

## Parallel Beam Line Sensor

## Z4LC

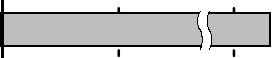
Visible RED Class II Laser Width/Profile Measurement Sensor Offers High Speed, Precision Object Measurement and Multiple-Mode Operation for Positioning and Size Discrimination

- FDA Class II IEC Class I visible RED laser emitter and CCD receiver ensure high performance
- 10-micron resolution
- 28-mm beam width
- 40 mm fixed or 0 to 300 mm sensing distance
- 4 to 20 mA 12 bit binary/RS-232C analog outputs
- 3-level discrimination outputs: NPN
- 5 input functions
- 9 measurement modes, including edge detection of clear material



## Ordering Information

### ■ SENSOR

| Sensing distance                                                                                | Measurement width | Type            | Part number       |
|-------------------------------------------------------------------------------------------------|-------------------|-----------------|-------------------|
|  40 mm       | 28 mm             | Integrated type | <b>Z4LC-S2840</b> |
|  0 to 300 mm | 28 mm             | Separate type   | <b>Z4LC-S28</b>   |

### ■ CONTROLLER

| Controller | Type      | Part number     |
|------------|-----------|-----------------|
|            | NPN model | <b>Z4LC-C28</b> |

### ■ EXTENSION CABLE

| Extension cable for emitter and receiver | Cable length | Part number      |
|------------------------------------------|--------------|------------------|
|                                          | 2 m          | <b>Z49-C6 2M</b> |
|                                          | 8 m          | <b>Z49-C6 8M</b> |

# Specifications

## ■ SENSOR

|                                |                                                                                                                                         |                                                                              |
|--------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------|
| Item                           | Z4LC-S2840                                                                                                                              | Z4LC-S28                                                                     |
| Light source                   | Visible-light semiconductor laser diode (wavelength: 670 nm, JIS Class 1, IEC Class I, FDA Class II)                                    |                                                                              |
| Measurement width              | 28 mm                                                                                                                                   |                                                                              |
| Sensing distance               | 40 mm                                                                                                                                   | 0 to 300 mm                                                                  |
| Min. sensing object            | 0.2 mm dia.                                                                                                                             | 0.5 mm dia.                                                                  |
| Linearity (See Note 1, 2.)     | ±0.1% F.S.                                                                                                                              |                                                                              |
| Temperature drift (see note 1) | 0.01% F.S./°C max.                                                                                                                      |                                                                              |
| Ambient temperature            | Operating: 0 to 40°C (32°F to 104°F) with no icing or condensation<br>Storage: -15 to 50°C (5°F to 122°F) with no icing or condensation |                                                                              |
| Ambient humidity               | Operating/Storage: 35 to 85% (with no condensation)                                                                                     |                                                                              |
| Ambient illuminance            | Incandescent lamp: 1,000 lux max.                                                                                                       |                                                                              |
|                                | Sunlight: 3,000 lux max.                                                                                                                |                                                                              |
| Vibration resistance           | 10 to 150 Hz half-amplitude of 0.75 mm or acceleration of 100 m/s <sup>2</sup> (whichever is smaller)                                   |                                                                              |
| Degree of protection           | IEC60529, IP40                                                                                                                          |                                                                              |
| Material                       | Diecast aluminum                                                                                                                        |                                                                              |
| Cable length                   | 2 m                                                                                                                                     |                                                                              |
| Weight                         | Approx. 520 g (including a 2-m cable)                                                                                                   | Emitter: Approx. 250 g<br>Receiver: Approx. 250 g<br>(including a 2-m cable) |

**Note: 1.** The values given are typical values for *one-side interruption mode 1* (with the distance between an emitter and a receiver set to 40 mm and the target placed 20 mm from the receiver).

**2.** Linearity: The value deviated from the ideal straight line of measurement value outputs in *one-side interruption mode 1* (when the distance between an emitter and a receiver is set to 40 mm, and the target is placed 20 mm from the receiver).

## ■ CONTROLLER

|                                |                                                                                                                                                                                                                                                  |                       |                                                                                                                                                |
|--------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|------------------------------------------------------------------------------------------------------------------------------------------------|
| Item                           | Z4LC-C28                                                                                                                                                                                                                                         |                       |                                                                                                                                                |
| Display                        | 7-segment LED, 4 digits                                                                                                                                                                                                                          |                       |                                                                                                                                                |
| Minimum reading                | 10 μm                                                                                                                                                                                                                                            |                       |                                                                                                                                                |
| Repeatability (See Note 1, 2.) | 20 μm (process value for averaging: 16)                                                                                                                                                                                                          |                       |                                                                                                                                                |
| Measurement value output       | Analog                                                                                                                                                                                                                                           | Output form           | 4 to 20 mA, load impedance: 300 Ω max.                                                                                                         |
|                                |                                                                                                                                                                                                                                                  | Response time         | 3.3 ms (process value for averaging: 1)                                                                                                        |
|                                | Digital                                                                                                                                                                                                                                          | Output form           | 12-bit binary output<br>NPN open collector output: 30 VDC, 20 mA max.<br>Residual voltage: 2 V max.                                            |
|                                |                                                                                                                                                                                                                                                  | 1 digit (See Note 3.) | 10 μm                                                                                                                                          |
|                                |                                                                                                                                                                                                                                                  | Response time         | 3.3 ms (process value for averaging: 1)                                                                                                        |
| Output signals                 | Discrimination output (HI, PASS, LOW)                                                                                                                                                                                                            |                       | NPN open collector output 30 VDC 20 mA max.<br>Residual voltage 2 V max.                                                                       |
| Input signals                  | Enable input<br>LD OFF input<br>Bank switch input<br>Forced zero input<br>External reset input                                                                                                                                                   |                       | Photocoupler input<br>Input voltage: 12 to 24 VDC±10%<br>ON voltage: 10.2 VDC min.<br>OFF voltage: 3.0 VDC max.<br>Input current: 10 mA (Typ.) |
| Communications                 | RS-232C                                                                                                                                                                                                                                          |                       |                                                                                                                                                |
| Temperature drift              | 0.005% F.S./°C                                                                                                                                                                                                                                   |                       |                                                                                                                                                |
| Power supply voltage           | 24 VDC +10% -15%, ripple (p-p): 10% max.                                                                                                                                                                                                         |                       |                                                                                                                                                |
| Current consumption            | 0.4 A max.                                                                                                                                                                                                                                       |                       |                                                                                                                                                |
| Main functions                 | Measurement value display, measurement mode selection, discrimination value setting selection, number of process values to average selection, forced zero function, bank number selection, linear output range setting, enable mode measurement. |                       |                                                                                                                                                |

This table (with applicable Notes) continues on the next page.

Table continued from previous page

|                      |                                                                                                                                         |
|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------|
| Item                 | Z4LC-C28                                                                                                                                |
| Ambient temperature  | Operating: 0 to 50°C (32°F to 122°F) with no icing or condensation<br>Storage: -15 to 60°C (5°F to 140°F) with no icing or condensation |
| Ambient humidity     | Operating/Storage: 35 to 85% (with no condensation)                                                                                     |
| Vibration            | 10 to 150 Hz half-amplitude of 0.15 mm or acceleration of 20 m/s <sup>2</sup> (whichever is smaller)                                    |
| Degree of protection | IEC60529, IP20                                                                                                                          |
| Material             | ABS/PC                                                                                                                                  |
| Weight               | Approx. 290 g                                                                                                                           |

- Note: 1.** The values given are typical values for *one-side interruption mode 1* (with the distance between an emitter and a receiver set to 40 mm and the target placed 20 mm from the receiver).
- 2.** The repeatability is the variation in the display and digital output when the target is stationary. Performance specifications may not be satisfied if the environment is altered adversely (e.g., if there is a strong magnetic field).
- 3.** The value converted to a distance corresponding to the 1LSB of the digital output.

### Communications Specifications

|                          |                                                             |
|--------------------------|-------------------------------------------------------------|
| Electric Characteristics | RS-232C                                                     |
| Synchronization          | Stop-start (asynchronous)                                   |
| Baud rate                | 1200, 2400, 4800, 9600, 19200 bps                           |
| Data length              | 7, 8-bit ASCII                                              |
| Parity                   | Even, Odd, None                                             |
| Stop bit                 | 1-bit, 2-bit                                                |
| Header/Footer            | CR, CR+LF, STX+ETX                                          |
| Output data              | Measurement data, error messages, setting conditions output |
| Input commands           | Measurement mode selection, forced zero, etc.               |

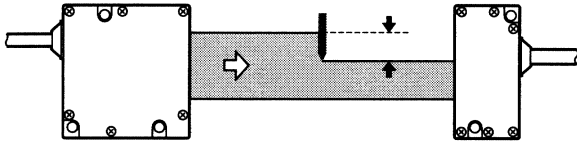
# Explanation of Each Mode

## MEASUREMENT MODES

Select one of the following measurement modes according to the measurement conditions.

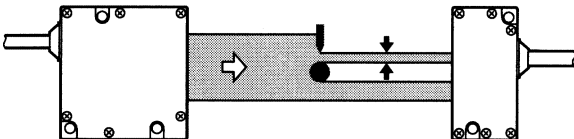
### (1.) One-side Interruption Mode 1 (First Dark Edge)

Measures the width from the edge of the beam to the end of the first dark section. (For meander detection, orientation flat positioning, etc.)



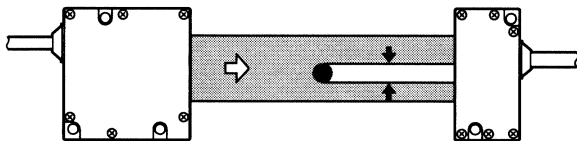
### (2.) One-side Interruption Mode 2 (First Light Edge)

Measures the width from the edge of the beam to the end of the first light section. (For gap measurement, etc.)



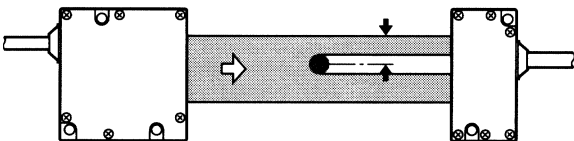
### (3.) Bar Diameter Measurement Mode (Diameter)

Measures the width from the first edge to the last edge of the beam. (For measuring the diameter of bars, etc.)



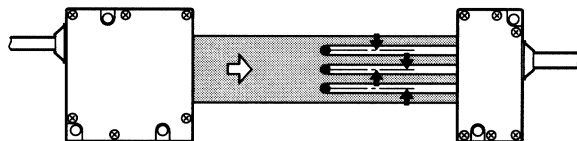
### (4.) Bar Position Measurement Mode (Position)

Measures the center point between the first edge and the last edge of the beam. (For position detection of bars, etc.)



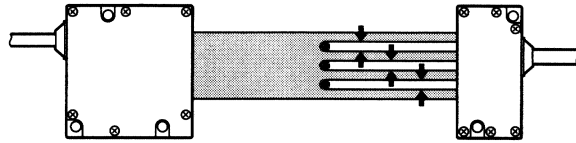
### (5.) Pin Pitch Determination Mode (Pin Pitch)

Measures the pin pitch and determines if pins are centered or not. It is passed if all pin pitch are within the tolerance and rejected if not. (Pin number: 14 max.)



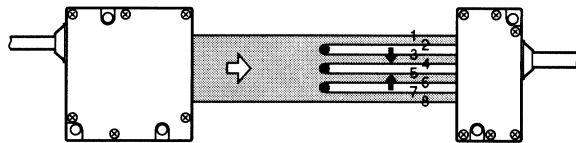
### (6.) Pin Diameter Determination Mode (Pin Diameter)

Determines whether pin diameters are within a set range. (Pin number: 14 max.)



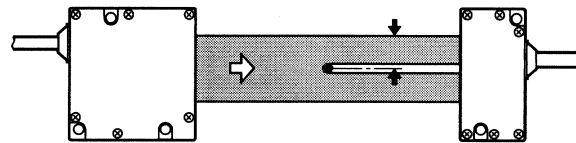
### (7.) Specified Edge Measurement Mode (Edge)

Measures the width of two specified edges.



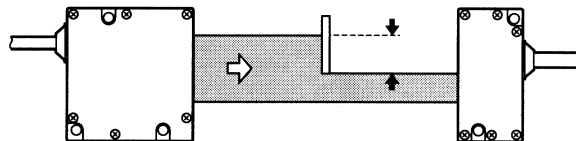
### (8.) Wire Position Detection Mode (Fine Line)

Measures the position of fine lines with minimum of 0.1 dia. The measurement details are the same as that of bar position measurement mode. (For positioning of wires more than 0.1 dia.)



### (9.) Transparent Object Edge Detection Mode (Glass)

Detects the edge of glass boards and transparent sheets. The distance between the upper edge of the beam and the edge of the transparent object is measured. (For detecting edges of transparent objects.)



### Forced Zero Function

The displayed value can be set to zero by the ZERO/ENT Key on the front panel or external input.

Suitable for the discrimination of standard workpieces.

### Analog Output Setting Function

The range of analog output can be set within the measurement width 28 mm.

### Enable Mode Measurement Function

The processing item (i.e. maximum, minimum, maximum minus minimum, or average) can be set. The set item is calculated and output while the enable mode signal is input.

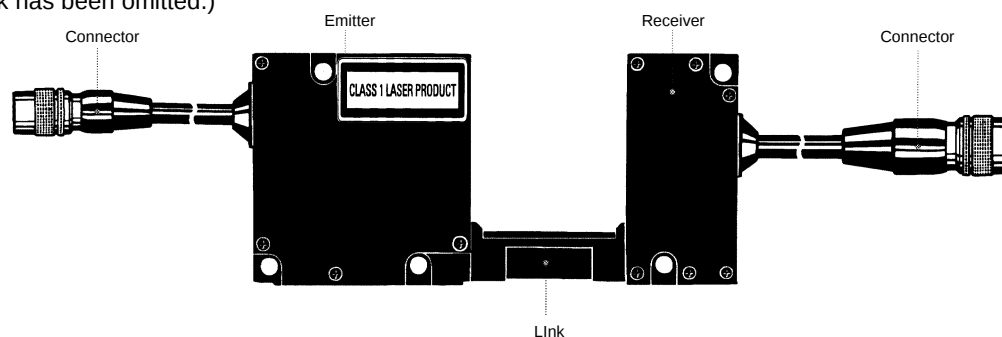
Suitable for the measurement of bar movement.

## Nomenclature

### ■ SENSORS

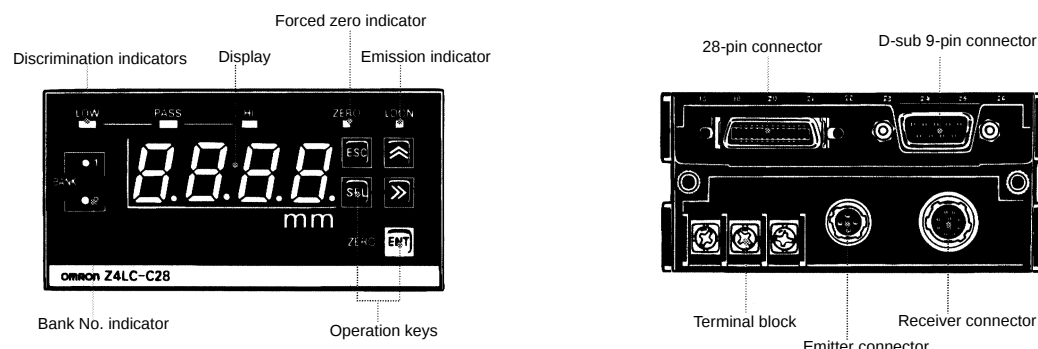
Z4LC-S2840

Z4LC-S28 (Link has been omitted.)



### ■ CONTROLLER

Z4LC-C28



## Operation

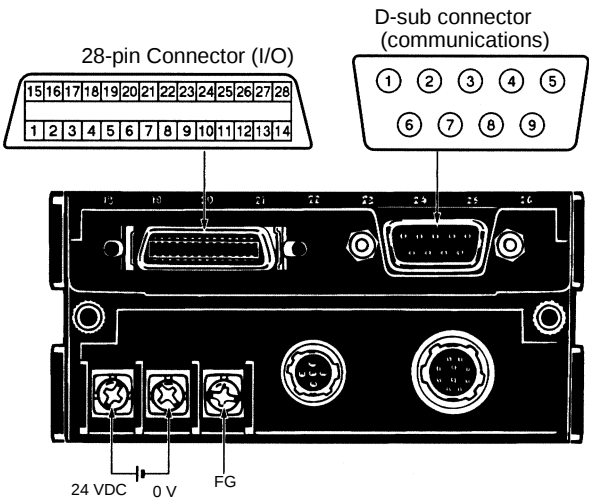
### ■ INPUT/OUTPUT SPECIFICATIONS

#### I/O Signals

| I/O                       | Signals                                                                                               | Specifications                                                              |
|---------------------------|-------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|
| <b>Input Signals</b>      | Enable input ( $\overline{\text{ENABLE}}$ )                                                           | Photocoupler input                                                          |
|                           | LD OFF input ( $\overline{\text{LD-OFF}}$ )                                                           | Input voltage: 12 to 24 VDC $\pm$ 10%                                       |
|                           | Bank switch input ( $\overline{\text{BANK}}$ )                                                        | ON voltage: 10.2 VDC min.                                                   |
|                           | Forced zero input ( $\overline{\text{ZERO}}$ )                                                        | OFF voltage: 3.0 VDC max.                                                   |
|                           | External reset input ( $\overline{\text{EXRESET}}$ )                                                  | Input current: 10 mA (Typ.)                                                 |
| <b>Output Signals</b>     | Discrimination output ( $\overline{\text{HI}}$ , $\overline{\text{PASS}}$ , $\overline{\text{LOW}}$ ) | NPN open collector output: 30 VDC, 20 mA max.                               |
|                           | Error output ( $\overline{\text{ERR}}$ )                                                              | Residual voltage: 2 V max.                                                  |
| <b>Binary Data Output</b> | $\overline{\text{D0}}$ to $\overline{\text{D11}}$ , $\overline{\text{STB}}$                           | NPN open collector output: 30 VDC, 20 mA max.<br>Residual voltage: 2 V max. |

# ■ TERMINAL CONNECTIONS

## Z4LC-C28 (Rear Section)



## 28-pin Connector (I/O)

| Pin No. | Signals                |
|---------|------------------------|
| 1       | Output COM             |
| 2       | $\overline{D0}$ (LSB)  |
| 3       | D2                     |
| 4       | D4                     |
| 5       | D6                     |
| 6       | D8                     |
| 7       | D10                    |
| 8       | STB                    |
| 9       | PASS                   |
| 10      | ERR                    |
| 11      | ZERO                   |
| 12      | ENABLE                 |
| 13      | Input COM              |
| 14      | Linear Output GND      |
| 15      | Output COM             |
| 16      | D1                     |
| 17      | D3                     |
| 18      | D5                     |
| 19      | D7                     |
| 20      | D9                     |
| 21      | $\overline{D11}$ (MSB) |
| 22      | HI                     |
| 23      | LOW                    |
| 24      | LD-OFF                 |
| 25      | BANK                   |
| 26      | EXRESET                |
| 27      | Input COM              |
| 28      | Linear Output          |

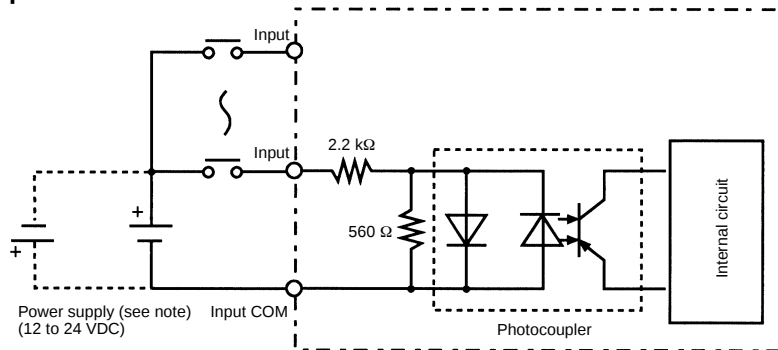
## D-sub Connector (Communications)

| Pin No. | Signals |
|---------|---------|
| 1       | N.C     |
| 2       | RD      |
| 3       | SD      |
| 4       | N.C     |
| 5       | SG      |
| 6       | N.C     |
| 7       | N.C     |
| 8       | N.C     |
| 9       | N.C     |

**Note:** Pins 4 and 6, and pins 7 and 8 are respectively connected internally.

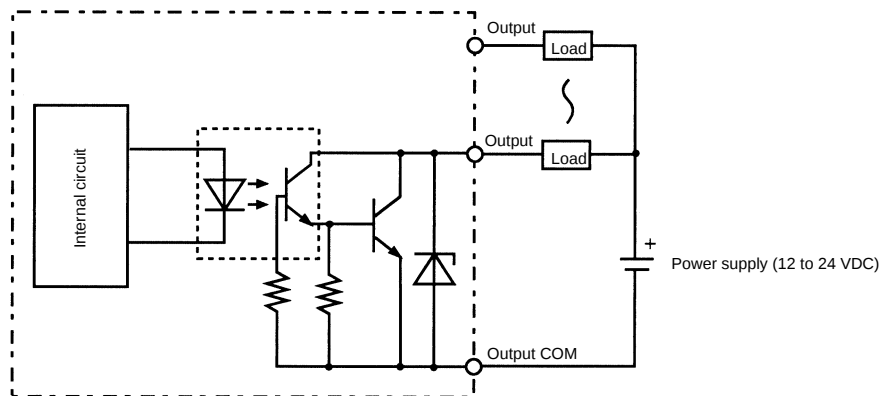
## ■ INPUT/OUTPUT CIRCUIT

### Input Circuit



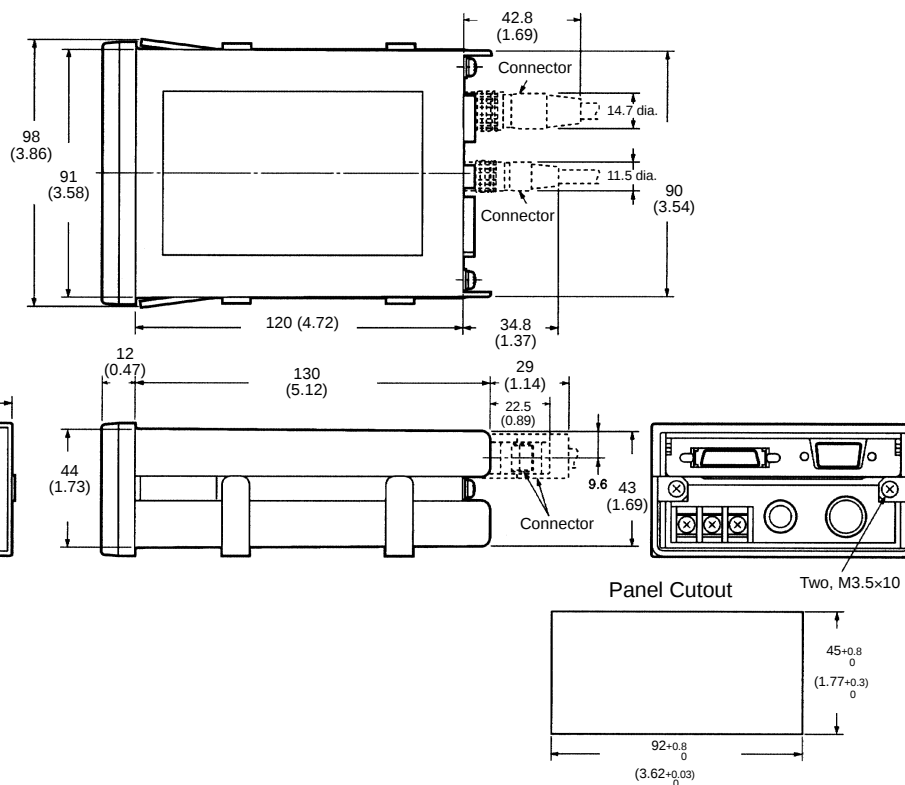
**Note:** There is no need to be concerned about the polarity of power supply.

### Output Circuit

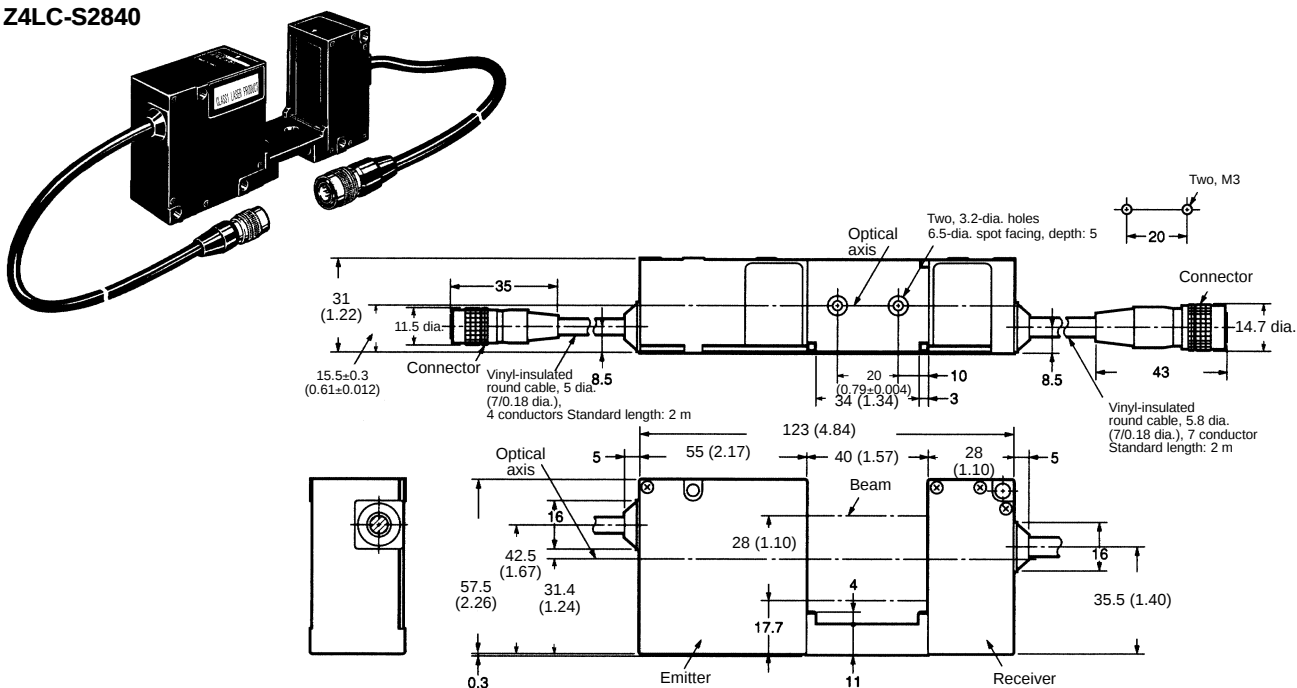


## Unit: mm (inch)

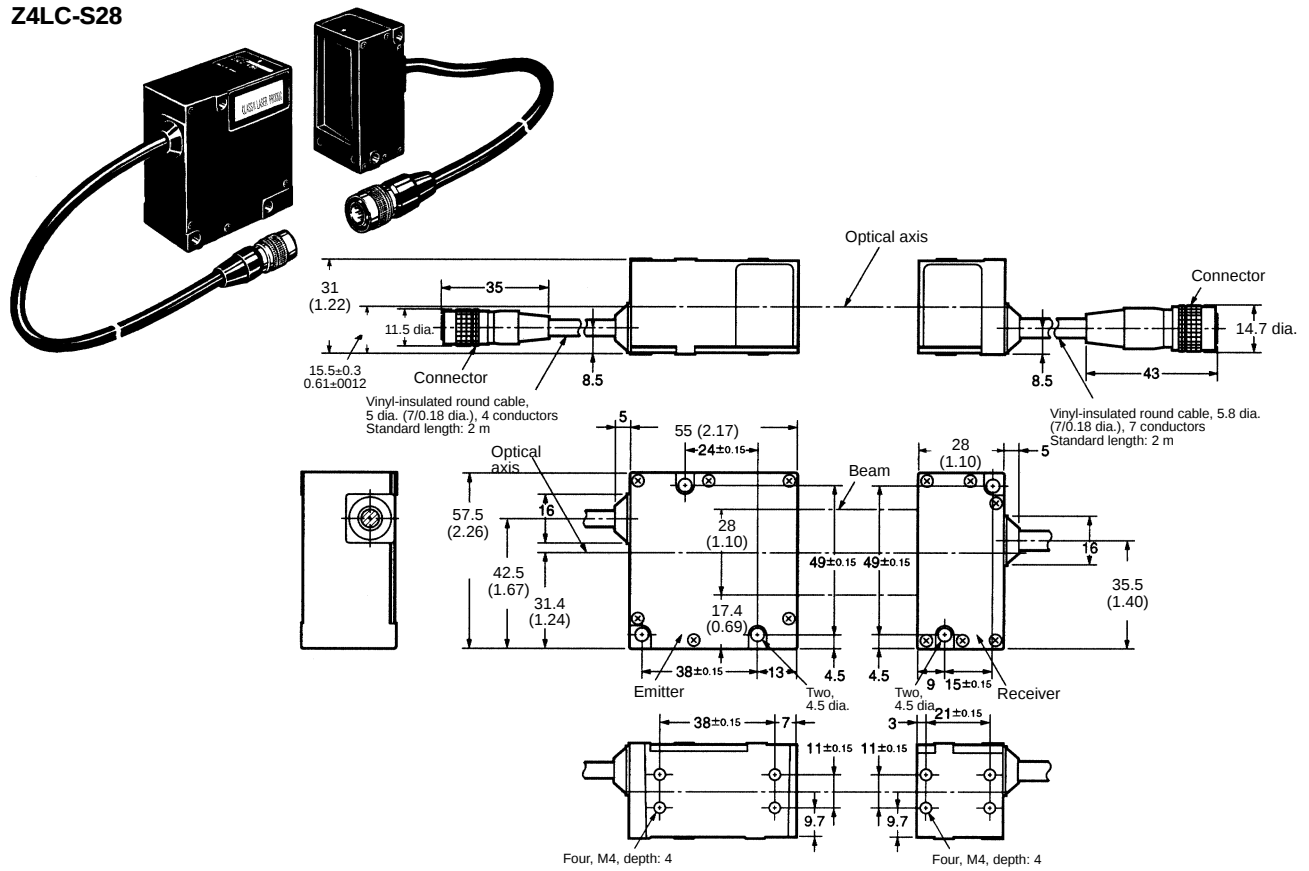
**Z4LC-C28**



**Z4LC-S2840**



**Z4LC-S28**



## Precautions

The Z4LC Parallel Beam Line Sensor, is a Class 1 Laser Product according to EN60825 (IEC825) and JIS C6802 and a Class II Laser Product according to FDA (21 CFR1040.10) (see note). The Z4LC is meant to be built into final system equipment. Pay special attention to the following precautions for the safe use of the product:

**Note:** Europe: Class 1 of EN60825: 1991 = IEC825: 1984 & IEC825-A1: 1990  
Japan: Class 1 of JIS C6802: 1991  
U.S.A.: Class II of FDA (21 CFR1040.10)

**CLASS 1 LASER PRODUCT**

- Use this product as specified in this datasheet, or you may be exposed to hazardous laser radiation.
- Be careful not to expose your eyes directly to the laser radiation or indirectly to laser radiation reflected from mirror or shiny surfaces.
- To avoid exposure to hazardous laser radiation, do not displace nor remove the protective housing during operation, maintenance, and any other servicing.
- The user should return the product to OMRON for all repair and servicing.
- When used in other countries, observe the regulations and standards specified by each country.

### ■ LABEL INDICATIONS

EN

**CLASS 1 LASER PRODUCT**

JIS

クラス1レーザー製品

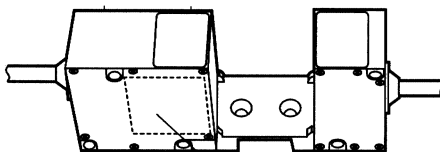
FDA

Certification and Identification Label

TYPE Z4LC-S28  
(T<sub>c</sub> = 25°C, 16 μW)  
T: 3260 μsec ts: 990 μsec f: 0.306 KHz  
This product complies with 21 CFR 1040.10 and 1040.11  
OMRON Corporation  
KARASUMA NANAJI, SHIMOGYO-KU, KYOTO, 600 JAPAN  
MANUFACTURED A

Aperture Label

AVOID  
EXPOSURE  
Laser  
radiation is  
emitted from  
this aperture



Class II Caution  
Label Logo Type



**Note:** Use of controls, adjustments, or procedures other than those specified herein may result in hazardous radiation exposure.

### ■ MEASUREMENT ACCURACY

To improve the measurement accuracy, place the sensing object as close as possible to the receiver.

### ■ COMPATIBILITY

The Sensor or Controller can be used with another controller or sensor. However, the emitter and receiver are adjusted as a set. When setting up the Sensor, be sure to set the binary level before operation.

### ■ MAINTENANCE

Install the Sensor in clean environment and keep the filter on the front panel of the Sensor free from oil and dust. If affected by oil or dust, clean the filter as follows.

Use a blower brush (used to clean camera lenses) to blow large dust particles from the surface. Do not blow the dust away with your mouth.

Use a soft cloth (for lenses) with a little alcohol to remove the remaining dust. Do not use a scrubbing action when cleaning as scratches on the filter could result in a Sensor malfunction.

### ■ ENVIRONMENT

Do not use in strong electromagnetic fields or in an environment where the operation of the Sensor is subject to the reflection of intensive light (such as other laser beams or electric arc welding machine).

The Sensor may not detect the object or the resolution may be insufficient depending on the material or shape of objects. (i.e. transparent objects, etc.)

### ■ MUTUAL INTERFERENCE

Sensors can be closely mounted. Do not, however, make each laser beam closer, or the Sensors may malfunction.

### ■ APPROPRIATE USE

The user must operate the product according to the performance specifications described in the instruction manual.

Before using the product under conditions which are not described in the manual or applying the product to nuclear control systems, railroad systems, aviation systems vehicles, combustion systems, medical equipment, amusement machines, safety environment, and other systems, machines, and equipment that may have a serious influence on lives and property if used improperly, consult your OMRON representative.

Make sure that the ratings and performance characteristics of the product are sufficient to the systems, machines, and equipment, and be sure to provide the systems, machines, and equipment with double safety mechanisms.

## ■ WIRING

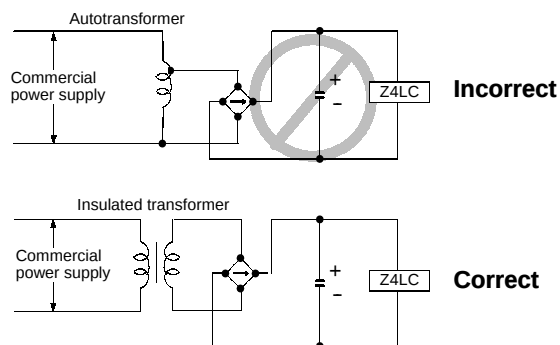
Do not impose voltage exceeding the rated voltage, or the Sensor may be broken.

Do not short-circuit the load supplied with open collector output, or the Sensor may be damaged.

Do not lay power supply cable for the Z4LC together with high-voltage lines or power lines to prevent interference, damage, or malfunction.

A Z49-C6 Extension Cable (2 or 8 m long) can be connected to the sensor cable or amplifier cable. The total length of the sensor cables or amplifier cables, however, must be 10 m or less. Use a shielded cable to extend the amplifier cable, in which case the same kind of shielded cable as that of the amplifier cable must be used.

Use an insulated transformer for the power supply of the Z4LC as shown in the illustration. Do not use an autotransformer or the Z4LC may malfunction.



**Note:** The product has been produced at OMRON Ayabe which obtained ISO9001-approval for its quality system and ISO14001-approval for its environmental management system from international certification bodies.

**NOTE: DIMENSIONS SHOWN ARE IN MILLIMETERS. To convert millimeters to inches divide by 25.4.**

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