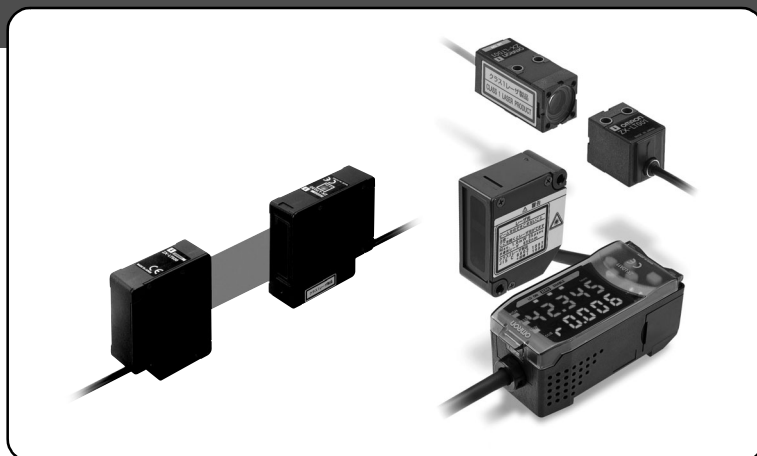


Smart Sensors (Laser Type) ZX Series (ZX-L-N)



Ordering Information

■ Sensors

Sensor Heads (Reflective)

Optical system	Beam shape	Sensing distance	Resolution*1	Model
Diffuse reflective	Spot beam	40±10 mm	2 μm	ZX-LD40
		100±40 mm	16 μm	ZX-LD100
		300±200 mm	300 μm	ZX-LD300
	Line beam	40±10 mm	2 μm	ZX-LD40L
		100±40 mm	16 μm	ZX-LD100L
		300±200 mm	300 μm	ZX-LD300L
Regular reflective	Spot beam	30±2 mm	0.25 μm	ZX-LD30V
	Line beam			ZX-LD30VL


*1. For an average count of 4,096.

Sensor Heads (Through-beam)

Optical system	Measuring width	Sensing distance	Resolution*1	Model
Through-beam	1-mm dia.	0 to 2000 mm	4 μm	ZX-LT001
	5 mm	0 to 500 mm	12 μm	ZX-LT005
	10 mm			ZX-LT010
	30 mm			ZX-LT030

*1. For an average count of 64.


Amplifier Units

Appearance	Power supply	Output type	Model
	DC	NPN	ZX-LDA11-N
		PNP	ZX-LDA41-N


Note: Compatible connection with the Sensor Head.

Accessories (Order Separately)



Calculating Unit

Appearance	Model
	ZX-CAL2

Side-view Attachments

Appearance	Applicable Sensor Head	Model
	ZX-LT1001/LT005	ZX-XF12
	ZX-LT010	ZX-XF22

SmartMonitor Sensor Setup Tool for Personal Computer Connection

Appearance	Name	Model
	ZX-series Communications Interface Unit	ZX-SF11
	ZX-series Communications Interface Unit + ZX-series Sensor Setup Software Basic	ZX-SFW11EV3 *1*2
CD-ROM	ZX-series Sensor Setup Software	ZX-SW11EV3 *1

*1. When using the ZX-LDA11-N/41-N with the SmartMonitor, either the ZX-SFW11EV3 or the ZX-SW11EV3 SmartMonitor must be used. Earlier versions cannot be used.

*2. The ZX-SFW11EV3 SmartMonitor can be used only to set functions and monitor waveforms.

Cables with Connectors on Both Ends (for Extension)*1

Cable length	Model	Quantity
1 m	ZX-XC1A	1
4 m	ZX-XC4A	
8 m	ZX-XC8A	
9 m *2	ZX-XC9A	

*1. Robot Cable models are also available. The model numbers are ZX-XC□R.

*2. For use only with Reflective Sensors.

Specifications

■ Sensor Heads (Reflective)

Item	Model	ZX-LD40	ZX-LD100	ZX-LD300	ZX-LD30V	ZX-LD40L	ZX-LD100L	ZX-LD300L	Z3X-LD30VL
Optical system	Diffuse reflective				Regular reflective	Diffuse reflective			Regular reflective
Light source (wave length)	Visible-light semiconductor laser with a wavelength of 650 nm and an output of 1 mW max.								
	EN class 2, FDA class II								
Measurement point	40 mm	100 mm	300 mm	30 mm	40 mm	100 mm	300 mm	30 mm	
Measurement range	±10 mm	±40 mm	±200 mm	±2 mm	±10 mm	±40 mm	±200 mm	±2 mm	
Beam shape	Spot				Line				
Beam size*1	50-μm dia.	100-μm dia.	300-μm dia.	75-μm dia.	75 μm x 2 mm	150 μm x 2 mm	450 μm x 2 mm	100 μm x 1.8 mm	
Resolution*2	2 μm	16 μm	300 μm	0.25 μm	2 μm	16 μm	300 μm	0.25 μm	
Linearity*3	±0.2% FS (entire range)	±0.2% FS (80 to 120 mm)	±2% FS (200 to 400 mm)	±0.2% FS (entire range)	±0.2% FS (32 to 48 mm)	±0.2% FS (80 to 120 mm)	±2% FS (200 to 400 mm)	±0.2% FS (entire range)	
Temperature characteristic*4	±0.03% FS/°C (Except for ZX-LD300 and ZX-LD300L, which are ±0.1% FS/°C.)								
Ambient illumination	Incandescent lamp: 3,000 lx max. (on light receiving side)								
Ambient temperature	Operating: 0 to 50°C, Storage: -15 to 60°C (with no icing or condensation)								
Ambient humidity	Operating and storage: 35% to 85% (with no condensation)								
Insulation resistance	20 MΩ min. at 500 VDC								
Dielectric strength	1,000 VAC, 50/60 Hz for 1 min								
Vibration resistance (destruction)	10 to 150 Hz, 0.7-mm double amplitude 80 min each in X, Y, and Z directions								
Shock resistance (destruction)	300 m/s ² 3 times each in six directions (up/down, left/right, forward/backward)								
Degree of protection	IEC60529, IP50				IEC60529, IP40	IEC60529, IP50			IEC60529, IP40
Connection method	Connector relay (standard cable length: 500 mm)								
Weight (packed state)	Approx. 150 g				Approx. 250 g	Approx. 150 g			Approx. 250 g
Materials	Case: PBT (polybutylene terephthalate), Cover: Aluminum, Lens: Glass				Case and cover: Aluminum, Lens: Glass	Case: PBT (polybutylene terephthalate), Cover: Aluminum, Lens: Glass			Case and cover: Aluminum, Lens: Glass
Accessories	Instruction sheet, Laser warning label (English)								

*1. Beam size: The beam size is defined by $1/e^2$ (13.5%) of the strength of the beam at the beam center (measured value). Incorrect detection may occur if there is light leakage outside the defined spot and the material around the sensing object is more reflective than the sensing object.

*2. Resolution: The resolution is the deviation ($\pm 3\sigma$) in the linear output when connected to the ZX-LDA Amplifier Unit. (The resolution is measured with the standard reference object (white ceramic), at the measurement point with the ZX-LDA set for an average count of 4,096 per period.) The resolution is given at the repeat accuracy for a stationary workpiece, and is not an indication of the distance accuracy. The resolution may be adversely affected under strong electromagnetic fields.

*3. Linearity: The linearity is given as the error in an ideal straight line displacement output when measuring the standard reference object. The linearity and measurement values vary with the object being measured.

*4. Temperature characteristic: The temperature characteristic is measured at the measurement point with the Sensor and reference object (OMRON's standard reference object) secured with an aluminum jig.

Note: Highly reflective objects can result in incorrect detection by causing out-of-range measurements.

■ Sensor Heads (Through-beam)

Item	Model	ZX-LT001		ZX-LT005	ZX-LT010	ZX-LT030
Optical system		Through-beam				
Light source (wave length)		Visible-light semiconductor laser with a wavelength of 650 nm				
		EN class 1, FDA class II				
	Maximum output	0.2 mW max.		0.35 mW max.		0.2 mW max.
Measurement width		1-mm dia.	1- to 2.5-mm dia.	5 mm	10 mm	30 mm
Measurement distance		0 to 500 mm	500 to 2,000 mm	0 to 500 mm		
Minimum sensing object		8-μm dia. (opaque)	8- to 50-μm dia. (opaque)	0.05-mm dia. (opaque)	0.1-mm dia. (opaque)	0.3-mm dia. (opaque)
Resolution*1		4 μm *2	---	4 μm *3		12 μm *4
Temperature characteristic		±0.2% FS/°C				±0.3% FS/°C
Ambient illumination		Incandescent lamp: 10,000 lx max. (on light-receiving side)				
Ambient temperature		Operating: 0 to 50°C, Storage: −25 to 70°C (with no icing or condensation)				
Ambient humidity		Operating: 35% to 85% (with no condensation)				
Degree of protection		IEC60529, IP40				
Connection method		Connector relay (standard cable length: 500 mm)				
Weight (packed state)		Approx. 220 g				Approx. 450 g
Cable length		Extendable up to 10 m with special extension cable.				
Materials	Case	Polyether imide				Zinc die-cast
	Cover	Polycarbonate				
	Front filter	Glass				
Tightening torque		0.3 N·m max.				
Accessories		Instruction sheet, Sensor Head-Amplifier Connection Cable				
		Optical axis adjustment seal				Mounting Bracket

*1. This value is obtained by converting the deviation ($\pm 3\sigma$) in the linear output that results when the sensor head is connected to the amplifier unit, into the measurement width.

*2. For an average count of 64. The value is 5 μm for an average count of 32.

This is the value that results when a minimum sensing object blocks the light near the center of the 1-mm measurement width.

*3. For an average count of 64. The value is 5 μm for an average count of 32.

*4. For an average count of 64. The value is 15 μm for an average count of 32.

■ Amplifier Units

Item	Model	ZX-LDA11-N	ZX-LDA41-N
Measurement period		150 μ s	
Possible average count settings*1		1, 2, 4, 8, 16, 32, 64, 128, 256, 512, 1,024, 2,048, or 4,096	
Temperature characteristic		When connected to a Reflective Sensor Head: 0.01% FS/°C, When connected to a Through-beam Sensor Head: 0.1% FS/°C	
Linear output*2		4 to 20 mA/FS, Max. load resistance: 300 Ω , ± 4 V (± 5 V, 1 to 5 V *3), Output impedance: 100 Ω	
Judgement outputs (3 outputs: HIGH/PASS/LOW)*1		NPN open-collector outputs, 30 VDC, 50 mA max. Residual voltage: 1.2 V max.	PNP open-collector outputs, 30 VDC, 50 mA max. Residual voltage: 2 V max.
Laser OFF input, zero reset input, timing input, reset input		ON: Short-circuited with 0-V terminal or 1.5 V or less OFF: Open (leakage current: 0.1 mA max.)	ON: Supply voltage short-circuited or supply voltage within 1.5 V OFF: Open (leakage current: 0.1 mA max.)
Functions		Measurement value display, present value/set value/light level/resolution display, scaling, display reverse, display OFF mode, ECO mode, number of display digit changes, sample hold, peak hold, bottom hold, peak-to-peak hold, self-peak hold, self-bottom hold, average hold, delay hold, intensity mode, zero reset, initial reset, ON-delay timer, OFF-delay timer, one-shot timer, deviation, previous value comparison, sensitivity adjustment, keep/clamp switch, direct threshold value setting, position teaching, 2-point teaching, automatic teaching, hysteresis width setting, timing inputs, reset input, monitor focus, linear output compensation, (A-B) calculations*4, (A+B) calculations*4, mutual interference*4, laser deterioration detection, zero reset memory, zero reset display, key lock	
Indications		Operation indicators: High (orange), pass (green), low (yellow), 7-segment main display (red), 7-segment subdisplay (yellow), laser ON (green), zero reset (green), enable (green)	
Power supply voltage		12 to 24 VDC $\pm 10\%$, Ripple (p-p): 10% max.	
Current consumption		140 mA max. with power supply voltage of 24 VDC (with Sensor connected)	
Ambient temperature		Operating: 0 to 50°C, Storage: -15 to 60°C (with no icing or condensation)	
Ambient humidity		Operating and storage: 35% to 85% (with no condensation)	
Insulation resistance		20 M Ω min. at 500 VDC	
Dielectric strength		1,000 VAC, 50/60 Hz for 1 min	
Vibration resistance (destruction)		10 to 150 Hz, 0.7-mm double amplitude 80 min each in X, Y, and Z directions	
Shock resistance (destruction)		300 m/s ² 3 times each in six directions (up/down, left/right, forward/backward)	
Connection method		Prewired (standard cable length: 2 m)	
Weight (packed state)		Approx. 350 g	
Materials		Case: PBT (polybutylene terephthalate), Cover: Polycarbonate	
Accessories		Instruction sheet	

- *1. The response speed of the linear output is calculated as the measurement period \times (average count setting + 1) (with fixed sensitivity).
The response speed of the judgement outputs is calculated as the measurement period \times (average count setting + 1) (with fixed sensitivity).
- *2. The output can be switched between a current output and voltage output using a switch on the bottom of the Amplifier Unit.
- *3. Setting is possible via the monitor focus function.
- *4. A Calculating Unit (ZX-CAL2) is required.

■ Calculating Unit

Item	ZX-CAL2
Applicable Amplifier Units	ZX-LDA11-N/41-N/ZX-EDA11/41/ZX-TDA11/41
Current consumption	12 mA max. (supplied from the Smart Sensor Amplifier Unit)
Ambient temperature	Operating: 0 to 50°C, Storage: –15 to 60°C (with no icing or condensation)
Ambient humidity	Operating and storage: 35% to 85% (with no condensation)
Connection method	Connector
Dielectric strength	1,000 VAC, 50/60 Hz for 1 min
Insulation resistance	100 MΩ (at 500 VDC)
Vibration resistance (destructive)	10 to 150 Hz, 0.7-mm double amplitude 80 min each in X, Y, and Z directions
Shock resistance (destructive)	300 m/s ² 3 times each in six directions (up/down, left/right, forward/backward)
Materials	Display: Acrylic, Case: ABS resin
Weight (packed state)	Approx. 50 g

■ ZX-series Communications Interface Unit

Item		ZX-SF11
Current consumption		60 mA max. (supplied by the Amplifier Unit)
Applicable Amplifier Units		ZX Series
Applicable Amplifier Unit versions		ZX-LDA□1-N Ver. 1.000 or higher ZX-EDA□1 Ver. 1.100 or higher ZX-TDA□1 Ver. 1.000 or higher
Max. No. of Amplifier Units		5
Communications functions	Communications port	RS-232C port (9-pin D-Sub Connector)
	Communications protocol	CompoWay/F*
	Baud rate	38,400 bps
	Data configuration	Data bits: 8, Parity: none, Start bits: 1, Stop bits: 1, Flow control: none
Indicators		Power supply: green, Sensor communications: green, Sensor communications error: red, External terminal communications: green, External terminal communications error: red
Protective circuits		Reverse polarity protection
Ambient temperature		Operating: 0 to 50°C, storage: –15 to 60°C (with no icing or condensation)
Ambient humidity		Operating and storage: 35% to 85% (with no condensation)
Insulation resistance		20 MΩ min. (at 500 VDC)
Dielectric strength		1,000 VAC, 50/60 Hz for 1 min, Leakage current: 10 mA max.
Materials		Case: PBT (polybutylene terephthalate), Cover: Polycarbonate
Accessories		Instruction sheet, 2 clamps

* Contact your OMRON representative for CompoWay/F communications specifications.

Engineering Data (Typical)

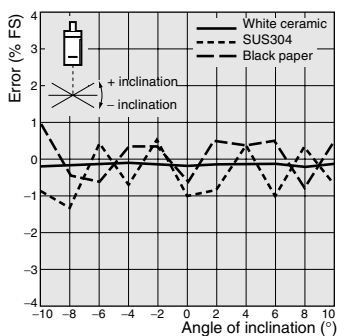
Angle Characteristic (Reflective Sensors)

The angle characteristic plots the relation between the inclination of the measurement object and the error in the linear output at the measurement point.

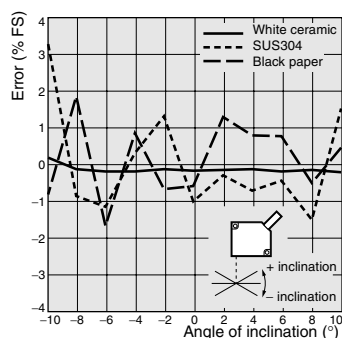
Note: SUS304 = Stainless steel SUS304

● ZX-LD40

Side-to-side Inclination

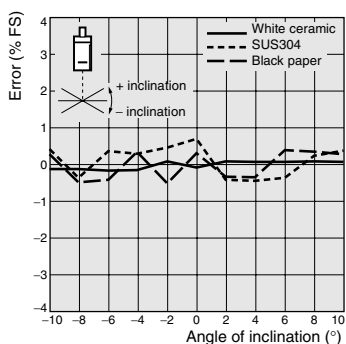


Front-to-back Inclination

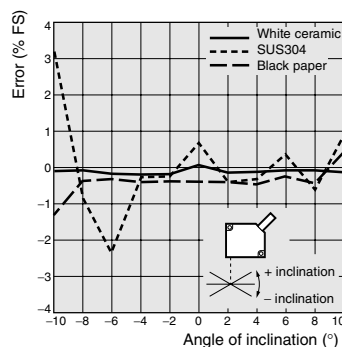


● ZX-LD40L

Side-to-side Inclination

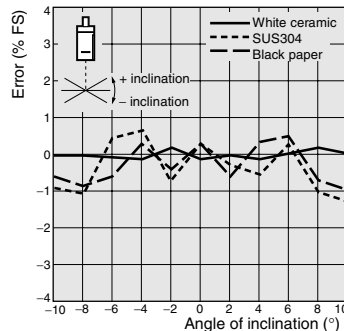


Front-to-back Inclination

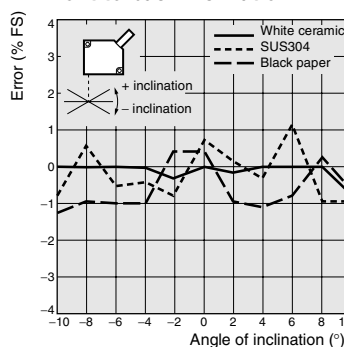


● ZX-LD100

Side-to-side Inclination

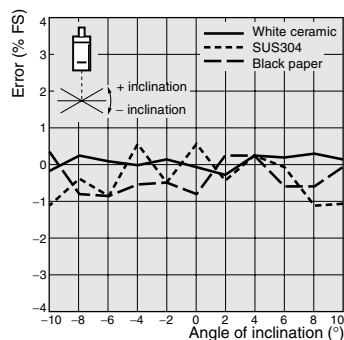


Front-to-back Inclination

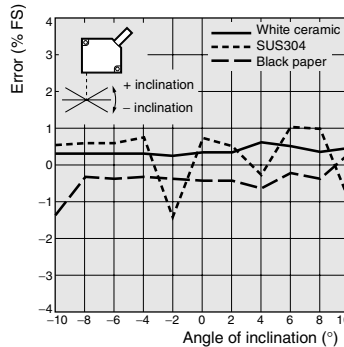


● ZX-LD100L

Side-to-side Inclination

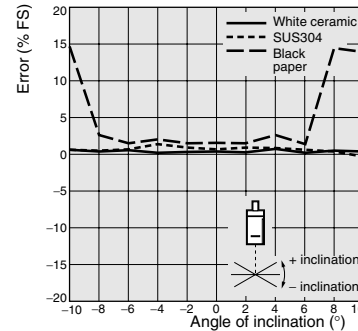


Front-to-back Inclination

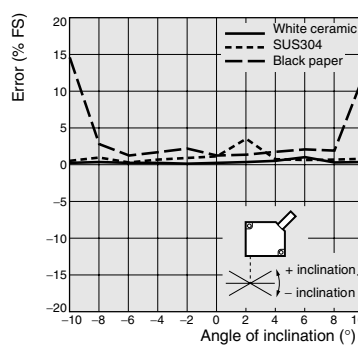


● ZX-LD300

Side-to-side Inclination

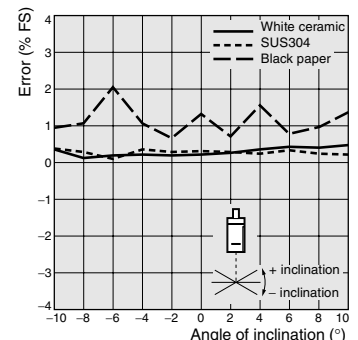


Front-to-back Inclination

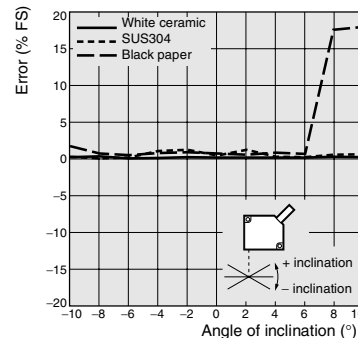


● ZX-LD300L

Side-to-side Inclination

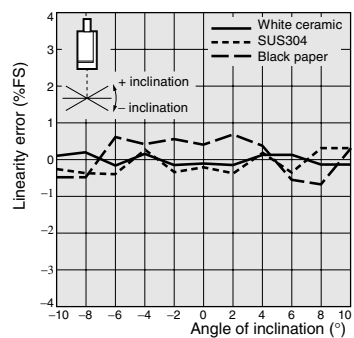


Front-to-back Inclination

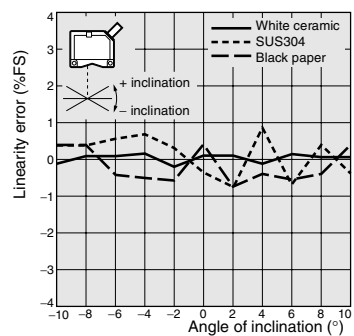


● ZX-LD30V

Side-to-side Inclination

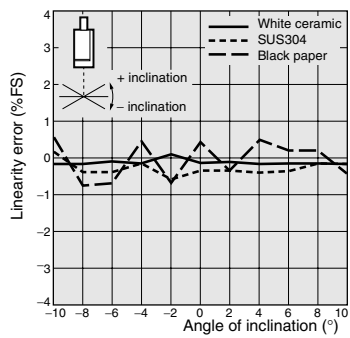


Front-to-back Inclination

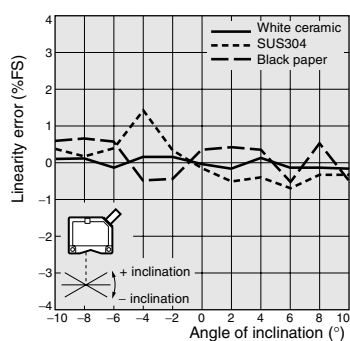


● ZX-LD30VL

Side-to-side Inclination



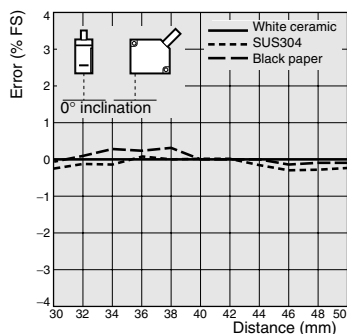
Front-to-back Inclination



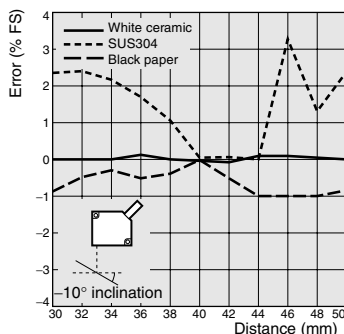
Linearity Characteristic for Different Materials (Reflective Sensors)

● ZX-LD40

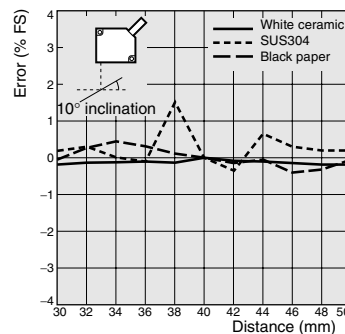
0° Inclination



-10° Inclination Front-to-back

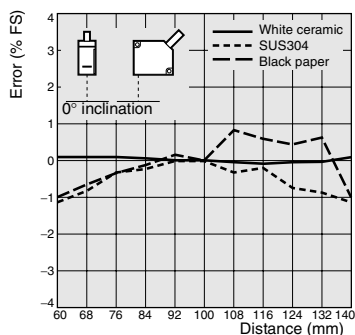


10° Inclination

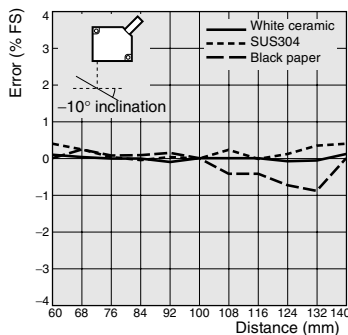


● ZX-LD100

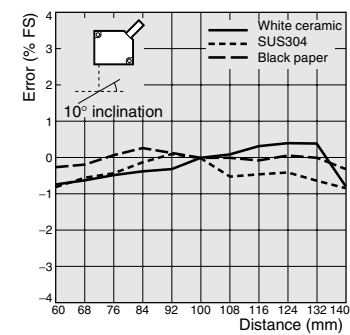
0° Inclination



-10° Inclination Front-to-back

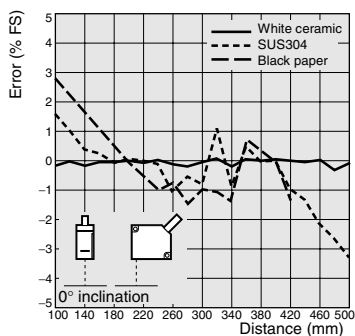


10° Inclination

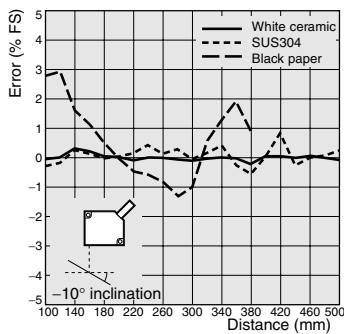


● ZX-LD300

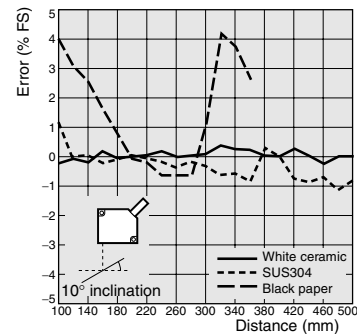
0° Inclination



-10° Inclination Front-to-back

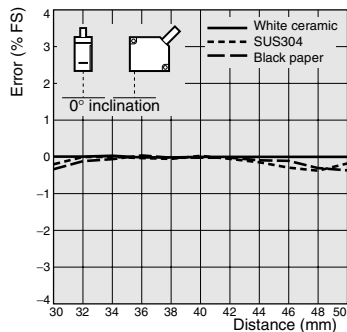


10° Inclination

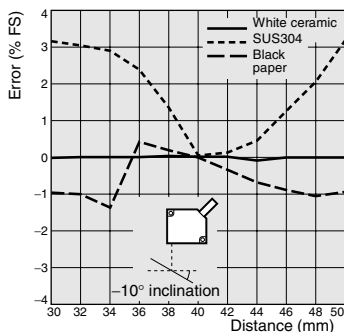


● ZX-LD40L

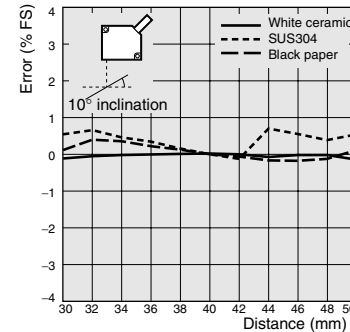
0° Inclination



-10° Inclination Front-to-back

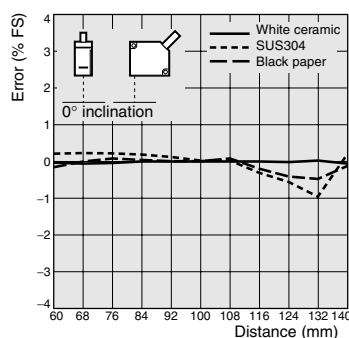


10° Inclination

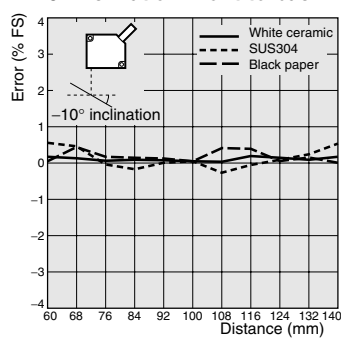


● ZX-LD100L

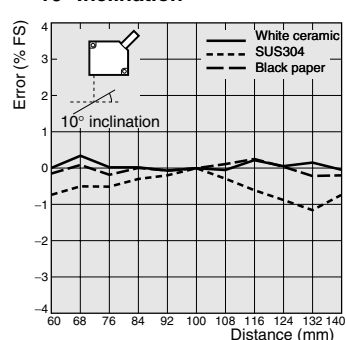
0° Inclination



-10° Inclination Front-to-back

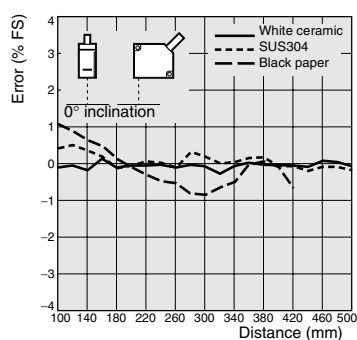


10° Inclination

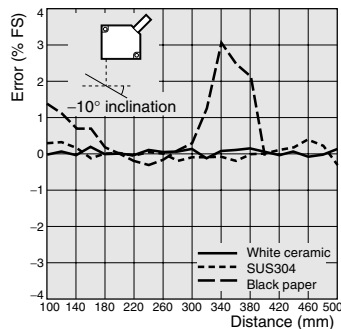


● ZX-LD300L

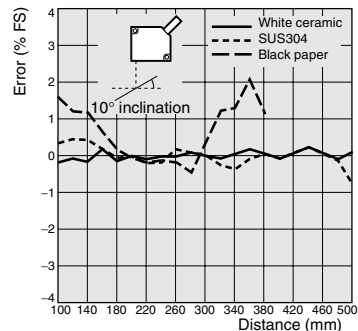
0° Inclination



-10° Inclination Front-to-back

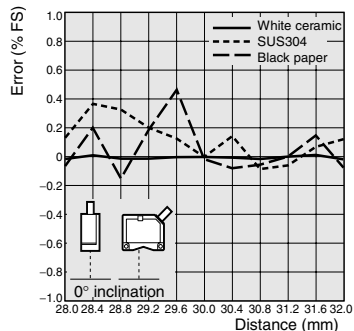


10° Inclination

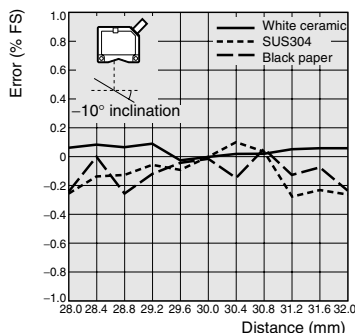


● ZX-LD30V

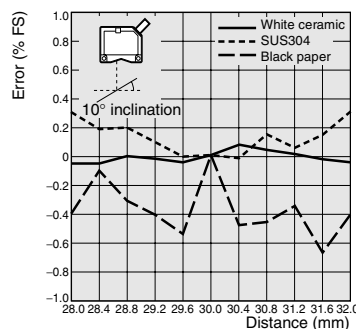
0° Inclination



-10° Inclination Front-to-back

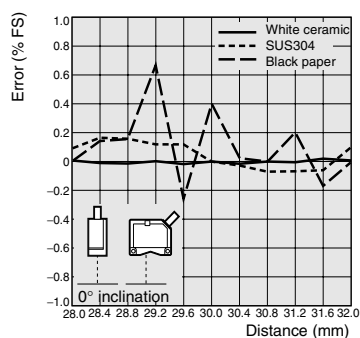


10° Inclination

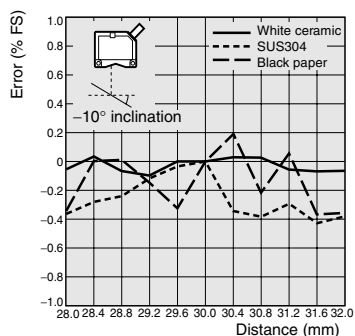


● ZX-LD30VL

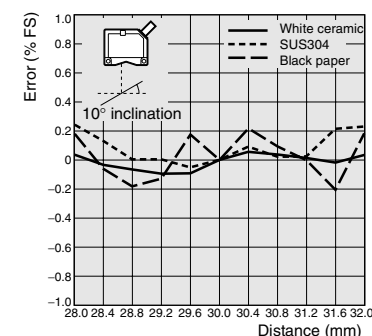
0° Inclination



-10° Inclination Front-to-back

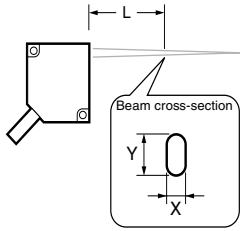


10° Inclination



Beam Size (Reflective Sensors)

● Spot Beams



ZX-LD40

L	30 mm	40 mm	50 mm
X	240 μm	40.0 μm	250 μm
Y	350 μm	30.0 μm	370 μm

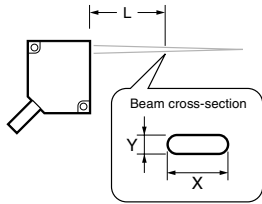
ZX-LD100

L	60 mm	100 mm	140 mm
X	390 μm	100 μm	430 μm
Y	620 μm	65.0 μm	650 μm

ZX-LD300

L	100 mm	300 mm	500 mm
X	1,050 μm	180 μm	1,100 μm
Y	450 μm	300 μm	850 μm

● Line Beams



ZX-LD40L

L	30 mm	40 mm	50 mm
X	2,000 μm	2,000 μm	2,000 μm
Y	240 μm	50.0 μm	250 μm

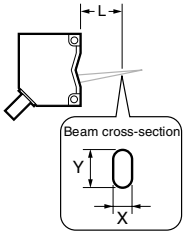
ZX-LD100L

L	60 mm	100 mm	140 mm
X	2,000 μm	2,000 μm	2,000 μm
Y	410 μm	100 μm	430 μm

ZX-LD300L

L	100 mm	300 mm	500 mm
X	2,000 μm	2,000 μm	2,500 μm
Y	750 μm	300 μm	650 μm

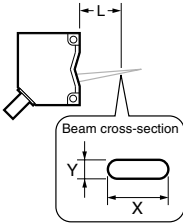
● Spot Beams



ZX-LD30V

L	28 mm	30 mm	32 mm
X	60.0 μm	30.0 μm	120 μm
Y	50.0 μm	40.0 μm	90.0 μm

● Line Beams



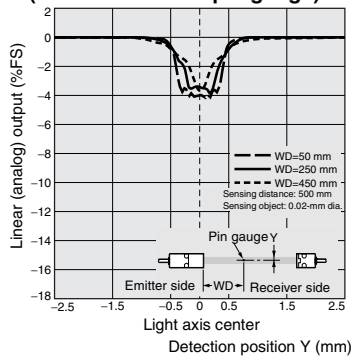
ZX-LD30VL

L	28 mm	30 mm	32 mm
X	1,800 μm	1,800 μm	1,800 μm
Y	90.0 μm	60.0 μm	110 μm

Sensing Object Characteristics (Through-beam Sensors)

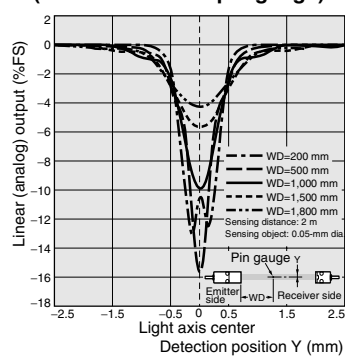
● ZX-LT001

(For 0.02-mm-dia. pin gauge)



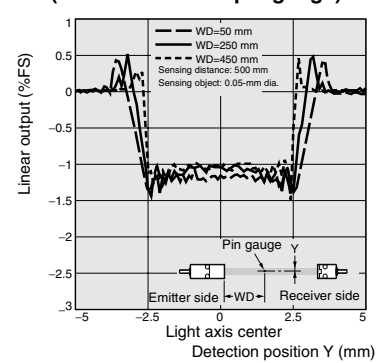
● ZX-LT001

(For 0.05-mm-dia. pin gauge)



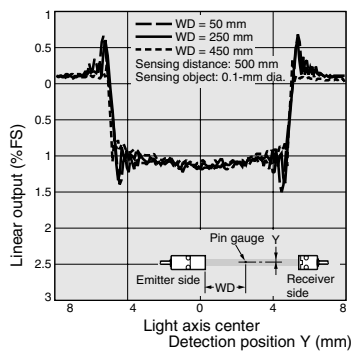
● ZX-LT005

(For 0.05-mm-dia. pin gauge)



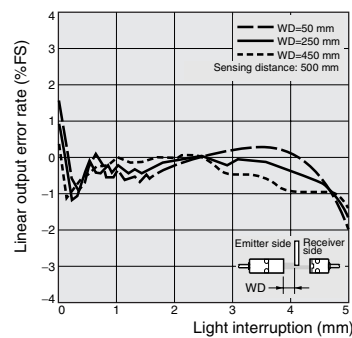
● ZX-LT010

(For 0.1-mm-dia. pin gauge)

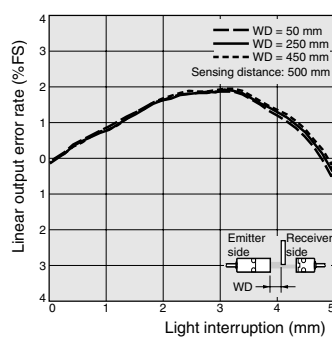


Linearity Characteristics

● ZX-LT005



● ZX-LT010

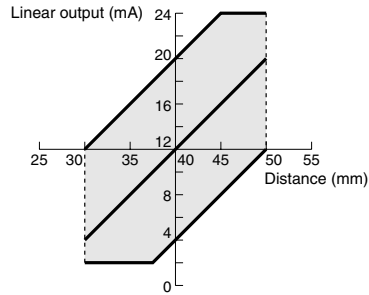


Linear Output vs. Sensing Distance

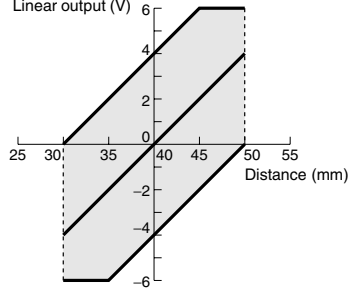
The output can be switched between a current output and a voltage output using a switch on the Amplifier Unit.

ZX-LD40/LD40L

Current Output

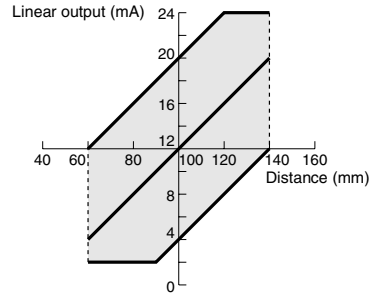


Voltage Output

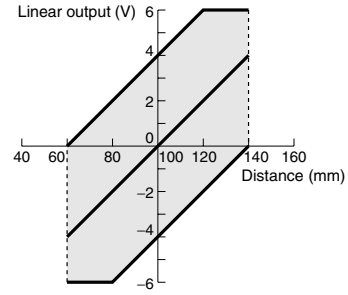


ZX-LD100/LD100L

Current Output

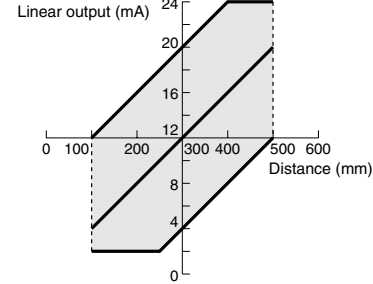


Voltage Output

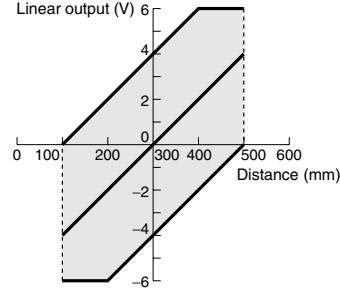


ZX-LD300/LD300L

Current Output

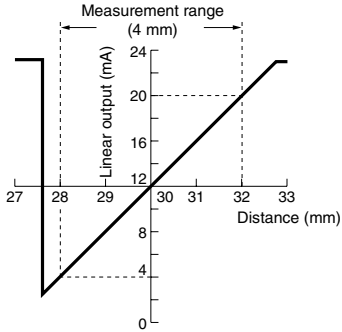


Voltage Output

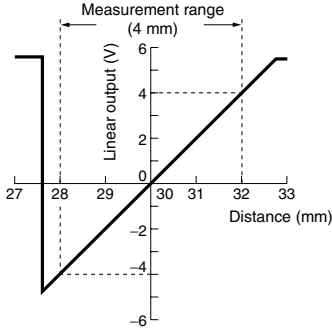


ZX-LD30V/LD30VL

Current Output

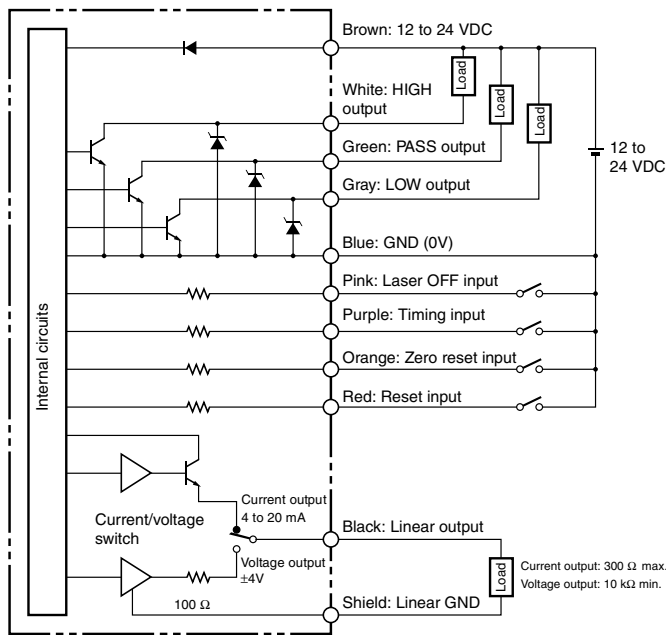


Voltage Output

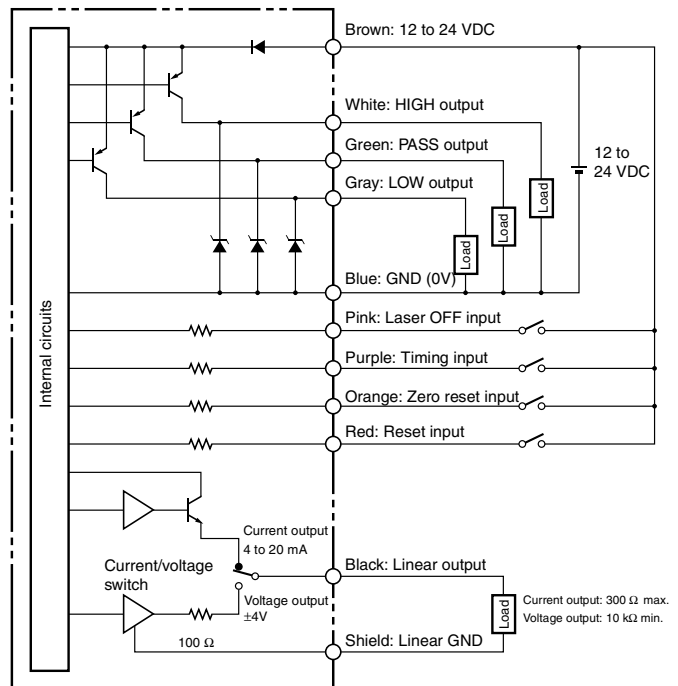


I/O Circuit Diagrams

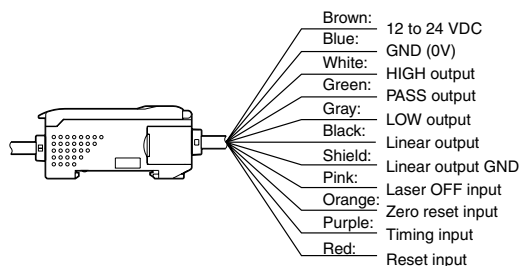
NPN Amplifier Unit: ZX-LDA11-N



PNP Amplifier Unit: ZX-LDA41-N



Connections: Amplifier Unit

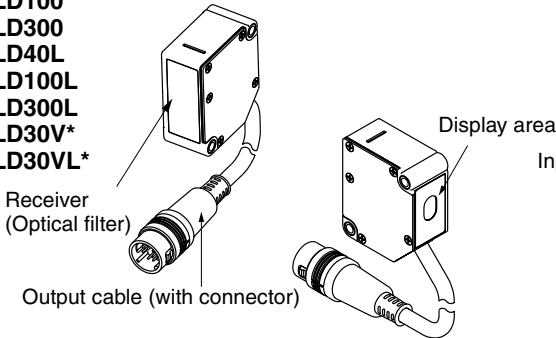


- Note 1.** Use a separate stabilized power supply for the Amplifier Unit, particularly when high resolution is required.
- 2.** Wire the Unit correctly. Incorrect wiring may result in damage to the Unit. (Do not allow wiring, particularly the linear output, to come into contact with other lines.)
- 3.** Use the 0-V line (blue) for the power supply and use the shield wire (linear output ground) together with the linear output (black line) for linear output. Each of these grounds must be used for the designed purpose. When not using the linear output, connect the linear ground (shield) to the 0-V ground.

Part Names

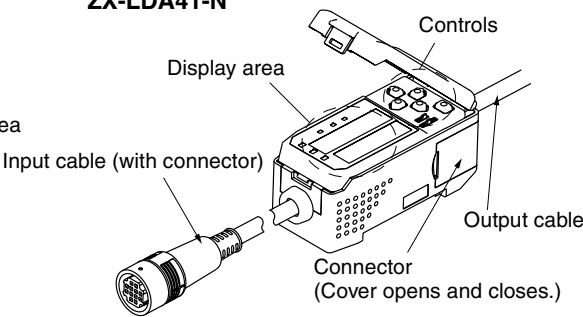
Sensor Heads (Reflective)

ZX-LD40
ZX-LD100
ZX-LD300
ZX-LD40L
ZX-LD100L
ZX-LD300L
ZX-LD30V*
ZX-LD30VL*



Amplifier Units

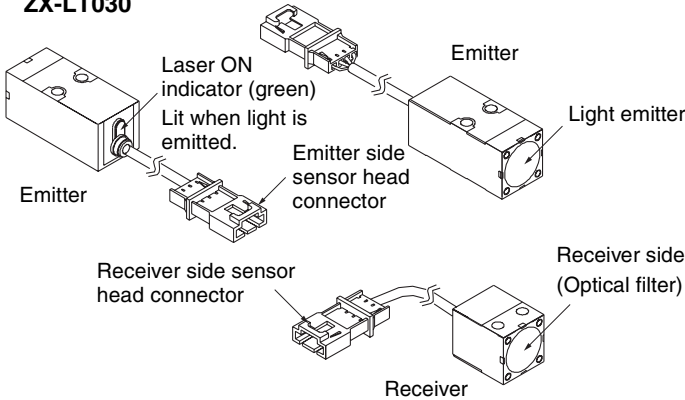
ZX-LDA11-N
ZX-LDA41-N



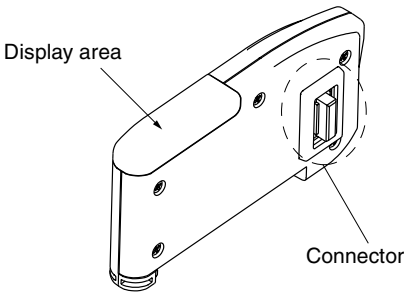
*The dimensions for these models are slightly different. Refer to page 23 for details.

Sensor Heads (Through-beam)

ZX-LT001
ZX-LT005
ZX-LT010
ZX-LT030



Calculating Unit ZX-CAL2



Precautions

■ Design Precautions

Ratings and Performance

- Conform to the specified ratings and performance. Refer to *Specifications* for details.
 1. Do not impose voltage exceeding the rated voltage, otherwise the Sensor may be damaged.
 2. When supplying power to the Sensor, make sure that the polarity of the power is correct, otherwise, the Sensor may be damaged. Do not connect to an AC power supply.
 3. Do not short-circuit the load for the open collector output, otherwise the Sensor may be damaged.
- Do not disconnect the connector connecting the Sensor Head and the controller while power is being supplied, otherwise the Sensor may be damaged.
- Allow a warm-up period of approximately 10 minutes after turning ON the power supply.
- Objects of certain materials or shapes may not be detectable, or the detection accuracy may not be sufficiently high. These include materials that are transparent or have extremely low reflectivity, and objects that are smaller than the Sensor's spot diameter or have extreme curvature or inclination.

Power Supply and Wiring

- Prior to turning ON the power supply after wiring is completed, check to make sure that the power supply is correct, that there are no mistaken connections, e.g., connections that would short-circuit the load, and that the load current is appropriate. Incorrect wiring may result in damage to the Sensor or Unit.
- The total length of the Sensor cable or Amplifier cable must be 10 m or less. Use an ZX-XC□A Extension Cable (order separately) if required to extend the cable from the Sensor. Use a shielded cable to extend the Amplifier cable. The shielded cable must be the same as that of the Amplifier cable.
- Do not lay a power supply cable for the ZX together with high-voltage lines or power lines to prevent interference, damage, and malfunction.
- When using a commercially available switching regulator, ground the FG (frame ground) terminal.
- If the power supply line is subject to surges, connect a surge absorber that meets the conditions of the usage environment.
- When using a Calculating Unit, connect the corresponding linear ground of the Amplifier Unit.

Compatibility

- All Sensor Heads and Amplifier Units are compatible. Different Sensor Heads may be purchased at a later date and used with existing Amplifier Units.

Mutual Interference

- Two Sensor Heads can be used together, without danger of mutual interference, by connecting the ZX-CAL 2 Calculating Unit between two Amplifier Units.

Maintenance

- Always turn OFF the power supply before adjusting or removing the Sensor Head.
- Cleaning

Do not use thinners, benzine, acetone, or kerosene for cleaning. If dust or oil adheres to the filter on the front of the Sensor Head, use the following procedure to clean.

 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 small amount of alcohol to remove the remaining dust. Do not use a scrubbing action when cleaning because scratches on the filter could result in Sensor inaccuracy.

■ Other Precautions

Environment

1. Do not use the Sensor in strong electromagnetic fields or in an environment where the operation of the Sensor is subject to the reflection of intense light (such as other laser beams or electric arc-welding machines.)
2. Do not operate the Sensor in the following locations:
 - Locations subject to strong vibration.
 - Locations subject to direct sunlight or near heating equipment.
 - Locations subject to high humidity.
 - Locations where the Sensor would accumulate dust, dirt, metallic powder, etc.
 - Locations subject to corrosive or flammable gases.
 - Locations subject to exposure to organic solvents, water, oil, etc.
 - Locations subject to strong electromagnetic or electrical fields.
 - Locations subject to rapid changes in temperature.
 - Locations subject to freezing.

Laser Safety

The ZX-LD-Series Sensor Heads are FDA Class II and EN Class 2 Laser Products. The ZX-LT-Series Sensor Heads are FDA Class II and EN Class 1 Laser Products. The ZX Series 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 and Class 2 of EN60825-1: 1994 = IEC825-1: 1993
U.S.A.: Class I and Class II of FDA (21 CFR1040.10)

1. Use this product as specified in this instruction manual. Otherwise, you may be exposed to hazardous laser radiation.
2. The ZX-series Smart Sensors radiate laser beams in the visible light range. Do not expose your eyes directly to the laser radiation. Ensure that the laser beam path is terminated during use. If a mirror or shiny surface is positioned in the laser beam path, ensure that the reflected beam path is also terminated. If the Unit must be used without terminating the laser beam path, position the laser beam path so that it is not at eye level.
3. To avoid exposure to hazardous laser radiation, do not displace nor remove the protective housing during operation, maintenance, and any other servicing.
4. The user should return the product to OMRON for all repair and servicing.
5. As for other countries, observe the regulations and standards specified by each country.



Requirements from Regulations and Standards

EN60825-1 “Safety of Laser Products, Equipment Classification, Requirements and User’s Guide”

● Summary of Manufacturer’s Requirements

Requirements; Sub-clause	Classification				
	Class 1	Class 2	Class 3A	Class 3B*	Class 4
Description of hazard class	Safe under reasonably foreseeable conditions	Low power; eye protection normally afforded by aversion responses	Same as Class 2. Direct intrabeam viewing with optical aids may be hazardous	Direct intrabeam viewing may be hazardous	High power; diffused reflection may be hazardous
Protective housing	Required for each laser product; limits access necessary for performance of functions of the products				
Safety interlock in protective housing	Designed to prevent removal of the panel until accessible emission values are below the AEL (see note 2) for the class assigned				
Remote control	Not required			Permits easy addition of external interlock in laser installation	
Key control	Not required			Laser inoperative when key is removed	
Emission warning device	Not required			Gives audible or visible warning when laser is switched on or if capacitor bank of pulsed laser is being charged	
Attenuator	Not required			Gives means beside ON/OFF switch to temporarily block beam	
Location controls	Not required		Controls so located that there is no danger of exposure to AEL above Classes 1 or 2 when adjustments are made.		
Viewing optics	Emission from all viewing systems must be below Class 1 AEL's as applicable				
Scanning	Scan failure shall not cause product to exceed its classification				
Class label	Required wording	Figures A and B and specified wording			
Aperture label	Not required			Specified wording required	
Service entry label	Required as appropriate to the class of accessible radiation				
Override interlock label	Required under certain conditions as appropriate to the class of laser used				
User information	Operation manuals must contain instructions for safe use				
Purchasing and service information	Promotion brochures must reproduce classification labels; service manuals must contain safety information				
Medical products	Special calibration instructions required			Special calibration instructions, means for measurement and target-indicator required	
Fibre optic	Cable service connections require tool to disconnect if disconnection breaks protective housing and permits access above Class 1				

*With respect to the requirements of remote interlock connector, key control, emission warning and attenuator, Class 3B laser products not exceeding five times the AEL of Class 2 in the wavelength range of 400 nm to 700 nm are to be treated as Class 3A laser products.

Note 1. This table is intended to provide a convenient summary of requirements. See text of this standard for complete requirements.

2. AEL: Accessible Emission Limit
The maximum accessible emission level permitted within a particular class.
For your reference, see ANSI Z136.1-1993, Section 2.

Symbol and border: black
Background: yellow

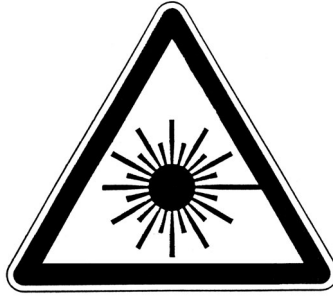


Figure A Warning label - Hazard symbol

Legend and border: black
Background: yellow



Figure B Explanatory label

● FDA (Compliance Guide for Laser Products, 1985, according to 21 CFR1040.10)

Requirements	Class (see note 1)					
	I	IIa	II	IIIa	IIIb	IV
Performance (all laser products)						
Protective housing	R (see note 2)	R (see note 2)	R (see note 2)	R (see note 2)	R (see note 2)	R (see note 2)
Safety interlock	R (see notes 3, 4)	R (see notes 3, 4)	R (see notes 3, 4)	R (see notes 3, 4)	R (see notes 3, 4)	R (see notes 3, 4)
Location of controls	N/A	R	R		R	R
Viewing optics	R	R	R	R	R	R
Scanning safeguard	R	R	R	R	R	R
Performance (laser systems)						
Remote control connector	N/A	N/A	N/A	N/A	R	R
Key control	N/A	N/A	N/A	N/A	R	R
Emission indicator	N/A	N/A	R	R	R (see note 10)	R (see note 10)
Beam attenuator	N/A	N/A	R	R	R	R
Reset	N/A	N/A	N/A	N/A	N/A	R (see note 13)
Performance (specific purpose products)						
Medical	S	S	S	S (see note 8)	S (see note 8)	S (see note 8)
Surveying, leveling, alignment	S	S	S	S	NP	NP
Demonstration	S	S	S	S	S (see note 11)	S (see note 11)
Labeling (all laser products)						
Certification & identification	R	R	R	R	R	R
Protective housing	D (see note 5)	D (see note 5)	D (see note 5)	D (see note 5)	D (see note 5)	D (see note 5)
Aperture	N/A	N/A	R	R	R	R
Class warning	N/A	R (see note 6)	R (see note 7)	R (see note 9)	R (see note 12)	R (see note 12)
Information (all laser products)						
User information	R	R	R	R	R	R
Product literature	N/A	R	R	R	R	R
Service information	R	R	R	R	R	R

Abbreviations:

R: Required.

N/A: Not applicable.

S: Requirements: Same as for other products of that Class.

Also see footnotes.

NP: Not permitted.

D: Depends on level of interior radiation.

Footnotes:

1. Based on highest level accessible during operation.
2. Required wherever & whenever human access to laser radiation above Class I limits is not needed for product to perform its function.
3. Required for protective housings opened during operation or maintenance, if human access thus gained is not always necessary when housing is open.
4. Interlock requirements vary according to Class of internal radiation.
5. Wording depends on level & wavelength of laser radiation within protective housing.
6. Warning statement label.
7. CAUTION logotype.
8. Requires means to measure level of laser radiation intended to irradiate the body.
9. CAUTION if 2.5 mW cm² or less, DANGER if greater than 2.5 mW cm².
10. Delay required between indication & emission.
11. Variance required for Class IIb or IV demonstration laser products and light shows.
12. DANGER logotype.
13. Required after August 20, 1986.

Use Precautions

● EN60825-1

Requirements; Sub-clause	Classification				
	Class 1	Class 2	Class 3A	Class 3B*	Class 4
Remote interlock	Not required			Connect to room or door circuits	
Key control	Not required			Remove key when not in use	
Beam attenuator	Not required			When in use prevents inadvertent exposure	
Emission indicator device	Not required			Indicates laser is energized	
Warning signs	Not required			Follow precautions on warning signs	
Beam path	Not required	Terminate beam at end of useful length			
Specular reflection	No requirements			Prevent unintentional reflections	
Eye protection	No requirements		Required if engineering and administrative procedures not practicable and MPE exceeded		
Protective clothing	No requirements			Sometimes required	Specific requirements
Training	No requirements		Required for all operator and maintenance personnel		

*With respect to the requirements of remote interlock connector, key control, beam attenuator, and emission indicator, Class 3B laser products not exceeding five times the AEL of Class 2 in the wavelength range of 400 nm to 700 nm are to be treated as Class 3A laser products.

Note: This table is intended to provide a convenient summary of requirements. See text of this standard for complete precautions.

● ANSI Z136.1:1993 “American National Standard for the Safe Use of Lasers” Control Measures for the Four Laser Classes

Control measures	Classification					
Engineering Controls	1	2a	2	3a	3b	4
Protective Housing (4.3.1)	X	X	X	X	X	X
Without Protective Housing (4.3.1.1)	LSO (see note 2) shall establish Alternate Controls					
Interlocks on Protective Housing (4.3.2)	☆	☆	☆	☆	X	X
Service Access Panel (4.3.3)	☆	☆	☆	☆	X	X
Key Control (4.3.4)	---	---	---	---	•	X
Viewing Portals (4.3.5.1)	---	---	MPE	MPE	MPE	MPE
Collecting Optics (4.3.5.2)	MPE	MPE	MPE	MPE	MPE	MPE
Totally Open Beam Path (4.3.6.1)	---	---	---	---	X NHZ	X NHZ
Limited Open Beam Path (4.3.6.2)	---	---	---	---	X NHZ	X NHZ
Enclosed Beam Path (4.3.6.3)	None is required if 4.3.1 and 4.3.2 fulfilled					
Remote Interlock Connector (4.3.7)	---	---	---	---	•	X
Beam Stop or Attenuator (4.3.8)	---	---	---	---	•	X
Activation Warning Systems (4.3.9)	---	---	---	---	•	X
Emission Delay (4.3.9.1)	---	---	---	---	---	X
Indoor Laser Controlled Area (4.3.10)	---	---	---	---	X NHZ	X NHZ
Class 3b Laser Controlled Area (4.3.10.1)	---	---	---	---	X	---
Class 4 Laser Controlled Area (4.3.10.2)	---	---	---	---	---	X
Laser Outdoor Controls (4.3.11)	---	---	---	---	X NHZ	X NHZ
Laser in Navigable Airspace (4.3.11.2)	---	---	---	•	•	•
Temporary Laser Controlled Area (4.3.12)	☆ MPE	☆ MPE	☆ MPE	☆ MPE	---	---
Remote Firing & Monitoring (4.3.13)	---	---	---	---	---	•
Labels (4.3.14 and 4.7)	X	X	X	X	X	X
Area Posting (4.3.15)	---	---	---	•	X NHZ	X NHZ
Administrative & Procedural Controls	1	2a	2	3a	3b	4
Standard Operating Procedures (4.4.1)	---	---	---	---	•	X
Output Emission Limitations (4.4.2)	---	---	---	LSO Determination		
Education and Training (4.4.3)	---	---	•	•	X	X
Authorized Personnel (4.4.4)	---	---	---	---	X	X
Alignment Procedures (4.4.5)	---	---	X	X	X	X

Control measures	Classification					
Protective Equipment (4.4.6)	---	---	---	---	•	X
Spectator (4.4.7)	---	---	---	---	•	X
Service Personnel (4.4.8)	☆ MPE	☆ MPE	☆ MPE	☆ MPE	X	X
Demonstration with General Public (4.5.1)	MPE †	---	X	X	X	X
Laser Optical Fiber Systems (4.5.2)	MPE	MPE	MPE	MPE	X	X
Laser Robotic Installations (4.5.3)	---	---	---	---	X NHZ	X NHZ
Eye Protection (4.6.2)	---	---	---	---	• MPE	X MPE
Protective Windows (4.6.3)	---	---	---	---	X NHZ	X NHZ
Protective Barriers and Curtains (4.6.4)	---	---	---	---	•	•
Skin Protection (4.6.5)	---	---	---	---	X MPE	X MPE
Other Protective Equipment (4.6.5)	Use may be required					
Warning Signs and Labels (4.7) (Design Requirements)	---	---	•	•	X NHZ	X NHZ
Service and Repairs (4.8)	LSO Determination					
Modification of Laser Systems (4.9)	LSO Determination					

Note 1. LEGEND

- X: Shall
- : Should
- : No requirement
- ☆: Shall if enclosed Class 3b or Class 4
- MPE: Shall if MPE is exceeded
- NHZ: Nominal Hazard Zone analysis required
- †: Applicable only to UV and IR Lasers (4.5.1.2)

2. LSO: Laser Safety Officer

An individual shall be designated the Laser Safety Officer with the authority and responsibility to monitor and enforce the control of laser hazards, and to effect the knowledgeable evaluation and control of laser hazards.
For your reference, see ANSI Z136.1-1993, Section 1.3.

Laser Product Classifications

● EN

Class	Description
Class 1	Lasers which are safe under reasonably foreseeable conditions of operation.
Class 2	Lasers emitting visible radiation in the wavelength range from 400 nm to 700 nm. Eye protection is normally afforded by aversion responses including the blink reflex.
Class 3A	Lasers which are safe for viewing with the unaided eye. For laser emitting in the wavelength range from 400 nm to 700 nm, protection is afforded by aversion responses including the blink reflex. For other wavelengths the hazard to the unaided eye is no greater than for Class 1. Direct intrabeam viewing of Class 3A lasers with optical aides (e.g., binoculars, telescopes, microscopes) may be hazardous.
Class 3B	Direct intrabeam viewing of these lasers is always hazardous. Viewing diffuse reflections is normally safe (see note).
Class 4	Lasers which are also capable of producing hazardous diffuse reflections. They may cause skin injuries and could also constitute a fire hazard. Their use requires extreme caution.

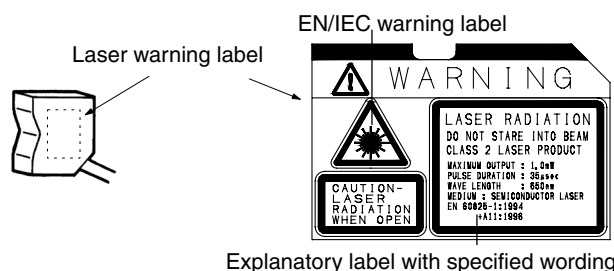
Note: Conditions for safe viewing of diffuse reflections for Class 3B visible lasers are: minimum viewing distance of 13 cm between screen and cornea and a maximum viewing time of 10 s. Other viewing conditions require a comparison of the diffuse reflection exposure with the MPE.

Comparison of Classifications between FDA and ANSI

Class	FDA definition	ANSI description
Class I/1	Limits applicable to devices that have emissions in the ultraviolet, visible, and infrared spectra, and limits below which biological hazards have not been established.	A Class 1 laser is considered to be incapable of producing damaging radiation levels during operation and maintenance and is, therefore, exempt from any control measures or other forms of surveillance.
Class IIa/2a	Limits applicable to products whose visible emission does not exceed Class I limits for emission durations of 1,000 seconds or less and are not intended for viewing.	Class 2 lasers are divided into two subclasses, 2 and 2a. A Class 2 laser emits in the visible portion of the spectrum (0.4 to 0.7 μm) and eye protection is normally afforded by the aversion response including the blink reflex.
Class II/2	Limits applicable to products that have emissions in the visible spectrum (400 to 710 nm) for emission durations in excess of 0.25 second, providing that emissions for other durations and/or wavelengths do not exceed the Class I limits. Class II products are considered hazardous for direct long-term ocular exposure.	
Class IIIa/3a	Limits to products that have emissions in the visible spectrum and that have beams where the total collectable radiant power does not exceed 5 milliwatts.	Class 3 lasers are divided into two subclasses, 3a and 3b. A Class 3 laser may be hazardous under direct and specular reflection viewing conditions, but the diffuse reflection is usually not a hazard.
Class IIIb/3b	Limits applicable to devices that emit in the ultraviolet, visible, and infrared spectra. Class IIIb products include laser systems ranging from 5 to 500 milliwatts in the visible spectrum. Class IIIb emission levels are ocular hazards for direct exposure throughout the range of the Class, and skin hazards at the higher levels of the Class.	
Class IV/4	Exceeding the limits of Class IIIb and are a hazard for scattered reflection as well as for direct exposure.	A Class 4 laser is a hazard to the eye or skin from the direct beam and sometimes from a diffuse reflection and also can be a fire hazard. Class 4 lasers may also produce laser-generated air contaminants and hazardous plasma radiation.

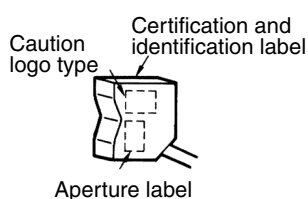
Label Indications

● EN

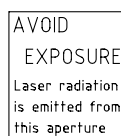


Note: Use of controls, adjustments, or procedures other than those specified herein may result in hazardous radiation exposure.

● FDA



Aperture Label



Class II Caution logo type



Certification and Identification Label



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

■ Sensor Heads (Diffuse Reflective)

Technical drawing of the ZX-LD series laser detector, showing front, side, and detail views with dimensions and labels.

Front View Dimensions:

- Top mounting holes: 17 mm total width, 16.6 mm center-to-center, 12.4 mm from top edge.
- Emitter axis: 1.8 mm from top edge.
- Receiver axis: 31.1 mm from top edge.
- Mounting holes: Two 3.2-dia. mounting holes, 7 mm from top edge.
- Range indicators: 30.05 mm from top edge.
- Connector: 15 dia. diameter, 46 mm length.
- Vinyl-insulated round cable: 5.1 dia., Standard: 500 mm.

Side View Dimensions:

- Measurement point: 33 mm from front face.
- Reference surface: 7 mm from front face.
- Emitter axis: 39 mm from front face.
- Receiver axis: 39 mm from front face.
- Mounting holes: Two 3.2-dia. mounting holes, 7 mm from front face.
- Range indicators: 32 mm from front face.
- Connector: 15 dia. diameter, 46 mm length.
- Vinyl-insulated round cable: 5.1 dia., Standard: 500 mm.

Detail View Dimensions:

- Mounting holes: Two, M3 holes, 14.8 mm from top edge, 3.4 mm from side edge.
- Range indicators: 14.8 mm from top edge, 3.4 mm from side edge.
- Mounting holes: Two, M3 holes, 26 ± 0.1 mm from side edge, 32 ± 0.1 mm from top edge.

Labels:

- Measurement point
- Reference surface
- Emitter axis
- Receiver axis
- Mounting holes
- Range indicators
- Connector
- Vinyl-insulated round cable

Notes:

- * ZX-LD40L: L = 40 mm, A = 23°
- ZX-LD10L: L = 100 mm, A = 11°
- ZX-LD30L: L = 300 mm, A = 3.8°

30V
30VL

Vinyl-insulated round cable,
5.1 dia., Standard: 0.5 m

Connector

Mounting Holes
Two, M4 holes
47 \pm 0.1

Light axis

Two, 4.5-dia. mounting holes

Reference plain

Receiver axis

Emitter axis

Measurement center

Lens (16 dia.)

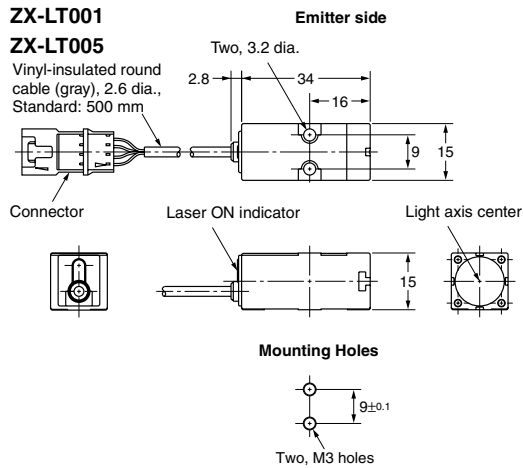
Lens (10 dia.)

■ Sensor Heads (Through-beam)

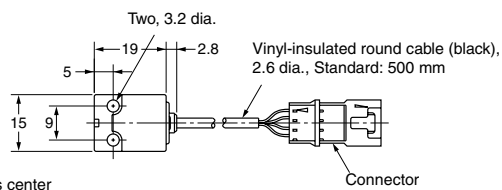
ZX-LT001

ZX-LT005

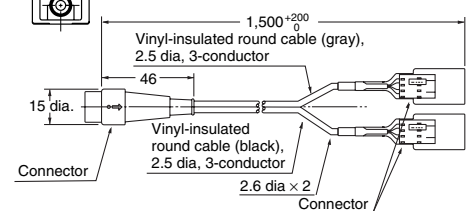
Vinyl-insulated round cable (gray), 2.6 dia., Standard: 500 mm



Receiver side

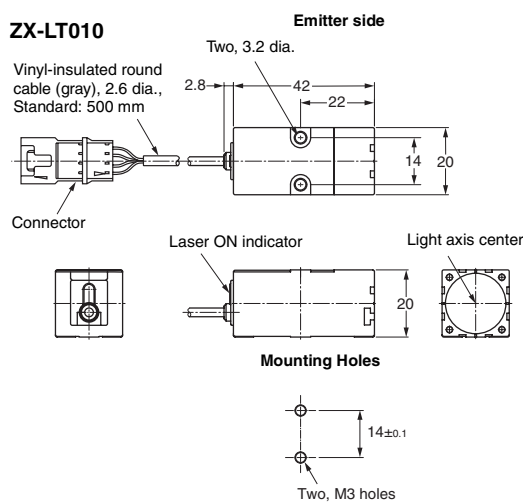


Sensor Head-Amplifier Unit Connecting Cable (Provided)

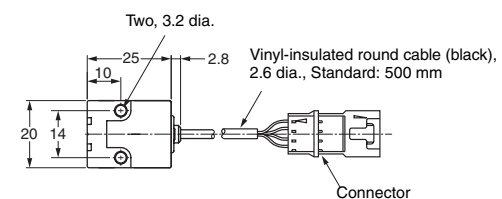


ZX-LT010

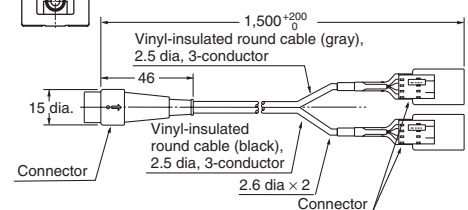
Vinyl-insulated round cable (gray), 2.6 dia., Standard: 500 mm



Receiver side

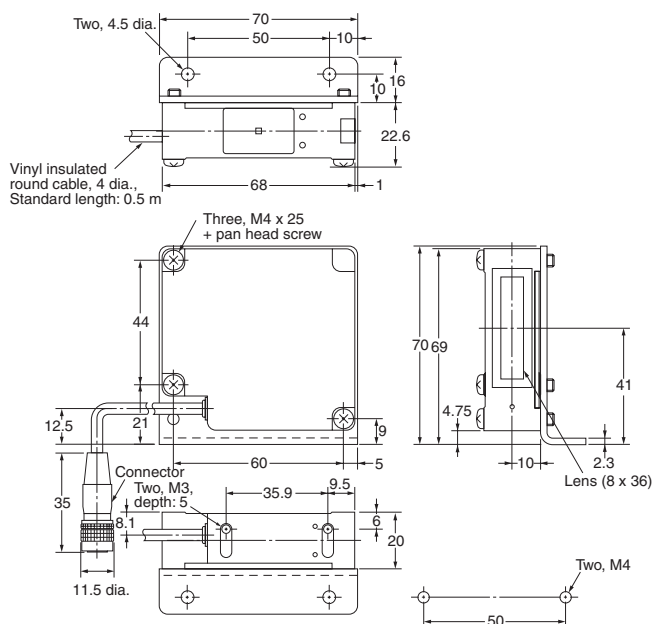


Sensor Head-Amplifier Unit Connecting Cable (Provided)

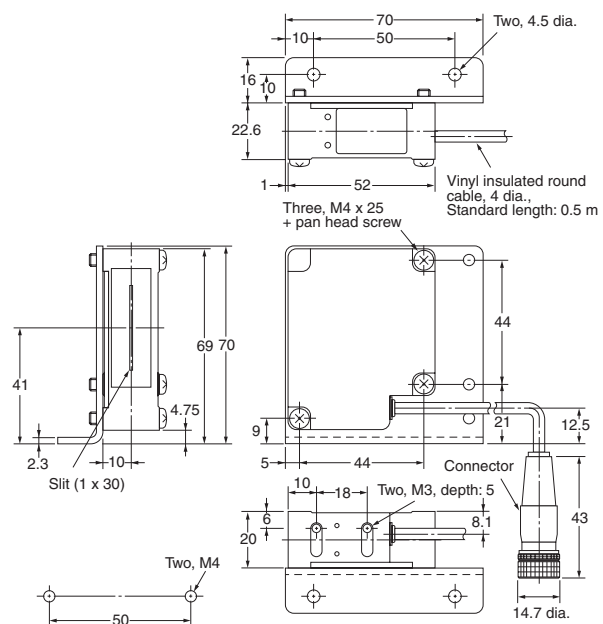


ZX-LT030

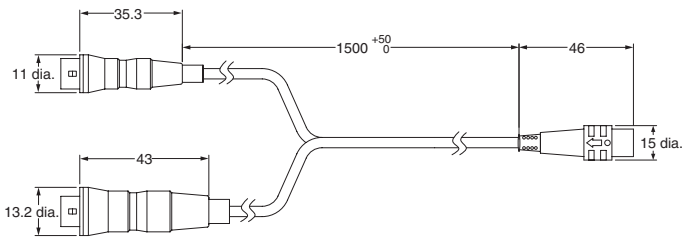
Emitter



Receiver

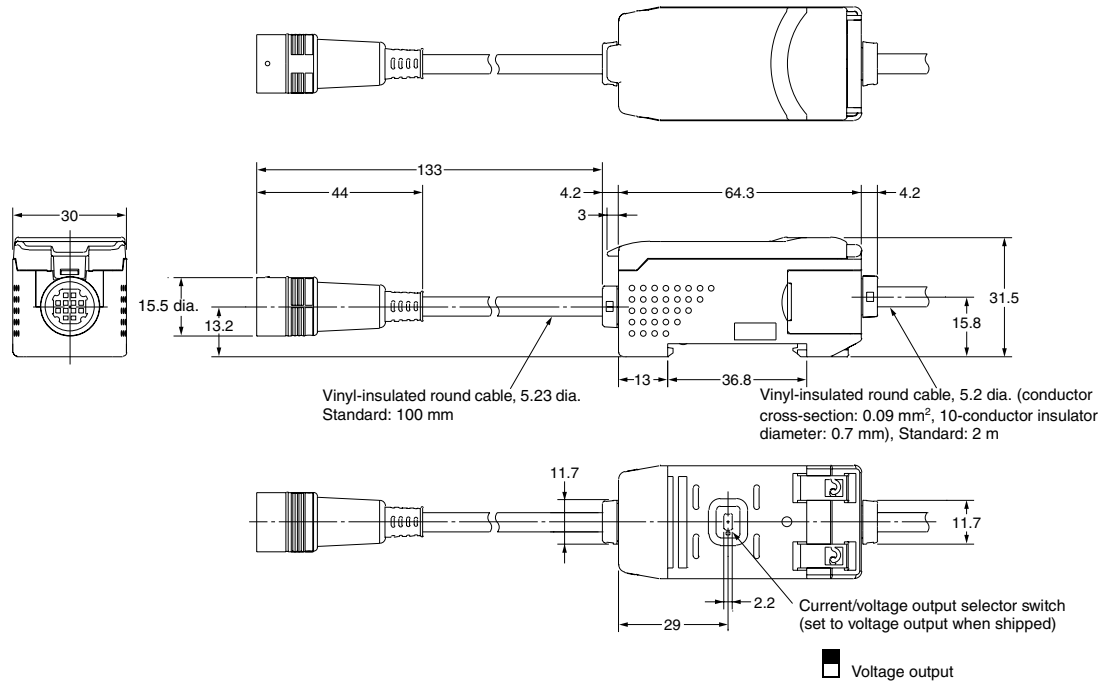


■ Sensor Head - Amplifier Connection Cable



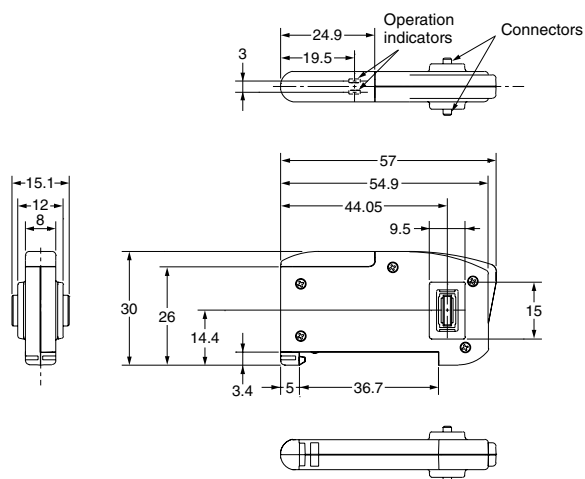
■ Amplifier Units

ZX-LDA11-N
ZX-LDA41-N

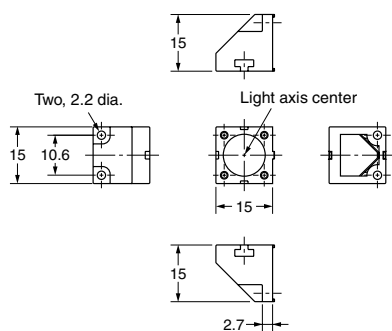


■ Accessories (Order Separately)

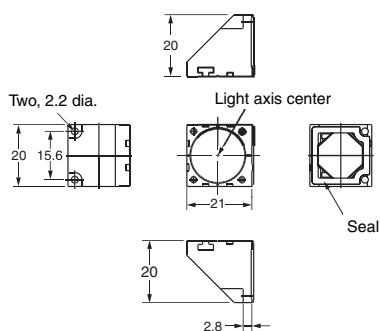
Calculating Unit ZX-CAL2



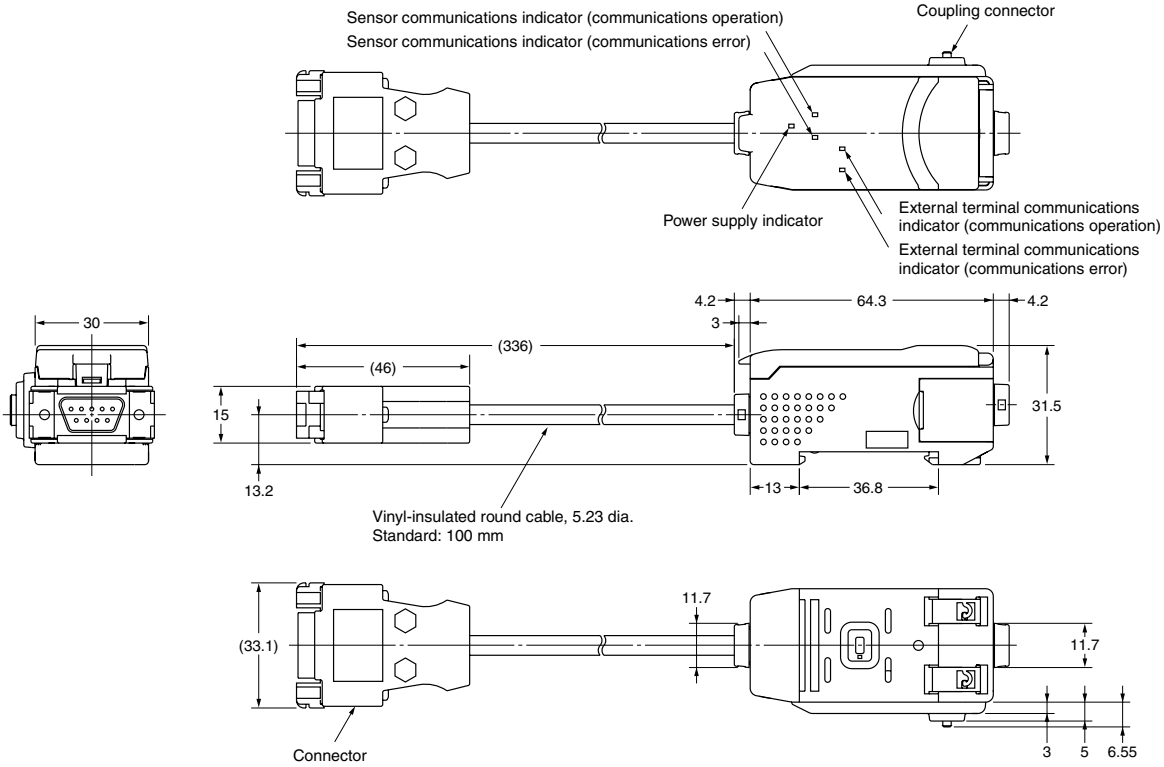
Side-view Attachments ZX-XF12



ZX-XF22

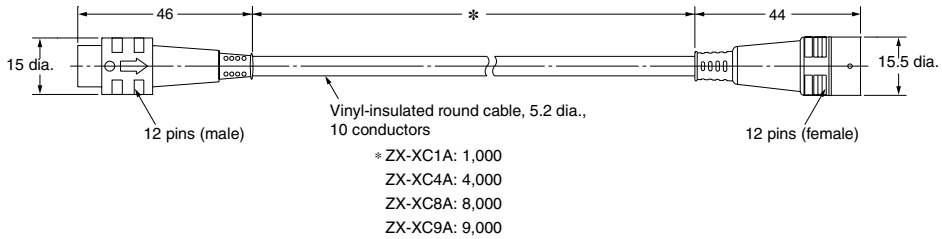


ZX-series Communications Interface Unit
ZX-SF11



Cables with Connectors on Both Ends (for Extension)

- ZX-XC1A (1 m)**
- ZX-XC4A (4 m)**
- ZX-XC8A (8 m)**
- ZX-XC9A (9 m)**



Terms and Conditions of Sale

1. **Offer; Acceptance.** These terms and conditions (these "Terms") are deemed part of all quotes, agreements, purchase orders, acknowledgments, price lists, catalogs, manuals, brochures and other documents, whether electronic or in writing, relating to the sale of products or services (collectively, the "Products") by Omron Electronics LLC and its subsidiary companies ("Omron"). Omron objects to any terms or conditions proposed in Buyer's purchase order or other documents which are inconsistent with, or in addition to, these Terms.
2. **Prices; Payment Terms.** All prices stated are current, subject to change without notice by Omron. Omron reserves the right to increase or decrease prices on any unshipped portions of outstanding orders. Payments for Products are due net 30 days unless otherwise stated in the invoice.
3. **Discounts.** Cash discounts, if any, will apply only on the net amount of invoices sent to Buyer after deducting transportation charges, taxes and duties, and will be allowed only if (i) the invoice is paid according to Omron's payment terms and (ii) Buyer has no past due amounts.
4. **Interest.** Omron, at its option, may charge Buyer 1-1/2% interest per month or the maximum legal rate, whichever is less, on any balance not paid within the stated terms.
5. **Orders.** Omron will accept no order less than \$200 net billing.
6. **Governmental Approvals.** Buyer shall be responsible for, and shall bear all costs involved in, obtaining any government approvals required for the importation or sale of the Products.
7. **Taxes.** All taxes, duties and other governmental charges (other than general real property and income taxes), including any interest or penalties thereon, imposed directly or indirectly on Omron or required to be collected directly or indirectly by Omron for the manufacture, production, sale, delivery, importation, consumption or use of the Products sold hereunder (including customs duties and sales, excise, use, turnover and license taxes) shall be charged to and remitted by Buyer to Omron.
8. **Financial.** If the financial position of Buyer at any time becomes unsatisfactory to Omron, Omron reserves the right to stop shipments or require satisfactory security or payment in advance. If Buyer fails to make payment or otherwise comply with these Terms or any related agreement, Omron may (without liability and in addition to other remedies) cancel any unshipped portion of Products sold hereunder and stop any Products in transit until Buyer pays all amounts, including amounts payable hereunder, whether or not then due, which are owing to it by Buyer. Buyer shall in any event remain liable for all unpaid accounts.
9. **Cancellation; Etc.** Orders are not subject to rescheduling or cancellation unless Buyer indemnifies Omron against all related costs or expenses.
10. **Force Majeure.** Omron shall not be liable for any delay or failure in delivery resulting from causes beyond its control, including earthquakes, fires, floods, strikes or other labor disputes, shortage of labor or materials, accidents to machinery, acts of sabotage, riots, delay in or lack of transportation or the requirements of any government authority.
11. **Shipping; Delivery.** Unless otherwise expressly agreed in writing by Omron:
 - a. Shipments shall be by a carrier selected by Omron; Omron will not drop ship except in "break down" situations.
 - b. Such carrier shall act as the agent of Buyer and delivery to such carrier shall constitute delivery to Buyer;
 - c. All sales and shipments of Products shall be FOB shipping point (unless otherwise stated in writing by Omron), at which point title and risk of loss shall pass from Omron to Buyer; provided that Omron shall retain a security interest in the Products until the full purchase price is paid;
 - d. Delivery and shipping dates are estimates only; and
 - e. Omron will package Products as it deems proper for protection against normal handling and extra charges apply to special conditions.
12. **Claims.** Any claim by Buyer against Omron for shortage or damage to the Products occurring before delivery to the carrier must be presented in writing to Omron within 30 days of receipt of shipment and include the original transportation bill signed by the carrier noting that the carrier received the Products from Omron in the condition claimed.
13. **Warranties.** (a) **Exclusive Warranty.** Omron's exclusive warranty is that the Products will be free from defects in materials and workmanship for a period of twelve months from the date of sale by Omron (or such other period expressed in writing by Omron). Omron disclaims all other warranties, express or implied. (b) **Limitations.** OMRON MAKES NO WARRANTY OR REPRESENTATION, EXPRESS OR IMPLIED, ABOUT NON-INFRINGEMENT, MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OF THE PRODUCTS. BUYER ACKNOWLEDGES THAT IT ALONE HAS DETERMINED THAT THE PRODUCTS WILL SUITABLY MEET THE REQUIREMENTS OF THEIR INTENDED USE. Omron further disclaims all warranties and responsibility of any type for claims or expenses based on infringement by the Products or otherwise of any intellectual property right. (c) **Buyer Remedy.** Omron's sole obligation hereunder shall be, at Omron's election, to (i) replace (in the form originally shipped with Buyer responsible for labor charges for removal or replacement thereof) the non-complying Product, (ii) repair the non-complying Product, or (iii) repay or credit Buyer an amount equal to the purchase price of the non-complying Product; provided that in no event shall Omron be responsible for warranty, repair, indemnity or any other claims or expenses regarding the Products unless Omron's analysis confirms that the Products were properly handled, stored, installed and maintained and not subject to contamination, abuse, misuse or inappropriate modification. Return of any Products by Buyer must be approved in writing by Omron before shipment. Omron Companies shall not be liable for the suitability or unsuitability or the results from the use of Products in combination with any electrical or electronic components, circuits, system assemblies or any other materials or substances or environments. Any advice, recommendations or information given orally or in writing, are not to be construed as an amendment or addition to the above warranty. See <http://oeweb.omron.com> or contact your Omron representative for published information.
14. **Limitation on Liability; Etc.** OMRON COMPANIES SHALL NOT BE LIABLE FOR SPECIAL, INDIRECT, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, LOSS OF PROFITS OR PRODUCTION OR COMMERCIAL LOSS IN ANY WAY CONNECTED WITH THE PRODUCTS, WHETHER SUCH CLAIM IS BASED IN CONTRACT, WARRANTY, NEGLIGENCE OR STRICT LIABILITY. Further, in no event shall liability of Omron Companies exceed the individual price of the Product on which liability is asserted.
15. **Indemnities.** Buyer shall indemnify and hold harmless Omron Companies and their employees from and against all liabilities, losses, claims, costs and expenses (including attorney's fees and expenses) related to any claim, investigation, litigation or proceeding (whether or not Omron is a party) which arises or is alleged to arise from Buyer's acts or omissions under these Terms or in any way with respect to the Products. Without limiting the foregoing, Buyer (at its own expense) shall indemnify and hold harmless Omron and defend or settle any action brought against such Companies to the extent based on a claim that any Product made to Buyer specifications infringed intellectual property rights of another party.
16. **Property; Confidentiality.** Any intellectual property in the Products is the exclusive property of Omron Companies and Buyer shall not attempt to duplicate it in any way without the written permission of Omron. Notwithstanding any charges to Buyer for engineering or tooling, all engineering and tooling shall remain the exclusive property of Omron. All information and materials supplied by Omron to Buyer relating to the Products are confidential and proprietary, and Buyer shall limit distribution thereof to its trusted employees and strictly prevent disclosure to any third party.
17. **Export Controls.** Buyer shall comply with all applicable laws, regulations and licenses regarding (i) export of products or information; (ii) sale of products to "forbidden" or other proscribed persons; and (iii) disclosure to non-citizens of regulated technology or information.
18. **Miscellaneous.** (a) **Waiver.** No failure or delay by Omron in exercising any right and no course of dealing between Buyer and Omron shall operate as a waiver of rights by Omron. (b) **Assignment.** Buyer may not assign its rights hereunder without Omron's written consent. (c) **Law.** These Terms are governed by the law of the jurisdiction of the home office of the Omron company from which Buyer is purchasing the Products (without regard to conflict of law principles). (d) **Amendment.** These Terms constitute the entire agreement between Buyer and Omron relating to the Products, and no provision may be changed or waived unless in writing signed by the parties. (e) **Severability.** If any provision hereof is rendered ineffective or invalid, such provision shall not invalidate any other provision. (f) **Setoff.** Buyer shall have no right to set off any amounts against the amount owing in respect of this invoice. (g) **Definitions.** As used herein, "including" means "including without limitation"; and "Omron Companies" (or similar words) mean Omron Corporation and any direct or indirect subsidiary or affiliate thereof.

Certain Precautions on Specifications and Use

1. **Suitability of Use.** Omron Companies shall not be responsible for conformity with any standards, codes or regulations which apply to the combination of the Product in the Buyer's application or use of the Product. At Buyer's request, Omron will provide applicable third party certification documents identifying ratings and limitations of use which apply to the Product. This information by itself is not sufficient for a complete determination of the suitability of the Product in combination with the end product, machine, system, or other application or use. Buyer shall be solely responsible for determining appropriateness of the particular Product with respect to Buyer's application, product or system. Buyer shall take application responsibility in all cases but the following is a non-exhaustive list of applications for which particular attention must be given:
 - (i) Outdoor use, uses involving potential chemical contamination or electrical interference, or conditions or uses not described in this document.
 - (ii) Use in consumer products or any use in significant quantities.
 - (iii) Energy control systems, combustion systems, railroad systems, aviation systems, medical equipment, amusement machines, vehicles, safety equipment, and installations subject to separate industry or government regulations.
 - (iv) Systems, machines and equipment that could present a risk to life or property. Please know and observe all prohibitions of use applicable to this Product.
 NEVER USE THE PRODUCT FOR AN APPLICATION INVOLVING SERIOUS RISK TO LIFE OR PROPERTY OR IN LARGE QUANTITIES WITHOUT ENSURING THAT THE SYSTEM AS A WHOLE HAS BEEN DESIGNED TO ADDRESS THE RISKS, AND THAT THE OMRON'S PRODUCT IS PROPERLY RATED AND INSTALLED FOR THE INTENDED USE WITHIN THE OVERALL EQUIPMENT OR SYSTEM.
2. **Programmable Products.** Omron Companies shall not be responsible for the user's programming of a programmable Product, or any consequence thereof.
3. **Performance Data.** Data presented in Omron Company websites, catalogs and other materials is provided as a guide for the user in determining suitability and does not constitute a warranty. It may represent the result of Omron's test conditions, and the user must correlate it to actual application requirements. Actual performance is subject to the Omron's Warranty and Limitations of Liability.
4. **Change in Specifications.** Product specifications and accessories may be changed at any time based on improvements and other reasons. It is our practice to change part numbers when published ratings or features are changed, or when significant construction changes are made. However, some specifications of the Product may be changed without any notice. When in doubt, special part numbers may be assigned to fix or establish key specifications for your application. Please consult with your Omron's representative at any time to confirm actual specifications of purchased Product.
5. **Errors and Omissions.** Information presented by Omron Companies has been checked and is believed to be accurate; however, no responsibility is assumed for clerical, typographical or proofreading errors or omissions.

Complete "Terms and Conditions of Sale" for product purchase and use are on Omron's website at www.omron.com/oei – under the "About Us" tab, in the Legal Matters section.

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.

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

OMRON[®]

OMRON ELECTRONICS LLC

One Commerce Drive
Schaumburg, IL 60173

847-843-7900

For US technical support or other inquiries:

800-556-6766

OMRON CANADA, INC.

885 Milner Avenue
Toronto, Ontario M1B 5V8

416-286-6465

OMRON ON-LINE

Global - <http://www.omron.com>
USA - <http://www.omron.com/oei>
Canada - <http://www.omron.ca>