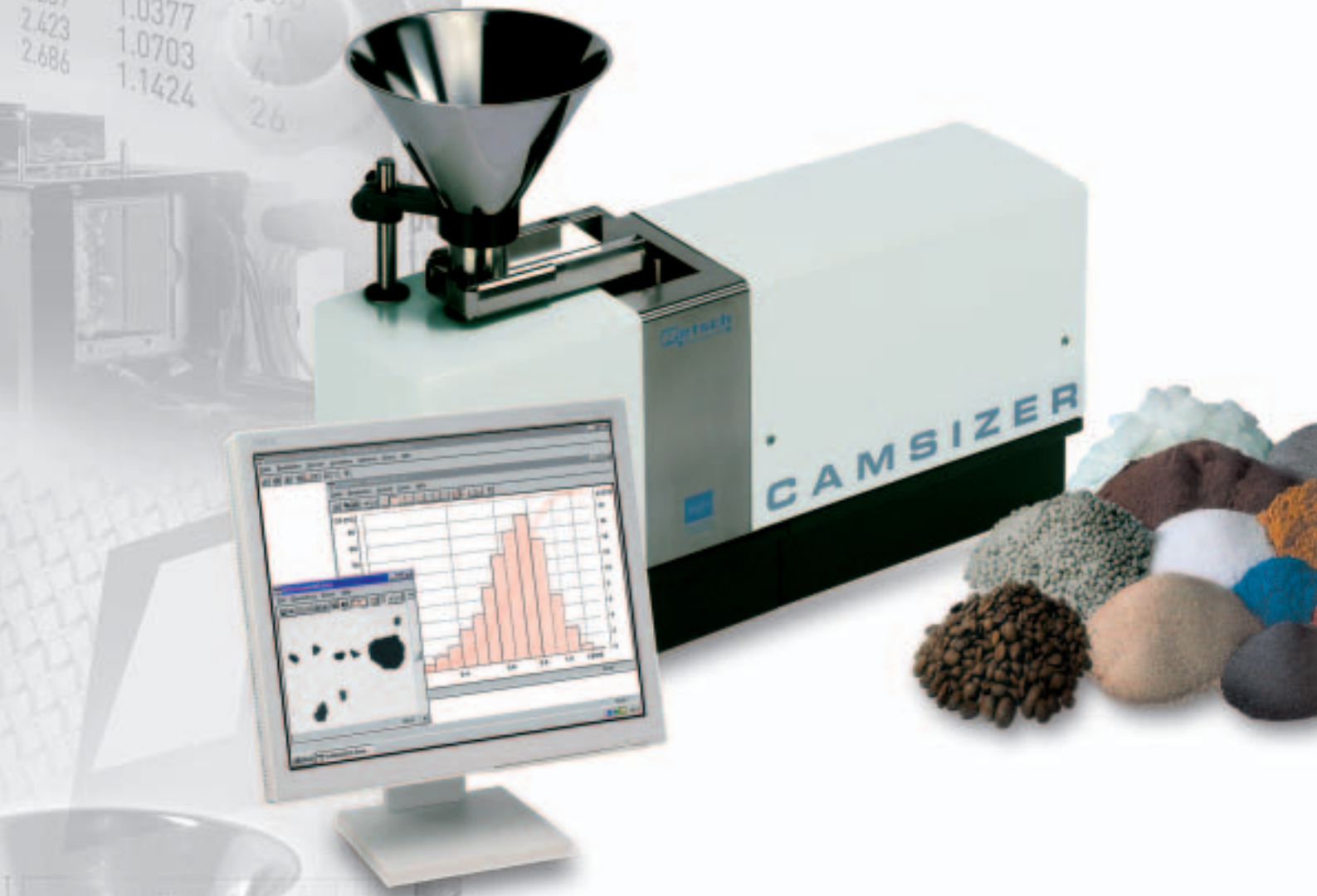
CAMSIZER®

Particle analysis with digital image processing



The superior alternative

The CAMSIZER sets new standards for the analysis of dry, pourable bulk materials. As a result of its large measuring range from 30 µm to 30 mm the CAMSIZER provides an efficient alternative to traditional sieve analysis. The unique and patented measuring method allows the simultaneous analysis of the particle size and shape of the sample by digital image processing. The main fields of application of the CAMSIZER are to be found in quality control, research and production monitoring. It is possible to partially or completely automate the measuring procedure making continuous sample analysis achievable with substantial economic benefits.

Retsch® TECHNOLOGY

Solutions in Particle Sizing

The CAMSIZER® system

Particle size and particle shape analysis

The CAMSIZER has been developed to comprehensively characterize dry and pourable bulk materials. For example, whereas traditional sieve analysis can only determine the approximate particle size, the CAMSIZER simultaneously determines both the particle size and shape – very detailed and at a high resolution. The CAMSIZER is the result of cooperation between Retsch Technology GmbH, Haan and Jenoptik AG, Jena.

100% Quality control

The CAMSIZER is a time and cost-saving alternative whenever permanent quality assurance is demanded during production, immediate checks on incoming and outgoing goods are required or meaningful laboratory measurements are to be made on a wide range of different samples. Typical examples of applications are:

- Salt/sugar
- Plastics
- Catalysts
- Abrasives
- Carbon products
- Sand
- Carbon black/coal
- Coffee
- Refractory products
- Foodstuffs
- Polystyrene
- Glass/ceramics
- Fertilizers
- Drugs
- Metal powder

The robust construction and interference-proof measuring principle of the CAMSIZER allow operation even under rough industrial conditions. Therefore, Retsch Technology also supplies online versions for the continuous monitoring of production processes.

Unique design

Patented measuring method with 2 adaptive full-frame matrix cameras

- Maximum resolution
- Extremely large dynamic measuring range
- Complete and therefore exact particle recording with each digital image

Air flushing options

- Avoids instrument contamination even with very dusty samples
- Optimal particle focusing
- Representative measurements even with strongly varying densities and particle sizes

Certified calibration standard

- High degree of measuring accuracy and reliability with more than 50 reference objects
- Calibration throughout whole measuring range
- Compatibility with national standards and other measuring methods

CAMSIZER® versus sieve analysis – maximum benefits from minimal efforts

	Effort	Results	Benefits/Advantages
Sieve analysis	■ Assemble sieve tower ■ Weigh/tare sieves ■ Feed in sample material ■ Start sieving ■ Weigh fractions ■ Evaluate ■ Clean sieves	Analysis ■ Particle size distribution from a few sieving fractions ■ Sample fractioning ■ High reproducibility ■ Established measuring method	Effects ■ Further analysis of individual fractions possible ■ Wet sieving possible
CAMSIZER®	■ Feed in sample material ■ Start measurement ■ Remove sample material	Analysis ■ Detailed particle size analysis ■ Simultaneous analysis of the particle shape and volume ■ Highest degree of accuracy and reproducibility ■ Very fast: results in real time ■ Avoidance of random errors by extremely simple handling	Effects ■ Drastic reduction in the amount of work and time ■ Automatic, individual evaluation of size, shape, density and number ■ Contact-free and therefore nondestructive analysis ■ Online measurement allows best possible process and quality monitoring ■ Self-cleaning and almost wear-free ■ Can be recalibrated in seconds

The measuring procedure of the CAMSIZER is fully automated, so that random errors can be ruled out. Manual operating steps are reduced to filling the hopper and removing the material.

The CAMSIZER is virtually maintenance-free. Continuous air flushing of the optical components together with the contact-free measuring procedure ensure convenient work.

30 mm

The patented CAMSIZER® principle

From 30 µm to 30 mm: accurate – quick – reliable

The innovative CAMSIZER measuring system is based on the digital image processing principle. The bulk material flow falls between light source and cameras. The particles are optically recorded, digitized and processed in the connected computer.

Simultaneous analysis of number, size and shape

The patented measuring setup of the CAMSIZER – two digital cameras as an adaptive measuring unit – improves and optimizes particle analysis by digital image processing. Thus, it is possible to measure a wide range of particles from 30 µm to 30 mm extremely accurately, without having to switch measuring ranges or make adjustments.

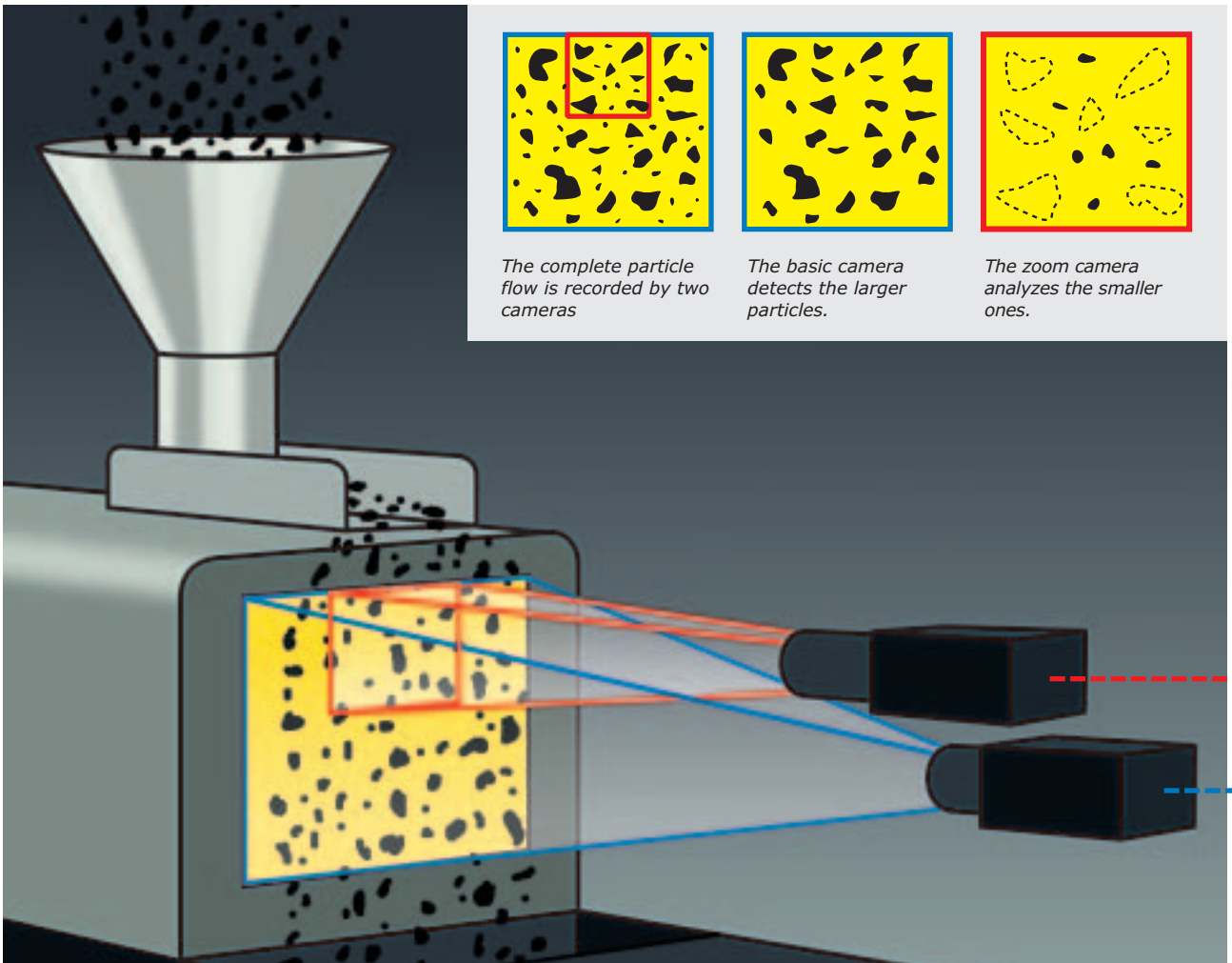
The sample is fed in from the feed channel so that all particles fall through the measurement field. During the measurement procedure the two digital cameras (CCD) perform different tasks. The basic camera (CAM-B) records large particles, the zoom camera (CAM-Z) records the small ones. The contact-free optical measurement is carried out in real time and simultaneously obtains all the required information about particle size and particle shape.

A modularly configurable online version of the instrument has been developed to allow automated measurements to be conducted continuously.

LongLife light source and auto adjustment

The LongLife light source of the new CAMSIZER generation ensures an extremely long working life of the illumination unit. After each measurement the intensity is reduced and the light source switched to the standby mode.

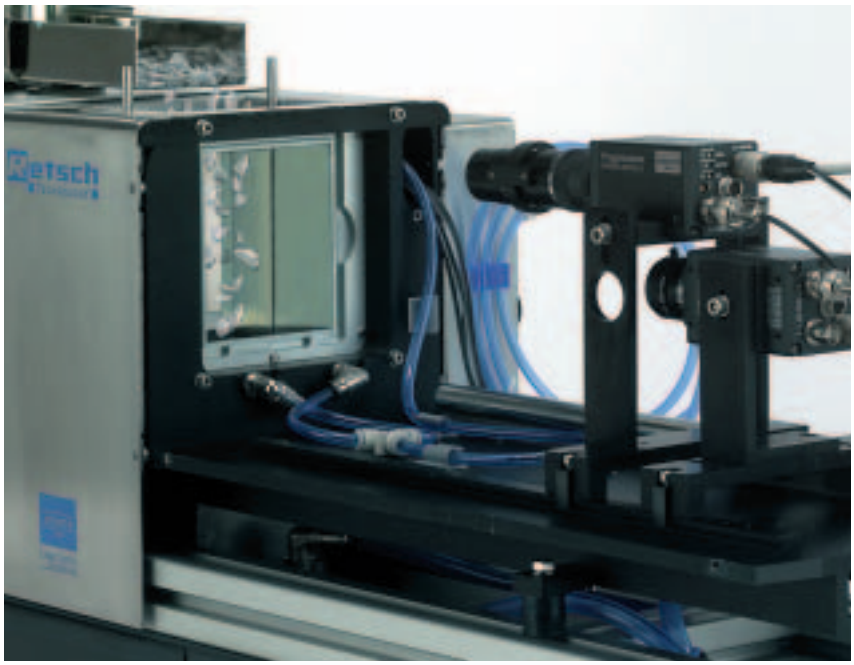
The optional automatic height adjustment of the filling hopper guarantees correct feeding of the sample and eliminates manual working steps. Thus, the CAMSIZER provides measuring results with excellent reproducibility.



The complete particle flow is recorded by two cameras

The basic camera detects the larger particles.

The zoom camera analyzes the smaller ones.



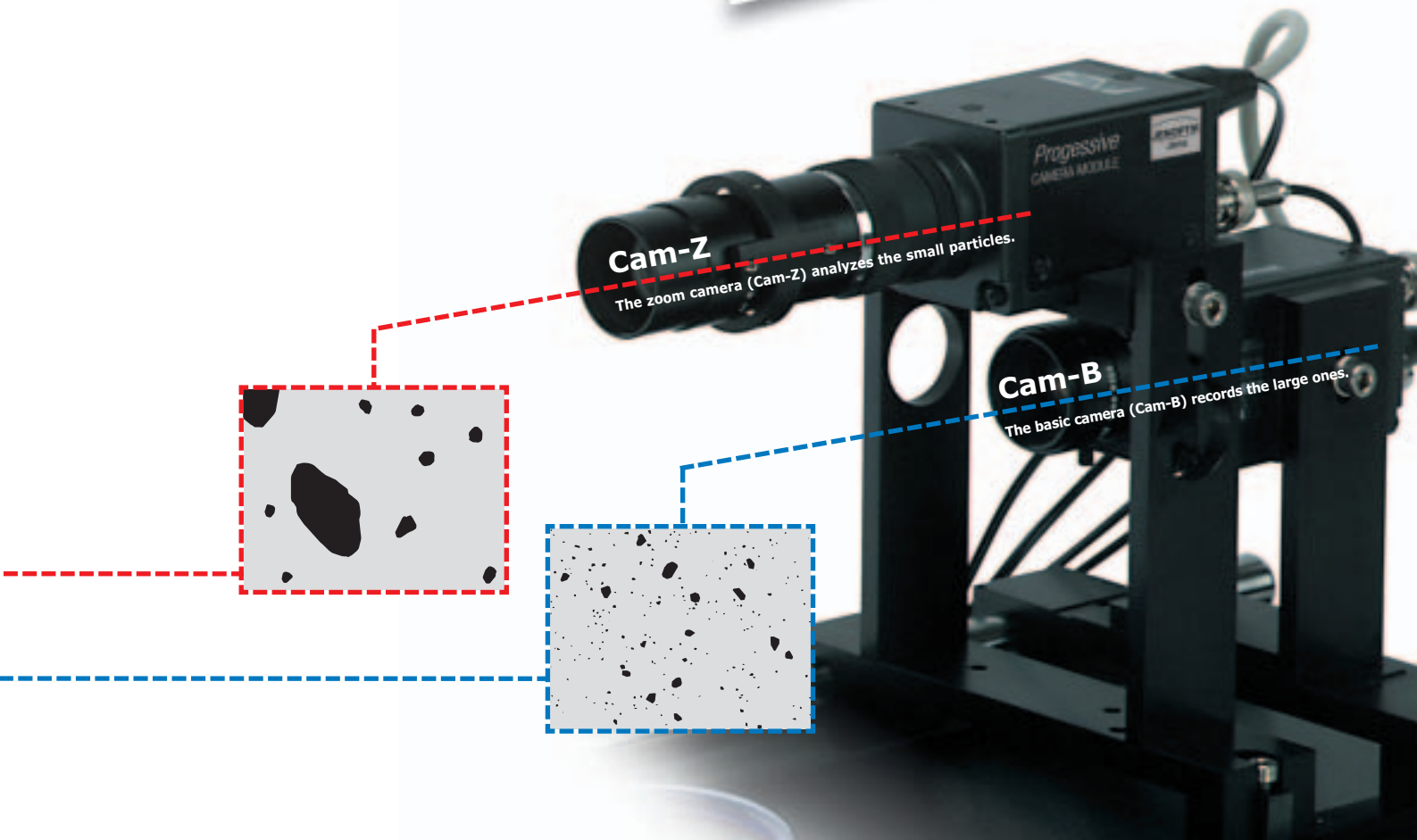
Quick analysis of representative samples

The sample throughput can vary from grams to kilograms per minute. The size range being analysed is an important factor. For small particle sizes a very small amount of the sample may be fully adequate.
The feed hopper has a capacity of 3.5 litres but for a CAMSIZER measurement there is no limit to the maximum sample volume. Depending on the sample and the particular requirements, a measuring time of approx. 3 minutes is typical. This means that real-time monitoring of the production process is possible at any time.

Maximum resolution

The resolution capacity of the CAMSIZER lies in the micrometer range. This means that detailed studies are easily possible even on very narrow and multi-modal particle size distributions. After the digital images have been processed electronically, the analytical results are saved in more than 1,000 size classes according to the density of information. The user can define the size classes to be shown conveniently and individually according to the features that are relevant to the particular sample.

By using a high-precision reference object made by electronic lithography, which simulates differently sized particles, the CAMSIZER can be recalibrated in a few seconds at any time. This means that the requirements of modern test agent monitoring are fulfilled.

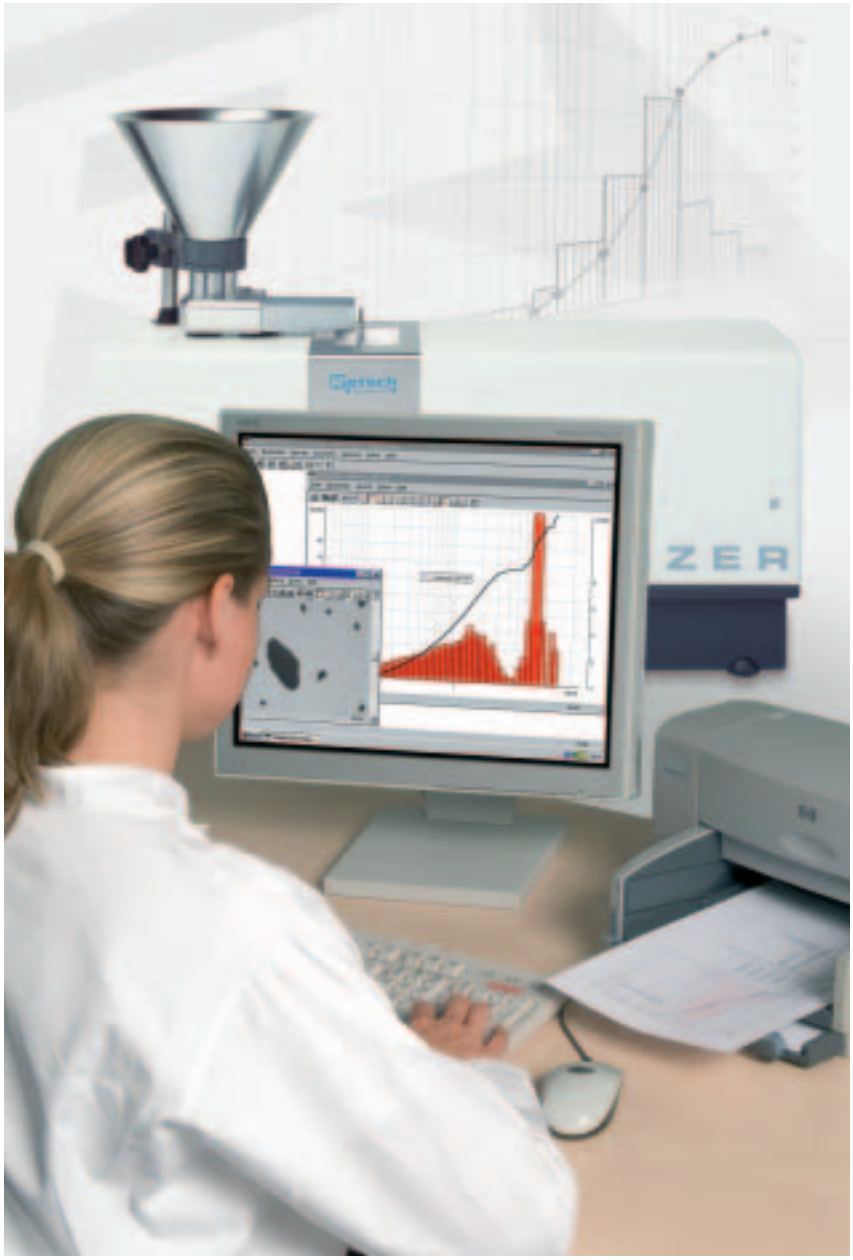


CAMSIZER® results

Evaluation and documentation

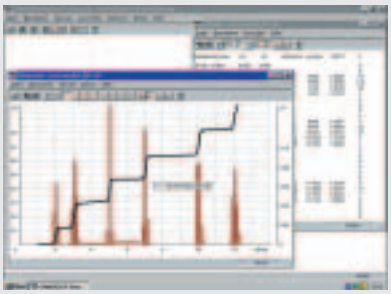
Real-time results

A major advantage in the practical application of the CAMSIZER is the evaluation of the results in real time. Graphical presentation of the results is even available while the measurement is still running. At the same time the measurement process can be checked visually by observing the digital images. Any irregularities detected in the sample material can be archived and evaluated at the touch of a button. Retsch Technology supplies the CAMSIZER complete with powerful Windows-based control and evaluation software. Export of the results to office programs is quick and convenient.

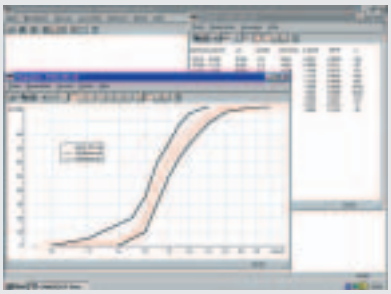


Simple and reliable operation

The setting of measurement and evaluation parameters is made easy by a "Wizard" function in the software which guides the user through this process. This effectively eliminates operator errors. Product-specific settings for the measurement parameters can be saved which simplifies the change between different repetitive measuring tasks, which are known as standard operating procedures (SOPs). These SOPs can be protected against manipulation by a password that ensures that the same instrument settings are always used with the result that the highest degree of reliability is always achieved.



Resolution capacity (6 fractions)
Individually configured results graph and tabular presentation



Quality control during measurement
Comparison of the measurement result with upper and lower specification limits

Trend analysis of production processes
Up to 4 selectable parameters of the sample material can be continuously monitored

More detailed information due to efficient technology

The basis of the precise and quick measuring results is the processing of the particle projections in real time. At a recording rate of 50 images per second, each with more than 425,000 pixels, the CAMSIZER processes information from more than 20 million measuring points per second. In the presentation of the results as graphs, tables, characteristics or digital images, a wide range of customers' wishes has been taken into account.
The computer calculates all standard particle distributions (volume, area and number-related) as well as the characteristics of the particle size, particle shape and their distributions and standard deviations.

The results obtained can be presented graphically and in tabular form as size fractions, frequency distribution or cumulative distribution.
In addition, the CAMSIZER can determine the number of particles in the sample as well as the specific surface area and, optionally, the density of the sample material. All measured variables are determined very exactly and with excellent reproducibility. The CAMSIZER software also allows the presentation of daily reports, trend analyses, mean value calculations, standard deviations and much more.
A clear, individually configurable measuring protocol based on DIN 66 165 can be produced.

Smooth changeover from sieve analysis to CAMSIZER®

In practice the traditional sieve analysis frequently forms the basis for quality standards and product specifications on which the communication between suppliers and customers is based.

A rapid and efficient alternative to sieve analysis must take this into account and produce results that are fully compatible. This is why the CAMSIZER software is provided with algorithms for simulating sieve analysis. In this way many users have been able to replace the time-consuming sieve analysis by using the CAMSIZER without having to dispense with the familiar quality features.
The automated and wear-free measurement means that the results obtained are more reliable and reproducible.

Particle shape analysis and its applications

In many applications particle shape information provides an important process and quality indicator. Based on digital image processing the CAMSIZER is immediately able to analyze the particle shape of the sample material in a detailed and representative manner.

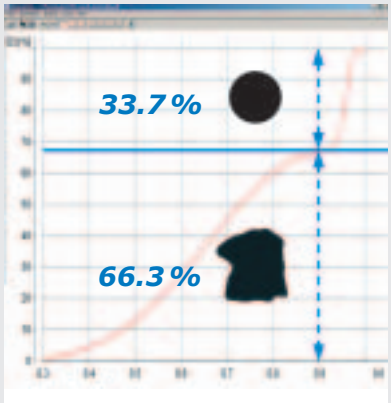
As a result of the high information content obtained from the digital images made during the measurement procedure, the particle projections can be evaluated in many different ways. Depending on the application, the CAMSIZER measures the particle projections according to various areas, circumferences and lengths by making a high-resolution scan of each individual particle in 64 directions. The results obtained can be, for example:

- chord length
- Martin diameter
- Feret diameter
- straight length
- width/length aspect ratio
- roundness
- symmetry
- convexity

The advantages of the full-frame cameras used in the CAMSIZER for the distortion-free recording of all the particle projections is particularly obvious when measuring the particle shape.

Examples of particle shape analysis applications are:

- **determination of fractions of mixture components (see graph)**
  e.g. of ion exchangers and active charcoal for water filters as well as glass beads and corundum in colors used for road markings
- **determination of edge-holding property (angularity)**
  e.g. quality assessment of abrasives as a preliminary to further processing
- **analysis of the broken fraction of granules**
  e.g. as a replacement for time-consuming breakage studies on the rolling properties of granules
- **determination of width/length distribution of extrudates ("rods")**
  e.g. determining the volumetric density of catalysts in reactor containers
- **prediction of flow and compacting behavior**
  e.g. press-molding powders and granules to form tablets



CAMSIZER® automation options

AutoSampler and online version

The use of the CAMSIZER is very economical, particularly with high sample throughput. In combination with the AutoSampler efficiency can be increased due to the automated sample measurement. A further improvement is possible by ensuring continuous quality monitoring in online operation.

The AutoSampler – automatic, reliable, flexible

No matter whether varying sample materials are to be analyzed or series measurements need to be carried out, the AutoSampler adapts itself perfectly to the defined measuring routine. The use of the automatic height adjustment makes the manual adjustment of the hopper position superfluous, even for samples with a greatly differing particle size distribution. The sample is fed in by an electro-pneumatic robot arm which lifts the beakers and empties them into the feed hopper. A built-in shaking function ensures complete emptying. The sample beakers are collected in a container for reuse. Even during operation a laser-based sample recognition device enables the user to alter the priority of individual samples on the conveyer belt. The use of the AutoSampler allows the utilization of the CAMSIZER to be maximized.

Increased flexibility due to barcode reader

The barcode reader ensures that defined instrument and measurement settings (SOPs) are read in automatically for all the products to be analyzed. Even specific evaluations, depending on the identification of the product or batch number, can also be carried out automatically. This effectively avoids operator errors and ensures constant measuring conditions for each analysis.

Optimized safety

With Retsch Technology, safety is not limited to the analytical process. The AutoSampler safety devices comply with the relevant guidelines and standards. Moveable parts are located behind covers whose status is permanently monitored by safety switches. If anything unexpected should occur, an emergency stop-button immediately brings all moving parts to a standstill.

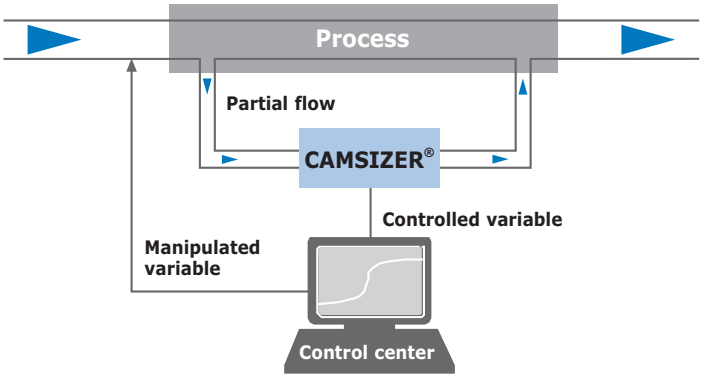
Online application

Even in the powder and granule processing and production sector many customer requests indicate a trend towards continual process automation in order to optimize quality costs. This requires continuous and integral quality assurance within the framework of so-called online registration of product features.

Due to its robust construction and interference-free measuring principle, the CAMSIZER is particularly suitable for integration in the production line in online operation. In such applications, the online version of the CAMSIZER is optimally matched to the specific "on-site" needs. Usually, this includes some individual adjustments to the design, electronics and software. Typically, a representative sample of the bulk material is removed from the process for online analysis and fed to the CAMSIZER.
Immediately after the measurement has been completed, the next batch of the product is automatically transferred and analyzed. Thus, an up-to-date measurement result is available at all times, which guarantees uninterrupted quality control.
The process parameters can then be continuously optimized through a closed loop control circuit, which means that the reject quota can be minimized.

In order to ensure long operating periods even in a dusty environment, the online version is equipped with an additional air flushing device. The robust housing usually stands on vibration absorbers which means that the system can also be used at sites subjected to intensive vibrations.
Air conditioning is also available at different performance levels as an option. This guarantees that the system can function properly throughout an extended temperature range of -20 °C to +50 °C.

Enclosed CAMSIZER for extreme operation conditions



Schematic diagram showing the inclusion of the CAMSIZER in a continuous quality monitoring system

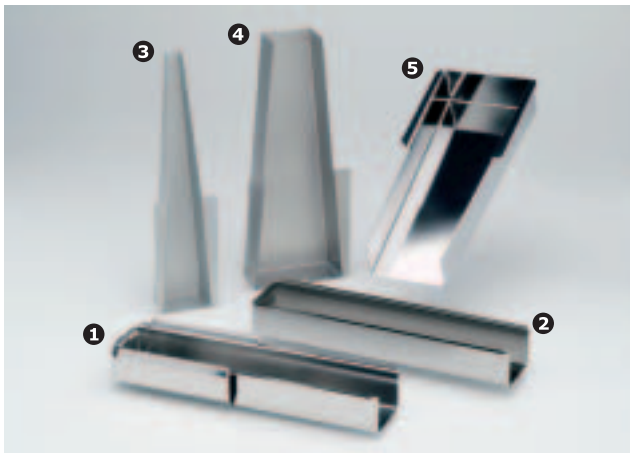
CAMSIZER® accessories

Retsch Technology offers a comprehensive range of accessories for the CAMSIZER in order to fulfill the individual requirements for each and every application. The individual components are selected according to the sample material properties.

Push-fit feed chutes

The flow behavior of the sample can be considerably improved by a favorable choice of material properties and feed chute surface. Feed chutes made from high-quality stainless steel are used as standard, but even difficult materials such as coffee or cocoa can be fed in uniformly and continuously by choosing the most suitable chute coating. For example, for oily/fatty materials we recommend chutes made from aluminum hard-coat. The push-fit attachment means that the feed chute can be exchanged within a few seconds whenever necessary. For the effective feed of different-sized particles chutes with different widths are available:

- 40/15 mm chutes for powders and finely grained samples
- 40/40 mm chutes for medium-sized granules
- 75/60 mm chutes for coarse materials



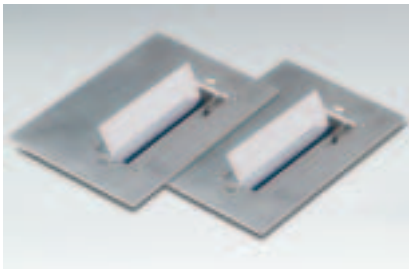
1. 40/40 mm feed chute (stainless steel)
2. 40/40 mm feed chute (Cerid)
3. 40/15 mm feed chute (aluminum hard-coat)
4. 75/40 mm feed chute (aluminum hard-coat)
5. 75/60 mm feed chute (stainless steel)

Feed hoppers

Different hopper sizes are available for different amounts of sample. Hoppers can be supplied with a capacity of 0.6 l as well as 2.8 l and 3.5 l. For optimal sample feed these hoppers are available in different materials and with different coatings (stainless steel, aluminum hard-coat, etc.).

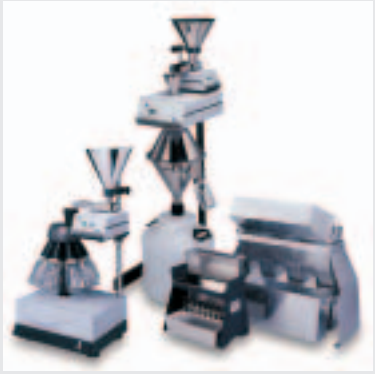
Feed guides

By the use of a feed guide even the finest products fall through the focusing range of the cameras without any unwanted turbulence and can therefore be measured accurately. For special applications feed guides are available that orient the sample in a preferred direction. For example, this allows the precise measurement of the length and width when analyzing extrudates.



Sample division – as important as the analysis itself

Sample preparation errors can no longer be corrected even by the most up-to-date analytical instruments. This is why Retsch Technology offers a range of sample dividers for obtaining representative part-samples.



CAMSIZER® at a glance

Technical data	
CAMSIZER®	
Measuring range:	recommended range 30 µm to 30 mm
Measurement:	50 images/s, each with more than 425,000 pixels (corresponds to more than 20 megapixels per second)
Measuring time:	approx. 2 to 3 min (depends on required measurement statistics)
Instrument data:	dimensions (H x W x D) approx. 650 x 850 x 350 mm weight (without PC): approx. 40 kg
The CAMSIZER is CE-tested and complies with the relevant guidelines and standards.	

AutoSampler	
Compressed air supply:	min. 6 bar
Compressed air consumption:	10 l/min
Instrument data:	dimensions (H x W x D) approx. 900 x 1450 x 490 mm weight: 60 kg
Sample feed:	control of the endless conveyor belt by light barrier interruption during sample container positioning, sample feed by electro-pneumatic robot arm, emergency stop-button
The AutoSampler is CE-tested and complies with the relevant guidelines and standards.	

CAMSIZER®-Online	
Measuring data:	see CAMSIZER for measuring range, measurement, measuring time
Working range:	temperature range -20 °C to +50 °C (air-conditioned), enclosed for rough surroundings by housing (IP 54), shock and vibration-absorbing installation
Instrument data:	dimensions (H x W x D) approx. 800 x 1600 x 600 mm weight: approx. 250 kg compressed air supply: 4 - 8 bar
Interfaces:	Ethernet, Profibus, various digital and analog contacts (e.g. 4 - 20 mA)

Fields of application	
Scope and purpose:	rapid and exact particle size and shape analysis of all dry, pourable bulk materials and powders
Sample material:	e.g. salt/sugar, plastics, catalysts, abrasives, carbon products, sand, carbon black/coal, coffee, refractory products, foodstuffs, polystyrene, glass/ceramics, fertilizers, pharmaceuticals, metal powder, etc.
Operating sites:	factory laboratories, research institutes, locations close to the production line as well as online for optimal quality control of products and processes

Further information about us and our products can be found under: www.retsch-technology.com

Order data

CAMSIZER®	Item No.
Particle measuring instrument CAMSIZER with LongLife illumination unit, two full-frame matrix cameras as adaptive measuring system, air flushing unit for cleaning, efficient industrial PC including operating system, monitor, keyboard and mouse, network card, PC interface cards for hardware communication, evaluation software	11.0001
Options	
Automated sample hopper height adjustment	11.0003
Adjustment and calibration standard, tested and approved by the German Calibration Institute	12.0000

AutoSampler	Item No.
AutoSampler for CAMSIZER Incl. conveyor belt with control by light barrier monitoring, robot swing arm for automatic sample feed, PC interface card for hardware communication, sample beakers	11.0100
Options	
Barcode reader for product recognition, with control software	11.0102
Bench for AutoSampler, dimensions (H x W x D) approx. 650 x 1160 x 80 mm	11.0101

CAMSIZER® Online	Item No.
Particle measuring instrument CAMSIZER with customer-specific adaptation for online operation, robust housing (IP 54), Ethernet and Profibus interfaces as well as numerous digital and analog contacts for transferring data and commands	on request
Options	
Air-conditioning unit for extended temperature range from -20 °C to +50 °C, vibration-free mounting with vibration compensators	on request

Accessories						Item No.
Push-fit feed chutes	Width at hopper side	Width at feed side	Holder	Cerid coating	Aluminum hard-coat	Stainless steel
Feed chute	75 mm	60 mm	75	–	30.1005	30.1006
Feed chute	75 mm	40 mm	75	–	30.1023	30.1020
Feed chute	40 mm	18 mm	75	–	30.1033	30.1030
Feed chute	40 mm	40 mm	40	30.1011	30.1013	30.1010
Feed chute	40 mm	15 mm	40	–	–	30.1040
Feed chute	40 mm	10 mm	40	–	30.1042	–
Holder for push-fit feed chutes					Aluminum hard-coat	Stainless steel
Holder 75	for 75 mm feed chutes (width at hopper side)				–	30.1050
Holder 40	for 40 mm feed chutes (width at hopper side)				–	30.1051
Feed hoppers			Hopper capacity		Aluminum hard-coat	Stainless steel
Feed hopper	for 75 mm feed chutes (width at hopper side)		3.5 l		–	30.1060
Feed hopper	for 40 mm feed chutes (width at hopper side)		2.8 l		–	30.1061
Feed hopper	for 40 mm feed chutes (width at hopper side)		0.6 l		30.1064	30.1063
Feed guides						
Feed guide, stainless steel, "Standard"						12.0002
Feed guide, stainless steel, "Extrudate"						12.0003
Sample dividers						
Our Application laboratory will be pleased to advise you about choosing a suitable sample divider.						

As additional information we recommend our CAMSIZER and AutoSampler video presentations.

The videos are available from ***www.retsch-technology.com*** *for downloading or can be requested on a CD-ROM free-of-charge.*

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Retsch Technology – your specialist for particle analysis offers you a comprehensive range of instruments. We would be pleased to provide you with further information about our analytical instruments for size and shape measurement.

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