KEYENCE

NEW **Wide-Area 3D Measurement System**
VR Series

Form, Contour, and Roughness Measurements in as Little as 1 Second

3D imaging & measurement with a single device

NEW

Wide-Area 3D Measurement System
VR Series

5× greater scan range

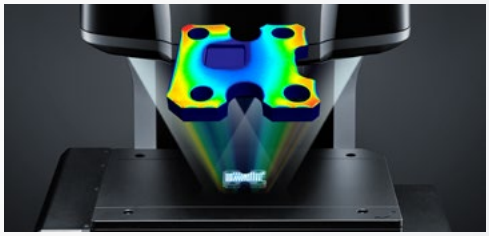
Non-contact, wide-area measurement

Large measurement range covers 200 (L) × 100 (W) × 50 (H) mm
7.87"(L) × 3.94"(W) × 1.97"(H)

4× faster than conventional systems

High-speed data acquisition and analysis

Scan and measure a surface in as little as 1 second



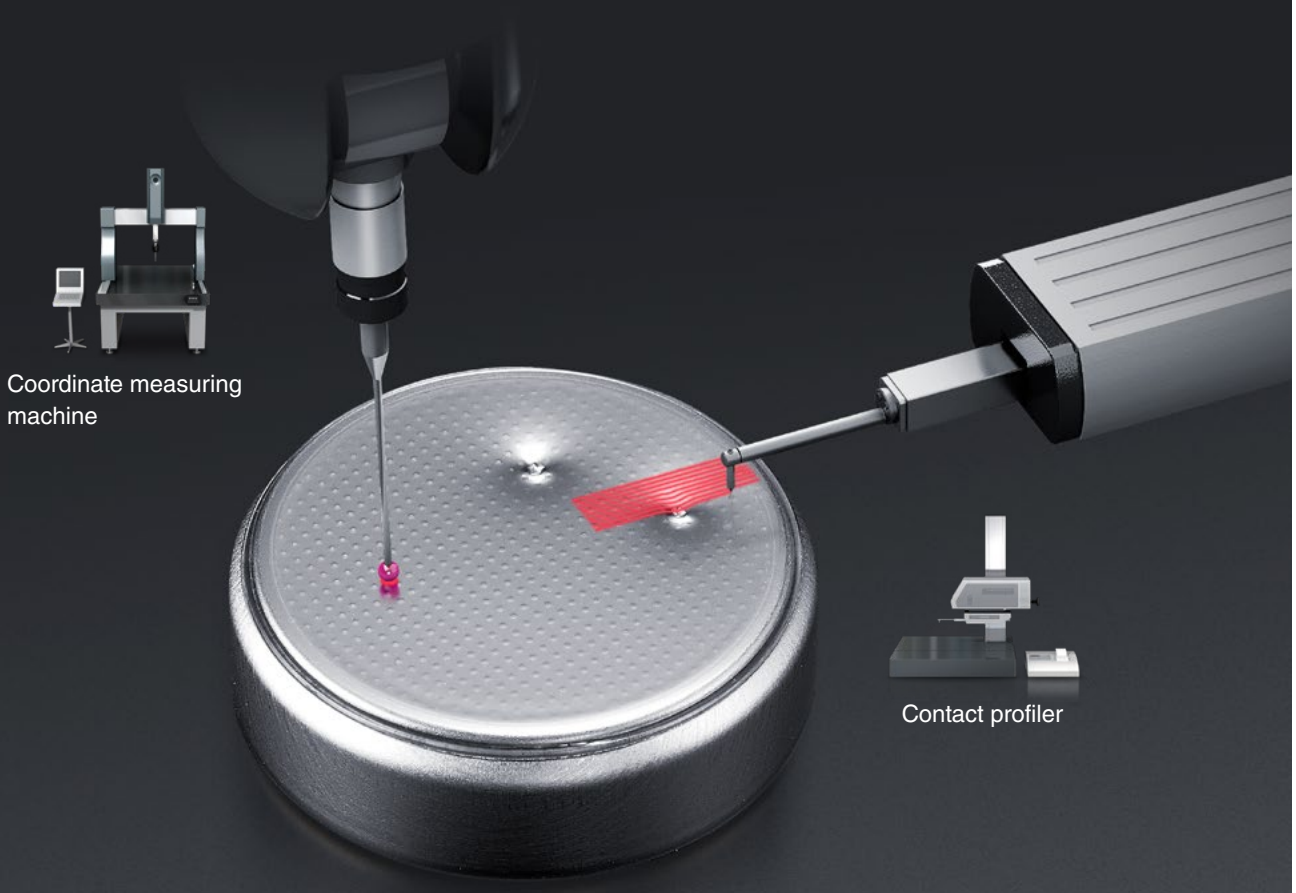
Industry's first

Automatic operation with place-and-measure capability

Automatically identifies and adjusts measurement settings based on object size

Contact-based measurement

Typical measurement systems only provide measurement data on the areas
that they are able to contact with a probe tip.
Measuring specific locations by simply eye-balling where to put the probe makes the results unreliable.
Data is limited to points or lines.

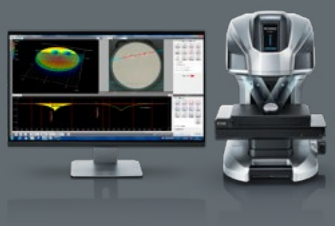


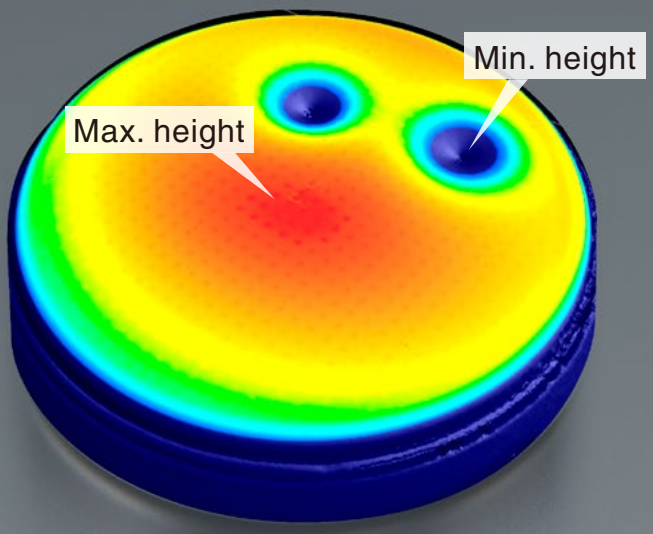
Ex.: Depressions on a button battery

- Measurement of specific areas is difficult
- Measurements take a long time
- Measurement results vary from person to person

Non-contact surface measurement

The VR Series Wide-Area 3D Measurement System quickly scans an entire surface
for reliable measurement of any point on the object.
A dense data set is captured over an entire area.

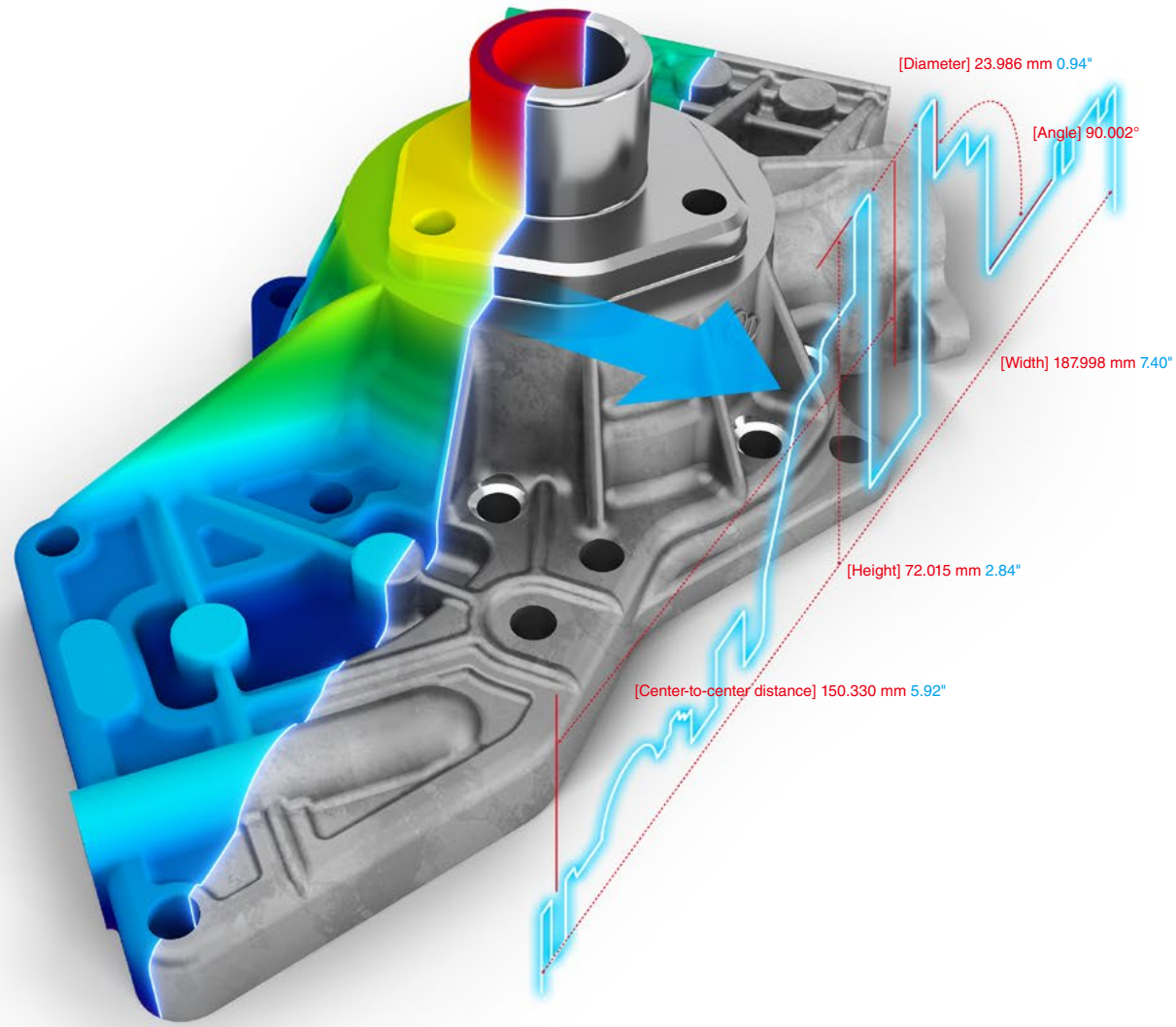




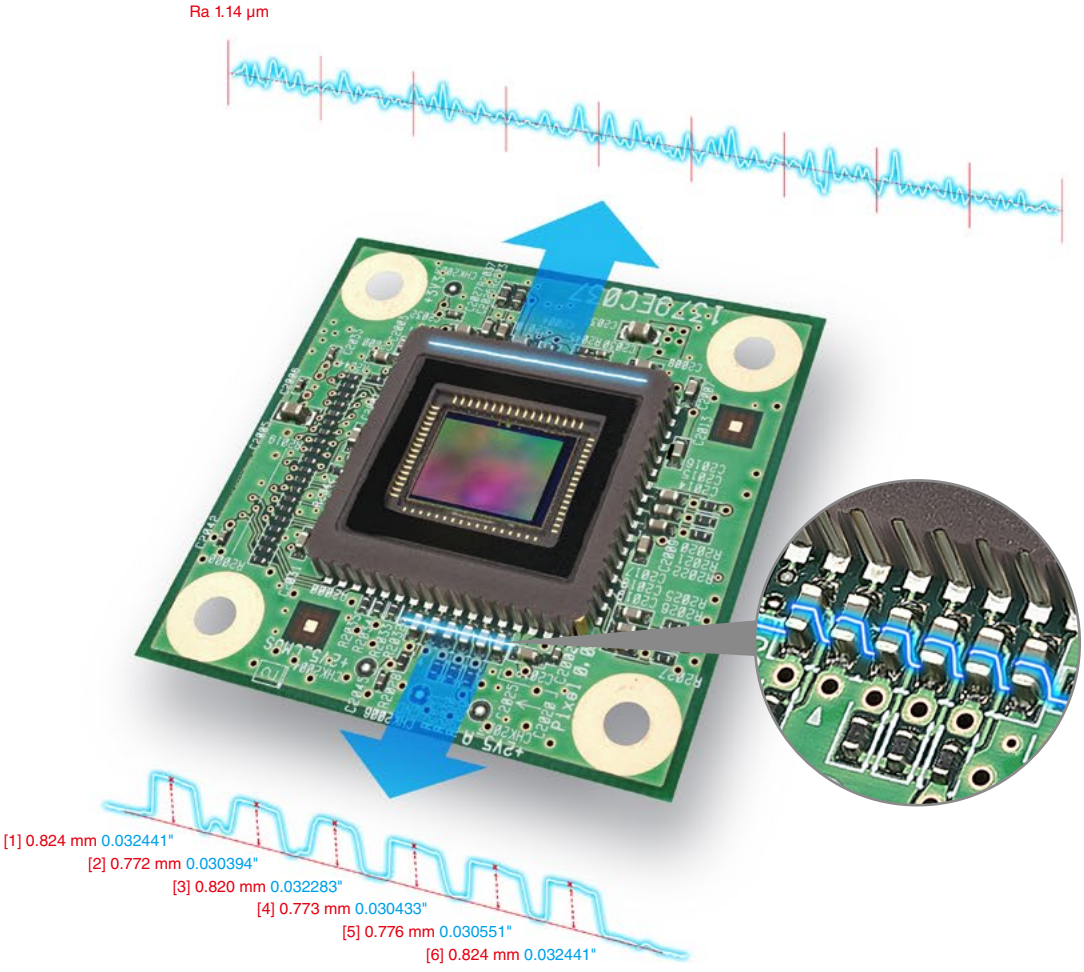
- Max and min heights can be reliably measured
- Scans in as little as 1 second
- Repeatable and reproducible measurement results

Detect 1 µm changes over a 200 mm 7.87" area

Measure 3D surface changes over a large area

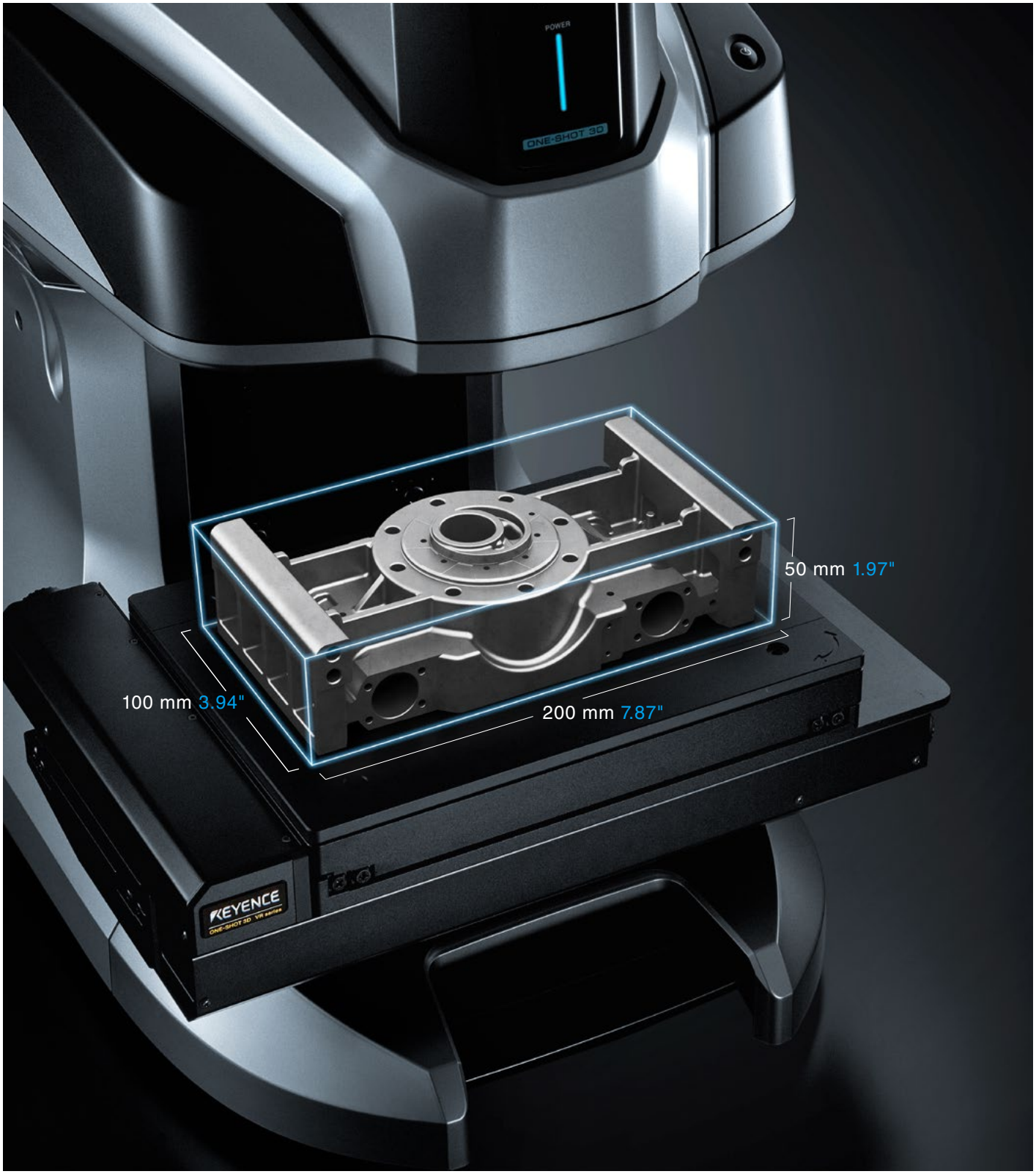


Measure complex shapes and roughness



5× greater scan range

Measurement area up to 200 × 100 × 50 mm 7.87" × 3.94" × 1.97"

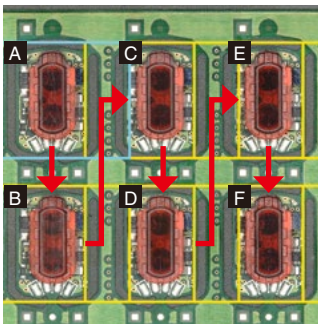


5× the measurable height range of conventional systems

Measurement is possible for targets up to 50 mm 1.97" tall —five times that of conventional systems. Measurement can be done on a wide range of targets including screws, electronic components, non-flat castings, and assembled products.

Measure multiple targets simultaneously

With a 200 × 100 mm 7.87" × 3.94" measurement range, multiple objects can be placed on the stage and measured at the same time. The VR Series can also be used to measure a tray of parts, as well as equidistant pins or holes. Automating both the data acquisition and analysis in this way dramatically improves productivity.



Electronic PCB

Product	Height (mm inch)
A	2.562 0.1009"
B	2.555 0.1006"
C	2.371 0.0933"
D	2.489 0.0980"
E	2.511 0.0989"
F	2.609 0.1027"

Proprietary sensing technology for high-accuracy measurement

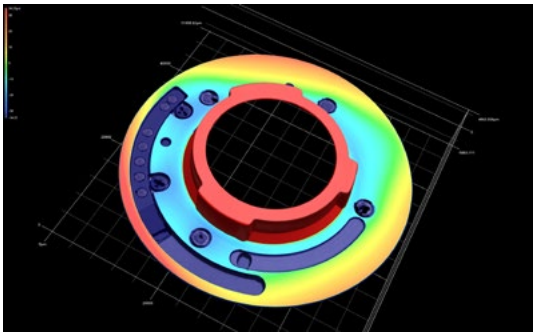
To ensure high measurement accuracy, the stage is equipped with a high-precision linear scale and a proprietary sensor. By eliminating influence from various environmental factors such as temperature changes or tilting due to load weight, the VR series ensures constant measurement quality regardless of the user.

4× faster than conventional systems

Unprecedented surface analysis in as little as 1 second

High-density 3D data

Each scan from the VR contains nearly 800,000 data points to help users to quickly visualize a surface in 3D, while conventional contact-based systems can easily miss small surface changes. Complex shapes can be more accurately analyzed for more thorough evaluation.



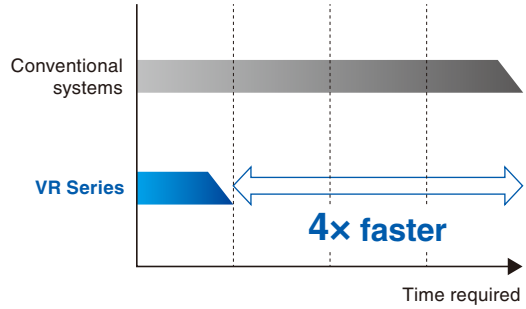
Lens mount

Unprecedented speeds with measurements in as little as 1 second

With unmatched measurement speed, the VR Series can process substantially more samples, reducing work hours. This also leads to improvements in measurement quality, improved allocation of personnel and resources, and an increase in production performance. Measurement tasks can be performed faster and more efficiently, including evaluations of prototypes and inspections before shipment.

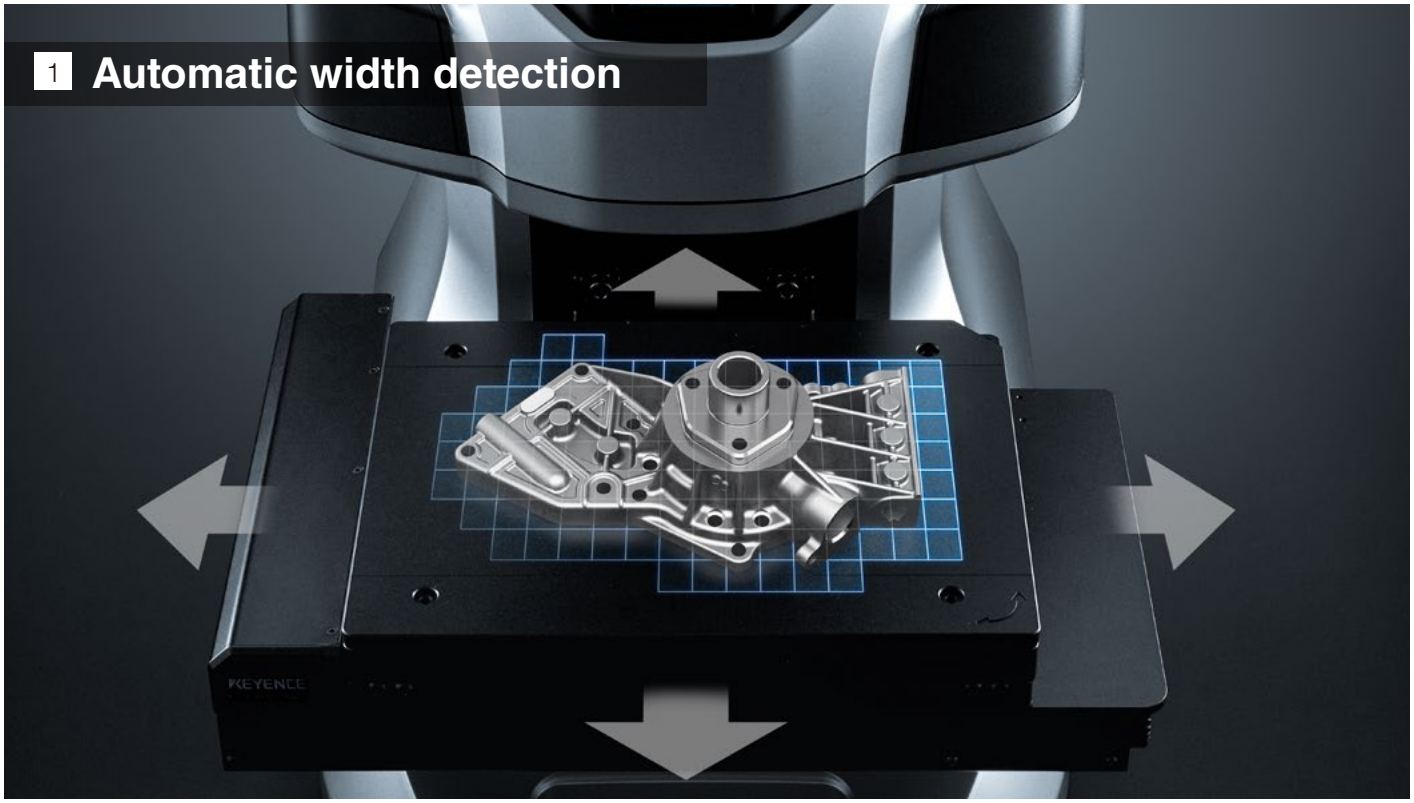
Quick measurement for stress-free operation

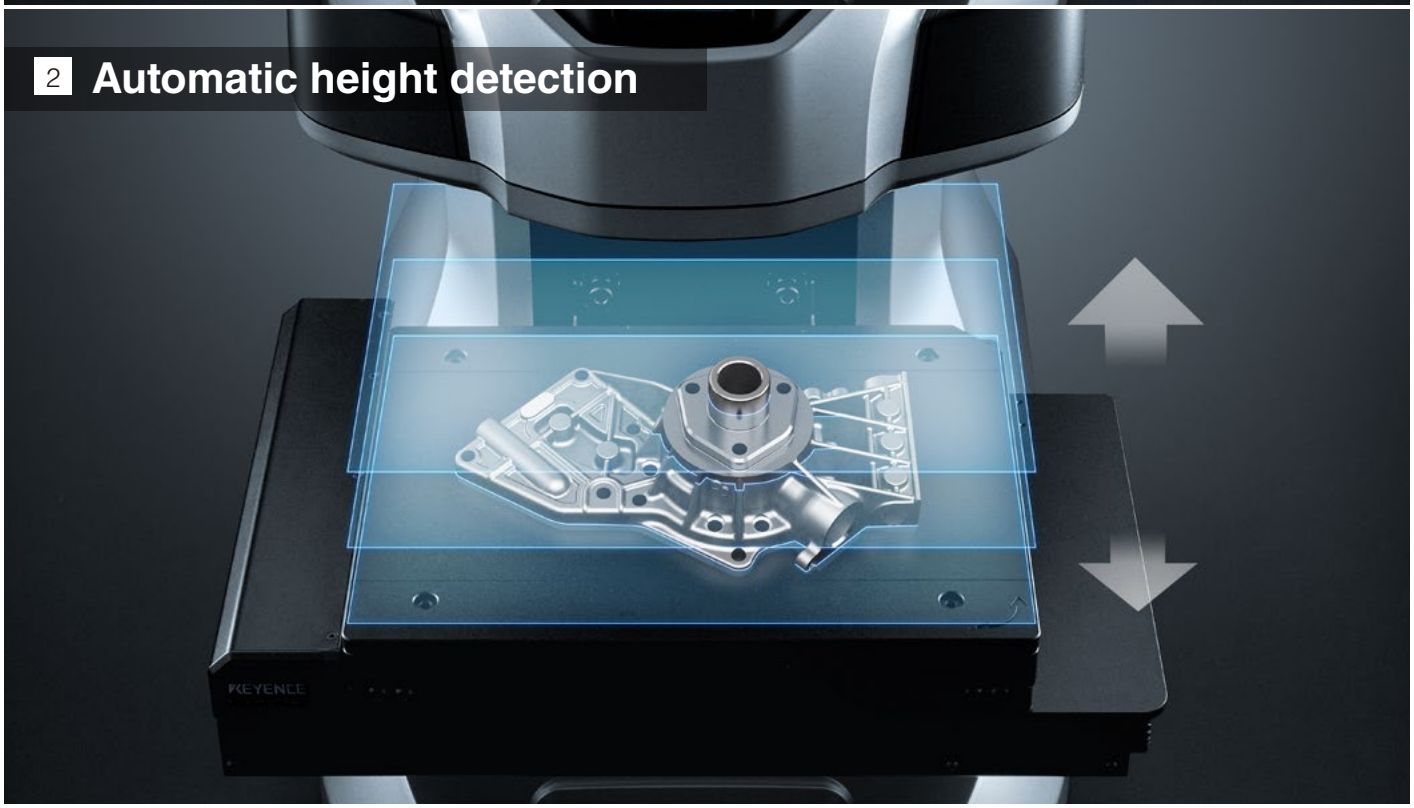
When it comes to performing measurements, users want results as quickly as possible. With this in mind, KEYENCE designed the VR Series with a focus on measurement algorithms and hardware, resulting in measurements in as little as 1 second. The stage also offers improved travel speeds for a greater reduction in overall operation time.



Industry's first

User-free measurement configuration [Smart Measurement]





Placement without the need to worry about orientation

The VR Series is able to automatically accommodate for object rotation and tilt. Users can simply place the sample on the stage and click a button to start the measurement process.

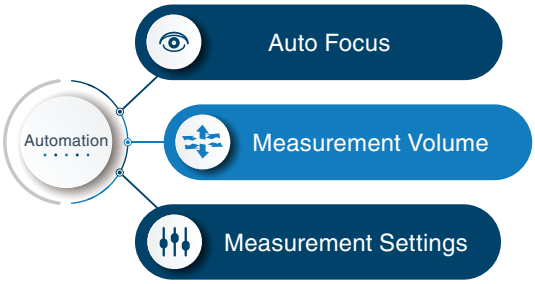
Automatically adjusts measurement range based on object size

The VR Series automatically recognizes the width and height of the target in order to automatically set the optimal measurement range. By eliminating the need to set measurement length, height range, and other aspects required with general measuring instruments, the VR Series ensures mistakes, such as failing to measure a certain part of the target, do not occur. Once a target is placed, the motorized stage moves automatically to complete the measurement.

*Stitching along the XY axes requires the VR-H3J software.

Optimum brightness and focus positioning eliminates human error

With the VR Series, everything is configured automatically to suit the target, from the selection of the optimum brightness and measurement mode to focus positioning. Measurement itself is done with the click of a button, ensuring that even new operators can measure without issue.

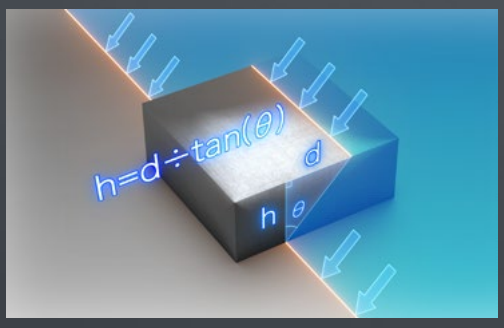


High-accuracy 3D measurements

Measurement principle

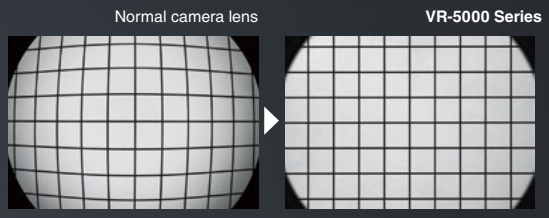
Light-section method

Structured light is emitted from the transmitter lens and projected onto the surface of the object. The reflected light is then detected by the receiver lens and will appear banded and bent based on changes in the topography of the surface. Triangulation is then used to calculate and measure the height of the surface.



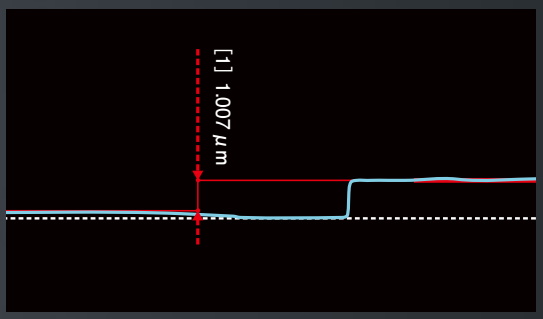
High-precision telecentric lens

To enable high-accuracy measurements throughout the field of view, the VR Series uses a telecentric lens with extremely low lens aberration. Objects can be captured as they actually appear and at their actual size, ensuring high measurement accuracy anywhere on the screen.



Measure height differences down to 1 µm

Based on the light-section method of measurement, the VR Series calculates data down to 1 pixel or less using proprietary light projection patterns. This results in highly accurate, ultra-precise measurement. The VR Series' ability to accurately measure height differences of only 1 µm has been confirmed through measurement of a calibrated height difference gauge.

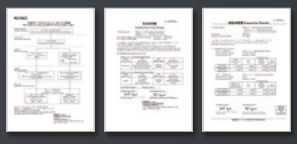


1 µm height difference gauge

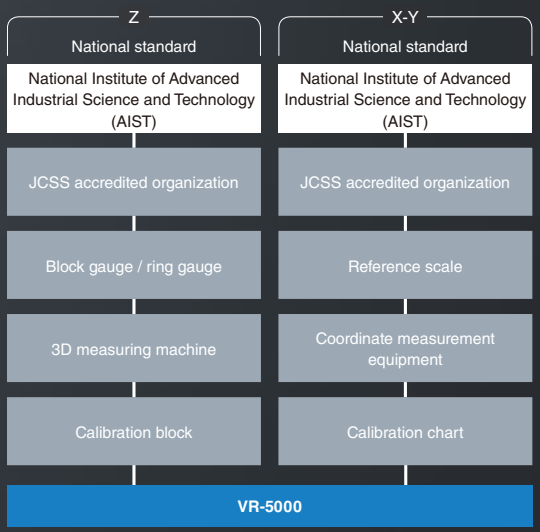
XYZ traceability

The measurement results are traceable according to international standards, so users can obtain highly-reliable measurements.

Calibration



The calibration gauge uses the same reference scale used by JCSS certified operators. Instead of hiring a technician to perform calibration, users can easily do it themselves on-site.



What makes accurate and repeatable measurements possible

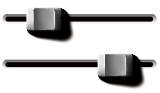
Contact profile measurement systems present a variety of problems

Many pre-measurement tasks

1 **Probe selection**

2 **Target placement**

3 **Parameter selection**

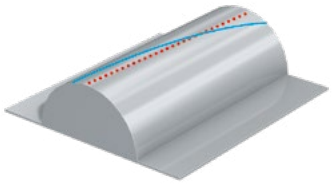


Measurement

Low measurement reproducibility

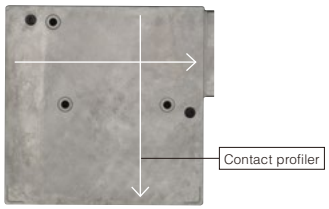
Probes cannot always measure as intended

From straight lines along the center of a cylinder or curved surface to lines passing through the center of a circle, ensuring a probe moves as intended is often a difficult task. Such deviations in the point of measurement can result in subtle variations in measured values.



Measurement is performed only at the point of contact

For any areas the probe doesn't pass over, knowing the actual appearance or shape is impossible. Even measuring across multiple locations would still not be representative of the true shape of the part.



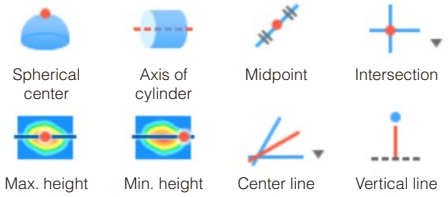
Few pre-measurement tasks

Just place the sample and press the button

High measurement reproducibility

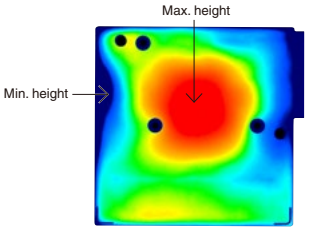
Measure at any location

The use of assist tools makes it possible to create reference points and lines to prevent variations between users. With the VR Series, all users are able to measure the same location as intended.



Obtain shapes from the entire field of view

The VR Series' ability to capture the shape of an entire surface ensures measurement over the entire field of view with no missing points. Averages can also be calculated from the measured values of the overall shape, resulting in greater stability.

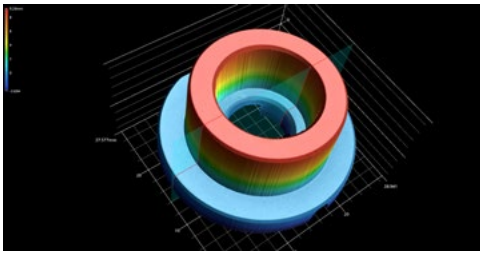


Wide-Area 3D Measurement System VR Series

The best features of multiple measuring systems in one device

Contact profiler

Profile measurement

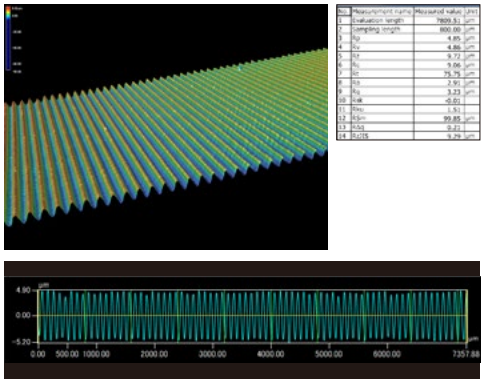


Cut metal piece

By measuring the 3D shape of a target, the VR Series is able to measure the height, width, angle, and radius from the cross-sectional shape. In addition, the non-contact design enables measurement of soft objects such as rubber and cloth products.

Roughness meter

Line roughness measurement

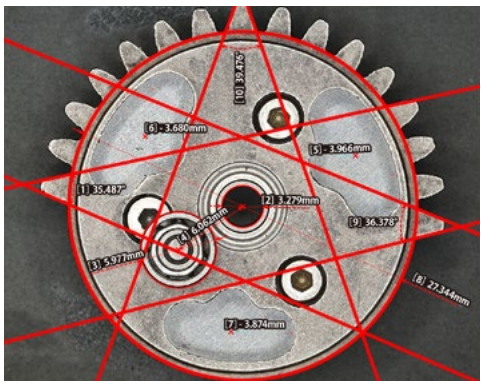


Standard roughness piece

Roughness measurement results conform to ISO 4287 requirements. Measurements along a circular profile or non-uniform surface are also possible.

Optical comparator, measuring microscope

2D measurement

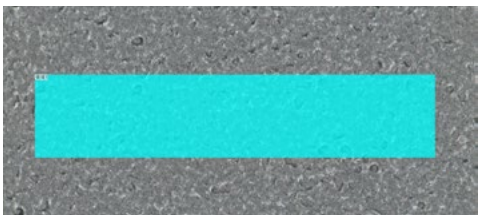


Metal gear

The VR Series measures the XY dimension while viewing the target from directly above. Height measurements can also be obtained as with a height gauge.

Laser microscope

Surface roughness measurement



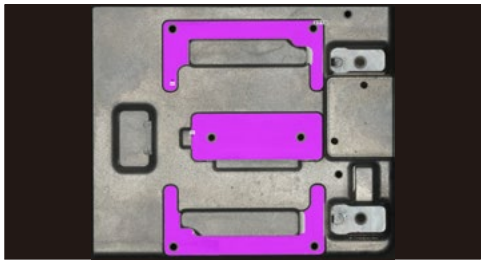
	Sa	Sz	Str	Spc	Ssk	Sku	Spk	Svk
	um	um		1/mm			um	um
Max.	1.553	16.13	0.886	1.467	0.572	5.546	2.497	1.881
Min.	1.396	10.23	0.567	1.467	0.063	2.582	1.663	1.519
Ave.	1.475	13.18	0.726	1.467	0.318	4.064	2.08	1.7
Std. DV	0.079	2.95	0.16	0	0.255	1.482	0.417	0.181
Area1	1.396	16.13	0.886	1.467	0.572	5.546	2.497	1.881
Area2	1.553	10.23	0.567	1.467	0.063	2.582	1.663	1.519

Textured surface

Measure surface roughness in accordance with ISO 25178. Because measurement is performed using a large number of data points, measurement results are more stable.

3D measuring machine

Height difference and flatness measurement



	Max. height	Min. height	Max.-Min.
	mm	mm	mm
Area 1	0.205	-0.07	0.275

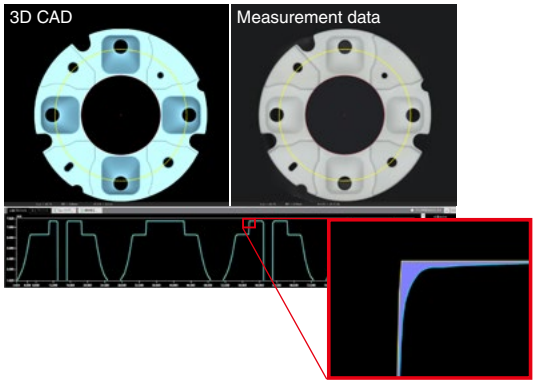
Cutting surface of casting

Height and angle differences between two surfaces can be measured in one shot using 800,000 data points. The height data from the specified surface can also be used for flatness measurements.

3D scanner

Comparative measurement

*VR-H3CA (optional)

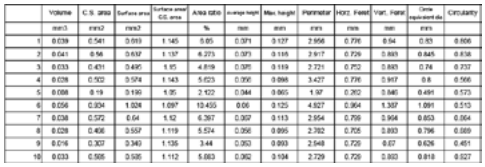


Resin molded parts

Comparison of two different sets of 3D data is possible, such as non-defective and defective workpieces, or CAD data and prototypes. This comparison makes it easy to see height differences and overall surface displacement.

3D scanner

Volume and area measurement



Resin markings

Using height data, a target's volume and area can be measured. Counting the number of uneven surfaces is also possible with a certain height specified as the threshold.

Microscope

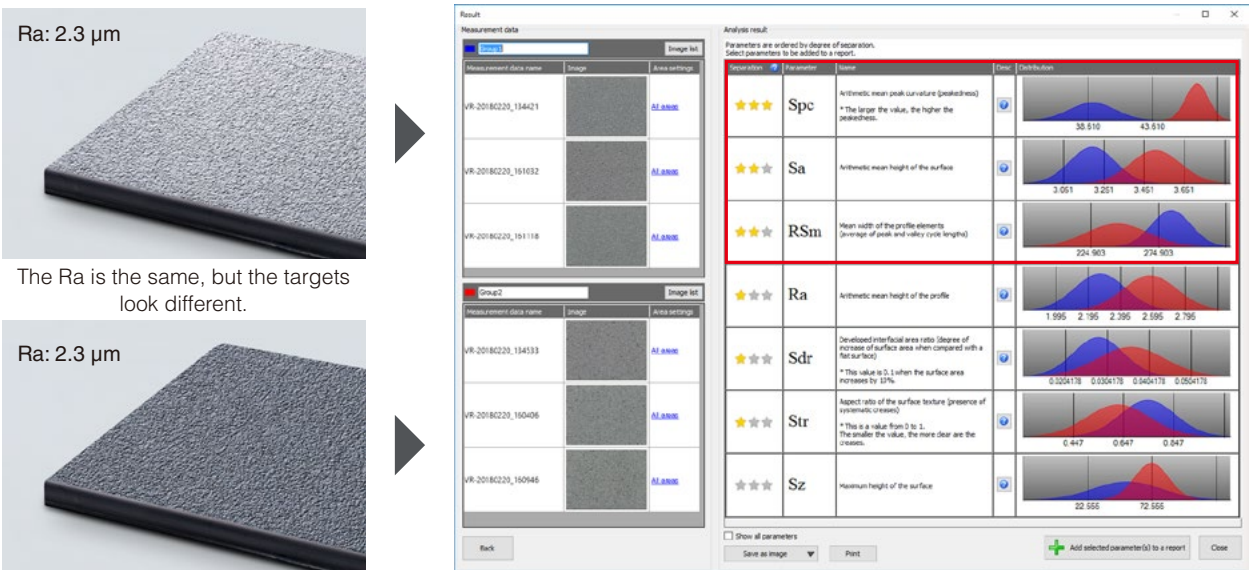
High-magnification observation

Electronic PCB

View objects at up to 160× magnification. The VR Series features an HDR function and a Depth Composition function that allows users to capture images with greater detail and focus.

Quickly measure and compare roughness

Parameter suggestions



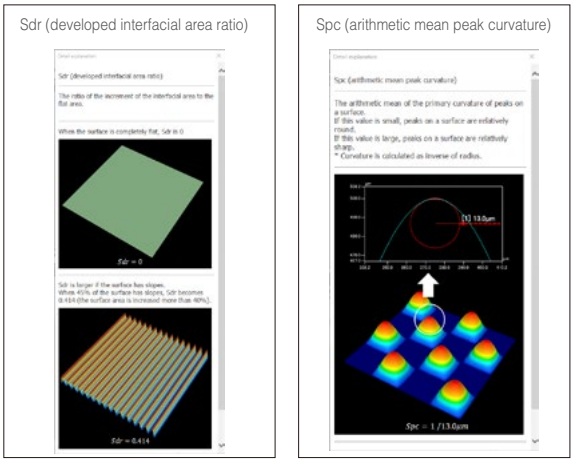
The Ra is the same, but the targets look different.

The VR Series is capable of automatically comparing and analyzing multiple data sets to determine which roughness parameters differ the most between surfaces. Data is displayed graphically and a help section for each parameter is displayed to assist users that are unfamiliar with less frequently used parameters.

Supports 42 ISO roughness parameters

The VR Series supports 42 different ISO-based parameters. Knowing the differences in parameters makes discovery of the cause behind defective parts easier as well as allowing for a new quality control index to be set in place.

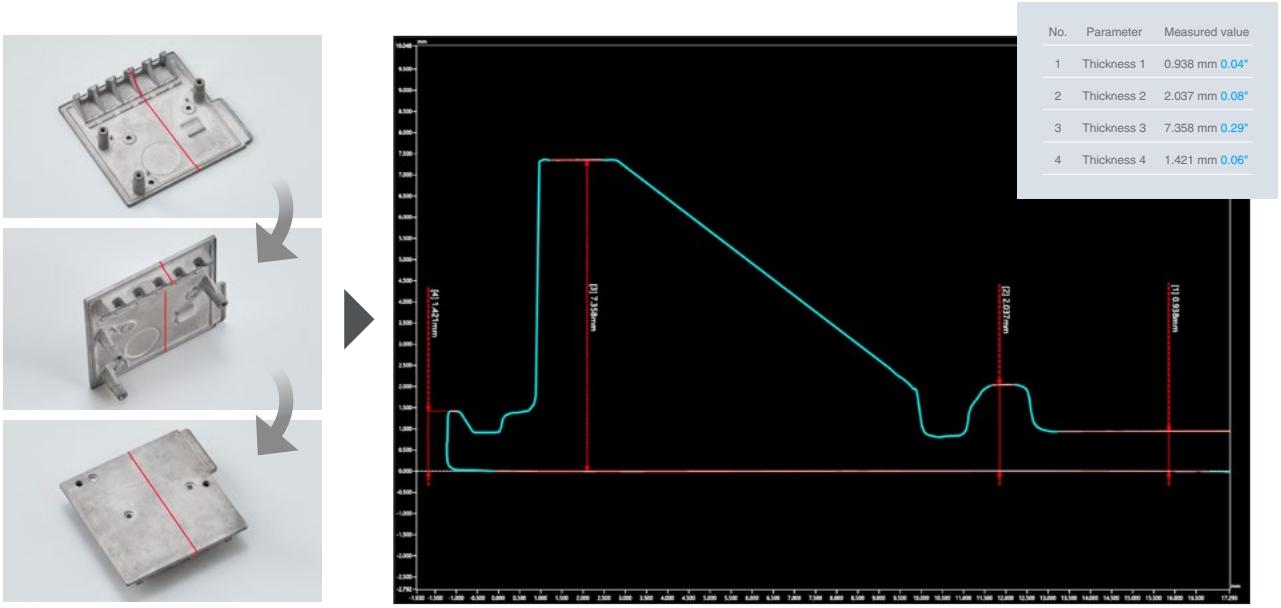
Easy-to-understand explanations even for users with no detailed knowledge of roughness



The VR Series makes it easy to work with unfamiliar roughness parameters. With just a single click, users are able to bring up an explanation for any given parameter. This ensures easy understanding of the analysis results even for those who are not familiar with roughness.

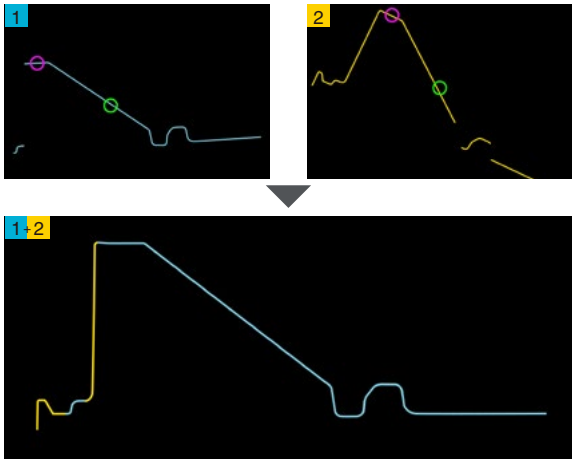
Non-contact measurement of wall thicknesses

Profile composition function *VR-H3W (optional)



Profiles from different angles can be combined, allowing for measurement as a single piece of data. This makes it possible to measure the thickness of objects as well as the shape of undercuts that could otherwise not be seen when viewed from directly above.

High-accuracy composition process with intuitive operation



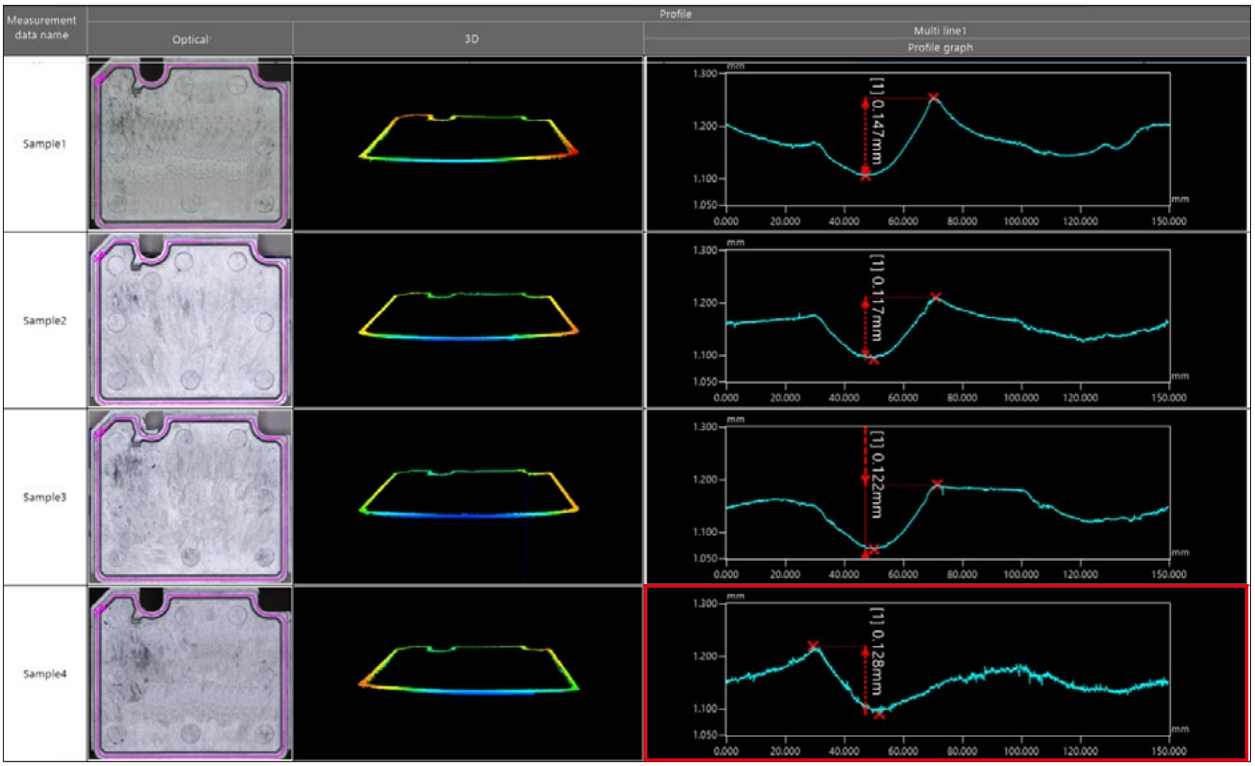
The VR Series is able to generate a composite profile line simply by specifying two identical locations from each set of data. With no complicated operations, users are able to complete analysis easily.

Specially designed jig for part rotation

This special set of jigs can be used to secure and rotate various types of objects to assist with profile composition.

Batch analysis of multiple data files

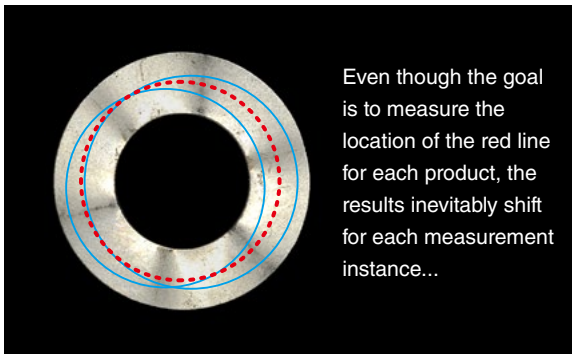
Multi-file analysis



With the VR Series, multiple measurement data points can be displayed in a list while simultaneously applying analysis to each data set. This greatly improves work efficiency when measuring a large number of targets, allowing users to see differences between the data at a glance.

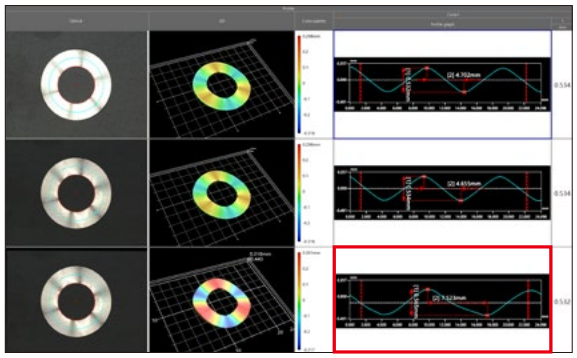
Clear differentiation between non-defective and defective parts

Problems with conventional equipment



Production problems give rise to the need for measurement and comparison of non-defective and defective parts. However, because the measurement location varies from one person to the next, accurate comparison is not possible.

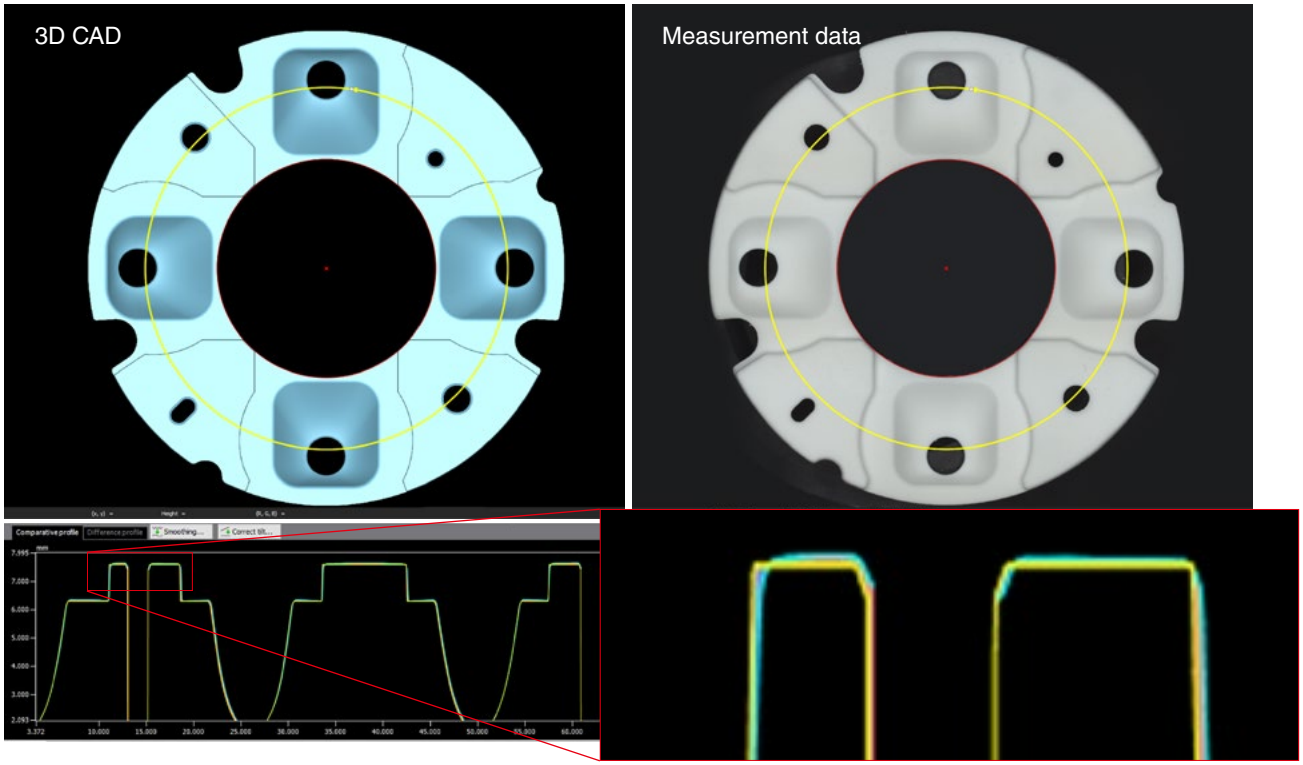
VR Series



Comparing targets in exactly the same measurement conditions with the VR Series makes it possible to see slight differences between the shape of a good and bad part.

Verification of product design

CAD comparative measurement *VR-H3CA (optional)



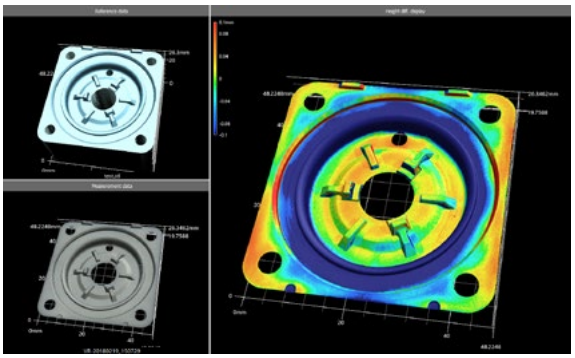
The VR Series lets users compare 3D scan and measurement data directly with a CAD file. Prototypes or other manufactured parts can be quickly evaluated to determine if the product meets design specifications.

Fast problem-solving through visual comparisons

Problems with conventional equipment

A water leak occurred inside the product, but the cause could not be identified by examining the seal surface. The measured values seem correct...

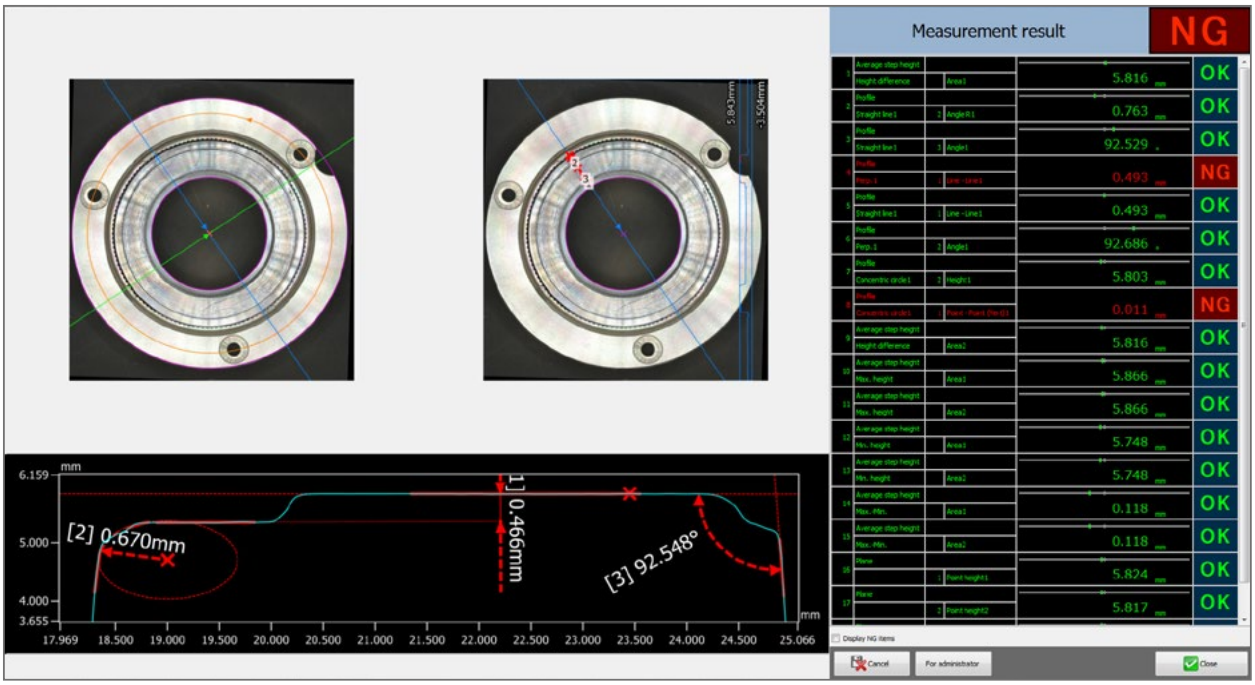
VR Series



The cause of the leak was not due to the shape of the seal surface but the deviation from the overall design. Visualization of the entire product allowed for better understanding of the situation.

Significant reduction in inspection time

Pass/Fail judgment function



By setting the measurement items and tolerances, users can obtain pass/fail inspection based on the measurement results. All of the pre-configured measurements are performed automatically just by placing the target and pressing a button.

Consolidate measurements into one device for major cost and time savings

Problems with conventional equipment

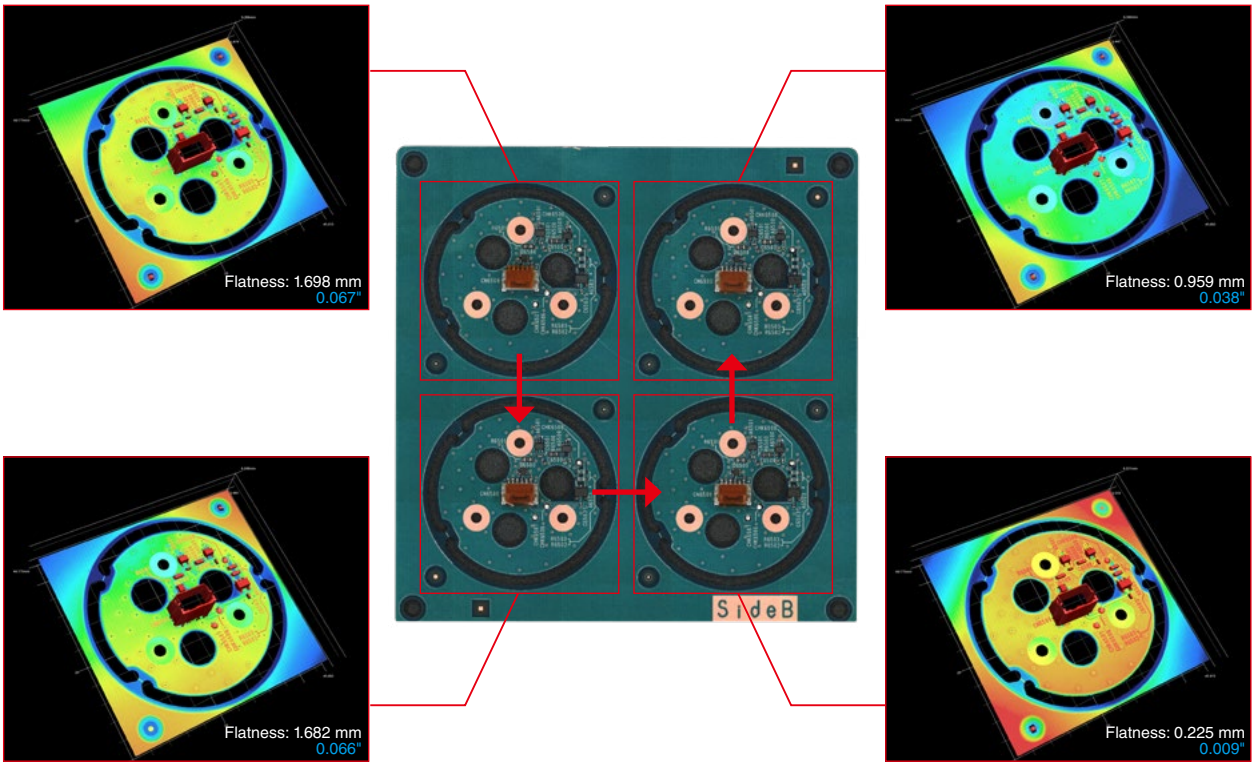
With conventional systems, each inspection item required a different measuring instrument, so follow-up measurements were troublesome. Moreover, because users must move back and forth between measuring instruments, inspection results had to be written on paper as they were obtained.

VR Series

With the VR Series, all inspections can be carried out using only one device, thereby greatly reducing measurement times. Moreover, the same results can be obtained regardless of the user.

Fully automatic inspection with no programming required

Multi-area inspection mode



Even for products with a large number of inspection points, users can configure the order in which the points should be measured to allow for automatic measurement. This minimizes the effort required for each inspection, creating an efficient workflow without the need for experienced inspection staff.

Reduced inspection time increases production efficiency

Problems with conventional equipment

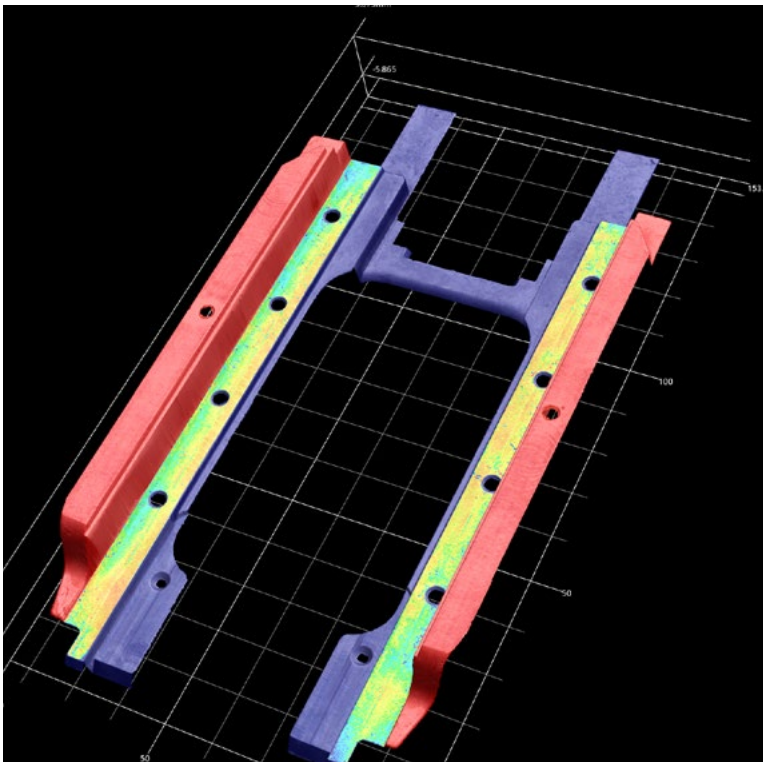
When using conventional systems, inspectors have to measure products one by one. An increase in products resulted in an increase in inspection staff. Nevertheless, inspections still take time, and mistakes are common.

VR Series

Thanks to the VR Series' ability to measure products automatically on a tray or pallet, almost no manual labor is required. The shorter inspection times allow for increased production.

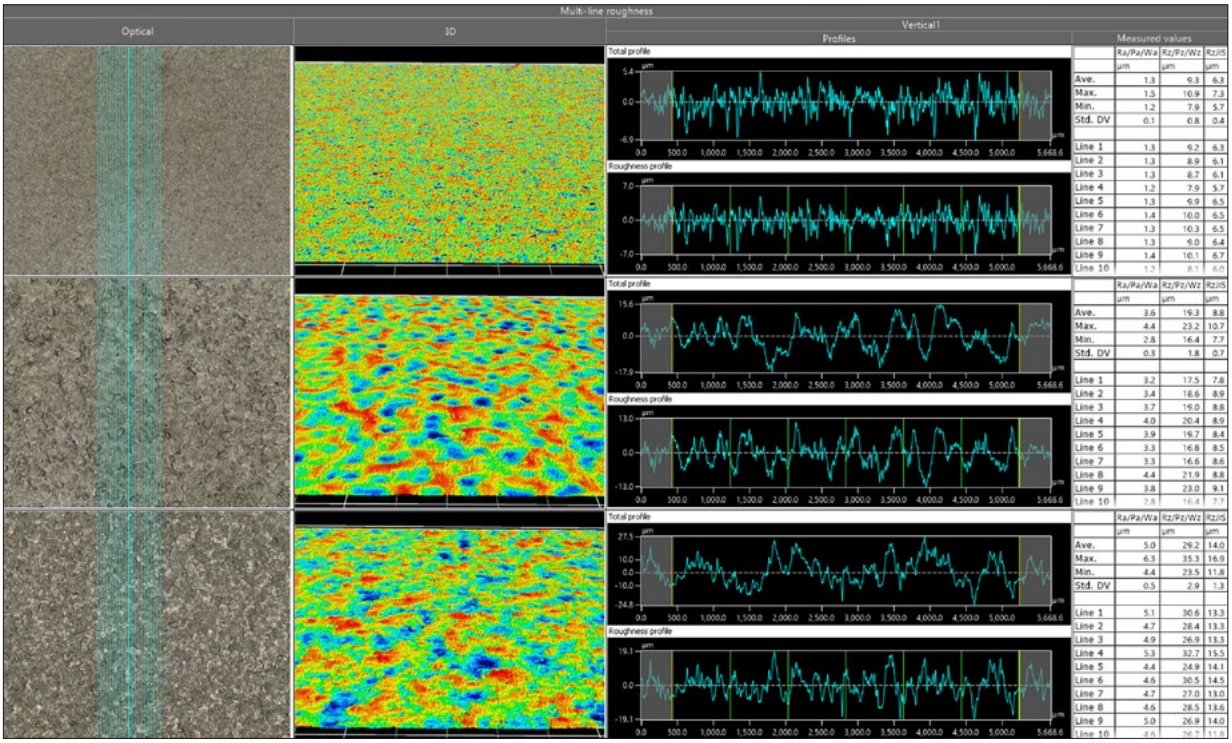
Application Examples

Automotive and Metal Industries

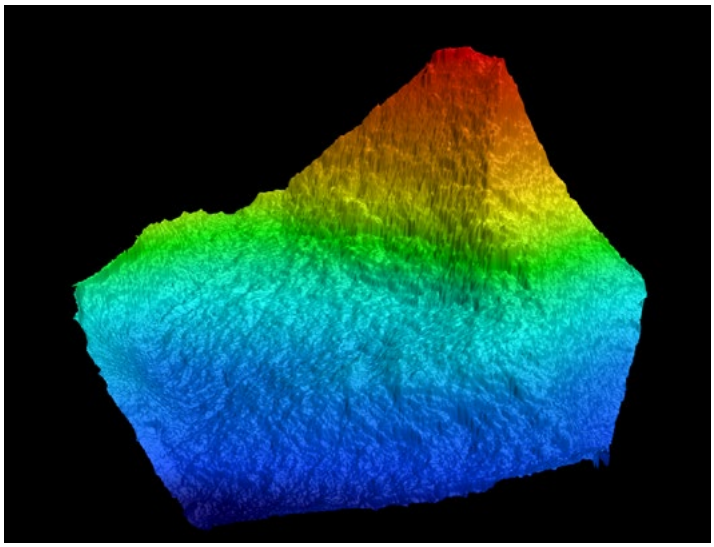


	Measured value	
Max. height (△)	0.028 0.0011"	mm inch
Min. height (▽)	-0.023 -0.0009"	mm inch
Max. - Min.	0.052 0.0020"	mm inch

Cut metal surface (flatness of mating surface)

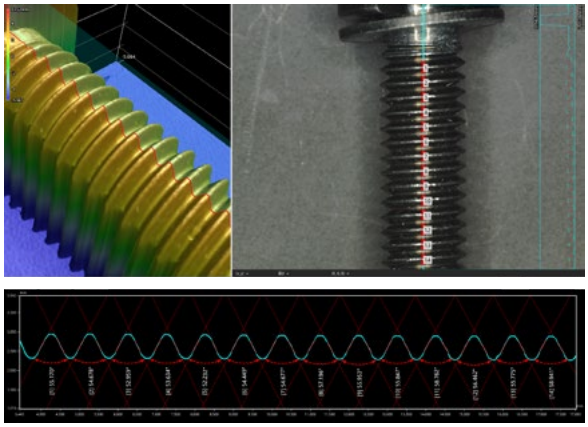


Shot blasted surface (roughness evaluation)

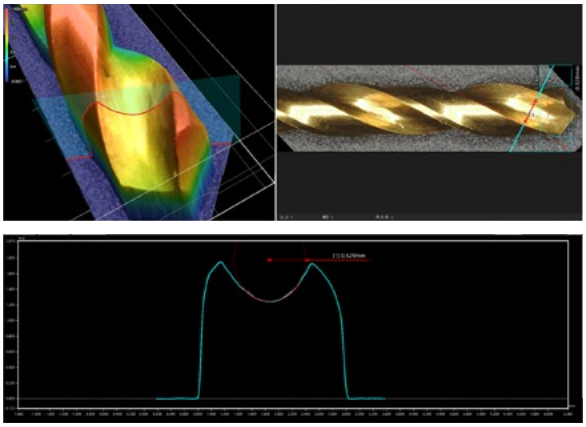


	Volume	Cross sectional area	Surface area
	mm^3	mm^2	mm^2
Total	32.9645	21.0559	34.4040

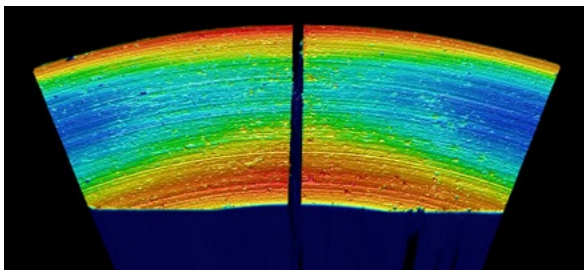
Metal fracture surface (surface area and volume analysis)



Threads (thread angle)

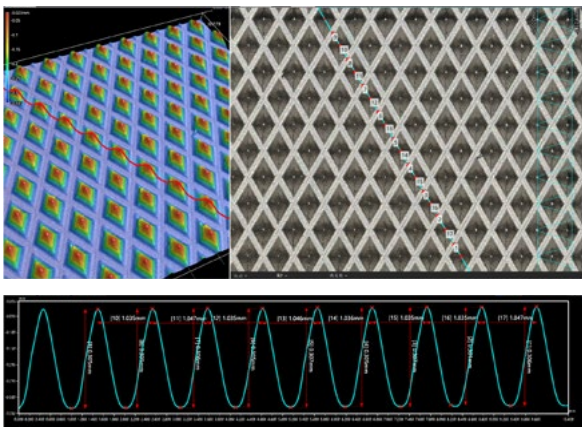


Drill (rake surface shape)



Area name	Average height	Max. height	Min. height	Max. - Min.
Unit	mm inch	mm inch	mm inch	mm inch
Brake surface	-0.234 -0.009"	0.085 0.003"	-5.478 -0.216"	5.563 0.219"

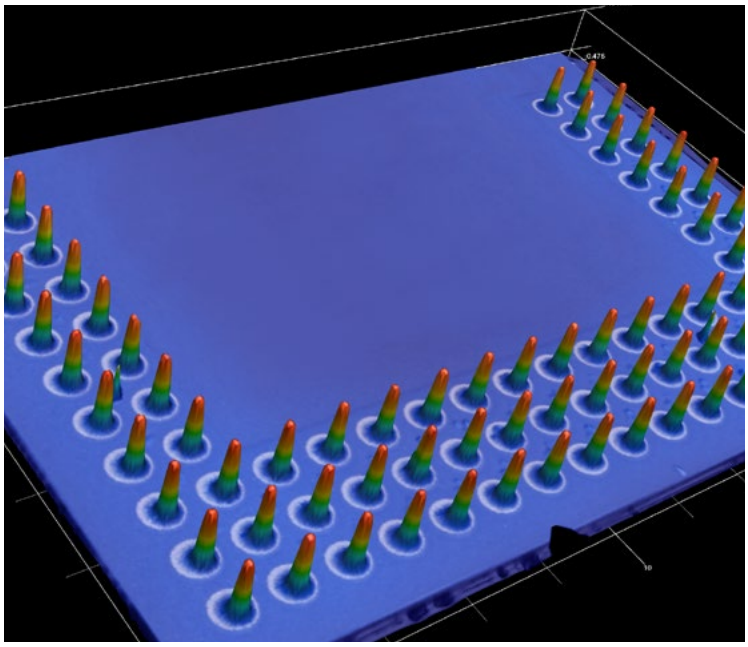
Brake pads (flatness)

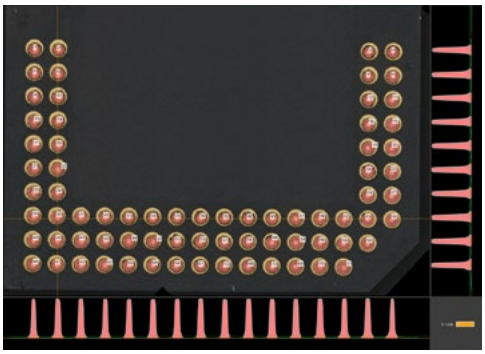


Knurled surface (peak height and pitch measurement)

Application Examples

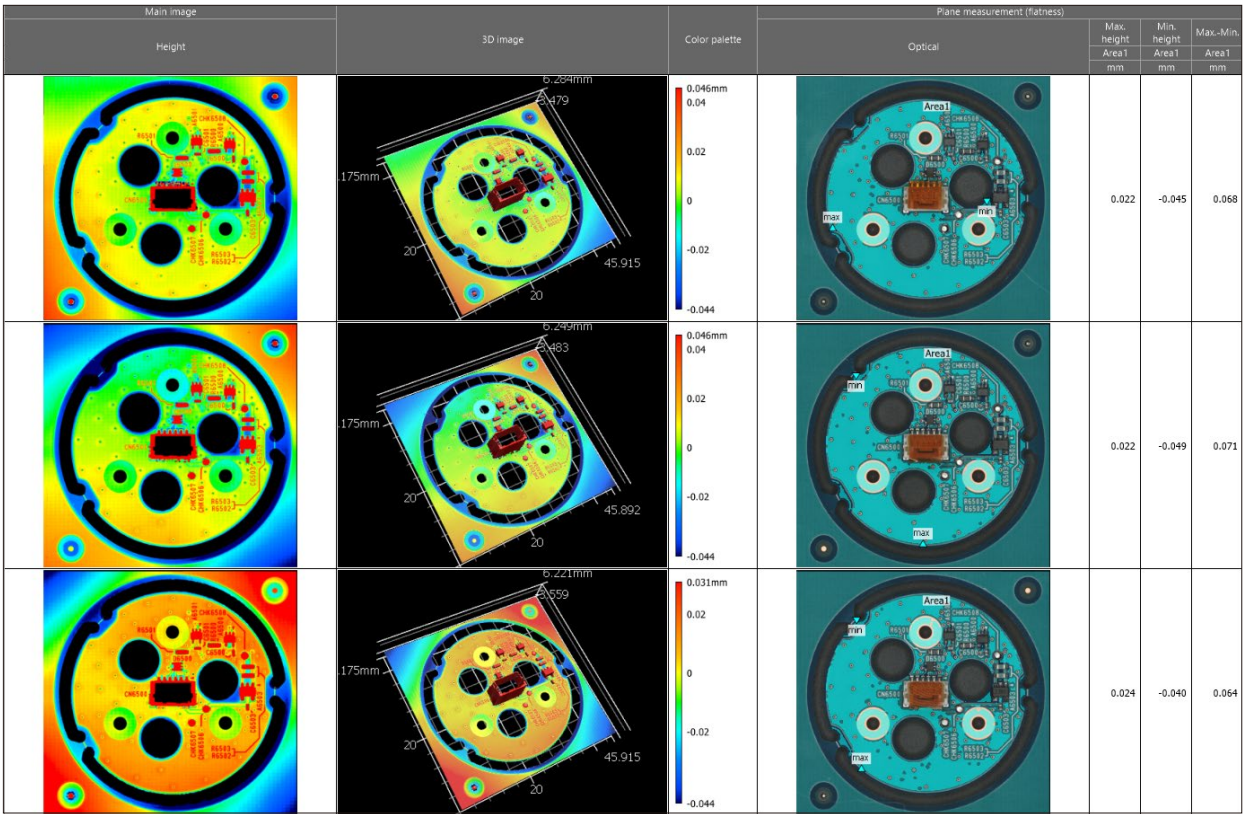
Electrical Devices and Electronics Industries



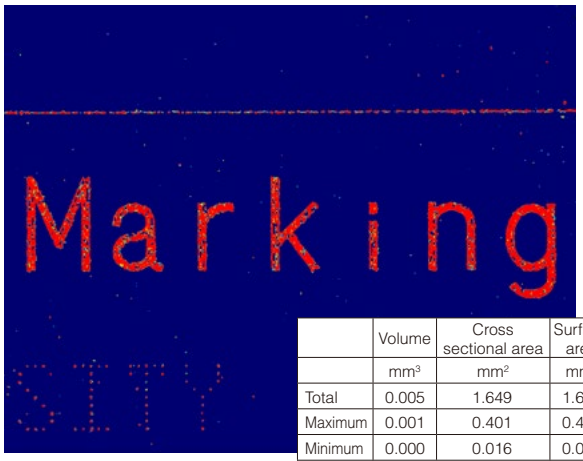


	Volume	Cross sectional area	Surface area	Area ratio	Max. height
	mm^3	mm^2	mm^2	%	mm inch
Total	10.022	21.786	114.813	6.206	102.885 4.0506"
Maximum	0.151	0.4	1.737	0.114	1.431 0.0563"
Minimum	0.127	0.232	1.479	0.066	1.39 0.0547"
Average	0.137	0.298	1.573	0.085	1.409 0.0555"
3σ	0.019	0.111	0.163	0.032	0.029 0.0011"
1	0.144	0.273	1.62	0.078	1.414 0.0557"
2	0.134	0.258	1.536	0.074	1.397 0.0550"

PGA (simultaneous height and count measurement)

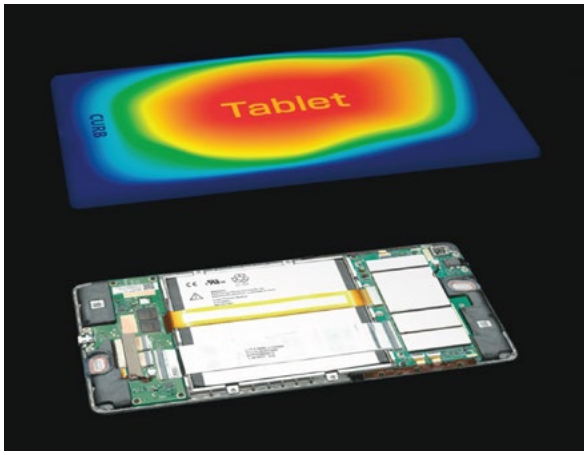


Electronic PCB (curvature/flatness measurement)

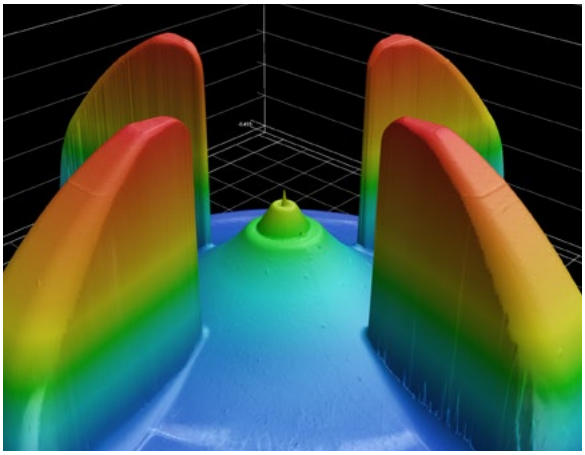


	Volume	Cross sectional area	Surface area
	mm^3	mm^2	mm^2
Total	0.005	1.649	1.664
Maximum	0.001	0.401	0.405
Minimum	0.000	0.016	0.016
Average	0.001	0.206	0.208
3σ	0.001	0.366	0.369

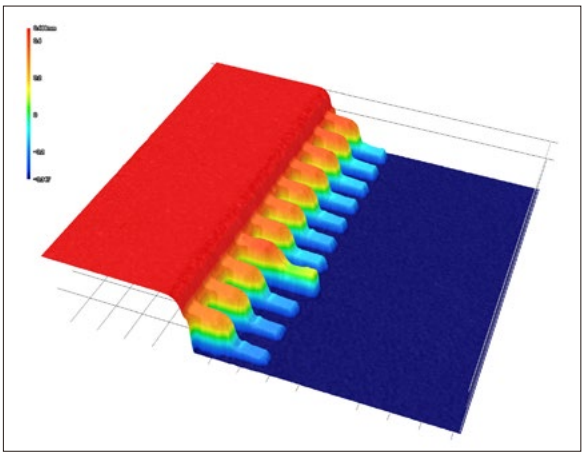
Laser marking (volume and area measurement)



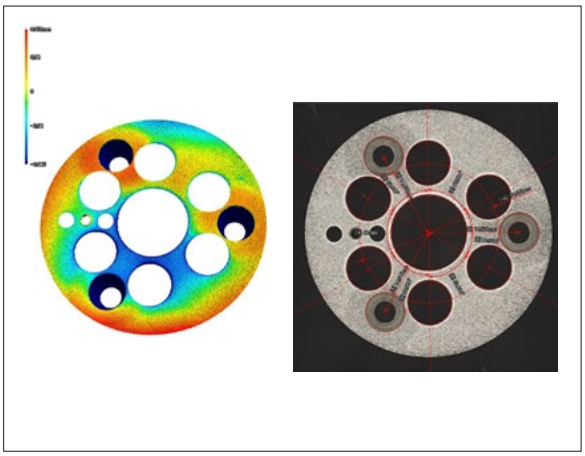
7-inch tablet (case curvature)



Needle on static eliminator



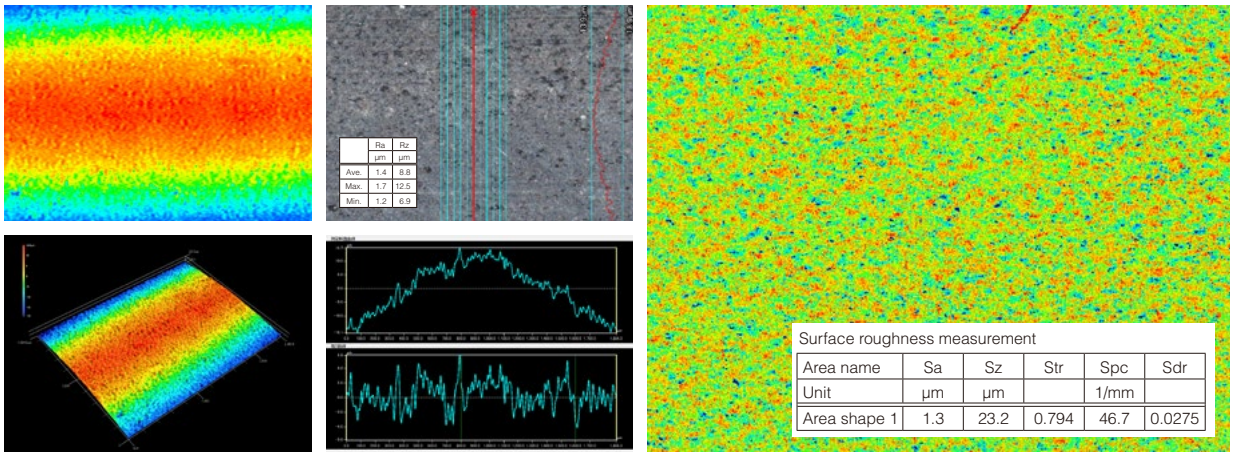
IC (lead float)



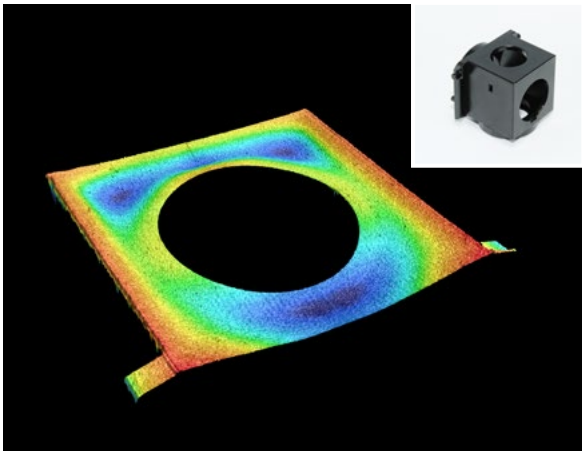
Metal components (curvature, 2D measurements)

Application Examples

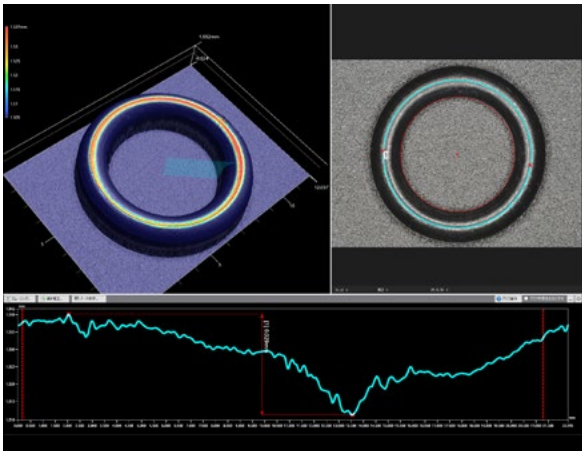
Rubber and Plastic Materials



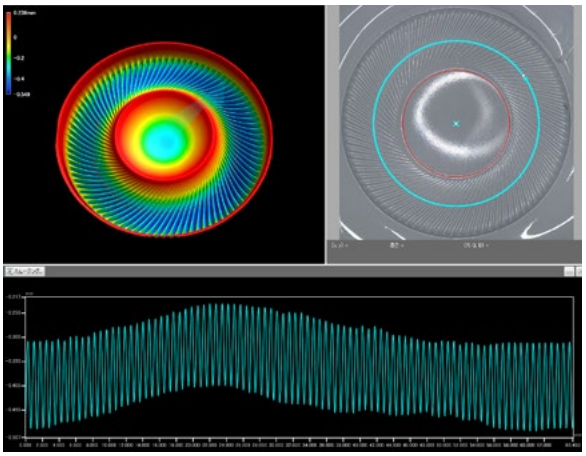
Weather-stripping (line roughness, surface roughness)



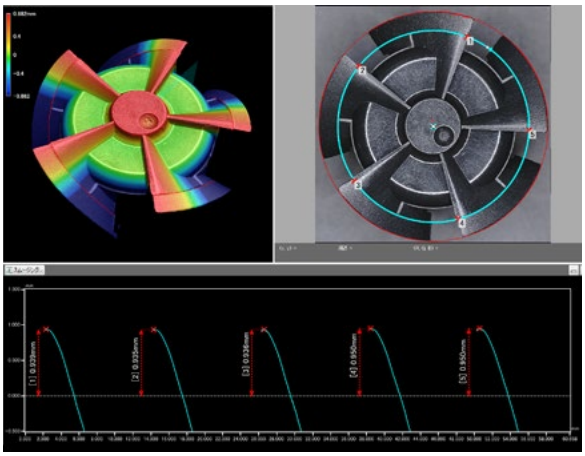
Optical filter case (resin mold sink marks)



O-ring (Curvature after molding)



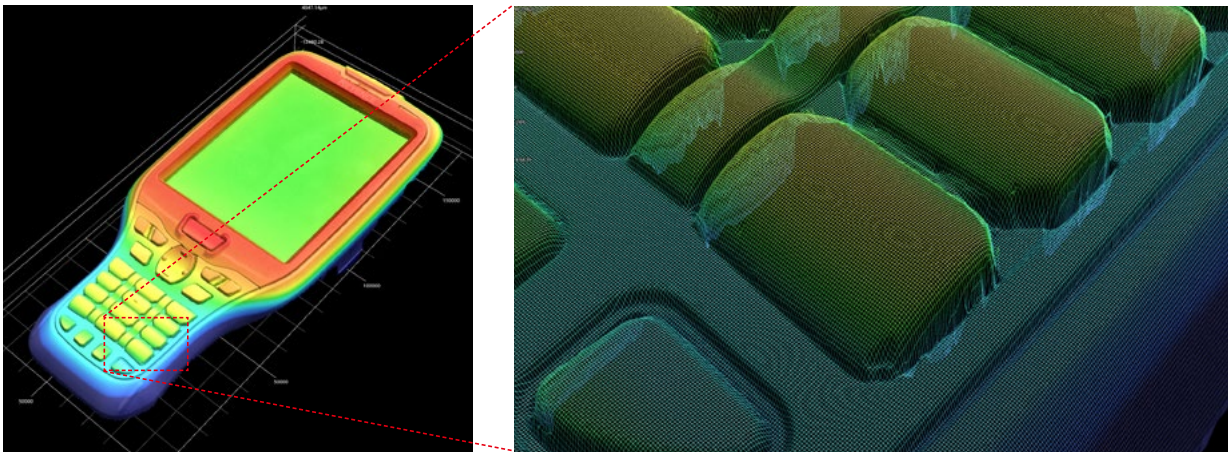
Diaphragm (shape, distortion)



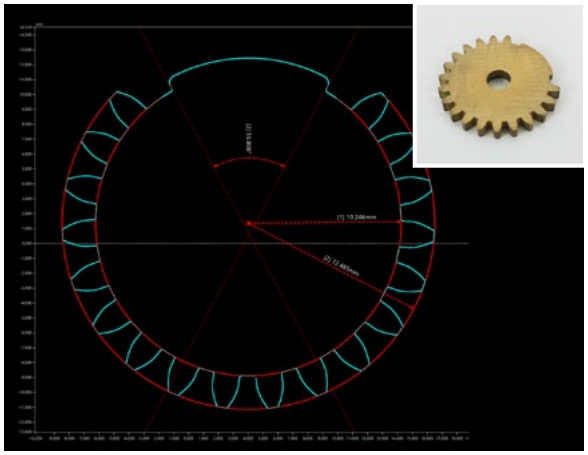
Fan (height from reference)

Application Examples

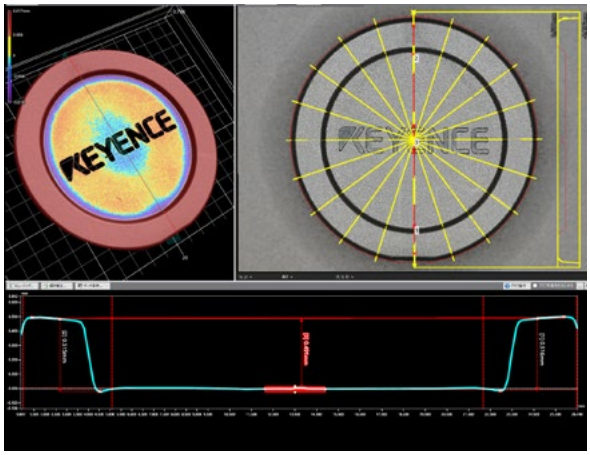
Other Industries



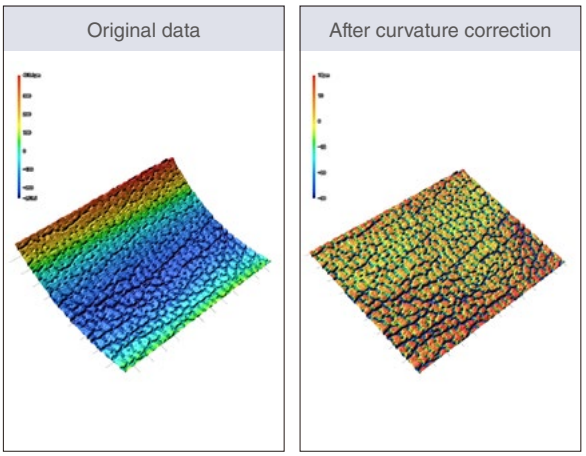
Handheld terminal (creation of a precise 3D model using height data of about 800,000 points per field of view)



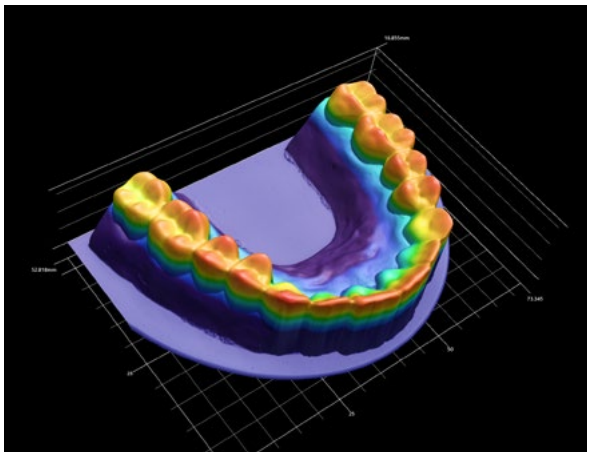
Gear (profile measurement of entire circumference cross-section)



Plastic cap (measurement of sink mark due to height difference)



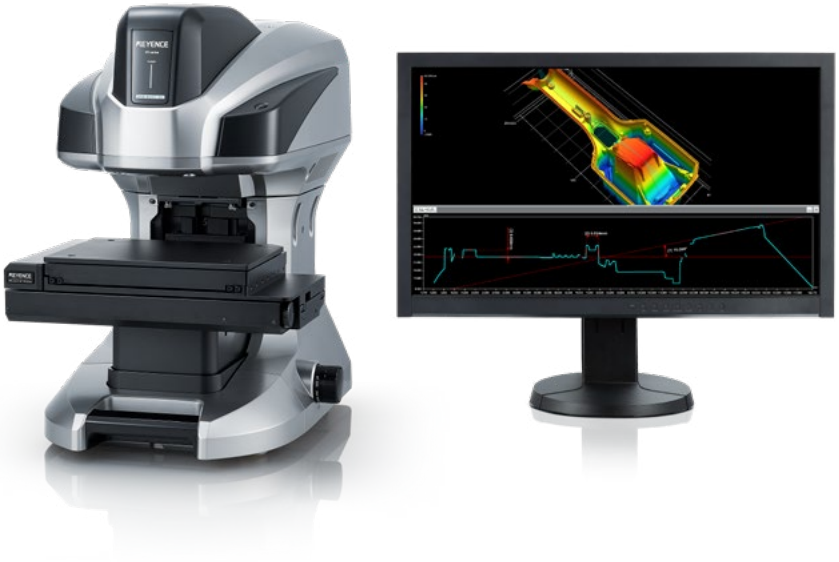
Grain (overall grain depth)



Dentures (overall shape)

Fully-automated Model
VR-5200

XYZ-axis
motorized control



Standard Model
VR-5100

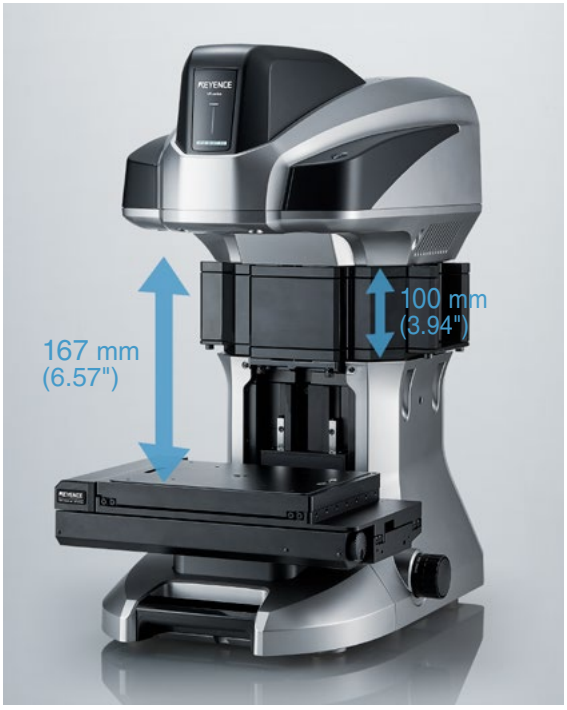
XY-axis
manual control

Z-axis
motorized control

100 mm 3.94" height spacer

OP-88274

Inserting this 100 mm 3.94" high spacer between the measurement unit and the base allows you to measure objects up to 167 mm 6.57" in height. This extra space can be also used for setting a heating stage or special jig.



Motorized stage

VR-S300

The manual stage model can be upgraded to a motorized stage later on. This enables quick and accurate stitching, as well as easier navigation around a sample.

Rotating stage

Standard item with VR-H3W

Securing the target and rotating it in one direction allows for measurement from any angle. Combining the profile data makes it possible to measure the wall thickness of the target.

Large sample stage

A variety of large-sized or special stages are available to meet your needs. Contact us for more details. Measurement can be performed for various products including large PCBs and housing products that cannot be placed on the stage.

*Large sample stages are not available from KEYENCE.

Tilt stage

OP-87709

This stage allows users to observe and measure objects from an angle without having to manipulate the object by hand. The OP-87709 is convenient for measurement of vertical walls and areas otherwise not visible from a top-down view.

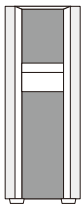
System Configuration / Dimensions

VR-5200

VR-5100

Head

Controller
VR-5000



Control PC

Monitor

100 mm 3.94" height spacer
OP-88274 (optional)

Motorized stage
VR-S300 (optional)
* Optional accessory for VR-5100 only

Calibration gauge
OP-88275 (optional)

Standard software set
VR-A1*1

Measurement expansion module
VR-H3J (optional)

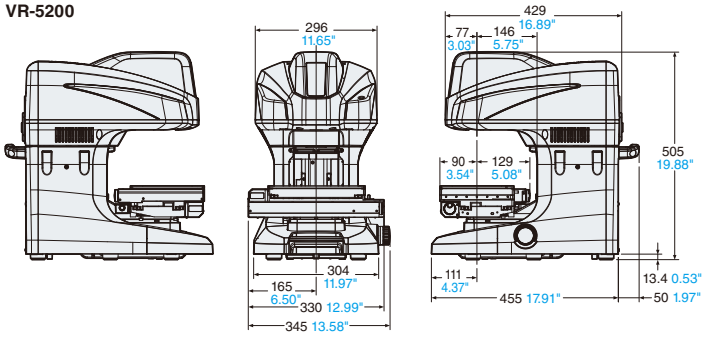
Comparative measurement module
VR-H3CA (optional)

Profile composition module
VR-H3W (optional)

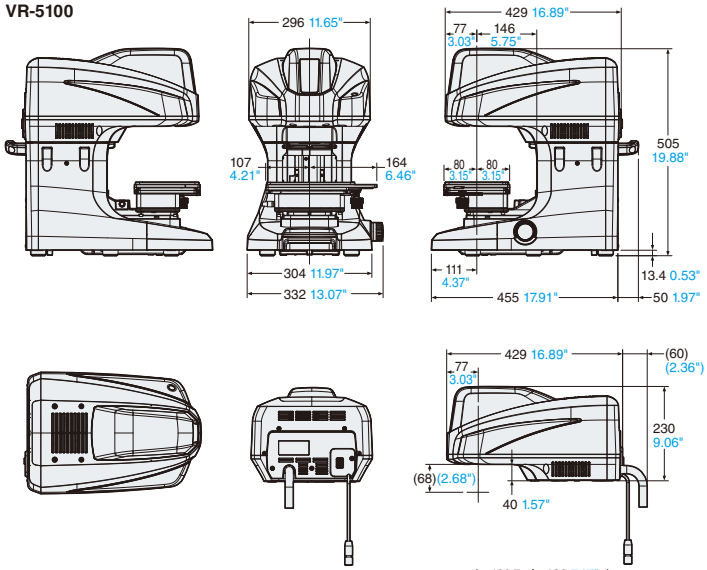
*1 Models may vary according to the instrument language.
VR-A1 (Japanese) / VR-A1E (English) / VR-A1D (German) / VR-A1C (Simplified Chinese) / VR-A1W (Traditional Chinese) /VR-A1K (Korean) / VR-A1T (Thai)

Unit: mm inch

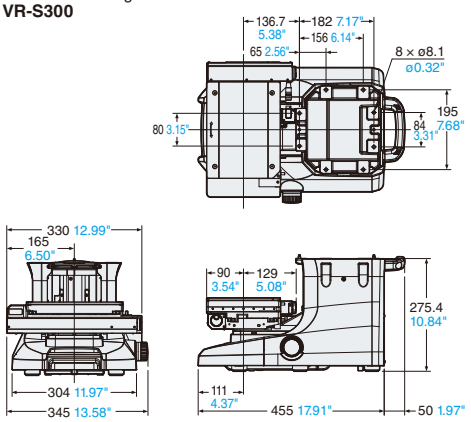
Head
VR-5200



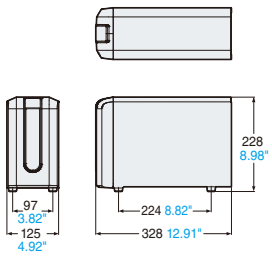
Head
VR-5100



Motorized XY stage
VR-S300



Controller
VR-5000



Specifications

VR Head/Controller

Model	Controller		VR-5000													
	Head		VR-5200								VR-5100					
Camera			Low magnification (wide field of view)				High magnification (high resolution)				Low magnification (wide field of view)				High magnification (high resolution)			
Magnification on a 15" monitor			12×	25×	38×	50×	40×	80×	120×	160×	12×	25×	38×	50×	40×	80×	120×	160×
Field-of-view	Horizontal: mm inch		24.0 0.94"	12.0 0.47"	8.0 0.31"	6.0 0.24"	7.6 0.30"	3.8 0.15"	2.5 0.10"	1.9 0.07"	24.0 0.94"	12.0 0.47"	8.0 0.31"	6.0 0.24"	7.6 0.30"	3.8 0.15"	2.5 0.10"	1.9 0.07"
	Vertical: mm inch		18.0 0.71"	9.0 0.35"	6.0 0.24"	4.5 0.18"	5.7 0.22"	2.9 0.11"	1.9 0.07"	1.4 0.06"	18.0 0.71"	9.0 0.35"	6.0 0.24"	4.5 0.18"	5.7 0.22"	2.9 0.11"	1.9 0.07"	1.4 0.06"
Zoom			1× to 4×															
Height measurement	Display resolution		0.1 µm															
	Height measurement range	Without Z stitching	10 mm 0.39"				1 mm 0.04"				10 mm 0.39"				1 mm 0.04"			
		With Z stitching	50 mm 1.97"				30 mm 1.18"				50 mm 1.97"				30 mm 1.18"			
	Repeatability (σ)*1	Without Z stitching	0.4 µm															
		With Z stitching	1.0 µm															
	Measurement accuracy*1	Without Z stitching	±2.5 µm															
		With Z stitching	±4.0 µm															
Width measurement	Repeatability (σ) *1		1 µm				0.5 µm				1 µm				0.5 µm			
	Measurement accuracy*1		±5 µm				±2 µm				±5 µm				±2 µm			
Stitching function*2			Fully-automated measurement (XY automatic control + Z automatic control)								Manual measurement (XY manual operation + Z automatic control)							
			Automatic mapping creation, Automatic area setting								–							
XY measurable range*2			206 × 104 mm 8.11" × 4.09"								92 × 86 mm 3.62" × 3.39"							
Stage	XY stroke		184 × 88 mm 7.24" × 3.46" (motorized)								70 × 70 mm 2.76" × 2.76" (manual)							
	Z stroke		73 mm 2.87" (motorized)															
	Load capacity		4.5 kg															
Working distance			75 mm 2.95"															
Image receiving element			4 megapixel monochrome CMOS															
Transmitter lens			Double-telecentric lens × 2															
Receiver lens			Double-telecentric lens															
Light sources	Observation light source		LED ring light (red, blue, green)															
	Measurement light source		White LED															
Power supply	Power voltage		100 to 240 VAC, 50/60 Hz															
	Power consumption		200 VA max.															
Environmental resistance	Ambient temperature		+15 to 30°C 59 to 86°F															
	Ambient humidity		35 to 80% RH (no condensation)															
Weight	Controller		Approx. 4 kg															
	Head*3		Approx. 28 kg								Approx. 25 kg							
Data processing			Dedicated PC specified by KEYENCE (OS: Windows 10 Pro)															

*1 Value obtained using KEYENCE's specified standard gauge with measurement in KEYENCE's specified measurement mode (ambient temperature: 23±1°C 73.4±1.8°F)
*2 Measurement expansion module (VR-H3J) required
*3 Weight of only measurement unit: Approx. 11 kg
* Windows is either registered trademark or trademark of Microsoft Corporation in the United States and/or other countries.

First-class customer support that only a direct service company can provide

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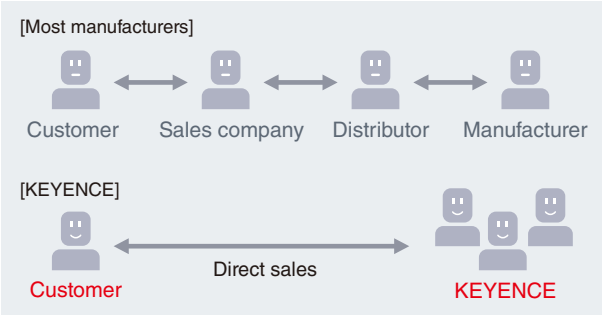
Our experienced, highly-skilled sales engineers respond quickly to customers' inquiries, providing them with exceptional after-sales service and support. KEYENCE also offers free on-site inspection services and provides equipment loans free of charge in the event of a failure. With this level of service, KEYENCE provides post-sales support you can rely on.



In-Depth Analysis of Roughness

Introduction to roughness

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SAFETY INFORMATION
Please read the instruction manual carefully in order to safely operate any KEYENCE product.

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