


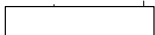


Compact Displacement Sensor with 1.5-micron Resolution Using a Separate Amplifier for In-line Measurement

- New models with ease-to-use visible light.
- Emitter with minimal temperature drift incorporated with an aspherical glass lens.
- Assures a resolution of 1.5 μm with a response speed of 60 ms when sensing white ceramic. A high-speed response model (Z4M-W40RA/-W40 with a response speed of 0.15 ms) and a wide range model (Z4M-W100RA/-W100 with a range of 100 \pm 40 mm) are available.
- Incorporates easy-to-use range indicators.
- Automatic sensitivity selector minimizes sensing errors caused by the difference in object color.
- Incorporates laser OFF input and enable output.
- Amplifier can be DIN-track mounted.
- Connection to the Z49-SF2 Laser Safety Kit possible (sold separately, refer to page 22).



Ordering Information

Sensor	Sensing distance	Resolution	Model
With visible-light	40 \pm 10 mm 	3 μm (60 ms) 20 μm (2 ms) 80 μm (0.15 ms)	Z4M-W40RA
	100 \pm 40 mm 	16 μm (500 ms) 60 μm (20 ms) 300 μm (0.7 ms)	Z4M-W100RA
With invisible-light	40 \pm 10 mm 	1.5 μm (60 ms) 10 μm (2 ms) 40 μm (0.15 ms)	Z4M-W40
	100 \pm 40 mm 	8 μm (500 ms) 30 μm (20 ms) 150 μm (0.7 ms)	Z4M-W100

■ Accessories (Order Separately)

Extension Cable

Model	Z49-C1
Cable length	3m, 8m


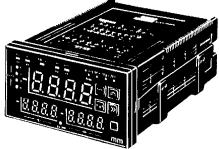
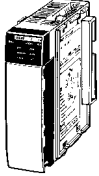
Note: Designate the length of the cable when ordering.

Laser Safety Kit

Model	Z49-SF2
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■ Selecting a Controller

To display the linear output of the Z4M or use the Z4M for discriminating operation purposes, use the Z4M with one of the following products.

Unit				
Name	Intelligent Signal Processor	Intelligent Signal Processor	Intelligent Signal Processor	Linear Sensor Interface Unit
Model	K3NX-VD□□-□□	K3NX-AD□□-□□	K3TS-SD□□□□-□□	CQM1-LSE01/02
Features	High-precision Intelligent Signal Processor with an operational error of $\pm 0.1\%$. Five-level discrimination. Scaling function and forced zero function incorporated.	$\pm 0.1\%$ rdg ± 1 digit max. Five-level discrimination. Scaling function and forced zero function incorporated.	High-speed sampling of 1.04 ms. Two-input operation. Forced zero function and other versatile functions incorporated.	High-speed sampling of 1 ms (0.3 ms for timing input) without a CQM1 program.

■ K3NX (5-digit) Process Meter

Model Number Legend:

Base Units and Output Boards can be ordered individually or as sets.

Base Units

K3NX -
1 2 3 4



Output Boards

K31 -
5 6 7 8

Base Units with Output Boards

K3NX - -
1 2 3 4 5 6 7 8

Base Units

Model	Input type	Supply voltage	
		100 to 240 VAC	12 to 24 VDC
Basic Models These models provide a present value LED and front-panel control keys. Can be connected to any Output Board, or can be used for display only without an Output Board. 	DC voltage	K3NX-VD1A	K3NX-VD2A
	DC current	K3NX-AD1A	K3NX-AD2A
Set Value LED Models These models provide a present value LED, set value LED, and front-panel control keys. Can be connected to Relay, Transistor, or Combination Output Boards. 	DC voltage	K3NX-VD1C	K3NX-VD2C
	DC current	K3NX-AD1C	K3NX-AD2C

Available Output Board Combinations

Output type	Output configuration	Output boards	Base units	
			Basic	Set Value LED Display
Relay contact	3 outputs: H, PASS, L (SPDT)	K31-C1	Yes	Yes
	5 outputs: HH, H, L, LL (SPST-NO), and PASS (SPDT)	K31-C2	Yes	Yes
	5 outputs: HH, H, L, LL (SPST-NC), and PASS (SPDT)	K31-C5	Yes	Yes
Transistor	5 outputs (NPN open collector)	K31-T1	Yes	Yes
	5 outputs (PNP open collector)	K31-T2	Yes	Yes
BCD (see note)	5-digit output (NPN open collector)	K31-B2	Yes	---
Linear	4 to 20 mA DC	K31-L1	Yes	---
	1 to 5 VDC	K31-L2	Yes	---
	1 mV/10 digits	K31-L3	Yes	---
	0 to 5 VDC	K31-L7	Yes	---
	0 to 10 VDC	K31-L8	Yes	---
Communication boards (see note)	RS-232C	K31-FLK1	Yes	---
	RS-485	K31-FLK2	Yes	---
	RS-422	K31-FLK3	Yes	---
Combination output and communication boards	BCD output + 5 transistor outputs (NPN open collector)	K31-B4	Yes	Yes
	4 to 20 mA + 5 transistor outputs (NPN open collector)	K31-L4	Yes	Yes
	1 to 5 V + 5 transistor outputs (NPN open collector)	K31-L5	Yes	Yes
	1 mV/10 digits + 5 transistor outputs (NPN open collector)	K31-L6	Yes	Yes
	0 to 5 VDC + 5 transistor outputs (NPN open collector)	K31-L9	Yes	Yes
	0 to 10 VDC + 5 transistor outputs (NPN open collector)	K31-L10	Yes	Yes
	RS-232C + 5 transistor outputs (NPN open collector)	K31-FLK4	Yes	Yes
	RS-485 + 5 transistor outputs (NPN open collector)	K31-FLK5	Yes	Yes
	RS-422 + 5 transistor outputs (NPN open collector)	K31-FLK6	Yes	Yes

Note: For details, refer to the *Communication Operation Manual*.

■ K3TS Intelligent Signal Processors

Model Number Legend:

Base Units and Output Boards can be ordered individually or as sets.

Base Units

K3TS -
 1 2 3 4 5



Output Boards

K31 -
 6 7

Base Units with Output Boards

K3TS - -
 1 2 3 4 5 6 7

Base Unit

Model		Supply voltage	
		100 to 240 VAC	12 to 24 VDC
Set Value LED Models These models provide a present value LED, set value LED, and front-panel control keys. Can be connected to Relay, Transistor, or Combination Output Boards. 	Standard	K3TS-SD11B	K3TS-SD12B
	Forced zero RAM	K3TS-SD21B	---
	Display shift function	K3TS-SD31B	---
Thumbwheel Switches Models These models provide a present value LED, thumbwheel switches for the set value, and front-panel control keys. Can be connected to K31-C1, K31-T1, K31-T2, and K31-B4 Output Boards. 	Standard	K3TS-SD11D	K3TS-SD12D

Available Output Board Combinations

Output type	Output configuration	Output boards	Base units	
			Set value LED Display	Thumbwheel Switches
Relay contact	3 outputs: H, PASS, L (SPDT)	K31-C1	Yes	Yes
	5 outputs: HH, H, L, LL (SPST-NO), and PASS (SPDT)	K31-C2	Yes	---
	5 outputs: HH, H, L, LL (SPST-NC), and PASS (SPDT)	K31-C5	Yes	---
Transistor	5 outputs (NPN open collector)	K31-T1	Yes	Yes**
	5 outputs (PNP open collector)	K31-T2	Yes	Yes**
BCD*	4-digit output (NPN open collector)	K31-B2	---	---
Linear	4 to 20 mA DC	K31-L1	---	---
	1 to 5 VDC	K31-L2	---	---
	1 mV/digit	K31-L3	---	---
	0 to 5 VDC	K31-L7***	---	---
	0 to 10 VDC	K31-L8***	---	---
Communication boards*	RS-232C	K31-S1	---	---
	RS-485	K31-S2	---	---
	RS-422	K31-S3	---	---
Combination output and communication boards	BCD output + 5 transistor outputs (NPN open collector)	K31-B4***	Yes	Yes**
	4 to 20 mA + 5 transistor outputs (NPN open collector)	K31-L4***	Yes	---
	1 to 5 V + 5 transistor outputs (NPN open collector)	K31-L5***	Yes	---
	1 mV/digit + 5 transistor outputs (NPN open collector)	K31-L6***	Yes	---
	0 to 5 VDC + 5 transistor outputs (NPN open collector)	K31-L9***	Yes	---
	0 to 10 VDC + 5 transistor outputs (NPN open collector)	K31-L10***	Yes	---
	RS-485 + 5 transistor outputs (NPN open collector)	K31-S5***	Yes	---
	RS-422 + 5 transistor outputs (NPN open collector)	K31-S6***	Yes	---

*For details, refer to *K3TS Communication Output-type Intelligent Signal Processor Operation Manual*.

**Only H, PASS, and L outputs are available as transistor outputs on Thumbwheel Switches Models.

*** Special specifications

■ Linear Sensor Interface Units

Model	Analog input	Analog output	Type
CQM1-LSE01	1 point	---	Standard
CQM1-LSE02	1 point	1 point	With monitor output

Specifications

■ Ratings

Item	Z4M-W40RA	Z4M-W100RA	Z4M-W40	Z4M-W100
Measurement range	±10 mm	±40 mm	±10 mm	±40 mm
Measurement point	40 mm	100 mm	40 mm	100 mm
Offset adjustment range	±10 mm	±40 mm	±10 mm	±40 mm
Span adjustment range	0.8 mA/mm ±10%	0.2 mA/mm ±10%	0.4 V/mm ±30%	0.1 V/mm ±30%
Light source	Visible-light semiconductor lasers with a wavelength of 670 nm and an output of 1.2 mW max.; class 2 (IEC), class II (FDA)		Infrared semiconductor laser with a wavelength of 780 nm and an output of 3 mW max., class 3B (IEC), class IIIb (FDA)	
Spot diameter (see note 2)	1 mm dia. max. (at measurement point)	1 x 2 mm max. (at measurement point)	1 mm dia. max. (at measurement point)	1 x 2 mm max. (at measurement point)
Resolution (see note 3)	3 μm (60 ms), 20 μm (2 ms), 80 μm (0.15 ms)	16 μm (500 ms), 60 μm (20 ms), 300 μm (0.7 ms)	1.5 μm (60 ms), 10 μm (2 ms), 40 μm (0.15 ms)	8 μm (500 ms), 30 μm (20 ms), 150 μm (0.7 ms)
Linearity (see note 4)	1% FS	1.5% FS	1% FS	1.5% FS
Response time (see note 5)	0.15 ms/2 ms/60 ms switch-selectable	0.7 ms/20 ms/500 ms switch-selectable	0.15 ms/2 ms/60 ms switch-selectable	0.7 ms/20 ms/500 ms switch-selectable
Sensitivity selector	WHITE/BLACK/AUTO switch-selectable			
Temperature characteristics (at measurement point)	Sensor: 0.03% FS/°C max. Amplifier: 0.03% FS/°C max.	Sensor: 0.02% FS/°C max. Amplifier: 0.03% FS/°C max.	Sensor: 0.03% FS/°C max. Amplifier: 0.03% FS/°C max.	Sensor: 0.02% FS/°C max. Amplifier: 0.03% FS/°C max.
Range indicators (sensor and amplifier) also used as laser warning lights (green)	Outside range, abnormal volume of light: NEAR indicator and FAR indicator flash. Near: NEAR indicator is lit. Measurement point: NEAR indicator and FAR indicator are lit. Far: FAR indicator is lit.			
Stability indicator (amplifier)	Stable operating range: Green Possible operating range: Not lit Insufficient or excessive light: Red			
Linear output (see note 6)	4 to 20 mA/30 to 50 mm Permissible load resistance: 0 to 300 Ω	4 to 20 mA/60 to 140 mm Permissible load resistance: 0 to 300 Ω	-4 to 4 V/30 to 50 mm Output impedance: 100 Ω Permissible load resistance: 10 kΩ min.	-4 to 4 V/60 to 140 mm Output impedance: 100 Ω Permissible load resistance: 10 kΩ min.
Enable output	NPN open collector, 50 mA max. at 40 VDC, residual voltage: 1 V max.			
Laser emission OFF input	Short-circuited with the 0-V terminal (residual voltage: 2 V max.): Laser emission is turned off. Open (current leakage: 0.1 mA max.): Laser emission is turned on. Linear output, indicators, and enable output holding function incorporated.			

Note: 1. The FS (full scale) value is calculated as follows:

Example: 1% FS on the Z4M-W40RA

Distance full scale conversion: 20 mm x 0.01 = 0.2 mm

Current full scale conversion: 16 mA x 0.01 = 0.16 mA

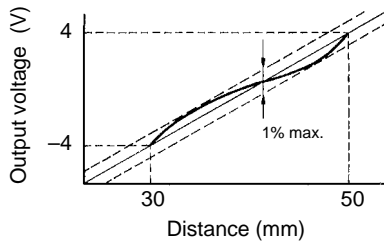
Item	Z4M-W40RA	Z4M-W100RA	Z4M-W40	Z4M-W100
Distance full scale	20 mm	80 mm	20 mm	80 mm
Voltage full scale*	---	---	8 V ±30%	8 V ±30%
Current full scale*	16 mA ±10%	16 mA ±10%	---	---

*The value changes according to the span to be adjusted.

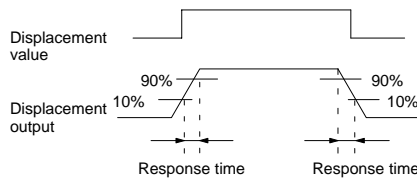
2. The spot diameter is defined by 1/e² (13.5%) of the sensor's laser beam center. There is light leakage outside the defined spot and the environment of the object may influence sensing accuracy. Reduce the influence of the environment as much as possible.

3. Resolution:
The resolution is the peak-to-peak displacement conversion value of the analog output (Condition: white alumina ceramic at the center of measurement point).
4. The linearity of the sensor is checked with a white alumina ceramic object. The peak-to-peak value deviated from the displacement linear output voltage is within the specified range as shown in the graph. The deviation value may vary with the object.

Z4M-W40



5. The response time of the sensor 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). To decrease the error ratio to within 1% at the rise time or at the fall time, the time required will be two or three times as long as the specified value.



6. It is possible to adjust the linear output of the sensor to between -5.2 and 5.2 V or 3.2 to 20.8 mA with span adjustment.

Voltage full scale	-5.2 to 5.2 V
Current full scale	3.2 to 20.8 mA

■ Characteristics

Item	Z4M-W40RA	Z4M-W100RA	Z4M-W40	Z4M-W100
Power supply voltage	12 to 24 VDC \pm 10%, ripple (p-p): 10% max.			
Current consumption	150 mA max.		120 mA max.	
Dielectric strength	Sensor: 1,000 VAC, 50/60 Hz for 1 min Amplifier: 300 VAC, 50/60 Hz for 1 min			
Vibration resistance	10 to 55 Hz (1.5-mm double amplitude) for 32 min each in X, Y, and Z directions			
Shock resistance	300 m/s ² (30G) for 3 times each in \pm X, Y, and Z directions			
Ambient temperature	Operating: 0°C to 40°C (with no icing)		Operating: 0°C to 50°C (with no icing)	
Ambient humidity	Operating: 35% to 85% (with no condensation)			
Ambient illuminance	Operating: 3,000 lx max. (incandescent lamp)			
Weight	Sensor: Approx. 180 g (with 2-m cable), approx. 50 g (excluding the cable) Amplifier: Approx. 200 g (with 2-m cable)			
Material	Sensor: Aluminum diecast Amplifier: ABS			
Degree of protection	IEC60529 IP40			
Attachments	Flat-blade screwdriver for sensor adjustment, FDA Caution Label			

Z49-SF2

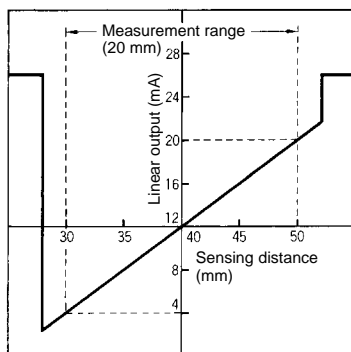
Item	Z49-SF2
Power supply voltage	12 to 24 VDC \pm 10%, ripple (p-p): 10% max.
Current consumption	10 mA max. (excluding the current consumption of the sensor)
Indicator	Green laser warning light (power indicator)
Insulation resistance	20 M Ω (at 500 VDC)
Dielectric strength	1,000 VAC, 50/60 Hz for 1 min
Vibration resistance	10 to 55 Hz (1.5-mm double amplitude) for 32 min each in X, Y, and Z directions
Shock resistance	300 m/s ² (30G) for 3 times each in \pm X, Y, and Z directions
Ambient temperature	Operating: 0°C to 50°C (with no icing) Storage: -15°C to 60°C (with no icing)
Ambient humidity	Operating: 35% to 85% (with no condensation)
Weight	Approx. 200 g (with cable)
Cable length	2 m
Material	Case: ABS, Beam cover: SUS
Degree of protection	IEC60529 IP40
Attachments	One beam cover; one laser emission warning seal

Note: The Z4M-W40 or Z4M-W100 Sensors with invisible light can be combined with the Safety Kit to easily meet the safety standards in JIS C6802 and the legal requirements of the Japanese Labor Safety and Sanitation Act. Visible-light Sensors are not required.

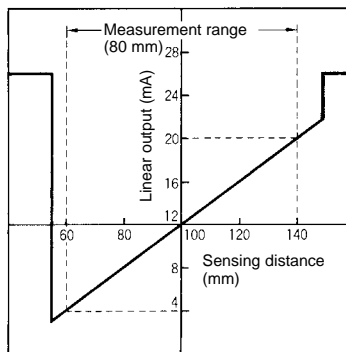
Engineering Data

■ Linear Output vs. Sensing Distance

Z4M-W40RA

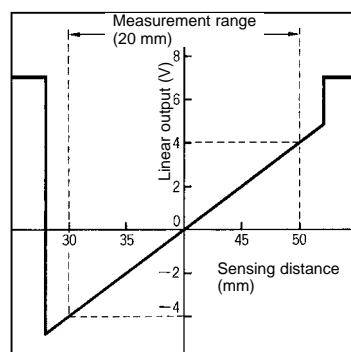


Z4M-W100RA

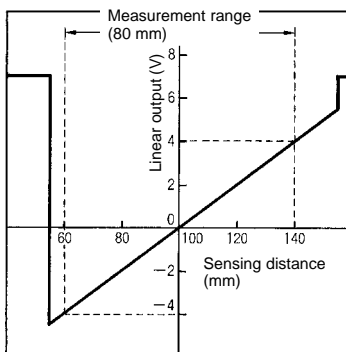


Note: The linear output of the sensor is locked between 21 and 26 mA when the object is outside the measurement range or when the enable output is OFF. It is also locked between 21 and 26 mA for 3 to 10 s after the sensor is turned on, at which time no laser beam is turned on.

Z4M-W40



Z4M-W100

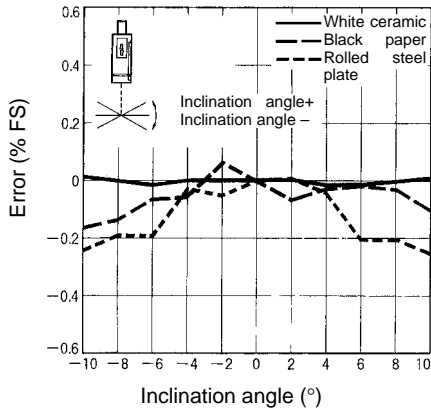


Note: The linear output of the sensor is locked between 6 and 8 V when the object is outside the measurement range or when the enable output is OFF. It is also locked between 6 and 8 V for 3 to 10 s after the sensor is turned on, at which time no laser beam is turned on.

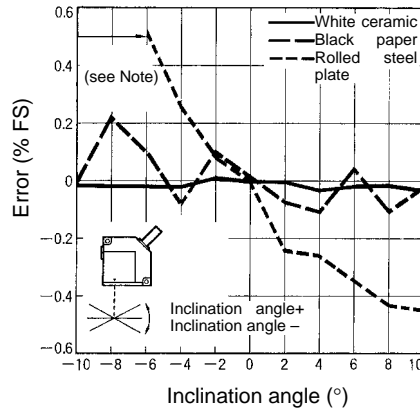
■ Angle Characteristics (Typical Example)

The angle characteristics are obtained by detecting an object with different angles of inclination at the measurement point and plotting the linear output error resulting from each operation.

Z4M-W40RA/-W40
Inclined Object

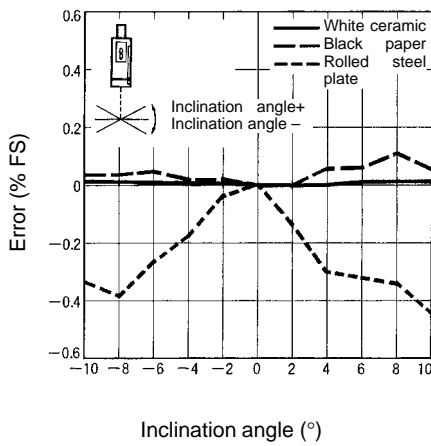


Obliquely Positioned Object

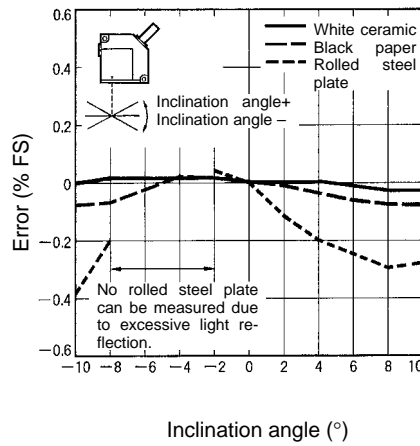


Note: No rolled steel plate can be measured due to excessive light reflection.

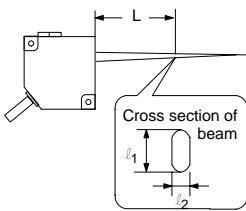
Z4M-W100RA/-W100
Inclined Object



Obliquely Positioned Object



■ Spot Diameter (Typical Example)



Z4M-W40RA/-W40

L	30 mm	40 mm	50 mm
ϕ_1	1.2 mm	0.6 mm	0.2 mm
ϕ_2	0.6 mm	0.3 mm	0.1 mm

Z4M-W100RA/-W100

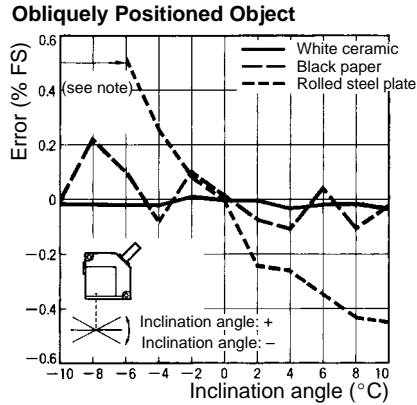
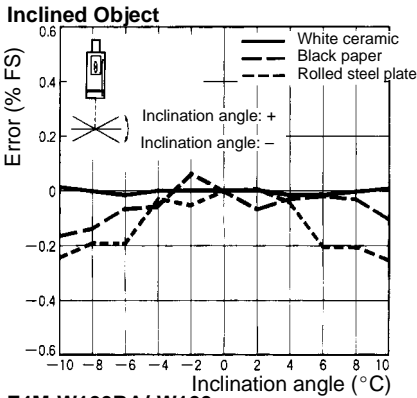
L	60 mm	100 mm	140 mm
ϕ_1	2 mm	1.4 mm	0.7 mm
ϕ_2	1 mm	0.7 mm	0.4 mm

Note: Defined by $1/e^2$ (13.5%) of the sensor's laser beam center.

■ Linearity vs. Sensing Objects (Typical Example)

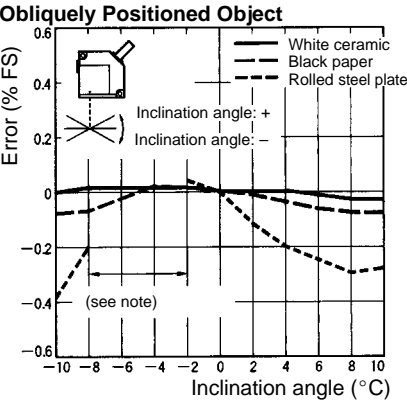
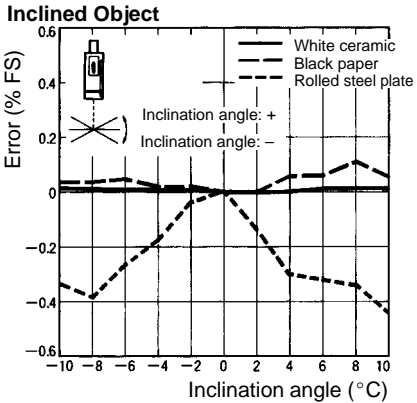
Linearity characteristic curves are obtained by detecting an object at different positions within the measurement range and plotting the linear output error resulting from each operation.

Z4M-W40RA/-W40

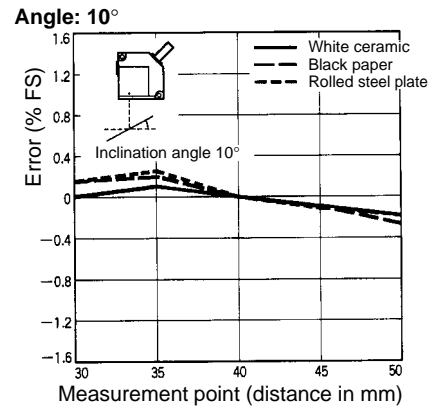
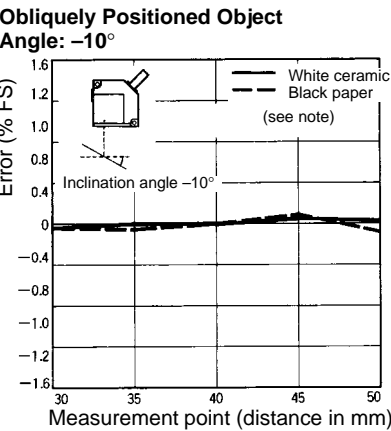
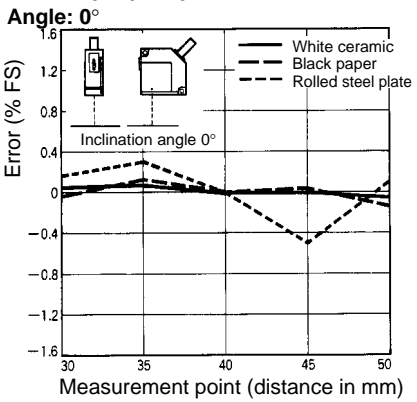


Note: No rolled steel plate can be measured due to excessive light reflection.

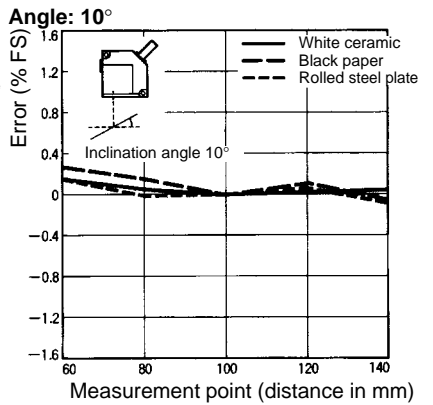
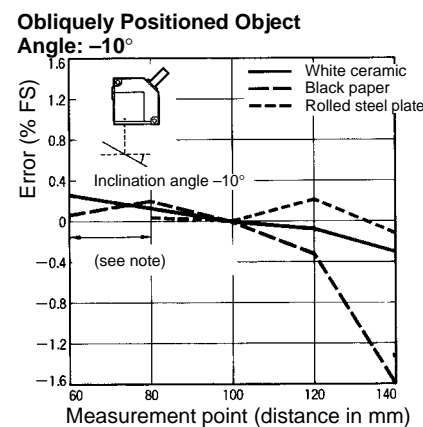
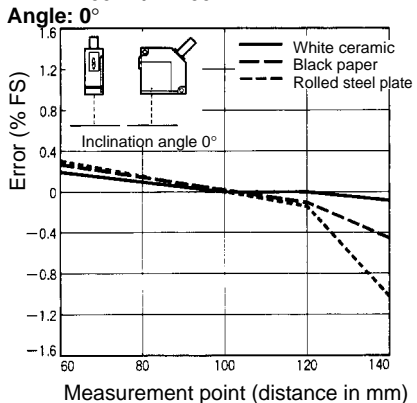
Z4M-W100RA/-W100



Z4M-W40RA/-W40



Z4M-W100RA/-W100



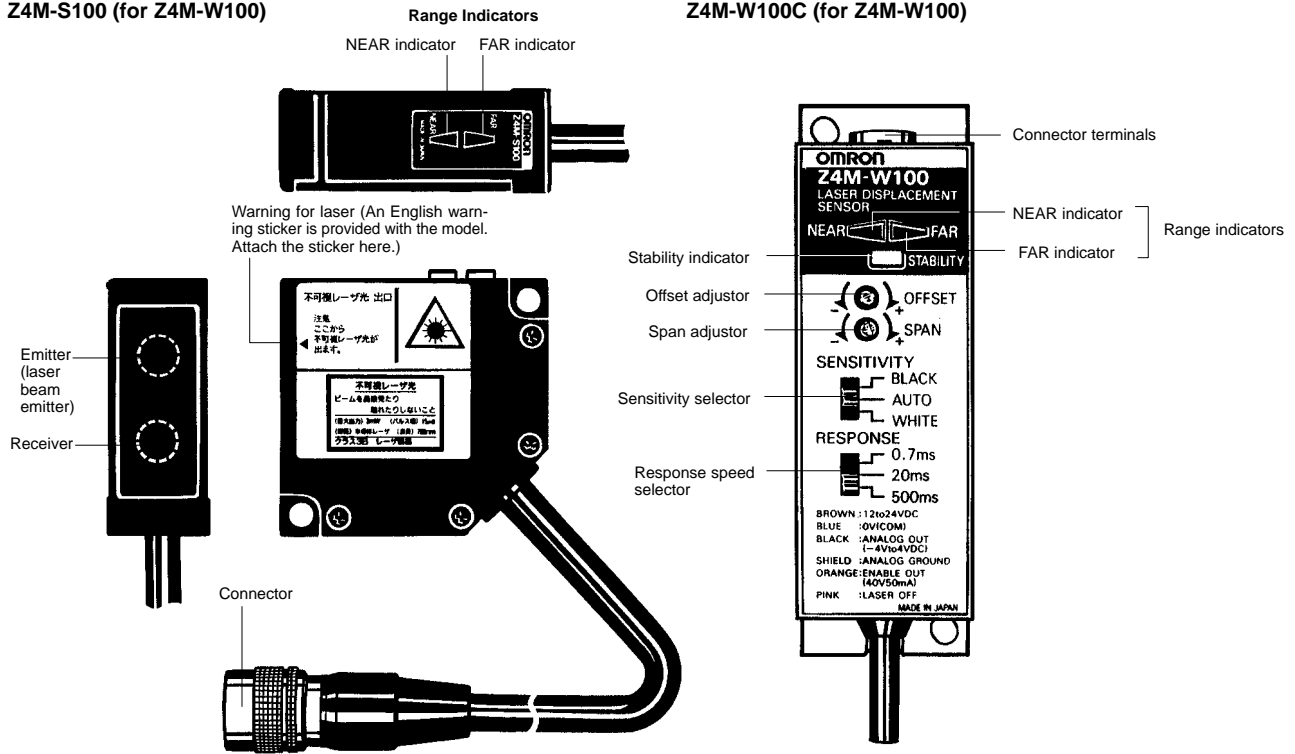
Nomenclature

Sensor

- Z4M-S40R (for Z4M-W40RA)
- Z4M-S100R (for Z4M-W100RA)
- Z4M-S40 (for Z4M-W40)
- Z4M-S100 (for Z4M-W100)

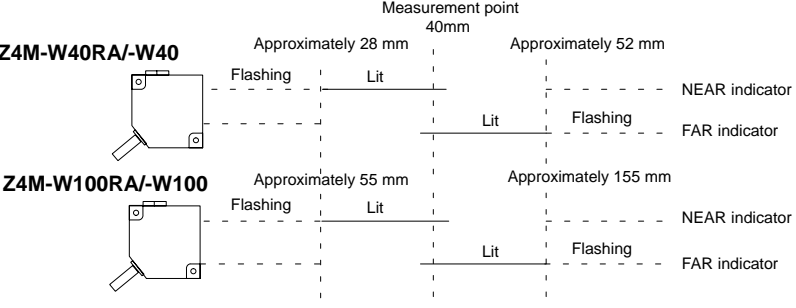
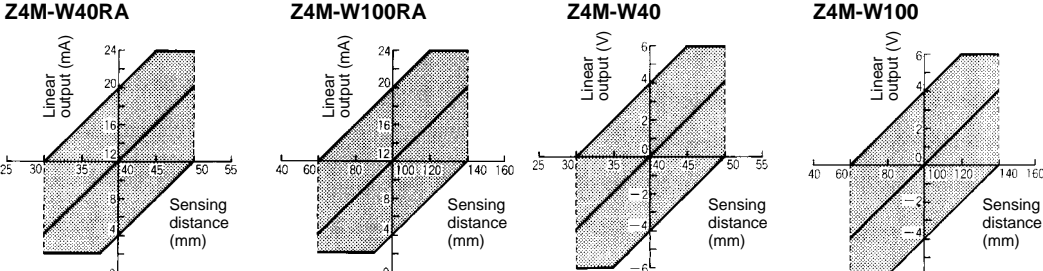
Amplifier

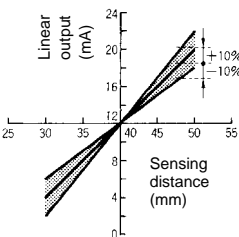
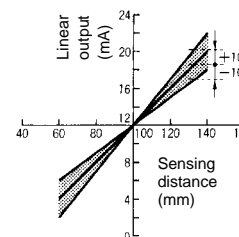
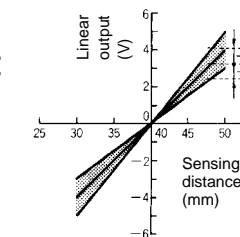
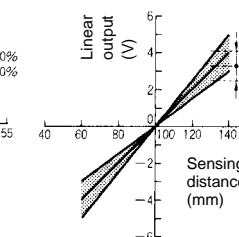
- Z4M-W40AC (for Z4M-W40RA)
- Z4M-W100AC (for Z4M-W100RA)
- Z4M-W40C (for Z4M-W40)
- Z4M-W100C (for Z4M-W100)



Operation

■ Functions

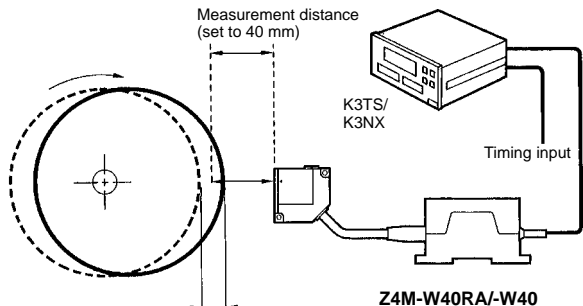
Classification	Functions
<p>Range indicators (NEAR and FAR), also used as laser warning lights (sensor and amplifier)</p>	<p>The FAR green indicator and NEAR green indicator will be lit when the object is within the measurement range of the sensor. When the object is outside the measurement range or in the case of insufficient or excessive light, both the NEAR indicator and FAR indicator will flash. If the object is near the sensor and outside the measurement range, only the NEAR indicator may flash.</p>  <p>Mount the sensor so that both the NEAR indicator and FAR indicator will be lit when the object is placed in front of the sensor. The NEAR indicator and FAR indicator are also used as laser warning lights. When the sensor is turned on, the NEAR indicator or FAR indicator or both the indicators will be lit or flash. When the laser OFF input is ON, the previous condition will be on hold (i.e., the indicator(s) will be lit or flash), thus alerting the user that the laser beam will be turned on when the laser OFF input is turned off.</p>
<p>Stability indicator (amplifier)</p>	<p>The indicator will be lit in green when the object is within the measurement range and the receiver receives intense-enough light reflected from the object. When the indicator is green, the sensor's measuring operation is stable. If the indicator is not lit in green while the sensitivity selector is set to WHITE, set it to BLACK or AUTO for a more stable measuring operation. Normal output can be obtained even if the indicator is not lit in green. The indicator will be lit in red when there is no object in front of the sensor or if the light reflected from the object is insufficient or too intense. Check if the sensitivity selector is set properly according to the reflection ratio of the object if the indicator is red.</p>
<p>Sensitivity selector (amplifier)</p>	<p>Set the sensitivity selector according to the reflection ratio of the object. If the color of the object is white, set it to WHITE. If the color of the object is black, set it to BLACK. If the object is alternating white and black, set it to AUTO. When the sensitivity selector is set to AUTO, the enable output may be ON even if the object is outside the measurement range, in which case set the sensitivity selector to WHITE so that the number of errors that may occur can be minimized.</p>
<p>Response speed selector (amplifier)</p>	<p>Select the response speed by taking the required response speed and resolution into consideration. Response speed Fast: Resolution Low Response speed Slow: Resolution High</p>
<p>Offset adjuster (amplifier)</p>	<p>Offset adjustment is possible at any position within the measurement range since the output will be 0 V (voltage output type) or 12 mA (current output type). The output must be within ± 5 V (voltage output type) or 4 to 20 mA (current output type) or the linearity of the output cannot be guaranteed. The output is adjusted before shipping so that it will be approximately 0 V or 12 mA when the object is in the middle of the measurement range.</p> 

Classification	Functions
<p>Span adjuster (amplifier)</p>	<p>With the span adjuster, it is possible to adjust the full scale of the voltage or the current that is output when the object is within the measurement range. Use the span adjuster to adjust the relationship between displacement and displacement output (refer to <i>Operation</i>).</p> <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>Z4M-W40RA</p>  </div> <div style="text-align: center;"> <p>Z4M-W100RA</p>  </div> <div style="text-align: center;"> <p>Z4M-W40</p>  </div> <div style="text-align: center;"> <p>Z4M-W100</p>  </div> </div>
<p>Enable output (amplifier)</p>	<p>The enable output is ON when the sensor is performing a displacement measuring operation. The enable output is OFF when there is no object in front of the sensor or if the light reflected from the object is insufficient or too intense. An open collector output of 50 mA at 40 VDC maximum can be obtained. In the case of measuring an metal or glossy object, the enable output may be ON even if the object is outside the measurement range.</p>
<p>Linear output (amplifier)</p>	<p>An analog voltage signal according to the measuring distance will be output from the output line (black shield wire). Current output: 4 to 20 mA/30 to 50 mm (Z4M-W40RA), 4 to 20 mA/60 to 140 mm (Z4M-W100RA) Load impedance: 300 Ω max. Voltage output: -4 to 4 V/30 to 50 mm (Z4M-W40), -4 to 4 V/60 to 140 mm (Z4M-W100) Output impedance: 100 Ω (typical) The linear output will be locked between 6 and 8 V (voltage output type) or 21 to 26 mA (current output type) when the enable output is OFF.</p>
<p>Laser OFF input (amplifier)</p>	<p>The laser OFF input controls laser emission. Laser emission is turned on when there is no laser OFF input (with a current leakage of 0.1 mA max.) and it is turned off when the laser OFF input is short-circuited to the 0-V terminal (with a residual voltage of 2 V max.). When laser emission is turned off, the linear output, indicators, and the enable output of the sensor are on hold. There will be a drift of 0.1% FS/s when the analog output of the sensor is on hold. The response time required to turn on or off laser emission is 3 ms max. Linear outputs have transient characteristics that vary with the response speeds.</p>
<p>Laser emission delaying function (sensor and amplifier)</p>	<p>When the sensor is turned on, the range indicators (green) will flash for 3 to 10 s, thus alerting the user to laser emission, during which time the linear output is locked between 6 and 8 V (voltage output type) or 21 to 26 mA (current output type). After this time, the laser beam will be turned on.</p>

Application Example (Z4M and K3TS) Detection of Round Object Decentering

Using the scaling function, it is possible to convert the sensor's output (± 4 V or 4 to 20 mA) into the actual measured dimension of the object for display.

By selecting the proper measurement mode corresponding to the application, necessary data can be easily obtained. In the following application, the peak-to-peak hold mode is used in order to measure the decentering of an object by measuring the difference between the maximum and minimum values while the timing input is ON.



Deflection value = maximum value - minimum value

Note: The timing input must be turned ON while the decentering of the object is measured, for which a push-button switch must be used.

K3TS Settings Level 3

FUn1: A (One linear sensor only. IN A is used.)
FUn2: $\bar{\alpha}$ FF (No previous average comparison)
FUn3: PPH (Peak-to-peak hold)

Level 2

Ln: 9.999 (± 9.999 V is selected as the input mode.)
AVE: B (The number of measuring operations used to obtain the average. Input the number required.)
tDf: 0.00 (Timing delay setting. Set to 0.)

Level 1

ESL0 to *ESL7*: (Select HH, H, L, or LL for determining the decentering of an object when the comparison output is used.)
SEAL: (Converts the ± 4 V output of the Z4M into the actual dimension.) If the Z4M-W40 is used, the linear output will increase by 0.4 V with a displacement value of 1 mm. The output will be 0 V when the object is in the center of the measurement range (40 mm between the object and the sensor) and the output will be 0.4 V when the distance between the object and the sensor is 41 mm. The output value is used for scaling.
X2: 0000 (When the linear output is 0 V)
Y2: 0000 (A distance of 40 mm between the object and the sensor (i.e. the object is in the center of the measurement range) is regarded as the standard distance (0 mm).)
X1: 0400 (The linear output is 0.4 V (400 mV).)
Y1: 1000 (When the sensing distance is 41 mm, the difference between the sensing distance and the standard distance is 1 mm.)
a.aaa (Set the decimal points of Y2 and Y1.)
Prat: (To prohibit the comparison set position change in the RUN mode after all settings have been completed, set to $\bar{\alpha}$ n.)

Operations Axis Adjustment

Z4M-W40RA/W100RA

The Z4M-W40RA/W100RA use a highly luminous red laser beam. The spot of the beam can be confirmed where it strikes an object. Adjust the position of the object or the position of the sensor until the spot is focused on the object.

The sensor incorporates a laser beam delaying circuit, so the laser will start emitting 3 to 10 s after the sensor is turned on.

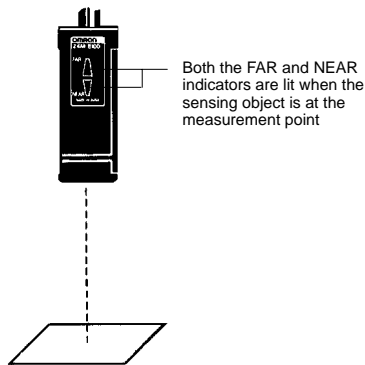
Z4M-W40/W100

The Z4M-W40/W100 use an infrared laser beam. The spot of the beam, however, can be confirmed in the dark by locating blue paper at the measurement point so that the beam will be reflected by the blue paper.

The sensor incorporates a laser beam delaying circuit, so the laser will start emitting 3 to 10 s after the sensor is turned on.

Distance Adjustment

Make sure that the center of the object displacement will be in the center of the sensor's measurement range.



Beam and Object

When sensing an object located near another object whose reflection ratio is larger than the reflection ratio of the sensing object, make a distance of at least 10 mm between the center of the beam and the more-reflective object, otherwise a sensing error will result possibly due to the shape of the sensing object or the configuration of the equipment.

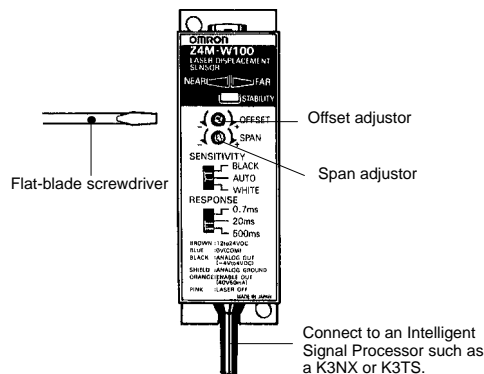
Offset Adjustment

Z4M-W40RA/W100RA

To set the sensor output to 12 mA at the standard distance, connect an Intelligent Signal Processor (such as K3NX-AD or K3TS-SD) to the output terminal of the sensor, place a standard object in front of the sensor, and adjust the output with the offset adjuster.

Z4M-W40/W100

To set the sensor output to 0 V at the standard distance, connect an Intelligent Signal Processor (such as K3NX-VD or K3TS-SD) to the output terminal of the sensor, place a standard object in front of the sensor, and adjust the output with the offset adjuster. Offset adjustment is made using a white ceramic object before shipping, so the user may not need to adjust the output.



Span Adjustment

Adjust the span adjuster to calibrate the displacement output with the following method.

1. Locate the object at the standard distance and adjust the offset adjuster.
2. Move the object for a specified distance and adjust the span adjuster so that the voltage will change properly according to the displacement.

Take the following steps to change ± 4 V to ± 5 V or from "4 to 20 mA" to "3.2 to 20.8 mA" regardless of sensing objects.

1. Connect an Intelligent Signal Processor to the sensor and move the object so that the output will be 4 V or 20 mA.
2. Use the span adjuster to adjust the voltage to 5 V or 20.8 mA.

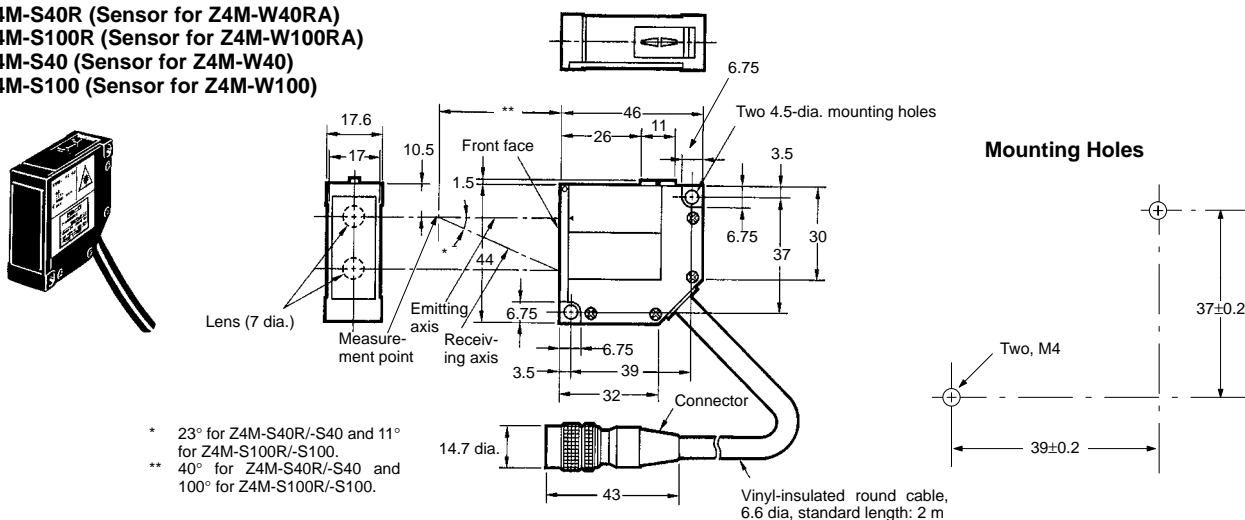
Span adjustment is made using a white ceramic object before shipping, so the user may not need to adjust the span.

Dimensions

Note: All units are in millimeters unless otherwise indicated.

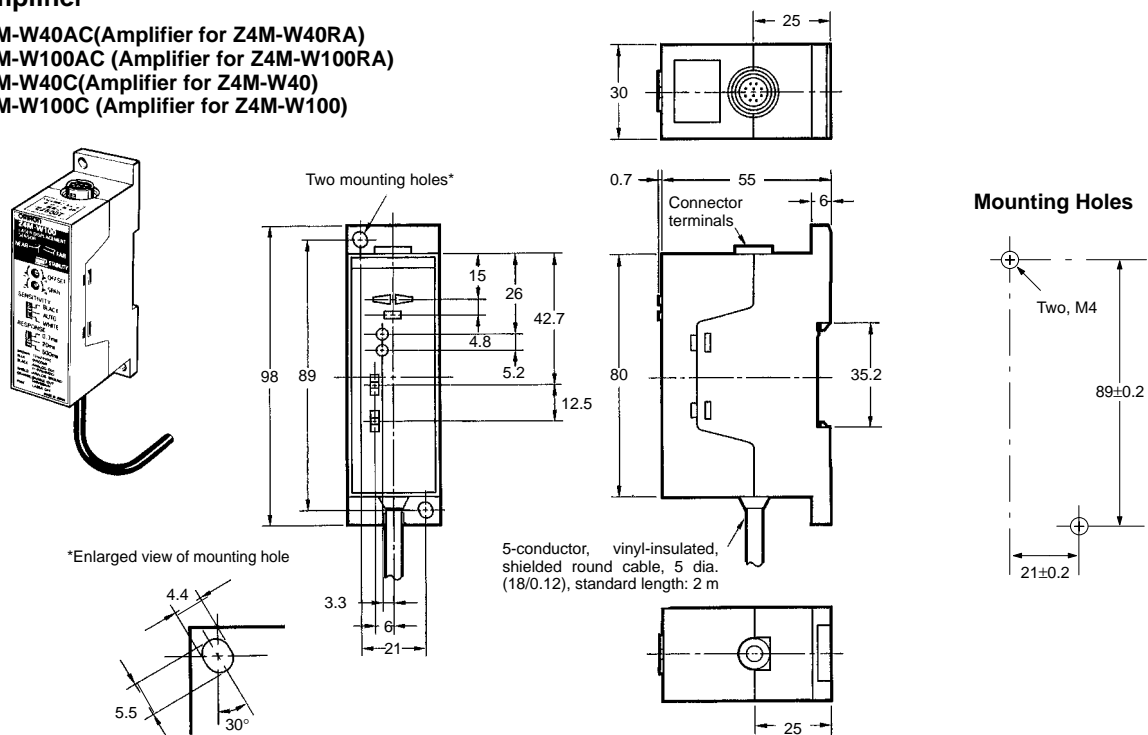
Sensor

- Z4M-S40R (Sensor for Z4M-W40RA)
- Z4M-S100R (Sensor for Z4M-W100RA)
- Z4M-S40 (Sensor for Z4M-W40)
- Z4M-S100 (Sensor for Z4M-W100)



Amplifier

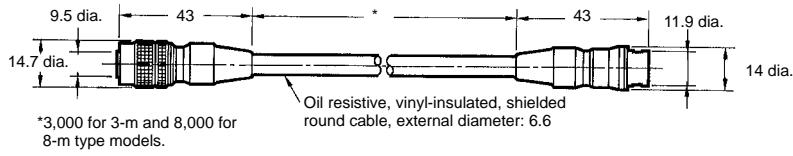
- Z4M-W40AC (Amplifier for Z4M-W40RA)
- Z4M-W100AC (Amplifier for Z4M-W100RA)
- Z4M-W40C (Amplifier for Z4M-W40)
- Z4M-W100C (Amplifier for Z4M-W100)



- Note:**
1. Do not mount the Z4M to a DIN track for use at a place with excessive vibration.
 2. The sensor and amplifier can be easily connected to each other via connectors. Do not turn or twist the cable or cable breakage may result.

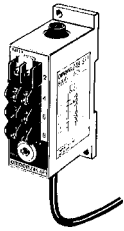
Extension Cable

Z49-C1

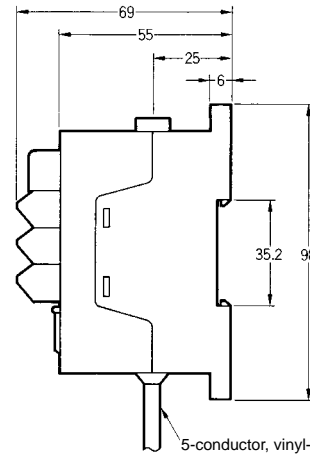
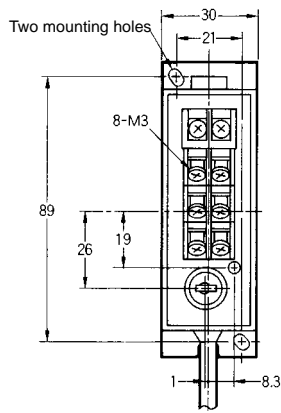
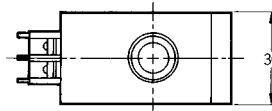
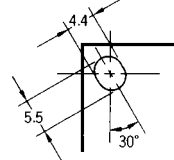


Laser Safety Kit

Z49-SF2

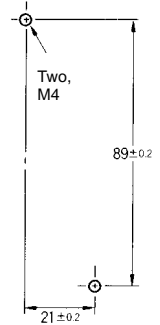


Enlarged view of mounting hole



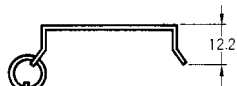
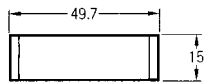
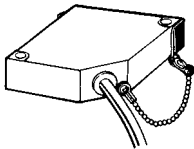
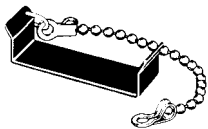
5-conductor, vinyl-insulated, shielded round cable, 5 dia. (18/0.12), standard length: 2 m

Mounting Holes



Beam Cover

Z49-BS



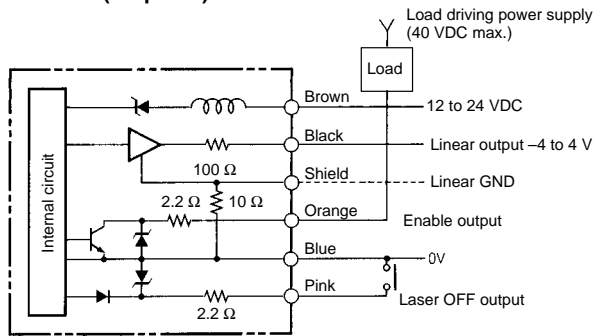
Chain, standard length: 100

Secured with an M2 screw to be provided with the model.

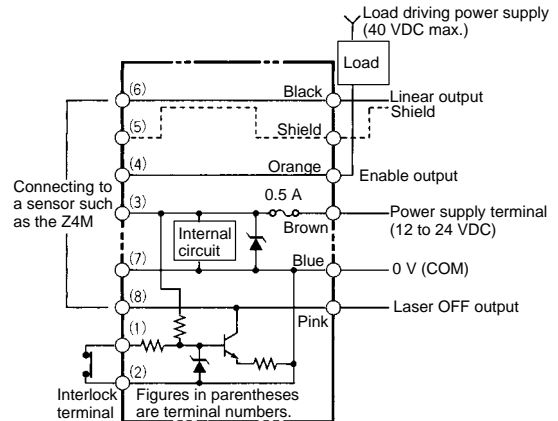
Installation

Output Circuit Diagram

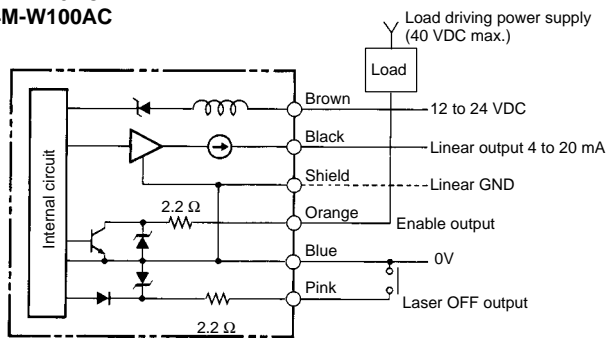
Z4M-W40C (Amplifier)
Z4M-W100C (Amplifier)



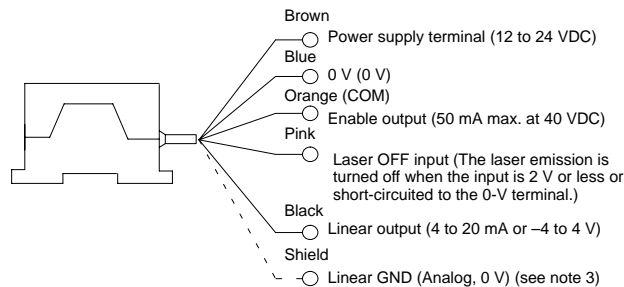
Z49-SF2 Laser Safety Kit



Z4M-W40AC
Z4M-W100AC



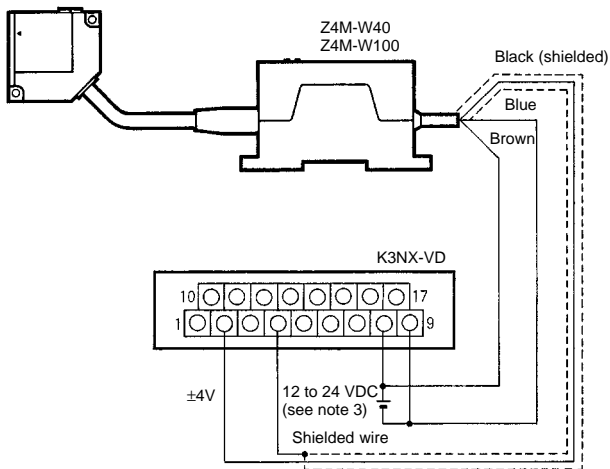
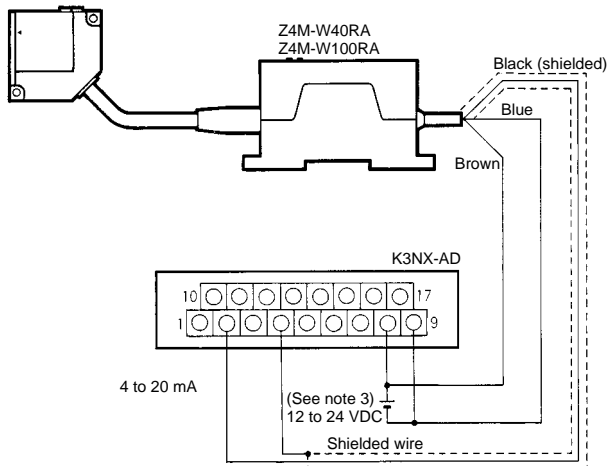
Connections



Power supply terminal	Connect a power supply with a capacity of 150 mA minimum at 12 to 24 VDC.
0 V	Used as the common terminal for the enable output and laser OFF input.
Enable output	Turned on with open collector output when the sensor can be operated (when the stability indicator is not red).
Laser OFF input	The laser emission of the sensor will be turned off by short-circuiting the laser OFF input line with the 0-V terminal (with a residual voltage of 2 V max.), at which time the linear output of the sensor will be on hold.
Linear output	According to the displacement value, the following output will be obtained. Z4M-W40RA/-W100RA: current output, 4 to 20 mA Z4M-W40/-W100: voltage output, -4 to 4 V
Linear GND	Used as a ground (0V) terminal for the linear output of the sensor. Connect this line to the input device.

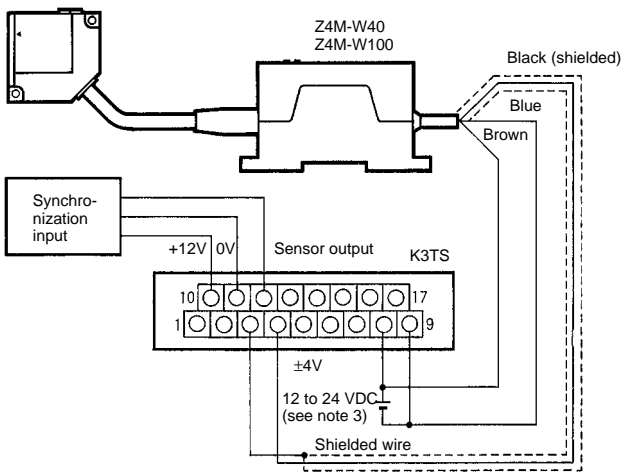
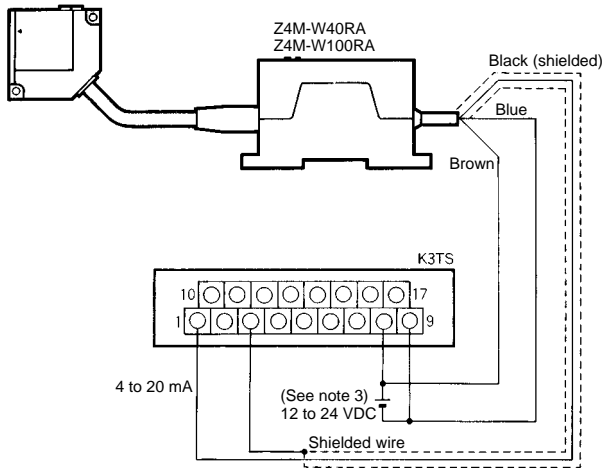
- Note:**
1. If high resolution is required, connect an independent regulated power supply to the sensor.
 2. Wire the sensor correctly, otherwise the sensor may be damaged. The linear output line must not be in contact with any other line.
 3. The 0-V (blue) and linear GND (shielded) line are internally connected via a resistor. Use the 0-V (blue) line for the power supply and use the shield wire (linear GND) and linear output (black) line for linear output.

Connection with K3NX Intelligent Signal Processor



- Note:**
1. Choose an appropriate K3NX model according to the application.
 2. Refer to the K3NX datasheet for operational instructions in detail.
 3. If a K3NX model is used with an AC power supply, connect an independent DC power supply to the Z4M.

Connection with K3TS Intelligent Signal Processor



- Note:**
1. Choose an appropriate K3TS model according to the application.
 2. For the K3TS operation in detail refer to the *K3TS Intelligent Signal Processor Operation Manual*.
 3. If a K3TS model is used with an AC power supply, connect an independent DC power supply to the Z4M.

Precautions

Laser Beam Safety

Lasers are potentially dangerous if not handled properly. Certain precautions must be observed to ensure safe operation and certain steps must be taken to meet local safety standards.

Almost all countries have safety standards relating to lasers that both classify the lasers according to safety requirements and require certain labels containing warnings and other information to be attached to the lasers.

It is assumed that the Sensor will be used as part of a larger system which may possibly be exported to a foreign country. Information is provided below for general safety considerations and for the labeling requires in the USA. You must confirm and meet all safety requirements for the country in which the laser will be used.

General Safety Precautions

Follow the instructions on this datasheet for the adjustment and mounting of the Z4M.

Make sure that the laser beam will not be directly or indirectly reflected into human eyes. The safety distance is approximately 1 m for the Z4M-W40/W40RA and 2 m for the Z4M-W100/W100RA. If there a possibility of laser beam reflection by any objects around the emitter at the time of adjustment, apply paint with a low light reflection ratio to the objects.

The sensor incorporates laser emission warning light and laser OFF input circuit. It is possible to interlock laser emission via an external circuit.

The Z4M-W40RA/W100RA (with visible light) can be used to increase safety, or safety measures can be taken by using the Z4M-W40/W100 in combination with the Z49-SF2 Laser Safety Kit, which is sold separately.

Summary of Safety Measures for Operators

Item	Class 1	Class 2 (Z4M-W40RA /W100RA)	Class 3A	Class 3B (Z4M-W40/W100)		Class 4
				3B*	3B	
Remote interlock	Not required			Connect the remote interlock of the laser beam to the emergency main interlock, the interlock of the room, or the interlock of the door.		
Key control	Not required			Do not keep the key in the lock when the laser beam is not used.		
Beam breaker or attenuator	Not required			Used to protect people from accidental radiation by the laser beam.		
Warning sign	Not required			Post a proper warning sign on the door to the room where laser beam equipment is installed.		
Beam path	Not required	The laser beam must be terminated and, as a rule, must be enclosed. If the laser beam is exposed, the vertical height of the beam must not be the same as that of the eyes.				
Mirror reflection	Not required			Appropriate optical elements must be securely attached and you must be able to control the optical elements during laser radiation.		
Eye protection	Not required			Use eye protectors except in special, specified locations.		
Protection clothes	Not required		Wear protection clothes if exposure of the skin to the laser beam may exceed the MPE of the skin.			
Training	Not required			The laser system must be operated by only properly trained people.		

Note: *Class 3B applies to any laser beam with a power of 5 mW maximum in the visible range of the laser beam.

USA Safety Requirements

Laser Control

The Z4M Laser Displacement Sensor meets the standards required by the U.S. Food and Drug Administration (FDA). OMRON has also reported to the Center for Devices and Radiological Health (CDRH).

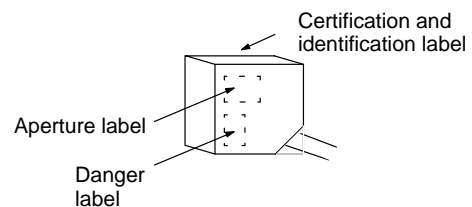
The report includes the condition that the Sensor be used as part of a larger system. The following standards must be used when building the Sensor into a larger system.

Sensor	Standard
Z4M-W40RA/W100RA	21CFR1040.10 and 1040.11
Z4M-W40/W100	

Labels (FDA Regulations)

If the Z4M will be used in the U.S., be sure the three FDA labels shown below are attached to the Sensor in the location indicated in the diagram. These labels are to be attached to the sensor body prior to use in the U.S.

Label Location

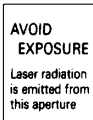


Z4M-S40R/S100R (Class II)

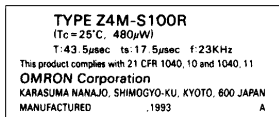
Danger Label



Aperture Label



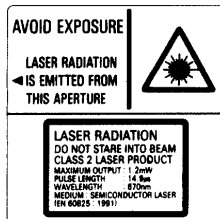
Certification and Identification Label (Z4M-S100R shown below)



Safety Requirements in Other Countries

Labeling requirements vary with the country (e.g., in Europe, EN requirements may be applicable). The following English labels are provided for general use in English-speaking countries, but it is your responsibility to confirm and meet the requirements in the country where the Sensors will be used. Contact you OMRON representative for assistance if you require it.

Z4M-S40R



Z4M-S100R

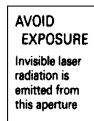


Z4M-S40/S100 (Class IIIb)

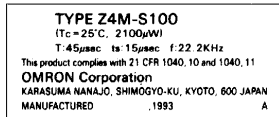
Danger Label



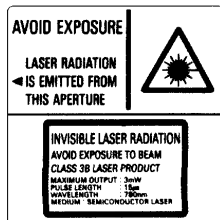
Aperture Label



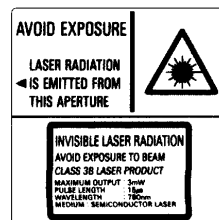
Certification and Identification Label (Z4M-S100 shown below)



Z4M-S40



Z4M-S100



Maintenance and Repairs

1. Users cannot carry out repairs or maintenance of the Z4M, which contains no user serviceable parts. Refer all servicing to an authorized OMRON agent.
2. Never disassemble the Sensor. Users expose themselves to the risk of laser radiation if they disassemble the device.
3. Never move or remove the Sensor during operation to avoid possible exposure to the laser light.

Compatibility

The sensor and amplifier are adjusted as a set and they have the same serial number. The sensor or amplifier cannot be used with another amplifier or sensor.

Mutual Interference

Separate each sensor as specified in the following table when using more than two sensors in close proximity to one another.

Installing direction			
Z4M-W40RA/-W40	30 mm	30 mm	60 mm
Z4M-W100RA/-W100	60 mm	60 mm	80 mm

Environment

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:

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.

Note: Do not use a scrubbing action when cleaning as scratches on the filter could result in the Sensor malfunctioning.

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

The Laser Displacement Sensor cannot accurately detect the following types of objects: mirror-like objects, transparent objects, objects with an extremely low reflection ratio, objects smaller than the Sensor's sensing spot diameter, or largely inclined objects.

Wiring

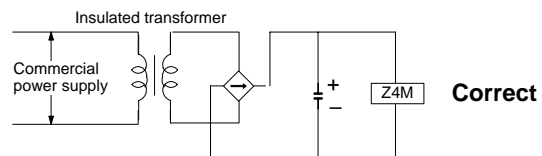
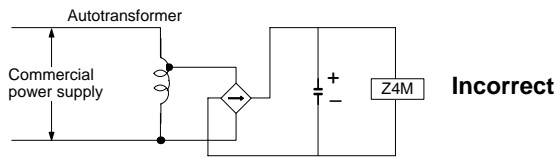
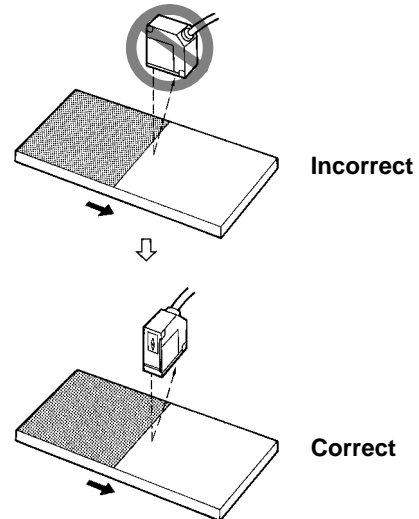
Do not lay power supply cable for the Z4M together with high-voltage lines or power lines to prevent interference, damage, or malfunction.

A Z49-C1 Extension Cable (3 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 Z4M as shown in the illustration. Do not use an autotransformer or the Z4M may malfunction.

Others

The Sensor cannot detect 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 case install the Sensor so that the boundaries of the materials and the Sensor are parallel.



Z49-SF Laser Safety Kit

Dedicated Laser Safety Kit for Z4M Conforming to Safety Standards (JIS C6802)

- With the Z49-SF Laser Safety Kit, the Z4M can meet the requirements of various safety standards. The user should be fully aware of the contents of the safety standards and precautions before using the Z49-SF Laser Safety Kit.
- Controller incorporates key switch, interlock terminal, and laser warning light.
- Beam cover which intercepts the laser beam is provided.
- Slim controller can be DIN-track mounted.

Ordering Information

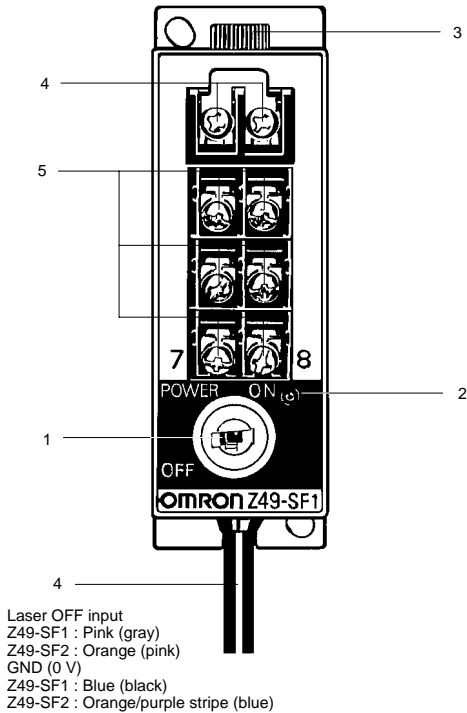
Model	Applicable Sensor
Z49-SF2	Z4M Laser Displacement Sensor

Specifications

Characteristics

Item	Z49-SF2 (for Z4M)
Power supply voltage	12 to 24 VDC±10%, ripple (p-p): 10% max.
Current consumption	10 mA max. (excluding the current consumption of the sensor)
Indicator	Green laser warning light (power indicator)
Insulation resistance	20 MΩ (at 500 VDC)
Dielectric strength	1,000 VAC, 50/60 Hz for 1 min
Vibration resistance	10 to 55 Hz (1.5-mm double amplitude) for 32 min each in X, Y, and Z directions
Shock resistance	300 m/s ² (30G) for 3 times each in ±X, Y, and Z directions
Ambient temperature	Operating: 0°C to 50°C (with no icing) Storage: -15°C to 60°C (with no icing)
Ambient humidity	Operating: 35% to 85% (with no condensation)
Weight	Approx. 200 g (with cable)
Cable length	2 m
Material	Case: ABS, Beam cover: SUS
Degree of protection	IEC60529 IP40
Attachments	One beam cover for Z4M; one laser emission warning seal for Z4M

■ Nomenclature



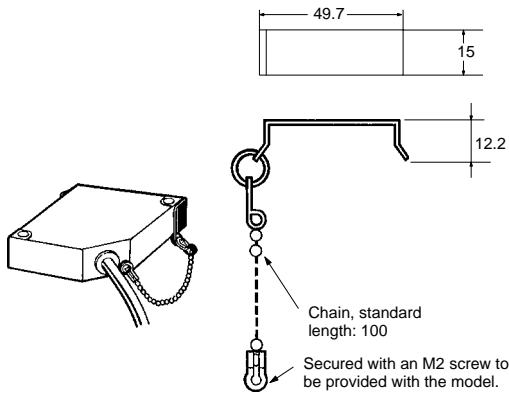
No.	Name	Functions											
1	Key switch	Turn on and off the emitter of the Z4M (in the case of Z49-SF2) connected to the terminals of the Laser Safety Kit as well as the internal circuitry of the Laser Safety Kit.											
2	Laser warning light (Power indicator)	When the Z4M is emitting a laser beam or ready to emit a laser beam, the green indicator is lit. The green indicator is lit by turning the key switch on and the indicator goes off by turning the key switch off.											
3	Fuse	This fuse protects the power supply in case terminal 3 (power terminal) and terminal 8 (GND) are short-circuited. Use a glass tube fuse (5.2 dia. x 20 mm) with a capacity of 0.5 A at 125 V.											
4	Interlock terminal (terminals 1 and 2) Laser off input Z49-SF2: Orange GND (0 V) Z49-SF2: Orange/purple stripe	Used to connect an interlock switch for safety. When terminals 1 and 2 are open, the laser emission of the Z4M will stop. The terminals are short-circuited with a short bar before shipping. Laser emission will also stop by short-circuiting the laser OFF input line (orange line for the Z49-SF2) to the 0-V terminal or dropping the input voltage to 2 V or below. The relationship between the laser OFF input and interlock terminals are as follows: <table border="1" style="margin: 10px auto;"> <thead> <tr> <th rowspan="2">Laser OFF input</th> <th colspan="2">Interlock terminals</th> </tr> <tr> <th>Open</th> <th>Short-circuited</th> </tr> </thead> <tbody> <tr> <td>Open</td> <td>Laser emission stops</td> <td>Laser emission starts</td> </tr> <tr> <td>2 V max. or short-circuit to 0-V terminal</td> <td>Laser emission stops</td> <td>Laser emission stops</td> </tr> </tbody> </table> <p>When the interlock terminals are open, no laser emission is turned on regardless of the condition of the laser OFF input. If the laser OFF input is dropped to 2 V or below or short-circuited to the 0-V terminal, no laser emission is turned on regardless of whether or not the interlock terminals are opened or short-circuited. The laser warning light is lit whether or not the laser emission of the Z4M is turned on.</p>	Laser OFF input	Interlock terminals		Open	Short-circuited	Open	Laser emission stops	Laser emission starts	2 V max. or short-circuit to 0-V terminal	Laser emission stops	Laser emission stops
Laser OFF input	Interlock terminals												
	Open	Short-circuited											
Open	Laser emission stops	Laser emission starts											
2 V max. or short-circuit to 0-V terminal	Laser emission stops	Laser emission stops											
5	Sensor terminals (terminals 3 to 8)	Used to connect the Laser Safety Kit to the emitter of the Z4M's amplifier (in the case of Z49-SF2).											

■ Operation

Beam Cover

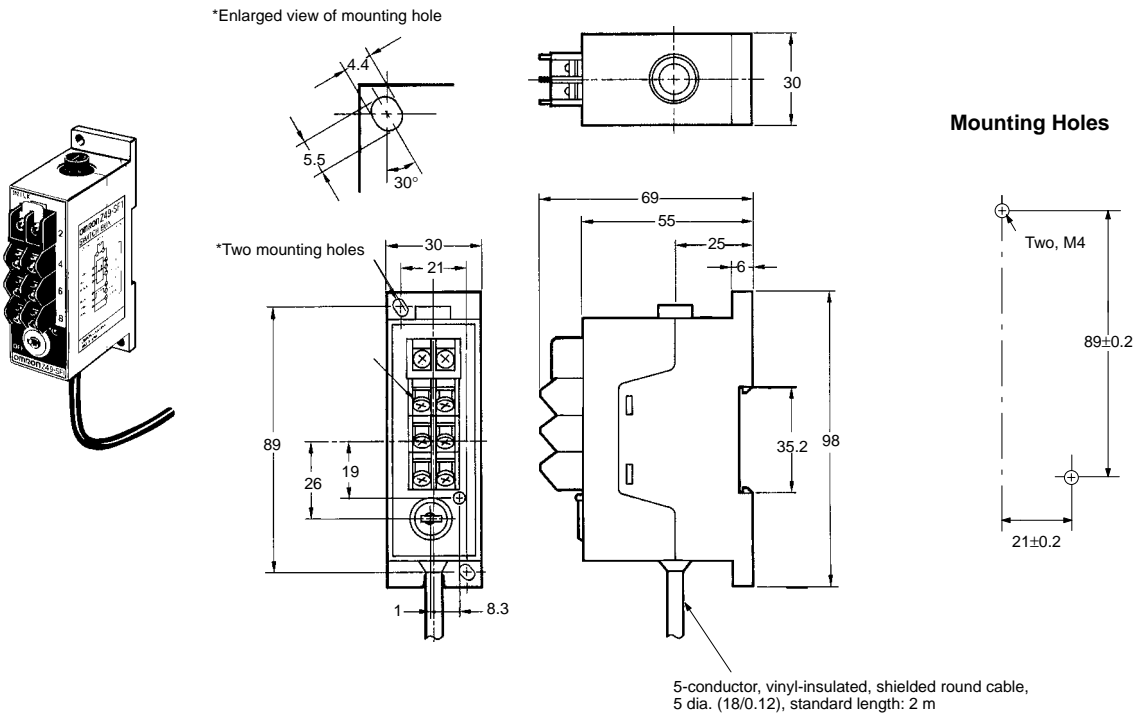
Z49-SF2

Attach the beam cover to the front panel (where the laser beam is emitted) of the Z4M when the Z4M is not in use.
Secure the beam cover with a M2 screw provided with the beam cover.



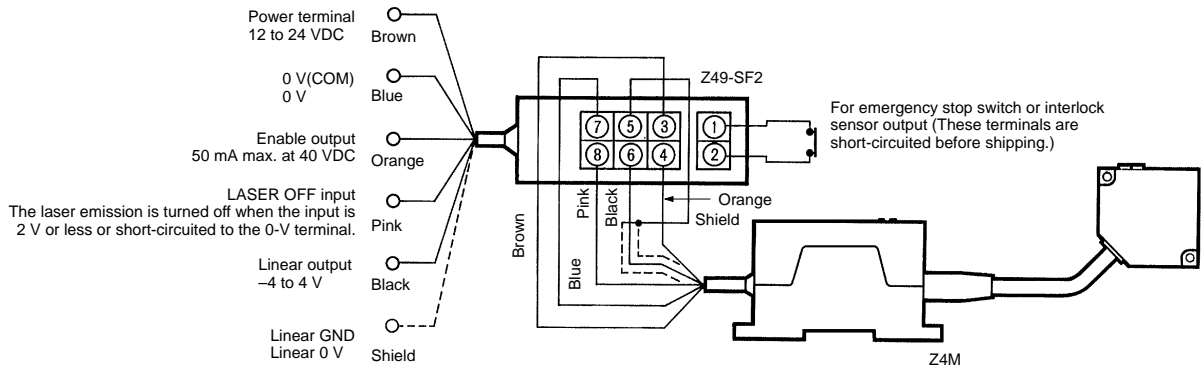
■ Dimensions

Note: All units are in millimeters unless otherwise indicated.



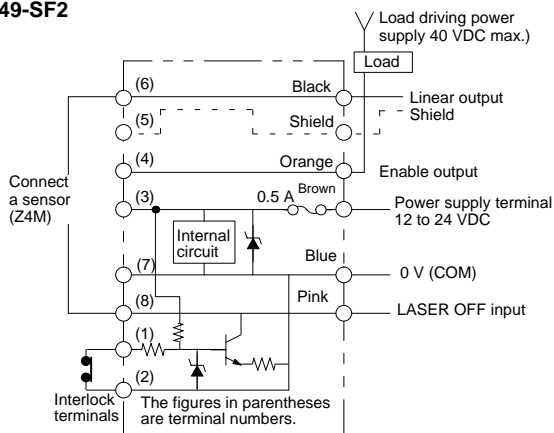
■ Installation
Connections

Z49-SF2



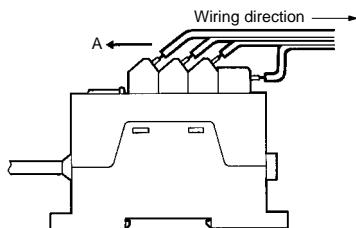
I/O Circuit Diagram

Z49-SF2



■ Precautions
Wiring Direction

Wire in the direction as shown in the following illustration. Do not pull the wires in the A direction, otherwise the terminals may be damaged.



Wiring

Do not lay wires for the Z49-SF2 or Z4M with high voltage lines or power lines within the same conduit in order to prevent interference, damage, or malfunctioning.

Labels (Attachments)

The Z4M-W40/-W100 abide by IEC's Class 3B and FDA's Class IIIb regulations, thus warning labels are to be attached to the sensor body before use.

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.

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.

To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Cat. No. E225-E1-2A **In the interest of product improvement, specifications are subject to change without notice.**

OMRON Corporation

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