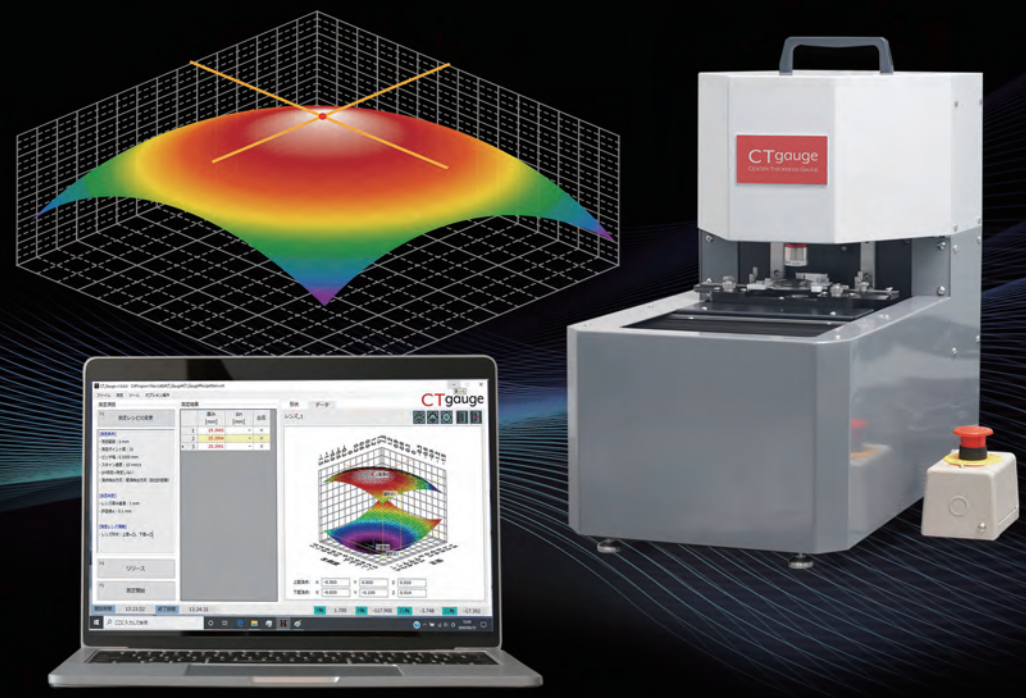
G-Freude

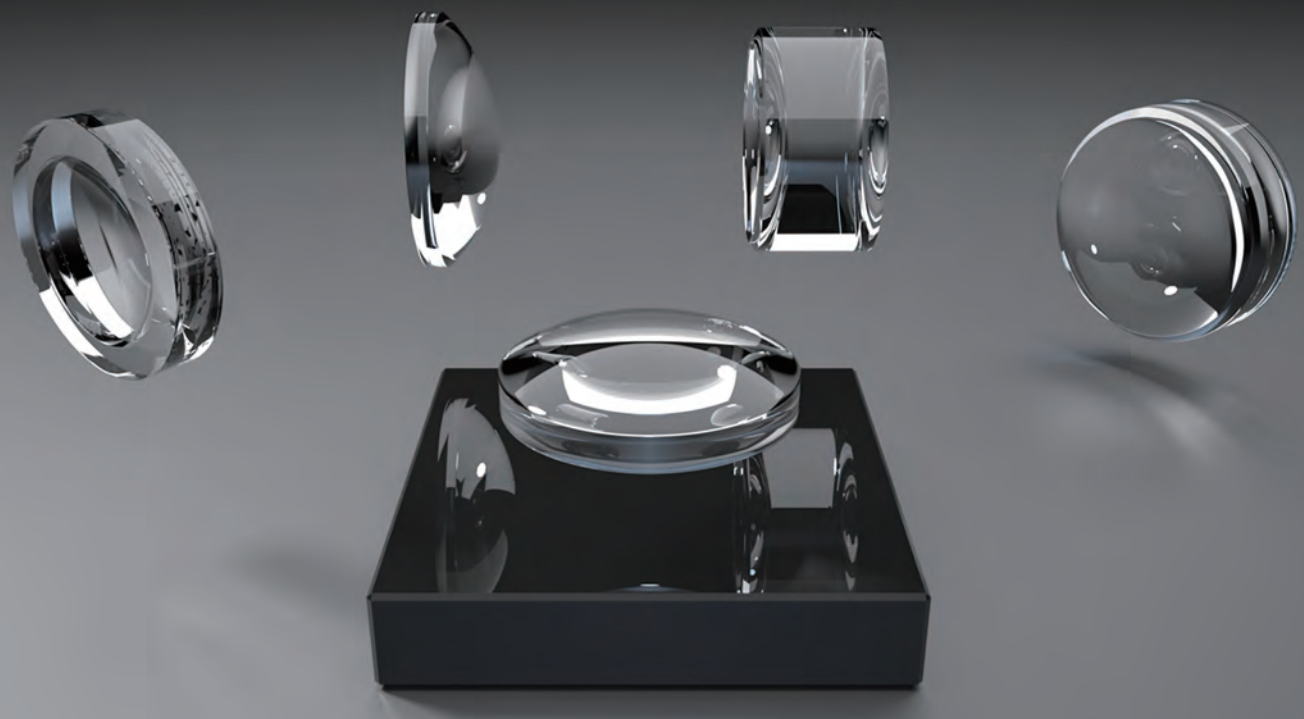
Seek and measure lens cener thickness
only an exact point you need

Non-contacting
Lens Center Thickness Gauge

CTgauge



"Measure the center thickness of the lens without touching it, regardless of the "refractive index" or "radius of curvature.

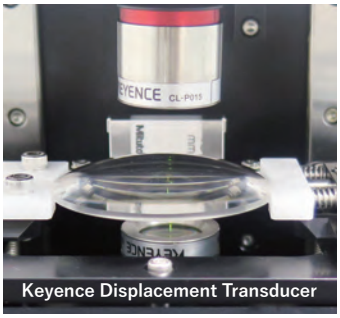


Mastering the Measurement of Lens Center Thickness

1 Non-contact automatic measurement without touching the lens

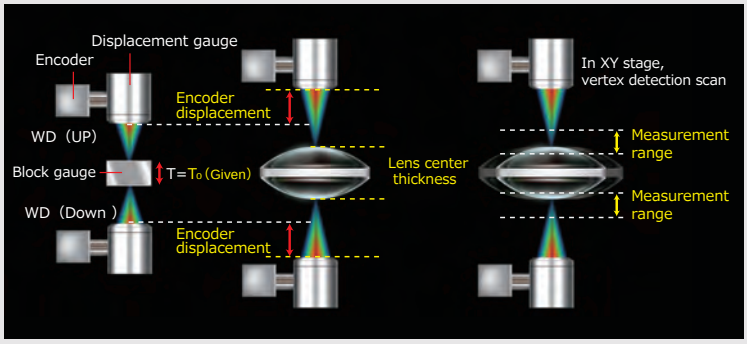
Although the center thickness of the lens is clearly indicated on the design drawing, it is difficult to measure accurately, and the "contact type" device is the mainstream. The accuracy of the "contact type" depends on the mechanical structure, and "measurement scratch" is also an issue.

Accurate and automatic “non-contact" measurement would be an ideal. This machine was developed in response to such requests.



Keyence Displacement Transducer

Principle and method of measurement



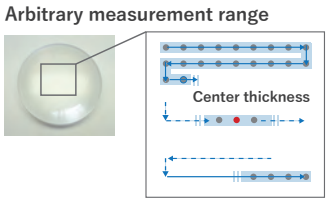
What is lens center thickness?

The displacement transducer slides smoothly up and down along the two LM guides located on the back plate of the instrument. In addition, the combination of the displacement transducer's own measurements and the LM guides allows the system to handle a wide range of lens thickness changes.

Lens center thickness = Block gauge thickness ± Encoder displacement ± Measurement of Displacement Sensor

2 Automatic vertex detection and fast scan measurement

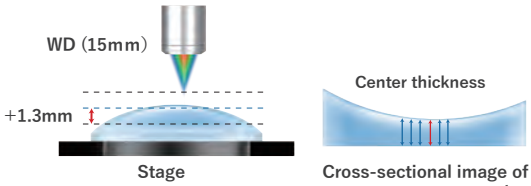
Automatically detects vertices by automatically scanning an arbitrary measurement range.This feature eliminates the need for centering of the lens. In addition, the input of "refractive index" and “the radius of curvature” of the material is not required.



Automatic scan in the XY stage

Lens vertex detection method

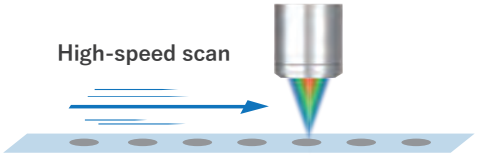
Measurement range of the adopted displacement transducer in the Z direction = WD ±1.3 mm.
The scanning XY stage calculates all center thicknesses within the measurement range and automatically detects the center thickness at its maximum (minimum) value.



Cross-sectional image of concave measurement

line scan method

The measurement data captured by the linear motion of the stage is once imported to the PC side for high-speed calculation processing and 3D analysis.



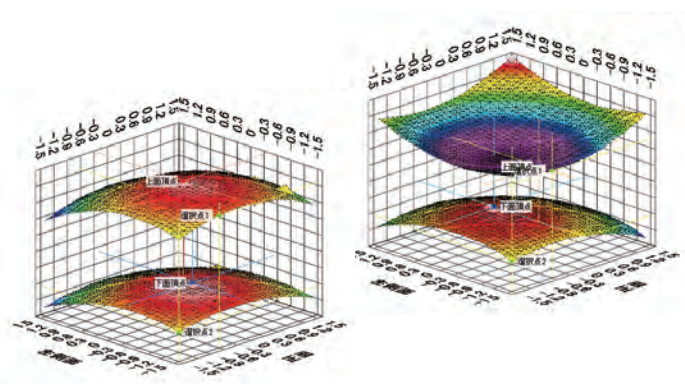
Measuring point

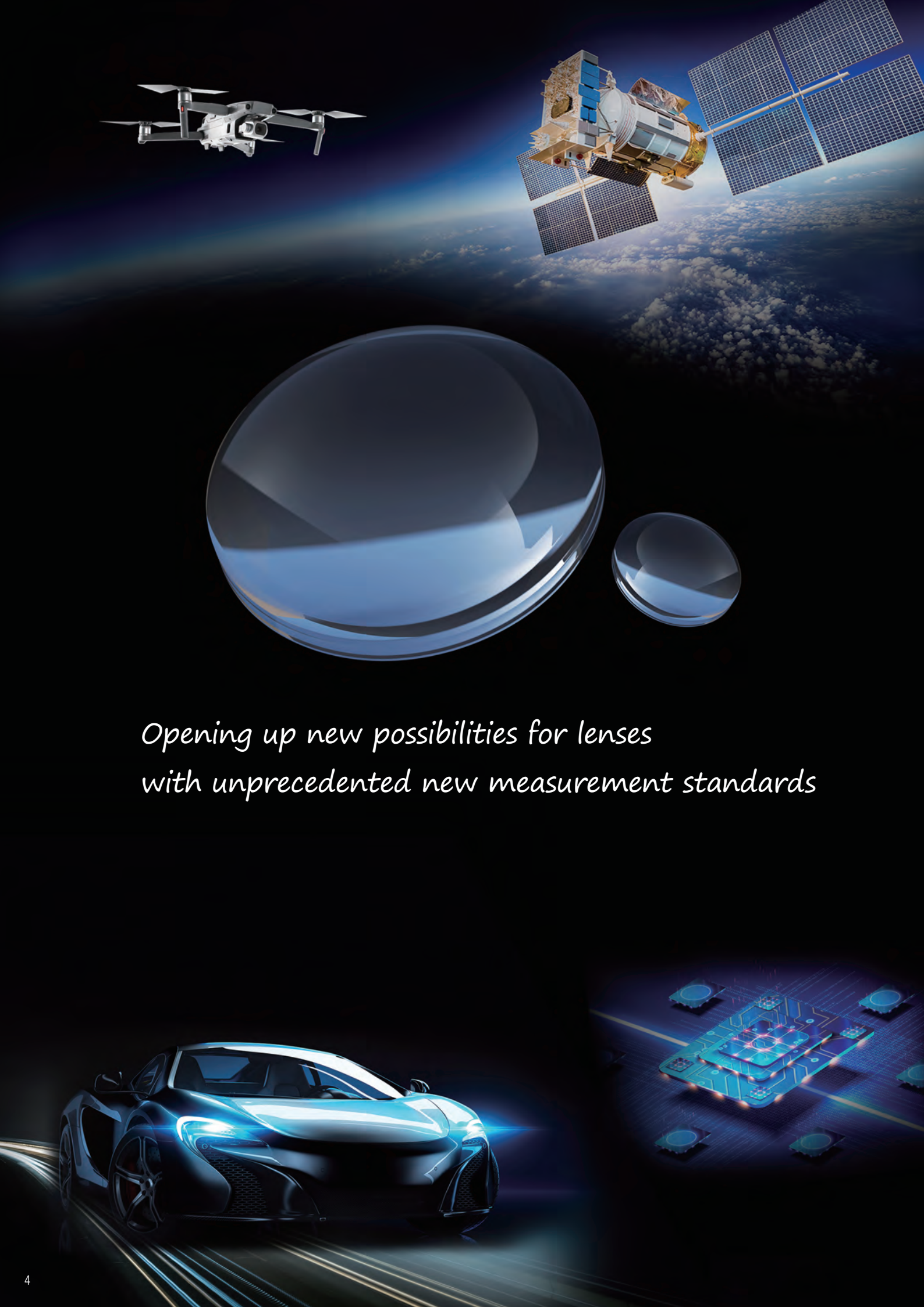
3 3D map display to capture visually

If the output is only numerical values, it is difficult to know if the surface vertex is really captured. Therefore, this system outputs a 3D map for each measurement to visually enhance the reliability of the measurement.

Display of 3D maps

It is possible to display the front and back sides simultaneously.
It is also possible to use the scroll function to rotate the 3D map and display the coordinates of the vertices.



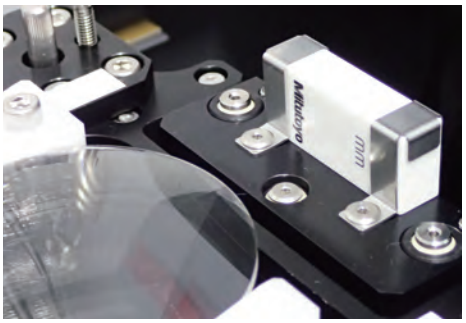


Opening up new possibilities for lenses
with unprecedented new measurement standards

In search of "accurate measurement precision"

1 Comparative measurement with a block gauge built into the device

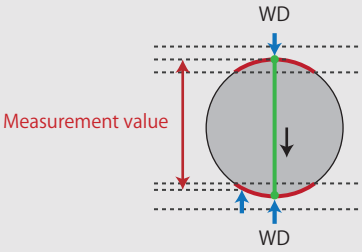
The way to increase the accuracy is to calibrate the instrument more often. This instrument has a built-in ceramic block gauge, which is programmed to automatically calibrate itself first before starting the actual measurement. Since the measurement is "reflective", it does not depend on the refractive index of the lens.



Verification of accuracy

Principle of Master Steel Ball Measurement

A measuring machine needs a master plate called "Master", but there is no master plate for this measurement. The reason for this is that there is no exact method for measuring the center thickness. Therefore, the accuracy of the center thickness measurement can be demonstrated by measuring the diameter of a steel ball with ultra-high precision (right figure).



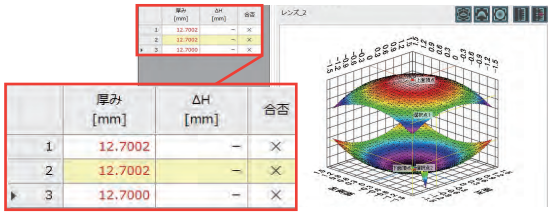
The length of the green line : diameter of the steel ball

Comparative verification by steel ball measurement

The figure below shows the Master Steel Ball, which is the manufacturing standard for steel balls used in slide bearings, and its certificate and the data measured by this device.

Master steel ball: 1/2 inch = 12.70000mm

CT-gauge: 12.7001mm in average (error is +0.1 μ)



	厚み [mm]	ΔH [mm]	合否
1	12.7002	–	×
2	12.7002	–	×
3	12.7000	–	×

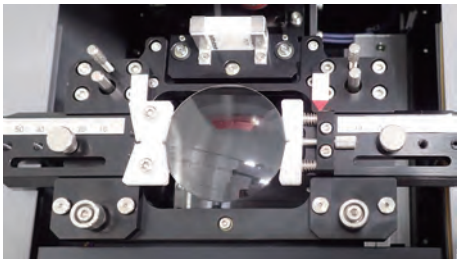
2 Mechanical mechanism to measure the center thickness of the lens correctly

In lens measurement, a "yatoi" is often used, but it is costly and time-consuming to manufacture one for each measurement. In this system, a lens holding mechanism that does not use a tool is available. In addition, orthogonality between the measurement light and the sample is important to measure the center thickness accurately with the reflection type.

Sample chucking mechanism

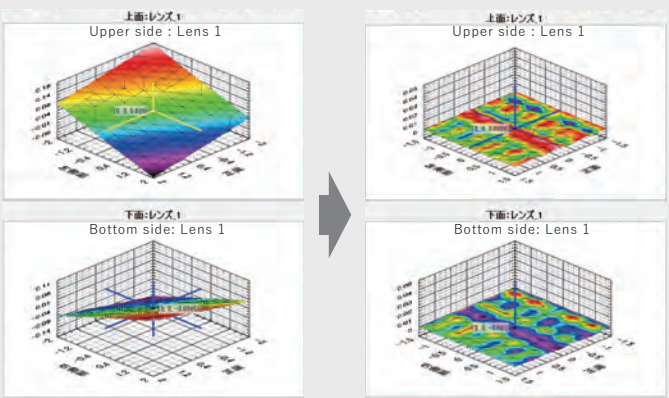
The lens holding mechanism is a V-shaped support made of Delrin material that can hold any diameter. Also, automatic vertex detection eliminates the need for centering and holding.

Available in diameters from 10 to 100 mm. Individual holder is required for ϕ10 or less.



Check the level on a 3D map.

Use the parallel plane plate to adjust the level of the sample holding surface.



Before tilt adjustment　　After tilt adjustment

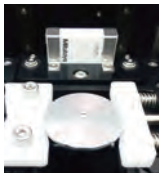
Other measurements and functions in "Expanding Possibilities"

1 Small diameter lens measurement function

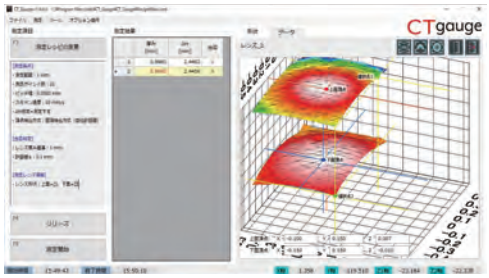
Small diameter lens measurement

For small-diameter lenses such as those used in microscopes, even the slightest center thickness error is severe. This system uses a dedicated holder that enables accurate measurement.

The figure on the right shows the results of hemispherical lens measurement with a diameter of 3 mm.



Holder mounted



Measurement of hemispherical lens of 3 mm diameter

Measuring machine for large diameter
***Special specification**

The center thickness of lenses for semiconductor lithography equipment is in the 100mm class. In addition, the cost of glass material is high, so high-precision non-contact measurement is essential.

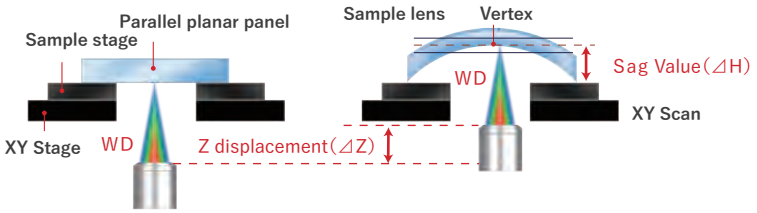
High-speed center thickness measuring machine
***Currently under development**

In order to meet the demands of a measurement with a more focus on a higher speed than accuracy" and "additional measurement of the outer diameter", a new measuring system has been developed.
The project is scheduled for completion by the end of 2021.

2 Non-contact ΔH measurement function

ΔH measurement function

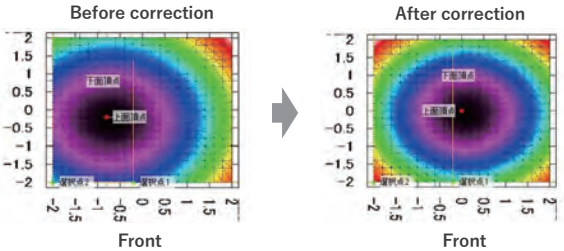
In the past, there was no way to measure the amount of ΔH in a "non-contact" manner, and the only way to do so was to use a depth gauge.



3 Software that is easy to use and ingenious

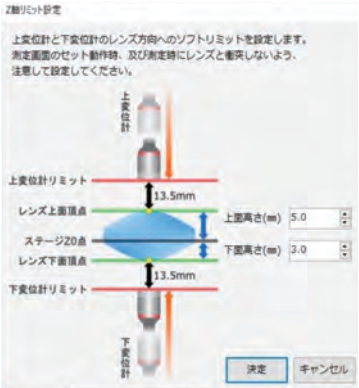
Sample centering correction function

In the case of a small diameter lens with a small radius, the reflected light may not return properly depending on the starting position of the scan. The stage side is equipped with a function to correct this slight misalignment.



Sample anti-collision software

Depending on the reflectivity of the sample, the displacement transducer may move abnormally close to the sample. To prevent this movement, the height information of the sample is input in advance to prevent collision of the displacement transducer.



Inspection certificate

The system can create a pass/fail judgment report for sample accuracy tolerance values required for production control.

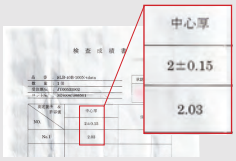
Comparison of ”contact” and ”non-contact” data

Measurement examples and data comparison

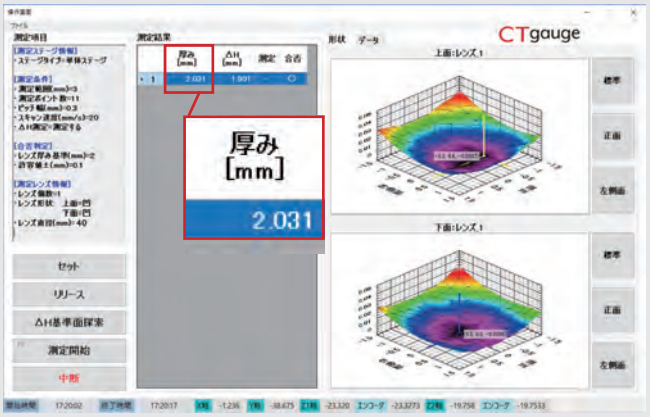
① Double concave lens

CT measurement conditions

Shape：Double concave lens ϕ40mm
Measurement range: 3mm square scan
Scan pitch: 0.3 mm
Number of points measured : 121 points
Measurement time: 15 seconds



Contact measurement data

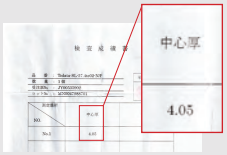


Contact measurement	: CT=2.03mm
Non-contact measurement (CT gauge)	: CT=2.031mm

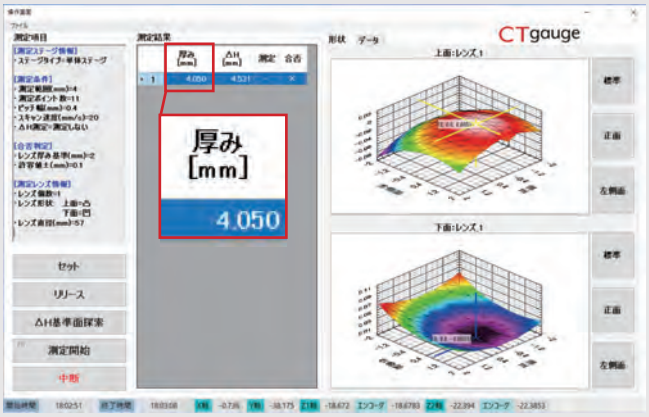
② Meniscus lens

CT measurement conditions

Shape：Meniscus lens ϕ57mm
Measurement range: 4mm square scan
Scan pitch: 0.4 mm
Number of points measured : 121 points
Measurement time: 17 seconds



Contact measurement data



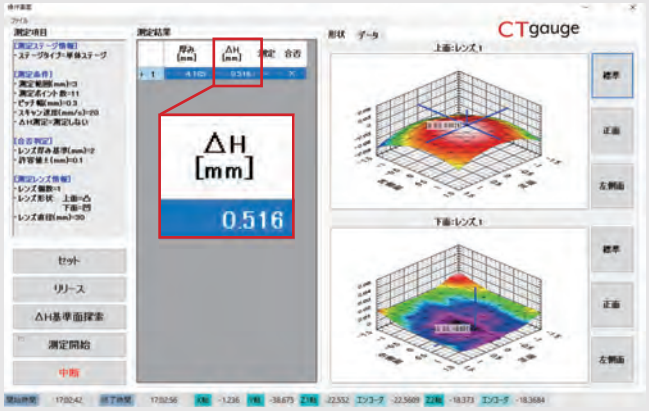
Contact measurement	: CT=4.05mm
Non-contact measurement (CT gauge)	: CT=4.050mm

③ ΔH measurement

CT measurement conditions

Shape：Meniscus lens ϕ27.8 mm
Measurement range: 3mm square scan
Scan pitch: 0.3 mm
Number of points measured : 121 points
Measurement time: 14 seconds


Zero reset



Contact measurement	: Sag=0.517mm
Non-contact measurement (CT gauge)	: Sag=0.516mm

Performance specification table

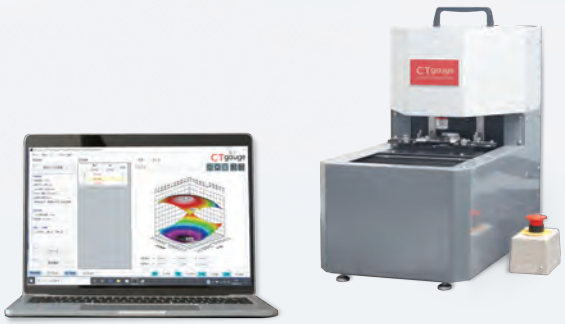
Item	Specifications
① Measurement lens shape	Convexity, meniscus (both spherical and aspherical)
② Measurement range (MAX)	Convex surface up to 50mm / Concave surface (including meniscus) up to 30mm
③ Measurement range (MIN)	Up to 90 μm
④ Measurable ϕ	10 to 100 mm (ϕ10 or less can be handled with a dedicated holder)
⑤ ΔH	Up to approx. 10 mm
⑥ Measurement accuracy (precision)	<±2μm compared to the steel ball master instrument
⑦ Measurement accuracy (repeatability)	Variation in 25 measurements <±2 μm
⑧ Equipment dimensions (main unit)	W 295xD505XH503(mm)
⑨ Equipment dimensions (control box)	W220xD480XH508(mm)
⑩ Displacement Gauge	CL-3000 Multicolor Laser Coaxial Displacement Transducer manufactured by Keyence Corporation
⑪ Weight	Main unit (approx. 33kg) + Electrical box (approx. 25kg) Total: approx. 58kg
⑫ Power consumption	6A/600W

*Steel ball master sold separately (1", 1/2", with measurement data)

◆ Manufacturer

G-Freude Co., Ltd.

203 Itabashi Hilltop Mansion
2-20-5, Itabashi, Itabashi-ku, Tokyo 173-0004
Phone: +81-3-6905-7575 Fax: +81-3-6905-7576
URL: https://www.g-freude.co.jp



◆ Distributor

Nagata Co., Ltd.

Headquarters
2-4-15 Daiei-cho, Okaya City, Nagano 394-0025 Japan
Tel : +81 266-22-4592 (Main) Fax : +81 266-24-0317
Mail : inf@nagata-ss.co.jp

Tokyo Office
5-27-10 Owada-cho, Hachioji City,
Tokyo 192-0045 Japan
Tel : +81 42-631-1782 Fax : +81 42-631-1786

Utsunomiya Office
43-102 Hiraide-Kogyo-Danchi, Utsunomiya City,
Tochigi 321-0905 Japan
Tel : +81 28-613-0255 Fax : +81 28-613-0277

Osaka Office
Shinko Kensetsu bldg. 405, 2-11 Kaimei-cho,
Amagasaki City, Hyogo 660-0862 Japan
Tel : +81 6-6430-0125 Fax : +81 6-6430-0135

Oita Office
4-1 Kitaju, Beppu City, Oita 874-0845 Japan
Tel : +81 977-76-8201 Fax : +81 977-76-8202

Nagata (Hong Kong) Co., Ltd.
Ctr.,2-16 Kwai Fung Crescent, Kwai Chung, NT, HK
Tel :+852 2614-7755 Fax : +852 2614-7767
Mail : info@nagata.com.hk

Nagata (Shanghai International) Trade Co., Ltd.
Hankou Road,Huang Pu Dist. Shanghai
Tel :+86 21-6360-1527 Fax : +86 21-6360-1608
Mail : ekinlin@nagata-ss.co. jp / liupeisheng@nagata-ss.co. jp

Indonesia Jakarta Office
Jl. Raya Sukabumi, Ciawi, Bogor, Jawa Barat, Indonesia
Tel :+62 812-941-0760
Mail : shimazu@nagata-opto.co.id