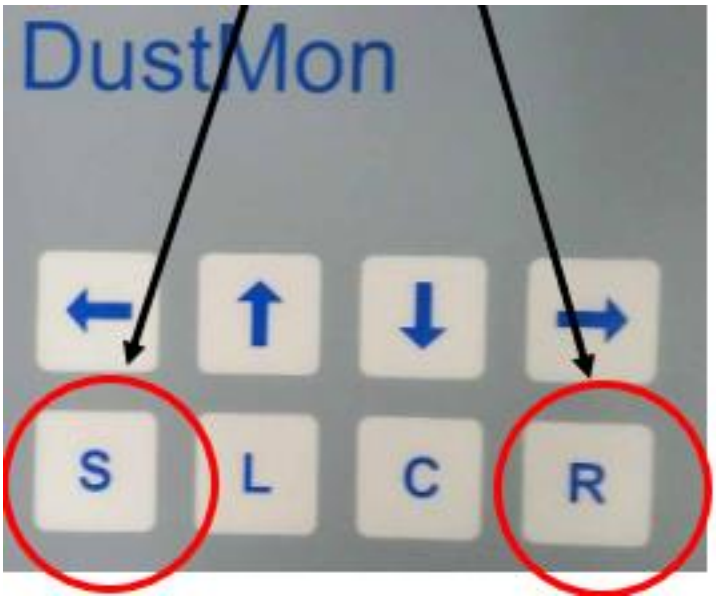


Fig. 10: DustMon RD 100 display

Performing a measurement:

- After filling the sample container (typically 30 g), press the **R** button
- "AutoZero" is shown on the display; there is then a countdown from 5 to 0 to perform a “Zero measurement”.
- The sample flap opens and closes audibly.
- The sample material falls into the collecting box and the measurement begins.
- After 30 seconds the measurement has finished and results are displayed.

7.1 Measurement Considerations

- The standard sample volume should be 30 grams and measured for 30 seconds. Depending on the situation, longer times can be set. If the course of the curve has not arrived at a value of zero after 30 sec, the measuring time can be extended if this is relevant.
- To avoid cross-contamination and falsification of the result, the collection receptacle and the tube must be thoroughly cleaned after each measurement.
- The samples should be stored in a drying chamber to avoid humidity effects. Humidity and other agglomeration effects can influence the amount of dust.
- Carry out pre-measurement
    - Make sure the sample container is empty and clean (make sure that there is not any sample nor dust).

  - Make sure that the DustMon RD 100 (sample container, tube, sample collection box) is clean (vacuum cleaning is recommended).
  - Weigh 30 grams of material in a glass container with a pouring tip. This offers the best possibility to transfer the sample into the sample container.
  - Before the measurement, the sample must be homogenised.
  - Transfer the sample to the sample container.
  - Press R (Execute). A delay occurs during background measurement. A "click" is heard when the sample flap opens and the sample falls through the tube into the sample collection receptacle. Dust rises and falls again. Light absorption measurements are taken and data is shown on the display.

- Expected course of measurement
  - Initially, there is a sharp peak in the measurement curve. The peak then decreases during the measurement.
  - The measurement curve flattens out as the measurement is taken and the dust settles.
  - When the measurement is complete, take note of the dust index.

7.2 DustMon RD 100 display during the measurement

You can follow the progress of the measurement on the display of the DustMon RD 100.

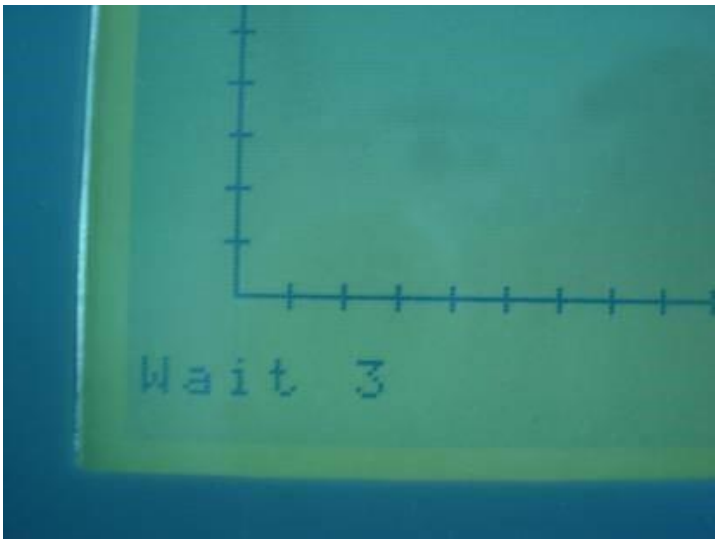


Fig. 11: Countdown before the measurement

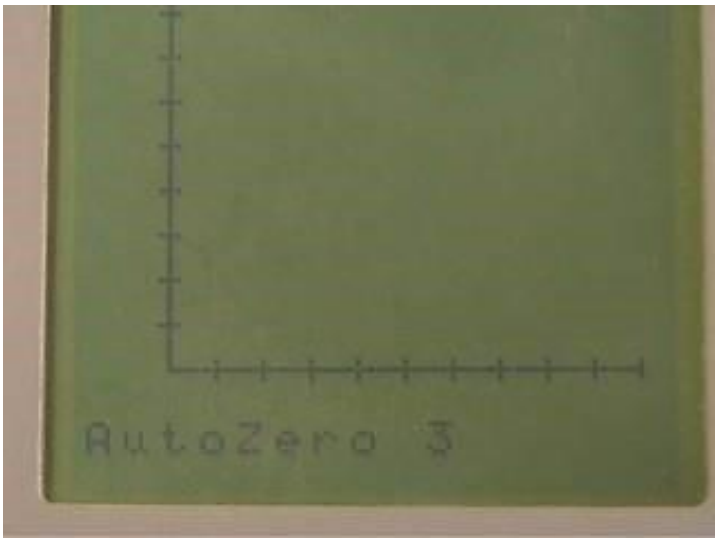


Fig. 12: Zero measurement before the measurement

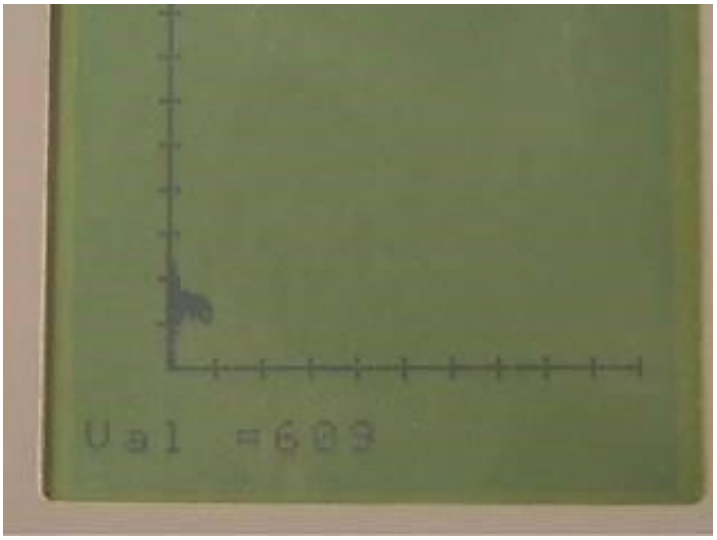


Fig. 13: Readings during the measurement in real time

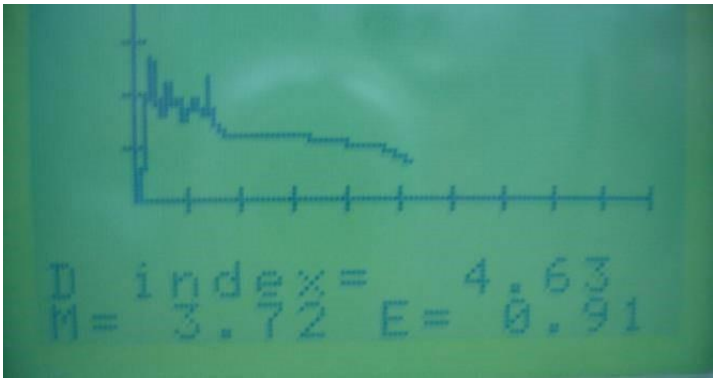


Fig. 14: Result of the measurement after 30 seconds

Pressing the ↑ button once changes the "D Index" (DustIndex) in the top row to "D Area" (DustArea). When pressed twice, the result for "Area + M" (DustArea + maximum value measured) is shown. The MaxValue (maximum value measured) is abbreviated as M, and the end value as E.

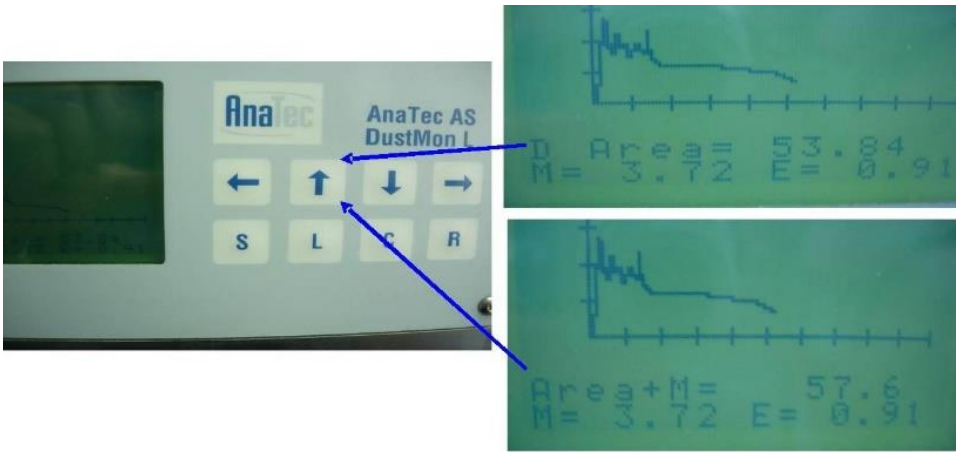


Fig. 15: Changing the display

8 DustMon RD 100 using PC control unit / software installation

Any PC with the Microsoft Windows operating system and a USB interface can be used for installation.

Software installation:

1. Create a folder on your PC and copy *DustMonL.exe,* the licence file (.lic) and the *Language.txt* to this folder.
2. Using the USB cable, connect the measurement system and PC.
3. Please switch the DustMon L on before starting the software!
4. Start the program by double clicking the "DustMonL.exe" file

The following window appears when starting the software:

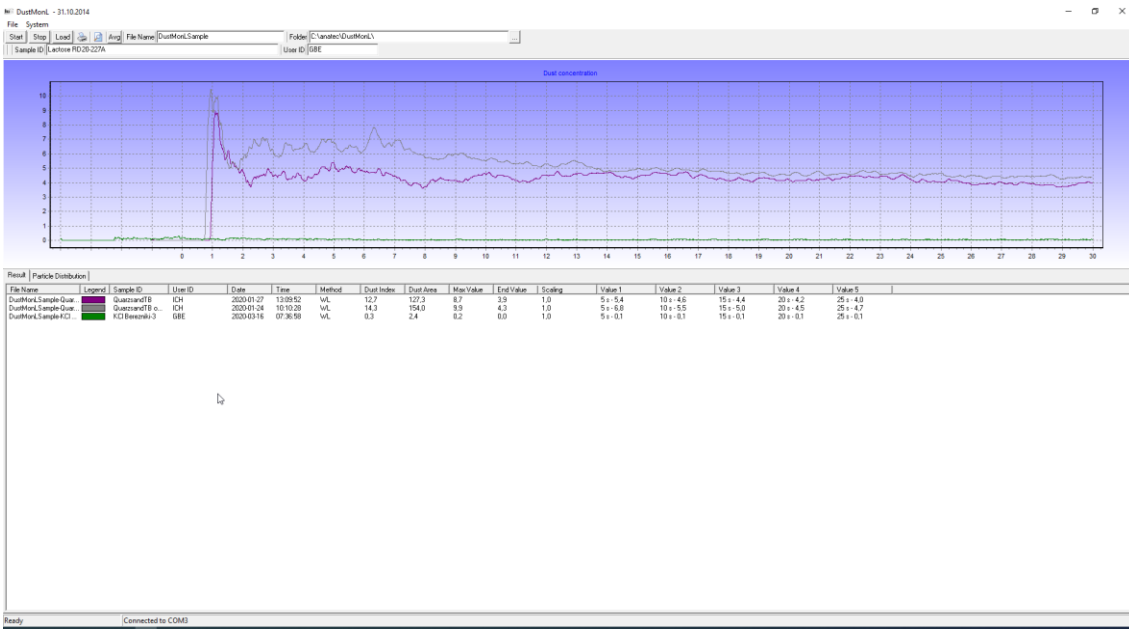


Fig. 16: Software window

8.1 Description of the program interface

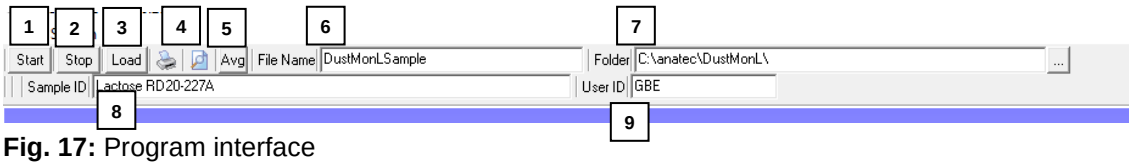


Fig. 17: Program interface

	Function
1	"Start" button to start the measurement
2	"Stop" button to stop/cancel the measurement
3	"Load" button to retrieve previously saved results (file ending .dur)
4	"Print/Preview" buttons - Output of the results/the result to a printer or generation of a pdf file. - Print preview: a separate window opens. The printer can also be selected here
5	"Ø" (average value) button Clicking on the " Ø " button displays the results data for some previously loaded measurements as an average calculation (refer also to the "Calculation of results as an average" chapter)
6	"File name" input box The file name is entered here. Please note: if you carry out a series of measurements and subsequently want to save the data in Excel in txt format, the file name should always be the same. More detailed distinctions can be made in the "Sample ID" field (refer also to Point 8). Example: File name = *TEST MEASUREMENT* Sample ID comment for 1st measurement: *Sample A* Sample ID comment for 1st measurement: *Sample B* Sample ID comment for 1st measurement: *Sample C* Sample ID comment for 1st measurement: *Sample D* ⓘ All results from these four measurements are saved in a TXT file and can be imported as a measurement series, e.g. to Excel (also see 6.9, Transfer of results to Excel)
7	"Folder" input box Clicking on the ... button to the right of the input box opens a dialog box which can be used to search for an existing folder or to create a new file folder.
8	" Sample ID " input box Comment regarding the sample, e.g. batch number, consecutive number etc. (becomes part of the measurement file [dur])
9	"Operator" input box Entry of the operator (or department) is possible. This information is saved with the measurement.

8.2 System settings before the first measurement

Before the first measurement, the basic settings of the DustMon RD 100 may be changed or adapted according to your requirements.
A password is needed to make changes. Proceed as follows:

1. Select "System" and then "Login" in the menu bar.

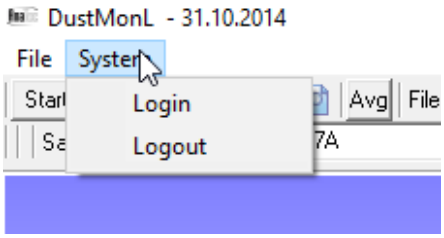


Fig. 18: Software login

2. The “Password dialog" window opens. Enter the password here and confirm by clicking "OK".

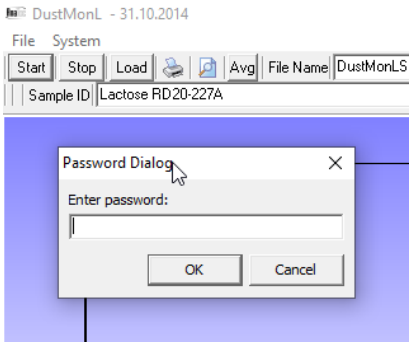


Fig. 19: Password entry

3. Select "System" in the menu bar again. An expanded selection is now available. Select "Settings".

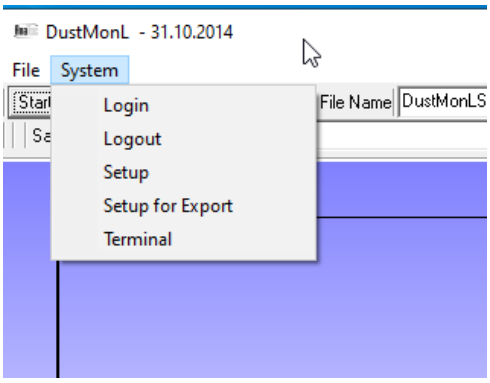


Fig. 20: Select **"**Settings"

4. The "Setup" dialog box opens:

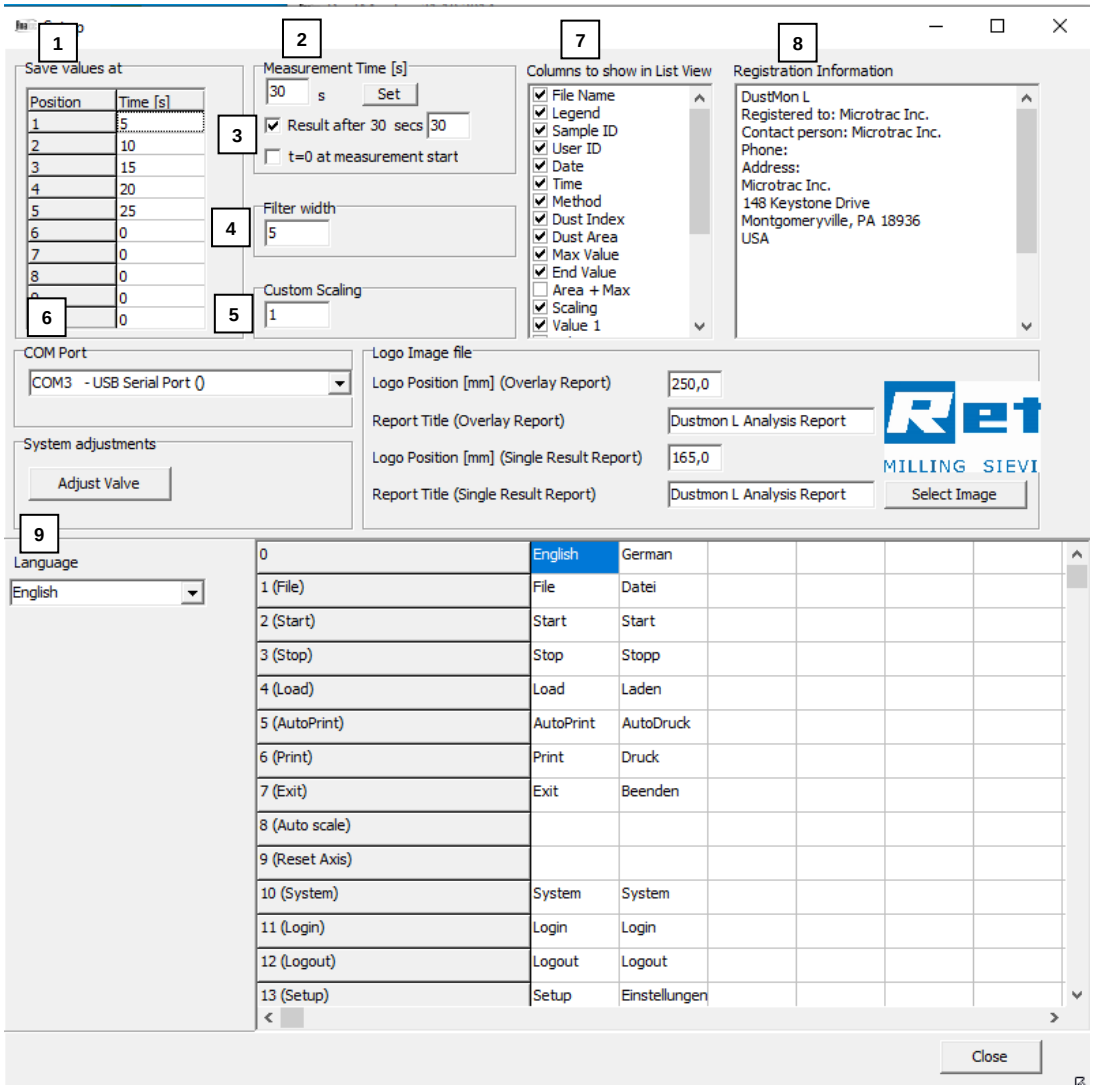


Fig. 21: "Setup" dialog box

	Function
1	Save data at x seconds: Up to 10 measurement points can be freely selected and inserted here, i.e. the dust value is, for example, recorded and specified after 5 seconds, 10 seconds etc. after reaching the MaxValue. These values are shown on the monitor, in the print-out and are also saved accordingly. ⓘ Note: only enter whole numbers.
2	Measurement time [s] Total duration of the measurement. Typical: 30 seconds The measurement time can be adjusted to suit requirements/applications and increased to a maximum 999 seconds. For this the PC must be connected to the DustMon RD 100 and the DustMon RD 100 must be switched on. If you have set a different measurement time, please click on the "Set/OK" button for the change to take effect.
3	Result after 30 secs. If "Result after 30 secs" has been activated (the box has been checked), the DustIndex will be calculated using the maximum value measured + value after 30 secs (standard setting). If "Result after 30 secs" has been deactivated (the box has not been checked): the DustIndex will be calculated using the maximum value measured + value after x secs (the measurement duration set up beforehand (see (2); e.g. after 120 seconds))
4	Filter Number of measurement points that calculate the results (up to 1000 measurement points per second). Using the filter you can set the number of averaged values, i.e. a sliding average over x measurements to smooth the course of the curve.
5	Adjustment/Factor Entering a factor (e.g. 1 or 2) enables the results to be adjusted here if required.
6	Com interface Setting/Selection of the interface
7	Selection of values The marked options are displayed in the table below the graph. The values can be selected individually.
8	Licensing Details of the end user or the company
9	Language The language can be selected using the dropdown menu (further languages can be entered by the user).

If desired, it is possible to change the logo that appears on the print-out (file format: jpg or bmp. Height of the logo: max. 60 pixels).

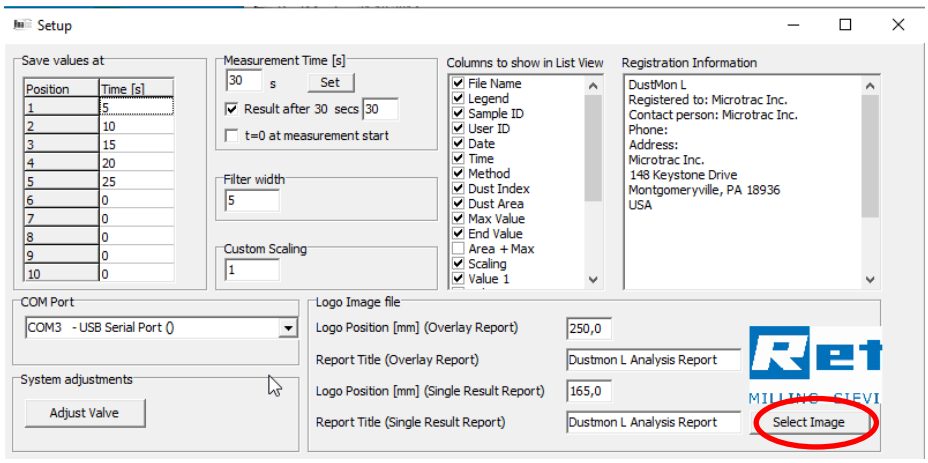


Fig. 22: Changing the logo

⇨ Login via the "System" menu item
⇨ Select "Settings"

⇨ The "Setup" dialog box opens
⇨ Click the "Select Image" button

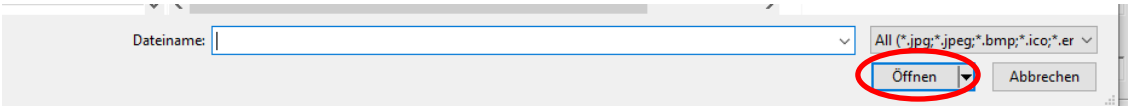


Fig. 23: Selecting a file

⇨ Select the folder in which the logo has been saved
⇨ Select the file and then click "Open"

8.3 Starting the measurement using the DustMon RD 100 software

1. Place the material in the sample container of the DustMon RD 100 (typically 30 g).
2. Check and where necessary change the folder in which the results are to be stored **(1).**
3. Assign a file name **(2)** under which the results will be stored.
4. Assign the sample name **(3)** to the respective Sample ID description.
5. Click Start **(4)** to begin the measurement.

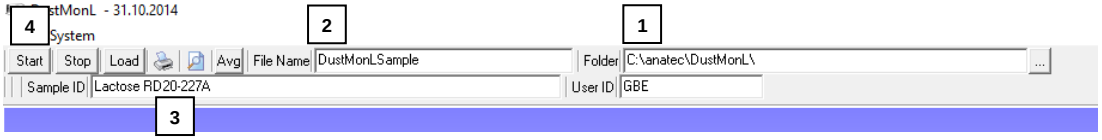


Fig. 24: Starting the measurement

Before starting the measurement the DustMon RD 100 conducts a “Zero measurement”. This “Zero measurement/AutoZero” is always performed before every measurement.
The duration when switching the system on for the first time is approx. 30 seconds, and thereafter approx. 5 seconds before every measurement. “AutoZero” is shown on the on-board display of the DustMon RD 100. Once the zero measurement has been completed, the flap opens and closes audibly. The sample falls into the collecting box and the dust measurement begins. When the measurement begins the values are plotted and shown on the monitor in real time. After 30 seconds (basic setting) the measurement stops (beep). The result is displayed as a graph – the values are set out beneath the graph.

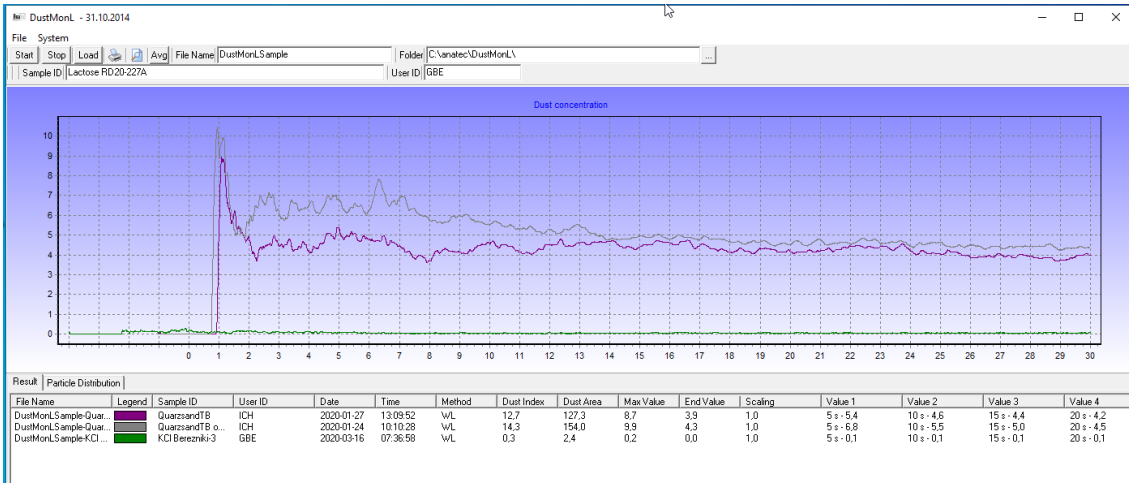


Fig. 25: Result of the measurement

NOTICE Before starting the next measurement ensure you have thoroughly removed any sample material from the previous measurement from the sample collection receptacle! In the case of very dusty products it is worth vacuum cleaning the box quickly after emptying it.

8.4 Results and information about the sample

After the measurement the following results are displayed (basic setting/as delivered):

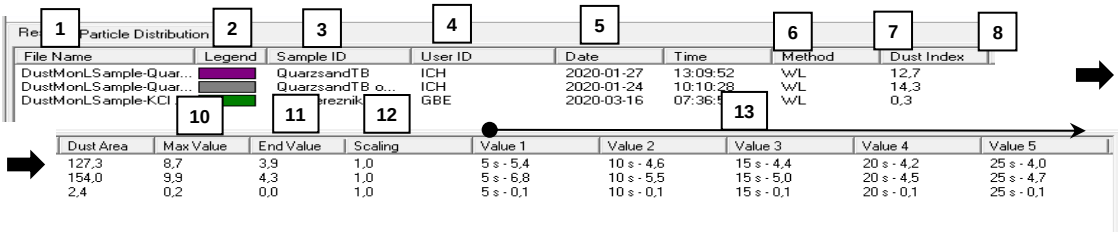


Fig. 26: Display of the results

	Explanation
1	File name Consisting of: File name – Sample ID – Date – Time File ending: dur; dur-files can only be opened using the DustMon RD 100 software.
2	Key Assignment of the colour to the curve(s) shown.
3	Sample ID Description/comment on the sample.
4	User ID Details of the operator (or department, company etc.).
5	Date Date of the measurement.
6	Time Time of the measurement.
7	Method WL = White light (LED).
8	Dust Index MaxValue + value after 30 seconds.
9	Dust area Integral beneath the graph.
10	Max value Maximum value measured during the measurement.
11	End value Dust value after 30 seconds (basic setting).
12	Factor Specification of the factor by which the measurement has been adjusted. 1 is shown if no adjustment has been made.
13	Value 1 to 10 To be individually set (see the "System settings before the first measurement ") chapter. If selected, the values (dust value after x seconds) are specified.

ⓘ All details can be sorted by clicking on the column heading (14)!

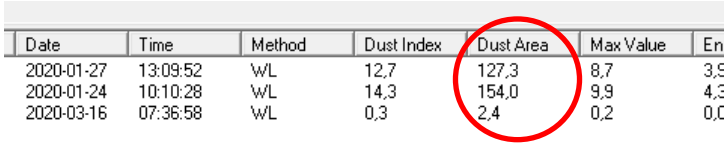


Fig. 27: Display of the results

ⓘ Information about the measurement results can be adjusted, i.e. data and values that you do not need can be faded out. Refer also to the "System settings before the first measurement" chapter.

8.5 Loading the results

If you have saved results in different folders, ensure that you have selected the correct folder. Results can also be merged if you have saved them in different folders.

To retrieve a result, click Load **(1)**. A dialog box **(2)** opens. The measurement files (always with the "dur" file ending) are listed here. If necessary a different folder can also be selected from here. Mark the desired file, click the "Open" button and the measurement result will be displayed.

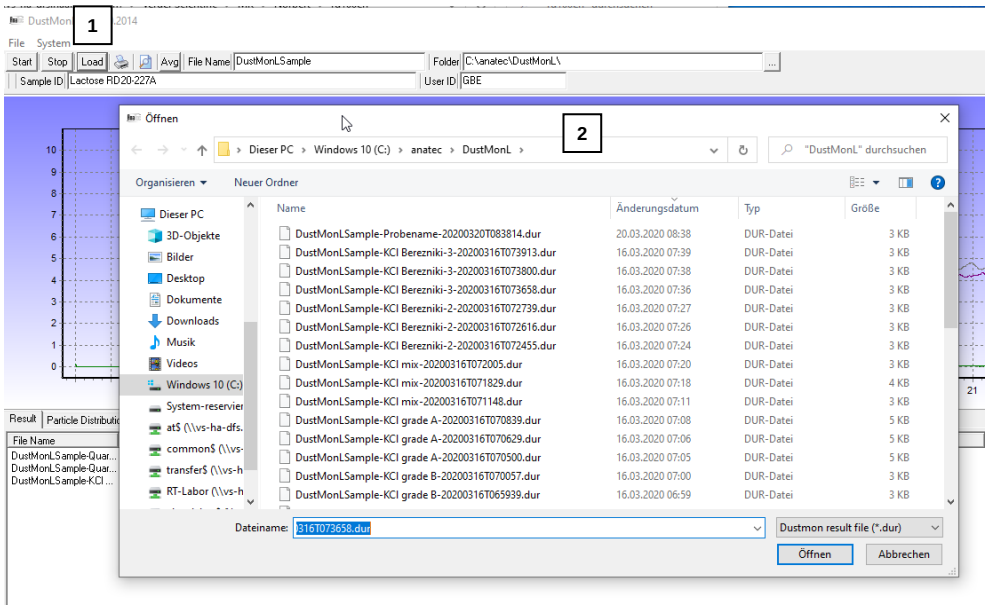


Fig. 28: Loading the results

8.6 Superimposing measurement results

In order to be able to compare measurements, the DustMon RD 100 software offers the option of superimposing data from up to ten measurements.

Proceed as follows: Click Load **(1)** and select the results (keep the CTRL button pressed + left click = selection of multiple data) that you want to superimpose **(2)**. Click the "Open" button **(3),** and all marked files will be retrieved.

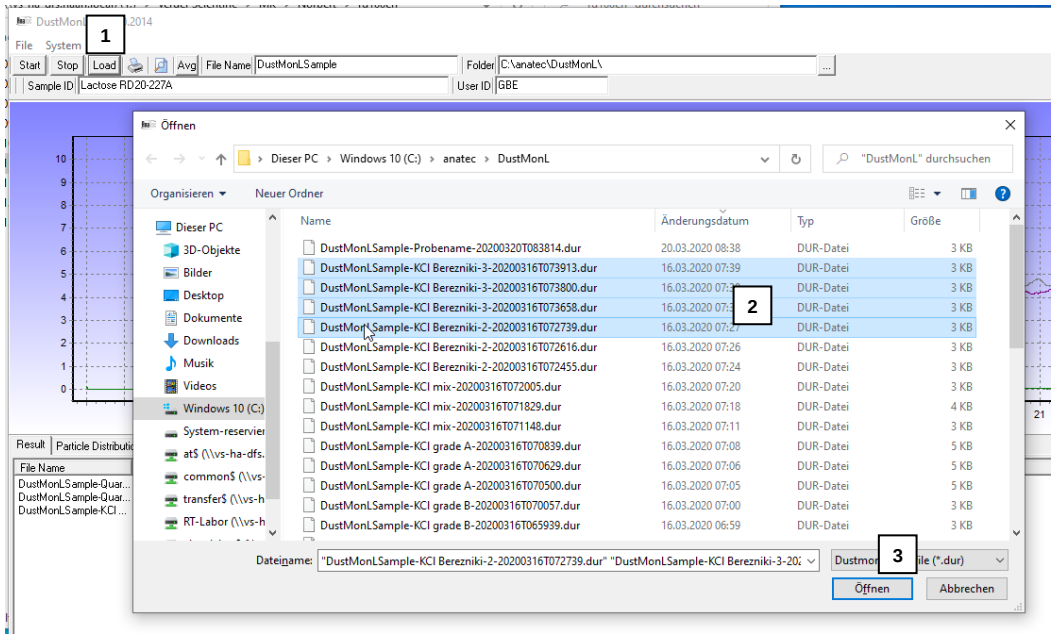


Fig. 29: Superimposing measurement results

The following figure shows three results superimposed in one graph:

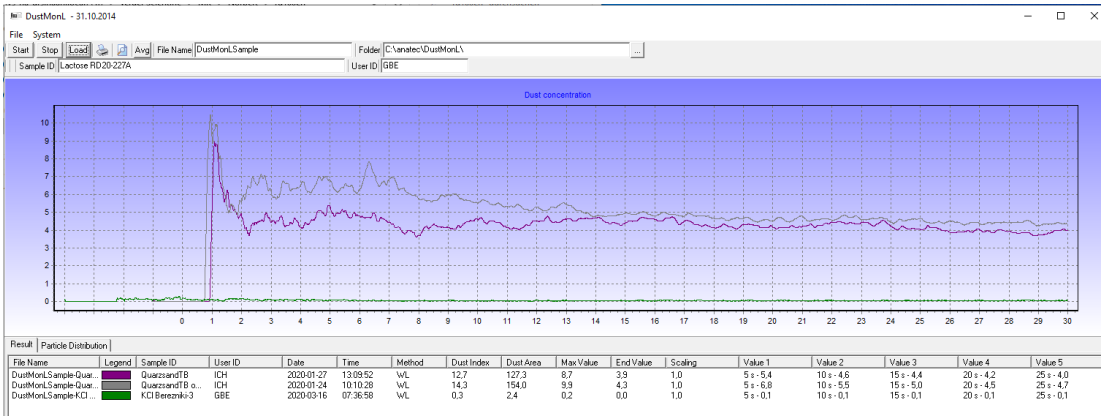


Fig. 30: Display of multiple results

8.7 Changing the graphics display

It can be difficult to view a single graph if a number of measurement results are portrayed together. Using a simple function it is possible to fade graphs out and back in again or delete them from the presentation.

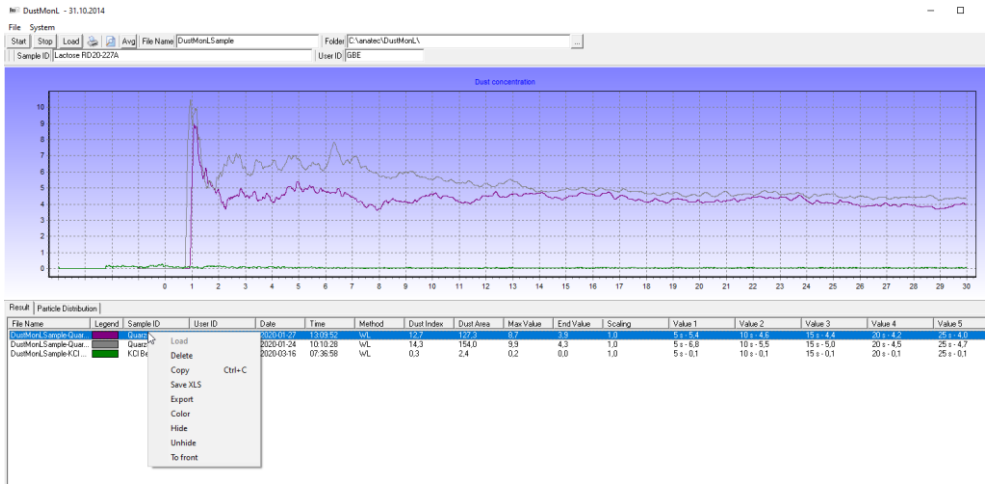


Fig. 31: Changing the graph presentation

⇨ Select the relevant row of results by clicking on them **(1)**. A right click opens a command screen **(2).** Now select the desired function:

Load:	The "Load" function is not available. If an additional result needs to be added, this is achieved using the "Load" button
Delete:	The series of results (data) and graph are deleted
Copy:	
Save XLS:	
Export:	
Color:	If necessary a different colour can be assigned to the graph here
Hide:	The curve is faded out and no longer displayed in the graph; the series of results continues to be listed
Unhide:	The curve is faded back into the graph
To front:	No function

8.8 Calculating results as an average

The DustMon RD 100 software enables you to calculate the average from results that have already been loaded.
Example: initial situation as shown below – 3 results have been superimposed.

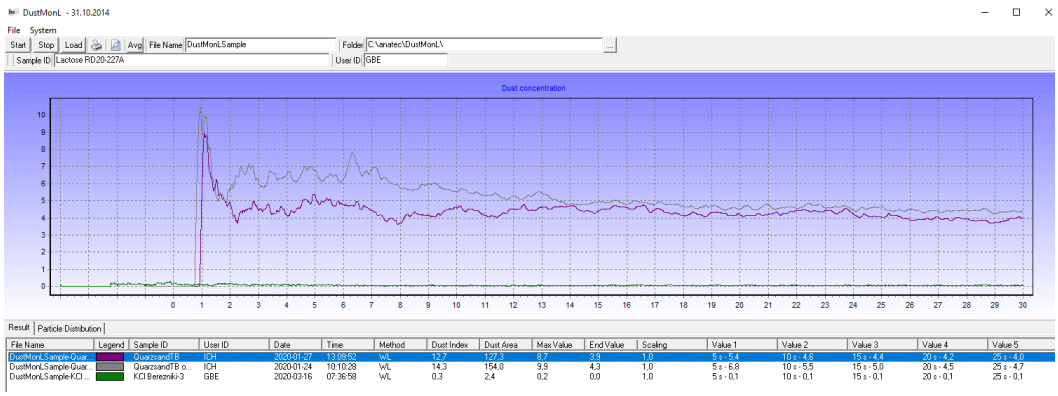


Fig. 32: Calculating results as an average

Clicking on the button **(1)** "∅" (=average) displays both an additional curve in the graph and another row of data **(2)** in the table.

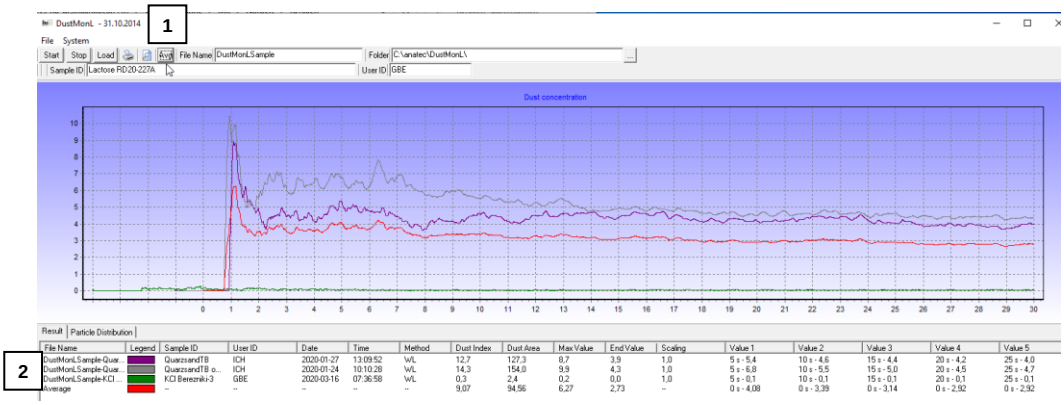


Fig. 33: Displaying the average

The average is also shown in the graph, but may be covered by the other curves.

Proceed as follows to only display the average curve:
Mark all data series below the graph (by clicking and holding down the Ctrl button) and fade the curves out (right click to open the command screen, then select "Hide").
Now only the average is visible as a graph, as shown below.

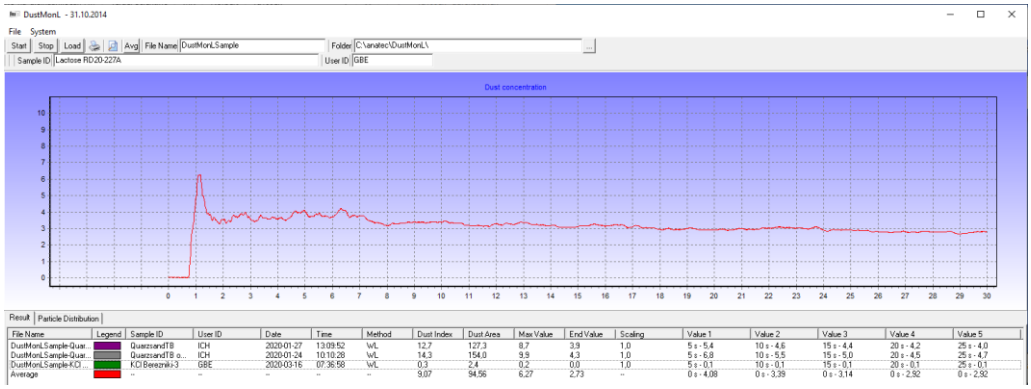


Fig. 34: Displaying the average value curve

8.9 DustMon RD 100 - Transfer of results to Excel (txt file)

Every measurement is fundamentally saved as a dur-file. Parallel to this the DustMon RD 100 software creates a TXT file with all measurement data. This TXT file can, for example, be imported to Excel for further evaluation.
The data will not be imported correctly if the Windows operating system is running in German because the decimal and thousands separators in Germany differ from the international standard (German: 1.000,00 -> International: 1,000.00).
The following settings must be made in Excel before importing a TXT file:

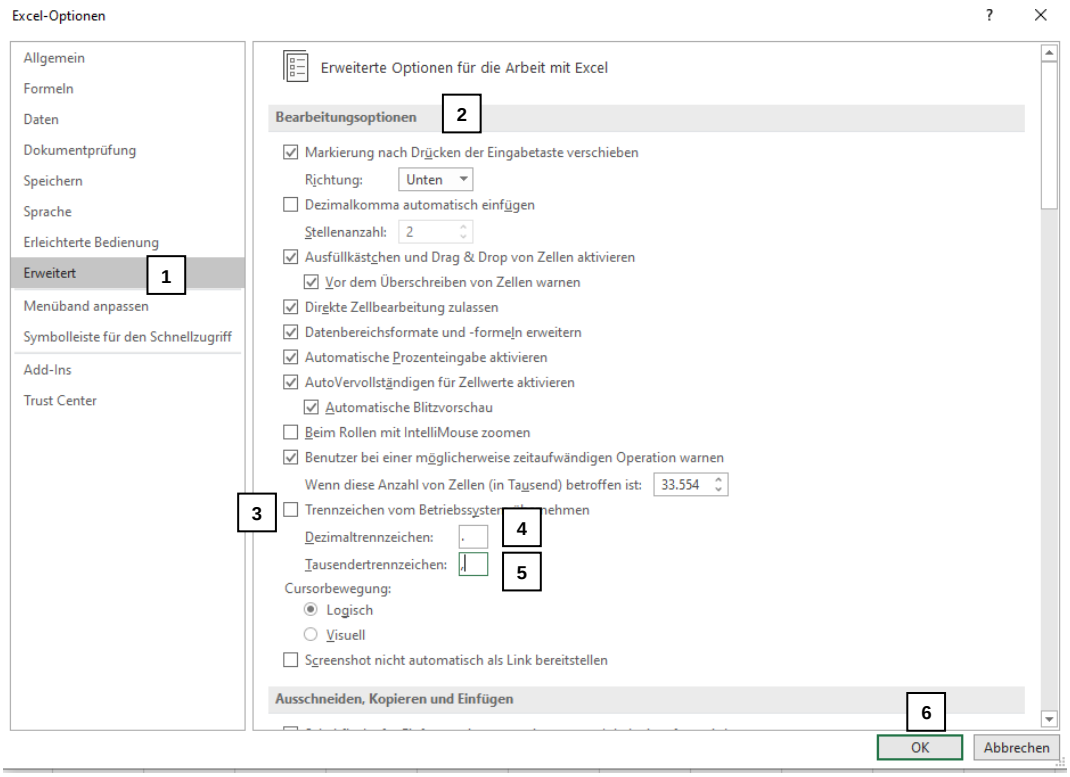


Fig. 35: Changing settings in Excel

Start the Excel program.

- ⇨ Select File and then Options in the Excel menu bar
- ⇨ Switch to the “Advanced” area (1)
- ⇨ Scroll to the Editing options.

- ⇨ Remove the tick on the "Use system separators" option (3)
- ⇨ Enter a *dot* in the "Decimal separator" **(4)**:
- ⇨ Enter a *comma* in the "Thousands separator" **(5)**
- ⇨ Confirm changes by clicking OK **(6)**

9 Troubleshooting

9.1 "Error clean" message on the on-board display

The DustMon RD 100 system is too dirty. Please clean thoroughly but carefully (as described in the "Cleaning and maintenance" chapter).
You can also clean the measurement chambers and the sample collection receptacle using gentle compressed air, using a brush to free the light source and detector of any dust clinging to them.

9.2 White light source OFF – device is not functional

It is possible to start a measurement – using both the DustMon RD 100 software from your PC and directly on the device ("R" button on the on-board display) – however no measurement will be conducted.

Please check that all connections have been connected correctly and are not loose.
Check whether the white light source is on (prerequisite: turn the DustMon RD 100 on):

- ⇨ Remove the sample box
- ⇨ The light source is situated inside on the right-hand side. Generally you should be able to see whether the light source is on, but you can also hold your hand in front of the light source.

Action:
Please proceed as follows if the check shows that the white light source is not on:

- ⇨ Make sure that the DustMon RD 100 has been switched on
- ⇨ Press button **C** and then button **R** on the on-board display of the DustMon RD 100
- ⇨ The white light source should now be on again; if not, please turn the DustMon RD 100 off and back on again and repeat the process if necessary.

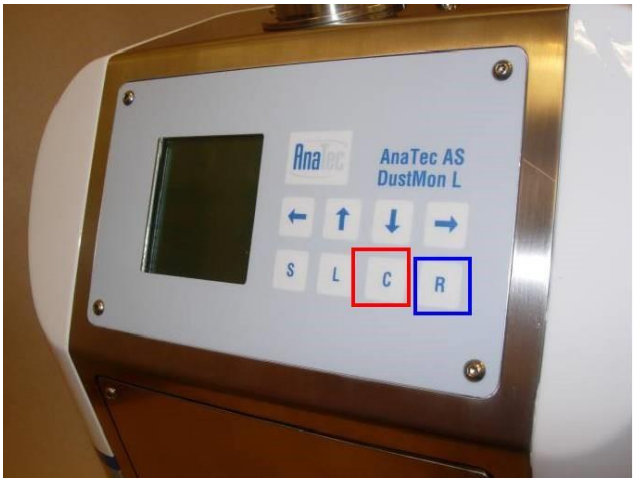


Fig. 36: Activating the white light source

ⓘ This error description occurs on DustMon RD 100 systems that are ONLY equipped with a white light source.
Background: the white light source (LED) can be deactivated by use of a key combination on the on-board display. This can occur if somebody presses the buttons randomly or when cleaning the surface while the device is switched on.

10 Cleaning and maintenance

The DustMon RD 100 is easy to clean and almost maintenance-free.
Depending on the sample material, it may be necessary to clean the tube after every measurement.
The DustMon RD 100 should be cleaned at least once a day depending on use.

Press the button right down to release the tube locking system. The tube can now be removed.

Fig. 37: Removing the tube

Clean the DustMon RD 100 with a vacuum cleaner and brush where necessary.
ⓘ Push the brush through the tube from top to bottom!

Fig. 38: Cleaning the device

11 Checking the white light source

A calibration filter is supplied to check the DustMon RD 100. This is used to calibrate and check the system.

The DustMon RD 100 system must be switched on in order to carry out such an inspection. Ensure that both the tube and the sample box are clean. A measurement time of 30 seconds is sufficient.

- ⇨ Pull the sample collection receptacle on the DustMon RD 100 out and place a lens (glass) in front of the opening using the mechanism at the back on the left.
- ⇨ Pull the sample collection receptacle up to the front edge of the DustMon RD 100.
- ⇨ Start the measurement and wait for the "zero measurement".
- ⇨ As soon as the "Zero measurement/AutoZero" has taken place, the flap in the tube audibly opens and closes.
- ⇨ Once this has occurred you can gently slide the sample collection receptacle as far as it will go into the DustMon RD 100.
- ⇨ A constant value now appears on the display
- ⇨ The data are displayed at the end of the measurement. Attention should be paid to the end value (= 30 seconds); this should be 47.1 +/- 0.3 %.

Fig. 39: Sample collection receptacle with inserted calibration filter

Fig. 40: Calibration filter: the lens with specified tint must reflect the value (end value) +/- 3%

3 lens test (glass test) results. The increase at the start of measurements results from inserting the sample collection receptacle.

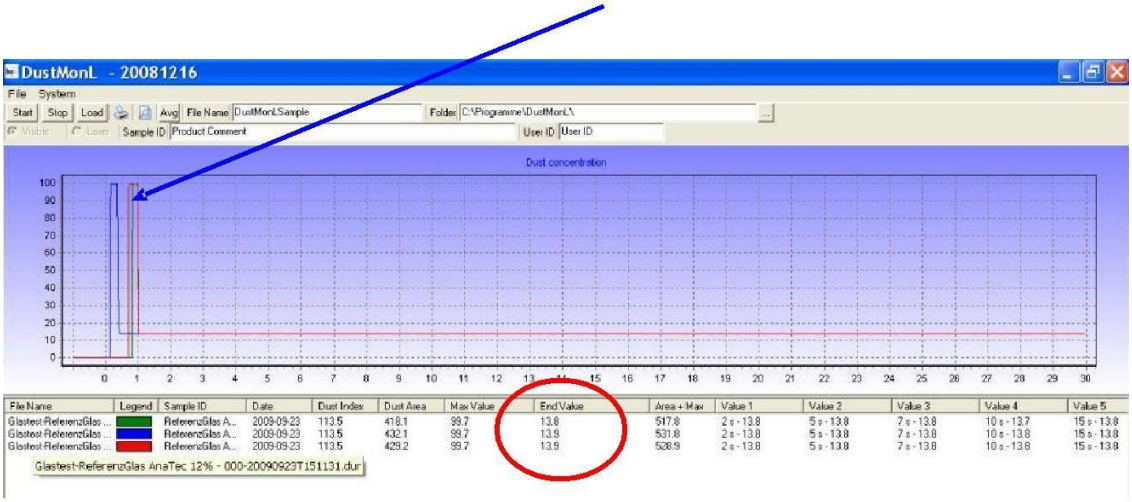


Fig. 41: 3 lens test results

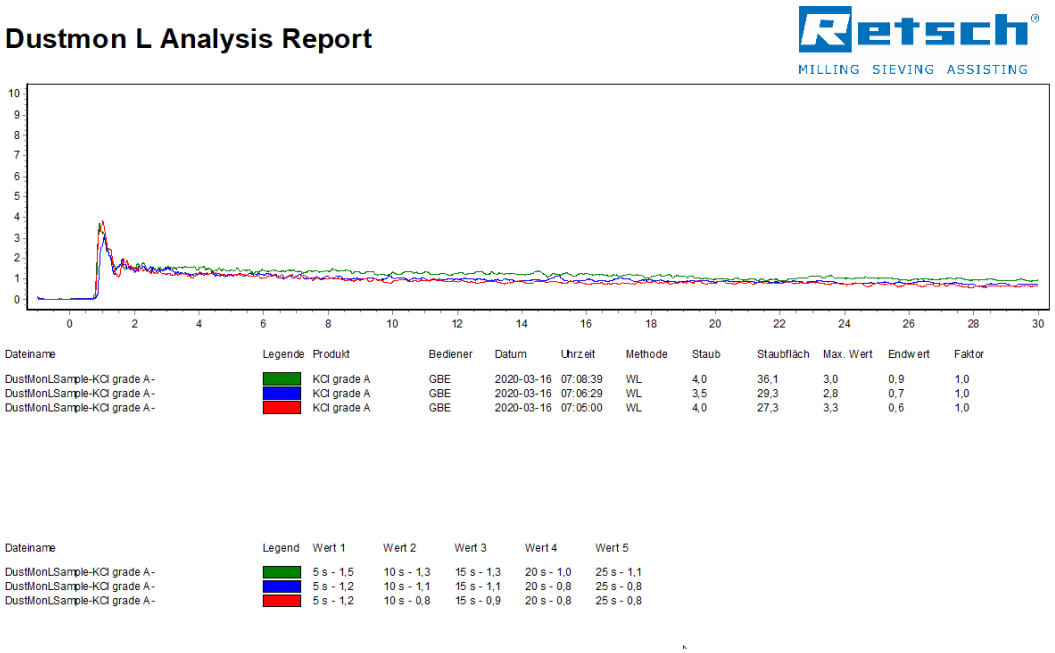


Fig. 42: Print view of the 3 lens test measurements

12 Calibration

Beginning with firmware version 0191 the DustMon RD 100 product design allows for a variety of calibration techniques.

a. Reference glass or filter lens
b. One reference standard sample
c. Two reference standard samples

12.1 Setup Kalibration

Prior to performing calibration the DustMon RD 100 unit must be connected to a PC which has the DustMon RD 100software installed. The following calibration option parameters should be modified as desired using the **Terminal** mode of the software:

Description of Settings:

LED_low_cal_ref = Standard 1 Reference Dustindex value

LED_high_cal_ref = Standard 2 Reference Dustindex value (2 point calibration mode)

LED_cal_N = Number of required measurements for each ref sample

LED_ref_enable = 0 (False) or 1 (True) enabling the Calibration to Dustindex function

LED_cal_mode = 1 or 2 Point Standard Calibration

The default calibration settings in DustMon RD 100Ver. 0191+ firmware are:

LED_low_cal_ref = 5

LED_high_cal_ref = 10

LED_cal_N = 5

LED_ref_enable = 1

LED_cal_mode = 2

When connected to a PC, these settings can be viewed and changed in the DustMon RD 100Program by selecting menu Options → Set Calibration values:

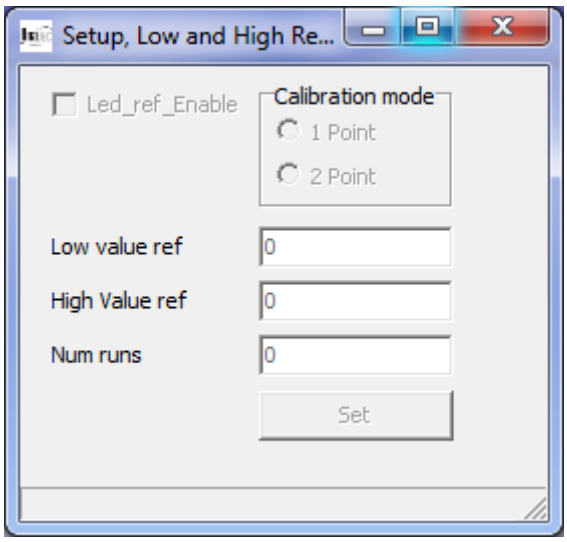


Abb. 43: Set Calibration Values

Or the settings can be changed by using terminal mode:

LED_low_cal_ref = "Standard 1 reference value"

LED_high_cal_ref = "Standard 2 reference value" (If using 2 point calibration)

LED_cal_N = "Number of measurements for each ref sample that is required"

LED_ref_enable = 1 (Functionality ON ➔ Apply calibration to the Dustindex)

By setting "LED_ref_enable=0", the calibration functionality is turned off.

Select the correct mode

LED_cal_mode = 2 (Two point calibration, using two standards)

LED_cal_mode = 1 (Linear calibration using one standard)

After this is set up correctly you may proceed to the actual calibration steps in either standalone mode or while connected to the software.

12.2 Disable calibration function for Standalone mode

If the standalone functionality calibration functionality described in the next section is not desired in order to prevent accidental or unauthorized changes to the calibration factor, the functionality can be disabled or subsequently reenabled. To change this setting you must access the instrument's terminal mode and use the associated code to enable (0) or disable (1) the standalone calibration function.

To enable calibration functionality:

$login rix56bf
$dis_standalone 0
$logout

To disable calibration functionality:

$login rix56bf

$dis_standalone 1

$logout

12.3 Calibration using reference glass (filter lens) in standalone mode

The following procedure applies to DustMon RD 100 units with a firmware rev of 0185 or newer:

1. Turn off the DustMon RD 100
2. Keep the C button depressed while turning the DustMon RD 100 on, and keep it depressed for one more second. Now the DustMon RD 100 is in standalone LED calibration mode.
3. Run one or two standard LED analysis in order to ensure warmup and stabilization (no sample needed).
4. Start the correct calibration sequence according to Table 1.
5. Follow the instructions on the LCD display. When prompted to press a key, use the C key on the keyboard.
6. When calibration is finished the calibration factor will be visible on the display.

	Keys to depress simultaneously	
10 % Ref glass calibration	⇐	⇓
50 % Ref glass calibration	⇐	⇑
User defined calibration value	⇐	⇒

Table 1: Keyboard combinations

How to change the calibration parameters:

1. Turn off the DustMon RD 100
2. Keep the C button depressed while turning the DustMon RD 100 on, and keep it depressed for one more second. Now the DustMon RD 100 is in standalone LED calibration mode.
3. Use the keystrokes in Table 2.
4. Follow on screen instructions.
5. Use arrow up / arrow down to increment/decrement.
6. Press C button to finalize the modification (R button to cancel).

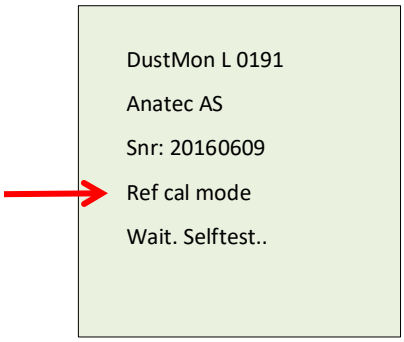
	Keys to depress simultaneously	
Change user defined calibration value	⇒	⇓
Change calibration factor	⇒	⇑

Table 2: Keyboard combinations for changing calibration constants

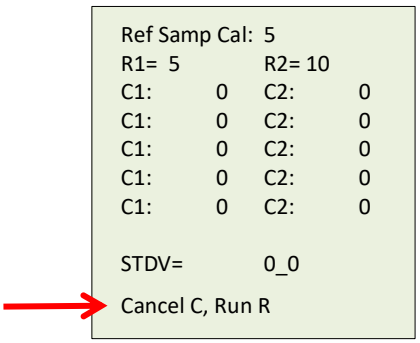
12.4 Calibration against Reference Sample(s) using standalone mode

1. Turn on DustMon RD 100 in Calibration mode:
   a. Turn off theDustMon RD 100.

b. While turning the DustMon RD 100on, keep the L button depressed until the DustMon RD 100 signifies that it is in “Ref cal mode” on the LCD screen.

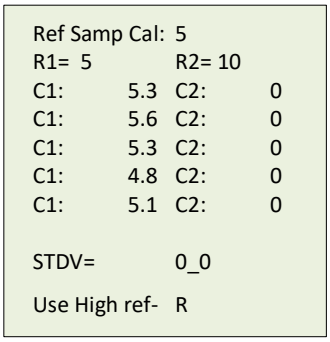


Splash screen at power up



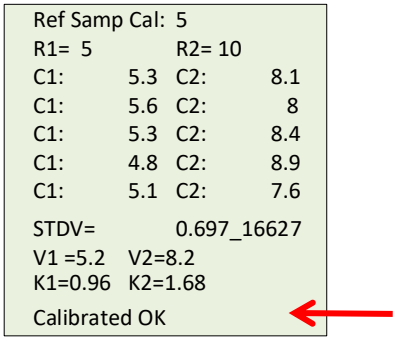
Screen before starting calibration

2. Perform low value calibration:
   a. Verify drawer is empty and installed.
   b. Load 40mL of Dust Standard A.
   c. Press **R**.
   d. Once run is complete, repeat steps A through C until "Use High ref-R" is displayed on screen.



Screen after performing low value calibration

3. Perform high value calibration if 2 point calibration was selected, otherwise skip to step 4:
   a. Verify drawer is empty and installed.
   b. Load 80mL of Dust Standard B.
   c. Press **R**.
   d. Once run is complete, repeat steps A through C until "Calibrated OK" is displayed on screen.



Screen at calibration completion

4. Verify Calibration
   a. Verify drawer is empty and installed.
   b. Load 80mL of Dust Standard B.
   c. Press **R**.
   d. Once run is complete verify results match COA.

12.5 User defined calibration value

Beginning with DustMon RD 100 firmware version 0185, calibration can be made to a reference glass filter lens using terminal mode and establising a user defined calibration value for that reference standard.

ⓘ **Note!** In order to store or read the current user defined calibration value, the user must log in to terminal mode with the following password:

$login rix56bf

Typing the command "calibration" will display the current userdefined calibration value, example:

$calibratio

Current userdefined calibration value = 50.3 and the calibration factor = 1.02444

To change the "userdefined calibration value" when in terminal mode issue the command: calibration xx.x
Example :

$calibration 50.7

Insert box without calibration device and press space

In LED Mode, Wait autozero..

Insert box with calibration device and press space when done..

Calibrating, Wait... Old CalFact = 1.02444 , adv=490 ref= 50.7

Calibration done

Current userdefined calibration value=50.7

and the calibration factor=1.034694

$

Now the box is calibrated to the Calibration filter, assuming the correct reading for this filter is 50.7% – This gives a correction factor of 1.034694.

ⓘ **Note that the calibration value last used in terminal mode will become the "user defined calibration value" for standalone mode. This value is stored in the DustMon RD 100 immediately after the "calibration xx.x" command is given. After this, the value entered can be used for calibration in the standalone mode.**

13 Repairs

⚠ CAUTION C6.0013

Risk of injury
Improper repairs

– Unauthorised and improper repairs can cause injuries.
- **Repairs to the device may only be carried out by the Retsch GmbH , an authorised representative or by qualified service technicians.**
- **Do not carry out any unauthorised or improper repairs to the device!**

⚠ CAUTION C7.0015

Risk of injury
Improper modifications to the device

– Improper modifications to the device can result in injuries.
- **Do not make any unauthorised changes to the device.**
- **Only use the spare parts and accessories approved by Retsch GmbH!**

13.1 Returning for repair and maintenance

Fig. 44: Return form

The acceptance of devices and accessories of the Retsch GmbH for repair, maintenance or calibration can only be effected, if the return form including the decontamination declaration service has been correctly and fully completed.

⇨ Download the return form located in the download section "Miscellaneous" on the Retsch GmbH homepage (http://www.retsch.com/downloads/miscellaneous/).
⇨ When returning a device, attach the return form to the outside of the packaging.

In order to eliminate any health risk to the service technicians, Retsch GmbH reserves the right to refuse the acceptance and to return the respective delivery at the expense of the sender.

14 Accessories

Information about available accessories and the corresponding manuals can be found directly on the Retsch GmbH website (**https://www.retsch.com**) under "Downloads" for the device.

Accessories include the following:

- Collection receptacle (Art. No. 22.069.0001)
- Tube (Art. No. 22.069.0002)
- Calibration filter (Art. No. 22.069.0003)

15 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.

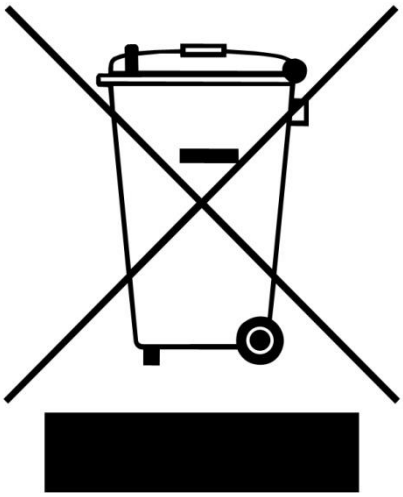


Fig. 1: Disposal label

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.

16 Index

EU Declaration of Conformity
Translation

DUST ANALYZER

DustMon RD 100 | 70.100.xxxx

EU DECLARATION OF CONFORMITY

Herewith we declare, represented by the signatory, that the above mentioned device complies with the following directives and harmonized standards:

Electromagnetic Compatibility 2014/30/EU

EN 61000-6-2:2019	Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity standard for industrial environments
EN 61000-6-4:2007 + A1:2011	Electromagnetic compatibility (EMC) - Part 6-4: Generic standards - Emission standard for industrial environments
2014/35/EU	Electrical equipment designed for use within certain voltage limits
2006/42/EG	Safety of machinery
DIN EN 60204-1:2006	Safety of machinery - Electrical equipment of machines - Part 1: General requirements
EN 61326-1:2013	Electrical equipment for measurement, control and laboratory use. EMC requirements. General requirements

Authorized person for the compilation of technical documents:
Stefan Drechsler (Technische Dokumentation)

Furthermore, we declare that the relevant technical documentation for the above mentioned device has been compiled according to Annex VII Part A of the Machinery Directive, and we undertake to submit this documentation on request to the market surveillance authorities.

In case of a modification of the device not previously agreed with Retsch GmbH, as well as the use of unauthorised spare parts or accessories, this declaration will lose its validity.

Retsch GmbH
Dr. Stefan Mähler, Technischer Leiter

Haan, 06/2020

CE