

# Displacement Sensors

Displacement sensors must be easy to operate, compact in size and have high accuracy. Optex-FA offers the CD1 and the CD3 series of laser displacement sensors for OEM use that may demand compact dimensions.

CD4 series Specular Type provides 0.1  $\mu\text{m}$  resolution as well as  $\pm 0.1\%$  accuracy.

CD1 series	165
CD3 series	171
CD4 series	177
CD4L-25 series	185

Laser Displacement Sensor : PSD system

# CD1 series

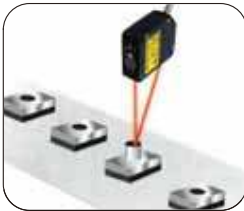


(Sensing distance : 30±4mm)  
· CD1-30N / P / CN / CP

(Sensing distance : 50±10mm)  
· CD1-50N / P / CN / CP

(Sensing distance : 100±35mm)  
· CD1-100N / P / CN / CP

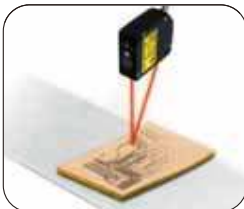
## Applications



Checking mechanical parts.



Level check of food package



Checking height of components.



Cap of bottled beverage

- **As small as the best dimensions for Built-in use for OEM machine.**
- **Versatility from 30+/-4mm to 250+/-150mm distance.**
- **Both transistor and analogue output applicable to digital panel meter if you need display and signal control.**

Five different types of products give variety of distance

OEM Use CD1 series	measuring distance
CD1-30	30 +/- 4mm
CD1-50	50 +/- 10mm
CD1-100	100 +/- 35mm
CD1-130	130 +/- 50mm
CD1-250	250 +/- 150mm

## Control panel

**Output/Teaching indicator**  
Switching output status & teaching status is indicated

**Teaching indicator**  
Sensing Range/offset/Initializing

**Mode selector**  
3 positions : SET/RUN/RUN OFF DELAY

**Response time selector**  
3 positions : 100ms/10ms/1ms  
Slower response gives higher resolution

**Distance indicator**  
The distance can be indicated by 3 color of LED between sensor and object

**Stability indicator**  
Green=stable  
Off=possible  
Red=impossible  
Level of received light intensity is indicated.

**Sensitivity selector**  
3 positions : SET/FIX/AUTO



(Sensing distance : 130±50mm)  
· CD1-130N / P / CN / CP

(Sensing distance : 250±150mm)  
· CD1-250N / P / CN / CP

## Features

### Teach-in system

The CD1 is simple to setup and easy to operate. It is not necessary to make manual adjustments to the sensor, just push the button.



### All-in-one solution

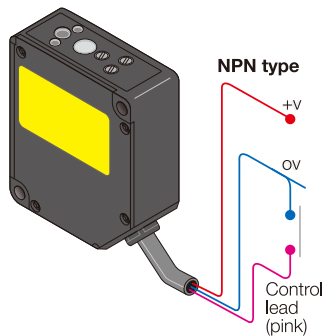
The amplifier and sensor are built-in, the CD1 is a complete self-contained sensor.



### Remote teaching input

The teaching procedure can be carried out remotely by using the remote teach input. There is no need to perform this step at the sensor.

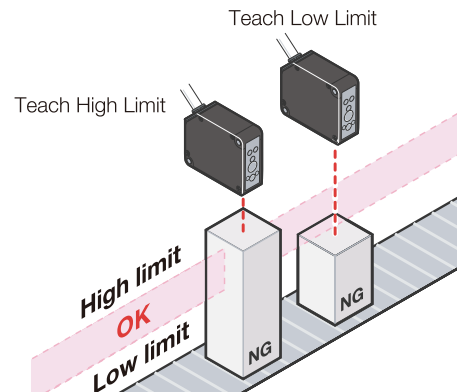
This feature is good for OEM machine builders.



### Easy set-up and Measuring

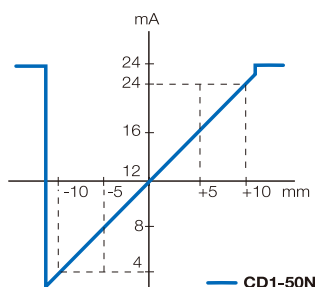
The High and Low limit of the measuring range can be set.

- 1: Go to the SET mode.
- 2: Teach the High and Low limit using the workpiece.
- 3: Return to RUN mode.



### Dual Output - Digital On/Off and Analog

There is a choice of NPN or PNP transistor for the control output, choose the model number based on the desired type. The 4 to 20 mA analog output is standard on both types.



CD1

CD3

CD4

CD4L-25



### IP67 rating

This stand-alone unit is protected with IP67 design.

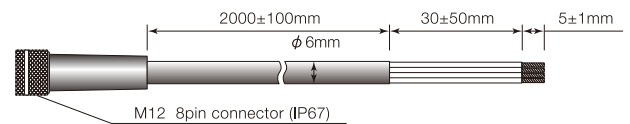


### Class 2 laser product

Classified to Class 2 laser, 650nm, Max 1mW.



### M12 exclusive connector CD3CN-S. Applicable for CD1 (2M standard. 5M type is available as option)



brown — DC12-24V	gray — Blank input	white	blue
black — Control output	rose — Remote teach	orange	black
blue — OV	orange — Ground	rose	gray
white — Analogue			

- CD1
- CD3
- CD4
- CD4L-25

### Linearity

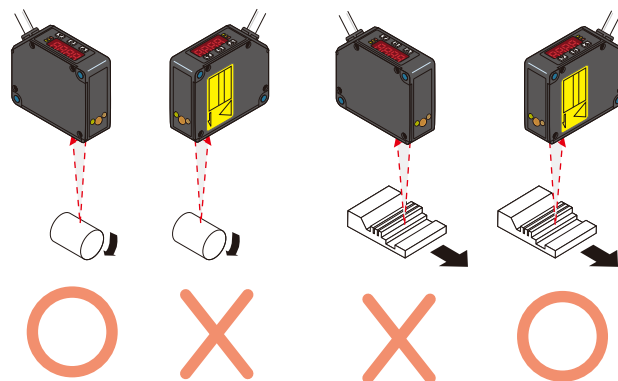
Analogue output in Voltage will increase in proportion to the distance to the target. An ideal relation between analogue value and distance shall be theoretically indicated in a straight line (as illustrated), but the actual line deviates slightly. "Linearity" indicates the tolerance between the theoretical and actual value. Linearity is indicated by % against Full Scale (FS) value. For examples of CD3-30, Linearity is 1% against FS (8mm), therefore; +/- 8mm x 0,01 = +/- E1120,08mm will be the linearity.

### Resolution

Analogue output is always influenced by internal noise and gives slight fluctuation at analogue output voltage. The amount of fluctuation is called as Resolution. Resolution is defined against FS (Full Scale), and depends on Response Time.

### Hint of installation for best accuracy

To obtain accuracy the sensor head must be oriented as shown below.

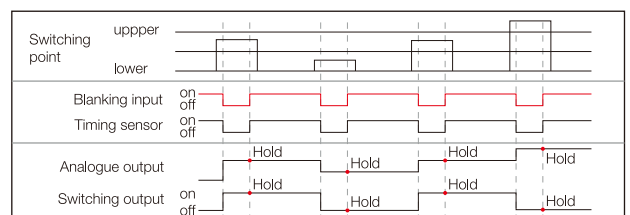


### Temperature Drift

The analogue output is influenced as surrounding temperature fluctuates. Temperature Drift refers to the change of analogue output. This is defined as % against Full Scale (FS) for instance(CD3-30,FS 8mm) Temperature Drift 0,08% / Celsius means : 8mm x 0,0008 = 0,0064mm / Celsius

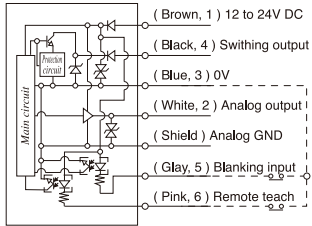
### Blanking input

Measuring / switching timing can be easily provided via this input. Analogue and seitching output can be held according to the pulse duration a second sensor (NPN / PNP).

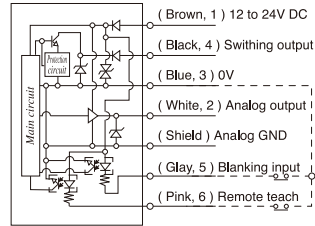


## Circuit diagram

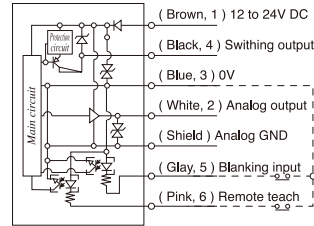
### Cable type



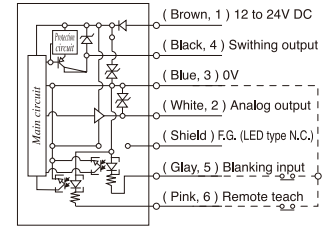
### Connector type



### Cable type

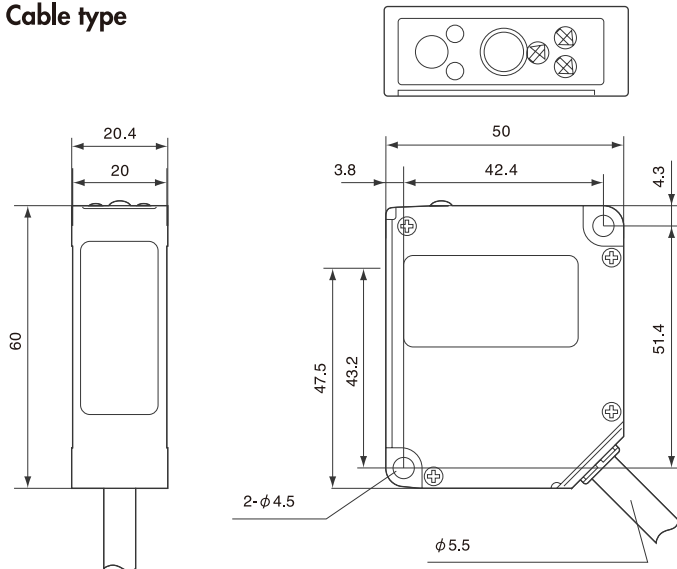


### Connector type

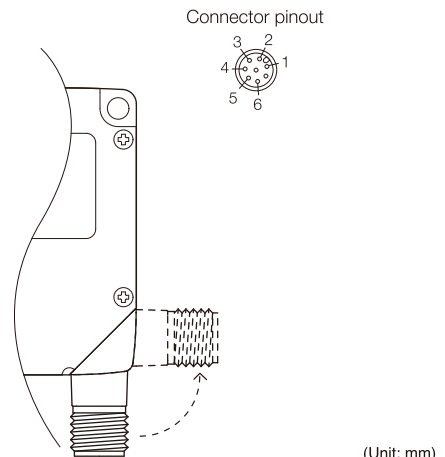


## Dimensions

### Cable type



### M12 Connector type



CD1

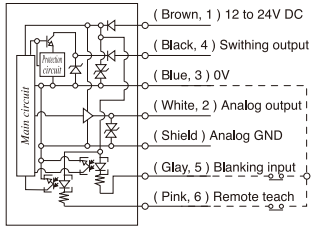
CD3

CD4

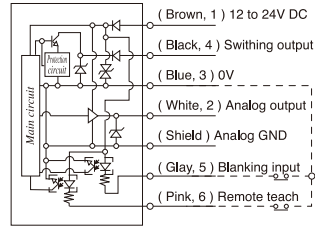
CD4L-25

## Circuit diagram

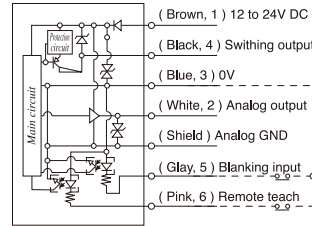
### Cable type



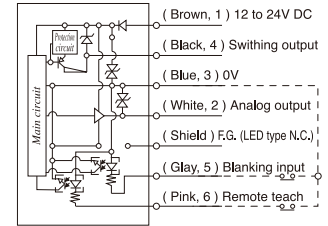
### Connector type



### Cable type

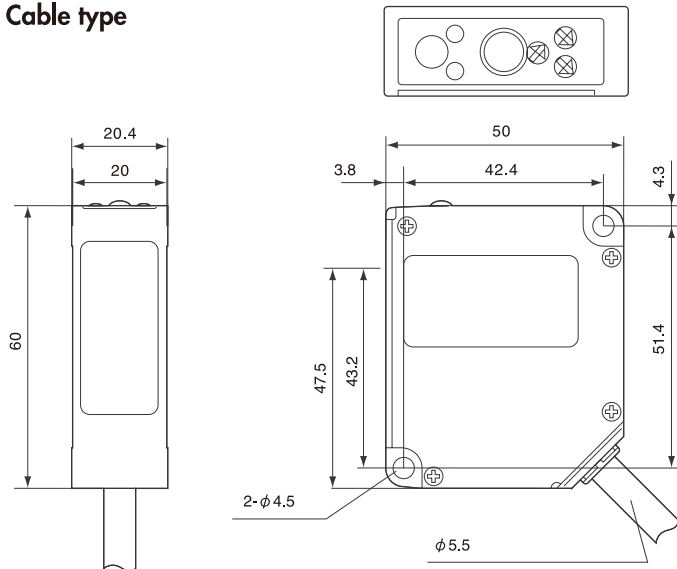


### Connector type

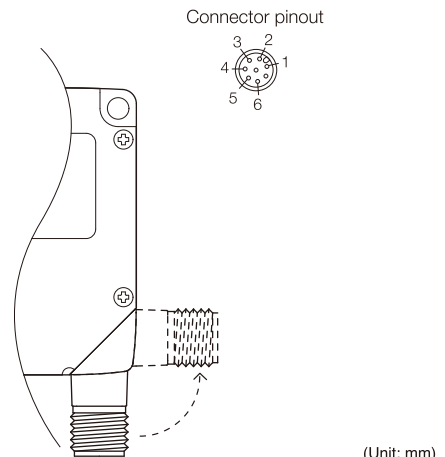


## Dimensions

### Cable type



### M12 Connector type



CD1

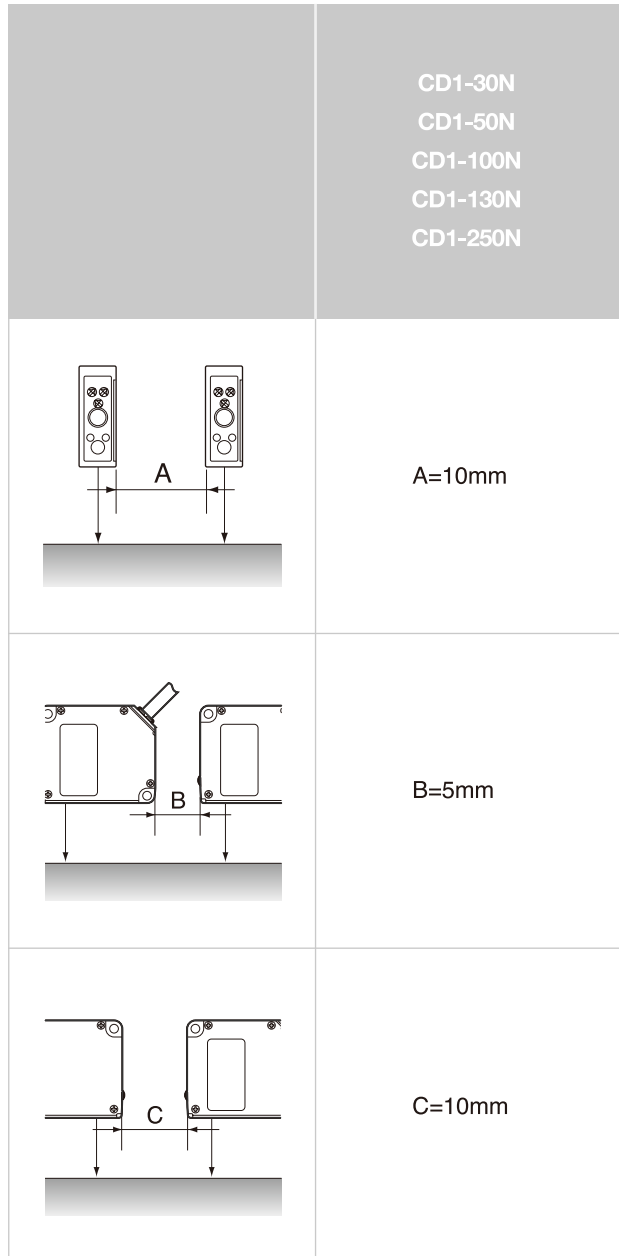
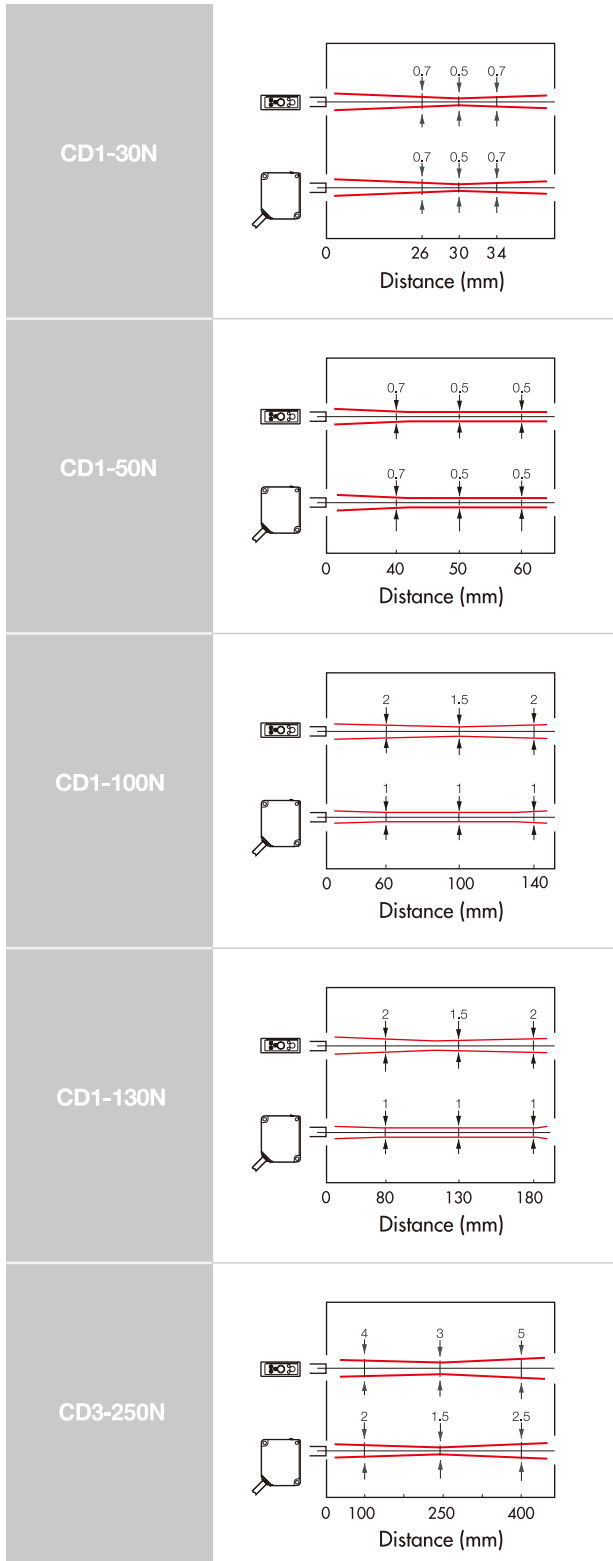
CD3

CD4

CD4L-25

**Spot size (typical)**

**Cross-talk area (typical)**



CD1

CD3

CD4

CD4L-25

# Laser Displacement Sensor : CMOS system CD3 series



M12 QD type

Cable type

(Sensing distance : 30±4mm)  
·CD3-30N / P / CN / CP

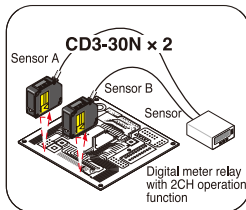
(Sensing distance : 80±15mm)  
·CD3-80N / P / CN / CP

(Sensing distance : 250±150mm)  
·CD3-250N / P / CN / CP

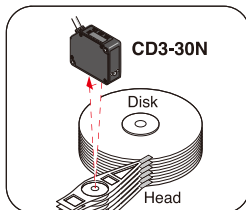
(Sensing distance : 50±10mm)  
·CD3-50N / P / CN / CP

(Sensing distance : 100±40mm)  
·CD3-100N / P / CN / CP

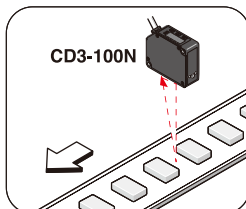
## Applications



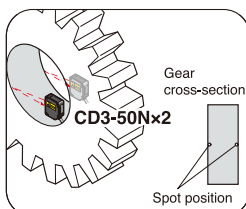
**Detection of Warp in Circuit Board**



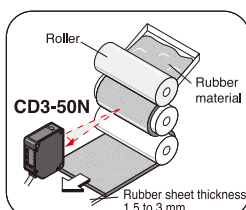
**Detection of Warp in HDD Assembly and Actuator**



**Measurement of product thickness**



**Interior diameter inspection of gear**



**Thickness Measurement of Rubber Sheets**

- **CMOS Image Sensor for high accuracy displacement measurement.**
- **Span adjustment and Offset functions for flexible control of analogue output.**
- **Preset alarm for Peak/Bottom limit of analogue value.**
- **Accurate detection of dark colored targets.**

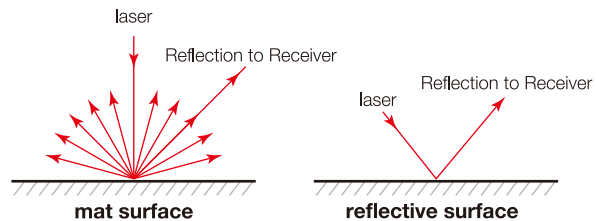
Five different types of products give variety of distance

With digital display CD3 series	measuring distance
CD3-30	30 +/- 4mm
CD3-50	50 +/- 10mm
CD3-80	80 +/- 15mm
CD3-100	100 +/- 40mm
CD3-250	250 +/- 150mm

## Measurement Principle - CMOS Image sensor

CMOS Image Sensor CD3 Series Displacement Sensors use a Triangulation Measurement System. The CMOS Image element provides accurate measurement that has been impossible with conventional products.

While PSD type displacement sensors are sometimes influenced by the surface condition of the target.

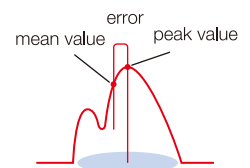


Displacement sensors operate by detecting the reflection of the projected light from the surface, this reflection can sometimes be effected if the surface is rough or reflective.

The CD3 series "CMOS Image" type displacement sensor gives stable and accurate measurement by detecting the "real peak value" for precise distance calculation.

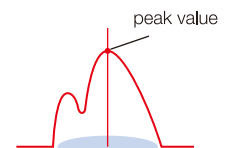
### Spot of PSD

A conventional displacement sensors that uses a PSD sensing element detects the mean value of the reflected light. This can sometimes be at a different location than the peak value of incoming reflected light if the surface is too reflective.



### Spot of CMOS image sensor (CD3 series)

The CD3 Series displacement sensor uses a CMOS Image sensing system that detects the peak value without being influenced by the dispersion of light from the surface. This method minimizes errors and provides accurate measurement.



## Simple Pushbutton Teach, and Easy-to-view digital panel.

**stability indicator**  
 Green — Stable operation  
 Dark — Unstable operation  
 Red — No operation due to low light or too much light

**distance indicator**  
 Actual distance between sensor and object as below.

green / red blinking	Out of range
red	Near limit
orange	+/- 5% of reference distance
green	Far limit
red / green blinking	Out of range

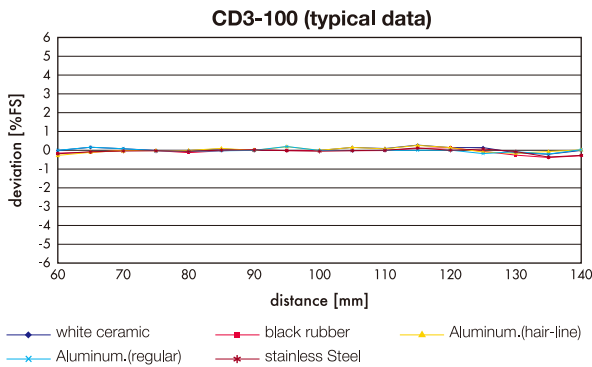
Remarks : The border between the Near / Far Limit and Out of range depends upon the sensor model.

**output indicator**

**(operation panel)**  
 Run indicator  
 Function indicator  
 Adjustment indicator  
 Down  
 Up  
 Mode selection

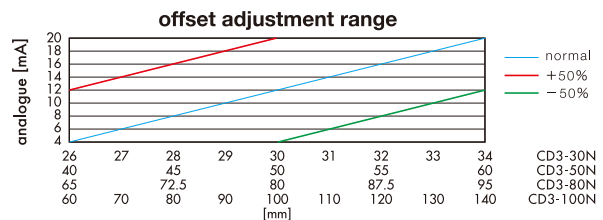
## Features

Stable measurement even of high reflection materials like glass.  
 Even black object doesn't matter.



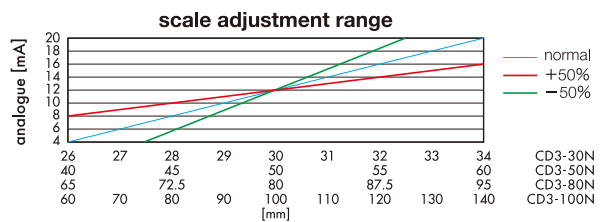
## Offset

"Offset function" shifts the output value in either positive or negative direction. When the sensor is desired to use with relatively preset value of "0". This is possible as far as it is within the measuring range.



## Span adjustment

Span adjustment changes the proportion of output value (displacement) to the distance. This is available within +/-50% against rated value.



## Voltage output converter CV-15

If you need to convert 4-20mA analogue output into 1-5V voltage output connect the resistor CV-15.

### Digital Meter, etc

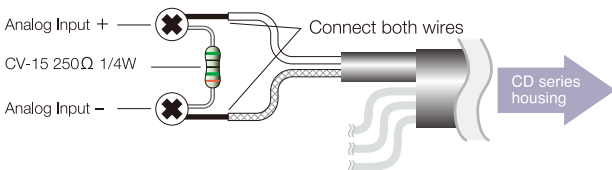


photo : CV-15



## Analogue restraint function

In case analogue value overflows the limit, you can choose ;  
 CLP mode = Analogue value remains 24mA for any overflowing value.  
 HOLD mode = Analogue value is held at the last value before overflow.

CD1

CD3

CD4

CD4L-25

## AUX input

AUX input is customized by interconnecting between Rose and Gray wires to have BANK setting, Laser-off, Zero-reset, etc.

## IP67 rating

This stand-alone unit is protected with IP67 design.



## Class 2 laser product

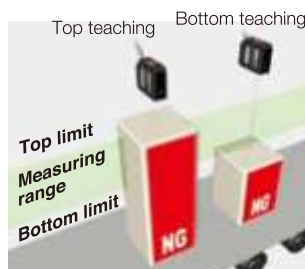
Classified to Class 2 laser, 650nm, Max 1mW.



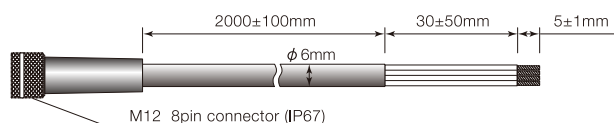
## Control output pre-setting enables to restrict top and bottom limit to work between.

By using built-in digital panel meter, you can set measuring range of open collector output without object.

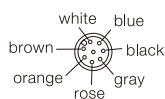
Off course, teaching set-up is available by reading actual workpiece.



## M12 exclusive connector CD3CN-S. Applicable for CD3 (2M standard. 5M type is available as option)



brown — DC12-24V	gray — Blank input
black — Control output	rose — Remote teach
blue — OV	orange — Ground
white — Analogue	

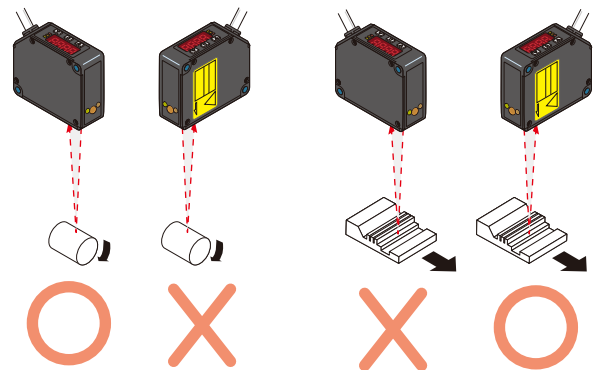


## BANK memory

4 banks are available for memory.

## Hint of installation for best accuracy

To obtain accuracy the sensor head must be oriented as shown below.



## Resolution

Analogue output is always influenced by internal noise and gives slight fluctuation at analogue output voltage. The amount of fluctuation is called as Resolution. Resolution is defined against FS (Full Scale), and depends on Response Time.

## Linearity

Analogue output in Voltage will increase in proportion to the distance to the target. An ideal relation between analogue value and distance shall be theoretically indicated in a straight line (as illustrated), but the actual line deviates slightly. "Linearity" indicates the tolerance between the theoretical and actual value. Linearity is indicated by % against Full Scale (FS) value. For examples of CD3-30, Linearity is 1% against FS (8mm), therefore;  $\pm 8\text{mm} \times 0.01 = \pm 0.08\text{mm}$  will be the linearity.

## Temperature Drift

The analogue output is influenced as surrounding temperature fluctuates. Temperature Drift refers to the change of analogue output. This is defined as % against Full Scale (FS) for instance (CD3-30, FS 8mm) Temperature Drift 0.08% / Celsius means:  $8\text{mm} \times 0.0008 = 0.0064\text{mm} / \text{Celsius}$



## Response Time and Averaging

**With Fixed Sensitivity (any value between 1 - 20)**

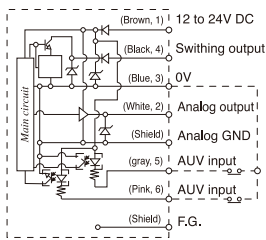
Averaging Value	Analogue output	Control Output
1	1.00 msec	2.2 msec
4	4.05 msec	5.06 msec
16	16.2 msec	17.2 msec
64	64.8 msec	65.8 msec
256	259 msec	260 msec
1024	1037 msec	1038 msec

**With Auto Sensitivity**

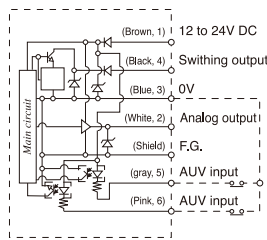
Averaging Value	Analogue output	Control Output
1	21.0 msec	22.5 msec
4	24.1 msec	25.5 msec
16	36.2 msec	37.2 msec
64	84.8 msec	85.8 msec
256	279 msec	280 msec
1024	1057 msec	1058 msec

## Circuit diagram

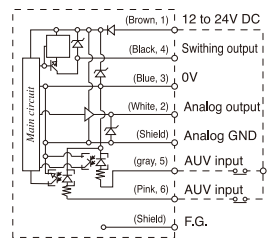
**NPN Cable type**



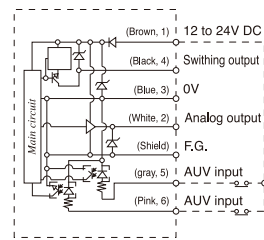
**NPN Connector type**



**PNP Cable type**



**PNP Connector type**



**NPN Cable type**

**NPN Connector type**



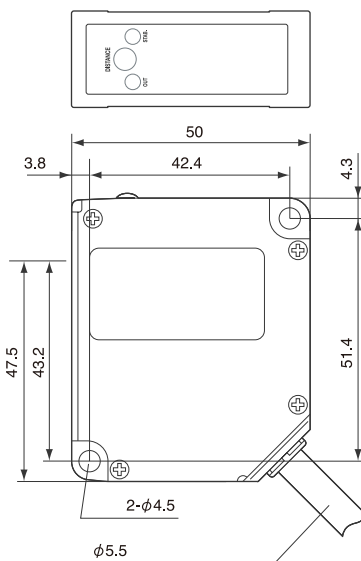
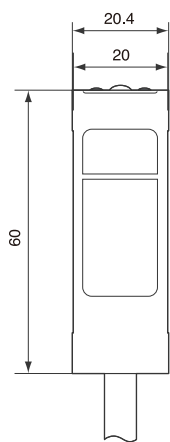
**PNP Cable type**

**PNP Connector type**

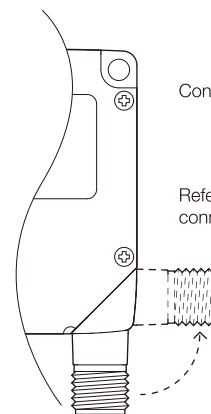
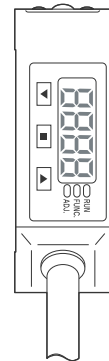


## Dimensions

**Cable type**



**M12 QD type**



(Unit: mm)

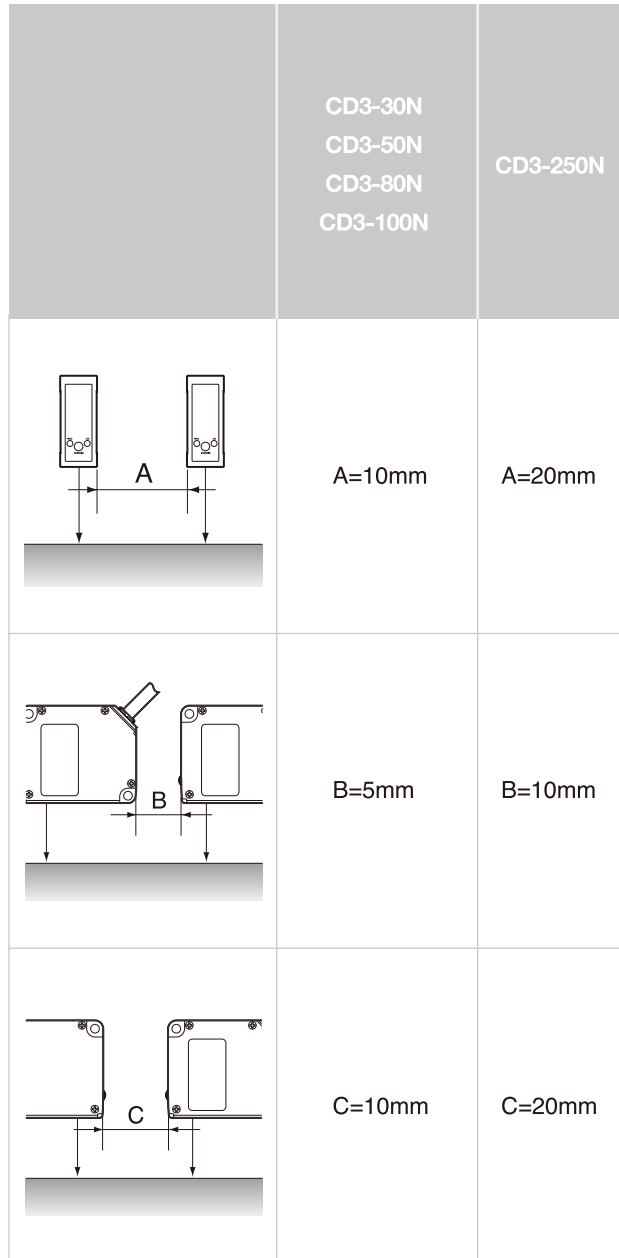
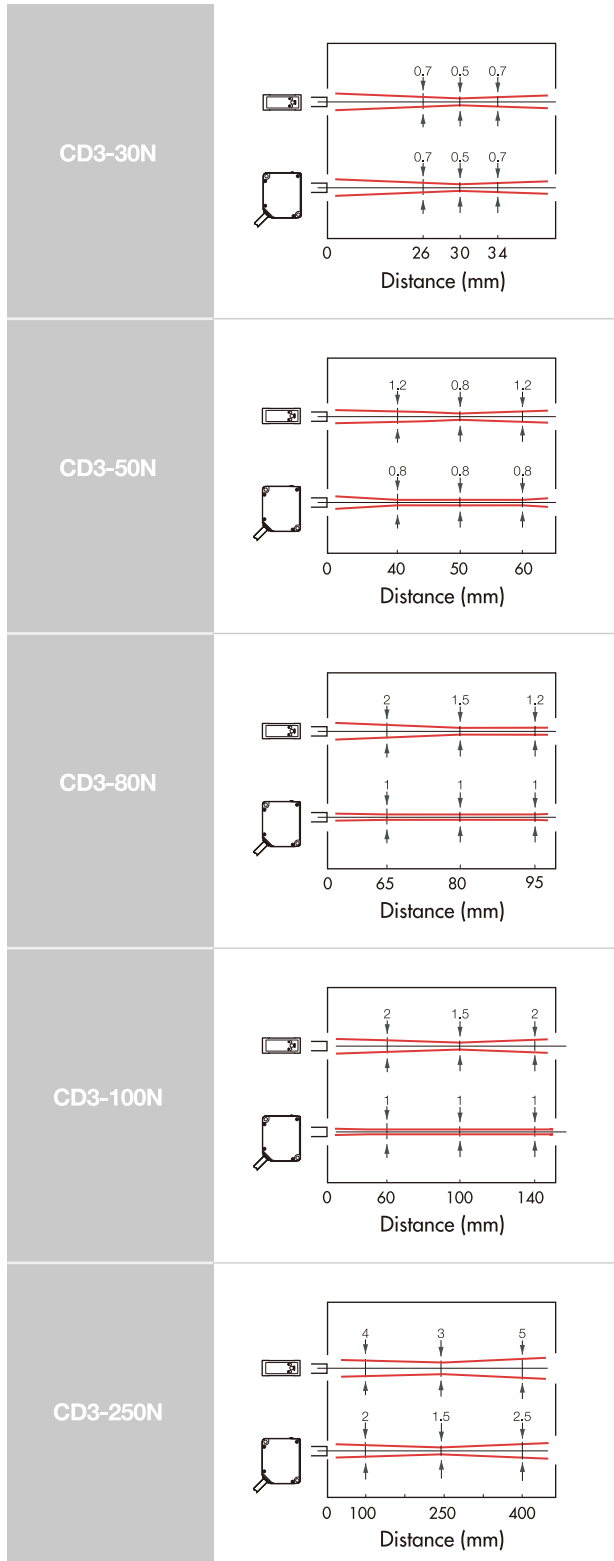


## Specifications

Cable	CD3 Series, CMOS Image Laser Displacement Sensor				
	CD3-30N/P CD3-30CN/CP	CD3-50N/P CD3-50CN/CP	CD3-80N/P CD3-80CN/CP	CD3-100N/P CD3-100CN/CP	CD3-250N/P CD3-250CN/CP
M12 Connector					
Transistor output	N = NPN output, P = PNP output				
Measuring range	30+/-4mm	50 +/- 10mm	80 +/- 15mm	100 +/- 40mm	250 +/- 150mm
FS (full scale)	8mm	20mm	30mm	80mm	300mm
Light source	Class 2 Laser, 650nm, Max 1mW				
Min spot size	φ@0.5 mm	φ@0.8 mm	1 X 1.5mm	1 X 1.5mm	3 X 1.5mm
Supply voltage	12 - 24V DC (-5 to +10%)				
Sensitivity adjustment	Nominal value 1-20, or AUTO				
Power consumption	Max 120mA (DC12V), 80mA (DC24V), including analog output current				
Resolution (typical value)	(Unit : Micron. Under AUTO sensitivity. White ceramic as an object)				
(Averaging 64: default value)	4	10	10	30	150
(Averaging 1)	12	30	40	80	2mm
(Averaging 4)	8	20	30	60	800
(Averaging 16)	6	12	20	40	400
(Averaging 256)	2	8	8	20	100
(Averaging 1024)	below 2	below 8	below 8	below 10	50
Linearity	+/- 1% FS				+/- 1.5%FS (up to 250mm) +/- 2.5%FS (up to 400mm)
Temp drift	+/- 0.08% FS / Celsius				
Response time	Max 2.2ms (at fixed sensitivity between 1-20), Max 15ms (at Auto sensitivity)				
Sampling rate	500 μs				
Analogue output	4-20 mA				
Control output	NPN or PNP, Max 100mA/DC24V, Residual Voltage Max 1.8V				
Timer	On delay / Off delay / Oneshot (1msec increment for 0-999ms, 1sec for 0-10 sec)				
Distance indicator	Red = Near, Orange = Middle, Green = Far, Red/Green = Error *Remark : Errors as "out of measuring range", "Too high reflection", etc				
Stability indicator	Green = Stable, Red = Error, No light = Unstable, need adjustment				
Control output indicator	Orange = Output (NPN or PNP)				
Environmental illuminance	Sun light : Max 10,000 lux, Incandescent Lamp = Max 3,000 lux				
Operating temp / humidity	-10 to 40 °C, 35 to 95% RH				
Insulation resistance	20 MΩ / DC 500V				
Material	Zinc diecast				
Protection category	IP67				
Conformity	CE				
Warm-up time	30 minutes				

**Spot size (typical)**

**Cross-talk area (typical)**



- CD1
- CD3
- CD4
- CD4L-25

# Laser Displacement Sensor CD4 series



**Sensor head Regular type**  
(Measuring distance : 30+/-5mm) (Measuring distance : 85+/-20mm)  
· CD4-30 · CD4-85

Displacement Sensor

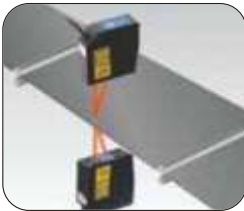
CD1

CD3

CD4

CD4L-25

## Applications



**Measuring thickness of black rubber sheet**



**Tire inspection**



**Monitoring the die cast**



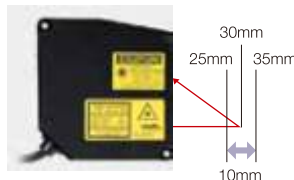
**Checking clear package of IC mounted on PCB**



**Quality check of gear**

- **Laser Displacement sensor features easy setup and operation.**
- **CD4 Series Laser Displacement sensor with Linear Image Sensor and Electronic Shutter provides accurate measurement.**

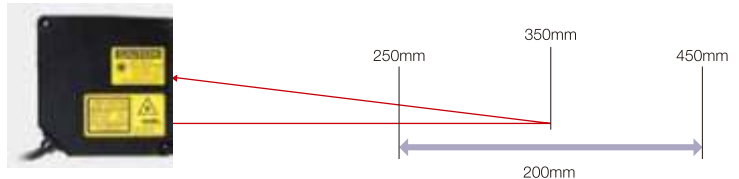
**CD4-30** Short distance : 30 +/- 5mm



**CD4-85** Middle distance : 85 +/- 20mm



**CD4-350** Long distance : 350 +/- 100mm



### Class 3R - High power types

For matte black objects or any application that requires a higher power laser, there are models of the CD4 series available which use a Class 3R light source.

**CD4-30-3R** Short distance : 30 +/- 5mm

**CD4-85-3R** Middle distance : 85 +/- 20mm

**CD4-350-3R** Long distance : 350 +/- 100mm

**High Power type**

(Measuring distance : 350+/-100mm)  
· CD4-350

(Measuring distance : 30+/-5mm)  
· CD4-30-3R

(Measuring distance : 85+/-20mm)  
· CD4-85-3R

(Measuring distance : 350+/-100mm)  
· CD4-350-3R

→  
Next page

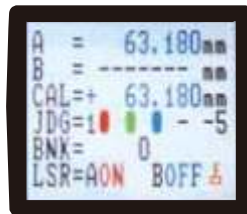
**Features**

No other Displacement sensor has been this easy to use!  
The CD4 controller is easy to operate with simple pushbutton setup and an LCD display to verify/change the settings.

**LCD Display**

The CD4A-N(or P) controller has a built-in color display that indicates multiple data values on the same screen.

Distance Values from both heads, Calculated Value, Output Status, Bank Number, etc. are displayed on the normal Run screen.



CD1

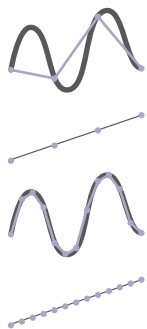
CD3

CD4

CD4L-25

**High speed sampling rate**

The CD4 Displacement Sensor has a 100μsec. sampling rate and High Density Linear Image detector.

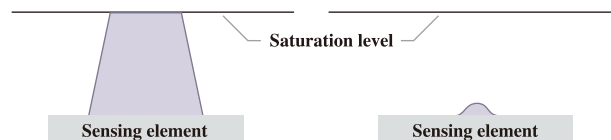


Conventional Displacement Sensor with slow response.

CD4 Series sensors, high speed sampling rate improves overall accuracy.

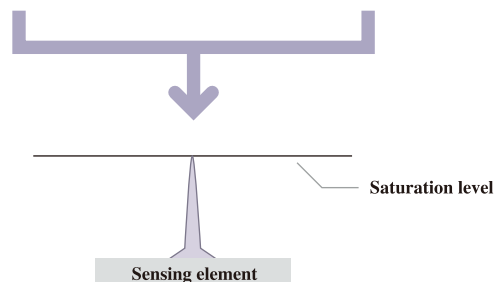
**Electronic Shutter**

The Microcomputer in the CD4 controller will automatically control the shutter speed depending upon the reflectance of the target. This will select the best light intensity level for accurate measurement and will help to minimize the error (AUTO Sensitivity Mode).



Highly reflective materials will result in excessive reflected light that may cause an error in finding the peak position.

Low reflective materials such as black rubber will have a very low amount of reflected light. This can cause unstable measurement.



Automatic control of light intensity will find the peak correctly.

**IP67 Environmental rating**

The sensing heads of the CD4 series have an IP67 rating for use in applications where they may be exposed to water.



**High Power type**

(Measuring distance : 350+/-100mm)  
· CD4-350

(Measuring distance : 30+/-5mm)  
· CD4-30-3R

(Measuring distance : 85+/-20mm)  
· CD4-85-3R

(Measuring distance : 350+/-100mm)  
· CD4-350-3R

→  
Next page

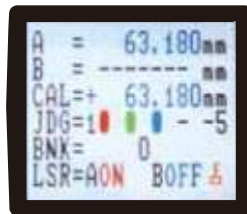
**Features**

No other Displacement sensor has been this easy to use!  
The CD4 controller is easy to operate with simple pushbutton setup and an LCD display to verify/change the settings.

**LCD Display**

The CD4A-N(or P) controller has a built-in color display that indicates multiple data values on the same screen.

Distance Values from both heads, Calculated Value, Output Status, Bank Number, etc. are displayed on the normal Run screen.



CD1

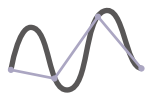
CD3

CD4

CD4L-25

**High speed sampling rate**

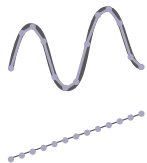
The CD4 Displacement Sensor has a 100μsec. sampling rate and High Density Linear Image detector.



Conventional Displacement Sensor with slow response.



CD4 Series sensors, high speed sampling rate improves overall accuracy.



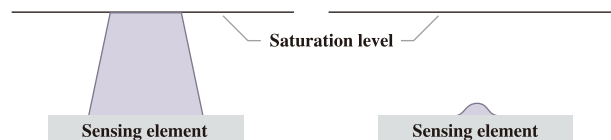
**IP67 Environmental rating**

The sensing heads of the CD4 series have an IP67 rating for use in applications where they may be exposed to water.



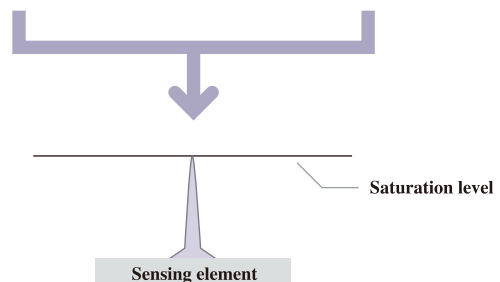
**Electronic Shutter**

The Microcomputer in the CD4 controller will automatically control the shutter speed depending upon the reflectance of the target. This will select the best light intensity level for accurate measurement and will help to minimize the error (AUTO Sensitivity Mode).



Highly reflective materials will result in excessive reflected light that may cause an error in finding the peak position.

Low reflective materials such as black rubber will have a very low amount of reflected light. This can cause unstable measurement.



Automatic control of light intensity will find the peak correctly.

### Ten formulas of calculation

<b>A</b>	Sensor Head A
<b>B</b>	Sensor Head B
<b>A+B</b>	Adding of A and B
<b>A-B</b>	Gap between A and B
<b>-A-B</b>	Reverse of A+B
<b>K-A-B</b>	K = distance between sensors. Good for measuring thickness.
<b>K+A+B</b>	K = Offset value
<b>K+A-B</b>	K = Offset value
<b>K+A</b>	Offset the sensor A. K = Offset value
<b>K+B</b>	Offset the sensor B. K = Offset value

### 8 Banks selections

Bank No.	Bank 2 input	Bank 1 input	Bank 0 input
0	OFF	OFF	OFF
1	OFF	OFF	ON
2	OFF	ON	OFF
3	OFF	ON	ON
4	ON	OFF	OFF
5	ON	OFF	ON
6	ON	ON	OFF
7	ON	ON	ON

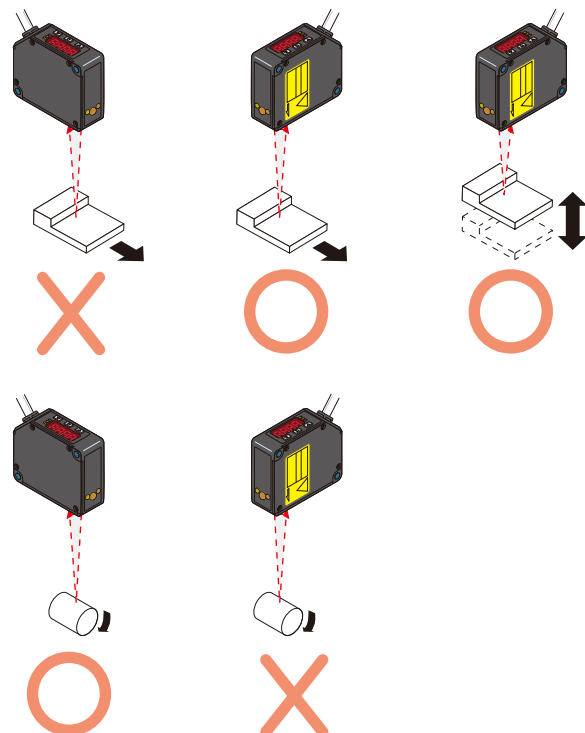
### IP67 Environmental rating

The sensing heads of the CD4 series have an IP67 rating for use in applications where they may be exposed to water.



### Hint of installation for best accuracy

To obtain accuracy the sensor head must be oriented as shown below.



### Class 2 (IEC/JIS) Class II (FDA) laser product

High power type (models with "-3R") has class 3 laser



CD1

CD3

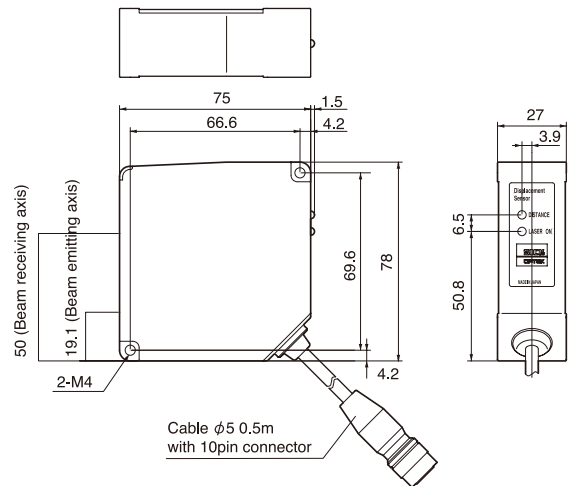
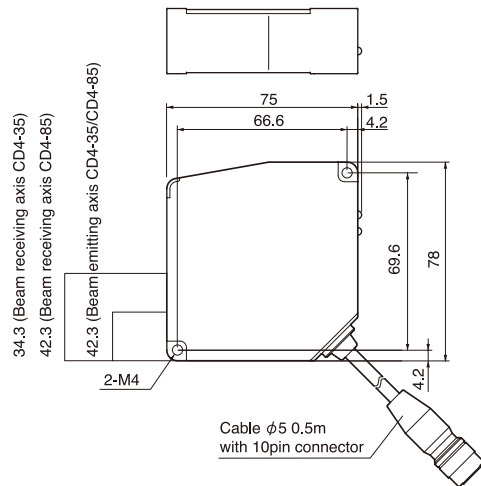
CD4

CD4L-25

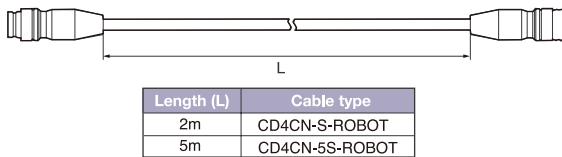
## Dimensions (Sensor head)

CD4-30 / CD4-30-3R  
CD4-85 / CD4-85-3R

CD4-350 / CD4-350-3R



### Extension cable to connect the sensor head



(Unit: mm)

## Specifications

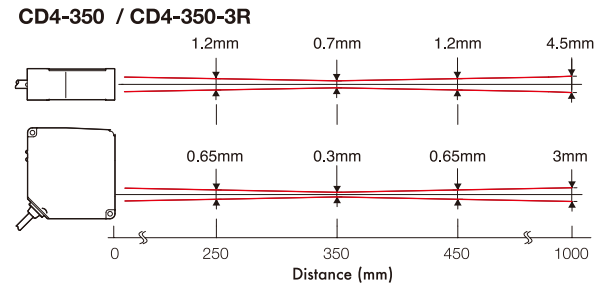
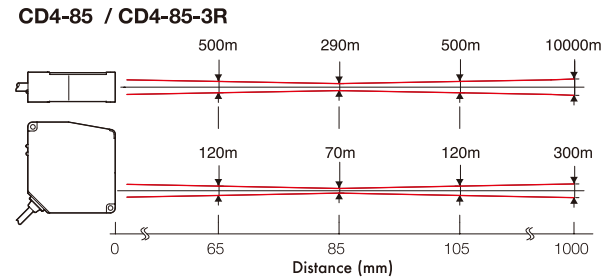
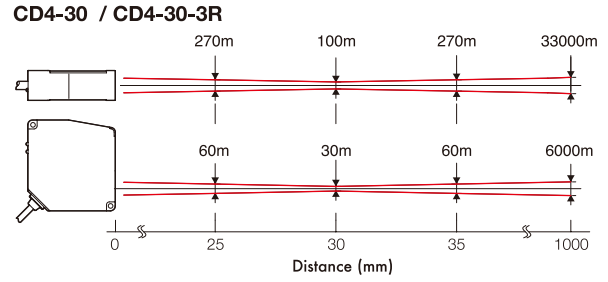
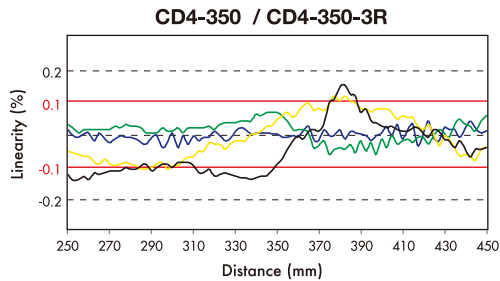
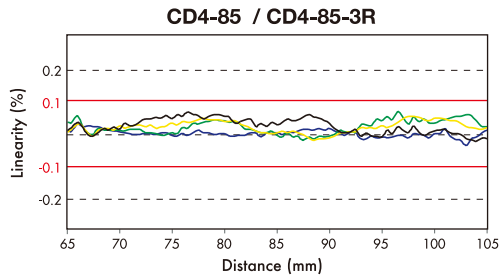
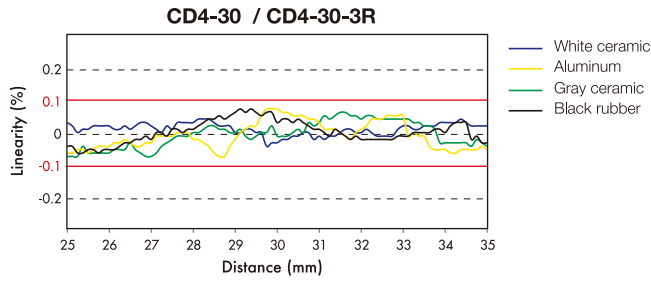
IEC Class 1 (FDA Class II) Type	CD4-30	CD4-85	CD4-350
High power Class 3R Type	CD4-30-3R	CD4-85-3R	CD4-350-3R
Measuring range	30+/-5mm	85+/-20mm	350+/-100mm
Light source	Class 2 (IEC/JIS) Class II (FDA) Red Laser Diode , 650nm, Max 1m W (Regular type) Class 3R (IEC/JIS) Class III a (FDA) Red Laser Diode, 650nm, Max 5mW) (High Power type)		
Spot size (*1)	30 x 100µm	70 x 290µm	300 x 700µm
Linearity (*2)	±0.1% FS		
Resolution (*3)	1µm	3µm	40µm
Supply voltage	Supplied by CD4A-N/P Controller		
Temp drift	±0.01% FS/ C° F°		
Laser emission LED	Green = Laser emission		
Measurement LED	Red = In range, closer than center 5% of measurement range (0 to 45%) Orange = Within +/- 5% of the center of the measuring range Green = In range, farther than center 5% of measurement range (55 to 100%) Red/Green alternating = Out of measuring range		
Protection category	IP67		
Operation temp / humidity	-10 to 45 °C (14 to 113 F°), 35 to 85% RH		
Storage temp / humidity	-20 to 60 °C (-4 to 140 F°), 35 to 85% RH		
Environmental illuminance	Incandescent Lamp = Max 3,000 lux		
Vibration resistance	10 to 55 Hz double amplitude 1.5mm for XYZ		
Shock resistance	50G (050m/s²)		
Cable	50cm (19.7 inch) cable		
Cable extension	CD4CN-S-ROBOT (2m, 78 inch), CD4CN-5S-ROBOT (5m, 197 inch)		
Material	Aluminum diecast		

\*1 Defined with center strength 1/e<sup>2</sup> (13.5%). There may be leak light other than the spot size.  
The sensor may be affected when there is a highly reflective object close to the detection area.

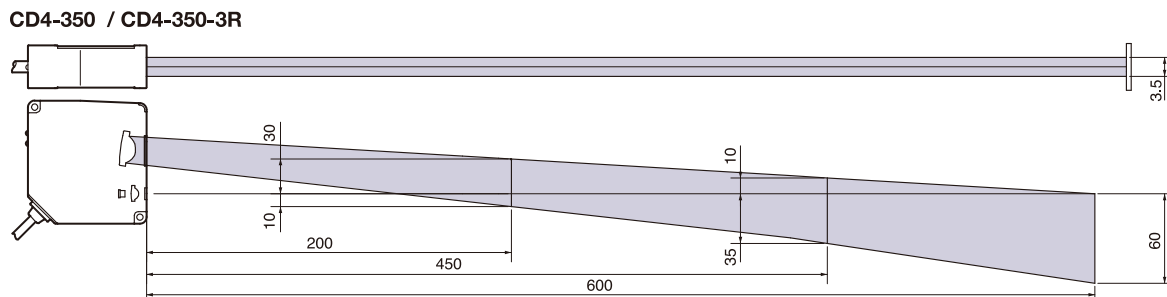
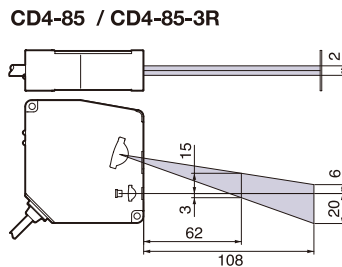
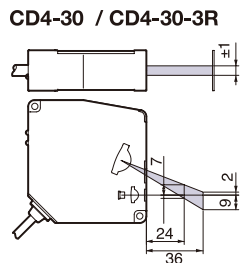
\*2 256 times in average (using the special amplifier), object: White Ceramic. The value is subject to objects.

\*3 The typical value in the conditions of 256 times in average (using the special amplifier), object: White Ceramic, distance range: Middle.  
The value is subject to objects.

## Linearity by materials



## Measuring Area



CD1

CD3

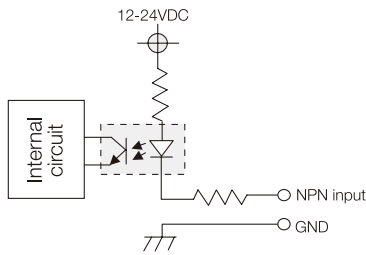
CD4

CD4L-25

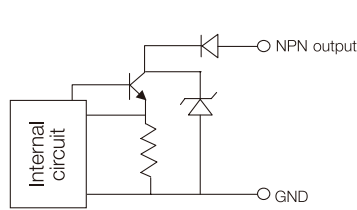


## Input / Output diagrams

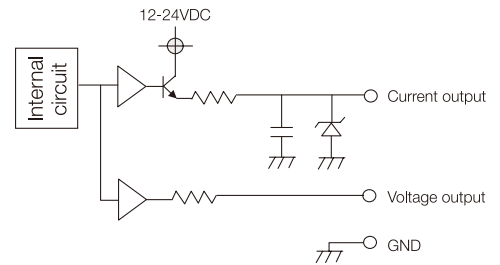
**NPN model bank input**  
Hold input  
Zero reset input



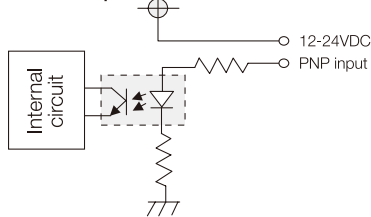
**NPN model control output**  
Alarm output



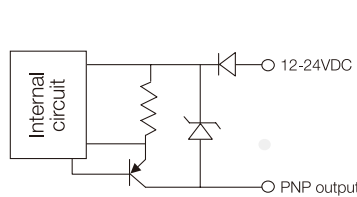
**Analog output (A/B)**



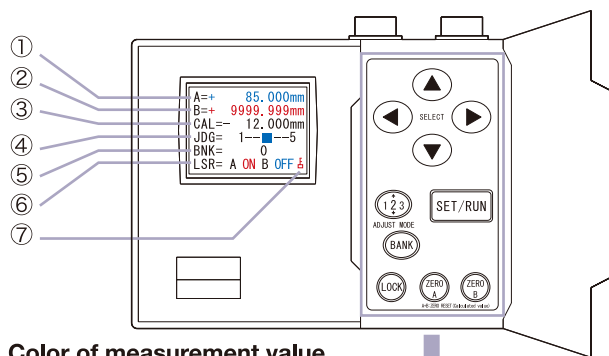
**PNP model bank input**  
Hold input  
Zero reset input



**PNP model control output**  
Alarm output



## Parts identifications

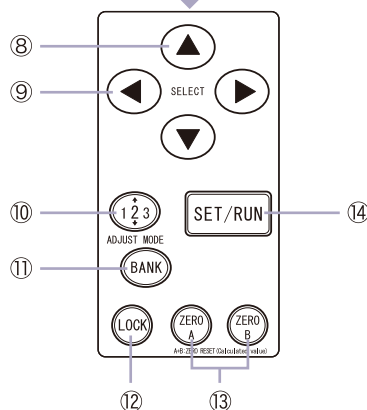


### Color of measurement value

Blue : The spot value in real time.

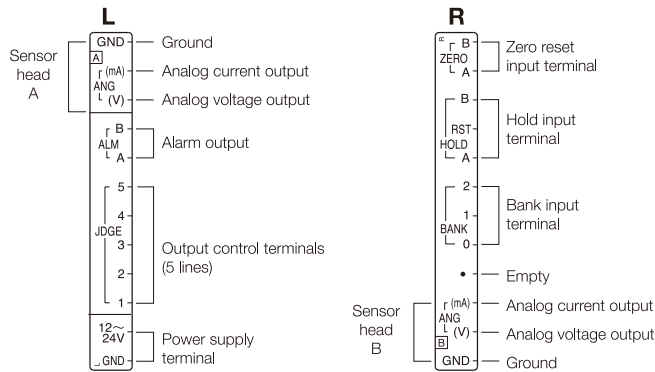
Black : The value held by the hold function.

Red : The sensor head is incapable of measurement.



- ① Setting value of Sensor Head A
- ② Setting value of Sensor Head B
- ③ Calculation result processed according to the Calculation function setting
- ④ Output status of the control output (output 1,2,3,4,5)
- ⑤ Bank number
- ⑥ Displays the laser emission status of each sensor.  
ON : During laser emission, OFF : No laser emission.
- ⑦ Lock indicator
- ⑧ **UP / DOWN buttons**  
Press to select the setting items.
- ⑨ **RIGHT / LEFT buttons**  
Press to select the function display or change the setting items.
- ⑩ **Digit Position button**  
Press to change the digit position of the setting items with a wide range of setting value. (Activated only in Setup mode.)
- ⑪ **Bank Selection button**  
Press to select the bank containing the programmed measurement settings. You can store up to eight(8) programs.
- ⑫ **Lock button**  
Press and hold for one(1) second or more to lock the button operation. \*The backlights of the operation buttons turn off during Lock status.
- ⑬ **Zero reset input**  
Press and hold one(1) second or more to perform zero reset of the sensor head(A or B). Press and hold again for two(2) seconds or more to cancel the function. Simultaneous pressing of the A and B buttons resets the calculation result (CAL). Press and hold simultaneously for one(1) second or more to cancel the function.
- ⑭ **Mode Selection button**  
Press to switch the display mode.

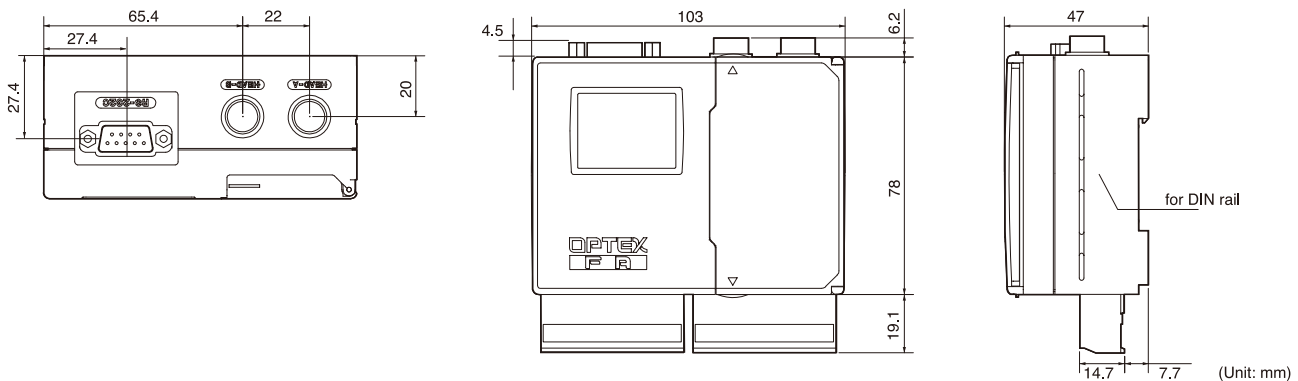
## Wiring connections



### ● Zero reset input

Zero reset of single sensor (either A or B) is activated with input of 10 ms or more, and deactivated with 500 ms or more.  
Zero reset of calculation reset is activated with simultaneous input from sensor A and B, and deactivated with simultaneous input of 500 ms or more. (For "simultaneous" input, the time difference between sensor A and B inputs should be within 10 ms.)

## Dimensions (Amplifier)



## Specifications

Model	CD4A-N (NPN output type)	CD4A-P (PNP output type)
Number of connected sensor heads	Max. 2 pcs	
Sampling frequency	100 $\mu$ s	
Supply voltage	12 to 24V, DC $\pm$ 10%	
Power consumption	270 mA/24 V (When connected with 2 sensor heads. Including analog current output)	
Temp drift	$\pm$ 0.01 % F.S./ $^{\circ}$ C	
Analog output	Voltage output $\pm$ 5 V/F.S. (Output impedance 100 $\Omega$ , resolution 1 mV) Current output 4 to 20 mA/F.S. (Load impedance 300 $\Omega$ , resolution 1.5 $\mu$ A)	
Alarm output	ALM A, ALM B	ALM A, ALM B
Control output	JDGE 1 to 5	JDGE 1 to 5
Bank input	BANK 0 to 2	BANK 0 to 2
Hold input	HOLD A, HOLD B, HOLD RST	HOLD A, HOLD B, HOLD RST
Zero reset input	ZERO A, ZERO B	ZERO A, ZERO B
Optional features	Average sampling times, Filter mode (Cut-off frequency), Calculation, Hold setting, Output during alarm, Output control (Hysteresis), Analog output, Sensor head sensitivity control, Timer function, Memory function, Memory bank function, Auto zero reset	
Display type	LCD display	
Protection category	IP20	
Operation temp	-10 to +45 $^{\circ}$ C (Non-condensing) / For storage : -20 to +60 $^{\circ}$ C	
Operating humidity	35 to 85% RH / For storage: 35 to 85 % RH	
Vibration resistance	10 to 55 Hz, Double amplitude 1.5mm, 2 h for XYZ axis	
Shock resistance	20G (196m/S $^2$ )	
Material	Chassis: Polycarbonate, Connection terminals: Nylon 66	
Weight	240g (including connection terminals)	

Specular type Laser Displacement Sensor

# CD4L-25 series



**Sensor head Specular type**  
(Measuring distance : 25+/-1mm)  
· CD4L-25

Displacement Sensor

CD1

CD3

CD4

CD4L-25

### Applications



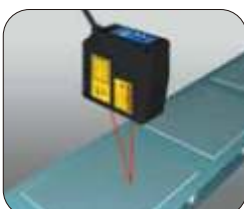
**Monitoring warping sagging of glass plate**



**Presence of glass material on pickup arm.**



**Mirror surface object**



**Glass plate running on conveyor**

- **Laser Displacement sensor features easy setup and operation.**
- **High accuracy of 0.1 m resolution and +/- 0.1% linearity. (Specular Type)**
- **Specular type optics that is ideal for glass sensing.**

**CD4L-25** Specular type : 25+/- 1mm

The optical path is designed to project the correct angle for the detection of specular reflections from transparent objects.

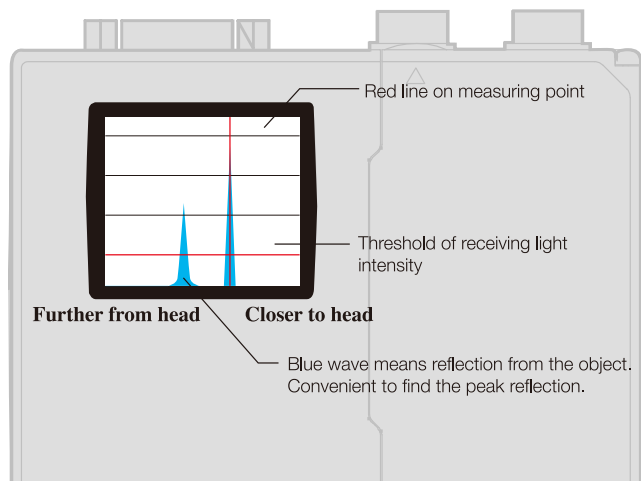


### Features

#### Light Intensity Monitor (For specular type only)

For stable measurement and improved accuracy the light intensity needs to be adjusted to the optimum setting.

With the built-in monitor the status of the level can be verified.

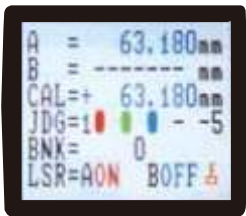


**Amplifier**    **Specular type**  
**NPN output type**    **PNP output type**  
 · CD4A-LN    · CD4A-LP

No other Displacement sensor has been this easy to use!  
 The CD4 controller is easy to operate with simple pushbutton setup and an LCD display to verify/change the settings.

**LCD Display**

The CD4A-N(or P) controller has a built-in color display that indicates multiple data values on the same screen.  
 Distance Values from both heads, Calculated Value, Output Status, Bank Number, etc. are displayed on the normal Run screen.



CD1

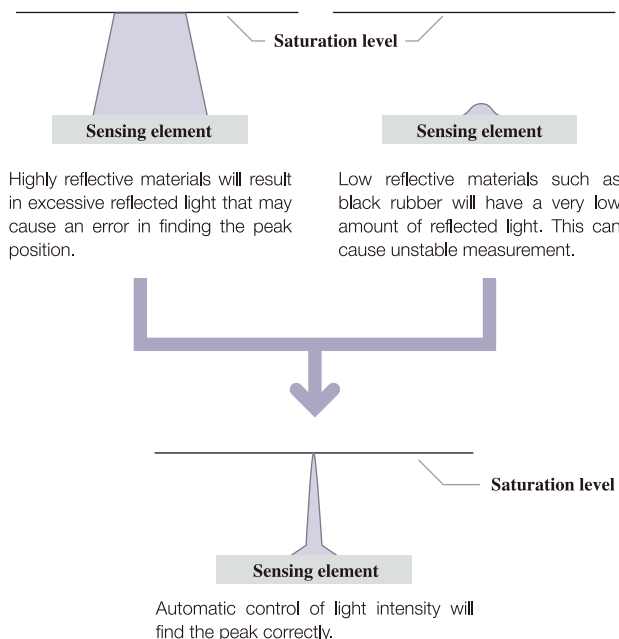
CD3

CD4

CD4L-25

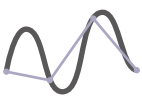
**Electronic Shutter**

The Microcomputer in the CD4 controller will automatically control the shutter speed depending upon the reflectance of the target. This will select the best light intensity level for accurate measurement and will help to minimize the error (AUTO Sensitivity Mode).

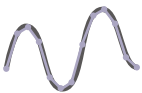


**High speed sampling rate**

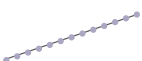
The CD4 Displacement Sensor has a 100μsec. sampling rate and High Density Linear Image detector.



Conventional Displacement Sensor with slow response.



CD4 Series sensors, high speed sampling rate improves overall accuracy.



## RS-232C Communications

By connecting the CD4 controller to a PC, the following operations can be performed from the PC via RS232.

- Writing and reading out the setting value
- Reading out the measurement value
- Reading out the control output status
- Operating the control input
- Data buffer function

Communication method	RS-232C
Transmission type	Asynchronous
Baud rate	9600/19200/ <u>38400</u> /115200 bps
Transmission code	ASCII
Data length	7/8 bit
Stop bit length	1 bit
Parity check	Nil/Even number/Odd number
Data classification	STX · ETX

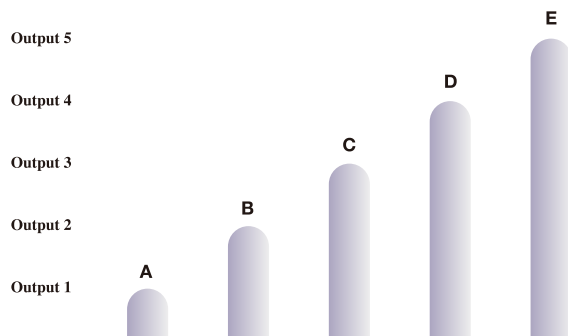
The underlined values are the factory default settings.

Adjust the communication settings of the PC and the CD4 using the values in the above table. The settings of the CD4 controller can be accessed in screen number 14 (RS232C).

## 5 Independent outputs are available

This is convenient for sorting items according to size.

Each of the 5 comparator outputs can be set independently, all outputs have a High and Low threshold limit.



## Low / High Pass Filters

High / Low Pass filters are built into the CD4 controller.

A Low Pass filter will help to reduce any sudden changes in the measurement while the High Pass filter will eliminate slow gradual changes.

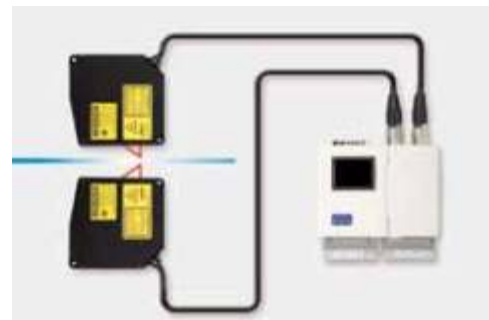


Easy disconnection of QD type.

## Two Sensing heads can be controlled

Therefore it computes for the purpose of measuring thickness, width, etc.

Independent measurement from each head is possible as well.



### Ten formulas of calculation

A	Sensor Head A
B	Sensor Head B
A+B	Adding of A and B
A-B	Gap between A and B
-A-B	Reverse of A+B
K-A-B	K = distance between sensors. Good for measuring thickness.
K+A+B	K = Offset value
K+A-B	K = Offset value
K+A	Offset the sensor A. K = Offset value
K+B	Offset the sensor B. K = Offset value

### 8 Banks selections

Bank No.	Bank 2 input	Bank 1 input	Bank 0 input
0	OFF	OFF	OFF
1	OFF	OFF	ON
2	OFF	ON	OFF
3	OFF	ON	ON
4	ON	OFF	OFF
5	ON	OFF	ON
6	ON	ON	OFF
7	ON	ON	ON

### IP67 Environmental rating

The sensing heads of the CD4 series have an IP67 rating for use in applications where they may be exposed to water.



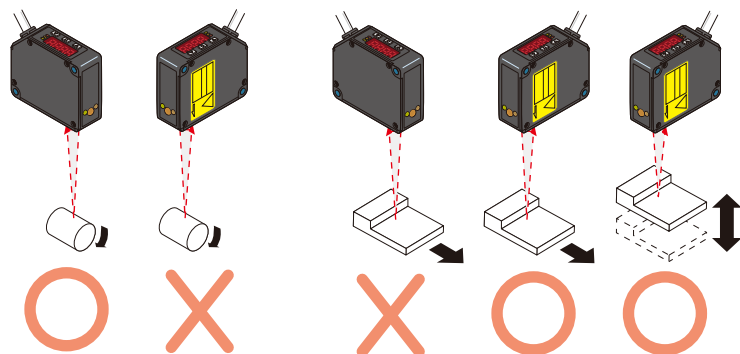
### Class 1 (IEC) Class II (FDA) laser product

CD4L-25 is registered to CDRH. (Center of Devices and Radiological Health)



### Hint of installation for best accuracy

To obtain accuracy the sensor head must be oriented as shown below.



CD1

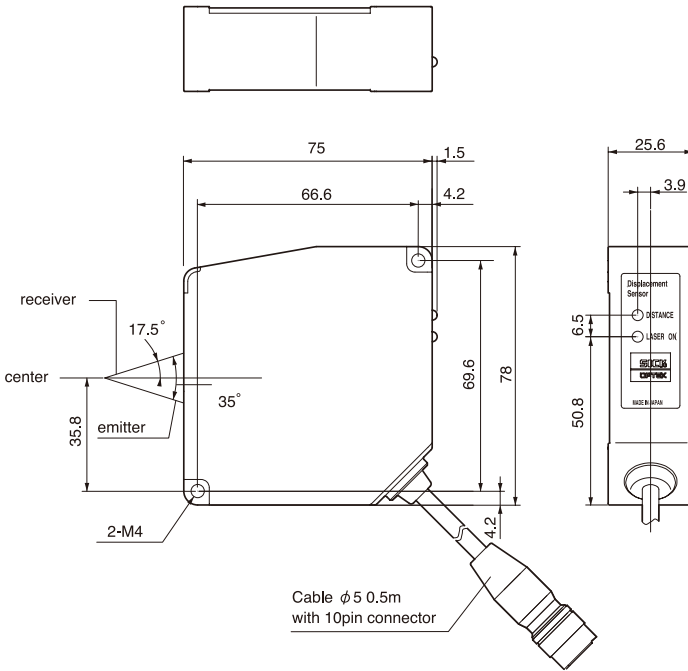
CD3

CD4

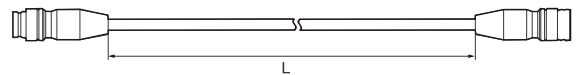
CD4L-25

## Dimensions (Sensor head)

### CD4-L25



### Extension cable to connect the sensor head



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

(Unit: mm)

## Specifications

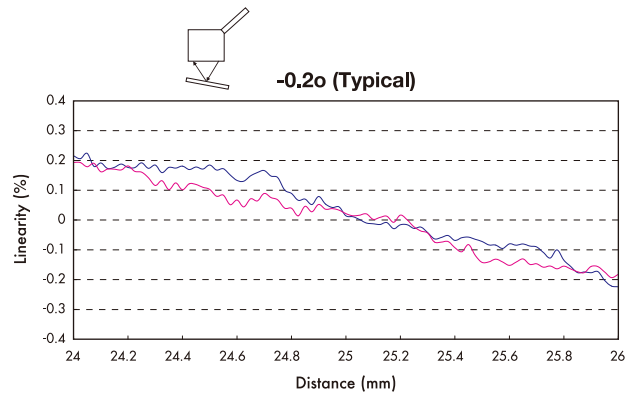
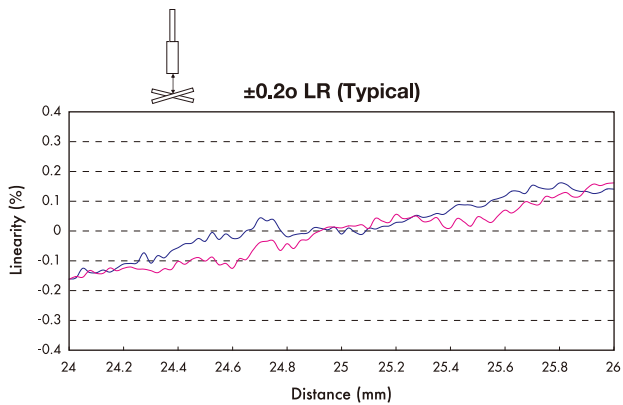
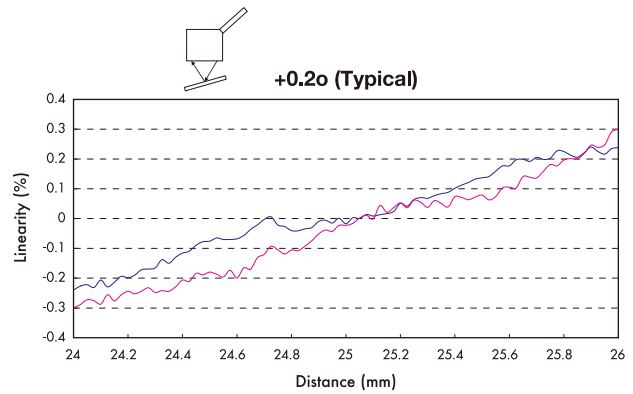
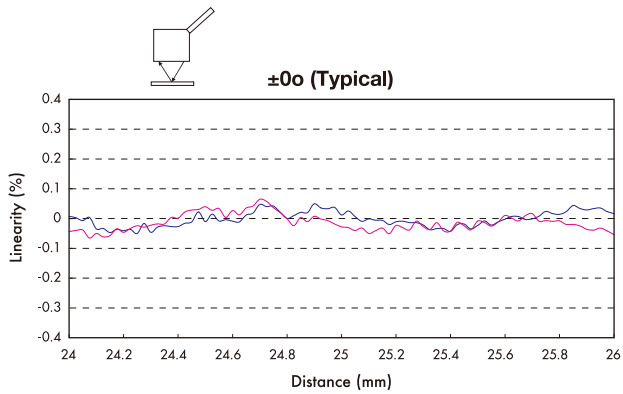
Model	CD4-L25
<b>Measuring range</b>	25±1mm
<b>Light source</b>	Class 1 (IEC/JIS) Class II (FDA) Laser, 650nm, Max 390 Micro W
<b>Spot size</b> (*1)	25 × 35 μm
<b>Linearity</b> (*2)	± 0.1% FS
<b>Resolution</b> (*3)	0.1 μm
<b>Supply voltage</b>	supplied by CD4A-LN/LP Controller
<b>Temp drift</b>	± 0.01% FS/ °C, F°
<b>Laser emission LED</b>	Green = Laser emission
<b>Measurement LED</b>	Red = In range, closer than center 5% of measurement range (0 to 45%) Orange = Within +/- 5% of the center of the measuring range Green = In range, farther than center 5% of measurement range (55 to 100%) Red/Green alternating = Out of measuring range
<b>Protection category</b>	IP67
<b>Operation temp / humidity</b>	-10 to 45 °C (14 to 113 F°), 35 to 85% RH
<b>Storage temp / humidity</b>	-20 to 60 °C (-4 to 140 F°), 35 to 85% RH
<b>Environmental illuminance</b>	Incandescent Lamp = Max 3,000 lux
<b>Vibration resistance</b>	10 to 55 Hz double amplitude 1.5mm for XYZ
<b>Shock resistance</b>	50G (050m/s²)
<b>Cable</b>	50cm (19.7 inch) cable
<b>Cable extension</b>	CD4CN-S-ROBOT (2m, 78 inch), CD4CN-5S-ROBOT (5m, 197 inch)
<b>Material</b>	Aluminum diecast

\*1 Defined with center strength 1/e² (13.5%). There may be leak light other than the spot size.

\*2 The sensor may be affected when there is a highly reflective object close to the detection area.

\*3 256 times in average (using the special amplifier), object: White Ceramic. The value is subject to objects.  
The typical value in the conditions of 256 times in average (using the special amplifier), object: White Ceramic, distance range: Middle.  
The value is subject to objects.

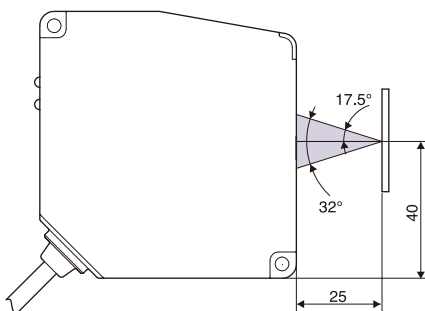
## Linearity by detection angle



— Mirror(SENS=MIN)  
— Glass(SENS=8)

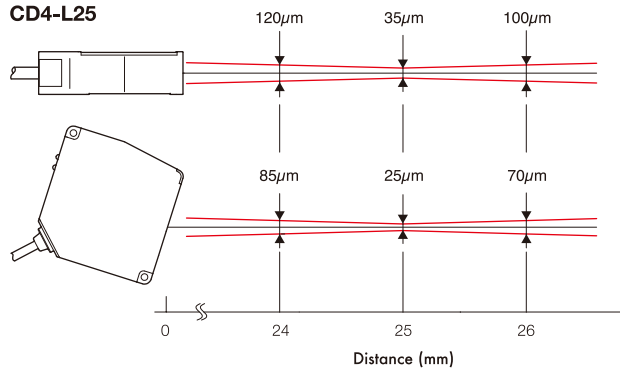
## Measuring Area

CD4-L25



## Spot size

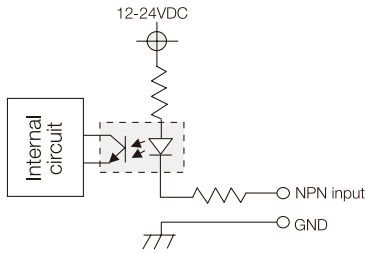
CD4-L25



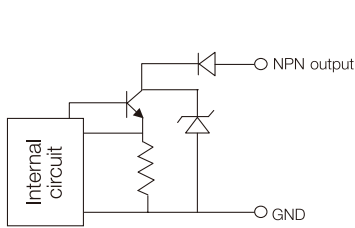


## Input / Output diagrams

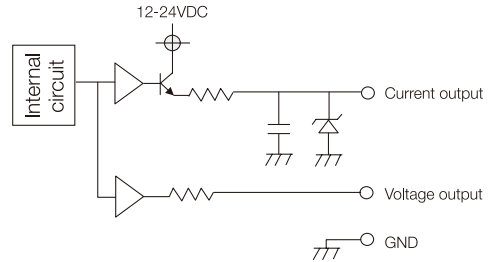
**NPN model bank input**  
Hold input  
Zero reset input



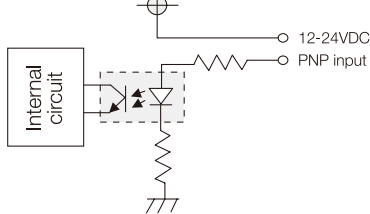
**NPN model control output**  
Alarm output



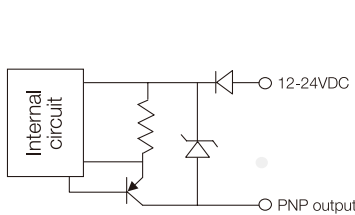
**Analog output (A/B)**



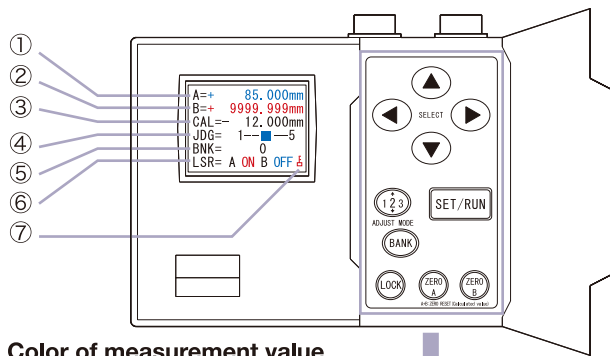
**PNP model bank input**  
Hold input  
Zero reset input



**NPN model control output**  
Alarm output



## Parts identifications

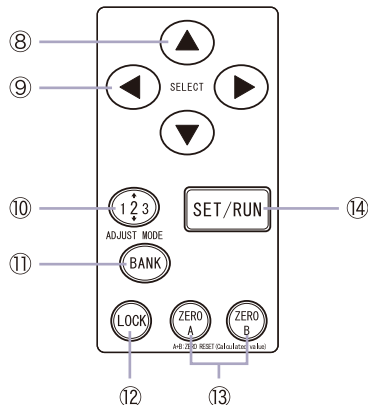


### Color of measurement value

Blue : The spot value in real time.

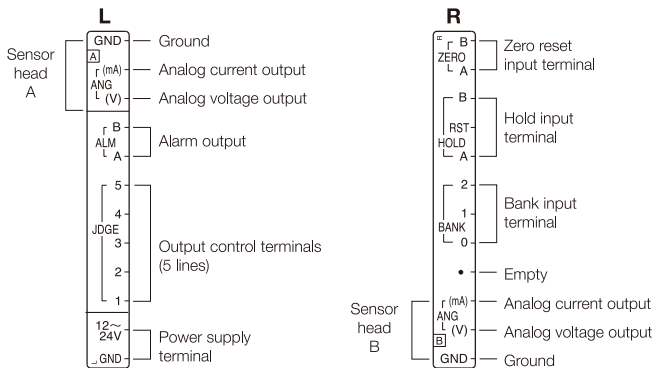
Black : The value held by the hold function.

Red : The sensor head is incapable of measurement.



- ① Setting value of Sensor Head A
- ② Setting value of Sensor Head B
- ③ Calculation result processed according to the Calculation function setting
- ④ Output status of the control output (output 1,2,3,4,5)
- ⑤ Bank number
- ⑥ Displays the laser emission status of each sensor.  
ON : During laser emission, OFF : No laser emission.
- ⑦ Lock indicator
- ⑧ **UP / DOWN buttons**  
Press to select the setting items.
- ⑨ **RIGHT / LEFT buttons**  
Press to select the function display or change the setting items.
- ⑩ **Digit Position button**  
Press to change the digit position of the setting items with a wide range of setting value. (Activated only in Setup mode.)
- ⑪ **Bank Selection button**  
Press to select the bank containing the programmed measurement settings. You can store up to eight(8) programs.
- ⑫ **Lock button**  
Press and hold for one(1) second or more to lock the button operation.  
\*The backlights of the operation buttons turn off during Lock status.
- ⑬ **Zero reset input**  
Press and hold one(1) second or more to preform zero reset of the sensor head(A or B). Press and hold again for two(2) seconds or more to cancel the function. Simultaneous pressing of the A and B buttons resets the calculation result (CAL). Press and hold simultaneously for one(1) second or more to cancel the function.
- ⑭ **Mode Selection button**  
Press to switch the display mode.

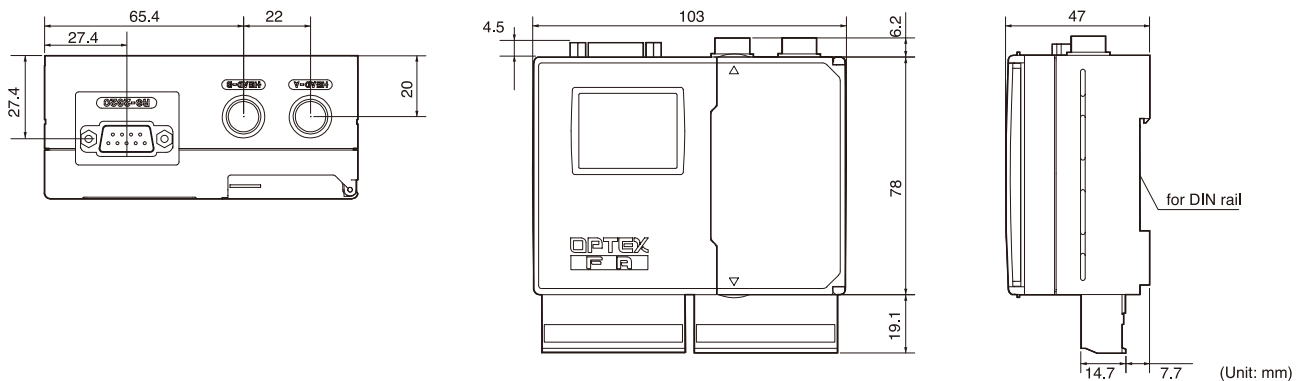
## Wiring connections



### ● Zero reset input

Zero reset of single sensor (either A or B) is activated with input of 10 ms or more, and deactivated with 500 ms or more.  
 Zero reset of calculation reset is activated with simultaneous input from sensor A and B, and deactivated with simultaneous input of 500 ms or more. (For "simultaneous" input, the time difference between sensor A and B inputs should be within 10 ms.)

## Dimensions (Amplifier)



## Specifications

Model	CD4A-LN (NPN output type)	CD4A-LP (PNP output type)
Number of connected sensor heads	Max. 2 pcs	
Sampling frequency	100 $\mu$ s	
Supply voltage	12 to 24V, DC $\pm$ 10%	
Power consumption	270 mA/24 V (When connected with 2 sensor heads. Including analog current output)	
Temp drift	$\pm$ 0.01 % F.S./ $^{\circ}$ C	
Analog output	Voltage output $\pm$ 5 V/F.S. (Output impedance 100 $\Omega$ , resolution 1 mV) Current output 4 to 20 mA/F.S. (Load impedance 300 $\Omega$ , resolution 1.5 $\mu$ A)	
Alarm output	ALM A, ALM B	ALM A, ALM B
Control output	JDGE 1 to 5	JDGE 1 to 5
Bank input	BANK 0 to 2	BANK 0 to 2
Hold input	HOLD A, HOLD B, HOLD RST	HOLD A, HOLD B, HOLD RST
Zero reset input	ZERO A, ZERO B	ZERO A, ZERO B
Optional features	Average sampling times, Filter mode (Cut-off frequency), Calculation, Hold setting, Output during alarm, Output control (Hysteresis), Analog output, Sensor head sensitivity control, Timer function, Memory function, Memory bank function, Auto zero reset	
Display type	LCD display	
Protection category	IP20	
Operation temp	-10 to +45 $^{\circ}$ C (Non-condensing) / For storage : -20 to +60 $^{\circ}$ C	
Operating humidity	35 to 85% RH / For storage: 35 to 85 % RH	
Vibration resistance	10 to 55 Hz, Double amplitude 1.5mm, 2 h for XYZ axis	
Shock resistance	20G (196m/S $^2$ )	
Material	Chassis: Polycarbonate, Connection terminals: Nylon 66	
Weight	240g (including connection terminals)	