

High-speed 2D Optical Micrometer TM-3000 Series

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REYENCE

**IN-LINE 2D** MEASUREMENT SYSTEM

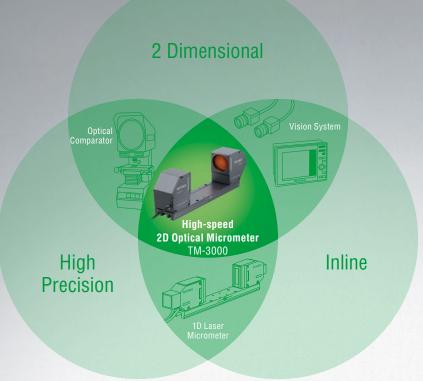
MEASURES 2 DIMENSIONS WITH MICRON PRECISION

KEYENCE KEYENCE TM-065T 24.000 Outer diameter A **Two-dimensional Micrometer** Outer diameter B 31.998 Outer diameter C 30.002 Outer diameter D [mm] 29.980 2.000 2.020 GO [mm] LO 1.980 0.499 0.520 Step b [mm] 0.480 LO 0.12 HI 0.30 [deg] LO -0.30 3.550 3.500 [mm]

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# Commitment to In-line Measurement

Performs in line 2D dimensional measurements with high speed and precision. The TM-3000 Series, the industry's first inline 2D measurement system.



## Because the TM-3000 is 2D it can...

#### Measure single point and edge dimensions

No need to position an object, outer diameter and angles can be measured instantaneously. In addition, since the object position is recognized, accurate measurement is performed with position correction. Furthermore, variations due to surface roughness of an object are suppressed with edge averaging, improving the reliability of measurement.



## High speed production support

#### Newly developed HT processor

Newly developed high speed 2D dedicated includes a high-speed computing CPU and two dedicated image processing DSPs. Using a total of four processors for parallel processing, TM-3000 Series allows for fast processing of 1800(images)/minute.

\*HT Processor...High Speed Two Dimensional Processor \*1800 images/min... calculated with approx. 33 ms trigger interval (default setting)

## High precision inspection

A high brightness LED and a double telecentric optical system ensure high precision performance

A advantage of the thrubeam type which is not affected by external lighting,  $\pm 0.15 \ \mu m$  repeatability.





## Traceable two dimensional inspections in line

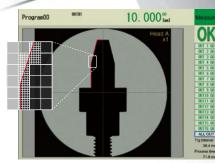
#### Measurement principle

Uniform collimated lighting with a green LED. Two-dimensional CMOS array detects the light-dark edges in the received light, and measures the dimensions.

#### Dual telecentric optical system

Dual telecentric lenses ensure only collimated light is used for imaging. Even though the distance from the object to the lenses change, the size of the image on the CMOS does not change. High precision measurement is possible.

> Even with slight deviations of the object within the measurement area, the size of the image does not change.



#### Pinpoint sub-pixel processing

High speed and high precision are achieved by performing pinpoint extraction and sub-pixel processing on just the contour within the specified measurement area, from the silhouette imaged on the CMOS.

#### HUD unit + collimator lens

Collimated light is produced without any unevenness by spreading LED light uniformly across the complete range. \*HUD unit = High Uniform Diffusion unit

## High brightness InGaN green LED

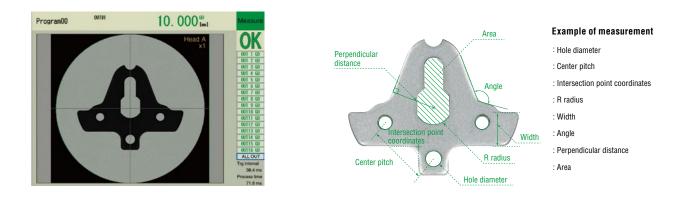
A high brightness LED is used, combining three features,

- Even Brightness Distribution Resistant to EMF
- Eye Safe

## A variety of measurement modes greatly expand the inspection possibilities

### Because the system works in two dimensions it can...

Simultaneously measure a maximum of 16 measurement points within the measurement area. The time for measurement has been greatly reduced.

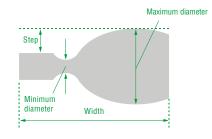


#### Diverse measurement modes

A flexible combination of 15 types of basic measurement modes, and 8 types of auxiliary measurement modes, can support a variety of inspections.

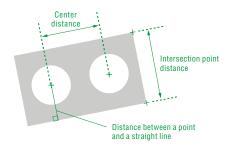
#### Outer diameter/Step/Width

Measures a maximum diameter/minimum diameter within the specified area, and a step/width between the detected edges.



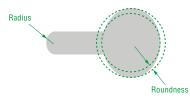
#### **Distance/Intersection Point Distance**

Measures a center of the circles and intersection point, distance between 2 specified points, distance from a point to a straight line.



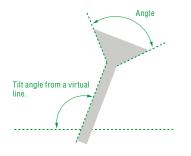
#### Radius/Roundness

Measures radius and roundness of specified arc.



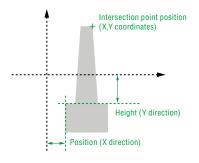
#### Angle

Measures an angle between two detected straight lines, and a tilt angle from a virtual line.



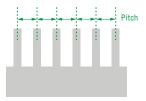
#### Height / Position/Coordinates

Measures height/ position of detected edges and coordinates of specified points.



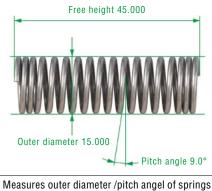
#### Pitch

Measures a maximum/minimum/average pitch within the specified area.

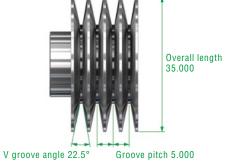


## APPLICATIONS

Unit: mm





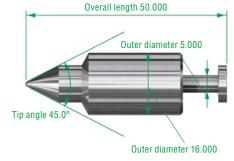


Measures pulley groove pitches/V groove angles

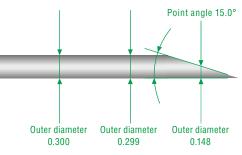
Diameter 21.000

Distance 12.000

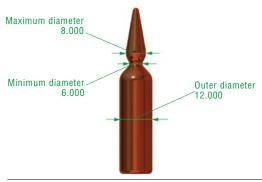
Convex height 2.000



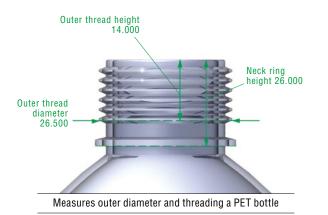
Measures outer diameter/tip angle of needle valves



Measures multi-point outer diameter/point angle of injection needles



Measures maximum diameter/minimum diameter of ampules



Measures diameter/height of lenses

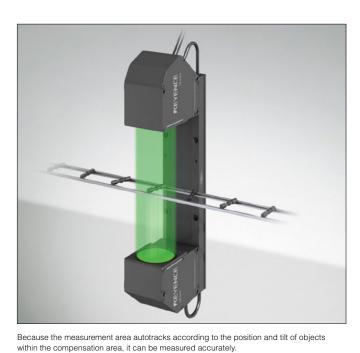


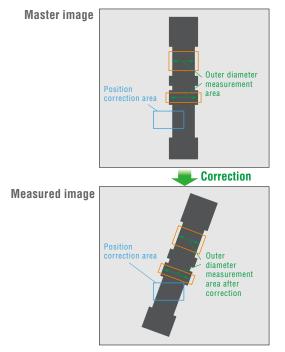
Measures roundness/thickness of O-rings

## Correction function with on-the-spot power

## Position correction function [edge correction/pattern correction]

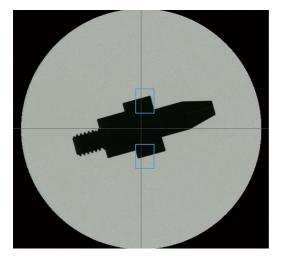
Automatically corrects misalignments and tilt of the target which is directly linked to measurement errors. Can measure accurately even when positioning is difficult or objects are conveyed in random orientations.



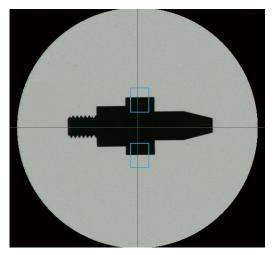


## Tilt correction function

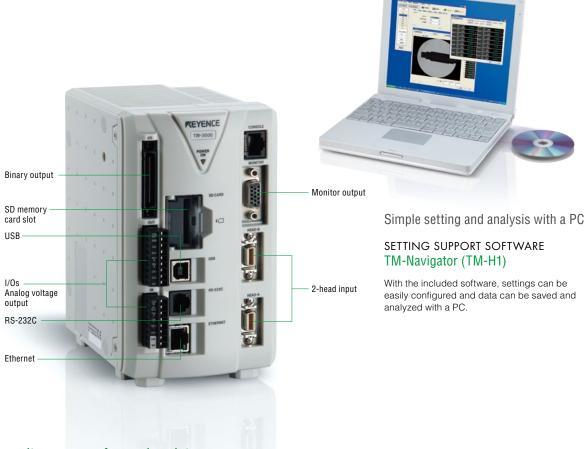
When installing the sensor head, a tilt of the master workpiece is horizontally/vertically corrected, which significantly reduces adjustment times.



The image of the workpiece is tilted due to the sensor head which has not been installed at an appropriate angle.



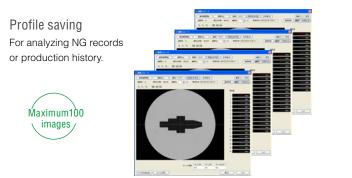
By means of the tilt correction function, the workpiece image is horizontally/vertically captured and accurately measured.



## Large capacity memory for saving data

The controller has built in high capacity memory.

A memory card slot is included for recording histories of multiproduct/mass production.



	A	D	0	0	E	7	0	+1	1	J	K	L
1	2009/9/9 204419	0.476	0.52	0.582	0314	0.554	0542	0.559	0.603	0125	0.407	0.63
2	2009/9/9 2044 59	0.471	0.639	0.551	0.513	0.621	0.545	0.552	0.003	0325	0.405	0.0
3	2009/9/0 2044.59	0.466	0644	0.547	0.512	0.61 8	0.546	0.58	0.005	0527	0.005	0.643
4	2008/9/8 204459	8340	0644	0548	0.518	0.64	0546	0.607	0.005	0525	0.482	0.643
5	2009/9/8 204459	0.47	0.641	0.548	0.512	0.663	0.549	0.597	0.606	0524	0.487	0.644
	2000/0/8 204819	0475	6438	0.662	0512	0488	0.55	6.613	0.606	0.525	0.488	0.44
3	2000/9/9 204459	0.472	0.637	0.584	0.511	0.663	0.553	0.600	0.61	0527	0.400	0.648
8	2009/9/9 204419	0.471	0.642	0.566	0.509	0.705	0.550	0.629	0.613	0125	0.491	0.655
2	2008/9/9 204459	0.476	0.637	0358	057	0.704	0.505	0.619	0.019	0522	0.495	0.648
10	2009/9/9 2045:00	0.479	0.631	0.961	0511	0.662	0.590	0.616	0.628	0521	0.894	0.645
11	2008/9/8 2045 00	0479	0.632	0.568	0.51	0.664	0.591	0.525	0.038	0521	0.498	0.0
12	2000/9/9 2045 00	0.485	0.624	0.568	0.508	0.665	0568	0.549	0.645	0521	05	0.63
13	2009/6/8 2045 00	0.465	0423	COMM	0.507	0465	0541	0.576	0.644	0.52	0.503	0.63
14	2008/9/9 2045:00	0.487	0.622	0.562	0.505	0.668	0.556	0.541	0.657	0510	0.502	0.63/
15	2008/9/9 2045:00	0.466	0.625	0.561	0.505	0.669	0.550	0.545	0.663	0119	0,505	0.62*
16	2008/9/5 2045 00	0.481	0119	0.56	0.505	0.669	0.555	0.512	0.967	0517	0.903	0.62*
17	2009/9/8 2045.00	0.485	0.617	0.559	0504	0.667	0.547	0.519	0.008	0521	0,505	0.65
18	2008/9/8 2045 00	0.480	0.602	0.558	0.508	0.661	0.551	0.515	0671	0119	0,508	0.629
10	2009/9/8 2045 00	05	0.602	0.558	0.506	0.685	0.551	0.519	0.671	0515	0.505	0.62
20	2000/0/8 2045 00	61	0.6	0.552	0.508	0676	0.551	0.515	0.670	0115	0.508	0.630
21	2000/9/9 2045 00	0.501	0.530	0.586	0.500	0.67	0.55	0.417	0.677	0512	0.508	0.630
22	2008/9/9 2045:00	0505	0.537	0554	0.500	0.632	0.552	0.400	01671	03:00	0.509	0.63

For daily production control and traceability

65536 data can be stored

#### Handling many product types

The memory in the controller stores up to 16 programs. By using a function to search from the memory card, up to 256 programs can be switched to handle various product types.

Handles 256 types

	Program setting	Image saving	Data storage		
Internal memory	16	100	65,536 × 16		
SD card (4GB)	256	Approx. 3,800	65,536 × Approx.8,000		

#### SPECIFICATIONS (SENSOR HEADS)

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Model		TM-006	TM-040	TM-065			
Measuring rang	le	ø6 mm ø0.24"	ø40 mm ø1.57"	ø65 mm ø2.56*			
Smallest detectable object		0.04 mm 0.001"	0.3 mm 0.01"	0.5 mm 0.02"			
Transmitter/receiver distance		60 mm 2.36"	180 mm 7.09"	270 mm 10.63"			
Light source		GaN Green LED InGaN Green LED					
Measurement accuracy		±0.5 μm 0.000020" *1	±2 μm 0.000079" * <sup>3</sup>	±3 μm 0.000118" * <sup>5</sup>			
Repeatability		±0.06 μm *2	±0.15 μm 0.000006" * <sup>4</sup>	±0.2 μm 0.000008" * <sup>6</sup>			
Sampling cycle (trigger interval) *7			5.5ms (33ms at the initial setting)				
Environmental resistance	Enclosure rating *8	IP64					
	Ambient temperature	0 to 50°C 32 to 122°F					
	Relative humidity	35 to 85% (No condensation)					
Material		Aluminum					
	Transmitter	Approx. 140g	Approx. 560g	Approx. 1280g			
Weight	Receiver	Approx. 340g	Approx. 720g	Approx. 1460g			
	Base	Approx. 220g	Approx. 630g	Approx. 1500g			

\*1 In a measurement area of 2 mm 0.06<sup>3</sup> x ø4 mm 00.16<sup>3</sup> error when measuring width of KEYENCE standard object (glass calibration scale).
\*2 Value of ±2σ measuring the width of KEYENCE standard object (glass calibration scale) in the centre of the measurement area, an average 16 times, average 1.3 mm 0.05<sup>4</sup> line.

\*3 In a measurement area of 10 mm 0.39"× ø26 mm ø1.02" error when measuring width of KEYENCE standard object (glass calibration scale).

\*4 Value of ±2 $\sigma$  measuring the width of KEYENCE standard object (glass calibration scale) in the center of the measurement area, an average 16 times, average 8 mm 0.31\* line. \*5 Error when measuring width of KEYENCE standard object (glass calibration scale) in a measurement area of 20 mm 0.79\* x e40 mm g1.57\*.

\*6 Value of ±2 or measuring the width of KEYENCE standard object (glass calibration scale) in the center of the measurement area, an average 16 times, average 14 mm 0.55\* line.

\*7 When measurement area is minimum, others are initial settings \*8 Apart from connector component

#### SPECIFICATIONS (CONTROLLER)

And compatibility         Compatibile           umber of connectable sensors *1         2 units max.           isplay         Minimum display unit         0.0 1 µm, 0.001 nm², 0.01 °           isplay         Minimum display range         ±9999.99 mm², ±99999.9 mm², ±99999.9 °           put         Tigger input (FH eda A)         Non-voltage input         Non-voltage input           Timing 1 input         Auto-zero 1 input         #10 V × 2 outputs, out put impedance: 100 Ω         Non-voltage input           Total judgment output         NON-voltage input         *10 V × 2 outputs, out put impedance: 100 Ω         PNP open-collector output           Total judgment output         NPN open-collector output         PNP open-collector output (N.C.)         PNP open-collector output (N.C.)           Trigger input enable output         NPN open-collector output (N.C.)         PNP open-collector output (N.C.)         PNP open-collector output (N.C.)           Trigger input enable output         NPN open-collector output         PNP open-collector output (N.C.)         PNP open-collector output (N.C.)           Trigger input (For Head A)         Timing 2 input         Non-voltage input, 4 inputs         Voltage input, 4 inputs           Voltage input         Non-voltage input, 4 inputs         Voltage input, 4 inputs         Voltage input, 4 inputs           Trigger input (For Head A)         Timing 2 input (For He	Model		TM-3001	TM-3001P					
umber of connettable sensors **         2 units max.           isplay         Minimum display range         0.01 µm, 0.001 mm <sup>2</sup> , 0.017           Maximum display range         ±9999.99 mm <sup>2</sup> , ±99999.9"           Laser renote interiock input         rigger input (for fead A)           Tinger input (for fead A)         Non-voltage input           Auto-zero 1 input         Non-voltage input           Reset input         ±10 V x 2 outputs, out put impedance: 100 Ω           Total judgment output         NPN open-collector output           Process output         PNP open-collector output (NC.)           Process output         NPN open-collector output (NC.)           Process output         NPN open-collector output (NC.)           PNP open-collector output (NC.)         PNP open-collector output (NC.)           PNP open-collector output         PNP open-collector output (NC.)           Adjusted error output         NPN open-collector output (NC.)           PNP open-collector output         NOn-voltage input           Auto-zero 2 input         Non-voltage input           Program switching input         Non-voltage input           Auto-zero 2 input         Non-voltage input           Program switching input         Non-voltage input           Judgment/Binary output <sup>2</sup> 3-level judgment output: OUT1 is 0UT16 total judg		npatibility							
Minimum display unit Maximum display range         0.01 µm, 0.001 µm <sup>2</sup> , 0.01°           put minal ock         Laser renote interlock input         Non-voltage input           Trigger input (for Head A) minal ock         Non-voltage input         Non-voltage input           Auto-zero 1 Input method         Analog voltage output         10 V x 2 outputs, out put impedance: 100 Ω           Analog voltage output         Non-voltage input         Voltage input           Trigger input (for Head A)         Non-voltage input         Non-voltage input           Trigger input (for Head A)         Non-voltage input         Non-voltage input           Trigger input (for Head A)         Non-voltage input         Non-voltage input           Trigger input (for Head A)         NPN open-collector output (N.C.)         PNP open-collector output (N.C.)           Process output         NPN open-collector output (N.C.)         PNP open-collector output (N.C.)           Program switching input         Non-voltage input         Voltage input (N.C.)           Advacer 0 Input         Non-voltage input         Voltage input (N.C.)           Program switching input         Non-voltage input (A inputs)         Voltage input (N.C.)           Advacer 0 Input         Non-voltage input (A inputs)         Voltage input (A inputs)           Voltage input (Stringeringut (Gr Head A)         Non-voltage input (A input									
Splay         Maximum display range         ±9999.99 mm, ±9999.9 mm, ±99999.9 mm, ±99999.9°           Isaer remote interlock input Tinger input (for Head A)         Non-voltage input           Timing 1 input ock         Timing 1 input Auto-zero 1 input         Non-voltage input           Analog voltage output         ±10 V × 2 outputs, out put impedance: 100 Ω           Process output         PNP open-collector output         PNP open-collector output           Process output         Non-voltage input         PNP open-collector output           Trigger input enable output         NPN open-collector output         PNP open-collector output           Aglusted error output         Non-voltage input         PNP open-collector output           Aglusted error output         Non-voltage input         Voltage input           Auto-zero 2 input         Non-voltage input         Non-voltage input           Auto-zero 2 input         Non-voltage input, 4 inputs         Voltage input, 4 inputs           Memory card save input         Non-voltage input, 4 inputs         Voltage input, 4 inputs           Judgment/Binary output*2         3-level judgment output         3-level judgment output           Binary output*1         Non-voltage input, 1 inputs         Voltage input, 1 inputs           Judgment/Binary output*2         S-level judgment output         3-level judgment output, 1 input inferaseu									
Laser remote interlock input minal put minal du/czero 1 input Auto-zero 1 input Auto-zero 1 input Reset input         Non-voltage input Non-voltage input ±10 V 2 outputs, out put impedance: 100 Ω ±10 V 2 outputs, out put impedance: 100 Ω Total judgment output Error output Fror output Process output ock         Non-voltage input NNN open-collector output NPN open-collector output Non-voltage input Non-voltage input N	Display	· · ·	• *	·					
put minial ock         Trigger input (for Head A) Auto-zero 1 input         Non-voltage input         Voltage input           Reset input         Analog voltage output         ±10 V x 2 outputs, out put impedance: 100 Ω           tuput         Analog voltage output         ±10 V x 2 outputs, out put impedance: 100 Ω           Total judgment output         NPN open-collector output (N.C.)         PNP open-collector output (N.C.)           Process output         NPN open-collector output (N.C.)         PNP open-collector output (N.C.)           Trigger input enable output         NPN open-collector output (N.C.)         PNP open-collector output (N.C.)           Tringger input (for Head A)         NPN open-collector output (N.C.)         PNP open-collector output (N.C.)           Tringger input (for Head A)         NPN open-collector output (N.C.)         PNP open-collector output (N.C.)           Tringger input (for Head A)         NOn-voltage input         Voltage input           Aduczero 2 input         Non-voltage input         Voltage input           Memory card save input         Non-voltage input         Voltage input           Judgment/Binary output* <sup>2</sup> 3-level judgment output         3-level judgment output           Binary output* <sup>2</sup> 3-level judgment output         3-level judgment output           Binary output* <sup>2</sup> NPN open-collector output         NPN open-collector		. , .							
Timinal ock         Timing 1 input         Non-voltage input         Voltage input           Auto.zero 1 input         Reset input         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1	Innut	· · ·	-						
Auto-zero 1 input         Voltage input           Reset input         +10 V x 2 outputs, out put impedance: 100 Ω           Auto-zero 1 input         Analog voltage output         +10 V x 2 outputs, out put impedance: 100 Ω           Total judgment output         NPN open-collector output         PNP open-collector output           Foro output         NPN open-collector output (N.C.)         PNP open-collector output           Trigger input enable output         NPN open-collector output         PNP open-collector output           Adjusted error output         NPN open-collector output         PNP open-collector output           Auto-zero 1 input         NOn-voltage input         Voltage input           Memory card save input         Non-voltage input         Voltage input           Memory card save input         Non-voltage input         Voltage input           Judgment/Binary output*2         3-level judgment output: 0UT1 to 0UT16, total judgment output         3-level judgment output: 0UT1 to 0UT16 measured data output (21 bits) NPN open-collector output         3-level judgment output: 0UT1 to 0UT16 measured data output (21 bits) NPN open-collector output         PNP open-collector output           Strobe output         S1-level judgment output: 0UT1 to 0UT16 total judgment output: 0UT1 to 0UT16 measured data output (21 bits) NPN open-collector output         PNP open-collector output           Strobe output         NPN open-collector output <t< th=""><th>terminal</th><th></th><th> Non-voltage input</th></t<>	terminal		 Non-voltage input						
Reset input         Analog voltage output         ±10 V x 2 outputs, out put impedance: 100 Ω           Total judgment output         NPN open-collector output         PNP open-collector output           Trigger input enable output         NPN open-collector output (N.C.)         PNP open-collector output (N.C.)           Process output         Trigger input enable output         NPN open-collector output (N.C.)         PNP open-collector output (N.C.)           Trigger input enable output         Adjusted error output         PNP open-collector output         PNP open-collector output           Adjusted error output         NPN open-collector output         PNP open-collector output         PNP open-collector output           Adjusted error output         NPN open-collector output         PNP open-collector output         PNP open-collector output           Adjusted error output         Non-voltage input         Voltage input         Voltage input           Auto-zero 2 input         Non-voltage input         Voltage input         Voltage input           Auto-zero 2 input         S-level judgment output: OUT1 to OUT16 to O	block								
Analog voltage output         ±10 V x 2 outputs, out put impedance: 100 Ω           Total judgment output         NPN open-collector output         PNP open-collector output           For output         NPN open-collector output (N.C.)         PNP open-collector output (N.C.)           Process output         NPN open-collector output (N.C.)         PNP open-collector output (N.C.)           Process output         Adjusted error output         PNP open-collector output           Adjusted error output         NPN open-collector output         PNP open-collector output           Adjusted error output         NPN open-collector output         PNP open-collector output           Adjusted error output         NPN open-collector output         PNP open-collector output           Mato-zero 2 input         Non-voltage input, 4 inputs         Voltage input           Program switching input         Non-voltage input, 4 inputs         Voltage input           Memory card save input         3-level judgment output: 0UT1 to 0UT16, total judgment output: 0UT1 to 0UT16 measured data output (21 bits) NPN open-collector output         3-level judgment output: 0UT1 to 0UT16 measured data output (21 bits) NPN open-collector output           Strobe output         NPN open-collector output         S-level judgment output: 0UT1 to 0UT16 measured data output (21 bits) NPN open-collector output         PNP open-collector output           Strobe output         NPN open-collector output </th <th></th> <th>· .</th> <th></th>		· .							
tuput minial ock Total judgment output NPN open-collector output (N.C.) PNP open-collector output Voltage input A inputs Voltage input Output: 0UT1 to OUT16 neasured data output (21 bits) NPN open-collector output Binary output* <sup>2</sup> Measured data output (21 bits) NPN open-collector output PNP open-collector output PNP open-collector output PNP open-collector output StGA (800 × 600 pixels) S-232C interface Measured data output and control input/output (Maximum baud rate: 115200 bps, selectable) St interface Inconformity with US B Revision 2.0 HI-SPEED (USB 1.1 Full-SPEED compatible) In conformity with USB Revision 2.0 HI-SPEED (SI 1.1 Full-SPEED compatible) Merrer interface SD Card CA-SD1G (1GB) support		· ·	+10.V x 2 outputs out	r nut imnedance: 100.0					
International cock         Error output         NPN open-collector output (N.C.)         PNP open-collector output (N.C.)           Process output         Trigger input enable output         NPN open-collector output (N.C.)         PNP open-collector output (N.C.)           Adjusted error output         Adjusted error output         NPN open-collector output         PNP open-collector output           Trigger input enable output         Adjusted error output         Non-voltage input         Voltage input           Auto-zero 2 input         Non-voltage input, 4 inputs         Voltage input, 4 inputs         Voltage input           Memory card save input         Non-voltage input, 4 inputs         Voltage input, 4 inputs         Voltage input           Judgment/Binary output*2         3-level judgment output: OUT1 in OUT16 in cala iudgment output         3-level judgment output: 011 in OUT16 in cala auotput (21 bits) NPN open-collector output         3-level judgment output: 011 in OUT16 in cala auotput (21 bits) NPN open-collector output         3-level judgment output: 011 in OUT16 in cala auotput (21 bits) NPN open-collector output         PNP open-collector output           Strobe output         Trigger input enable output         NPN open-collector output         SVGA (800 × 600 pixels)           S-232C interface         Measured data output data output (Maximum baud rate: 115200 bps, selectable)         SS interface           St interface         In conformity with USB Revision 2.0 HI-SPEED (USB 1									
Process output         Process output           Trigger input enable output         NPN open-collector output           Adjusted error output         NPN open-collector output           Adjusted error output         Non-voltage input           Trigger input (for Head A)         Non-voltage input           Tining 2 input         Non-voltage input           Auto-zero 2 input         Voltage input           Program switching input         Non-voltage input, 4 inputs           Voltage input         Voltage input           Judgment/Binary output*2         3-level judgment output: 0UT1 to 0UT16, total judgment output           Binary output*2         3-level judgment output: 0UT1 to 0UT16 measured data output (21 bits) NPN open-collector output           Strobe output         NPN open-collector output         PNP open-collector output           Strobe output         NPN open-collector output         PNP open-collector output           Strobe output         NPN open-collector output         PNP open-collector output           Strobe output         NPN open-collector output and control input/output (Maximum baud rate: 115200 bps, selectable)           Strobe output         In conformity with USB Revision 2.0 HI-SPEED (USB 1.1 Full-SPEED compatible)           In conformity with USB Revision 2.0 HI-SPEED (USB 1.1 Full-SPEED compatible)         In conformity with USB Revision 2.0 HI-SPEED (USB 1.1 Full-SPEED compat	Output		· · ·						
Tigger input enable output Adjusted error output         NPN open-collector output         PNP open-collector output           Adjusted error output         Trigger input (for Head A)         Voltage input         Voltage input           Timing 2 input         Mano-voltage input         Voltage input, 4 inputs         Voltage input, 4 inputs           Adjusted error output         Frogram switching input         Non-voltage input, 4 inputs         Voltage input, 4 inputs           Adjusted error output         Memory card save input         Selevel judgment output: 0UT1 to 0UT16, total judgment output         Voltage input: 0UT1 to 0UT16, total judgment output           Judgment/Binary output* <sup>2</sup> S-level judgment output: 0UT1 to 0UT16 measured data output (21 bits) NPN open-collector output         Selevel judgment output: 0UT1 to 0UT16 measured data output (21 bits) NPN open-collector output         PNP open-collector output           Strobe output         NPN open-collector output         NPN open-collector output         Binary output: 0UT1 to 0UT16 measured data output (21 bits) NPN open-collector output           Strobe output         NPN open-collector output         NPN open-collector output         PNP open-collector output           Strobe output         NPN open-collector output         Selevel judgment output: 0UT1 to OUT16, total judgment output: 0UT1 to OUT16 measured data output (21 bits) NPN open-collector output         PNP open-collector output           Strobe output         NPN open-collector o	terminal	· ·							
Adjusted error output       Adjusted error output         Trigger input (for Head A)       Trigger input (for Head A)         Timing 2 input       Non-voltage input         Auto-zero 2 input       Non-voltage input, 4 inputs         Program switching input       Non-voltage input, 4 inputs         Memory card save input       Non-voltage input, 4 inputs         Judgment/Binary output* <sup>2</sup> 3-level judgment output: OUT1 to OUT16, total judgment output         Strobe output       3-level judgment output: OUT1 to OUT16 measured data output (21 bits)         NPN open-collector output       PNP open-collector output         Binary output* <sup>2</sup> Measured data output (21 bits)         NPN open-collector output       PNP open-collector output         Binary output* <sup>2</sup> Measured data output and control input/output (Maximum baud rate: 115200 bps, selectable)         stobe output       In conformity with USB Revision 2.0 HI-SPEED (USB 1.1 Full-SPEED compatible)         stobe notter       In conformity with USB Revision 2.0 HI-SPEED (USB 1.1 Full-SPEED compatible)         stobe notter       In conformity with USB Revision 2.0 HI-SPEED (USB 1.1 Full-SPEED compatible)         stobe notter       In conformity with USB Revision 2.0 HI-SPEED (USB 1.1 Full-SPEED compatible)         stobe notter       In conformity with USB Revision 2.0 HI-SPEED (USB 1.1 Full-SPEED compatible)         stobe notter	block	· ·	NPN open-collector output	PNP open-collector output					
Image region         Trigger input (for Head A) Timing 2 input         Non-voltage input         Voltage input           Auto-zero 2 input         Non-voltage input, 4 inputs         Voltage input, 4 inputs           Program switching input         Non-voltage input, 4 inputs         Voltage input           Memory card save input         Non-voltage input, 4 inputs         Voltage input           Judgment/Binary output*2         3-level judgment output: OUT1 to OUT16, total judgment output (21 bits) NPN open-collector output         3-level judgment output: OUT1 to OUT16 measured data output (21 bits) NPN open-collector output         3-level judgment output: OUT1 to OUT16 measured data output (21 bits) NPN open-collector output         Binary output: OUT1 to OUT16 measured data output (21 bits) NPN open-collector output         PNP open-collector output           Strobe output         NPN open-collector output         SVGA (800 x 600 pixels)         PNP open-collector output           S-232C interface         Measured data output and control input/output (Maximum baud rate: 115200 bps, selectable)         Strobe output           Sb interface         In conformity with USB Revision 2.0 HI-SPEED (USB 1.1 Full-SPEED compatible)           Interface         1000BASE-TX/100 BASE-TX/100									
Timing 2 input         Non-voltage input         Voltage input           Auto-zero 2 input         Program switching input         Non-voltage input, 4 inputs         Voltage input, 4 inputs           Program switching input         Non-voltage input, 4 inputs         Voltage input         Voltage input           Memory card save input         Non-voltage input, 4 inputs         Voltage input         Voltage input           Judgment/Binary output*2         3-level judgment output: OUT1 to OUT16, total judgment output (21 bits) NPN open-collector output         3-level judgment output: OUT1 to OUT16 measured data output (21 bits) NPN open-collector output         3-level judgment output: OUT1 to OUT16 measured data output (21 bits) NPN open-collector output         Binary output: OUT1 to OUT16 measured data output (21 bits) NPN open-collector output           strobe output         Trigger input enable output         NPN open-collector output         PNP open-collector output           s-232C interface         Measured data output and control input/output (Maximum baud rate: 115200 bps, selectable)         Strobe output           Stinterface         In conformity with USB Revision 2.0 HI-SPEED (USB 1.1 Full-SPEED compatible)         Strobe Strope output           Strope card         SD card CA-SD4G (4GB), CA-SD1G (1GB) support         Strope output		· · ·							
Auto-zero 2 input         Auto-zero 2 input         Auto-zero 2 input           Program switching input         Non-voltage input, 4 inputs         Voltage input, 4 inputs           Memory card save input         Non-voltage input, 4 inputs         Voltage input           Judgment/Binary output*2         3-level judgment output: OUT1 to OUT16, total judgment output         3-level judgment output           Judgment/Binary output*2         3-level judgment output: OUT1 to OUT16, total judgment output         3-level judgment output: OUT1 to OUT16, total judgment output           Strobe output         3-level judgment output: OUT1 to OUT16 measured data output (21 bits) NPN open-collector output         Binary output: OUT1 to OUT16 measured data output (21 bits) PNP open-collector output           strobe output         Trigger input enable output         NPN open-collector output         PNP open-collector output           strobe coutput         NPN open-collector output         SVGA (800 x 600 pixels)         SVGA (800 x 600 pixels)           strobe coutput         Measured data output and control input/output (Maximum baud rate: 115200 bps, selectable)         In conformity with USB Revision 2.0 HI-SPEED (USB 1.1 Full-SPEED compatible)           there interface         1000BASE-TX/100 BASE-TX/100 BASE-TX/100 BASE-T         SD card CA-SD4G (4GB), CA-SD1G (1GB) support			 Non-voltage input	Voltage input					
Program switching input         Non-voltage input, 4 inputs         Voltage input, 4 inputs           Memory card save input         Non-voltage input, 4 inputs         Voltage input           Judgment/Binary output* <sup>2</sup> 3-level judgment output: 0UT1 to 0UT16, total judgment output         3-level judgment output: 0UT1 to 0UT16, total judgment output           Strobe output         3-level judgment output: 0UT1 to 0UT16 measured data output (21 bits) NPN open-collector output         3-level judgment output: 0UT1 to 0UT16 measured data output (21 bits) NPN open-collector output         NPN open-collector output           rigger input enable output         NPN open-collector output         PNP open-collector output           stage RGB monitor output         SVGA (800 x 600 pixels)         PNP open-collector output           Stage interface         In conformity with USB Revision 2.0 HI-SPEED (USB 1.1 Full-SPEED compatible)         Stage: TX/100 BASE-TX/100		• .							
Memory card save input         Non-voltage input         Voltage input           Judgment/Binary output*2         3-level judgment output: OUT1 to OUT16, total judgment output Binary output: OUT1 to OUT16 measured data output (21 bits) NPN open-collector output         3-level judgment output: OUT1 to OUT16, total judgment output Binary output*2           Strobe output         NPN open-collector output         PNP open-collector output           Trigger input enable output         NPN open-collector output         PNP open-collector output           S-232C interface         Measured data output and control input/output (Maximum baud rate: 115200 bps, selectable)           Sb interface         In conformity with USB Revision 2.0 HI-SPEED (USB 1.1 Full-SPEED compatible)           Interface         1000BASE-TX/100 BASE-TX/10 BASE-T           Iemory card         SD card CA-SD4G (4GB), CA-SD1G (1GB) support		·	Non-voltage input 4 inputs	Voltage input, 4 inputs					
Judgment/Binary output*2         3-level judgment output: OUT1 to OUT16, total judgment output Binary output: OUT1 to OUT16 measured data output (21 bits) NPN open-collector output         3-level judgment output: OUT1 to OUT16, total judgment output Binary output: OUT1 to OUT16 measured data output (21 bits) NPN open-collector output         3-level judgment output: OUT1 to OUT16, total judgment output Binary output: OUT1 to OUT16 measured data output (21 bits) NPN open-collector output           Strobe output         NPN open-collector output         PNP open-collector output           Trigger input enable output         NPN open-collector output         PNP open-collector output           S-232C interface         Measured data output and control input/output (Maximum baud rate: 115200 bps, selectable)           Sb interface         In conformity with USB Revision 2.0 HI-SPEED (USB 1.1 Full-SPEED compatible)           ihternet interface         1000BASE-TX/100 BASE-TX/10 BASE-T           lemory card         SD card CA-SD4G (4GB), CA-SD1G (1GB) support	Fynansion								
Trigger input enable output         NPN open-collector output         PNP open-collector output           nalog RGB monitor output         SVGA (800 x 600 pixels)         SVGA (800 x 600 pixels)           S-232C interface         Measured data output and control input/output (Maximum baud rate: 115200 bps, selectable)         Selectable           SB interface         In conformity with USB Revision 2.0 HI-SPEED (USB 1.1 Full-SPEED compatible)         Selectable           interface         SD card CA-SD4G (4GB), CA-SD1G (1GB) support         SD card CA-SD4G (4GB), CA-SD1G (1GB) support	connector		3-level judgment output: OUT1 to OUT16, total judgment output Binary output: OUT1 to OUT16 measured data output (21 bits)						
Trigger input enable output       Image RGB monitor output         nalog RGB monitor output       SVGA (800 x 600 pixels)         S-232C interface       Measured data output and control input/output (Maximum baud rate: 115200 bps, selectable)         SB interface       In conformity with USB Revision 2.0 HI-SPEED (USB 1.1 Full-SPEED compatible)         Ihternet interface       1000BASE-T/1000 BASE-TX/100 BASE-T         lemory card       SD card CA-SD4G (4GB), CA-SD1G (1GB) support		Strobe output	NPN open-collector output	PNP open-collector output					
S-232C interface         Measured data output and control input/output (Maximum baud rate: 115200 bps, selectable)           SB interface         In conformity with USB Revision 2.0 HI-SPEED (USB 1.1 Full-SPEED compatible)           Interface         1000BASE-T/1000 BASE-TX/10 BASE-T           Itempry card         SD card CA-SD4G (4GB), CA-SD1G (1GB) support		Trigger input enable output							
SB interface         In conformity with USB Revision 2.0 HI-SPEED (USB 1.1 Full-SPEED compatible)           ihernet interface         1000BASE-T/1000 BASE-TX/10 BASE-T           lemory card         SD card CA-SD4G (4GB), CA-SD1G (1GB) support	Analog RGB monitor output								
Internet interface         1000BASE-T/1000 BASE-T X/10 BASE-T           lemory card         SD card CA-SD4G (4GB), CA-SD1G (1GB) support	RS-232C interface								
SD card CA-SD4G (4GB), CA-SD1G (1GB) support	USB interface		In conformity with USB Revision 2.0 HI-SPEED (USB 1.1 Full-SPEED compatible)						
	Ethernet interface		1000BASE-T/1000 BASE-TX/10 BASE-T						
Position correction function OIIT name change function select measurement mode (outer diameter height step height position width distance intersection	Memory card		SD card CA-SD4G (4GB), CA-SD1G (1GB) support						
ajor functions       tance, angle, radius, roundness, coordinates, area, search, ring test, pitch) functions, OUT function between operators, auxiliary measurements (straight edge, edge, the edge bounding line, center line, intersection, straight line between two points, any line, any point), functions, scaling function, average function, me ment function, measurement value alarm setting function, tolerance setting function, auto-zero function, storage (data/image) function, memory card storage function, memory function, trigger mode change function, mutual interference prevention function, adjustable measuring range function, thereby	Major functions		Position correction function, OUT name change function, select measurement mode (outer diameter, height, step height, position, width, distance, intersection dis- tance, angle, radius, roundness, coordinates, area, search, ring test, pitch) functions, OUT function between operators, auxiliary measurements (straight edge, circular edge, the edge bounding line, center line, intersection, straight line between two points, any line, any point), functions, scaling function, average function, measure- ment function, measurement value alarm setting function, tolerance setting function, auto-zero function, storage (data/image) function, memory card storage function, program memory function, trigger mode change function, mutual interference prevention function, adjustable measuring range function, threshold value change function, attitude correction function, display language switching function, support software setting function, trigger interval-measure- ment time display function, others						
Power supply voltage 24 VDC ±10%, Ripple: 10% (P to P) or less	Potingo	Power supply voltage	24 VDC ±10%, Ripple	e: 10% (P to P) or less					
tungs Current consumption 1 head connected 480mA max./ 2 heads connected 550mA max.	Ratings	Current consumption							
nvironmental Ambient temperature 0 to 50°C 32 to 122°F	Environmental	Ambient temperature	0 to 50°C 32 to 122°F						
	resistance	Relative humidity	35 to 85% (No condensation)						
aterial Polycarbonate	Material		Polyca	rbonate					
	Weight								

\*1 1 or 2 units can be connected only with the same head model

2 OUT 1 to OUT 8 decision result, OUT 9 to OUT 16 decision result, time share output of binary measurement data.
 The rating of the NPN/PNP open collector output (output terminal block): 50 mA (30 V or less) max., residual voltage: 1.4 V or less (50 mA) 1.0 V (20 mA)

• The rating of the NPN/PNP open collector output (expansion connector): 50 mA (30 V or less) max., residual voltage: 1.0 V or less

Rating for non-voltage input, ON voltage 1V max., OFF current 0.3mA max. (trigger input terminal, ON voltage 5V max., OFF current 1mA max.)
 Voltage rating, maximum rating 26.4V, ON voltage 10.8V, OFF current 0.3mA (trigger input terminal maximum rating 26.4V, ON voltage 10.8V, OFF current 1mA)

#### OPERATING SYSTEM ENVIRONMENT

СРИ	Pentium III 1GHz min. (recommended 1.7GHz min.)				
	Windows 10 <sup>*1</sup> Windows 7 (SP1 or later) <sup>*2</sup>				
Support OS	Windows Vista (SP2 or later) <sup>*3</sup>				
	Windows XP (SP3 or later) <sup>*4</sup>				
Memory capacity	512MB min. (1GB min. recommended)				
Resolution of display	XGA (1024 x 768 pixels) min, 256 colors min.				
Free disk space	1GB min.				
Interface	As described above, all those mounted, USB2.0/1.1 <sup>*5</sup> , Ethernet <sup>*6</sup>				

\*For your OS, use environments above that recommended. \*1 Home, Pro, and Enterprise editions are supported.

\*2 Home Premium, Professional, and Ultimate editions are supported.

\*3 Ultimate, Business, Home Premium, and Home Basic editions are supported. \*4 Professional and Home editions are supported.

\*5 Connection through a USB hub is not included in the guarantee. \*6 Connection to LAN and connection via a router is not included in the guarantee.

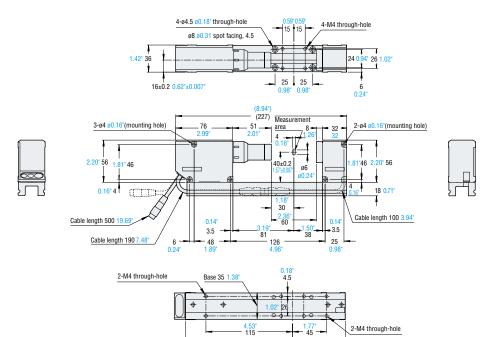
CONTROLLER SENSOR HEADS Sensor head Sensor head Sensor head Controller ø6 mm ø0.24" type ø40 mm ø1.57" type ø65 mm ø2.56" type TM-3001(P) TM-006 TM-040 TM-065 CONTROLLER LINEUP ñ TM-3001 NPN Output type Ó PNP Output type TM-3001P MONITOR Console (Optional) USB cable Setting and support software High-resolution monitor Monitor stand OP-82125 TM-H1 OP-66844 CA-MP81 0P-42278 CABLE - CONNECTOR OPTION I/O connector cable Cable between Transmitter to receiver Cable between controller - monitor Protective cover OP-87035 (2 per pack) (for TM-040) OP-87036 (2 per pack) head and controller expansion cable OP-51657 (3 m 9.8') OP-87033 (1 m 3.3') OP-87034 (3 m 9.8') CB-A×× OP-66842 (3 m 9.8') (0.7, 2, 5, 10, 20, 30 m) (2.3', 6.6', 16.4', 32.8', 65.6', 98.4') (for TM-065) RS-232C communication cable D-sub9 pin conversion connector D-sub25 pin conversion Ethernet cable Memory card CA-SD4G (4GB) CA-SD1G (1GB) OP-66843 (3 m 9.8') connector OP-96368 (2.5m 8.2') OP-26401 OP-96369 83 57

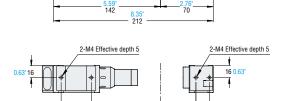
9

#### DIMENSIONS (SENSOR HEADS)

Unit: mm inch



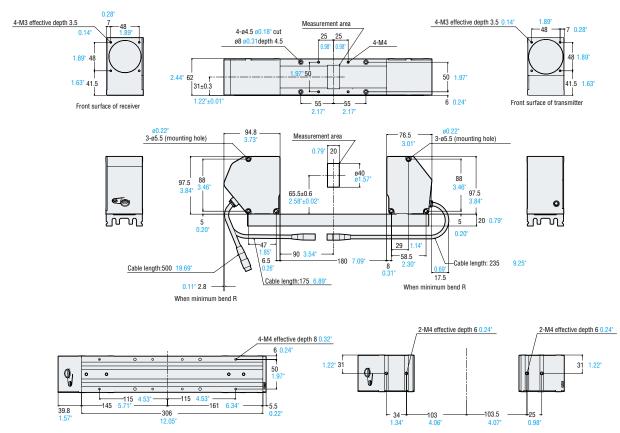




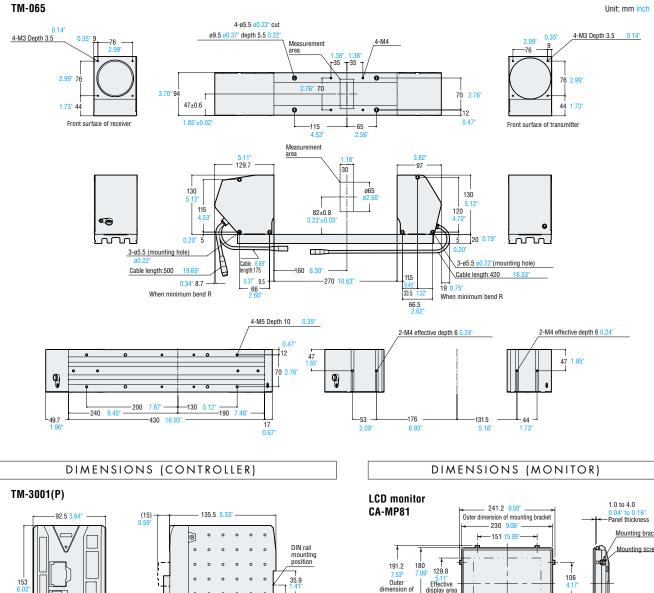
- 92 -3.62" 47 - 18

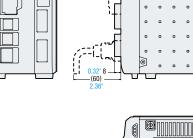
1.85" 0.71"

TM-040

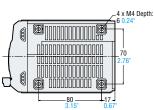


40

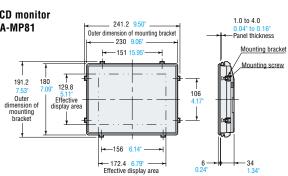




6 <sup>1</sup> 0.24"

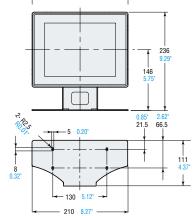


83.3 65.3



- 230 9.06"-





#### LASER DISPLACEMENT (2D)



- High-accuracy of ±0.1% of F.S.
- High-speed sampling
- Simultaneous measurement/judgment at 8 points
- Stable measurement of all targets



Confirmation of sealant coating

**LJ-G Series** 

Confirmation of door/hood mounting accuracy



Confirmation of welding groove position

**OPTICAL MICROMETER** 



Measuring the outer diameter of a piston

Measuring the outer diameter of a processed shaft



I High-repeatability ±0.06 µm

- High-speed 2,400 samples/second
- Maintenance-free design
- Easy set-up, target viewer

#### LASER DISPLACEMENT



Sampling rate of 392 kHz

- Linearity of ± 0.02% of F.S.
- Repeatability down to 0.01 µm



LK-G5000 Series





Thickness measurement/ loop control of a rubber sheet

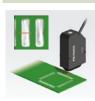


Measuring the outer diameter of a fiber

asuring the width

and camber angle of a rubber sheet

Surface scanning method for a variety of high-accuracy measurements I Multiple measurement modes ■ 0.3 µm 0.000012" resolution



LT Series



Measuring the profile of solder paste on a PWB



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