TRIOPTICS

See the Difference.

SpheroCompact® & Spherotronic®

Spherometers for Tactile Radius Measurements

LEADING TO THE FUTURE OF OPTICS

Optical systems have changed the world. And they will continue to do so. TRIOPTICS is significantly involved in this process.

We are a solution provider for optical measurement and manufacturing systems and offer our customers the right system for their current and future applications.

www.trioptics.com

Spherometers – Fast and Efficient Radius of Curvature Measurements

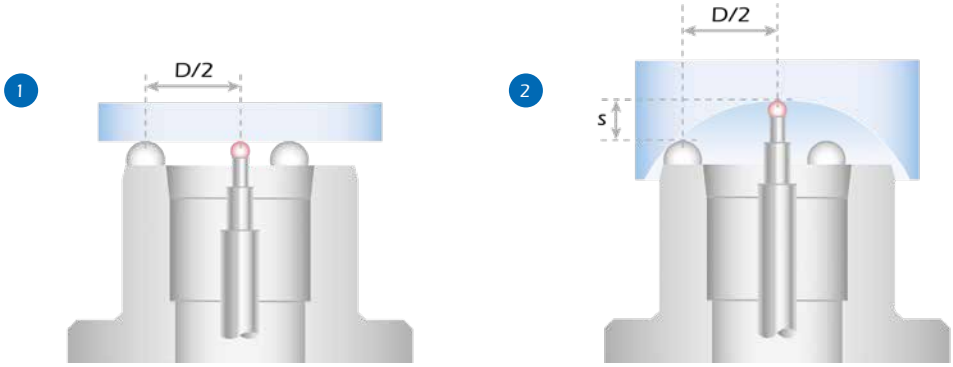
Spherometers made by TRIOPTICS are used worldwide by hundreds of optics companies and laboratories for the precise measurement of the radius of curvature of planar, concave and convex lenses as well as metallic components (such as spheres, for example). The radius of curvature is determined by the tactile measurement of the sagittal height of the curved surface. The long-term accuracy and automated functions of our spherometers are highly appreciated in laboratory and manufacturing environments. The SpheroCompact® and Spherotronic® thus represent the industry standard. The high-precision radius measurement performed by the Spherotronic® are also used in development laboratories for calibrating test plates and test tubes.

Measuring Principle

A prerequisite for precise measurements using the SpheroCompact® and Spherotronic® is knowledge of the exact size of the rings used. Thus, during the calibration process at TRIOPTICS, their radius is determined with highest accuracy and certified in an individual calibration sheet.

Before starting the measurements, a precision optical flat is placed on the selected spherometer ring. This determines the reference position (zero point) for the subsequent sample measurement. In the second step, the sample is placed on the ring.

The spherometer measures the sagittal height of the curved lens surface. The radius of curvature is quickly determined from the ratio between the sagittal height and radius.



1 Determination of the reference position using a precision optical flat.
2 The radius of curvature is calculated from the known radius of the measuring ring (D/2) and the measured sagittal height (s).

Compared to other measurement methods, such as interferometry, tactile radius measurements offer considerable advantages:

- The spherometer is a cost-efficient alternative that offers comparable accuracy.
- The short setup time ensures fast working processes.
- The measurement method is easy to learn and use – very little operator training is required.

Advantages of the TRIOPTICS Spherometers

All TRIOPTICS spherometers – SpheroCompact® and Spherotronic® – are used universally to determine the radius of curvature of concave and convex lenses. They feature:

High Precision and Stability

The high-precision ruby gauge head of the central encoder enables radius measurements with a measurement accuracy of up to ±0.005 % and a sphericity deviation of less than 0.1 µm. In addition to the high-precision measurement of samples, this accuracy is needed for the calibration of optical flats and test tubes. The integrity of the samples is ensured, of course.

Traceability

The certified measuring rings and precision optical flats allow traceability of the measuring accuracy to international standards. This sophisticated technology is therefore regarded as the gold standard for laboratories and manufacturing. The reliable measurement can be used for quality control purposes as early as during the manufacturing process, since the sample does not have to be polished prior to the measurement.

Versatility

The selection of the model and associated selection of measuring rings with various diameters can be adapted to individual requirements. The versatile systems thus cover a very large measurement range.

Product Overview

TRIOPTICS offers three different spherometers designed for various applications and the requirements placed on them.

- SpheroCompact®:
  The simple, yet precise spherometer for use in manufacturing
- SuperSpherotronic® HR:
  High-precision radius measurement for manufacturing and laboratory applications
- UltraSpherotronic®:
  For the highest precision requirements for radius measurements and calibrations

Legende: ☑ Standard configuration · ○ Optional configuration

	SpheroCompact®	SuperSpherotronic® HR	UltraSpherotronic®
Measurement accuracy	Up to ±0.05 %	Up to ±0.01 %	Up to ±0.005 %
Samples with diameters from 6 mm to 500 mm	☑	☑	☑
Encoder with central ruby gauge head	☑	☑	☑
Application			
Production	☑	☑	
Laboratory		☑	☑
Calibration of optical flats and test tubes			☑
Material of Test Balls			
Ruby	☑		
Tungsten carbide		☑	☑
Operation			
Manual encoder	☑		
Motorized encoder		☑	☑
Software control	☑	☑	☑
Output of Results and Evaluation			
SpheroPRO software	☑	☑	☑
Statistical evaluation of measurements	☑	☑	☑
Integration in the company network	☑	☑	☑
Accessories			
Interchangeable precision rings with various diameters	○	○	○
Mechanical pressure pad		○	○
Foot switch	○	○	○

SpheroCompact®

The SpheroCompact® is particularly flexible and versatile due to its compact design and easy operation. Its price-performance ratio makes it the ideal measuring system for manufacturing applications. It can be used universally, since it can also determine highly curved convex and concave surfaces with very small radiuses ranging from +2.5 mm and -4 mm respectively, with accuracies of up to ±0.05 %.

The hand switch is used to bring the central measuring encoder into contact with the sample. After activating the measurement process, the SpheroPRO software outputs the determined radius of curvature and performs a statistical evaluation.

SpheroCompact® with operating console and hand switch for positioning the measuring encoder.

Accessories

TRIOPTICS offers a selection of precision rings as accessories for the SpheroCompact®. Ruby balls are used to hold the sample. Since the measuring precision increases with the ring size, TRIOPTICS recommends selecting the largest possible ring for each test sample.

- Standard set (diameter):
  12.5 mm, 25 mm, 50 mm, 75 mm, 100 mm, 125 mm
- Special sizes (diameter):
  6 mm, 20 mm, 30 mm, 38 mm, 40 mm, 150 mm, 225 mm

Precision rings with ruby balls for the SpheroCompact®

Other ring sizes are available upon request.

An additional foot switch is available to activate the measuring process.

Spherotronic®

Both the SuperSpherotronic® HR and UltraSpherotronic® determine the radius of convex and concave surfaces up to +2 mm and -4 mm respectively. The balls of the test ring, which the sample is positioned on during the measurement process, are made of tungsten carbide and are extremely resistant to mechanical deformation. The long 60 mm travel distance of the central encoder also allows high precision measurements of samples with large lens diameters and highly curved surfaces.

The stable tabletop devices are easily operated using the buttons built into the base. They move the encoder upwards and downwards and start the measuring process. All other settings as well as the output of the measurement results are controlled by the SpheroPRO software.

The SuperSpherotronic® HR for measuring the radius of curvature with an accuracy of up to ±0.01 %.

With the highest precision worldwide of ±0.005 %, the UltraSpherotronic® is used to calibrate optical flats and test tubes.

The SuperSpherotronic® HR and UltraSpherotronic® differ in their degree of measuring accuracy:

- Due to the built-in Heidenhain linear encoder, the SuperSpherotronic® HR achieves an accuracy of up to ±0.01 %.
- In contrast, with an accuracy of ±0.005 %, the UltraSpherotronic® achieves the highest measurement precision worldwide, making it particularly suitable for use in laboratories for calibrating optical flats and test tubes.

Upgrades and Accessories for the Spherotronic® Devices

With their extensive range of accessories, the SuperSpherotronic® HR and UltraSpherotronic® are easily adaptable to a wide variety of samples and conditions of use.

Precision rings

The precision rings for the SuperSpherotronic® HR and UltraSpherotronic® are equipped with tungsten carbide balls. Since the measuring precision increases with the ring size, TRIOPTICS recommends selecting the largest possible ring for each test sample.

The following ring sizes are available:

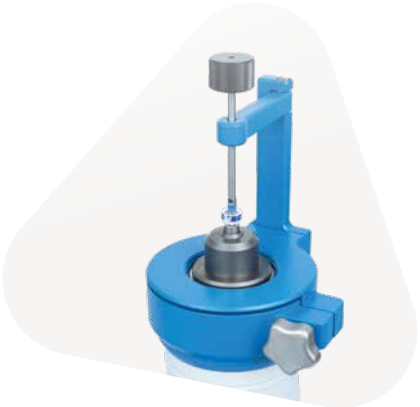
- Standard set (diameter):
  7.8 mm, 14 mm, 20 mm, 28 mm, 38 mm, 60 mm, 90 mm, 120 mm
- Special sizes (diameter):
  3.5 mm, 12 mm, 14 + 3.5 mm, 20 + 1.8 mm, 28 + 1.2 mm, 48 mm, 75 mm, 150 mm, 225 mm

Other ring sizes are available upon request.

Precision rings with tungsten carbide balls for the SuperSpherotronic® HR and UltraSpherotronic®

Mechanical pressure pad

The mechanical pressure pad ensures a constant and fixed contact pressure between the sample and ring. It is particularly useful for small lenses with a low net weight. If required, the mechanical pressure pad can simply be placed on the Spherotronic®.

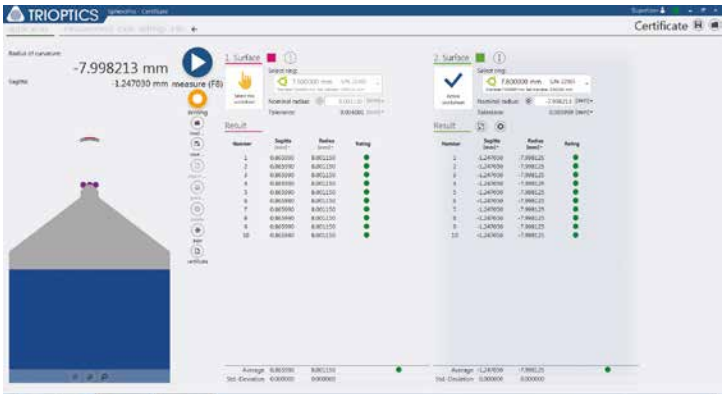


Foot switch for activating the measurement process

In addition to the software and the push-button on the Spherotronic®, the optional foot switch offers another option for activating the measuring process. This lets the operator efficiently use his/her hands to handle samples, especially during serial measurements.

SpheroPRO

All TRIOPTICS spherometers are operated with the user-oriented SpheroPRO software. The software was designed to optimally meet the requirements of real-life applications and is operated via touchscreen monitor. The intuitive user menu enables the easy, quick and error-free determination of the radius of curvature of lenses via pre-configured measurement programs. A schematic representation of the measured radius of curvature (concave or convex) provides direct control of the current test step. Quality control is ensured by means of a continuous statistical evaluation of the measurement results.



The SpheroPRO software is easy to operate via a touchscreen interface and enables a quick evaluation of the measurement results.

Key Features

- Easy operation through pre-configured measurement programs for various applications, e.g. test tube and single surface measurements
- Quick plausibility check of the test step and measurement process through a schematic representation of the radius of curvature (convex/concave) and current number of measurements
- Continuous quality control through statistical evaluation of measurements, including mean value, standard deviations and pass / fail analysis
- Compact but comprehensive documentation in measurement certificates that can be stored digitally and printed
- Ring calibration data is easy to import and, if necessary, update for product extensions or product inspections
- To reduce general maintenance and space requirements, the software has also been designed for touchscreen operation

Technical Data

	SpheroCompact®	SuperSpherotronic® HR	UltraSpherotronic®
Sample radius (convex)	+2.5 mm to ∞	+2 mm to ∞ [1]	+2 mm to ∞ [1]
Sample radius (concave)	-4 mm to ∞	-4 mm to ∞	-4 mm to ∞
Travel distance of linear encoder	±12.5 mm	±30 mm	±30 mm
Diameter of sample	6 mm to 500 mm	6 mm to 500 mm	6 mm to 500 mm
Resolution of linear encoder	0.1 µm	0.1 µm	0.02 µm
Absolute accuracy of linear encoder	±0.5 µm	±0.5 µm	±0.1 µm
Measurement accuracy [2]	Up to ±0.05 %	Up to ±0.01 %	Up to ±0.005 %

[1] Radius measurements of < +4 mm require the exchange of the ruby gauge head and use of the 3.5 mm precision ring.

[2] The maximum measurement accuracy depends on the radius of the lens and the ring used.

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