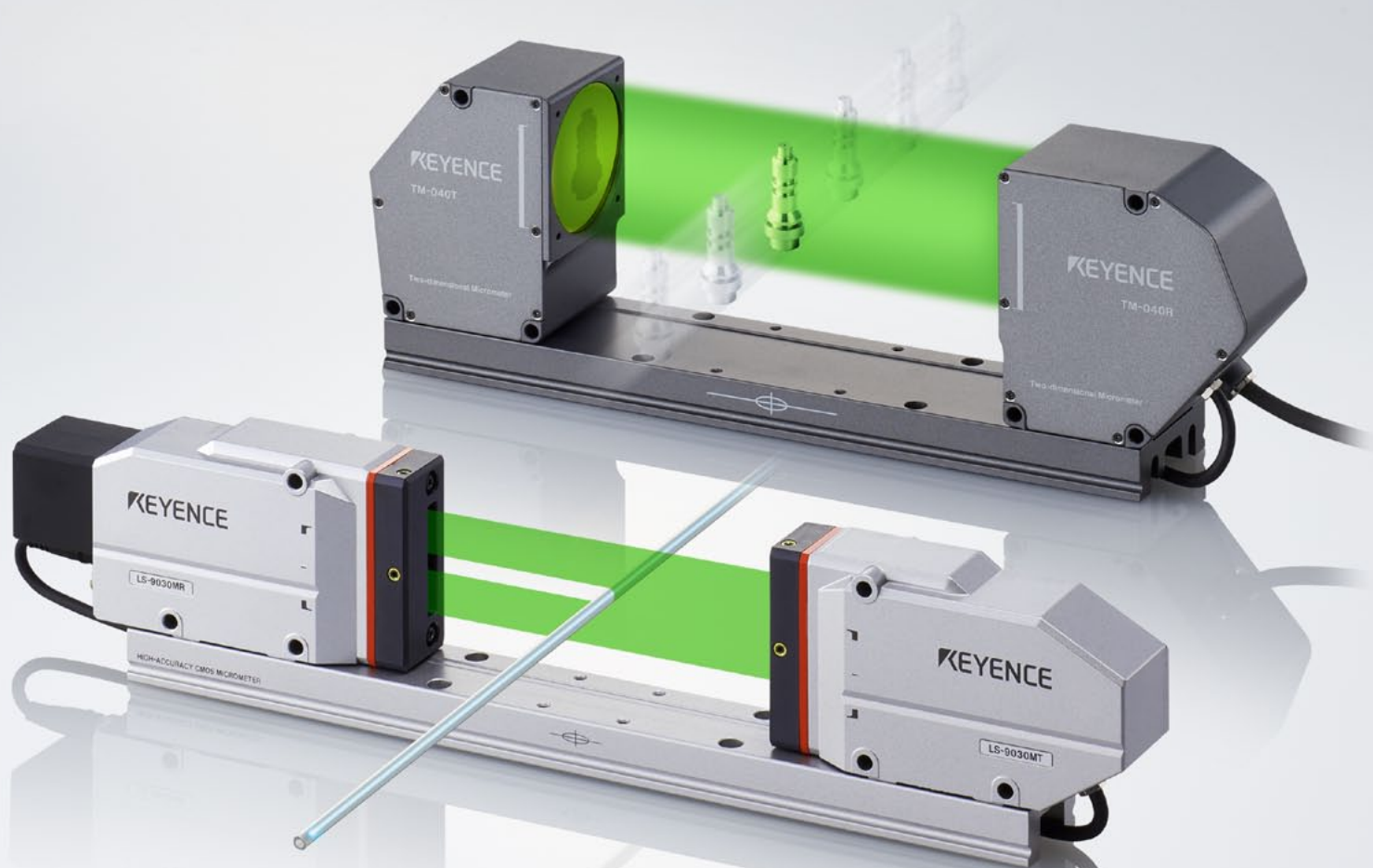




Optical Micrometers



TM-3000 Series

LS-9000 Series

LS-7000 Series

Make the Ultimate Upgrade to an LED.



Laser type

Laser Scanning Micrometer

Typical micrometer

- ▶ Low durability due to deterioration of moving parts
- ▶ Instability in measurements due to temperature fluctuation



LED type

Advanced Optical Micrometer | P.32

LS-7000 Series

- ▶ No moving parts with LED-based optical system
- ▶ Longterm stability achieved with higher speed and accuracy



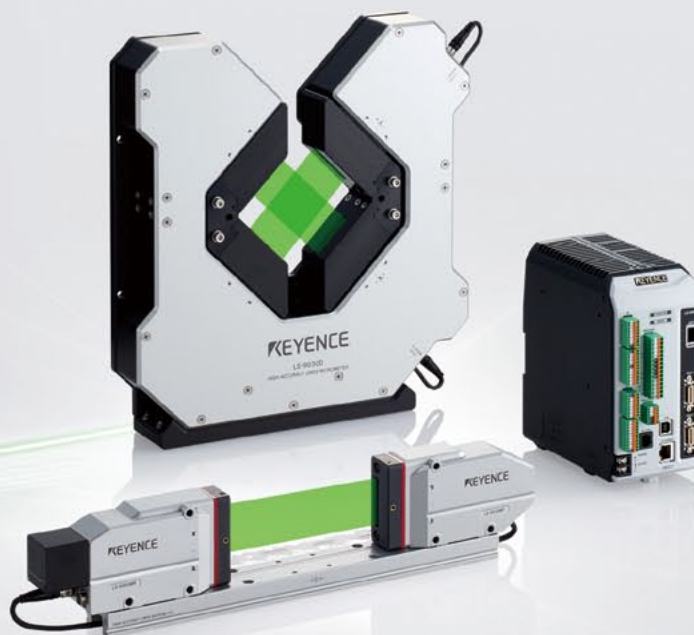
Evolution to 2D

2D Optical Micrometer

P. 6

TM-3000 Series

- ▶ Measures areas rather than points for increased stability
- ▶ 2D In-line measurement



Improved 1D Capabilities

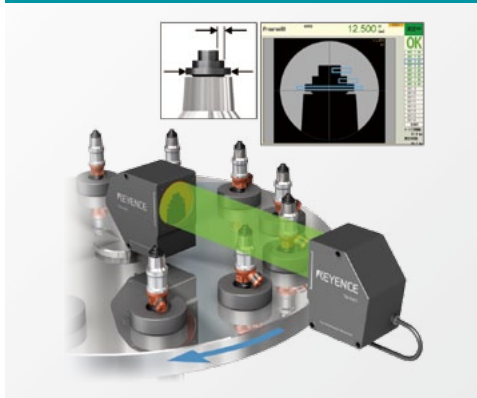
High-speed Optical Micrometer

P. 18

LS-9000 Series

- ▶ High-speed sampling surpassing conventional models
- ▶ Active tilt-correction allows for accurate measurement on mis-aligned parts.

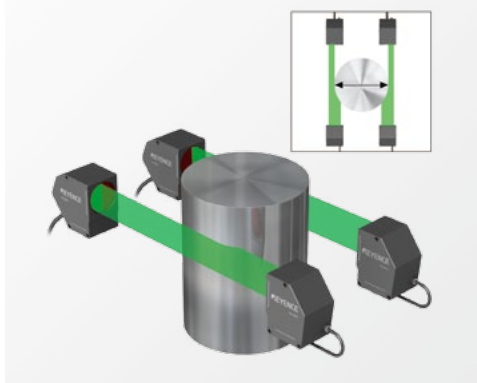
Measuring targets on an index table



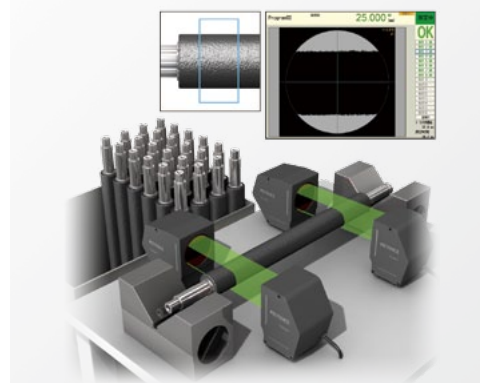
Measuring targets transferred by a robot



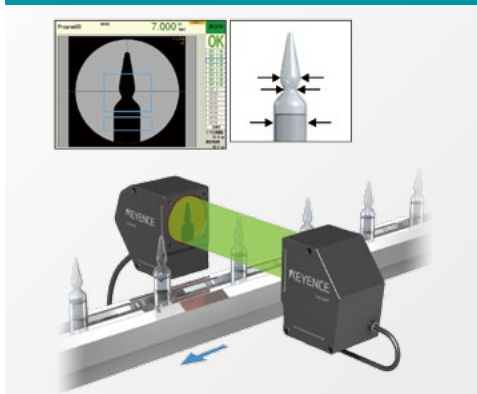
Measuring the outer diameter of a large target



Measuring the shaft run-out of a rough-surfaced target



Measuring targets moving on a conveyor



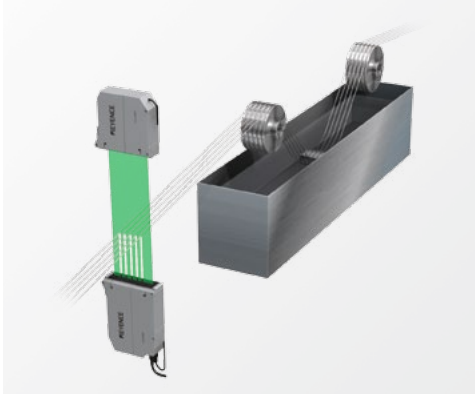
Measuring the inner diameter of a target on a glass table



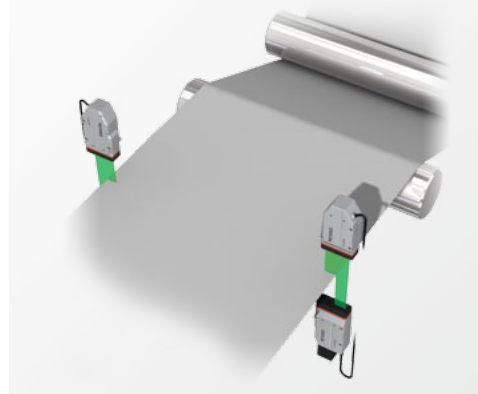
Application Examples LS Series

LS-9000 Series

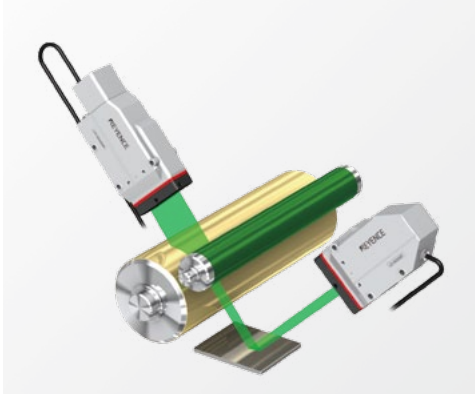
Measuring the outer diameter of multiple wires simultaneously



Measuring sheet width and position



Measuring a roller gap by deflecting the optical axis with a mirror



Measuring the outer diameter of a glass tube



Measuring the outer diameter in two axes in a harsh environment



Measuring the outer diameter of ultra-thin wires



TM-3000 Series

LS-9000 Series

LS-7000 Series

2D Optical Micrometer

TM-3000 Series

Take measurements in-line
from a 2D image



Accurately measure anywhere in the wide field of view

TM-3000 Series

2D measurement

Multiple points

can be measured simultaneously

Area measurement has enabled measurement at multiple points without the need to move targets. Moreover, the system can recognize the orientation of the target and correct it automatically to ensure accurate measurement.

High-accuracy measurement

$\pm 0.15 \mu\text{m}$ 0.000006"

repeatability

The use of a double telecentric optical system and green LED has achieved high-accuracy measurement regardless of the position of the target relative to the lens. Calibration certificates are available for every sensor head.

In-line measurement

5.5 ms max.

high-speed measurement

A new processor dedicated for high-speed processing has been developed for in-line measurement. It enables 100% inspection instead of sample inspection.

Conventional problems

Measuring at multiple points is time-consuming.

To measure multiple points with a conventional 1D micrometer, you would have to mount multiple sensor heads or move the target.

Accuracy cannot be guaranteed.

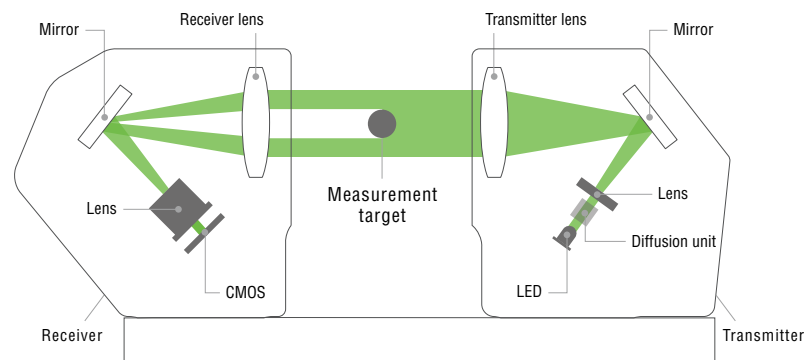
When a camera is used for measurement, the accuracy cannot be guaranteed due to illumination setting conditions or lens distortion, making high-accuracy measurements impossible.

Measurement takes too long.

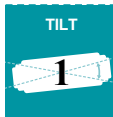
Using an optical comparator can be very time consuming because measurement cannot be performed in-line, requiring parts to be removed and tested one by one.

Measurement principle

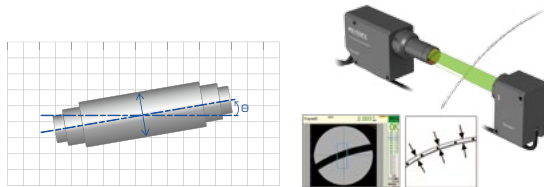
The green LED light is distributed from the transmitter as parallel light, and the silhouette of the target interrupting the light is captured by the CMOS in the receiver. Then the edges between the bright and dark sides are detected from the silhouette and used to measure outer diameter or other dimensions. This method utilizes a unique advantage of threbeam devices, that they are unaffected by lighting or target surface conditions, to achieve high-accuracy measurements.



Various outer diameter measurements possible with 2D detection



Measuring the outer diameter of an inclined target

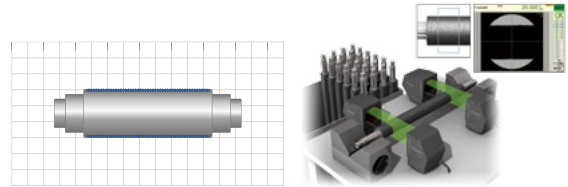


Measuring the outer diameter of a catheter

Since the TM-3000 Series measures outer diameter based on a 2D image, it can ascertain information on the target inclination. Based on this information, it can measure outer diameters while correcting for the inclination automatically.



Measuring the outer diameter of a target with a rough surface

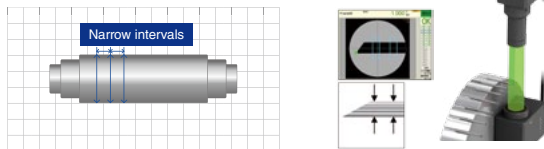


Measuring the outer diameter of a copy roller

The size of a measurement area is customizable. Calculating the average of the diameters within the area minimizes the error caused by surface roughness during measurement.



Measuring the outer diameter at multiple points near each other

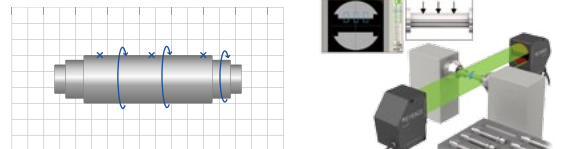


Measuring the outer diameter of an injection needle

You can obtain measured values by just specifying an area around the target section on the captured image. Unlike conventional micrometers, the measurement can be completed without the troublesome process of changing the target position or preparing a moving mechanism.



Measuring the eccentricity at multiple points of a rotating target

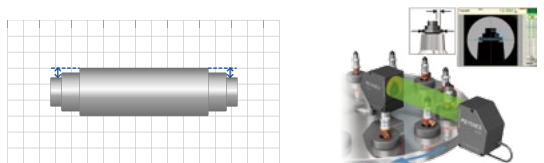


Measuring the eccentricity at multiple points of a solenoid valve

Simply selecting measurement points from the captured image allows measurement. The measurement of the deviation at multiple points can be perfectly synchronized and conducted at once, resulting in significant reduction of cycle time.



Measuring the height difference of a stepped target

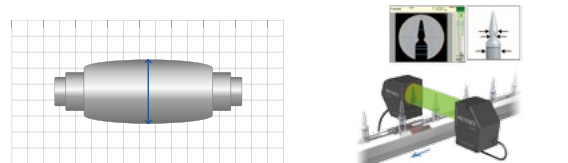


Measuring the height difference/outer diameter of an injector

Effects of inclination can be corrected during measurement when calculating from 2D data. Both height difference and outer diameter can be measured with one sampling, allowing In-line measurement.



Measuring the maximum/minimum outer diameter



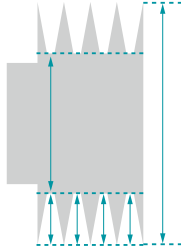
Measuring the outer diameter of an ampule

Measurement is conducted at once using the entire image, and the maximum diameter can be determined from the result. Since the maximum value can be specified from the entire image, measurement is not affected by errors resulting from the use of a jig.

Diverse measurement modes enabled by 2D detection

Step

Measuring the depth of pulley V-grooves



Measures the height difference between detected edges.

Width

Measuring the width of ampoules



Measures the maximum, minimum or average width between detected edges.

Angle

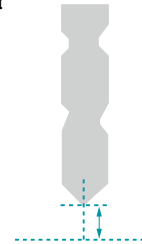
Measuring the tip angle of injection needles



Measures the angle between two detected straight lines.

Distance

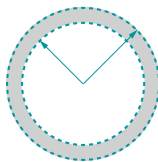
Measuring the distance between a drill and a target



Measures the distance to or position of a detected edge.

Radius

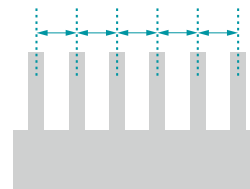
Measuring the radius of O-rings



Measures the radius of a specified arc.

Pitch

Measuring the pitch of connector terminals



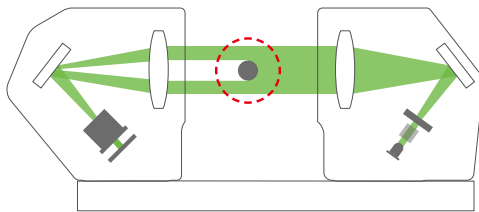
Measures the pitch of specified points.

Technologies to achieve high accuracy

Less affected by misalignment of a target

Using a large focal ratio allows a large depth of field (wide measuring range between the transmitter and receiver). The telecentric optical systems used in both the transmitter and receiver capture sharp edges, allowing accurate measurement without being affected by misalignment of the target.

When the target is at the optimum position



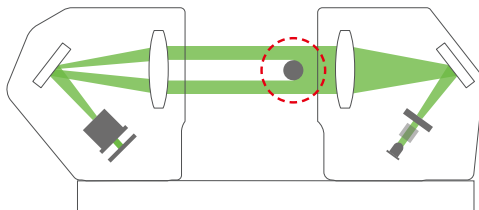
Typical optical system



TM-3000



When the target deviates from the optimum position



The edges blur when the position deviates.



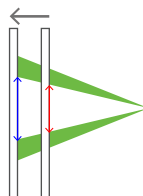
The edges are sharp even when the position deviates.

Minimizing the influence of ambient light/temperature

The incorporated double telecentric optical system receives parallel light and maintains the parallelism to form an image on the light receiving element. Since it only receives parallel light based on its principle, it is less affected by ambient light^{*1}. The structure is also designed to minimize the influence of temperature changes on measurements by suppressing the change in size of the formed image even when the light receiving element changes its position due to thermal expansion^{*2}.

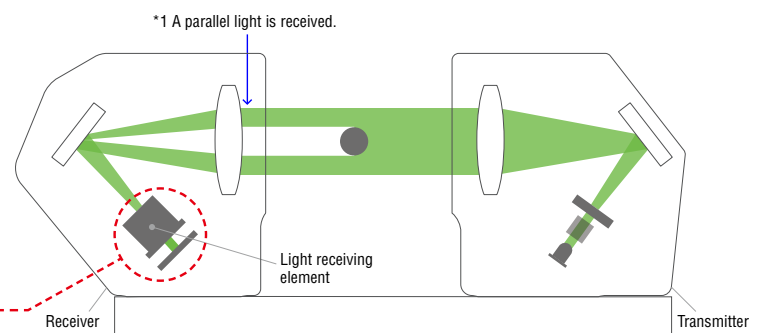
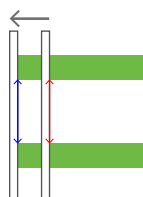
Typical optical system

If the light receiving element changes its position due to thermal expansion, the size of the formed image changes.



TM-3000

Even if the light receiving element shifts due to thermal expansion, the size of the formed image does not change.

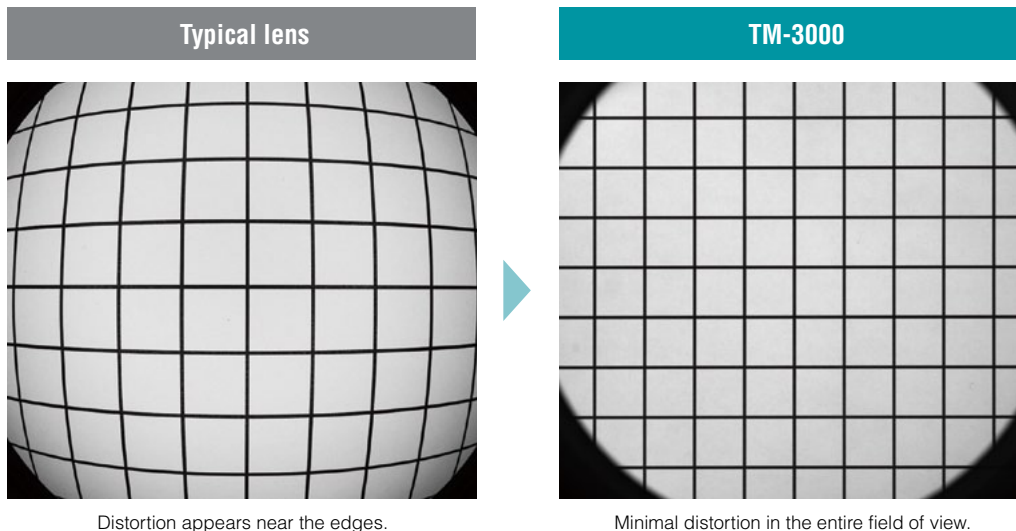


*1 A parallel light is received.

*2 The light is made to be parallel to form an image.

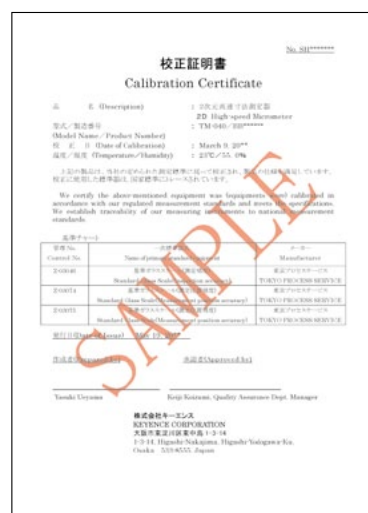
No adjustment necessary to ensure accuracy

A low distortion lens is used, which produces minimal distortion in captured images, even near the edges. Moreover, the original algorithm processing allows measurement without the need to carefully position the target. Conventional illumination and the position adjustment of targets are no longer necessary.

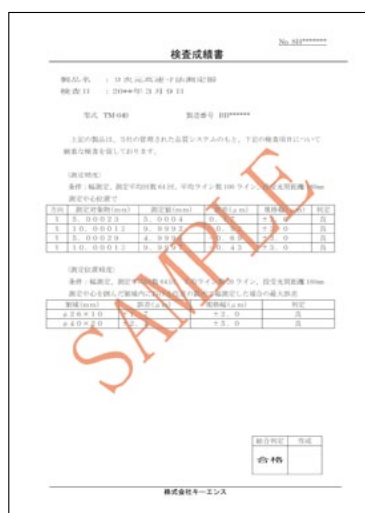


Calibration certificate for guaranteed accuracy

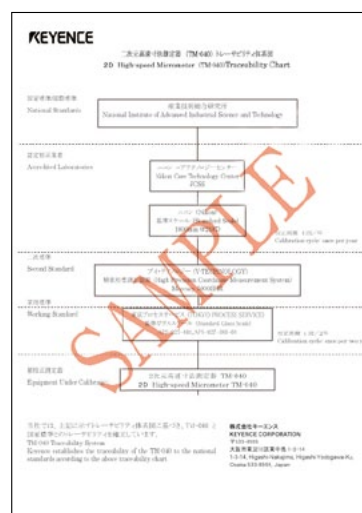
Unlike camera systems, calibration certificates including traceability, are available for all sensor heads.



Calibration certificate



Inspection report

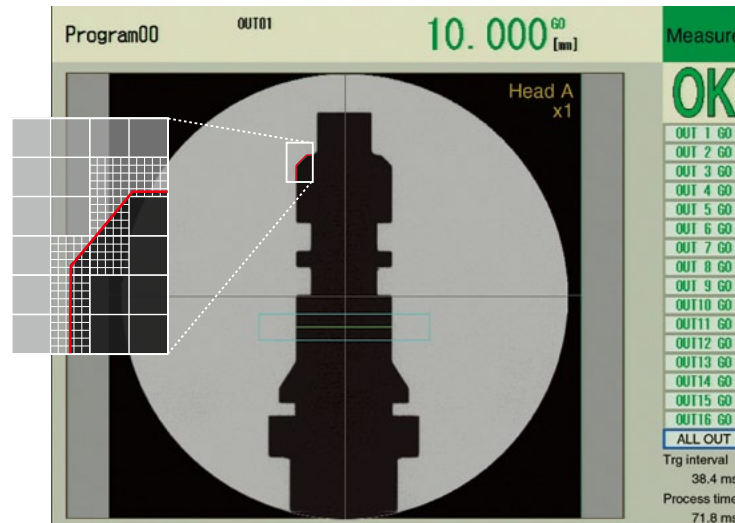


Traceability system diagram

Technologies to achieve high-speed measurement

Instantaneous measurement of 16 points – sub-pixel processing & dedicated processor

High speed and high precision are achieved through pinpoint extraction and sub-pixel processing of only the contour selected for the measurement. A new processor dedicated for high-speed 2D processing has been developed. Moreover, the system uses a high-speed calculation CPU and two image processing DSPs. Using a total of four processors for parallel processing enables a maximum processing capacity of 1800 targets/minute.



High intensity green LED – Acquire images of moving targets without blurring

The use of a high intensity LED has reduced the light receiving period to accumulate light on the CMOS, resulting in measurement using unblurred images even of moving targets. The LED offers four advantages: even brightness distribution, EMF resistance, eye safety, and high intensity.



Typical measuring instrument



Blurred edges

TM-3000



Sharp edges

TM-3000 Series

Sensor head lineup

2D measurement of small diameter targets

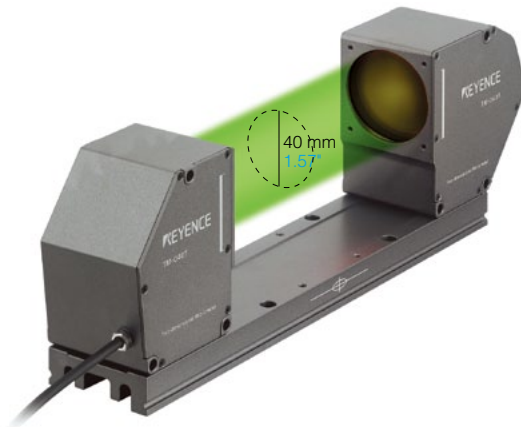


Small
diameter
type

TM-006

Measuring range	ø6 mm $\phi 0.24''$
Smallest detectable object	0.04 mm $0.0016''$
Repeatability	$\pm 0.06 \mu\text{m}$
Measurement accuracy	$\pm 0.5 \mu\text{m} \pm 0.00002''$

Standard model for 2D measurement achieving good field of view and accuracy

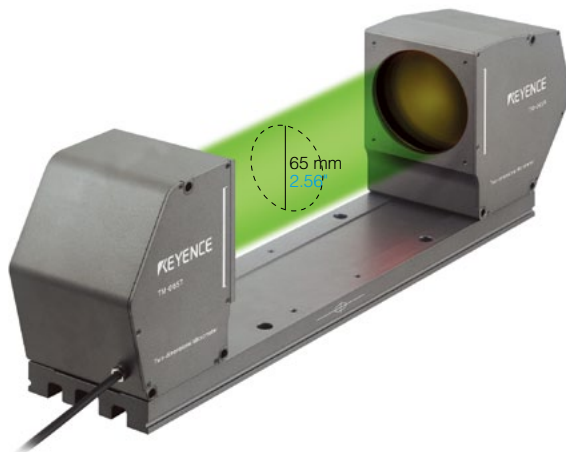


Standard
type

TM-040

Measuring range	ø40 mm $\phi 1.57''$
Smallest detectable object	0.3 mm $0.01''$
Repeatability	$\pm 0.15 \mu\text{m} \pm 0.000006''$
Measurement accuracy	$\pm 2 \mu\text{m} \pm 0.00008''$

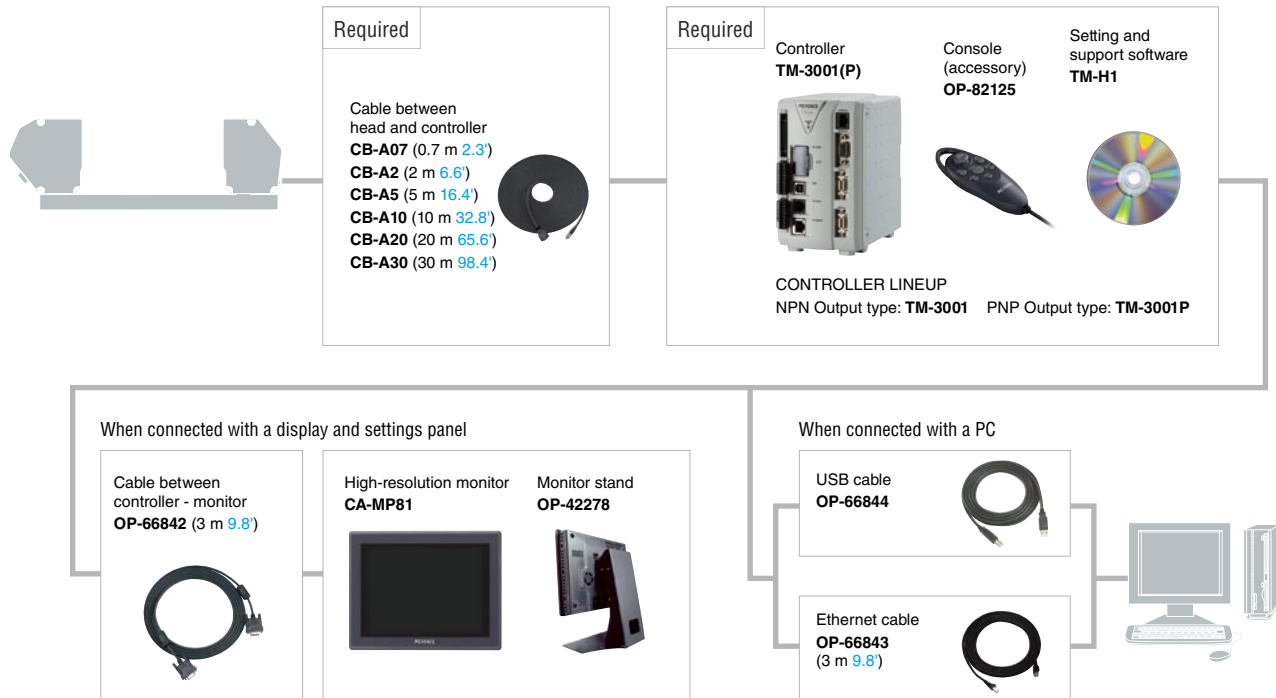
2D measurement of large diameter targets up to 65 mm 2.56"



Large
diameter
type

TM-065

Measuring range	ø65 mm $\phi 2.56''$
Smallest detectable object	0.5 mm $0.02''$
Repeatability	$\pm 0.2 \mu\text{m} \pm 0.000008''$
Measurement accuracy	$\pm 3 \mu\text{m} \pm 0.0001''$



CABLE - CONNECTOR

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



D-sub9 pin conversion connector
OP-26401



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



D-sub25 pin conversion connector
OP-96369



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



OPTION

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



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



OPERATING SYSTEM ENVIRONMENT

CPU	Pentium III 1GHz min. (recommended 1.7 GHz 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	512 MB min. (1 GB min. recommended)
Resolution of display	XGA (1024 × 768 pixels) min, 256 colors min.
Free disk space	1 GB 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.



■ 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	
Repeatability	±0.06 µm ^{*1}	±0.15 µm ±0.000006" ^{*2}	±0.2 µm ±0.000008" ^{*3}
Measurement accuracy	±0.5 µm ±0.00002" ^{*4}	±2 µm ±0.00008" ^{*5}	±3 µm ±0.00012" ^{*6}
Sampling cycle (trigger interval) ^{*7}		5.5 ms (33 ms 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. 140 g	Approx. 560 g
	Receiver	Approx. 340 g	Approx. 720 g
	Base	Approx. 220 g	Approx. 630 g
			Approx. 1500 g

^{*1} 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 1.3 mm **0.05"** line.

^{*2} 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.

^{*3} 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.

^{*4} Error when measuring width of KEYENCE standard object (glass calibration scale) in a measurement area of 2 mm **0.08"** × ø4 mm **ø1.6"**.

^{*5} Error when measuring width of KEYENCE standard object (glass calibration scale) in a measurement area of 10 mm **0.39"** × ø26 mm **ø1.02"**.

^{*6} Error when measuring width of KEYENCE standard object (glass calibration scale) in a measurement area of 20 mm **0.79"** × ø40 mm **ø1.57"**.

^{*7} When measurement area is minimum, others are initial settings

^{*8} Apart from connector component

■ 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 mm ² , 0.01°
	Maximum display range	±9999.99 mm ±393.7" , ±99999.9 mm ² , ±99999.9°
Input terminal block	Laser remote interlock 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 × 2 outputs, output impedance: 100 Ω
	Total judgment output	NPN open-collector output
	Error output	NPN open-collector output (N.C.)
	Process output	PNP open-collector output (N.C.)
	Trigger input enable output	PNP open-collector output
	Adjusted error output	
Expansion connector	Trigger input (for Head A)	Voltage input
	Timing 2 input	
	Auto-zero 2 input	
	Program switching input	
	Memory card save input	Voltage input, 4 inputs
	Judgment/Binary output ^{*2}	Voltage input
	Stroke output	3-level judgment output: OUT1 to OUT16, total judgment output
	Trigger input enable output	Binary output: OUT1 to OUT16 measured data output (21 bits)
Analog RGB monitor output	SVGA (800 × 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 (4 GB), CA-SD1G (1 GB) 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 480 mA max./ 2 heads connected 550 mA max.
Environmental resistance	Ambient temperature	0 to 50°C 32 to 122°F
	Relative humidity	35 to 85% (No condensation)
Material	Polycarbonate	
Weight	Approx. 1120 g	

^{*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.

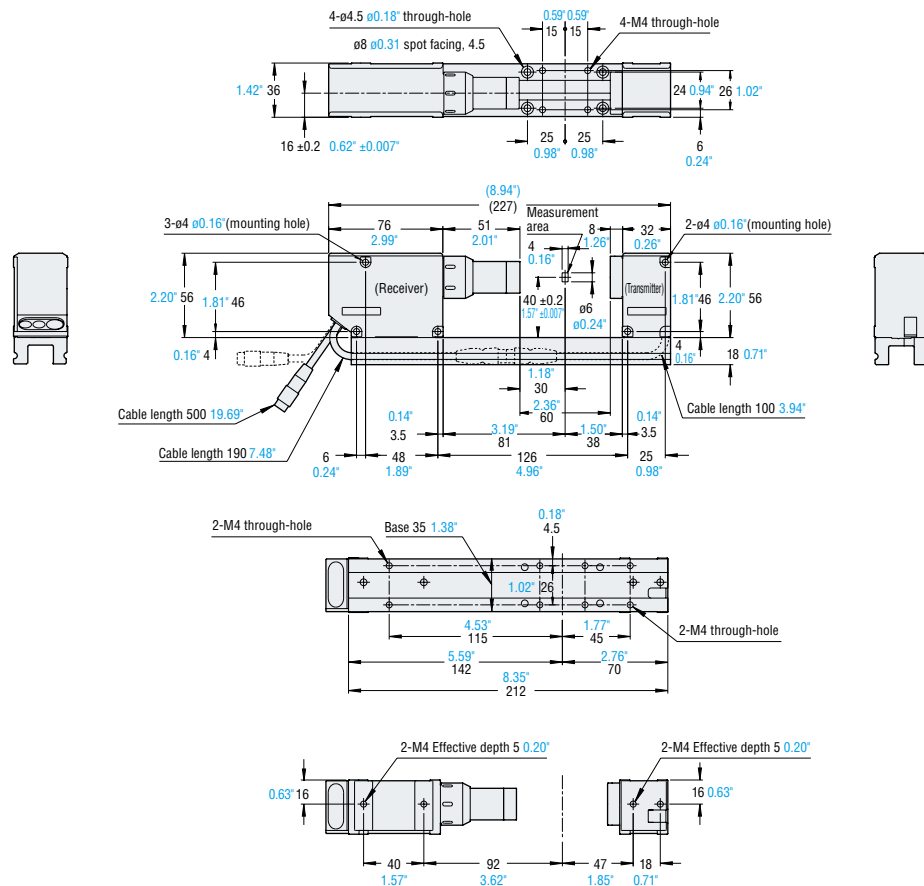
• The rating of the NPN/PNP open collector output (output terminal block): 50 mA (30 V or less) max., residual voltage: 1.4 V or less (50 mA) 1.0 V (20 mA)

• 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

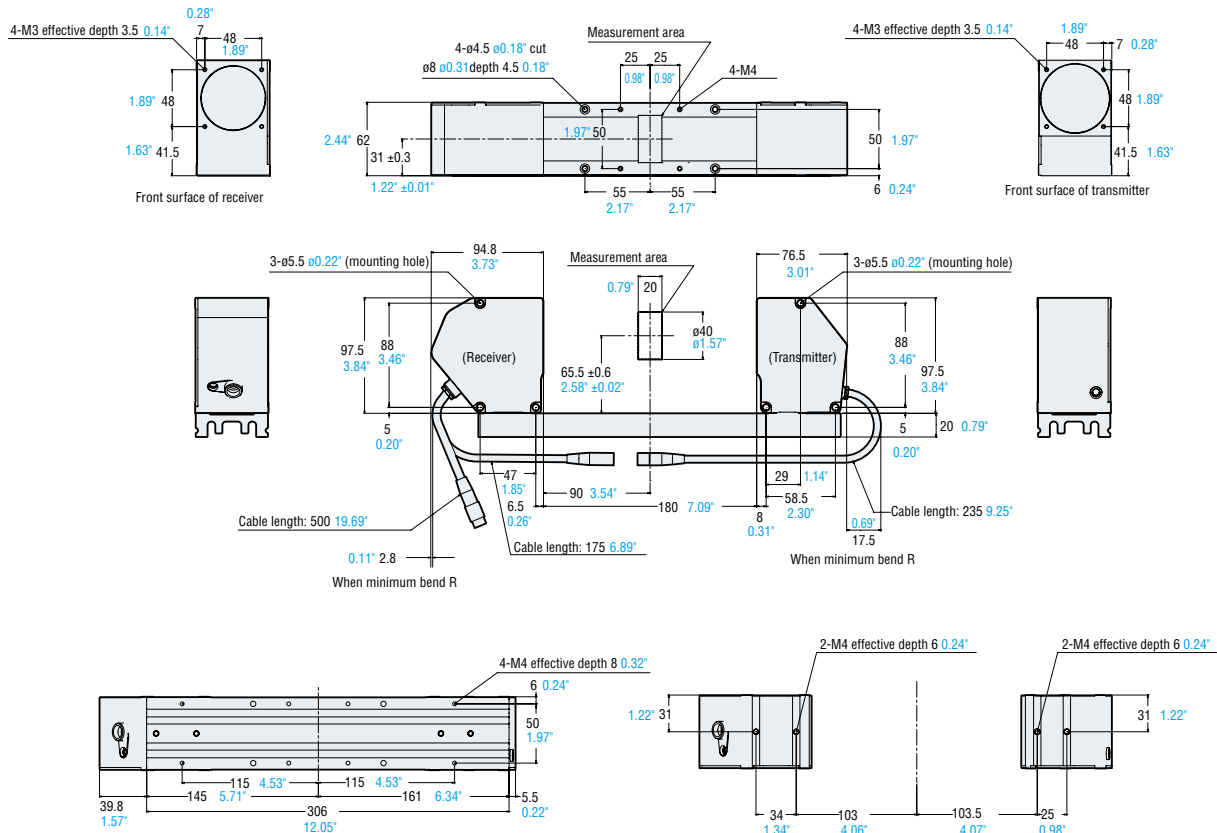
• Rating for non-voltage input, ON voltage 1 V max., OFF current 0.3 mA max. (trigger input terminal, ON voltage 5 V max., OFF current 1 mA max.)

• Voltage rating, maximum rating 26.4 V, ON voltage 10.8 V, OFF current 0.3 mA (trigger input terminal maximum rating 26.4 V, ON voltage 10.8 V, OFF current 1 mA)

TM-006

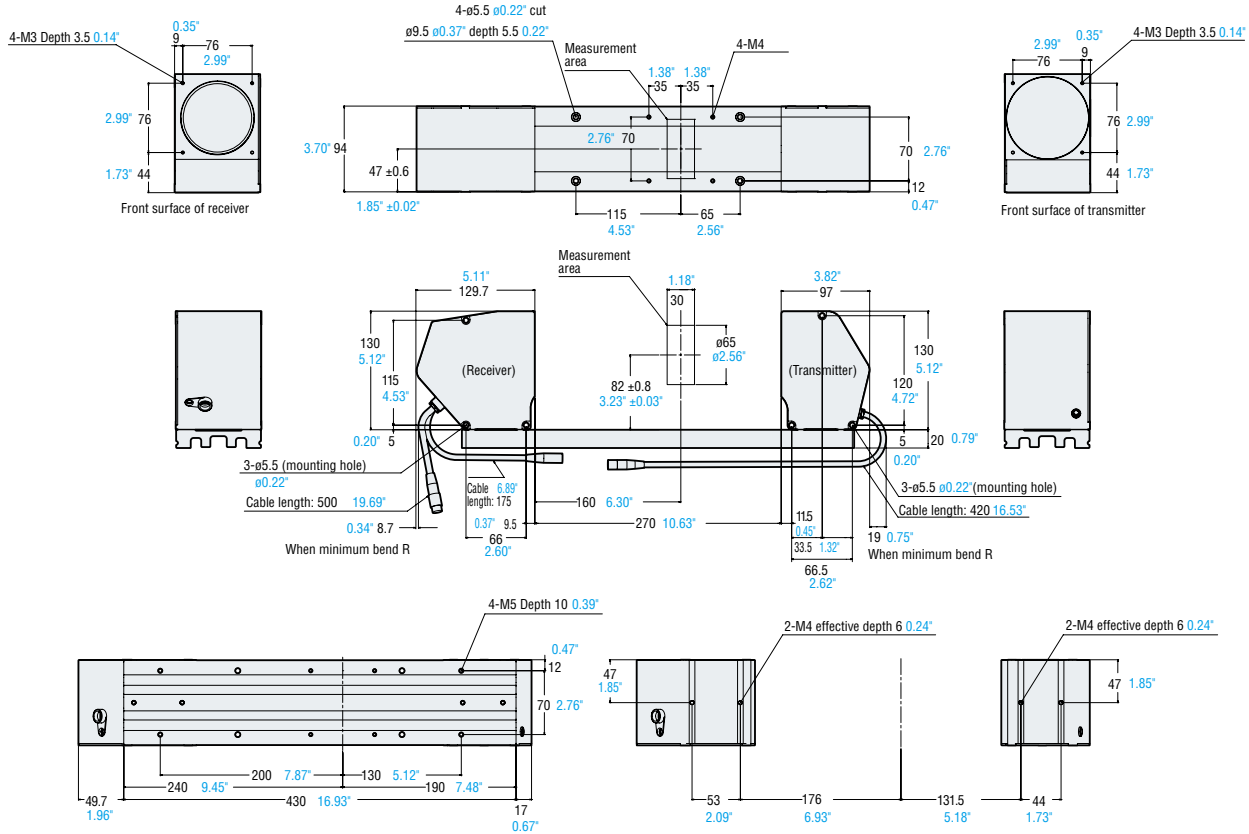


TM-040



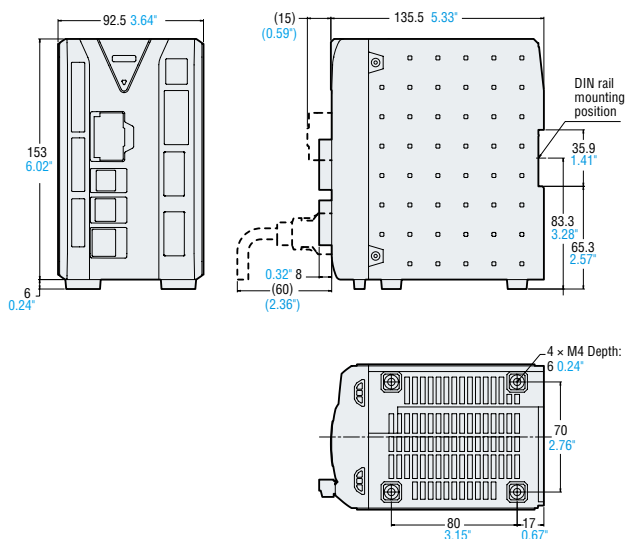
Unit: mm inch

TM-065

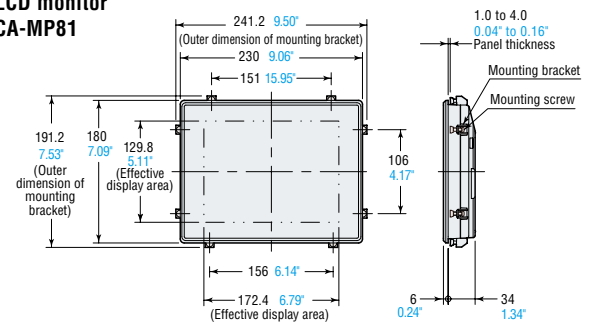
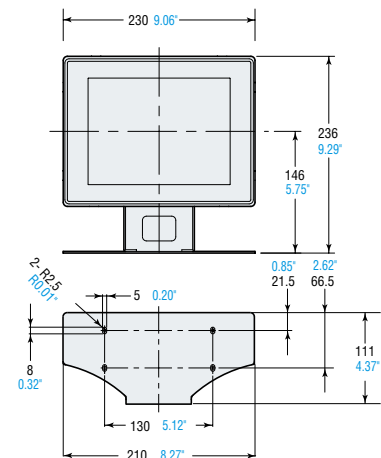


Controller

TM-3001(P)



Monitor

LCD monitor
CA-MP81Stand
OP-42278

High-speed Optical Micrometer

LS-9000 Series

Making conventionally
impossible measurements possible



Innovative measurement method for optimal performance

With the LS-9000 Series

Fastest in its class

13.3 times
faster than
conventional
systems

16,000 Hz sampling rate

Fitted with a high-speed exposure CMOS and high-intensity Green-LED to produce a 16,000 Hz sampling rate, far surpassing previous systems. Improves production line processing time and reduces variation in measurement results.

World's first

Active Tilt and Vibration Correction

The high-speed exposure CMOS clearly recognizes measurement targets that suddenly move due to target vibration and corrects measurement errors. The "Monitor CMOS" determines the alignment of the target to enable accurate measurement of tilted targets.

Low maintenance

No moving parts

Thanks to KEYENCE's proprietary optic design, there are no moving parts. The use of an LED light source means no errors due to external sources. This combination of no moving parts with a LED light source means it can be used on-site for extended periods of time without requiring regular maintenance.

Problems with conventional systems

1,200 Hz sampling

Motor speed must be increased to raise the sampling rate. However, it was hard to achieve both durability and stability, so sampling speed could not be dramatically increased.

* LS-5000 Series

Target alignment and vibration cause errors

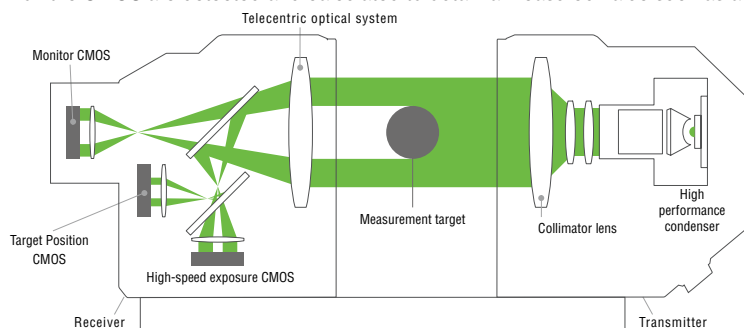
Conventional systems cannot recognize tilting of the target due to only having one source of measurement data. Vibration in the target could also cause errors in the scan that lead to incorrect values.

Moving parts deteriorate

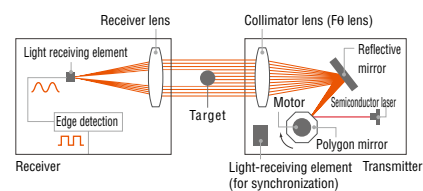
Regular calibration of the polygon mirror and laser are required due to the wear-related deterioration of moving parts.

Measurement principle

The green LED light is distributed as uniform, parallel light and applied to the target. The edges between the bright and dark areas on the CMOS are detected and calculated to obtain a measured value such as an outer diameter.



Principle diagram of laser-scanning method



A measured value such as outer diameter is determined by measuring the difference in the timing between bright and dark areas created by the scanning laser beam.

Enhanced speed and accuracy

3-CMOS System

Three separate CMOS sensors provide advanced inspection capabilities

Target positioning CMOS

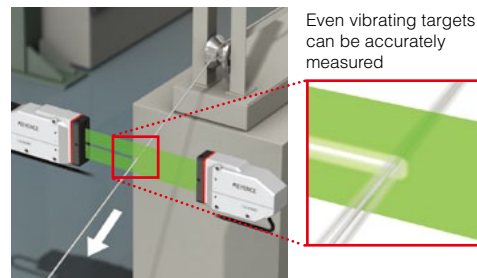
Monitor CMOS

High-speed exposure CMOS

Even vibrating targets are measured stably

High-speed exposure is used so that a precise inspection of the target can be performed even if the target is vibrating, making accurate measurement possible.

Measuring the outer diameter of a high-speed wire

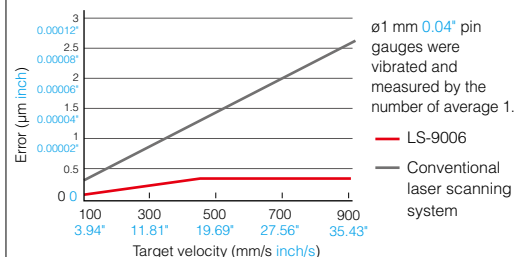


High-speed CMOS

16,000 Hz sampling

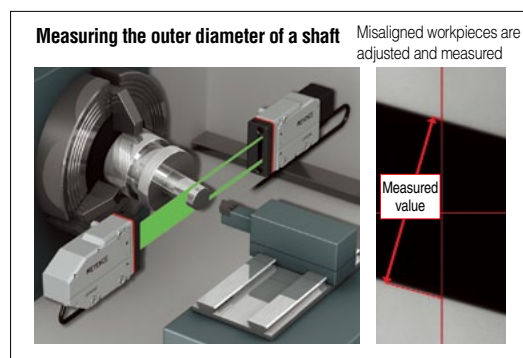
By integrating the peripheral circuits of the measurement CMOS into one chip, the S/N ratio has been dramatically improved and high-speed sampling achieved. For example, targets that move at 1000 m $3280.8'$ /min. can be measured at a pitch of around 1 mm $0.04''$. Even parts that vibrate at high speeds can be measured stably.

Error in relation to vibrating workpieces



Even misaligned parts are measured stably

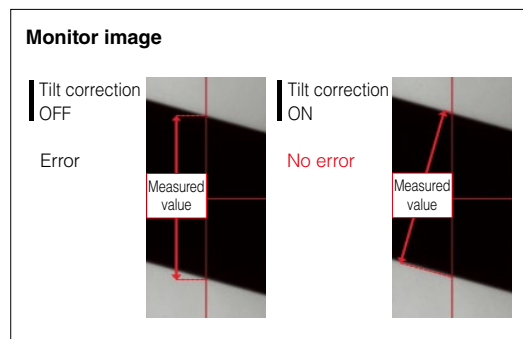
The target monitor CMOS recognizes the orientation of the part and adjusts the measured value so there are no measurement errors due to inclination.



Monitor CMOS

Alignment adjustment*1

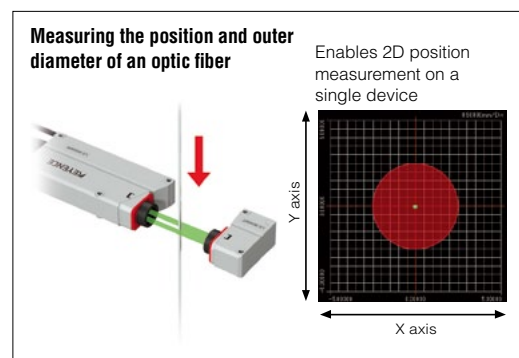
Recognizes the misalignment of a workpiece from the image taken by the monitor CMOS. Inclination error is removed automatically and does not affect the measurement result. The captured image can also be checked with computer software so even novices will have no problem taking accurate measurements.



*1 Functions of the LS-9006M and LS-9030M heads only.

Two axis target position indicator

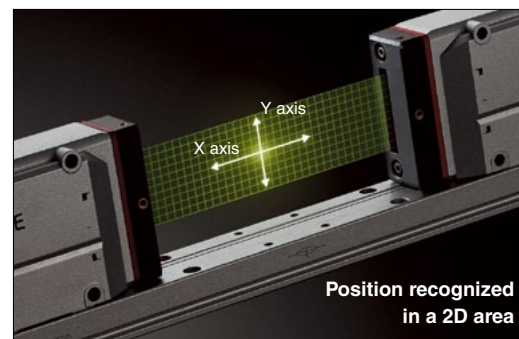
The LS-9000 can use the target positioning CMOS receiver to determine the location of the measurement target in two axes. This makes installation and part position feedback simple, even with a single axis system.



Target positioning CMOS

Transmitter/receiver direction and position measurement*2

With the additional data obtained from the target positioning CMOS, the LS-9000 can determine the position of the target in both the X and Y axes.

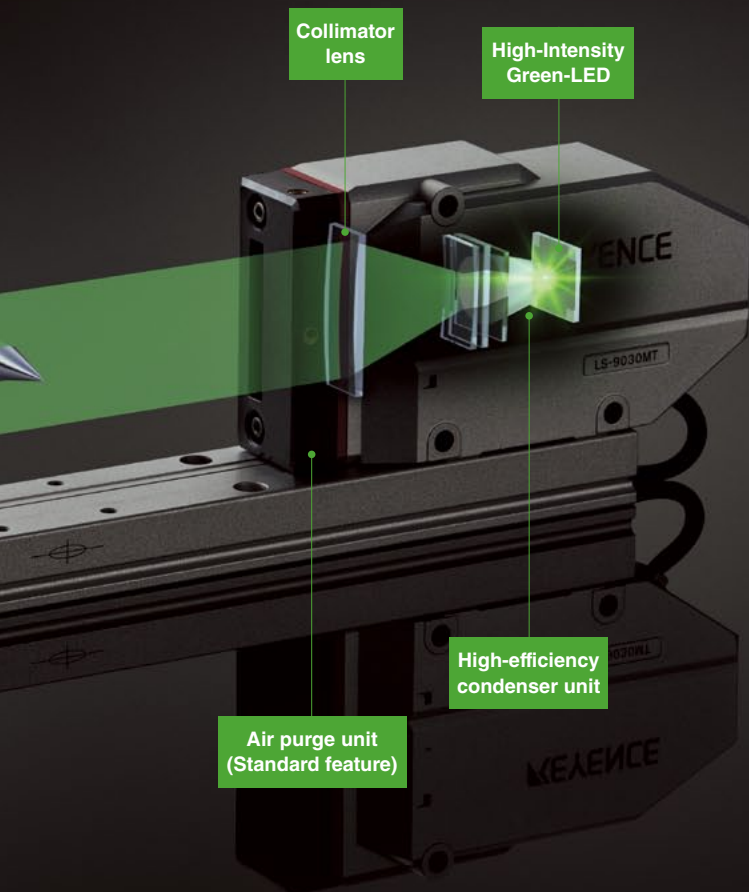


*2 Functions of the LS-9006 (M) and LS-9030 (M) heads only.

Enhanced durability and reliability

High durability design

Constructed with no moving parts, this design offers enhanced service life.



Huge reduction of maintenance time

With no motor to introduce wear and a long lifespan LED, minimal maintenance is required.

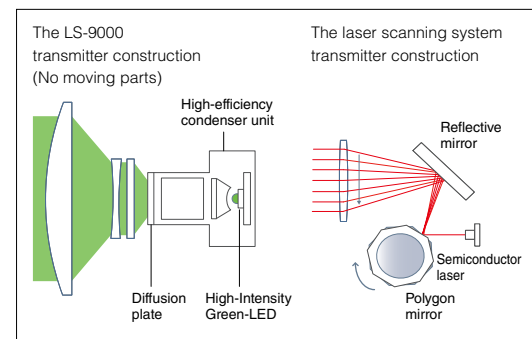
	LS-9000 Series	Existing systems
Motor durability	✓	×
Light source durability	✓	×



**High-intensity Green-LED +
high-efficiency condenser unit**

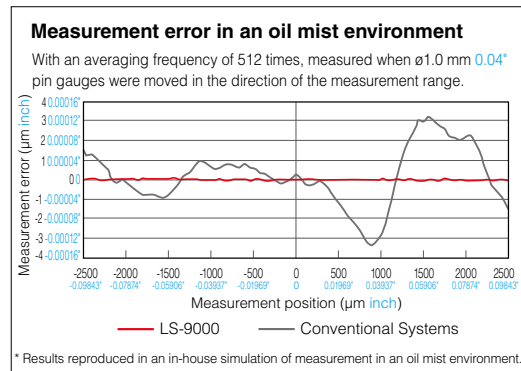
Our proprietary wear-free construction

By using a high intensity green LED to generate the measurement beam, laser degradation typical with traditional systems is completely avoided. In addition, as the entire beam is generated with no moving parts, there is no motor or mirror system to wear out or replace.



Stable measurements in harsh environments

The effects of water, dust, and oil mist on the measurement value are eliminated.



IP67 construction + air purge unit

Best in class environmental resistance design

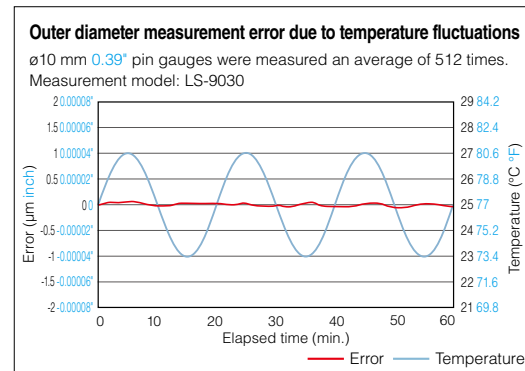
The system enclosure maintains an IP67 rated protection for all internal components. In addition, the LS-9000 series heads come standard with a built in air purge mechanism* to further enhance the system's resistance to environmental influence.



* The air purge unit is sold as an optional accessory only for the LS-9120M head.

Extreme resistance to shock and temperature drift

Revolutionary design eliminates the influence of shock and temperature fluctuations on the measurement value.



Die-cast housing + designed for optical unit protection

Hardened housing protects internal construction

The outer die-cast body has been mechanically isolated from the internal optical unit so that the outer body absorbs shocks and temperature variations, protecting the internal optics. Meets the IEC 68-2-29 standard (15G/6 ms) for shock resistance.



Image of the receiver's internal construction

Software simplifies setup and analysis

Computer software solves conventional difficulties in setting and measuring

Conventional measurement system

- Setting each device separately is time-consuming
- Original settings are easily lost
- Controller setup is complicated and hard to understand
- Difficult to verify measurement setup
- Needs a separate recorder to save data

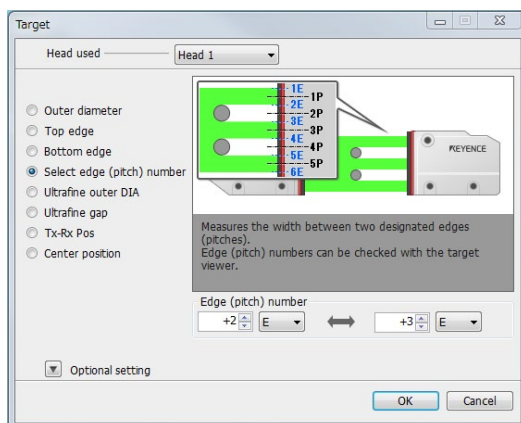
The LS-Navigator2 setup and diagnostics software simplifies and streamlines setup. (OPTIONAL)



Easy setting and backup

Easy visual setting

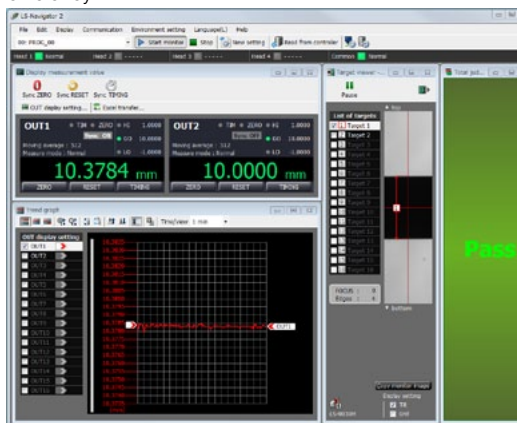
Measurement details can be selected from a picture, so settings are simple, even for a novice. Setting details are stored on the computer as backup files.



Customize your display

Multi-function measurement display

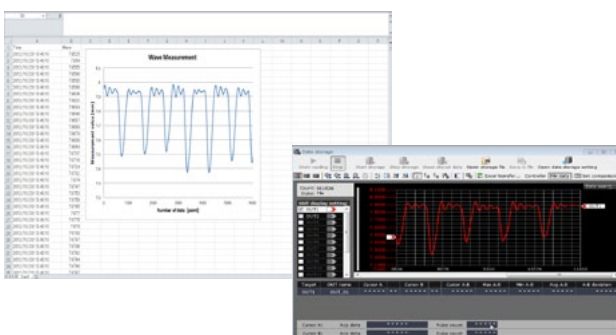
Support software features 12 independent display tools that let you customize your display. View any and all of the information you need on a single screen to maximize efficiency.



Automatically record data

High-capacity data storage

With a storage capacity of 400,000 points, it is easy to record output data without external units. This data can then easily be exported to Excel.

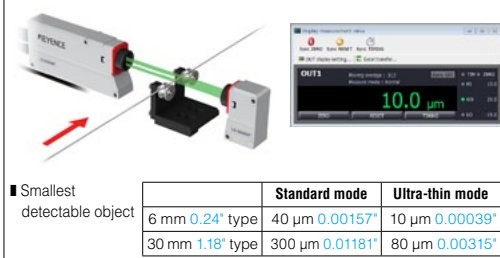


New measurement functions make previously unobtainable measurements easy

Ultra-thin outer diameter and ultra-thin gap measurement*

Specialized ultra-fine diameter / gap tool now allows measurement of previously undetectable gaps and diameters.

Measuring the outer diameter of an ultra-thin wire



* Functions of the LS-9006 (M) and LS-9030 (M) heads only.

16-channel simultaneous measurement

With up to 16 simultaneous outputs, it is possible to measure any combination of diameters, positions, gaps, etc. to meet your needs.

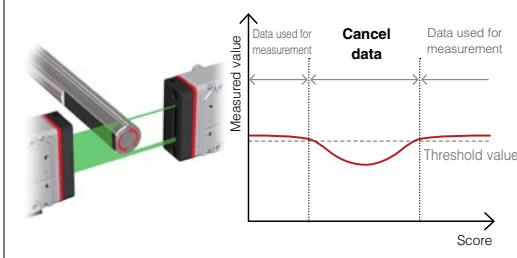
Measuring the outer diameter and runout of a photocopier roller



Irregular surface cancellation

Irregular surface cancellation allows for proper outer diameter inspection of parts with complex profiles such as key slots or D-cuts.

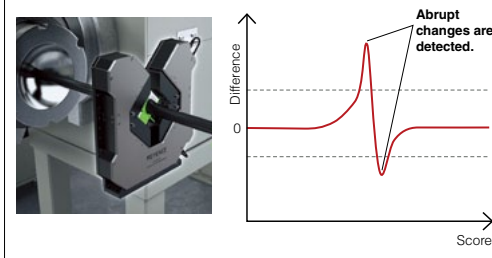
Measuring the outer diameter of a motor shaft



Difference function

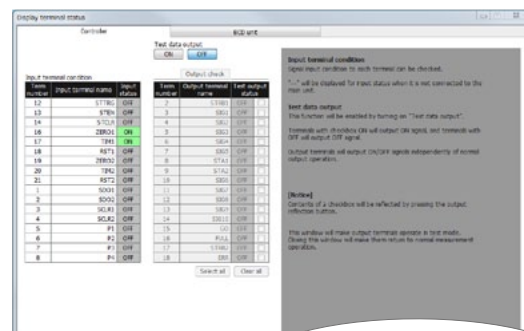
Detecting only abrupt changes allows detection of irregularities on the target surface.

Detecting irregularities after extrusion



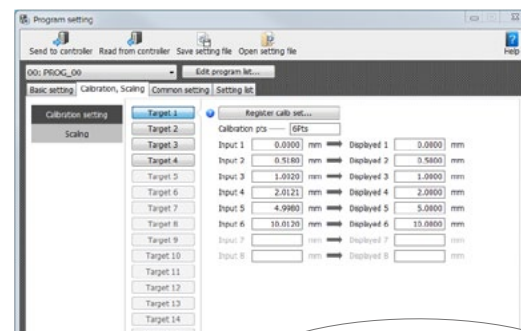
Terminal operation monitoring

Ability to monitor live terminal I/O status with manual test data output greatly simplifies setup and troubleshooting.

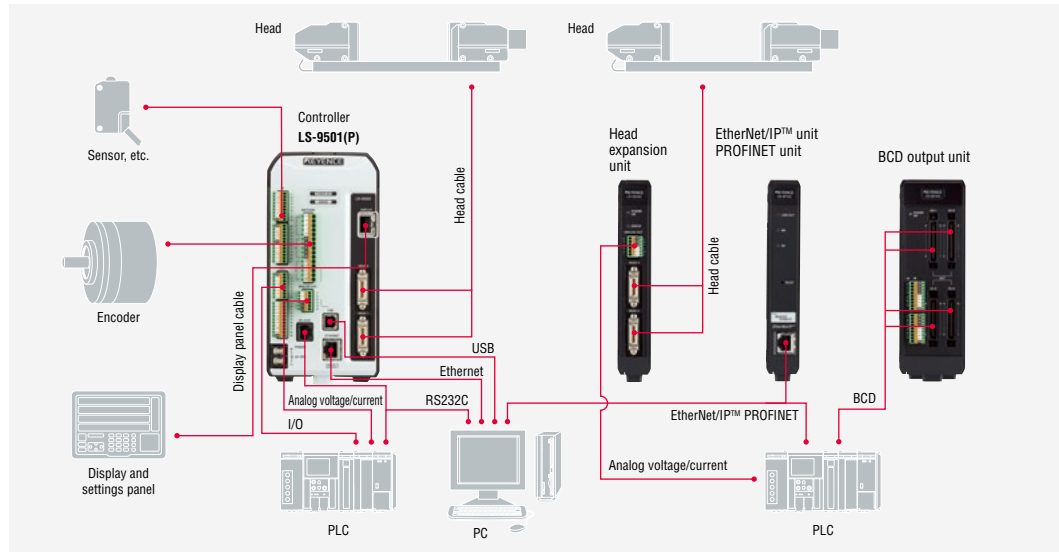


Multi-point calibration

Up to 8 points can be adjusted and scaled allowing multiple targets with differing diameters to be measured more precisely.



Various communication interfaces



Field Network for easy communication

EtherNet/IP™

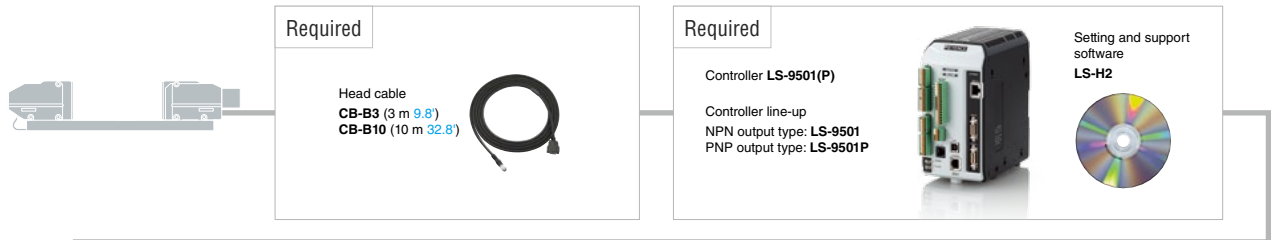
PROFINET®

Various control options possible via PLC

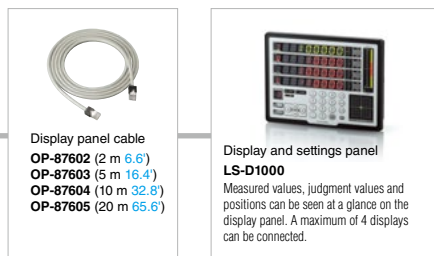
Feedback control through various communication methods

High-speed digital communication

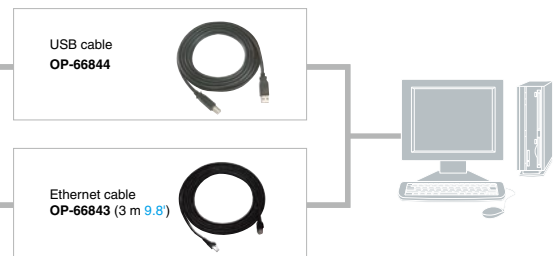
Simultaneous output from 4 BCD channels



When connected with a display and settings panel



When connected with a PC



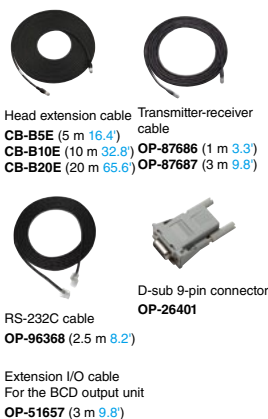
Expansion units



HMI / Display



Cables



Options



LS-9000 Series

Sensor head lineup

More accurate measurement for small-diameter targets



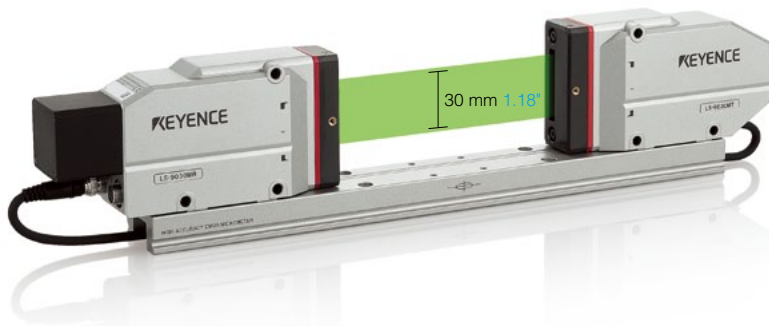
Small diameter type

LS-9006M (with monitor camera)

LS-9006 (without monitor camera)

Measuring range	0.01 to 6 mm 0.0004" to 0.24"
Smallest detectable object	0.01 mm 0.0004"
Repeatability	±0.03 μm
Measurement accuracy	±0.5 μm ±0.00002"

Standard type offers both high speed and high precision



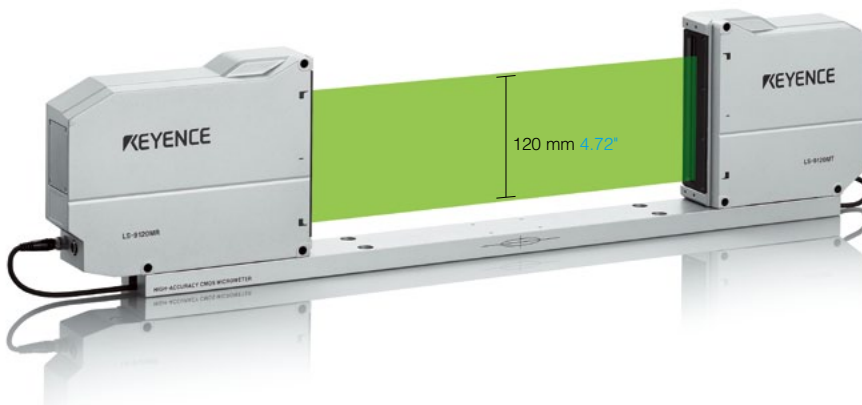
Standard type

LS-9030M (with monitor camera)

LS-9030 (without monitor camera)

Measuring range	0.08 to 30 mm 0.003" to 1.18"
Smallest detectable object	0.08 mm 0.003"
Repeatability	±0.1 μm ±0.000004"
Measurement accuracy	±2 μm ±0.00008"

Measures large-diameter workpieces of up to 120 mm 4.72" in size



Large diameter model

LS-9120M (with monitor camera)

Measuring range	0.8 to 120 mm 0.03" to 4.72"
Smallest detectable object	0.8 mm 0.03"
Repeatability	±0.3 μm ±0.00001"
Measurement accuracy	±8 μm ±0.00031"

Uses two axes to perform highly accurate measurements of small-diameter workpieces



2-axis small diameter model

LS-9006D (without monitor camera)

Measuring range	0.04 to 6 mm 0.002" to 0.24"
Smallest detectable object	0.04 mm 0.002"
Repeatability	±0.03 μm
Measurement accuracy	±0.5 μm ±0.00002"

Achieves high-speed and high-accuracy with two axes



2-axis standard model

LS-9030D (without monitor camera)

Measuring range	0.3 to 30 mm 0.01" to 1.18"
Smallest detectable object	0.3 mm 0.01"
Repeatability	±0.1 μm ±0.000004"
Measurement accuracy	±2 μm ±0.00008"

Specifications

■ Head (Small-diameter model/Standard model/Large-diameter model)



Model	LS-9006M (with monitor camera)	LS-9006 (without monitor camera)	LS-9030M (with monitor camera)	LS-9030 (without monitor camera)	LS-9120M
Measurement range	0.04 mm (0.01 mm) to 6 mm 0.001" (0.0004") to 0.24"		0.3 mm (0.08 mm) to 30 mm 0.01" (0.003") to 1.18"		0.8 mm to 120 mm 0.03" to 4.72"
Smallest detectable object	0.04 mm (0.01 mm) 0.001" (0.0004")		0.3 mm (0.08 mm) 0.01" (0.003")		0.8 mm 0.03"
Transmitter/receiver distance	60 ±5 mm 2.36" ±0.2"		160 ±40 mm 6.3" ±1.57"		400 ±100 mm 15.75" ±3.94"
Repeatability	±0.03 μm*1		±0.1 μm ±0.000004"*2		±0.3 μm ±0.000012"*3
Measurement accuracy	±0.5 μm ±0.00002"*4		±2 μm ±0.00008"*5		±8 μm ±0.00031"*6
Sampling cycle*7	16000 samples/sec.				
Transmitter/ receiver direction and position detection	Detection area	4 × 5 mm 0.16" × 0.2"	20 × 24 mm 0.79" × 0.94"		—
	Smallest detectable object	0.04 mm 0.001"	0.3 mm 0.01"		—
	Repeatability	±0.02 mm ±0.0008"*5	±0.2 mm ±0.01"*6		—
	Sampling cycle	4000 samples/sec.			—
Light source	InGaN green LED				
Monitor camera	Provided	Not provided	Provided	Not provided	Provided
Environmental resistance	Ambient temperature	0 to +50°C 32 to 122°F			
	Relative humidity	20 to 85% RH (no condensation)			
	Ambient light	Incandescent lamp/fluorescent lamp 3000 lux or lower			
	Vibration resistance	10 to 55 Hz, double amplitude 1.5 mm 0.06", 2 hours in each direction (X,Y, and Z)			
	Shock resistance	15G/6 ms			
Enclosure rating	IP67 (including connector)				
Material	Aluminum				
Weight	Transmitter: Approx. 130 g Receiver: Approx. 300 g Base: Approx. 180 g	Transmitter: Approx. 130 g Receiver: Approx. 280 g Base: Approx. 180 g	Transmitter: Approx. 440 g Receiver: Approx. 500 g Base: Approx. 430 g	Transmitter: Approx. 440 g Receiver: Approx. 440 g Base: Approx. 430 g	Transmitter: Approx. 1800 g Receiver: Approx. 2800 g Base: Approx. 1600 g

The values in brackets are measured in ultra-thin mode. For details on the accuracy of ultra-thin mode, contact the nearest KEYENCE office. *1 A ±2σ margin of error when measuring a ø1.0 mm ø0.04" rod in the center of the measurement area using outer diameter mode with the average measurement number set as 2048 times. *2 A ±2σ margin of error when measuring a ø10 mm ø0.39" rod in the center of the measurement area using outer diameter mode with the average measurement number set as 2048 times. *3 A ±2σ margin of error when measuring a ø40 mm ø1.57" rod in the center of the measurement area using outer diameter mode with the average measurement number set as 2048 times. *4 Margin of error when a moving ø1.0 mm ø0.04" rod is measured in the 2 mm × 4 mm 0.08" × 0.16" measurement area using outer diameter mode. *5 Margin of error when a moving ø10 mm ø0.39" rod is measured in the 10 mm × 20 mm 0.39" × 0.79" measurement area using outer diameter mode. *6 Margin of error when a moving ø40 mm ø1.57" rod is measured in the 40 mm × 120 mm 1.57" × 4.72" measurement area using outer diameter mode. *7 The sampling cycle is changed by the number of OUT set, and by the use of the mutual interference prevention function. *8 The value of ±2σ when the position of a rod ø1.0 mm 0.04" is measured at the center of the measuring area while the number of averaging measurements is set to 512. *9 The value of ±2σ when the outer diameter of a rod ø10 mm 0.39" is measured at the center of the measuring area while the number of averaging measurements is set to 512.

■ Head (2-axis small-diameter model/2-axis standard model)



Model	LS-9006D	LS-9030D
Measurement range	ø0.04 mm to ø6 mm ø0.001" to ø0.24"	ø0.3 mm to ø30 mm ø0.01" to ø1.18"
Smallest detectable object	0.04 mm 0.001"	0.3 mm 0.01"
Repeatability	±0.03 μm ^{*1}	±0.1 μm ±0.000004 ^{*2}
Measurement accuracy	±0.5 μm ±0.00002 ^{*3}	±2 μm ±0.00008 ^{*4}
Sampling cycle ^{*5}	16000 samples/sec.	
Light source	InGaN green LED	
Monitor camera	Not provided	
Environmental resistance	Ambient temperature	0 to +50°C 32 to 122°F
	Relative humidity	20 to 85% RH (no condensation)
	Ambient light	Incandescent lamp/fluorescent lamp 3000 lux or lower
	Vibration resistance	10 to 55 Hz, double amplitude 1.5 mm 0.06"; 2 hours in each direction (X,Y, and Z)
	Shock resistance	15G/6 ms
Measuring head enclosure rating	IP67 (including connector)	
Material	Aluminum	
Weight	Approx. 4.8 kg	Approx. 9 kg

*1 A ±2σ margin of error when measuring a ø1.0 mm ø0.04" rod in the center of the measurement area using outer diameter mode with the average measurement number set as 2048 times. *2 A ±2σ margin of error when measuring a ø10 mm ø0.39" rod in the center of the measurement area using outer diameter mode with the average measurement number set as 2048 times. *3 Margin of error when a moving ø1.0 mm ø0.04" rod is measured in the 2 mm × 2 mm 0.08" × 0.08" measurement area. *4 Margin of error when a moving ø10 mm ø0.39" rod is measured in the 10 mm × 10 mm 0.39" × 0.39" measurement area. *5 The sampling cycle is changed by the number of OUT set, and by the use of the mutual interference prevention function.

■ Controller



Model	LS-9501	LS-9501P
No. of connectable sensor heads	2	
Head compatibility	Yes	
Display	Minimum display unit	0.01 μm
	Display range	±99999.99 μm to ±9999.9 mm 3.937" to 393.7"
Input terminal block	LED display	POWER ON indicator, ERROR indicator
	Encoder input	NPN/PNP open-collector output, voltage output (5 V / 12 V / 24 V), line-driver output
	Synchronous 1, 2 input	Non-voltage input
	Auto-zero 1, 2 input	
	Reset 1, 2 input	
	Storage trigger input	
	Storage enable input	
	Storage data clear input	
	Statistics 1, 2 input	
	Statistics clear 1, 2 input	
	Program selection input	Non-voltage input × 4 inputs
Output terminal	Analog voltage output	±10 V × 2 outputs, output impedance 100 Ω
	Analog current output	4 to 20 mA × 2 outputs, compatible load max. 350 Ω
	Universal output	NPN open-collector output × 10 outputs Measured value and tolerance judgment output, status output allocatable
	Status 1, 2 output	PNP open-collector output × 10 outputs Measured value and tolerance judgment output, status output allocatable
	Total judgment output	
	Memory FULL output	
	Strobe 1, 2 output	
	Error output	NPN open-collector output (N.C.)
Ethernet interface	1000BASE-T/100BASE-TX	
USB interface	USB 2.0 HI-SPEED supported (USB 1.1 Full-SPEED compatible)	
RS-232C interface	Measured value output, control I/O, setting change, baud rate can be selected up to 115,200 bps	
Display and settings panel interface	LS-D1000 Max. four heads connectable	
Rating	Power supply voltage	24 VDC ±10%, including ripple (P-P)
	Current consumption ^{*1}	When LS-HA100 not used: 1.0 A max. when 1 head connected; 1.4 A max. when 2 heads connected When LS-HA100 in use: 2.0 A max. when 3 heads connected; 2.3 A max. when 4 heads connected
Environmental resistance	Ambient temperature	When LS-HA100 not used: 0 to +50°C 32 to 122°F When LS-HA100 in use: 0 to +45°C 32 to 113°F
	Relative humidity	20 to 85% RH (no condensation)
Weight	Approx. 1500 g	

■ Head expansion unit



Model		LS-HA100
No. of connectable sensor heads		2
Head compatibility		Yes
LED display		POWER ON indicator, head status indicator
Analog voltage output		±10 V × 2 outputs Output impedance 100 Ω
Analog current output		4 to 20 mA × 2 outputs Compatible load max. 350 Ω
Power source		Supplied from the controller
Environmental resistance	Ambient temperature	0 to +45°C 32 to 113°F
	Relative humidity	20 to 85% RH (no condensation)
Weight		Approx. 600 g

- NPN open-collector output rating: 50 mA max. (40 V max.), residual voltage of 1 V max.
 - PNP open-collector output rating: 50 mA max. (30 V max.), residual voltage of 1 V max.
 - Non-voltage input rating: ON voltage of 1 V max., OFF current of 0.6 mA max.
 - Voltage input rating: Input max. voltage 26.4 V, min. ON voltage 10.8 V, OFF current 0.6 mA max.
- *1 Add the current consumption values for all units when connecting the display settings panel and expansion units.

When the LS-9006D or LS-9030D is connected, it counts as two heads.



■ OS environment for using the LS-H2 (LS-Navigator 2) Setting Support Software

Item	Required environment
Operating System	Windows 10 ^{*1} Windows 7 (SP1 or later) ^{*2} Windows Vista (SP2 or later) ^{*3} Windows XP (SP3 or later) ^{*4}
Supported languages	English, Japanese, German, Simplified Chinese, Traditional Chinese
CPU	Core 2 Duo 2 GHz or more
Memory capacity	2 GB or more
L2 cache memory	2 MB or more
Free space in hard disk	10 GB or more
Display	XGA (1024 × 768 pixels) or more, 256 colors or more
Interface	USB Ethernet
	USB 2.0 Hi-SPEED supported (USB 1.1 Full-SPEED compatible) ^{*5} Ethernet 1000BASE-T/100BASE-TX ^{*6}

If you wish to use the send to Excel function, please check that one of the Excel versions listed below is installed on your computer.

Excel 2010 (32 bit/64 bit), Excel 2007, Excel 2003, Excel 2002

^{*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.

■ Display and settings panel

Model	LS-D1000
Display interface	Measured value display Program number display Position monitor display Display update cycle
Operation input interface	Numeric keypad, function key, lock key timing input key, zero input key, reset input key, escape key, arrow keys (4)
Display and settings panel connection port	2
Power supply	Supplied from the controller
Rating	Current consumption
Environmental resistance	Ambient temperature Relative humidity
Enclosure rating	IP65 (When panel attached, front surface only)
Weight	Approx. 400 g

■ BCD output unit



Model	CB-BD100
LED display	POWER-ON LED
Output terminal	BCD output ^{*1} Strobe output OUT selection output
Input terminal	OUT selection input
Power source	Supplied from the controller
Rating	Current consumption
Environmental resistance	Ambient temperature Relative humidity
Weight	800 g

^{*}Up to 1 unit can be connected to the controller.

· NPN open-collector output rating: 30 mA max. (30 V max.), residual voltage of 0.5 V max.

· Non-voltage input rating: ON voltage of 1 V max., OFF current of 0.6 mA max.

^{*1} Selectable from BCD output (29 bits, signed), binary output (25 bits, negative numbers are represented by the two's complement), and judgment output.

■ PROFINET unit



Model	CB-PN100
Compatible network	PROFINET IO communication
Ethernet	Compliant standards Transmission speed Transmission media Maximum cable length
PROFINET IO	Supported functions Number of connectable PROFINET IO controllers Update time GSDML Conformance class Conformance test version Applicable protocol
Power supply voltage	24 V ±10% (supplied from the controller unit of the laser scanner)
Current consumption	0.12 A max.
Weight	Approx. 470 g

^{*1} Although this unit conforms to IEEE 802.3u and can establish 100 Mbps full duplex communication using AutoNegotiation function, it does not have AutoCrossOver and AutoPolarity functions that are normally required for the PROFINET IO standard. Select a straight or cross cable according to the Ethernet port of the device to be connected.

■ EtherNet/IP™ unit

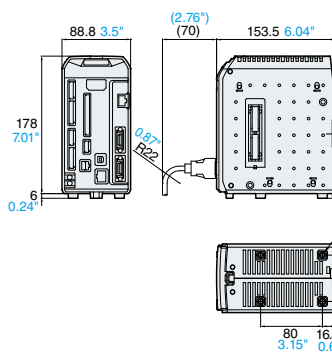


Model	CB-EP100
Compatible network	EtherNet/IP™ and displacement sensor-specific protocols (socket communication)
Ethernet	Compliant standards Transmission speed Transmission media Maximum cable length Maximum number of connectable hubs ^{*1}
EtherNet/IP™	Supported functions Number of connections RPI Tolerable communication bandwidth for cyclic communication Message communication Conformance test
Power supply voltage	24 VDC ±10%, including ripple (P-P) (supplied from the controller unit of the laser scanner)
Current consumption	0.12 A max.
Environmental resistance	Ambient temperature Relative humidity
Weight	Approx. 470 g

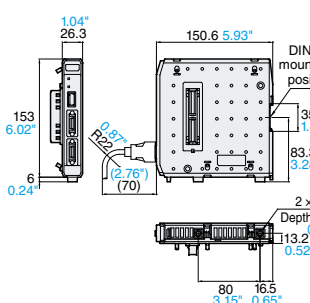
^{*1} The number of connectable hubs is not limited when using a switching hub.

Unit: mm inch

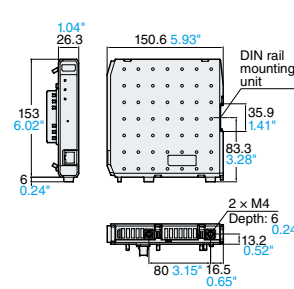
LS-9501/LS-9501P



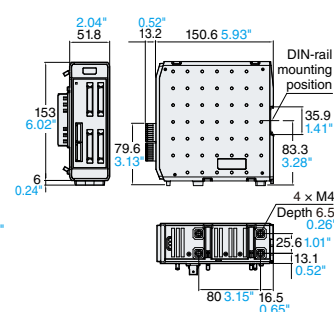
LS-HA100



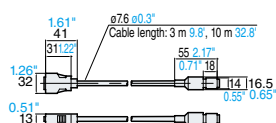
CB-EP100/CB-PN100



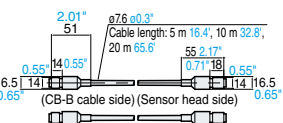
CB-BD100



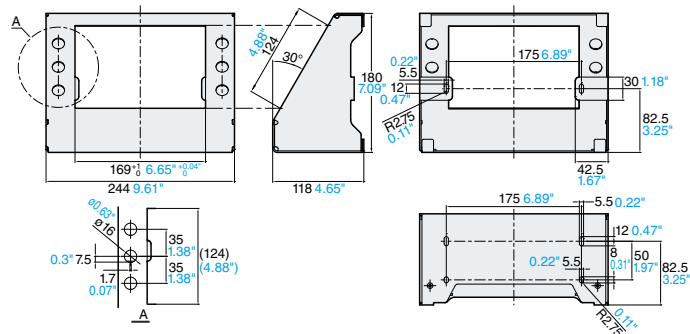
CB-B3/CB-B10



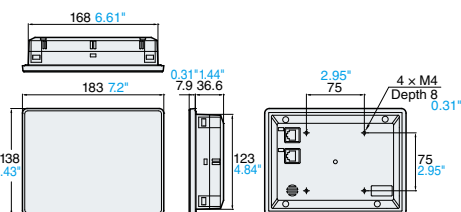
CB-B5E/CB-B10E/CB-B20E



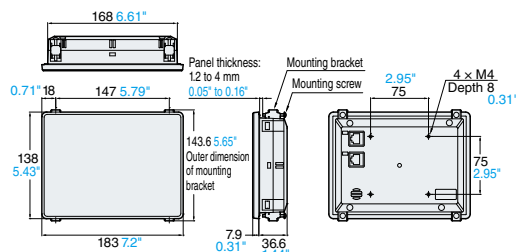
OP-87610



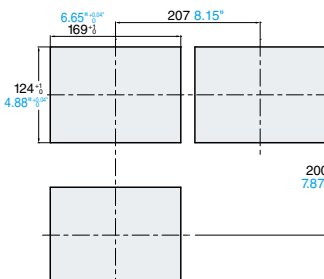
LS-D1000



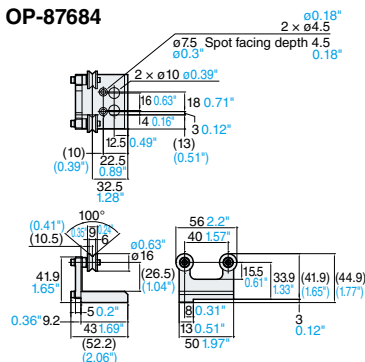
With mounting bracket attached



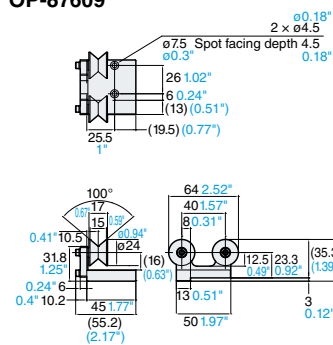
Panel cutout dimensions



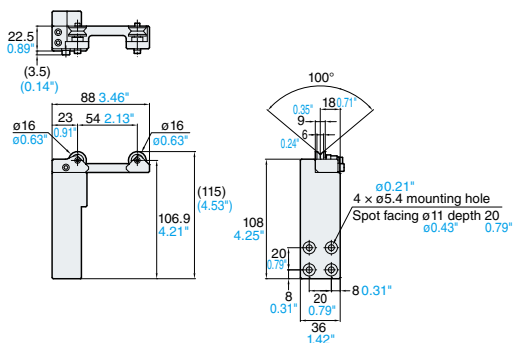
OP-87684



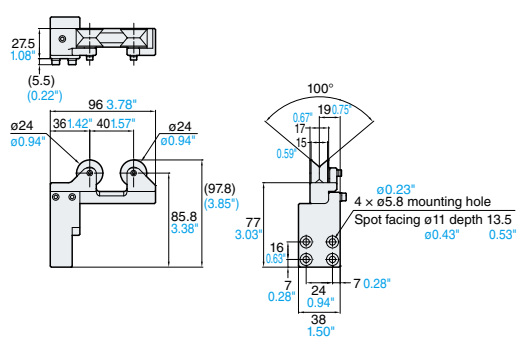
OP-87609



OP-87750



OP-87749

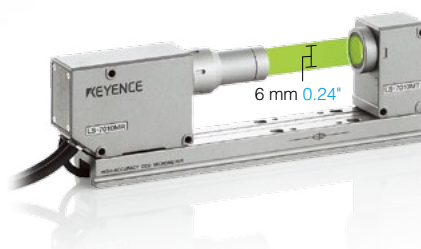


Advanced Optical Micrometer

LS-7000 Series

Sensor head lineup

High-accuracy measurement of small-diameter targets

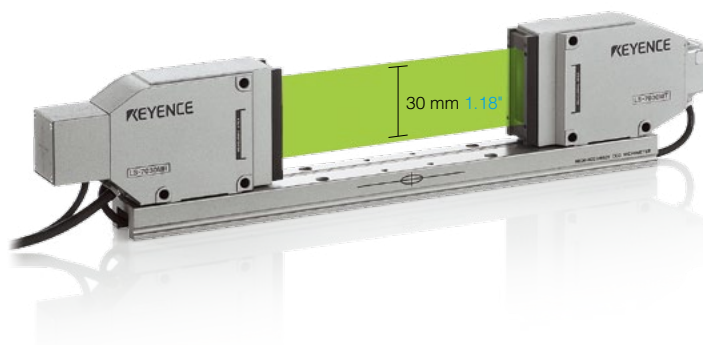


Small
diameter
type

LS-7010M (with monitoring function)
LS-7010 (without monitoring function)

Measuring range	0.04 to 6 mm 0.0016" to 0.24"
Smallest detectable object	0.04 mm 0.0016"
Repeatability	±0.06 μm
Measurement accuracy	±0.5 μm ±0.00002"

Basic model with high accuracy and long life

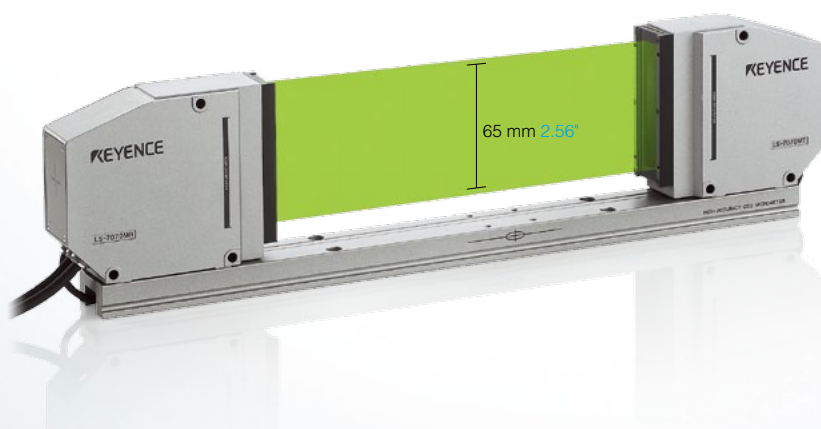


Standard
type

LS-7030M (with monitoring function)
LS-7030 (without monitoring function)

Measuring range	0.3 to 30 mm 0.01" to 1.18"
Smallest detectable object	0.3 mm 0.01"
Repeatability	±0.15 μm ±0.000006"
Measurement accuracy	±2 μm ±0.00008"

Wide measuring range with high accuracy



Large
diameter
type

LS-7070M (with monitoring function)
LS-7070 (without monitoring function)

Measuring range	0.5 to 65 mm 0.02" to 2.56"
Smallest detectable object	0.5 mm 0.02"
Repeatability	±0.2 μm ±0.000008"
Measurement accuracy	±3 μm ±0.00012"

Structure without moving parts achieves high durability & long service life

With the LS-7000 Series

Low maintenance

No moving parts

Thanks to KEYENCE's proprietary optic design there are no moving parts. The use of a LED light source means no errors due to external sources. This combination of no moving parts with a LED light source means it can be used on-site for extended periods without requiring regular maintenance.

First in the world

Target Monitor

The CMOS monitor camera built into the measuring head captures the image of a target, which is displayed on the LCD monitor. Since the measurement condition is visible, target positioning and checking measurement conditions become easier.

Problems with conventional systems

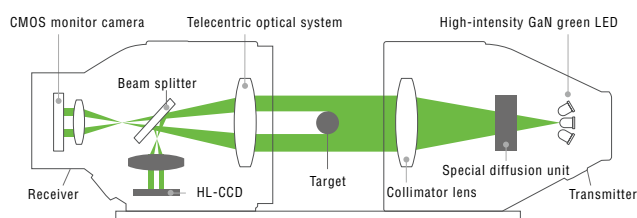
Moving parts deteriorate

Regular calibration of the polygon mirror and laser was required due to the wear-related deterioration of moving parts.

Difficult position alignment

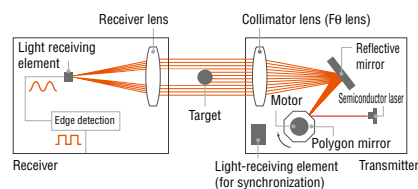
When the target is small or has a complicated shape, it is difficult to check the position of the measurement point, so position alignment took some time.

Measurement principle



The green LED light is distributed as a uniform, parallel light and is applied to a target. The edge between the bright and dark area on the CCD is detected and converted to a measured value, such as an outer diameter.

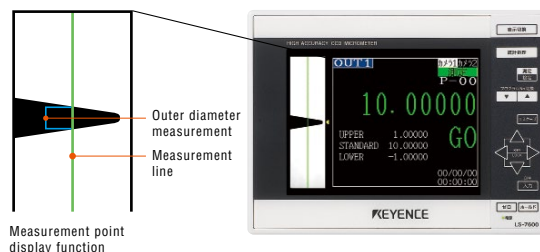
Principle diagram of laser-scanning method



A measured value such as an outer diameter is determined by measuring the difference in the timing between bright and dark areas created by the scanning laser beam.

Target viewer function

The CMOS monitor camera built into the measuring head captures the image of a target. The measurement condition is visible on the LCD monitor, which can be used for target positioning and measurement condition checking. The measurement area of the current measurement mode is indicated in real time.



Specifications

Head with monitoring function



Required

Camera cable
LS-C3AM (3 m 9.8')
LS-C10AM (10 m 32.8')
LS-C30AM (30 m 98.4')



Required

Measuring head cable
LS-C3A (3 m 9.8')
LS-C10A (10 m 32.8')
LS-C30A (30 m 98.4')



Controller LS-7601



Setting support software LS-H1W



Head without monitoring function



Required

Measuring head cable
LS-C3A (3 m 9.8')
LS-C10A (10 m 32.8')
LS-C30A (30 m 98.4')



Controller LS-7001



Setting support software LS-H1W



Measuring head (Small-diameter type/Standard type/Large-diameter type)



Type	Small-diameter		Standard		Large-diameter	
Category	with monitor camera	without monitor camera	with monitor camera	without monitor camera	with monitor camera	without monitor camera
Model	LS-7010M	LS-7010	LS-7030M	LS-7030	LS-7070M	LS-7070
Measuring range	0.04 to 6 mm 0.002" to 0.24"		0.3 to 30 mm 0.01" to 1.18"		0.5 to 65 mm 0.02" to 2.56"	
Smallest detectable object	0.04 mm 0.002"		0.3 mm 0.01"		0.5 mm 0.02"	
Transmitter/receiver distance	60 ±5 mm 2.36" ±0.20"		160 ±40 mm 6.30" ±1.57"		250 ±50 mm 9.84" ±1.97"	
Light source	GaIn green LED		GaIn green LED		GaIn green LED	
CCD scanning range	Approx. 7 mm 0.28"		Approx. 33 mm 1.30"		Approx. 69 mm 2.72"	
Measurement accuracy	±0.5 μm ±0.00002"*1		±2 μm ±0.00008"*2		±3 μm ±0.00012"*3	
Repeatability	±0.06 μm*4		±0.15 μm ±0.00006"*5		±0.2 μm ±0.00008"*6	
No. of samples*7	2400 samples/sec.		2400 samples/sec.		2400 samples/sec.	
Monitor camera	Provided	Not provided	Provided	Not provided	Provided	Not provided
Enclosure rating*8	IP64		IP64		IP64	
Ambient temperature	0 to +50°C 32 to 122°F		0 to +50°C 32 to 122°F		0 to +50°C 32 to 122°F	
Relative humidity	35 to 85% (No condensation)		35 to 85% (No condensation)		35 to 85% (No condensation)	
Weight	Transmitter: Approx. 140 g Receiver: Approx. 380 g Base: Approx. 220 g	Transmitter: Approx. 140 g Receiver: Approx. 340 g Base: Approx. 220 g	Transmitter: Approx. 420 g Receiver: Approx. 570 g Base: Approx. 430 g	Transmitter: Approx. 420 g Receiver: Approx. 470 g Base: Approx. 430 g	Transmitter: Approx. 540 g Receiver: Approx. 770 g Base: Approx. 660 g	Transmitter: Approx. 540 g Receiver: Approx. 730 g Base: Approx. 660 g

*1 The error when a moving rod 1 mm 0.04" in diameter is measured within the measuring area of 2 × 4 mm 0.08" × 0.16".

*2 The error when a moving rod 10 mm 0.39" in diameter is measured within the measuring area of 10 × 20 mm 0.39" × 0.79".

*3 The error when a moving rod 20 mm 0.79" in diameter is measured within the measuring area of 20 × 40 mm 0.79" × 1.57".

*4 The value of ±2σ when the outer diameter of a rod 1 mm 0.04" in diameter is measured at the center of the measuring area while the number of averaging measurements is set to 512.

*5 The value of ±2σ when the outer diameter of a rod 10 mm 0.39" in diameter is measured at the center of the measuring area while the number of averaging measurements is set to 512.

*6 The value of ±2σ when the outer diameter of a rod 20 mm 0.79" in diameter is measured at the center of the measuring area while the number of averaging measurements is set to 512.

*7 1200 samples/sec. when the mutual interference prevention function is used.

*8 The connector section is excluded.

Controller



Type	High-performance		Standard
Model	LS-7601		LS-7001
No. of connectable measuring heads			2 (fully compatible for all head types)
Display	Measurement display	TFT 5.5-inch LCD display	
	Minimum display unit	0.01 to 100 μm 0.0039" (7-level selectable)	
	Display range	±99.99999 to ±9999.9 mm ±3.94" to ±393.7" (Linked to minimum display unit setting, mm/μm selectable)	
Terminal block	Measurement position monitor	Monitor image (When the measuring head with the monitor function is connected.)	7-level display with a red LED
	Tolerance check output display	5-level LCD indicator	Green LED (GO), Red LED × 2 (HI, LO)
	Alarm output	NPN open-collector output (N.C.)	
	5-level comparator output	NPN open-collector output for OUT1	
	Comparator ready output		
	Strobe output		
	Synchronous input	Non-voltage input for OUT1	
	Reset input		
	Auto-zero input		
	Program selection input	Non-voltage input × 4 inputs	
	Statistical processing input	Non-voltage input for OUT1	
Analog output	±10 V × 2 outputs		
Connector I/O	SUB mode*1	5-level comparator output	NPN open-collector output for OUT2
		Comparator ready output	
		Strobe output	
		Statistical processing output	
	BCD mode*1	Function output	Selectable from focus, area check, and differential, NPN open-collector output × 2 outputs
		BCD output	Measurement data output (Sign + 7 digits), OUT1/OUT2 selectable, NPN open-collector output
		BCD selection output	NPN open-collector output
		BCD selection input	Non-voltage input
	Synchronous input	Non-voltage input for OUT2	
	Reset input		
	Auto-zero input		
Statistical processing input			
RS-232C interface		Measurement data output and control I/O, printer (Baud rate can be selected up to 115200 bps.)	
Video output		Conforming to the NTSC system (PIN connector)	
Rating*2	Power supply voltage	24 VDC ±10%	
	Current consumption	1.2 A max.	
Environmental resistance	Enclosure rating	IP64 (Panel surface only)	
	Ambient temperature	0 to +40°C 32 to 104°F	
	Relative humidity	35 to 85%, (No condensation)	
Weight		Approx. 1,010 g	Approx. 820 g

*1. Either SUB mode or BCD mode can be selected.

*2. AC power supply can be used when the LS-S11 (AC power supply stand) is connected.

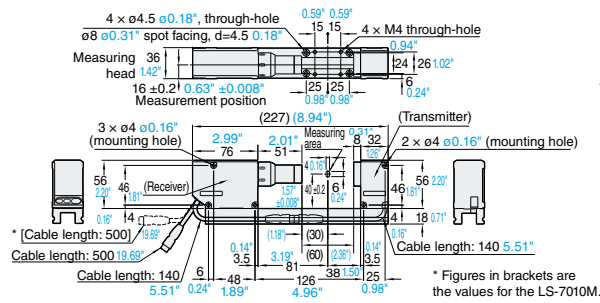
The rating of the NPN open-collector inside the terminal block is: 100 mA max. (40 V max.), residual voltage of 0.5 V max.

The rating of the NPN open-collector inside the connector I/O is: 30 mA max. (30 V max.), residual voltage of 0.5 V max.

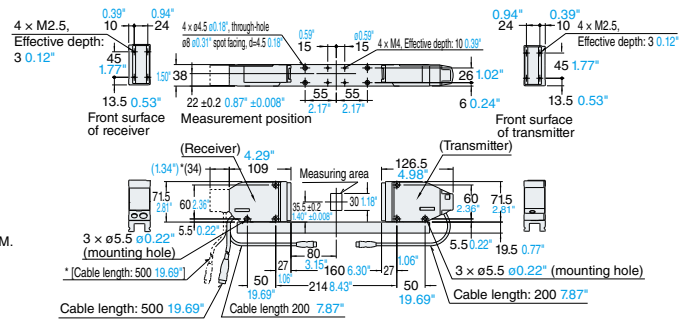
The rating of non-voltage input is: ON voltage of 1 V max., OFF current of 0.6 mA max.

Measuring head

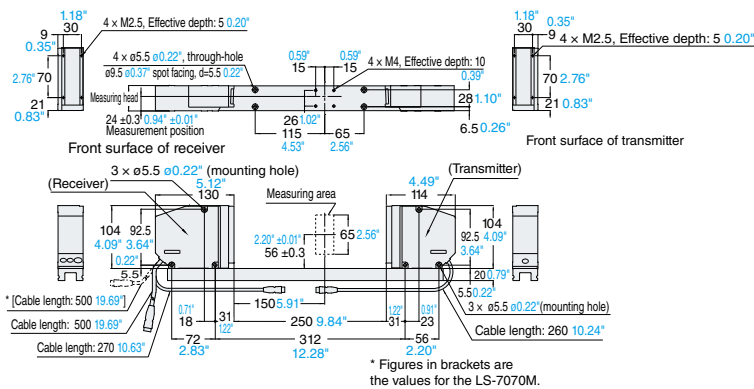
LS-7010/LS-7010M



LS-7030/LS-7030M

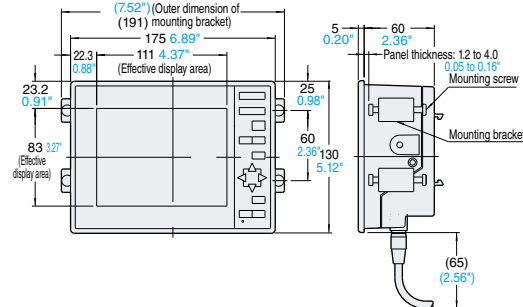


LS-7070/LS-7070M

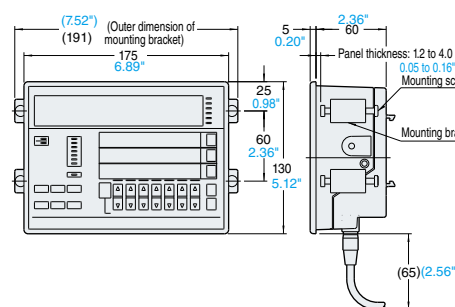


Controller

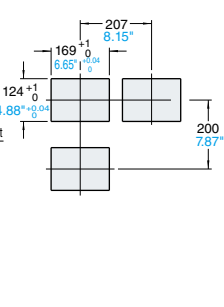
High-performance controller LS-7601



Standard controller LS-7001

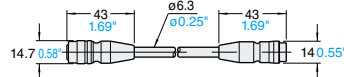


Panel cutout



Measuring head-controller cable
LS-CxxA

Model	Cable length
LS-C3A	3 m 9.8'
LS-C10A	10 m 32.8'
LS-C30A	30 m 98.4'



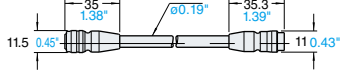
Camera cable
LS-CxxAM

Model	Cable length
LS-C3AM	3 m 9.8'
LS-C10AM	10 m 32.8'
LS-C30AM	30 m 98.4'

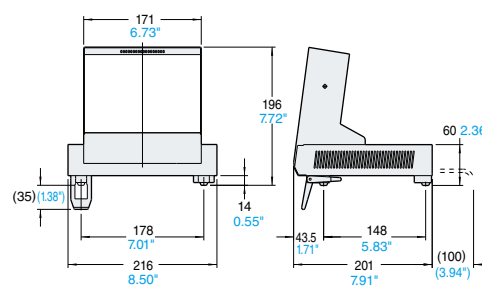


Transmitter-receiver cable
OP-42182/OP-42183

Model	Cable length
OP-42182	1 m 3.3'
OP-42183	3 m 9.8'



AC power supply stand
LS-S11





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SAFETY INFORMATION

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

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