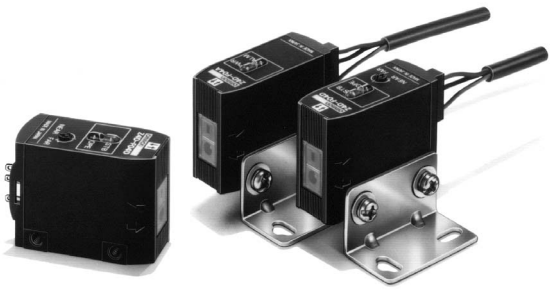
OMRON

Micro Displacement Sensor | Z4D-F

Compact, High-performance Micro Displacement Sensor

- Meets various needs with high performance at the resolution of 5 μm.
- Numerous applications are possible when the analog output model is integrated with OMRON's K3TX Intelligent Signal Processors.
- ON/OFF output model (NPN open collector) is available.



ISO 9001 Approved
OMRON Corporation, Ayabe Factory, Sensing Components and Systems

Ordering Information

■ Z4D-F

Output	Model
Analog	Z4D-F04A
ON/OFF	Z4D-F04D

■ Accessories (Attached)

Item	Z4D-F04A	Z4D-F04D
Mounting bracket	1 pc.	1 pc.
Mounting screws (M3 x 2)	2 pcs.	2 pcs.
Connector with 1-m cord	1 pc.	1 pc.
Screwdriver	---	1 pc.
Operation Manual	1 copy	1 copy

Specifications

■ Ratings/Characteristics

Item	Z4D-F04A	Z4D-F04D
Supply voltage	12 to 24 VDC±10%, ripple voltage (p-p): 10 mV max.	
Current consumption	35 mA max.	
Sensing range (see note 1)	4±1.25 mm	
Light source	Red LED with a wavelength of 700 nm	
Spot diameter (see note 2)	1.5 x 1.5 mm max. (at the sensing range of 4 mm)	
Connection impedance (see note 3)	200 kΩ min.	---
Resolution (see note 4)	5 μm max.	---
Hysteresis (see note 1)	---	40 μm
Linearity (see note 5)	±1% FS	---
Analog output (see note 1)	1 to 5 V (1.6 V/mm±10%)	---
Control output	---	NPN open collector, 12 to 24 VDC, 50 mA max.
Residual output voltage	---	1 V max.
Response time (see note 6)	5 ms max.	1.5 ms max.
Temperature influence (see note 7)	0.15% FS/°C	---
Indicator	PWR indicator (green): Lit when power is supplied ALM indicator (red): Lit when illumination is insufficient.	STB indicator (green): Lit when illumination is sufficient. OPE indicator (orange): Lit when output is ON.
Ambient temperature	Operating: –10°C to 55°C (with no icing) Storage: –15°C to 60°C (with no icing)	
Ambient humidity	Operating: 35% to 85% (with no icing)	
Ambient illumination	Operating: 3000 ℓx max. (incandescent lamp), 10,000 ℓx max. (sunlight)	
Enclosure rating	IP50 (IEC standard)	
Vibration resistance	Destruction: 10 to 500 Hz (1-mm max. single amplitude) for 11 min for 3 times each in X, Y, and Z directions	
Shock resistance	Destruction: 500 m/s^2 for 3 times each in X, Y, and Z directions (total of 18 times)	
Dielectric strength	1,000 VAC for 1 min between current carry parts and case	
Tightening torque	0.6 N • m max.	
Material	ABS (Polycarbonate for the sensing part)	
Weight	Approx. 10 g (without connector cable)	
Insulation resistance	20 MΩ min. (at 500 VDC)	
Cable length	1 m	

Note: 1. The values are for N8.5 Munsell paper.

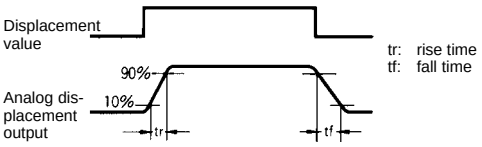
2. The spot diameter is defined by $1/e^2$ of the Sensor's laser beam center. Although a sub-beam may be observed around the main beam, this does not mean that the product is defective.

3. Refers to input impedance of a device to be connected.

4. **Resolution (Z4D-F04A)**
The resolution is the peak-to-peak displacement conversion value of the analog displacement output (Conditions: N8.5 Munsell mat paper at the center of measurement point with a power ripple noise of 10 mV (p-p) max.)

5. The value is the peak-to-peak error rate of a displacement output voltage line with N8.5 Munsell mat paper. The value varies with the sensing object.

6. **Response Time (Z4D-F04A)**
   The response time of the Sensor (Z4D-F04A) is the time required for the analog displacement output to increase from 10% to 90% of the full value (at the rise time) or decrease from 90% to 10% of the full value (at the fall time).



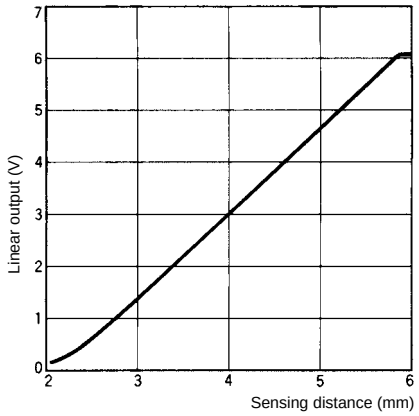
   The response time of the Sensor (Z4D-F04D): ON/OFF switching time
7. The value is at the sensing range of 4 mm.

Engineering Data

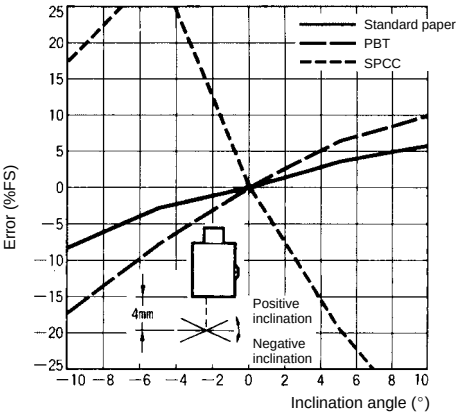
■ Characteristics Data

Analog Output Model (Z4D-F04A)

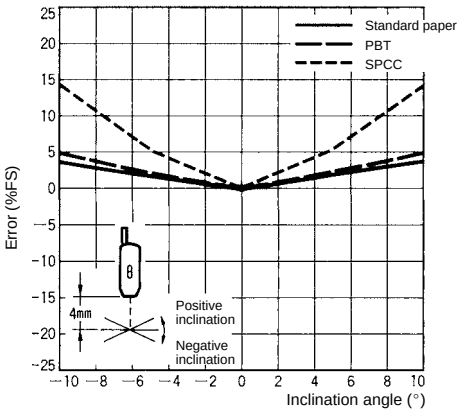
Sensing Distance vs. Analog Output Characteristics (Typical)



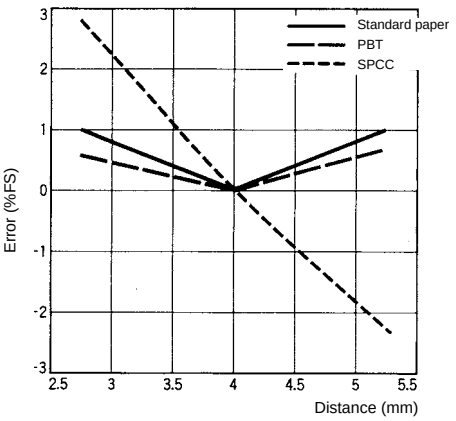
Angle Characteristics with Difference in Horizontal Inclination



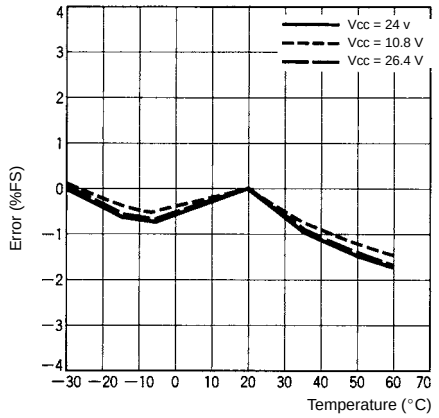
Angle Characteristics with Difference in Vertical Inclination



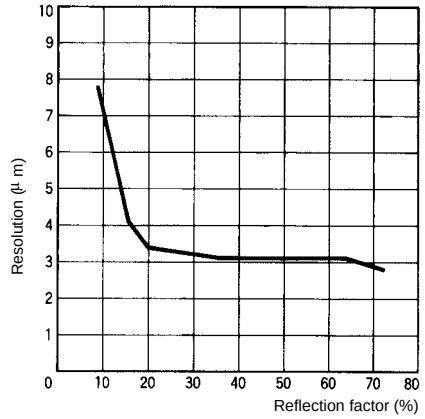
Analog Output Characteristics with Difference in Sensing Object



Temperature Characteristics

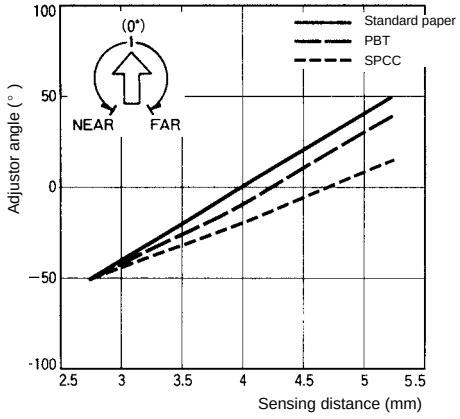


Resolution Characteristics with Difference in Reflection Rate



ON/OFF Output Model (Z4D-F04D)

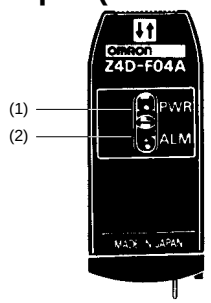
Sensing Distance vs. Adjustor Angle Characteristics



Note: The PBT plastic referred in this data was detected under its natural state.

Nomenclature

■ Analog Output (Z4D-F04A)



(1) Power (PWR) Indicator

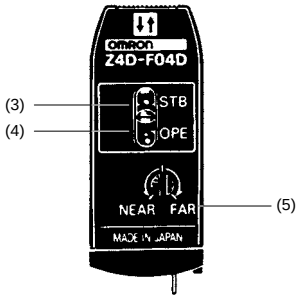
The green PWR indicator is lit when power is properly supplied to the Sensor.

(2) Alarm (ALM) Indicator

The red ALM indicator is lit if there is no sensing object or the reflectivity of the sensing object is low and it is impossible for the Sensor to process the light reflected to the Sensor. The indicator is lit when the amount of light is less than what is required for computation by the Sensor. When the ALM indicator is lit, make necessary adjustments so that the indicator turns OFF.

Appropriate amount of light:	Not lit
Insufficient amount of light:	Lit in red

■ ON/OFF Output (Z4D-F04D)



(3) Stability (STB) Indicator

The green STB indicator is lit when the Sensor is receiving sufficient light to process. If the indicator is not lit, adjust the amount of light to turn on the indicator.

(4) Operation (OPE) Indicator

The Sensor is synchronized with the ON/OFF output and the orange OPE indicator is lit when the Sensor has ON output.

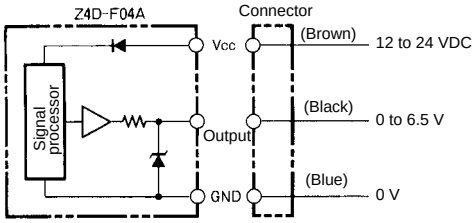
(5) Distance Adjustor

The ON/OFF position can be set with the distance adjustor if a sensing object is at the sensing range (i.e., 4±1.25 mm). The ON/OFF position will shift farther from the Sensor if the distance adjustor is turned clockwise and the ON/OFF position will shift closer to the Sensor if the distance adjustor is turned counterclockwise.

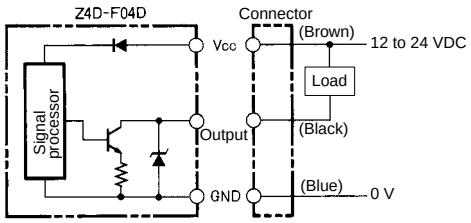
Operation

■ Connections/Output Circuits

Analog Output

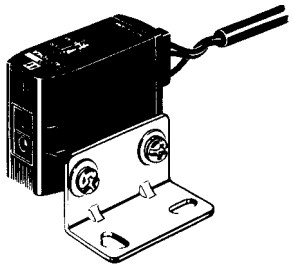


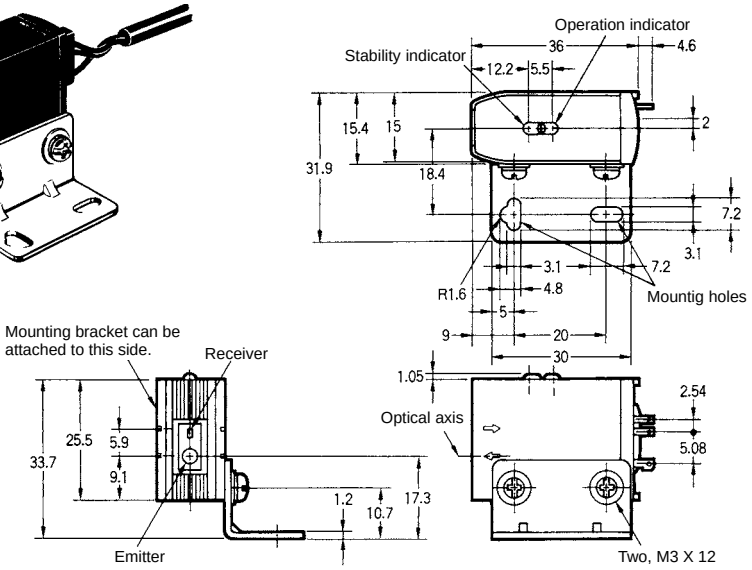
NPN Open Collector Output



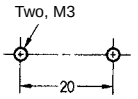
Dimensions

■ Z4D-F04A

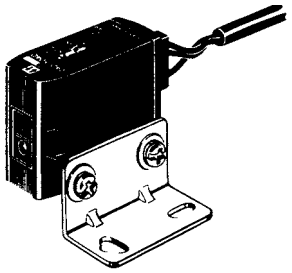


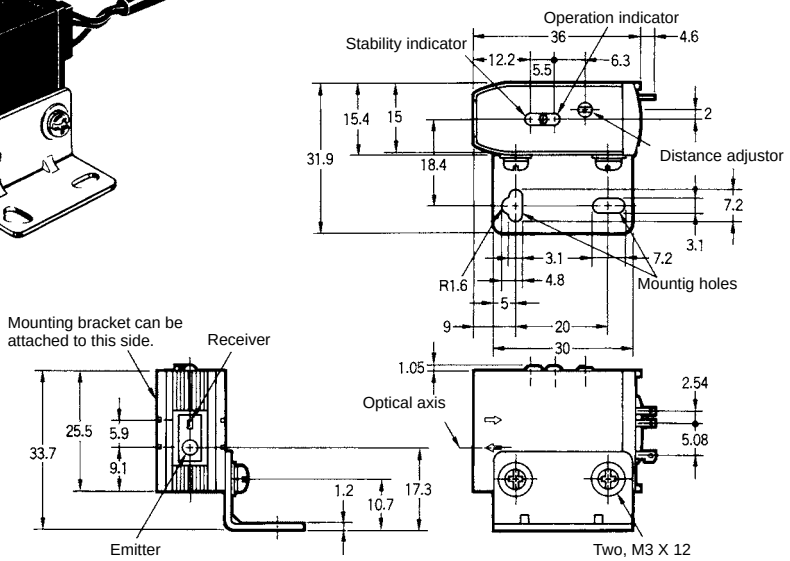


Mounting Holes

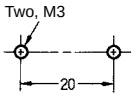


■ Z4D-F04D





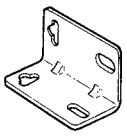
Mounting Holes

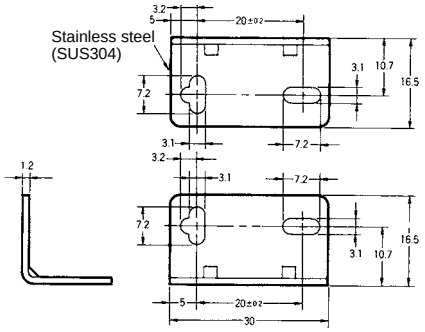


■ Accessories

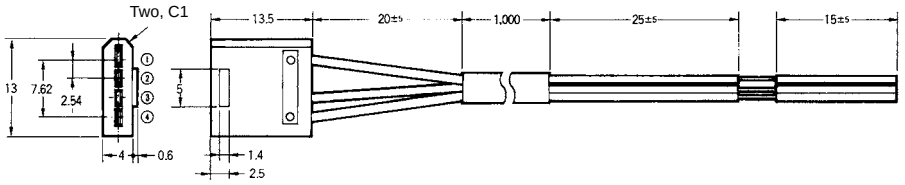
The following products are provided with the Sensors. The products can also be purchased separately.

E39-L69 Mounting Bracket





EE-1010D Connector with 1-m Cord



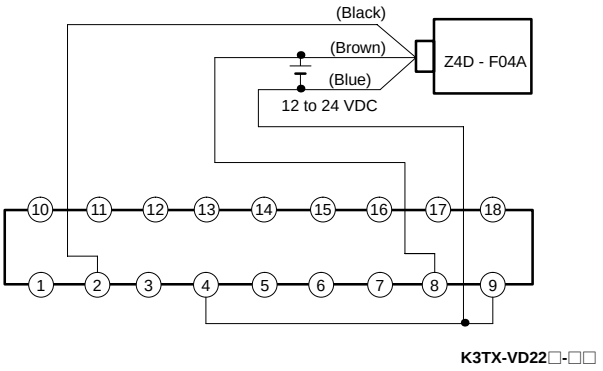
Terminal Arrangement

No.	Designation	Color
1	Vcc	Brown (red)
2	---	---
3	Output	Black (white)
4	GND	Blue (black)

Installation

■ Controller Connections

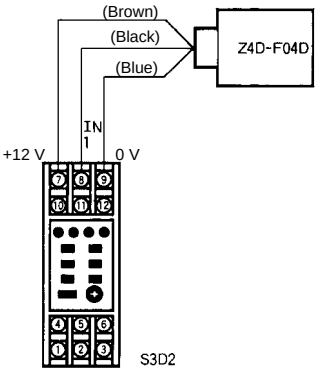
Z4D-F04A and K3TX-VD



K3TX-VD22□-□□

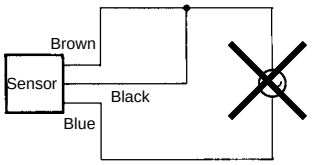
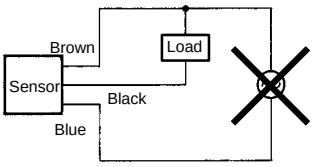
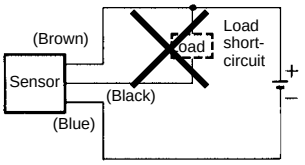
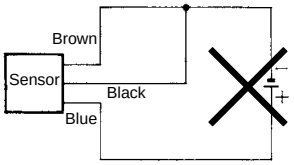
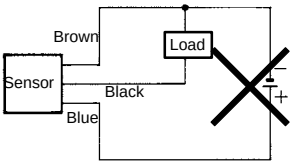
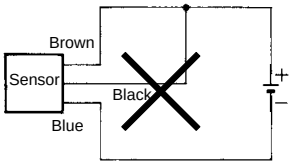
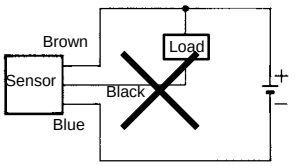
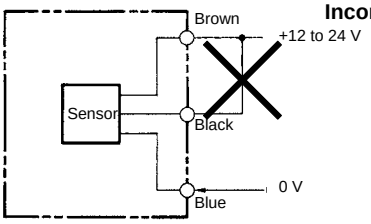
Note:
1. Use a K3TX DC voltage input model.
2. K3TX models are available in various output units. Select the most appropriate K3TX model depending on the application.
3. For details about the K3TX, refer to the *K3TX Datasheet*.
4. The diagram shown here is for a K3TX model with DC power specifications. When using a K3TX with AC power specifications, separate the AC power supply to the K3TX from the DC power supply to the Z4D-F04A.

Z4D-F04D and S3D2



Note: Reverse operation is possible with the signal input selector of the S3D2.

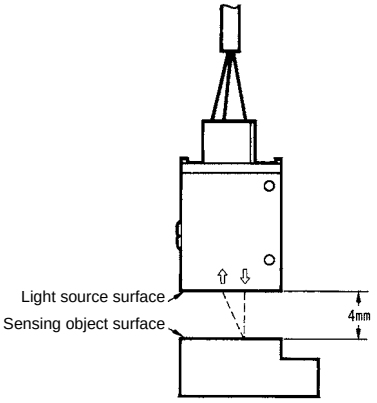
⚠ Caution

Item	Examples
Power supply Do not impose an excessive voltage on the Z4D-F, otherwise it may explode or burn. Do not impose 100 VAC on any Z4D-F model, otherwise it may explode or burn.	**Incorrect**  **Incorrect** 
Load short-circuit Do not short-circuit the load, or the Z4D-F may explode or burn.	**Incorrect** 
Wiring Be sure to wire the Z4D-F correctly and be careful not to connect the polarities incorrectly, otherwise it may explode or burn.	Wrong polarity **Incorrect**  **Incorrect**  Wrong wiring **Incorrect**  **Incorrect** 
Connection with no load If connected to the power supply without any load, internal elements may explode or burn. Make sure to connect a proper load to the Z4D-F.	**Incorrect** 

■ Correct Use

Mounting

Install the Sensor so that the optical axis of the Sensor and the surface of the object meet at right angles (i.e., the panel that incorporates the light source is parallel with the object). For accurate results, it is recommended that the sensing distance is set to the measurement point (4 mm).



Note: As the optical axis will be adjusted later, temporarily fix the Sensor.

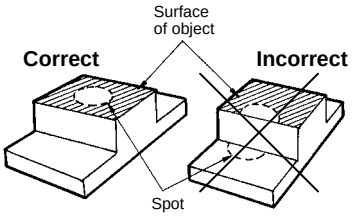
Wiring

Connect the Sensor to the controlling device using an attached sensor cable. Do not switch the power ON during wiring. Refer to the instructions on the Sensor and the connection diagram (page 8) before connecting the Sensor to the controlling device.

Axis Adjustment

When the Sensor power is switched ON, the red transmitter indicator is lit. Move the Sensor so that the red beam (see the figure below) focuses on the object. The entire light beam should be focused on the object or an error will result.

After the optical axis has been adjusted, tighten the mounting screws firmly.

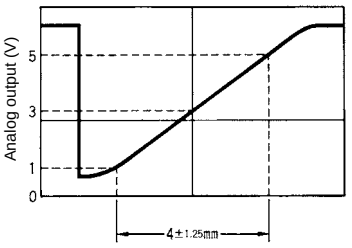


Z4D-F04A

Analog Output

The Z4D-04A has an output of 3 V if a sensing object is located at the standard distance (i.e., 4±0.3 mm). The output decreases if the sensing object is closer to the Sensor and the output increases if the sensing object is farther from the Sensor. The output changes by 1.6 V±10% if the sensing object moves by 1 mm. The standard upper and lower limits of the output are 6.5 and 0 V respectively. If there is no sensing object or the reflectivity of the sensing object is low and no light is reflected to the Sensor, the analog output will output the standard upper limit.

Analog Output Diagram

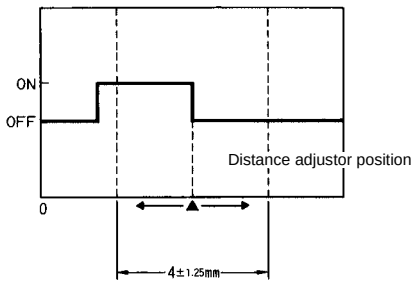


Z4D-F04D

ON/OFF Output Diagram

The ON/OFF position can be set with the distance adjustor if a sensing object is at the sensing range (i.e., 4±1.25 mm). The ON/OFF position will shift farther from the Sensor if the distance adjustor is turned clockwise and the ON/OFF position will shift closer to the Sensor if the distance adjustor is turned counterclockwise.

If there no sensing object is present or if the reflectivity from a sensing object is too small to reach the Sensor, the output will turn OFF.



Precautions

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

1. 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.
2. Use a soft cloth (for lenses) with a little alcohol to remove the remaining dust.
   Do not use a scrubbing action when cleaning as a scratch on the filter could result in the Sensor malfunctioning.

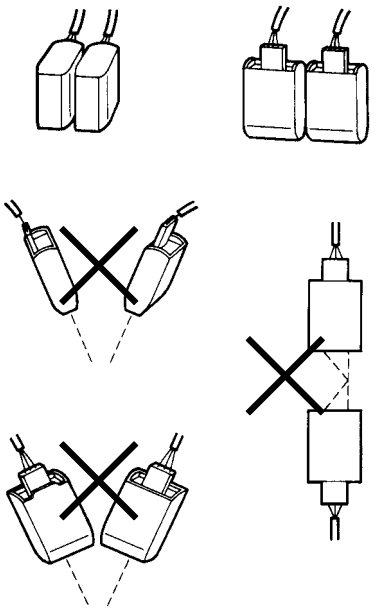
Connector

When removing the connector from the Sensor, be sure to hold the connector and pull it together with the attached cable.

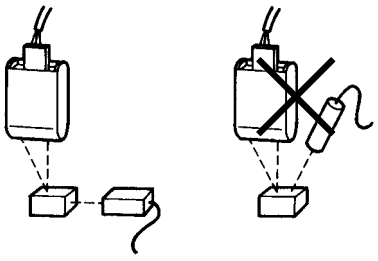
If pulled by the cable alone, it will damage the lock mechanism inside the connector.

Interference

Z4D-F04A/D Micro Displacement Sensors can be installed within close proximity to each other and operate independently without interference (refer to the figures below). However, if they are installed at an oblique angle to each other, interference may result.



When using the Micro Displacement Sensor in combination with another type of Sensor (such as a Photoelectric Sensor), the sensor beams should be as close to perpendicular as possible.



Environment

Refrain from using the Micro Displacement Sensor in a strong electromagnetic field or in an environment where the operation of the Sensor is subject to the reflection of intensive light (such as a laser beam or an electric arc welding machine).

The Displacement Microensor cannot accurately sense a mirror-like object, a transparent object, one with an extremely small reflection ratio, an object smaller than the diameter of the Sensor's sensing spot, or an inclined object.

Wiring

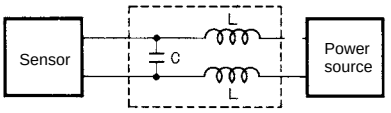
The power supply cable for the Z 4D-F04A/D should not be wired with high-voltage lines or power lines in order to avoid interference, damage, or malfunction.

Do not solder wires to the Sensor connector, otherwise the Sensor may malfunction.

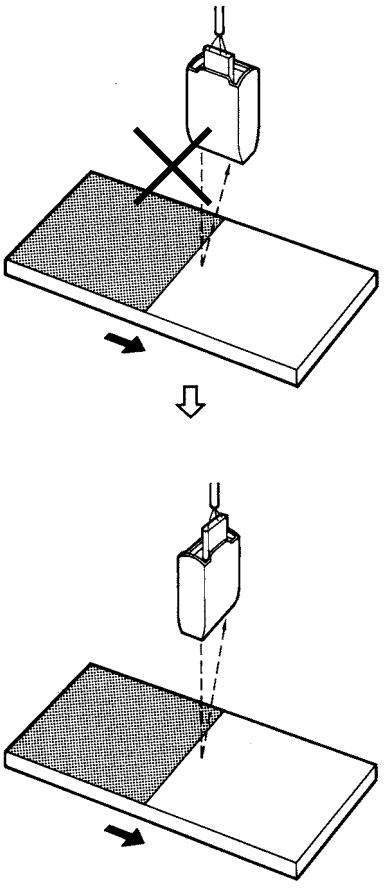
Others

Do not use switching power supplies that generate excessive noise, which may cause sensing errors.

The following LC filter effectively reduces noise.



The Sensor cannot sense an object accurately if the surface of the object consists of different materials placed next to each other (refer to the figures below). In such a case install the Sensor so that the boundaries of the materials and the Sensor are parallel.



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