Operating instructions

PARTICLE SIZER

ANALYSETTE 28 IMAGESIZER

Valid starting with: 28.2000/00131

Read the instructions prior to performing any task!

Translation of the original operating instructions

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Certifications and CE conformity

Certification

Fritsch GmbH has been certified by the TÜV-Zertifizierungsgemeinschaft e.V.

An audit certified that Fritsch GmbH conforms to the requirements of the DIN EN ISO 9001:2015.

CE Conformity

The enclosed Conformity Declaration lists the guidelines the FRITSCH instrument conforms to, to be able to bear the CE mark.

CE

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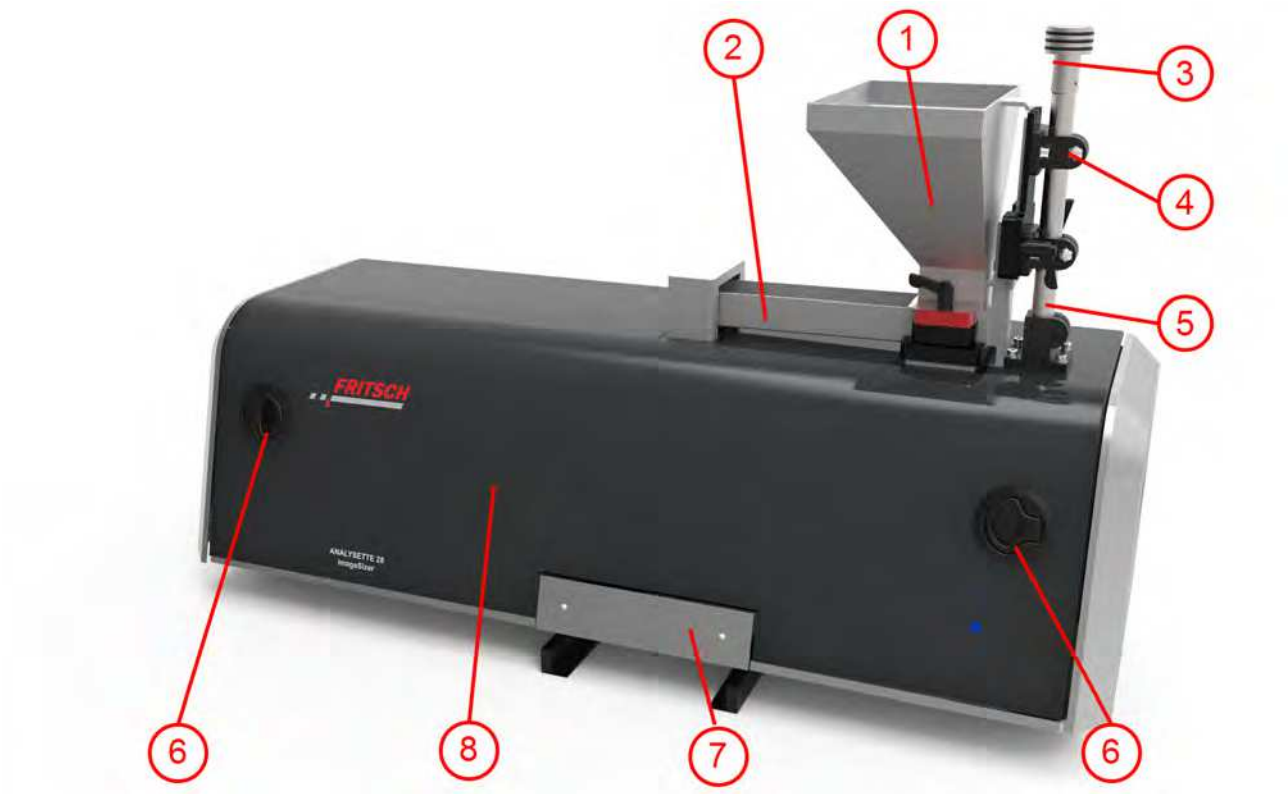
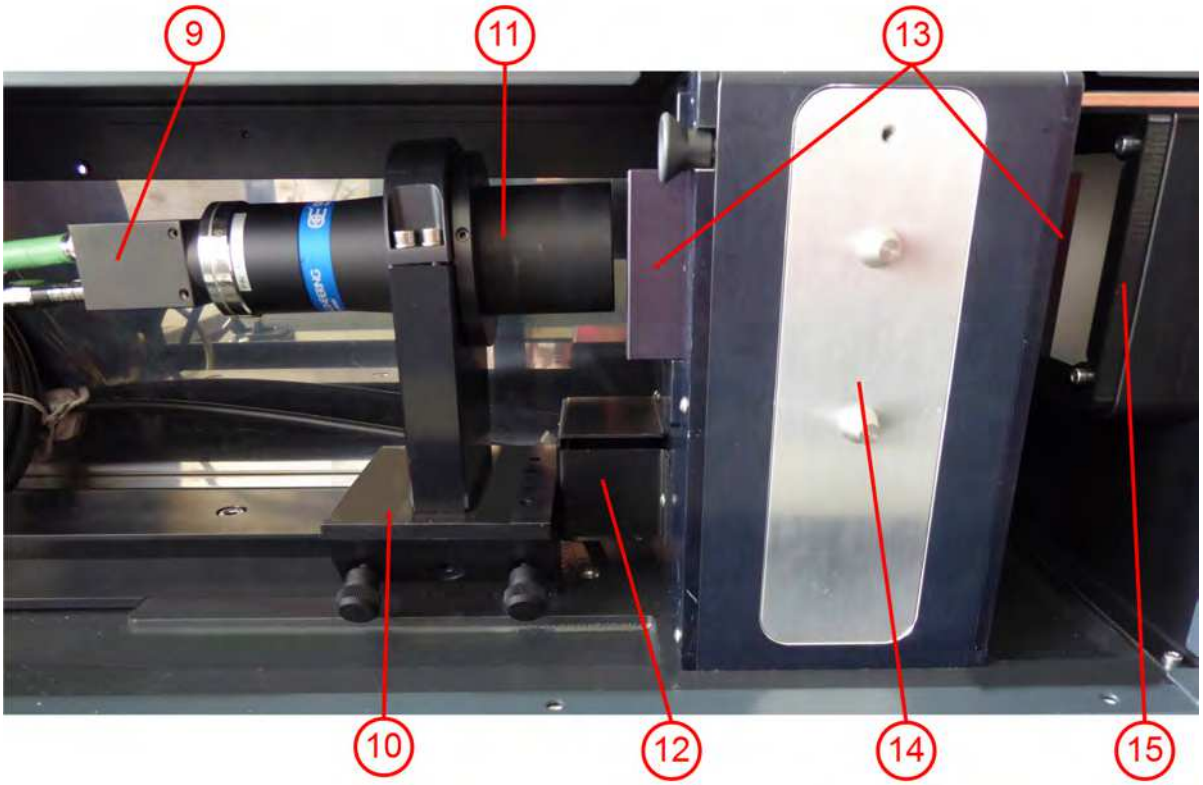
1 Basic structure

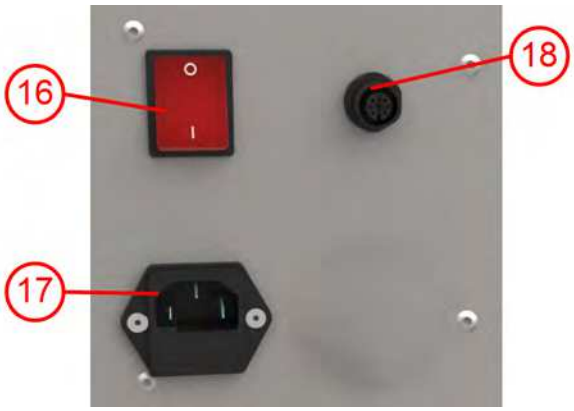


1 Funnel
2 Feeder
3 Rotary knob for funnel adjustment
4 Height-adjustable funnel holder
5 Funnel support column
6 Latches
7 Sample collecting vessel
8 Housing flap

Basic structure



9 5 MP digital camera
10 Lens holder
11 Lens
12 Lens holder end stop
13 Window holder
14 Falling chute (wet measuring cell holder)
15 Flash unit



16 Main switch
17 Mains connection
18 Wet dispersion unit port

20 Wet dispersion unit
21 ImageSizer measuring unit
22 Sample bath
23 Measuring cell holder
24 Wet measuring cell

2 Safety information and use

2.1 Requirements for the user

This operating manual is intended for persons assigned with operating and monitoring the Fritsch of the ANALYSETTE 28 ImageSizer. The operating manual and especially its safety instructions are to be observed by all persons working on or with this device. In addition, the applicable rules and regulations for accident prevention at the installation site are to be observed. Always keep the operating manual at the installation site of the of the ANALYSETTE 28 ImageSizer.

People with health problems or under the influence of medication, drugs, alcohol or exhaustion must not operate this device.

The of the ANALYSETTE 28 ImageSizer may only be operated by authorised persons and serviced or repaired by trained specialists. All commissioning, maintenance and repair work may only be carried out by technically qualified personnel. Qualified personnel are persons who, because of their education, experience and training as well as their knowledge of relevant standards, regulations, accident prevention guidelines and operating conditions, are authorised by those responsible for the safety of the machine to carry out the required work and are able to recognize and avoid possible hazards as defined for skilled workers in IEC 364.

In order to prevent hazards to users, follow the instructions in this manual.

Malfunctions that impair the safety of persons, the of the ANALYSETTE 28 ImageSizer or other material property must be rectified immediately. The following information serves both the personal safety of operating personnel as well as the safety of the products described and any devices connected to them: All maintenance and repair work may only be performed by technically qualified personnel.

This operating manual is not a complete technical description. Only the details required for operation and maintaining usability are described.

Fritsch has prepared and reviewed this operating manual with the greatest care. However, no guarantee is made for its completeness or accuracy.

Subject to technical modifications.

2.2 Scope of application

The ANALYSETTE 28 ImageSizer is used for the analysis of the particle shape and size of powders and bulk solids. The particle sizer has an extra-large measuring range of 20 µm to 20 mm! It is therefore an ideal device for uncomplicated quality control in various areas of application.

The particle sizer described here is an operations resource for use in industrial environments. This operations resource possesses hazardous live components during operation.

2.3 Obligations of the operator

Before using the of the ANALYSETTE 28 ImageSizer, this manual is to be carefully read and understood. The use of the of the ANALYSETTE 28 ImageSizer requires technical knowledge; only commercial use is permitted.

The operating personnel must be familiar with the content of the operating manual. For this reason, it is very important that these persons actually receive the present operating manual. Ensure that the operating manual is always near the device.

The of the ANALYSETTE 28 ImageSizer may exclusively be used within the scope of applications set down in this manual and within the framework of guidelines put forth in this manual. In case of non-compliance or improper use, the customer assumes full liability for the functional capability of the ANALYSETTE 28 ImageSizer and for any damage or injury arising from failure to fulfil this obligation.

By using the of the ANALYSETTE 28 ImageSizer the customer agrees with this and recognizes that defects, malfunctions or errors cannot be completely excluded. To prevent risk of damage to persons or property or of other direct or indirect damage, resulting from this or other causes, the customer must implement sufficient and comprehensive safety measures for working with the of the ANALYSETTE 28 ImageSizer.

Neither compliance with this manual nor the conditions and methods used during installation, operation, use and maintenance of the of the ANALYSETTE 28 ImageSizer can be monitored by Fritsch GmbH. Improper execution of the installation can result in property damage and thus endanger persons. Therefore, we assume absolutely no responsibility or liability for loss, damage or costs that result from errors at installation, improper operation or improper use or improper maintenance or are in any way connected to these.

The applicable accident prevention guidelines must be complied with.

Generally applicable legal and other obligatory regulations regarding environmental protection must be observed.

2.4 Information on hazards and symbols used in this manual

Safety information

Safety information in this manual is designated by symbols. Safety information is introduced by keywords that express the extent of the hazard.

DANGER!

This symbol and keyword combination points out a directly hazardous situation that can result in death or serious injury if not avoided.

Safety information and use

WARNING!
This symbol and keyword combination points out a possibly hazardous situation that can result in death or serious injury if not avoided.

CAUTION!
This symbol and keyword combination points out a possibly hazardous situation that can result in slight or minor injury if not avoided.

NOTICE!
This symbol and keyword combination points out a possibly hazardous situation that can result in property damage if not avoided.

Special safety information

To call attention to specific hazards, the following symbols are used in the safety information:

DANGER!
This symbol and keyword combination points out a directly hazardous situation due to electrical current. Ignoring information with this designation will result in serious or fatal injury.

DANGER!
This symbol and keyword combination designates contents and instructions for proper use of the machine in explosive areas or with explosive substances. Ignoring information with this designation will result in serious or fatal injury.

DANGER!
This symbol and keyword combination designates contents and instructions for proper use of the machine with combustible substances. Ignoring information with this designation will result in serious or fatal injury.

WARNING!

This symbol and keyword combination points out a directly hazardous situation due to movable parts. Ignoring information with this designation can result in hand injuries.

WARNING!

This symbol and keyword combination points out a directly hazardous situation due to hot surfaces. Ignoring information with this designation can result in serious burn injuries due to skin contact with hot surfaces.

Safety information in the procedure instructions

Safety information can refer to specific, individual procedure instructions. Such safety information is embedded in the procedure instructions so that the text can be read without interruption as the procedure is being carried out. The keywords described above are used.

Example:

1. Loosen screw.
2. 

   CAUTION!

   Risk of entrapment at the lid.

   Close the lid carefully.
3. Tighten screw.

Tips and recommendations

This symbol emphasises useful tips and recommendations as wells as information for efficient operation without malfunction.

Further designations

To emphasise procedure instructions, results, lists, references and other elements, the following designations are used in this manual:

Designation	Explanation
1., 2., 3. ...	Step-by-step procedure instructions
⇨	Results of steps in the procedure
↯	References to sections in this manual and relevant documentation
■	Lists without a specific order
[Button]	Operating elements (e.g. push button, switch), display elements (e.g. signal lamps)
„Display“	Screen elements (e.g. buttons, function key assignment)

2.5 Device safety information

- The particle sizer has been designed from the viewpoint of safety to users; nevertheless, residual hazards cannot be ruled out.
- The device may only be used for the purpose described under ↯ *Chapter 2.2 „Scope of application“ on page 10*.
- Only use original accessories and original spare parts. Failure to observe this instruction can compromise the safety of the machine.
- Safe conduct must be strictly observed during all work with the device.
- All currently applicable national and international accident prevention guidelines must be complied with.
- Do not remove the information signs.

DANGER!

Explosion hazard!

– The device is not explosion-protected!
– The device must not be used in electrically conductive, dusty or damp environments.

DANGER!

Mains voltage

– Do not allow any liquids to run inside the device.

WARNING!

The maximum accepted concentration (MAC) levels of the valid safety regulations must be observed. If necessary, ventilation must be provided or the machine must be operated under an extractor hood.

NOTICE!

Immediately replace damaged or illegible information signs.

- Unauthorised alterations will void Fritsch's declaration of conformity to European directives and void the guarantee.
- If after reading the operating manual you still have questions or problems, please do not hesitate to contact our technical specialists.

2.6 Hazardous points

DANGER!

There is a risk of fatal injuries from power surges when cleaning the device. Disconnect the mains plug before cleaning the device.

CAUTION!

Crushing hazard!

When

- Moving the funnel
- Closing the device
- Inserting the holders with the "measuring windows" 13 + 14
- Inserting the lenses
- Mounting the camera
- Inserting the sample collection container

NOTICE!

Do not leave any oxidizing parts on the channel or in the funnel - risk of corrosion.

2.7 Electrical safety

2.7.1 General information

- The main switch separates the device from the mains on two poles.
- Switch off the main switch if the ANALYSETTE 28 ImageSizer is to stand idle for a longer duration (e.g. overnight).

In the switched-on state, the switch is illuminated red and the control lamp on the front side blue.

3 Technical data

3.1 Dimensions

ImageSizer:

84 x 20 x 28 cm (width x depth x height without funnel and feed channel)

Wet dispersion unit:

32 x 65 x 44 cm (W x D x H)

3.2 Weight

ImageSizer:

43.8 kg net

Wet dispersion unit:

30.8 kg

3.3 Operating noise

The noise level is up to approx. 78 dB(A).

3.4 Voltage

The voltage range is from 100 - 240 V.

3.5 Current consumption

The maximum current consumption is 0.2 A (230 V), 0.6 A (115 V) .

3.6 Power consumption

The maximum power consumption is 50 W.

3.7 Electrical fuses

Micro-fuse 5 x 20 mm 2A slow-blow, 2 pieces The fuses are located inside the mains power socket (19).

4 Installation

4.1 Transport and storage

DANGER!
Do not step under the transport pallet during transport.

The ANALYSETTE 28 is delivered in a wooden crate on a pallet. Do not tilt or stack this crate. The ImageSizer must be transported and stored in its packaging and protected from weather and outside influences.

Transport over larger distances only in the original Fritsch packaging.

We recommend using a forklift or pallet truck for transporting the packed device.

WARNING!
Improper lifting can lead to personal injury or property damage. The machine is only to be lifted with suitable equipment and by qualified personnel.

The guarantee excludes all claims for damage due to improper transport.

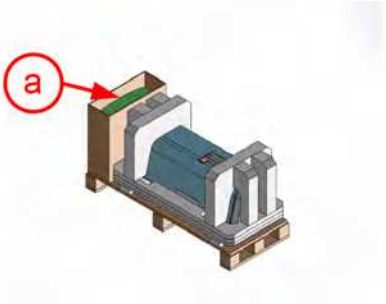
4.2 Unpacking

Remove the transport packaging as shown in the following illustrations.

1. Cut open the straps of the package using side cutters.
2. Remove the staples using an appropriate tool.
3. Lift the lid off.

   The accessories case becomes visible.

4. Remove the surrounding packaging.
5. Remove the accessories case.



6. Remove the foam trays and lift the ImageSizer from the transport cradle using two people.

> **NOTICE!**
> Do not use the funnel support column to lift the ANALYSETTE 28 from the transport cradle.
>
> For lifting, reach under the base plate.

If you have ordered the ANALYSETTE 28 ImageSizer with two lenses, you will find the second lens stored vertically next to the ImageSizer in a lens case (a).

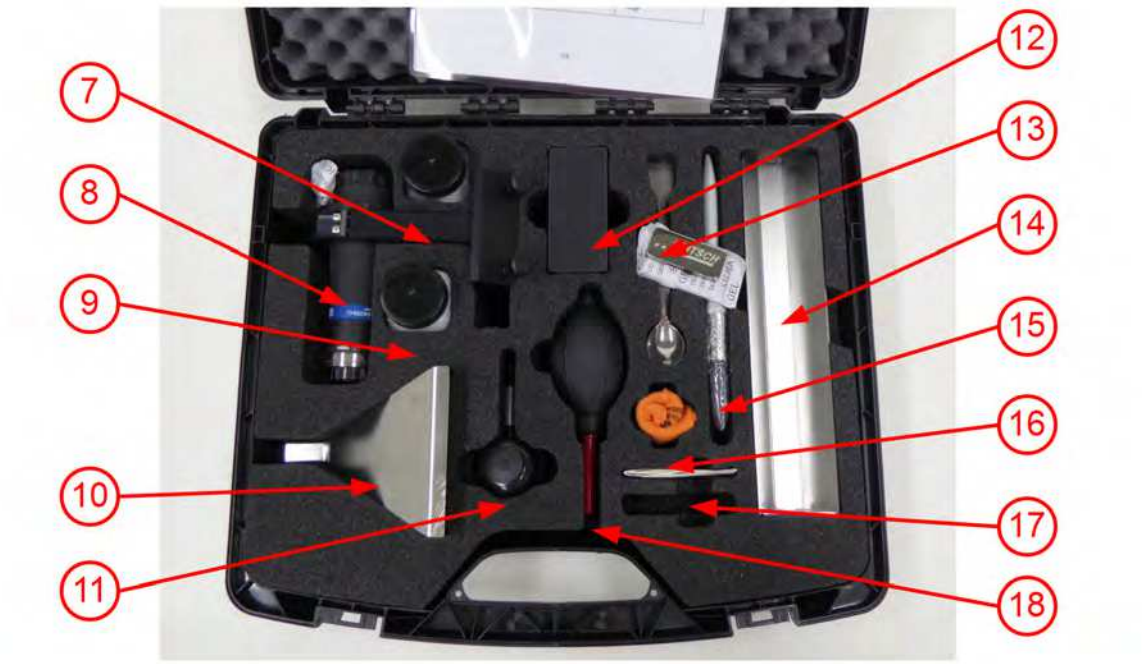
4.3 Scope of delivery

Please check the delivery against your order! If the delivery is incomplete or damaged, inform the shipping agent immediately and inform Fritsch GmbH within 24 hours. Any claims received later cannot be considered.

4.3.1 Accessory case

1 USB cable and USB interface cable
2 Data stick with software, operating instructions and manual
3 Multiple socket outlet with mains switch
4 Round jar with small parts
5 Connection cable
6 Digital camera
Country-specific adapter

4.3.2 Accessories case 1 - dry



7 Standard test powder F 70 and/or F 16
8 Lens
9 Cleaning sand
10 Funnel
11 Lens brush
12 Shaft cover
13 Spoon spatula
14 Feeder
15 Flat brush
16 Antistatic cloth
17 Optics tissue
18 Bellows

4.3.3 Accessory case 2 - wet dispersion unit

20 Connection cables
21 Flow measuring cell
22 Hose clamp pliers and antistatic cloth
23 Standard test powder F 70
24 Cleaning sand
25 Optics tissue
26 Screwdriver
27 Lens
28 Powder spatula
29 Dusazin 901 tenside
30 Round jar with various small parts
31 Lens brush

4.4 Setting up

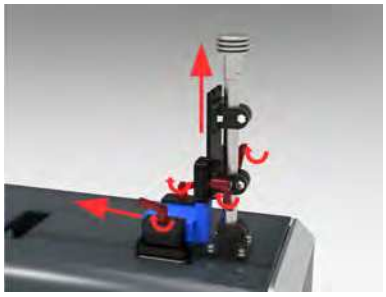
- Place the ANALYSETTE 28 ImageSizer on an even and stable surface in an interior room.

Make sure that the ANALYSETTE 28 ImageSizer stands on the surface evenly balanced. Failure to observe this information may lead to problems with feeding on the feeder. All feet of the ANALYSETTE 28 ImageSizer are adjustable and can be used to balance the device.

NOTICE!
Never operate of the ANALYSETTE 28 ImageSizer while it is standing on the transport pallet!

- Make sure that:
  - all switches / control elements are easy to access;
  - the connections (USB, network connections) are freely accessible.
- Please store the transport packaging so that it can be reused if you need to return the product. Fritsch GmbH accepts no liability for damage caused by improper packaging (non-original packaging).

4.4.1 Transport securing devices



Proceed as follows to remove the transport securing device:

1. Loosen the two knurled screws on the funnel holder.
2. Unscrew the funnel holder until it is over the transport securing device.
3. Loosen the two knurled screws on the vibration feeder holder and pull out the transport securing device towards the front.

4.5 Ambient conditions

WARNING!

Mains voltage

- The device may only be operated indoors.
- The surrounding air must not contain any electrically conductive particles.
- Maximum relative humidity 80% for temperatures up to 31 °C, linearly decreasing down to 50% relative humidity at 40 °C.

- The room temperature should be between 5 and 40 °C.
- Storage and transport is possible between 1 and 40 °C.
- If stored or transported below 10 °C, you must wait until the device has warmed up to ambient temperature before switching on.

4.6 Electrical connection

DANGER!

Provide short-circuit protection!

Risk of damage due to short-circuits.

– Make sure that the socket is connected to a mains line protected with a residual current circuit breaker.

DANGER!

Mains voltage!

Changes to the connection line may only be made by a qualified person.

Before establishing the connection, compare the voltage and current values stated on the type plate with the values of the power supply system to be used.

CAUTION!

Ignoring the values on the type plate may result in damage to the electrical and mechanical components.

CAUTION!

Ensure that the mains supply provides a functional device ground connection!

4.6.1 Stability of the mains voltage

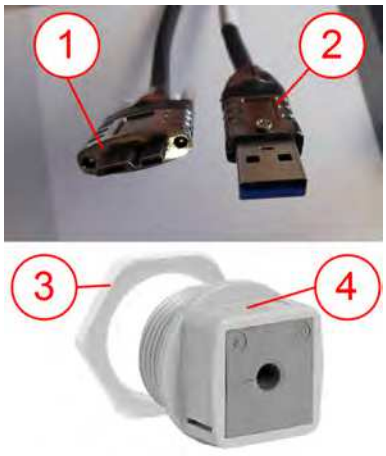
Instruments with electronic components require a stable supply voltage (+/- 10% deviation). For weak or non-interference free mains supplies (voltage peaks through inductive load changes or switched-mode power supplies), we recommend connecting via a voltage stabiliser and filter (Art. No. 20.6000.00).

4.7 Preparation of the ANALYSETTE 28 ImageSizer

→ Open the front flap (7) forwards by lifting up both latches (6).

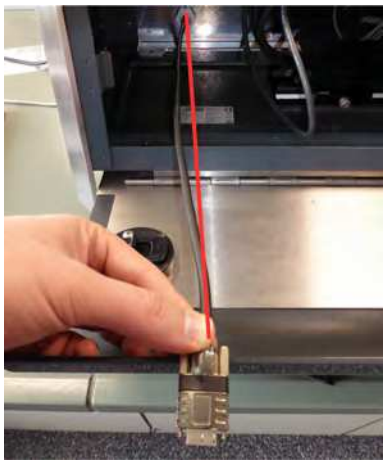
4.7.1 Connect the data transfer cable of the camera to the PC

Fasten the USB cable for data transmission to the ANALYSETTE 28 Image-Sizer as follows:



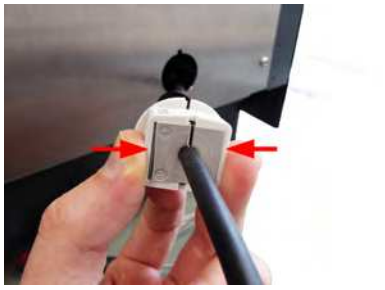
1 Camera connection
2 PC connection
3 Locking ring
4 Threaded cable gland

1. → Slip the locking ring (3) over the cable and guide the thinner end (2) away from the interior of the ANALYSETTE 28 through the hole in the rear panel.



2. → Guide the cable until the plug (1) to be connected to the camera reaches the front edge of the lid.

Make sure that the length of the cable within the ANALYSETTE 28 ImageSizer is long enough to allow the lens and camera to be removed from the device somewhat. This makes installation easier when changing the lens or cleaning the different components.



3. On the back of the ANALYSETTE 28 ImageSizer, insert the seal ring and then slip the threaded cable gland (4) over the cable.

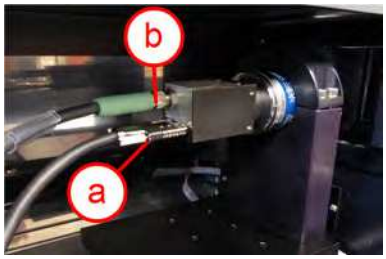
4. Press the threaded cable gland (4) together and guide the seal ring over the thread.

5. Position the threaded cable gland on the rear panel and tighten the screw connection in the interior.

6. Connect both ends of the data transfer cable to the camera and the PC.

4.7.2 Connection of the camera to the lens and insertion

1. Remove the caps from the camera and from the screw thread of the lens. Screw the lens hand-tight onto the camera!

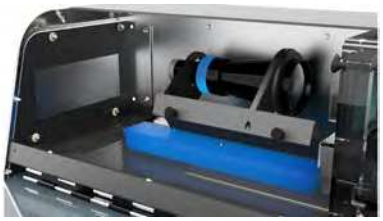


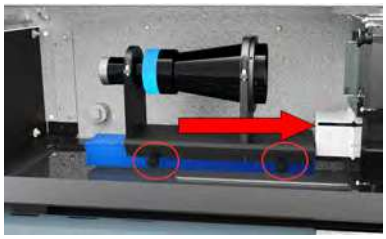
(a) USB connection for data transmission
(b) Flash and current supply control

2. Connect the camera as shown in the picture.

3. Insert the camera with lens. To do this, hold the lens tilted backwards in the device housing, as shown in the picture, and hook the flat rail runner onto the rail from behind. Then tilt the lens forwards and position it on the rail. The lens holder can be moved back and forth on the rail.

NOTICE!
Only remove the front cap from the lens once it is located on the rail!





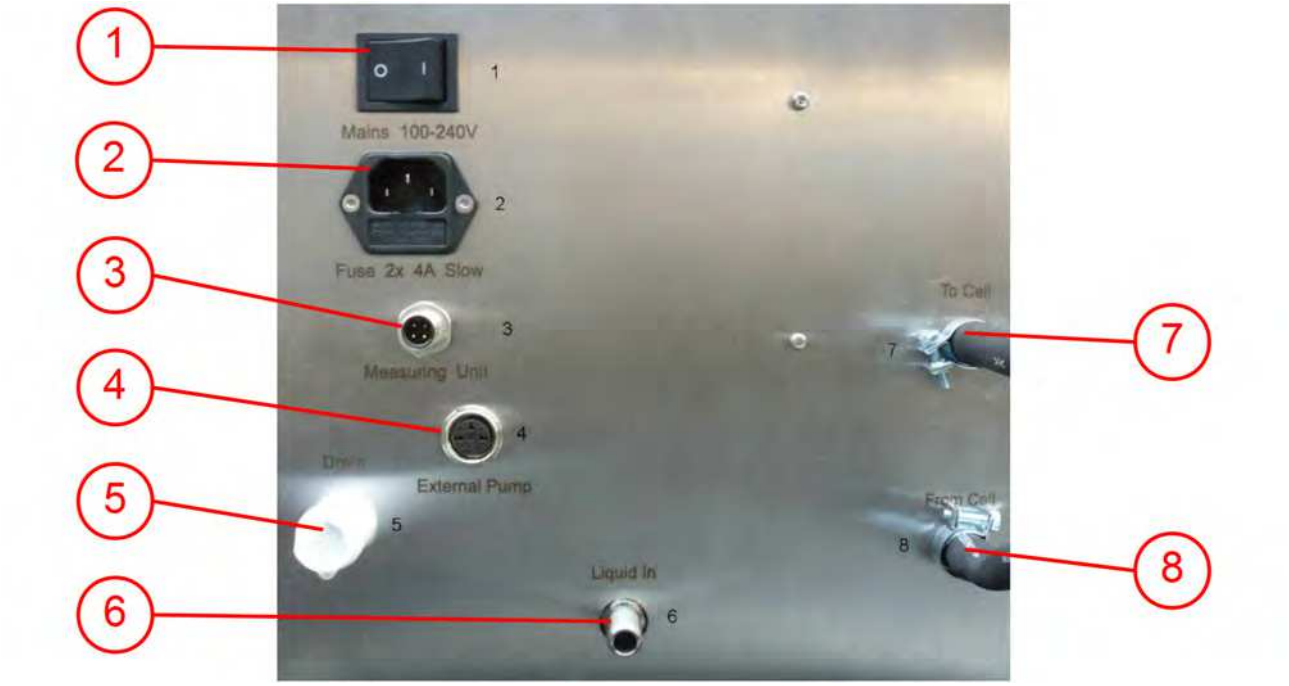
4. Remove the front cap and push the flat rail runner in the direction of the falling chute as far as the end stop.

5. When the flat rail runner is seated at the end stop, secure it with the two knurled screws.

The lens is recognised automatically by the device and shown in the software.

4.8 Connections for supply units

The following connections are located on the back of the wet dispersion unit:



1 Main switch
2 Mains connection socket
3 "Measuring Unit" connection socket
4 "External Pump" connection socket
5 Outlet connector for measuring liquid (Drain)
6 Inlet connector for measuring liquid (ATTENTION: max. 0.8 bar, pressure controller is included in the scope of delivery)
7 Inlet to measuring cell
8 Outlet from measuring cell

1. Before you connect the device to the mains, switch the main switch to 0. Connect the supplied mains cable to the mains connection socket (2).

2. Connect the supplied data cable to the "Measuring Unit" connection socket (3) of the dispersion unit and to one of the "Dispersion Units" connection sockets on the measuring unit.

3. You can connect an external boost pump to the "External Pump" connection socket. This is required if you want to feed the measuring liquid to the dispersion unit from a separate canister. For this, you must use the immersion pump set (22.2129.00), which is available as an accessory. See Chapter *Chapter 6.2.1 „Immersion pump set“ on page 46*.

4. Connect the supplied outlet hose with inner diameter of 20 mm to the outlet connector (5) and fasten the hose clamp with the help of the pliers provided.

NOTICE!

During the flushing procedure, the measuring or flushing liquid is pumped at pressure out of the outlet hose. Ensure that the hose cannot slip out of the outlet or collecting vessel, and that it is placed below the outlet connector on the dispersion unit. Otherwise the measuring liquid cannot drain completely out of the system.

5. The connection marked "Liquid In" (6) is used to fill the system. Connect the hoses attached to the pressure controller to your water connection (b) or a liquid storage container and to the "Liquid In" connection (6) on your supply unit (a).

   The pressure controller is permanently set at 0.8 bar.

NOTICE!

All hoses must be fastened securely to the connections provided with a hose clamp. When laying, ensure that no kinks occur.

6. The connections "To Cell" and "From Cell" are already connected to the corresponding connections of the measuring cell insertion at the factory. See Chapter *Chapter 8.1 „Replacing hoses in wet dispersion units“ on page 56*.

4.9 Preparation of the computer

Computers provided by Fritsch GmbH are already equipped with the software you need and can be used directly after the device has been connected.

Installation

System requirements:

- *Intel Core i7 Quad Core processor or equivalent*
- *Minimum of 8 GB system memory*
- *Primary drive: minimum of 256 GB SSD*
- *Secondary drive: 1 TB HDD*
- *NVIDIA graphics card*
- *USB 3.0 connection*
- *22" monitor with 1920 x 1080 pixels resolution or better*

Software:

- *Windows 7 or higher*
- *Adobe PDF reader*

1. Insert the supplied USB stick into the USB port on your PC provided for this purpose.

2. Select the USB stick and run the CD_Start application on this.

3. Select the ANALYSETTE 28.

4. Then choose *„Image Sizing Software (ISS)“*.

5. Install the 64-bit version of the USB driver. (If you have already installed the newest FTDI-USB driver on your system, you do not need to install this in addition.)

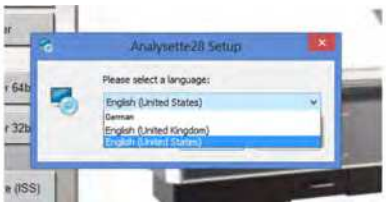
6. Following this, connect the ImageSizer camera to the PC using the supplied USB cable (26).

NOTICE!

When connecting the USB cable, make sure that the USB plug is in the correct position. Connecting the cable incorrectly to the ANALYSETTE 28 can result in property damage or a connection problem with the PC.

7. Establish the USB connection between the ImageSizer camera and the PC USB 3.0 port.

8. Install the Image Sizing Software (ISS).

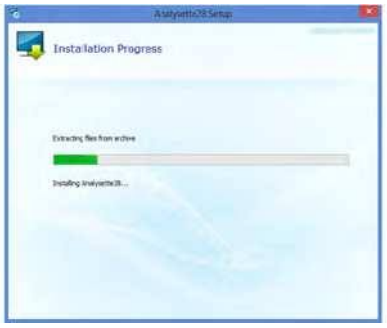


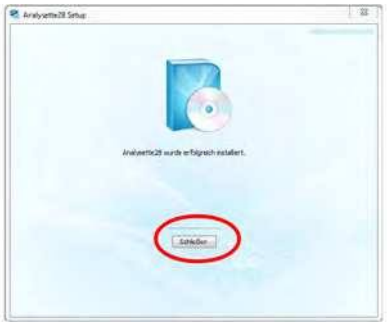
9. Select a language for the installation.

10. A welcome window for the "Image Sizing Software" Set-up Wizard opens. Click on "Next" to continue the installation.

11. The default target folder for the installation is C:\Program Files. Click on "Next" to continue the installation.

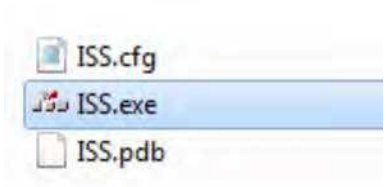
12. You can now start the installation by clicking on the "Install" button.





13. Finish the installation by clicking on "Close".

14. A FRITSCH ANALYSETTE 28 icon "ISS.exe" has now been placed on the desktop.



15. To start the program without the desktop icon, proceed as follows:

- Start Windows Explorer.
- The target folder shown during the installation contains the folder "Fritsch GmbH".
- In this folder, open the folder "Image Sizing Software".
- This "Image Sizing Software" folder contains the file "ISS.exe" with which the program can be started manually. Double-click on the file "ISS.exe" to start the program.

After initially starting the software you must specify the memory location for the measuring data.

4.10 Checking the communication between the device and the PC

You have the possibility in the Image Sizing software to check whether the device has been recognised by the PC and which COM port it is installed on. Proceed as follows:

1. Click on the icon "ISS.exe" to start the Image Sizing software.

2. Click on *„Configuration“* to go to the configuration settings.

3. In the left part of the screen, the software opens a new window with the various configuration options. Click on *„Select device“*.

4. In this window, the interface used and the attached device with specifications are shown automatically. If no device is displayed, a message about the possible cause of the problem appears in the bar at the top. Since the camera is connected via a USB 3.0 interface and the device is connected to the PC via USB, both interfaces are detected and precisely displayed. Check the cables and click *„Search“*. All detected devices that are connected to the system should then be listed. If only one device is connected, it is directly selected. If multiple devices are connected, click a device to select it and the current device and the software will restart.

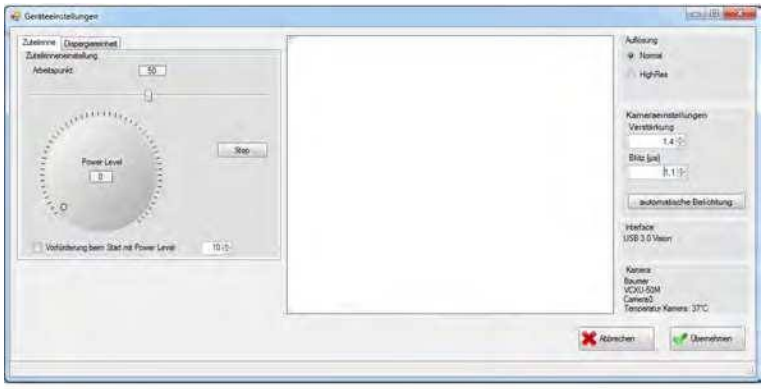
If no device is found, check whether the device is switched on. If so, check the used drivers and right connections of the used ports on your PC and device.

4.10.1 Checking the communication between the camera and the PC

1. Click on the icon "ISS.exe" to start the Image Sizing software.
2. Click on *„Configuration“* to go to the configuration settings.

3. In the left part of the screen, the software opens a new window with the various configuration options. Click on *„Measurement settings“*.

4. Then click *„Setup“* under "Device settings".



5. When the camera has been recognized, you can test the image transfer and the camera function by holding a brush or pencil in the falling chute, whereby the object will be displayed in the "Camera Set-up" window.
6. If this is the case, then the communication between the camera and the PC is functioning correctly.

5 Using the device

Dirt on the windows can lead to incorrect measurement results. It is therefore essential that these be cleaned. Check windows for dirt after every measurement.

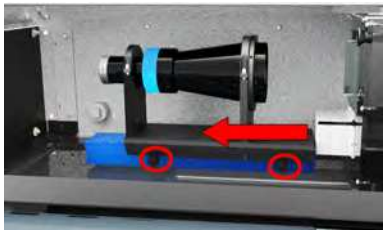
Depending on the type of sample, the lens, the windows and the digital camera lens must be checked for soiling before each measurement or measurement series and cleaned if necessary. Also, if smearing or permanent dots can be seen in the picture transmitted by the camera during camera adjustment or when making a measurement, the components mentioned must be checked and cleaned, as described in Chapter 7 „Cleaning“ on page 48!

The Soft Pad (34) provided is intended to protect the top surface of the housing should anything be placed upon it.

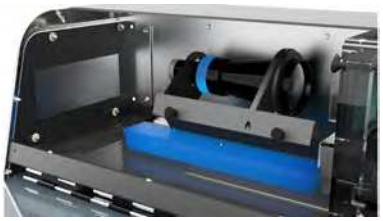
5.1 Changing the lens

The camera can be left connected to the cables while changing the lens.

The lens is recognised automatically by the device and shown in the software.



1. Open the front flap forwards by lifting up both latches (6).
2. Loosen the knurled screw on the flat rail runner and pull the runner backwards away from the falling chute.
3. Place the cap on the lens.



4. Tilt the lens backwards and remove the flat rail runner upwards.
5. Unscrew the lens from the camera, attach the rear lens cap and store in the accessory case.

6. Now, as described in *Chapter 4.7.2 „Connection of the camera to the lens and insertion“ on page 26*, connect the other lens to the camera and place it in the device.

5.1.1 Adjusting the camera angle

The lenses are preassembled with the holders in such a way that all that is left to do is screw them to the digital camera. If, however, a lens is twisted out of position, it is possible to correct this:

1. Attach the camera to the lens.
2. Remove the 2 hexagon screws closest to you.
3. Turn the lens until the camera is once again correctly aligned with the lens.
4. Once this position has been found, fix the lens in place again with the two hexagon screws.
5. Now the lens is positioned correctly in the lens holder.

5.2 Dry measurement

5.2.1 Installing the feeder and funnel

The U-shaped channel is supplied with the large funnel and the V-shaped channel is supplied with the small funnel.

The two feeders are installed in the same way:

Using the device

1. Loosen the two clamping screws and position the feeder under the 2 fasteners.
2. Re-tighten the clamping screws.

3. Pay attention to the falling chute when positioning the feeder. The overhang of the channel has to be adjusted to the type and size of particles.

4. The scale has to be visible on the front, to the left of the clamp. The feeder is positioned at position 0, precisely in the middle of the falling chute.
5. Next, move the funnel holder to the lowest point using the knurled screw.

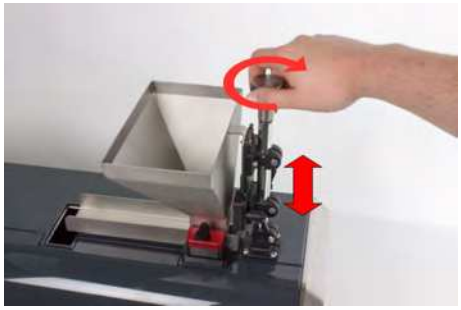
6. Loosen the clamp screws of the funnel holder and position one of the two funnels.

Make sure the large funnel is sitting in the two grooves on the top of the funnel holder.

7. Re-tighten the clamp screws.

5.2.2 Adjusting the funnel height

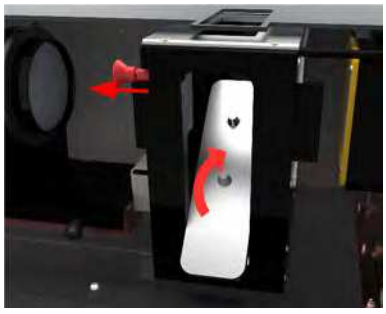
Depending on the flowing properties and size of the material, a smaller gap (for fine powder with good flowing properties) or a larger gap (for coarse material) between the funnel and the feeder is needed. The gap to the feeder should be about three times the maximum diameter of the material.



→ Turn the knurled screw on the top of the funnel support column in order to move the funnel up and down.

5.3 Wet measurement

5.3.1 Inserting the measuring cell



1. → Open the housing flap.
2. → Unlock the centring plate and hinge it backwards.
3. → Close the housing flap again.

4. → Remove the connected measuring cell of the wet supply unit and position it in the ANALYSETTE 28 ImageSizer.

5.3.2 Selecting the liquids

Fritsch GmbH recommends using fresh water of drinking water quality as measuring liquid for the dispersion unit.

CAUTION!
When using the liquids listed below make sure that these are used in a well-ventilated room or under an extractor hood.

The measuring liquid in the supply unit only comes in contact with largely chemically resistant materials. Certain organic liquids or saturated inorganic salt solutions can be used temporarily without damaging the device.

Please note that the measuring liquid comes into contact with stainless steel, glass, PTFE, Viton (FPM or FKM) and silicon hoses.

When measuring samples which are incompatible with water, a suitable liquid with a high boiling point can be selected from the following list:

- Monovalent, bivalent or trivalent alcohols e.g. isopropanol
- Benzines (e.g. white spirit),
- Mineral and organic oils (e.g. petroleum and soy bean oil, nut oil, olive oil, Miglyol)
- Cyclic aromatics/hydrocarbon rings (e.g. only use toluol briefly and rinse out thoroughly after the measurement)
- Saturated solutions of inorganic salts

Samples, which are available in oil (e.g. oils like machine oil), must not always be measured in oil. They can often be measured in white spirit.

DANGER!
Before using other measuring liquids, consult Fritsch Gmbh in advance or call up the list of suitable chemicals on our homepage www.fritsch-sizing.de under the corresponding wet dispersion unit.

We advise against the use of harmful, explosive or flammable liquids.

The above list just states the chemical compatibility of the device with the liquids that can be used.

The measuring unit and dispersion units are not designed to be explosion-protected.

DANGER!

The following must not be used:

Ketones (e.g. acetone, propanone, butanone, cyclohexanone),

Ether, chlorofluorocarbons,

Amines, freone 21-32, methanol, aniline, benzol

Chlorinated hydrocarbons like acetic acid and its derivatives, undiluted acids and bases.

DANGER!

When using harmful liquids be sure to observe the valid safety regulations (MAC values). Where necessary, the measuring unit and dispersion units must be set up in a ventilated safety area.

5.3.3 Filling the measuring circuit

In order to fill the measuring circuit of the wet dispersion unit, proceed as follows:

1. Check whether the hose attached to the "Liquid in" connection via the pressure regulator is connected to your water connection or a liquid storage tank.
2. Also check whether the outlet hose is installed.
3. Open the tap of the water connection or the storage container.
4. Start ISS.
5. Open SOP management and insert a new SOP. Insert the command *„Rinse“*.

6. Then press the button with the triangle on the right side of the command to execute the command.

Make sure that the water connection or the storage container is open.

5.3.4 Sample addition

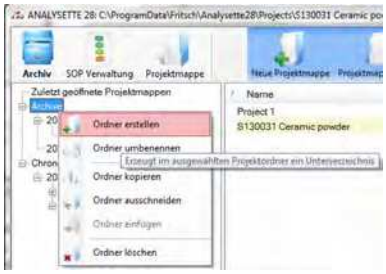
1. Start the desired SOP in the "ISS" program. (see Chapter *Chapter 5.5 „Fritsch test powder F70“ on page 44*)
2. You can add sample material as follows:
   - Add suspensions in small doses to the sample bath using a pipette until the beam absorption set in the SOP is reached.
   - Solids can be put directly into the sample bath using a small spatula, until the beam absorption set in the SOP is reached.
3. Start the measurement once the parameters defined in the SOP have been reached.

5.4 Fritsch test powder F16

You can check the precision and accuracy of your device by measuring the Fritsch test powder at least once a week, depending on how often you use the device. This will indicate contamination or malfunctions in your system.

Measure the supplied Fritsch test powder F16 with the ANALYSETTE 28 ImageSizer as follows:

1. Set the device to I (On) with the main switch.
2. Start the Image Sizing software.
3. Create a new folder in the archive.
4. A "New Project Case" must be created In the newly created folder.



5. In this project case you can select the SOP "F16 Standard measure" by clicking on "New measurement".

SOP refers to a Standard Operating Procedure used in our software. In an SOP, work steps are pre-defined and processed with a single key-stroke.

Ensure that you select the SOP which is suitable for your device.

6. The measuring window with the live image, camera and flash settings opens.
7. If necessary and depending on the setting in the SOP, the intensity of the feeder can vary. Once the beam absorption is correct, you can start the measurement.

The current beam absorption is displayed in the lower line as „good, high and low density“.

8. Once the cancellation criteria "Image count" or "Particle count" are reached, the measurement is finished and you can display the evaluation by clicking on "Stop" and "Close.

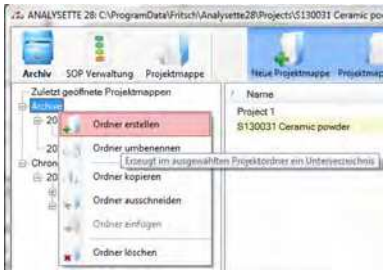
9. When the measurement is finished, remove the sample from the collecting vessel and clean the parts that come into contact with the samples before you begin to measure other materials.

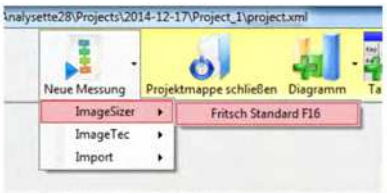
5.5 Fritsch test powder F70

You can check the precision and accuracy of your device by measuring the Fritsch test powder at least once a week, depending on how often you use the device. This will indicate contamination or malfunctions in your system.

Measure the supplied Fritsch test powder F70 with the ANALYSETTE 28 ImageSizer as follows:

1. Set the device to I (On) with the main switch.
2. Start the Image Sizing software.
3. Create a new folder in the archive.
4. A "New Project Case" must be created In the newly created folder.





5. In this project case you can select the SOP "F70 Standard measure" by clicking on "New measurement".

SOP refers to a Standard Operating Procedure used in our software. In an SOP, work steps are pre-defined and processed with a single key-stroke.

Ensure that you select the SOP which is suitable for your device.

6. The measuring window with the live image, camera and flash settings opens.

7. If necessary and depending on the setting in the SOP, the intensity of the feeder can vary. If using the wet dispersion unit, gradually add sample material to the sample bath. You can start the measurement once the beam absorption is correct.

If using the wet version of the ImageSizer, make sure to wait a few seconds each time you add sample material to allow the sample material to be distributed in the measuring circuit. In this way, you can add add the optimal amount of sample material.

The current beam absorption is displayed in the lower line as „good, high and low density“.

8. Once the cancellation criteria "Image count" or "Particle count" are reached, the measurement is finished and you can display the evaluation by clicking on "Stop" and "Close.

9. When the measurement is finished, if using the dry version, remove the sample from the collecting vessel and clean the parts that come into contact with the samples before you begin to measure other materials. The wet dispersion unit must be thoroughly rinsed after a measuring process or a series of measurements.

6 Accessories

Operating instructions for the optional accessories can be found in the packaging of the respective device.

6.1 Lenses for dry measurement

The lenses, which are available as accessories, include the appropriate feeder and the matching funnel.

1. Telecentric lens for particle sizes from 90 - 20000 µm. (28.2060.00)
2. Telecentric lens for a measuring range of 40 - 9000 µm. (28.2061.00)
3. Telecentric lens for a measuring range of 20 - 4500 µm. (28.2062.00)

6.2 Accessories for wet measurement

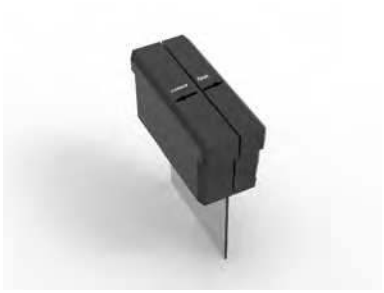
To use the ANALYSETTE 28 ImageSizer for wet measurements, you need the wet dispersion unit with the flow measuring cell and the associated lens (28.2500.00).

6.2.1 Immersion pump set

The immersion pump set (22.2129.00) is required if you would like to connect a separate storage container for measuring liquid to the wet and small volume wet dispersion unit. The set contains:

- A 12 V immersion pump
- A switchbox
- Power supply with various adapters
- PVC mesh wire hose
- Hose clamp
- and a fuel filter

6.3 Calibration plate



Two different calibration plates are available for calibrating the ANALYSETTE 28 ImageSizer. Order these plates according to the lenses you are using. These calibration plates are used as follows:

1. Remove the chute lid.
2. Move the feeder as far back as possible. (See *Chapter 5.2.1 „Installing the feeder and funnel“ on page 37*)

3. The calibration plate has the designations "camera" and "flash". The "camera" side must point to the left in the direction of the lens and the camera, the "flash" side to the right towards the feeder and flash.

7 Cleaning

Depending on the type of sample, the lens, the windows and the digital camera lens must be checked for soiling before each measurement or measurement series and cleaned if necessary. Also, if smearing or permanent dots can be seen in the picture transmitted by the camera during camera adjustment or when making a measurement, the components mentioned must be checked and cleaned, as described in Chapter 7 „Cleaning“ on page 48!

7.1 Cleaning the device

DANGER!

Mains voltage!

- Before beginning with cleaning work, disconnect the mains plug and protect the device against being unintentionally switched back on!
- Do not allow any liquids to flow into the device.
- Indicate cleaning work with warning signs.
- Put safety equipment back into operation after cleaning work.

When switched off, the device can be cleaned using a moist cloth or a microfibre cloth.

7.1.1 Cleaning the falling chute

First remove the sample guide plate (17). Remove residual material from the falling chute (16) using the brush (32)!

7.2 Cleaning the lens

Clean the front and rear lens elements using the lens brush (33). In case of heavy soiling, use the antistatic cloth (30) to remove dirt from the lenses.

For cleaning the lens, a separate description from the manufacturer is provided in the accessory case. These instructions must be closely observed!

7.3 Cleaning the windows

The optical windows (13) require no special handling. It is sufficient to rinse them with water and allow them to dry, or to clean them with the optics tissue (25) provided in the accessory case.

7.3.1 Removing the window holder

The holders for the two windows are attached to the falling chute by four magnets each.

Holders with optical glass panes

1. To remove the holders, simply tilt the handle of the holder forwards.

2. In this way, the magnets are released and the holders can be pulled out.
3. On reinsertion, the magnetic attraction ensures correct positioning.

7.4 Cleaning the lens of the digital camera

If smearing or fixed dots can be seen on the picture transmitted by the camera, all components must be checked! If the windows and the lens have been cleaned, but the soiling is still visible, check the camera by turning it. If the soiling moves in the turning direction of the camera, the soiling must be on the glass cover of the sensor.

CAUTION!
On no account may the camera lens be put under mechanical stress during cleaning.

The lens must be cleaned using the lens brush (33) and the optics tissue (25) located in the accessory case.

7.5 Cleaning the hoses

You can clean stubborn soiling in the hoses of the wet dispersion unit by adding quartz sand. The feed particle size of the sand used should be between 1 and 2 mm. Sand that is too fine can add to the already existing soiling, sand that is too coarse can clog the system.

Proceed as follows for cleaning the hoses:

1. Empty the sample bath.
2. Remove the hoses on the measuring cell insertion and connect both hoses with the supplied connector. This creates a new liquid circulation system.
3. Fill the sample bath with liquid.
4. Set the pump power to maximum and add 10 ml of sand (feed particle size between 1 and 2 mm) to the sample bath.
5. Let the pump run for approx. 2 minutes. Then rinse the system 2 - 3 times to rinse out all the dirt.

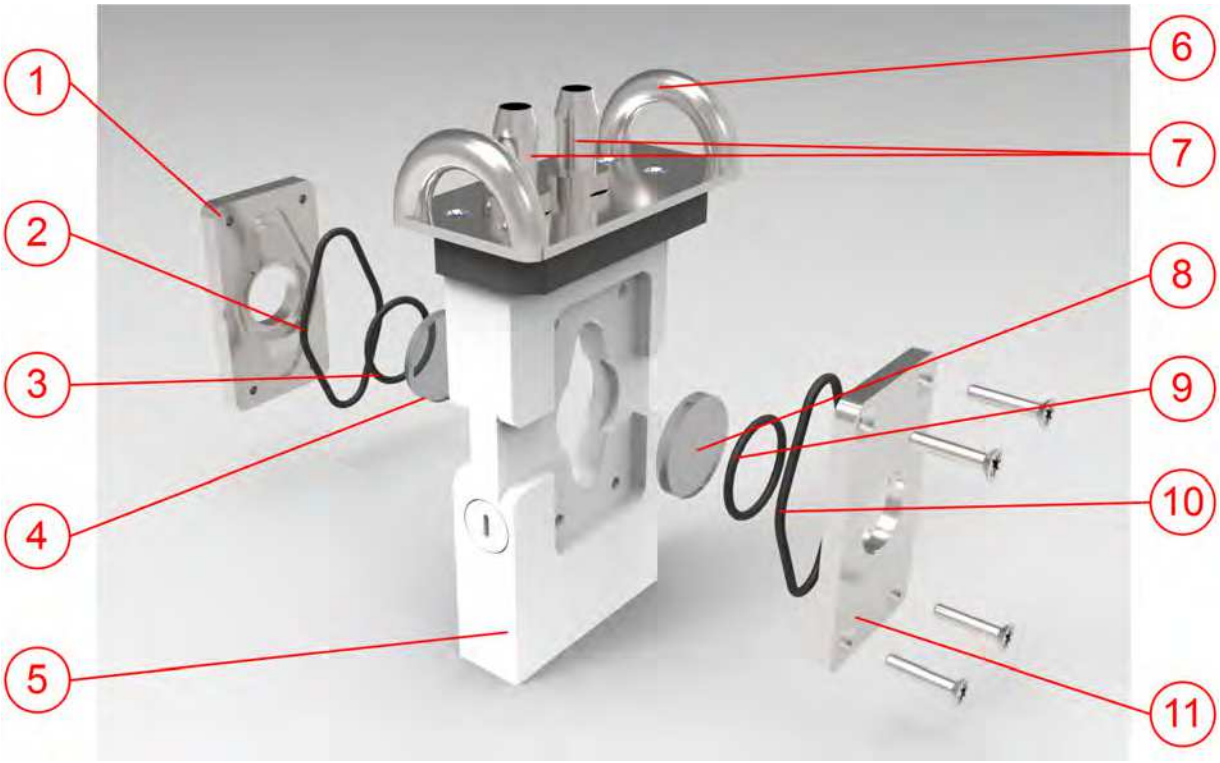
7.6 Cleaning the wet measuring cell

NOTICE!

The measuring cell glasses should always be cleaned with the same liquid that is used for the actual measurement. The addition of tensides is also permitted.

Normally it is sufficient to rinse the measuring cell in the liquid in which you measure. To remove stubborn residues you can add a cleaning agent to the rinsing liquid. A few drops of a tenside (surfactant, e.g. Span 80™) or a surface-active household cleaner (washing-up liquid e.g. Pril™ or liquid soap) is usually enough.

7.6.1 Design of wet measuring cell



1 Rear flange
2 O-ring 46 x 2.5
3 O-ring 25 x 2.5
4 Measuring cell glass Ø 30 mm
5 Sample feeding
6 Handle
7 Connection nipple
8 Measuring cell glass Ø 30 mm
9 O-ring 25 x 2.5
10 O-ring 46 x 2.5
11 Front flange

NOTICE!
When depositing the measuring cell, ensure that the measuring cell glasses do not get scratched.

7.6.2 Preparation

Have the following ready:

- Slotted screwdriver for bits with T20 Torx bit
- Lens cleaning paper
- Clean paper towels
- Spray bottle with cleaning liquid

7.6.3 Emptying the system

1. Check whether the hose at the "Liquid in" connection is connected via the pressure controller to your water connection or a liquid storage container.
2. Open the tap of the water connection or the storage container.
3. Start ISS.
4. Open SOP management and insert a new SOP. Insert the *„Empty“* command.
5. Then press the button with the triangle on the right side of the command to execute the command.

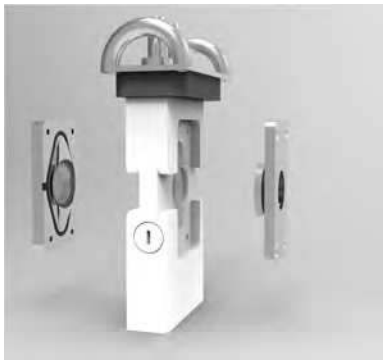
7.6.4 Removing the wet measuring cell

Although the measuring circuit should be completely without liquid, it is possible that liquid residues remain in the measuring cell itself. As a precaution use a paper towel or similar to immediately collect liquid flowing out.

1. Lift the measuring cell drawer out of the measuring unit and place it on a prepared piece of paper towel.

   Remove the 4 screws which close the measuring cell.

> **NOTICE!**
> Ensure that the rear cover and the measuring cell glass can not fall out.



2. The rear flange falls out of the casing when the 4 screws are released. Take care not to scratch the rear measuring cell glass during disassembly. The front flange can now be removed just as carefully.
3. All parts can now be cleaned. Extreme care must be taken when cleaning the measuring cell glasses. To do this, proceed as described in *Chapter 7.6.5 „Cleaning the measuring cell glasses“ on page 53*.

7.6.5 Cleaning the measuring cell glasses

Great care must be taken when cleaning the measuring cell glasses. The glasses must only be touched by hand at the edges.

The measuring cell glasses are made of sapphire glass. The glasses have an anti-reflective coating on the outside which is very soft. A scratch in the anti-reflective coating has the same effect as a scratch in the glass and can affect the measurement.

NOTICE!

The anti-reflective coating is very soft. Cleaning with standard solvent-free cleaning agents can cause scratches.

Therefore only use lens cleaning paper from the accessory case.

7.6.5.1 Measuring cell glasses

The following cleaning method for the measuring cell glasses has proven successful:

Rinse the glasses with a spray bottle, filled with the measuring liquid used, until no more major soiling is visible. Then place the optics tissue on the inside of the glass and moisten it with the measuring liquid and a drop of tenside (Pril™), so that the paper clings to the glass surface.

Now to "wipe" the surface, just pull the tissue off parallel to the surface, without pressing the tissue onto the glass.

You may have to repeat this wiping of the glass surface with fresh tissue, until you can see no more soiling. You can soak extremely adhesive sample residues with a tenside (e.g. Pril™) and wipe them very carefully with the optics tissue.

Then rinse the measuring cell glasses clean with the spray bottle and dab them carefully with the dry optics tissue. You should keep the glasses carefully covered until you reinstall them in the measuring cell.

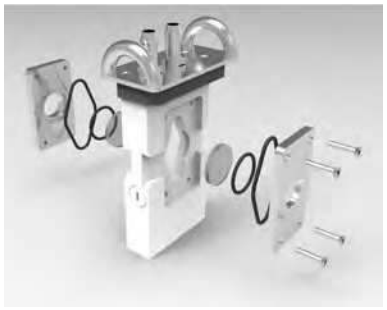
7.6.6 Sealing rings

Rinse the seal rings under particle-free, running water and then dry them with lint-free soft tissue.

7.6.7 Mounting the wet measuring cell

Once you have cleaned the parts, you must re-install the measuring cell.

To assemble the measuring cell, follow the same steps in reverse order:



1. Assemble the wet measuring cell as shown in the image.

2. Observe the installation direction when inserting the measuring cell glasses.

> *The **bluish shimmering anti-reflective coating** must face outwards. There are arrows on the window edges (see image); the arrow tip faces the coating.*

3. Tighten the 4 screws carefully **"crosswise"**.

7.6.8 Check the wet measuring cell for impermeability

Leave the measuring cell on a paper towel and check the measuring cell for leaks.

To do this start the MaS control software, open the measuring results and select a measurement. The measuring results folder opens. Now click on the "New Measurement" button and select the SOP "Clean / Fill". The system then rinses itself and fills up with measuring liquid.

While rinsing and filling the system you can see whether the measuring cell was put together properly and that no liquid is leaking.

> **NOTICE!**
>
> Never insert the measuring cell insertion into the measuring unit after removal and assembly without checking it, this can result in damage to the device from leaks.

8 Maintenance

DANGER!

Mains voltage

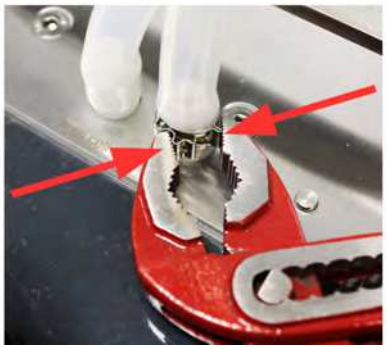
- Before beginning with maintenance work, unplug the mains plug and protect the device against being unintentionally switched back on again!
- Indicate maintenance work with warning signs.
- Maintenance work may only be performed by specialised personnel.
- Put safety equipment back into operation after maintenance or repair work.

The ANALYSETTE 28 ImageSizer is - with the exception of regular cleaning - maintenance-free.

We recommend keeping a safety logbook Chapter 13 „Safety logbook“ on page 64, where all work (maintenance, repairs.....) performed on the device is entered.

8.1 Replacing hoses in wet dispersion units

Before replacing the hoses, the measuring liquid must be drained from the system. To do this empty the system as described in Chapter ↳ *Chapter 7.6.3 „Emptying the system“ on page 52*.



In order to loosen the screwless hose clamps you must pry them open with a small slotted screwdriver. Then remove the hoses from the connections and replace them with a new set of hoses (22.8980.84 NanoTec). You can close these hose clamps with the pliers provided.

When replacing the sample hoses observe the names "To Cell" and "From Cell" on the wet dispersion units and on the measuring cell insertion. Only connect connections with the same names.

9 Repairs

DANGER!

Mains voltage!

- Before beginning with repair work, unplug the mains plug and protect the device against being unintentionally switched back on.
- Indicate repair work with warning signs.
- Repair work may only be performed by specialised personnel.
- Put safety equipment back into operation after maintenance work.

9.1 Checklist for troubleshooting

Fault description	Cause	Remedy
"ANALYSETTE 28 device not found"; "Camera not found"	USB cable not connected correctly!	Check the USB cable and properly connect it to the device / camera and PC. Start the software again!
	Main switch at 0 (OFF)	Switch on main switch.
	No mains connection	Plug in mains plug and switch on the device!
Particle density during measurement is too high	Too much sample material is being fed	Reduce the feed rate (see "ISS" software manual)
	Gap between funnel and feeder too large	Lower the funnel! Reduce gap between funnel and feeder. (See *Chapter 5.2.2 „Adjusting the funnel height“ on page 39*)
Blurred images	Lens for wrong measuring range used	Insert lens for the required measuring range
	Material is not distributed in the focal range	Adjust the feeder optimally
	Lens installed incorrectly	Push lens forward as far as the end stop of the lens holder and screw it tight. (see *Section 5 on page 26*)
While setting the camera in the "Measurement settings" configuration item, a black image is shown.	Device was not recognised	Search for the device in the "device selection" configuration item and select it! (see point 1 "ANALYSETTE 28 device not found"; "Camera not found")

Repairs

Fault description	Cause	Remedy
While setting the camera in the "Measurement settings" configuration item, a black image is shown.	USB cable not connected correctly	Check USB cable and connect it properly to the device and PC! Start the software again!
	Protective lens cap not removed	Remove protective lens cap (see *Section 4 on page 26*)
	Camera not connected correctly	Check the camera connections! Start the software again! (see *Section 2 on page 26*)
No commands executed by the A28!	USB cable not connected correctly	Check USB cable and connect it properly to the device and PC! Start the software again!
No settings can be made in the feeder 'setup'	USB cable not connected correctly	Check USB cable and connect it properly to the device and PC! Start the software again!
Dots are visible in the same places in all images	Soiled windows, lens or camera lens	Clean these parts as described in *Chapter 7 „Cleaning“ on page 48*.
Dark corners are visible in the preview image while setting up the camera	Camera settings not correctly adjusted	Optimise camera settings (gain, flash)

10 Disposal

It is hereby confirmed that FRITSCH has implemented the directive 2002/95/EC of the European Parliament and Council from 27th January 2003 for the limitation of the use of certain dangerous substances in electrical and electronic devices.

FRITSCH has registered the following categories according to the German electrical and electronic equipment act, section 6, paragraph 1, clause 1 and section 17, paragraphs 1 and 2:

Mills and devices for the preparation of samples have been registered under category 6 for electrical and electronic tools (except for large stationary industrial tools).

Analytical devices have been registered under category 9, monitoring and control instruments.

It has been accepted that FRITSCH is operating only in the business-to-business area. The German registration number for FRITSCH is WEEE reg. no. DE 60198769

FRITSCH WEEE coverage

Since the registration of FRITSCH is classified for bilateral transactions, no legal recycling or disposal process is described. FRITSCH is not obliged to take back used FRITSCH devices.

FRITSCH declares it is prepared to take back used FRITSCH devices for recycling or disposal free of charge whenever a new device is purchased. The used FRITSCH device must be delivered free of charge to a FRITSCH establishment.

In all other cases FRITSCH takes back used FRITSCH devices for recycling or disposal only against payment.

11 Guarantee terms

Guarantee period

As manufacturer, FRITSCH GmbH provides – above and beyond any guarantee claims against the seller – a guaranty valid for the duration of two years from the date of issue of the guarantee certificate supplied with the device.

Within this guarantee period, we shall remedy all deficiencies due to material or manufacturing defects free of charge. Rectification may take the form of either repair or replacement of the device, at our sole discretion. The guarantee may be redeemed in all countries in which this FRITSCH device is sold with our authorisation.

Conditions for claims against the guarantee

This guarantee is subject to the condition that the device is operated according to the instructions for use / operating manual and its intended use.

Claims against the guarantee must include presentation of the original receipt, stating the date of purchase and name of the dealer, together with the complete device type and serial number.

For this guarantee to take effect, the answer card entitled "Securing of Guarantee" (enclosed with the device) must be properly filled out and despatched without delay after receipt of the device and be received by us within three weeks or alternatively, *online registration* must be carried out with the above-mentioned information.

Reasons for loss of the guarantee

The guarantee will not be granted in cases where:

- Damage has arisen due to normal wear and tear, especially for wear parts, such as: Crushing jaws, support walls, grinding bowls, grinding balls, sieve plates, brush strips, grinding sets, grinding disks, rotors, sieve rings, pin inserts, conversion kits, sieve inserts, bottom sieves, grinding inserts, cutting tools, sieve cassettes, sieve and measuring cell glasses.
- Repairs, adaptations or modifications were made to the device by unauthorized persons or companies.
- The device was not used in a laboratory environment and/or has been used in continuous operation.
- Damage is present due to external factors (lightning, water, fire or similar) or improper handling.
- Damage is present that only insubstantially affects the value or proper functioning of the device.
- The device type or serial number on the device has been changed, deleted, removed or in any other way rendered illegible
- The above-mentioned documents have been changed in any way or rendered illegible.

Costs not covered by the guarantee

This guarantee excludes any costs for transport, packaging or travel that accrue in the event the product must be sent to us or in the event that one of our specialist technicians is required to come to your site. Any servicing done by persons not authorised by us and any use of parts that are not original FRITSCH accessories and spare parts will void the guarantee.

Further information about the guarantee

The guarantee period will neither extend nor will a new period of guarantee begin in the event that a claim is placed against the guarantee.

Please provide a detailed description of the type of error or the complaint. If no error description is enclosed, we shall interpret the shipment as an assignment to remedy all recognisable errors or faults, including those not covered by the guarantee. Errors or faults not covered by the guarantee shall in this case be rectified at cost.

We recommend reading the operating manual before contacting us or your dealer, in order to avoid unnecessary inconvenience.

Ownership of defective parts is transferred to us with the delivery of the replacement part; the defective part shall be returned to us at buyer's expense.

NOTICE!

Please note that in the event that the device must be returned, the device must be shipped in the original Fritsch packaging. Fritsch GmbH denies all liability for any damage due to improper packaging (packaging not from Fritsch).

Any enquiries must include a reference to the serial number imprinted on the type plate.

12 Exclusion of liability

Before using the product, be sure to have read and understood this operating manual.

The use of the product requires technical knowledge; only commercial use is permitted.

The product may be used exclusively within the scope of applications set down in this operating manual and within the framework of guidelines put forth in this operating manual and must be subject to regular maintenance. In case of non-compliance, improper use or improper maintenance, the customer assumes full liability for the functional capability of the product and for damage or injury arising from violating these obligations.

This operating manual has been prepared to the best of our knowledge and checked for accuracy at the time of printing. FRITSCH GMBH assumes no guarantee or liability whatsoever for the accuracy or completeness of the contents of this operating manual, including but not limited to the implied warranties of merchantability and fitness for a particular purpose, unless liability is expressly prescribed by applicable laws or jurisprudence.

FRITSCH GMBH expressly reserves the right to modify and/or update this operating manual without prior notice. The same applies to modifications and improvements to the products described in this operating manual. It is the responsibility of the user to ensure that they have the current version of this operating manual. For more information, please contact your local FRITSCH GMBH distributor or Fritsch GmbH, Industriestr. 8, D-55473 Idar-Oberstein.

Not all parts shown here are necessarily installed in the product. The buyer is not entitled to delivery of these parts. If interested, please contact your local FRITSCH GMBH distributor or Fritsch GmbH, Industriestr. 8, D-55743 Idar-Oberstein.

FRITSCH GMBH takes the greatest care to ensure that the quality, reliability and safety of your products are continuously improved and adapted to the state of the art. The supplied products as well as this operating manual conform to the current state of the art when they leave the sphere of influence of FRITSCH GMBH.

By using the product the customer agrees with this and recognizes that defects, malfunctions or errors cannot be completely excluded. To prevent risk of damage to persons or property or of other direct or indirect damage, resulting from this or other causes, the customer must implement sufficient and comprehensive safety measures for working with the product.

Fritsch GmbH excludes any liability, warranty, or other obligation to compensate for damages, regardless of whether this liability, warranty, or other obligation is explicit or implicit, contractual or arising from unlawful acts or prescribed contractually, by law, or otherwise. In no event shall the buyer be entitled to any compensation from Fritsch GmbH for any special, direct, indirect, coincidental or consequential damage, including but not limited to lost profits, lost savings, lost sales or financial loss of any kind or for compensation of third parties, for downtimes, for lost goodwill, for damage to or replacement of equipment and property, for costs or restoration of materials or goods related to the product or the use of our products, for other damage or injury to persons (including fatal injuries) or similar. The above exclusion of liability is limited by mandatory liability as prescribed by laws or jurisprudence. Liability for negligence is excluded in all cases.

No permission is given expressly, implicitly or otherwise for the use of patents, brands or other copyrights. We also assume no liability for copyright infringements or infringements of the rights of third parties arising from the use of this product.

Neither compliance with this operating manual nor the conditions and methods used during installation, operation, use and maintenance of the product can be monitored by Fritsch GmbH. Improper execution of the installation can result in property damage and thus endanger persons. Therefore, we assume absolutely no responsibility or liability for loss, damage or costs that result from errors at installation, improper operation or improper use or improper maintenance or are in any way connected to these.

13 Safety logbook

Date	Maintenance / Repair	Name	Signature

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