CD4 is discontinued Contact Ramco Innovations for best replacement options

High-accuracy laser displacement sensor

CD4 series

Featuring a 100 µs sampling period and ±0.1% linearity

- Seven types of sensor heads for various applications are available
- Sensor heads feature IP67 level water-resistance
- Two technologies that make high speed and high accuracy measurements possible

Related products

Higher performance type **CDX** P.438

Compact type **CD22** P.464

Height/width measurement **LS** P.454

Selection table

Type		Measurement range	Repeat accuracy	Laser class	Model
Sensor head	Diffuse-reflective	30 mm (25 mm, 35 mm) ±5 mm	1 µm	Class 2	**CD4-30**
		85 mm (65 mm, 105 mm) ±20 mm	3 µm	Class 2	**CD4-85**
		350 mm (250 mm, 450 mm) ±100 mm	40 µm	Class 2	**CD4-350**
	Specular reflection	25 mm ±1 mm (24 to 26 mm)	0.1 µm	Class 1*	**CD4-L25**

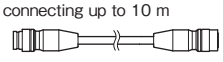
Type	Shape	I/O interface	No. of connectable sensor heads	Model	
				NPN type	PNP type
Amplifier unit for diffuse-reflective heads		Analog output, alarm output, control output, bank input, hold input, zero reset input, laser OFF input, RS-232C	Max. 2 units	**CD4A-N**	**CD4A-P**
Amplifier unit for specular reflection heads				**CD4A-LN**	**CD4A-LP**

*Classified as Class II in the US FDA standards.

Options/Accessories

Head-to-amplifier extension cable

Extension is possible by connecting up to 10 m



CD4CN-5S-ROBOT
Cable length: 5 m

CD4CN-S-ROBOT
Cable length: 2 m

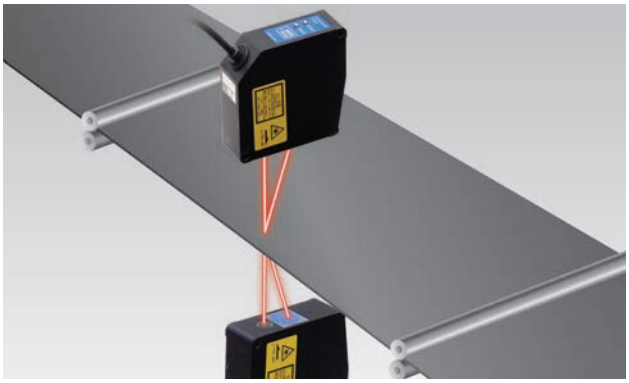
Regarding applicability of Export Trade Control Orders for the CD4-L25

Caution

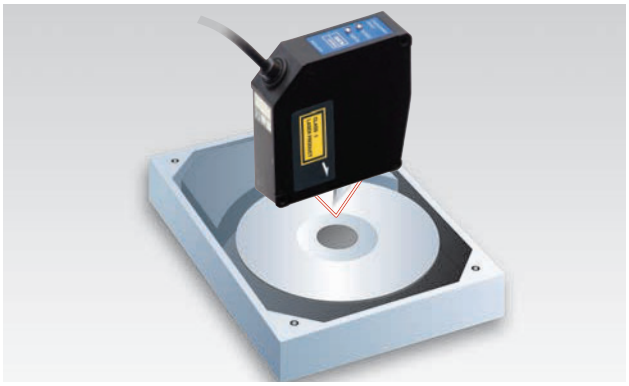
The CD4-L25 specular reflection type sensor head is subject to "Export Trade Control Order Appended Table 1 2-(12)" regarding measurement devices for measuring deviation on straight lines. CD5 series models CD5-L25A and CD5-LW25A are not subject. For details, refer to "Regarding applicability of Export Trade Control Orders for the CD5 series" on page 505.

Applications

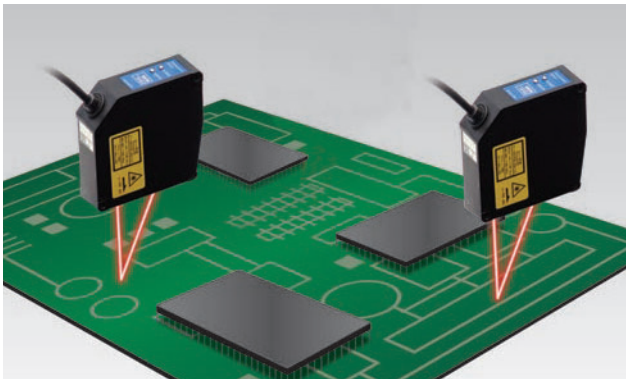
Black rubber thickness measurement Diffuse-reflective type
By calculating measurement results from two sensors, thickness measurements for black rubber can be performed even if there is deflection.



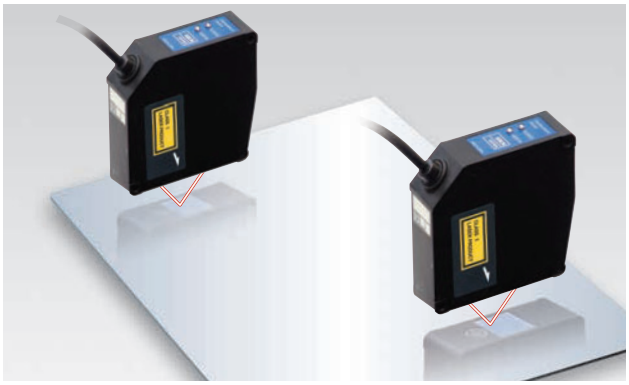
Hard disk deflection measurement Specular reflection type
Even when hard disks spin at high speeds, 10,000 measurements can be performed in one second thanks to the 100 µs sampling period.



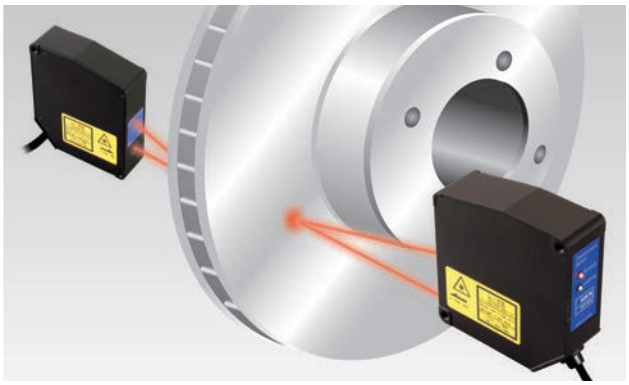
Substrate tilting/warpage measurement Diffuse-reflective type
By calculating measurement results from two sensors, substrate tilting measurements can be performed. The two sensor units can also perform measurements separately.



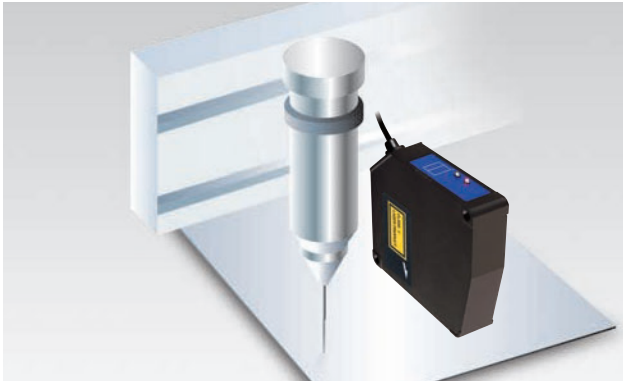
Glass substrate distortion measurement Specular reflection type
With the specular reflection type, highly transparent glass substrates can be measured with stability.



Brake disc thickness measurement Diffuse-reflective type
High-speed brake disc thickness measurements are possible at a sampling period of 100 µs. Tooling changes can also be performed with ease.



Dispenser nozzle height control Specular reflection type
Because the repeat accuracy of specular reflection types is high, high-accuracy nozzle height control is possible.



High-accuracy laser displacement sensor CD4 series

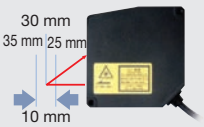
Seven types of sensor heads for various measurement ranges, repeat accuracies, and applications are available

Diffuse-reflective type

■ **Short range type**

Laser class 2 : CD4-30

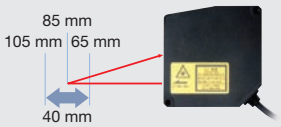
Repeat accuracy: 1 µm



■ **Middle range type**

Laser class 2 : CD4-85

Repeat accuracy: 3 µm



■ **Long range type**

Laser class 2 : CD4-350

Repeat accuracy: 40 µm

Laser Class 3R is suitable for workpieces with low levels of reflected light such as black workpieces.

Specular reflection type

■ **For transparent/specular objects**

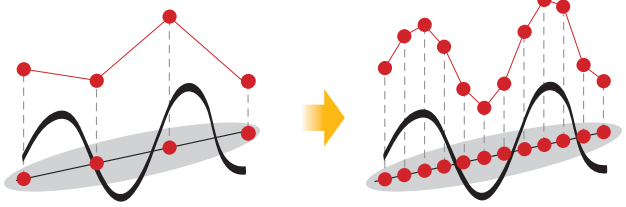
Laser class 1 : CD4-L25

Repeat accuracy: 0.1 µm

Two technologies that make high speed and high accuracy measurements possible

High sensitivity linear image sensor

The newly employed linear image sensor as a receiver element with 5 times more pixels than the conventional product. This has resulted in significant improved element sensitivity that improved linearity ten times better than the conventional product.



Conventional models

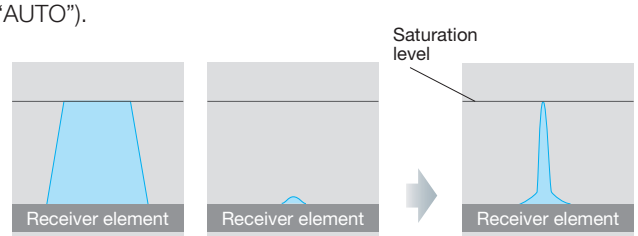
Because element sensitivity is poor, measurements cannot be performed with short sampling periods.

CD4

Because element sensitivity is good, measurements can be performed with short sampling periods.

Electric shutter (automatic light amount control)

Shutter opening degree is automatically adjusted to match workpiece reflectivity. It controls receiving light quantity to optimal levels and minimizes errors (when sensitivity is set to "AUTO").



If the reflectance is too high, such as in the case of specular objects, errors will occur during peak position calculation due to an excessive receiving light quantity.

If the reflectance is too low, such as in the case of black rubber, instability will occur due to an insufficient receiving light quantity.

Control is performed to ensure the optimal receiving light quantity.

IP67 level water-resistant sensor heads

(excluding connector part)

These sensor heads feature IP67 level water-resistance. It doesn't break even when wet and can be used for a wide range of applications.

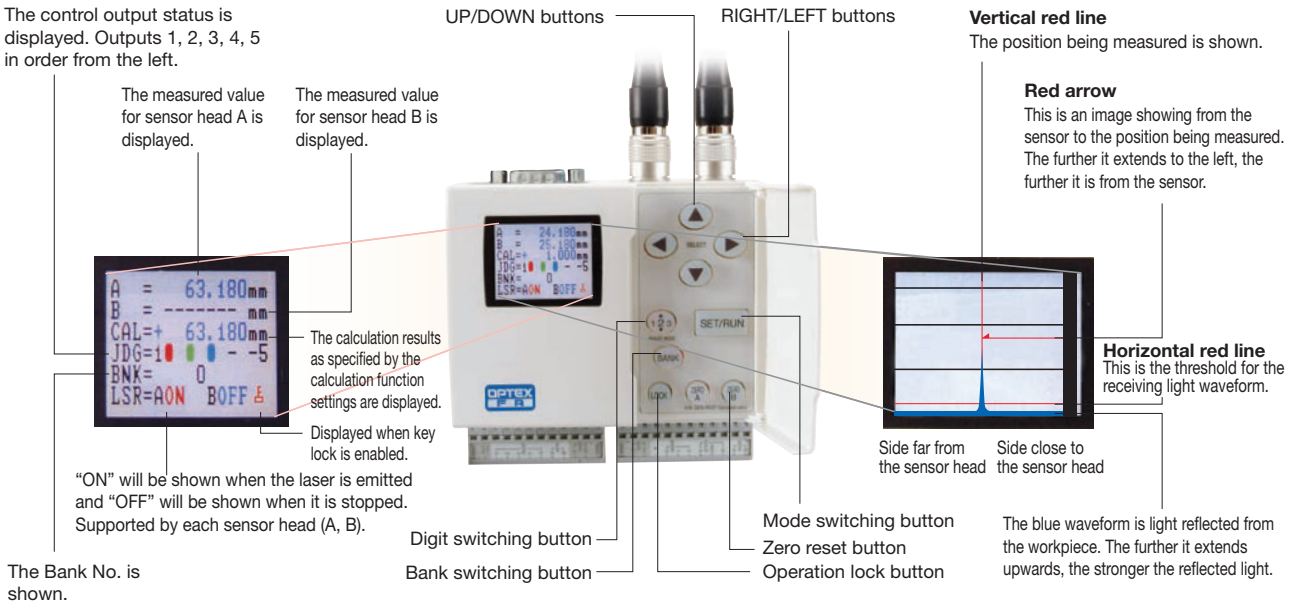
*Water or oil that adhere to the window could cause light to refract and prevent measurements from being performed correctly.

Functions (amplifier unit)

Controller with built-in monitor

This is the industry's first amplifier featuring a controller with built-in monitor. Because a color liquid-crystal display is used for the monitor, various forms of data can be displayed at once. Also, the operating panel features an easy-to-use layout with back-lit large buttons. This friendly design means that frequently having to refer the instruction manual is not necessary.

To perform stable measurements, it is necessary for measurements to be performed with the optimal receiving light quantity.
With the CD4A-LN, because receiving light waveforms can be displayed on the built-in LCD, light axis adjustments can be performed while viewing the waveforms to achieve the optimal receiving light quantity.
(only CD4A-LN for specular reflection types)



*The received light waveform display is a function only for CD4A-LN for specular reflection types.

Up to two sensor heads can be controlled by one amplifier

Thickness and width can be measured by calculating the measurement results from two sensor heads.
The two sensor units can also perform measurements separately.
Different models of sensor heads can be connected to achieve the desired combination.

Calculations to measure thickness (specular reflection type)

Separate measurements (diffuse-reflective type)

Functions (amplifier unit)

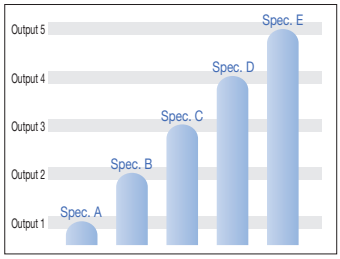
Settings for five control outputs can be performed individually

CD4 series models are equipped with five control outputs for which upper and lower limit settings are possible. Also, this enables outputs to be set as desired within the measurement range.

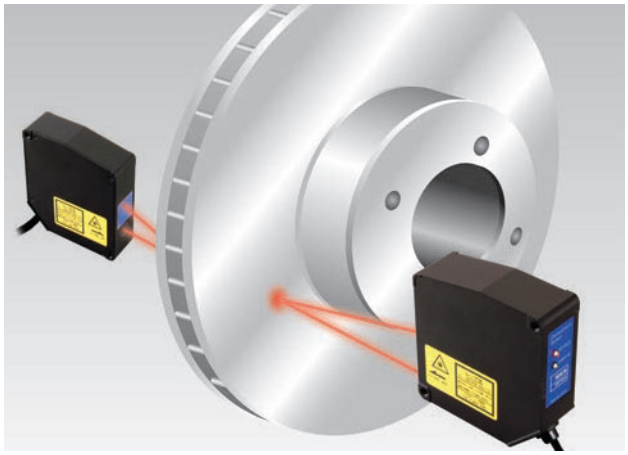
This is a convenient function for sorting workpieces based on size.

For example,

Output 1 = 0.9 to 1.1 mm (Spec. A)
Output 2 = 1.9 to 2.1 mm (Spec. B)
Output 3 = 2.9 to 3.1 mm (Spec. C)
Output 4 = 3.9 to 4.1 mm (Spec. D)
Output 5 = 4.9 to 5.1 mm (Spec. E)



By performing settings such as these, output 1 will turn on for workpieces of Spec. A and output 2 will turn on for workpieces of Spec. B, while no output will turn on in the case of workpieces that do not fit the set Spec. (such as defective items). Settings such as these are not possible using the HH/HI/LO/LL setting method.



Brake disc thickness measurement

A wide range of calculation functions are available for various applications

The optimal calculation process for the target application can be selected from the 10 calculation processes shown below.

Calculation formula settings

A	Sensor head A measured value
B	Sensor head B measured value
A + B	Addition formula
A - B	Subtraction formula (used for height difference measurements)
-A - B	Positive/negative inversion of addition formula
K - A - B	Used for thickness measurements (K = distance between sensor heads)
K + A + B	Offsetting of addition formula (K = offset amount)
K + A - B	Offsetting of subtraction formula (K = offset amount)
K + A	Offsetting the sensor head A measured value (K = offset amount)
K + B	Offsetting the sensor head B measured value (K = offset amount)

Analog output can be used with current output and voltage output

Equipped with a 4 to 20 mA current output and ±5 V voltage output. Either can be used depending on input device specifications.

Featuring a filter function

Equipped with a low pass/high pass filter in addition to settings for average number of cycles. A low pass filter will help to reduce sudden changes in the measurement while the high pass filter will eliminate slow gradual changes.

Easy disconnection type terminal block

Wiring can be performed more efficiently because the terminal block is an easy disconnection type. Workability has been improved to facilitate wiring in narrow and difficult to reach locations which eliminates difficulty when replacing amplifiers or rewiring.

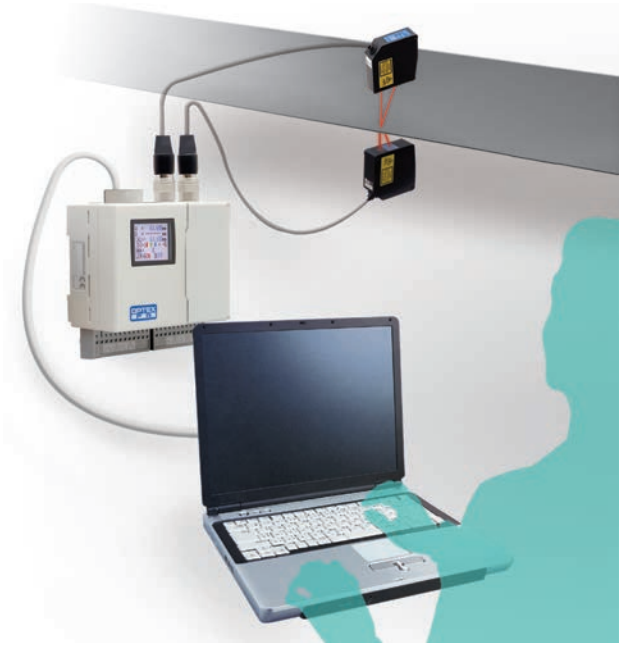
8 channel bank switching is possible

Up to 8 settings can be saved and various external settings can be recalled instantaneously using the bank switching input. Of course, recalling of settings can also be performed using amplifier buttons. It is not necessary to perform settings again when making tooling changes.

Serial interface

Remote control by connecting to a computer

By connecting a commercially available RS-232C cable to the amplifier unit, various types of data management, as well as remote operation, can be performed using a PC. Operations that can be performed using a PC are as follows.



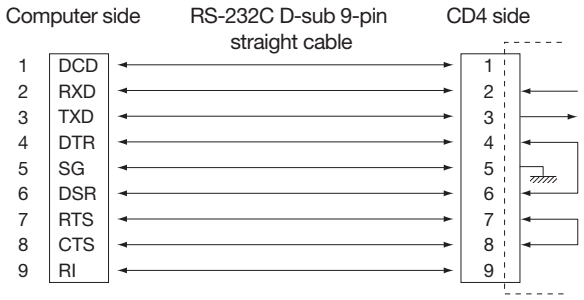
Operation settings

- Continuous / synchronous readout of measurement value/ data buffering (Max. 2000 data)
- Readout/writing settings of the sensors
- Readout of control output status
- Input (bank, hold, zero reset) operations

Communication method	RS-232C
Synchronization method	Start-stop synchronization
Baud rate	9600/19200/38400*/115200 bps
Transmission code	ASCII
Data length	7/8* bit
Stop bit length	1 bit
Parity check	None*/even/odd
Data protocol	STX/ETX

*Default setting

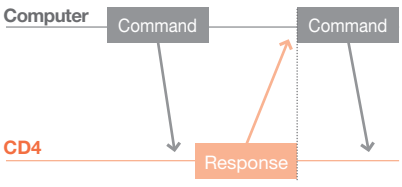
Computer connection



4 and 6, as well as 7 and 8 are connected within CD4.

[Communication procedure]

When the computer sends a command to the CD4, the CD4 sends a response back to the computer. Basically, one response is sent to one command. When the computer sends a command, be sure to send it after receiving the response to the previous command. However, stop command can be sent while measurement values are being read continuously.
Also, in regards to the data buffering function, a response of ">" will be received when buffer recording has completed.



Specifications

■ Sensor head

Model	CD4-L25	CD4-30	CD4-85	CD4-350
Optical method	Specular reflection	Diffuse-reflective		
Measurement range	25 ±1 mm	30 ±5 mm	85 ±20 mm	350 ±100 mm
Light source	Red semiconductor laser, wavelength: 650 nm			
	Max. output 390 µW	Maximum output 1 mW (model 1) 5 mW (model 2)		
IEC/JIS Class	Class 1	Class 2		
FDA Class	Class II	Class II		
Spot size*1	Approx. 25 × 35 µm	Approx. 30 × 100 µm	Approx. 70 × 290 µm	Approx. 300 × 700 µm
Linearity*2	±0.1% F.S.			
Repeat accuracy*3	0.1 µm	1 µm	3 µm	40 µm
Supply voltage	Supplied from amplifier unit			
Temperature drift	±0.01% F.S./°C			
Indicators	Laser emission indicator: Green (lights up during laser emission) Measurement range indicator: Red (near side) : Orange (measurement center) : Green (far side) : Red/green alternating (alternated lighting occurs when outside the measurement range or when measurement is not possible)			
Degree of protection	IP67 (excluding joint of connector)			
Ambient temperature	-10 to +45°C (no freezing or condensation) / Storage: -20 to +60°C			
Ambient humidity	35 to 85% RH / When stored: 35 to 85% RH			
Ambient illuminance	Light receiving surface illuminance of 3,000 lx or less (incandescent lamp)			
Vibration resistance	10 to 55 Hz; double amplitude 1.5 mm; 2 hours in each of the X, Y, and Z directions			
Shock resistance	Approx. 50 G (500 m/s^2), 3 times in each of the X, Y, and Z directions			
Applicable regulations	EMC directive (2004/108/EC) / FDA regulations (21 CFR 1040.10)			
Applicable standards	EN 60947-5-7			
Warm-up time	Approx. 30 minutes			
Material	Sensor head housing: Aluminum die-cast, emitting/receiving part cover: Glass			
Cable extension	Up to 10 m using an optional extension cable			
Weight	250 g (including 500 mm cable)			

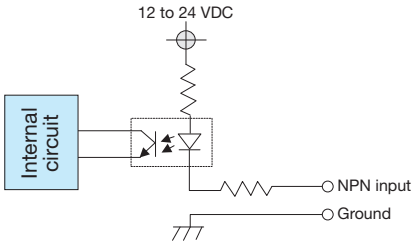
*1 Defined with center strength 1/e^2 (13.5%) at the center of measurement. There may be leak light other than the specified spot size. The sensor may be affected when there is a highly reflective object close to the detection area.
*2 Average number of times: 256 (for specialized amplifier unit). These values are for white ceramic in the case the diffuse-reflective type, and glass in the case of the specular reflection type. This may change depending on the target.
*3 Average number of times: 256 (for specialized amplifier unit). These are typical values when at the measurement center. This may change depending on the target.

Amplifier

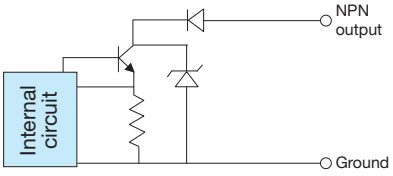
Type		Amplifier unit for diffuse-reflective heads	Amplifier unit for specular reflection heads
Model	NPN	**CD4A-N**	**CD4A-LN**
	PNP	**CD4A-P**	**CD4A-LP**
No. of connectable sensor heads		Max. 2 units	
Sampling period		100 µs	
Supply voltage		12 to 24 VDC ±10%	
Current consumption		270 mA/24 VDC (includes analog current output when two sensor heads are connected)	
Temperature drift		±0.01% F.S./°C	
Analog output	ANG (V) [A], [B]	Voltage output ±5 V / F.S. (output impedance: 100 Ω, resolution: 1 mV)	
	ANG (mA) [A], [B]	Current output 4 to 20 mA / F.S. (load impedance: 300 Ω or less, resolution: 1.5 µA)	
Alarm output	ALM A, ALM B	NPN open collector Max. 100 mA / 24 VDC (residual voltage of Max. 1.8 V) ON when head measurement not possible	
Control output	JDGE1 to 5	NPN open collector Max. 100 mA / 24 VDC (residual voltage of Max. 1.8 V) HI/LO settings possible, hysteresis settings possible	
Bank input	BANK0 to 2	ON when connected to ground 8 bank switching	
Hold input	HOLD A, HOLD B, HOLD RST	ON when connected to ground Laser OFF or measured value hold (set using the menu)	
Zero reset input	ZERO A, ZERO B	ON when connected to ground Zero resetting possible for sensor head A measured value / sensor head B measured value / calculated values	
Sub-functions		Average number of times settings, filter settings (frequency settings), calculation function settings, hold settings, measured value settings during alarm, control output settings (hysteresis settings), analog output settings, sensor head sensitivity settings, timer settings, memory settings, bank settings, auto zero reset	
Display		Liquid-crystal display	
Degree of protection		IP20	
Ambient temperature		-10 to +45°C / When stored: -20 to +60°C (no freezing)	
Ambient humidity		35 to 85% RH / When stored: 35 to 85% RH (no condensation)	
Vibration resistance		10 to 55 Hz; double amplitude 1.5 mm; 2 hours in each of the X, Y, and Z directions	
Shock resistance		Approx. 20 G (196 m/s^2), 3 times in each of the X, Y, and Z directions	
Applicable regulations		EMC directive (2004/108/EC)	
Applicable standards		EN 60947-5-7	
Material		Housing: Polycarbonate, Terminal block: Nylon 66	
Weight		240 g (including terminal block)	

I/O circuit diagram

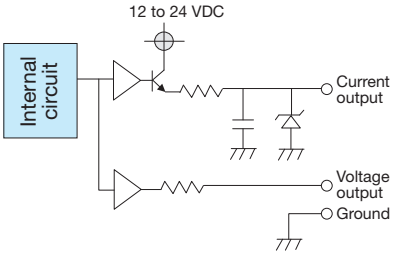
NPN model bank input Hold input Zero reset input



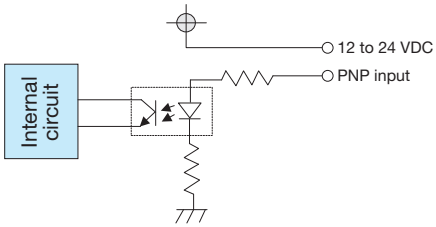
NPN model control output Alarm output



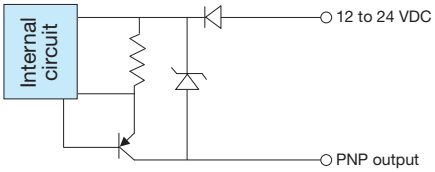
Analog output (A/B)



PNP model bank input Hold input Zero reset input

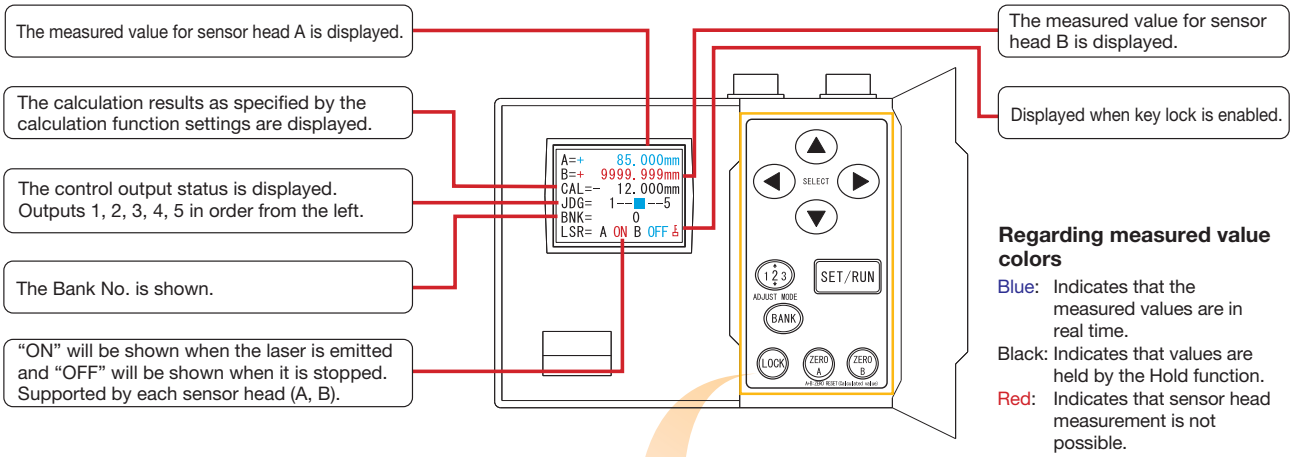


PNP model control output Alarm output



Names and functions of parts

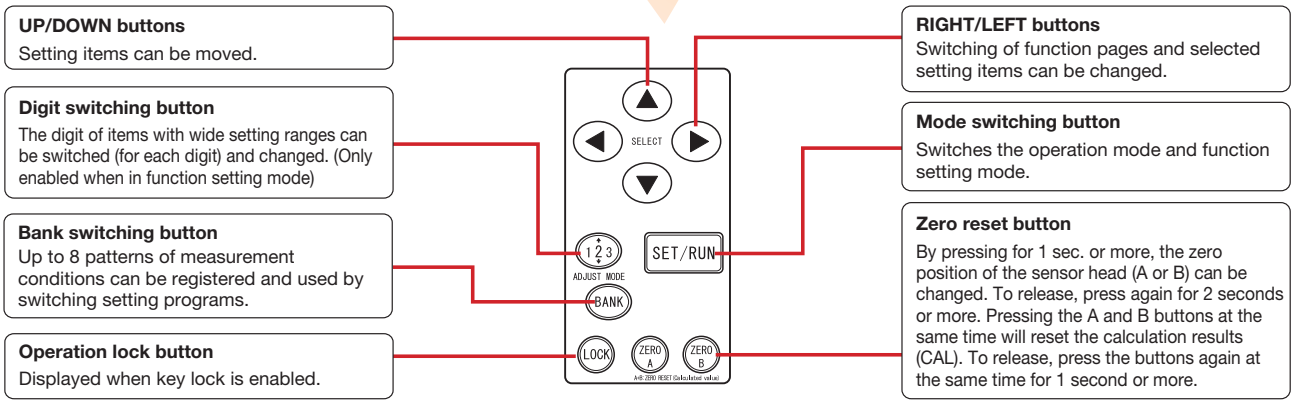
Monitor display



Regarding measured value colors

Blue: Indicates that the measured values are in real time.
Black: Indicates that values are held by the Hold function.
Red: Indicates that sensor head measurement is not possible.

Enlarged diagram of button layout

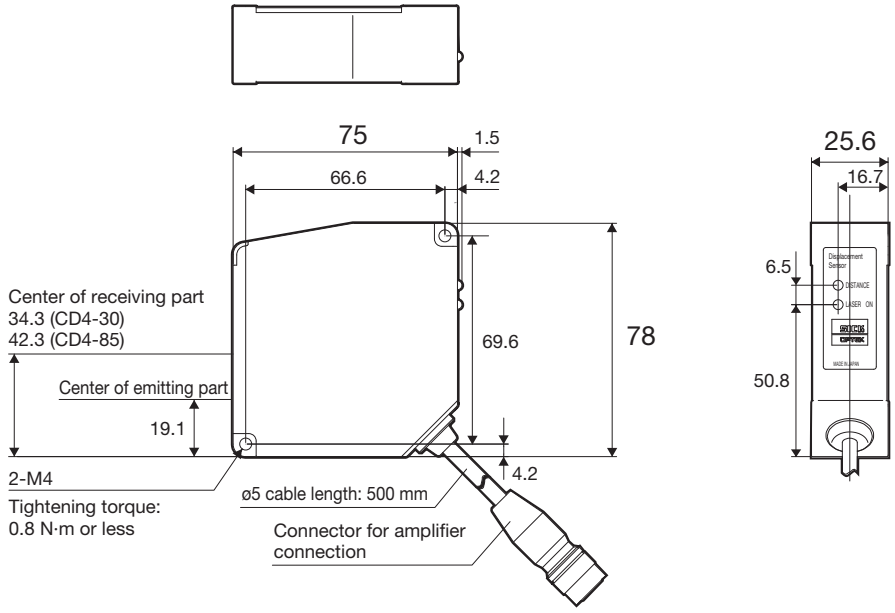


Dimensions

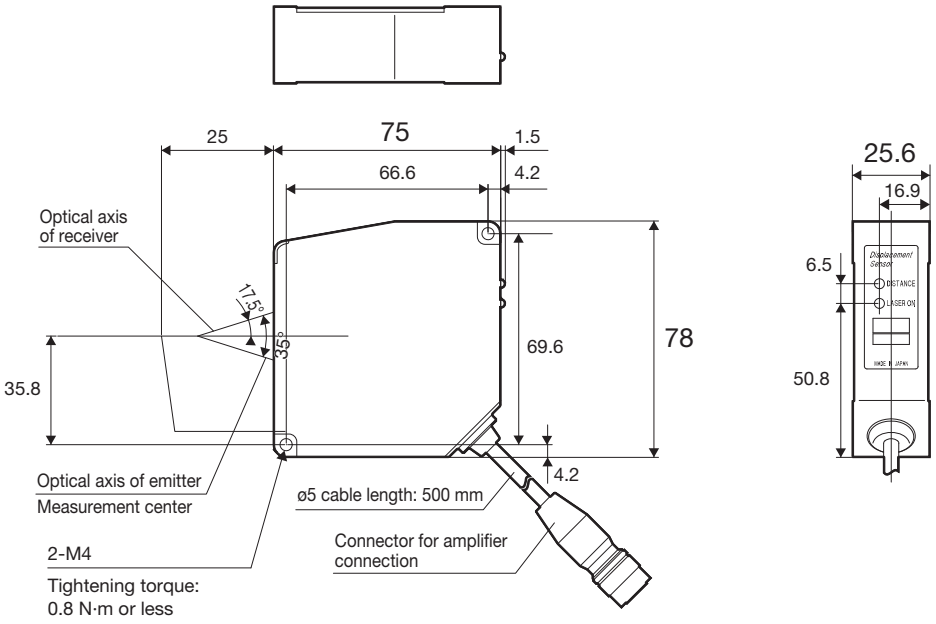
Sensor head

(Unit: mm)

■ **CD4-30, CD4-85**



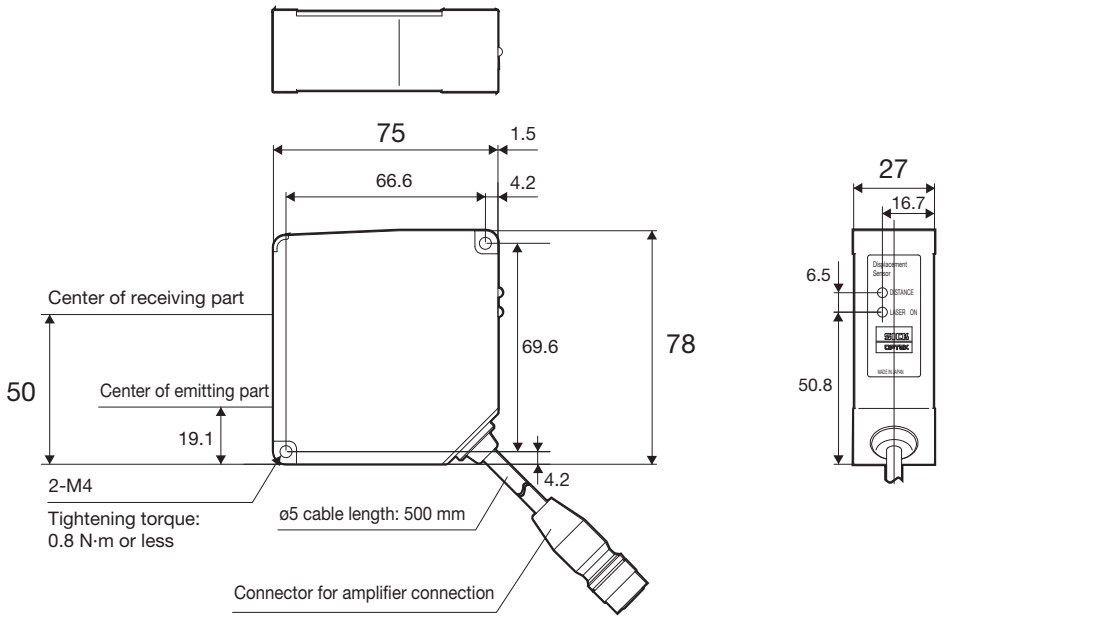
■ **CD4-L25**



Dimensions

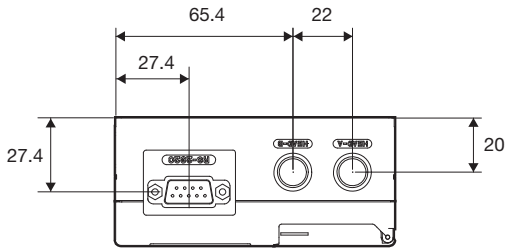
■ **CD4-350**

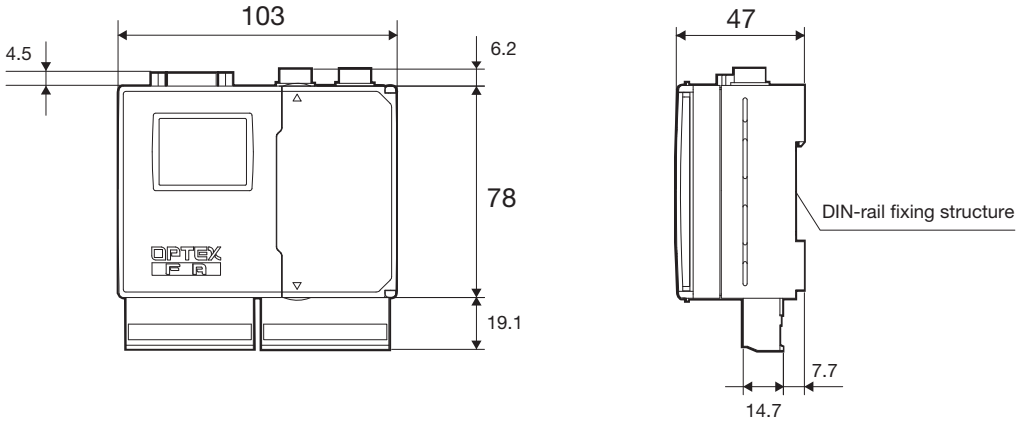
(Unit: mm)



Amplifier unit

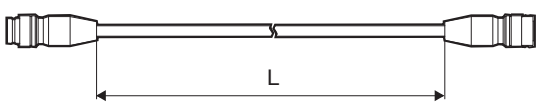
■ **CD4A-□, CD4A-L□**





Options

■ **Head-to-amplifier extension cable**



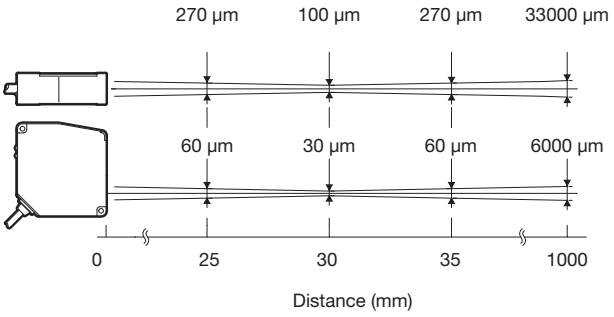
Length (L)	Cable model
2 m	CD4CN-S-ROBOT
5 m	CD4CN-5S-ROBOT

Typical characteristic data

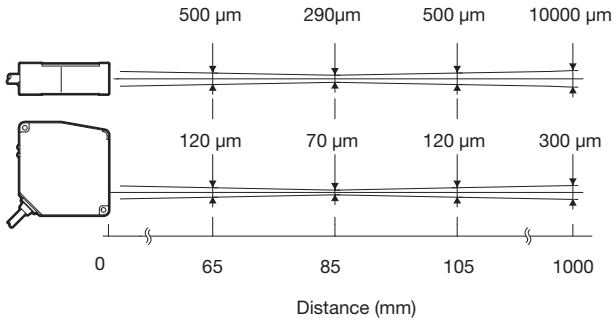
Spot size

(Unit: mm)

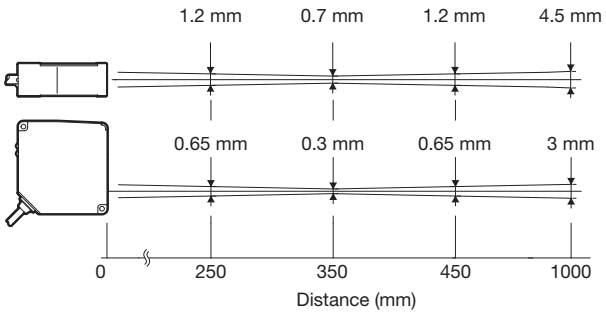
CD4-30



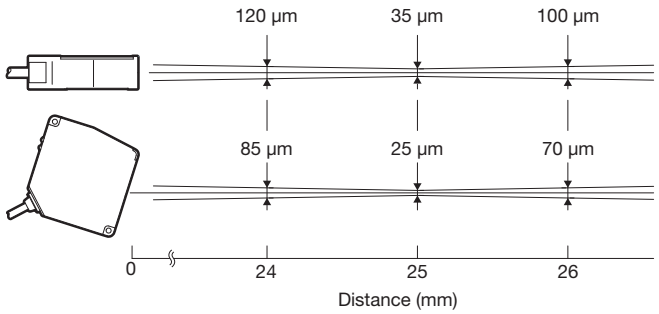
CD4-85



CD4-350

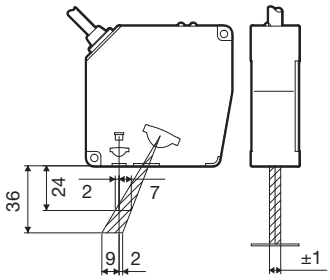


CD4-L25

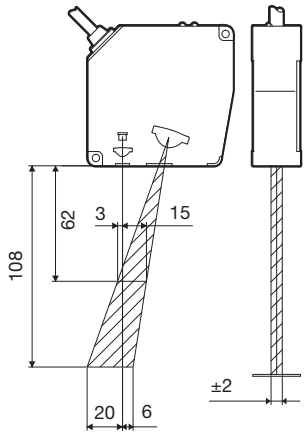


Interference area

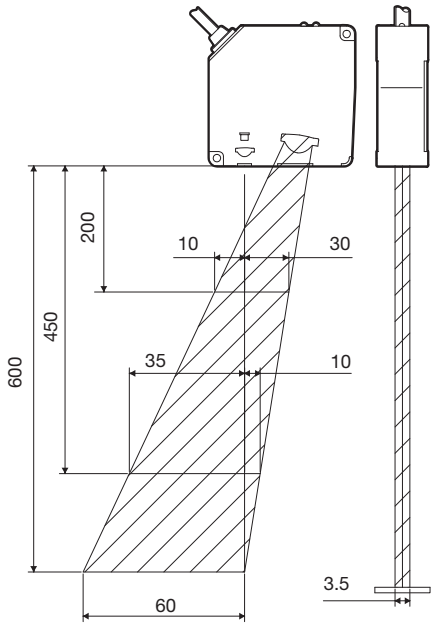
CD4-30



CD4-85



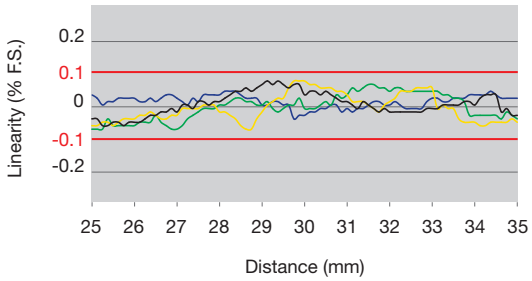
CD4-350



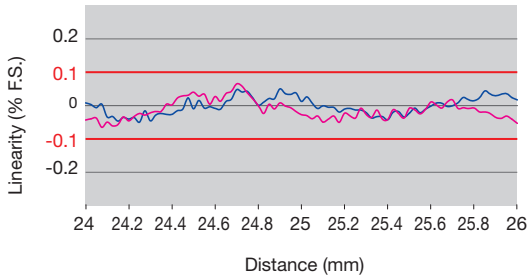
High-accuracy laser displacement sensor CD4 series

Material linearity

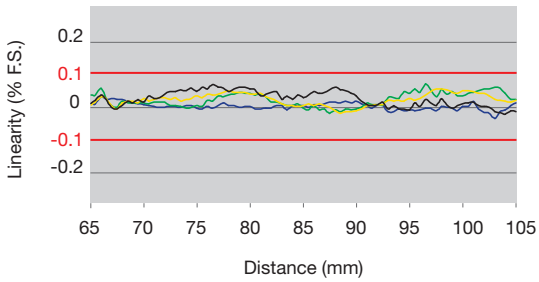
CD4-30



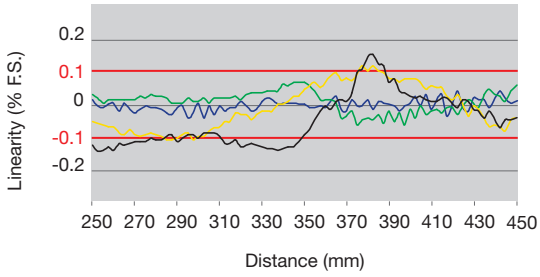
CD4-L25



CD4-85

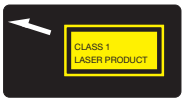


CD4-350



Precautions for laser use

This product emits a Class 1/Class 2 (II) visible laser beam that is compliant with JIS C 6802/IEC/FDA laser safety standards.
Class 1/Class 2 (II) warnings or explanation labels are affixed to the side of the sensor.



Type of laser used in this product

Type	Red semiconductor laser
Wavelength	650 nm
Output	390 μW/1 mW/5 mW

If you install this product in a piece of machinery that will then be exported to the United States, it is necessary to follow laser standards as stipulated by the American Food and Drug Administration (FDA).
This product has already been submitted to the CDRH (Center for Devices and Radiological Health). (Please inquire for details.)

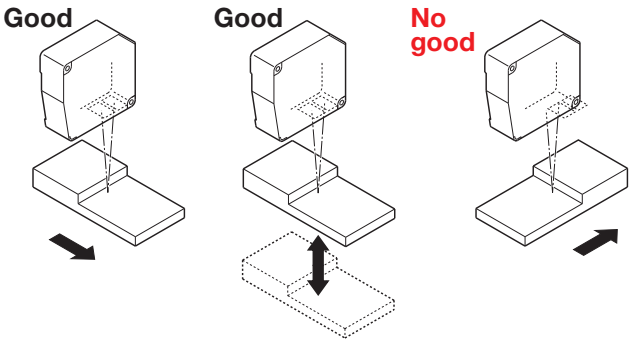
Installation of sensor

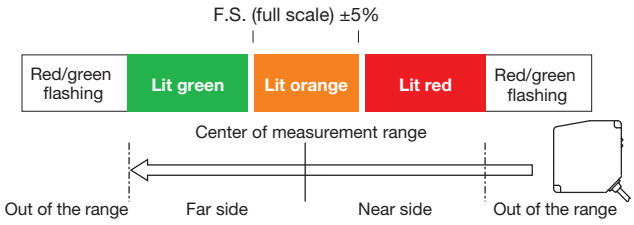
Warning

- Install the sensor head at a height that is not at worker eye level.
- Connect with the specialized amplifier unit after mounting the sensor heads. (Do not perform while the power supply is on.)

Workpieces with large fluctuations in height difference or color

Mount the sensor head so that the detection surface (optical plane) is always parallel to the detection target. Adjust the target so that the spot aligns with the detection position, and ensure that the distance indicator lights up orange at the reference window (center of change).





Rotating workpieces