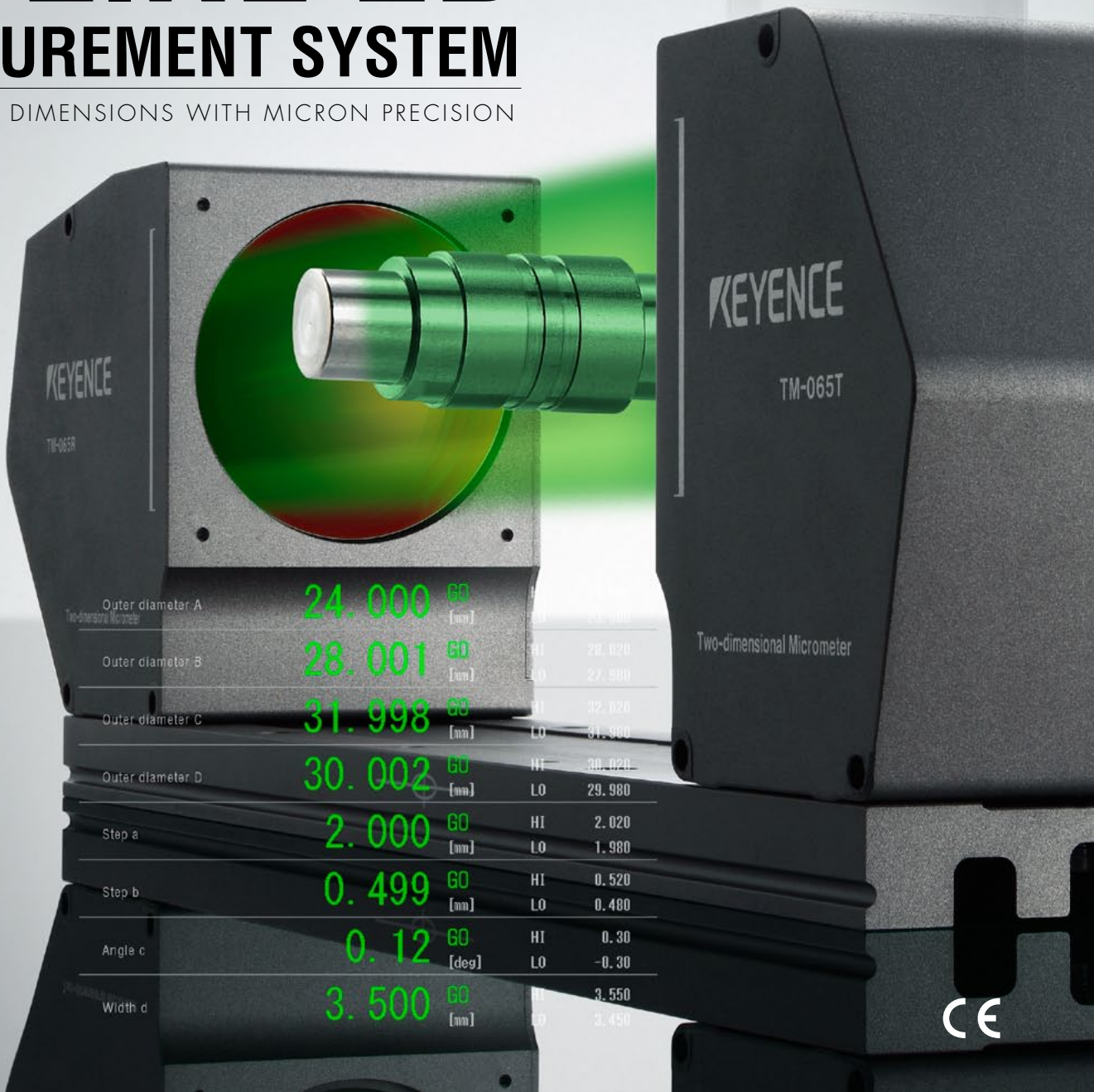
KEYENCE

High-speed 2D Optical Micrometer
TM-3000 Series

IN-LINE 2D MEASUREMENT SYSTEM

MEASURES 2 DIMENSIONS WITH MICRON PRECISION

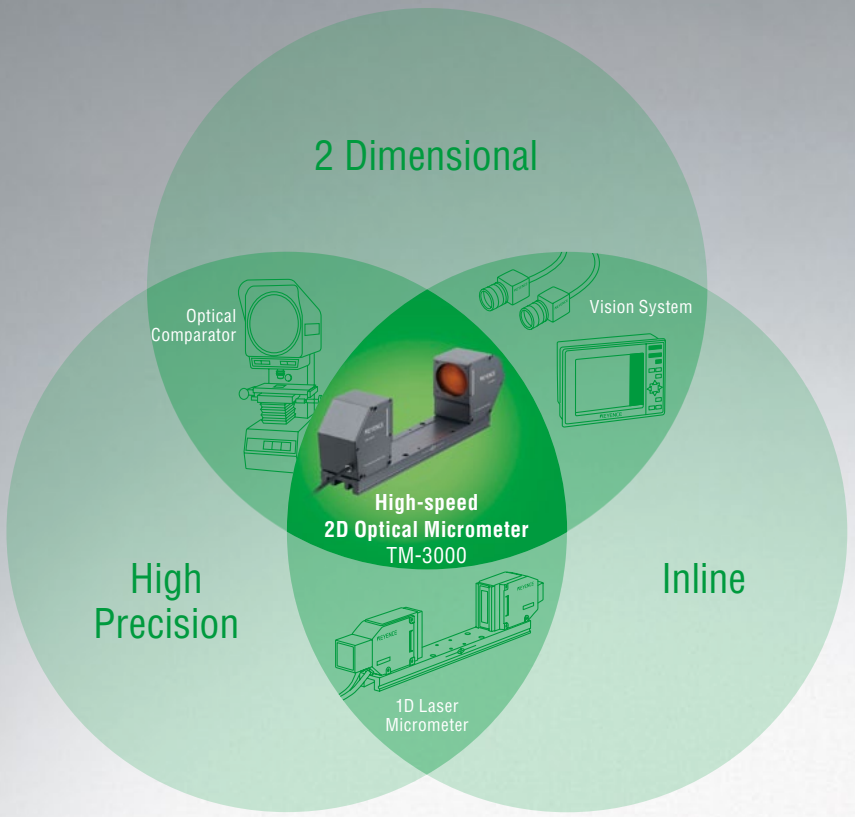


CE

HIGH-SPEED 2D OPTICAL MICROMETER

Commitment to In-line Measurement

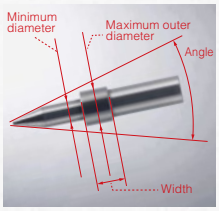
Performs in line 2D dimensional measurements with high speed and precision.
The TM-3000 Series, the industry's first inline 2D measurement system.



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, ±0.15 µm repeatability.

Traceable two dimensional inspections in line

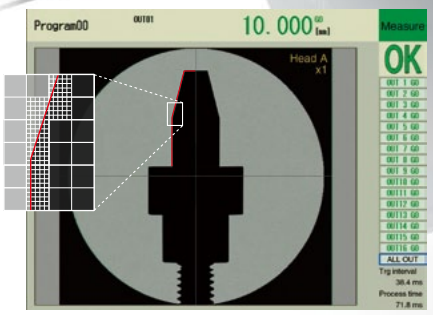
Measurement principle

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

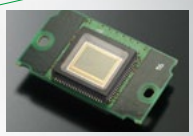
Dual telecentric optical system

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

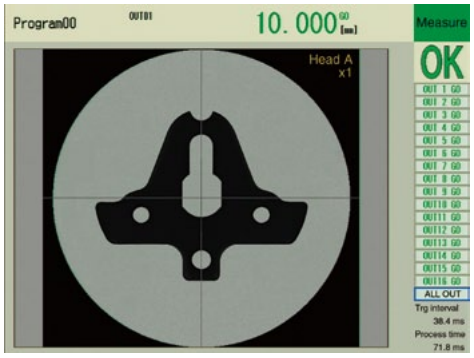
A high brightness LED is used, combining three features,

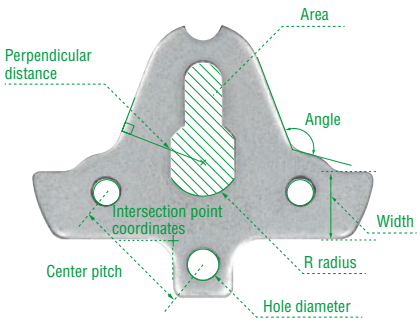
- Even Brightness Distribution
- Resistant to EMF
- Eye Safe

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.





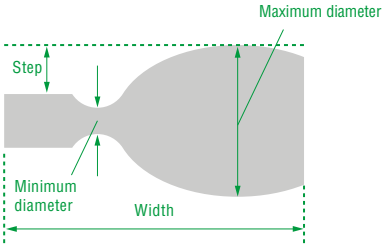
Example of measurement

: Hole diameter
: Center pitch
: Intersection point coordinates
: R radius
: Width
: Angle
: Perpendicular distance
: Area

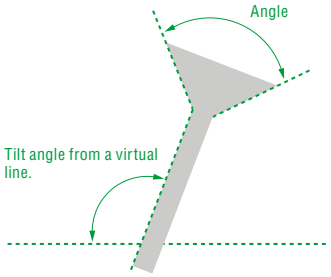
Diverse measurement modes

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

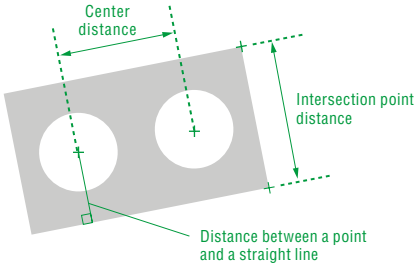
Outer diameter/Step/Width
Measures a maximum diameter/minimum diameter within the specified area, and a step/width between the detected edges.



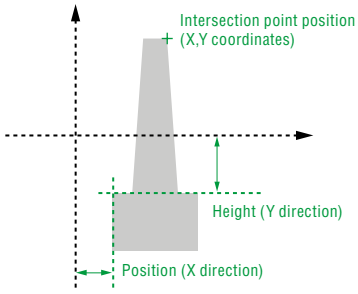
Angle
Measures an angle between two detected straight lines, and a tilt angle from a virtual line.



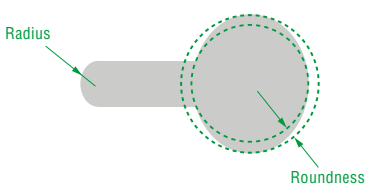
Distance/Intersection Point Distance
Measures a center of the circles and intersection point, distance between 2 specified points, distance from a point to a straight line.



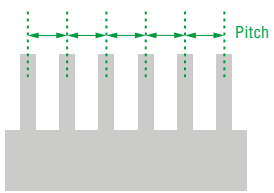
Height / Position/Coordinates
Measures height/ position of detected edges and coordinates of specified points.



Radius/Roundness
Measures radius and roundness of specified arc.

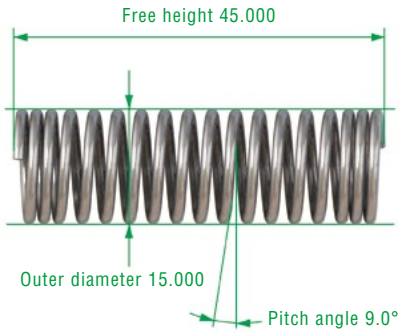


Pitch
Measures a maximum/minimum/average pitch within the specified area.

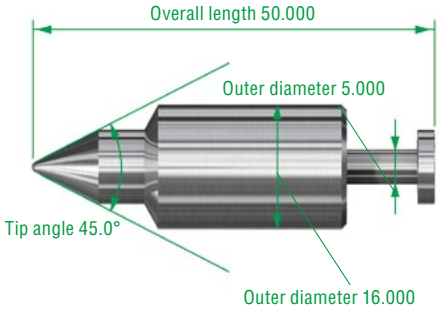


APPLICATIONS

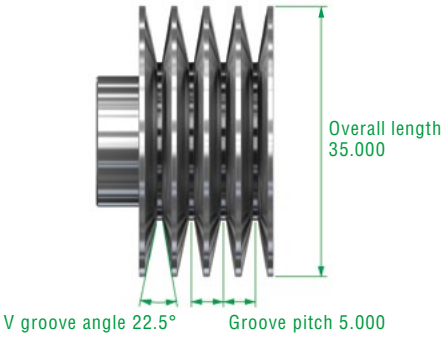
Unit: mm



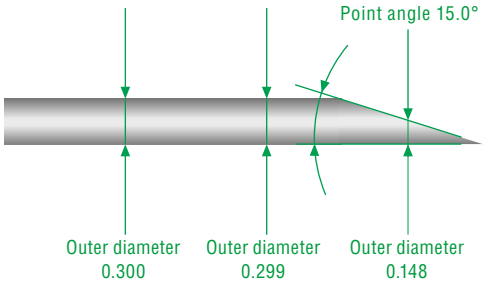
Measures outer diameter /pitch angel of springs



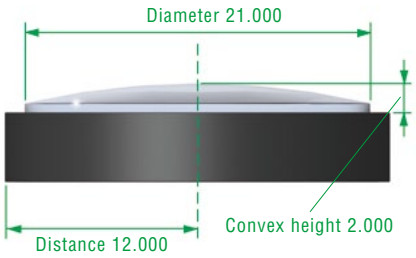
Measures outer diameter/tip angle of needle valves



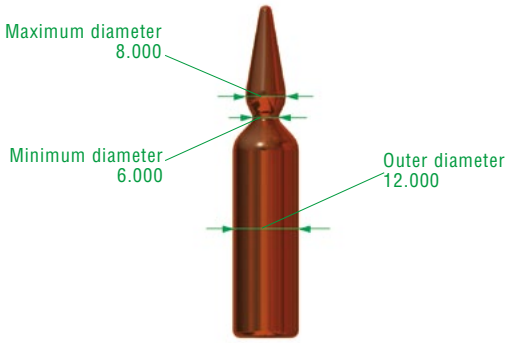
Measures pulley groove pitches/V groove angles



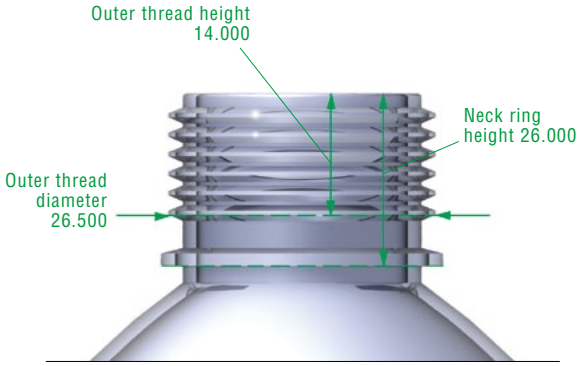
Measures multi-point outer diameter/point angle of injection needles



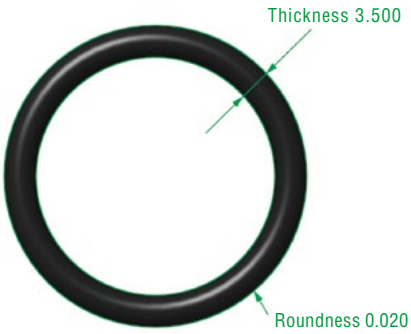
Measures diameter/height of lenses



Measures maximum diameter/minimum diameter of ampules



Measures outer diameter and threading a PET bottle

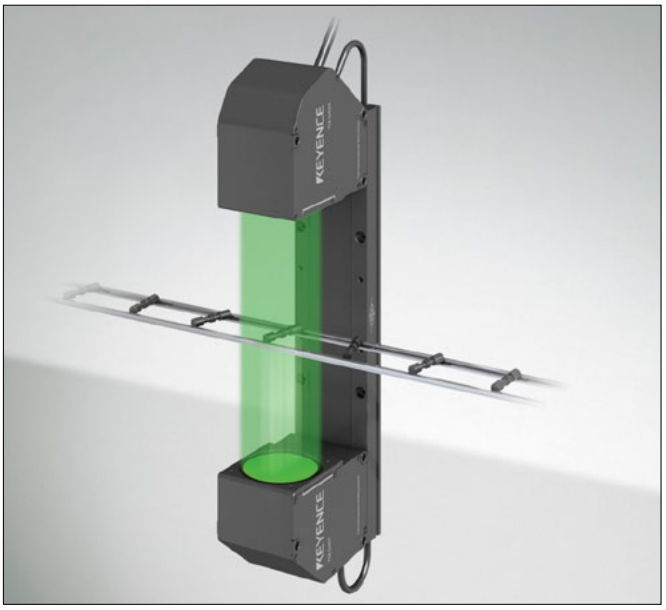


Measures roundness/thickness of O-rings

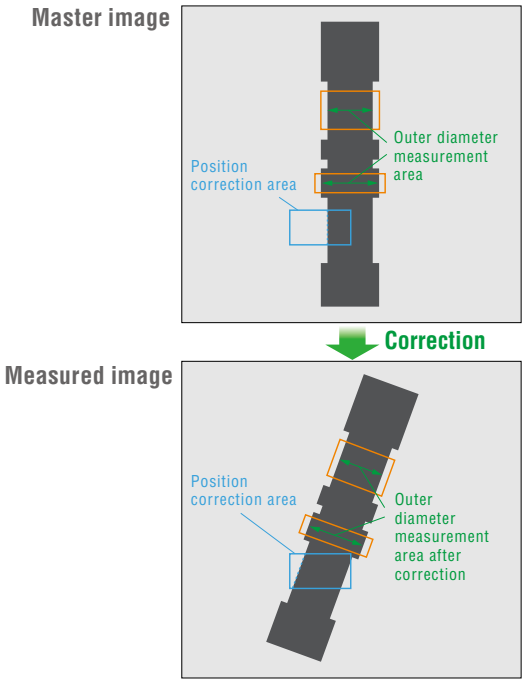
Correction function with on-the-spot power

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.

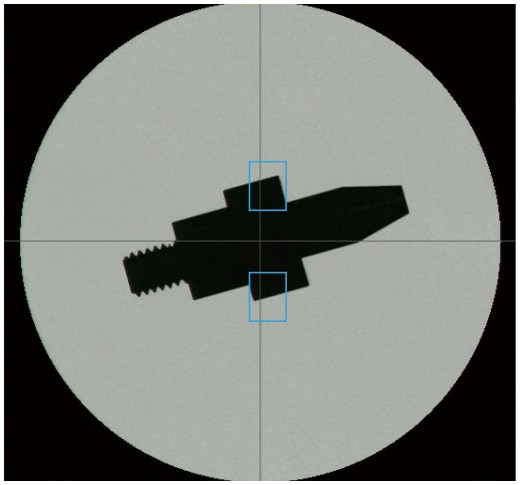


Because the measurement area autotracks according to the position and tilt of objects within the compensation area, it can be measured accurately.

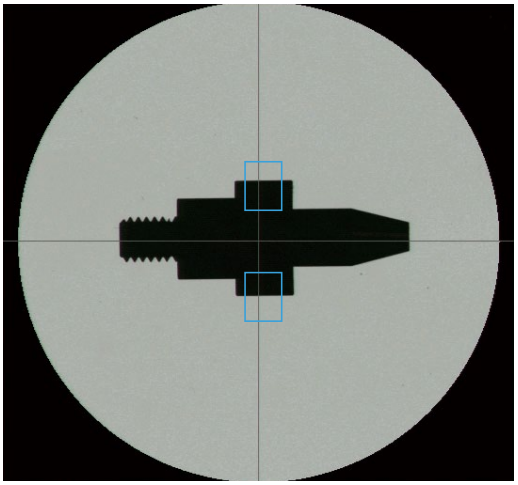


Tilt correction function

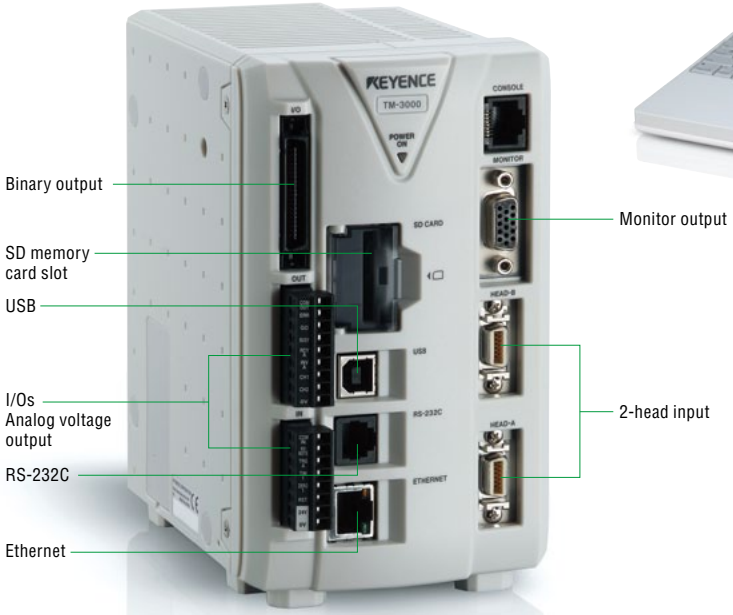
When installing the sensor head, a tilt of the master workpiece is horizontally/vertically corrected, which significantly reduces adjustment times.



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.



Simple setting and analysis with a PC

SETTING SUPPORT SOFTWARE
TM-Navigator (TM-H1)

With the included software, settings can be easily configured and data can be saved and analyzed with a PC.

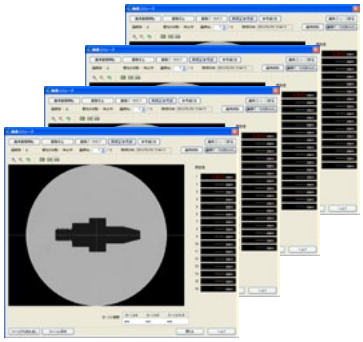
Large capacity memory for saving data

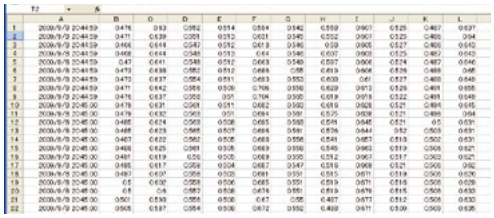
The controller has built in high capacity memory.
A memory card slot is included for recording histories of multiproduct/mass production.

Profile saving

For analyzing NG records or production history.

Maximum100 images





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)

Model		TM-006	TM-040	TM-065
Measuring range		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" *3	±3 µm 0.000118" *5
Repeatability		±0.06 µm *2	±0.15 µm 0.000006" *4	±0.2 µm 0.000008" *6
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		
Weight	Transmitter	Approx. 140g	Approx. 560g	Approx. 1280g
	Receiver	Approx. 340g	Approx. 720g	Approx. 1460g
	Base	Approx. 220g	Approx. 630g	Approx. 1500g

*1 In a measurement area of 2 mm 0.08"× ø4 mm ø0.16" 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" 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 ±2σ 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"× ø40 mm ø1.57".
*6 Value of ±2σ 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)

Model		TM-3001	TM-3001P
Sensor head compatibility		Compatible	
Number of connectable sensors *1		2 units max.	
Display	Minimum display unit	0.01 µm, 0.001 mm², 0.01°	
	Maximum display range	±9999.99 mm, ±99999.9 mm², ±99999.9°	
Input terminal block	Laser remote interlock input	Non-voltage input	Non-voltage input
	Trigger input (for Head A)		Voltage input
	Timing 1 input		
	Auto-zero 1 input		
	Reset input		
Output terminal 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
	Error output	NPN open-collector output (N.C.)	PNP open-collector output (N.C.)
	Process output	NPN open-collector output	PNP open-collector output
	Trigger input enable output		
	Adjusted error output		
Expansion connector	Trigger input (for Head A)	Non-voltage input	Voltage input
	Timing 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	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: OUT1 to OUT16 measured data output (21 bits) PNP open-collector output
	Strobe output	NPN open-collector output	PNP open-collector output
	Trigger input enable output		
Analog RGB monitor output		SVGA (800 x 600 pixels)	
RS-232C interface		Measured data output and control input/output (Maximum baud rate: 115200 bps, selectable)	
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	
Memory card		SD card CA-SD4G (4GB), CA-SD1G (1GB) support	
Major functions		Position correction function, OUT name change function, select measurement mode (outer diameter, height, step height, position, width, distance, intersection distance, 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, measurement 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, detection threshold value change function, mask function, attitude correction function, display language switching function, support software setting function, trigger interval-measurement time display function, others	
Ratings	Power supply voltage	24 VDC ±10%, Ripple: 10% (P to P) or less	
	Current consumption	1 head connected 480mA max./ 2 heads connected 550mA max.	
Environmental resistance	Ambient temperature	0 to 50°C 32 to 122°F	
	Relative humidity	35 to 85% (No condensation)	
Material		Polycarbonate	
Weight		Approx. 1120g	

*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

CPU	Pentium III 1GHz min. (recommended 1.7GHz min.)
Support OS	Windows 10 *1 Windows 7 (SP1 or later) *2
	Windows Vista (SP2 or later) *3
	Windows XP (SP3 or later) *4
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 *5, Ethernet *6

*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

Controller
TM-3001(P)

CONTROLLER LINEUP

NPN Output type	TM-3001
PNP Output type	TM-3001P

SENSOR HEADS

Sensor head
ø6 mm ø0.24" type
TM-006

Sensor head
ø40 mm ø1.57" type
TM-040

Sensor head
ø65 mm ø2.56" type
TM-065

MONITOR

Console (Optional)
OP-82125

Setting and support software
TM-H1

USB cable
OP-66844

High-resolution monitor
CA-MP81

Monitor stand
OP-42278

CABLE - CONNECTOR

Cable between head and controller
CB-A××
(0.7, 2, 5, 10, 20, 30 m)
(2.3', 6.6', 16.4', 32.8', 65.6', 98.4')

Transmitter to receiver expansion cable
OP-87033 (1 m 3.3')
OP-87034 (3 m 9.8')

Cable between controller - monitor
OP-66842 (3 m 9.8')

I/O connector cable
OP-51657 (3 m 9.8')

Ethernet cable
OP-66843 (3 m 9.8')

RS-232C communication cable
OP-96368 (2.5m 8.2')

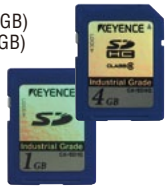
D-sub9 pin conversion connector
OP-26401

D-sub25 pin conversion connector
OP-96369

OPTION

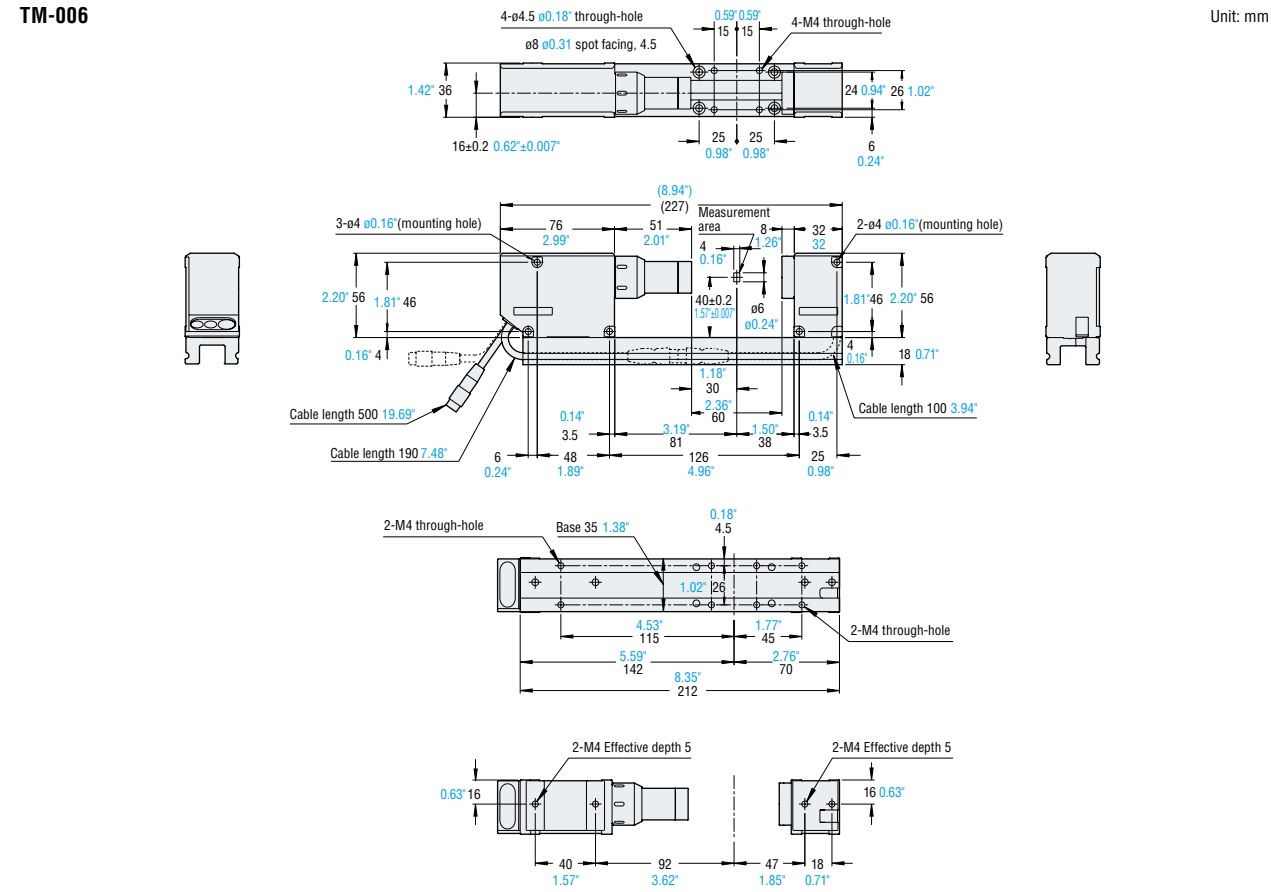
Protective cover
OP-87035 (2 per pack)
(for TM-040)
OP-87036 (2 per pack)
(for TM-065)

Memory card
CA-SD4G (4GB)
CA-SD1G (1GB)

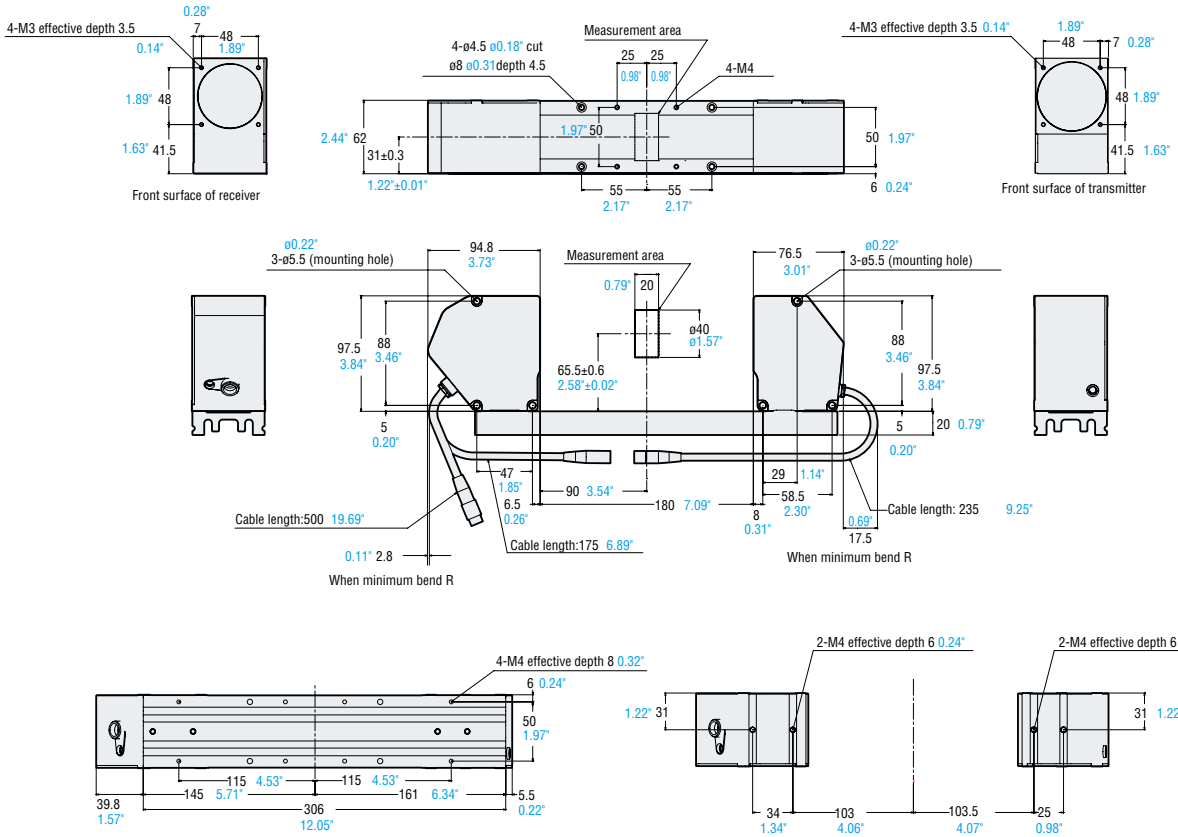


Unit: mm inch

TM-006



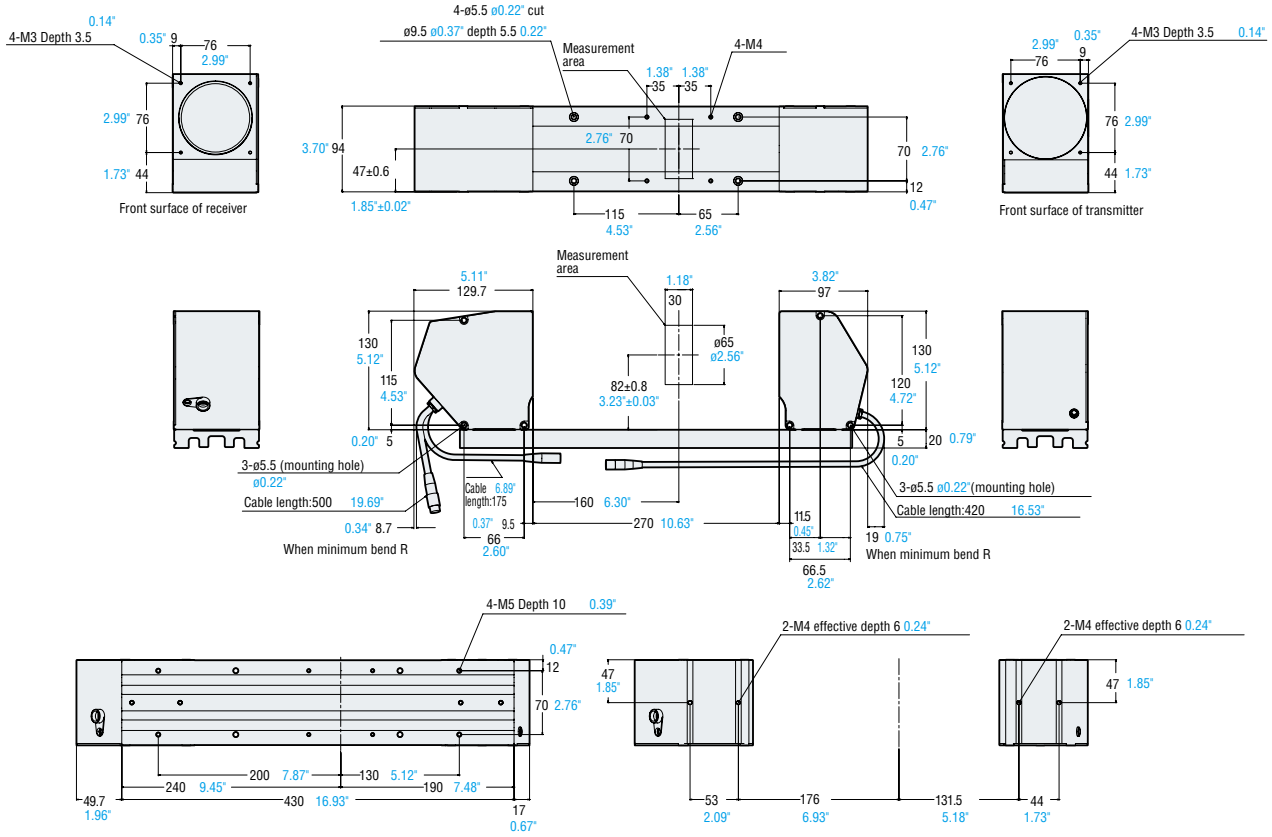
TM-040



DIMENSIONS (SENSOR HEADS)

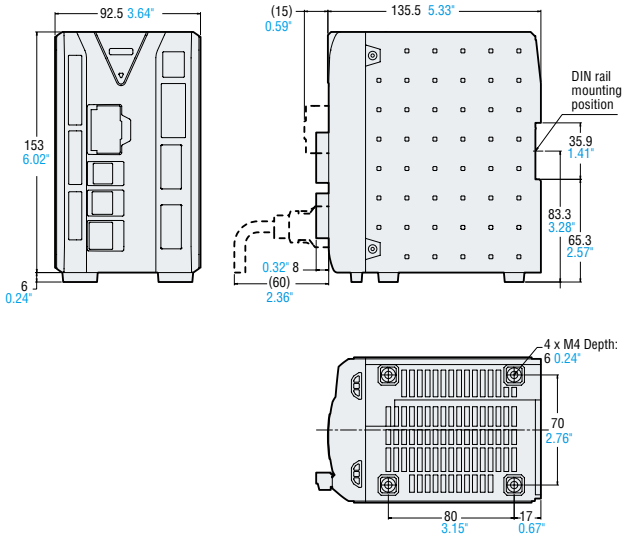
TM-065

Unit: mm inch



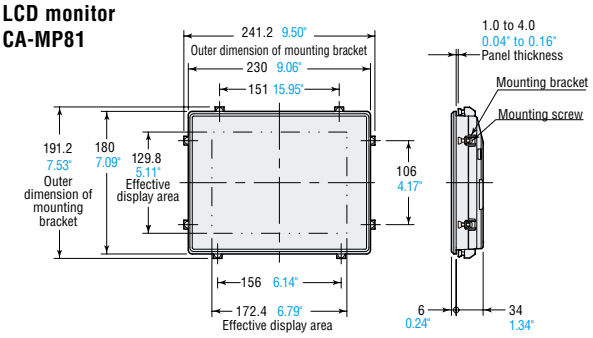
DIMENSIONS (CONTROLLER)

TM-3001(P)

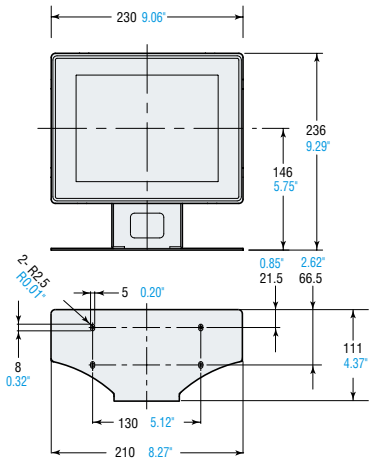


DIMENSIONS (MONITOR)

LCD monitor CA-MP81



Stand OP-42278



LASER DISPLACEMENT (2D)

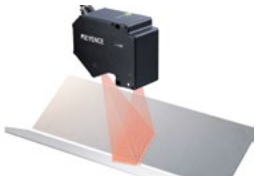
LJ-G Series

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

Confirmation of PCB mounting height

Confirmation of sealant coating profile

Confirmation of door/hood mounting accuracy



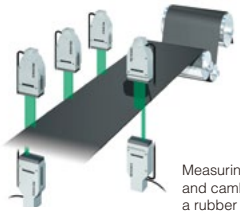
Confirmation of welding groove position

OPTICAL MICROMETER

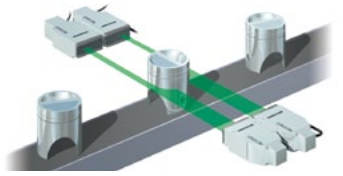
LS Series

- High-repeatability ±0.06 µm
- High-speed 2,400 samples/second
- Maintenance-free design
- Easy set-up, target viewer

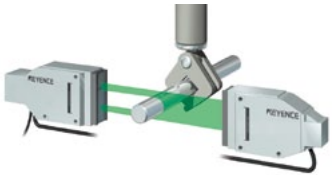
Measuring the outer diameter of a fiber



Measuring the width and camber angle of a rubber sheet



Measuring the outer diameter of a piston



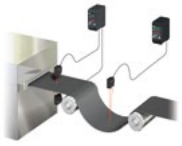
Measuring the outer diameter of a processed shaft

LASER DISPLACEMENT

LK-G5000 Series

- Sampling rate of 392 kHz
- Linearity of ± 0.02% of F.S.
- Repeatability down to 0.01 µm

Vibration test of high-temperature-muffler

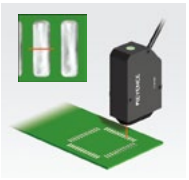


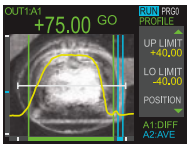
Thickness measurement/ loop control of a rubber sheet

CONFOCAL DISPLACEMENT

LT Series

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





Measuring the profile of solder paste on a PWB

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SAFETY INFORMATION
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