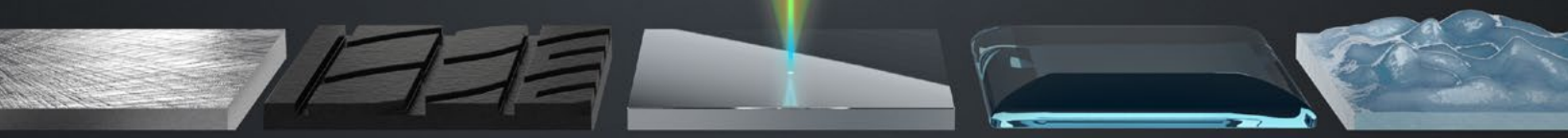
KEYENCE

Confocal Displacement Sensor

NEW CL-3000 Series



High-precision measurement on any material or surface

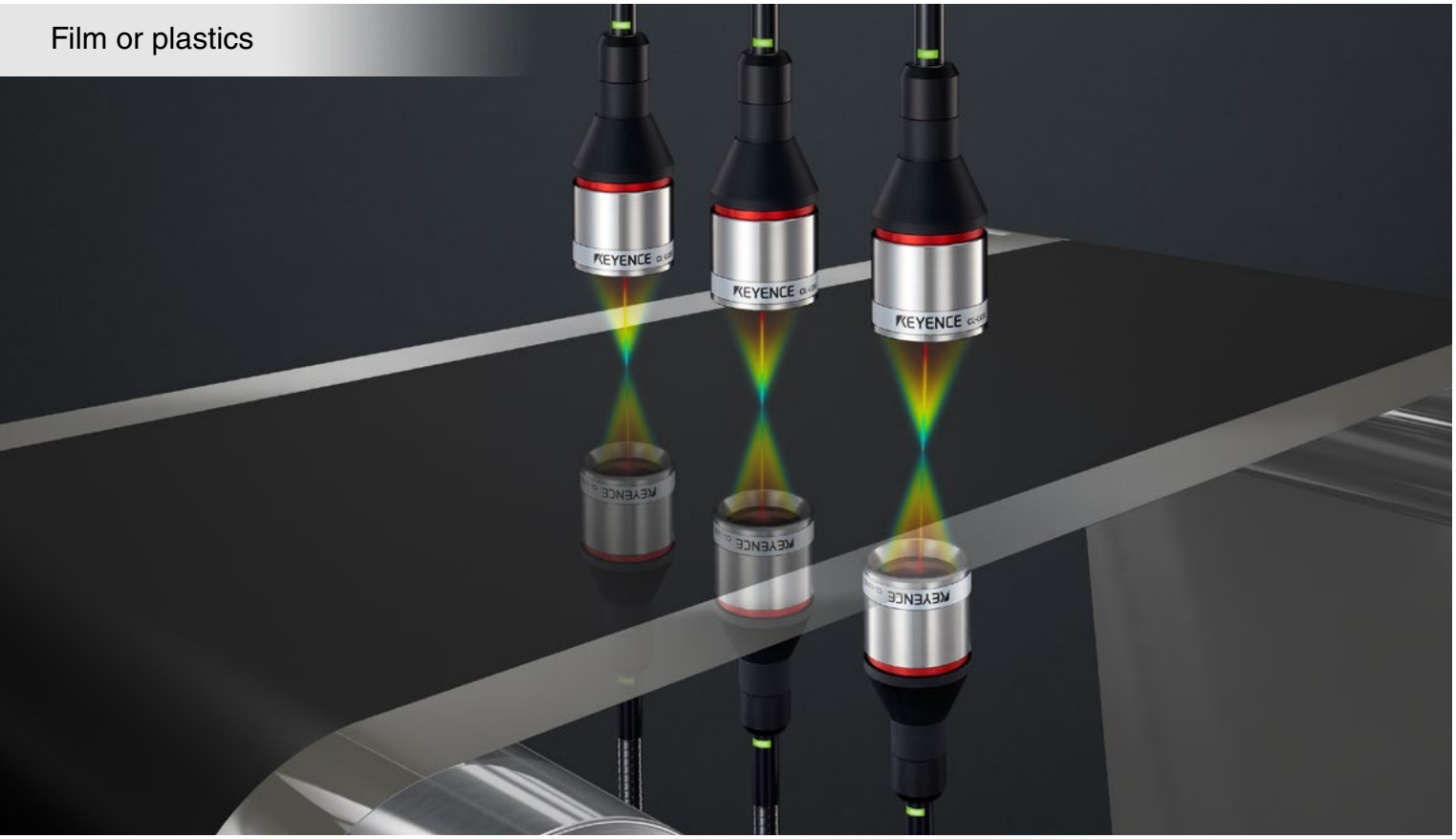
CL-3000 Series

Ultra-compact coaxial laser displacement sensors for any application in any location

High-precision measurement on all targets, with simple sensor head installation and program settings.

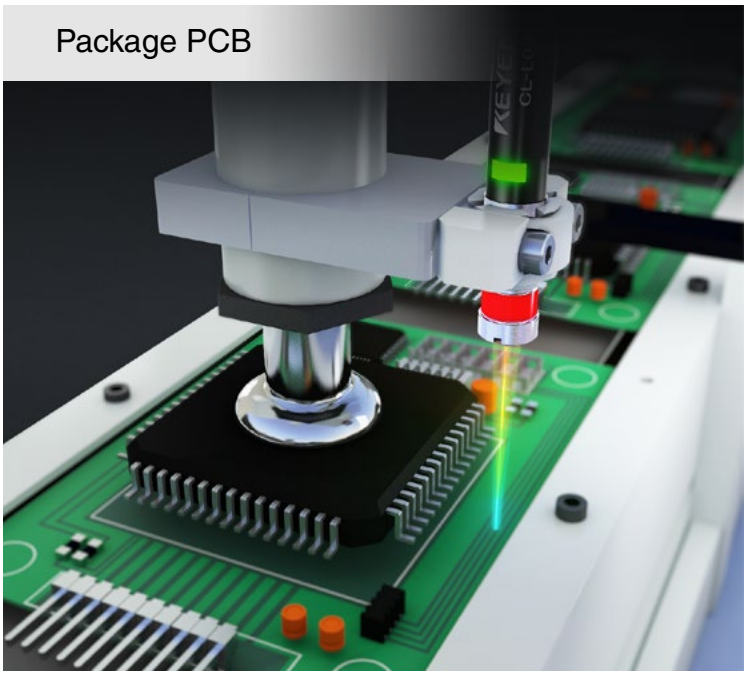
CL-3000 Series ultra-compact coaxial laser displacement sensors address manufacturing challenges such as improving quality, preventing the shipment of defective parts and increasing production.

Film or plastics



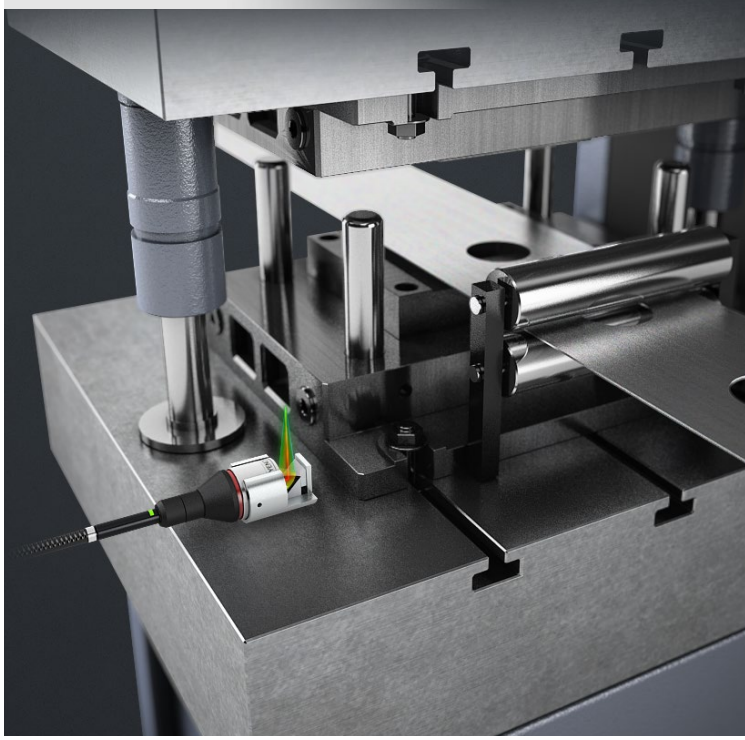
Silicon wafer

Package PCB



Machined parts

Precision press



Glass

Cover a wide range of applications using the new standard in laser displacement sensors.

Confocal Displacement Sensor
CL-3000 Series

No influence from heat or electrical noise
High-precision displacement sensors that perform to specifications

In the new multi-color confocal method displacement sensors, the light sources and other parts are all mounted in the optical unit.
Since the lens is the only part inside the head, it is not impacted by heat, electrical noise or other error-producing sources not listed in the specifications.
These are high accuracy displacement sensors that you can truly rely on in manufacturing environments.

Operation Indicator

Features an operation indicator with high visibility even from a distance.

Designed to be unaffected by external error sources

Structure designed with only the lens inside the head. Without electrical components, no noise or heat is generated.

The multi-color confocal method allows for performance not possible with conventional systems

Ultra-compact and lightweight

Not only can the sensor head be installed in small and constrained spaces, it can be easily mounted on robots as well.

Effective on curved, uneven and rough surfaces

The wide angle lensing allows for high-accuracy measurement on a wide variety of target shapes, including curved or uneven surfaces, and surfaces with rough finishes.

High precision regardless of the material

Measures precisely on all targets, including transparent, mirrored, unfinished metal, ceramic and adhesive surfaces. Measures stably on targets that cast multiple reflections or absorb light.

Easy installation and high-accuracy measurement even for multi-point thickness measurements that used to be so troublesome

The adjustable fixture for thickness measurement and the optical axis alignment function make accurate set-up quick and easy, eliminating errors from mis-installation.

Ultra-compact and lightweight

With a diameter of just 8 mm (0.31"), non-contact measurement can be performed in tight spaces

Run-out measurement of a roll coater

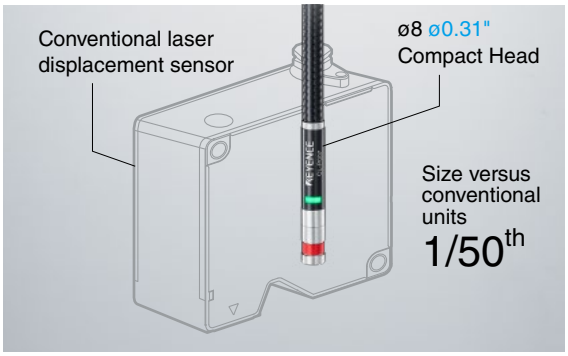
A cable enclosure rating that can withstand harsh manufacturing conditions

The flexible metal tubing around the cable protects the fragile fibers from tensile loads, shock, bending and lateral pressure. Cable length can be extended to a maximum of 30 m 98.4'.

Ultra-compact structure, with only the lens inside the head

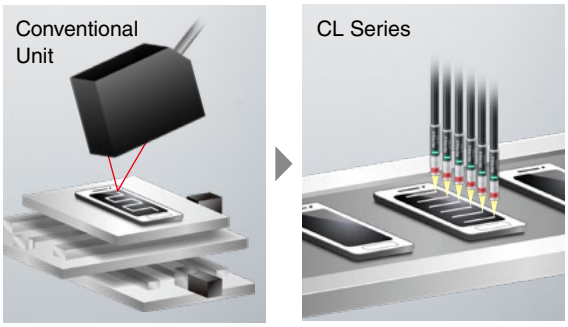
Small form factor, at just 1/50th of the conventional size

Designed with only the lens inside the head, the sensor is reduced to 1/50th the size of conventional systems. Meeting the increasing need for miniaturization in manufacturing equipment, it offers easy installation while eliminating space restrictions.



Multiple sensors can be installed side-by-side

Due to the head size of conventional laser displacement sensors, targets needing multi-point measurement need to be moved with an XY stage, increasing equipment cost and complexity.
The CL Series of ultra-compact heads can be installed in parallel even in cramped spaces, allowing users to keep equipment costs down.



Heads can be installed within 9 mm 0.35" of each other

Lightweight and easy to integrate with robots

At roughly 1/2 the weight of a conventional laser displacement sensor the CL series can be easily mounted on the end of a robot arm. Additionally, the lighter weight reduces the residual vibration when the robot arm is brought to a stop.

Effective on curved, uneven and rough surfaces

Multi-color confocal method

Sensor head

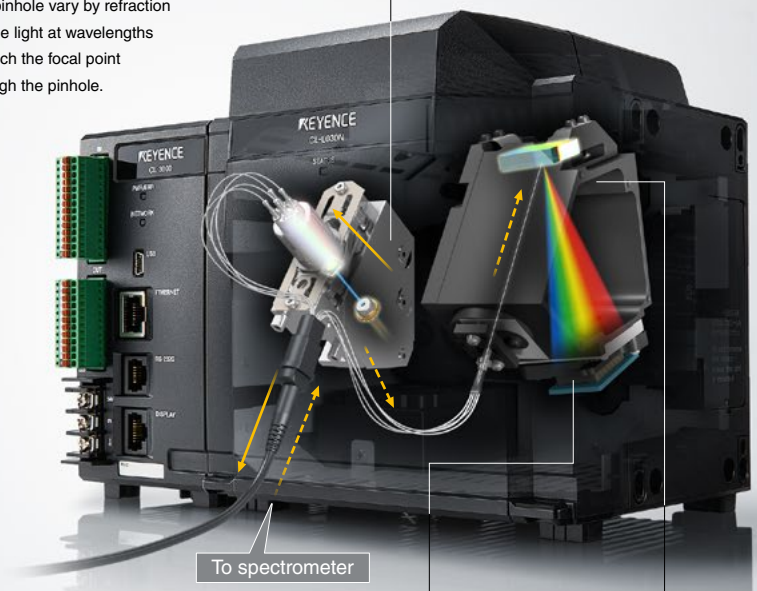
Transmitting

Transmits light at varying focal distances for each wavelength

Receiving

Wavelengths of light that pass through the pinhole vary by refraction point. Only the light at wavelengths that best match the focal point passes through the pinhole.

Controller and optical unit



Light source unit

The ultra-high brightness LPD light source generates light stably at all wavelength bands.

Quad CMOS

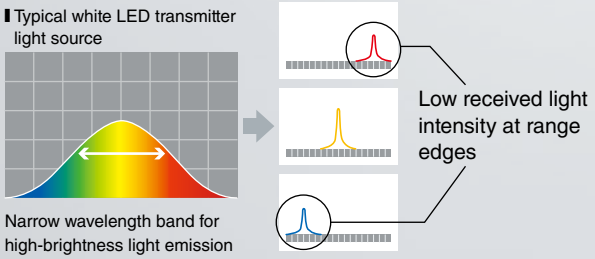
A dynamic range 26 times greater than conventional units. Light is received by four high-resolution CMOSs allowing for high accuracy measurement on all kinds of materials.

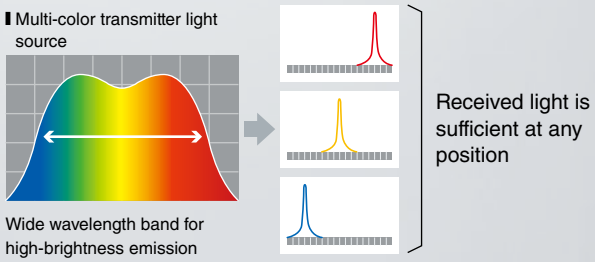
Spectrometer

The received light is split by wavelength and focused onto the Quad CMOS.

Ultra-bright light source produces stable measurement over the sensor's full range

Multi-color light is generated using a LPD light source that emits red and green light simultaneously. The emitted light is more stable and of higher brightness over a wider range of wavelength bands compared to typical white LEDs. This ensures there are sufficient light levels at all points in the measurement range, allowing for higher accuracy.



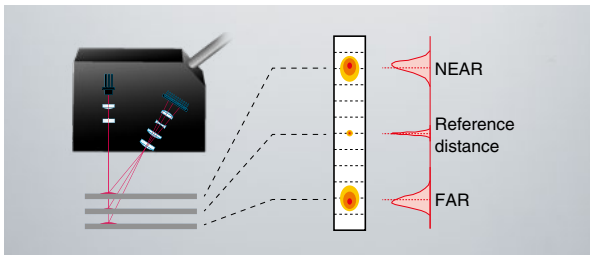


Multi-color confocal method increases measurement stability

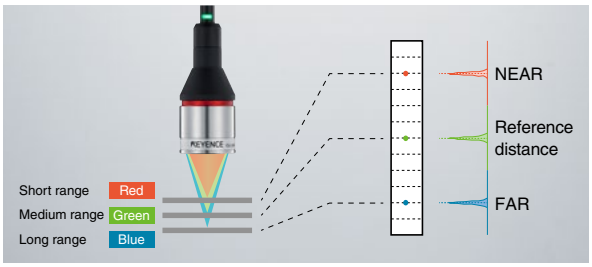
No spot diameter change even with distance changes

The spot diameter of conventional laser displacement sensors increases near the edge of measurement ranges, which resulted in poor accuracy or the inability to trace shapes accurately. The spot diameter of the CL Series never changes at any point within a measurement range, allowing for highly accurate measurement.

▮ Spot diameters on light receiving elements of typical triangulation laser displacement sensors



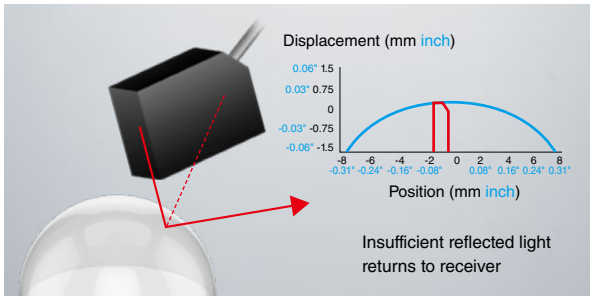
▮ Spot diameters on light receiving elements using the multi-color confocal method



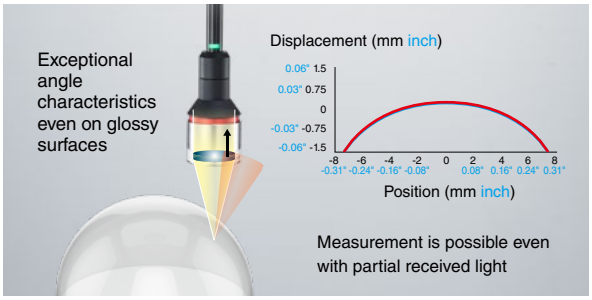
High-precision measurement even on transparent or mirrored targets with curved surfaces or oblique angles

The wide angle opening, combined with the coaxial multi-color confocal method, allow the CL Series to accurately measure curved or angled targets where only small amounts of light are reflected back from the target.

▮ Conventional laser displacement sensor



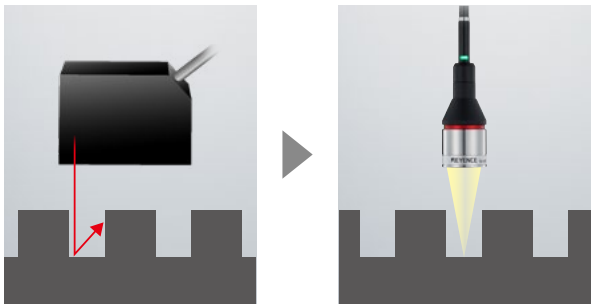
▮ CL Series



No dead angles on step heights or uneven surfaces

Measurements are not impacted by head installation direction or travel direction thanks to the coaxial multi-color confocal method.

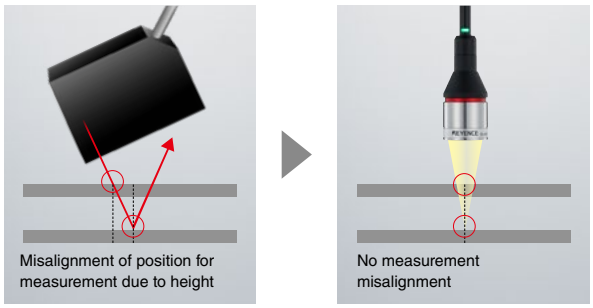
▮ Conventional laser displacement sensor ▮ CL Series



Accurate measurement even on transparent and mirrored surfaces

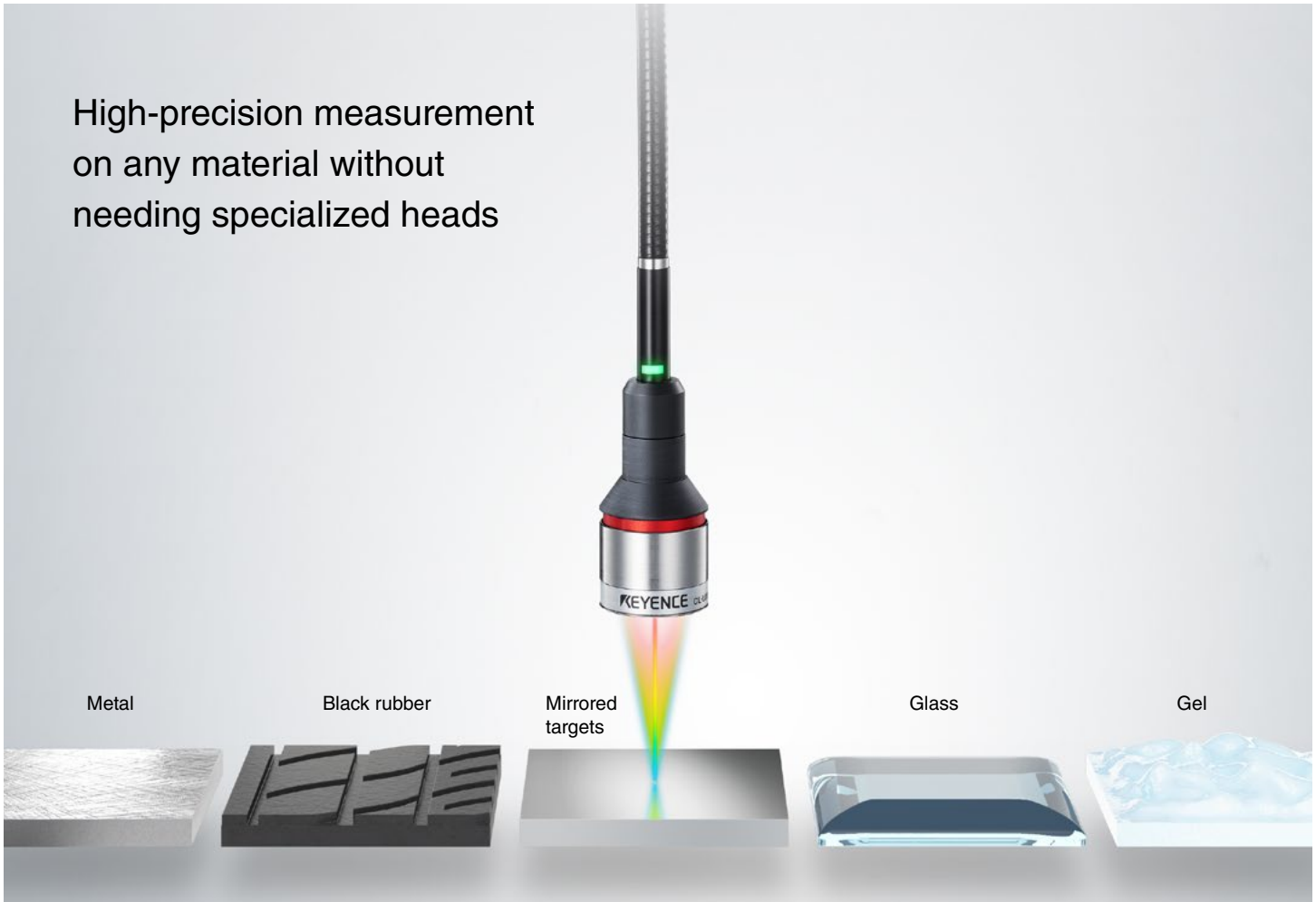
Conventional laser displacement sensors need to be mounted at an angle to measure off of transparent or highly-reflective targets. As the height of the target changes, this mounting angle causes the measurement point on the target to change.
The CL Series measurement is vertical for all targets, so the measurement point remains consistent.

▮ Conventional laser displacement sensor ▮ CL Series



High precision regardless of the material

High-precision measurement on any material without needing specialized heads

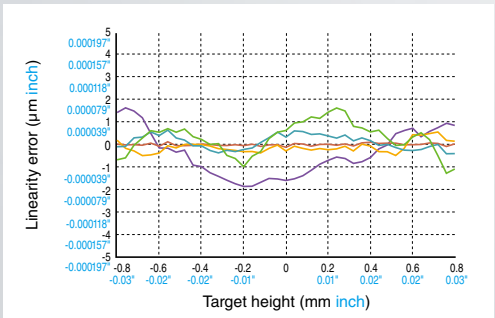


Measurement Image Charts

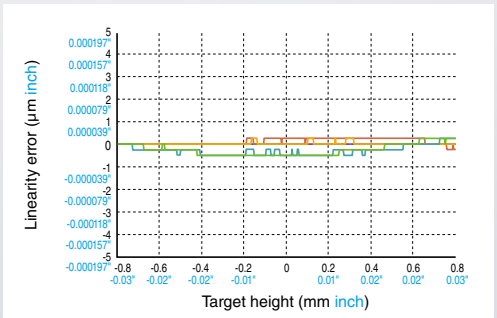
: Conventional laser displacement sensor : CL Series

High-precision linearity on a wide variety of materials

Conventional laser displacement sensor (Typical)



CL-3000 Series For CL-L015 / CL-L015N (Typical)

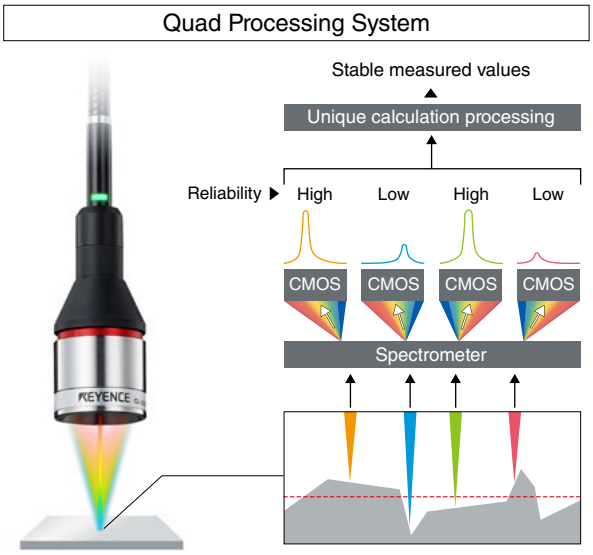


: Transparent or mirrored targets
: White ceramic
: Unfinished metal
: Black rubber
: White resin

Stable, high-accuracy measurement even on difficult targets

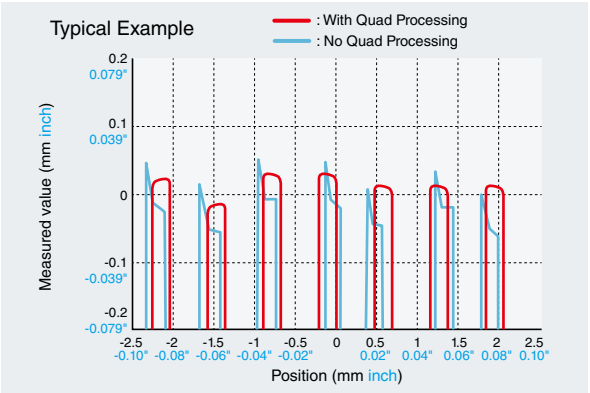
Accurate measurement even on rough surfaces

The Quad Spot system directs light onto four points on the target. The light from each of these four points is received onto four separate CMOSs and measurements are determined for each point. The signal strength and reliability of each point is evaluated and the unique processing system determines the true measurement by removing the influence from irregular reflections.



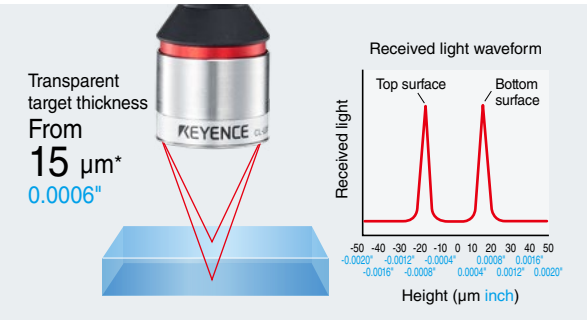
Resistant against multiple reflections

Quad processing is not impacted by irregular or multi-reflection light. This makes it possible for the CL series to stably measure on reflective or angled surfaces such as those on the connector pins of IC chips.



Effective for transparent film measurement

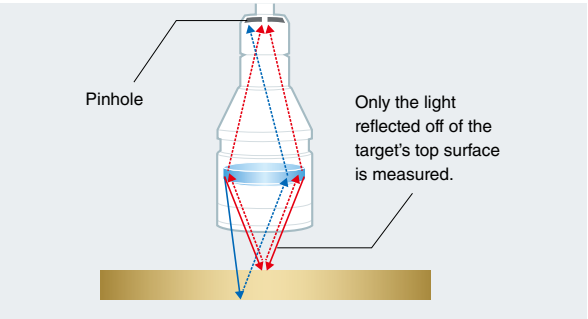
Accurately differentiates reflected light from different surfaces to measure transparent films and coatings as thin as 15 µm 0.0006".



* For CL-PT010

High-accuracy on translucent targets

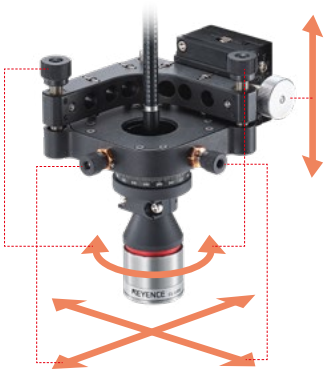
Capable of high-accuracy measurement even on PCBs, translucent liquids and other targets that absorb light.

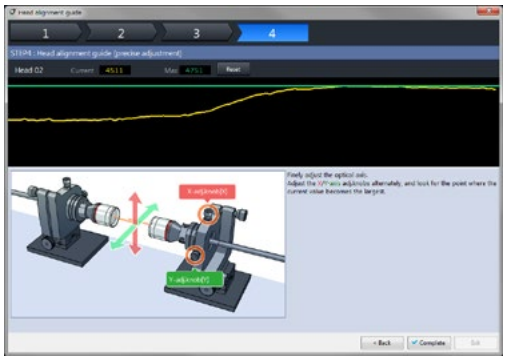


Easy installation and high-accuracy measurement, even for multi-point thickness

Easy installation with adjustable fixture and the optical-axis alignment function

With conventional laser measurement sensors, optical axis alignment, which is critical for achieving high-accuracy thickness measurement, is challenging to configure. With the CL Series, anyone can easily align the sensors using the optical-axis alignment function included in the PC software combined with the adjustable fixture for thickness measurement.

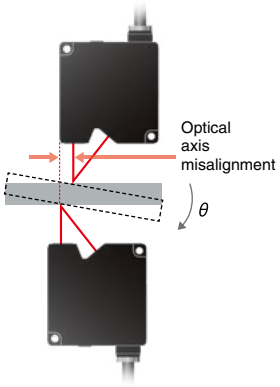




Optical-axis alignment function prevents installation errors

When taking thickness measurements from both sides of the target, major errors occur when the optical axes of both sensor heads do not align or when the target vibrates or tilts even slightly. The CL Series can align the optical axes accurately, enabling high-accuracy thickness measurement from both sides of the target.

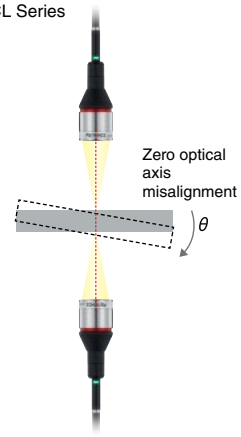
▌Triangulation method



Thickness	1000 µm 0.04"
Optical axis misalignment	500 µm 0.0197"

θ Angle	Thickness measurement result (µm inch)	Error (µm inch)
1.5	987.2 0.038866"	-12.8 -0.000504"
1.0	991.1 0.039020"	-8.9 -0.000350"
0.5	995.7 0.039201"	-4.3 -0.000169"
0.3	997.4 0.039268"	-2.6 -0.000102"
0.0	1000.0 0.039370"	0.0
-0.3	1002.6 0.039472"	2.6 0.000102"
-0.5	1004.4 0.039543"	4.4 0.000173"
-1.0	1008.9 0.039720"	8.9 0.000350"
-1.5	1013.4 0.039898"	13.4 0.000528"

▌CL Series

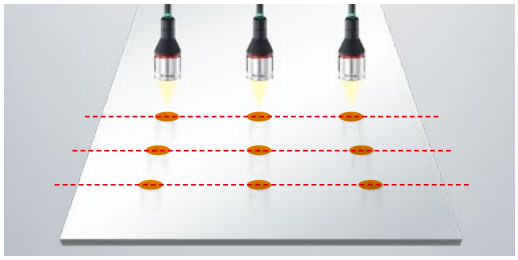


Thickness	1000 µm 0.04"
Optical axis misalignment	0 µm

θ Angle	Thickness measurement result (µm inch)	Error (µm inch)
1.5	1000.3 0.039382"	0.3 0.000012"
1.0	1000.2 0.039378"	0.2 0.000008"
0.5	1000.0 0.039370"	0.0
0.3	1000.0 0.039370"	0.0
0.0	1000.0 0.039370"	0.0
-0.3	1000.0 0.039370"	0.0
-0.5	1000.0 0.039370"	0.0
-1.0	1000.2 0.039378"	0.2 0.000008"
-1.5	1000.3 0.039382"	0.3 0.000012"

Synchronized measurement between all sensor heads allows for measurement without positional misalignment

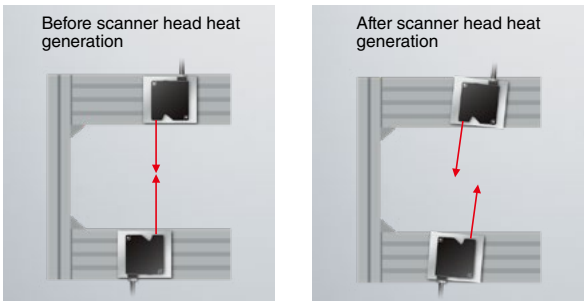
Synchronized measurement is possible since one controller operates all sensor heads. The accuracy of sheet thickness measurement is improved without the need for difficult PLC programming.



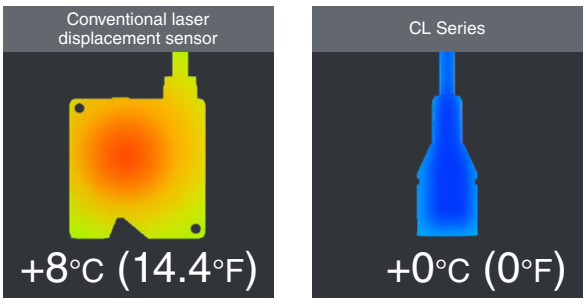
The sensor head design eliminates heat generation, enabling high-accuracy measurement

The heat generated by conventional laser displacement sensors causes thermal distortion of the fixture, making it susceptible to measurement errors resulting from optical axis misalignment. The CL Series is designed so that there are no electronic components generating heat inside the head. As a result there is no thermal distortion of the mounting jig. This is the ideal for high-accuracy measurement.

▌Conventional laser displacement sensor



▌Sensor head 10 minutes after powering on

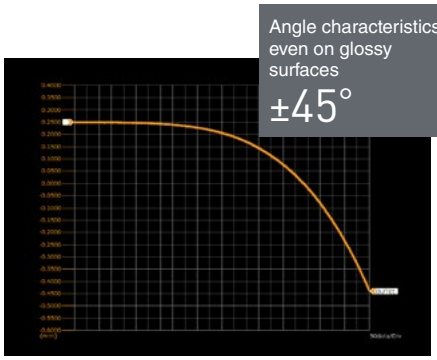


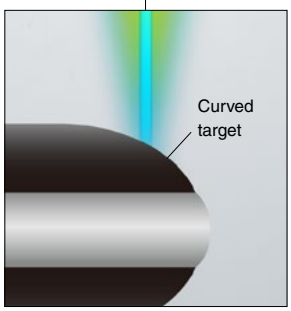
Accurate measurement of ultra-fine shapes

Profile Measurement Head **CL-PT010**

The profile measurement head can measure even very fine targets with its small beam spot

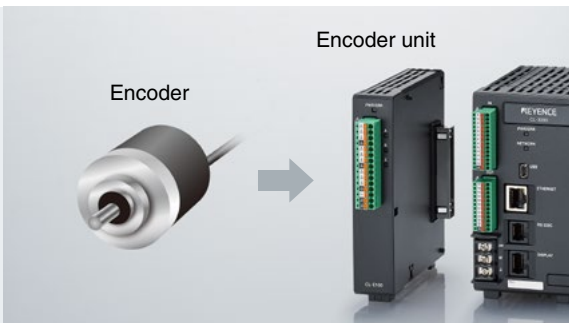
Capable of accurately tracing even target shapes with sharp angles.





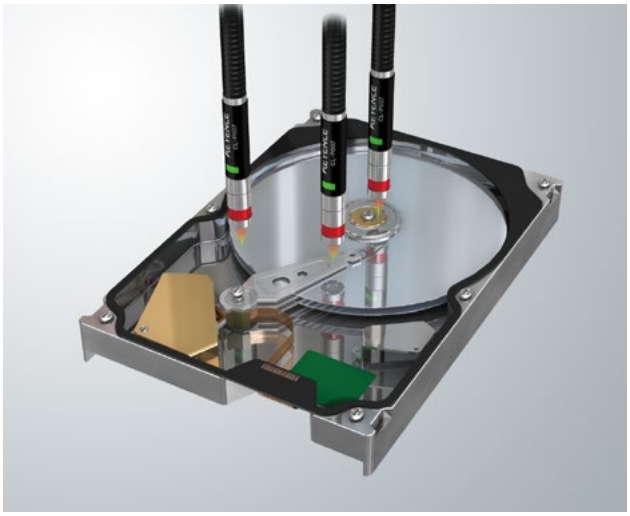
Available encoder input

Enables measurement by synchronizing with the target's position.
Uses a unitary design with a direct connection to the controller for simple synchronization.



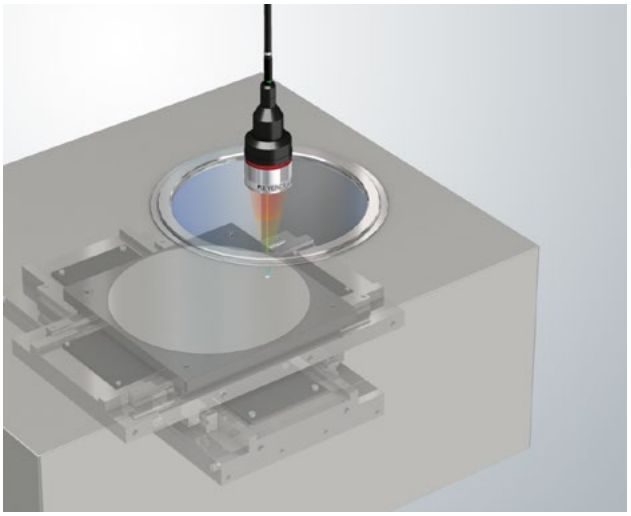
Electronics/Semiconductor Industry

HDD Motor Run-Out and Head Height



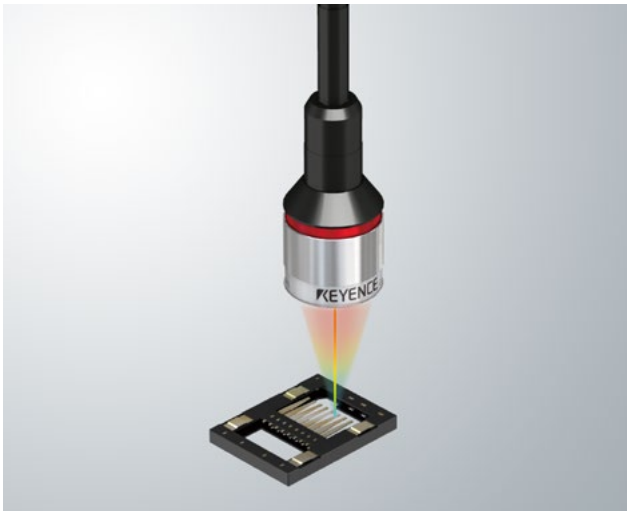
Measure height or height difference between multiple sensors in close proximity using these compact ø8 ø0.31" heads. Surface finish does not impact the measurement.

Wafer Height in a Vacuum Chamber



The height position of the internal wafer can be measured even through the viewport of the vacuum chamber.

Connector Terminal Coplanarity



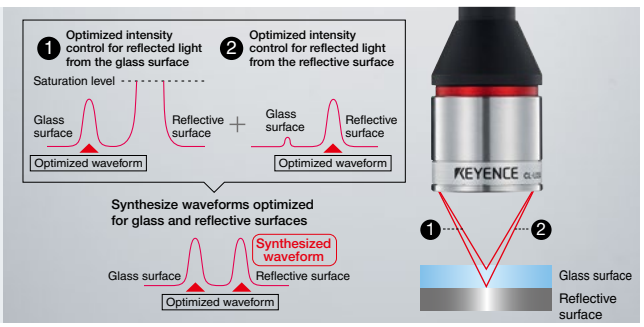
Quad processing, which is resistant to multiple reflections, allows highly accurate measurement of coplanarity without being affected by multiple reflections on connector pins.

Solder Mask Thickness

With a small beam spot of 3.5 µm ø0.000138", it is possible to measure the thickness of a transparent solder mask on a PCB as thin as 15 µm ø0.0006".

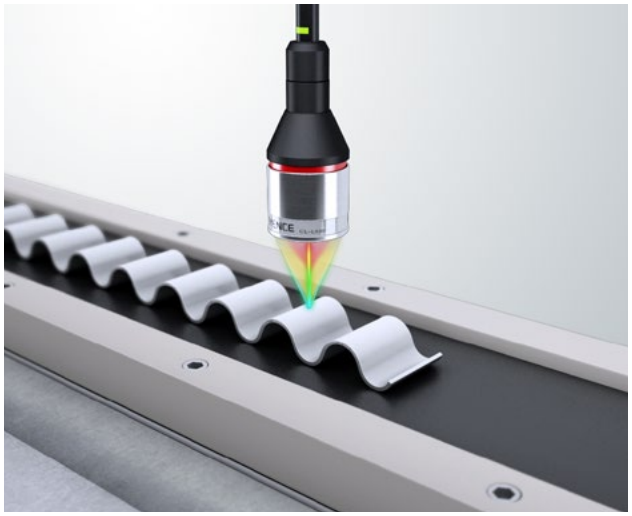
Highly accurate measurement of combined reflective and glass surface

As shown in the figure on the right, light reflected from the glass surface is weak while light reflected from the reflective surface is strong. This difference in intensity causes issues for typical sensors. However, with the CL Series, highly accurate measurement is possible by optimizing and synthesizing each of these types of reflected light.



Automotive Industry

Aluminum Fin Profile

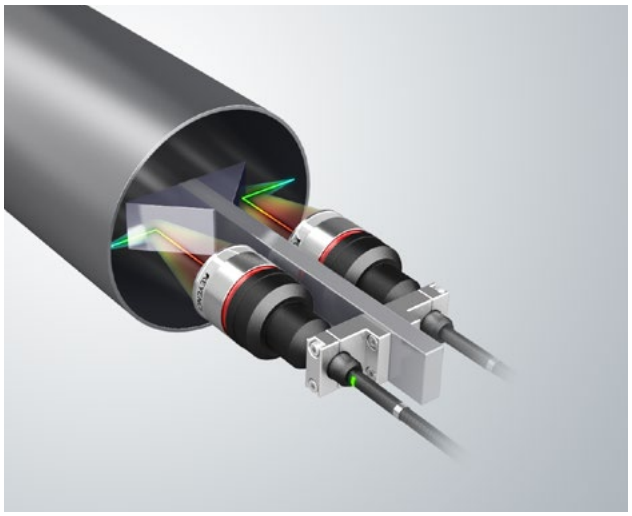


Measure the shape of targets with uneven surfaces. The coaxial measurement principle allows accurate measurement that is unaffected by dead angles.

Disk Rotor Runout

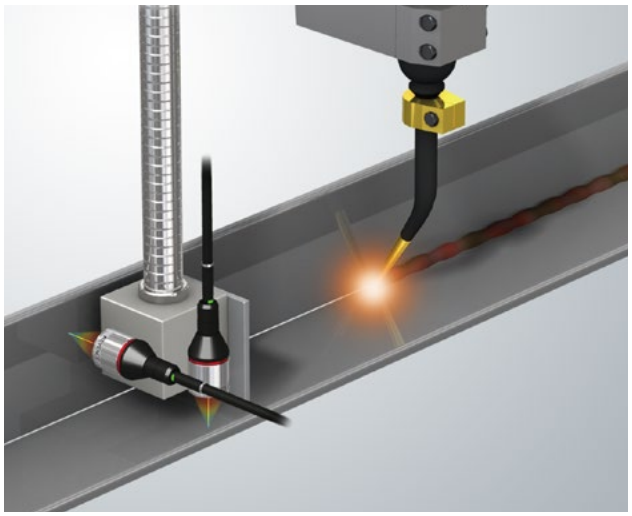
With the CL Series, stable measurement of all targets is possible with the Quad Processing System, which is not easily affected by rough surface conditions.

Pipe Inner Diameter



Measure the inner diameter of pipes without contact. Utilization of a jig with an angled mirror allows non-contact measurement even in places with limited space for installation.

Weld Profiling Control



Weld quality is improved by checking for target misalignment during welding. The Quad Processing System allows stable measurement, even on rough surfaces.

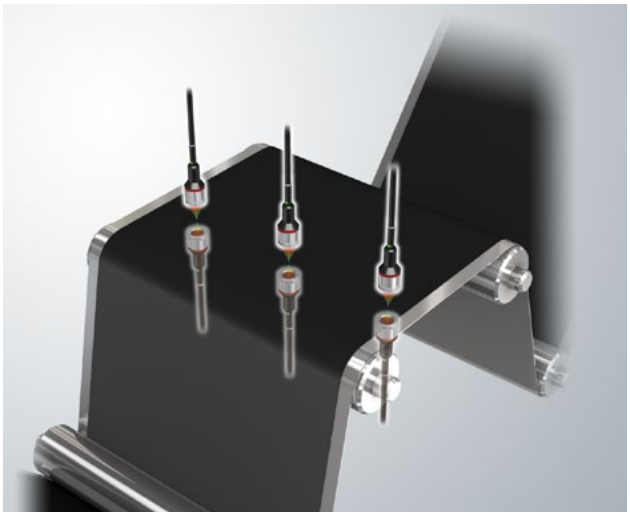
Meets IP67 dust and water-resistance standards allowing use in all manufacturing environments

Can be used without worries even in processing areas with frequent water spray, thanks to its high water-resistant performance.

* Measurement may become unstable due to light refraction if lens is fully covered by water or oil.
* CL-PT010 meets IP64 standard.

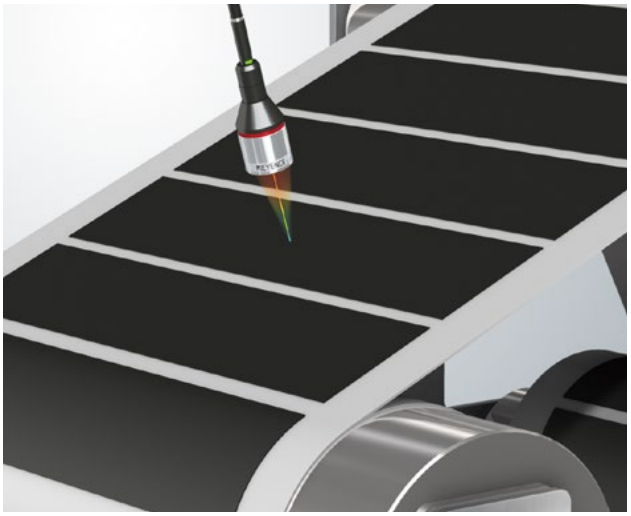
Batteries/Steel Sheets

Lithium-Ion Battery Electrode Thickness



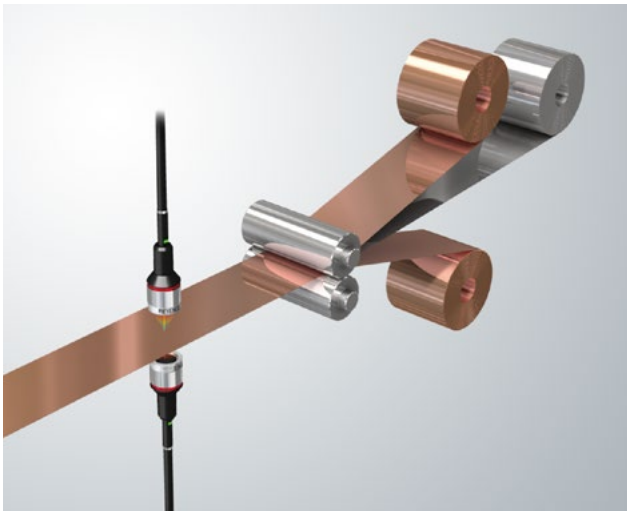
Measure thickness after electrode coating, while the coating is still wet. Installing multiple units crosswise allows thickness to be controlled more precisely.

Electrode Terminal Profile Measurement



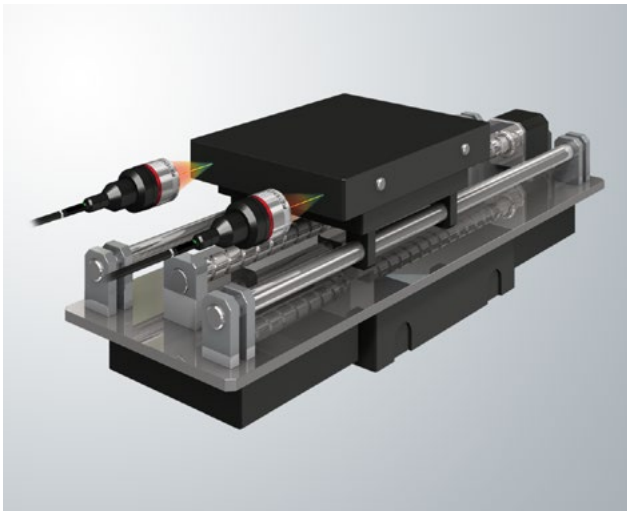
Measure profiles of electrode terminals that have been coated during intermittent coating. Allows accurate inspection while the coating is still wet.

Clad Material Thickness Measurement



The CL Series enables stable measurement on any surface color or material. The Quad processing system enables more reliable thickness measurement, even on targets with hairline metal surfaces.

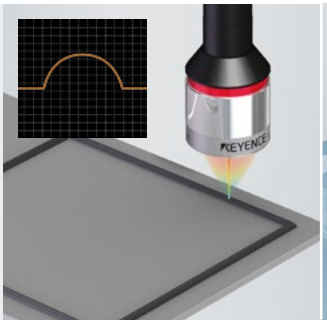
Stop Position and Residual Vibration of High-Precision Stages

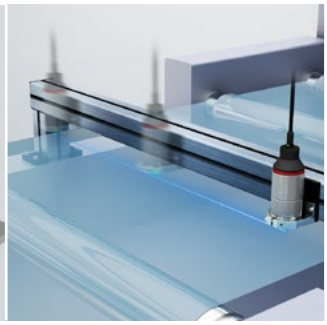


Stop position and residual vibration when a stage stops can be measured. The high-speed and highly accurate CL Series gives stable measurement.

Stable measurement of low reflectivity targets with the new high-sensitivity mode

Stable measurement of inclined or curved black surfaces and coatings with little reflected light is now possible with the newly expanded dynamic range.



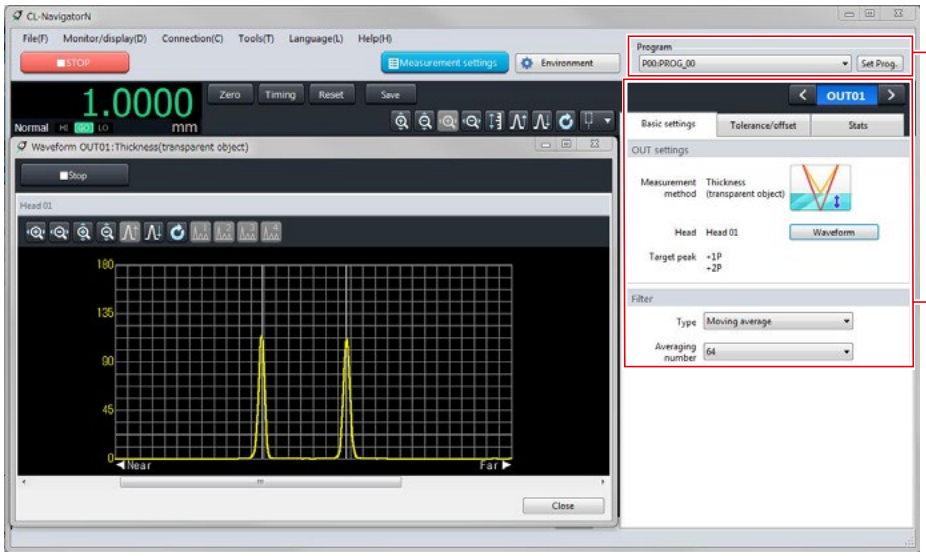


Easy Configuration / Data Collection

Dedicated PC Software: **CL-NavigatorN**

Easy Configuration

Intuitive and easy to configure menus allow for quick programming.
Drop-down menus and icons make for simple operation, letting anyone configure the system easily.



Program Switching

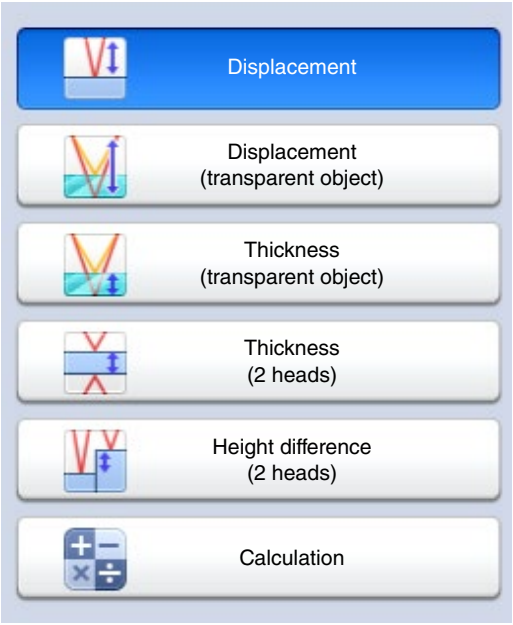
It is possible to switch between eight different programs. It's easy to copy settings between programs or restore initial settings.

OUT Switching

Supports eight OUT settings. No difficult settings are required, and accurate measurement is possible with minimal settings.

Measurement mode

Intuitive operation allows users to perform the desired measurement with ease. No special programming skills required; just click the icons to configure settings.

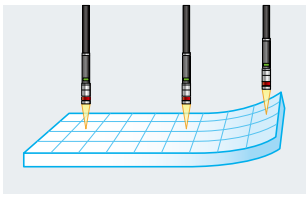


Multi-calculation function

Measured values are calculated instantly across multiple sensor heads. Complex calculations previously carried out on a PLC or PC can now be processed simply within the controller.

Warpage Measurement

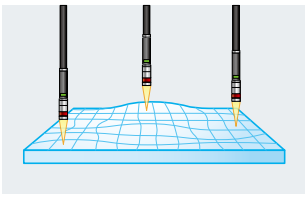
Calculates variance between reference point and all measurement points.



Measured value 1 = B - (A+C) / 2...

Flatness Measurement

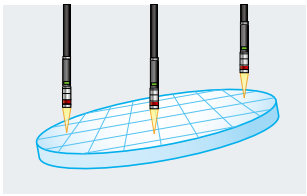
Calculates variance between MIN and MAX values within measurement points.



Measured value 1 = MAX (A,B,C...) - MIN (A,B,C...)...

Step Measurement

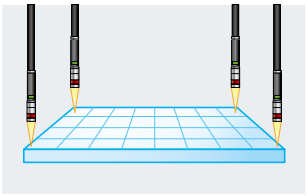
Calculates variance between all measurement points.



Measured value 1 = A - B, measured value 2 = B - C, measured value 3 = A - C...

Average Height Measurement

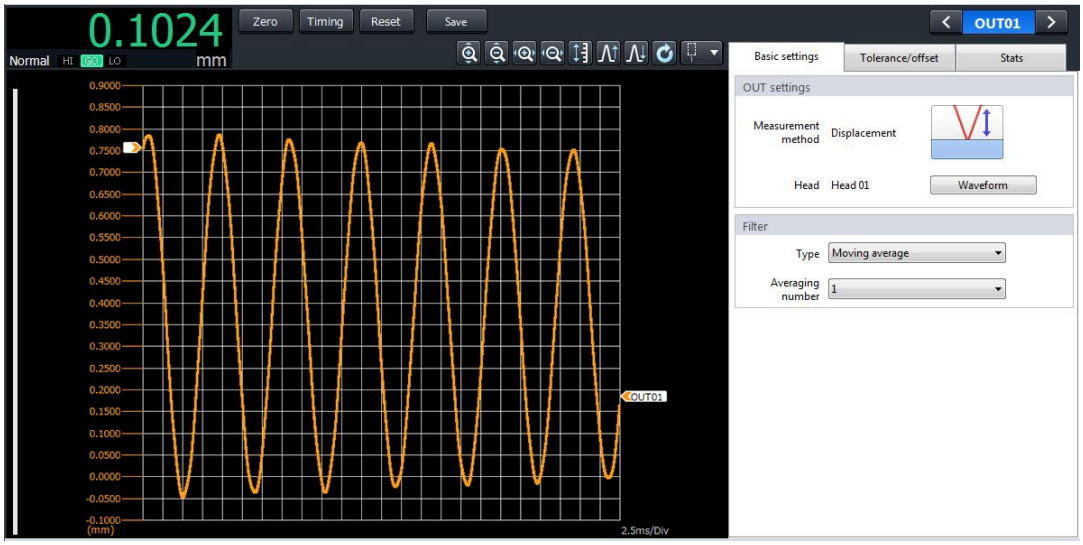
Calculates average height of a surface based on the measurements from multiple points.



Measured value 1 = Ave (A,B,C...)...

Trend Graph

Measurement values are displayed in real-time, in easy-to-understand format. Useful for initial startup at work sites. The display can be easily configured for optimal display for all applications.

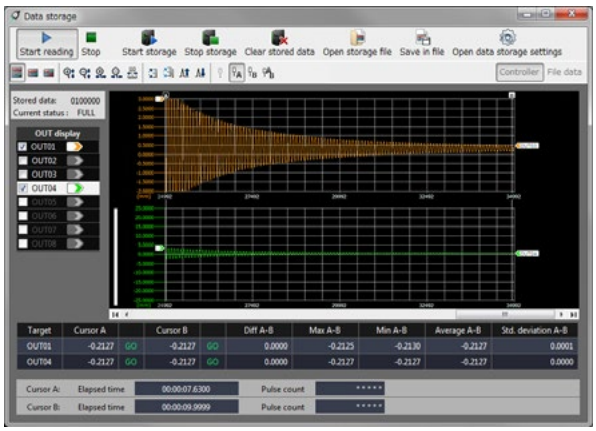


Data Storage

The controller's internal memory can store a maximum of 1.6 million measured values. The data can be loaded to a PC via USB communication.

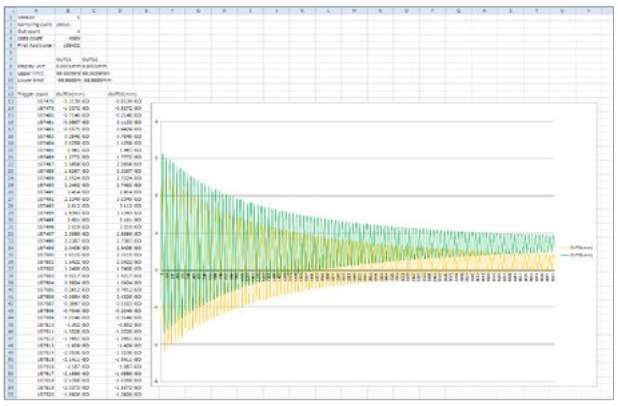
Analysis with CL-NavigatorN

Features a full array of functions, including numerical readings via cursor, as well as zoom in, zoom out and overlap functions.

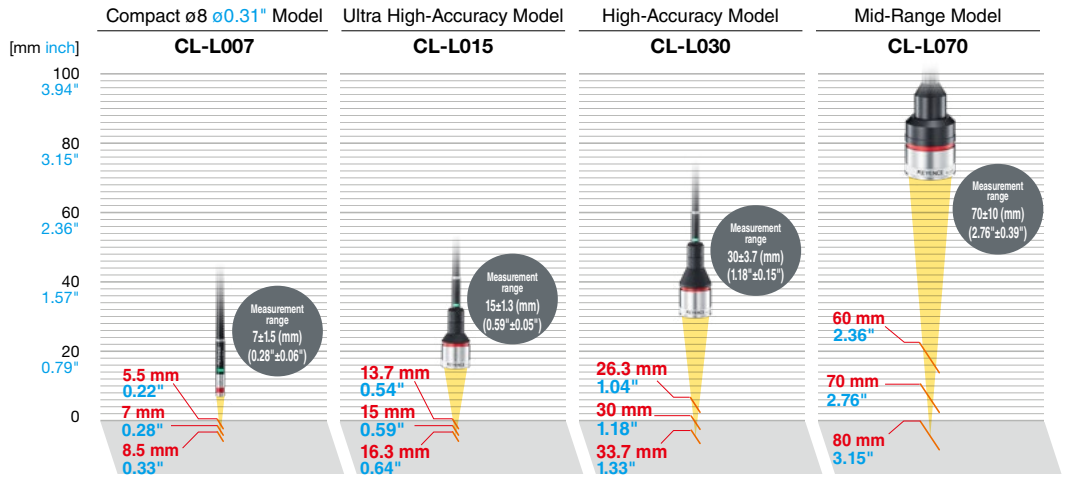


Analysis with Excel

Data collected in CL-NavigatorN can be loaded into Excel by saving in CSV format.



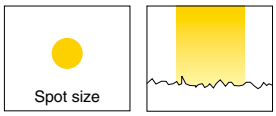
Quad Type Sensor Heads



	CL-L007	CL-L015	CL-L030	CL-L070
Linearity (Standard)	±2.1 µm ±0.000083"	±0.49 µm ±0.000019"	±0.94 µm ±0.000037"	±2.2 µm ±0.000087"
Linearity (High precision)	±0.91 µm ±0.000036"	±0.41 µm ±0.000016"	±0.72 µm ±0.000028"	±2.0 µm ±0.000079"

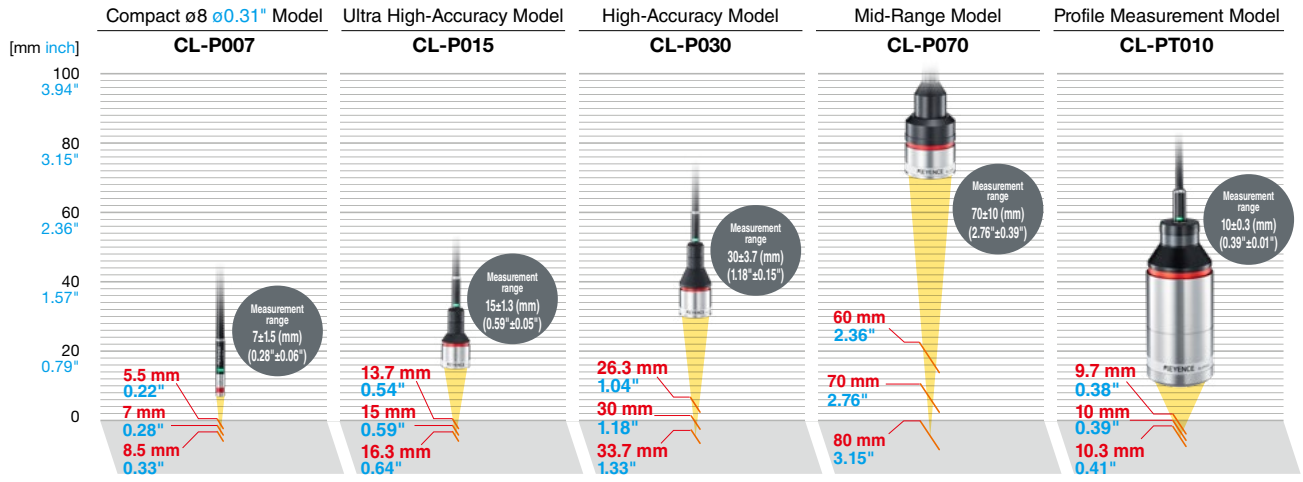
Eliminates the influence of extremely small bumps and divots with a quad processing system. Allows for stable measurement.

Position **Thickness**
Height **Run-out**



	CL-L007	CL-L015	CL-L030	CL-L070
Spot diameter	ø750 µm ø0.0295"	ø300 µm ø0.0118"	ø500 µm ø0.0197"	ø600 µm ø0.0236"

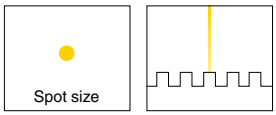
Focused Spot Type Sensor Heads



	CL-P007	CL-P015	CL-P030	CL-P070	CL-PT010
Linearity (Standard)	±0.96 µm ±0.000038"	±0.49 µm ±0.000019"	±0.94 µm ±0.000037"	±2.2 µm ±0.000087"	±0.22 µm ±0.000009"
Linearity (High precision)	±0.55 µm ±0.000022"	±0.41 µm ±0.000016"	±0.72 µm ±0.000028"	±2.0 µm ±0.000079"	±0.2 µm ±0.000008"

Reliably detects fine targets using an ultra-small beam spot of ø3.5 µm ø0.000138" at minimum. Ideal for profile measurement.

Appearance **Height difference**
Warpage **Ultra small**



	CL-P007	CL-P015	CL-P030	CL-P070	CL-PT010
Spot diameter	ø50 µm ø0.0020"	ø25 µm ø0.0010"	ø38 µm ø0.0015"	ø50 µm ø0.0020"	ø3.5 µm ø0.000138"

Device Configuration List

Sensor heads

Compact ø8 ø0.31" Model
CL-L(P)007

Ultra High-Accuracy Model
CL-L(P)015

High-Accuracy Model
CL-L(P)030

Mid-Range Model
CL-L(P)070

Profile Measurement Model
CL-PT010

Controllers

Controller
CL-3000

Expansion unit
CL-H100

Expansion unit (with analog output)
CL-H150

Relay unit
CL-H200

Encoder unit
CL-E100

EtherCAT® unit
CL-EC100

Units

Optical units
CL-L(P)007N
CL-L(P)015N
CL-L(P)030N
CL-L(P)070N
CL-PT010N

Cables

Head extension cable
CL-C5 (5 m 16.4')
CL-C10 (10 m 32.8')
CL-C30 (30 m 98.4')

Expansion cable
CL-AC1 (1 m 3.3')
CL-AC2 (2 m 6.6')

Display panel cable
OP-88281 (3 m 9.8')
OP-88282 (10 m 32.8')

USB cable for PC connection
OP-51580

RS-232C cable
OP-96368

Ethernet cable
OP-66843

Dsub 9-pin connector
OP-26401

Display

Display panel
CL-D500

Optional Parts

Head fixtures
For CL-L(P)015/030/070: **OP-88283**
For CL-L(P)007: **OP-88353/OP-88354/OP-88355**
For CL-PT010: **OP-88289**

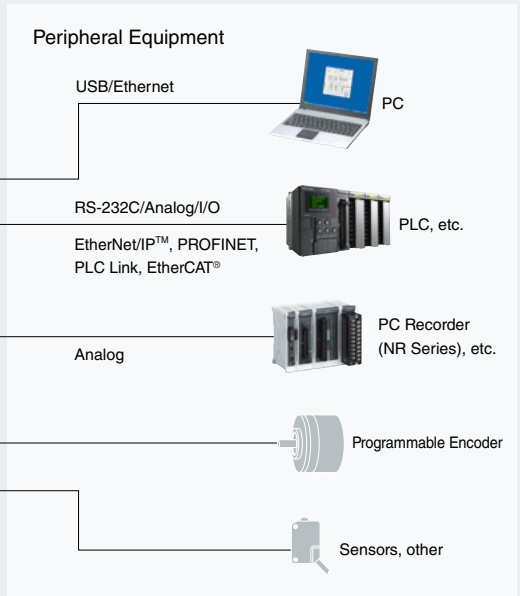
Adjustable fixture for thickness measurement CL-L(P)015/030/070:
OP-88284/OP-88285/ OP-88286

Multiple I/O Communications

Equipped with 7 types of I/O, including USB, as standard. Can also be used with encoders and data loggers, with the use of an expansion unit. Expand your range of control by making use of I/O to suit your needs.

Display panel **CL-D500**
EtherCAT® unit **CL-EC100***
Encoder unit **CL-E100***
Controller **CL-3000**
Expansion unit (with analog output) **CL-H150**

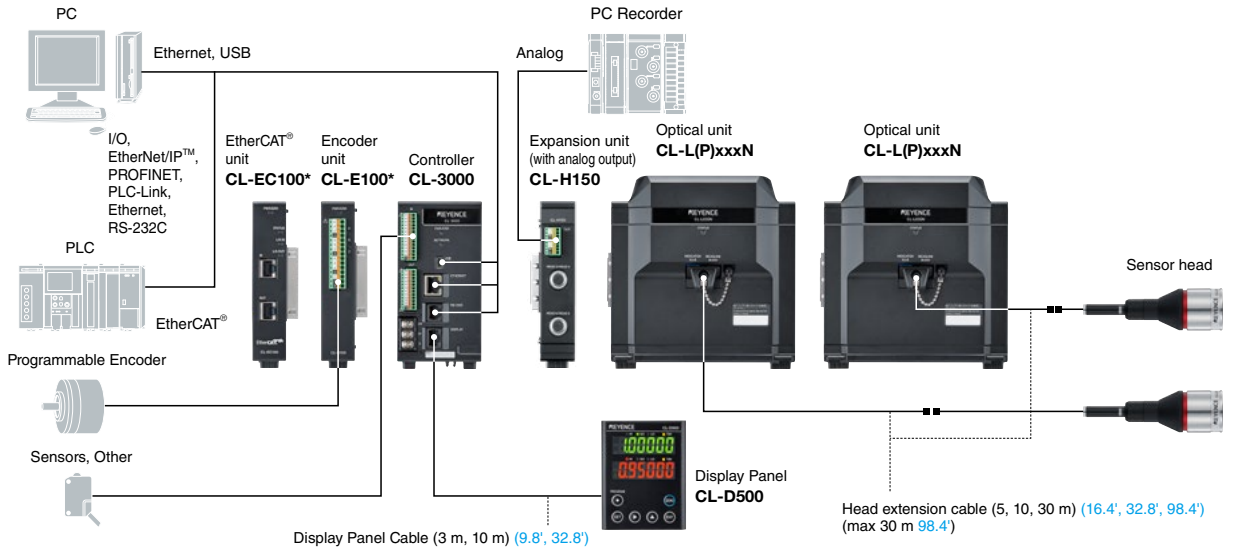
* CL-E100 and CL-EC100 units cannot be connected simultaneously.



EtherNet/IP™ EtherCAT® PROFINET®

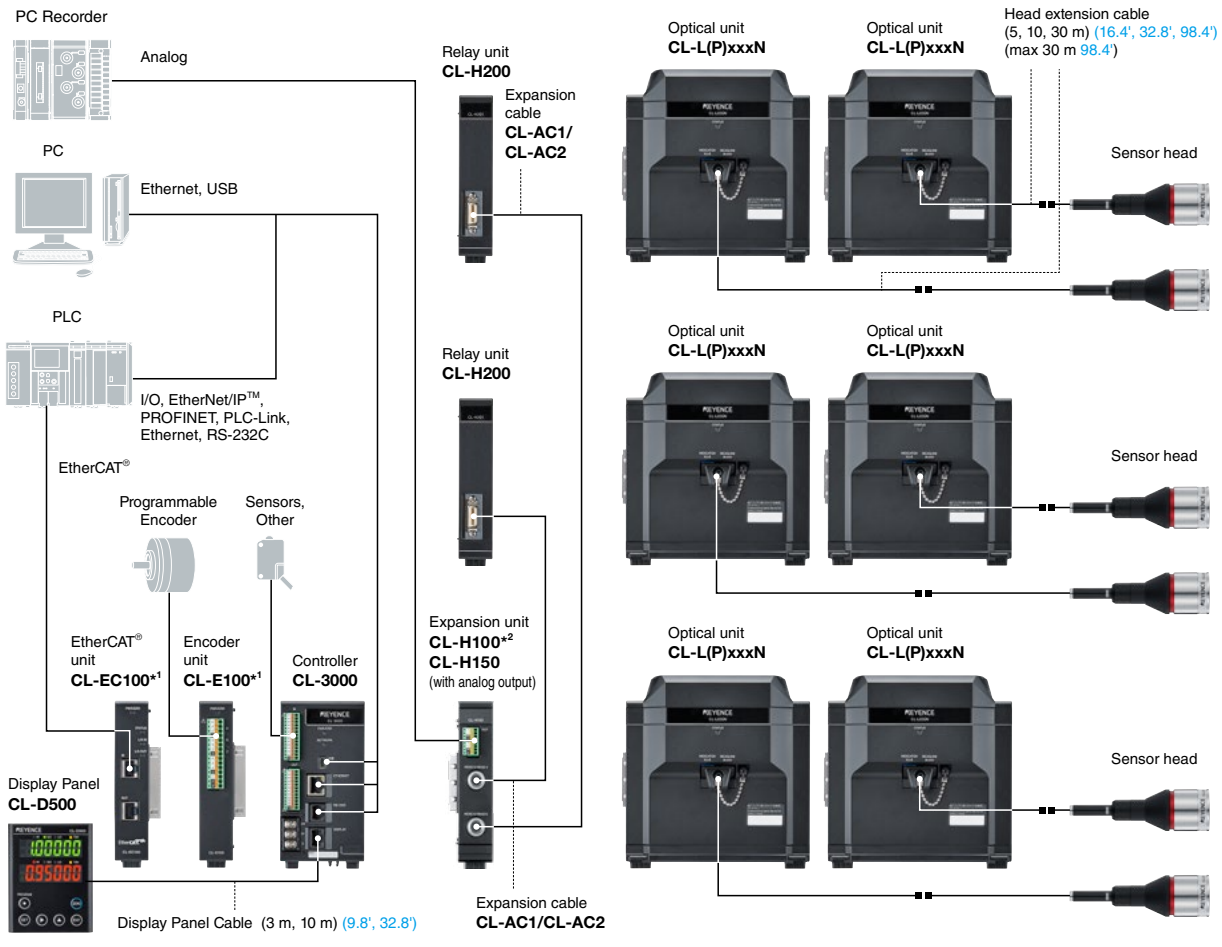
EtherCAT® is registered trademark and patented technology, licensed by Beckhoff Automation GmbH, Germany.

Sensor Head Connections: With Two Units



* CL-E100 and CL-EC100 units cannot be connected simultaneously.

Sensor Head Connections: With Six Units



*1 CL-E100 and CL-EC100 units cannot be connected simultaneously. *2 Analog output is not possible with CL-H100.

Specifications

Sensor Heads and Optical Units

Quad type

Model*1	Head	CL-L007	CL-L015	CL-L030	CL-L070
	Optical unit	CL-L007N	CL-L015N	CL-L030N	CL-L070N
Reference distance		7 mm 0.28"	15 mm 0.59"	30 mm 1.18"	70 mm 2.76"
Reference measurement range	Measurement range	±1.5 mm ±0.06"	±1.3 mm ±0.05"	±3.7 mm ±0.15"	±10 mm ±0.39"
	Linearity*2	±2.1 µm ±0.000083"	±0.49 µm ±0.000019"	±0.94 µm ±0.000037"	±2.2 µm ±0.000087"
High precision measurement range	Measurement range	±0.5 mm ±0.02"	±0.5 mm ±0.02"	±1.0 mm ±0.04"	±3.0 mm ±0.12"
	Linearity*2	±0.91 µm ±0.000036"	±0.41 µm ±0.000016"	±0.72 µm ±0.000028"	±2.0 µm ±0.000079"
Resolution*3		0.25 µm 0.000010"	0.25 µm 0.000010"	0.25 µm 0.000010"	0.25 µm 0.000010"
Spot diameter		ø750 µm ø0.0295"	ø300 µm ø0.0118"	ø500 µm ø0.0197"	ø600 µm ø0.0236"
Laser class	Optical unit	Class 1			
Sampling cycle		100/200/500/1000 µs (Adjustable 4-stage)			
Environmental resistance	Enclosure rating — Head	IP67 (IEC60529)			
	Ambient operating illuminance	Target surface illuminance 30,000 lux (Incandescent lamp)			
	Operating ambient temperature	0 to 50°C 32 to 122°F			
	Operating ambient humidity	20% RH to 85% RH (no condensation)			
	Vibration resistance — Head	10 to 57 Hz, double amplitude 1.5 mm 0.06"; 2 hours each for X, Y, and Z axes			
	Vibration resistance — Optical unit	10 to 57 Hz, double amplitude 0.3 mm 0.01"; 2 hours each for X, Y, and Z axes			
	Shock resistance	15G 6 ms			
Temperature characteristic	Head	0.005% of F.S. / °C			
	Optical unit	0.015% of F.S. / °C			
Material	Head	SUS	Front: SUS Rear: Aluminum		
	Optical unit	Polycarbonate			
Weight	Head	Approx. 140 g	Approx. 180 g	Approx. 200 g	Approx. 280 g
	Optical unit	Approx. 1600 g			

*1 Sensor head and optical unit are a matched pair. Not cross compatible. *2 Value measured in displacement mode with KEYENCE reference workpiece (mirrored surface).
*3 Value measured using 16,384 average cycles with KEYENCE reference workpiece (mirrored surface).

Focused spot type

Model*1	Head	CL-P007	CL-P015	CL-P030	CL-P070	CL-PT010
	Optical unit	CL-P007N	CL-P015N	CL-P030N	CL-P070N	CL-PT010N
Reference distance		7 mm 0.28"	15 mm 0.59"	30 mm 1.18"	70 mm 2.76"	10 mm 0.39"
Reference measurement range	Measurement range	±1.5 mm ±0.06"	±1.3 mm ±0.05"	±3.7 mm ±0.15"	±10 mm ±0.39"	±0.3 mm ±0.01"
	Linearity*2	±0.96 µm ±0.000038"	±0.49 µm ±0.000019"	±0.94 µm ±0.000037"	±2.2 µm ±0.000087"	±0.22 µm ±0.000009"
High precision measurement range	Measurement range	±0.5 mm ±0.02"	±0.5 mm ±0.02"	±1.0 mm ±0.04"	±3.0 mm ±0.12"	±0.15 mm ±0.01"
	Linearity*2	±0.55 µm ±0.000022"	±0.41 µm ±0.000016"	±0.72 µm ±0.000028"	±2.0 µm ±0.000079"	±0.2 µm ±0.000008"
Resolution*3		0.25 µm 0.000010"	0.25 µm 0.000010"	0.25 µm 0.000010"	0.25 µm 0.000010"	0.25 µm 0.000010"
Spot diameter		ø50 µm ø0.0020"	ø25 µm ø0.0010"	ø38 µm ø0.0015"	ø50 µm ø0.0020"	ø3.5 µm ø0.000138"
Laser class	Optical unit	Class 1				
Sampling cycle		100/200/500/1000 µs (Adjustable 4-stage)				
Environmental resistance	Enclosure rating — Head	IP67 (IEC60529)				IP64 (IEC60529)
	Ambient operating illuminance	Target surface illuminance 30,000 lux (Incandescent lamp)				
	Operating ambient temperature	0 to 50°C 32 to 122°F				
	Operating ambient humidity	20% RH to 85% RH (no condensation)				
	Vibration resistance — Head	10 to 57 Hz, double amplitude 1.5 mm 0.06"; 2 hours each for X, Y, and Z axes				10 to 57 Hz, double amplitude 0.45 mm 0.02" 2 hours each for X, Y, and Z axes
	Vibration resistance — Optical unit	10 to 57 Hz, double amplitude 0.3 mm 0.01"; 2 hours each for X, Y, and Z axes				
	Shock resistance	15G 6 ms				
Temperature characteristic	Head	0.005% of F.S. / °C				0.1% of F.S. / °C
	Optical unit	0.015% of F.S. / °C				0.015% of F.S. / °C
Material	Head	SUS	Front: SUS Rear: Aluminum			
	Optical unit	Polycarbonate				
Weight	Head	Approx. 140 g	Approx. 180 g	Approx. 200 g	Approx. 280 g	Approx. 1100 g
	Optical unit	Approx. 1600 g				

*1 Sensor head and optical unit are a matched pair. Not cross compatible. *2 Value measured in displacement mode with KEYENCE reference workpiece (mirrored surface).
*3 Value measured using 16,384 average cycles with KEYENCE reference workpiece (mirrored surface). (Value measured with 4096 average cycles on CL-PT010 only.)

Expansion cable

Model	CL-AC1	CL-AC2
Length	1 m 3.3'	2 m 6.6'
Weight	200 g	400 g

Sensor head extension cable

Model	CL-C5	CL-C10	CL-C30
Length	5 m 16.4'	10 m 32.8'	30 m 98.4'
Weight	450 g	850 g	2500 g

Controller

Model		CL-3000
Number of optical unit connections		Controller only: 2 units; using expansion units/relay units: 6 units
Interface	EtherNet/IP™	Supports cyclic communication and message communication; RPI: 1 to 10,000 ms (0.5 ms units) Maximum number of connections: 8, complies with Version CT14 conformance test Cannot be used when using PROFINET, PLC link or EtherCAT®
	PROFINET	Compatible with conformance class A. Cannot be used when using EtherNet/IP™, PLC link or EtherCAT®
	PLC-Link	The following PLCs are supported: Mitsubishi Electric: MELSEC iQ-R Series, iQ-F Series, Q Series, L Series, FX Series Cannot be used when using EtherNet/IP™, PROFINET or EtherCAT®
	Ethernet*2	Allows for measurement data output and control I/O via no-protocol command communication with PCs and PLCs 100Base-TX, capable of communication with CL-NavigatorN
	USB*2	Conforms to USB 2.0 HighSpeed, capable of communication with CL-NavigatorN
	RS-232C	Allows for measurement data output and control I/O via no-protocol command communication with PCs and PLCs Baud rate: 9600 to 115,200 bps, data length: 8 bit, stop bit: 1 bit, parity: none/even numbers/odd numbers
	Terminal (IN)	13 (supports function switching via software)
	Terminal (OUT)	11*1 (supports function switching via software)
Ratings	Power voltage	24 VDC ±10%
	Maximum current consumption	With 1 optical unit connected: 0.86 A, with 4 optical units connected: 3.3 A, with 6 optical units connected: 4.5 A
Environmental resistance	Operating ambient temperature	0 to 50°C 32 to 122°F
	Operating ambient humidity	20% RH to 85% RH (no condensation)
	Vibration resistance	10 to 57 Hz, double amplitude 0.3 mm 0.01" ; 2 hours each for X, Y, and Z axes
Monitor/Setting support software		CL-NavigatorN
Weight		Approx. 600 g

*1 Positive common connection is supported for NPN input devices, and negative common connection for PNP input devices.
*2 Sample DLL and LabVIEW programs are available. Contact your local sales office for details.

Expansion Unit and Relay Unit

Model		Expansion unit	Expansion unit (with analog output)	Relay unit
		CL-H100	CL-H150	CL-H200
Number of optical unit connections		Supports two CL-H200 expansion units		Supports two optical unit connections
Terminal block	Analog voltage output	Not available	±10 V ×4 outputs, output impedance: 100 Ω	Not available
Environmental resistance	Operating ambient temperature	0 to 50°C 32 to 122°F		
	Operating ambient humidity	20% RH to 85% RH (no condensation)		
Weight		Approx. 300 g		

Encoder Unit

Model		CL-E100
Number of encoder axes		Incremental method (A/B/Z phase)
Minimum encoder input time		100 ns to 20 µs
Maximum current consumption		0.18 A
Service power supply		5 VDC ±10%, maximum power supply 200 mA
Input terminal		Compatible with NPN/PNP open collector output (5 V/12 V/24 V). Compatible with line driver output
Environmental resistance	Operating ambient temperature	0 to 50°C 32 to 122°F
	Operating ambient humidity	20% RH to 85% RH (no condensation)
Weight		Approx. 300 g

EtherCAT® Unit

Model		CL-EC100
EtherCAT® communication specifications*	Conforming standard	IEEE802.3u (100BASE-TX)
	Communication speed	100 Mbps (100BASE-TX)
	Communication period	Shortest 125 µs
	Connection cable	STP/UTP cable, category 5e or above
	Inter-node distance	100 m 328.1'
	Communications port	RJ45 × 2
	Supported functions	Process Data Object (PDO) communication (Cyclic communication: Process data communication) Service Data Object (SDO) communication (Non-cyclic communication: Mailbox communication) CoE Distributed Clock Explicit Device Identification
Environmental resistance	Ambient temperature	0 to 50°C 32 to 122°F
	Operating ambient humidity	20% RH to 85% RH (no condensation)
Weight		Approx. 330 g

* Cannot be used when using EtherNet/IP™, PROFINET or PLC Link.
• Cannot be used simultaneously with an encoder unit.

CL-NavigatorN OS environment

Item	Required Environment
Supported OS	Windows 10*1 / Windows 7*2
CPU	Celeron dual core 1.7 GHz or higher
Memory capacity	4 GB or more
Required free space on hard disk	1 GB or more
Display resolution	XGA (1024×768 pixels) or higher

*1 Home, Pro and Enterprise Editions are supported. *2 Home Premium, Professional and Ultimate Editions are supported. • Windows and Excel are either registered trademarks or trademarks of Microsoft Corporation in the United States and/or other countries.

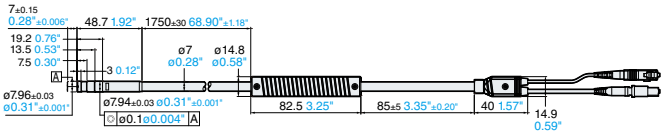
Display panel

Model		CL-D500
Minimum display unit		0.001 µm
Display range		±999.999 µm to ±9999.99 mm ±0.0394" to ±393.70"
Display cycle		Approximately 10 times/second
Environmental resistance	Operating ambient temperature	0 to 50°C 32 to 122°F
	Operating ambient humidity	20% RH to 85% RH (no condensation)
Weight		Approx. 100 g

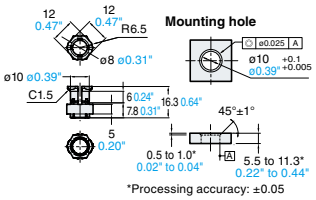
Dimensions Units: mm inch

Sensor heads

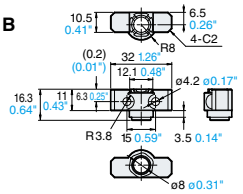
ø8 ø0.31"
Compact Model
CL-L007/P007



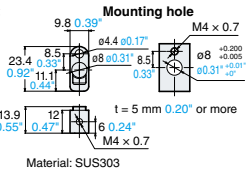
Head Fixture A
OP-88353



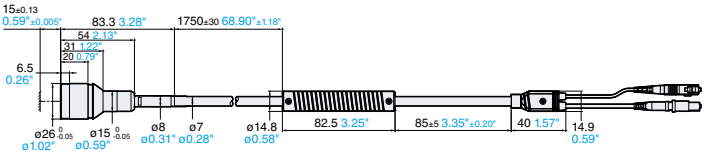
Head Fixture B
OP-88354



Head Fixture C
OP-88355

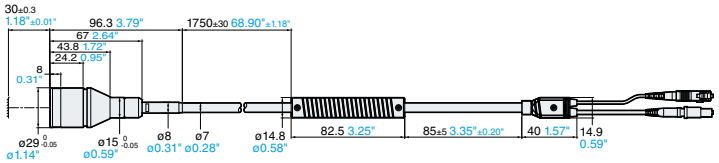


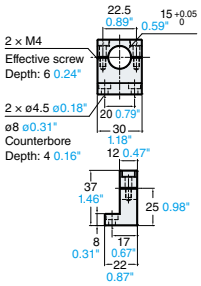
Ultra High-Accuracy Model
CL-L015/P015



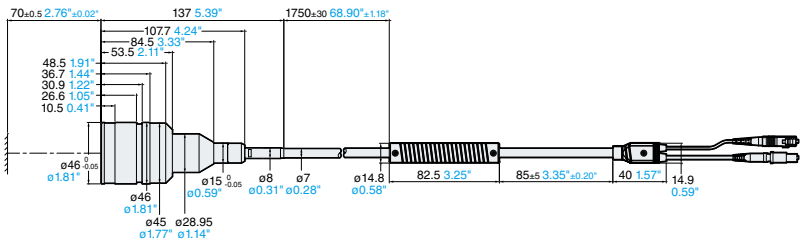
Head Fixture
OP-88283

High-Accuracy Model
CL-L030/P030

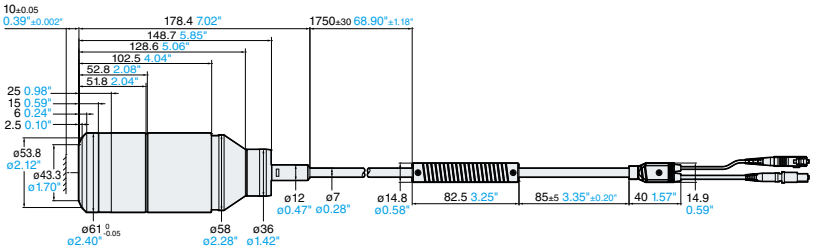




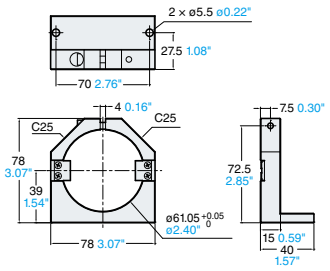
Mid-Range Model
CL-L070/P070



Profile Measurement Model
CL-PT010

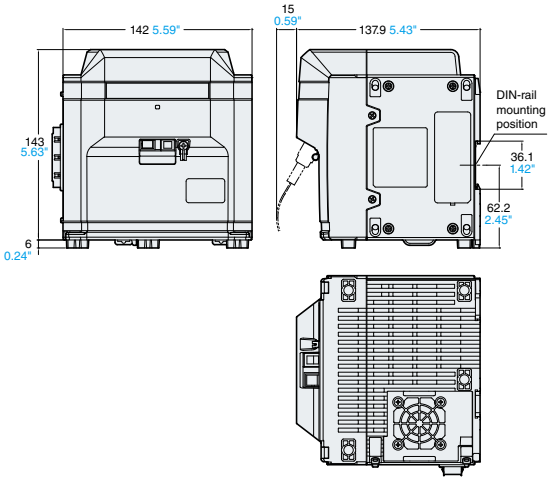


Head Fixture
OP-88289



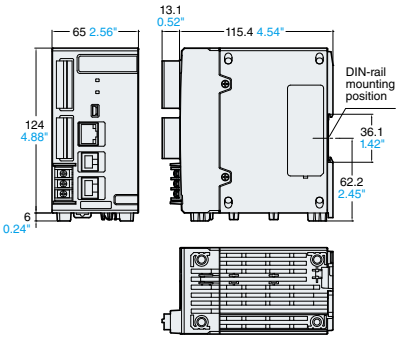
Units

Optical unit
CL-L(P)007N/
L(P)015N/
L(P)030N/
L(P)070N/
PT010N



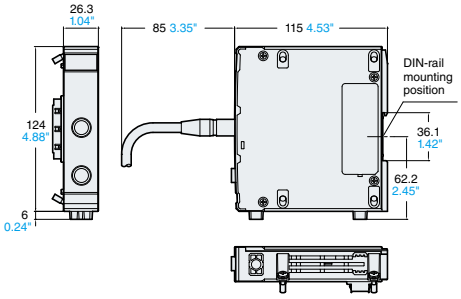
Controller

Controller
CL-3000

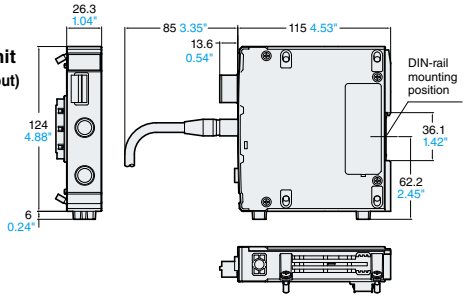


Controller

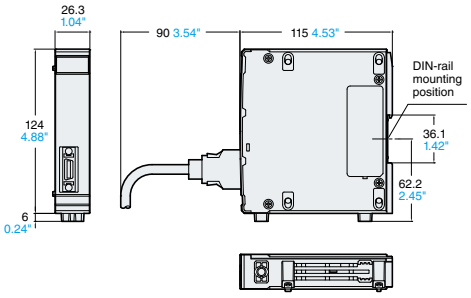
Expansion unit
CL-H100



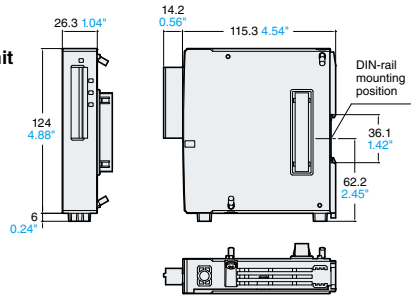
Expansion unit
(with analog output)
CL-H150



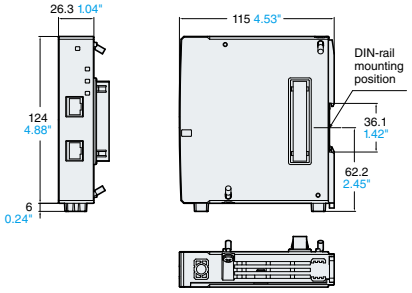
Relay unit
CL-H200



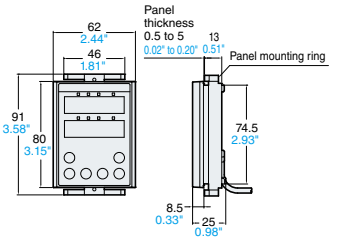
Encoder unit
CL-E100



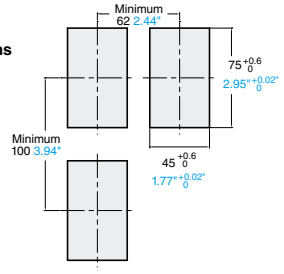
EtherCAT® unit
CL-EC100



Display panel
CL-D500

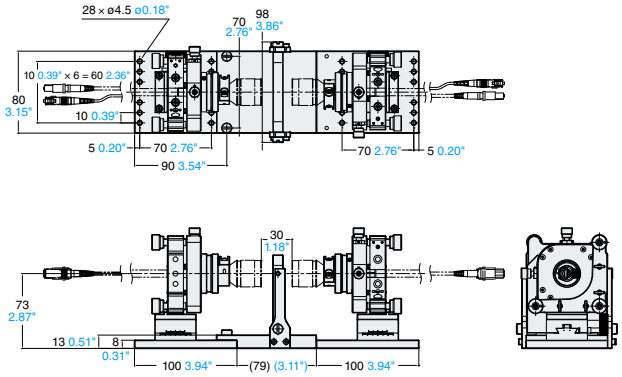


Panel cut dimensions

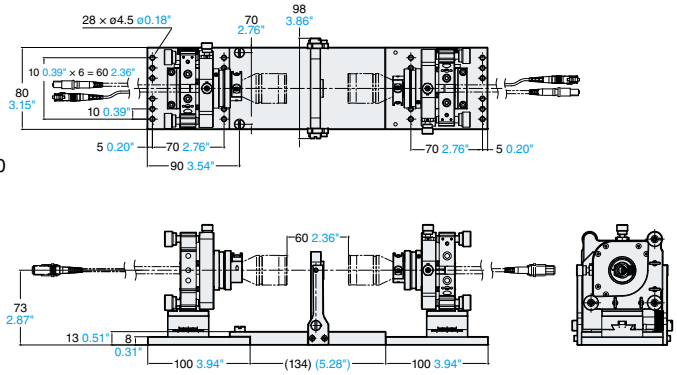


Optional Parts

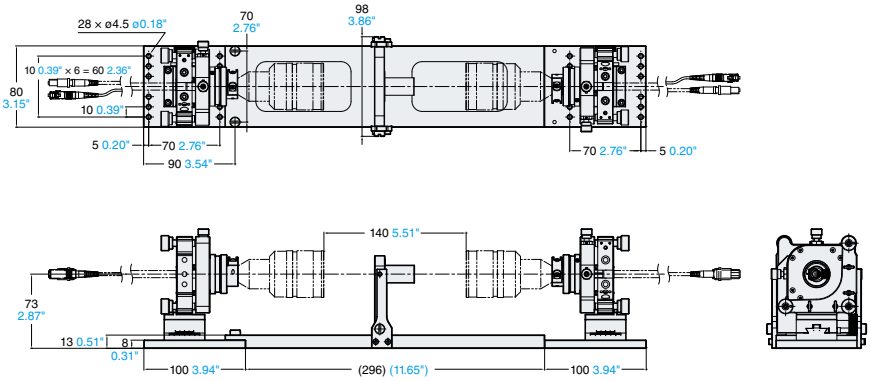
Adjustable Fixture for Thickness Measurement
OP-88284
For CL-L(P)015



Adjustable Fixture for Thickness Measurement
OP-88285
For CL-L(P)030

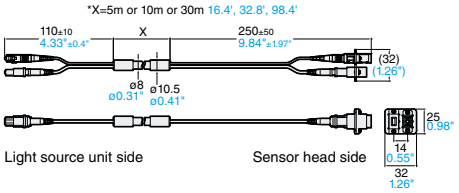


Adjustable Fixture for Thickness Measurement
OP-88286
For CL-L(P)070

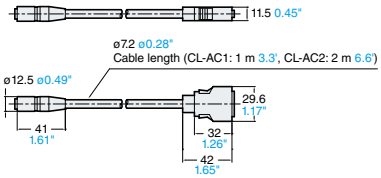


Cables

Head extension cable
CL-C5/C10/C30



Expansion cable
CL-AC1/AC2



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